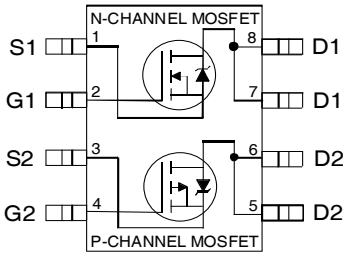
N+P-Channel MOSFET

Applications

- High and Low Side Switches for Inverter
- High and Low Side Switches for Generic Half-Bridge



Top View

Features

N-Channel

- V_{DS} (V) = 30V
- I_D = 6.8A (V_{GS} = 10V)
- $R_{DS(ON)}$ < 27mΩ (V_{GS} = 10V)

P-Channel

- V_{DS} (V) = -30V
- I_D = -4.6A (V_{GS} = -10V)
- $R_{DS(ON)}$ < 64mΩ (V_{GS} = -10V)

Absolute Maximum Ratings

	Parameter	Max.		Units
		N-Channel	P-Channel	
V_{GS}	Gate-to-Source Voltage	±20	±20	V
I_D @ T_A = 25°C	Continuous Drain Current, V_{GS} @ 10V	6.8	-4.6	A
I_D @ T_A = 70°C	Continuous Drain Current, V_{GS} @ 10V	5.4	-3.7	
I_{DM}	Pulsed Drain Current ①	34	-23	
P_D @T_A = 25°C	Power Dissipation	2.0		W
P_D @T_A = 70°C	Power Dissipation	1.3		
	Linear Derating Factor	0.016		W/°C
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150		°C

Thermal Resistance

	Parameter	Typ.	Max	Units
$R_{\theta JL}$	Junction-to-Drain Lead ④		20	°C/W
$R_{\theta JA}$	Junction-to-Ambient ③		62.5	

Static @ T_J = 25°C (unless otherwise specified)

	Parameter		Min.	Typ.	Max.	Units	
BV_{DSS}	Drain-to-Source Breakdown Voltage	N-Ch	30			V	V_{GS} = 0V, I_D = 250μA
		P-Ch	-30				V_{GS} = 0V, I_D = -250μA
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	N-Ch		0.03		V/°C	Reference to 25°C, I_D = 1mA
		P-Ch		0.02			Reference to 25°C, I_D = -1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	N-Ch		22	27	mΩ	V_{GS} = 10V, I_D = 6.8A ②
				33	40		V_{GS} = 4.5V, I_D = 5.4A ②
		P-Ch		51	64	mΩ	V_{GS} = -10V, I_D = -4.6A ②
				82	103		V_{GS} = -4.5V, I_D = -3.7A ②
$V_{GS(th)}$	Gate Threshold Voltage	N-Ch	1.3	1.8	2.3	V	V_{DS} = V_{GS}, I_D = 10μA
		P-Ch	-1.3	-1.8	-2.3		V_{DS} = V_{GS}, I_D = -10μA
I_{DSS}	Drain-to-Source Leakage Current	N-Ch			1.0	μA	V_{DS} = 24V, V_{GS} = 0V
		P-Ch			-1.0		V_{DS} = -24V, V_{GS} = 0V
		N-Ch			150		V_{DS} = 24V, V_{GS} = 0V, T_J = 125°C
		P-Ch			-150		V_{DS} = -24V, V_{GS} = 0V, T_J = 125°C
I_{GSS}	Gate-to-Source Forward Leakage	N-Ch			100	nA	V_{GS} = 20V
		P-Ch			-100		V_{GS} = -20V
	Gate-to-Source Reverse Leakage	N-Ch			-100		V_{GS} = -20V
		P-Ch			100		V_{GS} = 20V
gfs	Forward Transconductance	N-Ch	8.2			S	V_{DS} = 15V, I_D = 5.4A
		P-Ch	4.1				V_{DS} = -15V, I_D = -3.7A
Q_g	Total Gate Charge	N-Ch		6.8	14	nC	N-Channel
		P-Ch		8.1	16		V_{GS} = 10V, V_{DS} = 15V, I_D = 6.8A
Q_{gs}	Gate-to-Source Charge	N-Ch		1.4			
		P-Ch		1.3			P-Channel
Q_{gd}	Gate-to-Drain ("Miller") Charge	N-Ch		0.98			V_{GS} = -10V, V_{DS} = -15V, I_D = -4.6A
		P-Ch		2.1			
R_G	Gate Resistance	N-Ch		2.2	4.4	Ω	
		P-Ch		9.4	19		
$t_{d(on)}$	Turn-On Delay Time	N-Ch		5.1		ns	N-Channel
		P-Ch		8.0			V_{DD} = 15V, V_{GS} = 4.5V ②
t_r	Rise Time	N-Ch		4.8			I_D = 1.0A, R_G = 6.2
		P-Ch		14			
$t_{d(off)}$	Turn-Off Delay Time	N-Ch		4.9			P-Channel
		P-Ch		17			V_{DD} = -15V, V_{GS} = -4.5V ②
t_f	Fall Time	N-Ch		3.9			I_D = -1.0A, R_G = 6.8
		P-Ch		15			
C_{iss}	Input Capacitance	N-Ch		398		pF	N-Channel
		P-Ch		383			V_{GS} = 0V, V_{DS} = 15V, f = 1.0MHz
C_{oss}	Output Capacitance	N-Ch		82			
		P-Ch		104			P-Channel
C_{rss}	Reverse Transfer Capacitance	N-Ch		36			V_{GS} = 0V, V_{DS} = -15V, f = 1.0KHz
		P-Ch		64			

Diode Characteristics

	Parameter		Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode	N-Ch			2.0	A	
		P-Ch			-2.0		
I_{SM}	Pulsed Source Current (Body Diode)	N-Ch			34		
		P-Ch			-23		
V_{SD}	Diode Forward Voltage	N-Ch			1.2	V	T = 25°C, I = 2.0A, V = 0V ②
		P-Ch			-1.2		T = 25°C, I = -2.0A, V = 0V ②
t_{rr}	Reverse Recovery Time	N-Ch		8.4	13	ns	N-Channel: T = 25°C, I = 2.0A,
		P-Ch		11	17		V_{DD} = 15V, di/dt = 102/μs ②
Q_{rr}	Reverse Recovery Charge	N-Ch		2.3	3.5	nC	P-Channel: T = 25°C, I = -2.0A,
		P-Ch		4.8	7.2		V_{DD} = -15V, di/dt = 102/μs ②

Notes:

① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 16)

② Pulse width ≤ 400μs; duty cycle ≤ 2%.

③ Surface mounted on 1 in square Cu board

④ R_θ is measured at T_J approximately 90°C

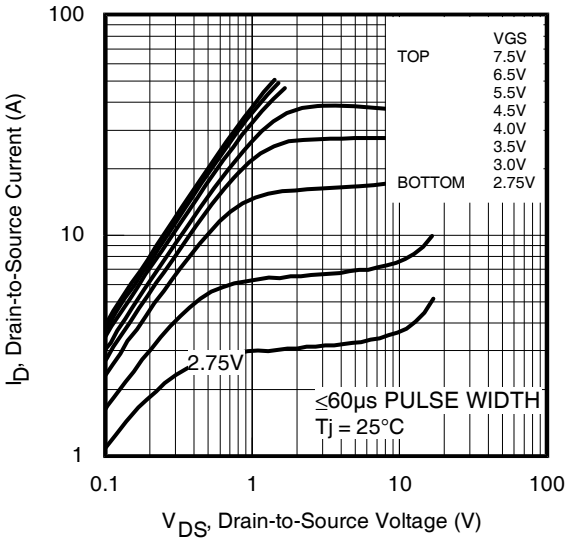


Fig 1. Typical Output Characteristics

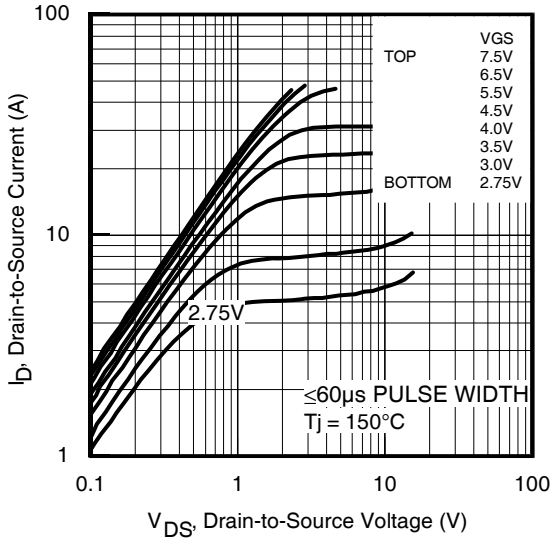


Fig 2. Typical Output Characteristics

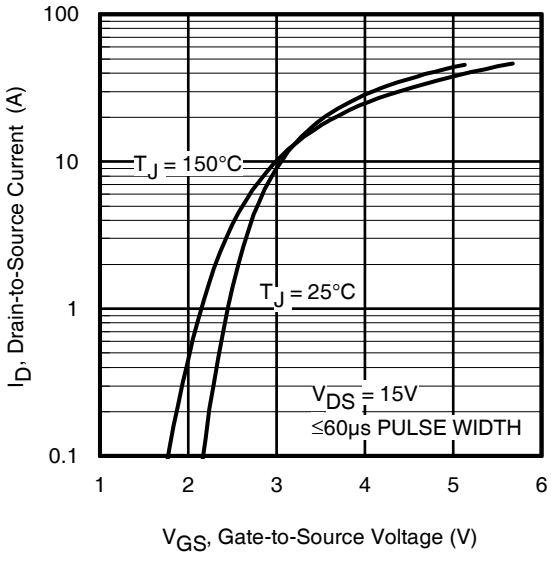


Fig 3. Typical Transfer Characteristics

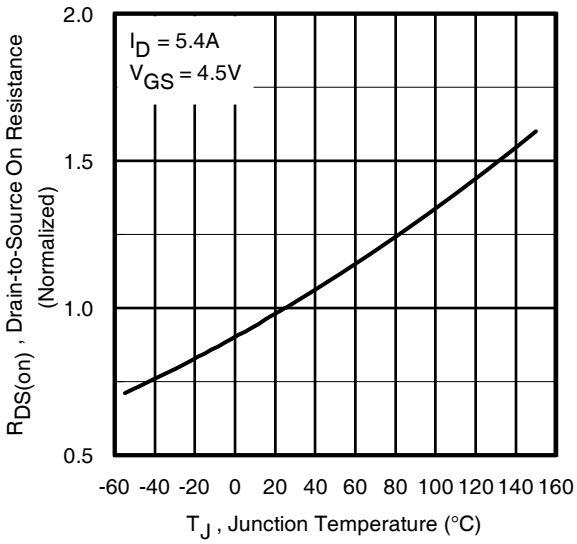


Fig 4. Normalized On-Resistance vs. Temperature

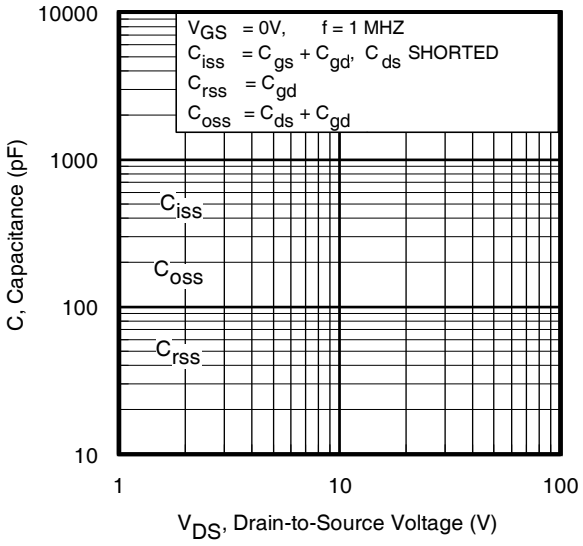


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

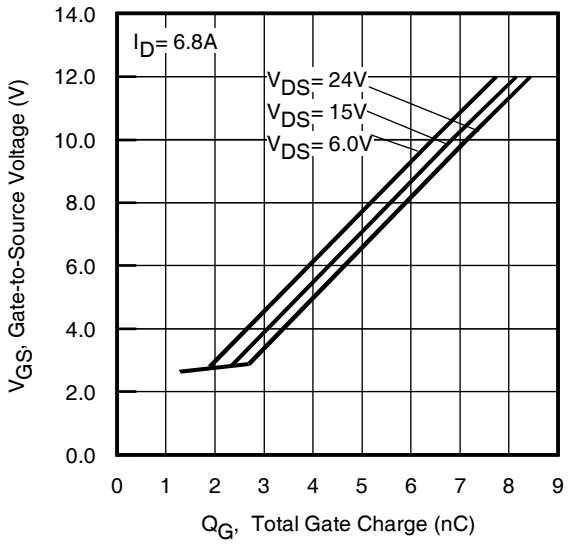


Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage

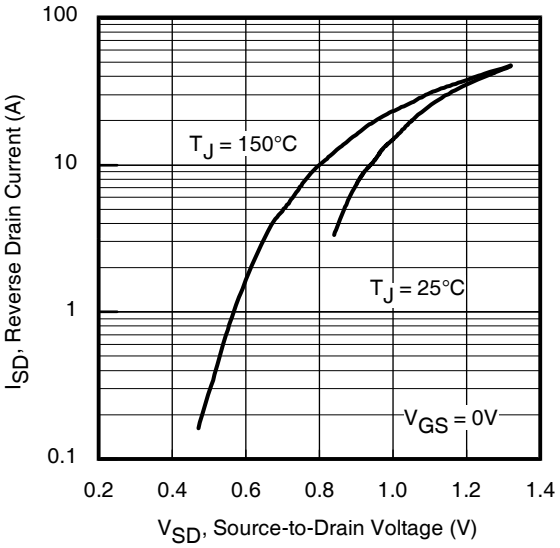


Fig 7. Typical Source-Drain Diode Forward Voltage

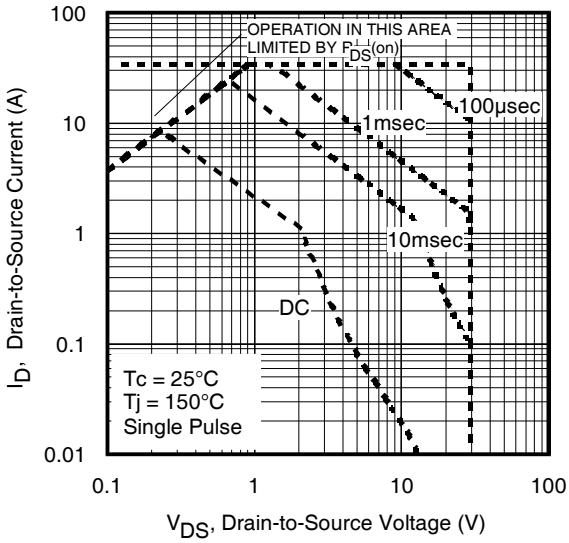


Fig 8. Maximum Safe Operating Area

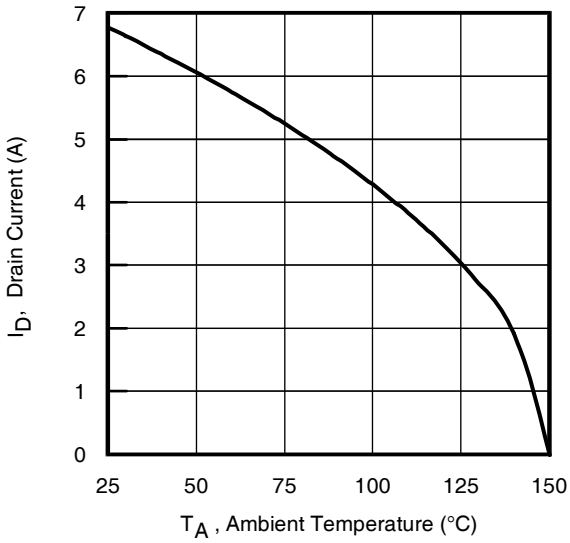


Fig 9. Maximum Drain Current vs. Ambient Temperature

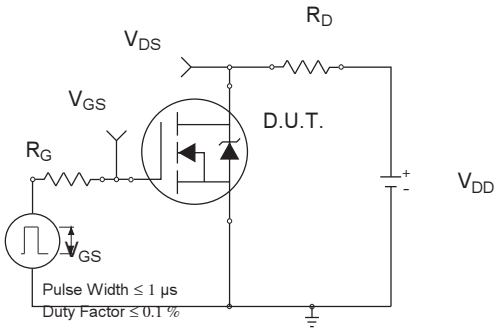


Fig 10a. Switching Time Test Circuit

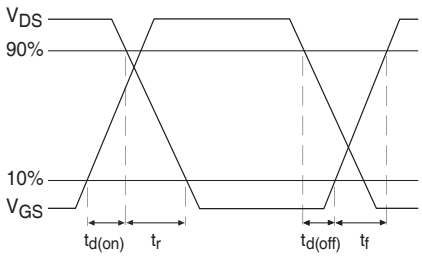


Fig 10b. Switching Time Waveforms

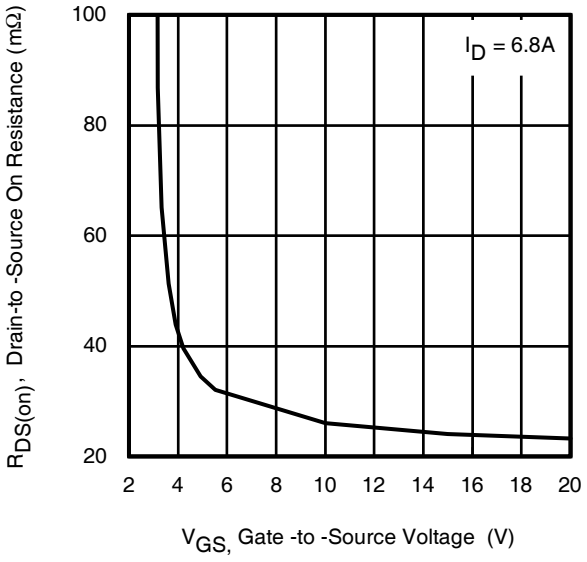


Fig 11. Typical On-Resistance vs. Gate Voltage

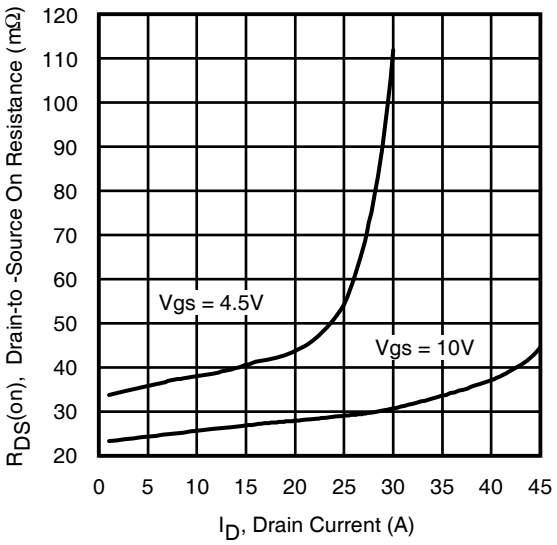


Fig 12. Typical On-Resistance vs. Drain Current

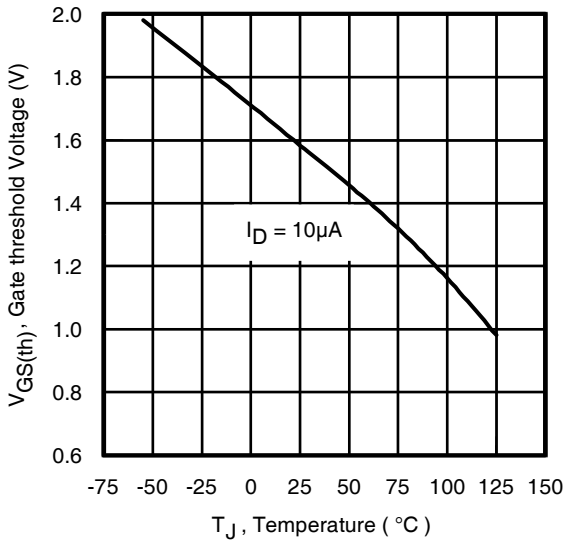


Fig 13. Threshold Voltage vs. Temperature

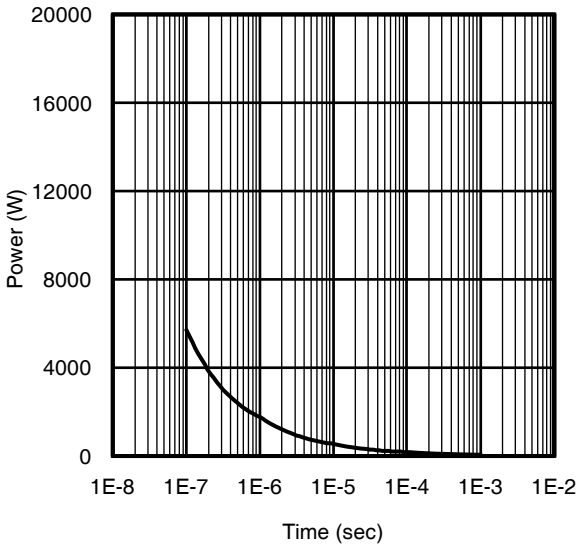


Fig 14. Typical Power vs. Time

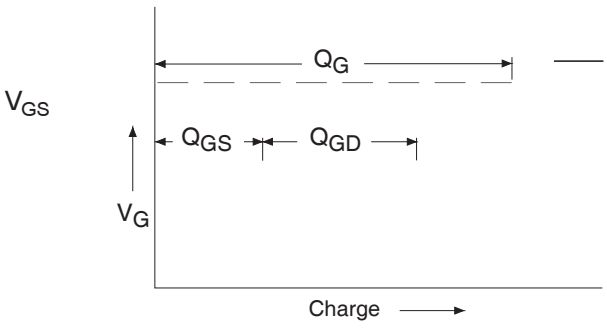


Fig 15a. Basic Gate Charge Waveform

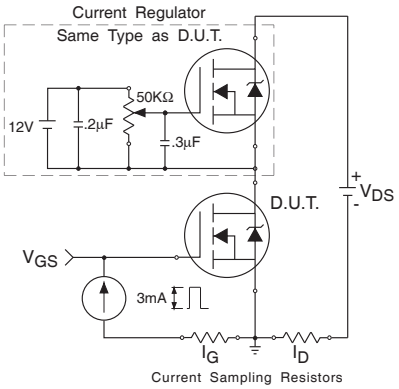


Fig 15b. Gate Charge Test Circuit

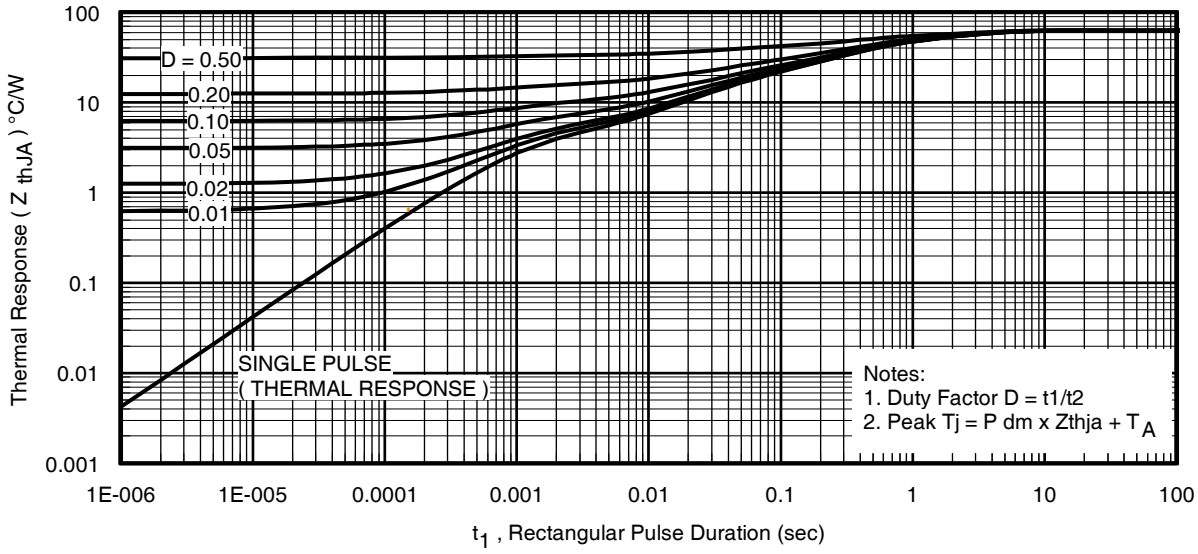


Fig 16. Typical Effective Transient Thermal Impedance, Junction-to-Ambient

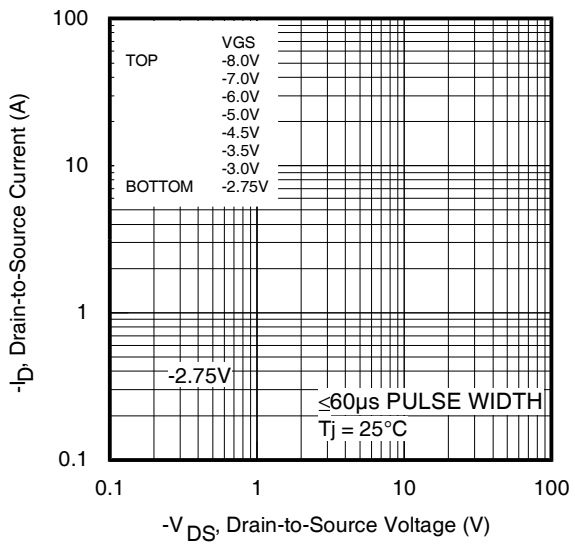


Fig 17. Typical Output Characteristics

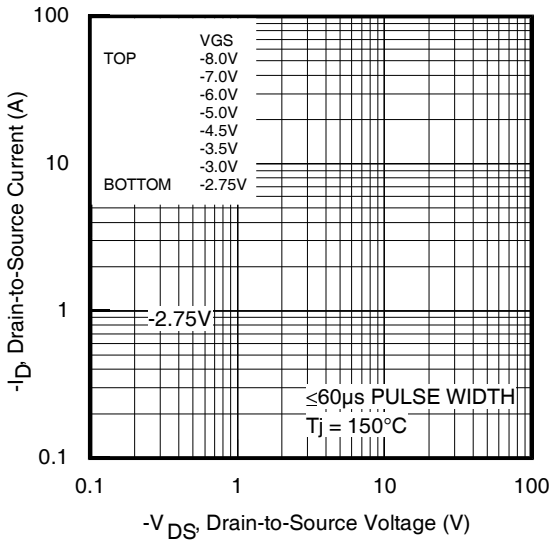


Fig 18. Typical Output Characteristics

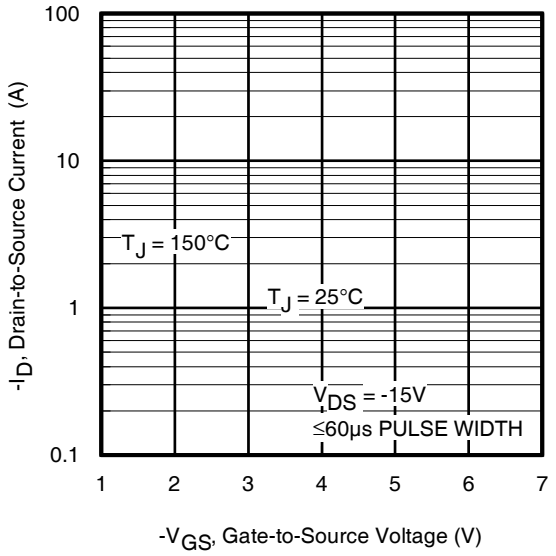


Fig 19. Typical Transfer Characteristics

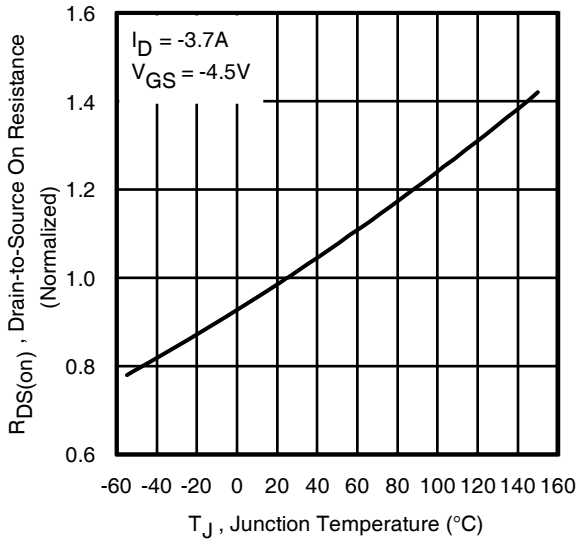


Fig 20. Normalized On-Resistance vs. Temperature

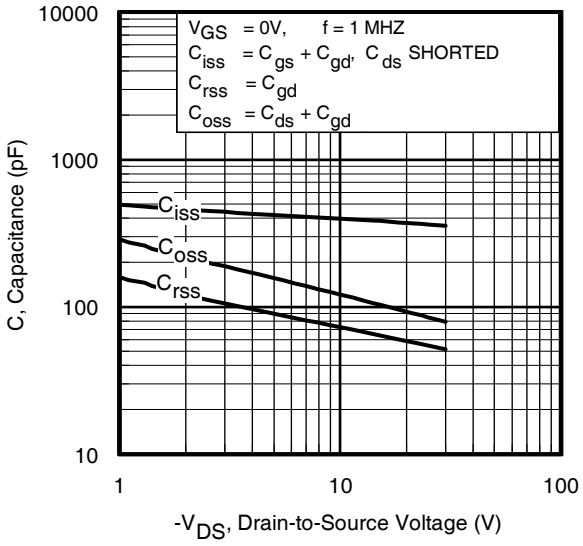


Fig 21. Typical Capacitance vs. Drain-to-Source Voltage

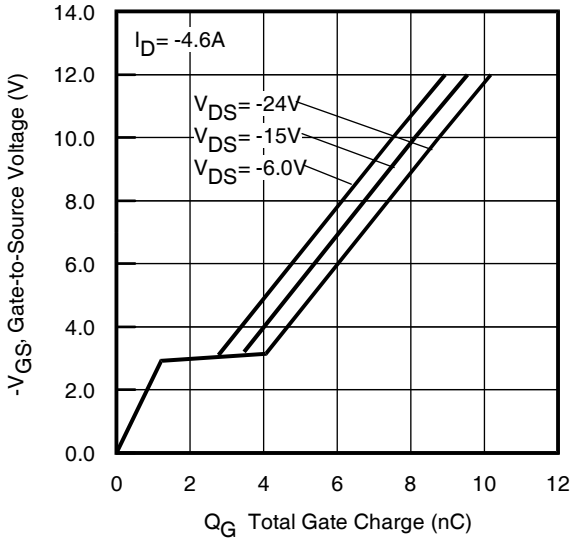


Fig 22. Typical Gate Charge vs. Gate-to-Source Voltage

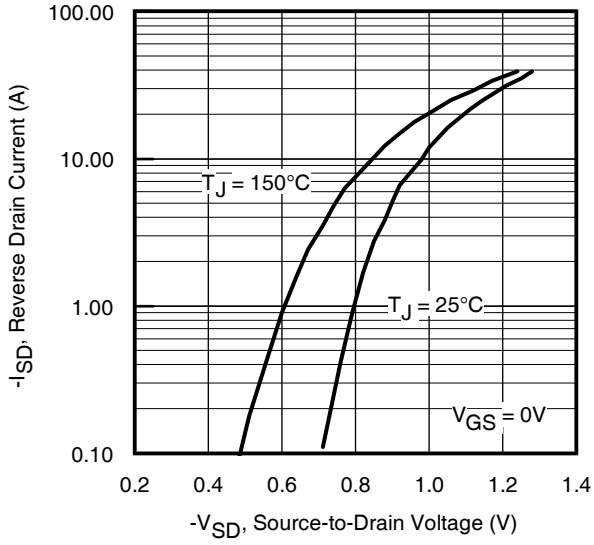


Fig 23. Typical Source-Drain Diode Forward Voltage

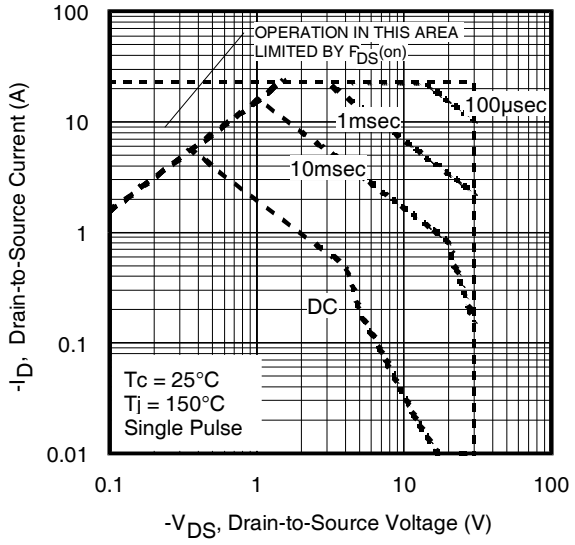


Fig 24. Maximum Safe Operating Area

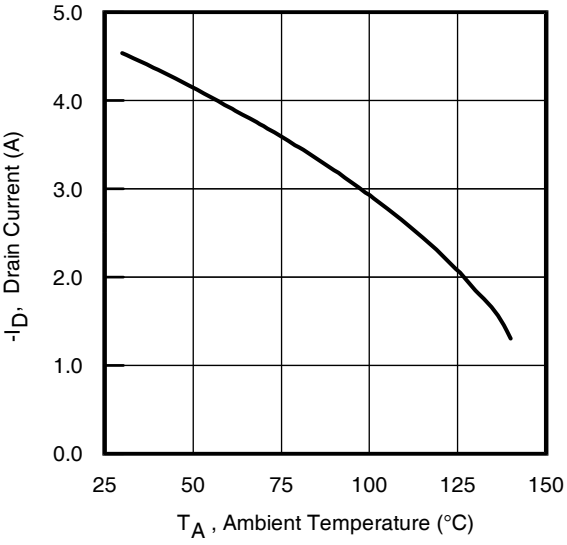


Fig 25. Maximum Drain Current vs. Ambient Temperature

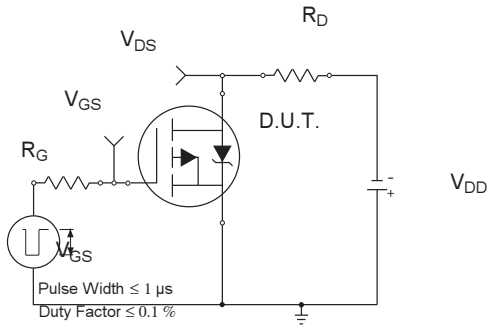


Fig 26a. Switching Time Test Circuit

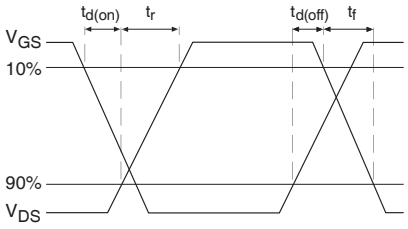


Fig 26b. Switching Time Waveforms

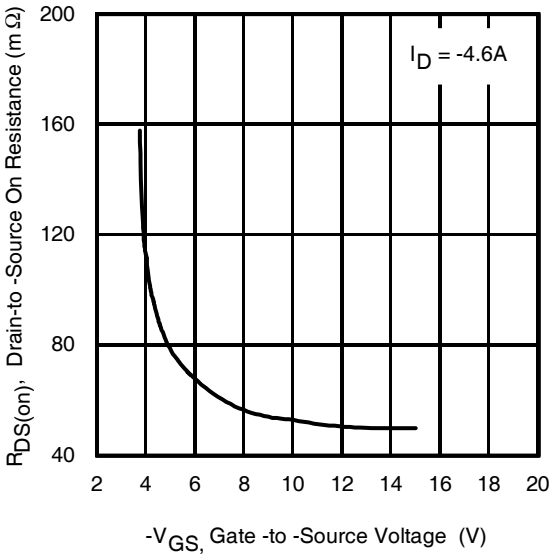


Fig 27. Typical On-Resistance vs. Gate Voltage

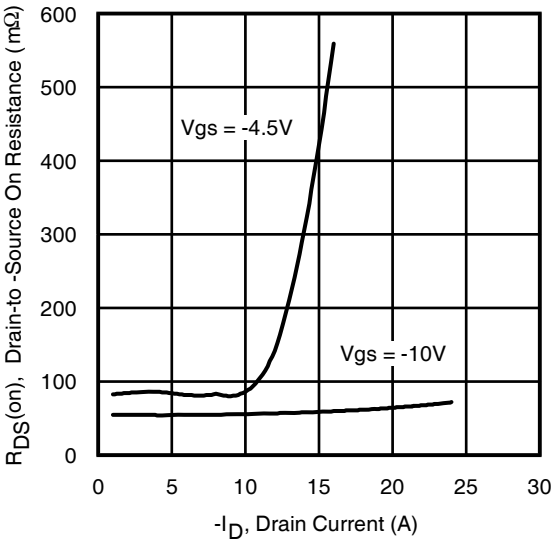


Fig 28. Typical On-Resistance vs. Drain Current

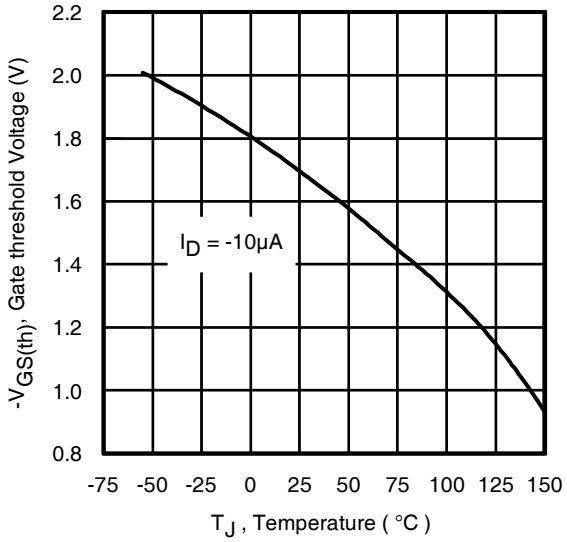


Fig 29. Threshold Voltage vs. Temperature

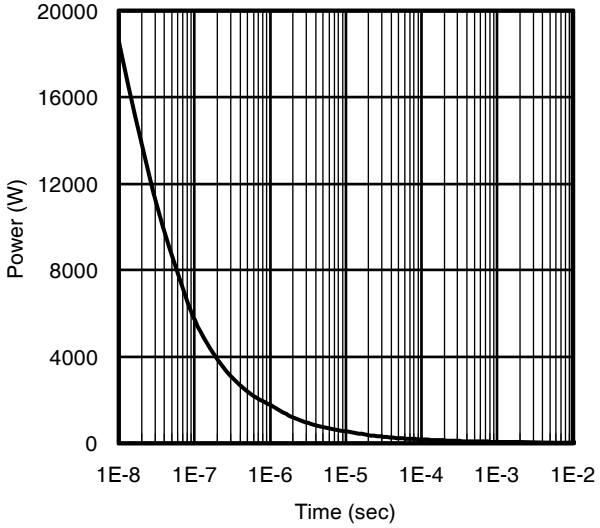


Fig 30. Typical Power vs. Time

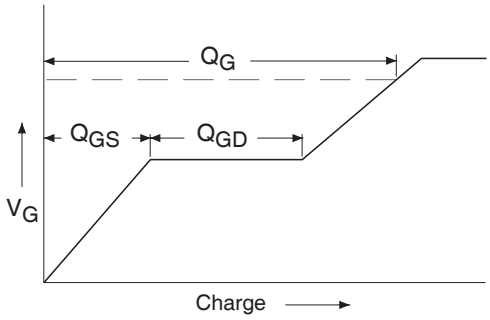


Fig 31a. Basic Gate Charge Waveform

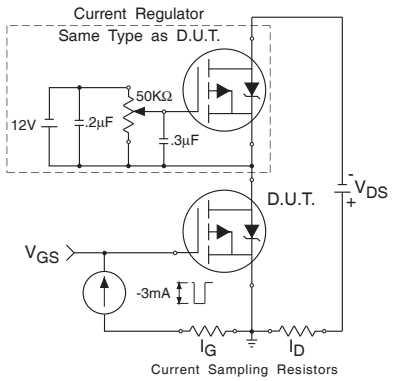
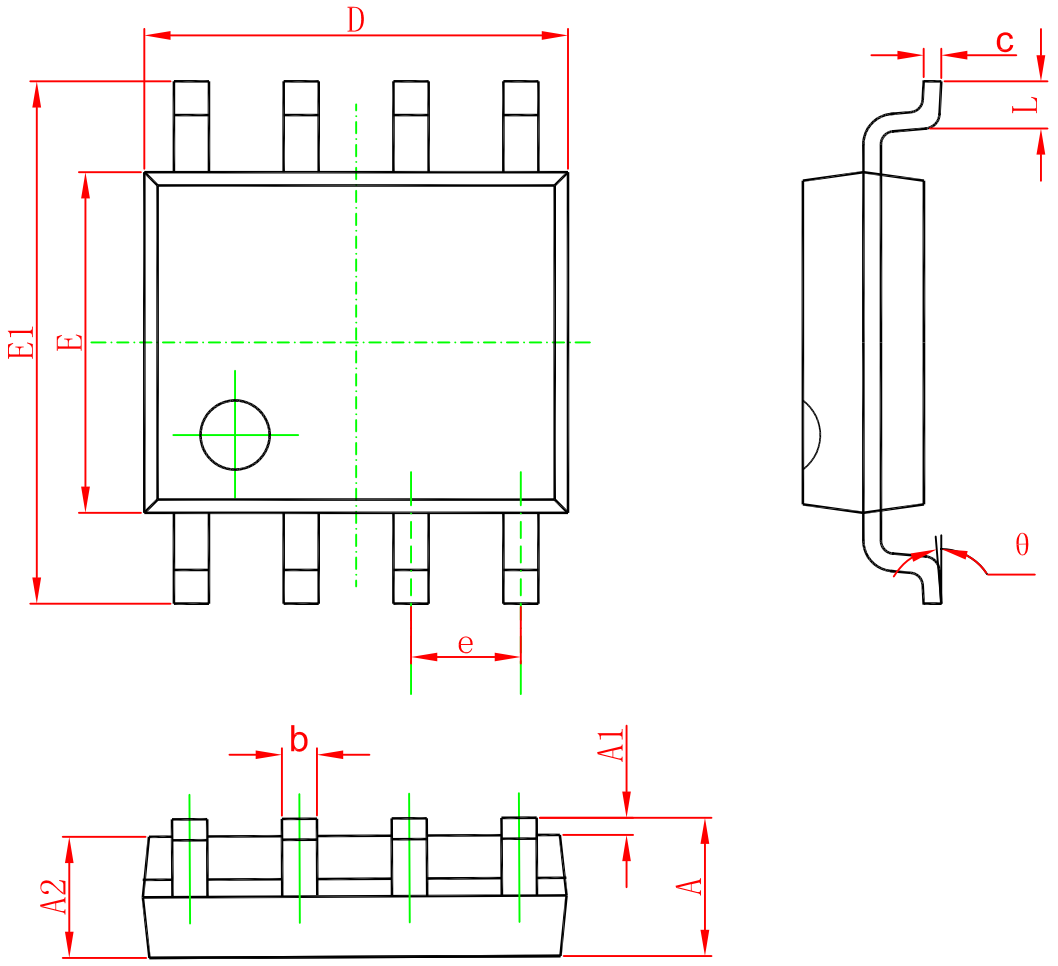


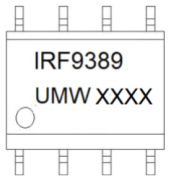
Fig 31b. Gate Charge Test Circuit

Package Mechanical Data SOP-8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

Marking



Ordering information

Order code	Package	Baseqty	Deliverymode
UMW IRF9389TR	SOP-8	3000	Tape and reel