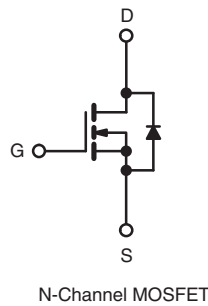


Power MOSFET

| PRODUCT SUMMARY | |
|---------------------------|------------------------------|
| V_{DS} (V) | 500 |
| $R_{DS(on)}$ (Ω) | $V_{GS} = 10\text{ V}$ 0.135 |
| Q_g (Max.) (nC) | 190 |
| Q_{gs} (nC) | 59 |
| Q_{gd} (nC) | 84 |
| Configuration | Single |



FEATURES

- Low Gate Charge Q_g Results in Simple Drive Requirement
- Improved Gate, Avalanche and Dynamic dV/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Low $R_{DS(on)}$
- Compliant to RoHS Directive 2002/95/EC



RoHS*
COMPLIANT

APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply
- High Speed Power Switching
- Hard Switching and High Frequency Circuits

| ORDERING INFORMATION | |
|----------------------|----------------|
| Package | TO-247AC |
| Lead (Pb)-free | IRFP32N50KPbF |
| | SiHFP32N50K-E3 |
| SnPb | IRFP32N50K |
| | SiHFP32N50K |


| ABSOLUTE MAXIMUM RATINGS ($T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted) | | | |
|---|----------------------------------|-----------------------------------|---------------------|
| PARAMETER | SYMBOL | LIMIT | UNIT |
| Drain-Source Voltage | V_{DS} | 500 | V |
| Gate-Source Voltage | V_{GS} | ± 30 | |
| Continuous Drain Current | V_{GS} at 10 V | $T_C = 25\text{ }^\circ\text{C}$ | A |
| | | $T_C = 100\text{ }^\circ\text{C}$ | |
| Pulsed Drain Current ^a | I_{DM} | 130 | |
| Linear Derating Factor | | 3.7 | W/ $^\circ\text{C}$ |
| Single Pulse Avalanche Energy ^b | E_{AS} | 450 | mJ |
| Repetitive Avalanche Current ^a | I_{AR} | 32 | A |
| Repetitive Avalanche Energy ^a | E_{AR} | 46 | mJ |
| Maximum Power Dissipation | $T_C = 25\text{ }^\circ\text{C}$ | P_D | 460 |
| Peak Diode Recovery dV/dt^c | | dV/dt | 13 |
| Operating Junction and Storage Temperature Range | T_J, T_{stg} | - 55 to + 150 | $^\circ\text{C}$ |
| Soldering Recommendations (Peak Temperature) | for 10 s | 300 ^d | |
| Mounting Torque | 6-32 or M3 screw | | 10 |
| | | | 1.1 |

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- Starting $T_J = 25\text{ }^\circ\text{C}$, $L = 0.87\text{ mH}$, $R_G = 25\text{ }^\circ\Omega$, $I_{AS} = 32\text{ A}$.
- $I_{SD} \leq 32\text{ A}$, $dI/dt \leq 197\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^\circ\text{C}$.
- 1.6 mm from case.

* Pb containing terminations are not RoHS compliant, exemptions may apply

| THERMAL RESISTANCE RATINGS | | | | |
|-------------------------------------|------------|------|------|------|
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
| Maximum Junction-to-Ambient | R_{thJA} | - | 40 | °C/W |
| Case-to-Sink, Flat, Greased Surface | R_{thCS} | 0.24 | - | |
| Maximum Junction-to-Case (Drain) | R_{thJC} | - | 0.26 | |

| 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} | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 500 | - | - | V |
| V_{DS} Temperature Coefficient | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$ | - | 0.54 | - | V/°C |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | 3.0 | - | 5.0 | V |
| Gate-Source Leakage | I_{GSS} | $V_{GS} = \pm 30\text{ V}$ | - | - | ± 100 | nA |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$ | - | - | 50 | μA |
| | | $V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$ | - | - | 250 | |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}, I_D = 32\text{ A}^b$ | - | 0.135 | 0.16 | Ω |
| Forward Transconductance | g_{fs} | $V_{DS} = 50\text{ V}, I_D = 32\text{ A}$ | 14 | - | - | S |
| Dynamic | | | | | | |
| Input Capacitance | C_{iss} | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1.0\text{ MHz}$, see fig. 5 | - | 5280 | - | pF |
| Output Capacitance | C_{oss} | | - | 550 | - | |
| Reverse Transfer Capacitance | C_{rss} | | - | 45 | - | |
| Output Capacitance | C_{oss} | $V_{GS} = 0\text{ V}$ | $V_{DS} = 1.0\text{ V}, f = 1.0\text{ MHz}$ | - | 5630 | - |
| Effective Output Capacitance | $C_{oss\text{ eff.}}$ | | $V_{DS} = 400\text{ V}, f = 1.0\text{ MHz}$ | - | 155 | - |
| Total Gate Charge | Q_g | $V_{GS} = 10\text{ V}, I_D = 32\text{ A}, V_{DS} = 400\text{ V}^b$ | $V_{DS} = 0\text{ V to } 400\text{ V}^c$ | - | 265 | - |
| Gate-Source Charge | Q_{gs} | | - | - | 190 | nC |
| Gate-Drain Charge | Q_{gd} | | - | - | 59 | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = 250\text{ V}, I_D = 32\text{ A}, R_g = 4.3\text{ }\Omega, V_{GS} = 10\text{ V}^b$ | - | 28 | - | ns |
| Rise Time | t_r | | - | 120 | - | |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 48 | - | |
| Fall Time | t_f | | - | 54 | - | |
| Drain-Source Body Diode Characteristics | | | | | | |
| Continuous Source-Drain Diode Current | I_S | MOSFET symbol showing the integral reverse p - n junction diode  | - | - | 32 | A |
| Pulsed Diode Forward Current ^a | I_{SM} | | - | - | 130 | |
| Body Diode Voltage | V_{SD} | $T_J = 25\text{ }^\circ\text{C}, I_S = 32\text{ A}, V_{GS} = 0\text{ V}^b$ | - | - | 1.5 | V |
| Body Diode Reverse Recovery Time | t_{rr} | $T_J = 25\text{ }^\circ\text{C}, I_F = 32\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$ | - | 530 | 800 | ns |
| Body Diode Reverse Recovery Charge | Q_{rr} | | - | 9.0 | 13.5 | μC |
| Body Diode Reverse Recovery Current | I_{RRM} | | - | 30 | - | A |
| Forward Turn-On Time | t_{on} | Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D) | | | | |

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- Pulse width $\leq 400\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.
- $C_{oss\text{ eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS} .

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

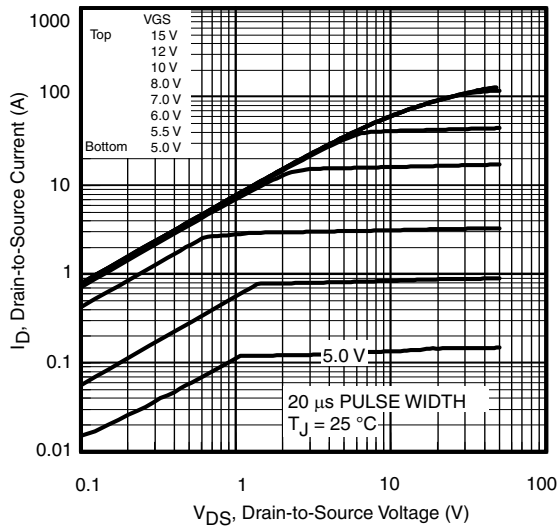


Fig. 1 - Typical Output Characteristics

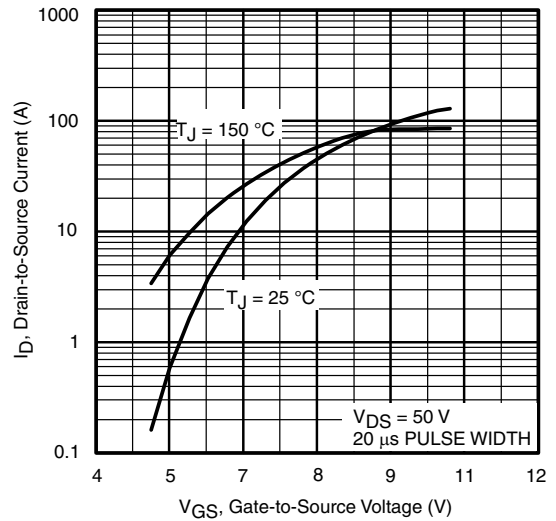


Fig. 3 - Typical Transfer Characteristics

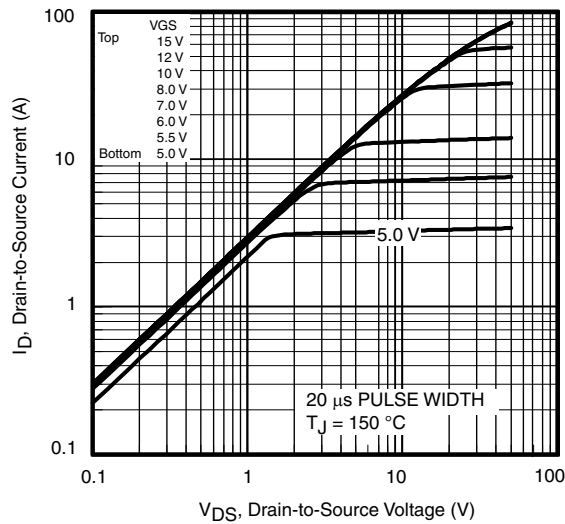


Fig. 2 - Typical Output Characteristics

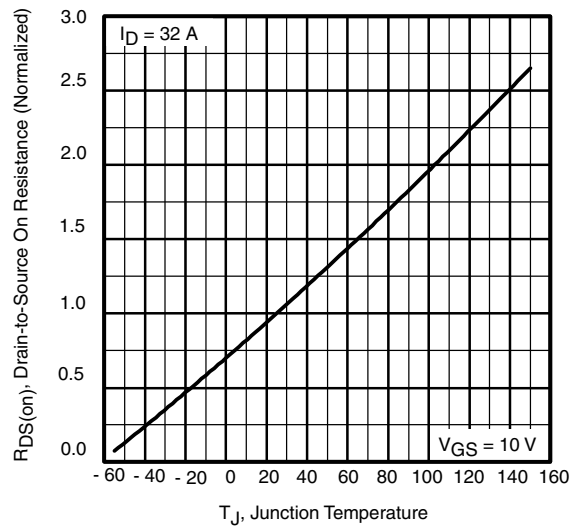


Fig. 4 - Normalized On-Resistance vs. Temperature

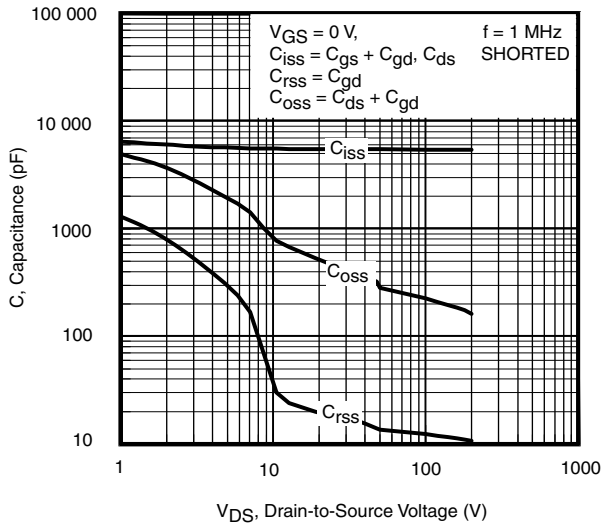


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

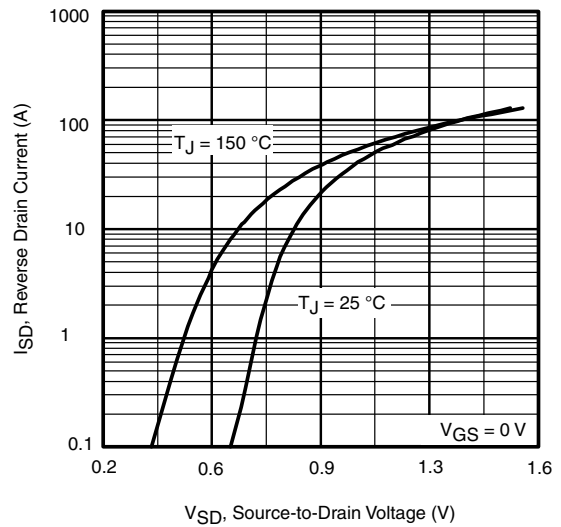


Fig. 7 - Typical Source-Drain Diode Forward Voltage

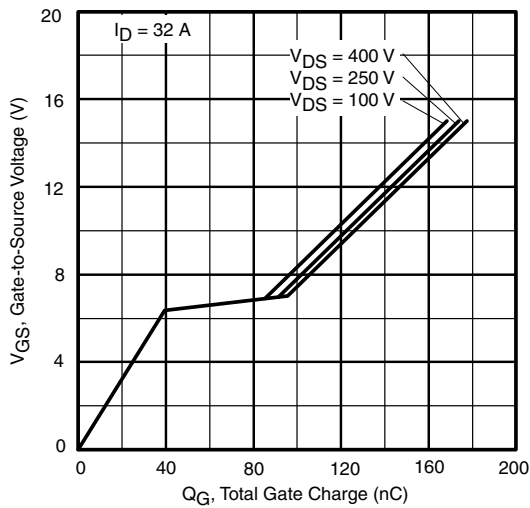


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

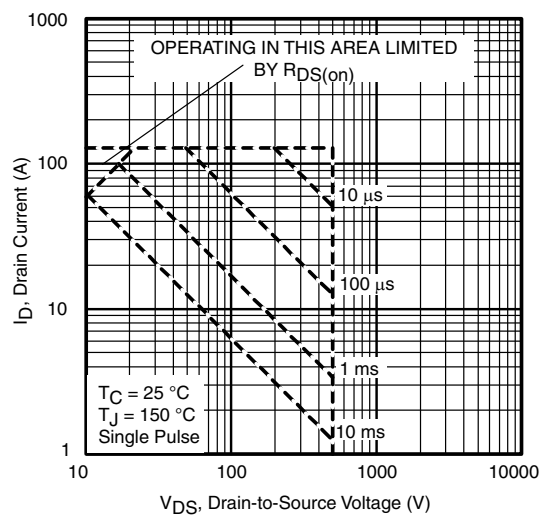


Fig. 8 - Maximum Safe Operating Area

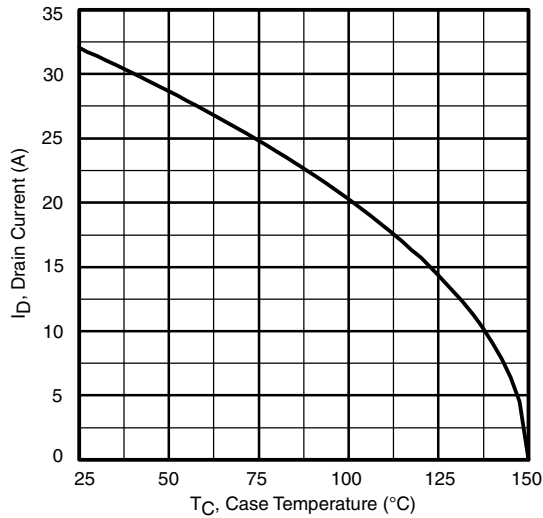


Fig. 9 - Maximum Drain Current vs. Case Temperature



Fig. 10a - Switching Time Test Circuit



Fig. 10b - Switching Time Waveforms

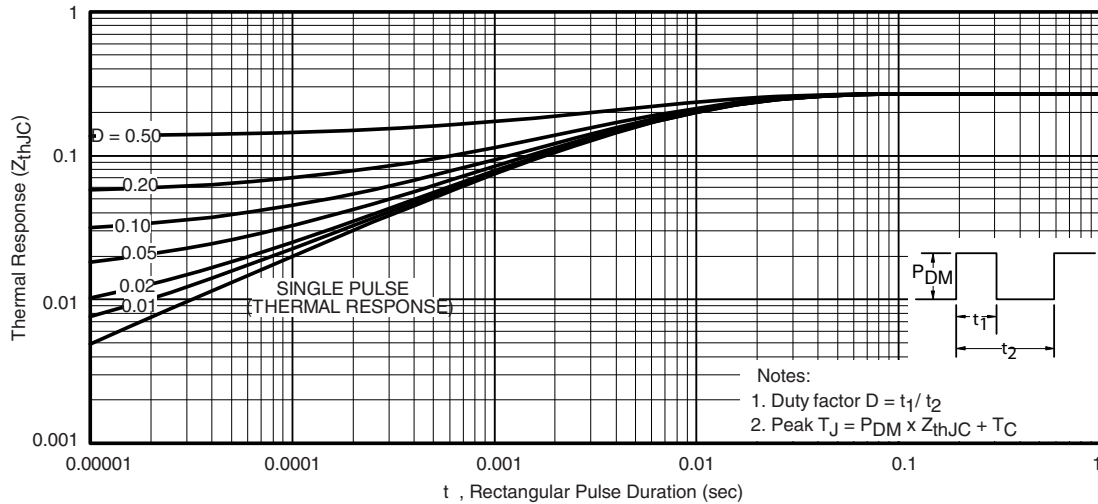


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

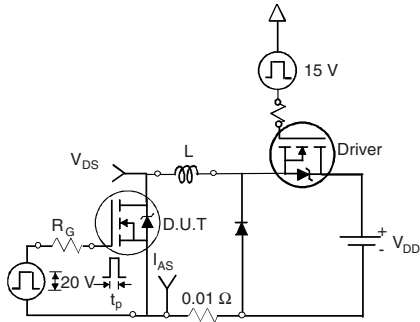


Fig. 12a - Unclamped Inductive Test Circuit

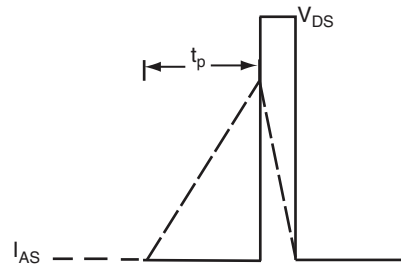


Fig. 12b - Unclamped Inductive Waveforms

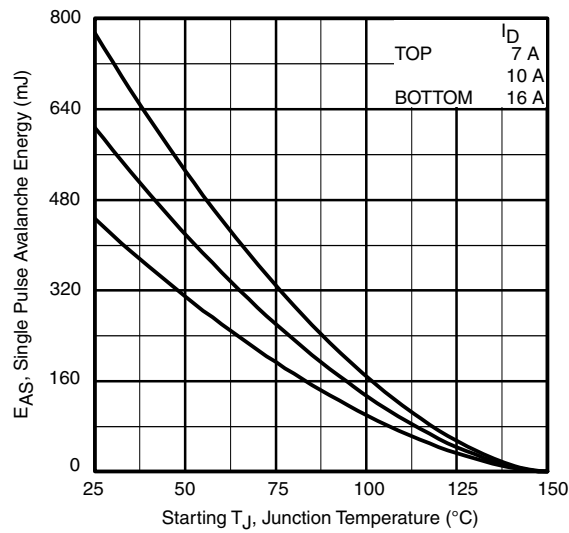


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

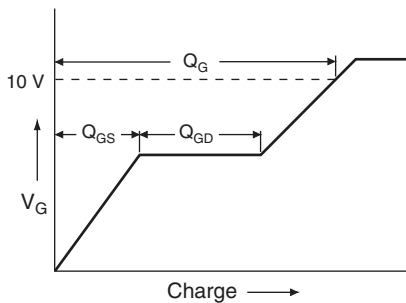


Fig. 13a - Basic Gate Charge Waveform

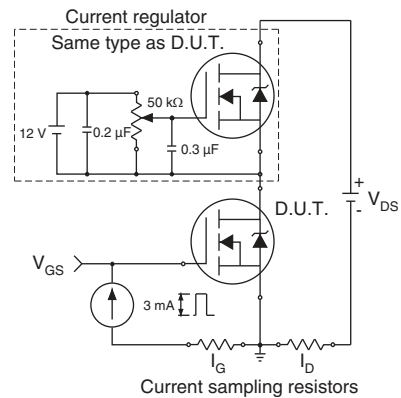


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



Note

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

Fig. 14 - For N-Channel

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TO-247AC (High Voltage)



| DIM. | MILLIMETERS | | INCHES | |
|------|-------------|-------|--------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 4.58 | 5.31 | 0.180 | 0.209 |
| A1 | 2.21 | 2.59 | 0.087 | 0.102 |
| A2 | 1.17 | 2.49 | 0.046 | 0.098 |
| b | 0.99 | 1.40 | 0.039 | 0.055 |
| b1 | 0.99 | 1.35 | 0.039 | 0.053 |
| b2 | 1.53 | 2.39 | 0.060 | 0.094 |
| b3 | 1.65 | 2.37 | 0.065 | 0.093 |
| b4 | 2.42 | 3.43 | 0.095 | 0.135 |
| b5 | 2.59 | 3.38 | 0.102 | 0.133 |
| c | 0.38 | 0.86 | 0.015 | 0.034 |
| c1 | 0.38 | 0.76 | 0.015 | 0.030 |
| D | 19.71 | 20.82 | 0.776 | 0.820 |
| D1 | 13.08 | - | 0.515 | - |

| DIM. | MILLIMETERS | | INCHES | |
|------|-------------|-------|-----------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| D2 | 0.51 | 1.30 | 0.020 | 0.051 |
| E | 15.29 | 15.87 | 0.602 | 0.625 |
| E1 | 13.72 | - | 0.540 | - |
| e | 5.46 BSC | | 0.215 BSC | |
| Ø k | 0.254 | | 0.010 | |
| L | 14.20 | 16.25 | 0.559 | 0.640 |
| L1 | 3.71 | 4.29 | 0.146 | 0.169 |
| N | 7.62 BSC | | 0.300 BSC | |
| Ø P | 3.51 | 3.66 | 0.138 | 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 | |

ECN: X13-0103-Rev. D, 01-Jul-13
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").
7. Outline conforms to JEDEC outline TO-247 with exception of dimension c.
8. Xian and Mingxin actually photo.





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