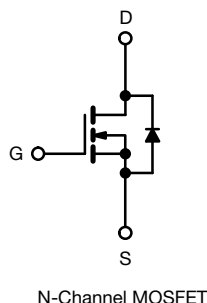
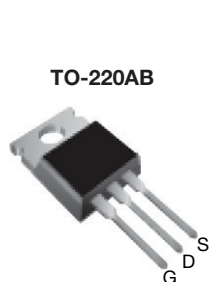


Power MOSFET



FEATURES

- Low gate charge Q_g results in simple drive requirement
- Improved gate, avalanche and dynamic dV/dt ruggedness
- Fully characterized capacitance and avalanche voltage and current
- Effective C_{oss} specified
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS*
Available

Note

* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

APPLICATIONS

- Switch mode power supply (SMPS)
- Uninterruptable power supply
- High speed power switching

TYPICAL SMPS TOPOLOGIES

- Two transistor forward
- Half bridge
- Full bridge

PRODUCT SUMMARY

| | |
|---------------------------|----------------------------|
| V_{DS} (V) | 500 |
| $R_{DS(on)}$ (Ω) | $V_{GS} = 10\text{ V}$ 3.0 |
| Q_g (Max.) (nC) | 17 |
| Q_{gs} (nC) | 4.3 |
| Q_{gd} (nC) | 8.5 |
| Configuration | Single |

ORDERING INFORMATION

| | |
|---------------------------------|----------------|
| Package | TO-220AB |
| Lead (Pb)-free | IRF820APbF |
| Lead (Pb)-free and halogen-free | IRF820APbF-BE3 |

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

| PARAMETER | SYMBOL | LIMIT | UNIT |
|---|------------------|------------------|---------------------|
| Drain-source voltage | V_{DS} | 500 | V |
| Gate-source voltage | V_{GS} | ± 30 | |
| Continuous drain current | I_D | 2.5 1.6 | A |
| Pulsed drain current ^a | I_{DM} | 10 | |
| Linear derating factor | | 0.40 | W/ $^\circ\text{C}$ |
| Single pulse avalanche energy ^b | E_{AS} | 140 | mJ |
| Repetitive avalanche current ^a | I_{AR} | 2.5 | A |
| Repetitive avalanche energy ^a | E_{AR} | 5.0 | mJ |
| Maximum power dissipation | P_D | 50 | W |
| Peak diode recovery dV/dt ^c | dV/dt | 3.4 | V/ns |
| Operating junction and storage temperature range | T_J, T_{stg} | -55 to +150 | $^\circ\text{C}$ |
| Soldering recommendations (peak temperature) ^d | For 10 s | 300 ^d | |
| Mounting torque | 6-32 or M3 screw | 10 1.1 | lbf · in N · m |


Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- Starting $T_J = 25\text{ }^\circ\text{C}$, $L = 45\text{ mH}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 2.5\text{ A}$ (see fig. 12)
- $I_{SD} \leq 2.5\text{ A}$, $dI/dt \leq 270\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^\circ\text{C}$
- 1.6 mm from case

**THERMAL RESISTANCE RATINGS**

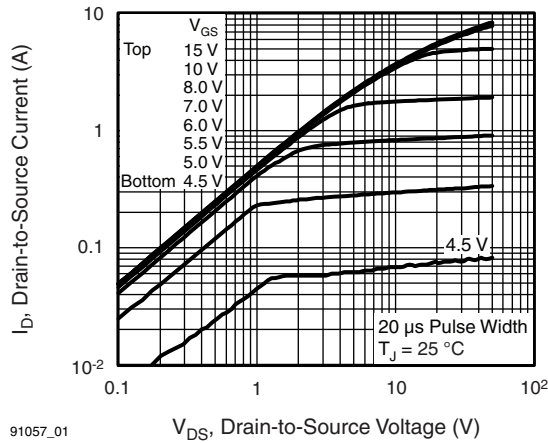
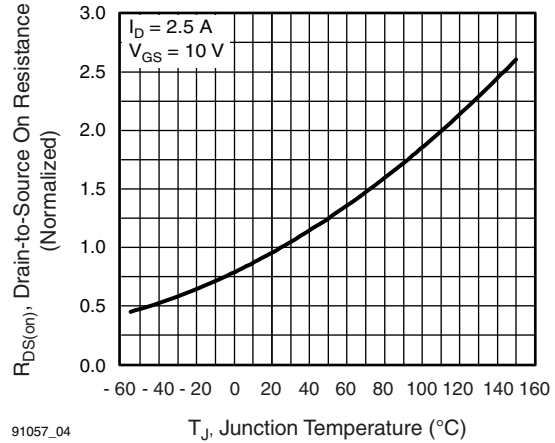
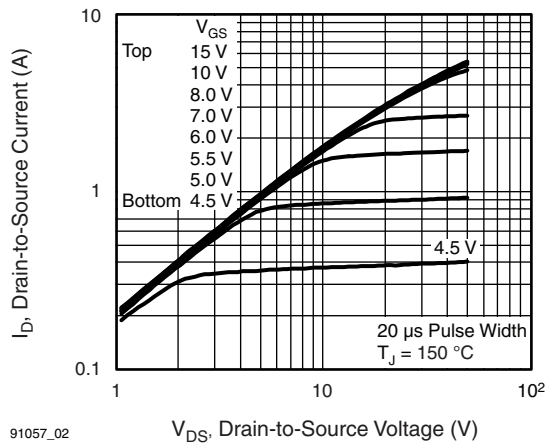
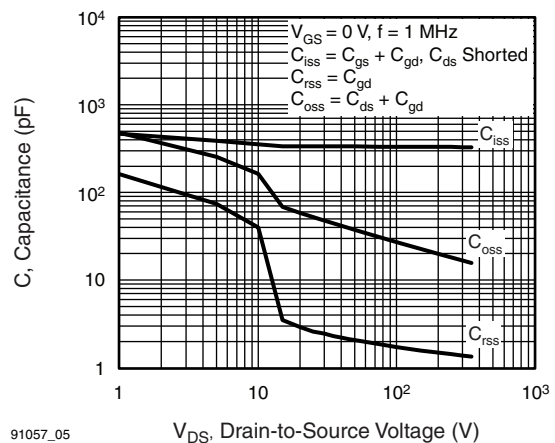
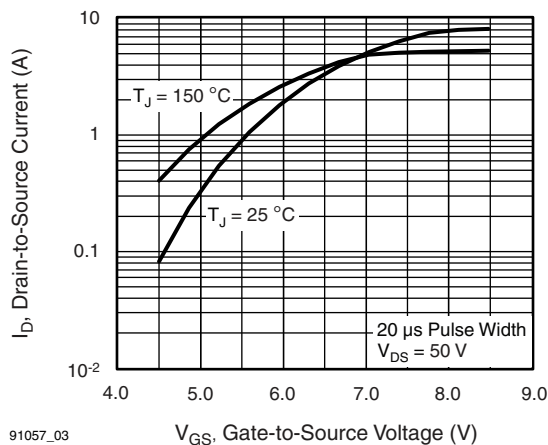
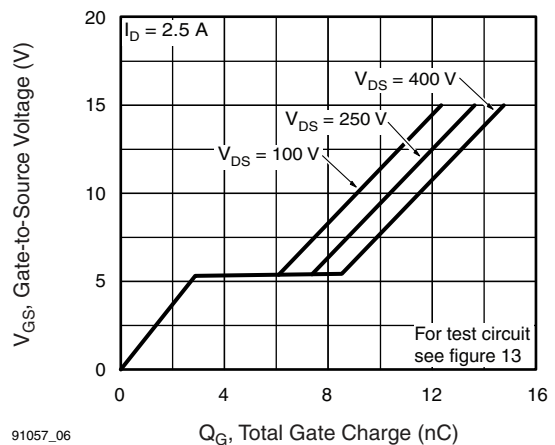
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
|-------------------------------------|------------|------|------|------|
| Maximum junction-to-ambient | R_{thJA} | - | 62 | °C/W |
| Case-to-sink, flat, greased surface | R_{thCS} | 0.50 | - | |
| Maximum junction-to-case (drain) | R_{thJC} | - | 2.5 | |

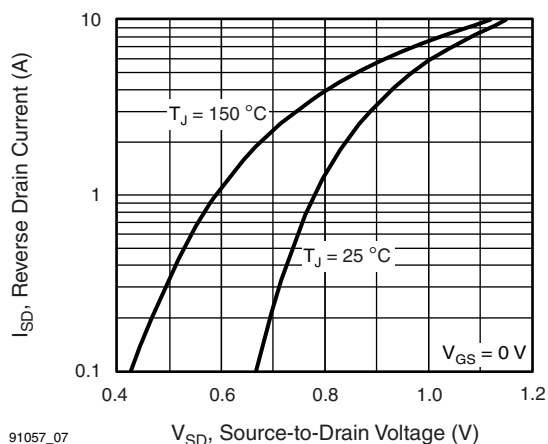
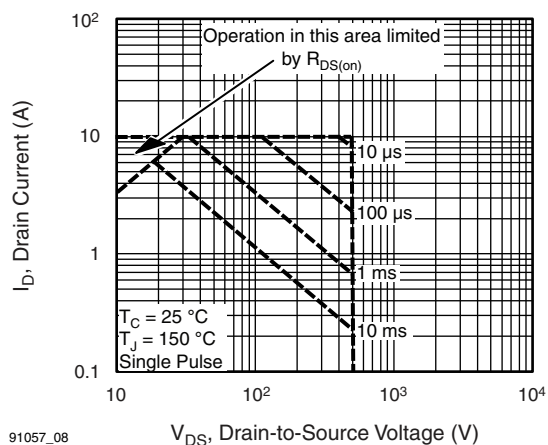
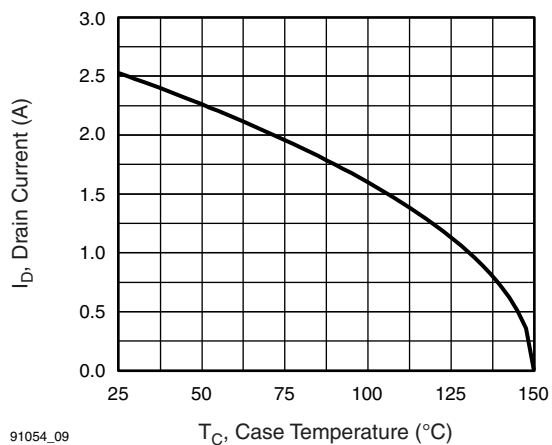
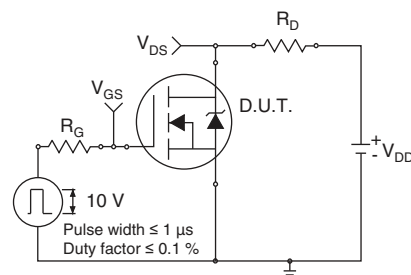
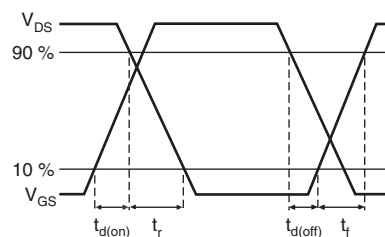
SPECIFICATIONS ($T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

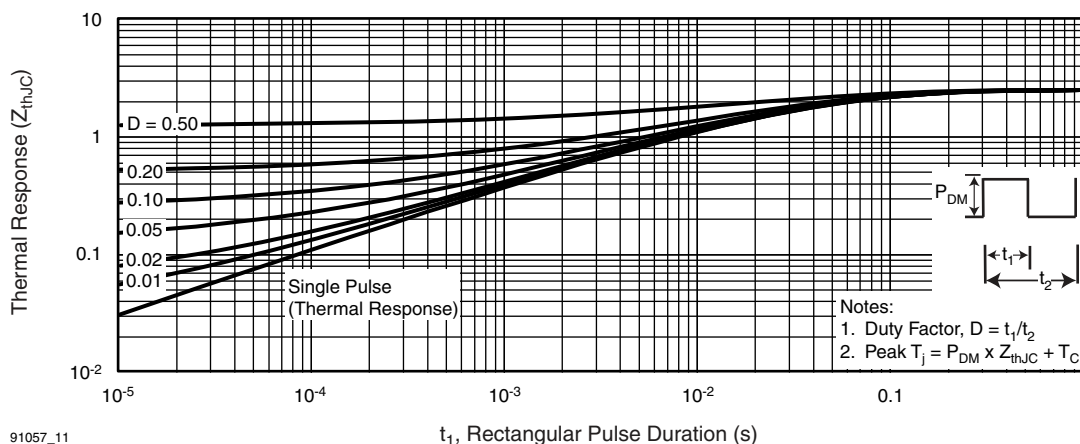
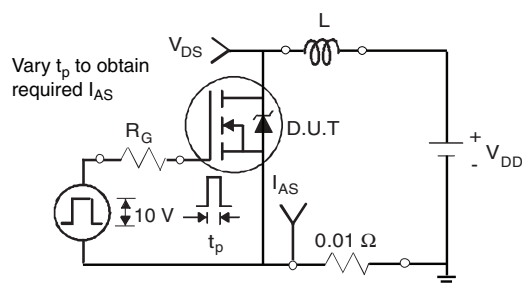
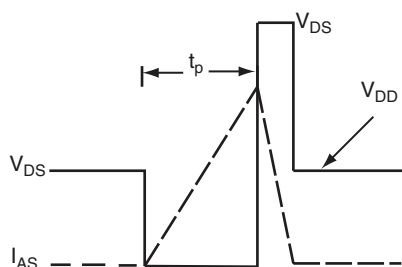
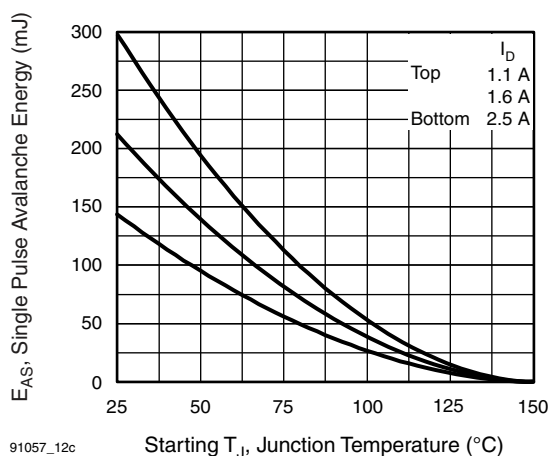
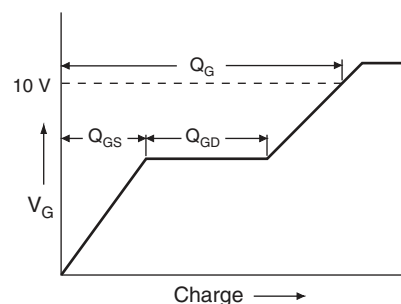
| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNIT |
|---|----------------------------------|--|--|------|------|-------|------|
| Static | | | | | | | |
| Drain-source breakdown voltage | V _{DS} | V _{GS} = 0 V, I _D = 250 μA | | 500 | - | - | V |
| V _{DS} temperature coefficient | ΔV _{DS} /T _J | Reference to 25 °C, I _D = 1 mA | | - | 0.60 | - | V/°C |
| Gate-source threshold voltage | V _{GS(th)} | V _{DS} = V _{GS} , I _D = 250 μA | | 2.0 | - | 4.5 | V |
| Gate-source leakage | I _{GSS} | V _{GS} = ± 30 V | | - | - | ± 100 | nA |
| Zero gate voltage drain current | I _{DSS} | V _{DS} = 500 V, V _{GS} = 0 V | | - | - | 25 | μA |
| | | V _{DS} = 400 V, V _{GS} = 0 V, T _J = 125 °C | | - | - | 250 | |
| Drain-source on-state resistance | R _{DS(on)} | V _{GS} = 10 V | I _D = 1.5 A ^b | - | - | 3.0 | Ω |
| Forward transconductance | g _{fs} | V _{DS} = 50 V, I _D = 1.5 A ^b | | 1.4 | - | - | S |
| Dynamic | | | | | | | |
| Input capacitance | C _{iss} | V _{GS} = 0 V, V _{DS} = 25 V, f = 1.0 MHz, see fig. 5 | | - | 340 | - | pF |
| Output capacitance | C _{oss} | | | - | 53 | - | |
| Reverse transfer capacitance | C _{rss} | | | - | 2.7 | - | |
| Output capacitance | C _{oss} | V _{GS} = 0 V; V _{DS} = 1.0 V, f = 1.0 MHz | | - | 490 | - | |
| Output capacitance | C _{oss} | V _{GS} = 0 V; V _{DS} = 400 V, f = 1.0 MHz | | - | 15 | - | |
| Effective output capacitance | C _{oss eff.} | V _{GS} = 0 V; V _{DS} = 0 V to 400 V ^c | | - | 28 | - | |
| Total gate charge | Q _g | V _{GS} = 10 V | I _D = 2.5 A, V _{DS} = 400 V, see fig. 6 and 13 ^b | - | - | 17 | nC |
| Gate-source charge | Q _{gs} | | | - | - | 4.3 | |
| Gate-drain charge | Q _{gd} | | | - | - | 8.5 | |
| Turn-on delay time | t _{d(on)} | V _{DD} = 250 V, I _D = 2.5 A, R _g = 21 Ω, R _D = 97 Ω, see fig. 10 ^b | | - | 8.1 | - | ns |
| Rise time | t _r | | | - | 12 | - | |
| Turn-Off delay time | t _{d(off)} | | | - | 16 | - | |
| Fall time | t _f | | | - | 13 | - | |
| Drain-Source Body Diode Characteristics | | | | | | | |
| Continuous source-drain diode current | I _S | MOSFET symbol showing the integral reverse p - n junction diode  | | - | - | 2.5 | A |
| Pulsed diode forward current ^a | I _{SM} | | | - | - | 10 | |
| Body diode voltage | V _{SD} | T _J = 25 °C, I _S = 2.5 A, V _{GS} = 0 V ^b | | - | - | 1.6 | V |
| Body diode reverse recovery time | t _{rr} | T _J = 25 °C, I _F = 2.5 A, dI/dt = 100 A/μs ^b | | - | 330 | 500 | ns |
| Body diode reverse recovery charge | Q _{rr} | | | - | 760 | 1140 | nC |
| Forward turn-on time | t _{on} | Intrinsic turn-on time is negligible (turn-on is dominated by L _S and L _D) | | | | | |

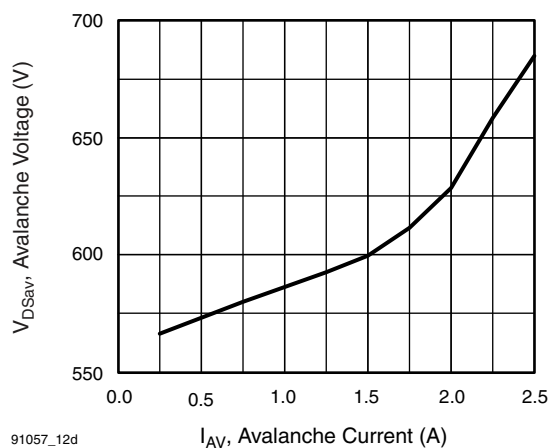
Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
b. Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$
c. $C_{oss\text{ eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS}

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

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

Fig. 4 - Normalized On-Resistance vs. Temperature

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

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

Fig. 3 - Typical Transfer Characteristics

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


Fig. 7 - Typical Source-Drain Diode Forward Voltage

Fig. 8 - Maximum Safe Operating Area

Fig. 9 - Maximum Drain Current vs. Case Temperature

Fig. 10 - Switching Time Test Circuit

Fig. 11 - Switching Time Waveforms


Fig. 12 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

Fig. 13 - Unclamped Inductive Test Circuit

Fig. 14 - Unclamped Inductive Waveforms

Fig. 15 - Maximum Avalanche Energy vs. Drain Current

Fig. 16 - Basic Gate Charge Waveform



91057_12d

Fig. 17 - Typical Drain-to-Source Voltage vs. Avalanche Current

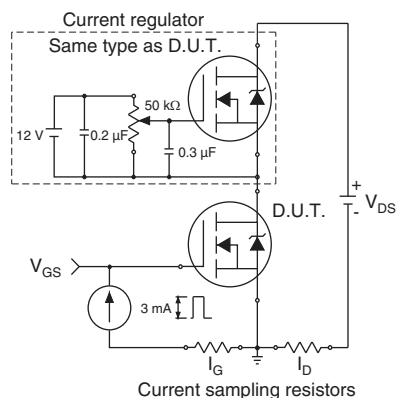
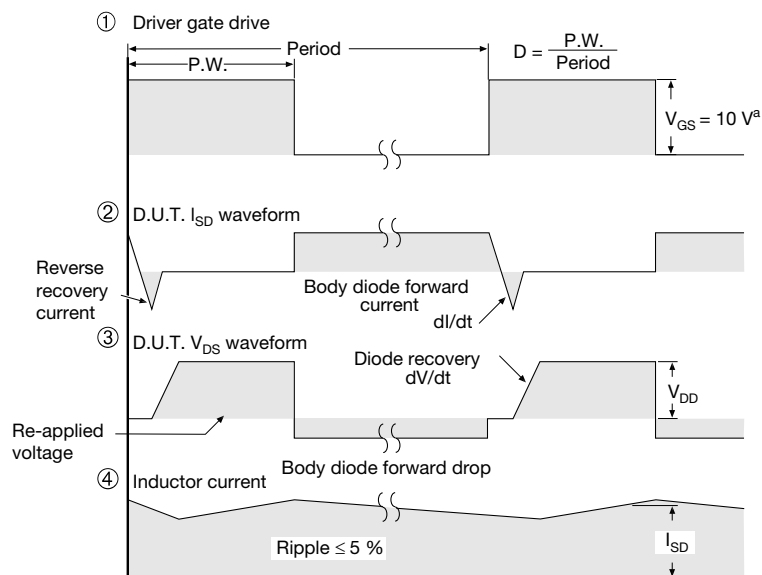
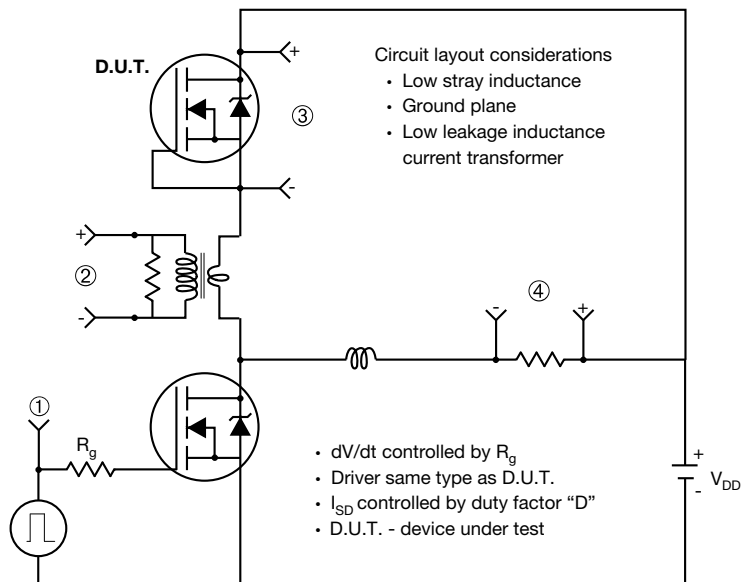


Fig. 18 - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



Note

a. $V_{GS} = 5\text{ V}$ 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 |
| $\varnothing P$ | 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

Package Picture





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