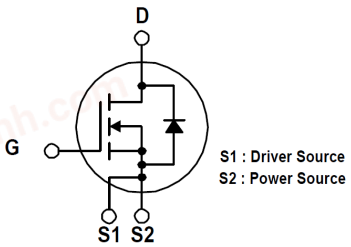
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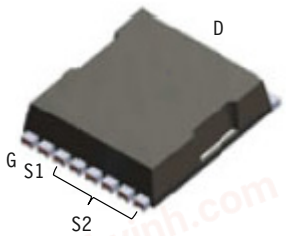
Silicon Carbide (SiC) MOSFET – EliteSiC, 33 mohm, 650 V, M2, TOLL

NTBL045N065SC1

V_{DSS}	$R_{DS(ON)}$ MAX	I_D MAX
650 V	50 mΩ @ 18 V	73 A



N−Channel MOSFET



H−PSOF8L
CASE 100DC

Features

- Typ. $R_{DS(on)}$ = 33 mΩ @ V_{GS} = 18 V
  Typ. $R_{DS(on)}$ = 45 mΩ @ V_{GS} = 15 V
- Ultra Low Gate Charge ($Q_{G(tot)}$ = 105 nC)
- Low Effective Output Capacitance (C_{oss} = 162 pF)
- 100% Avalanche Tested
- T_J = 175°C
- RoHS Compliant

Typical Applications

- SMPS (Switching Mode Power Supplies)
- Solar Inverters
- UPS (Uninterruptable Power Supplies)
- Energy Storage

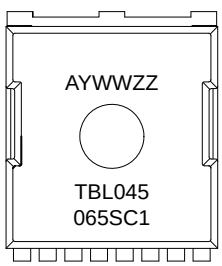
MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	650	V
Gate−to−Source Voltage			V_{GS}	−8/+22	V
Recommended Operation Values of Gate − Source Voltage		T_C < 175°C	V_{GSop}	−5/+18	V
Continuous Drain Current (Note 2)	Steady State	T_C = 25°C	I_D	73	A
Power Dissipation (Note 2)	Steady State	T_C = 25°C	P_D	348	W
Continuous Drain Current (Notes 1, 2)	Steady State	T_C = 100°C	I_D	51	A
Power Dissipation (Notes 1, 2)	Steady State	T_C = 100°C	P_D	174	W
Pulsed Drain Current (Note 3)		T_C = 25°C	I_{DM}	182	A
Operating Junction and Storage Temperature Range			T_J, T_{stg}	−55 to +175	°C
Source Current (Body Diode)			I_S	75	A
Single Pulse Drain−to−Source Avalanche Energy (I_L = 12 A_{pk}, L = 1 mH) (Note 4)			E_{AS}	72	mJ
Maximum Lead Temperature for Soldering, 1/8″ from Case for 10 Seconds			T_L	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.

1. Surface mounted on a FR−4 board using1 in2 pad of 2 oz copper.
2. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
3. Repetitive rating, limited by max junction temperature.
4. E_{AS} of 72 mJ is based on starting T_J = 25°C; L = 1 mH, I_{AS} = 12 A, V_{DD} = 50 V, V_{GS} = 18 V.

MARKING DIAGRAM



A	= Assembly Location
Y	= Year
WW	= Work Week
ZZ	= Assembly Lot Code
TBL045065SC1	= Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

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NTBL045N065SC1

THERMAL CHARACTERISTICS

Parameter	Symbol	Max	Units
Junction−to−Case − Steady State (Note 2)	$R_{\theta JC}$	0.43	°C/W
Junction−to−Ambient − Steady State (Notes 1, 2)	$R_{\theta JA}$	43	°C/W

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise stated)

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
OFF CHARACTERISTICS							
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 1 mA		650			V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	I_D = 20 mA, refer to 25°C			0.15		V/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = 650 V	T_J = 25°C			10	μA
			T_J = 175°C			1	mA
Gate−to−Source Leakage Current	I_{GSS}	V_{GS} = +18/−5 V, V_{DS} = 0 V				250	nA
ON CHARACTERISTICS							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS} , I_D = 8 mA		1.8	2.8	4.3	V
Recommended Gate Voltage	V_{GOP}			−5		+18	V
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = 15 V, I_D = 25 A, T_J = 25°C			45		mΩ
		V_{GS} = 18 V, I_D = 25 A, T_J = 25°C			33	50	
		V_{GS} = 18 V, I_D = 25 A, T_J = 175°C			40		
Forward Transconductance	g_{FS}	V_{DS} = 10 V, I_D = 25 A			16		S
CHARGES, CAPACITANCES & GATE RESISTANCE							
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1 MHz, V_{DS} = 325 V			1870		pF
Output Capacitance	C_{OSS}				162		
Reverse Transfer Capacitance	C_{RSS}				14		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = −5/18 V, V_{DS} = 520 V, I_D = 25 A			105		nC
Gate−to−Source Charge	Q_{GS}				27		
Gate−to−Drain Charge	Q_{GD}				30		
Gate−Resistance	R_G	f = 1 MHz			3.1		Ω
SWITCHING CHARACTERISTICS							
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = −5/18 V, V_{DS} = 400 V, I_D = 25 A, R_G = 2.2 Ω, Inductive Load			13		ns
Rise Time	t_r				14		
Turn−Off Delay Time	$t_{d(OFF)}$				26		
Fall Time	t_f				7		
Turn−On Switching Loss	E_{ON}				47		μJ
Turn−Off Switching Loss	E_{OFF}				33		
Total Switching Loss	E_{TOT}				80		
SOURCE−DRAIN DIODE CHARACTERISTICS							
Continuous Source−Drain Diode Forward Current	I_{SD}	V_{GS} = −5 V, T_J = 25°C				75	A
Pulsed Source−Drain Diode Forward Current (Note 3)	I_{SDM}	V_{GS} = −5 V, T_J = 25°C				182	A
Forward Diode Voltage	V_{SD}	V_{GS} = −5 V, I_{SD} = 25 A, T_J = 25°C			4.4		V

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ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise stated)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
SOURCE−DRAIN DIODE CHARACTERISTICS						
Reverse Recovery Time	t_{RR}	V_{GS} = −5/18 V, I_{SD} = 25 A, dI_S/dt = 1000 A/μs		20		ns
Reverse Recovery Charge	Q_{RR}			108		nC
Reverse Recovery Energy	E_{REC}			4.5		μJ
Peak Reverse Recovery Current	I_{RRM}			11		A
Charge time	Ta			11		ns
Discharge time	Tb			8.5		ns

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.

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TYPICAL CHARACTERISTICS

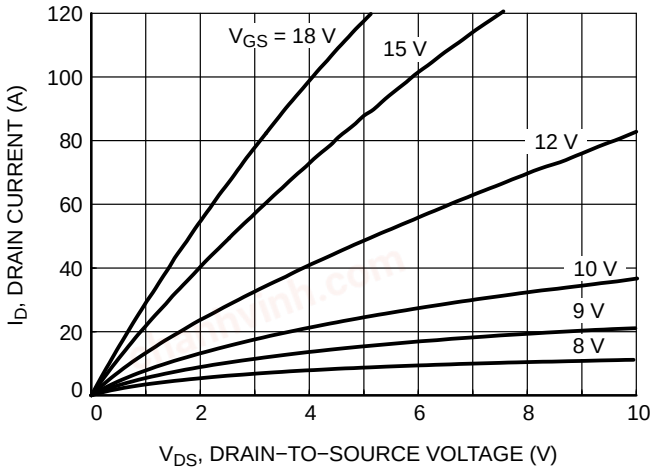


Figure 1. On−Region Characteristics

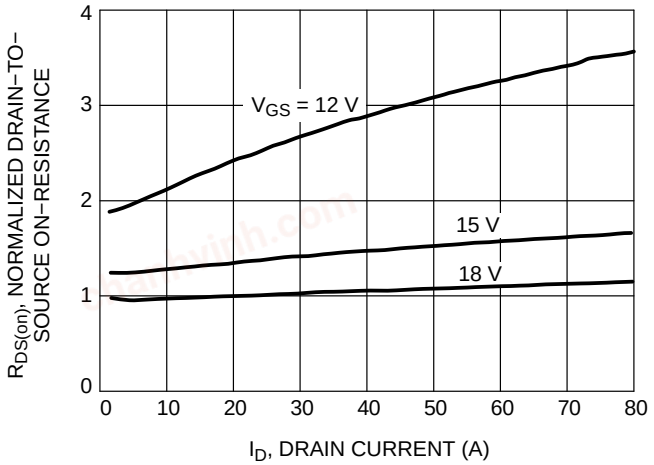


Figure 2. Normalized On−Resistance vs. Drain Current and Gate Voltage

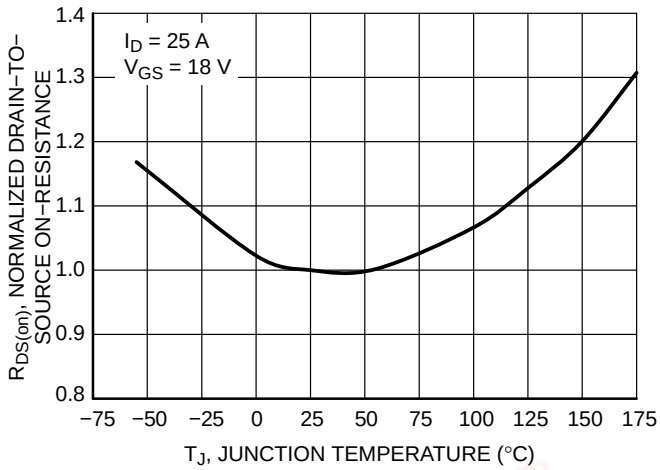


Figure 3. On−Resistance Variation with Temperature

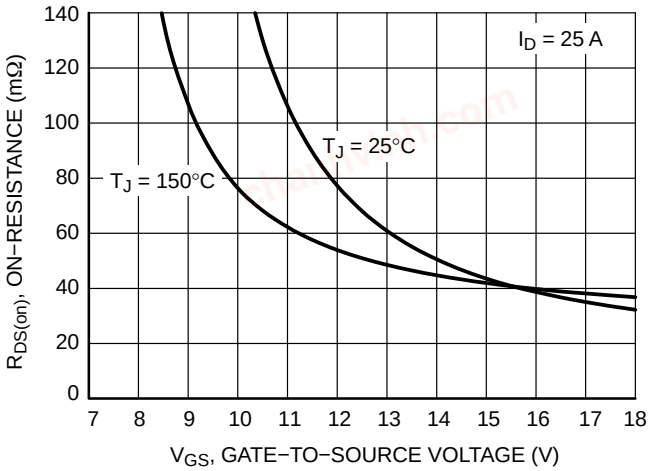


Figure 4. On−Resistance vs. Gate−to−Source Voltage

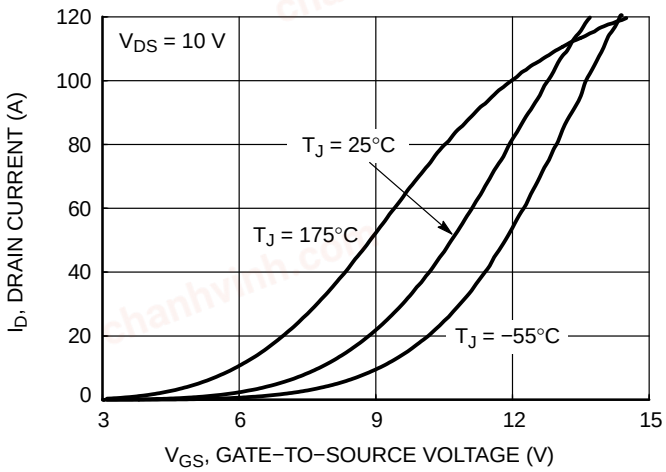


Figure 5. Transfer Characteristics

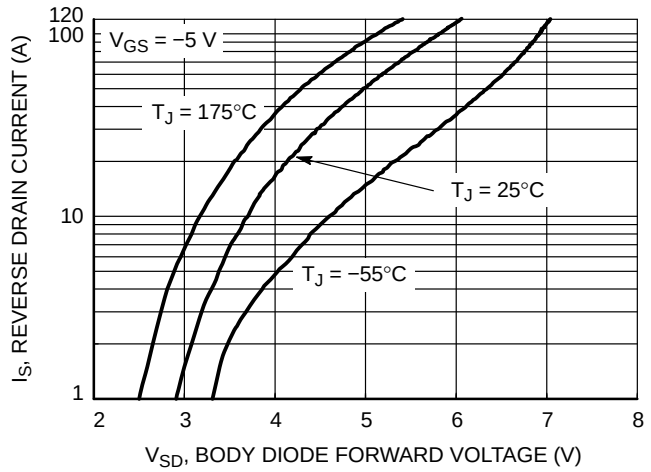


Figure 6. Diode Forward Voltage vs. Current

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TYPICAL CHARACTERISTICS

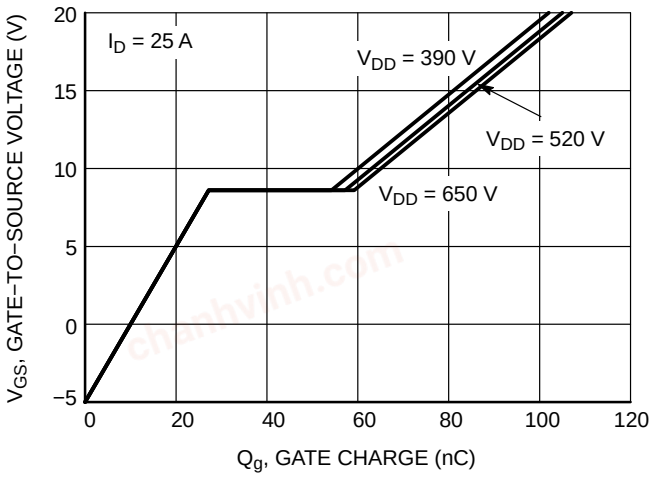


Figure 7. Gate−to−Source Voltage vs. Total Charge

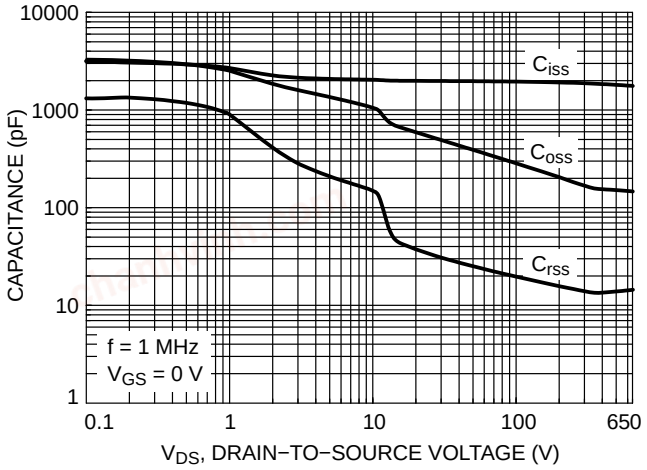


Figure 8. Capacitance vs. Drain−to−Source Voltage

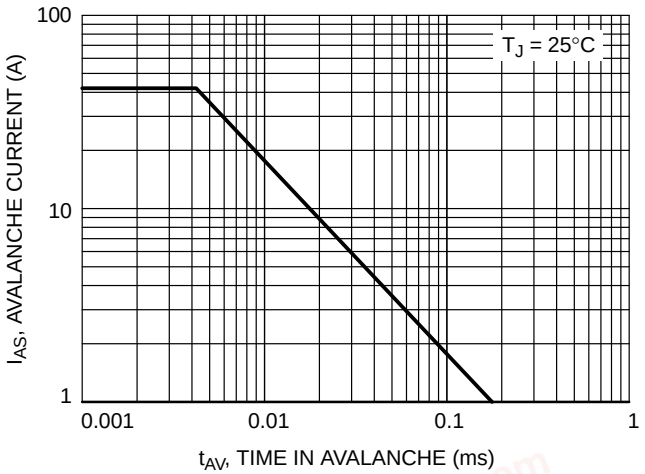


Figure 9. Unclamped Inductive Switching Capability

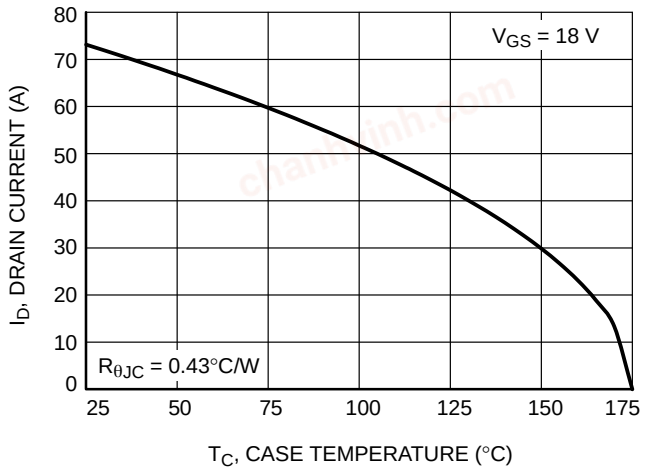


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

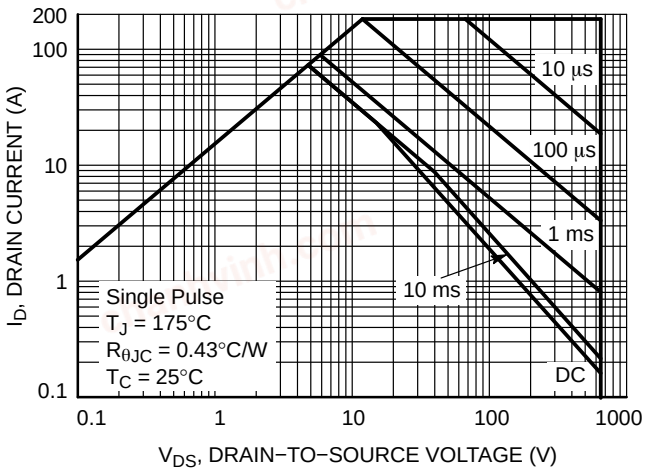


Figure 11. Safe Operating Area

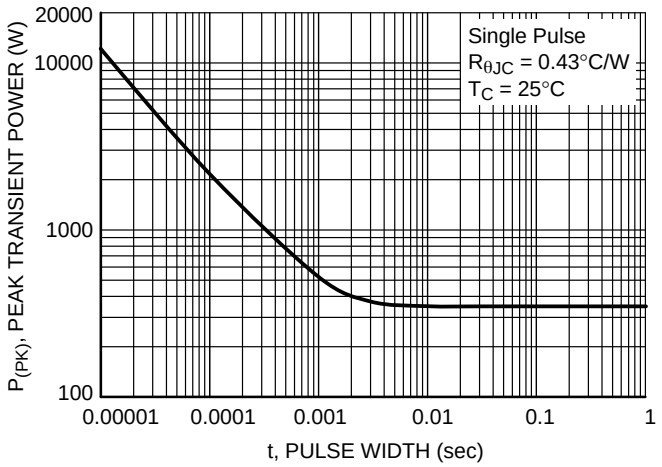


Figure 12. Single Pulse Maximum Power Dissipation

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TYPICAL CHARACTERISTICS

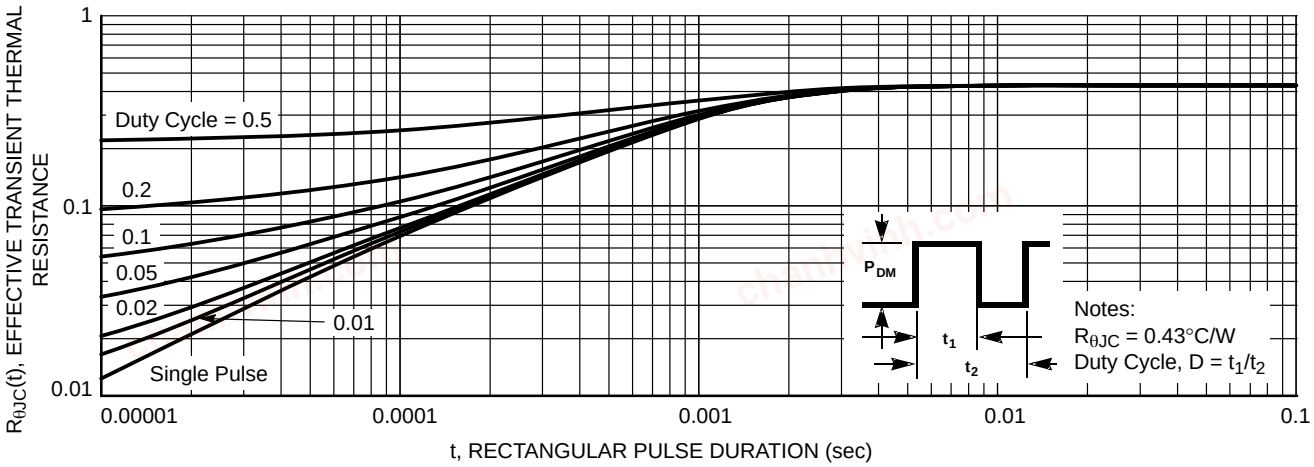


Figure 13. Transient Thermal Impedance

DEVICE ORDERING INFORMATION

Device	Package	Shipping†
NTBL045N065SC1	H−PSOF8L	2000 / Tape & Reel

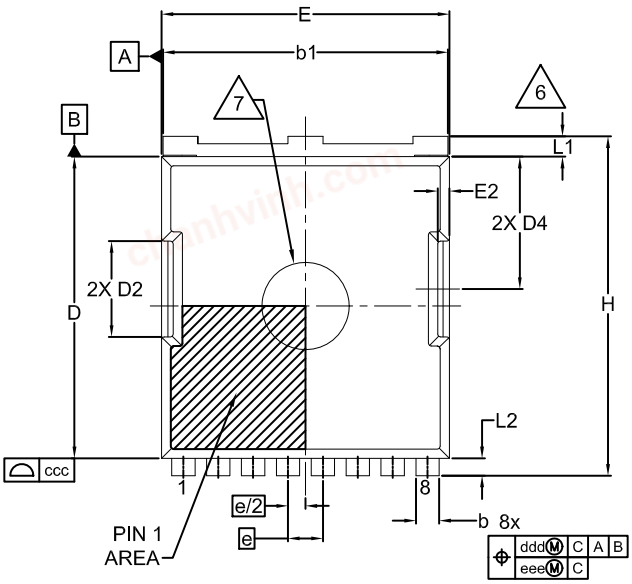
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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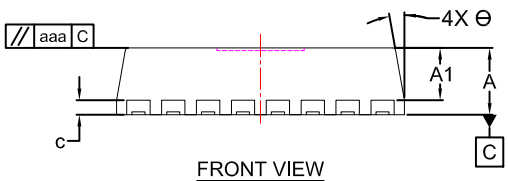
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

H−PSOF8L 9.90x11.68, 1.20P
CASE 100DC
ISSUE O

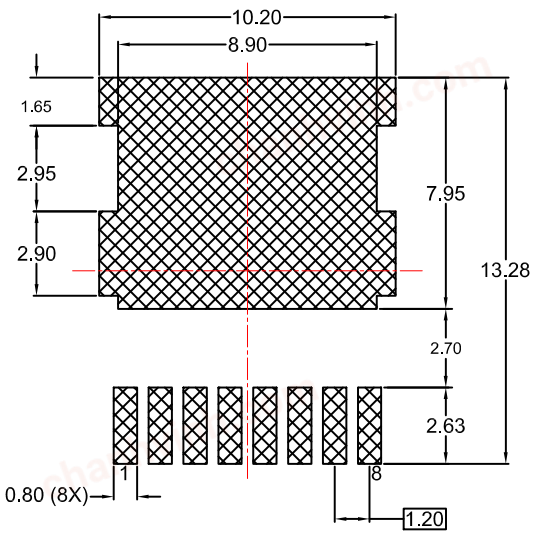
DATE 08 AUG 2018



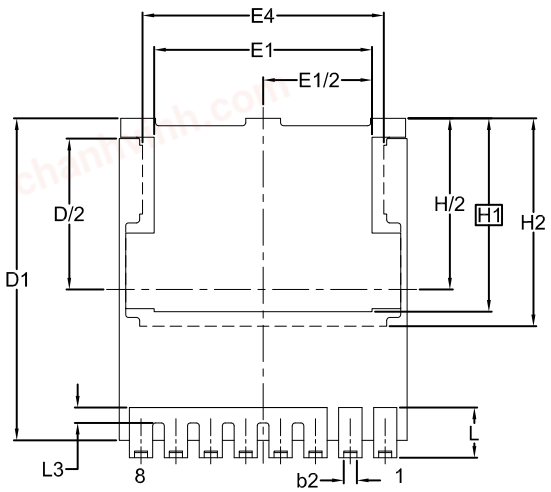
TOP VIEW



FRONT VIEW



RECOMMENDED LAND PATTERN



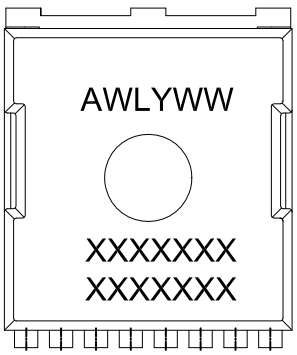
BOTTOM VIEW

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	2.20	2.30	2.40
A1	1.70	1.80	1.90
b	0.70	0.80	0.90
b1	9.70	9.80	9.90
b2	0.35	0.45	0.55
c	0.40	0.50	0.60
D	10.28	10.38	10.48
D1	10.98	11.08	11.18
D2	3.20	3.30	3.40
D/2	5.09	5.19	5.29
D4	4.45	4.55	4.65
E	9.80	9.90	10.00
E1	7.40	7.50	7.60
E2	0.30	0.40	0.50
E4	8.20	8.30	8.40
e	1.20 BSC		
H	11.58	11.68	11.78
H1	6.66 BSC		
H2	7.05	7.15	7.25
H/2	5.79	5.89	5.99
L	1.63	1.73	1.83
L1	0.60	0.70	0.80
L2	0.50	0.60	0.70
L3	0.43	0.53	0.63
Θ	10° REF.		
aaa	0.20		
ccc	0.20		
ddd	0.25		
eee	0.20		

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLEMETERS.
3. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.

GENERIC MARKING DIAGRAM*



A	= ASSY LOCATION
WL	= WAFER LOT CODE
Y	= YEAR CODE
WW	= WORK WEEK CODE
XXXXXXX	= DEVICE CODE
XXXXXXX	= DEVICE CODE

*THIS INFORMATION IS GENERIC. PLEASE REFER TO DEVICE DATA SHEET FOR ACTUAL PART MARKING.

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DESCRIPTION:	**H−PSOF8L 9.90x11.68, 1.20P**	**PAGE 1 OF 1**

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