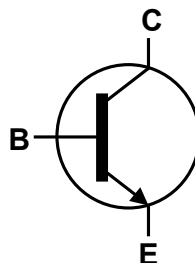


**NPN SURFACE MOUNT SMALL SIGNAL TRANSISTOR IN SOT23**
**Features**

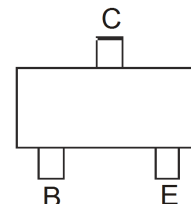
- Ideally Suited for Automatic Insertion
- Complementary PNP Types Available (BC856 – BC858)
- For switching and AF Amplifier Applications
- **Totally Lead-Free & Fully RoHS compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **PPAP capable (Note 4)**



Top View



Device Symbol


 Top View  
Pin-Out

**Mechanical Data**

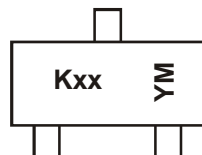
- Case: SOT23
- Case material: molded plastic, "Green" molding compound
- UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 ③
- Weight: 0.008 grams (Approximate)

**Ordering Information** (Notes 4 & 5)

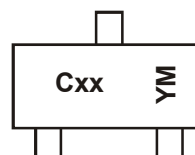
| Product      | Compliance | Marking   | Reel size (inches) | Quantity per reel |
|--------------|------------|-----------|--------------------|-------------------|
| BC846A-7-F   | AEC-Q101   | K1Q       | 7                  | 3,000             |
| BC846AQ-7-F  | Automotive | K1Q       | 7                  | 3,000             |
| BC846B-7-F   | AEC-Q101   | K1R / C1R | 7                  | 3,000             |
| BC846BQ-7-F  | Automotive | K1R       | 7                  | 3,000             |
| BC846B-13-F  | AEC-Q101   | K1R / C1R | 13                 | 10,000            |
| BC846BQ-13-F | Automotive | K1R       | 13                 | 10,000            |
| BC847A-7-F   | AEC-Q101   | K1Q       | 7                  | 3,000             |
| BC847AQ-7-F  | Automotive | K1Q       | 7                  | 3,000             |
| BC847A-13-F  | AEC-Q101   | K1Q       | 13                 | 10,000            |
| BC847B-7-F   | AEC-Q101   | K1R / C1R | 7                  | 3,000             |
| BC847BQ-7-F  | Automotive | K1R       | 7                  | 3,000             |

| Product     | Compliance | Marking   | Reel size (inches) | Quantity per reel |
|-------------|------------|-----------|--------------------|-------------------|
| BC847B-13-F | AEC-Q101   | K1R / C1R | 13                 | 10,000            |
| BC847C-7-F  | AEC-Q101   | K1M       | 7                  | 3,000             |
| BC847CQ-7-F | Automotive | K1M       | 7                  | 3,000             |
| BC847C-13-F | AEC-Q101   | K1M       | 13                 | 10,000            |
| BC848A-7-F  | AEC-Q101   | K1Q       | 7                  | 3,000             |
| BC848B-7-F  | AEC-Q101   | K1R       | 7                  | 3,000             |
| BC848B-13-F | AEC-Q101   | K1R       | 13                 | 10,000            |
| BC848C-7-F  | AEC-Q101   | K1M       | 7                  | 3,000             |
| BC848CQ-7-F | Automotive | K1M       | 7                  | 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/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) 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. Automotive products are AEC-Q101 qualified and are PPAP capable. Automotive, AEC-Q101 and standard products are electrically and thermally the same, except where specified. For more information, please refer to [http://www.diodes.com/quality/product\\_compliance\\_definitions/](http://www.diodes.com/quality/product_compliance_definitions/).
  5. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>

**Marking Information**


K = SAT (Shanghai Assembly / Test site)  
 xx = Product Type Marking Code  
 YM = Date Code Marking  
 Y = Year (ex: Y = 2011)  
 M = Month (ex: 9 = September)



C = CAT (Chengdu Assembly / Test site)  
 xx = Product Type Marking Code  
 YM = Date Code Marking  
 Y = Year (ex: Y = 2011)  
 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   |

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

| Characteristic               |              | Symbol           | Value | Unit |
|------------------------------|--------------|------------------|-------|------|
| Collector-Base Voltage       | BC846        | V <sub>CBO</sub> | 80    | V    |
|                              | BC847        |                  | 50    |      |
|                              | BC848        |                  | 30    |      |
| Collector-Emitter Voltage    | BC846        | V <sub>CEO</sub> | 65    | V    |
|                              | BC847        |                  | 45    |      |
|                              | BC848        |                  | 30    |      |
| Emitter-Base Voltage         | BC846, BC847 | V <sub>EBO</sub> | 6.0   | V    |
|                              | BC848        |                  | 5.0   |      |
| Continuous Collector Current |              | I <sub>C</sub>   | 100   | mA   |
| Peak Collector Current       |              | I <sub>CM</sub>  | 200   | mA   |
| Peak Emitter Current         |              | I <sub>EM</sub>  | 200   | mA   |

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

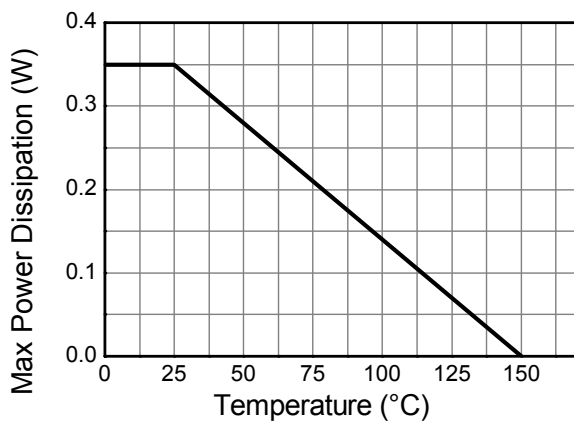
| Characteristic                          |          | Symbol                            | Value       | Unit |
|-----------------------------------------|----------|-----------------------------------|-------------|------|
| Power Dissipation                       | (Note 6) | P <sub>D</sub>                    | 310         | mW   |
|                                         | (Note 7) |                                   | 350         |      |
| Thermal Resistance, Junction to Ambient | (Note 6) | R <sub>θJA</sub>                  | 403         | °C/W |
|                                         | (Note 7) |                                   | 357         |      |
| Thermal Resistance, Junction to Leads   | (Note 8) | R <sub>θJL</sub>                  | 350         | °C/W |
| Operating and Storage Temperature Range |          | T <sub>J</sub> , T <sub>STG</sub> | -65 to +150 | °C   |

**ESD Ratings** (Note 9)

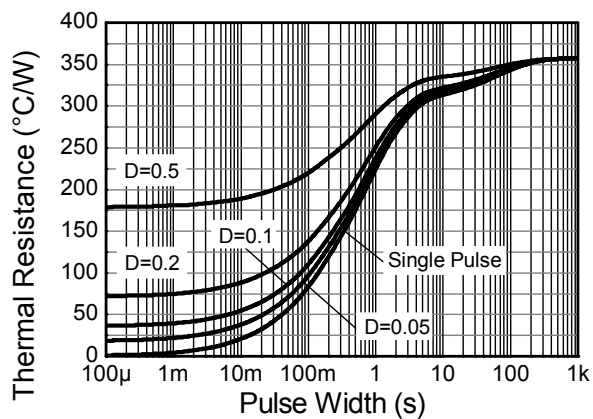
| Characteristic                             | Symbol  | Value   | Unit | JEDEC Class |
|--------------------------------------------|---------|---------|------|-------------|
| Electrostatic Discharge - Human Body Model | ESD HBM | ≥ 8,000 | V    | 3B          |
| Electrostatic Discharge - Machine Model    | ESD MM  | ≥ 400   | V    | C           |

- Notes:
6. For the device mounted on minimum recommended pad layout FR4 PCB with high coverage of single sided 1oz copper, in still air conditions.
  7. For the device mounted on 15mm x 15mm x 1.6mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions.
  8. Thermal resistance from junction to solder-point (at the end of the leads).
  9. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

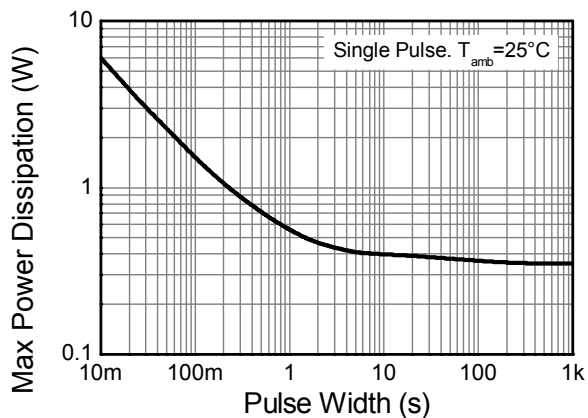
## Thermal Characteristics and Derating Information



**Derating Curve**



**Transient Thermal Impedance**



**Pulse Power Dissipation**

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

| Characteristic                                    |                          | Symbol               | Min | Typ                  | Max | Unit | Test Condition                                                                        |                                                          |                                                          |                                                          |
|---------------------------------------------------|--------------------------|----------------------|-----|----------------------|-----|------|---------------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|
| Collector-Base Breakdown Voltage                  | BC846                    | BV <sub>CBO</sub>    | 80  | —                    | —   | V    | I <sub>C</sub> = 10μA                                                                 |                                                          |                                                          |                                                          |
|                                                   | BC847                    |                      | 50  |                      |     |      |                                                                                       |                                                          |                                                          |                                                          |
|                                                   | BC848                    |                      | 30  |                      |     |      |                                                                                       |                                                          |                                                          |                                                          |
| Collector-Emitter Breakdown Voltage<br>(Note 10)  | BC846                    | BV <sub>CEO</sub>    | 65  | —                    | —   | V    | I <sub>C</sub> = 10mA                                                                 |                                                          |                                                          |                                                          |
|                                                   | BC847                    |                      | 45  |                      |     |      |                                                                                       |                                                          |                                                          |                                                          |
|                                                   | BC848                    |                      | 30  |                      |     |      |                                                                                       |                                                          |                                                          |                                                          |
| Emitter-Base Breakdown Voltage                    | BC846 / BC847            | BV <sub>EBO</sub>    | 6   | —                    | —   | V    | I <sub>E</sub> = 1μA                                                                  |                                                          |                                                          |                                                          |
|                                                   | BC848                    |                      | 5   |                      |     |      |                                                                                       |                                                          |                                                          |                                                          |
| Collector Cutoff Current                          |                          | I <sub>CBO</sub>     | —   | —                    | —   | μA   | V <sub>CB</sub> = 40V                                                                 |                                                          |                                                          |                                                          |
|                                                   |                          |                      |     |                      | —   |      | V <sub>CB</sub> = 30V, T <sub>A</sub> = +150°C                                        |                                                          |                                                          |                                                          |
| Collector Emitter Cutoff Current                  | BC846                    | I <sub>CES</sub>     | —   | —                    | 15  | nA   | V <sub>CE</sub> = 80V                                                                 |                                                          |                                                          |                                                          |
|                                                   | BC847                    |                      |     |                      | 15  |      | V <sub>CE</sub> = 50V                                                                 |                                                          |                                                          |                                                          |
|                                                   | BC848                    |                      |     |                      | 15  |      | V <sub>CE</sub> = 30V                                                                 |                                                          |                                                          |                                                          |
| Small Signal Current Gain<br>(Note 10)            | BC846A / BC847A / BC848A | h <sub>fe</sub>      | —   | 200                  | —   | —    | I <sub>C</sub> = 2.0mA, V <sub>CE</sub> = 5V<br>f=1.0kHz                              |                                                          |                                                          |                                                          |
|                                                   | BC846B / BC847B / BC848B |                      |     | 330                  |     |      |                                                                                       |                                                          |                                                          |                                                          |
|                                                   | BC847C / BC848C          |                      |     | 600                  |     |      |                                                                                       |                                                          |                                                          |                                                          |
| Input Impedance<br>(Note 10)                      | BC846A / BC847A / BC848A | h <sub>ie</sub>      | —   | 2.7                  | —   | kΩ   |                                                                                       | I <sub>C</sub> = 2.0mA, V <sub>CE</sub> = 5V<br>f=1.0kHz |                                                          |                                                          |
|                                                   | BC846B / BC847B / BC848B |                      |     | 4.5                  |     |      |                                                                                       |                                                          |                                                          |                                                          |
|                                                   | BC847C / BC848C          |                      |     | 8.7                  |     |      |                                                                                       |                                                          |                                                          |                                                          |
| Output Admittance<br>(Note 10)                    | BC846A / BC847A / BC848A | h <sub>oe</sub>      | —   | 18                   | —   | μS   |                                                                                       |                                                          | I <sub>C</sub> = 2.0mA, V <sub>CE</sub> = 5V<br>f=1.0kHz |                                                          |
|                                                   | BC846B / BC847B / BC848B |                      |     | 30                   |     |      |                                                                                       |                                                          |                                                          |                                                          |
|                                                   | BC847C / BC848C          |                      |     | 60                   |     |      |                                                                                       |                                                          |                                                          |                                                          |
| Reverse Voltage Transfer<br>Ratio (Note 10)       | BC846A / BC847A / BC848A | h <sub>re</sub>      | —   | 1.5x10 <sup>-4</sup> | —   | —    |                                                                                       |                                                          |                                                          | I <sub>C</sub> = 2.0mA, V <sub>CE</sub> = 5V<br>f=1.0kHz |
|                                                   | BC846B / BC847B / BC848B |                      |     | 2x10 <sup>-4</sup>   |     |      |                                                                                       |                                                          |                                                          |                                                          |
|                                                   | BC847C / BC848C          |                      |     | 3x10 <sup>-4</sup>   |     |      |                                                                                       |                                                          |                                                          |                                                          |
| DC Current Gain (Note 10)                         | BC846A / BC847A / BC848A | h <sub>FE</sub>      | 110 | 180                  | 220 | —    | I <sub>C</sub> = 2.0mA, V <sub>CE</sub> = 5V                                          |                                                          |                                                          |                                                          |
|                                                   | BC846B / BC847B / BC848B |                      | 200 | 290                  | 450 |      |                                                                                       |                                                          |                                                          |                                                          |
|                                                   | BC847C / BC848C          |                      | 420 | 520                  | 800 |      |                                                                                       |                                                          |                                                          |                                                          |
| Collector-Emitter Saturation Voltage<br>(Note 10) |                          | V <sub>CE(sat)</sub> | —   | 90                   | 250 | mV   | I <sub>C</sub> = 10mA, I <sub>B</sub> = 0.5mA                                         |                                                          |                                                          |                                                          |
|                                                   |                          |                      |     | 200                  | 600 |      | I <sub>C</sub> = 100mA, I <sub>B</sub> = 5.0mA                                        |                                                          |                                                          |                                                          |
| Base-Emitter Turn-On Voltage(Note 10)             |                          | V <sub>BE(on)</sub>  | 580 | 660                  | 700 | mV   | I <sub>C</sub> = 2mA, V <sub>CE</sub> = 5V                                            |                                                          |                                                          |                                                          |
|                                                   |                          |                      | -   | —                    | 770 |      | I <sub>C</sub> = 10mA, V <sub>CE</sub> = 5V                                           |                                                          |                                                          |                                                          |
| Base-Emitter Saturation Voltage(Note 10)          |                          | V <sub>BE(sat)</sub> | —   | 700                  | —   | mV   | I <sub>C</sub> = 10mA, I <sub>B</sub> = 0.5mA                                         |                                                          |                                                          |                                                          |
|                                                   |                          |                      |     | 900                  |     |      | I <sub>C</sub> = 100mA, I <sub>B</sub> = 5mA                                          |                                                          |                                                          |                                                          |
| Output Capacitance                                |                          | C <sub>obo</sub>     | —   | 3                    | —   | pF   | V <sub>CB</sub> = 10V, f = 1.0MHz                                                     |                                                          |                                                          |                                                          |
| Transition Frequency                              |                          | f <sub>T</sub>       | 100 | 300                  | —   | MHz  | V <sub>CE</sub> = 5V, I <sub>C</sub> = 10mA,<br>f = 100MHz                            |                                                          |                                                          |                                                          |
| Noise Figure                                      |                          | NF                   | —   | 2                    | 10  | dB   | V <sub>CE</sub> =5V, I <sub>C</sub> =200μA<br>R <sub>S</sub> =2kΩ, f=1kHz<br>Δf=200Hz |                                                          |                                                          |                                                          |

Note: 10. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%

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

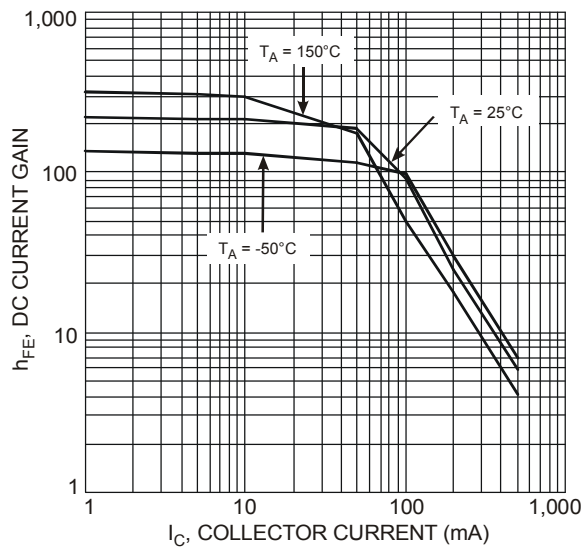


Figure 1 Typical DC Current Gain vs. Collector Current

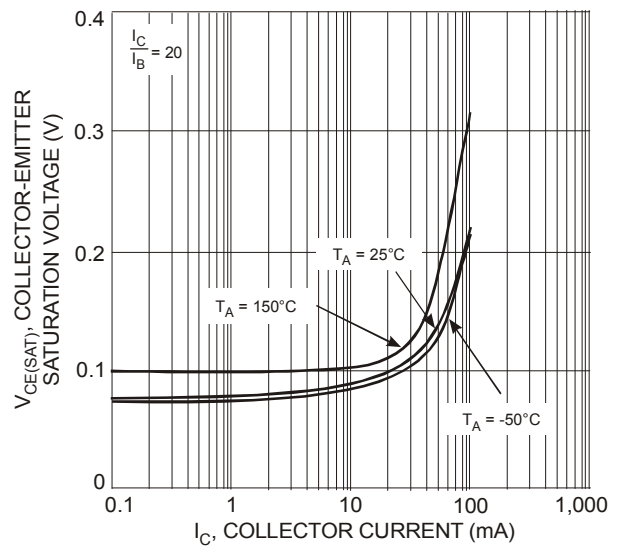


Figure 2 Typical Collector-Emitter Saturation Voltage vs. Collector Current

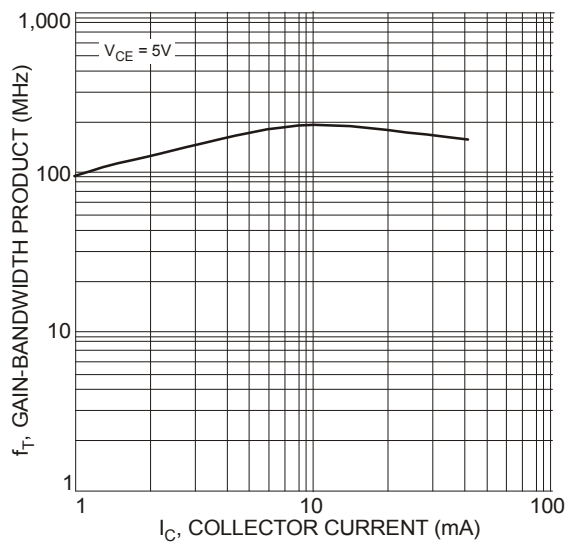
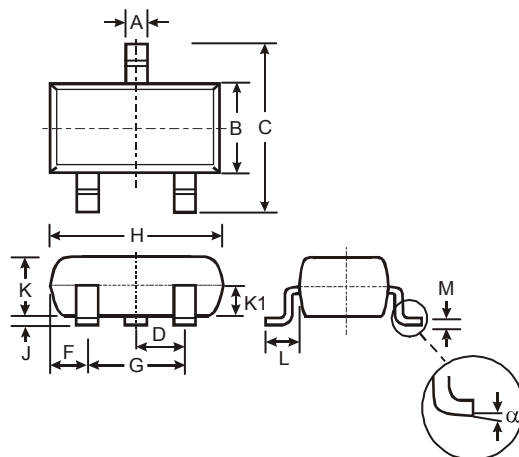


Figure 3 Typical Gain-Bandwidth Product vs. Collector Current

## Package Outline Dimensions

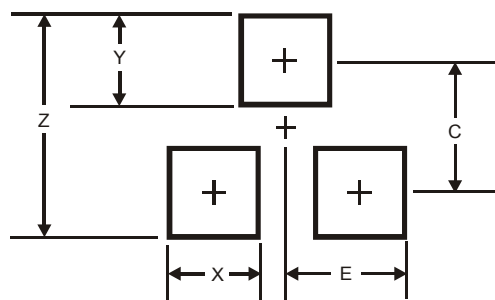
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.



| SOT23                |       |      |       |
|----------------------|-------|------|-------|
| Dim                  | Min   | Max  | Typ   |
| A                    | 0.37  | 0.51 | 0.40  |
| B                    | 1.20  | 1.40 | 1.30  |
| C                    | 2.30  | 2.50 | 2.40  |
| D                    | 0.89  | 1.03 | 0.915 |
| F                    | 0.45  | 0.60 | 0.535 |
| G                    | 1.78  | 2.05 | 1.83  |
| H                    | 2.80  | 3.00 | 2.90  |
| J                    | 0.013 | 0.10 | 0.05  |
| K                    | 0.903 | 1.10 | 1.00  |
| K1                   | -     | -    | 0.400 |
| L                    | 0.45  | 0.61 | 0.55  |
| M                    | 0.085 | 0.18 | 0.11  |
| α                    | 0°    | 8°   | -     |
| 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          | 2.9           |
| X          | 0.8           |
| Y          | 0.9           |
| C          | 2.0           |
| E          | 1.35          |

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