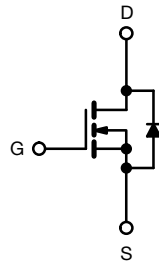
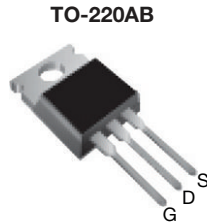




**THE DATASHEET OF  
SIHP25N60EFL-GE3**



## E Series Power MOSFET With Fast Body Diode and Low Gate Charge



N-Channel MOSFET

**FEATURES**

- Reduced figure-of-merit (FOM):  $R_{on} \times Q_g$
- Fast body diode MOSFET using E series technology
- Reduced  $t_{rr}$ ,  $Q_{rr}$ , and  $I_{RRM}$
- Increased robustness due to low  $Q_{rr}$
- Low input capacitance ( $C_{iss}$ )
- Reduced switching and conduction losses
- Avalanche energy rated (UIS)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



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

| PRODUCT SUMMARY                         |                 |       |
|---|-----------------|-------|
| $V_{DS}$ (V) at $T_J$ max.              | 650             |       |
| $R_{DS(on)}$ typ. ( $\Omega$ ) at 25 °C | $V_{GS} = 10$ V | 0.127 |
| $Q_g$ (Max.) (nC)                       | 75              |       |
| $Q_{gs}$ (nC)                           | 17              |       |
| $Q_{gd}$ (nC)                           | 19              |       |
| Configuration                           | Single          |       |

**APPLICATIONS**

- Telecommunications
  - Server and telecom power supplies
- Computing
  - ATX power supplies
- Industrial
  - Welding
  - Induction heating
  - Battery chargers
  - Uninterruptible power supplies (UPS)
- Renewable energy
  - String PV inverters

| ORDERING INFORMATION            |                               |
|---------------------------------|-------------------------------|
| Package                         | TO-220AB                      |
| Lead (Pb)-free and halogen-free | SiHP25N60EFL-BE3 <sup>a</sup> |
|                                 | SiHP25N60EFL-GE3              |

**Note**

- a. "-BE3" denotes alternate manufacturing location

| ABSOLUTE MAXIMUM RATINGS ( $T_C = 25$ °C, unless otherwise noted) |                  |                |             |      |
|---|------------------|----------------|-------------|------|
| PARAMETER   | SYMBOL           |                | LIMIT       | UNIT |
| Drain-source voltage  | $V_{DS}$         |                | 600         | V    |
| Gate-source voltage   | $V_{GS}$         |                | $\pm 30$    |      |
| Continuous drain current ( $T_J = 150$ °C)                        | $V_{GS}$ at 10 V | $T_C = 25$ °C  | 25          | A    |
|   |                  | $T_C = 100$ °C | 16          |      |
| Pulsed drain current <sup>a</sup>                                 | $I_{DM}$         |                | 61          |      |
| Linear derating factor  |                  |                | 2           | W/°C |
| Single pulse avalanche energy <sup>b</sup>                        | $E_{AS}$         |                | 353         | mJ   |
| Maximum power dissipation   | $P_D$            |                | 250         | W    |
| Operating junction and storage temperature range                  | $T_J, T_{stg}$   |                | -55 to +150 | °C   |
| Drain-source voltage slope  | $T_J = 125$ °C   |                | 70          | V/ns |
| Reverse diode dV/dt <sup>d</sup>                                  | $dV/dt$          |                | 15          |      |
| Soldering recommendations (peak temperature) <sup>c</sup>         | For 10 s         |                | 300         | °C   |


**Notes**

- a. Repetitive rating; pulse width limited by maximum junction temperature  
 b.  $V_{DD} = 140$  V, starting  $T_J = 25$  °C,  $L = 28.2$  mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 5$  A  
 c. 1.6 mm from case



d.  $I_{SD} \leq I_D$ ,  $di/dt = 100 \text{ A}/\mu\text{s}$ , starting  $T_J = 25 \text{ }^\circ\text{C}$

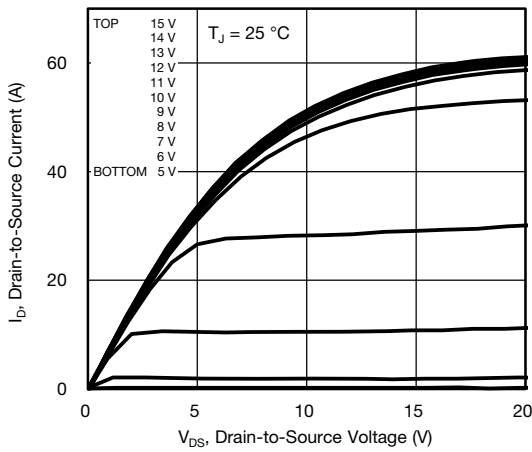
| THERMAL RESISTANCE RATINGS       |            |      |      |                           |
|----------------------------------|------------|------|------|---------------------------|
| PARAMETER                        | SYMBOL     | TYP. | MAX. | UNIT                      |
| Maximum junction-to-ambient      | $R_{thJA}$ | -    | 62   | $^\circ\text{C}/\text{W}$ |
| Maximum junction-to-case (drain) | $R_{thJC}$ | -    | 0.5  |                           |

| 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   | $V_{DS}$            | $V_{GS} = 0 \text{ V}$ , $I_D = 250 \mu\text{A}$  |   | 600  | -     | -         | V                         |
| $V_{DS}$ temperature coefficient   | $\Delta V_{DS}/T_J$ | Reference to $25 \text{ }^\circ\text{C}$ , $I_D = 10 \text{ mA}$  |   | -    | 0.69  | -         | $\text{V}/^\circ\text{C}$ |
| Gate-source threshold Voltage (N)  | $V_{GS(th)}$        | $V_{DS} = V_{GS}$ , $I_D = 250 \mu\text{A}$   |   | 3.0  | -     | 5.0       | V                         |
| Gate-source leakage  | $I_{GSS}$           | $V_{GS} = \pm 20 \text{ V}$   |   | -    | -     | $\pm 100$ | nA                        |
|  |                     | $V_{GS} = \pm 30 \text{ V}$   |   | -    | -     | $\pm 1$   | $\mu\text{A}$             |
| Zero gate voltage drain current  | $I_{DSS}$           | $V_{DS} = 480 \text{ V}$ , $V_{GS} = 0 \text{ V}$   |   | -    | -     | 1         | $\mu\text{A}$             |
|  |                     | $V_{DS} = 480 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $T_J = 125 \text{ }^\circ\text{C}$  |   | -    | -     | 500       |                           |
| Drain-source on-state resistance   | $R_{DS(on)}$        | $V_{GS} = 10 \text{ V}$   | $I_D = 12.5 \text{ A}$                            | -    | 0.127 | 0.146     | $\Omega$                  |
| Forward transconductance   | $g_{fs}$            | $V_{DS} = 30 \text{ V}$ , $I_D = 12.5 \text{ A}$  |   | -    | 11.3  | -         | S                         |
| <b>Dynamic</b>   |                     |   |   |      |       |           |                           |
| Input capacitance  | $C_{iss}$           | $V_{GS} = 0 \text{ V}$ ,<br>$V_{DS} = 100 \text{ V}$ ,<br>$f = 1 \text{ MHz}$   |   | -    | 2274  | -         | pF                        |
| Output capacitance   | $C_{oss}$           |   |   | -    | 137   | -         |                           |
| Reverse transfer capacitance   | $C_{rss}$           |   |   | -    | 4     | -         |                           |
| Effective output capacitance, energy related <sup>a</sup>                    | $C_{o(er)}$         |   |   | -    | 79    | -         |                           |
| Effective output capacitance, time related <sup>b</sup>                      | $C_{o(tr)}$         | $V_{DS} = 0 \text{ V to } 480 \text{ V}$ , $V_{GS} = 0 \text{ V}$   |   | -    | 330   | -         |                           |
| Total gate charge  | $Q_g$               | $V_{GS} = 10 \text{ V}$   | $I_D = 12.5 \text{ A}$ , $V_{DS} = 480 \text{ V}$ | -    | 50    | 75        | nC                        |
| Gate-source charge   | $Q_{gs}$            |   |   | -    | 17    | -         |                           |
| Gate-drain charge  | $Q_{gd}$            |   |   | -    | 19    | -         |                           |
| Turn-on delay time   | $t_{d(on)}$         | $V_{DD} = 480 \text{ V}$ , $I_D = 12.5 \text{ A}$ ,<br>$R_g = 9.1 \Omega$ , $V_{GS} = 10 \text{ V}$   |   | -    | 25    | 50        | ns                        |
| Rise time  | $t_r$               |   |   | -    | 39    | 68        |                           |
| Turn-off delay time  | $t_{d(off)}$        |   |   | -    | 47    | 94        |                           |
| Fall time  | $t_f$               |   |   | -    | 21    | 42        |                           |
| Gate input resistance  | $R_g$               | $f = 1 \text{ MHz}$ , open drain  |   | 0.4  | 0.7   | 1.4       | $\Omega$                  |
| <b>Drain-Source Body Diode Characteristics</b>                               |                     |   |   |      |       |           |                           |
| Continuous source-drain diode current  | $I_S$               | MOSFET symbol showing the integral reverse p - n junction diode  | -   | -    | 25    | A         |                           |
| Pulsed diode forward current   | $I_{SM}$            |   | -   | -    | 61    |           |                           |
| Diode forward voltage  | $V_{SD}$            | $T_J = 25 \text{ }^\circ\text{C}$ , $I_S = 12.5 \text{ A}$ , $V_{GS} = 0 \text{ V}$   |   | -    | 0.9   | 1.2       | V                         |
| Reverse recovery time  | $t_{rr}$            | $T_J = 25 \text{ }^\circ\text{C}$ , $I_F = I_S = 12.5 \text{ A}$ ,<br>$di/dt = 100 \text{ A}/\mu\text{s}$ , $V_R = 25 \text{ V}$                      |   | -    | 138   | 276       | ns                        |
| Reverse recovery charge  | $Q_{rr}$            |   |   | -    | 0.8   | 1.6       | $\mu\text{C}$             |
| Reverse recovery current   | $I_{RRM}$           |   |   | -    | 11    | -         | A                         |

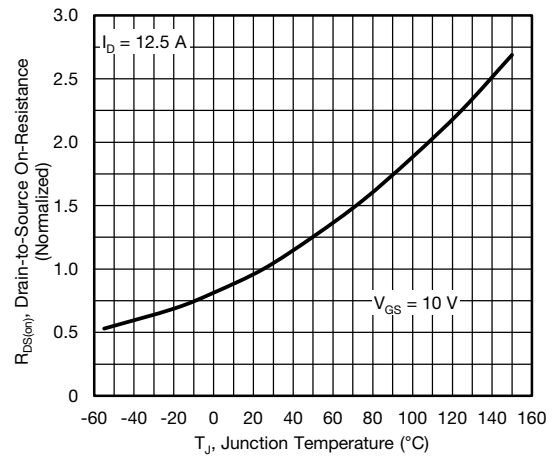
**Notes**

- a.  $C_{oss(er)}$  is a fixed capacitance that gives the same energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DSS}$
- b.  $C_{oss(tr)}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DSS}$

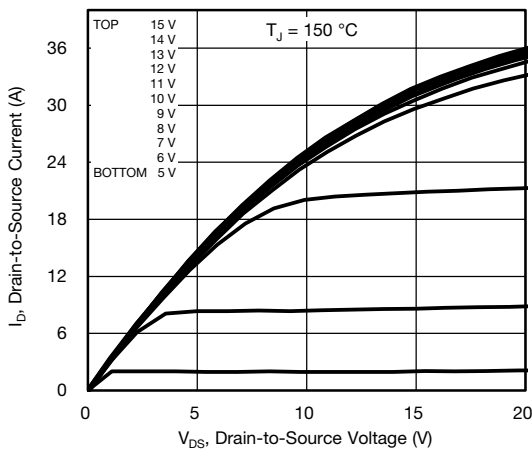
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



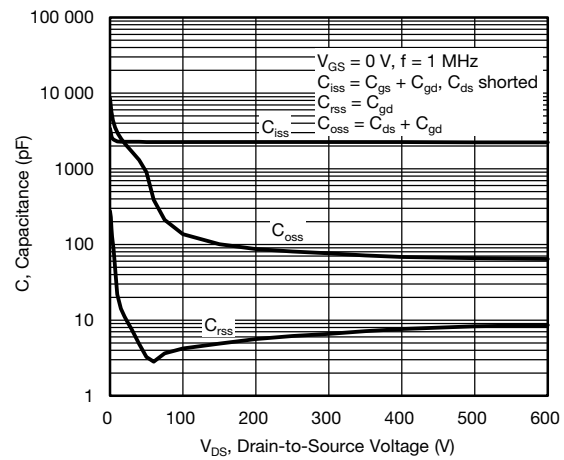
**Fig. 1 - Typical Output Characteristics**



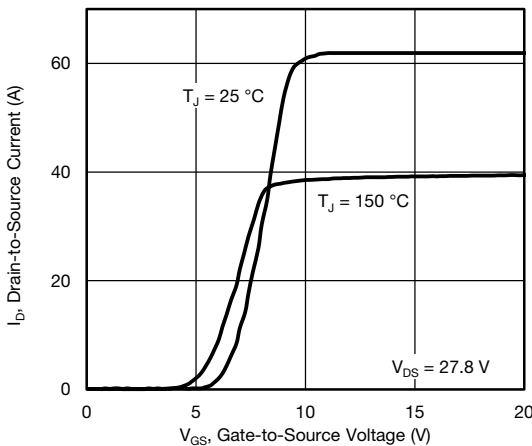
**Fig. 4 - Normalized On-Resistance vs. Temperature**



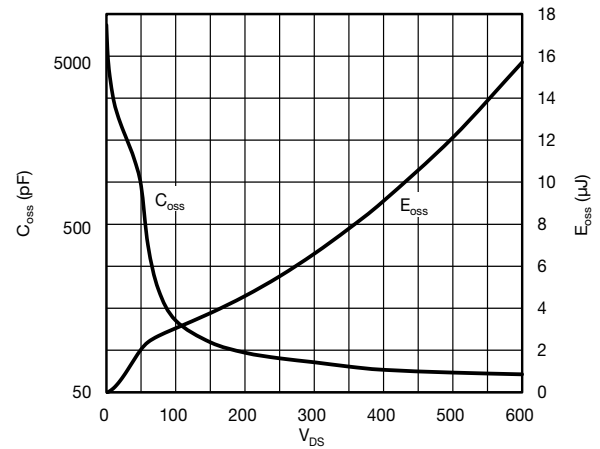
**Fig. 2 - Typical Output Characteristics**



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



**Fig. 3 - Typical Transfer Characteristics**



**Fig. 6 - Coss and Eoss vs. Vds**

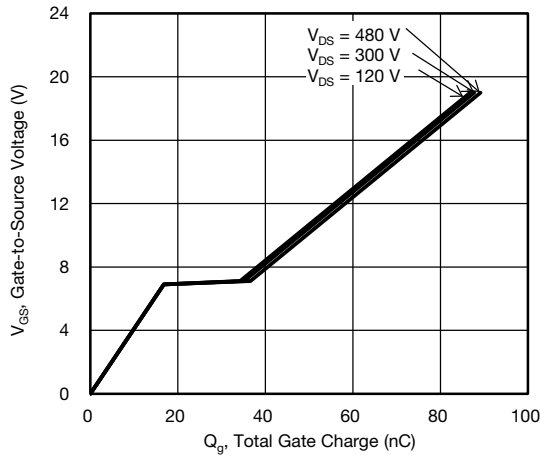


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

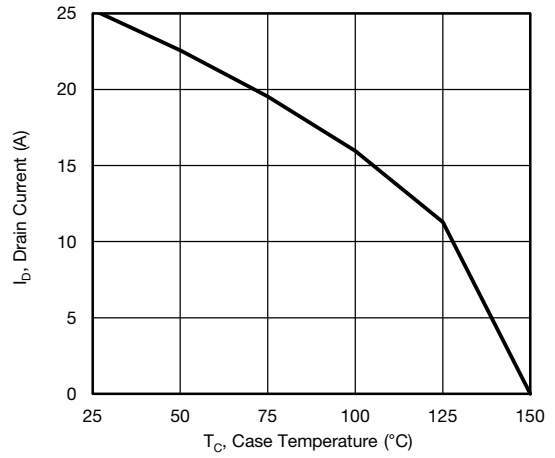


Fig. 10 - Maximum Drain Current vs. Case Temperature

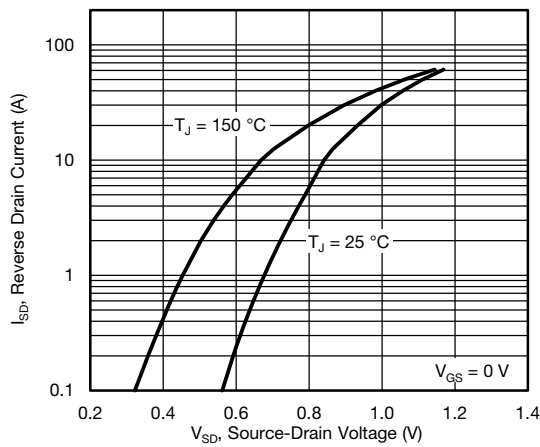


Fig. 8 - Typical Source-Drain Diode Forward Voltage

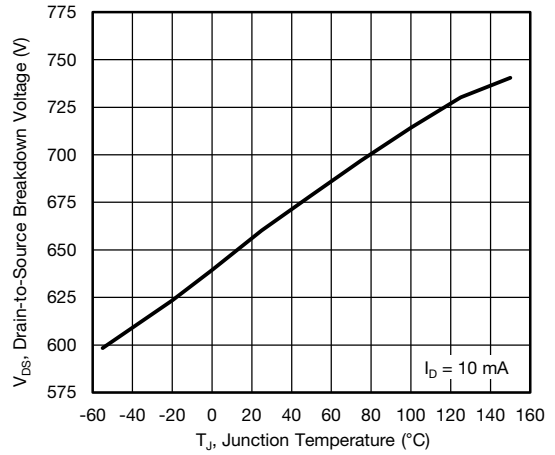


Fig. 11 - Typical Drain-to-Source Voltage vs. Temperature

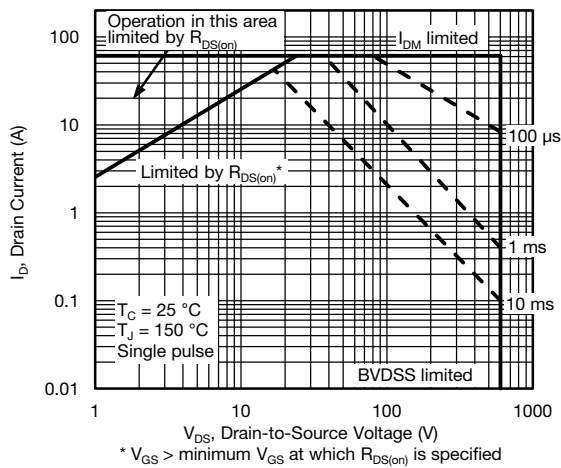


Fig. 9 - Maximum Safe Operating Area

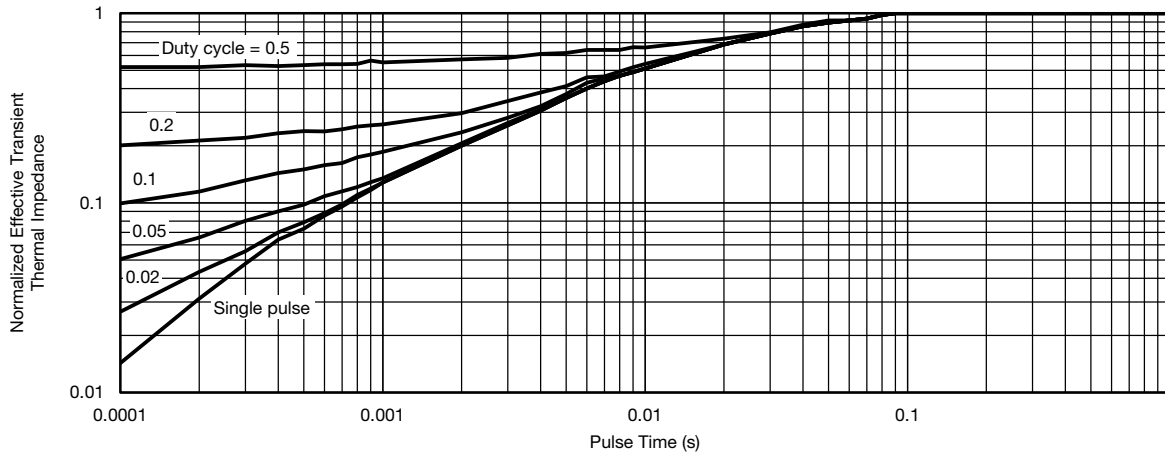


Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case

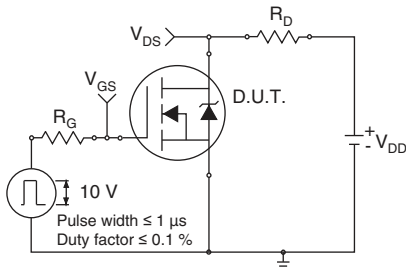


Fig. 13 - Switching Time Test Circuit

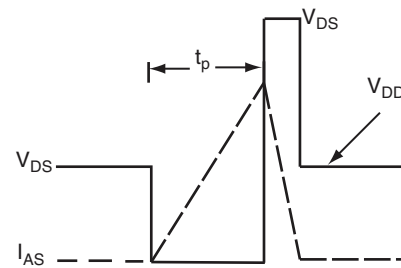


Fig. 16 - Unclamped Inductive Waveforms

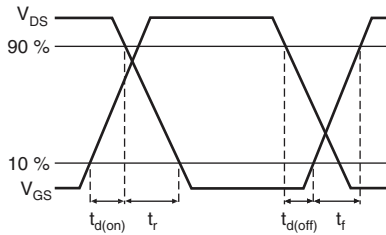


Fig. 14 - Switching Time Waveforms

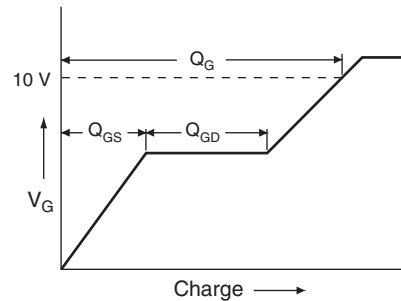


Fig. 17 - Basic Gate Charge Waveform

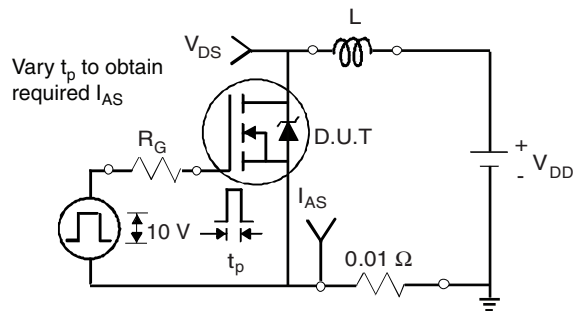


Fig. 15 - Unclamped Inductive Test Circuit

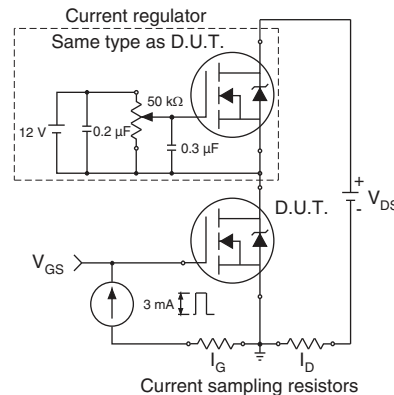
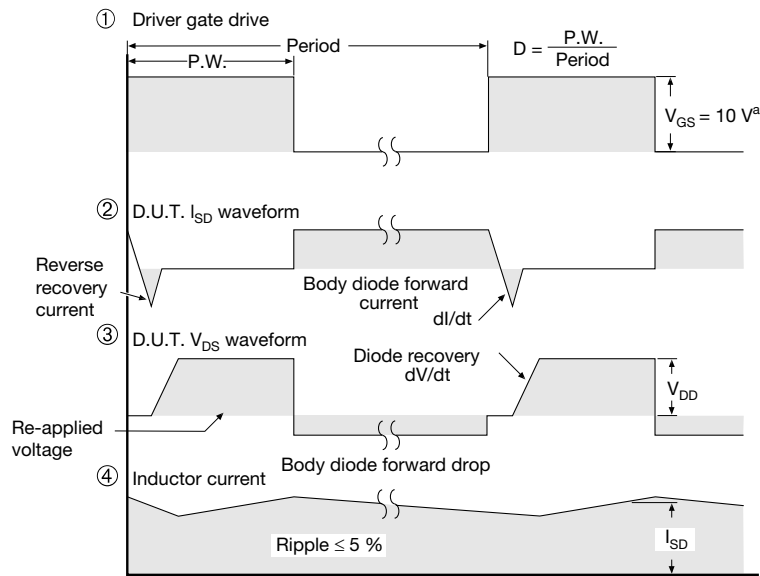
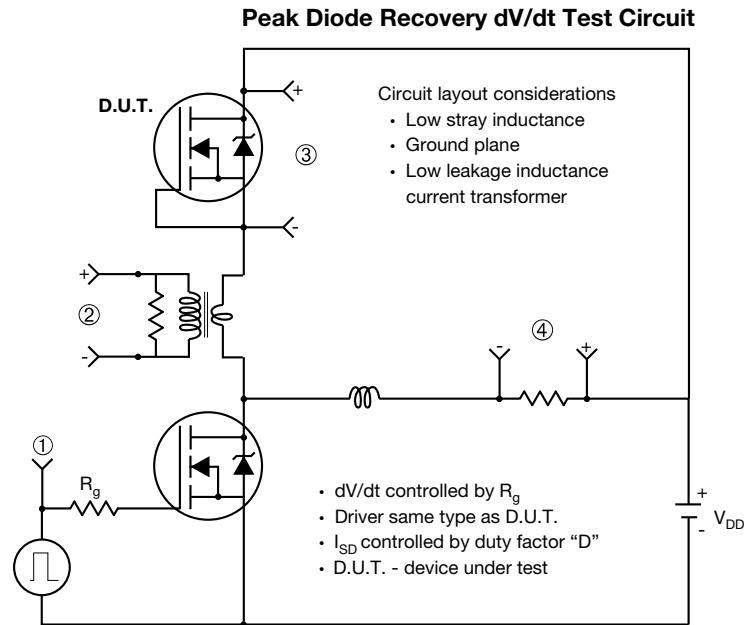


Fig. 18 - Gate Charge Test Circuit



**Note**

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

**Fig. 19 - For N-Channel**

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