NPN SILICON EPITAXIAL TRANSISTORS

CMBT3903
CMBT3904

SOT-23

SOT-23
SMD Package
RoHS compliant

DEVICE MARKING

CMBT3903 = **1Y**
CMBT3904 = **1A**

FEATURE

1. Low power loss, high efficiency,
2. Collector-to-base voltage (VCBO) of 60V,
3. Collector-to-emitter voltage (VCEO) of 40V,
4. High surge current capability.
5. Complimentry of **NPN CMBT3903 is PNP CMBT3905**
   Complimentry of **NPN CMBT3904 is PNP CMBT3906**
6. This product is available in AEC-Q101 Compliant and PPAP Capable also.

Note: For AEC-Q101 compliant products, please use suffix -AQ in the part number while ordering.

APPLICATIONS

1. Telephony and professional communication equipment.
2. Medium Power Amplification and Switching applications.

ABSOLUTE MAXIMUM RATINGS (Ta = 25 ℃ Unless otherwise specified)

PARAMETER		SYMBOL	VALUE	UNIT
Collector–base voltage (open emitter)		V_{CBO}	60	V
Collector–emitter voltage (open base)		V_{CEO}	40	V
Emitter–base voltage (open collector)		V_{EBO}	6	V
Collector current (DC)		I_C	200	mA
Total power dissipation up to T_{amb} = 25°C		P_{tot}	250	mW
D.C. current gain at I_C = 10mA; V_{CE} = 1V	**CMBT3903**	h_{FE}	50 ~150	
D.C. current gain at I_C = 10mA; V_{CE} = 1V	**CMBT3904**	h_{FE}	100 ~ 300	
Transition frequency at f = 35MHz I_C = 10mA; V_{CE} = 20V		f_T	300	MHz
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	250	mW
Storage temperature		T_{stg}	-55 to +150	°C
Junction temperature		T_j	150	°C

THERMAL RESISTANCE $T_j = P (R_{th\ j–t} + R_{th\ t–s} + R_{th\ s–a}) + T_{amb}$

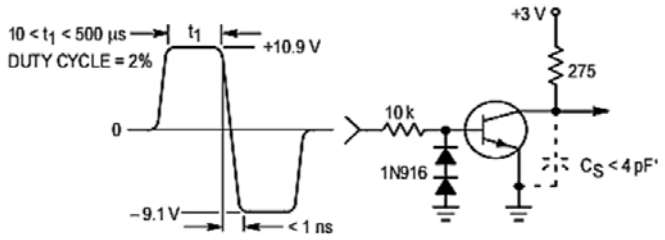
from junction to ambient	$R_{th\ j–a}$	500	K/W

ELECTRICAL CHARACTERISTICS at (Ta = 25 ℃ Unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	VALUE			UNIT
			Min.	Typ.	Max	
Collector–emitter breakdown voltage	$V_{(BR)CEO}$	I_C = 1mA; I_B = 0	40	--	--	V
Collector–base breakdown voltage	$V_{(BR)CBO}$	I_C = 10μA; I_E = 0	60	--	--	V
Emitter–base breakdown voltage	$V_{(BR)EBO}$	I_E = 10μA; I_C = 0	6	--	--	V
Collector cut–off current	I_{CEX}	V_{CE} = 30V; V_{EB} = 3V	--	--	50	nA
Output capacitance at f = 1 MHz	C_c	I_E = 0; V_{CB} = 5V	--	--	4	pF
Input capacitance at f = 1 MHz	C_e	I_C = 0; V_{BE} = 0,5V	--	--	8	pF
Base current with reverse biased emitter junction	I_{BEX}	V_{EB} = 3V; V_{CE} = 30V	--	--	50	nA
Saturation voltages	V_{CEsat}	I_C = 10mA; I_B = 1mA	--	--	0.2	V
	V_{CEsat}	I_C = 50mA; 1_B = 5mA	--	--	0.3	V
	V_{BEsat}	I_C = 10mA; I_B = 1mA	0.65	--	0.85	V
	V_{BEsat}	I_C = 50mA; I_B = 5mA	--	--	0.95	V
				CMBT 3903	**CMBT 3904**	
D.C. current gain	h_{FE}	I_C = 0,1mA; V_{CE} = 1V	Min.	20	40	
		I_C = 1mA; V_{CE} = 1V	Min.	35	70	
		I_C = 10mA; V_{CE} = 1V	Min.	50	100	
			Max.	150	300	
		I_C = 50mA; V_{CE} = 1V	Min.	30	60	
		I_C = 100mA; V_{CE} = 1V	Min.	15	30	
Transition frequency at f = 100 MHz	f_T	I_C = 10mA; V_{CE} = 20V	Min.	250	300	MHz
Noise figure at R_S = 1 kΩ	F	I_C = 100mA; V_{CE} = 5V f = 10Hz to 15,7kHz	Max.	6	5	dB
Small Signal Current Gain	h_{fe}	V_{CE} = 10V; I_C = 1mA; f = 1KHz	Min.	50	100	
			Max.	200	400	

TEST CIRCUIT AND DIAGRAMS

Delay and Rise Time Equivalent Test Circuit



Typical Characteristic Curves

Fig 1: Capacitance

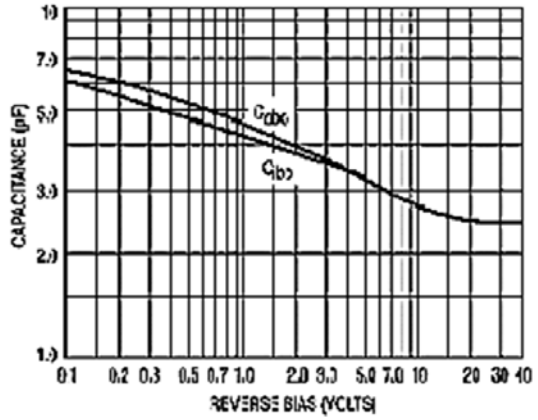


Fig 2: Turn–On Time

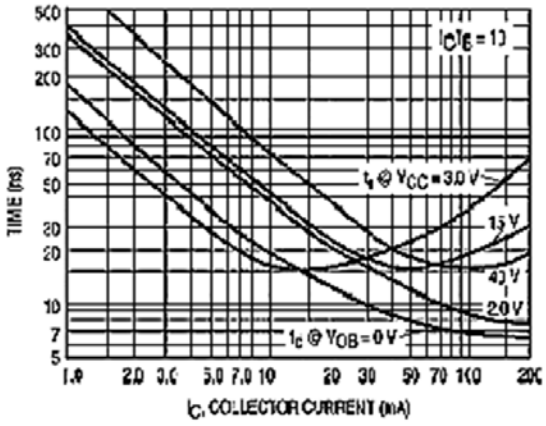


Figure 3: “ON” Voltages

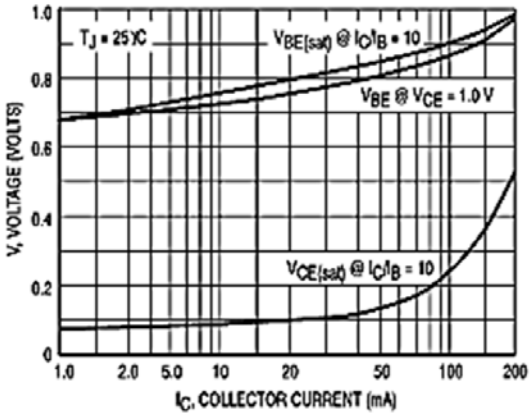


Fig 4: Charge Data

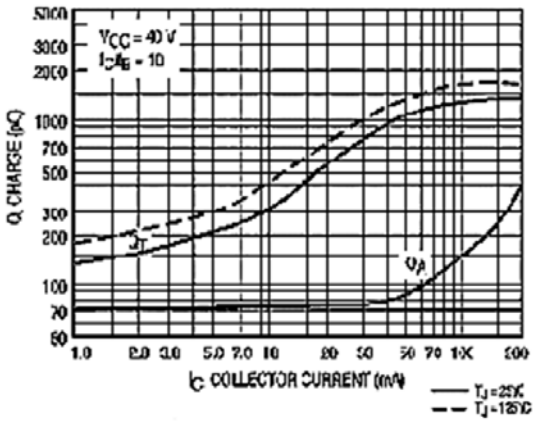


Fig 5: Fall Time

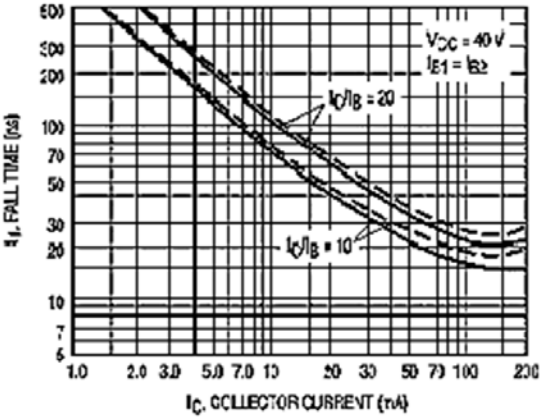
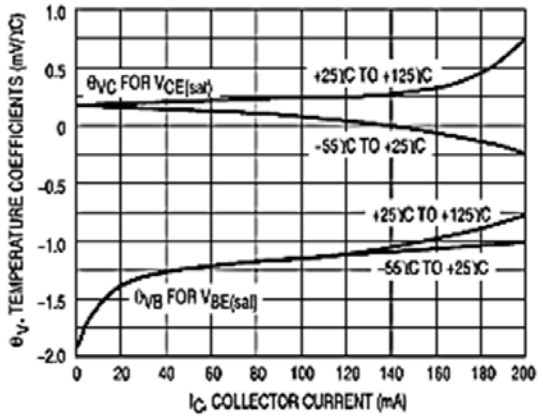


Figure 6: Temperature Coefficients



Typical Characteristic Curves

Figure 7. DC Current Gain

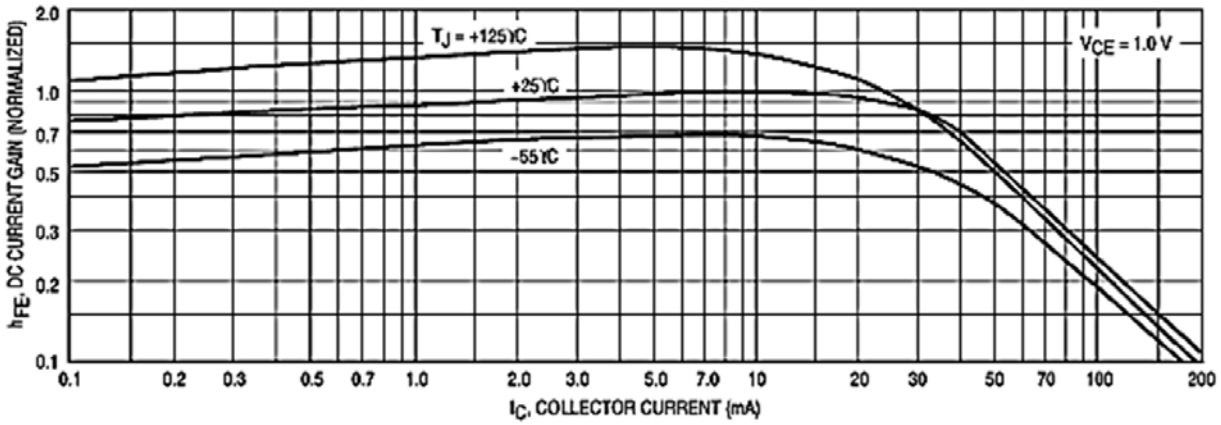
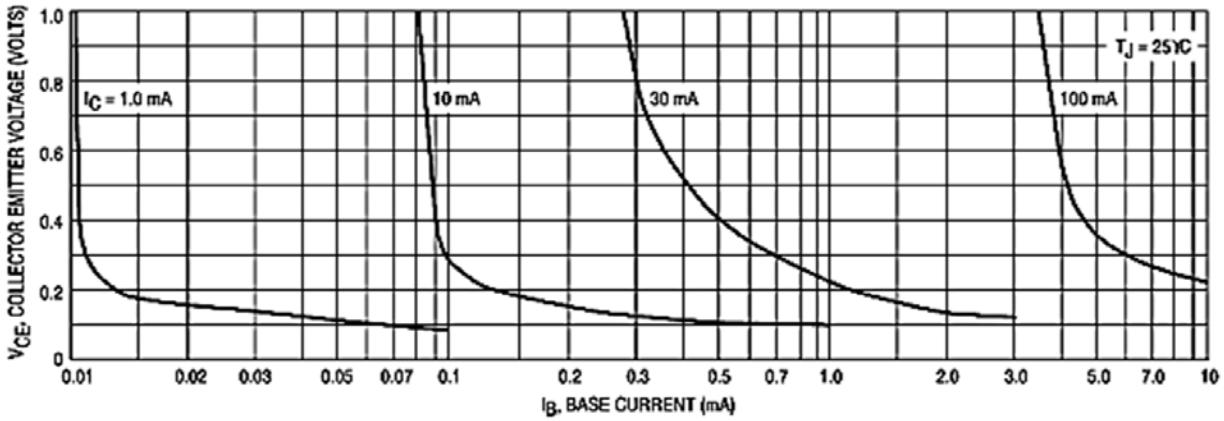
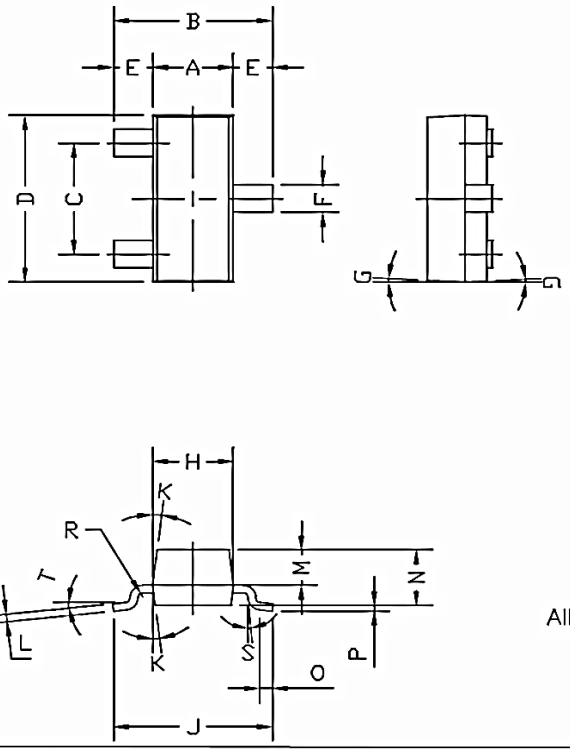


Figure 8. Collector Saturation Region



PACKAGE DETAILS

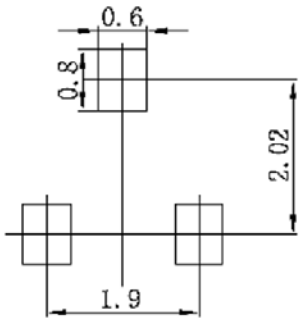
SOT-23 SMD Package



DIM	MIN	MAX
A	1.275	1.325
B	2.40	2.60
C	1.85	1.95
D	2.875	2.925
E	0.54 REF	
F	0.38	0.48
G	3 DEG	
H	–	1.30
J	2.40	2.60
K	7 DEG	
L	0.11	0.13
M	0.58	0.62
N	0.925	0.975
O	0.21	–
P	0.02	0.10
R	–	0.08
S	2 DEG	8 DEG
T	2 DEG	10 DEG

All dimensions are in mm

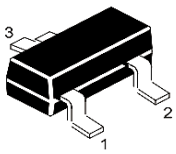
Suggested Pad Layout

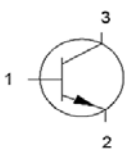


Note:
1.Controlling dimension:In millimeters.
2.General tolerance:± 0.05mm.
3.The pad layout is for reference purposes only.

Pin Configuration

1. BASE
2. EMITTER
3. COLLECTOR

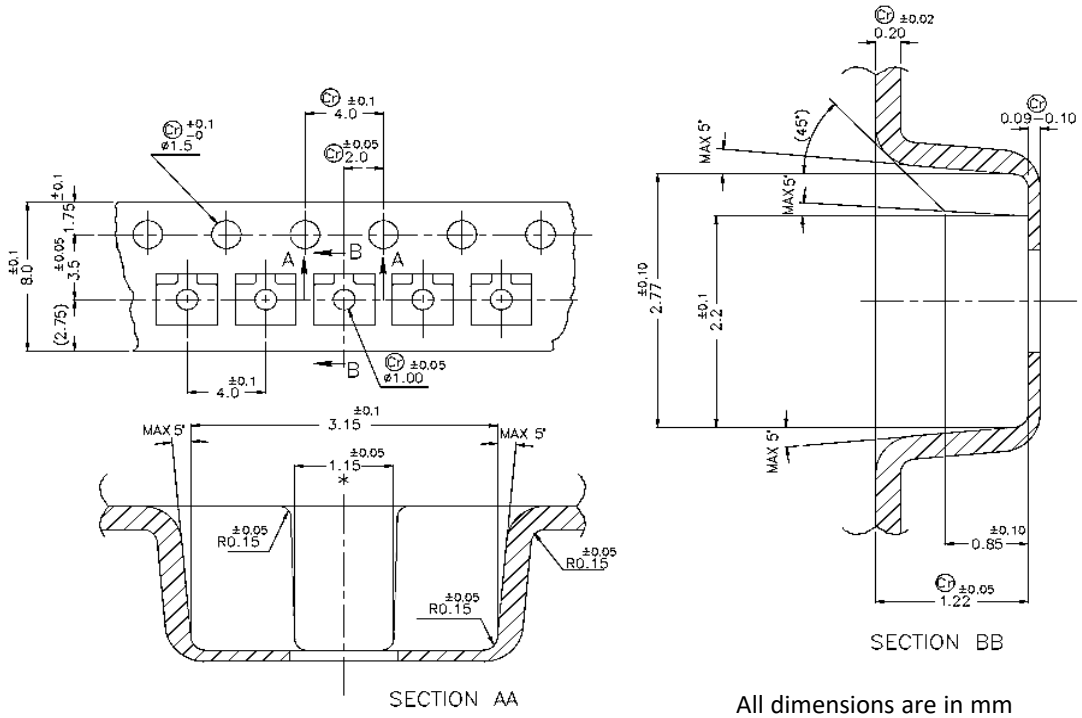




CMBT3903_04
Rev04_10062025M

PACKING INFORMATION

EMBOSSED PLASTIC CARRIER TAPE FOR SOT-23



NOTES:

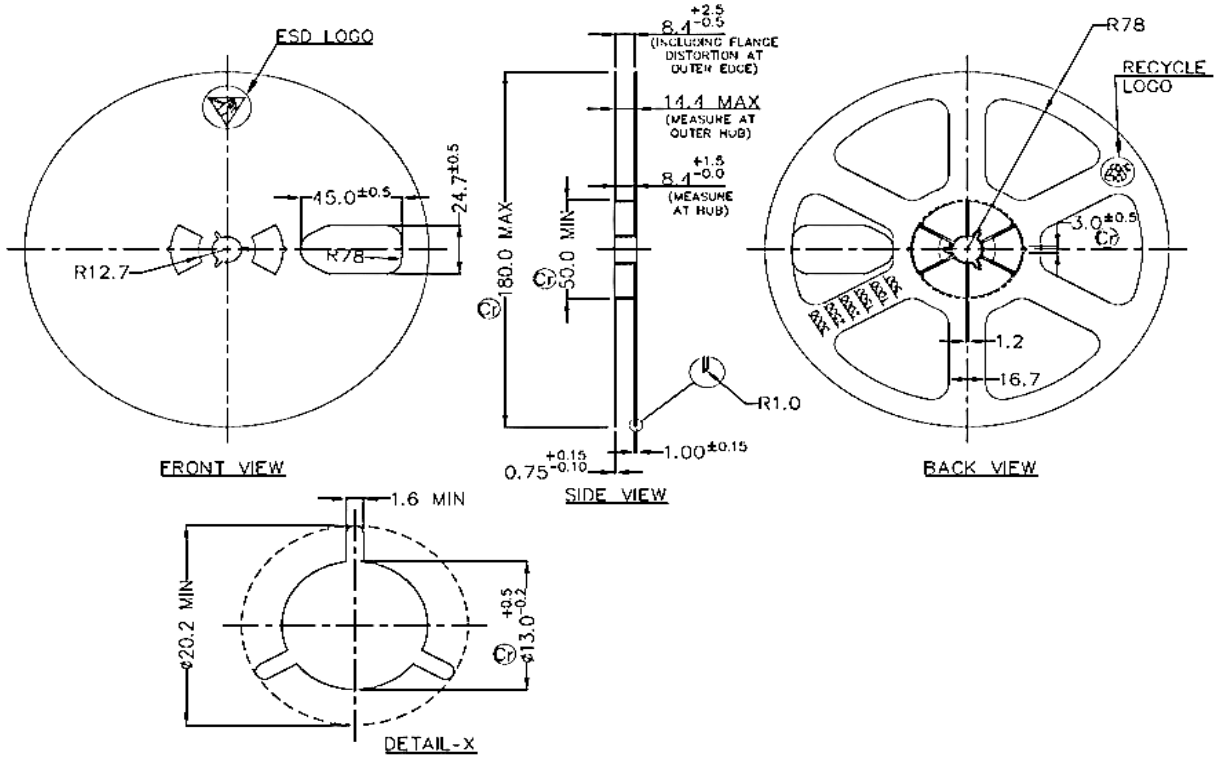
1. The bandoier of 330mm reel contains at least 10,000 device.
2. The bandoier of 180mm reel contains at least 3,000 device.
3. No more than 0.5% missing device/reel 50 empty compartments for 330mm reel. 15 empty compartments for 180mm reel.
4. Three consecutive empty places might be found provided this gap is followed by 6 consecutive devices.
5. The carrier tape (leader) starts with at least 75 empty positions (equivalent to 330 mm). In order to fix the carrier tape a self adhesive tape of 20 to 50 mm is applied. At the end of the bandolier at least 40 empty positions (equivalent to 160 mm) are there.

Mechanical Data

1. Package Material: Molded Plastic. UL Flammability Classification Rating 94V-0
2. Polarity: Pls. see pin configuration
3 Weight: 0.008 grams (Approximate)

PACKING INFORMATION

SOT-23 Tape and Reel



All Dimensions are in mm

Note: 13" Reel is also available.

Size of Tape	8mm	8mm
Size of reel	330mm (13")	180mm (7")
No. of Device	10,000 Pcs	3,000 Pcs

Packing Detail

SOT 23						
Package	Standard Pack		Inner Carton Box		Outer Box	
	Details	Net Weight/Qty	Size	Qty	Size	Qty
SOT 23 T&R	3K/reel	110 gm/3K pcs	7.5" x 7.5" x 3"	18 K	18" x 9" x 9"	150 K
			9" x 9" x 9"	60 K	18" x 12" x 9"	180 K
					18" x 15" x 9"	240 K
					19" x 19" x 20"	480 K
	10K/reel	370 gm/10Kpcs	13.5" x 13.5" x 1"	20 K	13.5" x 13.5" x 6"	100 K

Recommended Reflow Solder Profiles

The recommended reflow solder profiles for Pb and Pb-free devices are shown below.

Figure 1 shows the recommended solder profile for devices that have Pb-free terminal plating, and where a Pb-free solder is used.

Figure 2 shows the recommended solder profile for devices with Pb-free terminal plating used with leaded solder, or for devices with leaded terminal plating used with a leaded solder.

Figure 1

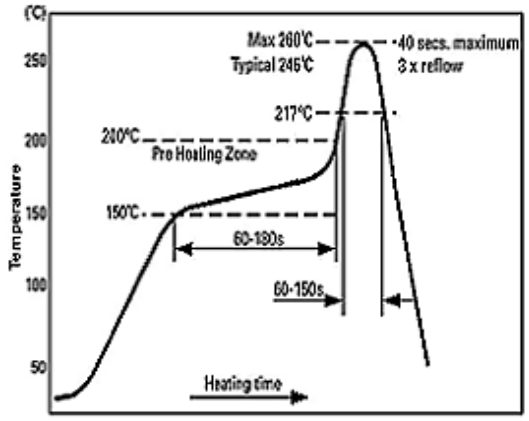
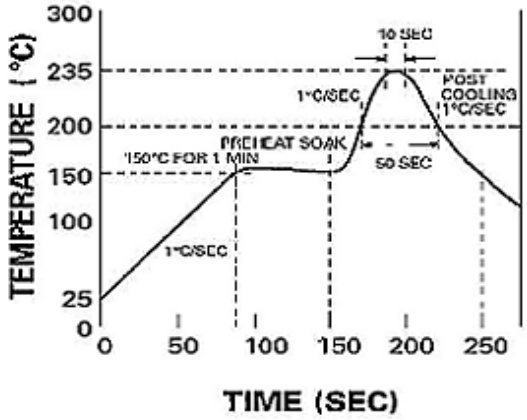


Figure 2

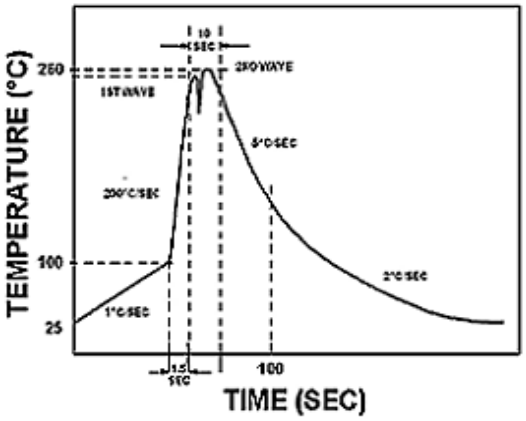


Reflow profiles in tabular form

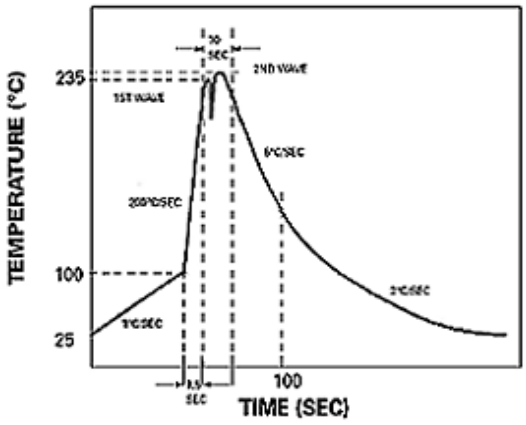
Profile Feature	Sn-Pb System	Pb-Free System
Average Ramp-Up Rate	~3°C/second	~3°C/second
Preheat – Temperature Range – Time	 150-170°C 60-180 seconds	 150-200°C 60-180 seconds
Time maintained above: – Temperature – Time	 200°C 30-50 seconds	 217°C 60-150 seconds
Peak Temperature	235°C	260°C max.
Time within +0 -5°C of actual Peak	10 seconds	40 seconds
Ramp-Down Rate	3°C/second max.	6°C/second max.

Recommended Wave Solder Profiles

The Recommended solder Profile For Devices with Pb-free terminal plating where a Pb-free solder is used



The Recommended solder Profile For Devices with Pb-free terminal plating used with leaded solder, or for devices with leaded terminal plating used with leaded solder



Wave Profiles in Tabular Form

Profile Feature	Sn-Pb System	Pb-Free System
Average Ramp-Up Rate	~200°C/second	~200°C/second
Heating rate during preheat	Typical 1-2, Max 4°C/sec	Typical 1-2, Max 4°C/Sec
Final preheat Temperature	Within 125°C of Solder Temp	Within 125°C of Solder Temp
Peak Temperature	235°C	260°C max.
Time within +0 -5°C of actual Peak	10 seconds	10 seconds
Ramp-Down Rate	5°C/second max.	5°C/second max

Recommended Product Storage Environment for Discrete Semiconductor Devices

This storage environment assumes that the Diodes and transistors are packed properly inside the original packing supplied by CDIL.

- Temperature 5 °C to 30 °C
- Humidity between 40 to 70 %RH
- Air should be clean.
- Avoid harmful gas or dust.
- Avoid outdoor exposure or storage in areas subject to rain or water spraying .
- Avoid storage in areas subject to corrosive gas or dust. Product shall not be stored in areas exposed to direct sunlight.
- Avoid rapid change of temperature.
- Avoid condensation.
- Mechanical stress such as vibration and impact shall be avoided.
- The product shall not be placed directly on the floor.
- The product shall be stored on a plane area. They should not be turned upside down. They should not be placed against the wall.

Shelf Life of CDIL Products

The shelf life of products is the period from product manufacture to shipment to customers. The product can be unconditionally shipped within this period. The period is defined as 2 years.
If products are stored longer than the shelf life of 2 years the products shall be subjected to quality check as per CDIL quality procedure.
The products are further warranted for another one year after the date of shipment subject to the above conditions in CDIL original packing.

Floor Life of CDIL Products and MSL Level

When the products are opened from the original packing, the floor life will start.
For this, the following JEDEC table may be referred:

JEDEC MSL Level		
Level	**Time**	**Condition**
1	Unlimited	≤30 °C / 85% RH
2	1 Year	≤30 °C / 60% RH
2a	4 Weeks	≤30 °C / 60% RH
3	168 Hours	≤30 °C / 60% RH
4	72 Hours	≤30 °C / 60% RH
5	48 Hours	≤30 °C / 60% RH
5a	24 Hours	≤30 °C / 60% RH
6	Time on Label(TOL)	≤30 °C / 60% RH

Customer Notes

Component Disposal Instructions

1. CDIL Semiconductor Devices are RoHS compliant, customers are requested to please dispose as per prevailing Environmental Legislation of their Country.
2. In Europe, please dispose as per EU Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE).

Disclaimer

The product information and the selection guides facilitate selection of the CDIL's Semiconductor Device(s) best suited for application in your product(s) as per your requirement. It is recommended that you completely review our Data Sheet(s) so as to confirm that the Device(s) meet functionality parameters for your application. The information furnished in the Data Sheet and on the CDIL Web Site/CD are believed to be accurate and reliable. CDIL however, does not assume responsibility for inaccuracies or incomplete information. Furthermore, CDIL does not assume liability whatsoever, arising out of the application or use of any CDIL product; neither does it convey any license under its patent rights nor rights of others. These products are not designed for use in life saving/support appliances or systems. CDIL customers selling these products (either as individual Semiconductor Devices or incorporated in their end products), in any life saving/support appliances or systems or applications do so at their own risk and CDIL will not be responsible for any damages resulting from such sale(s). CDIL strives for continuous improvement and reserves the right to change the specifications of its products without prior notice.

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