

E Series Power MOSFET

| PRODUCT SUMMARY | | |
|---|-----------------|------|
| V_{DS} (V) at T_J max. | 650 | |
| $R_{DS(on)}$ max. (Ω) at 25 °C | $V_{GS} = 10$ V | 0.28 |
| Q_g max. (nC) | 78 | |
| Q_{gs} (nC) | 9 | |
| Q_{gd} (nC) | 17 | |
| Configuration | Single | |

FEATURES

- Low figure-of-merit (FOM) $R_{on} \times Q_g$
- Low input capacitance (C_{iss})
- Reduced switching and conduction losses
- Ultra low gate charge (Q_g)
- Avalanche energy rated (UIS)
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

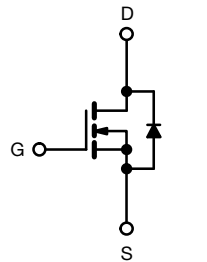
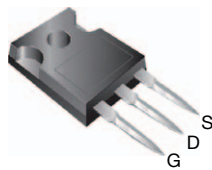


RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- Lighting
 - High-intensity discharge (HID)
 - Fluorescent ballast lighting
- Industrial
 - Welding
 - Induction heating
 - Motor drives
 - Battery chargers
 - Renewable energy
 - Solar (PV inverters)

TO-247AC



N-Channel MOSFET

| ORDERING INFORMATION | |
|---------------------------------|----------------|
| Package | TO-247AC |
| Lead (Pb)-free and Halogen-free | SiHG15N60E-GE3 |


| ABSOLUTE MAXIMUM RATINGS ($T_C = 25$ °C, unless otherwise noted) | | | | |
|---|---------------------------------|----------------|-------------|------|
| PARAMETER | SYMBOL | | LIMIT | UNIT |
| Drain-Source Voltage | V_{DS} | | 600 | V |
| Gate-Source Voltage | V_{GS} | | ± 30 | |
| Continuous Drain Current ($T_J = 150$ °C) | V_{GS} at 10 V | $T_C = 25$ °C | 15 | A |
| | | $T_C = 100$ °C | 9.6 | |
| Pulsed Drain Current ^a | I_{DM} | | 39 | |
| Linear Derating Factor | | | 1.4 | W/°C |
| Single Pulse Avalanche Energy ^b | E_{AS} | | 102 | mJ |
| Maximum Power Dissipation | P_D | | 180 | W |
| Operating Junction and Storage Temperature Range | T_J, T_{stg} | | -55 to +150 | °C |
| Drain-Source Voltage Slope | $V_{DS} = 0$ V to 80 % V_{DS} | | 70 | V/ns |
| Reverse Diode dV/dt ^d | | | 7.7 | |
| Soldering Recommendations (Peak temperature) ^c | for 10 s | | 300 | °C |

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 50$ V, starting $T_J = 25$ °C, $L = 11.6$ mH, $R_g = 25$ Ω , $I_{AS} = 4.2$ A.
- 1.6 mm from case.
- $I_{SD} \leq I_D$, $dI/dt = 100$ A/ μ s, starting $T_J = 25$ °C.



| THERMAL RESISTANCE RATINGS | | | | |
|----------------------------------|------------|------|------|------|
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
| Maximum Junction-to-Ambient | R_{thJA} | - | 62 | °C/W |
| Maximum Junction-to-Case (Drain) | R_{thJC} | - | 0.7 | |

| SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted) | | | | | | | |
|---|---------------------|---|---|------|------|-----------|---------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNIT |
| Static | | | | | | | |
| Drain-Source Breakdown Voltage | V_{DS} | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | | 600 | - | - | V |
| V_{DS} Temperature Coefficient | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^\circ\text{C}, I_D = 1\text{ mA}$ | | - | 0.71 | - | V/°C |
| Gate-Source Threshold Voltage (N) | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | | 2 | - | 4 | V |
| Gate-Source Leakage | I_{GSS} | $V_{GS} = \pm 20\text{ V}$ | | - | - | ± 100 | nA |
| | | $V_{GS} = \pm 30\text{ V}$ | | - | - | ± 1 | μA |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$ | | - | - | 1 | μA |
| | | $V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$ | | - | - | 10 | |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}$ | $I_D = 8\text{ A}$ | - | 0.23 | 0.28 | Ω |
| Forward Transconductance | g_{fs} | $V_{DS} = 30\text{ V}, I_D = 8\text{ A}$ | | - | 4.6 | - | S |
| Dynamic | | | | | | | |
| Input Capacitance | C_{iss} | $V_{GS} = 0\text{ V}, V_{DS} = 100\text{ V}, f = 1\text{ MHz}$ | | - | 1350 | - | pF |
| Output Capacitance | C_{oss} | | | - | 70 | - | |
| Reverse Transfer Capacitance | C_{rss} | | | - | 5 | - | |
| Effective Output Capacitance, Energy Related ^a | $C_{o(er)}$ | $V_{DS} = 0\text{ V to } 480\text{ V}, V_{GS} = 0\text{ V}$ | | - | 53 | - | pF |
| Effective Output Capacitance, Time Related ^b | $C_{o(tr)}$ | | | - | 177 | - | |
| Total Gate Charge | Q_g | $V_{GS} = 10\text{ V}$ | $I_D = 8\text{ A}, V_{DS} = 480\text{ V}$ | - | 39 | 78 | nC |
| Gate-Source Charge | Q_{gs} | | | - | 11 | - | |
| Gate-Drain Charge | Q_{gd} | | | - | 17 | - | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = 480\text{ V}, I_D = 8\text{ A}, V_{GS} = 10\text{ V}, R_g = 9.1\text{ }\Omega$ | | - | 16 | 32 | ns |
| Rise Time | t_r | | | - | 26 | 52 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | - | 41 | 82 | |
| Fall Time | t_f | | | - | 22 | 44 | |
| Gate Input Resistance | R_g | $f = 1\text{ MHz}, \text{open drain}$ | | 0.3 | 0.86 | 1.7 | Ω |
| Drain-Source Body Diode Characteristics | | | | | | | |
| Continuous Source-Drain Diode Current | I_S | MOSFET symbol showing the integral reverse p - n junction diode  | | - | - | 15 | A |
| Pulsed Diode Forward Current | I_{SM} | | | - | - | 60 | |
| Diode Forward Voltage | V_{SD} | $T_J = 25\text{ }^\circ\text{C}, I_S = 8\text{ A}, V_{GS} = 0\text{ V}$ | | - | 1.0 | 1.2 | V |
| Reverse Recovery Time | t_{rr} | $T_J = 25\text{ }^\circ\text{C}, I_F = I_S = 8\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, V_R = 25\text{ V}$ | | - | 302 | 604 | ns |
| Reverse Recovery Charge | Q_{rr} | | | - | 4.0 | 8 | μC |
| Reverse Recovery Current | I_{RRM} | | | - | 24 | - | A |

Notes

- a. $C_{oss(er)}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS} .
- b. $C_{oss(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS} .



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

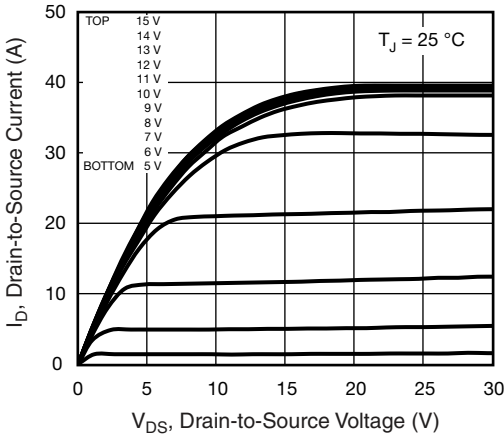


Fig. 1 - Typical Output Characteristics

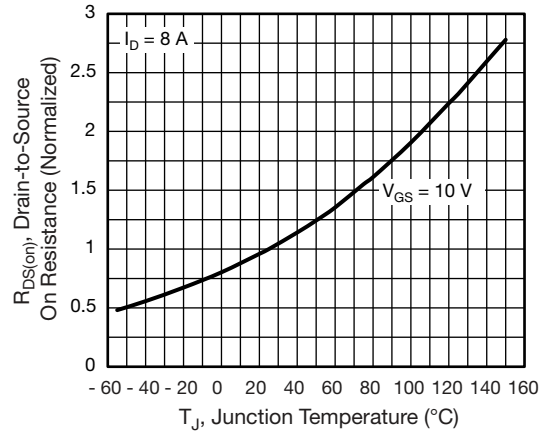


Fig. 4 - Normalized On-Resistance vs. Temperature



Fig. 2 - Typical Output Characteristics

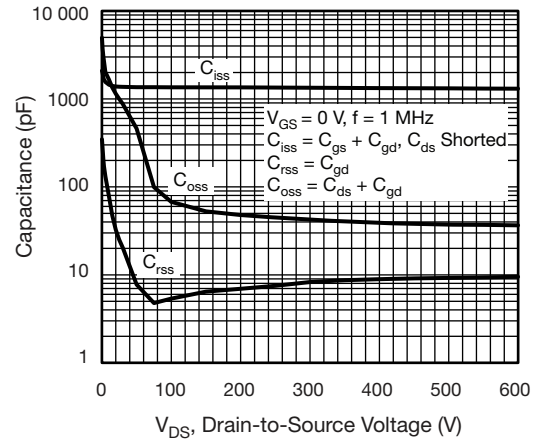


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

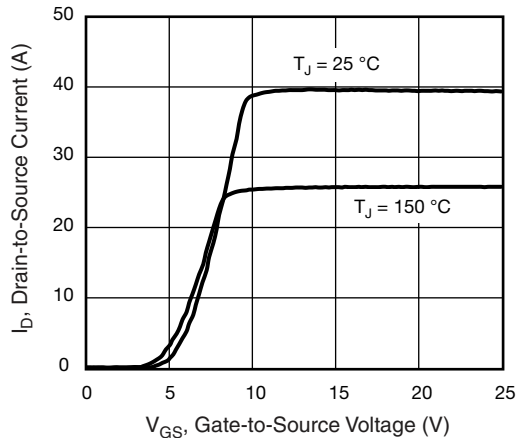


Fig. 3 - Typical Transfer Characteristics

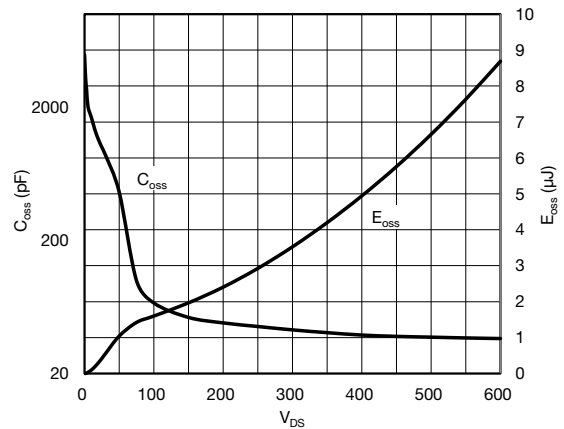


Fig. 6 - C_{oss} and E_{oss} vs. V_{DS}

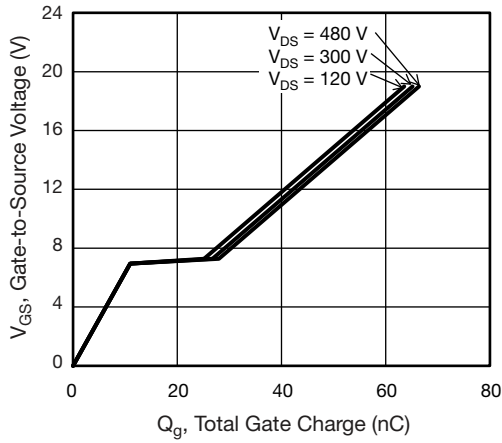


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

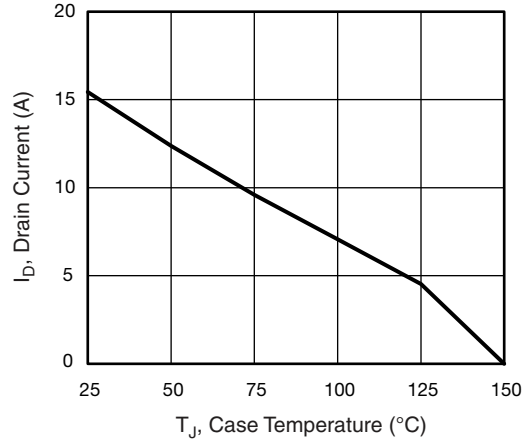


Fig. 10 - Maximum Drain Current vs. Case Temperature

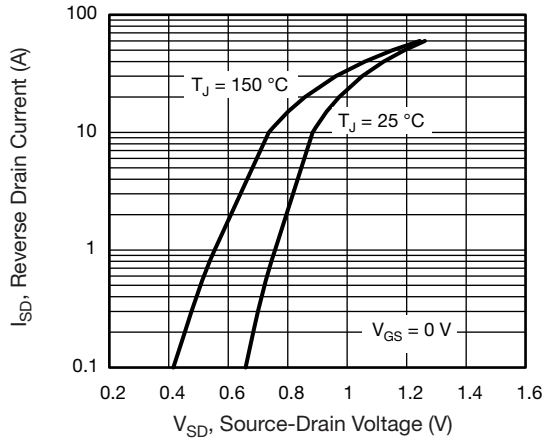


Fig. 8 - Typical Source-Drain Diode Forward Voltage

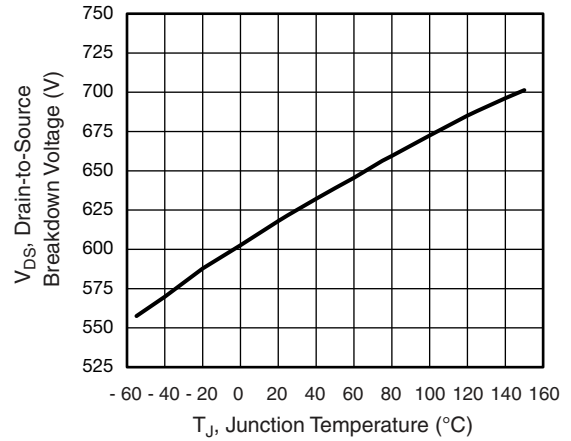


Fig. 11 - Temperature vs. Drain-to-Source Voltage

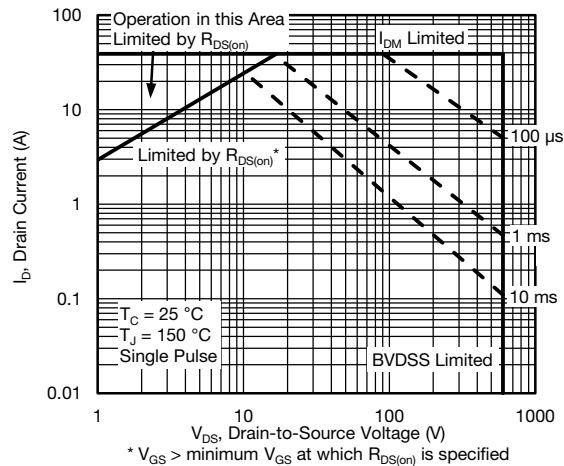


Fig. 9 - Maximum Safe Operating Area

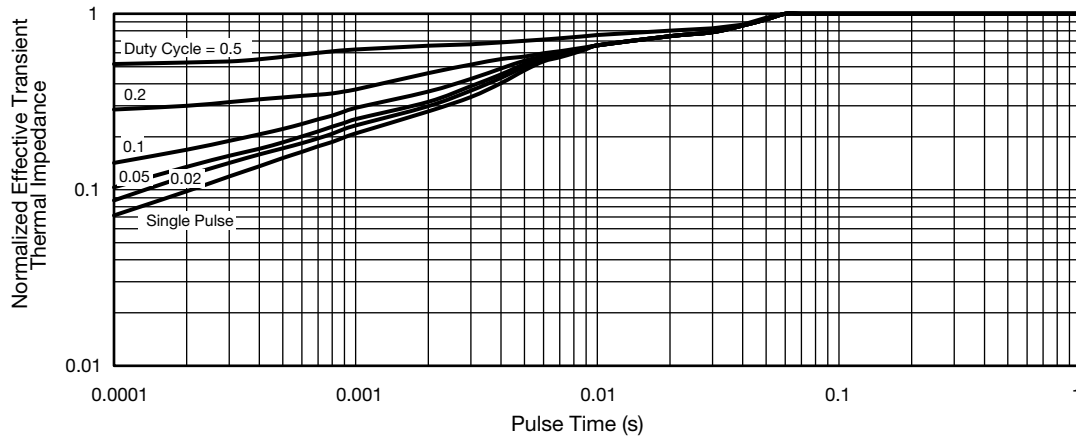


Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case

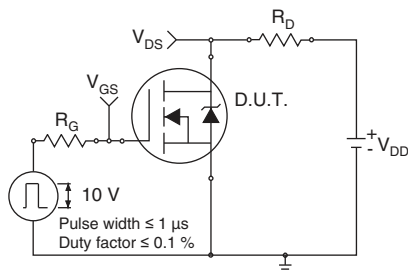


Fig. 13 - Switching Time Test Circuit

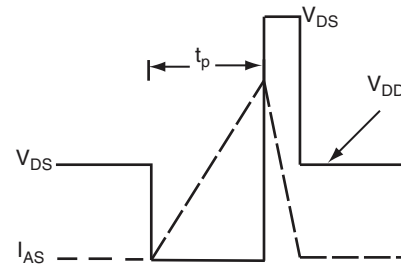


Fig. 16 - Unclamped Inductive Waveforms

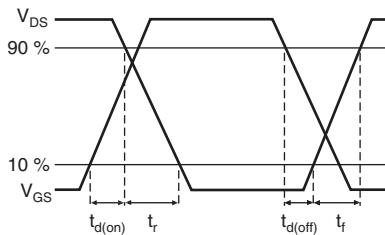


Fig. 14 - Switching Time Waveforms

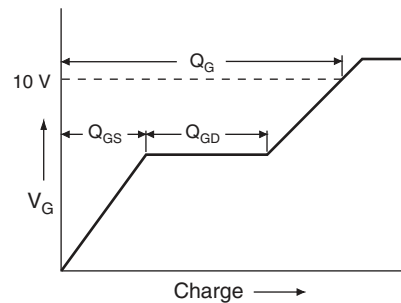


Fig. 17 - Basic Gate Charge Waveform

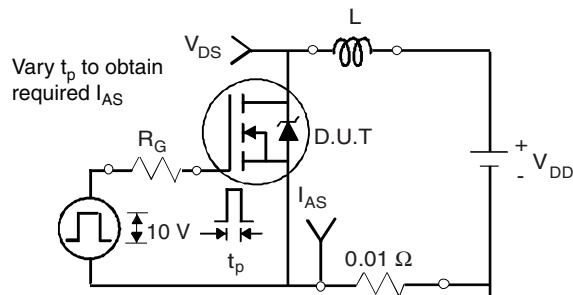


Fig. 15 - Unclamped Inductive Test Circuit

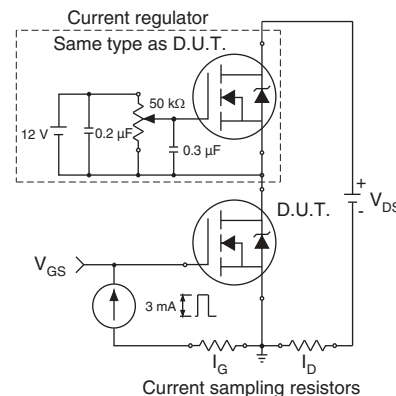


Fig. 18 - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



Note

a. $V_{GS} = 5 V$ for logic level devices

Fig. 19 - For N-Channel

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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: E22-0452-Rev. G, 31-Oct-2022
 DWG: 5971

- Notes**
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 - (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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