MOSFET - Power, Single N-Channel, TOLL

40 V, 0.57 mΩ, 300 A

NVBLS0D5N04C

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°C unless otherwise noted)

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

THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction−to−Case − Steady State	$R_{\theta JC}$	0.77	°C/W
Junction−to−Ambient − Steady State (Note 2)	$R_{\theta JA}$	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 mm^2, 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.

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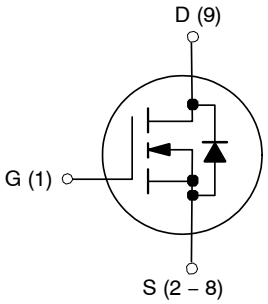
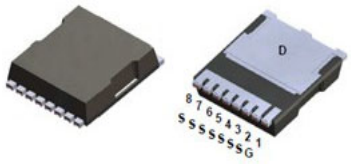
$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	I_D MAX
40 V	0.57 mΩ @ 10 V	300 A



N−CHANNEL MOSFET



H−PSOF8L
CASE 100CU

ORDERING INFORMATION

Device	Package	Shipping†
NVBLS0D5N04CTXG	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.

Table 1. ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Parameter	Symbol	Test Conditions		Min	Typ	Max	Units
OFF CHARACTERISTICS							
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	I_D = 250 μA, V_{GS} = 0 V		40			V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$				21.3		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 40 V, V_{GS} = 0 V	T_J = 25°C			1	μA
			T_J = 175°C			1	mA
Gate−to−Source Leakage Current	I_{GSS}	V_{DS} = 0 V, V_{GS} = +20/−16 V				±100	nA
ON CHARACTERISTICS (Note 4)							
Gate Threshold Voltage	$V_{GS(th)}$	V_{GS} = V_{DS}, I_D = 475 μA		2	2.8	4	V
Threshold Temperature Coefficient	$V_{GS(th)}/T_J$				−7.4		mV/°C
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 50 A			0.5	0.57	mΩ
CHARGES, CAPACITANCES & GATE RESISTANCE							
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 25 V, f = 1 MHz			12600		pF
Output Capacitance	C_{oss}				6705		pF
Reverse Transfer Capacitance	C_{rss}				227		pF
Gate Resistance	R_g	V_{GS} = 0.5 V, f = 1 MHz			1.8		Ω
Total Gate Charge	$Q_{G(tot)}$	V_{GS} = 10 V, V_{DS} = 20 V, I_D = 50 A			185		nC
Threshold Gate Charge	$Q_{G(th)}$	V_{GS} = 0 to 2 V			22		nC
Gate−to−Source Gate Charge	Q_{gs}	V_{DD} = 32 V, I_D = 50 A			48		nC
Gate−to−Drain “Miller” Charge	Q_{gd}				38		nC
Plateau Voltage	V_{GP}				4.2		V
SWITCHING CHARACTERISTICS (Note 5)							
Turn−On Delay Time	$t_{d(on)}$	V_{GS} = 10 V, V_{DD} = 20 V, I_D = 50 A, R_{GEN} = 6 Ω			40		ns
Turn−On Rise Time	t_r				84		ns
Turn−Off Delay Time	$t_{d(off)}$				164		ns
Turn−Off Fall Time	t_f				81		ns
DRAIN−SOURCE DIODE CHARACTERISTICS							
Source−to−Drain Diode Voltage	V_{SD}	I_{SD} = 50 A, V_{GS} = 0 V			0.76	1.2	V
Reverse Recovery Time	t_{rr}	V_{GS} = 0 V, dI_S/d_t = 100 A/μs, I_S = 50 A			108		ns
Charge Time	t_a				62		ns
Discharge Time	t_b				46		ns
Reverse Recovery Charge	Q_{rr}				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 ≤ 300 μs, duty cycle ≤ 2%.
5. Switching characteristics are independent of operating junction temperatures

TYPICAL CHARACTERISTICS

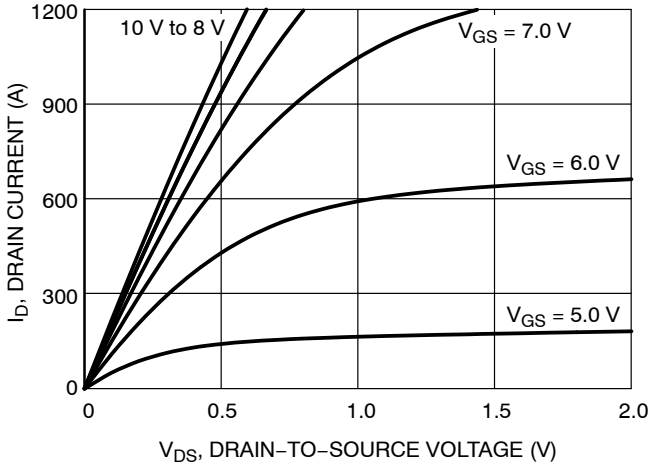


Figure 1. On−Region Characteristics

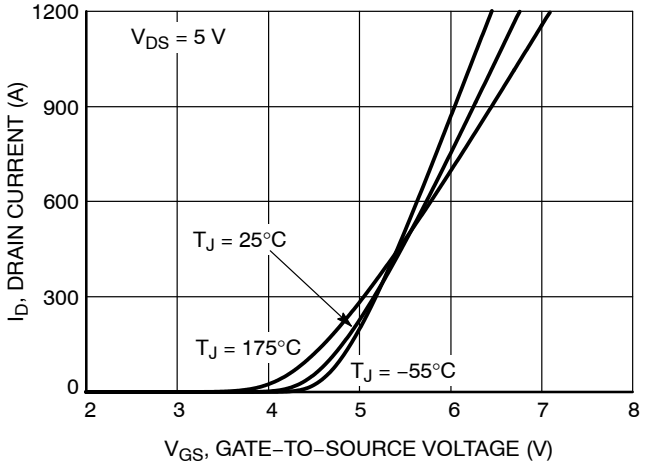


Figure 2. Transfer Characteristics

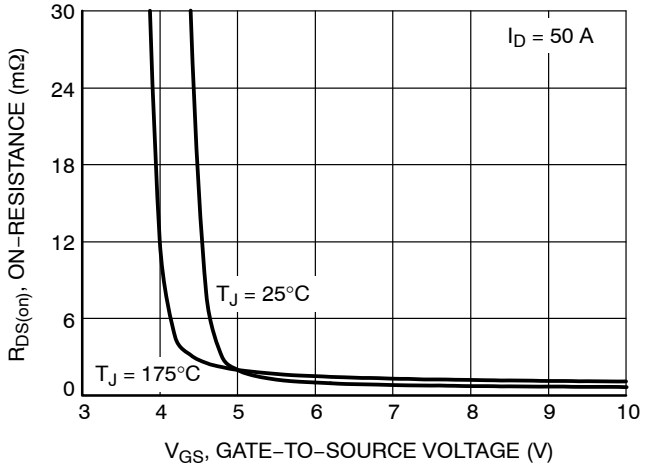


Figure 3. On−Resistance vs. Gate−to−Source Voltage

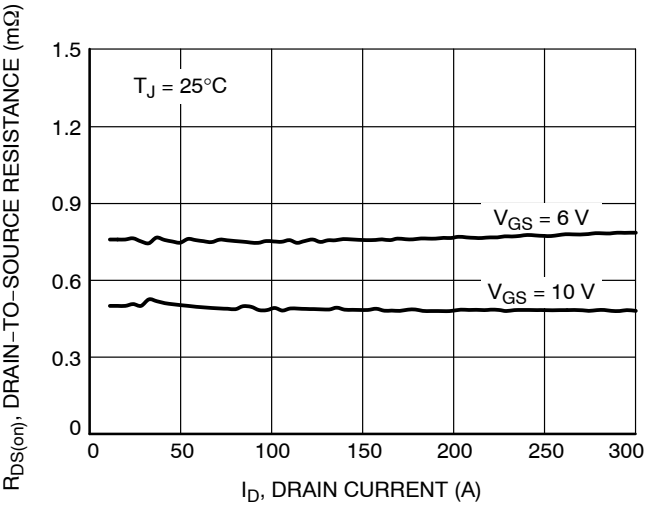


Figure 4. On−Resistance vs. Drain Current and Gate Voltage

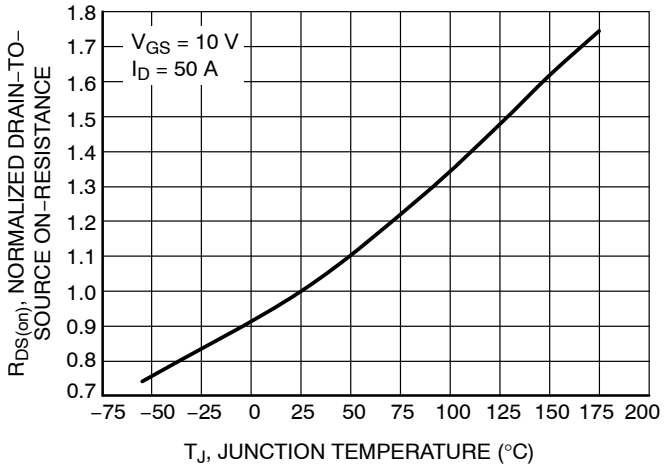


Figure 5. On−Resistance Variation with Temperature

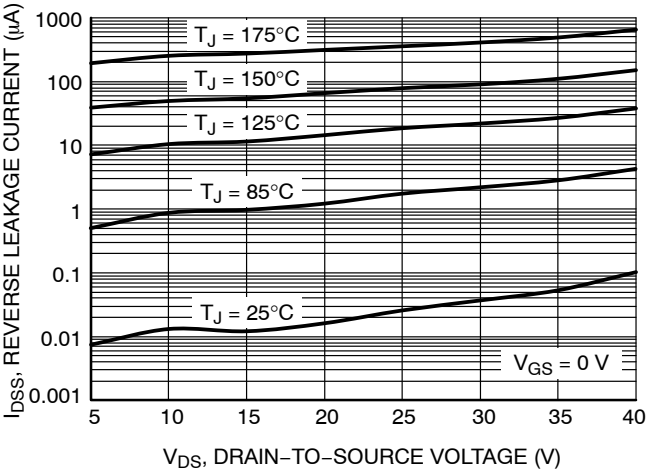


Figure 6. Drain−to−Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

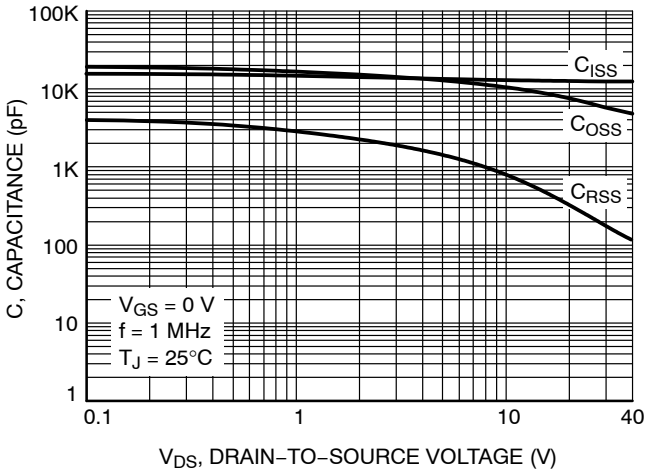


Figure 7. Capacitance Variation

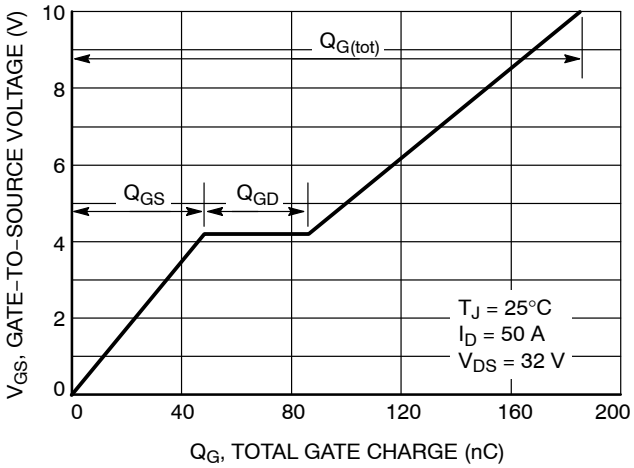


Figure 8. Gate−to−Source Voltage vs. Total Charge

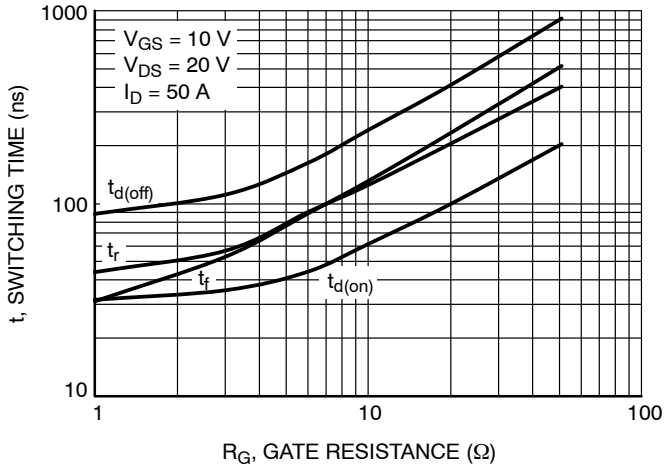


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

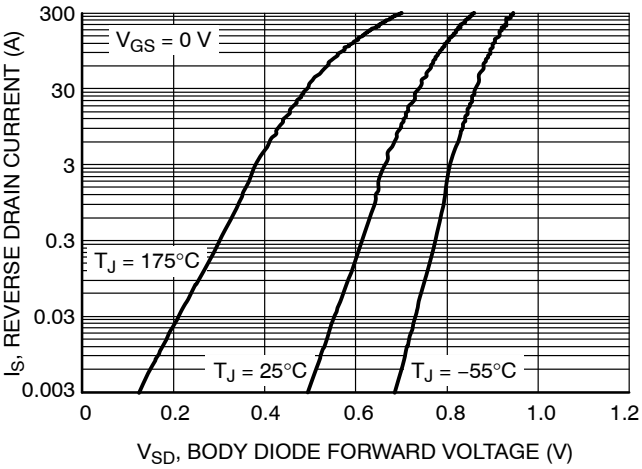


Figure 10. Diode Forward Voltage vs. Current

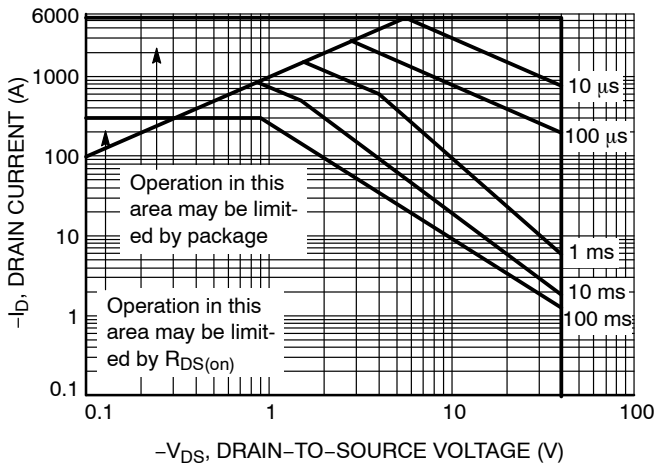


Figure 11. Forward Biased Safe Operating Area

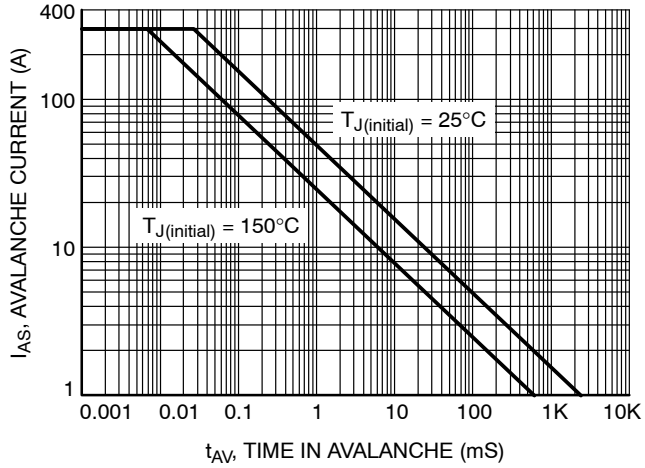


Figure 12. Maximum Drain Current vs. Time in Avalanche

TYPICAL CHARACTERISTICS

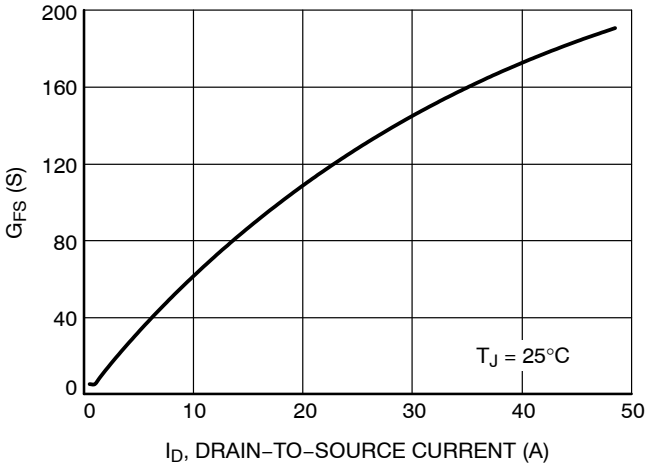


Figure 13. G_{FS} vs. I_D

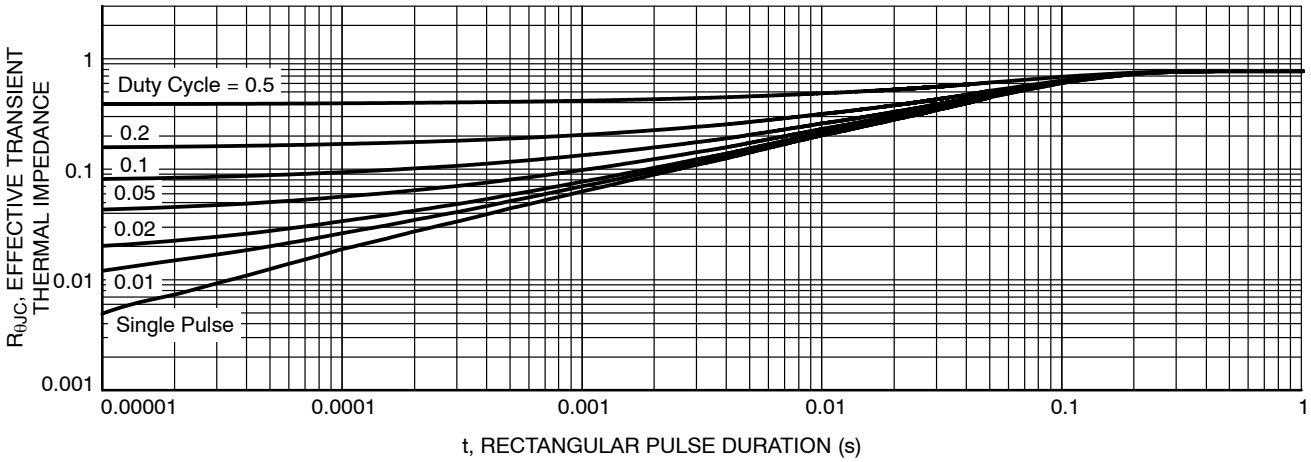


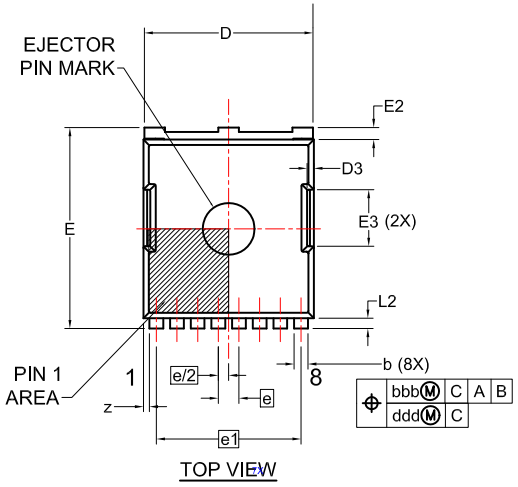
Figure 14. Transient Thermal Impedance

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

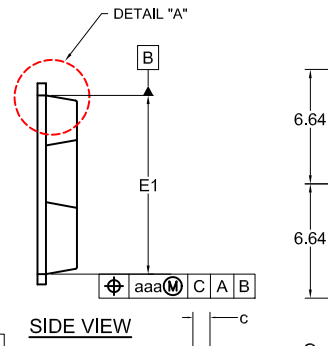
ON Semiconductor®

H−PSOF8L 11.68x9.80
CASE 100CU
ISSUE A

DATE 06 JAN 2020

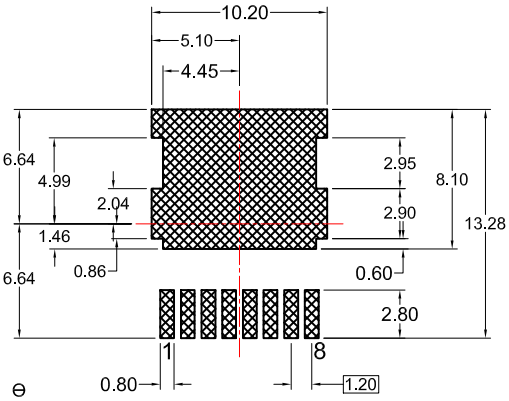


TOP VIEW



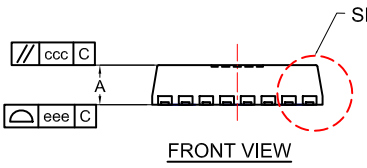
SIDE VIEW

DETAIL "A"
SCALE: 2X

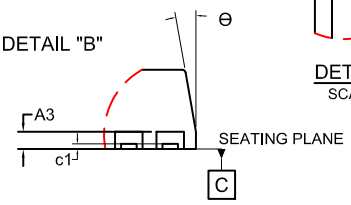


LAND PATTERN RECOMMENDATION

*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

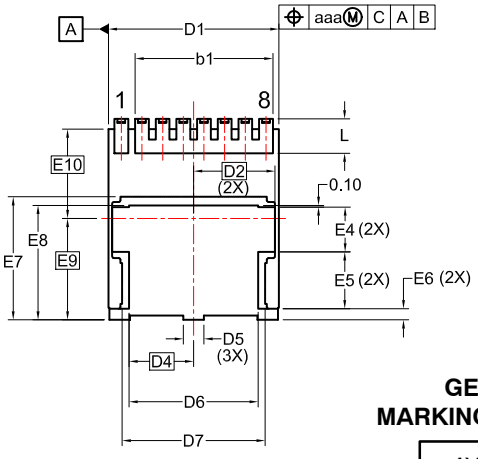


FRONT VIEW



DETAIL "B"
SCALE: 2X

NOTES:
1. PACKAGE STANDARD REFERENCE: JEDEC MO-299, ISSUE A.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
3. CONTROLLING DIMENSION: MILLIMETERS.
4. COPLANARITY APPLIES TO THE EXPOSED WELL AS THE TERMINALS.
5. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
6. 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.

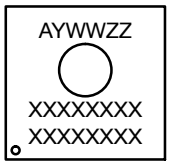


BOTTOM VIEW

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	2.20	2.30	2.40
A3	0.40	0.50	0.60
b	0.70	0.80	0.90
b1		8.00 REF	
c	0.40	0.50	0.60
c1	0.10	---	---
D	9.70	9.80	9.90
D1	9.80	9.90	10.00
D2		4.73 BSC	
D3		0.40 REF	
D4		3.75 BSC	
D5	—	1.20	---
D6	7.40	7.50	7.60
D7		(8.30)	
E	11.58	11.68	11.78
E1	10.28	10.38	10.48
E2	0.60	0.70	0.80
E3		3.30 REF	
E4	—	2.60	---

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
e		1.20 BSC	
e/2		0.60 BSC	
e1		8.40 BSC	
K	1.50	1.57	1.70
L	1.90	2.00	2.10
L2	0.50	0.60	0.70
z		0.35 REF	
θ	0°	---	12°
aaa		0.20	
bbb		0.25	
ccc		0.20	
ddd		0.20	
eee		0.10	
E5	---	3.30	—
E6	---	0.65	—
E7		7.15 REF	
E8	6.55	6.65	6.75
E9		5.89 BSC	
E10		5.19 BSC	

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.

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