

**Linear Battery Charger Controller****PT7120**

## DESCRIPTION

The PT7120 is a low cost linear battery charger controller with similar features to the industry standard "1734" style controller, but with the extra ability to charge multiple cell Lithium Ion batteries as well as NiCad types. In addition the maximum  $V_{in}$  is 18 volts. The PT7120 flexibility allows the setting of the charge voltage and current with the addition of a minimum number of external components.

The open collector output is capable of driving an external PNP transistor. A temperature compensated 1.25V reference controls the maximum output voltage, while a current control circuit sets a constant charging current

## FEATURES

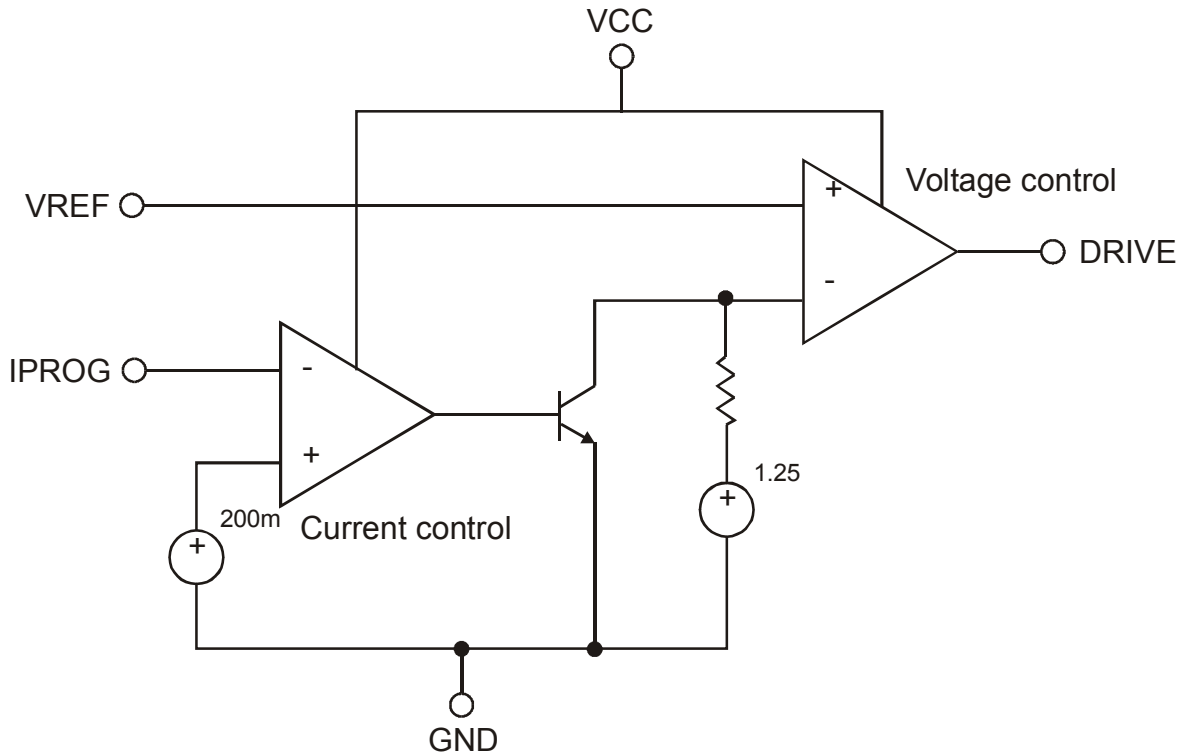
- 1.25V reference with 1% accuracy
- Multiple cell compatible
- Programmable charge current
- Low current consumption
- Compact Package
- No blocking diode required
- Wide  $V_{in}$  range: 2.2V to 18V
- Low voltage operation 2.2V
- 50mA drive current sink
- No sense resistor required
- No battery drain in shutdown
- Sleep mode with input supply removal

## APPLICATIONS

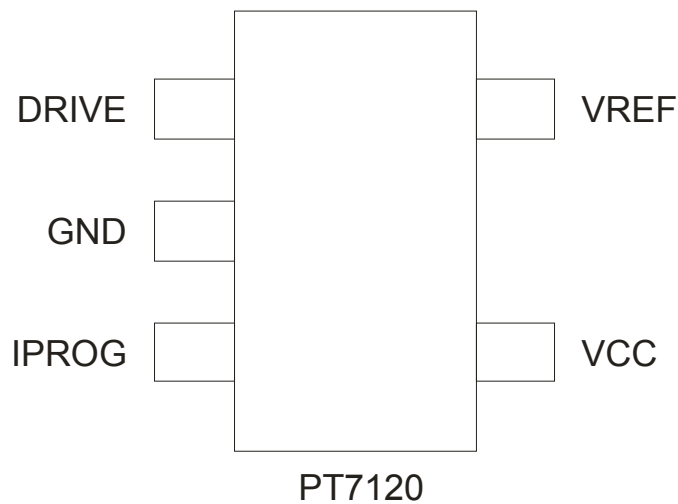
- Battery chargers

**Linear Battery Charger Controller** **PT7120**

**BLOCK DIAGRAM**



**PIN CONFIGURATION**



## PIN DESCRIPTION

Pin	Pin Name	Function
1	DRIVE	Error amplifier output: 30 mA sink capability.
2	GND	Ground
3	I PROG	Current programming pin: threshold of 200 mV.
4	VCC	Positive supply
5	VREF	Voltage programming pin: threshold of 1.25V.

## ABSOLUTE MAXIMUM RATINGS

Parameter	Rating	Unit
VCC Voltage	20	V
DRIVE Voltage	20	V
REF Voltage	20	V
VCC, DRIVE, REF Current	50	mA
Operating Junction Temperature	150	°C
Lead Temperature (soldering 1 seconds)	300	°C
Operating Temperature	-40 ~ +85	°C
Storage Temperature	-65 ~ +150	°C

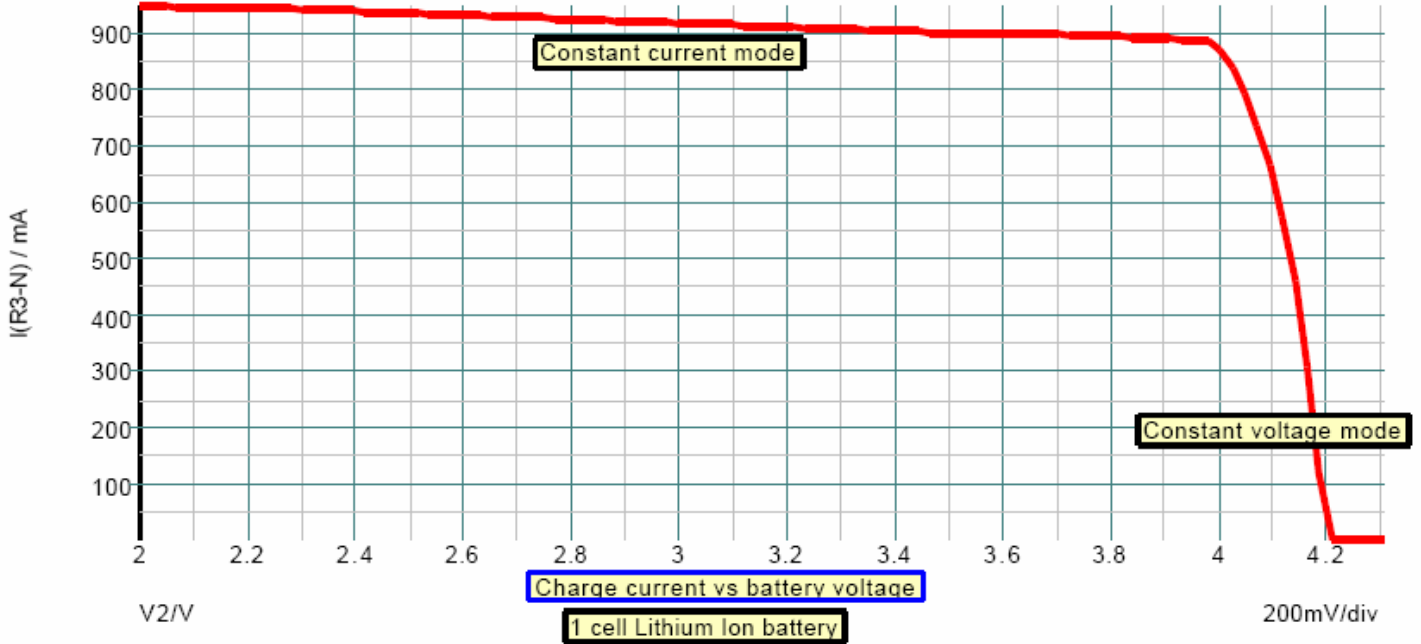
**Linear Battery Charger Controller**

**PT7120**

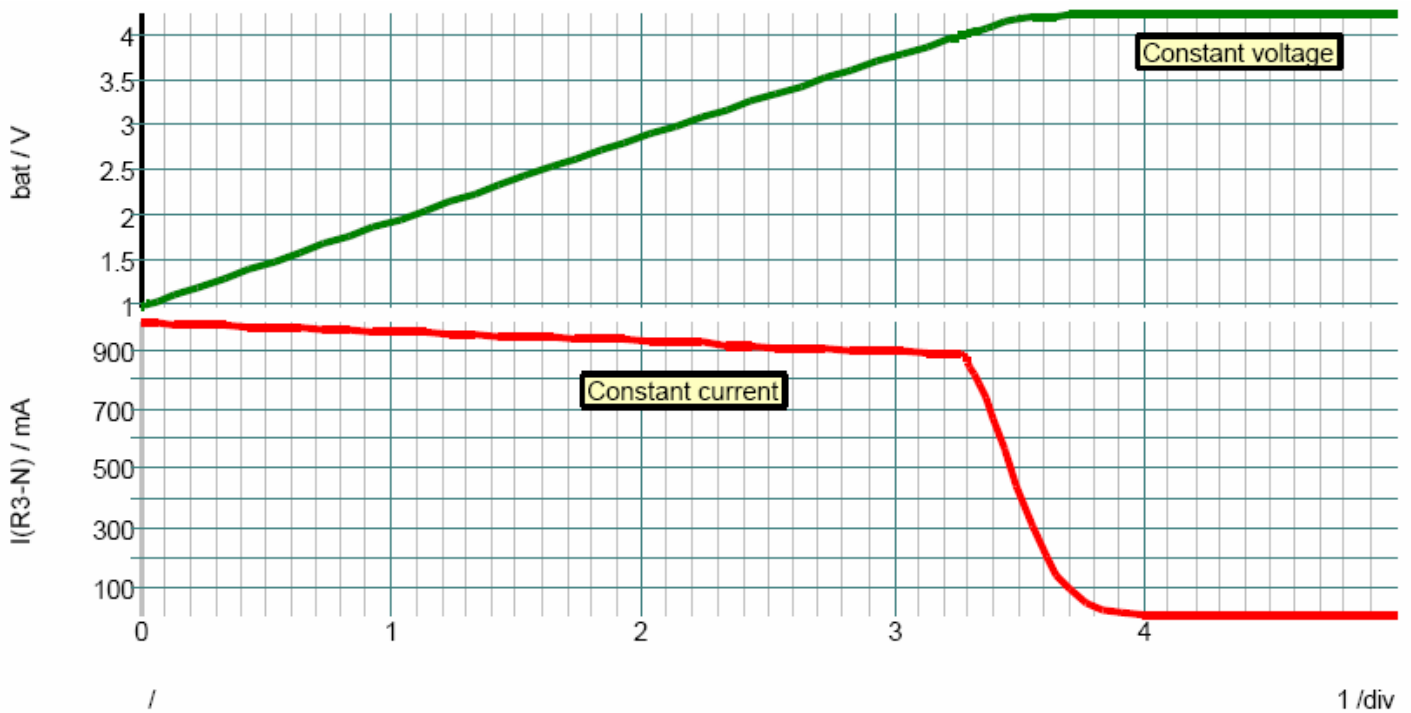
**ELECTRICAL SPECIFICATIONS**

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Vcc	Supply Voltage		2.2		18	V
Icc	Quiescent Supply Current	VDRIVE=1V VCC=15V		0.2	0.5	mA
Vref	Output Voltage	Ta=25°C	1.238	1.250	1.263	V
TCref	Reference Temperature Deviation	-20°C <Tj<105°C		0.5	1	%
DVcc	Reference variation with Supply Voltage	VCC=2.5V to 18V		0.2	0.5	mV
IREF	REF input current		-500	-200		nA
Vdrive low	Output Saturation Voltage	IDRIVE=10mA, VREF=HIGH		200	250	mV
I drive	Drive Current	V DRIVE=1.5V,	30	50	80	mA
Ileak	Output Leakage Current	VDRIVE=16 VREF=0		200	400	nA
V I prog	I PROG threshold voltage	Tj=25°C -20<Tj<105°C	197 195		203 205	mV
Gain	I PROG reference change	Per mV change CS T=25°C -20<Tj<105°C	36	40 40	44	mV/mV
Iprog	I PROG input current	Vcs=-200 mV Vcs=-250 mV		-150 -220		µA

# TYPICAL PERFORMANCE CHARACTERISTICS



Charge current vs. battery voltage



Battery charge vs. time

## OPERATION

The PT7120 is a linear battery charger controller. Charging begins when  $V_{cc}$  rises above 2.2V. When charging, the collector of the external PNP transistor provides the charge current.

Below the target charge voltage the controller is in current mode. When the battery voltage reaches the target voltage then the controller switches to the voltage mode. The target voltage is programmable through an external resistor divider. This allows flexibility to set the voltage (to one or more cells Li ion batteries, NiMH or NiCd batteries).

In current mode the PT7120 regulates the voltage across the sense resistor to be 200mV. The charge current is therefore given by  $I_{ch}=0.2V/R_{sense}$ . The PT7120 is designed for a maximum current in excess of 1A. The external PNP transistor must have adequate beta, low saturation voltage and sufficient power dissipation capability. With low supply voltages, the PNP saturation voltage becomes important as well.

In constant voltage mode, the controller will control the battery voltage not to exceed the target charge voltage.

When  $V_{cc}$  is applied, the charger can be manually shut down by opening the resistor R2 of the resistor divider (floating the otherwise grounded end of R2) or by pulling high the REF pin. This can be used in conjunction with an external thermostat switch.

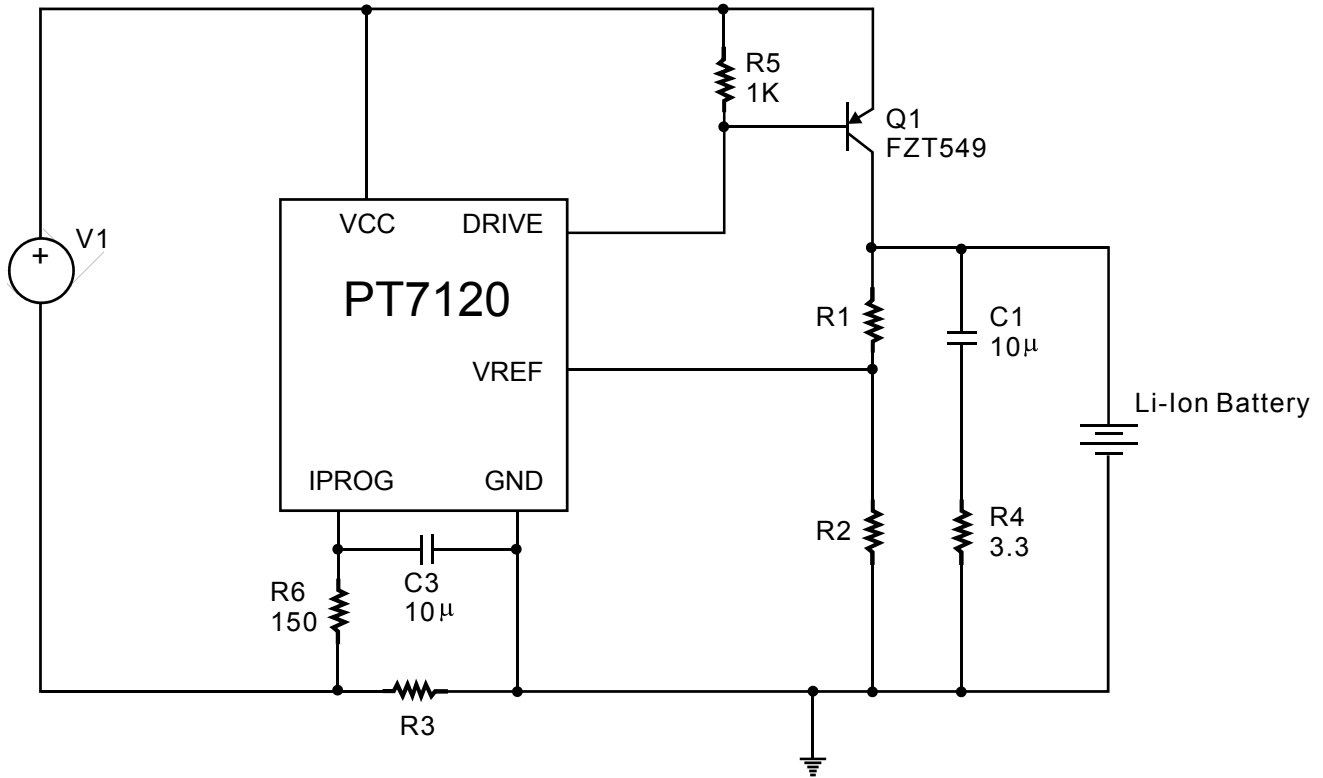
When input power is removed or manual shutdown is entered, the charger will drain only very small leakage currents from the battery, thus maximizing battery standby time. The leakage current is due to the reverse-biased B-E junction of the external PNP transistor.

A LED indicator can be added to show when the charger is operational, simply connecting the base-emitter of an additional PNP transistor in parallel to the base-emitter of Q1 and its collector to the LED.

The PT7120 contains two control loops. To maintain good AC stability in the constant voltage mode, a capacitor of at least 4.7 $\mu$ F is usually required from the collector of the external PNP to ground. The stability of the system is also depending on the type of external PNP transistor. High beta PNPs may be reducing the phase margin in some cases. R4 and C3 insure system stability both in current mode and in voltage mode. Furthermore the use of an external PMOS in place of the PNP represents a valid alternative to the application when wanting to minimize the current consumption during charge.

Linear Battery Charger Controller PT7120

## TYPICAL APPLICATION



Note: The values of R1 and R2 set the charge voltage (up to three Li-Ion cells is possible). The value of R3 sets the charge current.

## ORDER INFORMATION

Valid Part Number	Package Type	Top Code
PT7120	5 Pins, SOT-23 Package	PT7120
PT7120 (L)	5 Pins, SOT-23 Package	PT7120

Notes:

1. (L) = Lead Free
2. The Lead Free mark is put in front of the date code.





Linear Battery Charger Controller

PT7120

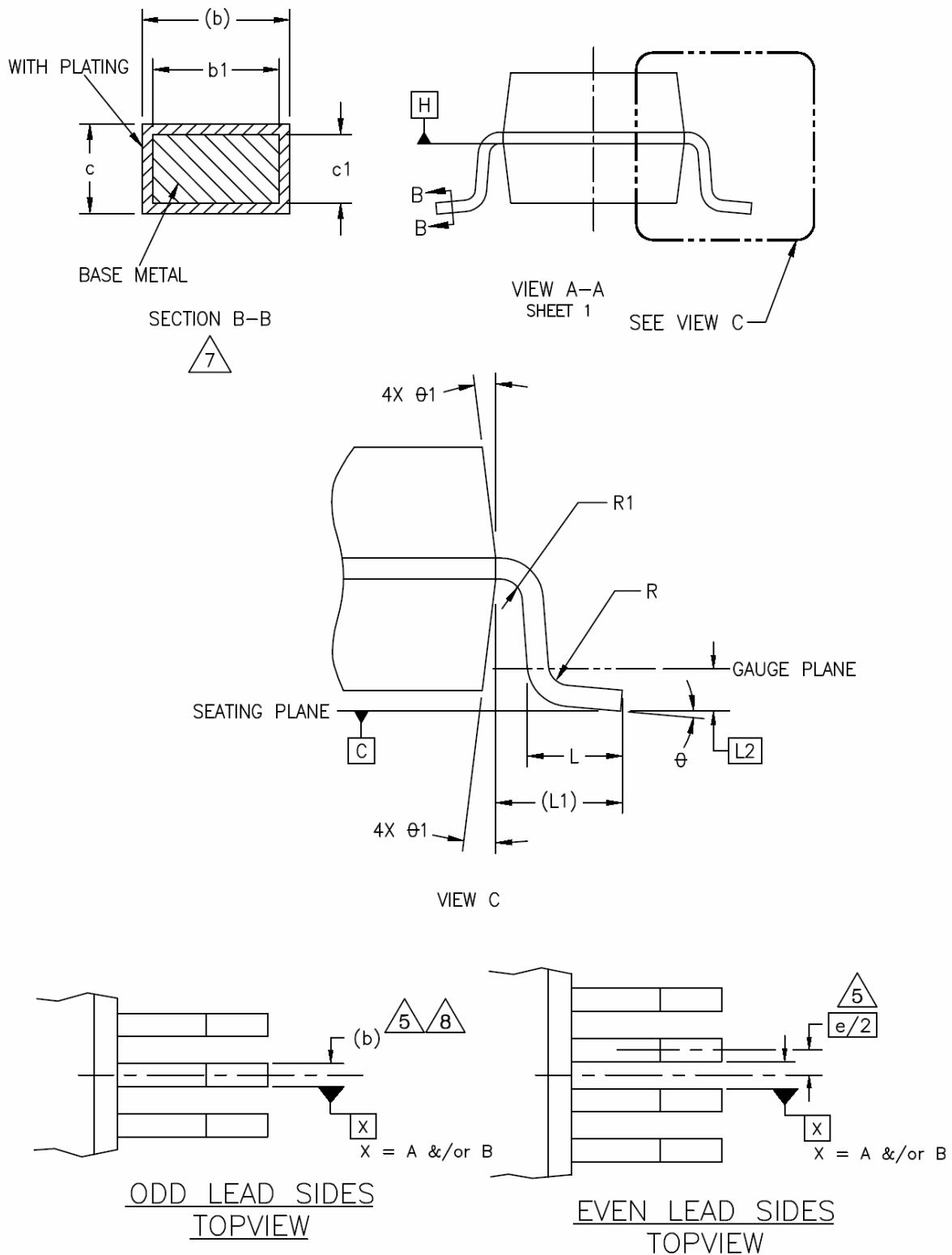


FIGURE 2

**Linear Battery Charger Controller**
**PT7120**

Symbol	Min.	Typ.	Max.
A	-	-	1.45
A1	0	-	0.15
A2	0.90	1.15	1.30
b	0.30	-	0.50
b1	0.30	0.40	0.45
c	0.08	-	0.22
c1	0.08	0.13	0.20
D	2.90 BSC.		
E	2.80 BSC.		
E1	1.60 BSC.		
e	0.95 BSC.		
e1	1.90 BSC.		
L	0.30	0.45	0.60
L1	0.60 REF.		
L2	0.25 BSC.		
R	0.10	-	-
R1	0.10	-	0.25
$\theta$	0°	4°	8°
$\theta 1$	5°	10°	15°

- Note:
1. Dimension and tolerancing per ASME Y14.5M-1994.
  2. Dimension in Millimeters.
  3. Dimension D does not include mold flash, protrusion or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 0.25mm per end. Dimension E1 does not include interlead flash or protrusion. Interlead flash or protrusion shall not exceed 0.25mm per side. D and E1 dimensions are determined at datum H.
  4. The package top may be smaller than the package bottom. Dimensions D and E1 are determined at the outermost extremes of the plastic body exclusive of mold flash, tie bar burrs, gate burrs and interlead flash, but including any mismatch between the top and bottom of the plastic body. D and E1 dimensions are determined at datum H.
  5. Datums A & B to be determined at datum H.
  6. Package variation "AA" is a 5 lead version of the 6 lead variation "AB" where lead #5 removed from the 6 lead "AB" variation.
  7. These dimensions apply to the flat section of the lead between 0.08mm and 0.15mm from the lead tip.
  8. Dimension "b" does not include dambar protrusion. Allowable dambar protrusion shall be 0.08mm total in exceed of the "b" dimension at maximum material condition. The dambar cannot be located on the lower radius of the foot. Minimum space between protrusion and an adjacent lead shall not be less than 0.07mm.
  9. Details of the pin 1 identifier are optional, but must be located within the zone indicated.
  10. Refer to JEDEC MO-178 Variation AA

JEDEC is the trademark of JEDEC SOLID STATE TECHNOLOGY ASSOCIATION