Advanced Power MOSFET

IRF650A

FEATURES

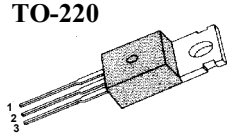
- Avalanche Rugged Technology
- Rugged Gate Oxide Technology
- Lower Input Capacitance
- Improved Gate Charge
- Extended Safe Operating Area
- Lower Leakage Current : 10 μA (Max.) @ V_{DS} = 200V
- Low $R_{DS(ON)}$: 0.071 Ω (Typ.)

BV_{DSS} = 200 V

$R_{DS(on)}$ = 0.085 Ω

I_D = 28 A

TO-220



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°C)	28	A
	Continuous Drain Current (T_C=100°C)	17.7	
I_{DM}	Drain Current-Pulsed ①	112	A
V_{GS}	Gate-to-Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy ②	523	mJ
I_{AR}	Avalanche Current ①	28	A
E_{AR}	Repetitive Avalanche Energy ①	15.6	mJ
dv/dt	Peak Diode Recovery dv/dt ③	5.0	V/ns
P_D	Total Power Dissipation (T_C=25 °C)	156	W
	Linear Derating Factor	1.25	W/°C
T_J , T_{STG}	Operating Junction and Storage Temperature Range	- 55 to +150	°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	°C/W
$R_{\theta CS}$	Case-to-Sink	0.5	--	
$R_{\theta JA}$	Junction-to-Ambient	--	62.5	

SAMSUNG ELECTRONICS

Electrical Characteristics (T_C=25°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=250μA
$\Delta BV/\Delta T_J$	Breakdown Voltage Temp. Coeff.	--	0.24	--	V/°C	I_D=250μA ***See Fig 7***
$V_{GS(th)}$	Gate Threshold Voltage	2.0	--	4.0	V	V_{DS}=5V,I_D=250μA
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}=200V
		--	--	100		V_{DS}=160V,T_C=125 °C
$R_{DS(on)}$	Static Drain-Source On-State Resistance	--	--	0.085	Ω	V_{GS}=10V,I_D=14A ④
g_{fs}	Forward Transconductance	--	18.44	--	℧	V_{DS}=40V,I_D=14A ④
C_{iss}	Input Capacitance	--	2300	3000	pF	V_{GS}=0V,V_{DS}=25V,f =1MHz ***See Fig 5***
C_{oss}	Output Capacitance	--	410	475		
C_{rss}	Reverse Transfer Capacitance	--	200	230		
$t_{d(on)}$	Turn-On Delay Time	--	21	50	ns	V_{DD}=100V,I_D=32A, R_G=6.2Ω ***See Fig 13*** ④ ⑤
t_r	Rise Time	--	20	50		
$t_{d(off)}$	Turn-Off Delay Time	--	77	160		
t_f	Fall Time	--	38	90		
Q_g	Total Gate Charge	--	95	123	nC	V_{DS}=160V,V_{GS}=10V, I_D=32A ***See Fig 6 & Fig 12*** ④ ⑤
Q_{gs}	Gate-Source Charge	--	18	--		
Q_{gd}	Gate-Drain("Miller") Charge	--	45.3	--		

Source-Drain Diode Ratings and Characteristics

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Condition
I_S	Continuous Source Current	--	--	28	A	Integral reverse pn-diode in the MOSFET
I_{SM}	Pulsed-Source Current ①	--	--	112		
V_{SD}	Diode Forward Voltage ④	--	--	1.5	V	T_J=25°C,I_S=28A,V_{GS}=0V
t_{rr}	Reverse Recovery Time	--	203	--	ns	T_J=25°C ,I_F=32A
Q_{rr}	Reverse Recovery Charge	--	1.52	--	μC	di_F/dt=100A/μs ④

Notes ;

① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature

② L=1mH, I_{AS}=28A, V_{DD}=50V, R_G=27Ω, Starting T_J=25 °C

③ I_{SD}≤ 32A, di/dt≤ 320A/μs, V_{DD}≤ BV_{DSS}, Starting T_J=25°C

④ Pulse Test : Pulse Width = 250μs, Duty Cycle≤ 2%

⑤ Essentially Independent of Operating Temperature

Electrical Characteristics (T_C=25°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=250μA
$\Delta BV/\Delta T_J$	Breakdown Voltage Temp. Coeff.	--	0.24	--	V/°C	I_D=250μA ***See Fig 7***
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		--	--	100		V_{DS}=160V,T_C=125 °C
$R_{DS(on)}$	Static Drain-Source On-State Resistance	--	--	0.085	Ω	V_{GS}=10V,I_D=14A ④
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$t_{d(on)}$	Turn-On Delay Time	--	21	50	ns	V_{DD}=100V,I_D=32A, R_G=6.2Ω ***See Fig 13*** ④ ⑤
t_r	Rise Time	--	20	50		
$t_{d(off)}$	Turn-Off Delay Time	--	77	160		
t_f	Fall Time	--	38	90		
Q_g	Total Gate Charge	--	95	123	nC	V_{DS}=160V,V_{GS}=10V, I_D=32A ***See Fig 6 & Fig 12*** ④ ⑤
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② L=1mH, I_{AS}=28A, V_{DD}=50V, R_G=27Ω, Starting T_J=25 °C

③ I_{SD}≤ 32A, di/dt≤ 320A/μs, V_{DD}≤ BV_{DSS}, Starting T_J=25°C

④ Pulse Test : Pulse Width = 250μs, Duty Cycle≤ 2%

⑤ Essentially Independent of Operating Temperature

Fig 7. Breakdown Voltage vs. Temperature

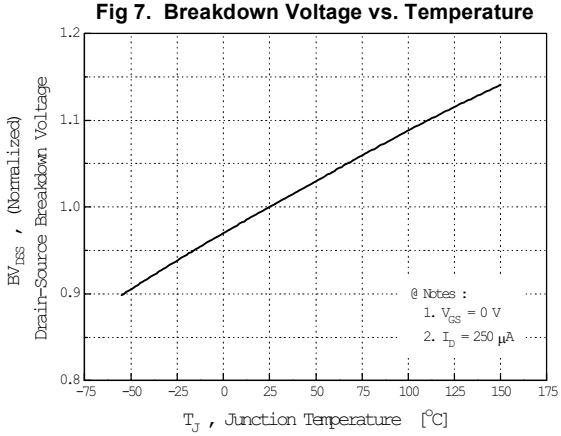

Fig 8. On-Resistance vs. Temperature

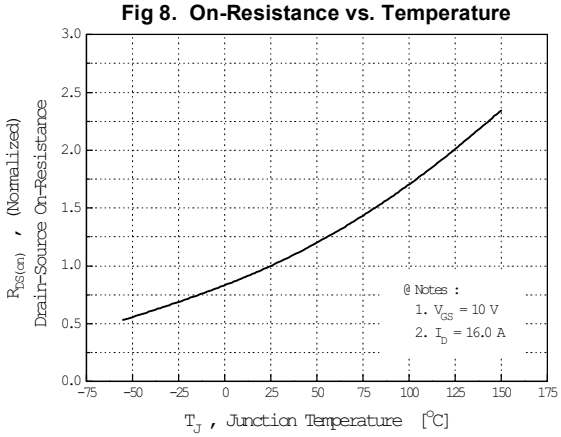

Fig 9. Max. Safe Operating Area

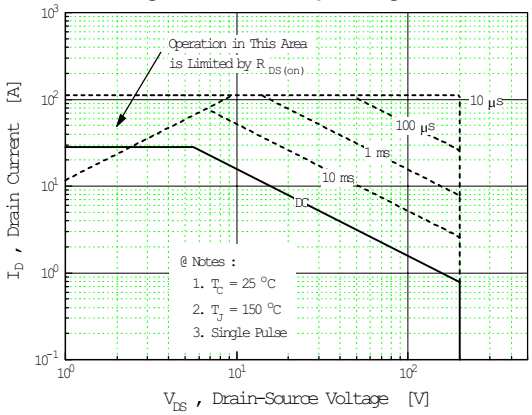

Fig 10. Max. Drain Current vs. Case Temperature

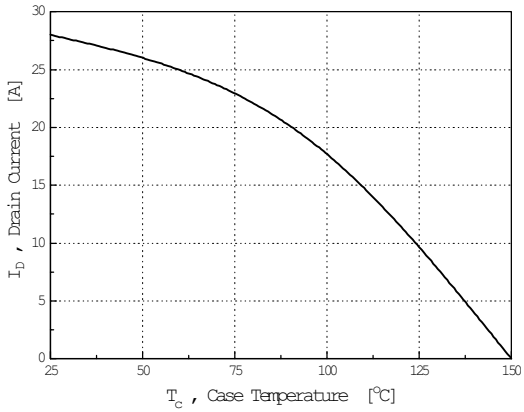

Fig 11. Thermal Response

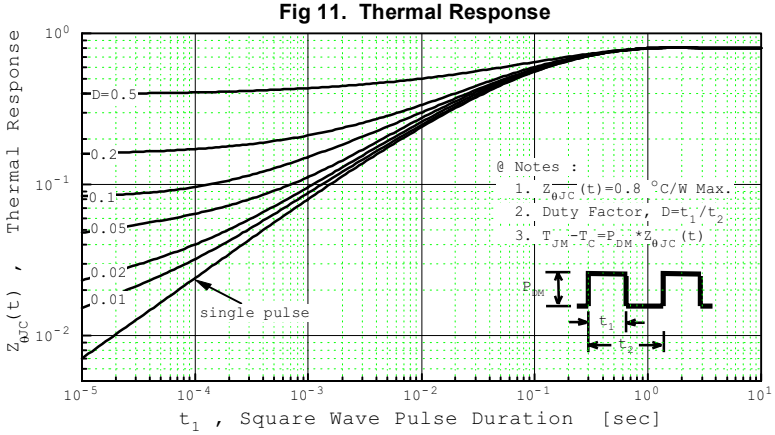

Fig 12. Gate Charge Test Circuit & Waveform

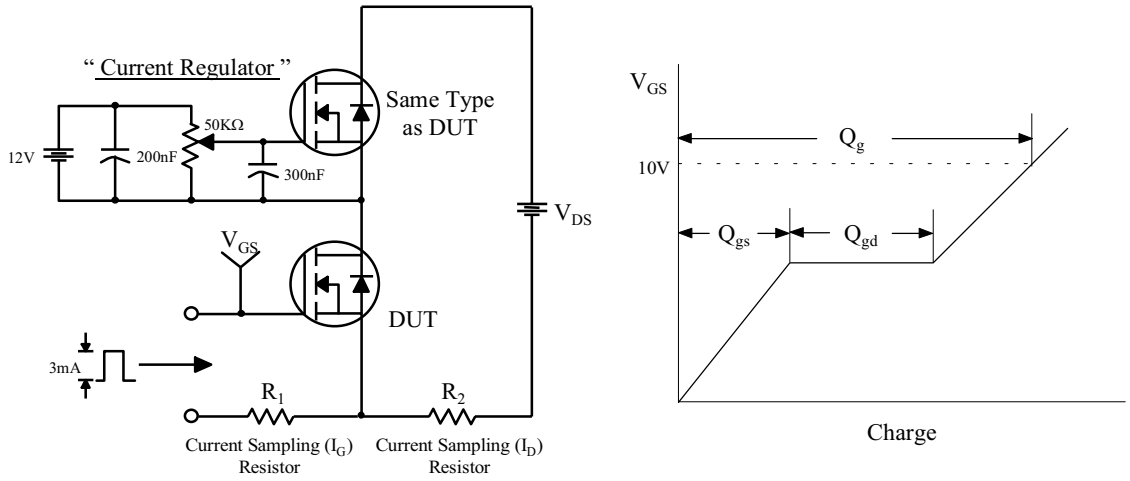

Fig 13. Resistive Switching Test Circuit & Waveforms

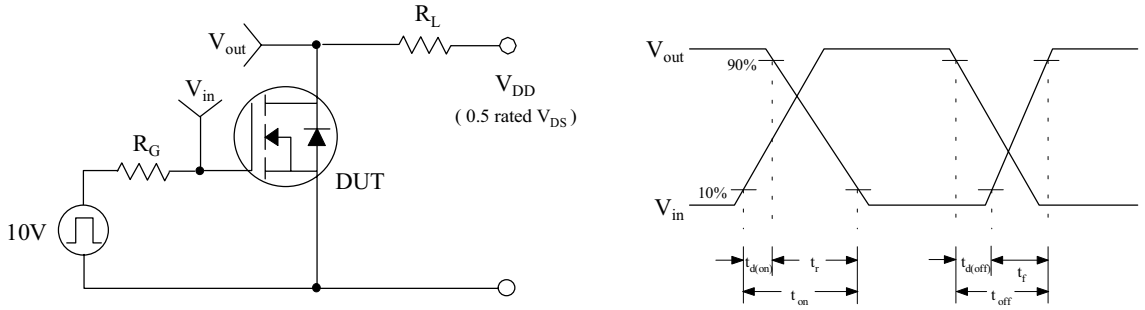

Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

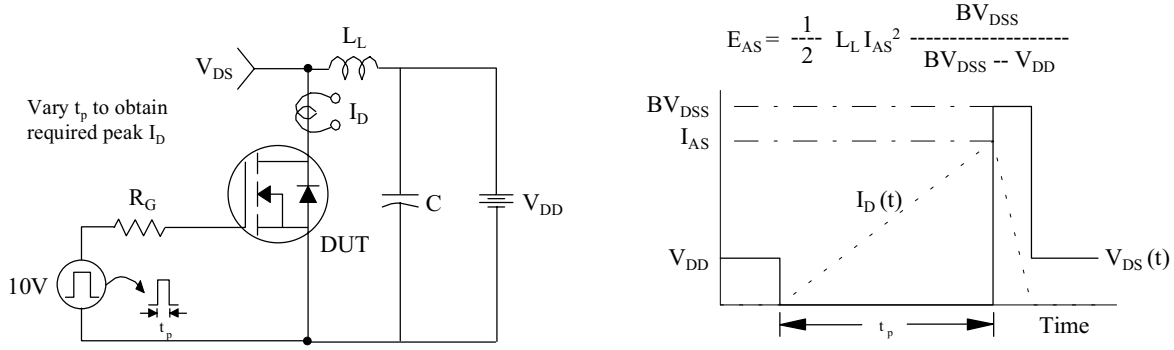

Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms