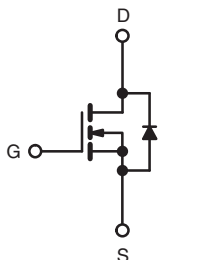
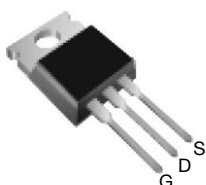


Power MOSFET

PRODUCT SUMMARY

| | | |
|---------------------------|------------------------|-------|
| V_{DS} (V) | 100 | |
| $R_{DS(on)}$ (Ω) | $V_{GS} = 10\text{ V}$ | 0.077 |
| Q_g (Max.) (nC) | 72 | |
| Q_{gs} (nC) | 11 | |
| Q_{gd} (nC) | 32 | |
| Configuration | Single | |

TO-220AB


N-Channel MOSFET

FEATURES

- Dynamic dV/dt Rating
- Repetitive Avalanche Rated
- 175 °C Operating Temperature
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- Compliant to RoHS Directive 2002/95/EC


RoHS*
COMPLIANT

DESCRIPTION

Third generation Power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The TO-220AB package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 50 W. The low thermal resistance and low package cost of the TO-220AB contribute to its wide acceptance throughout the industry.

ORDERING INFORMATION

| | |
|----------------|------------|
| Package | TO-220AB |
| Lead (Pb)-free | IRF540PbF |
| | SiHF540-E3 |
| SnPb | IRF540 |
| | SiHF540 |

ABSOLUTE MAXIMUM RATINGS ($T_C = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

| PARAMETER | SYMBOL | LIMIT | UNIT |
|--|------------------|-------------------------------------|-----------------------|
| Drain-Source Voltage | V_{DS} | 100 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | |
| Continuous Drain Current | I_D | $T_C = 25\text{ }^{\circ}\text{C}$ | A |
| | | $T_C = 100\text{ }^{\circ}\text{C}$ | |
| Pulsed Drain Current ^a | I_{DM} | 110 | |
| Linear Derating Factor | | 1.0 | W/ $^{\circ}\text{C}$ |
| Single Pulse Avalanche Energy ^b | E_{AS} | 230 | mJ |
| Repetitive Avalanche Current ^a | I_{AR} | 28 | A |
| Repetitive Avalanche Energy ^a | E_{AR} | 15 | mJ |
| Maximum Power Dissipation | P_D | 150 | W |
| Peak Diode Recovery dV/dt ^c | dV/dt | 5.5 | V/ns |
| Operating Junction and Storage Temperature Range | T_J, T_{stg} | - 55 to + 175 | $^{\circ}\text{C}$ |
| Soldering Recommendations (Peak Temperature) | for 10 s | 300 ^d | |
| Mounting Torque | 6-32 or M3 screw | 10 | lbf · in |
| | | 1.1 | N · m |

Notes

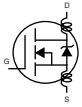
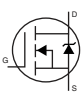
- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 25\text{ V}$, starting $T_J = 25\text{ }^{\circ}\text{C}$, $L = 440\text{ }\mu\text{H}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 28\text{ A}$ (see fig. 12).
- $I_{SD} \leq 28\text{ A}$, $dI/dt \leq 170\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 175\text{ }^{\circ}\text{C}$.
- 1.6 mm from case.

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

THERMAL RESISTANCE RATINGS

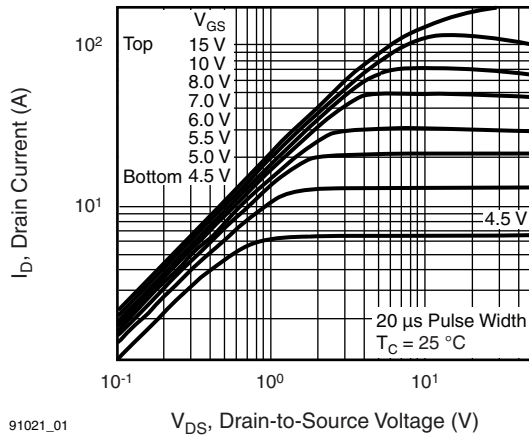
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
|-------------------------------------|------------|------|------|------|
| Maximum Junction-to-Ambient | R_{thJA} | - | 62 | °C/W |
| Case-to-Sink, Flat, Greased Surface | R_{thCS} | 0.50 | - | |
| Maximum Junction-to-Case (Drain) | R_{thJC} | - | 1.0 | |

SPECIFICATIONS ($T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

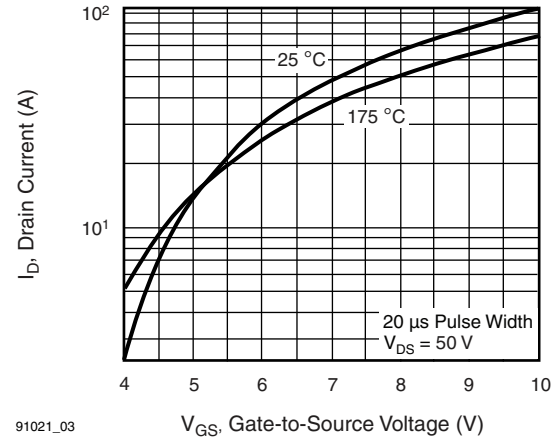
| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNIT |
|---|----------------------------------|---|--|------|------|-------|------|
| Static | | | | | | | |
| Drain-Source Breakdown Voltage | V _{DS} | V _{GS} = 0 V, I _D = 250 μA | | 100 | - | - | V |
| V _{DS} Temperature Coefficient | ΔV _{DS} /T _J | Reference to 25 °C, I _D = 1 mA | | - | 0.13 | - | V/°C |
| Gate-Source Threshold Voltage | V _{GS(th)} | V _{DS} = V _{GS} , I _D = 250 μA | | 2.0 | - | 4.0 | V |
| Gate-Source Leakage | I _{GSS} | V _{GS} = ± 20 V | | - | - | ± 100 | nA |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} = 100 V, V _{GS} = 0 V | | - | - | 25 | μA |
| | | V _{DS} = 80 V, V _{GS} = 0 V, T _J = 150 °C | | - | - | 250 | |
| Drain-Source On-State Resistance | R _{DS(on)} | V _{GS} = 10 V | I _D = 17 A ^b | - | - | 0.077 | Ω |
| Forward Transconductance | g _{fs} | V _{DS} = 50 V, I _D = 17 A ^b | | 8.7 | - | - | S |
| Dynamic | | | | | | | |
| Input Capacitance | C _{iss} | V _{GS} = 0 V, V _{DS} = 25 V, f = 1.0 MHz, see fig. 5 | | - | 1700 | - | pF |
| Output Capacitance | C _{oss} | | | - | 560 | - | |
| Reverse Transfer Capacitance | C _{rss} | | | - | 120 | - | |
| Total Gate Charge | Q _g | V _{GS} = 10 V | I _D = 17 A, V _{DS} = 80 V, see fig. 6 and 13 ^b | - | - | 72 | nC |
| Gate-Source Charge | Q _{gs} | | | - | - | 11 | |
| Gate-Drain Charge | Q _{gd} | | | - | - | 32 | |
| Turn-On Delay Time | t _{d(on)} | V _{DD} = 50 V, I _D = 17 A R _g = 9.1 Ω, R _D = 2.9 Ω, see fig. 10 ^b | | - | 11 | - | ns |
| Rise Time | t _r | | | - | 44 | - | |
| Turn-Off Delay Time | t _{d(off)} | | | - | 53 | - | |
| Fall Time | t _f | | | - | 43 | - | |
| Internal Drain Inductance | L _D | Between lead, 6 mm (0.25") from package and center of die contact  | | - | 4.5 | - | nH |
| Internal Source Inductance | L _S | | | - | 7.5 | - | |
| Drain-Source Body Diode Characteristics | | | | | | | |
| Continuous Source-Drain Diode Current | I _S | MOSFET symbol showing the integral reverse p - n junction diode  | | - | - | 28 | A |
| Pulsed Diode Forward Current ^a | I _{SM} | | | - | - | 110 | |
| Body Diode Voltage | V _{SD} | T _J = 25 °C, I _S = 28 A, V _{GS} = 0 V ^b | | - | - | 2.5 | V |
| Body Diode Reverse Recovery Time | t _{rr} | T _J = 25 °C, I _F = 17 A, dI/dt = 100 A/μs ^b | | - | 180 | 360 | ns |
| Body Diode Reverse Recovery Charge | Q _{rr} | | | - | 1.3 | 2.8 | μC |
| Forward Turn-On Time | t _{on} | Intrinsic turn-on time is negligible (turn-on is dominated by L _S and L _D) | | | | | |

Notes

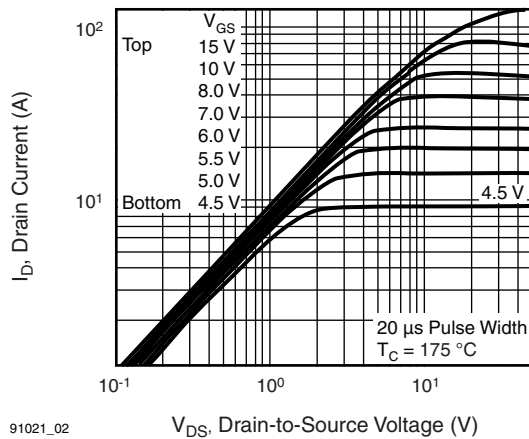
- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
b. Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)


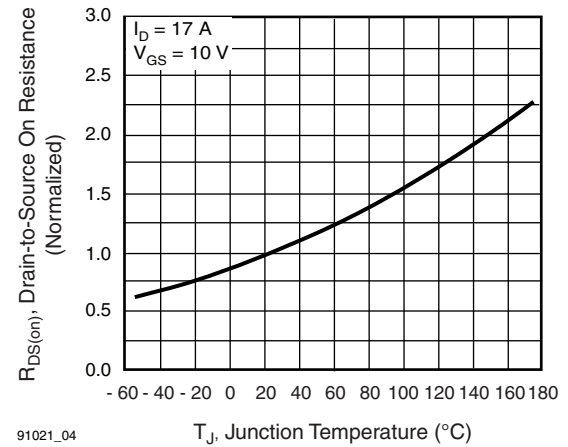
91021_01

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


91021_03

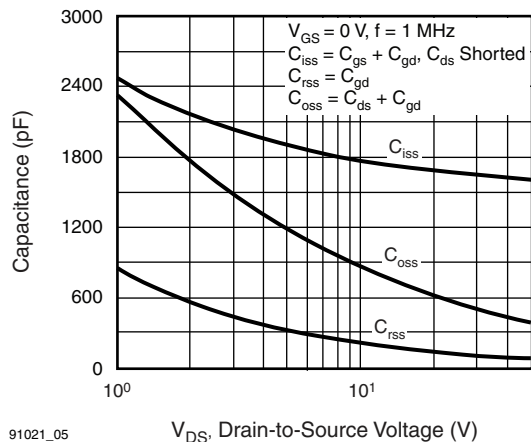
Fig. 3 - Typical Transfer Characteristics


91021_02

Fig. 2 - Typical Output Characteristics, $T_C = 175^\circ\text{C}$


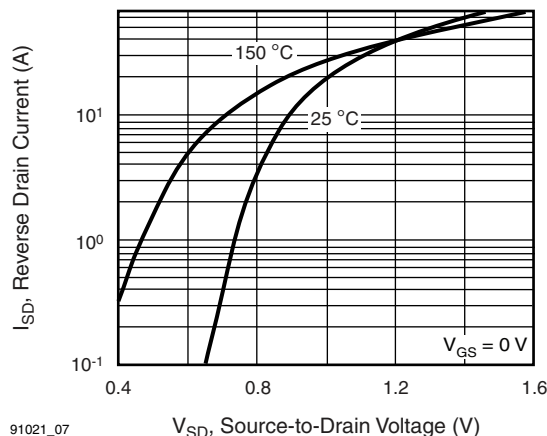
91021_04

Fig. 4 - Normalized On-Resistance vs. Temperature



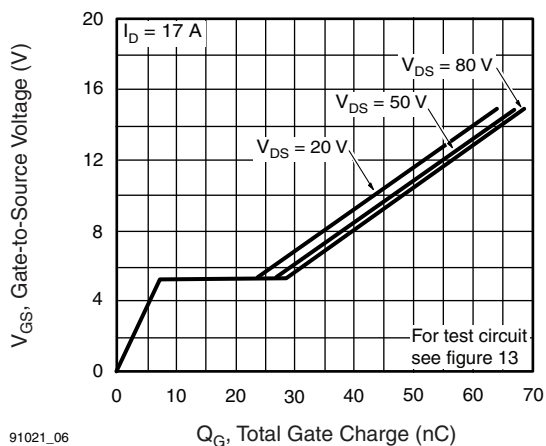
91021_05

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



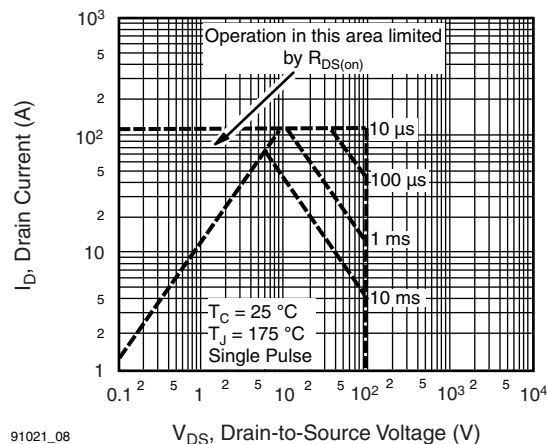
91021_07

Fig. 7 - Typical Source-Drain Diode Forward Voltage



91021_06

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



91021_08

Fig. 8 - Maximum Safe Operating Area

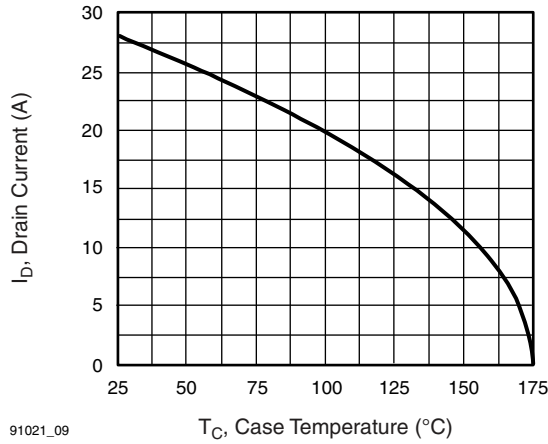


Fig. 9 - Maximum Drain Current vs. Case Temperature

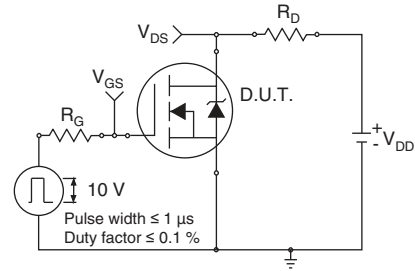


Fig. 10a - Switching Time Test Circuit



Fig. 10b - Switching Time Waveforms

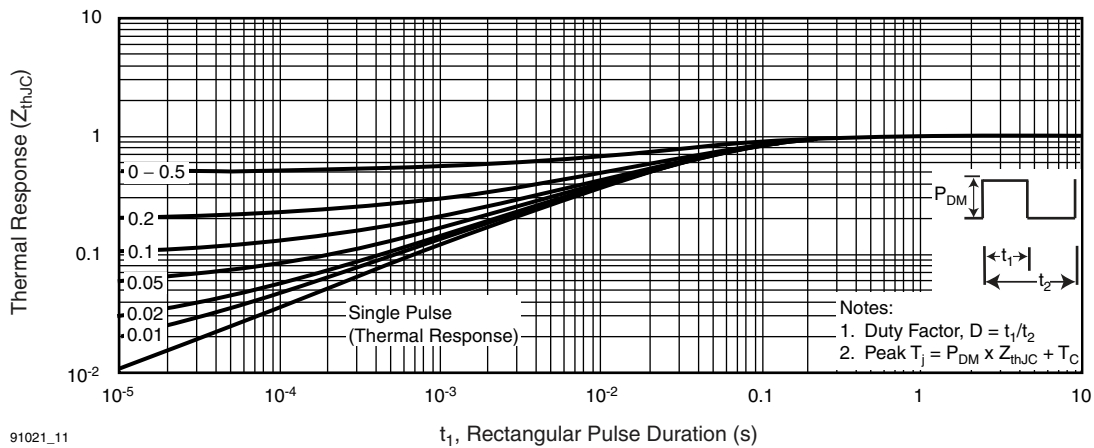


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

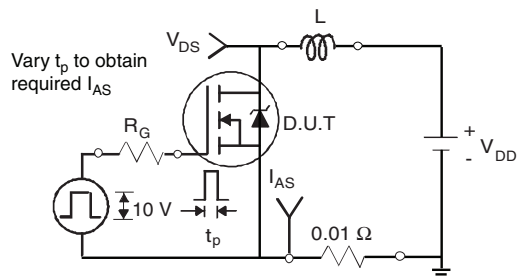


Fig. 12a - Unclamped Inductive Test Circuit

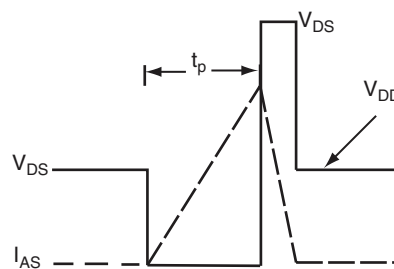


Fig. 12b - Unclamped Inductive Waveforms

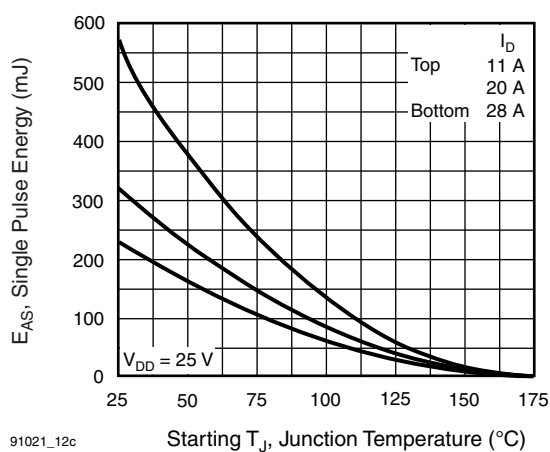


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

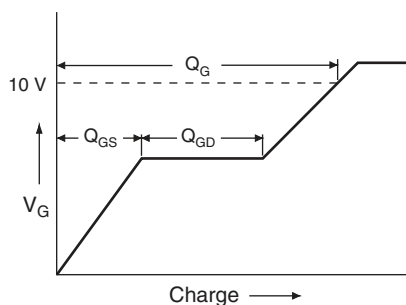


Fig. 13a - Basic Gate Charge Waveform

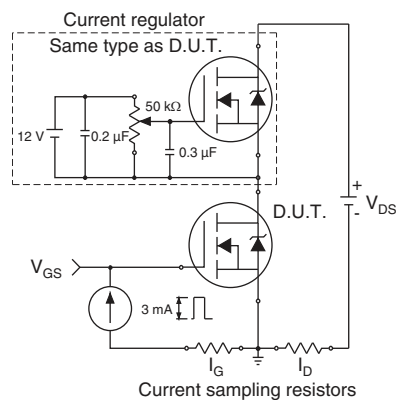
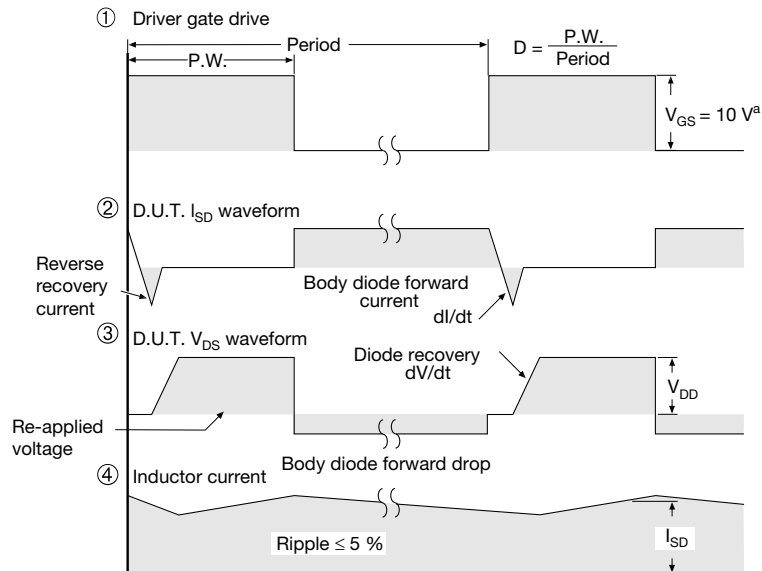
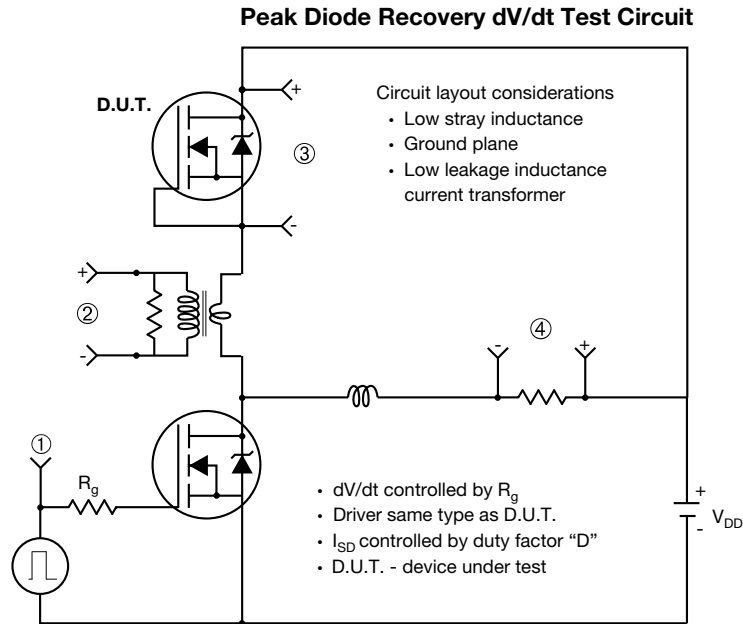


Fig. 13b - Gate Charge Test Circuit


Note

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

Fig. 14 - For N-Channel

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see <http://www.vishay.com/ppg?91021>.

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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