

# MOSFET - Power, DUAL COOL<sup>®</sup> N-Channel, DFN8 5x6 60 V, 1.5 mΩ, 235 A NTMFSC1D6N06CL

## Features

- Advanced Dual-sided Cooled Packaging
- Ultra Low R<sub>DS(on)</sub>
- MSL1 Robust Packaging Design

## Typical Applications

- Orring FET/Load Switching
- Synchronous Rectifier
- DC-DC Conversion

## 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> (Note 2)	Steady State	T <sub>C</sub> = 25°C	I <sub>D</sub>	235	A
			P <sub>D</sub>	166	W
Continuous Drain Current R <sub>θJA</sub> (Notes 1, 2)	Steady State	T <sub>A</sub> = 25°C	I <sub>D</sub>	36	A
			P <sub>D</sub>	3.8	W
Pulsed Drain Current	T <sub>A</sub> = 25°C, t <sub>p</sub> = 10 μs		I <sub>DM</sub>	900	A
Operating Junction and Storage Temperature Range			T <sub>J</sub> , T <sub>stg</sub>	-55 to +175	°C
Source Current (Body Diode)			I <sub>S</sub>	164	A
Single Pulse Drain-to-Source Avalanche Energy (I <sub>L(pk)</sub> = 17 A)			E <sub>AS</sub>	451	mJ
Lead Temperature Soldering Reflow for Soldering Purposes (1/8" from case for 10 s)			T <sub>L</sub>	300	°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.

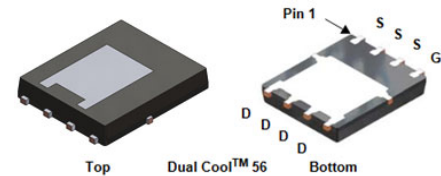
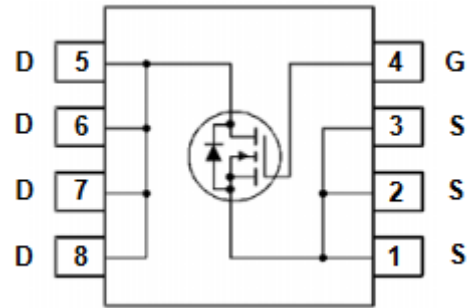
## THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case - Steady State (Note 2)	R <sub>θJC</sub>	0.9	°C/W
Junction-to-Top Source - Steady State (Note 2)	R <sub>θJC</sub>	1.4	
Junction-to-Ambient - Steady State (Note 2)	R <sub>θJA</sub>	39	

1. Surface-mounted on FR4 board using a 1 in<sup>2</sup> pad size, 1 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.

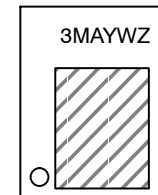
V <sub>(BR)DSS</sub>	R <sub>DS(ON) MAX</sub>	I <sub>D MAX</sub>
60 V	1.5 mΩ @ 10 V	235 A
	2.3 mΩ @ 4.5 V	

## N-Channel MOSFET



DFN8 5x6  
CASE 506EG

## MARKING DIAGRAM



- 3M = Specific Device Code
- A = Assembly Location
- Y = Year
- W = Work Week
- Z = Assembly Lot Code

## ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

# NTMFSC1D6N06CL

## 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	$V_{(BR)DSS}/T_J$	$I_D = 250\ \mu\text{A}$ , ref to $25^\circ\text{C}$		12.7		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	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		100	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$			100	nA

## ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	1.2		2.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$	$I_D = 250\ \mu\text{A}$ , ref to $25^\circ\text{C}$		-5.8		mV/ $^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 50\text{ A}$	1.25	1.5	$\text{m}\Omega$
		$V_{GS} = 4.5\text{ V}$	$I_D = 50\text{ A}$	1.65	2.3	
Gate-Resistance	$R_G$	$T_A = 25^\circ\text{C}$		2		$\Omega$

## CHARGES & CAPACITANCES

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 25\text{ V}$		6660		$\text{pF}$
Output Capacitance	$C_{OSS}$			3000		
Reverse Transfer Capacitance	$C_{RSS}$			45		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 30\text{ V}, I_D = 50\text{ A}$		41		$\text{nC}$
Total Gate Charge	$Q_{G(TOT)}$			91		
Gate-to-Source Charge	$Q_{GS}$			17		
Gate-to-Drain Charge	$Q_{GD}$			9		
Plateau Voltage	$V_{GP}$			2.9		

## SWITCHING CHARACTERISTICS (Note 3)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 10\text{ V}, V_{DS} = 48\text{ V}, I_D = 50\text{ A}, R_G = 1\ \Omega$		14.5		ns
Rise Time	$t_r$			55.6		
Turn-Off Delay Time	$t_{d(OFF)}$			47.5		
Fall Time	$t_f$			14.1		

## DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 50\text{ A}$	$T_J = 25^\circ\text{C}$		0.78	1.2	V
			$T_J = 125^\circ\text{C}$		0.66		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, di_S/dt = 100\text{ A}/\mu\text{s}, I_S = 50\text{ A}$			76		ns
Reverse Recovery Charge	$Q_{RR}$				130		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.

3. Switching characteristics are independent of operating junction temperatures.

# NTMFSC1D6N06CL

## TYPICAL CHARACTERISTICS

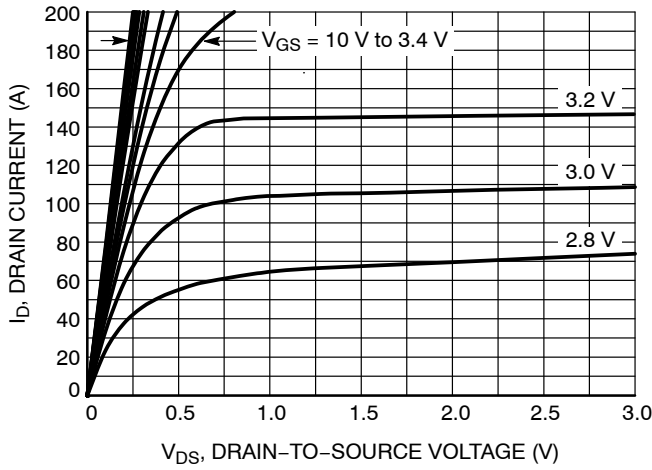


Figure 1. On-Region Characteristics



Figure 2. Transfer Characteristics

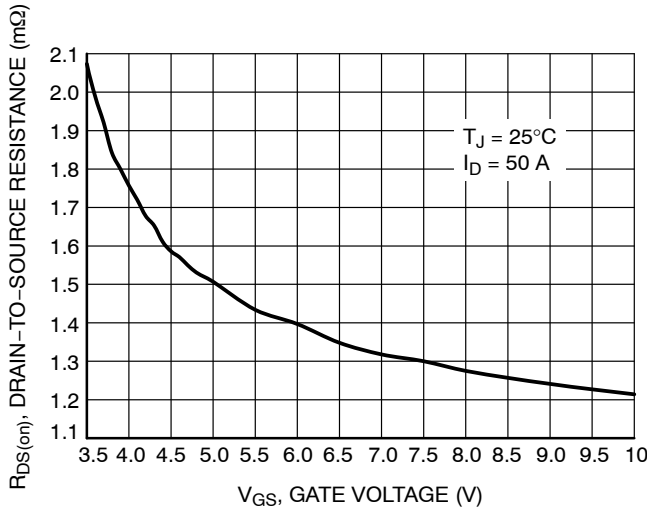


Figure 3. On-Resistance vs. Gate-to-Source Voltage

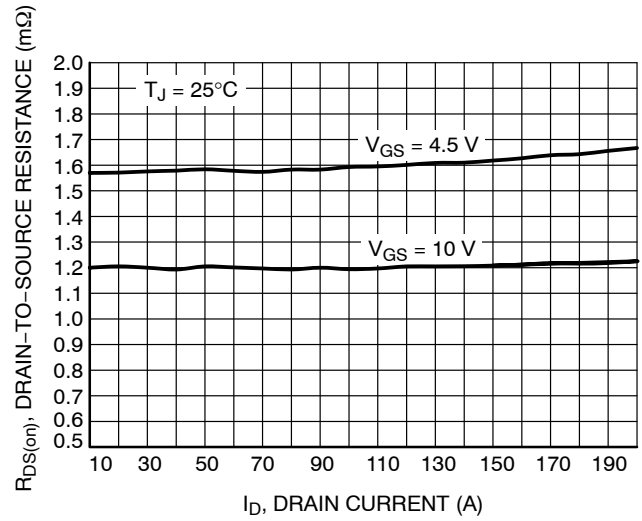


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

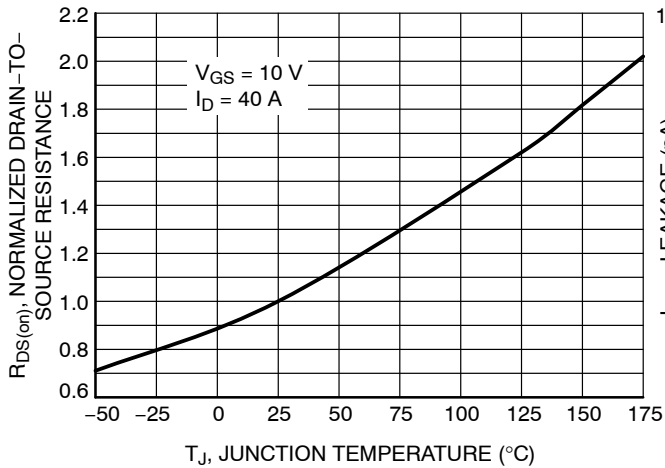


Figure 5. On-Resistance Variation with Temperature

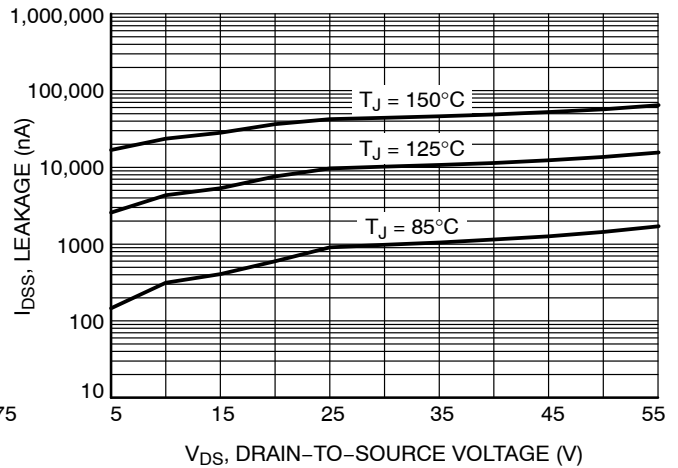


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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## TYPICAL CHARACTERISTICS



Figure 7. Capacitance Variation

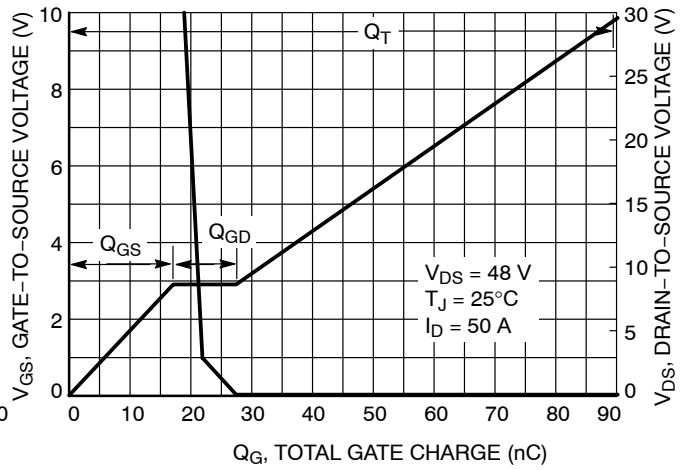


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

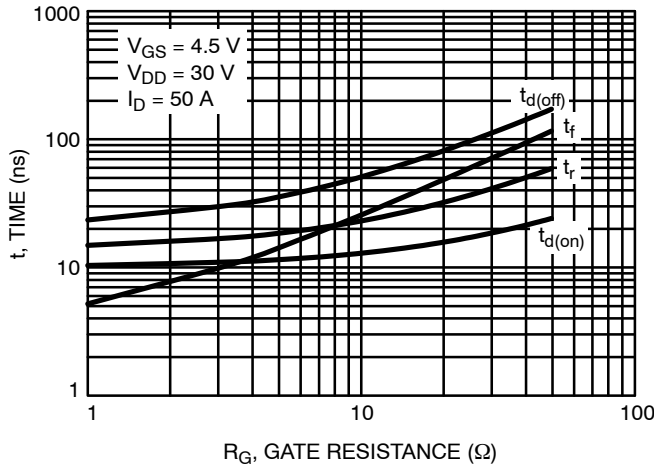


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

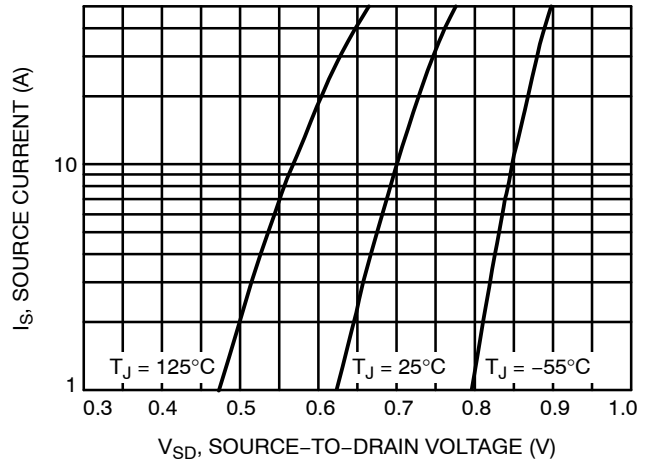


Figure 10. Diode Forward Voltage vs. Current

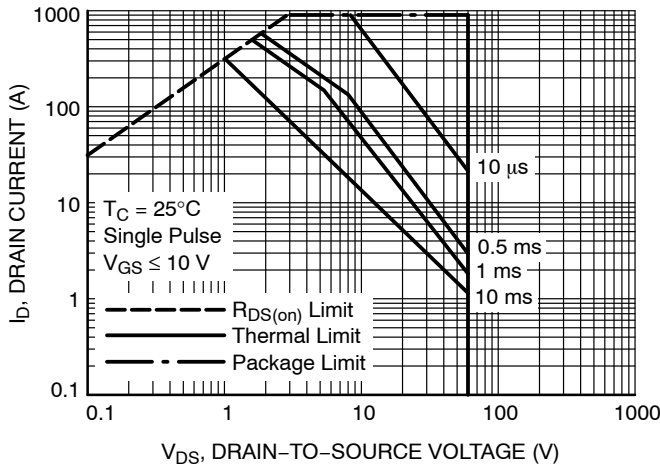


Figure 11. Safe Operating Area

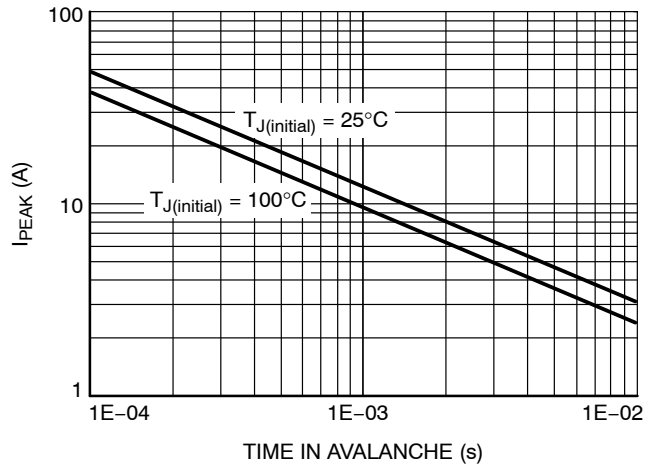
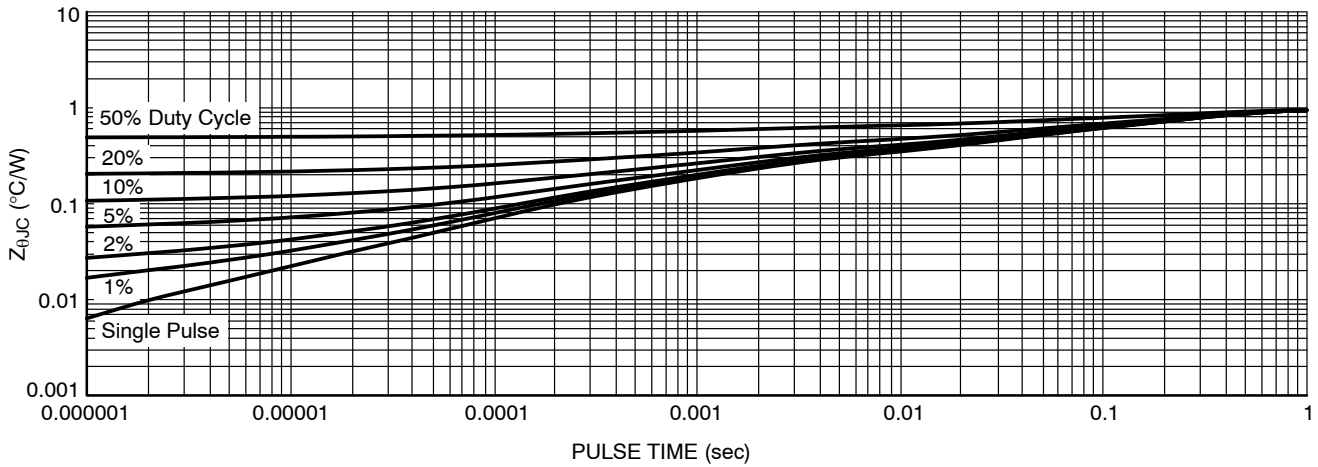


Figure 12.  $I_{PEAK}$  vs. Time in Avalanche

# NTMFSC1D6N06CL

## TYPICAL CHARACTERISTICS



**Figure 13. Thermal Characteristics**

### ORDERING INFORMATION

Device	Device Marking	Package	Shipping <sup>†</sup>
NTMFSC1D6N06CL	612LDC	DFN8 5x6 (Pb-Free/Halogen Free)	3000 / 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.

# MECHANICAL CASE OUTLINE

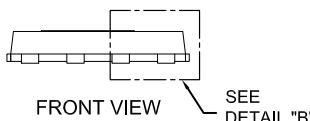
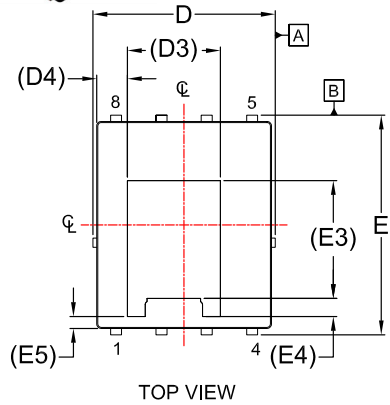
## PACKAGE DIMENSIONS

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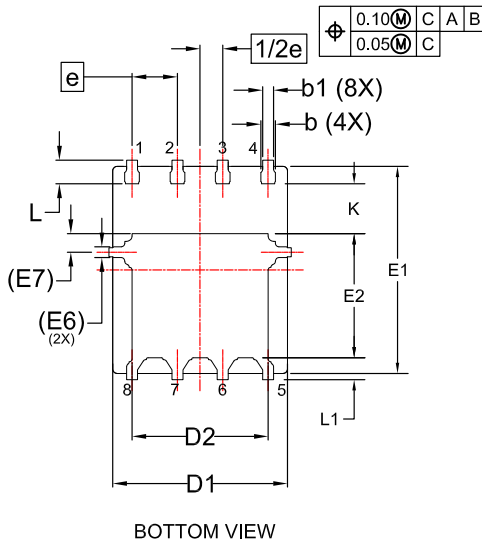
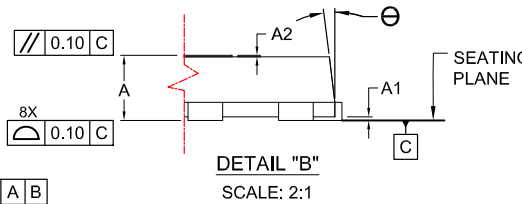
### DFN8 5x6.15, 1.27P, DUAL COOL CASE 506EG ISSUE D

DATE 25 AUG 2020



NOTES:

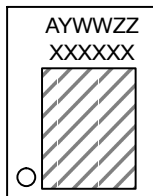
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
5. SEATING PLANE IS DEFINED BY THE TERMINALS. "A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.



\*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.85	0.90	0.95
A1	-	-	0.05
A2	-	-	0.05
b	0.31	0.41	0.51
b1	0.21	0.31	0.41
c	0.20	0.25	0.30
D	4.90	5.00	5.10
D1	4.80	4.90	5.00
D2	3.67	3.82	3.97
D3	2.60 REF		
D4	0.86 REF		
E	6.05	6.15	6.25
E1	5.70	5.80	5.90
E2	3.38	3.48	3.58
E3	3.30 REF		
E4	0.50 REF		
E5	0.34 REF		
E6	0.30 REF		
E7	0.52 REF		
e	1.27 BSC		
1/2e	0.635 BSC		
K	1.30	1.40	1.50
L	0.56	0.66	0.76
L1	0.52	0.62	0.72
θ	0°	---	12°

### GENERIC MARKING DIAGRAM\*



XXXX = Specific Device Code  
 A = Assembly Location  
 Y = Year  
 WW = 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 "•", may or may not be present. Some products may not follow the Generic Marking.

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