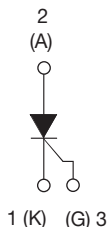
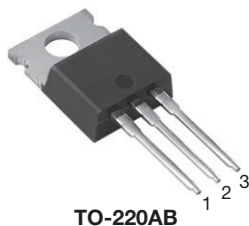


# Thyristor High Voltage, Phase Control SCR, 25 A



## FEATURES

- Easy control peak current at charger power up to reduce passive / electromechanical components
- Meets JESD 201 class 1A whisker test
- Flexible solution for reliable AC power rectification
- AEC-Q101 qualified
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

## PRIMARY CHARACTERISTICS

|                       |                   |
|-----------------------|-------------------|
| $I_{T(AV)}$           | 16 A              |
| $V_{DRM}/V_{RRM}$     | 1200 V            |
| $V_{TM}$              | 1.25 V            |
| $I_{GT}$              | 45 mA             |
| $T_J$                 | -40 °C to +125 °C |
| Package               | TO-220AB          |
| Circuit configuration | Single SCR        |

## APPLICATIONS

- On-board and off-board EV/HEV battery chargers
- Renewable energy inverters

## DESCRIPTION

The VS-25TTS12HM3 high voltage series of silicon controlled rectifiers are specifically designed for medium power switching and phase control applications.

## OUTPUT CURRENT IN TYPICAL APPLICATIONS

| APPLICATIONS                                                                     | SINGLE-PHASE BRIDGE | THREE-PHASE BRIDGE | UNITS |
|----------------------------------------------------------------------------------|---------------------|--------------------|-------|
| Capacitive input filter $T_A = 55$ °C, $T_J = 125$ °C, common heatsink of 1 °C/W | 18                  | 22                 | A     |

## MAJOR RATINGS AND CHARACTERISTICS

| PARAMETER         | TEST CONDITIONS     | VALUES      | UNITS |
|-------------------|---------------------|-------------|-------|
| $I_{T(AV)}$       | Sinusoidal waveform | 16          | A     |
| $I_{RMS}$         |                     | 25          |       |
| $V_{RRM}/V_{DRM}$ |                     | 1200        | V     |
| $I_{TSM}$         |                     | 320         | A     |
| $V_T$             | 16 A, $T_J = 25$ °C | 1.25        | V     |
| $dV/dt$           |                     | 500         | V/μs  |
| $dI/dt$           |                     | 150         | A/μs  |
| $T_J$             |                     | -40 to +125 | °C    |

## VOLTAGE RATINGS

| PART NUMBER   | $V_{RRM}$ , MAXIMUM PEAK REVERSE VOLTAGE<br>V | $V_{DRM}$ , MAXIMUM PEAK DIRECT VOLTAGE<br>V | $I_{RRM}/I_{DRM}$<br>AT 125 °C<br>mA |
|---------------|-----------------------------------------------|----------------------------------------------|--------------------------------------|
| VS-25TTS12HM3 | 1200                                          | 1200                                         | 10                                   |

**ABSOLUTE MAXIMUM RATINGS**

| PARAMETER                                             | SYMBOL          | TEST CONDITIONS                                                                                     |                                       | VALUES |      | UNITS         |
|-------------------------------------------------------|-----------------|-----------------------------------------------------------------------------------------------------|---------------------------------------|--------|------|---------------|
|                                                       |                 |                                                                                                     |                                       | TYP.   | MAX. |               |
| Maximum average on-state current                      | $I_{T(AV)}$     | $T_C = 93\text{ }^{\circ}\text{C}$ , 180° conduction half sine wave                                 |                                       | 16     |      | A             |
| Maximum RMS on-state current                          | $I_{RMS}$       |                                                                                                     |                                       | 25     |      |               |
| Maximum peak, one-cycle, non-repetitive surge current | $I_{TSM}$       | 10 ms sine pulse, rated $V_{RRM}$ applied                                                           |                                       | 270    |      |               |
|                                                       |                 | 10 ms sine pulse, no voltage reapplied                                                              |                                       | 320    |      |               |
| Maximum $I^2t$ for fusing                             | $I^2t$          | 10 ms sine pulse, rated $V_{RRM}$ applied                                                           |                                       | 365    |      | $A^2s$        |
|                                                       |                 | 10 ms sine pulse, no voltage reapplied                                                              |                                       | 515    |      |               |
| Maximum $I^2\sqrt{t}$ for fusing                      | $I^2\sqrt{t}$   | $t = 0.1$ to 10 ms, no voltage reapplied                                                            |                                       | 5152   |      | $A^2\sqrt{s}$ |
| Maximum on-state voltage drop                         | $V_{TM}$        | 16 A, $T_J = 25\text{ }^{\circ}\text{C}$                                                            |                                       | 1.25   |      | V             |
| On-state slope resistance                             | $r_t$           | $T_J = 125\text{ }^{\circ}\text{C}$                                                                 |                                       | 12.0   |      | $m\Omega$     |
| Threshold voltage                                     | $V_{T(TO)}$     |                                                                                                     |                                       | 1.0    |      | V             |
| Maximum reverse and direct leakage current            | $I_{RM}/I_{DM}$ | $T_J = 25\text{ }^{\circ}\text{C}$                                                                  | $V_R = \text{rated } V_{RRM}/V_{DRM}$ | 0.5    |      | mA            |
|                                                       |                 | $T_J = 125\text{ }^{\circ}\text{C}$                                                                 |                                       | 10     |      |               |
| Holding current                                       | $I_H$           | Anode supply = 6 V, resistive load, initial $I_T = 1\text{ A}$ , $T_J = 25\text{ }^{\circ}\text{C}$ |                                       | -      | 150  |               |
| Maximum latching current                              | $I_L$           | Anode supply = 6 V, resistive load, $T_J = 25\text{ }^{\circ}\text{C}$                              |                                       | 200    |      |               |
| Maximum rate of rise of off-state voltage             | $dV/dt$         | $T_J = T_{J\text{ max.}}$ , linear to 80 °C, $V_{DRM} = R_g - k = \text{open}$                      |                                       | 500    |      | V/ $\mu s$    |
| Maximum rate of rise of turned-on current             | $dI/dt$         |                                                                                                     |                                       | 150    |      | A/ $\mu s$    |

**TRIGGERING**

| PARAMETER                                   | SYMBOL      | TEST CONDITIONS                                                         | VALUES | UNITS |
|---------------------------------------------|-------------|-------------------------------------------------------------------------|--------|-------|
| Maximum peak gate power                     | $P_{GM}$    |                                                                         | 8.0    | W     |
| Maximum average gate power                  | $P_{G(AV)}$ |                                                                         | 2.0    |       |
| Maximum peak positive gate current          | $+I_{GM}$   |                                                                         | 1.5    | A     |
| Maximum peak negative gate voltage          | $-V_{GM}$   |                                                                         | 10     | V     |
| Maximum required DC gate current to trigger | $I_{GT}$    | Anode supply = 6 V, resistive load, $T_J = -10\text{ }^{\circ}\text{C}$ | 60     | mA    |
|                                             |             | Anode supply = 6 V, resistive load, $T_J = 25\text{ }^{\circ}\text{C}$  | 45     |       |
|                                             |             | Anode supply = 6 V, resistive load, $T_J = 125\text{ }^{\circ}\text{C}$ | 20     |       |
| Maximum required DC gate voltage to trigger | $V_{GT}$    | Anode supply = 6 V, resistive load, $T_J = -10\text{ }^{\circ}\text{C}$ | 2.5    | V     |
|                                             |             | Anode supply = 6 V, resistive load, $T_J = 25\text{ }^{\circ}\text{C}$  | 2.0    |       |
|                                             |             | Anode supply = 6 V, resistive load, $T_J = 125\text{ }^{\circ}\text{C}$ | 1.0    |       |
| Maximum DC gate voltage not to trigger      | $V_{GD}$    | $T_J = 125\text{ }^{\circ}\text{C}$ , $V_{DRM} = \text{rated value}$    | 0.25   | mA    |
| Maximum DC gate current not to trigger      | $I_{GD}$    |                                                                         | 2.0    |       |

**SWITCHING**

| PARAMETER                     | SYMBOL   | TEST CONDITIONS                     | VALUES | UNITS   |
|-------------------------------|----------|-------------------------------------|--------|---------|
| Typical turn-on time          | $t_{gt}$ | $T_J = 25\text{ }^{\circ}\text{C}$  | 0.9    | $\mu s$ |
| Typical reverse recovery time | $t_{rr}$ | $T_J = 125\text{ }^{\circ}\text{C}$ | 4      |         |
| Typical turn-off time         | $t_q$    |                                     | 110    |         |



| THERMAL AND MECHANICAL SPECIFICATIONS           |                                   |                                      |            |                        |
|-------------------------------------------------|-----------------------------------|--------------------------------------|------------|------------------------|
| PARAMETER                                       | SYMBOL                            | TEST CONDITIONS                      | VALUES     | UNITS                  |
| Maximum junction and storage temperature range  | T <sub>J</sub> , T <sub>Stg</sub> |                                      | -40 to 125 | °C                     |
| Maximum thermal resistance, junction to case    | R <sub>thJC</sub>                 | DC operation                         | 1.1        | °C/W                   |
| Maximum thermal resistance, junction to ambient | R <sub>thJA</sub>                 |                                      | 62         |                        |
| Typical thermal resistance, case to heatsink    | R <sub>thCS</sub>                 | Mounting surface, smooth and greased | 0.5        |                        |
| Approximate weight                              |                                   |                                      | 2          | g                      |
|                                                 |                                   |                                      | 0.07       | oz.                    |
| Mounting torque                                 | minimum                           |                                      | 6 (5)      | kgf · cm<br>(lbf · in) |
|                                                 | maximum                           |                                      | 12 (10)    |                        |
| Marking device                                  |                                   | Case style TO-220AB                  | 25TTS12H   |                        |

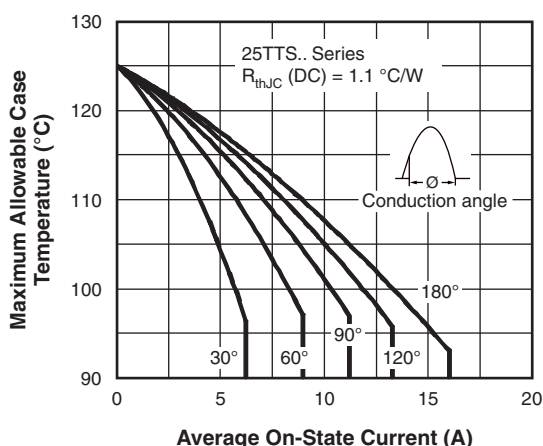


Fig. 1 - Current Rating Characteristics

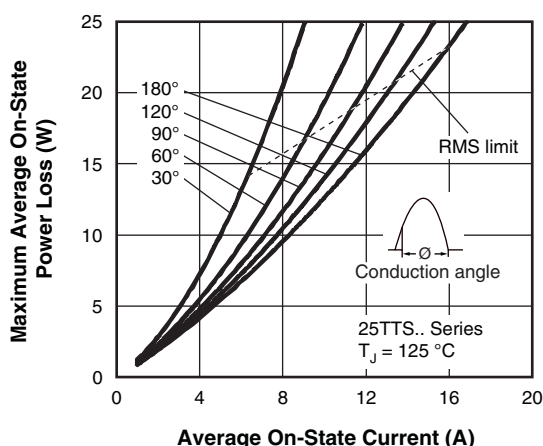


Fig. 3 - On-State Power Loss Characteristics

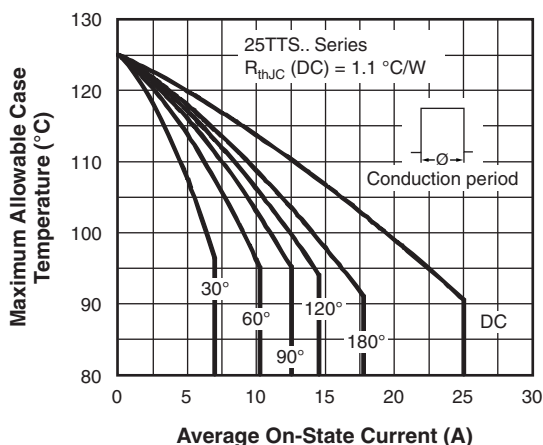


Fig. 2 - Current Rating Characteristics

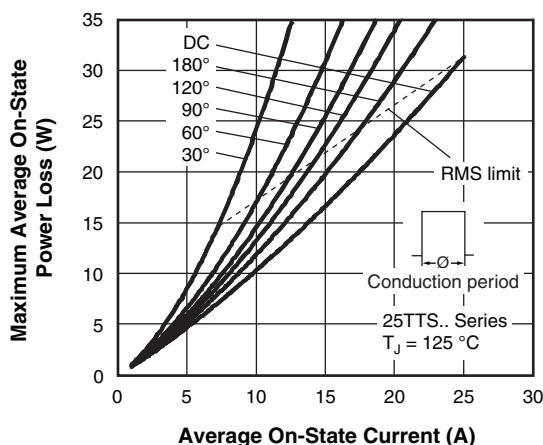


Fig. 4 - On-State Power Loss Characteristics

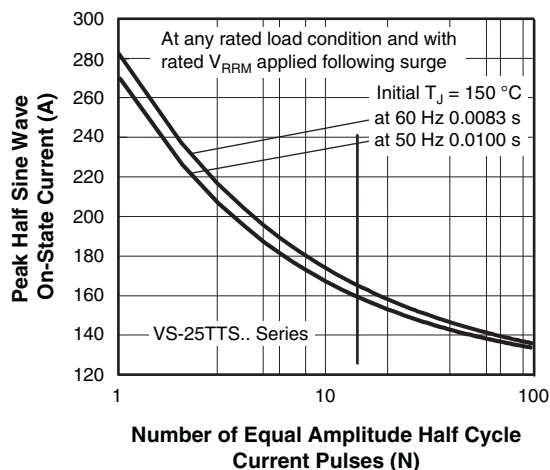


Fig. 5 - Maximum Non-Repetitive Surge Current

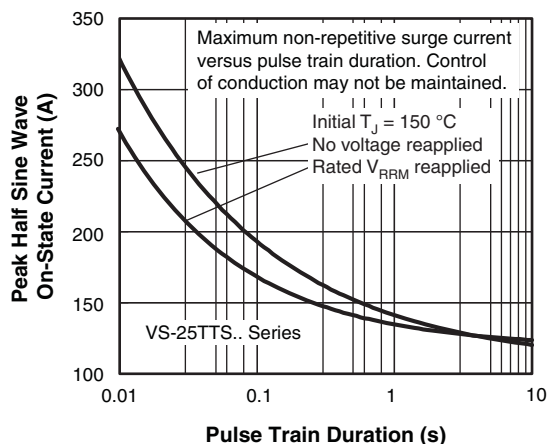


Fig. 6 - Maximum Non-Repetitive Surge Current

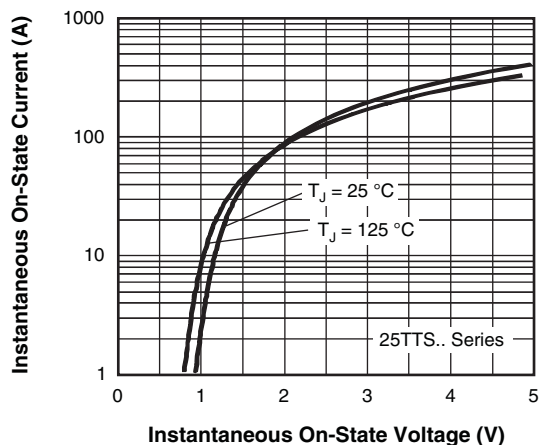


Fig. 7 - On-State Voltage Drop Characteristics

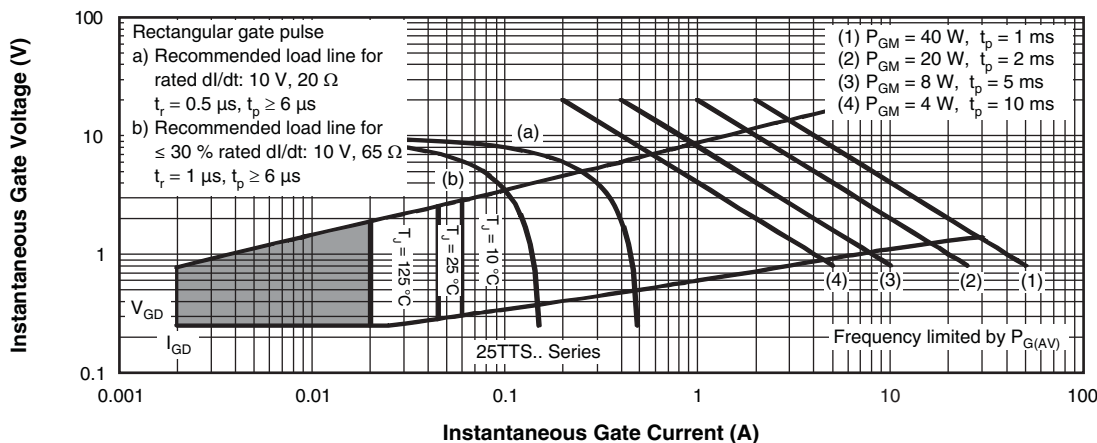


Fig. 8 - Gate Characteristics

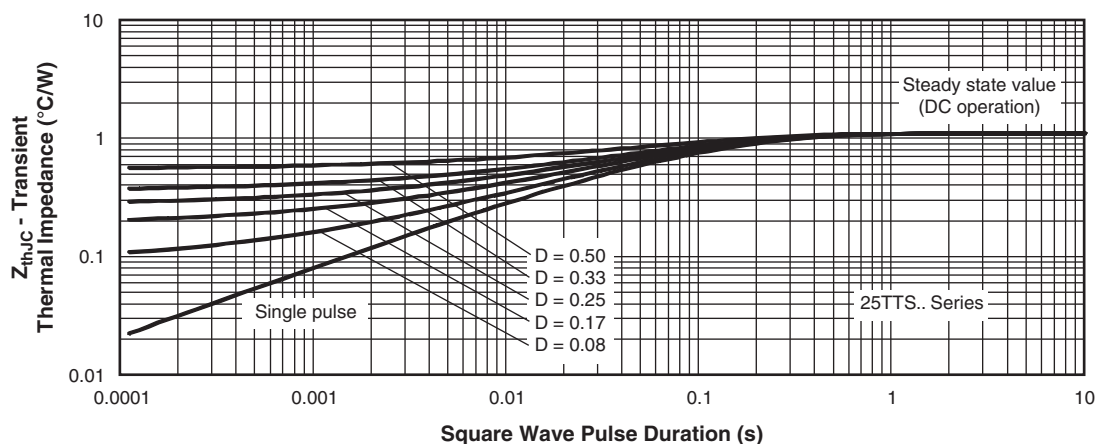


Fig. 9 - Thermal Impedance  $Z_{th,JC}$  Characteristics

## ORDERING INFORMATION TABLE

Device code

|     |    |   |   |   |    |   |    |
|-----|----|---|---|---|----|---|----|
| VS- | 25 | T | T | S | 12 | H | M3 |
| 1   | 2  | 3 | 4 | 5 | 6  | 7 | 8  |

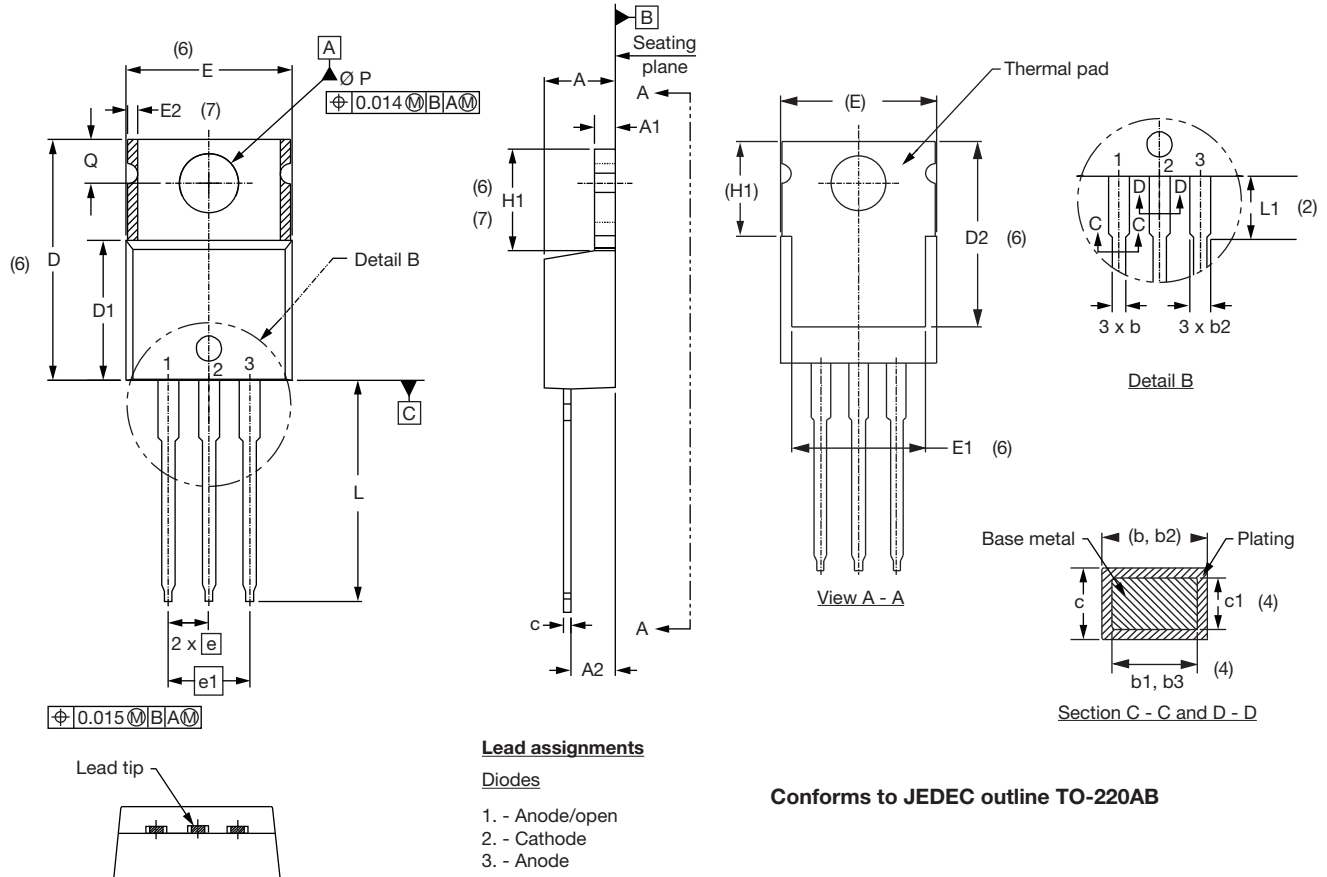
- 1 - Vishay Semiconductors product
- 2 - Current rating (25 = 25 A)
- 3 - Circuit configuration:  
T = single thyristor
- 4 - Package:  
T = TO-220AB
- 5 - Type of silicon:  
S = standard recovery rectifier
- 6 - Voltage rating 12 = 1200 V
- 7 - H = AEC-Q101 qualified
- 8 - Environmental digit:  
M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

| ORDERING INFORMATION (Example) |                  |                        |                          |
|--------------------------------|------------------|------------------------|--------------------------|
| PREFERRED P/N                  | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION    |
| VS-25TTS12HM3                  | 50               | 1000                   | Antistatic plastic tubes |

| LINKS TO RELATED DOCUMENTS |                                                                        |
|----------------------------|------------------------------------------------------------------------|
| Dimensions                 | <a href="http://www.vishay.com/doc?95222">www.vishay.com/doc?95222</a> |
| Part marking information   | <a href="http://www.vishay.com/doc?95028">www.vishay.com/doc?95028</a> |

### TO-220AB

**DIMENSIONS** in millimeters and inches



| SYMBOL | MILLIMETERS |       | INCHES |       | NOTES |
|--------|-------------|-------|--------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |
| A      | 4.25        | 4.65  | 0.167  | 0.183 |       |
| A1     | 1.14        | 1.40  | 0.045  | 0.055 |       |
| A2     | 2.56        | 2.92  | 0.101  | 0.115 |       |
| b      | 0.69        | 1.01  | 0.027  | 0.040 |       |
| b1     | 0.38        | 0.97  | 0.015  | 0.038 | 4     |
| b2     | 1.20        | 1.73  | 0.047  | 0.068 |       |
| b3     | 1.14        | 1.73  | 0.045  | 0.068 | 4     |
| c      | 0.36        | 0.61  | 0.014  | 0.024 |       |
| c1     | 0.36        | 0.56  | 0.014  | 0.022 | 4     |
| D      | 14.85       | 15.25 | 0.585  | 0.600 | 3     |
| D1     | 8.38        | 9.02  | 0.330  | 0.355 |       |
| D2     | 11.68       | 12.88 | 0.460  | 0.507 | 6     |

| SYMBOL | MILLIMETERS |       | INCHES     |       | NOTES |
|--------|-------------|-------|------------|-------|-------|
|        | MIN.        | MAX.  | MIN.       | MAX.  |       |
| E      | 10.11       | 10.51 | 0.398      | 0.414 | 3, 6  |
| E1     | 6.86        | 8.89  | 0.270      | 0.350 | 6     |
| E2     | -           | 0.76  | -          | 0.030 | 7     |
| e      | 2.41        | 2.67  | 0.095      | 0.105 |       |
| e1     | 4.88        | 5.28  | 0.192      | 0.208 |       |
| H1     | 6.09        | 6.48  | 0.240      | 0.255 | 6, 7  |
| L      | 13.52       | 14.02 | 0.532      | 0.552 |       |
| L1     | 3.32        | 3.82  | 0.131      | 0.150 | 2     |
| Ø P    | 3.54        | 3.73  | 0.139      | 0.147 |       |
| Q      | 2.60        | 3.00  | 0.102      | 0.118 |       |
| θ      | 90° to 93°  |       | 90° to 93° |       |       |

#### Notes

- (1) Dimensioning and tolerancing as per ASME Y14.5M-1994
- (2) Lead dimension and finish uncontrolled in L1
- (3) Dimension D, D1 and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body
- (4) Dimension b1, b3 and c1 apply to base metal only
- (5) Controlling dimensions: inches
- (6) Thermal pad contour optional within dimensions E, H1, D2 and E1
- (7) Dimensions E2 x H1 define a zone where stamping and singulation irregularities are allowed
- (8) Outline conforms to JEDEC TO-220, except A2 (maximum) and D2 (minimum) where dimensions are derived from the actual package outline



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