Liteon Semiconductor Corporation

LSP2159

1.5A Low Voltage Low Dropout CMOS Regulator

FEATURES

- Output Voltage Available in 1.5V, 1.8V, 2.5V, 2.8V, 2.85V, 3.0V, 3.3V, 5.0 V
- Stable with a Ceramic Output Capacitor of 4.7uF or Higher
- Low Dropout Voltage: 600mV at 1.5A
- Typical low Quiescent Current 95uA
- Over Temperature Shutdown
- Short Circuit Protection
- Low Temperature Coefficient
- Standard SOT223-3L, TO252-3L and TO263-3L Packages.

APPLICATIONS

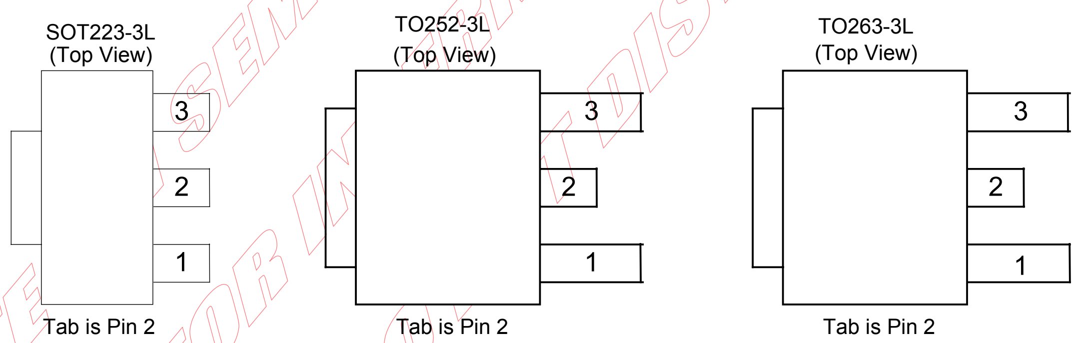
- SATA Power Supply
- LCD TV/ Monitors
- Wireless Devices
- Communication Devices
- Portable Electronics
- Post Regulator for SMPS

GENERAL DESCRIPTION

The LSP2159 is a 1.5A 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 and TO263-3L packages. The fixed output voltage of the LSP2159 is set at the factory and trimmed to ±2%. The LSP2159 is stable with a ceramic output capacitor of 4.7uF 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.

PIN CONFIGURATION

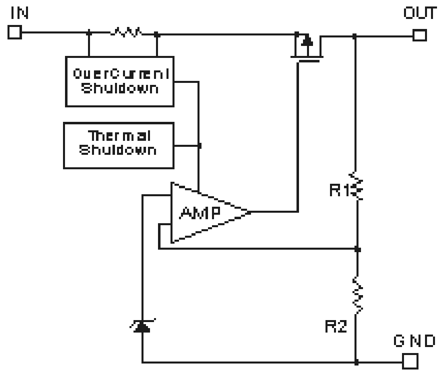


PIN DESCRIPTION

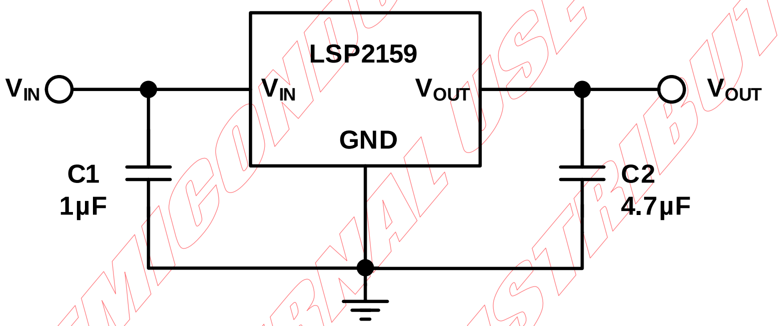
Pin Number		Pin Name	Pin Function
SOT223-3L TO252-3L TO263-3L	**SOT223-3L B type TO252-3L B type TO263-3L B type**		
1	3	VIN	Input
2,TAB	1	GND	Ground
3	2,TAB	VOUT	Output

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.

■ BLOCK DIAGRAM



■ TYPICAL APPLICATIONS CIRCUITS



■ ABSOLUTE MAXIMUM RATINGS

Parameter		Rating	Unit
Input Supply Voltage, EN Pin Voltage		+6	V
Maximum Output Current		PD/(VIN-VO)	
Output Pin Voltage		-0.3 to VIN+0.3	V
Internal Power Dissipation	SOT223-3L	625	mW
	TO252-3L	1200	
	TO263-3L	1600	
Junction to Case Thermal Resistance (θ_{JC})	SOT223-3L	7	°C/ W
	TO252-3L	7	
	TO263-3L	2.7	
Junction to Ambient Thermal Resistance (θ_{JA})	SOT223-3L	160	°C/ W
	TO252-3L	90	
	TO263-3L	45	
Operating temperature		-40 to 85	°C
Operating Junction Temperature		-40 to 125	°C
Storage Temperature		-65 to 150	°C
Maximum Junction Temperature		150	°C
Lead Temperature (Soldering, 5 sec)		300	°C

Note: These are stress ratings only and functional operation is not implied. Exposure to absolute maximum ratings for prolonged time periods may affect device reliability. All voltages are with respect to ground.

1.5A Low Voltage Low Dropout CMOS Regulator

■ RECOMMENDED OPERATING CONDITIONS

Parameter	Rating	Unit
Input Supply Voltage	5.5	V
Operating temperature	-40 to 85	°C
Operating Junction Temperature	-40 to 125	°C

■ ELECTRICAL CHARACTERISTICS

(V_{IN} = V_{OUT} + 0.5V, C_{IN} = 1µF, C_O = 4.7µF, T_A= 25°C unless otherwise specified.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage	V_{IN}		Note1		5.5	V
Output Voltage Accuracy	V_O	I_O= 100mA	-2		+2	%
Short Circuit Current	I_{SC}	V_O < 0.3V			1.0	A
Ground Current	I_{GND}	I_O= 1mA to 1.5A			600	µA
Quiescent Current	I_Q	I_O= 0mA		60	80	µA
Line Regulation	LNR	I_O= 10mA, $V_O \le$ 2.5V V_{IN} =V_O + 0.5V to V_O + 1.5V		0.5	1	%/V
		I_O= 10mA, V_O>2.5V V_{IN} = 3.3V to 5.5V		0.5	1	
Load Regulation	LDR	I_O = 1mA to 1.5A		0.5	2	%/A
Temperature Coefficient	T_C			30		ppm/°C
Over Temperature Shutdown	OTS			150		°C
Over Temperature Hysteresis	OTH			30		°C
Power Supply Ripple Rejection	PSRR	I_O = 100mA, V_o =1.5V, f=100Hz		65		dB
		f= 1KHz		55		
		f= 10KHz		35		
Dropout Voltage	V_{DROP}	I_O = 1.5A, 1.5V ≤ V_O < 2.5V		1300		mV
		2.5V ≤ V_O < 2.8V		800		
		V_O ≥ 2.8V		300		
Output Noise	V_n	f = 10Hz to 100kHz		40		µV_{RMS}

Note 1：The minimum input voltage of the LSP2159 is determined by output voltage and dropout voltage. The minimum input voltage is defined as:

$V_{IN(MIN)}=V_O+V_{DROP}$

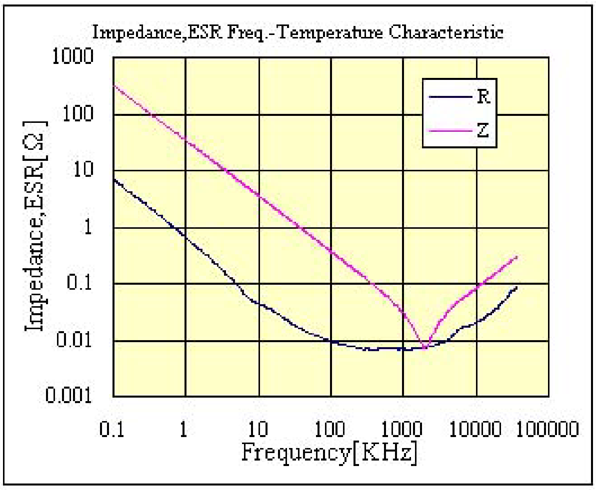
■ APPLICATION INFORMATION

The LSP2159 families of low-dropout (LDO) regulators have several features that allow them to apply to a wide range of applications. The family operates with very low input voltage (1.4V) and low dropout voltage (typically 150mV at full load), making it an efficient stand-alone power supply or post regulator for battery or switch mode power supplies. The 1.5A output current make the LSP2159 family suitable for powering many microprocessors and FPGA supplies. The LSP2159 family also has low output noise (typically 40µVRMS with 4.7µF output capacitor), making it ideal for use in telecom equipment.

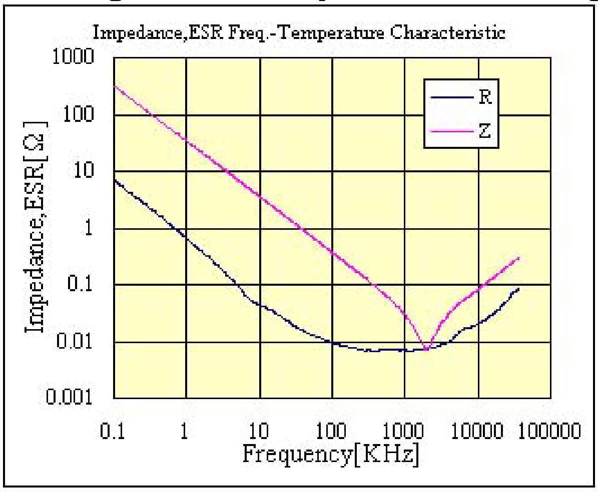
External Capacitor Requirements

A 4.7µF or larger ceramic input bypass capacitor, connected between VIN and GND and located close to the LSP2159, is required for stability. A 1.0uF minimum value capacitor from VO to GND is also required. To improve transient response, noise rejection, and ripple rejection.

1.5A Low Voltage Low Dropout CMOS Regulator



(1) 1 uF Capacitor for input



(2) 4.7uF Capacitor for output

Regulator Protection

The LSP2159 features internal current limiting, thermal protection and short circuit protection. During normal operation, the LSP2159 limits output current to about 3A. 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 150°C, thermal-protection circuitry will shut down. Once the device has cooled down to approximately 30°C below the high temp trip point, regulator operation resumes. The short circuit current of the LSP2159 is about 1A when its output pin is shorted to ground.

Thermal Information

The amount of heat that an LDO linear regulator generates is:

$P_D=(V_{IN}-V_O)I_O$.

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 heatsinks. 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:

$$P_{D(MAX)} = \left(V_{I(avg)} - V_{O(avg)}\right)I_{O(avg)} + V_{I(avg)}I_{(Q)}$$

Where:

$V_{I\,(avg)}$ is the average input voltage.

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

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

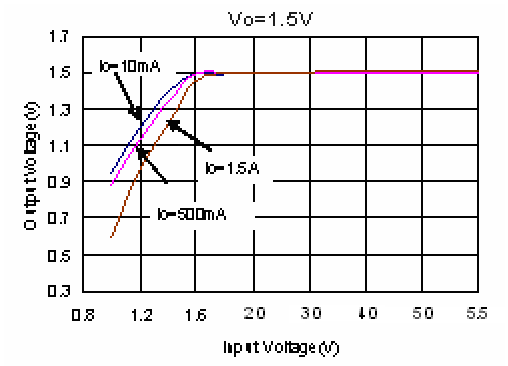
$I_{(Q)}$ is the quiescent current.

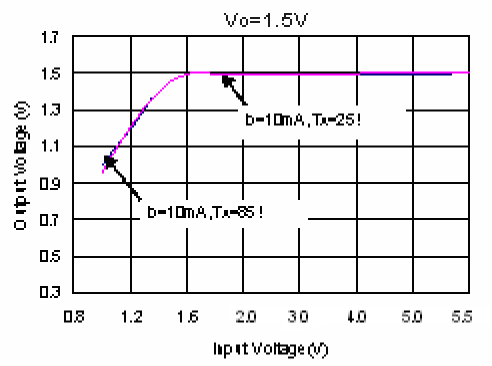
For most LDO regulators, the quiescent current is insignificant compared to the average output current; therefore, the term $V_{I(avg)}\ xI_{(Q)}$ can be neglected. The operating junction temperature is computed by adding the ambient temperature (T_A) and the increase in temperature due to the regulator's 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 heatsink ($R_{\theta CS}$), and the heatsink to ambient ($R_{\theta SA}$). Thermal resistances are measures of how effectively an object dissipates heat. Typically, the larger the devices, the more surface area available for power dissipation so that the object's thermal resistance will be lower.

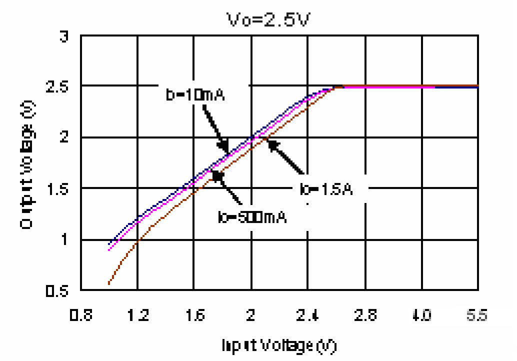
1.5A Low Voltage Low Dropout CMOS Regulator

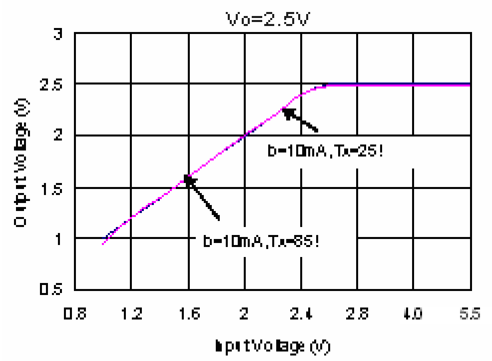
■ TYPICAL PERFORMANCE CHARACTERISTICS

1. Output Voltage vs. Input Voltage

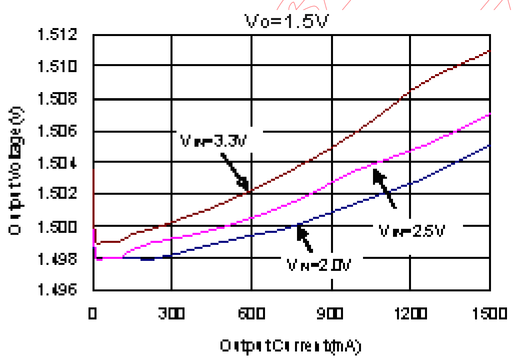


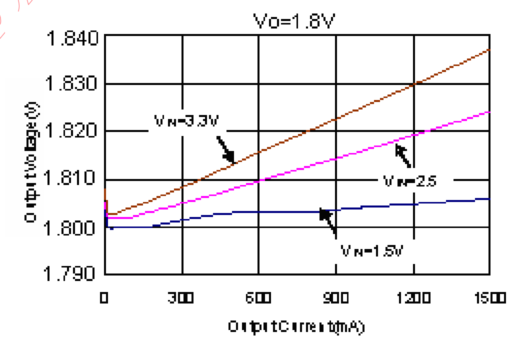




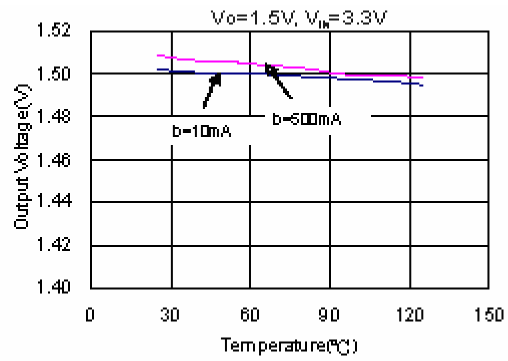


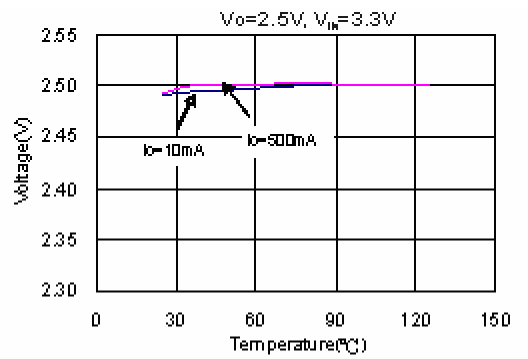
2. Output Voltage vs. Output current





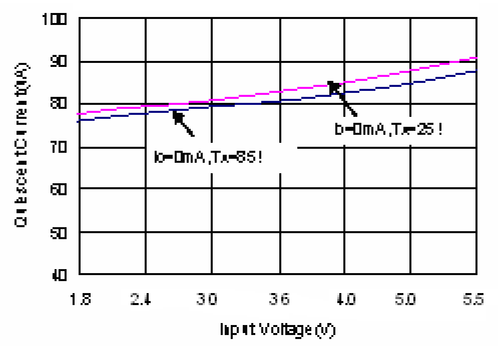
3. Output Voltage vs. Temperature



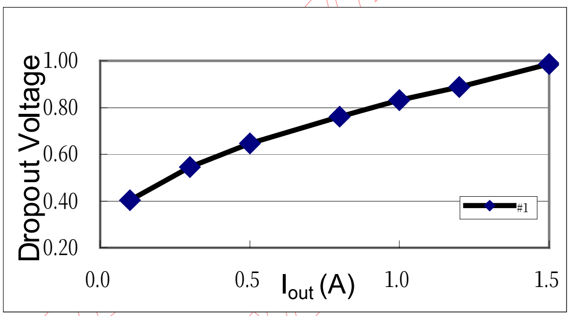


■ TYPICAL PERFORMANCE CHARACTERISTICS（CONTINUED）

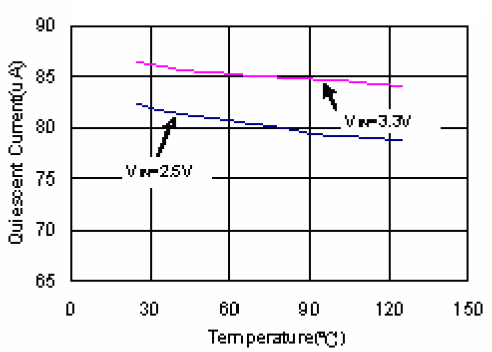
4. Quiescent Current vs. Input Voltage



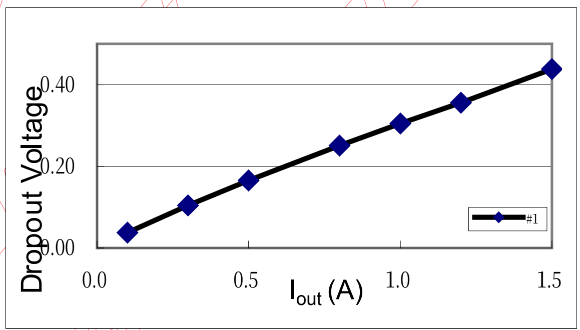
8. Dropout Voltage vs. Output Current (1.8V)



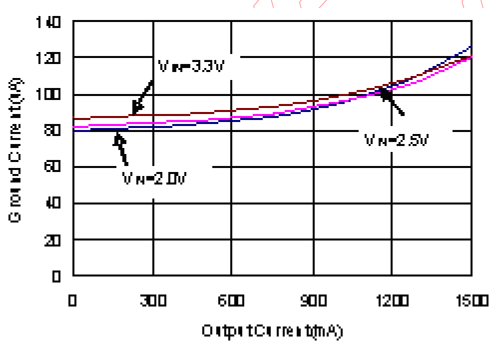
5. Quiescent Current vs. Temperature



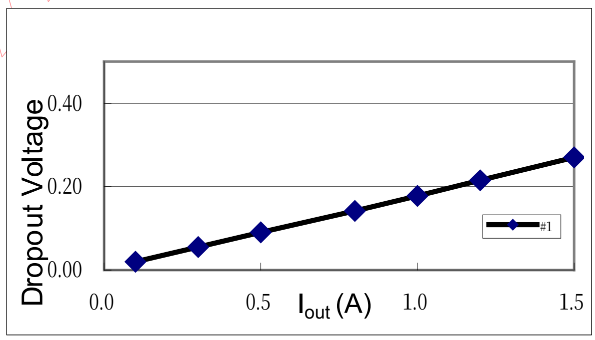
9. Dropout Voltage Output Current (2.5V)



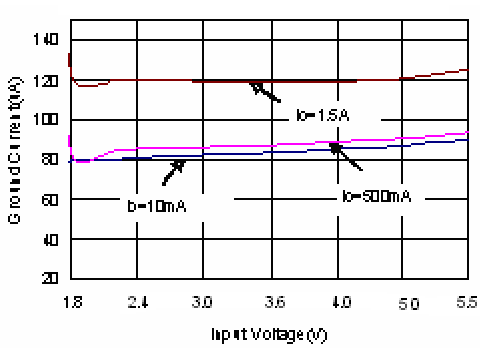
6. Ground Current vs. Output Current



10. Dropout Voltage Output Current (3.3V)

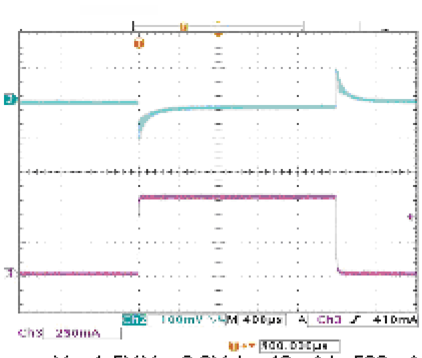


7. Ground Current vs. Input Voltage

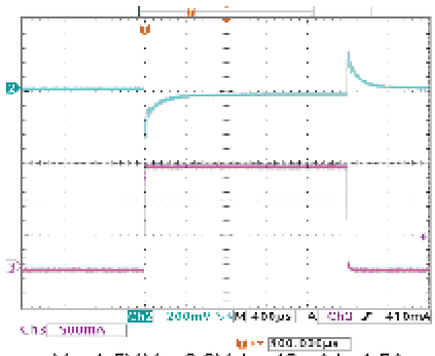


■ TYPICAL PERFORMANCE CHARACTERISTICS（CONTINUED）

11. Load Transient Response

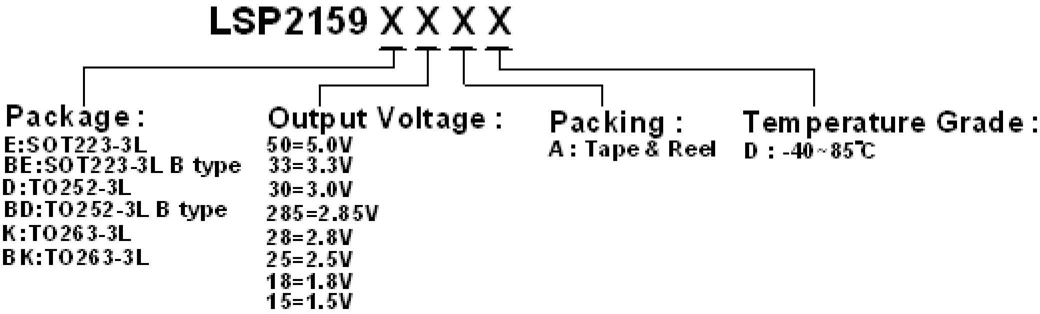


V_o=1.5V,V_{IN}=3.3V, Io=10mA to 500mA



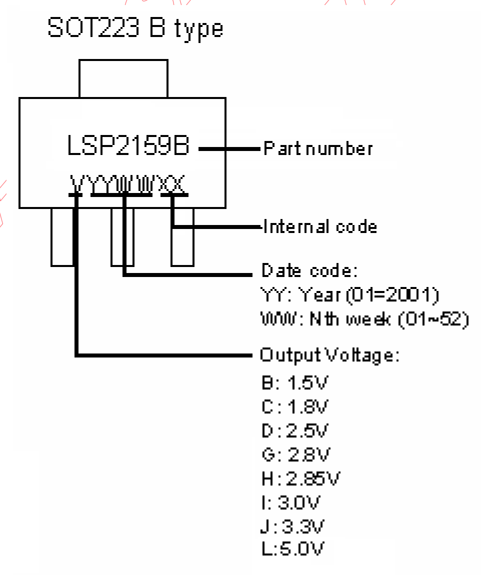
V_o=1.5V,V_{IN}=3.3V, Io=10mA to 1.5A

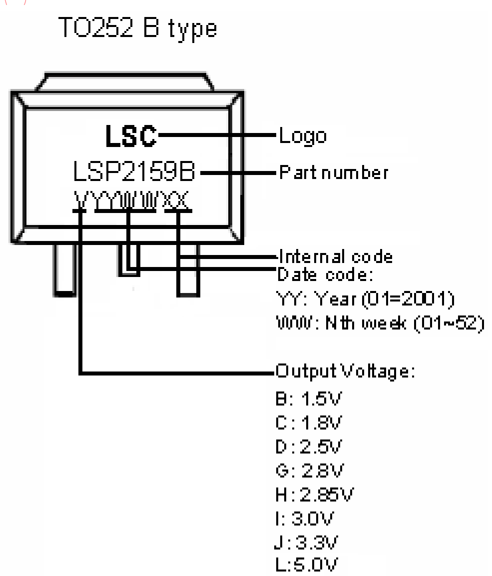
■ ORDERING INFORMATION



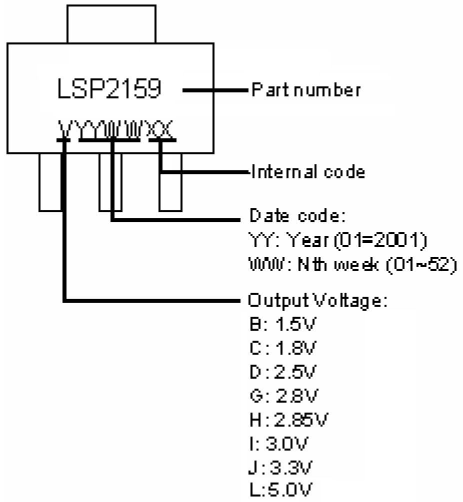
Device	Package Code	Package	Tape & Reel		Temperature
			Quantity	Part Number Suffix	
LSP2159EXXAD	E	SOT223-3L	2500	A	D : -40℃~85℃
LSP2159BEXXAD	E	SOT223-3L	2500	A	D : -40℃~85℃
LSP2159DXXAD	D	TO252-3L	2500	A	D : -40℃~85℃
LSP2159BDXXAD	D	TO252-3L	2500	A	D : -40℃~85℃
LSP2159KXXAD	K	TO263-3L	800	A	D : -40℃~85℃
LSP2159BKXXAD	K	TO263-3L	800	A	D : -40℃~85℃

■ MARKING INFORMATION

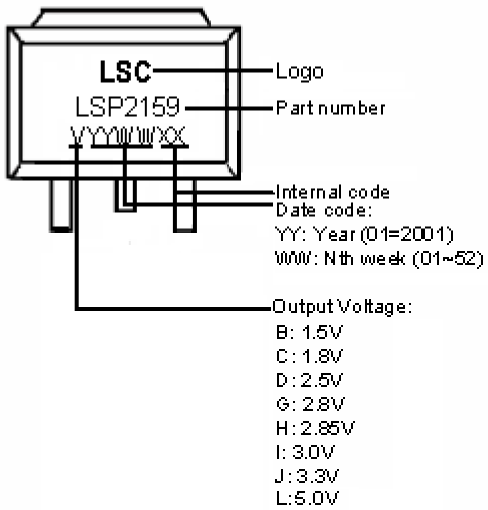




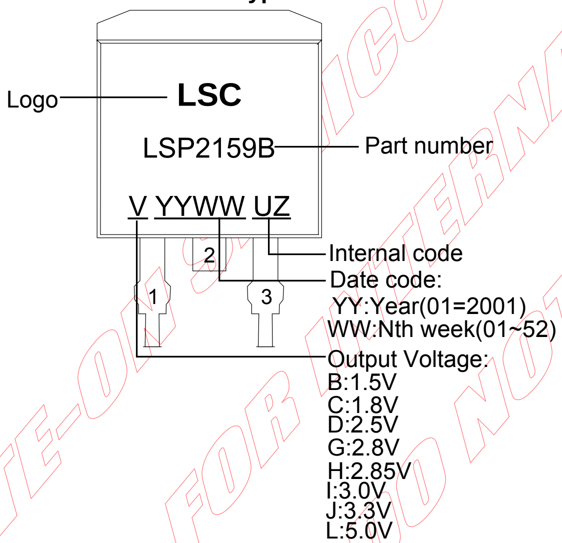
SOT223 type



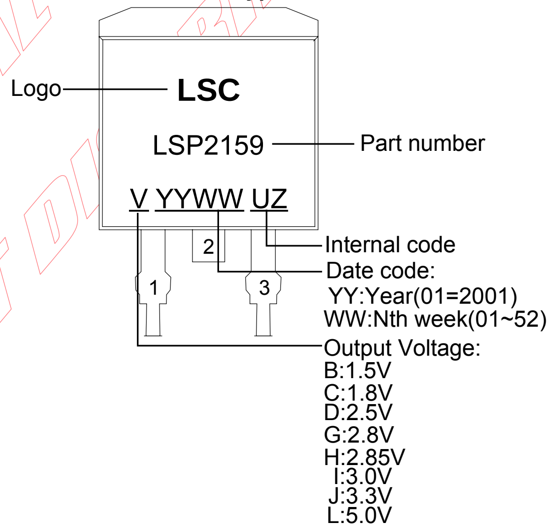
TO252 type



TO263 B type



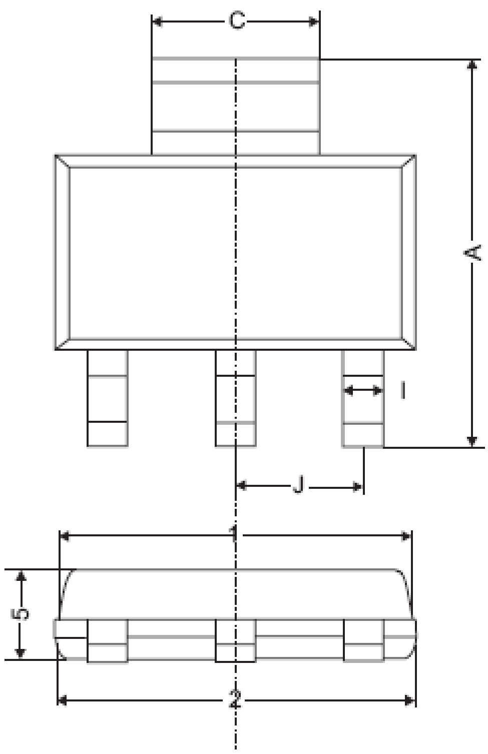
TO263 type



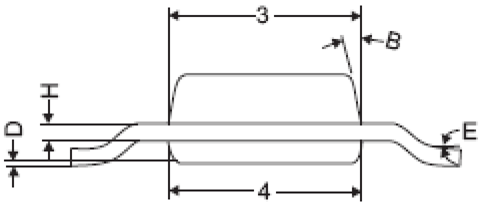
■ PACKAGE INFORMATION

(1). SOT223-3L

SOT-223

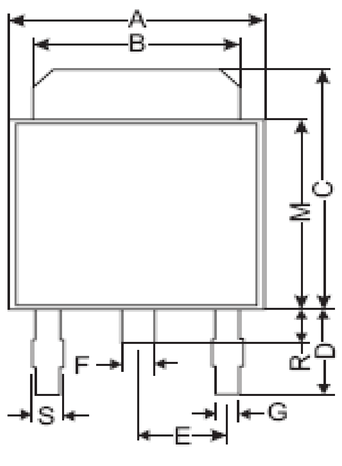


Dimensions(Millimeter)			
Symbol	MIN	NOM	MAX
A	6.70	7.00	7.30
C	2.90	3.00	3.10
D	0.02	0.06	0.10
E	0º	5º	10º
I	0.60	0.70	0.80
H	0.25	0.30	0.35
B	13º TYP		
J	2.30 REF.		
1	6.30	6.50	6.70
2	6.30	6.50	6.70
3	3.30	3.50	3.70
4	3.30	3.50	3.70
5	1.40	1.60	1.80

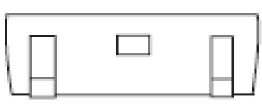


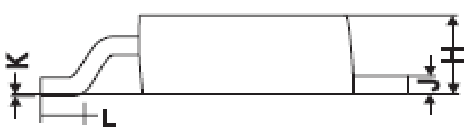
(2).TO252-3L

To-252

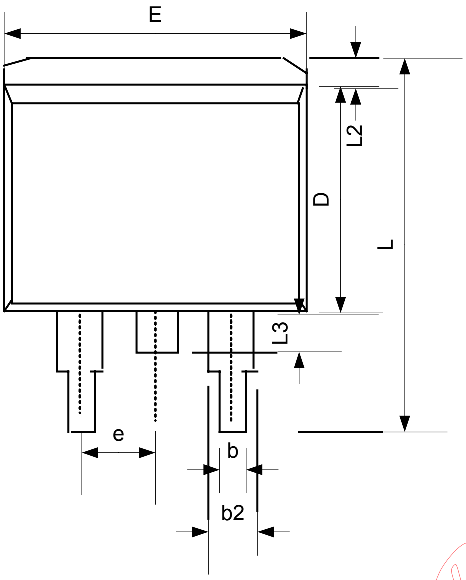


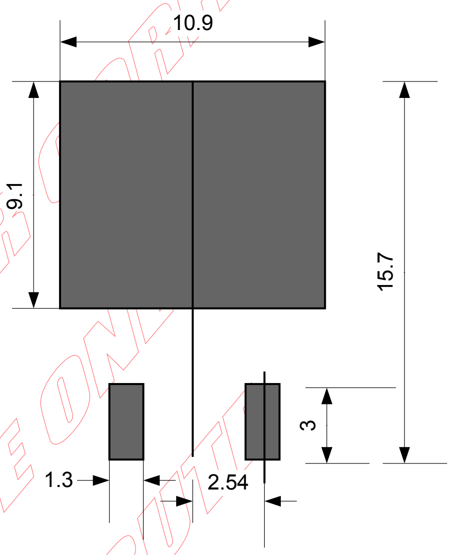
Dimensions(Millimeter)			
Symbol	MIN	NOM	MAX
A	6.40	6.60	6.80
B	5.20	5.35	5.50
C	6.80	7.00	7.20
D	2.20	2.50	2.80
E	2.30 REF.		
F	0.70	0.80	0.90
S	0.60	0.75	0.90
G	0.50	0.60	0.70
H	2.20	2.30	2.40
J	0.45	0.50	0.55
K	0	0.07	0.15
L	0.90	1.20	1.50
M	5.40	5.60	5.80
R	0.80	1.00	1.20



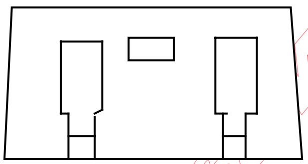


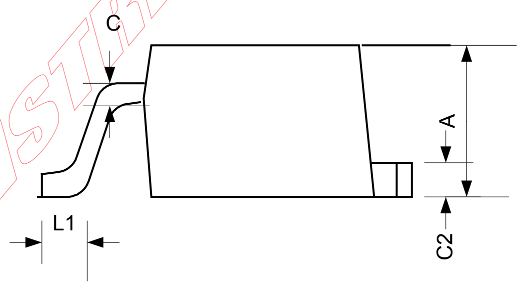
(2).TO263-3L





Land Pattern Recommendation (Unit : mm)





Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	4.06	4.45	4.83	0.160	0.175	0.190
b	0.51	0.75	0.99	0.020	0.030	0.039
b2	1.14	1.27	1.40	0.045	0.050	0.055
C	0.38TYP.			0.015TYP.		
C2	1.14	1.27	1.40	0.045	0.050	0.055
D	8.65	9.15	9.65	0.341	0.360	0.380
E	9.65	9.97	10.29	0.380	0.393	0.405
e	2.54BSC.			0.100BSC.		
L	14.61	15.24	15.88	0.575	0.600	0.625
L1	2.28	2.54	2.80	0.090	0.100	0.110
L2		1.30	2.92		0.051	0.115
L3	1.27	1.52	1.78	0.050	0.060	0.070

Important Notice and Disclaimer

LSC reserves the right to make changes to this document and its products and specifications at any time without notice. Customers should obtain and confirm the latest product information and specifications before final design, purchase or use.

LSC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does LSC assume any liability for application assistance or customer product design. LSC does not warrant or accept any liability with products which are purchased or used for any unintended or unauthorized application.

No license is granted by implication or otherwise under any intellectual property rights of LSC.

LSC products are not authorized for use as critical components in life support devices or systems without express written approval of LSC.