

N-Channel Power MOSFET

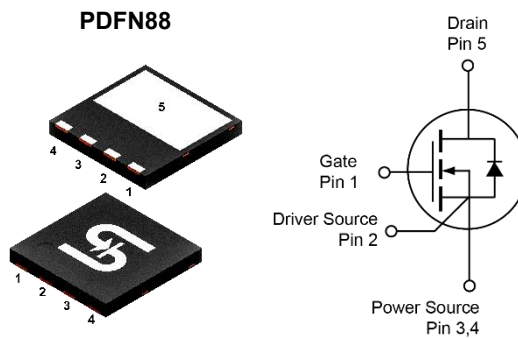
FEATURES

- Latest super-junction technology
- Low gate charge capacitance
- The driver source pin (Kelvin-source) helps reduce switching losses
- High gate noise immunity
- RoHS compliant
- Halogen-free

APPLICATIONS

- Switching power supply
- HV motor driver

KEY PERFORMANCE PARAMETERS		
PARAMETER	VALUE	UNIT
$V_{DS} @ T_{j,max}$	650	V
$R_{DS(on)} (max)$	110	m Ω
$Q_{g,typ}$	56	nC



Note: MSL 1 (Moisture Sensitivity Level) per J-STD-020

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	V_{DS}	600	V
Gate-Source Voltage	V_{GS}	± 30	V
Continuous Drain Current	I_D	27	A
$T_C = 25^\circ\text{C}$			
Pulsed Drain Current (Note 1)	I_{DM}	81	A
Total Power Dissipation @ $T_C = 25^\circ\text{C}$	P_D	178	W
Single Pulse Avalanche Energy (Note 2)	E_{AS}	161	mJ
Single Pulse Avalanche Current (Note 2)	I_{AS}	2.4	A
Operating Junction and Storage Temperature Range	T_J, T_{STG}	- 55 to +150	$^\circ\text{C}$

THERMAL PERFORMANCE			
PARAMETER	SYMBOL	LIMIT	UNIT
Junction to Case Thermal Resistance	$R_{\theta JC}$	0.7	$^\circ\text{C/W}$
Junction to Ambient Thermal Resistance (Note 3)	$R_{\theta JA}$	48	$^\circ\text{C/W}$

Notes:

1. Pulse Width $\leq 100\mu\text{s}$.
2. $L = 50\text{mH}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$.
3. Device on a PCB FR4 with 1 in² (single layer, 2 oz thickness) copper area for drain connection

ELECTRICAL SPECIFICATIONS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNIT
Static (Note 4)						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 1mA$	BV_{DSS}	600	--	--	V
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 2.5mA$	$V_{GS(TH)}$	4	4.6	6	V
Gate Body Leakage	$V_{GS} = \pm 30V, V_{DS} = 0V$	I_{GSS}	--	--	± 100	nA
Zero Gate Voltage Drain Current	$V_{DS} = 600V, V_{GS} = 0V$	I_{DSS}	--	--	100	μA
Drain-Source On-State Resistance	$V_{GS} = 10V, I_D = 9A$	$R_{DS(on)}$	--	94	110	m Ω
	$V_{GS} = 12V, I_D = 9A$		--	90	105	
Dynamic (Note 5)						
Total Gate Charge	$V_{DS} = 480V, I_D = 27A,$ $V_{GS} = 10V$	Q_g	--	56	--	nC
Gate-Source Charge		Q_{gs}	--	20	--	
Gate-Drain Charge		Q_{gd}	--	29	--	
Input Capacitance	$V_{DS} = 300V, V_{GS} = 0V,$ $f = 100kHz$	C_{iss}	--	2306	--	pF
Output Capacitance		C_{oss}	--	59	--	
Reverse Transfer Capacitance		C_{rss}	--	10	--	
Effective output capacitance energy related		$C_{o(er)}$	--	146	--	
Effective output capacitance time related	$V_{GS} = 0V$ $V_{DS} = 0V \text{ to } 480V$	$C_{o(tr)}$	--	580	--	
Gate Resistance	$f = 1.0MHz$	R_g	--	1.7	--	Ω
Switching (Note 6)						
Turn-On Delay Time	$V_{DD} = 300V, R_G = 6\Omega,$ $I_D = 27A, V_{GS} = 10V$	$t_{d(on)}$	--	37	--	ns
Turn-On Rise Time		t_r	--	72	--	
Turn-Off Delay Time		$t_{d(off)}$	--	57	--	
Turn-Off Fall Time		t_f	--	19	--	
Source-Drain Diode						
Forward Voltage (Note 4)	$I_S = 9A, V_{GS} = 0V$	V_{SD}	--	0.8	1.5	V
Reverse Recovery Time	$I_S = 13.5A$	t_{rr}	--	351	--	ns
Reverse Recovery Charge	$dI_F/dt = 100A/\mu s$	Q_{rr}	--	6	--	μC

Notes:

4. Pulse test: Pulse Width $\leq 300\mu s$, duty cycle $\leq 2\%$.
5. Defined by design. Not subject to production test.
6. Switching time is essentially independent of operating temperature.

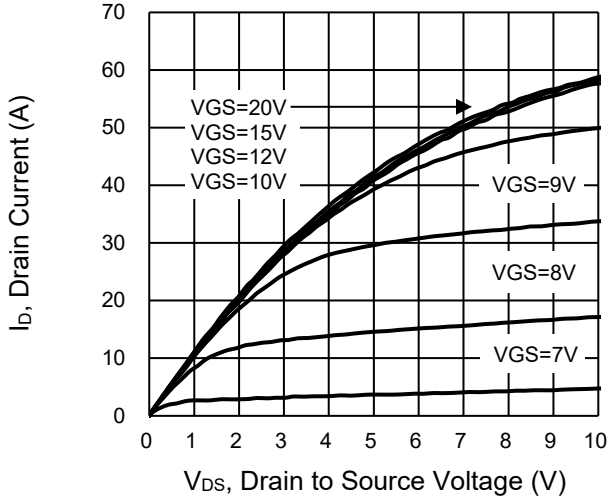
ORDERING INFORMATION

ORDERING CODE	PACKAGE	PACKING
TSM60NE110CE RVG	PDFN88	3,000pcs / 13" Reel

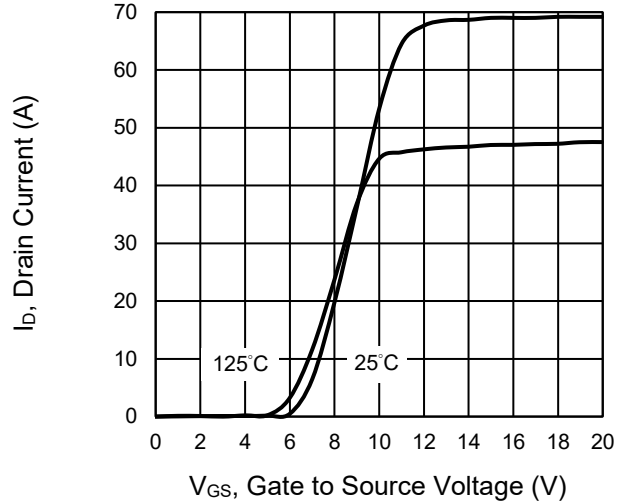
CHARACTERISTICS CURVES

($T_c = 25^\circ\text{C}$ unless otherwise noted)

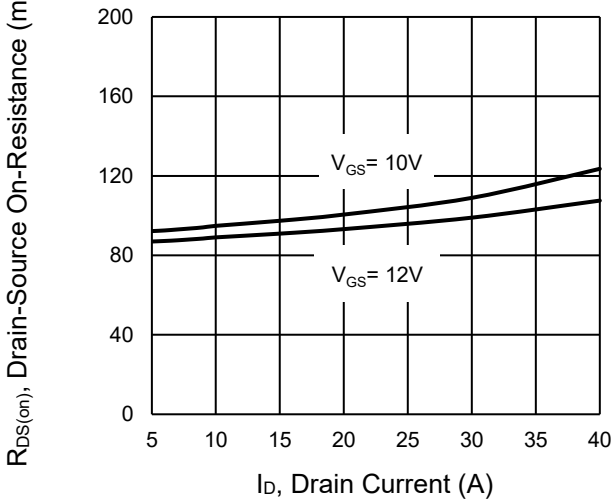
Output Characteristics



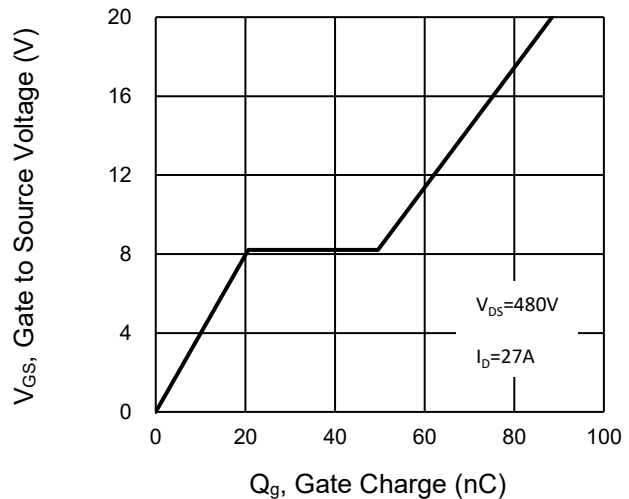
Transfer Characteristics



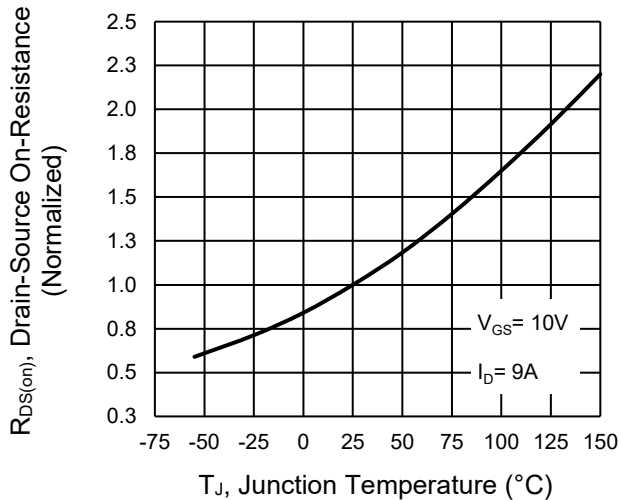
On-Resistance vs. Drain Current



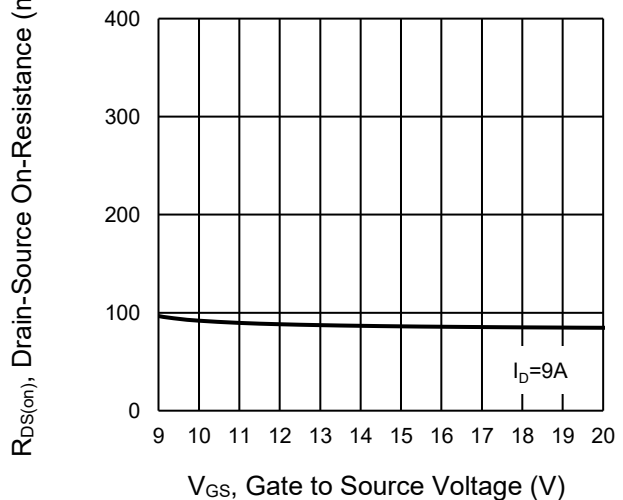
Gate-Source Voltage vs. Gate Charge



On-Resistance vs. Junction Temperature



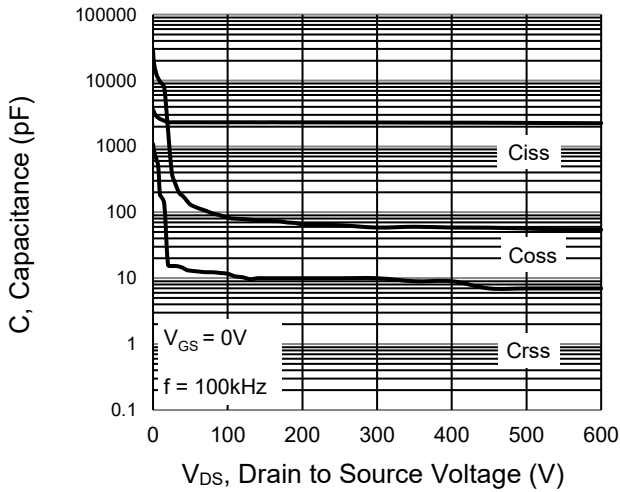
On-Resistance vs. Gate-Source Voltage



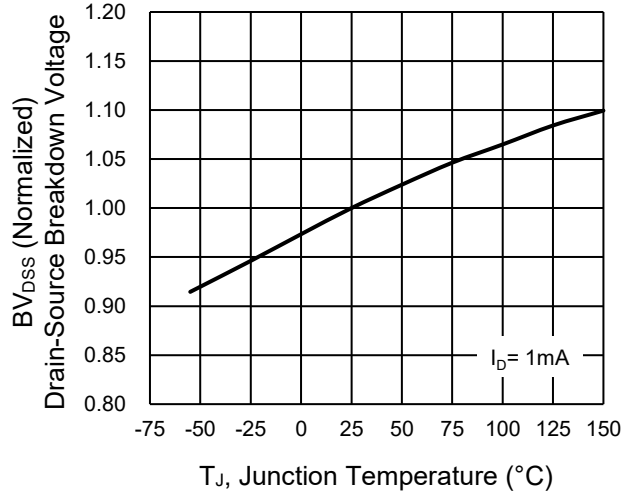
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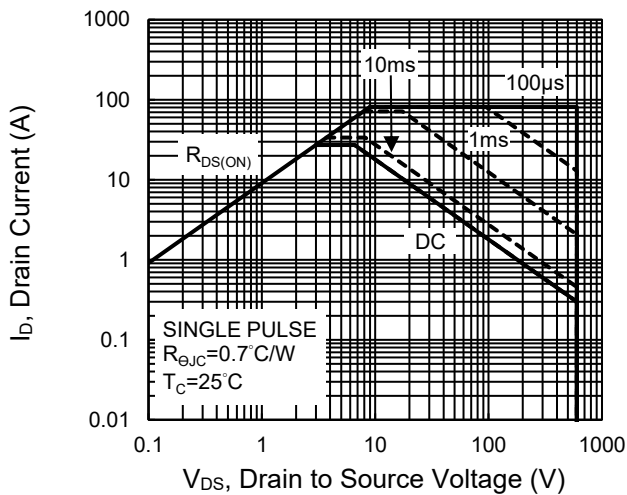
Capacitance vs. Drain-Source Voltage



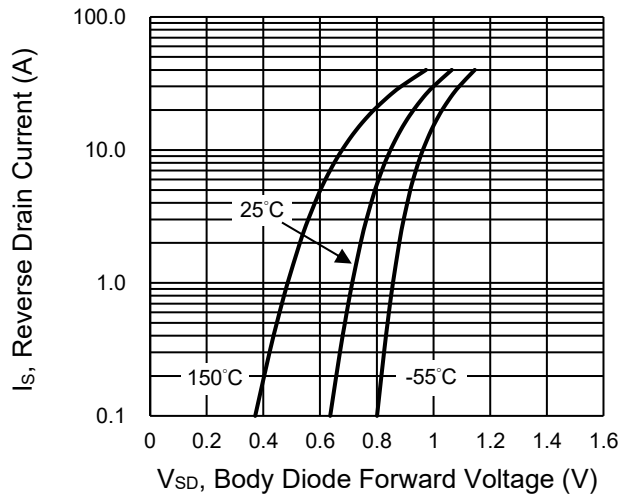
BV_{DSS} vs. Junction Temperature



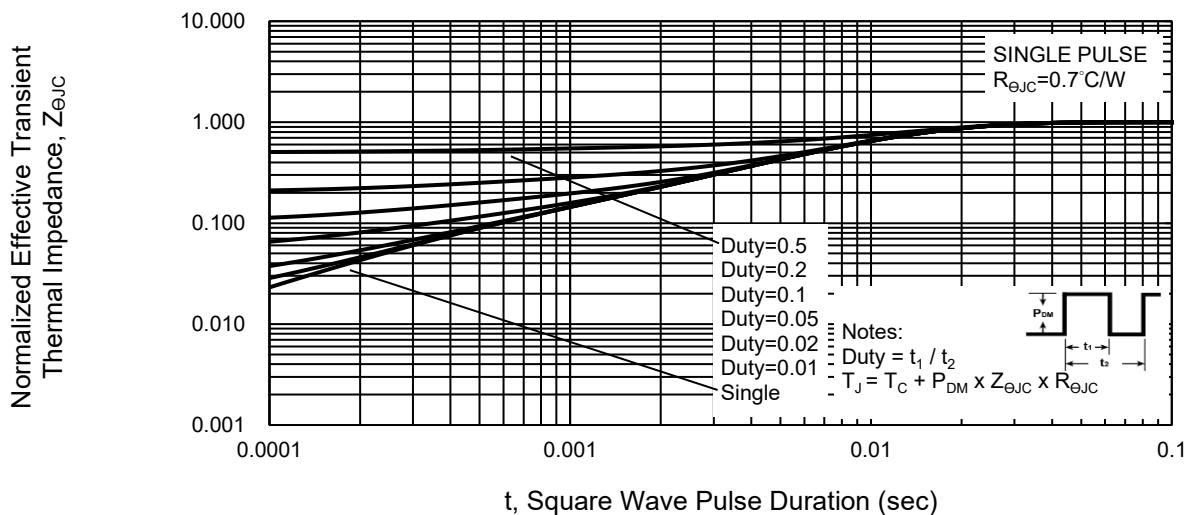
Maximum Safe Operating Area, Junction-to-Case



Source-Drain Diode Forward Current vs. Voltage



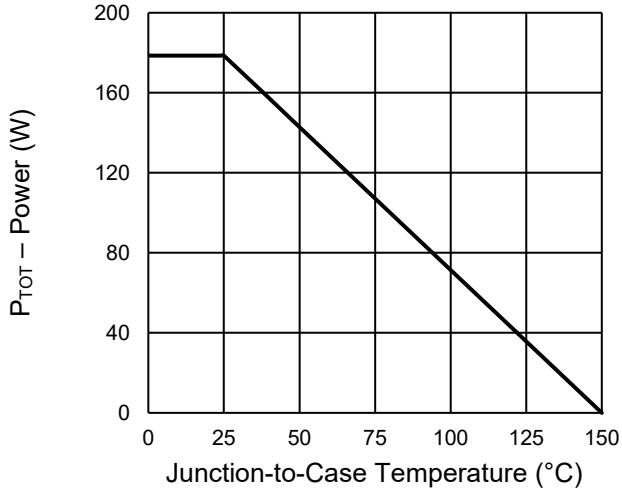
Normalized Thermal Transient Impedance, Junction-to-Case



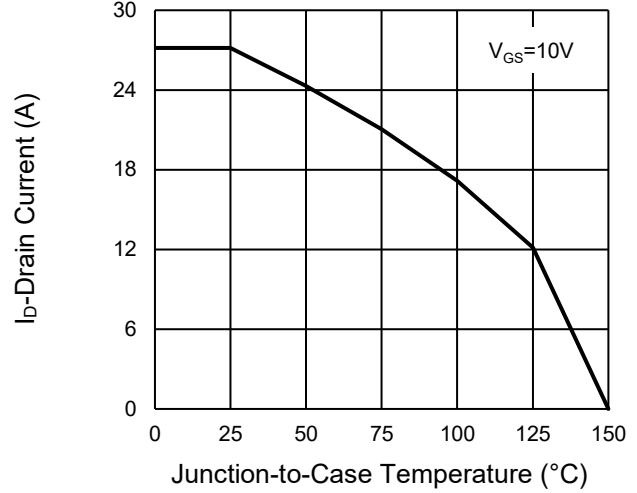
CHARACTERISTICS CURVES

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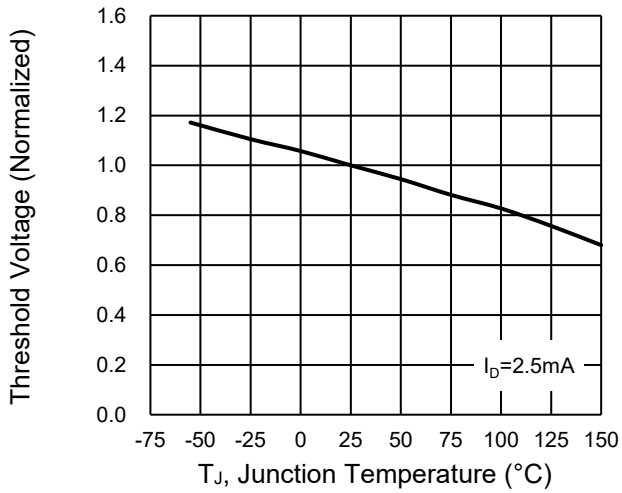
Power Dissipation



Drain Current

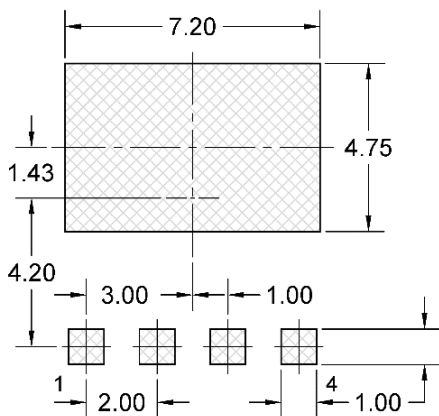
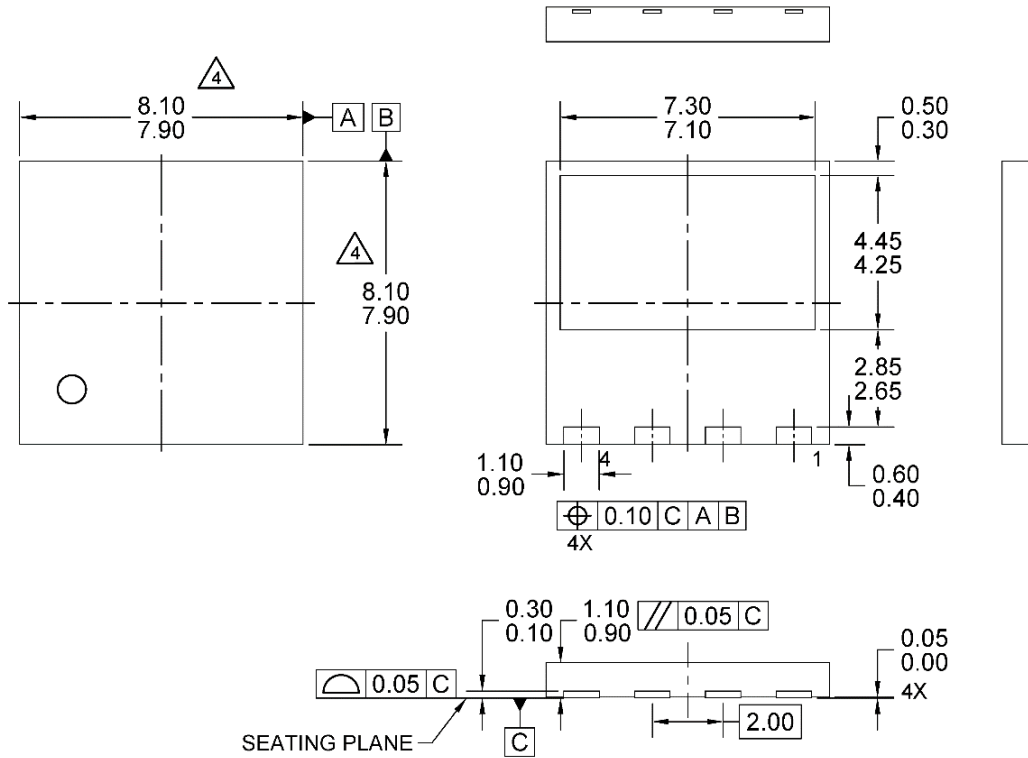


Normalized gate threshold voltage vs Temperature

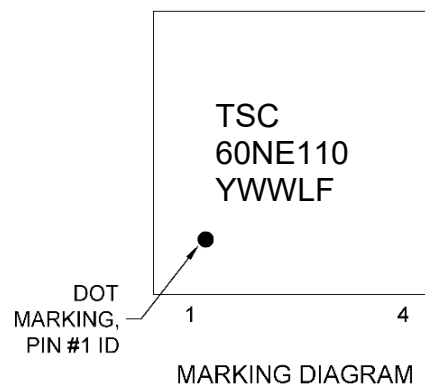


PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

PDFN88



SUGGESTED PAD LAYOUT
(REFERENCE ONLY)



60NE110 = Device marking
Y = Year Code
WW = Week Code (01~52)
L = Lot Code (1~9,A~Z)
F = Factory Code

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
3. THERE IS NO EXISTING INDUSTRY STANDARD FOR THIS PACKAGE.

$\Delta 4$ MOLDED PLASTIC BODY DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.

5. DWG NO REF: HQ2SD07-PDFN88-126 REV A.

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