

**HIGH VOLTAGE FAST SWITCHING NPN POWER TRANSISTOR****APT13005S****General Description**

The APT13005S is a high voltage, high speed, high efficiency switching transistor, and it is specially designed for off-line switch mode power supplies with low output power.

The APT13005S is available in TO-220F-3, TO-126 and TO-251 packages.

**Features**

- High Switching Speed
- High Collector-Emitter Voltage: 700V
- Low Cost
- High Efficiency

**Applications**

- Battery Chargers for Mobile Phone of BCD Solution
- Power Supply for DVD/STB of BCD Solution
- Driver for LED Lighting of BCD Solution

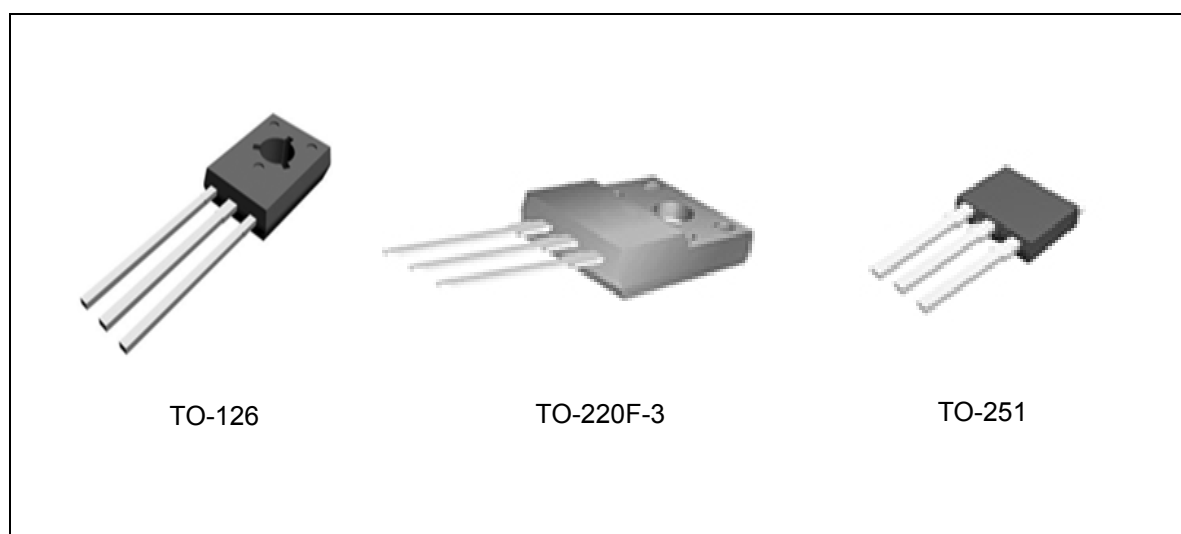


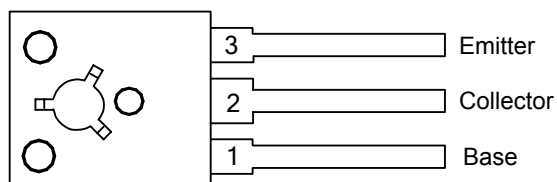
Figure 1. Package Types of APT13005S

# HIGH VOLTAGE FAST SWITCHING NPN POWER TRANSISTOR

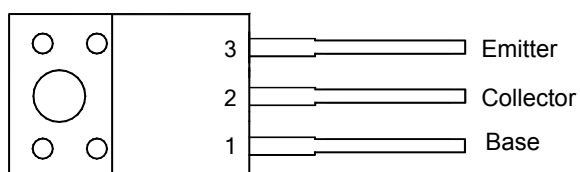
**APT13005S**

## Pin Configuration

U Package  
(TO-126)



TF Package  
(TO-220F-3)



I Package  
(TO-251)

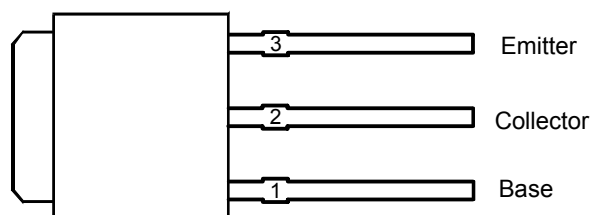
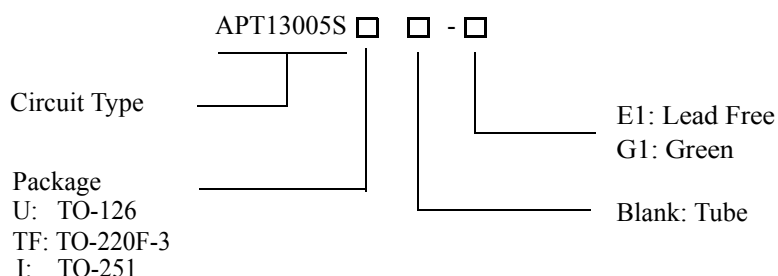


Figure 2. Pin Configuration of APT13005S (Front View)

**HIGH VOLTAGE FAST SWITCHING NPN POWER TRANSISTOR****APT13005S****Ordering Information**

| Package   | Part Number    |                | Marking ID     |                | Packing Type |
|-----------|----------------|----------------|----------------|----------------|--------------|
|           | Lead Free      | Green          | Lead Free      | Green          |              |
| TO-126    | APT13005SU-E1  | APT13005SU-G1  | EU13005S       | GU13005S       | Tube         |
| TO-220F-3 | APT13005STF-E1 | APT13005STF-G1 | APT13005STF-E1 | APT13005STF-G1 | Tube         |
| TO-251    | APT13005SI-E1  | APT13005SI-G1  | APT13005SI-E1  | APT13005SI-G1  | Tube         |

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant. Products with "G1" suffix are available in green packages.

**Absolute Maximum Ratings (Note 1)**

| Parameter                                   |           | Symbol    | Value      | Unit               |
|---------------------------------------------|-----------|-----------|------------|--------------------|
| Collector-Emitter Voltage ( $V_{BE}=0$ )    |           | $V_{CES}$ | 700        | V                  |
| Collector-Emitter Voltage ( $I_B=0$ )       |           | $V_{CEO}$ | 450        | V                  |
| Emitter-Base Breakdown Voltage ( $I_C=0$ )  |           | $V_{EBO}$ | 9          | V                  |
| Collector Current                           |           | $I_C$     | 3.2        | A                  |
| Collector Peak Current                      |           | $I_{CM}$  | 6.4        | A                  |
| Base Current                                |           | $I_B$     | 1.6        | A                  |
| Base Peak Current                           |           | $I_{BM}$  | 3.2        | A                  |
| Power Dissipation, $T_C=25^{\circ}\text{C}$ | TO-220F-3 | $P_{TOT}$ | 28         | W                  |
|                                             | TO-251    |           | 25         |                    |
|                                             | TO-126    |           | 20         |                    |
| Operating Junction Temperature              |           | $T_J$     | 150        | $^{\circ}\text{C}$ |
| Storage Temperature Range                   |           | $T_{STG}$ | -55 to 150 | $^{\circ}\text{C}$ |

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

**HIGH VOLTAGE FAST SWITCHING NPN POWER TRANSISTOR****APT13005S****Thermal Characteristics**

| Parameter                  | Symbol        | Condition        |           | Value | Unit                 |
|----------------------------|---------------|------------------|-----------|-------|----------------------|
| Maximum Thermal Resistance | $\theta_{JC}$ | Junction to Case | TO-220F-3 | 4.5   | $^{\circ}\text{C/W}$ |
|                            |               |                  | TO-251    | 5.0   |                      |
|                            |               |                  | TO-126    | 6.25  |                      |

**Electrical Characteristics**(  $T_C=25^{\circ}\text{C}$ , unless otherwise specified.)

| Parameter                                                 | Symbol                | Condition                                                                          | Min | Typ | Max | Unit          |
|-----------------------------------------------------------|-----------------------|------------------------------------------------------------------------------------|-----|-----|-----|---------------|
| Collector Cut-off Current<br>( $V_{BE}=-1.5\text{V}$ )    | $I_{CEV}$             | $V_{CE}=700\text{V}$                                                               |     |     | 10  | $\mu\text{A}$ |
| Collector-Emitter Sustaining Voltage ( $I_B=0$ ) (Note 2) | $V_{CEO}(\text{sus})$ | $I_C=100\mu\text{A}$                                                               | 450 |     |     | V             |
| Collector-Emitter Saturation Voltage                      | $V_{CE}(\text{sat})$  | $I_C=1.0\text{A}, I_B=0.2\text{A}$                                                 |     |     | 0.3 | V             |
|                                                           |                       | $I_C=2.0\text{A}, I_B=0.5\text{A}$                                                 |     |     | 0.6 |               |
|                                                           |                       | $I_C=3.0\text{A}, I_B=0.75\text{A}$                                                |     |     | 1.0 |               |
| Base-Emitter Saturation Voltage                           | $V_{BE}(\text{sat})$  | $I_C=1.0\text{A}, I_B=0.2\text{A}$                                                 |     |     | 1.2 | V             |
|                                                           |                       | $I_C=2.0\text{A}, I_B=0.5\text{A}$                                                 |     |     | 1.4 |               |
| DC Current Gain (Note 2)                                  | $h_{FE}$              | $I_C=1.0\text{A}, V_{CE}=5.0\text{V}$                                              | 15  |     | 35  |               |
|                                                           |                       | $I_C=2.0\text{A}, V_{CE}=5.0\text{V}$                                              | 8   |     | 35  |               |
| Turn-on Time with Resistive Load                          | $t_{on}$              | $I_C=2.0\text{A}, V_{CC}=125\text{V}$<br>$I_{B1}=0.4\text{A}, I_{B2}=-0.4\text{A}$ |     |     | 0.7 | $\mu\text{s}$ |
| Storage Time with Resistive Load                          | $t_s$                 |                                                                                    |     |     | 4.5 | $\mu\text{s}$ |
| Fall Time with Resistive Load                             | $t_f$                 |                                                                                    |     |     | 0.8 | $\mu\text{s}$ |
| Output Capacitance                                        | $C_{OB}$              | $V_{CB}=10\text{V}, f=0.1\text{MHz}$                                               |     | 35  |     | pF            |
| Current Gain Bandwidth Product                            | $f_T$                 | $V_{CE}=10\text{V}, I_C=0.5\text{A}$                                               | 4   |     |     | MHz           |

Note 2: Pulse test for Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

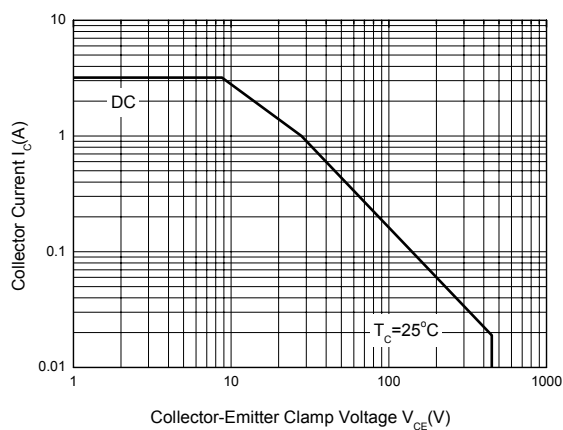
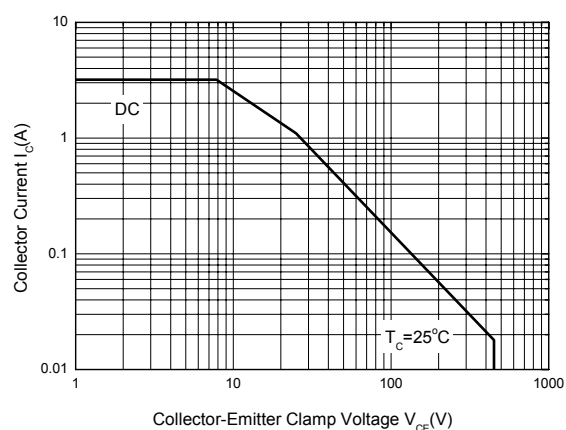
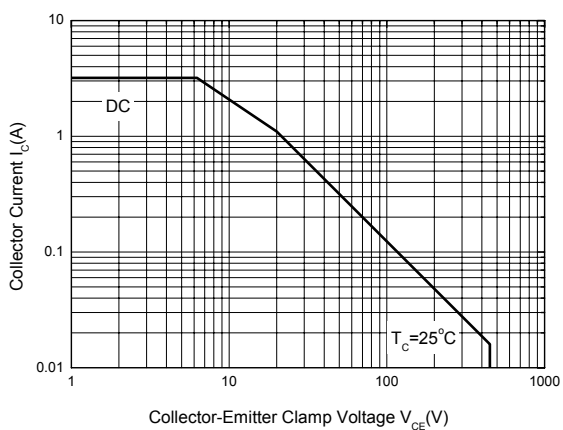
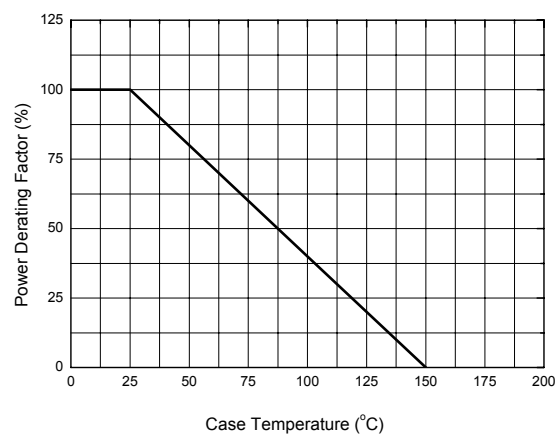
**HIGH VOLTAGE FAST SWITCHING NPN POWER TRANSISTOR****APT13005S****Typical Performance Characteristics**Figure 3. Safe Operating Areas  
(TO-220F-3 Package)Figure 4. Safe Operating Areas  
(TO-251 Package)Figure 5. Safe Operating Areas  
(TO-126 Package)

Figure 6. Power Derating Curve

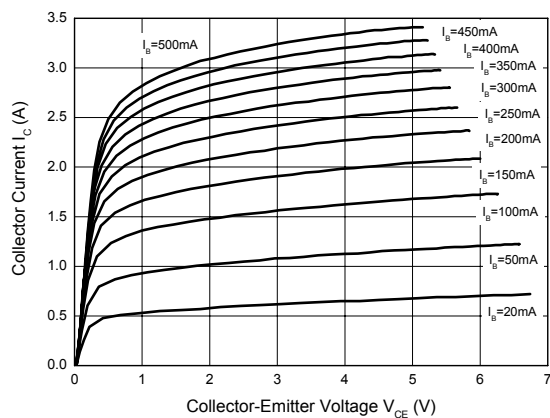
**HIGH VOLTAGE FAST SWITCHING NPN POWER TRANSISTOR****APT13005S****Typical Performance Characteristics (Continued)**

Figure 7. Static Characteristics

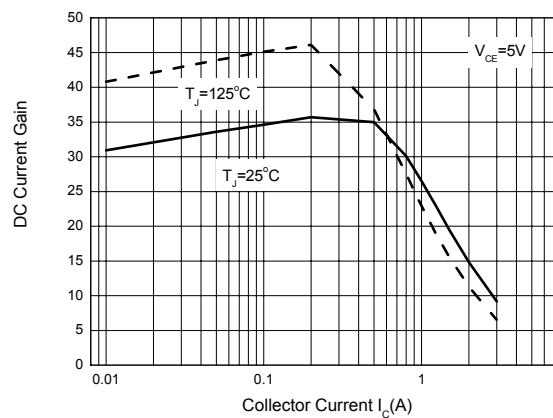


Figure 8. DC Current Gain

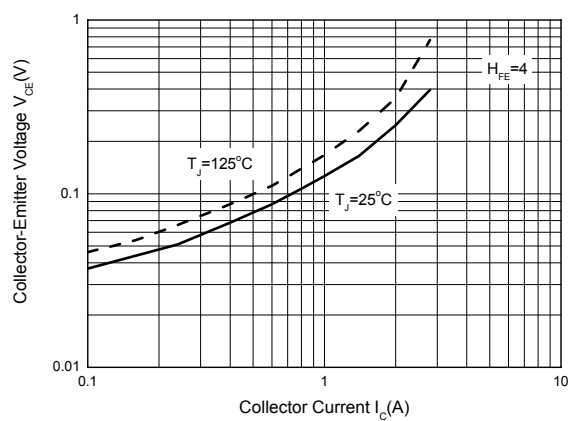


Figure 9. Collector-Emitter Saturation Region

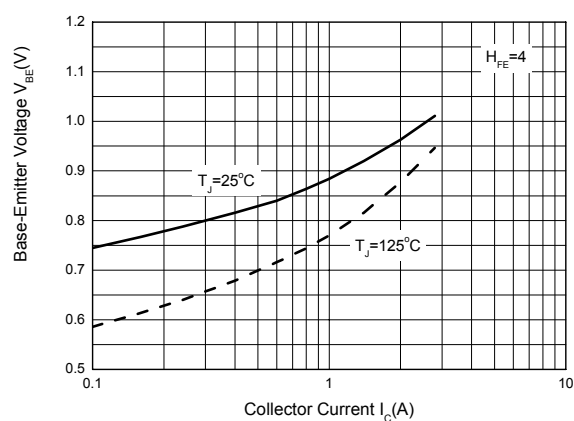
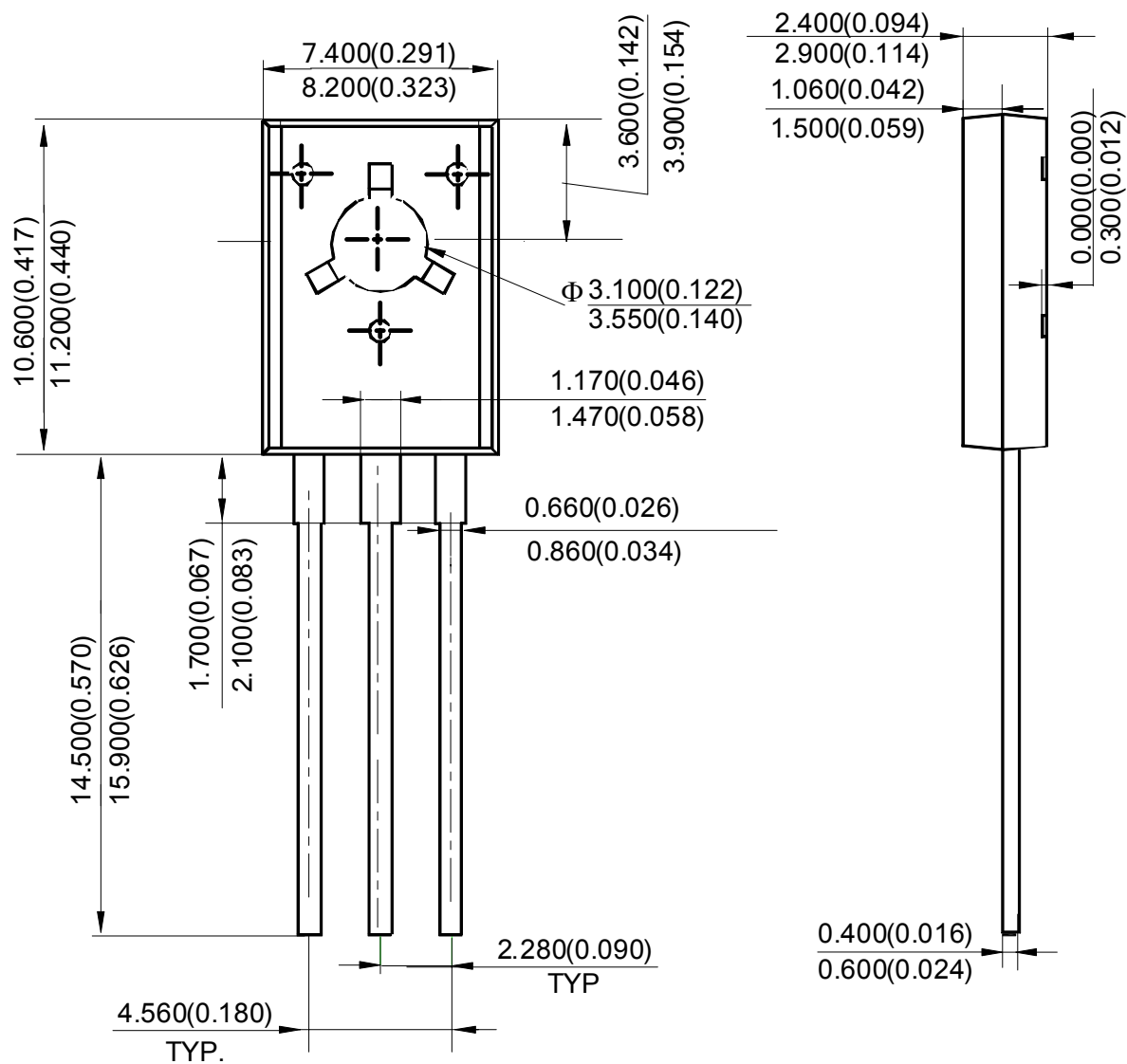
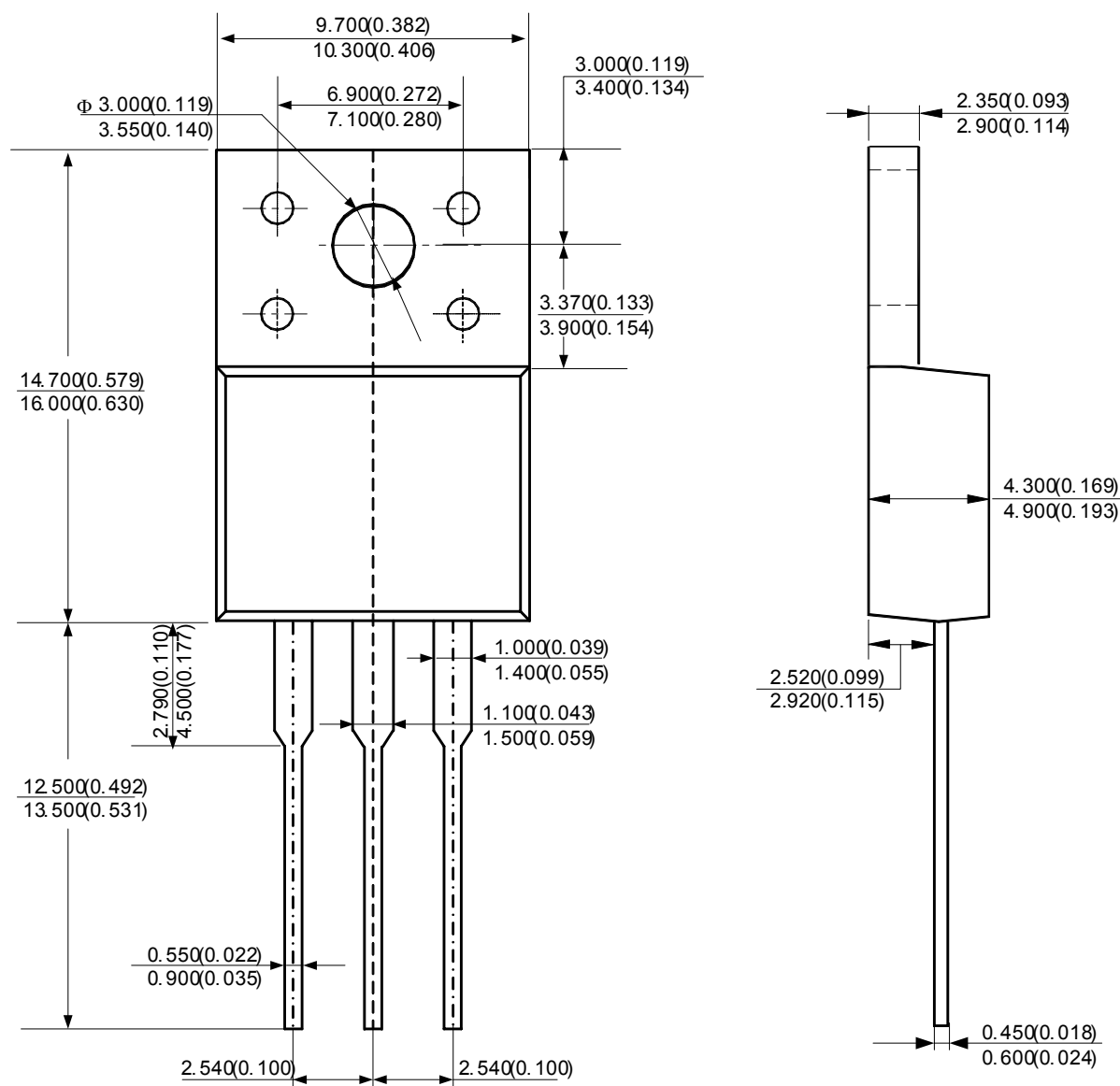
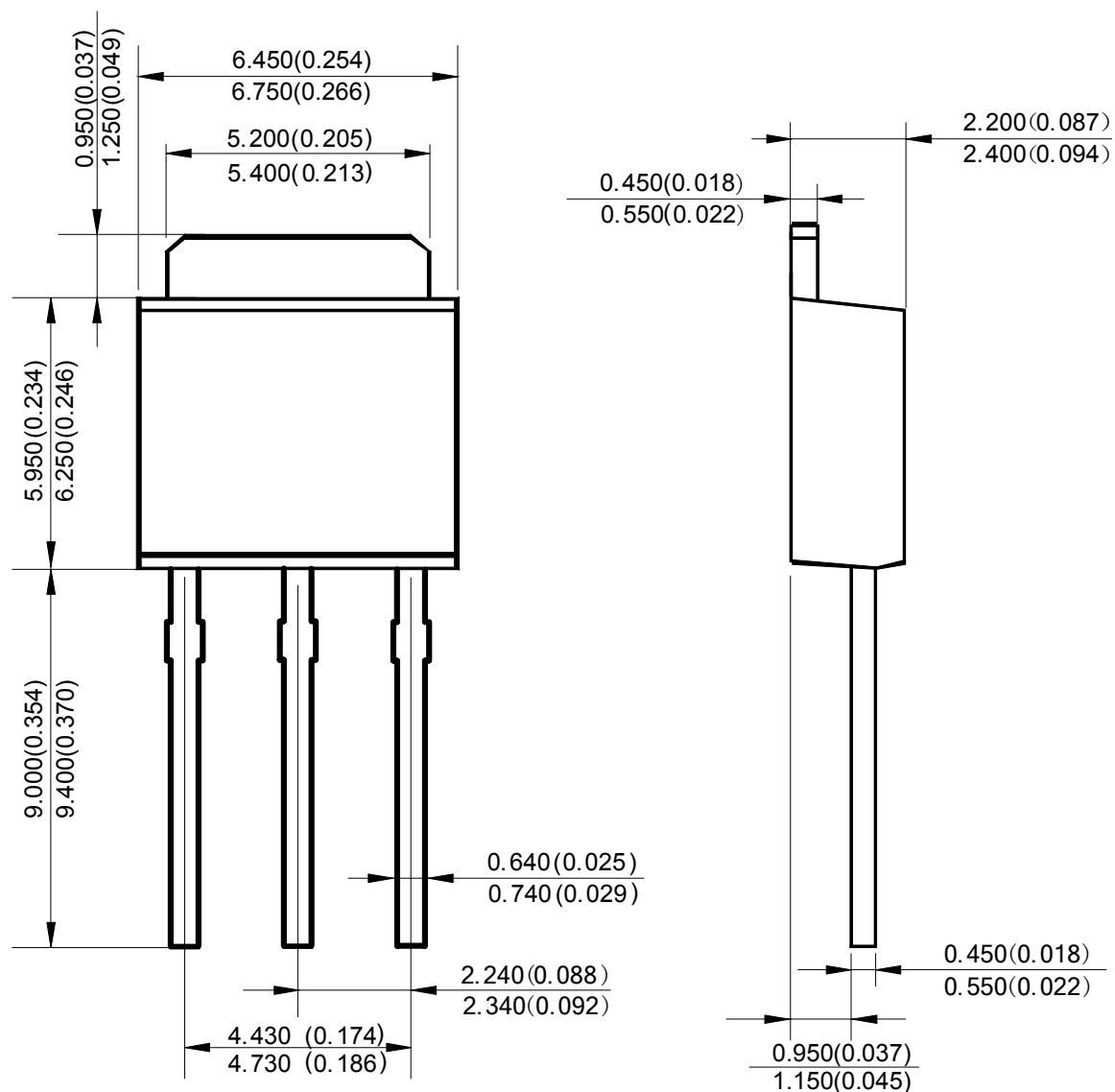


Figure 10. Base-Emitter Saturation Voltage

**HIGH VOLTAGE FAST SWITCHING NPN POWER TRANSISTOR****APT13005S****Mechanical Dimensions****TO-126****Unit: mm(inch)**

**HIGH VOLTAGE FAST SWITCHING NPN POWER TRANSISTOR****APT13005S****Mechanical Dimensions (Continued)****TO-220F-3****Unit: mm(inch)**



**HIGH VOLTAGE FAST SWITCHING NPN POWER TRANSISTOR****APT13005S****Mechanical Dimensions (Continued)****TO-251****Unit: mm(inch)**



## **BCD Semiconductor Manufacturing Limited**

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