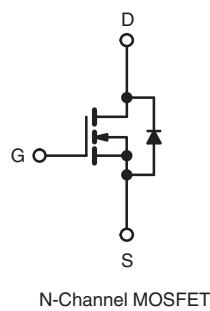
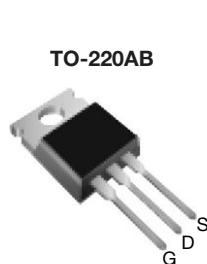


Power MOSFET

| PRODUCT SUMMARY | | |
|---------------------------|-----------------|-----|
| V_{DS} (V) | 500 | |
| $R_{DS(on)}$ (Ω) | $V_{GS} = 10$ 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 SiHF820A-E3 |
| SnPb | IRF820A SiHF820A |

ABSOLUTE MAXIMUM RATINGS ($T_C = 25$ °C, unless otherwise noted)

| PARAMETER | SYMBOL | LIMIT | UNIT |
|--|------------------|------------------|----------|
| Drain-Source Voltage | V_{DS} | 500 | |
| Gate-Source Voltage | V_{GS} | ± 30 | |
| Continuous Drain Current | I_D | 2.5 | A |
| | | 1.6 | |
| Pulsed Drain Current ^a | I_{DM} | 10 | |
| Linear Derating Factor | | 0.40 | W/°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 | |
| Soldering Recommendations (Peak Temperature) | for 10 s | 300 ^d | °C |
| Mounting Torque | 6-32 or M3 screw | 10 | lbf · in |
| | | 1.1 | N · m |

Notes

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

* Pb containing terminations are not RoHS compliant, exemptions may apply



RoHS*
COMPLIANT

THERMAL RESISTANCE RATINGS

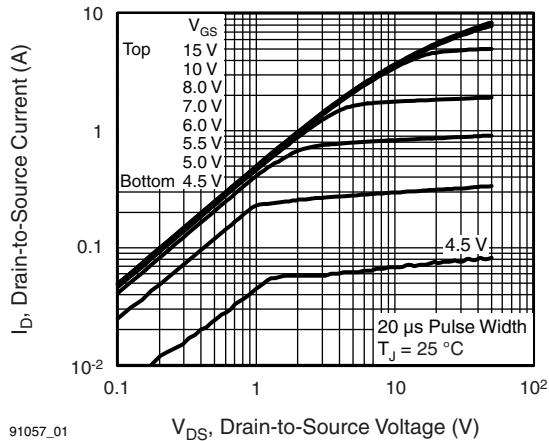
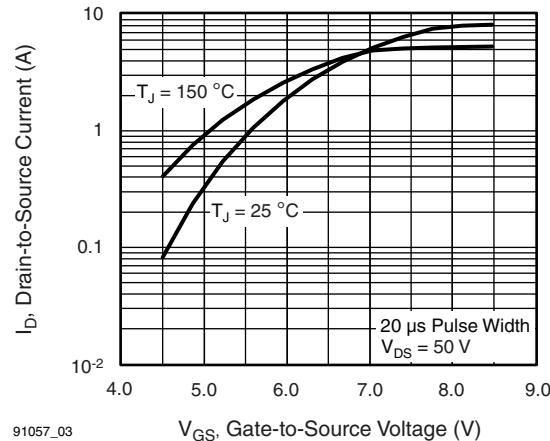
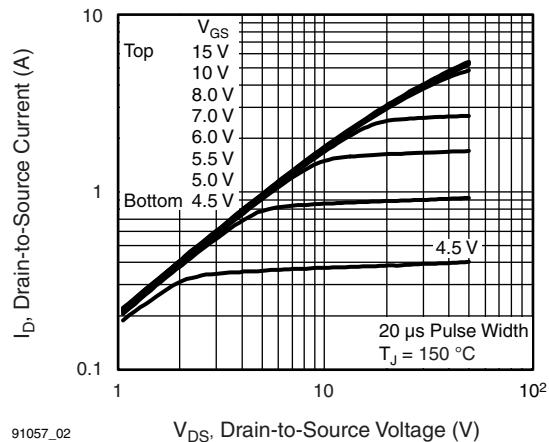
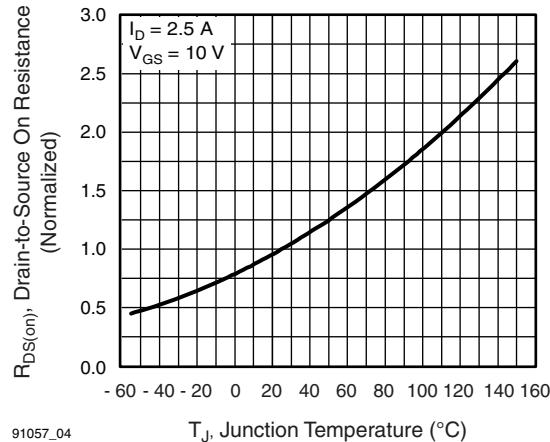
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
|-------------------------------------|------------|------|------|-----------------------------|
| Maximum Junction-to-Ambient | R_{thJA} | - | 62 | $^{\circ}\text{C}/\text{W}$ |
| Case-to-Sink, Flat, Greased Surface | R_{thCS} | 0.50 | - | |
| Maximum Junction-to-Case (Drain) | R_{thJC} | - | 2.5 | |

SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)

| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNIT | |
|--|---------------------|--|--|------|------|-----------|-----------------------------|--|
| Static | | | | | | | | |
| Drain-Source Breakdown Voltage | V_{DS} | $V_{GS} = 0 \text{ V}$ | $I_D = 250 \mu\text{A}$ | 500 | - | - | V | |
| V_{DS} Temperature Coefficient | $\Delta V_{DS}/T_J$ | Reference to 25 °C, $I_D = 1 \text{ mA}$ | | - | 0.60 | - | $^{\circ}\text{C}/\text{C}$ | |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}$, $I_D = 250 \mu\text{A}$ | | 2.0 | - | 4.5 | V | |
| Gate-Source Leakage | I_{GSS} | $V_{GS} = \pm 30 \text{ V}$ | | - | - | ± 100 | nA | |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 500 \text{ V}$, $V_{GS} = 0 \text{ V}$ | | - | - | 25 | μA | |
| | | $V_{DS} = 400 \text{ V}$, $V_{GS} = 0 \text{ V}$, $T_J = 125 \text{ }^{\circ}\text{C}$ | | - | - | 250 | | |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS} = 10 \text{ V}$ | $I_D = 1.5 \text{ A}^b$ | - | - | 3.0 | Ω | |
| Forward Transconductance | g_{fs} | $V_{DS} = 50 \text{ V}$, $I_D = 1.5 \text{ A}^b$ | | 1.4 | - | - | S | |
| Dynamic | | | | | | | | |
| Input Capacitance | C_{iss} | $V_{GS} = 0 \text{ V}$, $V_{DS} = 25 \text{ V}$, $f = 1.0 \text{ MHz}$, see fig. 5 | | - | 340 | - | pF | |
| Output Capacitance | C_{oss} | | | - | 53 | - | | |
| Reverse Transfer Capacitance | C_{rss} | | | - | 2.7 | - | | |
| Output Capacitance | C_{oss} | $V_{GS} = 0 \text{ V}$; $V_{DS} = 1.0 \text{ V}$, $f = 1.0 \text{ MHz}$ | | | 490 | | | |
| Output Capacitance | C_{oss} | $V_{GS} = 0 \text{ V}$; $V_{DS} = 400 \text{ V}$, $f = 1.0 \text{ MHz}$ | | | 15 | | | |
| Effective Output Capacitance | $C_{oss\ eff.}$ | $V_{GS} = 0 \text{ V}$; $V_{DS} = 0 \text{ V}$ to 400 V ^c | | | 28 | | | |
| Total Gate Charge | Q_g | $V_{GS} = 10 \text{ V}$ | $I_D = 2.5 \text{ A}$, $V_{DS} = 400 \text{ V}$, 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 | $t_{d(on)}$ | $V_{DD} = 250 \text{ V}$, $I_D = 2.5 \text{ A}$, $R_g = 21 \Omega$, $R_D = 97 \Omega$, 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} | $T_J = 25 \text{ }^{\circ}\text{C}$, $I_S = 2.5 \text{ A}$, $V_{GS} = 0 \text{ V}^b$ | | - | - | 1.6 | V | |
| Body Diode Reverse Recovery Time | t_{rr} | $T_J = 25 \text{ }^{\circ}\text{C}$, $I_F = 2.5 \text{ A}$, $dI/dt = 100 \text{ A}/\mu\text{s}^b$ | | - | 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

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Pulse width $\leq 300 \mu\text{s}$; duty cycle $\leq 2 \%$.
- $C_{oss\ eff.}$ 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, $T_c = 25 \text{ }^\circ\text{C}$

Fig. 3 - Typical Transfer Characteristics

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

Fig. 4 - Normalized On-Resistance vs. Temperature

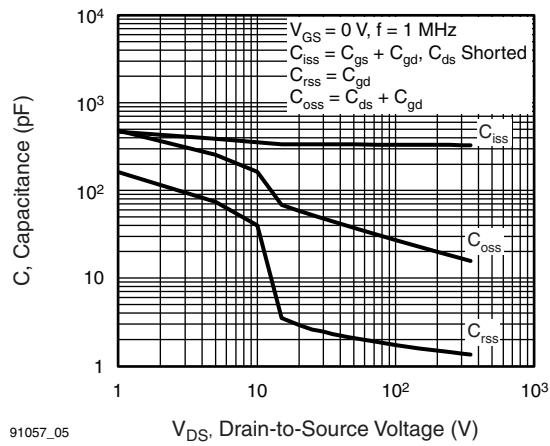


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

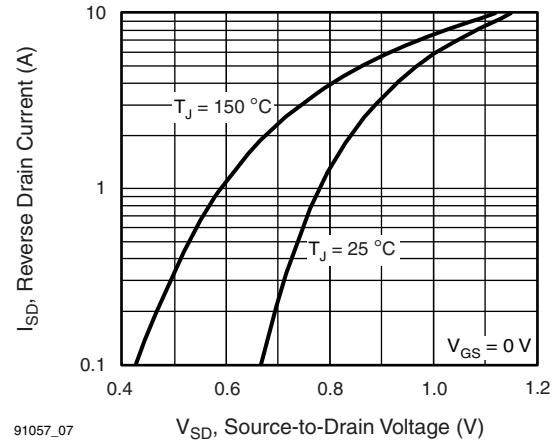


Fig. 7 - Typical Source-Drain Diode Forward Voltage

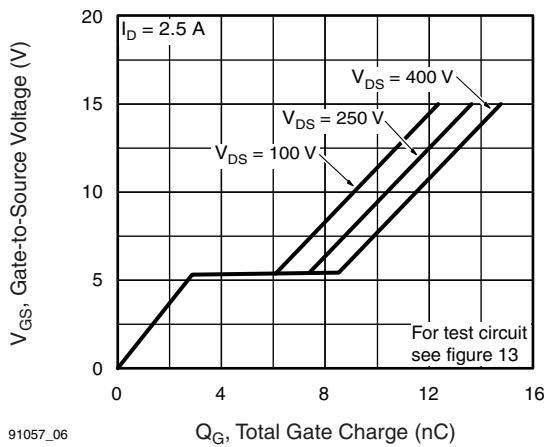


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

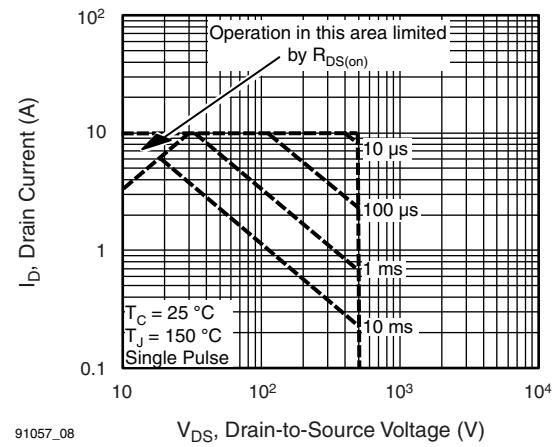
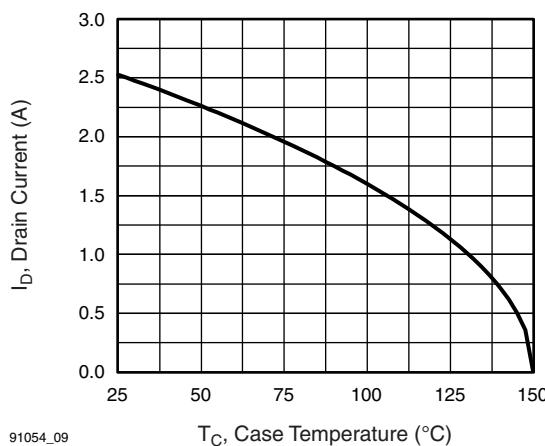
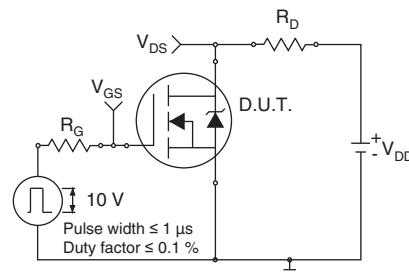
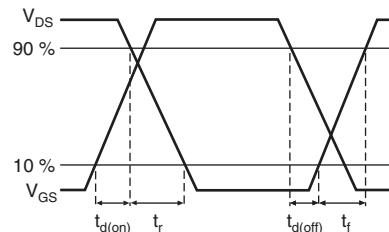
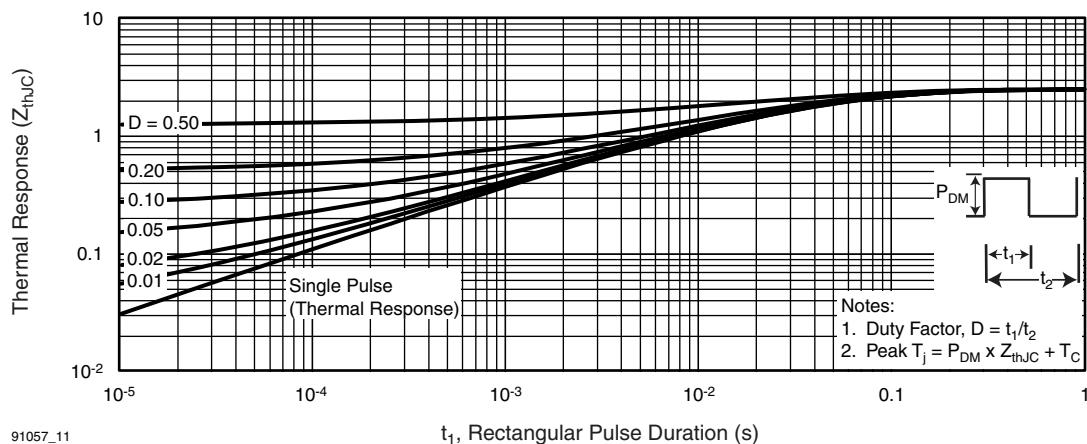


Fig. 8 - Maximum Safe Operating Area


Fig. 9 - Maximum Drain Current vs. Case Temperature

Fig. 10a - Switching Time Test Circuit

Fig. 10b - Switching Time Waveforms

Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

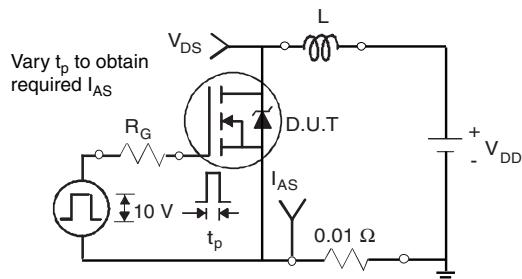


Fig. 12a - Unclamped Inductive Test Circuit

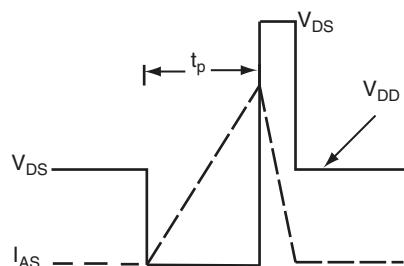
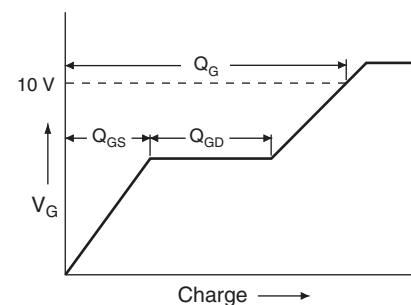


Fig. 12b - Unclamped Inductive Waveforms

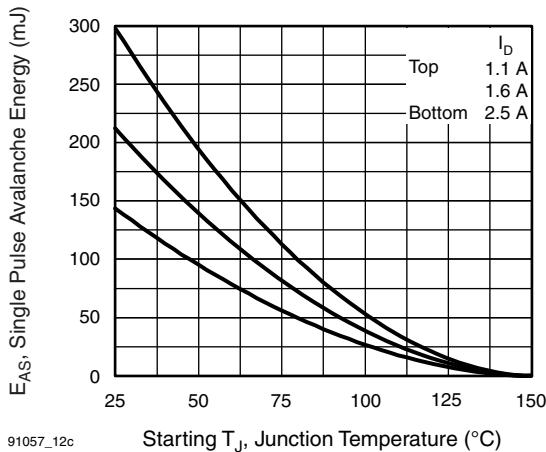


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

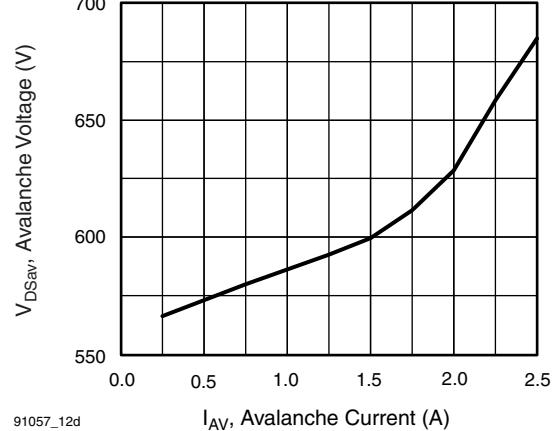


Fig. 13a - Typical Drain-to-Source Voltage vs. Avalanche Current

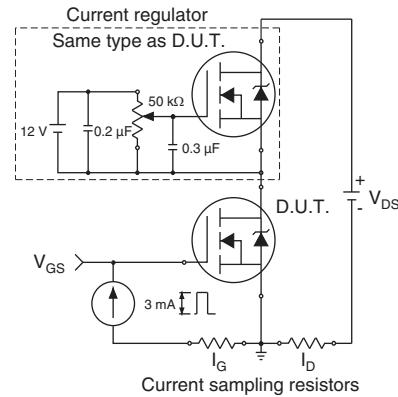
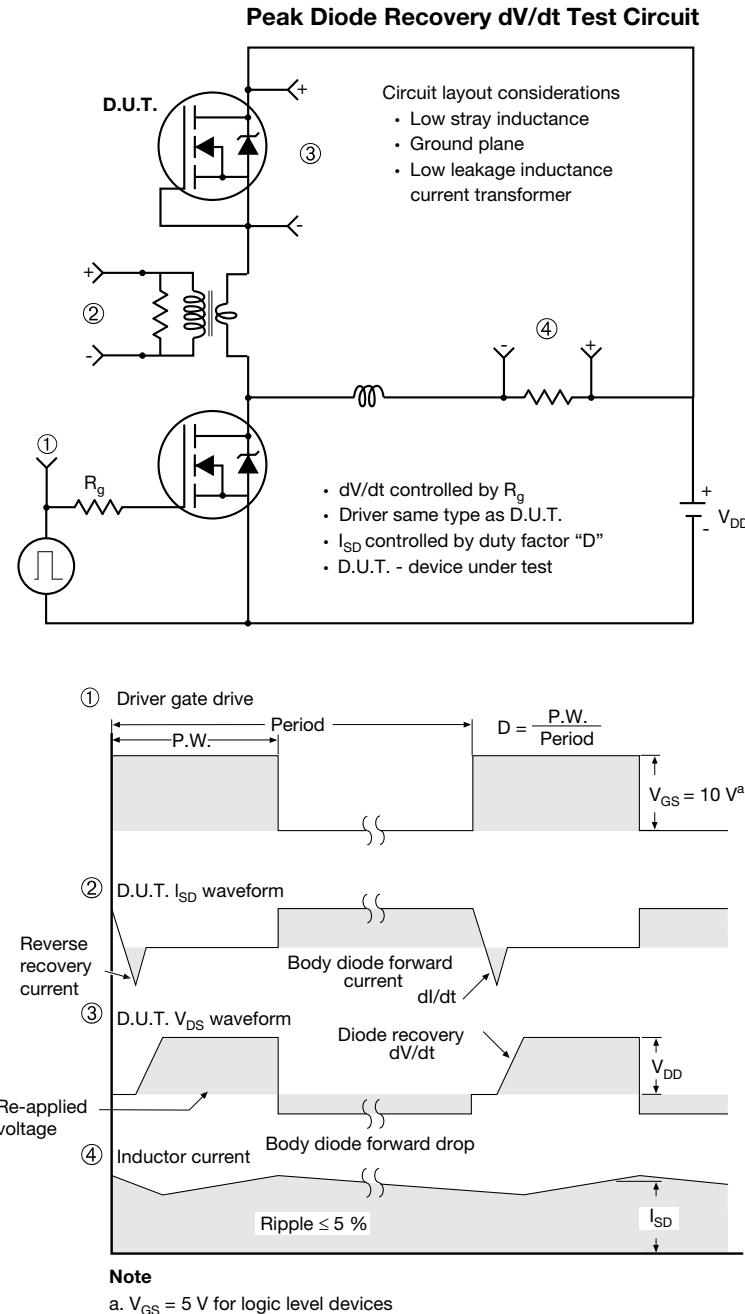
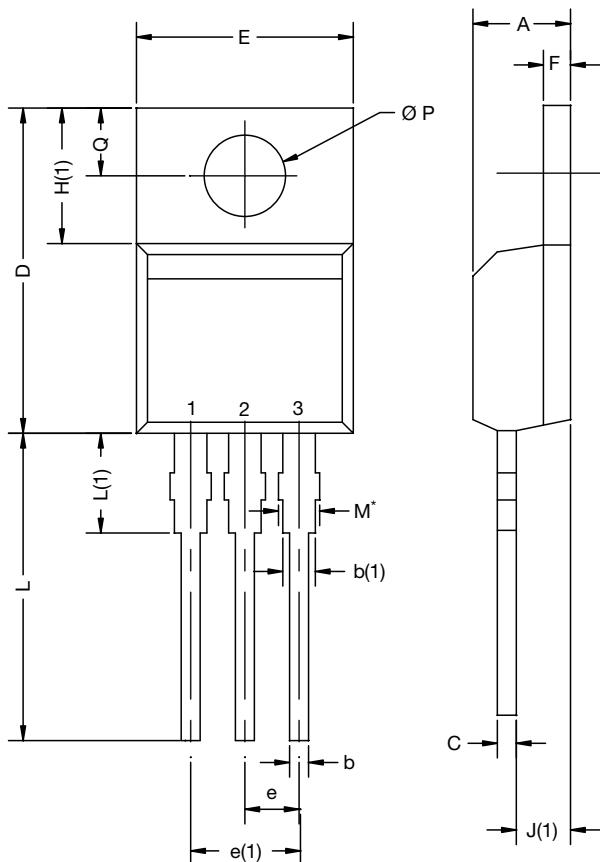


Fig. 13b - Gate Charge Test Circuit


Fig. 14 - 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 |
| Ø 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

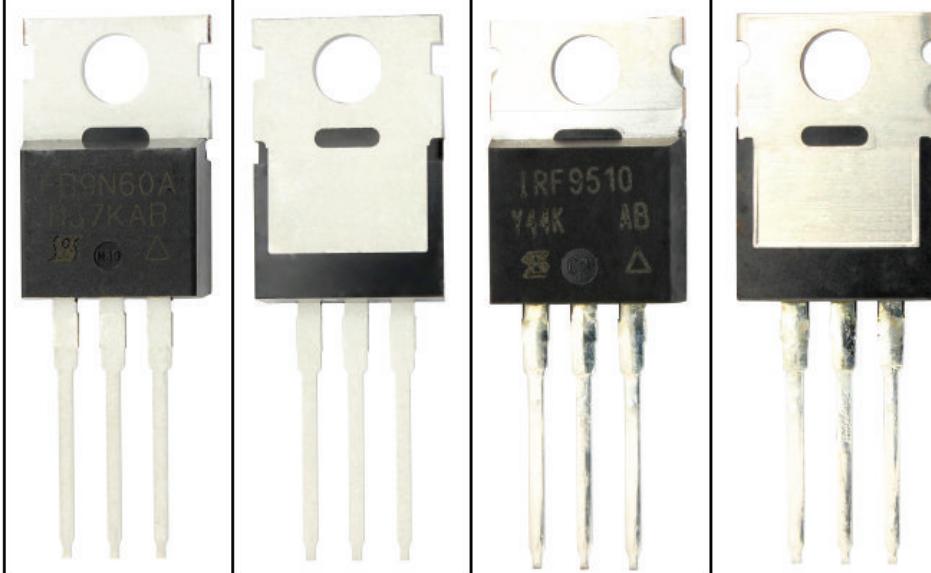
Note

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

Package Picture

ASE

Xi'an



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