

COMPLEX TRANSISTOR ARRAY FOR BIPOLAR TRANSISTOR HALF H-BRIDGE MOTOR/ACTUATOR DRIVER
Features

- Epitaxial Planar Die Construction
- **Lead Free By Design/RoHS Compliant (Note 1)**
- **"Green" Device (Note 2)**

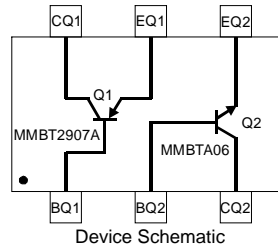
| Sub-Component P/N | Reference | Device Type |
|-------------------|-----------|----------------|
| MMBT2907A_DIE | Q1 | PNP Transistor |
| MMBTA06_DIE | Q2 | NPN Transistor |



Top View

Mechanical Data

- Case: SOT-363
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020D
- Terminal Connections: See Schematic & Pin Configuration
- Terminals: Finish - Matte Tin annealed over Alloy 42 leadframe. Solderable per MIL-STD-202, Method 208
- Marking Information: See Page 6
- Ordering Information: See Page 6
- Weight: 0.016 grams (approximate)



Device Schematic

Maximum Ratings: Total Device @ $T_A = 25^\circ\text{C}$ unless otherwise specified

| Characteristic | Symbol | Value | Unit |
|--|-----------|-------------|------------------|
| Operating and Storage Junction Temperature Range | V_{EBO} | -55 to +150 | $^\circ\text{C}$ |

Thermal Characteristics: Total Device

| Characteristic | Symbol | Value | Unit |
|--|-----------------|-------|--------------------|
| Power Dissipation (Note 3) | P_D | 200 | mW |
| Thermal Resistance, Junction to Ambient Air (Note 3) | $R_{\theta JA}$ | 625 | $^\circ\text{C/W}$ |

Maximum Ratings: Sub-Component Devices @ $T_A = 25^\circ\text{C}$ unless otherwise specified

| Characteristic | Symbol | Q1-PNP Transistor (MMBT2907A) | Q2-NPN Transistor (MMBTA06) | Unit |
|---|-----------|-------------------------------|-----------------------------|------|
| Collector-Base Voltage | V_{CBO} | -60 | 80 | V |
| Collector-Emitter Voltage | V_{CEO} | -60 | 65 | V |
| Emitter-Base Voltage | V_{EBO} | -5.5 | 6 | V |
| Collector Current - Continuous (Note 3) | I_C | -600 | 500 | mA |

- Notes:
1. No purposefully added lead.
 2. Diodes Inc.'s "Green" policy can be found on our website at http://www.diodes.com/products/lead_free/index.php.
 3. Device mounted on FR-4 PCB, 1 inch x 0.85 inch x 0.062 inch; pad layout as shown on page 7 or on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at <http://www.diodes.com/datasheets/ap02001.pdf>.

Electrical Characteristics: PNP (MMBT2907A) Transistor (Q1) @ $T_A = 25^\circ\text{C}$ unless otherwise specified

| Characteristic | Symbol | Min | Max | Unit | Test Condition |
|--------------------------------------|---------------|------|---------------|------|--|
| OFF CHARACTERISTICS (Note 4) | | | | | |
| Collector-Base Breakdown Voltage | $V_{(BR)CBO}$ | -60 | — | V | $I_C = -10\mu\text{A}, I_E = 0$ |
| Collector-Emitter Breakdown Voltage | $V_{(BR)CEO}$ | -60 | — | V | $I_C = -10\text{mA}, I_B = 0$ |
| Emitter-Base Breakdown Voltage | $V_{(BR)EBO}$ | -5.5 | — | V | $I_E = -10\mu\text{A}, I_C = 0$ |
| Collector Cutoff Current | I_{CBO} | — | -10 | nA | $V_{CB} = -50\text{V}, I_E = 0$ |
| Collector Cutoff Current | I_{CEX} | — | -50 | nA | $V_{CE} = -30\text{V}, V_{EB(OFF)} = -0.5\text{V}$ |
| Base Cutoff Current | I_{BL} | — | -50 | nA | $V_{CE} = -30\text{V}, V_{EB(OFF)} = -0.5\text{V}$ |
| ON CHARACTERISTICS (Note 4) | | | | | |
| DC Current Gain | h_{FE} | 100 | — | — | $I_C = -100\mu\text{A}, V_{CE} = -10\text{V}$ |
| | | 100 | — | — | $I_C = -1.0\text{mA}, V_{CE} = -10\text{V}$ |
| | | 100 | — | — | $I_C = -10\text{mA}, V_{CE} = -10\text{V}$ |
| | | 100 | 300 | — | $I_C = -150\text{mA}, V_{CE} = -10\text{V}$ |
| | | 50 | — | — | $I_C = -500\text{mA}, V_{CE} = -10\text{V}$ |
| Collector-Emitter Saturation Voltage | $V_{CE(SAT)}$ | — | -0.3 -0.5 | V | $I_C = -150\text{mA}, I_B = -15\text{mA}$ $I_C = -500\text{mA}, I_B = -50\text{mA}$ |
| Base-Emitter Saturation Voltage | $V_{BE(SAT)}$ | — | -0.95 -1.3 | V | $I_C = -150\text{mA}, I_B = -15\text{mA}$ $I_C = -500\text{mA}, I_B = -50\text{mA}$ |
| SMALL SIGNAL CHARACTERISTICS | | | | | |
| Current Gain-Bandwidth Product | f_T | 100 | — | MHz | $V_{CE} = -2.0\text{V}, I_C = -10\text{mA}, f = 100\text{MHz}$ |
| SWITCHING CHARACTERISTICS | | | | | |
| Turn-On Time | t_{on} | — | 45 | ns | $V_{CE} = -30\text{V}, I_C = -150\text{mA}, I_{B1} = -15\text{mA}$ |
| Delay Time | t_d | — | 10 | ns | |
| Rise Time | t_r | — | 40 | ns | |
| Turn-Off Time | t_{off} | — | 100 | ns | $V_{CC} = -6.0\text{V}, I_C = -150\text{mA}, I_{B1} = I_{B2} = -15\text{mA}$ |
| Storage Time | t_s | — | 80 | ns | |
| Fall Time | t_f | — | 30 | ns | |

Electrical Characteristics: NPN (MMBTA06) Transistor (Q2) @ $T_A = 25^\circ\text{C}$ unless otherwise specified

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|--------------------------------------|---------------|-----|------|------|------|---|
| OFF CHARACTERISTICS (Note 4) | | | | | | |
| Collector-Base Breakdown Voltage | $V_{(BR)CBO}$ | 80 | — | — | V | $I_C = 100\mu\text{A}, I_E = 0$ |
| Collector-Emitter Breakdown Voltage | $V_{(BR)CEO}$ | 65 | — | — | V | $I_C = 1\text{mA}, I_B = 0$ |
| Emitter-Base Breakdown Voltage | $V_{(BR)EBO}$ | 6 | — | — | V | $I_E = 100\mu\text{A}, I_C = 0$ |
| Collector-Base Cutoff Current | I_{CBO} | — | — | 100 | nA | $V_{CB} = 80\text{V}, I_E = 0$ |
| Collector Cutoff Current | I_{CES} | — | — | 100 | nA | $V_{CE} = 90\text{V}, V_{BE} = 0$ |
| Emitter-Base Cutoff Current | I_{EBO} | — | — | 100 | nA | $V_{EB} = 5\text{V}, I_C = 0$ |
| ON CHARACTERISTICS (Note 4) | | | | | | |
| DC Current Gain | h_{FE} | 250 | — | — | — | $V_{CE} = 1\text{V}, I_C = 10\text{mA}$ |
| | | 100 | — | — | — | $V_{CE} = 1\text{V}, I_C = 100\text{mA}$ |
| Collector-Emitter Saturation Voltage | $V_{CE(SAT)}$ | — | 0.2 | 0.4 | V | $I_C = 100\text{mA}, I_B = 10\text{mA}$ |
| Base-Emitter Turn-on Voltage | $V_{BE(ON)}$ | 0.7 | 0.75 | 0.8 | V | $V_{CE} = 1\text{V}, I_C = 100\text{mA}$ |
| Base-Emitter Saturation Voltage | $V_{BE(SAT)}$ | — | — | 0.95 | V | $I_C = 100\text{mA}, I_B = 5\text{mA}$ |
| SMALL SIGNAL CHARACTERISTICS | | | | | | |
| Current Gain-Bandwidth Product | f_T | 100 | — | — | MHz | $V_{CE} = 20\text{V}, I_C = 10\text{mA}, f = 100\text{MHz}$ |

Notes: 4. Short duration pulse test used to minimize self-heating effect.

Typical Characteristics @ $T_A = 25^\circ\text{C}$ unless otherwise specified

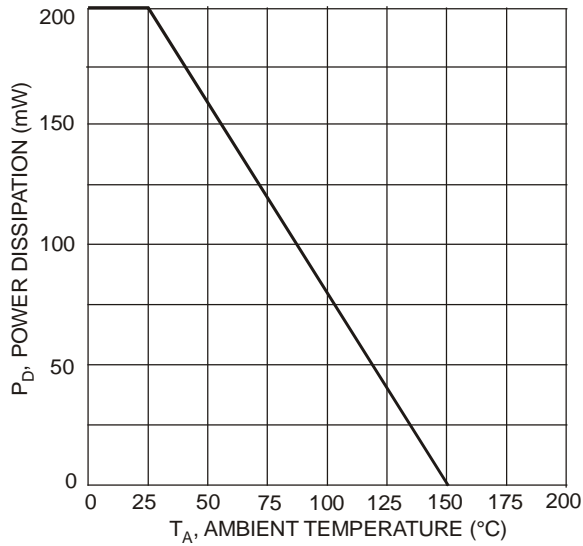


Fig. 1 Power Derating Curve

PNP (MMBT2907A) Transistor (Q1) Plots:

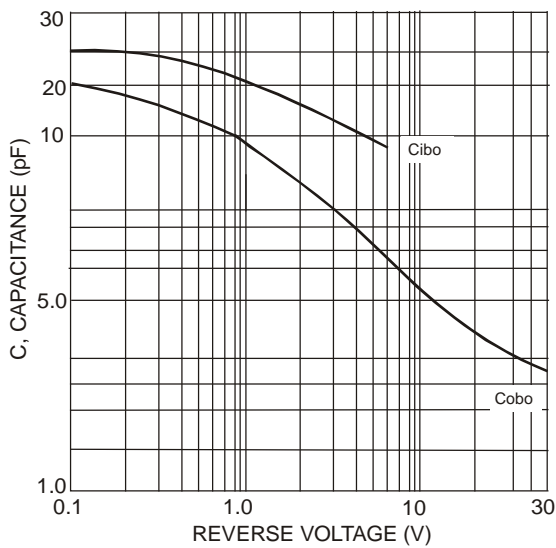


Fig. 2 Typical Capacitance

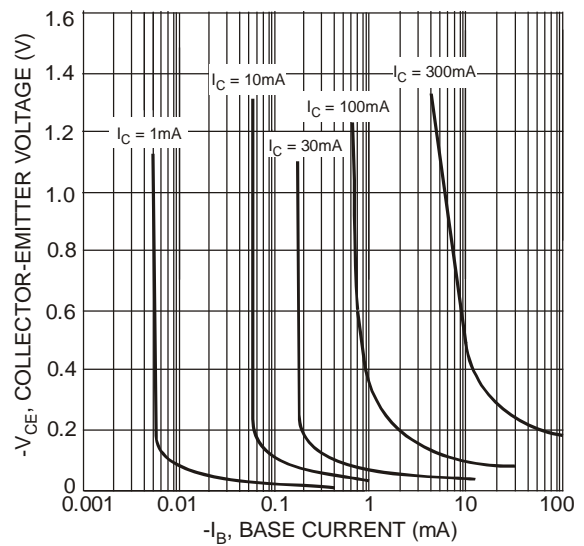


Fig. 3 Typical Collector Saturation Region

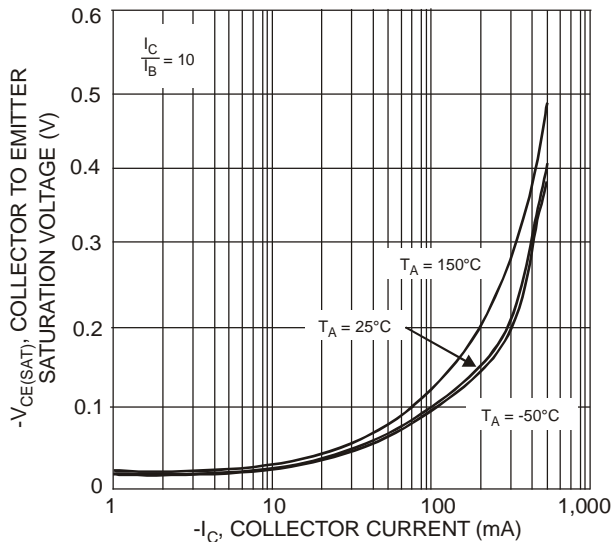


Fig. 4 Collector Emitter Saturation Voltage vs. Collector Current

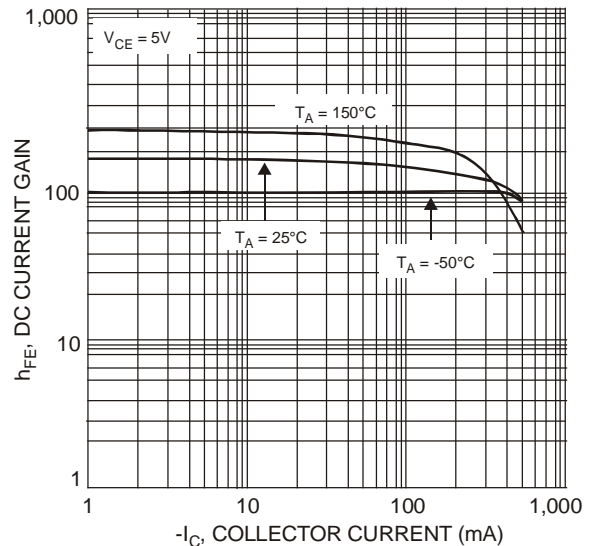


Fig. 5 Typical DC Current Gain vs. Collector Current

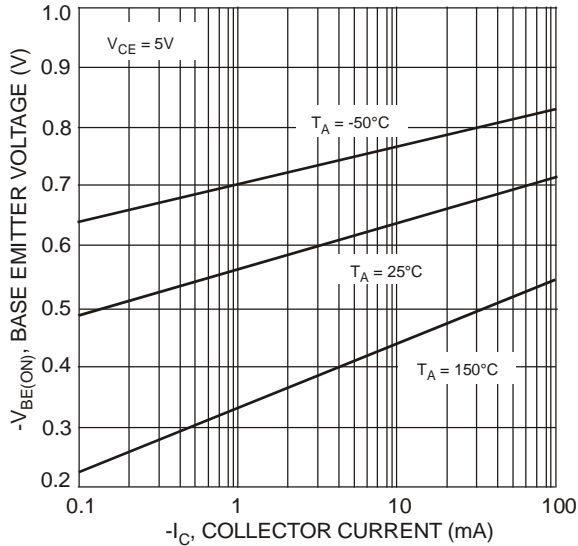


Fig. 6 Typical Base Emitter Voltage vs. Collector Current

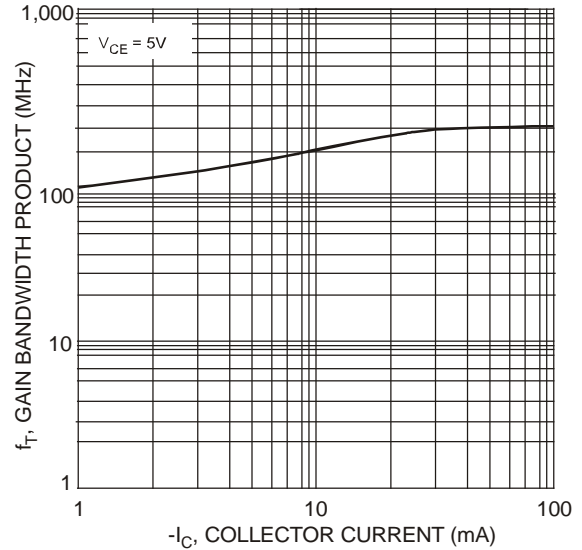


Fig. 7 Typical Gain Bandwidth Product vs. Collector Current

NPN (MMBTA06) Transistor (Q2) Plots

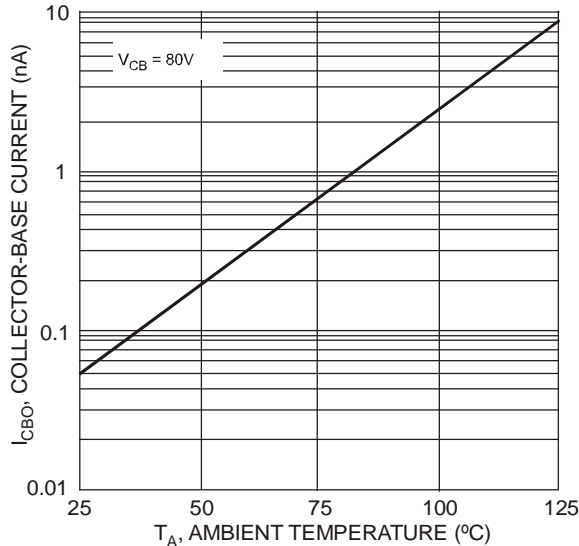


Fig. 8 Typical Collector-Cutoff Current vs. Ambient Temperature

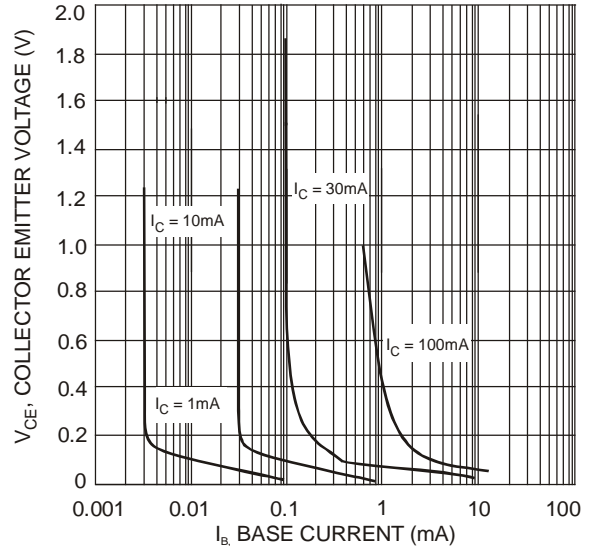


Fig. 9 Typical Collector Saturation Region

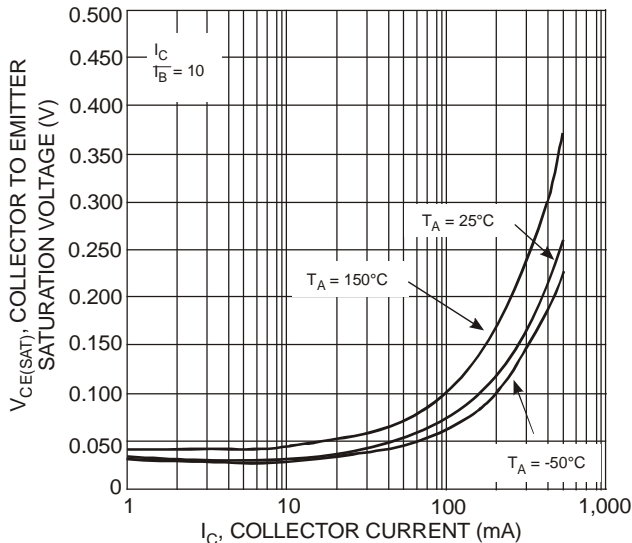


Fig. 10 Typical Collector Emitter Saturation Voltage vs. Collector Current

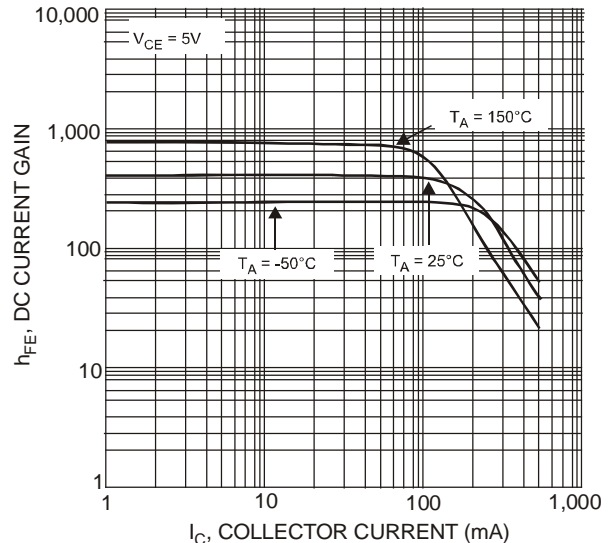
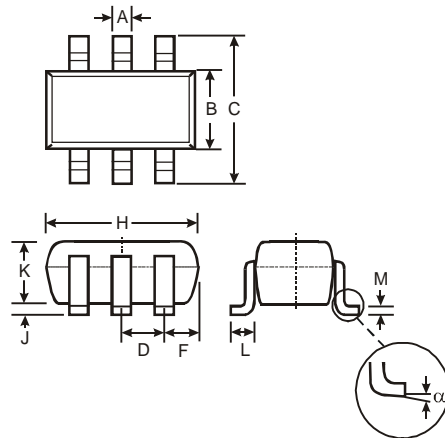


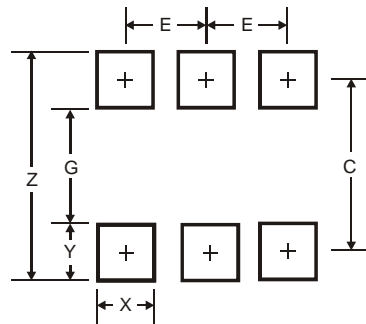
Fig. 11 Typical DC Current Gain vs. Collector Current

Package Outline Dimensions



| SOT-363 | | |
|----------------------|----------|------|
| Dim | Min | Max |
| A | 0.10 | 0.30 |
| B | 1.15 | 1.35 |
| C | 2.00 | 2.20 |
| D | 0.65 Typ | |
| F | 0.40 | 0.45 |
| H | 1.80 | 2.20 |
| J | 0 | 0.10 |
| K | 0.90 | 1.00 |
| L | 0.25 | 0.40 |
| M | 0.10 | 0.22 |
| α | 0° | 8° |
| All Dimensions in mm | | |

Suggested Pad Layout



| Dimensions | Value (in mm) |
|------------|---------------|
| Z | 2.5 |
| G | 1.3 |
| X | 0.42 |
| Y | 0.6 |
| C | 1.9 |
| E | 0.65 |

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