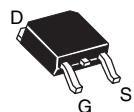


## Power MOSFET

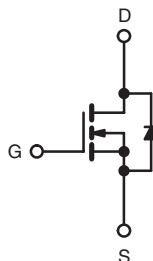
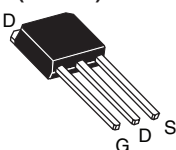
### PRODUCT SUMMARY

$V_{DS}$ (V)	500	
$R_{DS(on)}$ ( $\Omega$ )	$V_{GS} = 10\text{ V}$	3.0
$Q_g$ (Max.) (nC)	19	
$Q_{gs}$ (nC)	3.3	
$Q_{gd}$ (nC)	13	
Configuration	Single	

DPAK  
(TO-252)



IPAK  
(TO-251)



N-Channel MOSFET

### FEATURES

- Dynamic dV/dt Rating
- Repetitive Avalanche Rated
- Surface Mount (IRFR420, SiHFR420)
- Straight Lead (IRFU420, SiHFU420)
- Available in Tape and Reel
- Fast Switching
- Ease of Paralleling
- Compliant to RoHS Directive 2002/95/EC



Available  
**RoHS\***  
COMPLIANT

### DESCRIPTION

Third generation Power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The DPAK is designed for surface mounting using vapor phase, infrared, or wave soldering techniques. The straight lead version (IRFU, SiHFU series) is for through-hole mounting applications. Power dissipation levels up to 1.5 W are possible in typical surface mount applications.

### ORDERING INFORMATION

Package	DPAK (TO-252)	DPAK (TO-252)	DPAK (TO-252)	DPAK (TO-252)	IPAK (TO-251)
Lead (Pb)-free	IRFR420PbF	IRFR420TRPbF <sup>a</sup>	IRFR420TRLpbf <sup>a</sup>	IRFR420TRRPbF <sup>a</sup>	IRFU420PbF
	SiHFR420-E3	SiHFR420T-E3 <sup>a</sup>	SiHFR420TL-E3 <sup>a</sup>	-	SiHFU420-E3
SnPb	IRFR420	IRFR420TR <sup>a</sup>	IRFR420TRL <sup>a</sup>	IRFR420TRR <sup>a</sup>	IRFU420
	SiHFR420	SiHFR420T <sup>a</sup>	SiHFR420TL <sup>a</sup>	-	SiHFU420

#### Note

a. See device orientation.

### 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	$V_{GS}$	$\pm 20$	
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>	$I_{DM}$	8.0	
Linear Derating Factor		0.33	W/ $^\circ\text{C}$
Linear Derating Factor (PCB Mount) <sup>e</sup>		0.020	
Single Pulse Avalanche Energy <sup>b</sup>	$E_{AS}$	400	mJ
Repetitive Avalanche Current <sup>a</sup>	$I_{AR}$	2.4	A
Repetitive Avalanche Energy <sup>a</sup>	$E_{AR}$	4.2	mJ
Maximum Power Dissipation	$P_D$	$T_C = 25\text{ }^\circ\text{C}$	W
Maximum Power Dissipation (PCB Mount) <sup>e</sup>		$T_A = 25\text{ }^\circ\text{C}$	
Peak Diode Recovery dV/dt <sup>c</sup>	dV/dt	3.5	V/ns
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to + 150	$^\circ\text{C}$
Soldering Recommendations (Peak Temperature)	for 10 s	260 <sup>d</sup>	

#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 50\text{ V}$ , starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 124\text{ mH}$ ,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 2.4\text{ A}$  (see fig. 12).
- $I_{SD} \leq 2.4\text{ A}$ ,  $dI/dt \leq 50\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150\text{ }^\circ\text{C}$ .
- 1.6 mm from case.
- When mounted on 1" square PCB (FR-4 or G-10 material).

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

**THERMAL RESISTANCE RATINGS**

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	$R_{thJA}$	-	110	°C/W
Maximum Junction-to-Ambient (PCB Mount) <sup>a</sup>	$R_{thJA}$	-	50	
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	3.0	

**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 <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA		500	-	-	V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	Reference to 25 °C, I <sub>D</sub> = 1 mA		-	0.59	-	V/°C
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA		2.0	-	4.0	V
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>GS</sub> = ± 20 V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 500 V, V <sub>GS</sub> = 0 V		-	-	25	μA
		V <sub>DS</sub> = 400 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C		-	-	250	
Drain-Source On-State Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 1.4 A <sup>b</sup>	-	-	3.0	Ω
Forward Transconductance	g <sub>fs</sub>	V <sub>DS</sub> = 50 V, I <sub>D</sub> = 1.4 A		1.5	-	-	S
Dynamic							
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 25 V, f = 1.0 MHz, see fig. 5		-	360	-	pF
Output Capacitance	C <sub>oss</sub>			-	92	-	
Reverse Transfer Capacitance	C <sub>rss</sub>			-	37	-	
Total Gate Charge	Q <sub>g</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 2.1 A, V <sub>DS</sub> = 400 V, see fig. 6 and 13 <sup>b</sup>	-	-	19	nC
Gate-Source Charge	Q <sub>gs</sub>			-	-	3.3	
Gate-Drain Charge	Q <sub>gd</sub>			-	-	13	
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 250 V, I <sub>D</sub> = 2.1 A, R <sub>g</sub> = 18 Ω, R <sub>D</sub> = 120 Ω, see fig. 10 <sup>b</sup>		-	8.0	-	ns
Rise Time	t <sub>r</sub>			-	8.6	-	
Turn-Off Delay Time	t <sub>d(off)</sub>			-	33	-	
Fall Time	t <sub>f</sub>			-	16	-	
Internal Drain Inductance	L <sub>D</sub>	Between lead, 6 mm (0.25") from package and center of die contact		-	4.5	-	nH
Internal Source Inductance	L <sub>S</sub>			-	7.5	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I <sub>S</sub>	MOSFET symbol showing the integral reverse p - n junction diode		-	-	2.4	A
Pulsed Diode Forward Current <sup>a</sup>	I <sub>SM</sub>			-	-	8.0	
Body Diode Voltage	V <sub>SD</sub>	T <sub>J</sub> = 25 °C, I <sub>S</sub> = 2.4 A, V <sub>GS</sub> = 0 V <sup>b</sup>		-	-	1.6	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25 °C, I <sub>F</sub> = 2.1 A, dI/dt = 100 A/μs <sup>b</sup>		-	260	520	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			-	0.70	1.4	μC
Forward Turn-On Time	t <sub>on</sub>	Intrinsic turn-on time is negligible (turn-on is dominated by L <sub>S</sub> and L <sub>D</sub> )					

**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  $\leq 2\%$ .

## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

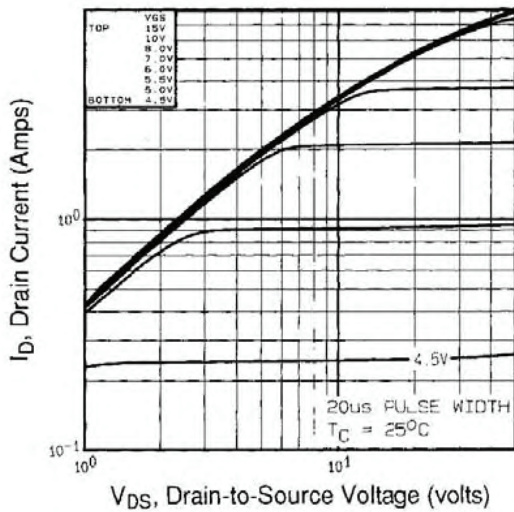


Fig. 1 - Typical Output Characteristics,  $T_C = 25^\circ\text{C}$

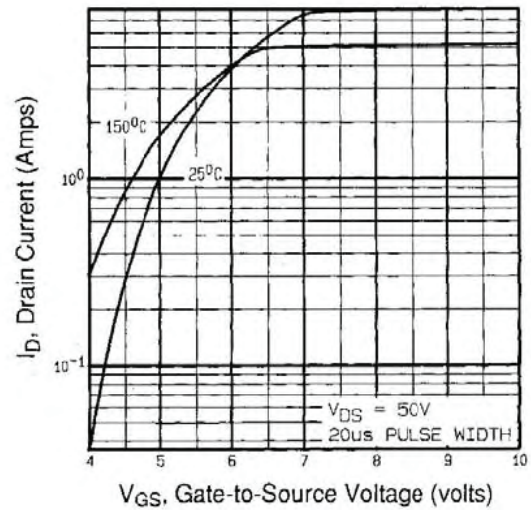


Fig. 3 - Typical Transfer Characteristics

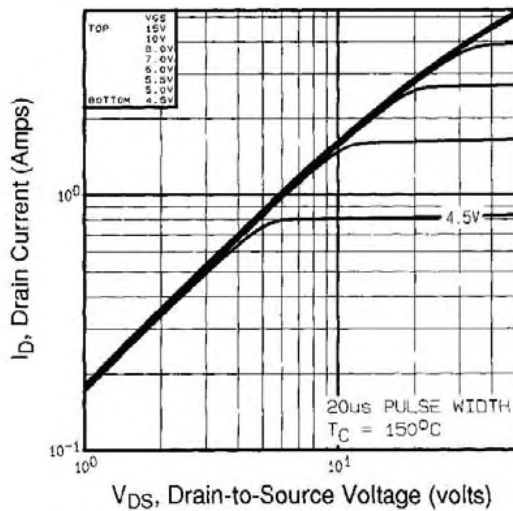


Fig. 2 - Typical Output Characteristics,  $T_C = 150^\circ\text{C}$

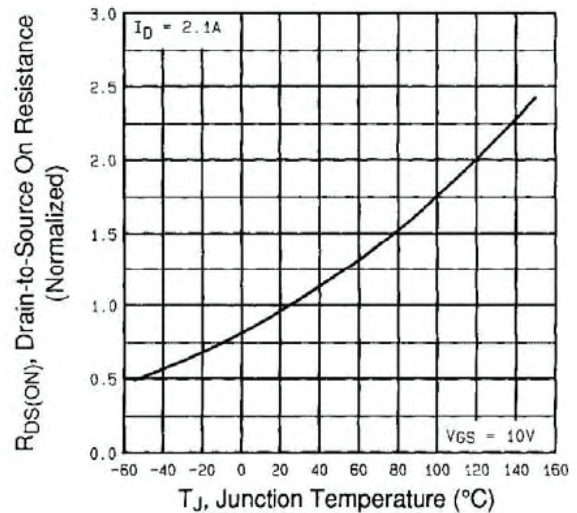


Fig. 4 - Normalized On-Resistance vs. Temperature

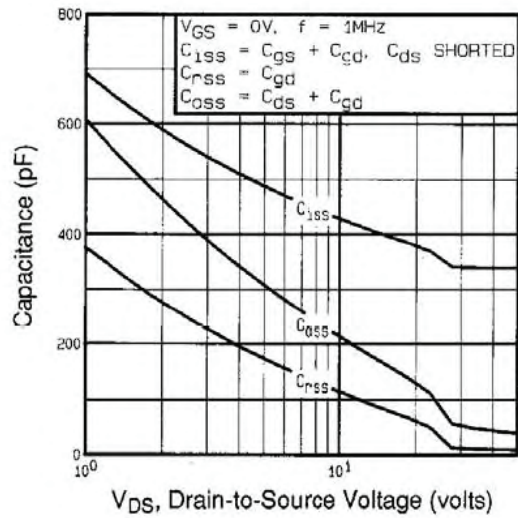


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

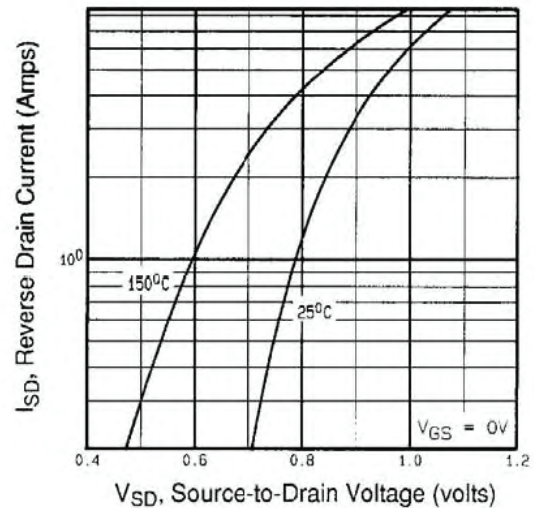


Fig. 7 - Typical Source-Drain Diode Forward Voltage

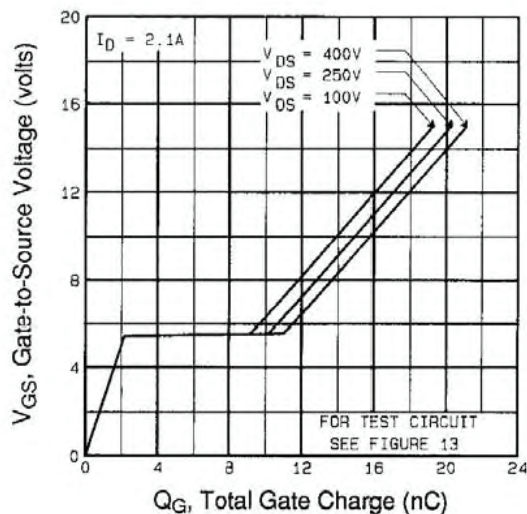


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

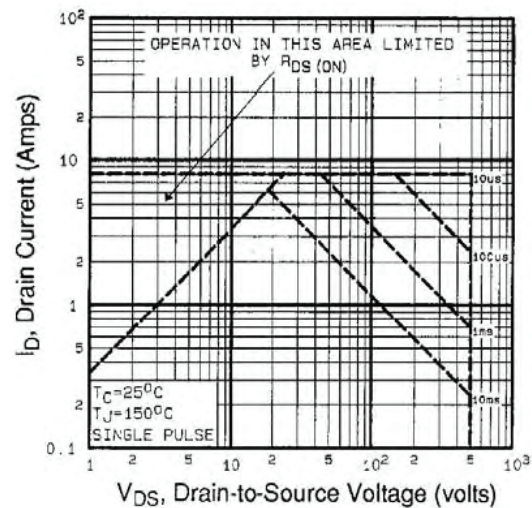


Fig. 8 - Maximum Safe Operating Area



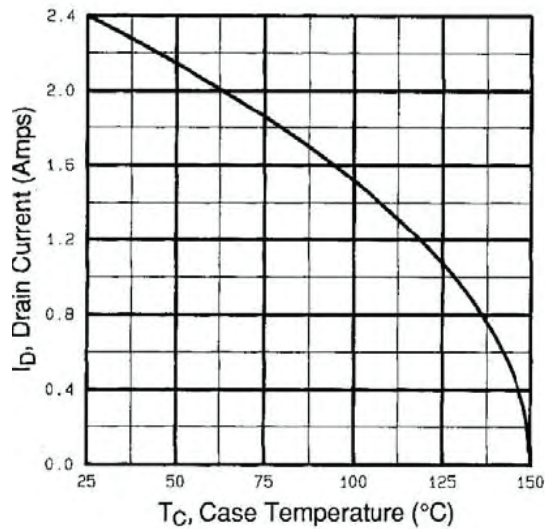


Fig. 9 - Maximum Drain Current vs. Case Temperature

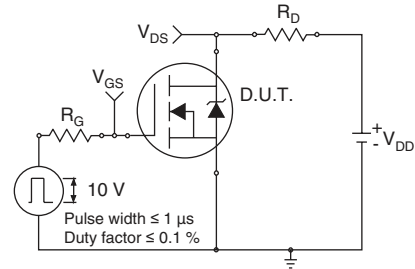


Fig. 10a - Switching Time Test Circuit

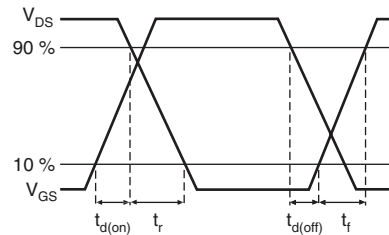


Fig. 10b - Switching Time Waveforms

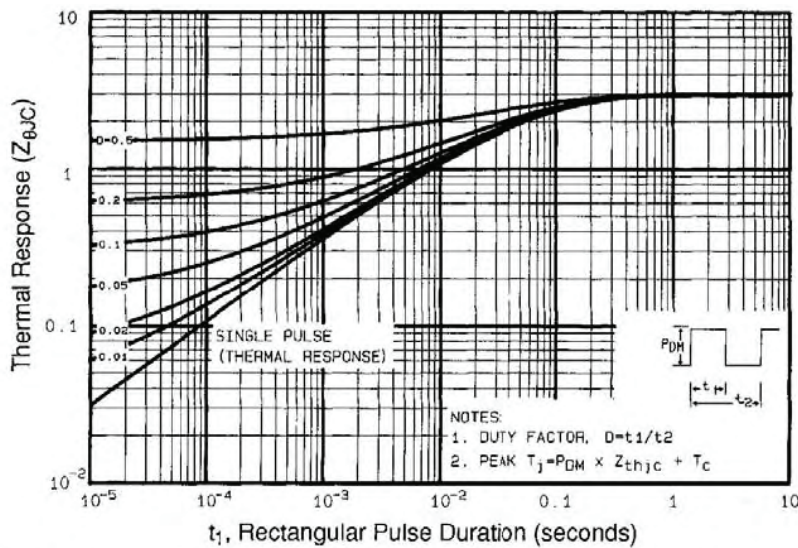


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

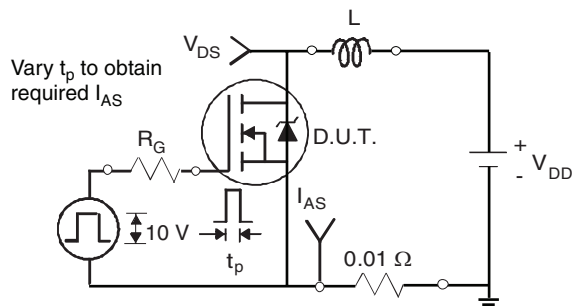


Fig. 12a - Unclamped Inductive Test Circuit

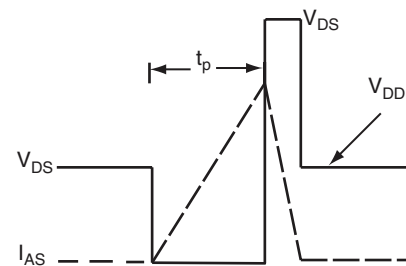


Fig. 12b - Unclamped Inductive Waveforms

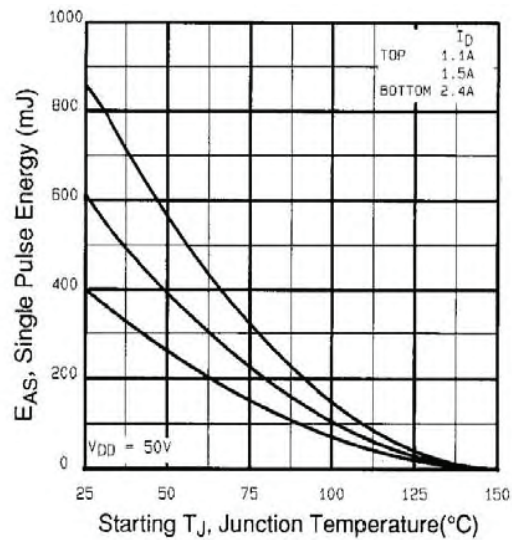


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

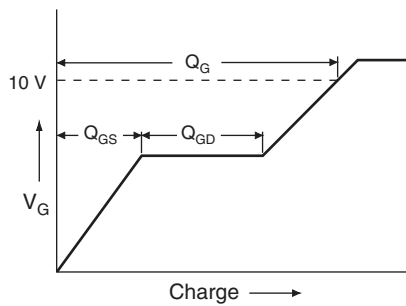


Fig. 13a - Basic Gate Charge Waveform

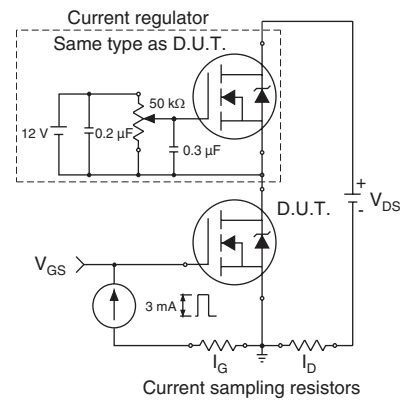
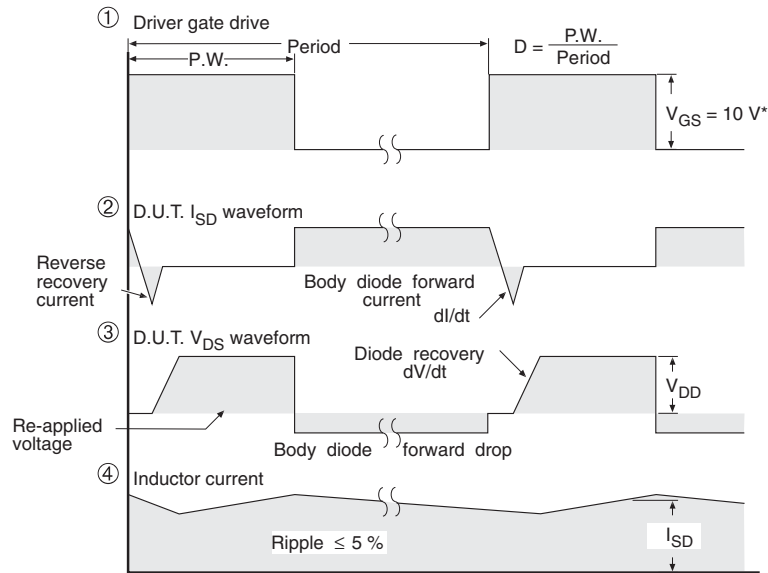
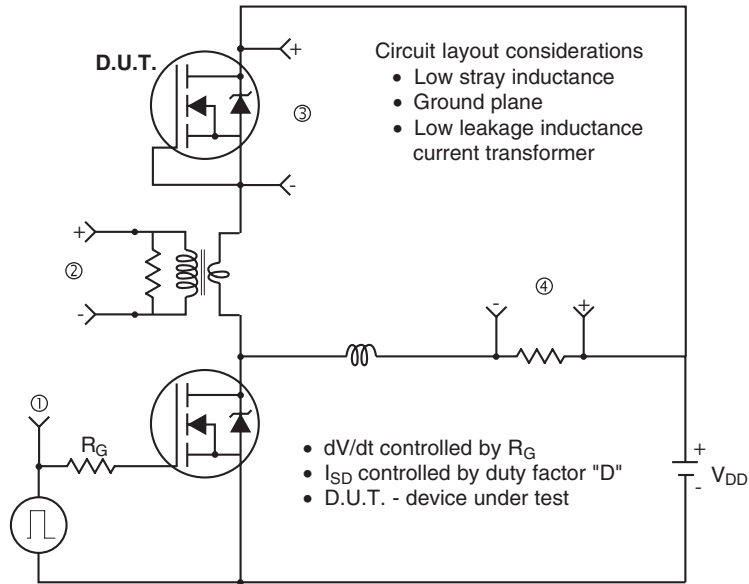


Fig. 13b - Gate Charge Test Circuit

## Peak Diode Recovery $dV/dt$ Test Circuit



\*  $V_{GS} = 5 V$  for logic level devices and  $3 V$  drive devices

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

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