

# MOSFET – Power, Single, N-Channel

**60 V, 185 A, 1.8 mΩ**

## NTMFS5H615NL

### 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 and are RoHS Compliant

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

Symbol	Parameter		Value	Unit	
$V_{DSS}$	Drain-to-Source Voltage		60	V	
$V_{GS}$	Gate-to-Source Voltage		$\pm 20$	V	
$I_D$	Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3)	Steady State	$T_C = 25^\circ\text{C}$	185	A
			$T_C = 100^\circ\text{C}$	117	
$P_D$	Power Dissipation $R_{\theta JC}$ (Note 1)	Steady State	$T_C = 25^\circ\text{C}$	139	W
			$T_C = 100^\circ\text{C}$	55	
$I_D$	Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	Steady State	$T_A = 25^\circ\text{C}$	28	A
			$T_A = 100^\circ\text{C}$	18	
$P_D$	Power Dissipation $R_{\theta JA}$ (Notes 1, 2)	Steady State	$T_A = 25^\circ\text{C}$	3.2	W
			$T_A = 100^\circ\text{C}$	1.3	
$I_{DM}$	Pulsed Drain Current	$T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$	900	A	
$T_J, T_{stg}$	Operating Junction and Storage Temperature Range		-55 to +150	$^\circ\text{C}$	
$I_S$	Source Current (Body Diode)		116	A	
$E_{AS}$	Single Pulse Drain-to-Source Avalanche Energy ( $I_{L(pk)} = 16 \text{ A}$ )		419	mJ	
$T_L$	Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		260	$^\circ\text{C}$	

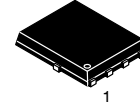
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### THERMAL RESISTANCE MAXIMUM RATINGS

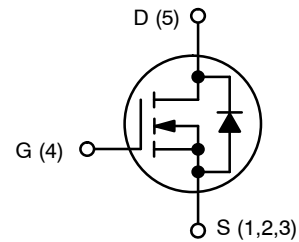
Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Junction-to-Case – Steady State	0.9	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-Ambient – Steady State (Note 2)	39	

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	1.8 mΩ @ 10 V	185 A
	2.5 mΩ @ 4.5 V	

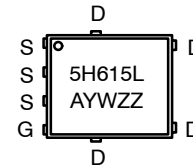


DFN5  
(SO-8FL)  
CASE 488AA  
STYLE 1



N-CHANNEL MOSFET

### MARKING DIAGRAM



5H615L = Specific Device Code  
A = Assembly Location  
Y = Year  
W = Work Week  
ZZ = Lot Traceability

### ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 5 of this data sheet.

# NTMFS5H615NL

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

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>						
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	60			V
$V_{(BR)DSS}/T_J$	Drain-to-Source Breakdown Voltage Temperature Coefficient			37.8		mV/°C
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}$	$T_J = 25^\circ\text{C}$		10	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		250	
$I_{GSS}$	Gate-to-Source Leakage Current	$V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$			100	nA

## ON CHARACTERISTICS (Note 4)

$V_{GS(TH)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	1.2		2.0	V
$V_{GS(TH)}/T_J$	Threshold Temperature Coefficient			-5.2		mV/°C
$R_{DS(on)}$	Drain-to-Source On Resistance	$V_{GS} = 10\text{ V}$	$I_D = 49\text{ A}$	1.5	1.8	m $\Omega$
		$V_{GS} = 4.5\text{ V}$	$I_D = 39\text{ A}$	2.0	2.5	

## CHARGES, CAPACITANCES & GATE RESISTANCE

$C_{ISS}$	Input Capacitance	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 30\text{ V}$		4860		pF
$C_{OSS}$	Output Capacitance			900		
$C_{RSS}$	Reverse Transfer Capacitance			18		
$Q_{OSS}$	Output Charge	$V_{GS} = 0\text{ V}, V_{DD} = 30\text{ V}$		79		nC
$Q_{G(TOT)}$	Total Gate Charge	$V_{GS} = 10\text{ V}, V_{DS} = 30\text{ V}; I_D = 49\text{ A}$		63		
$Q_{G(TOT)}$	Total Gate Charge	$V_{GS} = 4.5\text{ V}, V_{DS} = 30\text{ V}; I_D = 49\text{ A}$		28		
$Q_{G(TH)}$	Threshold Gate Charge			7.7		
$Q_{GS}$	Gate-to-Source Charge			14.2		
$Q_{GD}$	Gate-to-Drain Charge			4.6		
$V_{GP}$	Plateau Voltage			3		

## SWITCHING CHARACTERISTICS (Note 5)

$t_{d(ON)}$	Turn-On Delay Time	$V_{GS} = 4.5\text{ V}, V_{DS} = 30\text{ V}, I_D = 49\text{ A}, R_G = 2.5\ \Omega$		28		ns
$t_r$	Rise Time			116		
$t_{d(OFF)}$	Turn-Off Delay Time			63		
$t_f$	Fall Time			138		

## DRAIN-SOURCE DIODE CHARACTERISTICS

$V_{SD}$	Forward Diode Voltage	$V_{GS} = 0\text{ V}, I_S = 49\text{ A}$	$T_J = 25^\circ\text{C}$		0.8	1.2	V
			$T_J = 125^\circ\text{C}$		0.65		
$t_{RR}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, di_S/dt = 100\text{ A}/\mu\text{s}, I_S = 25\text{ A}$		61		ns	
$t_a$	Charge Time			31			
$t_b$	Discharge Time			30			
$Q_{RR}$	Reverse Recovery Charge			76			nC

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.

# NTMFS5H615NL

## TYPICAL CHARACTERISTICS

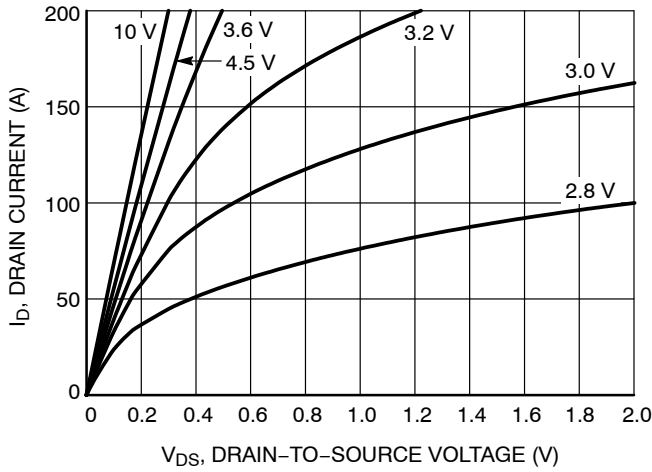


Figure 1. On-Region Characteristics

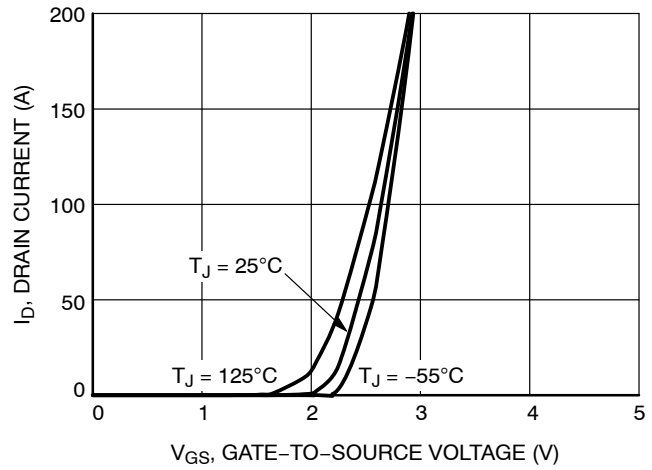


Figure 2. Transfer Characteristics

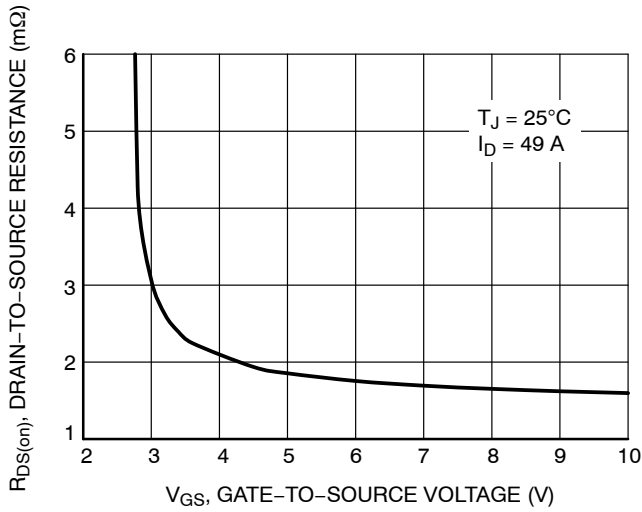


Figure 3. On-Resistance vs. Gate-to-Source Voltage

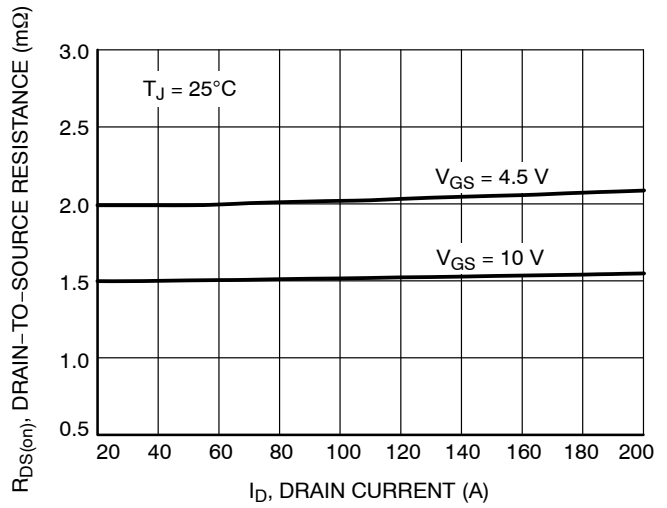


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

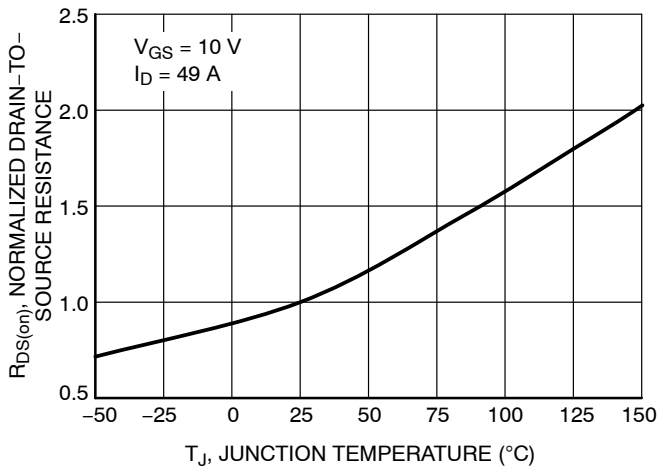


Figure 5. On-Resistance Variation with Temperature

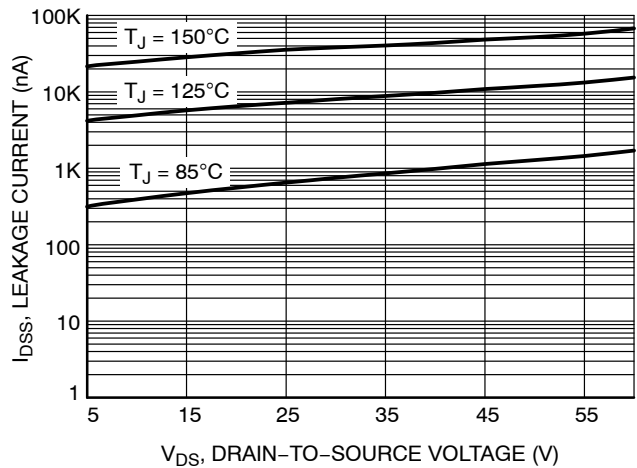


Figure 6. Drain-to-Source Leakage Current vs. Voltage

# NTMFS5H615NL

## TYPICAL CHARACTERISTICS (continued)

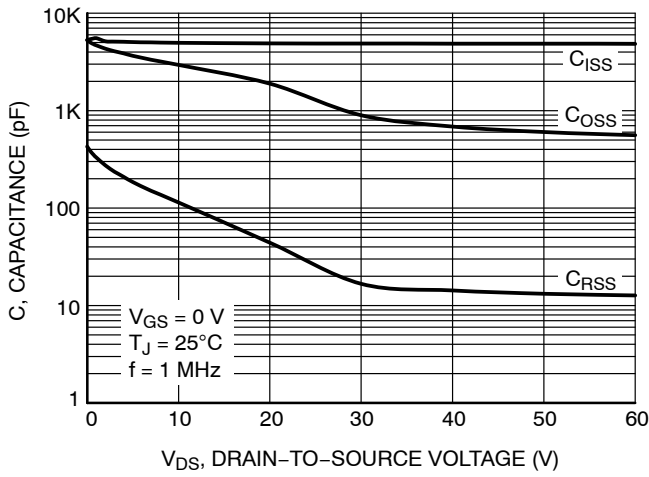


Figure 7. Capacitance Variation

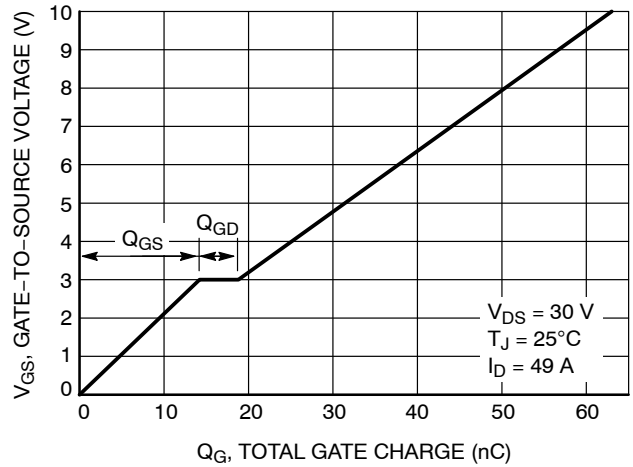


Figure 8. Gate-to-Source Voltage vs. Total Charge

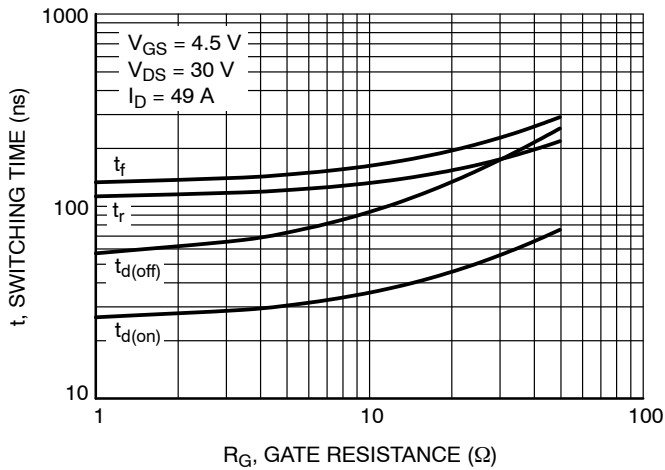


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

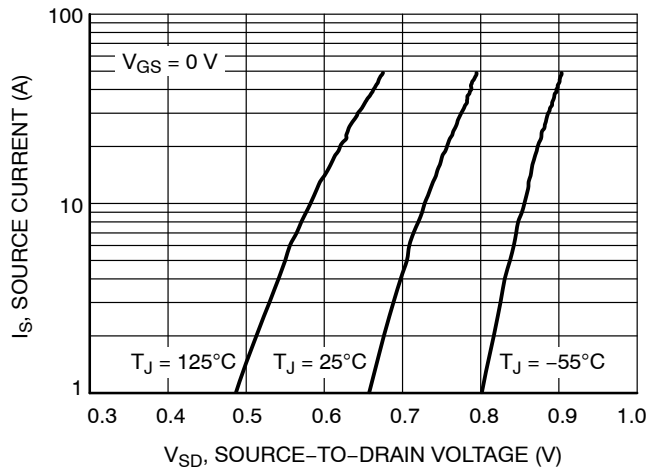


Figure 10. Diode Forward Voltage vs. Current

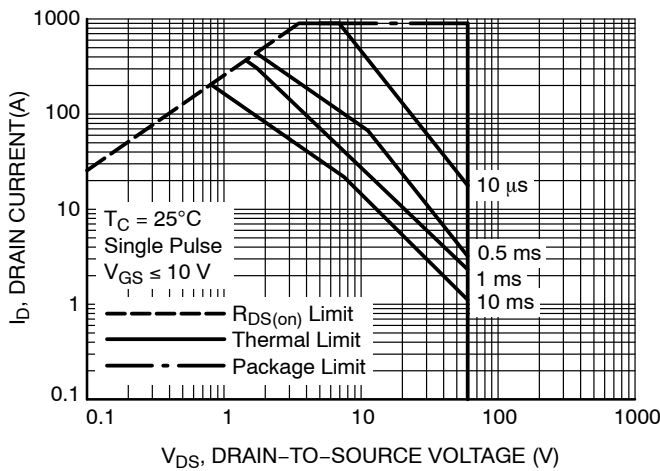


Figure 11. Maximum Rated Forward Biased Safe Operating Area

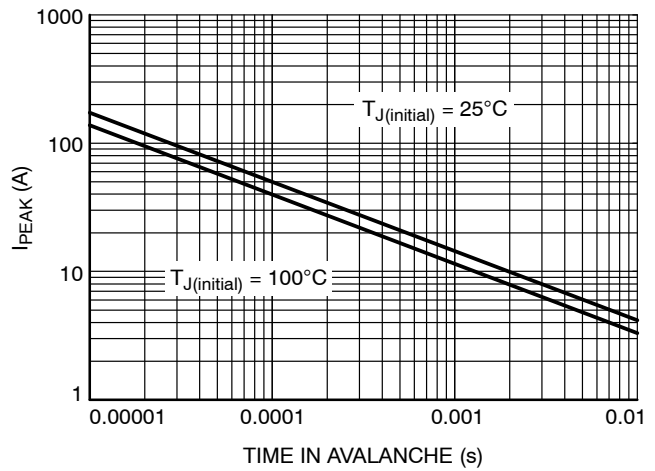


Figure 12.  $I_{PEAK}$  vs. Time in Avalanche

# NTMFS5H615NL

## TYPICAL CHARACTERISTICS (continued)

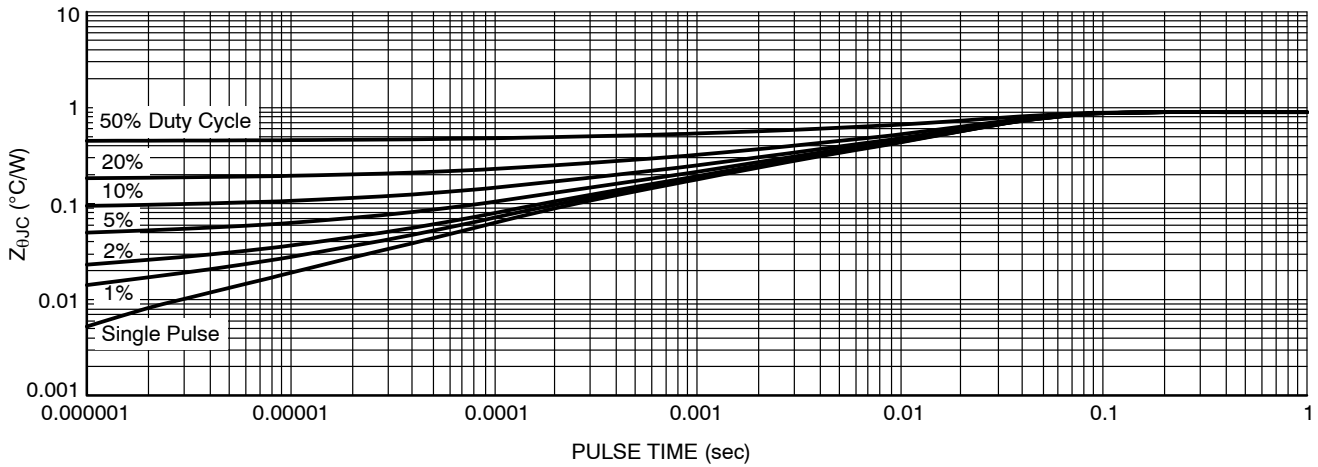
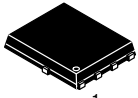


Figure 13. Thermal Characteristics

### DEVICE ORDERING INFORMATION

Device	Marking	Package	Shipping <sup>†</sup>
NTMFS5H615NLT1G	5H615L	DFN5 (Pb-Free)	1,500 / Tape & Reel

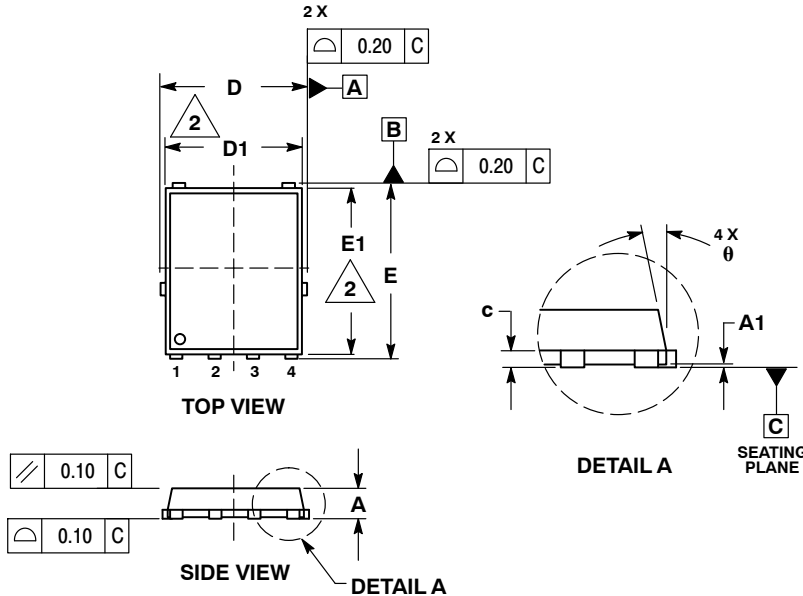
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, [BRD8011/D](#).



1  
SCALE 2:1

DFN5 5x6, 1.27P  
(SO-8FL)  
CASE 488AA  
ISSUE N

DATE 25 JUN 2018



NOTES:

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

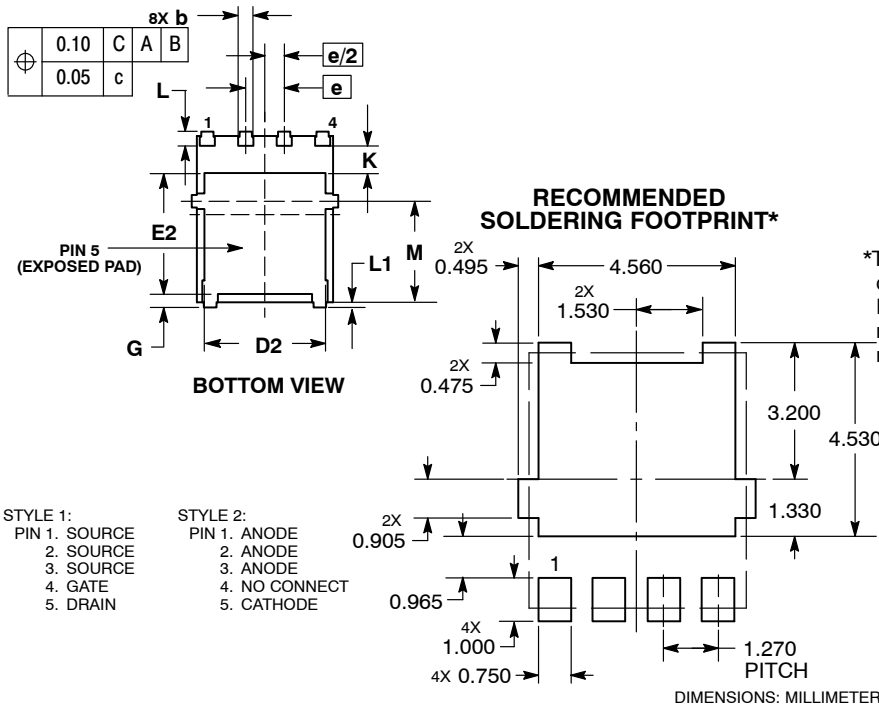
DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.90	1.00	1.10
A1	0.00	---	0.05
b	0.33	0.41	0.51
c	0.23	0.28	0.33
D	5.00	5.15	5.30
D1	4.70	4.90	5.10
D2	3.80	4.00	4.20
E	6.00	6.15	6.30
E1	5.70	5.90	6.10
E2	3.45	3.65	3.85
e	1.27 BSC		
G	0.51	0.575	0.71
K	1.20	1.35	1.50
L	0.51	0.575	0.71
L1	0.125 REF		
M	3.00	3.40	3.80
θ	0°	---	12°

GENERIC MARKING DIAGRAM\*



- XXXXXX = Specific Device Code
- A = Assembly Location
- Y = Year
- W = Work Week
- ZZ = Lot Traceability

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.



- STYLE 1:  
PIN 1. SOURCE  
2. SOURCE  
3. SOURCE  
4. GATE  
5. DRAIN
- STYLE 2:  
PIN 1. ANODE  
2. ANODE  
3. ANODE  
4. NO CONNECT  
5. CATHODE

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

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DESCRIPTION:	DFN5 5x6, 1.27P (SO-8FL)	PAGE 1 OF 1

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