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August 2000

QFET™

FQS4900

Dual N & P-Channel, Logic Level MOSFET

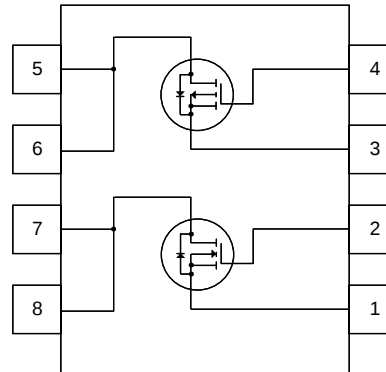
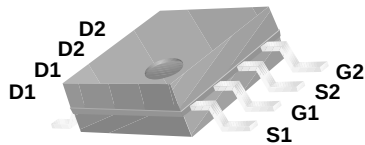
General Description

These dual N and P-channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.

This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. This device is well suited for high interface in telephone sets.

Features

- N-Channel 1.3A, 60V, $R_{DS(on)} = 0.55 \Omega @ V_{GS} = 10 V$
 $R_{DS(on)} = 0.65 \Omega @ V_{GS} = 5 V$
 P-Channel -0.3A, -300V, $R_{DS(on)} = 15.5 \Omega @ V_{GS} = -10 V$
 $R_{DS(on)} = 16 \Omega @ V_{GS} = -5 V$
- Low gate charge (typical N-Channel 1.6 nC)
 (typical P-Channel 3.6 nC)
- Fast switching
- Improved dv/dt capability



Absolute Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	N-Channel	P-Channel	Units
V_{DSS}	Drain-Source Voltage	60	-300	V
I_D	Drain Current - Continuous ($T_A = 25^\circ\text{C}$)	1.3	-0.3	A
	- Continuous ($T_A = 70^\circ\text{C}$)	0.82	-0.19	A
I_{DM}	Drain Current - Pulsed (Note 1)	5.2	-1.2	A
V_{GSS}	Gate-Source Voltage	± 20		V
dv/dt	Peak Diode Recovery dv/dt (Note 2)	7.0	4.5	V/ns
P_D	Power Dissipation ($T_A = 25^\circ\text{C}$)	2.0		W
	($T_A = 70^\circ\text{C}$)	1.3		W
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150		$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	Typ	Max	Units
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	62.5	$^\circ\text{C/W}$

Electrical Characteristics $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units		
Off Characteristics									
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0 V, I _D = 250 μA	N-Ch	60	--	--	V		
		V _{GS} = 0 V, I _D = -250 μA	P-Ch	-300	--	--	V		
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 60 V, V _{GS} = 0 V	N-Ch	--	--	1	μA		
		V _{DS} = 48 V, T _C = 55°C		--	--	10	μA		
		V _{DS} = -300 V, V _{GS} = 0 V	P-Ch	--	--	-1	μA		
		V _{DS} = -240 V, T _C = 55°C		--	--	-10	μA		
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 20 V, V _{DS} = 0 V	All	--	--	100	nA		
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -20 V, V _{DS} = 0 V	All	--	--	-100	nA		
On Characteristics									
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = 4V, I _D = 20 mA	N-Ch	1.0	--	1.95	V		
		V _{DS} = 4V, I _D = -20 mA	P-Ch	-1.0	--	-1.95	V		
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 0.65 A	N-Ch	--	0.39	0.55	Ω		
		V _{GS} = 5 V, I _D = 0.65 A		--	0.46	0.65	Ω		
		V _{GS} = -10 V, I _D = -0.15 A	P-CH	--	11.2	15.5	Ω		
		V _{GS} = -5 V, I _D = -0.15 A		--	11.4	16	Ω		
g _{FS}	Forward Transconductance	V _{DS} = 10 V, I _D = 0.65 A	N-CH	--	1.7	--	S		
		V _{DS} = -10 V, I _D = -0.15 A	P-CH	--	0.6	--	S		
Switching Characteristics									
t _{d(on)}	Turn-On Delay Time	N-Channel V _{DD} = 30 V, I _D = 1.3 A, R _G = 25 Ω	N-Ch	--	5.7	21	ns		
t _r	Turn-On Rise Time		P-Ch	--	10	30	ns		
			N-Ch	--	21	50	ns		
t _{d(off)}	Turn-Off Delay Time		P-Channel V _{DD} = -150 V, I _D = -0.3 A, R _G = 25 Ω	P-Ch	--	25	60	ns	
		N-Ch		--	11	32	ns		
		t _f		Turn-Off Fall Time	P-Ch	--	35	80	ns
					N-Ch	--	17	45	ns
Q _g	Total Gate Charge	N-Channel V _{DS} = 48 V, I _D = 1.3 A,	P-Ch	--	47	105	ns		
			N-Ch	--	1.6	2.1	nC		
Q _{gs}	Gate-Source Charge	V _{GS} = 5 V P-Channel	P-Ch	--	3.6	4.7	nC		
			N-Ch	--	0.28	--	nC		
Q _{gd}	Gate-Drain Charge	V _{DS} = -240 V, I _D = -0.3 A, V _{GS} = -5 V	P-Ch	--	0.42	--	nC		
			N-Ch	--	0.82	--	nC		
			P-Ch	--	2.1	--	nC		
			N-Ch	--	2.1	--	nC		
Drain-Source Diode Characteristics and Maximum Ratings									
I _S	Maximum Continuous Drain-Source Diode Forward Current		N-Ch	--	--	1.3	A		
			P-Ch	--	--	-0.3	A		
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 1.3 A	N-Ch	--	--	1.5	V		
		V _{GS} = 0 V, I _S = -0.3 A	P-Ch	--	--	-4.0	V		

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
3. Pulse Test : Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$
4. Essentially independent of operating temperature

Typical Characteristics : N-Channel

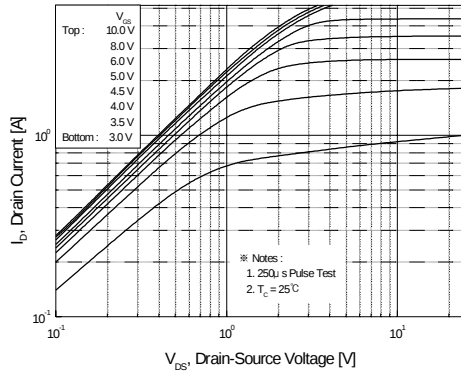


Figure 1. On-Region Characteristics

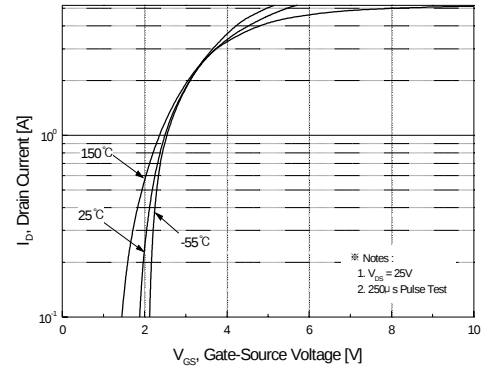


Figure 2. Transfer Characteristics

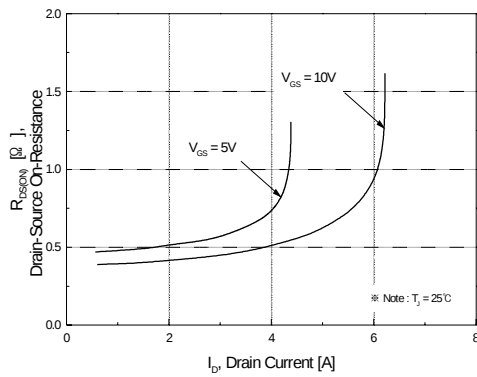


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

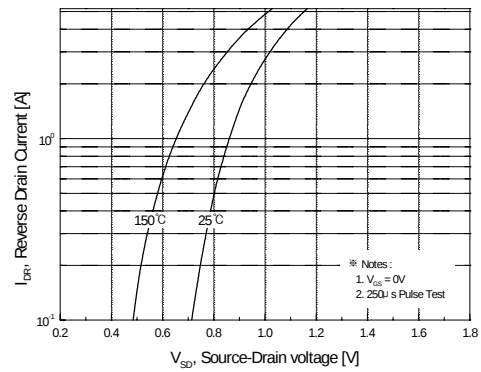


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

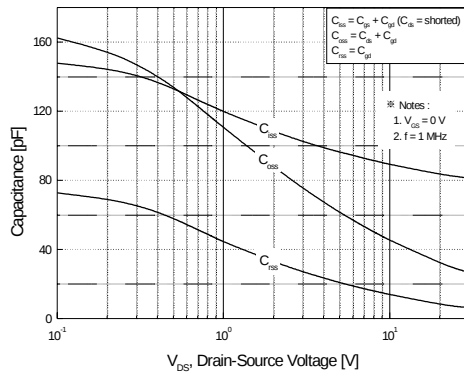


Figure 5. Capacitance Characteristics

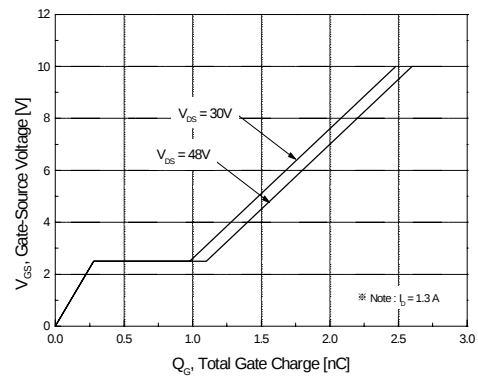


Figure 6. Gate Charge Characteristics

Typical Characteristics : N-Channel (Continued)

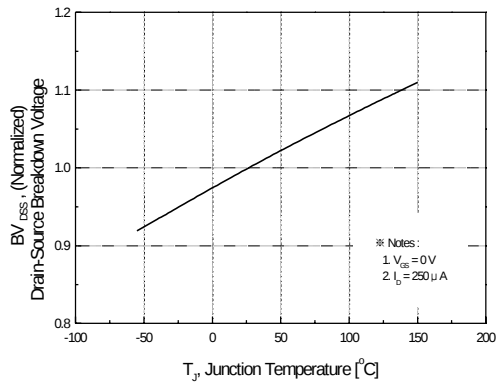


Figure 7. Breakdown Voltage Variation vs. Temperature

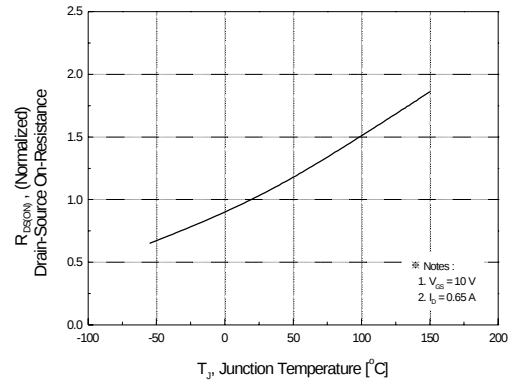


Figure 8. On-Resistance Variation vs. Temperature

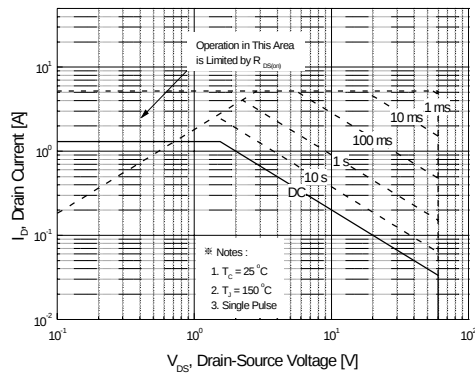


Figure 9. Maximum Safe Operating Area

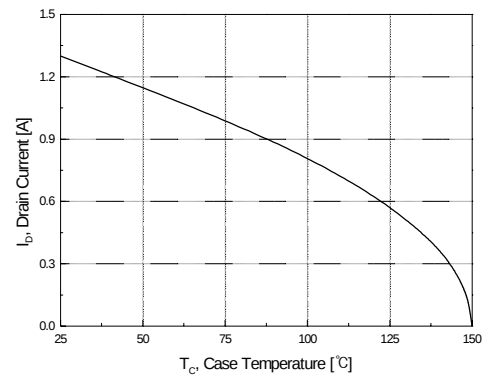


Figure 10. Maximum Drain Current vs. Case Temperature

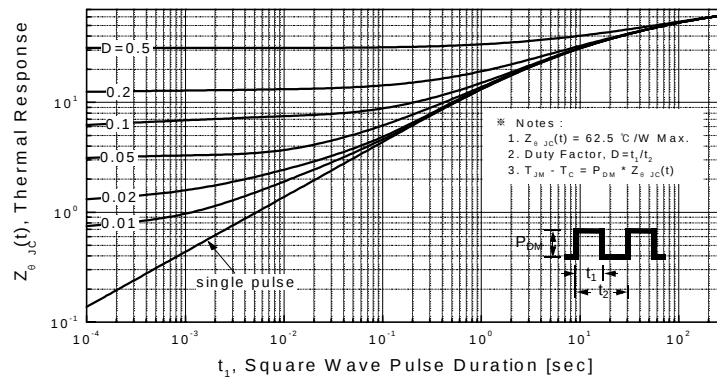


Figure 11. Transient Thermal Response Curve

Typical Characteristics : P-Channel (Continued)

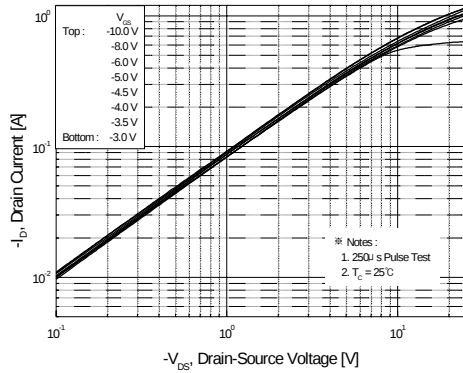


Figure 1. On-Region Characteristics

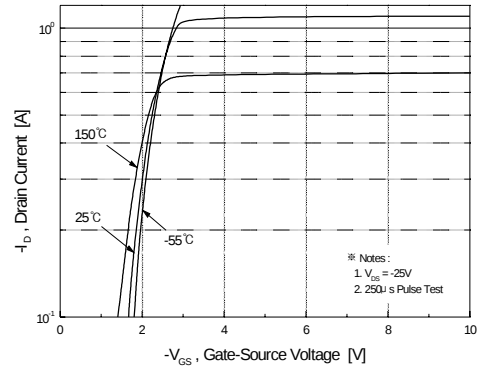


Figure 2. Transfer Characteristics

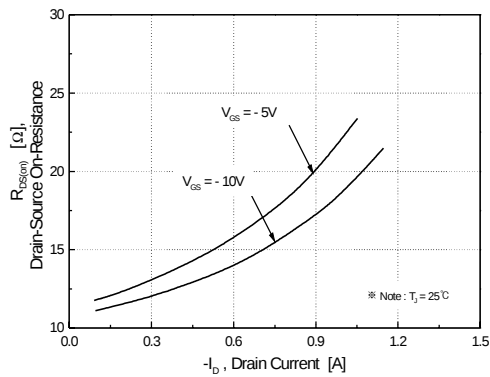


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

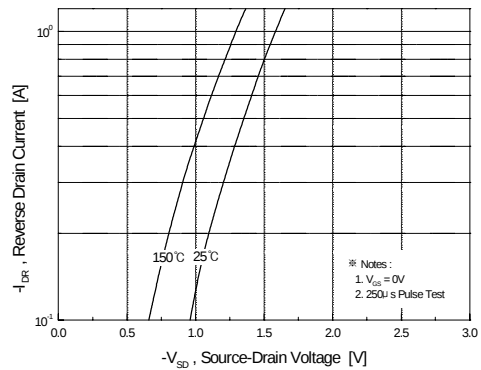


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

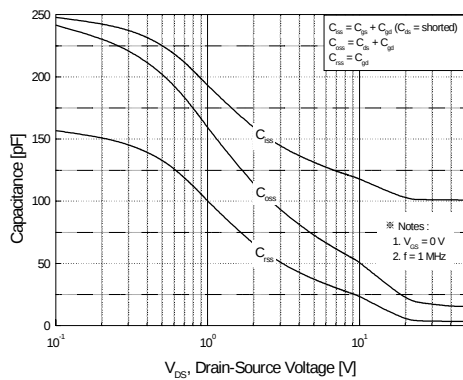


Figure 5. Capacitance Characteristics

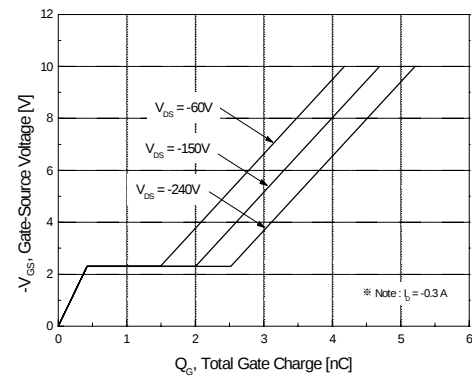


Figure 6. Gate Charge Characteristics

Typical Characteristics : P-Channel (Continued)

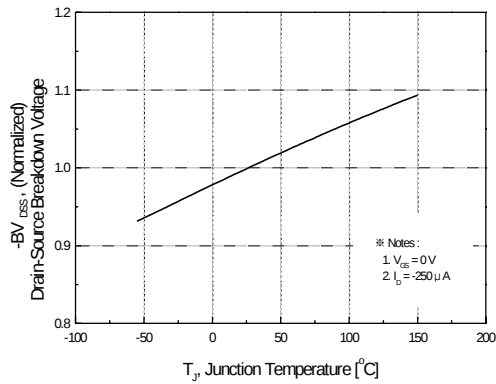


Figure 7. Breakdown Voltage Variation vs. Temperature

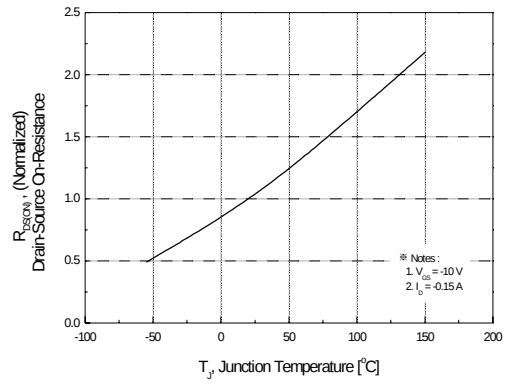


Figure 8. On-Resistance Variation vs. Temperature

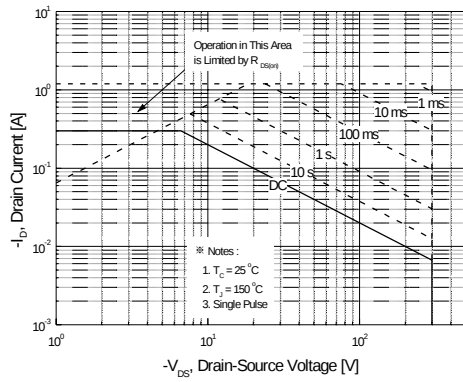


Figure 9. Maximum Safe Operating Area

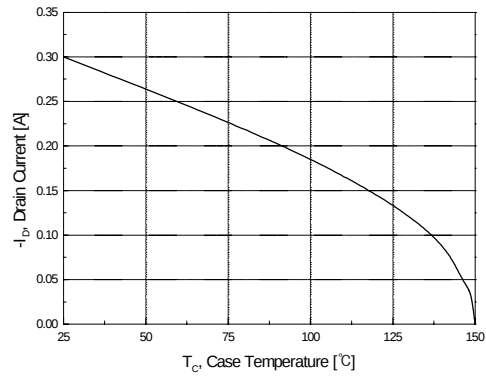


Figure 10. Maximum Drain Current vs. Case Temperature

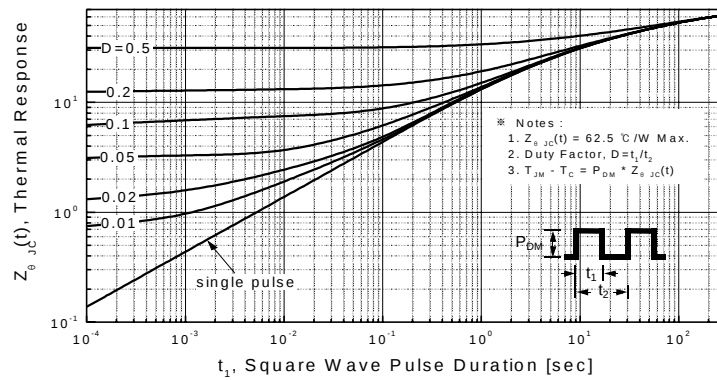
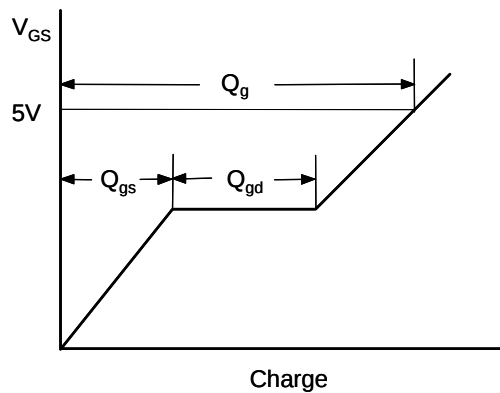
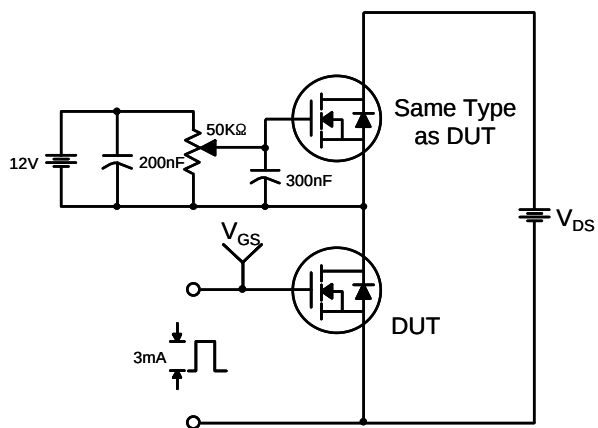
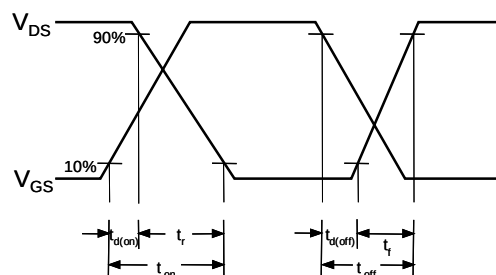
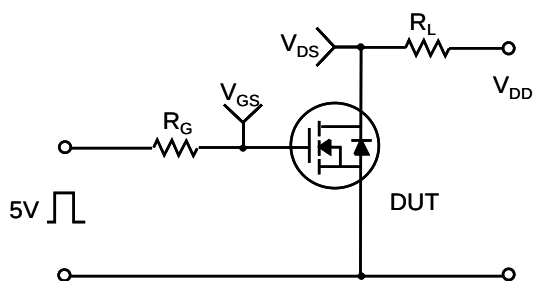


Figure 11. Transient Thermal Response Curve

Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



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