1.5A Fixed Voltage LDO Linear Regulator

General Description

The EC8815 series is a CMOS low-dropout linear regulator that operates in the input voltage range from +2.4V to +7.0V and delivers 1.5A output current.
The EC8815 is available fixed output voltage type is preset at an internally trimmed voltage 1.8V, 2.5V, or 3.3V. Other options 1.0V, 1.2V, 1.5V, 2.85V, 3.0V and 3.6V are available by special order only.
The EC8815 consists of a 0.95V bandgap reference, an error amplifier, and a P-channel pass transistor. Other features include short-circuit protection and thermal shutdown protection. The EC8815 series devices are available in SOT-223,TO-252, and TO-263 packages.

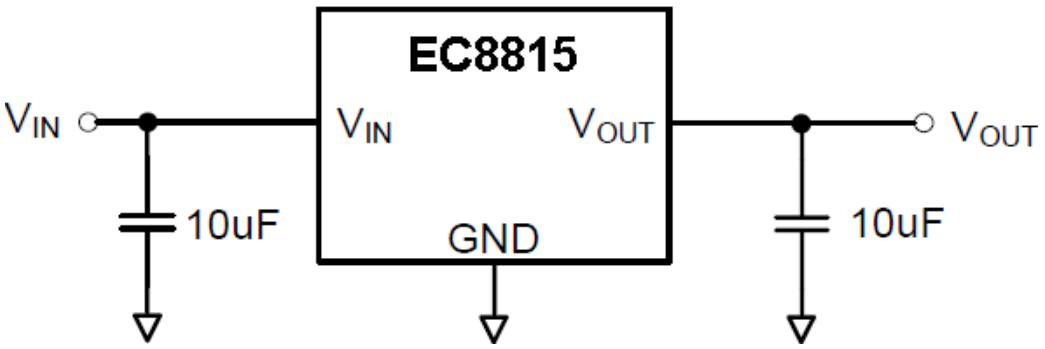
Applications

- Active SCSI Terminators
- High Efficiency Linear Regulators
- Monitor Microprocessors
- Low Voltage Micro-Controllers
- Post Regulator for Switching Power

Features

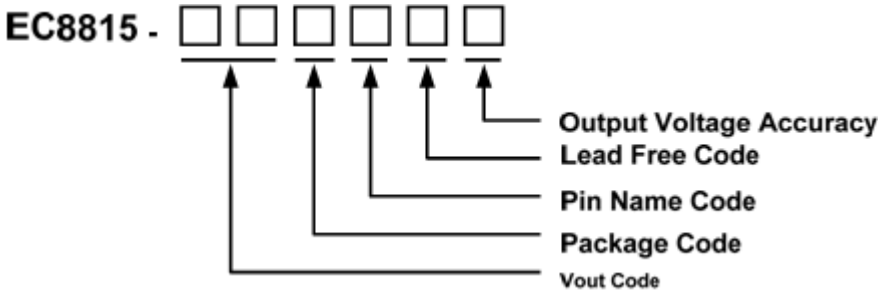
- Operating Voltage Range：+2.4V to +7.0V
- Output Voltages：+1.0V to +5.0V (0.1V Step)
- Maximum Output Current：1.5A
- Dropout Voltage：900mV @ 1.5A(Typ.)
- 35 uS Fast Response when Power-on
- Low Current Consumption：40μA (Typ.)
- ±2% Output Voltage Accuracy, $V_{OUT} \geqq 1.8V$
- Low ESR Capacitor Compatible
- High Ripple Rejection：55 dB (Typ.)
- Output Current Limit Protection：2.0A (Typ.)
- Short Circuit Protection：1.0A (Typ.)
- Thermal Overload Shutdown Protection
- SOT-223, TO-252 and TO-263 Packages
- RoHS Compliant and 100% Green
  (Halogen Free with Commercial Standard)

Simplified Application Circuit



1.5A Fixed Voltage LDO Linear Regulator

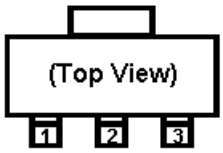
Ordering Information

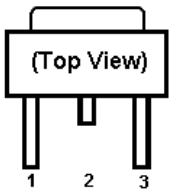


Vout Code :			
10=1.0V,**12=**1.2V, **15=**1.5V,**18=**1.8V, **25=**2.5V, **33=**3.3V			
Package Code :	SOT -223 = **B7**	TO-252 = **A4**	TO-263=A8
Pin name Code :	SOT-223 = **J ' G ' X**	TO-252 = **P ' R**	TO-263=**Q ' S**
Lead Free Code :	**G** : Green (Halogen Free with Commercial Standard)		
Output Voltage Accuracy :	**2** : ±2%		

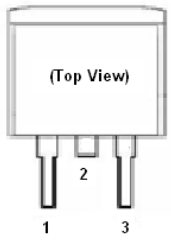
Note :
The difference between "J", "G" & "X" type and "P" & "R" type and "Q" & "S" please refer to "Pin Description".

Pin Description

Part NO.	Pin			Symbol	Pin Description
SOT-223	SOT-223(J)	SOT-223(G)	SOT-223(X)		
	3	1	3	V_{IN}	Regulator Input Pin.
	1	2	2	GND	Ground Pin.
	2	3	1	V_{OUT}	Regulator Output Pin

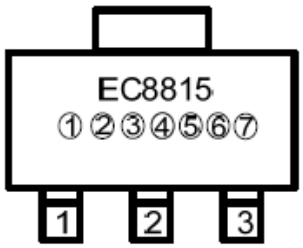
Part NO.	Pin		Symbol	Pin Description
TO-252	TO-252 (P)	TO-252 (R)		
	1	3	V_{IN}	Regulator Input Pin.
	2	1	GND	Ground Pin.
	3	2	V_{OUT}	Regulator Output Pin

Pin Description

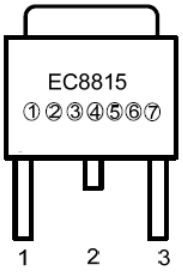
Part NO.	Pin		Symbol	Pin Description
TO-263	TO-263 (Q)	TO-263 (S)		
	1	3	V_{IN}	Regulator Input Pin.
	2	1	GND	Ground Pin.
	3	2	V_{OUT}	Regulator Output Pin

Package Marking Information

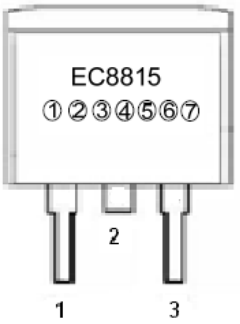
SOT-223
(Top View)



TO-252
(Top View)



TO-263
(Top View)



Top Point Represents Products Series

Mark	Product Series
Top Point	Part No.：EC8815

①、②、③、④、⑤ Represents Products Series

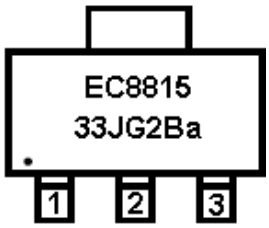
Mark Description		
①、②	Voltage	Voltage Code
③	J, G, X, P, R,Q,S	Pin Name Code
④	G	Green Code
⑤	Accuracy	2(±2%)

⑥、⑦ Represents Production Date Code

⑥ Year 16 bit code ' 08 = 8'09 = 9'10 = A'11 = B' 12 = C….16 = F

⑦ Weekly 1 ~ 26 = A ~ Z' 27 ~ 52 = a ~ z

Example:



SOT-223
(Top View)

Part No.:EC8815-33JG2
Date Code: Ba
2011/27 Week
Green Package

Absolute Maximum Ratings

Parameter		Symbol	Ratings	Units
Input Voltage V_{IN} to GND		V_{IN}	9.0	V
Output Current Limit, $I_{(LIMIT)}$		I_{OUT}	2.0	A
Junction Temperature		T_J	+155	°C
Thermal Resistance	SOT-223	θ_{JA}	155	°C/W
	TO-252		85	°C/W
	TO-263		60	°C/W
Power Dissipation	SOT-223	P_D	900	mW
	TO-252		1200	
	TO-263		1670	
Operating Ambient Temperature		T_{OPR}	-40~+85	°C
Storage Temperature		T_{STG}	-55~+150	°C
Lead Temperature (soldering, 10sec)			+260	°C

Note：

- The power dissipation values are based on the condition that junction temperature T_J and ambient temperature T_A difference is 100°C.
- Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and function 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.

Electrical Characteristics

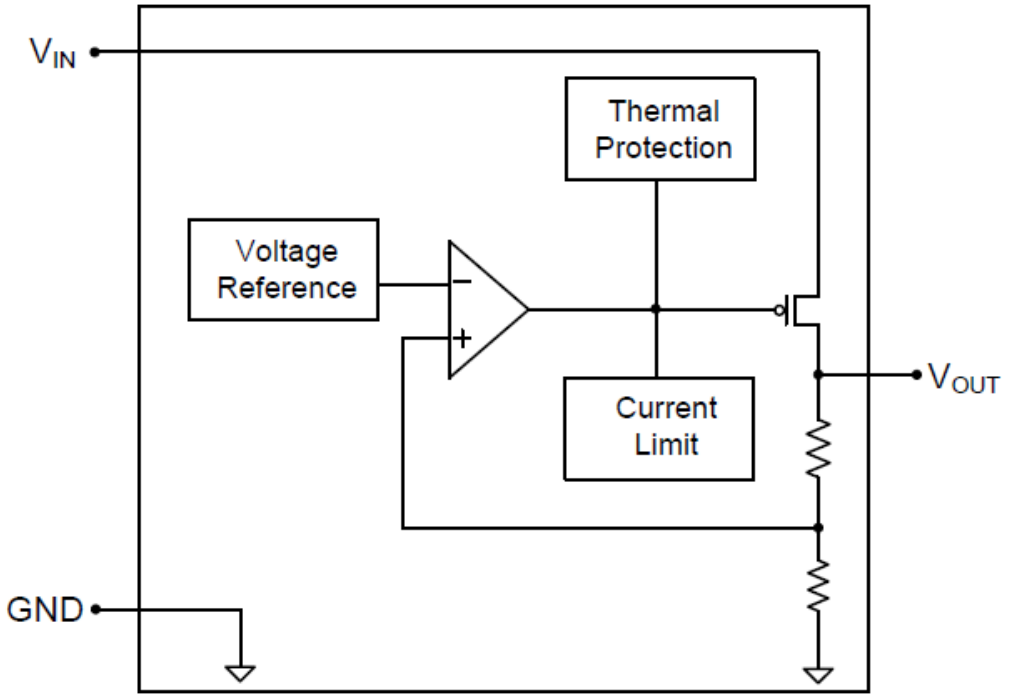
(V_{IN}=5V, T_A=25°C, unless otherwise noted.)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN}	Input Voltage		2.4		7.0	V
V_{OUT}	Output Voltage	V_{IN} = V_{OUT}+1.0V, I_{OUT}=1mA, V_{OUT}≧1.8V	-1% -2%	V_{OUT}	+1% +2%	V
		V_{IN} = V_{OUT}+1.0V, I_{OUT}=1mA, V_{OUT}＜1.8V, V_{IN}＞2.4V	-35		+35	mV
I_{MAX}	Output Current(see note *1)				1.5	A
I_{LIMIT}	Current Limit			1.8		A
V_{DROP}	Dropout Voltage	I_{OUT}= 100mA, V_{OUT}＞2.4V		30	45	mV
		I_{OUT}= 500mA, V_{OUT}＞2.4V		230	350	mV
		I_{OUT}= 900mA, V_{OUT}＞2.4V		500	750	mV
		I_{OUT}= 1500mA, V_{OUT}＞2.4V		900	1350	mV
ΔV_{LINE}	Line Regulation	V_{OUT}+1.0V≦V_{IN}≦7.0V, I_{OUT}=1mA For Fixed Voltage Type		0.2	0.3	%/V
ΔV_{LOAD}	Load Regulation	V_{IN}=V_{OUT}+1V, 1mA≦I_{OUT}≦100mA		0.01	0.02	%/mA
I_Q	Ground Pin Current	I_{LOAD}=0mA to 1.5A, V_{IN} = V_{OUT}+1.0V		40	65	μA
I_{SC}	Short Circuit Current			1.0		A
P_{SRR}	Ripple Rejection	I_{OUT}=30mA, F=1KHz, C_{OUT}=10μF		55		dB
e_N	Output Noise	I_{OUT}=100mA , F=1KHz, C_{OUT}=10μF		40		$\mu V_{(rms)}$
T_{SD}	Thermal Shutdown Temperature			155		°C
T_{HYS}	Thermal Shutdown Hysteresis			20		°C

Note：

Measured using a double sided board with 1” x 2” square inches of copper area connected to the GND pins for “heat spreading”.

EC8815 Function Block Diagram



Detail Description

The EC8815 is a CMOS low-dropout linear regulator. The device provides preset 1.8V, 2.5V and 3.3V output voltages for output current up to 1.5A. As illustrated in function block diagram, it consists of a 0.95V band-gap reference, an error amplifier, a P-channel pass transistor and an internal feedback voltage divider.
The band-gap reference voltage is connected to the error amplifier, which compares this reference with the feedback voltage and amplifies the voltage difference. If the feedback voltage is lower than the reference voltage, the pass-transistor gate is pulled lower, which allows more current to pass to the output pin and increases the output voltage. If the feedback voltage is too high, the pass transistor gate is pulled up to decrease the output voltage.
The output voltage is feed back through an internal resistive divider connected to OUT pin. Additional blocks include an output current limiter, thermal sensor, and shutdown logic.

Internal P-channel Pass Transistor
The EC8815 features a P-channel MOSFET pass transistor. Unlike similar designs using PNP pass transistors, P-channel MOSFET require no base drive, which reduces quiescent current. PNP-bas- ed regulators also waste considerable current in dropout when the pass transistor saturates, and use high base-drive currents under large loads. The EC8815 does not suffer from these problems and consumes only 60μA (Typ.) of current consum-ption under heavy loads as well as in dropout conditions.

Output Voltage Selection
For voltage type of EC8815, the output voltage is preset at an internally trimmed voltage. The first two digits of part number suffix identify the output voltage (see Ordering Information). For example, the EC8815-33 has a preset 3.3V output voltage.

Current Limit
The EC8815 also includes a fold back current limiter. It monitors and controls the pass transis- tor's gate voltage, estimates the output current, and limits the output current within 2.0A (Typ.).

Thermal Overload Protection

Thermal overload protection limits total power dissipation in the EC8815. When the junction temperature exceeds T_J = +155°C, a thermal sensor turns off the pass transistor, allowing the IC to cool down. The thermal sensor turns the pass transistor on again after the junction temperature cools down by 20°C, resulting in a pulsed output during continuous thermal overload conditions.

Thermal overload protection is designed to protect the EC8815 in the event of fault conditions. For continuous operation, the absolute maximum oper- ating junction temperature rating of T_J = +125°C should not be exceeded.

Operating Region and Power Dissipation

Maximum power dissipation of the EC8815 depends on the thermal resistance of the case and circuit board, the temperature difference between the die junction and ambient air, and the rate of airflow. The power dissipation across the devices is P = I_{OUT} x (V_{IN}-V_{OUT}). The resulting maximum power dissipation is:

$$P_{MAX} = \frac{(T_J - T_A)}{\theta_{JC} + \theta_{CA}} = \frac{(T_J - T_A)}{\theta_A}$$

Where (T_J-T_A) is the temperature difference between the EC8815 die junction and the surrounding air, θ_{JC} is the thermal resistance of the package chosen, and θ_{CA} is the thermal resistance through the printed circuit board, copper traces and other materials to the surrounding air. For better heat-sinking, the copper area should be equally shared between the IN, OUT, and GND pins.

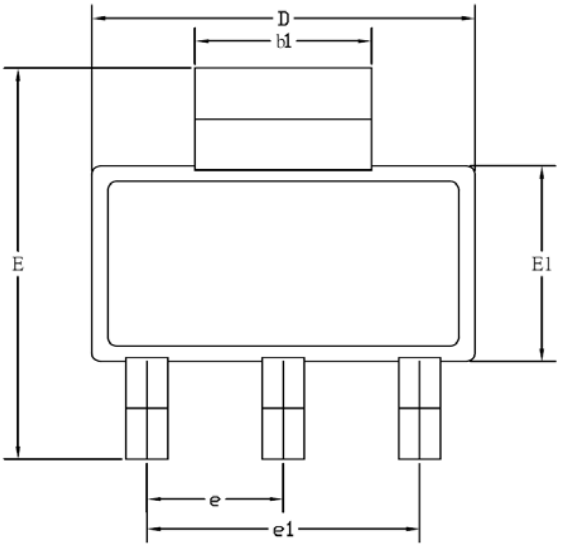
Dropout Voltage

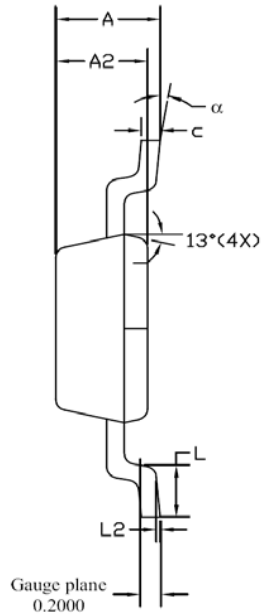
A regulator's minimum input-output voltage differential, or dropout voltage, determines the lowest usable supply voltage. In battery-powered systems, this will determine the useful end-of-life battery voltage. The EC8815 use a P-channel MOSFET pass transistor, its dropout voltage is a function of drain-to-source on-resistance $R_{DS(ON)}$ multiplied by the load current.

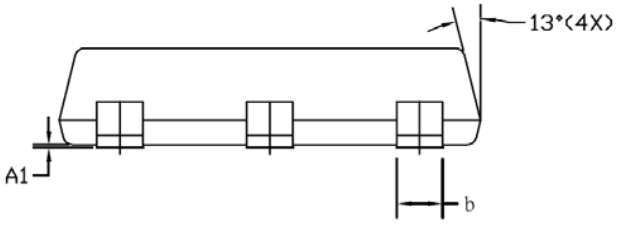
$$V_{DROPOUT} = V_{IN} - V_{OUT} = R_{DS(ON)} \times I_{OUT}$$

Mechanical Dimensions

OUTLINE DRAWING SOT-223



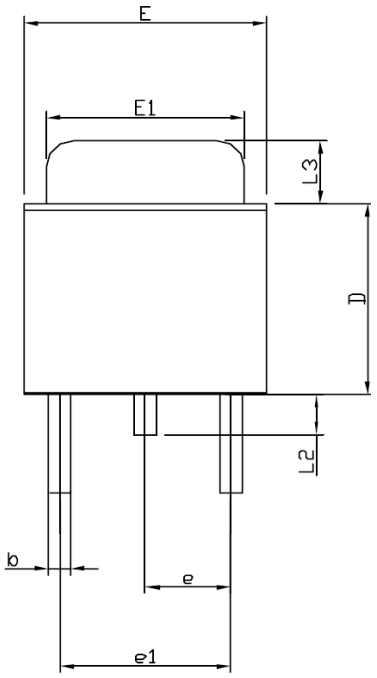


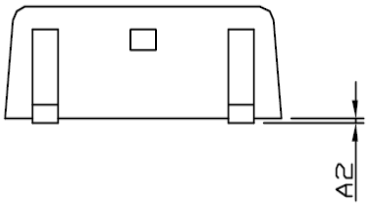


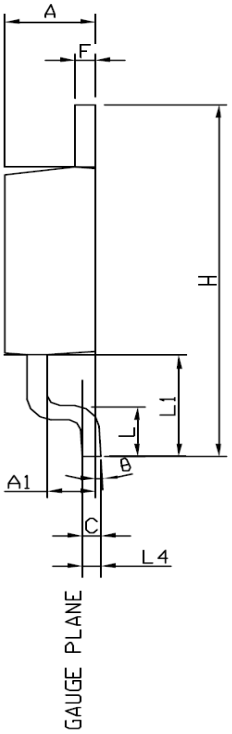
Symbols	Millimeters		Inches	
	Min	Max	Min	Max
A	1.52	1.80	0.061	0.071
A1	0.02	0.10	0.0008	0.0040
A2	1.50	1.70	0.059	0.067
b	0.60	0.80	0.024	0.031
b1	2.90	3.10	0.114	0.122
C	0.24	0.32	0.009	0.013
D	6.30	6.80	0.248	0.268
E1	3.30	3.70	0.130	0.146
e	2.30 BSC		0.090 BSC	
e1	4.60 BSC		0.181 BSC	
E	6.70	7.30	0.264	0.287
L	0.90 MIN		0.036 MIN	
L2	0.06 BSC		0.0024 BSC	
α	0°	10°	0°	10°

Mechanical Dimensions

OUTLINE DRAWING TO-252



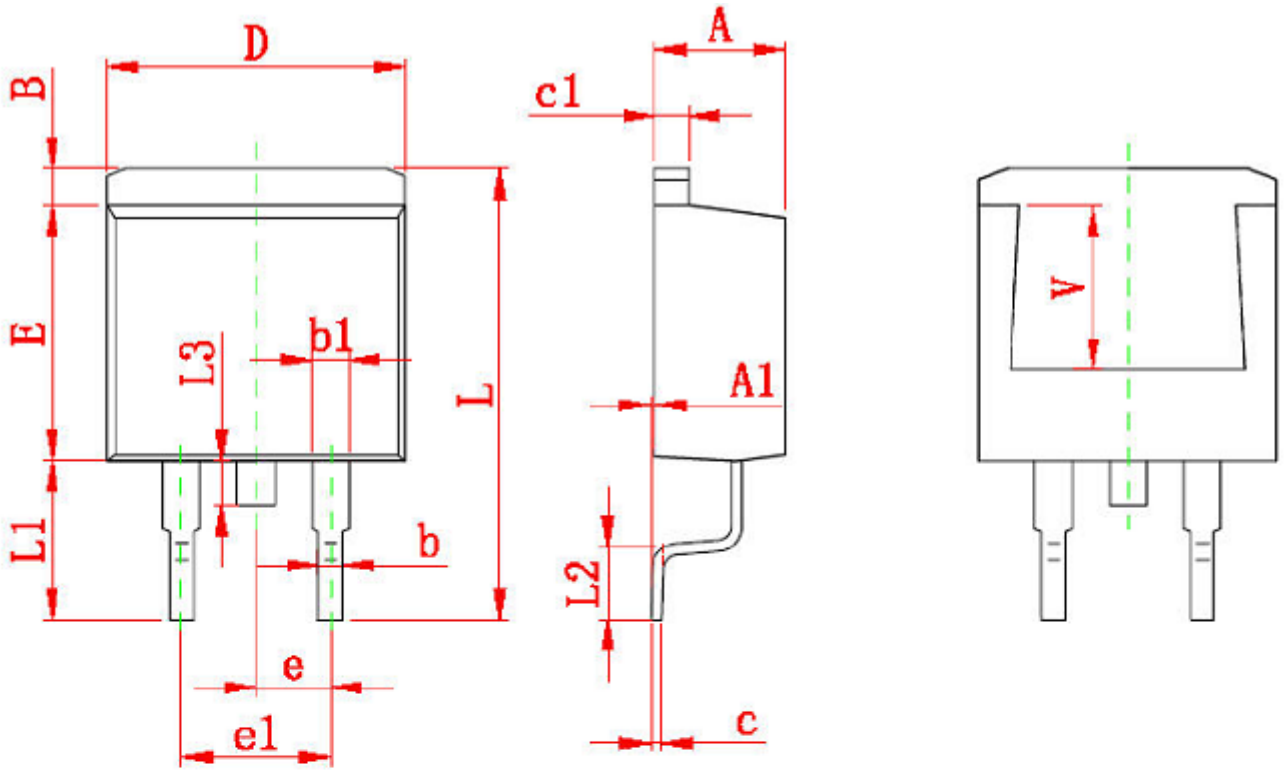




Symbols	Millimeters		Inches	
	Min	Max	Min	Max
A	2.19	2.38	0.086	0.094
A1	0.89	1.27	0.035	0.050
A2	0.00	0.13	0.000	0.005
b	0.51	0.89	0.020	0.035
C	0.46	0.58	0.018	0.023
D	5.97	6.22	0.235	0.245
E	6.35	6.73	0.250	0.265
E1	5.21	5.46	0.205	0.0215
e	2.28 BSC		0.090 BSC	
e1	3.96	5.18	0.156	0.204
F	0.46	0.58	0.018	0.023
L	1.40	1.78	0.055	0.070
L1	2.67 (REF.)		0.105 (REF.)	
L2	0.64	1.02	0.025	0.040
L3	1.52	2.03	0.060	0.080
L4	0.51 BSC		0.020 BSC	
H	9.40	10.40	0.370	0.410
θ	0°	8°	0°	8°

Mechanical Dimensions

OUTLINE DRAWING TO-263



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.470	4.670	0.176	0.184
A1	0.000	0.150	0.000	0.006
B	1.170	1.370	0.046	0.054
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.310	0.530	0.012	0.021
c1	1.170	1.370	0.046	0.054
D	10.010	10.310	0.394	0.406
E	8.500	8.900	0.335	0.350
e	2.540 TYP		0.100 TYP	
e1	4.980	5.180	0.196	0.204
L	15.050	15.450	0.593	0.608
L1	5.080	5.480	0.200	0.216
L2	2.340	2.740	0.092	0.108
L3	1.300	1.700	0.051	0.067
V	5.600 REF		0.220 REF	