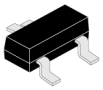
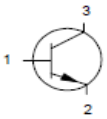
NPN SILICON PLANAR EPITAXIAL TRANSISTORS

CMBT2222
CMBT2222A



SOT-23



SOT-23
SMD Package
RoHS compliant

Device marking
CMBT2222 =1B
CMBT2222A =1P

ABSOLUTE MAXIMUM RATINGS (T_a = 25 °C)

Parameter		Symbol	Min/ Max	CMBT 2222	CMBT 2222A	Unit
Collector-base voltage (open emitter)		V_{CBO}	Max	60	75	V
Collector emitter voltage (open base)		V_{CEO}	Max	30	40	V
Emitter base voltage (open collector)		V_{EBO}	Max	5	6	V
Collector current (dc.)		I_C	Max	600		mA
collector current Peak		I_{CM}	Max	800		mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	Max	250		mW
DC Current Gain	I_C = 150mA, V_{CE} = 10 V	h_{FE}	Min	100		
	I_C = 150mA, V_{CE} = 10 V	h_{FE}	Max	300		
	I_C = 500 mA, V_{CE} =10 V	h_{FE}	Min	30	40	
Transition Frequency at f = 100 MHz	I_C = 20 mA, V_{CE} = 20 V	f_T	Min	250	300	MHz
Storage Temperature Range		T_{stg}	Min	-55		°c
		T_{stg}	Max	150		°c
Junction Temperature		T_j	Max	150		°c
THERMAL RESISTANCE						
From junction to ambient		$R_{\theta ja}$		500		K/W

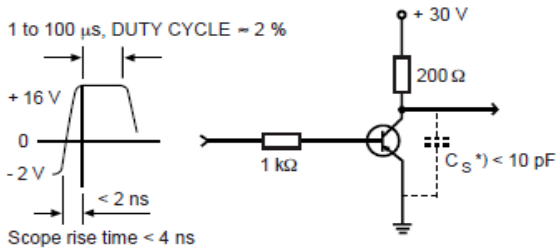
ELECTRICAL CHARACTERISTICS (T_j = 25 °C Unless Otherwise Specified)

Parameter	Symbol	Test Conditions	Min/ Max	CMBT 2222	CMBT 2222A	Unit
Collector Emitter Breakdown Voltage	BV_{CEO}	Ic=10mA, Ib=0	Min	30	40	V
Collector Base Break down Voltage	BV_{CBO}	I_C = 100uA; I_E = 0	Min	75		V
Emitter Base Break down Voltage	BV_{EBO}	I_C = 0; I_E = 10uA	Min	6		V
Emitter-Base cutoff Current	I_{CB0}	V_{CE}=60V, V_{EB} =3.0V	max	--	20	nA
Emitter-Base Cutoff Current	I_{EBO}	V_{EB}=3V, Ic=0	Max	--	100	nA
Collector Cut Off Current	I_{CBO}	I_E = 0 , V_{CB} = 50 V	Max	0.01	0.01	µA
	I_{CBO}	I_E = 0 , V_{CB} = 60 V	Max	-	0.01	µA
	I_{CBO}	V_{EB} = 3V; V_{CE} = 60V	Max	10	10	nA
	I_{CBO}	I_E = 0; V_{CB} = 60V; Tj = 125 ºC	Max	10		µA
	I_{CEX}	V_{EB} = 3V, V_{CE} = 60V	Max	10		nA
Base current with reverse biased Emitter Junction	I_{BEX}	V_{FB} =3V, V_{CE} = 60V	Max	20		nA
Emitter-base cut-off current	I_{EBO}	I_C = 0, V_{EB} = 3V	Max	10		nA
Saturation Voltages	V_{CESat}	I_C= 150mA , I_B= 15mA	Max	400	300	mV
	V_{BESat}		Min	-	0.6	
	V_{BESat}		Max	1.3	1.2	V
	V_{CESat}	I_C= 500mA , I_B= 50mA	Max	1.6	1	V
	V_{BESat}		Max	2.6	2	V
Breakdown Voltages	$V_{BR(CEO)}$	I_C= 1mA, I_B= 0	Min	30	40	V
	$V_{BR(CBO)}$	I_C= 100µA, I_E= 0	Min	60	75	V
	$V_{BR(EBO)}$	I_C= 0, I_E= 10µA	Min	5	6	V
DC Current Gain	h_{FE}	I_C = 0.1mA; V_{CE} = 10V	Min	35		
		I_C = 1mA; V_{CE} = 10V	Min	50		
		I_C = 10 mA; V_{CE} = 10 V	Min	75		
		I_C = 10mA, V_{CE} = 10V, T_j = 125°C	Min	35		
		I_C = 10 mA; V_{CE} = 10 V; T_{amb} = –55 °C	Min	35		
		I_C = 150mA; V_{CE} = 10V	Min	100		
		I_C = 150mA; V_{CE} = 10V	Max	300		
		I_C = 150mA; V_{CE} = 1V	Min	50		
		I_C = 500mA; V_{CE} = 10V	Min	30	40	

ELECTRICAL CHARACTERISTICS (T_j = 25 °C Unless Otherwise Specified)						
Current - Gain - Bandwidth Product	f_T	V_{CE} = 20 V, I_C = 20 mA, f = 100 MHz	Min	300		MHz
Input Impedance	h_{ie}	V_{CE}= 10V, I_C= 1mA f = 1 kHz	Min	2		kΩ
			Max	8		
		V_{CE}= 10V, I_C= 10mA f = 1 kHz	Min	0.25		
			Max	1.25		

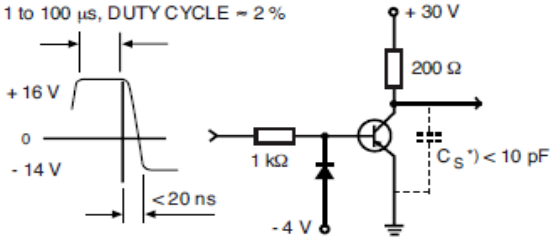
Parameter	Symbol	Test Conditions	Min/ Max	CMBT 2222	CMBT 2222A	Unit
Voltage feedback Ratio	h_{re}	V_{CE}=10 V, I_C=1 mA	Min	50		
			Max	300		
		f=1 kHz	Min	75		
			Max	375		
Output Admittance	h_{oe}	V_{CE}=10 V, I_C=1mA, f=1 kHz	Min	5		umhos
			Max	35		
		V_{CE}=10 V, I_C=10mA, f=1 kHz	Min	25		
			Max	200		
Collector Base Time constant	$r_b C_{CC}$	I_E = 20 mA, V_{CB} = 20 V, f = 31.8 MHz	Max.	150		ps
Transition Frequency at f = 100 MHz	f_T	I_C = 20mA, V_{CE} = 20V	Min	250	300	MHz
Output Capacitance at f =1 MHz	C_o	I_E = 0 , V_{CB} = 10V	Max	8		pF
Input Capacitance at f = 1 MHz	C_i	I_C = 0, V_{EB} = 0.5V	Max	30	25	pF
Noise figure at Rs = 1 KΩ	NF	I_C = 100µA, V_{CE}=10V, f = 1KHz	Max	4		dB
Delay Time [fig.1]	t_d	V_{CC}=30V, V_{BEoff}=-0.5V, I_C=150mA , I_{B1}= 15mA	Max	10		ns
Rise Time [fig.1]	t_r	V_{CC}=30V, V_{BEoff}=-0.5V, I_C=150mA , I_{B1}= 15mA	Max	25		ns
Storage Time [fig.2]	t_s	V_{CC} = 30V, I_C = 150mA, I_{B1} = -I_{B2} = 15mA	Max	225		ns
Fall Time [fig.2]	t_f	V_{CC} = 30V, I_C = 150mA, I_{B1} = -I_{B2} = 15mA	Max	60		ns
SWITCHING TIME (BETWEEN 10% AND 90% LEVELS)						
Small Signal Current Gain	h_{FE}	I_C = 1 mA, V_{CE}=10 V, f = 1KHz	Min	50		
			Max	300		
		I_C = 10 mA, V_{CE}=10 V, f = 1KHz	Min	75		
			Max	375		

Test circuits



Total shunt capacitance of test jig,connectors and oscilloscope

Fig. 1. Turn-On Time



.Total shunt capacitance of test jig, connectors and oscilloscope

Fig. 2. Turn-Off Time

Typical Characteristic curves

Fig 3: Typical VBE vs Collector Current

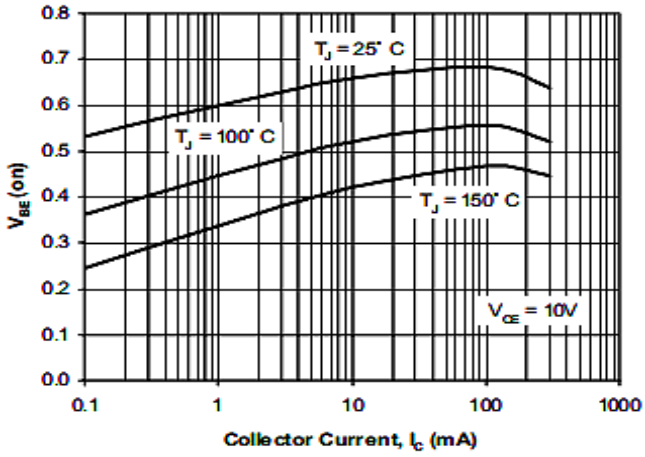


Fig 4:Typical $V_{CE\ (sat)}$ vs Collector Current

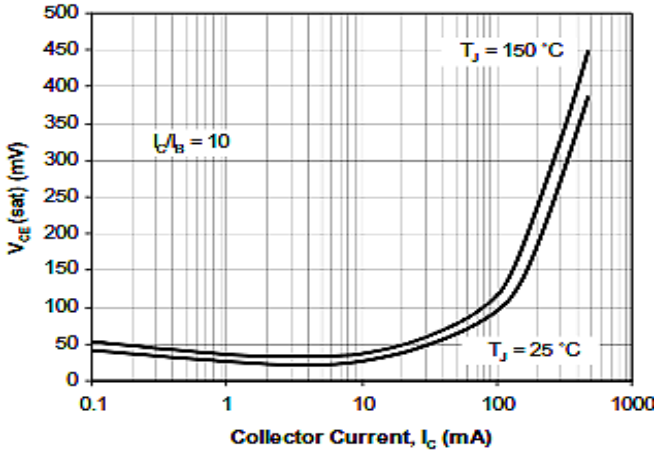


Fig 5:Typical Capacitance vs Reverse Voltage

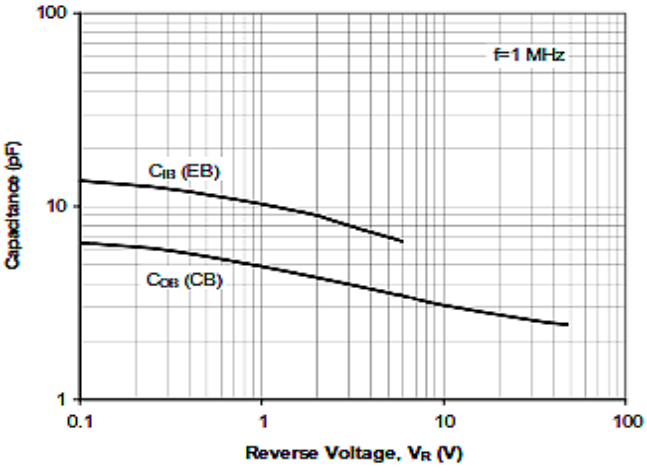


Fig 6:Turn On and Turn Off Times vs Collector Current

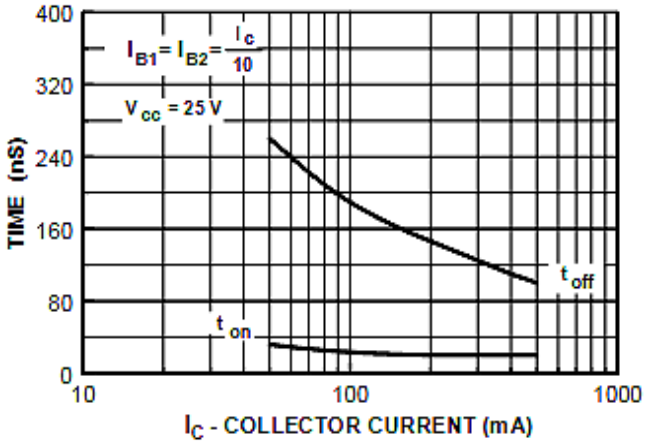


Fig 7:Typical $V_{BE\ (sat)}$ vs Collector Current

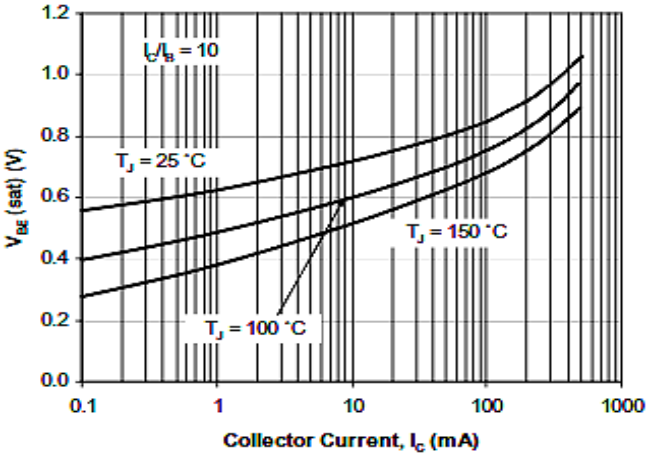
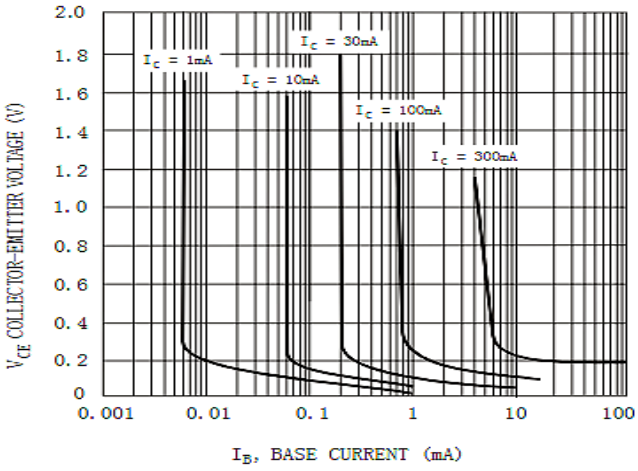


Fig 8:Typical Collector Saturation Region



CMBT2222A
Rev6_27042024M

Typical Characteristic curves

Fig 9: Gain Bandwidth Product VS. Collector Current

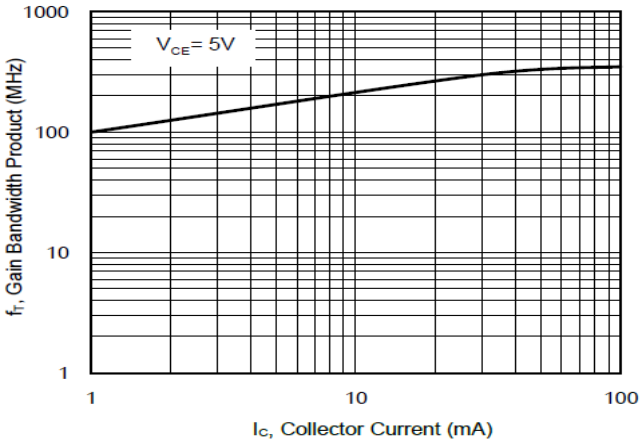


Fig 11: Frequency effects

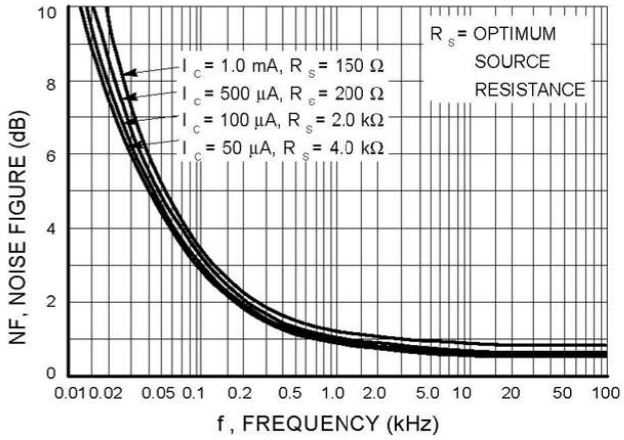
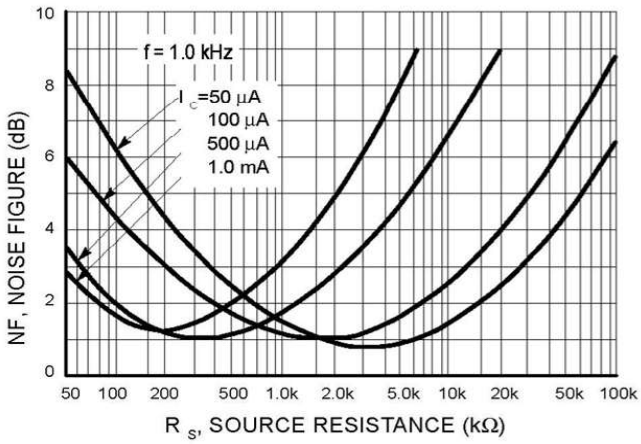
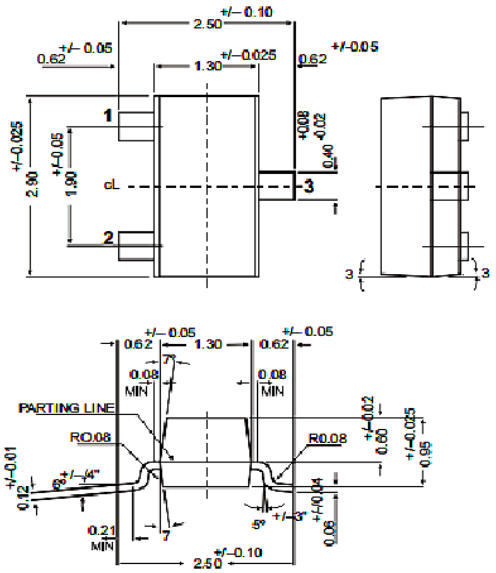


Fig 10:Source resistance Vs Noise Figure



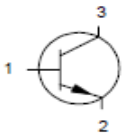
PACKAGE DETAILS

SOT-23 SMD Package

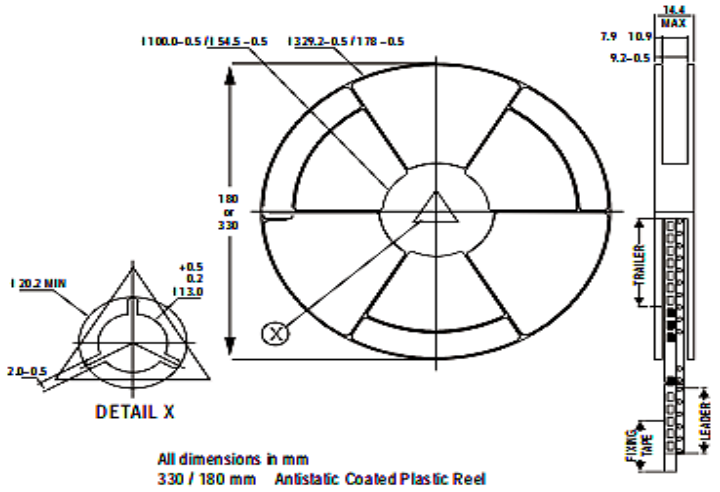


PIN CONFIGURATION (NPN)

1. BASE
2. EMITTER
3. COLLECTOR



Reel specifications for Packing (13"/7" reels)

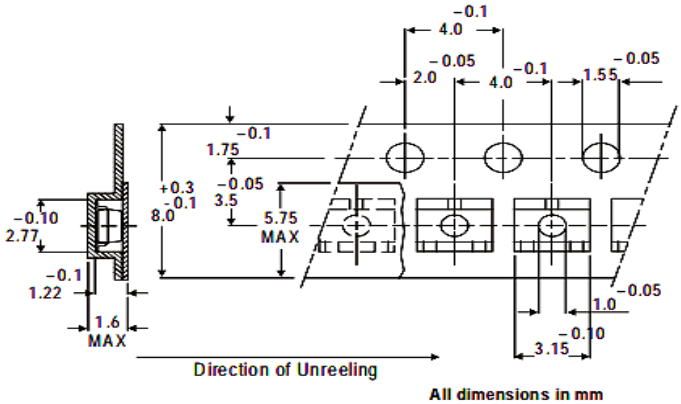


Size of Tape	8mm	8mm
Size of reel	330mm (13")	180mm (7")
No. of Device	10,000 Pcs	3,000 Pcs

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
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.

Tape Specification for SOT-23 Surface Mount Device



Packing Detail

PACKAGE	STANDARD PACK		INNER CARTON BOX		OUTER CARTON BOX		
	Details	Net Weight/Qty	Size	Qty	Size	Qty	Gr Wt
SOT-23 T&R	3K/reel	136 gm/3K pcs	3" x 7.5" x 7.5"	12.0K	17" x 15" x 13.5"	192.0K	12 kgs
			9" x 9" x 9"	51.0K	19" x 19" x 19"	408.0K	28 kgs
	10K/reel	415 gm/10K pcs	13" x 13" x 0.5"	10.0K	17" x 15" x 13.5"	300.0K	16 kgs

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

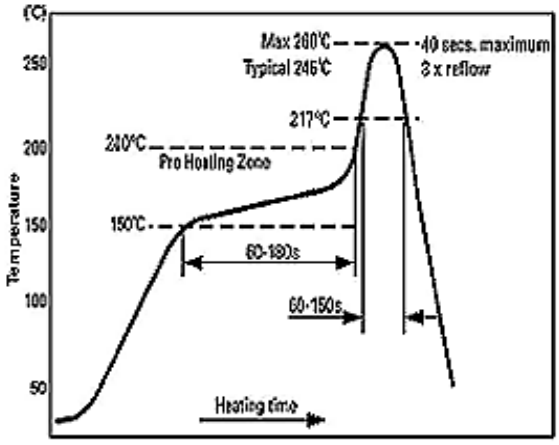
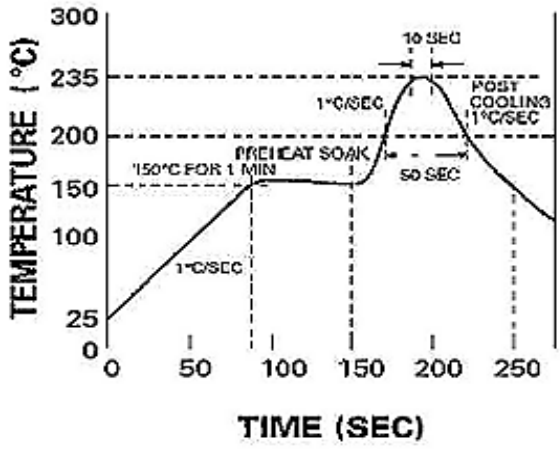


Figure 2

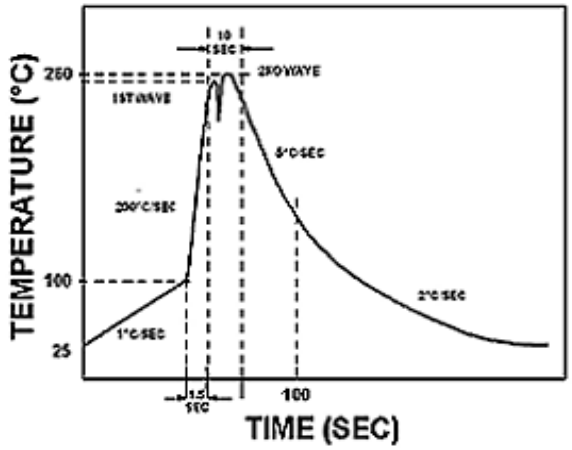


Reflow profiles in tabular form

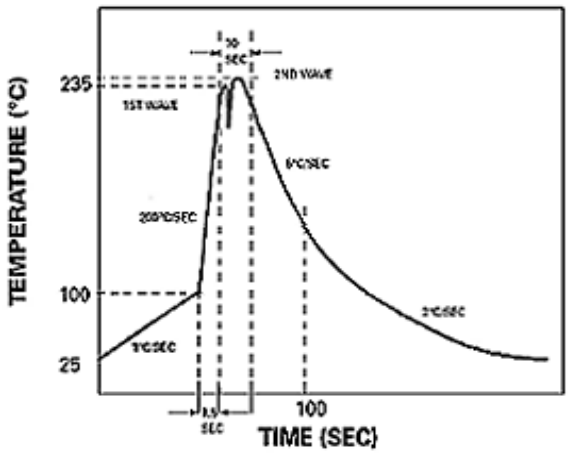
Profile Feature	Sn-Pb System	Pb-Free System
Average Ramp-Up Rate	~3°C/second	~3°C/second
Preheat – Temperature Range – Time	 150-170°C 60-180 seconds	 150-200°C 60-180 seconds
Time maintained above: – Temperature – Time	 200°C 30-50 seconds	 217°C 60-150 seconds
Peak Temperature	235°C	260°C max.
Time 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).
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Continental Device India Pvt. Limited
C-120 Naraina Industrial Area, New Delhi 110 028, India.
Telephone +91-11-2579 6150, 4141 1112 Fax +91-11-2579 5290, 4141 1119
email@cdil.com www.cdil.com
CIN No. U32109DL1964PTC004291