

# MOSFET - Power, Single N-Channel, SO8-FL

## 40 V, 0.42 mΩ, 509 A

### NTMFS0D4N04XM

#### Features

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

#### Applications

- Motor Drive
- Battery Protection
- ORing

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

Parameter		Symbol	Value	Unit
Drain-to-Source Voltage		$V_{DS}$	40	V
Gate-to-Source Voltage	DC	$V_{GS}$	$\pm 20$	V
Continuous Drain Current	$T_C = 25^\circ\text{C}$	$I_D$	509	A
	$T_C = 100^\circ\text{C}$		360	
Power Dissipation	$T_C = 25^\circ\text{C}$	$P_D$	197	W
Pulsed Drain Current	$T_C = 25^\circ\text{C}$ , $t_p = 10 \mu\text{s}$	$I_{DM}$	4044	A
Operating Junction and Storage Temperature Range		$T_J, T_{STG}$	-55 to +175	$^\circ\text{C}$
Source Current (Body Diode)		$I_S$	202	A
Single Pulse Avalanche Energy	$I_{PK} = 38.6 \text{ A}$	$E_{AS}$	2396	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		$T_L$	260	$^\circ\text{C}$

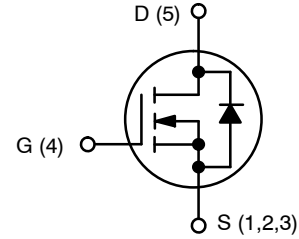
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

#### THERMAL CHARACTERISTICS

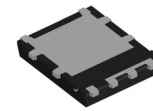
Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Note 2)	$R_{\theta JC}$	0.76	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient (Notes 1, 2)	$R_{\theta JA}$	38.2	

1. Surface-mounted on FR4 board using 650 mm<sup>2</sup>, 2 oz Cu pad.
2. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.

$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	$I_D$ MAX
40 V	0.42 mΩ @ 10 V	509 A

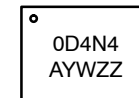


N-CHANNEL MOSFET



DFN5 (SO8-FL)  
CASE 506FA

#### MARKING DIAGRAM



- 0D4N4 = Specific Device Code  
A = Assembly Location  
Y = Year  
W = Work Week  
ZZ = Lot Traceability

#### ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 2 of this data sheet.

# NTMFS0D4N04XM

## 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	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}, T_J = 25^\circ\text{C}$	40			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$\Delta V_{(BR)DSS} / \Delta T_J$	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		14.9		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 40\text{ V}, T_J = 25^\circ\text{C}$			10	$\mu\text{A}$
		$V_{DS} = 40\text{ V}, T_J = 125^\circ\text{C}$			100	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$			100	nA

### ON CHARACTERISTICS

Drain-to-Source On Resistance	$R_{DS(ON)}$	$V_{GS} = 10\text{ V}, I_D = 50\text{ A}, T_J = 25^\circ\text{C}$		0.33	0.42	m $\Omega$
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 330\ \mu\text{A}, T_J = 25^\circ\text{C}$	2.5	3	3.5	V
Gate Threshold Voltage Temperature Coefficient	$\Delta V_{GS(TH)} / \Delta T_J$	$V_{GS} = V_{DS}, I_D = 330\ \mu\text{A}$		-7.21		mV/ $^\circ\text{C}$
Forward Trans-conductance	$g_{FS}$	$V_{DS} = 5\text{ V}, I_D = 50\text{ A}$		286		S

### CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		8577		pF		
Output Capacitance	$C_{OSS}$			6090				
Reverse Transfer Capacitance	$C_{RSS}$			120				
Output Charge	$Q_{OSS}$	$V_{DD} = 20\text{ V}, I_D = 50\text{ A}, V_{GS} = 10\text{ V}$		183		nC		
Total Gate Charge	$Q_{G(TOT)}$			133				
Threshold Gate Charge	$Q_{G(TH)}$			25.2				
Gate-to-Source Charge	$Q_{GS}$			37.2				
Gate-to-Drain Charge	$Q_{GD}$			24.2				
Gate Resistance	$R_G$		$f = 1\text{ MHz}$		0.42			$\Omega$

### SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	Resistive Load, $V_{GS} = 0/10\text{ V}$ , $V_{DD} = 20\text{ V}, I_D = 50\text{ A}, R_G = 0\ \Omega$		34.5		ns
Rise Time	$t_r$			11.1		
Turn-Off Delay Time	$t_{d(OFF)}$			49.4		
Fall Time	$t_f$			13		

### SOURCE-TO-DRAIN DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$I_S = 50\text{ A}, V_{GS} = 0\text{ V}, T_J = 25^\circ\text{C}$		0.79	1.2	V
		$I_S = 50\text{ A}, V_{GS} = 0\text{ V}, T_J = 125^\circ\text{C}$		0.63		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, I_S = 50\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}, V_{DD} = 20\text{ V}$		94.4		ns
Charge Time	$t_a$			55.3		
Discharge Time	$t_b$			39.1		
Reverse Recovery Charge	$Q_{RR}$			316		

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.

### DEVICE ORDERING INFORMATION

Device	Marking	Package	Shipping†
NTMFS0D4N04XMT1G	0D4N4	DFN5 (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 Specifications Brochure, BRD8011/D.

# NTMFS0D4N04XM

## TYPICAL CHARACTERISTICS

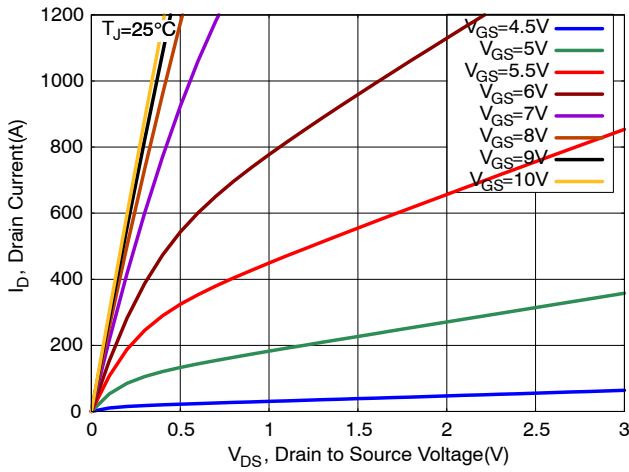


Figure 1. On-Region Characteristics

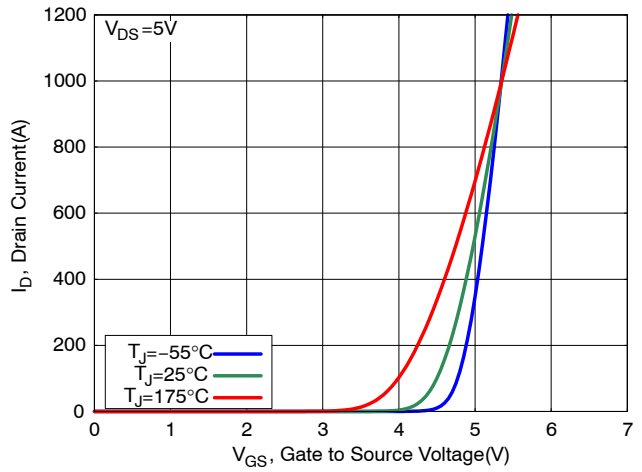


Figure 2. Transfer Characteristics

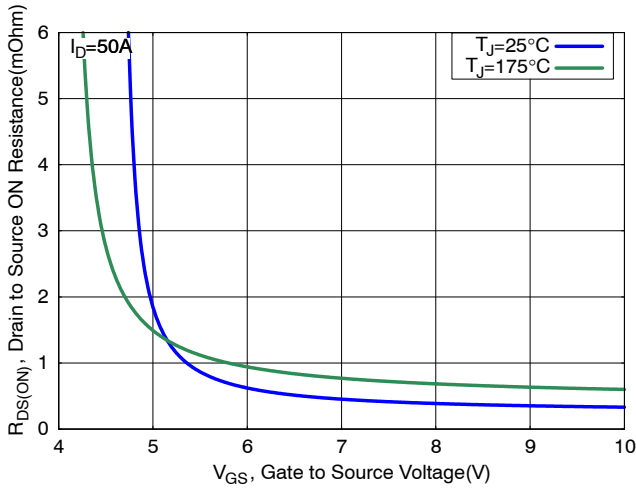


Figure 3. On-Resistance vs. Gate Voltage

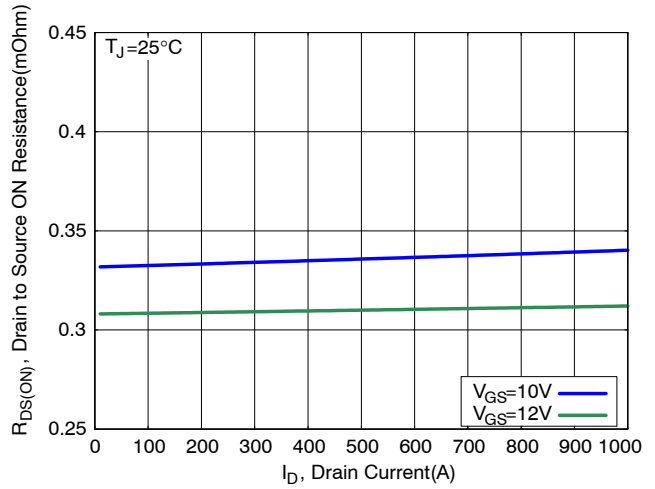


Figure 4. On-Resistance vs. Drain Current

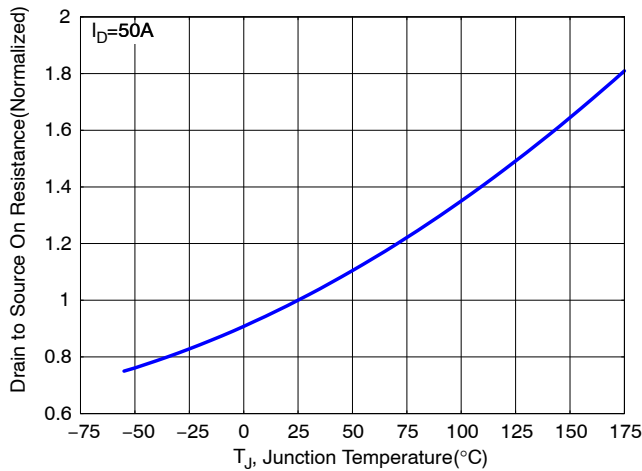


Figure 5. Normalized ON Resistance vs. Junction Temperature

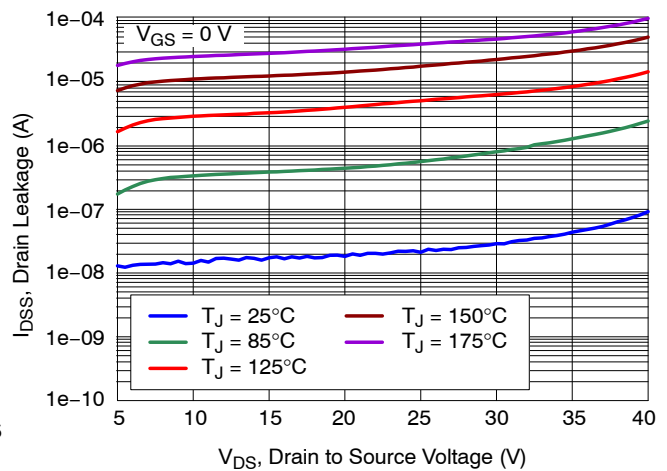


Figure 6. Drain to Source Voltage vs. Drain Leakage

# NTMFS0D4N04XM

## TYPICAL CHARACTERISTICS (CONTINUED)

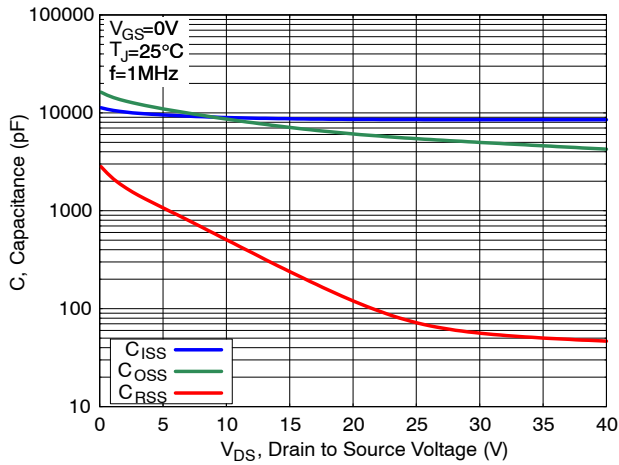


Figure 7. Capacitance Characteristics

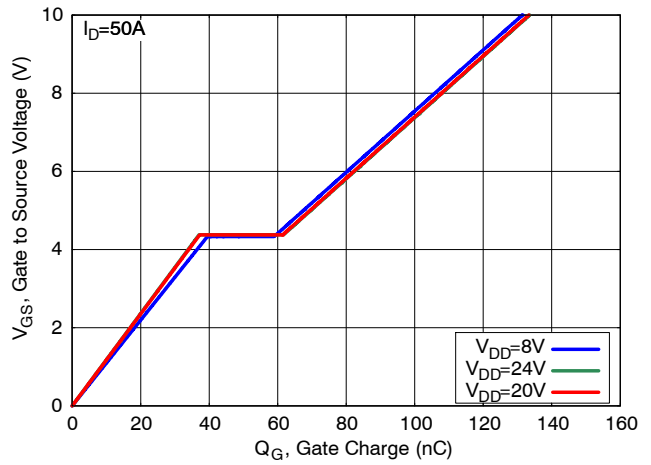


Figure 8. Gate Charge Characteristics

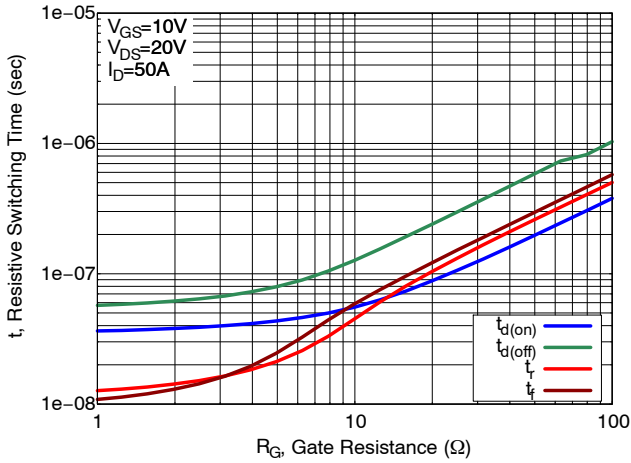


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

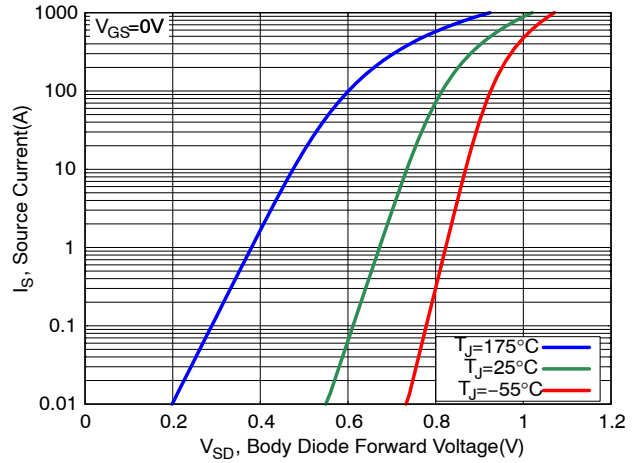


Figure 10. Diode Forward Characteristics

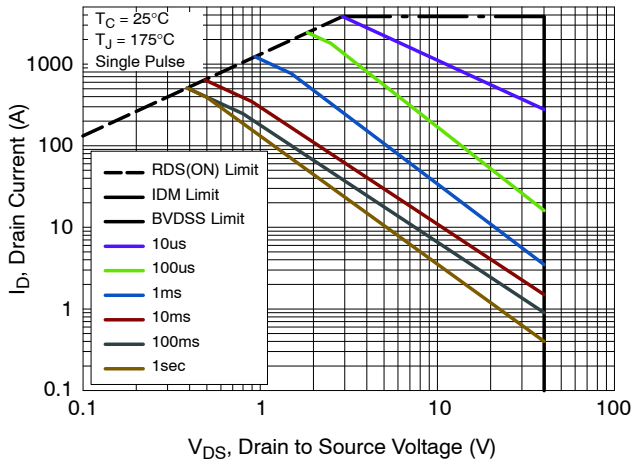


Figure 11. Safe Operating Area (SOA)

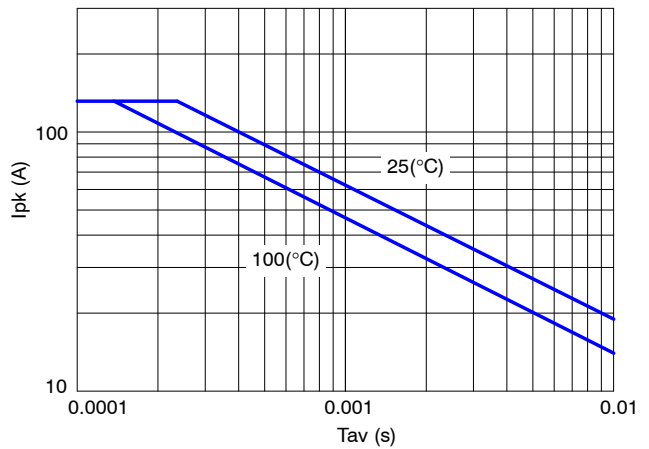


Figure 12. Avalanche Current vs. Pulse Time (UIS)

# NTMFS0D4N04XM

## TYPICAL CHARACTERISTICS (CONTINUED)

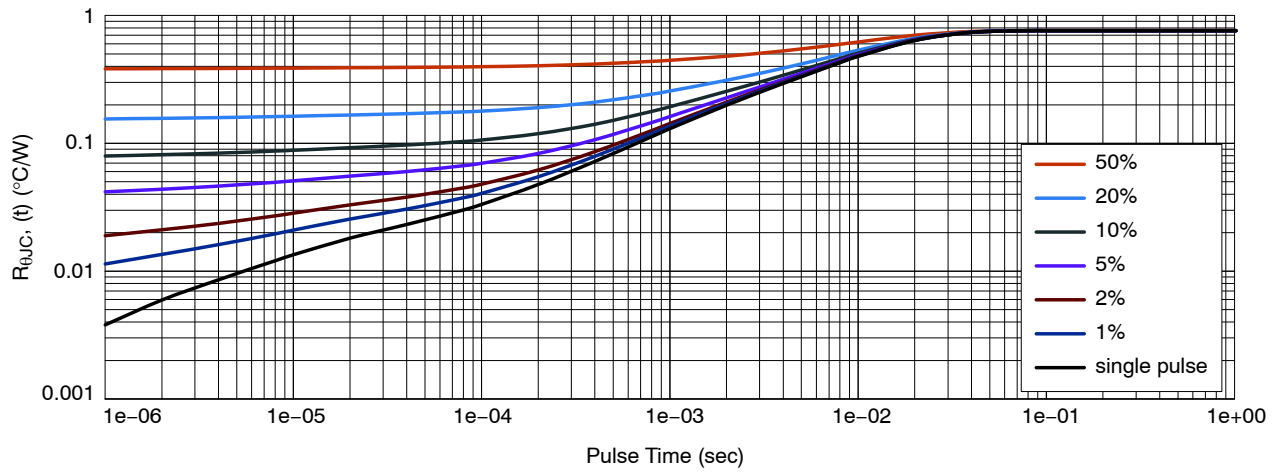
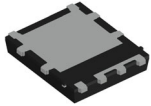
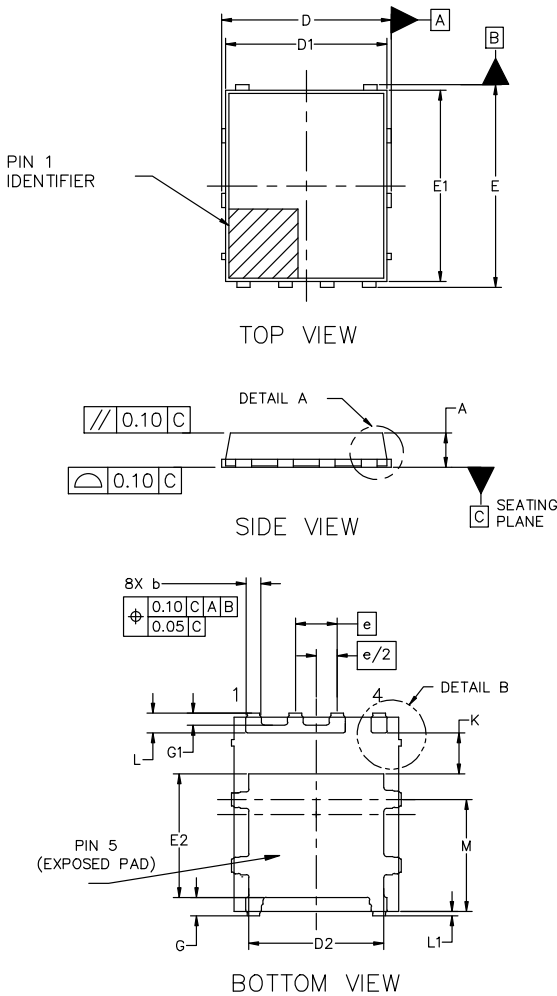


Figure 13. Thermal Response



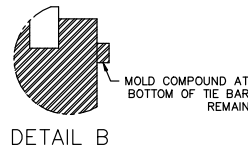
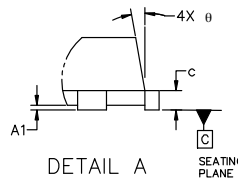
**DFN5 5.00x5.90x1.00, 1.27P**  
CASE 506FA  
ISSUE A

DATE 03 OCT 2024

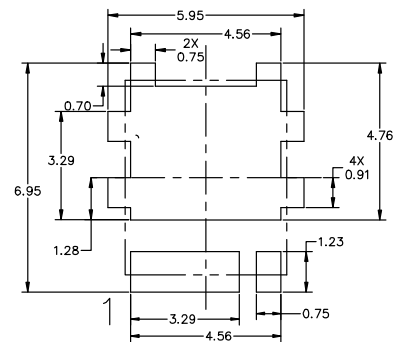


NOTES:

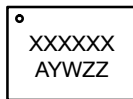
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.



MILLIMETERS			
DIM	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	4.80	5.00	5.20
D2	3.90	4.10	4.30
E	6.00	6.15	6.30
E1	5.70	5.90	6.10
E2	3.55	3.75	3.95
e	1.27 BSC		
G	0.50	0.55	0.70
G1	0.26	0.36	0.46
k	1.10	1.25	1.40
L	0.50	0.60	0.70
L1	0.150 REF		
M	3.00	3.40	3.80
theta	0°	---	12°



**GENERIC MARKING DIAGRAM\***



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

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

RECOMMENDED MOUNTING FOOTPRINT

\*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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