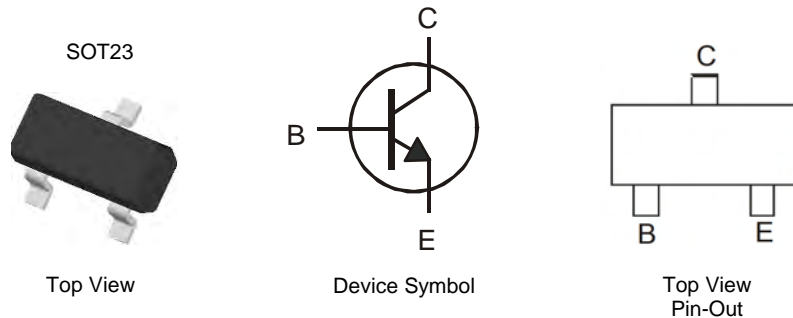


**40V NPN SURFACE MOUNT SMALL SIGNAL TRANSISTOR IN SOT23**
**Features**

- Epitaxial Planar Die Construction
- Complementary PNP Type Available (MMBT4403)
- Ideal for Medium 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**
- **PPAP capable (Note 4)**

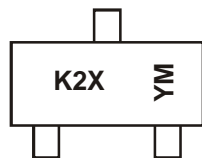
**Mechanical Data**

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

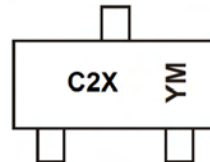

**Ordering Information** (Notes 4 & 5)

Product	Compliance	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
MMBT4401-7-F	AEC-Q101	K2X / C2X	7	8	3,000
MMBT4401-13-F	AEC-Q101	K2X / C2X	13	8	10,000
MMBT4401Q-13-F	Automotive	K2X	13	8	10,000

- 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. 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.
  5. For packaging details, go to our website at <http://www.diodes.com>.

**Marking Information**


K = SAT (Shanghai Assembly / Test site)  
 2X = Product Type Marking Code  
 YM = Date Code Marking  
 Y = Year (ex: Y = 2011)  
 M = Month (ex: 9 = September)



C = CAT (Chengdu Assembly / Test site)  
 2X = 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

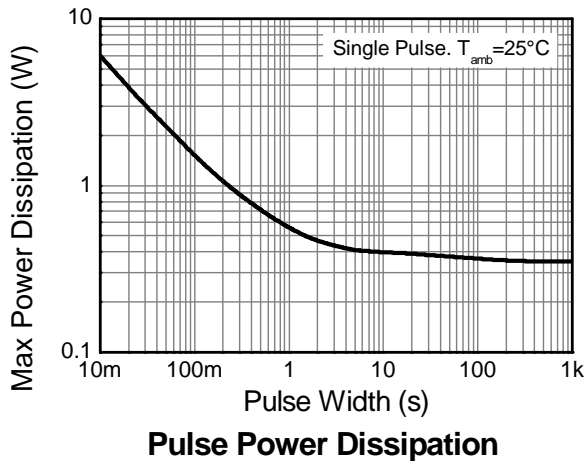
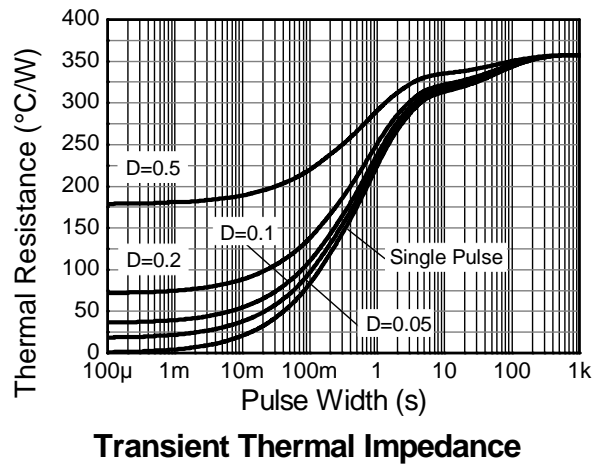
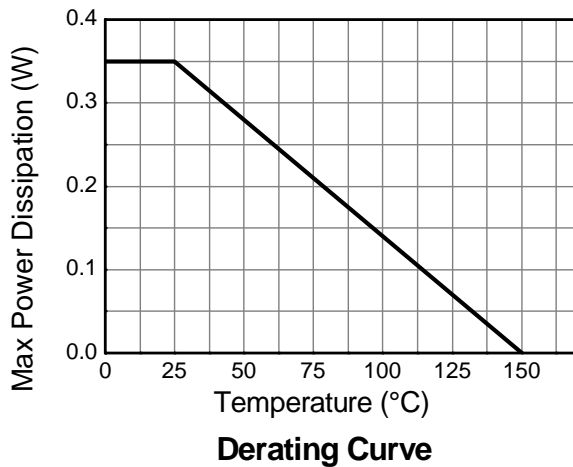
### Maximum Ratings (@T<sub>A</sub> = +25°C unless otherwise specified)

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	V <sub>CBO</sub>	60	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

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

Characteristic	Symbol	Value	Unit
Collector Power Dissipation	P <sub>D</sub>	(Note 6)	310
		(Note 7)	350
Thermal Resistance, Junction to Ambient	R <sub>θJA</sub>	(Note 6)	403
		(Note 7)	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>	-55 to +150	°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 collector lead).



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

Characteristic	Symbol	Min	Max	Unit	Test Condition	
<b>OFF CHARACTERISTICS (Note 9)</b>						
Collector-Base Breakdown Voltage	BV <sub>CB0</sub>	60	—	V	I <sub>C</sub> = 100μA, I <sub>E</sub> = 0	
Collector-Emitter Breakdown Voltage	BV <sub>CEO</sub>	40	—	V	I <sub>C</sub> = 10.0mA, 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>CEX</sub>	—	100	nA	V <sub>CE</sub> = 35V, V <sub>EB(OFF)</sub> = 0.4V	
Base Cutoff Current	I <sub>BL</sub>	—	100	nA	V <sub>CE</sub> = 35V, V <sub>EB(OFF)</sub> = 0.4V	
<b>ON CHARACTERISTICS (Note 9)</b>						
DC Current Gain	h <sub>FE</sub>	20	—	—	I <sub>C</sub> = 100μA, V <sub>CE</sub> = 1.0V	
		40	—			I <sub>C</sub> = 1.0mA, V <sub>CE</sub> = 1.0V
		80	—			I <sub>C</sub> = 10mA, V <sub>CE</sub> = 1.0V
		100	300			I <sub>C</sub> = 150mA, V <sub>CE</sub> = 1.0V
		40	—			I <sub>C</sub> = 500mA, V <sub>CE</sub> = 2.0V
Collector-Emitter Saturation Voltage	V <sub>CE(sat)</sub>	—	0.40 0.75	V	I <sub>C</sub> = 150mA, I <sub>B</sub> = 15mA I <sub>C</sub> = 500mA, I <sub>B</sub> = 50mA	
Base-Emitter Saturation Voltage	V <sub>BE(sat)</sub>	0.75 —	0.95 1.2	V	I <sub>C</sub> = 150mA, I <sub>B</sub> = 15mA I <sub>C</sub> = 500mA, I <sub>B</sub> = 50mA	
<b>SMALL SIGNAL CHARACTERISTICS</b>						
Output Capacitance	C <sub>cb</sub>	—	6.5	pF	V <sub>CB</sub> = 5.0V, f = 1.0MHz, I <sub>E</sub> = 0	
Input Capacitance	C <sub>eb</sub>	—	30	pF	V <sub>EB</sub> = 0.5V, f = 1.0MHz, I <sub>C</sub> = 0	
Input Impedance	h <sub>ie</sub>	1.0	15	kΩ	V <sub>CE</sub> = 10V, I <sub>C</sub> = 1.0mA, f = 1.0kHz	
Voltage Feedback Ratio	h <sub>re</sub>	0.1	8.0	x 10 <sup>-4</sup>		
Small Signal Current Gain	h <sub>fe</sub>	40	500	—		
Output Admittance	h <sub>oe</sub>	1.0	30	μS		
Current Gain-Bandwidth Product	f <sub>T</sub>	250	—	MHz	V <sub>CE</sub> = 10V, I <sub>C</sub> = 20mA, f = 100MHz	
<b>SWITCHING CHARACTERISTICS</b>						
Delay Time	t <sub>d</sub>	—	15	ns	V <sub>CC</sub> = 30V, I <sub>C</sub> = 150mA,	
Rise Time	t <sub>r</sub>	—	20	ns	V <sub>BE(off)</sub> = 2.0V, I <sub>B1</sub> = 15mA	
Storage Time	t <sub>s</sub>	—	225	ns	V <sub>CC</sub> = 30V, I <sub>C</sub> = 150mA,	
Fall Time	t <sub>f</sub>	—	30	ns	I <sub>B1</sub> = I <sub>B2</sub> = 15mA	

Notes: 9. Short duration pulse test used to minimize self-heating effect.

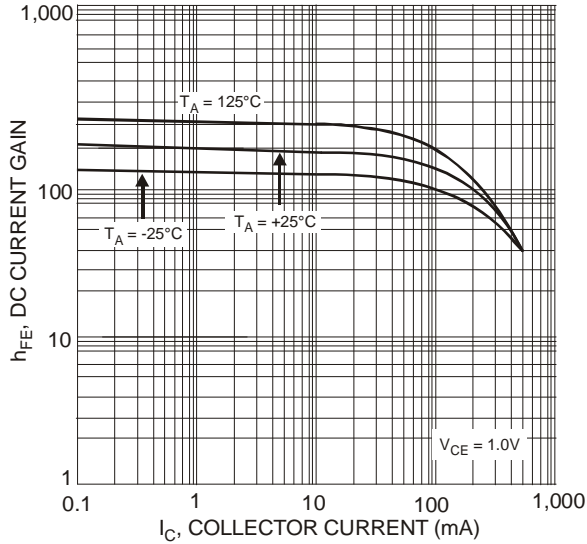


Figure 1 Typical DC Current Gain vs. Collector Current

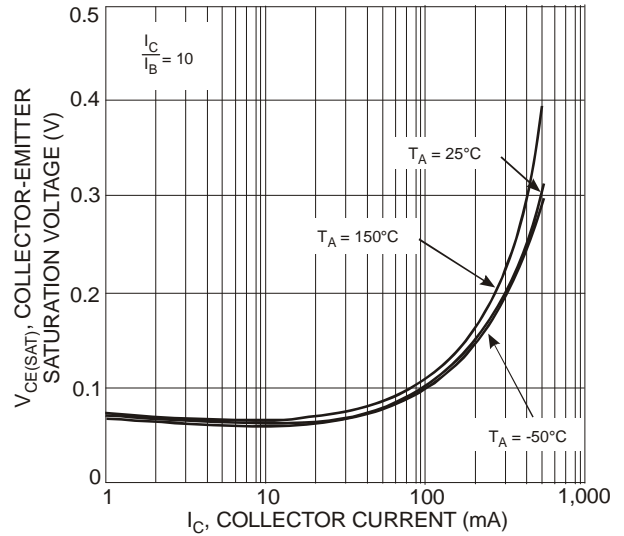


Figure 2 Collector-Emitter Saturation Voltage vs. Collector Current

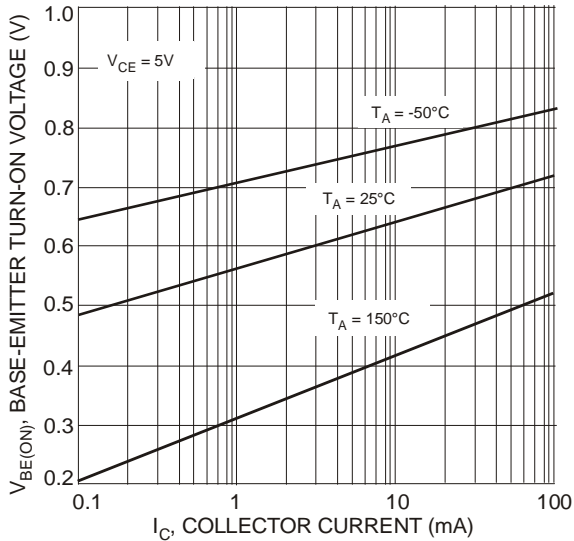


Figure 3 Typical Base-Emitter Turn-On Voltage vs. Collector Current

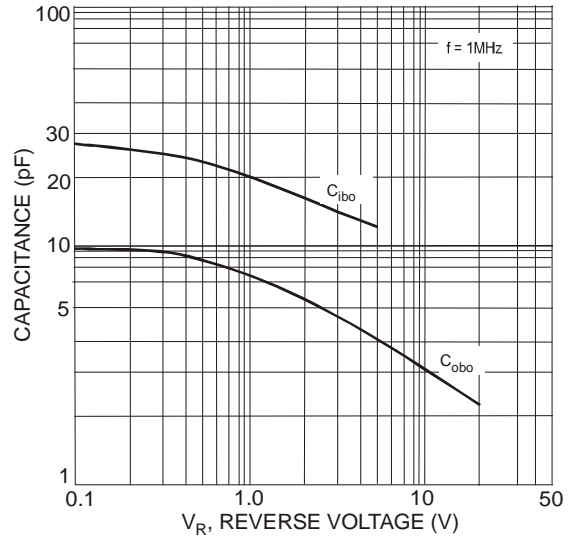


Figure 4 Typical Capacitance Characteristics

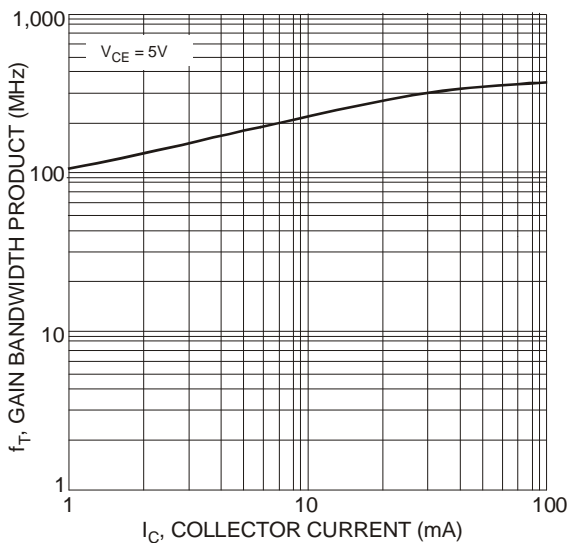


Figure 5 Typical Gain Bandwidth Product vs. Collector Current

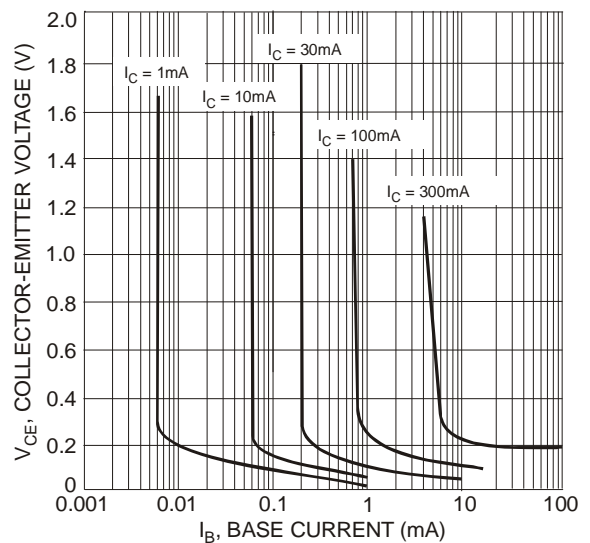
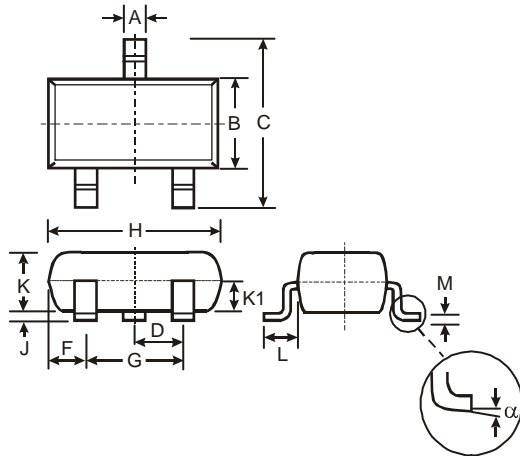


Figure 6 Typical Collector Saturation Region

**Package Outline Dimensions**

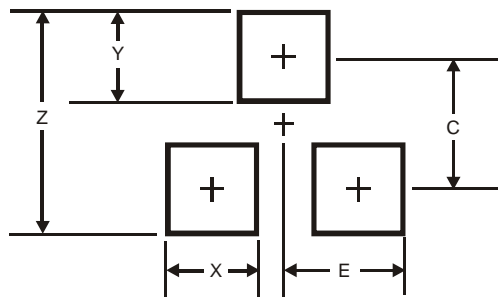
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.



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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