

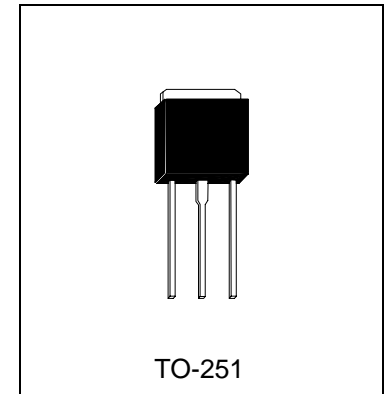


# HSB1386I

LOW FREQUENCY TRANSISTOR (-20V, -4A)

## Features

- Low  $V_{CE(sat)}$   
 $V_{CE(sat)} = -0.55V$  (Typ.) ( $I_C/I_B = -4A/-0.1A$ )
- Excellent DC current gain characteristics.



## Structure

Epitaxial planar type PNP silicon transistor

## Absolute Maximum Ratings ( $T_A = 25^\circ C$ )

| Symbol    | Parameter  | Limits   | Unit       |
|-----------|--|----------|------------|
| $V_{CBO}$ | Collector-Base Voltage                             | -30      | V          |
| $V_{CEO}$ | Collector-Emitter Voltage                          | -20      | V          |
| $V_{EBO}$ | Emitter-Base Voltage                               | -6       | V          |
| $I_C$     | Collector Current                                  | -4       | A          |
|           |  | -10      | A(Pulse)*  |
| $P_D$     | Collector Power Dissipation ( $T_C = 25^\circ C$ ) | 20       | W          |
| $T_j$     | Junction Temperature                               | 150      | $^\circ C$ |
| $T_{stg}$ | Storage Temperature                                | -55~+150 | $^\circ C$ |

## Electrical Characteristics ( $T_A = 25^\circ C$ )

| Symbol          | Parameter                            | Min. | Typ. | Max. | Unit    | Test Conditions                       |
|-----------------|--------------------------------------|------|------|------|---------|---------------------------------------|
| $BV_{CBO}$      | Collector-Base Breakdown Voltage     | -30  | -    | -    | V       | $I_C = -50\mu A$                      |
| $BV_{CEO}$      | Collector-Emitter Breakdown Voltage  | -20  | -    | -    | V       | $I_C = -1mA$                          |
| $BV_{EBO}$      | Emitter-Base Breakdown Voltage       | -6   |      |      |         | $I_C = -50\mu A$                      |
| $I_{CBO}$       | Collector Cutoff Current             | -    | -    | -0.5 | $\mu A$ | $V_{CB} = -20V$                       |
| $I_{EBO}$       | Emitter Cutoff Current               | -    | -    | -0.5 | $\mu A$ | $V_{EB} = -5V$                        |
| * $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | -    | -    | -1   | V       | $I_C/I_B = -4A/-0.1A$                 |
| * $h_{FE}$      | DC Current Transfer Ratio            | 82   | -    | 580  |         | $V_{CE} = -2V, I_C = -0.5A$           |
| fT              | Transition Frequency                 | -    | 110  | -    | MHz     | $V_{CE} = -6V, I_E = 50mA, f = 30MHz$ |
| Cob             | Output Capacitance                   | -    | 30   | -    | pF      | $V_{CB} = -20V, I_E = 0A, f = 1MHz$   |

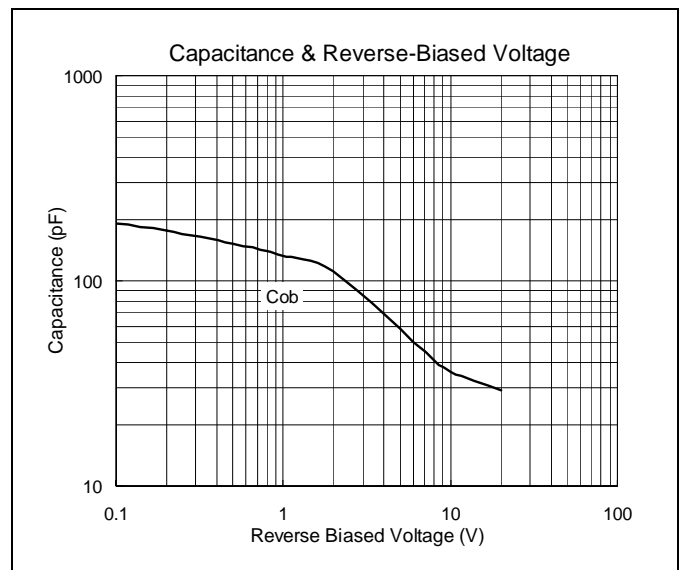
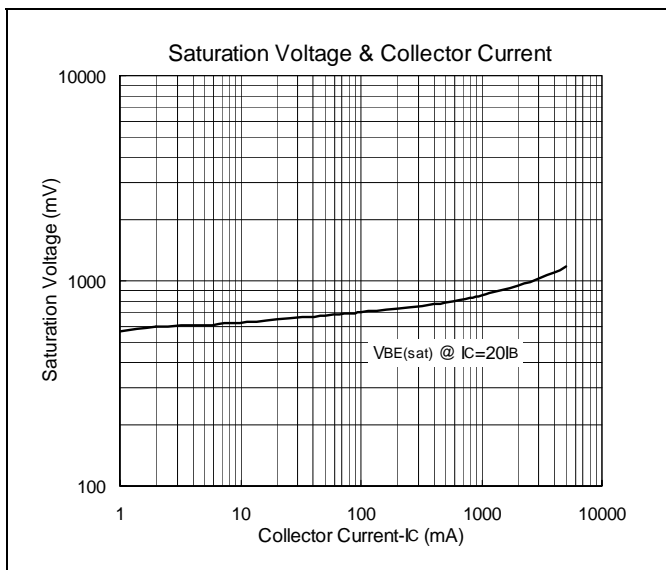
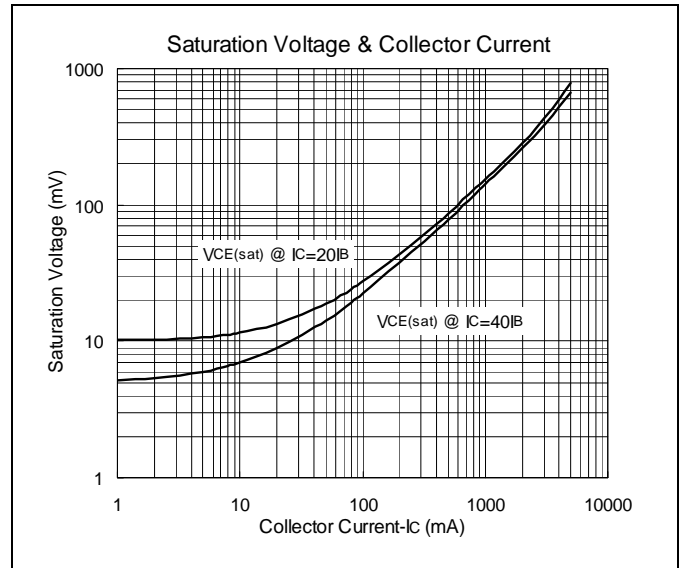
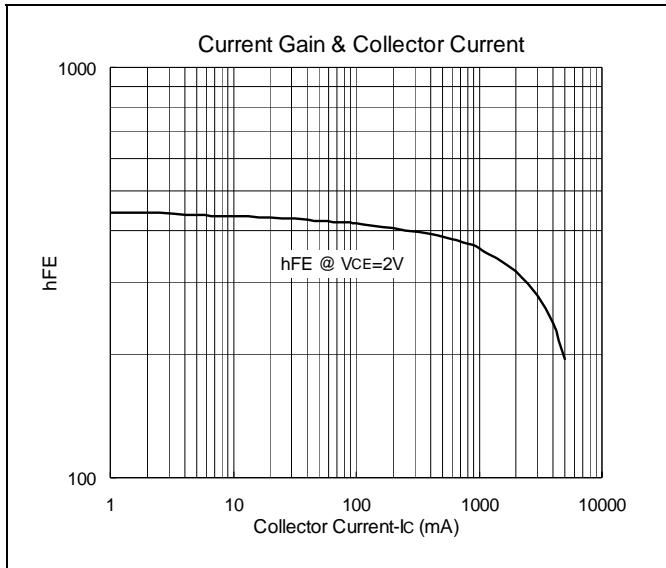
\*Pulse Test: Pulse Width  $\leq 380\mu s$ , Duty Cycle  $\leq 2\%$

## Classification Of hFE

| Rank  | P      | Q       | R       | E       |
|-------|--------|---------|---------|---------|
| Range | 82-180 | 120-270 | 180-390 | 370-580 |



### Characteristics Curve





### TO-251 Dimension

**Marking:**

Pb Free Mark  
 Pb-Free: "●" (Note)  
 Normal: None

Date Code      Control Code

Note: Green label is used for pb-free packing

Pin Style: 1.Base 2/Tab.Collector 3.Emitter

**Material:**

- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

| DIM | Min. | Max.  |
|-----|------|-------|
| A   | 6.35 | 6.80  |
| C   | 4.80 | 5.50  |
| F   | 1.30 | 1.70  |
| G   | 5.40 | 6.25  |
| H1  | 6.75 | 8.00  |
| K   | 0.50 | 0.90  |
| K1  | 0.40 | 0.90  |
| L   | 0.90 | 1.50  |
| M   | 2.20 | 2.40  |
| a1  | 0.40 | 0.65  |
| a2  | -    | *2.30 |

\*: Typical, Unit: mm

**3-Lead TO-251  
Plastic Package  
HSMC Package Code: I**

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 Normal: None

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- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

| DIM | Min. | Max.   |
|-----|------|--------|
| A   | 6.40 | 6.80   |
| B   | -    | 6.00   |
| C   | 5.04 | 5.64   |
| D   | -    | *4.34  |
| E   | 0.40 | 0.80   |
| F   | 0.50 | 0.90   |
| G   | 5.90 | 6.30   |
| H   | -    | *1.80  |
| H1  | -    | *9.30  |
| I   | -    | *16.10 |
| J   | -    | *0.80  |
| K   | -    | 0.96   |
| K1  | -    | *0.76  |
| M   | 2.20 | 2.40   |
| a1  | 0.40 | 0.60   |
| a2  | 2.10 | 2.50   |
| y1  | -    | 5°     |
| y2  | -    | 3°     |

\*: Typical, Unit: mm

**3-Lead TO-251  
Plastic Package  
HSMC Package Code: I**

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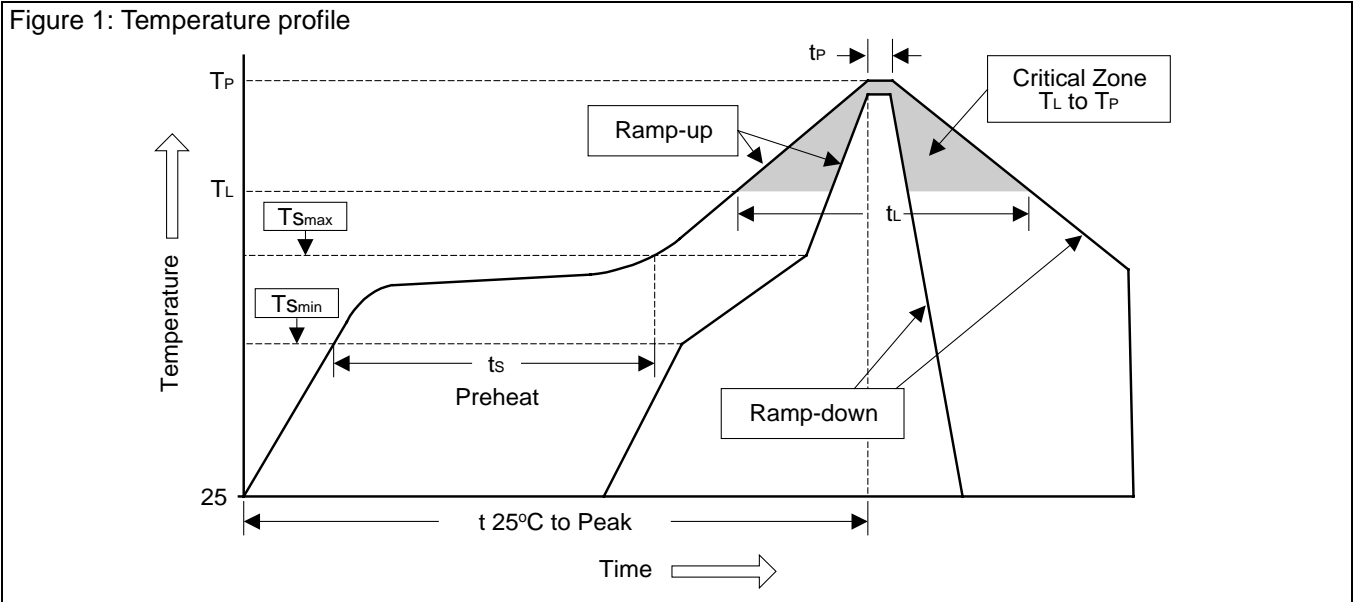
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### Soldering Methods for HSMC's Products

1. Storage environment: Temperature=10°C~35°C Humidity=65%±15%
2. Reflow soldering of surface-mount devices



| Profile Feature                                      | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|--|-------------------------|------------------|
| Average ramp-up rate ( $T_L$ to $T_P$ )              | <3°C/sec                | <3°C/sec         |
| Preheat  |                         |                  |
| - Temperature Min ( $T_{Smin}$ )                     | 100°C                   | 150°C            |
| - Temperature Max ( $T_{Smax}$ )                     | 150°C                   | 200°C            |
| - Time (min to max) ( $t_s$ )                        | 60~120 sec              | 60~180 sec       |
| $T_{Smax}$ to $T_L$                                  |                         |                  |
| - Ramp-up Rate                                       | <3°C/sec                | <3°C/sec         |
| Time maintained above:                               |                         |                  |
| - Temperature ( $T_L$ )                              | 183°C                   | 217°C            |
| - Time ( $t_L$ )                                     | 60~150 sec              | 60~150 sec       |
| Peak Temperature ( $T_P$ )                           | 240°C +0/-5°C           | 260°C +0/-5°C    |
| Time within 5°C of actual Peak Temperature ( $t_P$ ) | 10~30 sec               | 20~40 sec        |
| Ramp-down Rate                                       | <6°C/sec                | <6°C/sec         |
| Time 25°C to Peak Temperature                        | <6 minutes              | <8 minutes       |

### 3. Flow (wave) soldering (solder dipping)

| Products         | Peak temperature | Dipping time |
|------------------|------------------|--------------|
| Pb devices.      | 245°C ±5°C       | 5sec ±1sec   |
| Pb-Free devices. | 260°C +0/-5°C    | 5sec ±1sec   |