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## 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.) @  $V_{DS} = -60V$
- Lower  $R_{DS(ON)}$  : 0.362  $\Omega$  (Typ.)

$BV_{DSS} = -60 V$   
 $R_{DS(on)} = 0.5 \Omega$   
 $I_D = -5.3 A$

D-PAK I-PAK



1. Gate 2. Drain 3. Source

## Absolute Maximum Ratings

Symbol	Characteristic	Value	Units
$V_{DSS}$	Drain-to-Source Voltage	-60	V
$I_D$	Continuous Drain Current ( $T_C=25^\circ C$ )	-5.3	A
	Continuous Drain Current ( $T_C=100^\circ C$ )	-3.7	
$I_{DM}$	Drain Current-Pulsed	21	A
$V_{GS}$	Gate-to-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy	120	mJ
$I_{AR}$	Avalanche Current	-5.3	A
$E_{AR}$	Repetitive Avalanche Energy	2.4	mJ
$dv/dt$	Peak Diode Recovery $dv/dt$	-5.5	V/ns
$P_D$	Total Power Dissipation ( $T_A=25^\circ C$ ) *	2.5	W
	Total Power Dissipation ( $T_C=25^\circ C$ )	24	W
	Linear Derating Factor	0.19	$W^\circ C$
$T_J, T_{STG}$	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	--	5.21	$^\circ C/W$
$R_{\theta JA}$	Junction-to-Ambient *	--	50	
$R_{\theta JA}$	Junction-to-Ambient	--	110	

\* When mounted on the minimum pad size recommended (PCB Mount).

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## Electrical Characteristics ( $T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Condition
$\text{BV}_{\text{DSS}}$	Drain-Source Breakdown Voltage	-60	--	--	V	$\text{V}_{\text{GS}}=0\text{V}, \text{I}_D=-250\mu\text{A}$
$\Delta \text{BV}/\Delta T_J$	Breakdown Voltage Temp. Coeff.	--	-0.05	--	$\text{V}/^\circ\text{C}$	$\text{I}_D=-250\mu\text{A}$ See Fig 7
$\text{V}_{\text{GS(th)}}$	Gate Threshold Voltage	-2.0	--	-4.0	V	$\text{V}_{\text{DS}}=-5\text{V}, \text{I}_D=-250\mu\text{A}$
$\text{I}_{\text{GSS}}$	Gate-Source Leakage , Forward	--	--	-100	nA	$\text{V}_{\text{GS}}=-20\text{V}$
	Gate-Source Leakage , Reverse	--	--	100		$\text{V}_{\text{GS}}=20\text{V}$
$\text{I}_{\text{DSS}}$	Drain-to-Source Leakage Current	--	--	-10	$\mu\text{A}$	$\text{V}_{\text{DS}}=-60\text{V}$
		--	--	-100		$\text{V}_{\text{DS}}=-48\text{V}, \text{T}_C=125^\circ\text{C}$
$\text{R}_{\text{DS(on)}}$	Static Drain-Source On-State Resistance	--	--	0.5	$\Omega$	$\text{V}_{\text{GS}}=-10\text{V}, \text{I}_D=-2.7\text{A}$ ④
$\text{g}_{\text{fs}}$	Forward Transconductance	--	2.2	--	S	$\text{V}_{\text{DS}}=-30\text{V}, \text{I}_D=-2.7\text{A}$ ④
$\text{C}_{\text{iss}}$	Input Capacitance	--	270	350	pF	$\text{V}_{\text{GS}}=0\text{V}, \text{V}_{\text{DS}}=-25\text{V}, \text{f}=1\text{MHz}$ See Fig 5
$\text{C}_{\text{oss}}$	Output Capacitance	--	90	135		
$\text{C}_{\text{rss}}$	Reverse Transfer Capacitance	--	25	35		
$\text{t}_{\text{d(on)}}$	Turn-On Delay Time	--	10	30	ns	$\text{V}_{\text{DD}}=-30\text{V}, \text{I}_D=-6.7\text{A}, \text{R}_G=24\Omega$ See Fig 13 ④⑤
$\text{t}_r$	Rise Time	--	19	50		
$\text{t}_{\text{d(off)}}$	Turn-Off Delay Time	--	21	50		
$\text{t}_f$	Fall Time	--	16	40		
$\text{Q}_g$	Total Gate Charge	--	9	11	nC	$\text{V}_{\text{DS}}=-48\text{V}, \text{V}_{\text{GS}}=-10\text{V}, \text{I}_D=-6.7\text{A}$ See Fig 6 & Fig 12 ④⑤
$\text{Q}_{\text{gs}}$	Gate-Source Charge	--	1.8	--		
$\text{Q}_{\text{gd}}$	Gate-Drain("Miller") Charge	--	4.2	--		

## Source-Drain Diode Ratings and Characteristics

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Condition
$\text{I}_s$	Continuous Source Current	--	--	-5.3	A	Integral reverse pn-diode in the MOSFET
$\text{I}_{\text{SM}}$	Pulsed-Source Current ①	--	--	-21		
$\text{V}_{\text{SD}}$	Diode Forward Voltage ④	--	--	-3.8	V	$\text{T}_J=25^\circ\text{C}, \text{I}_s=-5.3\text{A}, \text{V}_{\text{GS}}=0\text{V}$
$\text{t}_{\text{rr}}$	Reverse Recovery Time	--	75	--	ns	$\text{T}_J=25^\circ\text{C}, \text{I}_F=-6.7\text{A}$
$\text{Q}_{\text{rr}}$	Reverse Recovery Charge	--	0.17	--	$\mu\text{C}$	$\text{di}/\text{dt}=100\text{A}/\mu\text{s}$ ④

### Notes :

- ① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ②  $L=5.0\text{mH}, \text{I}_{\text{AS}}=-5.3\text{A}, \text{V}_{\text{DD}}=-25\text{V}, \text{R}_G=27\Omega^*$ , Starting  $\text{T}_J=25^\circ\text{C}$
- ③  $\text{I}_{\text{SD}} \leq -6.7\text{A}, \text{di}/\text{dt} \leq 200\text{A}/\mu\text{s}, \text{V}_{\text{DD}} \leq \text{BV}_{\text{DSS}}$ , Starting  $\text{T}_J=25^\circ\text{C}$
- ④ Pulse Test : Pulse Width =  $250\mu\text{s}$ , Duty Cycle  $\leq 2\%$
- ⑤ Essentially Independent of Operating Temperature

Fig 1. Output Characteristics

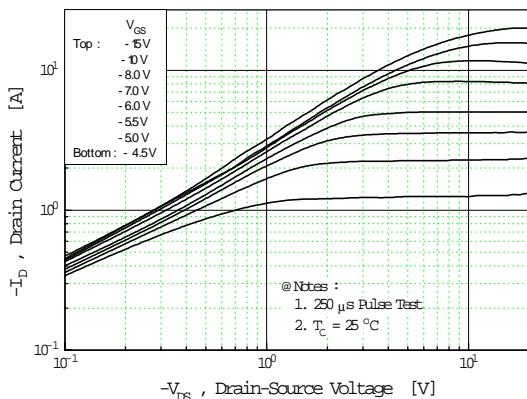


Fig 2. Transfer Characteristics

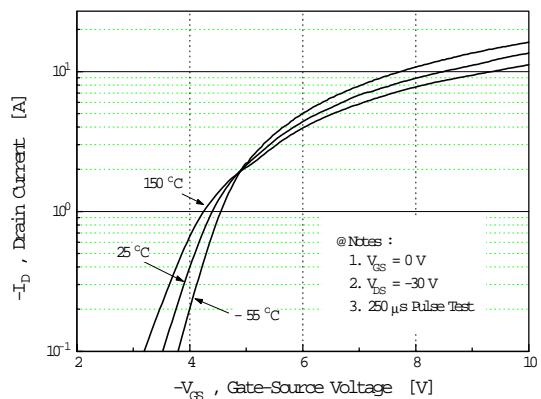


Fig 3. On-Resistance vs. Drain Current

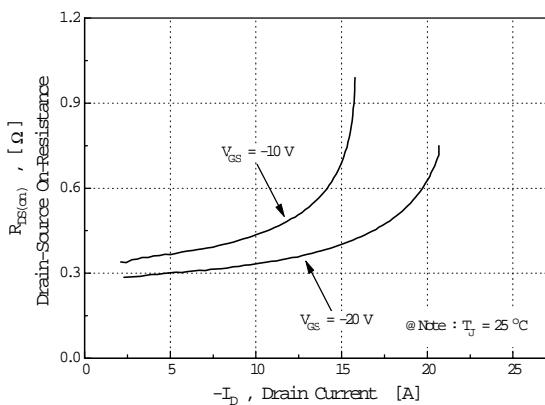


Fig 4. Source-Drain Diode Forward Voltage

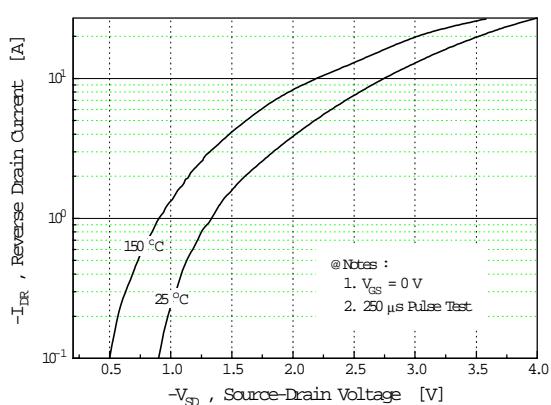


Fig 5. Capacitance vs. Drain-Source Voltage

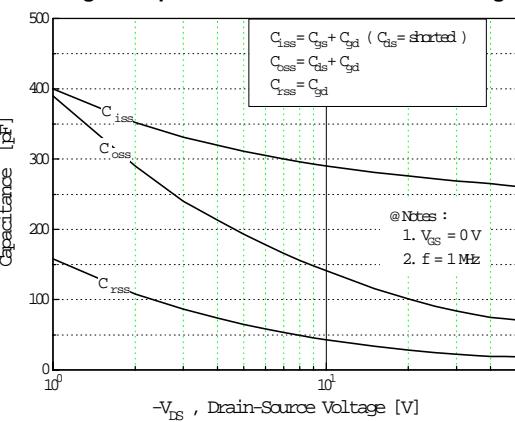
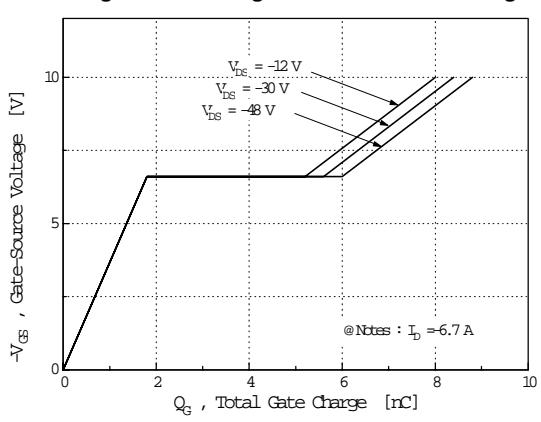


Fig 6. Gate Charge vs. Gate-Source Voltage



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Fig 7. Breakdown Voltage vs. Temperature

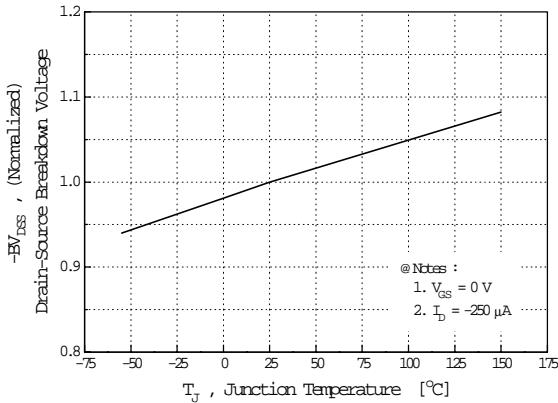


Fig 8. On-Resistance vs. Temperature

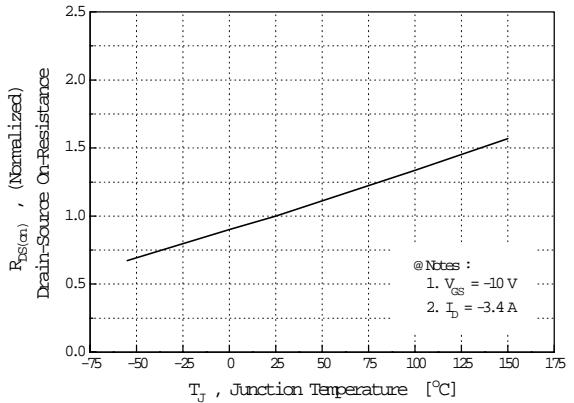


Fig 9. Max. Safe Operating Area

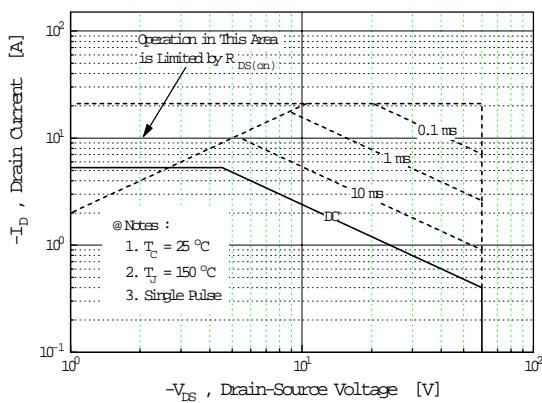


Fig 10. Max. Drain Current vs. Case Temperature

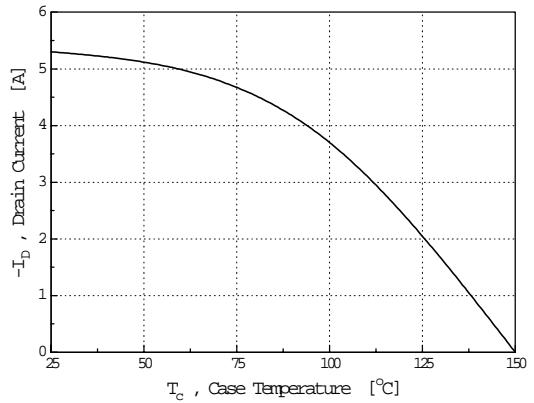


Fig 11. Thermal Response

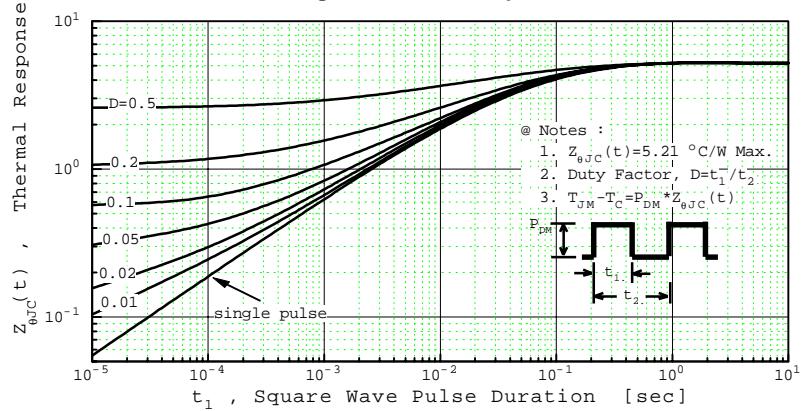


Fig 12. Gate Charge Test Circuit & Waveform

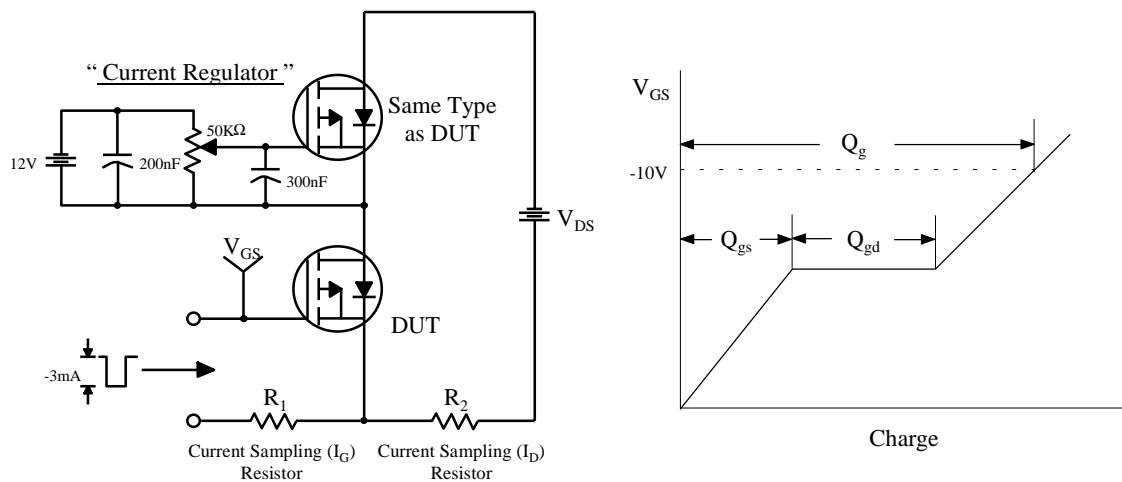


Fig 13. Resistive Switching Test Circuit & Waveforms

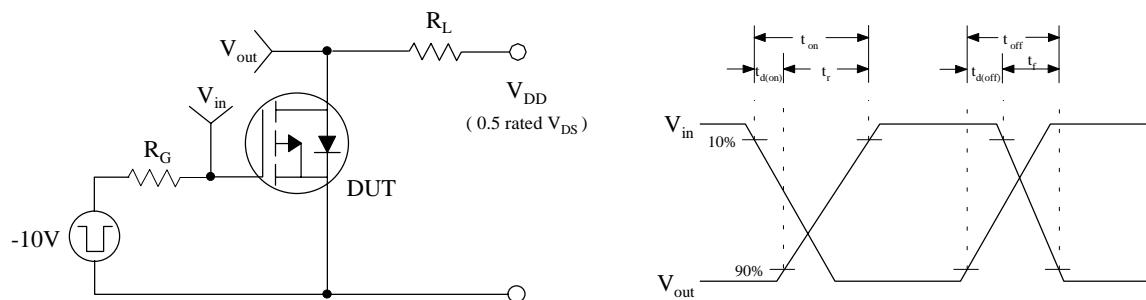


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

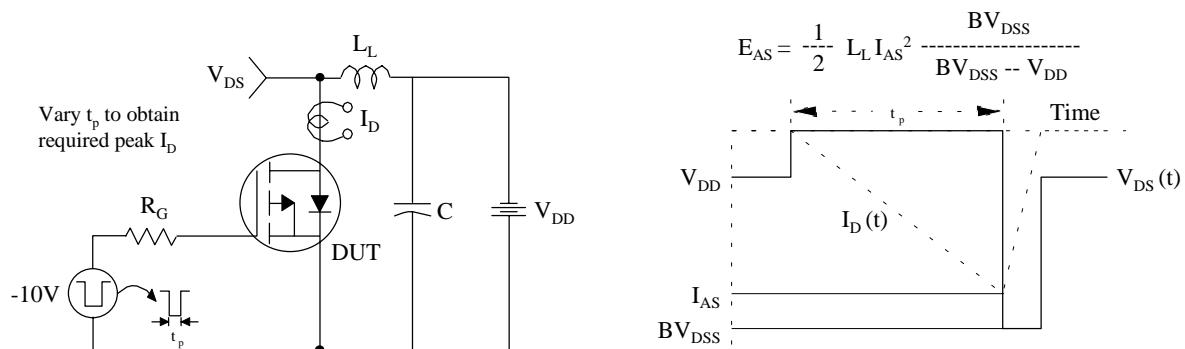
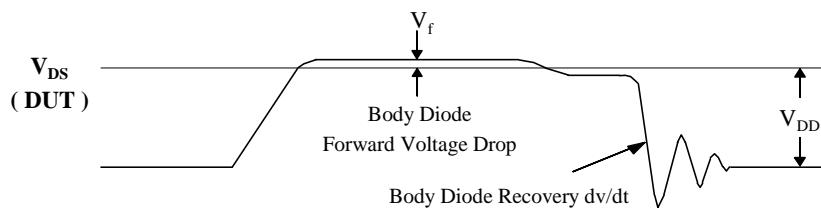
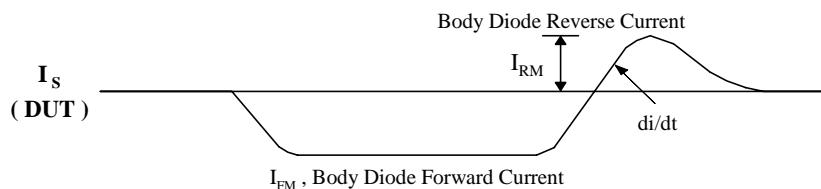
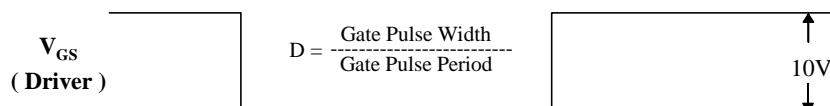
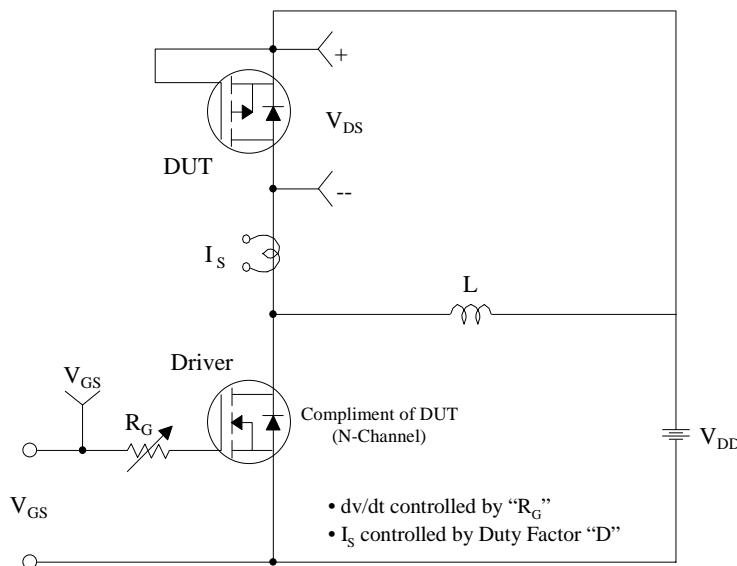


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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