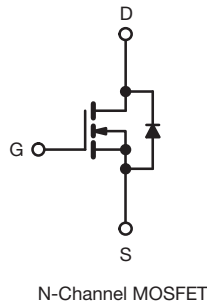


E Series Power MOSFET with Fast Body Diode and Low Gate Charge

Thin-Lead TO-220 FULLPAK



FEATURES

- Reduced figure-of-merit (FOM): $R_{on} \times Q_g$
- Fast body diode MOSFET using E series technology
- Reduced t_{rr} , Q_{rr} , and I_{RRM}
- Increased robustness due to low Q_{rr}
- Low input capacitance (C_{iss})
- Reduced switching and conduction losses
- Avalanche energy rated (UIS)
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE
Available

APPLICATIONS

- Telecommunications
 - Server and telecom power supplies
- Computing
 - ATX power supplies
- Industrial
 - Welding
 - Induction heating
 - Battery chargers
 - Uninterruptible power supplies (UPS)
- Renewable energy
 - String PV inverters

PRODUCT SUMMARY

| | | |
|---|-----------------|-------|
| V_{DS} (V) at T_J max. | 650 | |
| $R_{DS(on)}$ typ. (Ω) at 25 °C | $V_{GS} = 10$ V | 0.127 |
| Q_g max. (nC) | 75 | |
| Q_{gs} (nC) | 17 | |
| Q_{gd} (nC) | 19 | |
| Configuration | Single | |

ORDERING INFORMATION

| | |
|---------------------------------|--------------------------|
| Package | Thin-Lead TO-220 FULLPAK |
| Lead (Pb)-free | SiHA25N60EFL-E3 |
| Lead (Pb)-free and halogen-free | SiHA25N60EFL-GE3 |

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) ^e | V_{GS} at 10 V | $T_C = 25$ °C | A |
| | | $T_C = 100$ °C | |
| Pulsed drain current ^a | I_{DM} | 61 | |
| Linear derating factor | | 2 | W/°C |
| Single pulse avalanche energy ^b | E_{AS} | 353 | mJ |
| Maximum power dissipation | P_D | 39 | 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} | V/ns |
| Reverse diode dV/dt ^d | | 15 | |
| 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
- $V_{DD} = 140$ V, starting $T_J = 25$ °C, $L = 28.2$ mH, $R_g = 25$ Ω , $I_{AS} = 5$ A
- 1.6 mm from case
- $I_{SD} \leq I_D$, $dI/dt = 100$ A/ μ s, starting $T_J = 25$ °C
- Limited by maximum junction



| THERMAL RESISTANCE RATINGS | | | | |
|----------------------------------|------------|------|------|------|
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
| Maximum junction-to-ambient | R_{thJA} | - | 65 | °C/W |
| Maximum junction-to-case (drain) | R_{thJC} | - | 3.2 | |

| 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 $25\text{ }^\circ\text{C}, I_D = 10\text{ mA}$ | | - | 0.69 | - | V/°C |
| Gate-source threshold voltage (N) | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | | 3.0 | - | 5.0 | 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} | $V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}$ | | - | - | 1 | μA |
| | | $V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$ | | - | - | 500 | |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}$ | $I_D = 12.5\text{ A}$ | - | 0.127 | 0.146 | Ω |
| Forward transconductance | g_{fs} | $V_{DS} = 30\text{ V}, I_D = 12.5\text{ A}$ | | - | 11.3 | - | S |
| Dynamic | | | | | | | |
| Input capacitance | C_{iss} | $V_{GS} = 0\text{ V},$ $V_{DS} = 100\text{ V},$ $f = 1\text{ MHz}$ | | - | 2274 | - | pF |
| Output capacitance | C_{oss} | | | - | 137 | - | |
| Reverse transfer capacitance | C_{rss} | | | - | 4 | - | |
| Effective output capacitance, energy related ^a | $C_{o(er)}$ | | | - | 79 | - | |
| Effective output capacitance, time related ^b | $C_{o(tr)}$ | | | - | 330 | - | |
| Total gate charge | Q_g | $V_{GS} = 10\text{ V}$ | $I_D = 12.5\text{ A}, V_{DS} = 480\text{ V}$ | - | 50 | 75 | nC |
| Gate-source charge | Q_{gs} | | | - | 17 | - | |
| Gate-drain charge | Q_{gd} | | | - | 19 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD} = 480\text{ V}, I_D = 12.5\text{ A},$ $R_g = 9.1\text{ }\Omega, V_{GS} = 10\text{ V}$ | | - | 25 | 50 | ns |
| Rise time | t_r | | | - | 39 | 68 | |
| Turn-off delay time | $t_{d(off)}$ | | | - | 47 | 94 | |
| Fall time | t_f | | | - | 21 | 42 | |
| Gate input resistance | R_g | $f = 1\text{ MHz}, \text{open drain}$ | | 0.4 | 0.7 | 1.4 | Ω |
| Drain-Source Body Diode Characteristics | | | | | | | |
| Continuous source-drain diode current | I_S | MOSFET symbol showing the integral reverse p - n junction diode | | - | - | 25 | A |
| Pulsed diode forward current | I_{SM} | | | - | - | 61 | |
| Diode forward voltage | V_{SD} | $T_J = 25\text{ }^\circ\text{C}, I_S = 12.5\text{ A}, V_{GS} = 0\text{ V}$ | | - | 0.9 | 1.2 | V |
| Reverse recovery time | t_{rr} | $T_J = 25\text{ }^\circ\text{C}, I_F = I_S = 12.5\text{ A},$ $dI/dt = 100\text{ A}/\mu\text{s}, V_R = 25\text{ V}$ | | - | 138 | 276 | ns |
| Reverse recovery charge | Q_{rr} | | | - | 0.8 | 1.6 | μC |
| Reverse recovery current | I_{RRM} | | | - | 11 | - | 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)

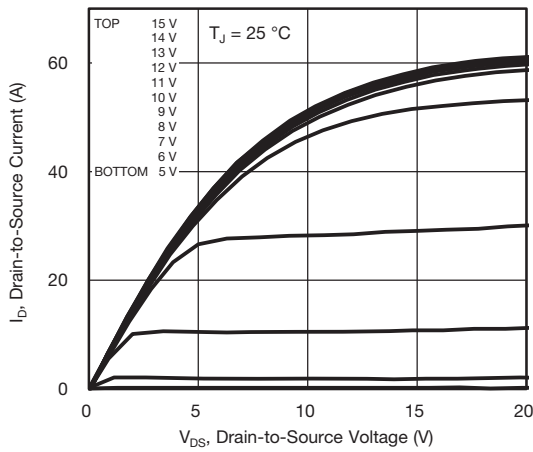


Fig. 1 - Typical Output Characteristics

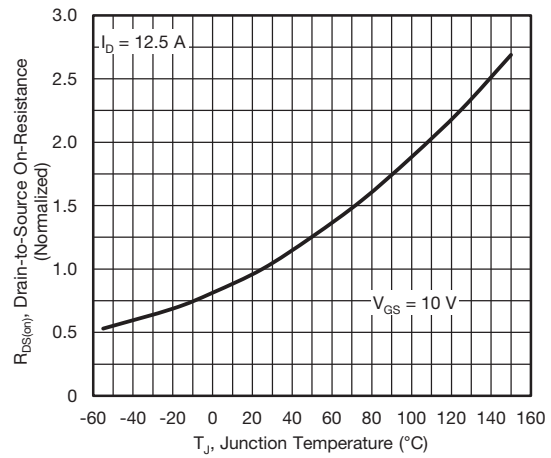


Fig. 4 - Normalized On-Resistance vs. Temperature

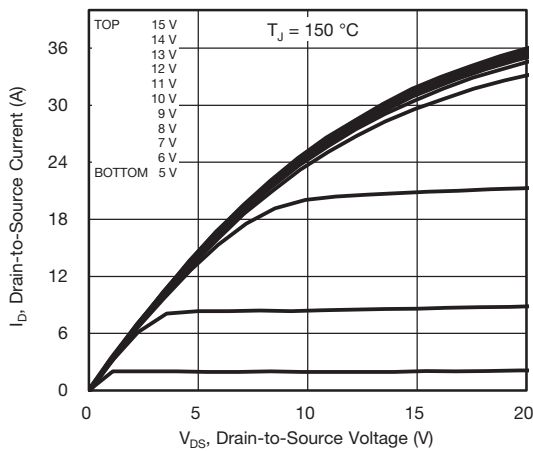


Fig. 2 - Typical Output Characteristics

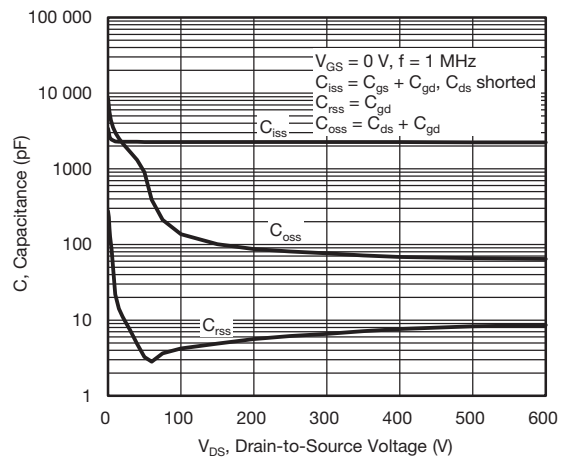


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

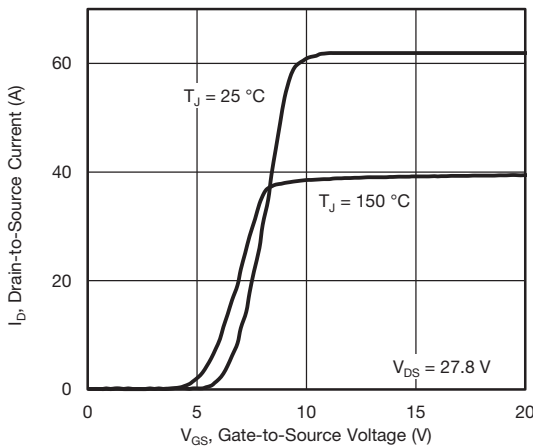


Fig. 3 - Typical Transfer Characteristics

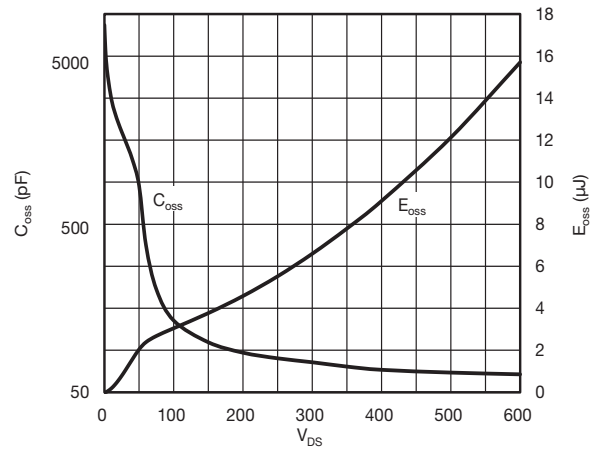


Fig. 6 - Coss and Eoss vs. Vds

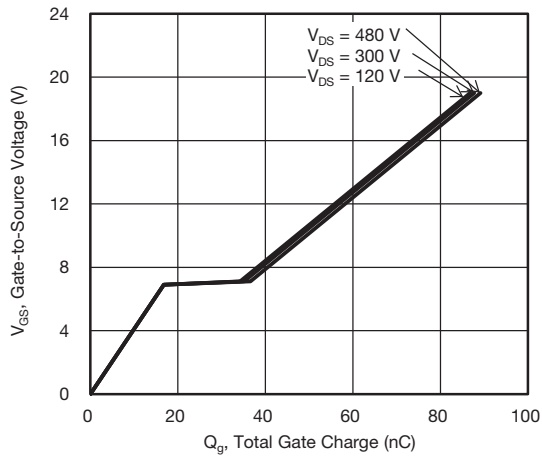


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

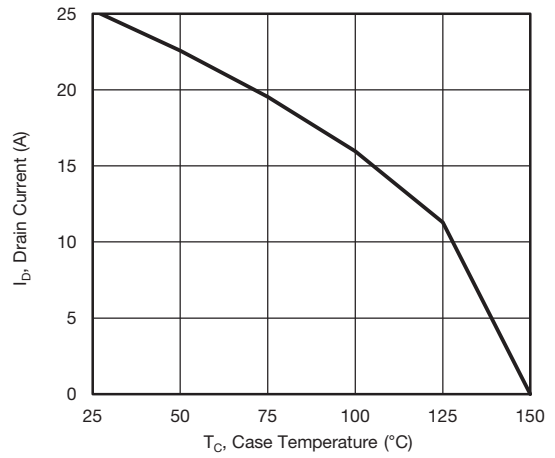


Fig. 10 - Maximum Drain Current vs. Case Temperature

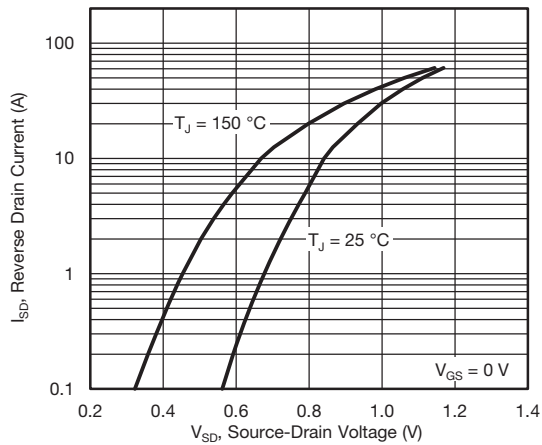


Fig. 8 - Typical Source-Drain Diode Forward Voltage

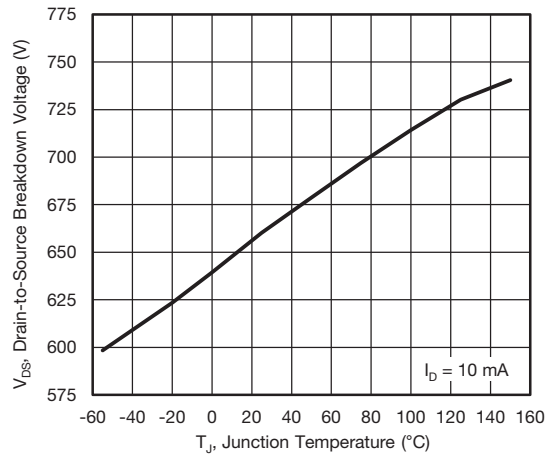


Fig. 11 - Typical Drain-to-Source Voltage vs. Temperature

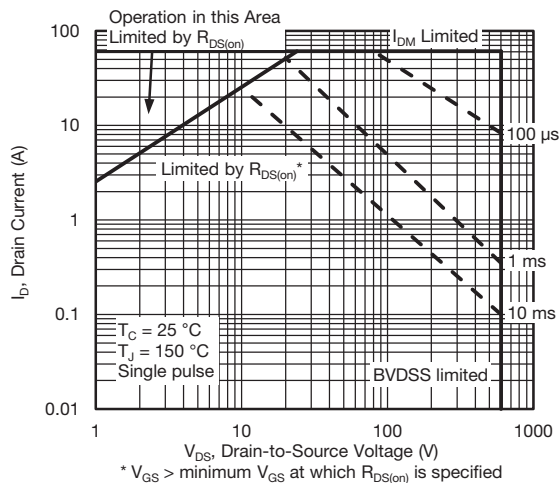


Fig. 9 - Maximum Safe Operating Area

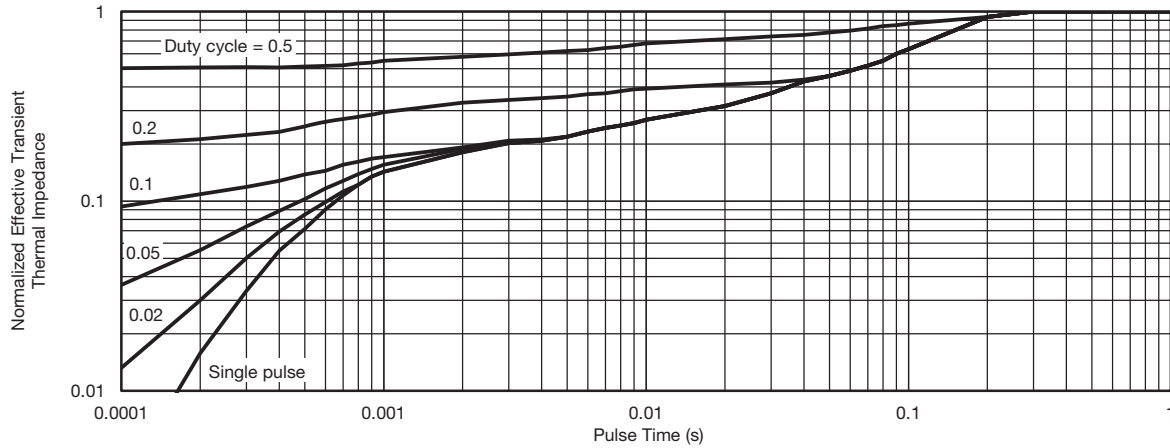


Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case

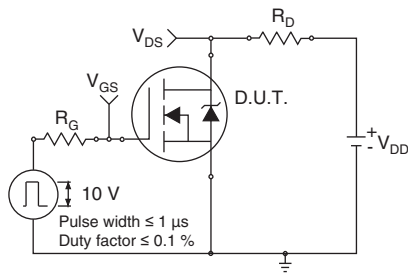


Fig. 13 - Switching Time Test Circuit

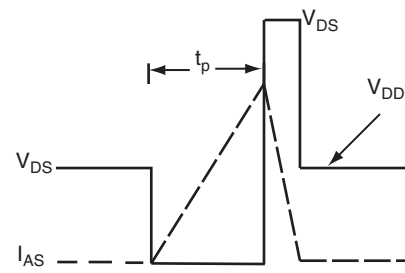


Fig. 16 - Unclamped Inductive Waveforms

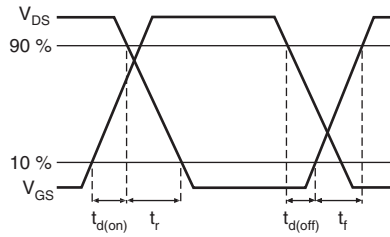


Fig. 14 - Switching Time Waveforms

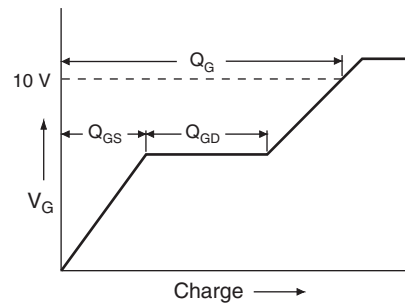


Fig. 17 - Basic Gate Charge Waveform

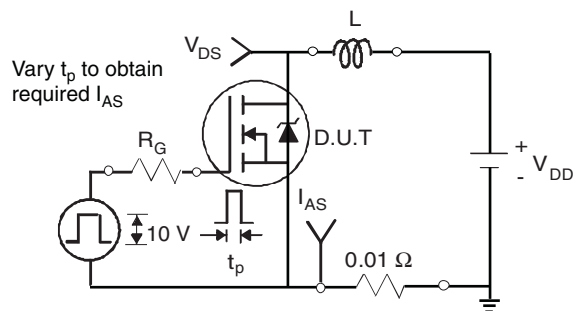


Fig. 15 - Unclamped Inductive Test Circuit

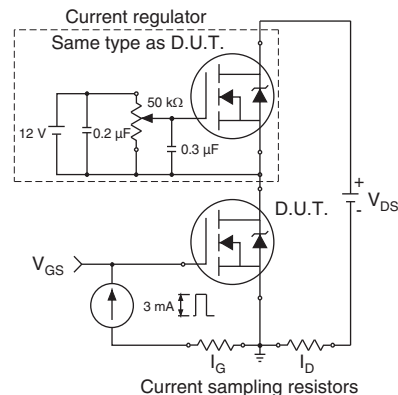
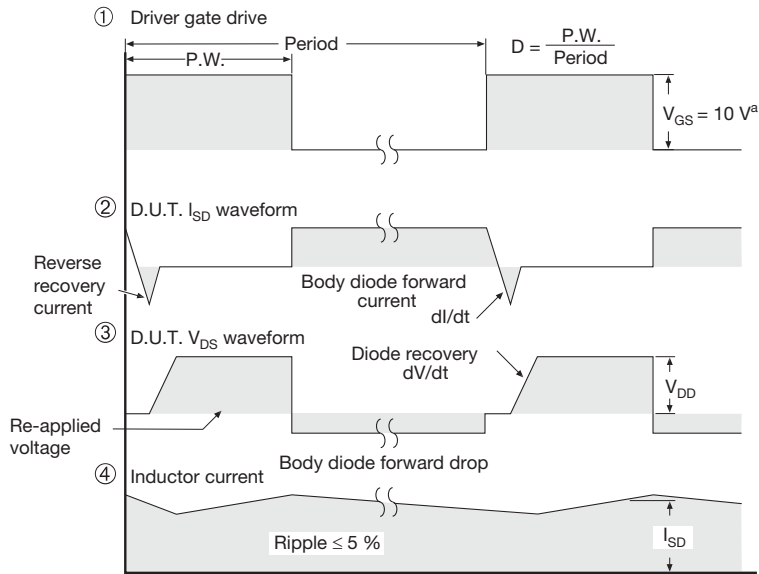
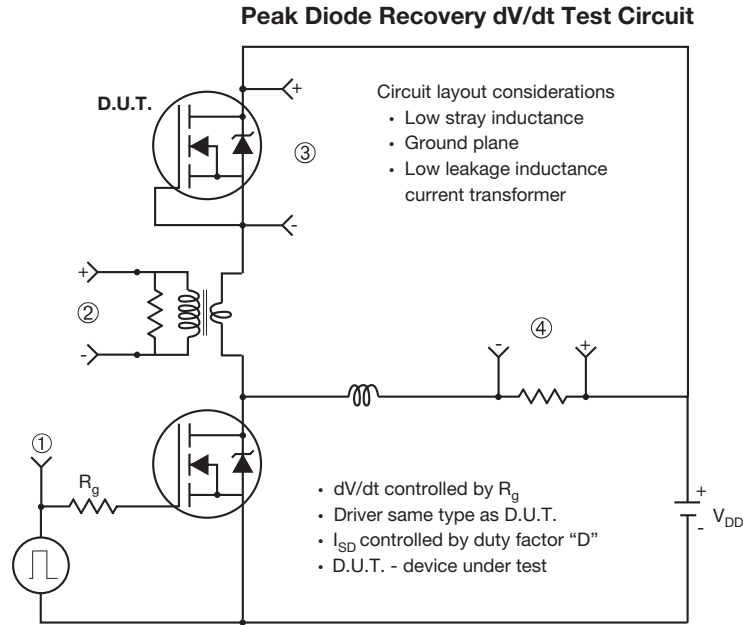


Fig. 18 - Gate Charge Test Circuit



Note

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

Fig. 19 - For N-Channel

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TO-220 FULLPAK Thin Lead



| SYMBOL | DIMENSIONS | | | |
|--------|-------------|-------|--------|-------|
| | MILLIMETERS | | INCHES | |
| | MIN. | MAX. | MIN. | MAX. |
| A | 4.30 | 4.70 | 0.169 | 0.185 |
| A1 | 2.50 | 2.90 | 0.098 | 0.114 |
| A2 | 2.40 | 2.80 | 0.094 | 0.110 |
| b | 0.60 | 0.80 | 0.024 | 0.031 |
| b2 | 0.60 | 0.90 | 0.024 | 0.035 |
| c | - | 0.60 | - | 0.024 |
| D | 8.30 | 8.70 | 0.327 | 0.342 |
| d1 | 14.70 | 15.30 | 0.579 | 0.602 |
| d2 | 2.90 | 3.10 | 0.114 | 0.122 |
| d3 | 3.30 | 3.70 | 0.130 | 0.146 |
| E | 9.70 | 10.30 | 0.382 | 0.406 |
| e | 2.50 | 2.70 | 0.098 | 0.106 |
| L | 13.40 | 13.80 | 0.528 | 0.543 |
| L1 | 1.00 | 2.80 | 0.039 | 0.110 |
| Ø P | 3.00 | 3.40 | 0.118 | 0.134 |

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 DWG: 6021



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