

## Advanced Power MOSFET

## IRLR/U230A

### FEATURES

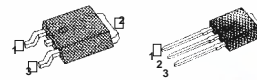
- ◆ Avalanche Rugged Technology
- ◆ Rugged Gate Oxide Technology
- ◆ Lower Input Capacitance
- ◆ Improved Gate Charge
- ◆ Extended Safe Operating Area
- ◆ Lower Leakage Current: 10µA (Max.) @  $V_{DS} = 200V$
- ◆ Lower  $R_{DS(ON)}$ : 0.335Ω (Typ.)

$$BV_{DSS} = 200 V$$

$$R_{DS(on)} = 0.4\Omega$$

$$I_D = 7.5 A$$

**D-PAK**      **I-PAK**



1. Gate 2. Drain 3. Source

### Absolute Maximum Ratings

Symbol	Characteristic	Value	Units
$V_{DSS}$	Drain-to-Source Voltage	200	V
$I_D$	Continuous Drain Current ( $T_C=25^\circ C$ )	7.5	A
	Continuous Drain Current ( $T_C=100^\circ C$ )	4.7	
$I_{DM}$	Drain Current-Pulsed (1)	26	A
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulsed Avalanche Energy (2)	37	mJ
$I_{AR}$	Avalanche Current (1)	7.5	A
$E_{AR}$	Repetitive Avalanche Energy (1)	4.8	mJ
dv/dt	Peak Diode Recovery dv/dt (3)	5	V/ns
$P_D$	Total Power Dissipation ( $T_A=25^\circ C$ ) *	2.5	W
	Total Power Dissipation ( $T_C=25^\circ C$ )	48	W
	Linear Derating Factor	0.38	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	--	2.6	$^\circ C/W$
$R_{\theta JA}$	Junction-to-Ambient *	--	50	
$R_{\theta JA}$	Junction-to-Ambient	--	110	

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

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	200	--	--	V	$V_{GS}=0V, I_D=250\mu A$
$\Delta BV/\Delta T_J$	Breakdown Voltage Temp. Coeff.	--	0.25	--	V/°C	$I_D=250\mu A$ <b>See Fig 7</b>
$V_{GS(th)}$	Gate Threshold Voltage	1.0	--	2.0	V	$V_{DS}=5V, I_D=250\mu A$
$I_{GSS}$	Gate-Source Leakage, Forward	--	--	100	nA	$V_{GS}=20V$
	Gate-Source Leakage, Reverse	--	--	-100		$V_{GS}=-20V$
$I_{DSS}$	Drain-to-Source Leakage Current	--	--	10	$\mu A$	$V_{DS}=200V$
		--	--	100		$V_{DS}=160V, T_C=125^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-State Resistance	--	--	0.4	$\Omega$	$V_{GS}=5V, I_D=3.75A$ (4)
$g_{fs}$	Forward Transconductance	--	4.2	--	$\bar{O}$	$V_{DS}=40V, I_D=4.5A$ (4)
$C_{iss}$	Input Capacitance	--	580	755	pF	$V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$ <b>See Fig 5</b>
$C_{oss}$	Output Capacitance	--	90	115		
$C_{rss}$	Reverse Transfer Capacitance	--	44	55		
$t_{d(on)}$	Turn-On Delay Time	--	8	25	ns	$V_{DD}=100V, I_D=9A,$ $R_G=6\Omega$ <b>See Fig 13</b> (4) (5)
$t_r$	Rise Time	--	6	20		
$t_{d(off)}$	Turn-Off Delay Time	--	30	70		
$t_f$	Fall Time	--	9	30		
$Q_g$	Total Gate Charge	--	18.6	27	nC	$V_{DS}=160V, V_{GS}=5V,$ $I_D=9A$ <b>See Fig 6 &amp; Fig 12</b> (4) (5)
$Q_{gs}$	Gate-Source Charge	--	3.5	--		
$Q_{gd}$	Gate-Drain (. Miller. ) Charge	--	8.3	--		

### Source-Drain Diode Ratings and Characteristics

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Condition
$I_S$	Continuous Source Current	--	--	7.5	A	Integral reverse pn-diode in the MOSFET
$I_{SM}$	Pulsed-Source Current (1)	--	--	26		
$V_{SD}$	Diode Forward Voltage (4)	--	--	1.5	V	$T_J=25^\circ\text{C}, I_S=7.5A, V_{GS}=0V$
$t_{rr}$	Reverse Recovery Time	--	158	--	ns	$T_J=25^\circ\text{C}, I_F=9A$
$Q_{rr}$	Reverse Recovery Charge	--	0.78	--	$\mu C$	$di_F/dt=100A/\mu s$ (4)

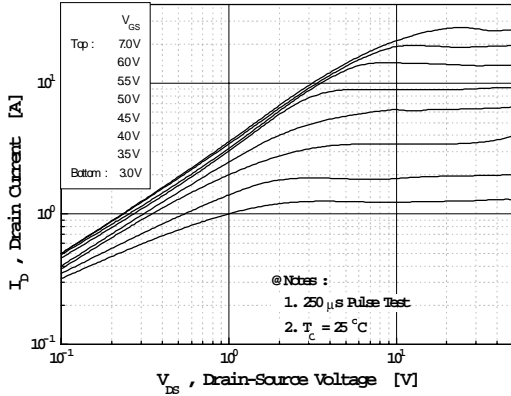
#### Notes;

- Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
- $L=1\text{mH}, I_{AS}=7.5A, V_{DD}=50V, R_G=27\Omega$ , Starting  $T_J=25^\circ\text{C}$
- $I_{SD} \leq 9A, di/dt \leq 220A/\mu s, V_{DD} \leq BV_{DSS}$ , Starting  $T_J=25^\circ\text{C}$
- Pulse Test: Pulse Width = 250 $\mu s$ , Duty Cycle  $\leq 2\%$
- Essentially Independent of Operating Temperature

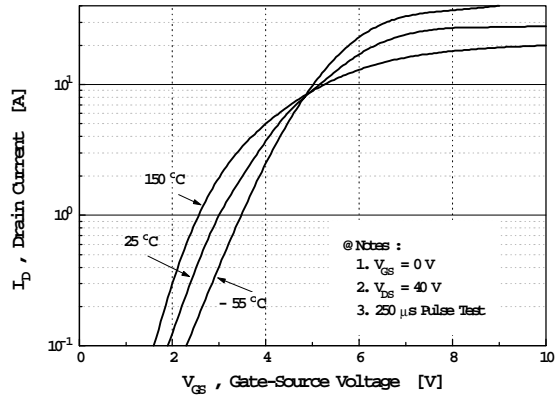
**N-CHANNEL  
POWER MOSFET**

**IRLR/U230A**

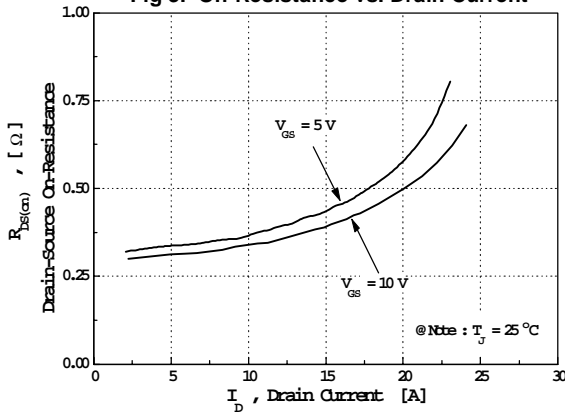
**Fig 1. Output Characteristics**



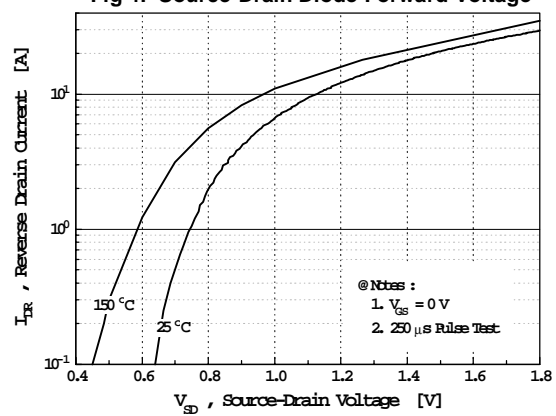
**Fig 2. Transfer Characteristics**



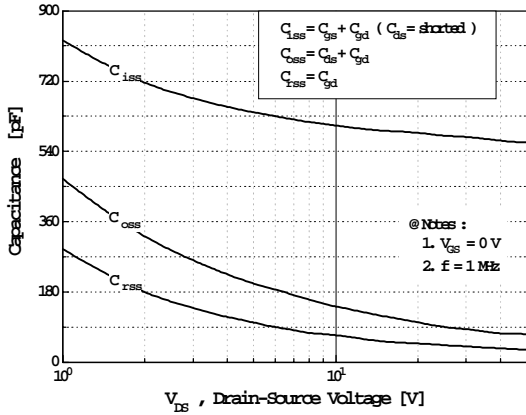
**Fig 3. On-Resistance vs. Drain Current**



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



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



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

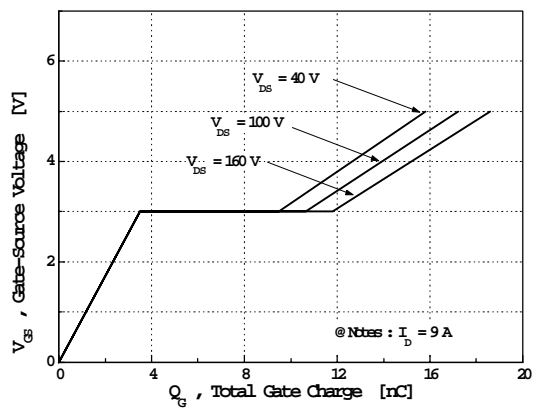


Fig 7. Breakdown Voltage vs. Temperature

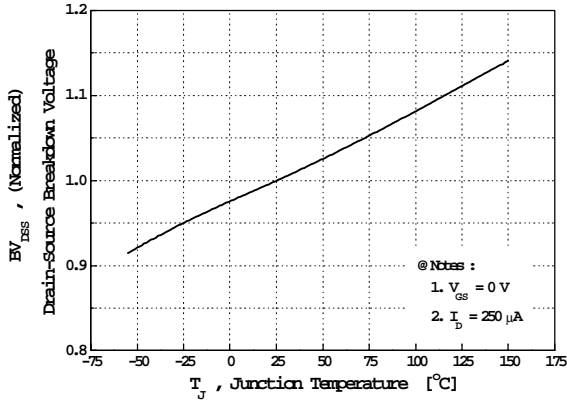


Fig 8. On-Resistance vs. Temperature

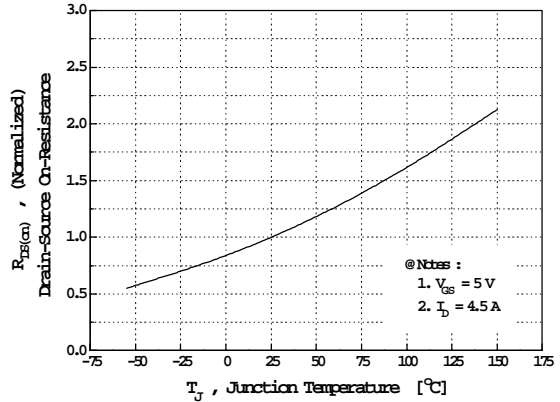


Fig 9. Max. Safe Operating Area

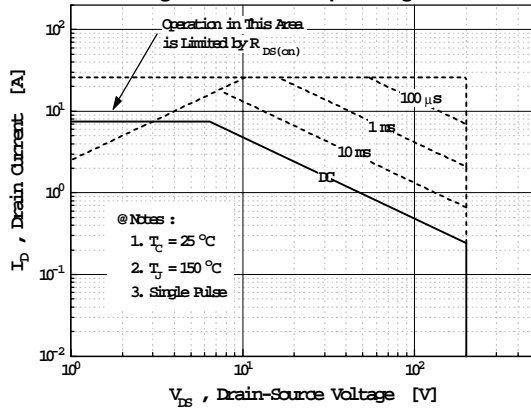


Fig 10. Max. Drain Current vs. Case Temperature

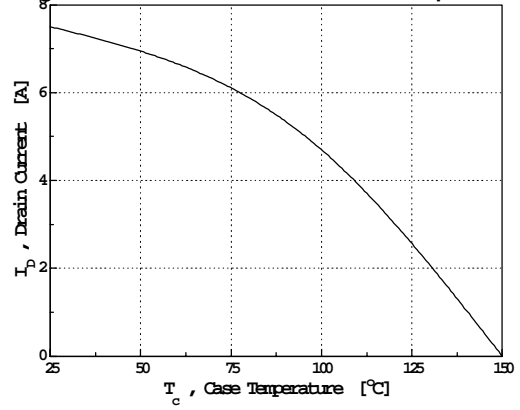
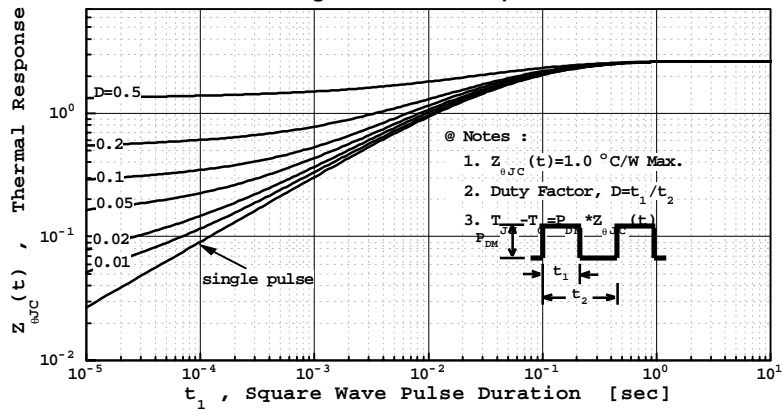
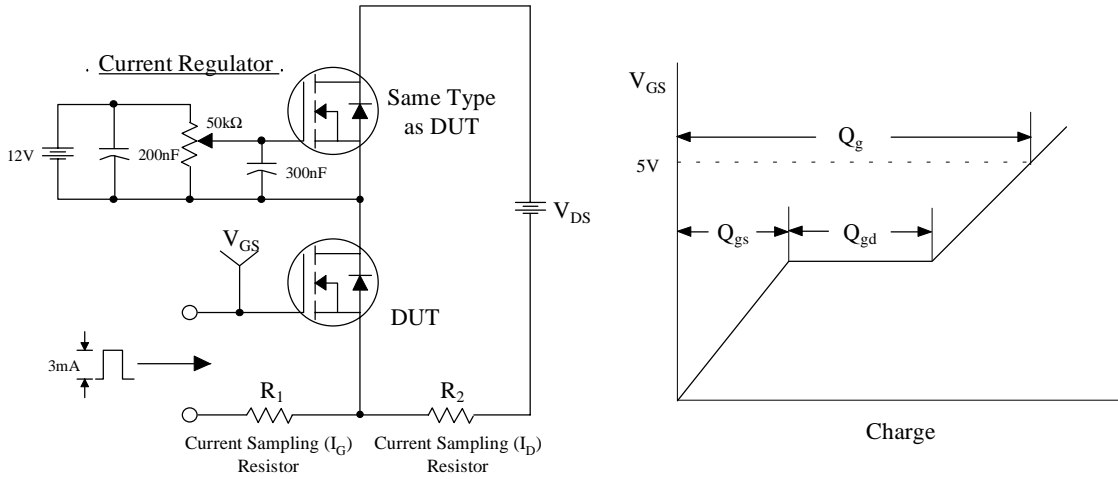


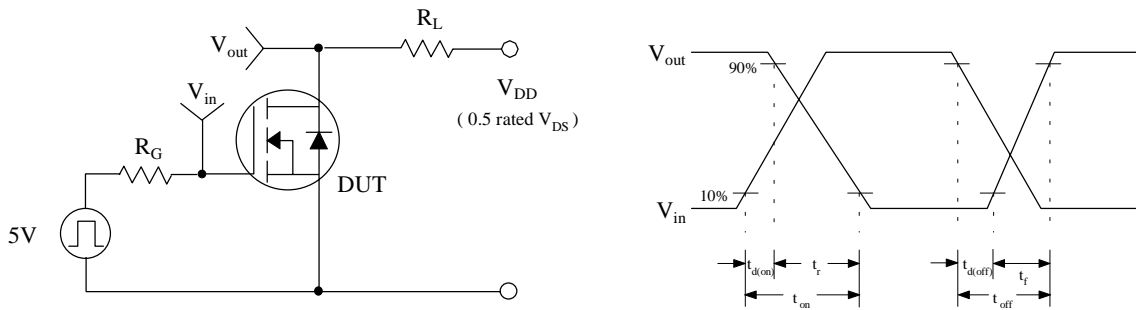
Fig 11. Thermal Response



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



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



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

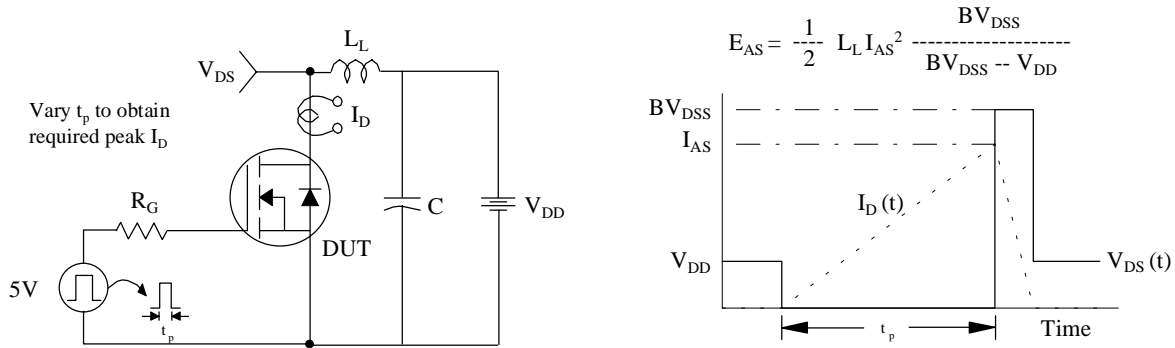
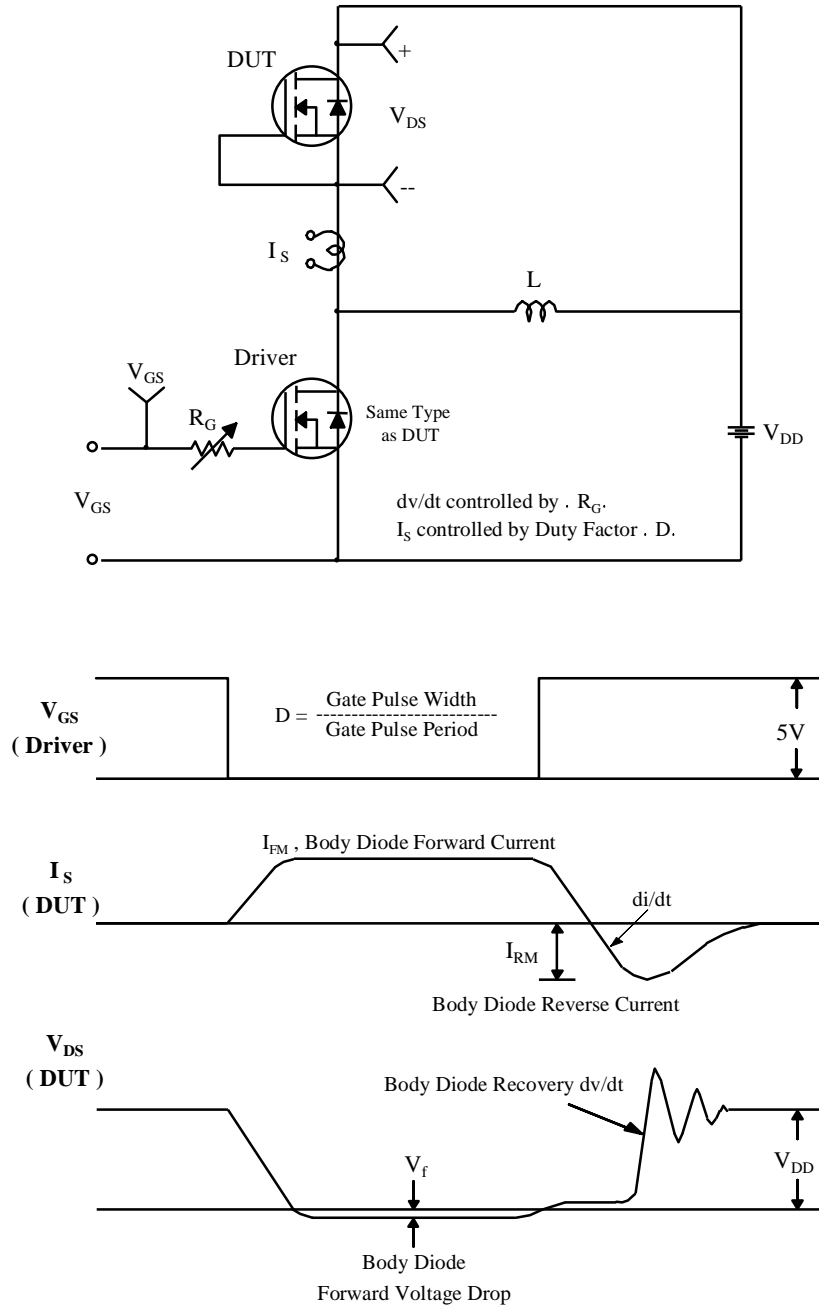


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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