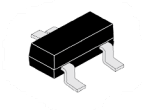
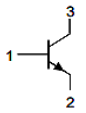
# NPN General Purpose Transistors

**BC846**
**BC847**
**BC848**



SOT-23




**SOT-23**
**SMD Package**
**RoHS compliant**

## GENERAL DISCRIPTION:

PNP complements: BC856, BC857 and BC858

## FEATURE:

1. Low current (max.100mA)
2. Low voltage (max. 65V)
3. This product is available in AEC-Q101 Qualified and PPAP Capable also.

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

## Marking

BC846 =1D
BC846A=1A
BC846B=1B
BC847 =1H
BC847A=1E
BC847B=1F
BC847C=1G
BC848B=1K

## APPLICATION:

General purpose switching and amplification.

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

| PARAMETER | SYMBOL | VALUE | | | UNIT |
|---|---|---|---|---|---|
| | | BC846 | BC847 | BC848 | |
| Collector-base voltage (open emitter) | $V_{CBO}$ | 80 | 50 | 30 | V |
| Collector-emitter voltage (open base) | $V_{CEO}$ | 65 | 45 | 30 | V |
| Emitter-base voltage (open collector) | $V_{EBO}$ | 6 | 6 | 5 | V |
| collector current (DC) | $I_C$ | 100 | | | mA |
| Peak collector current | $I_{CM}$ | 200 | | | mA |
| Peak base current | $I_{BM}$ | 200 | | | mA |
| Total power dissipation ( $T_{amb} \leq 25$ °C; [1]) | $P_{tot}$ | 250 | | | mW |
| Storage temperature | $T_{stg}$ | -65 to +150 | | | °C |
| Junction temperature | $T_j$ | 150 | | | °C |
| Operating ambient temperature | $T_{amb}$ | -65 to +150 | | | °C |

## THERMAL RESISTANCE

| PARAMETER | SYMBOL | TEST CONDITION | VALUE | UNIT |
|---|---|---|---|---|
| Thermal resistance from junction toambient | $R_{th(j-a)}$ | in free air; [2] | 500 | K/W |

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

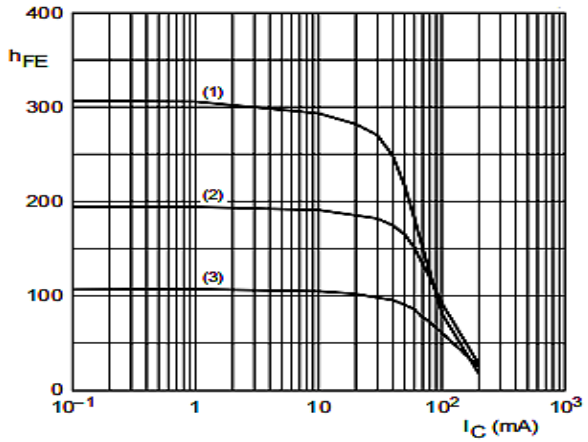
| PARAMETER | | SYMBOLS | TEST CONDITION | VALUE | | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | |
| Collector-base cut-off current | | $I_{CBO}$ | $V_{CB}$ = 30 V; $I_E$ = 0 | -- | -- | 15 | nA |
| | | | $V_{CB}$ = 30 V; $I_E$ = 0; $T_j$ = 150°C | -- | -- | 5 | µA |
| Emitter-base cut-off current | | $I_{EBO}$ | $V_{EB}$ = 5V; $I_C$ = 0 | -- | -- | 100 | nA |
| DC current gain | BC846A; BC847A | $h_{FE}$ | $I_C$ = 10µA; $V_{CE}$ =5V | -- | 90 | -- | |
| | BC846B; BC847B; BC848B | | | -- | 150 | -- | |
| | BC847C | | | -- | 270 | -- | |
| DC current gain | BC846 | | $I_C$ = 2mA; $V_{CE}$ =5V | 110 | -- | 450 | |
| | BC847 | | | 110 | -- | 800 | |
| | BC846A; BC847A | | | 110 | 180 | 220 | |
| | BC846B; BC847B; BC848B | | | 200 | 290 | 450 | |
| | BC847C | | | 420 | 520 | 800 | |
| Collector-emitter saturation voltage | | $V_{CEsat}$ | $I_C$ = 10 mA; $I_B$ = 0.5mA | -- | 90 | 250 | mV |
| | | | $I_C$ = 100mA; $I_B$ = 5mA [2] | -- | 200 | 600 | mV |
| Base-emitter saturation voltage | | $V_{BEsat}$ | $I_C$ = 10mA; $I_B$ = 0.5mA | -- | 700 | -- | |
| | | | $I_C$ = 100mA; $I_B$ = 5mA [2] | -- | 900 | -- | |
| Base-emitter voltage | | $V_{BE}$ | $I_C$ = 2mA; $V_{CE}$ = 5V | 580 | 660 | 700 | mV |
| | | | $I_C$ = 10mA; $V_{CE}$ =5V | -- | -- | 770 | mV |
| Collector capacitance | | $C_c$ | $V_{CB}$ = 10V; $I_E$ = Ie = 0; f = 1MHz | -- | 2.5 | -- | pF |
| Transition frequency | | $f_T$ | $V_{CE}$ = 5V; $I_C$ = 10mA; f = 100MHz | 100 | -- | -- | MHz |
| Noise figure | | F | $I_C$ = 200µA; $V_{CE}$ = 5V; RS =2kΩ; f = 1kHz; B = 200Hz | -- | 2 | 10 | dB |

**Note:**

1. Transistor mounted on an FR4 printed-circuit board, standard footprint.
2. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.

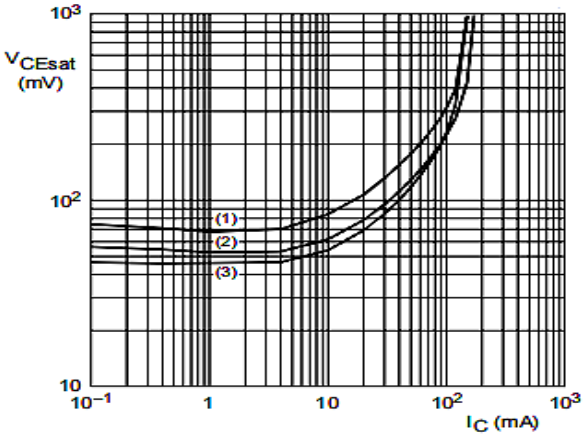
## TYPICAL CHARACTERISTICS CURVES

Fig 1: DC current gain as a function of collector current; typical values



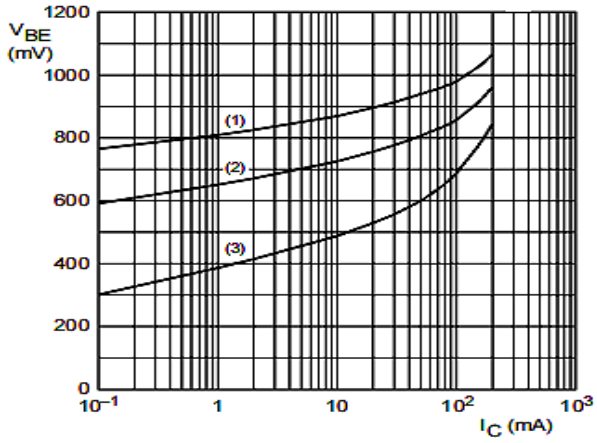

**BC846A;** $V_{CE}$ = 5 V.
(1) $T_{amb}$ = 150 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = −55 °C.

Fig 2: Collector-emitter saturation voltage as a function of collector current; typical values.



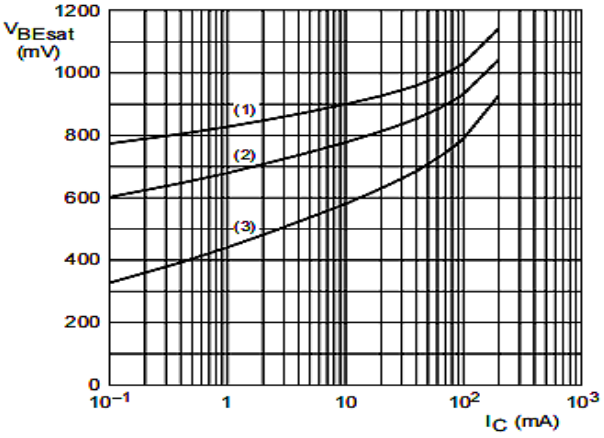

**BC846A;** $I_C/I_B$ = 20.
(1) $T_{amb}$ = 150 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = −55 °C.

Fig 3: Base-emitter voltage as a function of collector current; typical values




**BC846A;** $V_{CE}$ = 5 V.
(1) $T_{amb}$ = −55 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = 150 °C.

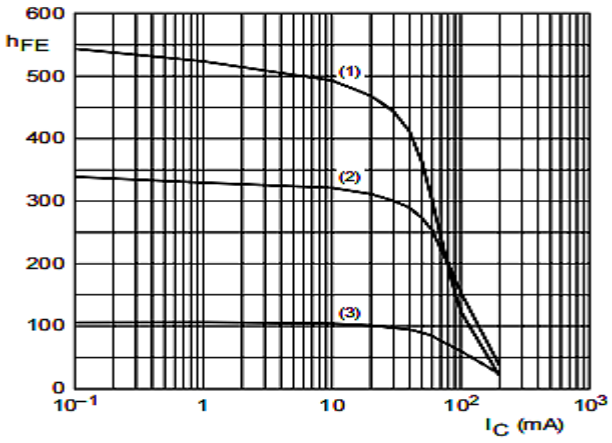
Fig 4: Base-emitter saturation voltage as a function of collector current; typical values




**BC846A;** $I_C/I_B$ = 10.
(1) $T_{amb}$ = −55 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = 150 °C.

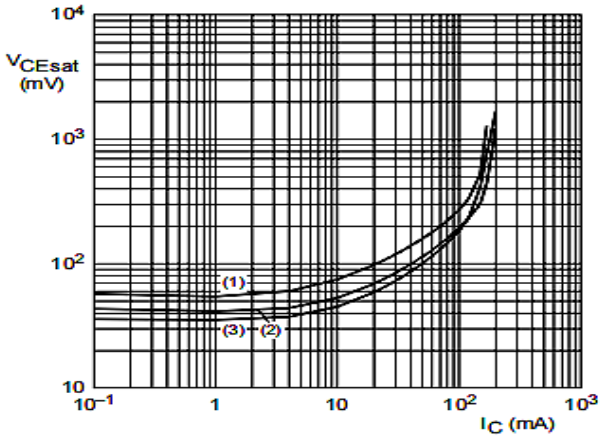
## TYPICAL CHARACTERISTICS CURVES

Fig 5: DC current gain as a function of collector current; typical values.



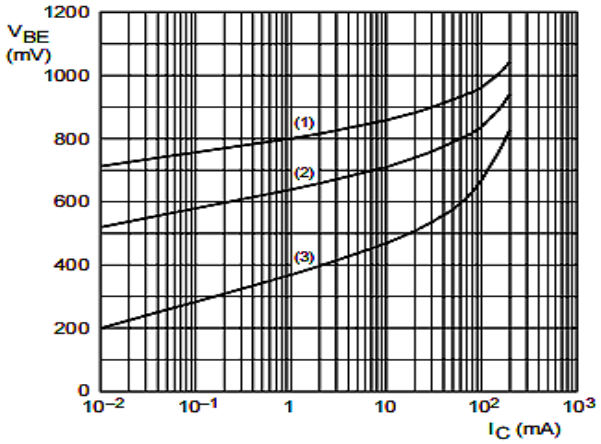

**BC847B;** $V_{CE}$ = 5 V.
(1) $T_{amb}$ = 150 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = −55 °C.

Fig 6: Collector-emitter saturation voltage as a function of collector current; typical values.



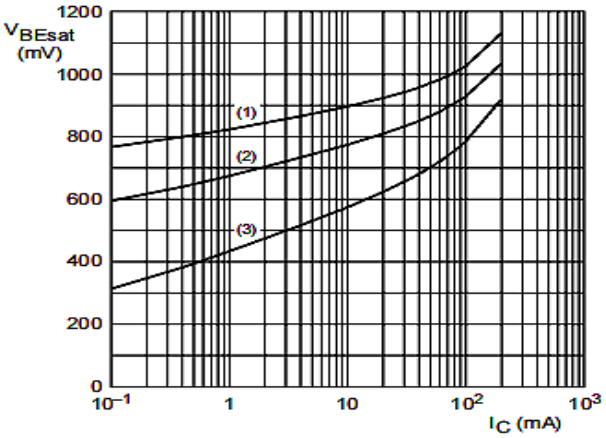

**BC847B;** $I_C/I_B$ = 20.
(1) $T_{amb}$ = 150 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = −55 °C.

Fig 7: Base-emitter voltage as a function of collector current; typical values.




**BC847B;** $V_{CE}$ = 5 V.
(1) $T_{amb}$ = −55 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = 150 °C.

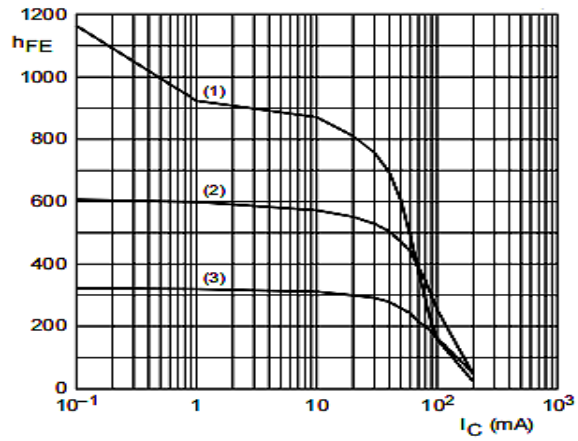
Fig 8: Base-emitter saturation voltage as a function of collector current; typical values.




**BC847B;** $I_C/I_B$ = 10.
(1) $T_{amb}$ = −55 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = 150 °C.

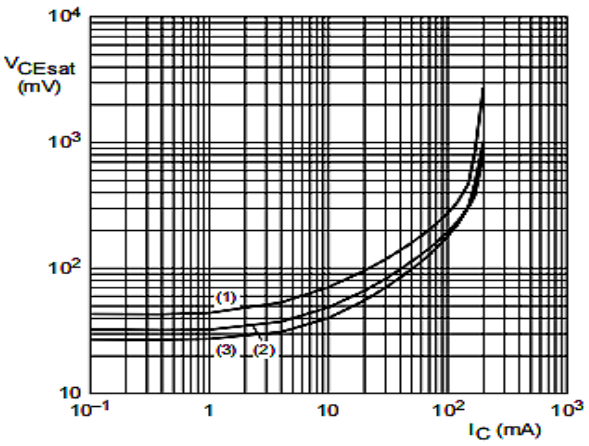
## TYPICAL CHARACTERISTICS CURVES

Fig 9: DC current gain as a function of collector current; typical values.



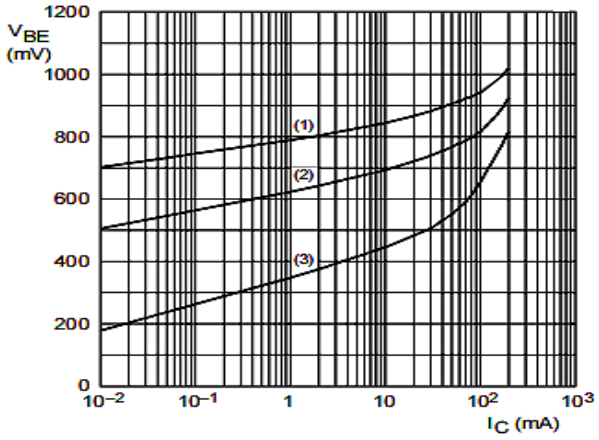

**BC847C;** $V_{CE}$ = 5 V.
(1) $T_{amb}$ = 150 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = −55 °C.

Fig 10: Collector-emitter saturation voltage as a function of collector current; typical values



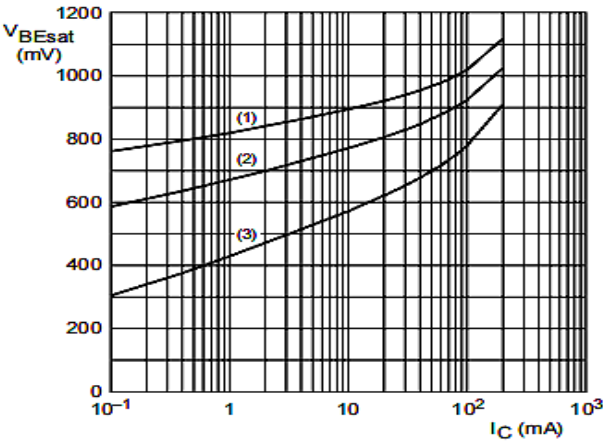

**BC847C;** $I_C/I_B$ = 20.
(1) $T_{amb}$ = 150 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = −55 °C.

Fig 11: Base-emitter voltage as a function of collector current; typical values.




**BC847C;** $V_{CE}$ = 5 V.
(1) $T_{amb}$ = −55 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = 150 °C.

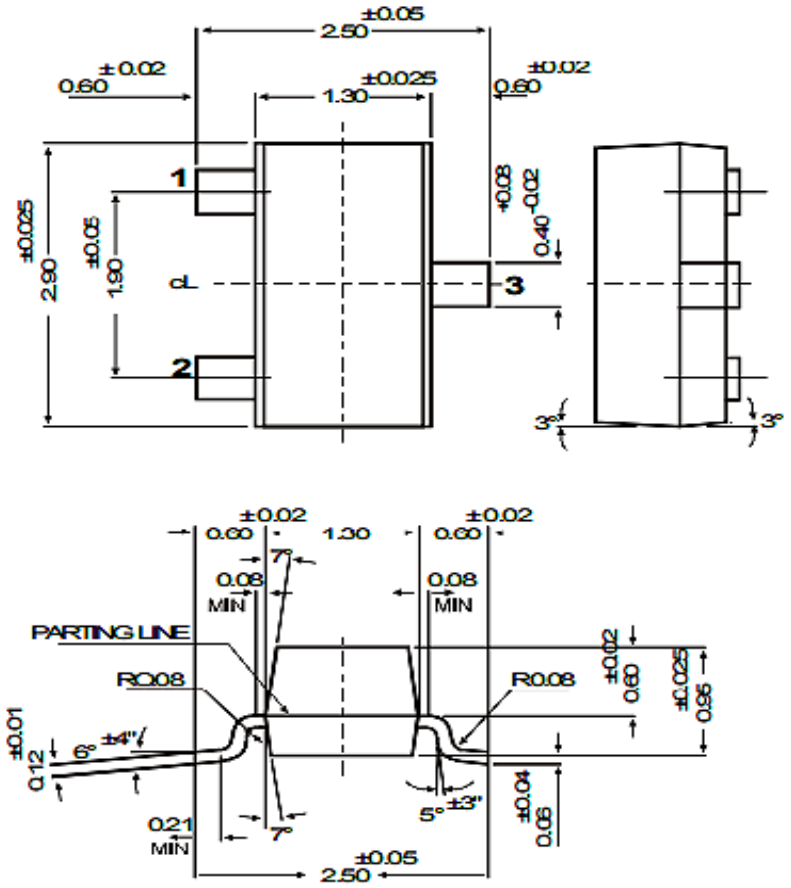
Fig 12: Base-emitter saturation voltage as a function of collector current; typical values.




**BC847C;** $I_C/I_B$ = 10.
(1) $T_{amb}$ = −55 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = 150 °C.

## Package Details:

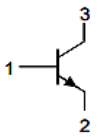
### SOT-23 Formed SMD Package




All dimensions are in mm

**PIN CONFIGURATION (NPN)**

1. Base
2. Emitter
3. Collector

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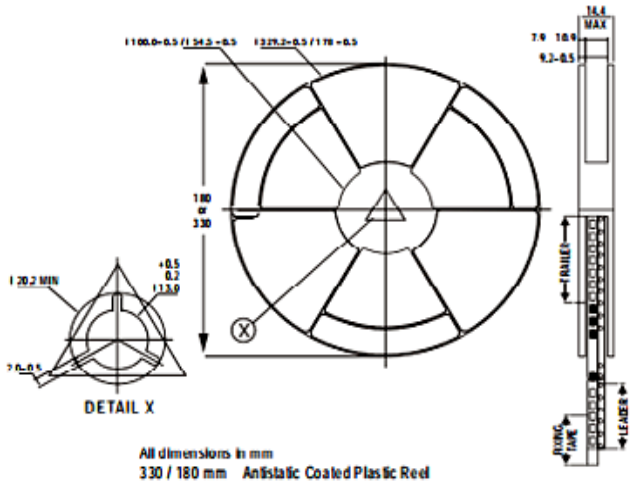
Rev0 15022023E

**SOT-23 Package Reel Information Reel specifications for Packing (13"/7" reels)**

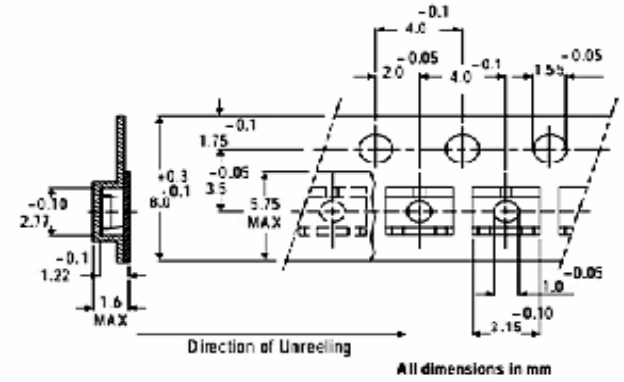



| Size of Tape | 8mm | 8mm |
|---|---|---|
| Size of reel | 330mm (13") | 180mm (7") |
| No. of Device | 10,000 Pcs | 3,000 Pcs |

**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 180mm reel.
4. Three consecutive empty places might be found provided this gap is followed by 6 consecutive de
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**




| 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 K | 17" x 15" x 13.5" | 192 K | 12 kgs |
| | | | 9" x 9" x 9" | 51 K | 19" x 19" x 19" | 408 K | 28 kgs |
| | 10K/reel | 415 gm/10K pcs | 13" x 13" x 0.5" | 10 K | 17" x 15" x 13.5" | 300 K | 16 kgs |

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## 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**

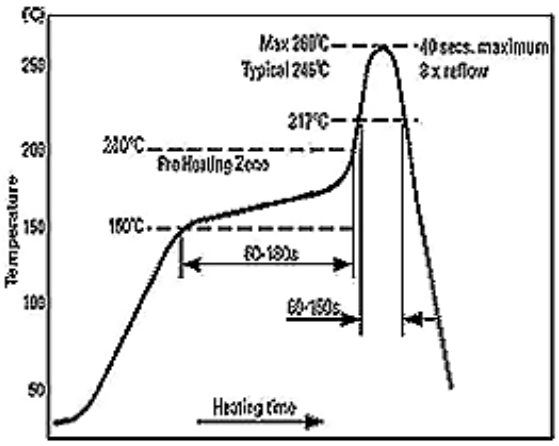
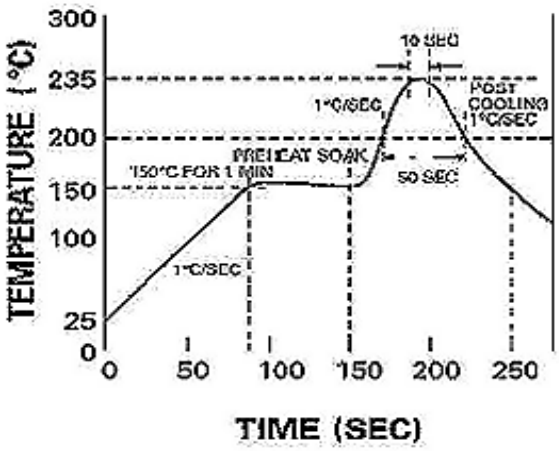



**Figure 2**

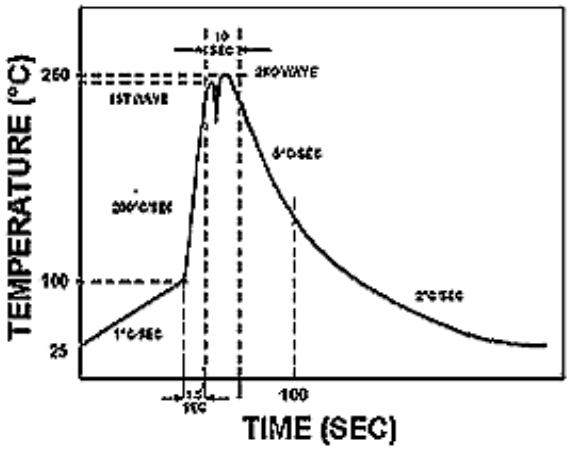



**Reflow profiles in tabular form**

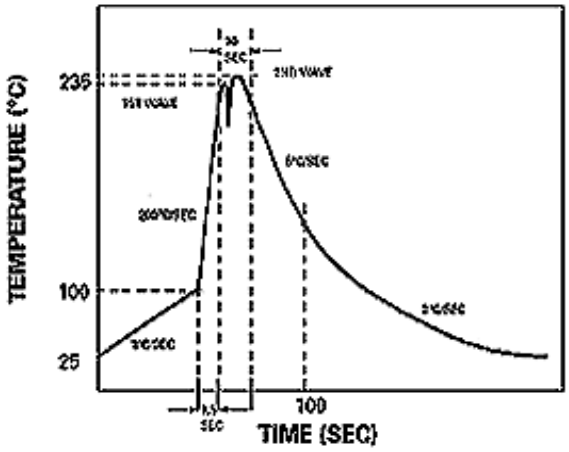
| Profile Feature | Sn-Pb System | Pb-Free System |
|---|---|---|
| Average Ramp-Up Rate | ~3°C/second | ~3°C/second |
| **Preheat**<br>– Temperature Range<br>– Time | <br>150-170°C<br>60-180 seconds | <br>150-200°C<br>60-180 seconds |
| Time maintained above:<br>– Temperature<br>– Time | <br>200°C<br>30-50 seconds | <br>217°C<br>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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BC846_848
Rev0 15022023E