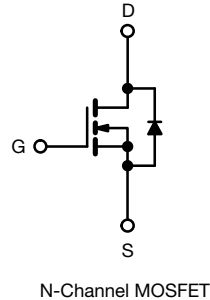
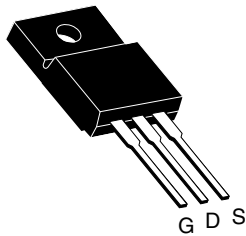


E Series Power MOSFET

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

TO-220 FULLPAK

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-220 FULLPAK |
| Lead (Pb)-free and Halogen-free | SiHF30N60E-GE3 |
| Lead (Pb)-free | SiHF30N60E-E3 |


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) ^d | V_{GS} at 10 V | $T_C = 25$ °C | 29 | A |
| | | $T_C = 100$ °C | 18 | |
| Pulsed Drain Current ^a | I_{DM} | 76 | | |
| Linear Derating Factor | | 0.29 | W/°C | |
| Single Pulse Avalanche Energy ^b | E_{AS} | 690 | mJ | |
| Maximum Power Dissipation | P_D | 37 | W | |
| Operating Junction and Storage Temperature Range | T_J, T_{stg} | -55 to +150 | °C | |
| Drain-Source Voltage Slope | dV/dt | $V_{DS} = 0$ V to 80 % V_{DS} | 70 | V/ns |
| Reverse Diode dV/dt ^e | | 18 | | |
| Soldering Recommendations (Peak temperature) ^c | for 10 s | 300 | °C | |
| Mounting Torque | M3 screw | 0.6 | Nm | |

Notes

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

| THERMAL RESISTANCE RATINGS | | | | |
|----------------------------------|------------|------|------|------|
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
| Maximum Junction-to-Ambient | R_{thJA} | - | 65 | °C/W |
| Maximum Junction-to-Case (Drain) | R_{thJC} | - | 3.4 | |

| 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 ^a | $C_{o(er)}$ | $V_{DS} = 0\text{ V to } 480\text{ V}, V_{GS} = 0\text{ V}$ | | - | 98 | - | |
| Effective Output Capacitance, Time Related ^b | $C_{o(tr)}$ | | | - | 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. $C_{oss(er)}$ 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)

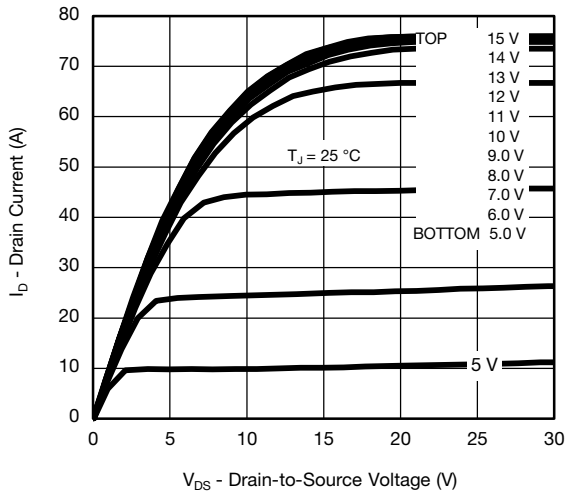


Fig. 1 - Typical Output Characteristics, $T_C = 25\text{ }^\circ\text{C}$

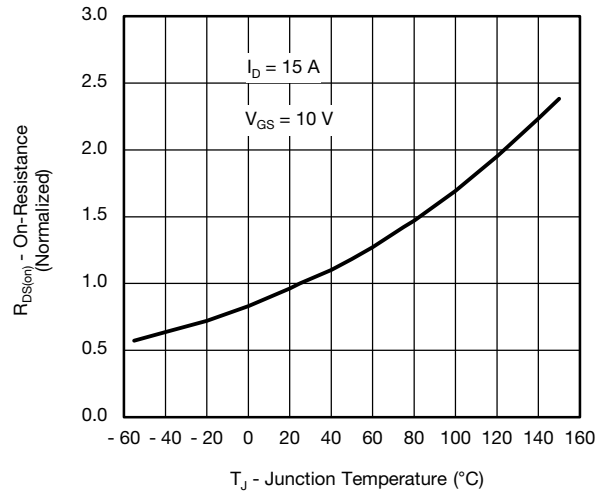


Fig. 4 - Normalized On-Resistance vs. Temperature

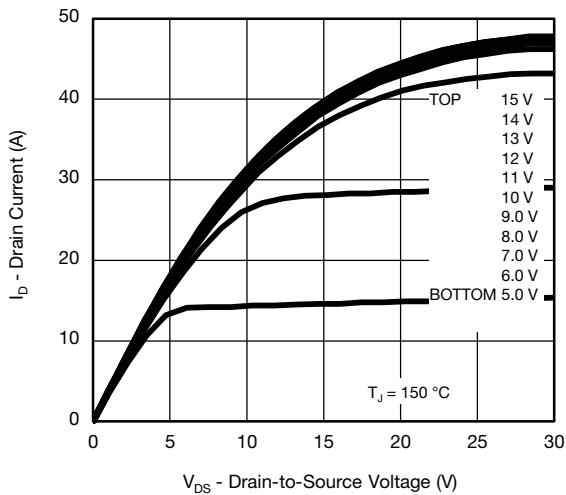


Fig. 2 - Typical Output Characteristics, $T_C = 150\text{ }^\circ\text{C}$

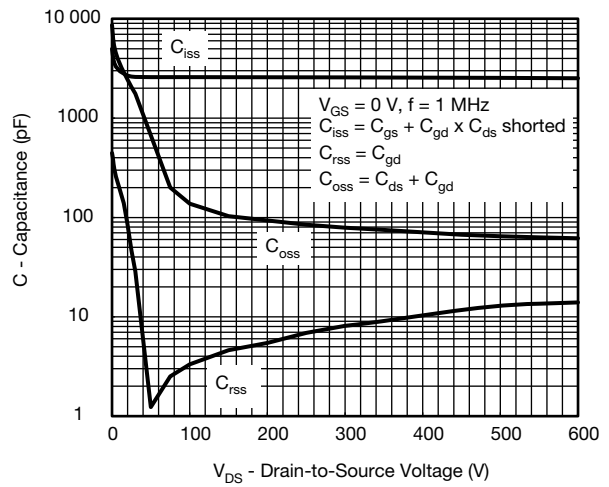


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

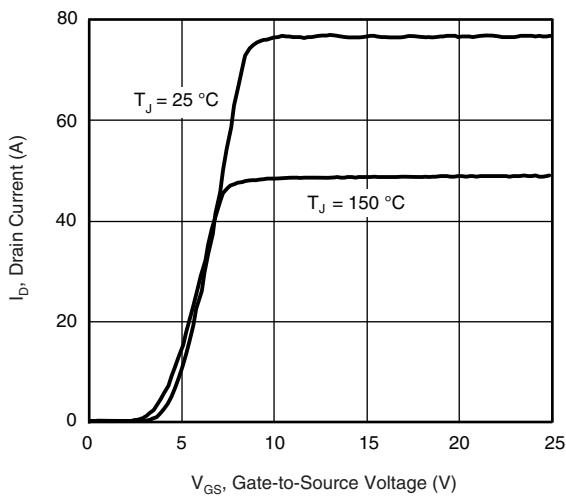


Fig. 3 - Typical Transfer Characteristics

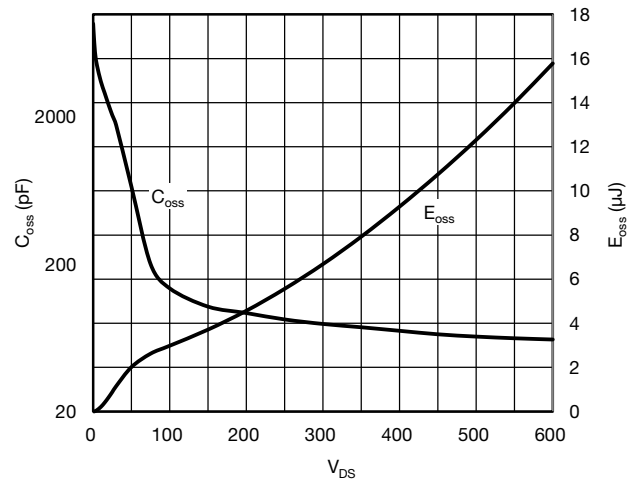


Fig. 6 - C_{oss} and E_{oss} vs. V_{DS}

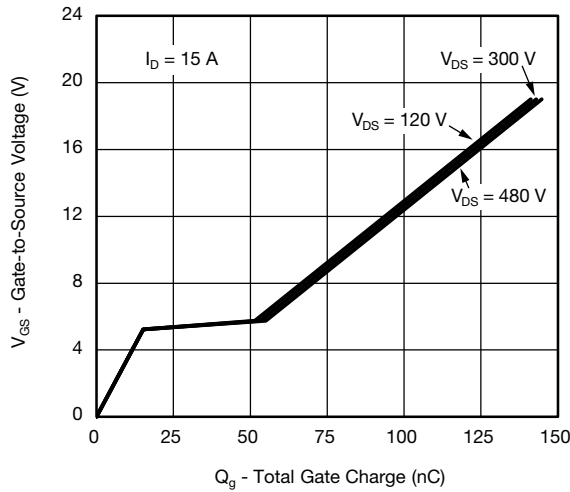


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

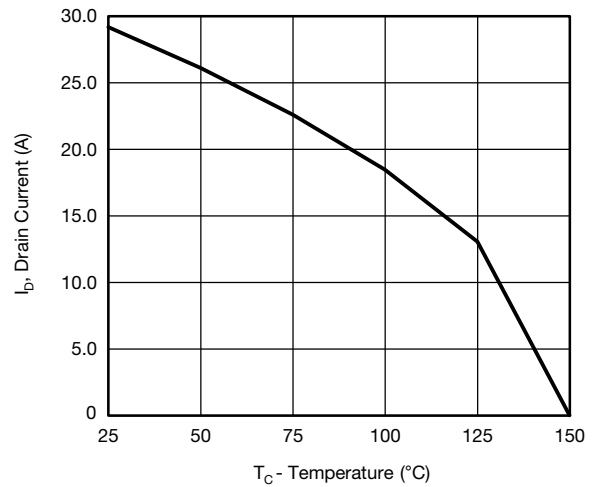


Fig. 10 - Maximum Drain Current vs. Case Temperature

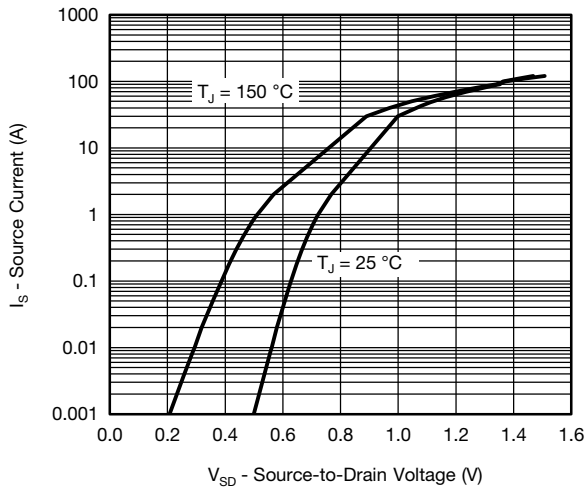


Fig. 8 - Typical Source-Drain Diode Forward Voltage

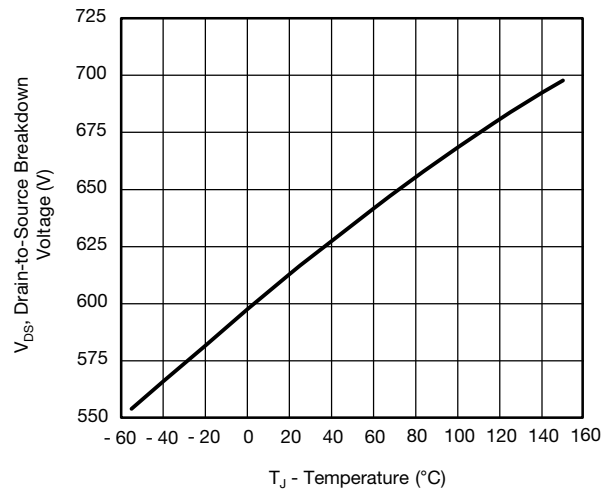


Fig. 11 - Temperature vs. Drain-to-Source Voltage

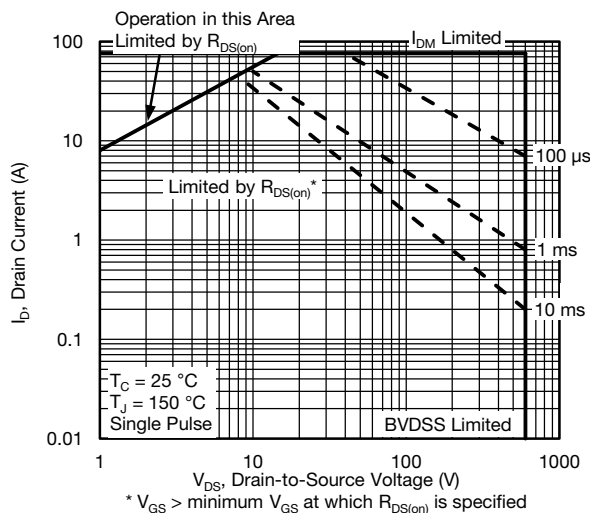


Fig. 9 - Maximum Safe Operating Area

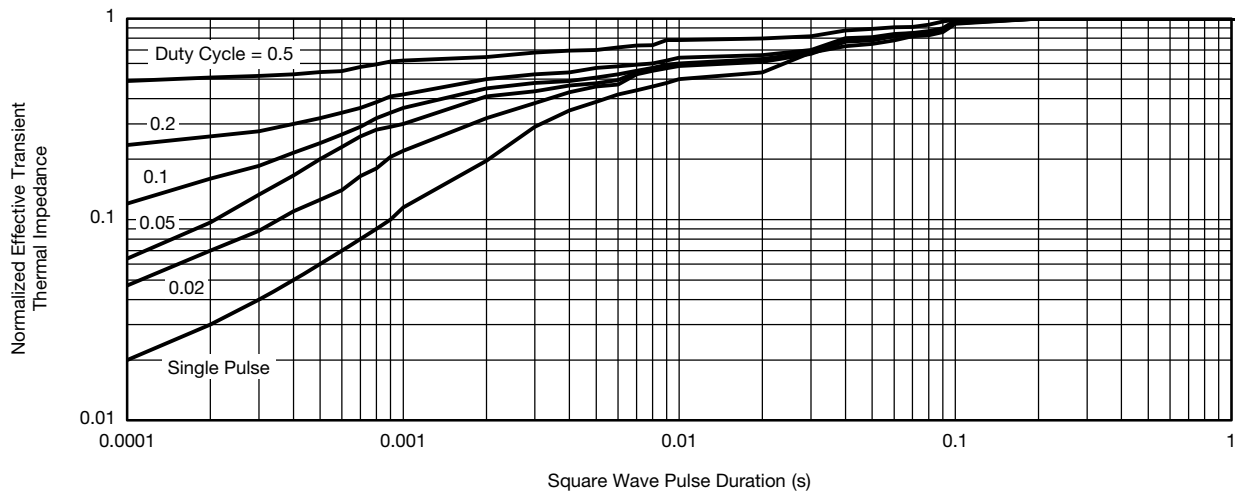


Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case

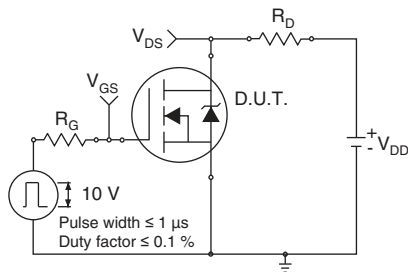


Fig. 13 - Switching Time Test Circuit

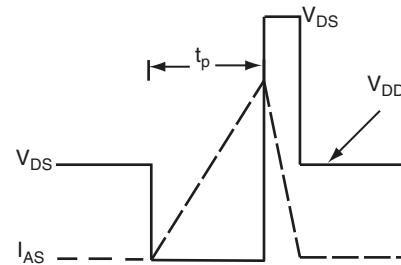


Fig. 16 - Unclamped Inductive Waveforms

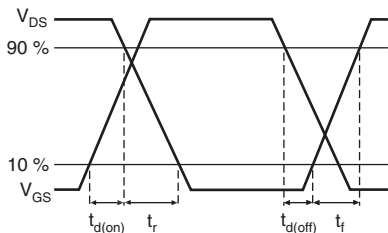


Fig. 14 - Switching Time Waveforms

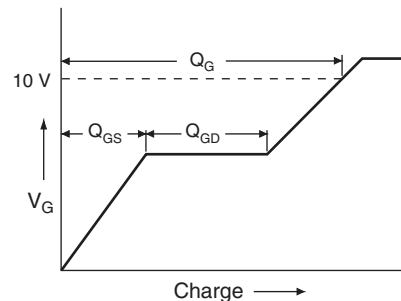


Fig. 17 - Basic Gate Charge Waveform

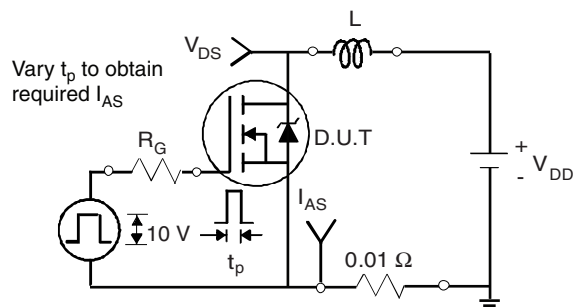


Fig. 15 - Unclamped Inductive Test Circuit

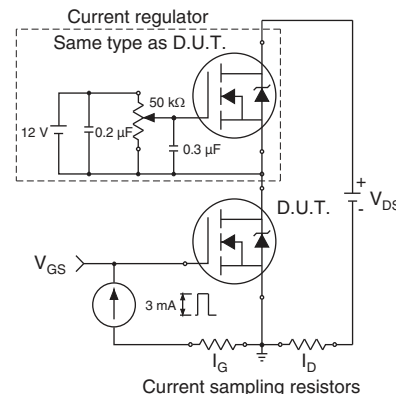


Fig. 18 - Gate Charge Test Circuit

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 FULLPAK (HIGH VOLTAGE)



| DIM. | MILLIMETERS | | INCHES | |
|------|-------------|--------|-----------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 4.570 | 4.830 | 0.180 | 0.190 |
| A1 | 2.570 | 2.830 | 0.101 | 0.111 |
| A2 | 2.510 | 2.850 | 0.099 | 0.112 |
| b | 0.622 | 0.890 | 0.024 | 0.035 |
| b2 | 1.229 | 1.400 | 0.048 | 0.055 |
| b3 | 1.229 | 1.400 | 0.048 | 0.055 |
| c | 0.440 | 0.629 | 0.017 | 0.025 |
| D | 8.650 | 9.800 | 0.341 | 0.386 |
| d1 | 15.88 | 16.120 | 0.622 | 0.635 |
| d3 | 12.300 | 12.920 | 0.484 | 0.509 |
| E | 10.360 | 10.630 | 0.408 | 0.419 |
| e | 2.54 BSC | | 0.100 BSC | |
| L | 13.200 | 13.730 | 0.520 | 0.541 |
| L1 | 3.100 | 3.500 | 0.122 | 0.138 |
| n | 6.050 | 6.150 | 0.238 | 0.242 |
| Ø P | 3.050 | 3.450 | 0.120 | 0.136 |
| u | 2.400 | 2.500 | 0.094 | 0.098 |
| v | 0.400 | 0.500 | 0.016 | 0.020 |

ECN: X09-0126-Rev. B, 26-Oct-09
DWG: 5972

Notes

1. To be used only for process drawing.
2. These dimensions apply to all TO-220, FULLPAK leadframe versions 3 leads.
3. All critical dimensions should C meet $C_{pk} > 1.33$.
4. All dimensions include burrs and plating thickness.
5. No chipping or package damage.



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