

# IRFB4229-VB Datasheet

## Power MOSFET

### PRODUCT SUMMARY

|                           |                        |       |
|---------------------------|------------------------|-------|
| $V_{DS}$ (V)              | 250                    |       |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10\text{ V}$ | 0.041 |
| $Q_g$ (Max.) (nC)         | 70                     |       |
| $Q_{gs}$ (nC)             | 13                     |       |
| $Q_{gd}$ (nC)             | 39                     |       |
| Configuration             | Single                 |       |

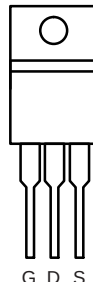
### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Surface Mount
- Low-Profile Through-Hole
- Available in Tape and Reel
- Dynamic  $dV/dt$  Rating
- 150 °C Operating Temperature
- Fast Switching
- Fully Avalanche Rated
- Compliant to RoHS Directive 2002/95/EC

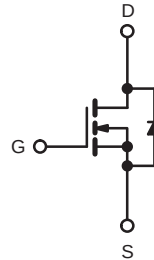


**RoHS\***  
 COMPLIANT  
 HALOGEN  
**FREE**  
 Available

TO-220AB



Top View



N-Channel MOSFET

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

| PARAMETER                                        |                         |                         | SYMBOL                            | LIMIT            | UNIT |
|--------------------------------------------------|-------------------------|-------------------------|-----------------------------------|------------------|------|
| Drain-Source Voltage                             |                         |                         | V <sub>DS</sub>                   | 250              | V    |
| Gate-Source Voltage                              |                         |                         | V <sub>GS</sub>                   | ± 20             |      |
| Continuous Drain Current                         | V <sub>GS</sub> at 10 V | T <sub>C</sub> = 25 °C  | I <sub>D</sub>                    | 50               | A    |
|                                                  |                         | T <sub>C</sub> = 100 °C |                                   | 43               |      |
| Pulsed Drain Current <sup>a, e</sup>             |                         |                         | I <sub>DM</sub>                   | 172              |      |
| Linear Derating Factor                           |                         |                         |                                   | 1.0              | W/°C |
| Single Pulse Avalanche Energy <sup>b, e</sup>    |                         |                         | E <sub>AS</sub>                   | 580              | mJ   |
| Avalanche Current <sup>a</sup>                   |                         |                         | I <sub>AR</sub>                   | 20               | A    |
| Repetiitive Avalanche Energy <sup>a</sup>        |                         |                         | E <sub>AR</sub>                   | 13               | mJ   |
| Maximum Power Dissipation                        | T <sub>C</sub> = 25 °C  |                         | P <sub>D</sub>                    | 3.1              | W    |
|                                                  | T <sub>A</sub> = 25 °C  |                         |                                   | 130              |      |
| Peak Diode Recovery dV/dt <sup>c, e</sup>        |                         |                         | dV/dt                             | 5.0              | V/ns |
| Operating Junction and Storage Temperature Range |                         |                         | T <sub>J</sub> , T <sub>stg</sub> | - 55 to + 150    | °C   |
| Soldering Recommendations (Peak Temperature)     | for 10 s                |                         |                                   | 300 <sup>d</sup> |      |

#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 50\text{ V}$ , starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 2.7\text{ mH}$ ,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 18\text{ A}$  (see fig. 12).
- $I_{SD} \leq 20\text{ A}$ ,  $dI/dt \leq 150\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150\text{ }^\circ\text{C}$ .
- 1.6 mm from case.

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

**THERMAL RESISTANCE RATINGS**

| PARAMETER                                                               | SYMBOL     | TYP. | MAX. | UNIT |
|-------------------------------------------------------------------------|------------|------|------|------|
| Maximum Junction-to-Ambient<br>(PCB Mounted, Steady-State) <sup>a</sup> | $R_{thJA}$ | -    | 40   | °C/W |
| Maximum Junction-to-Case (Drain)                                        | $R_{thJC}$ | -    | 1.0  |      |

**Note**

a. When mounted on 1" square PCB (FR-4 or G-10 material).

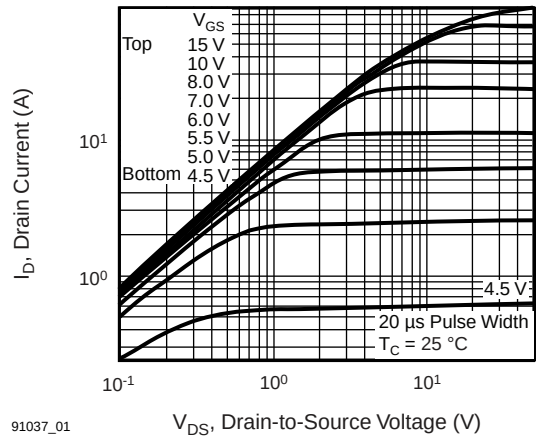
**SPECIFICATIONS** ( $T_J = 25\text{ °C}$ , unless otherwise noted)

| PARAMETER                                 | SYMBOL              | TEST CONDITIONS                                                                                                                                         |                                                                                      | MIN. | TYP.  | MAX.      | UNIT                |
|-------------------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|------|-------|-----------|---------------------|
| Static                                    |                     |                                                                                                                                                         |                                                                                      |      |       |           |                     |
| Drain-Source Breakdown Voltage            | $V_{DS}$            | $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$                                                                                                  |                                                                                      | 250  | -     | -         | V                   |
| $V_{DS}$ Temperature Coefficient          | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}^c$                                                                                         |                                                                                      | -    | 0.29  | -         | V/ $^\circ\text{C}$ |
| Gate-Source Threshold Voltage             | $V_{GS(th)}$        | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                                                                                                      |                                                                                      | 2.0  | -     | 4.0       | V                   |
| Gate-Source Leakage                       | $I_{GSS}$           | $V_{GS} = \pm 20\text{ V}$                                                                                                                              |                                                                                      | -    | -     | $\pm 100$ | nA                  |
| Zero Gate Voltage Drain Current           | $I_{DSS}$           | $V_{DS} = 200\text{ V}$ , $V_{GS} = 0\text{ V}$                                                                                                         |                                                                                      | -    | -     | 25        | $\mu\text{A}$       |
|                                           |                     | $V_{DS} = 160\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125\text{ }^\circ\text{C}$                                                                     |                                                                                      | -    | -     | 250       |                     |
| Drain-Source On-State Resistance          | $R_{DS(on)}$        | $V_{GS} = 10\text{ V}$                                                                                                                                  | $I_D = 11\text{ A}^b$                                                                | -    | 0.041 | -         | $\Omega$            |
| Forward Transconductance                  | $g_{fs}$            | $V_{DS} = 50\text{ V}$ , $I_D = 11\text{ A}^d$                                                                                                          |                                                                                      | 6.7  | -     | -         | S                   |
| Dynamic                                   |                     |                                                                                                                                                         |                                                                                      |      |       |           |                     |
| Input Capacitance                         | $C_{iss}$           | $V_{GS} = 0\text{ V}$ ,<br>$V_{DS} = 25\text{ V}$ ,<br>$f = 1.0\text{ MHz}$ , see fig. 5 <sup>d</sup>                                                   |                                                                                      | -    | 1300  | -         | pF                  |
| Output Capacitance                        | $C_{oss}$           |                                                                                                                                                         |                                                                                      | -    | 430   | -         |                     |
| Reverse Transfer Capacitance              | $C_{rss}$           |                                                                                                                                                         |                                                                                      | -    | 130   | -         |                     |
| Total Gate Charge                         | $Q_g$               | $V_{GS} = 10\text{ V}$                                                                                                                                  | $I_D = 20\text{ A}$ , $V_{DS} = 160\text{ V}$ ,<br>see fig. 6 and 13 <sup>b, c</sup> | -    | -     | 70        | nC                  |
| Gate-Source Charge                        | $Q_{gs}$            |                                                                                                                                                         |                                                                                      | -    | -     | 13        |                     |
| Gate-Drain Charge                         | $Q_{gd}$            |                                                                                                                                                         |                                                                                      | -    | -     | 39        |                     |
| Turn-On Delay Time                        | $t_{d(on)}$         | $V_{DD} = 100\text{ V}$ , $I_D = 20\text{ A}$ ,<br>$R_g = 9.1\text{ }\Omega$ , $R_D = 5.4\text{ }\Omega$ , see fig. 10 <sup>b, c</sup>                  |                                                                                      | -    | 14    | -         | ns                  |
| Rise Time                                 | $t_r$               |                                                                                                                                                         |                                                                                      | -    | 51    | -         |                     |
| Turn-Off Delay Time                       | $t_{d(off)}$        |                                                                                                                                                         |                                                                                      | -    | 45    | -         |                     |
| Fall Time                                 | $t_f$               |                                                                                                                                                         |                                                                                      | -    | 36    | -         |                     |
| Drain-Source Body Diode Characteristics   |                     |                                                                                                                                                         |                                                                                      |      |       |           |                     |
| Continuous Source-Drain Diode Current     | $I_S$               | MOSFET symbol showing the integral reverse p - n junction diode<br> |                                                                                      | -    | -     | 20        | A                   |
| Pulsed Diode Forward Current <sup>a</sup> | $I_{SM}$            |                                                                                                                                                         |                                                                                      | -    | -     | 72        |                     |
| Body Diode Voltage                        | $V_{SD}$            | $T_J = 25\text{ }^\circ\text{C}$ , $I_S = 20\text{ A}$ , $V_{GS} = 0\text{ V}^b$                                                                        |                                                                                      | -    | -     | 2.0       | V                   |
| Body Diode Reverse Recovery Time          | $t_{rr}$            | $T_J = 25\text{ }^\circ\text{C}$ , $I_F = 20\text{ A}$ , $dI/dt = 100\text{ A}/\mu\text{s}^{b, c}$                                                      |                                                                                      | -    | 300   | 610       | ns                  |
| Body Diode Reverse Recovery Charge        | $Q_{rr}$            |                                                                                                                                                         |                                                                                      | -    | 3.4   | 7.1       | $\mu\text{C}$       |
| Forward Turn-On Time                      | $t_{on}$            | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$ and $L_D$ )                                                                         |                                                                                      |      |       |           |                     |

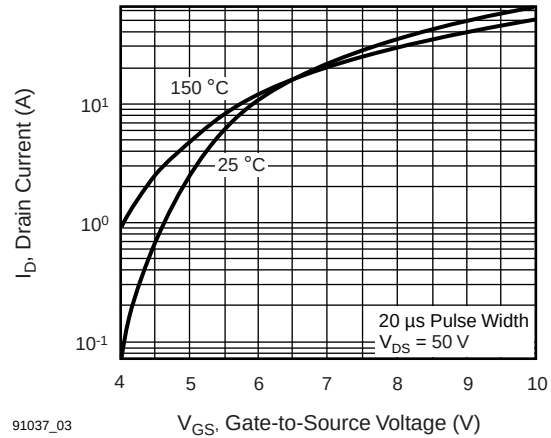
**Notes**

- 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. Uses IRF640/SiHF640 data and test conditions.

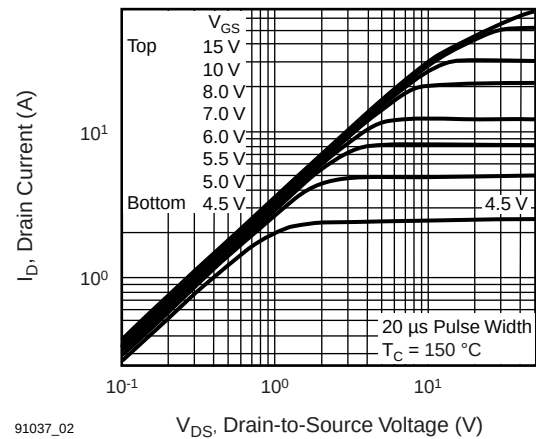
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



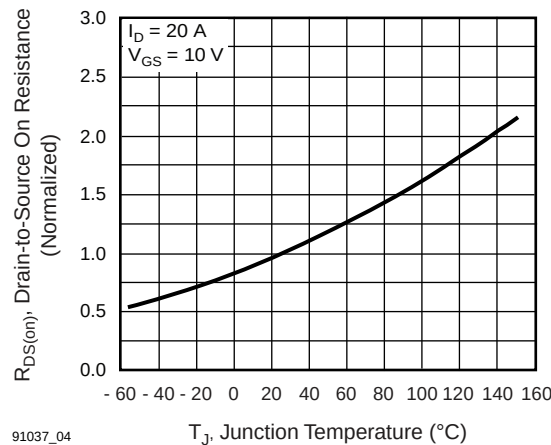
**Fig. 1 - Typical Output Characteristics,  $T_J = 25\text{ }^{\circ}\text{C}$**



**Fig. 3 - Typical Transfer Characteristics**



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



**Fig. 4 - Normalized On-Resistance vs. Temperature**

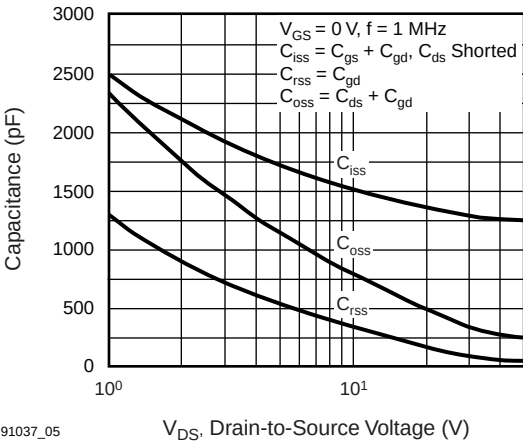


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

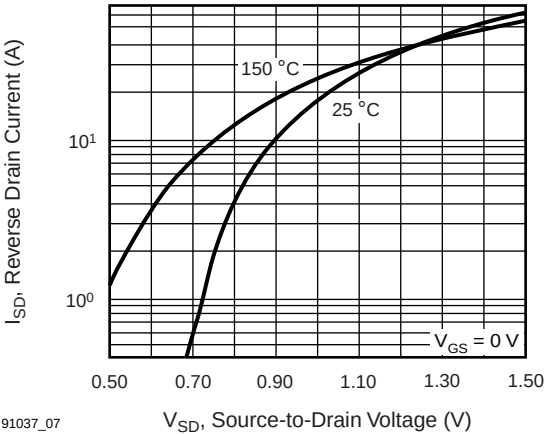


Fig. 7 - Typical Source-Drain Diode Forward Voltage

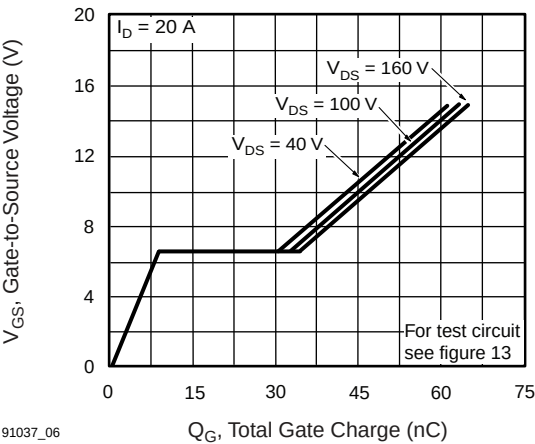


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

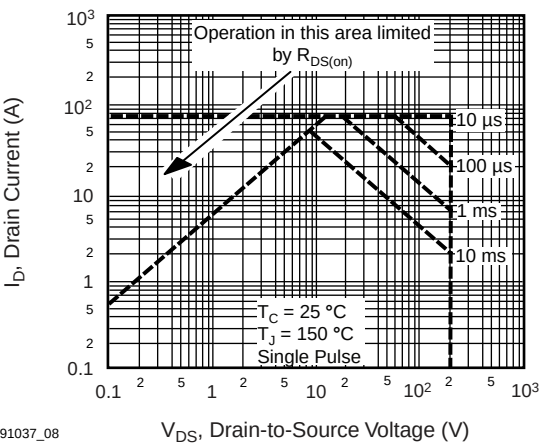


Fig. 8 - Maximum Safe Operating Area

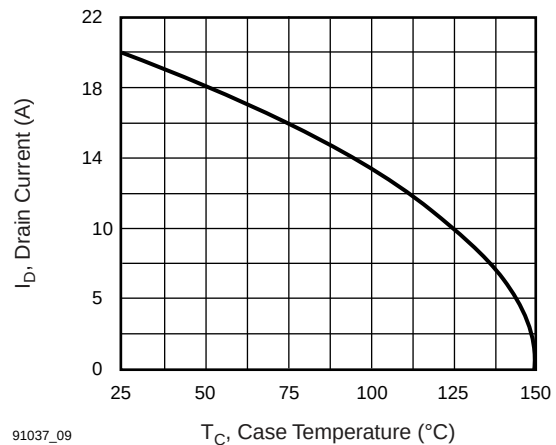


Fig. 9 - Maximum Drain Current vs. Case Temperature

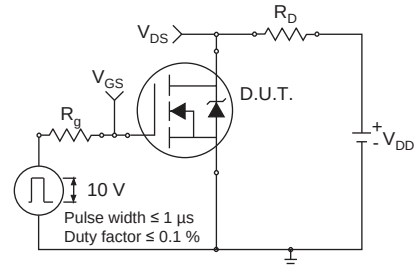


Fig. 10a - Switching Time Test Circuit

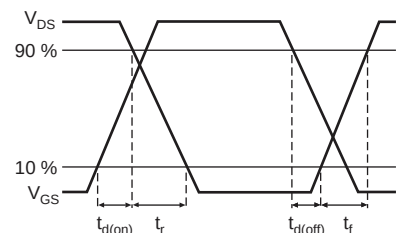


Fig. 10b - Switching Time Waveforms

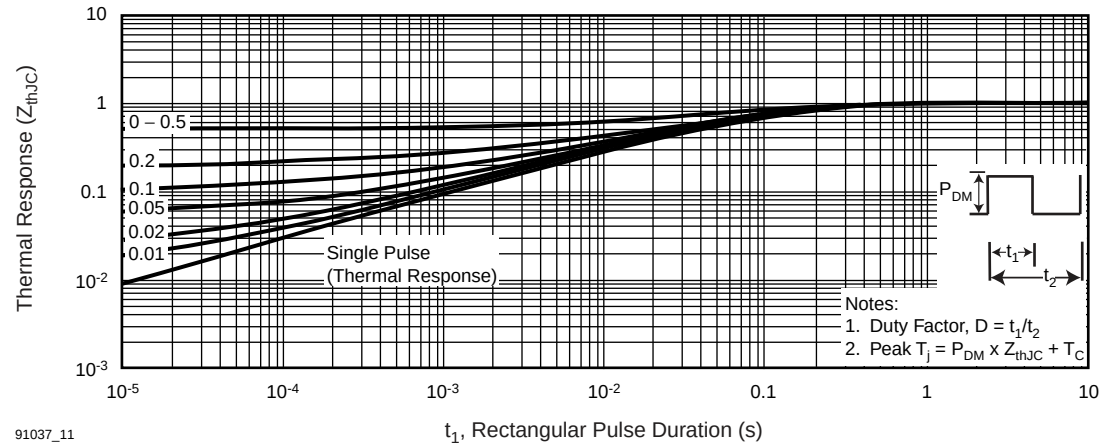


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

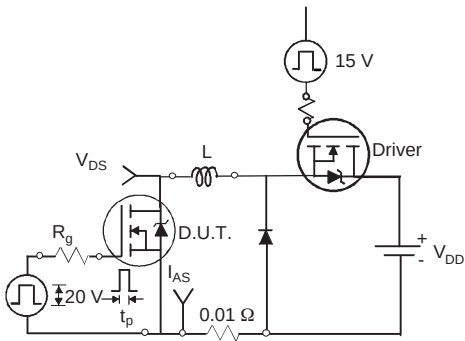


Fig. 12a - Unclamped Inductive Test Circuit

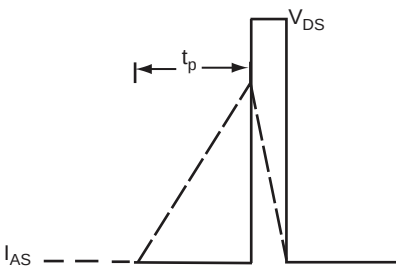


Fig. 12b - Unclamped Inductive Waveforms

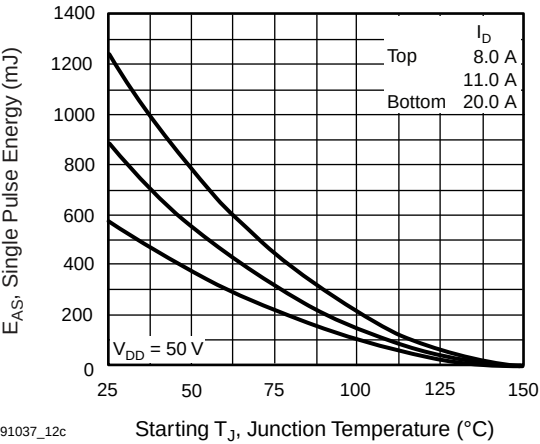


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

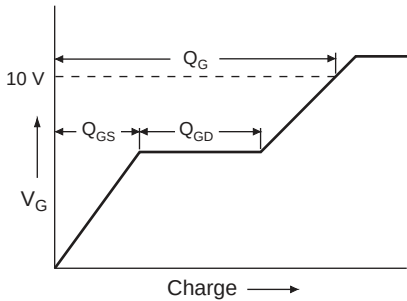


Fig. 13a - Basic Gate Charge Waveform

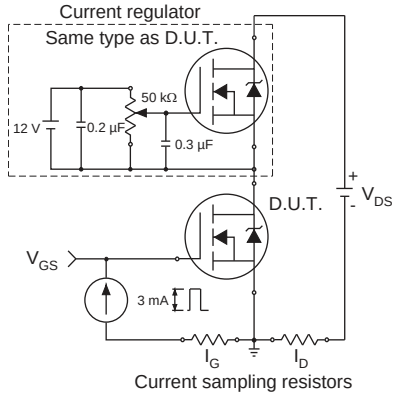
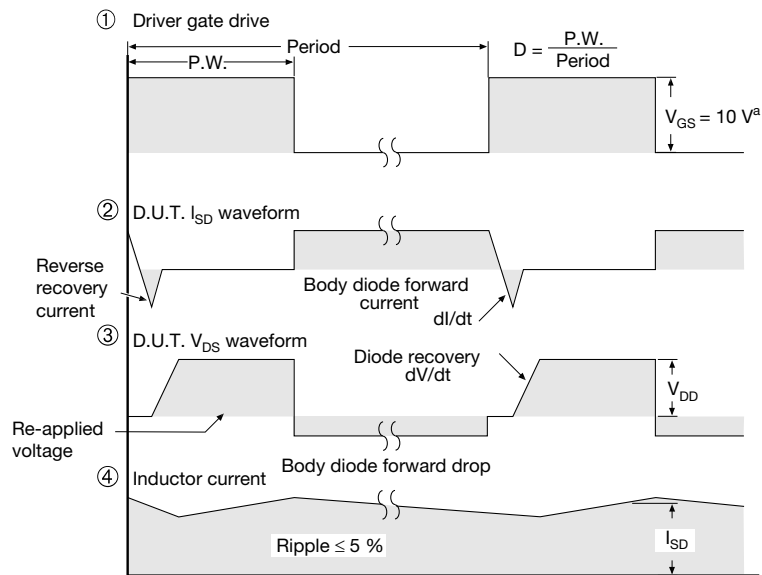
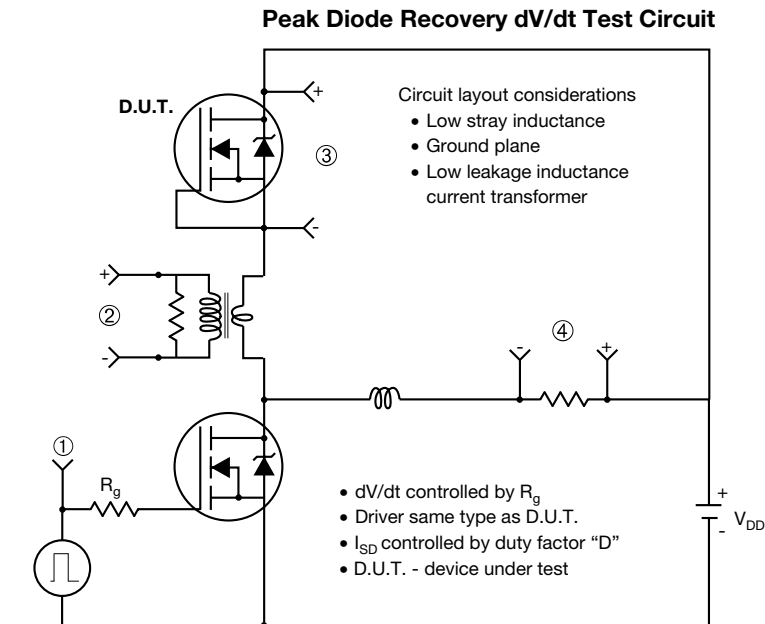


Fig. 13b - Gate Charge Test Circuit

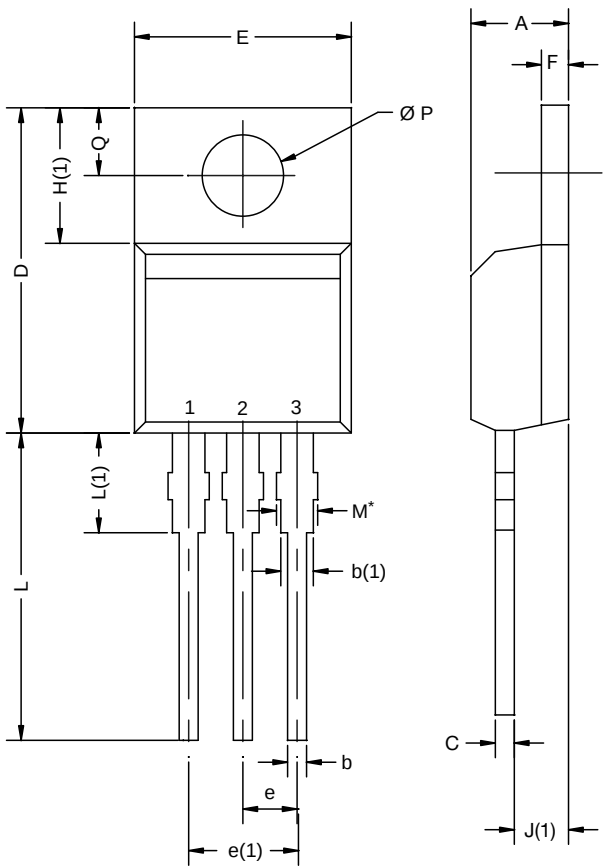


**Note**

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

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

# 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: X12-0208-Rev. N, 08-Oct-12<br>DWG: 5471 |             |       |        |       |

## Notes

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



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