

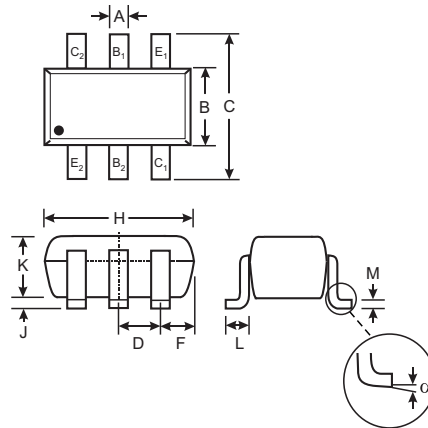
## COMPLEMENTARY NPN / PNP SMALL SIGNAL SURFACE MOUNT TRANSISTOR

### Features

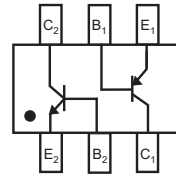
Complementary Pair  
 Epitaxial Planar Die Construction  
 One 2222A Type (NPN),  
 One 2907A Type (PNP)  
 Ideal for Low Power Amplification and Switching  
**Lead Free By Design/RoHS Compliant (Note 2)**  
**"Green Device" (Note 3)**

### Mechanical Data

Case: SOT-26  
 Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0  
 Moisture Sensitivity: Level 1 per J-STD-020C  
 Terminals: Finish - Matte Tin annealed over Copper leadframe. Solderable per MIL-STD-202, Method 208  
 Terminal Connections: See Diagram  
 Ordering & Date Code Information: See Page 3  
 Marking (See Page 3): K27  
 Weight: 0.006 grams (approximate)



Note: E1, B1, and C1 = 2907A Type (PNP),  
 E2, B2, and C2 = 2222A Type (NPN).  
 Type marking indicates orientation.



| SOT-26               |       |      |      |
|----------------------|-------|------|------|
| Dim                  | Min   | Max  | Typ  |
| A                    | 0.35  | 0.50 | 0.38 |
| B                    | 1.50  | 1.70 | 1.60 |
| C                    | 2.70  | 3.00 | 2.80 |
| D                    |       |      | 0.95 |
| F                    |       |      | 0.55 |
| H                    | 2.90  | 3.10 | 3.00 |
| J                    | 0.013 | 0.10 | 0.05 |
| K                    | 1.00  | 1.30 | 1.10 |
| L                    | 0.35  | 0.55 | 0.40 |
| M                    | 0.10  | 0.20 | 0.15 |
|                      | 0     | 8    |      |
| All Dimensions in mm |       |      |      |

### Maximum Ratings, 2222A Type (NPN)

@ T<sub>A</sub> = 25 °C unless otherwise specified

| Characteristic                 | Symbol           | 2222A (NPN) | Unit |
|--------------------------------|------------------|-------------|------|
| Collector-Base Voltage         | V <sub>CBO</sub> | 75          | V    |
| Collector-Emitter Voltage      | V <sub>CEO</sub> | 40          | V    |
| Emitter-Base Voltage           | V <sub>EBO</sub> | 6.0         | V    |
| Collector Current - Continuous | I <sub>C</sub>   | 600         | mA   |

### Maximum Ratings, 2907A Type (PNP) @ T<sub>A</sub> = 25 °C unless otherwise specified

| Characteristic                 | Symbol           | 2907A (PNP) | Unit |
|--------------------------------|------------------|-------------|------|
| Collector-Base Voltage         | V <sub>CBO</sub> | -60         | V    |
| Collector-Emitter Voltage      | V <sub>CEO</sub> | -60         | V    |
| Emitter-Base Voltage           | V <sub>EBO</sub> | -5.0        | V    |
| Collector Current - Continuous | I <sub>C</sub>   | -600        | mA   |

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

| Characteristic                                   | Symbol                            | Value       | Unit |
|--------------------------------------------------|-----------------------------------|-------------|------|
| Total Power Dissipation (Note 1)                 | P <sub>d</sub>                    | 300         | mW   |
| Thermal Resistance, Junction to Ambient (Note 1) | R <sub>JA</sub>                   | 417         | °C/W |
| Operating and Storage Temperature Range          | T <sub>J</sub> , T <sub>STG</sub> | -55 to +150 | °C   |

- Note:
- Device mounted on FR-4 PCB, 1 inch x 0.85 inch x 0.062 inch; 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>.
  - No purposefully added lead.
  - 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).

**Electrical Characteristics, 2222A Type (NPN)**

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

| Characteristic                       | Symbol        | Min                                     | Max        | Unit    | Test Condition                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------|---------------|-----------------------------------------|------------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>OFF CHARACTERISTICS (Note 4)</b>  |               |                                         |            |         |                                                                                                                                                                                                                                                                                                                                                 |
| Collector-Base Breakdown Voltage     | $V_{(BR)CBO}$ | 75                                      |            | V       | $I_C = 10\text{ A}, I_E = 0$                                                                                                                                                                                                                                                                                                                    |
| Collector-Emitter Breakdown Voltage  | $V_{(BR)CEO}$ | 40                                      |            | V       | $I_C = 10\text{mA}, I_B = 0$                                                                                                                                                                                                                                                                                                                    |
| Emitter-Base Breakdown Voltage       | $V_{(BR)EBO}$ | 6.0                                     |            | V       | $I_E = 10\text{ A}, I_C = 0$                                                                                                                                                                                                                                                                                                                    |
| Collector Cutoff Current             | $I_{CBO}$     |                                         | 10         | nA<br>A | $V_{CB} = 60\text{V}, I_E = 0$<br>$V_{CB} = 60\text{V}, I_E = 0, T_A = 150^\circ\text{C}$                                                                                                                                                                                                                                                       |
| Collector Cutoff Current             | $I_{CEX}$     |                                         | 10         | nA      | $V_{CE} = 60\text{V}, V_{EB(OFF)} = 3.0\text{V}$                                                                                                                                                                                                                                                                                                |
| Emitter Cutoff Current               | $I_{EBO}$     |                                         | 10         | nA      | $V_{EB} = 3.0\text{V}, I_C = 0$                                                                                                                                                                                                                                                                                                                 |
| Base Cutoff Current                  | $I_{BL}$      |                                         | 20         | nA      | $V_{CE} = 60\text{V}, V_{EB(OFF)} = 3.0\text{V}$                                                                                                                                                                                                                                                                                                |
| <b>ON CHARACTERISTICS (Note 4)</b>   |               |                                         |            |         |                                                                                                                                                                                                                                                                                                                                                 |
| DC Current Gain                      | $h_{FE}$      | 35<br>50<br>75<br>100<br>40<br>50<br>35 | 300        |         | $I_C = 100\text{ A}, V_{CE} = 10\text{V}$<br>$I_C = 1.0\text{mA}, V_{CE} = 10\text{V}$<br>$I_C = 10\text{mA}, V_{CE} = 10\text{V}$<br>$I_C = 150\text{mA}, V_{CE} = 10\text{V}$<br>$I_C = 500\text{mA}, V_{CE} = 10\text{V}$<br>$I_C = 10\text{mA}, V_{CE} = 10\text{V}, T_A = -55^\circ\text{C}$<br>$I_C = 150\text{mA}, V_{CE} = 1.0\text{V}$ |
| Collector-Emitter Saturation Voltage | $V_{CE(SAT)}$ |                                         | 0.3<br>1.0 | V       | $I_C = 150\text{mA}, I_B = 15\text{mA}$<br>$I_C = 500\text{mA}, I_B = 50\text{mA}$                                                                                                                                                                                                                                                              |
| Base-Emitter Saturation Voltage      | $V_{BE(SAT)}$ | 0.6                                     | 1.2<br>2.0 | V       | $I_C = 150\text{mA}, I_B = 15\text{mA}$<br>$I_C = 500\text{mA}, I_B = 50\text{mA}$                                                                                                                                                                                                                                                              |
| <b>SMALL SIGNAL CHARACTERISTICS</b>  |               |                                         |            |         |                                                                                                                                                                                                                                                                                                                                                 |
| Output Capacitance                   | $C_{obo}$     |                                         | 8          | pF      | $V_{CB} = 10\text{V}, f = 1.0\text{MHz}, I_E = 0$                                                                                                                                                                                                                                                                                               |
| Input Capacitance                    | $C_{ibo}$     | —                                       | 25         | pF      | $V_{EB} = 0.5\text{V}, f = 1.0\text{MHz}, I_C = 0$                                                                                                                                                                                                                                                                                              |
| Current Gain-Bandwidth Product       | $f_T$         | 300                                     |            | MHz     | $V_{CE} = 20\text{V}, I_C = 20\text{mA},$<br>$f = 100\text{MHz}$                                                                                                                                                                                                                                                                                |
| <b>SWITCHING CHARACTERISTICS</b>     |               |                                         |            |         |                                                                                                                                                                                                                                                                                                                                                 |
| Delay Time                           | $t_d$         |                                         | 10         | ns      | $V_{CC} = 30\text{V}, I_C = 150\text{mA},$<br>$V_{BE(off)} = -0.5\text{V}, I_{B1} = 15\text{mA}$                                                                                                                                                                                                                                                |
| Rise Time                            | $t_r$         |                                         | 25         | ns      |                                                                                                                                                                                                                                                                                                                                                 |
| Storage Time                         | $t_s$         |                                         | 225        | ns      | $V_{CC} = 30\text{V}, I_C = 150\text{mA},$<br>$I_{B1} = I_{B2} = 15\text{mA}$                                                                                                                                                                                                                                                                   |
| Fall Time                            | $t_f$         |                                         | 60         | ns      |                                                                                                                                                                                                                                                                                                                                                 |

 Note: 4. Pulse test: Pulse width 300  $\mu\text{s}$ , duty cycle 2%.

**Electrical Characteristics, 2907A Type (PNP)** @ T<sub>A</sub> = 25 °C unless otherwise specified

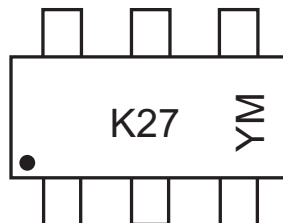
| Characteristic                       | Symbol               | Min                           | Max          | Unit    | Test Condition                                                                                                                                                                                                                                             |
|--------------------------------------|----------------------|-------------------------------|--------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>OFF CHARACTERISTICS (Note 5)</b>  |                      |                               |              |         |                                                                                                                                                                                                                                                            |
| Collector-Base Breakdown Voltage     | V <sub>(BR)CBO</sub> | -60                           |              | V       | I <sub>C</sub> = -10 A, I <sub>E</sub> = 0                                                                                                                                                                                                                 |
| Collector-Emitter Breakdown Voltage  | V <sub>(BR)CEO</sub> | -60                           |              | V       | I <sub>C</sub> = -10mA, I <sub>B</sub> = 0                                                                                                                                                                                                                 |
| Emitter-Base Breakdown Voltage       | V <sub>(BR)EBO</sub> | -5.0                          |              | V       | I <sub>E</sub> = -10 A, I <sub>C</sub> = 0                                                                                                                                                                                                                 |
| Collector Cutoff Current             | I <sub>CBO</sub>     |                               | -10          | nA<br>A | V <sub>CB</sub> = -50V, I <sub>E</sub> = 0<br>V <sub>CB</sub> = -50V, I <sub>E</sub> = 0, T <sub>A</sub> = 125 °C                                                                                                                                          |
| Collector Cutoff Current             | I <sub>CEX</sub>     |                               | -50          | nA      | V <sub>CE</sub> = -30V, V <sub>EB(OFF)</sub> = -0.5V                                                                                                                                                                                                       |
| Base Cutoff Current                  | I <sub>BL</sub>      |                               | -50          | nA      | V <sub>CE</sub> = -30V, V <sub>EB(OFF)</sub> = -0.5V                                                                                                                                                                                                       |
| <b>ON CHARACTERISTICS (Note 5)</b>   |                      |                               |              |         |                                                                                                                                                                                                                                                            |
| DC Current Gain                      | h <sub>FE</sub>      | 75<br>100<br>100<br>100<br>50 | 300          |         | I <sub>C</sub> = -100μA, V <sub>CE</sub> = -10V<br>I <sub>C</sub> = -1.0mA, V <sub>CE</sub> = -10V<br>I <sub>C</sub> = -10mA, V <sub>CE</sub> = -10V<br>I <sub>C</sub> = -150mA, V <sub>CE</sub> = -10V<br>I <sub>C</sub> = -500mA, V <sub>CE</sub> = -10V |
| Collector-Emitter Saturation Voltage | V <sub>CE(SAT)</sub> |                               | -0.4<br>-1.6 | V       | I <sub>C</sub> = -150mA, I <sub>B</sub> = -15mA<br>I <sub>C</sub> = -500mA, I <sub>B</sub> = -50mA                                                                                                                                                         |
| Base-Emitter Saturation Voltage      | V <sub>BE(SAT)</sub> |                               | -1.3<br>-2.6 | V       | I <sub>C</sub> = 150mA, I <sub>B</sub> = 15mA<br>I <sub>C</sub> = 500mA, I <sub>B</sub> = 50mA                                                                                                                                                             |
| <b>SMALL SIGNAL CHARACTERISTICS</b>  |                      |                               |              |         |                                                                                                                                                                                                                                                            |
| Output Capacitance                   | C <sub>obo</sub>     |                               | 8.0          | pF      | V <sub>CB</sub> = -10V, f = 1.0MHz, I <sub>E</sub> = 0                                                                                                                                                                                                     |
| Input Capacitance                    | C <sub>ibo</sub>     | —                             | 30           | pF      | V <sub>EB</sub> = -2.0V, f = 1.0MHz, I <sub>C</sub> = 0                                                                                                                                                                                                    |
| Current Gain-Bandwidth Product       | f <sub>T</sub>       | 200                           |              | MHz     | V <sub>CE</sub> = -20V, I <sub>C</sub> = -50mA,<br>f = 100MHz                                                                                                                                                                                              |
| <b>SWITCHING CHARACTERISTICS</b>     |                      |                               |              |         |                                                                                                                                                                                                                                                            |
| Turn-On Time                         | t <sub>on</sub>      |                               | 45           | ns      | V <sub>CC</sub> = -30V, I <sub>C</sub> = -150mA,<br>I <sub>B1</sub> = -15mA                                                                                                                                                                                |
| Delay Time                           | t <sub>d</sub>       |                               | 10           | ns      |                                                                                                                                                                                                                                                            |
| Rise Time                            | t <sub>r</sub>       |                               | 40           | ns      |                                                                                                                                                                                                                                                            |
| Turn-Off Time                        | t <sub>off</sub>     |                               | 100          | ns      | V <sub>CC</sub> = -6.0V, I <sub>C</sub> = -150mA,<br>I <sub>B1</sub> = I <sub>B2</sub> = -15mA                                                                                                                                                             |
| Storage Time                         | t <sub>s</sub>       |                               | 80           | ns      |                                                                                                                                                                                                                                                            |
| Fall Time                            | t <sub>f</sub>       |                               | 30           | ns      |                                                                                                                                                                                                                                                            |

Note: 5. Short duration pulse test used to minimize self-heating effect.

**Ordering Information** (Note 6)

| Device      | Packaging | Shipping         |
|-------------|-----------|------------------|
| MMDT2227M-7 | SOT-26    | 3000/Tape & Reel |

Note: 6. For Packaging Details, go to our website at <http://www.diodes.com/datasheets/ap02007.pdf>.

**Marking Information**


K27 = Product Type Marking Code  
 YM = Date Code Marking  
 Y = Year ex: S = 2005  
 M = Month ex: 9 = September

Date Code Key

| Year | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|------|------|------|------|------|------|------|------|------|
| Code | S    | T    | U    | V    | W    | X    | Y    | Z    |

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

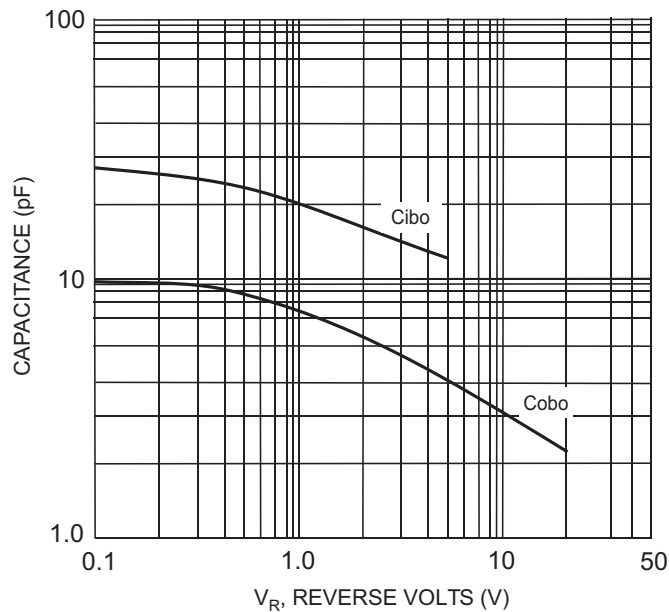


Fig. 1 (2222A) Typical Capacitance

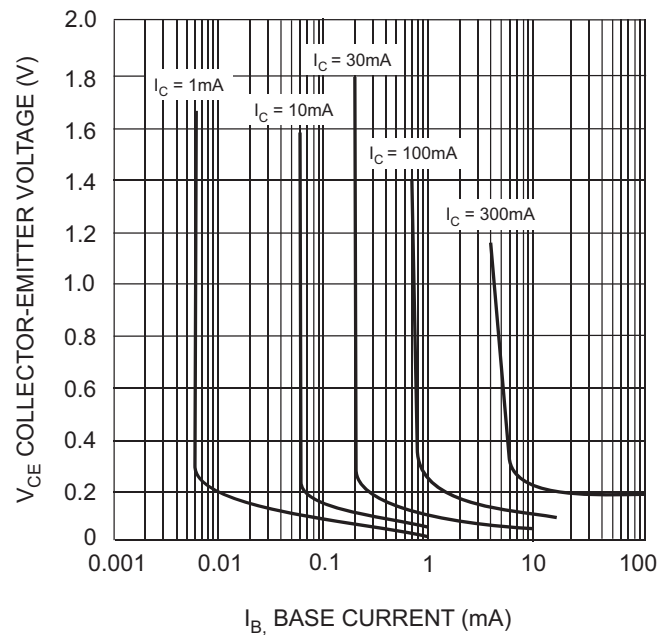


Fig. 2 (2222A) Typical Collector Saturation Region

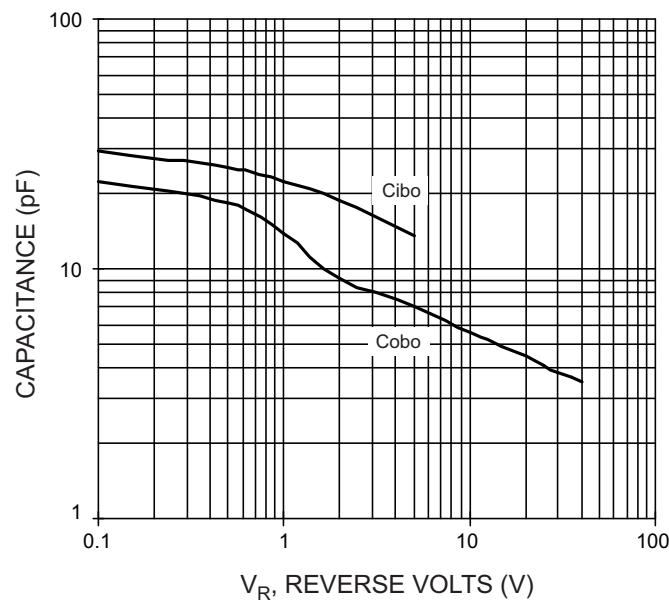


Fig. 3 (2907A) Typical Capacitance

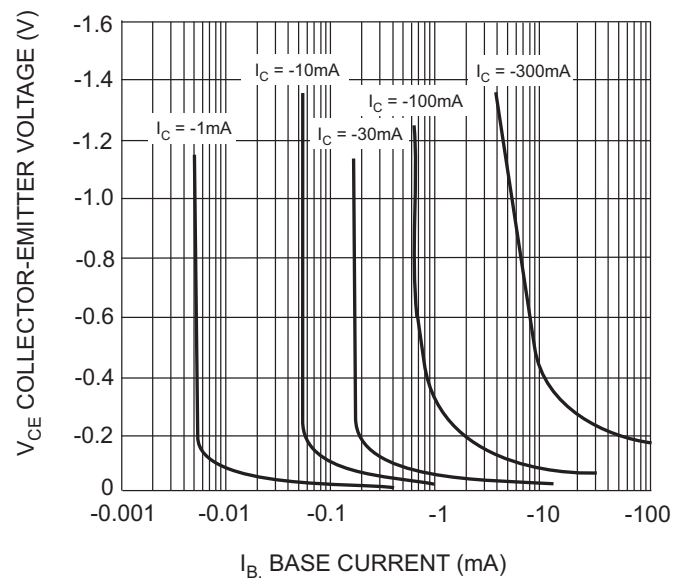


Fig. 4 (2907A) Typical Collector Saturation Region

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