

## E Series Power MOSFET

PRODUCT SUMMARY	
$V_{DS}$ (V) at $T_J$ max.	700
$R_{DS(on)}$ ( $\Omega$ ) typ. at 25 °C	$V_{GS} = 10\text{ V}$   0.025
$Q_g$ (nC) max.	591
$Q_{gs}$ (nC)	84
$Q_{gd}$ (nC)	160
Configuration	Single

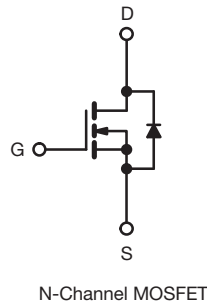
### FEATURES

- Low figure-of-merit (FOM)  $R_{on} \times Q_g$
- Low input capacitance ( $C_{iss}$ )
- Reduced switching and conduction losses
- Ultra low gate charge ( $Q_g$ )
- 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

### APPLICATIONS

- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- Lighting
  - High-intensity discharge (HID)
  - Fluorescent ballast lighting
- Industrial
  - Welding
  - Induction heating
  - Motor drives
  - Battery chargers
  - Renewable energy
  - Solar (PV inverters)



ORDERING INFORMATION	
Package	Super-247
Lead (Pb)-free	SiHS90N65E-E3


ABSOLUTE MAXIMUM RATINGS ( $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	$V_{DS}$	650	V
Gate-Source Voltage	$V_{GS}$	$\pm 30$	
Continuous Drain Current ( $T_J = 150\text{ }^\circ\text{C}$ )	$V_{GS}$ at 10 V	$T_C = 25\text{ }^\circ\text{C}$	A
		$T_C = 100\text{ }^\circ\text{C}$	
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	323	
Linear Derating Factor		5	W/ $^\circ\text{C}$
Single Pulse Avalanche Energy <sup>b</sup>	$E_{AS}$	1930	mJ
Maximum Power Dissipation	$P_D$	625	W
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$
Drain-Source Voltage Slope	$dV/dt$	$T_J = 125\text{ }^\circ\text{C}$	V/ns
Reverse Diode $dV/dt$ <sup>d</sup>			
Soldering Recommendations (Peak Temperature) <sup>c</sup>	for 10 s	300	$^\circ\text{C}$

### Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 140\text{ V}$ , starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 28.2\text{ mH}$ ,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 11.7\text{ A}$ .
- 1.6 mm from case.
- $I_{SD} \leq I_D$ ,  $dI/dt = 100\text{ A}/\mu\text{s}$ , starting  $T_J = 25\text{ }^\circ\text{C}$ .



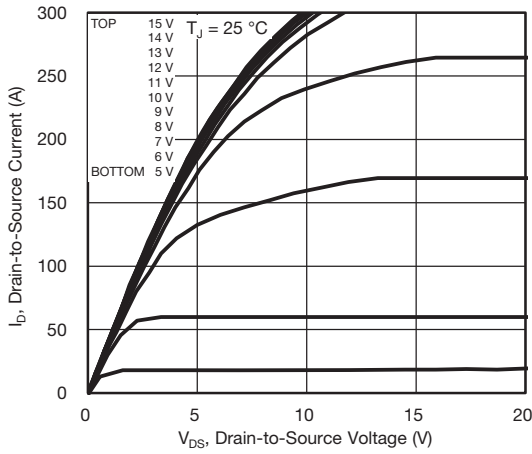
THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	$R_{thJA}$	-	40	°C/W
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	0.2	

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	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		650	-	-	V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}, I_D = 1\text{ mA}$		-	0.83	-	V/°C
Gate Threshold Voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$		2.0	-	4.0	V
Gate-Source Leakage	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}$		-	-	$\pm 100$	nA
		$V_{GS} = \pm 30\text{ V}$		-	-	$\pm 1$	$\mu\text{A}$
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$		-	-	1	$\mu\text{A}$
		$V_{DS} = 520\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	25	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 45\text{ A}$	-	0.025	0.029	$\Omega$
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 30\text{ V}, I_D = 45\text{ A}$		-	32	-	S
<b>Dynamic</b>							
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = 100\text{ V}, f = 300\text{ kHz}$		-	11 826	-	pF
Output Capacitance	$C_{oss}$			-	528	-	
Reverse Transfer Capacitance	$C_{rss}$			-	9	-	
Effective Output Capacitance, Energy Related <sup>a</sup>	$C_{o(er)}$	$V_{GS} = 0\text{ V}, V_{DS} = 0\text{ V to } 520\text{ V}$		-	384	-	pF
Effective Output Capacitance, Time Related <sup>b</sup>	$C_{o(tr)}$			-	1502	-	
Total Gate Charge	$Q_g$	$V_{GS} = 10\text{ V}$	$I_D = 45\text{ A}, V_{DS} = 520\text{ V}$	-	394	591	nC
Gate-Source Charge	$Q_{gs}$			-	84	-	
Gate-Drain Charge	$Q_{gd}$			-	160	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 520\text{ V}, I_D = 45\text{ A}, V_{GS} = 10\text{ V}, R_g = 9.1\text{ }\Omega$		-	85	128	ns
Rise Time	$t_r$			-	152	228	
Turn-Off Delay Time	$t_{d(off)}$			-	323	485	
Fall Time	$t_f$			-	267	401	
Gate Input Resistance	$R_g$	$f = 1\text{ MHz}, \text{open drain}$		0.6	1.2	2.4	$\Omega$
<b>Drain-Source Body Diode Characteristics</b>							
Continuous Source-Drain Diode Current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	87	A
Pulsed Diode Forward Current	$I_{SM}$			-	-	323	
Diode Forward Voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}, I_S = 45\text{ A}, V_{GS} = 0\text{ V}$		-	0.9	1.2	V
Reverse Recovery Time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}, I_F = I_S = 45\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, V_R = 25\text{ V}$		-	971	1942	ns
Reverse Recovery Charge	$Q_{rr}$			-	26	52	$\mu\text{C}$
Reverse Recovery Current	$I_{RRM}$			-	42	-	A

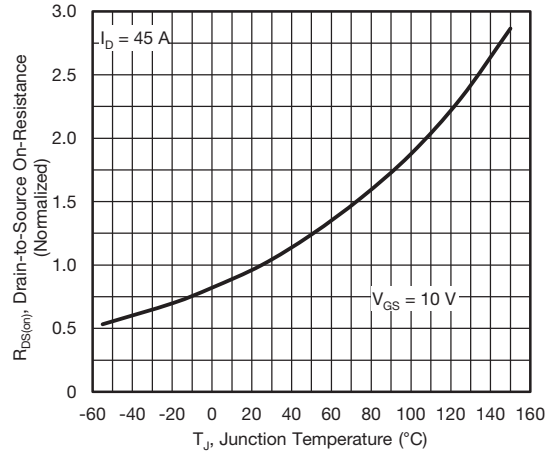
**Notes**

- 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 %  $V_{DS}$ .
- 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 %  $V_{DS}$ .

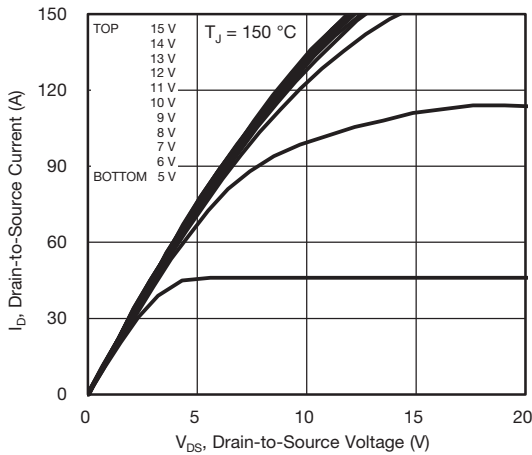
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



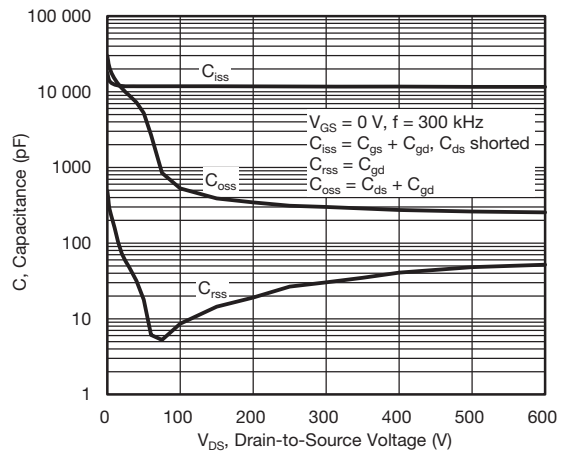
**Fig. 1 - Typical Output Characteristics**



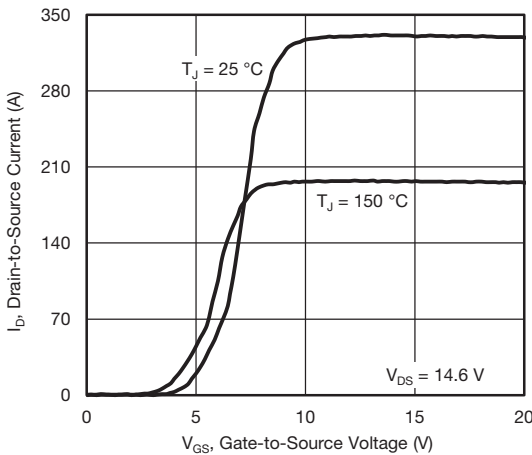
**Fig. 4 - Normalized On-Resistance vs. Temperature**



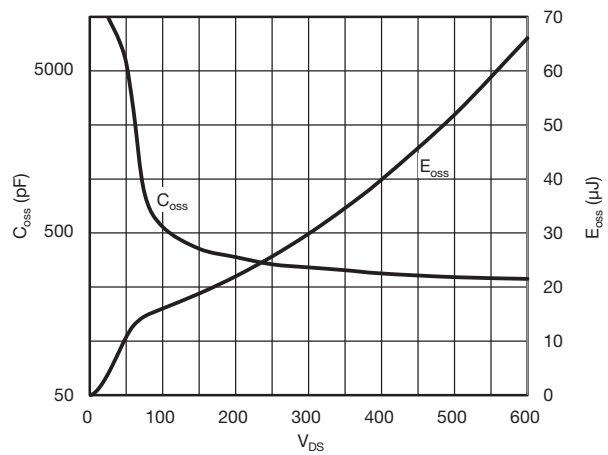
**Fig. 2 - Typical Output Characteristics**



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



**Fig. 3 - Typical Transfer Characteristics**



**Fig. 6 -  $C_{oss}$  and  $E_{oss}$  vs.  $V_{DS}$**

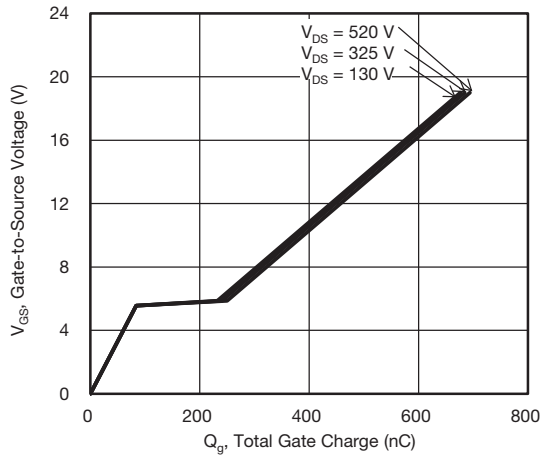


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

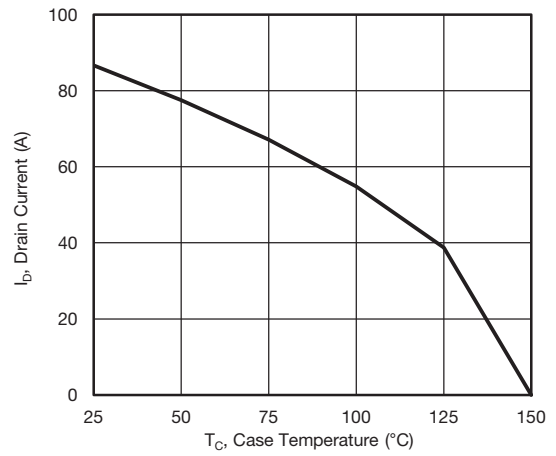


Fig. 10 - Maximum Drain Current vs. Case Temperature

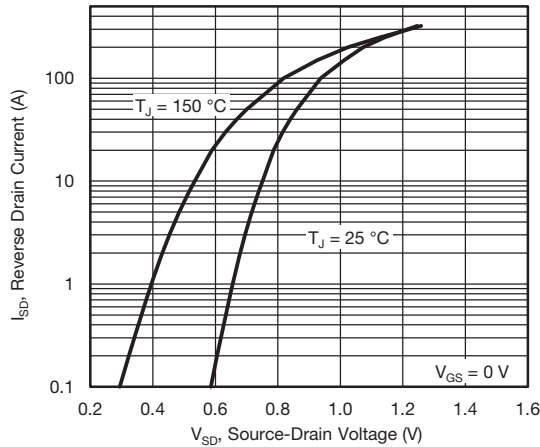


Fig. 8 - Typical Source-Drain Diode Forward Voltage

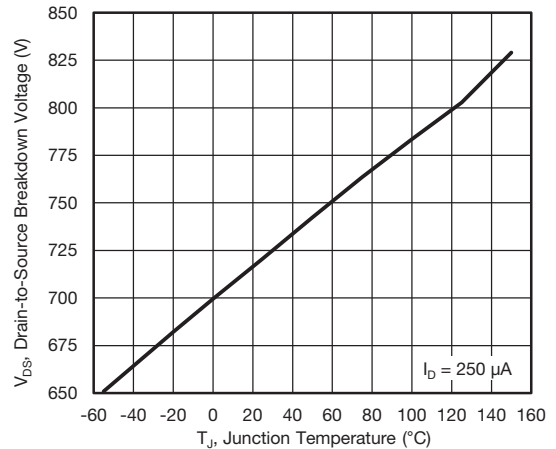


Fig. 11 - Temperature vs. Drain-to-Source Voltage

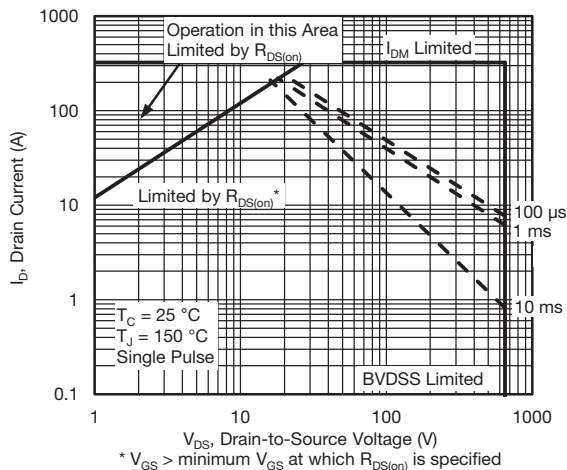


Fig. 9 - Maximum Safe Operating Area

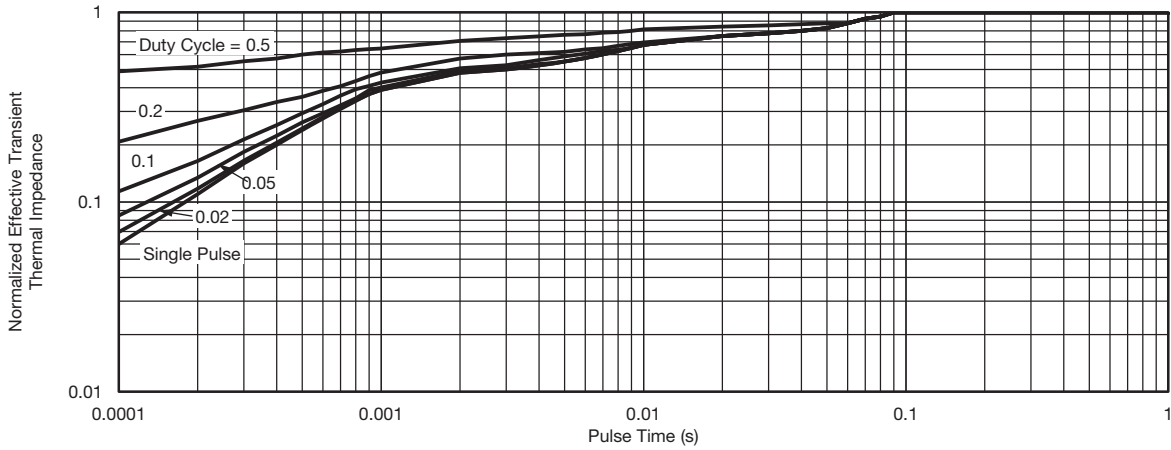


Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case

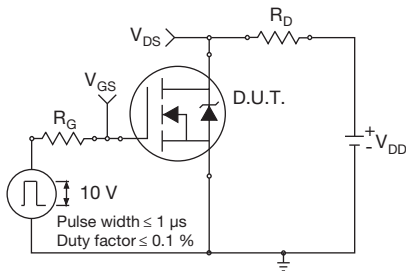


Fig. 13 - Switching Time Test Circuit

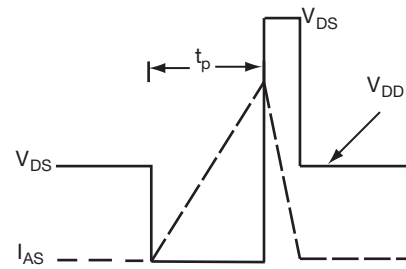


Fig. 16 - Unclamped Inductive Waveforms

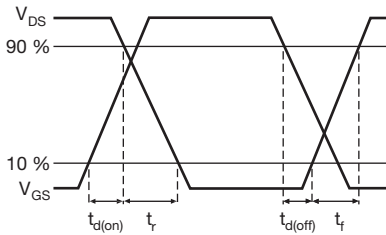


Fig. 14 - Switching Time Waveforms

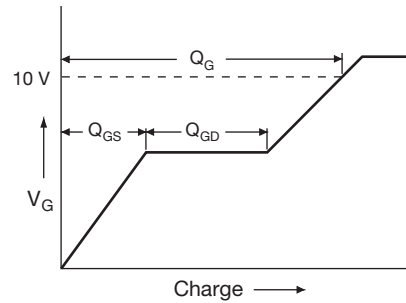


Fig. 17 - Basic Gate Charge Waveform

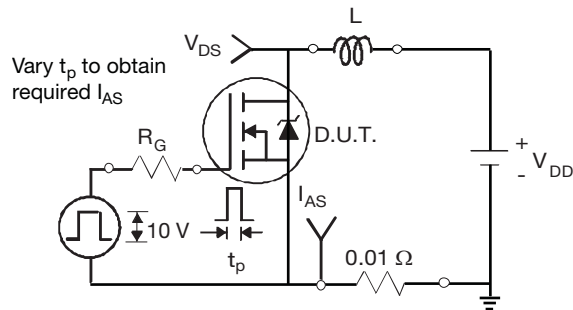


Fig. 15 - Unclamped Inductive Test Circuit

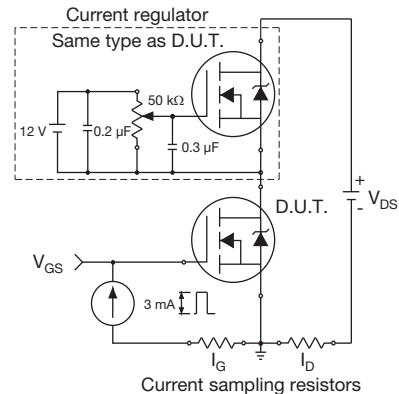
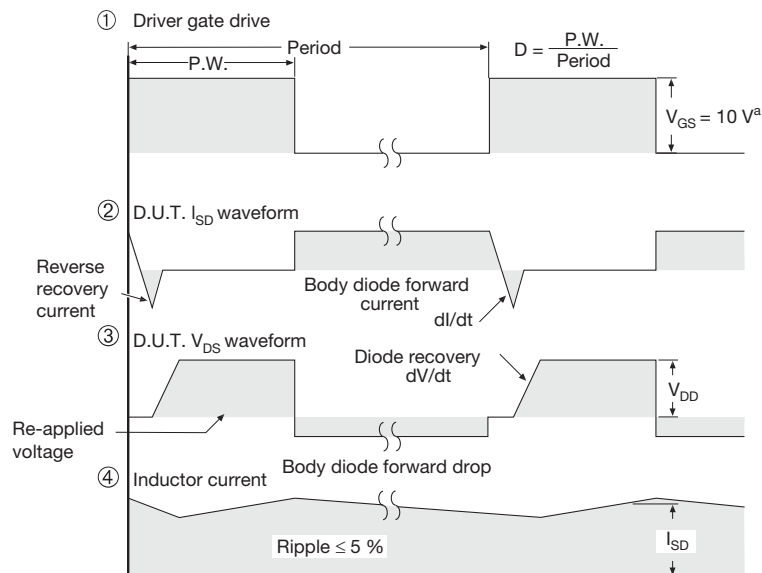
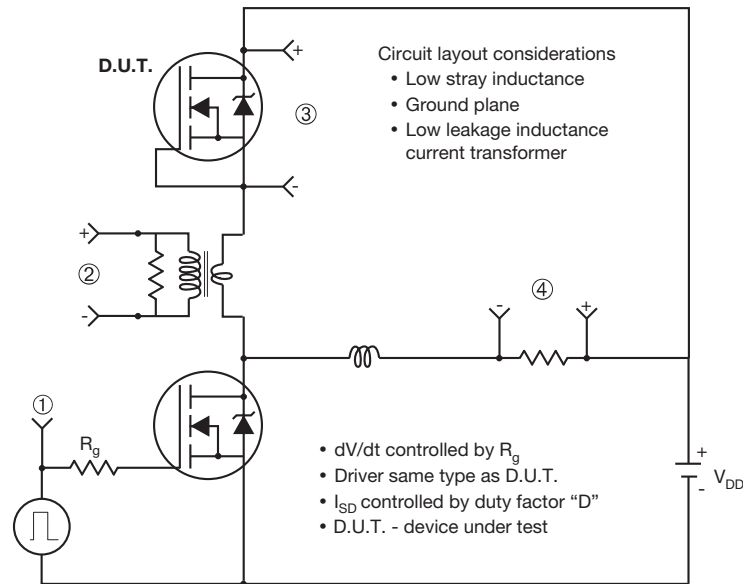


Fig. 18 - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



Note

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

Fig. 19 - For N-Channel

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