

# MOSFET - Power, Single N-Channel, SUPERFET<sup>®</sup>, FAST, TOLL-4L

## 600 V, 125 mΩ, 22 A NTBL125N60S5H

### Description

The SUPERFET V MOSFET FAST series helps maximize system efficiency by the extremely low switching losses in hard switching application. The TOLL package offers improved thermal performance and excellent switching performance by providing a Kelvin Source configuration and lower parasitic source inductance.

### Features

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

### Applications

- Telecom / Server Power Supplies
- EV Charger / UPS / Solar / Industrial Power Supplies

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

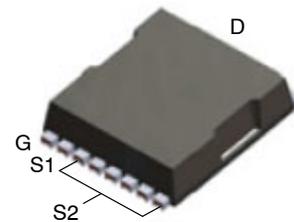
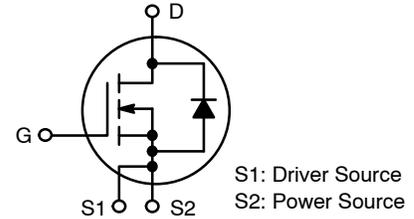
Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DSS}$	600	V
Gate-to-Source Voltage	$V_{GS}$	DC	$\pm 30$
		AC ( $f > 1\text{ Hz}$ )	$\pm 30$
Continuous Drain Current	$I_D$	$T_C = 25^\circ\text{C}$	22
		$T_C = 100^\circ\text{C}$	13
Power Dissipation	$T_C = 25^\circ\text{C}$	$P_D$	152
Pulsed Drain Current (Note 1)	$T_C = 25^\circ\text{C}$	$I_{DM}$	77
Pulsed Source Current (Body Diode) (Note 1)		$I_{SM}$	77
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	$^\circ\text{C}$
Source Current (Body Diode)	$I_S$	22	A
Single Pulse Avalanche Energy	$I_L = 4.5\text{ A}$ $R_G = 25\ \Omega$	$E_{AS}$	184
Avalanche Current	$I_{AS}$	4.5	A
Repetitive Avalanche Energy (Note 1)	$E_{AR}$	1.52	mJ
MOSFET dv/dt	dv/dt	120	V/ns
Peak Diode Recovery dv/dt (Note 2)		20	
Lead Temperature for Soldering Purposes (1/8" from case for 10 seconds)	$T_L$	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.

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2.  $I_{SD} \leq 11\text{ A}$ ,  $di/dt \leq 200\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq 400\text{ V}$ , starting  $T_J = 25^\circ\text{C}$ .

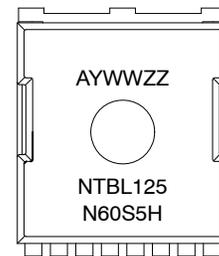
$V_{(BR)DSS}$	$R_{DS(ON)}\text{ MAX}$	$I_D\text{ MAX}$
600 V	125 mΩ @ $V_{GS} = 10\text{ V}$	22 A

### N-CHANNEL MOSFET



**H-PSOF8L  
CASE 100DC**

### MARKING DIAGRAM



- A = Assembly Location
- Y = Year
- WW = Work Week
- ZZ = Assembly Lot Code
- NTBL125N60S5H = Specific Device Code

### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
NTBL125N60S5H	H-PSOF8L	2000 / Tape & Reel

<sup>†</sup>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.

# NTBL125N60S5H

## THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.82	°C/W
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	43	

## 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	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 10\text{ mA}, T_J = 25^\circ\text{C}$	600	-	-	V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$\Delta V_{(BR)DSS} / \Delta T_J$	$I_D = 10\text{ mA}$ , Referenced to $25^\circ\text{C}$	-	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	$\mu\text{A}$
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$	-	-	$\pm 100$	nA

### ON CHARACTERISTICS

Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 11\text{ A}, T_J = 25^\circ\text{C}$	-	100	125	m $\Omega$
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS} = V_{DS}, I_D = 2.1\text{ mA}, T_J = 25^\circ\text{C}$	2.7	-	4.3	V
Forward Trans-conductance	$g_{FS}$	$V_{DS} = 20\text{ V}, I_D = 11\text{ A}$	-	21.7	-	S

### CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, f = 250\text{ kHz}$	-	2036	-	pF
Output Capacitance	$C_{OSS}$		-	31.2	-	
Time Related Output Capacitance	$C_{OSS(tr)}$	$I_D = \text{Constant}, V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$	-	485	-	
Energy Related Output Capacitance	$C_{OSS(er)}$		$V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$	-	52.2	
Total Gate Charge	$Q_{G(tot)}$	$V_{DD} = 400\text{ V}, I_D = 11\text{ A}, V_{GS} = 10\text{ V}$	-	37.1	-	nC
Gate-to-Source Charge	$Q_{GS}$		-	9.92	-	
Gate-to-Drain Charge	$Q_{GD}$		-	10.2	-	
Gate Resistance	$R_G$		$f = 1\text{ MHz}$	-	1.08	

### SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 0/10\text{ V}, V_{DD} = 400\text{ V}, I_D = 11\text{ A}, R_G = 7.5\ \Omega$	-	18.5	-	ns
Rise Time	$t_r$		-	5.15	-	
Turn-Off Delay Time	$t_{d(OFF)}$		-	56.4	-	
Fall Time	$t_f$		-	2.7	-	

### SOURCE-TO-DRAIN DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_{SD} = 11\text{ A}, T_J = 25^\circ\text{C}$	-	-	1.2	V
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, I_{SD} = 11\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, V_{DD} = 400\text{ V}$	-	336	-	ns
Reverse Recovery Charge	$Q_{RR}$		-	4513	-	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.

# NTBL125N60S5H

## TYPICAL CHARACTERISTICS

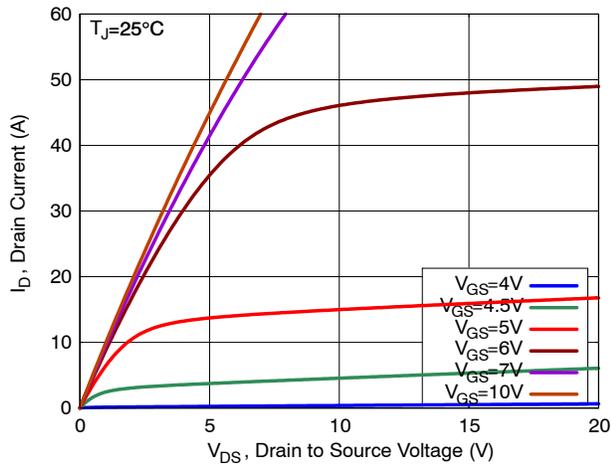


Figure 1. On-Region Characteristics

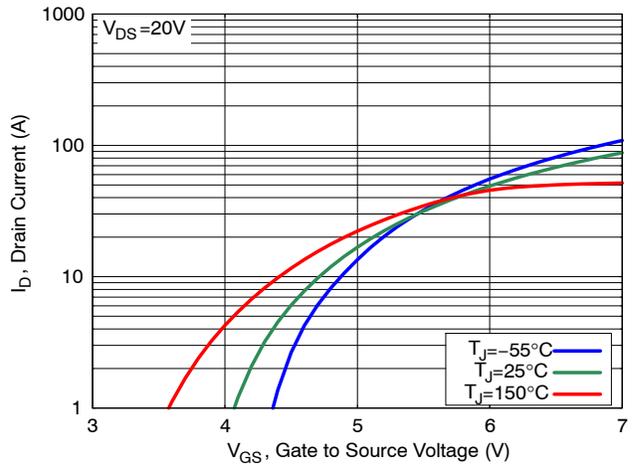


Figure 2. Transfer Characteristics

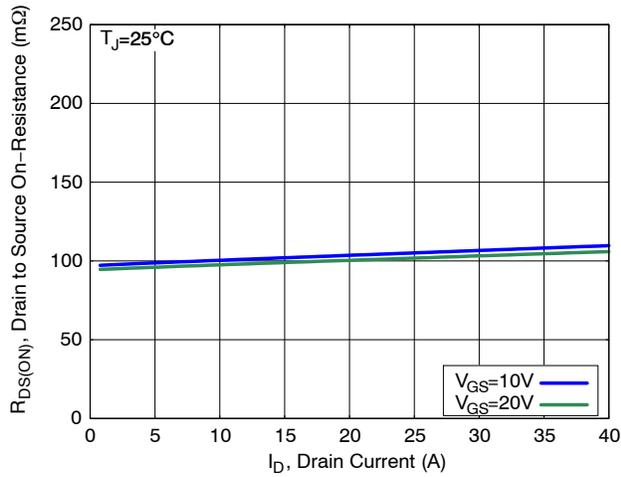


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

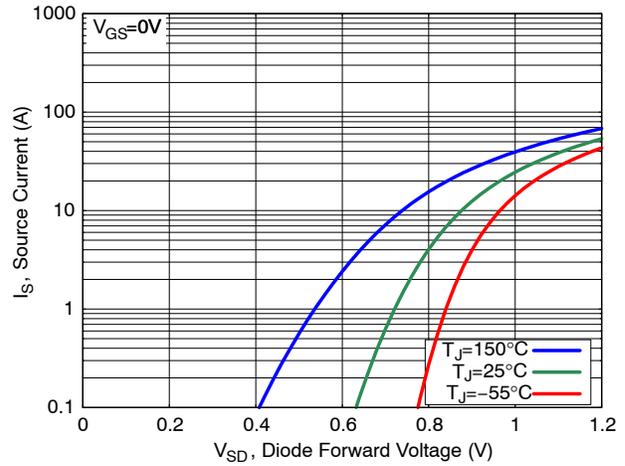


Figure 4. Diode Forward Voltage vs. Source Current

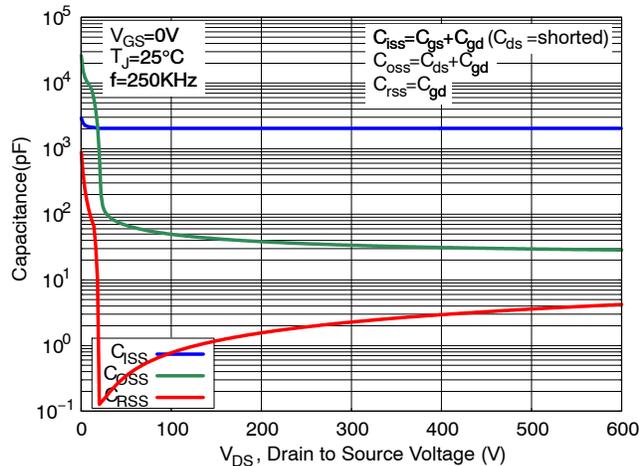


Figure 5. Capacitance Characteristics

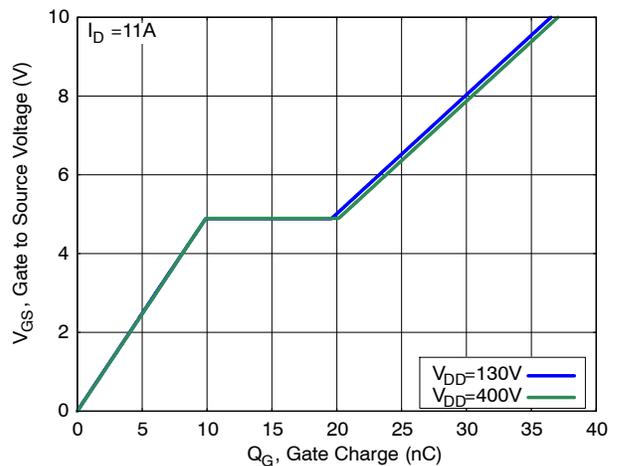
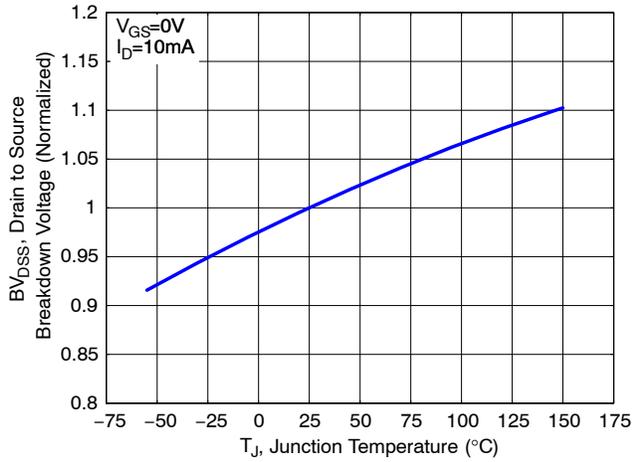


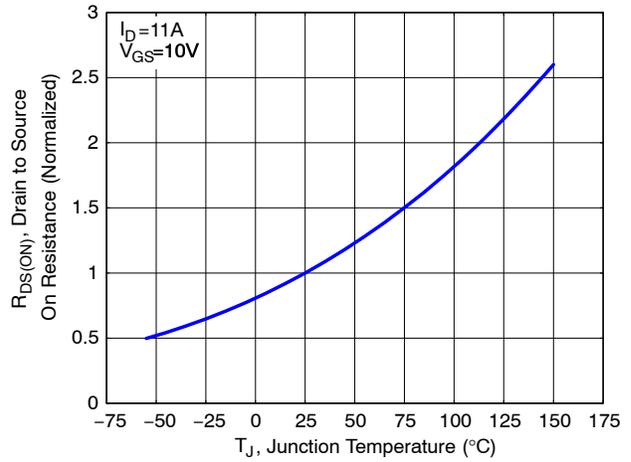
Figure 6. Gate Charge Characteristics

# NTBL125N60S5H

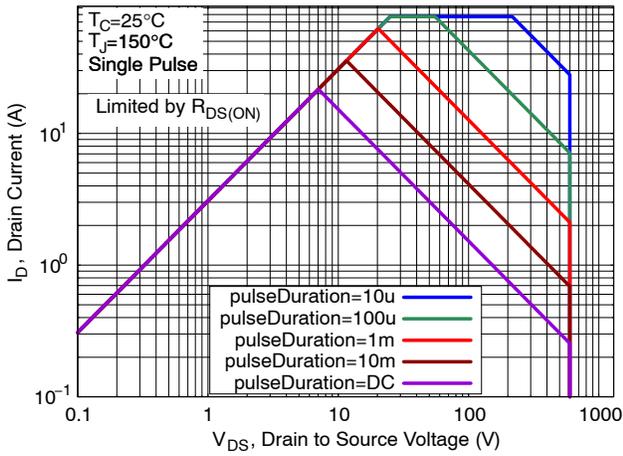
## TYPICAL CHARACTERISTICS



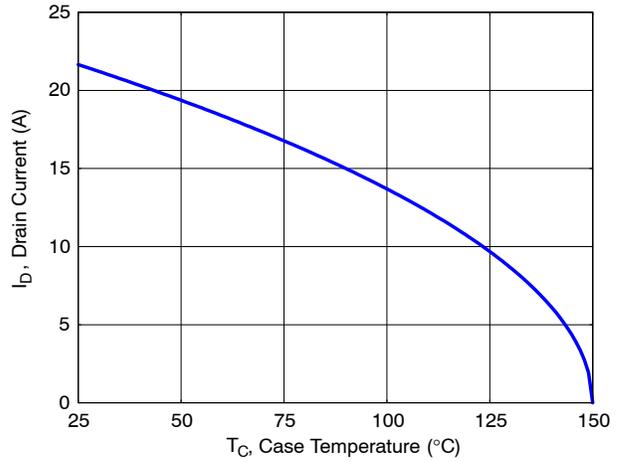
**Figure 7. Breakdown Voltage Variation vs. Temperature**



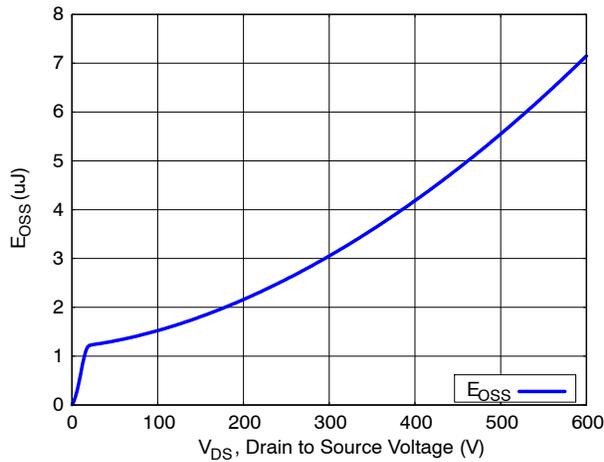
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area**



**Figure 10. Maximum Drain Current vs. Case Temperature**



**Figure 11. Eoss vs. Drain-to-Source Voltage**

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## TYPICAL CHARACTERISTICS

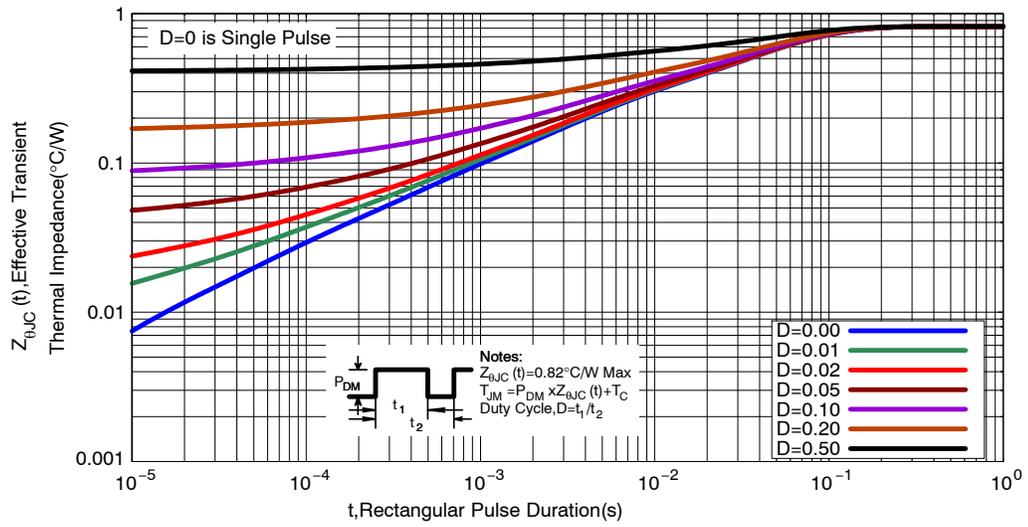
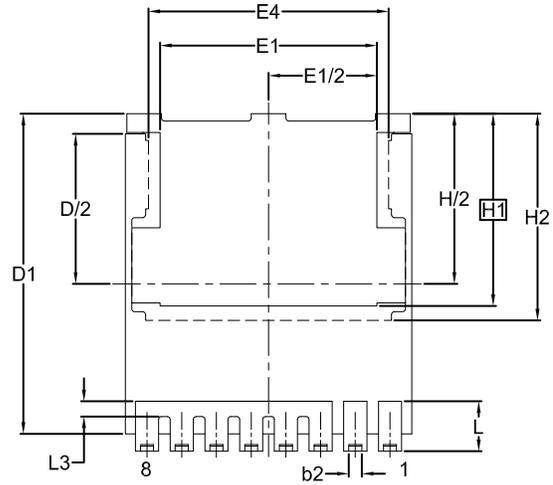
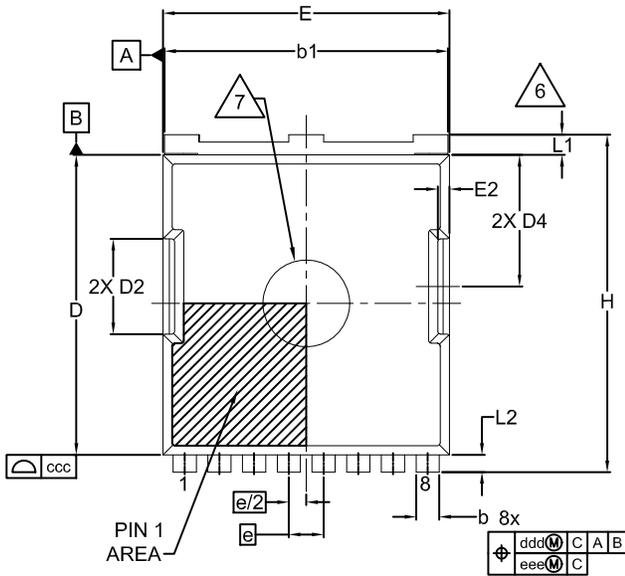


Figure 12. Transient Thermal Impedance

# NTBL125N60S5H

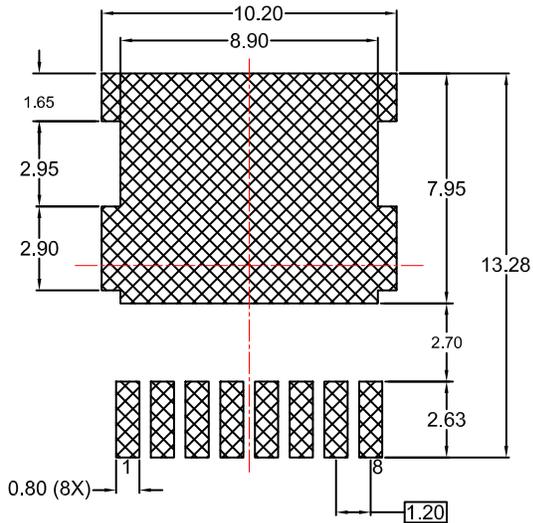
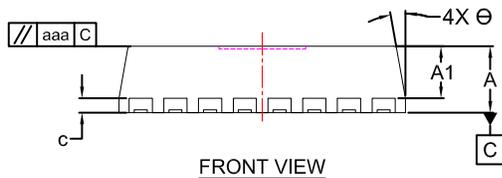
## PACKAGE DIMENSIONS

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



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS.
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.



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
Ø	10° REF.		
aaa	0.20		
ccc	0.20		
ddd	0.25		
eee	0.20		

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