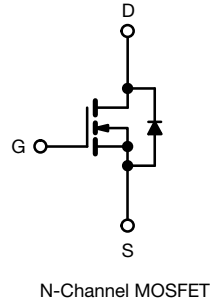
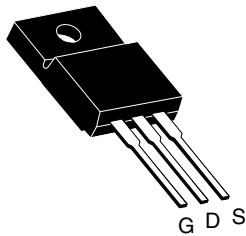


E Series Power MOSFET

| 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)

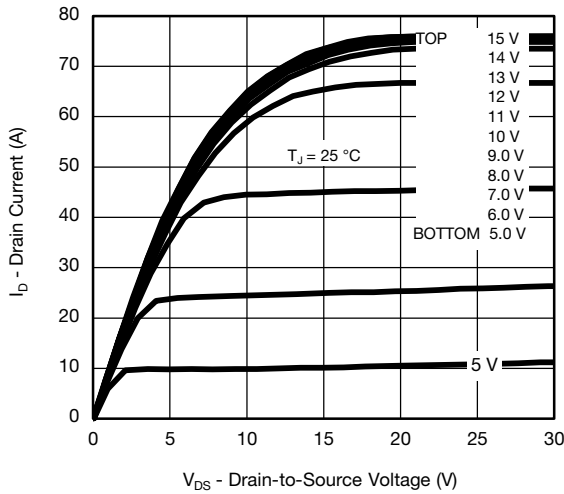


Fig. 1 - Typical Output Characteristics, $T_C = 25\text{ }^\circ\text{C}$

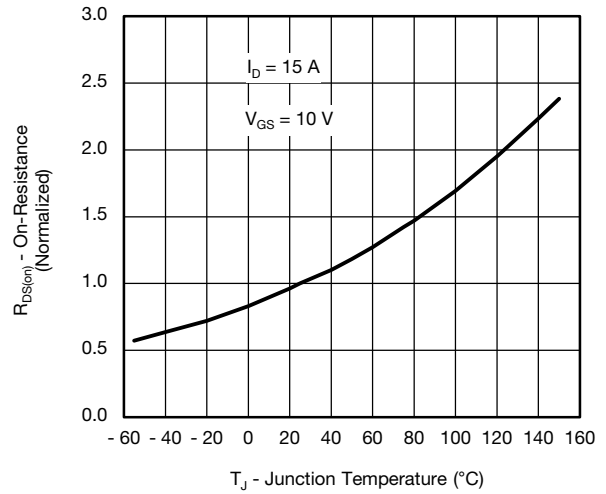


Fig. 4 - Normalized On-Resistance vs. Temperature

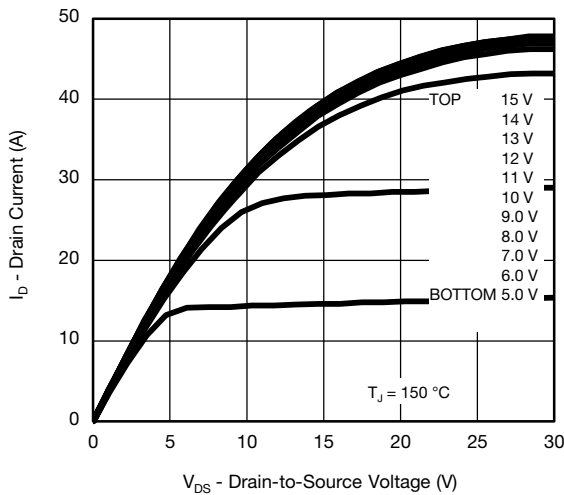


Fig. 2 - Typical Output Characteristics, $T_C = 150\text{ }^\circ\text{C}$

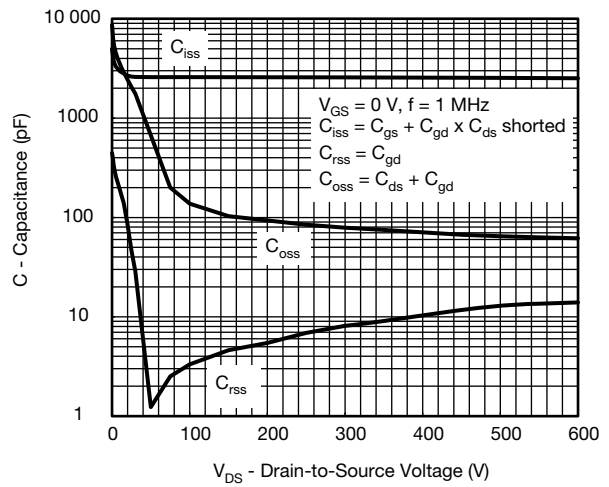


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

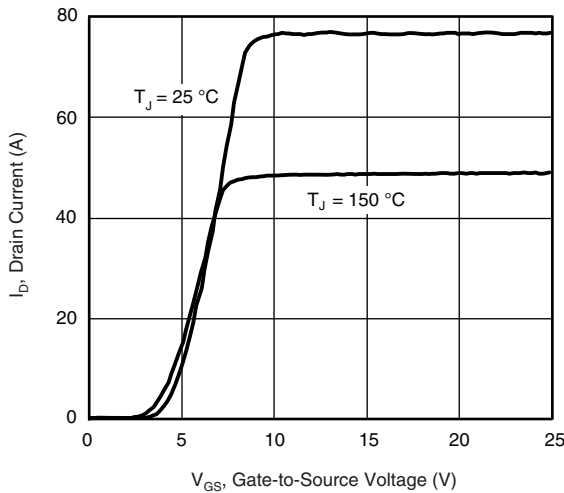


Fig. 3 - Typical Transfer Characteristics

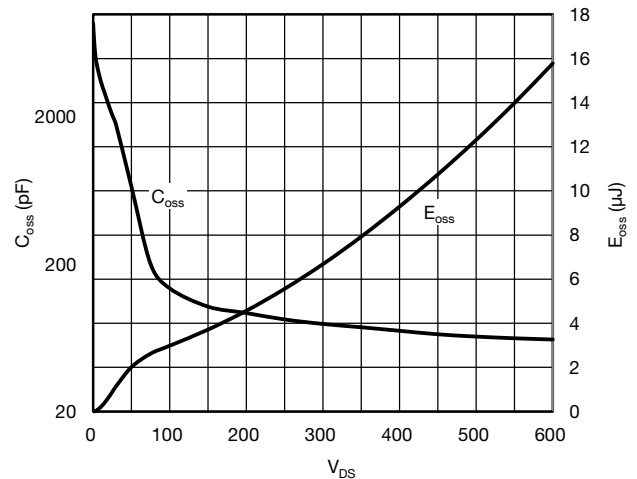


Fig. 6 - C_{oss} and E_{oss} vs. V_{ds}

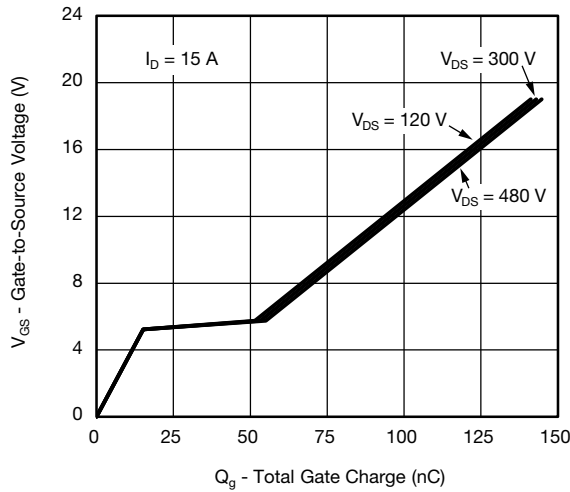


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

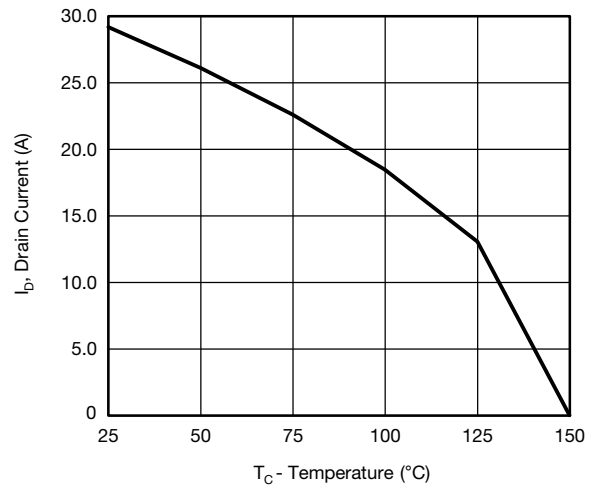


Fig. 10 - Maximum Drain Current vs. Case Temperature

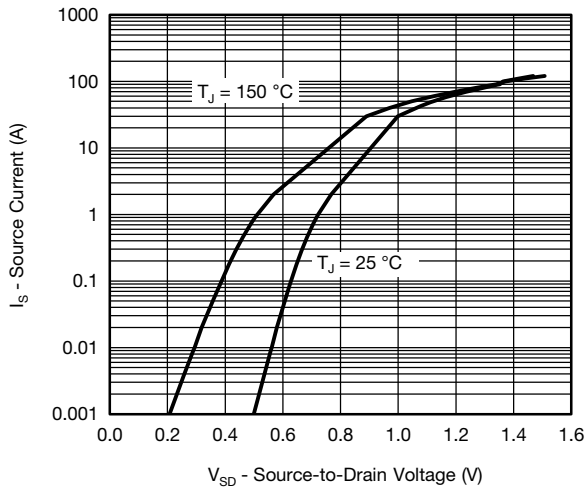


Fig. 8 - Typical Source-Drain Diode Forward Voltage

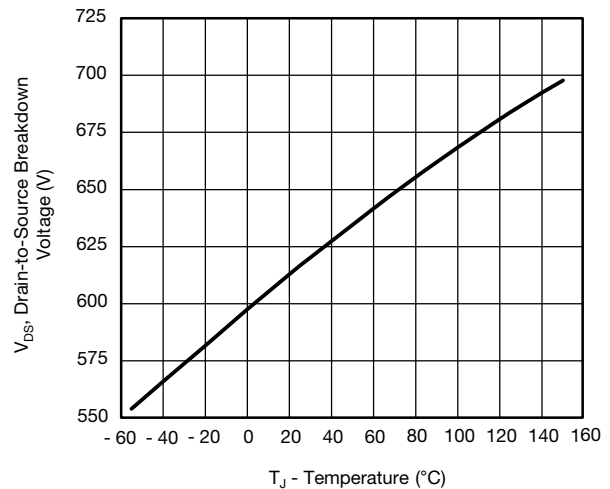


Fig. 11 - Temperature vs. Drain-to-Source Voltage

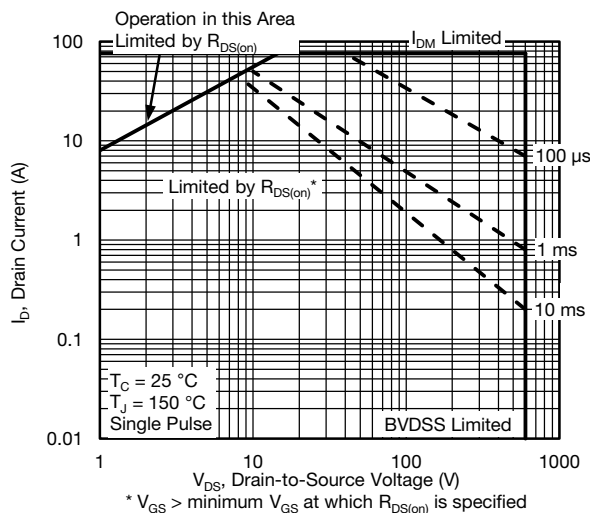


Fig. 9 - Maximum Safe Operating Area

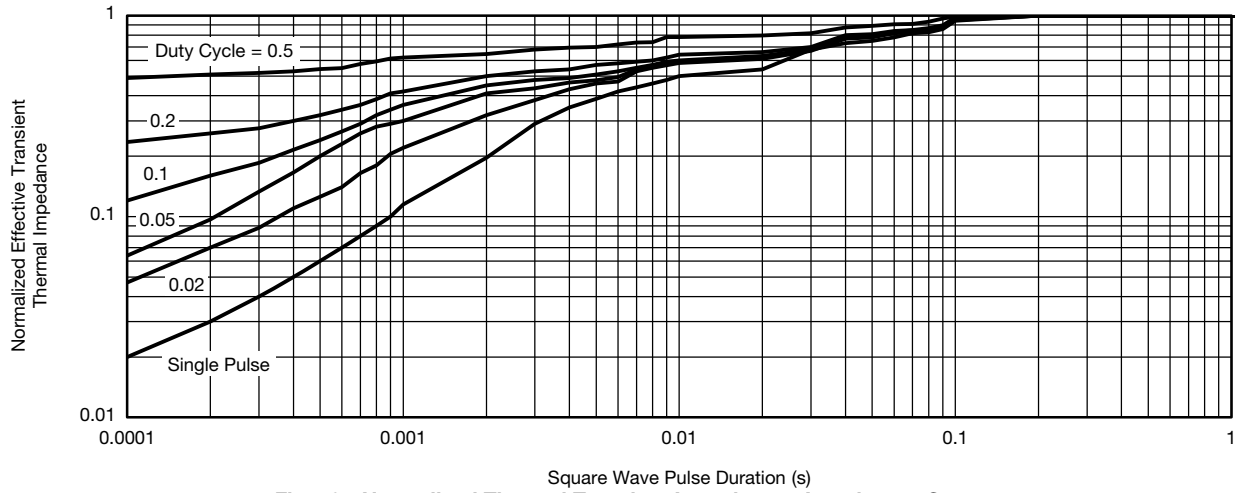


Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case

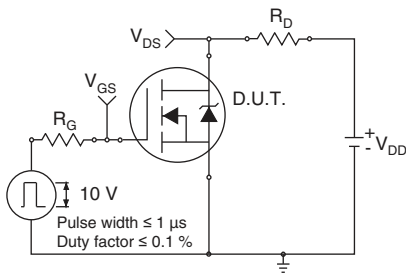


Fig. 13 - Switching Time Test Circuit

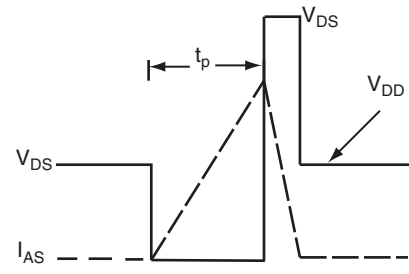


Fig. 16 - Unclamped Inductive Waveforms

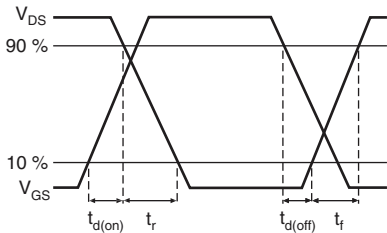


Fig. 14 - Switching Time Waveforms

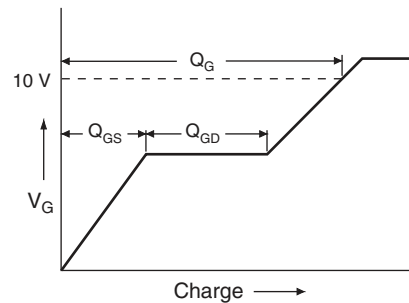


Fig. 17 - Basic Gate Charge Waveform

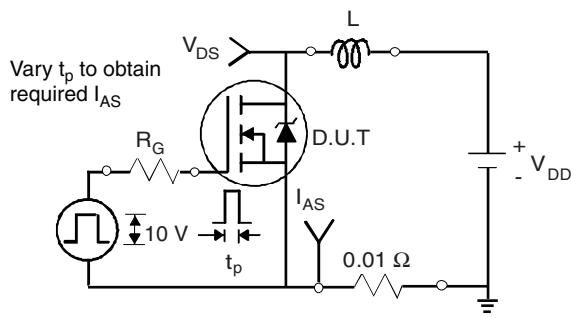


Fig. 15 - Unclamped Inductive Test Circuit

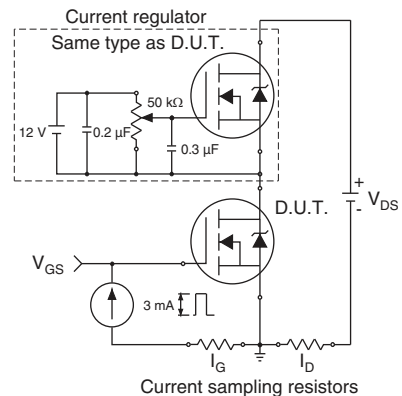


Fig. 18 - Gate Charge Test Circuit



Note

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

Fig. 19 - For N-Channel

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TO-220 FULLPAK (High Voltage)

OPTION 1: FACILITY CODE = 9



| DIM. | MILLIMETERS | | |
|-----------------|-------------|-------|-------|
| | MIN. | NOM. | MAX. |
| A | 4.60 | 4.70 | 4.80 |
| b | 0.70 | 0.80 | 0.91 |
| b1 | 1.20 | 1.30 | 1.47 |
| b2 | 1.10 | 1.20 | 1.30 |
| C | 0.45 | 0.50 | 0.63 |
| D | 15.80 | 15.87 | 15.97 |
| e | 2.54 BSC | | |
| E | 10.00 | 10.10 | 10.30 |
| F | 2.44 | 2.54 | 2.64 |
| G | 6.50 | 6.70 | 6.90 |
| L | 12.90 | 13.10 | 13.30 |
| L1 | 3.13 | 3.23 | 3.33 |
| Q | 2.65 | 2.75 | 2.85 |
| Q1 | 3.20 | 3.30 | 3.40 |
| $\varnothing R$ | 3.08 | 3.18 | 3.28 |

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
6. Facility code will be the 1st character located at the 2nd row of the unit marking



OPTION 2: FACILITY CODE = Y



| 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: E19-0180-Rev. D, 08-Apr-2019
DWG: 5972

Notes

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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
6. Facility code will be the 1st character located at the 2nd row of the unit marking



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