

# MOSFET - Power, Single, N-Channel

## 60 V, 1.5 mΩ, 238 A

### NTMFS5C612N

#### Features

- Small Footprint (5x6 mm) for Compact Design
- Low RDS(on) to Minimize Conduction Losses
- Low Q<sub>G</sub> and Capacitance to Minimize Driver Losses
- NTMFS5C612NWFT1G – Wettable Flank Option for Enhanced Optical Inspection
- These Devices are Pb-Free and are RoHS Compliant

#### MAXIMUM RATINGS (T<sub>J</sub> = 25°C unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V <sub>DSS</sub>	60	V
Gate-to-Source Voltage	V <sub>GS</sub>	±20	V
Continuous Drain Current R <sub>θJC</sub> (Notes 1, 3)	I <sub>D</sub>	T <sub>C</sub> = 25°C	238
		T <sub>C</sub> = 100°C	168
Power Dissipation R <sub>θJC</sub> (Note 1)	P <sub>D</sub>	T <sub>C</sub> = 25°C	170
		T <sub>C</sub> = 100°C	84
Continuous Drain Current R <sub>θJA</sub> (Notes 1, 2, 3)	I <sub>D</sub>	T <sub>A</sub> = 25°C	35
		T <sub>A</sub> = 100°C	25
Power Dissipation R <sub>θJA</sub> (Notes 1, 2)	P <sub>D</sub>	T <sub>A</sub> = 25°C	3.8
		T <sub>A</sub> = 100°C	1.9
Pulsed Drain Current	I <sub>DM</sub>	T <sub>A</sub> = 25°C, t <sub>p</sub> = 10 μs	900
Operating Junction and Storage Temperature	T <sub>J</sub> , T <sub>stg</sub>	-55 to +175	°C
Source Current (Body Diode)	I <sub>S</sub>	190	A
Single Pulse Drain-to-Source Avalanche Energy (I <sub>L(pk)</sub> = 17 A)	E <sub>AS</sub>	451	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	T <sub>L</sub>	260	°C

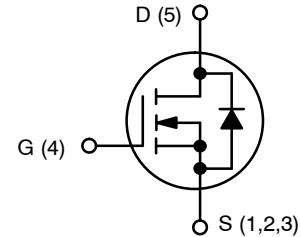
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

#### THERMAL RESISTANCE MAXIMUM RATINGS

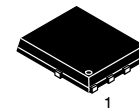
Parameter	Symbol	Value	Unit
Junction-to-Case – Steady State	R <sub>θJC</sub>	0.9	°C/W
Junction-to-Ambient – Steady State (Note 2)	R <sub>θJA</sub>	39	

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 <sub>(BR)DSS</sub>	R <sub>DS(ON)</sub> MAX	I <sub>D</sub> MAX
60 V	1.5 mΩ @ 10 V	238 A

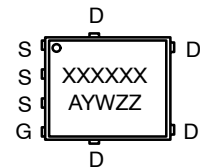


N-CHANNEL MOSFET



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

#### MARKING DIAGRAM



XXXXXX = 5C612N  
(NTMFS5C612NT1G) or  
= 612NWF  
(NTMFS5C612NWFT1G)  
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.

NOTE: Some of the device on this data sheet have been **DISCONTINUED**. Please refer to the table on page 5.

# NTMFS5C612N

## 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	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	60			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			25		mV/ $^\circ\text{C}$
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	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	2.0		4.0	V
Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			-9.4		mV/ $^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 50\text{ A}$		1.27	1.5	m $\Omega$

### CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 30\text{ V}$		4860		pF
Output Capacitance	$C_{OSS}$			2880		
Reverse Transfer Capacitance	$C_{RSS}$			40		
Output Charge	$Q_{OSS}$			128		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 30\text{ V}; I_D = 50\text{ A}$		65		nC
Threshold Gate Charge	$Q_{G(TH)}$			13		
Gate-to-Source Charge	$Q_{GS}$			22		
Gate-to-Drain Charge	$Q_{GD}$			11		
Plateau Voltage	$V_{GP}$			4.6		V
Gate Resistance	$R_G$	$f = 1\text{ MHz}$		2.0		$\Omega$

### SWITCHING CHARACTERISTICS (Note 5)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 10\text{ V}, V_{DS} = 30\text{ V}, I_D = 50\text{ A}, R_G = 2.5\text{ }\Omega$		26		ns
Rise Time	$t_r$			8.0		
Turn-Off Delay Time	$t_{d(OFF)}$			50		
Fall Time	$t_f$			9.0		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V},$ $I_S = 50\text{ A}$	$T_J = 25^{\circ}\text{C}$		0.81	1.0	V
			$T_J = 125^{\circ}\text{C}$		0.67		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s},$ $I_S = 50\text{ A}$			82.4		ns
Charge Time	$t_a$				40.8		
Discharge Time	$t_b$				41.6		
Reverse Recovery Charge	$Q_{RR}$					139	

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  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

5. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

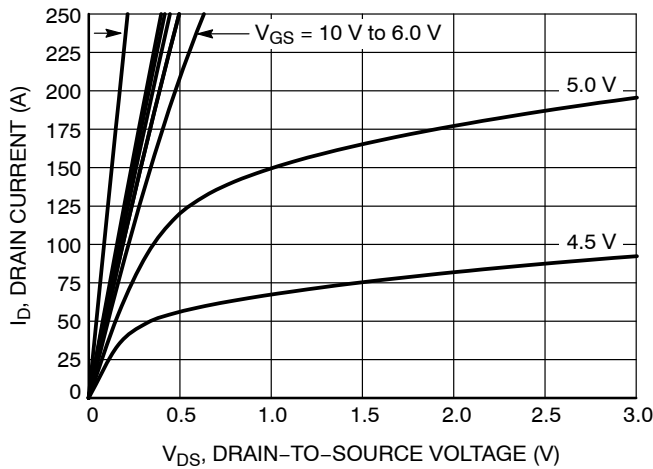


Figure 1. On-Region Characteristics

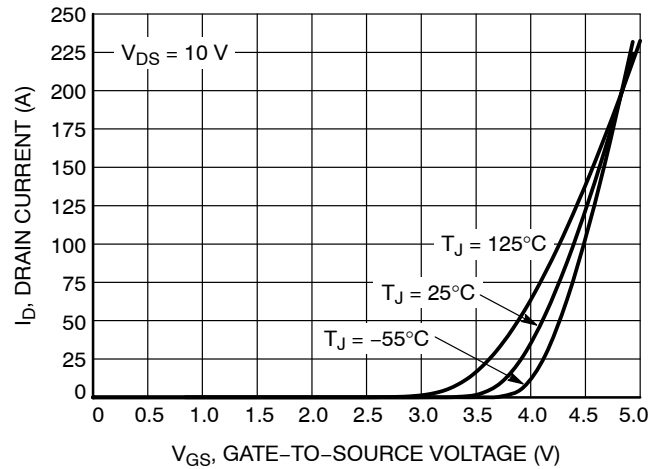


Figure 2. Transfer Characteristics

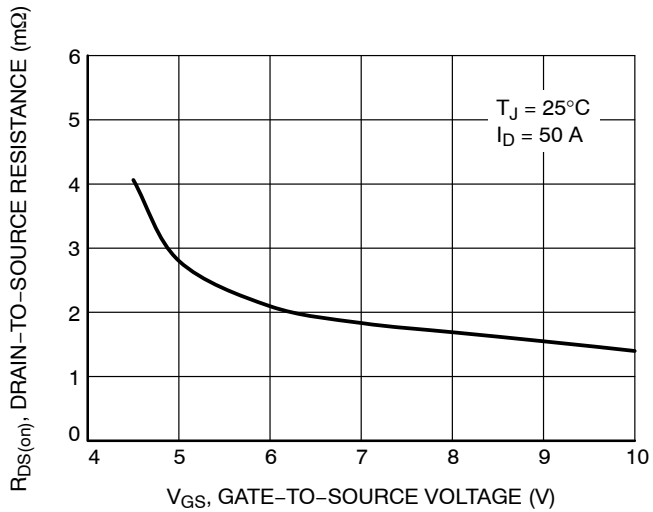


Figure 3. On-Resistance vs. Gate-to-Source Voltage

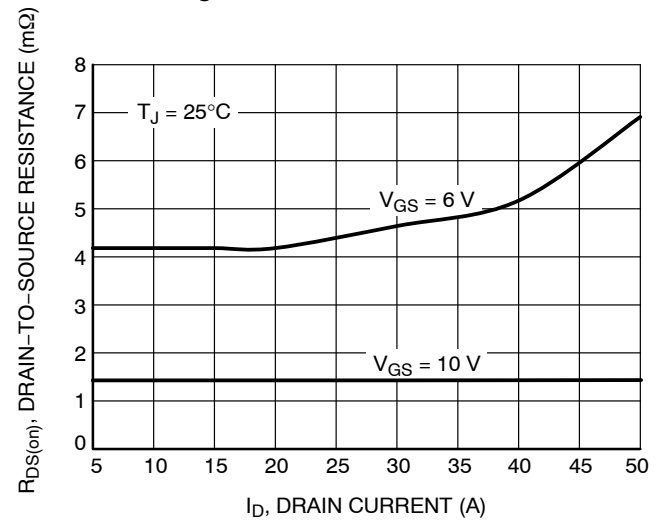


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

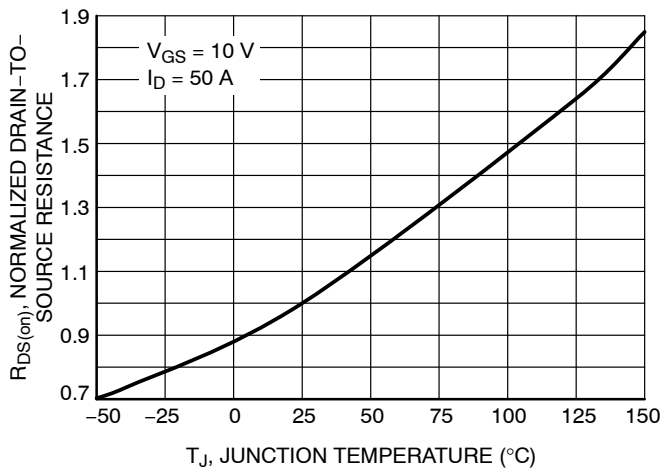


Figure 5. On-Resistance Variation with Temperature

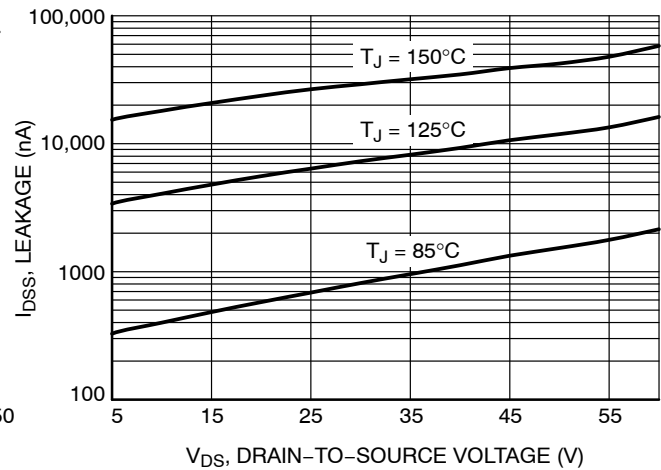


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

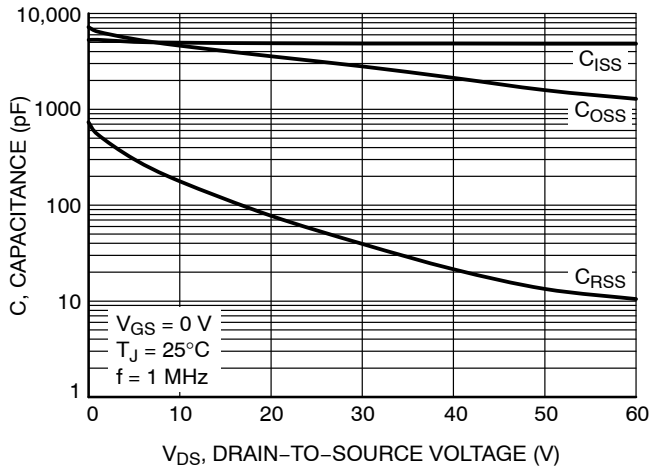


Figure 7. Capacitance Variation

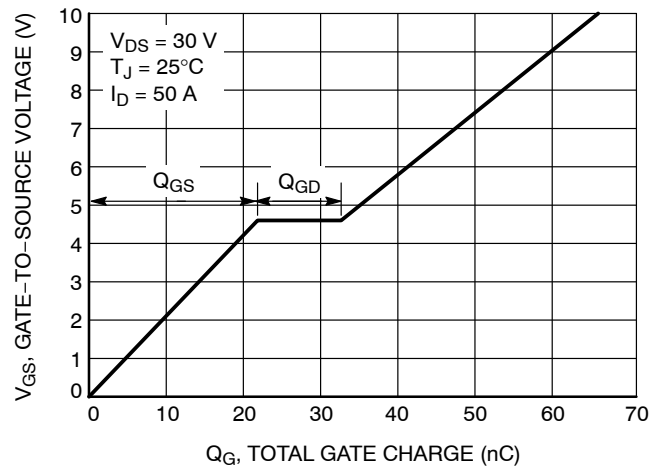


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

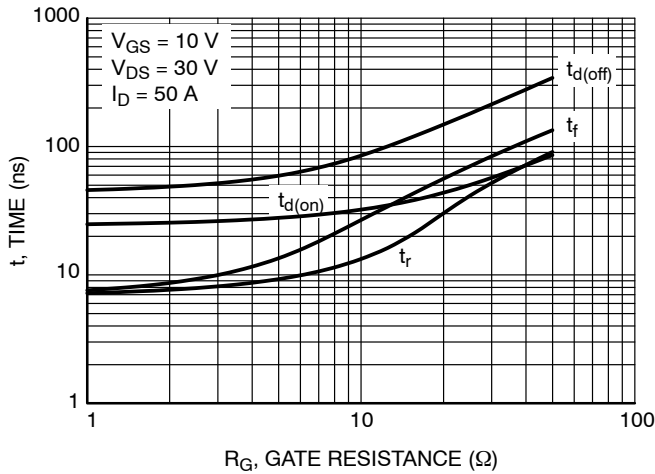


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

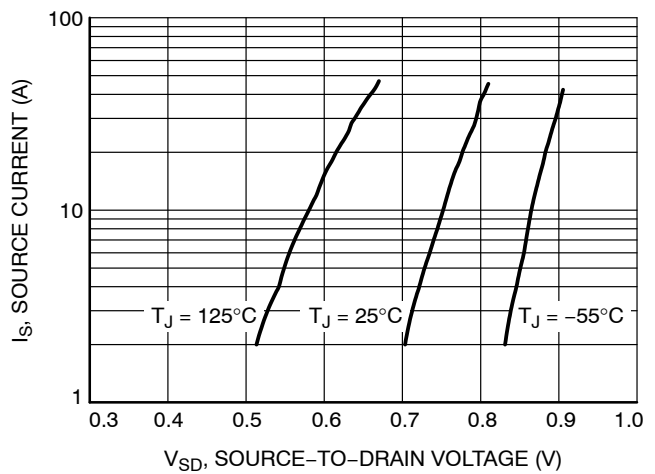


Figure 10. Diode Forward Voltage vs. Current

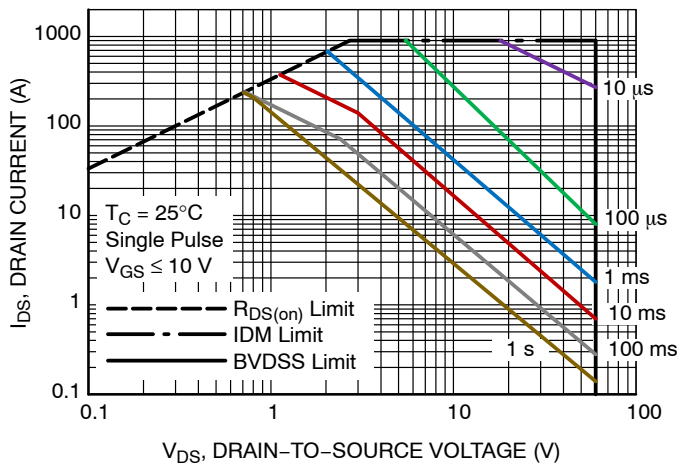


Figure 11. Safe Operating Area

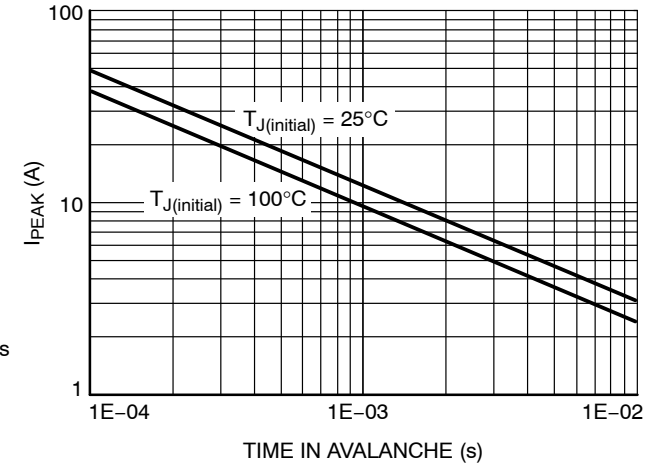


Figure 12.  $I_{PEAK}$  vs. Time in Avalanche

# NTMFS5C612N

## TYPICAL CHARACTERISTICS

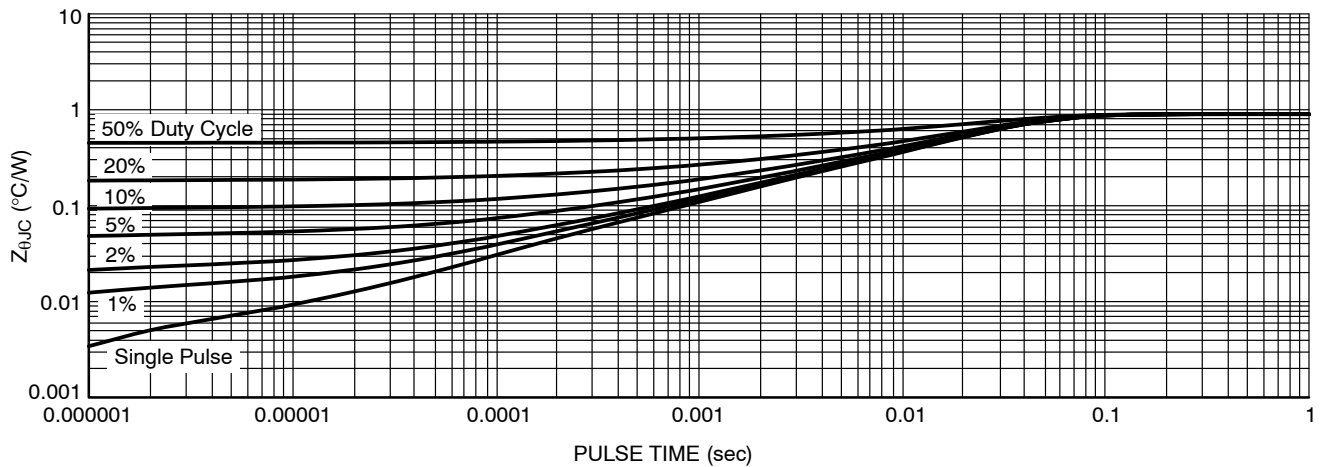


Figure 13. Thermal Characteristics

### ORDERING INFORMATION

Device	Marking	Package	Shipping†
NTMFS5C612NT1G	5C612N	DFN5 (Pb-Free)	1500 / Tape & Reel

### DISCONTINUED (Note 6)

NTMFS5C612NWFT1G	612NWF	DFN (Pb-Free, Wettable Flanks)	1500 / Tape & Reel
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†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](#).

6. **DISCONTINUED:** This device is not recommended for new design. Please contact your **onsemi** representative for information. The most current information on this device may be available on [www.onsemi.com](http://www.onsemi.com).



SCALE 2:1

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

DATE 25 JUN 2018

## NOTES:

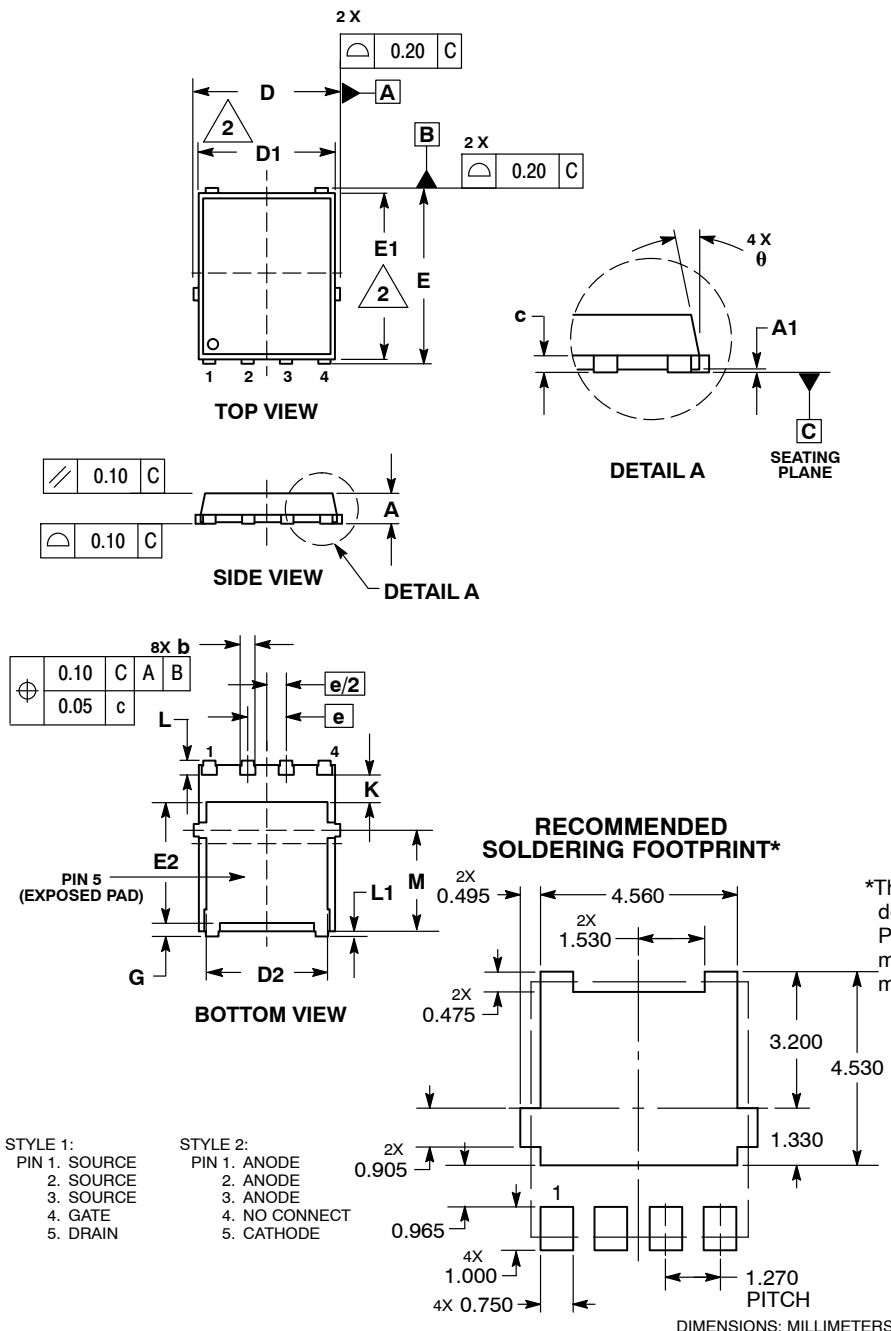
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

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.



\*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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