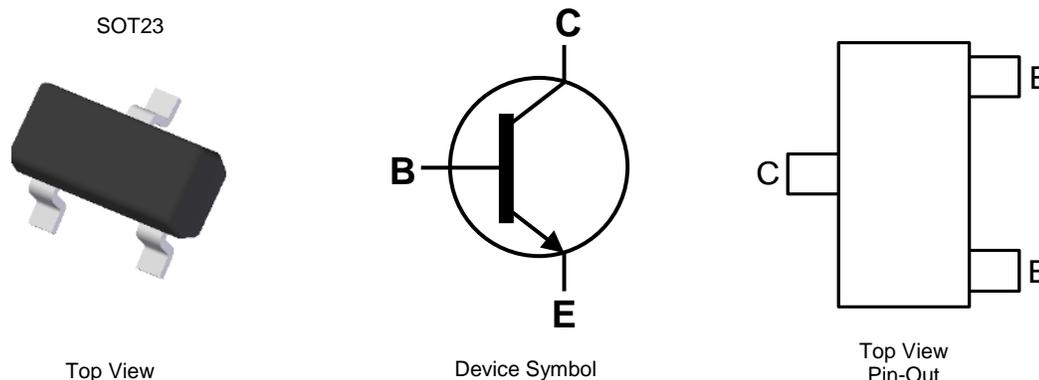


## Features

- Epitaxial Planar Die Construction
- Ideal for Medium Power Amplification and Switching
- Complementary PNP Type: MMBT4403
- **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 ([MMBT4401Q](#))**

## Mechanical Data

- Package: SOT23
- Package Material: Molded Plastic "Green" Compound  
UL Flammability 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)

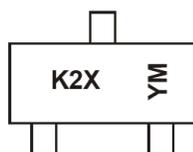


## Ordering Information (Note 4)

Part Number	Package	Marking	Reel Size (inches)	Tape Width (mm)	Packing	
					Qty.	Carrier
MMBT4401-7-F	SOT23	K2X	7	8	3,000	Reel
MMBT4401-13-F	SOT23	K2X	13	8	10,000	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



K2X = Product Type Marking Code  
 YM = Date Code Marking  
 Y or  $\bar{Y}$  = Year (ex: K = 2023)  
 M or  $\bar{M}$  = Month (ex: 9 = September)

### Date Code Key

Year	2010	-	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Code	X	-	K	L	M	N	P	R	S	T	U	V

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

**Absolute 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	I <sub>C</sub>	600	mA
Peak Collector Current	I <sub>CM</sub>	1	A
Peak Base Current	I <sub>BM</sub>	200	mA

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

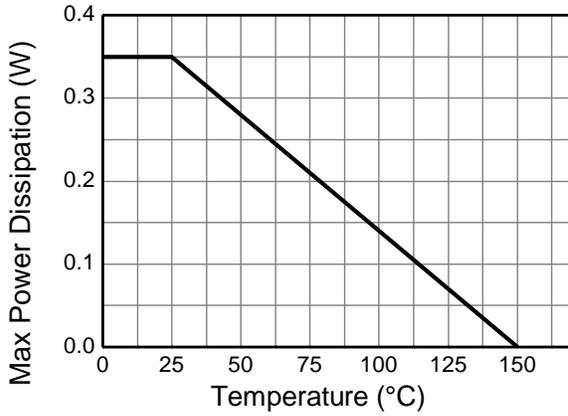
Characteristic	Symbol	Value	Unit
Power Dissipation	P <sub>D</sub>	(Note 5)	310
		(Note 6)	350
Thermal Resistance, Junction to Ambient	R <sub>θJA</sub>	(Note 5)	403
		(Note 6)	357
Thermal Resistance, Junction to Leads	R <sub>θJL</sub>	350	°C/W
Thermal Resistance, Junction to Case	R <sub>θJC</sub>	120	°C/W
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

**ESD Ratings** (Note 8)

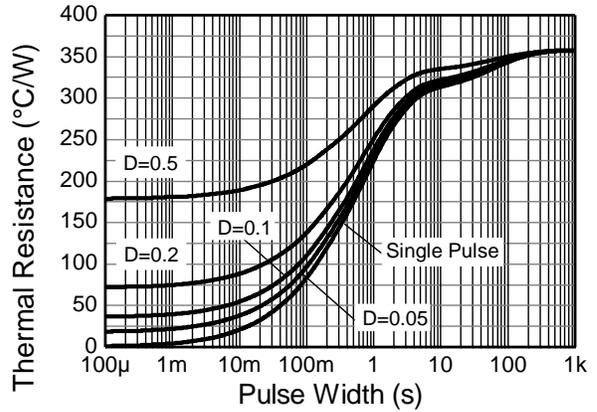
Characteristic	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge - Human Body Model	ESD HBM	4,000	V	3A
Electrostatic Discharge - Machine Model	ESD MM	400	V	C
Electrostatic Discharge – Charged Device Model	ESD CDM	1,000	V	C3

- Notes:
5. 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.
  6. Same as note (5), except the device is mounted on 15mm x 15mm 1oz copper.
  7. Thermal resistance from junction to solder-point (at the end of the leads).
  8. Refer to JEDEC specification JESD22-A114, JESD22-A115 and JES-022-C101.

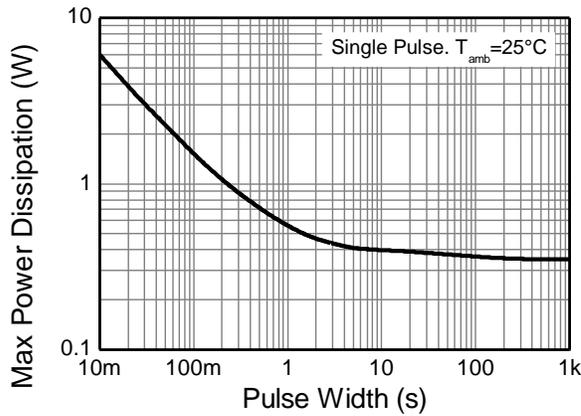
**Thermal Characteristics and Derating Information**



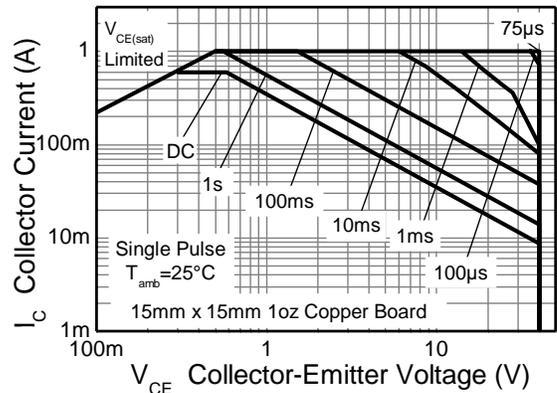
**Figure 1. Derating Curve**



**Figure 2. Transient Thermal Impedance**



**Figure 3. Pulse Power Dissipation**



**Figure 4. Safe Operating Area**

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

Characteristic	Symbol	Min	Max	Unit	Test Condition	
<b>OFF CHARACTERISTICS</b>						
Collector-Base Breakdown Voltage	$BV_{CBO}$	60	—	V	$I_C = 100\mu\text{A}$	
Collector-Emitter Breakdown Voltage (Note 9)	$BV_{CEO}$	40	—	V	$I_C = 10\text{mA}$	
Emitter-Base Breakdown Voltage	$BV_{EBO}$	6	—	V	$I_E = 100\mu\text{A}$	
Collector Cutoff Current	$I_{CEX}$	—	100	nA	$V_{CE} = 35\text{V}$ , $V_{EB(off)} = 0.4\text{V}$	
Base Cutoff Current	$I_{BL}$	—	100	nA	$V_{CE} = 35\text{V}$ , $V_{EB(off)} = 0.4\text{V}$	
<b>ON CHARACTERISTICS (Note 9)</b>						
DC Current Gain	$h_{FE}$	20	—	—	$I_C = 100\mu\text{A}$ , $V_{CE} = 1\text{V}$	
		40	—			$I_C = 1\text{mA}$ , $V_{CE} = 1\text{V}$
		80	—			$I_C = 10\text{mA}$ , $V_{CE} = 1\text{V}$
		100	300			$I_C = 150\text{mA}$ , $V_{CE} = 1\text{V}$
		40	—			$I_C = 500\text{mA}$ , $V_{CE} = 2\text{V}$
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	—	0.4 0.75	V	$I_C = 150\text{mA}$ , $I_B = 15\text{mA}$ $I_C = 500\text{mA}$ , $I_B = 50\text{mA}$	
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	0.75 —	0.95 1.2	V	$I_C = 150\text{mA}$ , $I_B = 15\text{mA}$ $I_C = 500\text{mA}$ , $I_B = 50\text{mA}$	
<b>SMALL SIGNAL CHARACTERISTICS</b>						
Output Capacitance	$C_{cb}$	—	6.5	pF	$V_{CB} = 5\text{V}$ , $f = 1\text{MHz}$	
Input Capacitance	$C_{eb}$	—	30	pF	$V_{EB} = 0.5\text{V}$ , $f = 1\text{MHz}$	
Input Impedance	$h_{ie}$	1	15	k $\Omega$	$V_{CE} = 10\text{V}$ , $I_C = 1\text{mA}$ , $f = 1\text{kHz}$	
Voltage Feedback Ratio	$h_{re}$	0.1	8	$\times 10^{-4}$		
Small Signal Current Gain	$h_{fe}$	40	500	—		
Output Admittance	$h_{oe}$	1	30	$\mu\text{S}$		
Current Gain-Bandwidth Product	$f_T$	250	—	MHz		
<b>SWITCHING CHARACTERISTICS</b>						
Delay Time	$t_d$	—	15	ns	$V_{CC} = 30\text{V}$ , $I_C = 150\text{mA}$ , $V_{BE(off)} = 2\text{V}$ , $I_{B1} = 15\text{mA}$	
Rise Time	$t_r$	—	20	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	$t_f$	—	30	ns		

Note: 9. Measured under pulsed conditions. Pulse width  $\leq 300\mu\text{s}$ . Duty cycle  $\leq 2\%$ .

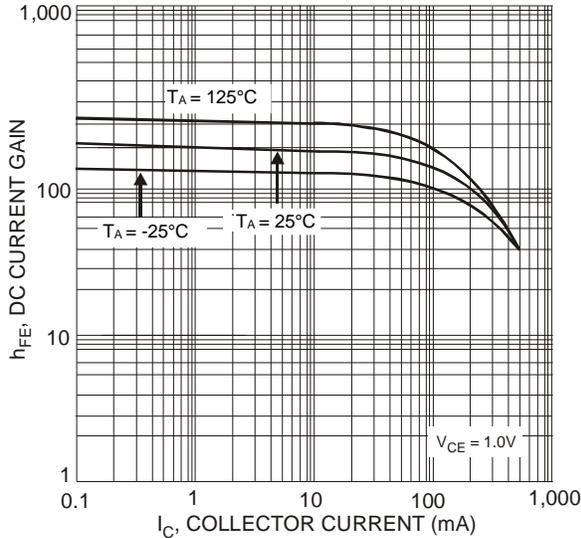


Figure 5 Typical DC Current Gain vs. Collector Current

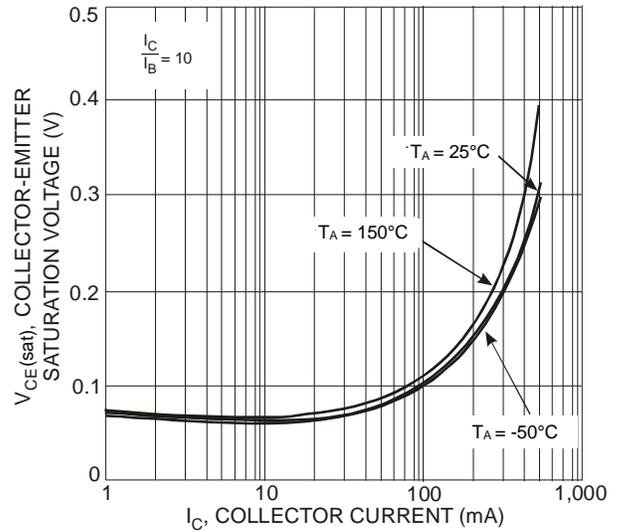


Figure 6 Collector-Emitter Saturation Voltage vs. Collector Current

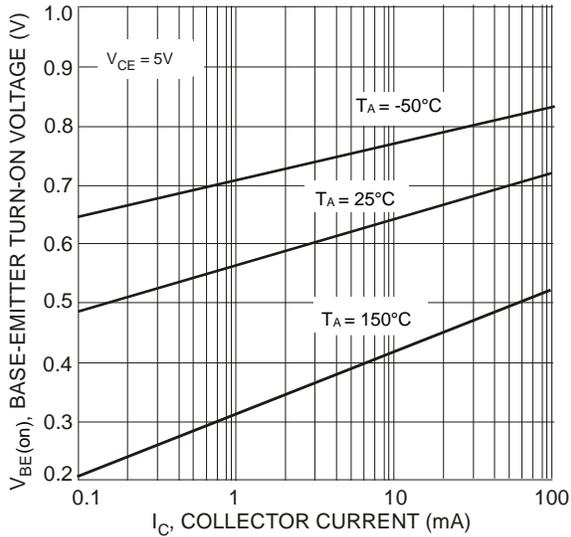


Figure 7 Typical Base-Emitter Turn-On Voltage vs. Collector Current

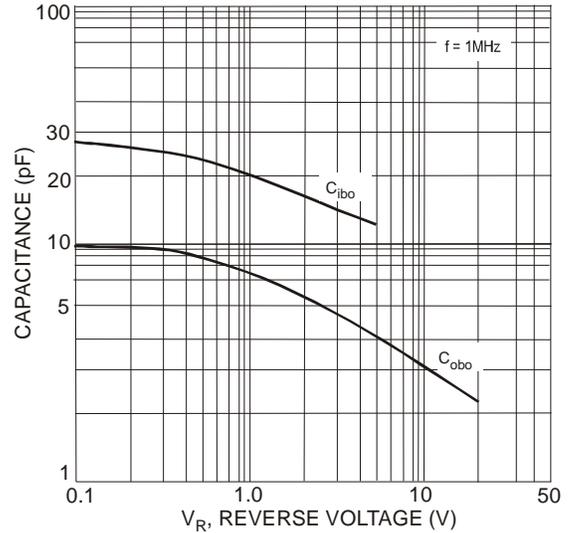


Figure 8 Typical Capacitance Characteristics

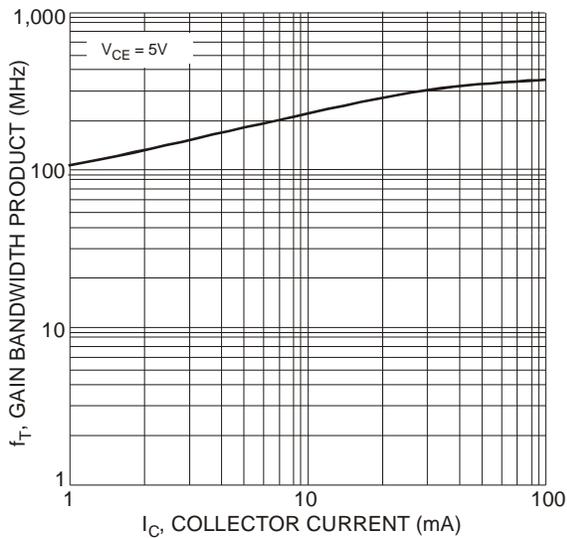


Figure 9 Typical Gain Bandwidth Product vs. Collector Current

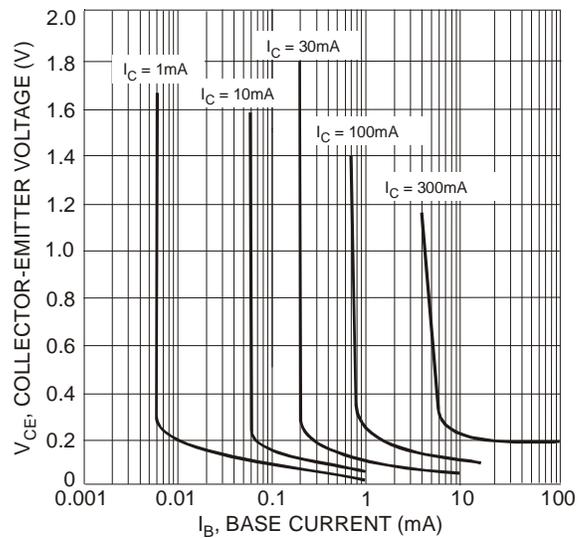
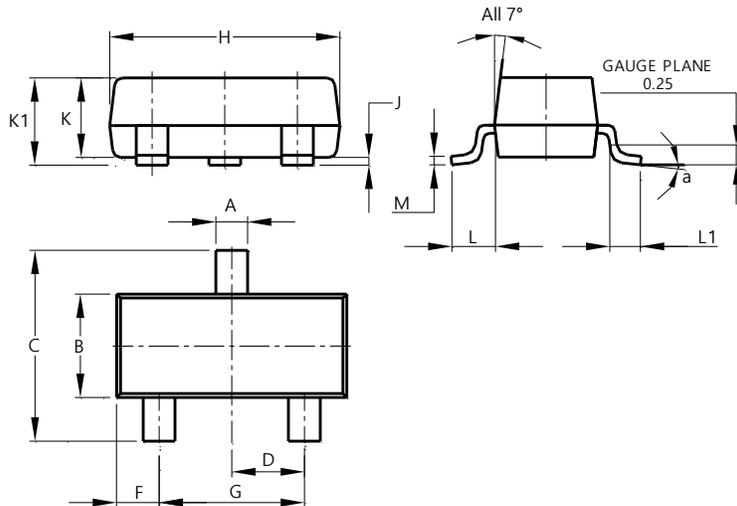


Figure 10 Typical Collector Saturation Region

## Package Outline Dimensions

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

**SOT23**

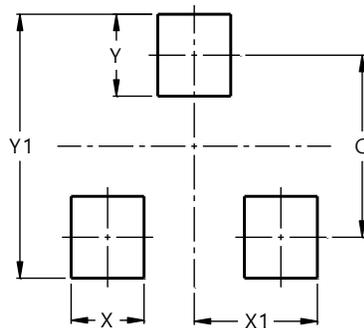


SOT23			
Dim	Min	Max	Typ
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	0°	8°	--
All Dimensions in mm			

## 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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