# HMBT5401

## High Voltage PNP Transistor

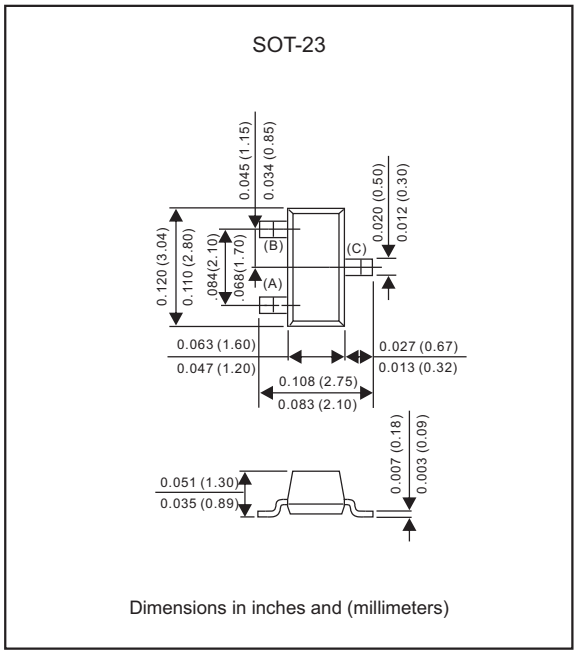
## Features

- Lead-free parts for green partner, exceeds environmental standards of MIL-STD-19500 /228

## Mechanical data

- Epoxy:UL94-V0 rated flame retardant
- Case : Molded plastic, SOT-23
- Terminals : Solder plated, solderable per MIL-STD-750, Method 2026
- Mounting Position : Any
- Weight : Approximated 0.008 gram

## Package outline




## Maximum ratings (AT $T_A$=25°C unless otherwise noted)

| PARAMETER | CONDITIONS | Symbol | Value | UNIT |
|---|---|---|---|---|
| Collector −Base Voltage | | $V_{CBO}$ | -160 | Vdc |
| Collector −Emitter Voltage | | $V_{CEO}$ | -150 | Vdc |
| Emitter −Base Voltage | | $V_{EBO}$ | -5.0 | Vdc |
| Collector Current − Continuous | | $I_C$ | -500 | mAdc |

## Thermal Characteristics

| Characteristics | CONDITIONS | Symbol | Max | UNIT |
|---|---|---|---|---|
| Total device dissipation FR-5 board (1) | $T_A$ = 25°C | $P_D$ | 225 | mW |
| | Derate above 25°C | $P_D$ | 1.8 | mW/°C |
| Thermal resistance | Junction to ambient | $R_{\theta JA}$ | 556 | °C/W |
| Total device dissipation alumina substrate(2) | $T_A$ = 25°C | $P_D$ | 300 | mW |
| | Derate above 25°C | $P_D$ | 2.4 | mW/°C |
| Thermal resistance | Junction to ambient | $R_{\theta JA}$ | 417 | °C/W |
| Operating temperature | | $T_J$ | -55 ~ +150 | °C |
| Storage temperature | | $T_{STG}$ | -55 ~ +150 | |

1.FR-5 = 1.0 X 0.75 X0.062 in.
2.Alumina = 0.4 X 0.3 X 0.024 in. 99.5% alumina.

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## ELECTRICAL CHARACTERISTICS ($T_a$=25℃ unless otherwise specified)

| Parameter | Symbol | Test conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Collector-base breakdown voltage** | $V_{(BR)CBO}$ | $I_C$=-100μA, $I_E$=0 | -160 | | | V |
| **Collector-emitter breakdown voltage** | $V_{(BR)CEO}$* | $I_C$=-1mA, $I_B$=0 | -150 | | | V |
| **Emitter-base breakdown voltage** | $V_{(BR)EBO}$ | $I_E$=-10μA, $I_C$=0 | -5 | | | V |
| **Collector cut-off current** | $I_{CBO}$ | $V_{CB}$=-120V, $I_E$=0 | | | -0.1 | μA |
| **Emitter cut-off current** | $I_{EBO}$ | $V_{EB}$=-4V, $I_C$=0 | | | -0.1 | μA |
| **DC current gain** | $h_{FE(1)}$* | $V_{CE}$=-5V, $I_C$=-1mA | 80 | | | |
| | $h_{FE(2)}$* | $V_{CE}$=-5V, $I_C$=-10mA | 100 | | 300 | |
| | $h_{FE(3)}$* | $V_{CE}$=-5V, $I_C$=-50mA | 50 | | | |
| **Collector-emitter saturation voltage** | $V_{CE(sat)1}$* | $I_C$=-10mA, $I_B$=-1mA | | | -0.2 | V |
| | $V_{CE(sat)2}$* | $I_C$=-50mA, $I_B$=-5mA | | | -0.5 | V |
| **Base-emitter saturation voltage** | $V_{BE(sat)1}$* | $I_C$=-10mA, $I_B$=-1mA | | | -1 | V |
| | $V_{BE(sat)2}$* | $I_C$=-50mA, $I_B$=-5mA | | | -1 | V |
| **Transition frequency** | $f_T$ | $V_{CE}$=-5V,$I_C$=-10mA, f=30MHz | 100 | | | MHz |

*Pulse test: pulse width ≤300μs, duty cycle≤ 2.0%.

**Small−Siglal characteristics**

| PARAMETER | CONDITIONS | Symbol | Min. | Max. | UNIT |
|---|---|---|---|---|---|
| Current-Gain-Bandwidth Product | $I_C$ =- 10mAdc, $V_{CE}$ = -10Vdc, f=100MHz | $f_T$ | 100 | 300 | MHZ |
| Output Capacitance | $V_{CB}$=-10Vdc,$I_E$ =0, f=1.0MHz | $C_{obo}$ | | 6.0 | pF |
| Small Signal Current Gain | $I_C$ =- 1.0mAdc, $V_{CE}$ = -10Vdc, f=1.0KHz | $h_{fe}$ | 40 | 200 | - |
| Noise Figure | $I_C$ =- 200uAdc, $V_{CE}$ = -5.0Vdc, $R_S$=10Ω,f=1.0KHz | NF | | 8.0 | dB |

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**FIG.1 DC Current Gain**

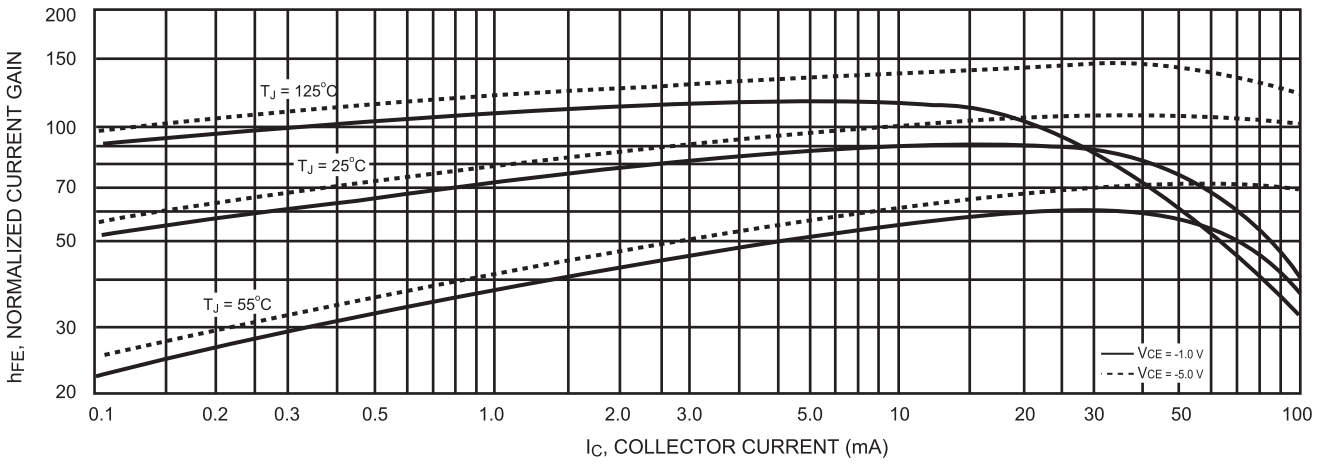


**FIG.2 Collector Saturation Region**

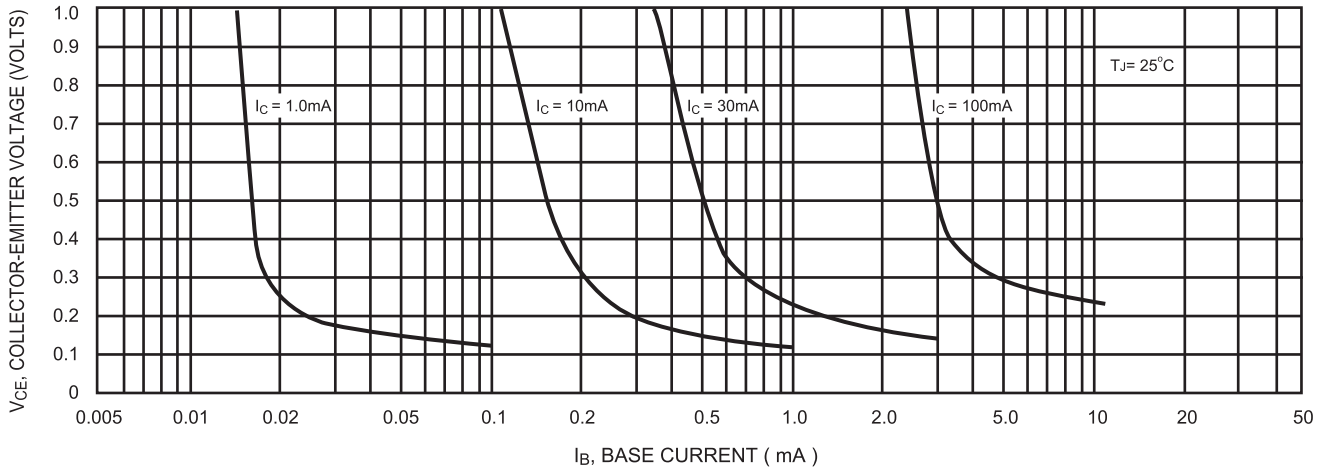


**FIG.3 Temperature Coefficients**

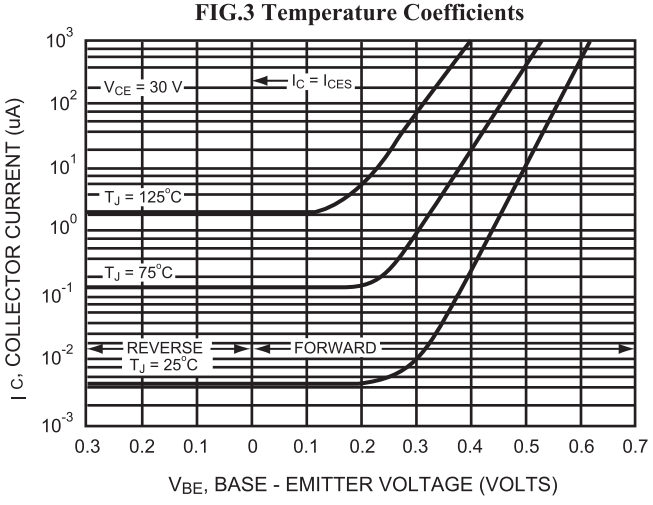


**FIG.4 " On " Voltages**

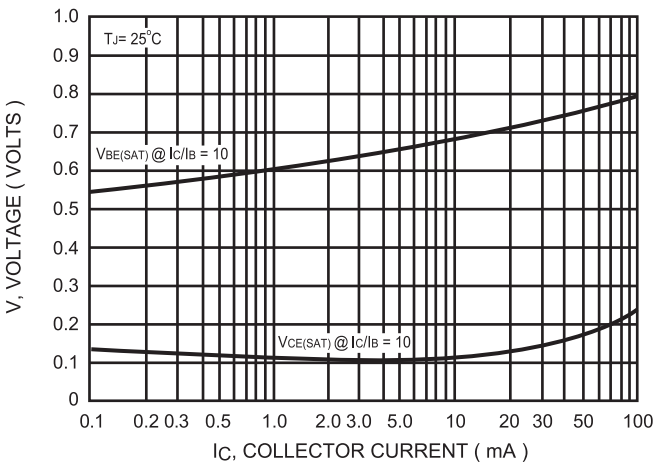

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**FIG.5 Temperature Coefficients**

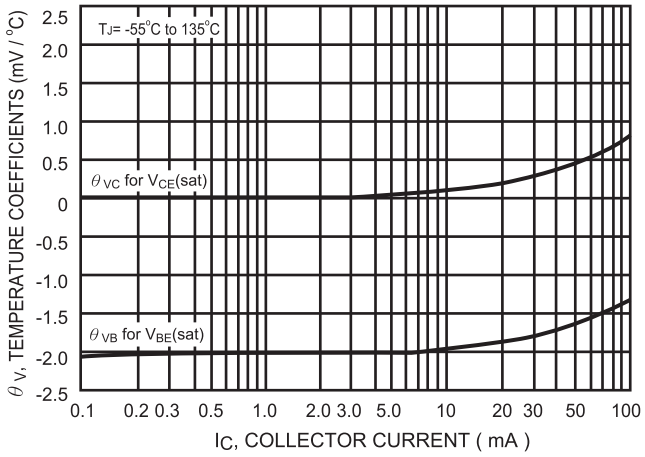
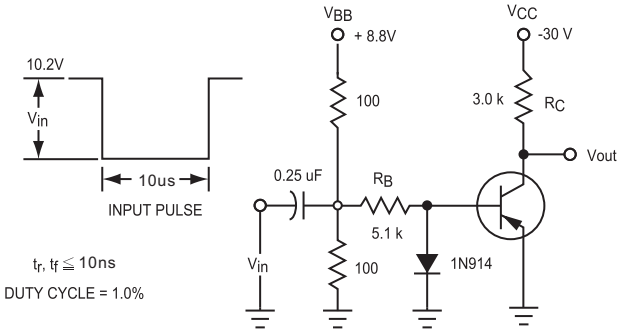



**FIG.6 Switching Time Test Circuit**




VALUES SHOWN ARE FOR IC @ 10 mA

**FIG.7 Capacitances**

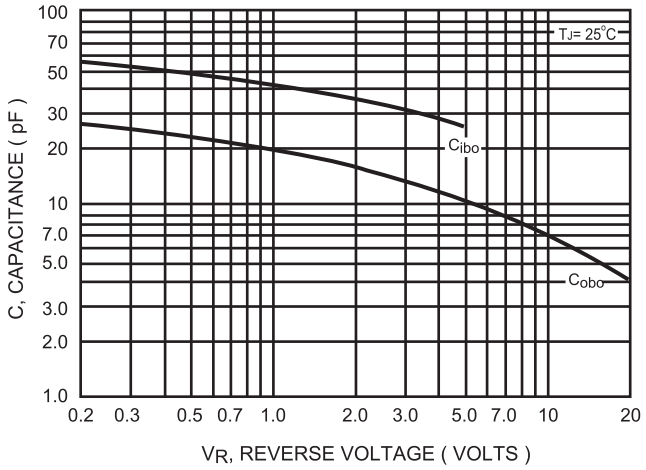



**FIG.8 Turn - On Time**

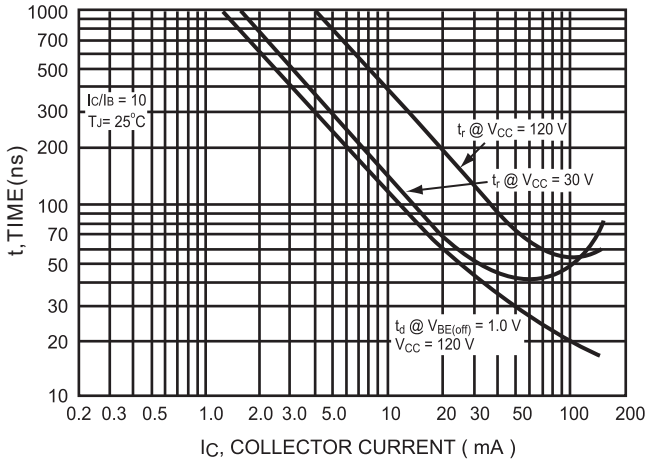
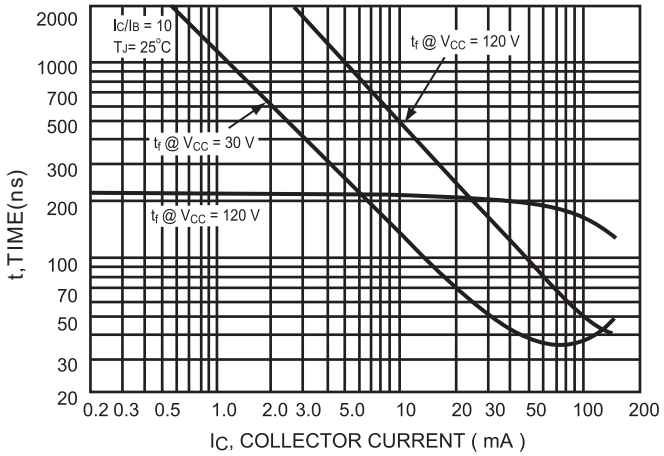



**FIG.9 Turn - Off Time**



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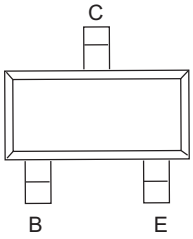
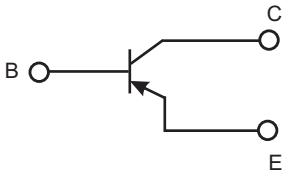
## Pinning information

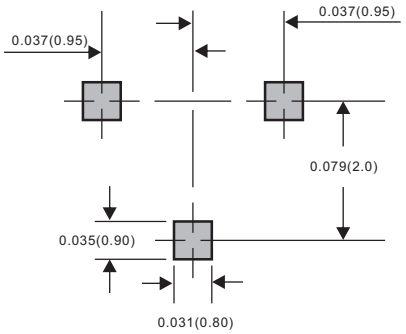
| Pin | Simplified outline | Symbol |
|---|---|---|
| PinB Base<br>PinC Collector<br>PinE Emitter |  |  |

## Marking

| Type number | Marking code |
|---|---|
| HMBT5401 | 2L |

## Suggested solder pad layout

**SOT-23**




Dimensions in inches and (millimeters)