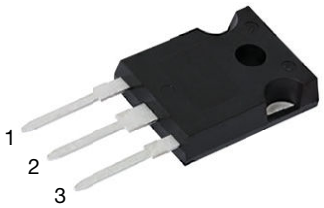
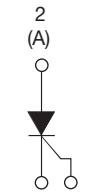
# Thyristor High Voltage, Phase Control SCR, 40 A




TO-247AC 3L




## FEATURES

- Designed and qualified according to JEDEC®-JESD 47
- Low $I_{GT}$ parts available
- 125 °C max. operating junction temperature
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT
HALOGEN FREE Available

## APPLICATIONS

- Typical usage is in input rectification crowbar (soft start) and AC switch motor control, UPS, welding and battery charge

## DESCRIPTION

The VS-40TPS... high voltage series of silicon controlled rectifiers are specifically designed for medium power switching and phase control applications. The glass passivation technology used has reliable operation up to 125 °C junction temperature.

| PRIMARY CHARACTERISTICS | |
|---|---|
| $I_{T(AV)}$ | 35 A |
| $V_{DRM}/V_{RRM}$ | 800 V, 1200 V |
| $V_{TM}$ | 1.45 V |
| $I_{GT}$ | 150 mA |
| $T_J$ | -40 °C to +125 °C |
| Package | TO-247AC 3L |
| Circuit configuration | Single SCR |

| MAJOR RATINGS AND CHARACTERISTICS | | | |
|---|---|---|---|
| PARAMETER | TEST CONDITIONS | VALUES | UNITS |
| $I_{T(AV)}$ | Sinusoidal waveform | 35 | A |
| $I_{RMS}$ | | 55 | |
| $V_{RRM}/V_{DRM}$ | | 800 to 1200 | V |
| $I_{TSM}$ | | 600 | A |
| $V_T$ | 40 A, $T_J$ = 25 °C | 1.45 | V |
| dV/dt | | 1000 | V/µs |
| dI/dt | | 100 | A/µs |
| $T_J$ | | -40 to +125 | °C |

| VOLTAGE RATINGS | | | |
|---|---|---|---|
| PART NUMBER | $V_{RRM}/V_{DRM}$, MAXIMUM REPETITIVE PEAK AND OFF-STATE VOLTAGE V | $V_{RSM}$, MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V | $I_{RRM}/I_{DRM}$ AT 125 °C mA |
| VS-40TPS08A-M3 | 800 | 900 | 10 |
| VS-40TPS08-M3 | 800 | 900 | |
| VS-40TPS12A-M3 | 1200 | 1300 | |
| VS-40TPS12-M3 | 1200 | 1300 | |

| ABSOLUTE MAXIMUM RATINGS | | | | | |
|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | | **VALUES** | **UNITS** |
| Maximum average on-state current | $I_{T(AV)}$ | $T_C$ = 79 °C, 180° conduction half sine wave | | 35 | A |
| Maximum continuous RMS on-state current as AC switch | $I_{T(RMS)}$ | | | 55 | A |
| Maximum peak, one-cycle non-repetitive surge current | $I_{TSM}$ | 10 ms sine pulse, rated $V_{RRM}$ applied | Initial $T_J = T_J$ max. | 500 | A |
| | | 10 ms sine pulse, no voltage reapplied | | 600 | A |
| Maximum $I^2t$ for fusing | $I^2t$ | 10 ms sine pulse, rated $V_{RRM}$ applied | | 1250 | $A^2s$ |
| | | 10 ms sine pulse, no voltage reapplied | | 1760 | $A^2s$ |
| Maximum $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | t = 0.1 ms to 10 ms, no voltage reapplied | | 17 600 | $A^2\sqrt{s}$ |
| Low level value of threshold voltage | $V_{T(TO)1}$ | $T_J$ = 125 °C | | 1.02 | V |
| High level value of threshold voltage | $V_{T(TO)2}$ | | | 1.23 | V |
| Low level value of on-state slope resistance | $r_{t1}$ | | | 9.74 | mΩ |
| High level value of on-state slope resistance | $r_{t2}$ | | | 7.50 | mΩ |
| Maximum peak on-state voltage | $V_{TM}$ | 110 A, $T_J$ = 25 °C | | 1.85 | V |
| Maximum rate of rise of turned-on current | dI/dt | $T_J$ = 25 °C | | 100 | A/µs |
| Maximum holding current | $I_H$ | Anode supply = 6 V, resistive load, initial $T_J$ = 1 A, $I_T$ = 25 °C | | 200 | mA |
| Maximum latching current | $I_L$ | Anode supply = 6 V, resistive load, $T_J$ = 25 °C | | 300 | mA |
| Maximum reverse and direct leakage current | $I_{RRM}/I_{DRM}$ | $T_J$ = 25 °C | $V_R$ = Rated $V_{RRM}/V_{DRM}$ | 0.5 | mA |
| | | $T_J$ = 125 °C | | 10 | mA |
| Maximum rate of rise of off-state voltage 40TPS12A | dV/dt | $T_J = T_J$ maximum, linear to 80 % $V_{DRM}$, $R_g$ - k = 100 Ω | | 500 | V/µs |
| Maximum rate of rise of off-state voltage 40TPS12 | | | | 1000 | V/µs |

| TRIGGERING | | | | | |
|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | | **VALUES** | **UNITS** |
| Maximum peak gate power | $P_{GM}$ | | | 10 | W |
| Maximum average gate power | $P_{G(AV)}$ | | | 2.5 | W |
| Maximum peak gate current | $I_{GM}$ | | | 2.5 | A |
| Maximum peak negative gate voltage | - $V_{GM}$ | | | 10 | V |
| Maximum required DC gate voltage to trigger | $V_{GT}$ | $T_J$ = - 40 °C | Anode supply = 6 V resistive load | 4.0 | V |
| | | $T_J$ = 25 °C | | 2.5 | V |
| | | $T_J$ = 125 °C | | 1.7 | V |
| Maximum required DC gate current to trigger | $I_{GT}$ | $T_J$ = - 40 °C | Anode supply = 6 V resistive load | 270 | mA |
| | | $T_J$ = 25 °C | | 150 | mA |
| | | $T_J$ = 125 °C | | 80 | mA |
| | | $T_J$ = 25 °C, for 40TPS..APbF and 40TPS..A-M3 | | 40 | mA |
| Maximum DC gate voltage not to trigger for 40TPS12 | $V_{GD}$ | $T_J$ = 125 °C, $V_{DRM}$ = rated value | | 0.25 | V |
| Maximum DC gate current not to trigger for 40TPS12 | $I_{GD}$ | | | 6 | mA |
| Maximum DC gate voltage not to trigger for 40TPS12A | $V_{GD}$ | $T_J$ = 125 °C, $V_{DRM}$ = rated value | | 0.15 | V |
| Maximum DC gate current not to trigger for 40TPS12A | $I_{GD}$ | | | 1 | mA |

| THERMAL AND MECHANICAL SPECIFICATIONS | | | | | |
|---|---|---|---|---|---|
| PARAMETER | | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
| Maximum junction and storage temperature range | | $T_J$, $T_{Stg}$ | | -40 to +125 | °C |
| Maximum thermal resistance, junction to case | | $R_{thJC}$ | DC operation | 0.6 | °C/W |
| Maximum thermal resistance, junction to ambient | | $R_{thJA}$ | | 40 | |
| Maximum thermal resistance, case to heatsink | | $R_{thCS}$ | Mounting surface, smooth and greased | 0.2 | |
| Approximate weight | | | | 6 | g |
| | | | | 0.21 | oz. |
| Mounting torque | minimum | | | 6 (5) | kgf · cm (lbf · in) |
| | maximum | | | 12 (10) | |
| Marking device | | | Case style TO-247AC 3L | 40TPS08A | |
| | | | | 40TPS12A | |
| | | | | 40TPS08 | |
| | | | | 40TPS12 | |

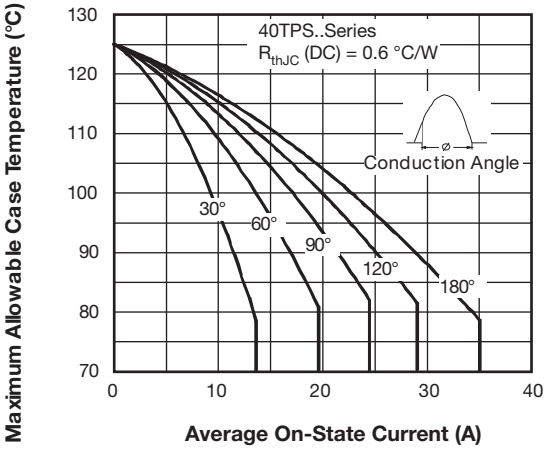



Fig. 1 - Current Rating Characteristics

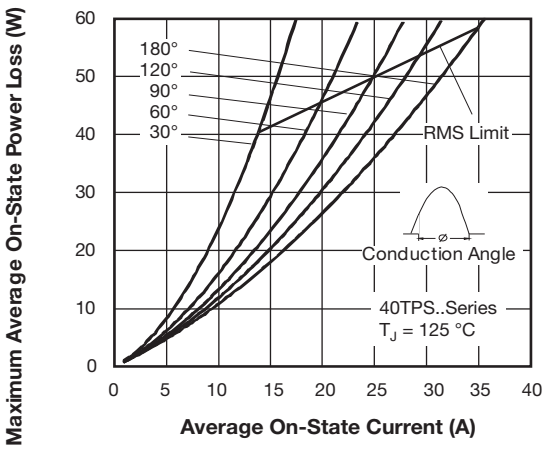



Fig. 3 - On-State Power Loss Characteristics

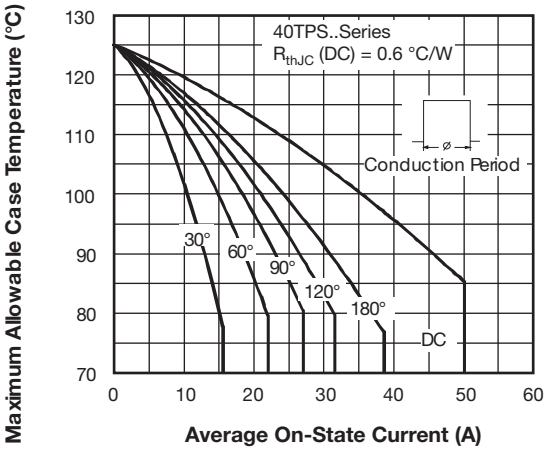



Fig. 2 - Current Rating Characteristics

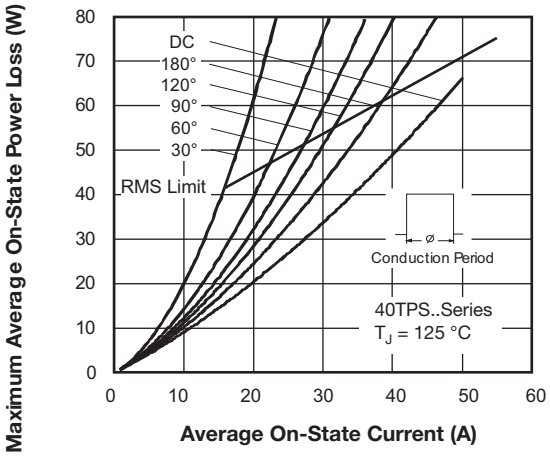



Fig. 4 - On-State Power Loss Characteristics

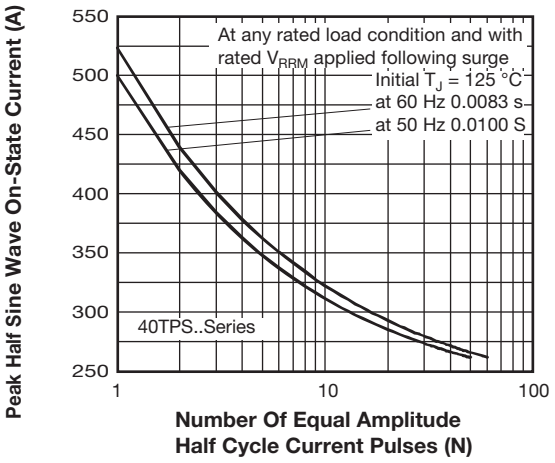



Fig. 5 - Maximum Non-Repetitive Surge Current

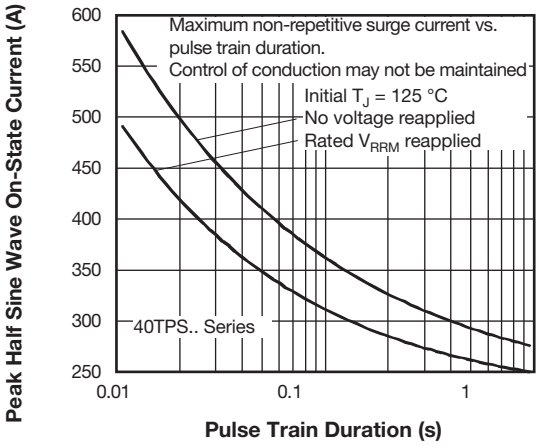



Fig. 6 - Maximum Non-Repetitive Surge Current

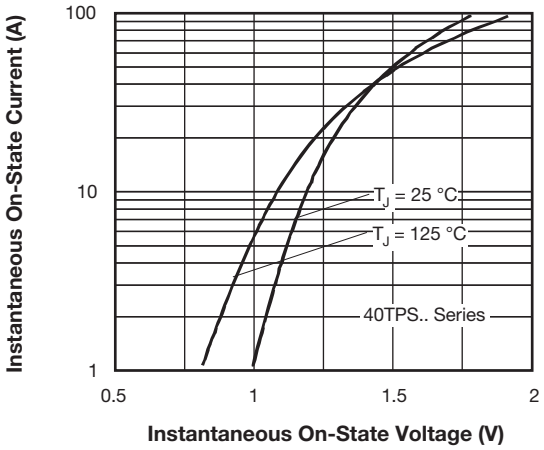



Fig. 7 - On-State Voltage Drop Characteristics

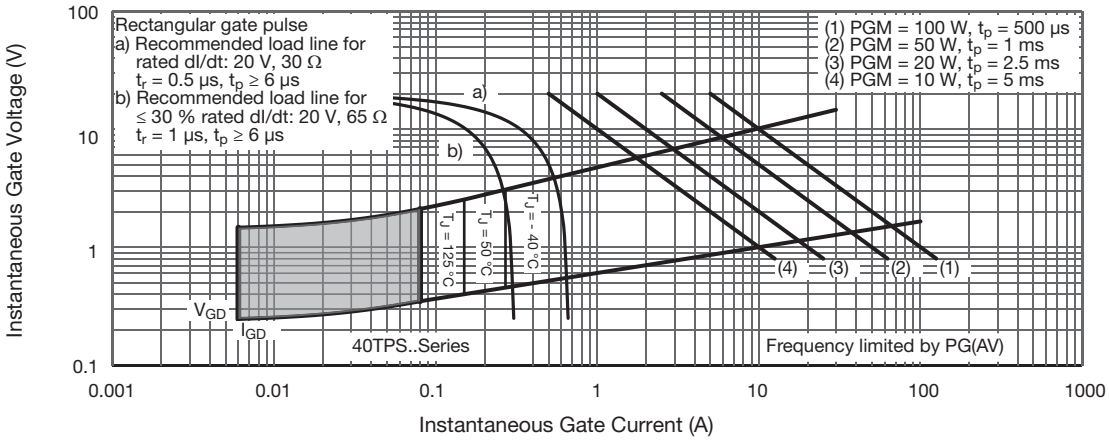



Fig. 8 - Gate Characteristics

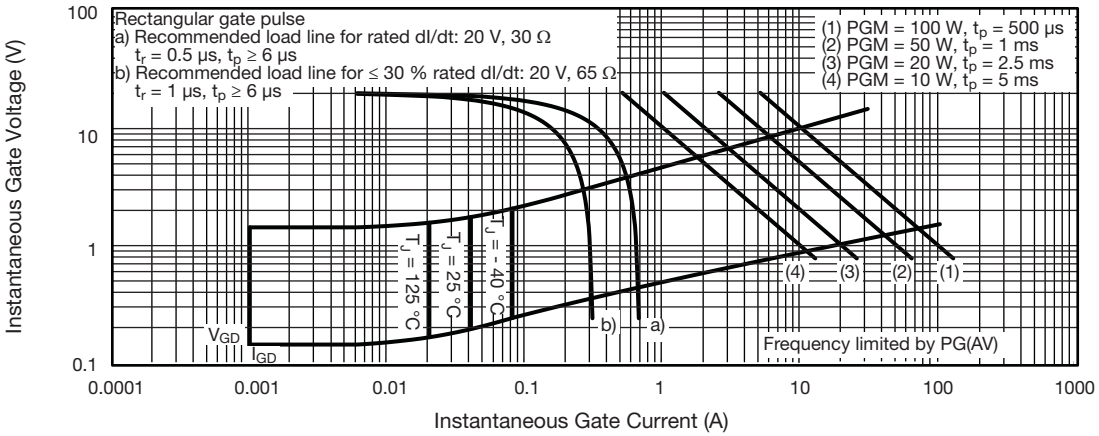



Fig. 9 - Gate Characteristics, 40TPS..A Series

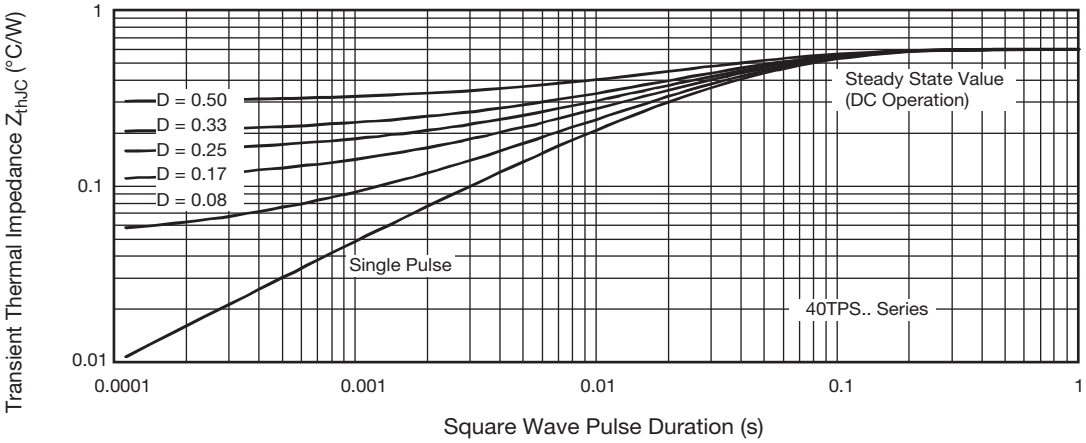



Fig. 10 - Thermal Impedance $Z_{thJC}$ Characteristics

## ORDERING INFORMATION TABLE

| Device code | VS- | 40 | T | P | S | 12 | A | -M3 |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

1 - Vishay Semiconductors product

2 - Current rating (40 = 40 A)

3 - Circuit configuration:
T = thyristor

4 - Package:
P = TO-247AC 3L

5 - Type of silicon:
S = standard recovery rectifier

6 - Voltage ratings
08 = 800 V
12 = 1200 V

7 - • A = low $I_{GT}$ selection 40 mA maximum
• None = standard Igt selection

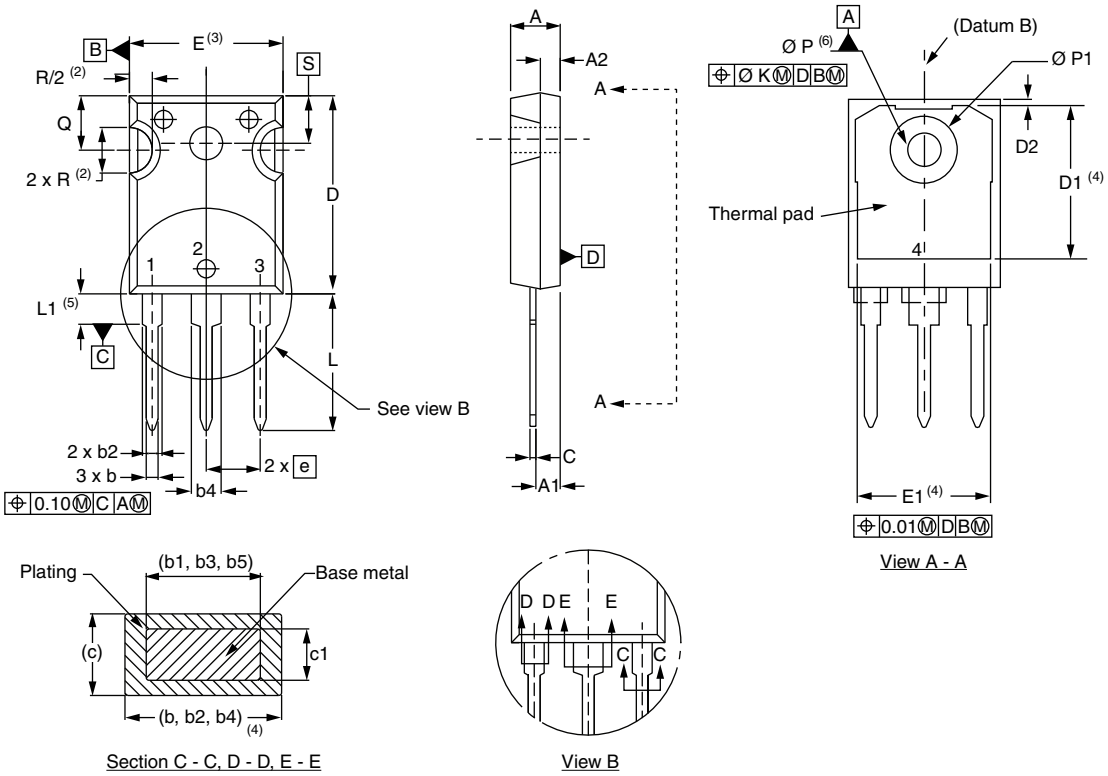
8 - Environmental digit:
-M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

| **ORDERING INFORMATION** (Example) | | | |
|---|---|---|---|
| **PREFERRED P/N** | **QUANTITY PER T/R** | **MINIMUM ORDER QUANTITY** | **PACKAGING DESCRIPTION** |
| VS-40TPS08A-M3 | 25 | 500 | Antistatic plastic tubes |
| VS-40TPS08-M3 | 25 | 500 | Antistatic plastic tubes |
| VS-40TPS12A-M3 | 25 | 500 | Antistatic plastic tubes |
| VS-40TPS12-M3 | 25 | 500 | Antistatic plastic tubes |

| **LINKS TO RELATED DOCUMENTS** | |
|---|---|
| Dimensions | www.vishay.com/doc?96138 |
| Part marking information | www.vishay.com/doc?95007 |

# TO-247AC 3L

**DIMENSIONS** in millimeters and inches




| SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.65 | 5.31 | 0.183 | 0.209 | |
| A1 | 2.21 | 2.59 | 0.087 | 0.102 | |
| A2 | 1.17 | 1.37 | 0.046 | 0.054 | |
| b | 0.99 | 1.40 | 0.039 | 0.055 | |
| b1 | 0.99 | 1.35 | 0.039 | 0.053 | |
| b2 | 1.65 | 2.39 | 0.065 | 0.094 | |
| b3 | 1.65 | 2.34 | 0.065 | 0.092 | |
| b4 | 2.59 | 3.43 | 0.102 | 0.135 | |
| b5 | 2.59 | 3.38 | 0.102 | 0.133 | |
| c | 0.38 | 0.89 | 0.015 | 0.035 | |
| c1 | 0.38 | 0.84 | 0.015 | 0.033 | |
| D | 19.71 | 20.70 | 0.776 | 0.815 | 3 |
| D1 | 13.08 | - | 0.515 | - | 4 |

| SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | |
| D2 | 0.51 | 1.35 | 0.020 | 0.053 | |
| E | 15.29 | 15.87 | 0.602 | 0.625 | 3 |
| E1 | 13.46 | - | 0.53 | - | |
| e | 5.46 BSC | | 0.215 BSC | | |
| Ø K | 0.254 | | 0.010 | | |
| L | 14.20 | 16.10 | 0.559 | 0.634 | |
| L1 | 3.71 | 4.29 | 0.146 | 0.169 | |
| Ø P | 3.56 | 3.66 | 0.14 | 0.144 | |
| Ø P1 | - | 7.39 | - | 0.291 | |
| Q | 5.31 | 5.69 | 0.209 | 0.224 | |
| R | 4.52 | 5.49 | 0.178 | 0.216 | |
| S | 5.51 BSC | | 0.217 BSC | | |

**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. 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) 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 Q

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