

MOSFET - Power, Single N-Channel, SUPERFET[®], with Zener Diode, DPAK

600 V, 280 mΩ, 13 A

NTD280N60S5Z

Description

SUPERFET V MOSFET Easy Drive series combines excellent switching performance without sacrificing ease of use and EMI issues for both hard and soft switching topologies.

Features

- 650 V @ $T_J = 150^\circ\text{C}$, Typ.
- $R_{DS(on)} = 224\text{ m}\Omega$
- 100% Avalanche Tested
- Pb-Free, Halogen Free / BFR Free and are RoHS Compliant

Applications

- Computing / Display Power Supplies
- Telecom / Server Power Supplies
- Lighting / Charger / Adapter / Industrial Power Supplies

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

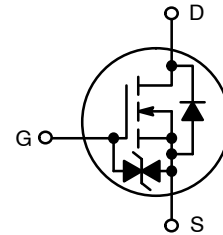
Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DSS}	600	V
Gate-to-Source Voltage	V_{GS}	DC	± 20
		AC ($f > 1\text{ Hz}$)	± 20
Continuous Drain Current	I_D	$T_C = 25^\circ\text{C}$	13
		$T_C = 100^\circ\text{C}$	8
Power Dissipation	$T_C = 25^\circ\text{C}$	P_D	89
Pulsed Drain Current (Note 1)	$T_C = 25^\circ\text{C}$	I_{DM}	39
Pulsed Source Current (Body Diode) (Note 1)		I_{SM}	39
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 to +150	$^\circ\text{C}$
Source Current (Body Diode)	I_S	13	A
Single Pulse Avalanche Energy	$I_L = 2.9\text{ A}$ $R_G = 25\ \Omega$	E_{AS}	82
Avalanche Current	I_{AS}	2.9	A
Repetitive Avalanche Energy (Note 1)	E_{AR}	0.89	mJ
MOSFET dv/dt	dv/dt	120	V/ns
Peak Diode Recovery dv/dt (Note 2)		50	
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.

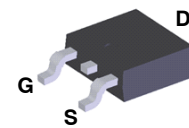
*Drain current limited by maximum junction temperature.

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. $I_{SD} \leq 5.5\text{ A}$, $di/dt \leq 200\text{ A/s}$, $V_{DD} \leq 400\text{ V}$, starting $T_J = 25^\circ\text{C}$.

$V_{(BR)DSS}$	$R_{DS(ON)}\text{ MAX}$	$I_D\text{ MAX}$
600 V	280 mΩ @ $V_{GS} = 10\text{ V}$	13 A



N-CHANNEL MOSFET



DPAK
CASE 369AS

MARKING DIAGRAM



T280N60S5Z = Specific Device Code
 A = Assembly Location
 Y = Year
 WW = Work Week
 ZZ = Lot Code

ORDERING INFORMATION

Device	Package	Shipping [†]
NTD280N60S5Z	DPAK (Pb-Free)	2500 / Tape & Reel

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

NTD280N60S5Z

THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.4	°C/W
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	52	

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}, T_J = 25^\circ\text{C}$	600	-	-	V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$\Delta V_{(BR)DSS} / \Delta T_J$	$I_D = 10\text{ mA}$, Referenced to 25°C	-	630	-	mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 600\text{ V}, T_J = 25^\circ\text{C}$	-	-	1	μA
Gate-to-Source Leakage Current	I_{GSS}	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$	-	-	± 5	μA

ON CHARACTERISTICS

Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 5.5\text{ A}, T_J = 25^\circ\text{C}$	-	224	280	m Ω
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS} = V_{DS}, I_D = 1\text{ mA}, T_J = 25^\circ\text{C}$	2.4	-	4	V
Forward Trans-conductance	g_{FS}	$V_{DS} = 20\text{ V}, I_D = 5.5\text{ A}$	-	10.6	-	S

CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C_{ISS}	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, f = 250\text{ kHz}$	-	978	-	pF
Output Capacitance	C_{OSS}		-	16.8	-	
Time Related Output Capacitance	$C_{OSS(tr)}$	$I_D = \text{Constant}, V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$	-	276	-	
Energy Related Output Capacitance	$C_{OSS(er)}$		$V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$	-	30.5	
Total Gate Charge	$Q_{G(TOT)}$	$V_{DD} = 400\text{ V}, I_D = 5.5\text{ A}, V_{GS} = 10\text{ V}$	-	17.9	-	nC
Gate-to-Source Charge	Q_{GS}		-	4.53	-	
Gate-to-Drain Charge	Q_{GD}		-	4.8	-	
Gate Resistance	R_G		$f = 1\text{ MHz}$	-	5.11	

SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 0/10\text{ V}, V_{DD} = 400\text{ V}, I_D = 5.5\text{ A}, R_G = 12\ \Omega$	-	15.5	-	ns
Rise Time	t_r		-	4.27	-	
Turn-Off Delay Time	$t_{d(OFF)}$		-	52	-	
Fall Time	t_f		-	4.53	-	

SOURCE-TO-DRAIN DIODE CHARACTERISTICS

Forward Diode Voltage	V_{SD}	$I_{SD} = 5.5\text{ A}, V_{GS} = 0\text{ V}, T_J = 25^\circ\text{C}$	-	-	1.2	V
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}, I_{SD} = 5.5\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, V_{DD} = 400\text{ V}$	-	229	-	ns
Reverse Recovery Charge	Q_{RR}		-	2114	-	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.

NTD280N60S5Z

TYPICAL CHARACTERISTICS

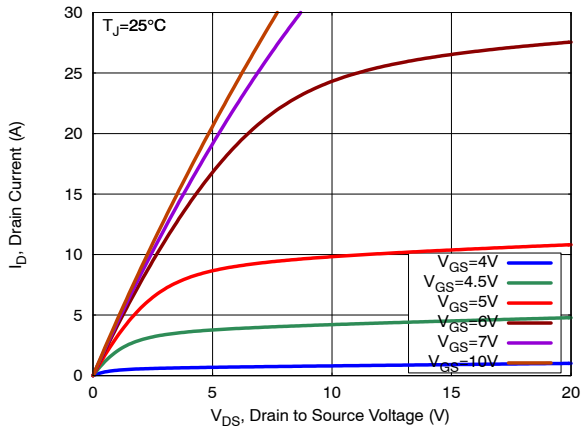


Figure 1. On-Region Characteristics

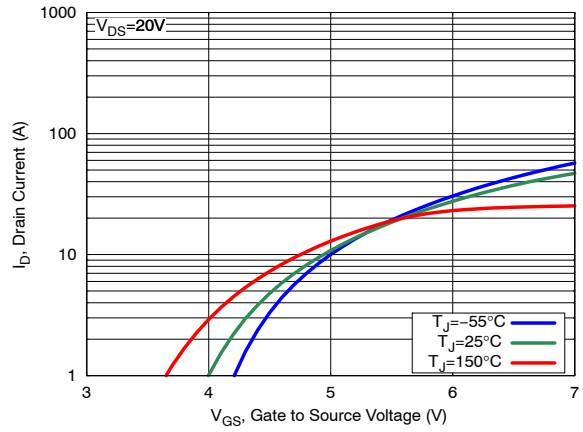


Figure 2. Transfer Characteristics

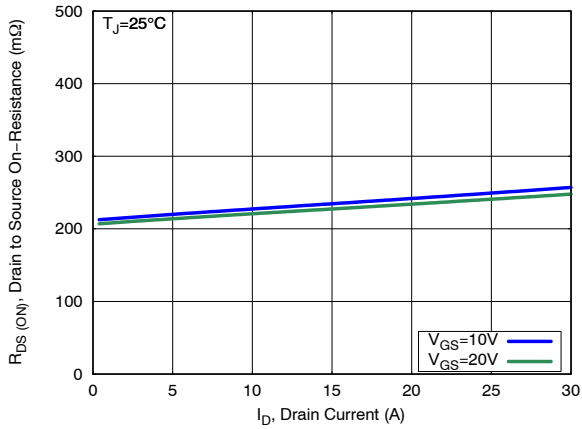


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

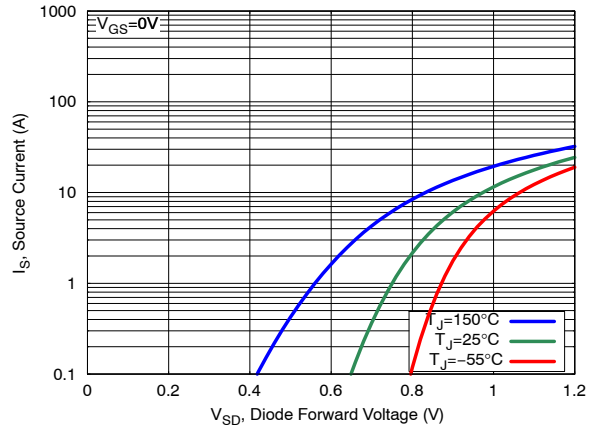


Figure 4. Diode Forward Voltage vs. Source Current

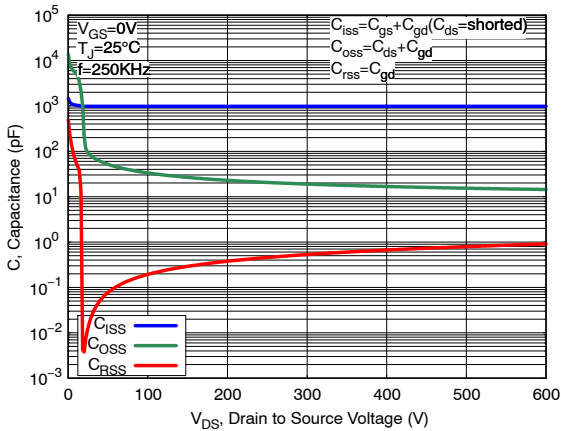


Figure 5. Capacitance Characteristics

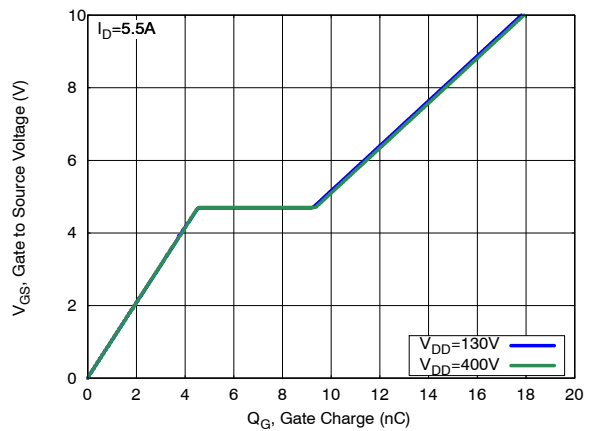


Figure 6. Gate Charge Characteristics

NTD280N60S5Z

TYPICAL CHARACTERISTICS

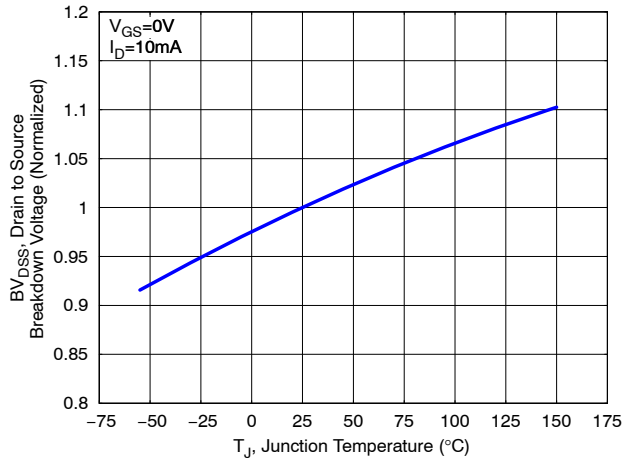


Figure 7. Breakdown Voltage Variation vs. Temperature

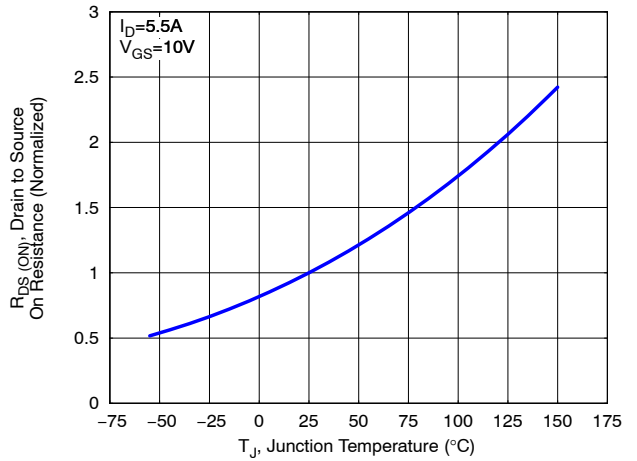


Figure 8. On-Resistance Variation vs. Temperature

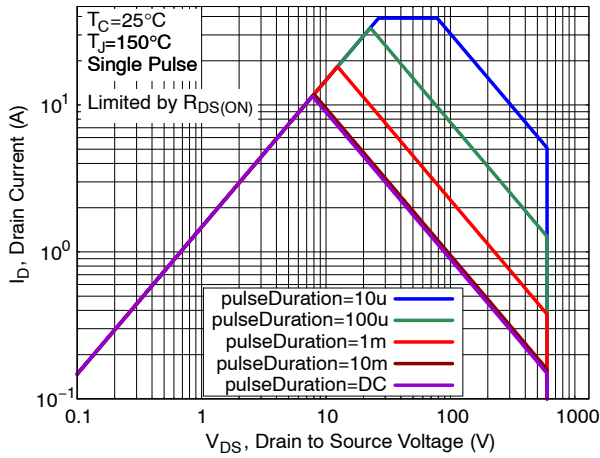


Figure 9. Maximum Safe Operating Area

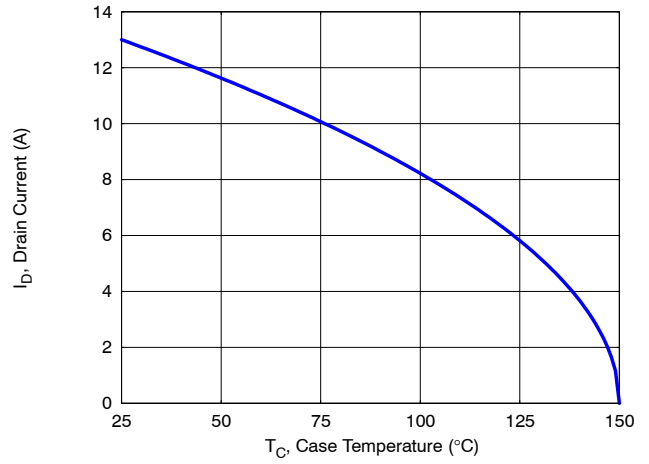


Figure 10. Maximum Drain Current vs. Case Temperature

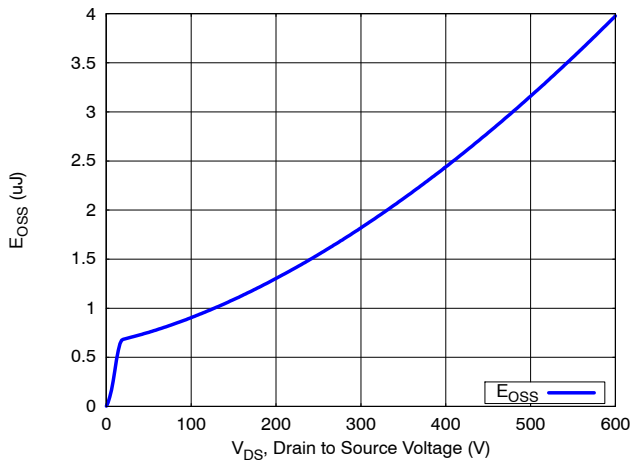


Figure 11. E_{OSS} vs. Drain-to-Source Voltage

NTD280N60S5Z

TYPICAL CHARACTERISTICS

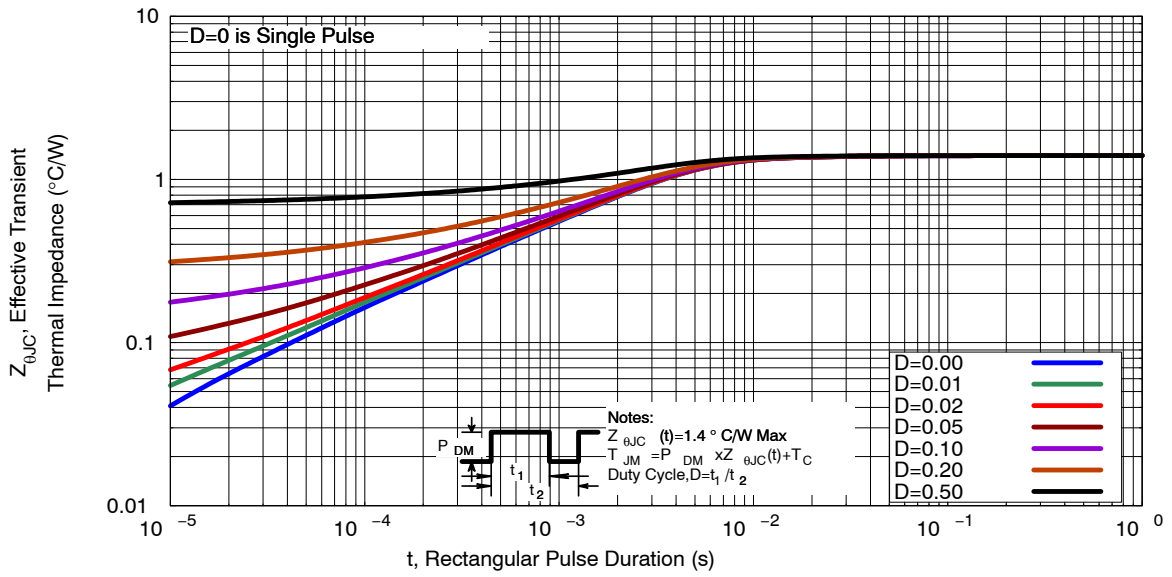
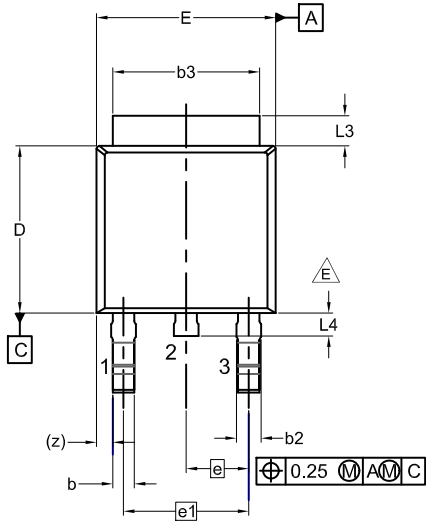


Figure 12. Transient Thermal Impedance

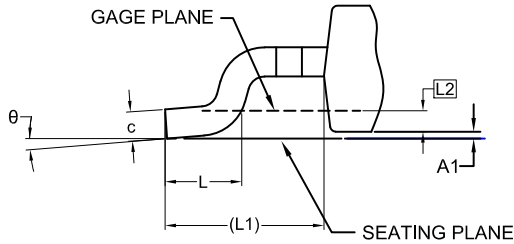
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PACKAGE DIMENSIONS

DPAK3 (TO-252 3 LD) CASE 369AS ISSUE A



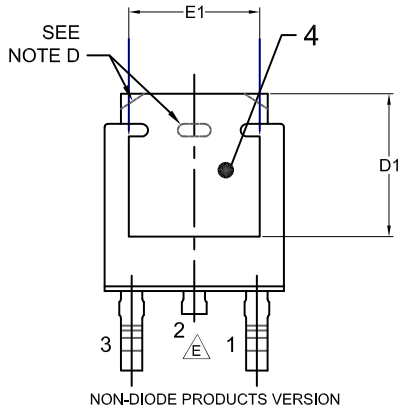
- NOTES: UNLESS OTHERWISE SPECIFIED
- A) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE C, VARIATION AA.
 - B) ALL DIMENSIONS ARE IN MILLIMETERS.
 - C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
 - D) SUPPLIER DEPENDENT MOLD LOCKING HOLES OR CHAMFERED CORNERS OR EDGE PROTRUSION.
 - E) FOR DIODE PRODUCTS, L4 IS 0.25 MM MAX.
 - F) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.
 - G) LAND PATTERN RECOMMENDATION IS BASED ON IPC7351A STD TO228P991X239-3N.



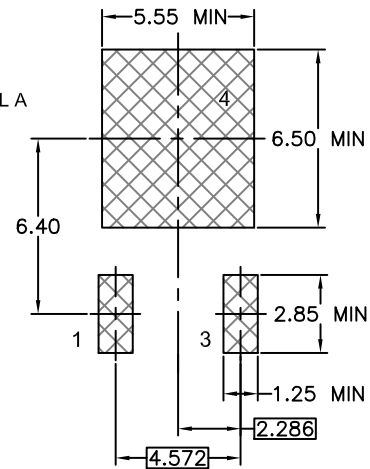
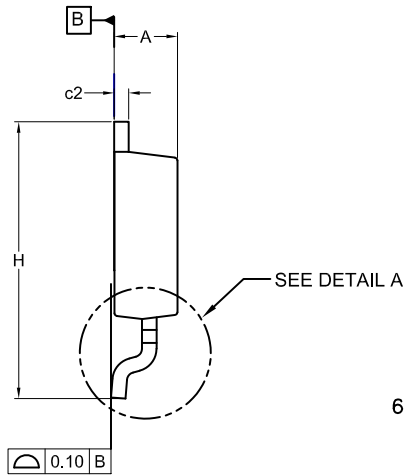
DETAIL A
(ROTATED -90°)
SCALE: 12X

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	2.18	2.29	2.39
A1	0.00	-	0.127
b	0.64	0.77	0.89
b2	0.76	0.95	1.14
b3	5.21	5.34	5.46
c	0.45	0.53	0.61
c2	0.45	0.52	0.58
D	5.97	6.10	6.22
D1	5.21	-	-
E	6.35	6.54	6.73
E1	4.32	-	-
e	2.286 BSC		
e1	4.572 BSC		
H	9.40	9.91	10.41
L	1.40	1.59	1.78
L1	2.90 REF		
L2	0.51 BSC		
L3	0.89	1.08	1.27
L4	-	-	1.02
θ	0°	--	10°

NON-DIODE PRODUCTS VERSION



NON-DIODE PRODUCTS VERSION



LAND PATTERN RECOMMENDATION

*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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[1.5KE47ARL4G](#) [1.5SMC20AT3](#) [1.5SMC24AT3](#) [1.5SMC27AT3](#) [1.5SMC39AT3](#) [1.5SMC47AT3](#) [1.5SMC68AT3](#) [1.5SMC82AT3](#)
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[1N4007RLG](#) [1N4148](#) [1N4148_T26A](#)