# ACE1117H

**1A Bipolar Linear Regulator**

## Description

ACE1117H is a series of low dropout three-terminal regulators with a dropout of 1.3V at 1A load current. ACE1117H features a low standby current 2mA.

Other than a fixed version (Vout = 1.2V, 1.8V, 2.5V, 3.3V, 5V, and 12V), ACE1117H has an adjustable version, which can provide an output voltage from 1.25 to 12V with only two external resistors.

ACE1117H offers thermal shut down and current limit functions, to assure stability of chip and power system. Trimming technique is used to guarantee output voltage accuracy within ±2%. Other output voltage accuracy such as ±1% can be customized on demand.

## Features

- Other than a fixed version and an adjustable version, output value can be customized on command.
- Maximum output current is 1A.
- Range of operation input voltage: Max 18V
- Standby current: 2mA (typ.)
- Line regulation: 0.1% (typ.)
- Load regulation: 10mV (typ.)
- Environment Temperature: -20℃~85℃
- Compatible with tantalum capacitor, electrolytic capacitor and MLCC

## Application

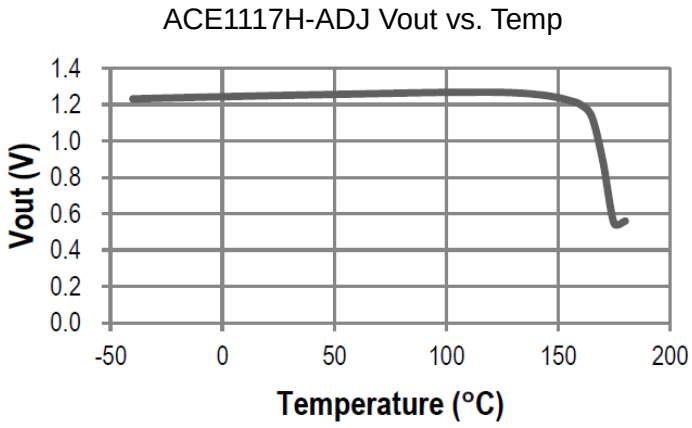
- Power Management for Computer Mother Board, Graphic Card
- LCD Monitor and LCD TV
- DVD Decode Board
- ADSL Modem
- Post Regulators for switching supplies

## Absolute Maximum Ratings

| Parameter | | Symbol | Max | Unit |
|---|---|---|---|---|
| Input voltage | | $V_{IN}$ | 18 | V |
| Operating Junction Temperature | | $T_J$ | 150 | °C |
| Ambient Temperature | | $T_A$ | -40~85 | °C |
| Package Thermal Resistance | SOT-223 | | 20 | °C/W |
| | TO-252 | | 12.5 | |
| Storage temperature | | $T_S$ | - 40 to 150 | °C |

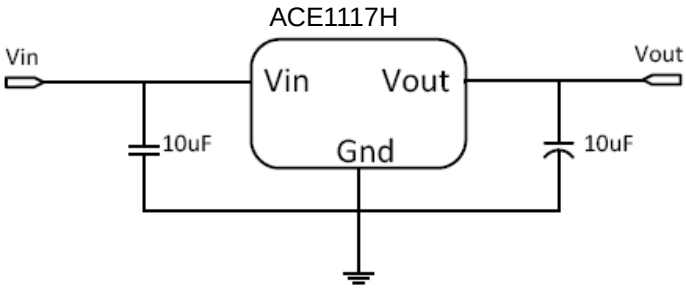
Note: Exceed these limits to damage to the device. Exposure to absolute maximum rating conditions may affect device reliability.

## Typical Electrical Characteristics

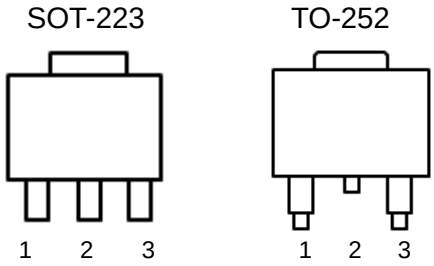



## Typical Application

Application circuit of ACE1117H fixed version




## Packaging Type




| SOT-223 / TO-252 | Description |
|---|---|
| 1 | Vss/ADJ |
| 2 | Vout |
| 3 | Vin |

## Recommended work conditions

| Parameter | Value |
|---|---|
| Input Voltage Range | Max. 16V (1) |
| Operating Junction Temperature ($T_J$) | -20 ~ 125 °C |

Note 1. Exceptional for ACE1117H-12V, the maximum input voltage for ACE1117H-12V is 20V.

## Ordering information

ACE1117H XX XX + H

- H: Halogen - free
- +: Pb - free
- XX: XM : SOT-223, YM : TO-252
- XX: Output Voltage : 1.2 / 1.8V ….. / Default: Adjustable Version

## Electrical Characteristics ($T_J$=25℃)

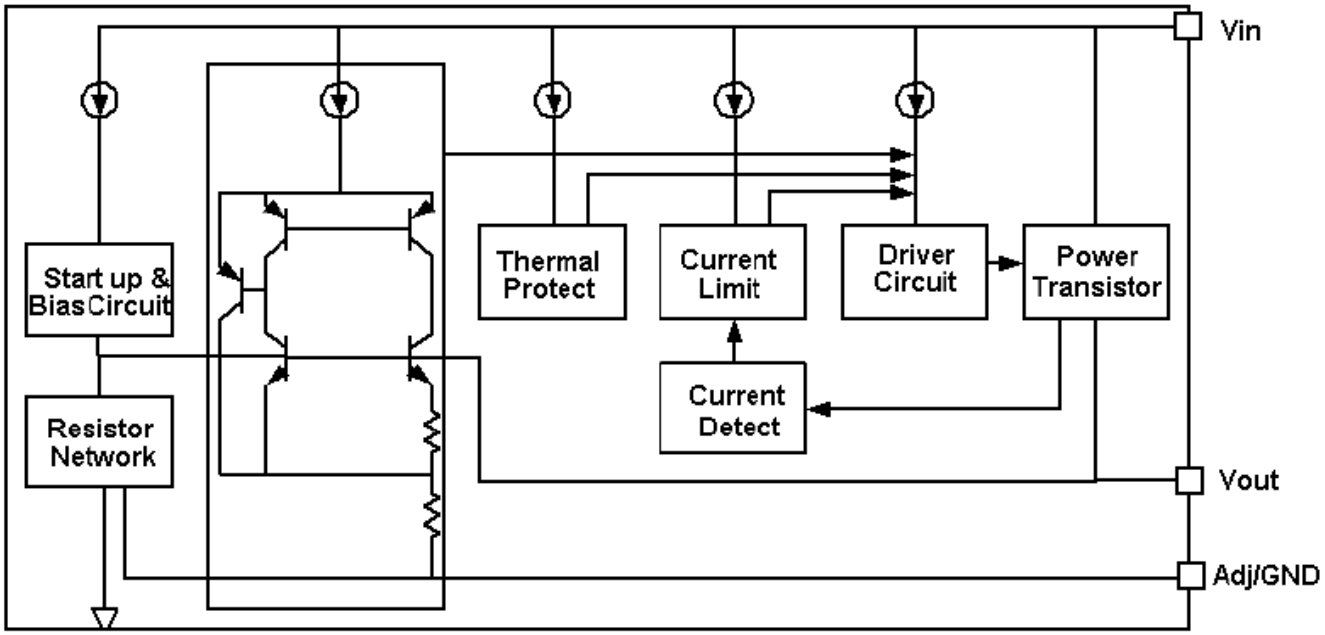
| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | Vout | ACE1117H-1.2V<br>0≦Iout≦1A, Vin=3.2V | 1.176 | 1.20 | 1.224 | V |
| | | ACE1117H-1.8V<br>0≦Iout≦1A, Vin=3.8V | 1.764 | 1.80 | 1.836 | |
| | | ACE1117H-2.5V<br>0≦Iout≦1A, Vin=4.5V | 2.45 | 2.5 | 2.55 | |
| | | ACE1117H-3.3V<br>0≦Iout≦1A, Vin=5.3V | 3.234 | 3.3 | 3.366 | |
| | | ACE1117H-5.0V<br>0≦Iout≦1A, Vin=7.0V | 4.9 | 5 | 5.1 | |
| | | ACE1117H-12.0V<br>0≦Iout≦1A, Vin=14V | 11.76 | 12 | 12.24 | |
| Reference Voltage | $V_{REF}$ | ACE1117H-ADJ<br>10mA≦Iout≦1A, Vin=3.25V | 1.225 | 1.25 | 1.275 | V |
| Line Regulation | ΔVout | ACE1117H-ADJ<br>Iout=10mA, 2.75V≦Vin≦16V | | 0.1 | 0.2 | %/V |
| | | ACE1117H-1.2V<br>Iout=10mA, 2.7V≦Vin≦15V | | 0.1 | 0.2 | |
| | | ACE1117H-1.8V<br>Iout=10mA, 3.3V≦Vin≦16V | | 0.1 | 0.2 | |
| | | ACE1117H-2.5V<br>Iout=10mA, 4.0V≦Vin≦16V | | 0.1 | 0.2 | |
| | | ACE1117H-3.3V<br>Iout=10mA, 4.8V≦Vin≦16V | | 0.1 | 0.2 | |
| | | ACE1117H-5.0V<br>Iout=10mA, 6.5V≦Vin≦16V | | 0.1 | 0.2 | |
| | | ACE1117H-12.0V<br>Iout=10mA, 13.5V≦Vin≦20V | | 0.1 | 0.2 | |
| Load Regulation | ΔVout | ACE1117H-ADJ<br>Vin=2.7V, 10mA≦Iout≦1A | | 10 | 30 | mV |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | ACE1117H-1.2V<br>Vin=2.75V, 10mA≦Iout≦1A | | 10 | 30 | |
| | | ACE1117H-1.8V<br>Vin=3.3V, 10mA≦Iout≦1A | | 10 | 30 | |
| | | ACE1117H-2.5V<br>Vin=4.0V, 10mA≦Iout≦1A | | 10 | 30 | |
| | | ACE1117H-3.3V<br>Vin=4.8V, 10mA≦Iout≦1A | | 10 | 30 | |
| | | ACE1117H-5.0V<br>Vin=6.5V, 10mA≦Iout≦1A | | 10 | 30 | |
| | | ACE1117H-12.0V<br>Vin=13.5V, 10mA≦Iout≦1A | | 10 | 30 | |
| Quiescent Current | $I_Q$ | ACE1117H-1.2V, Vin=10V | | 2 | 5 | mA |
| | | ACE1117H-1.8V, Vin=12V | | 2 | 5 | |
| | | ACE1117H-2.5V, Vin=12V | | 2 | 5 | |
| | | ACE1117H-3.3V, Vin=12V | | 2 | 5 | |
| | | ACE1117H-5.0V, Vin=12V | | 2 | 5 | |
| | | ACE1117H-12.0V, Vin=20V | | 2 | 5 | |
| Adjust Pin Current | $I_{ADJ}$ | ACE1117H-ADJ Vin=5V,<br>10mA≦Iout≦1A | | 55 | 120 | uA |
| Iadj change | Ichange | ACE1117H-ADJ Vin=5V,<br>10mA≦Iout≦1A | | 0.2 | 10 | uA |
| Current Limit | Ilimit | Vin-Vout=2V, $T_J$=25℃ | 1 | | | A |
| Minimum load Current | Imin | ACE1117H-ADJ | | 2 | 10 | mA |
| Temperature coefficient | ΔV/ΔT | | | ±100 | | ppm |
| Vdrop | Dropout voltage | Iout=100mA | | 1.23 | 1.3 | V |
| | | Iout=1A | | 1.3 | 1.5 | V |
| Thermal Resistance | ΘJC | 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 ACE1117H-ADJ will lead to unstable or oscillation output.

## Block Diagram




## Detailed Description

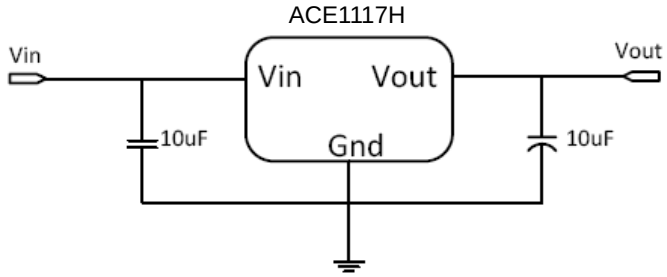
ACE1117H is a series of low dropout voltage, three terminal regulators. Its application circuit is very simple: the fixed version only needs two capacitors and the adjustable version only needs two resistors and two capacitors to work. It is composed of some modules including start-up circuit, bias circuit, bandgap, thermal shutdown, current limit, 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 100ppm/℃. And the accuracy of output voltage is guaranteed by trimming technique.

## Typical Application

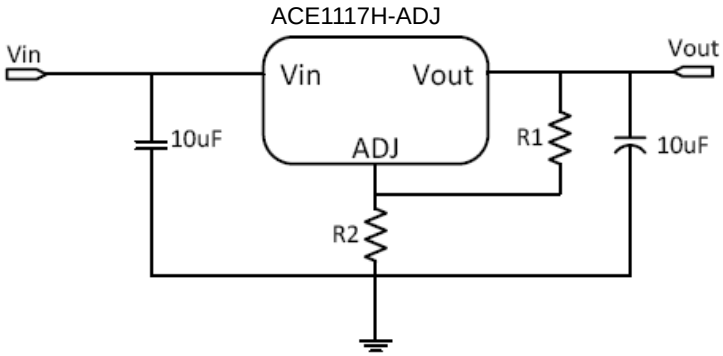
ACE1117H has an adjustable version and six fixed versions (1.2V, 1.8V, 2.5V, 3.3V, 5.0V and 12V)
Fixed output voltage version




Application circuit of ACE1117H 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
ACE1117H provides a 1.25V reference voltage. Any output voltage between 1.25V~12V can be achievable by choosing two external resistors (schematic is shown below), R1 and R2




Application Circuit of ACE1117H –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 125Ω or lower. As ACE1117H-ADJ can keep itself stable at load current about 2mA, R1 is not allowed to be higher than 625Ω.
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:$1/(2\ \pi\ f_{ripple}*C_{ADJ})<R1$.

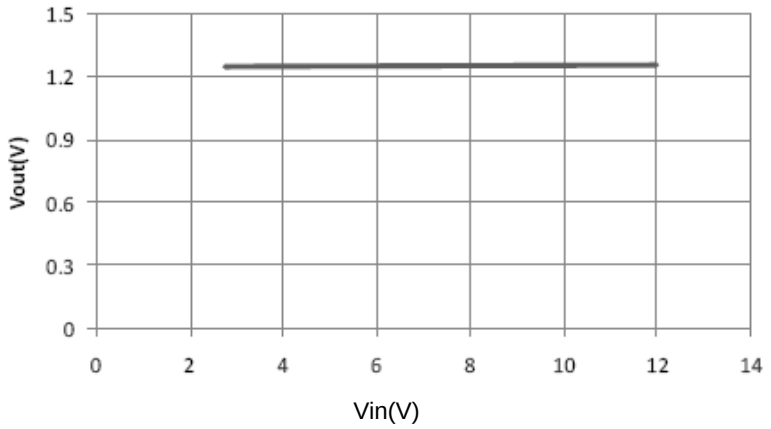
## Thermal Considerations

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 ACE1117H is very large. ACE1117H series uses SOT-223 package type and its thermal resistance is about 20°C/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°C/W. So the total thermal resistance is about 20°C/W + 30°C/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 ACE1117H could allow on itself is less than 1W. And furthermore, ACE1117H will work at junction temperature higher than 125°C under such condition and no lifetime is guaranteed.

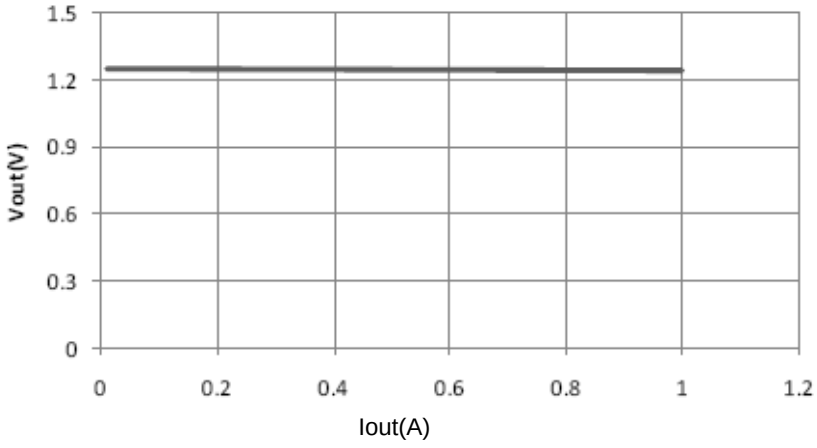
## Typical Performance Characteristic

$T_A$=25℃ unless specified

ACE1117H-ADJ Vout vs. Vin



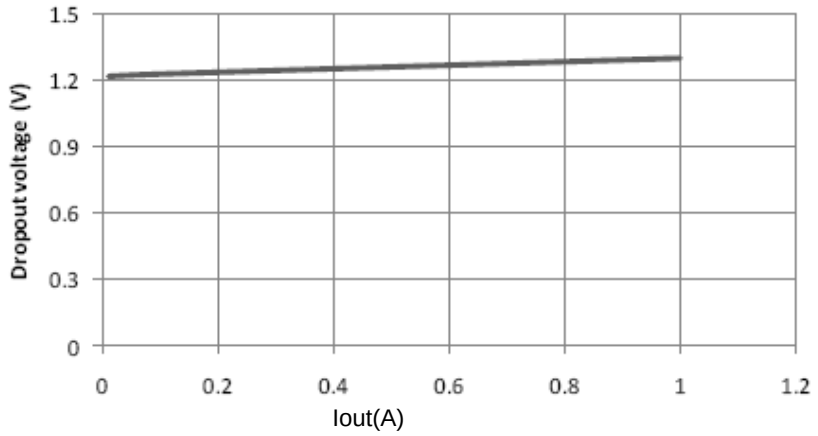

ACE1117H-ADJ Vout vs. Iout



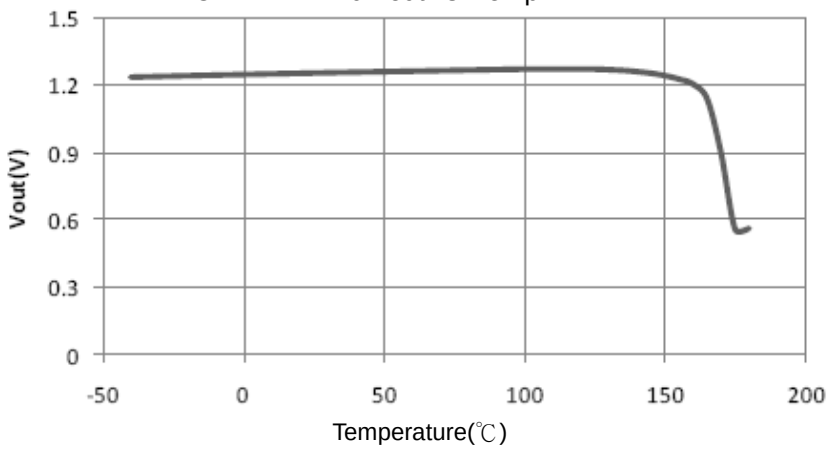
## Typical Performance Characteristic

$T_A$=25℃ unless specified

ACE1117H-ADJ Dropout vs. Iout

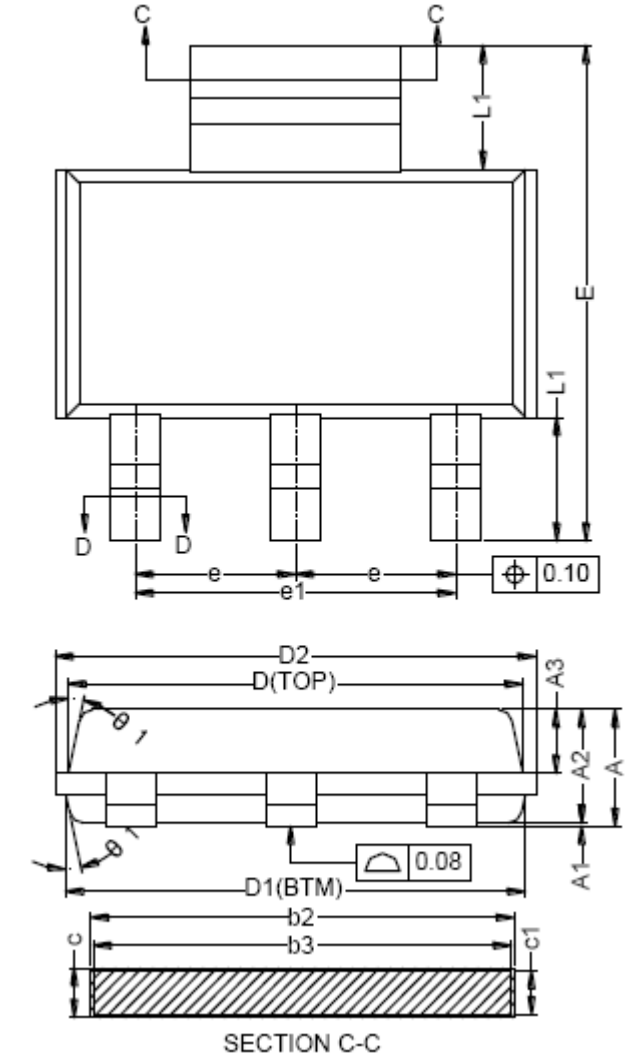



ACE1117H-ADJ Vout vs. Temp



## Packing Information

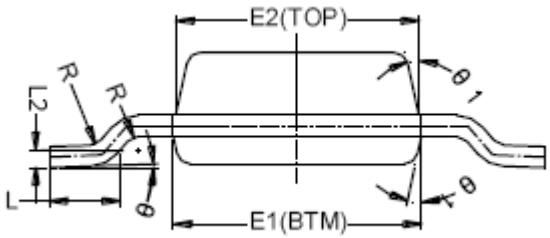
### SOT-223

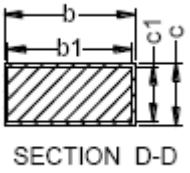



| Symbol | Min | Nom | Max |
|---|---|---|---|
| A | - | - | 1.80 |
| A1 | 0.02 | - | 0.10 |
| A2 | 1.50 | 1.60 | 1.70 |
| A3 | 0.80 | 0.90 | 1.00 |
| b | 0.67 | - | 0.80 |
| b1 | 0.66 | 0.71 | 0.76 |
| b2 | 2.96 | - | 3.09 |
| b3 | 2.95 | 3.00 | 3.05 |
| c | 0.30 | - | 0.35 |
| c1 | 0.29 | 0.30 | 0.31 |
| D | 6.48 | 6.53 | 6.58 |
| D1 | 6.55 | 6.60 | 6.65 |
| D2 | - | - | 7.05 |
| E | 6.80 | - | 7.20 |
| E1 | 3.40 | 3.50 | 3.60 |
| E2 | 3.33 | 3.43 | 3.53 |
| e | 2.30BSC | | |
| e1 | 4.60BSC | | |
| L | 0.8 | 1.00 | 1.20 |
| L1 | 1.75REF | | |
| L2 | 0.25BSC | | |
| R | 0.10 | - | - |
| R1 | 0.10 | - | - |
| Θ | 0° | - | 8° |
| Θ1 | 10° | 12° | 14° |

UNITS OF MEASURE=MILLIMETER

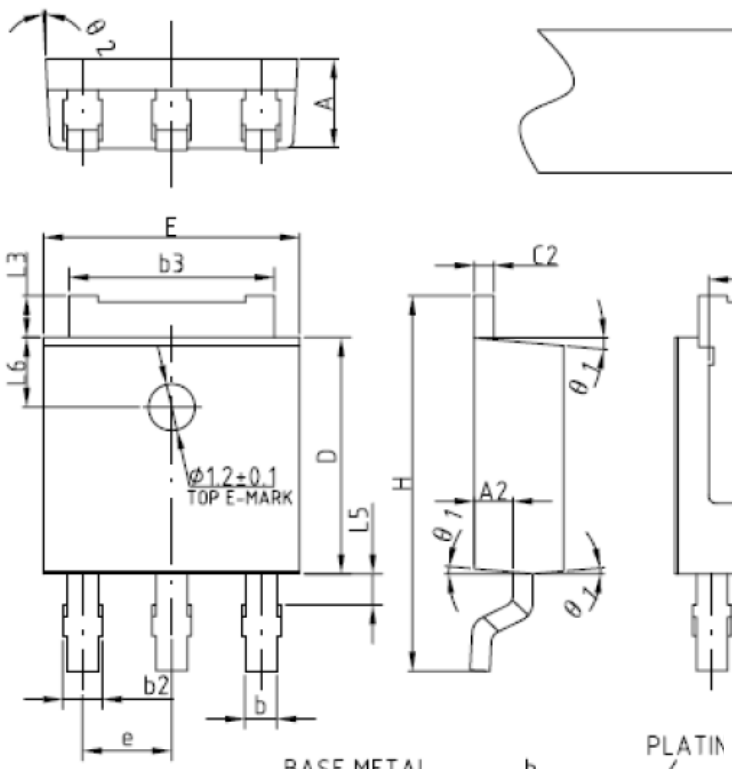
ALL DIMENSIONS REFER TO JEDEC STANDARD TO261-AA



## Packing Information

### TO-252




| SYMBOL | MIN | NOM | MAX |
|---|---|---|---|
| A | 2.20 | 2.30 | 2.38 |
| A1 | 0 | – | 0.10 |
| A2 | 0.90 | 1.00 | 1.10 |
| b | 0.77 | – | 0.89 |
| b1 | 0.76 | 0.81 | 0.86 |
| b2 | 0.77 | – | 1.10 |
| b3 | 5.23 | 5.33 | 5.43 |
| c | 0.47 | – | 0.60 |
| c1 | 0.46 | 0.51 | 0.56 |
| c2 | 0.47 | – | 0.60 |
| D | 6.00 | 6.10 | 6.20 |
| D1 | 5.25 | – | – |
| E | 6.50 | 6.60 | 6.70 |
| E1 | 4.70 | – | – |
| e | | 2.28BSC | |
| H | 9.80 | 10.10 | 10.40 |
| L | 1.40 | 1.50 | 1.70 |
| L1 | | 2.90REF | |
| L2 | | 0.51BSC | |
| L3 | 0.90 | – | 1.25 |
| L5 | 0.90 | – | 1.50 |
| L6 | | 1.80REF | |
| θ | 0° | – | 8° |
| θ1 | 3° | 5° | 7° |
| θ2 | 1° | 3° | 5° |

UNITS OF MEASURE=MILLIMETER

Notes

ACE does not assume any responsibility for use as critical components in life support devices or systems without the express written approval of the president and general counsel of ACE Electronics Co., LTD. As sued herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and shoes failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

ACE Technology Co., LTD.
http://www.ace-ele.com/