

Product Summary

The GPL6388 series are a group of positive voltage regulators manufactured by CMOS technologies with low power consumption and low dropout voltage, which provide large output currents even when the difference of the input-output voltage is small. The GPL6388 series can deliver 150mA output current and allow an input voltage as high as 50V. The series are very suitable for the battery-powered equipments, such as RF applications and other systems requiring a quiet voltage source.

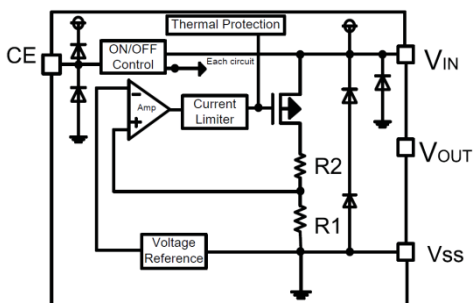
Features

- Low Quiescent Current: 3 μ A
- Operating Voltage Range: 2.5V~50V
- Output Current: 150mA
- Low Dropout Voltage:
500mV@50mA($V_{OUT}=3.3V$)
- Output Voltage: 1.2~ 12.0V
- High Accuracy: $\pm 2\%/\pm 1\%$ (Typ.)
- High Power Supply Rejection Ratio:
80dB@1kHz
- Low Output Noise:
27x $V_{OUT}\mu V_{RMS}$ (10Hz~100kHz)
- Excellent Line and Load Transient Response
- Built-in Current Limiter, Short-Circuit Protection
- Over-Temperature Protection

Applications

- Cordless Phones
- Radio control systems
- Laptop, Palmtops and PDAs
- Single-lens reflex DSC
- PC peripherals with memory
- Wireless Communication Equipment
- Portable Audio Video Equipment
- Car Navigation Systems
- LAN Cards
- Ultra-low Power Microcontrollers

Block Diagram



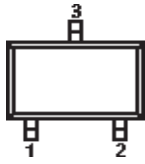
Order Information

GPL6388V①②

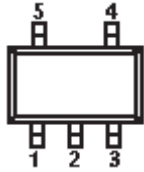
Designator	Description
①	Output Voltage e.g. 3.3V=33
②	Package: SOT-23-3L=K3 SOT-23-5L=K5 SOT-89-3L=KE SOT-89-5L=KT SOT-223=DT

Pin Configuration

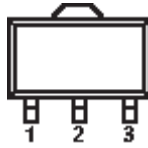
SOT-23-3L



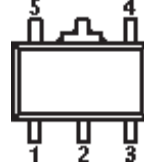
SOT-23-5L



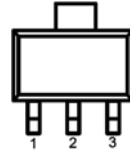
SOT-89-3L



SOT-89-5L



SOT-223



PIN NUMBER			PIN NAME	FUNCTION
SOT-23-3L	SOT-89-3L	SOT223		
1	1	1	V _{SS}	Ground
2	3	3	V _{OUT}	Output
3	2	2	V _{IN}	Power input

SOT-23-5L

PIN NUMBER	SYMBOL	FUNCTION
1	V _{IN}	Power Input Pin
2	V _{SS}	Ground
3	CE	Chip Enable Pin
4	NC	No Connection
5	V _{OUT}	Output Pin

SOT-89-5L

PIN NUMBER		SYMBOL	FUNCTION
1	5	V _{OUT}	Output Pin
2	2	V _{SS}	Ground
3	4	NC	No Connection
4	3	CE	Chip Enable Pin
5	1	V _{IN}	Power Input Pin

Absolute Maximum Ratings¹⁾ ($T_a=25^{\circ}\text{C}$, unless otherwise noted)

PARAMETER		SYMBOL	RATINGS	UNITS
Input Voltage ⁽²⁾		V_{IN}	-0.3~65	V
Output Voltage ⁽²⁾		V_{OUT}	-0.3~15	V
CE Pin Voltage ⁽²⁾		V_{CE}	-0.3~ $V_{IN}+0.3$	V
Output Current		I_{OUT}	400	mA
Power Dissipation	SOT-23-3L/5L	P_D	400	mW
	SOT-89-3L/5L		600	mW
	SOT-223		800	mW
Operating Junction Temperature Range		T_j	-40~125	$^{\circ}\text{C}$
Storage Temperature		T_{stg}	-40~125	$^{\circ}\text{C}$
Lead Temperature(Soldering, 10 sec)		T_{solder}	260	$^{\circ}\text{C}$
ESD rating ⁽³⁾	Human Body Model-(HBM)		2	kV
	Machine Model- (MM)		200	V

(1) Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) All voltages are with respect to network ground terminal.

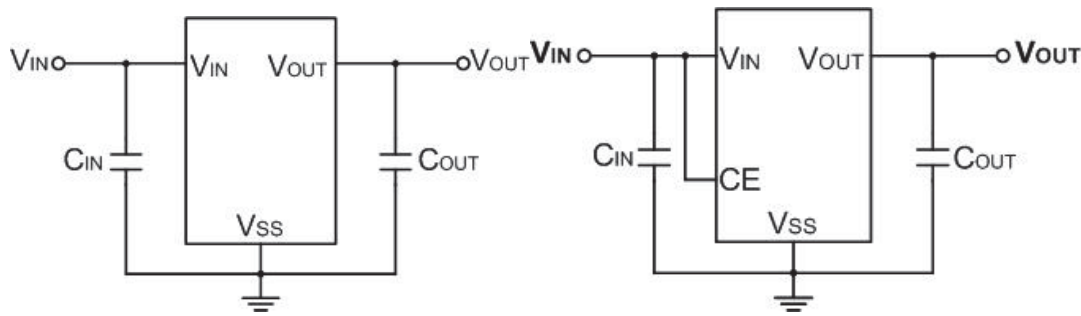
(3) ESD testing is performed according to the respective JEDEC standard. The human body model is a 100 pF capacitor discharged through a 1.5k Ω resistor into each pin. The machine model is a 200pF capacitor discharged directly into each pin.

Recommended Operating Conditions

PARAMETER	MIN.	NOM.	MAX.	UNITS
Supply voltage at V_{IN}	2.5		50	V
Operating junction temperature range, T_j	-40		125	$^{\circ}\text{C}$
Operating free air temperature range, T_A	-40		85	$^{\circ}\text{C}$

Electrical Characteristics ($V_{IN}=V_{OUT}+2V$, $C_{IN}=C_{OUT}=1\mu F$, $T_A=25^\circ C$, unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	
Input Voltage	V_{IN}		2.5	—	50	V	
Output Voltage Range	V_{OUT}		1.2	—	12	V	
DC Output Accuracy		$I_{OUT}=1mA$	-2	—	2	%	
			-1	—	1	%	
Dropout Voltage	V_{dif}	$I_{OUT}=50mA, V_{OUT}=3.3V$	—	500	—	mV	
Supply Current	I_{SS}	$I_{OUT}=0A$	$V_{OUT}\leq 5.0V$	—	3	6	μA
			$V_{OUT}>5.0V$		5	10	μA
Standby Current	I_{STBY}	$CE = V_{SS}$		0.1	0.5	μA	
Line Regulation	$\frac{\Delta V_{OUT}}{V_{OUT} \times \Delta V_{IN}}$	$I_{OUT}=10mA$ $V_{OUT}+1V \leq V_{IN} \leq 18V$	—	0.01	0.3	%/V	
Load Regulation	ΔV_{OUT}	$V_{IN}=V_{OUT}+1V$, $1mA \leq I_{OUT} \leq 100mA$	—	10	—	mV	
Temperature Coefficient	$\frac{\Delta V_{OUT}}{V_{OUT} \times \Delta T_A}$	$I_{OUT}=10mA$, $-40^\circ C < T_A < 125^\circ C$		50		ppm	
Output Current Limit	I_{LIM}	$V_{OUT}=0.5 \times V_{OUT(Normal)}$, $V_{IN}=5V$	150	250		mA	
Short Current	I_{SHORT}	$V_{OUT}=V_{SS}$	—	20	—	mA	
Power Supply Rejection Ratio	PSRR	$I_{OUT}=50mA$	100Hz		75		dB
			1kHz	—	80	—	
			10kHz	—	60	—	
			100kHz	—	45	—	
Output Noise Voltage	V_{ON}	BW=10Hz to 100kHz	—	$27 \times V_{OUT}$	—	μV_{RMS}	
Thermal Shutdown Temperature	T_{SD}	—	—	170	—	$^\circ C$	
Thermal Shutdown Hysteresis	ΔT_{SD}	—	—	20	—	$^\circ C$	
CE "High" Voltage	$V_{CE"H"}$		1.5		V_{IN}	V	
CE "Low" Voltage	$V_{CE"L"}$				0.3	V	

Typical Application Circuit

External Components List

Symbol	Description
C_{IN}	1.0 μ F or more
C_{OUT}	1.0 μ F or more, 10 μ F is recommended

Application Information
Selection of Input/ Output Capacitors

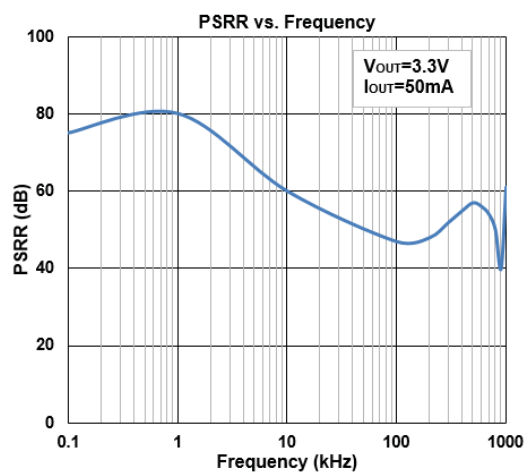
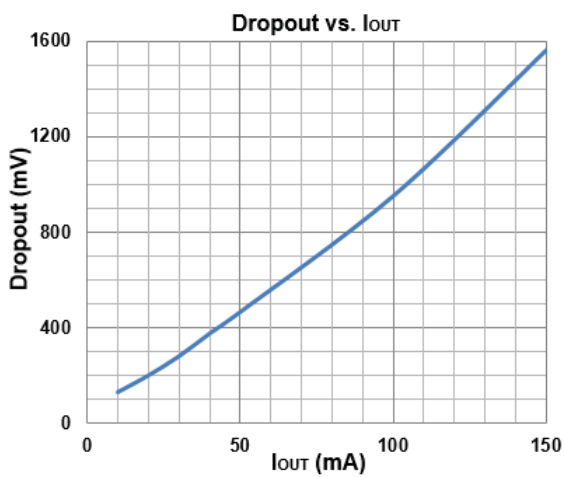
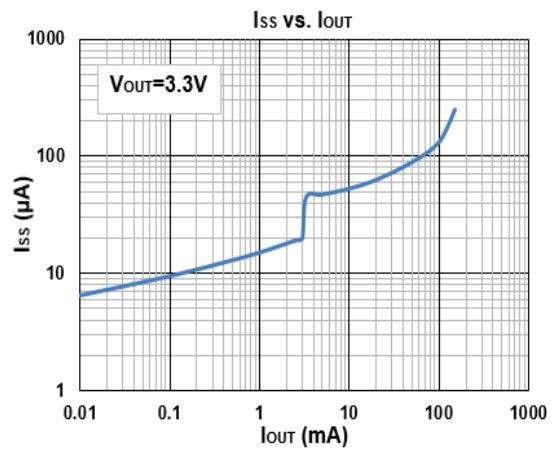
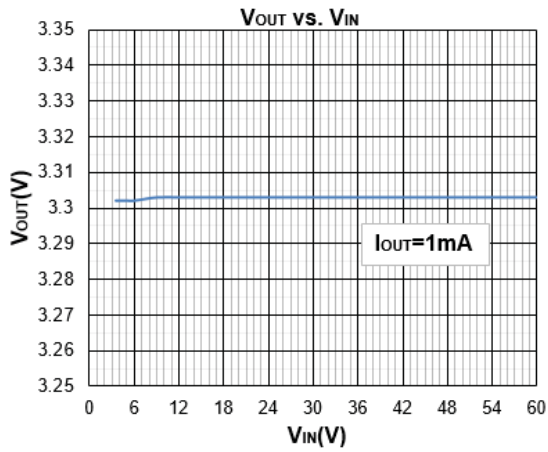
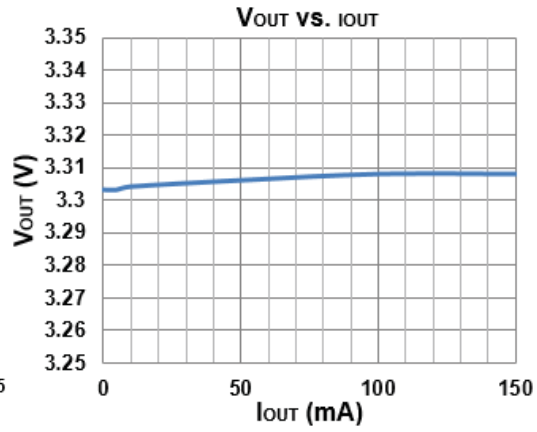
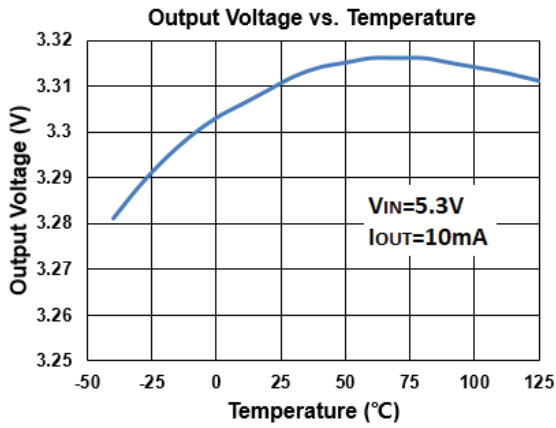
Phase compensation is provided to secure operation even when the load current is varied. For this purpose, use a 1.0 μ F or more output capacitor (C_{OUT}) with good frequency characteristics and proper ESR (Equivalent Series Resistance). Connect a 1.0 μ F or more input capacitor (C_{IN}) between the V_{IN} pin and the V_{SS} pin as close as possible to the pins. The value of the output overshoot or undershoot transient response varies depending on the value of the output capacitor. When selecting the output capacitor, perform sufficient evaluation, including evaluation of temperature characteristics, on the actual device.

In the design of portable devices the ceramic capacitors are often chosen because of their small size, low equivalent series resistance (ESR) and high RMS current capability. Also, designers have been looking to ceramic capacitors due to shortages of tantalum capacitors.

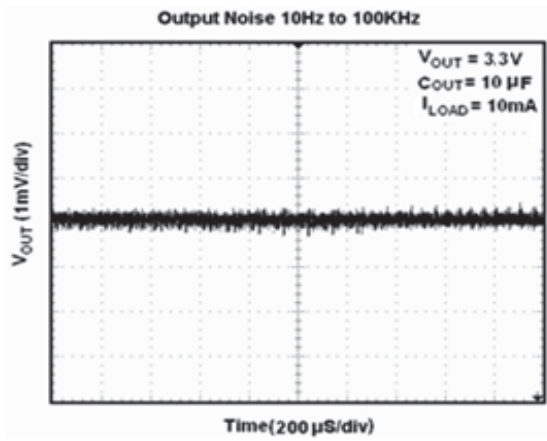
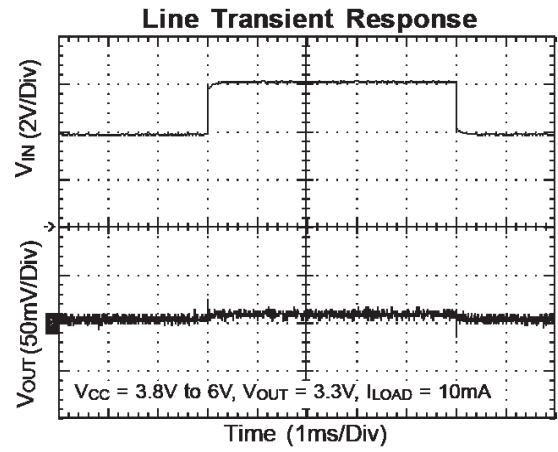
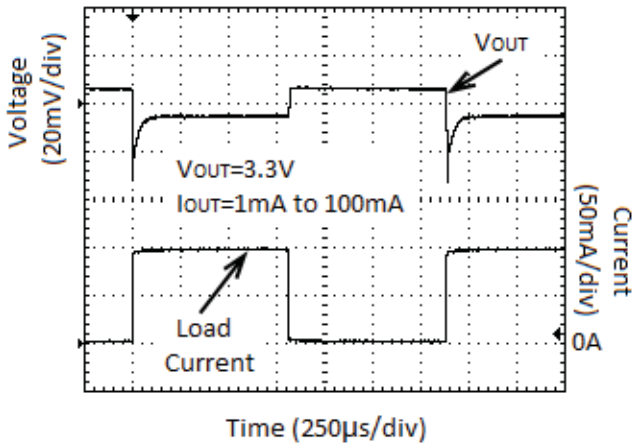
Unfortunately, using ceramic capacitors for input filtering can cause problems. Applying a voltage step to a ceramic capacitor causes a large current surge that stores energy in the inductances of the power leads. A large voltage spike is created when the stored energy is transferred from these inductances into the ceramic capacitor. These voltagespikes can easily be twice the amplitude of the input voltage step.

Many types of capacitors can be used for input bypassing, however, caution must be exercised when using multilayer ceramic capacitors (MLCC). Because of the self-resonant and high Q characteristics of some types of ceramic capacitors, high voltage transients can be generated under some start-up conditions, such as connecting the LDO input to a live power source. Adding a 3 Ω resistor in series with an X5R ceramic capacitor will minimize start-up voltage transients.

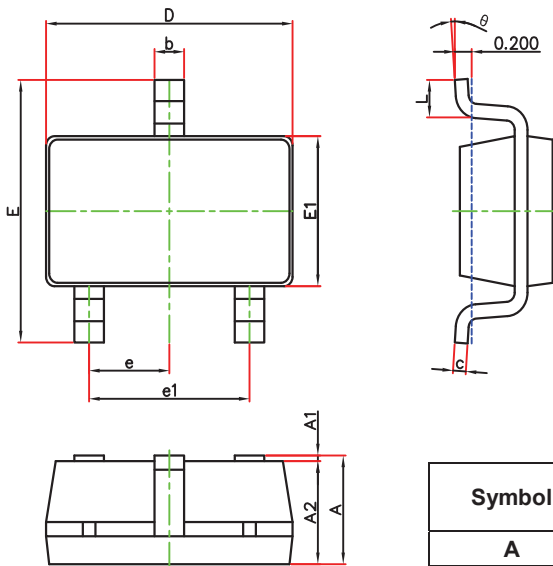
Typical Performance Characteristics



Typical Performance Characteristics

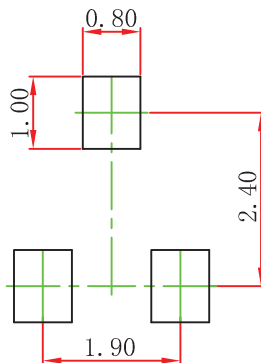


SOT-23-3L Package Outline Dimensions



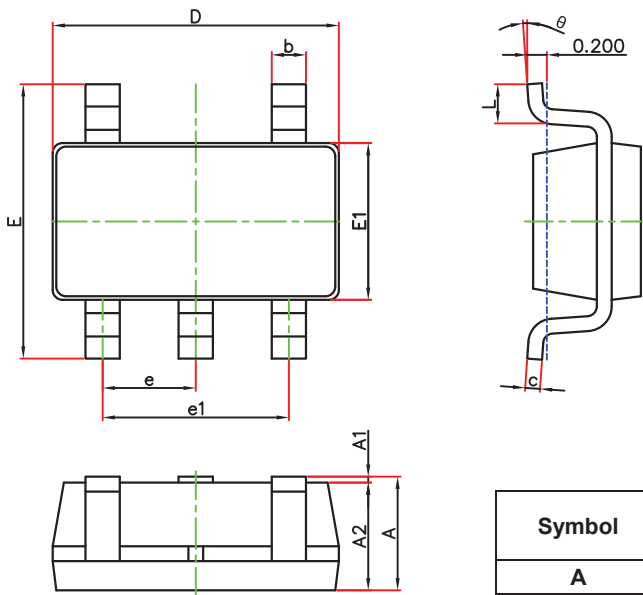
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

SOT-23-3L Suggested Pad Layout



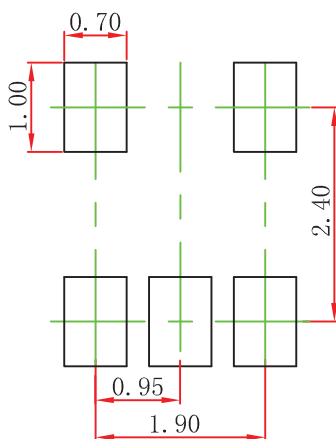
- Note:
1. Controlling dimension: in millimeters.
 2. General tolerance: $\pm 0.05\text{mm}$.
 3. The pad layout is for reference purposes only.

SOT-23-5L Package Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

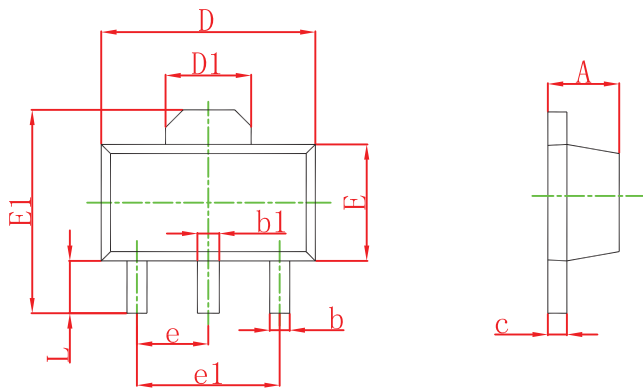
SOT-23-5L Suggested Pad Layout



Note:

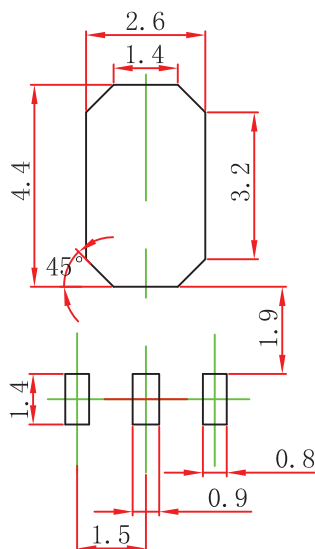
1. Controlling dimension: in millimeters.
2. General tolerance: $\pm 0.05\text{mm}$.
3. The pad layout is for reference purposes only.

SOT-89-3L Package Outline Dimensions



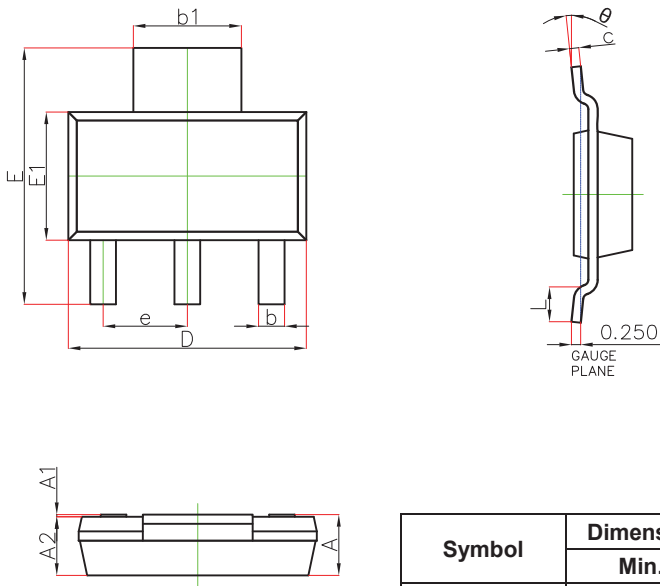
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.197
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF		0.061 REF	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP		0.060 TYP	
e1	3.000 TYP		0.118 TYP	
L	0.900	1.200	0.035	0.047

SOT-89-3L Suggested Pad Layout



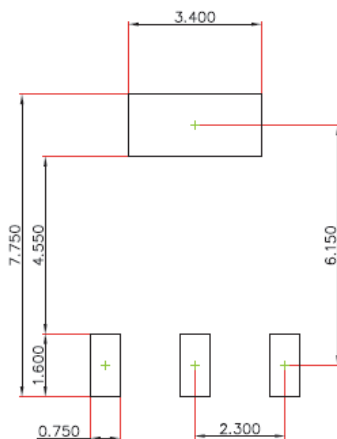
- Note:
1. Controlling dimension: in millimeters.
 2. General tolerance: $\pm 0.05\text{mm}$.
 3. The pad layout is for reference purposes only.

SOT-223 Package Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	—	1.800	—	0.071
A1	0.020	0.100	0.001	0.004
A2	1.500	1.700	0.059	0.067
b	0.660	0.840	0.026	0.033
b1	2.900	3.100	0.114	0.122
c	0.230	0.350	0.009	0.014
D	6.300	6.700	0.248	0.264
E	6.700	7.300	0.264	0.287
E1	3.300	3.700	0.130	0.146
e	2.300(BSC)		0.091(BSC)	
L	0.750	—	0.030	—
θ	0°	10°	0°	10°

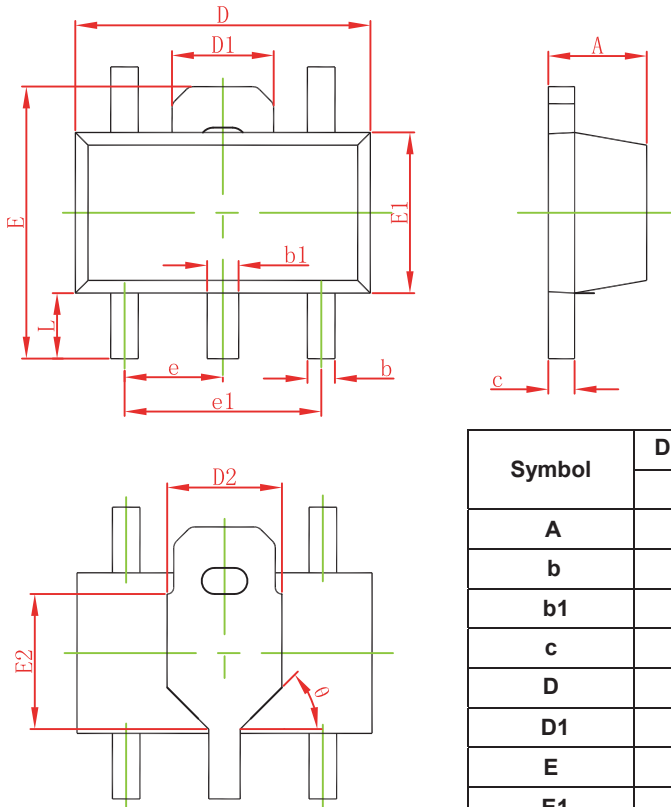
SOT-223 Suggested Pad Layout



Note:

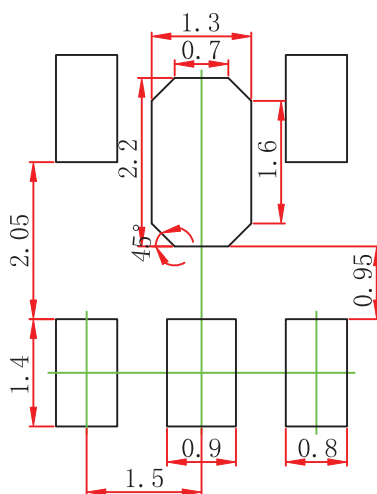
1. Controlling dimension: in millimeters.
2. General tolerance: ± 0.050 mm.
3. The pad layout is for reference purposes only.

SOT-89-5L Package Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.360	0.560	0.014	0.022
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.400	1.800	0.055	0.071
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500TYP		0.060TYP	
e1	2.900	3.100	0.114	0.122
L	0.900	1.100	0.035	0.043

SOT-89-5L Suggested Pad Layout



Note:

1. Controlling dimension: in millimeters.
2. General tolerance: $\pm 0.05\text{mm}$.
3. The pad layout is for reference purposes only.