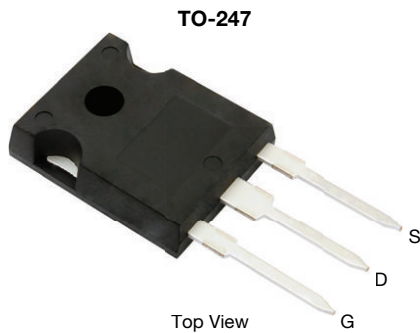


N-Channel 200 V (D-S) 175 °C MOSFET



FEATURES

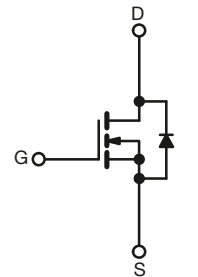
- ThunderFET® power MOSFET
- Low R_{DS} - Q_g figure-of-merit (FOM)
- Maximum 175 °C junction temperature
- 100 % R_g and UIS tested
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Synchronous rectification
- Power supplies
- DC/AC inverter
- DC/DC converter
- Solar micro inverter
- Motor drive switch



N-Channel MOSFET

PRODUCT SUMMARY

| | |
|--|------------------|
| V_{DS} (V) | 200 |
| $R_{DS(on)}$ max. (Ω) at $V_{GS} = 10$ V | 0.0095 |
| $R_{DS(on)}$ max. (Ω) at $V_{GS} = 7.5$ V | 0.0104 |
| Q_g typ. (nC) | 86 |
| I_D (A) | 100 ^d |
| Configuration | Single |

ORDERING INFORMATION

| | |
|---------------------------------|---------------|
| Package | TO-247 |
| Lead (Pb)-free and halogen-free | SUG90090E-GE3 |

ABSOLUTE MAXIMUM RATINGS ($T_A = 25$ °C, unless otherwise noted)

| PARAMETER | SYMBOL | LIMIT | UNIT |
|---|----------------|------------------|------------------|
| Drain-source voltage | V_{DS} | 200 | V |
| Gate-source voltage | V_{GS} | ± 20 | |
| Continuous drain current | I_D | $T_C = 25$ °C | 100 ^d |
| | | $T_C = 125$ °C | 77.6 |
| Pulsed drain current (t = 100 μ s) | I_{DM} | 300 | A |
| Continuous source-drain diode current | I_S | 100 ^d | |
| Single pulse avalanche current ^a | I_{AS} | 100 | mJ |
| Single pulse avalanche energy ^a | | | |
| Maximum power dissipation | P_D | $T_C = 25$ °C | 395 ^b |
| | | $T_C = 125$ °C | 132 ^b |
| Operating junction and storage temperature range | T_J, T_{stg} | -55 to +175 | °C |
| Soldering recommendations (peak temperature) ^c | | 260 | |

THERMAL RESISTANCE RATINGS

| PARAMETER | SYMBOL | MAXIMUM | UNIT |
|--|------------|---------|------|
| Maximum junction-to-ambient (PCB mount) ^c | R_{thJA} | 40 | °C/W |
| Maximum junction-to-case (drain) | R_{thJC} | 0.38 | |

Notes

- Duty cycle ≤ 1 %
- See SOA curve for voltage derating
- When mounted on 1" square PCB (FR4 material)
- Package limited



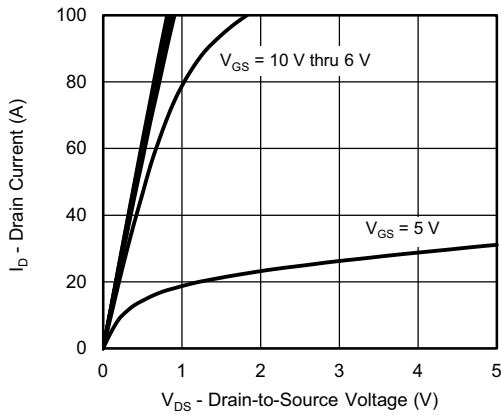
| SPECIFICATIONS (T _J = 25 °C, unless otherwise noted) | | | | | | |
|---|----------------------|--|------|--------|--------|------|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
| Static | | | | | | |
| Drain-source breakdown voltage | V _{DS} | V _{GS} = 0 V, I _D = 250 μA | 200 | - | - | V |
| Gate-source threshold voltage | V _{GS(th)} | V _{DS} = V _{GS} , I _D = 250 μA | 2 | - | 4 | V |
| Gate-source leakage | I _{GSS} | V _{DS} = 0 V, V _{GS} = ± 20 V | - | - | 250 | nA |
| Zero gate voltage drain current | I _{DSS} | V _{DS} = 200 V, V _{GS} = 0 V | - | - | 1 | μA |
| | | V _{DS} = 200 V, V _{GS} = 0 V, T _J = 125 °C | - | - | 150 | |
| | | V _{DS} = 200 V, V _{GS} = 0 V, T _J = 175 °C | - | - | 5 | mA |
| On-state drain current ^a | I _{D(on)} | V _{DS} ≥ 10 V, V _{GS} = 10 V | 30 | - | - | A |
| Drain-source on-state resistance ^a | R _{DS(on)} | V _{GS} = 10 V, I _D = 20 A | - | 0.0079 | 0.0095 | Ω |
| | | V _{GS} = 7.5 V, I _D = 15 A | - | 0.0083 | 0.0104 | |
| Forward transconductance ^a | g _{fs} | V _{DS} = 15 V, I _D = 20 A | - | 54 | - | S |
| Dynamic ^b | | | | | | |
| Input capacitance | C _{iss} | V _{DS} = 100 V, V _{GS} = 0 V, f = 1 MHz | - | 5220 | - | pF |
| Output capacitance | C _{oss} | | - | 495 | - | |
| Reverse transfer capacitance | C _{rss} | | - | 51 | - | |
| Total gate charge | Q _g | V _{DS} = 100 V, V _{GS} = 10 V, I _D = 20 A | - | 86 | 129 | nC |
| Gate-source charge | Q _{gs} | | - | 23 | - | |
| Gate-drain charge | Q _{gd} | | - | 22.7 | - | |
| Gate resistance | R _g | f = 1 MHz | 0.6 | 3.2 | 14.4 | Ω |
| Turn-on delay time | t _{d(on)} | V _{DD} = 100 V, R _L = 6.7 Ω, I _D ≅ 15 A, V _{GEN} = 10 V, R _g = 1 Ω | - | 18 | 27 | ns |
| Rise time | t _r | | - | 44 | 66 | |
| Turn-off delay time | t _{d(off)} | | - | 60 | 90 | |
| Fall time | t _f | | - | 40 | 60 | |
| Drain-Source Body Diode Characteristics | | | | | | |
| Pulse diode forward current (t = 100 μs) | I _{SM} | | - | - | 100 | A |
| Body diode voltage | V _{SD} | I _F = 15 A, V _{GS} = 0 V | - | 0.85 | 1.5 | V |
| Body diode reverse recovery time | t _{rr} | I _F = 15 A, di/dt = 100 A/μs | - | 146 | 220 | ns |
| Body diode reverse recovery charge | Q _{rr} | | - | 0.91 | 1.37 | μC |
| Reverse recovery fall time | t _a | | - | 115 | - | ns |
| Reverse recovery rise time | t _b | | - | 31 | - | |
| Body diode peak reverse recovery charge | I _{RM(REC)} | | - | - | 12 | 18 |

Notes

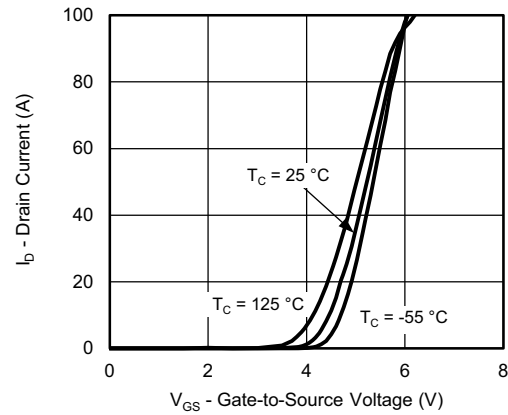
- Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %
- Guaranteed by design, not subject to production testing
- Independent of operating temperature

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

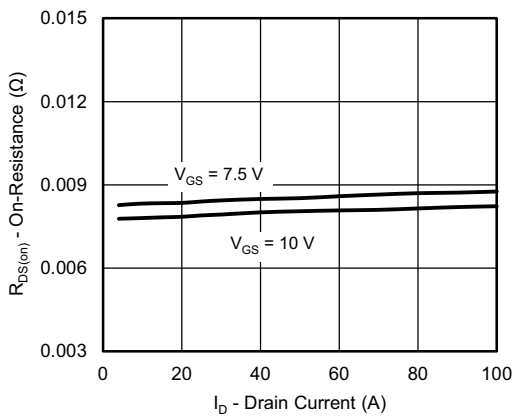
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



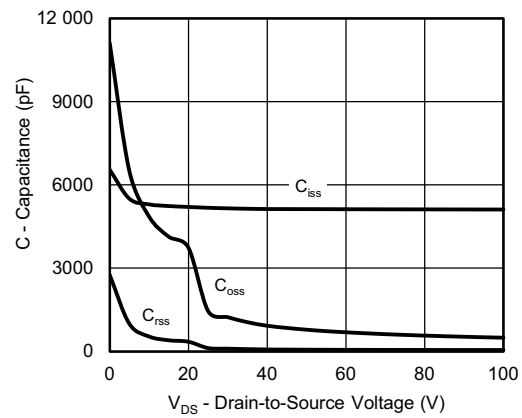
Output Characteristics



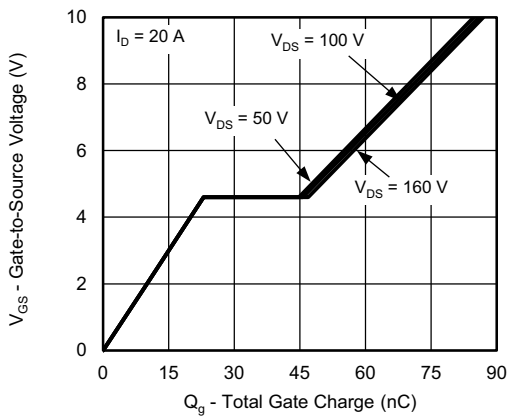
Transfer Characteristics



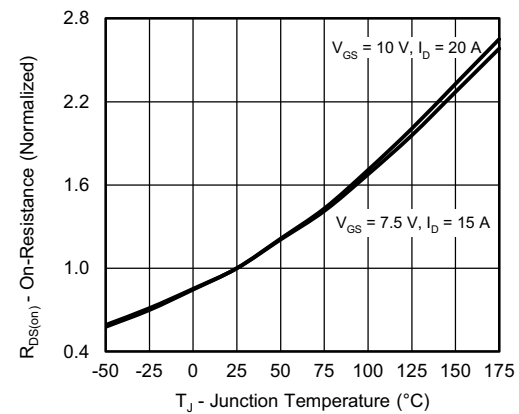
On-Resistance vs. Drain Current and Gate Voltage



Capacitance



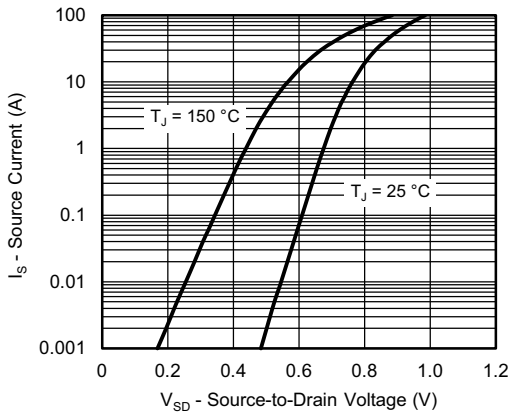
Gate Charge



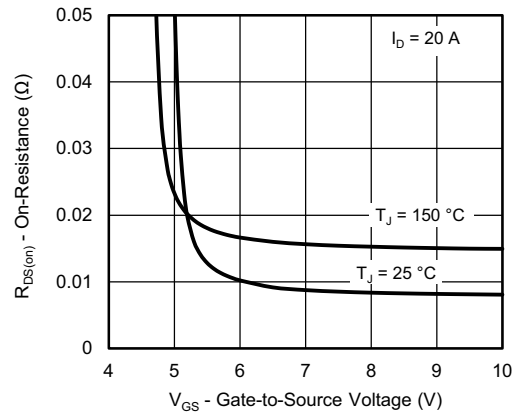
On-Resistance vs. Junction Temperature



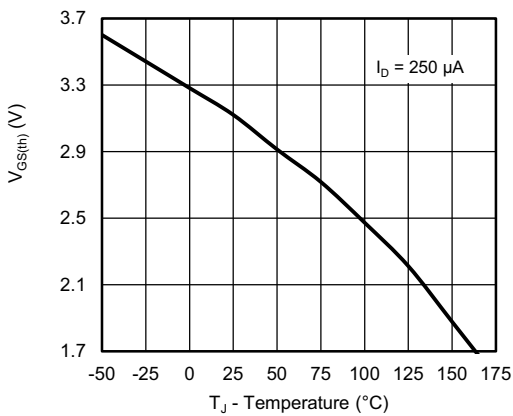
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



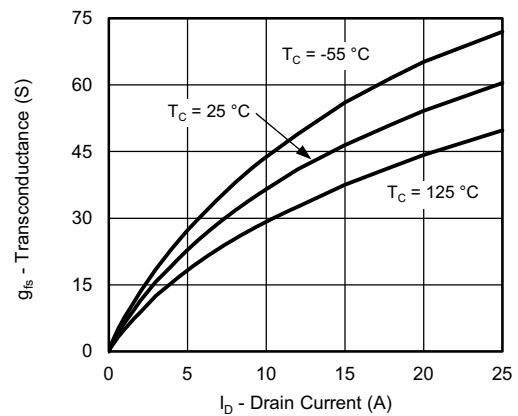
Source-Drain Diode Forward Voltage



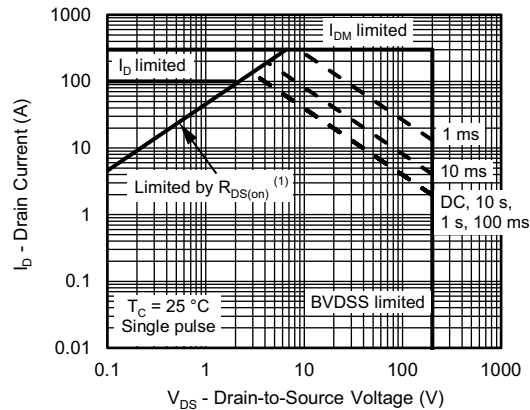
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

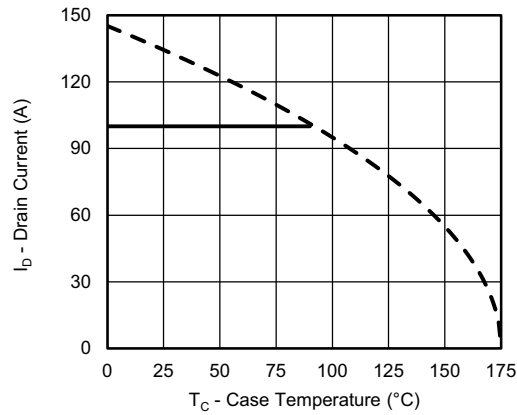
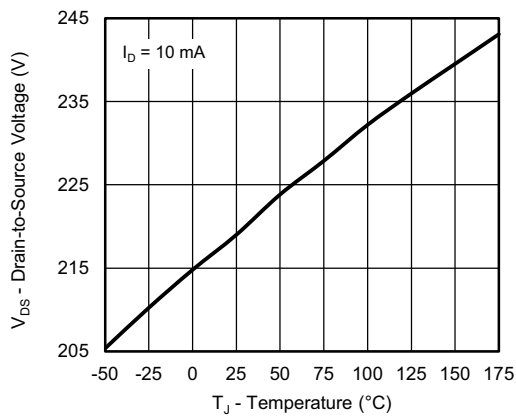
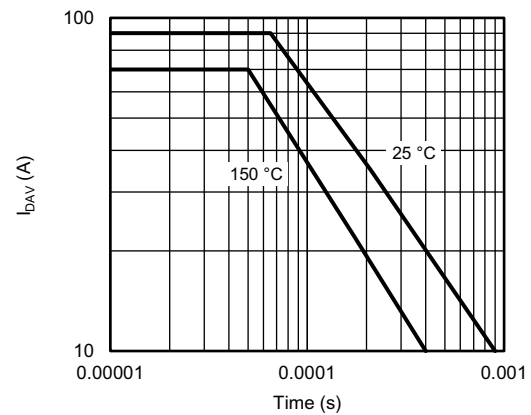


Transconductance



(1) $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

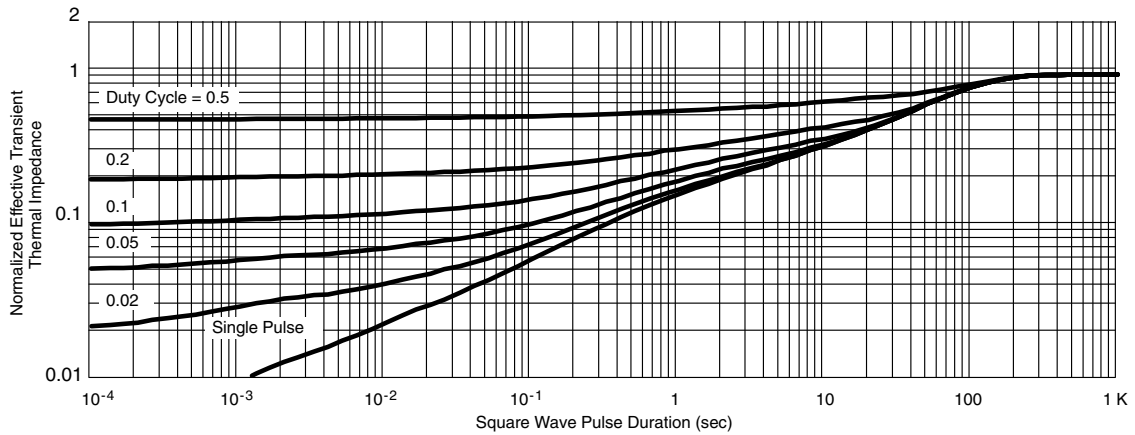
Safe Operating Area, Junction-to-Ambient

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Current Derating ^a

Drain Source Breakdown vs. Junction Temperature

 I_{DAV} vs. Time
Note

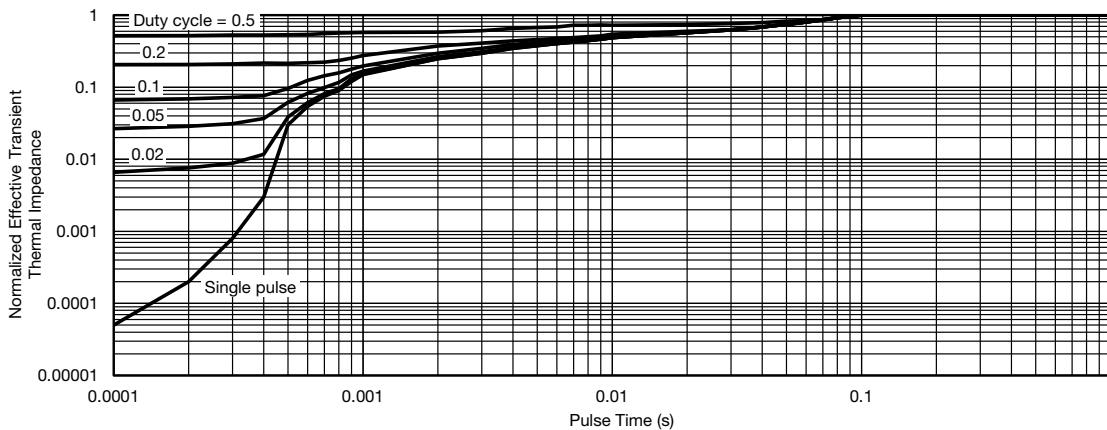
- a. The power dissipation P_D is based on T_J max. = 25 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient



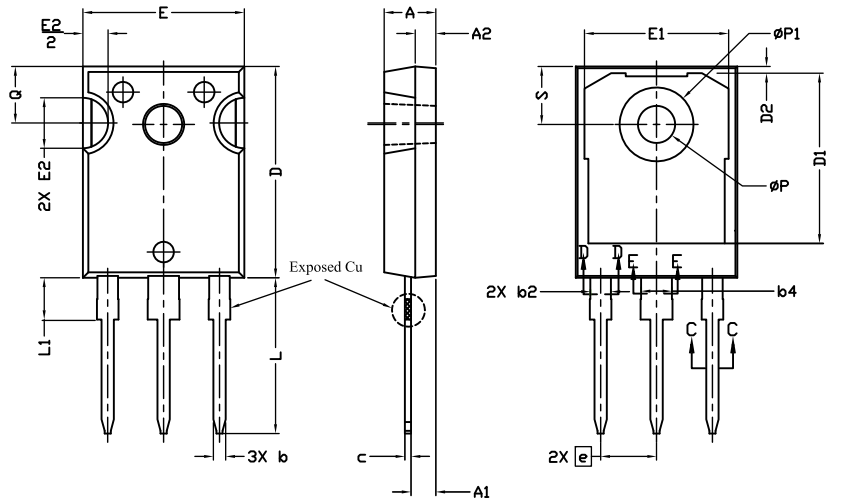
Normalized Thermal Transient Impedance, Junction-to-Case

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TO-247AC (High Voltage)

VERSION 1: FACILITY CODE = 9



Section C--C, D--D, E--E

| DIM. | MILLIMETERS | | NOTES |
|------|-------------|-------|-------|
| | MIN. | MAX. | |
| A | 4.83 | 5.21 | |
| A1 | 2.29 | 2.55 | |
| A2 | 1.50 | 2.49 | |
| b | 1.12 | 1.33 | |
| b1 | 1.12 | 1.28 | |
| b2 | 1.91 | 2.39 | 6 |
| b3 | 1.91 | 2.34 | |
| b4 | 2.87 | 3.22 | 6, 8 |
| b5 | 2.87 | 3.18 | |
| c | 0.55 | 0.69 | 6 |
| c1 | 0.55 | 0.65 | |
| D | 20.40 | 20.70 | 4 |

| DIM. | MILLIMETERS | | NOTES |
|------|-------------|-------|-------|
| | MIN. | MAX. | |
| D1 | 16.25 | 16.85 | 5 |
| D2 | 0.56 | 0.76 | |
| E | 15.50 | 15.87 | 4 |
| E1 | 13.46 | 14.16 | 5 |
| E2 | 4.52 | 5.49 | 3 |
| e | 5.44 BSC | | |
| L | 14.90 | 15.40 | |
| L1 | 3.96 | 4.16 | 6 |
| Ø P | 3.56 | 3.65 | 7 |
| Ø P1 | 7.19 ref. | | |
| Q | 5.31 | 5.69 | |
| S | 5.54 | 5.74 | |

Notes

- (1) Package reference: JEDEC® TO247, variation AC
- (2) All dimensions are in mm
- (3) Slot required, notch may be rounded
- (4) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm per side. These dimensions are measured at the outermost extremes of the plastic body
- (5) Thermal pad contour optional with dimensions D1 and E1
- (6) Lead finish uncontrolled in L1
- (7) 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
- (8) Dimension b2 and b4 does not include dambar protrusion. Allowable dambar protrusion shall be 0.1 mm total in excess of b2 and b4 dimension at maximum material condition



VERSION 2: FACILITY CODE = Y



| DIM. | MILLIMETERS | | NOTES |
|------|-------------|-------|-------|
| | MIN. | MAX. | |
| A | 4.58 | 5.31 | |
| A1 | 2.21 | 2.59 | |
| A2 | 1.17 | 2.49 | |
| b | 0.99 | 1.40 | |
| b1 | 0.99 | 1.35 | |
| b2 | 1.53 | 2.39 | |
| b3 | 1.65 | 2.37 | |
| b4 | 2.42 | 3.43 | |
| b5 | 2.59 | 3.38 | |
| c | 0.38 | 0.86 | |
| c1 | 0.38 | 0.76 | |
| D | 19.71 | 20.82 | |
| D1 | 13.08 | - | |

| DIM. | MILLIMETERS | | NOTES |
|------|-------------|-------|-------|
| | MIN. | MAX. | |
| D2 | 0.51 | 1.30 | |
| E | 15.29 | 15.87 | |
| E1 | 13.72 | - | |
| e | 5.46 BSC | | |
| Ø k | 0.254 | | |
| L | 14.20 | 16.25 | |
| L1 | 3.71 | 4.29 | |
| Ø P | 3.51 | 3.66 | |
| Ø P1 | - | 7.39 | |
| Q | 5.31 | 5.69 | |
| R | 4.52 | 5.49 | |
| S | 5.51 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 c



VERSION 3: FACILITY CODE = N



| MILLIMETERS | | |
|-------------|-------|-------|
| DIM. | MIN. | MAX. |
| A | 4.65 | 5.31 |
| A1 | 2.21 | 2.59 |
| A2 | 1.17 | 1.37 |
| b | 0.99 | 1.40 |
| b1 | 0.99 | 1.35 |
| b2 | 1.65 | 2.39 |
| b3 | 1.65 | 2.34 |
| b4 | 2.59 | 3.43 |
| b5 | 2.59 | 3.38 |
| c | 0.38 | 0.89 |
| c1 | 0.38 | 0.84 |
| D | 19.71 | 20.70 |
| D1 | 13.08 | - |

| MILLIMETERS | | |
|-------------|----------|-------|
| DIM. | MIN. | MAX. |
| D2 | 0.51 | 1.35 |
| E | 15.29 | 15.87 |
| E1 | 13.46 | - |
| e | 5.46 BSC | |
| k | 0.254 | |
| L | 14.20 | 16.10 |
| L1 | 3.71 | 4.29 |
| N | 7.62 BSC | |
| P | 3.56 | 3.66 |
| P1 | - | 7.39 |
| Q | 5.31 | 5.69 |
| R | 4.52 | 5.49 |
| S | 5.51 BSC | |

ECN: E20-0545-Rev. F, 19-Oct-2020
DWG: 5971

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")



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