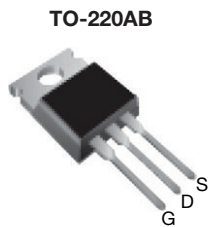


E Series Power MOSFET

| PRODUCT SUMMARY | |
|---|--------------------------------|
| V_{DS} (V) at T_J max. | 650 |
| $R_{DS(on)}$ max. at 25 °C (Ω) | $V_{GS} = 10\text{ V}$ 0.125 |
| Q_g max. (nC) | 130 |
| Q_{gs} (nC) | 15 |
| Q_{gd} (nC) | 39 |
| 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
Available

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
 - LED lighting
- Industrial
 - Welding
 - Induction heating
 - Motor drives
- Battery chargers
- Renewable energy
 - Solar (PV inverters)

| ORDERING INFORMATION | |
|---------------------------------|----------------|
| Package | TO-220AB |
| Lead (Pb)-free | SiHP30N60E-E3 |
| Lead (Pb)-free and Halogen-free | SiHP30N60E-GE3 |


| ABSOLUTE MAXIMUM RATINGS ($T_C = 25\text{ °C}$, unless otherwise noted) | | | | |
|---|---------------------------------------|-----------------------|-------------|------|
| PARAMETER | SYMBOL | LIMIT | UNIT | |
| Drain-Source Voltage | V_{DS} | 600 | V | |
| Gate-Source Voltage | V_{GS} | ± 30 | | |
| Continuous Drain Current ($T_J = 150\text{ °C}$) | V_{GS} at 10 V | $T_C = 25\text{ °C}$ | 29 | A |
| | | $T_C = 100\text{ °C}$ | 18 | |
| Pulsed Drain Current ^a | | I_{DM} | 65 | |
| Linear Derating Factor | | | 2 | W/°C |
| Single Pulse Avalanche Energy ^b | | E_{AS} | 690 | mJ |
| Maximum Power Dissipation | | P_D | 250 | W |
| Operating Junction and Storage Temperature Range | | T_J, T_{stg} | -55 to +150 | °C |
| Drain-Source Voltage Slope | $V_{DS} = 0\text{ V to } 80\% V_{DS}$ | dV/dt | 70 | V/ns |
| Reverse Diode dV/dt ^d | | | 18 | |
| Soldering Recommendations (Peak Temperature) ^c | for 10 s | | 300 | °C |

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 50\text{ V}$, starting $T_J = 25\text{ °C}$, $L = 28.2\text{ mH}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 7\text{ A}$.
- 1.6 mm from case.
- $I_{SD} \leq I_D$, $dI/dt = 100\text{ A}/\mu\text{s}$, starting $T_J = 25\text{ °C}$.



| THERMAL RESISTANCE RATINGS | | | | |
|----------------------------------|------------|------|------|------|
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
| Maximum Junction-to-Ambient | R_{thJA} | - | 62 | °C/W |
| Maximum Junction-to-Case (Drain) | R_{thJC} | - | 0.5 | |

| 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 $25\text{ }^\circ\text{C}, I_D = 250\text{ }\mu\text{A}$ | | - | 0.64 | - | V/°C |
| Gate-Source Threshold Voltage (N) | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | | 2.0 | 2.8 | 4.0 | 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 |
| | | $V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$ | | - | - | 100 | |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}$ | $I_D = 15\text{ A}$ | - | 0.104 | 0.125 | Ω |
| Forward Transconductance ^a | g_{fs} | $V_{DS} = 8\text{ V}, I_D = 3\text{ A}$ | | - | 5.4 | - | S |
| Dynamic | | | | | | | |
| Input Capacitance | C_{iss} | $V_{GS} = 0\text{ V},$ $V_{DS} = 100\text{ V},$ $f = 1.0\text{ MHz}$ | | - | 2600 | - | pF |
| Output Capacitance | C_{oss} | | | - | 138 | - | |
| Reverse Transfer Capacitance | C_{rss} | | | - | 3 | - | |
| Effective Output Capacitance, Energy Related ^b | $C_{o(er)}$ | $V_{DS} = 0\text{ V to } 480\text{ V}, V_{GS} = 0\text{ V}$ | | - | 98 | - | pF |
| Effective Output Capacitance, Time Related ^c | $C_{o(tr)}$ | | | - | 346 | - | |
| Total Gate Charge | Q_g | $V_{GS} = 10\text{ V}$ | $I_D = 15\text{ A}, V_{DS} = 480\text{ V}$ | - | 85 | 130 | nC |
| Gate-Source Charge | Q_{gs} | | | - | 15 | - | |
| Gate-Drain Charge | Q_{gd} | | | - | 39 | - | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = 380\text{ V}, I_D = 15\text{ A},$ $V_{GS} = 10\text{ V}, R_g = 4.7\text{ }\Omega$ | | - | 19 | 40 | ns |
| Rise Time | t_r | | | - | 32 | 65 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | - | 63 | 95 | |
| Fall Time | t_f | | | - | 36 | 75 | |
| Gate Input Resistance | R_g | $f = 1\text{ MHz}, \text{open drain}$ | | - | 0.63 | - | Ω |
| Drain-Source Body Diode Characteristics | | | | | | | |
| Continuous Source-Drain Diode Current | I_S | MOSFET symbol showing the integral reverse p - n junction diode  | | - | - | 29 | A |
| Pulsed Diode Forward Current | I_{SM} | | | - | - | 65 | |
| Diode Forward Voltage | V_{SD} | $T_J = 25\text{ }^\circ\text{C}, I_S = 15\text{ A}, V_{GS} = 0\text{ V}$ | | - | - | 1.3 | V |
| Body Diode Reverse Recovery Time | t_{rr} | $T_J = 25\text{ }^\circ\text{C}, I_F = I_S = 15\text{ A},$ $dI/dt = 100\text{ A}/\mu\text{s}, V_R = 20\text{ V}$ | | - | 402 | 605 | ns |
| Body Diode Reverse Recovery Charge | Q_{rr} | | | - | 7 | 15 | μC |
| Reverse Recovery Current | I_{RRM} | | | - | 32 | 65 | A |

Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature.
- b. $C_{oss(er)}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS} .
- c. $C_{oss(tr)}$ 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)

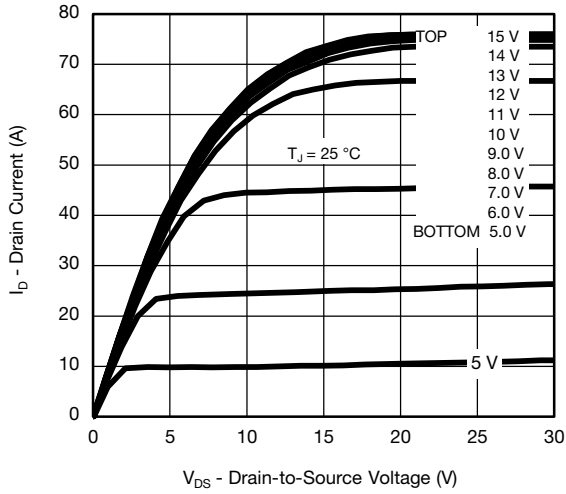


Fig. 1 - Typical Output Characteristics, $T_C = 25\text{ }^\circ\text{C}$

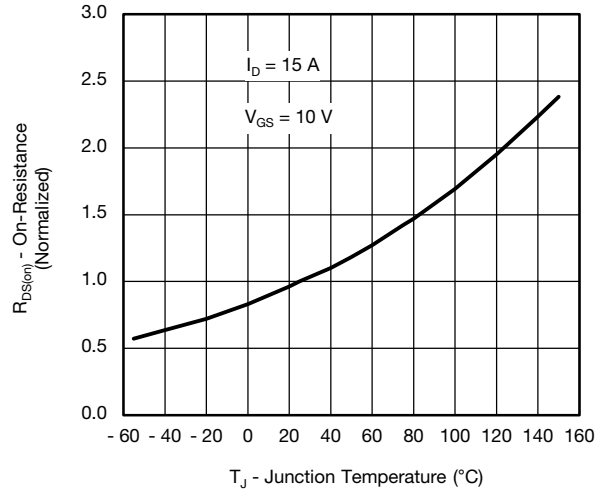


Fig. 4 - Normalized On-Resistance vs. Temperature

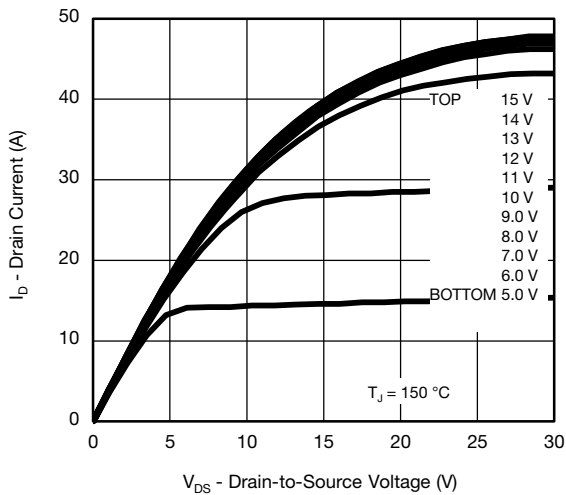


Fig. 2 - Typical Output Characteristics, $T_C = 150\text{ }^\circ\text{C}$

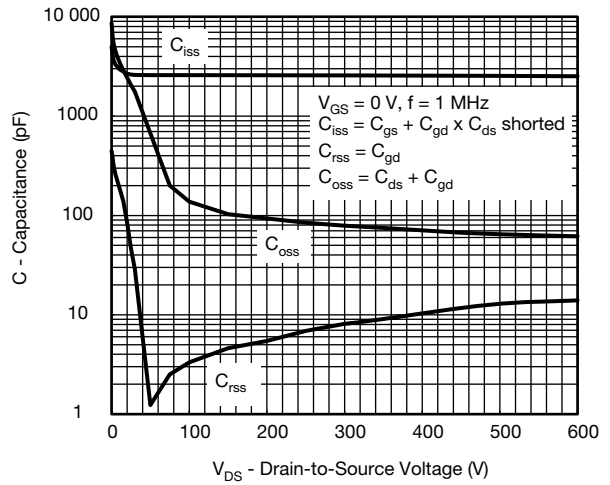


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

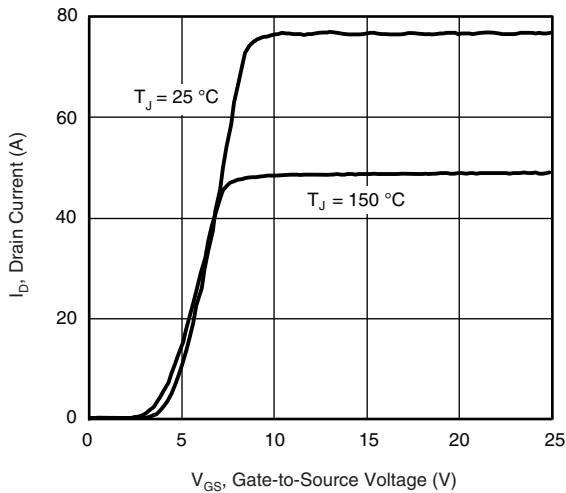


Fig. 3 - Typical Transfer Characteristics

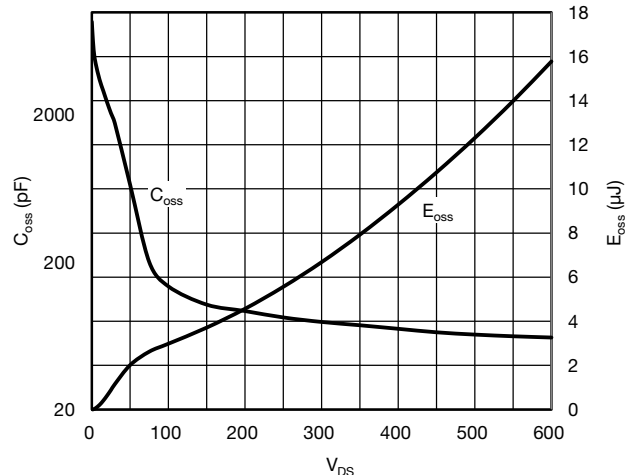


Fig. 6 - C_{oss} and E_{oss} vs. V_{DS}

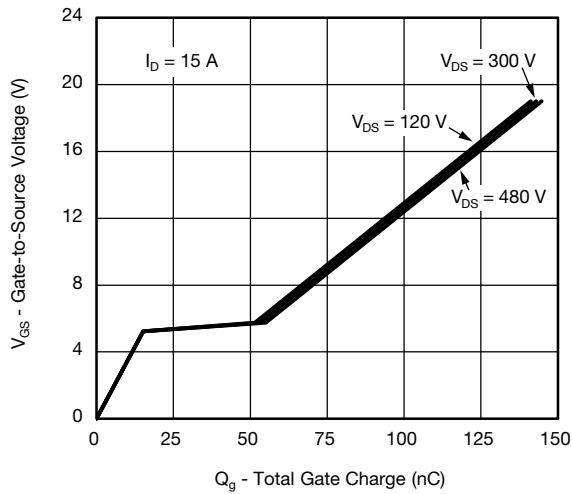


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage



Fig. 10 - Maximum Drain Current vs. Case Temperature

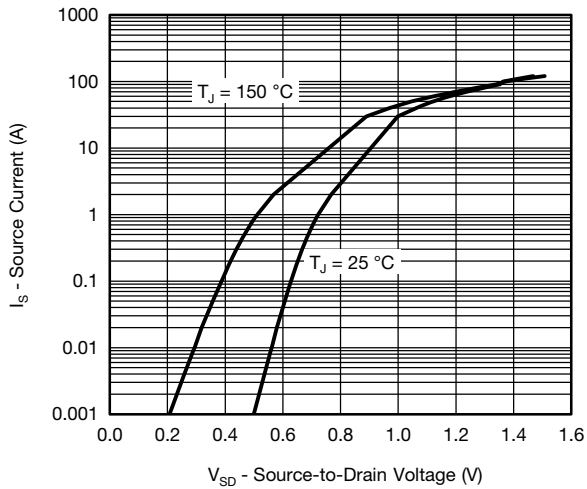


Fig. 8 - Typical Source-Drain Diode Forward Voltage

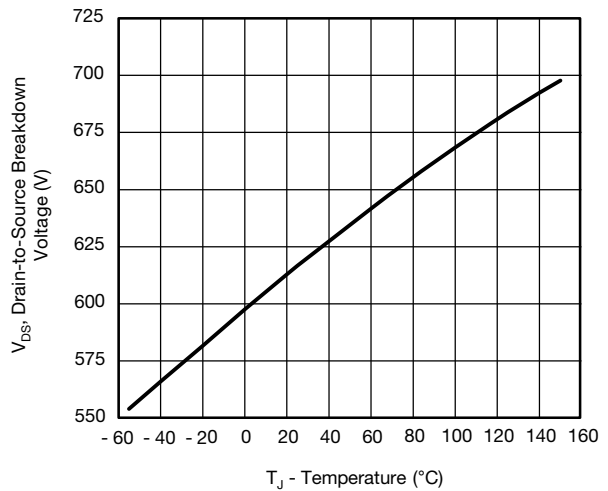


Fig. 11 - Temperature vs. Drain-to-Source Voltage

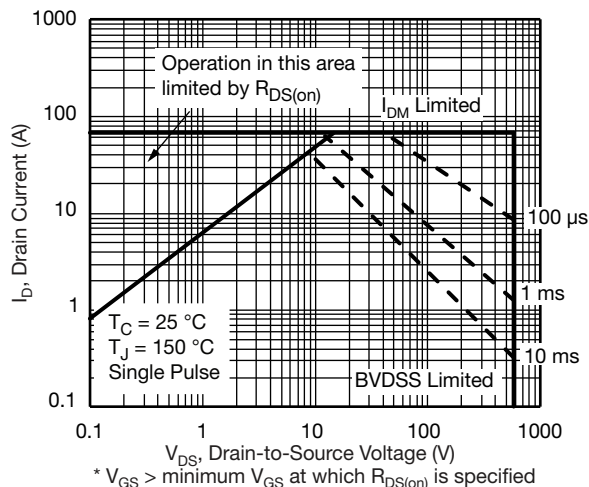


Fig. 9 - Maximum Safe Operating Area

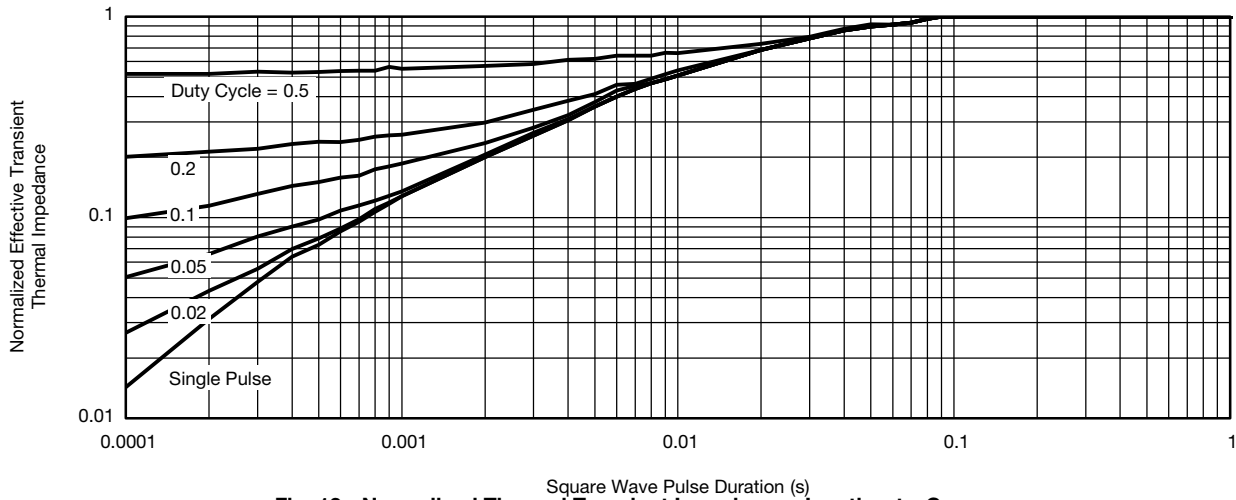


Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case

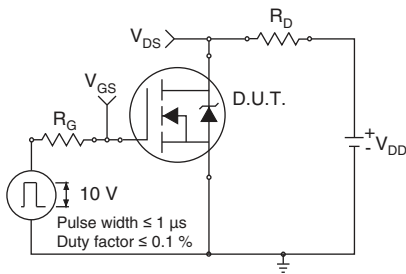


Fig. 13 - Switching Time Test Circuit

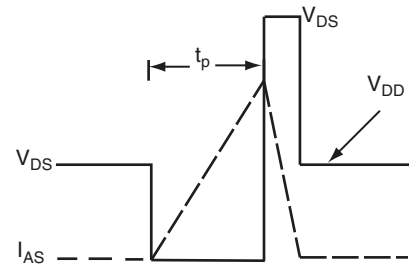


Fig. 16 - Unclamped Inductive Waveforms

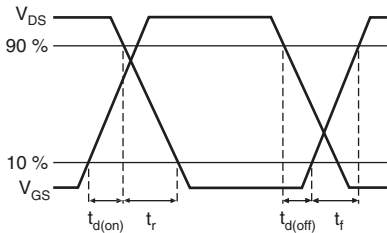


Fig. 14 - Switching Time Waveforms

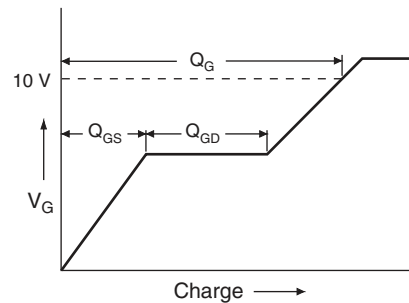


Fig. 17 - Basic Gate Charge Waveform

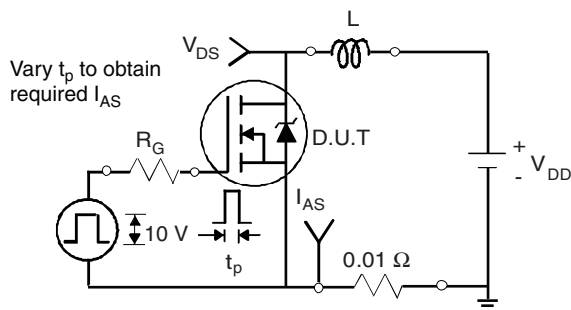


Fig. 15 - Unclamped Inductive Test Circuit

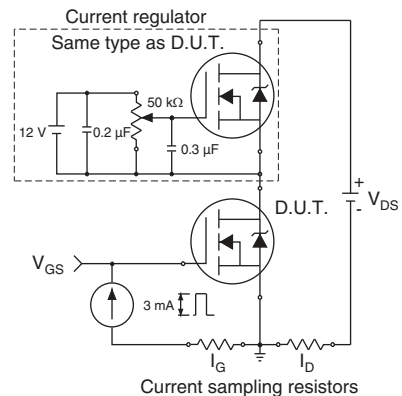


Fig. 18 - Gate Charge Test Circuit

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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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 |
| ØP | 3.53 | 3.94 | 0.139 | 0.155 |
| Q | 2.54 | 3.00 | 0.100 | 0.118 |

ECN: E21-0621-Rev. D, 04-Nov-2021
DWG: 6031

Note

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



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