

### ➤ General Description

This PAN60TD32DA N-Channel enhancement mode power field effect transistor is the high density trench technology and this advanced technology can provide excellent  $R_{ds(On)}$  performance and efficiency for power switching and load switching application., this device also comply with the RoHS and Green Product requirement with full function reliability approved.

### ➤ Feature

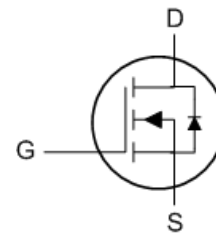
- Green Device Available
- Super Low Gate Charge
- 100% EAS Guaranteed
- Excellent  $CdV/dt$  effect decline
- Advanced high cell density Trench technology
- DFN3.3x3.3-8L package design

### ➤ DFN3.3x3.3-8L



### ➤ Application

- DC/DC Primary Side Switch
- Industrial Synchronous
- Rectification Load Switch
- DC/DC Converters



### ➤ Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Drain-Source Voltage	$V_{DS}$	60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current, $V_{GS} @ 10V_1$	$I_D @ T_C=25^\circ C$	50	A
Continuous Drain Current, $V_{GS} @ 10V_1$	$I_D @ T_C=100^\circ C$	31	A
Pulsed Drain Current <sub>2</sub>	$I_{DM}$	120	A
Single Pulse Avalanche Energy <sub>3</sub>	EAS	80	mJ
Avalanche Current	$I_{AS}$	40	A
Total Power Dissipation <sub>4</sub>	$P_D @ T_C=25^\circ C$	41	W
Storage Temperature Range	$T_{STG}$	-55 to 150	$^\circ C$
Operating Junction Temperature Range	$T_J$	-55 to 150	$^\circ C$
Thermal Resistance Junction-ambient <sub>1</sub> ( $t \leq 10S$ )	$R_{\theta JA}$	35	$^\circ C/W$
Thermal Resistance Junction-ambient <sub>1</sub> (Steady State)		55	$^\circ C/W$
Thermal Resistance Junction-case <sub>1</sub>	$R_{\theta JC}$	3	$^\circ C/W$

### ➤ Electrical Characteristics ( $T_J=25^\circ C$ Unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V$ , $I_D=250\mu A$	60	---	---	V
Static Drain-Source On-Resistance <sup>2</sup>	$R_{DS(ON)}$	$V_{GS}=10V$ , $I_D=20A$	---	7.1	8.5	$m\Omega$
		$V_{GS}=4.5V$ , $I_D=15A$	---	9.5	12	$m\Omega$
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}$ , $I_D=250\mu A$	1.2	---	2.5	V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=48V$ , $V_{GS}=0V$ , $T_J=25^\circ C$	---	---	1	$\mu A$
		$V_{DS}=48V$ , $V_{GS}=0V$ , $T_J=55^\circ C$	---	---	5	
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V$ , $V_{DS}=0V$	---	---	$\pm 100$	nA
Gate Resistance	$R_g$	$V_{DS}=0V$ , $V_{GS}=0V$ , $f=1MHz$	---	1.2	---	$\Omega$
Total Gate Charge (10V)	$Q_g$	$V_{DS}=30V$ , $V_{GS}=10V$ , $I_D=18A$	---	57	---	nC
Gate-Source Charge	$Q_{gs}$		---	8.7	---	
Gate-Drain Charge	$Q_{gd}$		---	14	---	
Turn-On Delay Time	$T_{d(on)}$	$V_{DD}=30V$ , $V_{GS}=10V$ , $R_G=3.3\Omega$ , $I_D=20A$	---	16.2	---	ns
Rise Time	$T_r$		---	41.2	---	
Turn-Off Delay Time	$T_{d(off)}$		---	56.4	---	
Fall Time	$T_f$		---	16.2	---	
Input Capacitance	$C_{iss}$	$V_{DS}=30V$ , $V_{GS}=0V$ , $f=1MHz$	---	3307	---	$\mu F$
Output Capacitance	$C_{oss}$		---	201	---	
Reverse Transfer Capacitance	$C_{rss}$		---	151	---	

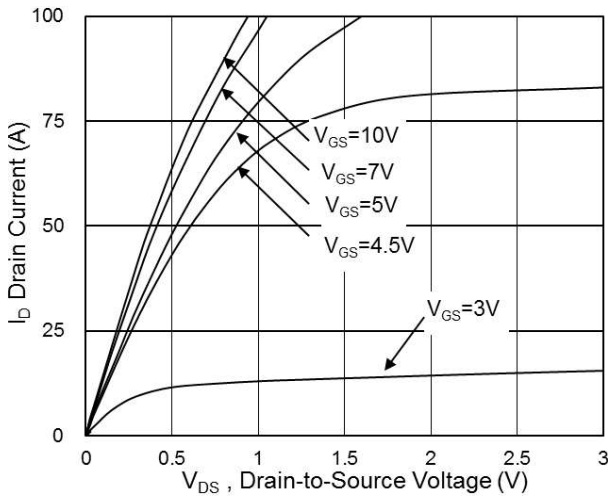
### ➤ Diode Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Continuous Source Current <sup>1,5</sup>	$I_S$	$V_G=V_D=0V$ , Force Current	---	---	50	A
Diode Forward Voltage <sup>2</sup>	$V_{SD}$	$V_{GS}=0V$ , $I_S=1A$ , $T_J=25^\circ C$	---	---	1.2	V
Reverse Recovery Time	$t_{rr}$	$I_F=20A$ , $dI/dt=100A/\mu s$ ,	---	22	---	nS
Reverse Recovery Charge	$Q_{rr}$	$T_J=25^\circ C$	---	72	---	

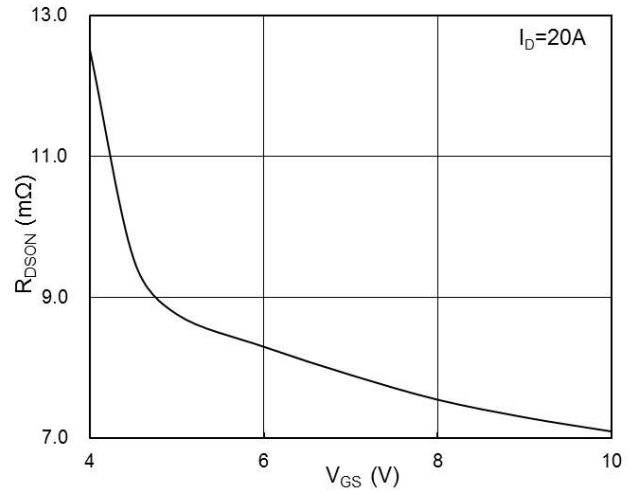
Note :

1. Pulse width limited by maximum junction temperature.
2. The data tested by pulsed, pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
3. The EAS data shows Max. rating. The test condition is  $V_{DD}=50V$ ,  $V_{GS}=10V$ ,  $L=0.1mH$ ,  $I_{AS}=40A$
4. Ensure that the channel temperature does not exceed  $150^\circ C$ .
5. The data is theoretically the same as  $I_D$  and  $IDM$ , in real applications, should be limited by total power dissipation.

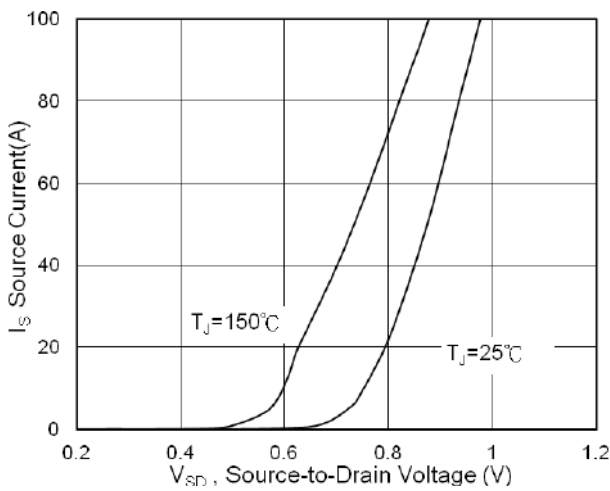
### ➤ Typical Characteristics



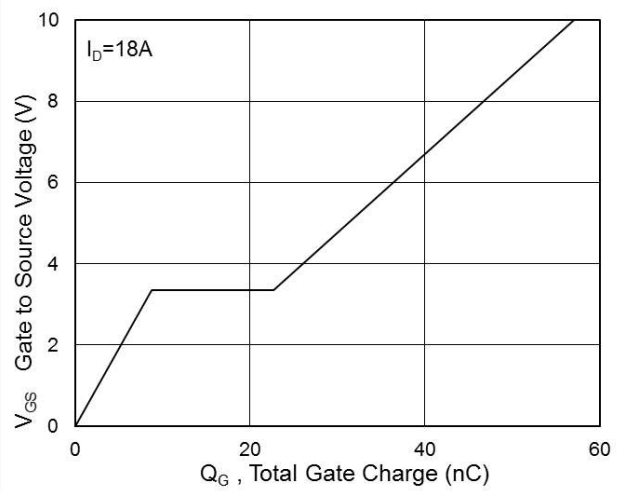
**Fig.1 Typical Output Characteristics**



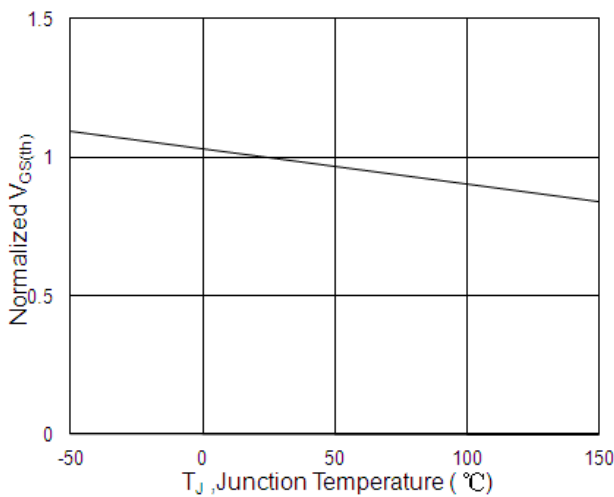
**Fig.2 On-Resistance v.s Gate-Source**



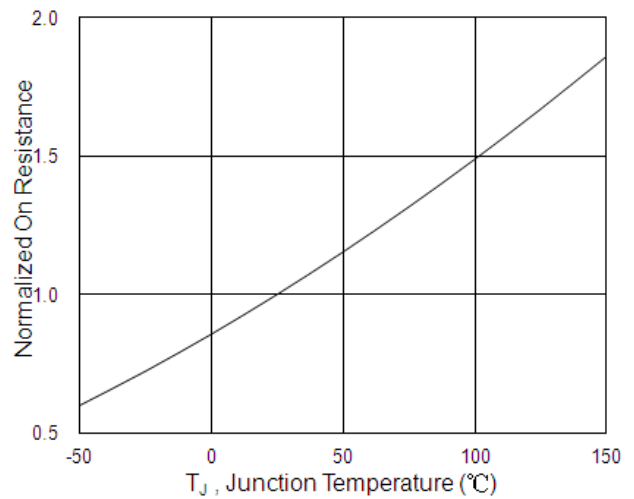
**Fig.3 Forward Characteristics of Reverse**



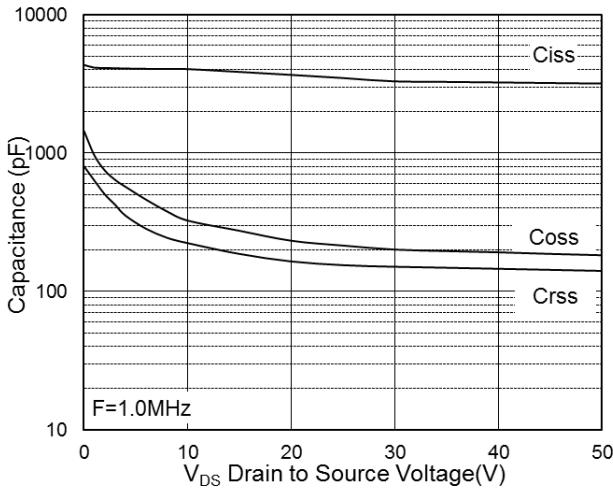
**Fig.4 Gate-Charge Characteristics**



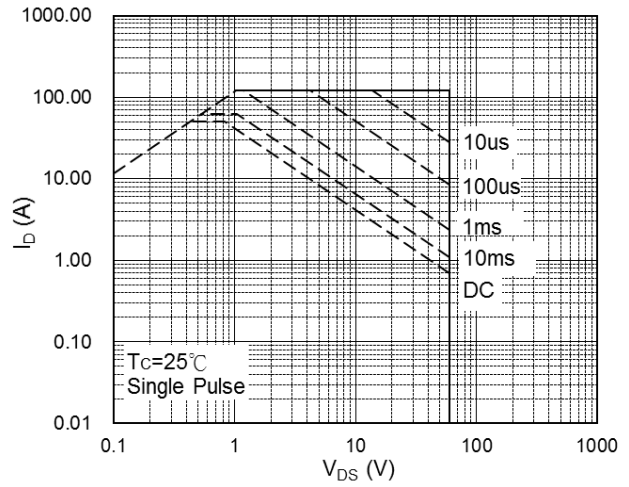
**Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$**



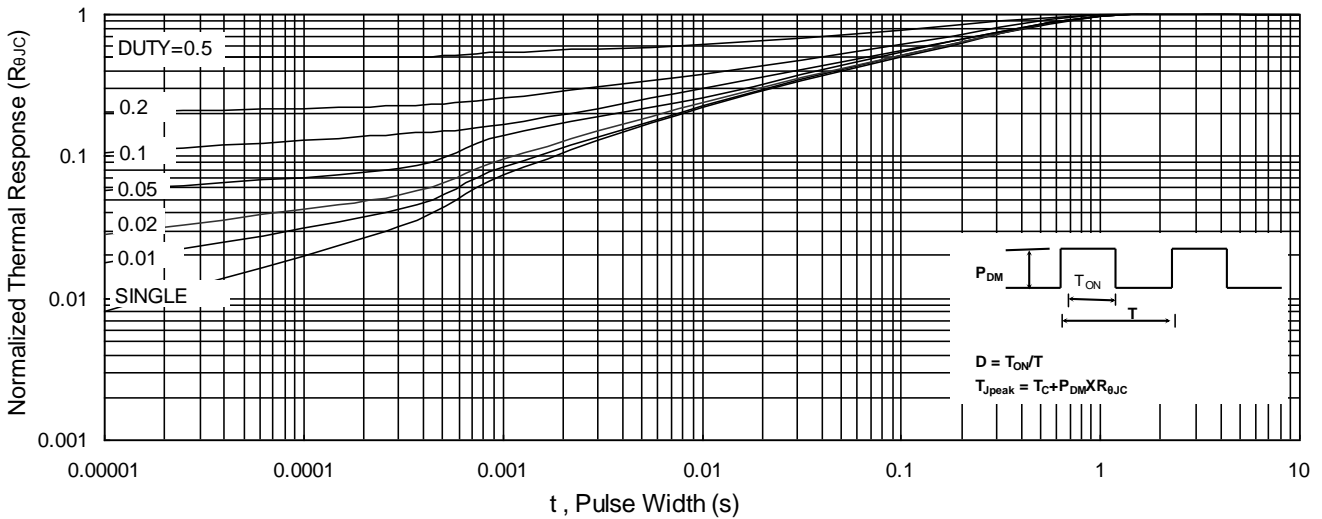
**Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$**



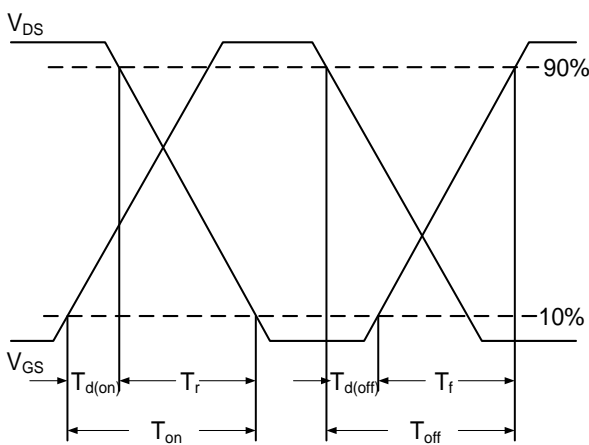
**Fig.7 Capacitance**



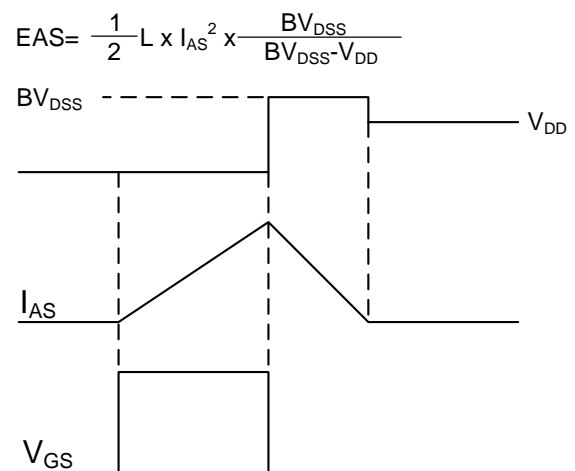
**Fig.8 Safe Operating Area**



**Fig.9 Normalized Maximum Transient Thermal Impedance**

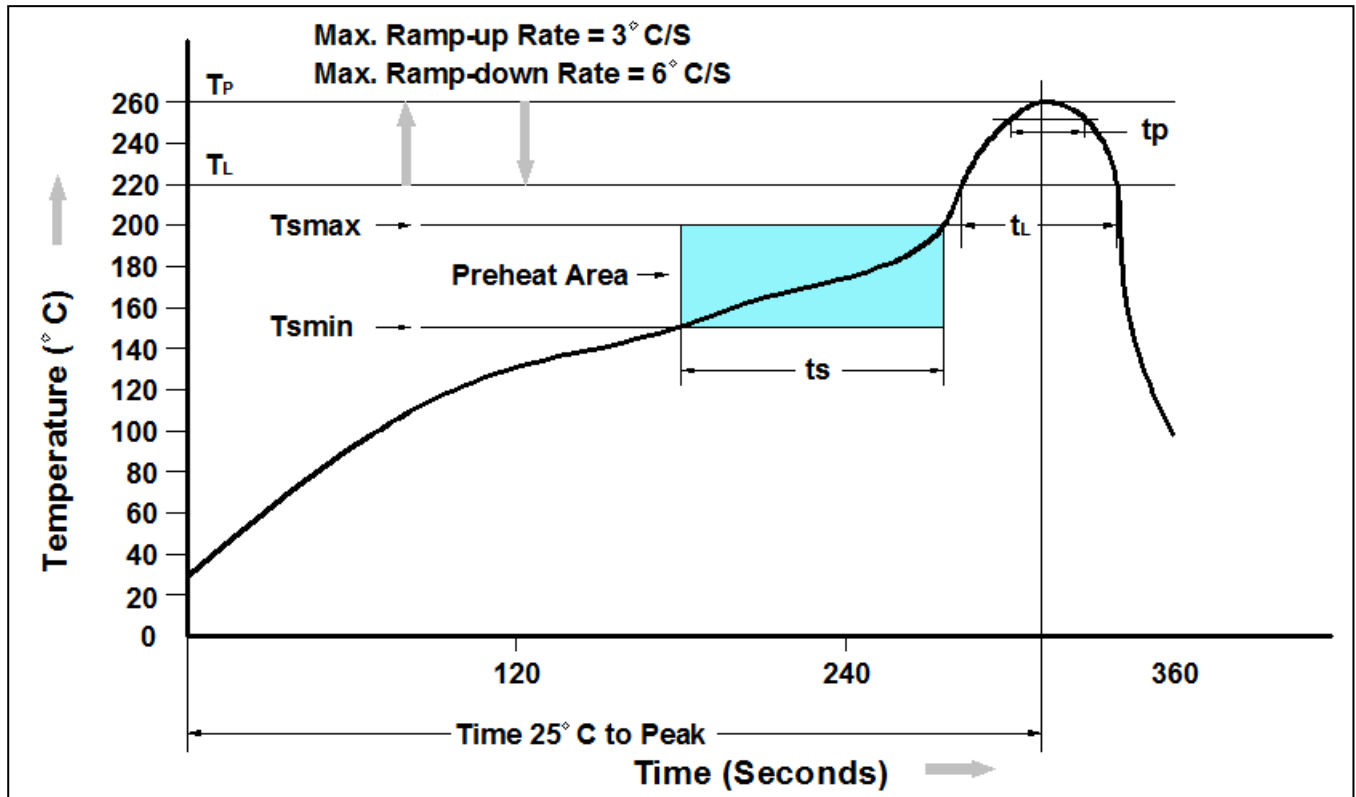


**Fig.10 Switching Time Waveform**



**Fig.11 Unclamped Inductive Switching Waveform**

### ➤ Recommend IR Reflow Soldering Thermal Profile

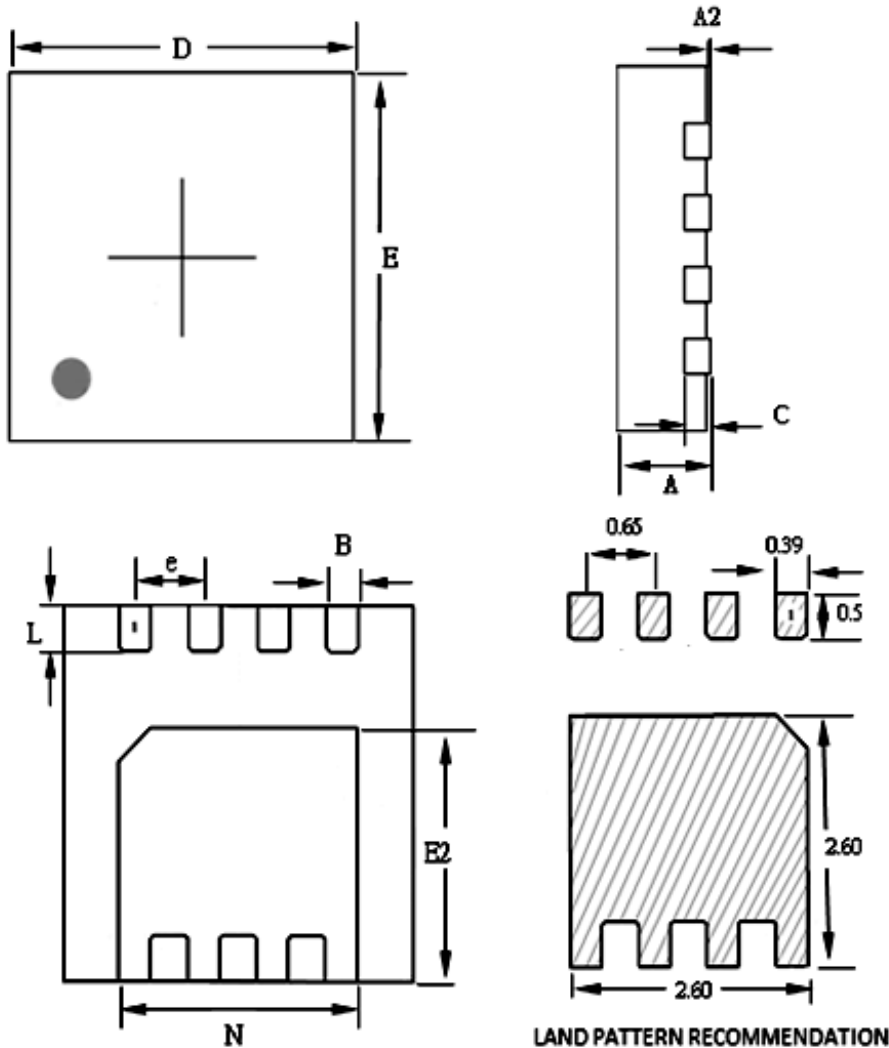


Profile Feature	Pb-Free Assembly Profile
Temperature Min. (T <sub>smin</sub> )	150°C
Temperature Max. (T <sub>smax</sub> )	200°C
Time (t <sub>s</sub> ) from (T <sub>smin</sub> to T <sub>smax</sub> )	60-120 seconds
Average Ramp-up Rate (t <sub>L</sub> to t <sub>P</sub> )	3°C/second max.
Liquidous Temperature (T <sub>L</sub> )	217°C
Time (t <sub>L</sub> ) Maintained Above (T <sub>L</sub> )	60 – 150 seconds
Peak Temperature	260°C +0°C / -5°C
Time (t <sub>P</sub> ) within 5°C of actual Peak Temperature	30 seconds
Ramp-down Rate (T <sub>P</sub> to T <sub>L</sub> )	6°C/second max
Time 25°C to Peak Temperature	8 minutes max.

### ➤ Ordering Information

Part Number	Description	Quantity
PAN60TD32DA	DFN3.3x3.3-8L Reel	3000 pcs

➤ Package Information (DFN3.3X3.3-8L)



SYMBOLS	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.70	0.75	0.80	0.028	0.030	0.031
A2	0.00	--	0.05	0.000	--	0.002
B	0.24	0.30	0.35	0.009	0.012	0.014
C	0.10	0.15	0.25	0.004	0.006	0.010
D	3.15	3.30	3.40	0.124	0.130	0.134
E	3.15	3.30	3.40	0.124	0.130	0.134
E2	2.15	2.25	2.35	0.085	0.089	0.093
L	0.35	0.40	0.45	0.014	0.016	0.018
N	2.10	2.25	2.35	0.083	0.089	0.093
e	--	0.65	--	--	0.026	--

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