

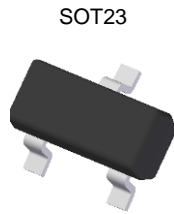


**THE DATASHEET OF  
AT89C51ED2-RDTUM**

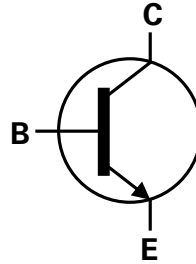


## Features

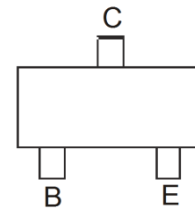
- Ideally Suited for Automatic Insertion
- Complementary PNP Types: BC856–BC858
- For Switching and AF Amplifier Applications
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **An automotive-compliant part is available under separate datasheet ([BC846AQ-BC848CQ](#))**



SOT23  
Top View



Device Symbol



Top View  
Pin-Out

## Mechanical Data

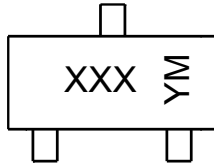
- Package: SOT23
- Package Material: Molded Plastic, "Green" Molding Compound  
UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 (E3)
- Weight: 0.008 grams (Approximate)

## Ordering Information (Note 4)

Part Number	Package	Marking	Reel Size (inches)	Packing	
				Qty.	Carrier
BC846A-7-F	SOT23	K1Q	7	3,000	Reel
BC846B-7-F	SOT23	K1R	7	3,000	Reel
BC846B-13-F	SOT23	K1R	13	10,000	Reel
BC847A-7-F	SOT23	K1Q	7	3,000	Reel
BC847A-13-F	SOT23	K1Q	13	10,000	Reel
BC847B-7-F	SOT23	K1R	7	3,000	Reel
BC847B-13-F	SOT23	K1R	13	10,000	Reel
BC847C-7-F	SOT23	K1M	7	3,000	Reel
BC847C-13-F	SOT23	K1M	13	10,000	Reel
BC848A-7-F	SOT23	K1Q	7	3,000	Reel
BC848B-7-F	SOT23	K1R	7	3,000	Reel
BC848B-13-F	SOT23	K1R	13	10,000	Reel
BC848C-7-F	SOT23	K1M	7	3,000	Reel

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
  2. See <https://www.diodes.com/quality/lead-free/> 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 <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

## Marking Information



XXX = Product Type Marking Code  
 YM = Date Code Marking  
 Y or  $\bar{Y}$  = Year (ex: L = 2024)  
 M or  $\bar{M}$  = Month (ex: 9 = September)

### Date Code Key

<b>Year</b>	2007	-	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
<b>Code</b>	U	-	L	M	N	P	R	S	T	U	V	W

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

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

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	V <sub>CB0</sub>	BC846A/B	80
		BC847A/B/C	50
		BC848A/B/C	30
Collector-Emitter Voltage	V <sub>CEO</sub>	BC846A/B	65
		BC847A/B/C	45
		BC848A/B/C	30
Emitter-Base Voltage	V <sub>EB0</sub>	BC846A/B	6.0
		BC847A/B/C	5.0
		BC848A/B/C	
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	P <sub>D</sub>	(Note 5)	310
		(Note 6)	350
Thermal Resistance, Junction to Ambient	R <sub>θJA</sub>	(Note 5)	403
		(Note 6)	357
Thermal Resistance, Junction to Leads	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 8)

Characteristic	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge - Human Body Model	ESD HBM	4,000	V	3A
Electrostatic Discharge - Machine Model	ESD MM	400	V	C

- Notes:
- For a device mounted on minimum recommended pad layout 1oz copper that is on a single-sided FR4 PCB; device is measured under still air conditions whilst operating in a steady-state.
  - Same as Note 5, except the device is mounted on 15mm x 15mm 1oz copper.
  - Thermal resistance from junction to solder-point (at the end of the leads).
  - Refer to JEDEC specification JESD22-A114 and JESD22-A115.

**Thermal Characteristics and Derating Information**

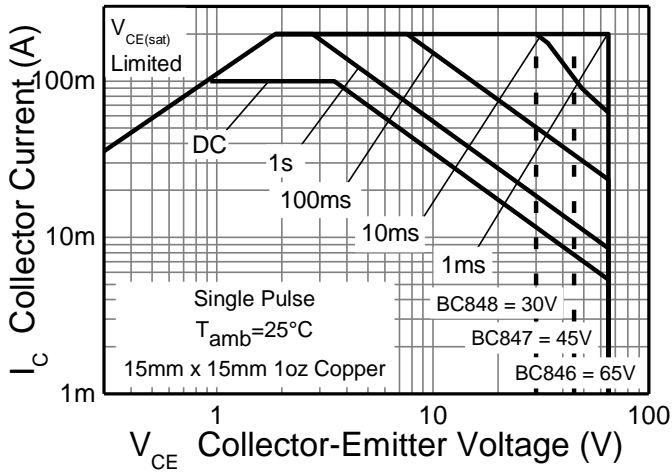


Figure 1. Safe Operating Area

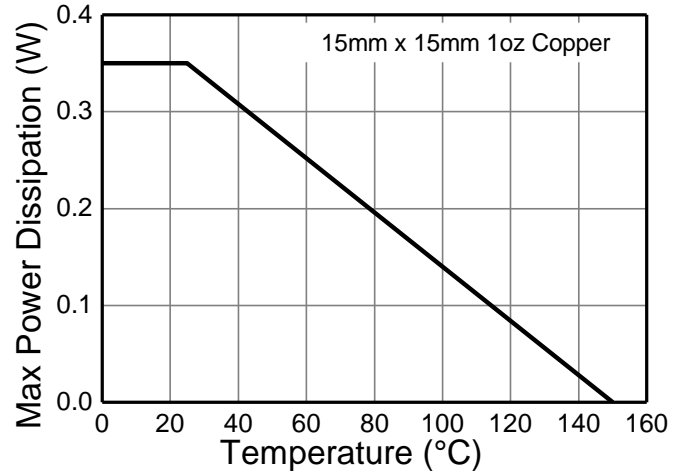


Figure 2. Derating Curve

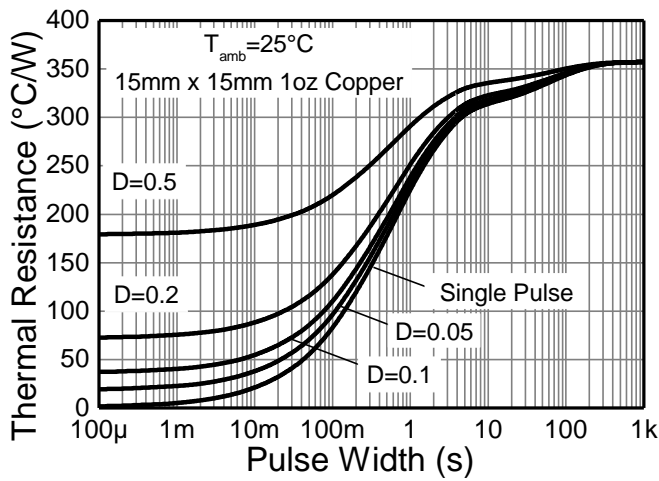


Figure 3. Transient Thermal Impedance

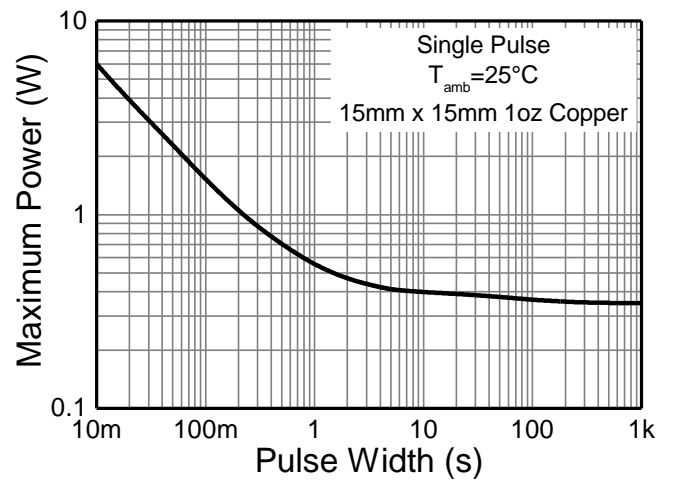


Figure 4. Pulse Power Dissipation

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

Characteristic		Symbol	Min	Typ	Max	Unit	Test Condition
Collector-Base Breakdown Voltage	BC846A/B	BV <sub>CBO</sub>	80	—	—	V	I <sub>C</sub> = 10μA
	BC847A/B/C		50				
	BC848A/B/C		30				
Collector-Emitter Breakdown Voltage (Note 9)	BC846A/B	BV <sub>CEO</sub>	65	—	—	V	I <sub>C</sub> = 10mA
	BC847A/B/C		45				
	BC848A/B/C		30				
Emitter-Base Breakdown Voltage	BC846A/B	BV <sub>EBO</sub>	6	—	—	V	I <sub>E</sub> = 1μA
	BC847A/B/C		5				
	BC848A/B/C						
Collector Cutoff Current		I <sub>CBO</sub>	—	—	15 5	nA μA	V <sub>CB</sub> = 30V V <sub>CB</sub> = 30V, T <sub>J</sub> = +150°C
Collector Emitter Cutoff Current	BC846A/B	I <sub>CES</sub>	—	—	15	nA	V <sub>CE</sub> = 80V
	BC847A/B/C				15		V <sub>CE</sub> = 50V
	BC848A/B/C				15		V <sub>CE</sub> = 30V
Emitter Base Cutoff Current		I <sub>EBO</sub>	—	—	100	nA	V <sub>EB</sub> = 5V
Small Signal Current Gain (Note 9)	BC846A/BC847A/BC848A	h <sub>FE</sub>	—	200	—	—	I <sub>C</sub> = 2.0mA, V <sub>CE</sub> = 5V f = 1.0kHz
	BC846B/BC847B/BC848B			330			
	BC847C/BC848C			600			
Input Impedance (Note 9)	BC846A/BC847A/BC848A	h <sub>ie</sub>	—	2.7	—	kΩ	
	BC846B/BC847B/BC848B			4.5			
	BC847C/BC848C			8.7			
Output Admittance (Note 9)	BC846A/BC847A/BC848A	h <sub>oe</sub>	—	18	—	μS	
	BC846B/BC847B/BC848B			30			
	BC847C/BC848C			60			
Reverse Voltage Transfer Ratio (Note 9)	BC846A/BC847A/BC848A	h <sub>re</sub>	—	1.5 × 10 <sup>-4</sup>	—	—	
	BC846B/BC847B/BC848B			2 × 10 <sup>-4</sup>			
	BC847C/BC848C			3 × 10 <sup>-4</sup>			
DC Current Gain (Note 9)	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 (Note 9)		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 9)		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 9)		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 f = 100MHz
Noise Figure		NF	—	2	10	dB	V <sub>CE</sub> = 5V, I <sub>C</sub> = 200μA R <sub>S</sub> = 2kΩ, f = 1kHz Δf = 200Hz

Note: 9. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.

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

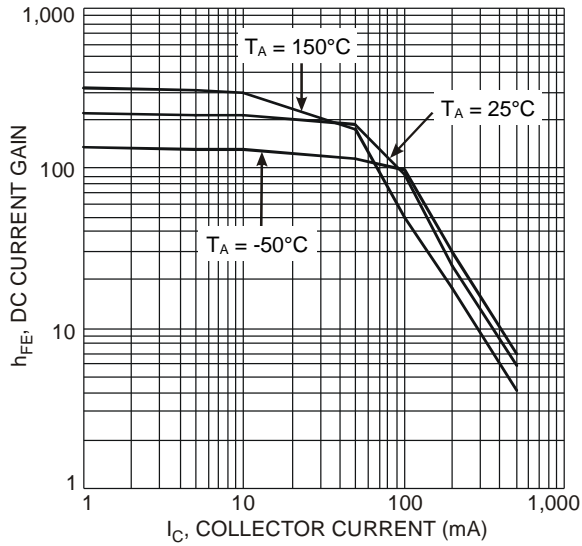


Figure 5. Typical DC Current Gain vs. Collector Current

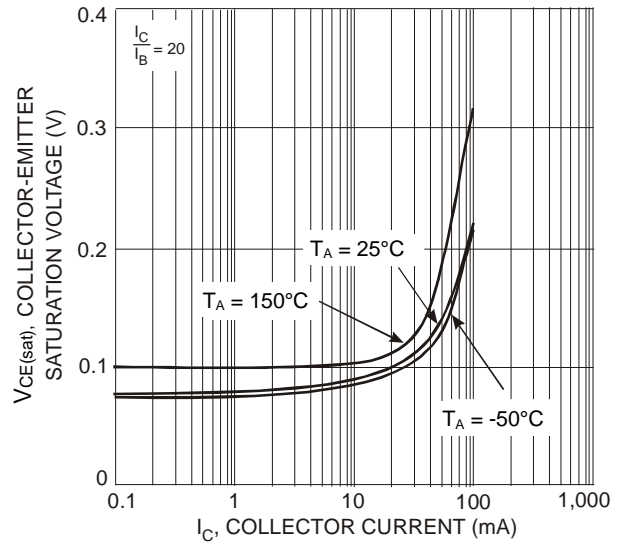


Figure 6. Typical Collector-Emitter Saturation Voltage vs. Collector Current

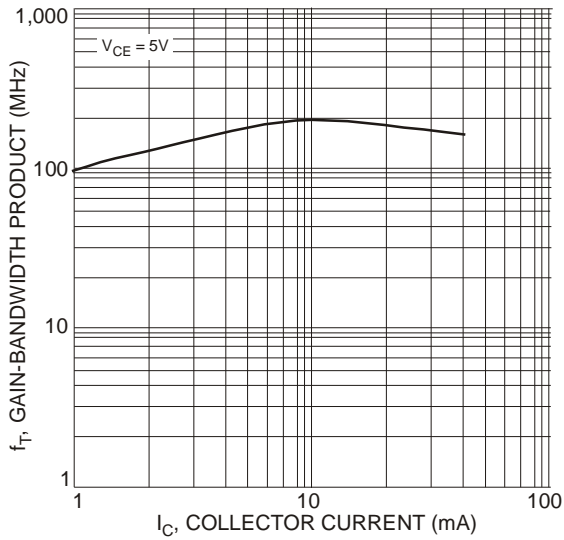
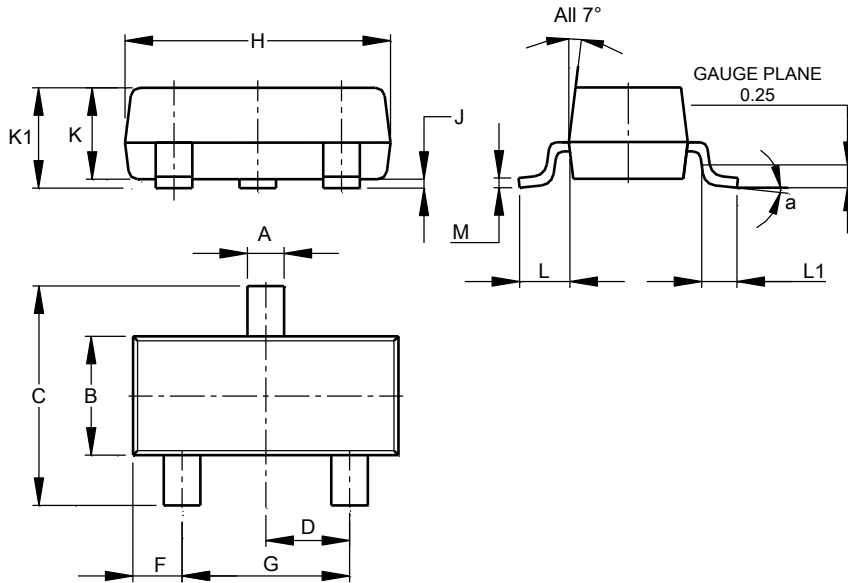


Figure 7. Typical Gain-Bandwidth Product vs. Collector Current

**Package Outline Dimensions**

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**SOT23**

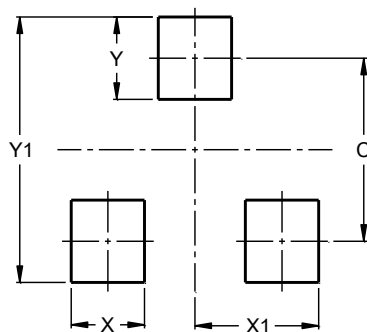


SOT23			
Dim	Min	Max	Typ
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	0°	8°	--
All Dimensions in mm			

**Suggested Pad Layout**

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**SOT23**



Dimensions	Value (in mm)
C	2.0
X	0.8
X1	1.35
Y	0.9
Y1	2.9

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