

MOSFET – Power Trench, N-Channel, Shielded Gate

100 V, 78 A, 7.2 mΩ

NTMFS10N7D2C

General Description

This N-Channel MV MOSFET is produced using onsemi’s advanced PowerTrench® process that incorporates Shielded Gate technology. This process has been optimized to minimize on-state resistance and yet maintain superior switching performance with best in class soft body diode.

Features

- Shielded Gate MOSFET Technology
- Max $r_{DS(on)}$ = 7.2 mΩ at $V_{GS} = 10\text{ V}$, $I_D = 28\text{ A}$
- Max $r_{DS(on)}$ = 23.4 mΩ at $V_{GS} = 6\text{ V}$, $I_D = 14\text{ A}$
- 50% Lower Q_{rr} than Other MOSFET Suppliers
- Lowers Switching Noise/EMI
- MSL1 Robust Package Design
- 100% UIL Tested
- These Devices are Pb-Free and are RoHS Compliant

Applications

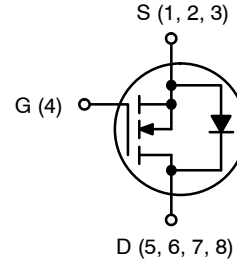
- Primary DC-DC MOSFET
- Synchronous Rectifier in DC-DC and AC-DC
- Motor Drive
- Solar

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

Symbol	Parameter	Value	Unit
V_{DS}	Drain to Source Voltage	100	V
V_{GS}	Gate to Source Voltage	±20	V
I_D	Drain Current: Continuous, $T_C = 25^\circ\text{C}$ (Note 5) Continuous, $T_C = 100^\circ\text{C}$ (Note 5) Continuous, $T_A = 25^\circ\text{C}$ (Note 1a) Pulsed (Note 4)	78 49 13 364	A
E_{AS}	Single Pulse Avalanche Energy (Note 3)	216	mJ
P_D	Power Dissipation: $T_C = 25^\circ\text{C}$ $T_A = 25^\circ\text{C}$ (Note 1a)	83 2.5	W
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +150	°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.

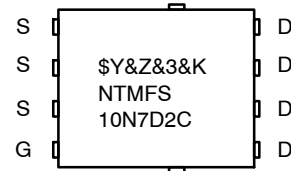
V_{DS}	$R_{DS(ON)}$ MAX	I_D MAX
100 V	7.2 mΩ @ 10 V	78 A
	23.4 mΩ @ 6 V	



N-CHANNEL MOSFET



MARKING DIAGRAM



\$Y = onsemi Logo
&Z = Assembly Plant Code
&3 = Numeric Date Code
&K = Lot Code
NTMFS10N7D2C = Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

NTMFS10N7D2C

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	50	

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

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 250 \mu\text{A}, V_{GS} = 0 \text{ V}$	100			V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$, referenced to 25°C		56		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 80 \text{ V}, V_{GS} = 0 \text{ V}$			1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$			100	nA

ON CHARACTERISTICS

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 150 \mu\text{A}$	2.0	3.2	4.0	V
$\Delta V_{GS(th)} / \Delta T_J$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 150 \mu\text{A}$, referenced to 25°C		-9		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 28 \text{ A}$		5.9	7.2	m Ω
		$V_{GS} = 6 \text{ V}, I_D = 14 \text{ A}$		9.3	23.4	
		$V_{GS} = 10 \text{ V}, I_D = 28 \text{ A}, T_J = 125^\circ\text{C}$		9.9	14.5	
g_{FS}	Forward Transconductance	$V_{DS} = 5 \text{ V}, I_D = 28 \text{ A}$		63		S

DYNAMIC CHARACTERISTICS

C_{iss}	Input Capacitance	$V_{DS} = 50 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$		1880	3165	pF
C_{oss}	Output Capacitance			1105	1860	pF
C_{rss}	Reverse Transfer Capacitance			13	30	pF
R_g	Gate Resistance		0.1	0.5	1.2	Ω

SWITCHING CHARACTERISTICS

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 50 \text{ V}, I_D = 28 \text{ A}, V_{GS} = 10 \text{ V}, R_{GEN} = 6 \Omega$		13	24	ns
t_r	Rise Time			4	10	ns
$t_{d(off)}$	Turn-Off Delay Time			18	33	ns
t_f	Fall Time			4	10	ns
Q_g	Total Gate Charge	$V_{GS} = 0 \text{ V to } 10 \text{ V}, V_{DD} = 50 \text{ V}, I_D = 28 \text{ A}$		26	44	nC
		$V_{GS} = 0 \text{ V to } 6 \text{ V}, V_{DD} = 50 \text{ V}, I_D = 28 \text{ A}$		17	28	nC
Q_{gs}	Gate to Source Charge	$V_{DD} = 50 \text{ V}, I_D = 28 \text{ A}$		8.2		nC
Q_{gd}	Gate to Drain "Miller" Charge	$V_{DD} = 50 \text{ V}, I_D = 28 \text{ A}$		5.1		nC
Q_{oss}	Output Charge	$V_{DD} = 50 \text{ V}, V_{GS} = 0 \text{ V}$		73		nC

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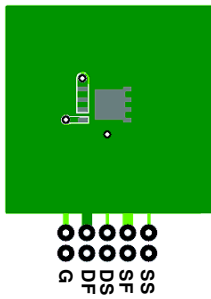
ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise noted) (continued)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
DRAIN-SOURCE DIODE CHARACTERISTICS						
V_{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 2.1\text{ A}$ (Note 2)		0.7	1.2	V
		$V_{GS} = 0\text{ V}, I_S = 28\text{ A}$ (Note 2)		0.8	1.3	
t_{rr}	Reverse Recovery Time	$I_F = 14\text{ A}, di/dt = 300\text{ A}/\mu\text{s}$		28	45	ns
Q_{rr}	Reverse Recovery Charge			52	84	nC
t_{rr}	Reverse Recovery Time	$I_F = 14\text{ A}, di/dt = 1000\text{ A}/\mu\text{s}$		22	36	ns
Q_{rr}	Reverse Recovery Charge			116	186	nC

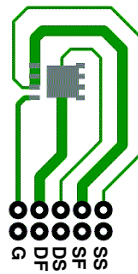
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

NOTES:

- $R_{\theta JA}$ is determined with the device mounted on a 1 in² pad 2 oz copper pad on a 1.5 × 1.5 in. board of FR-4 material. $R_{\theta CA}$ is determined by the user's board design.



- a) 50°C/W when mounted on a 1 in² pad of 2 oz copper.



- b) 125°C/W when mounted on a minimum pad of 2 oz copper.

- Pulse Test: Pulse Width < 300 μs , Duty cycle < 2.0%.
- E_{AS} of 216 mJ is based on starting $T_J = 25^\circ\text{C}$; N-ch: $L = 3\text{ mH}$, $I_{AS} = 12\text{ A}$, $V_{DD} = 100\text{ V}$, $V_{GS} = 10\text{ V}$. 100% test at $L = 0.1\text{ mH}$, $I_{AS} = 38\text{ A}$.
- Pulsed I_d please refer to Figure 11 SOA graph for more details.
- Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro-mechanical application board design.

PACKAGE MARKING AND ORDERING INFORMATION

Device	Marking	Package	Reel Size	Tape Width [†]	Quantity
NTMFS10N7D2C	NTMFS10N7D2C	Power 56 (PQFN8) (Pb-Free / Halogen Free)	13"	12 mm	3000 units

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TYPICAL CHARACTERISTICS

($T_J = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED)

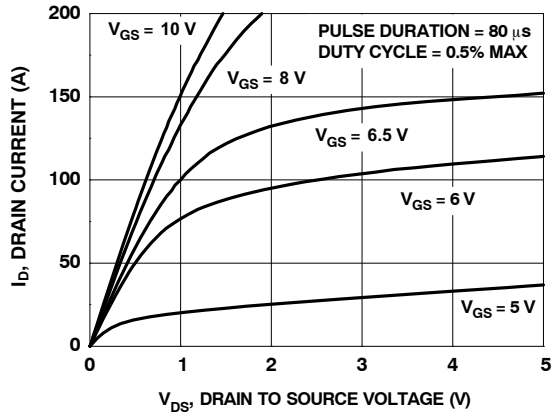


Figure 1. On Region Characteristics

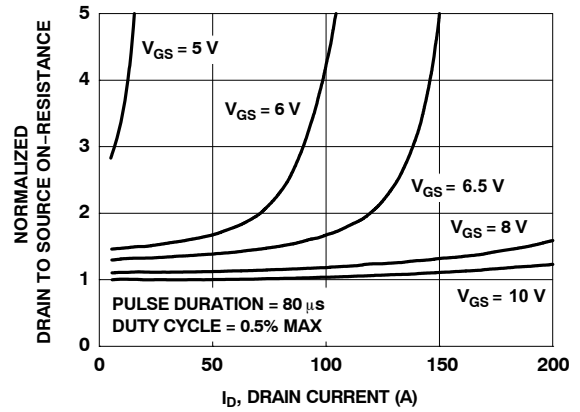


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

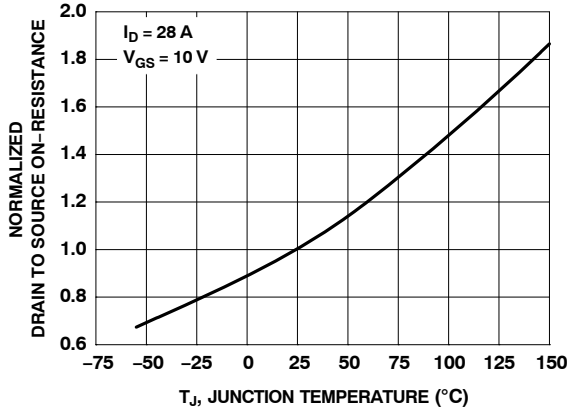


Figure 3. Normalized On-Resistance vs. Junction Temperature

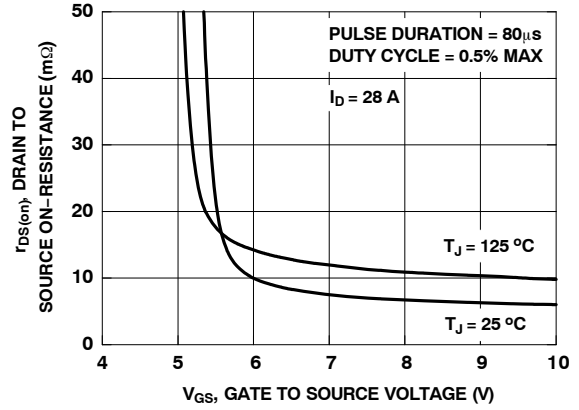


Figure 4. On-Resistance vs. Gate to Source Voltage

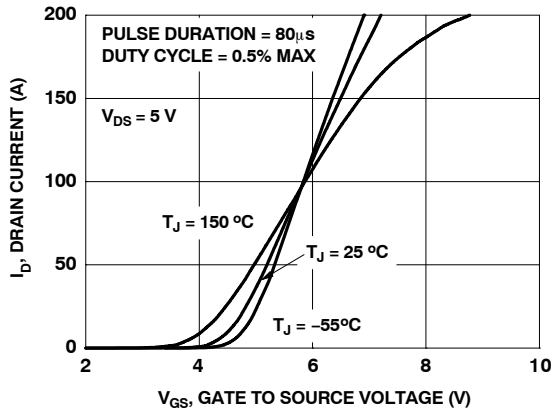


Figure 5. Transfer Characteristics

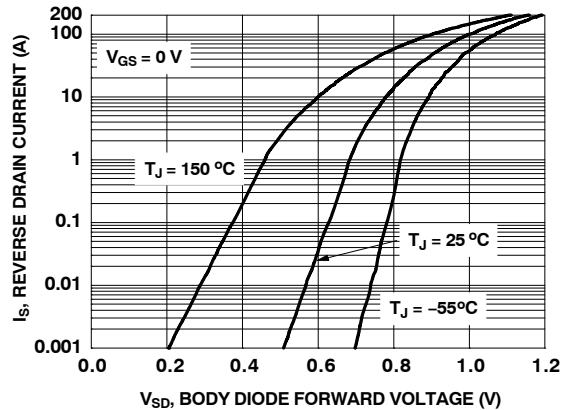


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

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TYPICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED)

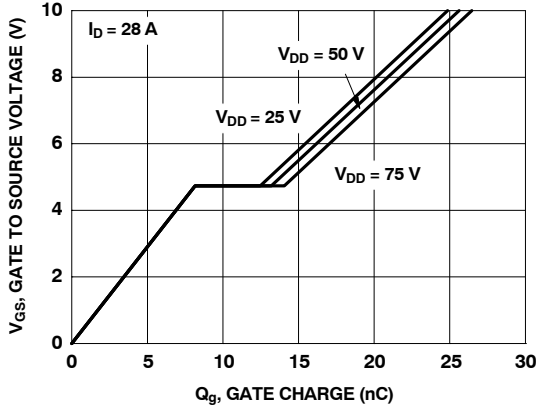


Figure 7. Gate Charge Characteristics

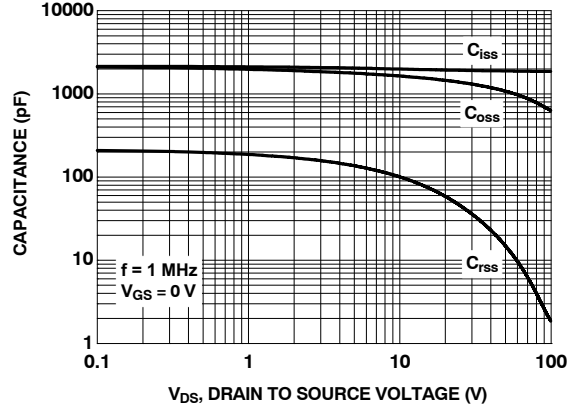


Figure 8. Capacitance vs. Drain to Source Voltage

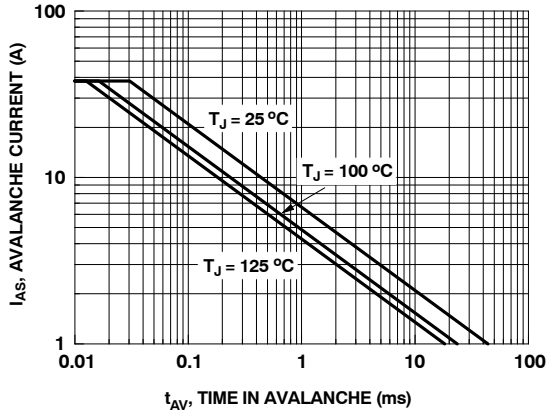


Figure 9. Unclamped Inductive Switching Capability

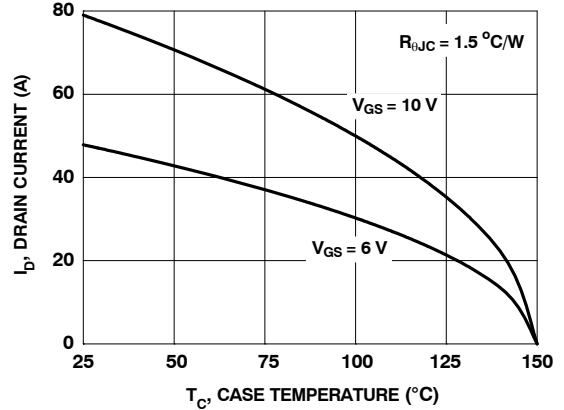


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

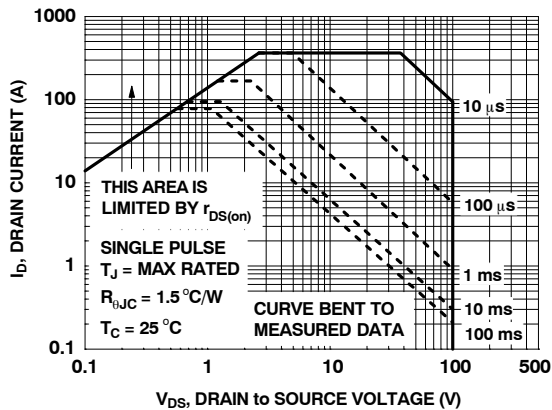


Figure 11. Forward Bias Safe Operating Area

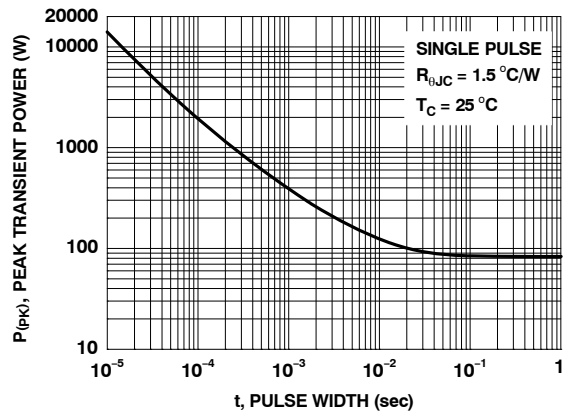


Figure 12. Single Pulse Maximum Power Dissipation

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TYPICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED)

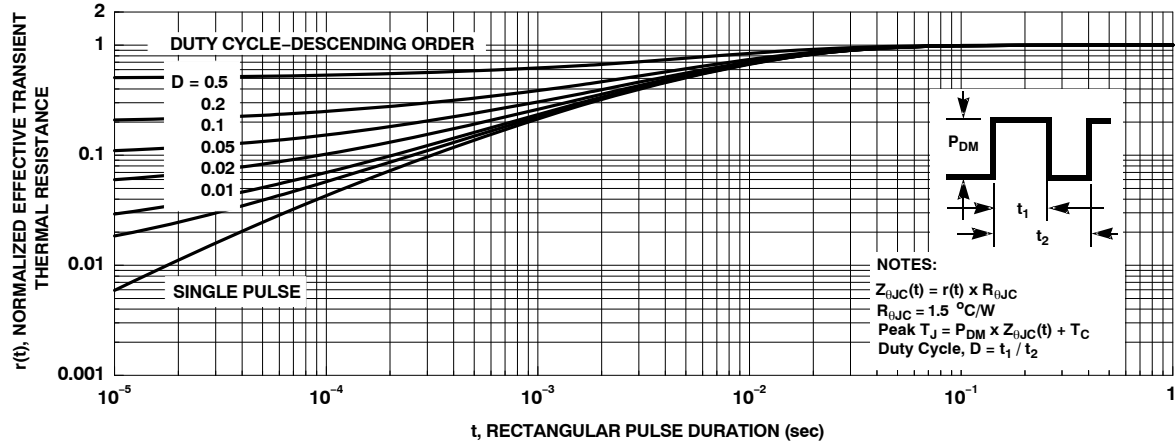
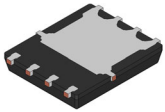


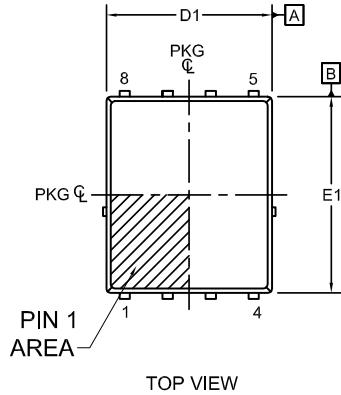
Figure 13. Junction-to-Case Transient Thermal Response Curve

MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



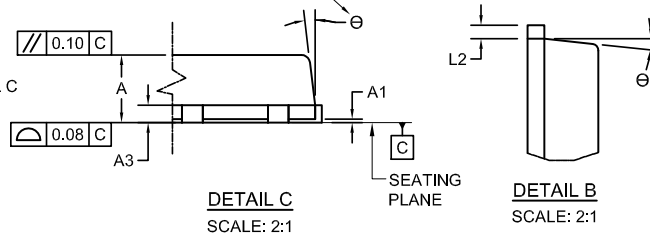
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CASE 483AE
ISSUE C

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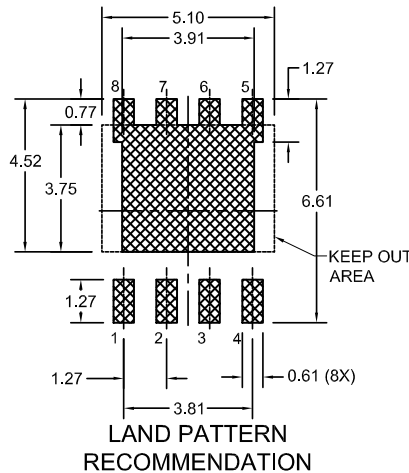
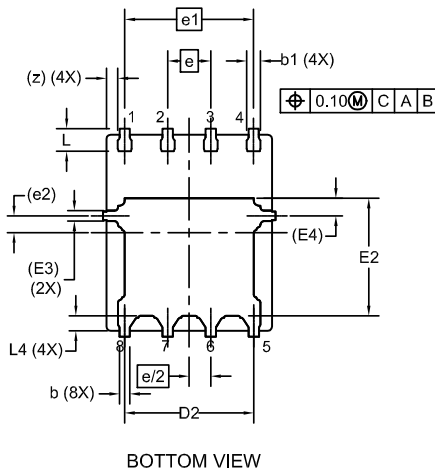


NOTES:

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.
6. IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.



DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0.00	-	0.05
b	0.21	0.31	0.41
b1	0.31	0.41	0.51
A3	0.15	0.25	0.35
D	4.90	5.00	5.20
D1	4.80	4.90	5.00
D2	3.61	3.82	3.96
E	5.90	6.15	6.25
E1	5.70	5.80	5.90
E2	3.38	3.48	3.78
E3	0.30 REF		
E4	0.52 REF		
e	1.27 BSC		
e/2	0.635 BSC		
e1	3.81 BSC		
e2	0.50 REF		
L	0.51	0.66	0.76
L2	0.05	0.18	0.30
L4	0.34	0.44	0.54
z	0.34 REF		
θ	0°	-	12°



*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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