

Power MOSFET

20 V/–20 V, 4.6 A/–4.1 A, μ Cool™

Complementary, 2x2 mm, WDFN Package

Features

- Complementary N-Channel and P-Channel MOSFET
- WDFN Package with Exposed Drain Pad for Excellent Thermal Conduction
- Footprint Same as SC-88 Package
- Leading Edge Trench Technology for Low On Resistance
- 1.8 V Gate Threshold Voltage
- Low Profile (< 0.8 mm) for Easy Fit in Thin Environments
- This is a Pb-Free Device

Applications

- Synchronous DC-DC Conversion Circuits
- Load/Power Management of Portable Devices like PDA's, Cellular Phones and Hard Drives
- Color Display and Camera Flash Regulators

MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter		Symbol	Value	Unit
Drain-to-Source Voltage	N-Ch	V_{DS}	20	V
	P-Ch		–20	
Gate-to-Source Voltage	N-Ch	V_{GS}	± 8.0	V
	P-Ch			
N-Channel Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	3.8	A
		$T_A = 85^\circ\text{C}$	2.8	
		$t \leq 5 \text{ s}$	4.6	
P-Channel Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	–3.3	A
		$T_A = 85^\circ\text{C}$	–2.4	
		$t \leq 5 \text{ s}$	–4.1	
Power Dissipation (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	1.5	W
		$t \leq 5 \text{ s}$	2.3	
N-Channel Continuous Drain Current (Note 2)	Steady State	$T_A = 25^\circ\text{C}$	2.6	A
		$T_A = 85^\circ\text{C}$	1.9	
P-Channel Continuous Drain Current (Note 2)	Steady State	$T_A = 25^\circ\text{C}$	–2.3	A
		$T_A = 85^\circ\text{C}$	–1.6	
Power Dissipation (Note 2)	Steady State	$T_A = 25^\circ\text{C}$	0.71	W
Pulsed Drain Current	N-Ch	$t_p = 10 \mu\text{s}$	18	A
	P-Ch		–20	
Operating Junction and Storage Temperature		T_J, T_{STG}	–55 to 150	$^\circ\text{C}$
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		T_L	260	$^\circ\text{C}$

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

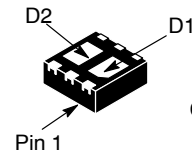
1. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).
2. Surface Mounted on FR4 Board using the minimum recommended pad size of 30 mm², 2 oz Cu.



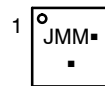
ON Semiconductor®

<http://onsemi.com>

$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	I_D MAX
N-Channel 20 V	65 m Ω @ 4.5 V	3.8 A
	85 m Ω @ 2.5 V	2.0 A
	120 m Ω @ 1.8 V	1.7 A
P-Channel –20 V	100 m Ω @ –4.5 V	–4.1 A
	135 m Ω @ –2.5 V	–2.0 A
	200 m Ω @ –1.8 V	–1.6 A

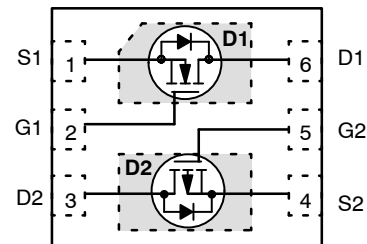


MARKING DIAGRAM



JM = Specific Device Code
M = Date Code
▪ = Pb-Free Package
(Note: Microdot may be in either location)

PIN CONNECTIONS



(Top View)

ORDERING INFORMATION

Device	Package	Shipping†
NTLJD3119CTAG	WDFN6 (Pb-Free)	3000/Tape & Reel
NTLJD3119CTBG	WDFN6 (Pb-Free)	3000/Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

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THEMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
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SINGLE OPERATION (SELF-HEATED)

Junction-to-Ambient – Steady State (Note 3)	$R_{\theta JA}$	83	°C/W
Junction-to-Ambient – Steady State Min Pad (Note 4)	$R_{\theta JA}$	177	
Junction-to-Ambient – $t \leq 5$ s (Note 3)	$R_{\theta JA}$	54	

DUAL OPERATION (EQUALLY HEATED)

Junction-to-Ambient – Steady State (Note 3)	$R_{\theta JA}$	58	°C/W
Junction-to-Ambient – Steady State Min Pad (Note 4)	$R_{\theta JA}$	133	
Junction-to-Ambient – $t \leq 5$ s (Note 3)	$R_{\theta JA}$	40	

3. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).
4. Surface Mounted on FR4 Board using the minimum recommended pad size (30 mm², 2 oz Cu).

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ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Parameter	Symbol	N/P	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS							
Drain-to-Source Breakdown Voltage	V _{(BR)DSS}	N	V _{GS} = 0 V	I _D = 250 μA	20		V
		P		I _D = -250 μA	-20		
Drain-to-Source Breakdown Voltage Temperature Coefficient	V _{(BR)DSS} /T _J	N			10.4		mV/°C
		P			9.95		
Zero Gate Voltage Drain Current	I _{DSS}	N	V _{GS} = 0 V, V _{DS} = 16 V	T _J = 25 °C		1.0	μA
		P	V _{GS} = 0 V, V _{DS} = -16 V			-1.0	
		N	V _{GS} = 0 V, V _{DS} = 16 V	T _J = 85 °C		10	
		P	V _{GS} = 0 V, V _{DS} = -16 V			-10	
Gate-to-Source Leakage Current	I _{GSS}	N	V _{DS} = 0 V, V _{GS} = ±8.0 V			±100	nA
		P	V _{DS} = 0 V, V _{GS} = ±8.0 V			±100	

ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage	V _{GS(TH)}	N	V _{GS} = V _{DS}	I _D = 250 μA	0.4	0.7	1.0	V
		P		I _D = -250 μA	-0.4	-0.7	-1.0	
Gate Threshold Temperature Coefficient	V _{GS(TH)} /T _J	N				-3.0		mV/°C
		P				2.44		
Drain-to-Source On Resistance	R _{DS(on)}	N	V _{GS} = 4.5 V , I _D = 3.8 A			37	65	mΩ
		P	V _{GS} = -4.5 V , I _D = -4.1 A			75	100	
		N	V _{GS} = 2.5 V , I _D = 2.0 A			46	85	
		P	V _{GS} = -2.5 V , I _D = -2.0 A			101	135	
		N	V _{GS} = 1.8 V , I _D = 1.7 A			65	120	
		P	V _{GS} = -1.8 V , I _D = -1.6 A			150	200	
Forward Transconductance	g _{FS}	N	V _{DS} = 10 V , I _D = 1.7 A			4.2		S
		P	V _{DS} = -5.0 V , I _D = -2.0 A			3.1		

CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	C _{ISS}	N	f = 1.0 MHz, V _{GS} = 0 V	V _{DS} = 10 V		271	pF
		P		V _{DS} = -10 V		531	
Output Capacitance	C _{OSS}	N		V _{DS} = 10 V		72	
		P		V _{DS} = -10 V		91	
Reverse Transfer Capacitance	C _{RSS}	N		V _{DS} = 10 V		43	
		P		V _{DS} = -10 V		56	
Total Gate Charge	Q _{G(TOT)}	N	V _{GS} = 4.5 V, V _{DS} = 10 V, I _D = 3.8 A		3.7		nC
		P	V _{GS} = -4.5 V, V _{DS} = -10 V, I _D = -2.0 A		5.5		
Threshold Gate Charge	Q _{G(TH)}	N	V _{GS} = 4.5 V, V _{DS} = 10 V, I _D = 3.8 A		0.3		
		P	V _{GS} = -4.5 V, V _{DS} = -10 V, I _D = -2.0 A		0.7		
Gate-to-Source Charge	Q _{GS}	N	V _{GS} = 4.5 V, V _{DS} = 10 V, I _D = 3.8 A		0.6		
		P	V _{GS} = -4.5 V, V _{DS} = -10 V, I _D = -2.0 A		1.0		
Gate-to-Drain Charge	Q _{GD}	N	V _{GS} = 4.5 V, V _{DS} = 10 V, I _D = 3.8 A		1.0		
		P	V _{GS} = -4.5 V, V _{DS} = -10 V, I _D = -2.0 A		1.4		

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ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Parameter	Symbol	N/P	Test Conditions	Min	Typ	Max	Unit
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SWITCHING CHARACTERISTICS (Note 6)

Turn-On Delay Time	t _{d(ON)}	N	V _{GS} = 4.5 V, V _{DD} = 16 V, I _D = 1.0 A, R _G = 2.0 Ω		3.8		ns
Rise Time	t _r				4.7		
Turn-Off Delay Time	t _{d(OFF)}				11.1		
Fall Time	t _f				5.8		
Turn-On Delay Time	t _{d(ON)}	P	V _{GS} = -4.5 V, V _{DD} = -10 V, I _D = -2.0 A, R _G = 2.0 Ω		5.2		
Rise Time	t _r				13.2		
Turn-Off Delay Time	t _{d(OFF)}				13.7		
Fall Time	t _f				19.1		

DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V _{SD}	N	V _{GS} = 0 V, T _J = 25 °C	I _S = 1.0 A		0.69	1.0	V
		P		I _S = -1.0 A		-0.75	-1.0	
		N	V _{GS} = 0 V, T _J = 125 °C	I _S = 1.0 A		0.52		
		P		I _S = -1.0 A		-0.64		
Reverse Recovery Time	t _{RR}	N	V _{GS} = 0 V, dI _S / dt = 100 A/μs	I _S = 1.0 A		10.2		ns
		P		I _S = -1.0 A		16.2		
Charge Time	t _a	N		I _S = 1.0 A		6.0		
		P		I _S = -1.0 A		10.6		
Discharge Time	t _b	N		I _S = 1.0 A		4.2		
		P		I _S = -1.0 A		5.6		
Reverse Recovery Charge	Q _{RR}	N		I _S = 1.0 A		3.0		nC
		P		I _S = -1.0 A		5.7		

5. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
6. Switching characteristics are independent of operating junction temperatures.

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TYPICAL PERFORMANCE CURVES – N-CHANNEL ($T_J = 25^\circ\text{C}$ unless otherwise noted)

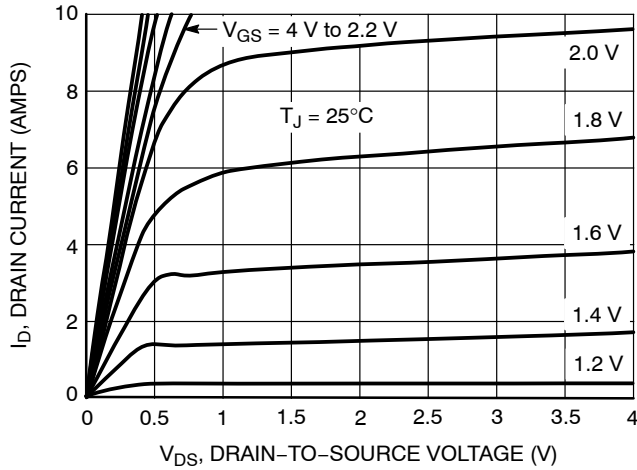


Figure 1. On-Region Characteristics

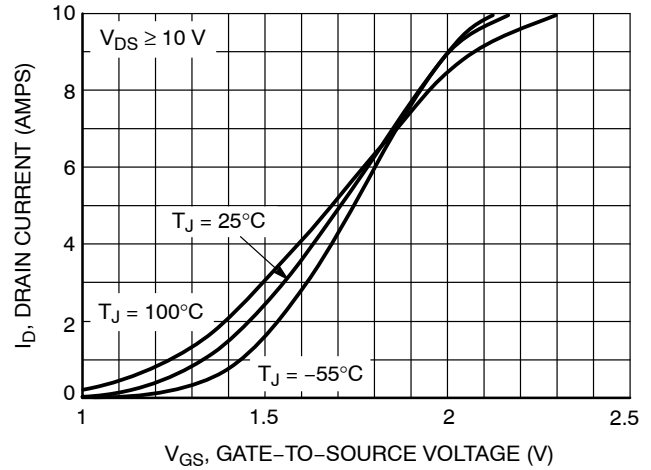


Figure 2. Transfer Characteristics

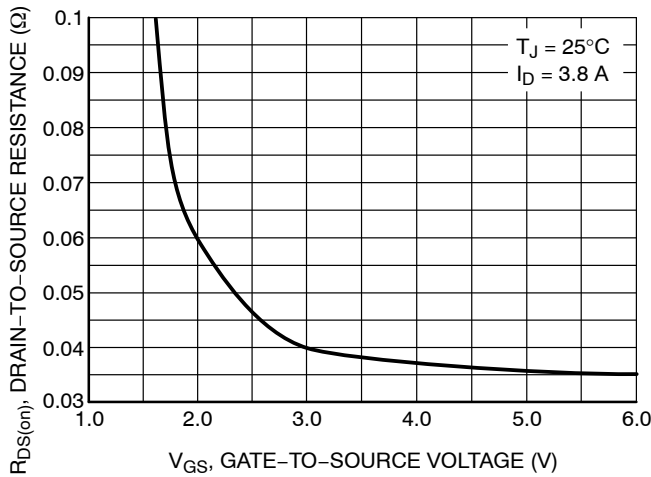


Figure 3. On-Resistance versus Drain Current

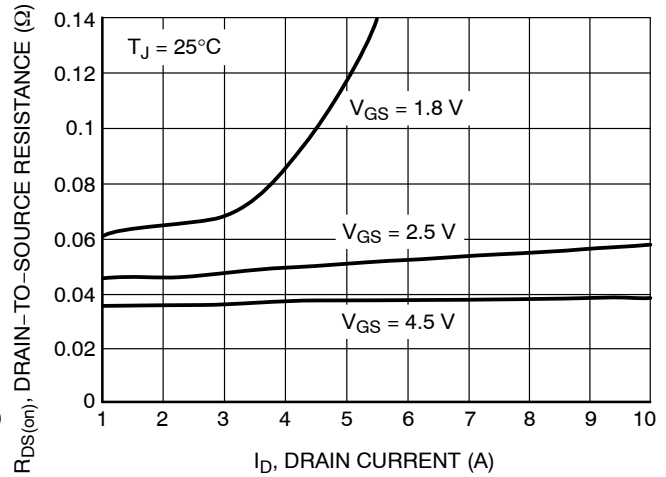


Figure 4. On-Resistance versus Drain Current and Gate Voltage

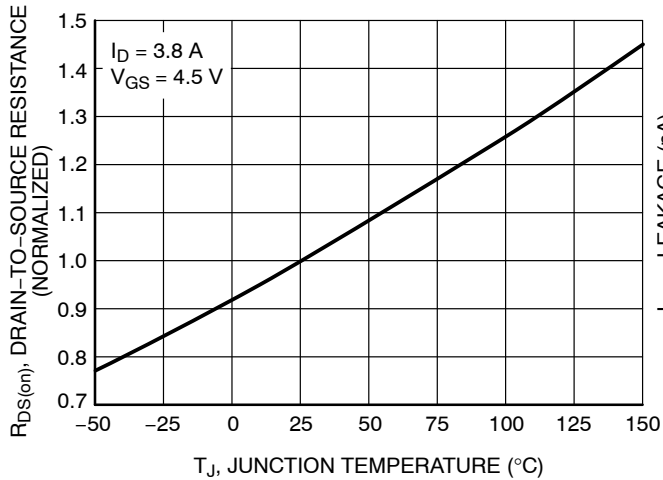


Figure 5. On-Resistance Variation with Temperature

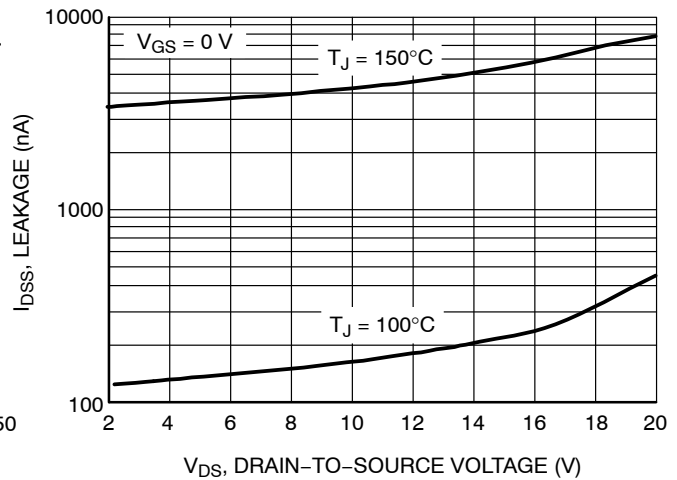


Figure 6. Drain-to-Source Leakage Current versus Voltage

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TYPICAL PERFORMANCE CURVES – N-CHANNEL ($T_J = 25^\circ\text{C}$ unless otherwise noted)

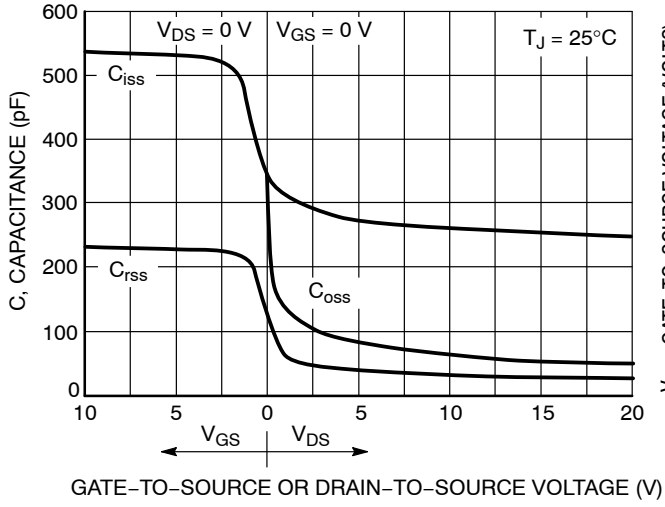


Figure 7. Capacitance Variation

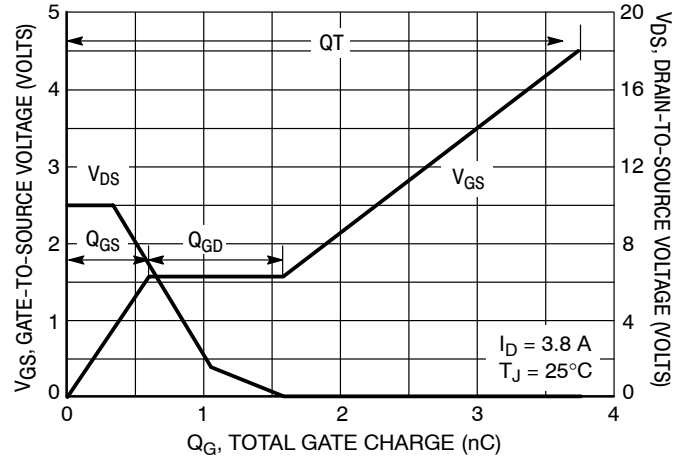


Figure 8. Gate-To-Source and Drain-To-Source Voltage versus Total Charge

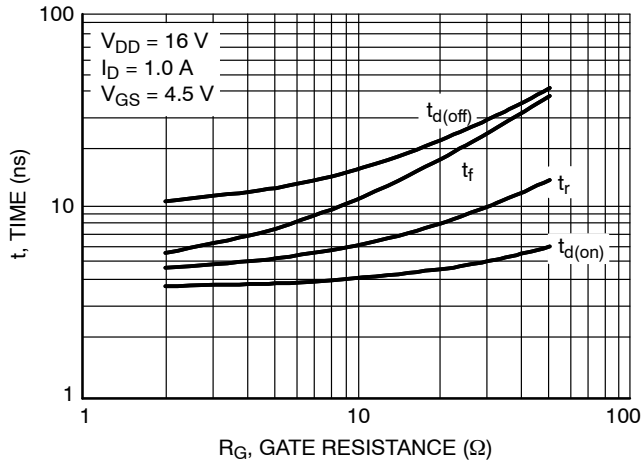


Figure 9. Resistive Switching Time Variation versus Gate Resistance

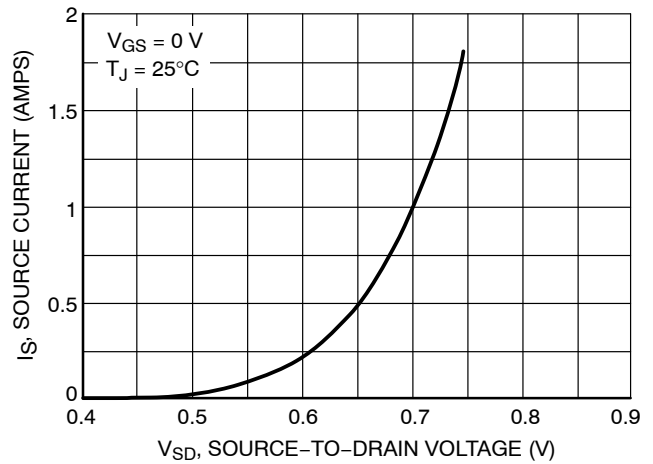


Figure 10. Diode Forward Voltage versus Current

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TYPICAL PERFORMANCE CURVES – P-CHANNEL ($T_J = 25^\circ\text{C}$ unless otherwise noted)

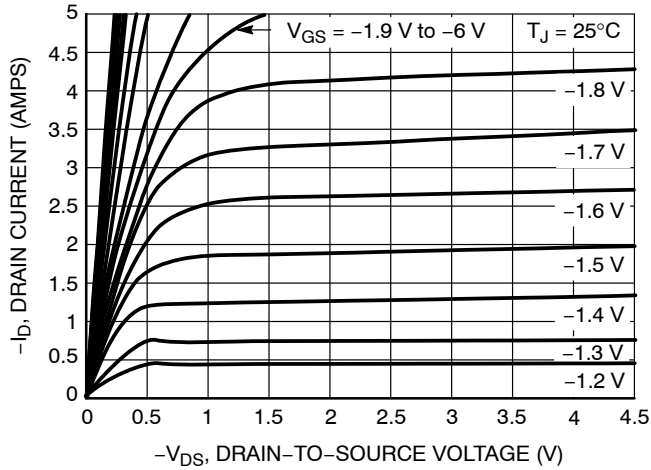


Figure 11. On-Region Characteristics

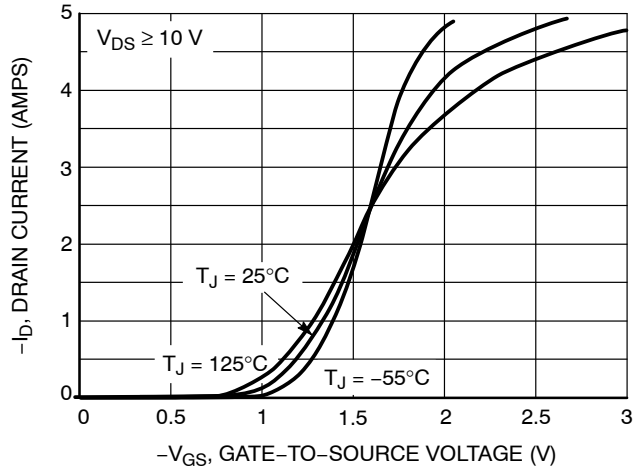


Figure 12. Transfer Characteristics

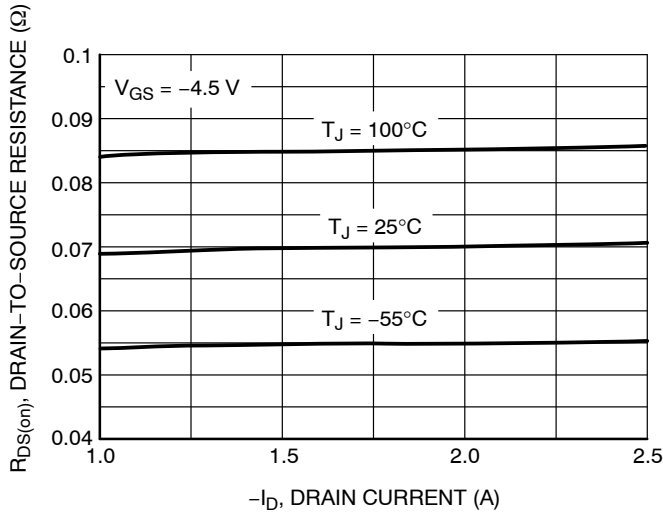


Figure 13. On-Resistance versus Drain Current

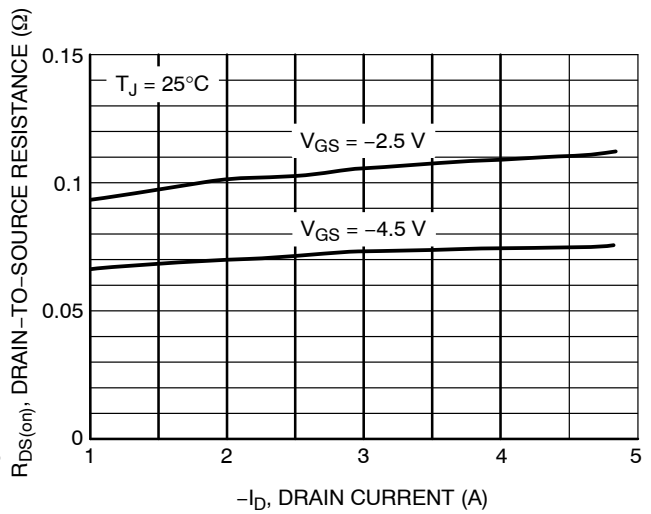


Figure 14. On-Resistance versus Drain Current and Gate Voltage

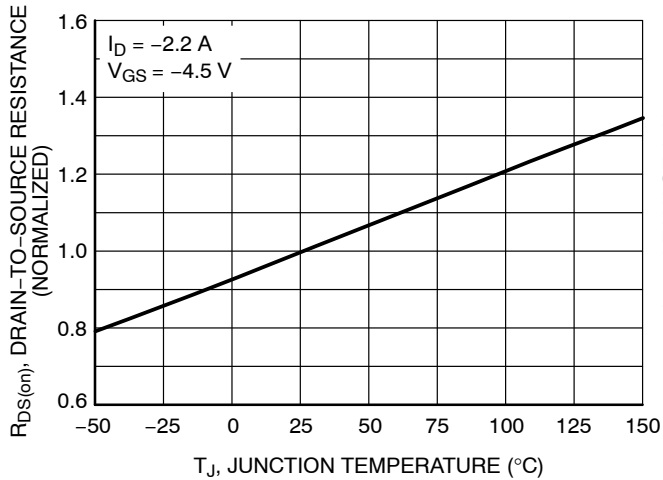


Figure 15. On-Resistance Variation with Temperature

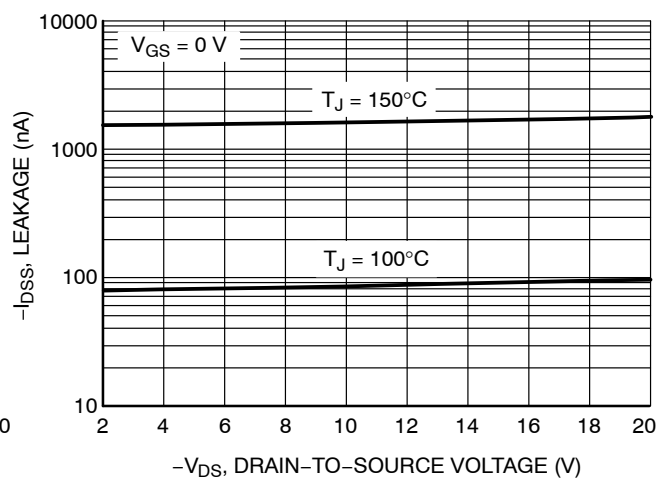


Figure 16. Drain-to-Source Leakage Current versus Voltage

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TYPICAL PERFORMANCE CURVES – P-CHANNEL ($T_J = 25^\circ\text{C}$ unless otherwise noted)

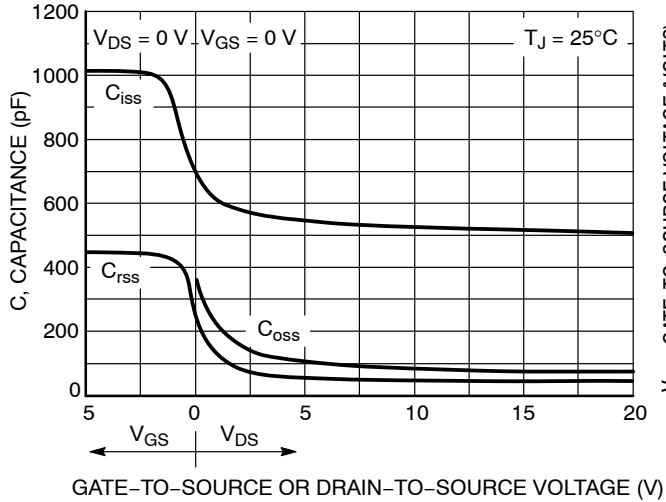


Figure 17. Capacitance Variation

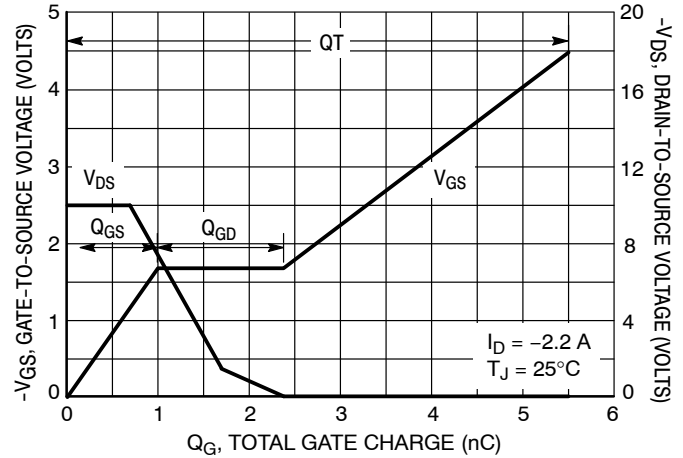


Figure 18. Gate-To-Source and Drain-To-Source Voltage versus Total Charge

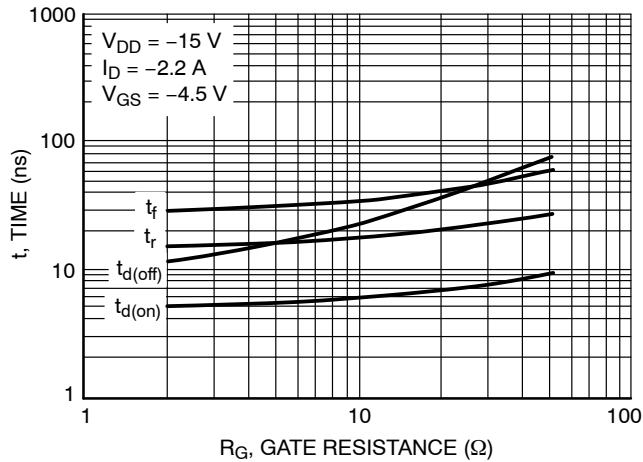


Figure 19. Resistive Switching Time Variation versus Gate Resistance

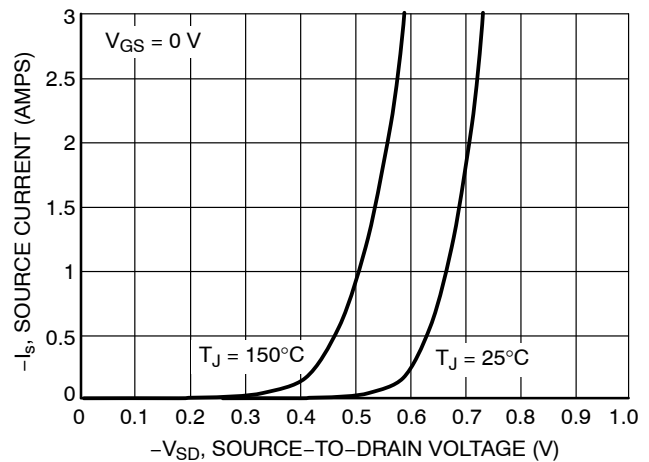


Figure 20. Diode Forward Voltage versus Current

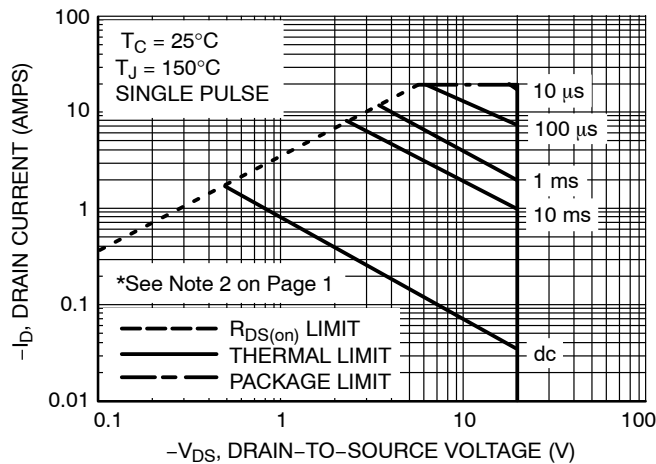


Figure 21. Maximum Rated Forward Biased Safe Operating Area

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TYPICAL PERFORMANCE CURVES ($T_J = 25^\circ\text{C}$ unless otherwise noted)

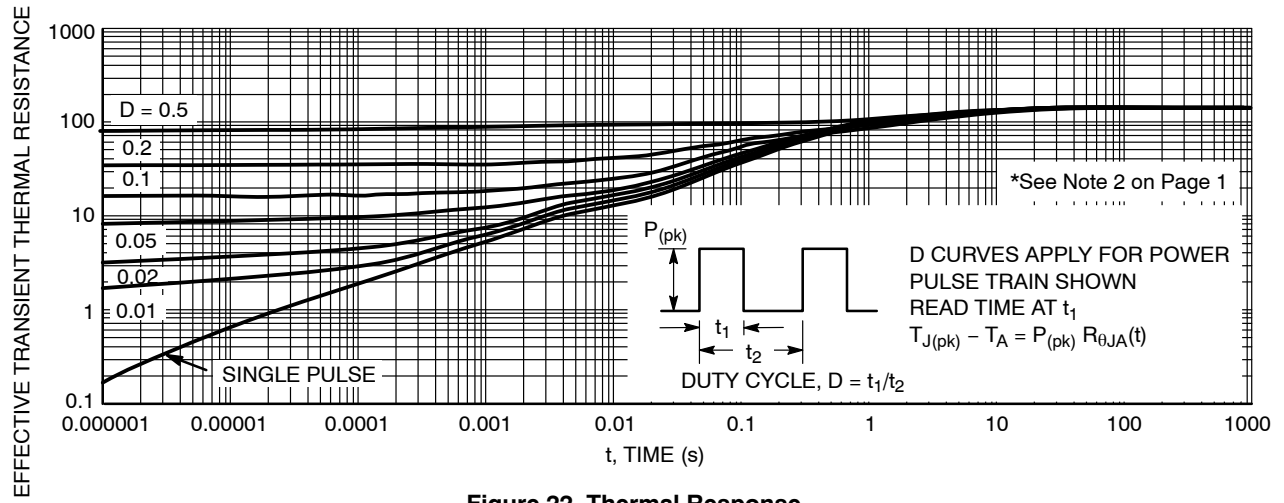


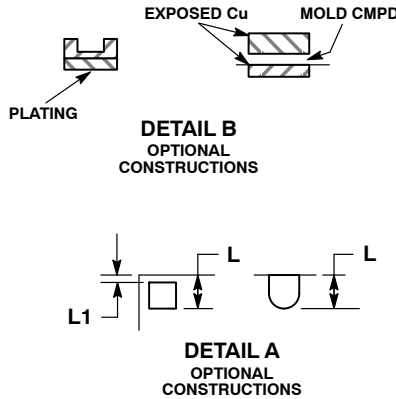
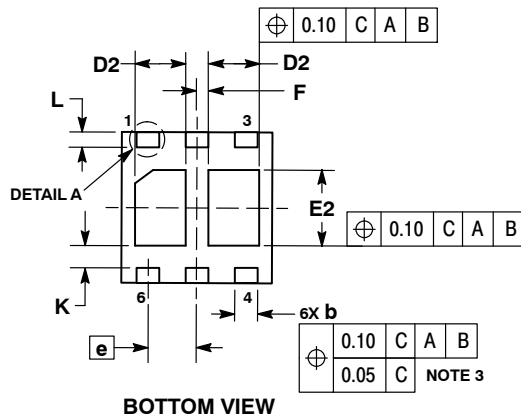
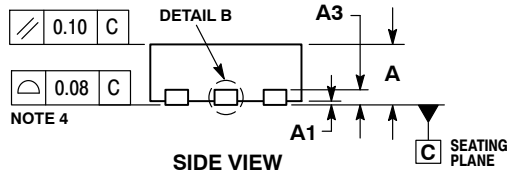
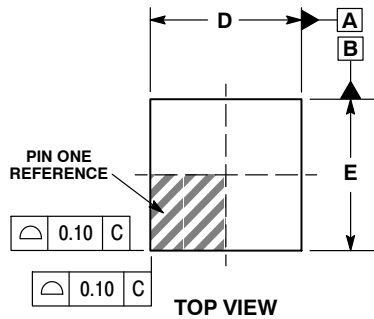
Figure 22. Thermal Response

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PACKAGE DIMENSIONS

WDFN6, 2x2, 0.65P
CASE 506AN-01
ISSUE D

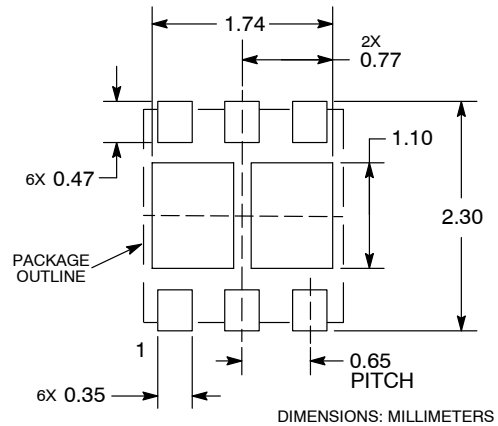


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

DIM	MILLIMETERS	
	MIN	MAX
A	0.70	0.80
A1	0.00	0.05
A3	0.20	REF
b	0.25	0.35
D	2.00	BSC
D2	0.57	0.67
E	2.00	BSC
E2	0.90	1.10
e	0.65	BSC
F	0.15	BSC
K	0.25	REF
L	0.20	0.30
L1	---	0.10

SOLDERMASK DEFINED MOUNTING FOOTPRINT



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