

**COMPLEMENTARY NPN / PNP SMALL SIGNAL SURFACE MOUNT TRANSISTOR**
**Features & Benefits**

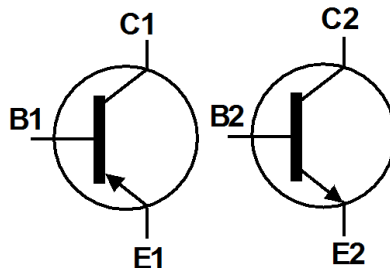
- Complementary Pairs One 2222A Type (NPN)
- One 2907A Type (PNP)
- Ideal for Low Power Amplification and Switching
- **Totally Lead-Free & Fully RoHS compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

**Mechanical Data**

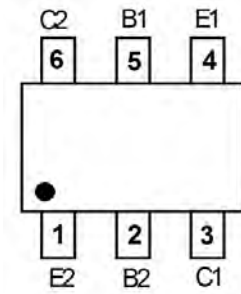
- Case: SOT363
- Case Material: Molded Plastic. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208
- Weight: 0.006 grams (approximate)



Top View



Device Symbol

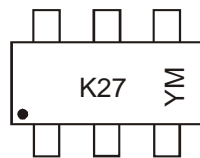


Top View Pin-Out

**Ordering Information** (Note 4)

| Product      | Marking | Reel size (inches) | Tape width (mm) | Quantity per reel |
|--------------|---------|--------------------|-----------------|-------------------|
| MMDT2227-7-F | K27     | 7                  | 8               | 3,000             |

- 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**


K27 = Product Type Marking Code  
 YM = Date Code Marking  
 Y = Year (ex: X = 2010)  
 M = Month (ex: 9 = September)

**Date Code Key**

| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|------|------|------|------|------|------|------|------|------|
| Code | X    | Y    | Z    | A    | B    | C    | D    | E    |

| 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   |

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**Maximum Ratings, 2222A Type (NPN)** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)
 

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| Characteristic               | Symbol    | Value | Unit |
|------------------------------|-----------|-------|------|
| Collector-Base Voltage       | $V_{CBO}$ | 75    | V    |
| Collector-Emitter Voltage    | $V_{CEO}$ | 40    | V    |
| Emitter-Base Voltage         | $V_{EBO}$ | 6     | V    |
| Continuous Collector Current | $I_C$     | 600   | mA   |

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**Maximum Ratings, 2907A Type (PNP)** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)
 

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| Characteristic               | Symbol    | Value | Unit |
|------------------------------|-----------|-------|------|
| Collector-Base Voltage       | $V_{CBO}$ | -60   | V    |
| Collector-Emitter Voltage    | $V_{CEO}$ | -60   | V    |
| Emitter-Base Voltage         | $V_{EBO}$ | -6.0  | V    |
| Continuous Collector Current | $I_C$     | -600  | mA   |

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**Thermal Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)
 

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| Characteristic                          | Symbol          | Value       | Unit |
|---|-----------------|-------------|------|
| Power Dissipation                       | $P_D$           | 200         | mW   |
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 625         | °C/W |
| Thermal Resistance, Junction to Case    | $R_{\theta JC}$ | 150         |      |
| Operating and Storage Temperature Range | $T_J, T_{STG}$  | -55 to +150 | °C   |

Notes: 5. Device mounted on 1 inch x 0.85 inch x 0.062 inch FR-4 PCB  
 6. Thermal resistance from junction to the top of package

**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 7)</b>  |               |     |            |                     |   |
| Collector-Base Breakdown Voltage     | $BV_{CBO}$    | 75  | —          | V                   | $I_C = 100\mu\text{A}, I_E = 0$   |
| Collector-Emitter Breakdown Voltage  | $BV_{CEO}$    | 40  | —          | V                   | $I_C = 10\text{mA}, I_B = 0$  |
| Emitter-Base Breakdown Voltage       | $BV_{EBO}$    | 6.0 | —          | V                   | $I_E = 100\mu\text{A}, I_C = 0$   |
| Collector Cutoff Current             | $I_{CBO}$     | —   | 10         | nA<br>$\mu\text{A}$ | $V_{CB} = 60\text{V}, I_E = 0$<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                  | $V_{EB} = 5.0\text{V}, I_C = 0$   |
| Base Cutoff Current                  | $I_{BL}$      | —   | 20         | nA                  | $V_{CE} = 60\text{V}, V_{EB(off)} = 3.0\text{V}$  |
| <b>ON CHARACTERISTICS (Note 7)</b>   |               |     |            |                     |   |
| DC Current Gain                      | $h_{FE}$      | 35  | —          | —                   | $I_C = 100\mu\text{A}, V_{CE} = 10\text{V}$<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>$I_C = 150\text{mA}, V_{CE} = 1.0\text{V}$ |
|                                      |               | 50  | —          |                     |   |
|                                      |               | 75  | —          |                     |   |
|                                      |               | 100 | 300        |                     |   |
|                                      |               | 40  | —          |                     |   |
|                                      |               | 50  | —          |                     |   |
| 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                 | $V_{CE} = 20\text{V}, I_C = 20\text{mA}, f = 100\text{MHz}$   |
| Noise Figure                         | NF            | —   | 4.0        | dB                  | $V_{CE} = 10\text{V}, I_C = 100\mu\text{A}, R_S = 1.0\text{k}\Omega, f = 1.0\text{kHz}$   |
| <b>SWITCHING CHARACTERISTICS</b>     |               |     |            |                     |   |
| Delay Time                           | $t_d$         | —   | 10         | ns                  | $V_{CC} = 30\text{V}, I_C = 150\text{mA}, V_{BE(off)} = -0.5\text{V}, I_{B1} = 15\text{mA}$   |
| Rise Time                            | $t_r$         | —   | 25         | ns                  |   |
| Storage Time                         | $t_s$         | —   | 225        | ns                  | $V_{CC} = 30\text{V}, I_C = 150\text{mA}, I_{B1} = I_{B2} = 15\text{mA}$  |
| Fall Time                            | $t_f$         | —   | 60         | ns                  |   |

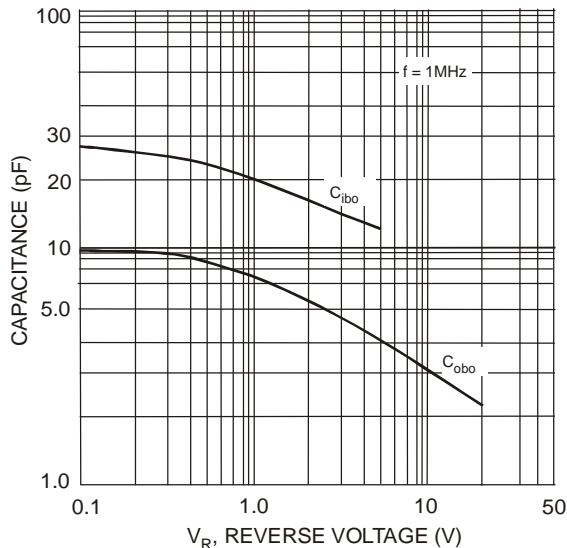
 Notes: 7. Pulse test: Pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$ .


Fig. 1 (2222A) Typical Capacitance

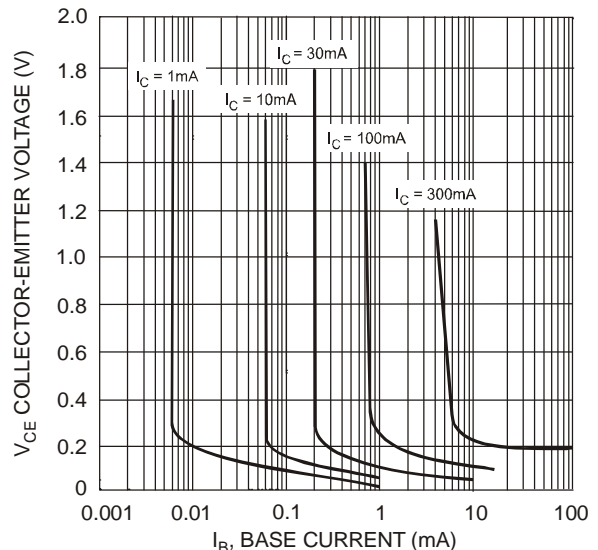


Fig. 2 Typical Collector Saturation Region (2222A Type - NPN)

**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 8)</b>  |                      |                               |                         |          |  |
| Collector-Base Breakdown Voltage     | BV <sub>CBO</sub>    | -60                           | —                       | V        | I <sub>C</sub> = -100μA, I <sub>E</sub> = 0  |
| Collector-Emitter Breakdown Voltage  | BV <sub>CEO</sub>    | -60                           | —                       | V        | I <sub>C</sub> = -10mA, 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>CBO</sub>     | —                             | -10                     | nA<br>μA | 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 8)</b>   |                      |                               |                         |          |  |
| DC Current Gain                      | h <sub>FE</sub>      | 75<br>100<br>100<br>100<br>50 | —<br>—<br>—<br>300<br>— | —        | 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       | —  |
| Delay Time                           | t <sub>d</sub>       | —                             | 10                      | ns       | V <sub>CC</sub> = -30V, I <sub>C</sub> = -150mA,<br>I <sub>B1</sub> = -15mA  |
| Rise Time                            | t <sub>r</sub>       | —                             | 40                      | ns       |  |
| Turn-Off Time                        | t <sub>off</sub>     | —                             | 100                     | ns       | —  |
| Storage Time                         | t <sub>s</sub>       | —                             | 80                      | ns       | V <sub>CC</sub> = -6.0V, I <sub>C</sub> = -150mA,<br>I <sub>B1</sub> = I <sub>B2</sub> = -15mA   |
| Fall Time                            | t <sub>f</sub>       | —                             | 30                      | ns       |  |

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

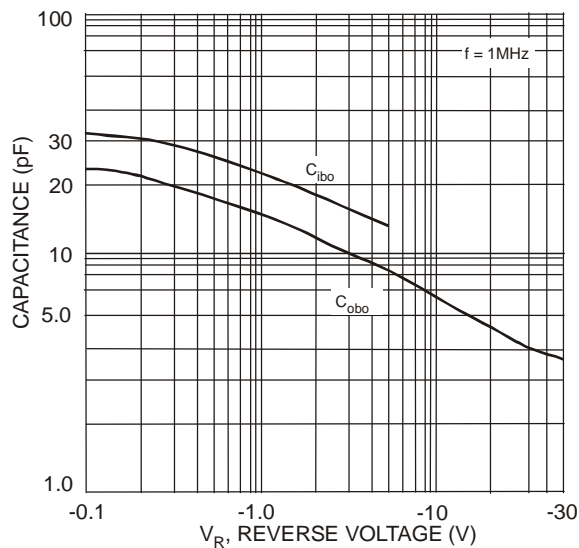


Fig. 3 (2907A) Typical Capacitance

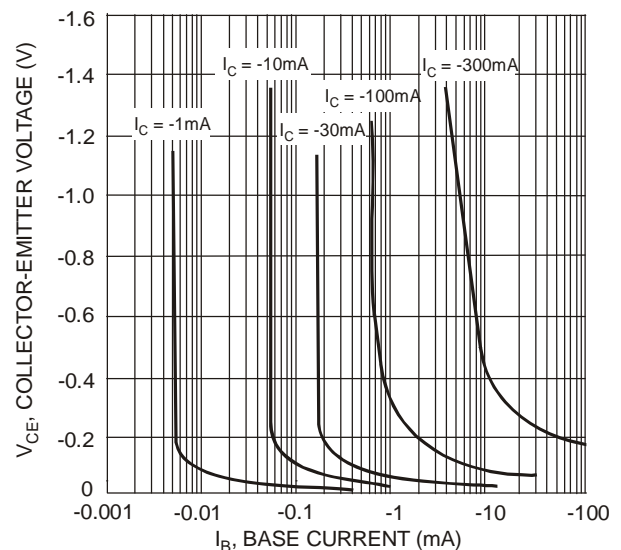
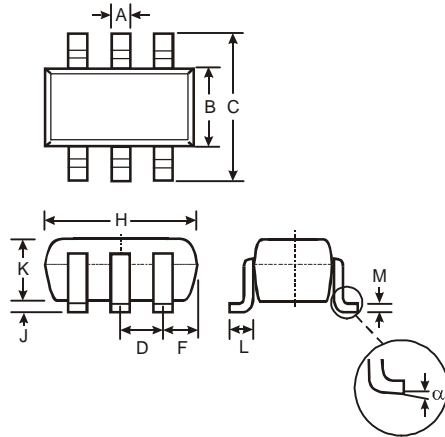


Fig. 4 Typical Collector Saturation Region (2907A Type - PNP)

## Package Outline Dimensions

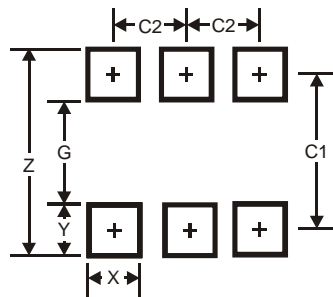
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.



| SOT363                      |          |      |       |
|-----------------------------|----------|------|-------|
| Dim                         | Min      | Max  | Typ   |
| A                           | 0.10     | 0.30 | 0.25  |
| B                           | 1.15     | 1.35 | 1.30  |
| C                           | 2.00     | 2.20 | 2.10  |
| D                           | 0.65 Typ |      |       |
| F                           | 0.40     | 0.45 | 0.425 |
| H                           | 1.80     | 2.20 | 2.15  |
| J                           | 0        | 0.10 | 0.05  |
| K                           | 0.90     | 1.00 | 1.00  |
| L                           | 0.25     | 0.40 | 0.30  |
| M                           | 0.10     | 0.22 | 0.11  |
| α                           | 0°       | 8°   | -     |
| <b>All Dimensions in mm</b> |          |      |       |

## Suggested Pad Layout

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



| Dimensions | Value (in mm) |
|------------|---------------|
| Z          | 2.5           |
| G          | 1.3           |
| X          | 0.42          |
| Y          | 0.6           |
| C1         | 1.9           |
| C2         | 0.65          |

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2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

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### Наши контакты:

**Телефон:** +7 812 627 14 35

**Электронная почта:** [sales@st-electron.ru](mailto:sales@st-electron.ru)

**Адрес:** 198099, Санкт-Петербург,  
Промышленная ул, дом № 19, литера Н,  
помещение 100-Н Офис 331