

**FEATURES**

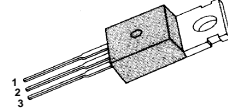
- ◆ Avalanche Rugged Technology
- ◆ Rugged Gate Oxide Technology
- ◆ Lower Input Capacitance
- ◆ Improved Gate Charge
- ◆ Extended Safe Operating Area
- ◆ Lower Leakage Current : 10  $\mu$ A (Max.) @  $V_{DS} = 250V$
- ◆ Low  $R_{DS(ON)}$  : 0.108  $\Omega$  (Typ.)

$$BV_{DSS} = 250 V$$

$$R_{DS(on)} = 0.14 \Omega$$

$$I_D = 21 A$$

**TO-220**



1. Gate 2. Drain 3. Source

**Absolute Maximum Ratings**

Symbol	Characteristic	Value	Units
$V_{DSS}$	Drain-to-Source Voltage	250	V
$I_D$	Continuous Drain Current ( $T_C=25^\circ C$ )	21	A
	Continuous Drain Current ( $T_C=100^\circ C$ )	13.3	
$I_{DM}$	Drain Current-Pulsed (1)	84	A
$V_{GS}$	Gate-to-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (2)	551	mJ
$I_{AR}$	Avalanche Current (1)	21	A
$E_{AR}$	Repetitive Avalanche Energy (1)	15.6	mJ
dv/dt	Peak Diode Recovery dv/dt (3)	4.8	V/ns
$P_D$	Total Power Dissipation ( $T_C=25^\circ C$ )	156	W
	Linear Derating Factor	1.25	
$T_J, T_{STG}$	Operating Junction and Storage Temperature Range	- 55 to +150	$^\circ C$
$T_L$	Maximum Lead Temp. for Soldering Purposes, 1/8" from case for 5-seconds	300	

**Thermal Resistance**

Symbol	Characteristic	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	--	0.8	$^\circ C/W$
$R_{\theta CS}$	Case-to-Sink	0.5	--	
$R_{\theta JA}$	Junction-to-Ambient	--	62.5	

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

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Condition
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	250	--	--	V	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA
ΔBV/ΔT <sub>J</sub>	Breakdown Voltage Temp. Coeff.	--	0.27	--	V/°C	I <sub>D</sub> =250 μA <b>See Fig 7</b>
V <sub>GS(th)</sub>	Gate Threshold Voltage	2.0	--	4.0	V	V <sub>DS</sub> =5V, I <sub>D</sub> =250μA
I <sub>GSS</sub>	Gate-Source Leakage , Forward	--	--	100	nA	V <sub>GS</sub> =30V
	Gate-Source Leakage , Reverse	--	--	-100		V <sub>GS</sub> =-30V
I <sub>DSS</sub>	Drain-to-Source Leakage Current	--	--	10	μA	V <sub>DS</sub> =250V
		--	--	100		V <sub>DS</sub> =200V, T <sub>C</sub> =125°C
R <sub>DS(on)</sub>	Static Drain-Source On-State Resistance	--	--	0.14	Ω	V <sub>GS</sub> =10V, I <sub>D</sub> =10.5A (4)
g <sub>fs</sub>	Forward Transconductance	--	15.7	--	∅	V <sub>DS</sub> =40V, I <sub>D</sub> =10.5A (4)
C <sub>iss</sub>	Input Capacitance	--	2300	3000	pF	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f =1MHz <b>See Fig 5</b>
C <sub>oss</sub>	Output Capacitance	--	345	400		
C <sub>rss</sub>	Reverse Transfer Capacitance	--	155	180		
t <sub>d(on)</sub>	Turn-On Delay Time	--	21	60	ns	V <sub>DD</sub> =125V, I <sub>D</sub> =25A, R <sub>G</sub> =5.3Ω <b>See Fig 13</b> (4) (5)
t <sub>r</sub>	Rise Time	--	20	60		
t <sub>d(off)</sub>	Turn-Off Delay Time	--	86	190		
t <sub>f</sub>	Fall Time	--	40	100		
Q <sub>g</sub>	Total Gate Charge	--	88	114	nC	V <sub>DS</sub> =200V, V <sub>GS</sub> =10V, I <sub>D</sub> =25A <b>See Fig 6 &amp; Fig 12</b> (4) (5)
Q <sub>gs</sub>	Gate-Source Charge	--	16	--		
Q <sub>gd</sub>	Gate-Drain ("Miller") Charge	--	35.6	--		

### Source-Drain Diode Ratings and Characteristics

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Condition
I <sub>S</sub>	Continuous Source Current	--	--	21	A	Integral reverse pn-diode in the MOSFET
I <sub>SM</sub>	Pulsed-Source Current (1)	--	--	84		
V <sub>SD</sub>	Diode Forward Voltage (4)	--	--	1.5	V	T <sub>J</sub> =25°C, I <sub>S</sub> =21A, V <sub>GS</sub> =0V
t <sub>rr</sub>	Reverse Recovery Time	--	255	--	ns	T <sub>J</sub> =25°C, I <sub>F</sub> =25A
Q <sub>rr</sub>	Reverse Recovery Charge	--	2.3	--	μC	di <sub>F</sub> /dt=100A/μs (4)

#### Notes ;

- (1) Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- (2) L=2mH, I<sub>AS</sub>=21A, V<sub>DD</sub>=50V, R<sub>G</sub>=27Ω, Starting T<sub>J</sub>=25°C
- (3) I<sub>SD</sub> ≤ 25A, di/dt ≤ 300A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub>=25°C
- (4) Pulse Test : Pulse Width = 250μs, Duty Cycle ≤ 2%
- (5) Essentially Independent of Operating Temperature

Fig 1. Output Characteristics

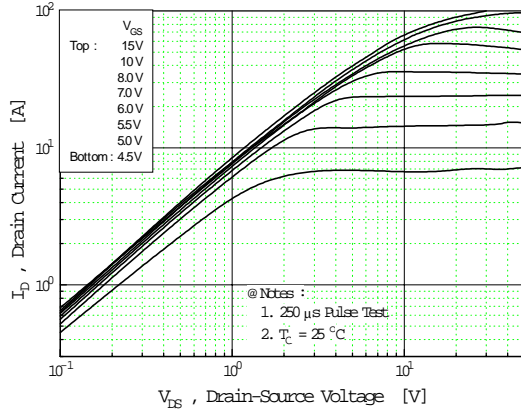


Fig 2. Transfer Characteristics

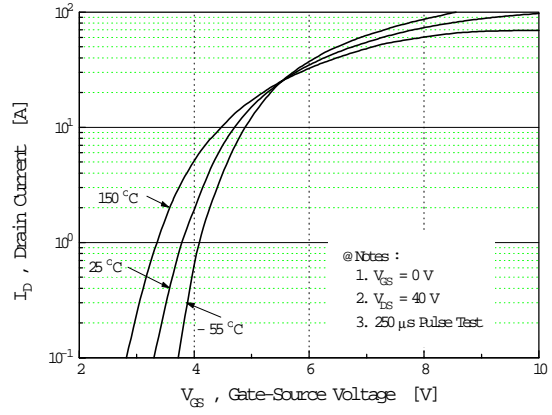


Fig 3. On-Resistance vs. Drain Current

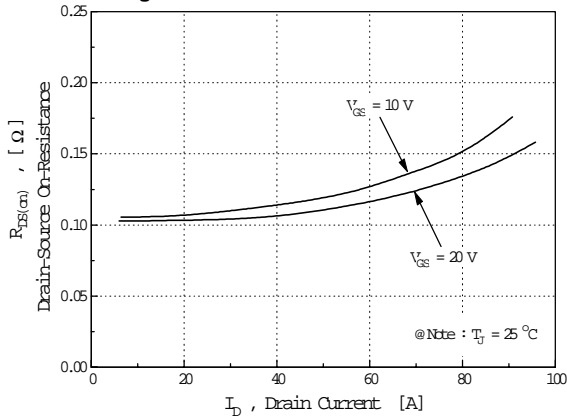


Fig 4. Source-Drain Diode Forward Voltage

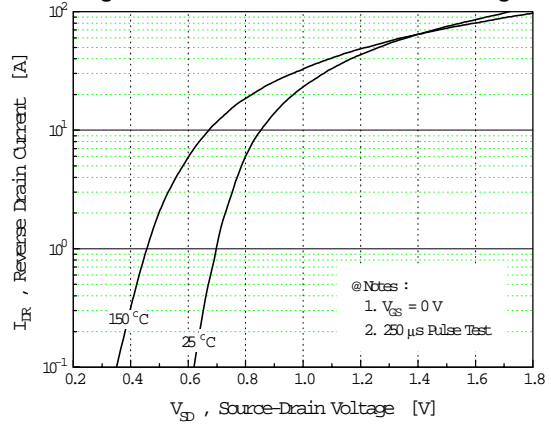


Fig 5. Capacitance vs. Drain-Source Voltage

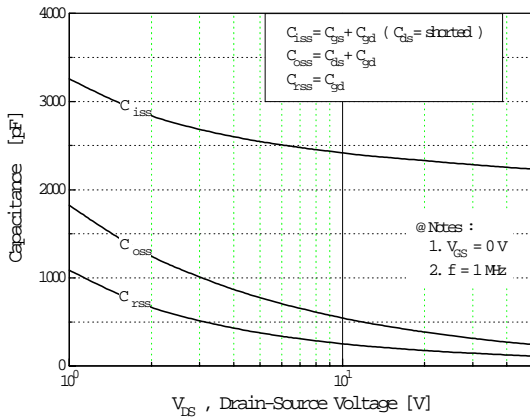
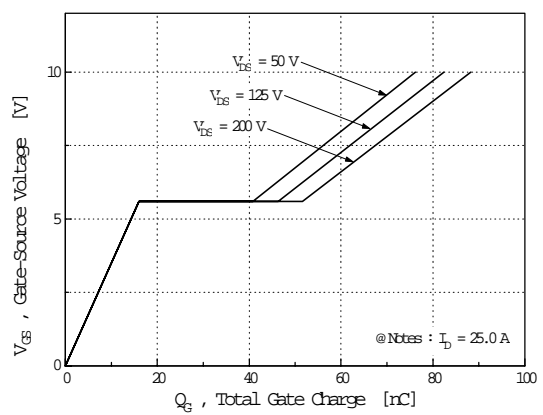
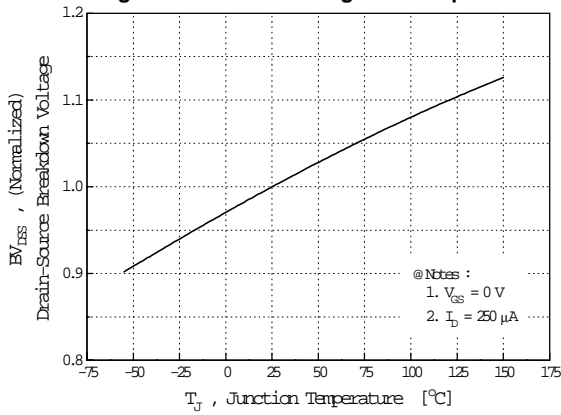


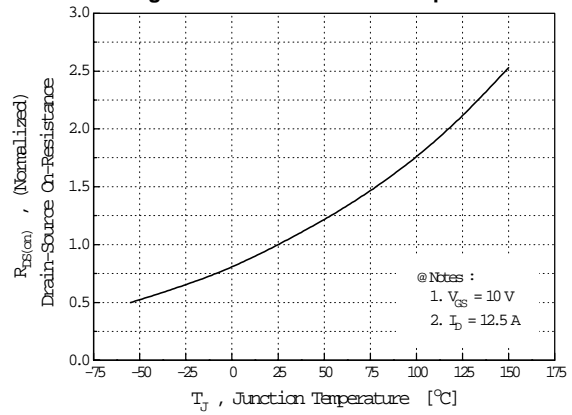
Fig 6. Gate Charge vs. Gate-Source Voltage



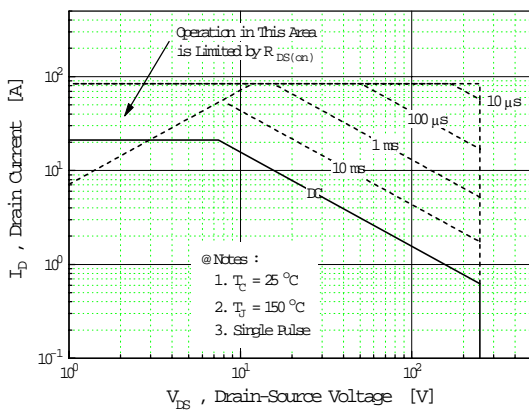
**Fig 7. Breakdown Voltage vs. Temperature**



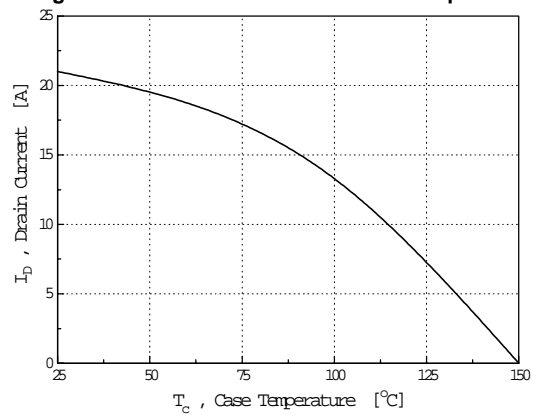
**Fig 8. On-Resistance vs. Temperature**



**Fig 9. Max. Safe Operating Area**



**Fig 10. Max. Drain Current vs. Case Temperature**



**Fig 11. Thermal Response**

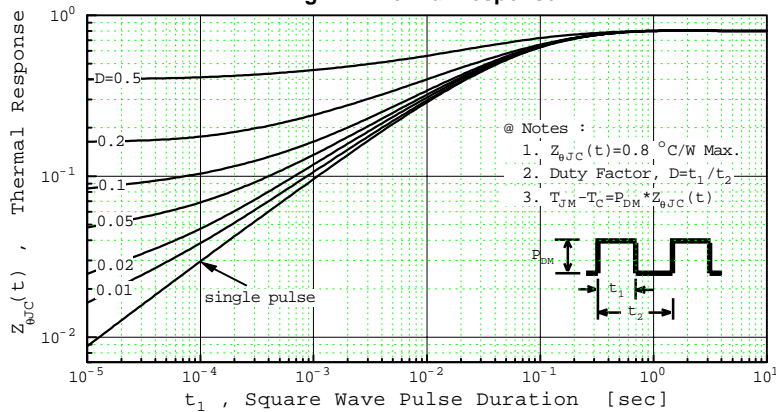


Fig 12. Gate Charge Test Circuit & Waveform

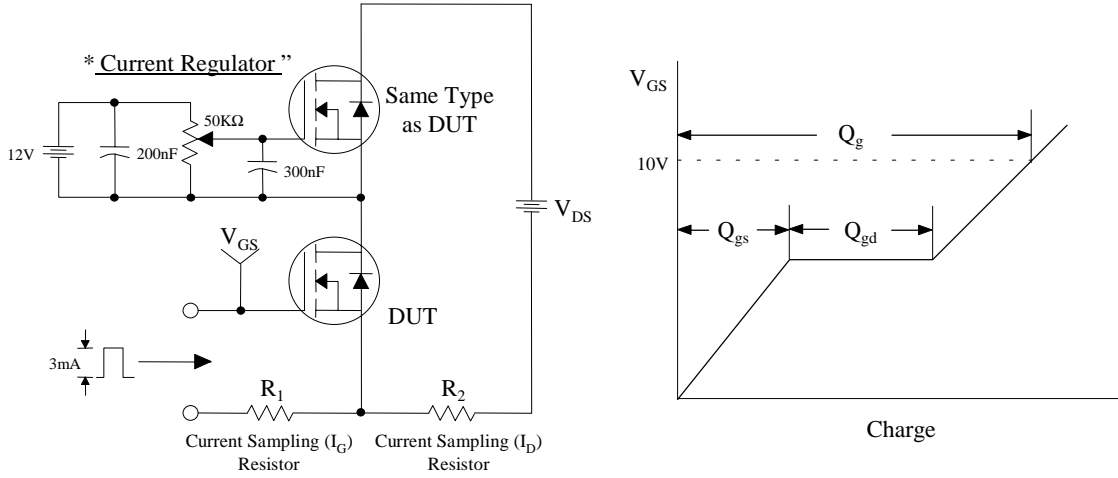


Fig 13. Resistive Switching Test Circuit & Waveforms

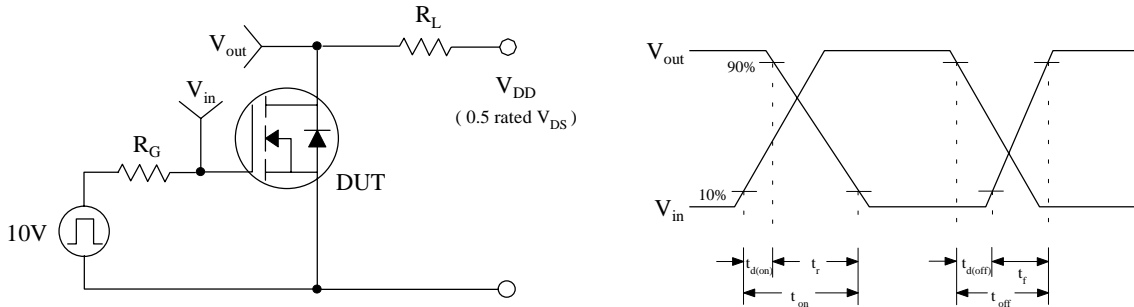


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

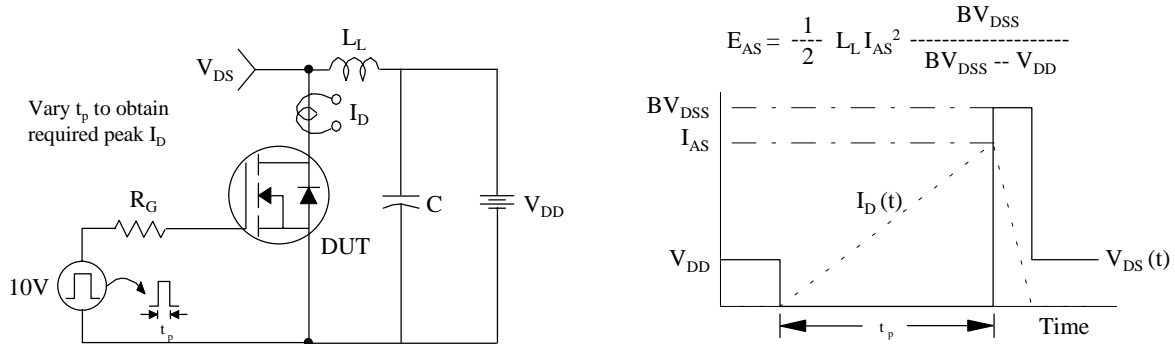
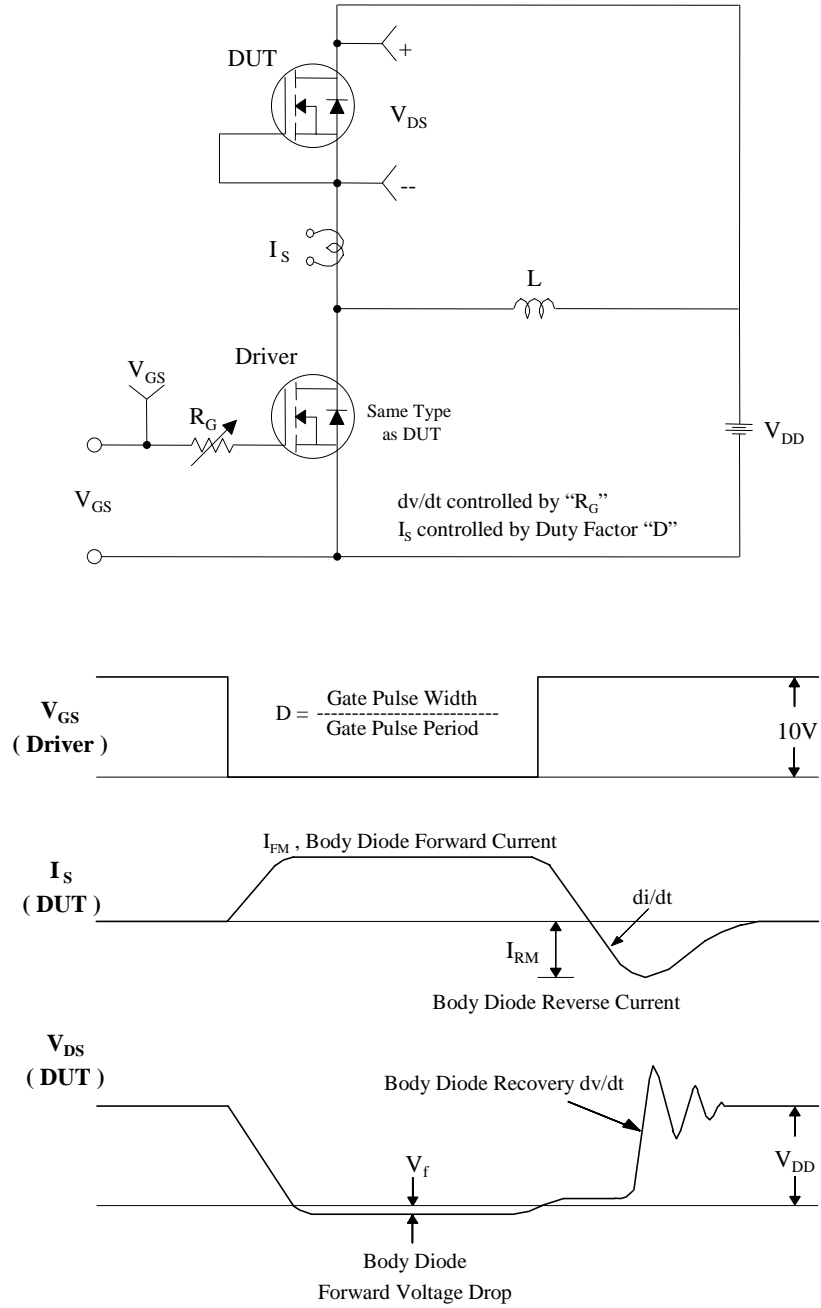


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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