## Features

- Maximum output current is 1.4A
- Range of operation input voltage: Max 20V
- Line regulation: 0.03%/V (typ.)
- Standby current: 2mA (typ.)
- Load regulation: 0.2%/A (typ.)
- Environment Temperature: -20℃~85℃

## Applications

- Power Management for Computer Mother Board, Graphic Card
- LCD Monitor and LCD TV
- DVD Decode Board
- ADSL Modem
- Post Regulators For Switching Supplies

## General Description

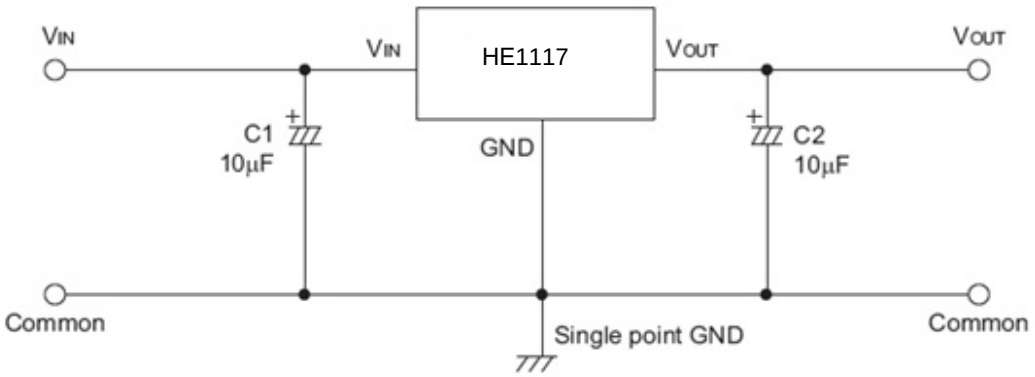
HE1117 is a series of low dropout three-terminal regulators with a dropout of 1.3V at 1A load current. HE1117 features a very low standby current 2mA compared to 5mA of competitor.

Other than a fixed version, Vout = 1.2V, 1.5V, 1.8V, 2.5V, 2.85V，3.3V, and 5V, HE1117 has an adjustable version, which can provide an output voltage from 1.25 to 12V with only two external resistors.

HE1117 offers thermal shut down function, to assure the stability of chip and power system. And it uses trimming technique to guarantee output voltage accuracy within 2%. Other output voltage accuracy can be customized on demand, such as 1%.

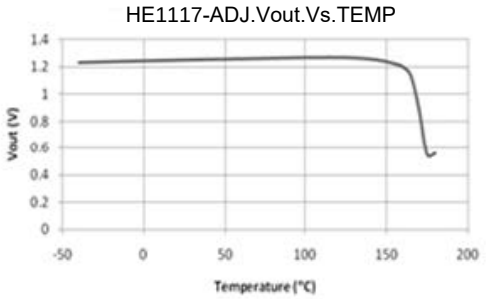
HE1117 is available in SOT-223, TO-252 power package.

## Typical Application




Application circuit of HE1117 fixed version

## Typical Electrical Characteristic




## Selection Table

| Marking | Part No. | Output Voltage | Package |
|---|---|---|---|
| 1117<br>XX YYWW | XX=12 | 1.2V | SOT-223<br>TO-252 |
| | XX=15 | 1.5V | |
| | XX=18 | 1.8V | |
| | XX=28 | 2.85V | |
| | XX=25 | 2.5V | |
| | XX=33 | 3.3V | |
| | XX=50 | 5.0V | |
| | XX=AD | Adj | |

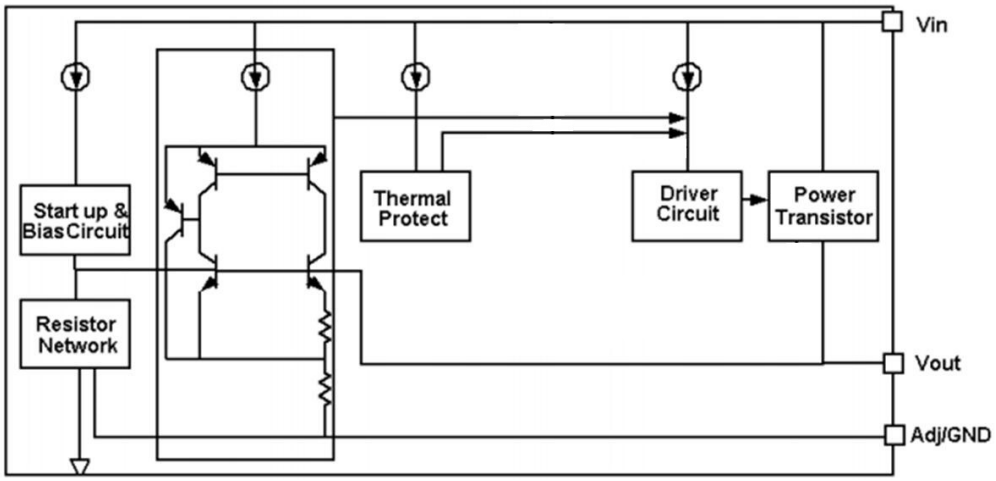
## Ordering Information

| Marking | Designator | Description |
|---|---|---|
| 1117<br>XX YYWW | 1117 | Product code |
| | XX | Output Voltage(1.2~12.0V) |
| | YYWW | DATE CODE |

Note:"XX" stands for output voltages. Other voltages can be specially customized

| Parameters | Description |
|---|---|
| Temperature & Rohs | C:-40~85℃ ,Pb Free Rohs Std. |
| Package type | L:SOT-223<br>O:TO-252 |
| Packing type: | TR: Tape & Reel (Standard) |
| Voltage accuracy | 2%(Customized) |

## Block Diagram




## Pin Configuration

SOT223 (Top View)

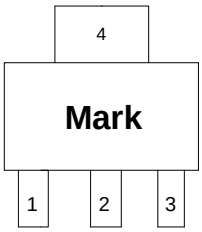



Table1: HE1117 series (SOT223 PKG)

| PIN NO. | PIN NAME | FUNCTION |
|---|---|---|
| 1 | VSS/ADJ | VSS/ADJ pin |
| 2 | VOUT | Output voltage pin |
| 3 | VIN | Input voltage pin |
| 4 | VOUT | Output voltage pin |

TO252 (Top View)

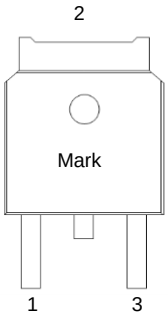



Table2: HE1117 series (TO252 PKG)

| PIN NO. | PIN NAME | FUNCTION |
|---|---|---|
| 1 | VSS/ADJ | VSS/ADJ pin |
| 2 | VOUT | Output voltage pin |
| 3 | VIN | Input voltage pin |

## Absolute Maximum Ratings

Max Input Voltage ····· ··30V
Max Operating Junction Temperature(Tj) ····· ··150℃
Ambient Temperature(Ta) ····· ···-40℃~ 85℃
Storage Temperature(Ts) ····· ···-40℃~150℃
Lead Temperature & Time ····· ··260℃ 10S

Caution: Exceed these limits to damage to the device. Exposure to absolute maximum rating conditions may affect device reliability.

## Recommended Work Conditions

Recommended maximum input voltage ····· 20V
Recommended operating junction temperature(Tj) ····· -20~125℃

## Thermal Information

| Parameter | Package | Rating | Unit |
|---|---|---|---|
| Package thermal resistance | SOT-223 | 20 | ℃/W |
| | TO-252 | 12.5 | ℃/W |

## Electrical Characteristics

$T_A$=25℃, unless otherwise noted.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Vref | Reference voltage | HE1117-Adj<br>10mA≤Iout≤1A , Vin=3.25V | 1.225 | 1.25 | 1.275 | V |
| Vout | Output voltage | HE1117-1.2V<br>0≤Iout≤1A , Vin=3.2V | 1.176 | 1.2 | 1.224 | V |
| | | HE1117-1.5V<br>0≤Iout≤1A , Vin=3.5V | 1.47 | 1.5 | 1.53 | V |
| | | HE1117-1.8V<br>0≤Iout≤1A , Vin=3.8V | 1.764 | 1.8 | 1.836 | V |
| | | HE1117-2.5V<br>0≤Iout≤1A , Vin=4.5V | 2.45 | 2.5 | 2.55 | V |
| | | HE1117-2.85V<br>0≤Iout≤1A , Vin=4.85V | 2.793 | 2.85 | 2.907 | V |
| | | HE1117-3.3V<br>0≤Iout≤1A , Vin=5.3V | 3.234 | 3.3 | 3.366 | V |
| | | HE1117-5.0V<br>0≤Iout≤1A , Vin=7.0V | 4.9 | 5 | 5.1 | V |

| | | | | | | |
|---|---|---|---|---|---|---|
| △Vout | Line regulation | HE1117-1.2V<br>Iout=10mA, 2.7V≤Vin≤10V | | 0.03 | 0.2 | %/V |
| | | HE1117-1.5V<br>Iout=10mA, 3.0V≤Vin≤10V | | 0.03 | 0.2 | %/V |
| | | HE1117-ADJ<br>Iout=10mA, 2.75V≤Vin≤12V | | 0.03 | 0.2 | %/V |
| | | HE1117-1.8V<br>Iout=10mA, 3.3V≤Vin≤12V | | 0.03 | 0.2 | %/V |
| | | HE1117-2.5V<br>Iout=10mA, 4.0V≤Vin≤12V | | 0.03 | 0.2 | %/V |
| | | HE1117-2.85V<br>Iout=10mA, 4.35V≤Vin≤12V | | 0.03 | 0.2 | %/V |
| | | HE1117-3.3V<br>Iout=10mA, 4.8V≤Vin≤12V | | 0.03 | 0.2 | %/V |
| | | HE1117-5.0V<br>Iout=10mA, 6.5V≤Vin≤12V | | 0.03 | 0.2 | %/V |

| | | | | | | |
|---|---|---|---|---|---|---|
| △Vout | Load regulation | HE1117-1.2V<br>Vin =2.7V, 10mA≤Iout≤1A | | 2 | 8 | mV |
| | | HE1117-1.5V<br>Vin =3.0V, 10mA≤Iout≤1A | | 2 | 8 | mV |
| | | HE1117-ADJ<br>Vin =2.75V, 10mA≤Iout≤1A | | 2 | 8 | mV |
| | | HE1117-1.8V<br>Vin =3.3V, 10mA≤Iout≤1A | | 3 | 12 | mV |
| | | HE1117-2.5V<br>Vin =4.0V, 10mA≤Iout≤1A | | 4 | 16 | mV |
| | | HE1117-2.85V<br>Vin =4.35V, 10mA≤Iout≤1A | | 5 | 20 | mV |
| | | HE1117-3.3<br>Vin =4.8V, 10mA≤Iout≤1A | | 6 | 24 | mV |
| | | HE1117-5.0<br>Vin =6.5V, 10mA≤Iout≤1A | | 9 | 36 | mV |
| Vdrop | Dropout voltage | Iout =100mA | | 1.15 | 1.3 | V |
| | | Iout=1A | | 1.3 | 1.5 | V |
| Imin | Minimum load current | HE1117-ADJ | | 2 | 10 | mA |
| | | HE1117-1.2V,Vin=10V | | 2 | 5 | mA |
| | | HE1117-1.5V,Vin=10V | | 2 | 5 | mA |

| | | | | | | |
|---|---|---|---|---|---|---|
| Iq | Quiescent Current | HE1117-1.8V,Vin=12V | | 2 | 5 | mA |
| | | HE1117-2.5V,Vin=12V | | 2 | 5 | mA |
| | | HE1117-2.85V,Vin=12V | | 2 | 5 | mA |
| | | HE1117-3.3V,Vin=12V | | 2 | 5 | mA |
| | | HE1117-5.0V,Vin=12V | | 2 | 5 | mA |
| IAdj | Adjust pin current | HE1117-ADJ<br>Vin=5V,10mA≤Iout≤1A | | 55 | 120 | uA |
| Ichange | Iadj change | HE1117-ADJ<br>Vin=5V,10mA≤Iout≤1A | | 0.2 | 10 | uA |
| ΔV/ΔT | Temperature coefficien | | | ±100 | | ppm |
| $\theta_{JC}$ | Thermal resistance | SOT-223 | | 20 | | ℃/W |
| | | TO-252 | | 10 | | |

Note1: All test are conducted under ambient temperature 25° C and within a short period of time 20ms

Note2: Load current smaller than minimum load current of HE1117-ADJ will lead to unstable or oscillation output.

## Detailed Description

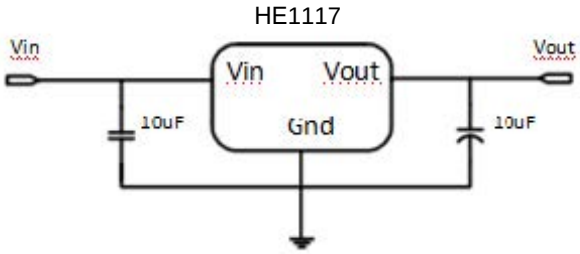
HE1117 is a series of low dropout voltage, three terminal regulators. Its application circuit is very simple: the fixed version only needs two capacitors and the adjustable version only needs two resistors and two capacitors to work. It is composed of some modules including start-up circuit, bias circuit, bandgap, thermal shutdown, power transistors and its driver circuit and so on.

The thermal shut down modules can assure chip and its application system working safety when the junction temperature is larger than 140℃.

The bandgap module provides stable reference voltage, whose temperature coefficient is compensated by careful design considerations. The temperature coefficient is under 100 ppm/℃. And the accuracy of output voltage is guaranteed by trimming technique.

## Typical Application

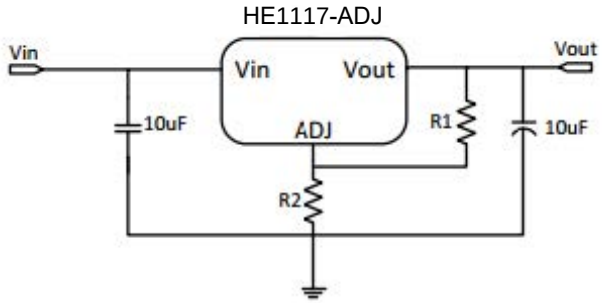
HE1117 has an adjustable version and six fixed versions (1.2V, 1.5V,1.8V, 2.5V, 2.85V , 3.3V and 5V) **Fixed Output Voltage Version**




Application circuit of HE1117 fixed version

1) Recommend using 10uF tan capacitor as bypass capacitor (C1) for all application circuit.
2) Recommend using 10uF tan capacitor to assure circuit stability.

### Adjustable Output Voltage Version




Application Circuit of HE1117-ADJ

The output voltage of adjustable version follows the equation: Vout=1.25×(1+R2/R1)+IAdj×R2. We can ignore IAdj because IAdj (about 50uA) is much less than the current of R1 (about 2~10mA).

1) To meet the minimum load current (>10mA) requirement, R1 is recommended to be 125ohm or lower. As

HE1117-ADJ can keep itself stable at load current about 2mA, R1 is not allowed to be higher than 625ohm.

2) Using a bypass capacitor ($C_{ADJ}$) between the ADJ pin and ground can improve ripple rejection. This bypass capacitor prevents ripple from being amplified as the output voltage is increased. The impedance of $C_{ADJ}$ should be less than R1 to prevent ripple from being amplified. As R1 is normally in the range of 100Ω~500Ω, the value of $C_{ADJ}$ should satisfy this equation: $1/(2\pi \times f_{ripple} \times C_{ADJ}) < R1$.

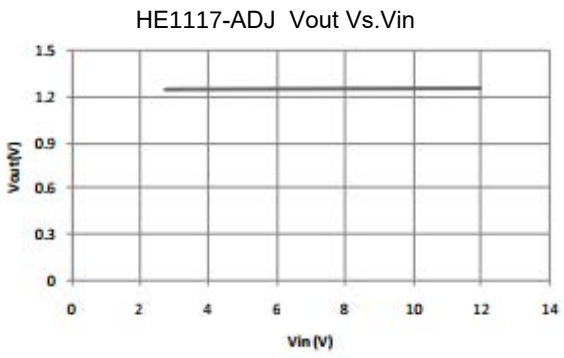
## Thermal Considerations

We have to take heat dissipation into great consideration when output current or differential voltage of input and output voltage is large. Because in such cases, the power dissipation consumed by HE1117 is very large. HE1117 series uses SOT-223 package type and its thermal resistance is about 20℃/W. And the copper area of application board can affect the total thermal resistance. If copper area is 5cm*5cm (two sides), the resistance is about 30℃/W. So the total thermal resistance is about 20℃/W + 30℃/W. We can decrease total thermal resistance by increasing copper area in application board. When there is no good heat dissipation copper are in PCB, the total thermal resistance will be as high as 120° C/W, then the power dissipation of HE1117 could allow on itself is less than 1W. And furthermore, HE1117 will work at junction temperature higher than 125° C under such condition and no lifetime is guaranteed.

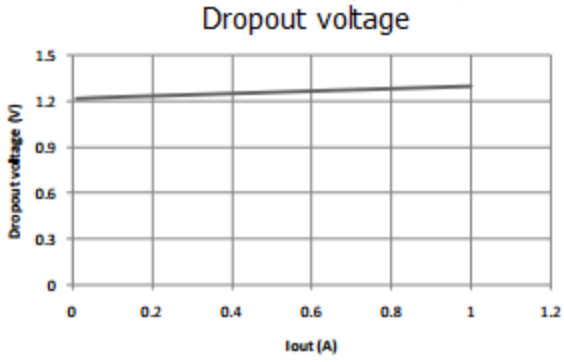
## Typical Performance Characteristics

$T_A$=25℃, unless otherwise noted.

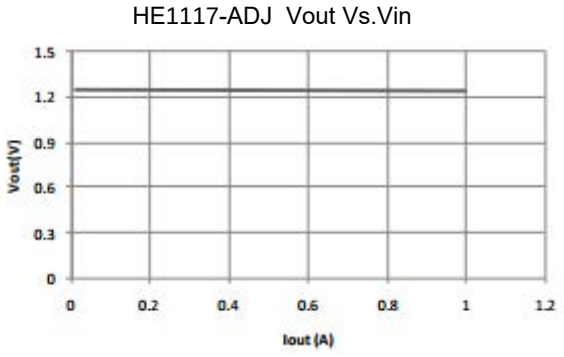
**Line regulation**



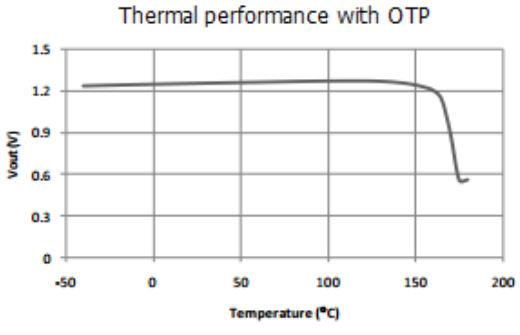

**Dropout voltage**




**Load regulation**

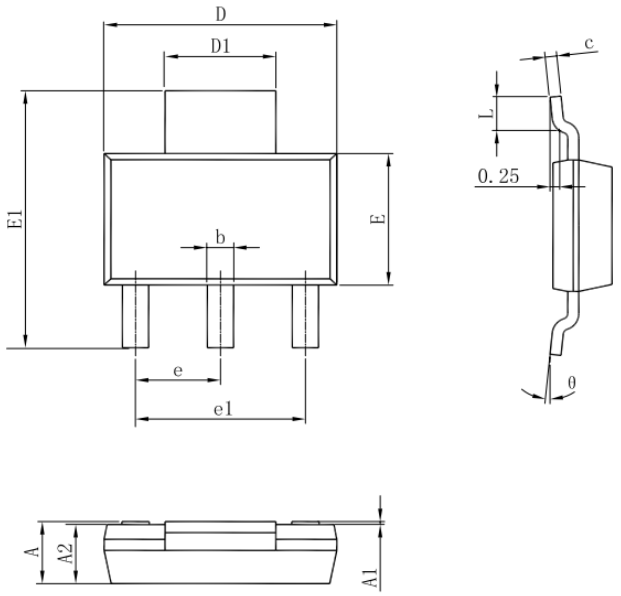


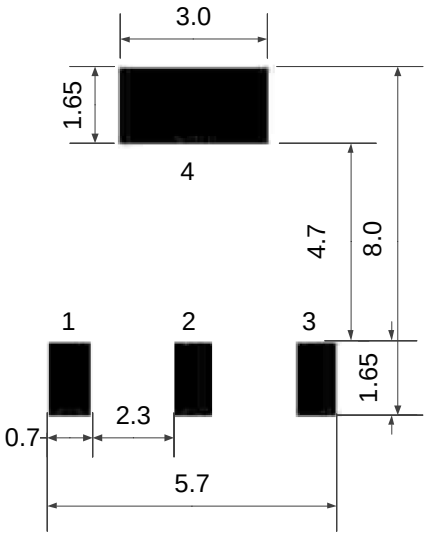

**Thermal performance with OTP**



## Package Information

SOT-223 PACKAGE OUTLINE DIMENSIONS

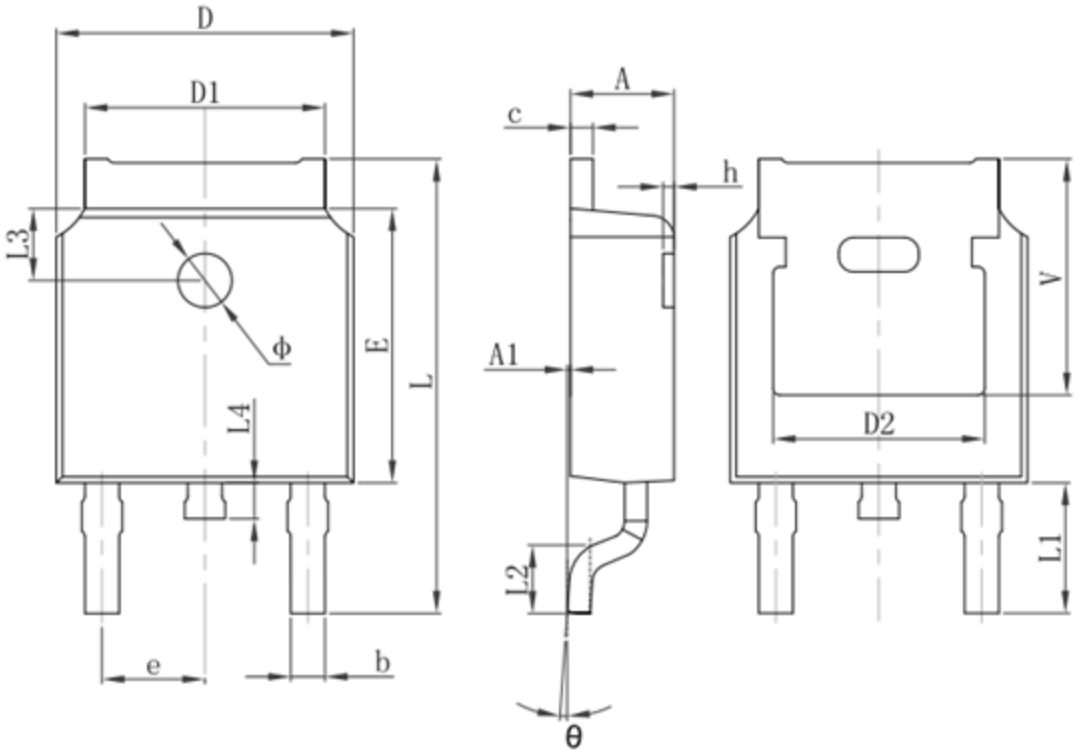



PCB Board

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 1.520 | 1.800 | 0.060 | 0.071 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 1.500 | 1.700 | 0.059 | 0.067 |
| b | 0.660 | 0.820 | 0.026 | 0.032 |
| c | 0.250 | 0.350 | 0.010 | 0.014 |
| D | 6.200 | 6.400 | 0.244 | 0.252 |
| D1 | 2.900 | 3.100 | 0.114 | 0.122 |
| E | 3.300 | 3.700 | 0.130 | 0.146 |
| E1 | 6.830 | 7.070 | 0.269 | 0.278 |
| e | 2.300(BSC) | | 0.091(BSC) | |
| e1 | 4.500 | 4.700 | 0.177 | 0.185 |
| L | 0.900 | 1.150 | 0.035 | 0.045 |
| θ | 0° | 10° | 0° | 10° |

## TO-252-2L PACKAGE OUTLINE DIMENSIONS




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 2.200 | 2.400 | 0.087 | 0.094 |
| A1 | 0.000 | 0.127 | 0.000 | 0.005 |
| b | 0.660 | 0.860 | 0.026 | 0.034 |
| c | 0.460 | 0.580 | 0.018 | 0.023 |
| D | 6.500 | 6.700 | 0.256 | 0.264 |
| D1 | 5.100 | 5.460 | 0.201 | 0.215 |
| D2 | 4.830 REF. | | 0.190 REF. | |
| E | 6.000 | 6.200 | 0.236 | 0.244 |
| e | 2.186 | 2.386 | 0.086 | 0.094 |
| L | 9.800 | 10.400 | 0.386 | 0.409 |
| L1 | 2.900 REF. | | 0.114 REF. | |
| L2 | 1.400 | 1.700 | 0.055 | 0.067 |
| L3 | 1.600 REF. | | 0.063 REF. | |
| L4 | 0.600 | 1.000 | 0.024 | 0.039 |
| Φ | 1.100 | 1.300 | 0.043 | 0.051 |
| θ | 0° | 8° | 0° | 8° |
| h | 0.000 | 0.300 | 0.000 | 0.012 |
| V | 5.350 REF. | | 0.211 REF. | |