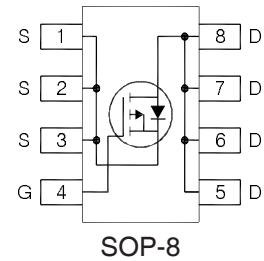## Applications

● Charge and Discharge Switch for Notebook PC Battery Application

Features

● $V_{DS (V)}$ =-30V

● I_D = -12 A (V_{GS} = -10V)

● $R_{DS(ON)}$ < 11.9mΩ (V_{GS}=-10V)

● $R_{DS(ON)}$ < 19.7 mΩ (V_{GS}=-4.5V)

SOP-8

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{DS}	Drain-to-Source Voltage	-30	V
V_{GS}	Gate-to-Source Voltage	± 20	
I_D @ T_A = 25°C	Continuous Drain Current, V_{GS} @ 10V	-12	A
I_D @ T_A = 70°C	Continuous Drain Current, V_{GS} @ 10V	-9.6	
I_{DM}	Pulsed Drain Current ①	-96	
P_D @T_A = 25°C	Power Dissipation ④	2.5	W
P_D @T_A = 70°C	Power Dissipation ④	1.6	
	Linear Derating Factor	0.02	W/°C
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C

Static @ T$_J$= 25°C (unless otherwise specified)

Parameter		Min.	Typ.	Max.	Units	Conditions
BV$_{DSS}$	Drain-to-Source Breakdown Voltage	-30			V	V$_{GS}$ = 0V, I$_D$ = -250µA
ΔBV$_{DSS}$/ΔT$_J$	Breakdown Voltage Temp. Coefficient		0.021		V/°C	Reference to 25°C, I$_D$ = -1mA
R$_{DS(on)}$	Static Drain-to-Source On-Resistance		10	11.9	mΩ	V$_{GS}$ = -10V, I$_D$ = -12A ③
			16.1	19.7		V$_{GS}$ = -4.5V, I$_D$ = -9.6A ③
V$_{GS(th)}$	Gate Threshold Voltage	-1.0	-1.5	-2.0	V	V$_{DS}$ = V$_{GS}$, I$_D$ = -25µA
ΔV$_{GS(th)}$	Gate Threshold Voltage Coefficient		-5.8		mV/°C	
I$_{DSS}$	Drain-to-Source Leakage Current			-1.0	µA	V$_{DS}$ = -24V, V$_{GS}$ = 0V
				-150		V$_{DS}$ = -24V, V$_{GS}$ = 0V, T$_J$ = 125°C
I$_{GSS}$	Gate-to-Source Forward Leakage			-100	nA	V$_{GS}$ = -20V
	Gate-to-Source Reverse Leakage			100		V$_{GS}$ = 20V
gfs	Forward Transconductance	20			S	V$_{DS}$ = -10V, I$_D$ = -9.6A
Q$_g$	Total Gate Charge ⑥		18		nC	V$_{DS}$ = -15V, V$_{GS}$ = -4.5V, I$_D$ = - 9.6A
Q$_g$	Total Gate Charge ⑥		35	52	nC	V$_{GS}$ = -10V
Q$_{gs}$	Gate-to-Source Charge ⑥		5.3			V$_{DS}$ = -15V
Q$_{gd}$	Gate-to-Drain Charge ⑥		8.5			I$_D$ = -9.6A
R$_G$	Gate Resistance ⑥		15		Ω	
t$_{d(on)}$	Turn-On Delay Time		19		ns	V$_{DD}$ = -15V, V$_{GS}$ = -4.5V ③
t$_r$	Rise Time		57			I$_D$ = -1.0A
t$_{d(off)}$	Turn-Off Delay Time		80			R$_G$ = 6.8Ω
t$_f$	Fall Time		66			See Figs. 20a &20b
C$_{iss}$	Input Capacitance		1680		pF	V$_{GS}$ = 0V
C$_{oss}$	Output Capacitance		350			V$_{DS}$ = -25V
C$_{rss}$	Reverse Transfer Capacitance		220			ƒ = 1.0kHz

Avalanche Characteristics

Parameter		Typ.	Max.	Units
E$_{AS}$	Single Pulse Avalanche Energy ②		120	mJ
I$_{AR}$	Avalanche Current ①		-9.6	A

Diode Characteristics

Parameter		Min.	Typ.	Max.	Units	Conditions
I$_S$	Continuous Source Current (Body Diode)			-2.5	A	MOSFET symbol showing the integral reverse p-n junction diode.
I$_{SM}$	Pulsed Source Current (Body Diode) ①			-96		
V$_{SD}$	Diode Forward Voltage			-1.2	V	T$_J$ = 25°C, I$_S$ = -2.5A, V$_{GS}$ = 0V ③
t$_{rr}$	Reverse Recovery Time		51	76	ns	T$_J$ = 25°C, I$_F$ = -2.5A, V$_{DD}$ = -24V
Q$_{rr}$	Reverse Recovery Charge		35	53	nC	di/dt = 100A/µs ③

Thermal Resistance

Parameter		Typ.	Max.	Units
R$_{θJL}$	Junction-to-Drain Lead ⑤		20	°C/W
R$_{θJA}$	Junction-to-Ambient ④		50	

Notes:

① Repetitive rating; pulse width limited by max. junction temperature.

② Starting T$_J$ = 25°C, L = 2.6mH, R$_G$ = 25Ω, I$_{AS}$ = -9.6A.

③ Pulse width ≤ 400µs; duty cycle ≤ 2%.

④ When mounted on 1 inch square copper board.

⑤ R$_θ$ is measured at T$_J$ of approximately 90°C.

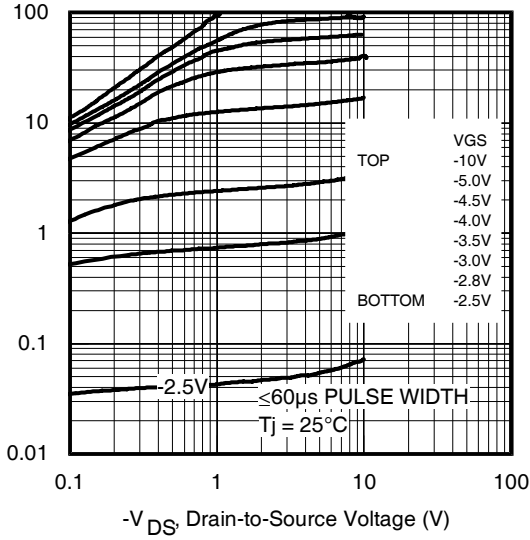⑥ For DESIGN AID ONLY, not subject to production testing.
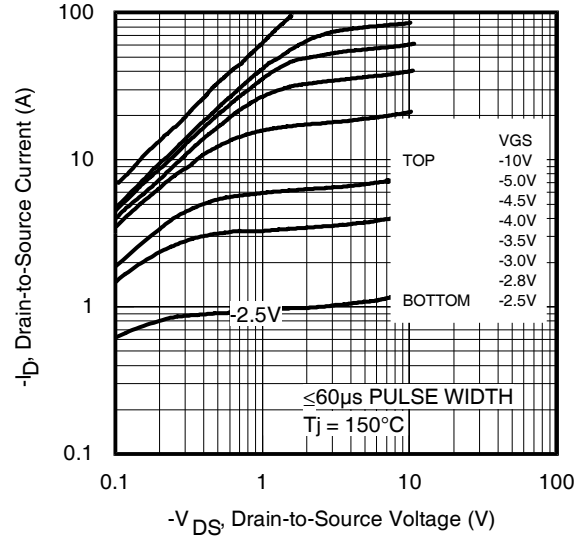
Fig 1. Typical Output Characteristics
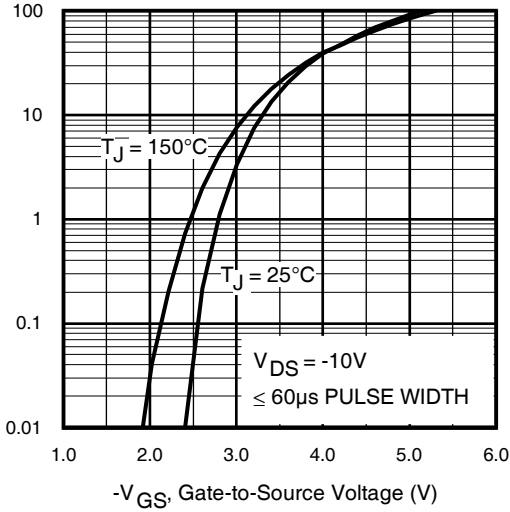

Fig 2. Typical Output Characteristics

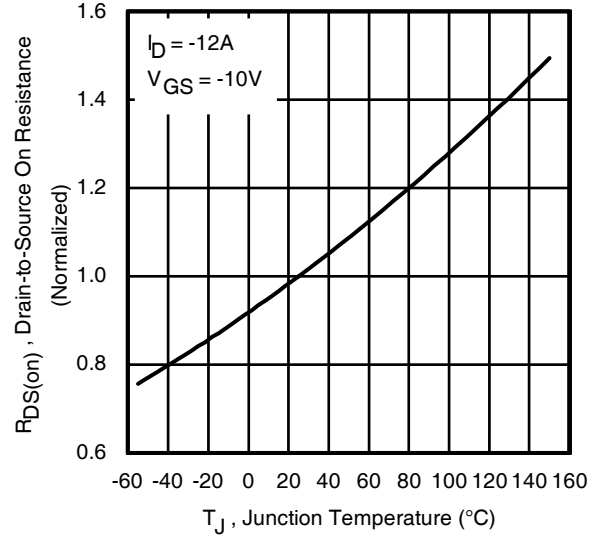**Fig 3.** Typical Transfer Characteristics

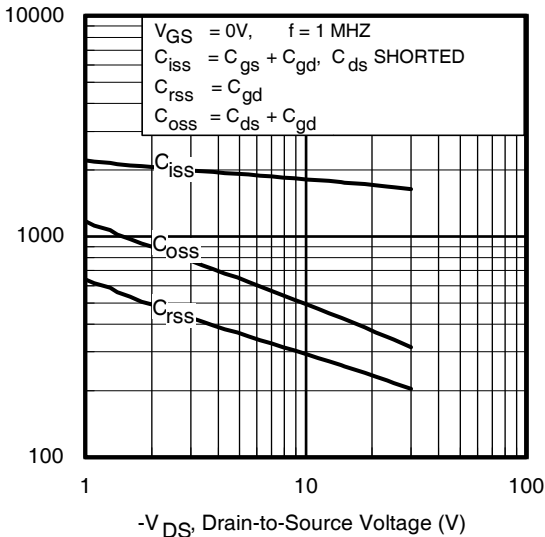**Fig 4.** Normalized On-Resistance vs. Temperature

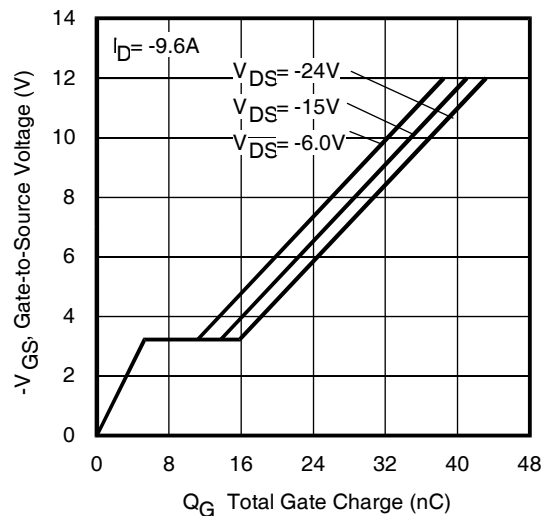**Fig 5.** Typical Capacitance vs.Drain-to-Source Voltage
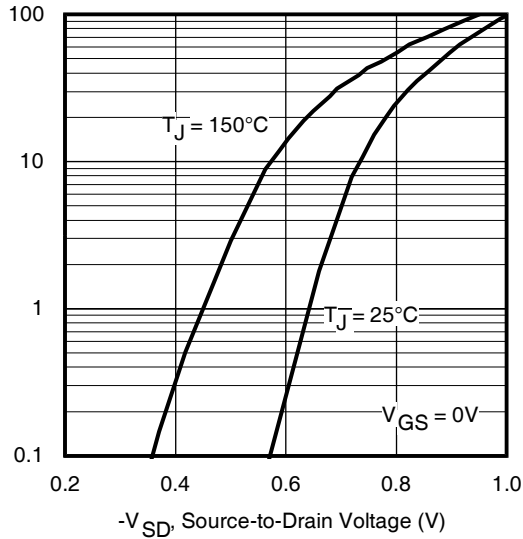

Fig 6. Typical Gate Charge vs.Gate-to-Source Voltage
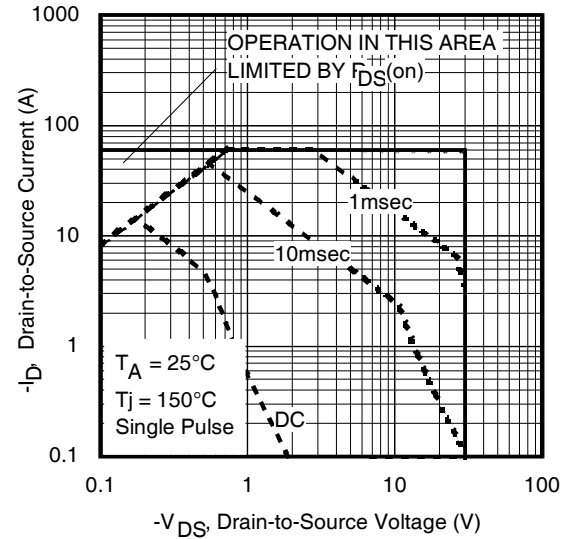
Fig 7. Typical Source-Drain Diode Forward Voltage
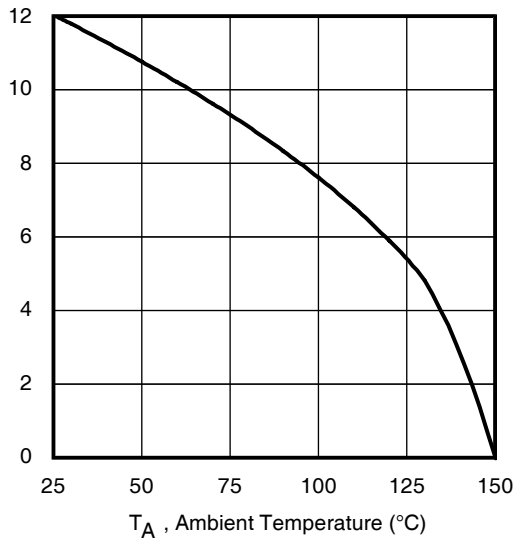

Fig 8. Maximum Safe Operating Area
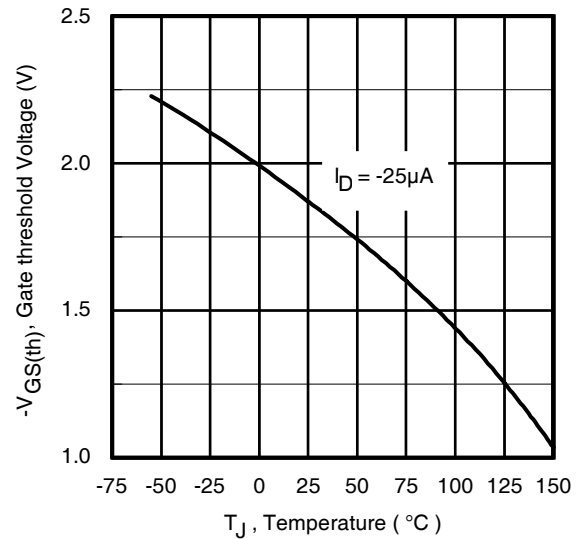

Fig 9. Maximum Drain Current vs. Ambient Temperature

Fig 10. Threshold Voltage vs. Temperature

Notes:
1. Duty Factor D = t1/t2
2. Peak Tj = P dm x Zthja + T_A

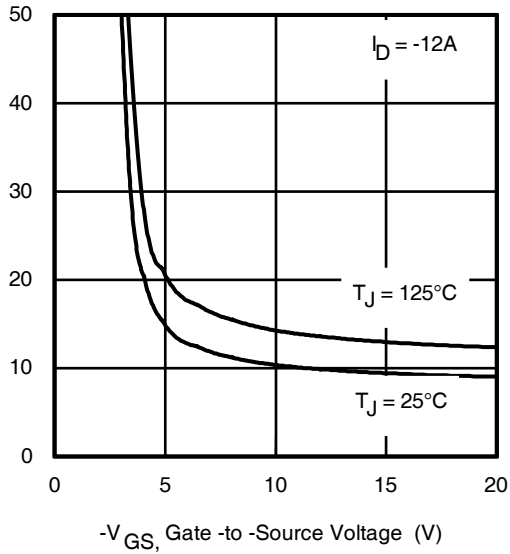**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient
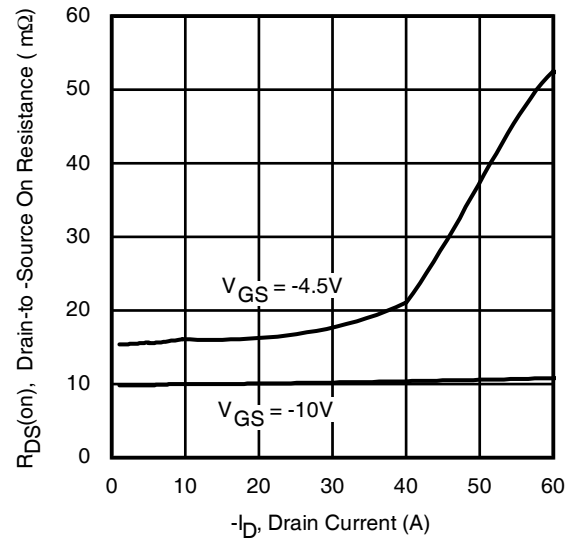
Fig 12. On-Resistance vs. Gate Voltage

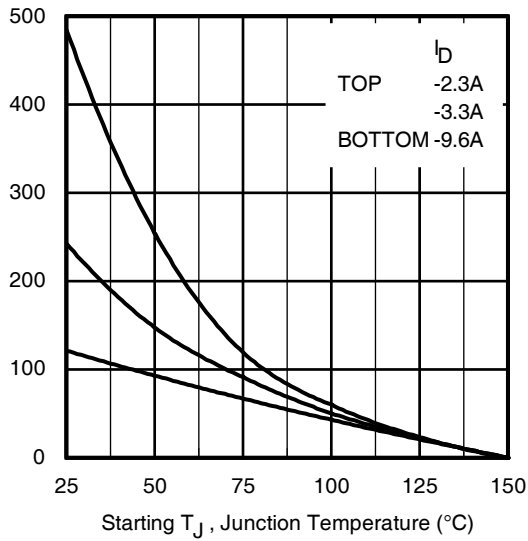Fig 13. Typical On-Resistance vs. Drain Current
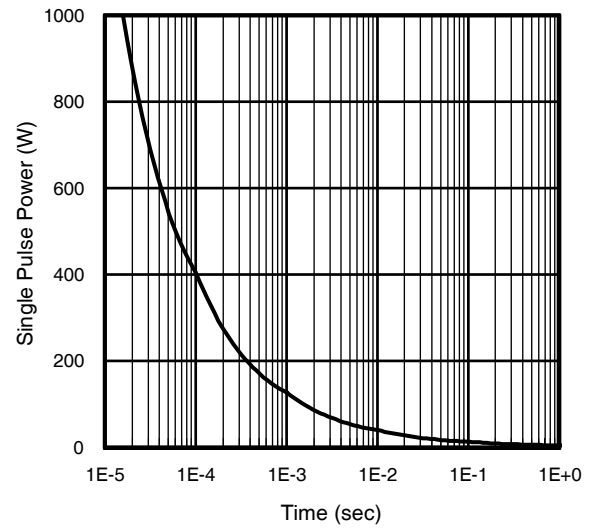

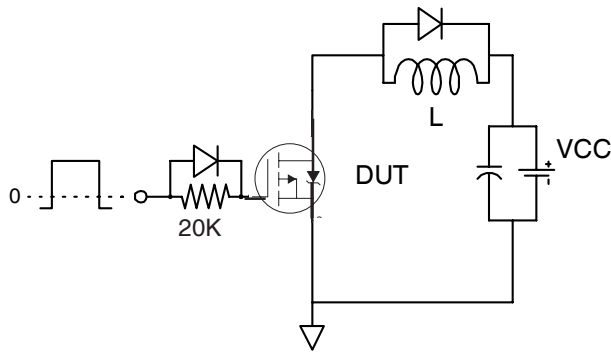Fig 14. Maximum Avalanche Energy vs. Drain Current

Fig 16. Typical Power vs. Time

Fig 17a. Gate Charge Test Circuit
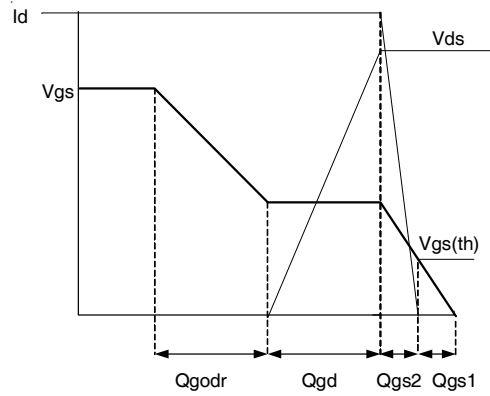

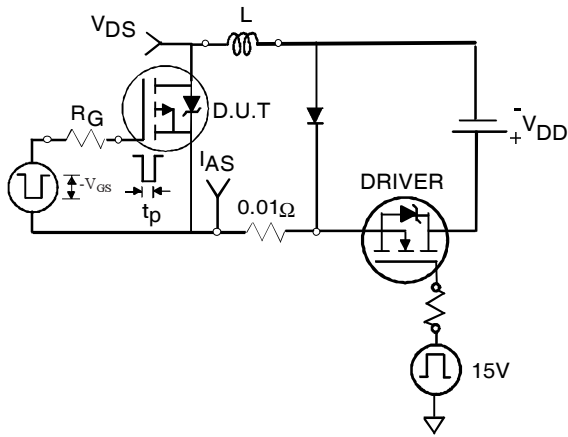**Fig 17b.** Gate Charge Waveform

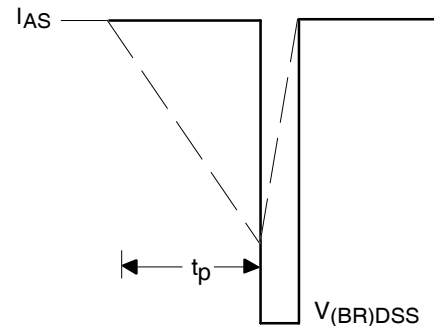**Fig 18a.** Unclamped Inductive Test Circuit

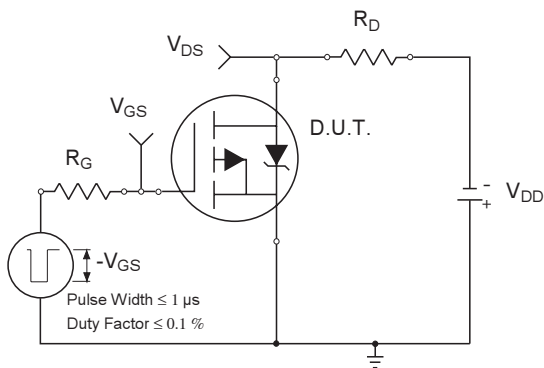**Fig 18b.** Unclamped Inductive Waveforms

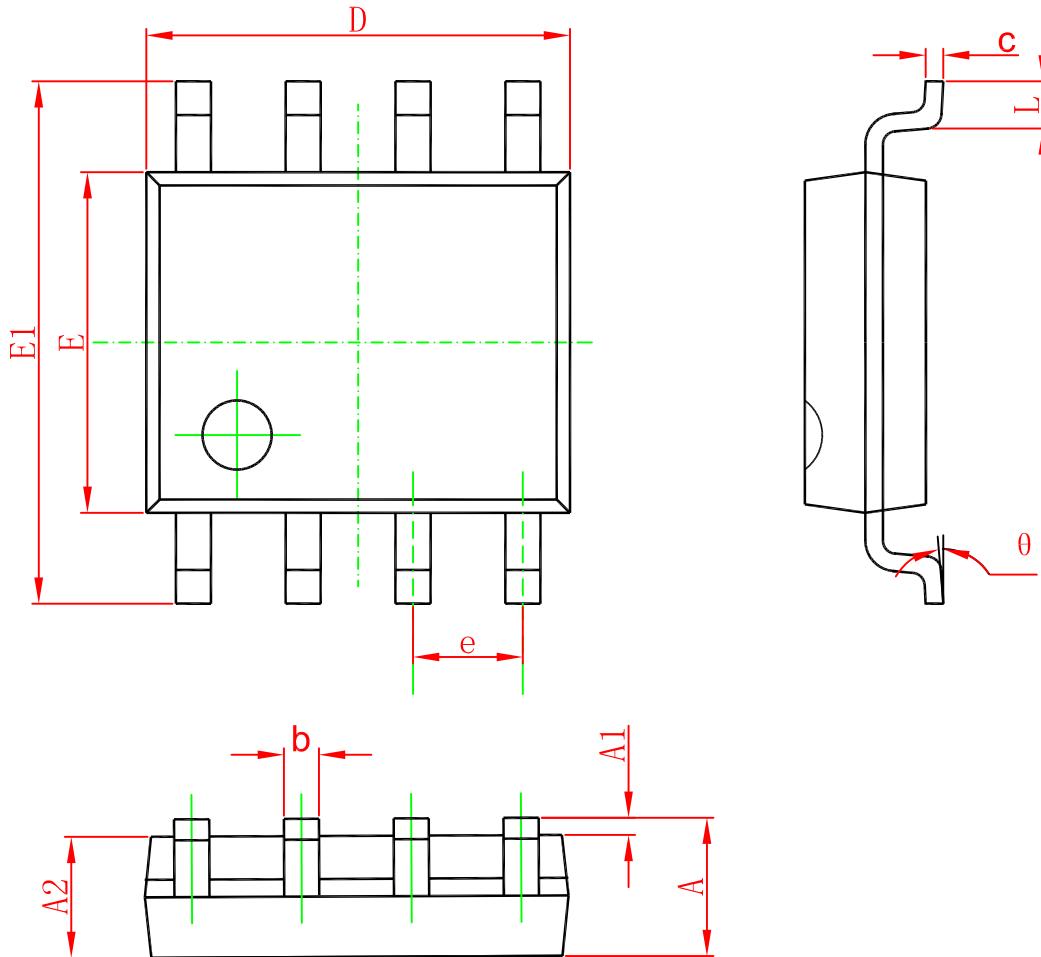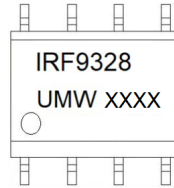**Fig 19a.** Switching Time Test Circuit

Fig 19b. Switching Time Waveforms

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

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IRF9328
UMW XXXX
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Ordering information

Order code	Package	Baseqty	Deliverymode
UMW IRF9328TR	SOP-8	3000	Tape and reel

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