LITE-ON SEMICONDUCTOR CORP.

LSP2155

1A Ultra Low Dropout CMOS Regulator

Features

- Low-Dropout Regulator Supports Input Voltages Down to 1.45V
- Output Voltage Available in fixed 1.2V, 1.8V, 2.5V, 3.3V and ADJ version
- Stable with 2.2uF or higher Ceramic Output Capacitor
- Low Dropout Voltage: 250mV at 1A
- Low Quiescent Current
- Over Temperature Protection
- Over Current Protection
- Short Circuit Protection
- Package：SOT223-3L, TO252-3L, SOP-8L

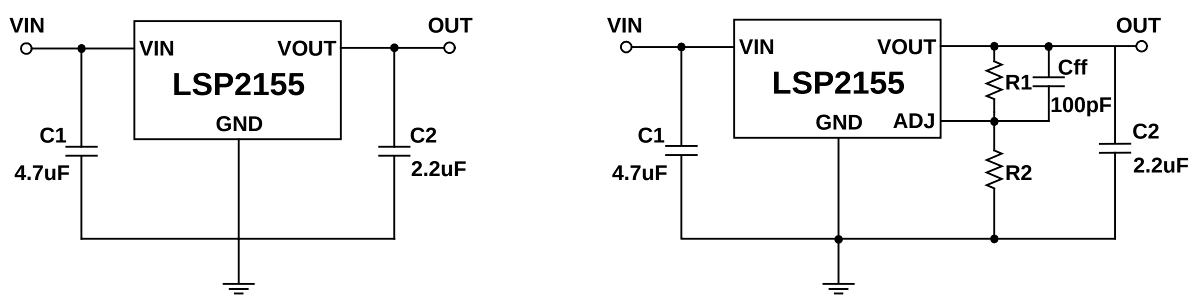
General Description

The LSP2155 is a 1A CMOS LDO regulator that features a low quiescent current, ultra low input, output and dropout voltages, as well as over temperature shutdown. It is available in SOT223-3L, TO252-3L**,** SOP-8L package. The fixed output voltage of the LSP2155 is set at the factory and trimmed to ±2%. The LSP2155 is stable with a ceramic output capacitor of 2.2uF or higher. This family of regulators can provide either a stand-alone power supply solution or act as a post regulator for switch mode power supplies. They are particularly well suited for applications requiring low input and output voltage.

Applications

- 1.2V Core Voltage for DSPs
- SATA Power Supply
- LCD TV/Monitor
- Telecom Equipment
- Portable Electronics

Typical Application Circuit



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.

Ordering Information

LSP2155 X X X

Package :
BE: SOT223-3L
BD: TO252-3L
E: SOT223-3L
D: TO252-3L
S: SOP-8L

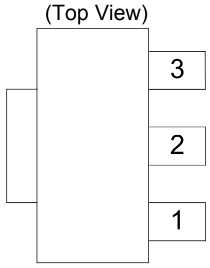
Output Voltage :
Blank: ADJ
12 : 1.2V
18 : 1.8V
25 : 2.5V
33 : 3.3V

Packing :
A : Tape & Reel

Device	Package Code	Package	Tape & Reel	
			Quantity	Part Number Suffix
LSP2155EXXA	E	SOT223-3L	2500	A
LSP2155BEXXA	BE	SOT223-3L	2500	A
LSP2155DXXA	D	TO252-3L	2500	A
LSP2155BDXXA	BD	TO252-3L	2500	A
LSP2155SA	S	SOP-8L	2500	A

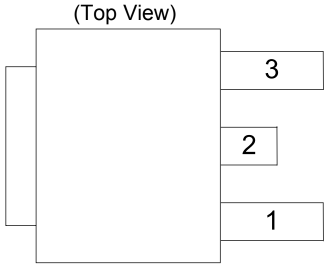
Pin Assignments

SOT223-3L
(Top View)



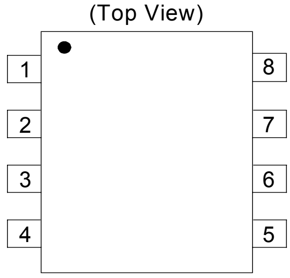
Tab is Pin 2

TO252-3L
(Top View)



Tab is Pin 2

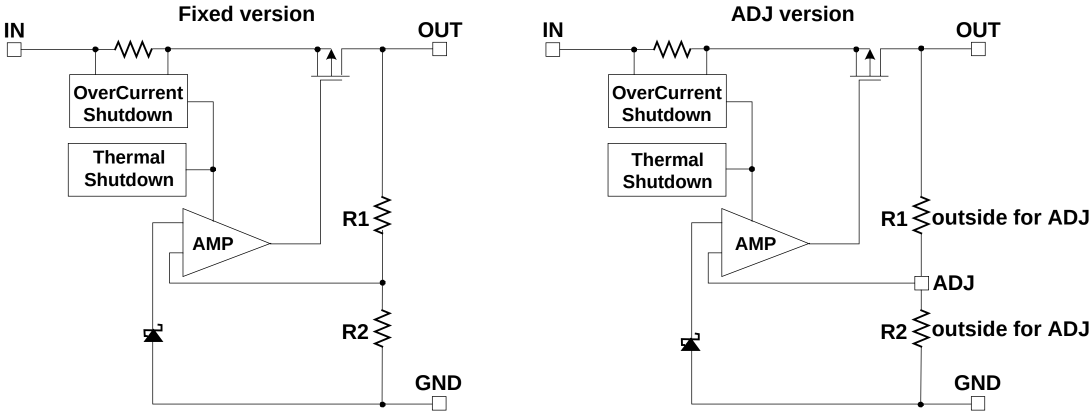
SOP-8L
(Top View)



Pin Descriptions

Pin Number			Name	Description
SOT223-3L TO252-3L	SOT223-3L (B) TO252-3L (B)	SOP-8L		
1	3	2	VIN	Voltage Input
2,TAB	1	1,4, 8	GND	Ground Pin
3	2,TAB	7	VOUT	Voltage Output
		6	ADJ	Feedback Pin
		3,5	NC	No Connected

Block Diagram



Absolute Maximum Ratings

Parameter		Value	Unit
Input Supply Voltage		-0.3 to 4	V
Maximum Output Current		$PD/(V_{IN}-V_{OUT})$	A
Power Dissipation	SOT223-3L	Internal Limitation	mW
	TO252-3L		
	SOP-8L		
Storage Temperature Range		-65 to +150	°C
Maximum Junction Temperature		150	°C

Recommended Operating Conditions

Parameter	Min	Max	Unit
Input Supply Voltage	1.45V (Notes1)	3.8	V
Operating Junction Temperature	-20	+125	°C
Output Current		1	A

Note1 : The minimum input voltage of the LSP2155 is determined by output voltage and dropout voltage. The minimum input voltage is defined as : $V_{IN} = V_{OUT} + V_{DROP}$

Electrical Characteristics

(V_{IN} = V_{OUT}+0.5V; C_{IN} = 4.7uF, C_{OUT} = 2.2 uF, T_A = 25℃ unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Voltage Accuracy	V_O	I_O= 100mA	-2		+2	%
Dropout Voltage	V_{DROP}	V_O = 0.9V,I_O=1A		550		mV
		V_O =1.2V,I_O=1A		250		
		V_O =1.8V,I_O=1A		160		
		V_O =2.5V,I_O=1A		140		
		V_O =3.3V,I_O=1A		130		
Current Limit	I_{Limit}			2		A
Short Circuit Current	I_{SC}	V_O < 0.3V		0.8		A
Quiescent Current	I_Q	V_{IN} = 1.7V, I_O= 0mA		250		uA
Line Regulation	L_{NR}	V_{IN} = 1.45 V to 3.8V, I_O = 10mA			1	%/V
Load Regulation Error	L_{DR}	I_O =10mA to 1A			2	%/V
ADJ Input Bias Current	I_{ADJ}	V_{IN} = 3.8V , V_{OUT} = 0.9V		1		%
ADJ Reference Voltage	V_{REF}		0.882	0.9	0.918	V
Over Temperature Protection	O_{TP}			150		℃
Over Temperature Hysteresis	O_{TH}			45		℃
Power Supply Ripple Rejection	PSRR			60		dB

Application Description

The LSP2155 family of low-dropout regulators have several features that allow them to apply to a wide range of applications. The family operates with very low input voltage (1.45V) and low dropout voltage (see Electrical Characteristics Table), making it an efficient stand-alone power supply or post regulator for battery or switch mode power supplies. The 1A output current make the LSP2155 family suitable for powering many microprocessors and FPGA supplies. The LSP2155 family also has low output noise (typically 40uVRMS with 2.2uF output capacitor), making it ideal for use in telecom equipment.

External Capacitor Requirement

A 2.2uF or larger ceramic input bypass capacitor, connected between VIN and GND and located close to the LSP2155, is required for stability. A 1.0uF minimum value capacitor from VOUT to GND is also required. To improve transient response, noise rejection, and ripple rejection, an additional 10uF or larger, low ESR capacitor is recommended at the output. A higher-value, low ESR output capacitor may be necessary if large, fast-rise-time load transients are anticipated and the device is located several inches from the power source, especially if the minimum input voltage of 1.45 V is used.

Regulator Protection

The LSP2155 features internal current limiting, thermal protection and short circuit protection. During normal operation, the LSP2155 limits output current to about 2A. When current limiting engages, the output voltage scales back linearly until the over current condition ends. While current limiting is designed to prevent gross device failure, care should be taken not to exceed the power dissipation ratings of the package. If the temperature of the device exceeds 160°C, thermal-protection circuitry will shut down. Once the device has cooled down to approximately 45°C below the high temp trip point, regulator operation resumes. The short circuit current of the LSP2155 is about 1A when its output pin is shorted to ground.

Thermal Information

The amount of heat that an LDO linear regulator generates is: D = (V_{IN}-V_{OUT}) x I_{OUT}. All integrated circuits have a maximum allowable junction temperature (T_J max) above which normal operation is not assured. A system designer must design the operating environment so that the operating junction temperature (T_J) does not exceed the maximum junction temperature (T_J max). The two main environmental variables that a designer can use to improve thermal performance are air flow and external heat-sink. The purpose of this information is to aid the designer in determining the proper operating environment for a linear regulator that is operating at a specific power level.

In general, the maximum expected power (P_D(max)) consumed by a linear regulator is computed as:

P_D(MAX) = (V_{IN}(avg)- V_{OUT}(avg)) x I_{OUT} (avg) x I_Q)

Where

V_{IN} (avg) is the average input voltage.

V_{OUT} (avg) is the average output voltage.

I_{OUT} (avg) is the average output current.

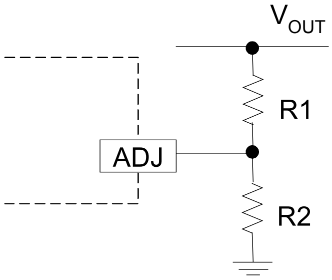
I_Q is the quiescent current.

For most LDO regulators, the quiescent current is insignificant compared to the average output current; therefore, the term V_{IN} (avg) x I_Q can be neglected. The operating junction temperature is computed by adding the ambient temperature (T_A) and the increase in temperature due to the regulator's power dissipation. The temperature rise is computed by multiplying the maximum expected power dissipation by the sum of the thermal resistances between the junction and the case ($R_{\Theta JC}$), the case to heat-sink ($R_{\Theta CS}$), and the heat-sink to ambient ($R_{\Theta SA}$). Thermal resistances are measures of how effectively an object dissipates heat. Typically, the larger the device, the more surface area available for power dissipation, so that the object's thermal resistance will be lower.

ADJ VERSION

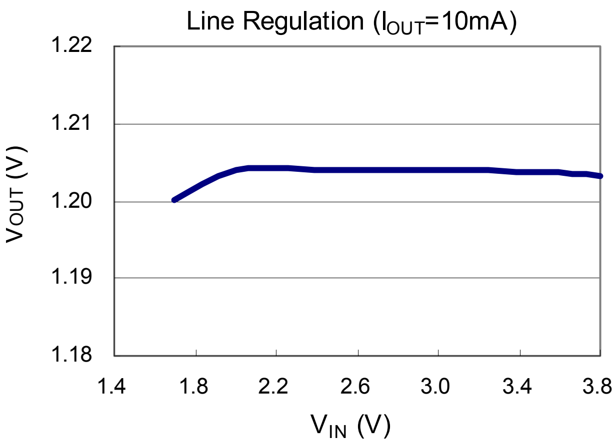
The adjustable version uses external feedback resistors to generate an output voltage anywhere from 1.45V to 5.0V. V_{ADJ} is trimmed to 0.9V and VOUT is given by the equation:

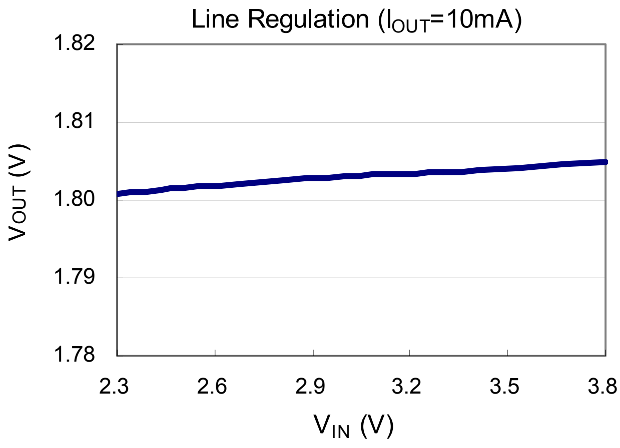
V_{OUT} = V_{ADJ} (1 + R1 / R2)

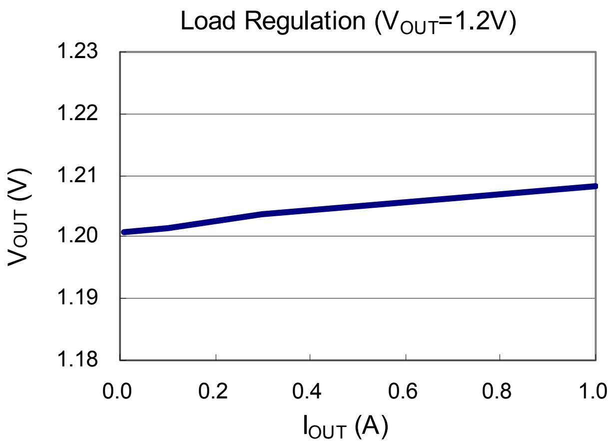


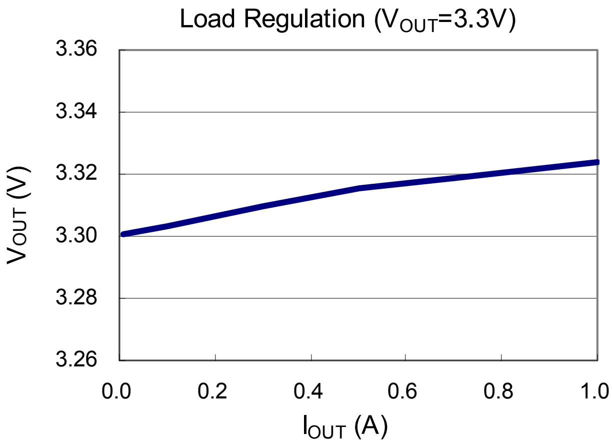
Feedback resistors R1 and R2 should be high enough to keep quiescent current low, but increasing R1 + R2 will reduce stability. In general, R1=100KΩ will produce adequate stability, given reasonable layout precautions. To improve stability characteristics, keep parasitic on the ADJ pin to a minimum, and lower R1 and R2 values.

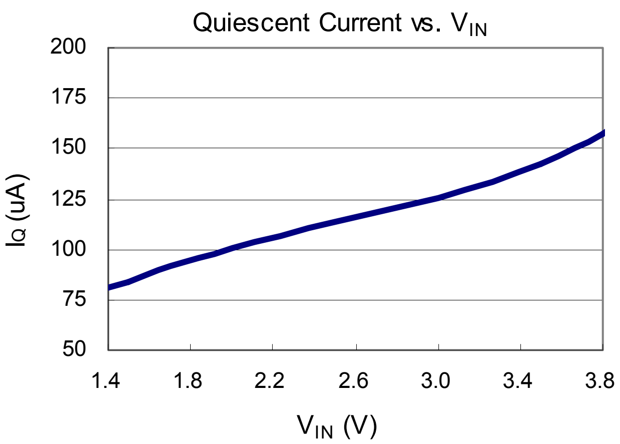
Typical Performance Characteristics

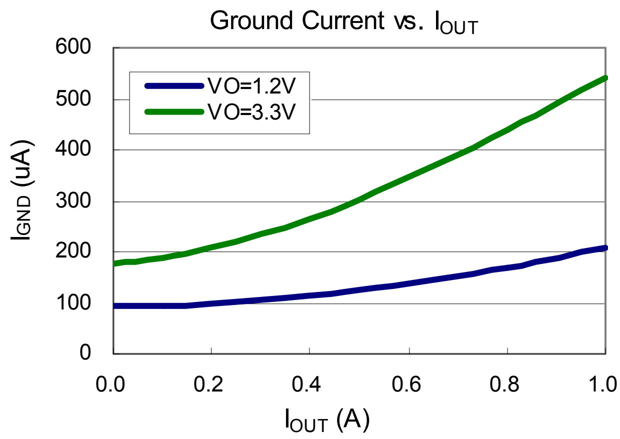




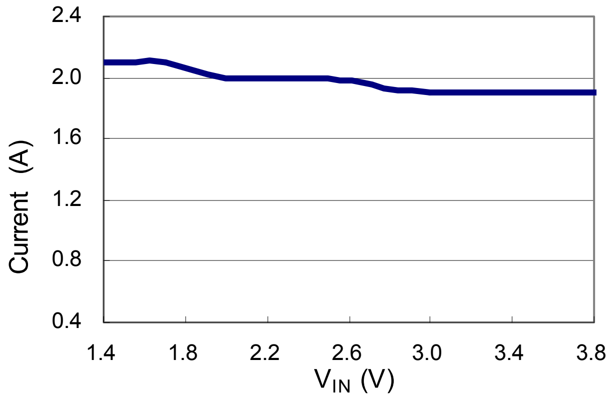




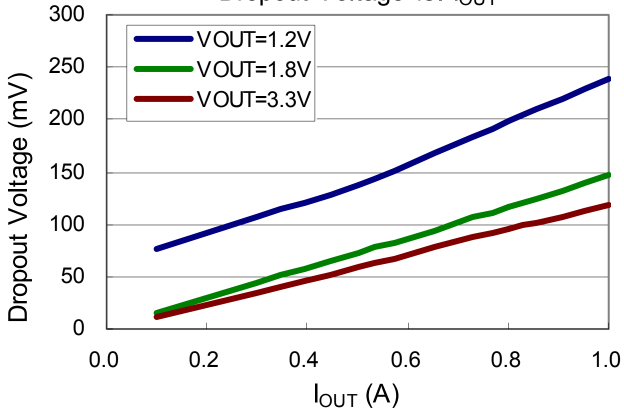




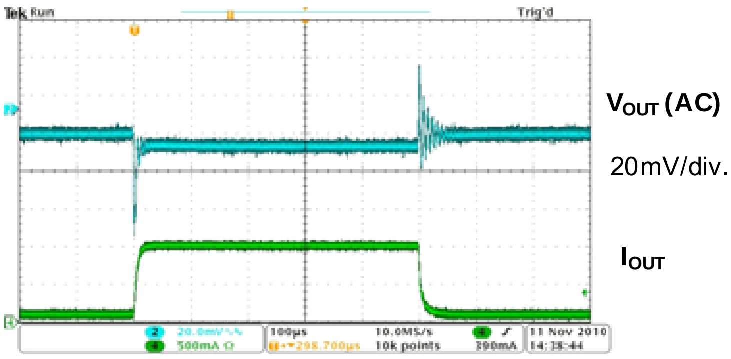
Current Limit vs. V_{IN}



Dropout Voltage vs. I_{OUT}

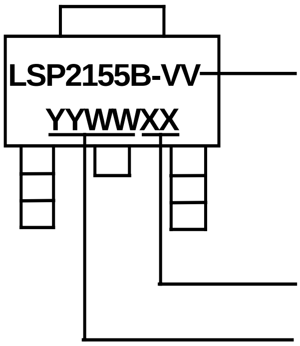


Load Transient
(V_{IN}=1.7V, Load=0.1A to 1A)



Marking Information

SOT223-3L B type

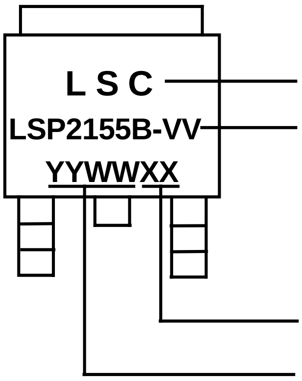


Part Number :
LSP2155B-ADJ : Blank
LSP2155B-12 : 1.2V
LSP2155B-18 : 1.8V
LSP2155B-25 : 2.5V
LSP2155B-33 : 3.3V

Internal Code

Date Code :
YY：Year(09=2009,10=2010,11=2011,12=2012...)
WW：Nth week (01~53)

TO252-3L B type



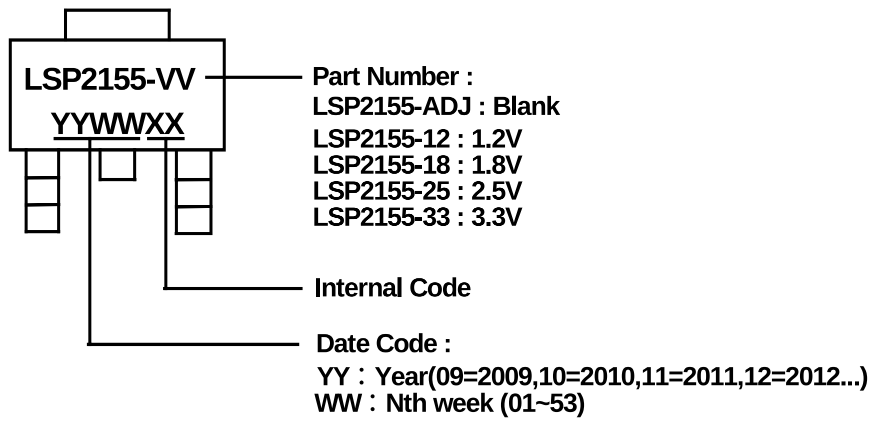
Logo

Part Number :
LSP2155B-ADJ : Blank
LSP2155B-12 : 1.2V
LSP2155B-18 : 1.8V
LSP2155B-25 : 2.5V
LSP2155B-33 : 3.3V

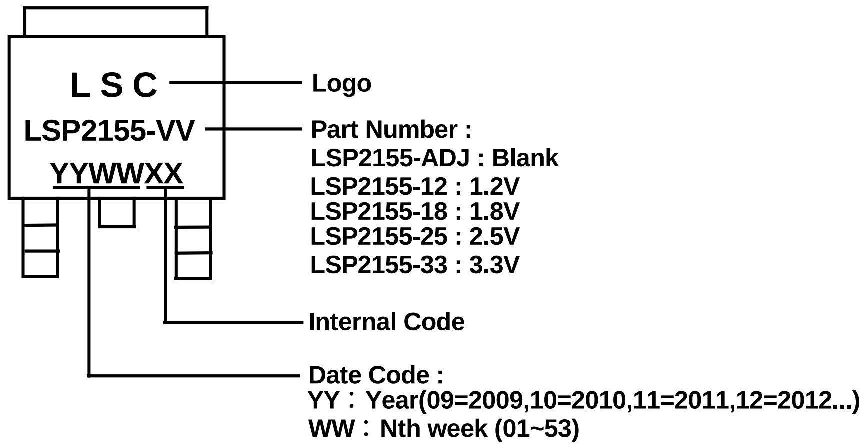
Internal Code

Date Code :
YY：Year(09=2009,10=2010,11=2011,12=2012...)
WW：Nth week (01~53)

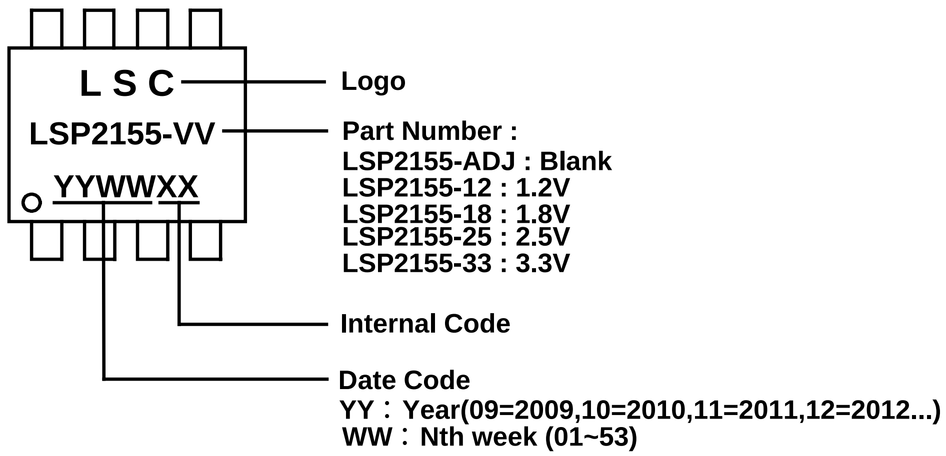
SOT223-3L



TO252-3L

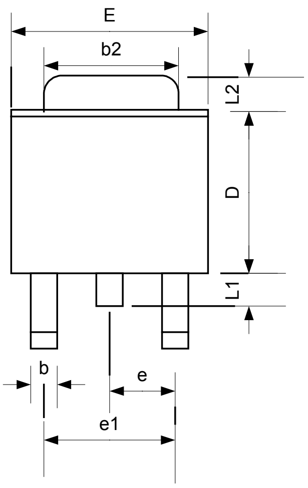


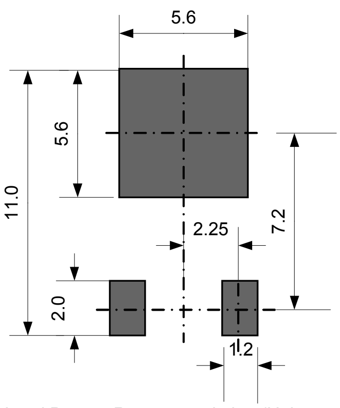
SOP-8L



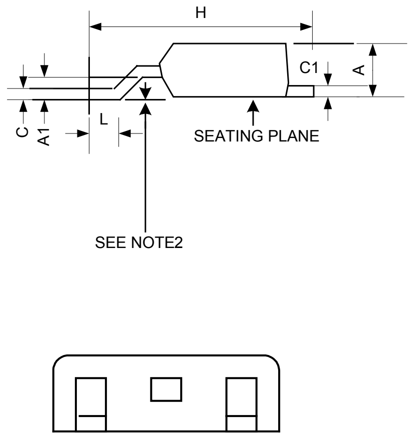
Package Information (All Dimensions in min)

(1) TO252-3L





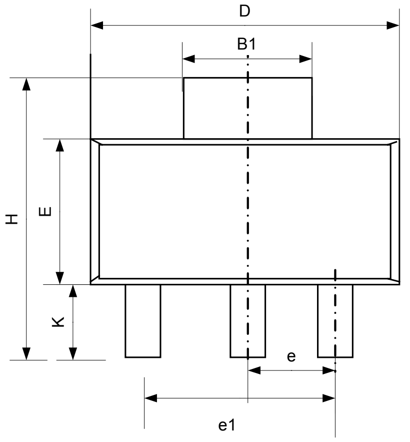
Land Pattern Recommendation (Unit : mm)

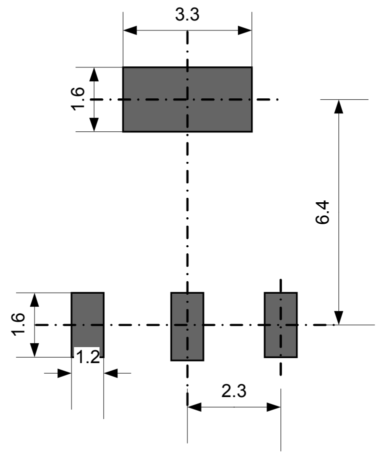


Notes:
1.JEDEC Outline:TO-252 AB
Mils suggested for positive contact at mounting

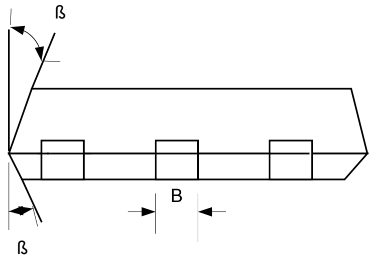
Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min	Nom	Max	Min	Nom	Max
A	2.18	2.29	2.39	0.086	0.090	0.094
A1	1.02	1.15	1.27	0.040	0.045	0.050
b	0.61TYP.			0.024TYP.		
b2	5.20	5.35	5.50	0.205	0.211	0.217
C	0.46	0.52	0.58	0.018	0.020	0.023
C1	0.46	0.52	0.58	0.018	0.020	0.023
D	5.33	5.57	5.80	0.210	0.219	0.228
E	6.35	6.58	6.80	0.250	0.259	0.268
e	2.25BSC.			0.089BSC.		
e1	4.50BSC.			0.177BSC.		
H	9.00	9.70	10.40	0.354	0.382	0.409
L	0.51			0.020		
L1	0.64	0.83	1.02	0.025	0.033	0.040
L2	1.52	1.78	2.03	0.060	0.070	0.080

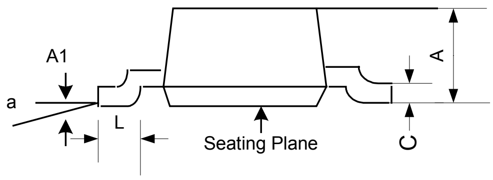
(2) SOT223-3L





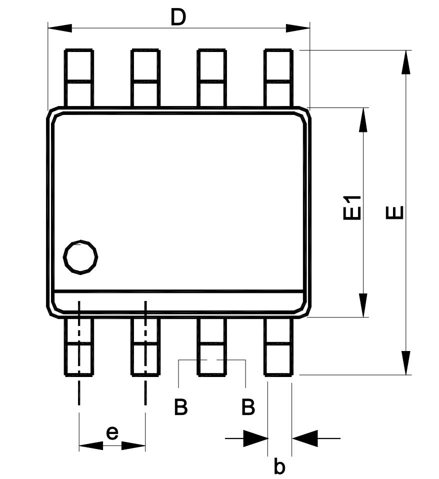
Land Pattern Recommendation (Unit :mm)

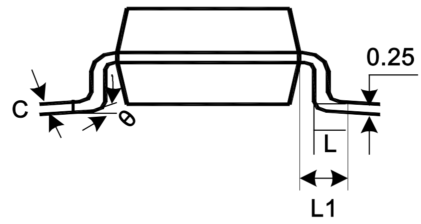


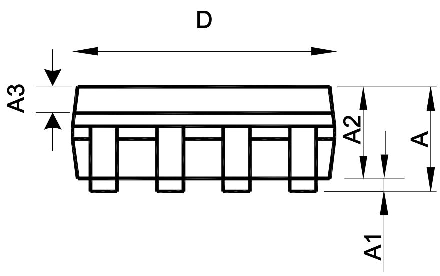


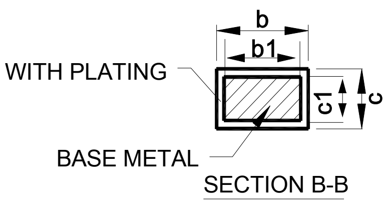
Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min	Nom	Max	Min	Nom	Max
A	1.50	1.65	1.80	0.059	0.065	0.071
A1	0.02	0.05	0.08	0.001	0.002	0.003
B	0.60	0.70	0.80	0.024	0.028	0.031
B1	2.90		3.15(Ref.)	0.114		0.124(Ref.)
c	0.28	0.30	0.32	0.011	0.012	0.013
D	6.30	6.50	6.70	0.248	0.256	0.264
E	3.30	3.50	3.70	0.130	0.138	0.146
e	2.3Basic			0.091Basic		
e1	4.6Basic			0.181Basic		
H	6.70	7.00	7.30	0.264	0.276	0.287
L	0.91	1.00	1.10	0.036	0.039	0.043
K	1.50	1.75	2.00	0.059	0.069	0.079
α	0°	5°	10°	0°	5°	10°
β		13°			13°	

(3) SOP-8L









Symbol	Dimensions In Millimeters		
	Min	Nom	Max
A	-	-	1.75
A1	0.10	-	0.25
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.39	-	0.48
b1	0.38	0.41	0.43
c	0.21	-	0.26
c1	0.19	0.20	0.21
D	4.70	4.90	5.10
E	5.80	6.00	6.20
E1	3.70	3.90	4.10
e	1.27BSC		
L	0.50	-	0.80
L1	1.05BSC		
θ	0	-	8°

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