

## Features

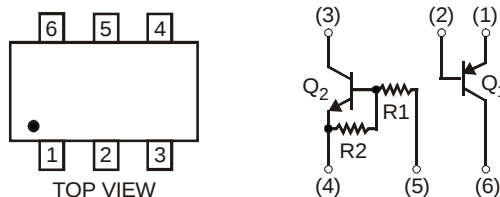
- Epitaxial Planar Die Construction
- One PNP Bipolar Transistor and One NPN Pre-Biased Transistor
- Ultra-Small Surface Mount Package
- **Lead Free By Design/RoHS Compliant (Note 1)**
- **"Green" Device (Note 2)**

## Mechanical Data

- Case: SOT-563
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020C
- Terminal Connections: See Diagram
- Terminals: Finish – Matte Tin Annealed Over Copper Leadframe. Solderable per MIL-STD-202, Method 208
- Marking Information: See Page 4
- Ordering Information: See Page 4
- Weight: 0.003 grams (approximate)



SOT-563



Schematic and Pin Configuration

## Maximum Ratings, Total Device @T<sub>A</sub> = 25°C unless otherwise specified

| Characteristic                                       | Symbol                            | Value       | Unit |
|------------------------------------------------------|-----------------------------------|-------------|------|
| Power Dissipation (Note 3)                           | P <sub>D</sub>                    | 300         | mW   |
| Thermal Resistance, Junction to Ambient Air (Note 3) | R <sub>θJA</sub>                  | 417         | °C/W |
| Operating and Storage Temperature Range              | T <sub>J</sub> , T <sub>STG</sub> | -55 to +150 | °C   |

## Maximum Ratings, PNP Transistor, Q<sub>1</sub> @T<sub>A</sub> = 25°C unless otherwise specified

| Characteristic                | Symbol           | Value | Unit |
|-------------------------------|------------------|-------|------|
| Collector-Base Voltage        | V <sub>CB0</sub> | -15   | V    |
| Collector-Emitter Voltage     | V <sub>CEO</sub> | -12   | V    |
| Emitter-Base Voltage          | V <sub>EBO</sub> | -6    | V    |
| Continuous Collector Current  | I <sub>C</sub>   | -500  | mA   |
| Peak Pulsed Collector Current | I <sub>CP</sub>  | -1.0  | A    |

## Maximum Ratings, Pre-Biased NPN Transistor, Q<sub>2</sub> @T<sub>A</sub> = 25°C unless otherwise specified

| Characteristic    | Symbol          | Value      | Unit |
|-------------------|-----------------|------------|------|
| Supply Voltage    | V <sub>CC</sub> | 50         | V    |
| Input Voltage     | V <sub>IN</sub> | -10 to +40 | V    |
| Collector Current | I <sub>C</sub>  | 100        | mA   |
| Output Current    | I <sub>O</sub>  | 50         | 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](http://www.diodes.com/products/lead_free/index.php).
  3. Device mounted on FR-4 PCB; pad layout as shown 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 Transistor, Q<sub>1</sub> @ T<sub>A</sub> = 25°C unless otherwise specified

| Characteristic (Note 4)              | Symbol               | Min | Typ  | Max  | Unit | Test Condition                                             |
|--------------------------------------|----------------------|-----|------|------|------|------------------------------------------------------------|
| Collector-Base Breakdown Voltage     | V <sub>(BR)CBO</sub> | -15 | —    | —    | V    | I <sub>C</sub> = -10μA, I <sub>E</sub> = 0                 |
| Collector-Emitter Breakdown Voltage  | V <sub>(BR)CEO</sub> | -12 | —    | —    | V    | I <sub>C</sub> = -1.0mA, I <sub>B</sub> = 0                |
| Emitter-Base Breakdown Voltage       | V <sub>(BR)EBO</sub> | -6  | —    | —    | V    | I <sub>E</sub> = -10μA, I <sub>C</sub> = 0                 |
| Collector Cutoff Current             | I <sub>CBO</sub>     | —   | —    | -100 | nA   | V <sub>CB</sub> = -15V, I <sub>E</sub> = 0                 |
| Collector Cutoff Current             | I <sub>EBO</sub>     | —   | —    | -100 | nA   | V <sub>EB</sub> = -6V, I <sub>C</sub> = 0                  |
| DC Current Gain                      | h <sub>FE</sub>      | 270 | —    | 680  | —    | V <sub>CE</sub> = -2.0V, I <sub>C</sub> = -10mA            |
| Collector-Emitter Saturation Voltage | V <sub>CE(SAT)</sub> | —   | -100 | -250 | mV   | I <sub>C</sub> = -200mA, I <sub>B</sub> = -10mA            |
| Gain-Bandwidth Product               | f <sub>T</sub>       | —   | 280  | —    | MHz  | V <sub>CE</sub> = -2.0V, I <sub>E</sub> = 10mA, f = 100MHz |
| Collector Output Capacitance         | C <sub>obo</sub>     | —   | 5    | —    | pF   | V <sub>CB</sub> = -10V, I <sub>E</sub> = 0, f = 1MHz       |

## Electrical Characteristics, Pre-Biased NPN Transistor, Q<sub>2</sub> @ T<sub>A</sub> = 25°C unless otherwise specified

| Characteristic                  | Symbol                         | Min | Typ | Max  | Unit | Test Condition                                           |
|---------------------------------|--------------------------------|-----|-----|------|------|----------------------------------------------------------|
| Input Voltage                   | V <sub>I(off)</sub>            | —   | —   | 0.5  | V    | V <sub>CC</sub> = 5V, I <sub>O</sub> = 100μA             |
|                                 | V <sub>I(on)</sub>             | 3   | —   | —    | V    | V <sub>O</sub> = 0.3V, I <sub>O</sub> = 10mA             |
| Output Voltage                  | V <sub>O(on)</sub>             | —   | 0.1 | 0.3  | V    | I <sub>O</sub> /I <sub>I</sub> = 10mA/0.5 mA             |
| Input Current                   | I <sub>I</sub>                 | —   | —   | 0.88 | mA   | V <sub>I</sub> = 5V                                      |
| Output Current                  | I <sub>O(off)</sub>            | —   | —   | 0.5  | μA   | V <sub>CC</sub> = 50V, V <sub>I</sub> = 0V               |
| DC Current Gain                 | G <sub>I</sub>                 | 30  | —   | —    | —    | V <sub>O</sub> = 5V, I <sub>O</sub> = 5mA                |
| Gain-Bandwidth Product (Note 5) | f <sub>T</sub>                 | —   | 250 | —    | MHz  | V <sub>CE</sub> = 10V, I <sub>E</sub> = -5mA, f = 100MHz |
| Input Resistance                | R <sub>I</sub>                 | 7   | 10  | 13   | kΩ   | —                                                        |
| Resistance Ratio                | R <sub>2</sub> /R <sub>1</sub> | 0.8 | 1   | 1.2  | —    | —                                                        |

- Notes:
4. Short duration pulse test used to minimize self-heating effect.
  5. Characteristics of the transistor. For reference only.

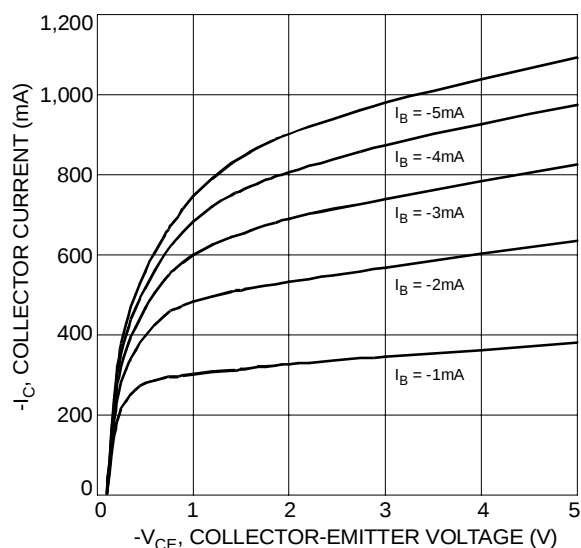


Fig. 1 Typical Collector Current vs. Collector-Emitter Voltage (Q1, PNP)

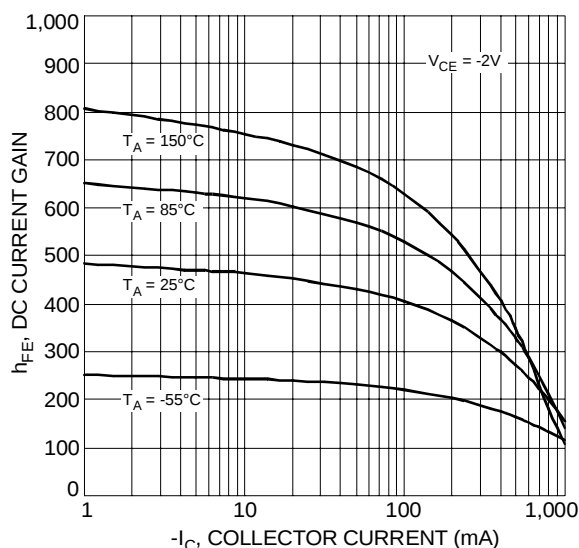


Fig. 2 Typical DC Current Gain vs. Collector Current (Q1, PNP)

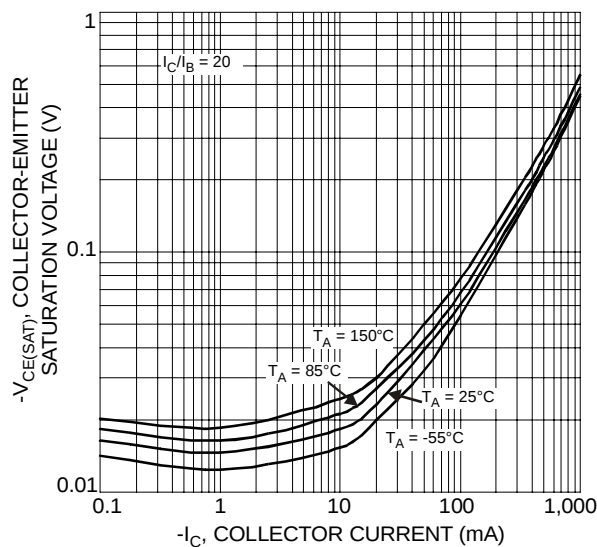


Fig. 3 Typical Collector-Emitter Saturation Voltage vs. Collector Current (Q1, PNP)

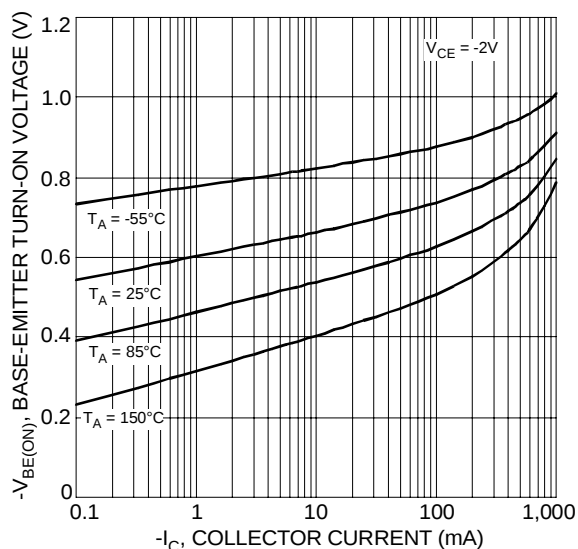


Fig. 4 Typical Base-Emitter Turn-On Voltage vs. Collector Current (Q1, PNP)

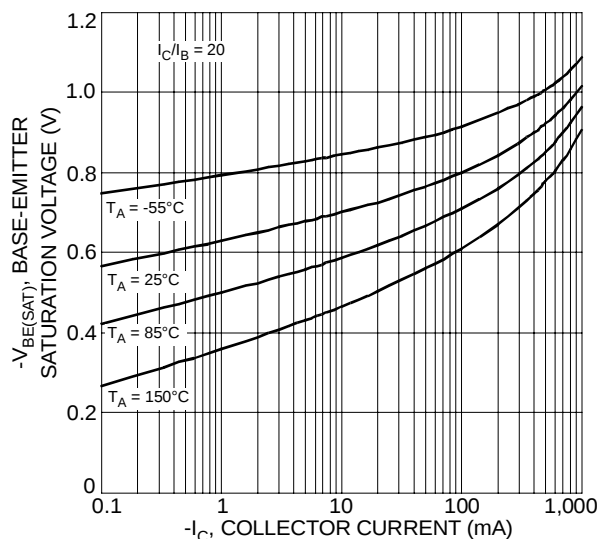


Fig. 5 Typical Base-Emitter Saturation Voltage vs. Collector Current (Q1, PNP)

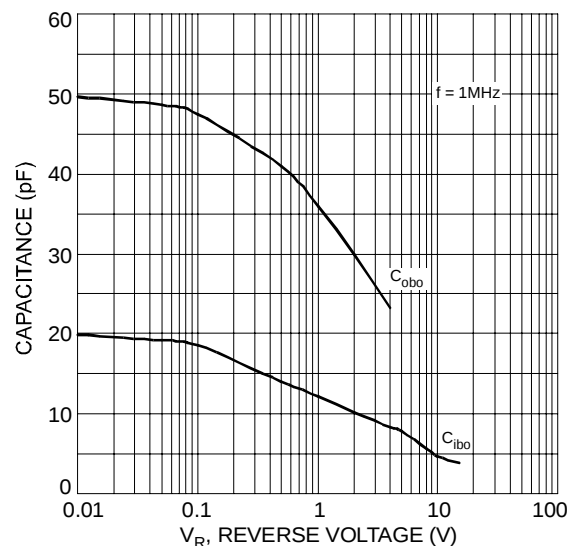


Fig. 6 Typical Capacitance Characteristics (Q1, PNP)

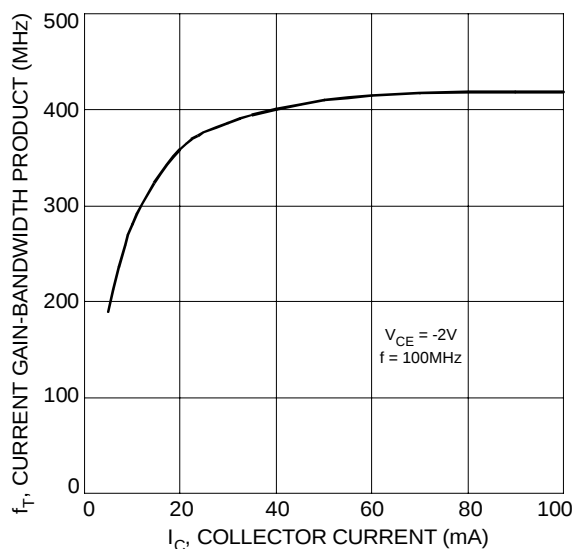


Fig. 7 Typical Gain-Bandwidth Product vs. Emitter Current (Q1, PNP)

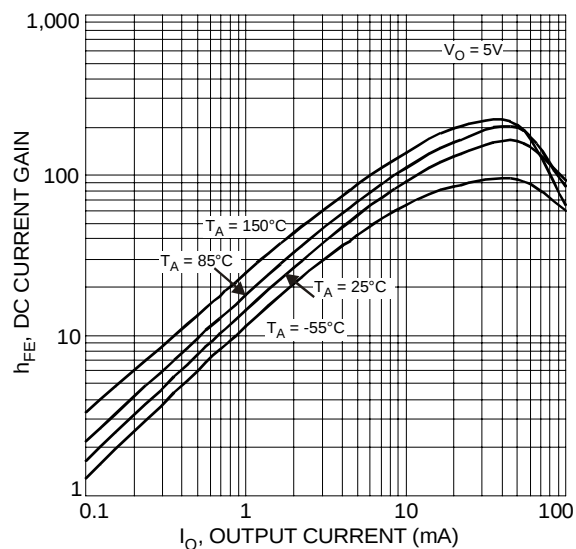


Fig. 8 Typical DC Current Gain vs. Output Current (Q2, NPN PBT)

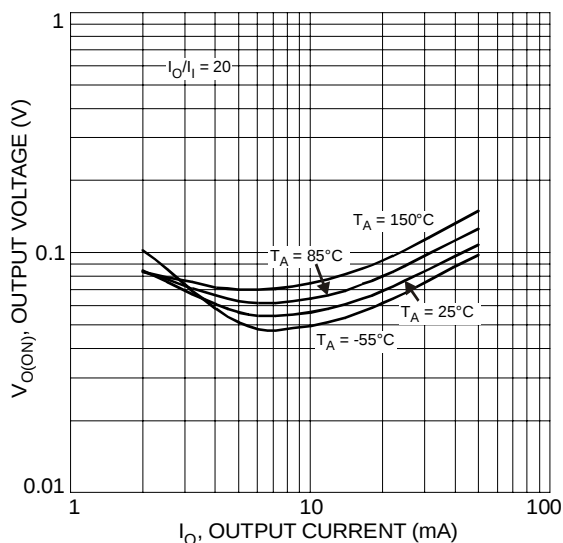


Fig. 9 Typical Output Voltage vs. Output Current (Q2, NPN PBT)

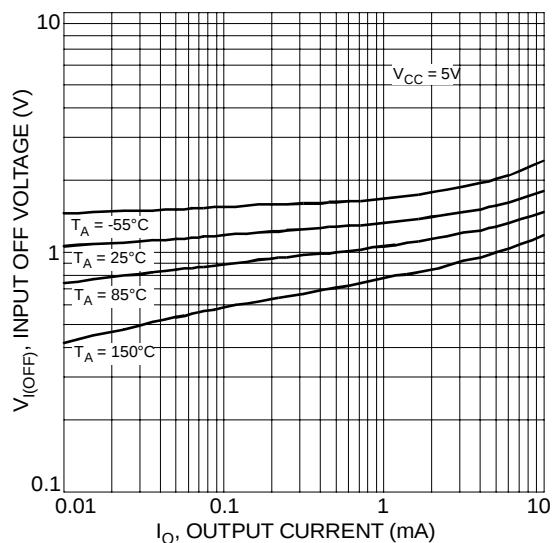


Fig. 10 Typical Input Off Voltage vs. Output Current (Q2, NPN PBT)

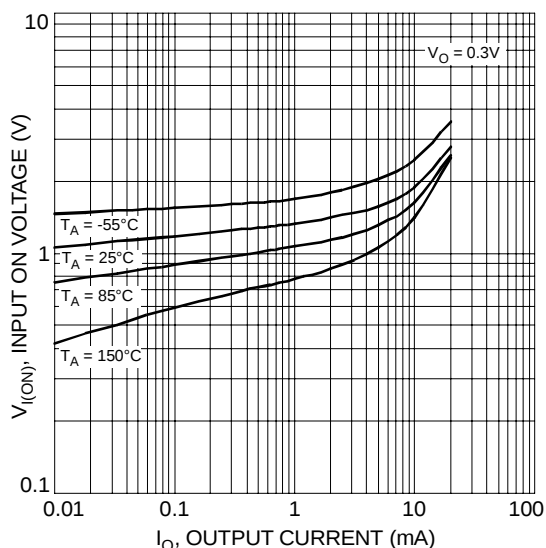


Fig. 11 Typical Input On Voltage vs. Output Current (Q2, NPN PBT)

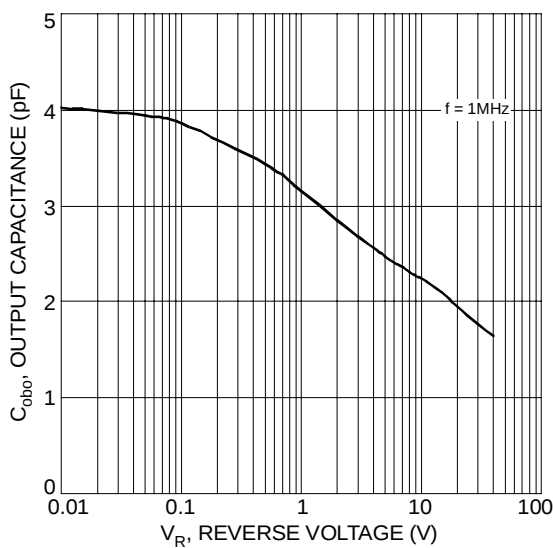


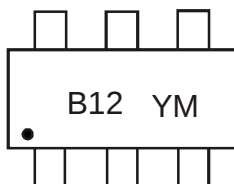
Fig. 12 Typical Output Capacitance Characteristics (Q2, NPN PBT)

## Ordering Information (Note 6)

| Device  | Packaging | Shipping         |
|---------|-----------|------------------|
| EMF21-7 | SOT-563   | 3000/Tape & Reel |

Notes: 6. For packaging details, go to our website at <http://www.diodes.com/datasheets/ap02007.pdf>.

## Marking Information



B12 = Product Type Marking Code  
YM = Date Code Marking  
Y = Year ex: U = 2007  
M = Month ex: 9 = September

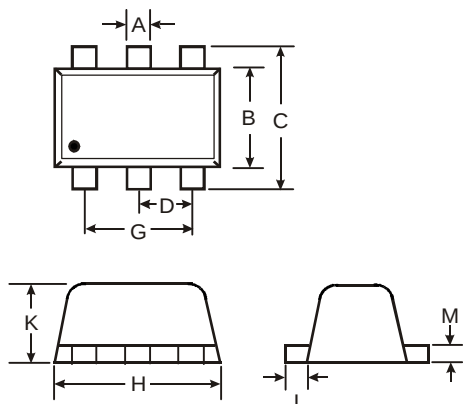
### Date Code Key

State Country

| Year | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|------|------|------|------|------|------|------|
| Code | U    | V    | W    | X    | Y    | Z    |

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Code  | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | O   | N   | D   |

## Package Outline Dimensions



| SOT-563              |      |      |      |
|----------------------|------|------|------|
| Dim                  | Min  | Max  | Typ  |
| A                    | 0.15 | 0.30 | 0.25 |
| B                    | 1.10 | 1.25 | 1.20 |
| C                    | 1.55 | 1.70 | 1.60 |
| D                    | 0.50 | -    | -    |
| G                    | 0.90 | 1.10 | 1.00 |
| H                    | 1.50 | 1.70 | 1.60 |
| K                    | 0.56 | 0.60 | 0.60 |
| L                    | 0.10 | 0.30 | 0.20 |
| M                    | 0.10 | 0.18 | 0.11 |
| All Dimensions in mm |      |      |      |

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