

## 40V PNP SMALL SIGNAL SURFACE MOUNT TRANSISTOR

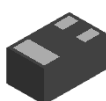
### Features

- Complementary NPN Type Available (MMBT3904LP)
- Ultra-Small Leadless Surface Mount Package
- **Totally Lead-Free & Fully RoHS compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

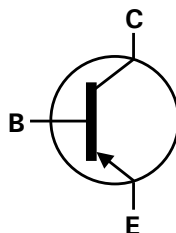
### Mechanical Data

- Case: X1-DFN1006-3
- Case Material: Molded Plastic, "Green" Molding Compound.  
UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish — NiPdAu, Solderable per MIL-STD-202,  
Method 208 
- Weight: 0.0008 grams (approximate)

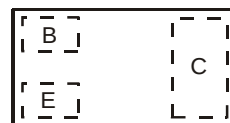
X1-DFN1006-3



Bottom View



Device Symbol



Top View  
Device Schematic

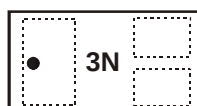
### Ordering Information (Note 4)

| Product       | Marking | Reel size (inches) | Tape width (mm) | Quantity per reel |
|---------------|---------|--------------------|-----------------|-------------------|
| MMBT3906LP-7  | 3N      | 7                  | 8               | 3,000             |
| MMBT3906LP-7B | 3N      | 7                  | 8               | 10,000            |

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
  2. See <http://www.diodes.com> for more information about Diodes Incorporated's definitions of Halogen and Antimony free, "Green" and Lead-Free.
  3. Halogen and Antimony free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
  4. For packaging details, go to our website at <http://www.diodes.com>.

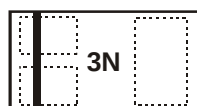
### Marking Information

MMBT3906LP-7



Top View  
Dot Denotes  
Collector Side

MMBT3906LP-7B



Top View  
Bar Denotes Base  
and Emitter Side

3N = Product Type Marking Code

**Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                          | Symbol           | Value | Unit |
|-----------------------------------------|------------------|-------|------|
| Collector-Base Voltage                  | V <sub>CBO</sub> | -40   | V    |
| Collector-Emitter Voltage               | V <sub>CEO</sub> | -40   | V    |
| Emitter-Base Voltage                    | V <sub>EBO</sub> | -6.0  | V    |
| Collector Current - Continuous (Note 5) | I <sub>C</sub>   | -200  | mA   |

**Thermal Characteristics**

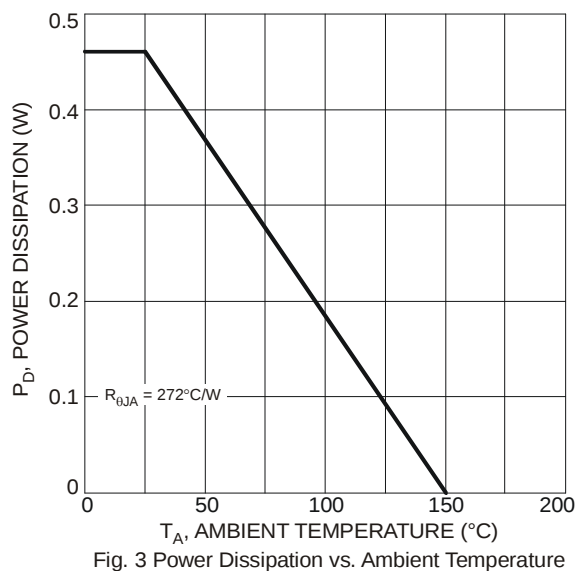
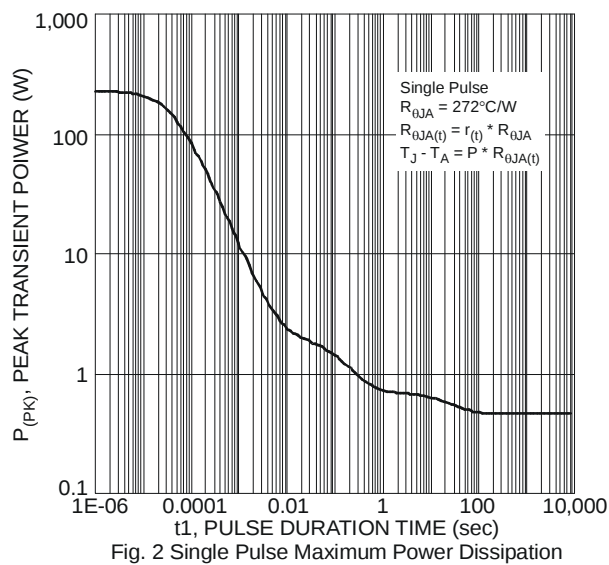
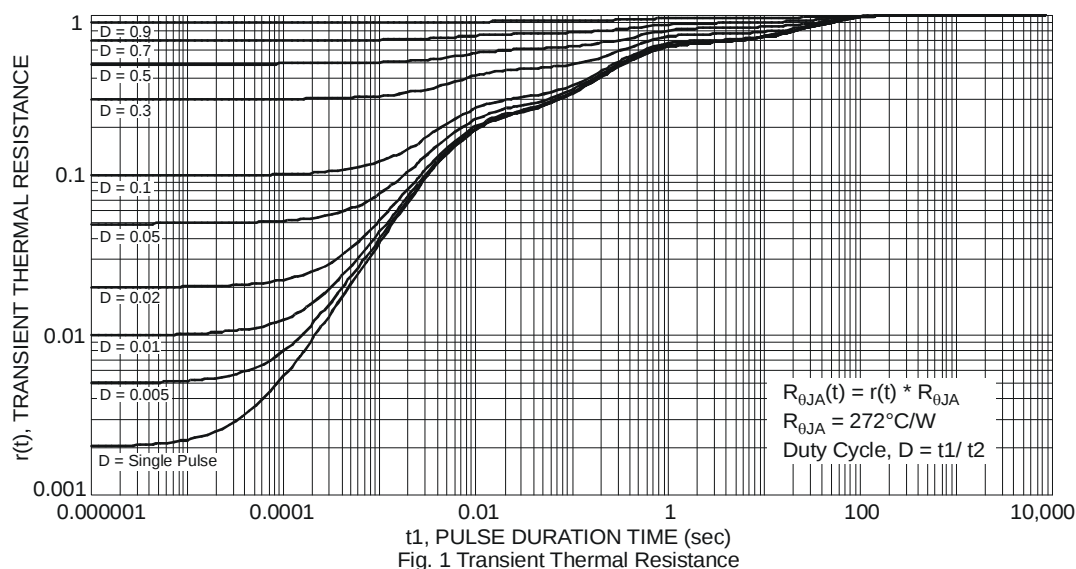
| Characteristic                                   | Symbol                            | Value       | Unit |
|--------------------------------------------------|-----------------------------------|-------------|------|
| Power Dissipation (Note 5)                       | P <sub>D</sub>                    | 460         | mW   |
| Thermal Resistance, Junction to Ambient (Note 5) | R <sub>θJA</sub>                  | 272         | °C/W |
| Thermal Resistance, Junction to Leads (Note 6)   | R <sub>θJL</sub>                  | 110         | °C/W |
| Operating and Storage and Temperature Range      | T <sub>J</sub> , T <sub>STG</sub> | -55 to +150 | °C   |

**ESD Ratings** (Note 7)

| Characteristic                             | Symbol  | Value           | Unit | JEDEC Class |
|--------------------------------------------|---------|-----------------|------|-------------|
| Electrostatic Discharge - Human Body Model | ESD HBM | 4,000 to <8,000 | V    | 3A          |
| Electrostatic Discharge - Machine Model    | ESD MM  | 200 to <400     | V    | B           |

- Notes:
5. For a device surface mounted on minimum recommended pad layout FR-4 PCB with single sided 1oz copper, in still air conditions; the device is measured when operating in a steady-state condition. The entire exposed collector pad is attached to the heat sink.
  6. Thermal resistance from junction to solder-point (at the end of the collector lead).
  7. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

## Thermal Characteristics



**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                               | Symbol               | Min   | Max   | Unit               | Test Condition                                                                                            |
|----------------------------------------------|----------------------|-------|-------|--------------------|-----------------------------------------------------------------------------------------------------------|
| OFF CHARACTERISTICS                          |                      |       |       |                    |                                                                                                           |
| Collector-Base Breakdown Voltage             | BV <sub>CBO</sub>    | -40   | —     | V                  | I <sub>C</sub> = -100μA, I <sub>E</sub> = 0                                                               |
| Collector-Emitter Breakdown Voltage (Note 8) | BV <sub>CEO</sub>    | -40   | —     | V                  | I <sub>C</sub> = -10.0mA, I <sub>B</sub> = 0                                                              |
| Emitter-Base Breakdown Voltage               | BV <sub>EBO</sub>    | -6.0  | —     | V                  | I <sub>E</sub> = -100μA, I <sub>C</sub> = 0                                                               |
| Collector Cutoff Current                     | I <sub>CEX</sub>     | —     | -50   | nA                 | V <sub>CE</sub> = -30V, V <sub>EB(OFF)</sub> = -3.0V                                                      |
|                                              | I <sub>CBO</sub>     | —     | -50   | nA                 | V <sub>CB</sub> = -30V, I <sub>E</sub> = 0                                                                |
| Base Cutoff Current                          | I <sub>BL</sub>      | —     | -50   | nA                 | V <sub>CE</sub> = -30V, V <sub>EB(OFF)</sub> = -3.0V                                                      |
| ON CHARACTERISTICS (Note 8)                  |                      |       |       |                    |                                                                                                           |
| DC Current Gain                              | h <sub>FE</sub>      | 60    | —     | —                  | I <sub>C</sub> = -100μA, V <sub>CE</sub> = -1.0V                                                          |
|                                              |                      | 80    | —     |                    | I <sub>C</sub> = -1.0mA, V <sub>CE</sub> = -1.0V                                                          |
|                                              |                      | 100   | 300   |                    | I <sub>C</sub> = -10mA, V <sub>CE</sub> = -1.0V                                                           |
|                                              |                      | 60    | —     |                    | I <sub>C</sub> = -50mA, V <sub>CE</sub> = -1.0V                                                           |
|                                              |                      | 30    | —     |                    | I <sub>C</sub> = -100mA, V <sub>CE</sub> = -1.0V                                                          |
| Collector-Emitter Saturation Voltage         | V <sub>CE(sat)</sub> | —     | -0.25 | V                  | I <sub>C</sub> = -10mA, I <sub>B</sub> = -1.0mA                                                           |
|                                              |                      | —     | -0.40 |                    | I <sub>C</sub> = -50mA, I <sub>B</sub> = -5.0mA                                                           |
| Base-Emitter Saturation Voltage              | V <sub>BE(sat)</sub> | -0.65 | -0.85 | V                  | I <sub>C</sub> = -10mA, I <sub>B</sub> = -1.0mA                                                           |
|                                              |                      | —     | -0.95 |                    | I <sub>C</sub> = -50mA, I <sub>B</sub> = -5.0mA                                                           |
| SMALL SIGNAL CHARACTERISTICS                 |                      |       |       |                    |                                                                                                           |
| Output Capacitance                           | C <sub>obo</sub>     | —     | 4.5   | pF                 | V <sub>CB</sub> = -5.0V, f = 1.0MHz, I <sub>E</sub> = 0                                                   |
| Input Capacitance                            | C <sub>ibo</sub>     | —     | 10    | pF                 | V <sub>EB</sub> = -0.5V, f = 1.0MHz, I <sub>C</sub> = 0                                                   |
| Input Impedance                              | h <sub>ie</sub>      | 2.0   | 12    | kΩ                 | V <sub>CE</sub> = 10V, I <sub>C</sub> = 1.0mA,<br>f = 1.0kHz                                              |
| Voltage Feedback Ratio                       | h <sub>re</sub>      | 0.1   | 10    | x 10 <sup>-4</sup> |                                                                                                           |
| Small Signal Current Gain                    | h <sub>fe</sub>      | 100   | 400   | —                  |                                                                                                           |
| Output Admittance                            | h <sub>oe</sub>      | 3.0   | 60    | μS                 |                                                                                                           |
| Current Gain-Bandwidth Product               | f <sub>T</sub>       | 300   | —     | MHz                | V <sub>CE</sub> = -20V, I <sub>C</sub> = -10mA,<br>f = 100MHz                                             |
| SWITCHING CHARACTERISTICS                    |                      |       |       |                    |                                                                                                           |
| Delay Time                                   | t <sub>d</sub>       | —     | 35    | ns                 | V <sub>CC</sub> = -3.0V, I <sub>C</sub> = -10mA,<br>V <sub>BE(off)</sub> = 0.5V, I <sub>B1</sub> = -1.0mA |
| Rise Time                                    | t <sub>r</sub>       | —     | 35    | ns                 |                                                                                                           |
| Storage Time                                 | t <sub>s</sub>       | —     | 225   | ns                 | V <sub>CC</sub> = -3.0V, I <sub>C</sub> = -10mA,<br>I <sub>B1</sub> = I <sub>B2</sub> = -1.0mA            |
| Fall Time                                    | t <sub>f</sub>       | —     | 75    | ns                 |                                                                                                           |

Notes: 8. Short duration pulse test used to minimize self-heating effect.

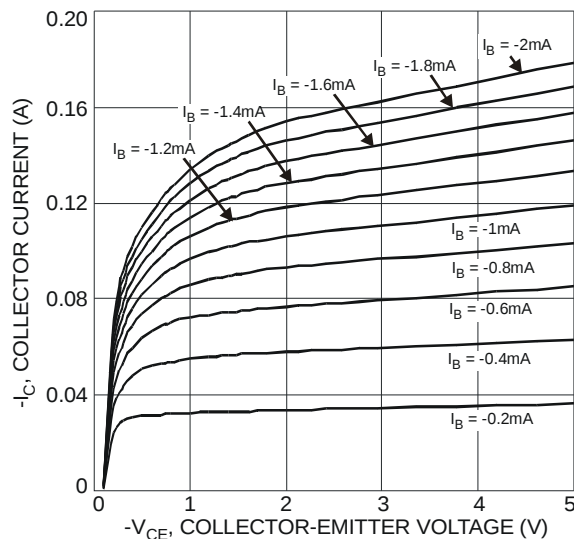


Fig. 4 Typical Collector Current vs. Collector-Emitter Voltage

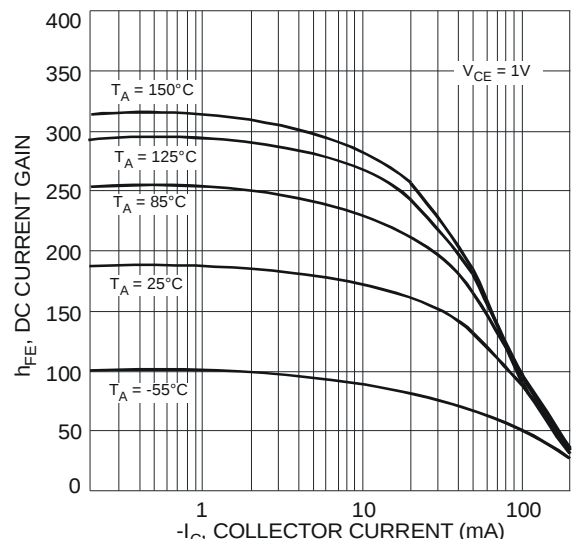


Fig. 5 Typical DC Current Gain vs. Collector Current

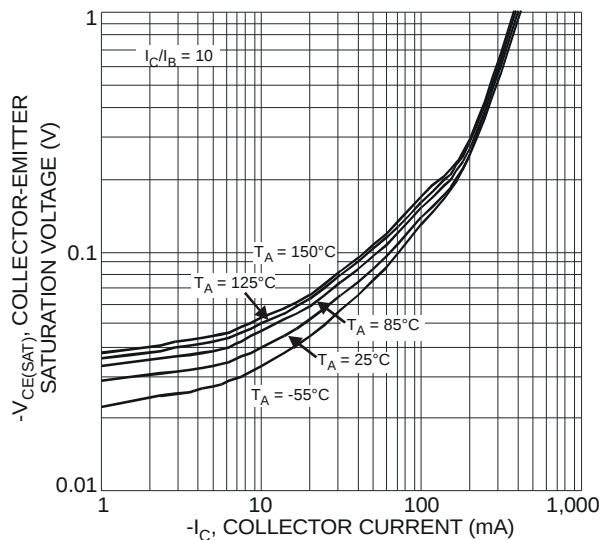


Fig. 6 Typical Collector-Emitter Saturation Voltage vs. Collector Current

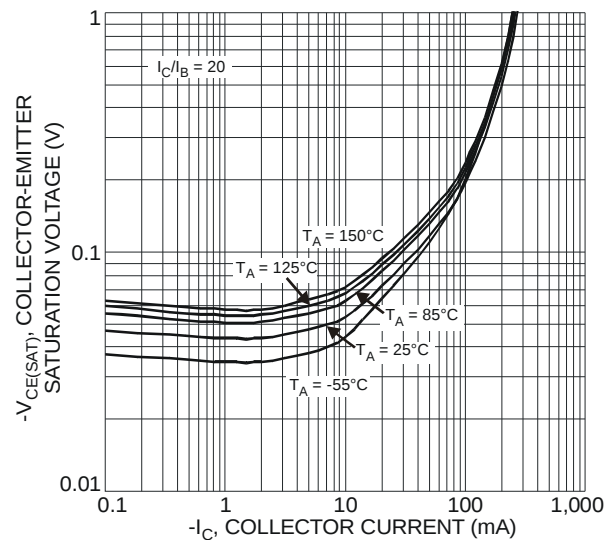


Fig. 7 Typical Collector-Emitter Saturation Voltage vs. Collector Current

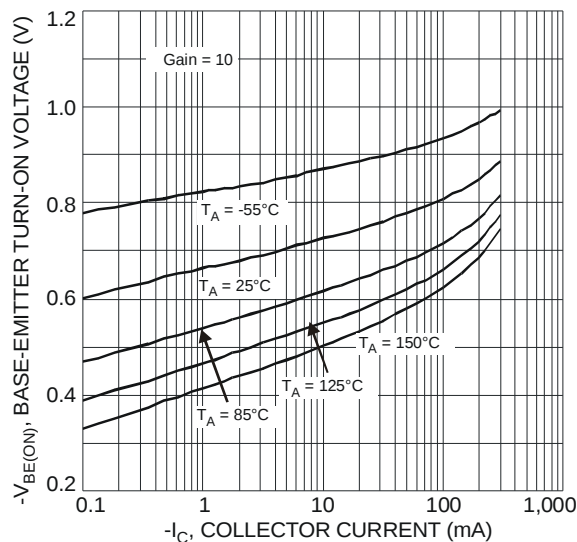


Fig. 8 Typical Base-Emitter Saturation Voltage vs. Collector Current

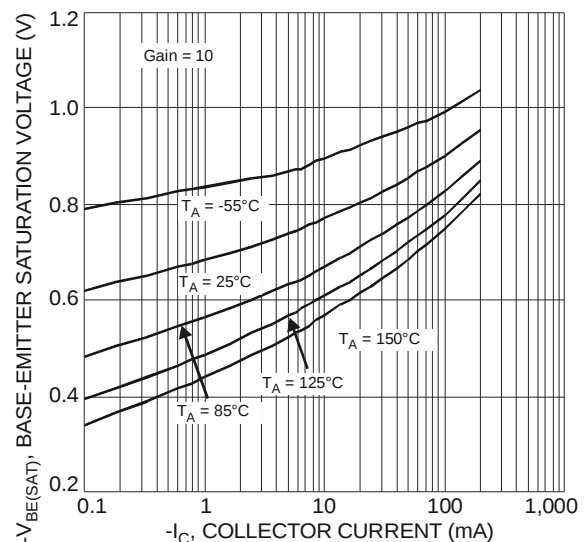
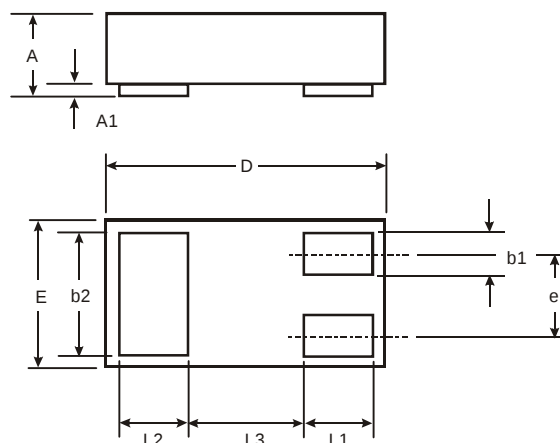


Fig. 9 Typical Base-Emitter Saturation Voltage vs. Collector Current

## Package Outline Dimensions

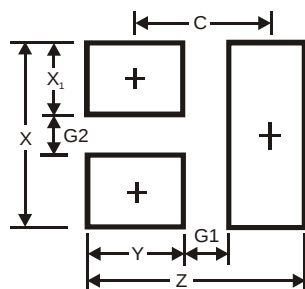
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.



| X1-DFN1006-3         |      |       |      |
|----------------------|------|-------|------|
| Dim                  | Min  | Max   | Typ  |
| A                    | 0.47 | 0.53  | 0.50 |
| A1                   | 0    | 0.05  | 0.03 |
| b1                   | 0.10 | 0.20  | 0.15 |
| b2                   | 0.45 | 0.55  | 0.50 |
| D                    | 0.95 | 1.075 | 1.00 |
| E                    | 0.55 | 0.675 | 0.60 |
| e                    | —    | —     | 0.35 |
| L1                   | 0.20 | 0.30  | 0.25 |
| L2                   | 0.20 | 0.30  | 0.25 |
| L3                   | —    | —     | 0.40 |
| All Dimensions in mm |      |       |      |

## Suggested Pad Layout

Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.



| Dimensions | Value (in mm) |
|------------|---------------|
| Z          | 1.1           |
| G1         | 0.3           |
| G2         | 0.2           |
| X          | 0.7           |
| X1         | 0.25          |
| Y          | 0.4           |
| C          | 0.7           |

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