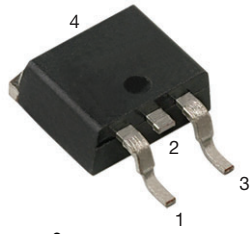
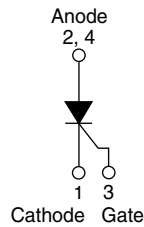


## Thyristor Surface Mount, Phase Control SCR, 16 A


**D<sup>2</sup>PAK (TO-263AB)**


### FEATURES

- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- AEC-Q101 qualified
- Meets JESD 201 class 1A whisker test
- Flexible solution for reliable AC power rectification
- Easy control peak current at charger power up to reduce passive / electromechanical components
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


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

### APPLICATIONS

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

### DESCRIPTION

The VS-25TTS16SLHM3 of silicon controlled rectifiers is specifically designed for medium power switching and phase control applications.

### PRIMARY CHARACTERISTICS

|                       |                               |
|-----------------------|-------------------------------|
| $I_{T(AV)}$           | 16 A                          |
| $V_{DRM}/V_{RRM}$     | 1600 V                        |
| $V_{TM}$              | 1.25 V                        |
| $I_{GT}$              | 45 mA                         |
| $T_J$                 | -40 °C to +125 °C             |
| Package               | D <sup>2</sup> PAK (TO-263AB) |
| Circuit configuration | Single SCR                    |

### OUTPUT CURRENT IN TYPICAL APPLICATIONS

| APPLICATIONS                                                         | SINGLE-PHASE BRIDGE | THREE-PHASE BRIDGE | UNITS |
|----------------------------------------------------------------------|---------------------|--------------------|-------|
| NEMA FR-4 or G10 glass fabric-based epoxy with 4 oz. (140 μm) copper | 3.5                 | 5.5                | A     |
| Aluminum IMS, $R_{thCA} = 15$ °C/W                                   | 8.5                 | 13.5               |       |
| Aluminum IMS with heatsink, $R_{thCA} = 5$ °C/W                      | 16.5                | 25.0               |       |

#### Note

- $T_A = 55$  °C,  $T_J = 125$  °C, footprint 300 mm<sup>2</sup>

### MAJOR RATINGS AND CHARACTERISTICS

| PARAMETER         | TEST CONDITIONS     | VALUES      | UNITS |
|-------------------|---------------------|-------------|-------|
| $I_{T(AV)}$       | Sinusoidal waveform | 16          | A     |
| $I_{RMS}$         |                     | 25          |       |
| $V_{RRM}/V_{DRM}$ |                     | 1600        | V     |
| $I_{TSM}$         |                     | 350         | 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 | $I_{RRM}/I_{DRM}$ , AT 125 °C<br>mA |
|-----------------|-----------------------------------------------|----------------------------------------------|-------------------------------------|
| VS-25TTS16SLHM3 | 1600                                          | 1600                                         | 10                                  |



| <b>ABSOLUTE MAXIMUM RATINGS</b>                       |                 |                                                                                                   |                                   |      |               |    |
|-------------------------------------------------------|-----------------|---------------------------------------------------------------------------------------------------|-----------------------------------|------|---------------|----|
| 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                                                         | 300                               |      |               |    |
|                                                       |                 | 10 ms sine pulse, no voltage reapplied                                                            | 350                               |      |               |    |
| Maximum $I^2t$ for fusing                             | $I^2t$          | 10 ms sine pulse, rated $V_{RRM}$ applied                                                         | 450                               |      | $A^2s$        |    |
|                                                       |                 | 10 ms sine pulse, no voltage reapplied                                                            | 630                               |      |               |    |
| Maximum $I^2\sqrt{t}$ for fusing                      | $I^2\sqrt{t}$   | $t = 0.1\text{ ms to }10\text{ ms}$ , no voltage reapplied                                        | 6300                              |      | $A^2\sqrt{s}$ |    |
| 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            | $I_{RM}/I_{DM}$ | $V_R = \text{Rated } V_{RRM}/V_{DRM}$                                                             | $T_J = 25\text{ }^\circ\text{C}$  | 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 %, $V_{DRM} = R_g - k = \text{Open}$                       | 500                               |      | $V/\mu s$     |    |
| Maximum rate of rise of turned-on current             | $dI/dt$         |                                                                                                   | 150                               |      | $A/\mu s$     |    |

| <b>TRIGGERING</b>                           |             |                                                                       |        |       |
|---------------------------------------------|-------------|-----------------------------------------------------------------------|--------|-------|
| 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   |       |
| Maximum DC gate current not to trigger      | $I_{GD}$    |                                                                       | 2.0    |       |

| <b>SWITCHING</b>              |          |                                   |        |         |
|-------------------------------|----------|-----------------------------------|--------|---------|
| 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              | $T_J, T_{Stg}$   |                                          | -40 to +125 | °C    |
| Soldering temperature                                       | $T_S$            | For 10 s (1.6 mm from case)              | 260         |       |
| Maximum thermal resistance, junction to case                | $R_{thJC}$       | DC operation                             | 1.1         | °C/W  |
| Typical thermal resistance, junction to ambient (PCB mount) | $R_{thJA}^{(1)}$ |                                          | 40          |       |
| Approximate weight                                          |                  |                                          | 2           | g     |
|                                                             |                  |                                          | 0.07        | oz.   |
| Marking device                                              |                  | Case style D <sup>2</sup> PAK (TO-263AB) | 25TTS16SH   |       |

**Note**

(1) When mounted on 1" square (650 mm<sup>2</sup>) PCB of FR-4 or G-10 material 4 oz. (140 μm) copper 40 °C/W

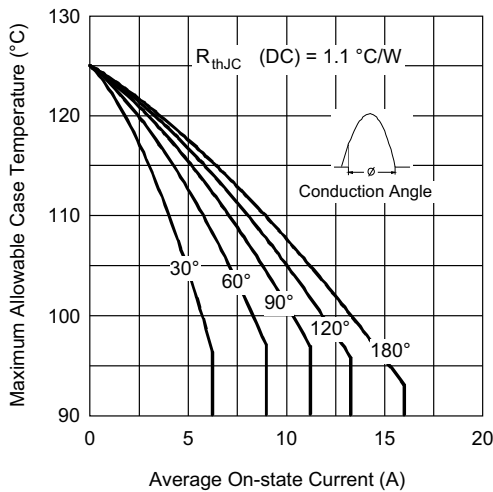


Fig. 1 - Current Rating Characteristics

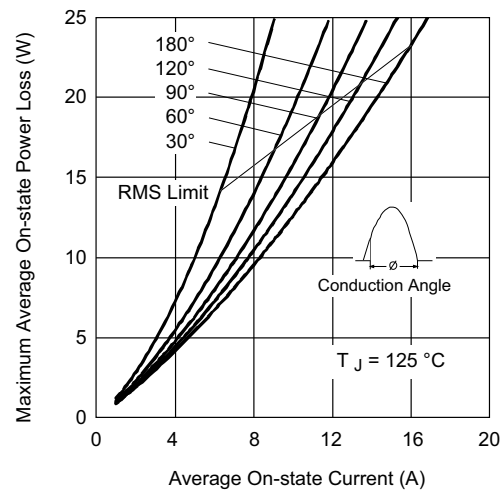


Fig. 3 - On-State Power Loss Characteristics

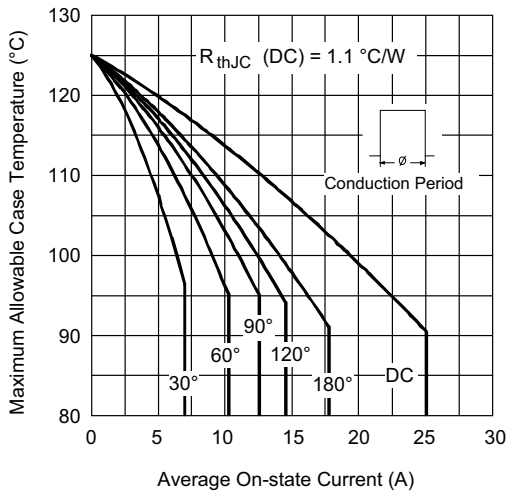


Fig. 2 - Current Rating Characteristics

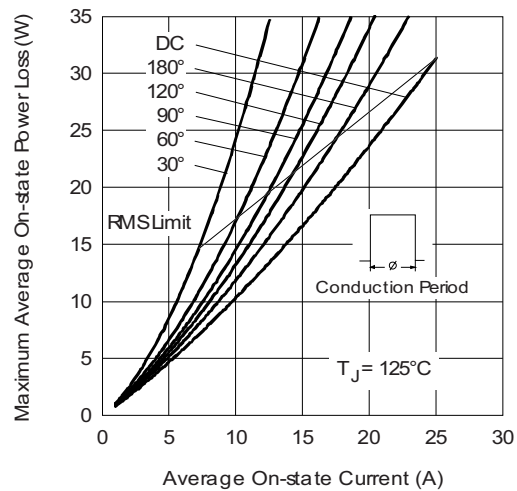


Fig. 4 - On-State Power Loss Characteristics

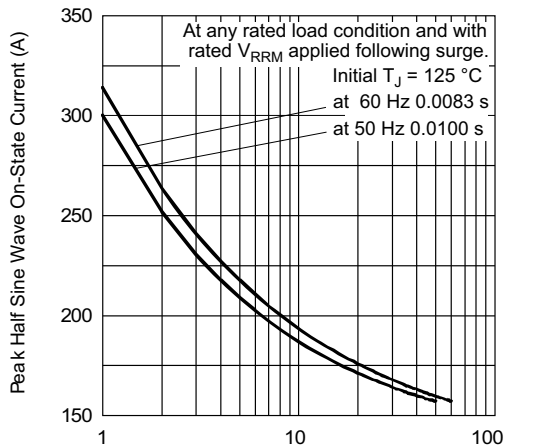


Fig. 5 - Maximum Non-Repetitive Surge Current

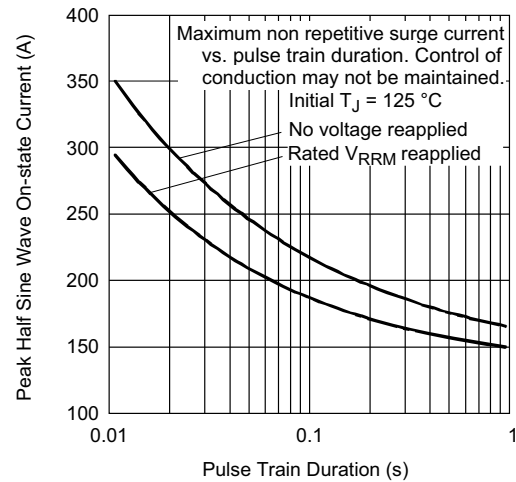


Fig. 6 - Maximum Non-Repetitive Surge Current

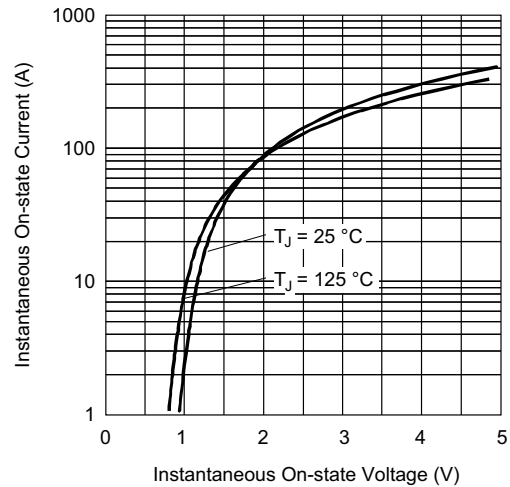


Fig. 7 - On-State Voltage Drop Characteristics

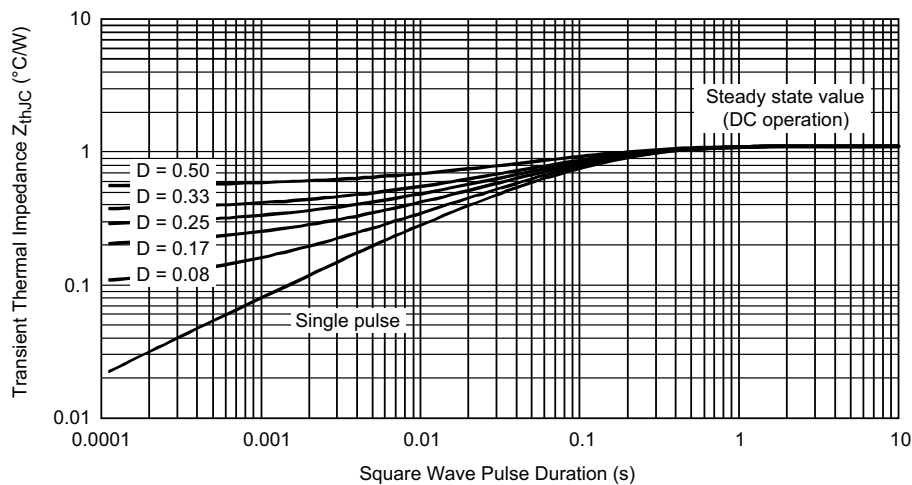


Fig. 8 - Gate Characteristics

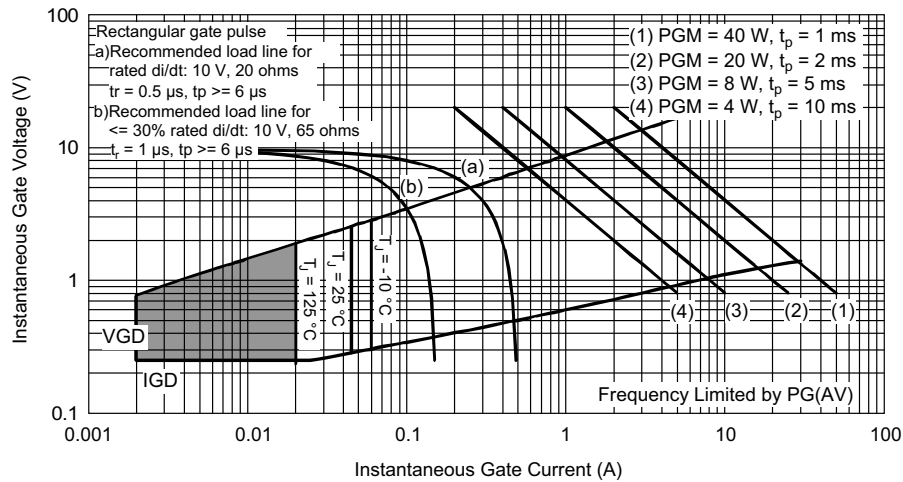


Fig. 9 - Thermal Impedance  $Z_{thJC}$  Characteristics

**ORDERING INFORMATION TABLE**

|             |            |           |          |          |          |           |          |          |          |           |
|-------------|------------|-----------|----------|----------|----------|-----------|----------|----------|----------|-----------|
| Device code | <b>VS-</b> | <b>25</b> | <b>T</b> | <b>T</b> | <b>S</b> | <b>16</b> | <b>S</b> | <b>L</b> | <b>H</b> | <b>M3</b> |
|             | ①          | ②         | ③        | ④        | ⑤        | ⑥         | ⑦        | ⑧        | ⑨        | ⑩         |

- 1** - Vishay Semiconductors product
- 2** - Current rating (25 = 25 A)
- 3** - Circuit configuration:  
T = single thyristor
- 4** - Package:  
T = D<sup>2</sup>PAK (TO-263AB)
- 5** - Type of silicon:  
S = standard recovery rectifier
- 6** - Voltage rating: Voltage code x 100 =  $V_{RRM}$  — **16 = 1600 V**
- 7** - S = surface mountable
- 8** - L = tape and reel (left oriented), for different orientation, contact factory
- 9** - H = AEC-Q101 qualified
- 10** - Environmental digit:  
M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

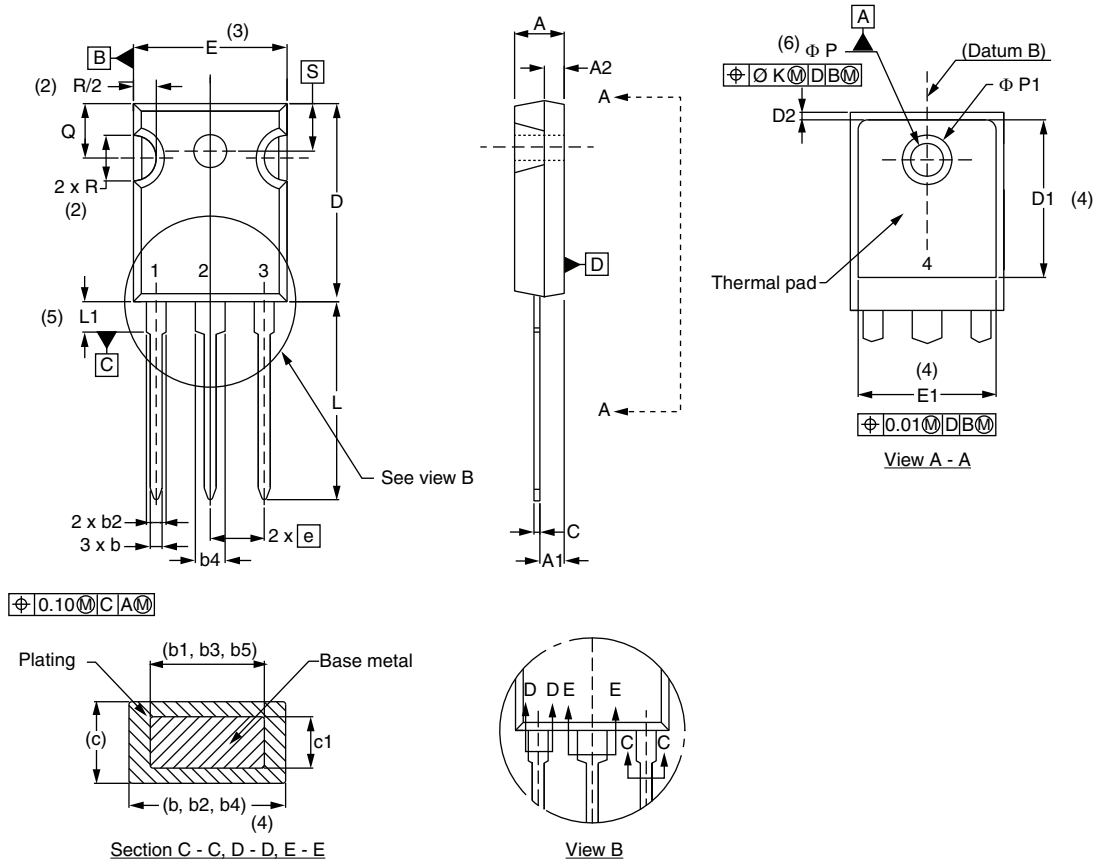
| <b>ORDERING INFORMATION</b> (Example) |                  |                        |                       |
|---------------------------------------|------------------|------------------------|-----------------------|
| PREFERRED P/N                         | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION |
| VS-25TTS16SLHM3                       | 800              | 800                    | 13" diameter reel     |

| <b>LINKS TO RELATED DOCUMENTS</b> |                                                                        |
|-----------------------------------|------------------------------------------------------------------------|
| Dimensions                        | <a href="http://www.vishay.com/doc?95046">www.vishay.com/doc?95046</a> |
| Part marking information          | <a href="http://www.vishay.com/doc?95444">www.vishay.com/doc?95444</a> |
| Packaging information             | <a href="http://www.vishay.com/doc?96317">www.vishay.com/doc?96317</a> |



TO-247AD 3L

**DIMENSIONS** in millimeters and inches



| SYMBOL | MILLIMETERS |       | INCHES |       | NOTES | SYMBOL | MILLIMETERS |       | INCHES    |       | NOTES |
|--------|-------------|-------|--------|-------|-------|--------|-------------|-------|-----------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |        | MIN.        | MAX.  | MIN.      | MAX.  |       |
| A      | 4.65        | 5.31  | 0.183  | 0.209 |       | D2     | 0.51        | 1.30  | 0.020     | 0.051 |       |
| A1     | 2.21        | 2.59  | 0.087  | 0.102 |       | E      | 15.29       | 15.87 | 0.602     | 0.625 | 3     |
| A2     | 1.50        | 2.49  | 0.059  | 0.098 |       | E1     | 13.46       | -     | 0.53      | -     |       |
| b      | 0.99        | 1.40  | 0.039  | 0.055 |       | e      | 5.46 BSC    |       | 0.215 BSC |       |       |
| b1     | 0.99        | 1.35  | 0.039  | 0.053 |       | Ø K    | 2.54        |       | 0.010     |       |       |
| b2     | 1.65        | 2.39  | 0.065  | 0.094 |       | L      | 19.81       | 20.32 | 0.780     | 0.800 |       |
| b3     | 1.65        | 2.34  | 0.065  | 0.092 |       | L1     | 3.71        | 4.29  | 0.146     | 0.169 |       |
| b4     | 2.59        | 3.43  | 0.102  | 0.135 |       | Ø P    | 3.56        | 3.66  | 0.14      | 0.144 |       |
| b5     | 2.59        | 3.38  | 0.102  | 0.133 |       | Ø P1   | -           | 6.98  | -         | 0.275 |       |
| c      | 0.38        | 0.89  | 0.015  | 0.035 |       | Q      | 5.31        | 5.69  | 0.209     | 0.224 |       |
| c1     | 0.38        | 0.84  | 0.015  | 0.033 |       | R      | 4.52        | 5.49  | 0.178     | 0.216 |       |
| D      | 19.71       | 20.70 | 0.776  | 0.815 | 3     | S      | 5.51 BSC    |       | 0.217 BSC |       |       |
| D1     | 13.08       | -     | 0.515  | -     | 4     |        |             |       |           |       |       |

**Notes**

- (1) Dimensioning and tolerancing per ASME Y14.5M-1994
- (2) Contour of slot optional
- (3) Dimension D and E do not include mold flash. These dimensions are measured at the outermost extremes of the plastic body
- (4) Thermal pad contour optional with dimensions D1 and E1
- (5) Lead finish uncontrolled in L1
- (6) Ø P to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")
- (7) Outline conforms to JEDEC® outline TO-247 with exception of dimension A min., D, E min., Q min., S, and note 4



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