

General Description

The LSP2021 is a low dropout linear regulator (LDO) family with 300mA output current. The output voltage can be fixed or adjustable, and are stable with 1.0uF or higher value ceramic capacitors.

The LSP2021 family provides several protections, such as over current protection (OCP), short circuit protection (SCP) and over temperature protection (OTP) to protect themselves from fault application conditions.

This family of LDOs have many different packages and pin assignments. Some LDOs have optional Enable pin and/or Bypass (BP) pin. The users can refer the **ordering information** of this datasheet to choice the most suitable LDOs for their applications.

Features

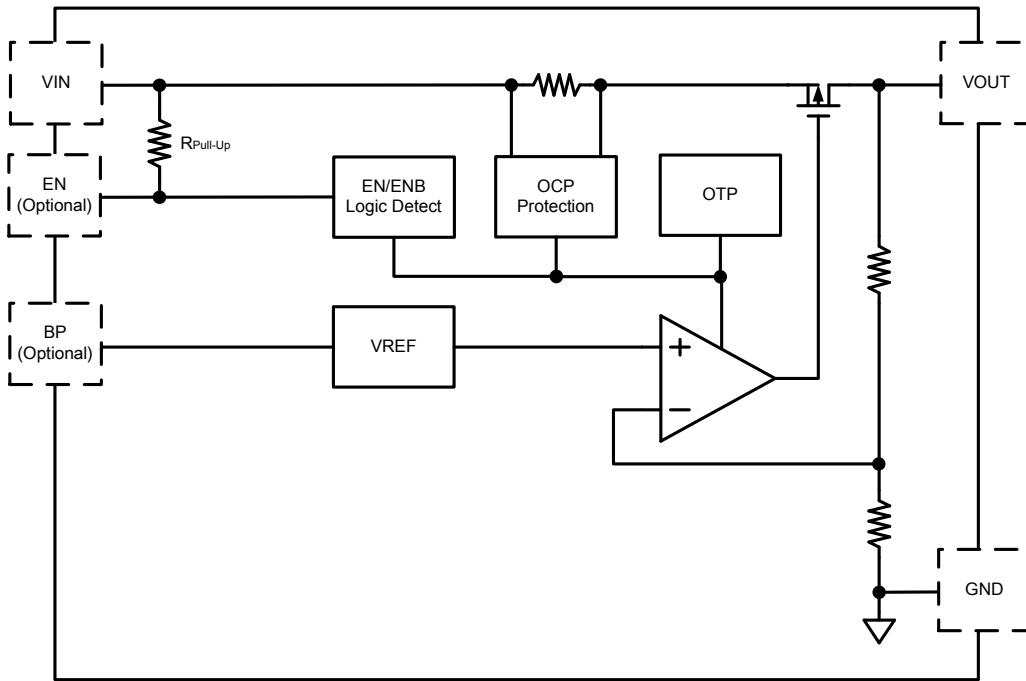
- Operating Input Voltage : 2.8V~5.5V
- Has Fixed Output Voltage (Fixed- V_{OUT}) And Adjustable Output Voltage (Adj- V_{OUT}) Options
- Fixed Output voltage range: 1.0V to 4.3V by 0.1V steps
- Output current is up to 300 mA
- Built-in Over Current Protection (OCP), Short Circuit Protection (SCP), and Over Temperature Protection (OTP)
- High PSRR=73dB @1KHz
- Fast transient response
- Optional EN and Bypass (BP) Pin(s)
- Stable with Ceramic Capacitors of 1.0uF
- Package : SOT23-3L, SOT23-5L and SC70-5L Packages

Applications

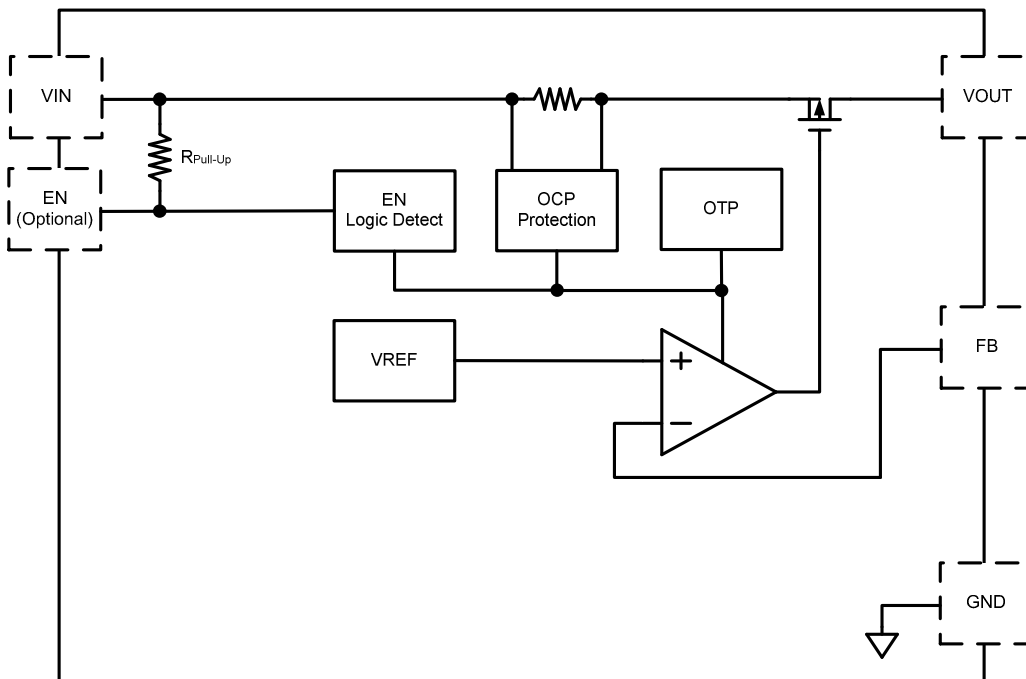
- Portable Electronics
- Wireless Applications
- Battery Power Devices

Please be aware that an Important Notice concerning availability, disclaimers, and use in critical applications of LSC products is at the end of this document.
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Block Diagram

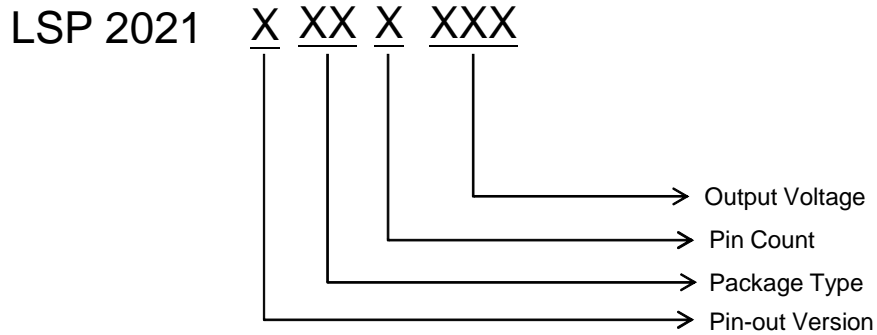


Fixed Output



Adjustable Output

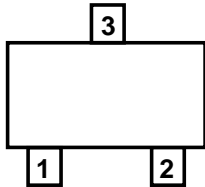
Ordering Information



Pin-out Version	Package Type	Pin Count	Output Voltage
A (SOT23-3L) 1. GND 2. VOUT 3. VIN	AA : SOT23 AS : SC70 DG : TDFN2020	B: 3 D: 5 E: 6	ADJ : Adjustable 120 : 1.20V 150 : 1.50V 180 : 1.80V 200 : 2.00V 250 : 2.50V 280 : 2.80V 330 : 3.30V 420 : 4.20V
A (SOT23-5L) (SC70-5L) 1. VIN 2. GND 3. EN 4. BP 5. VOUT			
B (SOT23-5L) (SC70-5L) 1. VIN 2. GND 3. EN 4. FB 5. VOUT			
C (SOT23-5L) (SC70-5L) 1. VIN 2. GND 3. EN 4. NC 5. VOUT			
A (TDFN2020-6L) 1. VOUT 2. BP 3. NC 4. GND 5. EN 6. VIN			

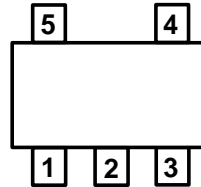
Pin Assignment

SOT23-3L
Top View



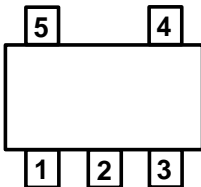
LSP2021AAB
1. GND
2. VOUT
3. VIN

SOT23-5L
Top View



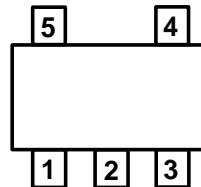
LSP2021AAD
1. VIN
2. GND
3. EN
4. BP
5. VOUT

SOT23-5L
Top View



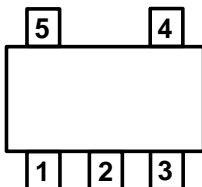
LSP2021BAAD
1. VIN
2. GND
3. EN
4. FB
5. VOUT

SOT23-5L
Top View



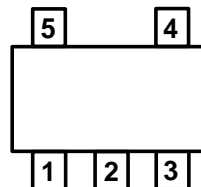
LSP2021CAAD
1. VIN
2. GND
3. EN
4. NC
5. VOUT

SC70-5L
Top View



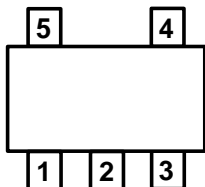
LSP2021AASD
1. VIN
2. GND
3. EN
4. BP
5. VOUT

SC70-5L
Top View



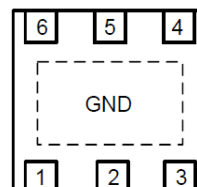
LSP2021BASD
1. VIN
2. GND
3. EN
4. FB
5. VOUT

SC70-5L
Top View



LSP2021CASD
1. VIN
2. GND
3. EN
4. NC
5. VOUT

TDFN2020-6
Top View



LSP2021ADGE
1. VOUT
2. BP
3. NC
4. GND
5. EN
6. VIN

Pin Descriptions

Pin Name	Pin Description
V _{IN}	Voltage input. The input capacitor in the range of 1uF to 10uF is sufficient.
GND	Ground
V _{OUT}	LDO Output
FB (Optional)	Feedback Input for Setting the Output Voltage. Connect to an external resistor divider for adjustable output operation.
BP (Optional)	Reference Noise Bypass (The Bypass capacitor ≥ 1nF)
EN (Optional)	Enable pin (Active High) A pull-high resistor is inside the IC. Need an external Logic-low source to disable the LDO.
NC	No connection

Absolute Maximum Ratings

Operate over the “Absolute Maximum Ratings” may cause permanent damage to the device. Exposure to such conditions for extended time may still affect the reliability of the device.

Parameter	Symbol	Value	Unit	
V _{IN} Pin Voltage	V _{IN}	GND - 0.3 to GND + 6	V	
FB, EN, BP, and V _{OUT} pin Voltages	V _{FB} , V _{EN} , V _{BP} & V _{OUT}	GND - 0.3 to V _{IN} + 0.3	V	
Maximum I _{OUT} Current (Note 1)	I _{OUT}	Internal Limit	mA	
Junction Temperature Range	T _J	-40 to +125	°C	
Storage Temperature Range	T _{STR}	-40 to +150	°C	
Lead Temperature (Soldering, 10 Seconds)	T _{Lead}	260	°C	
ESD Withstand Voltage (IEC 6100-4-2): -Human Body Model (HBM), Model = 2 -Machine Model (MM) Model = B	V _{ESD}	2000 200	V V	
Thermal Resistance (Junction to Case)	SOT23-5L	θ _{JC}	140	°C/W
	SOT23-3L			
Thermal Resistance (Junction to Ambient)	SOT23-5L	θ _{JA}	280	°C/W
	SOT23-3L			
Power Dissipation	SOT23-5L	P _D	400	mW
	SOT23-3L			
Moisture Sensitivity	MSL	Please refer the MSL label on the IC package bag/carton for detail		

Note 1 : The I_{OUT} of the LDO will be limited by the thermal protection , if the PCB design can't dissipate the heat generated by the LDO

Note 2 : R_{θJA} is highly dependent on the PCB heat sink area.

Recommended Operating Conditions

Characteristics	Min	Max	Unit	Note
Input Voltage	2.8	5.5	V	
Operating Temperature Range	-40	+85 (Note3)	°C	
ADJ Version Feedback Resistor (* From FB Pin to GND)		10K	Ohm	

Note 3 : If the IC experienced OTP, then the temperature may need to drop to < OTP recover temperature to let the IC recover.

Electrical Characteristics

($V_{IN} = V_{OUT} + 1V$ or $V_{IN} = 2.8V$ whichever is greater, $C_{IN} = C_{OUT} = 1\mu F$, $T_A = 25^\circ C$, unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Input Voltage (All Versions)						
Input Voltage Range	V_{IN}		2.8 (Note 4)		5.5	V
Feedback Voltage (ADJ-V_{OUT} Versions)						
FB Voltage	V_{FB}	$V_{IN} = V_{IN(min)}$ to 5.5V, $I_{OUT} = 1mA$ ($T_J = 25^\circ C$)	0.784	0.8	0.816	V
FB Input Leakage Current	I_{FB}	$V_{FB} = 1.0V$, $V_{IN} = V_{IN(min)}$ to 5.5V,	-100		100	nA
Adjustable Output Voltage Range	V_{OUT}		V_{FB}		4.3	V
V_{OUT} Voltage (Fixed-V_{OUT} Versions)						
Output Voltage Accuracy	ΔV_{OUT}	$V_{IN} = V_{IN(min)}$ to 5.5V, $I_{OUT} = 1mA$ ($T_J = 25^\circ C$)	-2.0		+2.0	%
Quiescent Current	I_Q	$I_{OUT} = 0mA$		30	60	μA
Shutdown Current	I_{SD}	$V_{IN} = 3.6V$, $V_{EN} = 0V$			1	μA
Dropout Voltage (Note4)	V_{DROP}	$I_{OUT} = 300mA$	$1.0V \leq V_{OUT} \leq 2.0V$		1800	mV
			$2.0V < V_{OUT} \leq 2.4V$		800	
			$2.4V < V_{OUT} \leq 2.8V$		500	
			$2.8V < V_{OUT}$		300	
Current Limit (Note 5)	I_{LIMIT}	$R_{LOAD} = 1\Omega$	300			mA
Short Circuit Current	I_{short}	$V_{OUT} < 0.25 * V_{OUT}$			$0.7 * I_{LIMIT}$	mA
Line Regulation	ΔV_{LINE}	$I_{OUT} = 1mA$, $V_{IN} = V_{OUT} + 1V$ to 5V		1	5	mV
Load Regulation (Note 6)	ΔV_{LOAD}	$I_{OUT} = 1m \sim 150mA$, $V_{IN} = V_{IN(min)}$		6	20	mV

Electrical Characteristics (Contd.)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
LDO Basic Characteristics (All Versions)						
V _{OUT} Temperature Coefficient (Note 7)	T _C	I _{OUT} =1mA, V _{IN} =5V		50		ppm/ °C
Ripple Rejection (Note 7)	PSRR	C _{OUT} =1μF I _{OUT} =1mA	f=1KHz	-73		dB
			f=10KHz	-60		
Thermal Shutdown (Note 7)	T _S			160		°C
Thermal Shutdown Hysteresis (Note 7)	T _{SH}			25		°C
Enable (EN, Optional)						
Enable Input Threshold	V _{ENH}		1.4		V _{IN}	V
	V _{ENL}		0		0.4	
Enable Pin Current	I _{ENH}	V _{EN} =V _{IN}			0.1	uA

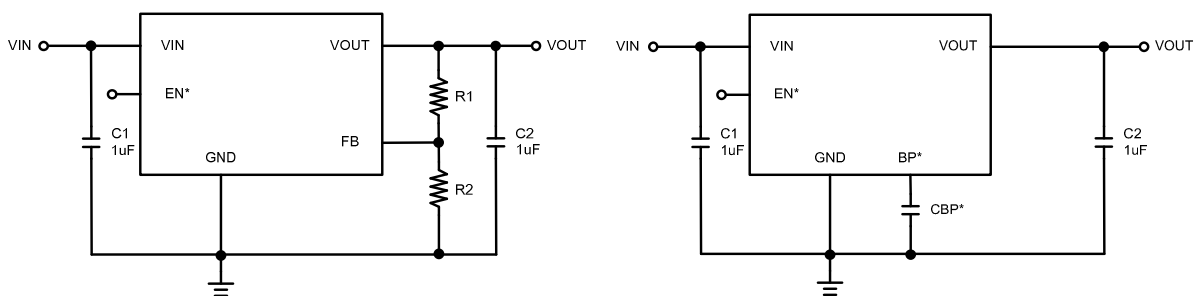
Note 4: Minimum V_{IN} voltage is defined by output adds a dropout voltage.

Note 5: Current limit and short circuit current are measured at constant junction temperature by using pulsed testing with a low ON time.

Note 6: Load Regulation is measured at constant junction temperature by using pulsed testing with a low ON time.

Note 7: Guarantee by design. Not test when manufacture.

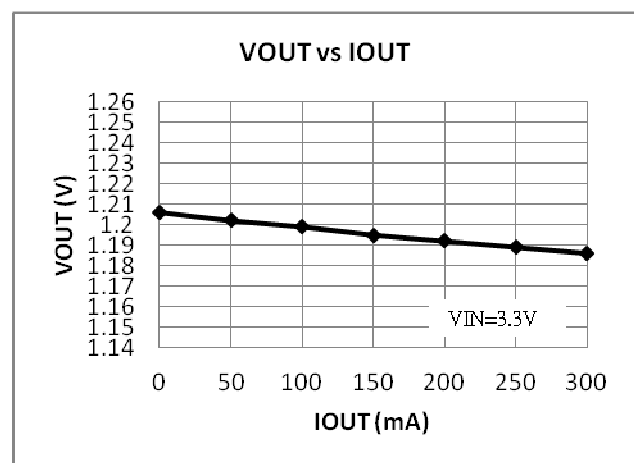
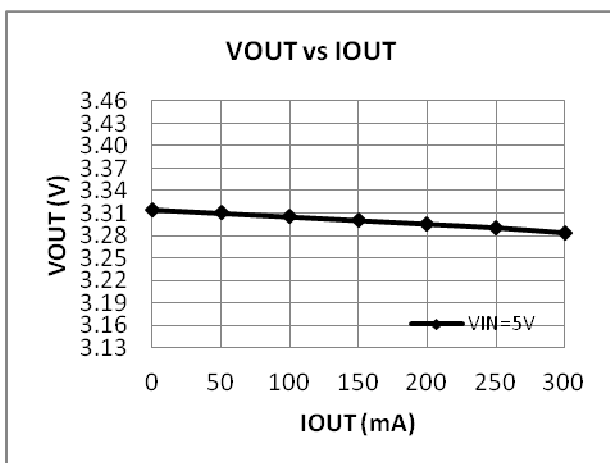
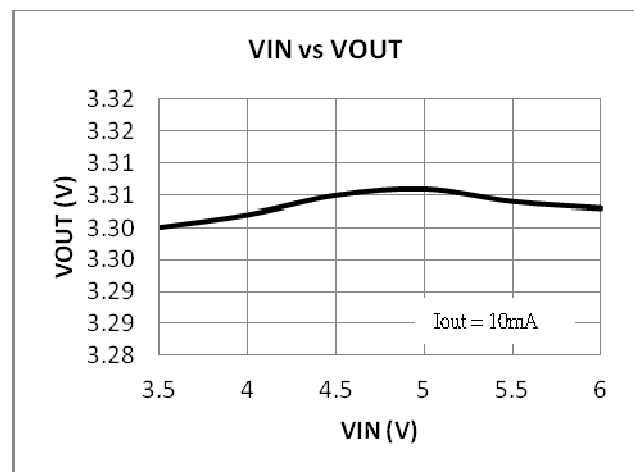
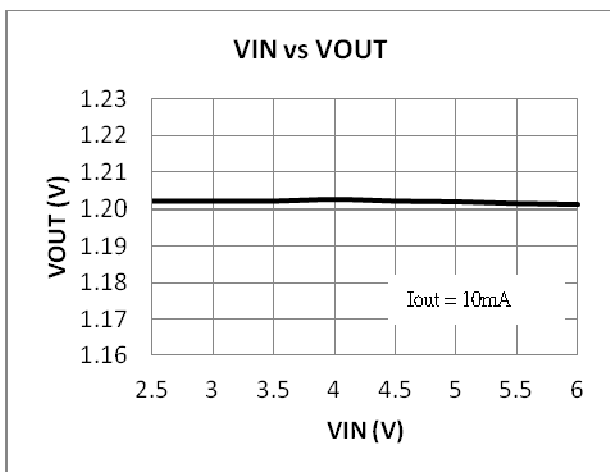
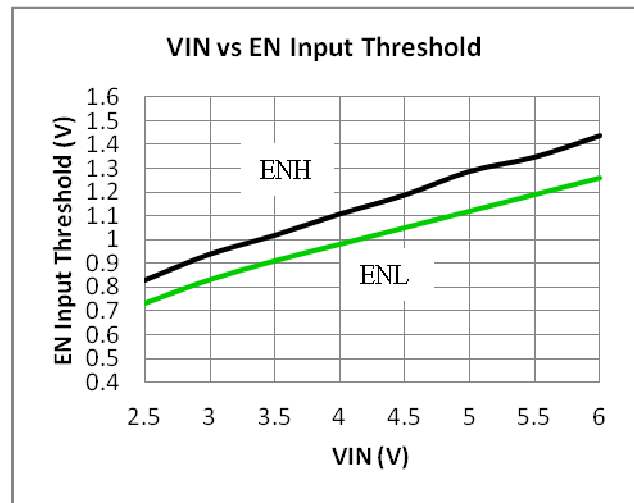
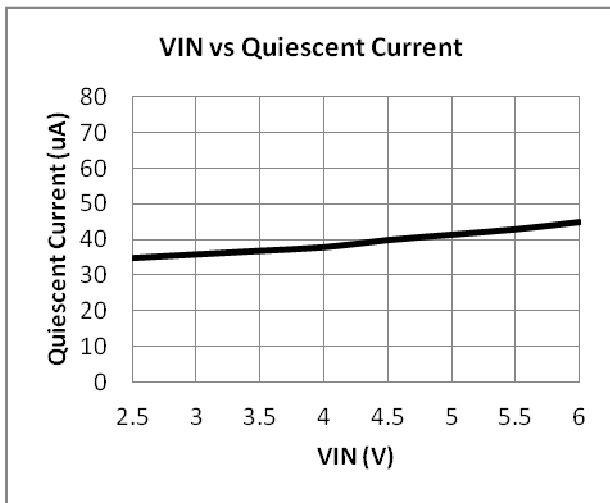
Application Circuit

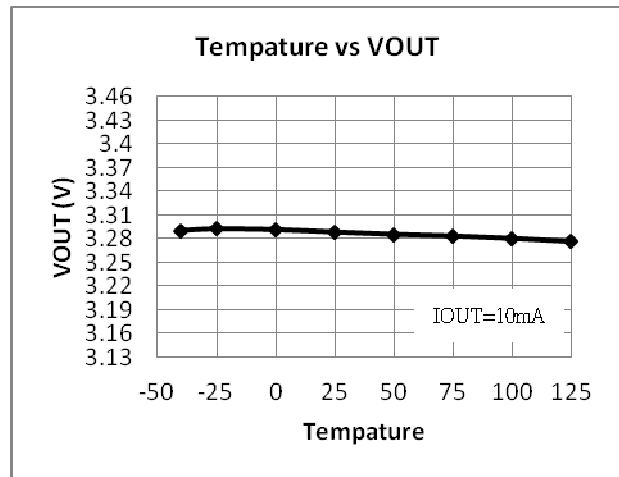
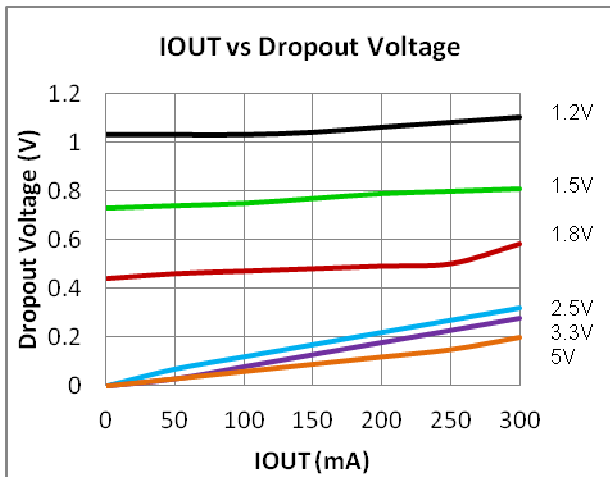


Adjustable Output
(*Optional Pin or Component)

Fixed Output
(*Optional Pin or Component)

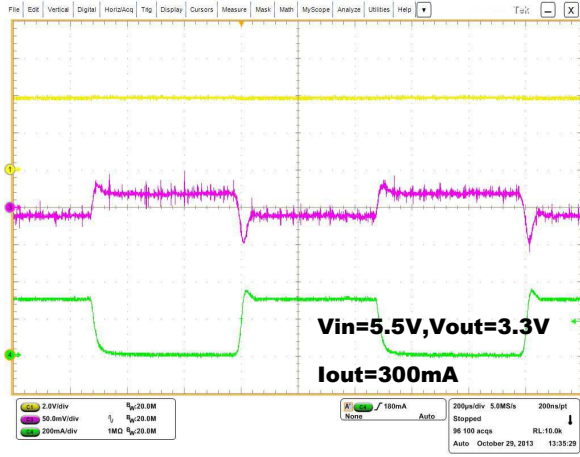
Typical Characteristics



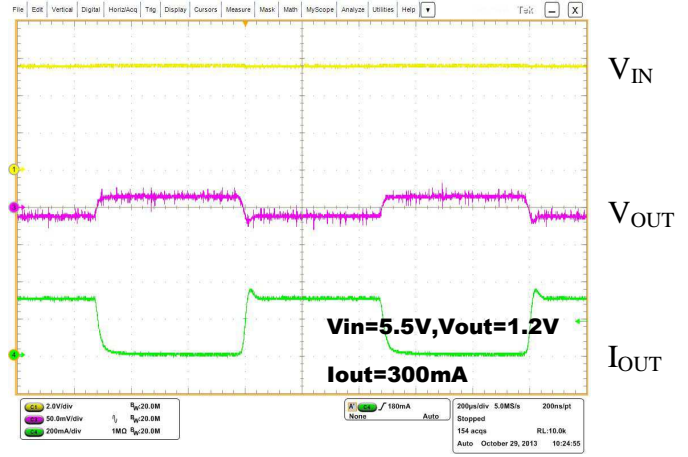


Typical Characteristics (Continue)

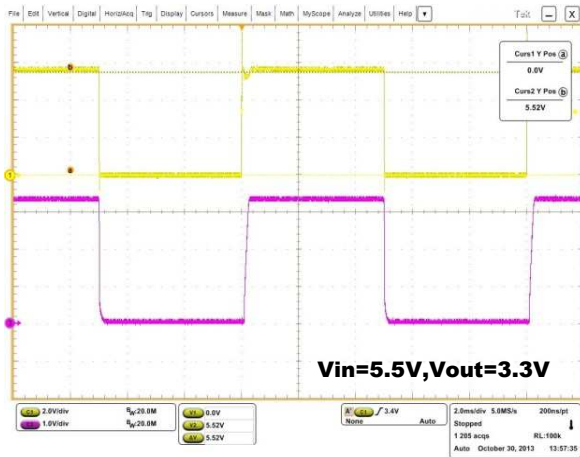
Load transient response



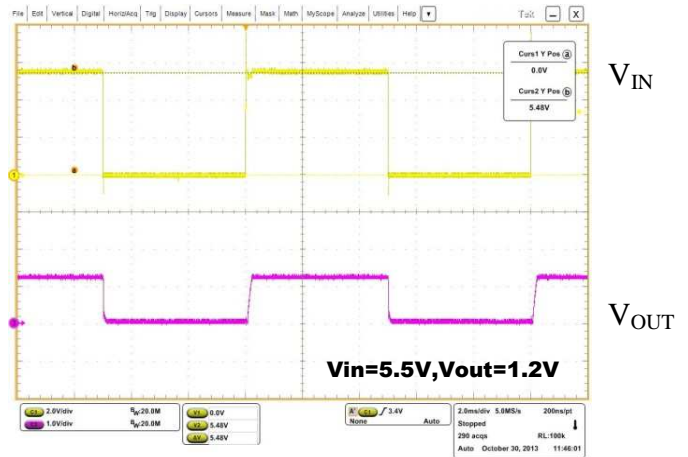
Load transient response



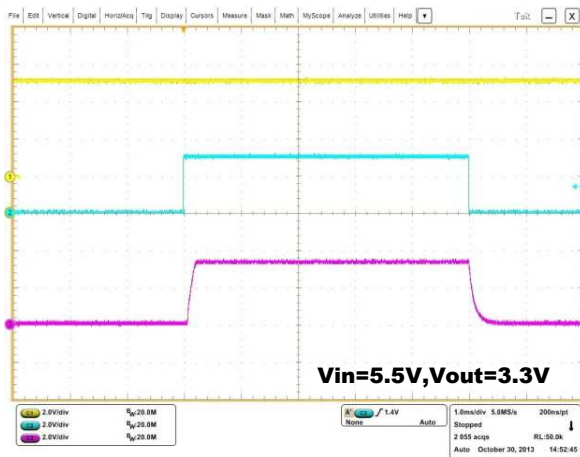
Power On



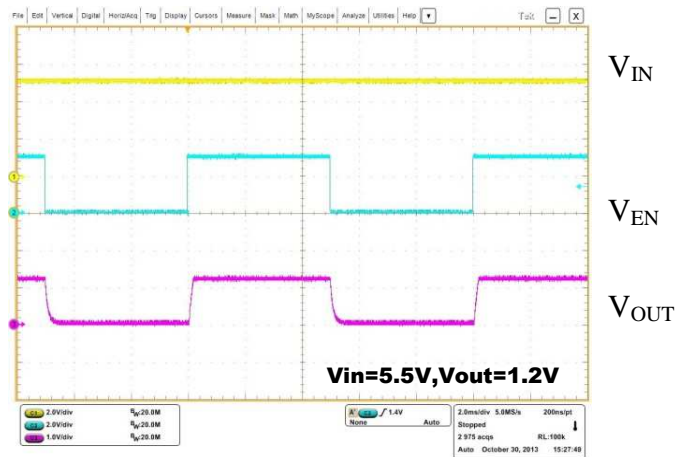
Power On



En On

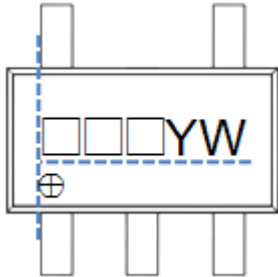


En On



Marking Information

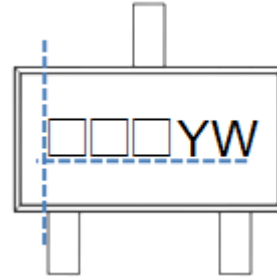
(1)SOT23-5L



- 1) □□□ = Marking Name
AA1 = LSP2021BAADADJ
AA2 = LSP2021AAAD120
AA3 = LSP2021AAAD150
AA4 = LSP2021AAAD180
AA5 = LSP2021AAAD250
AA6 = LSP2021AAAD280
AA7 = LSP2021AAAD330
AA8 = LSP2021AAAD420

- 2) YW = Date Code
Y = Year
W = Week

(2)SOT23-3L

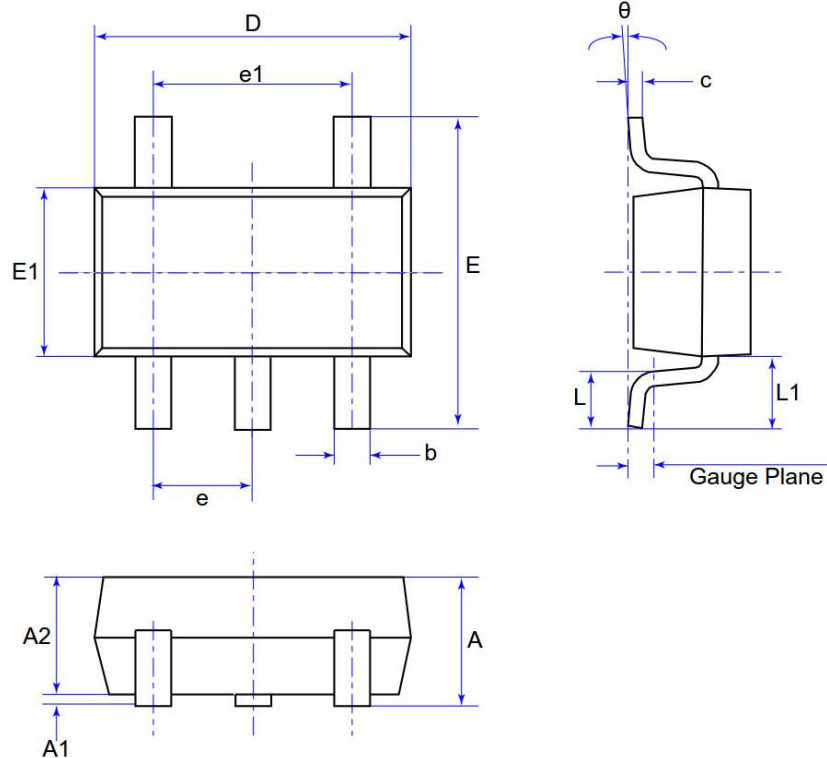


- 1) □□□ = Marking Name
AA9 = LSP2021AAAB330
ABA = LSP2021AAAB150
ABB = LSP2021AAAB180
ABC = LSP2021AAAB250
ABD = LSP2021AAAB280

- 2) YW = Date Code
Y = Year
W = Week

Mechanical Information

(1) SOT23-5L

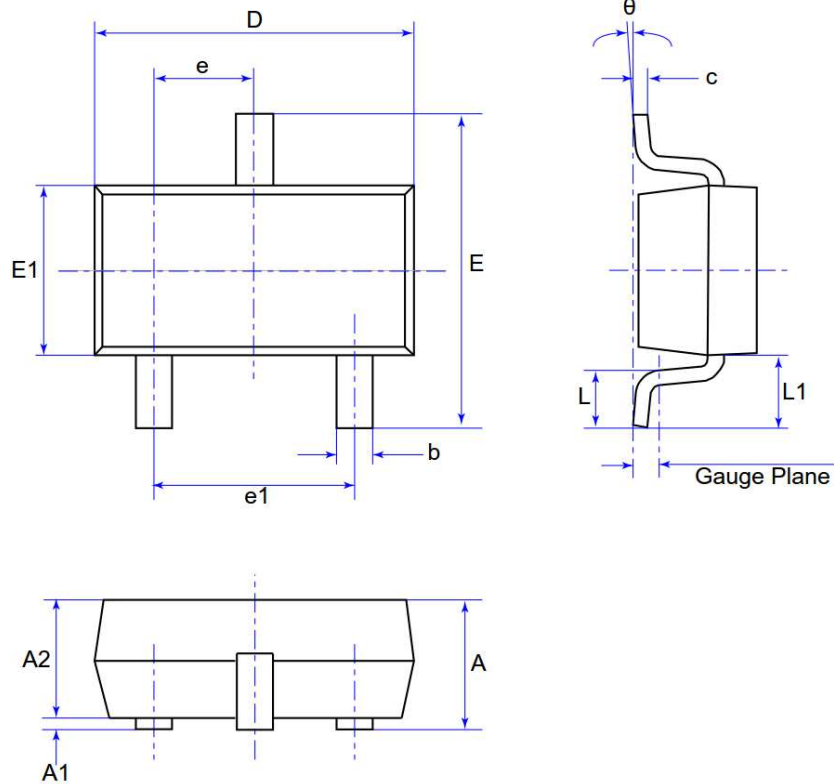


Unit: mm

Symbol	Min	Max
A	-	1.35
A1	-	0.15
A2	1.00	1.20
b	0.30	0.50
c	0.08	0.21
D	2.72	3.12
E	2.60	3.00
E1	1.40	1.80
e	0.95 BSC	
e1	1.80	2.00
L	0.30	0.60
L1	0.60 REF	
Gauge Plane	0.25 REF	
θ	0°	8°

Mechanical Information (Contd.)

(2) SOT23-3L



Unit: mm

Symbol	Min	Max
A	-	1.35
A1	0.00	0.15
A2	1.00	1.20
b	0.30	0.50
c	0.08	0.21
D	2.72	3.12
E	2.60	3.00
E1	1.40	1.80
e	0.95 BSC	
e1	1.90 REF	
L	0.30	0.60
L1	0.60 REF	
Gauge Plane	0.25 REF	
θ	0°	8°

MSL (Moisture Sensitive Level) Information

IPC/JEDEC J-STD-020D.1 Moisture Sensitivity Levels Table

LEVEL	FLOOR LIFE		SOAK REQUIREMENTS				
			Standard		Accelerated Equivalent ¹		
	TIME	CONDITION			TIME (hours)	CONDITION	eV 0.40-0.48 TIME (hours)
1	Unlimited	≤30 °C /85% RH	168 +5/-0	85 °C /85% RH	NA	NA	NA
2	1 year	≤30 °C /60% RH	168 +5/-0	85 °C /60% RH	NA	NA	NA
2a	4 weeks	≤30 °C /60% RH	696 ² +5/-0	30 °C /60% RH	120 -1/+0	168 -1/+0	60 °C/ 60% RH
3	168 hours	≤30 °C /60% RH	192 ² +5/-0	30 °C /60% RH	40 -1/+0	52 -1/+0	60 °C/ 60% RH
4	72 hours	≤30 °C /60% RH	96 ² +2/-0	30 °C /60% RH	20 +0.5/-0	24 +0.5/-0	60 °C/ 60% RH
5	48 hours	≤30 °C /60% RH	72 ² +2/-0	30 °C /60% RH	15 +0.5/-0	20 +0.5/-0	60 °C/ 60% RH
a	24 hours	≤30 °C /60% RH	48 ² +2/-0	30 °C /60% RH	10 +0.5/-0	13 +0.5/-0	60 °C/ 60% RH
6	Time on Label (TOL)	≤30 °C /60% RH	TOL	30 °C /60% RH	NA	NA	NA

Note 1: CAUTION - To use the “accelerated equivalent” soak conditions, correlation of damage response (including electrical, after soak and reflow), should be established with the “standard” soak conditions. Alternatively, if the known activation energy for moisture diffusion of the package materials is in the range of 0.40 - 0.48 eV or 0.30 - 0.39 eV, the “accelerated equivalent” may be used. Accelerated soak times may vary due to material properties (e.g .mold compound, encapsulant, etc.). JEDEC document JESD22-A120 provides a method for determining the diffusion coefficient.

Note 2: The standard soak time includes a default value of 24 hours for semiconductor manufacturer’s exposure time (MET) between bake and bag and includes the maximum time allowed out of the bag at the distributor’s facility. If the actual MET is less than 24 hours the soak time may be reduced. For soak conditions of 30 °C/60% RH, the soak time is reduced by 1 hour for each hour the MET is less than 24 hours. For soak conditions of 60 °C/60% RH, the soak time is reduced by 1 hour for each 5 hours the MET is less than 24 hours. If the actual MET is greater than 24 hours the soak time must be increased. If soak conditions are 30 °C/60% RH, the soak time is increased 1 hour for each hour that the actual MET exceeds 24 hours. If soak conditions are 60 °C/60% RH, the soak time is increased 1 hour for each 5 hours that the actual MET exceeds 24 hours.

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