

# NTTFS5116PL

## Power MOSFET

-60 V, -20 A, 52 mΩ

### Features

- Low  $R_{DS(on)}$
- Fast Switching
- These Devices are Pb-Free and are RoHS Compliant

### Applications

- Load Switches
- DC Motor Control
- DC-DC Conversion

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

Parameter	Symbol	Value	Unit	
Drain-to-Source Voltage	$V_{DSS}$	-60	V	
Gate-to-Source Voltage	$V_{GS}$	$\pm 20$	V	
Continuous Drain Current $R_{\theta JA}$ (Note 1)	$I_D$	$T_A = 25^\circ\text{C}$	-5.7	A
		$T_A = 100^\circ\text{C}$	-4.0	
Power Dissipation $R_{\theta JA}$ (Note 1)	$P_D$	$T_A = 25^\circ\text{C}$	3.2	W
		$T_A = 100^\circ\text{C}$	1.6	
Continuous Drain Current $R_{\theta JC}$ (Note 1)	$I_D$	$T_C = 25^\circ\text{C}$	-20	A
		$T_C = 100^\circ\text{C}$	-14	
Power Dissipation $R_{\theta JC}$ (Note 1)	$P_D$	$T_C = 25^\circ\text{C}$	40	W
		$T_C = 100^\circ\text{C}$	20	
Pulsed Drain Current	$t_p = 10 \mu\text{s}$	$I_{DM}$	-76	A
Operating Junction and Storage Temperature		$T_J, T_{stg}$	-55 to +175	$^\circ\text{C}$
Source Current (Body Diode)		$I_S$	-20	A
Single Pulse Drain-to-Source Avalanche Energy	$L = 0.1 \text{ mH}$	$E_{AS}$	45	mJ
		$I_{AS}$	30	A
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.

### THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case - Steady State (Note 1)	$R_{\theta JC}$	3.8	$^\circ\text{C/W}$
Junction-to-Ambient - Steady State (Note 1)	$R_{\theta JA}$	47	

1. Surface-mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).

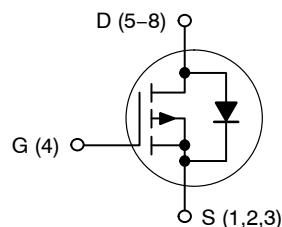


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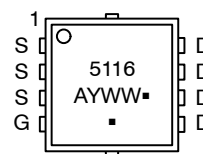
$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	$I_D$ MAX
-60 V	52 mΩ @ -10 V	-20 A
	72 mΩ @ -4.5 V	

### P-Channel MOSFET



WDFN8  
( $\mu 8\text{FL}$ )  
CASE 511AB

### MARKING DIAGRAM



5116 = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

Device	Package	Shipping†
NTTFS5116PLTAG	WDFN8 (Pb-Free)	1500/Tape & Reel
NTTFS5116PLTWG	WDFN8 (Pb-Free)	5000/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.

# NTTFS5116PL

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>						
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-60			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			69.7		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = -60\text{ V}$	$T_J = 25^\circ\text{C}$		-1.0	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		-100	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA

## ON CHARACTERISTICS (Note 2)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = -250\ \mu\text{A}$	-1		-3	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			-6.2		mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = -10\text{ V}, I_D = -6\text{ A}$		37	52	m $\Omega$
		$V_{GS} = -4.5\text{ V}, I_D = -4.4\text{ A}$		51	72	
Forward Transconductance	$g_{FS}$	$V_{DS} = -15\text{ V}, I_D = -6\text{ A}$		11		S

## CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = -30\text{ V}$		1258		pF	
Output Capacitance	$C_{oss}$			127			
Reverse Transfer Capacitance	$C_{rss}$			84			
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -10\text{ V}, V_{DS} = -48\text{ V}, I_D = -5\text{ A}$		25		nC	
			$V_{GS} = -4.5\text{ V}, V_{DS} = -48\text{ V}, I_D = -5\text{ A}$		14		
Threshold Gate Charge	$Q_{G(TH)}$	$V_{GS} = -4.5\text{ V}, V_{DS} = -48\text{ V}, I_D = -5\text{ A}$		1		nC	
Gate-to-Source Charge	$Q_{GS}$			4			
Gate-to-Drain Charge	$Q_{GD}$			7			
Plateau Voltage	$V_{GP}$			3.1			V
Gate Resistance	$R_G$			5.3			$\Omega$

## SWITCHING CHARACTERISTICS (Note 3)

Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = -4.5\text{ V}, V_{DS} = -48\text{ V}, I_D = -5\text{ A}, R_G = 6\ \Omega$		15		ns
Rise Time	$t_r$			58		
Turn-Off Delay Time	$t_{d(off)}$			30		
Fall Time	$t_f$			37		

## DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = -5\text{ A}$	$T_J = 25^\circ\text{C}$		-0.79	-1.2	V
			$T_J = 125^\circ\text{C}$		-0.64		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, dI_S/dt = -100\text{ A}/\mu\text{s}, I_S = -5\text{ A}$		20		ns	
Charge Time	$t_a$			15			
Discharge Time	$t_b$			5			
Reverse Recovery Charge	$Q_{RR}$			19			nC

2. Pulse Test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .

3. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

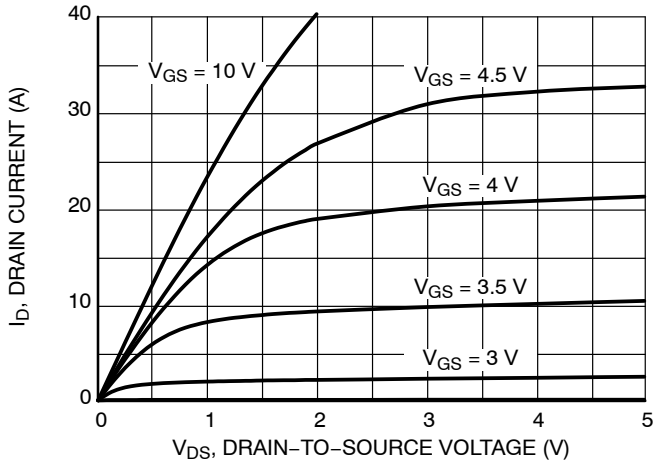


Figure 1. On-Region Characteristics

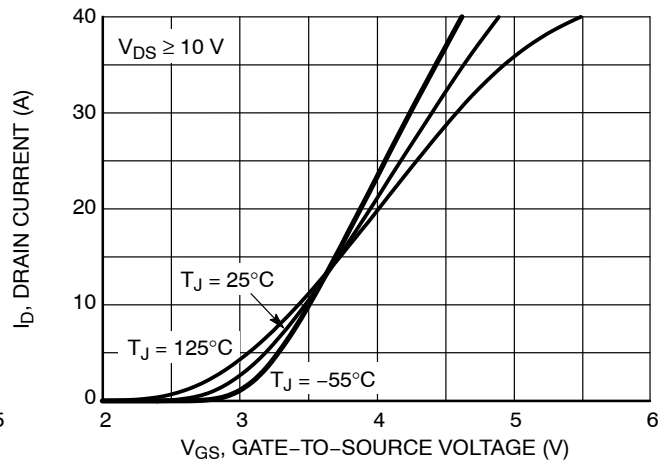


Figure 2. Transfer Characteristics

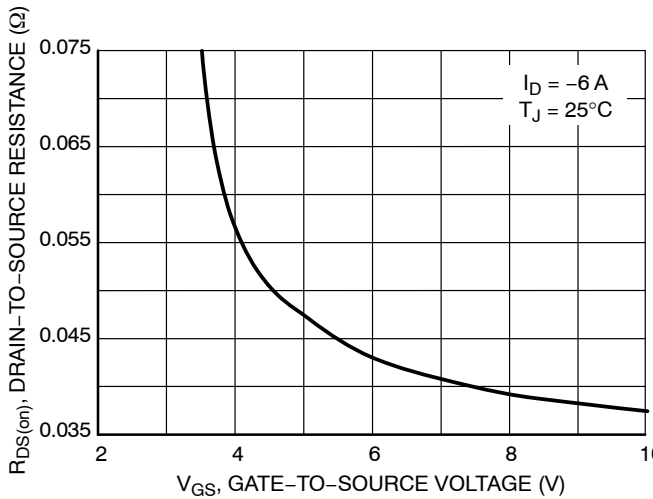


Figure 3. On-Resistance vs. Gate-to-Source Voltage

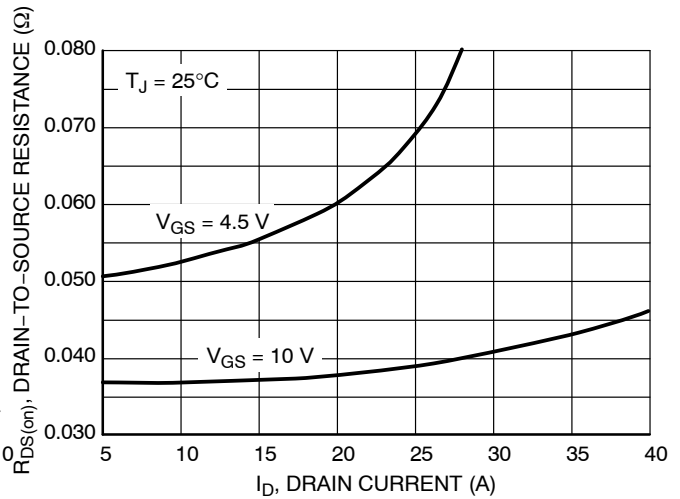


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

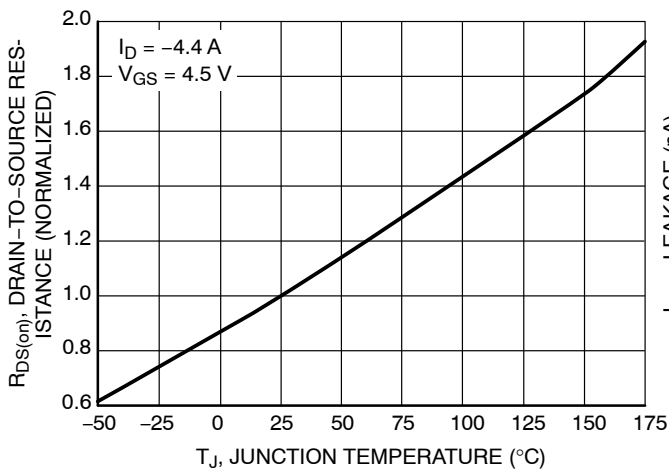


Figure 5. On-Resistance Variation with Temperature

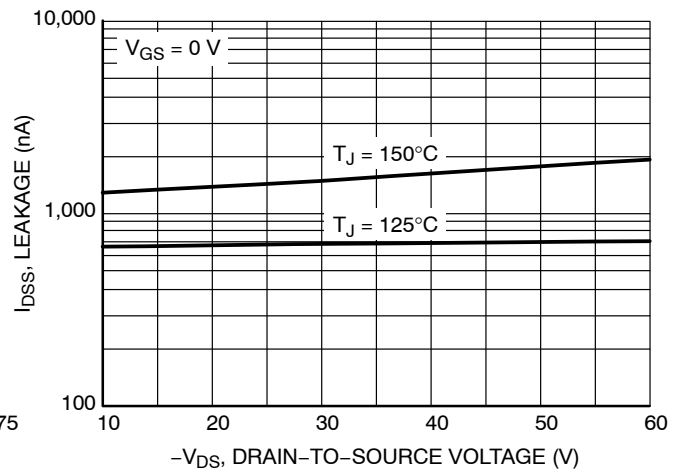


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

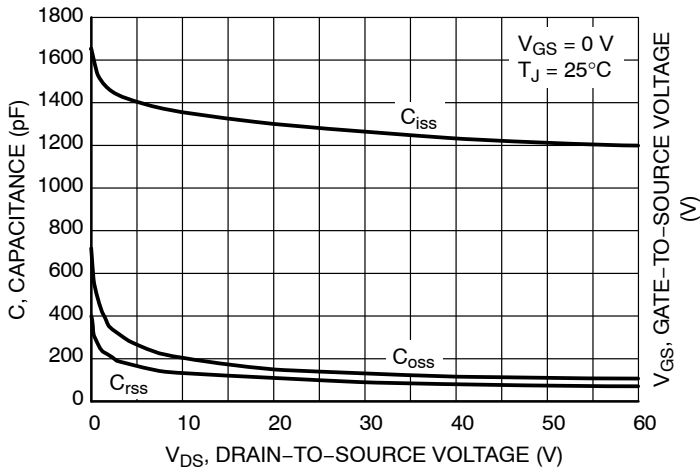


Figure 7. Capacitance Variation

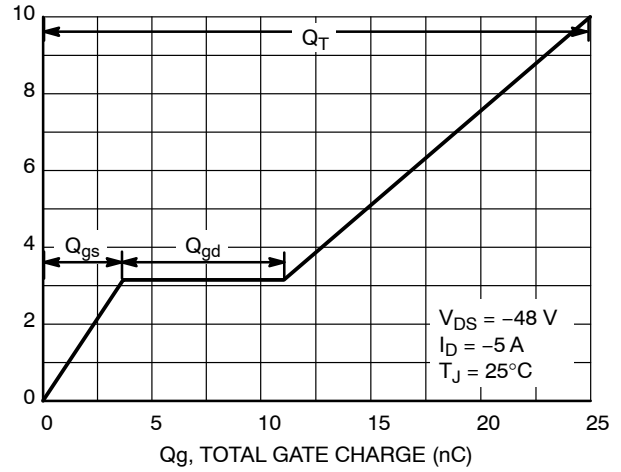


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

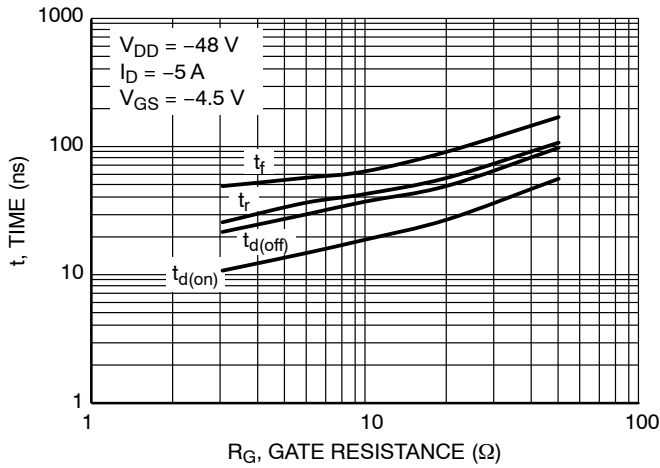


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

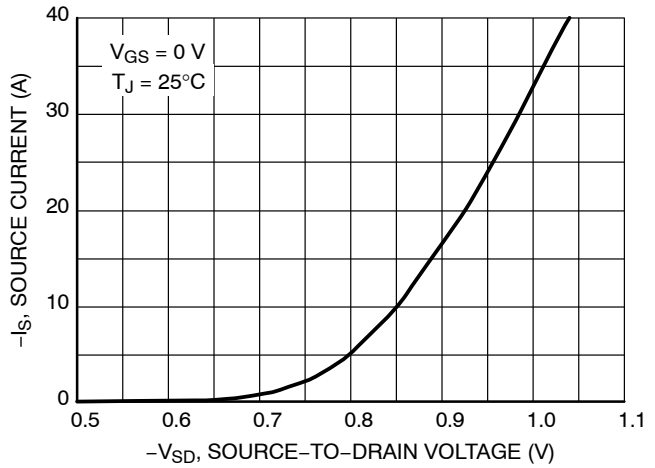


Figure 10. Diode Forward Voltage vs. Current

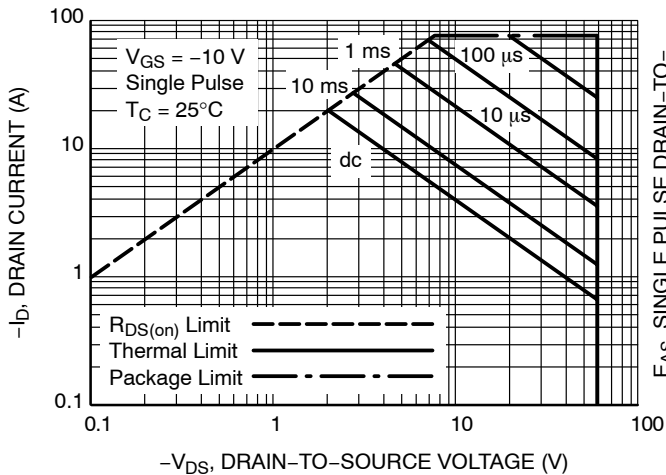


Figure 11. Maximum Rated Forward Biased Safe Operating Area

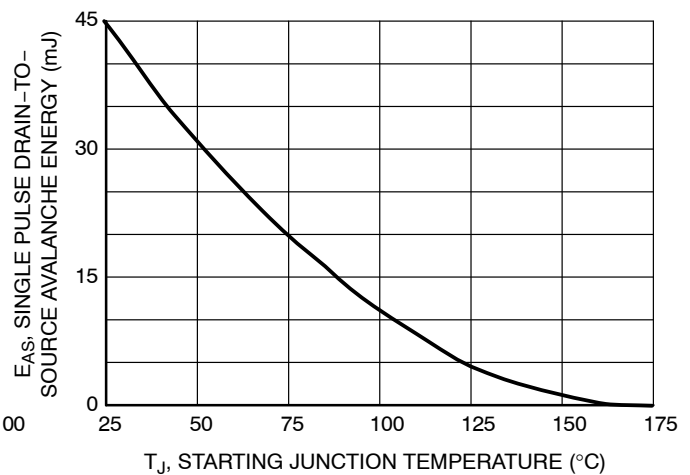


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

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## TYPICAL CHARACTERISTICS

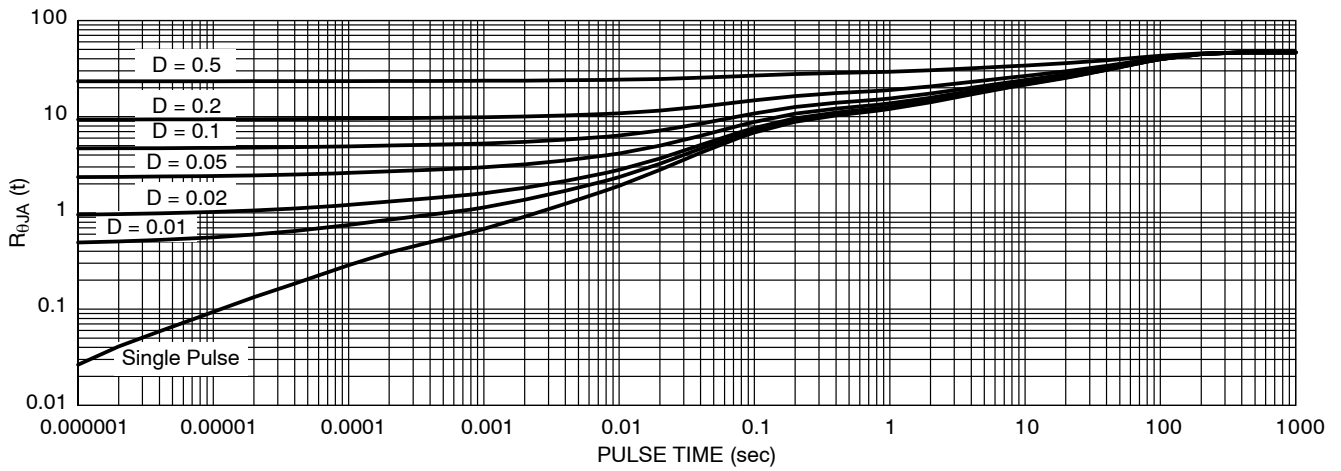
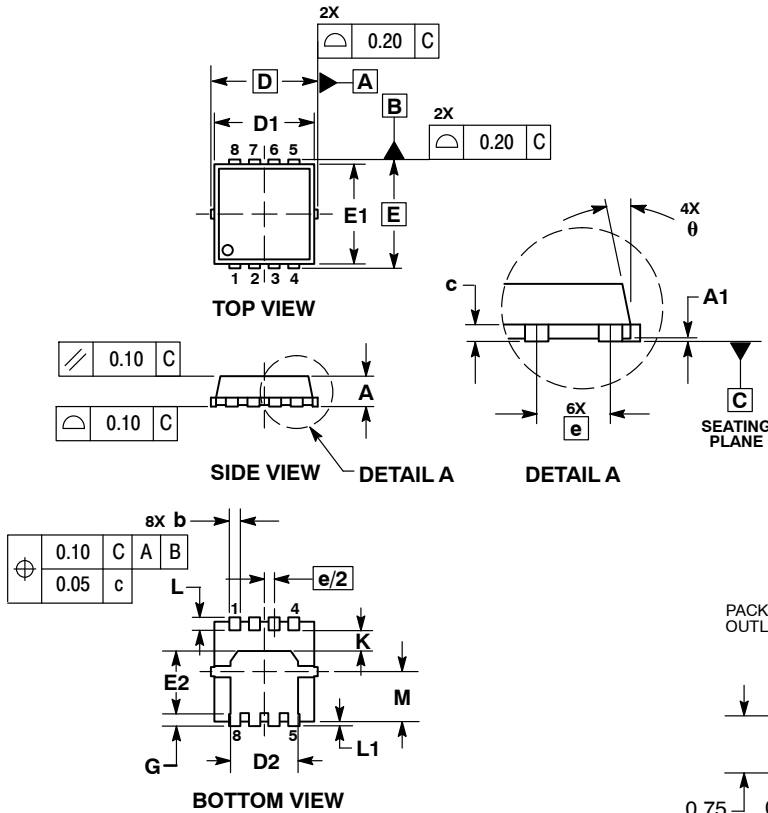


Figure 13. Thermal Response

# NTTFS5116PL

## PACKAGE DIMENSIONS

WDFN8 3.3x3.3, 0.65P  
CASE 511AB-01  
ISSUE B

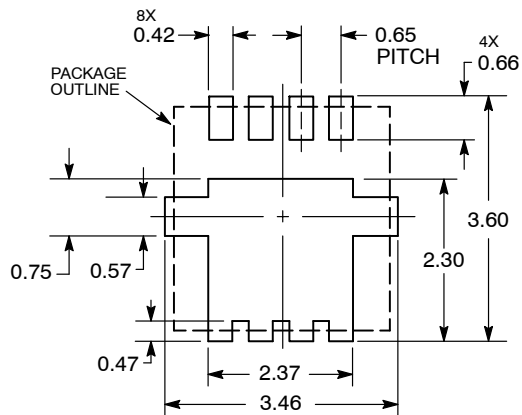


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.70	0.75	0.80	0.028	0.030	0.031
A1	0.00	----	0.05	0.000	----	0.002
b	0.23	0.30	0.40	0.009	0.012	0.016
c	0.15	0.20	0.25	0.006	0.008	0.010
D	3.30 BSC			0.130 BSC		
D1	2.95	3.05	3.15	0.116	0.120	0.124
D2	1.98	2.11	2.24	0.078	0.083	0.088
E	3.30 BSC			0.130 BSC		
E1	2.95	3.05	3.15	0.116	0.120	0.124
E2	1.47	1.60	1.73	0.058	0.063	0.068
e	0.65 BSC			0.026 BSC		
G	0.30	0.41	0.51	0.012	0.016	0.020
K	0.64	----	----	0.025	----	----
L	0.30	0.43	0.56	0.012	0.017	0.022
L1	0.06	0.13	0.20	0.002	0.005	0.008
M	1.40	1.50	1.60	0.055	0.059	0.063
θ	0°	----	12°	0°	----	12°

### SOLDERING FOOTPRINT\*



DIMENSION: MILLIMETERS

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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