



# Tape & Reel Packaging Standards

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## In Brief

The document is designed to align packaging specifications alignment with assembly line requirements. This comprehensive guide offers TNR (Tape and Reel) unit orientation guidelines, package orientation information, and details on reflow profile standards. This document serves as an indispensable resource for optimizing packaging practices and ensuring efficient assembly processes.

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### Revision History

<b>Rev.</b>	<b>Revision Description</b>	<b>Edit by</b>	<b>Date</b>
Rev.00	Document release	Raina Lin	2024/04/22
Rev.01	TOLL package and note 2 added	Raina Lin	2024/10/21

### TNR Unit Orientation Guidelines

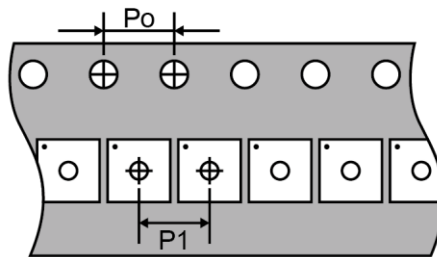
Package	Reel Size		Tape Width mm	Pitch Dimension(Po)		Pitch Dimension(P1)		Reel Q'ty	Figure No
	inch	mm		inch(±0.004)	mm(±0.1)	inch(±0.004)	mm(±0.1)	PCS	
DFN0603-2L	7	178	8	0.157	4	0.079	2	10,000	5
DFN1006-2L	7	178	8	0.157	4	0.079	2	10,000	5
DFN1006-3L	7	178	8	0.157	4	0.079	2	10,000	6
DFN1010-6L	7	178	8	0.157	4	0.079	2	5,000	3
DFN1610-2L	7	178	8	0.157	4	0.157	4	3,000	4
DFN2020-6L	7	178	8	0.157	4	0.157	4	3,000	2
DFN2020-8L	7	178	8	0.157	4	0.157	4	3,000	2
DFN2020B-6L	7	178	8	0.157	4	0.157	4	3,000	2
DFN3030B-8L	7	178	8	0.157	4	0.157	4	3,000	2
DFN3810-9L	7	178	8	0.157	4	0.157	4	3,000	2
DFN2510-10L	7	178	8	0.157	4	0.157	4	5,000	7
DFN2510-10L	13	330	8	0.157	4	0.157	4	12,000	7
DFN3333-8L	13	330	12	0.157	4	0.315	8	5,000	1
DFN3333B-8L	13	330	12	0.157	4	0.315	8	5,000	1
DFN5060-8L	13	330	12	0.157	4	0.315	8	3,000	1
DFN5060B-8L	13	330	12	0.157	4	0.315	8	3,000	1
DFN5060X-8L	13	330	12	0.157	4	0.315	8	3,000	1
SOD-923	7	178	8	0.157	4	0.079	2	8,000	23
SOD-123	7	178	8	0.157	4	0.157	4	3,000	22
SOD-123FL	7	178	8	0.157	4	0.157	4	3,000	22
SOD-123HE	7	178	8	0.157	4	0.157	4	3,000	22
SOD-123HE	13	330	8	0.157	4	0.157	4	10,000	22
SOD-323	7	178	8	0.157	4	0.157	4	5,000	22
SOD-323HE	7	178	8	0.157	4	0.157	4	5,000	22
SOD-323HE	13	330	8	0.157	4	0.157	4	12,000	22
SOD-523	7	178	8	0.157	4	0.157	4	5,000	22
SOD-523	13	330	8	0.157	4	0.157	4	12,000	22
SOT-723	7	178	8	0.157	4	0.079	2	8,000	21
SOT-523	7	178	8	0.157	4	0.157	4	4,000	19
SOT-23	7	178	8	0.157	4	0.157	4	3,000	16
SOT-23	13	330	8	0.157	4	0.157	4	12,000	16

### TNR Unit Orientation Guidelines

Package	Reel Size		Tape Width mm	Pitch Dimension(Po)		Pitch Dimension(P1)		Reel Q'ty	Figure No
	inch	mm		inch(±0.004)	mm(±0.1)	inch(±0.004)	mm(±0.1)	PCS	
SOT-323	7	178	8	0.157	4	0.157	4	3,000	16
SOT-323	13	330	8	0.157	4	0.157	4	12,000	16
SOT-563	7	178	8	0.157	4	0.157	4	4,000	20
SOT-563	13	330	8	0.157	4	0.157	4	10,000	20
SOT-353	7	178	8	0.157	4	0.157	4	3,000	17
SOT-353	13	330	8	0.157	4	0.157	4	10,000	17
SOT-363	7	178	8	0.157	4	0.157	4	3,000	18
SOT-363	13	330	8	0.157	4	0.157	4	10,000	18
SOT-23 6L	7	178	8	0.157	4	0.157	4	3,000	15
SOT-23 6L	13	330	8	0.157	4	0.157	4	10,000	15
SOT-23 6L-1	7	178	8	0.157	4	0.157	4	3,000	15
SOT-89	7	178	8	0.157	4	0.157	4	1,000	14
SMA	7	178	12	0.157	4	0.315	8	1,800	11
SMA	13	330	12	0.157	4	0.315	8	7,500	11
SMA(W)	7	178	12	0.157	4	0.315	8	1,800	11
SMA(W)	13	330	12	0.157	4	0.315	8	7,500	11
SMAF-C	7	178	12	0.157	4	0.157	4	3,000	11
SMB	7	178	12	0.157	4	0.315	8	800	10
SMB	13	330	12	0.157	4	0.315	8	3,000	10
SMBF	13	330	12	0.157	4	0.315	8	5,000	10
SMAG	7	178	12	0.157	4	0.315	8	800	10
SMC	7	178	16	0.157	4	0.157	4	800	9
SMC	13	330	16	0.157	4	0.157	4	3,000	9
SOP-8	13	330	12	0.157	4	0.315	8	2,500	13
SOT-223	13	330	12	0.157	4	0.315	8	2,500	12
TO-277	13	330	12	0.157	4	0.315	8	5,000	30
TO-277B	13	330	16	0.157	4	0.315	8	5,000	31
TO-277C	13	330	12	0.157	4	0.315	8	5,000	30
DO-218AB	13	330	24	0.157	4	0.63	16	600	8

### TNR Unit Orientation Guidelines

Package	Reel Size		Tape Width mm	Pitch Dimension(Po)		Pitch Dimension(P1)		Reel Q'ty	Figure No
	inch	mm		inch(±0.004)	mm(±0.1)	inch(±0.004)	mm(±0.1)	PCS	
MICRO-MELF	7	178	8	0.157	4	0.157	4	3,000	32
MICRO-MELF	13	330	8	0.157	4	0.157	4	10,000	32
MINI-MELF / LL34	7	178	8	0.157	4	0.157	4	2,500	32
MINI-MELF / LL34	13	330	8	0.157	4	0.157	4	10,000	32
ABS	13	330	12	0.157	4	0.63	16	4,000	27
MSBL	13	330	16	0.157	4	0.472	12	3,000	26
SDIP	13	330	16	0.157	4	0.472	12	1,500	26
M4	13	330	16	0.157	4	0.472	12	3,000	25
M8	13	330	24	0.157	4	0.63	16	2,000	24
MDI	13	330	12	0.157	4	0.315	8	3,000	27
MICRO DIP / TDI	7	178	12	0.157	4	0.315	8	1,000	27
MICRO DIP / TDI	13	330	12	0.157	4	0.315	8	4,000	27
TO-252AA	13	330	16	0.157	4	0.315	8	3,000	29
TO-263(D2PAK)	13	330	24	0.157	4	0.63	16	800	28
TOLL	13	330	24	0.157	4	0.472	12	2,000	33



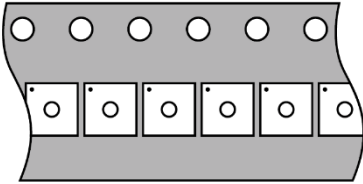
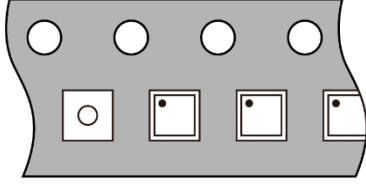
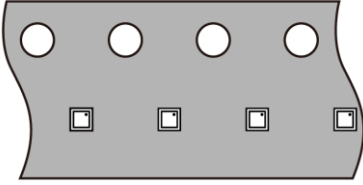
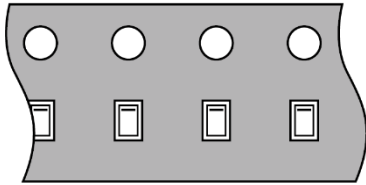
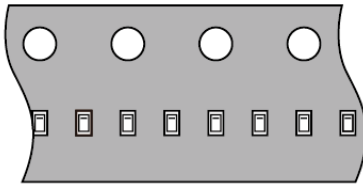
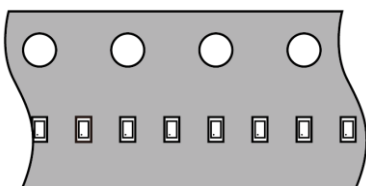
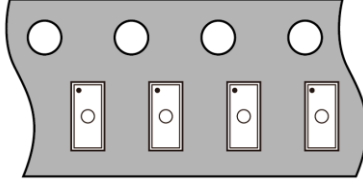
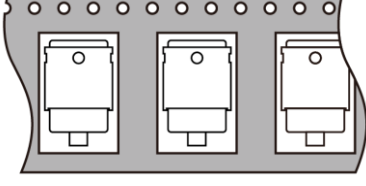
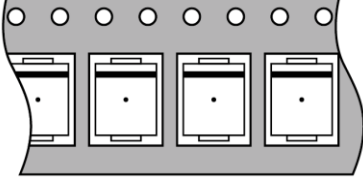
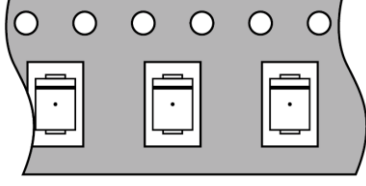
**Note 1:** Tape and reel dimensions and orientation

**Note 2:** Packaging methods referred to in this guideline are based on the R1/R2 orientations and apply to packages such as SOT-353, SOT-23 6L, SOT-23 6L-1, SOT-363, and SOT-563. Additionally, S1/S2 packaging options are available, featuring reversed polarities compared to the R1/R2 configurations.

## Package Orientation

Direction of Feed

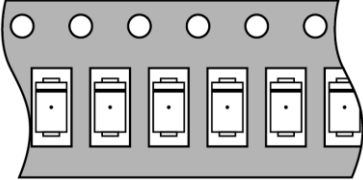
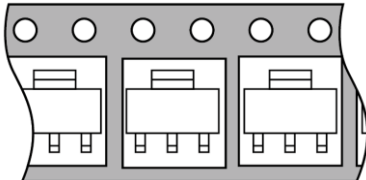
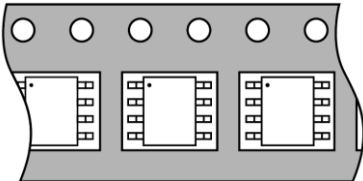
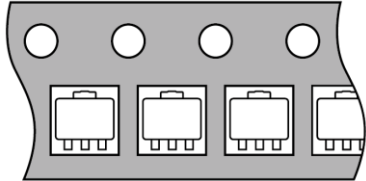
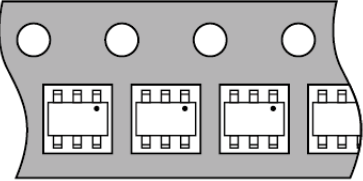
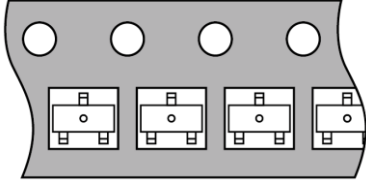
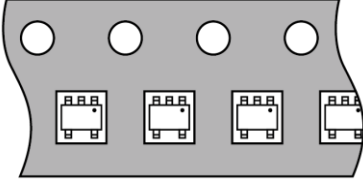
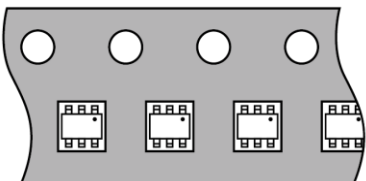
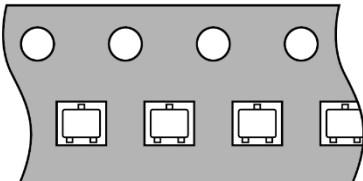
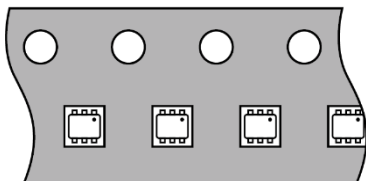


<p><b>Figure 1. DFN3333-8L/ DFN-3333B-8L/ DFN5060-8L/ DFN5060B-8L/ DFN5060X-8L</b> 12 mm (Tape Width, Typical)</p> 	<p><b>Figure 2. DFN2020-6L/ DFN2020B-6L/ DFN2020-8L/ / DFN3030B-8L/ DFN3810-9L</b> 8 mm (Tape Width, Typical)</p> 
<p><b>Figure 3. DFN1010-6L</b> 8 mm (Tape Width, Typical)</p> 	<p><b>Figure 4. DFN1610-2L</b> 8 mm (Tape Width, Typical)</p> 
<p><b>Figure 5. DFN0603-2L/ DFN1006-2L</b> 8 mm (Tape Width, Typical)</p> 	<p><b>Figure 6. DFN1006-3L</b> 8 mm (Tape Width, Typical)</p> 
<p><b>Figure 7. DFN2510-10L</b> 8 mm (Tape Width, Typical)</p> 	<p><b>Figure 8. DO-218AB</b> 24 mm (Tape Width, Typical)</p> 
<p><b>Figure 9. SMC</b> 16 mm (Tape Width, Typical)</p> 	<p><b>Figure 10. SMB/ SMBF/ SMAG</b> 12 mm (Tape Width, Typical)</p> 

## Package Orientation

Direction of Feed



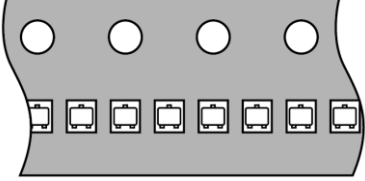
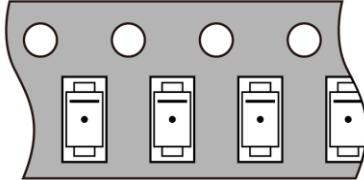
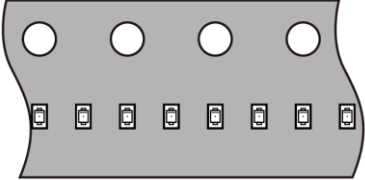
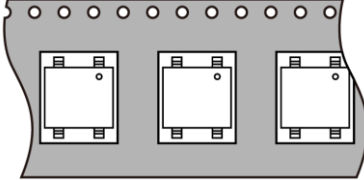
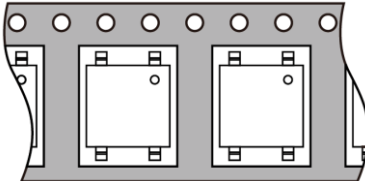
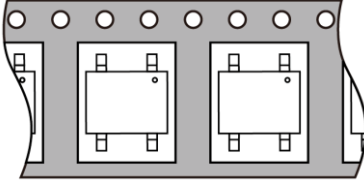
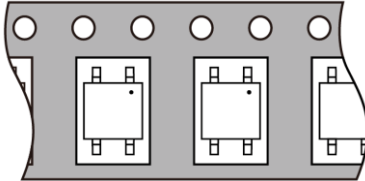
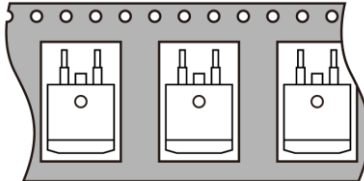
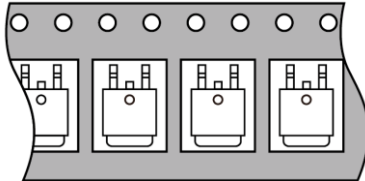
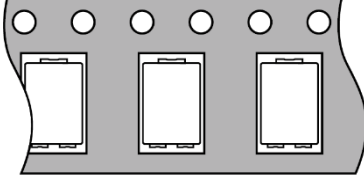
<p><b>Figure 11. SMA/ SMA(W)/ SMAF-C</b> 12 mm (Tape Width, Typical)</p> 	<p><b>Figure 12. SOT-223</b> 12 mm (Tape Width, Typical)</p> 
<p><b>Figure 13. SOP-8</b> 12 mm (Tape Width, Typical)</p> 	<p><b>Figure 14. SOT-89</b> 8 mm (Tape Width, Typical)</p> 
<p><b>Figure 15. SOT-23 6L/ SOT-23 6L-1</b> 8 mm (Tape Width, Typical) / (Note.2)</p> 	<p><b>Figure 16. SOT-23/ SOT-323</b> 8 mm (Tape Width, Typical)</p> 
<p><b>Figure 17. SOT-353</b> 8 mm (Tape Width, Typical) / (Note.2)</p> 	<p><b>Figure 18. SOT-363</b> 8 mm (Tape Width, Typical) / (Note.2)</p> 
<p><b>Figure 19. SOT-523</b> 8 mm (Tape Width, Typical)</p> 	<p><b>Figure 20. SOT-563</b> 8 mm (Tape Width, Typical) / (Note.2)</p> 



## Package Orientation

Direction of Feed

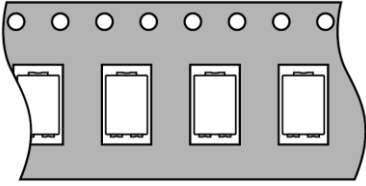
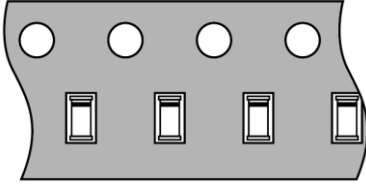
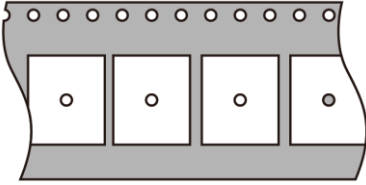


<p><b>Figure 21. SOT-723</b> 8 mm (Tape Width, Typical)</p> 	<p><b>Figure 22. SOD-123/ SOD-123FL/ SOD-123HE/ SOD-323/ SOD-323HE/ SOD-523</b> 8 mm (Tape Width, Typical)</p> 
<p><b>Figure 23. SOD-923</b> 8 mm (Tape Width, Typical)</p> 	<p><b>Figure 24. M8</b> 24 mm (Tape Width, Typical)</p> 
<p><b>Figure 25. M4</b> 16 mm (Tape Width, Typical)</p> 	<p><b>Figure 26. SDIP/ MSBL</b> 16 mm (Tape Width, Typical)</p> 
<p><b>Figure 27. MDI/ MICRO DIP/ ABS</b> 12 mm (Tape Width, Typical)</p> 	<p><b>Figure 28. TO-263</b> 24 mm (Tape Width, Typical)</p> 
<p><b>Figure 29. TO-252AA</b> 16 mm (Tape Width, Typical)</p> 	<p><b>Figure 30. TO-277/ TO-277C</b> 12 mm (Tape Width, Typical)</p> 

## Package Orientation

Direction of Feed



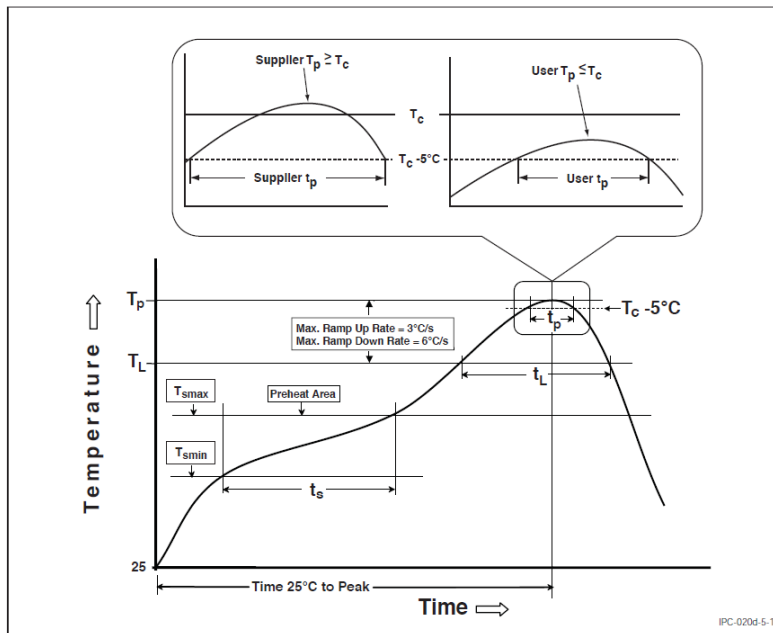
<p><b>Figure 31. TO-277B</b> 16 mm (Tape Width, Typical)</p> 	<p><b>Figure 32. MICRO-MELF/ MINI-MELF (LL34)</b> 8 mm (Tape Width, Typical)</p> 
<p><b>Figure 33. TOLL</b> 24 mm (Tape Width, Typical)</p> 	

### Reflow Profile

Base on current research, we propose using SnAg3Cu0.5 eutectic solder for lead free products and using Sn63 Pb37 eutectic solder for Sn-Pb products. Our temperature profile for product testing is based on experiment and JEDEC J-STD-020E specification.

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
<b>Preheat/Soak</b>		
Temperature Min ( $T_{smin}$ )	100 °C	150 °C
Temperature Max ( $T_{smax}$ )	150 °C	200 °C
Time ( $t_s$ ) from ( $T_{smin}$ to $T_{smax}$ )	60-120 seconds	60-120 seconds
Ramp-up rate ( $T_L$ to $T_p$ )	3 °C/second max.	3 °C/second max.
Liquidous temperature ( $T_L$ )	183 °C	217 °C
Time ( $t_L$ ) maintained above $T_L$	60-150 seconds	60-150 seconds
Peak package body temperature ( $T_p$ )	For users $T_p$ must not exceed the Classification temp in Table 4-1. For suppliers $T_p$ must equal or exceed the Classification temp in Table 4-1.	For users $T_p$ must not exceed the Classification temp in Table 4-2. For suppliers $T_p$ must equal or exceed the Classification temp in Table 4-2.
Time ( $t_p$ )* within 5 °C of the specified classification temperature ( $T_c$ ), see Figure 5-1.	20* seconds	30* seconds
Ramp-down rate ( $T_p$ to $T_L$ )	6 °C/second max.	6 °C/second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

\* Tolerance for peak profile temperature ( $T_p$ ) is defined as a supplier minimum and a user maximum.



S' ald 3,0 RmDa Dt scbsb Oqnbdr , BK r r ltb` snmSdl odq st qtr 'Sb(

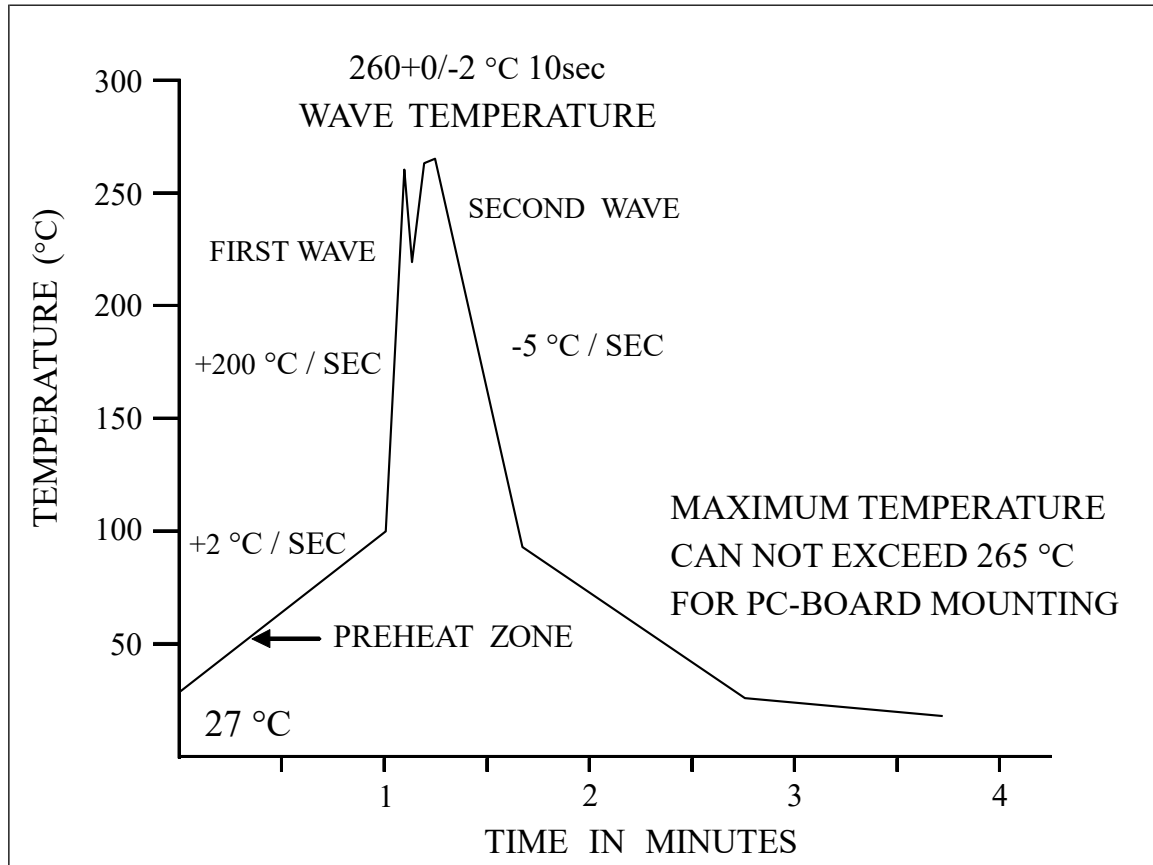
Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> ≥350
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

S' ald 3,1 Oa,Eqld Oqnbdr , BK r r ltb` snmSdl odq st qtr 'Sb(

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> 350 - 2000	Volume mm <sup>3</sup> >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm - 2.5 mm	260 °C	250 °C	245 °C
>2.5 mm	250 °C	245 °C	245 °C

### Lead Free Wave solder Profile

Wave soldering involves using the highest solder temperature and heat transfer rates, which particularly affect small resin-molded components such as transistors, integrated circuits, and surface mount components. This process includes a profile with a short dwell time in the solder pot and preheating to address thermal shock for ceramic components and temperature issues with resin-molded parts. Below is a typical temperature profile utilizing a 96.5/3.0/0.5 solder alloy.



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