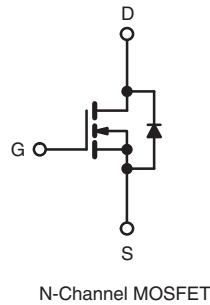
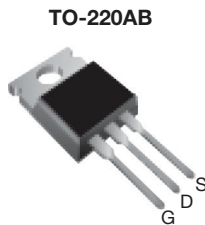


## Power MOSFET

| PRODUCT SUMMARY           |                  |       |
|---------------------------|------------------|-------|
| $V_{DS}$ (V)              | 60               |       |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 5.0$ V | 0.028 |
| $Q_g$ (Max.) (nC)         | 66               |       |
| $Q_{gs}$ (nC)             | 12               |       |
| $Q_{gd}$ (nC)             | 43               |       |
| Configuration             | Single           |       |



### FEATURES

- Dynamic  $dV/dt$  Rating
- Logic-Level Gate Drive
- $R_{DS(on)}$  Specified at  $V_{GS} = 4$  V and 5 V
- 175 °C Operating Temperature
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- Compliant to RoHS Directive 2002/95/EC



**RoHS\***  
COMPLIANT

### DESCRIPTION

Third generation Power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The TO-220AB package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 50 W. The low thermal resistance and low package cost of the TO-220AB contribute to its wide acceptance throughout the industry.

| ORDERING INFORMATION |                         |
|----------------------|-------------------------|
| Package              | TO-220AB                |
| Lead (Pb)-free       | IRLZ44PbF<br>SiHLZ44-E3 |
| SnPb                 | IRLZ44<br>SiHLZ44       |



| ABSOLUTE MAXIMUM RATINGS ( $T_C = 25$ °C, unless otherwise noted) |                  |                |          |
|---|------------------|----------------|----------|
| PARAMETER   | SYMBOL           | LIMIT          | UNIT     |
| Drain-Source Voltage  | $V_{DS}$         | 60             | V        |
| Gate-Source Voltage   | $V_{GS}$         | $\pm 10$       |          |
| Continuous Drain Current <sup>a</sup>                             | $I_D$            | $T_C = 25$ °C  | A        |
| Continuous Drain Current  |                  | $T_C = 100$ °C |          |
| Pulsed Drain Current <sup>a</sup>                                 | $I_{DM}$         | 200            |          |
| Linear Derating Factor  |                  | 1.0            | W/°C     |
| Single Pulse Avalanche Energy <sup>b</sup>                        | $E_{AS}$         | 400            | mJ       |
| Maximum Power Dissipation   | $P_D$            | 150            | W        |
| Peak Diode Recovery $dV/dt$ <sup>c</sup>                          | $dV/dt$          | 4.5            | V/ns     |
| Operating Junction and Storage Temperature Range                  | $T_J, T_{stg}$   | - 55 to + 175  | °C       |
| Soldering Recommendations (Peak Temperature) <sup>d</sup>         | for 10 s         | 300            |          |
| 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).
- $V_{DD} = 25$  V, starting  $T_J = 25$  °C,  $L = 179$   $\mu$ H,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 51$  A (see fig. 12).
- $I_{SD} \leq 51$  A,  $dV/dt \leq 250$  A/s,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 175$  °C.
- 1.6 mm from case.
- Current limited by the package, (die current = 51 A).

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

| 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)    | $R_{thJC}$ | -    | 1.0  |      |

| SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted) |                     |  |      |       |                 |               |
|---|---------------------|--|------|-------|-----------------|---------------|
| PARAMETER   | SYMBOL              | TEST CONDITIONS  | MIN. | TYP.  | MAX.            | UNIT          |
| <b>Static</b>   |                     |  |      |       |                 |               |
| Drain-Source Breakdown Voltage  | $V_{DS}$            | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$  | 60   | -     | -               | V             |
| $V_{DS}$ Temperature Coefficient  | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^\circ\text{C}, I_D = 1\text{ mA}$   | -    | 0.070 | -               | V/°C          |
| Gate-Source Threshold Voltage   | $V_{GS(th)}$        | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$  | 1.0  | -     | 2.0             | V             |
| Gate-Source Leakage   | $I_{GSS}$           | $V_{GS} = 10\text{ V}$   | -    | -     | $\pm 100$       | nA            |
| Zero Gate Voltage Drain Current   | $I_{DSS}$           | $V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$  | -    | -     | 25              | $\mu\text{A}$ |
|   |                     | $V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$   | -    | -     | 250             |               |
| Drain-Source On-State Resistance  | $R_{DS(on)}$        | $V_{GS} = 5.0\text{ V}, I_D = 31\text{ A}^b$   | -    | -     | 0.028           | $\Omega$      |
|   |                     | $V_{GS} = 4.0\text{ V}, I_D = 25\text{ A}^b$   | -    | -     | 0.039           |               |
| Forward Transconductance  | $g_{fs}$            | $V_{DS} = 25\text{ V}, I_D = 31\text{ A}^b$  | 23   | -     | -               | S             |
| <b>Dynamic</b>  |                     |  |      |       |                 |               |
| Input Capacitance   | $C_{iss}$           | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1.0\text{ MHz}, \text{ see fig. 5}$  | -    | 3300  | -               | pF            |
| Output Capacitance  | $C_{oss}$           |  | -    | 1200  | -               |               |
| Reverse Transfer Capacitance  | $C_{rss}$           |  | -    | 200   | -               |               |
| Total Gate Charge   | $Q_g$               | $V_{GS} = 5.0\text{ V}, I_D = 51\text{ A}, V_{DS} = 48\text{ V}, \text{ see fig. 6 and 13}^b$  | -    | -     | 66              | nC            |
| Gate-Source Charge  | $Q_{gs}$            |  | -    | -     | 12              |               |
| Gate-Drain Charge   | $Q_{gd}$            |  | -    | -     | 43              |               |
| Turn-On Delay Time  | $t_{d(on)}$         | $V_{DD} = 30\text{ V}, I_D = 51\text{ A}, R_g = 4.6\text{ }\Omega, R_D = 0.56\text{ }\Omega, \text{ see fig. 10}^b$                                    | -    | 17    | -               | ns            |
| Rise Time   | $t_r$               |  | -    | 230   | -               |               |
| Turn-Off Delay Time   | $t_{d(off)}$        |  | -    | 42    | -               |               |
| Fall Time   | $t_f$               |  | -    | 110   | -               |               |
| Internal Drain Inductance   | $L_D$               | Between lead, 6 mm (0.25") from package and center of die contact  | -    | 4.5   | -               | nH            |
| Internal Source Inductance  | $L_S$               |  | -    | 7.5   | -               |               |
| <b>Drain-Source Body Diode Characteristics</b>                              |                     |  |      |       |                 |               |
| Continuous Source-Drain Diode Current                                       | $I_S$               | MOSFET symbol showing the integral reverse p - n junction diode    | -    | -     | 50 <sup>c</sup> | A             |
| Pulsed Diode Forward Current <sup>a</sup>                                   | $I_{SM}$            |  | -    | -     | 200             |               |
| Body Diode Voltage  | $V_{SD}$            | $T_J = 25\text{ }^\circ\text{C}, I_S = 51\text{ A}, V_{GS} = 0\text{ V}^b$   | -    | -     | 2.5             | V             |
| Body Diode Reverse Recovery Time  | $t_{rr}$            | $T_J = 25\text{ }^\circ\text{C}, I_F = 51\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$  | -    | 130   | 180             | ns            |
| Body Diode Reverse Recovery Charge  | $Q_{rr}$            |  | -    | 0.84  | 1.3             | $\mu\text{C}$ |
| 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  $\leq 300\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- Current limited by the package, (die current = 51 A).

## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

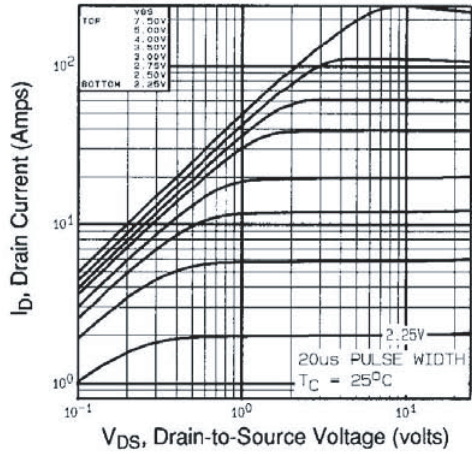


Fig. 1 - Typical Output Characteristics,  $T_C = 25\text{ }^\circ\text{C}$

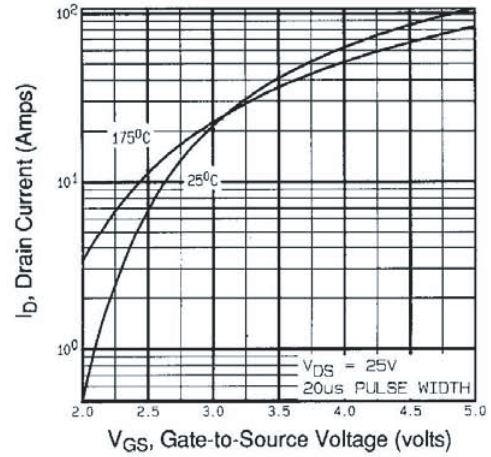


Fig. 3 - Typical Transfer Characteristics

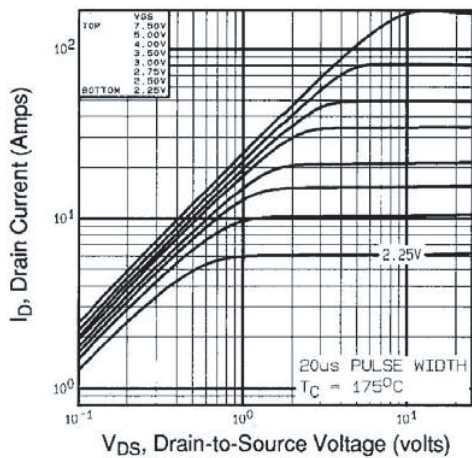


Fig. 2 - Typical Output Characteristics,  $T_C = 175\text{ }^\circ\text{C}$

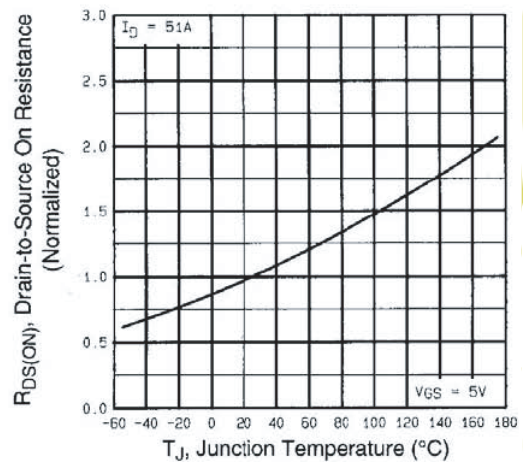


Fig. 4 - Normalized On-Resistance vs. Temperature

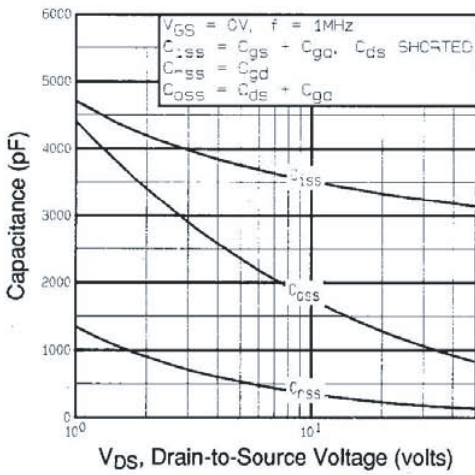


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

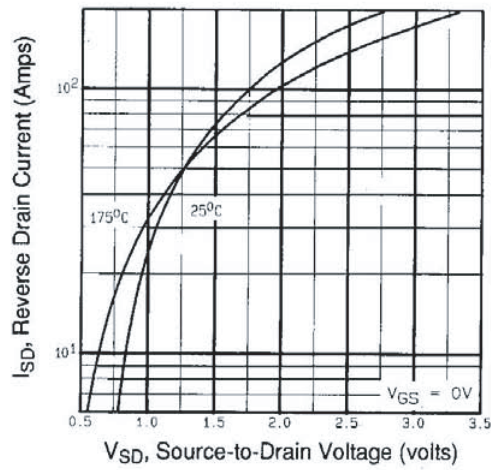


Fig. 7 - Typical Source-Drain Diode Forward Voltage

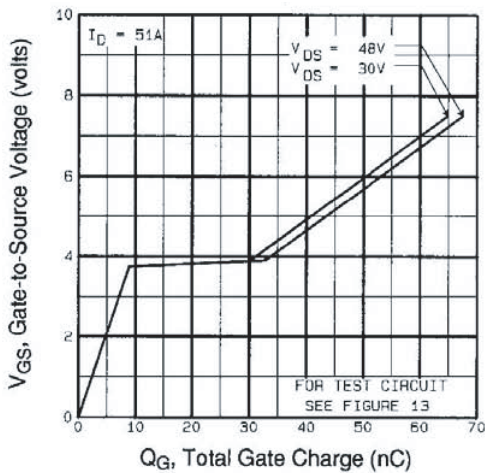


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

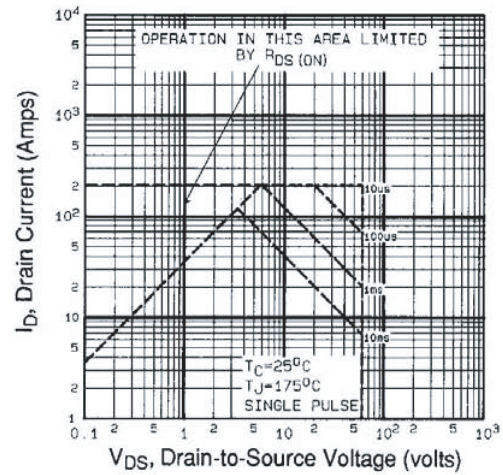


Fig. 8 - Maximum Safe Operating Area

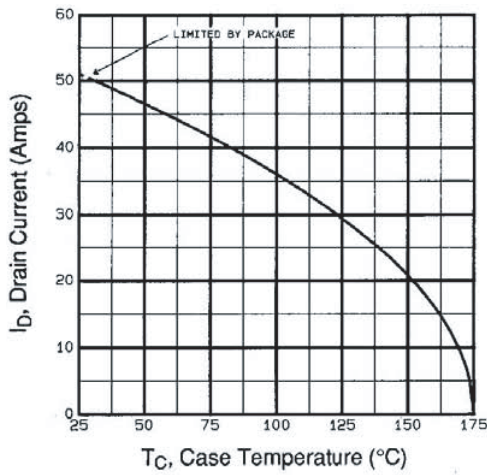


Fig. 9 - Maximum Drain Current vs. Case Temperature

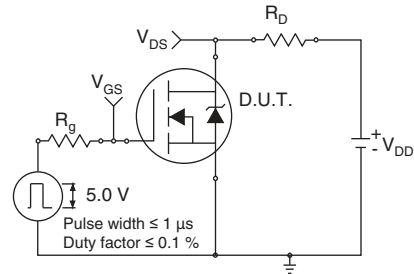


Fig. 10a - Switching Time Test Circuit

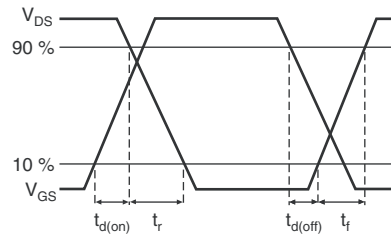


Fig. 10b - Switching Time Waveforms

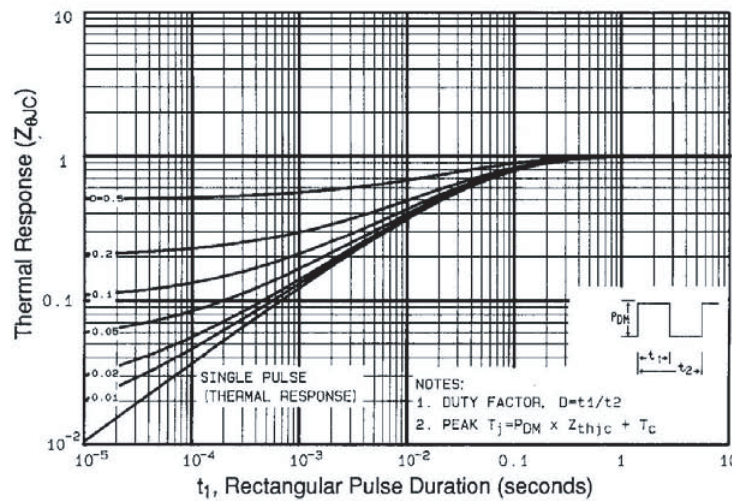


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case



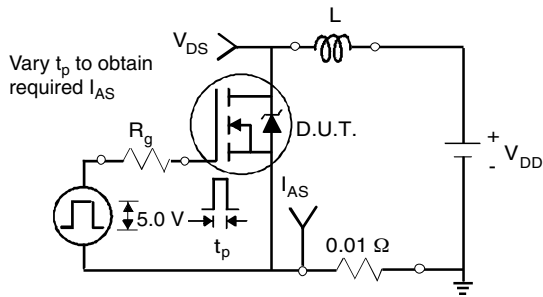


Fig. 12a - Unclamped Inductive Test Circuit

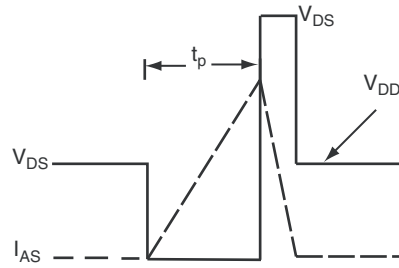


Fig. 12b - Unclamped Inductive Waveforms

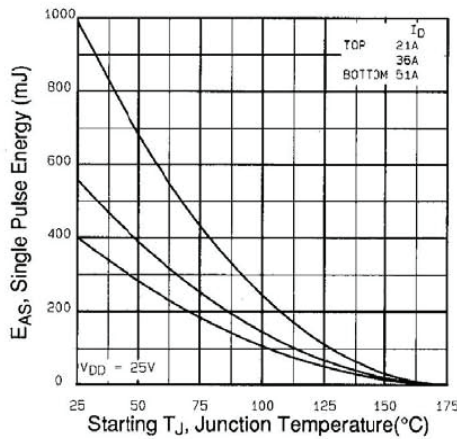


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

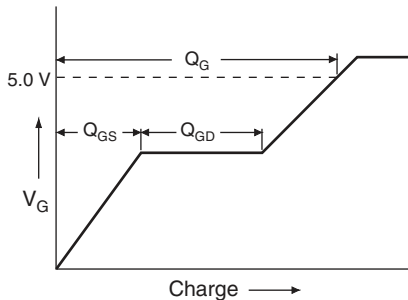


Fig. 13a - Basic Gate Charge Waveform

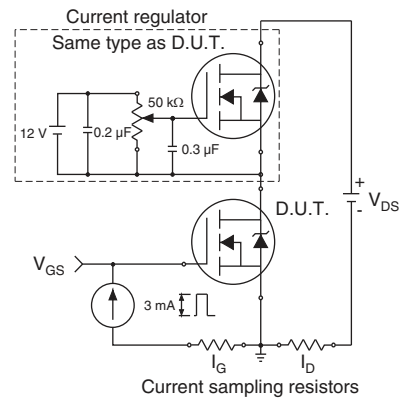
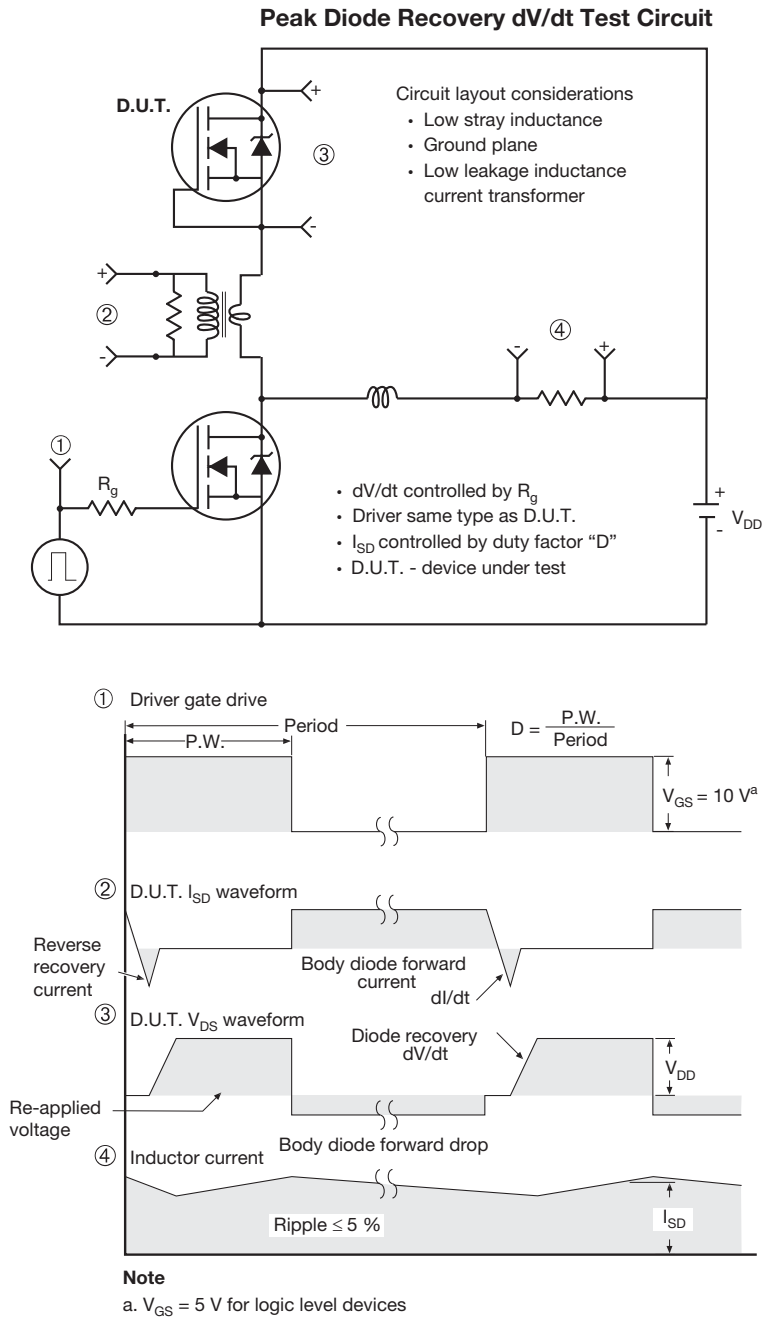
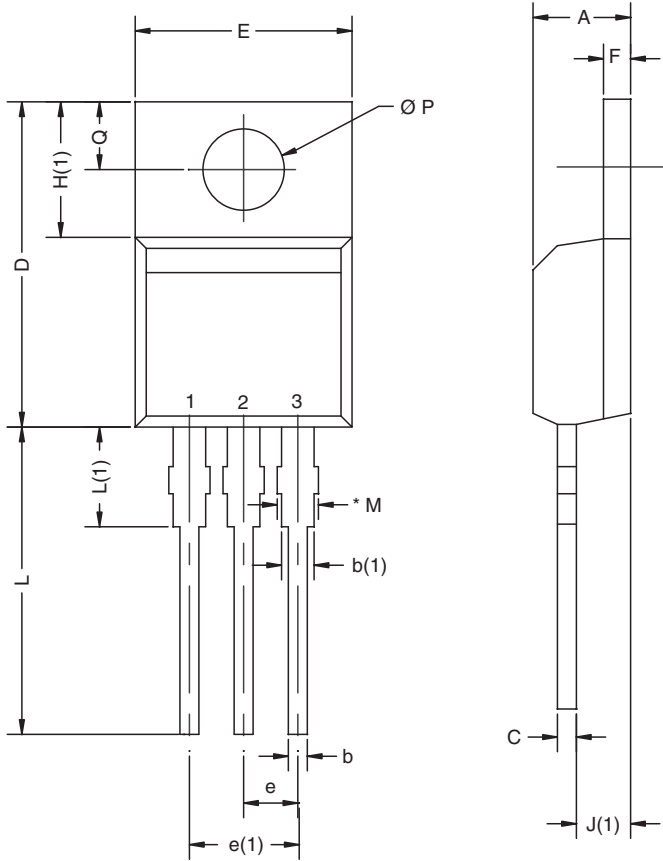


Fig. 13b - Gate Charge Test Circuit


**Fig. 14 - For N-Channel**

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## TO-220AB



| DIM.            | MILLIMETERS |       | INCHES |       |
|-----------------|-------------|-------|--------|-------|
|                 | MIN.        | MAX.  | MIN.   | MAX.  |
| A               | 4.25        | 4.65  | 0.167  | 0.183 |
| b               | 0.69        | 1.01  | 0.027  | 0.040 |
| b(1)            | 1.20        | 1.73  | 0.047  | 0.068 |
| c               | 0.36        | 0.61  | 0.014  | 0.024 |
| D               | 14.85       | 15.49 | 0.585  | 0.610 |
| E               | 10.04       | 10.51 | 0.395  | 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)            | 6.09        | 6.48  | 0.240  | 0.255 |
| J(1)            | 2.41        | 2.92  | 0.095  | 0.115 |
| L               | 13.35       | 14.02 | 0.526  | 0.552 |
| L(1)            | 3.32        | 3.82  | 0.131  | 0.150 |
| $\varnothing P$ | 3.54        | 3.94  | 0.139  | 0.155 |
| Q               | 2.60        | 3.00  | 0.102  | 0.118 |

ECN: X10-0416-Rev. M, 01-Nov-10  
DWG: 5471

**Note**

\* M = 1.32 mm to 1.62 mm (dimension including protrusion)  
Heatsink hole for HVM





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