

Silicon Carbide (SiC) MOSFET - EliteSiC, 44 mohm, 650 V, M2, TOLL NTBL060N065SC1

Features

- Typ. $R_{DS(on)} = 44 \text{ m}\Omega$ @ $V_{GS} = 18 \text{ V}$
Typ. $R_{DS(on)} = 60 \text{ m}\Omega$ @ $V_{GS} = 15 \text{ V}$
- Ultra Low Gate Charge ($Q_{G(tot)} = 74 \text{ nC}$)
- High Speed Switching with Low Capacitance ($C_{oss} = 133 \text{ pF}$)
- 100% Avalanche Tested
- $T_J = 175^\circ\text{C}$
- RoHS Compliant

Typical Applications

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

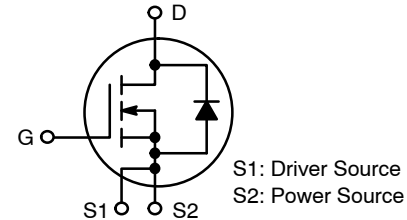
MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			V _{DSS}	650	V
Gate-to-Source Voltage			V _{GS}	-8/+22.6	V
Recommended Operation Values of Gate-to-Source Voltage		T _C < 175°C	V _{GSop}	-5/+18	V
Continuous Drain Current (Note 1)	Steady State	T _C = 25°C	I _D	46	A
Power Dissipation (Note 1)			P _D	170	W
Continuous Drain Current (Note 1)	Steady State	T _C = 100°C	I _D	33	A
Power Dissipation (Note 1)			P _D	85	W
Pulsed Drain Current (Note 2)	T _C = 25°C		I _{DM}	115	A
Operating Junction and Storage Temperature Range			T _J , T _{stg}	-55 to +175	°C
Source Current (Body Diode)			I _S	46	A
Single Pulse Drain-to-Source Avalanche Energy (I _{L(pk)} = 10.1 A, L = 1 mH) (Note 3)			E _{AS}	51	mJ
Maximum Lead Temperature for Soldering (1/8" from case for 5 s)			T _L	260	°C

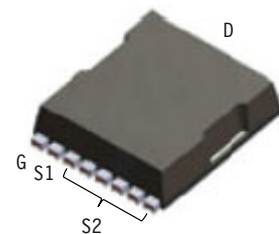
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

- The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
- Repetitive rating, limited by max junction temperature.
- EAS of 51 mJ is based on starting $T_J = 25^\circ\text{C}$; $L = 1 \text{ mH}$, $I_{AS} = 10.1 \text{ A}$, $V_{DD} = 50 \text{ V}$, $V_{GS} = 18 \text{ V}$.

$V_{(BR)DSS}$	$R_{DS(on)} \text{ MAX}$	$I_D \text{ MAX}$
650 V	70 m Ω @ 18 V	46 A

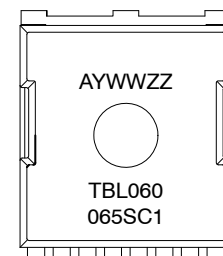


N-Channel MOSFET



H-PSOF8L
CASE 100DC

MARKING DIAGRAM



A	= Assembly Location
Y	= Year
WW	= Work Week
ZZ	= Assembly Lot Code
TBL060065SC1	= Specific Device Code

ORDERING INFORMATION

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

THERMAL CHARACTERISTICS

Parameter	Symbol	Max	Unit
Junction-to-Case – Steady State (Note 1)	$R_{\theta JC}$	0.88	°C/W
Junction-to-Ambient – Steady State (Note 1, 4)	$R_{\theta JA}$	43	

4. Device on 1 in², 2 oz copper pad on 1.5 × 1.5 in. board of FR-4 material.

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	650			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$I_D = 20\text{ mA}$, refer to 25°C		0.15		V/°C
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}$ $V_{DS} = 650\text{ V}$	$T_J = 25^\circ\text{C}$		10	μA
			$T_J = 175^\circ\text{C}$		1	mA
Gate-to-Source Leakage Current	I_{GSS}	$V_{GS} = +18/-5\text{ V}, V_{DS} = 0\text{ V}$			250	nA

ON CHARACTERISTICS

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 6.5\text{ mA}$	1.8	2.8	4.3	V
Recommended Gate Voltage	V_{GOP}		-5		+18	V
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 15\text{ V}, I_D = 20\text{ A}, T_J = 25^\circ\text{C}$		60		mΩ
		$V_{GS} = 18\text{ V}, I_D = 20\text{ A}, T_J = 25^\circ\text{C}$		44	70	
		$V_{GS} = 18\text{ V}, I_D = 20\text{ A}, T_J = 175^\circ\text{C}$		50		
Forward Transconductance	g_{FS}	$V_{DS} = 10\text{ V}, I_D = 20\text{ A}$ (Note 5)		12		S

CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1\text{ MHz},$ $V_{DS} = 325\text{ V}$ (Note 5)		1473		pF
Output Capacitance	C_{OSS}			133		
Reverse Transfer Capacitance	C_{RSS}			13		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -5/18\text{ V}, V_{DS} = 520\text{ V},$ $I_D = 20\text{ A}$ (Note 5)		74		nC
Gate-to-Source Charge	Q_{GS}			20		
Gate-to-Drain Charge	Q_{GD}			23		
Gate-Resistance	R_G	$f = 1\text{ MHz}$		3.9		Ω

SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -5/18\text{ V}, V_{DS} = 400\text{ V},$ $I_D = 20\text{ A}, R_G = 2.2\text{ Ω},$ Inductive Load (Note 5)		11		ns
Rise Time	t_r			14		
Turn-Off Delay Time	$t_{d(OFF)}$			24		
Fall Time	t_f			11		
Turn-On Switching Loss	E_{ON}			45		μJ
Turn-Off Switching Loss	E_{OFF}			18		
Total Switching Loss	E_{TOT}			63		

SOURCE-DrAIN DIODE CHARACTERISTICS

Continuous Source-Drain Diode Forward Current	I_{SD}	$V_{GS} = -5\text{ V}, T_J = 25^\circ\text{C}$ (Note 5)			46	A
Pulsed Source-Drain Diode Forward Current (Note 2)	I_{SDM}	$V_{GS} = -5\text{ V}, T_J = 25^\circ\text{C}$ (Note 5)			115	A
Forward Diode Voltage	V_{SD}	$V_{GS} = -5\text{ V}, I_{SD} = 20\text{ A}, T_J = 25^\circ\text{C}$		4.3		V

NTBL060N065SC1

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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SOURCE-DRAIN DIODE CHARACTERISTICS

Reverse Recovery Time	t _{RR}	V _{GS} = -5/18 V, I _{SD} = 20 A, dI _S /dt = 1000 A/μs (Note 5)		17.7		ns
Reverse Recovery Charge	Q _{RR}			90.6		nC
Reverse Recovery Energy	E _{REC}			8.7		μJ
Peak Reverse Recovery Current	I _{RRM}			10.2		A
Charge time	T _a			9.8		ns
Discharge time	T _b			7.8		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.

5. Defined by design, not subject to production test.

TYPICAL CHARACTERISTICS

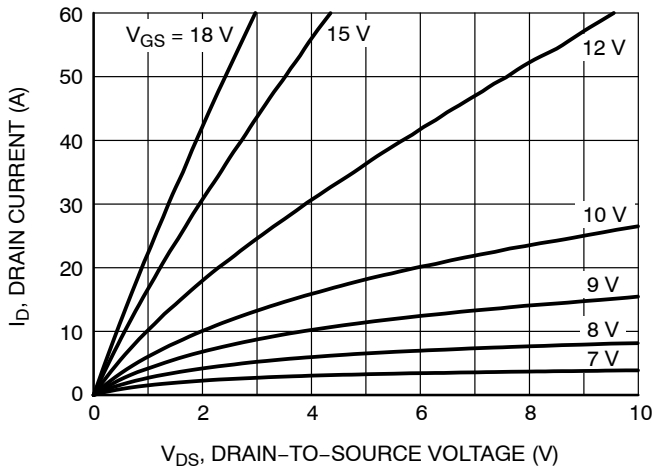


Figure 1. On-Region Characteristics

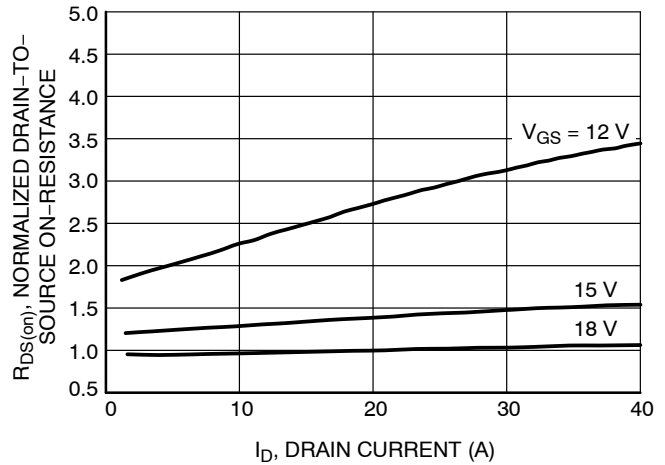


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

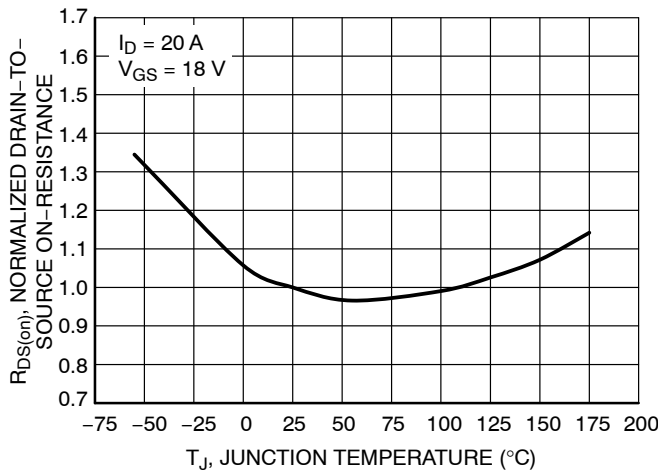


Figure 3. On-Resistance Variation with Temperature

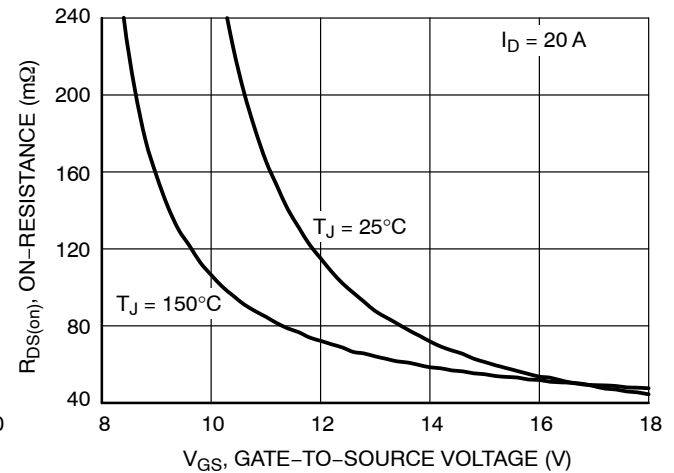


Figure 4. On-Resistance vs. Gate-to-Source Voltage

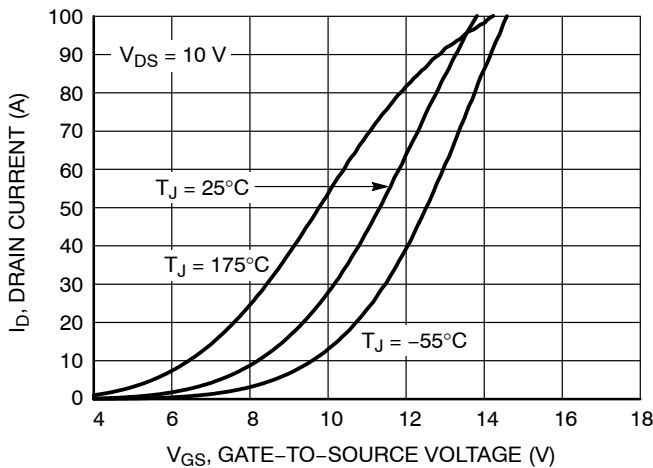


Figure 5. Transfer Characteristics

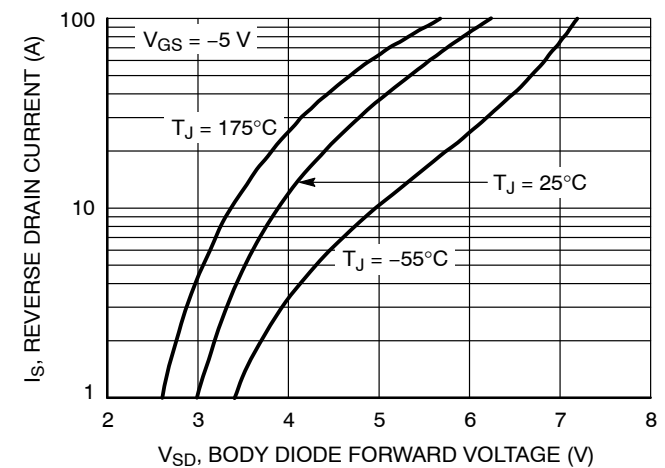


Figure 6. Diode Forward Voltage vs. Current

TYPICAL CHARACTERISTICS

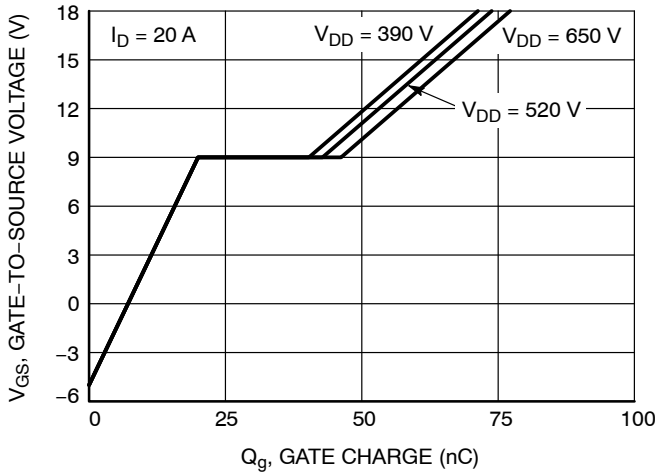


Figure 7. Gate-to-Source Voltage vs. Total Charge

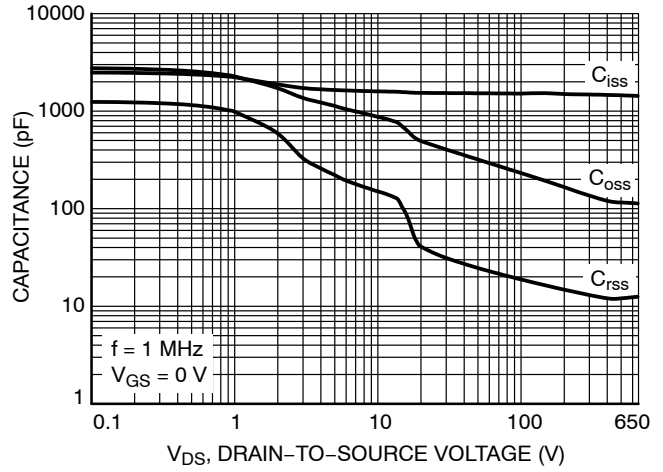


Figure 8. Capacitance vs. Drain-to-Source Voltage

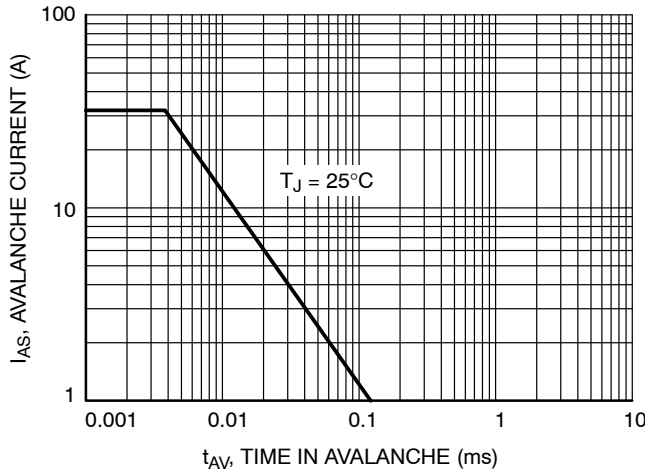


Figure 9. Unclamped Inductive Switching Capability

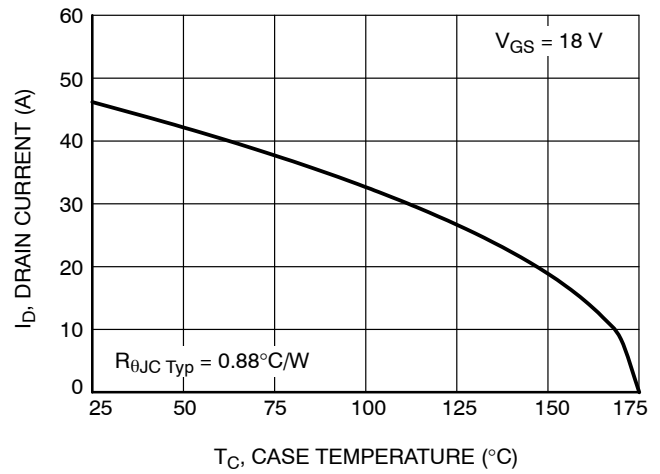


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

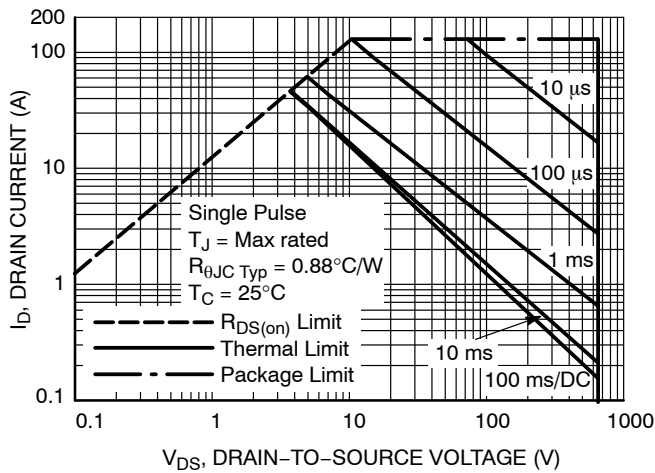


Figure 11. Safe Operating Area

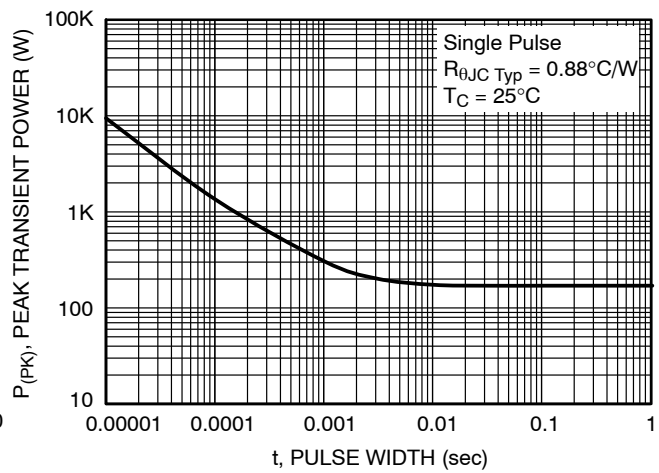


Figure 12. Single Pulse Maximum Power Dissipation

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TYPICAL CHARACTERISTICS

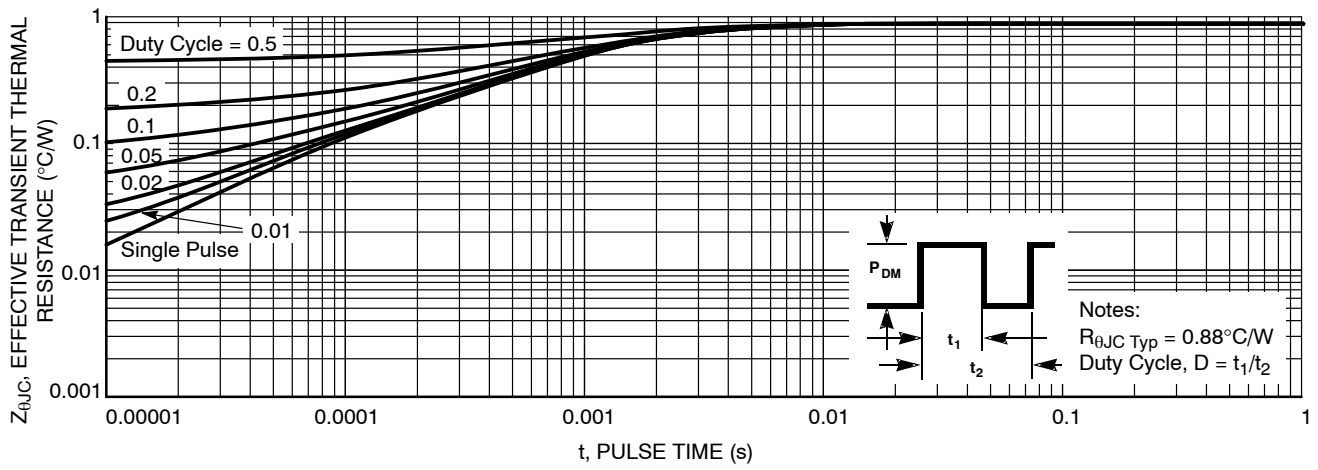
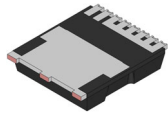


Figure 13. Junction-to-Case Transient Thermal Response

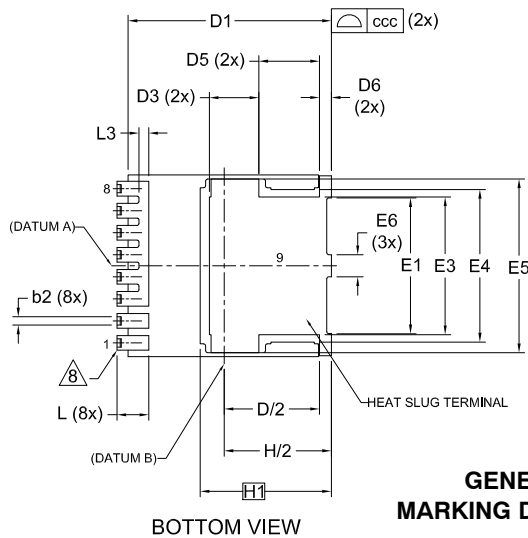
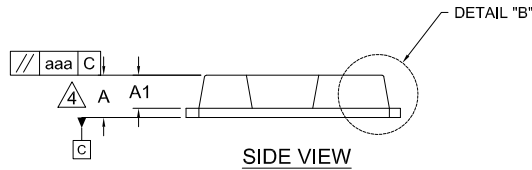
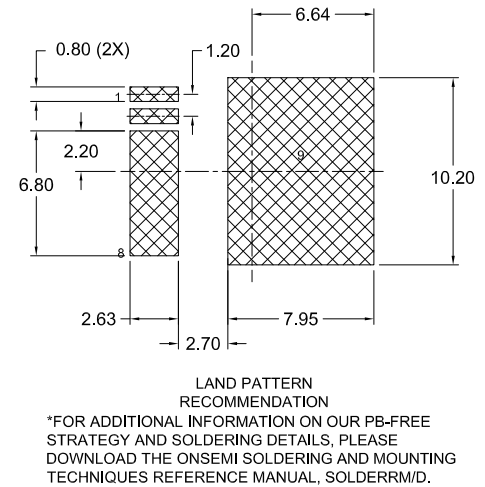
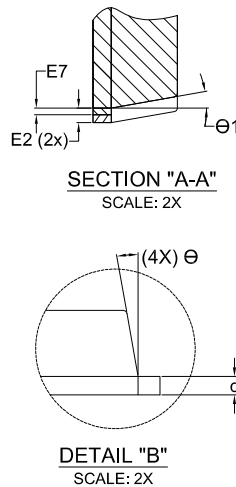
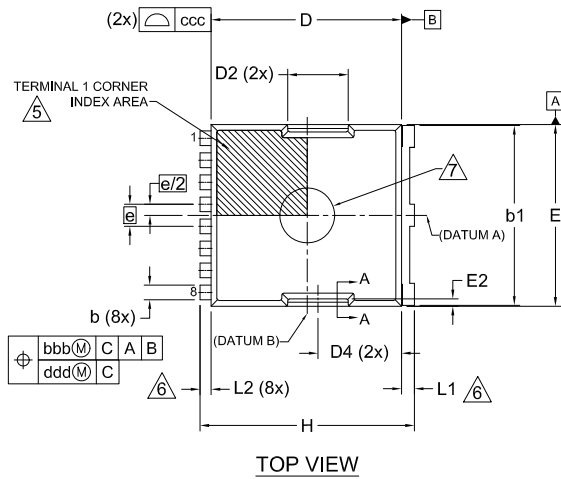
DEVICE ORDERING INFORMATION

Device	Package	Shipping [†]
NTBL060N065SC1	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.


H-PSOF8L 9.90x10.38x2.30, 1.20P
CASE 100DC
ISSUE D

DATE 30 JUL 2024


GENERIC MARKING DIAGRAM*


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

NOTES:

1. PACKAGE STANDARD REFERENCE: JEDEC MO-299, ISSUE B.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
3. "e" REPRESENTS THE TERMINAL PITCH.
4. THIS DIMENSION INCLUDES ENCAPSULATION THICKNESS "A1", AND PACKAGE BODY THICKNESS, BUT DOES NOT INCLUDE ATTACHED FEATURES, e.g., EXTERNAL OR CHIP CAPACITORS. AN INTEGRAL HEATSLUG IS NOT CONSIDERED AS ATTACHED FEATURE.
5. A VISUAL INDEX FEATURE MUST BE LOCATED WITHIN THE HATCHED AREA.
6. DIMENSIONS b1, L1, L2 APPLY TO PLATED TERMINALS.
7. THE LOCATION AND SIZE OF EJECTOR MARKS ARE OPTIONAL.
8. THE LOCATION AND NUMBER OF FUSED LEADS ARE OPTIONAL.

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
D/2	5.09	5.19	5.29
D1	10.98	11.08	11.18
D2	3.20	3.30	3.40
D3	2.60	2.70	2.80
D4	4.45	4.55	4.65
D5	3.20	3.30	3.40
D6	0.55	0.65	0.75
E	9.80	9.90	10.00
E1	7.30	7.40	7.50
E2	0.30	0.40	0.50
E3	7.40	7.50	7.60
E4	8.20	8.30	8.40

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
E5	9.36	9.46	9.56
E6	1.10	1.20	1.30
E7	0.15	0.18	0.21
e	1.20 BSC		
e/2	0.60 BSC		
H	11.58	11.68	11.78
H/2	5.74	5.84	5.94
H1	7.15 BSC		
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		
Θ1	10° REF		
aaa	0.20		
bbb	0.25		
ccc	0.20		
ddd	0.20		
eee	0.10		

*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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