

Advanced Power MOSFET

IRF720A

FEATURES

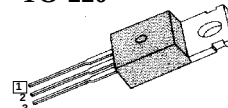
- ◆ Avalanche Rugged Technology
- ◆ Rugged Gate Oxide Technology
- ◆ Lower Input Capacitance
- ◆ Improved Gate Charge
- ◆ Extended Safe Operating Area
- ◆ Lower Leakage Current: 10 μ A (Max.) @ $V_{DS} = 400V$
- ◆ Lower $R_{DS(ON)}$: 1.408 Ω (Typ.)

$$BV_{DSS} = 400 V$$

$$R_{DS(on)} = 1.8\Omega$$

$$I_D = 3.3 A$$

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 ($T_C=25^\circ C$)	3.3	A
	Continuous Drain Current ($T_C=100^\circ C$)	2.1	
I_{DM}	Drain Current-Pulsed (1)	13	A
V_{GS}	Gate-to-Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (2)	249	mJ
I_{AR}	Avalanche Current (1)	3.3	A
E_{AR}	Repetitive Avalanche Energy (1)	4.9	mJ
dv/dt	Peak Diode Recovery dv/dt (3)	4.0	V/ns
P_D	Total Power Dissipation ($T_C=25^\circ C$)	49	W
	Linear Derating Factor	0.39	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	--	2.57	$^\circ C/W$
$R_{\theta CS}$	Case-to-Sink	0.5	--	
$R_{\theta JA}$	Junction-to-Ambient	--	62.5	

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Rev. B

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.	--	0.54	--	V/ $^\circ\text{C}$	$I_D=250\mu A$ See Fig 7
$V_{GS(th)}$	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	μA	$V_{DS}=400V$
		--	--	100		$V_{DS}=320V, T_C=125^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-State Resistance	--	--	1.8	Ω	$V_{GS}=10V, I_D=1.65A$ (4)
g_{fs}	Forward Transconductance	--	2.25	--	S	$V_{DS}=50V, I_D=1.65A$ (4)
C_{iss}	Input Capacitance	--	385	500	pF	$V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$ See Fig 5
C_{oss}	Output Capacitance	--	60	70		
C_{rss}	Reverse Transfer Capacitance	--	27	33		
$t_{d(on)}$	Turn-On Delay Time	--	12	35	ns	$V_{DD}=200V, I_D=3.3A,$ $R_G=18\Omega$ See Fig 13 (4) (5)
t_r	Rise Time	--	17	45		
$t_{d(off)}$	Turn-Off Delay Time	--	51	110		
t_f	Fall Time	--	18	45		
Q_g	Total Gate Charge	--	19	26	nC	$V_{DS}=320V, V_{GS}=10V,$ $I_D=3.3A$ See Fig 6 & Fig 12 (4) (5)
Q_{gs}	Gate-Source Charge	--	2.7	--		
Q_{gd}	Gate-Drain (. Miller.) Charge	--	11.1	--		

Source-Drain Diode Ratings and Characteristics

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Condition
I_S	Continuous Source Current	--	--	3.3	A	Integral reverse pn-diode in the MOSFET
I_{SM}	Pulsed-Source Current (1)	--	--	13		
V_{SD}	Diode Forward Voltage (4)	--	--	1.5	V	$T_J=25^\circ\text{C}, I_S=3.3A, V_{GS}=0V$
t_{rr}	Reverse Recovery Time	--	230	--	ns	$T_J=25^\circ\text{C}, I_F=3.3A$
Q_{rr}	Reverse Recovery Charge	--	1.16	--	μC	$di_F/dt=100A/\mu s$ (4)

Notes;

- (1) Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
- (2) $L=40\text{mH}, I_{AS}=3.3A, V_{DD}=50V, R_G=27\Omega$, Starting $T_J=25^\circ\text{C}$
- (3) $I_{SD} \leq 3.3A, di/dt \leq 110A/\mu s, V_{DD} \leq BV_{DSS}$, Starting $T_J=25^\circ\text{C}$
- (4) Pulse Test: Pulse Width = $250\mu s$, Duty Cycle $\leq 2\%$
- (5) Essentially Independent of Operating Temperature

Fig 1. Output Characteristics

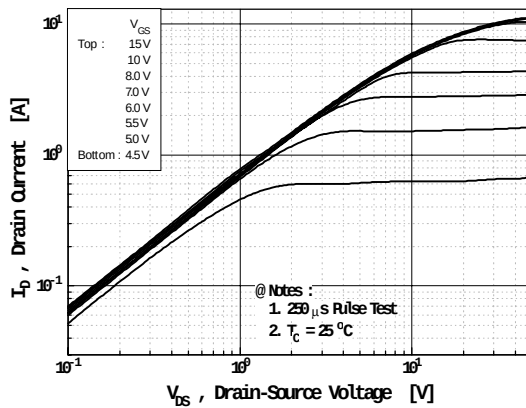


Fig 2. Transfer Characteristics

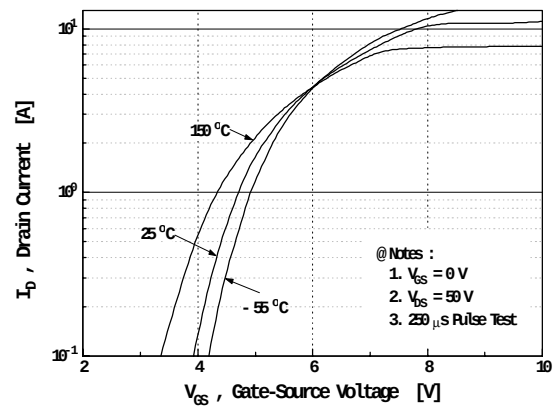


Fig 3. On-Resistance vs. Drain Current

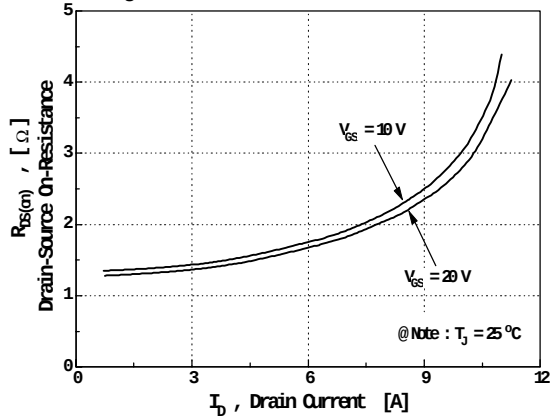


Fig 4. Source-Drain Diode Forward Voltage

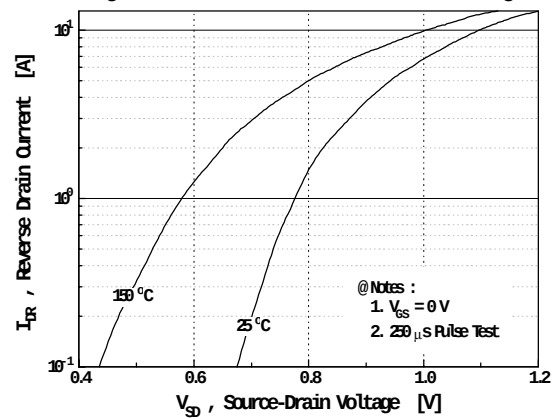


Fig 5. Capacitance vs. Drain-Source Voltage

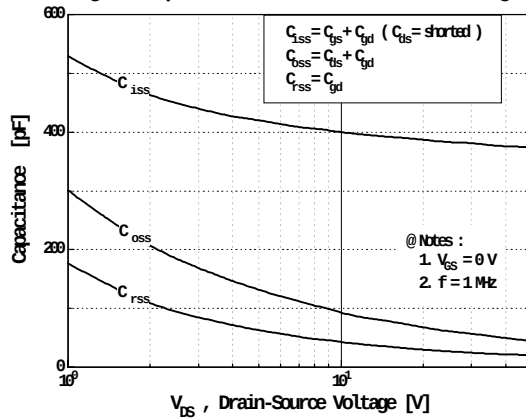


Fig 6. Gate Charge vs. Gate-Source Voltage

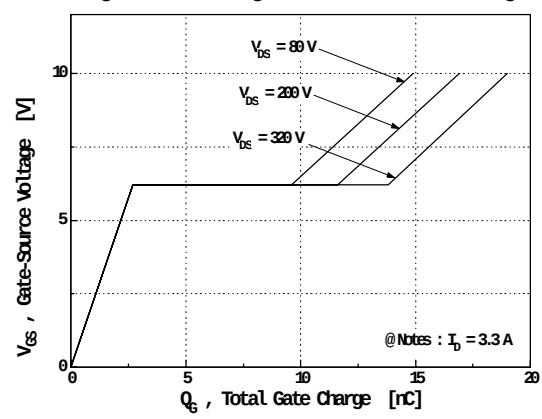


Fig 7. Breakdown Voltage vs. Temperature

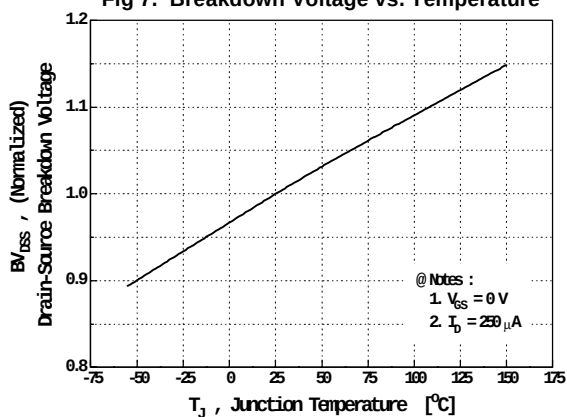


Fig 8. On-Resistance vs. Temperature

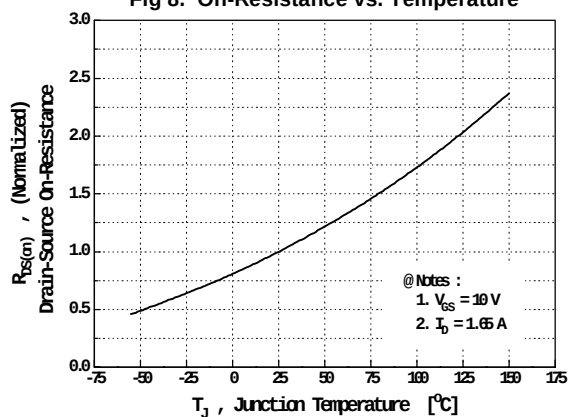


Fig 9. Max. Safe Operating Area

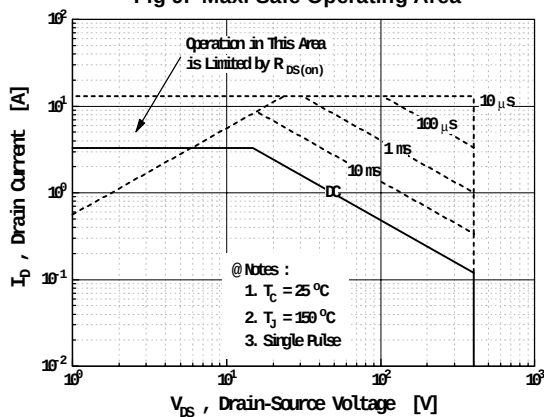


Fig 10. Max. Drain Current vs. Case Temperature

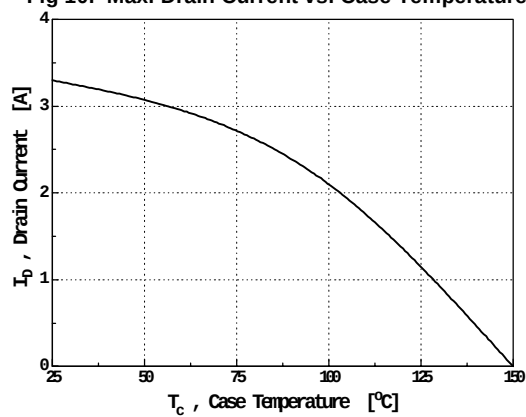
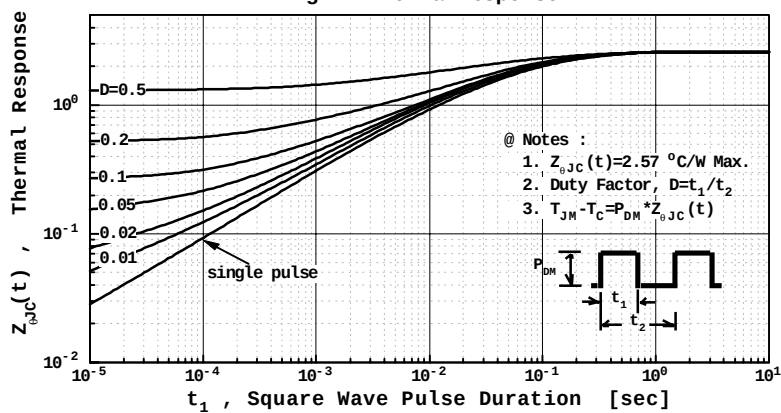
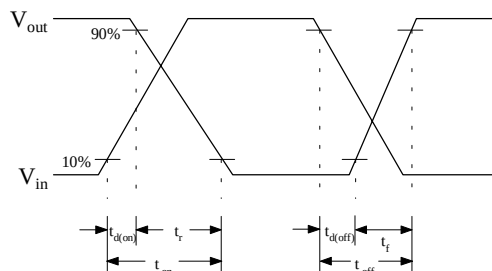
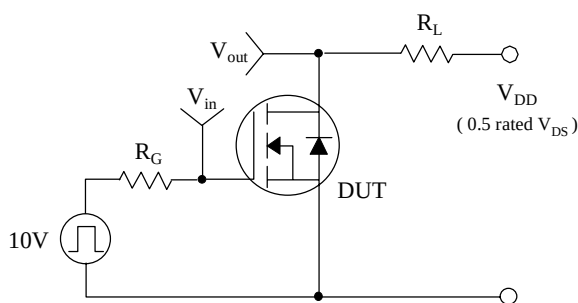


Fig 11. Thermal Response



The diagram shows a circuit for characterizing a Device Under Test (DUT). A 12V DC source is connected to a network of components: a 200nF capacitor, a 50kΩ resistor, and a 300nF capacitor. The output of this network is connected to the gate of a MOSFET (labeled 'Same Type as DUT'). The source of this MOSFET is connected to the gate of a second MOSFET (labeled 'DUT'). The source of the 'DUT' MOSFET is connected to ground through a resistor R_1 (labeled 'Current Sampling (I_G) Resistor'). The drain of the 'DUT' MOSFET is connected to a positive supply V_{DS} through a resistor R_2 (labeled 'Current Sampling (I_D) Resistor'). A 3mA current source is shown connected to the gate of the 'DUT' MOSFET, with an arrow indicating the current direction.



Vary t_p to obtain required peak I_D

10V

R_G

DUT

L_L

C

V_{DD}

V_{DS}

I_D

t_p

$$E_{AS} = \frac{1}{2} L_L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$

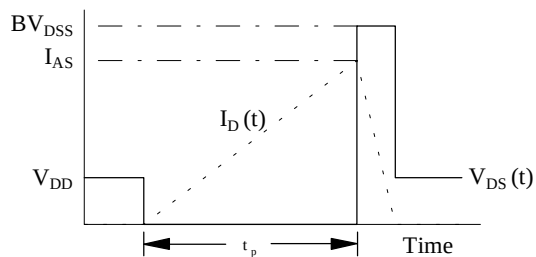
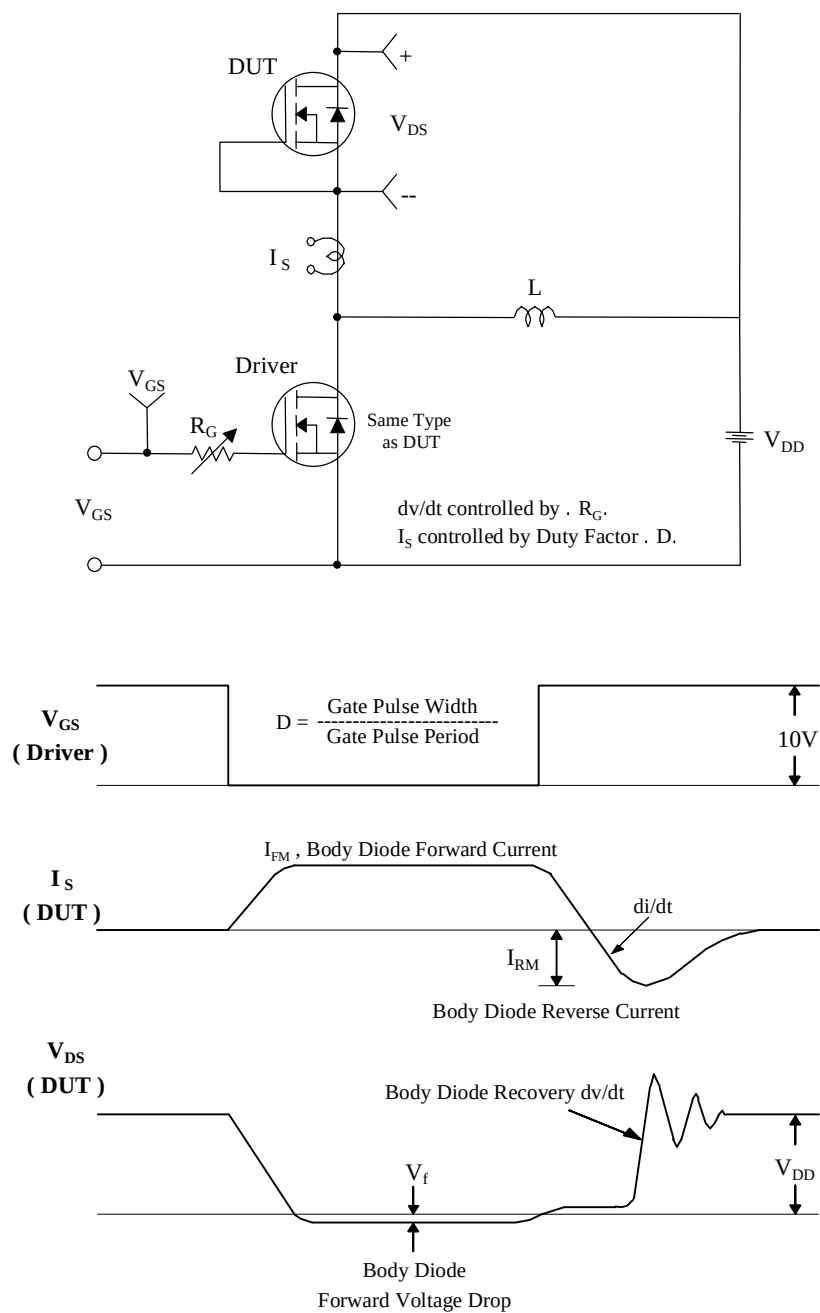


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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