

## Advanced Power MOSFET

## IRF710A

### FEATURES

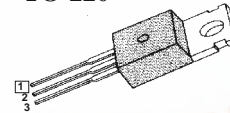
- ◆ Avalanche Rugged Technology
- ◆ Rugged Gate Oxide Technology
- ◆ Lower Input Capacitance
- ◆ Improved Gate Charge
- ◆ Extended Safe Operating Area
- ◆ Lower Leakage Current: 10 $\mu$ A (Max.) @  $V_{DS} = 400V$
- ◆ Low  $R_{DS(ON)}$ : 2.815 $\Omega$  (Typ.)

$$BV_{DSS} = 400 V$$

$$R_{DS(on)} = 3.6\Omega$$

$$I_D = 2 A$$

TO-220



1. Gate 2. Drain 3. Source

### Absolute Maximum Ratings

Symbol	Characteristic	Value	Units
$V_{DSS}$	Drain-to-Source Voltage	400	V
$I_D$	Continuous Drain Current ( $T_C=25^\circ C$ )	2	A
	Continuous Drain Current ( $T_C=100^\circ C$ )	1.3	
$I_{DM}$	Drain Current-Pulsed (1)	6	A
$V_{GS}$	Gate-to-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (2)	114	mJ
$I_{AR}$	Avalanche Current (1)	2	A
$E_{AR}$	Repetitive Avalanche Energy (1)	3.6	mJ
dv/dt	Peak Diode Recovery dv/dt (3)	4.0	V/ns
$P_D$	Total Power Dissipation ( $T_C=25^\circ C$ )	36	W
	Linear Derating Factor	0.29	
$T_J, T_{STG}$	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	--	3.44	$^\circ C/W$
$R_{\theta CS}$	Case-to-Sink	0.5	--	
$R_{\theta JA}$	Junction-to-Ambient	--	62.5	

Rev. B

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

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Condition
$BV_{DSS}$	Drain-Source Breakdown Voltage	400	--	--	V	$V_{GS}=0V, I_D=250\mu A$
$\Delta BV/\Delta T_J$	Breakdown Voltage Temp. Coeff.	--	0.53	--	V/°C	$I_D=250\mu A$ <b>See Fig 7</b>
$V_{GS(th)}$	Gate Threshold Voltage	2.0	--	4.0	V	$V_{DS}=5V, I_D=250\mu A$
$I_{GSS}$	Gate-Source Leakage, Forward	--	--	100	nA	$V_{GS}=30V$
	Gate-Source Leakage, Reverse	--	--	-100		$V_{GS}=-30V$
$I_{DSS}$	Drain-to-Source Leakage Current	--	--	10	$\mu A$	$V_{DS}=400V$
		--	--	100		$V_{DS}=320V, T_C=125^\circ C$
$R_{DS(on)}$	Static Drain-Source On-State Resistance	--	--	3.6	$\Omega$	$V_{GS}=10V, I_D=1A$ (4)
$g_{fs}$	Forward Transconductance	--	1.29	--	$\bar{S}$	$V_{DS}=50V, I_D=1A$ (4)
$C_{iss}$	Input Capacitance	--	215	280	pF	$V_{GS}=0V, V_{DS}=25V, f=1MHz$ <b>See Fig 5</b>
$C_{oss}$	Output Capacitance	--	35	42		
$C_{rss}$	Reverse Transfer Capacitance	--	13	17		
$t_{d(on)}$	Turn-On Delay Time	--	11	30	ns	$V_{DD}=200V, I_D=2A,$ $R_G=24\Omega$ <b>See Fig 13</b> (4) (5)
$t_r$	Rise Time	--	15	40		
$t_{d(off)}$	Turn-Off Delay Time	--	38	90		
$t_f$	Fall Time	--	13	35		
$Q_g$	Total Gate Charge	--	10	14	nC	$V_{DS}=320V, V_{GS}=10V,$ $I_D=2A$ <b>See Fig 6 &amp; Fig 12</b> (4) (5)
$Q_{gs}$	Gate-Source Charge	--	1.8	--		
$Q_{gd}$	Gate-Drain (. Miller. ) Charge	--	5.4	--		

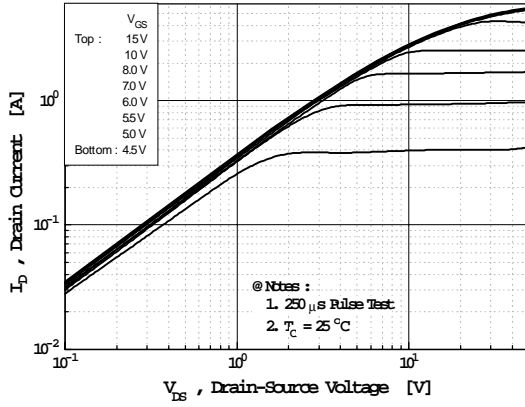
### Source-Drain Diode Ratings and Characteristics

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Condition
$I_S$	Continuous Source Current	--	--	2	A	Integral reverse pn-diode in the MOSFET
$I_{SM}$	Pulsed-Source Current (1)	--	--	6		
$V_{SD}$	Diode Forward Voltage (4)	--	--	1.5	V	$T_J=25^\circ C, I_S=2A, V_{GS}=0V$
$t_{rr}$	Reverse Recovery Time	--	224	--	ns	$T_J=25^\circ C, I_F=2A$
$Q_{rr}$	Reverse Recovery Charge	--	0.87	--	$\mu C$	$di_F/dt=100A/\mu s$ (4)

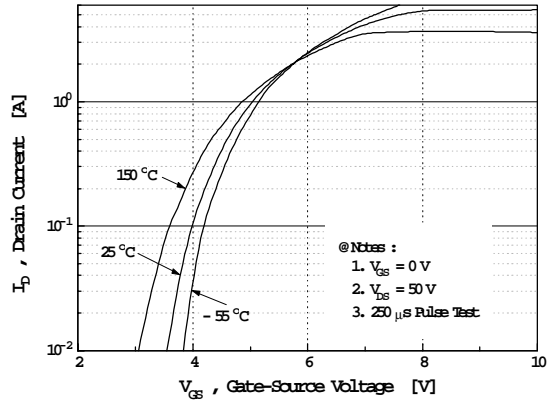
#### Notes;

- (1) Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
- (2)  $L=50mH, I_{AS}=2A, V_{DD}=50V, R_G=27\Omega, \text{Starting } T_J=25^\circ C$
- (3)  $I_{SD} \leq 2A, di/dt \leq 80A/\mu s, V_{DD} \leq BV_{DSS}, \text{Starting } T_J=25^\circ C$
- (4) Pulse Test: Pulse Width = 250 $\mu s$ , Duty Cycle  $\leq 2\%$
- (5) Essentially Independent of Operating Temperature

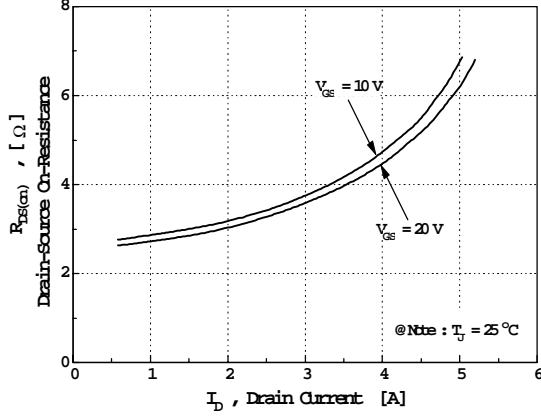
**Fig 1. Output Characteristics**



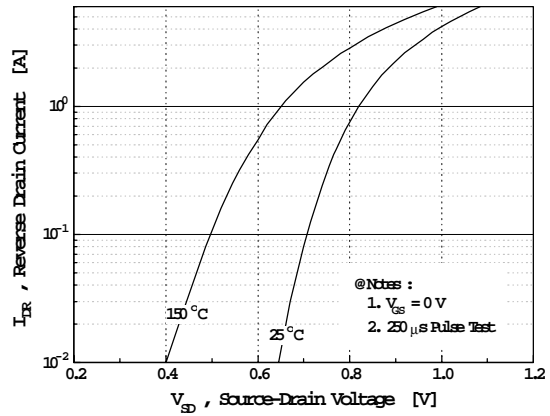
**Fig 2. Transfer Characteristics**



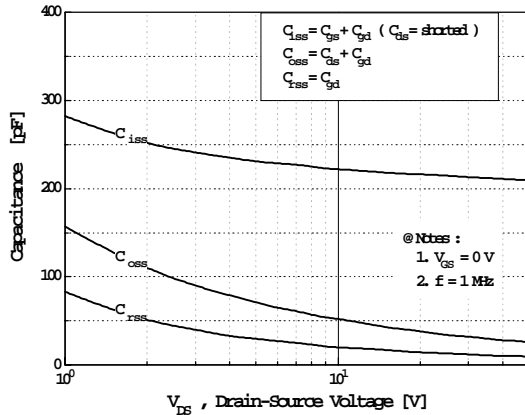
**Fig 3. On-Resistance vs. Drain Current**



**Fig 4. Source-Drain Diode Forward Voltage**



**Fig 5. Capacitance vs. Drain-Source Voltage**



**Fig 6. Gate Charge vs. Gate-Source Voltage**

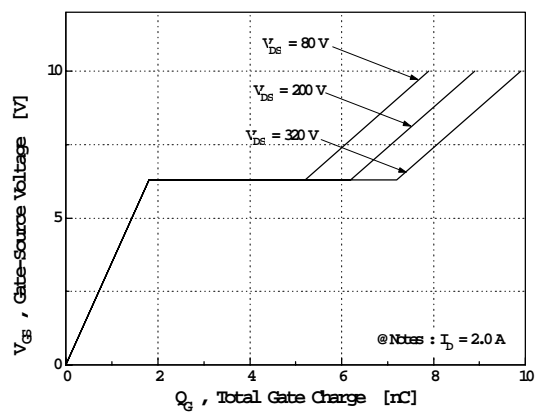


Fig 7. Breakdown Voltage vs. Temperature

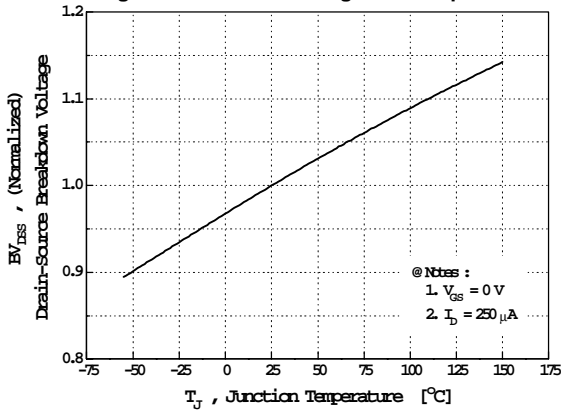


Fig 8. On-Resistance vs. Temperature

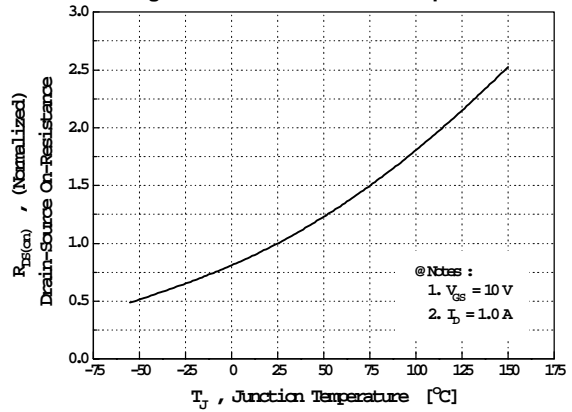


Fig 9. Max. Safe Operating Area

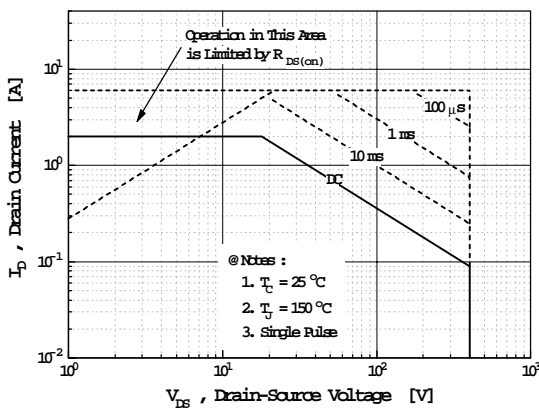


Fig 10. Max. Drain Current vs. Case Temperature

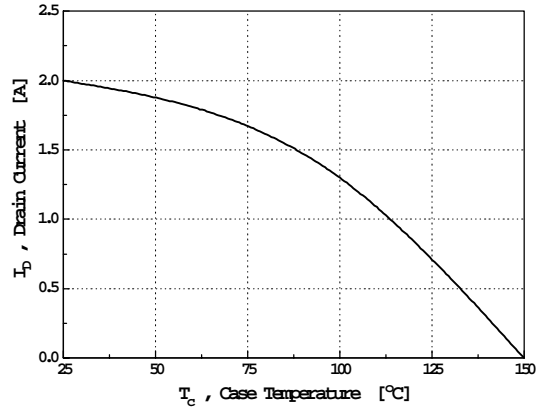
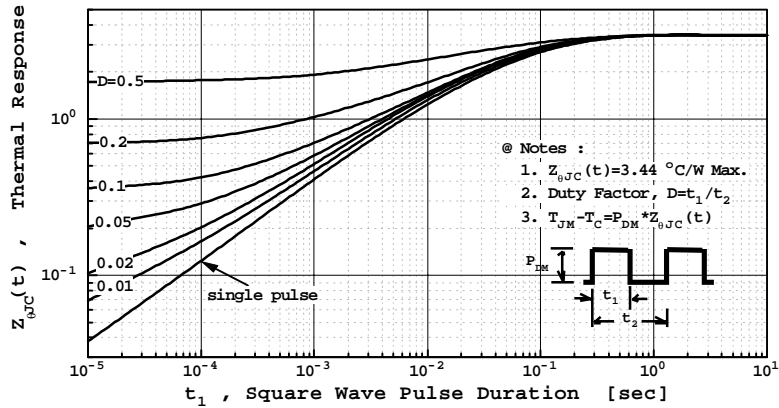
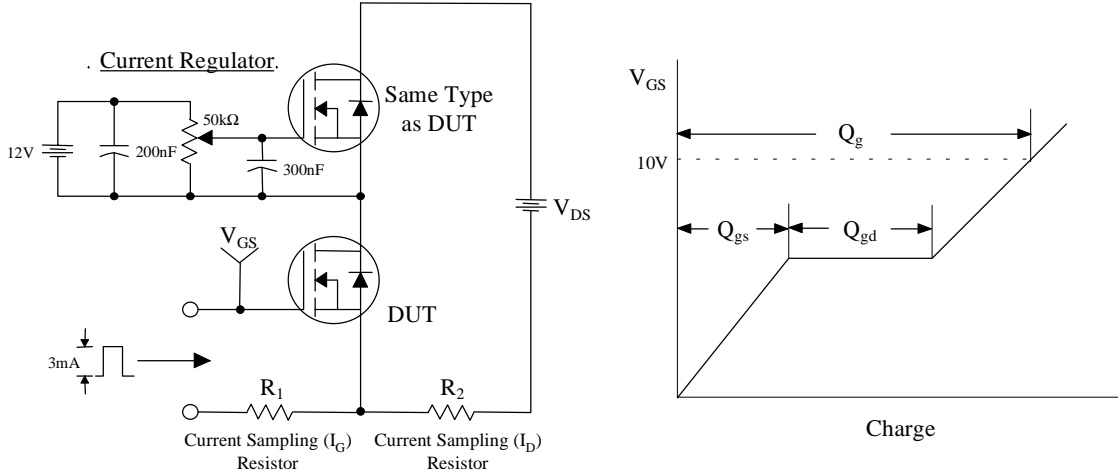


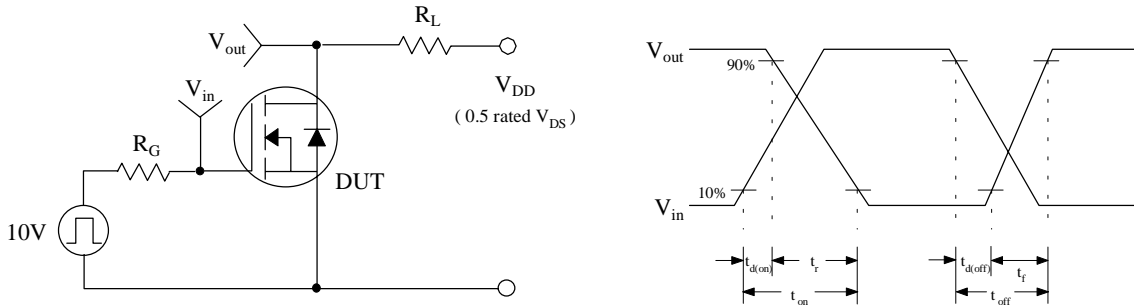
Fig 11. Thermal Response



**Fig 12. Gate Charge Test Circuit & Waveform**



**Fig 13. Resistive Switching Test Circuit & Waveforms**



**Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms**

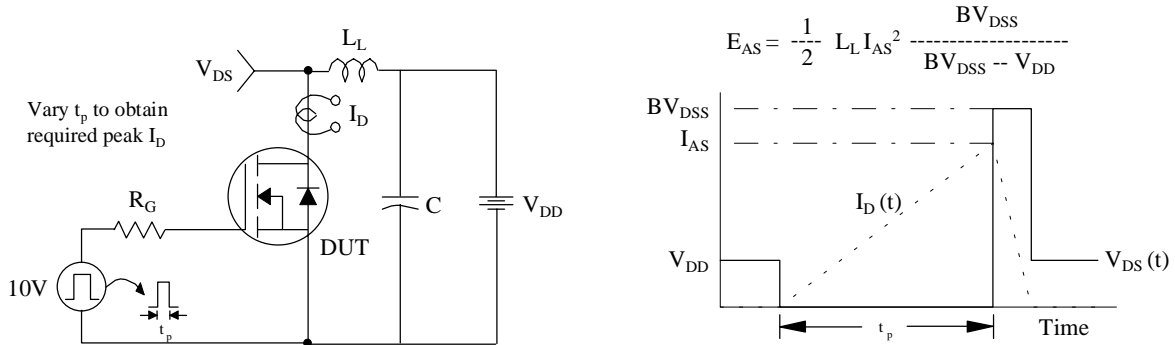
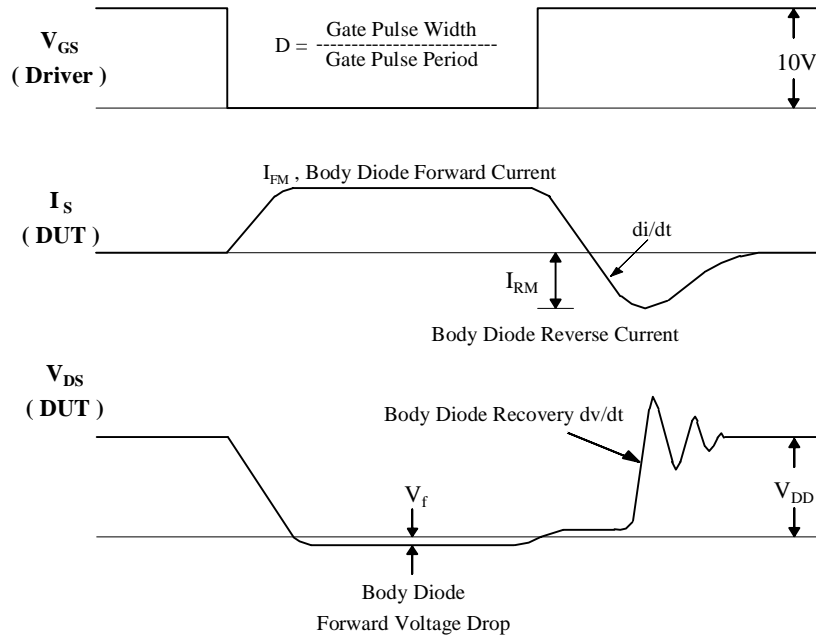
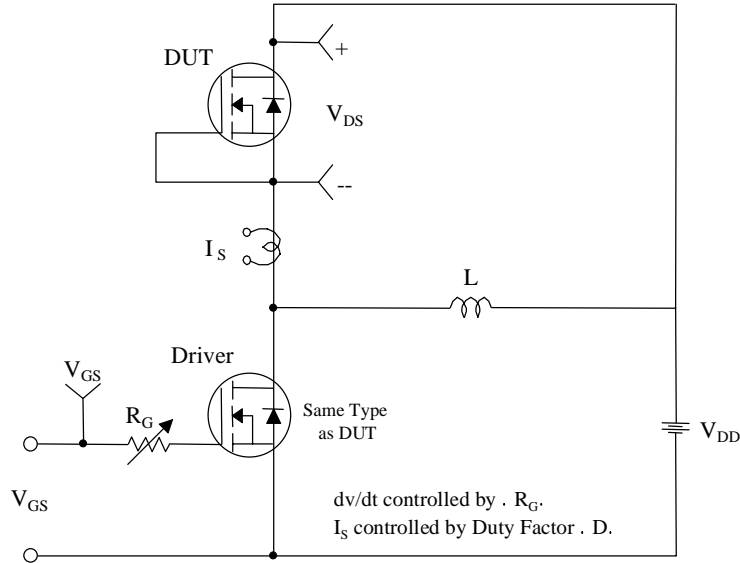


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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