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ON Semiconductor®

Energy Efficient Innovations

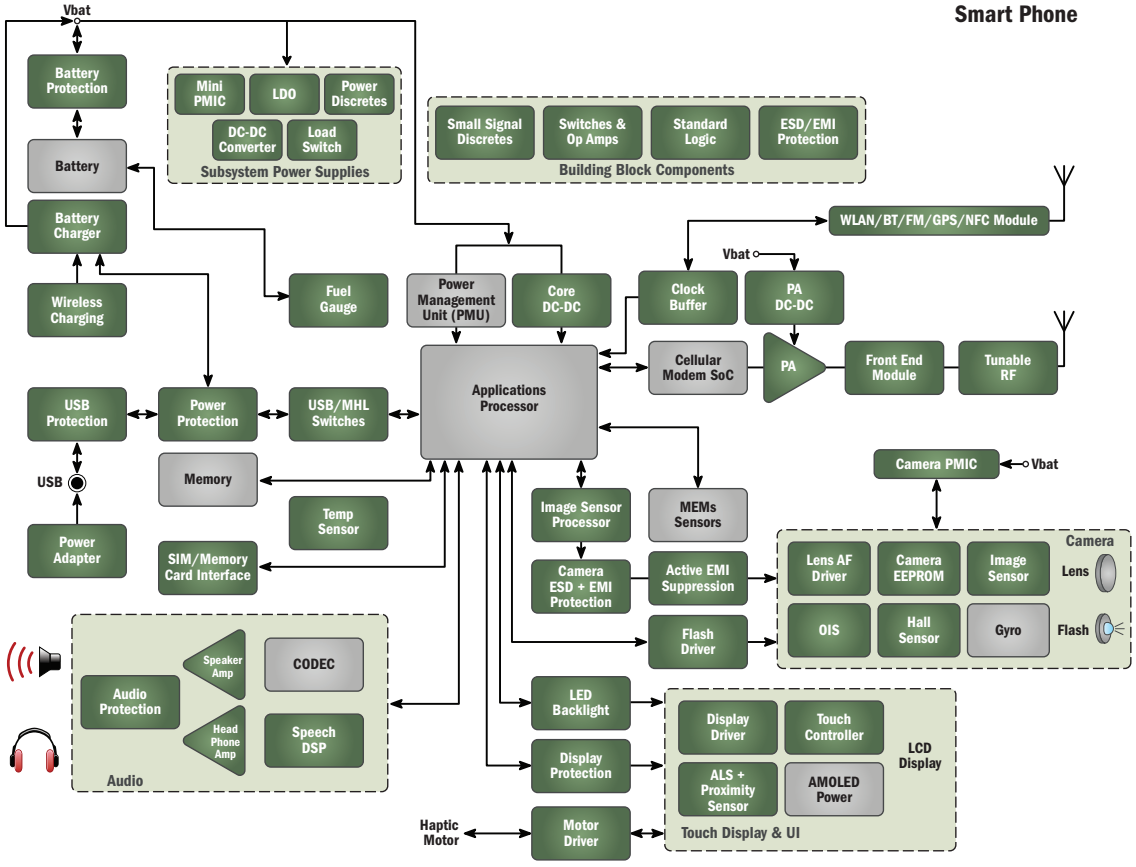
Portable & Wearable Solutions

Comprehensive imaging, display, RF, audio, power management, protection, USB, interface and memory solutions for portable and wearable devices from ON Semiconductor.

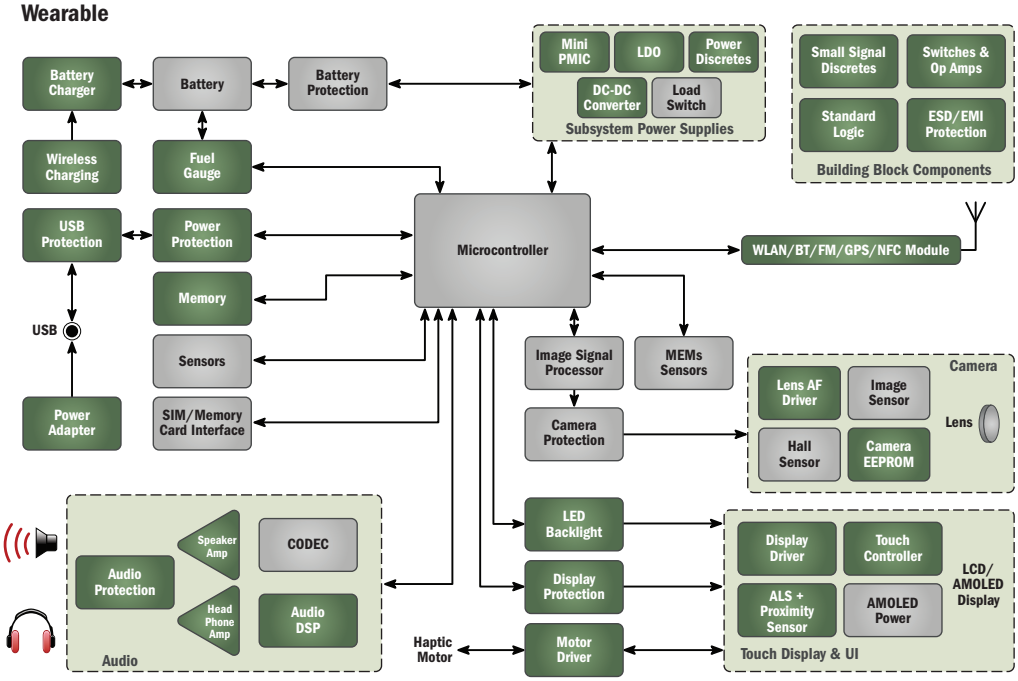
www.onsemi.com

Expansive Portfolio for Portable and Wearable Solutions

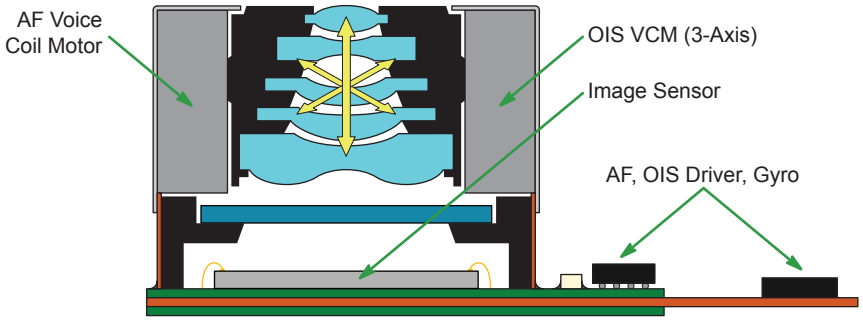
Smart Phone

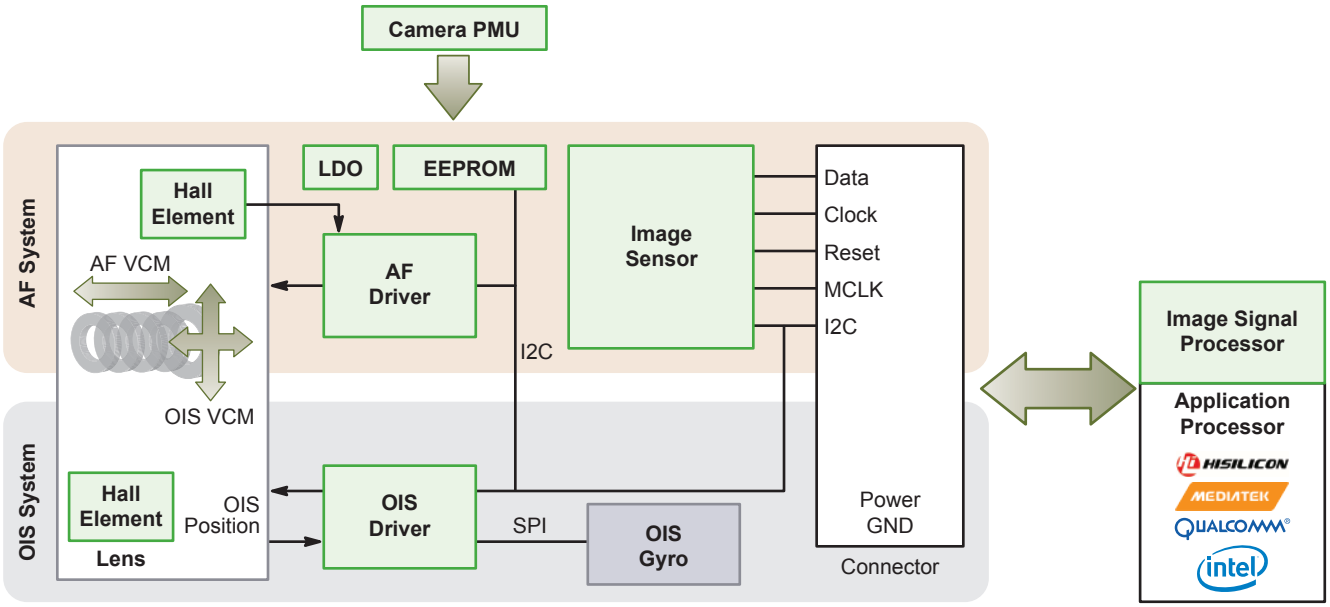


Wearable



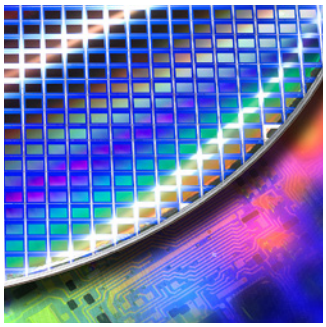
Camera Module





CMOS Imaging Sensors

The CMOS imaging sensor portfolio from ON Semiconductor provides options for all portable and wearable applications. Whether you're building a new AR/VR headset, a 360 degree camera, a new set of imaging glasses, or simply a new wearable device that wants to see the world around it, ON Semiconductor has an Image sensor that can help you deliver an amazing end user experience.



Key Features

- Superior image quality with advanced pixel technology
- Fast frame rates for action shots
- Low power for battery operation
- Great low light performance
- Resolution choice including VGA to 4K (UHD)

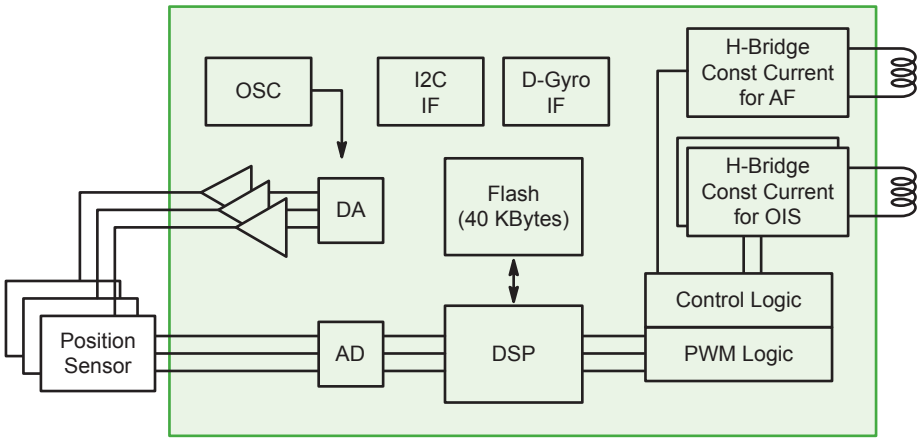
Device	Resolution (MP)	Optical Format	Pixel Size (μm)	Sensor Type	Frame Rate
MT9V115	VGA	1/13"	1.75	SOC	30fps
ASX370	VGA	1/7"	3	SOC	30fps
MT9M114	1.2 (720P)	1/6"	1.9	SOC	30fps
AR0130	1.2 (720P)	1/3"	3.75	RAW	60fps
AR0140	1.2 (720P)	1/4"	3	RAW	60fps
AS0260	2.1 (1080P)	1/6"	1.4	SOC	30fps
AR0261	2.1 (1080P)	1/6"	1.4	RAW	60fps
AR023Z	2.1 (1080P)	1/3"	3	RAW	60fps
AR0238	2.1 (1080P)	1/3"	3	RAW	60fps
AR0238IR	2.1 (1080P)	1/3"	3	RAW	60fps
AR0330	3.5	1/3"	1.75	RAW	60fps
AR0543	5	1/4"	1.4	RAW	15fps
AR0842CP	8	1/4"	1.1	RAW – Clarity+	30fps
AR0833	8	1/3.2"	1.4	RAW	30fps
AR0835	8	1/3.2"	1.4	RAW	42fps (1080P 60fps)
AR1335	13	1/3.2"	1.1	RAW	30fps
AR1337	13	1/3.2"	1.1	RAW	30fps
AR1820HS	18	1/2.3"	1.25	RAW	24fps
MT9V024	VGA	1/3"	6	RAW – Global Shutter	60fps
AR0134	1.2MP (720P)	1/3"	3.75	RAW – Global Shutter	54fps
AR0135	1.2MP (720P)	1/3"	3.75	RAW – Global Shutter	54fps

Optical Image Stabilization Drivers

LC898123F40 DSP-based Optical Image Stabilization (OIS) and Auto Focus (AF) controller/driver includes integrated Flash memory, analog circuits, H-bridge and constant current drivers. The integrated Flash enables fast wakeup and simplifies Host-side software implementation.

Key Features

- Integrated DSP software filter
- Integrated Flash memory (40 KB)
- Integrated OSC, LDO, and Hall amplifier
- Digital Gyro I/F
- 4-channel, 14-bit ADC; 3-channel, 8-bit DAC



LC898123F40 Block Diagram

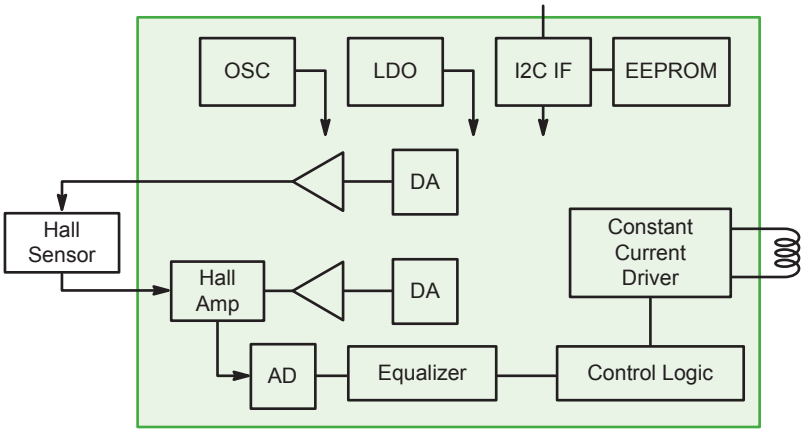
Device	Type	V_{DD} Min (V)	V_{DD} Max (V)	V_M Min (V)	V_M Max (V)	Driver (mA)	CPU IF	D/A	A/D	Package(s)
LC898122/122A	Feedback	2.6	3.6	2.6	3.6	220/150	I2C	8-Bit	12-Bit	WLCSP-30
LC898123AXD	Feedback	2.6	3.6	2.6	3.6	195/120	I2C	8-Bit	12-Bit	WLCSP-35
LC898123F40	Feedback	2.6	3.3	2.6	3.3	200/150	I2C	8-Bit	14-Bit	WLCSP-35

Closed Auto-Focus Drivers

LC898217XC/XH closed loop auto focus driver includes integrated driver, loop digital filter, and EEPROM. System implementation requires only a Hall sensor and by-pass condenser. LC898217XC/XH enables fast and accurate auto focusing, with low power consumption, from an extremely small footprint.

Key Features

- Integrated equalizer circuit
- Integrated EEPROM memory (128 byte)
- Integrated OSC, LDO, and Hall amplifier
- Integrated Constant Current Driver and Linear Compensation
- 1-channel, 11-bit ADC; 2-channel, 8-bit DAC



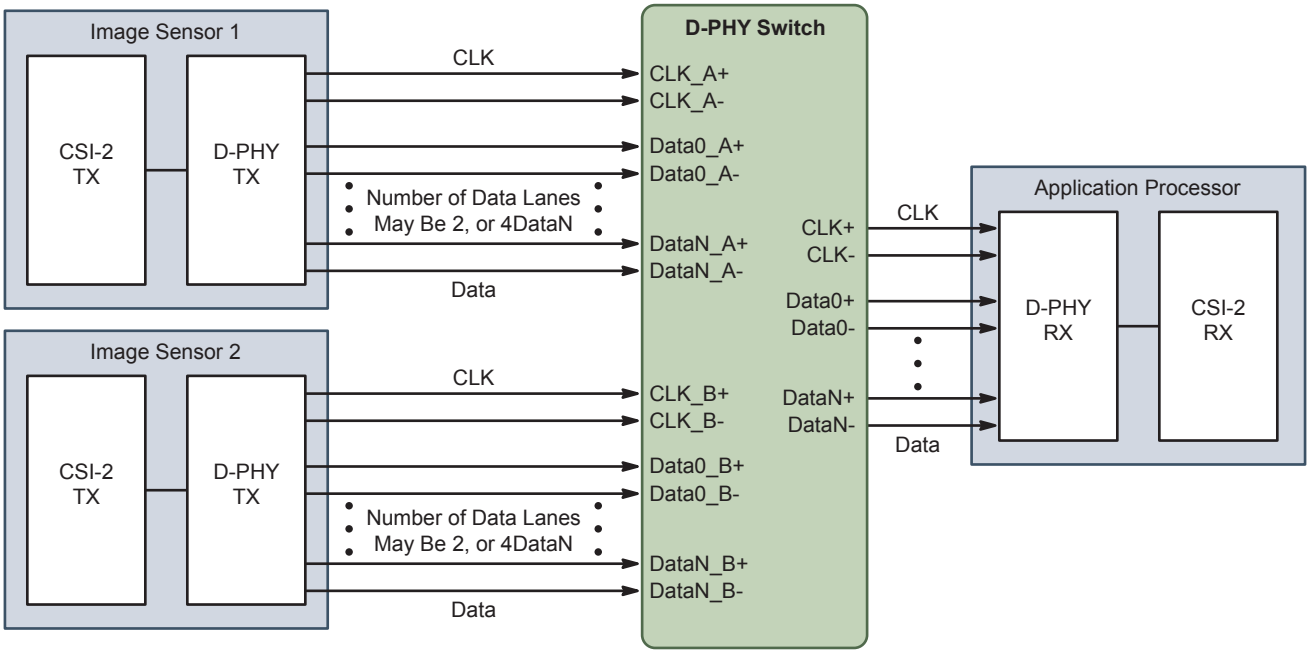
LC898217XC/XH Block Diagram

Device	Type	V_{DD} Min (V)	V_{DD} Max (V)	V_M Min (V)	V_M Max (V)	Driver (mA)	CPU IF	D/A	A/D	Package(s)
LC898212XD	Feedback	2.6	3.6	2.6	3.6	130	I2C	8-Bit	10-Bit	WLCSP-12
LC898214XD	Feedback	2.6	3.6	–	–	120	I2C	8-Bit	10-Bit	WLCSP-8
LC898217XC/XH	Feedback	2.6	3.3	–	–	110	I2C	8-Bit	11-Bit	WLCSP-10

MIPI Switching Devices

Key Features

- Optimized bandwidth for high data rate transition
- Low quiescent current consumption
- WLCSP or UMLP package

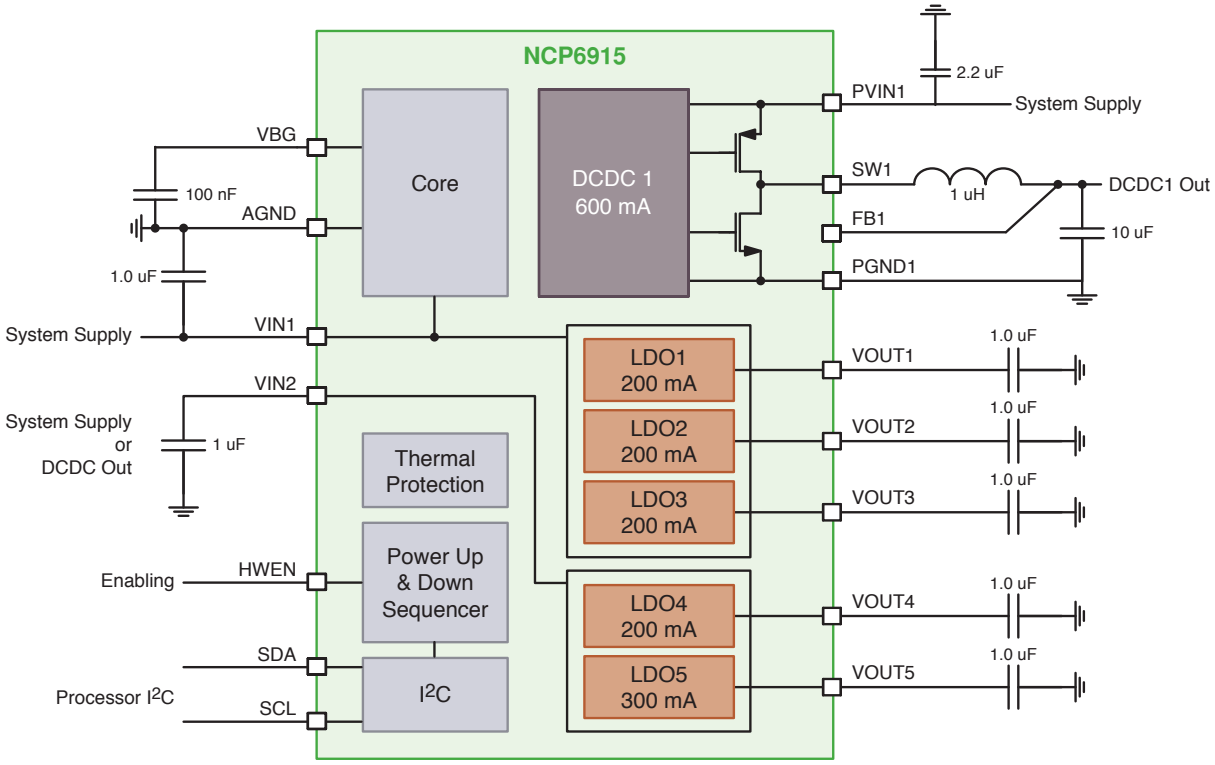


Device	Standard	Type	V_{CC} Max (V)	Quiescent Current Max	Packages
FSA646	D-PHY	4-Lane	5	30 µA	WLCSP-36
FSA644	D-PHY	4-Lane	4.5	32 µA	WLCSP-36
NL3HS644	D-PHY	4-Lane	4.5	55 µA	WLCSP-36
FSA642	D-PHY	2-Lane	4.3	1µA	UMLP-24
FSA660	C-PHY	1-Lane	5	30 µA	UMLP-18

Camera Module PMICs

Key Features

- Mid-size integration
  - Complements main PMU under minimum supervision
  - CSP package saves space on a flex or dedicated PCB
- High performance
  - High efficiency and low quiescent current for battery life
  - Low noise (<50 μV_{RMS}) for high resolution performance
  - Fully programmable through I2C to adapt default output voltages and power up and down sequencing
- Modular approach
  - 5 or 6 regulators for 2D / 3D modules and back / front cameras



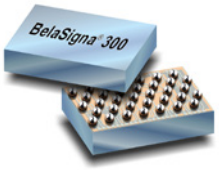
Device	DC-DC (mA)	LDO (mA)	Package(s)
NCP6925	2 x 1000	5 x 300	CSP-36
NCP6924	2 x 1000	2 x 300, 2 x 150	CSP-30
NCP6914	1 x 800	4 x 300	CSP-20
NCP6915	1 x 600	1 x 300, 4 x 150	CSP-16

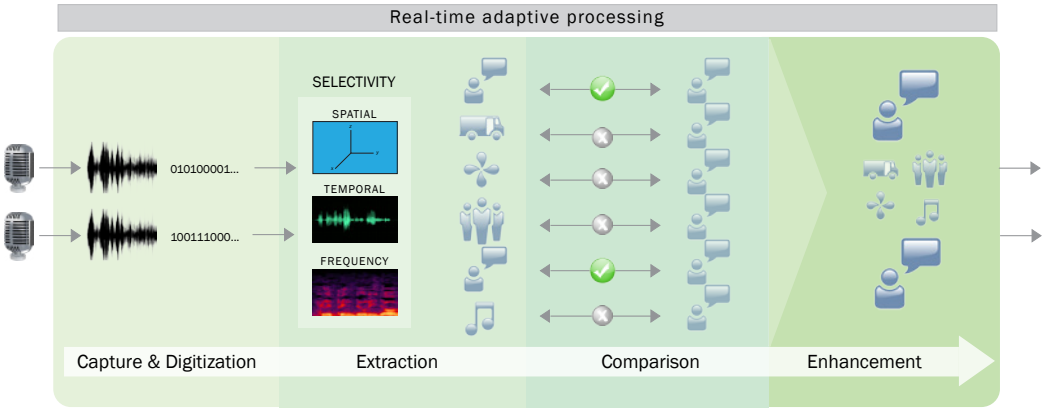
BelaSigna® Audio Processors

The BelaSigna line of audio processors is optimized for portable applications, delivering superior audio clarity without compromising size or battery life.BelaSigna offers ultra-low power consumption, design flexibility, and a miniature package by providing a highly integrated hardware solution with a dual-core architecture featuring an open-programmable DSP core with a highly configurable coprocessor.

Features and Benefits

- Ultra-low power consumption
- Design flexibility
- Miniature size
- Computational Efficiency
- Audio fidelity
- Comprehensive development tools





Device	Description	MIPS Max	Dynamic Range (dB)	RAM (kB)	Interfaces	Power Consumption	Standby Current (µA)	Analog Audio	Package(s)
BelaSigna 300	24-bit Audio Processor for Portable Communication Devices	240	110/88	110	I2C, SPI, I2S, PCM, GPIO,	1-5 mA typical	40	4/1	WLCSP-35, DFN-44
BelaSigna 250	16-bit Audio Processor, Full Stereo 2-in, 2-out	60	88	42	I2C, SPI, I2S, PCM, GPIO, UART	5 mA at 20 MHz	50	2/2	LFBGA-64, LFBGA-57

BelaSigna 300 AM with AfterMaster HD Technology

High-performance solution designed to process and enhance audio in real-time for a louder, fuller, and deeper sound. For more information, please visit aftermaster.com

BelaSigna R281 Always-Listening, Voice Trigger Solution

- Will detect a single, user-trained trigger phrase, asserting awake-up signal when this phrase is detected
- ~300 µW power consumption for true “always-on” operation without affecting battery Standby life
- Available in QFN and WLCSP packages

Developing a portable audio device from initial concept and design through to production can be a complex and lengthy process. Success, however, often depends on shortening product development cycles, enabling faster time-to-market.

ON Semiconductor addresses this need by providing designers with a complete solution, no matter which development path they chose. In addition to a variety of software algorithm bundles, BelaSigna audio processors are also complemented by an advanced suite of development tools. The fully integrated set of development tools enable manufacturers to quickly and easily develop, debug and test algorithm software for ON Semiconductor's audio DSP systems.

Evaluation and Development Kit Contents

Software
EDK Software and Documentation* Integrated Development Environment (IDE) Advanced Editor Debugger Project Manager Automated Build System Project Wizard EEPROM Manager Assembler Sample Applications System Libraries Documentation Set
WOLA Toolbox
SignaKlara™ Blockset
CTK Developer Kit (CTK DK)
CAA Drivers

Hardware
Evaluation and Development Board (EDB)
Communication Accelerator Adaptor (CAA)
RS-232 serial cable
USB cable
I2C cable
Universal power supply (input 100-240 VAC, ~60/50Hz; output 9 VDC, 1.1A)

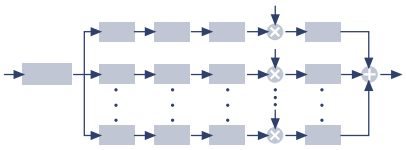
* The EDK includes one year of software updates.

Optional Hardware

Rapid Prototyping Module (RPM)	Available for Purchase
RPM Motherboard	Available for Purchase

Supplementary hardware, such as the Communication Accelerator Adaptor and Evaluation and Development Board, are also available for purchase.

Contact your local ON Semiconductor sales office at **www.onsemi.com/salessupport** for information on purchasing or renewing software subscriptions.



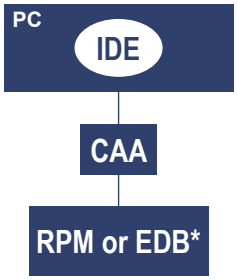
Solution Evaluation

To evaluate audio processors and signal processing software, ON Semiconductor offers a solution that is easy to demonstrate, evaluate and design in. Developers can use software tools to develop their own signal processing algorithms to run on the BelaSigna hardware.

RPM

Algorithm Development

To support the algorithm development process, ON Semiconductor offers an Evaluation and Development Kit (EDK) featuring an Integrated software Development Environment (IDE) for composing, compiling and debugging algorithm code. A Communication Accelerator Adaptor (CAA) connects the IDE running on a PC to a Rapid Prototyping Module (RPM) or Evaluation and Development Board (EDB)*. Using these components, developers can implement and immediately validate the performance of their proprietary algorithms, third-party algorithms, or other software integrated with BelaSigna bundles directly on BelaSigna hardware.

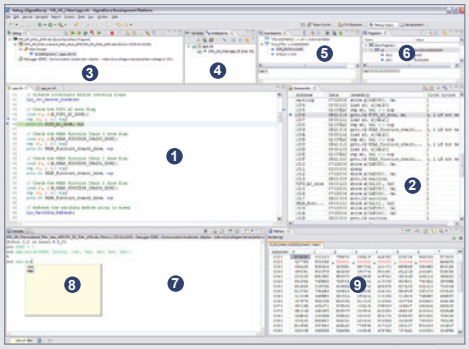


AUDIO

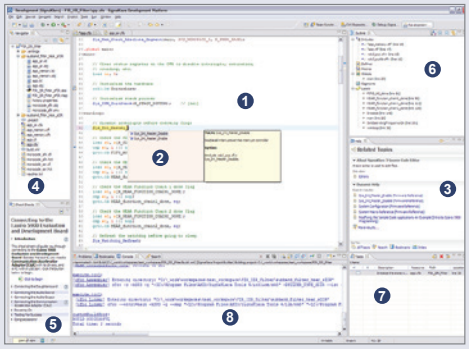
Integrated Development Environment (IDE)

ON Semiconductor's Integrated Development Environment is a fully integrated software development environment that enables developers to code, compile, debug and validate algorithms. Features include:

- **Team based programming** that greatly simplifies project management by allowing multiple developers to simultaneously work on the same design.
- **Project wizard** with templates based on sample algorithms, automatic no-maintenance project builder and system libraries to reduce development time.
- **Integrated debugger** providing full source code debugging and scriptable interface, customized expression watch, register, and memory views with changed value highlighting.
- **Sample application source code** provides complete sample algorithms plus samples of most basic application components.
- **Advanced editor** with content assist (command completion), syntax highlighting and integrated help enables context-sensitive, dynamic reference lookup.
- **Full user and reference documentation set** integrated with the IDE; dynamically searchable while editing.
- **Interactive scripting console** allowing developers to script activities within the IDE using a Python-like language, and to execute/test automated scripts that can interface with the chip and the development environment.



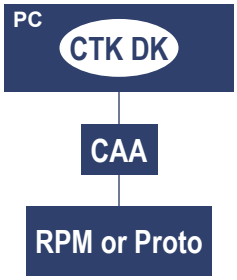
Debug perspective showing (1) source code, (2) disassembly, (3) debug, (4) breakpoint, (5) expression, (6) register, (7) command console, (8) content assist, and (9) memory views.



Development perspective showing (1) advanced editor with (2) content assist, (3) dynamic help, (4) workspace navigator, (5) cheat sheets for common tasks, (6) outline view, (7) tasks, and (8) console views. Console shows build output and is a tabbed overlay with search, bookmark and error views.

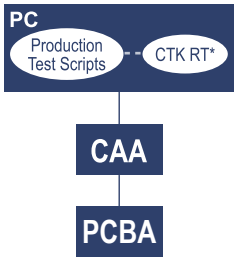
Hardware Testing & Prototyping

ON Semiconductor enables form-factor hardware testing and prototyping with an RPM, optionally attached to a motherboard, that connects directly to a CAA. The RPM's plug-in design enables developers to quickly transition from development in a simulation environment to testing a complete portable audio system. To facilitate development and testing even further, the RPM can be moved directly from the motherboard to a prototype for final hardware assessment.



Production & Final Testing

To prepare portable audio products for the market, the CTK Run-time and CAA enable manufacturers to store firmware and data on an attached EEPROM, tune parameters on a unit-by-unit basis, configure the chip, and run final tests. By attaching a CAA directly to a Printed Circuit Board Assembly (PCBA), the CTK DK can be used to develop a customized software-controlled production flow to meet the specific needs of your production environment.



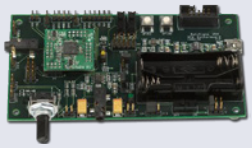
Communication Accelerator Adapter (CAA)

The Communication Accelerator Adaptor is a universal hardware adaptor that facilitates high-speed communication between host PCs (using USB 1.1 or 2.0) and ON Semiconductor development boards (EDB, RPM Motherboard). The CAA is reprogrammable and can also be used to transfer final software to products in a production or final test environment.

Rapid Prototyping Module (RPM)

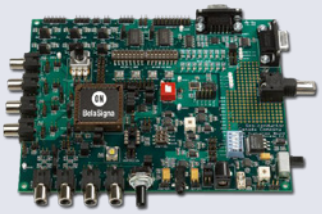
The Rapid Prototyping Module enables manufacturers to easily demonstrate and evaluate the audio performance and power consumption of ON Semiconductor audio processors in a real world environment. The small-footprint RPM is designed for easy attachment to existing portable audio devices while maintaining full portability. The RPM also facilitates fast and easy prototyping, and once concepts and possible configurations are tested and evaluated, the resulting integrated design will reduce risk and enable a faster time-to-market.

For added flexibility, a companion motherboard is also available that makes it easy to demonstrate and evaluate BelaSigna audio DSPs on their own, without the need for a product prototype. The motherboard also enables programming of the RPM. Full layout and schematic information for the RPM is provided with the board.



Evaluation and Development Board (EDB)

The Evaluation and Development Board enables the development, demonstration, testing and debugging of signal processing software. The EDB provides all peripherals needed for measurement and validation, including additional inputs and outputs for extra testing. By facilitating early validation of developed sound processing algorithm performance, the EDB helps to reduce overall development time.



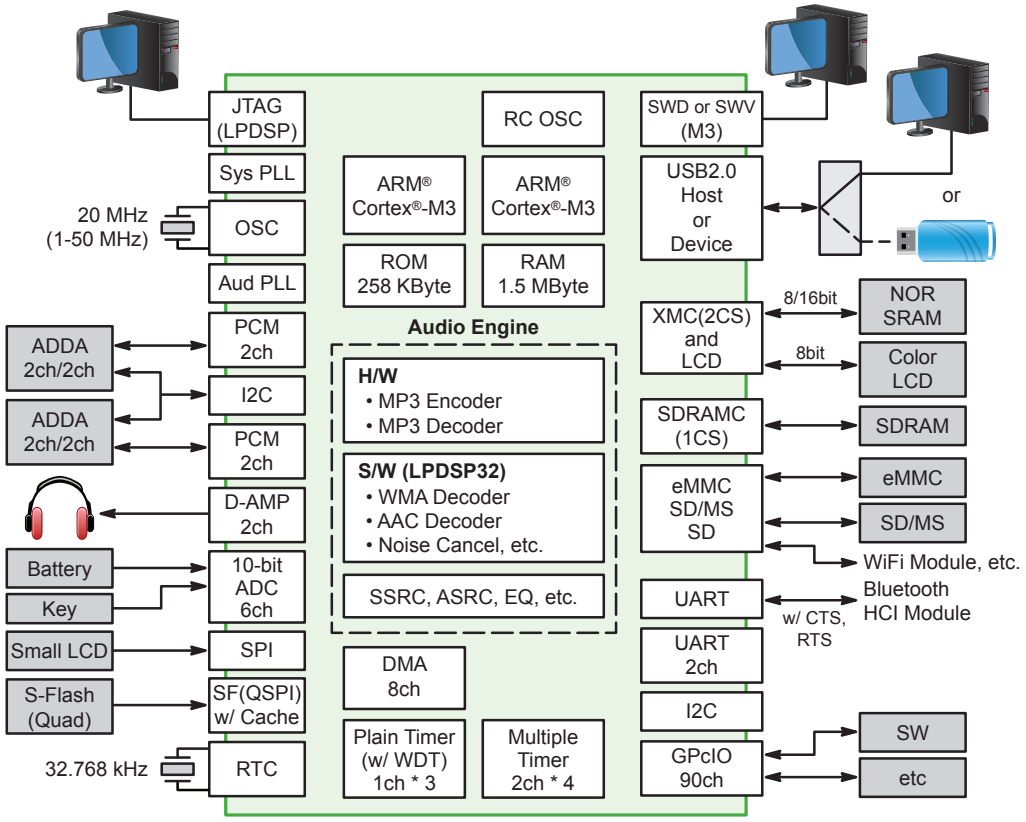
* EDB for BelaSigna 200 and 250 only.

Portable Sound Solution ASSP

LC823450 series high resolution, ultra-low power portable audio system solution

Key Features

- Ultra low power consumption
- Integrated 1656 KByte SRAM
- ARM® Cortex®-M3 Dual Core
- Proprietary 32-bit DSP Core (LPDSP32)
- DSP audio code available for MP3 codec, FLAC codec, Noise Cancel, Zoom Mic
- High resolution 32-bit & 192 KHz audio processing capability
- Integrated analog blocks for low-power Class D HP amplifier, system PLL, dedicated audio PLL
- Hard wired audio functions for MP3 encoder and decoder, EQ (6-band equalizer), ASRC (Asynchronous Sample Rate Converter)
- Integrated interfaces for USB2.0 HS device or host (not OTG), eMMC, SD card I/F
- ASRC with jitter hiding function, DSP code for SBC/AAC, UART with DMA & FIFO support for low power Bluetooth® audio



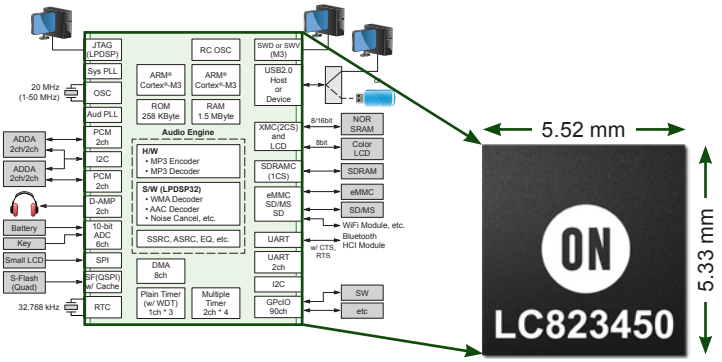
Device	Design Focus	Frequency (MHz)	RAM (KByte)	ARM Cortex-M3 Cores	SD Card I/F Channels	Features	Package
LC823450TA	Voice Recorder	160 @ 1.2 V Typ 100 @ 1.0 V Typ	1656	Single	3	Class D HP Amplifier	TQFP-128L
LC823450XC	Wearable	160 @ 1.2 V Typ 100 @ 1.0 V Typ	1656	Single	2	External LCD I/F (8-bit)	WLCSP-154
LC823450XD	High End	160 @ 1.2 V Typ 100 @ 1.0 V Typ	1656	Dual	3	Class D HP Amplifier; External LCD I/F (8-bit); HW MP3 Encoder	WLCSP-154

Portable Sound Solution ASSP

Ultra Low Power

- Over 120 hours playback with 2 x AAA battery (70% longer than popular portable music players)
- Advanced power management technology
- 4.8 mA @ 128 Kbps by MP3 hardware decoding
- 0.11 mW/MHz @ 1.0 V while Cortex®-M3 Single Core operation
- Integrated low power D class amplifier

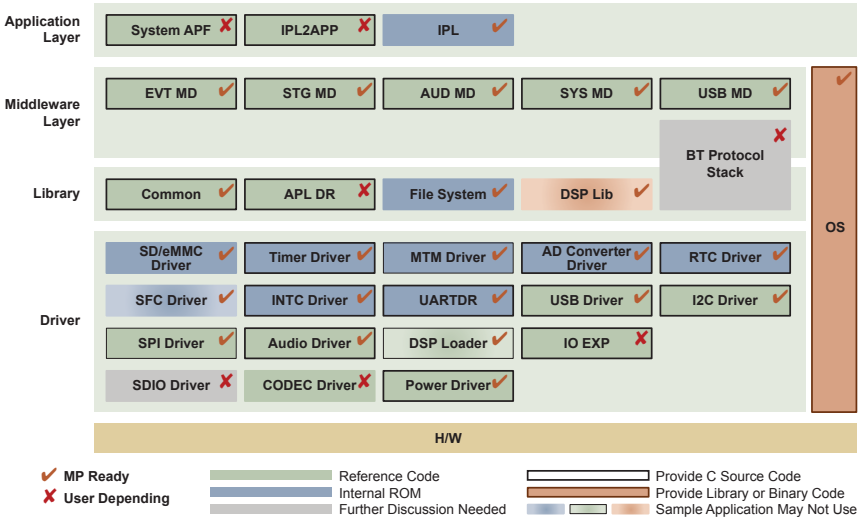
Small Footprint



- 5.52 mm x 5.33 mm WLCSP-154 suitable for portable, wearable audio
- Highly integrated SoC (CPU+DSP+AUDIO)
  - Hi-Resolution Recording/Playback capability
  - Cortex®-M3 dual core
  - Proprietary 32-bit DSP (LPDSP32)
  - 1656 Kbyte internal SRAM

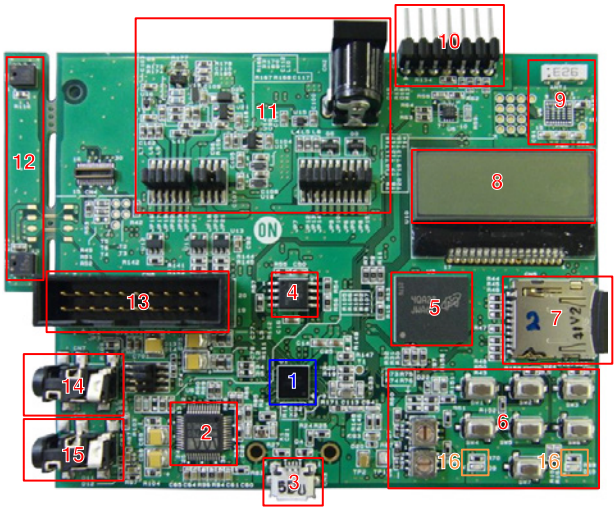
Turn Key Software Support

- Suitable for portable, wearable digital music
- Support wireless synchronized stereo playback



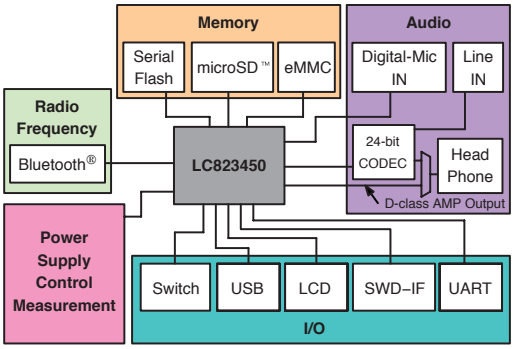
Portable Sound Solution ASSP Evaluation Kit

The LC823450XGEVK is an audio processing system Evaluation Kit used to demonstrate the LC823450. This part can record and playback, and offers high-resolution 32-bit & 192 kHz audio processing capability. It is possible to cover most of the functions necessary for portable audio with only this LSI. It has Dual CPU and DSP with high processing capability, and internal 1656K-Byte SRAM, which make it possible to implement large scale program. And it has integrated analog functions (low-power Class D HP amplifier, PLL, ADC etc.) so that PCB space and cost can be reduced, and it has various interface (USB, SD, SPI, UART, etc.) to make extensibility high. Also it is provided with various function including SBC/AAC codec by DSP and UART and ASRC (Asynchronous Sample Rate Converter) for Bluetooth audio. Low power consumption makes it suitable for portable audio devices, such as wireless headsets.



1	LC823450	9	Bluetooth®
2	Audio CODEC	10	UART Connector
3	USB Connector	11	Power Supply Control
4	Serial Flash	12	Digital Mic
5	eMMC	13	ICE Connector
6	Switches	14	Headphone
7	microSD™	15	Line Input
8	LCD	16	LEDs

LC823450XGEVK Evaluation Board



LC823450XGEVK Block Diagram

Key Features

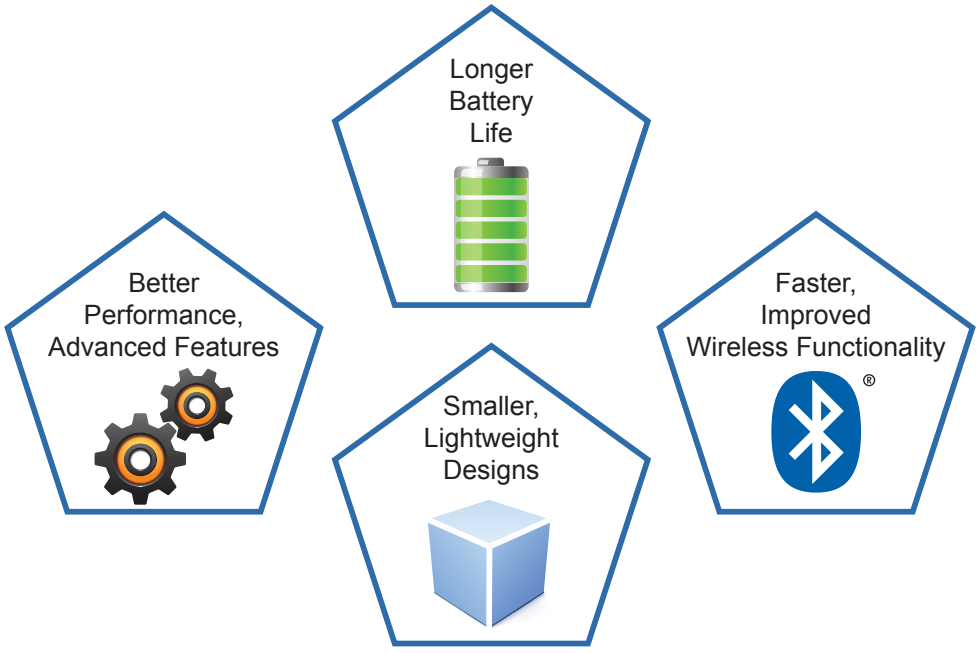
- File Transfer Connecting to PC with USB
- MP3 Recording with USB Bus Power Supply
- MP3 Playback with USB Bus Power Supply
- Measurement of Current Consumption

Bluetooth® Low Energy Technology Radio SoCs

The multi-protocol, Bluetooth 5 certified RSL10 radio System-on-Chip (SoCs) brings ultra-low-power wireless connectivity to IoT and "connected" health and wellness devices.

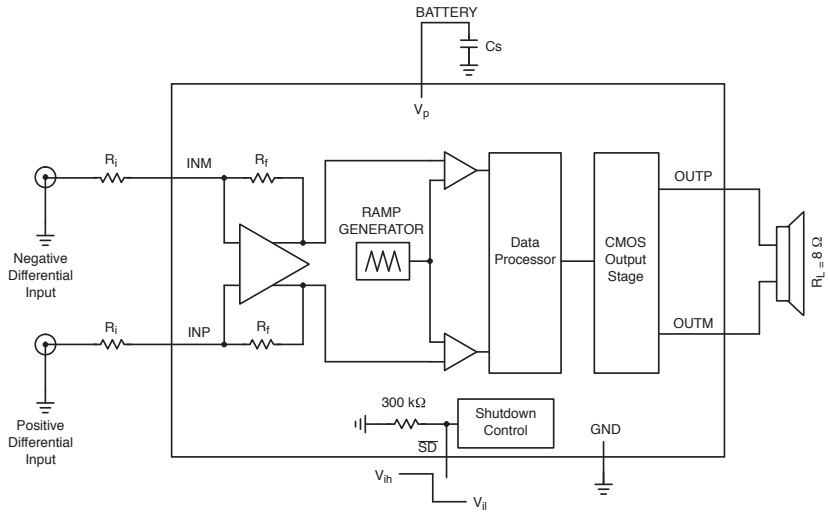
Offering the industry's lowest power consumption, RSL10 provides devices like fitness monitors with advanced wireless features without compromising system size and battery life.

Ultra-Low-Power Wireless for IoT and "Connected" Health & Wellness



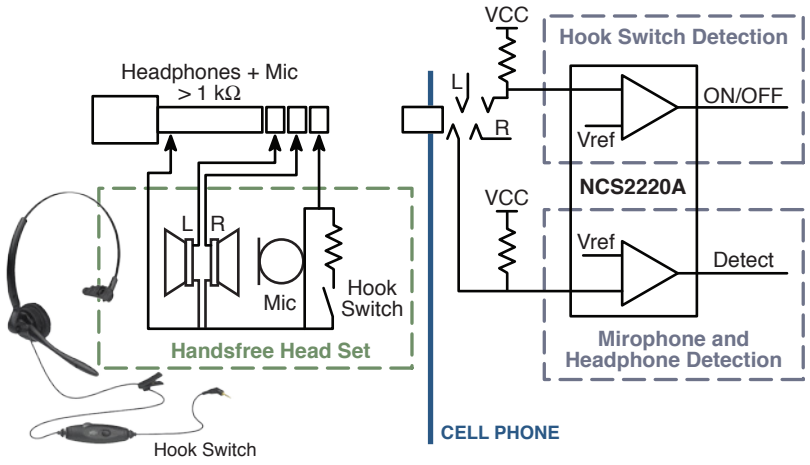
Audio Amplifiers

Device	Category	Description	Class	V_{IN} (V)	P_{out} (W)	I_Q (mA)	THD+N (%)	P_{SRR} (dB)	Package(s)
NCP2820	Speaker Amplifier	2.65 W Class D Amplifier, fast start up	D	2.5 to 5.5	2.65 W, 4 W, 5 V, 1% THD	2.15	0.05	65	CSP-9
NCP2823	Speaker Amplifier	3 W Class D Amplifier	D	2.5 to 5.5	2.65 W, 4 W, 5 V, 1% THD	1.8	0.08	77	CSP-9
NCP2890	Speaker Amplifier	1.0 W Audio Power Amplifier	AB	2.2 to 5.5	1.0 W, 8 W, 5 V, 0.1% THD	1.5	0.02	72	CSP-9, Micro8
NCP2993	Speaker Amplifier	1.3 W Class AB Amplifier, fast start up, zero pop	AB	2.5 to 5.5	1.25 W, 8 W, 5 V, 1% THD	1.5	0.02	80	CSP-9
NCP4894	Speaker Amplifier	1.8 W Differential Class AB Amplifier	AB	2.5 to 5.5	1.8 W, 8 Ω, 5 V, 1% THD	1.9	0.006	85	CSP-9, Micro-10, DFN-10
NCP2811	Headphone Amplifier	63 mW Stereo Headphone Amplifier, true ground reference	AB	2.9 to 5	63 mW, 16 Ω, 1% THD	6.5	0.01	100	CSP-12, UQFN-12, TSSOP-14
NCP2817	Headphone Amplifier	31 mW Long Play Stereo Headphone Amplifier, true ground reference	AB	1.6 to 5.5	31 mW, 16 Ω, 1% THD	2.3	0.019	100	CSP-12



NCP2820 Application Diagram

Low Power Comparators

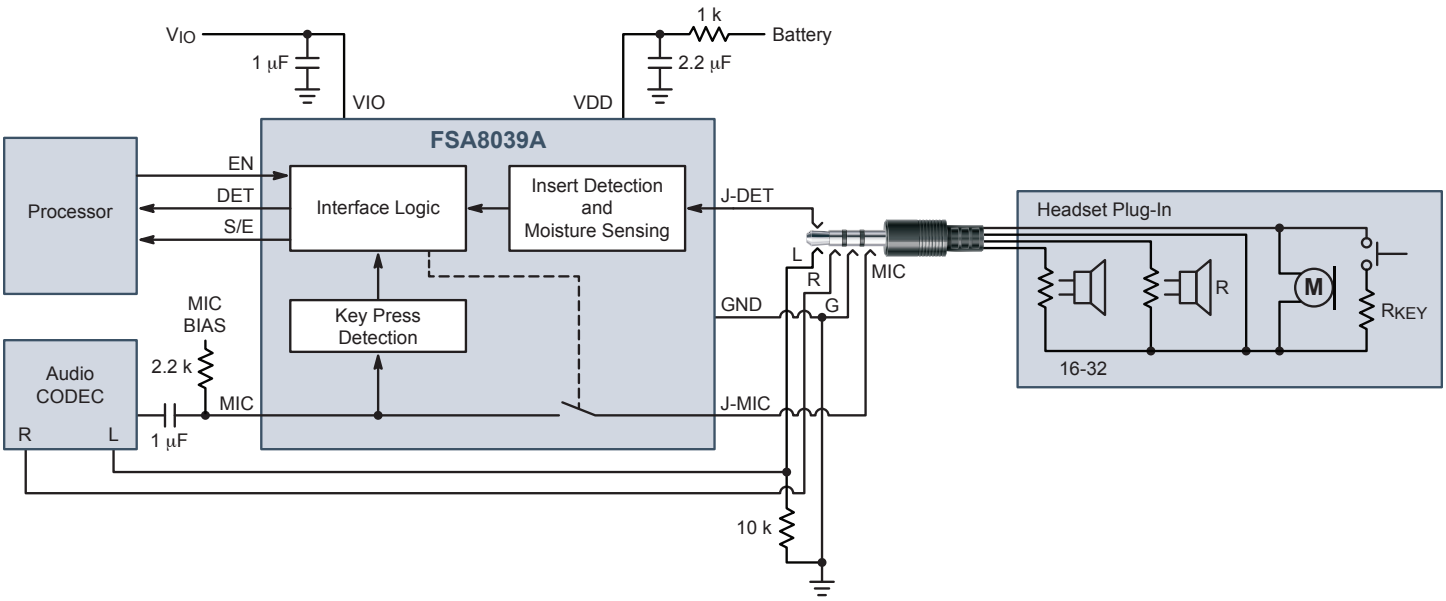


Typical Detection Circuit

Device	Configuration	V_S Min (V)	V_S Max (V)	I_Q/Channel (μA)	$t_{RESP(H-L)}$ (μs)	I_{OUT} (mA)	Output Type	Package(s)
NCS3402	2	2.5	16	0.47	18	10	Open Drain	SOIC-8
NCS2220	2	0.85	6	7.5	0.5	60	Complementary	UDFN-8, UQFN-8
NCS2200A	1	0.85	6	9	0.46	70	Complementary	UDFN-6
NCS2202A	1	0.85	6	9	0.46	70	Open Drain	UDFN-6
NCV2393	2	2.7	16	9	0.8	20	Open Drain	SOIC-8
NCS2200	1	0.85	6	10	0.7	70	Complementary	SOT-23-5, SC-70-5, DFN-6
NCS2202	1	0.85	6	10	0.7	70	Open Drain	SOT-23-5, SC-70-5
LMV339	4	2.7	5	35	0.5	84	Open Drain	SOIC-14, TSSOP-14
LMV393	2	2.7	5	35	0.5	84	Open Drain	Micro8, SOIC-8, UDFN-8
LMV331	1	2.7	5	40	0.5	84	Open Drain	SOT-23-5, SC-70-5

Audio Jack Detection

ON Semiconductor offers audio jack detection solutions to simplify 3/4 pole detection, key press detection, and moisture detection, while eliminating audio pop and click. The design of each product is optimized for minimal power consumption and package size.

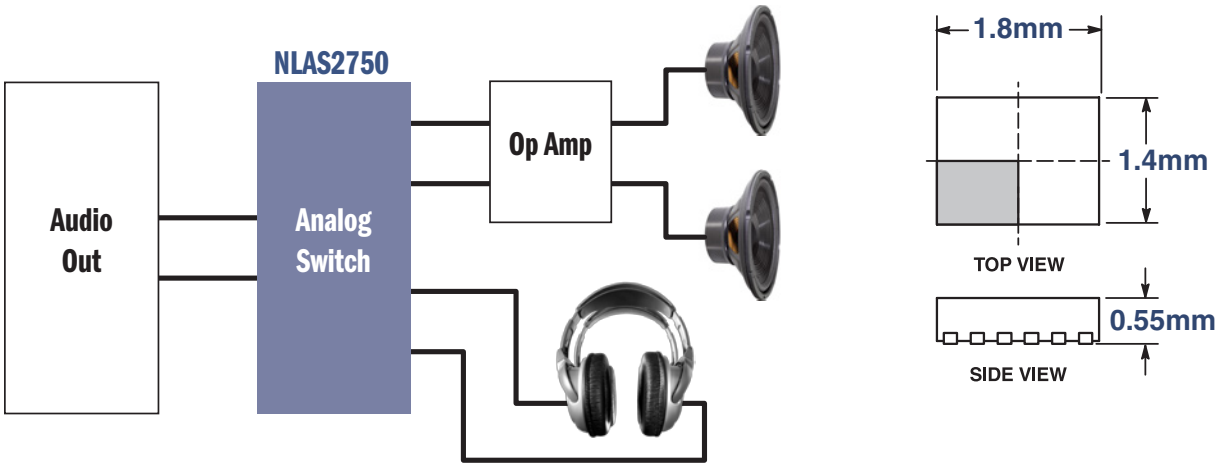


Audio Jack Detection System Diagram

Audio Jack/Headset Detection

Device	Category	VCC (V)	Typical IQ (µA)	Pop/Click Elimination	Send/End Key Detection	Moisture Detection	Volume Up/ Down Key Detection	3/4 Pole Polarity	LDO for Mic Bias	Package
NCS2300	Audio Jack Detection	1.6 to 2.75	7		✔					UDFN-6
NCS2302	Audio Jack Detection	1.6 to 2.5	17	✔	✔					UQFN-10
FSA8108B	Audio Jack Detection	2.7 to 4.5		✔	✔		✔		✔	CSP-12
FSA8008A	AJD & Config Switch	2.5 to 4.4	15	✔	✔					UQFN-10
FSA8028	AJD & Config Switch	2.5 to 4.4	15	✔	✔		✔			UQFN-10
FSA8029	AJD with Mic/Video Switch	2.5 to 4.3	20	✔	✔					UQFN-10
FSA8039A	AJD & Config Switch	2.5 to 4.5	20	✔	✔	✔				UQFN-10
FSA8049	AJD & Mic/GND Switch	2.5 to 4.4	0.1					✔		CSP-9
FSA8069	AJD & Impedance Detection	3.0 to 4.5	30	✔	✔	✔		✔	✔	CSP-12
FSA8501	AJD with (7) Key Press Detection	2.8 to 4.5	40	✔	✔	✔	✔	✔	✔	CSP-25

HiFi and Low Resistance Switches for Audio Signals



Device	Description	THD+N (dB)	V_{CC} Operating Range (V)	V_{IS} Max (V)	Packages
FSA2275	HiFi, Full Swing DPDT	-113	2.5 - 5.5	±3.0	µQFN-12
FSA2276	HiFi, Full Swing DPDT	-113	1.6 - 5.5	±3.0	µQFN-12
NLAS54404	HiFi, Full Swing DPDT	-108	–	2 VRMS	WLCSP-12
NLAS54405	HiFi, Full Swing DPDT	-108	3.3 or 5.0	-3 to VCC	WQFN-16
NLAS5157	Single SPDT	-74	1.65 - 4.5	0 to VCC	µDFN-6
NLAS3799B	Dual DPDT	-67	1.65 - 4.5	0 to VCC	µQFN-16
NLAS5223C	Dual SPDT	-62	1.65 - 4.5	0 to VCC	µQFN-10
NLAS2750	Dual SPDT	–	1.8 - 5.5	0 to VCC	µQFN-10

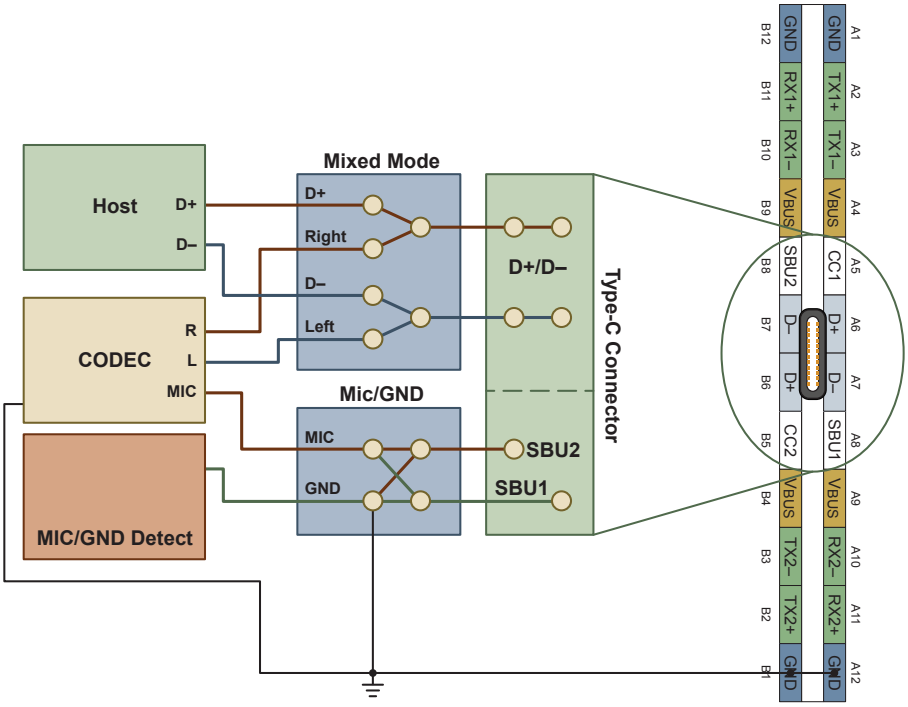
Key Performance Characteristics

- Excellent Audio Fidelity – Very Low THD to -113 dB Typical
- Wide 1.5 – 4.5 V Power Supply Range
- Extended Temperature Capable
- Low $R_{DS(on)}$, Tight Channel Matching

Mixed-Mode Switches for Audio Over USB Type-C Connector

Key Features

- High Bandwidth to support USB 2.0 over D+/D- Interface (Mixed Mode Devices)
- Ultra-Low THD+N to support HiFi Audio over D+/D- Interface (Mixed Mode Devices)
- Ultra-Low $R_{DS(ON)}$ to support GND/Mic switching over SBU1/SBU2 Interface (GND/MIC Switch)



Mixed Mode Analog Switches (USB + Data over D+/D-)

Device	V_{CC} Operating Range (V)	Bandwidth (MHz)	THD+N 32 Ω Load 0.707 V_{RMS}	Default Mode	Package
NL3S588	3.3 or 5.0	580	-112 dB	Dp0/Dn0	uQFN-10
NL3S22UH	2.7 – 3.6	810	-113 dB	Data	uQFN-10
NL3S22AH	2.7 – 3.6	810	-113 dB	Audio	uQFN-10

Mic/GND Switch (Mic/GND over SBU1/DBU2)

Device	V_{CC} Operating Range (V)	V_{IS} Range (V)	Typical $R_{DS(ON)}$ Mic Path	Typical $R_{DS(ON)}$ GND Path	Package
NL3S325*	1.6 – 3.6	0 – 3.6	46 mΩ	57 mΩ	WLCSP-9

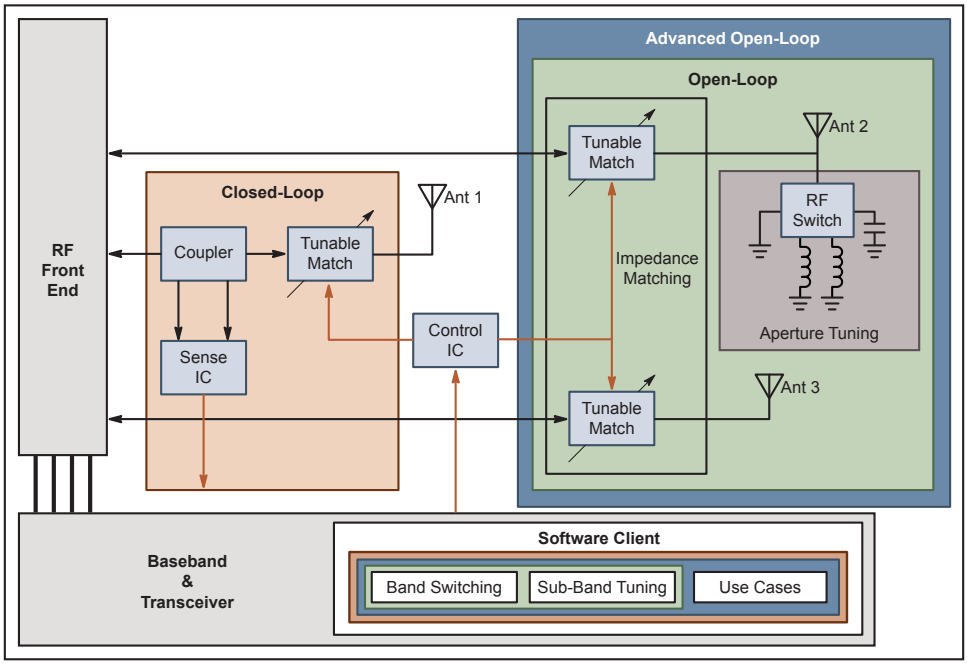
* Pending 3Q17.

RF Antenna Tuning Solutions

ON Semiconductor offers a family of dyanamic tunable RF components designed to enhance antenna performance of smartphones. The devices optimally combine tuning range, RF quality factor (Q), and frequency operation, providing a superior solution to existing fixed-match approaches. These components form a flexible and comprehensive solution that can be customized to meet the RF tuning needs of any smartphone design- from open-loop matching approaches, to advanced closed-loop tuning systems. Our tunable RF solutions are ideally suited for LTE-A networks with advanced features to support, including: Carrier Aggregation, MIMO, and ASDiv functionality.

- Reduced power consumption
- Enables thinner smartphone designs
- Faster data rates
- Greater coverage area of cell sites
- Fewer dropped or missed calls

Tuning for Any Smartphone



Open-Loop

Provides multiple tuning states to optimize performance in each band

Advanced Open-Loop

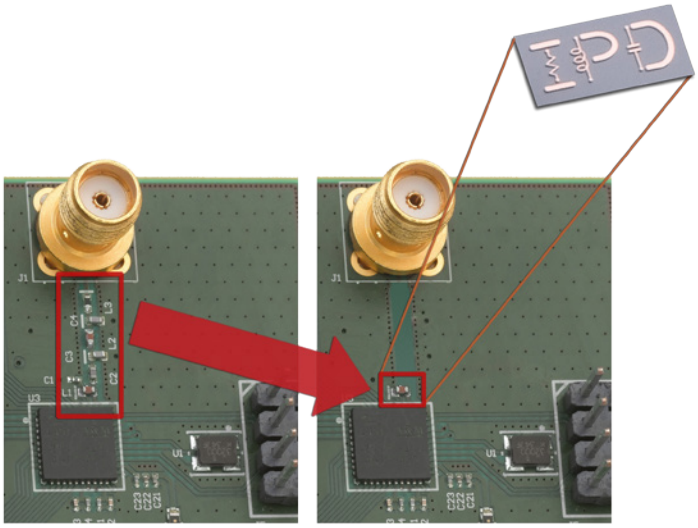
Uses sensor input to detect and adjust performance for certain conditions (e.g., head/hand, USB connected)

Fully Adaptive (Closed-Loop)

Detects environments and conditions and optimizes antenna performance

Integrated Passive Devices (IPD)

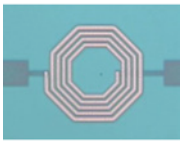
- Combines multiple resistors, capacitors and inductors onto a film substrate; typical applications include RF baluns, filters, and matching networks
- Reduces PCB footprint and component height versus discrete implementations, while also improving performance (reduced parasitics)
- Simplifies logistics, inventory managememt and pick-and-place assembly by elimination of multiple discrete passive SKUs



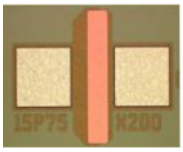
Discrete Solution **IPD Solution**

2.4 GHz LPF Designs for ZigBee®

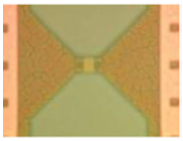
Available Components



- Copper inductors, IPD2 11 µm thick, IPD1 5 µm thick. Minimum spacing 3 µm, minimum line width 5 µm, current handling >50 mA/µm, achieves Q-factors up to 45



- MIM capacitors, 0.62 nF/mm2 , typical tolerance ±5%

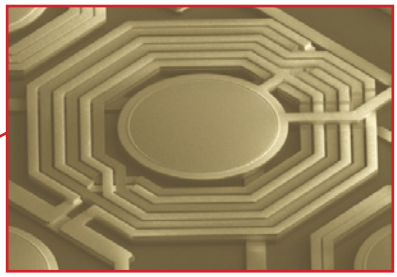


- TiN resistors, 9 Ω/sq

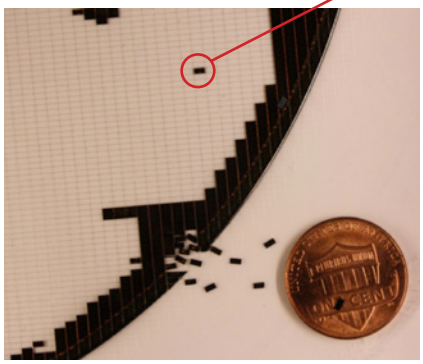
RF

Sub-Micron Tolerances – Trace Spacing/Width Down to 3/5 µm

- Flip-chip or wirebond pad finish options
- Additional back-end processing available



Inductor Within IPD (SEM Photo)



Picked & Diced Wafer Edge

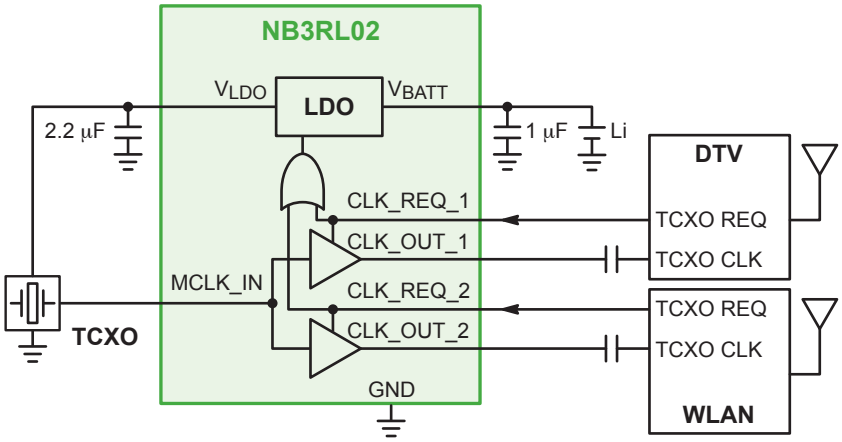
Single Ended Buffers

Clock Buffer with Integrated LDO

Key Features — NB3RL02

- Low additive noise: −149 dBc/Hz at 10 kHz offset phase noise
- 0.37 ps (rms) output jitter
- Limited output slew rate for EMI reduction (1 to 5 ns rise/fall time for 10−50 pF loads)
- Regulated 1.8 V externally available I/O supply
- ESD performance exceeds JESD 22
  - 2000 V Human−Body Model (A114−A)
  - 200 V Machine Model (A115−A)
  - 1000 V Charged−Device Model (JESD22−C101−A Level III)
- WLCSP-8 package

NB3RL02 has two CMOS outputs with clock request lines. Systems in need of TCXO clock will request clock from NB3RL02, and NB3RL02 powers the TCXO and delivers the requested clock.



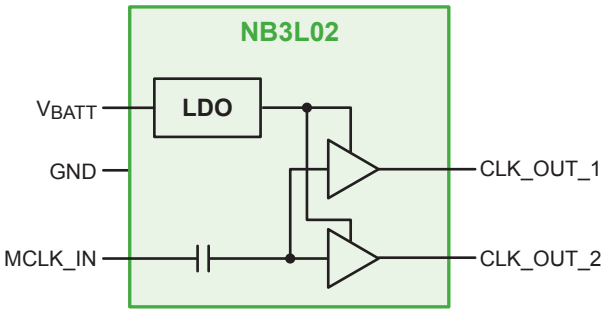
NB3RL02 Reduces Cost by Eliminating Multiple TCXOs

Clock Buffers for Wireless LAN and WiMax

Key Features — NB3L02, NB3L03

- 800 mV single ended outputs
- Low additive noise: -144 dBc/Hz at 10 kHz offset phase noise
- ESD performance exceeds JESD 22: 2 kV Human Body Model
- WLCSP-6 package

NB3L02 and NB3L03 are low-skew, low jitter, 1:2 and 1:3 clock buffers. The MCLK_IN pin has an AC coupling capacitor and will directly accept a square or sine wave clock input, such as a temperature compensated crystal oscillator (TCXO). The minimum acceptable input amplitude of the sine wave is 300 mV peak-to-peak.



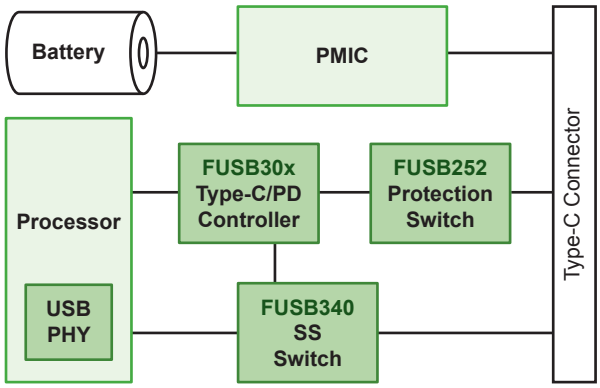
NB3L02 Simplified Block Diagram

RF

USB Type-C Controllers and Switches

Key Features

- Compliant with the latest Type-C and PD specifications
- Ultra low power consumption, 20x less power in some cases
- Smallest footprint and package size; 95% smaller than MCU-based solutions
- Easy integration into end systems



USB Type-C Controllers and Switches

Device	Configurations	Programmable or State Machine	Type-C or Type-C with PD	Standby I_{CC} Typ (μA)	Number of Ports in Application	Package
FUSB301	DRP, SRC, SNK	State Machine	Type-C	5	Single	TMLP-10
FUSB301A	DRP, SRC, SNK	State Machine	Type-C	5	Single	TMLP-12
FUSB3301	SRC	State Machine	Type-C	5	Single	MLP-10
FUSB302B	DRP, SRC, SNK	Programmable	Type-C with PD	25	Single or Multi	WLCSP-9, MLP-14
FUSB302T	DRP, SRC, SNK	Programmable	Type-C with PD	25	Single or Multi	MLP-14

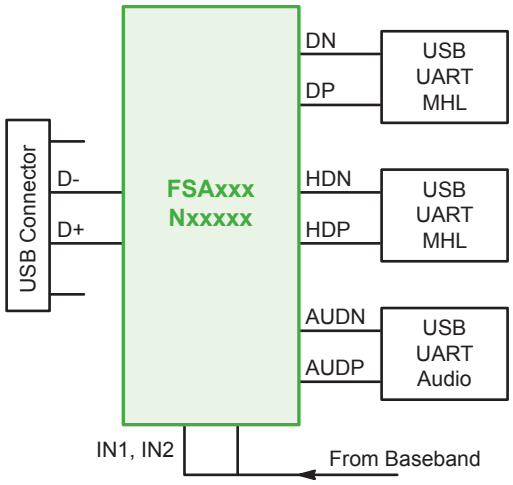
Device	Function	VDC Protection (HSD, VCC)	CC R_{ON} Typ (Ω)	D± R_{ON} Typ (Ω)	D± C_{ON} Typ (pF)	Standby I_{CC} Typ (μA)	Dead Battery Support	Package
FSUB252	HV Port Protection for CC and HSD±	16 V, 20 V	0.3	5	4	9	Yes	UMLP-16

Device	Function	Protocols	Data Rate	Bandwidth	Insertion Loss (@ 2.5 GHz)	Active I_{CC} Typ (μ)	HBM ESD Rating	Package
FSUB340	SuperSpeed 2:1 Switch	USB 3.1 Gen 2, PCIe Gen 3, Display Port 1.3, SATA, Fiber	10 Gbps	10 GHz	-1.0 dB	12	2 kV	TMLP-18

USB/Multimedia Switching Devices

Key Features

- Passes USB 2.0 High Speed Signals >480Mbps
- Passes Mobile High Definition (MHLTM) >3.0Gbps
- Supports Ground Centered Audio
- Low Audio Distortion <0.01% Typically
- Smallest Package in the Industry



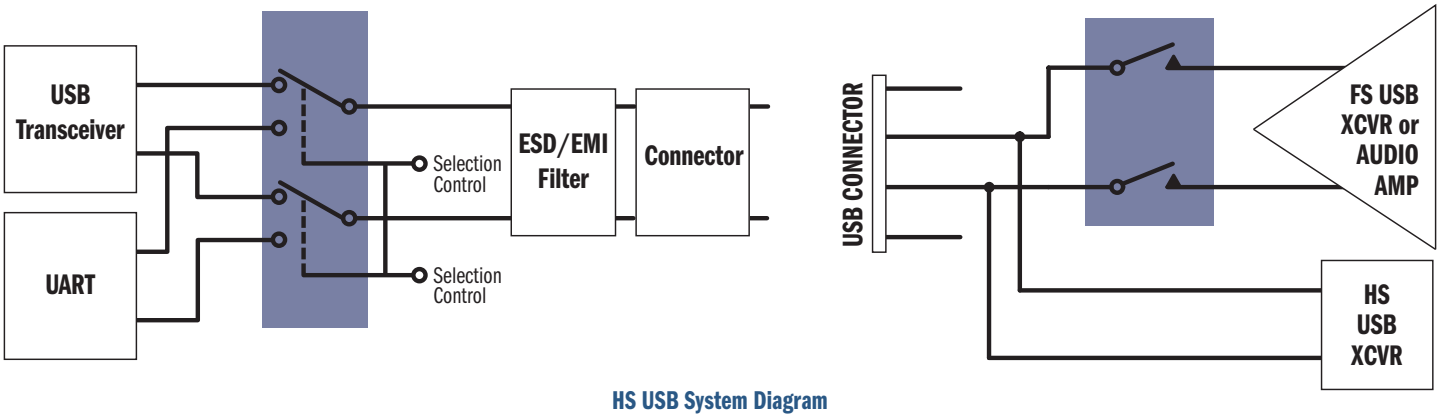
USB Multimedia System Diagram

Device	Configuration	Data Types	Quiescent Current Max (μA)	Package
FSA321	DPDT	USB, Full Swing Audio	15	UMLP-10, UPAK-10
FSA223	DPDT	USB, Full Swing Audio	20	UMLP-10, UPAK-10
NS5S1153	DPDT	USB, Full Swing Audio	35	UQFN-10
NCN1154	DP3T	USB, UART, Full Swing Audio	35	UQFN-12
NCN1188	DP3T	USB, MHL, Full Swing Audio	35	UQFN-12
FSA806	DP3T	USB, UART, Full Swing Audio	35	UMLP-12
FSA3341	DP4T	USB (3x), MHL	30	UMLP-16
FSA3030	DP3T	USB, MHL, Full Swing Audio	30	UMLP-12
FSA3041	DP4T	USB, MHL, UART, Full Swing Audio	30	UMLP-16
NCN1188	DP3T	USB, MHL, Full Swing Audio	35	UQFN-12

USB Switching Devices

Key Features

- Passes USB 2.0 High Speed Signals
- 6.5 W Typical RDSon @ 3.0 V
- >500 MHz Bandwidth
- Low Crosstalk: -45 dB @ 250 MHz
- Smallest Packages in the Industry

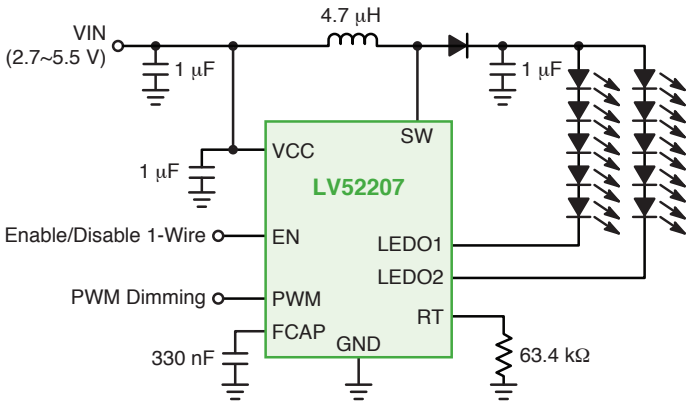


HS USB System Diagram

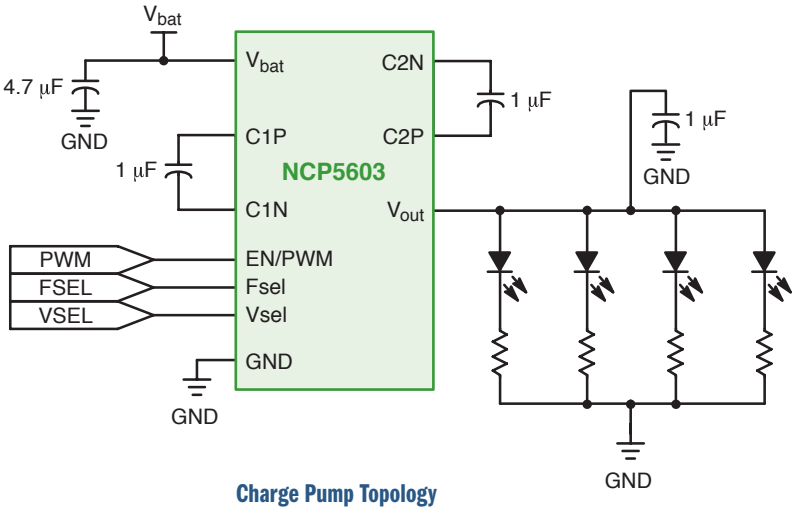
Device	Configuration	R_{ON} Max (Ω)	C_{ON} Typ (pF)	Quiescent Current Max (μA)	Package
FSUSB31	DPST	10	3.7	1	UPAK-8
NLAS7213	DPST	10	3	1	UQFN-8
NLAS7222A/B/C	DPDT	9	6.5	1	WQFN-10
NL3HS2222	DPDT	9	6.5	1	UQFN-10
NL3S2223	DPDT	9	6.5	1	UQFN-10
FSUSB42	DPDT	7.5	6.5	1	UMLP-10
NCN1188	DP3T	7.5	4.5	35	UQFN-12
NCN9252	DP3T	6	16	1	UQFN-12
FSUSB63	DP3T	7.8	6	16	UMLP-12
FSUSB74	DP4T	9	7.5	18	UMLP-16

Low-Voltage Portable LED Driver Topologies

White LED and RGB tricolor LEDs are widely used for backlighting small color LCD panels and keyboards, as well as indicators. High brightness LEDs are used as flash light sources in smart phones and digital cameras. These applications require optimized solutions which can maximize battery lifetime, as well as minimize the PCB area and height. ON Semiconductor has a variety of solutions using linear, inductive, and charge pump topologies. The inductive solution offers the best overall efficiency, while the charge pump solution takes up a minimal amount of space and height due to the use of low profile ceramic capacitors as the energy transfer mechanism. Linear drivers are ideal for color indicator as well as simple backlighting applications.



Inductive Boost Topology



Charge Pump Topology

Charge Pump Topology

Charge Pump/White and RGB LED Drivers — for LCD Backlight, LED Flash/Torch and Indicator

Device	Input Voltage Range (V)	Number of Outputs	Total Output Current (mA)	Regulation Mode	Charge Pump Operating Mode	LED-LED Current Matching, Typ	Dimming Method	Number of Current Level/ Profile	Operating Quiescent Current, Typ (mA)	Shutdown Current (µA)	Package	Notes
NCP5603	2.85 - 5.5	1	200 mA DC, 350 mA pulse	Voltage	1X, 1.5X, 2X	–	PWM	Depends on system	1	2.5 typ	DFN-10	• Backlight • 4.5 / 5 V output • Short circuit protection
NCP5623B/C	2.7 - 5.5	3 (Independent)	90	Current	1X, 2X	±0.5%	I2C	32/ quasi-log	0.35	0.8 typ	LLGA-12	• RGB illumination • Backlight • Built-in "gradual illumination" • B & C versions have different I2C addresses

Inductive Boost and Buck Topology

Inductive-Boost White-LED Drivers — for Backlighting and Torch/Flash Applications

Device	Input Voltage Range (V)	Max Output Volt, Typ (V)	Output Current (mA)	Condition	Number of LEDs/ Configuration	Switching Mode/ Frequency	Dimming Method	Efficiency (%)	Operating Quiescent Current, Typ (mA)	Shutdown Current, Typ (µA)	Package	Notes
NCP1529	2.7 - 5.5	3.9	1	Vout 1.2 V, Vin 3.6 V	1	PWM/PFM 1.7 MHz	PWM	96	28	0.3	TSOP-5, uDFN-6	• Flash/Torch • Auto-switching between PWM and PFM mode at light load
NCP1422	1.0 - 5.0	5	800	Vout 3.3 V, Vin 2.5 V	1 for flash	PFM, up to 1.2 MHz	PWM	94	1.3 µA	0.05	DFN-10	• Flash/Torch • Internal synchronous rectification
NCP5005	2.7 - 5.5	24	40	Over 5 LED, Vin 3.6 V	2 to 5/ series	PFM, up to 2.25 MHz	PWM	90	–	0.3	TSOP-5	• Backlight • Isw = 350 mA
LV52204	2.7 - 5.5	40	30	Vout 30 V, Vin 3.7 V	2 to 10 / Series	600 kHz	1-wire & PWM	90	3	0.1	UDFN-6	• Backlight • Isw = 750 mA
LV52207	2.7 - 5.5	40	30	Vout 30 V, Vin 3.7 V	2 to 10 / Series	600 kHz/1.2 MHz	1-wire & PWM	90	3	0.1	WLP-9	• Backlight • Isw = 750 mA

Multifunction LED Drivers

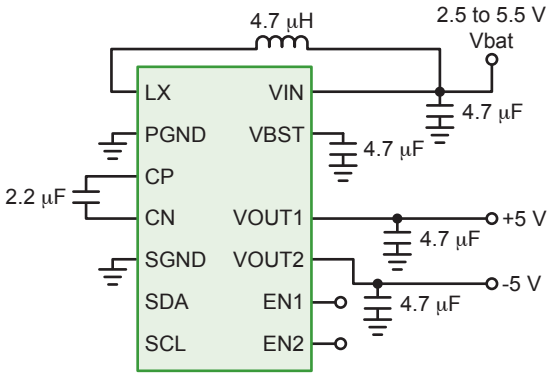
Device	Input Voltage Range (V)	Main Backlight LED Driver	RGB LED Driver 1	External Control	Topology	Serial Control	Package	Notes
LV5207LP	3.0 to 4.5	4-Ch (3-Ch Avail)	R,G,B Independent ON/OFF	✔	Charge Pump	I2C Control Bus	VCT-24	• 7 LED channels total • LED current programmable in 32 steps
LV5216	3.0 to 4.5	10-CH	R,G,B and 6 Main	✔	Charge Pump	I2C Control Bus	WLP-36	• LED current programmable in 32 steps

LCD Display Bias

The LV52133 and LV52134 generate user-programmable dual-out votages with a single inductor. Each device features short circuit protected output stages, small footprint, and ultra-low standby current.

Key Features

- Dual-outputs with single-inductor architecture
- Adjustable output voltages via I2C
- Short Circuit Protection



Device	Input Voltage Range	Default Output Voltage	Output Voltage Setting Range	Output Current	Standby Current	Package
LV52133A0XA LV52134A0XA	2.5 to 5.5 V	V_{OUT1} = +5.0 V V_{OUT2} = -5.0 V	V_{OUT1}: +4.1 to +5.7 V V_{OUT2} : -4. V to -5.7 V (100 mV step)	200 mA (V_{OUT1}); 100 mA (V_{OUT2})	0.3 µA	WLP-15J
LV52133A5XA LV52134A5XA		V_{OUT1} = +5.5 V V_{OUT2} = -5.5 V				

NOTE: LV52133 and LV52134 differ with respect to I2C control address.

Haptic Drivers

LC898302A

The LC898302A is a haptic driver able to drive LRA and ERM. The drive frequency is automatically adjusted to the resonance frequency of the linear vibrator without external components.

Unique Features

- Drive LRAs with automatic tuning and breaking
- Drive ERM; drive voltage controlled via PWM

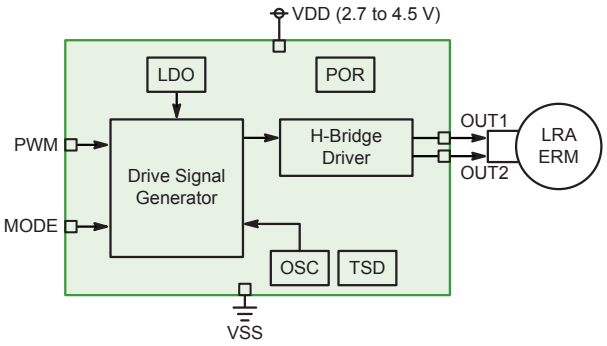
Other Features

- Supply voltage = +2.7 to +4.5 V
- I_{out} max = 200 mA
- Bridge $R_{DS(on)}$ = 2 x 2 Ω (4 x 2 Ω MOSFETs embedded)
- Low standby current

Benefits

- High efficiency
- Easy handling (no adjustment for any LRA)
- Strong vibration

Device	Description	Package
LC898302A	Haptic Driver for LRA and ERM	WLCSP-6



Block Diagram

LC898301

The LC898301 is an extended supply range version of the LC898300 LRA driver, compatible with cellular battery voltage. The architecture chosen enables strong vibration in minimal board space. Moreover, the LC898301 exhibits superior vibration performance.

Unique Features

- Automatically adjust driving frequency (ON Semiconductor patent)
- Minimized start-up and brake period (Quick stop)
- Automatically stop braking to avert counter vibration

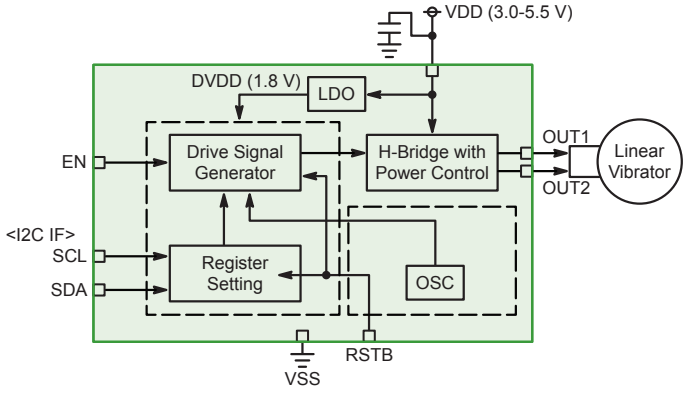
Other Features

- Supply voltage = +3.0 to +5.5 V
- I_{out} max = 200 mA
- Bridge $R_{DS(on)}$ = 2 x 2 Ω (4 x 2 Ω MOSFETs embedded)
- No peripheral component required (only 0.1 µF cap)
- Low power consumption

Benefits

- High efficiency
- Easy handling (no adjustment for any LRA)
- Strong vibration
- Fault-detection
- Battery direct supply
- Fully configurable through I2C

Device	Description	Package
LC898301XA	Haptic Driver for LRA	WLCSP-8
LC898301AXA	Haptic Driver for LRA with Immersion System	WLCSP-8

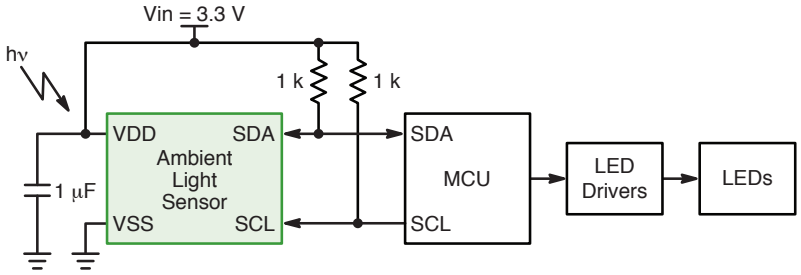


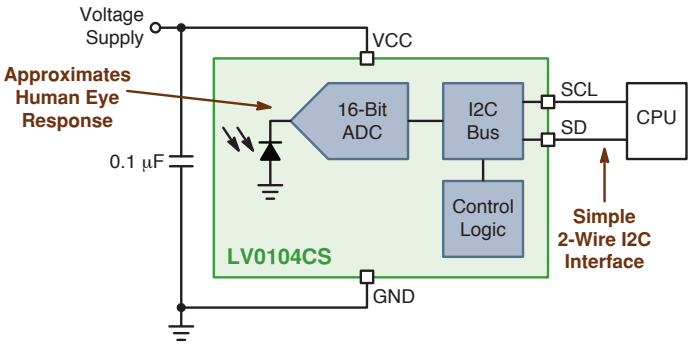
Block Diagram

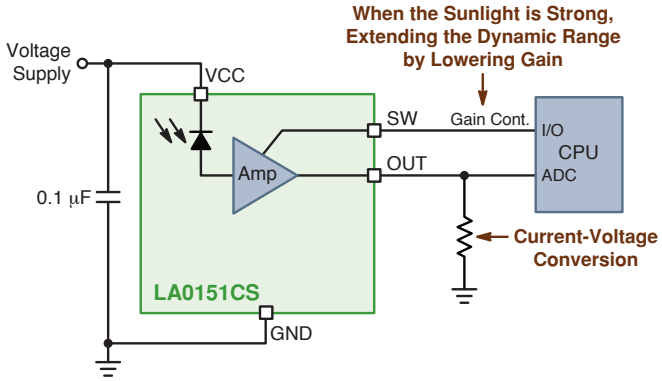
Ambient Light & Proximity Sensors

NOA1305 Features

- Design flexibility/customization (i.e., EEPROM if desired for trimming)
- 0.0125 lux detection with customizable filtering (i.e., Photopic Light Response)
- Dark current and temperature compensation
- Lowest power consumption per resolution bit
- I2C Interface (including High Speed Mode) and no effect on bus during power down





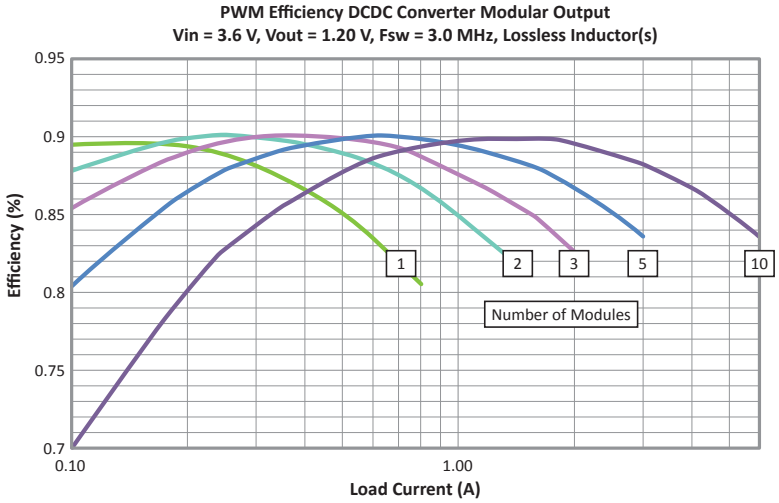


Device	Special Features	I_O Typ @ E_V = 100 Lux (μA)	Output Interface	V_{in} Range (V)	T_A Range (°C)	Package
LA0151CS	2-Stage Gain Switching	8 (high gain)	Analog, linear current	2.2 - 5.5	-30 to +85	ODCSP-4
LV0104CS	Integrated Sleep Mode	–	I2C, 16-bit ADC	2.3 - 3.6	-30 to +85	ODCSP-4
LV0111CF	Standby Function	21	Analog, logarithmic current	2.3 - 5.5	-30 to +85	ODCSP-4J
NOA1212	Dark Current Compensation	51 (high gain)	Analog, linear current	2.0 - 5.5	-40 to +85	CUDFN-6
NOA1213	Dark Current Compensation	–	Analog	2.0 - 5.5	-40 to +85	CUDFN-6
NOA1305	Dark Current Compensation	–	I2C, 16-bit ADC	2.4 - 3.6	-40 to +85	CUDFN-6
NOA3302	Proximity Sensor	–	I2C, 16-bit ADC	2.3 - 3.6	-40 to +80	CWDFN-8

ARM® Core DC-DC Converters

Key Features

- High regulating performance from 0.6 V to 1.4 V
  - Modular efficiency with fragmented power stage
  - Dynamic voltage scaling per output steps of 6.25 mV by I2C
  - Tight accuracy of ±1%, due to differential sensing
- Fast transient response
  - Proprietary PFM to PWM transition with equivalent performance to PWM only
  - Thermally handle high peak current demands up to 10 ms
  - Flexible design to transient handling output capacitor from 22 µF to 100 µF

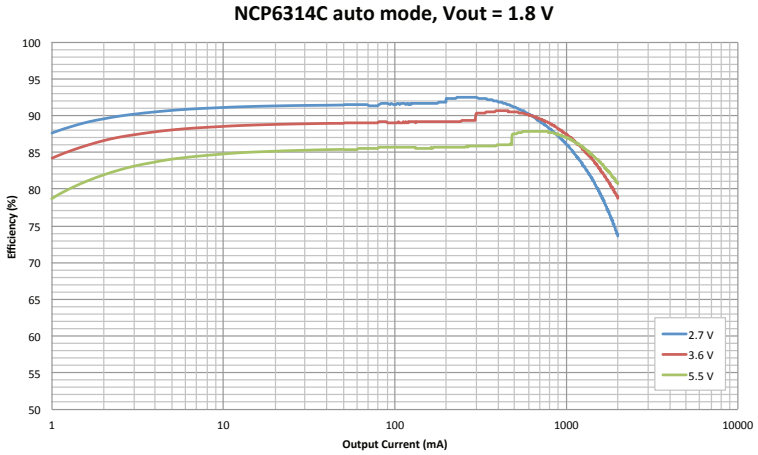


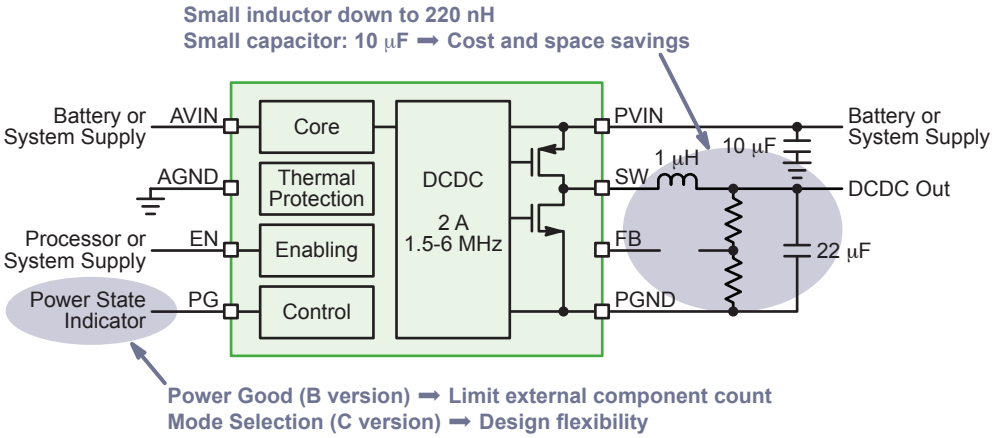
Device	V_{IN} (V)	V_{OUT} (V)	I_{OUT} (A)	f_{SW} (MHz)	Control	Features	Package
NCP6338	2.3 – 5.5	0.6 – 1.4	6.0	3.0	I²C; VSEL	Modular power stage; Differential sensing	WLCSP-30
NCP6335	2.3 – 5.5	0.6 – 1.4	4.0	3.0	I²C; VSEL	Transient load helper	WLCSP-20
NCP6343	2.3 – 5.5	0.6 – 1.4	3.5	3.0	I²C	Dynamic voltage scaling	WLCSP-15

Peripheral DC-DC Converters

Key Features

- High efficiency conversion - up to 94% - over large input & output voltage range
- High switching frequency - up to 6.0 MHz - reduces external component size (inductor down to 220 nH)
- Design flexibility with adjustable resistor bridge, independent enable control, power good or mode selection pin





Device	V_{IN} (V)	V_{OUT} (V)	I_{OUT} (A)	f_{SW} (MHz)	Operating Mode	Features	Package(s)
NCP1521B	2.7 – 5.5	0.9 – 3.3	0.6	1.5	PFM/PWM	–	TSOP-5, UDFN-6
NCP1522B	2.7 – 5.5	0.9 – 3.3	0.6	3	PFM/PWM	–	TSOP-5, UDFN-6
NCP1529	2.7 – 5.5	0.9 – 3.3	1.0	1.7	PFM/PWM	–	TSOP-5, UDFN-6
NCP6324	2.5 – 5.5	0.6 – 5.0	2.0	3	PFM/PWM	Mode Selection	WDFN-8
NCP6332B	2.3 – 5.5	0.6 – 5.0	1.2	3	PFM/PWM	Power Good	UDFN-8
NCP6332C	2.3 – 5.5	0.6 – 5.0	1.2	3	PFM/PWM	Mode Selection	UDFN-8
NCP6334B	2.3 – 5.5	0.6 – 5.0	2.0	3	PFM/PWM	Power Good	UDFN-8
NCP6334C	2.3 – 5.5	0.6 – 5.0	2.0	3	PFM/PWM	Mode Selection	UDFN-8
NCP6354	2.3 – 5.5	0.6 – 5.0	2.0	3	PWM	Power Good	UDFN-8

Mid Scale Power Management Integration

Key Features

- Extensive IP library
- Flexibility for platforms derivatives with full programmability by I2C
- Offers real time load management with Dynamic Voltage Scaling
- High performance
  - High efficiency (up to 96%) and low quiescent current (<100 µA) to improve battery life
  - Low noise LDO (30 µVrms @ 100 Hz-100 kHz) meets the latest sensors requirements
- Quick turn around and time to market solutions
- WLCSP, QFN packages

Core
- Vin 2.3 - 5.5 V
- Bandgap
- Oscillator
- Biasing

+

BUCKs
- Vin 2.3 - 5.5 V
- Vout 0.6 - 5.5 V
- Up to 6.0 A/ channel
- Dynamic voltage scaling

+

LDOs
- Low noise, low Iq
- High PSRR
- Vin 1.7 - 5.5 V
- Vout from 1.0 - 3.3 V
- Up to 300 mA/ channel

+

Features & Monitors
- 10-bit ADC
- I2C / OTP
- Sequencer
- External sync
- Individual enable
- Power Good

+

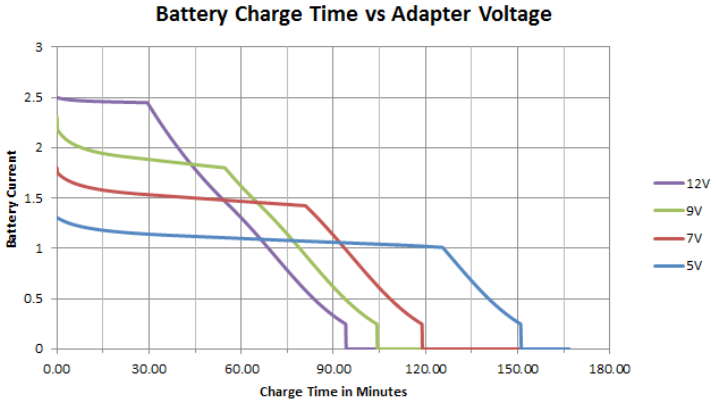
Customization
- Flash LED
- Load switch
- Boost/bypass
- Buck/boost
- Battery charger
- Clock Generator
- Memory
- Wireless Power

Device	DC-DC (mA)	LDO (mA)	Package(s)
NCP6925	2 x 1000	5 x 300	CSP-36
NCP6924	2 x 1000	2 x 300, 2 x 150	CSP-30
NCP6914	1 x 800	4 x 300	CSP-20
NCP6915	1 x 600	1 x 300, 4 x 150	CSP-16

Switching Battery Chargers

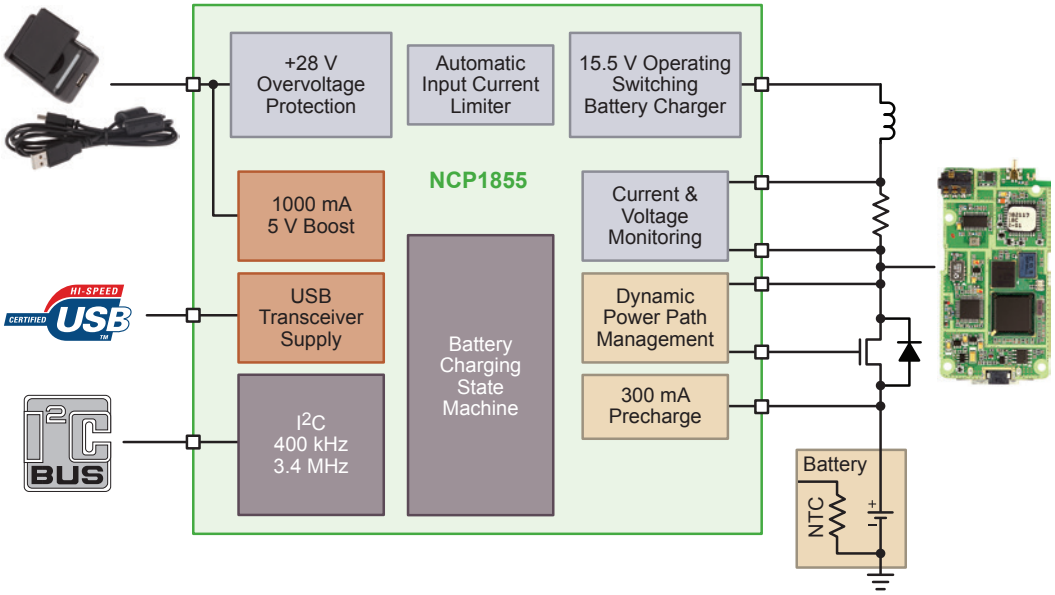
Key Features

- Sized for micro USB connector (USB BC1.2) with 1.5 A, 1.6 A, 1.8 A, 2.5 A charging current
- Automatic input current limit adapts charging current to the maximum capability of the power source; proven charging time decrease by 10 minutes
- Integrated 28 V over voltage protection with unique negative voltage support
- Up to 1 A embedded boost USB OTG saves BOM cost
- Automatically disconnects battery at end of charge, with reconnect in few seconds in case of peak current activity (GSM for instance)
- Instant turn-on at cable insertion when battery is weak
- Enable smart fast charging ports with input voltage capability up to 16 V (NCP1855)

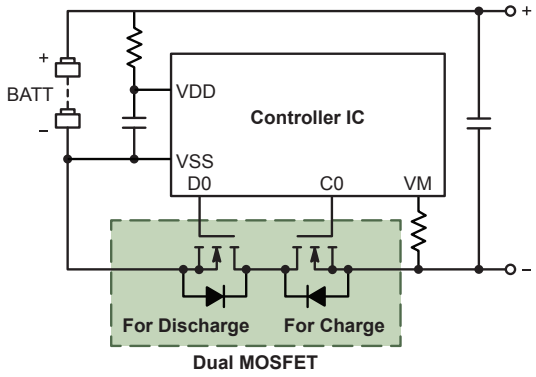


NCP1855 Charging Profile for 4.2 V, 2500 mAh Battery Pack, Input Source Limited to 1 A

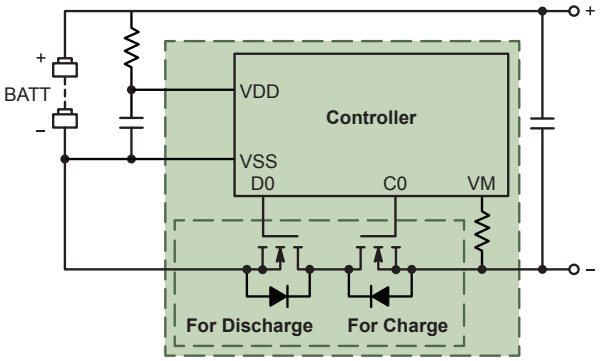
Device	Charging Current Max (A)	Pre-Charge Current Max (mA)	OTG Boost Current Max (mA)	V_{CC} Max (V)	OVP (V)	I2C	Automatic Input Current Limiting	Dual Path Management	Protected USB PHY Supply (mA)	Battery Temperature Sensing	Package
NCP1850	1.5	450	250	7	+28	400 kHz	Yes	Yes (external)	30	Threshold	WLCSP-25
NCP1851	1.6	300	500	7	+28	400 kHz / 3.4 MHz	Yes	Yes (external)	50	JEITA	Flip-Chip-25
NCP1852	1.8	300	500	7	+28/–20	400 kHz / 3.4 MHz	Yes	Yes (external)	50	JEITA	Flip-Chip-25
NCP1854	2.5	300	500	7	+28	400 kHz / 3.4 MHz	Yes	Yes (external)	50	JEITA	Flip-Chip-25
NCP1855	2.5	300	500	16	+28	400 kHz / 3.4 MHz	Yes	Yes (external)	50	JEITA	Flip-Chip-25



Li-ion Battery Protection



Dual MOSFET



2-in-1 Configuration
(Controller + Dual MOSFET Integrated Package)

Dual MOSFETs

Device	Configuration	Polarity	V_{SSS} Max (V)	V_{GSS} Max (V)	I_S (DC) (A)	$R_{SS(ON)}$ @ V_{GS} = 4.5 V Min/Typ/Max (mΩ)	$R_{SS(ON)}$ @ V_{GS} = 2.5 V Min/Typ/Max (mΩ)	Package(s)
CPH6636R	Dual	N-Channel	24	±12	6	15.0/17.5/20.0	19.5/24.5/29.5	CPH-6
ECH8693R	Dual	N-Channel	24	±12	11	5.6/8.5/10.4	7.8/13.0/18.2	ECH-8
ECH8695R	Dual	N-Channel	24	±12.5	11	5.6/7.0/9.1	7.5/9.5/13.3	ECH-8
ECH8697R	Dual	N-Channel	24	±12	10	7.7/11.0/14.3	11.4/19.0/26.6	ECH-8
EFC4612R-S	Dual	N-Channel	24	±12	6	24/39/45	33.5/58/72	EFCP
EFC4619R	Dual	N-Channel	24	±12	6	13.5/19.8/23.0	18.5/27.0/35.0	EFCP
EFC4621R	Dual	N-Channel	24	±12	9	10.8/15.5/18.0	14.9/23.0/30.0	EFCP
EFC4626R	Dual	N-Channel	24	±12	5	29.2/37.5/46.2	42.6/54.0/72.4	EFCP
EFC6601R	Dual	N-Channel	24	±12	13	6.6/9.5/11.5	9.0/13.0/17.0	EFCP
EMH2418R	Dual	N-Channel	24	±12	8.5	9.1/13.0/16.9	13.8/23.0/32.2	EMH
EFC3C001NUZ	Dual	N-Channel	20	±10	6	17.0/23.0/30.0	24.5/35.0/56.0	EFCP
EFC3J018NUZ	Dual	N-Channel	20	±10	23	2.5/3.6/4.7	3.3/4.75/9.0	EFCP
EFC4627R	Dual	N-Channel	12	±10	6	18.5/23.9/29.5	29.3 / 37.7/50.5	EFCP
EFC6602R	Dual	N-Channel	12	±12	18	3.1/4.5/ 5.9	5.2/7.5/11.0	EFCP
EFC6604R	Dual	N-Channel	12	±12	13	6.0/7.5/ 9.0	10.0/12.6/17.7	EFCP
EFC8811R	Dual	N-Channel	12	±8	27	1.8/2.3/ 3.2	2.7/4.0/6.3	EFCP

NOTE: $R_{SS(ON)} = R_{DS(ON)} \times 2$.

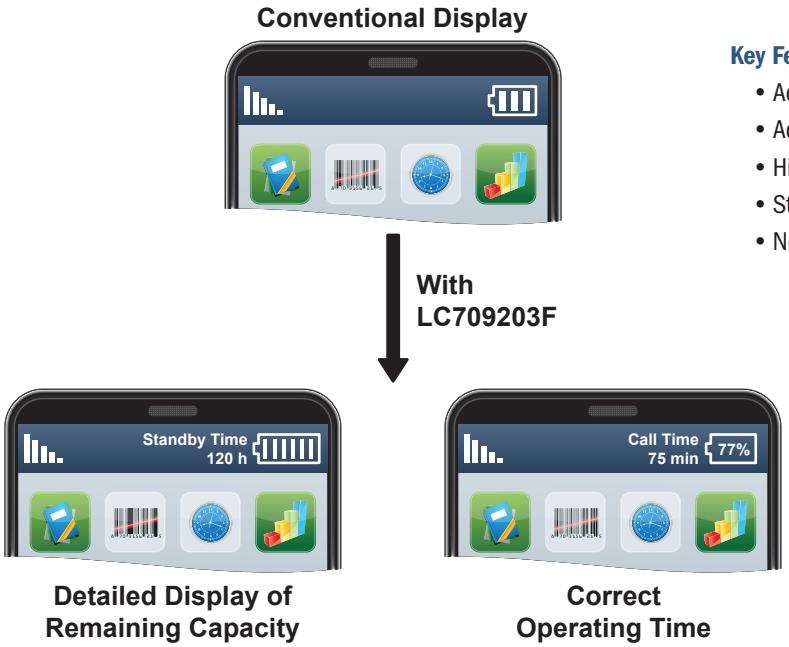
Battery Protection Controllers with Integrated MOSFETs for One-Cell Batteries

Device	Adjustable Range			V_{SSS} Max/ V_{GSS} Max (V)	$R_{SS(ON)}$ @ V_{GS} = 4.5 V Min/Typ/Max (mΩ)	$R_{SS(ON)}$ @ V_{GS} = 2.5 V Min/Typ/Max (mΩ)	Features	Package(s)
	V_{OV} Range (V)	V_{UV} Range (V)	I_{OC}/I_{OCH} Range (A)					
LC05111CMT	4.0 to 4.5	2.2 to 2.7	2 to 8	24/±12	8.8/11.2/14.0	10.4/13/18.2	Auto Wake-up, 0 V Charge	WDFN-6
LC05112CNMT	4.0 to 4.5	2.2 to 2.8	2 to 8	24/±12	8.8/11.2/14.0	10.4/13/18.2	–	WDFN-6
LC05132C01NMT	4.0 to 4.5	2.2 to 2.8	2 to 8	24/±12	8.8/11.2/14.0	10.4/13/18.2	Reset Function **	WDFN-6
LC05711ARA	4.1 to 4.6	2.2 to 2.8	2 to 16	20/±10	3.8/4.7/5.6	4.4/5.4/6.9	Auto Wake-up, 0 V Charge	ECP-30
LC05732ARA	4.1 to 4.6	2.1 to 2.7	2 to 16	20/±10	3.8/4.7/5.6	4.4/5.4/6.9	Reset Function **	ECP-30
LC06111TMT*	4.1 to 4.6	2.2 to 2.8	2 to 12	12/±12	6.6/8.4/10.6	8.6/10.8/15.2	Auto Wake-up, 0 V Charge	WDFN-6

* Pending 3Q17. ** Forced off of charge and discharge FET.

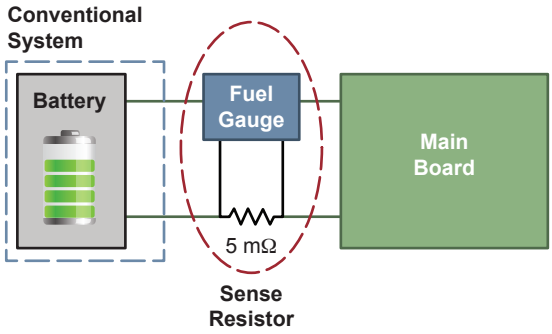
LC709203F High Accuracy Fuel Gauge LSI

Fuel Gauge for 1 Cell Li+ with Low Power and with No Sense Resistor



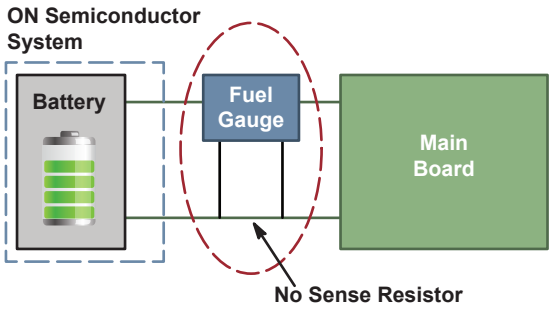
Key Features

- Accuracy of remaining capacity ±2.8% (0 ~ +50°C)
- Active mode current of 15 μA
- Hibernate mode current of 2 μA
- Standby mode current (RAM retention) of 0.1 μA
- No need for sense resistor for current detection



ON Semiconductor Solution (No Sense Resistor)

- No power loss
- No heat generation



AirFuel™ Wireless Charging

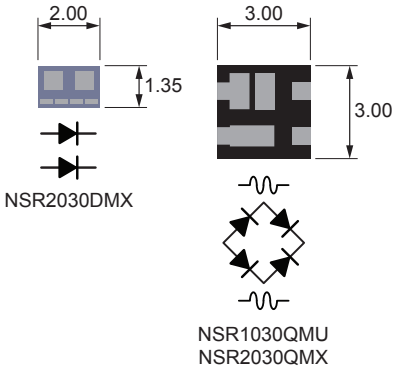
Loosely Coupled Wireless Charging Features

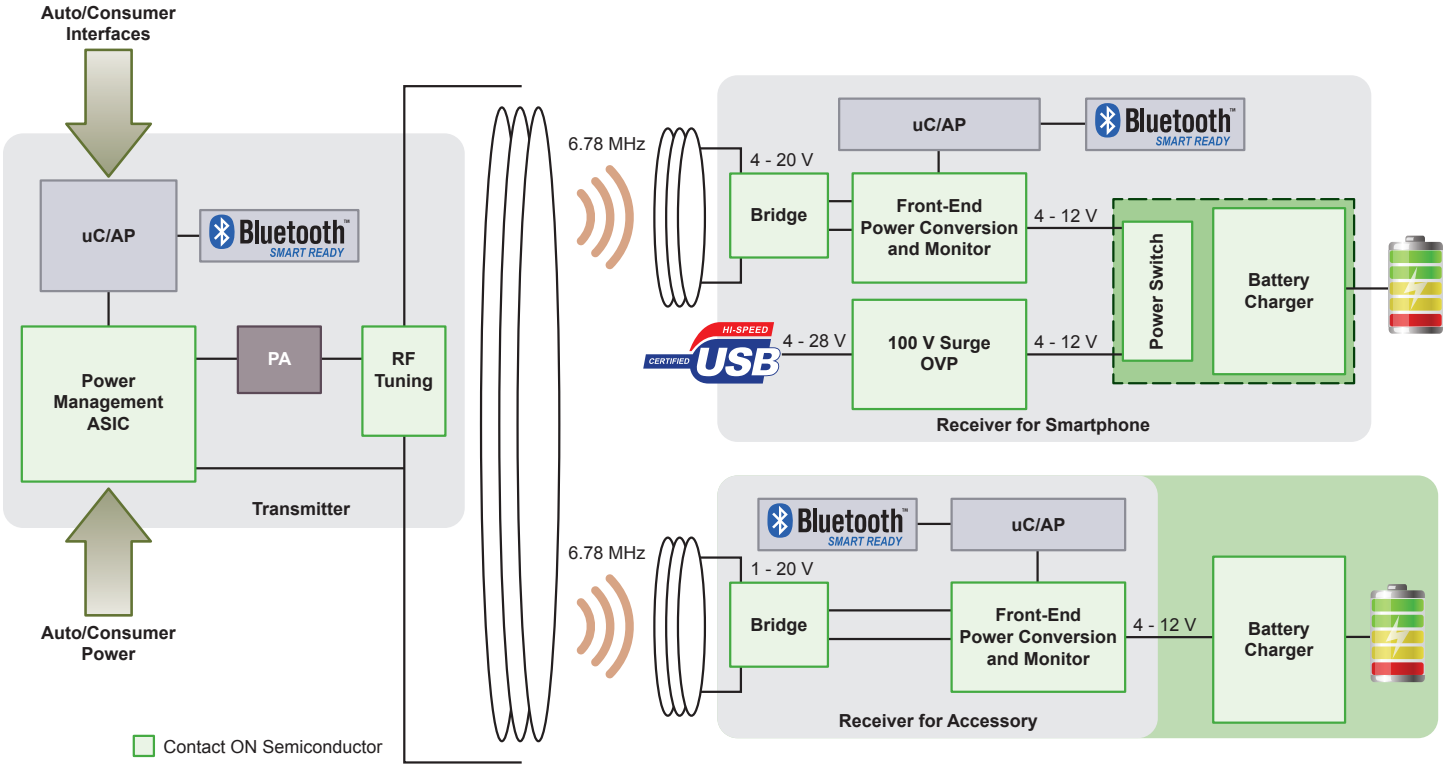
- Spatial Freedom; no alignment or direct contact to transmitter is required
- Charge multiple devices at once through surfaces
- Can charge in the presence of metal objects such as coins or keys

High Efficiency Rectifiers

- Ultra low VF
- DFN packages ideal for space constrained applications
- Specifically designed for AirFuel wireless charging receiver
- Half bridge provides high degree of routing flexibility

AirFuel™ Alliance





AirFuel Magnetic Resonance System Blocks

Device	V_R (V)	I_F (A)	V_F @ 0.5 A (mV)	V_F @ 1 A (mV)	V_F @ 2 A (mV)	I_R @ 30 V (µA)	Configuration	Package
NSR1030QMU	30	1	415	475	–	6	Bridge	UDFN-4
NSR2030QMU	30	2	400	455	545	7	Bridge	UDFN-4
NSR2030QMX*	30	2	410	455	545	5	Bridge	XDFN-4
NSR2030DMX	30	2	410	455	545	5	Dual	XDFN-4

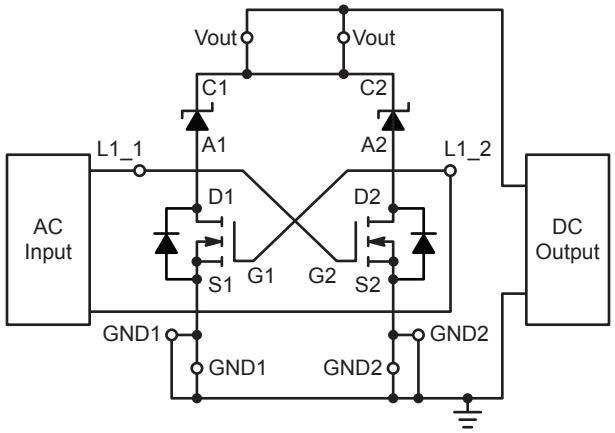
* Pending 3Q17.

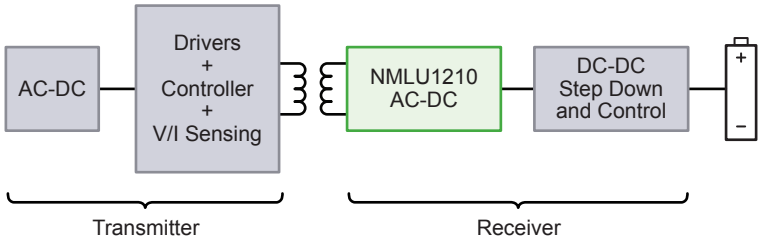
Full Bridge Rectifier for Inductive Wireless Charging

Key Features – NMLU1210

- Full Bridge Rectification block - up of 3.2 A of operation
- Low $R_{DS(ON)}$ minimizes conduction losses
- Low profile UDFN-8 package

Device	MOSFET			SCHOTTKY			Package(s)
	V_{LL} (V)	I_D (A)	$R_{DS(ON)}$ Max @ V_{GS} = 10 V (Ω)	V_R (V)	V_F (A)	I_F (A)	
NMLU1210	20	3.2	0.017	20	0.45	3.2	UDFN-8



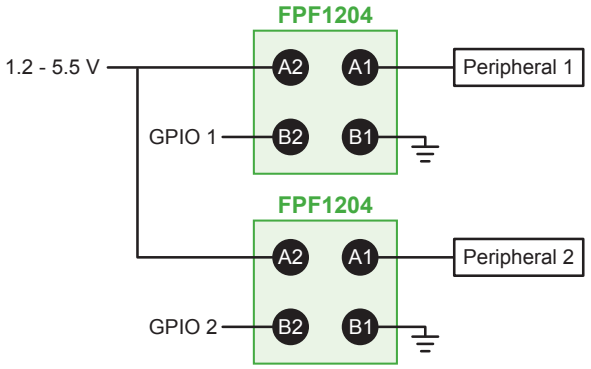


Power Distribution Load Switches

Key Features

- Optimized for power sequence control and low power consumption by reducing current leakages
- Slew rate control to reduce inrush current
- Low RON as low as 11 mΩ
- Simplified layout reduces PCB footprint
- WLCSP and DFN packages, as small as 0.76 mm x 0.76 mm

ecoSWITCH™
ADVANCED LOAD MANAGEMENT



Load Switches

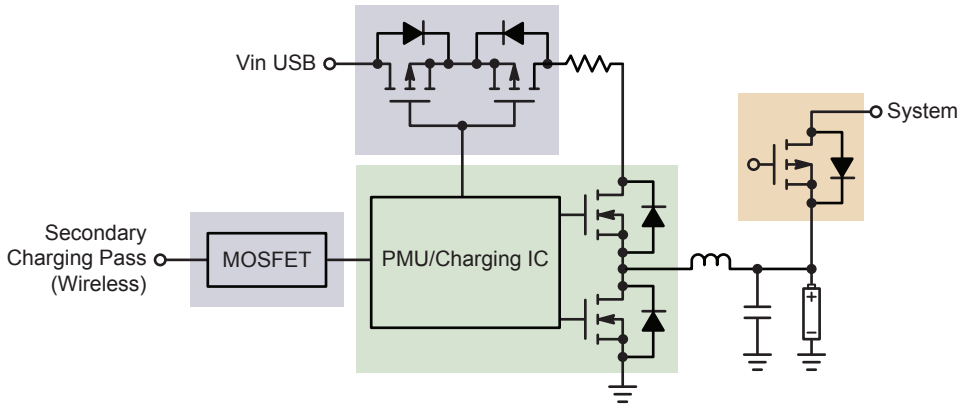
Device	Channel	V_{IN} Min (V)	V_{IN} Max (V)	$R_{DS(ON)}$ (mΩ)	I_{OUT} Max (A)	Discharge Path	RCB*	Package
NCP432	Single	1	3.6	50 @ 1.8 V	1.5	No	No	WLCSP-4
NCP433	Single	1	3.6	50 @ 1.8 V	1.5	Yes	No	WLCSP-4
NCP434	Single	1	3.6	29 @ 3.3 V	2	No	No	WLCSP-4
NCP435	Single	1	3.6	29 @ 3.3 V	2	Yes	No	WLCSP-4
FPF1203	Single	1.2	5.5	55 @ 3.3 V	2.2	No	No	WLCSP-4
FPF1204	Single	1.2	5.5	55 @ 3.3 V	2.2	Yes	No	WLCSP-4
NCP451	Single	0.75	5.5	12 @ 3.6 V	3	No	No	WLCSP-6
NCP451A	Single	0.75	5.5	12 @ 3.6 V	3	Yes	No	WLCSP-6
FPF1048	Single	1.5	5.5	23 @ 4.5 V	3	No	Yes	WLCSP-6
NCP340	Single	1.8	5.5	26 @ 3.0 V	3	No	Yes	UDFN-4
FPF1038	Single	1.2	5.5	21 @ 4.5 V	3.5	No	No	WLCSP-6
FPF1039	Single	1.2	5.5	21 @ 4.5 V	3.5	Yes	No	WLCSP-6
NCP458R	Single	0.75	5.5	11 @ 3.3 V	4	No	Yes	WLCSP-8
NCP459	Single	0.75	5.5	11 @ 3.3 V	4	Yes	No	WLCSP-8
FPF2411	Single	2.3	5.5	12 @ 3.8 V	6	No	Yes	WLCSP-12
FPF1320	DISO**	1.5	5.5	50 @ 3.3 V	1.5	No	Yes	WLCSP-6
FPF1321	DISO**	1.5	5.5	50 @ 3.3 V	1.5	Yes	Yes	WLCSP-6

* Reverse Current Block. ** Dual Input Single Output.

ecoSWITCH™ Integrated Load Switch

Device	r_{on} (mΩ)	I Max (A)	V_I Min (V)	V_I Max (V)	I_Q (µA)	Discharge	Slew Rate (µs)	Features	Package(s)
NCP45524	18.0	6	0.5	13.5	-	Adj	-	Power good	DFN-8
NCP45525	18.0	6	0.5	13.5	-	Adj	Adj	-	DFN-8
NCP45560	2.4	24	0.5	13.5	-	Adj	Adj	Power good; Fault	DFN-12
NCP45540	3.3	20	0.5	13.5	-	Adj	Adj	Power good; Fault	DFN-12
NCP45541	3.3	20	0.5	13.5	-	Adj	Adj	Power good	DFN-12
NCP45520	9.5	10.5	0.5	13.5	-	Adj	-	Power good; Fault	DFN-8
NCP45521	9.5	10.5	0.5	13.5	-	Adj	Adj	Fault	DFN-8

Simple Load Switches



Switching Charger – Step Down

Device	Polarity	Configuration	$V_{(BR)DSS}$ Min (V)	V_{GS} Max (V)	I_D Max (A)	$R_{DS(ON)}$ Max @ V_{GS} = 4.5 V (Ω)	Package(s)
ECH8420	N-Channel	Single	20	±12	14	0.0068	ECH-8
MCH6421	N-Channel	Single	20	±12	5.5	0.038	MCPH-6
MCH6437	N-Channel	Single	20	±12	7	0.024	MCPH-6
MCH6448	N-Channel	Single	20	±9	8	0.022	MCPH-6
MCH6662	N-Channel	Dual	20	±10	2	0.16	MCPH-6
EMH2418R	N-Channel	Dual	24	±12	8.5	0.0169	EMH-8
MCH6431	N-Channel	Single	30	±20	5	0.091	MCPH-6
NTLJD4116N	N-Channel	Dual	30	±12	3.7	0.07	WDFN-6
NTLJS4114N	N-Channel	Single	30	±12	6	0.035	WDFN-6
NTLUS4930N	N-Channel	Single	30	±20	6.3	0.033	UDFN-6
NTLUS4C12N	N-Channel	Single	30	±20	9.1	0.015	UDFN-6
MCH3486	N-Channel	Single	60	±20	2	0.192	MCPH-3
MCH3333A	P-Channel	Single	-30	±10	2	0.215	MCPH-3
MCH6337	P-Channel	Single	-20	±10	4.5	0.049	MCPH-6
NTLJS3A18PZ	P-Channel	Single	-20	±8	8.2	0.018	WDFN-6
NTLUD3A260PZ	P-Channel	Dual	-20	±8	1.7	0.2	UDFN-6
NTLUD3A50PZ	P-Channel	Dual	-20	±8	4.5	0.048	UDFN-6
NTLUS3A18PZ	P-Channel	Single	-20	±8	8.2	0.018	UDFN-6
NTLUS3A39PZ	P-Channel	Single	-20	±8	5.2	0.039	UDFN-6
NTTFS3A08PZ	P-Channel	Single	-20	±8	15	0.067	µ8FL
ECH8308	P-Channel	Single	-12	±10	10	0.013	ECH-8
EMH2314	P-Channel	Dual	-12	±10	6	0.037	EMH-8
MCH6320	P-Channel	Single	-12	±10	3.5	0.07	MCPH-6
MCH6336	P-Channel	Single	-12	±10	5	0.043	MCPH-6
MCH6353	P-Channel	Single	-12	±10	5.5	0.035	MCPH-6
NTLUS3C18PZ	P-Channel	Single	-12	±8	7	0.024	UDFN-6

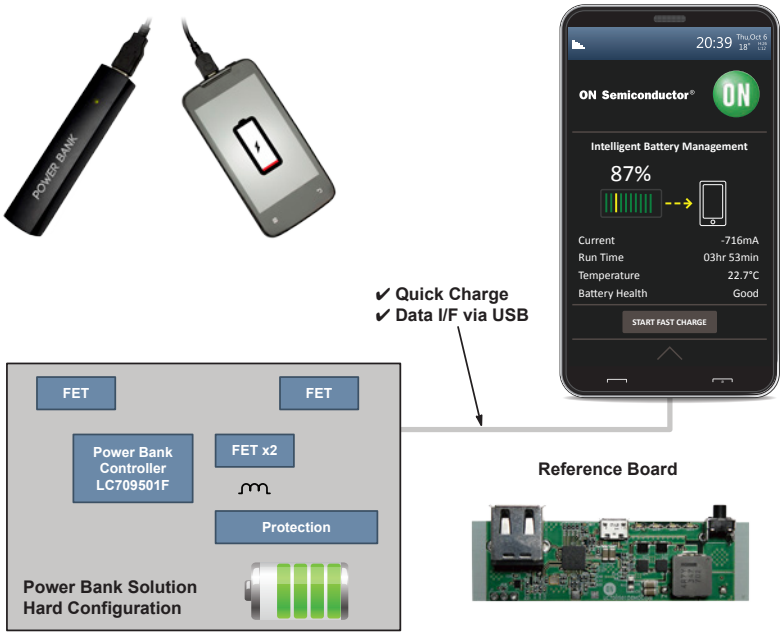
Power Bank Controller with Portable Device Communication, USB Type-C, & Quick/Fast Charge for 1-Cell Li-Ion and Li-Poly Battery

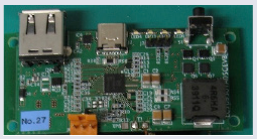
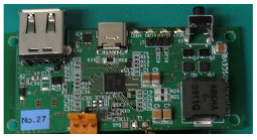
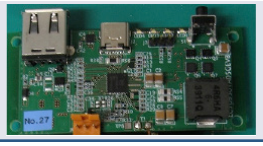
LC709501F Key Features

- Simple configuration (one main LSI)
- Scalability for Power (by external FETs)
- 5 V, 9 V, 12 V (cover Fast/Quick Charge)
- Smart Phone Data interface (USB Host I/F)

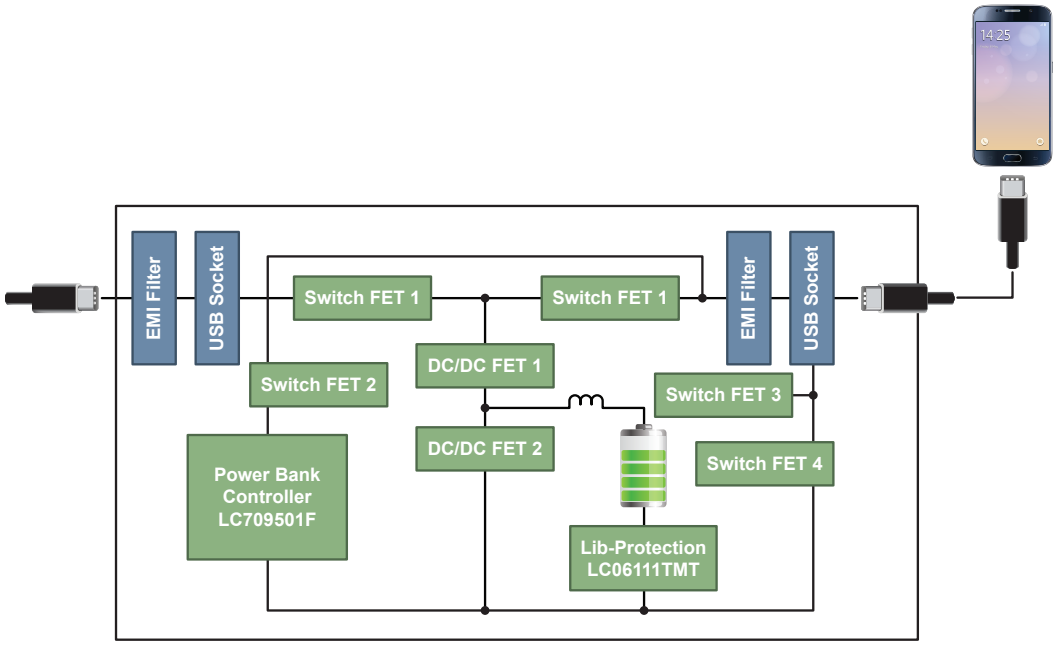
Base Features

- Buck Charge to Power Bank Battery
- Boost Charge to Smart Phone Battery
- Pass through Charge to smart Phone Battery
- Automatic USB detection
- Over voltage/Over current detection
- Redundant battery safety



Evaluation Board	USB Port Type	USB 1 Input	USB 2 Output	USB 3 Output	Board	
LC709501A02GEVB Conventional	Micro-B Type-A Type-A	Micro-B	Type-A (QC3.0) 5 V@3 A 9 V@3 A 12 V@2.25 A	Type-A (Apple) 5 V@2.1 A		Parts: LC709501F
LC709511A02GEVB Conventional	Micro-B Type-A Type-A	Micro-B	Type-A (QC3.0) 5 V@3 A 9 V@3 A 12 V@2.25 A	Type-A (Apple) 5 V@2.1 A		Parts: LC709511F
LC709501A05GEVB Type-C	Type-C Type-A	Type-C (Dual Role) 5 V@3 A (QC3.0) 5 V@2.1 A 9 V@2 A 12 V@1.5 A	–	Type-A (Apple) 5 V@2.1 A		Parts: LC709501F
LC709511A05GEVB Type-C	Type-C Type-A	Type-C (Dual Role) 5 V@3 A (QC3.0) 5 V@2.1 A 9 V@2 A 12 V@1.5 A	–	Type-A (Apple) 5 V@2.1 A		Parts: LC709511F
LC709501A06GEVB USB-PD (12 V)	Type-C Type-A	Type-C (Dual Role) (PD,QC3.0) 5 V@3 A 9 V@3 A 12 V@2.25 A	–	Type-A (Apple) 5 V@2.1 A		Parts: LC709501F

Support Devices for Power Bank Application



Switch MOSFETs

Function	Device	Configuration	Polarity	V_{DSS} Max (V)	V_{GSS} Max (V)	I_D Max (A)	$R_{DS(ON)}$ @ V_{GS} = 2.5 V Typ/Max (mΩ)	$R_{DS(ON)}$ @ V_{GS} = 4.5 V Typ/Max (mΩ)	$R_{DS(ON)}$ @ V_{GS} = 10 V Typ/Max (mΩ)	Package(s)
Switch FET 1	ECH8310	Single	P-Channel	-30	±20	9	–	20/28	13/17	ECH-8
	ECH8315	Single	P-Channel	-30	±20	7	–	31/44	19/25	ECH-8
Switch FET 2	MCH3375	Single	P-Channel	-30	±20	1.6	–	374/523	227/295	MCPH-3
	MCH6344	Single	P-Channel	-30	±20	2	–	182/255	115/150	MCPH-6
Switch FET 3	MCH3484	Single	N-Channel	20	±5	4.5	33/40	–	–	MCPH-3
	MCH3481	Single	N-Channel	20	±9	2	105/147	80/104	–	MCPH-3
Switch FET 4	ECH8420	Single	N-Channel	20	±12	14	7.5/10.5	5.2/6.8	–	ECH-8
	MCH6448	Single	N-Channel	20	±9	8	20/28	17/22	–	MCPH-6

DC-DC MOSFETs

Function	Device	Configuration	Polarity	V_{DSS} Max (V)	V_{GSS} Max (V)	I_D Max (A)	$R_{DS(ON)}$ @ V_{GS} = 2.5 V Typ/Max (mΩ)	$R_{DS(ON)}$ @ V_{GS} = 4.5 V Typ/Max (mΩ)	$R_{DS(ON)}$ @ V_{GS} = 10 V Typ/Max (mΩ)	Package(s)
DC/DC FET 1	ECH8310	Single	P-Channel	-30	±20	9	–	20/28	13/17	ECH-8
	ECH8315	Single	P-Channel	-30	±20	7	–	31/44	19/25	ECH-8
DC/DC FET 2	NTTFS4H05N	Single	P-Channel	25	±20	94	–	–/4.8	–/3.3	WDFN-8
	MCH6448	Single	N-Channel	20	±9	8	20/28	17/22	–	MCPH-6

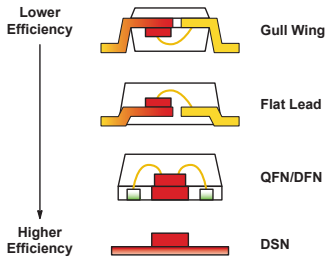
Li-Ion Battery Protection

Device	Configuration	Polarity	V_{SSS} Max (V)	V_{GSS} Max (V)	I_S (DC) (A)	$R_{SS(ON)}$ @ V_{GS} = 4.5 V Min/Typ/Max (mΩ)	$R_{SS(ON)}$ @ V_{GS} = 2.5 V Min/Typ/Max (mΩ)	Q_G Typ (V)	Package(s)
LC06111TMT*	2 in 1	N-Channel	12	±12	10	6.6/8.4/10.6	11.2/14.0/19.6	–	WDFN-6

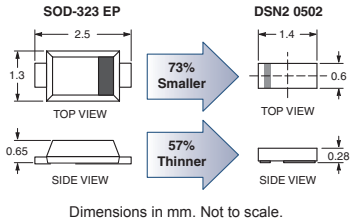
* Pending 3Q17.

Optimized Schottky Diodes

As wireless devices become smaller and thinner, more compact, energy efficient components are necessary. Power optimized Schottky diodes offer best in class thermal efficiency, and are considerably smaller than equivalent current handling devices. A lower forward voltage - compared to similar devices – also improves energy efficiency.

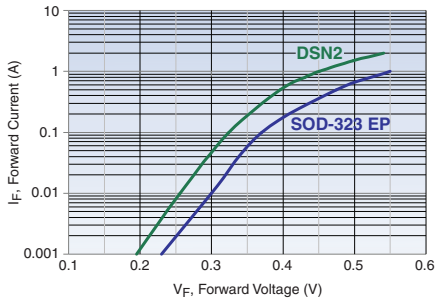


Thermal Efficiency

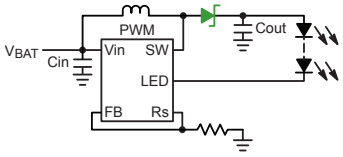


Dimensions in mm. Not to scale.

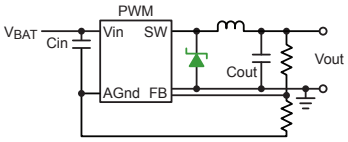
Package Size



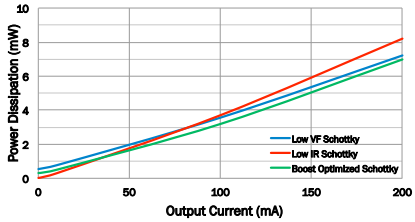
Energy Efficiency



DC-DC Boost Converter for LED Backlighting



DC-DC Buck Converter



Schottky Diodes in DSN2 Package

Device	I_F (A)	V_R (V)	V_F @ Rated I_F (mV)	I_R @ Rated V_R (µA)	DSN2 Package
NSR01L30NX	0.1	30	460	0.3	0201 DSN
NSR01F30NX	0.1	30	430	2	0201 DSN
NSR02L30NX	0.2	30	530	0.4	0201 DSN
NSR02F30NX	0.2	30	500	2	0201 DSN
NSR05402NX*	0.5	40	420	100	0201 DSN
NSR05F20NX	0.5	20	390	15	0402 DSN
NSR05F30NX	0.5	30	400	20	0402 DSN
NSR05F40NX	0.5	40	420	15	0402 DSN
NSR10404NX	1.0	40	500	10	0402 DSN
NSR15304NX	1.5	30	530	20	0402 DSN
NSR20204NX	2.0	20	540	15	0402 DSN
NSR10F20NX	1.0	20	430	25	0502 DSN
NSR10F30NX	1.0	30	450	30	0502 DSN
NSR10F40NX	1.0	40	430	10	0502 DSN
NSR15405NX	1.5	40	540	20	0502 DSN
NSR20305NX	2.0	30	550	30	0502 DSN
NSR20F30NX	2.0	30	425	40	0603 DSN
NSR15406NX	1.5	40	510	20	0603 DSN
NSR20206NX	2.0	20	450	40	0603 DSN
NSR20306NX	2.0	30	440	40	0603 DSN
NSR20406NX	2.0	40	520	35	0603 DSN

* Pending 2Q17.

Schottky Diodes in X3DFN-2 Package

Device	I_F (A)	V_R (V)	Max V_F @ 10 mA (mV)	Max I_R @ 10 V (µA)	Features
NSR01L30MX	100	30	460	0.2	Low Leakage
NSR01F30MX	100	30	350	5	Low V_F
NSR02F30MX	200	30	290	15	Low V_F

Schottky Diodes in Other Packages

Device	I_F (A)	V_R (V)	V_F @ Rated I_F (mV)	I_R @ Rated V_R (µA)	DSN2 Package
NSR05T40XV2	0.5	40	530	3	SOD-523
NSR05T30XV2	0.5	30	370	52	SOD-523
NSR0520V2	0.5	20	410	75	SOD-523
NSR0240V2	0.25	40	580	0.5	SOD-523
NSR0340V2	0.25	40	470	1.5	SOD-523
RB520S30	0.20	30	500	0.04	SOD-523
RB521S30	0.20	30	400	20	SOD-523
NSR10T20XV2	1.0	20	430	120	SOD-523
NSR05T40P2	0.5	40	580	2	SOD-923
NSR05T30P2	0.5	30	450	40	SOD-923
NSR0620P2	0.5	20	480	9	SOD-923
NSR0130P2	0.1	30	450	1	SOD-923
NSR0230P2	0.2	30	400	20	SOD-923
NSR0240P2	0.2	40	540	0.8	SOD-923
NSR0340P2	0.2	40	520	4	SOD-923
NSR0170P2	0.07	70	1.1	0.1	SOD-923
NSR10T306MU	1.0	30	470	235	UDFN-2
NSR05T404MX	0.5	40	560	3	X2DFN-2
NSR05T304MX	0.5	30	410	40	X2DFN-2
SB2003M	2	30	450	70	SOT-363
SS2003M	2	30	350	500	SOT-363
SB3003CH	3	30	470	15	SOT-457
SS3003CH	3	30	370	550	SOT-457

Bipolar Transistors and Digital Transistors

Bipolar Transistors

ON Semiconductor offers a wide portfolio of general purpose Bipolar Transistors. Below are the most common micro-packaged BJTs.

General Purpose Transistors

Device	Technology	$V_{CE(max)}$ (V)	$I_{C(max)}$ (mA)	Package
2SC5658M3	NPN	50	100	SOT-723
BC846BM3	NPN	65	100	SOT-723
2SA2029M3	PNP	50	100	SOT-723
BC856BM3	PNP	65	100	SOT-723
NST3904DP6	Dual NPN	40	200	SOT-963
NST3906DP6	Dual PNP	40	200	SOT-963
NST3946DP6	Comp NPN/PNP	40	200	SOT-963
NST847BDP6	Dual NPN	45	100	SOT-963
NST857BDP6	Dual PNP	45	100	SOT-963
NST847BPDP6	Comp NPN/PNP	45	100	SOT-963
NST3904F3	NPN	40	200	SOT-1123
NST3906F3	PNP	40	200	SOT-1123
NST847BF3	NPN	45	100	SOT-1123
NST857BF3	PNP	45	100	SOT-1123

Low $V_{CE(sat)}$ BJTs

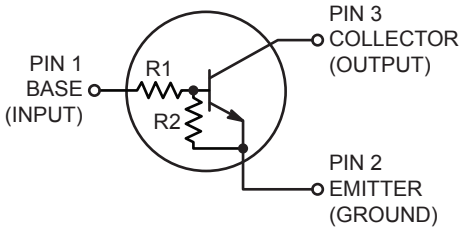
ON semiconductor is the leader in Low $V_{CE(sat)}$ BJTs with a portfolio that includes devices up to 6 A.

Low $V_{CE(sat)}$ BJTs

Device	Polarity	V_{CE} (V)	I_C DC (A)	$V_{CE(sat)}$ 1 A, Beta 10, Typ (mV)	H_{fa} @ 5 V, 100 mA, Typ	Package
NSS12100M3	PNP	12	1	280	250	SOT-723
NSS12100XV6	PNP	12	1	280	250	SOT-563
NSS12500UW3	PNP	12	5	55	250	WDFN-3
NSS12501UW3	NPN	12	5	31	300	WDFN-3
NSS12601CF8	NPN	12	6	30	300	ChipFET
NSS20101J	NPN	20	1	220	500	SC-89
NSS20500UW3	PNP	20	5	60	250	WDFN-3
NSS20501UW3	NPN	20	5	31	300	WDFN-3
NSS20601CF8	NPN	20	6	31	300	ChipFET
NSS35200CF8	PNP	35	2	79	253	ChipFET
NSS40200UW6	PNP	40	2	100	250	WDFN-6
NSS40500UW3	PNP	40	5	65	250	WDFN-3
NSS40501UW3	NPN	40	5	38	300	WDFN-3
NSS40600CF8	PNP	40	6	50	250	ChipFET
NSS40601CF8	NPN	40	6	31	300	ChipFET

Digital Transistors

As space becomes more constrained in wireless devices, integration becomes more desirable. Incorporating bias resistors into bipolar transistors performs this integration without degrading the performance of the transistor.



Digital Transistors

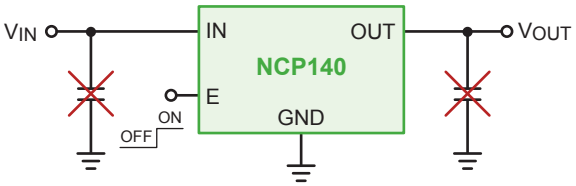
Part Body Number	R1 (Ω)	R2 (Ω)	Package(s)
113E	1K	1K	SOT-723, SOT-1123
114E	10K	10K	SOT-723, SOT-963, SOT-1123
114T	10K	None	SOT-723, SOT-963, SOT-1123
114Y	10K	47K	SOT-723, SOT-963, SOT-1123
115E	100K	100K	SOT-723
115T	100K	None	SOT-723, SOT-963, SOT-1123
123E	2.2K	2.2K	SOT-723, SOT-1123
123J	2.2K	47K	SOT-723, SOT-963, SOT-1123
123T	2.2K	None	SOT-723, SOT-963, SOT-1123
124E	22K	22K	SOT-723, SOT-963, SOT-1123
124X	22K	47K	SOT-723, SOT-1123
143E	4.7K	4.7K	SOT-723, SOT-963, SOT-1123
143T	4.7K	None	SOT-723, SOT-1123
143Z	4.7K	47K	SOT-723, SOT-963, SOT-1123
144E	47K	47K	SOT-723, SOT-963, SOT-1123
144T	47K	None	SOT-723, SOT-1123
144W	47K	22K	SOT-723, SOT-963, SOT-1123

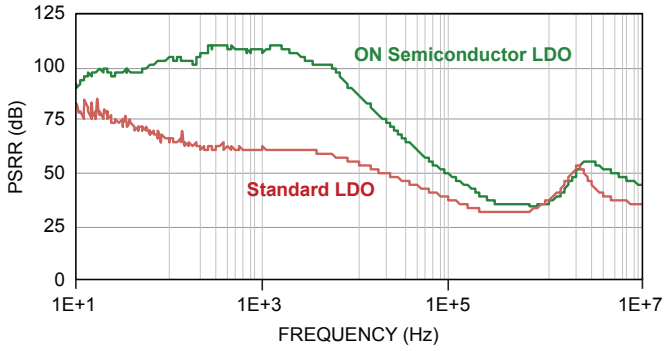
LDO Regulators

Device	I_O Typ (mA)	I_q Typ (µA)	V_{in} Max (V)	V_O (V)	PSRR (dB)	Noise (µVrms)	Package(s)
NCP186	1 A	90	5.5	1.2, 1.75, 1.8, 1.85, 2.5, 2.8, 3.0, 3.3, 3.5, 3.9	75	48	XDFN-8
NCP133	500	80	5.5	0.9, 1.0, 1.05, 1.1, 1.15, 1.2, 1.25, 1.3, 1.5, 1.8, Adj	80	40	XDFN-6
NCP161	450	20	5.5	1.8, 2.5, 2.8, 2.85, 3.0, 3.3, 3.5, 4.5, 5.0, 5.14	90	10	CSP-4, XDFN-4
NCP703	300	12	5.5	1.8, 1.9, 2.8, 3.0, 3.3, 3.5	68	13	TSOP-5/SOT-23-5; XDFN-6
NCP114	300	50	5.5	1.0, 1.05, 1.1, 1.2, 1.25, 1.3, 1.5, 1.8, 2.1, 2.6, 2.8, 2.85, 3.0, 3.1, 3.3, 3.45, 3.5	75	60	uDFN-4
NCP154	300	55	5.25	1.5/2.8, 1.8/2.7, 1.8/2.8, 1.8/2.9, 1.8/3.0, 2.8/2.7, 2.8/2.8, 3.0/1.8, 3.0/3.0, 3.1/3.1, 3.3/1.8, 3.3/2.8, 3.3/2.85, 3.3/3.0, 3.3/3.3	75	75	XDFN-8
NCP160	250	20	5.5	1.8, 2.5, 2.8, 2.85, 3.0, 3.3, 3.5, 4.5, 5.0, 5.14	90	10	CSP-4, XDFN-4
NCP163	250	120	5.5	1.8, 1.825, 1.9, 2.6, 2.75, 2.8, 2.85, 2.9, 2.925, 3.0, 3.3, 5.0	92	6.5	WLCSP-4, XDFN-4
NCP702	200	10	5.5	1.8, 2.8, 3.0, 3.3	70	11	TSOP-5/SOT-23-5; XDFN-6
NCP170	150	0.5	5.5	1.2, 1.5, 1.8, 2.5, 2.8, 3.0, 3.3	40	85	SOT-563, XDFN-4
NCP140	150	45	5.5	1.8, 2.8, 3.0, 3.3	55	17	XDFN-4
NCP103	150	50	5.5	1.0, 1.05, 1.1, 1.2, 1.25, 1.3, 1.5, 1.8, 2.1, 2.6, 2.8, 2.85, 3.0, 3.1, 3.3, 3.45, 3.5	75	60	uDFN-4
NCP716	80	4.7	24	1.2, 1.5, 1.8, 2.5, 2.8, 3.0, 3.3, 5.0	52	65	SC-70-5, xDFN6
NCP715	50	4.7	24	1.2, 1.5, 1.8, 2.5, 2.8, 3.0, 3.3, 5.0	52	65	xDFN-6

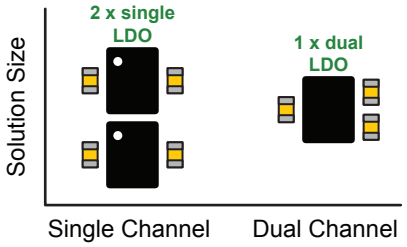
Capacitor-Free LDO Advantages

- XDFN 0.8 x 0.8 mm package
- Stable without input/output capacitors
- Significant PCB area savings
- System cost savings





Industry Leading High PSRR Performance



Protection Solutions

External Interface

USB3.1
USB3.0

USB2.0

Camera/Display Lines

#Pairs ?
Data Rate?

High Speed Differential Data

ESD Protection

- < 0.3 pF, industry leading insertion loss
- Low clamping voltage
- Unidirectional and Bidirectional
- Singles and space efficient arrays
- Smallest footprint in the industry

EMI Filter

- > 30 dB CM Attenuation
- Support for up to 8 Gbps
- Lowest clamping voltage in its class
- 1, 2, 3 pairs available

Single Ended Data

SDR50
SDR104

SIM

Audio

Speaker

Headphone

Microphone

Other Lines

General Purpose
ESD Protection

Low Speed Single Ended Data/Audio

ESD Protection

- Industry leading power density
- > 10 A Surge capable in 0201 form factor
- Smallest footprint in the industry
- Singles and arrays

EMI Filter

- > 40 dB Attenuation at antenna frequency
- Low clamping voltage
- Extremely low cross-talk
- Small form factor

Charging

USB Vbus
Battery Contacts

High Surge Protection

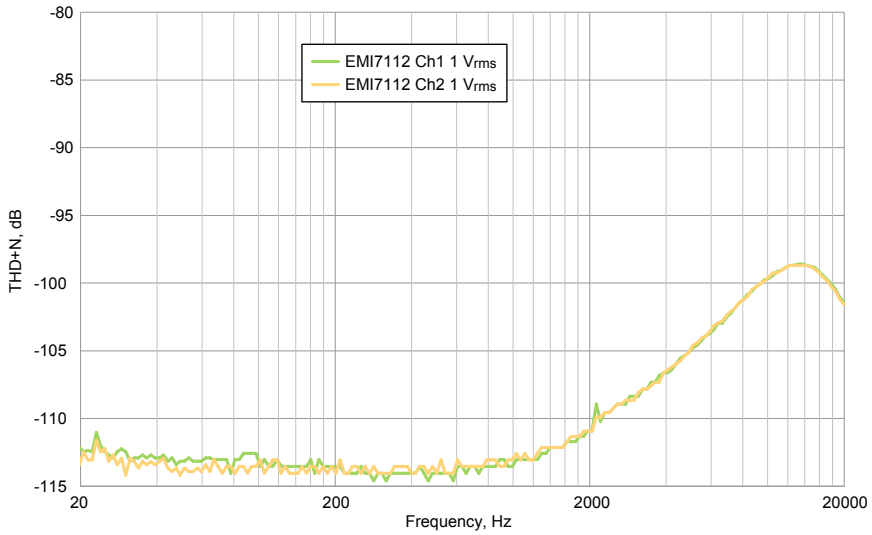
- Ipp > 125 A (8x20 µs)
- Superior clamping performance
- 4.8 V to 18 V V_{RWM} options
- Unidirectional and Bidirectional

PROTECTION

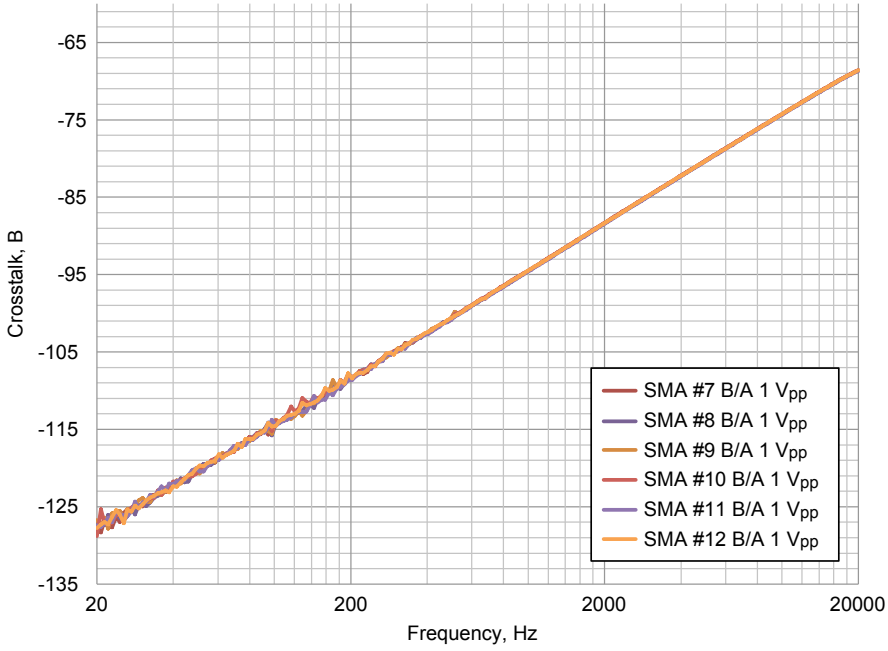
Audio Filtering for HiFi

EMI7112 Features

- >40 dB @ 750 MHz to 2.4 GHz
- Cross-talk < –65 dB, THD+N < 0.006%
- HiFi quality capable



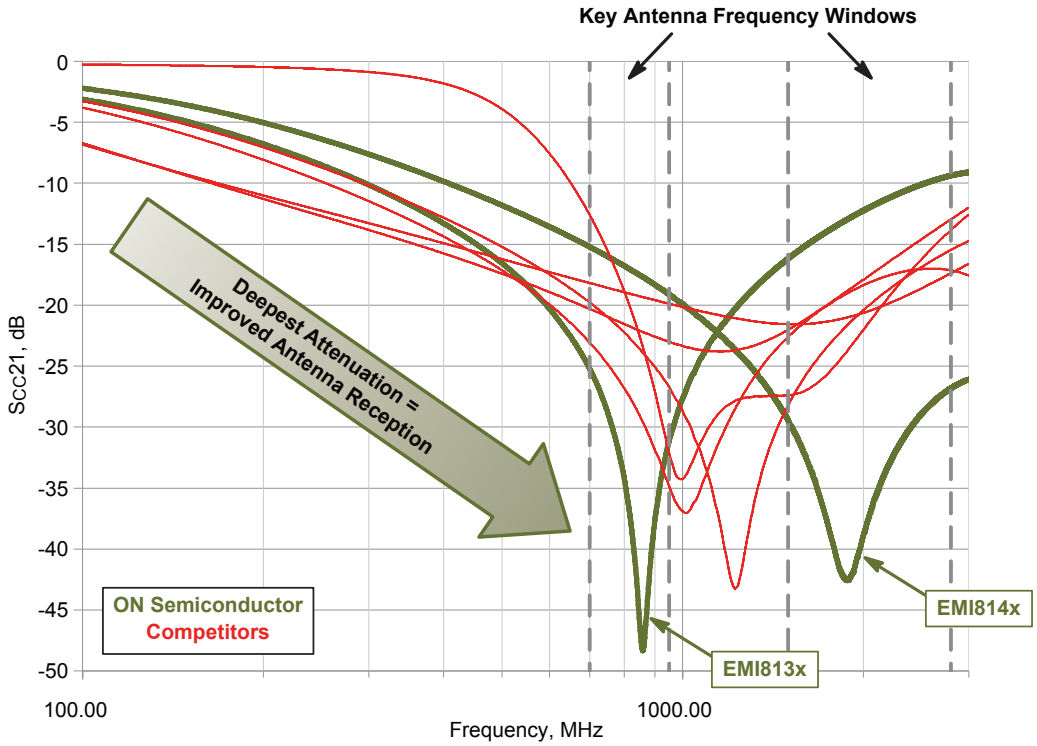
EMI7112 THD + N



EMI7112 Crosstalk with 1 V_{pp} Input Voltage

Common Mode Filters for High Speed Interfaces

Function	Filter CM Noise		Signal Integrity		Protect Chipset	
Device Series	Attenuation > 25 dB range	RF Receivers	Maximum Data Rate	Interfaces Supported	Vc @ 8 kV (TLP)	Minimum Chipset Geometry
EMI813x	700 MHz – 1.1 GHz	LTE, GSM,	4 Gb/s	USB2.0; MHL1-2; HDMI1.3/4; MIPI CSI-2	11.6 V	14 nm
EMI814x	1.3 GHz – 3 .0 GHz	LTE, WCDMA, WiFi, GPS	8 Gb/s	USB3.0; MIPI CSI-3; MHL3.0; HDMI2.0	11.6 V	14 nm



PROTECTION

ESD Protection for High Speed Data Lines

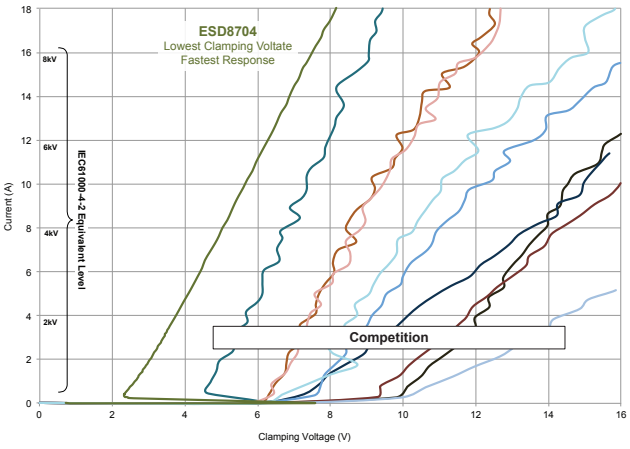
Industry leading insertion loss with excellent clamping performance

Applications

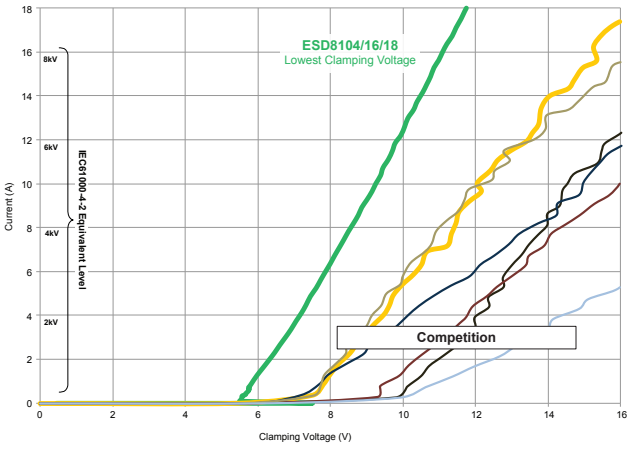
- USB 2.0/3.x
- Thunderbolt 2.0/3.0
- HDMI 1.4/2.0
- MHL 3/superMHL
- MIPI D/M/C PHYs
- NFC & Wi-Fi Antenna Protection

Device	Polarity	V_{RWM} (V)	8 x 20 µs Surge		Capacitance (pF)	Capacitance Max (pF)	No of Lines	Package
			I_{PP} Min (A)	V_{Clamp} @ I_{PP} (V)				
ESD8011	Bidirectional	5.5	3.6	8.7	0.1	0.2	1	X3DFN
ESD8451	Bidirectional	3.3	3.7	9.2	0.2	0.3	1	X3DFN
ESD8351	Unidirectional	3.3	5	8.2	0.37	0.55	1	X3DFN
ESD8111P	Bidirectional	3.3	7.1	8	0.2	0.4	1	XDFN
ESD7331	Bidirectional	3.3	2.5	7.5	0.4	0.75	1	X3DFN
ESD7501	Bidirectional	5	2	9.9	0.45	0.75	1	X3DFN
ESD9L5.0	Unidirectional	5	1	9	0.5	0.9	1	SOD-923
ESD9L3.3	Unidirectional	3.3	1	9.8	0.5	0.9	1	SOD-923
ESD8704	Unidirectional	3.3	7.5	6.7	0.37	0.5	4	UDFN-10
ESD8104	Unidirectional	3.3	3.5	8.1	0.3	0.37	4	UDFN-10
ESD8116	Unidirectional	3.3	3.5	8	0.3	0.35	6	UDFN-8
ESD8118	Unidirectional	3.3	3.5	8.1	0.3	0.35	8	UDFN-10
ESD8008	Unidirectional	3.3	5	5	0.3	0.35	8	UDFN-14
ESD7181	Bidirectional	18.5	1	32	0.3	0.5	1	X3DFN
ESD7241	Bidirectional	24	2.5	37	0.55	1	1	X2DFN-2
ESDL2011P*	Bidirectional	1	4.3	4.6	0.15	0.2	1	XDFN

* Pending 3Q17.



SCR Arrays – 100 ns TLP



LVPT Arrays – 100 ns TLP

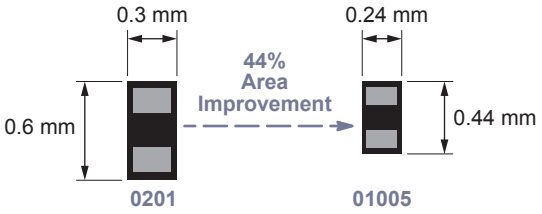
PROTECTION

ESD Protection Featuring x4DFN – Smallest Package in the Industry

Ideal ESD protection solutions for space constrained applications

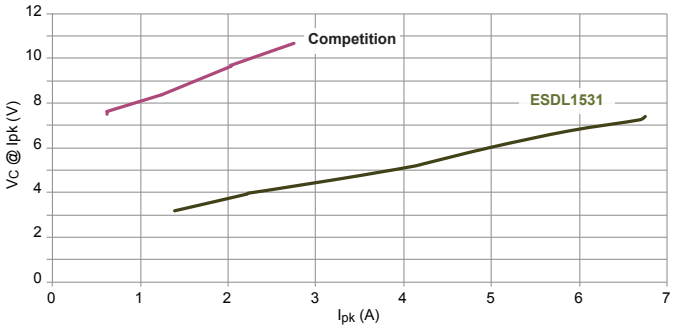
Industry leading x4DFN package offers

- Six side silicon encapsulation
- Best ESD protection performance in its class
- Increased reliability
  - Protective mechanical layer ➜ no chipping
  - Electrical insulation prevents short circuit conditions
  - Moisture barrier ➜ no corrosion
  - Lower reflectivity ➜ friendly to automated inspection
  - Light barrier ➜ reduces leakage caused by light sensitivity

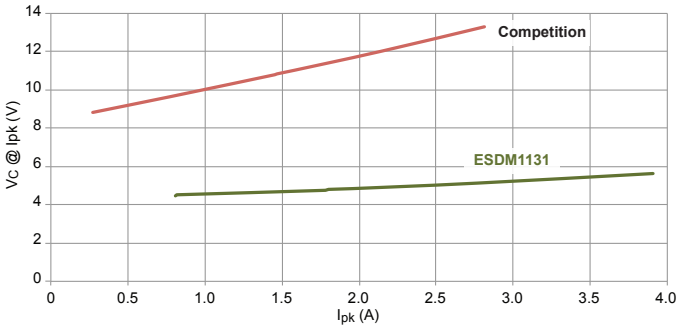


Device	Polarity	V_{RWM} (V)	C (pF)	V_{Clamp} @ 16 A TLP (V)	ESD Contact (kV)	Package
ESDL1531*	Bidirectional	3.3	0.15	10	25	x4DFN
ESDM1131*	Bidirectional	3.3	4	6.25	16	x4DFN

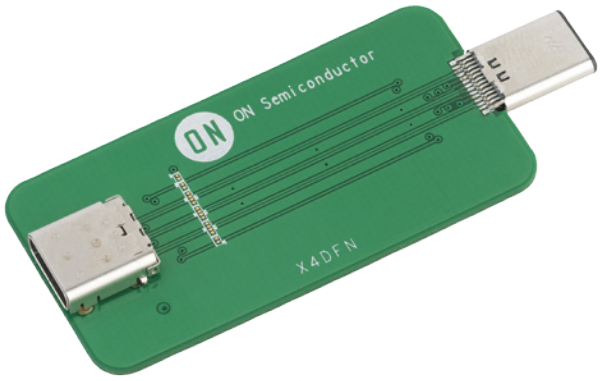
* Pending 3Q17.



High Speed Data Protection – 8 x 20 µs Surge Comparison



GPIO Protection – 8 x 20 µs Surge Comparison



X4DFN USB Type-C Evaluation Board

PROTECTION

ESD Protection for GPIO

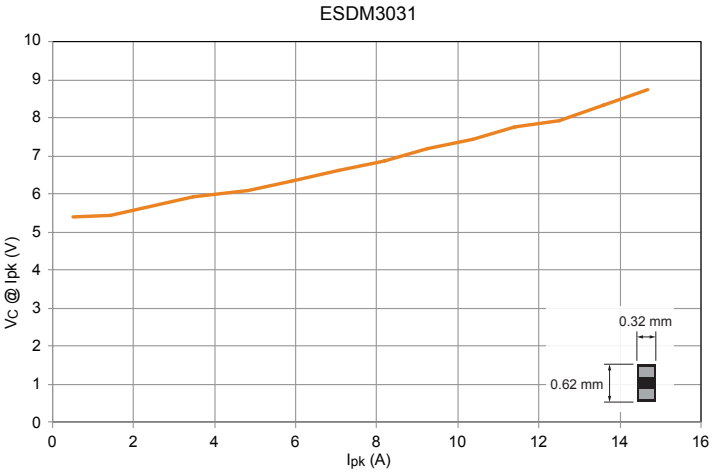
Small form factor solutions with lowest clamping voltage in class

Applications

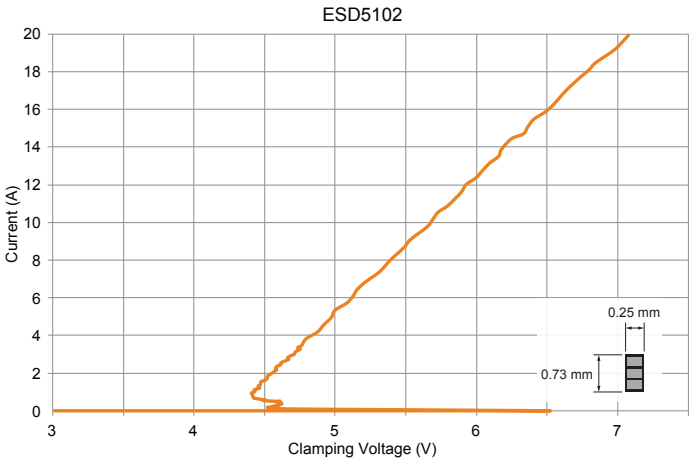
- SIM Card protection
- SD Card protection
- Biometrics/finger print sensor
- Audio In/Out
- USB Type C configuration channel
- Manufacturing test points

Device	Polarity	V_{RWM} (V)	8 x 20 µs Surge		Capacitance Max (pF)	No of Lines	Package
			I_{PP} Min (A)	V_{Clamp} @ I_{PP} (V)			
ESDM3031	Bidirectional	3.3	11	8.4	20	1	X3DFN
ESDM3051	Bidirectional	5	10	8.7	21	1	X3DFN
ESDM3551*	Bidirectional	5.5	9.9	8.8	21	1	X3DFN
ESD5371	Bidirectional	3.3	6	10.1	10	1	X3DFN
ESD5581	Bidirectional	5	6	10.3	10	1	X3DFN
ESD5111P	Bidirectional	3.3	4	5.8	5.5	1	XDFN
ESDM1131*	Bidirectional	3.3	3.9	5.7	5	1	X4DFN
ESD5102	Bidirectional	3.3	–	–	5.5	2	DSN-3
ESD5004	Bidirectional	3.3	3	6.8	5	4	X3DFN-4

* Pending 3Q17.



8 x 20 µs Surge Performance



100 ns TLP

PROTECTION

Surge Protection

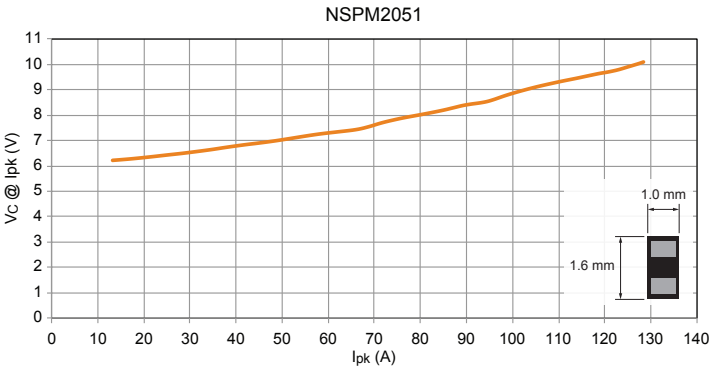
High performance, space efficient solutions

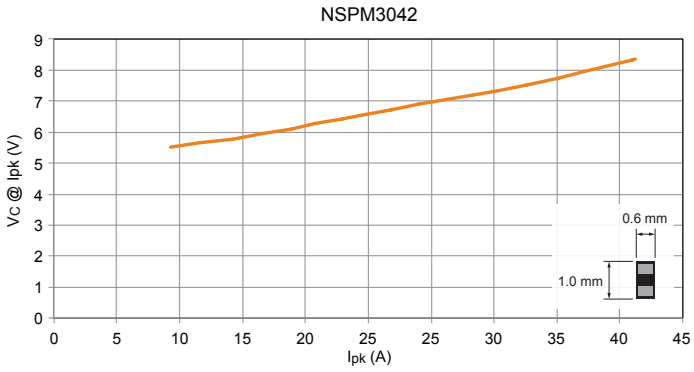
Applications

- V_{BUS} line
- Battery line
- Audio In/Out
- USB Type C Configuration Channel
- LCD power line
- RF Power Amplifier power line

Device	Polarity	V_{RWM} (V)	8 x 20 µs Surge		Package
			I_{PP} Min (A)	V_{Clamp} @ I_{PP} (V)	
NSPM1041	Bidirectional	4.8	125	9.25	UDFN-2
NSPM2051	Unidirectional	5	100	8.8	UDFN-2
NSPM0061	Unidirectional	6.3	70	11.3	UDFN-2
NSPM0101	Unidirectional	10	60	18.2	UDFN-2
NSPM5131	Unidirectional	13.5	160	26.5	UDFN-6
NSPM8151	Unidirectional	15	100	24.5	UDFN-6
NSPM8181	Unidirectional	18	119	31.5	UDFN-6
NSPM4041*	Unidirectional	4.8	50	8.25	XDFN-2
NSPU3051*	Unidirectional	5.5	30	7.8	SOD-882
NSPU3061*	Unidirectional	6.3	30	8.1	SOD-882
NSPM3031*	Bidirectional	3.3	40	7.0	SOD-882
NSPM3042*	Bidirectional	4.8	40	7.7	SOD-882

* Pending 3Q17.





8 x 20 µs Surge Performance – V_{BAT} Protection

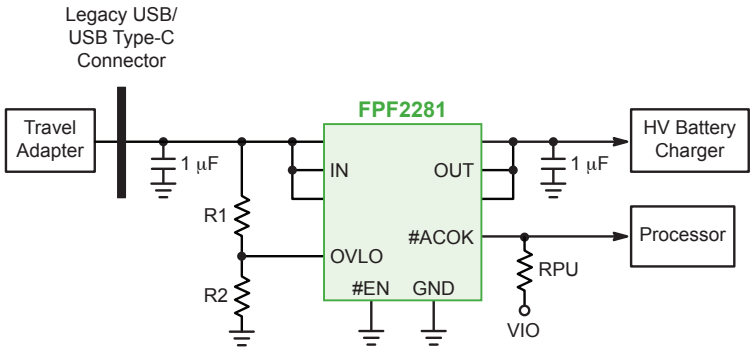
PROTECTION

Power Protection

Surge and Over-Voltage Protection Switches

Key Features

- Optimized for Input Power Stage with USB-C
- 100 V Surge Capable Integrated TVS
- Low RON for Low Power Loss
- Fast Over Voltage Response Time
- Design Flexibility with Adjustable/Selectable OVP
- Reverse Current Block
- Compact Packages, WLCSP and DFN



Over Voltage Protection Switches

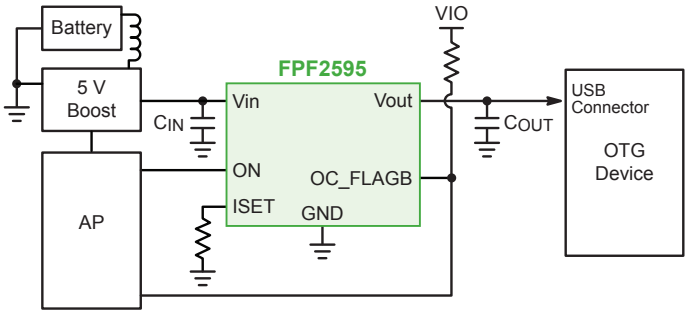
Device	Channel	V_{IN} Min (V)	V_{IN} Max (V)	OVP (V)	R_{ON} (mΩ)	I_{OUT} Max (A)	Integrated TVS	Discharge Path	Package
FPF2280	Single	2.5	28	6.8*	30 @ 5.0 V	4.5	Yes	No	WLCSP-12
FPF2281	Single	2.5	28	14*	30 @ 5.0 V	4.5	Yes	No	WLCSP-12
FPF2290	Single	2.5	28	SEL**	30 @ 5.0 V	4.5	Yes	No	WLCSP-12
FPF2498	Single	3.5	28	6.5	80 @ 5.0 V	1.75	No	No	WLCSP-6
NCP398	Single	2.9	28	5.65	190 @ 5.0 V	0.8	No	Yes	WLCSP-4
FPF3488	SIDO***	2.7	28	13.9	28 @ 5.0 V	3.5	Yes	No	WLCSP-28
FPF3042	DISO^	4	18	14	70 @ 5.0 V	2.7	No	No	WLCSP-16
FPF3695	Single	1.2	28	OPN^^	50 @ 3.5 V	3.4	No	No	WLCSP-40
NCP367	Single	1.2	28	OPN^^	50 @ 3.5 V	3.4	No	No	DFN-8

* Default but Adjustable w/ external R. ** Selectable w/ Logic Pins. *** Single Input Dual Output. ^ Dual Input Single Output. ^^ By Option.

Over Current Protection Switches

Key Features

- Optimized for 5V USB-OTG and VCONN with USB-C
- Fast Over Current Response Time
- Design Flexibility with Adjustable Current Limit Set
- True Reverse Current Block
- Compact Packages, WLCSP and DFN
- UL Certified



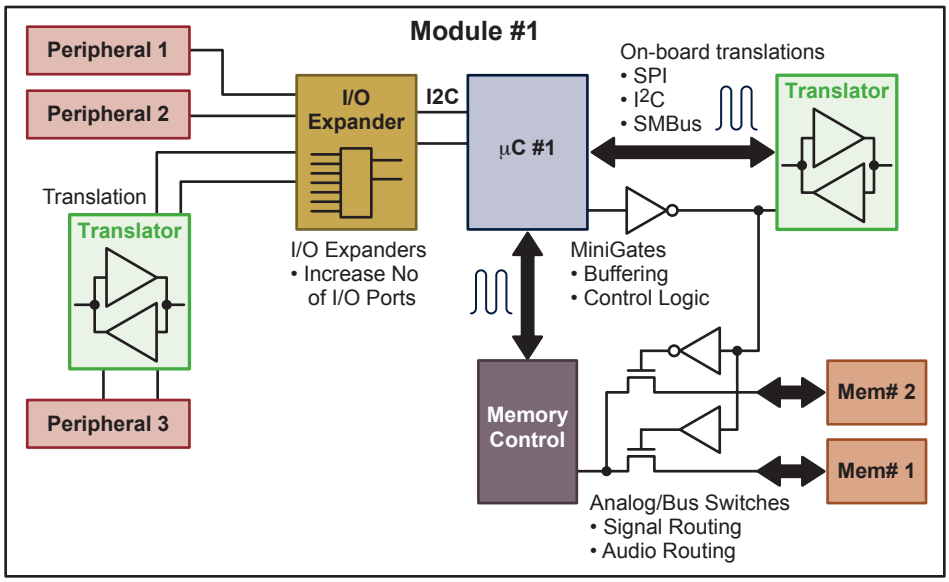
Over Current Protection Switches

Device	Channel	V_{IN} Min (V)	V_{IN} Max (V)	R_{ON} (mΩ)	I_{LIM} Range (A)	OVP	RCB*	Package
FPF2195	Single	1.8	5.5	55 @ 3.3 V	0.1 ~ 1.5	No	Yes	WLCSP-6
FPF2495	Single	2.5	5.5	70 @ 5.0 V	0.05 ~ 2.0	Yes	Yes	WLCSP-9
FPF2496	Single	3.5	5.5	70 @ 5.0 V	0.1 ~ 2.5	Yes	Yes	WLCSP-9
FPF2595	Single	2.5	5.5	35 @ 5.0 V	0.1 ~ 3.5	Yes	Yes	WLCSP-12
FPF2895	Single	4	22	27 @ 5.0 V	0.5 ~ 5.0	Yes	Yes	WLCSP-24
NCP380	Single	2.5	5.5	55 @ 5.0 V	0.5 ~ 2.1	No	Yes	UDFN-6
NCP382	SIDO**	2.5	5.5	80 @ 5.0 V	Fixed***	No	Yes	DFN-8
NCP383	SIDO**	2.7	5.5	45 @ 5.0 V	0.5 ~ 2.8	No	Yes	UDFN-10

* Reverse Current Block. ** Single Input Dual Output. *** By Option.

Logic and Digital Interfaces

- MiniGates™ and Standard Logic - condition logic signals
- Bus Switches and Analog Switches - low-cost signal routing and multiplexing
- Voltage Translators - interface sub-systems with different operating voltages
- I2C Interface – increase # of I/O ports, level shifting, repeaters
- Custom Logic Solutions - create “valued-added interface”

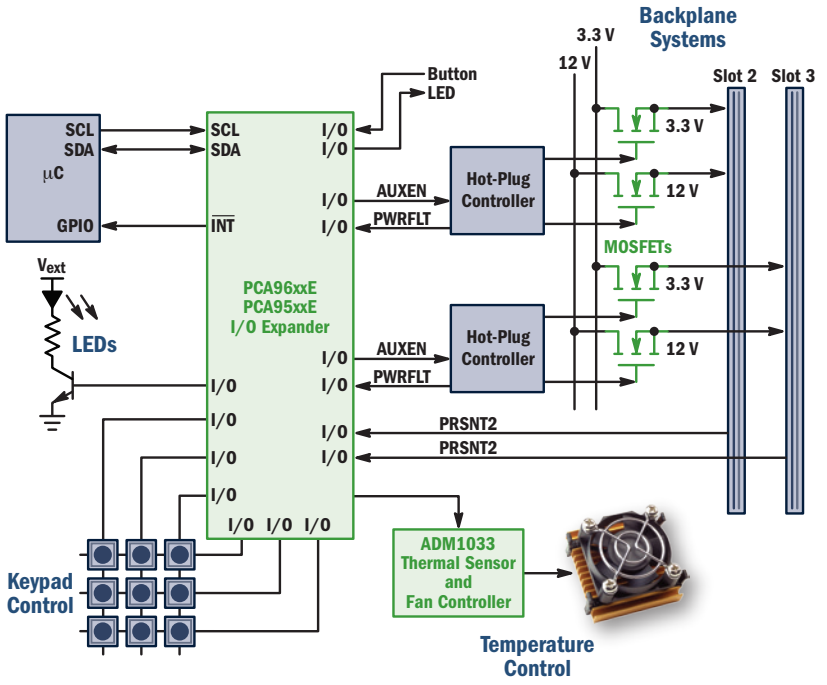


MiniGate™ Family	Operating Voltage (V)	Drive Current (mA)	Propagation Delay (ns)	SC-88	TSOP-5	SOT-553	UDFN	SOT-9
HC (High Speed CMOS)	2.0 – 6.0	5.2 @ 5 V	7	MC74HC1GxxDF	MC74HC1GxxDT			
VHC (Very High Speed CMOS)	2.0 – 5.5	8 @ 5 V	4.5	MC74VHC1GxxDF	MC74VHC1GxxDT		NLU1GxxCMU	NL17SHxxP5
LCX (Low-Voltage CMOS, Xtra Drive)	1.65 – 5.5	24 @ 5 V	2.9	NL17SZxxDF		NL17SZxxXV5	NLX1GxxCMU	NL17SZxxP5
VCX (Very High Speed CMOS, Xtra Drive)	0.9 – 3.6	24 @ 3.6 V	1.5			NL17SVxxX5		
SG (Super Low Voltage Gate)	0.9 – 3.6	8 @ 3.3 V	2.5	NL17SGxxDF			NL17SGxxMU	NL17SGxxP5

Cascadable I/O Expanders

Features

- I2C and SMBus interfaces
- 1 MHz SCL clock frequency
- 30 mA SDA sink capability



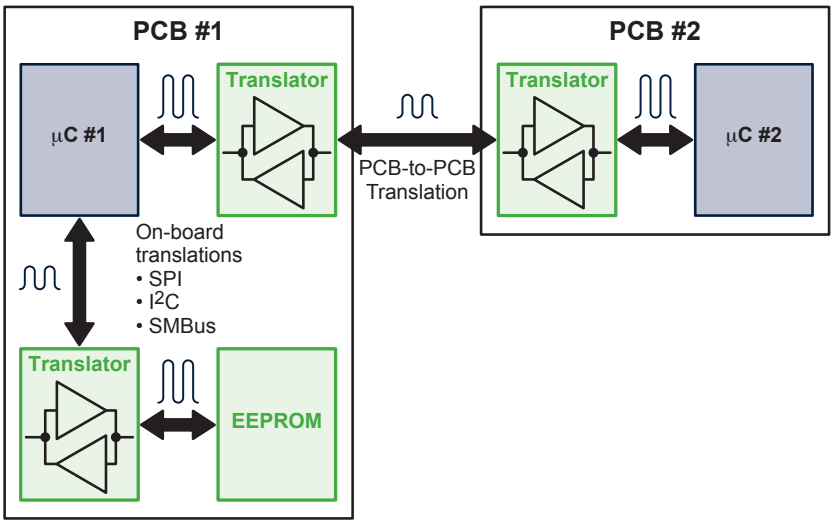
Device	I/O	Cascadable	Vcc Min (V)	Vcc Max (V)	Interrupt Output	I/O Pullups	LED Blink/ PWM	Package
PCA9535E	16	64 Programmable Slave Addresses	1.65	5.5	✔			QFN-24, SOIC-24, TSSOP-24
PCA9655E	16	64 Programmable Slave Addresses	1.65	5.5	✔			QFN-24, SOIC-24, TSSOP-24
PCA9654E	8	8 Slave ID Addresses	1.65	5.5	✔	✔		SOIC-16, WQFN-16, TSSOP-16

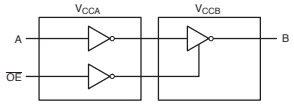
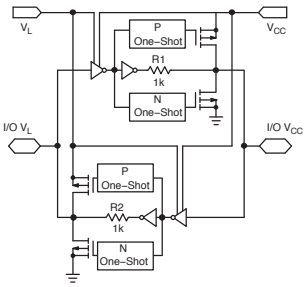
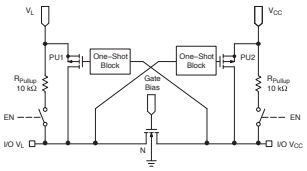
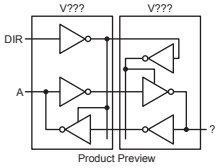
Logic Translators

Dual supply voltage logic translators connect ICs and PCBs together that operate at different supply voltages.

Key Features

- Industry's first devices with independent power supplies ($V_L < V_{CC}$, $V_L = V_{CC}$, or $V_L > V_{CC}$)
- High 100 pF capacitive drive capability
- Overvoltage tolerant enable and I/O pins
- Non-preferential power-up sequencing
- Power-off protection

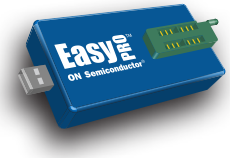


	Unidirectional Translator	Autosense Bidirectional Translator (Push-Pull Output)	Autosense Bidirectional Translator (Open-Drain Output)	Bidirectional Translator (with Direction Pin)
Block Diagram				
Attributes	• High Data Rate • Low Power Consumption	• High Data Rate • Low Power Consumption	• High Data Rate • Low Power Consumption • Flexible PCB Design	• High Data Rate • Low Power Consumption • Flexible PCB Design
Trade-Offs	• Fixed Input & Output Pins	• Modest Output Current	• Modest Bandwidth	• Directional Control Pin Required
Applications	• SPI • GPIO	• SPI • GPIO	• I2C, SMBus, PMBus • GPIO • SDIO Cards • 1-Wire Bus	• GPIO
Sample Device (I/O Channels, Package)	• NLSV1T34 (1-Bit, ULLGA-6) • NLSV1T240/244 (1-Bit, UDFN-6) • NLSV2T240/244 (2-Bit, UDFN-8) • NLSV4T240/244 (4-Bit, UDFN-12) • NLSV4T3234 (4-Bit, CSP-11) • NLSV8T240/244 (8-Bit, UDFN-20)	• NLSX3012 (2-Bit, UDFN-8) • NLSX3014 (4-Bit, UQFN-12) • NLSX3013 (8-Bit, CSP-20) • NLSX3018 (8-Bit, UDFN-20) • NLSX4014 (4-Bit, UQFN-12) • NLSX5011 (1-Bit, UULGA-6, UDFN-6) • NLSX5012 (2-Bit, UDFN-8) • NLSX5014 (4-Bit, UDFN-12)	• NLSX3373 (2-Bit, UDFN-8) • NLSX3378 (4-Bit, CSP-12) • NLSX4373 (2-Bit, UDFN-8) • NLSX4378 (4-Bit, CSP-12)	• NLSV1T45 (1-Bit, ULLGA-6) • NLSV2T245 (2-Bit, UQFN-10) • NLSV2T3236 (2-Bit, UQFN-10) • NLA16T245 (16-Bit, TSSOP-48)

Serial EEPROM Memory

Features

- Broad density range: 1 kb to 2 Mb
- Wide operating Vcc range: 1.8/1.7 V to 5.5 V
- High endurance: 1 million program/erase cycles
- Wide temperature range: industrial and extended



EasyPRO™ is a user-friendly, portable programming tool for ON Semiconductor serial EEPROMs (I^2C, SPI, Microwire)

EEPROMs

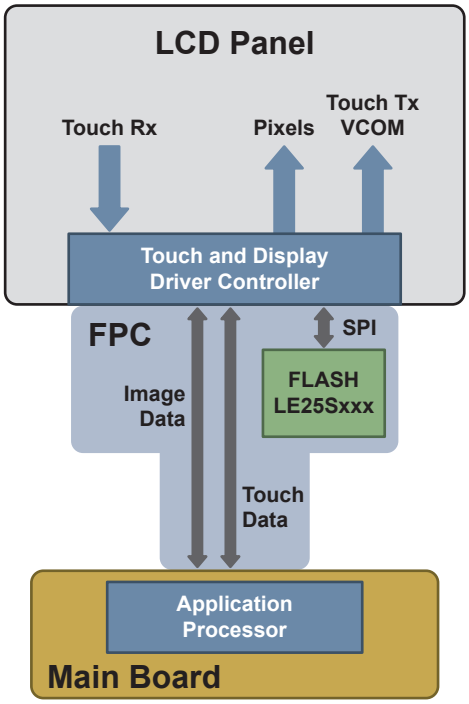
Data Transmission Standard	Device	Density	Organization*	V_{CC} Min (V)	V_{CC} Max (V)	f_{CLK} Max (MHz)	Package(s)
I^2C	CAT24M01	1 Mb	128k x 8	1.8	5.5	1	SOIC-8, TSSOP-8, UDFN-8
	CAT24C512	512 kb	64k x 8	1.8	5.5	1	SOIC-8, TSSOP-8, UDFN-8
	CAT24C256	256 kb	32k x 8	1.8	5.5	1	SOIC-8, TSSOP-8, UDFN-8
	CAT24C128	128 kb	16k x 8	1.8	5.5	1	SOIC-8, TSSOP-8, UDFN-8
	CAT24C64	64 kb	8k x 8	1.7	5.5	1	SOIC-8, TSSOP-8, UDFN-8
	N24C64	64 kb	8k x 8	1.7	5.5	1	US-8
	LE2464	64 kb	8k x 8	1.7	3.6	1	WLCSP-6
	CAT24C32	32 kb	4k x 8	1.7	5.5	1	SOIC-8, TSSOP-8, UDFN-8; WLCSP-5
	N24C32	32 kb	4k x 8	1.7	5.5	1	US-8
	LE2432	32 kb	4k x 8	1.7	3.6	1	WLCSP-6
	CAT24C16	16 kb	2k x 8	1.7	5.5	0.4	SOIC-8, TSSOP-8, UDFN-8, TSOT23-5, WLCSP-4, WLCSP-5
	LE2416	16 kb	2k x 8	1.7	3.6	1	WLCSP-6
	N24C16	16 kb	2k x 8	1.7	5.5	0.4	US-8
	CAT24C08	8 kb	1k x 8	1.7	5.5	0.4	SOIC-8, TSSOP-8, UDFN-8, TSOT23-5, WLCSP-4, WLCSP-5
	N24C08	8 kb	1k x 8	1.7	5.5	0.4	US-8
	CAT24C04	4 kb	512 x 8	1.7	5.5	0.4	SOIC-8, TSSOP-8, UDFN-8, TSOT23-5, WLCSP-4, WLCSP-5
	N24C04	4 kb	512 x 8	1.7	5.5	0.4	US-8
	CAT24C02	2 kb	256 x 8	1.7	5.5	0.4	SOIC-8, TSSOP-8, UDFN-8, TSOT23-5, WLCSP-4, WLCSP-5
	N24C02	2 kb	256 x 8	1.7	5.5	0.4	US-8
SPI	CAT25M02	2 Mb	256k x 8	1.7	5.5	10	SOIC-8
	CAT25M01	1 Mb	128k x 8	1.8	5.5	10	SOIC-8, TSSOP-8
	CAT25512	512 kb	64k x 8	1.8	5.5	20	SOIC-8, TSSOP-8, UDFN-8
	CAT25256	256 kb	32k x 8	1.8	5.5	20	SOIC-8, TSSOP-8, UDFN-8
	CAT25128	128 kb	16k x 8	1.8	5.5	20	SOIC-8, TSSOP-8, UDFN-8
	CAT25640	64 kb	8k x 8	1.8	5.5	20	SOIC-8, TSSOP-8, UDFN-8
	CAT25320	32 kb	4k x 8	1.8	5.5	20	SOIC-8, TSSOP-8, UDFN-8
	CAT25160	16 kb	2k x 8	1.8	5.5	20	SOIC-8, TSSOP-8, UDFN-8
	CAT25080	8 kb	1k x 8	1.8	5.5	20	SOIC-8, TSSOP-8, UDFN-8
	CAT25040	4 kb	512 x 8	1.8	5.5	20	SOIC-8, TSSOP-8, UDFN-8
	CAT25020	2 kb	256 x 8	1.8	5.5	20	SOIC-8, TSSOP-8, UDFN-8
	CAT25010	1 kb	128 x 8	1.8	5.5	20	SOIC-8, TSSOP-8, UDFN-8
Microwire	CAT93C86	16 kb	2k x 8 / 1k x 16	1.8	5.5	3	SOIC-8
	CAT93C86B	16 kb	2k x 8 / 1k x 16	1.8 / 1.65	5.5	4	SOIC-8, TSSOP-8, UDFN-8
	CAT93C76	8 kb	1k x 8 / 512 x 16	1.8	5.5	3	SOIC-8, TSSOP-8
	CAT93C76B	8 kb	1k x 8 / 512 x 16	1.8 / 1.65	5.5	4	SOIC-8, TSSOP-8, UDFN-8
	CAT93C66	4 kb	512 x 8 / 256 x 16	1.8	5.5	2	SOIC-8, TSSOP-8
	CAT93C56	2 kb	256 x 8 / 128 x 16	1.8	5.5	2	SOIC-8, TSSOP-8
	CAT93C46	1 kb	128 x 8 / 64 x 16	1.8	5.5	2	SOIC-8, TSSOP-8
	CAT93C46B	1 kb	128 x 8 / 64 x 16	1.8 / 1.65	5.5	4	SOIC-8, TSSOP-8, UDFN-8

* Organization for Microwire devices is selectable.

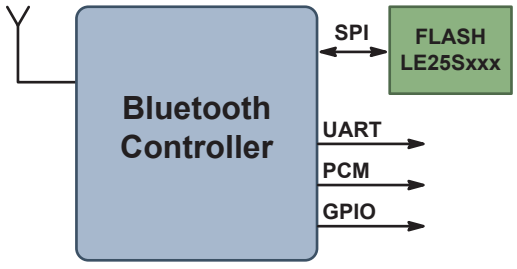
Serial NOR Flash Memory

Features

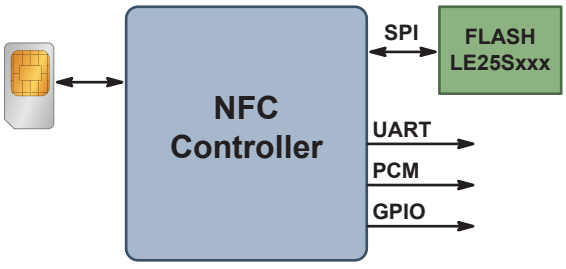
- SPI interface
- Supply voltage 1.65 to 1.95 V
- Minimum erase size (4 KB/64 KB)
- Fast write perfomance (Sector Erase/Page Program)
- Low standby current; support for deep standby mode



LCD Module Diagram



Bluetooth Block Diagram



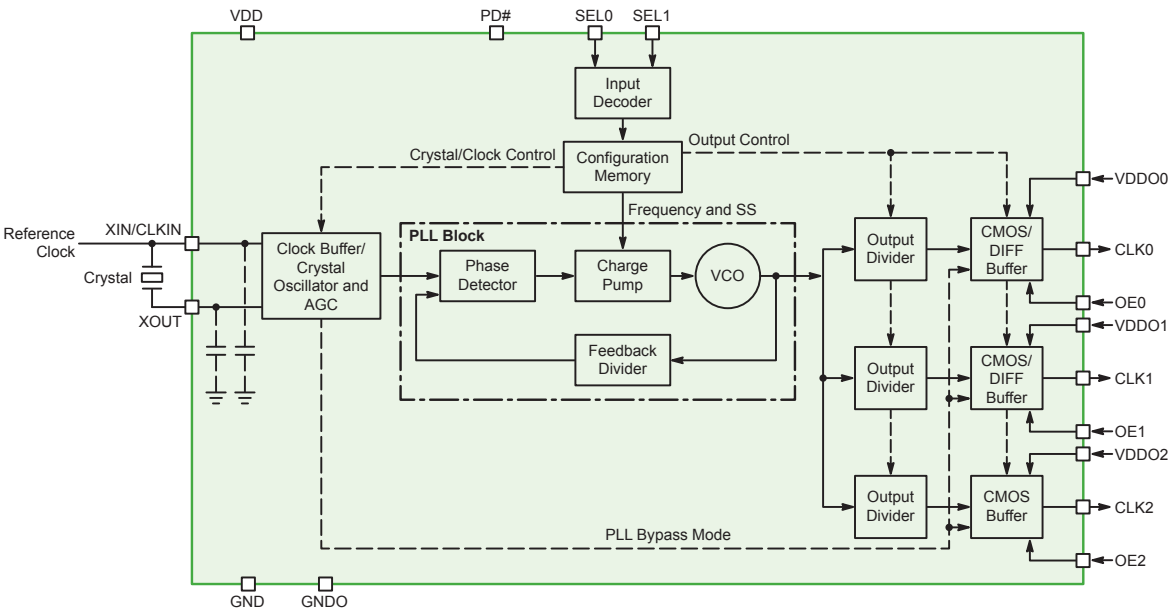
NFC Block Diagram

Device	Density	Power Supply (V)	Erase Size	Sector Erase Time (ms)	Page Program Time (ms)	Read/Write/Standby Current, Typ (mA)	Package
LE25S20	2 Mb	1.65 - 1.95	4 KB/64 KB/2 Mb	80	3.0	6.0/15.0/0.010	WLCSP-8
LE25S81	8 Mb	1.65 - 1.95	4 KB/64 KB/8 Mb	80	0.3	6.0/18.0/0.010	WLCSP-8
LE25S161	16 Mb	1.65 - 1.95	4 KB/64 KB/16 Mb	15	0.4	6.0/6.5/0.009	UDFN-8, WLCSP-8

Omniclock Programmable Clock Synthesizers

Key Features

- Single PLL
- Input Frequency Range:
  - Crystal: 3 – 50 MHz (low cost ESR crystal compatible)
  - Clock: 3 – 200 MHz (single-ended only)
- Up to 3 single-ended (LVCMOS/LVTTL) outputs, or up to 1 differential (LVPECL, LVDS, HCSL or CML) output + 1 single-ended (LVCMOS/LVTTL) output
- Output Frequency Range: 8 kHz (Min), 200 MHz (Max)
- Programmable Spread Spectrum Capabilities for EMI Suppression
  - Center Spread (0.125% steps): ± 0.125% to ± 3%
  - Down Spread (0.25% steps): -0.25% to -4%
  - Modulation Rate: 30 kHz – 130 kHz
- PLL Bypass mode
- Individual Output Enable pin for each output and Power Down Capability
- Individual Output Voltage pins per output, allowing setting of output voltage (1.8 V, 2.5 V or 3.3 V; equal to or less than VDD)
- Automatic Gain Control (Crystal Power Limiting)
- Programmable internal input crystal load capacitors
- Programmable Output Drive current
- Up to 4 independent configurations using SELx pins
- Supply Voltage: 3.3 V ±10%; 2.5 V ± 10%; 1.8 V ± 0.1 V
- Temperature Range: -40°C to +85°C
- Available in QFN-16 (3 mm x 3 mm) and WDFN-8 (2 mm x 2 mm) packages



Block Diagram

Omniclock Programmable Clock Synthesizers

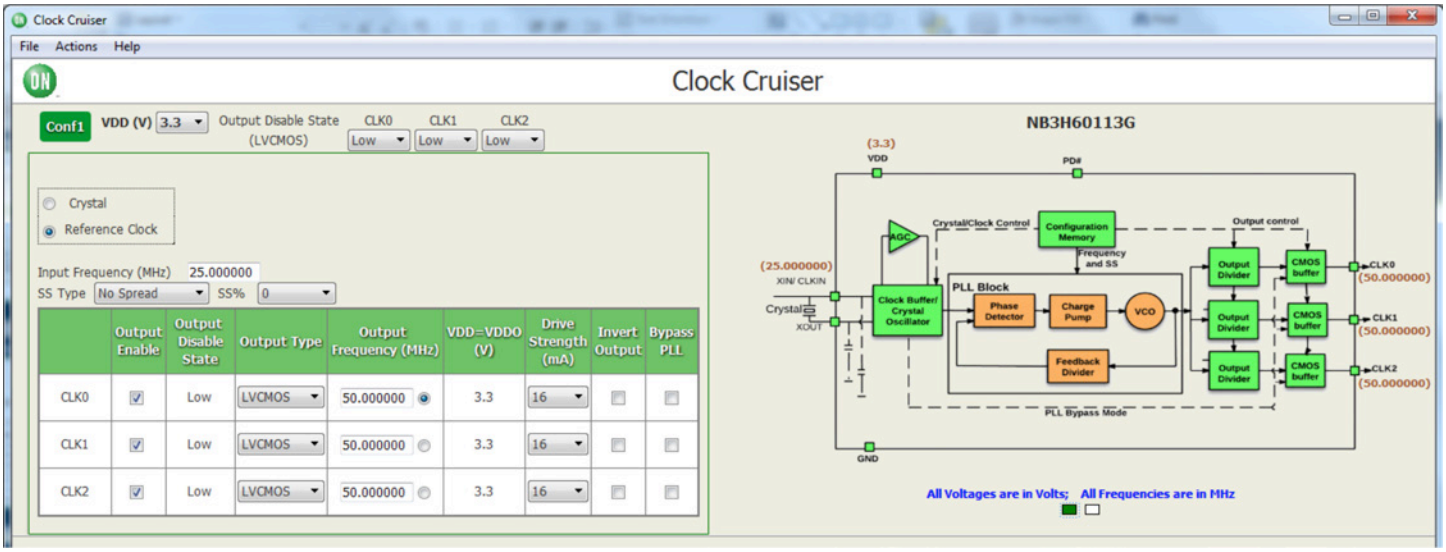
Using Omniclock in Your System

Customer orders blank Omniclock devices

Customer uses free GUI and supplied evaluation board to configure the blank device to the desired parameters: frequency, drive strength, spread spectrum, etc.

Customer provides configuration file to ON Semiconductor sales channel

ON Semiconductor programs device in factory with desired customer configuration, and creates customer-specific part number



Configuration GUI

Device	Individual OE	Individual V_{ddo}	Supply Voltage (V)	Number of Configurations	Number of Outputs	Package
NB3H63143G	Yes	Yes	2.5 / 3.3	4	3	QFN-16
NB3H60113G	No	No	2.5 / 3.3	1	3	DFN-8
NB3V63143G	Yes	Yes	1.8	4	3	QFN-16
NB3V60113G	No	No	1.8	1	3	DFN-8

EMI Reduction with Spread Spectrum Clocks

Spread spectrum frequency modulator clock generators reduce electromagnetic interference (EMI) at the clock source, allowing system wide EMI reduction on all clock dependent signals.

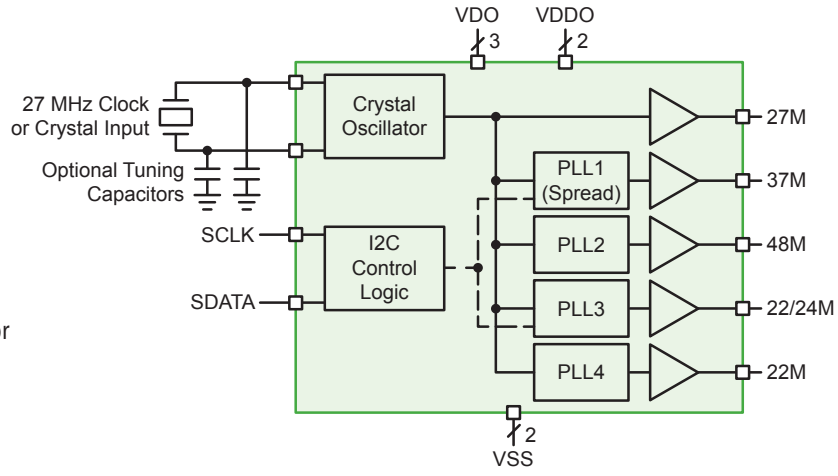
	Frequency (MHz)	Without Spread Spectrum (dB)	With Spread Spectrum (dB)	Reduction (dB)
Fundamental	46.9	-28	-28.4	0.4
3rd Harmonic	143.9	-31.1	-36.9	5.8
5th Harmonic	238.5	40	-47.1	7.1
7th Harmonic	333.1	-50.7	-57.6	6.9
9th Harmonic	434.9	-43.7	-50.9	7.2
11th Harmonic	524.7	-41.8	-49	7.2

Device	V_{DD} Typ (V)	f_{in} Typ (MHz)	f_{out} Typ (MHz)	Deviation Type	Features	Package(s)
P3MS650100H	1.8; 2.5; 3.3	15-30; 15-60	15-30; 15-60	±1.4% @ 24 MHz	Power Down	WDFN-4
P3MS650103H	1.8; 2.5; 3.3	15-30; 15-60	15-30; 15-60	±0.45% @ 24 MHz	Power Down	WDFN-4
P3PS550AH	2.3-3.6	18-36	18-36	±0.4 to ±2.5	High Drive, PDB	WDFN-8
P3PSL450AH	1.8	15-60	15-60	Analog	PDB	WDFN-8
PCS3PS550A	2.3-3.6	18-36	18-36	±0.4 to ±2.5	PDB	WDFN-8

4-PLL Audio/Video Clock Generator with Spread Spectrum Clock

Key Features – P1P40167

- Eliminates multiple crystals by using one device to generate multiple clocks
- Integrated loop filter
- Input: 27 MHz crystal or external input
- Outputs:
  - 27 MHz reference output
  - Fixed output frequency of 48 MHz and 22.5792 MHz
  - Configurable spread spectrum 37 MHz output
  - Selectable audio clock frequency of 22.5792 MHz or 24.576 MHz
- LVCMOS input and outputs
- Serial interface to control output enable/disable, SS selection and PLL frequency selection
- 1.8 V supply voltage



P1P40167 Block Diagram

INTERFACE & MEMORY

Analog Switches

Device	Data Type	Configuration	V_{CC} Min (V)	V_{CC} Max (V)	R_{ON} Max (Ω)	I_{Ikg} Max (μA)	C (pF)	BW (MHz)	Package(s)
NLAS7213	USB 2.0/UART	DPST	1.65	4.5	10	1	5	1100	UQFN-8
NLAS4717	USB 1.1/UART	Dual SPDT	1.8	5.5	4.5	1	110	40	Flip-Chip-10, Micro-10
NLAS4717EP	USB 1.1/UART	Dual SPDT	1.8	5.5	4.5	1	38	90	WQFN-10, Flip-Chip-10
NLAS7222A	USB 2.0/UART	DPDT	3	3.6	9	1	7	500	WQFN-10
NLAS7222B	USB 2.0/UART	DPDT	1.65	4.5	8	1	8	500	UQFN-10
NLAS7222C	USB 2.0/UART	DPDT	1.65	4.5	8	1	10	500	UQFN-10
NLAS7242	USB 2.0/UART	DPDT	1.65	4.5	7.5	1	7.5	900	UQFN-10
NL3HS2222	USB 2.0/UART	DPDT	1.65	4.5	8	1	7.5	950	UQFN-10
NCN9252	USB 2.0/UART	DP3T	1.65	4.5	6	1	16	525	UQFN-12
NLAS3899B	SIM card	Dual DPDT	1.65	4.3	4	1	20	280	WQFN-16, QFN-16
NS5S1153	USB 2.0/UART/Negative Audio	DPDT	-0.5	5	4.6	35	7	900	UQFN-10
NCN1154	USB 2.0/UART/Negative Audio	DP3T	-0.5	6	3	50	9	850	UQFN-12
NCN1188	USB 2.0/MHL 1.1/Negative Audio	DP3T	-0.5	6	-	-	-	-	UQFN-12
NL3HS644	4-Lane MIPI Switch	SPDT	1.65	4.5	12	0.1	12	1050	WLCSP-36
NLAS3257	Low Capacitance	SPDT	1.65	4.5	9	1	7.5	900	XLLGA-6
NLAS3157	Low Capacitance	SPDT	1.65	4.5	9	1	7.5	900	ULLGA-6

Small Signal MOSFETs

Device	Polarity	Configuration	$V_{(BR)DSS}$ Min (V)	V_{GS} Max (V)	I_D Max (A)	$R_{DS(ON)}$ Max @ V_{GS} = 4.5 V (Ω)	$R_{DS(ON)}$ Max @ V_{GS} = 2.5 V (Ω)	$R_{DS(ON)}$ Max @ V_{GS} = 1.8 V (Ω)	Package(s)
NTNS3193NZ	Single	N-Channel	20	±8	0.23	1.4	1.9	2.2	XLLGA-3
NTNS3A91PZ	Single	P-Channel	-20	±8	0.21	1.6	2.4	3.3	XLLGA-3
NTNS3164NZ	Single	N-Channel	20	±8	0.22	0.7	1	2	SOT-883
NTNS3A65PZ	Single	P-Channel	-20	±8	0.23	1.3	2	3.4	SOT-883
NTNUS3171PZ	Single	P-Channel	-20	±8	0.15	3.5	4	5.5	SOT-1123
NTK3139P	Single	P-Channel	-20	±6	0.78	0.48	0.67	0.95	SOT-723
NTK3134N	Single	N-Channel	20	±6	0.89	0.35	0.45	0.65	SOT-723
NTK3043N	Single	N-Channel	20	±10	0.26	3.4	4.5	10	SOT-723
NTZS3151P	Single	P-Channel	-20	±8	0.9	0.142	0.2	0.24	SOT-563
NTUD3170NZ	Dual	N-Channel	20	±8	0.22	1.5	2	3	SOT-963
NTZD3152P	Dual	P-Channel	-20	±6	0.4	0.9	1.2	2	SOT-563
NTZD3154N	Dual	N-Channel	20	±6	0.5	0.55	0.7	0.9	SOT-563
NTZD5110N	Dual	N-Channel	60	±20	0.3	2.5	-	-	SOT-563
NTUD3169CZ	Complementary	N-Channel	-20	±8	0.22	1.5	2	3	SOT-963
		P-Channel	20	±8	0.25	5	6	7	
NTZD3155C	Complementary	N-Channel	20	±6	0.54	0.55	0.7	0.9	SOT-563
		P-Channel	-20	±6	0.43	0.9	1.2	2	

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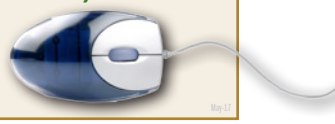

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