

N

NDS8858H

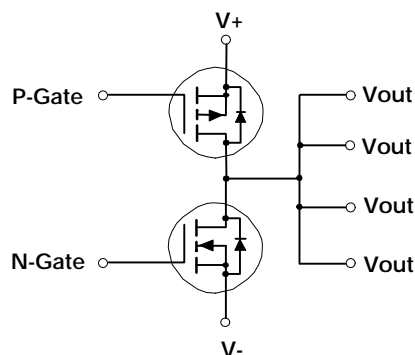
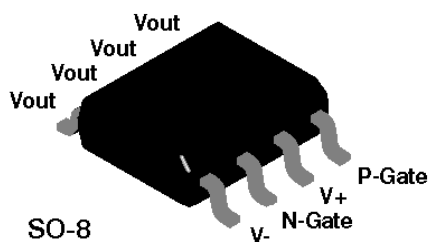
Complementary MOSFET Half Bridge

General Description

These Complementary MOSFET half bridge devices are produced using National's proprietary, high cell density, DMOS technology. This very high density process is especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulses in the avalanche and commutation modes. These devices are particularly suited for low voltage half bridge applications or CMOS applications when both gates are connected together.

Features

- N-Channel 6.3A, 30V, $R_{DS(ON)}=0.035\Omega$ @ $V_{GS}=10V$.
P-Channel -4.8A, -30V, $R_{DS(ON)}=0.065\Omega$ @ $V_{GS}=-10V$.
- High density cell design or extremely low $R_{DS(ON)}$.
- High power and current handling capability in a widely used surface mount package.
- Matched pair for equal input capacitance and power 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	30	-30	V
V_{GSS}	Gate-Source Voltage	20	-20	V
I_D	Drain Current - Continuous (Note 1a & 2)	6.3	-4.8	A
	- Pulsed	20	20	
P_D	Maximum Power Dissipation (Single Device)	(Note 1a)	2.5	W
		(Note 1b)	1.2	
		(Note 1c)	1	
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to 150		$^\circ\text{C}$

THERMAL CHARACTERISTICS

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Single Device) (Note 1a)	50	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Single Device) (Note 1a)	25	$^\circ\text{C/W}$

Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Type	Min	Typ	Max	Units	
OFF CHARACTERISTICS								
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0 V, I _D = 250 μA	N-Ch	30			V	
		V _{GS} = 0 V, I _D = -250 μA	P-Ch	-30			V	
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 24 V, V _{GS} = 0 V	N-Ch			1	μA	
				T _J = 55°C			10	μA
		V _{DS} = -24 V, V _{GS} = 0 V	P-Ch			-1	μA	
				T _J = 55°C			-10	μA
I _{GSSF}	Gate - Body Leakage, Forward	V _{GS} = 20 V, V _{DS} = 0 V	All			100	nA	
I _{GSSR}	Gate - Body Leakage, Reverse	V _{GS} = -20 V, V _{DS} = 0 V	All			-100	nA	
ON CHARACTERISTICS (Note 3)								
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250 μA	N-Ch		1	1.6	2.8	V
				T _J = 125°C	0.7	1.2	2.2	
		V _{DS} = V _{GS} , I _D = -250 μA	P-Ch		-1	-1.6	-2.8	
				T _J = 125°C	-0.7	-1.2	-2.2	
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 4.8 A	N-Ch		0.033	0.035	Ω	
				T _J = 125°C		0.046		0.063
		V _{GS} = 4.5 V, I _D = 3.7 A	P-Ch		0.046	0.05		
		V _{GS} = -10 V, I _D = -4.8 A			0.052	0.065		
		T _J = 125°C			0.075	0.13		
V _{GS} = -4.5 V, I _D = -3.7 A		0.085	0.1					
I _{D(on)}	On-State Drain Current	V _{GS} = 10 V, V _{DS} = 5 V	N-Ch	20			A	
		V _{GS} = -10 V, V _{DS} = -5 V	P-Ch	-20				
g _{FS}	Forward Transconductance	V _{DS} = 10 V, I _D = 4.8 A	N-Ch		10		S	
		V _{DS} = -10 V, I _D = -4.8 A	P-Ch		7			
DYNAMIC CHARACTERISTICS								
C _{ISS}	Input Capacitance	N-Channel V _{DS} = 15 V, V _{GS} = 0 V, f = 1.0 MHz	N-Ch		720		pF	
			P-Ch		690			
C _{OSS}	Output Capacitance		N-Ch		370		pF	
			P-Ch		430			
C _{rSS}	Reverse Transfer Capacitance	P-Channel V _{DS} = -15 V, V _{GS} = 0 V, f = 1.0 MHz	N-Ch		250		pF	
			P-Ch		160			

Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Type	Min	Typ	Max	Units
SWITCHING CHARACTERISTICS (Note 2)							
t _{D(on)}	Turn - On Delay Time	N-Channel V _{DD} = 10 V, I _D = 1 A, V _{GEN} = 10 V, R _{GEN} = 6 Ω	N-Ch		12	20	ns
			P-Ch		9	20	
t _r	Turn - On Rise Time	P-Channel V _{DD} = -10 V, I _D = -1 A, V _{GEN} = -10 V, R _{GEN} = 6 Ω	N-Ch		13	30	ns
			P-Ch		20	25	
t _{D(off)}	Turn - Off Delay Time		N-Ch		29	50	ns
			P-Ch		40	50	
t _f	Turn - Off Fall Time		N-Ch		10	20	ns
			P-Ch		19	40	
Q _g	Total Gate Charge	N-Channel V _{DS} = 10 V, I _D = 4.8 A, V _{GS} = 10 V	N-Ch		19	30	nC
			P-Ch		21	30	
Q _{gs}	Gate-Source Charge	P-Channel V _{DS} = -10 V, I _D = -4.8 A, V _{GS} = -10 V	N-Ch		2.1		nC
			P-Ch		3.2		
Q _{gd}	Gate-Drain Charge		N-Ch		5.2		nC
			P-Ch		5.2		

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

I _S	Maximum Continuous Drain-Source Diode Forward Current		N-Ch			2	A
			P-Ch			-2	
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 2.0 A (Note 2)	N-Ch		0.9	1.2	V
		V _{GS} = 0 V, I _S = -2.0 A (Note 2)	P-Ch		-0.85	-1.2	
t _{rr}	Reverse Recovery Time	N-Channel V _{GS} = 0 V, I _F = 2.0 A, dI _F /dt = 100 A/μs	N-Ch			100	ns
		P-Channel V _{GS} = 0 V, I _F = -2.0 A, dI _F /dt = 100 A/μs	P-Ch			100	

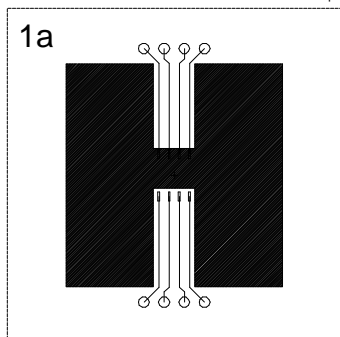
Notes:

- R_{θJA} is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. R_{θJC} is guaranteed by design while R_{θCA} is determined by the user's board design.

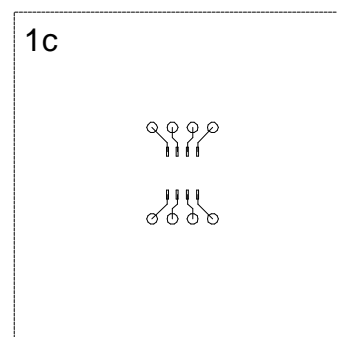
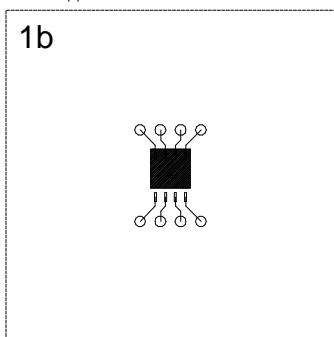
$$P_D(t) = \frac{T_J - T_A}{R_{\theta JA}(t)} = \frac{T_J - T_A}{R_{\theta JC} + R_{\theta CA}(t)} = I_D^2(t) \times R_{DS(ON)} @ T_J$$

Typical R_{θJA} using the board layouts shown below on 4.5"x5" FR-4 PCB in a still air environment:

- 50°C/W when mounted on a 1 in² pad of 2oz copper.
- 105°C/W when mounted on a 0.04 in² pad of 2oz copper.
- 125°C/W when mounted on a 0.006 in² pad of 2oz copper.



Scale 1 : 1 on letter size paper



- Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2.0%.

Typical Electrical Characteristics

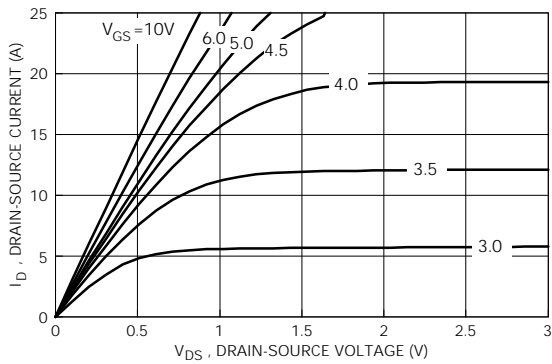


Figure 1. N-Channel On-Region Characteristics.

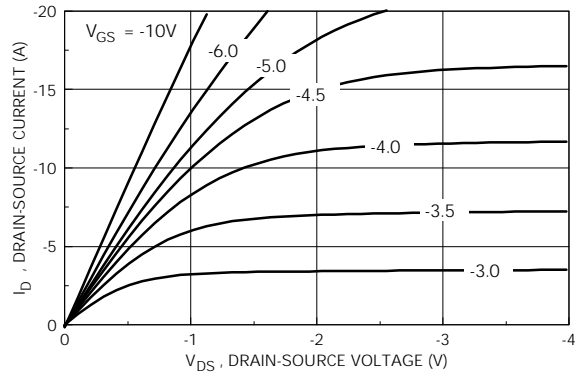


Figure 2. P-Channel On-Region Characteristics.

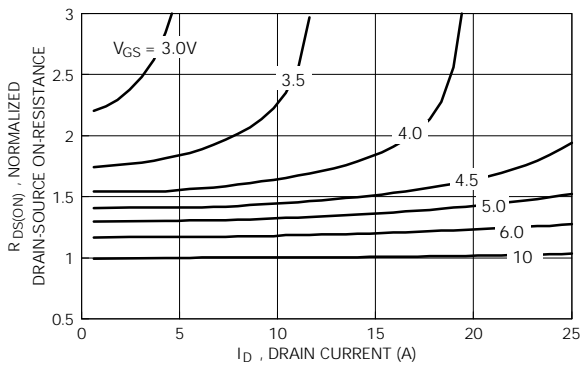


Figure 3. N-Channel On-Resistance Variation with Gate Voltage and Drain Current.

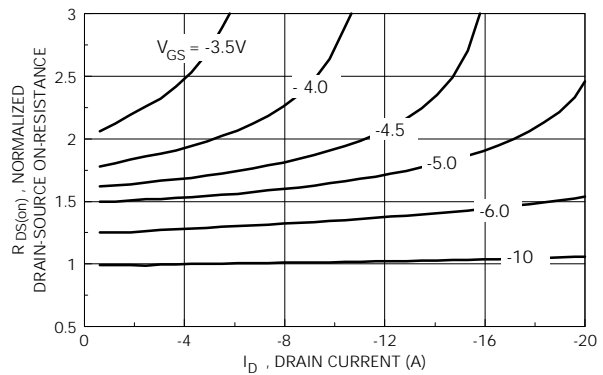


Figure 4. P-Channel On-Resistance Variation with Gate Voltage and Drain Current.

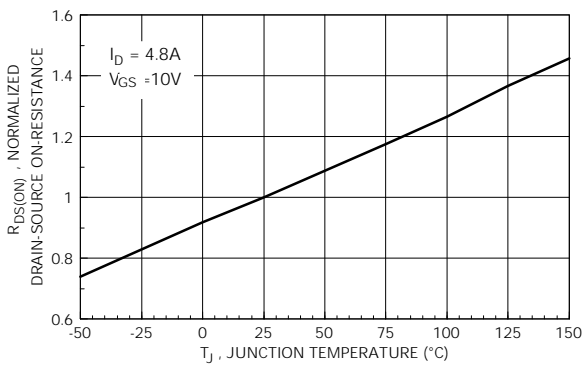


Figure 5. N-Channel On-Resistance Variation with Temperature.

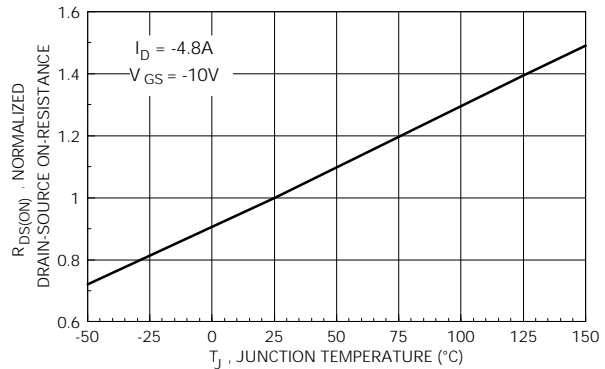


Figure 6. P-Channel On-Resistance Variation with Temperature.

Typical Electrical Characteristics

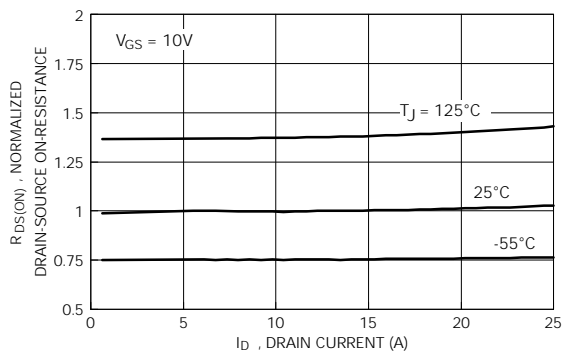


Figure 7. N-Channel On-Resistance Variation with Drain Current and Temperature.

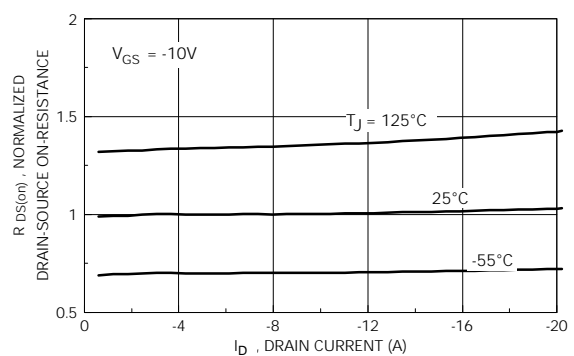


Figure 8. P-Channel On-Resistance Variation with Drain Current and Temperature.

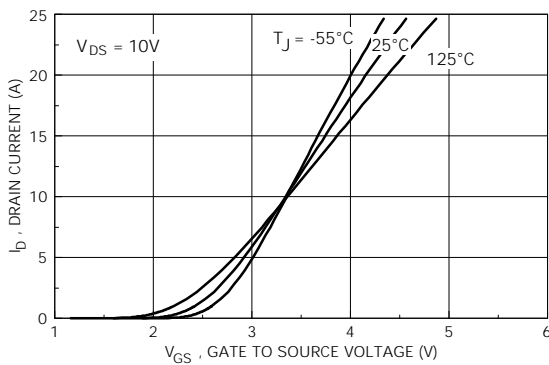


Figure 9. N-Channel Transfer Characteristics.

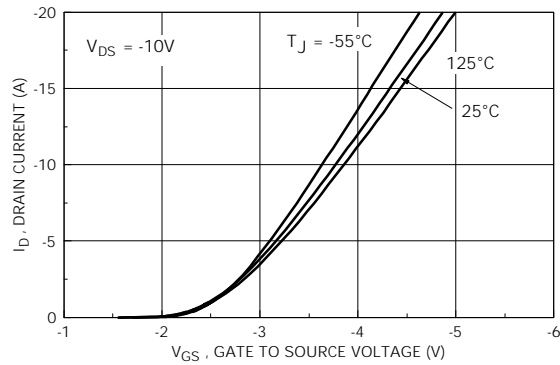


Figure 10. P-Channel Transfer Characteristics.

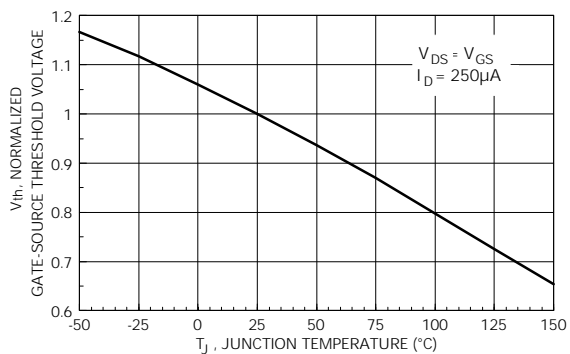


Figure 11. N-Channel Gate Threshold Variation with Temperature.

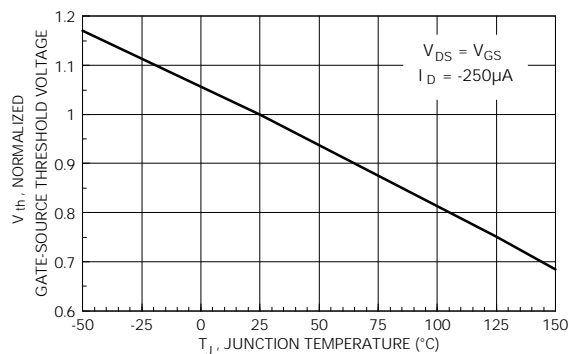


Figure 12. P-Channel Gate Threshold Variation with Temperature.

Typical Electrical Characteristics

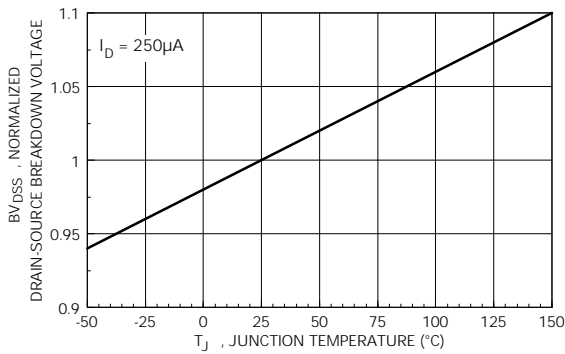


Figure 13. N-Channel Breakdown Voltage Variation with Temperature.

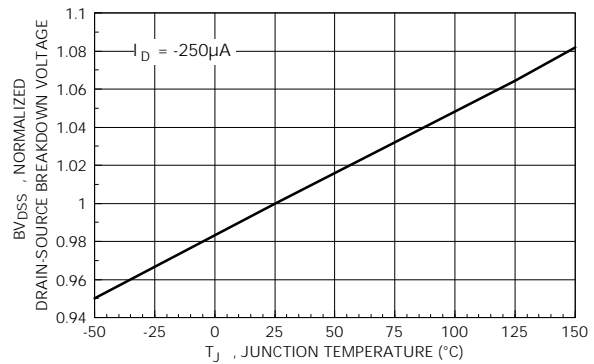


Figure 14. P-Channel Breakdown Voltage Variation with Temperature.

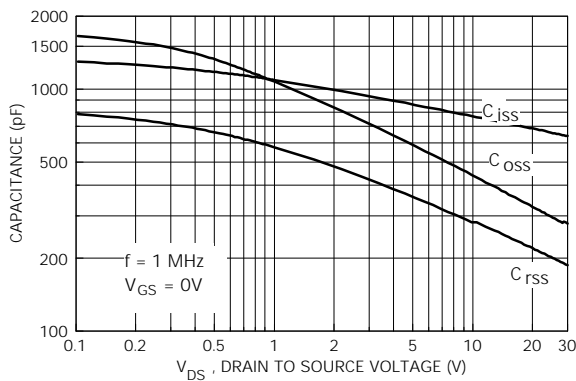


Figure 15. N-Channel Capacitance Characteristics.

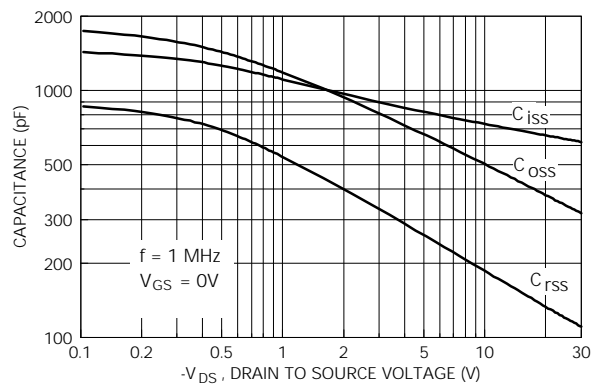


Figure 16. P-Channel Capacitance Characteristics.

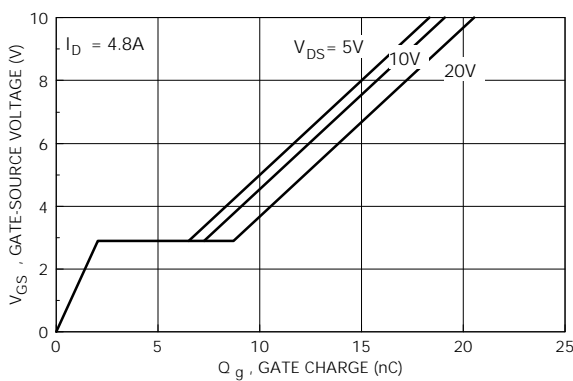


Figure 17. N-Channel Gate Charge Characteristics.

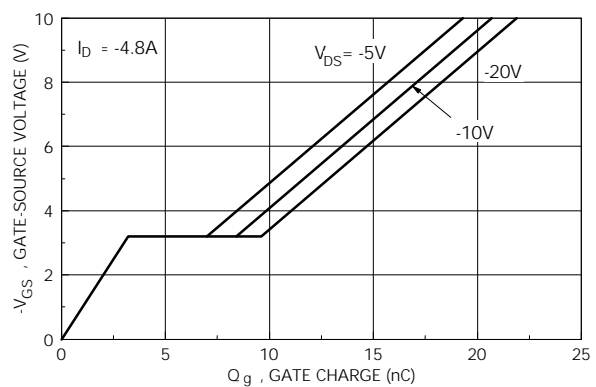


Figure 18. P-Channel Gate Charge Characteristics.

Typical Electrical and Thermal Characteristics

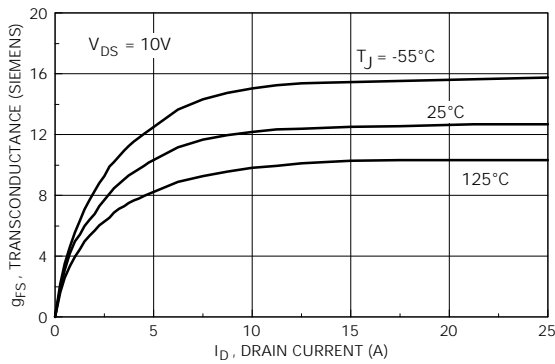


Figure 19. N-Channel Transconductance Variation with Drain Current and Temperature.

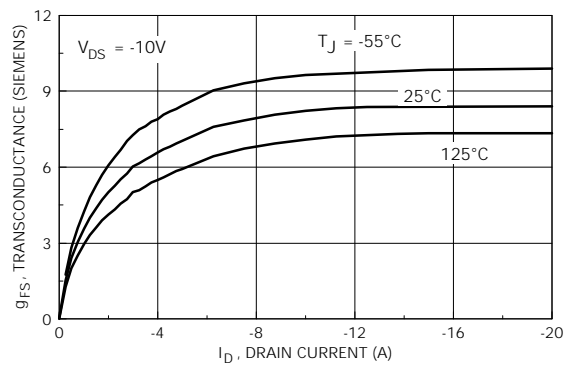


Figure 20. P-Channel Transconductance Variation with Drain Current and Temperature.

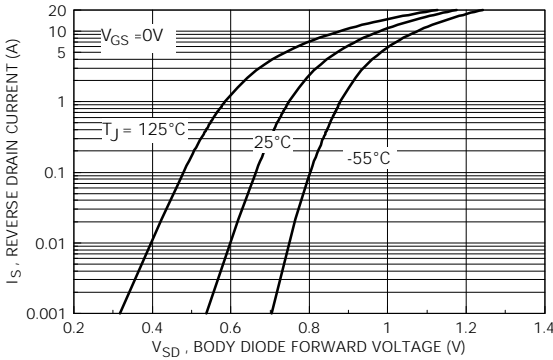


Figure 21. N-Channel Body Diode Forward Voltage Variation with Current and Temperature.

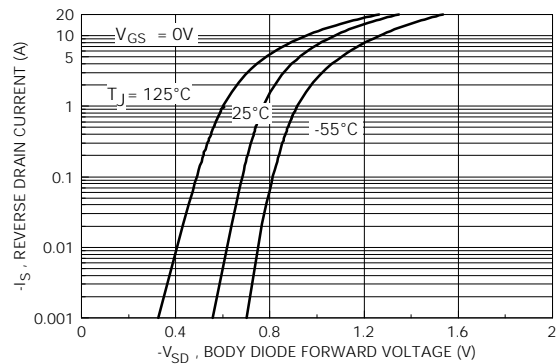


Figure 22. P-Channel Body Diode Forward Voltage Variation with Current and Temperature.

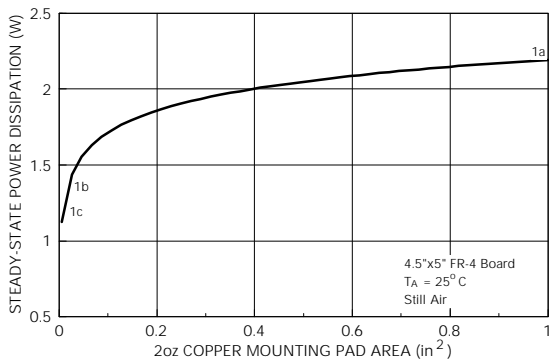


Figure 23. SO-8 Single Device DC Power Dissipation versus Copper Mounting Pad Area.

Typical Thermal Characteristics

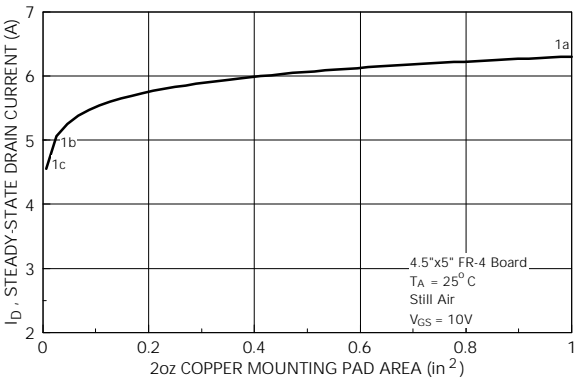


Figure 24. N-Ch Maximum Steady-State Drain Current versus Copper Mounting Pad Area.

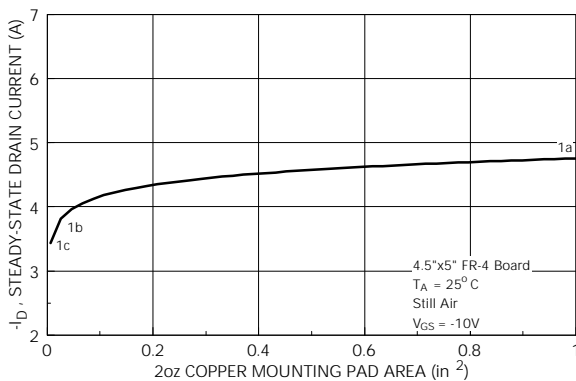


Figure 25. P-Ch Maximum Steady-State Drain Current versus Copper Mounting Pad Area.

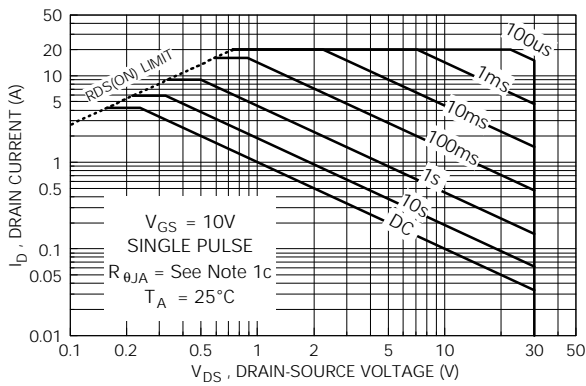


Figure 26. N-Ch Maximum Safe Operating Area.

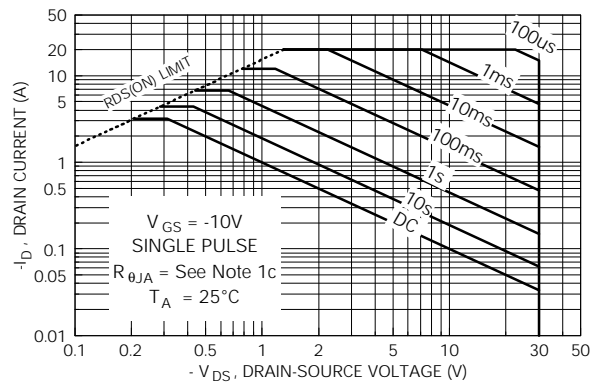


Figure 27. P-Ch Maximum Safe Operating Area.

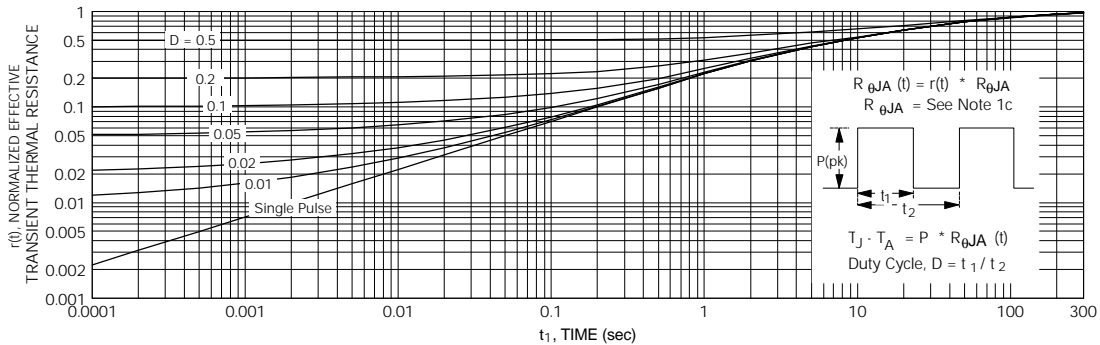


Figure 28. Transient Thermal Response Curve.

Note: Thermal characterization performed using the conditions described in note 1c. Transient thermal response will change depending on the circuit board design.