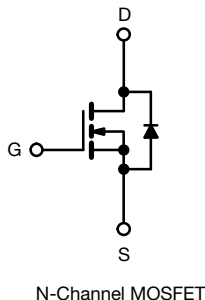
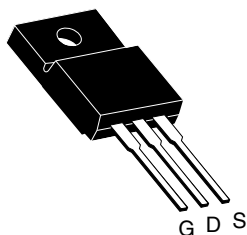


Power MOSFET

PRODUCT SUMMARY

V_{DS} (V)	600	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10\text{ V}$	0.75
Q_g max. (nC)	49	
Q_{gs} (nC)	13	
Q_{gd} (nC)	20	
Configuration	Single	

TO-220 FULLPAK



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
- Material categorization: for definitions of compliance please see 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)
- Uninterruptible power supply
- High speed power switching
- High voltage isolation = 2.5 kV_{RMS} (t = 60 s, f = 60 Hz)

TYPICAL SMPS TOPOLOGIES

- Single transistor forward
- Active clamped forward

ORDERING INFORMATION

Package	TO-220 FULLPAK
Lead (Pb)-free	IRFIB6N60APbF
	SiHFIB6N60A-E3
SnPb	IRFIB6N60A
	SiHFIB6N60A

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

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	V_{DS}	600	V
Gate-Source Voltage	V_{GS}	± 30	
Continuous Drain Current	V_{GS} at 10 V	$T_C = 25\text{ }^{\circ}\text{C}$	5.5
		$T_C = 100\text{ }^{\circ}\text{C}$	3.5
Pulsed Drain Current ^a	I_{DM}	37	
Linear Derating Factor		0.48	W/ $^{\circ}\text{C}$
Single Pulse Avalanche Energy ^b	E_{AS}	290	mJ
Repetitive Avalanche Current ^a	I_{AR}	9.2	A
Repetitive Avalanche Energy ^a	E_{AR}	6.0	mJ
Maximum Power Dissipation	$T_C = 25\text{ }^{\circ}\text{C}$	P_D	60
Peak Diode Recovery dV/dt ^c	dV/dt	5.0	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +150	$^{\circ}\text{C}$
Soldering Recommendations (Peak temperature) ^d	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 $T_J = 25\text{ }^{\circ}\text{C}$, $L = 6.8\text{ mH}$, $R_G = 25\text{ }\Omega$, $I_{AS} = 9.2\text{ A}$ (see fig. 12).
- $I_{SD} \leq 9.2\text{ A}$, $dI/dt \leq 50\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^{\circ}\text{C}$.
- 1.6 mm from case.

**THERMAL RESISTANCE RATINGS**

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	65	°C/W
Maximum Junction-to-Case (Drain)	R_{thJC}	-	2.1	

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

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$	600	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C , $I_D = 1\text{ mA}^d$	-	660	-	mV/°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}	$V_{GS} = \pm 30\text{ V}$	-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 600\text{ V}$, $V_{GS} = 0\text{ V}$	-	-	25	μA
		$V_{DS} = 480\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 125\text{ °C}$	-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$, $I_D = 3.3\text{ A}^b$	-	-	0.75	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 25\text{ V}$, $I_D = 5.5\text{ A}$	5.5	-	-	S
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1.0\text{ MHz}$, see fig. 5	-	1400	-	pF
Output Capacitance	C_{oss}		-	180	-	
Reverse Transfer Capacitance	C_{rss}		-	7.1	-	
Output Capacitance	C_{oss}	$V_{GS} = 0\text{ V}$ $V_{DS} = 1.0\text{ V}$, $f = 1.0\text{ MHz}$ $V_{DS} = 480\text{ V}$, $f = 1.0\text{ MHz}$ $V_{DS} = 0\text{ V to } 480\text{ V}^c$	-	1957	-	
Effective Output Capacitance	$C_{oss\text{ eff.}}$		-	96	-	nC
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}$ $I_D = 9.2\text{ A}$, $V_{DS} = 400\text{ V}$, see fig. 6 and 13 ^b	-	-	49	
Gate-Source Charge	Q_{gs}		-	-	13	
Gate-Drain Charge	Q_{gd}		-	-	20	ns
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 300\text{ V}$, $I_D = 9.2\text{ A}$, $R_G = 9.1\text{ }\Omega$, $R_D = 35.5\text{ }\Omega$, see fig. 10 ^b	-	13	-	
Rise Time	t_r		-	25	-	
Turn-Off Delay Time	$t_{d(off)}$		-	30	-	
Fall Time	t_f		-	22	-	
Gate Input Resistance	R_g	$f = 1\text{ MHz}$, open drain	0.5	-	3.2	Ω
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	5.5	A
Pulsed Diode Forward Current ^a	I_{SM}		-	-	37	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ °C}$, $I_S = 9.2\text{ A}$, $V_{GS} = 0\text{ V}^b$	-	-	1.5	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ °C}$, $I_F = 9.2\text{ A}$, $dI/dt = 100\text{ A}/\mu\text{s}^b$	-	530	800	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	3.0	4.4	μC
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} .
d. $t = 60\text{ s}$, $f = 60\text{ Hz}$.



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

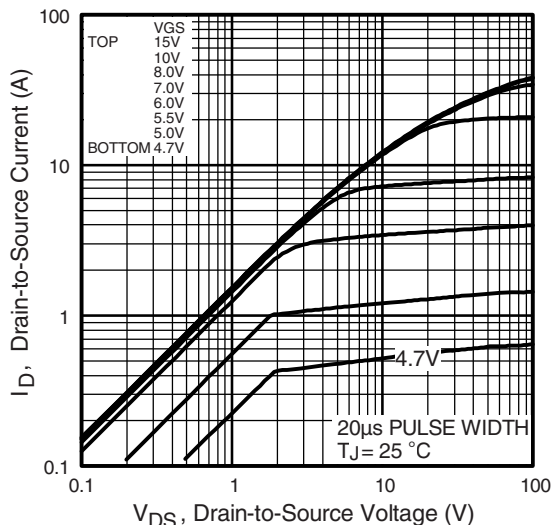


Fig. 1 - Typical Output Characteristics

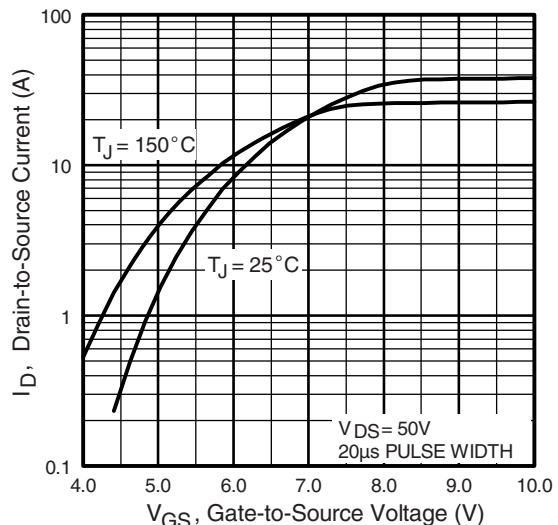


Fig. 3 - Typical Transfer Characteristics

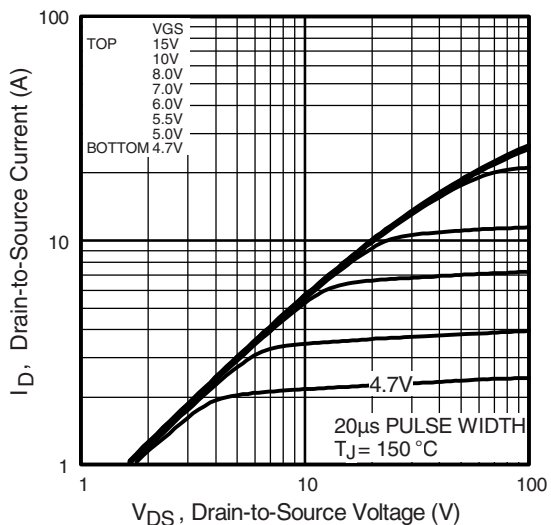


Fig. 2 - Typical Output Characteristics

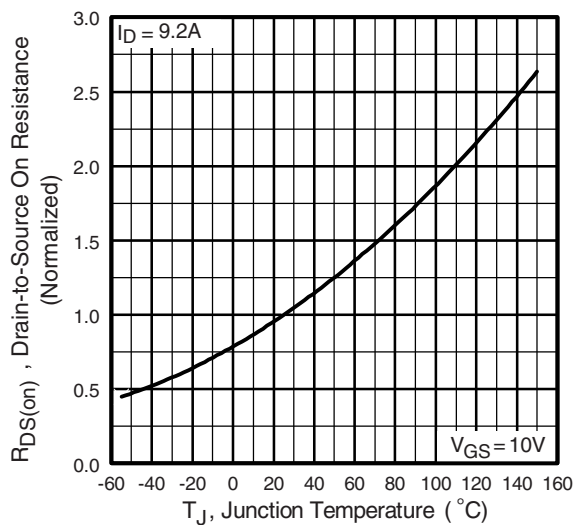
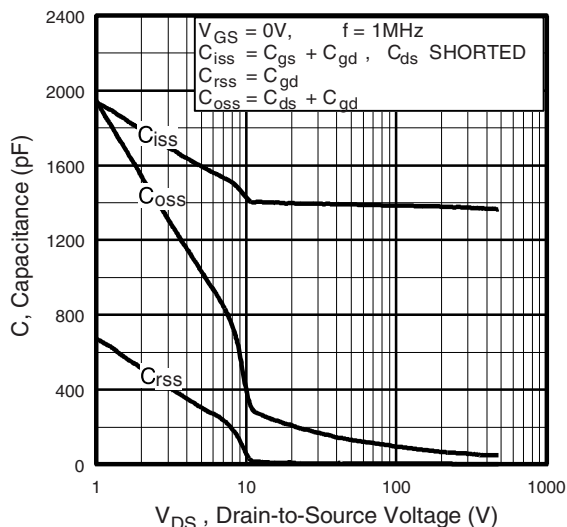
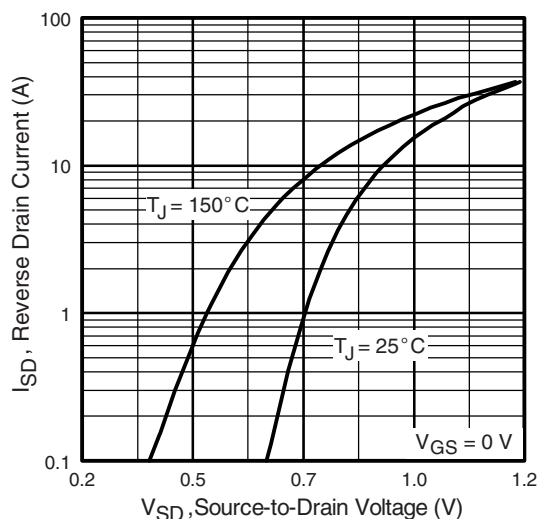
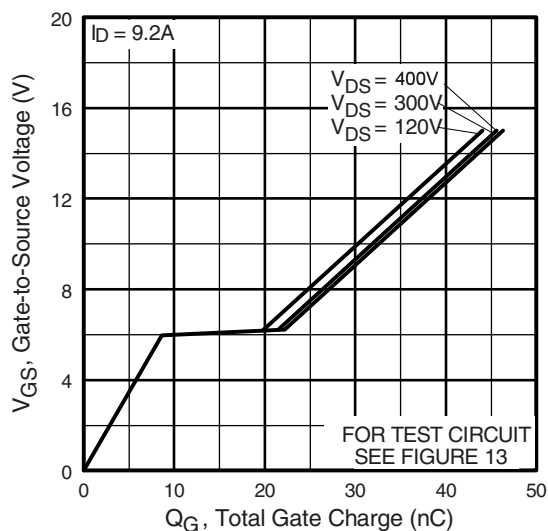
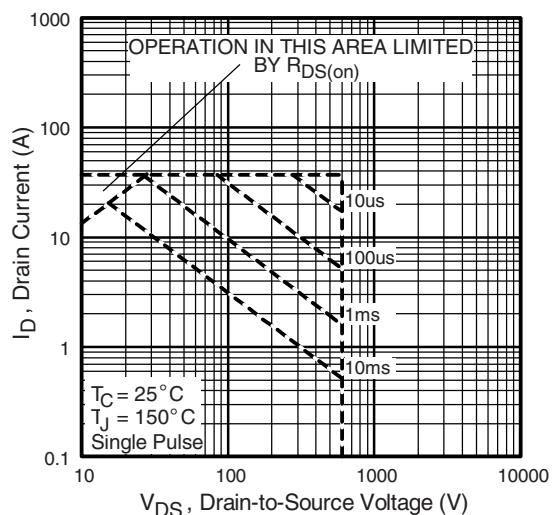
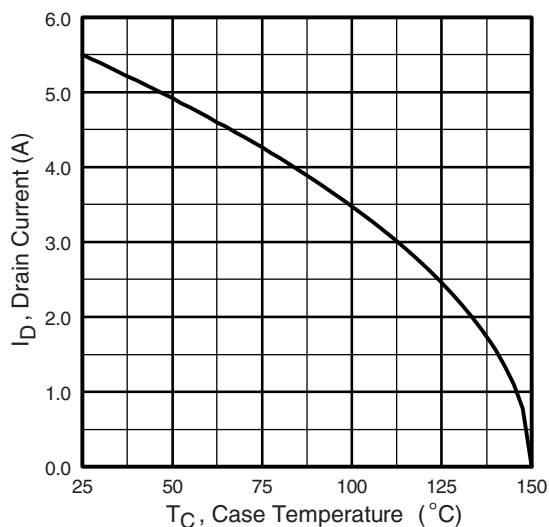
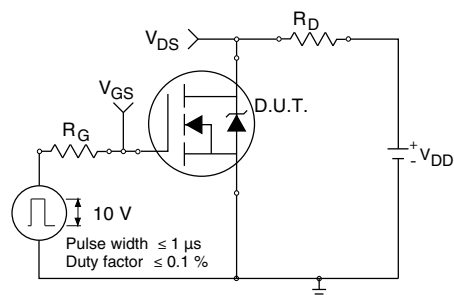
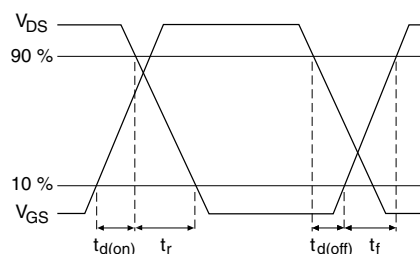
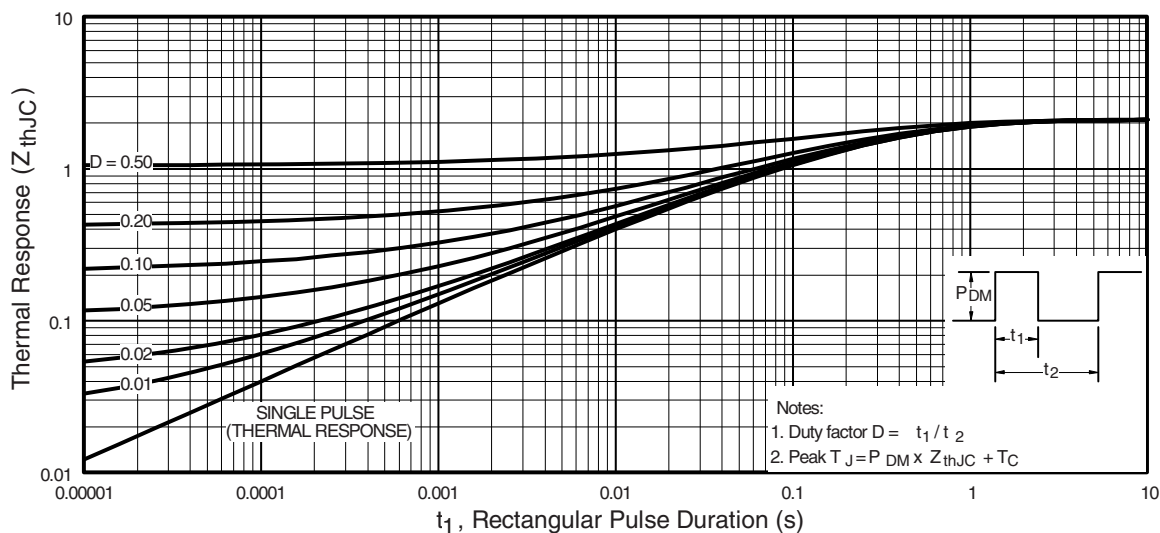
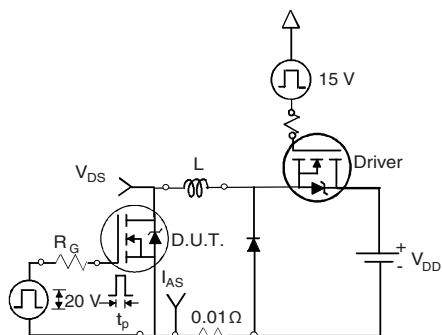
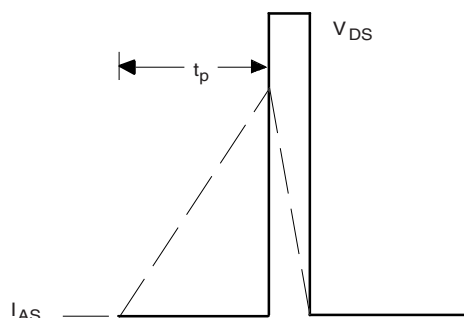
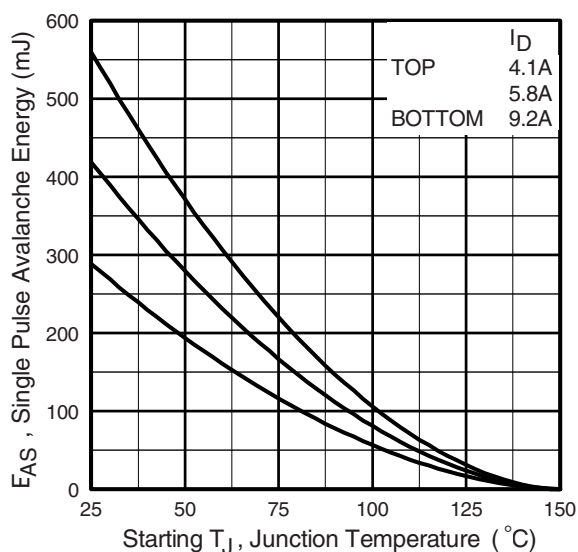
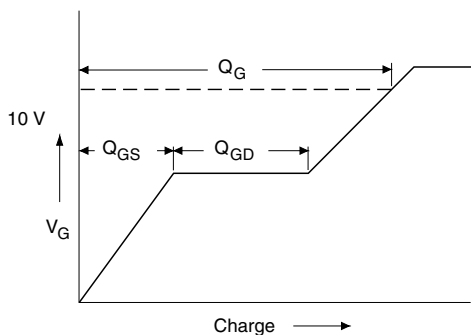
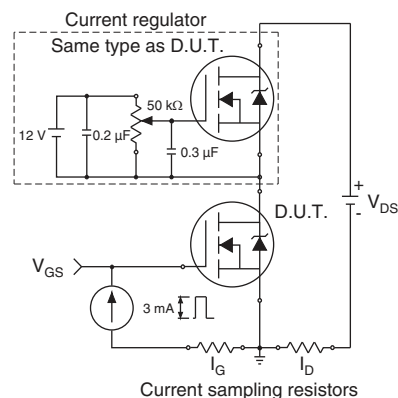
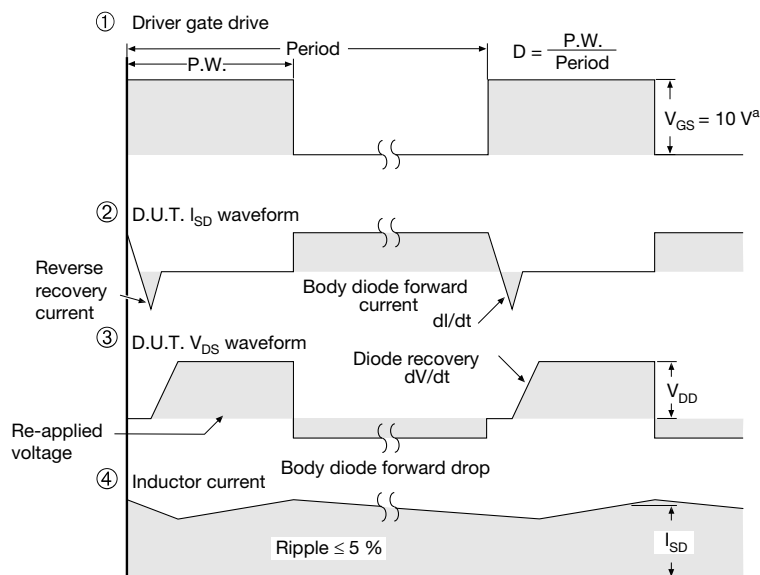
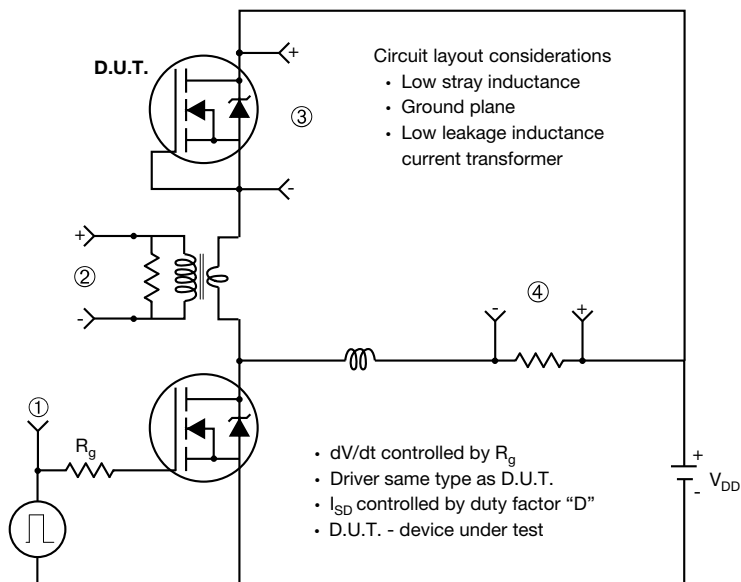


Fig. 4 - Normalized On-Resistance vs. Temperature


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

Peak Diode Recovery dV/dt Test Circuit

Note

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

Fig. 14 - For N-Channel

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