Everywhere you imagine. RENESAS

2008.12

Renesas General-Purpose Linear ICs

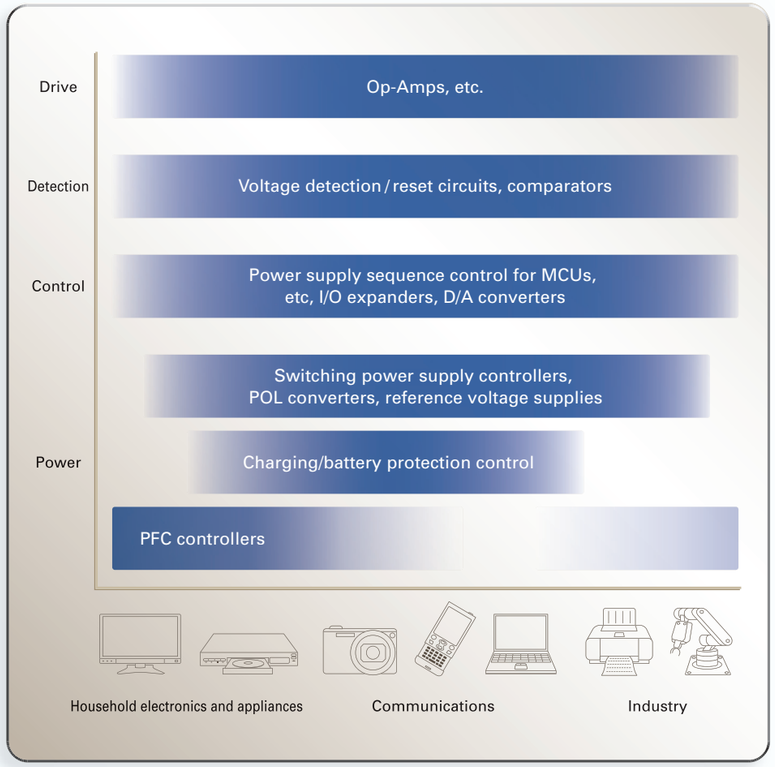
General Catalog

Power Management Linear ICs/Standard Linear ICs

Renesas Technology
www.renesas.com

Only One & Everywhere

Renesas linear IC devices bring the concepts of “indispensable” and “used everywhere” to a new level.



In our IC devices delivering uncompromising performance for specific functions, as well as our IC devices providing common application functions, we support your efforts to develop environmentally friendly products with reduced power consumption and lighter weight.

Power Management Linear ICs

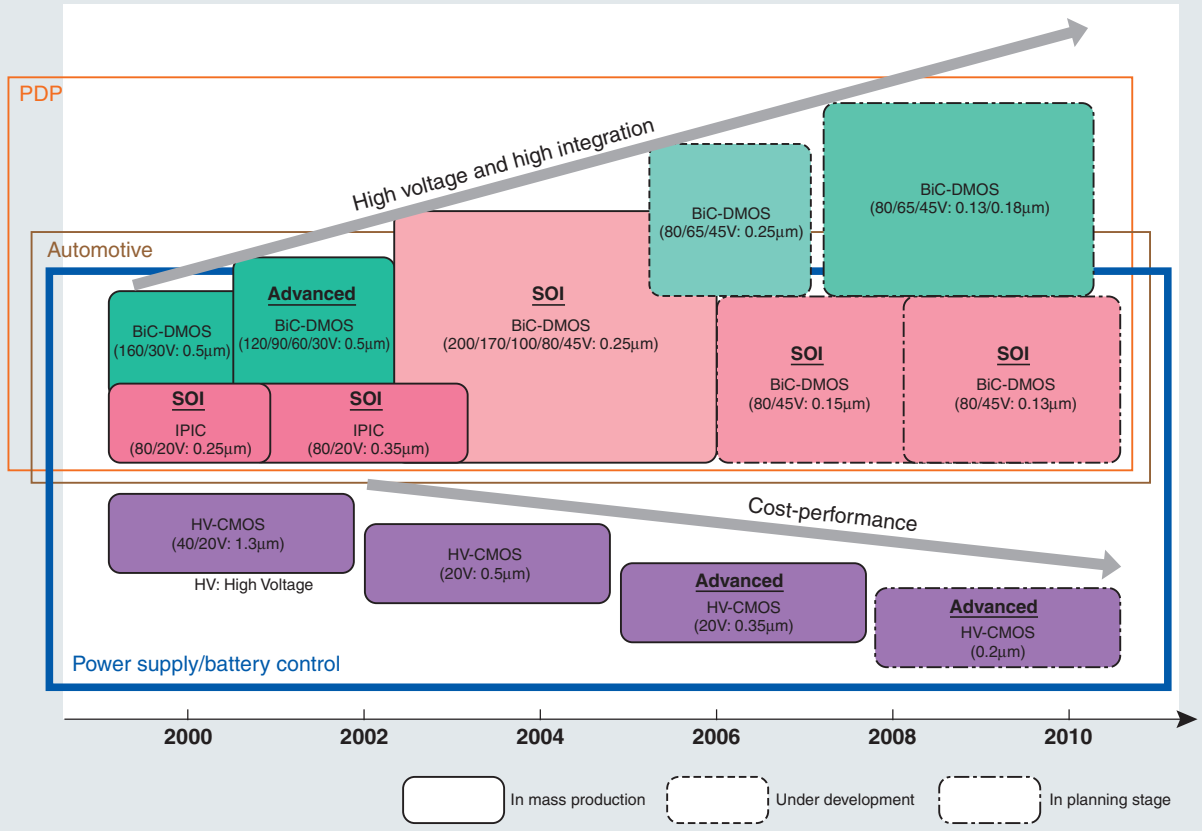
Based on superior process technology and abundant experience, Renesas delivers power supply ICs in a wide range of packages and optimized for many types of equipment.

Lineup of Renesas Power Supply ICs by Field

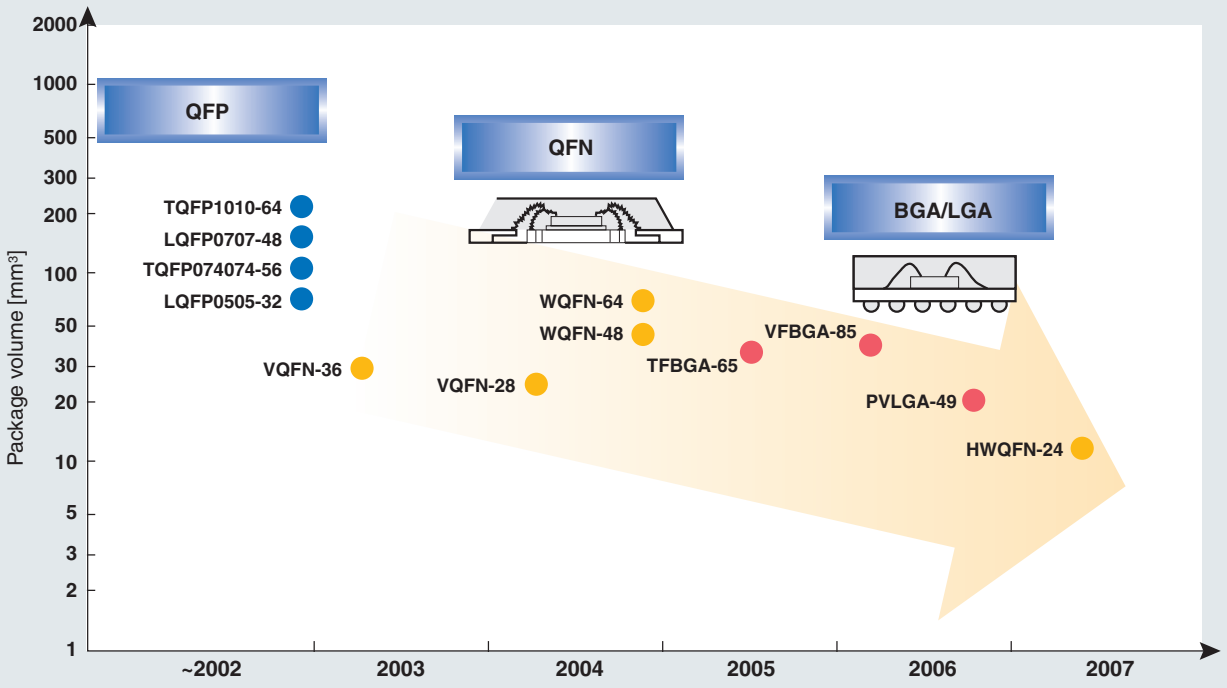
	Mobile devices (Digital cameras, Digital camcorders, etc.)	PC/office (PCs, printers, etc.)	AV/FPDs (LCDs, PDPs)	Car audio
Power supply	**DC/DC & POL** • Fast response/ high efficiency • Mult-/single-channel DC/DC • Compact size • Reduction in number of external devices		**AC/DC & PFC** • Low harmonic noise • On-chip protection circuits • Reduction in number of external components	**System power supplies** • Low standby current • On-chip switching power supply • On-chip protection circuits
Battery control	**Charging control** • High-precision reference voltage • Protection circuits (timer, temperature control)	**Battery protection** • Support for smart batteries • Support for 3 to 4 lithium-ion battery cells • Fuel gauge function • Coordinates with MCU		

Power Management Linear ICs

High-Voltage Process Roadmap



Development of High-Density Packages



●AC/DC Power Management Linear ICs

Low noise, Hige efficiency Critical Conduction Mode Interleave PFC IC R2A20112

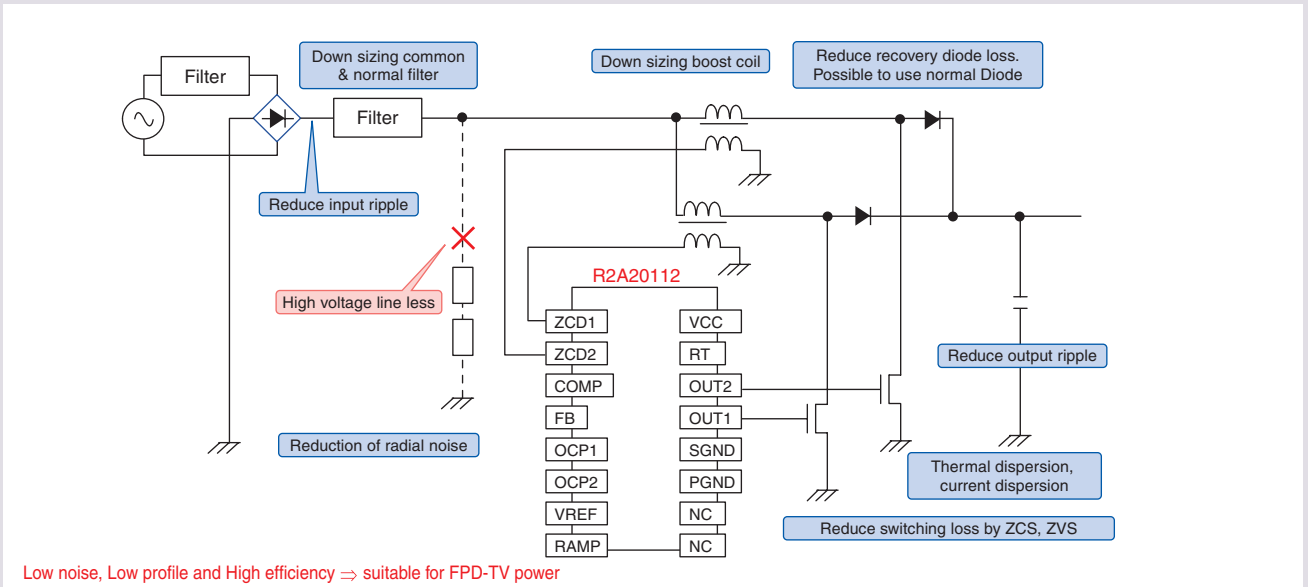
Features

- High Efficiency - Critical Conduction Mode (CRM)
- Low noise, Low ripple current - Interleave operation
- High accuracy 180 deg. phase shift control
- Dynamic, Static OVP function
- Feed back loop open detection function
- High voltage Line less
- Master and Slave independent over current protection

Main Characteristics

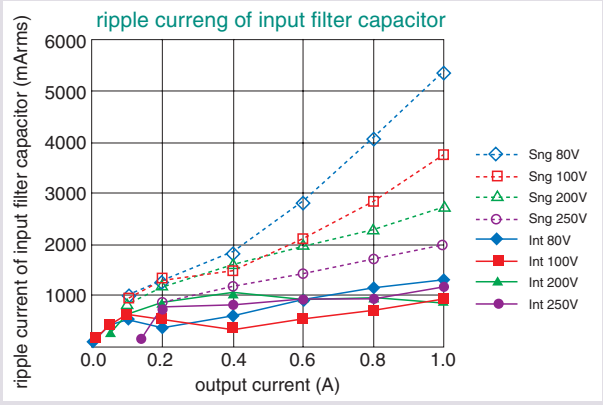
Item	Spec.
Supply voltage	24Vmax
Operating junction temp.	-40~+150˚C
Package	SOP-16/DILP-16

System merits of CRM Interleave PFC IC

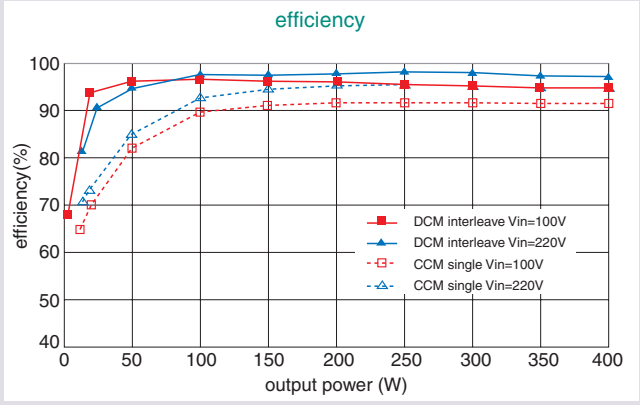


Low noise, Low profile and High efficiency ⇒ suitable for FPD-TV power

Ripple current comparison (CRM single vs. Interleave)



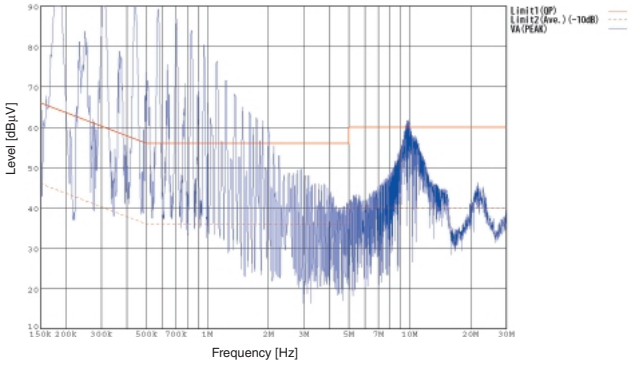
Efficiency comparison (CCM single vs. CRM Interleave)



Switching noise comparison (CCM single vs. CRM Interlearve)

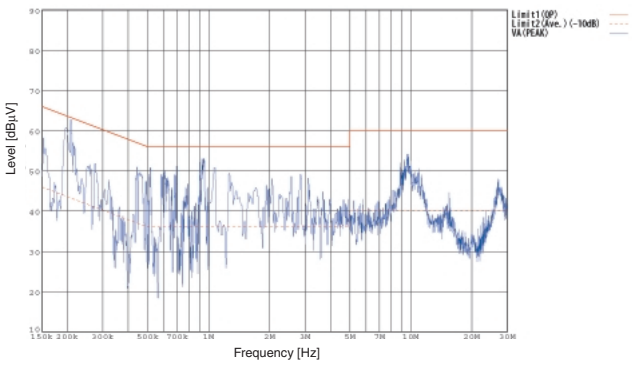
Vin=100VAC/Po=200W

Noise Terminal Voltage Measurement
Equipment name: HA16174P
Part No.:
Serial No.: 01
Measurement bands: 4 bands
Detection mode: Peak
Line mode: VA
Standard 1: [VCCI] Class B (QP)
Standard 2: [VCCI] Class B (mean value) (-10dB)
Temperature: deg C
Humidity: %
Measuring device: R3261C
Measurement date/time: 10-24-2006/20:49
Comment: PFC



CCM Single

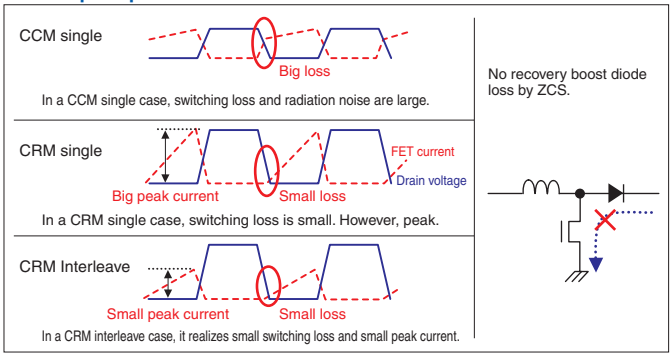
Noise Terminal Voltage Measurement
Equipment name: R2A20112
Part No.:
Serial No.: 01
Measurement bands: 4 bands
Detection mode: Peak
Line mode: VA
Standard 1: [VCCI] Class B (QP)
Standard 2: [VCCI] Class B (mean value) (-10dB)
Temperature: deg C
Humidity: %
Measuring device: R3261C
Measurement date/time: 10-24-2006/19:45
Comment: PFC



CRM Interleave

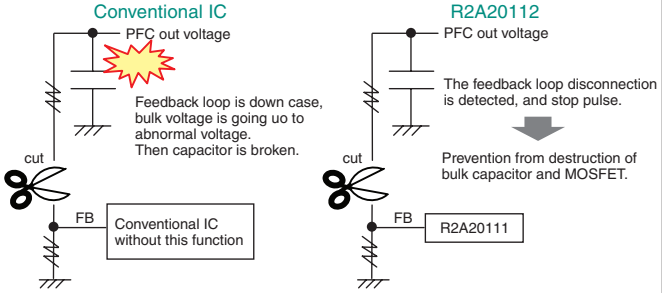
Principle power loss reduction

ZCS : Zero Current Switching

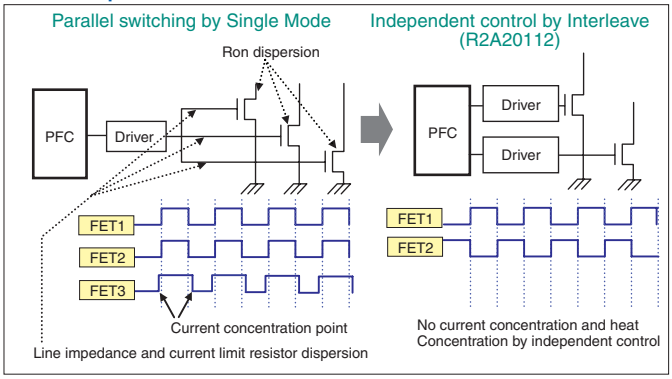


Feedback loop open detection

Built over voltage protection. And lose feedback loop detection can stop Output pulse.
Therefore, bulk capacitor & MOSET are not broken.

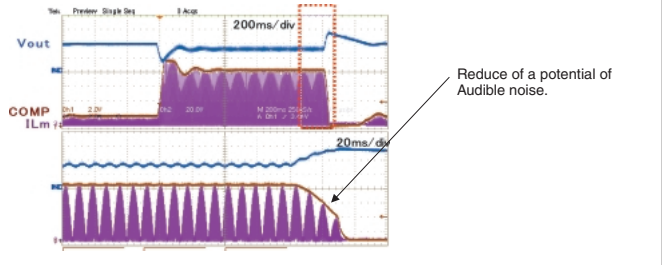


Heat separation & no current concentration



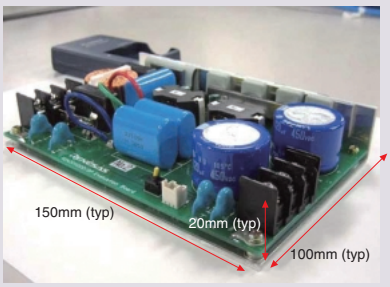
Dynamic over voltage protection

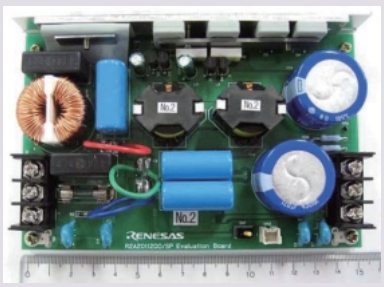
R2A20112 has “Dynamic” and “Static” OVP. Dynamic OVP is doing discharge error AMP voltage gradually when over voltage happened.
Because of this, it is possible to void audible noise caused by suddenly pulse stop.



Demo board

- Spec
  Vin: 85V to 265V
  Vout: 385V
  Power: 0 to 400W





Power Management Linear ICs

●DC/DC Power Management Linear ICs

Monolithic Synchronous Step-Down DC/DC Converter IC R2A20101BM/NP**

**Under Development

Features

Compact size
- Built-in hi/lo-side switching MOS
- Compact package options (WL-CSP, WQFN0404-24)
- High switching frequency
- Compact ceramic output capacitor

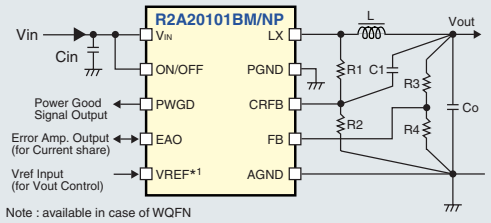
High efficiency
- Synchronous rectification
- Built-in switching MOS with low on-resistance

High-speed response
- Newly developed CR feedback control system allows use of smaller output capacitor

Note: Current sharing can be accomplished simply by making EAO, GND, and Vout connections.

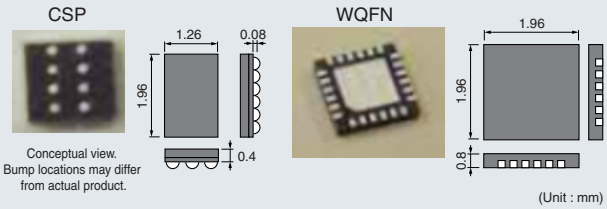
Other Functions
- Power good signal
- On/off function
- Overcurrent protection function
- Built-in software startup function
- Current sharing
- Tracking

Application Circuit Diagram



Note : available in case of WQFN

Package



Conceptual view.
Bump locations may differ from actual product.

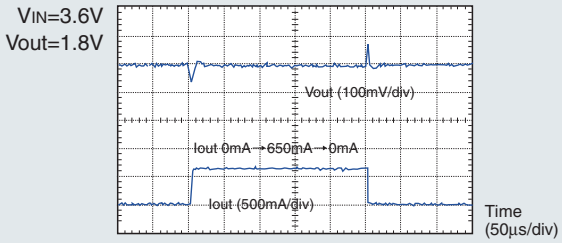
(Unit : mm)

Main Characteristics

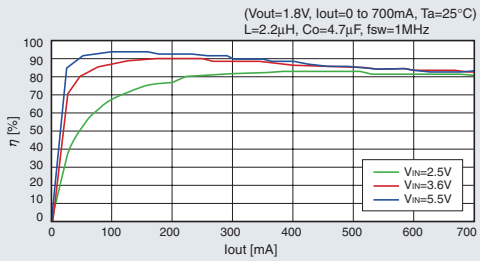
(VIN=3.6V Ta=25°C)

Input Voltage range		2.5-5.5V
Shut down current		1μAMax
Ref.Voltage fsw		0.5V±3%
fsw		2.0MHz_Max
Iout		650mA_Min
Vout-Range		0.5V~VIN-0.5V
Ron	Hi-Side	0.5ΩMax
	Lo-Side	0.25ΩMax

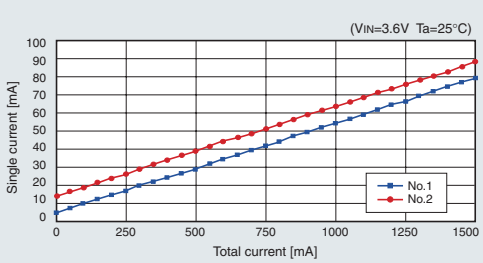
Transient Response Characteristics



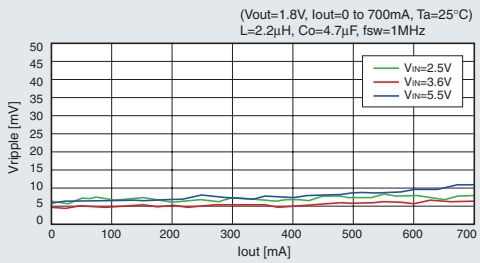
Efficiency



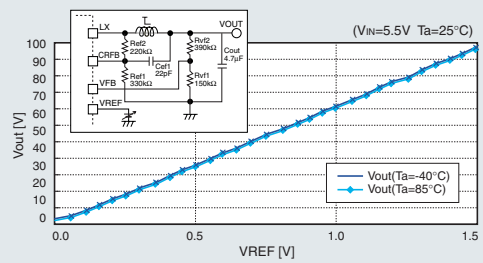
Current Sharing



Ripple Characteristics



Tracking (WQFN only)



7ch DC/DC Converter R2A20016NP

Features

- Fully integrated Output MOSFETs
- Built-in High efficient Auto Buck-Boost converter
- Automatically PWM/PFM switching to improve efficiency at light load

• Channel Configuration
7ch architecture suitable for DSC system
high efficient auto buck-boost converter

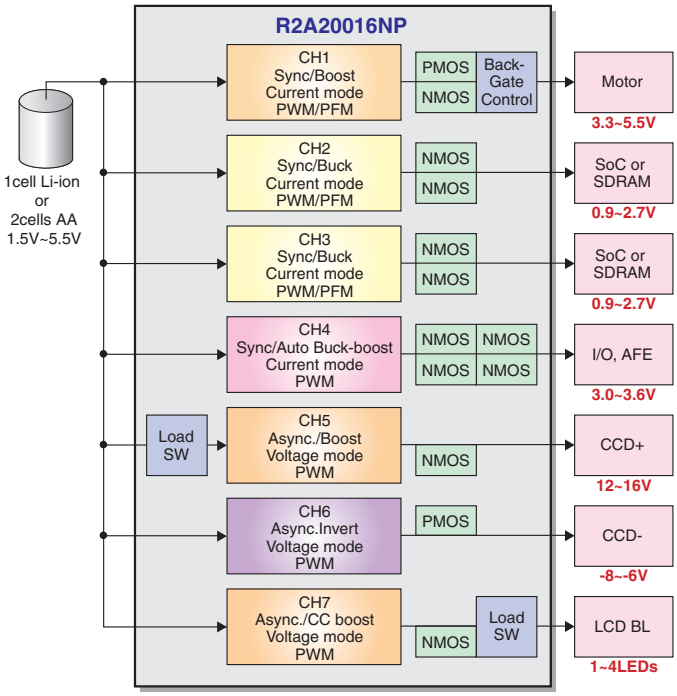
• Minimal External Components
Fully integrate output MOSFETs
Built-in Shutdown function for boost converters
Internal compensation

• Built-in Functions
Auto PWM/PFM mode switching for improving efficiency at light load (CH1~3)
Output voltage detector for system reset (CH4)
Power-on sequencer (CH1~4)
Discharge circuit (CH2~4, 6)
Dimmer control (CH7)

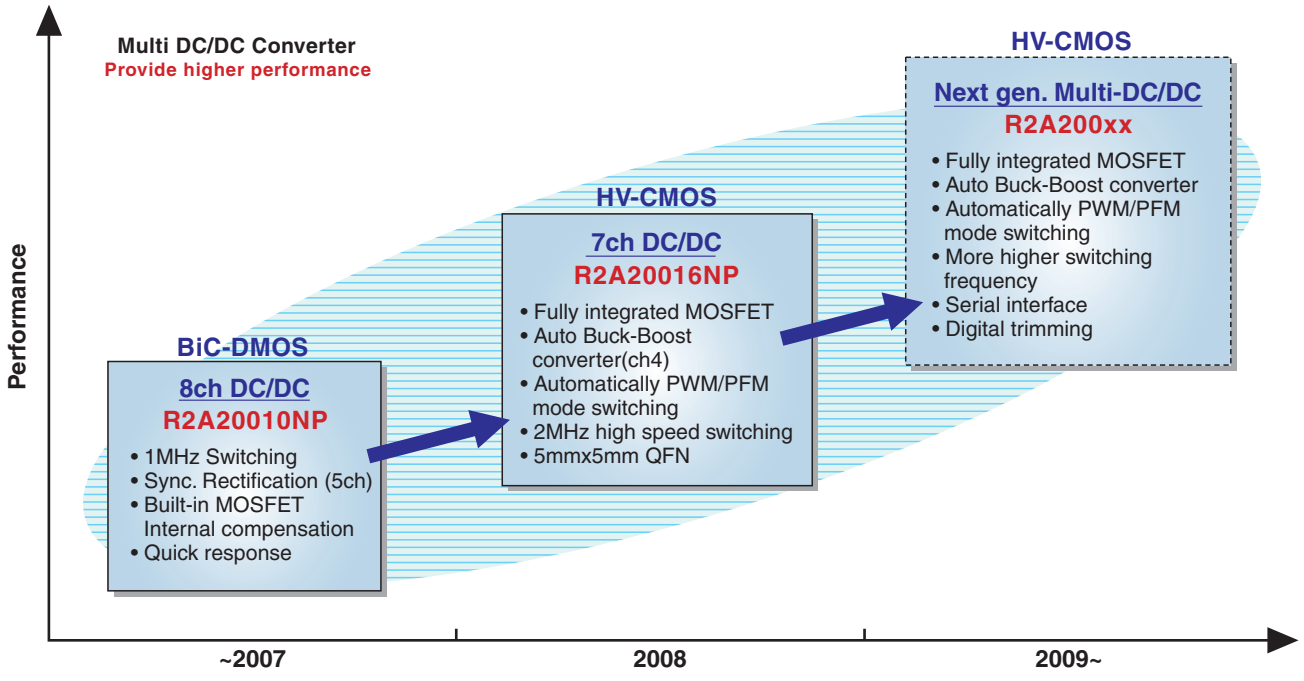
• Operating voltage
1.5V~5.5V
(for 1cell Li-ion and 2cell AA battery)

• SW Frequency (@PWM mode)
CH1~4 (Sync.rectifying) :2MHz
CH5~7 (Diode rectifying) :500kHz

• Small Package
5x5mm QFN-40



Roadmap of Multi Channel DC/DC Converter



Power Management Linear ICs

●Battery Charger Control ICs

Charge control IC for Lithium-ion battery R2A20051NS**

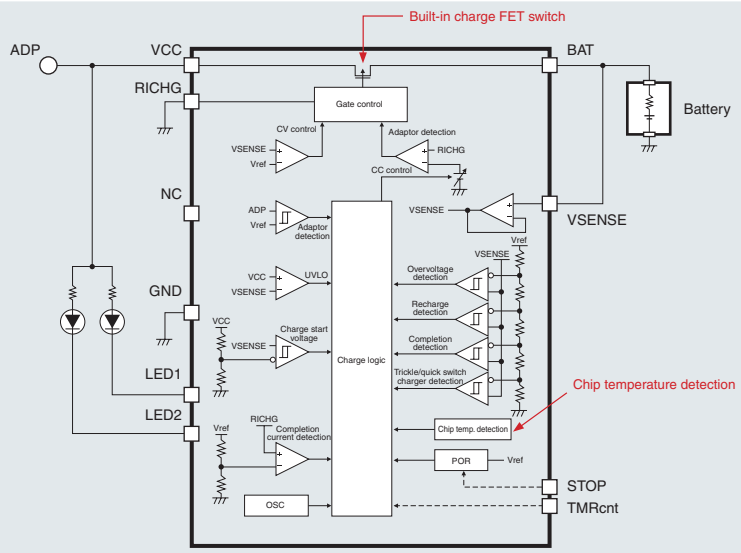
Realized world's smallest package outline for internal charger for mobile application

**Under Development

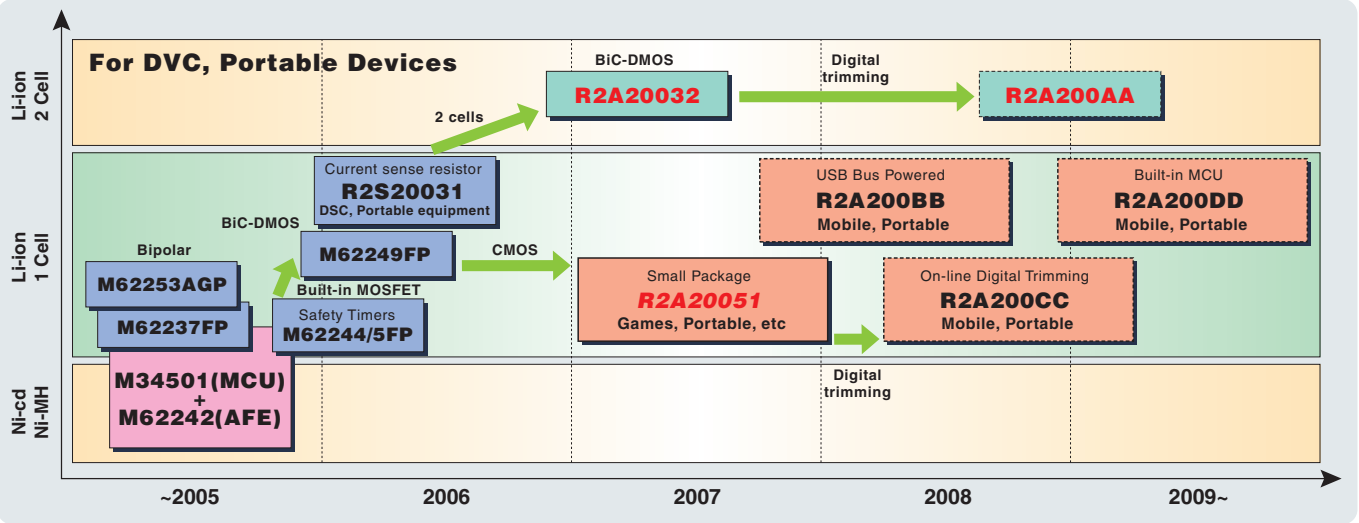
Features

- Built-in charge FET switch, Ultra-small leadless package (2.7mm x 2.5mm x 0.6mm)
- Charge circuit design made simple by one or two external components.
- Battery connection detection
- Adaptor connection detection
- Protection functions for safe charge for Lithium-ion battery, Charge timers
- Chip temperature detection function to limit charge current to control chip temperature
- High precision 0.7% charge(Charge control voltage: 4.2V±30mV)

R2A20051NS Application Circuit Example



Charger IC Roadmap



Power Management Linear ICs

●Battery Control ICs

Smart Battery System for notebook PC "R2J24010F**"

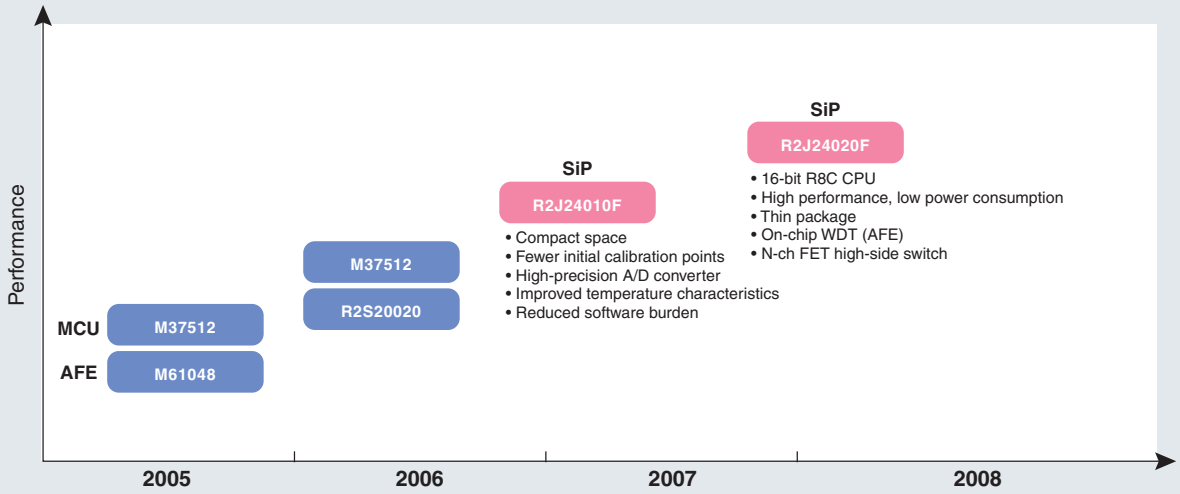
High-precision battery charge remaining management and battery protection functions in a single package

**Under Development

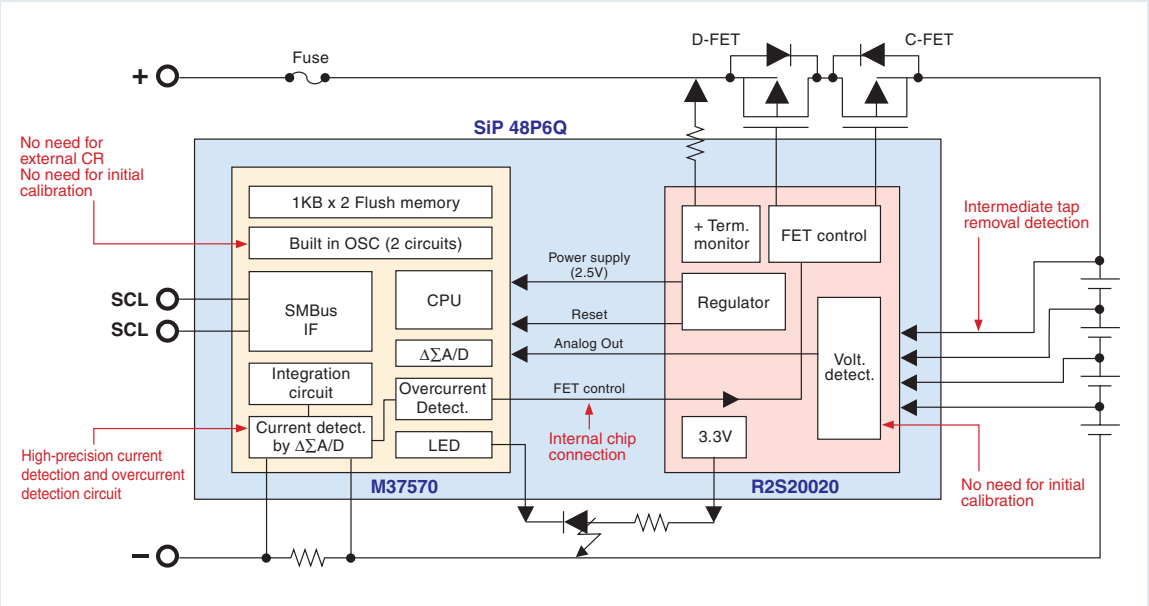
Features

- Smaller package footprint (48LQFP)→ simpler pattern layout
- Simpler initial calibration process→ shorter manufacturing process
  → reduction of production cost
- High-precision A/D converter for more exact charge remaining detection

Battery Solution Roadmap



Example PC Battery Implementation Using SiP (R2J24010F)



Power Management Linear ICs

●Shunt Regulator ICs

New Shunt Regulator IC Lineup

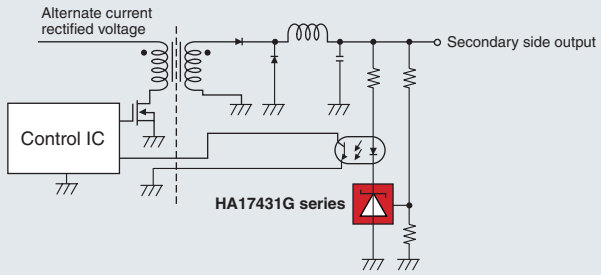
Renesas Technology is offering Shunt Regulator IC HA17431 Series to meet the needs of a output voltage detection for the power supply of various electronics devices or a reference voltage source of AD input of microcomputers. Especially, HA17431G Series achieves high-voltage, high-accuracy and miniaturization.

Renesas HA17431G Series Features

- Achieve both high voltage and high accuracy compared to conventional product.
  - Max. cathode voltage (Vkmax): 40V
  - Reference voltage (Vref at 25°C)
    - : 2.500V ±0.5%(A type)
    - : 2.500V±1.0% (Standard type)
- Abundant variations in packages including small surface mounting package for equipment downsizing.
  - Surface mounting type: MPAKV, MPAK-5V, UPAK
  - Through hole type: TO-92
  - K-REF pin reversed type: HA17432G (UPAK)

Application Example

Secondary side error amplifier circuit of switching power supply

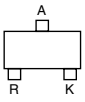
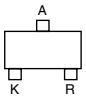
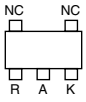
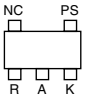
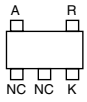
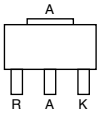
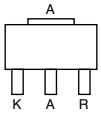


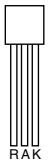
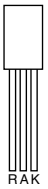
- Reference voltage generation circuits
- Switching power management error amplification circuits, etc.

Product Lineup

Item		Low voltage type (1.25V)		Standard voltage type (2.5V)				
		HA17L431A	HA17L431	HA17431V	HA17431H	HA17431A	HA17431GA	HA17431G
Reference voltage	Vref (V)	1.240	1.240	2.500	2.500	2.495	2.500	2.500
Maximum cathode voltage	VKA(V)	16	16	16	36	40	40	40
Continuous cathode current	IK(mA)	-30 ~ +50	-30 ~ +50	-50 ~ +50	-50 ~ +50	-100 ~ +150	-50 ~ +100	-50 ~ +100
Reference voltage accuracy	(%)	±1	±1.5	±1	±1	±2.2	±0.5	±1.0
Operating temperature range	Topr (°C)	-20 ~ +85	-20 ~ +85	-20 ~ +85	-20 ~ +85	-20 ~ +85	-40 ~ +85	-40 ~ +85
Package	MPAKV	HA17L431ALTP HA17L432ALTP	—	HA17431VLTP HA17432VLTP	HA17431HLTP HA17432HLTP	—	HA17431GLTPA	HA17431GLTP
	MPAK-5V	HA17L431ALP	—	HA17431VLP	HA17431HLP	—	HA17431GLPA	HA17431GLP
	TO-92	HA17L431AP	—	HA17431VP	HA17431HP	HA17431PNA	HA17431GPA	HA17431GP
	TO-92MOD	—	—	—	—	HA17431PA	—	—
	UPAK	—	HA17L431UP HA17L432UP	HA17431VUP HA17432VUP	HA17431HUP HA17432HUP	HA17431UA HA17432UA	—	HA17431GUP HA17432GUP

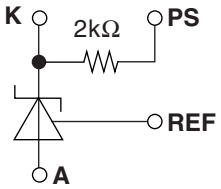
External Package Dimensions and Pin Arrangement

Package	MPAKV		MPAK-5V			UPAK	
Pin Arrangement (Top view) *1							
Part No.	HA17431GLTP HA17431GLTPA HA17431HLTP HA17431VLTP HA17L431ALTP	HA17432HLTP HA17432VLTP HA17L432ALTP	HA17431GLP HA17431GLPA HA17431HLP	HA17L431VLP	HA17L431ALP	HA17431GUP HA17431UA HA17431HUP HA17431VUP HA17L431UP	HA17432GUP HA17432UA HA17432HUP HA17432VUP HA17L432UP

Package	TO-92	TO-92MOD
Pin Arrangement (Top view) *1		
Part No.	HA17431GP HA17431GPA HA17431PNA HA17431HP HA17431VP HA17L431AP	HA17431PA

*1 R : Reference
A : Anode
K : Cathode
NC: No Connection
PS: Built-in Photocoupler Bypass Resistor (2 kΩ)

Package	Size	Pin pitch (mm)	Power dissipation (mW)	Abbreviation
MPAKV	1.5x2.95x1.1	(0.95)	150	LTP
MPAK-5V	1.6x2.9x1.1	0.95	150	LP
UPAK	2.5x4.5x1.5	1.5	385	UP
TO-92	5.0x4.8x3.8	1.27	500	P, PN
TO-92MOD	8.0x4.8x3.8	1.27	800	P



Symbol (HA17431VLP)

Power Management Linear ICs

●Three-Terminal Regulator ICs

Three-Terminal Regulator IC Lineup

These three-terminal regulator ICs always supply a stable output voltage, unaffected by fluctuations in the input voltage. They are suitable for use in audio equipment power supplies, for stabilization of unstable voltages of multi-output switching regulators, and for power supplies of various kinds of control devices.

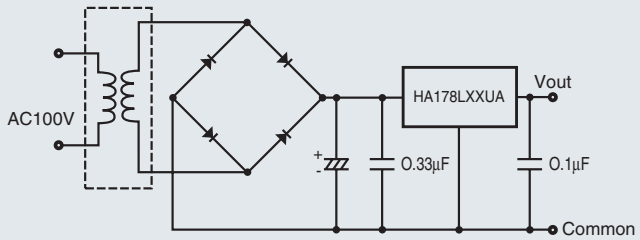
Features

- Variety of output voltage grades
- Various built-in protection circuits: current limiting circuit, chip junction temperature limiting circuit, internal power dissipation limiting circuit
- Wide operating temperature range:Ta=–40 to +85°C

Series Regulators

- Suitable for precision, high-stability, low-capacity power supplies (up to 20 W)
- Extremely low noise generation
- Facilitate circuit design

Example of Fixed-Output Regulator Circuit



Lineup

Output voltage	Current	Package	
		UPAK(SOT89)	TO-92MOD
5.0	100	HA178L05UA	HA178L05/A/P/PA
8	100	HA178L08UA	HA178L08/A/P/PA
12	100	HA178L12UA	HA178L12/A/PA
15	100	HA178L15UA	HA178L15/A/P
-5	100	HA179L05U	HA179L05/P
-8	100	HA179L08U	HA179L08/P
-12	100	HA179L12U	HA179L12/P
-15	100	HA179L15U	HA179L15/P

Output Voltage Precision & Grade

Grade	HA178Lxx Series	HA179Lxx Series
Standard	±8%	±4%
A Grade	±5%	–

Standard Linear ICs

●Op-Amp. and Comparator ICs

General-Purpose CMOS, Op-Amp. and Comparator ICs Series

Products Concept

We offer a lineup of products combining low-voltage operation, low power consumption, and compact size.

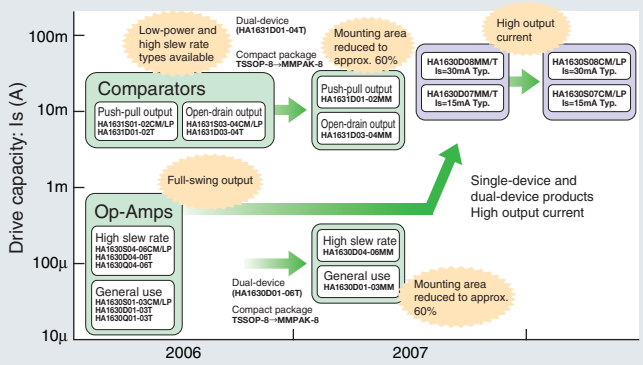
Applications

- Portable device (DSC, etc.)
- Amplification and detection of sensor signal (health machine, etc.)
- Signal controlling switch
- Detection of overvoltage of low-power electric source (monitor)

Features

- Ultra-small package saves you space (CMPAK-5, MPAK-5, TSSOP-8, MMPAK-8, TSSOP-14)
- Low-voltage operation and low current dissipation most suitable for battery-use device (V_{DD}=1.8 to 5.5V, I_{DD}: 15 to 800µA, The high output type supports 2.7 to 5.5V.)
  - Output full swing (operational amplifier) V_{OH}= 2.9Vmin (at V_{DD}=3V)
  - Low input offset voltage (operational amplifier) V_{IO}= 4mVmax
  - Low input bias current I_{IB}= 1pA (typ.)
  - Operating temperature range Topr=- 40 to +85°C
  - 15mA typ./30mA typ. (HA1630S/D07.08) high-current-ourput versions available.

Road Map



Lineup

• Op-Amps

Power supply voltage		Input offset voltage	Power supply current	Slew rate	Output drive current	Part No.		
V_{DD}(V)		V_{IO} max. (mV)	I_{DD} typ. (µA)	SR typ. (V/µs)	Is typ. (mA)	No. of channels		
						Single	Dual	Quad
General-Purpose	1.8 to 5.5	4	15 /ch	0.125	0.01	HA1630S01	HA1630D01	HA1630Q01
			50 /ch	0.5	0.05	HA1630S02	HA1630D02	HA1630Q02
			100 /ch	1	0.1	HA1630S03	HA1630D03	HA1630Q03
			200 /ch	2	0.2	HA1630S04	HA1630D04	HA1630Q04
			400 /ch	4	0.4	HA1630S05	HA1630D05	HA1630Q05
			800 /ch	8	0.8	HA1630S06	HA1630D06	HA1630Q06
High-power	2.7 to 5.5	6	60 /ch	1.0	15	HA1630S07	HA1630D07	
			170 /ch	1.5	30	HA1630S08	HA1630D08	
Package						CMPAK-5V & MPAK-5V	TSSOP-8 & MMPAK-8	TSSOP-14

• Comparators

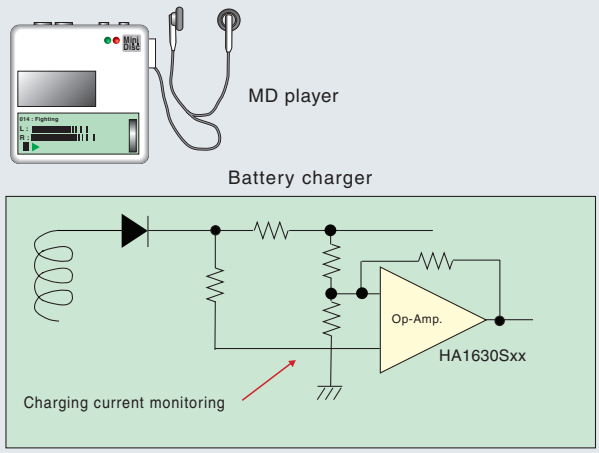
Power supply voltage	Input offset voltage	Power supply current	Response time	Output configuration	Output current	Part No.	
V_{DD}(V)	V_{IO} max. (mV)	I_{DD} typ. (µA)	TP_{HL}/TP_{LH} typ. (µs)		I_O@V_{DD}=3V (mA)	No. of channels	
						Single	Dual
1.8 to 5.5	5	5 /ch	1.2 / 0.6	Push-pull	14 / 13	HA1631S01	HA1631D01
		50 /ch	0.3 / 0.2			HA1631S02	HA1631D02
		5 /ch	– / 0.6	Open drain	14 / –	HA1631S03	HA1631D03
		50 /ch	– / 0.2			HA1631S04	HA1631D04
Package						CMPAK-5V & MPAK-5V	TSSOP-8 & MMPAK-8

Standard Linear ICs

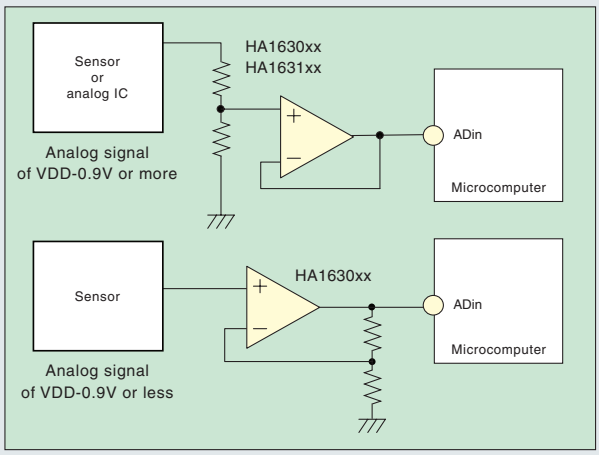
●Op-Amp. and Comparator ICs

CMOS, Op-Amp. and Comparator ICs

ex. (Power supply circuit)



ex. (Sensor output amplifier)



General-Purpose Bipolar Op-Amp. and Comparator ICs

Features

•Lineup of world standard compatible products
•Variety of packages (DP-8/14, SOP-8/14, TSSOP-8/14)

● Specifications

	Op-Amps		Comparators	
	HA17358A(Dual)	HA17324A(Quad)	HA17393A(Dual)	HA17339A(Quad)
Input offset voltage	Vio typ.=3mV		Vio typ.=2mV	
Power supply voltage	Vcc max=32V		Vcc max=36V	
Dissipation current	Icc typ.=0.8mA			
In-phase input voltage	Vin=-0.3~+Vcc			
Sink current	Iosink typ=20mA	Iosink typ=20mA	Iosink typ=16mA	
Source current	Iosource typ=40mA	Iosource typ=40mA	*Iosink(V_{OL}=2.5V),Iosource(V_{OH}=10V)	
Operating temperature	-40°C~+85°C			

*HA17901A, 902A, 903A and 904A models for communications industry use are also available.

● Product Lineup

• Op-Amps

Number of Channels	Part No.	Package
Dual (2ch)	HA17358A	DIP-8
	HA17358AF	JEITA SOP-8
	HA17358ARP	JEDEC SOP-8
	HA17358AT	TSSOP-8
Quad (4ch)	HA17324A	DIP-14
	HA17324AF	JEITA SOP-14
	HA17324ARP	JEDEC SOP-14
	HA17324AT	TSSOP-14

• Comparators

Number of Channels	Part No.	Package
Dual (2ch)	HA17393A	DIP-8
	HA17393AF	JEITA SOP-8
	HA17393ARP	JEDEC SOP-8
	HA17393AT	TSSOP-8
Quad (4ch)	HA17339A	DIP-14
	HA17339AF	JEITA SOP-14
	HA17339ARP	JEDEC SOP-14
	HA17339AT	TSSOP-14

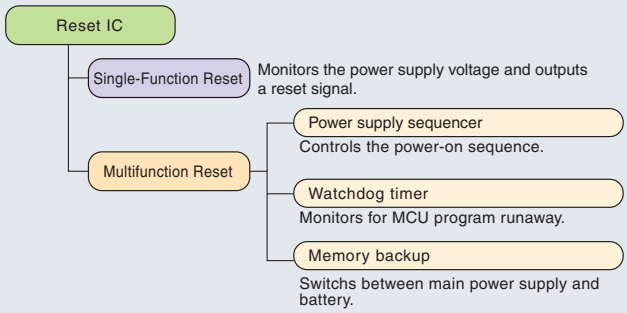
Standard Linear ICs

●Reset ICs

Accurate monitoring of MPU/MCU power supply operation

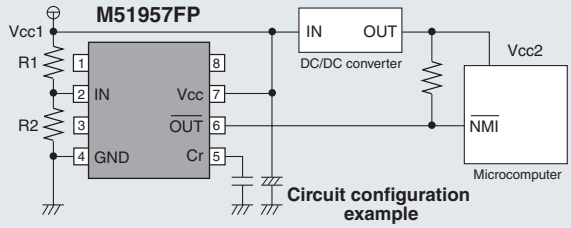
Two types are available, one in which the monitor voltage setting is variable and the other in which it is fixed. Users can select the type best suited to the application. There are also versions with a built in memory backup switch and with a clock signal monitoring (watchdog timer) function. Finally, our multifunction reset ICs support voltage sequence control for MCUs employing two or three power supplies.

Reset IC Types



Reset IC Application Example

Initial detection of system power supply voltage



•For M51953A/B, M51957A/B, a wide range of power supply voltage of 0.7V to 18V
•Detection voltage 1.25V for M51957A/B, etc. can be arbitrarily set with external resistance.
(Input pressure resistance of terminal 2V to 7V)

● Reset IC Features

• Single-Function System Reset ICs

Category	Part No.	Package FP	Package L	Package ML	Detection Voltage Vs
Power supply voltage detection	M51943A/B		○	○	4.25
	M51944A/B		○	○	
Input voltage detection	M51945A/B	○	○		1.25*
	M51946A/B	○	○		
Power supply voltage detection (delay time 200 µs)	M51951A/B		○	○	4.25
	M51952A/B		○	○	
Power supply voltage detection (variable delay time)	M51953A/B	○	○		
	RNA51953A/B	○			
	M51954A/B	○	○		
Input voltage detection (delay time 200 µs)	M51955A/B	○	○		1.25*
Input voltage detection (variable delay time)	M51957A/B*	○	○		
	RNA51957A/B	○			
	M51958A/B*	○	○		

Note: *The detection voltage may be set to any value from 2 to 7 V.
A: constant-current output/B: open drain

[Features]
- Wide withstand-voltage range up to 18 V
- Versions with 1.25 V detection voltage can be set to a user-selected detection voltage of 2 to 7 V by adding an external resistor.

• Multifunction Reset ICs

Category	Part No.	Function	Package MM	Package US
2-channel CMOS reset	RNA52A10	Reference voltage: 1.00 V Variable detection voltage	○	
Power supply sequence controller	RNA50C27A	Power supply sequences: Startup: 3.3 V to 1.8 V Shutdown: 1.8 V to 3.3 V	○	○

Recommended product

Package Codes

FP : PRSP0008DE-C
L : 5P5T
ML : SOT-89
LP : MPAK-5V
MM : MMPAK-8

● CMOS Reset ICs and Bipolar Reset ICs

• High-Precision CMOS Reset ICs

	Open Drain	CMOS
5.0V		RNA51B50FLP
4.4V	RNA51A44FLP	
4.5V	RNA51A45FLP	
4.6V	RNA51A46FLP	
3.1V	RNA51A31FLP	
3.0V	RNA51A30FLP	
2.9V	RNA51A29FLP	
2.8V	RNA51A28FLP	
2.7V	RNA51A27FLP	RNA51B27FLP
2.6V	RNA51A26FLP	
1.4V		RNA51B14FLP

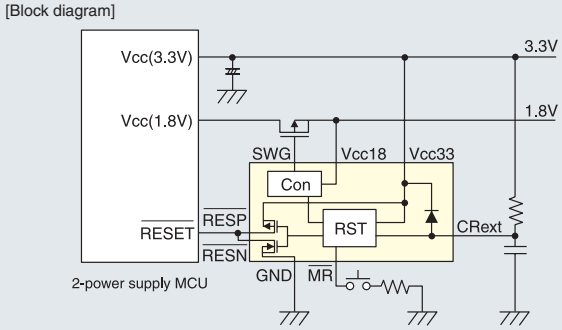
[Features]
- Detection accuracy: 1%
- Low current consumption: 100 nA (typ.)
- Size: 2.9 × 2.8 × 1.1 (mm)

● Multifunction Reset IC (Power Supply Sequencer) RNA52A10MM

[Example of required wave form]
[When there are 2 power sources]

In addition to always monitoring the 3.3V (power source), the 1.8V (core power source) release procedure during the 3.3V rising is observed by controlling the external Tr.

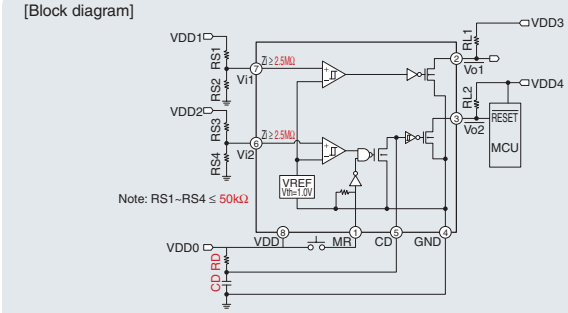
[Block diagram]



RNA50C27AUS/MM

•Equipped with input terminals dedicated to monitoring voltage, it is possible to set arbitrary reset voltage with external resistance.
•It features 1.0V±50mV of reference voltage by adopting low Vth process and can be used for low voltage systems.
•It features 1.1µA (typ) of consumption current by adopting CMOS process and can be used for battery-driven products.

[Block diagram]



Standard Linear ICs

●Data Converters

Mixed digital/analog capability: the dicisive factor in automatic adjustment and high-speed,high-precision control

These are D/A converters for trimming applications with 2 to 36 channels incorporated in one package, operating at low/medium speeds of 100 kHz to 1 MHz. The use of CMOS analog circuitry and pattern design employing patented technologies enables high precision to be achieved without using special processes, trimming, etc.

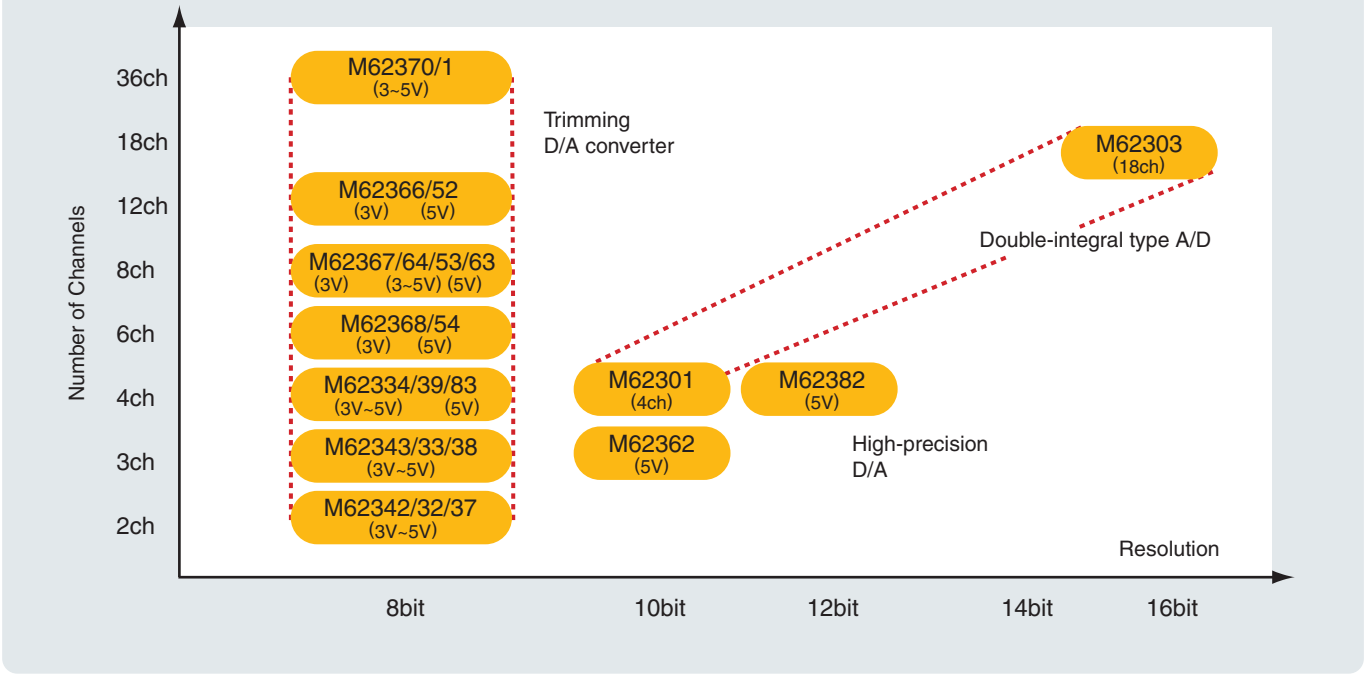
Features

•World's top runner in trimming D/A converter market
•Wide selection of variations(DAC)
-Number of channels: 2 to 36
-Resolution: 8 to 12 bits
-Bus type: Three-wire,I^2C
-Power supply voltage: 3V,5V systems available
•Fewer channel D/A converter lineup available

Applicable Market Areas

•Mobile phone,DVCs,DSCs,monitors,TVs,printers,CD-R,etc.

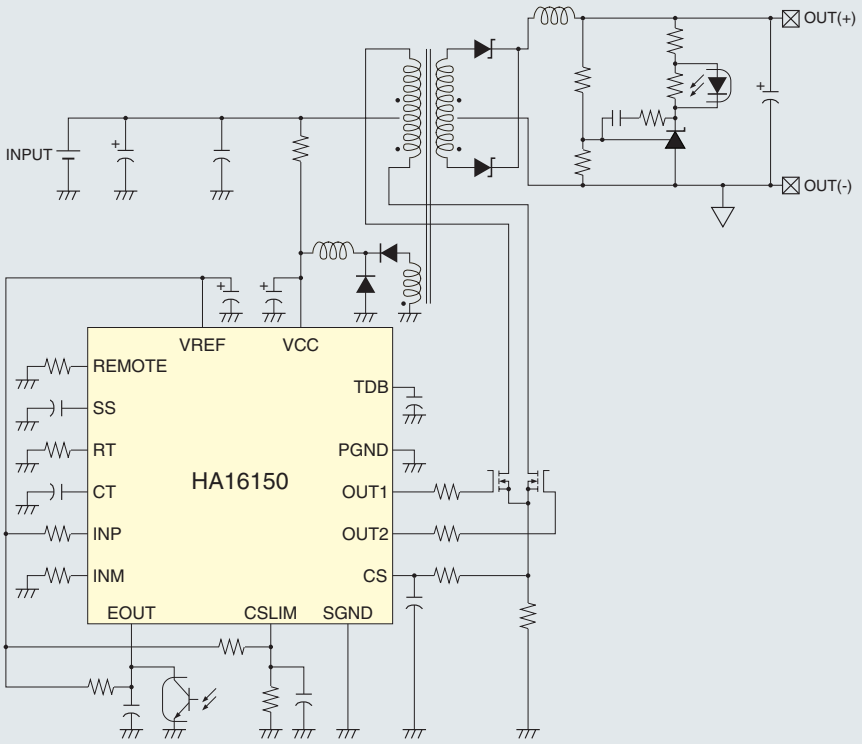
Data Converter Series



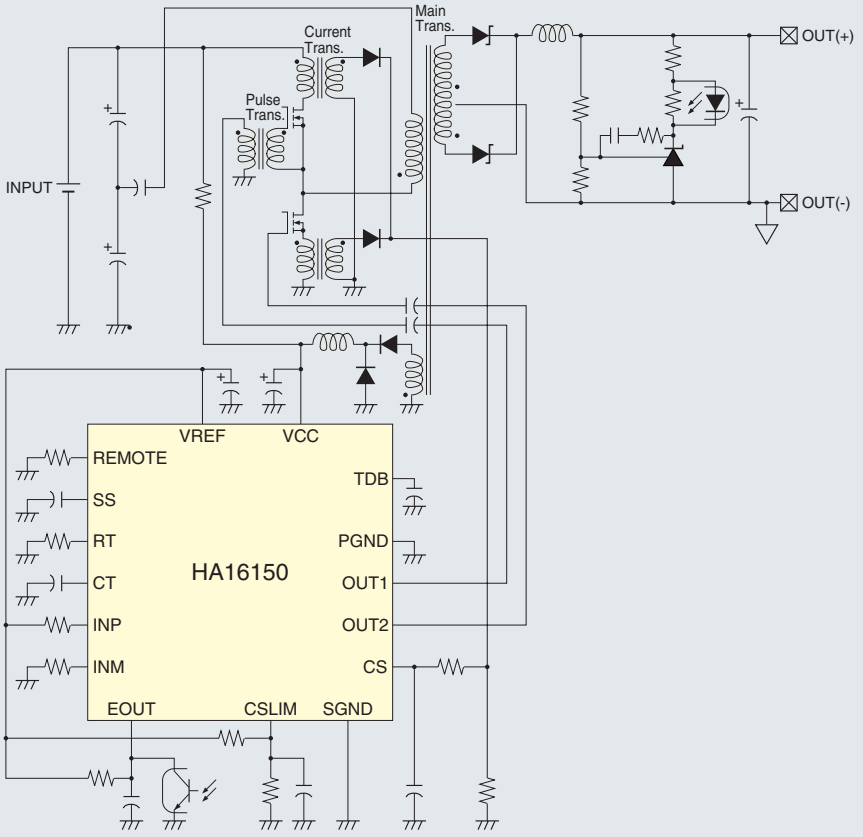
Applications

●Power Supplies

Isolation Type On-Board DC to DC Power Supply (Push-Pull Converter)



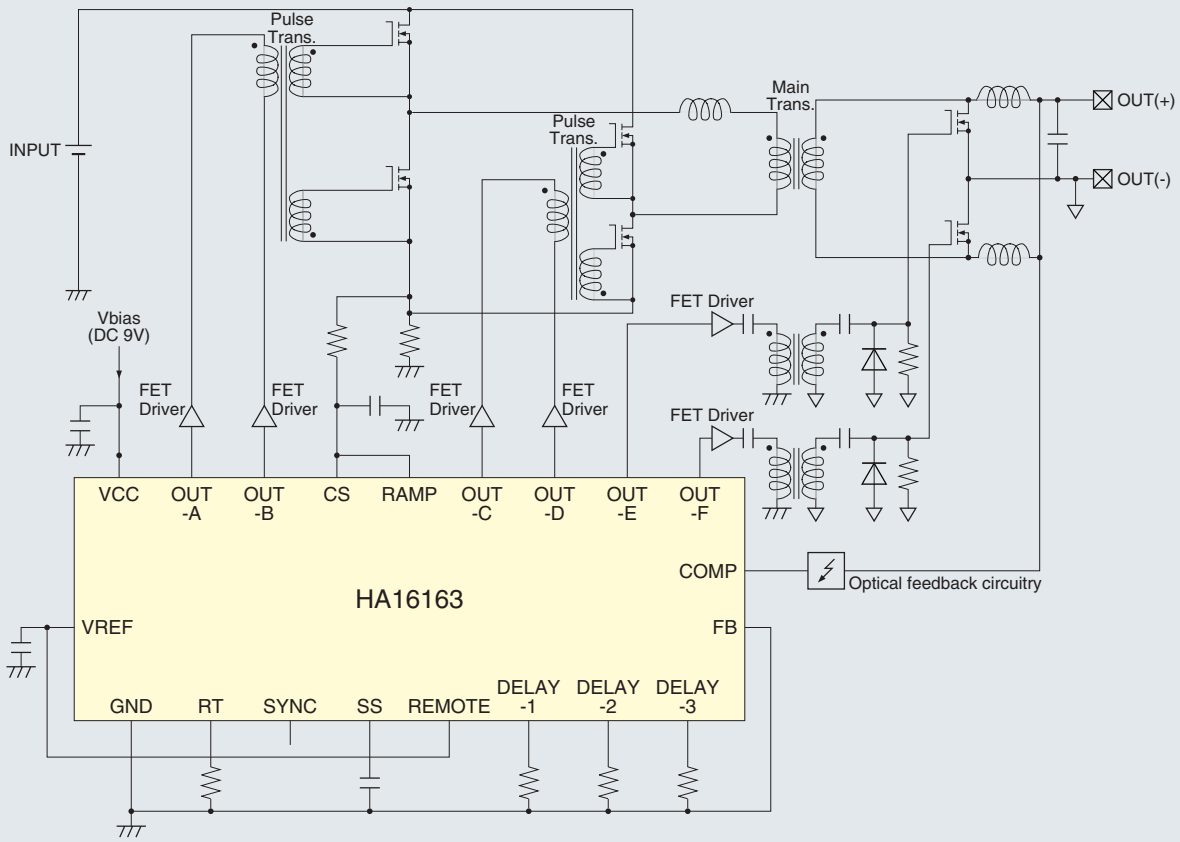
Isolation Type On-Board DC to DC Power Supply (Half-Bridge Converter)



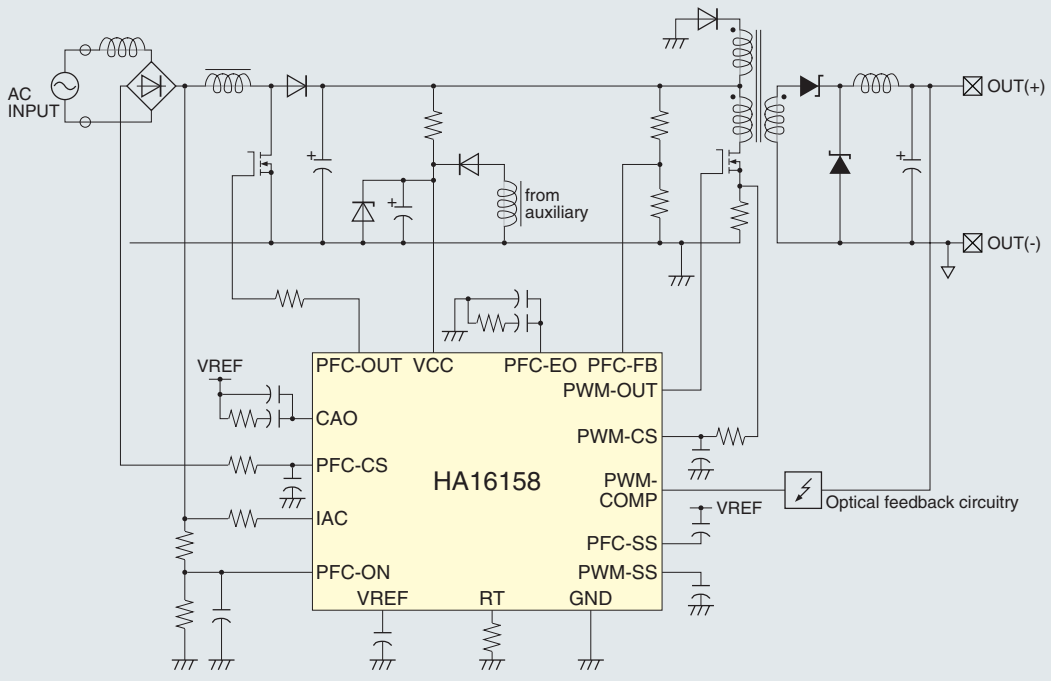
Applications

●Power Supplies

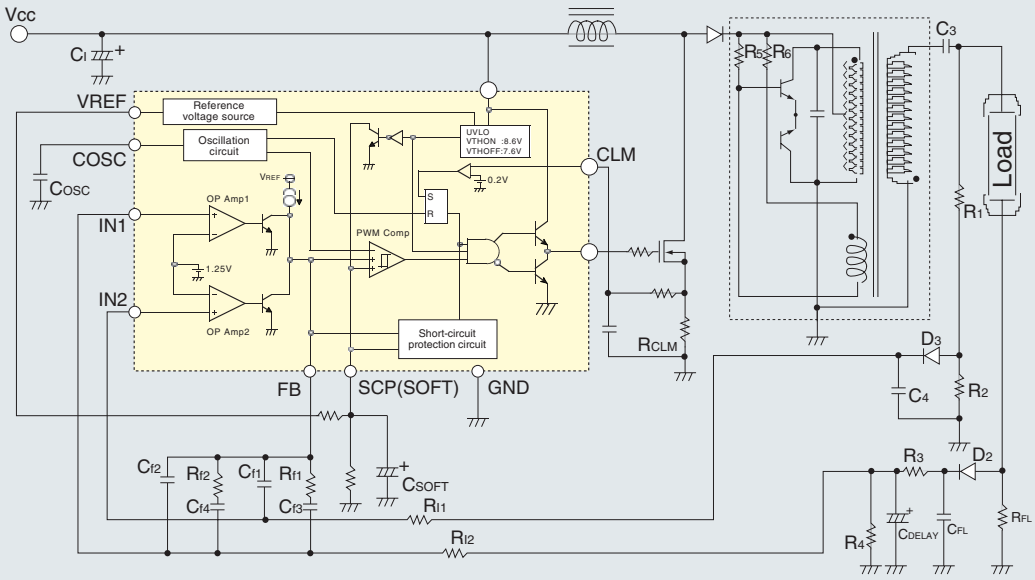
Isolation Type On-Board DC to DC Power Supply (Full-Bridge Converter)



PWM Power Supply with PFC Function (Forward Converter)



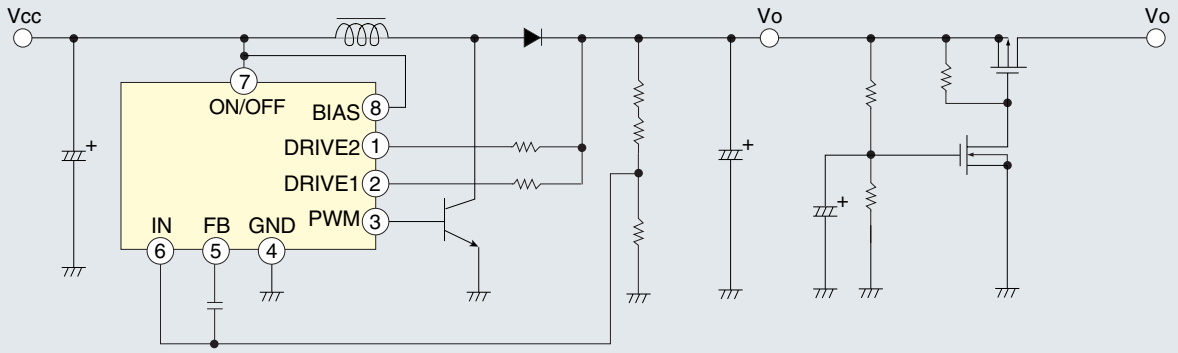
Sample Backlight Control Application Circuit Using M62215FP Dual-Input Type DC/DC Converter



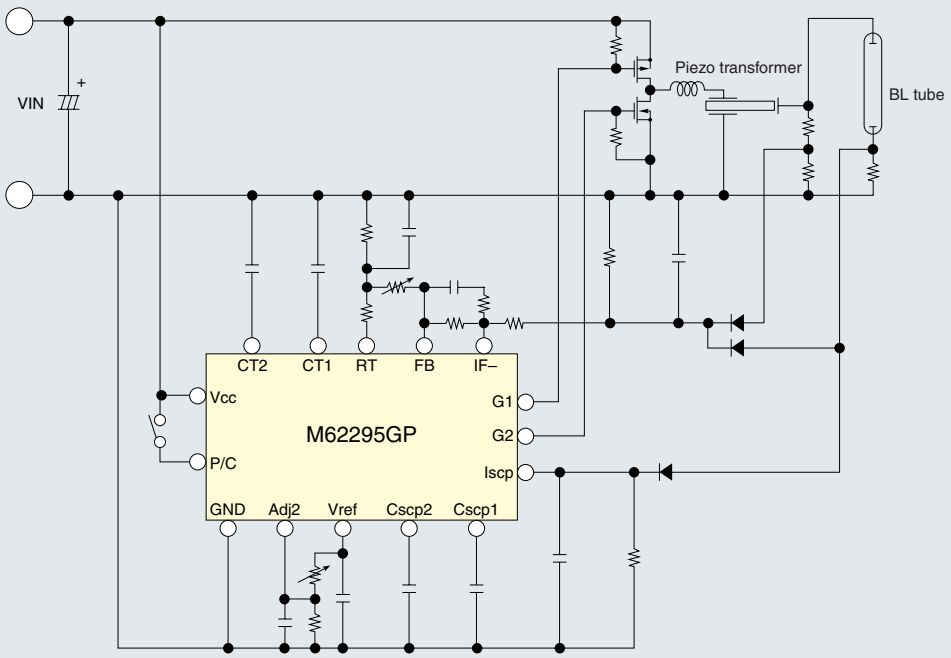
Applications

●Power Supplies

Sample M62216 Low-Voltage-Operation DC/DC Converter Application Circuit



Sample Backlight Control Application Circuit Using M62295GP

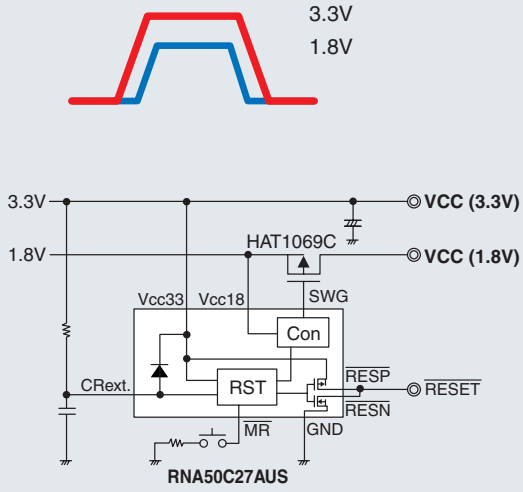


Applications

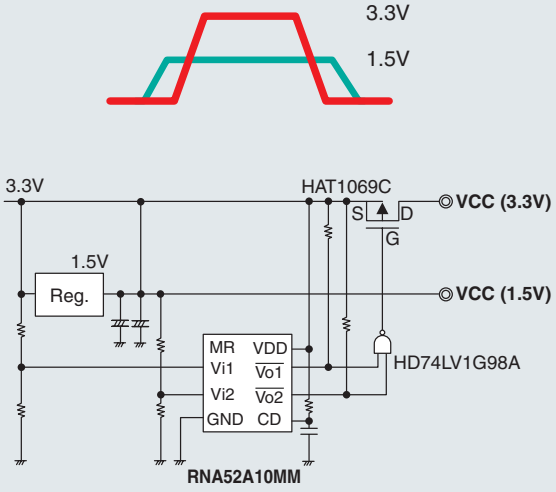
●Standard Linear ICs

Dual-Power-Supply MCU Power-On Sequence Example Using Multifunction Reset IC

For Dual Power Supplies MPU/MCU



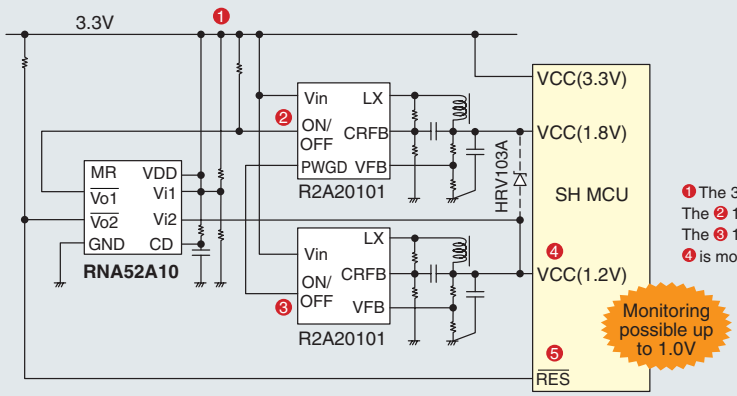
For Triple Power Supplies MPU/MCU



Note: This circuit diagram is intended for reference only. Careful verification should be performed before actually using this design ina a system.

Three-Power-Suplly MCU Power-On Sequence Example Using Multifunction Reset IC

In this example we use the RNA52A10 in combination with DC/DC converters to supply power to a device requiring three power supply voltage.



❶ The 3.3V power supply is monitored using a user-defined detection voltage.
The ❷ 1.8V output turns on when the voltage stabilizes at 3.3V.
The ❸ 1.2V output turns on when the PowerGood signal is applied.
❹ is monitored, and reset ❺ is cancelled after all voltages have stabilized.

Note: This circuit diagram is intended for reference only. Careful verification should be performed before actually using this design ina a system.

Applications

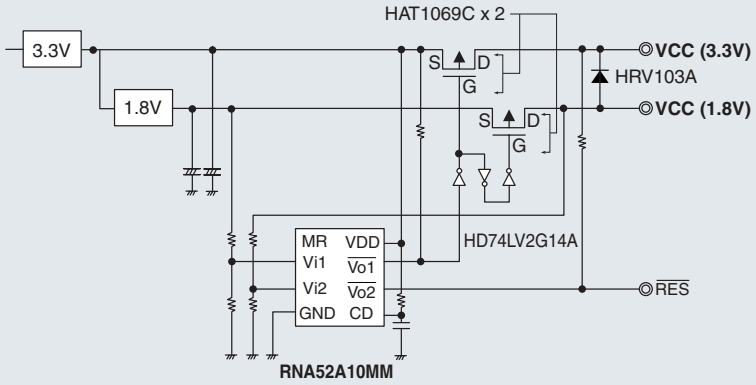
●Standard Linear ICs

Example of Starting Two Power Supplies Simultaneously Using a Multifunction Reset IC

[Required waveform example]

When attempting to start two power supplies simultaneously,
strictly speaking there is always a certain gap in the timing.
This configuration example is designed to make that gap as small as possible.

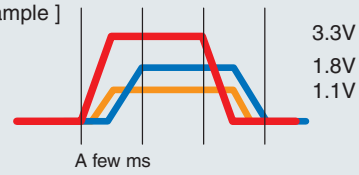
[Circuit example]



Note: This circuit diagram is intended for reference only. Careful verification should be performed before actually using this design ina a system.

Example of Starting Two Power Supplies Simultaneously Using a Multifunction Reset IC

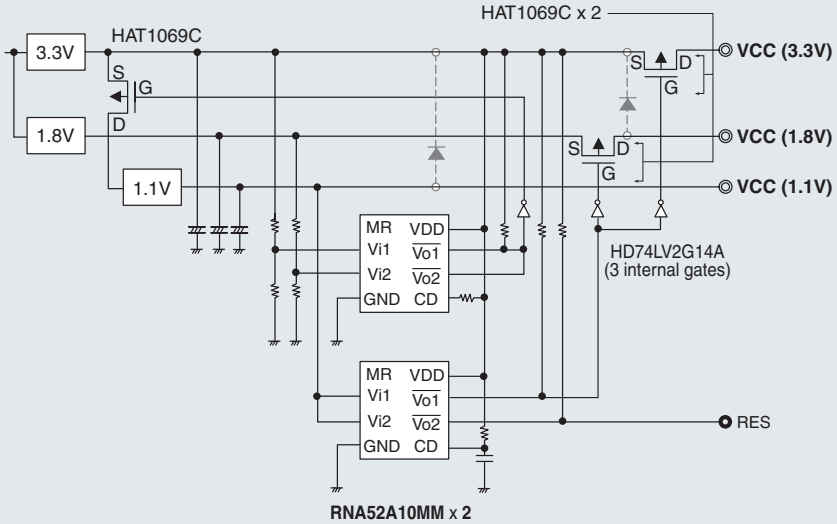
[Required waveform example]



Note: Simultanneous startup of SH7785 MCUs, etc.

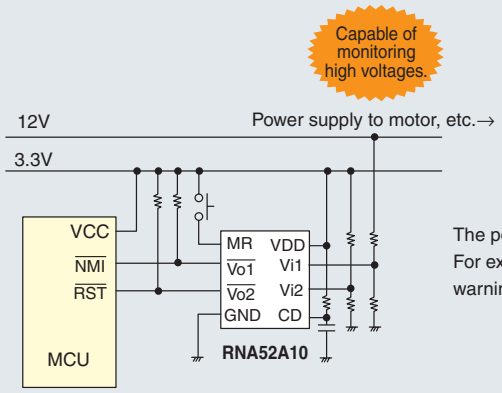
In this case an external power supply unit must be used due to the large current requirements.
Simultaneous power supply startup can be difficult under these circumstances.
This configuration example is designed to deal with this problem.

[Circuit example]



Note: This circuit diagram is intended for reference only. Careful verification should be performed before actually using this design ina a system.

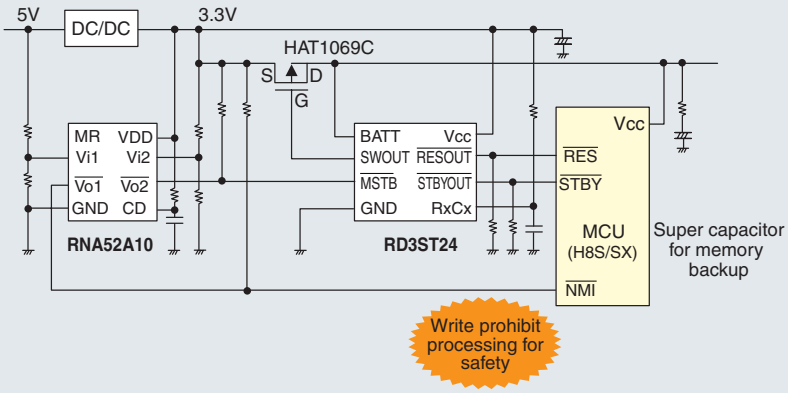
Multiple Power Supply Application Example a Multifunction Reset IC



The power supply to the RNA52A10MM enables monitoring of a separate voltage. For example, it is possible to monitor a motor drive power supply and have a warning lamp light when a voltage drop occurs.

Note: This circuit diagram is intended for reference only. Careful verification should be performed before actually using this design ina a system.

Circuit Example Using a Multifunction Reset IC for Memory Write Prohibit Processiong Before Hardware Standby



The hardware standby function of the H8S/SX can be used to maintain data in on-chip memory.
Using a standby controller (RD3ST24) in combination enables a simpler circuit design.
When the RNA52A10 in used, data can be maintained in memory with a higher degree of safety because the transition to standby mode can be mad after write prohibit processing.

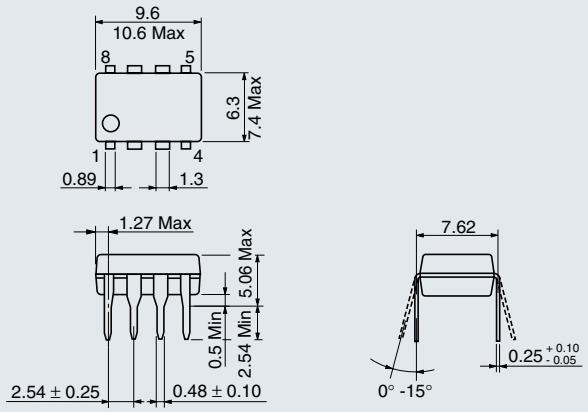
Note: This circuit diagram is intended for reference only. Careful verification should be performed before actually using this design ina a system.

Package Dimensions

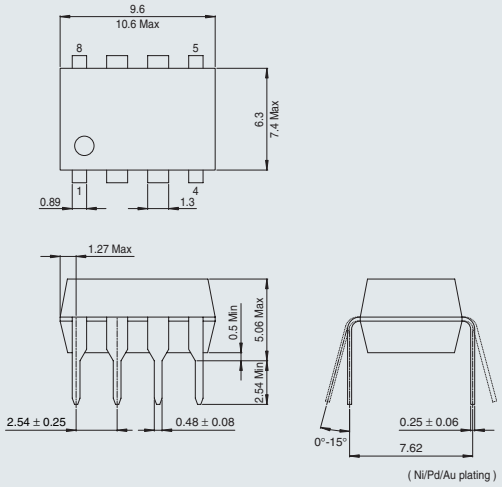
DIP

Package Name
Package Code (Units : mm)

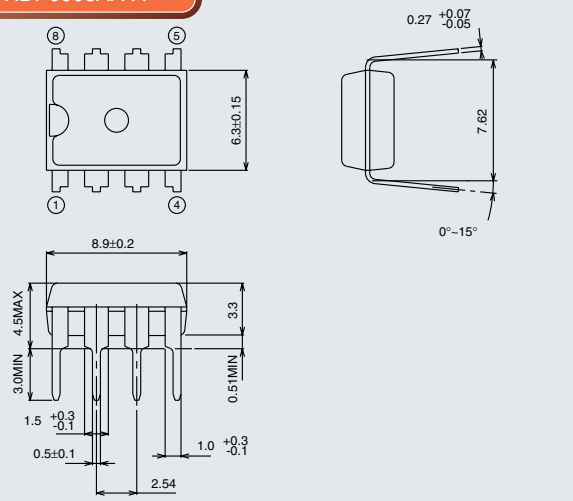
DP-8B
PRDP0008AF-A



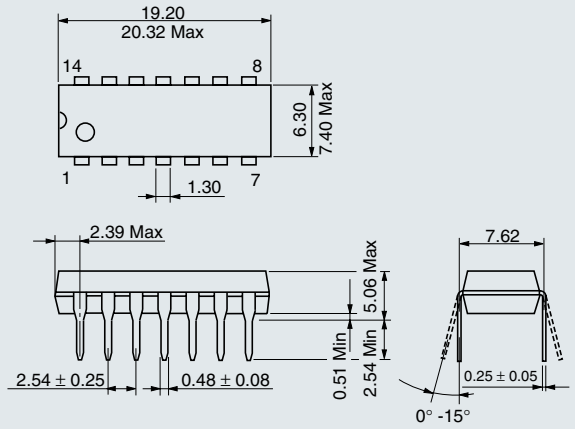
DP-8FV
PRDP0008AF-B



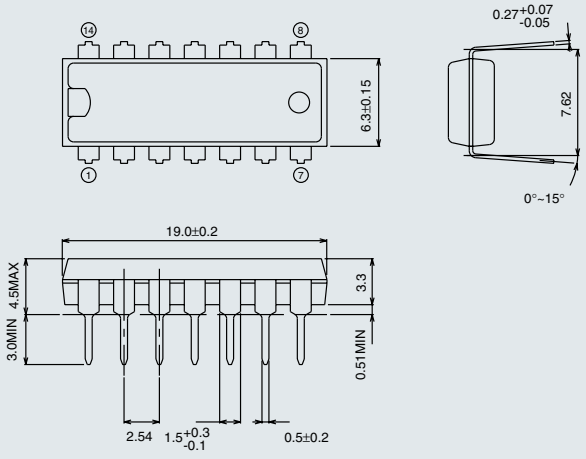
8P4
PRDP0008AA-A



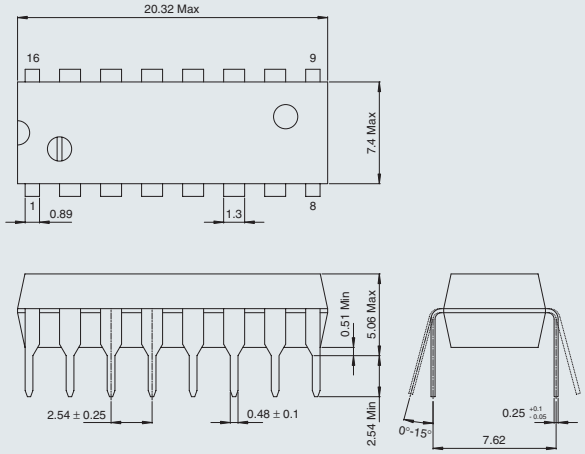
DP-14AV
PRDP0014AB-B



14P4
—



DP-16E
PRDP0016AE-A

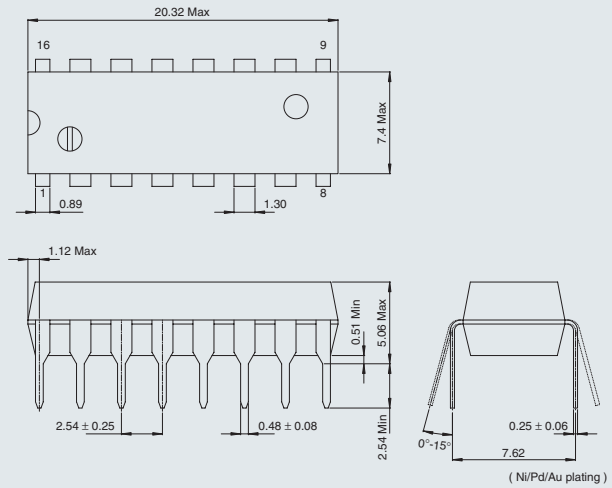


Package Dimensions

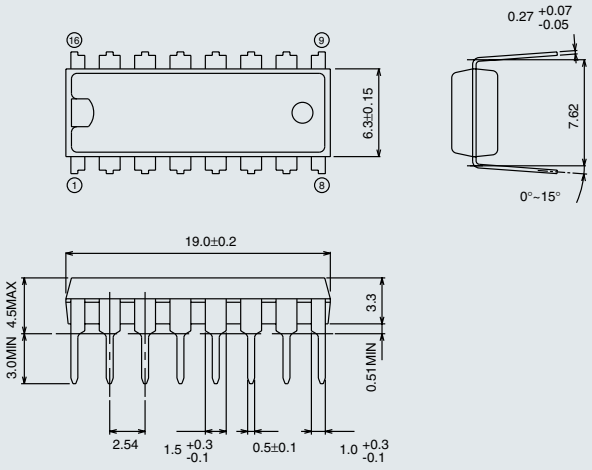
DIP

Package Name
Package Code (Units : mm)

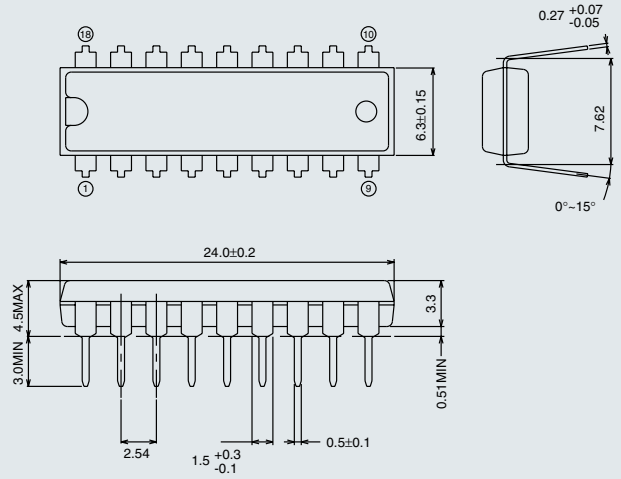
DP-16FV
PRDP0016AE-B



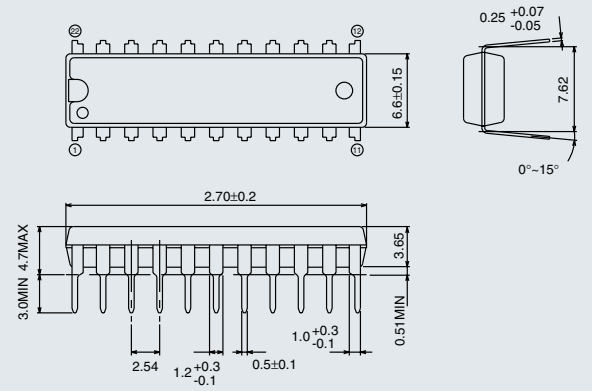
16P4
PRDP0016AA-A



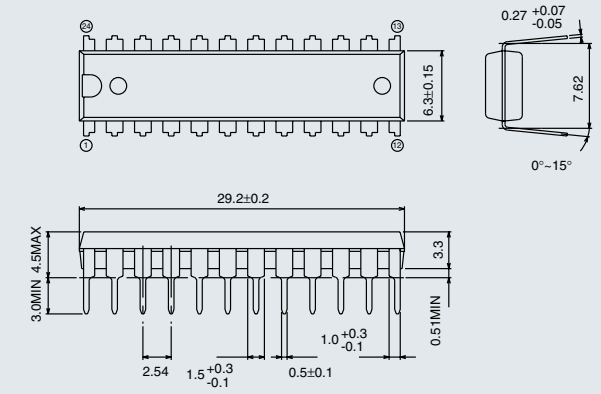
18P4
—



22P4H
—



24P4D
PRDP0024AA-A

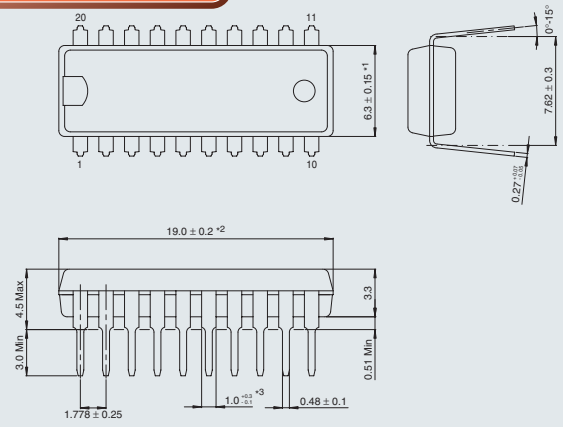


Package Dimensions

Package Name
Package Code (Units : mm)

SDIP

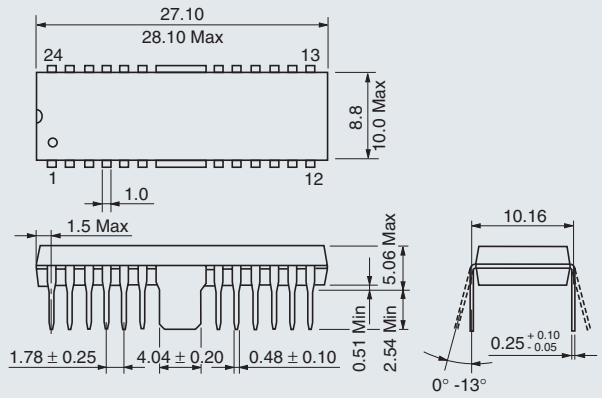
20P4B
PRDP0020BA-A



Notes) 1. Dimensions "*1" and "*2" do not include mold flash.
2. Dimension "*3" does not include trim offset.

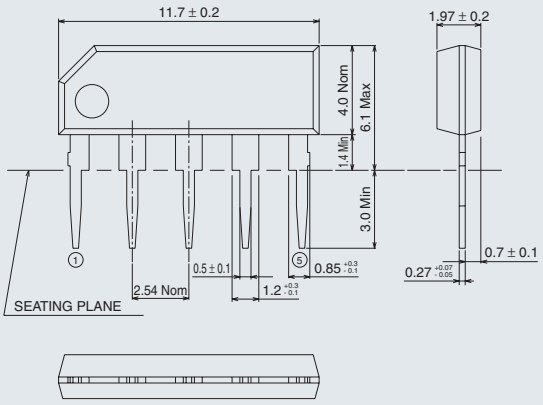
HSDIP

DP-24TS
—

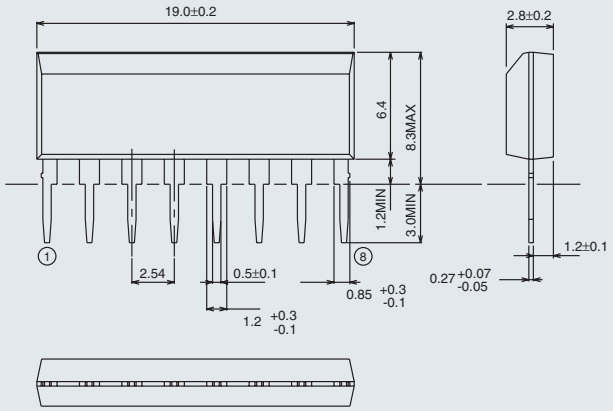


SIP

5P5T
—

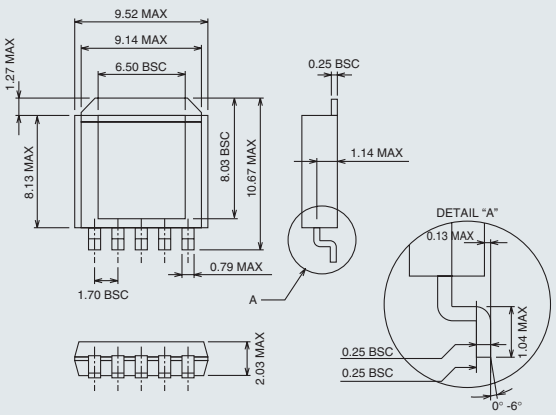


8P5
—

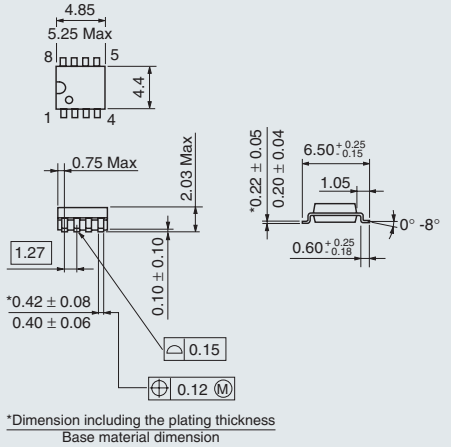


SOP

5pin Power Package
—



FP-8DGV (JEITA)
PRSP0008DE-B



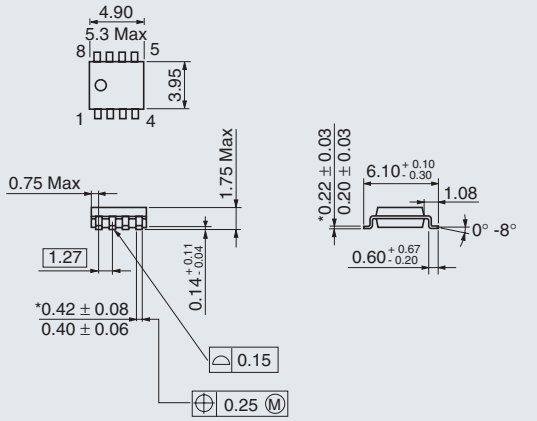
*Dimension including the plating thickness
Base material dimension

Package Dimensions

SOP

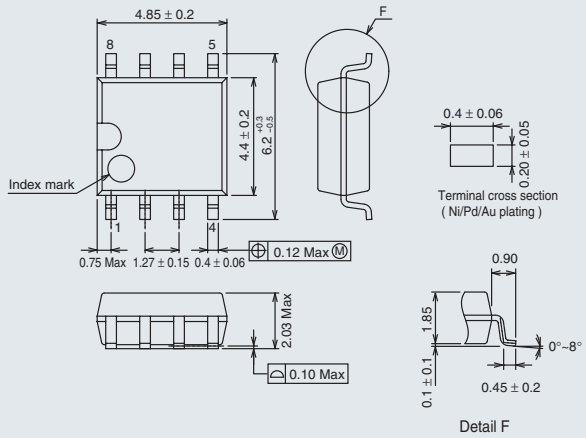
Package Name
Package Code (Units : mm)

FP-8DCV (JEDEC)
PRSP0008DD-C

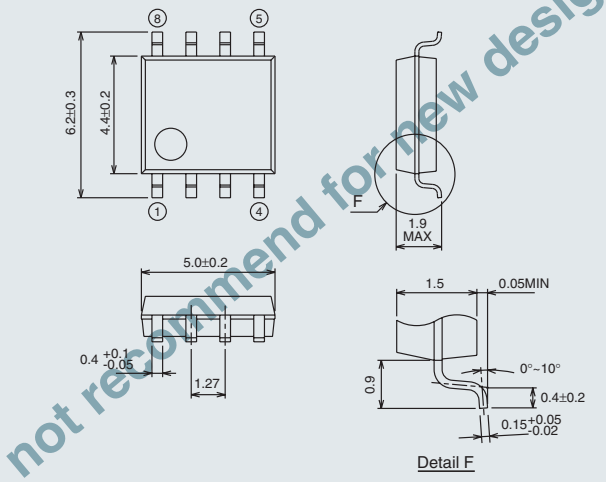


*Dimension including the plating thickness
Base material dimension

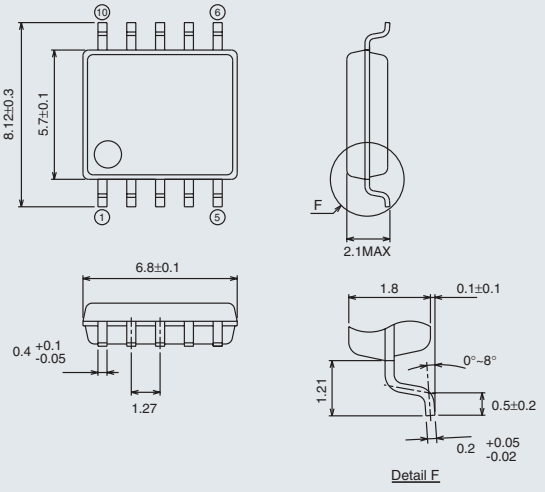
—
PRSP0008DE-C



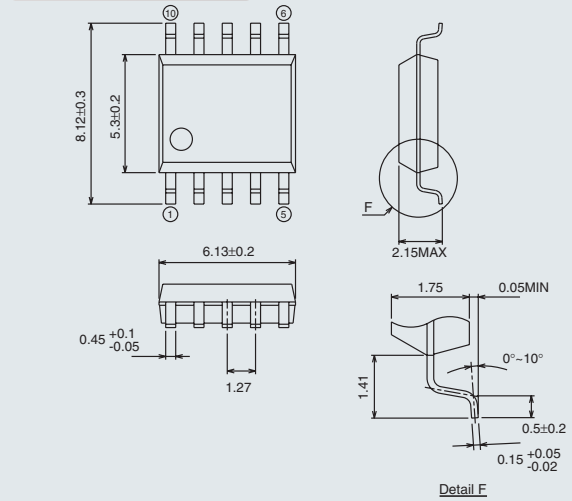
8P2S-A
PRSP0008DA-A



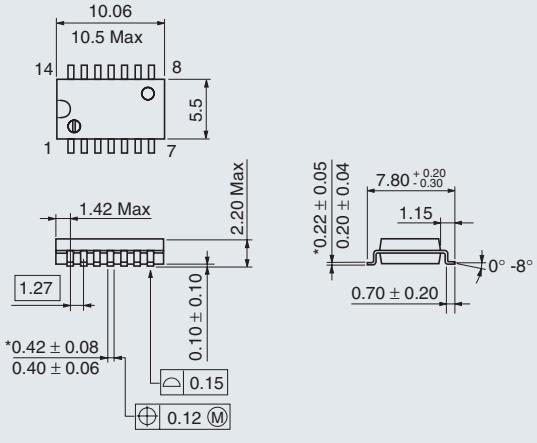
10P2N-A
PRSP0010DB-A



10P2-C
—



FP-14DAV (JEITA)
PRSP0014DF-B



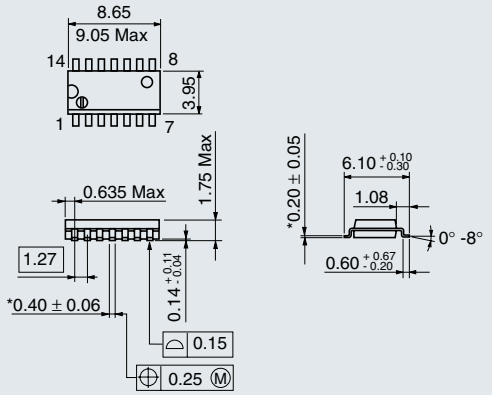
*Dimension including the plating thickness
Base material dimension

Package Dimensions

SOP

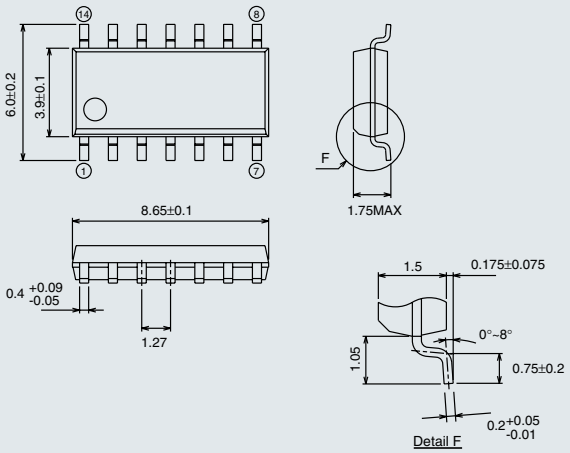
Package Name
Package Code (Units : mm)

FP-14DNV (JEDEC)
PRSP0014DE-A

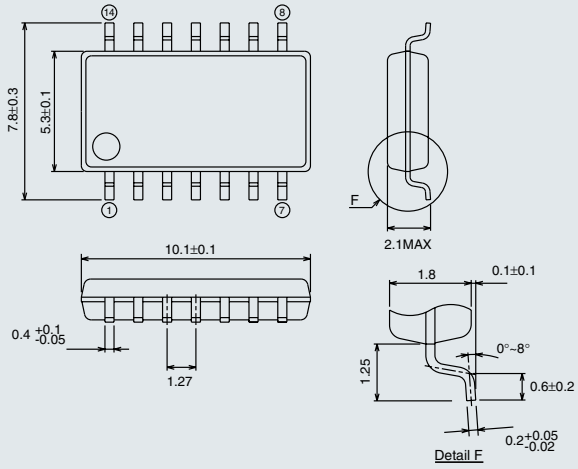


*Ni/Pd/Au plating

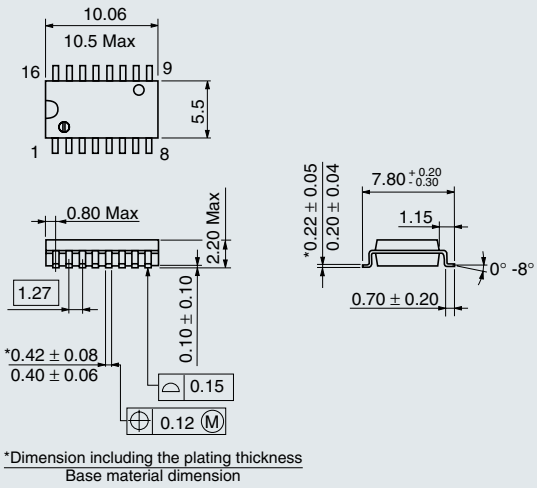
14P2P-A
—



14P2N-A
PRSP0014DD-A

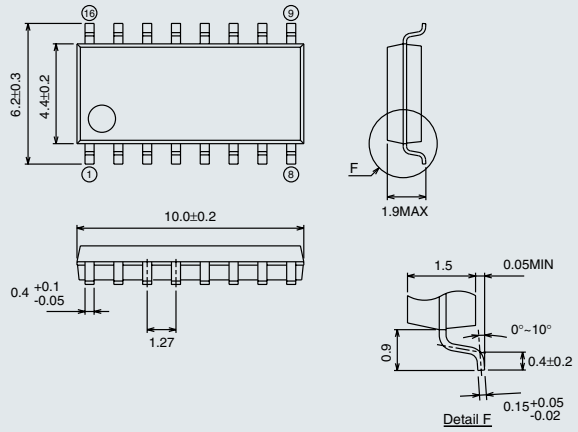


FP-16DAV (JEITA)
PRSP0016DH-B

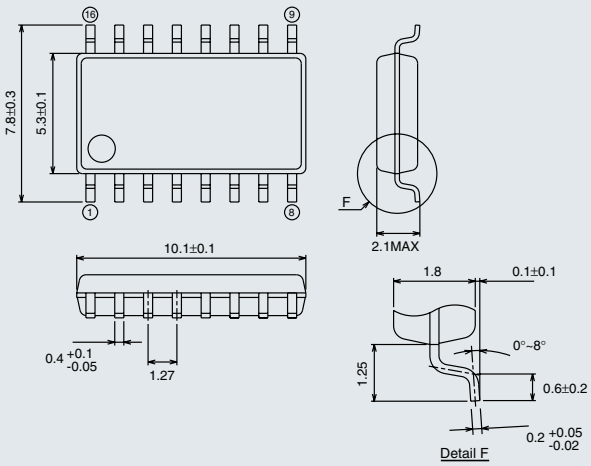


*Dimension including the plating thickness
Base material dimension

16P2S-A
—



16P2N-A
PRSP0016DE-A

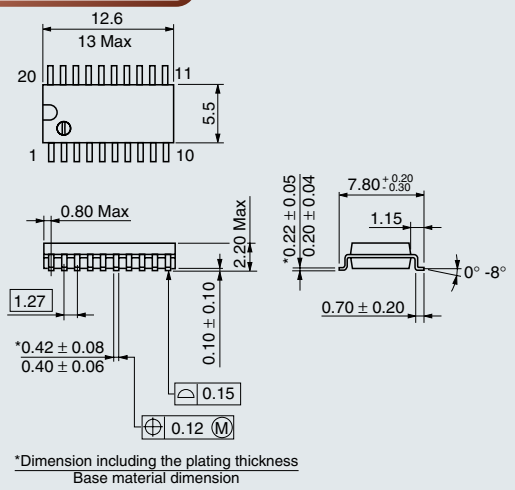


Package Dimensions

SOP

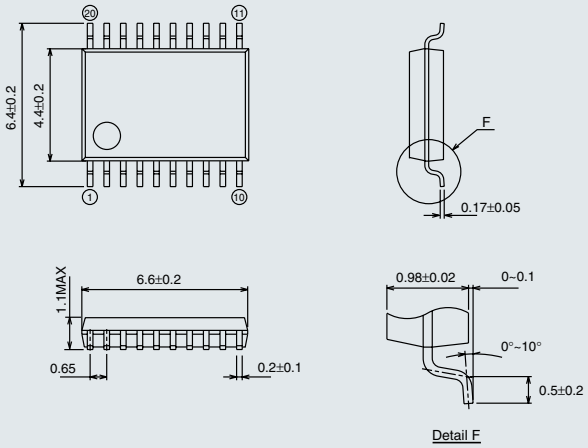
Package Name
Package Code (Units : mm)

FP-20DAV (JEITA)
PRSP0020DD-B

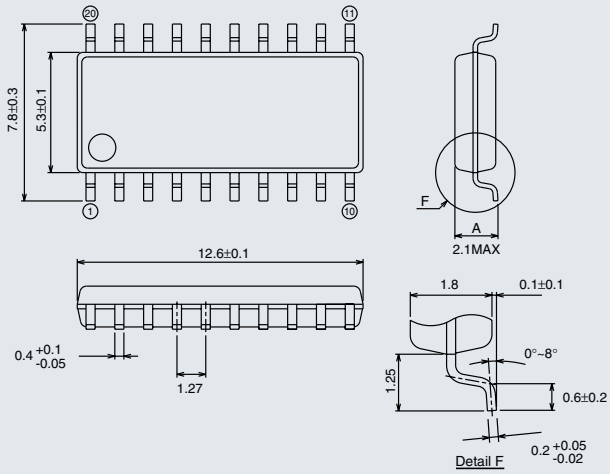


*Dimension including the plating thickness
Base material dimension

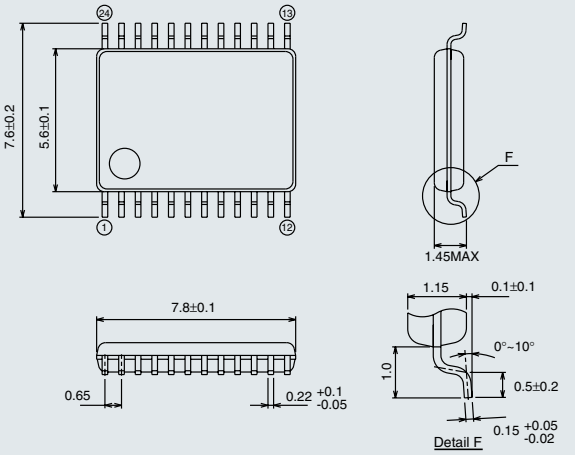
20P2X-A
—



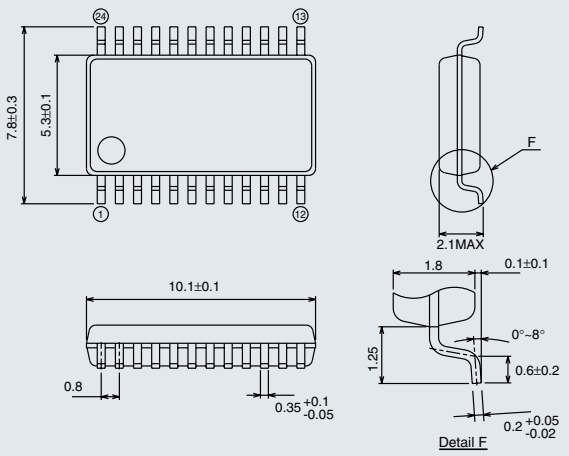
20P2N-A
PRSP0020DA-A



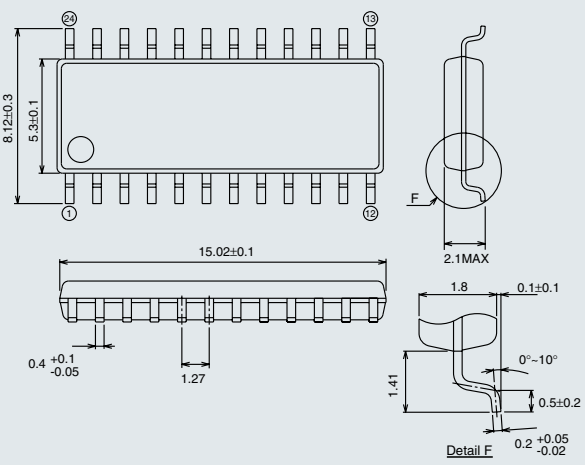
24P2E-A
PLSP0024JA-A



24P2Q-A
PRSP0024GA-A



24P2N-B
—



Package Dimensions

Package Name
Package Code (Units : mm)

SOP

24P2V-A
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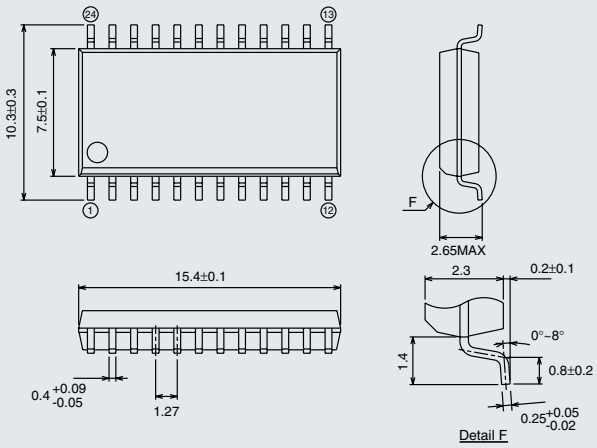

HSOP

FP-26DT (JEITA)
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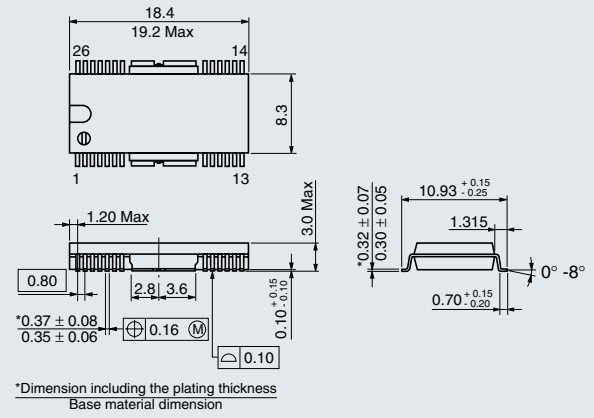
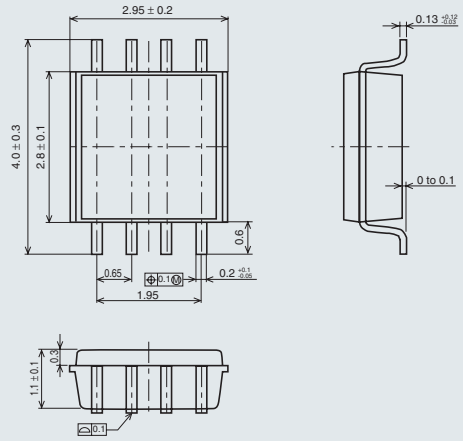
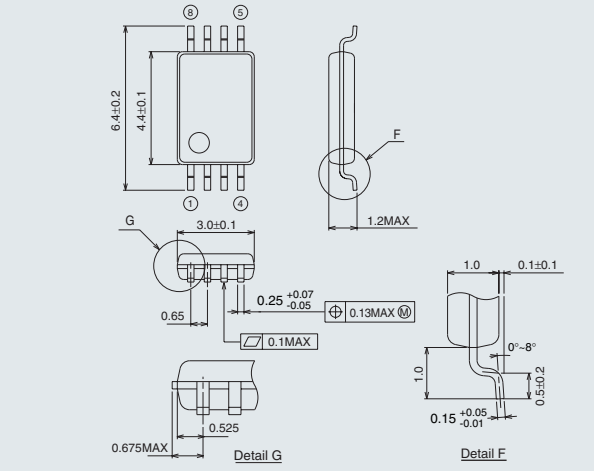


MMPAK-8
PLSP0008JC-A

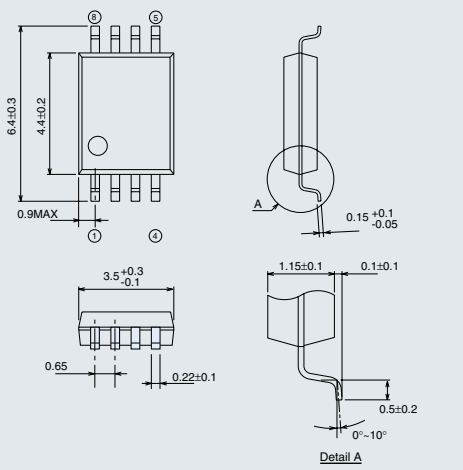


SSOP

8P2J-A
PTSP0008JA-A



8P2X-A
—

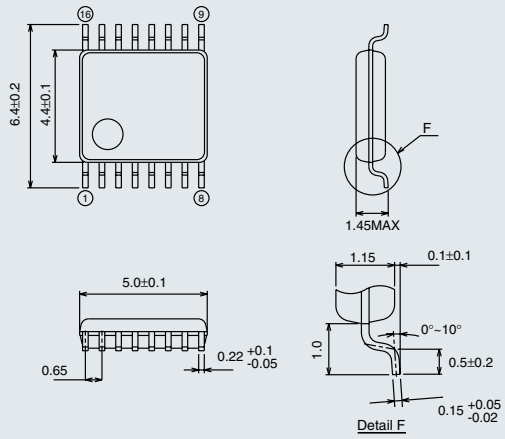


Package Dimensions

Package Name
Package Code (Units : mm)

SSOP

16P2E-A
PLSP0016JA-A



20P2E-A
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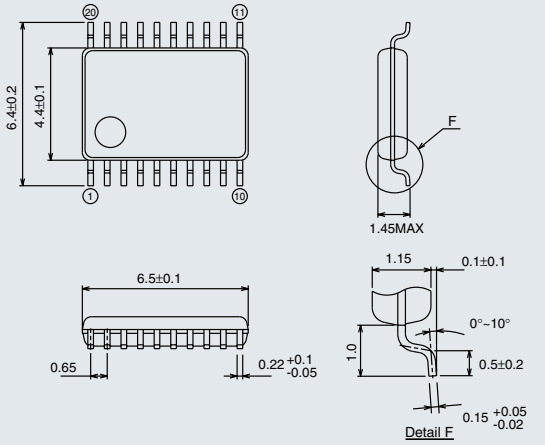
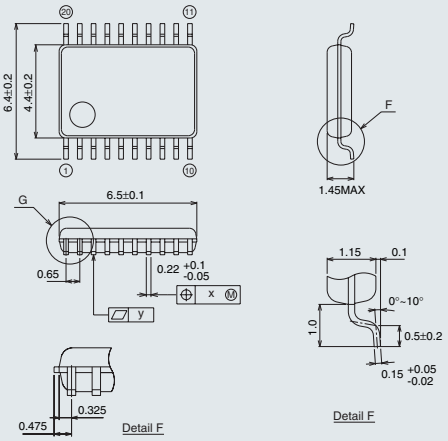
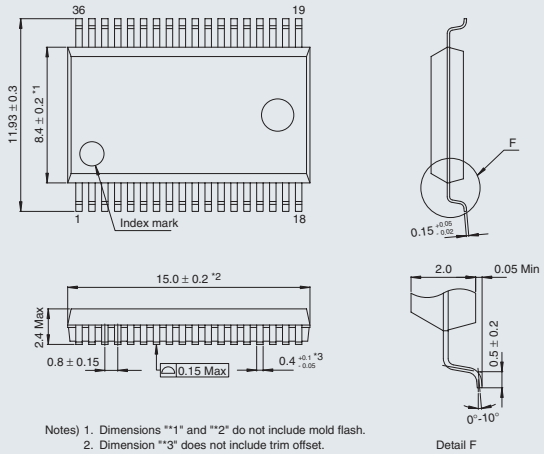


20P2F-A
PLSP0020JB-A



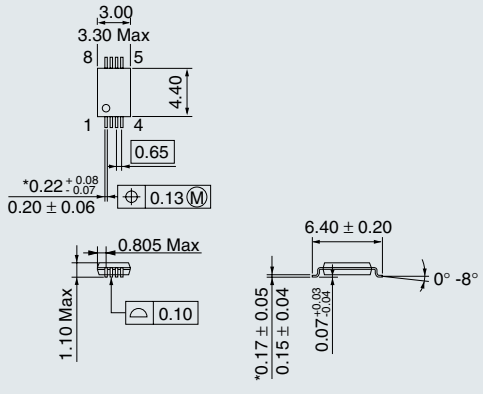
36P2R-A
PRSP0036GA-A



Notes) 1. Dimensions "*1" and "*2" do not include mold flash.
2. Dimension "*3" does not include trim offset.

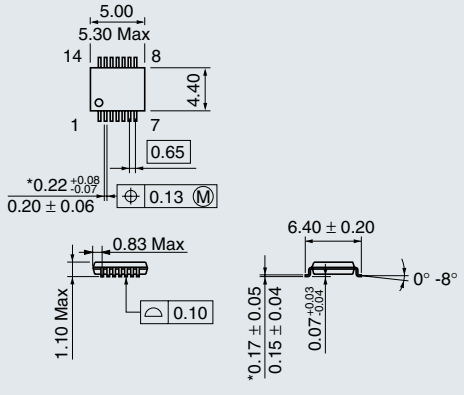
TSSOP

TTP-8DAV
PTSP0008JC-B



*Dimension including the plating thickness
Base material dimension

TTP-14DV
PTSP0014JA-B



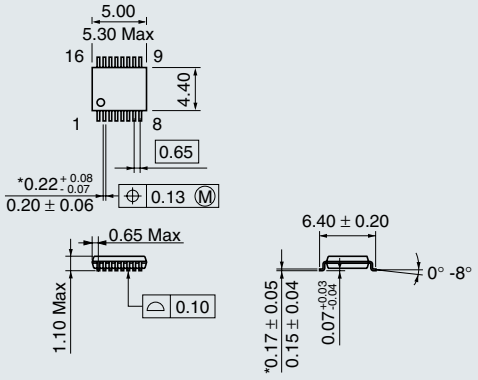
*Dimension including the plating thickness
Base material dimension

Package Dimensions

Package Name
Package Code (Units : mm)

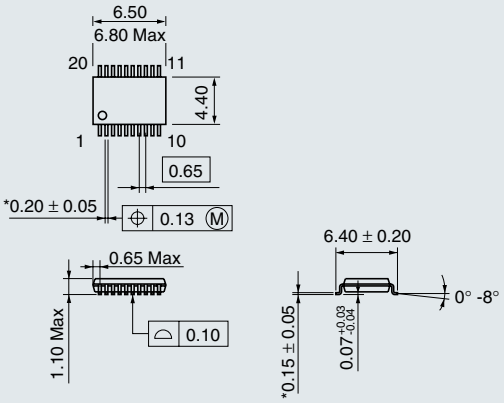
TSSOP

TTP-16DAV
PTSP0016JB-A



*Dimension including the plating thickness
Base material dimension

TTP-20DAV
PTSP0020JB-A



*Ni/Pd/Au plating

QFP

48P6D-A
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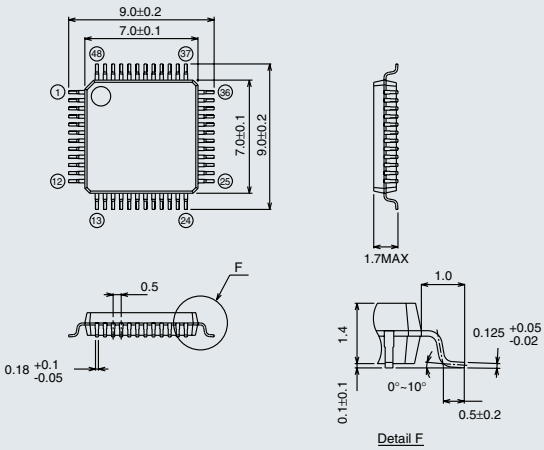

64P6S-A
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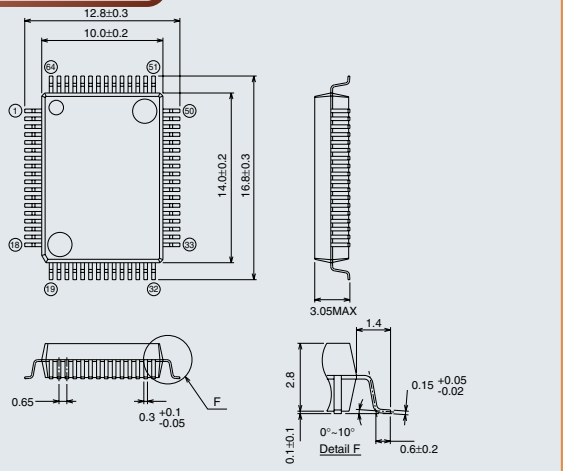
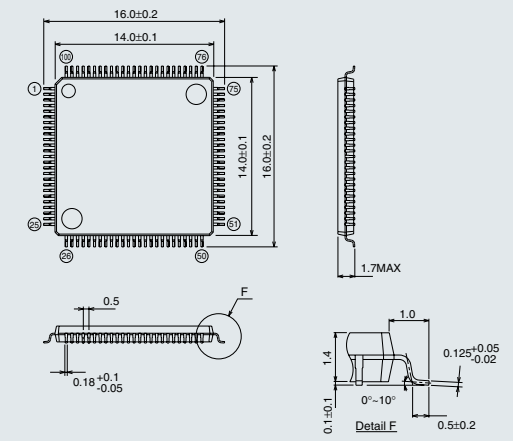


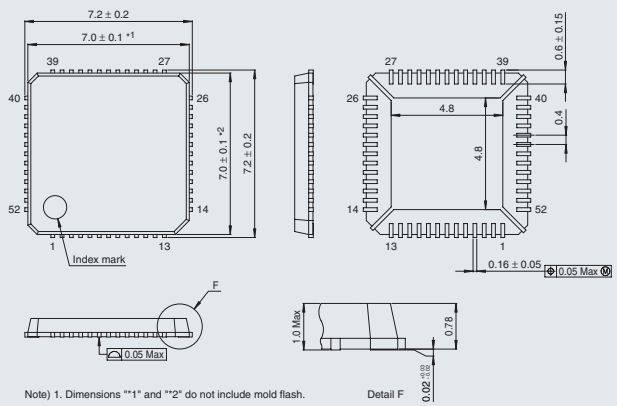
LQFP

100P6Q-A
PLQP0100KB-A



HVQFN

52PJV-A
PVQN0052LA-A



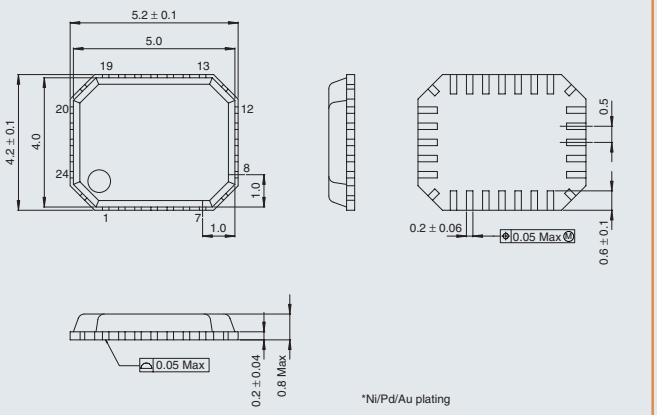
Note) 1. Dimensions "*1" and "*2" do not include mold flash.

Package Dimensions

Package Name
Package Code (Units : mm)

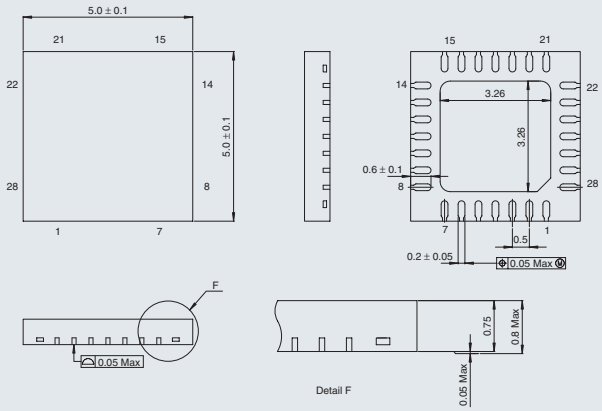
WQFN

TNP-24AV
PWQN0024KA-A



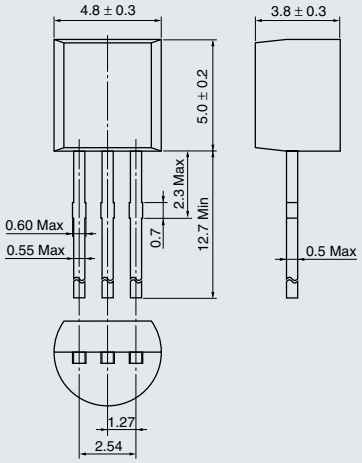
HWQFN

28PJW-A
PWQN0028KA-A



HWQFN

TO-92V
PRSS0003DA-A



TO-92L
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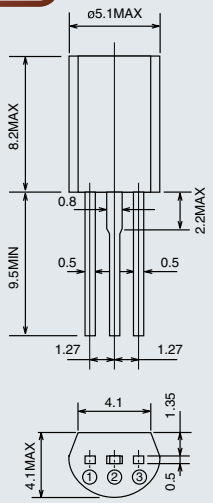
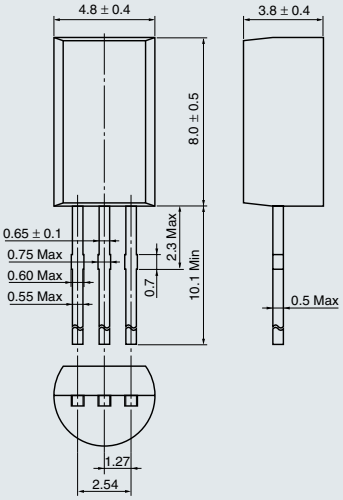
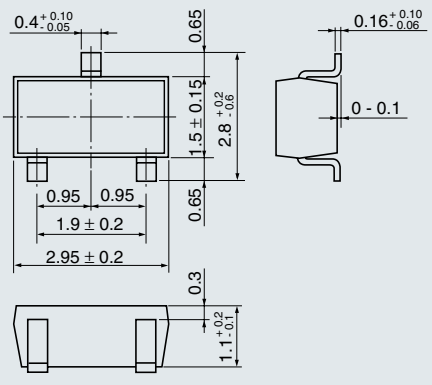


TO-92MODV
PLSP0024JA-A



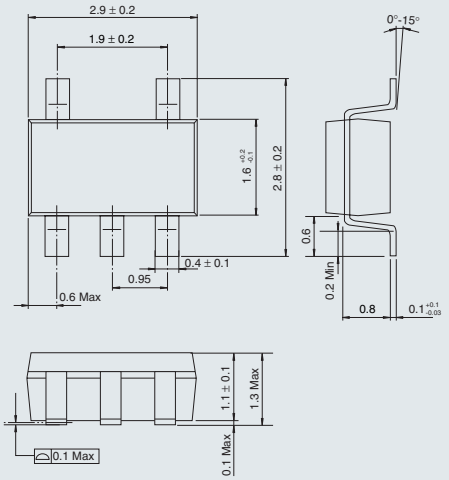
MPAKV
PLSP0003ZB-A



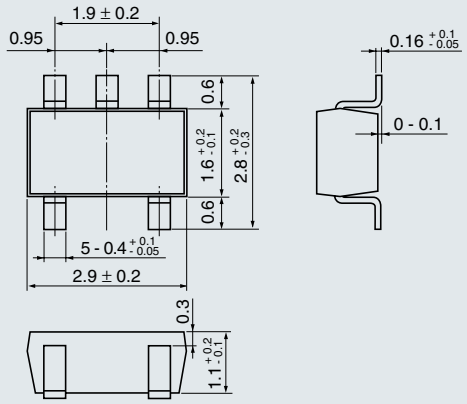
Package Dimensions

Package Name
Package Code (Units : mm)

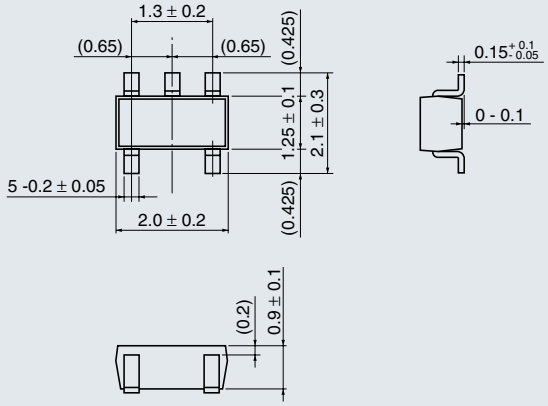
SOT-25
PLSP0005ZA-A



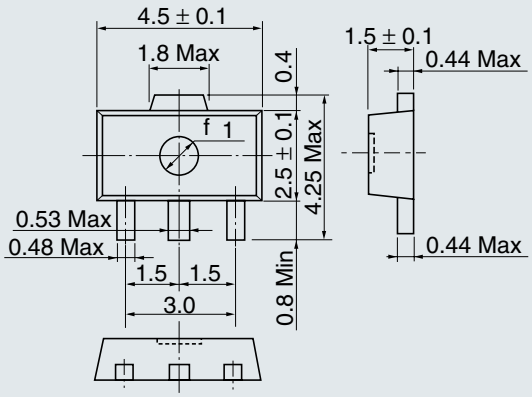
MPAK-5V
PLSP0005ZB-A



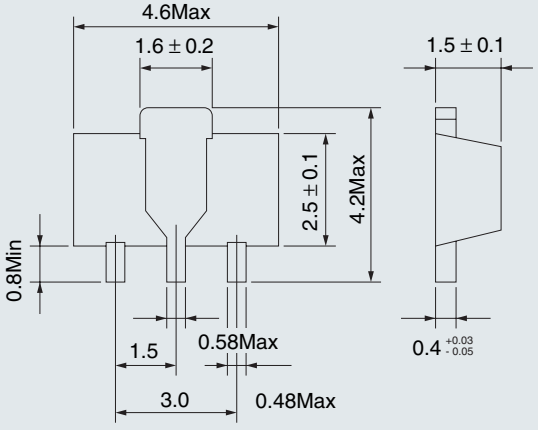
CMPAK-5V
PTSP0005ZA-A



UPAKV
PLZZ0004CA-A



SOT-89
PLZZ0004CB-A



Package Dimensions

Renesas New Package Code Destination

P R DP 0008 A F - A

- **P** — Package structure code (1 alphanumeric character)
- **R** — Package mounting height code (1 alphanumeric character)
- **DP** — Package appearance code (2 alphanumeric characters)
- **0008** — Number of pins (4-digit number)
- **A** — Pin pitch code (1 alphanumeric character)
- **F** — Appearance identification code (1 alphanumeric character; sequential)
  *No general common rules; this code is used to identify body shape and the like.
- **A** — Auxiliary appearance code (1 alphanumeric character; sequential)
  *No general common rules; this code is used to identify lead shape and the like.

Pin pitch code (1 alphanumeric character)

Code	Pin pitch	Code	Pin pitch	Code	Pin pitch
A	2.54	B	1.778	C	1.50
D	1.27	E	1.25	F	1.00
G	0.80	H	0.75	J	0.65
K	0.50	L	0.40	M	0.30
Z	Others				

Number of pins (4-digit number)

Display	No. Pins	Display	No. Pins
0000	Contact-less	0008	8 pin
Display	No. Pins	Display	No. Pins
0208	208 pin	0848	1848 pin

Package appearance code (2 alphanumeric characters)

Code	Appearance	Code	Appearance	Code	Appearance
BG	BGA				
CA	Card with connector	CB	No-contact card	CC	Card with surface-contact pin
DP	DIP	DT	DTP		
LG	LGA			PG	PGA
QF	QFF	QJ	QFJ	QN	QFN
QP	QFP	QT	QTP	QW	QFI
SA	TSOP(1)	SB	TSOP(2)	SF	SOF
SJ	SOJ	SN	SON	SP	SOP
SS	SIP	SV	SVP	SW	SOI
TP	Asymmetric DTP				
ZP	ZIP	ZZ	Special		

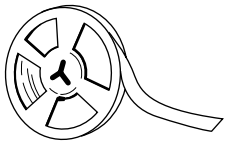
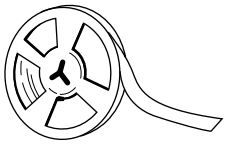
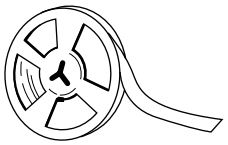
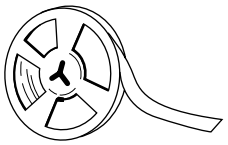
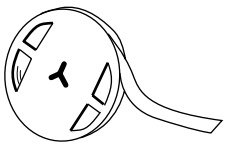
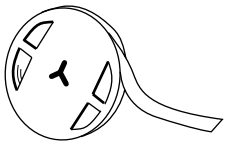
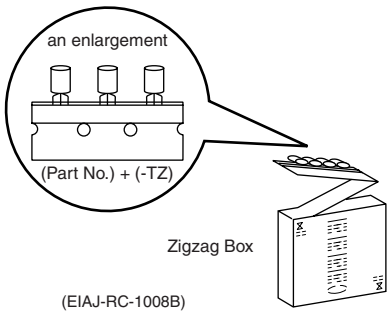
Package mounting height code (1 alphanumeric character)

Code	Description	Code	Description	Code	Description
R	1.70 < R	L	1.20 < L ≤ 1.70	T	1.00 < T ≤ 1.20
V	0.80 < V ≤ 1.00	W	0.65 < W ≤ 0.80	U	0.50 < U ≤ 0.65
X	X ≤ 0.50				

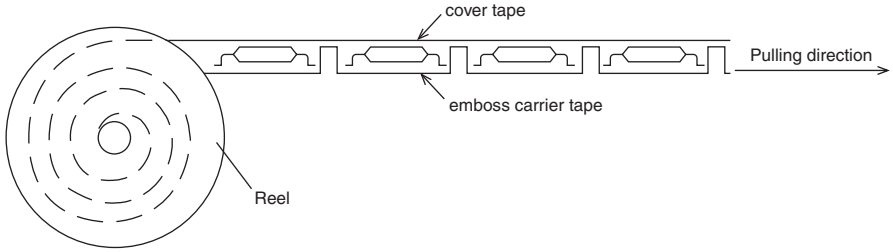
Package structure code (1 alphanumeric character)

Code	Description	Code	Description
C	Ceramic (Laminated ceramic)	G	Ceramic (Glass sealed)
M	Package consisting of metal	P	Package consisting of plastic
S	Package using wafer process	T	Package consisting of tape
W	Light transmissive package		

Taping

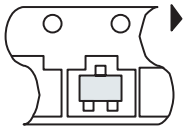
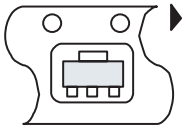
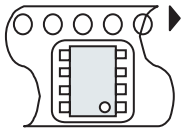
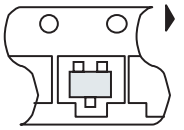
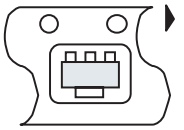
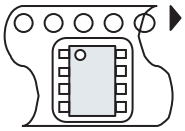
Package		Packing Unit (pcs/reel)	Symbol	Appearance	Magazine (pcs/Stick)	Magazine (pcs/Inner Box)
SOP (JEITA)	FP-8DGV	2,500	-EL	Pulling direction→  -EL (Part No.) + (-EL) 	100	1000
	FP14DAV/ 16DAV	2,000			50	1000
	FP-20DAV				40	1000
SOP (JEDEC)	FP-8DCV	2,500	-EL	Pulling direction→  -EL (Part No.) + (-EL) 	—	—
	FP-14DNV	2,500			—	2500
TSSOP	TTP-8DAV	3,000	EL	Pulling direction→  -EL (Part No.) + (EL) or (ELL) 	—	—
	TTP-14DV	2,000	ELL		—	2000
MMPAK-8		3,000	EL	Pulling direction→  -EL (Part No.) + (-EL) 	—	—
UPAKV		1,000 or 1,000 × 4	-TL	Pulling direction→  -TL (Part No.) + (-TL) 	25	2500
MPAK-5V MPAKV CMPAK-5V		3,000	-EL	Pulling direction→  -EL (Part No.) + (-EL) 	—	—
TO-92/ TO-92MODV		2,500 (pcs/BOX)	-TZ	 (EIAJ-RC-1008B)	—	—
DIP	DP-8	—	—	—	50	1000
	DP-14/16				25	1000
	DP-20				20	1000

Notes: Products with "-EL" and "-TL" (UPAKV) are the counterclockwise-reeled emboss-tape type.
Please order the products in multiples of 1000 in magazines.
Please order the products in packing units for shipment in reel.



Taping

Package		Emboss Taping (pcs/reel)		Tube (pcs/stick)		Tube (pcs/inner box)		Tray (pcs/tray)		Tray (pcs/inner box)	
		Normal	Moisture-proof	Normal	Moisture-proof	Normal	Moisture-proof	Normal	Moisture-proof	Normal	Moisture-proof
SIP	5P5P			45		4950					
	8P5			25		2500					
DIP	8P4			50		2250 or 2000					
	14P4			25		1125 or 1000					
	16P4			25		1125 or 1000					
	18P4			20		900 or 800					
	20P4			20		900 or 800 or 720					
	22P4H			17 19		765 or 680					
	24P4D			16		720 or 640					
SDIP	20P4B			25		1125 or 1000					
SOP	8P2S-A		3000	100		15000					
	10P2-C	2000	2000	80	80	8000 or 4800	1920 or 2560				
	10P2N-A		2000	70	70	7000	2240 or 4200				
	14P2P-A		3000	60	60	9000	1800				
	14P2N-A		2000	50	50	5000	1600 or 3000				
	16P2S-A		3000	50		7500					
	16P2N-A		1000	50	50	5000	1600 or 3000				
	20P2N-A		2000	40	40	4000	1280 or 2400				
	24P2N-B		2000	35	35	3500	1120 or 2100				
	24P2V-A		1000	30	30	2400	1800				
SSOP	8P2J-A										
	16P2E-A		3000 or 2500	90	90	2160	900				
	20P2E-A		4000 or 2500 or 500	70 80	70 80	1680 7680	4000 4000				
	24P2E-A		2500	60	60 65	5760	600 6240				
	24P2Q-A		2000	50	50	5000	1600 or 3000				
	36P2R-A		1000	35	35	2100	350 or 980		250		1250
LQFP	48P6D-A		1000						144		720

C Indicates T_1 direction			
D Indicates T_2 direction			

Part No. Composition

M51943 ML - D F 0J

- 0J: Internal code
- F: Lead plating specification ►
- D: Taping and packing specification ►
- ML: Package type ►
- M51943: Product type number

HA1630 S01 CM EL

RNA5 2A10 MM EL

- EL: Taping and packing specification ►
- MM: Package type ►
- 2A10: Internal code
- RNA5: Product type number ►

► Lead plating specifications

6	General product
F	Lead-free product

► Taping and packing specifications

D	Embossed tape (see the figure at right)
C	Embossed tape (see the figure at right)
A	Paper tape (TO-92L)
T	Tube (SIP)

► Package types

ML	SOT-89
SL	TO-92L
FP	SOP
GP	SOT-23, SSOP
HP	SOT-23

► Product type number (Base series)

HA1630	CMOS Operational Amplifier
HA1631	CMOS Comparator
HA17	Standard Linear IC
HA16	Standard Linear IC (for industry)
RNA5	Reset IC
RNB	Overseas Sales Only

► Taping and packing specifications

E	Embossed tape CMPAK, VSON, SSOP
EL	Embossed tape, left-winded SOP, TSSOP (24 or more pins)
ELL	Embossed tape, left-winded, large diameter TSSOP (20 or less pins)

► Package types

P	DIP, TO-92, TO-92MOD
F, FP	JEITA SOP
RP	JEDEC SOP
T	TSSOP, TVSOP-80
LP	MPAK-5
CM	CMPAK
LTP	MPAK
US	SSOP-8
U	UPAK
MM	MMPAK-8
PS	DIP-8
–	DIP

Description on Individual Products

●Power Management Linear ICs

PFC Control IC

HA16174P/FP

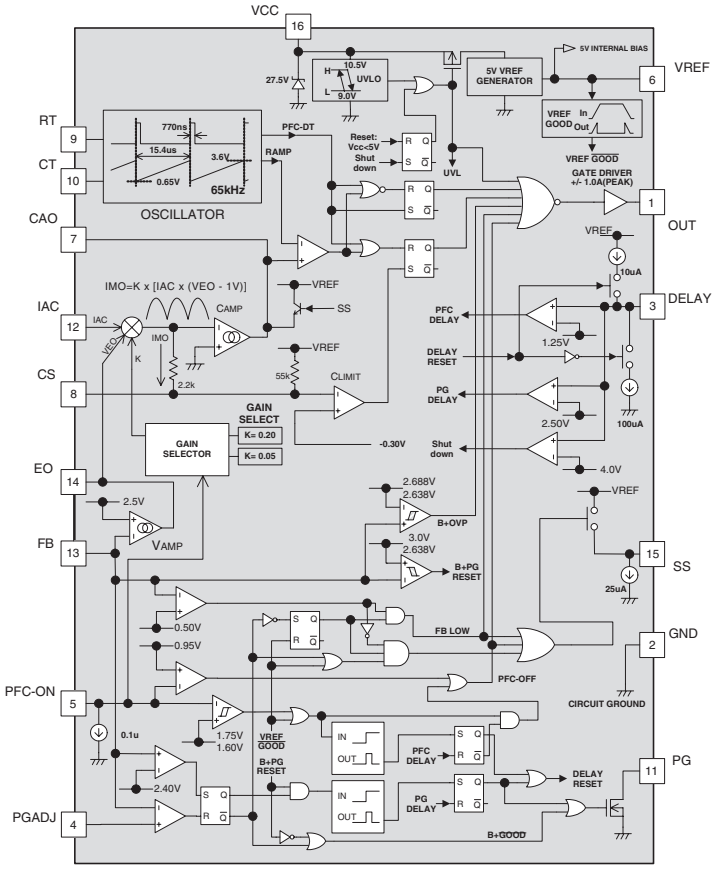
FEATURES

- Average Current Mode Control
- Boost Regulator Control
- World Wide Input Operation
- PFC Function ON/OFF Control
- Over Voltage Protection
- Soft Start Function
- Hold Time Adjust Function
- Programmable Power Good Signal Output (Open Drain Output)
- Package Lineup : DILP-16, SOP-16

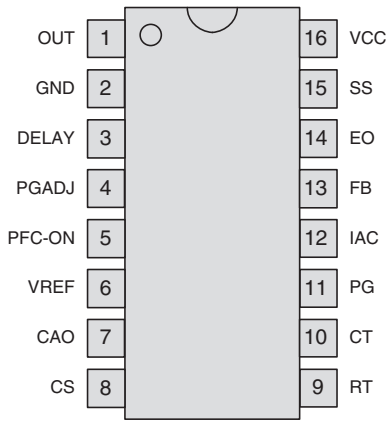
APPLICATION

- FPD,etc

BLOCK DIAGRAM



PIN ARRANGEMENT (TOP VIEW)



DIL-16P(DP-16E)
SOP-16P(FP-16DAV)

Critical conduction mode interleaved PFC control IC

R2A20112SP/DD

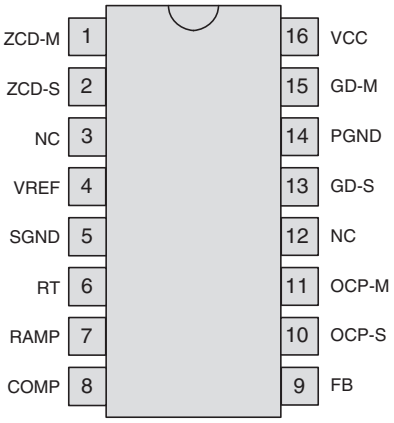
FEATURES

<Maximum Ratings>
- Supply voltage Vcc: 24V
- Operating junction temperature Tjopr: -40 to +150˚C

<Electrical characteristics>
- VREF output voltage VREF: 5.0V±3%
- UVLO operation start voltage VH: 10.5V±0.7V
- UVLO operation shutdown voltage VL: 9.3V±0.5V
- UVLO hysteresis voltage Hysuvl: 1.2V±0.5V

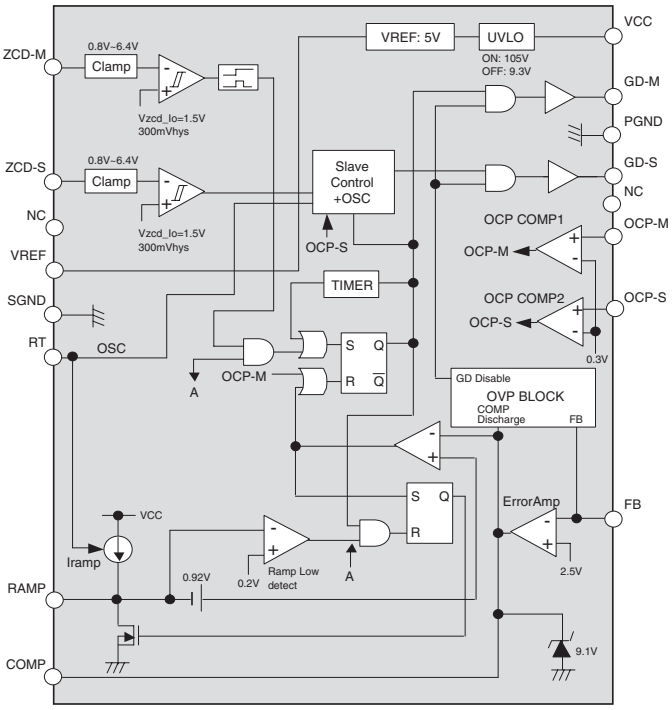
<Functions>
- Boost converter control with critical conduction mode
- Interleaving control
- Two mode overvoltage protection
  Mode1: Dynamic OVP corresponding to a voltage rise by load change
  Mode2: Static OVP corresponding to overvoltage in stable
- Feedback loop open detection
- Master and Slave independenced overcurrent protection
- 280µs restart timer
- Package lineup: Pb-free SOP-16/DILP-16

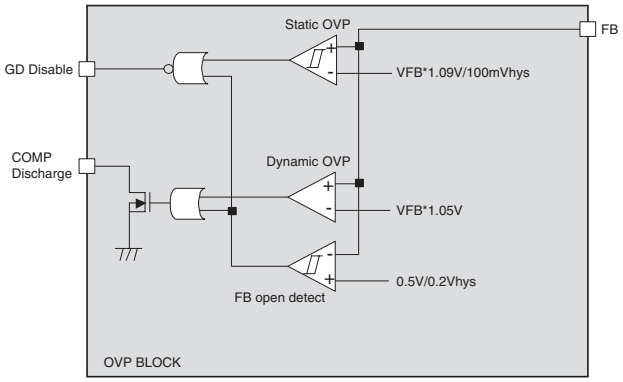
PIN ARRANGEMENT (TOP VIEW)



DIL-16P(DP-16FV)
SOP-16P(FP-16DAV)

BLOCK DIAGRAM





●Power Management Linear ICs

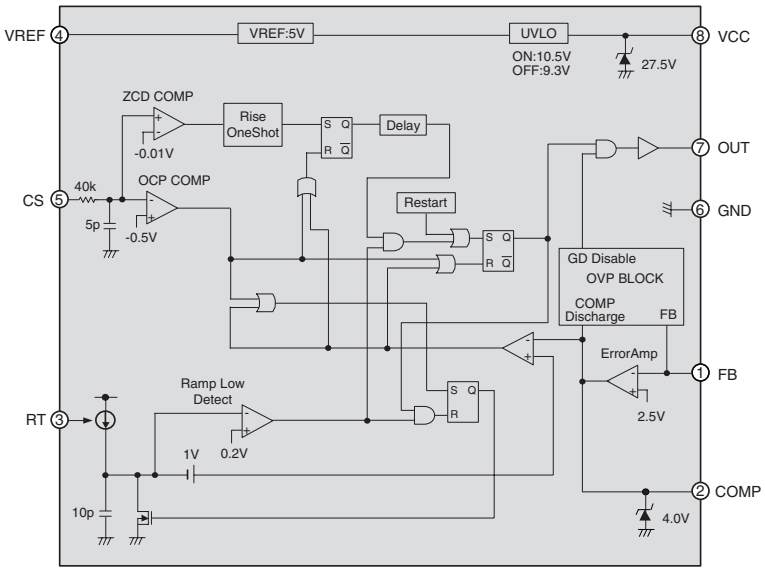
Critical Conduction mode PFC IC

R2A20113SP/DD

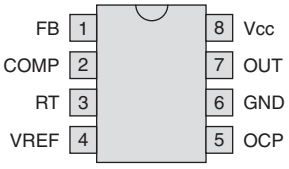
FEATURES

- High Efficiency-Critical Conduction Mode (CRM)
- High voltage line less
- ZCD line less
- Dynamic, Static OVP function
- Feed back loop open detection function
- Package Lineup: SOP-8, DILP-8

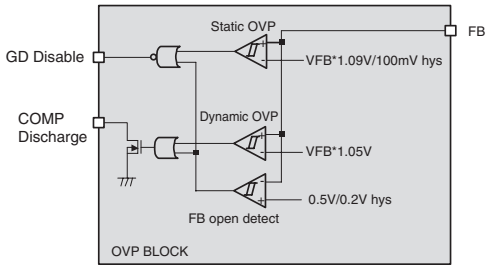
BLOCK DIAGRAM



PIN ARRANGEMENT (TOP VIEW)



DIL-8P
SOP-8P



Power Factor Correction Controller IC

R2A20111SP/DD

FEATURES

<Maximum ratings>
- Power-supply voltage Vcc: 24 V
- Operating junction temperature Tjopr: -40 to 125˚C

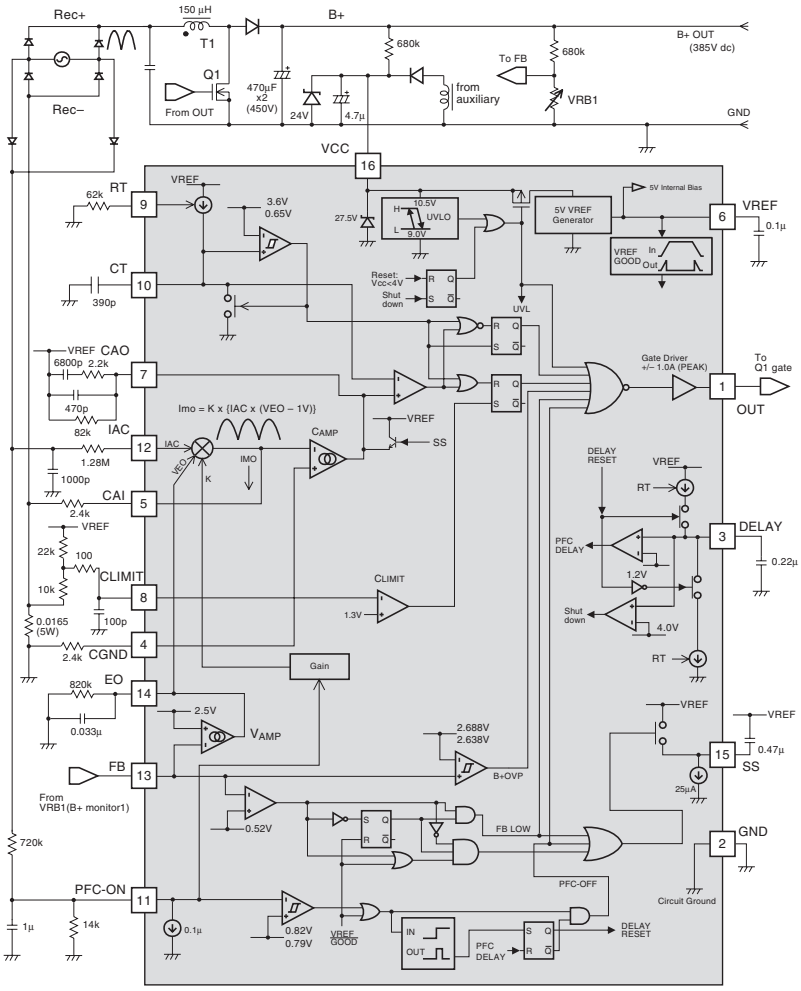
<Electrical characteristics>
- VREF output voltage VREF: 5.0V ± 3%
- UVLO operation start voltage VH: 10.5 ± 0.9 V
- UVLO operation stop voltage VL: 9.0 ± 0.7 V
- PFC output maximum ON duty Dmax-out: 95% (typ.)

<Functions>
- Constant power limit function
- Continuous conduction mode
- Hold function of PFC operation on momentary outage (PFC hold function)
- Overvoltage detection
- Overcurrent detection
- Soft start
- Feedback loop disconnection detection
- IC shutdown function
- Package lineup: SOP-16 and DILP-16

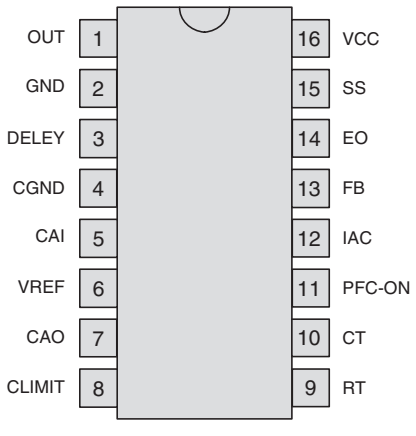
APPLICATION

- Flat panel display
- Projector
- Desktop PC
- White goods

BLOCK DIAGRAM



PIN ARRANGEMENT (TOP VIEW)



DIL-16P(DP-16FV)
SOP-16P(FP-16DAV)

Ordering Information

Part No.	Package Name	Package Code	Taping Spec.
R2A20111SPW0	FP-16DAV	PRSP0016DH-B	2000 pcs./one taping product
R2A20111DDU0	DP-16FV	PRDP0016AE-B	-

Description on Individual Products

●Power Management Linear ICs

Power Factor Correction Controller IC

HA16178P/FP

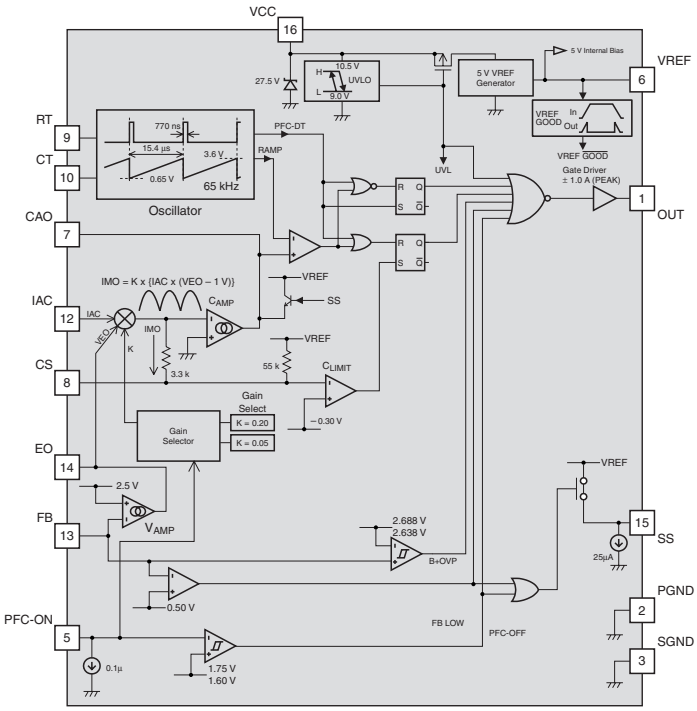
FEATURES

<Maximum ratings>
- Power-supply voltage Vcc: 24 V
- Operating junction temperature Tjopr: -40 to 125˚C

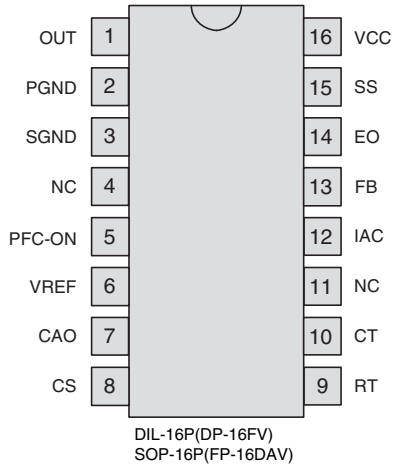
<Electrical characteristics>
- VREF output voltage VREF: 5.0 V ± 3%
- UVLO operation start voltage VH: 10.5 ± 0.7 V
- UVLO operation stop voltage VL: 9.0 ± 0.5 V
- PFC output maximum ON duty Dmax-out: 95% (typ.)

<Functions>
- Continuous conduction mode
- Over voltage detection
- Over current detection
- Soft start
- Feedback loop disconnection detection
- PFC function on/off control
- Package lineup: SOP-16 and DILP-16

BLOCK DIAGRAM



PIN ARRANGEMENT (TOP VIEW)



DIL-16P(DP-16FV)
SOP-16P(FP-16DAV)

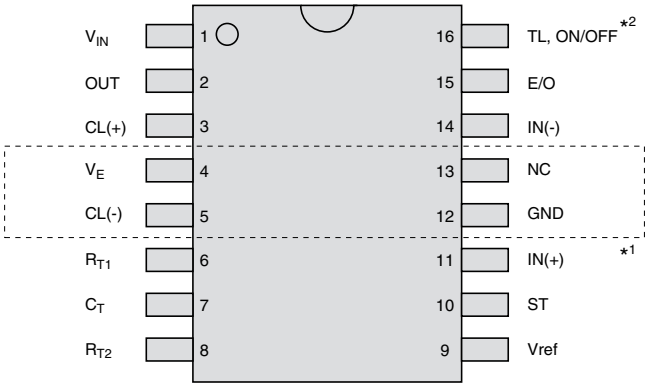
PWM Switching Regulator for High-performance Voltage Mode Control

HA16107P/FP, HA16108P/FP

FEATURES

- Operating frequencies up to a high 600 kHz
- Built-in pre-driver circuit for driving power MOS FET (output current ±2.0A peak in maximum rating)
- Built-in timer latch over-current protection function (HA16107)
- The OCL enables intermittent operation by an ON/OFF timer for prevention of secondary overcurrent. (HA16108)
- The UVL function (under voltage lockout) is applied to both Vin and Vref.
- ON/OFF reset: an auto-reset function which is based on the time constant of an external capacitor and observation ofdropsin Vin.
- Since the over-voltage protection function OVP (the TL pin) only observes voltage drops in Vin, it is possible to use the OVP and ON/OFF pin for independent purposes.
- Built-in 34 V Zener diode between Vin and ground.

PIN ARRANGEMENT (TOP VIEW)

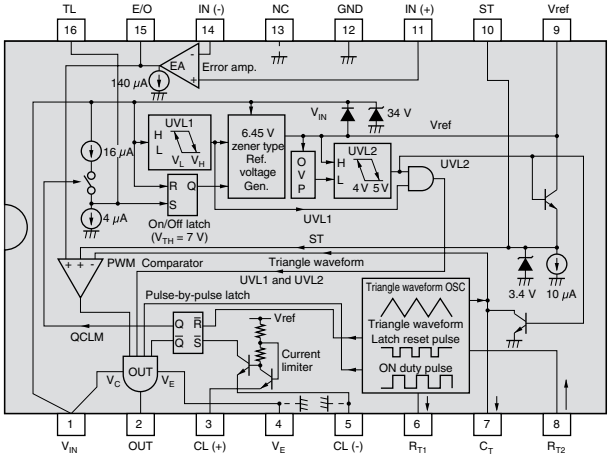


DIL-16P(DP-16E)
SOP-16P(FP-16DAV)

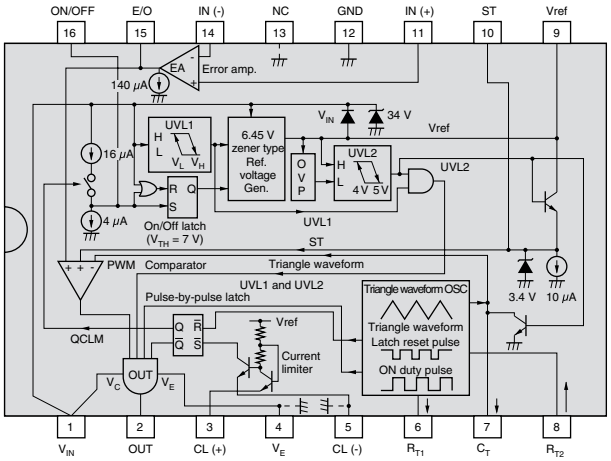
Notes: 1. In the SOP package models (HA16107FP and HA16108FP) pins 4, 5, and 13 are connected inside the IC. However, all must be connected to the system ground.
2. Pin 16 is TL (HA16107), ON/OFF (HA16108).

BLOCK DIAGRAM

• HA16107P/FP



• HA16108P/FP



Note: Dotted lines apply to the SOP package model (pins 4, 5, and 13: ground)

Description on Individual Products

●Power Management Linear ICs

High Speed Current Mode PWM Control IC for Switching Power Supply

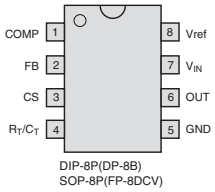
HA17384SPS/SRP, HA17384HPS/HRP, HA17385HPS/HRP

FEATURES

- Built-in high-safety UVL circuit (Both VIN and Vref are monitored)
- High speed operation:
  -Current detection response time: 100 ns Typ
  -Maximum oscillation frequency: 500 kHz
- Low standby current: 170μA Typ
- Wide range dead band time
  (Discharge current of timing capacitance is constant 8.4 mA Typ)
- Power MOSFET directly drivable
  (Output current ±1A peak in maximum rating)
- OVP function (over voltage protection) is included *1
  (Output stops when FB terminal voltage is 7.0 V Typ or higher)
- TSD function (thermal shut-down protection) is included *1
  (Output stops when the temperature is 160°C Typ or higher)
- Built-in zener protection
  (Clamp voltage between VIN and GND is 34 V Typ)
- Wide operating temperature range:
  -Operating temperature: -20°C to +105°C
  -Junction temperature: 150°C *2
  Notes: 1. H series only. 2. S series only.

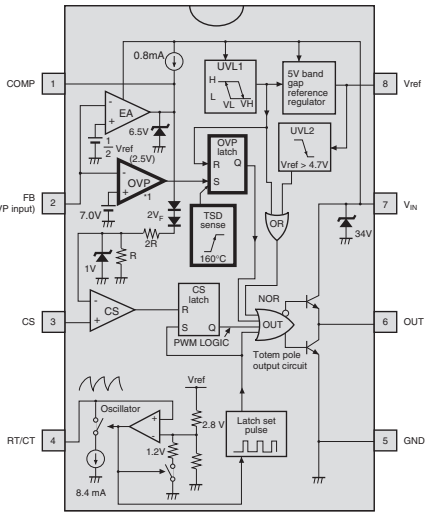
Part No. by package		Additional functions		UVL power supply threshold value voltage	
DILP8(DP-8B)	SOP8(FP-8DC)	TSD (overheating protection)	OVP (excess voltage protection)	$V_{TH\ UVL}$(V)Typ	$V_{TH\ UVL}$(V)Typ
HA17384SPS	HA17384SRP	–	–	16.0	10.0
HA17384HPS	HA17384HRP	○	○		
HA17385SPS	HA17385HRP	○	○	8.4	7.6

PIN ARRANGEMENT (TOP VIEW)



DIP-8P(DP-8B)
SOP-8P(FP-8DCV)

BLOCK DIAGRAM



Note: 1. Blocks with bold line are not included in HA17384SPS/SRP.

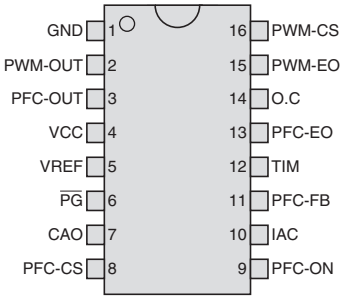
PFC and PWM Controller

HA16141P/FP, HA16142P/FP

FEATURES

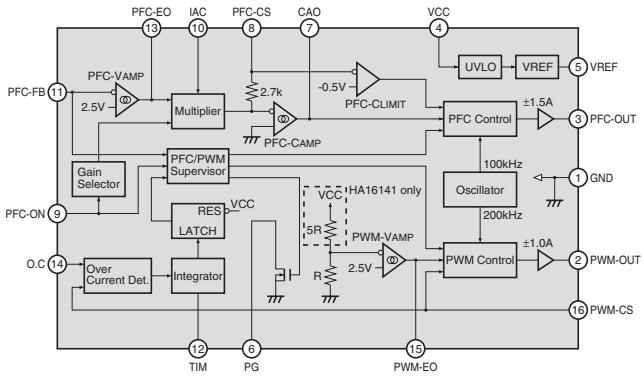
- Synchronized PFC and PWM timing
- Self oscillation with fixed frequency
  PFC : 100 kHz (±15 %)
  PWM : 200 kHz (±15 %)
- PFC function on/off control
- PFC boosted output voltage monitor
- High-output current gate drivers
  PFC driver peak current : ±1.5 A typ.
  PWM driver peak current : ±1.0 A typ.
- PWM maximum on duty cycle
  72% min (HA16141P/FP)
  49.5% max (HA16142P/FP)

PIN ARRANGEMENT (TOP VIEW)



DIL-16P,SOP-16P
(DP-16E,FP-16DAV)

BLOCK DIAGRAM



High-Speed Current Mode Push-Pull PWM Control IC

HA16150T/P

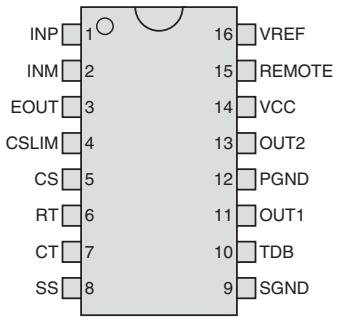
FEATURES

<Maximum Ratings>
- Supply voltage Vcc: 20 V
- Peak output current Ipk-out: ±1.0 A
- Operating junction temperature Tjopr: -40°C to +125°C

<Electrical Characteristics>
- VREF output voltage VREF: 5.0 V ±1%
- UVLO start threshold VH: 9.3 V ±0.7 V
- UVLO shutdown threshold VL: 8.3 V ±0.7 V
- Operating current Icc: 4 mA typ.
- Standby current Is: 150µ A typ.

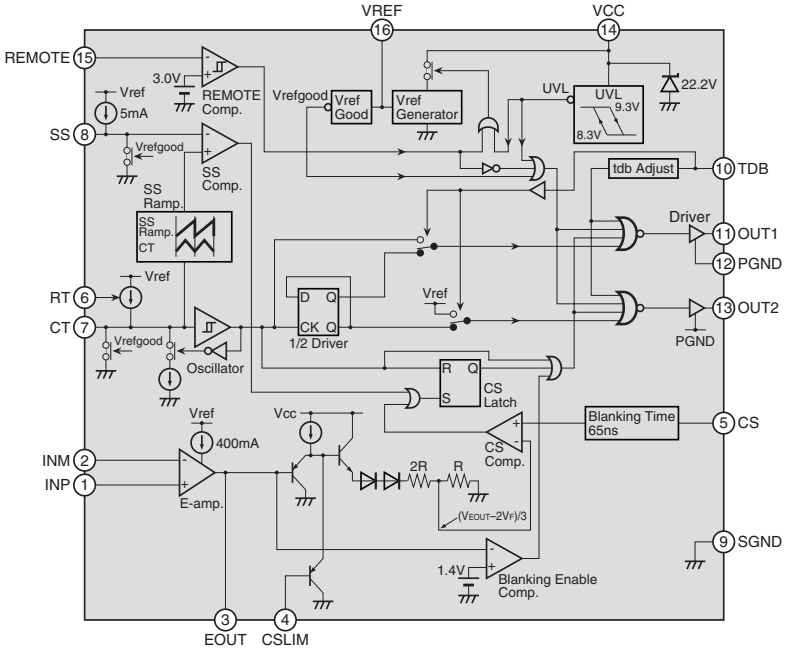
<Functions>
- Soft start (one external timing capacitance)
- Remote on/off control
- Independent dead band time adjustment
- Current limiter adjustment (set drooping characteristic adjustment)
- Push-pull/single-end output switching
- Package lineup: TSSOP-16/DILP-16

PIN ARRANGEMENT (TOP VIEW)



DIL-16P,TSSOP-16
(DP-16E,TTP16-DAV)

BLOCK DIAGRAM



Description on Individual Products

●Power Management Linear ICs

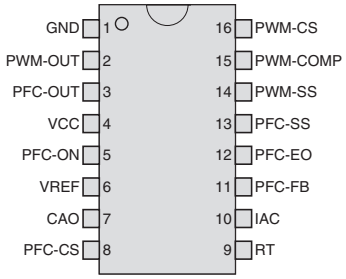
PFC & PWM Control IC

HA16158P/FP

FEATURES

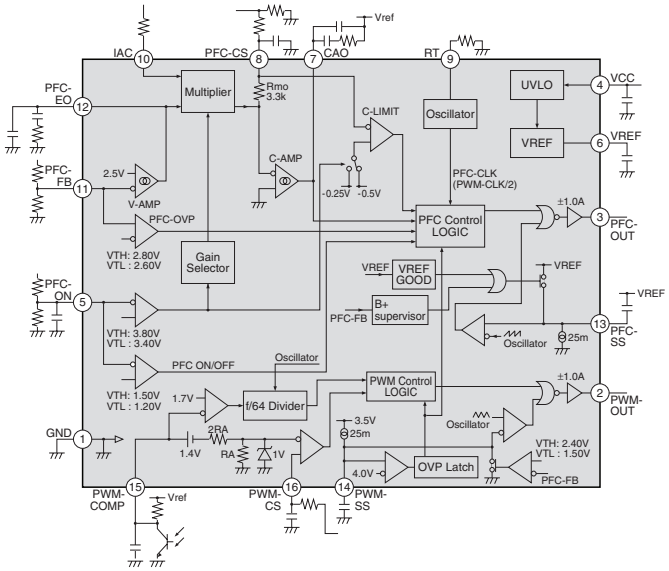
- Synchronized PFC and PWM timing
- World wide range AC input available (automatically adjust of gain & power limit)
- PFC Function remote ON/OFF control
- Over voltage protection
- Over voltage protection in case of losing feedback loop
- Package: SOP16, DIP16

PIN ARRANGEMENT (TOP VIEW)



DIL-16P,SOP-16P
(DP-16E,FP-16DAV)

BLOCK DIAGRAM



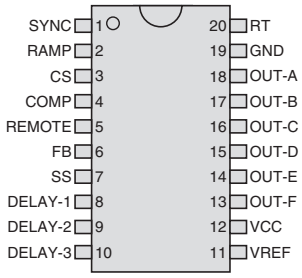
Synchronous Phase Shift Full-Bridge Control IC

HA16163T

FEATURES

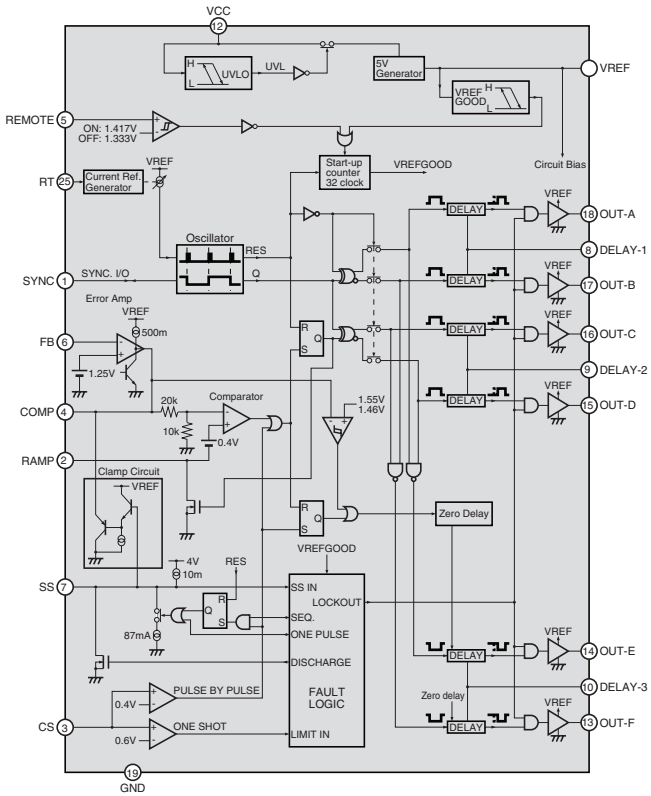
- High frequency operation; oscillator frequency = 2 MHz max.
- Full-bridge phase-shift switching circuit with adjustable delay times
- Integrated secondary synchronous rectification control with adjustable delay times
- Three-level over current protection; pulse by pulse, timer Latch, one shot OCP
- Package: TSSOP-20

PIN ARRANGEMENT (TOP VIEW)



TSSOP-20P
(TTP20-DAV)

BLOCK DIAGRAM



Note that all switches in the block diagram are turned on when control signal is high.

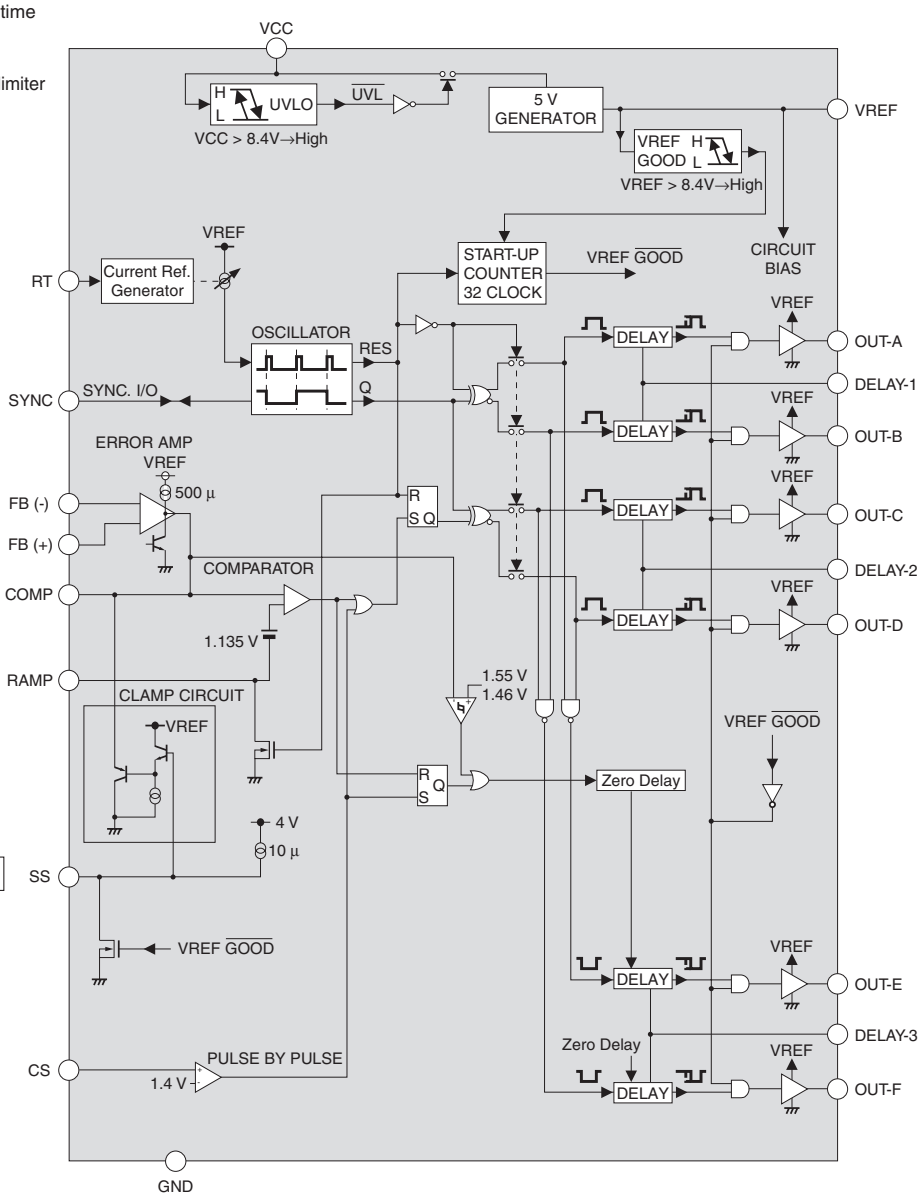
Synchronous Rectification Type Phase-Shift Full-Bridge Control IC

R2A20121SP

FEATURES

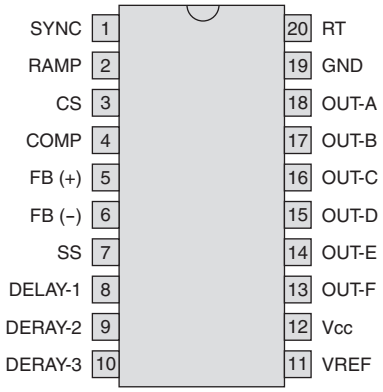
- High operating frequency: Oscillator frequency = 2 MHz max.
- Full-bridge control circuit with adjustable delay time
- Secondary synchronous rectifier circuit with adjustable delay time
- Overcurrent protection function: Pulse-by-pulse limiter
- Package: TSSOP-20

BLOCK DIAGRAM



Note: Switches in diagram are on when control signal is high-level.

PIN ARRANGEMENT (TOP VIEW)



TSSOP-20(TTP-20DAV)

●Power Management Linear ICs

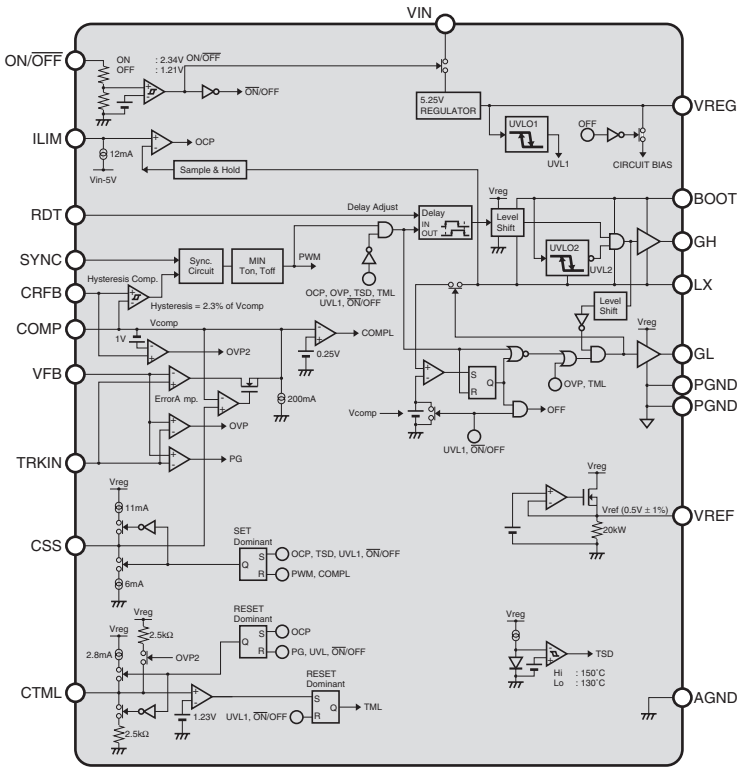
High Speed Response Synchronous Control IC

HA16167AT

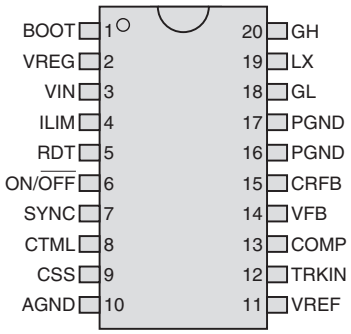
FEATURES

- High speed response
  di/dt=20~400A/µs
  Reduced ripple & spike voltage
  Reduced output capacitor
  Low ESR ceramic Capacitors are available
- High accuracy
  Built-in tracking function & vref=0.5V/1.0%
- High switching freqnency
  fsw=Max.1MHz
  Miniaturize external parts
  Input voltage range=4.5 to 14.5V

BLOCK DIAGRAM



PIN ARRANGEMENT (TOP VIEW)



TSSOP-20P
(TTP20-DAV)

Monolithic Synchronous Step-Down DC/DC Converter IC

R2A20101BM/NP

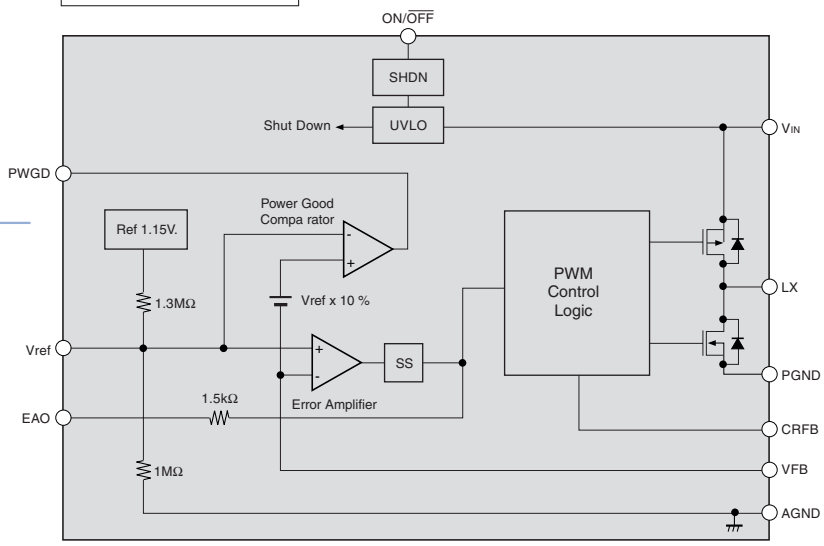
FEATURES

- Built-in Low Ron Power MOSFETs
  Pch Ron=0.30 Ω typ, Nch Ron=0.14 Ω typ
- High Switching Frequency ; Max. 2MHz
- Output Current ; Max. 650mA
- Output ON/OFF Control
- Vout Control
- Power Good Monitor
- Current Share for Redundant Power Supply Operation

APPLICATION

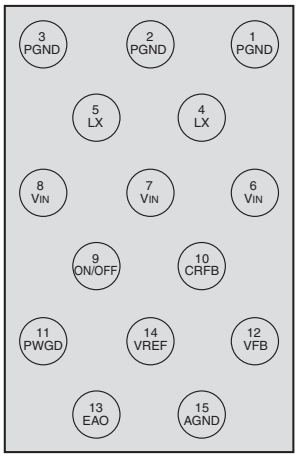
- POL (Point of Load) Power Supplies.
- Power Supply for Microcomputer Systems.
  MCU-Core, I/O, Memory
  (DDR, SRAM, FLASH, HDD, etc.),
  FPGA, DSP, Graphic Processor
- Battery Powered Equipment Systems.
  Cellular Phone
  (CDMA Power Amplifier, MCU, DSP, ASIC),
  PDA, Digital Camera, Portable Game, Handy Terminal

BLOCK DIAGRAM



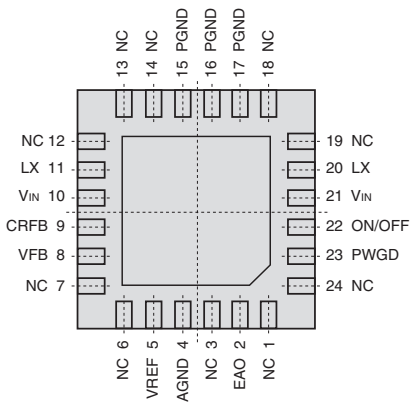
PIN ARRANGEMENT (BOTTOM VIEW)

R2A20101BM



XFBGA-15

R2A20101NP



WQFN-24 (TNP-24AV)

●Power Management Linear ICs

Switching Regulator for Chopper Type DC/DC Converter

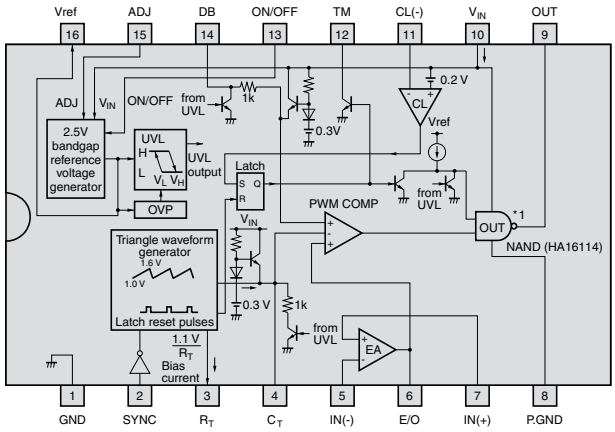
HA16114P/FP,HA16120FP

FEATURES

- Wide operating supply voltage range: 3.9 V to 40 V*1
- Able to drive a power MOS FET (±1 A maximum peak current) by the built-in totem-pole gate pre-driver circuit
- Can operate in synchronization with an external pulse signal, or with another controller IC
- Pulse-by-pulse overcurrent limiting (OCL)
- Intermittent operation under continuous overcurrent
- Low quiescent current drain when shut off by grounding the ON/OFF pin
  HA16114: I_{OFF} = 10µA (max)
  HA16120: I_{OFF} = 150µA (max)
- Externally trimmable reference voltage (V_{REF}): ±0.2 V
- Externally adjustable undervoltage lockout points (with respect to V_{IN})
- Stable oscillator frequency
- Soft start and quick shut function

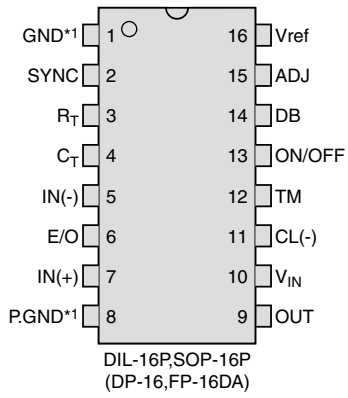
Note: 1. The reference voltage 2.5 V is under the condition of VIN ≤ 4.5 V.

BLOCK DIAGRAM



Note: 1. The HA16120 has an AND gate.

PIN ARRANGEMENT (TOP VIEW)



DIL-16P,SOP-16P
(DP-16,FP-16DA)

Note: 1. Pin 1 (GND) and Pin 8 (P.GND) must be connected each other with external wire.

Switching Regulator for Chopper Type DC/DC Converter

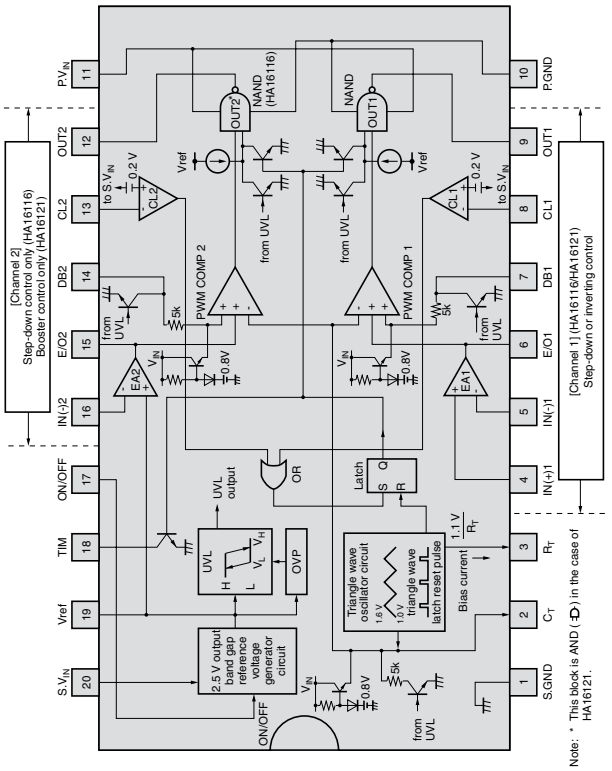
HA16116FP, HA16121FP

FEATURES

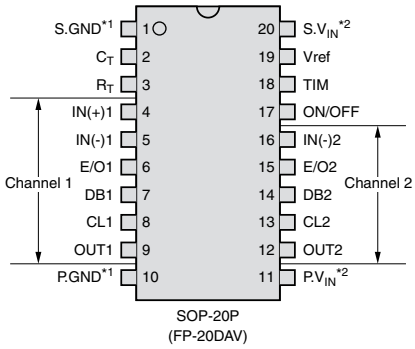
- Wide operating supply voltage range: 3.9 V to 40.0 V*1
- Wide operating frequency range (600 kHz maximum operation)
- Direct power MOS FET driving (output current ±1 A peak in maximum rating)
- Pulse-by-pulse overcurrent protection circuit with intermittent operation function (When overcurrent state continues beyond time set in timer, the IC operates intermittently to prevent excessive output current.)
- Grounding the ON/OFF pin turns the IC off, saving power dissipation. (HA16116: I_{OFF} = 10µA max.; HA16121: I_{OFF} = 150µA max.)
- Built-in UVL circuit (UVL voltage can be varied with external resistance.)
- Built-in soft start and quick shutoff functions

Note: The reference voltage 2.5 V is under the condition of VIN ≤ 4.5 V.

BLOCK DIAGRAM



PIN ARRANGEMENT (TOP VIEW)



Notes: 1. Pins S.GND (pin 1) and P.GND (pin 10) have no direct internal interconnection. Both pins must be connected to ground.
2. Pins $S.V_{IN}$ (pin 20) and P.V (pin 11) have no direct internal interconnection. Both pins must be connected to V_{IN}.

●Power Management Linear ICs

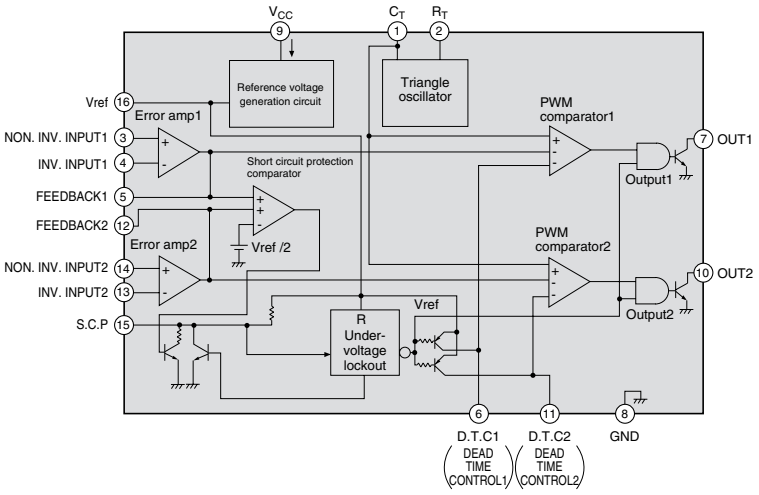
Dual Channel PWM Control IC

HA17451AP/AFP

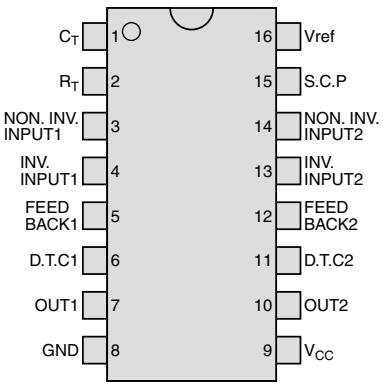
FEATURES

- Low-dropout 2.5V voltage reference
- Undervoltage lockout
- Timer-latch short-circuit protection
- Triangle-wave oscillator
- Adjustable dead-time control
- Error amplifier
- Output driver (open-collector transistor type)
- PWM comparator

BLOCK DIAGRAM

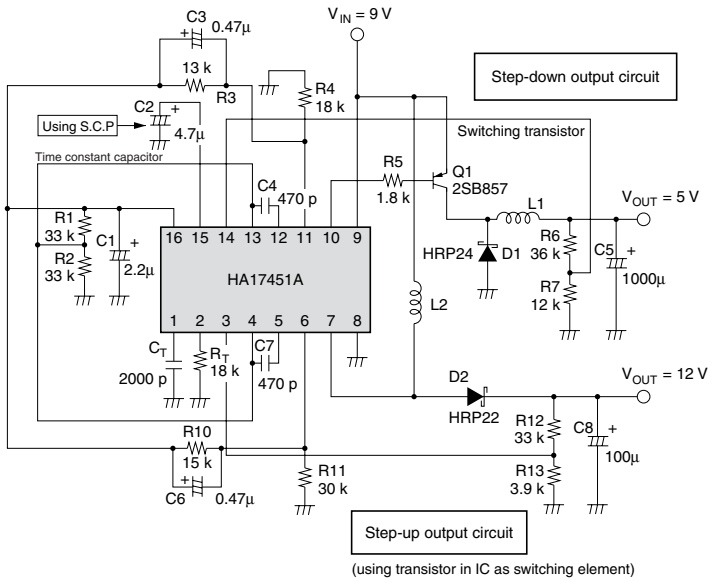


PIN ARRANGEMENT (TOP VIEW)



DIP-16P(DP-16E)
SOP-16P(FP-16DAV)

APPLICATION



(using transistor in IC as switching element)

Description on Individual Products

●Standard Linear ICs

Small & Low Voltage CMOS Op-Amp.

HA1630S01-08/D01-08/Q01-06

FEATURES

- Contribute to space-saving by built in ultra-small package. (CMPAK-5, MPAK-5, MMPAK-8, TSSOP-8, TSSOP-14)
- Best support for battery using equipment due to low voltage operation and low consumption current. (V_{DD}=1.8 to 5.5V, I_{DD}(/ch): 15 to 800µA typ.)(07/08: 2.7 to 5.5V)
- Operational stabilityin a noise area of mobile phone (RF). (fc: about 200MHz)
- Others
  - Output full-swing V_{OH} = 2.9V min. (@V_{DD}=3V)
  - Low input offset voltage V_{IO} = 4mV max. (07/08: 6mV max.)
  - Low input bias current I_{IB} = 1pAtyp.
  - Operating temp. range Topr = -40 to +85 degC
  - HA1630S07/D07 output drive current: 15mA typ.
  - HA1630S08/D08 output drive current: 30mA typ.

SINGLE TYPE: CMPAK-5V, MPAK-5V

HA1630S01/02/03
HA1630S04/05/06/07/08

DUAL TYPE: TSSOP-8

HA1630D01/02/03
HA1630D04/05/06/07/08

QUAD TYPE: TSSOP-14

HA1630Q01/02/03
HA1630Q04/05/06

	Unit	Part.No.		
		S01/D01/Q01	S02/D02/Q02	S03/D03/Q03
IDD (/ch) typ.	µA	15	50	100
SR typ.	V/µs	0.125	0.5	1

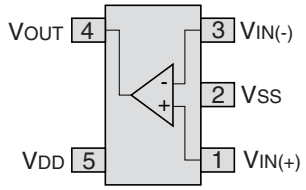
	Unit	Part.No.				
		S04/D04/Q04	S05/D05/Q05	S06/D06/Q06	S07/D07	S08/D08
IDD (/ch) typ.	µA	200	400	800	60	170
SR typ.	V/µs	2	4	8	1	1.5

APPLICATION

- Digital consumer equipment such as DSC and DVC.
- Sensor output amplifier such as measurement equipment, controllers and health appliance.
- Amplification and buffer for various analog circuits.

PACKAGE AND PIN ARRANGEMENT

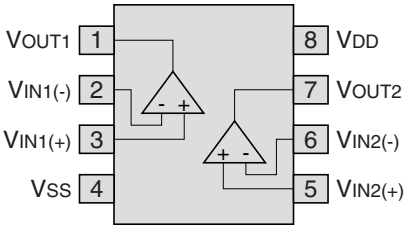
5pin



(Unit: mm)

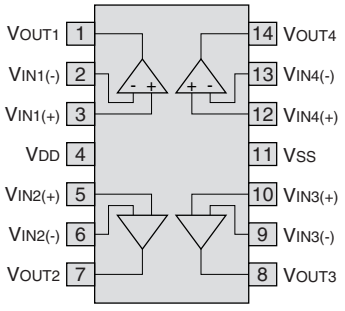
Package	Size	Pin pitch	Suffix	MP
MPAK-5V	1.6 x 2.9 x 1.1	0.95	LP	OK
CMPAK-5V	1.25 x 2.0 x 0.9	0.65	CM	OK

8pin



Package	Size	Pin pitch	Suffix	MP
MMPAK-8	4.0 x 2.95 x 1.1	0.65	MM	OK
TSSOP-8	6.4 x 3.0 x 1.1	0.65	T	OK

14pin



Package	Size	Pin pitch	Suffix	MP
TSSOP-14	6.4 x 5.0 x 1.1	0.65	T	OK

●Standard Linear ICs

Bipolar Op-Amps

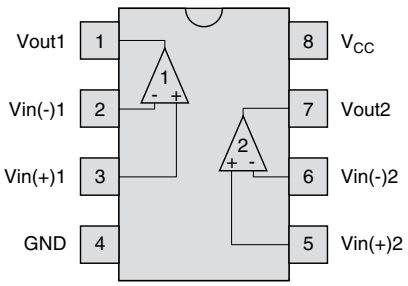
Dual Op-Amps

HA17358A Series

FEATURES

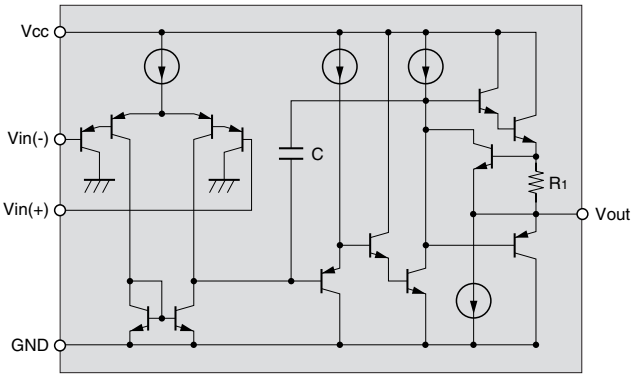
- Wide operating power supply voltage range, single-power-supply operation possible
- Wide in-phase input voltage range: operation possible for input in vicinity of 0 level, and output voltage can be dropped to vicinity of 0 level
- Temperature compensation of frequency characteristics and input bias current
- High RF noise immunity

PIN ARRANGEMENT (TOP VIEW)



DIL-8P,SOP-8P,TSSOP-8P
(DP-8B,FP-8DGV,FP-8DCV,TTP-8DAV)

CIRCUIT SCHEMATIC (1/2)



Small & Low Voltage CMOS Comparator

HA1631S01-04/D01-04

FEATURES

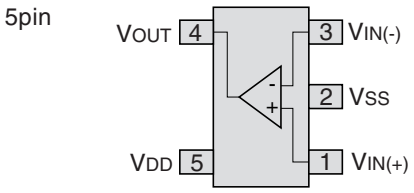
- Contribute to space-saving by built in ultra-small package. (CMPAK-5, MPAK-5, MMPAK-8, TSSOP-8)
- Best support for battery using equipment due to low voltage operation (V_{DD}=1.8 to 5.5V) and low consumption current (I_{DD}: µA order)
- Low input offset voltage: V_{IO} = 5mV max.
- Operational stability in a noise area of mobile phone (RF). (fc: about 200MHz)

APPLICATION

- Mobile equipment (DSC, etc.)
- Sensor signal detection (Health appliances, Disaster-related equipment, etc.)
- Switch for signal control
- Pulse generating circuit
- Over-voltage detection of low power supply (Monitor)

PACKAGE AND PIN ARRANGEMENT

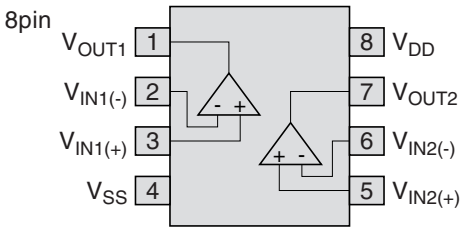
HA1631S01/02/03/04



(Unit: mm)

Package	Size	Pin pitch	Suffix	MP
MPAK-5V	1.6 x 2.9 x 1.1	0.95	LP	OK
CMPAK-5V	1.25 x 2.0 x 0.9	0.65	CM	OK

HA1631D01/02/03/04



Package	Size	Pin pitch	Suffix	MP
MMPAK-8	4.0 x 2.95 x 1.1	0.65	MM	OK
TSSOP-8	6.4 x 3.0 x 1.1	0.65	T	OK

Single	**HA1631S01**	**HA1631S02**	**HA1631S03**	**HA1631S04**
Dual	**HA1631D01**	**HA1631D02**	**HA1631D03**	**HA1631D04**
	(Low consumption current)	(High-speed type)	(Low consumption current)	(High-speed type)
Output system	Push-pull		Open-drain	
Operating voltage	V_{DD} = 1.8 ~ 5.5V			
Consumtion current (/ch)	I_{DD} = 5µA typ.	I_{DD} = 50µA typ.	I_{DD} = 5µA typ.	I_{DD} = 50µA typ.
Output full-swing	V_{OH} = 2.9V min. (V_{DD} = 3V)			
Response time	TP_{HL} = 0.55µs typ.	TP_{HL} = 0.17µs typ.	TP_{HL} = 0.55µs typ.	TP_{HL} = 0.17µs typ.
	TP_{LH} = 1.20µs typ.	TP_{LH} = 0.33µs typ.		
Output current	I_{SINK} = 14mA typ.			
	I_{SOURCE} = 13mA typ.			
Operating Temp.	- 40˚C ~ +85˚C			

●Standard Linear ICs

Bipolar Comparators

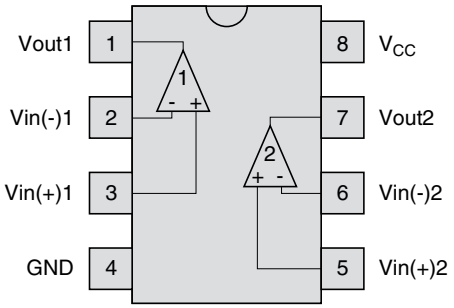
Dual Comparators

HA17393A Series

FEATURES

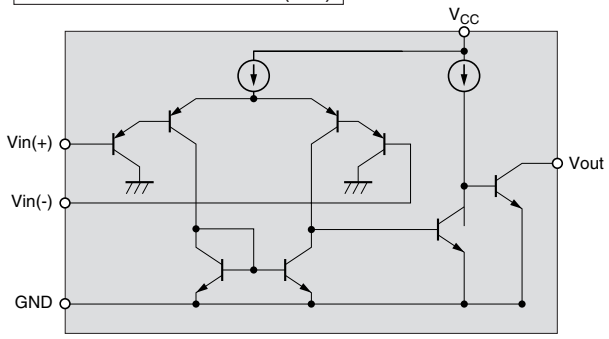
- Wide power supply voltage range: 2 V to 36 V
- Small power supply current: 0.8mA typ.
- Small input bias current: 25nA typ.
- Small input offset current: 3nA typ.
- Small input offset voltage: 2mV typ.
- High RF noise immunity

PIN ARRANGEMENT (TOP VIEW)



DIL-8P,SOP-8,TSSOP-8P
(DP-8B,FP-8DGV,FP-8DCV,TTP-8DAV)

CIRCUIT SCHEMATIC (1/2)



Description on Individual Products

●Power Management Linear ICs AC/DC

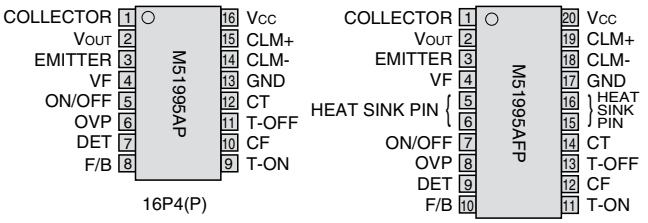
500kHz MULTIFUNCTION PWM CONTROL IC

M51995AP/AFP

FEATURES

- 500kHz applicable to MOSFET
  - -Output current ····· ±2A
  - -Output rise time 60ns, fall time 40ns
  - -Modified totempole output method with small through current
- Compact and light-weight power supply
  - -Small standby current ····· 90μA typ.
  - -Big difference between "start-up voltage" and "stop voltage" makes the smoothing capacitor of the power input section small. Start-up threshold 16V, stop voltage 10V
  - -Packages withstanding high power dissipation are applied for high the heat generation by the gate-drive current of MOSFET. 16-pin DIP, 20-pin SOP 1.5W (at 25°C)
- Simplified peripheral circuit with protection circuit and built-in large-capacity totempole output
  - -High-speed current limiting circuit using pulse-by-pulse method (Two systems of CLM + pin, CLM - pin)
  - -Protection by intermittent operation of output over current Timer protection circuit
  - -Over-voltage protection circuit with an externally resettable latch (OVP)
  - -Protection circuit for output malfunction at low supply voltage (UVLO)
- High-performance and highly functional power supply
  - -Triangular wave oscillator for easy dead time setting

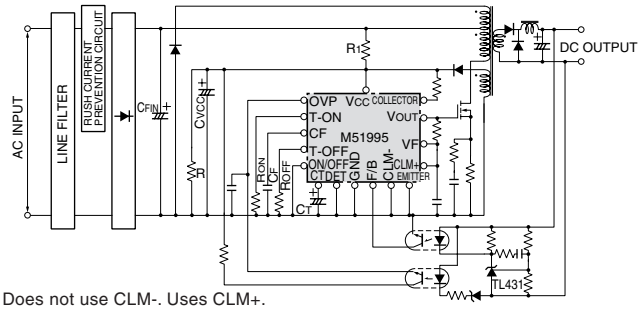
PIN ARRANGEMENT (TOP VIEW)



16P4(P)

20P2N-A(FP)

APPLICATION EXAMPLE



- Does not use CLM-. Uses CLM+.
- Short time constant CR of CLM pin is applicable for noise rejection with MOS-FET ON

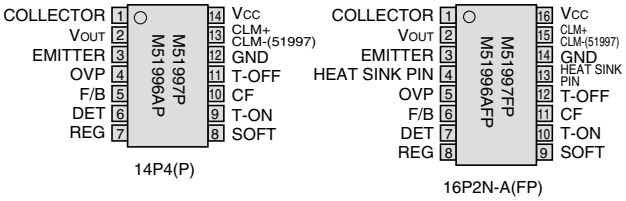
500kHz GENERAL PWM CONTROL IC

M51996AP/AFP

FEATURES

- 500kHz applicable to MOSFET
  - -Output current ····· ±1A
  - -Output rise time 60ns, fall time 40ns
  - -Modified totempole output method with small through current
- Compact and light-weight power supply
  - -Small standby current ····· 100μA typ.
  - -Big difference between "start-up voltage" and "stop voltage" makes the smoothing capacitor of the power input section small. Start-up threshold 16V, stop voltage 10V
  - -Packages withstanding high power dissipation are applied for high the heat generation by the gate-drive current of MOSFET. 14-pin DIP, 16-pin SOP 1.5W (at 25°C)
- Simplified peripheral circuit with protection circuit and built-in large-capacity totempole output
  - -High-speed current limiting circuit using pulse-by-pulse method (Two systems of CLM + pin, CLM - pin)
  - -Over-voltage protection circuit with an externally resettable latch (OVP)
  - -Protection circuit for output malfunction at low supply voltage (UVLO)

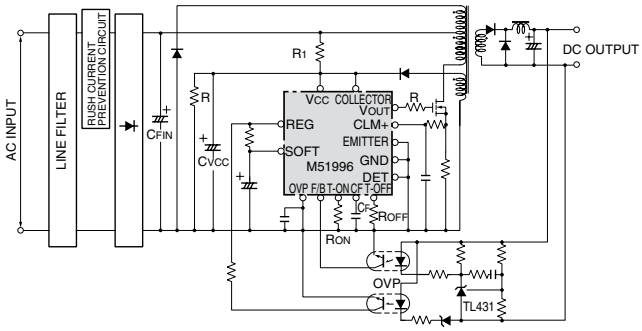
PIN ARRANGEMENT (TOP VIEW)



14P4(P)

16P2N-A(FP)

APPLICATION EXAMPLE



Description on Individual Products

●Power Management Linear ICs AC/DC

SWITCHING REGULATOR CONTROL

M51998P/FP

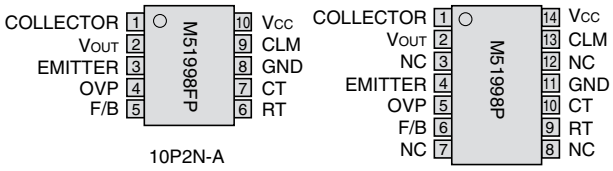
FEATURES

- Output current peak ±1A
- Totempole output
- Small start-up current 100μA(typ.)
- Start-up threshold.....16V, stop voltage.....10V
- Output duty 51% (internally fixed)
- Pulse-by-pulse current limit
- 10 pin SOP, 14 pin DIP package

APPLICATION

Fly-back regulator

PIN ARRANGEMENT (TOP VIEW)

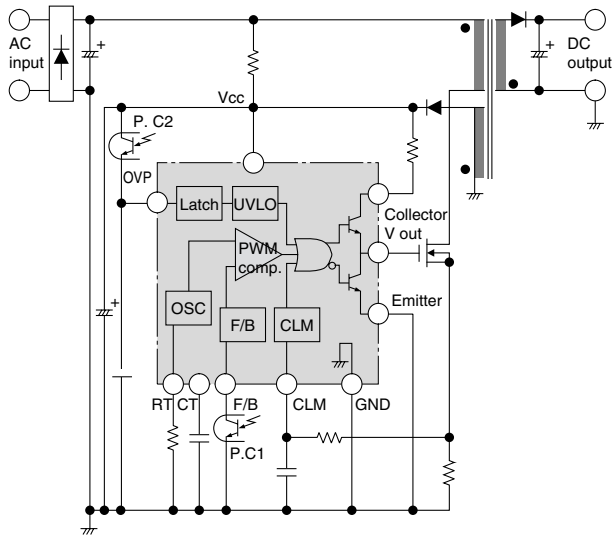


10P2N-A

14P4

NC :NO CONNECTION

APPLICATION EXAMPLE



GENERAL HIGH SPEED VOLTAGE MODE PWM CONTROL IC

M62213P/FP

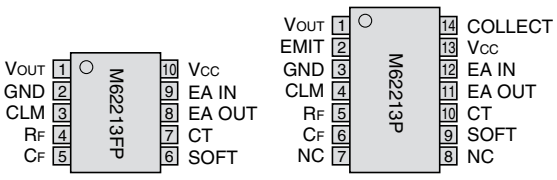
FEATURES

- 700kHz applicable to MOSFET
  -Output current IO (peak) 1A
  -Adoption of totempole output
- Timer type latch circuit to be used combined with OVP function
- Built-in soft start circuit (used combined with DTC)
- Built-in OPAmp for feedback (allowable photocoupler drive)
- High speed pulse-by-pulse system current limit circuit
- Small circuit current before activation 130μA
- Activation start voltage..12.5V, activation stop voltage 8.3V
- Adoption of 14-pin DIP package and small size 10-pin SOP package

APPLICATION

Local power supply for various types of switching power supply, DC/DC converter, etc.

PIN ARRANGEMENT (TOP VIEW)

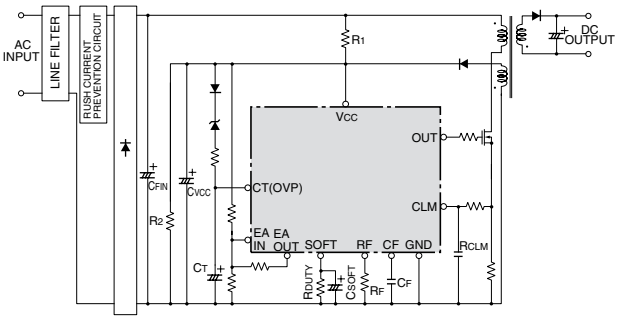


10P2N-A(FP)

14P4(P)

NC:NO CONNECTION

APPLICATION EXAMPLE



GENERAL HIGH SPEED CURRENT MODE PWM CONTROL IC

M62281P/FP

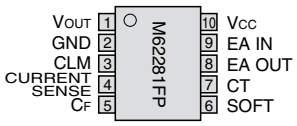
FEATURES

- 700kHz applicable to MOSFET
  -Output current Io (peak) 1A
  -Adoption of totempole output
- Since this IC provides independent current sense pins, it is capable of forming a SW power supply that is strong against noise.
- High speed pulse-by-pulse system current limit circuit
- Timer type latch circuit to be used combined with OVP (external reset possible)
- Built-in soft start circuit (used combined with DTC)
- Built-in OPAmp for feedback (photocoupler drive allowable)
- Small circuit current before activation 130μA
- Activation start voltage..12.5V, activation stop voltage 8.3V
- Adoption of 14-pin DIP package and small size 10-pin SOP package

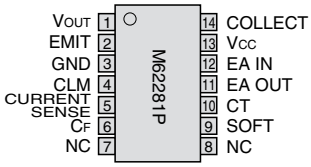
APPLICATION

Local power supply for various types of switching power supply, DC/DC converter, etc.

PIN ARRANGEMENT (TOP VIEW)

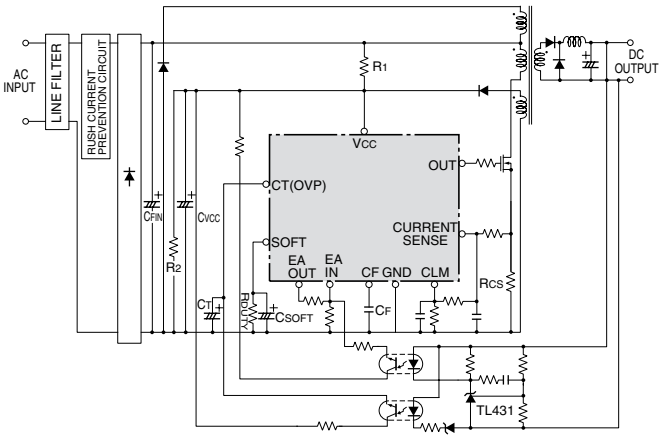


10P2N-A(FP)



14P4
NC:NO CONNECTION

APPLICATION EXAMPLE



SWITCHING POWER SUPPLY SECONDARY SIDE CONTROL IC

M62235P/FP

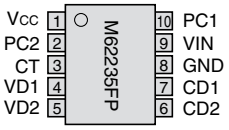
FEATURES

- 1 system output voltage detection (Output voltage can be set arbitrary)
- 2 system over voltage detection built-in (without delay circuit)
- 2 system over current detection built-in (with delay circuit)
- PC output drive current ..... 10mA (max)

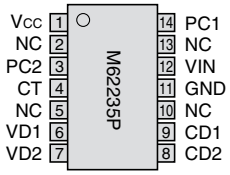
APPLICATION

Fly-back regulator

PIN ARRANGEMENT (TOP VIEW)

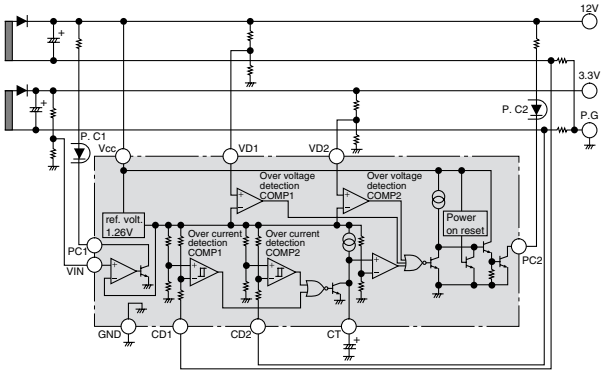


10P2N-A



14P4
NC:NO CONNECTION

APPLICATION EXAMPLE



Description on Individual Products

●Power Management Linear ICs DC/DC

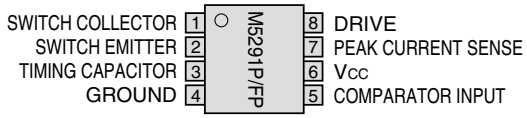
GENERAL PURPOSE DC/DC CONVERTER

M5291P/FP

FEATURES

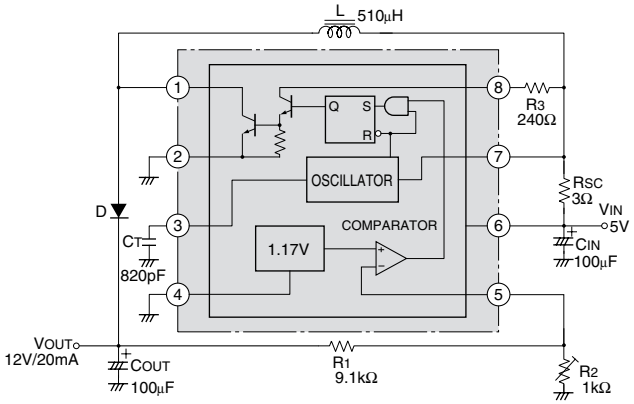
- Wide supply voltage range ····· 2.5 to 40V
- Low dissipation current ····· 1.4mA
- Wide range of output Voltage adjust ····· 1.17 to 40V
- Output switch current ····· 200mA
- Wide range of switching frequency ····· 100Hz to 100kHz
- Built-in peak current protection circuit
- External transistor is unnecessary for the power system of 100mA or less

PIN ARRANGEMENT (TOP VIEW)



8P4(P)
8P2S-A(FP)

APPLICATION EXAMPLE (12V/20mA)



GENERAL PURPOSE DC/DC CONVERTER

M62212P/FP/GP

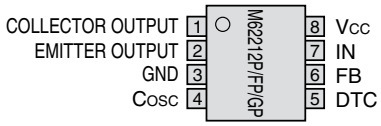
FEATURES

- Wide operation power supply voltage range ····· 2.5 to 18V
- Low power consumption ····· 1.3mA typ.
- High speed switching is possible. (Max 300 kHz)
- Output short protection circuit and ON/OFF control are used. The dead-time control and the soft-start operation are possible.
- 3 type package variation 8-pin DIP/SOP/SSOP

APPLICATION

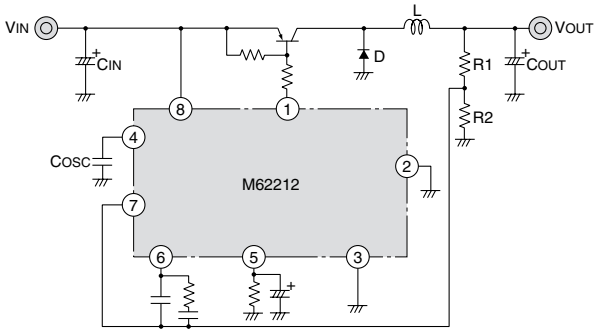
Local power supply for general electric equipments, and DC/DC converter

PIN ARRANGEMENT (TOP VIEW)



8P4(P)
8P2S-A(FP)
8P2X-A(GP)

APPLICATION EXAMPLE



MULTI-FUNCTION HIGH VOLTAGE WITHSTAND DC/DC CONVERTER

M62211P/FP

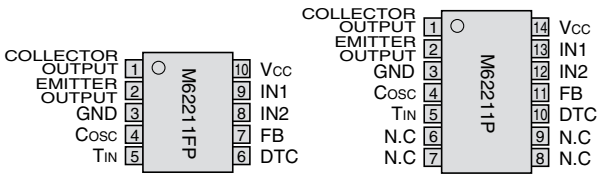
FEATURES

- Wide operation power supply voltage range ····· 2.5 to 35V
- Operation can be synchronized by the external sync singnal
- Operation can be controlled using two prioritized systems (High input has priority)
- High speed switching is possible. (Max 500kHz)
- Output short protection circuit and ON/OFF control are used. The dead-time control and the soft-start operation are possible.
- 14-pin DIP package and small size 10-pin SOP package

APPLICATION

Back light control for Note Book type PC and word processor, local power supply for general electronic equipment including portable devices, and DC/DC converter

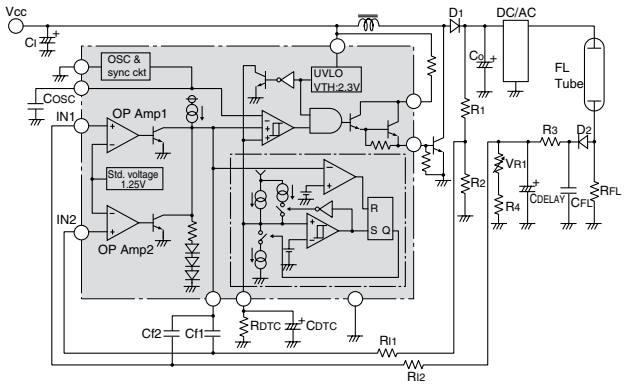
PIN ARRANGEMENT (TOP VIEW)



10P2N-A(FP) 14P4(P)

NC : NO CONNECTION

APPLICATION EXAMPLE



MULTI-FUNCTION DC-DC CONVERTER

M62215FP

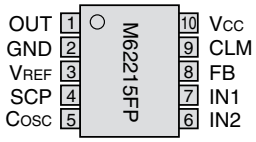
FEATURES

- Wide operation power supply voltage range 8.6 to 25V
- Operation can be controlled using two prioritized systems (High input has priority)
- High speed switching is possible (500kHz)
- Output shortcircuit protection circuit, ON/OFF control, dead time control, soft-start operation
- Small size 10pin SOP package
- High speed pulse-by-pulse current limit
- Totempole output
  output current Io (peak) ····· ± 1A

APPLICATION

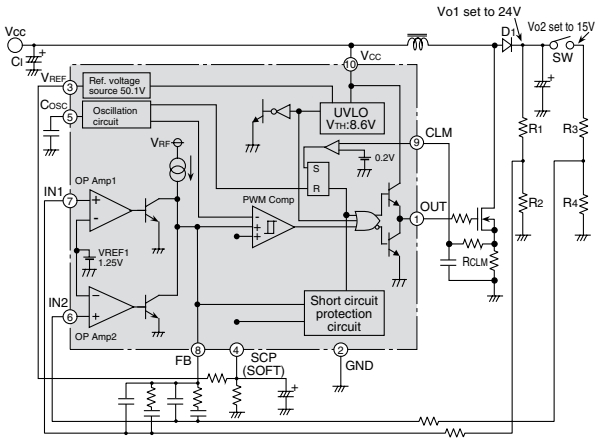
Backlight control for Note Book type PC, etc.
General electronic equipments including portable equipments.

PIN ARRANGEMENT (TOP VIEW)



10P2N-A

APPLICATION EXAMPLE



Description on Individual Products

●Power Management Linear ICs DC/DC

LOW VOLTAGE OPERATION STEP-UP CONVERTER

M62216FP/GP

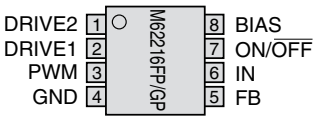
FEATURES

- Low voltage operation that can form a step-up converter from the voltage of a battery ····· 0.9 to 15V
- Lower current consumption PWM control
- Capable of output ON/OFF control
- Adoption of small 8-pin SOP and SSOP package

APPLICATION

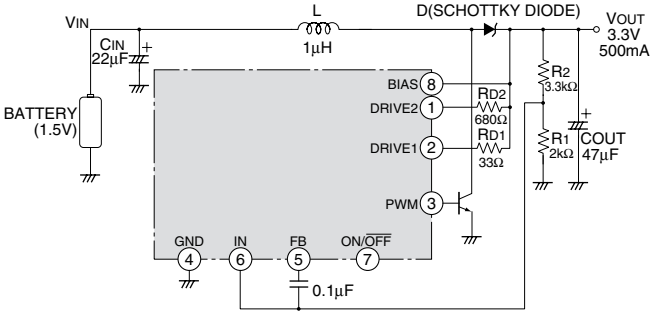
Local power supply for battery driving equipment including CD-ROM, portable terminal and portable equipment, DC/DC converter

PIN ARRANGEMENT (TOP VIEW)



8P2S-A(FP)
8P2X-A(GP)

APPLICATION EXAMPLE



Application example of forming 3.3/500mA output from a battery

5PIN SOT25,3.0V FIXED OUTPUT DC/DC CONVERTER FOR GENERAL USE

M62270GP

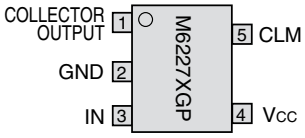
FEATURES

- Operating supply voltage ····· 4 to 15V(Vcc=5V Typ.)
- Low power dissipation ····· 500µA(Vcc=5V Typ., no load)
- Built-in OSC circuit (110kHz Typ.)
- Built-in shortcircuit protection circuit
- Ultra-small package 5 pin SOT-25 applied

APPLICATION

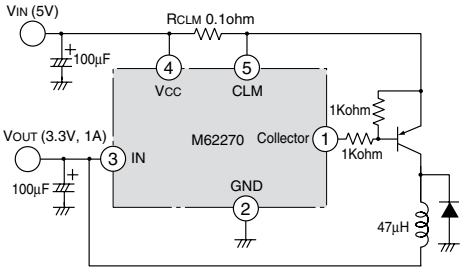
CD-ROM, general electronic equipments such as portable equipments.

PIN ARRANGEMENT (TOP VIEW)



SOT-25

APPLICATION EXAMPLE



3.3 V FIXED OUTPUT VOLTAGE DC/DC CONVERTER

M62220L/FP

FEATURES

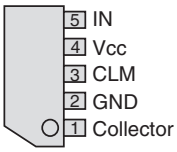
- Wide operation supply voltage range: 4 to 15V
- Low power consumption: 900μA (max.)
- Built-in oscillator without external components (110kHz typ.)
- Built-in over current protection circuit
- Small size 5-pin SIP and 8-pin SOP packages

APPLICATION

CD-ROM, PDA, general purpose electric products

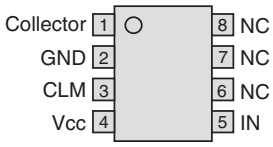
PIN ARRANGEMENT (TOP VIEW)

M62220L



Outline: 5P5T

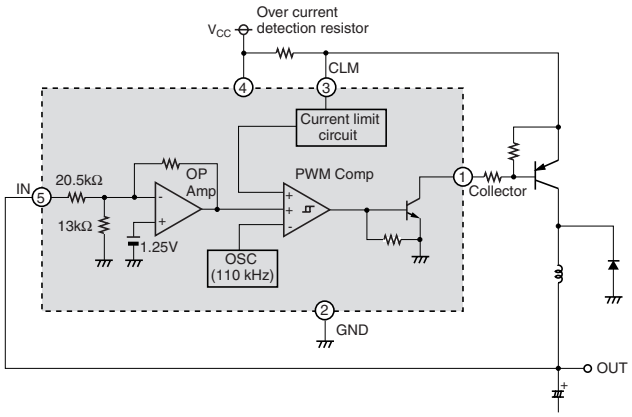
M62220FP



NC: No connection

Outline: PRSP0008DE-C (recommend)
PRSP0008DA-A (8P2S-A) (not recommend for new design)

BLOCK DIAGRAM



5.0 V FIXED OUTPUT VOLTAGE DC/DC CONVERTER

M62290L/FP

FEATURES

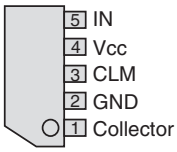
- Wide operation voltage range: 6 to 15V (typ. Vcc = 12V)
- Low power dissipation: 1.1mA (max., Vcc = 12V)
- Built-in oscillator without peripheral devices (120 kHz typ.)
- Built-in over current protection circuit
- Small 5-pin SIP and 8-pin SOP packages

APPLICATION

Local voltage regulator of audio sets and general electric products

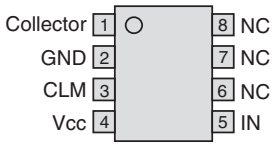
PIN ARRANGEMENT (TOP VIEW)

M62290L



Outline: 5P5T

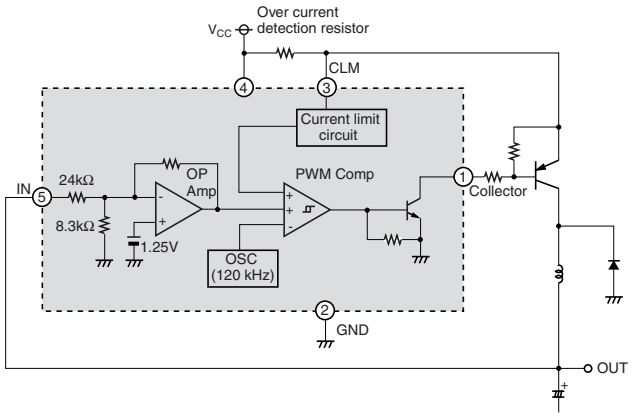
M62290FP



NC: No connection

Outline: PRSP0008DE-C (recommend)
PRSP0008DA-A (8P2S-A) (not recommend for new design)

BLOCK DIAGRAM



Description on Individual Products

●Power Management Linear ICs DC/DC

5PIN SOT25 5V FIXED OUTPUT VOLTAGE DC/DC CONVERTER FOR GENERAL USE

M62291GP

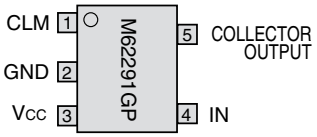
FEATURES

- Operating supply voltage range ····· 6 to 15V(typ. Vcc=12V)
- Low power dissipation ····· 400μA (typ.Vcc=12V, at no load)
- Built-in oscillation circuit with no external components (120kHz typ.)
- Built-in overcurrent protection
- Ultra-small package 5pin SOT-25 applied

APPLICATION

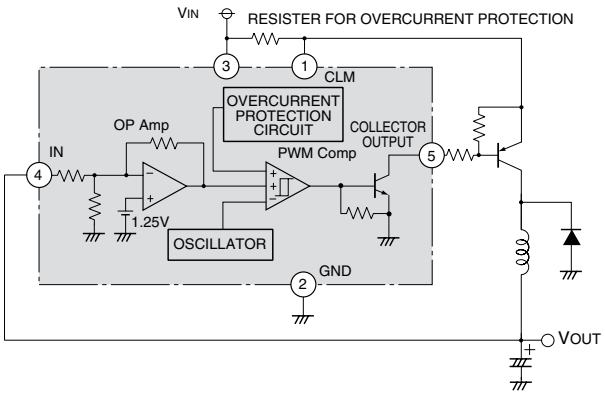
Local power source for audio equipments, portable equipments, electronic equipments in general.

PIN ARRANGEMENT (TOP VIEW)



SOT-25

APPLICATION EXAMPLE



3.3V,1.8V(2.0V, 2.5V,2.7V)2CH FIXED OUTPUT VOLTAGE DC/DC CONVERTER FOR GENERAL USE

M62292FP, M62293FP, M62294FP

FEATURES

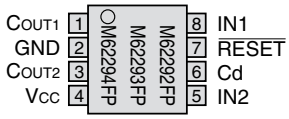
- Wide operation power supply voltage range ····· 4 to 15V(typ.5V)
- Low power dissipation ····· 1.5mA(Vcc=5V, no load)
- Built-in 2 system voltages (5V,3.3V) detection reset function
- 8pin SOP

APPLICATION

Power supply for M32R + flash memory.
General electronic equipments such as portable equipments.

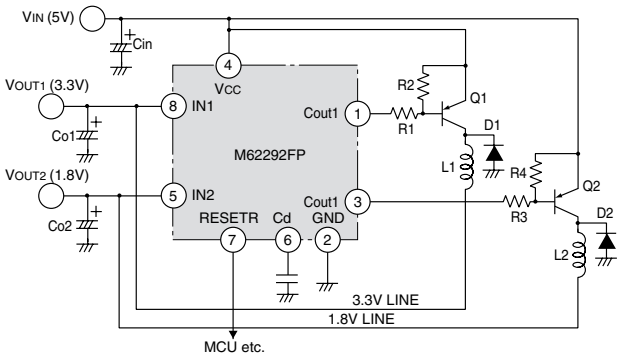
Part No.	IN1	IN2
M62292FP	3.3V	1.8V
M62293FP	3.3V	2.5V
M62294FP	3.3V	2.0V

PIN ARRANGEMENT (TOP VIEW)



8P2S-A

APPLICATION EXAMPLE (M62292FP)



7ch DC/DC CONVERTER IC FOR DIGITAL STILL CAMERA

R2A20016NP**

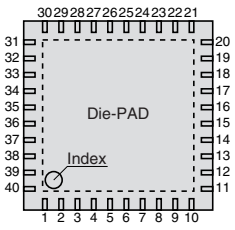
FEATURES

- Fully integrate output MOSFETs
- Internal phase compensation
- Built-in Shutdown function for all boost converters
- Highly efficient auto Buck-Boost converter (CH4)
- Auto PWM/PFM mode switching for improving efficiency at light load (CH1~3)
- SW frequency (@PWM mode)
  CH1~4 (Sync. rectifying): 2MHz
  CH5~7 (Diode rectifying): 500kHz
- Output voltage detector for system reset (CH4)
- Power-on sequencer
  PON1: CH1 → CH2 → CH3 → CH4
  PON56: CH5 & 6 are starting up at same time (CH5 complete prior.)
- Built-in Digital soft start function
- Built-in discharge circuit (CH2~4, 6)
- Built-in protection circuit (SCP, OCP, OVP and TSD)
- Dimmer control (CH7)
- Operating voltage range
  1.5V~5.5V (for 1cell Li-ion and 2cell AA battery)
- Package:
  5mm × 5mm × 0.8mmt, 0.40mm pitch, 40pin QFN

APPLICATION

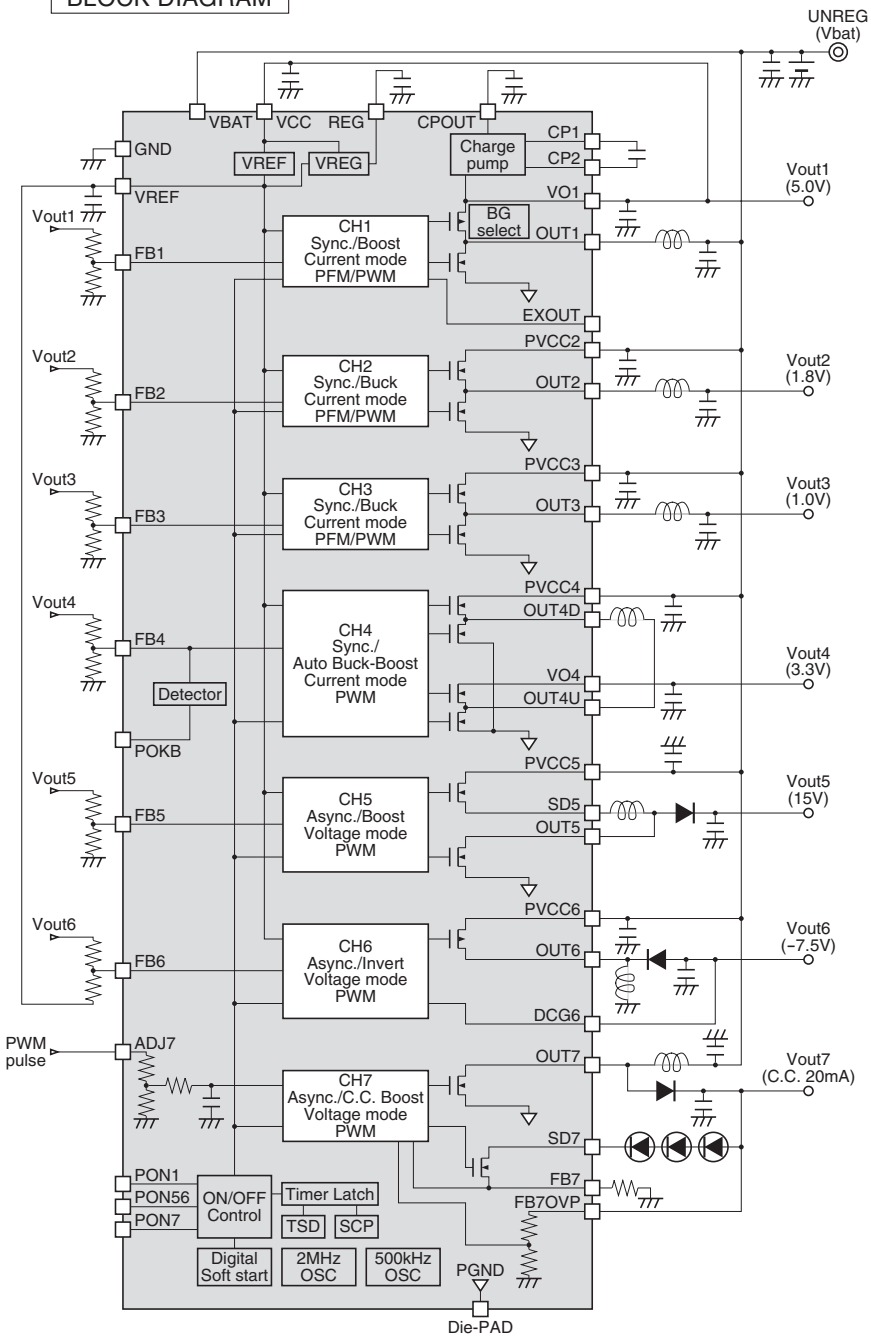
Digital Still Camera, DVC (DV)

PIN ARRANGEMENT (TOP VIEW)



40pin QFN

BLOCK DIAGRAM



** Under Development

●Power Management Linear ICs DC/DC

8ch DC/DC CONVERTER IC FOR LITHIUM-ION BATTERY AND 2CELL DRY BATTERY

R2A20010NP

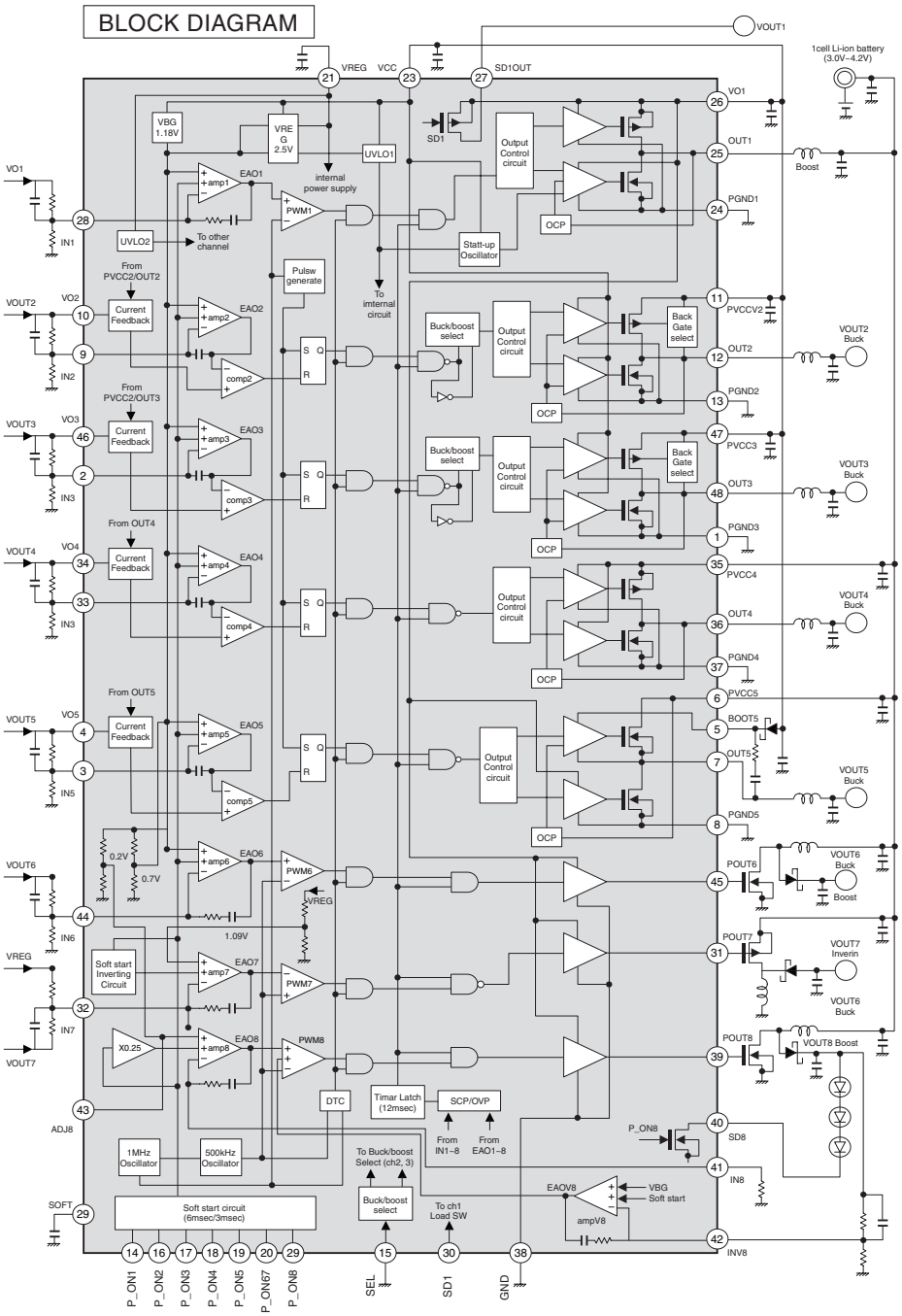
FEATURES

- 8-channel architecture (3ch step-up, 2ch srep-down, 2ch) selectable step-up/step-down, and 1ch Inverter)
- Built-in 5ch MOS transistor (ch1, ch2, ch3, ch4, and ch5)
- Built-in phase compensate parts (all channel)
- Built-in shut-down circuit (ch1 and ch8)
- 5ch synchronous rectification (ch1, ch2, ch3, ch4, and ch5)
- 3ch diode rectification (ch6, ch7, and ch8)
- High speed response curret feedback circuit (ch2, ch3, ch4, and ch5)
- Bootstrap circuit (ch5)
- High speed 1MHz swiching for synchronous rectifying channels
- Low speed 500kHz swiching for diode rectifying channels
- Independent ON/OFF control (except ch6 and ch7)
- Soft start (all channel)
- Protect function (SCP, OVP, OCP)
- Dimmer control for LCD BL (ch8)
- 3-kinds of reference voltage (1.18V for ch1 to ch4 and ch6,0.7V for ch5, 1.09V for ch7, 0.2V for ch8)
- Small LGA (5mm x 5mm), and QFN (6mm x 6mm) package are available to reducing mounting area

APPLICATION

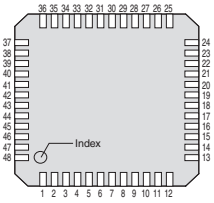
Digital Still Camera using 1-cell Li-ion battery or 2-cells Ni-MH battery (Size AA battery)

BLOCK DIAGRAM



PIN ARRANGEMENT (TOP VIEW)

R2A20010NP (48Pin QFN)



Description on Individual Products

●Power Management Linear ICs Battery Charger Control ICs

LITHIUM-ION BATTERY CHARGER CONTROL IC

M62242FP/AFP

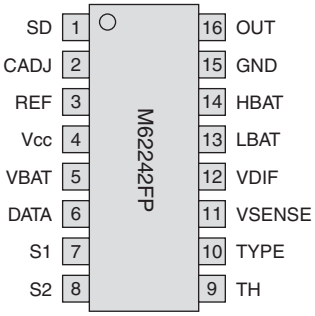
FEATURES

- High precision reference voltage built-in for full charge voltage detection (4.1V±30mV(AFP), 4.2V±30mV(FP) available)
- 5V power supply for MCU
- Various kinds of charge flows are available by the interface with MCU
- Package : 16 pin SSOP

APPLICATION

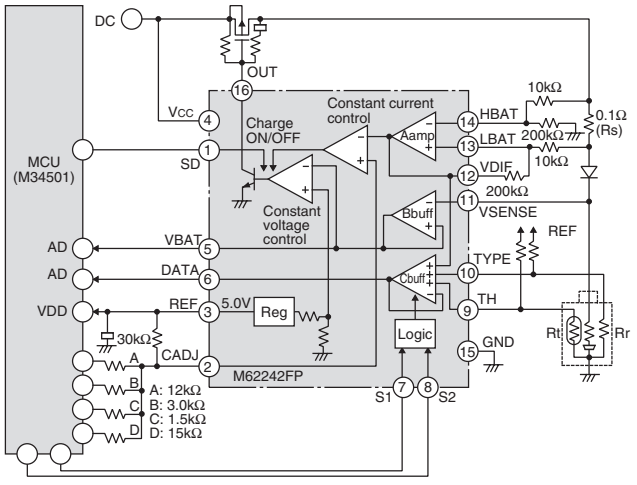
Personal Digital assistant battery charger for genaral electronic equipments

PIN ARRANGEMENT (TOP VIEW)



16P2E-A

BLOCK DIAGRAM



LITHIUM-ION BATTERY CHARGER CONTROL IC

M62255FP

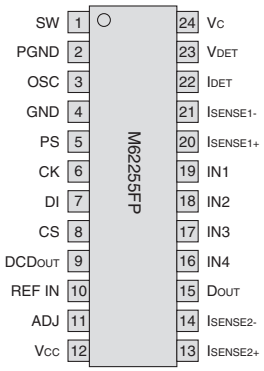
FEATURES

- Built-in 3-wire serial data interface for MCU
- Built-in multiplexer and level expanding circuit with 4 input ports
- Built-in DC/DC converter circuit for PWM function
- Built-in two current detection circuits at the plus side of the battery both detect able charge current and discharge current
- ON/OFF control with low power dissipation mode. (Power save)
- Package : 24pin SSOP

APPLICATION

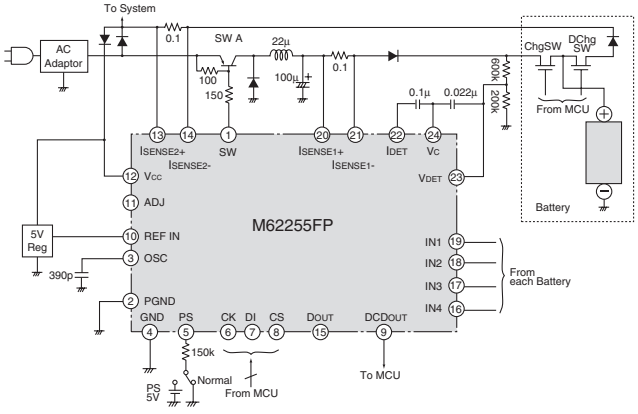
Laptop computers, Video camera and general battery charger for other digital equipment

PIN ARRANGEMENT (TOP VIEW)



24P2Q-A

BLOCK DIAGRAM



Description on Individual Products

●Power Management Linear ICs Battery Charger Control ICs

SINGLE CHIP BATTERY CHARGER CONTROL IC

M62240FP

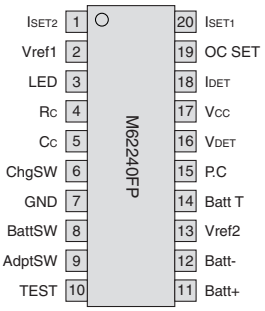
FEATURES

- Low voltage (3V) operation
- CR oscillator for internal logic
- Initialization timer and safety timer for -ΔV error detection and over-charging
- D/A converter and shift registers to maintain the peak voltage of battery
- Main output SW driving circuits
- LED driving circuit for displaying the status of the charging
- System reset circuit for detecting the power supply voltage
- Temperature detection circuit for the Ni-MH battery
- Voltage and current control circuits for feedback to the primary side of the SMPS
- Protective functions including detection of over-voltage in charge mode and over-current in adapter mode and so on
- Package : 20pin SOP

APPLICATION

Battery charger for video cameras and mobile phones, etc

PIN ARRANGEMENT (TOP VIEW)



20P2N-A

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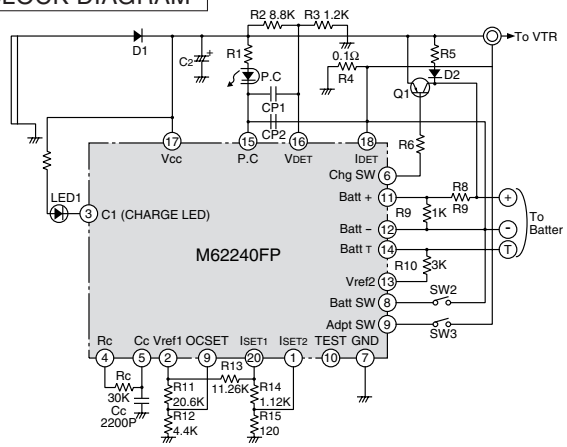


CONSTANT VOLTAGE CONSTANT CURRENT CONTROL IC

M62237FP

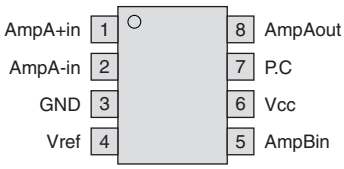
FEATURES

- Operating power supply voltage range 2.5 to 15V
- High precision reference voltage 1.25V ±1.0%
- PC terminal output current 20mA
- Package : 8pin SOP

APPLICATION

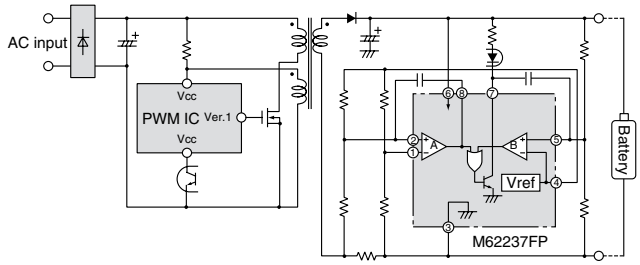
Charger, Switching mode power supply secondary side control

PIN ARRANGEMENT (TOP VIEW)



8P2S-A

BLOCK DIAGRAM



SINGLE CHIP BATTERY CHARGER CONTROL IC

M62241FP

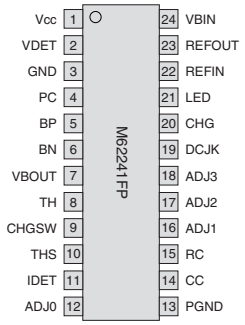
FEATURES

- Low-voltage operation design supports 4V drive
- CR oscillation circuit for internal logic
- Terminating timer for preventing overcharge 30min. indicating timer
- Main output switch drive circuit
- LED drive circuit (1 system) to indicate charging status
- System reset circuit for detecting the lowering of supply voltage
- Temperature detection for Lithium-ion battery
- Voltage/current control for feedback to the primary side of switching regulator
- Various protections such as overvoltage detection at charging, overcurrent detection at adaptor connection
- Package : 24pin SSOP

APPLICATION

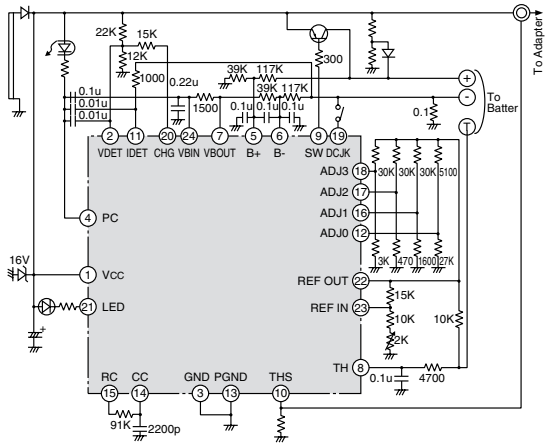
VCR with camera, cellular phone, battery charger for general electronic equipments.

PIN ARRANGEMENT (TOP VIEW)



24P2Q-A

BLOCK DIAGRAM



LITHIUM-ION BATTERY CHARGER CONTROL IC

M62253AGP

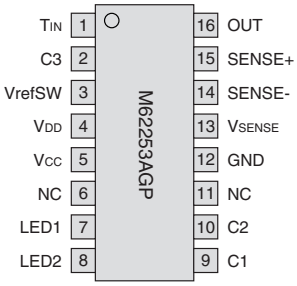
FEATURES

- Corresponding to 4.1V and 4.2V battery
- High precision reference voltage (charge voltage) built-in 4.2V±30mV
- Constant current and voltage charging
- Charging inhibit and protection function for over discharged battery
- Charge disabling functions for an over discharged battery and a high/low temperature battery
- Recharging function
- 2 LED driving circuits to Indicate charging conditions
- Delay circuit to prevent chattering
- Package : 16pin SSOP

APPLICATION

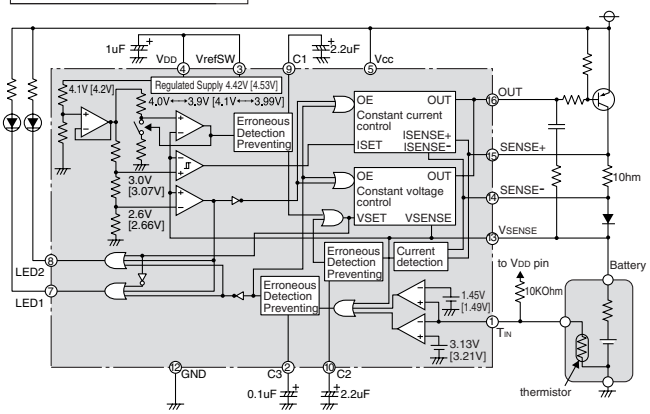
Lithium-ion battery charger for handheld telephones, etc.

PIN ARRANGEMENT (TOP VIEW)



16P2E-A

BLOCK DIAGRAM



●Power Management Linear ICs Battery Charger Control ICs

LITHIUM-ION BATTERY CHARGER CONTROL IC

M62244FP

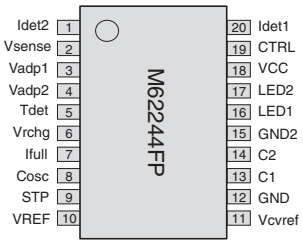
FEATURES

- Support 4.2V battery
- Built-in high precision ref. voltage (charge voltage)4.2V±30mV
- Built-in 3 kind of timer (externally variable)
  * Initial setting timer : about 5 min.
  * Recharge time : about a hour
  * Charge timer : about 4 hours
- Protection
  *Overdischarged Battery
  *High and Low temperature battery
- Built-in delay circuit for chattering prevention
- Built-in charge OFF function
  *When adaptor pulled out
  *When adaptor voltage goes down.
- Package : 20pin SSOP

APPLICATION

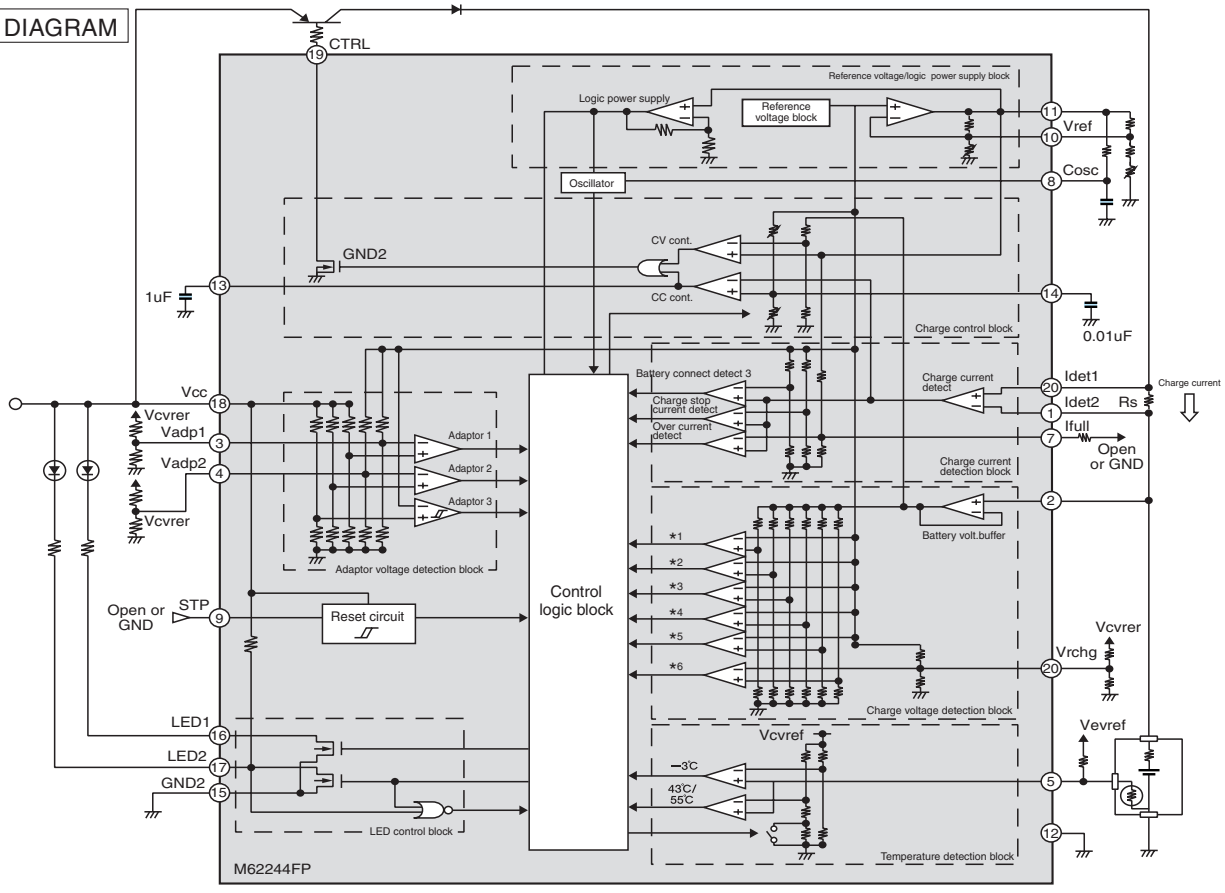
Chargers for lithium-ion batteries

PIN ARRANGEMENT (TOP VIEW)



20P2F-A

BLOCK DIAGRAM



★1.Over discharge detect
★2.Quick charge start volt.detect
★3.Over voltage detect
★4.Battery connect detect 1
★5.Battery connect detect 2
★6.Charge stop / recharge detect

LITHIUM-ION BATTERY CHARGER CONTROL IC

M62245FP

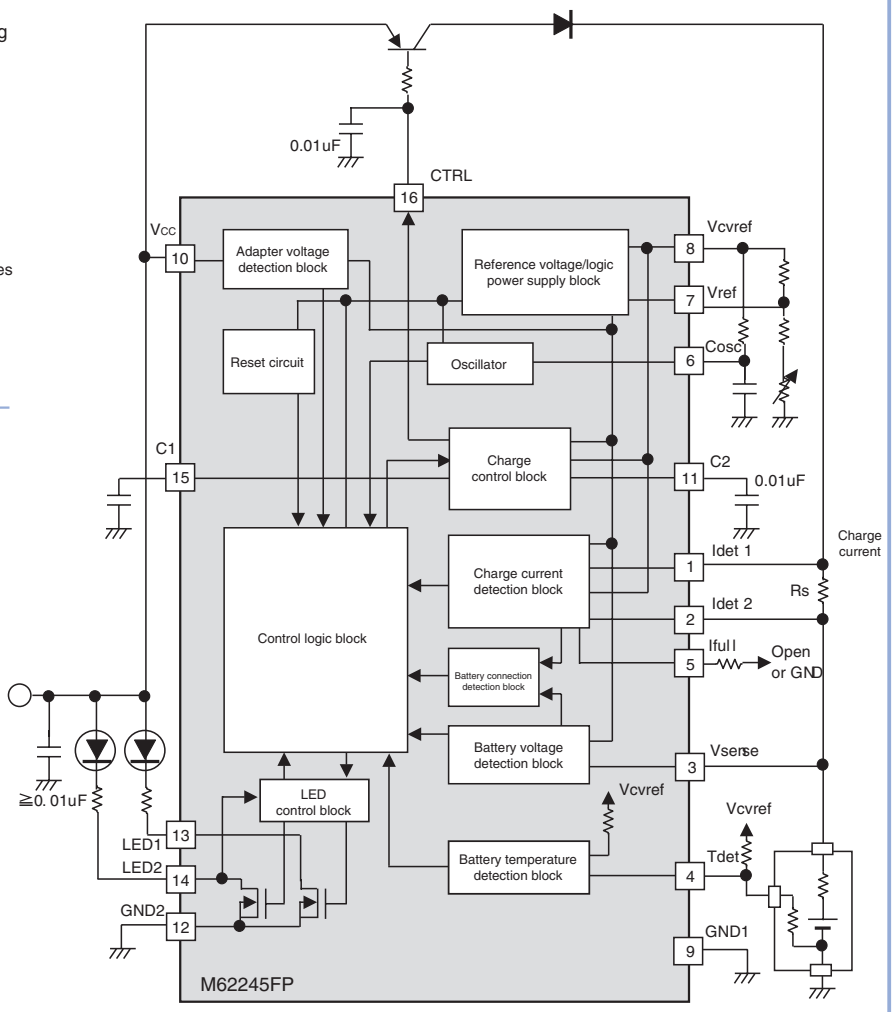
FEATURES

- Compatible with 4.2 V batteries
- On-chip high-precision reference voltage (charge voltage), 4.2 V ±30 mV
- Supports constant current, constant voltage charging
- On-chip protection function to prevent charging of over-discharged batteries
- On-chip protection function to prevent charging of batteries at excessively high or low temperatures
- On-chip recharge function
- 2 LEDs to indicate charging status
- On-chip delay circuit to prevent chattering
- 3 on-chip timers (settings variable by attaching external devices)
  - Initial setting timer (spare charge timer 1): Approx. 5 minutes
  - Spare charge timer (spare charge timer 1): Approx. 1 hour
  - Charge timer: Approx. 4 hours
- On-chip flashing LED malfunction indicator function

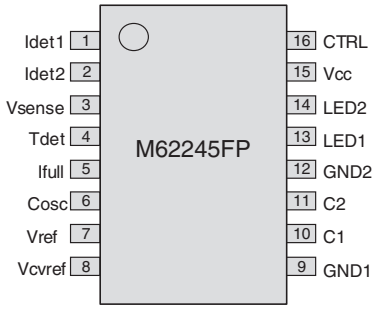
APPLICATION

Chargers for lithium-ion batteries, etc.

BLOCK DIAGRAM



PIN ARRANGEMENT (TOP VIEW)



16P2N-A

●Power Management Linear ICs Battery Charger Control ICs

LITHIUM-ION BATTERY CHARGER CONTROL IC BUILT-IN CHARGE SW

M62249FP

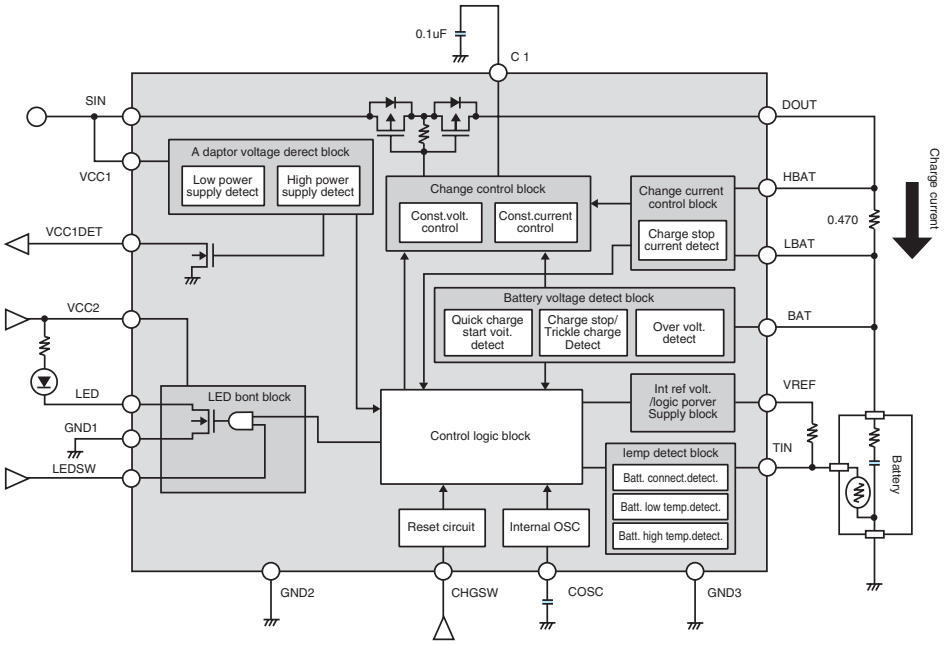
FEATURES

- High precision ref. voltage(±0.5%)
- Power MOSFET charge SW
- 3 safety timer circuits
  -Charge timer for overdischarged batt.
  -Precharge timer
  -20hrs timer
- Small package(28pin QFN)

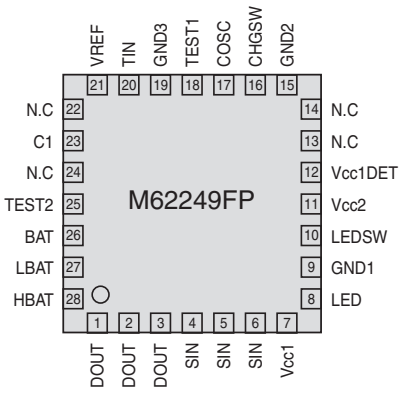
APPLICATION

Portable models such as DSC, etc

BLOCK DIAGRAM



PIN ARRANGEMENT (TOP VIEW)



28PJW-A

LITHIUM-ION BATTERY CHARGER CONTROL IC

R2S20030NP

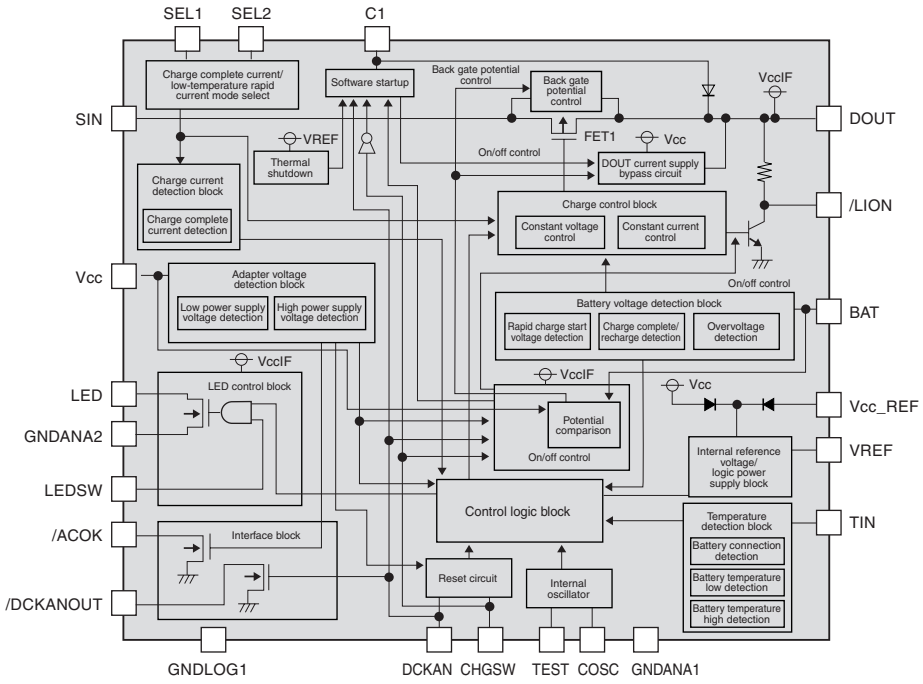
FEATURES

- High precision ref. voltage(±0.5%)
- Power MOSFET charge SW
- Current sense resistor built-in
- 3 safety timer circuits
  - -Charge timer for overdischarged batt.
  - -Precharge timer
  - -20hrs timer
- Small package(28pin QFN)

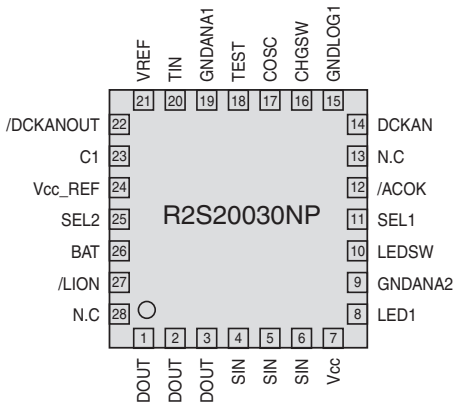
APPLICATION

DSC,etc.

BLOCK DIAGRAM



PIN ARRANGEMENT (TOP VIEW)



28PJW-A

●Power Management Linear ICs Battery Charger Control ICs

LITHIUM-ION BATTERY CHARGER CONTROL IC

R2S20031SP

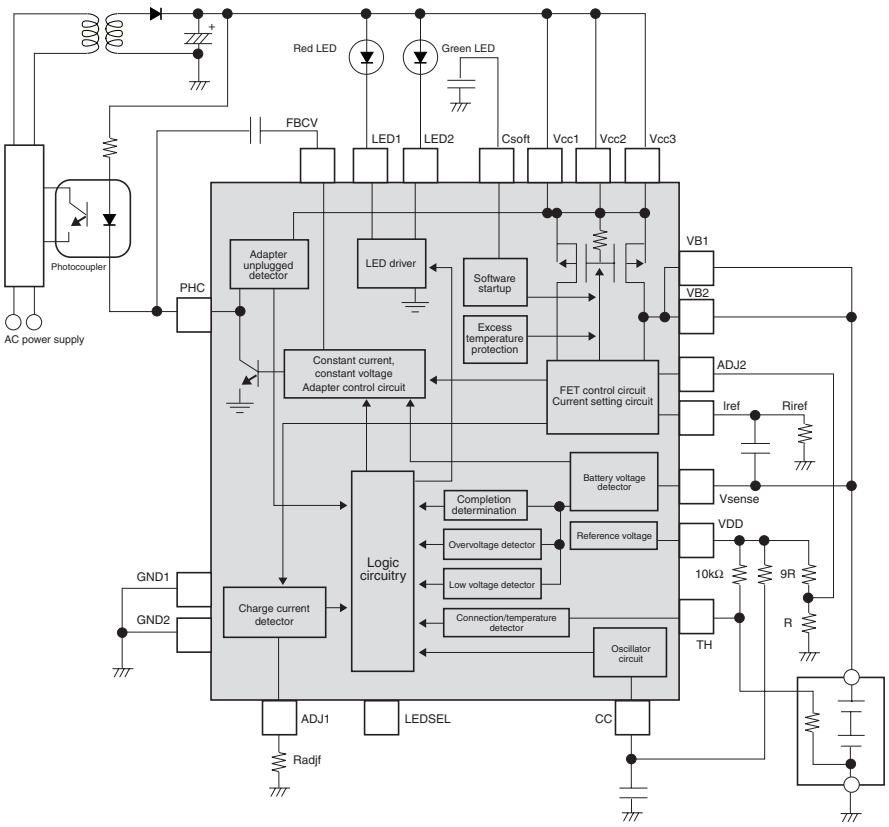
FEATURES

- Switching type constant voltage and constant current control for charging
- High-precision charging voltage control, 8.4 V ±60 mV (2 cells)
- Over-discharge, overvoltage, temperature, and excess heat protection
- Built-in drivers for 2 LEDs
- 2 on-chip timer functions (over-discharge, charge)
- Compact 20-pin SSOP package

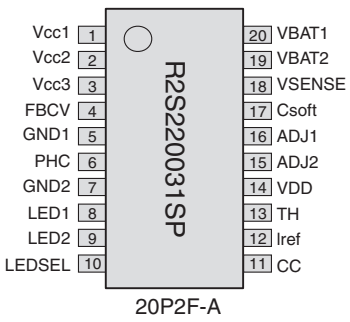
APPLICATION

DSC,etc.

BLOCK DIAGRAM



PIN ARRANGEMENT (TOP VIEW)



20P2F-A

LITHIUM-ION BATTERY CHARGER CONTROL IC

R2A20051NS

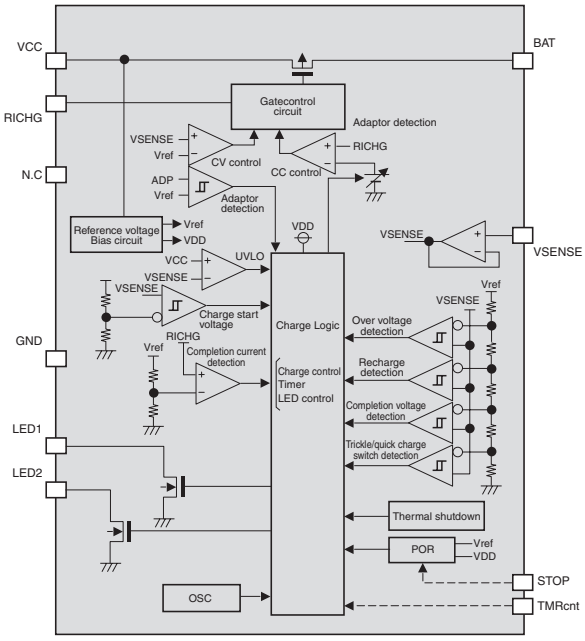
FEATURES

- Available for 4.2V battery
- Built-in high accuracy reference voltage (charge voltage) 4.20V±30mV(at Ta=25˚C)
- Constant current and constant voltage control function
- Battery connection detection function
- Built-in adaptor detection function
- Built-in recharge function
- Built-in chip temperature detection function
- Substantial protection functions
  - -Safety timer
  - -Overdischarge protection
  - -Overvoltage protection
  - -Charge prohibition protection for overvoltage and overdischarge battery.
  - -Thermal shutdown function
  - -Erroneous detection protection
- Built-in LED display function

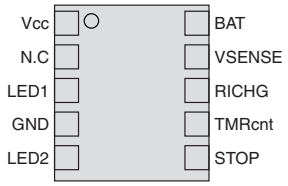
APPLICATION

For DSC, cellular phone, PDA, portable memory audio player, handheld game machine, and others

BLOCK DIAGRAM



PIN ARRANGEMENT (TOP VIEW)



10pin DFN

Description on Individual Products

●Power Management Linear ICs Protection Control ICs

SMART BATTERY I/F IC

M61040FP

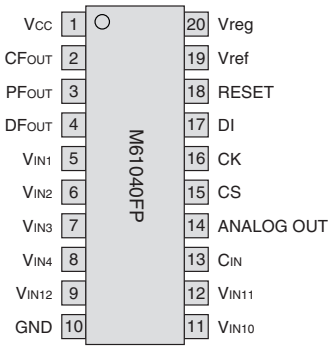
FEATURES

- High gain OP Amp. for charge/discharge current monitor
- Overcurrent detection for FET protection
- Control charge/discharge FET available by MCU
- Power save functions to lower dissipation current
- High voltage device (absolute maximum rating 33V)
- Package : 20pin TSSOP

APPLICATION

Smart battery system (SBS)

PIN ARRANGEMENT (TOP VIEW)



TTP-20DAV

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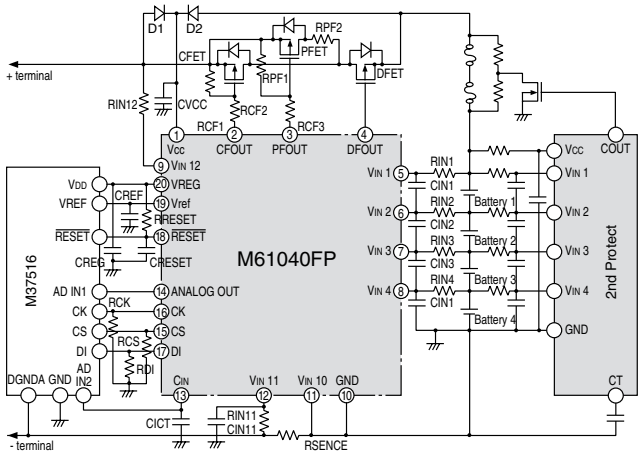


SMART BATTERY I/F IC

M61041FP, M61042FP

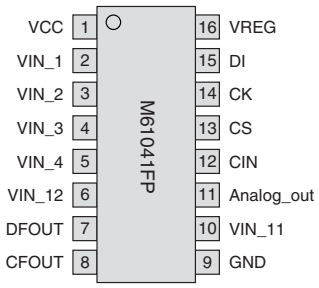
FEATURES

- High gain OP Amp. for charge/discharge current monitor
- Overcurrent detection for FET protection
- Control chareg/discharge FET available by MCU
- Power save function to lower dissipation current
- 5.2V operation to lower dissipation current for MCU (M61041FP)
- 3.3V operation to lower dissipation current for MCU (M61042FP)
- High voltage device (absolute maximum rating 33V)
- Package:16pin TSSOP

APPLICATION

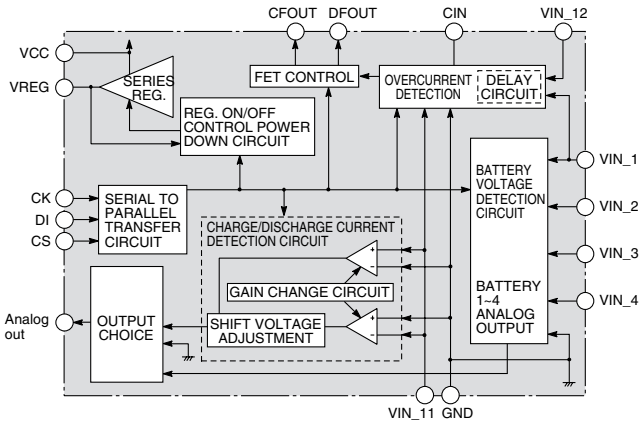
Smart battery system (SBS)

PIN ARRANGEMENT (TOP VIEW)



TTP-20DAV

BLOCK DIAGRAM



SMART BATTERY I/F IC

M61043FP, M61044FP

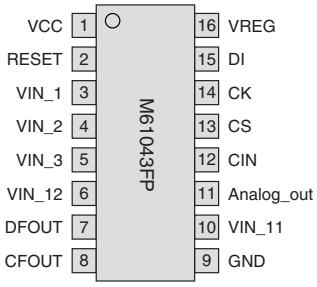
FEATURES

- High gain OP Amp. for charge/discharge current monitor
- Overcurrent detection for FET protection
- Control chareg/discharge FET available by MCU
- Power save function to lower dissipation current
- 5.2V operation to lower dissipation current for MCU (M61043FP)
- 3.3V operation to lower dissipation current for MCU (M61044FP)
- High voltage device (absolute maximum rating 33V)
- Package:16pin TSSOP

APPLICATION

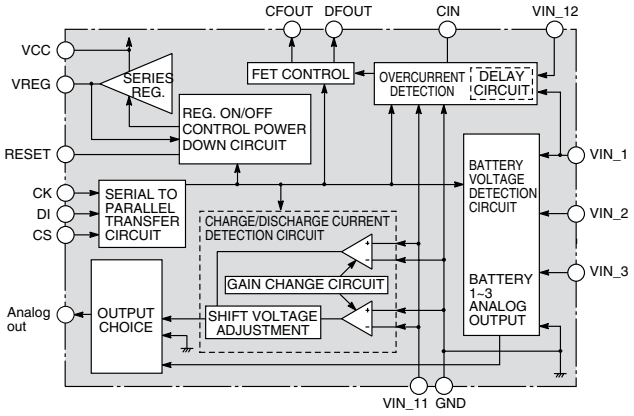
Smart battery system (SBS)

PIN ARRANGEMENT (TOP VIEW)



TTP-20DAT

BLOCK DIAGRAM



SMART BATTERY I/F IC

M61047FP

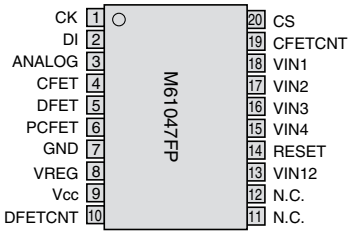
FEATURES

- ALL FETs are controlled by microcomputer
- Built-in series regulator for MCU(3.3V output. Able to change for 5V output by register setting at rewriting Flash memory.)
- Various powers saving function to reduce total power dissipation
- Built-in voltage detection circuit of each battery cell
- Built-in discharge circuit of each battery cell
- Built-in low dropout series regulator for microcomputer
- 3-wire serial data transfer system for communication from microcomputer
- High Input Voltage Device(Absolute Maximum Rating:33V)
- Package:20pin SSOP

APPLICATION

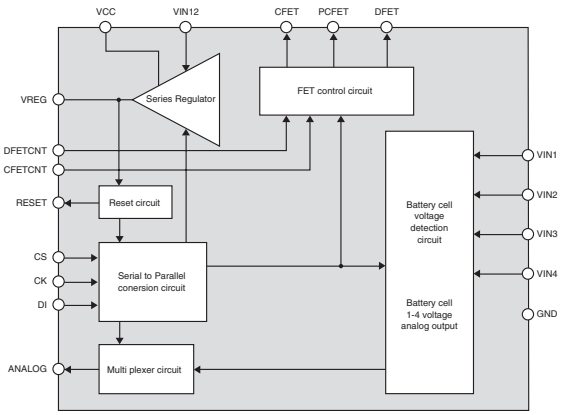
Smart battery system (SBS)

PIN ARRANGEMENT (TOP VIEW)



20P2F-A

BLOCK DIAGRAM



Description on Individual Products

●Power Management Linear ICs Protection Control ICs

SMART BATTERY I/F IC

M61048FP

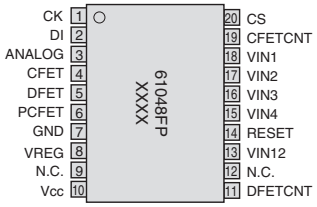
FEATURES

- ALL FETs are controlled by MCU
- Built-in series regulator for MCU(2.5V output)
- Various powers saving function to reduce total power dissipation
- Built-in voltage detection circuit of each battery cell
- Built-in discharge circuit of each battery cell
- Built-in low dropout series regulator for microcomputer
- 3-wire serial data transfer system for communication from microcomputer
- High Input Voltage Device(Absolute Maximum Rating:33V)
- Package:20pin SSOP

APPLICATION

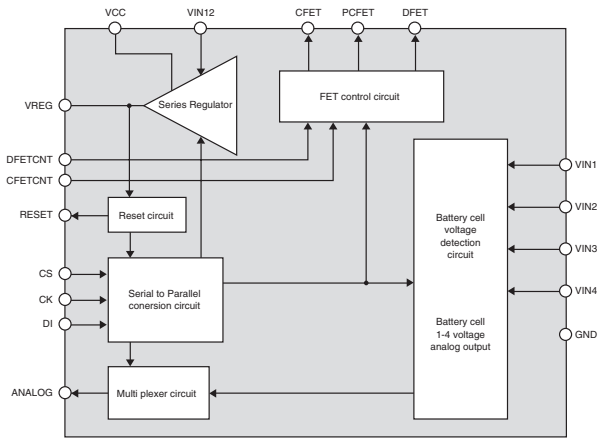
Smart battery system (SBS)

PIN ARRANGEMENT (TOP VIEW)



20P2F-A

BLOCK DIAGRAM



LITHIUM-ION BATTERY PROTECTION ANALOG FRONT END IC SPECIFICATION(TENTATIVE)

R2S20020SP

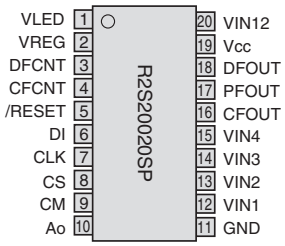
FEATURES

- CMOS monolithic IC
- All FET's are controlled by MCU
- Linear regulator(2.5V output) for MCU power supply
- Linear regulator(3.3V output) for LED power supply
- Power save function
- Cell balancing circuit for adjusting each cell voltage
- Reset circuit for detecting voltage drop to output reset signal by monitoring regulator voltage
- 3-wire interface with MCU
- High voltage device(Absolute Maximum Rating 30V)

APPLICATION

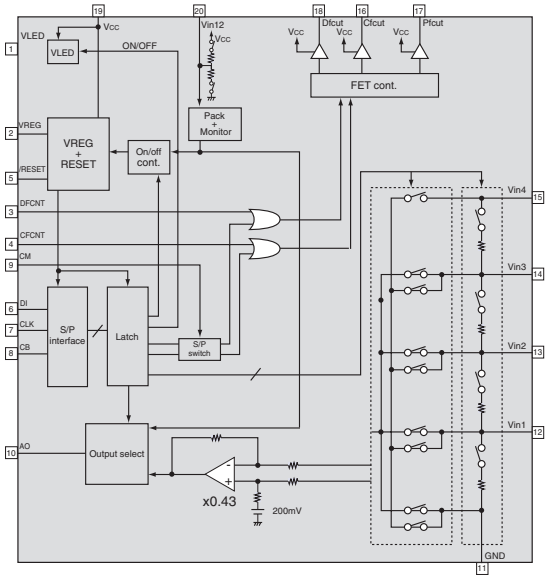
Smart battery

PIN ARRANGEMENT (TOP VIEW)



20P2E-A

BLOCK DIAGRAM



Description on Individual Products

●Power Management Linear ICs System Power Management ICs

PWM CONTROLLER FOR SYNCHRONIZATION DEFLECTION SYSTEM CONTROL FOR CRT MONITOR

M62501P/FP

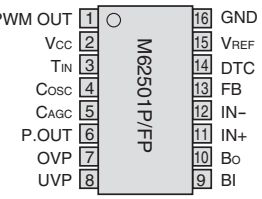
FEATURES

- PWM output in synchronization with external signals
- Wide range of PWM control frequency ····· 15kHz to 150kHz
- Built-in soft start circuit
- Built-in low voltage output malfunction prevention circuit
  Start Vcc > 9V
  Stop Vcc > 6V
- Built-in output overvoltage protection circuit (OVP) in the control line and built-in low voltage protection circuit (UVP)

APPLICATION

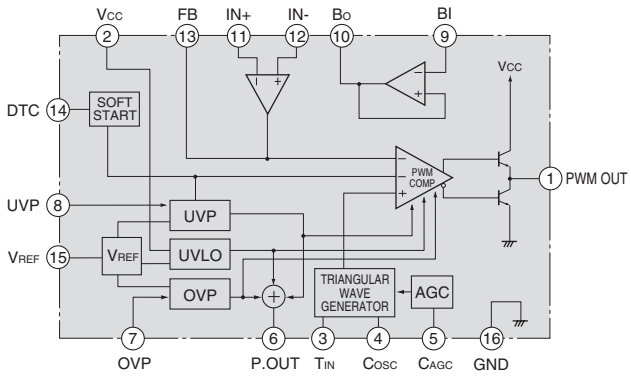
CRT display monitor

PIN ARRANGEMENT (TOP VIEW)



16P4(P)
16P2S-A(FP)

BLOCK DIAGRAM



PWM CONTROLLER FOR SYNCHRONIZATION DEFLECTION SYSTEM CONTROL FOR CRT MONITOR

M62504P/FP

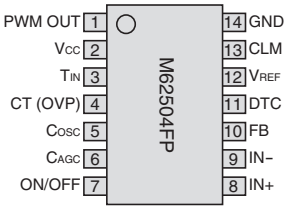
FEATURES

- PWM output in synchronization with external signals
- Wide range of PWM control frequency ····· 15kHz to 150kHz
- Built-in soft start circuit
- Built-in low voltage output malfunction prevention circuit
  Start Vcc > 9V
  Stop Vcc < 6V
- Built-in Pulse-By-Pulse method current limiting circuit
- Built-in Timer latch protection circuit

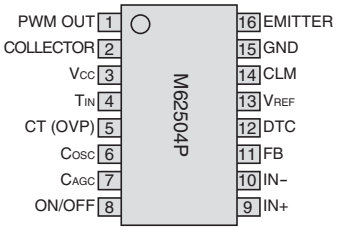
APPLICATION

CRT display monitor

PIN ARRANGEMENT (TOP VIEW)

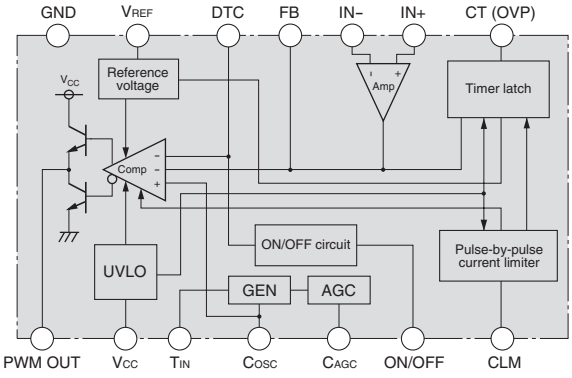


14P2N-A



16P4

BLOCK DIAGRAM



Description on Individual Products

●Standard Linear ICs Data Converters

3V TYPE 8-BIT 36CH D/A CONVERTER

M62370GP, M62371GP

FEATURES

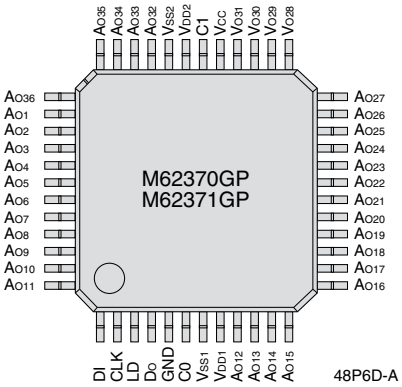
- Low voltage operation (2.7 to 3.6V)
- 16-bit serial data input (connected via 3 pins:DI, CLK, LD)
- 36 channels of 8-bit D/A converter
- 6 channels of D/A converters can select output from 4 data stored in each converter, through 2 control terminals (Ao31 to Ao36)

APPLICATION

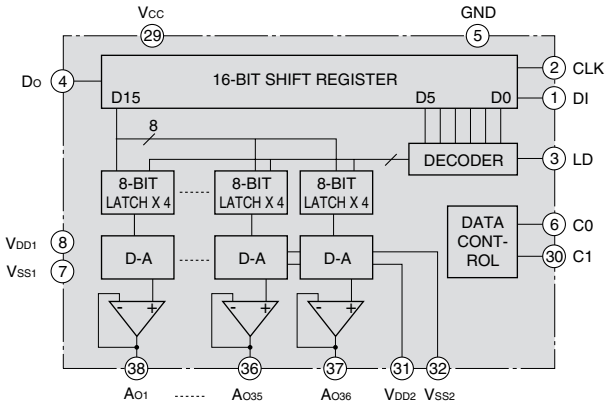
Adjustment/control of industrial or home-use electronic equipment, such as VCR camera, VCR set, TV, and CRT display

*M62371GP is a product with increased output drive capacity.

PIN ARRANGEMENT (TOP VIEW)



BLOCK DIAGRAM



3V TYPE 8-BIT 36CH D/A CONVERTER

M62366GP, M62367FP**/GP, M62368GP

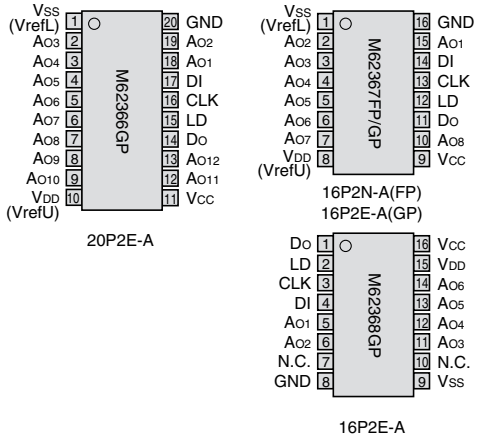
FEATURES

- Low voltage operation (2.7 to 3.6V)
- 12-bit serial data input (connected via 3 pins :DI,CLK, LD)
- 12/8/6 channels of R-2R and segment type high-performance 8-bit D/A converter
- 12/8/6 buffer operational amplifiers with full swing of output voltage between Vcc and GND
- High oscillation stability against the capacitive load of buffer operational amplifiers

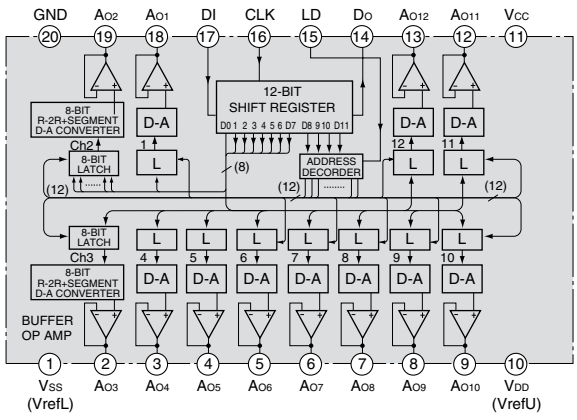
APPLICATION

Adjustment/control of industrial or home-use electronic equipment, such as VCR camera, VCR set, TV, and CRT display

PIN ARRANGEMENT (TOP VIEW)



BLOCK DIAGRAM



** Under Development

5V TYPE 8-BIT 12/8/6CH D/A CONVERTER

M62352P/FP/GP, M62353P/FP/GP M62354P/FP/GP

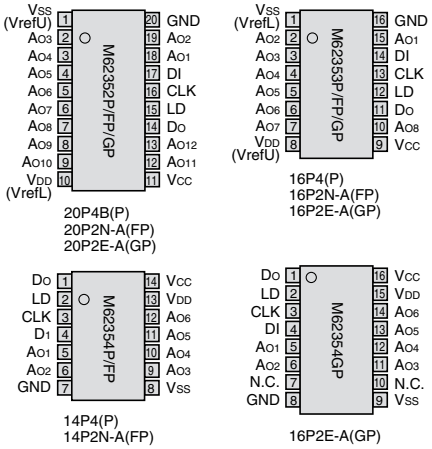
FEATURES

- 12-bit serial data input (connected via 3 pins:DI, CLK, LD)
- 12/8/6 channels of R-2R and segment type high-performance 8-bit D/A converters
- 12/8/6 buffer operational amplifiers with full swing of output voltage between Vcc and GND
- High oscillation stability against the capacitive load of buffer oparational amplifiers

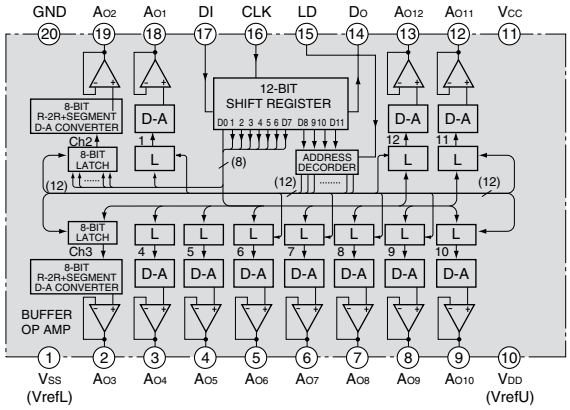
APPLICATION

Adjustment/control of industrial or home-use electronic equipment, such as VCR camera, VCR set, TV, and CRT display

PIN ARRANGEMENT (TOP VIEW)



BLOCK DIAGRAM



5V TYPE 8-BIT 12/8/6CH D/A CONVERTER

M62352AGP, M62353AGP, M62354AGP

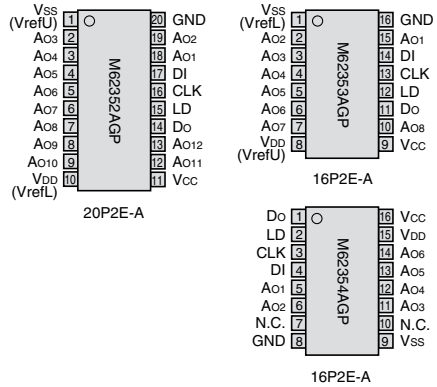
FEATURES

- 12-bit serial data input (connected via 3 pins:DI, CLK, LD)
- Corresponds to TTL input (3V CMOS input)
- 12/8/6 channels of R-2R and segment type high-performance 8-bit D/A converters
- 12/8/6 buffer operational amplifiers with full swing of output voltage between Vcc and GND.
- High oscillation stability against the capacitive load of buffer oparational amplifiers

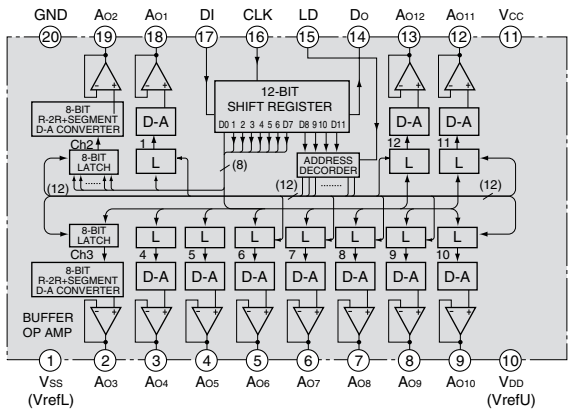
APPLICATION

Adjustment/control of industrial or home-use electronic equipment, such as VCR camera, VCR set, TV, and CRT display

PIN ARRANGEMENT (TOP VIEW)



BLOCK DIAGRAM



Description on Individual Products

●Standard Linear ICs Data Converters

8-BIT 2/3CH D/A CONVERTER

M62342P/FP/GP/HP, M62343P/FP/GP

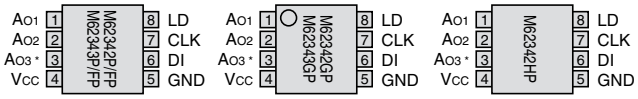
FEATURES

- Supply voltage 2.7 to 5.5V
- 10bit serial data input (3-wire serial data method)
- Output buffer operational amplifier
  Operates in the whole voltage range from Vcc to ground. (0 to 5V)
- High output current drive capability
  over ±1.0mA

APPLICATION

Conversion from digital data to analog control data for both consumer and industrial equipment.Gain control and automatic adjustment of DISPLAY-MONITOR or CTV

PIN ARRANGEMENT (TOP VIEW)



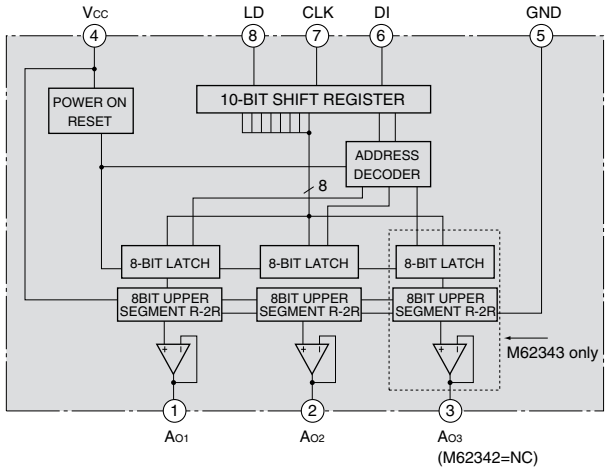
8P4(P)
8P2S-A(FP)

8P2J-A (GP)

MSOP-8(HP)

∗M62342 (3PIN=NC)
N.C : NO CONNECTION

BLOCK DIAGRAM



3~5V TYPE 8BIT 4CH D/A CONVERTER

M62384FP

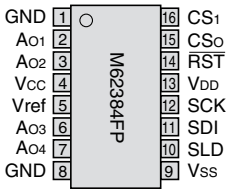
FEATURES

- Data transfer format: 3-wire serial data transfer method
- Serial data transfer clock frequency: 10MHz (max.)
- Built-in buffer operational amplifiers: operative in almost the whole range of Vcc to GND
- Short output settling time
- Power-on reset, external reset function built-in
- Built-in chip-select function (Up to 4 chips can be connected on the same bus.)
- Supply voltage: 2.7V to 5.5V

APPLICATION

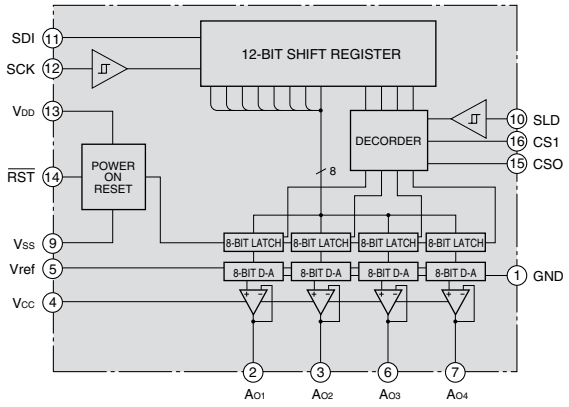
Conversion from digital to analog for home-use and industrial equipment, signal gain setting or tuning for CTV, display monitor, and so forth

PIN ARRANGEMENT (TOP VIEW)



16P2N-A

BLOCK DIAGRAM



5V TYPE 8-BIT 12/8CH I²C BUS D/A CONVERTER

M62392P/FP, M62393P/FP

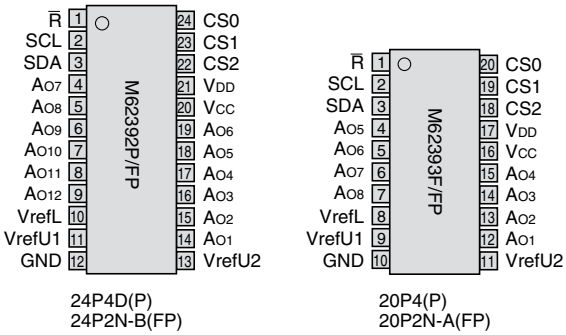
FEATURES

- Digital data transfer format
  I²C bus serial data method
- Output buffer operational amplifier
  Operates in the whole voltage range from VREFU to ground. (0 to 5V)
- High output current drive capacity
  ±1.0mA over
- Standard two high level reference voltage terminals
  With two high level reference voltage terminals, two differing voltage ranges can be set

APPLICATION

Adjustment/control of industrial or home-use electronic equipment, such as VCR camera, VCR set, and CRT display

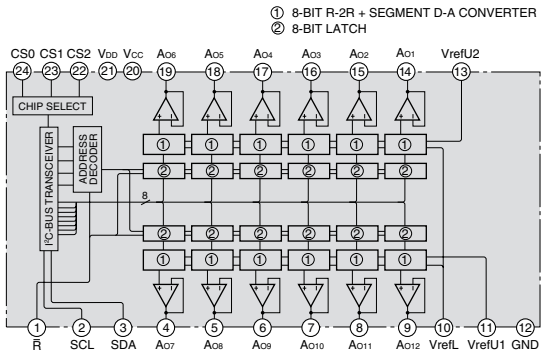
PIN ARRANGEMENT (TOP VIEW)



24P4D(P)
24P2N-B(FP)

20P4(P)
20P2N-A(FP)

BLOCK DIAGRAM



8-BIT 2/3/4CH I²C BUS D/A CONVERTER

M62332/337P/FP, M62333/338P/FP M62334/339P/FP

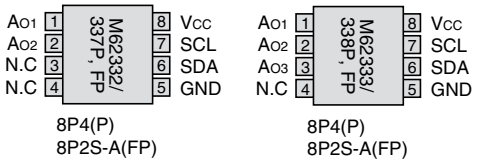
FEATURES

- Supply voltage 2.7 to 5.5V
- Digital data transfer format
  I²C BUS serial data method
- Output buffer operational amplifier
  Operates in the whole voltage range from VCC to ground
- High output current drive capacity
  ±1.0mA over

APPLICATION

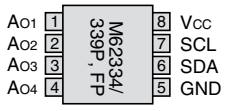
Conversion from digital data to analog control data for home-use and industrial equipment.Signal gain control or automatic adjustment of DISPLAY-MONITOR or CTV

PIN ARRANGEMENT (TOP VIEW)



8P4(P)
8P2S-A(FP)

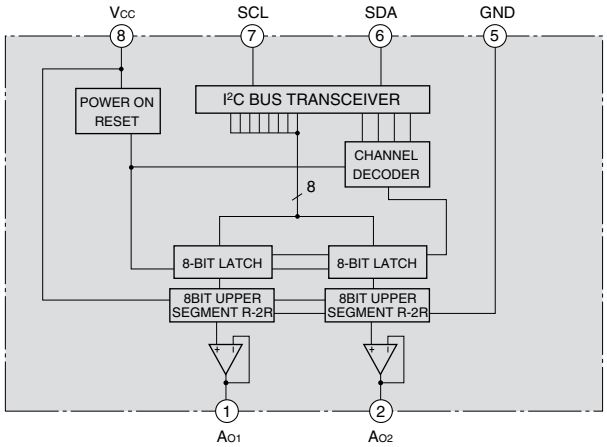
8P4(P)
8P2S-A(FP)



8P4(P)
8P2S-A(FP)

N.C : NO CONNECTION

BLOCK DIAGRAM



Description on Individual Products

●Standard Linear ICs Data Converters

5V TYPE 10-BIT 3CH MULTIPLYING D/A CONVERTER

M62362P/FP

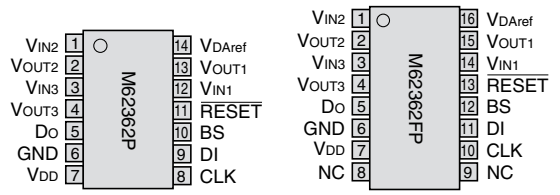
FEATURES

- Digital data transfer format
  3-wire serial data transfer method
- High resolution
  Resolution is more over 10-bit and error is less than ±1LSB
- Capable of 4 quadrant multiplication
- Capable of full voltage operation ranging from 0 to 5V for both input and output ranges
- Short setting time
- With reset terminal
  Recommend operation condition V_{DD} = 5V±10%

APPLICATION

Signal gain control of DISPLAY-MONITOR or CTV

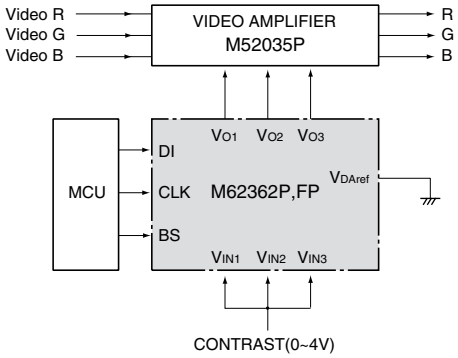
PIN ARRANGEMENT (TOP VIEW)



14P4(P)　　16P2N-A(FP)

N.C : NO CONNECTION

APPLICATION EXAMPLE OF CONTRAST CONTROL



In the drawing above, high precision control of 10 bits or more is applicable to 3-channel high speed video amplifier N52035 and, therefore, the IC is available to a high definition monitor as an optimum application.

5V TYPE 8-BIT 8CH HIGH-SPEED MULTIPLYING D/A CONVERTER

M62363FP

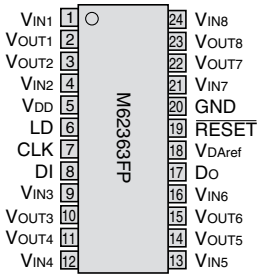
FEATURES

- Digtal data transfer format
  3-wire serial data transfer method
- D/A converter system
  Employment of the additional higher-order segment R-2R method doubled precision compared to the conventional R-2R method.
- 8 buffer operational amplifiers with full swing of output voltage between VCC and GND.
- High oscillation stability against the capacitive load of buffer operational apmlifiers
- Capable of 4 quadrant multiplication

APPLICATION

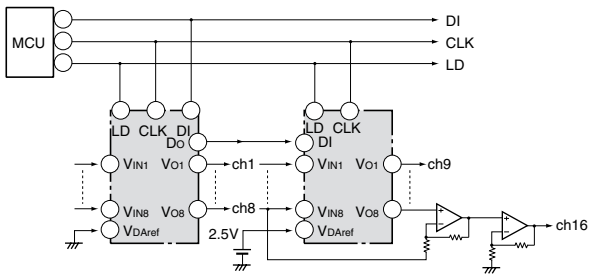
Signal gain control of DISPLAY-MONITOR or CTV

PIN ARRANGEMENT (TOP VIEW)



24P2Q-A

APPLICATION EXAMPLE OF CONTRAST CONTROL



8-BIT 2/3/4CH I²C BUS D/A CONVERTER

M62364FP/GP**

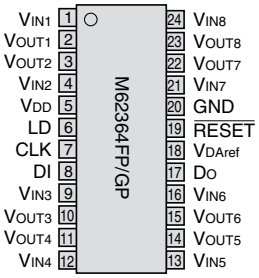
FEATURES

- Supply voltage 2.7 to 5.5V
- Digtal data transfer format
  3-wire serial data transfer method
- D/A converter system
  Employment of the additional higher-order segment R-2R method doubled precision compared to the conventional R-2R method.
- 8 buffer operational amplifiers with full swing of output voltage between Vcc and GND.
- High oscillation stability against the capacitive load of buffer operational apmlifiers
- Capable of 4 quadrant multiplication

APPLICATION

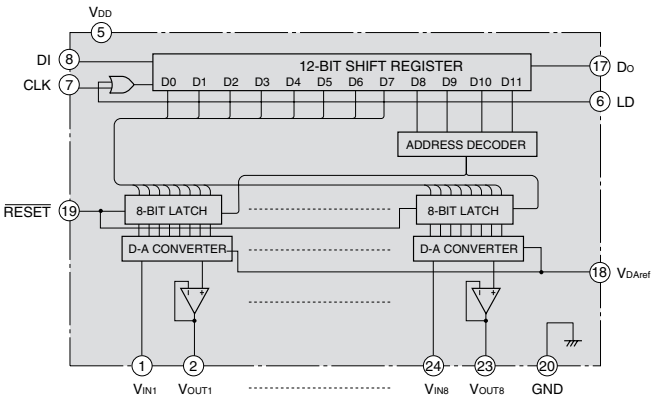
Signal gain control of DISPLAY-MONITOR or CTV

PIN ARRANGEMENT (TOP VIEW)



24P2Q-A(FP)
24P2E-A(GP)

BLOCK DIAGRAM (M62332P/FP)



** Under Development

5V TYPE 8-BIT 2CH×2 COMPOSITE D/A CONVERTER

M62383FP

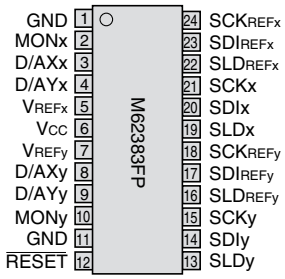
FEATURES

- Digital data transfer format
  3-wire serial data transfer method
- D/A converter system
  R-2R and segment type high-performance 8-bit multiplying D/A converter
- 8-bit D/A converter for adjusting standard voltage
- Buffer amplifier making full swing between Vcc and GND
- Fast settling time
- Reset terminal provided

APPLICATION

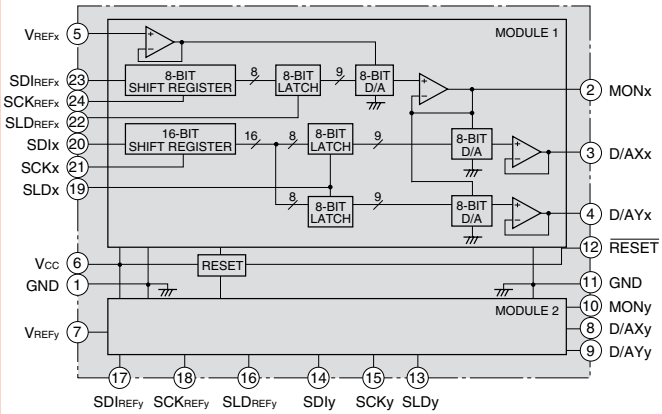
Transformation from digital control data to analogue control data for consumer and industrial equipments Automatic adjustment for electrical equipments

PIN ARRANGEMENT (TOP VIEW)



24P2Q-A

BLOCK DIAGRAM



Description on Individual Products

●Standard Linear ICs Data Converters

8-BIT 12CH D/A CONVERTER WITH DIG./ANA. EXPANDER

M62376GP

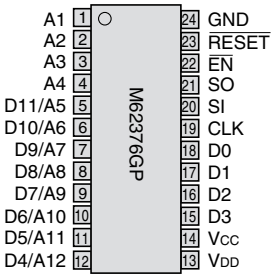
FEATURES

- Supply voltage 2.7 to 5.5V
- The status of input/output port can be set in individual ports
- Provides 4 pins for each of D/A converter output and I/O and 8 common pins for selectable D/A converter and I/O
- Built-in power-on reset where D/A output is set to [00] and I/O is placed in the input mode (Hi-Z) when power is turned on
- 0.65-mm pitch 24-pin small package

APPLICATION

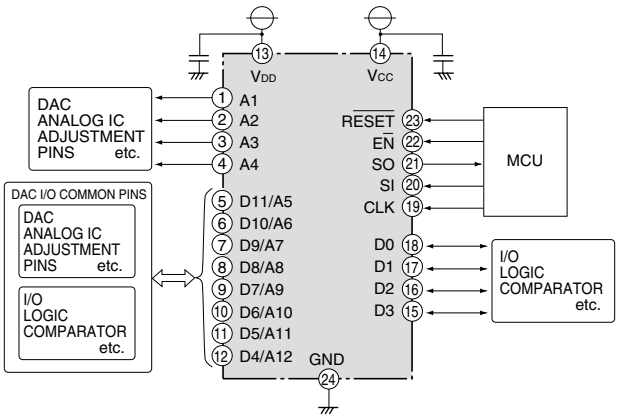
Adjustment/control of industrial or home-use electronic equipment, such as VCR camera, VCR set, TV, and CRT display

PIN ARRANGEMENT (TOP VIEW)



24P2E-A

APPLICATION EXAMPLE



5V TYPE 8-BIT I²C BUS EQUIVALENT I/O EXPANDER

M62320P/FP/GP*

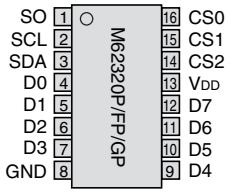
FEATURES

- Supporting I²C BUS enables to connect microcomputer via two pins of SCL and SDA
- I²C BUS is available for 8-bit serial/parallel conversion
- Up to 8 ICs can be connected to the same I²C BUS with chip select data (C0, C1 and C2)

APPLICATION

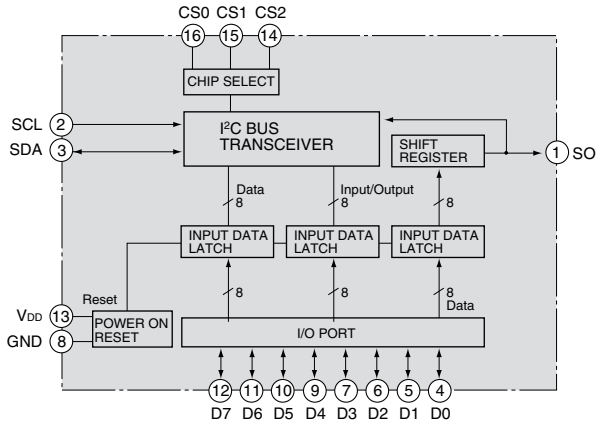
Extension of microcomputer input/output port Serial-parallel data conversion and parallel/serial data conversion of peripheral microcomputer

PIN ARRANGEMENT (TOP VIEW)



16P4(P)
16P2N-A(FP)
16P2E-A(GP)

BLOCK DIAGRAM



* New Product

10 to 12-BIT 4CH INTEGRATING A/D CONVERTER SUB SYSTEM

M62301SP/FP

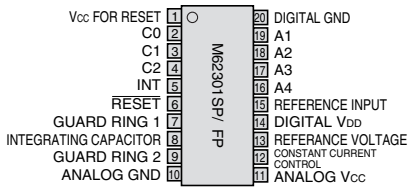
FEATURES

- Separate power supplies for analog section and digital section
- Low power dissipation 2mA(typ)
  (1mA for A/D conversion and the other 1mA for reset)
- Linear error ±0.02% (typ)
- Conversion time 526µs/ch (typ)
- Built-in system reset 4.45V (typ)

APPLICATION

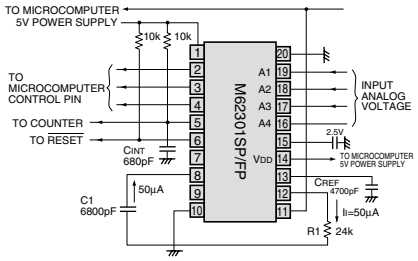
High-precision control systems such as temperature control and speed control

PIN ARRANGEMENT (TOP VIEW)

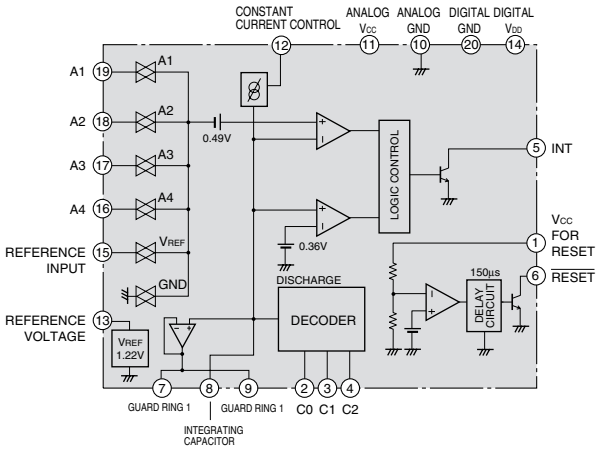


20P4B(SP)
20P2N-A(FP)

APPLICATION EXAMPLE



BLOCK DIAGRAM



Description on Individual Products

●Standard Linear ICs Data Converters

HIGH PRECISION DOUBLE-INTEGRAL TYPE A/D CONVERTER

M62303FP

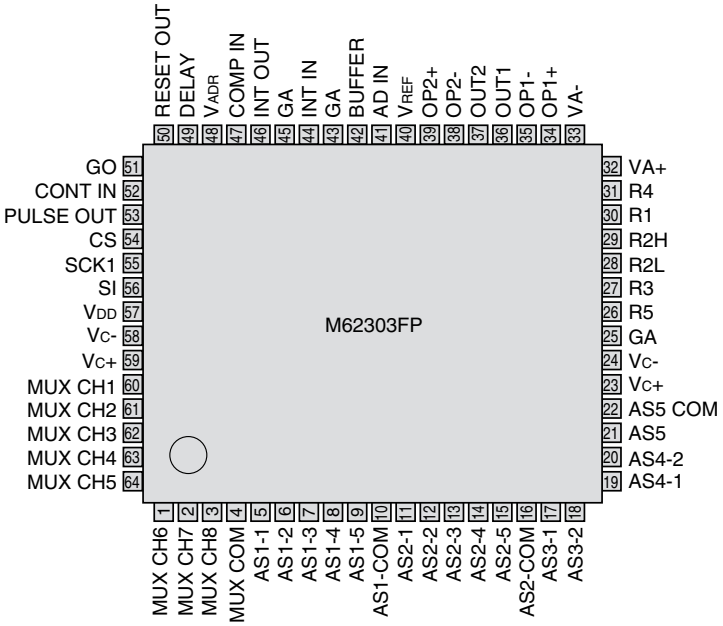
FEATURES

- High precision (14bit or more) double-integral type A/D converter
- Built-in voltage source (positive/negative) (TYP.+6.3V, -6.0V)
- Built-in current source (positive/negative)
  (max. Isource=2mA, Isink=0.2mA)
- Built-in independent operational amplifiers (2ch)
- Built-in system reset (TYP. 4.5V)

APPLICATION

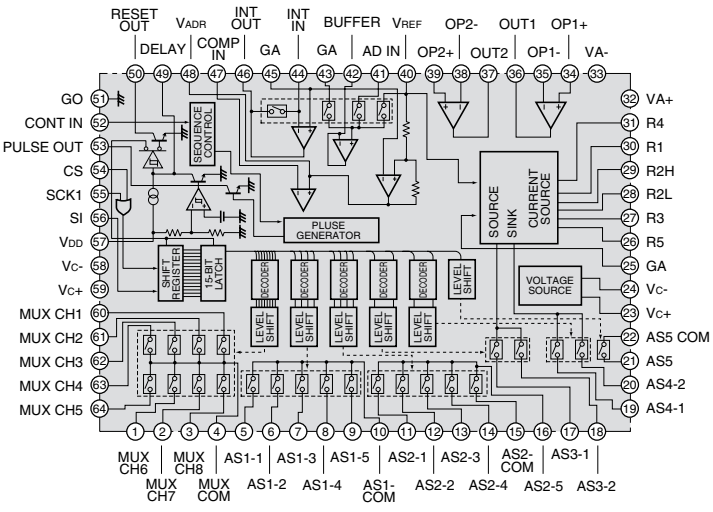
High precision control systems such as temperature control or speed control, etc

PIN ARRANGEMENT (TOP VIEW)



64P6S-A

BLOCK DIAGRAM



Description on Individual Products

●Standard Linear ICs Reset (Detector) ICs

Single-function reset ICs/Multifunctional reset ICs/Application specific reset ICs

CMOS SYSTEM–RESET IC

RNA51xx Series

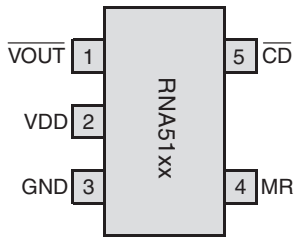
FEATURES

- Threshold voltage 1.4V to 5.0V (12 types lineup)
- Threshold voltage accuracy ±1.0%
- Threshold voltage hysteresis 5% typ.
- Low supply current 0.7µA typ.
- Capacitor-adjustable output delay time
- Manual reset
- VOUT cmos output, or open-drain output
- 5-pin MPAK-5 package
- Temperature range –40°C to 85°C

APPLICATION

- Power supply voltage monitoring for microprocessors
- Battery-powered portable equipment
- Computers and notebook computers
- Wireless Communication Systems
- Digital still camera, digital video camera, PDA

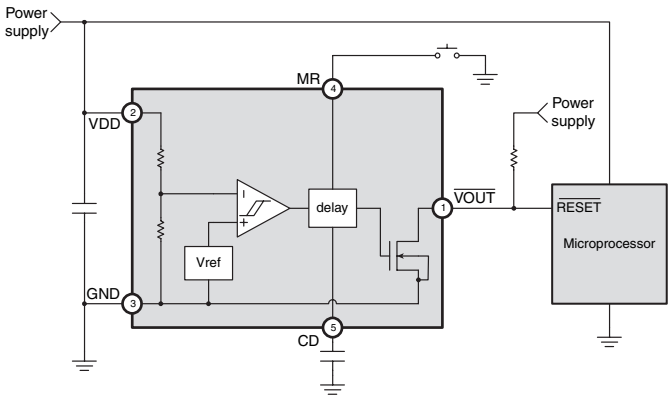
PIN ARRANGEMENT (TOP VIEW)



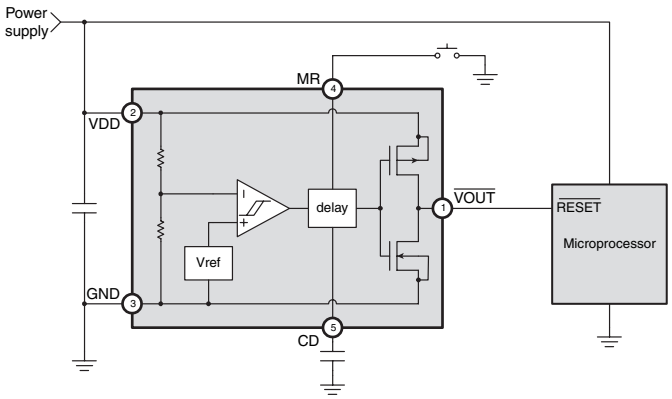
MPAK-5

Functional block diagram & typical application circuit

(1) RNA51Axx Products (Threshold voltage: 2.6V, 2.7V, 2.8V, 2.9V, 3.0V, 3.1V, 4.4V, 4.5V, 4.6V)



(2) RNA51Bxx Products (Threshold voltage: 1.4V, 2.7V, 5.0V)



Notes: 1. It is good for stable operation to use a decoupling capacitor with excellent high frequency characteristics between VDD and GND pin.
2. Capacitor value is determined by system conditions.

Description on Individual Products

●Standard Linear ICs Reset (Detector) ICs

Single-function reset ICs/Multifunctional reset ICs/Application specific reset ICs

LOW POWER 2 OUTPUT SYSTEM RESET IC

RNA52A10MM

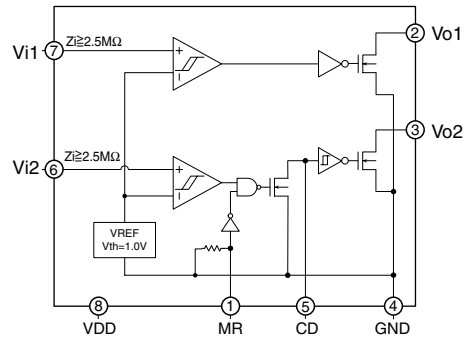
FEATURES

- To support for the system multi-power supply, a reset with 2 circuits for with delay and without delay is included.
- Input terminal used only for pilot voltage is provided to set any reset voltage.
- Adoption of low Vth process realizes the reference voltage of 1.0V±50mV, enabling the application on low voltage system.
- Adoption of CMOS process allows for current dissipation of 1.1μA (typ), enabling application on battery-driven products.

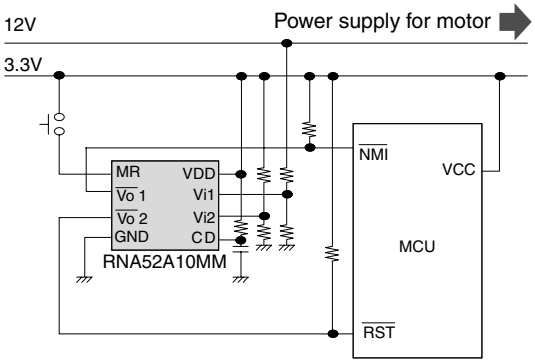
APPLICATION

Voltage monitoring of OA equipment, consumer equipment, and other multi-power sources

BLOCK DIAGRAM



APPLICATION EXAMPLE



Monitoring of the voltage of another system in addition to the power to RNA52A10MM is available. For example, while monitoring the power on the motor drive side, a warning lamp can be lit up when voltage drops.

LOW POWER 2 OUTPUT SYSTEM RESET IC

RNA50C27AUS/MM

FEATURES

- Simplifies the startup sequence of microcomputer peripheral equipment in total by monitoring power functions and simplifying the complicated turning-on procedure of microcomputer using 2 power sources of 3.3V and 1.8V.
- By making resistance and capacity for setting delay time external, delay time of reset signal can be easily changed.
- Adopting complementary open drain output enables the setting of open drain output, CMOS output and desired output.
- Detection voltage: 2.7V
- Detection voltage precision: ±1.0%
- Detection voltage hysteresis: 5% typ.
- Open drain/CMOS output settable
- Use of ultra-small SSOP-8 package
- Setting of delay time of reset signal with an external CR
- Direct actuation of reset terminal of microcomputer

APPLICATION

Application equipment of 2-power microcomputer with I/O power voltage 3.3V and core power voltage 1.8V

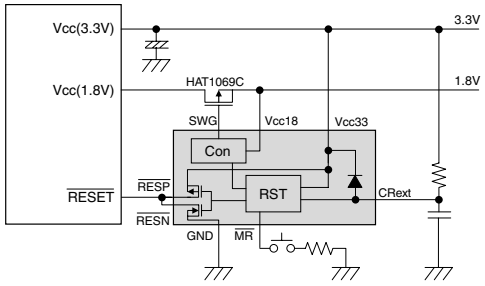
PIN ARRANGEMENT (TOP VIEW)

1	VDD33	I/O power input terminal
2	RESP	Pull-down reset output terminal
3	RESN	Pull-up reset output terminal
4	GND	Ground terminal
5	SWG	MOS drive output terminal for power control
6	VDD18	Core power input terminal
7	CR	External CR connecting terminal
8	MR	Manual reset terminal

Outside dimension (mm)

Package	Outside dimension	Pin pitch	Type no.
SSOP-8	2.0×3.1×0.7	0.50	AUS
MMPAK-8	4.0×2.95×1.1	0.65	MM

APPLICATION EXAMPLE



Always monitoring 3.3V (power) and following the turning-on procedure for 1.8V (core power) at startup of 3.3V by controlling the external Tr.

Products Lineup

Please check latest data by web site.

ICs for PFC Power Supply

Part No.	Vin (V) Max.	Icc (mA) Max.	Fmax (kHz) Max.	Topr [Tjopr] (°C)	Package	Function	Remarks
HA16174FP	24	6.45	400	-40 to +125	SOP (FP-16DAV)	Hold function, Loop detection	Power factor correction
HA16174P	24	6.45	400	-40 to +125	DIP (DP-16)	Hold function, PG, PG adjust	Power factor correction
HA16178FP	24	6.45	400	-40 to +125	SOP (FP-16DAV)	Loop detection	Power factor correction
HA16178P	24	6.45	400	-40 to +125	DIP (DP-16FV)	Loop detection	Power factor correction
R2A20111DD	24	6.45	400	-40 to +125	DIP (DP-16FV)	Hold function, Loop detection	Power factor correction
R2A20111SP	24	6.45	400	-40 to +125	SOP (FP-16DAV)	Hold function, Loop detection	Power factor correction
R2A20112DD	24	7	—	-40 to +150	DIP (DP-16FV)	PFC control IC	Power factor correction
R2A20112SP	24	7	—	-40 to +150	SOP (FP-16DAV)	PFC control IC	Power factor correction
R2A20113DD	24	4	—	-40 to +150	DIP (DP-8B)	PFC control IC	Power factor correction
R2A20113SP	24	4	—	-40 to +150	SOP (FP-8DCV)	PFC control IC	Power factor correction
HA16158FP	24	1	400	[-40 to +125]	SOP (FP-16DA)	PFC+PWM adjustable frequency, f-down mode	Switching regulator
HA16158P	24	1	200	[-40 to +125]	DIP (DP-16)	PFC+PWM adjustable frequency, f-down mode	Switching regulator

Products Lineup

ICs for Insulated SW Power Supply

Part No.	Vin (V) Max.	Icc (mA) Max.	Fmax (kHz) Max.	Topr [Tjopr] (°C)	Package	Function	Remarks
HA16107FP	30	20	600	-20 to +85	SOP (FP-16DA)	Timer latch fail safe,voltage mode both forward and flyback method available	Switching regulator
HA16107P	30	20	600	-20 to +85	DIP (DP-16)	Timer latch fail safe,voltage mode both forward and flyback method available	Switching regulator
HA16108FP	30	20	600	-20 to +85	SOP (FP-16DA)	ON/OFF timer latch fail safe,voltage mode both forward and flyback method available	Switching regulator
HA16108P	30	20	600	-20 to +85	DIP (DP-16)	ON/OFF timer latch fail safe,voltage mode both forward and flyback method available	Switching regulator
HA17384HPS	30	13	500	-20 to +105	DIP (DP-8B)	Current mode type AC/DC OVP+TSD	Switching regulator
HA17384SPS	30	13	500	-20 to +105	DIP (DP-8B)	Current mode type AC/DC	Switching regulator
HA17385HPS	30	13	500	-20 to +105	DIP (DP-8B)	Current mode type AC/DC OVP+TSD	Switching regulator
M51995AFP	10 to 35	15	500	-30 to +85	SOP (20P2N-A)	Switching Regulator Control (Voltage Mode type AC/DC)	Primary control MOSFET drive
M51995AP	10 to 35	15	500	-30 to +85	DIP (16P4)	Switching Regulator Control (Voltage Mode type AC/DC)	Primary control MOSFET drive
M51995FP	10 to 35	21	500	-30 to +85	SOP-20 (20P2N-A)	Switching Regulator Control (Voltage Mode type AC/DC)	Primary control MOSFET drive
M51995P	10 to 35	21	500	-30 to +85	DIP-16 (16P4)	Switching Regulator Control (Voltage Mode type AC/DC)	Primary control MOSFET drive
M51996AFP	10 to 30	11	500	-30 to +85	SOP (16P2N-A)	Switching Regulator Control (Voltage Mode type AC/DC)	Primary control MOSFET drive
M51996AP	10 to 30	11	500	-30 to +85	DIP (14P4)	Switching Regulator Control (Voltage Mode type AC/DC)	Primary control MOSFET drive
M51996FP	10 to 30	17	500	-30 to +85	SOP-16 (16P2N-A)	Switching Regulator Control (Voltage Mode type AC/DC)	Primary control MOSFET drive
M51996P	10 to 30	17	500	-30 to +85	DIP-14 (14P4)	Switching Regulator Control (Voltage Mode type AC/DC)	Primary control MOSFET drive
M51998FP	10 to 35	12	500	-20 to +85	SOP (10P2N-A)	Switching Regulator Control (Voltage Mode type AC/DC)	Primary control MOSFET drive
M51998P	10 to 35	12	500	-20 to +85	DIP (14P4)	Switching Regulator Control (Voltage Mode type AC/DC)	Primary control MOSFET drive
M62213FP	8.3 to 35	13	700	-20 to +85	SOP (10P2N-A)	Switching Regulator Control (Voltage Mode type AC/DC)	Primary control MOSFET drive
M62213P	8.3 to 35	13	700	-20 to +85	DIP (14P4)	Switching Regulator Control (Voltage Mode type AC/DC)	Primary control MOSFET drive
M62235FP	5 to 24	5	—	-30 to +85	SOP (10P2N-A)	Switching power supply secondary side control	1 system output voltage detection/ 2 system overvoltage (overcurrent)detection
M62235P	5 to 24	5	—	-30 to +85	DIP (14P4)	Switching power supply secondary side control	1 system output voltage detection/ 2 system overvoltage (overcurrent)detection
M62281FP	8.3 to 35	13	700	-20 to +85	SOP (10P2N-A)	Switching Regulator Control (Current Mode type AC/DC)	Primary control MOSFET drive
M62281P	8.3 to 35	13	700	-20 to +85	DIP (14P4)	Switching Regulator Control (Current Mode type AC/DC)	Primary control MOSFET drive
M62283FP	8.3 to 35	13(typ)	700	-20 to +85	SOP-10 (10P2N-A)	Current mode type AC/DC output peak current ±1A	Primary side control 500kHz MOSFET drive
HA16163T	20	10	2MHz	-40 to +125	TSSOP (TTP-20DAV)	Synchronous phase shift full-bridge control IC	Switching regulator
R2A20121SP	to 20	10	2MHz	-40 to +125	TSSOP-20 (TTP-20DAV)	Synchronous phase shift full-bridge control IC	Switching regulator

ICs for DC/DC Converter

Part No.	Vin (V) Max.	Icc (mA) Max.	Fmax (kHz) Max.	Topr [Tjopr] (°C)	Package	Function	Remarks
HA16114FP	40	11	600	-40 to +85	SOP (FP-16DA)	1 ch step down/ negative output DC/DC	Switching regulator
HA16114FPJ	40	11	600	-40 to +85	SOP (FP-16DA)	1 ch step down/ negative output DC/DC	Switching regulator
HA16114P	40	11	600	-40 to +85	DIP (DP-16)	1 ch step down/ negative output DC/DC	Switching regulator
HA16114PJ	40	11	600	-40 to +85	DIP (DP-16)	1 ch step down/ negative output DC/DC	Switching regulator
HA16116FP	40	20.5	600	-40 to +85	SOP (FP-20DA)	2 ch step down/ negative output DC/DC	Switching regulator
HA16116FPJ	40	20.5	600	-40 to +85	SOP (FP-20DA)	2 ch step down/ negative output DC/DC	Switching regulator
HA16120FP	40	11	600	-40 to +85	SOP (FP-16DA)	1 ch step up DC/DC	Switching regulator
HA16120FPJ	40	11	600	-40 to +85	SOP (FP-16DA)	1 ch step up DC/DC	Switching regulator
HA16121FP	40	20.5	600	-40 to +85	SOP (FP-20DA)	2 ch step up/step down/ negative output DC/DC	Switching regulator
HA16121FPJ	40	20.5	600	-40 to +85	SOP (FP-20DA)	2 ch step up/step down/ negative output DC/DC	Switching regulator
HA16150P	20	6	1 MHz	-40 to +125	DIP (DP-16)	Two-drive trs available in current mode for Push Pull, Half Bridge	Switching regulator
HA16150T	20	6	1 MHz	-40 to +125	TSSOP (TTP-16DAV)	Two-drive trs available in current mode for Push Pull, Half Bridge	Switching regulator
R2A20101BM	2.5 to 5.5	—	2 MHz (Adjustable)	-40 to +85	CSP (WCSP-15)	1 ch step down DC/DC Converter	Power MOS FET built-in Iout Max. = 650mA
R2A20101NP	2.5 to 5.5	—	2 MHz (Adjustable)	-40 to +85	QFN (QFN-24)	1 ch step down DC/DC Converter	Power MOS FET built-in Iout Max. = 650mA
HA16167AT	4.5 to 14.5	3.6	1 MHz (Adjustable)	—	TSSOP-20 (TTP-20DAV)	Synchronus method DC DC controller for POL	Fast transient response POL converter
M5291FP	2.5 to 40	1.4	100	-20 to +75	SOP (8P2S-A)	DC/DC Converter	—
M5291P	2.5 to 40	1.4	100	-20 to +75	DIP (8P4)	DC/DC Converter	—
M62211FP	2.5 to 35	3	500	-20 to +85	SOP (10P2N-A)	DC/DC Converter	Possible to trigger synchronous, 2-input control, Built-in load short circuit protection
M62211P	2.5 to 35	3	500	-20 to +85	DIP (14P4)	DC/DC Converter	Possible to trigger synchronous, 2-input control, Built-in load short circuit protection
M62212FP	2.5 to 18	1.3	300	-20 to +85	SOP (8P2S-A)	DC/DC Converter	Built-in load short circuit protection
M62212GP	2.5 to 18	1.3	300	-20 to +85	SSOP (8P2X-A)	DC/DC Converter	Built-in load short circuit protection
M62212P	2.5 to 18	1.3	300	-20 to +85	DIP (8P4)	DC/DC Converter	Built-in load short circuit protection
M62215FP	8.6 to 25	8	500	-20 to +85	SOP (10P2N-A)	Multifunction power DC/DC	2 input priority control
M62216FP	0.9 to 15.5	0.85	300	-20 to +85	SOP (8P2S-A)	Super Low Voltage operation DC/DC Converter	Stand-by function Built-in oscillator
M62216GP	0.9 to 15.5	0.85	300	-20 to +85	SSOP (8P2X-A)	Super Low Voltage operation DC/DC Converter	Stand-by function Built-in oscillator
M62220FP	4 to 15	0.9	110 (Fixed)	-20 to +85	SOP (8P2S-A)	3.3V fixed step down output DC/DC Converter	Built-in oscillator
M62220L	4 to 15	0.9	110 (Fixed)	-20 to +85	SIP (5P5T)	3.3V fixed step down output DC/DC Converter	Built-in oscillator
M62270GP	4 to 15	0.5	110 (Fixed)	-20 to +85	SOT-25 (5P2X-A)	3.3V fixed step down output DC/DC Converter	Built-in oscillator
M62290FP	6 to 15	1.1	120 (Fixed)	-20 to +85	SOP (8P2S-A)	5.0V fixed step down output DC/DC Converter	Built-in oscillator
M62290L	6 to 15	1.1	120 (Fixed)	-20 to +85	SIP (5P5T)	5.0V fixed step down output DC/DC Converter	Built-in oscillator
M62291GP	6 to 15	0.57	120 (Fixed)	-20 to +85	SOT-25 (5P2X-A)	5.0V fixed step down output DC/DC Converter	Built-in oscillator
M62292FP	4 to 15	1.5	110 (Fixed)	-20 to +85	SOP (8P2S-A)	2ch fixed step down DC/DC with reset	3.3V/1.8V 2ch fixed output
M62293FP	4 to 15	1.5	110 (Fixed)	-20 to +85	SOP (8P2S-A)	2ch fixed step down DC/DC with reset	3.3V/2.5V 2ch fixed output
M62294FP	4 to 15	1.5	110 (Fixed)	-20 to +85	SOP (8P2S-A)	2ch fixed step down DC/DC with reset	3.3V/2.0V 2ch fixed output
R2A20010NP	1.4 to 4.5	10	1 MHz	-20 to +85	QFN (PVQN0048LA-A)	8ch DC/DC Converter	Power MOS FET built-in

Products Lineup

System Power Management ICs

ICs for Car Audio Power Supply

Function	Part No.	Features	Topr (°C)	Package	Remarks
Multi Voltage regulator	HA13164AH	VDD=5.7/CD=8.0 Audio=9.0	-40 to +85	HSIP (SP-15TGV)	For car audio
	HA13165H	VDD=5.7/CD=7.0 Audio=8.5	-40 to +85	HSIP (SP-15TGV)	For car audio
	HA13166H	VDD=5.7/CD=8.0 Audio=9.0/DSP=3.3	-40 to +85	HSIP (SP-15TGV)	For car audio
	HA13168H	VDD=5.7/CD=8.0 Audio=9.0	-40 to +85	HSIP (SP-15TGV)	For car audio
	HA13173AH	VDD=5.0/CD=8.0 Audio=8.4/DSP=3.3	-40 to +85	HSIP (SP-15TGV)	For car audio
	HA13173H	VDD=5.0/CD=8.0 Audio=8.4/DSP=3.3	-40 to +85	HSIP (SP-15TGV)	For car audio

ICs for CRT Syncronous Deflection Control

Function	Part No.	Power-Supply Voltage (V)	Output Voltage (V)	Output Current (mA)	Circuit Current (mA)	Reference Voltage (V)	Over-Voltage Dtection Voltage (V)	Features	Package	Remarks
Synchronous Bias Control IC	M62501FP	15	15	100	20	5	5	1ch output	SOP (16P2S)	PWM output is synchronized with an external signal Wide PWM control frequency of 15kHz to 150kHz Built-in soft start function Built-in low-voltage output malfunction prevention circuit(UVLO) Start Vcc > 9V, Stop Vcc < 6V Built-in OVP and UVP circuits
	M62501P	15	15	100	20	5	5	1ch output	DIP (16P4)	
	M62504FP	15	15	100	20	5	—	1ch output	SOP (14P2N-A)	PWM output is synchronized with an external signal Wide PWM control frequency of 15kHz to 150kHz Built-in soft start function Built-in low-voltage output malfunction prevention circuit(UVLO) Start Vcc > 9V, Stop Vcc < 6V Built-in current limit function by pulse-by-pulse
	M62504P	15	15	100	20	5	—	1ch output	DIP (16P4)	

ICs for OA Equipment Power Supply

Function	Part No.	Power-Supply Voltage (V)	Output Current (mA)	Power Consumption (25°C) (mA)	Circuit Current (mA)	Output Voltage (V)	Package
2ch Reg. + 2ch Reset	M62510GP	-0.3 to 9.0	200	735	3.5	3.3	SSOP (16P2X-D)

ICs for CCD Image Sensor Vertical Drive

Function	Part No.	Power-Supply Voltage (V)	Supply Voltage VL (V)	Supply Voltage VH (V)	Circuit Current (mA)	Package
14-channel vertical driver for CCD	R2S20040LG	GND-0.3 to +7.0	GND to -10	VL +27	2.2	TFLGA (49F0G)

Products Lineup

Shunt Regulators

Part No.	V_{KA} (V)	I_{Off} (μA) Max.	Vref (V)	I_K (mA)	Topr (°C)	Package
HA17431PA	40	1	2.495 ± 2.2%	-100 to +150	-20 to +85	TO-92MODV
HA17431PNA	40	1	2.495 ± 2.2%	-100 to +150	-20 to +85	TO-92V (TO-92 (1))
HA17431UA	40	1	2.495 ± 2.2%	-100 to +150	-20 to +85	UPAKV
HA17432UA	40	1	2.495 ± 2.2%	-100 to +150	-20 to +85	UPAKV
HA17431GP	40	1	2.5 ± 1%	-50 to +100	-40 to +85	TO-92V (TO-92 (1))
HA17431GUP	40	1	2.5 ± 1%	-50 to +100	-40 to +85	UPAKV (UPAK)
HA17432GUP	40	1	2.5 ± 1%	-50 to +100	-40 to +85	UPAKV (UPAK)
HA17431GLP	40	1	2.5 ± 1%	-50 to +100	-40 to +85	MPAK-5V (MPAK-5)
HA17431GLTP	40	1	2.5 ± 1%	-50 to +100	-40 to +85	MPAKV (MPAK(T))
HA17431GPA	40	1	2.5 ± 0.5%	-50 to +100	-40 to +85	TO-92V (TO-92 (1))
HA17431GLPA	40	1	2.5 ± 0.5%	-50 to +100	-40 to +85	MPAK-5V (MPAK-5)
HA17431GLTPA	40	1	2.5 ± 0.5%	-50 to +100	-40 to +85	MPAKV (MPAK(T))
HA17431HP	36	1	2.5 ± 1%	-50 to +50	-20 to +85	TO-92V (TO-92 (1))
HA17431HUP	36	1	2.5 ± 1%	-50 to +50	-20 to +85	UPAKV
HA17432HUP	36	1	2.5 ± 1%	-50 to +50	-20 to +85	UPAKV
HA17431HLP	36	1	2.5 ± 1%	-50 to +50	-20 to +85	MPAK-5V
HA17431HLTP	36	1	2.5 ± 1%	-50 to +50	-20 to +85	MPAKV (MPAK(T)V)
HA17432HLTP	36	1	2.5 ± 1%	-50 to +50	-20 to +85	MPAKV (MPAK(T)V)
HA17431VP	16	1	2.5 ± 1%	-50 to +50	-20 to +85	TO-92V (TO-92 (1))
HA17431VUP	16	1	2.5 ± 1%	-50 to +50	-20 to +85	UPAKV
HA17432VUP	16	1	2.5 ± 1%	-50 to +50	-20 to +85	UPAKV
HA17431VLP	16	1	2.5 ± 1%	-50 to +50	-20 to +85	MPAK-5V
HA17431VLTP	16	1	2.5 ± 1%	-50 to +50	-20 to +85	MPAKV (MPAK(T)V)
HA17432VLTP	16	1	2.5 ± 1%	-50 to +50	-20 to +85	MPAKV (MPAK(T)V)
HA17L431AP	16	1	1.24 ± 1%	-30 to +50	-20 to +85	TO-92V (TO-92 (1))
HA17L431UP	16	1	1.24 ± 1.5%	-30 to +50	-20 to +85	UPAKV
HA17L432UP	16	1	1.24 ± 1.5%	-30 to +50	-20 to +85	UPAKV
HA17L431ALP	16	1	1.24 ± 1%	-30 to +50	-20 to +85	MPAK-5V
HA17L431ALTP	16	1	1.24 ± 1%	-30 to +50	-20 to +85	MPAKV (MPAK(T)V)
HA17L432ALTP	16	1	1.24 ± 1%	-30 to +50	-20 to +85	MPAKV (MPAK(T)V)

3 Terminal Regulators

Positive Voltage

Output Current	Part No.	Vout (V)	Topr (°C)	Package
100mA	HA178L05	5	-40 to +85	TO-92MODV
	HA178L05A	5	-40 to +85	TO-92MODV
	HA178L05P	5	-40 to +85	TO-92MODV
	HA178L05PA	5	-40 to +85	TO-92MODV
	HA178L05UA	5	-40 to +85	UPAKV
	HA178L08	8	-40 to +85	TO-92MODV
	HA178L08A	8	-40 to +85	TO-92MODV
	HA178L08P	8	-40 to +85	TO-92MODV
	HA178L08PA	8	-40 to +85	TO-92MODV
	HA178L08UA	8	-40 to +85	UPAKV
	HA178L12	12	-40 to +85	TO-92MODV
	HA178L12A	12	-40 to +85	TO-92MODV
	HA178L12P	12	-40 to +85	TO-92MODV
	HA178L12PA	12	-40 to +85	TO-92MODV
	HA178L12UA	12	-40 to +85	UPAKV
	HA178L15	15	-40 to +85	TO-92MODV
	HA178L15A	15	-40 to +85	TO-92MODV
	HA178L15P	15	-40 to +85	TO-92MODV
	HA178L15PA	15	-40 to +85	TO-92MODV
	HA178L15UA	15	-40 to +85	UPAKV

Negative Voltage

Output Current	Part No.	Vout (V)	Topr (°C)	Package
100mA	HA179L05	-5	-40 to +85	TO-92MODV
	HA179L05P	-5	-40 to +85	TO-92MODV
	HA179L05U	-5	-40 to +85	UPAKV
	HA179L08	-8	-40 to +85	TO-92MODV
	HA179L08P	-8	-40 to +85	TO-92MODV
	HA179L08U	-8	-40 to +85	UPAKV
	HA179L12	-12	-40 to +85	TO-92MODV
	HA179L12P	-12	-40 to +85	TO-92MODV
	HA179L12U	-12	-40 to +85	UPAKV
	HA179L15	-15	-40 to +85	TO-92MODV
	HA179L15P	-15	-40 to +85	TO-92MODV
	HA179L15U	-15	-40 to +85	UPAKV

Output Voltage Precision & Grade

Grade	HA178Lxx Series	HA179Lxx Series
Standard	±8%	±4%
A Grade	±5%	—

Note) Part No. with suffix "P" means telecommunication industrial use; others are for consumer use.

Products Lineup

Charger ICs

ICs for Battery Protection

Function	Part No.	Supply Voltage (V)	Supply Current (mA)	Package	Remarks
Battery protection and monitoring charge/ discharge current	M61040FP	6.2 to 30	0.2	SSOP (20P2X-A)	Built-in linear regulator over current detection circuit
Li-ion battery protection for 4cell and monitoring charge/ discharge current	M61041FP	30	0.15	SSOP (16P2X)	Built-in linear regulator Vreg=5.2V over current detection circuit
	M61042FP	30	0.15	SSOP (16P2X)	Built-in linear regulator Vreg=3.3V over current detection circuit
Li-ion battery protection for 3 cell and monitoring charge/ discharge current	M61043FP	30	0.15	SSOP (16P2X)	Built-in linear regulator Vreg=5.2V over current detection circuit
	M61044FP	30	0.15	SSOP (16P2X)	Built-in linear regulator Vreg=3.3V over current detection circuit
Li-ion battery protection for 3 to 4 cell	M61047FP	30	0.075	SSOP (20P2F-A)	Built-in linear regulator Vreg=3.3V or 5V
	M61048FP	30	0.075	SSOP (20P2F-A)	Built-in linear regulator Vreg=2.5V
	R2S20020SP	—	—	SSOP (20P2F-A)	—

ICs for Battery Charger Control

Function	Part No.	Supply Voltage (V)	Supply Current (mA)	Package	Remarks
Constant current/ voltage control	M62237FP	2.5 to 15	0.8	SOP (8P2S-A)	High precision ref. voltage 1.25V ±1%
1 Chip charge control for Ni-cd/Ni-MH battery	M62240FP	3.0 to 15	20	SOP (20P2N-A)	1 system output SW 1 system LED driver
Charge control	M62242FP	5.3 to 15	2	SOP (16P2E-A)	1 system output SW
Charge control for Li-ion battery	M62244FP	3.0 to 6.5	5	SOP (20P2F-A)	Built-in charge timer (5min., 1hr., 4hrs.)
	M62245FP	3.0 to 6.5	5	SOP (16P2N-A)	Constant current/ constant voltage control
	M62249FP	4.8 to 6.1	1.6	SOP (28PJW)	Built-in FET SW, timer, Smaller package.
	M62253AGP	5.0 to 15	7	SOP (16P2E-A)	Constant current/ constant voltage control
	R2S20030NP	4.75 to 6	1.6	SOP (28PJW)	Built-in FET SW, current detection circuit, small package.
	R2S20031SP	3 to 6.5	2.5	SOP (20P2F-A)	Constant current/ constant voltage control
	R2A20051NS	3 to 6.5	2.5	DFN-10	Constant current/ constant voltage control
Charge control for NOTE PC	M62255FP	7.5 to 22	7	SOP (24P2Q-A)	Low power dissipation mode DC/DC converter

Reset ICs (Voltage Detectors)

Single-Function Reset ICs

Function	Part No.	Delay Circuit	Detection Type	Detection Voltage (V)	Reset Level	Output Format	Circuit Current (μA)	Minimum Supply Voltage for Operation (V)			Package
								RL2.2K	RL100K	RL470K	
Single	M62702ML	—	Power-supply voltage	2.87	Low reset type	With fixed current load	210	0.7	0.6	—	SOT-89
	M62702SL	—	Power-supply voltage	2.87	Low reset type	With fixed current load	210	0.7	0.6	—	TO-92L
	M62703ML	—	Power-supply voltage	2.87	Low reset type	Open collector	200	0.7	0.6	—	SOT-89
	M62703SL	—	Power-supply voltage	2.87	Low reset type	Open collector	200	0.7	0.6	—	TO-92L
	M62704ML	—	Power-supply voltage	2.58	Low reset type	With fixed current load	210	0.7	0.6	—	SOT-89
	M62704SL	—	Power-supply voltage	2.58	Low reset type	With fixed current load	210	0.7	0.6	—	TO-92L
	M62705ML	—	Power-supply voltage	2.58	Low reset type	Open collector	200	0.7	0.6	—	SOT-89
	M62705SL	—	Power-supply voltage	2.58	Low reset type	Open collector	200	0.7	0.6	—	TO-92L
	M62706ML	—	Power-supply voltage	2.39	Low reset type	With fixed current load	210	0.7	0.6	—	SOT-89
	M62706SL	—	Power-supply voltage	2.39	Low reset type	With fixed current load	210	0.7	0.6	—	TO-92L
	M62707ML	—	Power-supply voltage	2.39	Low reset type	Open collector	200	0.7	0.6	—	SOT-89
	M62707SL	—	Power-supply voltage	2.39	Low reset type	Open collector	200	0.7	0.6	—	TO-92L
	M62708ML	—	Power-supply voltage	1.72	Low reset type	With fixed current load	210	0.7	0.6	—	SOT-89
	M62708SL	—	Power-supply voltage	1.72	Low reset type	With fixed current load	210	0.7	0.6	—	TO-92L
	M62709ML	—	Power-supply voltage	1.72	Low reset type	Open collector	190	0.7	0.6	—	SOT-89
	M62709SL	—	Power-supply voltage	1.72	Low reset type	Open collector	190	0.7	0.6	—	TO-92L
	M62712ML	Built-in 200μs	Power-supply voltage	2.87	Low reset type	With fixed current load	230	0.7	0.6	—	SOT-89
	M62712SL	Built-in 200μs	Power-supply voltage	2.87	Low reset type	With fixed current load	230	0.7	0.6	—	TO-92L
	M62713ML	Built-in 200μs	Power-supply voltage	2.87	Low reset type	Open collector	220	0.7	0.6	—	SOT-89
	M62713SL	Built-in 200μs	Power-supply voltage	2.87	Low reset type	Open collector	220	0.7	0.6	—	TO-92L
	M62714ML	Built-in 200μs	Power-supply voltage	2.58	Low reset type	With fixed current load	230	0.7	0.6	—	SOT-89
	M62714SL	Built-in 200μs	Power-supply voltage	2.58	Low reset type	With fixed current load	230	0.7	0.6	—	TO-92L
	M62715ML	Built-in 200μs	Power-supply voltage	2.58	Low reset type	Open collector	220	0.7	0.6	—	SOT-89
	M62715SL	Built-in 200μs	Power-supply voltage	2.58	Low reset type	Open collector	220	0.7	0.6	—	TO-92L
	M62716ML	Built-in 200μs	Power-supply voltage	2.39	Low reset type	With fixed current load	230	0.7	0.6	—	SOT-89
	M62716SL	Built-in 200μs	Power-supply voltage	2.39	Low reset type	With fixed current load	230	0.7	0.6	—	TO-92L
	M62717ML	Built-in 200μs	Power-supply voltage	2.39	Low reset type	Open collector	220	0.7	0.6	—	SOT-89
	M62717SL	Built-in 200μs	Power-supply voltage	2.39	Low reset type	Open collector	220	0.7	0.6	—	TO-92L
	M62718ML	Built-in 200μs	Power-supply voltage	1.72	Low reset type	With fixed current load	220	0.7	0.6	—	SOT-89
	M62718SL	Built-in 200μs	Power-supply voltage	1.72	Low reset type	With fixed current load	220	0.7	0.6	—	TO-92L
	M62719ML	Built-in 200μs	Power-supply voltage	1.72	Low reset type	Open collector	210	0.7	0.6	—	SOT-89
	M62719SL	Built-in 200μs	Power-supply voltage	1.72	Low reset type	Open collector	210	0.7	0.6	—	TO-92L
	M51953AFP	External delay capacitance	Power-supply voltage	4.25	Low reset type	With fixed current load	450	0.67	0.55	—	SOP (PRSP0008DE-C)
	M51953AL	External delay capacitance	Power-supply voltage	4.25	Low reset type	With fixed current load	450	0.67	0.55	—	SIP (5P5T)
	M51953BFP	External delay capacitance	Power-supply voltage	4.25	Low reset type	Open collector	420	0.67	0.55	—	SOP (PRSP0008DE-C)
	M51953BL	External delay capacitance	Power-supply voltage	4.25	Low reset type	Open collector	420	0.67	0.55	—	SIP (5P5T)
	M51954AFP	External delay capacitance	Power-supply voltage	4.25	High reset type	With fixed current load	450	—	—	—	SOP (PRSP0008DE-C)
	M51954AL	External delay capacitance	Power-supply voltage	4.25	High reset type	With fixed current load	450	—	—	—	SIP (5P5T)
	M51954BFP	External delay capacitance	Power-supply voltage	4.25	High reset type	Open collector	420	—	—	—	SOP (PRSP0008DE-C)

Products Lineup

Reset ICs (Voltage Detectors)

Single-Funtion Reset ICs

Function	Part No.	Delay Circuit	Detection Type	Detection Voltage (V)	Reset Level	Output Format	Circuit Current (μA)	Minimum Supply Voltage for Operation (V)			Package
								RL2.2K	RL100K	RL470K	
Single	M51954BL	External delay capacitance	Power-supply voltage	4.25	High reset type	Open collector	420	—	—	—	SIP (5P5T)
	M62022FP	External delay capacitance	Power-supply voltage	4.45	Low reset type	Open collector	420	0.67	0.55	—	SOP (8P2S-A)
	M62022L	External delay capacitance	Power-supply voltage	4.45	Low reset type	Open collector	420	0.67	0.55	—	SIP (5P5T)
	M51955AFP	Built-in 200μs	Input voltage	1.25	Low reset type	With fixed current load	390	0.67	0.55	—	SOP (PRSP0008DE-C)
	M51955AL	Built-in 200μs	Input voltage	1.25	Low reset type	With fixed current load	390	0.67	0.55	—	SIP (5P5T)
	M51955BFP	Built-in 200μs	Input voltage	1.25	Low reset type	Open collector	360	0.67	0.55	—	SOP (PRSP0008DE-C)
	M51955BL	Built-in 200μs	Input voltage	1.25	Low reset type	Open collector	360	0.67	0.55	—	SIP (5P5T)
	M51957AFP	External delay capacitance	Input voltage	1.25	Low reset type	With fixed current load	390	0.67	0.55	—	SOP (PRSP0008DE-C)
	M51957AL	External delay capacitance	Input voltage	1.25	Low reset type	With fixed current load	390	0.67	0.55	—	SIP (5P5T)
	M51957BFP	External delay capacitance	Input voltage	1.25	Low reset type	Open collector	360	0.67	0.55	—	SOP (PRSP0008DE-C)
	M51957BL	External delay capacitance	Input voltage	1.25	Low reset type	Open collector	360	0.67	0.55	—	SIP (5P5T)
	M51958AFP	External delay capacitance	Input voltage	1.25	High reset type	With fixed current load	390	—	—	—	SOP (PRSP0008DE-C)
	M51958AL	External delay capacitance	Input voltage	1.25	High reset type	With fixed current load	390	—	—	—	SIP (5P5T)
	M51958BFP	External delay capacitance	Input voltage	1.25	High reset type	Open collector	360	—	—	—	SOP (PRSP0008DE-C)
	M51958BL	External delay capacitance	Input voltage	1.25	High reset type	Open collector	360	—	—	—	SIP (5P5T)
	M51943AL	—	Power-supply voltage	4.25	Low reset type	With fixed current load	370	0.67	0.55	—	SIP (5P5T)
	M51943AML	—	Power-supply voltage	4.25	Low reset type	With fixed current load	370	0.67	0.55	—	SOT-89
	M51943ASL	—	Power-supply voltage	4.25	Low reset type	With fixed current load	370	0.67	0.55	—	TO-92L
	M51943BL	—	Power-supply voltage	4.25	Low reset type	Open collector	340	0.67	0.55	—	SIP (5P5T)
	M51943BML	—	Power-supply voltage	4.25	Low reset type	Open collector	340	0.67	0.55	—	SOT-89
	M51943BSL	—	Power-supply voltage	4.25	Low reset type	Open collector	340	0.67	0.55	—	TO-92L
	M51944AL	—	Power-supply voltage	4.25	High reset type	With fixed current load	370	—	—	—	SIP (5P5T)
	M51944AML	—	Power-supply voltage	4.25	High reset type	With fixed current load	370	—	—	—	SOT-89
	M51944ASL	—	Power-supply voltage	4.25	High reset type	With fixed current load	370	—	—	—	TO-92L
	M51944BL	—	Power-supply voltage	4.25	High reset type	Open collector	340	—	—	—	SIP (5P5T)
	M51944BML	—	Power-supply voltage	4.25	High reset type	Open collector	340	—	—	—	SOT-89
	M51944BSL	—	Power-supply voltage	4.25	High reset type	Open collector	340	—	—	—	TO-92L
	M51981ML	—	Power-supply voltage	4.4	Low reset type	Open collector	340	—	—	—	SOT-89
	M51981SL	—	Power-supply voltage	4.4	Low reset type	Open collector	340	—	—	—	TO-92L
	M51945AFP	—	Input voltage	1.25	Low reset type	With fixed current load	310	0.67	0.55	—	SOP (PRSP0008DE-C)
	M51945AL	—	Input voltage	1.25	Low reset type	With fixed current load	310	0.67	0.55	—	SIP (5P5T)
	M51945BFP	—	Input voltage	1.25	Low reset type	Open collector	280	0.67	0.55	—	SOP (PRSP0008DE-C)
	M51945BL	—	Input voltage	1.25	Low reset type	Open collector	280	0.67	0.55	—	SIP (5P5T)
	M51946AFP	—	Input voltage	1.25	High reset type	With fixed current load	310	—	—	—	SOP (PRSP0008DE-C)
	M51946AL	—	Input voltage	1.25	High reset type	With fixed current load	310	—	—	—	SIP (5P5T)
	M51951AL	Built-in 200μs	Power-supply voltage	4.25	Low reset type	With fixed current load	450	0.67	0.55	—	SIP (5P5T)
	M51951AML	Built-in 200μs	Power-supply voltage	4.25	Low reset type	With fixed current load	450	0.67	0.55	—	SOT-89
	M51951ASL	Built-in 200μs	Power-supply voltage	4.25	Low reset type	With fixed current load	450	0.67	0.55	—	TO-92L
	M51951BL	Built-in 200μs	Power-supply voltage	4.25	Low reset type	Open collector	420	0.67	0.55	—	SIP (5P5T)

Reset ICs (Voltage Detectors)

Single-Funtion Reset ICs

Function	Part No.	Delay Circuit	Detection Type	Detection Voltage (V)	Reset Level	Output Format	Circuit Current (μA)	Minimum Supply Voltage for Operation (V)			Package
								RL2.2K	RL100K	RL470K	
Single	M51951BML	Built-in 200μs	Power-supply voltage	4.25	Low reset type	Open collector	420	0.67	0.55	—	SOT-89
	M51951BSL	Built-in 200μs	Power-supply voltage	4.25	Low reset type	Open collector	420	0.67	0.55	—	TO-92L
	M51952AL	Built-in 200μs	Power-supply voltage	4.25	High reset type	With fixed current load	450	—	—	—	SIP (5P5T)
	M51952AML	Built-in 200μs	Power-supply voltage	4.25	High reset type	With fixed current load	450	—	—	—	SOT-89
	M51952ASL	Built-in 200μs	Power-supply voltage	4.25	High reset type	With fixed current load	450	—	—	—	TO-92L
	M51952BL	Built-in 200μs	Power-supply voltage	4.25	High reset type	Open collector	420	—	—	—	SIP (5P5T)
	M51952BML	Built-in 200μs	Power-supply voltage	4.25	High reset type	Open collector	420	—	—	—	SOT-89
	M51952BSL	Built-in 200μs	Power-supply voltage	4.25	High reset type	Open collector	420	—	—	—	TO-92L
CMOS Single	RNA51A26FLP	External delay capacitance	Power-supply voltage	2.6	Low reset type	Open drain	0.7	—	—	1.1	MPAK-5V
	RNA51A27FLP	External delay capacitance	Power-supply voltage	2.7	Low reset type	Open drain	0.7	—	—	1.1	MPAK-5V
	RNA51A28FLP	External delay capacitance	Power-supply voltage	2.8	Low reset type	Open drain	0.7	—	—	1.1	MPAK-5V
	RNA51A29FLP	External delay capacitance	Power-supply voltage	2.9	Low reset type	Open drain	0.7	—	—	1.1	MPAK-5V
	RNA51A30FLP	External delay capacitance	Power-supply voltage	3	Low reset type	Open drain	0.7	—	—	1.1	MPAK-5V
	RNA51A31FLP	External delay capacitance	Power-supply voltage	3.1	Low reset type	Open drain	0.7	—	—	1.1	MPAK-5V
	RNA51A44FLP	External delay capacitance	Power-supply voltage	4.4	Low reset type	Open drain	0.7	—	—	1.1	MPAK-5V
	RNA51A45FLP	External delay capacitance	Power-supply voltage	4.5	Low reset type	Open drain	0.7	—	—	1.1	MPAK-5V
	RNA51A46FLP	External delay capacitance	Power-supply voltage	4.6	Low reset type	Open drain	0.7	—	—	1.1	MPAK-5V
	RNA51B14FLP	External delay capacitance	Power-supply voltage	1.4	Low reset type	CMOS	0.7	—	—	1.1	MPAK-5V
	RNA51B27FLP	External delay capacitance	Power-supply voltage	2.7	Low reset type	CMOS	0.7	—	—	1.1	MPAK-5V
	RNA51B50FLP	External delay capacitance	Power-supply voltage	5	Low reset type	CMOS	0.7	—	—	1.1	MPAK-5V

Products Lineup

Reset ICs (Voltage Detectors)

Multifunction Reset ICs

Function	Part No.	Delay Circuit	Detection Type	Detection Voltage (V)	Reset Level	Operating Power-Supply Voltage Range (V)	Output Current (mA)	Output Format	Circuit Current (mA)	Package	Function/Feature
Internal Switch	M62021FP	External delay capacitance	—	4.4	Low/High 2 outputs	to 7	100	CMOS	2(4V) 7.5(5V)	SOP (PRSP0008DE-C)	• Memory backup switch installed • Low input/output voltage difference M62021: 0.2V (at input=80mA Vin=5V) M62023: 0.15V (at Iout=80mA Vin=3V) • Chip select signal output • Two reset outputs
	M62023FP	External delay capacitance	—	2.57	Low/High 2 outputs	to 7	100	CMOS	5(2V) 6.5(3V)	SOP (PRSP0008DE-C)	• Memory backup switch installed • Low input/output voltage difference M62021: 0.2V (at input=80mA Vin=5V) M62023: 0.15V (at Iout=80mA Vin=3V) • Chip select signal output • Two reset outputs
Internal Long-Time Delay	M62030FP	Built-in	—	Power supply : 4.20 Input : 1.25	High reset type	2 to 10	8	Open collector	1	SOP (PRSP0008DE-C)	• Two reset outputs • Delay time can be changed • Power-supply detection: 25/50/100/200 ms
2-Input Detection	M62032AFP	External delay capacitance	—	Input 1 : 1.25 Input 2 : 1.25	High reset type	2 to 10	8	Open collector	0.3	SOP (PRSP0008DE-C)	• 2-Input voltage detection, one output reset output • Delay time can be changed
Two-Stage Power-Supply Voltage Detection INTB Output Pulse	M62001FP	External delay capacitance	Power-supply voltage	4.45 2.15	Low reset type	0 to 5	—	CMOS	5μA (at Vcc=5V) 1μA (at Vcc=2.5V)	SOP (8P2S-A)	—
	M62002FP	External delay capacitance	Power-supply voltage	4.45 2.15	Low reset type	0 to 5	—	Open drain	5μA (at Vcc=5V) 1μA (at Vcc=2.5V)	SOP (8P2S-A)	—
	M62003FP	External delay capacitance	Power-supply voltage	4.45 2.15	Low reset type	0 to 5	—	CMOS	5μA (at Vcc=5V) 1μA (at Vcc=2.5V)	SOP (8P2S-A)	—
	M62004FP	External delay capacitance	Power-supply voltage	4.45 2.15	Low reset type	0 to 5	—	Open drain	5μA (at Vcc=5V) 1μA (at Vcc=2.5V)	SOP (8P2S-A)	—
Two-Stage Power-Supply Voltage Detection INTB Output Hold	M62005FP	External delay capacitance	Power-supply voltage	4.45 2.15	Low reset type	0 to 5	—	CMOS	5μA (at Vcc=5V) 1μA (at Vcc=2.5V)	SOP (8P2S-A)	—
	M62006FP	External delay capacitance	Power-supply voltage	4.45 2.15	Low reset type	0 to 5	—	Open drain	5μA (at Vcc=5V) 1μA (at Vcc=2.5V)	SOP (8P2S-A)	—
	M62007FP	External delay capacitance	Power-supply voltage	4.45 2.15	Low reset type	0 to 5	—	CMOS	5μA (at Vcc=5V) 1μA (at Vcc=2.5V)	SOP (8P2S-A)	—
	M62008FP	External delay capacitance	Power-supply voltage	4.45 2.15	Low reset type	0 to 5	—	Open drain	5μA (at Vcc=5V) 1μA (at Vcc=2.5V)	SOP (8P2S-A)	—
	M62015FP	External delay capacitance	Power-supply voltage	2.7 2	Low reset type	0 to 5	—	CMOS	3μA (at Vcc=3V) 1μA (at Vcc=2.5V)	SOP (8P2S-A)	—
	M62016FP	External delay capacitance	Power-supply voltage	2.7 2	Low reset type	0 to 5	—	Open drain	3μA (at Vcc=3V) 1μA (at Vcc=2.5V)	SOP (8P2S-A)	—
Two-Stage Power-Supply Voltage Detection INT Output Hold	M62009FP	External delay capacitance	Power-supply voltage	Variable 4.4 2	Low reset type	0 to 5	—	Open drain	7μA (Vcc1/2=5V) 5μA (Vcc1=5V) 1μA (Vcc1=2.5V)	SOP (8P2S-A)	—
Watchdog Timer	M5295AFP	—	—	4.25/4.7V changeable with an external resistor	Low reset type	4 to 15	10	—	0.8	SOP (PRSP0008DE-C)	• Two types of voltage monitoring watchdog timer • Power-on reset • Low input/output voltage difference
	M62050FP	External delay capacitance	—	Detection 1 : 2.2 Detection 2 : 2.5/2.3	Low reset type	2 to 7	10	—	0.6	SOP (PRSP0008DE-C)	• Two types of voltage monitoring watchdog timer • Power-on reset • Built-in delay circuit

Reset ICs (Voltage Detectors)

Application Specified Reset ICs

Function	Part No.	Delay Circuit	Delay Time (ms)	Detection Type	Detection Voltage (V)	Reset Level	Operating Power-Supply Voltage Range (V)	Output Current (mA)	Output Format	I_{DD} (μA) Typ.	I_{DD} (μA) Max.	Package	Function/Feature
Dual Power Supply Control and Detection	RNA50C27AUS	External CR	93 (Cext=0.1μF, Rext=1MΩ)	Supply voltage (3.3V)	2.7	Low reset type	2.7 to 4.6	25	CMOS/ Open drain	3	11	SSOP-8 (TTP-8DBV)	• 3.3V/1.8V power supply control • Delay time can be changed • Reset out : CMOS or Open drain can be selected
	RNA50C27AMM	External CR	93 (Cext=0.1μF, Rext=1MΩ)	Supply voltage (3.3V)	2.7	Low reset type	2.7 to 4.6	25	CMOS/ Open drain	3	11	MMPAK-8	• 3.3V/1.8V power supply control • Delay time can be changed • Reset out : CMOS or Open drain can be selected
CMOS Dual	RNA52A10MM	Ch1: — Ch2: External CR	11 (CD=0.3μF, RD=39kΩ)	Input voltage	1.0 External resistor	Low reset type	1.4 to 6	30	Open drain	1.1	19	MMPAK-8	• Low voltage detection(1.0V↑) • Manual reset available(ch2)

Operational Amplifiers (CMOS)

Configuration	Part No.	V_{DD} (V)	I_{DD}/ch (μA) Typ.	Vio (mV) Max.	SR (V/μs) Typ.	Topr (°C)	Package	Remarks
Single	HA1630S01CM	1.8 to 5.5	15	4	0.125	-40 to +85	CMPAK-5V	Output full swing, Standard
	HA1630S01LP	1.8 to 5.5	15	4	0.125	-40 to +85	MPAK-5V	Output full swing, Standard
	HA1630S02CM	1.8 to 5.5	50	4	0.5	-40 to +85	CMPAK-5V	Output full swing, Standard
	HA1630S02LP	1.8 to 5.5	50	4	0.5	-40 to +85	MPAK-5V	Output full swing, Standard
	HA1630S03CM	1.8 to 5.5	100	4	1	-40 to +85	CMPAK-5V	Output full swing, Standard
	HA1630S03LP	1.8 to 5.5	100	4	1	-40 to +85	MPAK-5V	Output full swing, Standard
	HA1630S04CM	1.8 to 5.5	200	4	2	-40 to +85	CMPAK-5V	Output full swing, High slew rate
	HA1630S04LP	1.8 to 5.5	200	4	2	-40 to +85	MPAK-5V	Output full swing, High slew rate
	HA1630S05CM	1.8 to 5.5	400	4	4	-40 to +85	CMPAK-5V	Output full swing, High slew rate
	HA1630S05LP	1.8 to 5.5	400	4	4	-40 to +85	MPAK-5V	Output full swing, High slew rate
	HA1630S06CM	1.8 to 5.5	800	4	8	-40 to +85	CMPAK-5V	Output full swing, High slew rate
	HA1630S06LP	1.8 to 5.5	800	4	8	-40 to +85	MPAK-5V	Output full swing, High slew rate
	HA1630S07CM	2.7 to 5.5	60	6	1	-40 to +85	CMPAK-5V	Output full swing, High output drive
	HA1630S07LP	2.7 to 5.5	60	6	1	-40 to +85	MPAK-5V	Output full swing, High output drive
	HA1630S08CM	2.7 to 5.5	170	6	1.5	-40 to +85	CMPAK-5V	Output full swing, High output drive
	HA1630S08LP	2.7 to 5.5	170	6	1.5	-40 to +85	MPAK-5V	Output full swing, High output drive
Dual	HA1630D01MM	1.8 to 5.5	15	4	0.125	-40 to +85	MMPAK (MMPAK-8)	Output full swing, Standard
	HA1630D01T	1.8 to 5.5	15	4	0.125	-40 to +85	TSSOP (TTP-8DAV)	Output full swing, Standard
	HA1630D02MM	1.8 to 5.5	50	4	0.5	-40 to +85	MMPAK (MMPAK-8)	Output full swing, Standard
	HA1630D02T	1.8 to 5.5	50	4	0.5	-40 to +85	TSSOP (TTP-8DAV)	Output full swing, Standard
	HA1630D03MM	1.8 to 5.5	100	4	1	-40 to +85	MMPAK (MMPAK-8)	Output full swing, Standard
	HA1630D03T	1.8 to 5.5	100	4	1	-40 to +85	TSSOP (TTP-8DAV)	Output full swing, Standard
	HA1630D04MM	1.8 to 5.5	200	4	2	-40 to +85	MMPAK (MMPAK-8)	Output full swing, High slew rate
	HA1630D04T	1.8 to 5.5	200	4	2	-40 to +85	TSSOP (TTP-8DAV)	Output full swing, High slew rate
	HA1630D05MM	1.8 to 5.5	400	4	4	-40 to +85	MMPAK (MMPAK-8)	Output full swing, High slew rate
	HA1630D05T	1.8 to 5.5	400	4	4	-40 to +85	TSSOP (TTP-8DAV)	Output full swing, High slew rate
	HA1630D06MM	1.8 to 5.5	800	4	8	-40 to +85	MMPAK (MMPAK-8)	Output full swing, High slew rate
	HA1630D06T	1.8 to 5.5	800	4	8	-40 to +85	TSSOP (TTP-8DAV)	Output full swing, High slew rate
	HA1630D07MM	2.7 to 5.5	60	6	1	-40 to +85	MMPAK (MMPAK-8)	Output full swing, High output drive
	HA1630D07T	2.7 to 5.5	60	6	1	-40 to +85	TSSOP (TTP-8DAV)	Output full swing, High output drive
	HA1630D08MM	2.7 to 5.5	170	6	1.5	-40 to +85	MMPAK (MMPAK-8)	Output full swing, High output drive
	HA1630D08T	2.7 to 5.5	170	6	1.5	-40 to +85	TSSOP (TTP-8DAV)	Output full swing, High output drive
Quad	HA1630Q01T	1.8 to 5.5	15	4	0.125	-40 to +85	TSSOP (TTP-14DV)	Output full swing, Standard
	HA1630Q02T	1.8 to 5.5	50	4	0.5	-40 to +85	TSSOP (TTP-14DV)	Output full swing, Standard
	HA1630Q03T	1.8 to 5.5	100	4	1	-40 to +85	TSSOP (TTP-14DV)	Output full swing, Standard
	HA1630Q04T	1.8 to 5.5	200	4	2	-40 to +85	TSSOP (TTP-14DV)	Output full swing, High slew rate
	HA1630Q05T	1.8 to 5.5	400	4	4	-40 to +85	TSSOP (TTP-14DV)	Output full swing, High slew rate
	HA1630Q06T	1.8 to 5.5	800	4	8	-40 to +85	TSSOP (TTP-14DV)	Output full swing, High slew rate

Products Lineup

Operational Amplifiers (Bipolar)

Configuration	Part No.	Vcc (V)	Icc (mA) Typ.	Vio (mV) Max.	SR (V/µs) Typ.	Topr (°C)	Package	Remarks
Dual	HA17358A	+32	0.8	7	0.2	-40 to +85	DIP (DP-8FV)	No error against RF noise
	HA17358AF	+32	0.8	7	0.2	-40 to +85	SOP (FP-8DGV)	No error against RF noise
	HA17358ARP	+32	0.8	7	0.2	-40 to +85	SOP (FP-8DCV)	No error against RF noise (JEDEC)
	HA17358AT	+32	0.8	7	0.2	-40 to +85	TSSOP (TTP-8DAV)	No error against RF noise
	HA17458	±18	3	6	0.6	-20 to +75	DIP (DP-8FV)	Standard
	HA17458F	±18	3	6	0.6	-20 to +75	SOP (FP-8DGV)	Standard
	HA17458FP	±18	3	6	0.6	-20 to +75	SOP (FP-8DGV)	Standard
	HA17458PS	±18	3	6	0.6	-20 to +75	DIP (DP-8FV)	Standard
	HA17904APS	+32	0.8	7	0.2	-40 to +85	DIP (DP-8FV)	No error against RF noise
	HA17904AFP	+32	0.8	7	0.2	-40 to +85	SOP (FP-8DGV)	No error against RF noise
	HA17904ARP	+32	0.8	7	0.2	-40 to +85	SOP (FP-8DCV)	No error against RF noise (JEDEC)
	HA17904AT	+32	0.8	7	0.2	-40 to +85	TSSOP (TTP-8DAV)	No error against RF noise
Quad	HA17324A	+32	0.8	7	0.19	-40 to +85	DIP (DP-14AV)	No error against RF noise
	HA17324AF	+32	0.8	7	0.19	-40 to +85	SOP (FP-14DAV)	No error against RF noise
	HA17324ARP	+32	0.8	7	0.19	-40 to +85	SOP (FP-14DNV)	No error against RF noise (JEDEC)
	HA17324AT	+32	0.8	7	0.19	-40 to +85	TSSOP (TTP-14DV)	No error against RF noise
	HA17902AP	+32	0.8	7	0.19	-40 to +85	DIP (DP-14AV)	No error against RF noise
	HA17902AFP	+32	0.8	7	0.19	-40 to +85	SOP (FP-14DAV)	No error against RF noise
	HA17902ARP	+32	0.8	7	0.19	-40 to +85	SOP (FP-14DNV)	No error against RF noise (JEDEC)
	HA17902AT	+32	0.8	7	0.19	-40 to +85	TSSOP (TTP-14DV)	No error against RF noise

Voltage Comparators (CMOS)

Configuration	Part No.	V_{DD} (V)	I_{DD}/ch (mA) Typ.	Vio (mV) Max.	Response Time (µs) Typ. TP_{HL}	Response Time (µs) Typ. TP_{LH}	Topr (°C)	Package	Remarks
Single (Low Consumption)	HA1631S01CM	1.8 to 5.5	5	5	0.55	1.2	-40 to +85	CMPAK-5V	Push-pull type
	HA1631S01LP	1.8 to 5.5	5	5	0.55	1.2	-40 to +85	MPAK-5V	Push-pull type
	HA1631S03CM	1.8 to 5.5	5	5	0.55	—	-40 to +85	CMPAK-5V	Open drain type
	HA1631S03LP	1.8 to 5.5	5	5	0.55	—	-40 to +85	MPAK-5V	Open drain type
Single (High SR)	HA1631S02CM	1.8 to 5.5	50	5	0.17	0.33	-40 to +85	CMPAK-5V	Push-pull type
	HA1631S02LP	1.8 to 5.5	50	5	0.17	0.33	-40 to +85	MPAK-5V	Push-pull type
	HA1631S04CM	1.8 to 5.5	50	5	0.17	—	-40 to +85	CMPAK-5V	Open drain type
	HA1631S04LP	1.8 to 5.5	50	5	0.17	—	-40 to +85	MPAK-5V	Open drain type
Dual (Low Consumption)	HA1631D01MM	1.8 to 5.5	5	5	0.55	1.2	-40 to +85	MMPAK (MMPAK-8)	Push-pull type
	HA1631D01T	1.8 to 5.5	5	5	0.55	1.2	-40 to +85	TSSOP (TTP-8DA)	Push-pull type
	HA1631D03MM	1.8 to 5.5	5	5	0.55	—	-40 to +85	MMPAK (MMPAK-8)	Open drain type
	HA1631D03T	1.8 to 5.5	5	5	0.55	—	-40 to +85	TSSOP (TTP-8DA)	Open drain type
Dual (High SR)	HA1631D02MM	1.8 to 5.5	50	5	0.17	0.33	-40 to +85	MMPAK (MMPAK-8)	Push-pull type
	HA1631D02T	1.8 to 5.5	50	5	0.17	0.33	-40 to +85	TSSOP (TTP-8DA)	Push-pull type
	HA1631D04MM	1.8 to 5.5	50	5	0.17	—	-40 to +85	MMPAK (MMPAK-8)	Open drain type
	HA1631D04T	1.8 to 5.5	50	5	0.17	—	-40 to +85	TSSOP (TTP-8DA)	Open drain type

Voltage Comparators (Bipolar)

Configuration	Part No.	V_{CC} (V)	I_{CC} (mA) Typ.	Vio (mV) Max.	Response Time (µs) Typ.	Topr (°C)	Package	Remarks
Dual	HA17393A	+36	0.8	7	1.3	-40 to +85	DIP (DP-8FV)	No error against RF noise
	HA17393AF	+36	0.8	7	1.3	-40 to +85	SOP (FP-8DGV)	No error against RF noise
	HA17393ARP	+36	0.8	7	1.3	-40 to +85	SOP (FP-8DCV)	No error against RF noise (JEDEC)
	HA17393AT	+36	0.8	7	1.3	-40 to +85	TSSOP (TTP-8DAV)	No error against RF noise
	HA17903APS	+36	0.8	7	1.3	-40 to +85	DIP (DP-8FV)	No error against RF noise
	HA17903AFP	+36	0.8	7	1.3	-40 to +85	SOP (FP-8DGV)	No error against RF noise
	HA17903ARP	+36	0.8	7	1.3	-40 to +85	SOP (FP-8DCV)	No error against RF noise (JEDEC)
	HA17903AT	+36	0.8	7	1.3	-40 to +85	TSSOP (TTP-8DAV)	No error against RF noise
Quad	HA17339A	+36	0.8	7	1.3	-40 to +85	DIP (DP-14AV)	No error against RF noise
	HA17339AF	+36	0.8	7	1.3	-40 to +85	SOP (FP-14DAV)	No error against RF noise
	HA17339ARP	+36	0.8	7	1.3	-40 to +85	SOP (FP-14DNV)	No error against RF noise (JEDEC)
	HA17339AT	+36	0.8	7	1.3	-40 to +85	TSSOP (TTP-14DV)	No error against RF noise
	HA17901AP	+36	0.8	7	1.3	-40 to +85	DIP (DP-14AV)	No error against RF noise
	HA17901AFP	+36	0.8	7	1.3	-40 to +85	SOP (FP-14DAV)	No error against RF noise
	HA17901ARP	+36	0.8	7	1.3	-40 to +85	SOP (FP-14DNV)	No error against RF noise (JEDEC)
	HA17901AT	+36	0.8	7	1.3	-40 to +85	TSSOP (TTP-14DV)	No error against RF noise

Overseas Sales Only

Operational Amplifiers (Bipolar)

Configuration	Part No.	V_{CC} (V)	I_{CC} (mA) Typ.	Vio (mV) Max.	SR (V/µs) Typ.	Topr (°C)	Package	Remarks
Dual	HA17358B	+36	0.5	5	—	-40 to +85	DIP (DP-8FV)	Standard
	HA17358BF	+36	0.5	5	—	-40 to +85	SOP (FP-8DGV)	Standard
	HA17358BRP	+36	0.5	5	—	-40 to +85	SOP (FP-8DCV)	Standard
	HA17558A	±18	3.5	6	2	-40 to +85	DIP (DP-8FV)	Low Noise No error against RF noise
	HA17558APS	±18	3.5	6	2	-40 to +85	DIP (DP-8FV)	Low Noise No error against RF noise
	HA17558AF	±18	3.5	6	2	-40 to +85	SOP (FP-8D)	Low Noise No error against RF noise
	HA17558AFP	±18	3.5	6	2	-40 to +85	SOP (FP-8DGV)	Low Noise No error against RF noise
	HA17558ARP	±18	3.5	6	2	-40 to +85	SOP (FP-8DC)	Low Noise No error against RF noise (JEDEC)
	HA17558AT	±18	3.5	6	2	-40 to +85	TSSOP (TTP-8DA)	Low Noise No error against RF noise
	HA17558B	±18	2.5	3	3	-40 to +85	DIP (DP-8FV)	Low noise
	HA17558BF	±18	2.5	3	3	-40 to +85	SOP (FP-8DGV)	Low noise
	HA17558BRP	±18	2.5	3	3	-40 to +85	SOP (FP-8DCV)	Low noise
	RNB4580	±18	4	3	7	-40 to +85	DIP (DP-8FV)	Low noise High slew rate
	RNB4580F	±18	4	3	7	-40 to +85	SOP (FP-8DGV)	Low noise High slew rate
	RNB4580RP	±18	4	3	7	-40 to +85	SOP (FP-8DCV)	Low noise High slew rate

Products Lineup

Overseas Sales Only

Voltage Comparators (Bipolar)

Configuration	Part No.	Vcc (V)	Icc (mA) Typ.	Vio (mV) Max.	SR (V/µs) Typ.	Topr (°C)	Package	Remarks
Dual	HA17393B	+36	0.6	5	1.3	-40 to +85	DIP (DP-8FV)	Standard
	HA17393BF	+36	0.6	5	1.3	-40 to +85	SOP (FP-8DGV)	Standard
	HA17393BRP	+36	0.6	5	1.3	-40 to +85	SOP (FP-8DCV)	Standard

Converters

D/A Converters

Function	Part No.	Resolution (bit)	Channel (ch)	Bus Format	Output Buffer Amp.	Power-Supply Voltage Vcc (V)	Setting Time (µs)	Output Current (mA)	Output Voltage (V)	Package
R-2R Type D/A converter with buffer	M62370GP	8	36	3-line Bus	Yes	3 to 5	100	0.2	0.1 to (Vcc -0.1)	QFP (48P6D-A)
	M62371GP	8	36	3-line Bus	Yes	3 to 5	100	0.2	0.1 to (Vcc -0.1)	QFP (48P6D-A)
	M62366GP	8	12	3-line Bus	Yes	3	100	0.7	0.1 to (Vcc -0.1)	SSOP (20P2E-A)
	M62367GP	8	8	3-line Bus	Yes	3	100	0.7	0.1 to (Vcc -0.1)	SSOP (16P2E-A)
	M62368GP	8	6	3-line Bus	Yes	3	100	0.7	0.1 to (Vcc -0.1)	SSOP (16P2E-A)
	M62352FP	8	12	3-line Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	SOP (20P2N-A)
	M62352GP	8	12	3-line Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	SSOP (20P2E-A)
	M62352P	8	12	3-line Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	DIP (20P4B)
	M62352AFP	8	12	3-line Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	SOP (20P2N-A)
	M62352AGP	8	12	3-line Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	SSOP (20P2E-A)
	M62352AP	8	12	3-line Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	DIP (20P4)
	M62353FP	8	8	3-line Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	SOP (16P2N-A)
	M62353GP	8	8	3-line Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	SSOP (16P2E-A)
	M62353P	8	8	3-line Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	DIP (16P4)
	M62353AFP	8	8	3-line Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	SOP (16P2N-A)
	M62353AGP	8	8	3-line Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	SSOP (16P2E-A)
	M62353AP	8	8	3-line Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	DIP (16P4)
	M62354FP	8	6	3-line Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	SOP (14P2N-A)
	M62354GP	8	6	3-line Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	SSOP (16P2E-A)
	M62354P	8	6	3-line Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	DIP (14P4)
	M62354AFP	8	6	3-line Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	SOP (14P2N-A)
	M62354AGP	8	6	3-line Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	SSOP (16P2E-A)
	M62354AP	8	6	3-line Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	DIP (14P4)
	M62343FP	8	3	3-line Bus	Yes	3 to 5	100	±1	0.1 to (Vcc -0.1)	SOP (8P2S-A)
	M62343GP	8	3	3-line Bus	Yes	3 to 5	100	±1	0.1 to (Vcc -0.1)	SSOP (8P2J-A)
	M62343P	8	3	3-line Bus	Yes	3 to 5	100	±1	0.1 to (Vcc -0.1)	DIP (8P4)
	M62342FP	8	2	3-line Bus	Yes	3 to 5	100	±1	0.1 to (Vcc -0.1)	SOP (8P2S-A)
	M62342GP	8	2	3-line Bus	Yes	3 to 5	100	±1	0.1 to (Vcc -0.1)	SSOP (8P2J-A)
	M62342P	8	2	3-line Bus	Yes	3 to 5	100	±1	0.1 to (Vcc -0.1)	DIP (8P4)
	M62342HP	8	2	3-line Bus	Yes	3 to 5	100	±1	0.1 to (Vcc -0.1)	SSOP (8P2X-F)
	M62384FP	8	4	3-line Bus	Yes	3 to 5	5	±0.5	0.1 to (Vcc -0.1)	SOP (16P2N-A)

Converters

D/A Converters

Function	Part No.	Resolution (bit)	Channel (ch)	Bus Format	Output Buffer Amp.	Power-Supply Voltage Vcc (V)	Setting Time (µs)	Output Current (mA)	Output Voltage (V)	Package
R-2R Type D/A converter with buffer	M62392FP	8	12	I²C Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	SOP (24P2N-A)
	M62392P	8	12	I²C Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	DIP (24P4D)
	M62393FP	8	8	I²C Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	SOP (20P2N-A)
	M62393P	8	8	I²C Bus	Yes	5	100	±1	0.1 to (Vcc -0.1)	DIP (20P4)
	M62334FP	8	4	I²C Bus	Yes	3 to 5	100	±1	0.1 to (Vcc -0.1)	SOP (8P2S-A)
	M62334P	8	4	I²C Bus	Yes	3 to 5	100	±1	0.1 to (Vcc -0.1)	DIP (8P4)
	M62339FP	8	4	I²C Bus	Yes	3 to 5	100	±1	0.1 to (Vcc -0.1)	SOP (8P2S-A)
	M62339P	8	4	I²C Bus	Yes	3 to 5	100	±1	0.1 to (Vcc -0.1)	DIP (8P4)
	M62333FP	8	3	I²C Bus	Yes	3 to 5	100	±1	0.1 to (Vcc -0.1)	SOP (8P2S-A)
	M62333P	8	3	I²C Bus	Yes	3 to 5	100	±1	0.1 to (Vcc -0.1)	DIP (8P4)
	M62338FP	8	3	I²C Bus	Yes	3 to 5	100	±1	0.1 to (Vcc -0.1)	SOP (8P2S-A)
	M62338P	8	3	I²C Bus	Yes	3 to 5	100	±1	0.1 to (Vcc -0.1)	DIP (8P4)
	M62332FP	8	2	I²C Bus	Yes	3 to 5	100	±1	0.1 to (Vcc -0.1)	SOP (8P2S-A)
	M62332P	8	2	I²C Bus	Yes	3 to 5	100	±1	0.1 to (Vcc -0.1)	DIP (8P4)
	M62337FP	8	2	I²C Bus	Yes	3 to 5	100	±1	0.1 to (Vcc -0.1)	SOP (8P2S-A)
	M62337P	8	2	I²C Bus	Yes	3 to 5	100	±1	0.1 to (Vcc -0.1)	DIP (8P4)
1280 Step resolution, Multiplying functioned 3ch D/A converter	M62362FP	10	3	3-line Bus	—	5	5	—	0.1 to (Vcc -0.1)	SOP (16P2N-A)
	M62362P	10	3	3-line Bus	—	5	5	—	0.1 to (Vcc -0.1)	DIP (14P4)
Multiplying functioned 8bit 8ch D/A converter	M62363FP	8	8	3-line Bus	—	5	5	—	0.1 to (Vcc -0.1)	SOP (24P2Q-A)
Multiplying functioned 8bit 8ch D/A converter with buffer	M62364FP	8	8	3-line Bus	Yes	3 to 5	100	±1.0	0.1 to (Vcc -0.1)	SOP (24P2Q-A)
4X(12 + 8 + 8)bit configured Multiplying functioned D/A converter	M62382AFP	12 + 8 + 8	4	—	—	5	—	—	—	— (100P6Q-A)
	M62382FP	12 + 8 + 8	4	—	—	5	—	—	—	— (100P6Q-A)
8bit 4ch composite type D/A converter with buffer	M62383FP	8	2ch x 2	3-line Bus	Yes	5	5	±0.5	—	SOP (24P2Q-A)

Products Lineup

Converters

A/D Converters

Function	Part No.	Resolution (bit)	Channel (ch)	Bus Format	Output Buffer Amp.	Power-Supply Voltage Vcc (V)	Setting Time (ms)	Output Current (mA)	Output Voltage (V)	Package
Integrating type A/D converter	M62301FP	10 to 12	4	—	—	4.5 to 12	0.5	6	—	SOP (20P2N-A)
Integrating type A/D converter	M62301SP	10 to 12	4	—	—	4.5 to 12	0.5	6	—	DIP (20P4B)
High precision Double Integrating type A/D converter	M62303FP	14	1	—	—	8.1 to 13	16	10	—	QFP (64P6S-A)

I/O Expanders

General I/O Expanders

Part No.	Function	Package
M66013FP	8-bit I/O expander with address input	20P2N-A
R8A66150SP	12-bits I/O Expander	20P2X-C
R8A66152SP	12-bit I/O Expander with LED drive function	20P2X-C
R8A66151SP	24-bit I/O Expander	32P2X-A
R8A66153FP	Programmable buffered I/O Expander	64P6X-B
M64620FP	High-speed parallel I/O Expander for Z80 CPU	64P6N
M64620P	High-speed parallel I/O Expander for Z80 CPU	64P4B
M64621FP	High-speed parallel I/O Expander for 68 series CPU	64P6N
M64621P	High-speed parallel I/O Expander for 68 series CPU	64P4B

I^2C BUS I/O Expanders

Part No.	Function	Package
M62320FP	I^2C to 8 bit I/O expander	SOP (16P2N-A)
M62320GP	I^2C to 8 bit I/O expander	SSOP (16P2Z-A)
M62320P	I^2C to 8 bit I/O expander	DIP (16P4)

Built-in D/A I/O Expanders

Part No.	Function	Package
M62376GP	Built-in 8 bit 12ch D/A converter I/O expander	SSOP (24P2E-A)

Other Functions

Timers

Function	Part No.	Vcc (V)	Output Current (mA) Max.	Output Tr/tf (ns) Typ.	Topr (°C)	Package
Precision Timer	HA17555	5 to 15	200	100	-20 to +75	DIP (DP-8FV)
Precision Timer	HA17555F	5 to 15	200	100	-20 to +75	SOP (FP-8DGV)
Precision Timer	HA17555FP	5 to 15	200	100	-20 to +75	SOP (FP-8DGV)
Precision Timer	HA17555PS	5 to 15	200	100	-20 to +75	DIP (DP-8FV)

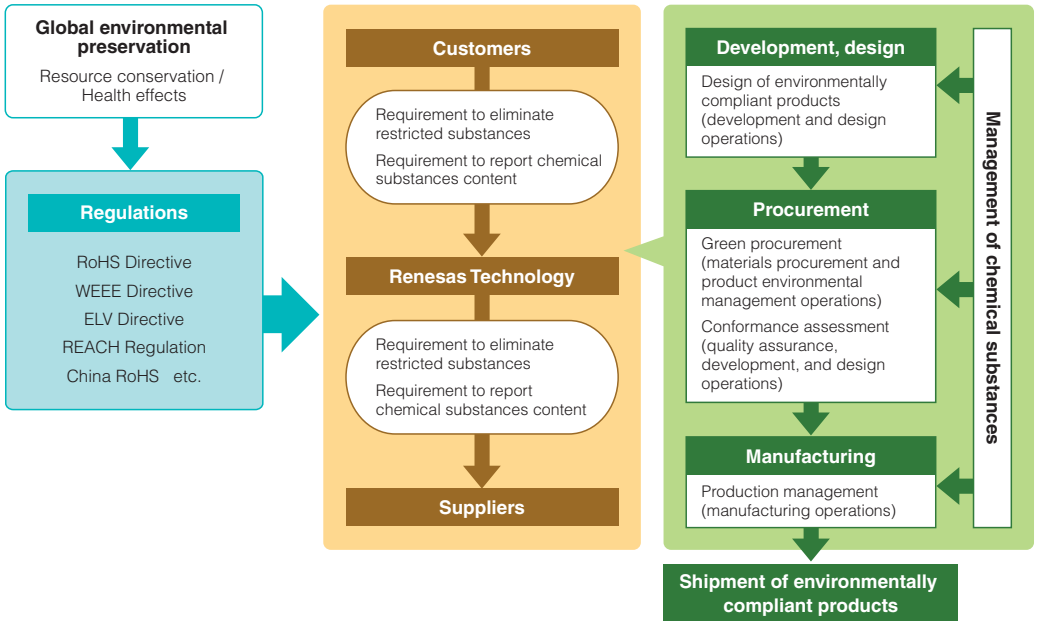
Environmental Considerations for Renesas Technology Products

Renesas Technology is working actively to improve product environmental quality in all aspects of its business operations, including product design, materials procurement, manufacturing, and shipping.

Design

- **Development of environmentally compliant products through product environmental assessment**
  Making products more resource and energy efficient (more compact, higher integration, reduced power consumption, extended service life)
  Reducing environmental load due to chemicals (management of chemical content of products)
- **Compliance with domestic and international product environmental regulations**
  EU RoHS Directive, China RoHS, ELV Directive, REACH Regulation

Renesas Product Environmental Quality Management Sequence



Procurement

- **Thoroughgoing green procurement activities**
- **Investigation and confirmation of chemical content of procured parts and materials**

Manufacturing

- **Prevention of inclusion or contamination by prohibited chemicals in products (process management)**
- **Reduction of CO_2 emissions (reduction of PFC output and energy usage), reduction of environmental load from chemicals used in manufacturing, reduction of waste materials**

Shipping

- **Reduction of volume of packing materials (expanding reuse of plastic packaging materials)**
- **Reduction of energy consumption in transport (improving overall efficiency of distribution)**

Compliance with customer requirements

Transmission of information such as chemical content of products

RoHS : Restriction of the use of certain Hazardous Substances in electrical and electronic equipment
WEEE : Waste Electrical and Electronic Equipment
ELV : End of Life Vehicles
REACH : Registration, Evaluation, Authorization and Restriction of Chemicals

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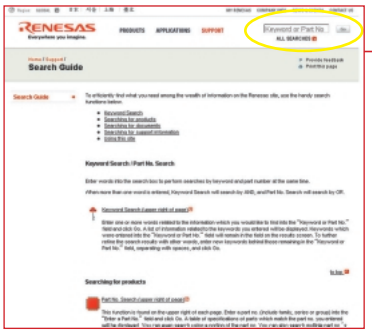

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