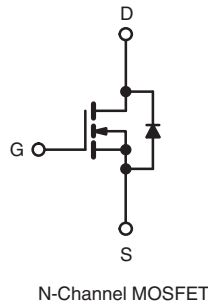
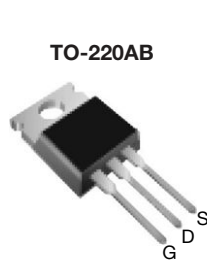


Power MOSFET

| PRODUCT SUMMARY | | |
|---------------------------|-----------------|-----|
| V_{DS} (V) | 500 | |
| $R_{DS(on)}$ (Ω) | $V_{GS} = 10$ V | 3.0 |
| Q_g (Max.) (nC) | 17 | |
| Q_{gs} (nC) | 4.3 | |
| Q_{gd} (nC) | 8.5 | |
| 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
- Effective C_{oss} Specified
- Compliant to RoHS Directive 2002/95/EC


RoHS*
COMPLIANT

APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptable Power Supply
- High Speed Power Switching

TYPICAL SMPS TOPOLOGIES

- Two Transistor Forward
- Half bridge
- Full bridge

| ORDERING INFORMATION | |
|----------------------|---------------------------|
| Package | TO-220AB |
| Lead (Pb)-free | IRF820APbF SiHF820A-E3 |
| SnPb | IRF820A SiHF820A |


| ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$, 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 | $T_C = 25^\circ\text{C}$ | A | |
| | | $T_C = 100^\circ\text{C}$ | | |
| Pulsed Drain Current ^a | I_{DM} | 10 | | |
| Linear Derating Factor | | 0.40 | W/ $^\circ\text{C}$ | |
| Single Pulse Avalanche Energy ^b | E_{AS} | 140 | mJ | |
| Repetitive Avalanche Current ^a | I_{AR} | 2.5 | A | |
| Repetitive Avalanche Energy ^a | E_{AR} | 5.0 | mJ | |
| Maximum Power Dissipation | $T_C = 25^\circ\text{C}$ | P_D | 50 | W |
| Peak Diode Recovery dV/dt^c | | dV/dt | 3.4 | V/ns |
| 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 | N · m |

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Starting $T_J = 25^\circ\text{C}$, $L = 45$ mH, $R_g = 25 \Omega$, $I_{AS} = 2.5$ A (see fig. 12).
- $I_{SD} \leq 2.5$ A, $dI/dt \leq 270$ A/ μs , $V_{DD} \leq V_{DS}$, $T_J \leq 150^\circ\text{C}$.
- 1.6 mm from case.

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

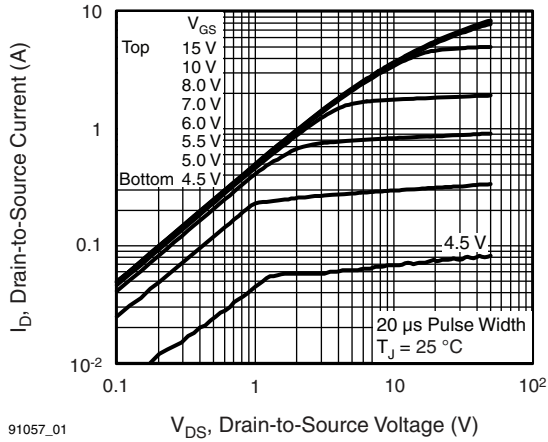
| THERMAL RESISTANCE RATINGS | | | | |
|-------------------------------------|------------|------|------|------|
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
| Maximum Junction-to-Ambient | R_{thJA} | - | 62 | °C/W |
| Case-to-Sink, Flat, Greased Surface | R_{thCS} | 0.50 | - | |
| Maximum Junction-to-Case (Drain) | R_{thJC} | - | 2.5 | |

| SPECIFICATIONS ($T_J = 25\text{ °C}$, 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 °C , $I_D = 1\text{ mA}$ | | - | 0.60 | - | V/°C |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | | 2.0 | - | 4.5 | V |
| Gate-Source Leakage | I_{GSS} | $V_{GS} = \pm 30\text{ V}$ | | - | - | ± 100 | nA |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$ | | - | - | 25 | μA |
| | | $V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ °C}$ | | - | - | 250 | |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}$ | $I_D = 1.5\text{ A}^b$ | - | - | 3.0 | Ω |
| Forward Transconductance | g_{fs} | $V_{DS} = 50\text{ V}, I_D = 1.5\text{ A}^b$ | | 1.4 | - | - | S |
| Dynamic | | | | | | | |
| Input Capacitance | C_{iss} | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1.0\text{ MHz}$, see fig. 5 | | - | 340 | - | pF |
| Output Capacitance | C_{oss} | | | - | 53 | - | |
| Reverse Transfer Capacitance | C_{rss} | | | - | 2.7 | - | |
| Output Capacitance | C_{oss} | $V_{GS} = 0\text{ V}; V_{DS} = 1.0\text{ V}, f = 1.0\text{ MHz}$ | | - | 490 | - | |
| Output Capacitance | C_{oss} | $V_{GS} = 0\text{ V}; V_{DS} = 400\text{ V}, f = 1.0\text{ MHz}$ | | - | 15 | - | |
| Effective Output Capacitance | $C_{oss\text{ eff.}}$ | $V_{GS} = 0\text{ V}; V_{DS} = 0\text{ V to } 400\text{ V}^c$ | | - | 28 | - | |
| Total Gate Charge | Q_g | $V_{GS} = 10\text{ V}$ | $I_D = 2.5\text{ A}, V_{DS} = 400\text{ V}$, see fig. 6 and 13 ^b | - | - | 17 | nC |
| Gate-Source Charge | Q_{gs} | | | - | - | 4.3 | |
| Gate-Drain Charge | Q_{gd} | | | - | - | 8.5 | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = 250\text{ V}, I_D = 2.5\text{ A}, R_g = 21\text{ }\Omega, R_D = 97\text{ }\Omega$, see fig. 10 ^b | | - | 8.1 | - | ns |
| Rise Time | t_r | | | - | 12 | - | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | - | 16 | - | |
| Fall Time | t_f | | | - | 13 | - | |
| Drain-Source Body Diode Characteristics | | | | | | | |
| Continuous Source-Drain Diode Current | I_S | MOSFET symbol showing the integral reverse p - n junction diode  | - | - | 2.5 | A | |
| Pulsed Diode Forward Current ^a | I_{SM} | | - | - | 10 | | |
| Body Diode Voltage | V_{SD} | $T_J = 25\text{ °C}, I_S = 2.5\text{ A}, V_{GS} = 0\text{ V}^b$ | | - | - | 1.6 | V |
| Body Diode Reverse Recovery Time | t_{rr} | $T_J = 25\text{ °C}, I_F = 2.5\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}^b$ | | - | 330 | 500 | ns |
| Body Diode Reverse Recovery Charge | Q_{rr} | | | - | 760 | 1140 | nC |
| Forward Turn-On Time | t_{on} | Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D) | | | | | |

Notes

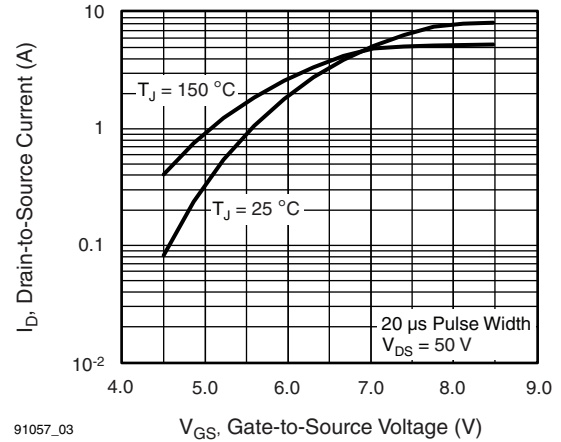
- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.
- $C_{oss\text{ eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS} .

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



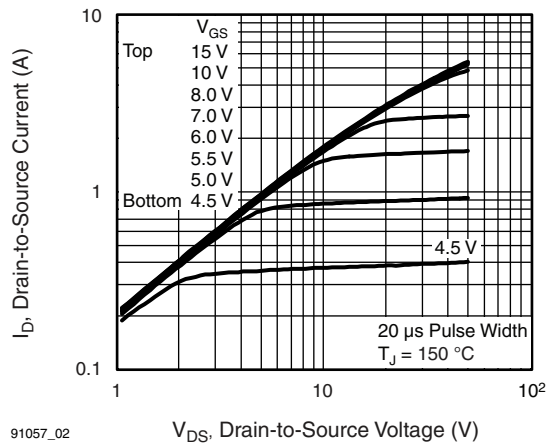
91057_01

Fig. 1 - Typical Output Characteristics, $T_C = 25\text{ }^\circ\text{C}$



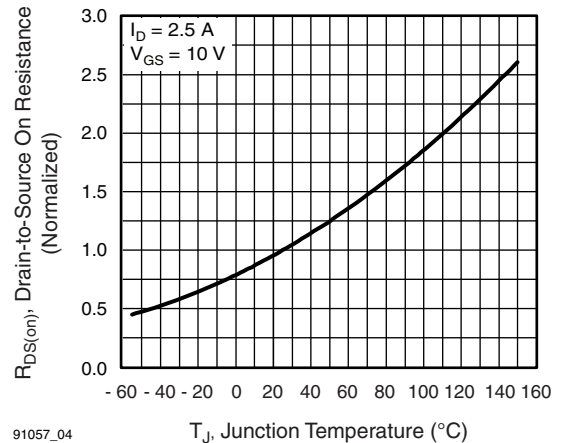
91057_03

Fig. 3 - Typical Transfer Characteristics



91057_02

Fig. 2 - Typical Output Characteristics, $T_C = 150\text{ }^\circ\text{C}$



91057_04

Fig. 4 - Normalized On-Resistance vs. Temperature

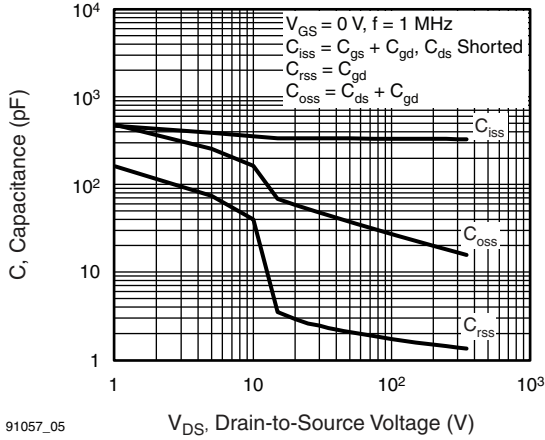


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

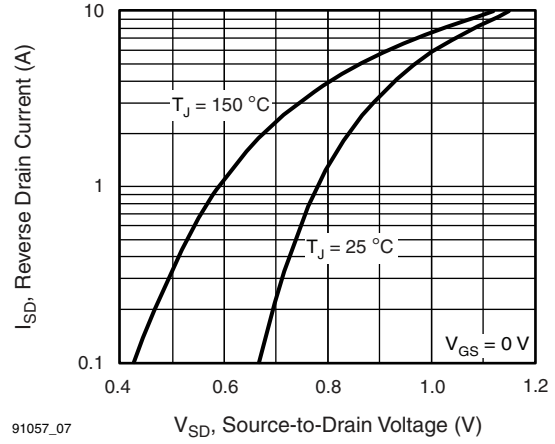


Fig. 7 - Typical Source-Drain Diode Forward Voltage

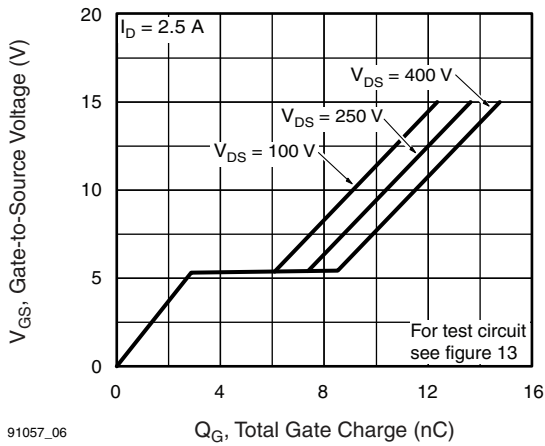


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

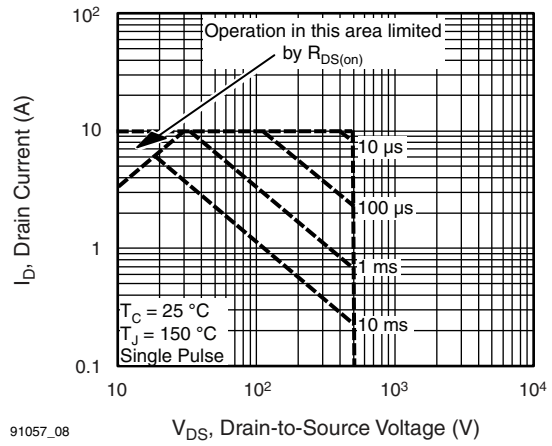
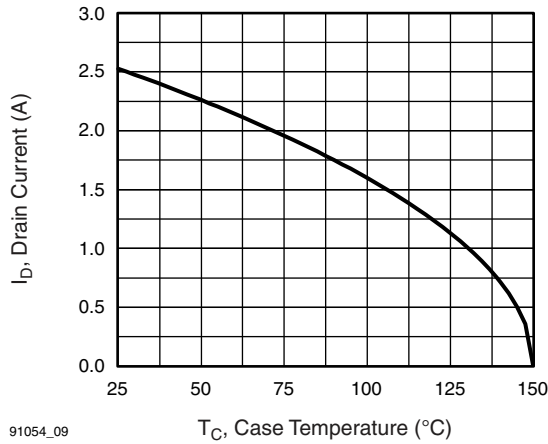


Fig. 8 - Maximum Safe Operating Area



91054_09

Fig. 9 - Maximum Drain Current vs. Case Temperature

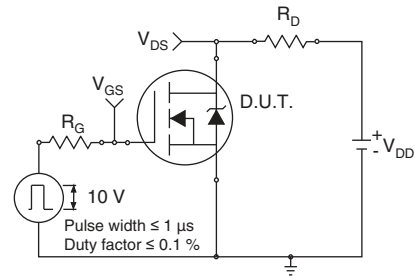
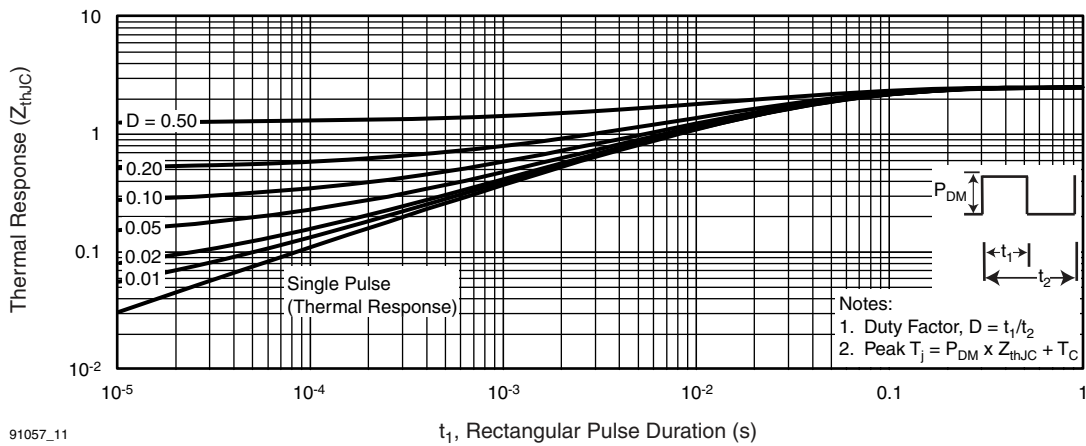


Fig. 10a - Switching Time Test Circuit



Fig. 10b - Switching Time Waveforms



91057_11

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

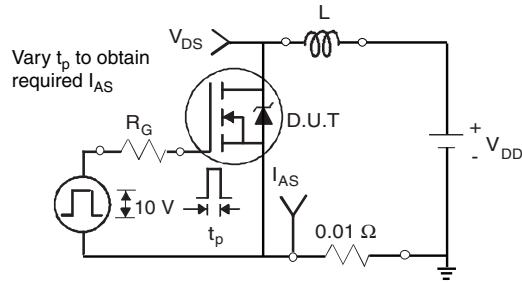


Fig. 12a - Unclamped Inductive Test Circuit

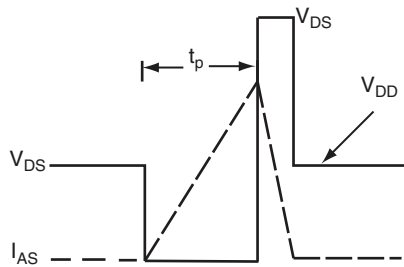
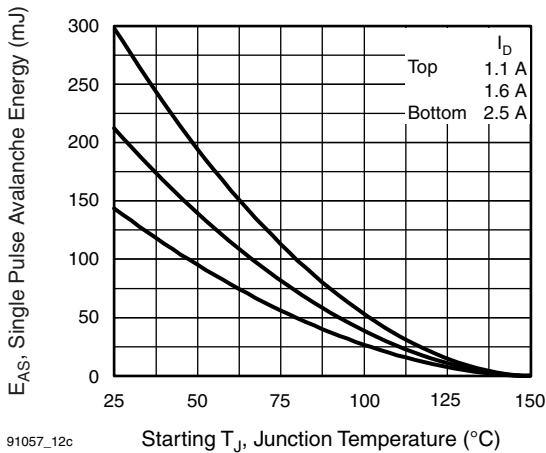


Fig. 12b - Unclamped Inductive Waveforms



91057_12c

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

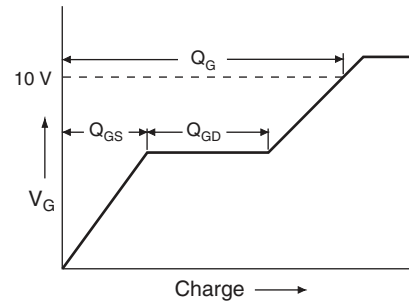
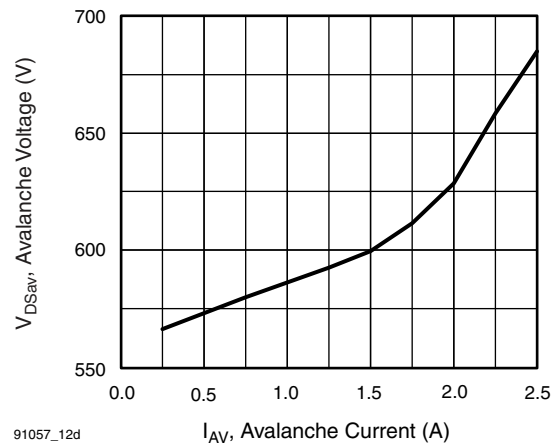


Fig. 12d - Basic Gate Charge Waveform



91057_12d

Fig. 13a - Typical Drain-to-Source Voltage vs. Avalanche Current

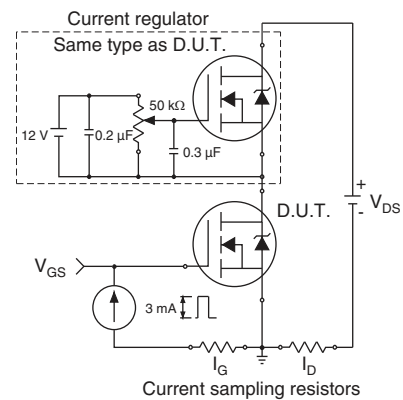
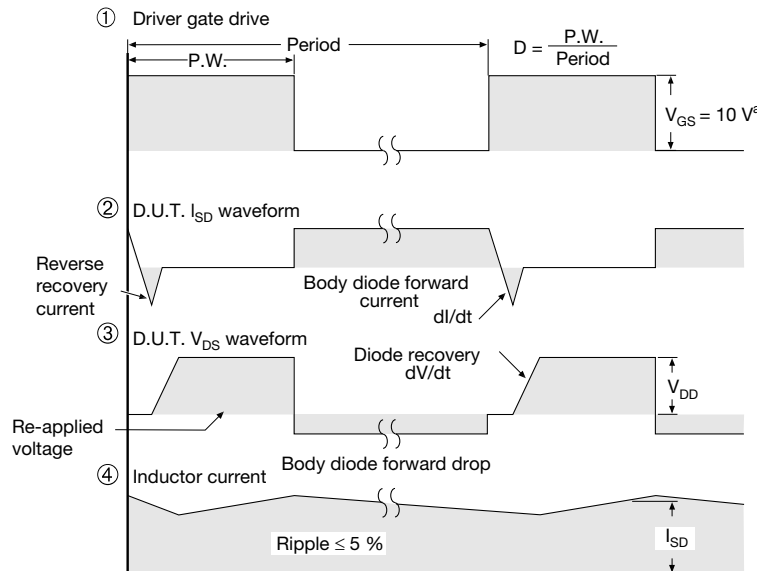


Fig. 13b - Gate Charge Test Circuit

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-220-1



| DIM. | MILLIMETERS | | INCHES | |
|------|-------------|-------|--------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 4.24 | 4.65 | 0.167 | 0.183 |
| b | 0.69 | 1.02 | 0.027 | 0.040 |
| b(1) | 1.14 | 1.78 | 0.045 | 0.070 |
| c | 0.36 | 0.61 | 0.014 | 0.024 |
| D | 14.33 | 15.85 | 0.564 | 0.624 |
| E | 9.96 | 10.52 | 0.392 | 0.414 |
| e | 2.41 | 2.67 | 0.095 | 0.105 |
| e(1) | 4.88 | 5.28 | 0.192 | 0.208 |
| F | 1.14 | 1.40 | 0.045 | 0.055 |
| H(1) | 6.10 | 6.71 | 0.240 | 0.264 |
| J(1) | 2.41 | 2.92 | 0.095 | 0.115 |
| L | 13.36 | 14.40 | 0.526 | 0.567 |
| L(1) | 3.33 | 4.04 | 0.131 | 0.159 |
| Ø P | 3.53 | 3.94 | 0.139 | 0.155 |
| Q | 2.54 | 3.00 | 0.100 | 0.118 |

ECN: X15-0364-Rev. C, 14-Dec-15
DWG: 6031

Note

- M* = 0.052 inches to 0.064 inches (dimension including protrusion), heatsink hole for HVM





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