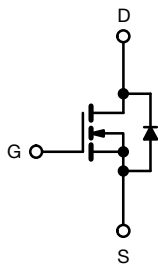
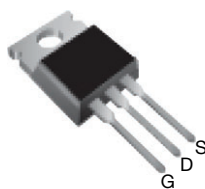


# Power MOSFET

**TO-220AB**


N-Channel 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](http://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                    |     |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10\text{ V}$ | 1.4 |
| $Q_g$ max. (nC)           | 24                     |     |
| $Q_{gs}$ (nC)             | 6.3                    |     |
| $Q_{gd}$ (nC)             | 11                     |     |
| Configuration             | Single                 |     |

## ORDERING INFORMATION

|                                 |                |
|---------------------------------|----------------|
| Package                         | TO-220AB       |
| Lead (Pb)-free                  | IRF830APbF     |
| Lead (Pb)-free and halogen-free | IRF830APbF-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                                       | $V_{GS}$         | $\pm 30$                          |                     |
| Continuous drain current                                  | $V_{GS}$ at 10 V | $T_C = 25\text{ }^\circ\text{C}$  | A                   |
|                                                           |                  | $T_C = 100\text{ }^\circ\text{C}$ |                     |
| Pulsed drain current <sup>a</sup>                         | $I_{DM}$         | 20                                |                     |
| Linear derating factor                                    |                  | 0.59                              | W/ $^\circ\text{C}$ |
| Single pulse avalanche energy <sup>b</sup>                | $E_{AS}$         | 230                               | mJ                  |
| Repetitive avalanche current <sup>a</sup>                 | $I_{AR}$         | 5.0                               | A                   |
| Repetitive avalanche energy <sup>a</sup>                  | $E_{AR}$         | 7.4                               | mJ                  |
| Maximum power dissipation                                 | $P_D$            | 74                                | W                   |
| Peak diode recovery $dV/dt$ <sup>c</sup>                  | $dV/dt$          | 5.3                               | V/ns                |
| Operating junction and storage temperature range          | $T_J, T_{stg}$   | -55 to +150                       | $^\circ\text{C}$    |
| 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)
- Starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 18\text{ mH}$ ,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 5.0\text{ A}$  (see fig. 12)
- $I_{SD} \leq 5.0\text{ A}$ ,  $dI/dt \leq 370\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150\text{ }^\circ\text{C}$
- 1.6 mm from case

**THERMAL RESISTANCE RATINGS**

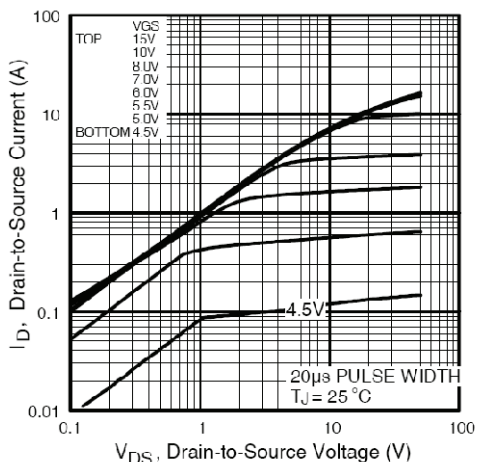
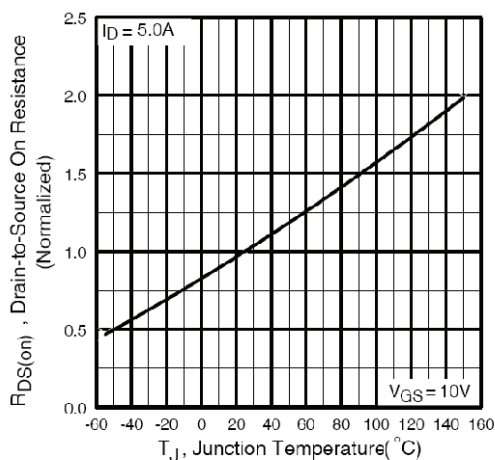
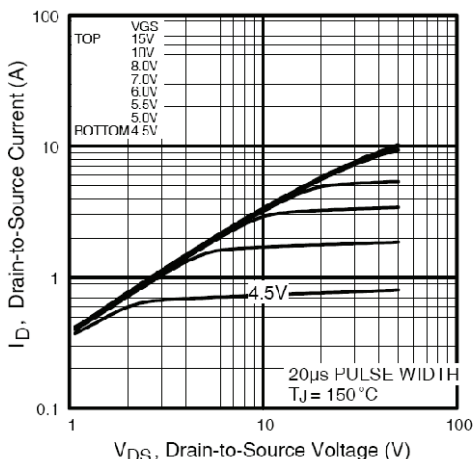
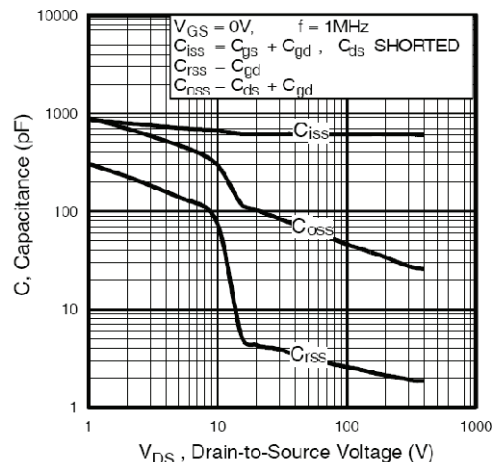
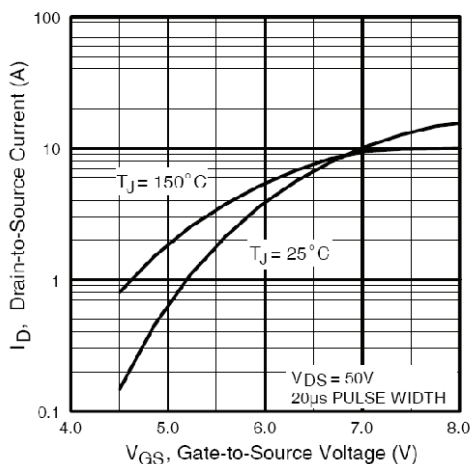
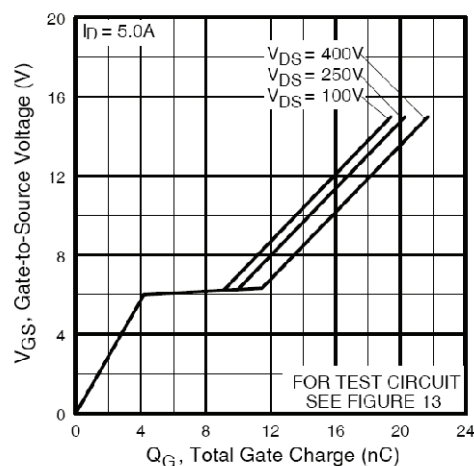
| PARAMETER                           | SYMBOL     | TYP. | MAX. | UNIT |
|-------------------------------------|------------|------|------|------|
| Maximum junction-to-ambient         | $R_{thJA}$ | -    | 62   | °C/W |
| Case-to-sink, flat, greased surface | $R_{thCS}$ | 0.50 | -    |      |
| Maximum junction-to-case (drain)    | $R_{thJC}$ | -    | 1.7  |      |

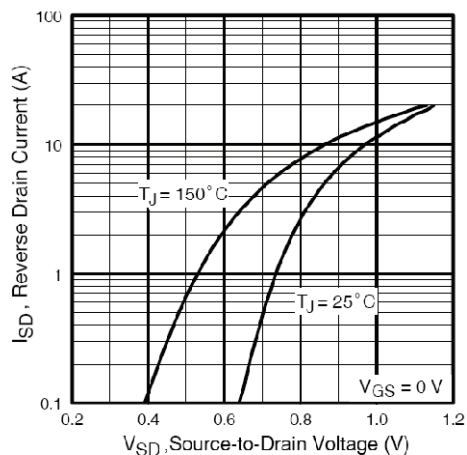
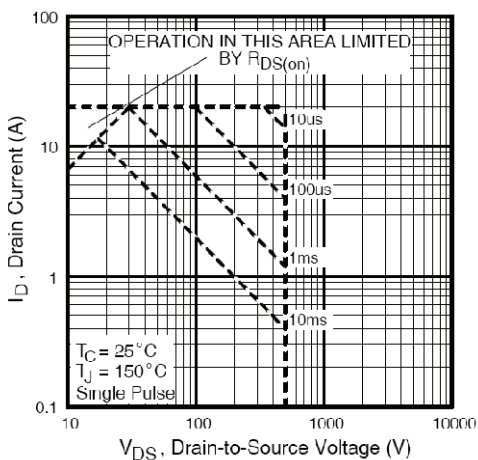
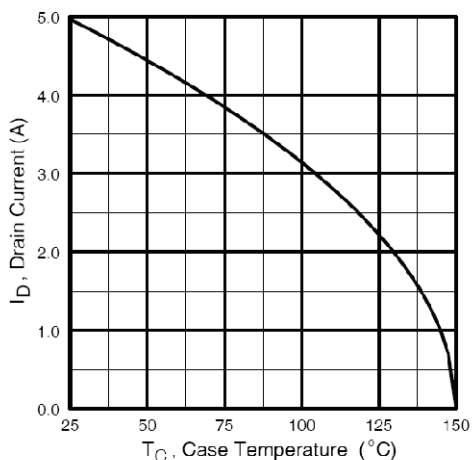
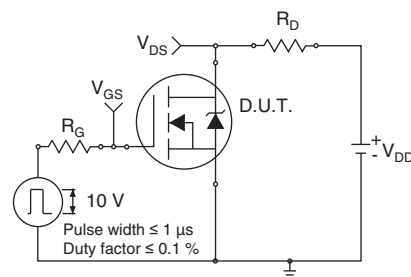
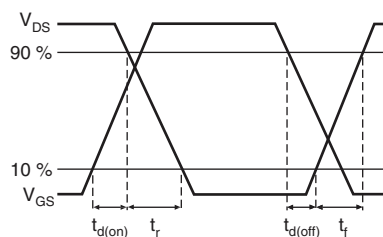
**SPECIFICATIONS** ( $T_J = 25\text{ °C}$ , unless otherwise noted)

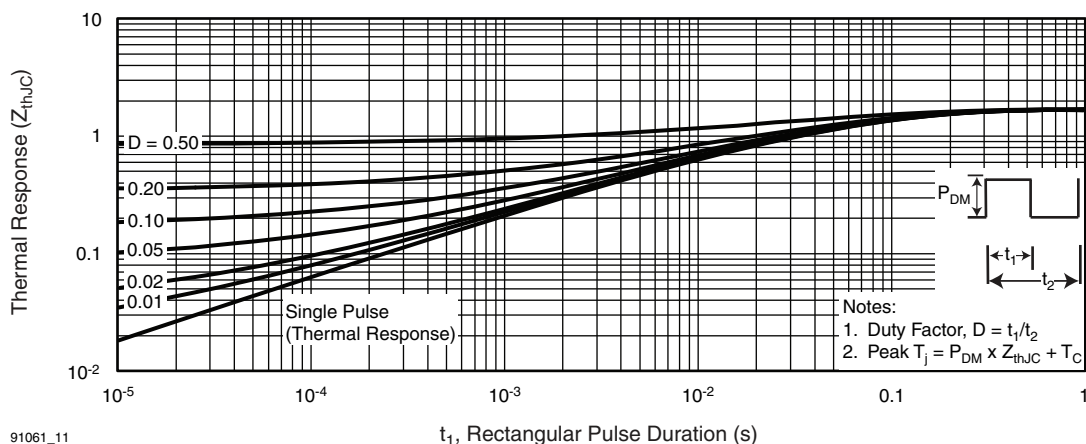
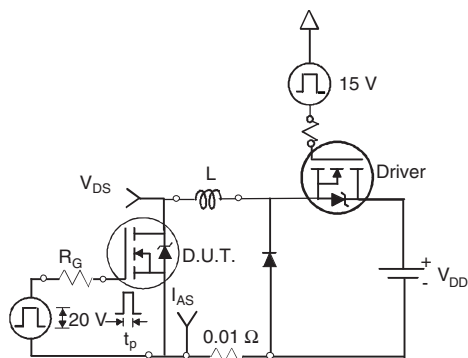
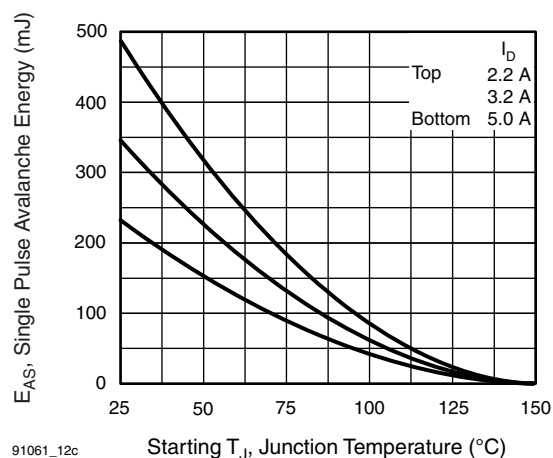
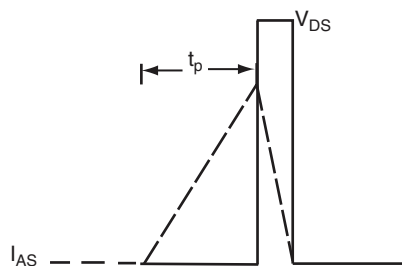
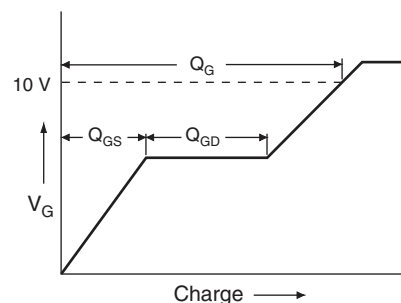
| PARAMETER                                      | SYMBOL                | TEST CONDITIONS                                                                                                                                      | MIN. | TYP. | MAX.      | UNIT          |
|------------------------------------------------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|-----------|---------------|
| <b>Static</b>                                  |                       |                                                                                                                                                      |      |      |           |               |
| Drain-source breakdown voltage                 | $V_{DS}$              | $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$                                                                                               | 500  | -    | -         | V             |
| $V_{DS}$ temperature coefficient               | $\Delta V_{DS}/T_J$   | Reference to $25\text{ °C}$ , $I_D = 1\text{ mA}$                                                                                                    | -    | 0.60 | -         | V/°C          |
| Gate-source threshold voltage                  | $V_{GS(th)}$          | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                                                                                                   | 2.0  | -    | 4.5       | V             |
| Gate-source leakage                            | $I_{GSS}$             | $V_{GS} = \pm 30\text{ V}$                                                                                                                           | -    | -    | $\pm 100$ | nA            |
| Zero gate voltage drain current                | $I_{DSS}$             | $V_{DS} = 500\text{ V}$ , $V_{GS} = 0\text{ V}$                                                                                                      | -    | -    | 25        | $\mu\text{A}$ |
|                                                |                       | $V_{DS} = 400\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125\text{ °C}$                                                                              | -    | -    | 250       |               |
| Drain-source on-state resistance               | $R_{DS(on)}$          | $V_{GS} = 10\text{ V}$ , $I_D = 3.0\text{ A}^b$                                                                                                      | -    | -    | 1.4       | $\Omega$      |
| Forward transconductance                       | $g_{fs}$              | $V_{DS} = 50\text{ V}$ , $I_D = 3.0\text{ A}^b$                                                                                                      | 2.8  | -    | -         | S             |
| <b>Dynamic</b>                                 |                       |                                                                                                                                                      |      |      |           |               |
| Input capacitance                              | $C_{iss}$             | $V_{GS} = 0\text{ V}$ ,<br>$V_{DS} = 25\text{ V}$ ,<br>$f = 1.0\text{ MHz}$ , see fig. 5                                                             | -    | 620  | -         | pF            |
| Output capacitance                             | $C_{oss}$             |                                                                                                                                                      | -    | 93   | -         |               |
| Reverse Transfer capacitance                   | $C_{rss}$             |                                                                                                                                                      | -    | 4.3  | -         |               |
| Output capacitance                             | $C_{oss}$             | $V_{GS} = 0\text{ V}$ ; $V_{DS} = 1.0\text{ V}$ , $f = 1.0\text{ MHz}$                                                                               | -    | 886  | -         |               |
| Output capacitance                             | $C_{oss}$             | $V_{GS} = 0\text{ V}$ ; $V_{DS} = 400\text{ V}$ , $f = 1.0\text{ MHz}$                                                                               | -    | 27   | -         |               |
| Effective output capacitance                   | $C_{oss\text{ eff.}}$ | $V_{GS} = 0\text{ V}$ ; $V_{DS} = 0\text{ V to } 400\text{ V}^c$                                                                                     | -    | 39   | -         |               |
| Total gate charge                              | $Q_g$                 | $V_{GS} = 10\text{ V}$ , $I_D = 5.0\text{ A}$ , $V_{DS} = 400\text{ V}$ ,<br>see fig. 6 and 13 <sup>b</sup>                                          | -    | -    | 24        | nC            |
| Gate-source charge                             | $Q_{gs}$              |                                                                                                                                                      | -    | -    | 6.3       |               |
| Gate-drain charge                              | $Q_{gd}$              |                                                                                                                                                      | -    | -    | 11        |               |
| Turn-on delay time                             | $t_{d(on)}$           | $V_{DD} = 250\text{ V}$ , $I_D = 5.0\text{ A}$ ,<br>$R_g = 14\text{ }\Omega$ , $R_D = 49\text{ }\Omega$ , see fig. 10 <sup>b</sup>                   | -    | 10   | -         | ns            |
| Rise time                                      | $t_r$                 |                                                                                                                                                      | -    | 21   | -         |               |
| Turn-off delay time                            | $t_{d(off)}$          |                                                                                                                                                      | -    | 21   | -         |               |
| Fall time                                      | $t_f$                 |                                                                                                                                                      | -    | 15   | -         |               |
| Gate input resistance                          | $R_g$                 | $f = 1\text{ MHz}$ , open drain                                                                                                                      | 1.7  | -    | 10.7      | $\Omega$      |
| <b>Drain-Source Body Diode Characteristics</b> |                       |                                                                                                                                                      |      |      |           |               |
| Continuous source-drain diode current          | $I_S$                 | MOSFET symbol showing the integral reverse p - n junction diode  | -    | -    | 5.0       | A             |
| Pulsed diode forward current <sup>a</sup>      | $I_{SM}$              |                                                                                                                                                      | -    | -    | 20        |               |
| Body diode voltage                             | $V_{SD}$              | $T_J = 25\text{ °C}$ , $I_S = 5.0\text{ A}$ , $V_{GS} = 0\text{ V}^b$                                                                                | -    | -    | 1.5       | V             |
| Body diode reverse recovery time               | $t_{rr}$              | $T_J = 25\text{ °C}$ , $I_F = 5.0\text{ A}$ , $dI/dt = 100\text{ A}/\mu\text{s}^b$                                                                   | -    | 430  | 650       | ns            |
| Body diode reverse recovery charge             | $Q_{rr}$              |                                                                                                                                                      | -    | 1.62 | 2.4       | $\mu\text{C}$ |
| Forward turn-on time                           | $t_{on}$              | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$ and $L_D$ )                                                                      |      |      |           |               |

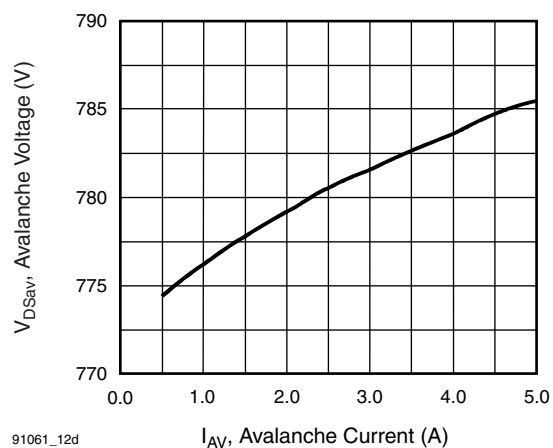
**Notes**

- 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.  $C_{oss\text{ eff.}}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DS}$

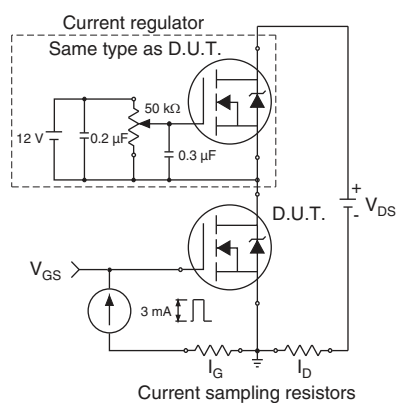
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Fig. 1 - Typical Output Characteristics**

**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 - 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. 10a - Switching Time Test Circuit**

**Fig. 10b - Switching Time Waveforms**

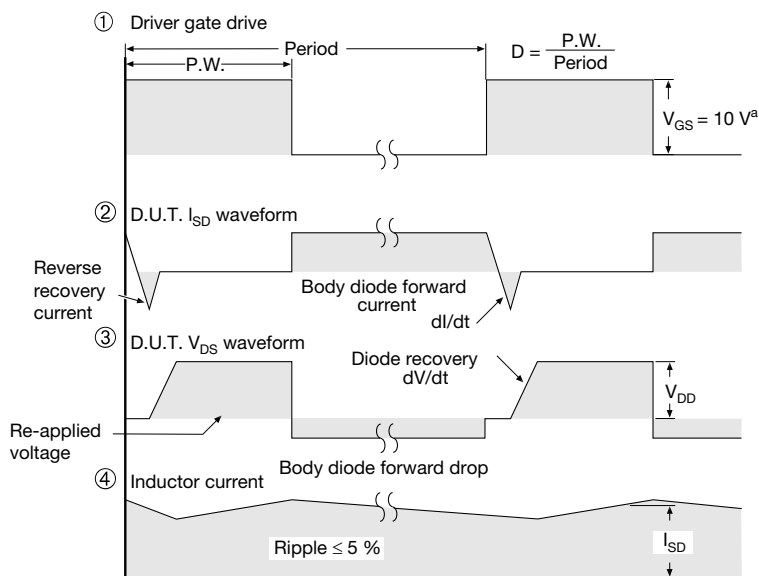
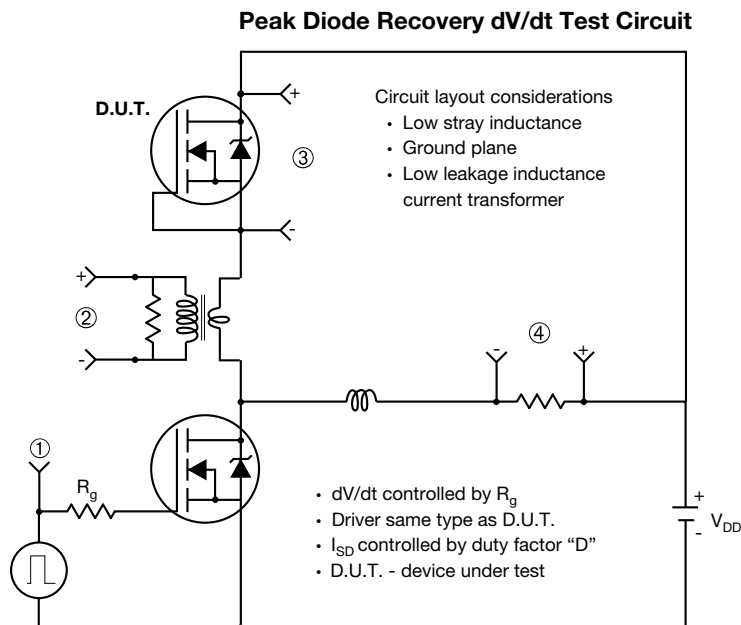

**Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case**

**Fig. 12a - Unclamped Inductive Test Circuit**

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

**Fig. 12b - Unclamped Inductive Waveforms**

**Fig. 12d - Basic Gate Charge Waveform**



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



**Fig. 13b - Gate Charge Test Circuit**


**Note**

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

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

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