



- Advanced Process Technology
- Ultra Low On-Resistance
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated

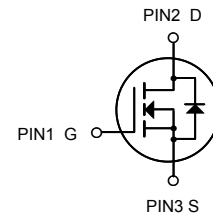


## Description

Advanced TENCH Power MOSFETs from International Rectifier utilize advanced processing techniques to achieve extremely low on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that TENCH power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in a wide variety of applications.

The TO-220 package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 50 watts. The low thermal resistance and low package cost of the TO-220 contribute to its wide acceptance throughout the industry.

## TO-220



N-Channel MOSFET

## Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D$ @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS}$ @ 10V	17	A
$I_D$ @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS}$ @ 10V	12	
$I_{DM}$	Pulsed Drain Current ①	60	
$P_D$ @ $T_C = 25^\circ\text{C}$	Power Dissipation	70	W
	Linear Derating Factor	0.47	W/°C
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$I_{AR}$	Avalanche Current ①	9.0	A
$E_{AR}$	Repetitive Avalanche Energy ①	7.0	mJ
dv/dt	Peak Diode Recovery dv/dt ③	7.4	V/ns
$T_J$	Operating Junction and	-55 to + 175	°C
$T_{STG}$	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case )	
	Mounting torque, 6-32 or M3 screw	10 lbf•in (1.1N•m)	

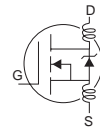
## Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	2.15	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient	—	62	



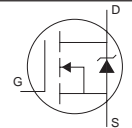
**Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)**

	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)DSS</sub>	Drain-to-Source Breakdown Voltage	100	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
ΔV <sub>(BR)DSS/ΔT<sub>J</sub></sub>	Breakdown Voltage Temp. Coefficient	—	0.11	—	V/°C	Reference to 25°C, I <sub>D</sub> = 1mA
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	—	—	90	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 9.0A ④
V <sub>GS(th)</sub>	Gate Threshold Voltage	2.0	—	4.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
g <sub>fs</sub>	Forward Transconductance	12	—	—	S	V <sub>DS</sub> = 50V, I <sub>D</sub> = 9.0A④
I <sub>DSS</sub>	Drain-to-Source Leakage Current	—	—	25	μA	V <sub>DS</sub> = 100V, V <sub>GS</sub> = 0V
		—	—	250	μA	V <sub>DS</sub> = 80V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 150°C
I <sub>GSS</sub>	Gate-to-Source Forward Leakage	—	—	100	nA	V <sub>GS</sub> = 20V
	Gate-to-Source Reverse Leakage	—	—	-100	nA	V <sub>GS</sub> = -20V
Q <sub>g</sub>	Total Gate Charge	—	—	37	nC	I <sub>D</sub> = 9.0A
Q <sub>gs</sub>	Gate-to-Source Charge	—	—	7.2	nC	V <sub>DS</sub> = 80V
Q <sub>gd</sub>	Gate-to-Drain ("Miller") Charge	—	—	11	nC	V <sub>GS</sub> = 10V, See Fig. 6 and 13
t <sub>d(on)</sub>	Turn-On Delay Time	—	9.2	—	ns	V <sub>DD</sub> = 50V
t <sub>r</sub>	Rise Time	—	22	—		I <sub>D</sub> = 9.0A
t <sub>d(off)</sub>	Turn-Off Delay Time	—	35	—		R <sub>G</sub> = 12Ω
t <sub>f</sub>	Fall Time	—	25	—		V <sub>GS</sub> = 10V, See Fig. 10 ④
L <sub>D</sub>	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact
L <sub>S</sub>	Internal Source Inductance	—	7.5	—		
C <sub>iss</sub>	Input Capacitance	—	920	—	pF	V <sub>GS</sub> = 0V
C <sub>oss</sub>	Output Capacitance	—	130	—		V <sub>DS</sub> = 25V
C <sub>rss</sub>	Reverse Transfer Capacitance	—	19	—		f = 1.0MHz, See Fig. 5
E <sub>AS</sub>	Single Pulse Avalanche Energy②	—	340⑤	93⑥		mJ



**Source-Drain Ratings and Characteristics**

	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	17	A	MOSFET symbol showing the integral reverse p-n junction diode.
I <sub>SM</sub>	Pulsed Source Current (Body Diode)①	—	—	60		
V <sub>SD</sub>	Diode Forward Voltage	—	—	1.3	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 9.0A, V <sub>GS</sub> = 0V ④
t <sub>rr</sub>	Reverse Recovery Time	—	93	140	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = 9.0A
Q <sub>rr</sub>	Reverse Recovery Charge	—	320	480	nC	di/dt = 100A/μs ④
t <sub>on</sub>	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L <sub>S</sub> +L <sub>D</sub> )				



**Notes:**

- ① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11)
- ② Starting T<sub>J</sub> = 25°C, L = 2.3mH  
R<sub>G</sub> = 25Ω, I<sub>AS</sub> = 9.0A, V<sub>GS</sub>=10V (See Figure 12)
- ③ I<sub>SD</sub> ≤ 9.0A, di/dt ≤ 410A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>,  
T<sub>J</sub> ≤ 175°C
- ④ Pulse width ≤ 400μs; duty cycle ≤ 2%.
- ⑤ This is a typical value at device destruction and represents operation outside rated limits.
- ⑥ This is a calculated value limited to T<sub>J</sub> = 175°C .

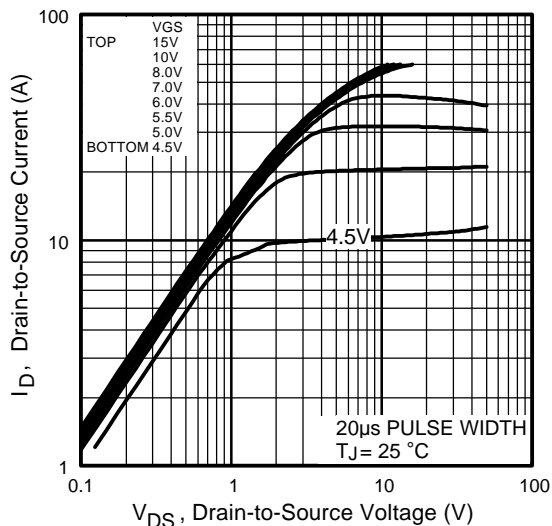


Fig 1. Typical Output Characteristics

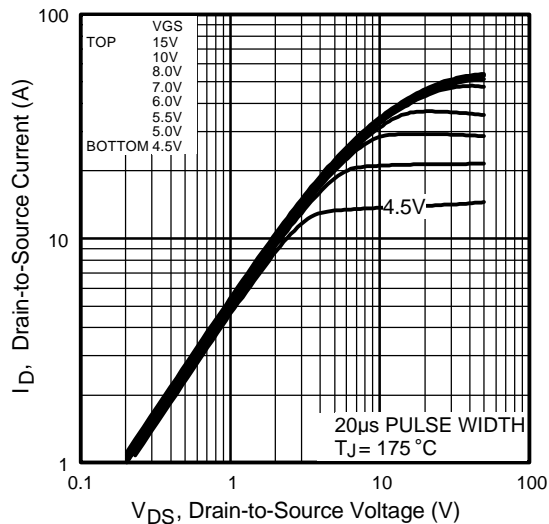


Fig 2. Typical Output Characteristics

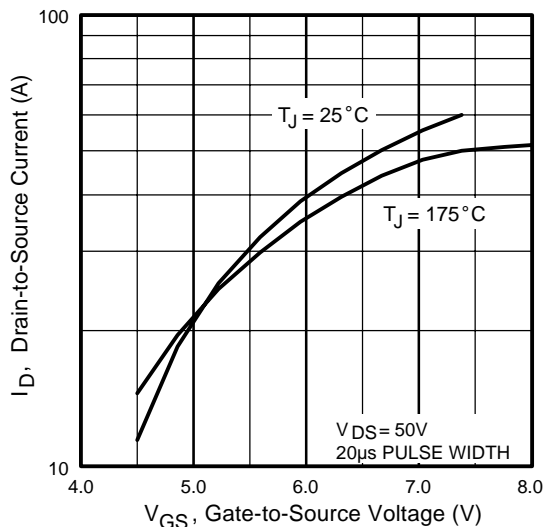


Fig 3. Typical Transfer Characteristics

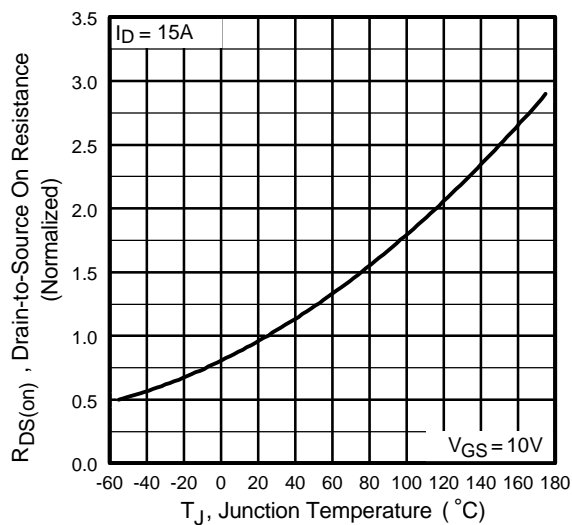


Fig 4. Normalized On-Resistance Vs. Temperature

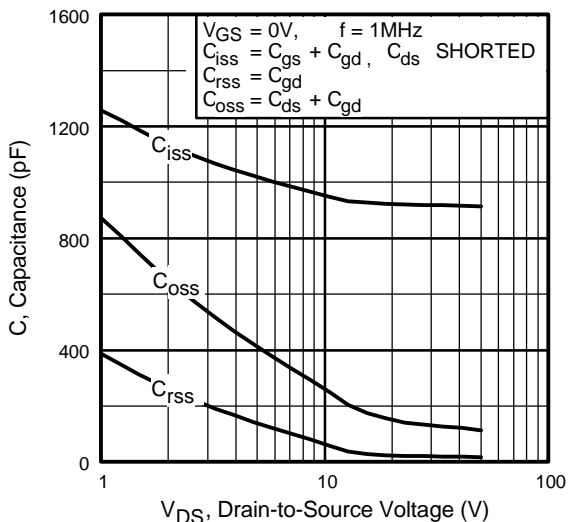


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

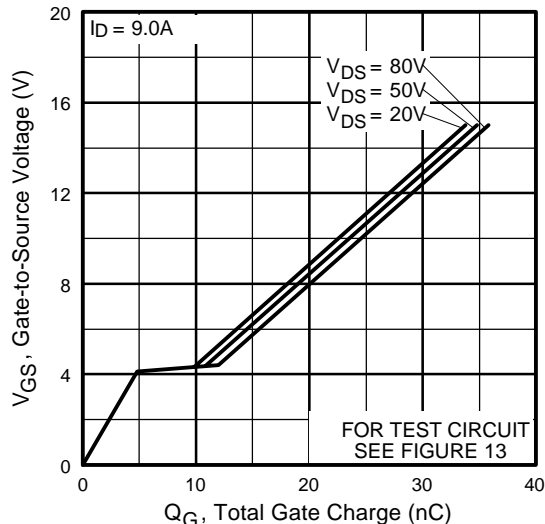


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

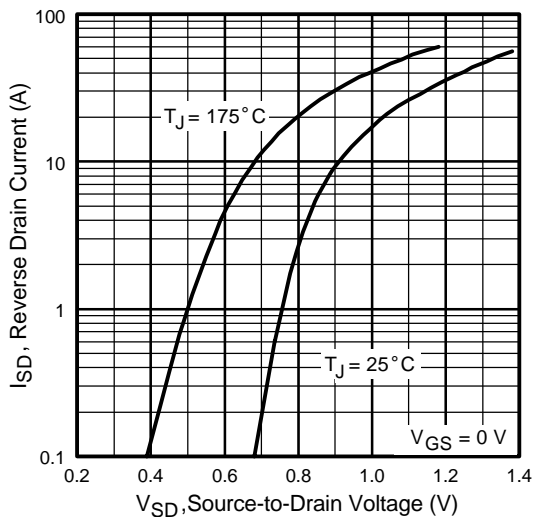


Fig 7. Typical Source-Drain Diode Forward Voltage

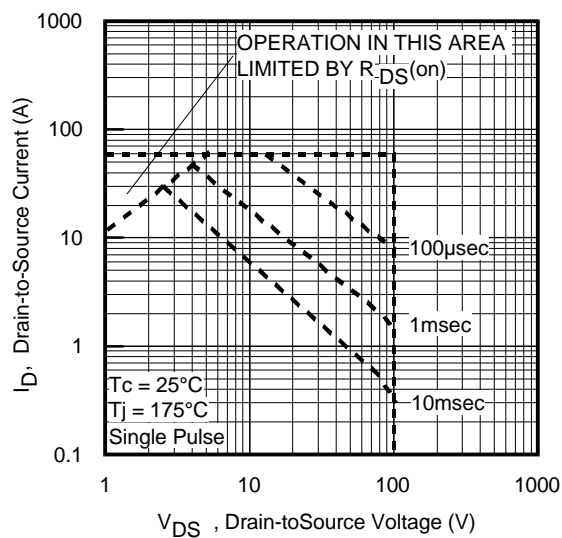


Fig 8. Maximum Safe Operating Area

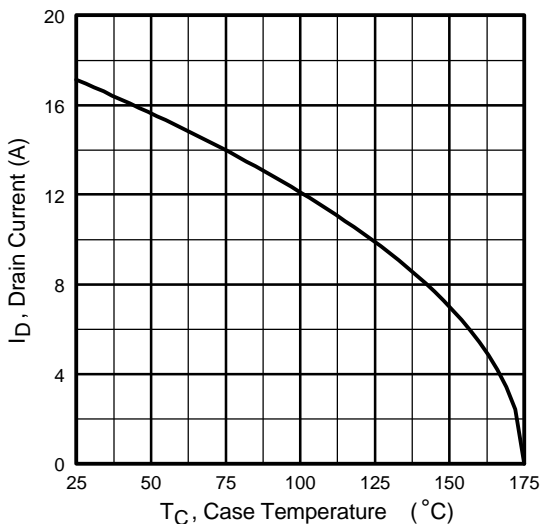


Fig 9. Maximum Drain Current Vs. Case Temperature

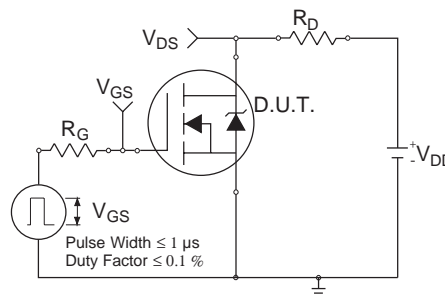


Fig 10a. Switching Time Test Circuit

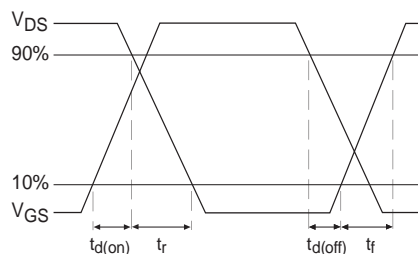


Fig 10b. Switching Time Waveforms

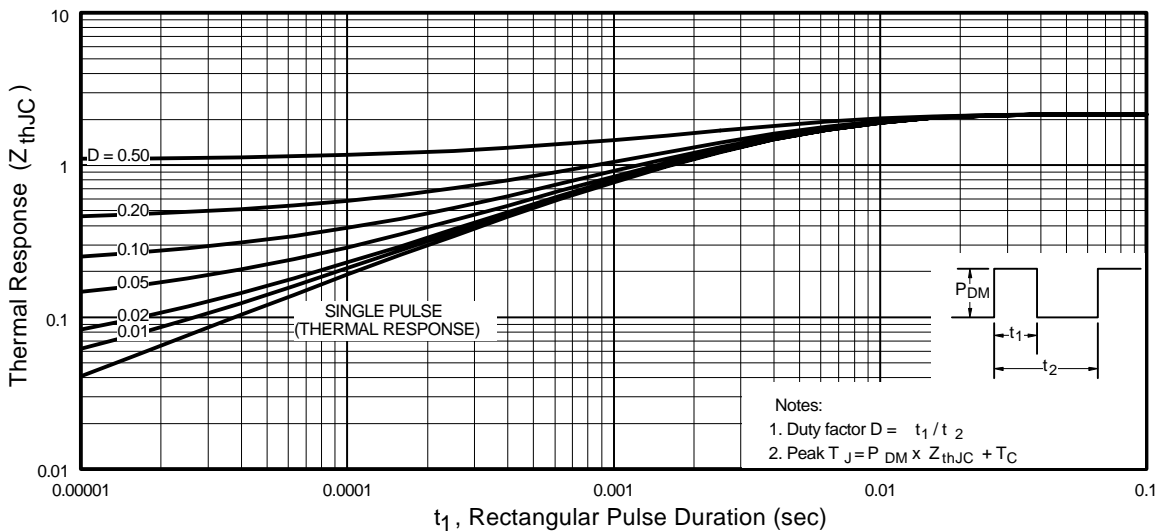


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

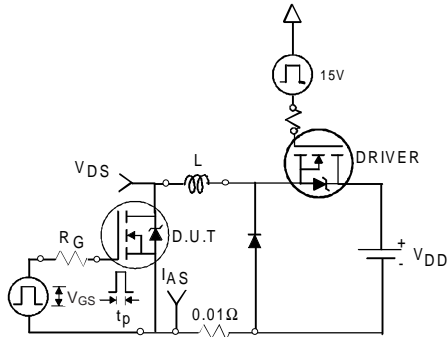


Fig 12a. Unclamped Inductive Test Circuit

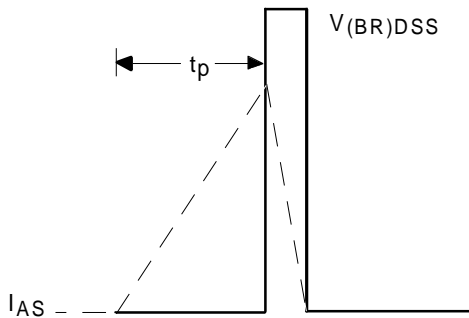


Fig 12b. Unclamped Inductive Waveforms

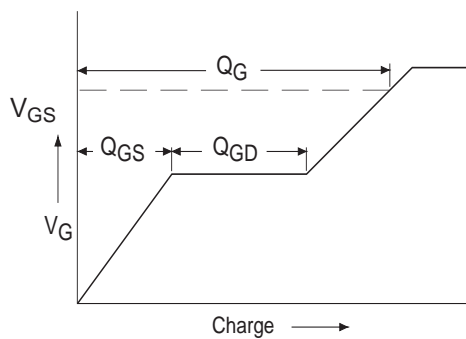


Fig 13a. Basic Gate Charge Waveform

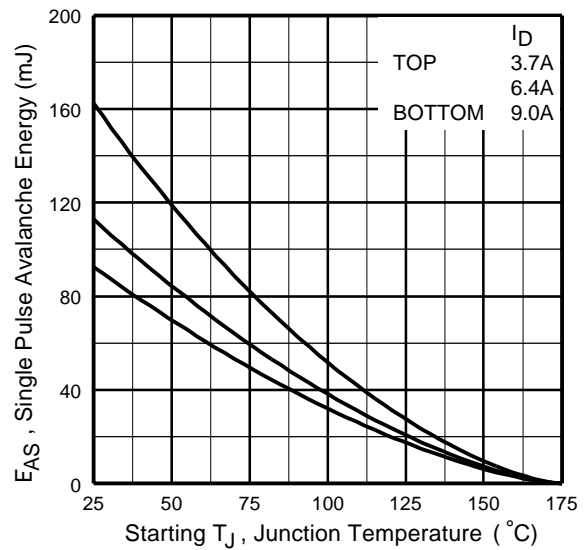


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

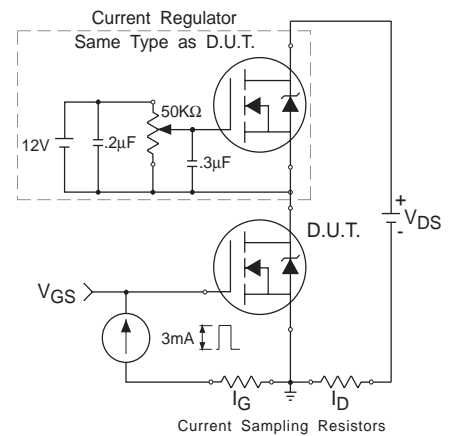
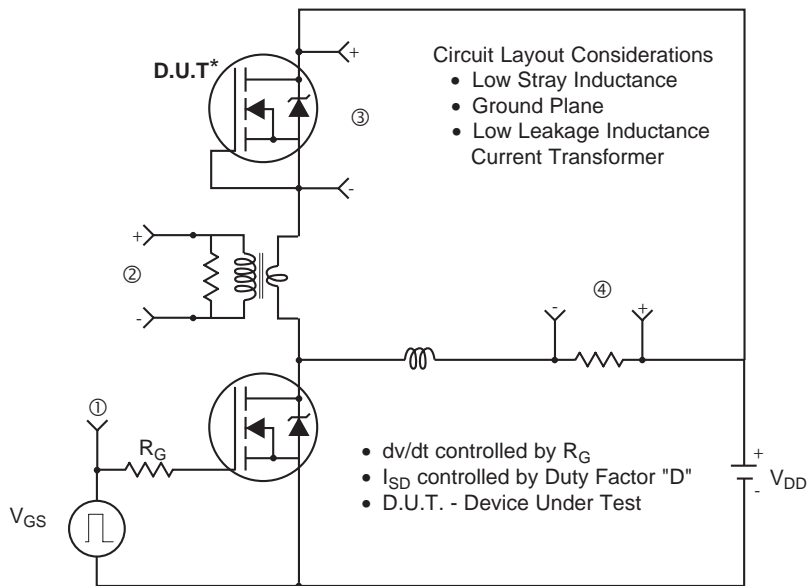


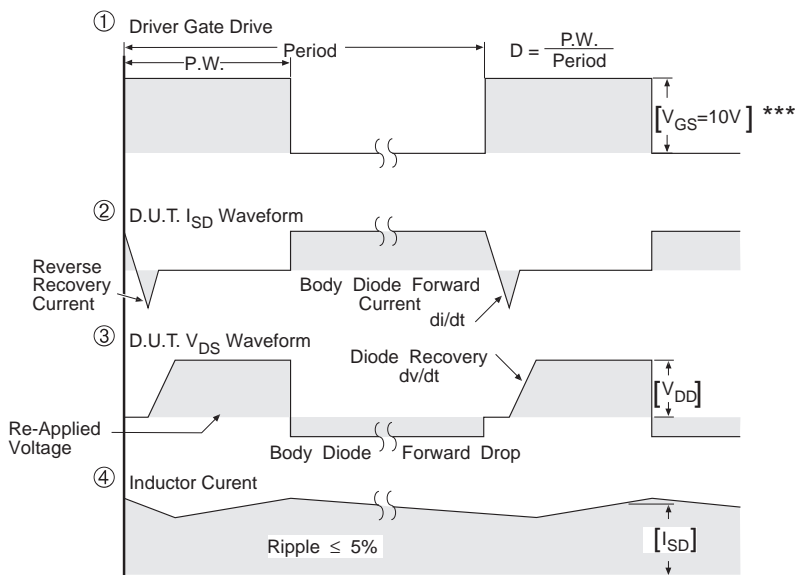
Fig 13b. Gate Charge Test Circuit



**Peak Diode Recovery dv/dt Test Circuit**



\* Reverse Polarity of D.U.T for P-Channel



\*\*\*  $V_{GS} = 5.0V$  for Logic Level and 3V Drive Devices

**Fig 14.** For N-channel TENCH power MOSFETs



### TO-220 Package Dimensions

