

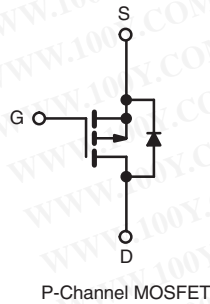
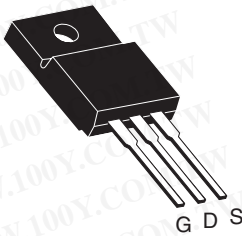


勝特力材料 886-3-5753170  
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 勝特力电子(深圳) 86-755-83298787  
 Http://www.100y.com.tw

## Power MOSFET

PRODUCT SUMMARY		
$V_{DS}$ (V)	- 60	
$R_{DS(on)}$ ( $\Omega$ )	$V_{GS} = -10$ V	0.28
$Q_g$ (Max.) (nC)	19	
$Q_{gs}$ (nC)	5.4	
$Q_{gd}$ (nC)	11	
Configuration	Single	

TO-220 FULLPAK



### FEATURES

- Isolated Package
- High Voltage Isolation = 2.5 kV<sub>RMS</sub> (t = 60 s; f = 60 Hz)
- Sink to Lead Creepage Distance = 4.8 mm
- P-Channel
- 175 °C Operating Temperature
- Dynamic dV/dt Rating
- Low Thermal Resistance
- Lead (Pb)-free 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 TO-220 FULLPAK eliminates the need for additional insulating hardware in commercial-industrial applications. The molding compound used provides a high isolation capability and a low thermal resistance between the tab and external heatsink. This isolation is equivalent to using a 100 micron mica barrier with standard TO-220 product. The FULLPAK is mounted to a heatsink using a single clip or by a single screw fixing.

ORDERING INFORMATION	
Package	TO-220 FULLPAK
Lead (Pb)-free	IRFI9Z24GPbF
	SiHF19Z24G-E3
SnPb	IRFI9Z24G
	SiHF19Z24G


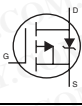
ABSOLUTE MAXIMUM RATINGS $T_C = 25$ °C, unless otherwise noted				
PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-Source Voltage	$V_{DS}$	- 60	V	
Gate-Source Voltage	$V_{GS}$	$\pm 20$		
Continuous Drain Current	$V_{GS}$ at - 10 V	$T_C = 25$ °C	- 8.5	A
		$T_C = 100$ °C	- 6.0	
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	- 34		
Linear Derating Factor		0.24	W/°C	
Single Pulse Avalanche Energy <sup>b</sup>	$E_{AS}$	200	mJ	
Repetitive Avalanche Current <sup>a</sup>	$I_{AR}$	- 8.5	A	
Repetitive Avalanche Energy <sup>a</sup>	$E_{AR}$	3.7	mJ	
Maximum Power Dissipation	$P_D$	37	W	
Peak Diode Recovery dV/dt <sup>c</sup>	dV/dt	- 4.5	V/ns	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to + 175	°C	
Soldering Recommendations (Peak Temperature)	for 10 s	300 <sup>d</sup>		
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).
- $V_{DD} = -25$  V, starting  $T_J = 25$  °C, L = 3.2 mH,  $R_G = 25$   $\Omega$ ,  $I_{AS} = -8.5$  A (see fig. 12).
- $I_{SD} \leq -11$  A,  $di/dt \leq 140$  A/ $\mu$ s,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 175$  °C.
- 1.6 mm from case.

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

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	$R_{thJA}$	-	65	°C/W
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	4.1	

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	$V_{DS}$	$V_{GS} = 0\text{ V}$ , $I_D = -250\text{ }\mu\text{A}$	-60	-	-	V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$ , $I_D = -1\text{ mA}$	-	-0.056	-	V/°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	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}$	-	-	$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -60\text{ V}$ , $V_{GS} = 0\text{ V}$	-	-	-100	$\mu\text{A}$
		$V_{DS} = -48\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 150\text{ }^\circ\text{C}$	-	-	-500	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = -10\text{ V}$ , $I_D = -5.1\text{ A}^b$	-	-	0.28	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = -25\text{ V}$ , $I_D = -5.1\text{ A}^b$	3.2	-	-	S
<b>Dynamic</b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}$ , $V_{DS} = -25\text{ V}$ , $f = 1.0\text{ MHz}$ , see fig. 5	-	570	-	pF
Output Capacitance	$C_{oss}$		-	360	-	
Reverse Transfer Capacitance	$C_{rss}$		-	65	-	
Drain to Sink Capacitance	$C$		$f = 1.0\text{ MHz}$	-	12	
Total Gate Charge	$Q_g$	$V_{GS} = -10\text{ V}$ , $I_D = -11\text{ A}$ , $V_{DS} = -48\text{ V}$ , see fig. 6 and 13 <sup>b</sup>	-	-	19	nC
Gate-Source Charge	$Q_{gs}$		-	-	5.4	
Gate-Drain Charge	$Q_{gd}$		-	-	11	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -30\text{ V}$ , $I_D = -11\text{ A}$ , $R_G = 18\text{ }\Omega$ , $R_D = 2.5\text{ }\Omega$ , see fig. 10 <sup>b</sup>	-	13	-	ns
Rise Time	$t_r$		-	68	-	
Turn-Off Delay Time	$t_{d(off)}$		-	15	-	
Fall Time	$t_f$		-	29	-	
Internal Drain Inductance	$L_D$	Between lead, 6 mm (0.25") from package and center of die contact 	-	4.5	-	nH
Internal Source Inductance	$L_S$		-	7.5	-	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	-8.5	A
Pulsed Diode Forward Current <sup>a</sup>	$I_{SM}$		-	-	-34	
Body Diode Voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}$ , $I_S = -8.5\text{ A}$ , $V_{GS} = 0\text{ V}^b$	-	-	-6.3	V
Body Diode Reverse Recovery Time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}$ , $I_F = -11\text{ A}$ , $dI/dt = 100\text{ A}/\mu\text{s}^b$	-	100	200	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$		-	0.32	0.64	$\mu\text{C}$
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  $\leq 2\%$ .

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

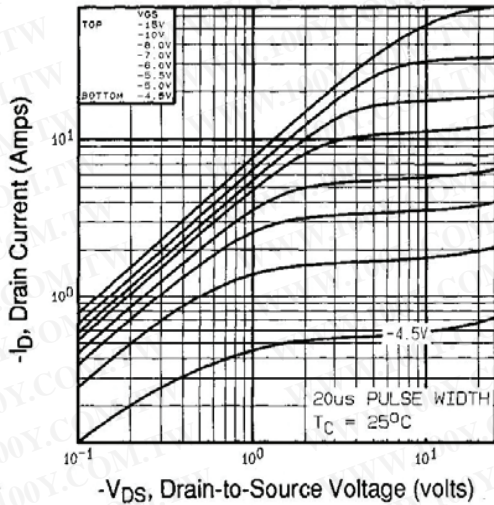


Fig. 1 - Typical Output Characteristics,  $T_C = 25^\circ\text{C}$

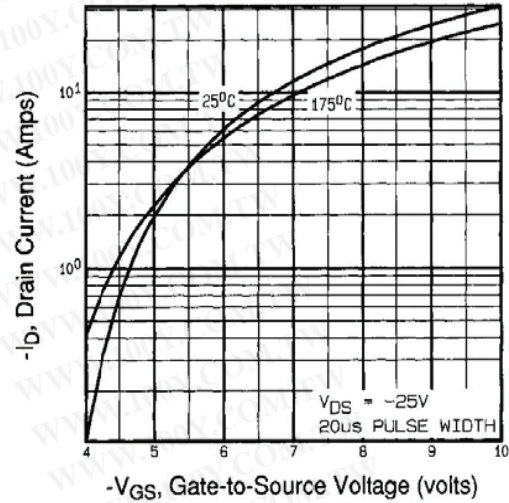


Fig. 3 - Typical Transfer Characteristics

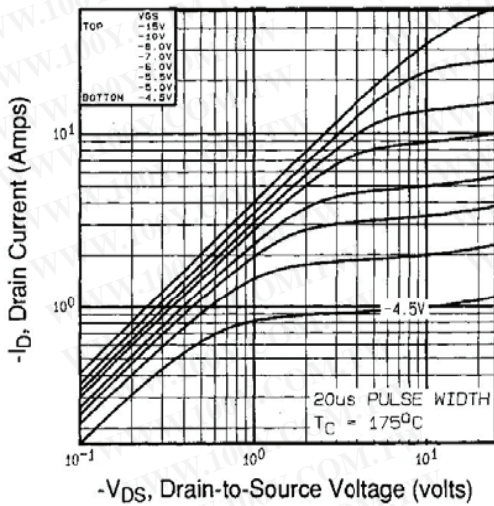


Fig. 2 - Typical Output Characteristics,  $T_C = 175^\circ\text{C}$

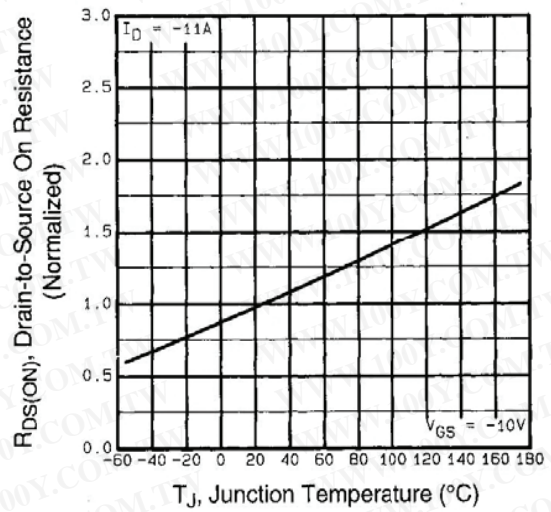


Fig. 4 - Normalized On-Resistance vs. Temperature



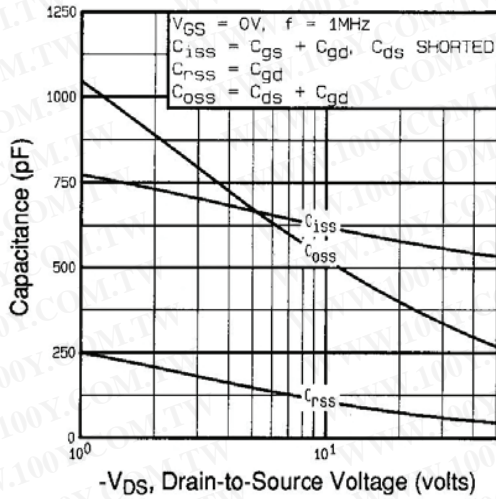


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

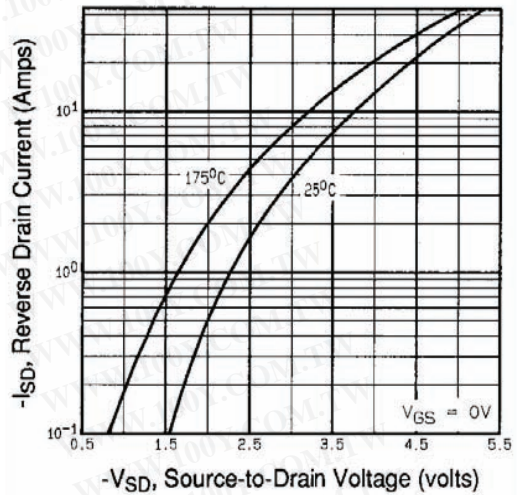


Fig. 7 - Typical Source-Drain Diode Forward Voltage

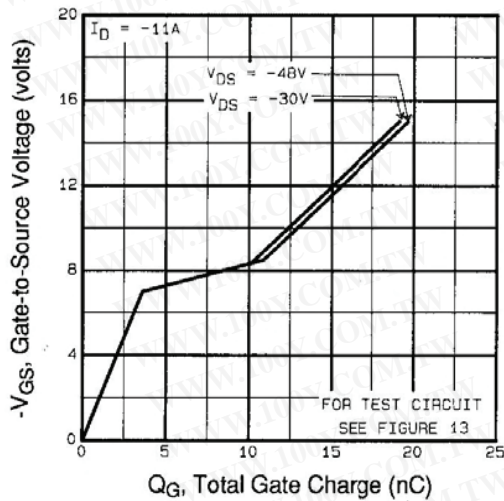


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

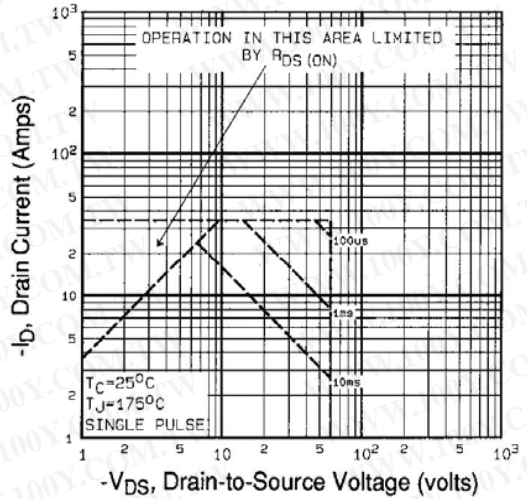


Fig. 8 - Maximum Safe Operating Area

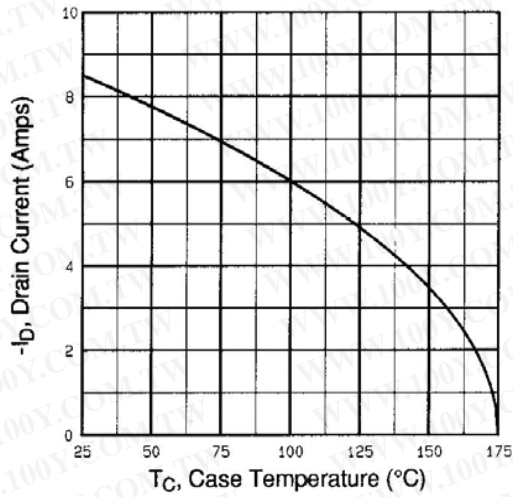


Fig. 9 - Maximum Drain Current vs. Case Temperature

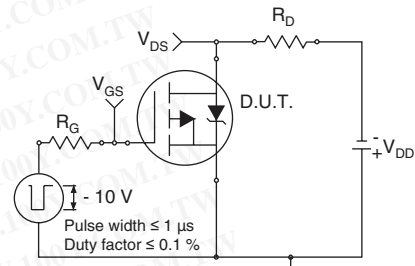


Fig. 10a - Switching Time Test Circuit

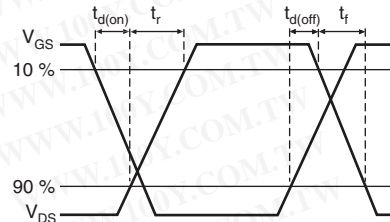


Fig. 10b - Switching Time Waveforms

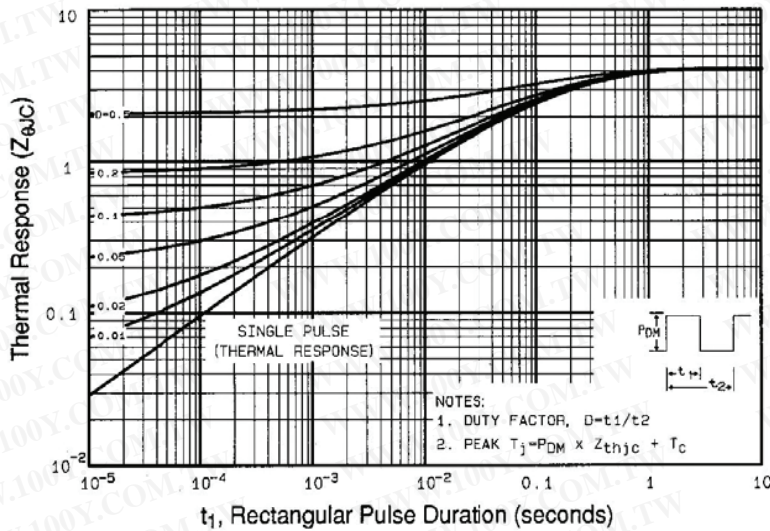


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

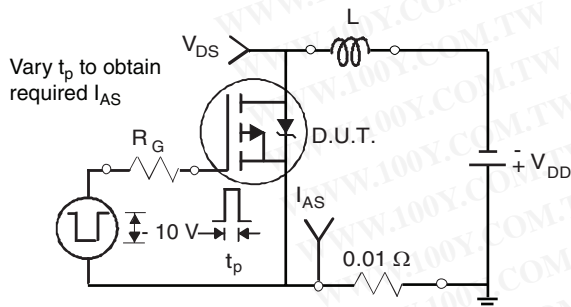


Fig. 12a - Unclamped Inductive Test Circuit

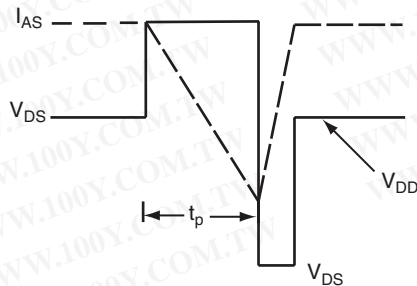


Fig. 12b - Unclamped Inductive Waveforms

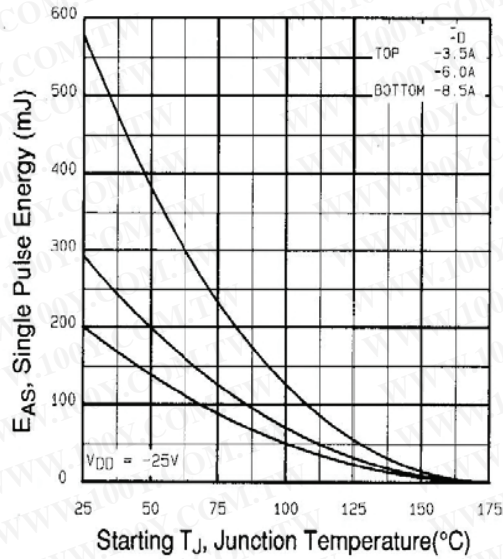


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

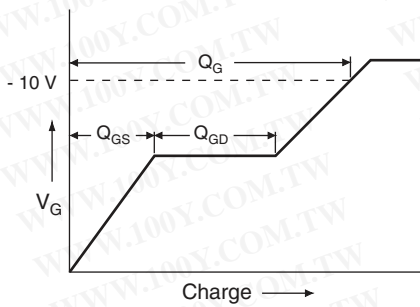


Fig. 13a - Basic Gate Charge Waveform

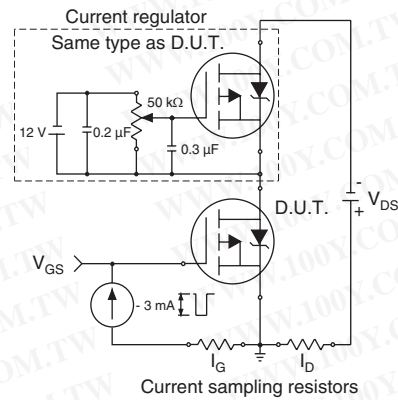
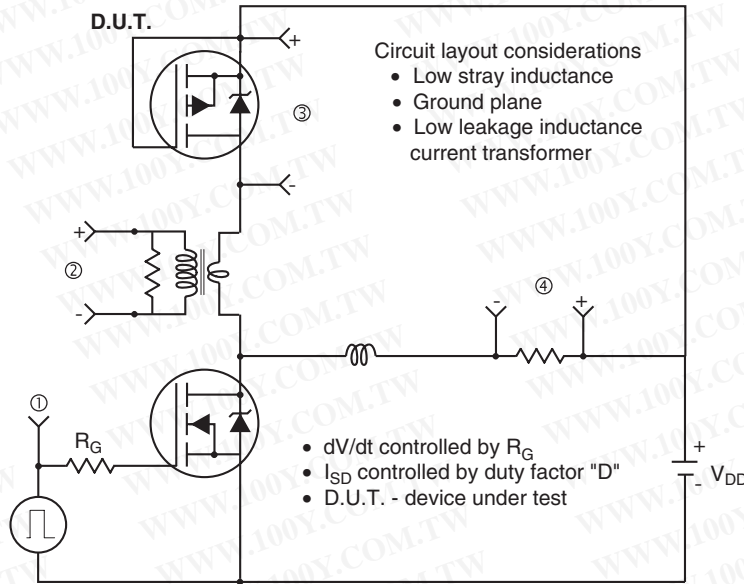
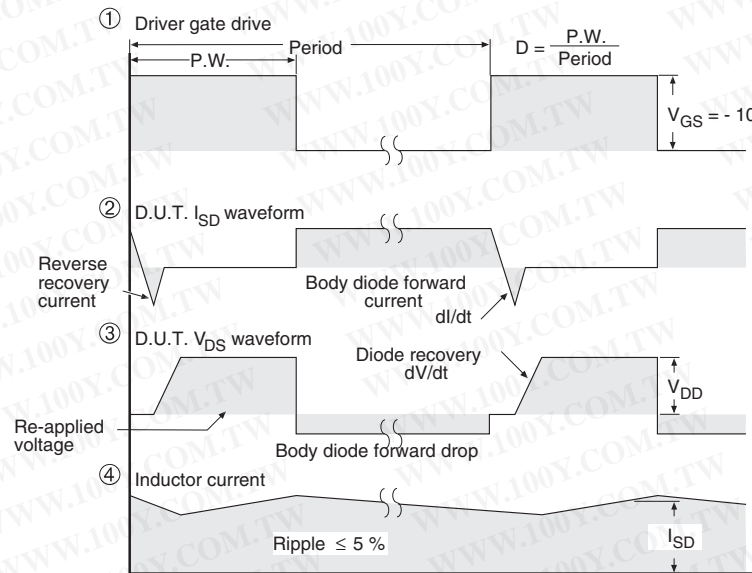


Fig. 13b - Gate Charge Test Circuit

## Peak Diode Recovery dV/dt Test Circuit



• Compliment N-Channel of D.U.T. for driver



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

**Fig. 14 - For P-Channel**

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