

MOSFET – Power, Single N-Channel, TOLL

40 V, 300 A, 0.57 mΩ

NVBL50D5N04C

Features

- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Q_G and Capacitance to Minimize Driver Losses
- AEC-Q101 Qualified and PPAP Capable
- Small Footprint (TOLL) for Compact Design
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

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

Symbol	Parameter	Value	Unit
V_{DSS}	Drain-to-Source Voltage	40	V
V_{GS}	Gate-to-Source Voltage	+20/-16	V
I_D	Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3)	<div> <div>$T_C = 25^\circ\text{C}$</div> <div>$T_C = 100^\circ\text{C}$</div> </div>	300 300 A
P_D	Power Dissipation $R_{\theta JC}$ (Note 1)	<div> <div>$T_C = 25^\circ\text{C}$</div> <div>$T_C = 100^\circ\text{C}$</div> </div>	198.4 97.4 W
I_D	Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	<div> <div>$T_A = 25^\circ\text{C}$</div> <div>$T_A = 100^\circ\text{C}$</div> </div>	65 46 A
P_D	Power Dissipation $R_{\theta JA}$ (Notes 1, 2)	<div> <div>$T_A = 25^\circ\text{C}$</div> <div>$T_A = 100^\circ\text{C}$</div> </div>	4.3 2.1 W
I_{DM}	Pulsed Drain Current $T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$	4700	A
T_J, T_{stg}	Operating Junction and Storage Temperature Range	-55 to +175	$^\circ\text{C}$
I_S	Source Current (Body Diode)	170	A
E_{AS}	Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)} = 55 \text{ A}, L = 1 \text{ mH}$)	1512	mJ
T_L	Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	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.

THERMAL RESISTANCE MAXIMUM RATINGS

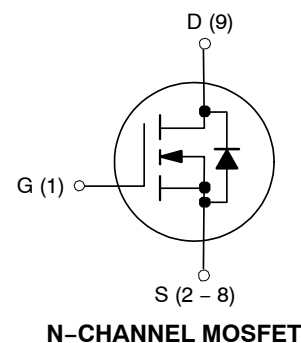
Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Junction-to-Case – Steady State	0.77	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-Ambient – Steady State (Note 2)	35	

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted. Current is limited by bondwire configuration.
2. Surface-mounted on FR4 board using a 650 mm², 2 oz. Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
40 V	0.57 mΩ @ 10 V	300 A



H-PSOF8L
CASE 100CU



ORDERING INFORMATION

Device	Package	Shipping [†]
NVBL50D5N04CTXG	H-PSOF8L (Pb-Free)	2000 / 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](#).

NVBLS0D5N04C

Table 1. ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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OFF CHARACTERISTICS

$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0\ \text{V}$	40			V
$V_{(BR)DSS}/T_J$	Drain-to-Source Breakdown Voltage Temperature Coefficient			21.3		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 40\ \text{V}$, $V_{GS} = 0\ \text{V}$	$T_J = 25^\circ\text{C}$		1	μA
			$T_J = 175^\circ\text{C}$		1	mA
I_{GSS}	Gate-to-Source Leakage Current	$V_{DS} = 0\ \text{V}$, $V_{GS} = +20/-16\ \text{V}$			± 100	nA

ON CHARACTERISTICS (Note 4)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 475\ \mu\text{A}$	2	2.8	4	V
$V_{GS(th)}/T_J$	Threshold Temperature Coefficient			-7.4		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Drain-to-Source On Resistance	$V_{GS} = 10\ \text{V}$, $I_D = 50\ \text{A}$		0.5	0.57	m Ω

CHARGES, CAPACITANCES & GATE RESISTANCE

C_{iss}	Input Capacitance	$V_{GS} = 0\ \text{V}$, $V_{DS} = 25\ \text{V}$, $f = 1\ \text{MHz}$		12600		pF
C_{oss}	Output Capacitance			6705		pF
C_{rss}	Reverse Transfer Capacitance			227		pF
R_g	Gate Resistance	$V_{GS} = 0.5\ \text{V}$, $f = 1\ \text{MHz}$		1.8		Ω
$Q_{G(tot)}$	Total Gate Charge	$V_{GS} = 10\ \text{V}$, $V_{DS} = 20\ \text{V}$, $I_D = 50\ \text{A}$		185		nC
$Q_{G(th)}$	Threshold Gate Charge	$V_{GS} = 0\ \text{to}\ 2\ \text{V}$		22		nC
Q_{gs}	Gate-to-Source Gate Charge	$V_{DD} = 32\ \text{V}$, $I_D = 50\ \text{A}$		48		nC
Q_{gd}	Gate-to-Drain "Miller" Charge			38		nC
V_{GP}	Plateau Voltage			4.2		V

SWITCHING CHARACTERISTICS (Note 5)

$t_{d(on)}$	Turn-On Delay Time	$V_{GS} = 10\ \text{V}$, $V_{DD} = 20\ \text{V}$, $I_D = 50\ \text{A}$, $R_{GEN} = 6\ \Omega$		40		ns
t_r	Turn-On Rise Time			84		ns
$t_{d(off)}$	Turn-Off Delay Time			164		ns
t_f	Turn-Off Fall Time			81		ns

DRAIN-SOURCE DIODE CHARACTERISTICS

V_{SD}	Source-to-Drain Diode Voltage	$I_{SD} = 50\ \text{A}$, $V_{GS} = 0\ \text{V}$		0.76	1.2	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\ \text{V}$, $dI_S/dt = 100\ \text{A}/\mu\text{s}$, $I_S = 50\ \text{A}$		108		ns
t_a	Charge Time			62		ns
t_b	Discharge Time			46		ns
Q_{rr}	Reverse Recovery Charge			288		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.

4. Pulse Test: pulse width $\leq 300\ \mu\text{s}$, duty cycle $\leq 2\%$.

5. Switching characteristics are independent of operating junction temperatures

TYPICAL CHARACTERISTICS

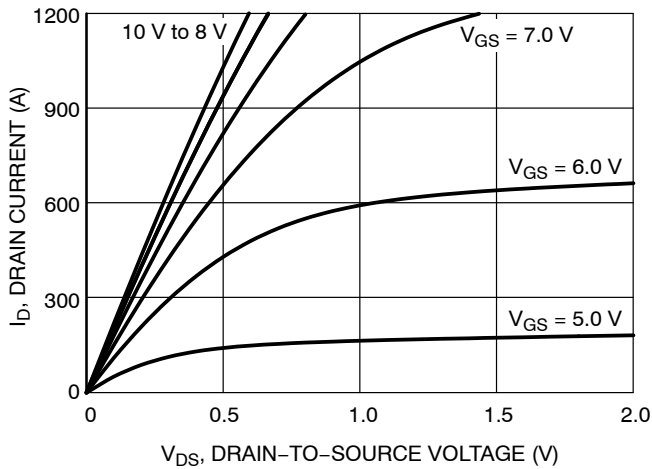


Figure 1. On-Region Characteristics

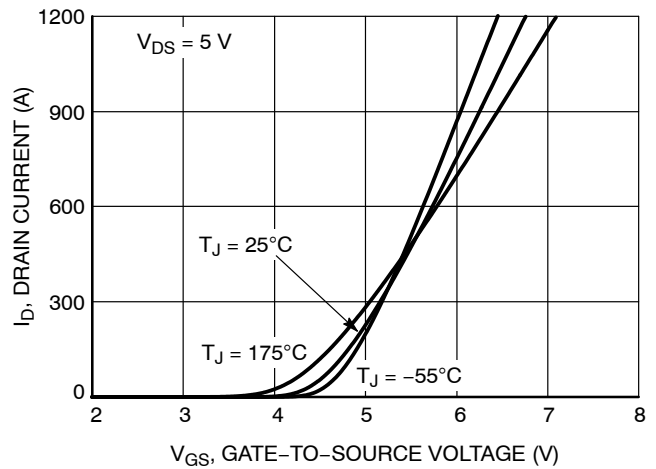


Figure 2. Transfer Characteristics

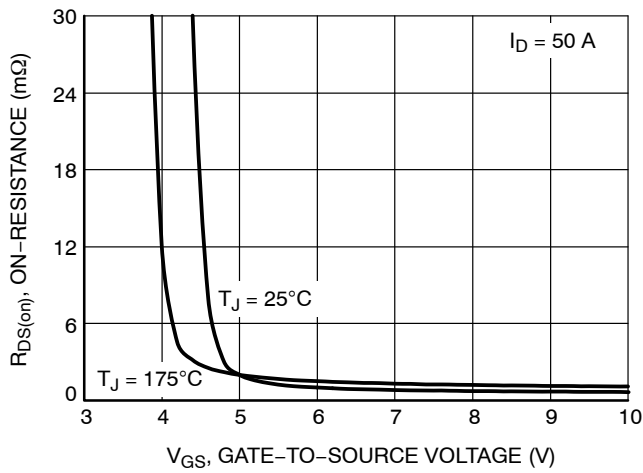


Figure 3. On-Resistance vs. Gate-to-Source Voltage

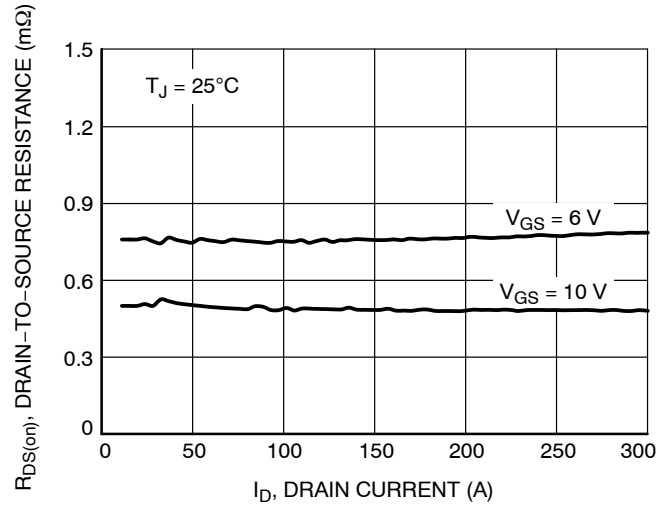


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

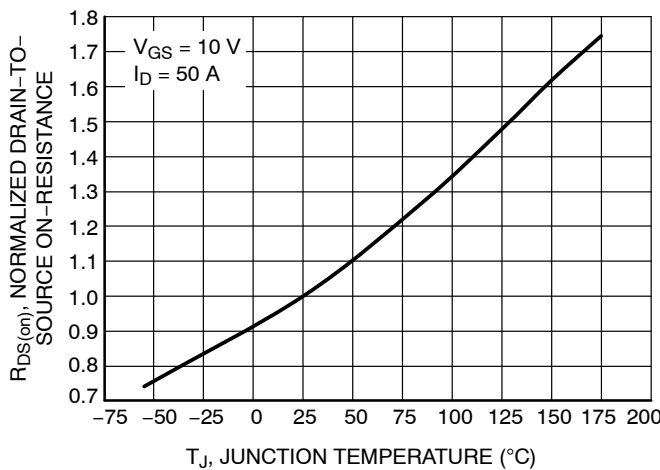


Figure 5. On-Resistance Variation with Temperature

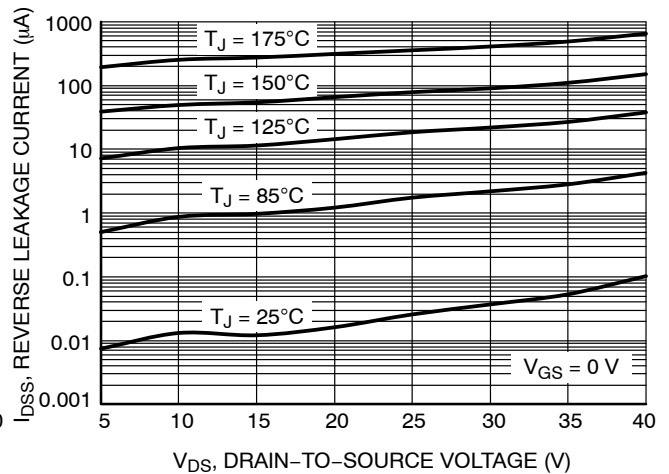


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS (continued)

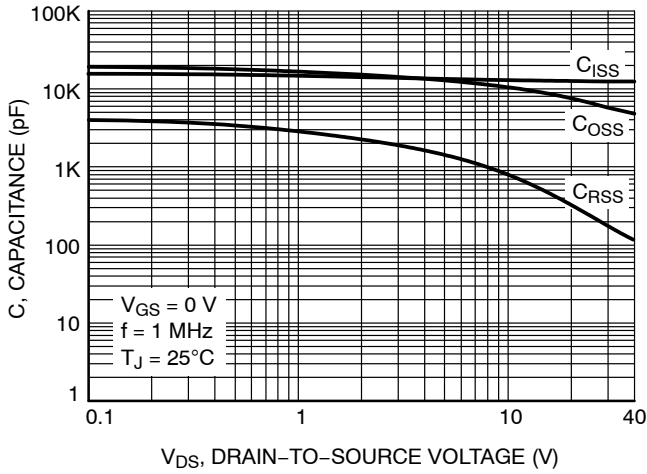


Figure 7. Capacitance Variation

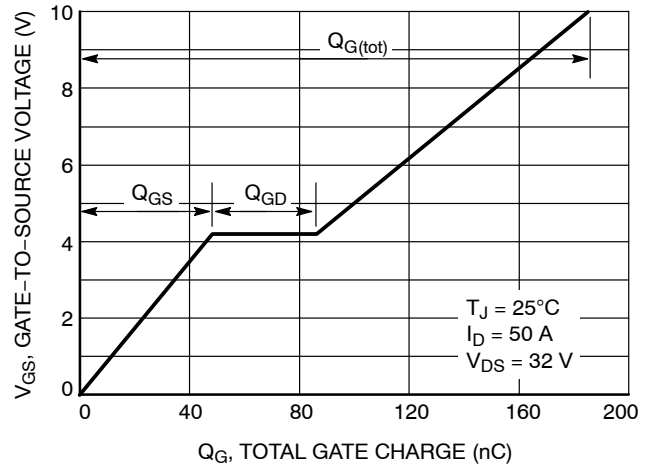


Figure 8. Gate-to-Source Voltage vs. Total Charge

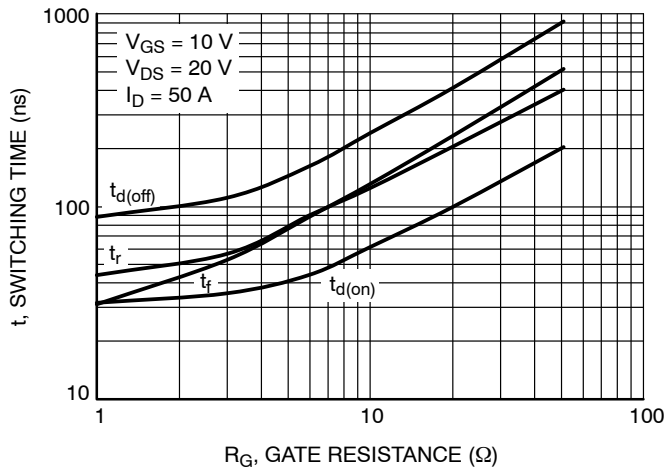


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

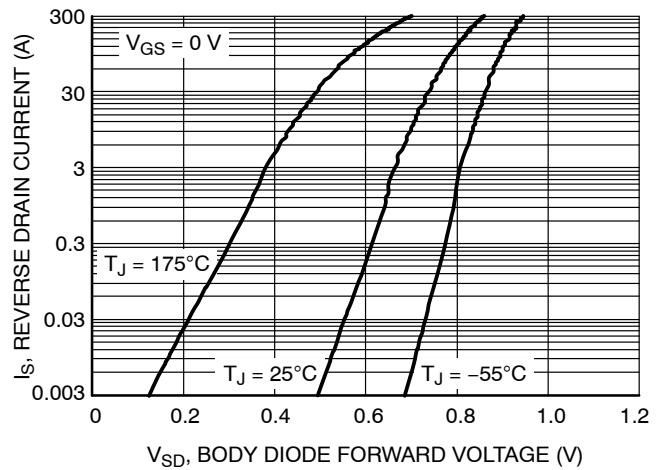


Figure 10. Diode Forward Voltage vs. Current

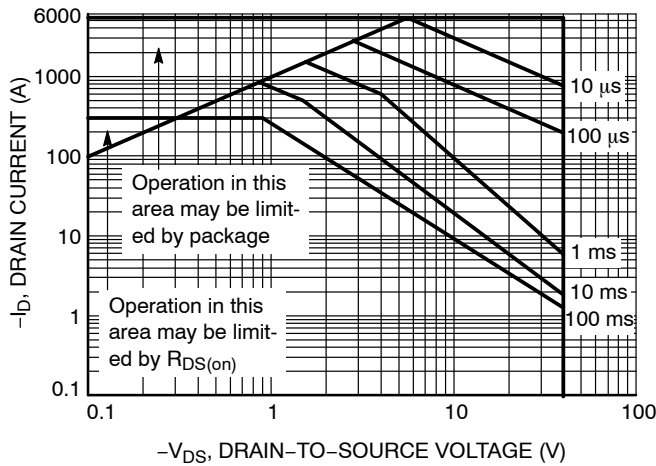


Figure 11. Forward Biased Safe Operating Area

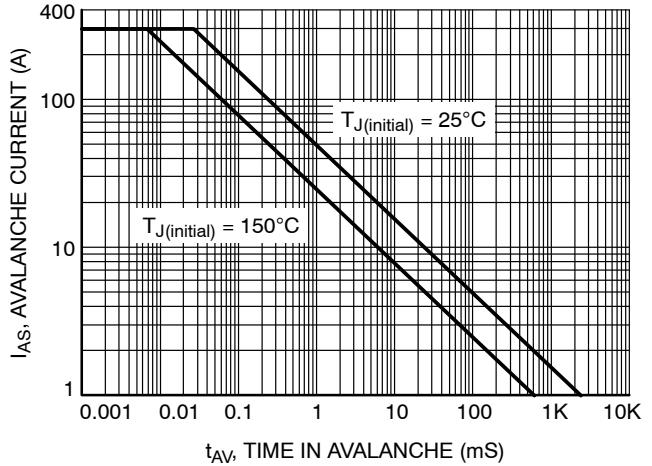


Figure 12. Maximum Drain Current vs. Time in Avalanche

TYPICAL CHARACTERISTICS (continued)

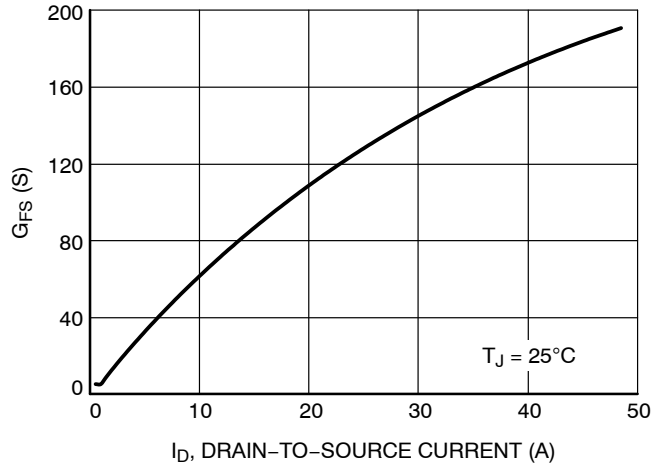


Figure 13. G_{FS} vs. I_D

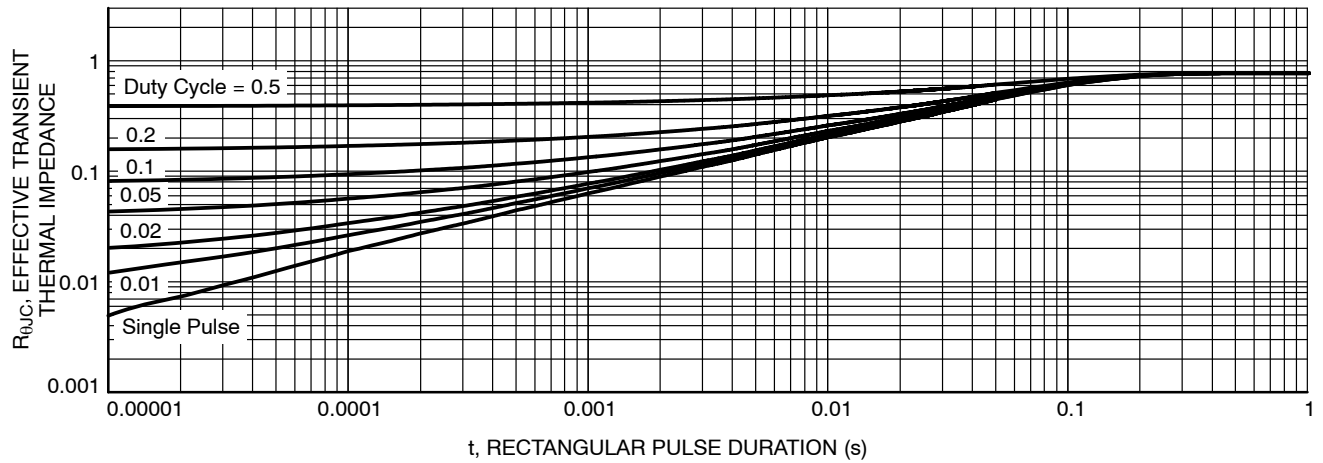
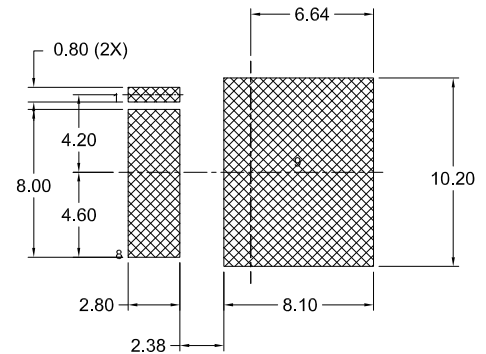


Figure 14. Transient Thermal Impedance



H-PSOF8L 11.68x9.80x2.30, 1.20P
CASE 100CU
ISSUE F

DATE 30 JUL 2024

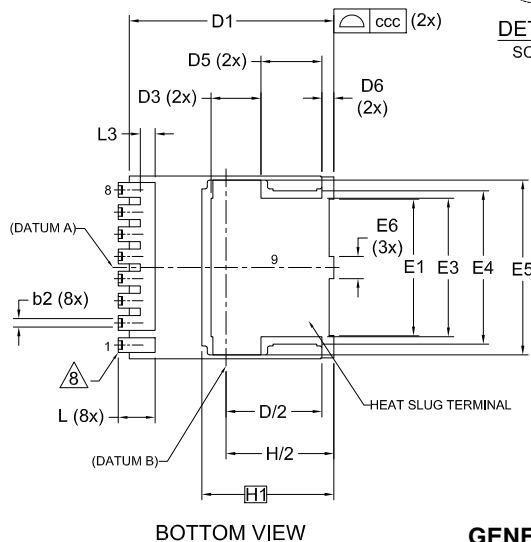


*FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERM/D.



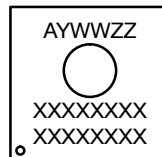
NOTES:

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.



GENERIC
MARKING DIAGRAM*

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

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	1.90	2.00	2.10
L1	0.60	0.70	0.80
L2	0.50	0.60	0.70
L3	0.70	0.80	0.90
Θ	10° REF		
Θ1	10° REF		
aaa	0.20		
bbb	0.25		
ccc	0.20		
ddd	0.20		
eee	0.10		

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DESCRIPTION: H-PSOF8L 11.68x9.80x2.30, 1.20P

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