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# MOSFET - Power, Dual N-Channel, DUAL SO8FL

## 60 V, 16.3 mΩ, 32 A



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## NTMFD016N06C

### Features

- Small Footprint (5x6 mm) for Compact Design
- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low  $Q_G$  and Capacitance to Minimize Driver Losses
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Typical Applications

- Power Tools, Battery Operated Vacuums
- UAV/Drones, Material Handling
- BMS/Storage, Home Automation

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

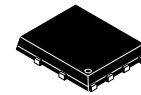
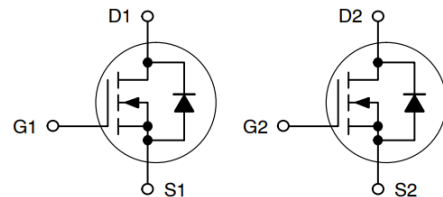
Parameter		Symbol	Value	Units	
Drain-to-Source Voltage		$V_{DSS}$	60	V	
Gate-to-Source Voltage		$V_{GS}$	$\pm 20$	V	
Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3)	Steady State	$I_D$	$T_C = 25^\circ\text{C}$	32	A
			$T_C = 100^\circ\text{C}$	23	
Power Dissipation $R_{\theta JC}$ (Note 1)	Steady State	$P_D$	$T_C = 25^\circ\text{C}$	36	W
			$T_C = 100^\circ\text{C}$	18	
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	Steady State	$I_D$	$T_A = 25^\circ\text{C}$	9	A
			$T_A = 100^\circ\text{C}$	6	
Power Dissipation $R_{\theta JA}$ (Notes 1, 2)	Steady State	$P_D$	$T_A = 25^\circ\text{C}$	3.1	W
			$T_A = 100^\circ\text{C}$	1.5	
Pulsed Drain Current	$T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$	$I_{DM}$	128	A	
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	-55 to +175	$^\circ\text{C}$	
Source Current (Body Diode)		$I_S$	30	A	
Single Pulse Drain-to-Source Avalanche Energy ( $I_L = 6.4 \text{ A}_{pk}$ )		$E_{AS}$	21	mJ	
Lead Temperature Soldering Reflow for Soldering Purposes (1/8" from case for 10 s)		$T_L$	260	$^\circ\text{C}$	

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Surface-mounted on FR4 board using a 650 mm<sup>2</sup>, 2 oz Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

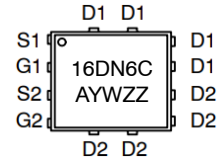
$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
60 V	16.3 mΩ @ 10 V	32 A

### Dual N-Channel



1  
DFN8 5x6  
(SO8FL)  
CASE 506BT

### MARKING DIAGRAM



16DN6C = Specific Device Code  
A = Assembly Location  
Y = Year  
W = Work Week  
ZZ = Lot Traceability

### ORDERING INFORMATION

Device	Package	Shipping†
NTMFD016N06CT1G	SO8FL Dual (Pb-Free)	1500 / 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.

# NTMFD016N06C

## THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Case – Steady State (Note 2)	$R_{\theta JC}$	4.1	°C/W
Junction-to-Ambient – Steady State (Note 2)	$R_{\theta JA}$	47.3	

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

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	$V_{(BR)DSS} / T_J$	$I_D = 250\ \mu\text{A}$ , ref to $25^\circ\text{C}$		29		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}$	$T_J = 25^\circ\text{C}$		10	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		250	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$			100	nA

### ON CHARACTERISTICS (Note 4)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 25\ \mu\text{A}$	2.0		4.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)} / T_J$	$I_D = 25\ \mu\text{A}$ , ref to $25^\circ\text{C}$		-8.2		mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 5\text{ A}$		13.6	16.3	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS} = 5\text{ V}, I_D = 5\text{ A}$		15		S
Gate Resistance	$R_G$	$T_A = 25^\circ\text{C}$		1.4		$\Omega$

### CHARGES & CAPACITANCES

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 30\text{ V}$		489		pF
Output Capacitance	$C_{OSS}$			319		
Reverse Transfer Capacitance	$C_{RSS}$			5.7		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 30\text{ V}, I_D = 5\text{ A}$		6.9		nC
Threshold Gate Charge	$Q_{G(TH)}$			1.6		
Gate-to-Source Charge	$Q_{GS}$			2.6		
Gate-to-Drain Charge	$Q_{GD}$			0.62		

### SWITCHING CHARACTERISTICS, $V_{GS} = 10\text{ V}$ (Note 5)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 10\text{ V}, V_{DS} = 30\text{ V}, I_D = 5\text{ A}, R_G = 6\ \Omega$		7.2		ns
Rise Time	$t_r$			1.7		
Turn-Off Delay Time	$t_{d(OFF)}$			11.1		
Fall Time	$t_f$			2.7		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 5\text{ A}$	$T_J = 25^\circ\text{C}$	0.81	1.2	V
			$T_J = 125^\circ\text{C}$	0.67		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s}, V_{DS} = 30\text{ V}, I_S = 5\text{ A}$		27		ns
Charge Time	$t_a$			13		
Discharge Time	$t_b$			14		
Reverse Recovery Charge	$Q_{RR}$			15		

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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

5. Switching characteristics are independent of operating junction temperatures.

# NTMFD016N06C

## TYPICAL CHARACTERISTICS

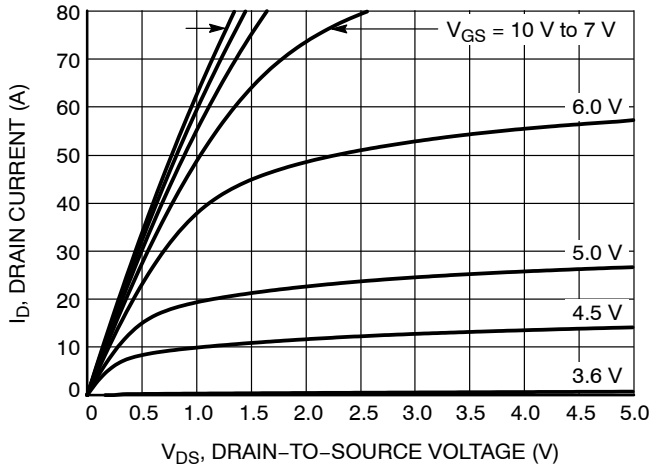


Figure 1. On-Region Characteristics

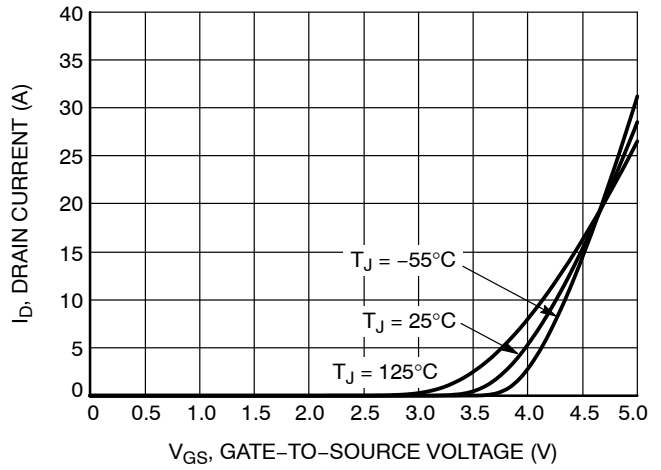


Figure 2. Transfer Characteristics

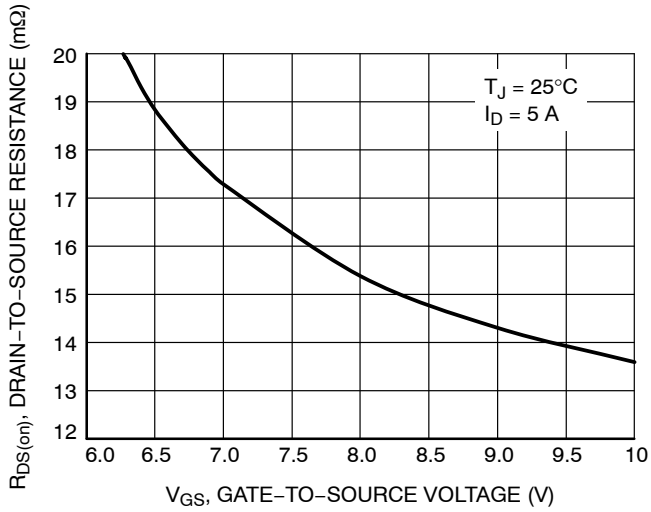


Figure 3. On-Resistance vs. Gate-to-Source Voltage

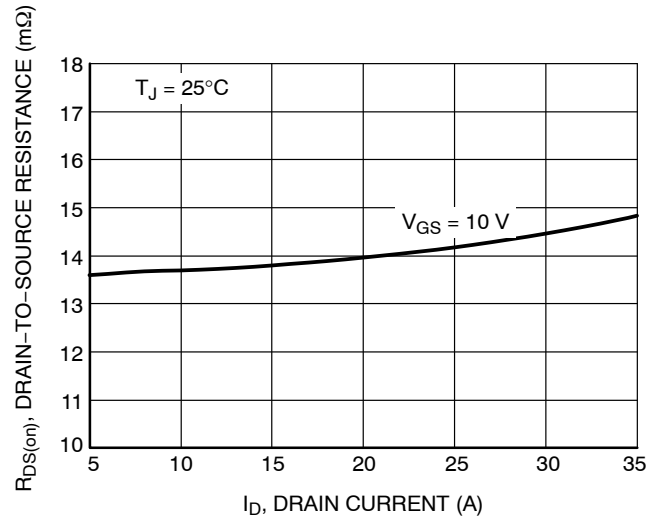


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

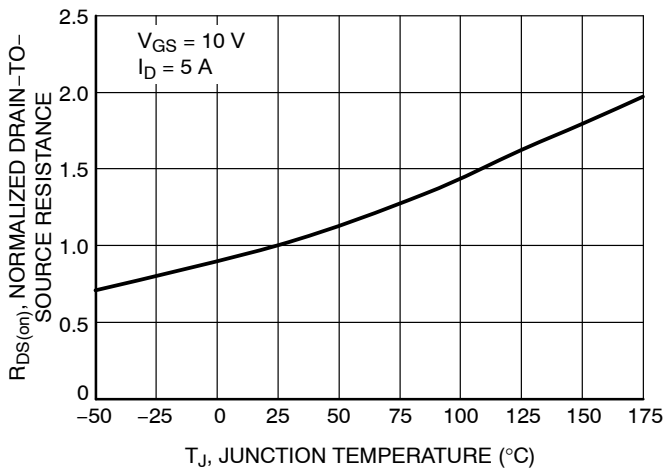


Figure 5. On-Resistance Variation with Temperature

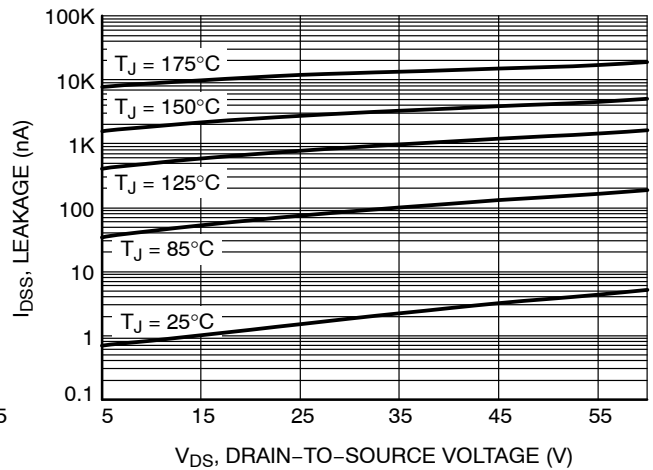
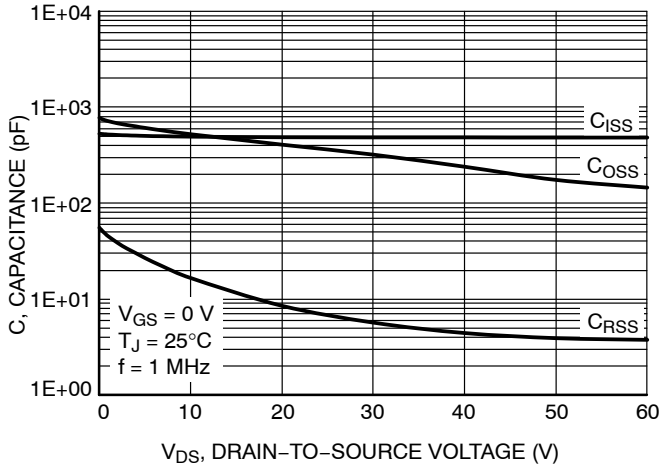


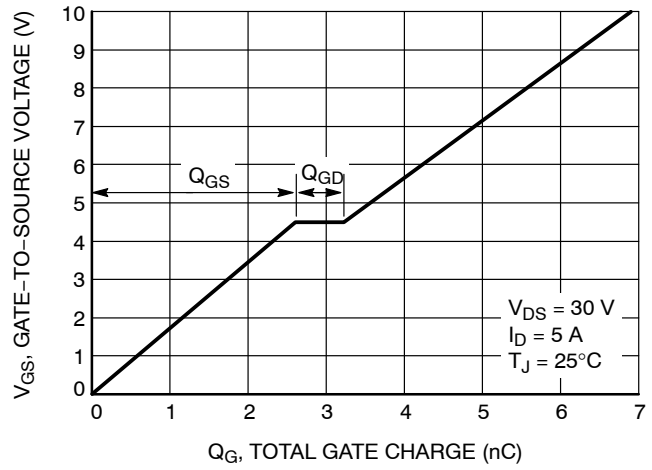
Figure 6. Drain-to-Source Leakage Current vs. Voltage

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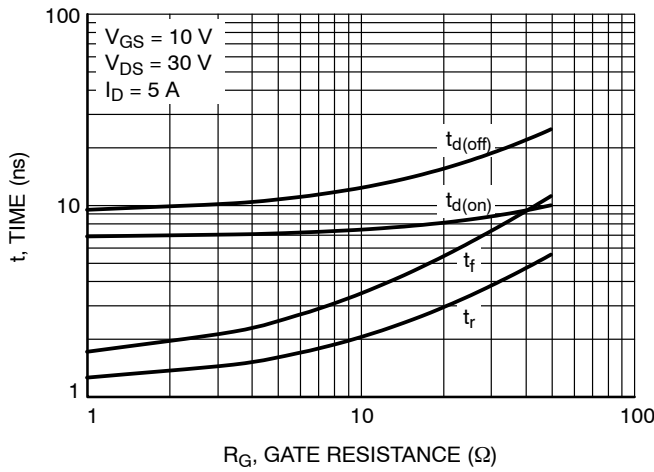
## TYPICAL CHARACTERISTICS



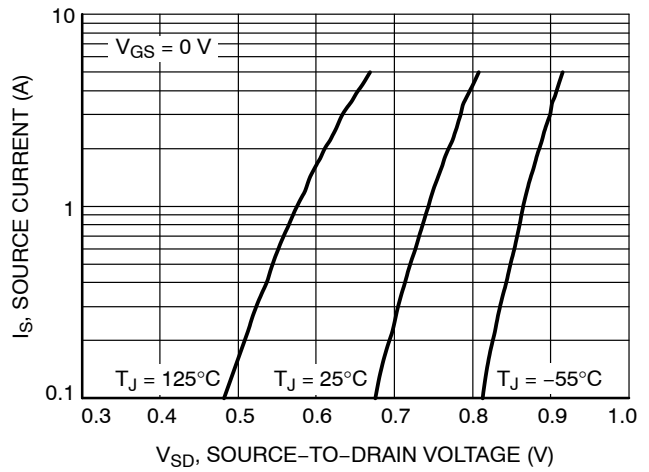
**Figure 7. Capacitance Variation**



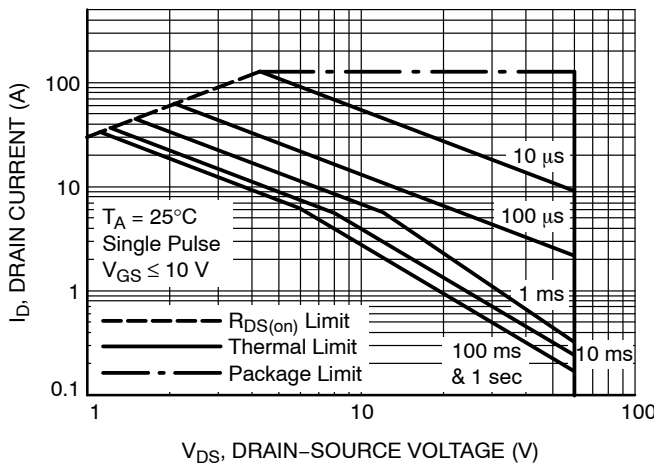
**Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge**



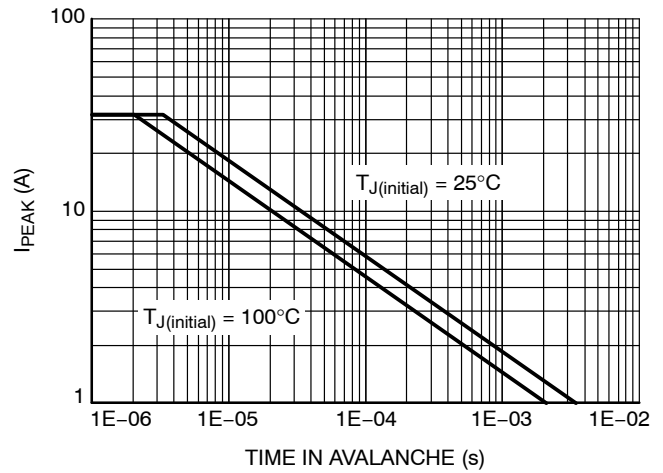
**Figure 9. Resistive Switching Time Variation vs. Gate Resistance**



**Figure 10. Diode Forward Voltage vs. Current**



**Figure 11. Safe Operating Area**



**Figure 12. Maximum Drain Current vs. Time in Avalanche**

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## TYPICAL CHARACTERISTICS

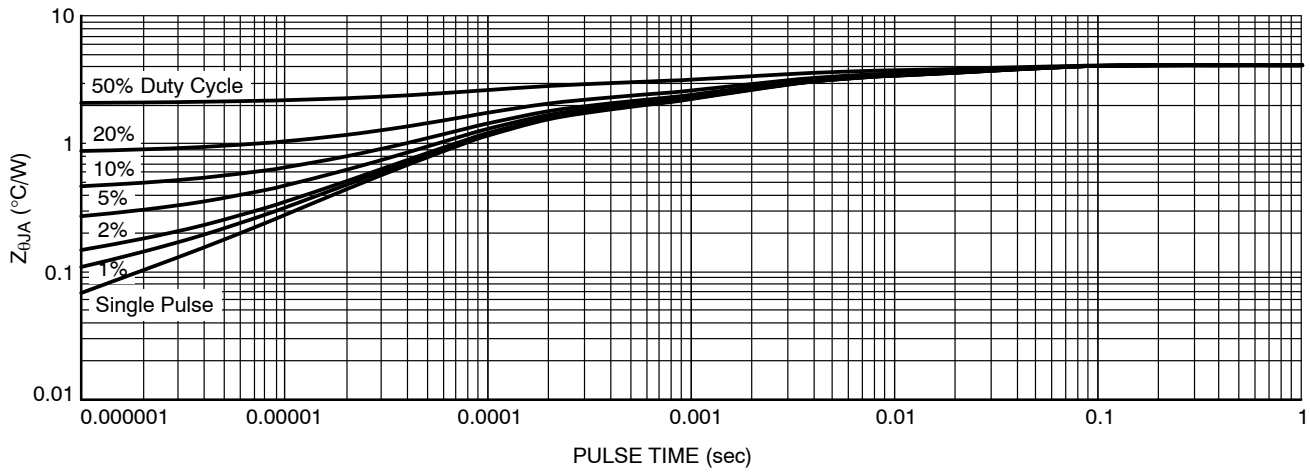
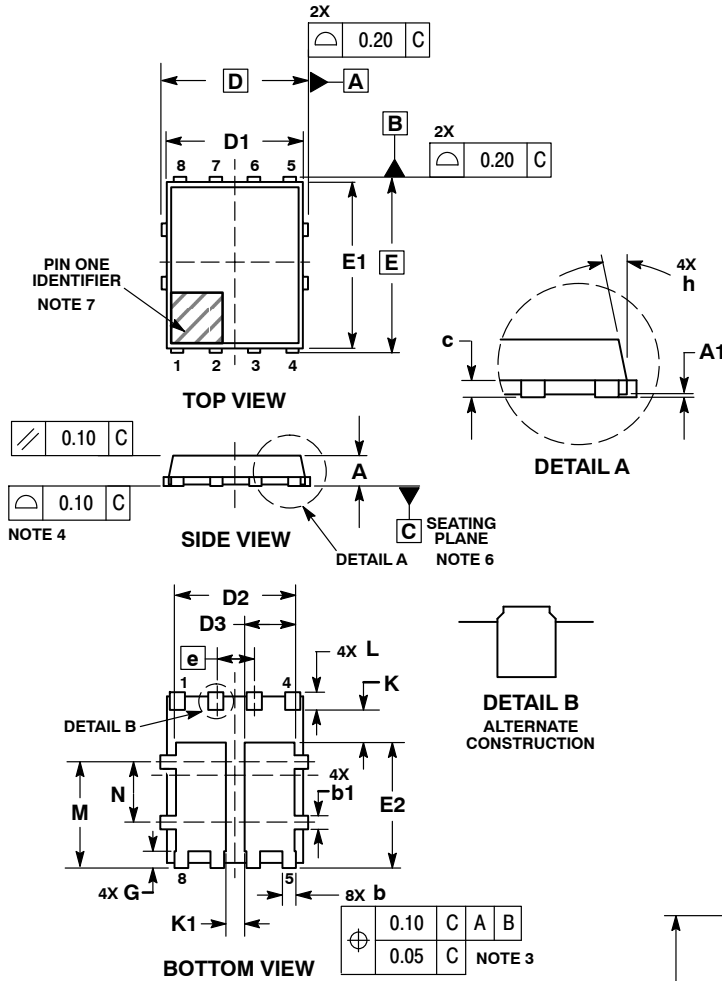


Figure 13. Thermal Characteristics

# NTMFD016N06C

## PACKAGE DIMENSIONS

### DFN8 5x6, 1.27P Dual Flag (SO8FL-Dual) CASE 506BT ISSUE E

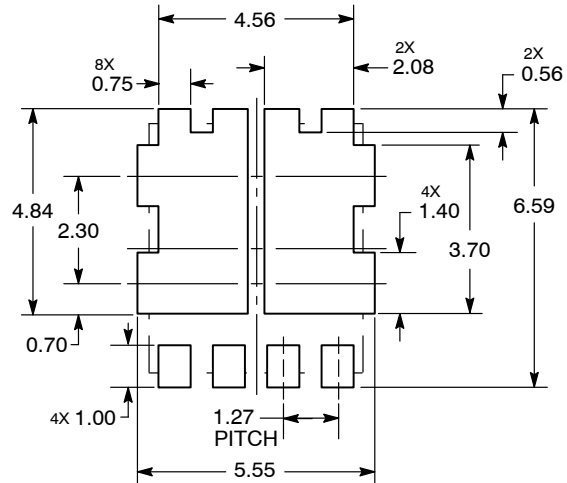


**NOTES:**

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. PROFILE TOLERANCE APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.
5. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
6. SEATING PLANE IS DEFINED BY THE TERMINALS. A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
7. A VISUAL INDICATOR FOR PIN 1 MUST BE LOCATED IN THIS AREA.

DIM	MILLIMETERS		
	MIN	MAX	MAX
A	0.90	----	1.10
A1	----	----	0.05
b	0.33	0.42	0.51
b1	0.33	0.42	0.51
c	0.20	----	0.33
D	5.15 BSC		
D1	4.70	4.90	5.10
D2	3.90	4.10	4.30
D3	1.50	1.70	1.90
E	6.15 BSC		
E1	5.70	5.90	6.10
E2	3.90	4.15	4.40
e	1.27 BSC		
G	0.45	0.55	0.65
h	----	----	12 °
K	0.51	----	----
K1	0.56	----	----
L	0.48	0.61	0.71
M	3.25	3.50	3.75
N	1.80	2.00	2.20

#### 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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