



**THE DATASHEET OF  
MMBT4401T-7-F**



**NPN SMALL SIGNAL SURFACE MOUNT TRANSISTOR**

**Features**

- $BV_{CEO} > 40V$
- $I_C = 600mA$  Collector Current
- Epitaxial Planar Die Construction
- Ultra-Small Surface Mount Package
- Complementary PNP Type: MMBT2907AT
- **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**

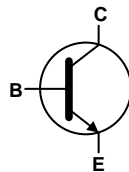
**Mechanical Data**

- Case: SOT523
- 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 (E3)
- Weight: 0.002 grams (Approximate)

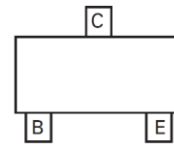
SOT523



Top View



Device Schematic



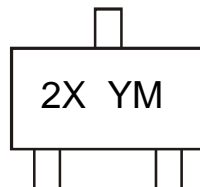
Package Pin Out Configuration

**Ordering Information** (Note 4)

Part Number	Compliance	Marking	Reel Size (inches)	Tape Width (mm)	Quantity Per Reel
MMBT4401T-7-F	AEC-Q101	2X	7	8	3,000

- 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**



- 2X = Product Type Marking Code (See Ordering Information)
- YM = Date Code Marking
- Y or  $\bar{Y}$  = Year (ex: F = 2018)
- M = Month (ex: 9 = September)

Date Code Key

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Code	F	G	H	I	J	K	L	M	N	O	P

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

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	$V_{CBO}$	60	V
Collector-Emitter Voltage	$V_{CEO}$	40	V
Emitter-Base Voltage	$V_{EBO}$	6	V
Collector Current	$I_C$	600	mA

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

Characteristic	Symbol	Value	Unit
Power Dissipation (Note 5)	$P_D$	150	mW
Thermal Resistance, Junction to Ambient (Note 5)	$R_{\theta JA}$	833	$^\circ\text{C/W}$
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$

**ESD Ratings** (Note 6)

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 with the collector lead on minimum recommended pad layout 1oz copper that is on a single-sided 1.6mm FR-4 PCB; device is measured under still air conditions whilst operating in a steady-state.
  - Refer to JEDEC specification JESD22-A114 and JESD22-A115.

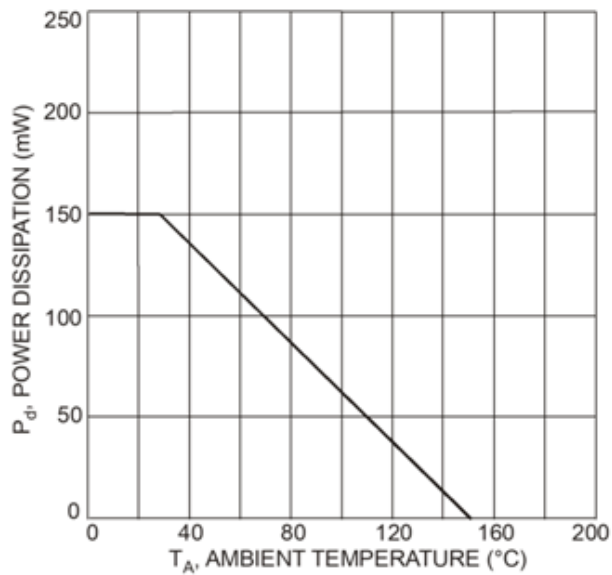
**Thermal Characteristics and Derating Information**


Fig. 1 Power Derating Curve

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

Characteristic	Symbol	Min	Max	Unit	Test Condition	
<b>OFF CHARACTERISTICS (Note 7)</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>	40	—	V	I <sub>C</sub> = 1mA, I <sub>B</sub> = 0	
Emitter-Base Breakdown Voltage	BV <sub>EBO</sub>	6	—	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 7)</b>						
DC Current Gain	h <sub>FE</sub>	20	—	—	I <sub>C</sub> = 100μA, V <sub>CE</sub> = 1V	
		40	—			I <sub>C</sub> = 1.0mA, V <sub>CE</sub> = 1V
		80	—			I <sub>C</sub> = 10mA, V <sub>CE</sub> = 1V
		100	300			I <sub>C</sub> = 150mA, V <sub>CE</sub> = 1V
		40	—			I <sub>C</sub> = 500mA, V <sub>CE</sub> = 2V
Collector-Emitter Saturation Voltage	V <sub>CE(SAT)</sub>	—	0.4 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>obo</sub>	—	6.5	pF	V <sub>CB</sub> = 5V, f = 1.0MHz, I <sub>E</sub> = 0	
Input Capacitance	C <sub>ibo</sub>	—	30	pF	V <sub>EB</sub> = 0.5V, f = 1.0MHz, I <sub>C</sub> = 0	
Input Impedance	h <sub>ie</sub>	1	15	kΩ	V <sub>CE</sub> = 10V, I <sub>C</sub> = 1mA, f = 1MHz	
Voltage Feedback Ratio	h <sub>re</sub>	0.1	8.0	x 10 <sup>-4</sup>		
Small Signal Current Gain	h <sub>fe</sub>	75	375	—		
Output Admittance	h <sub>oe</sub>	1	30	μS		
Current Gain-Bandwidth Product	f <sub>T</sub>	250	—	MHz	V <sub>CE</sub> = 20V, 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, V <sub>BE(OFF)</sub> = 2V, I <sub>B1</sub> = 15mA	
Rise Time	t <sub>R</sub>	—	20	ns		
Storage Time	t <sub>S</sub>	—	225	ns	V <sub>CC</sub> = 30V, I <sub>C</sub> = 150mA I <sub>B1</sub> = - I <sub>B2</sub> = 15mA	
Fall Time	t <sub>F</sub>	—	30	ns		

Notes: 7. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.

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

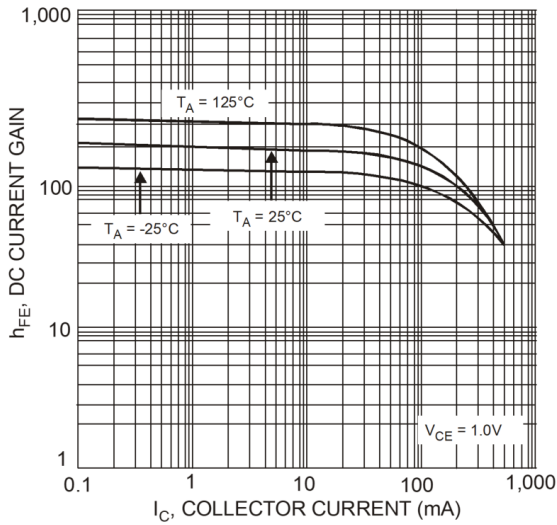


Fig. 2 Typical DC Current Gain vs. Collector Current

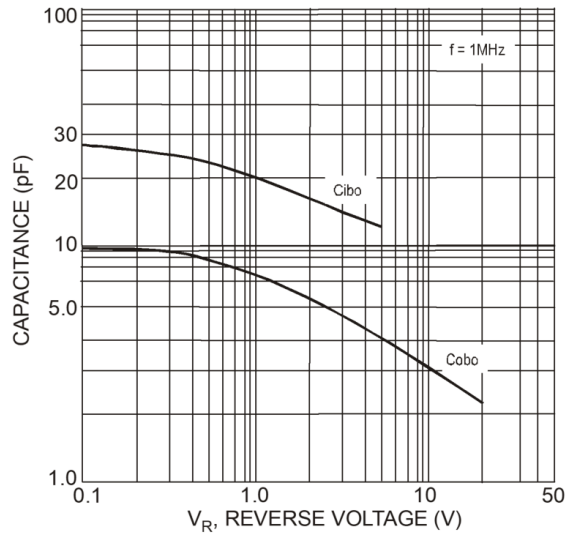


Fig. 3 Typical Capacitance

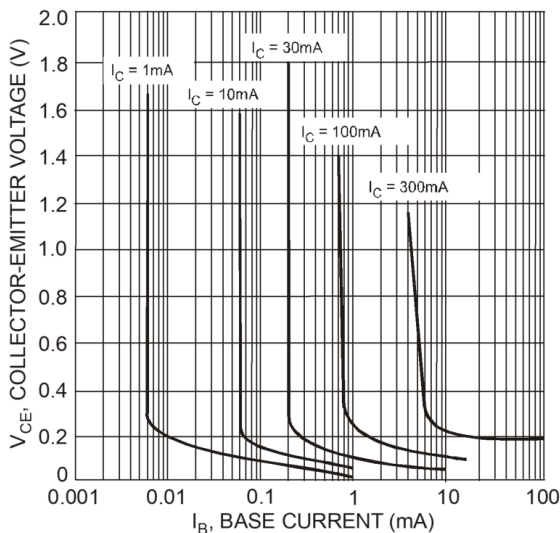


Fig. 4 Typical Collector Saturation Region

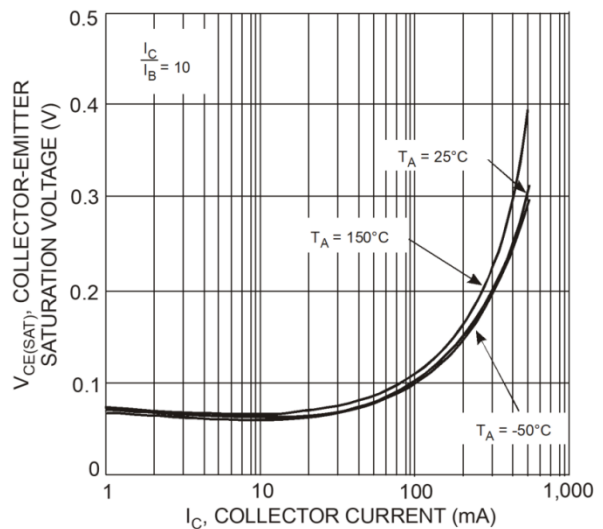


Fig. 5 Typical Collector Emitter Saturation Voltage vs. Collector Current

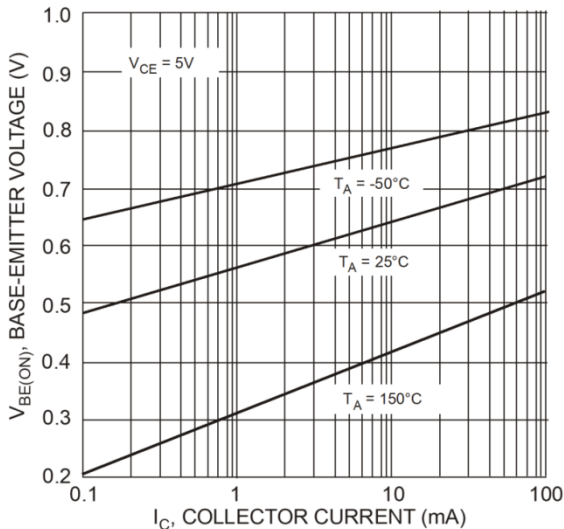


Fig. 6 Typical Base-Emitter Voltage vs. Collector Current

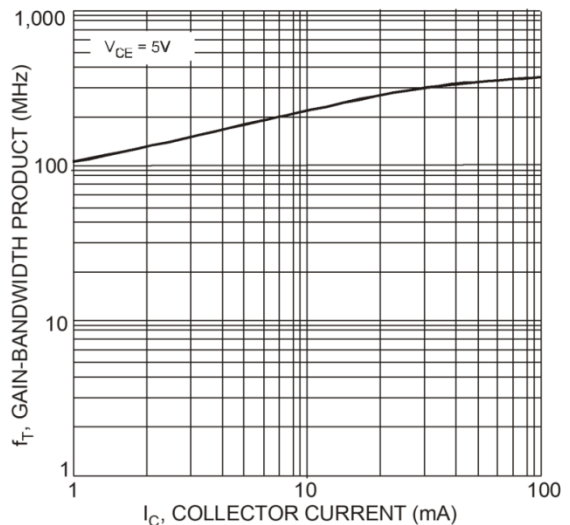
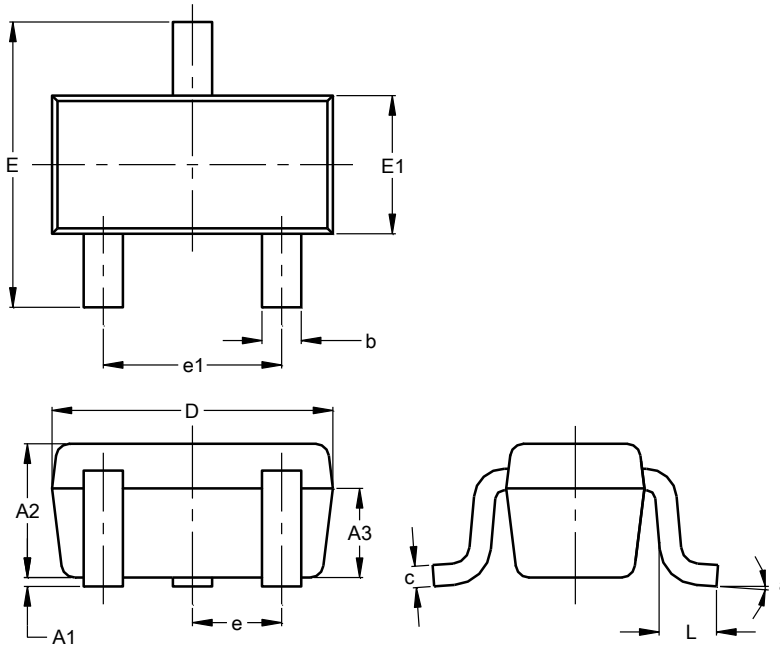


Fig. 7 Typical Gain-Bandwidth Product vs. Collector Current

**Package Outline Dimensions**

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

**SOT523**

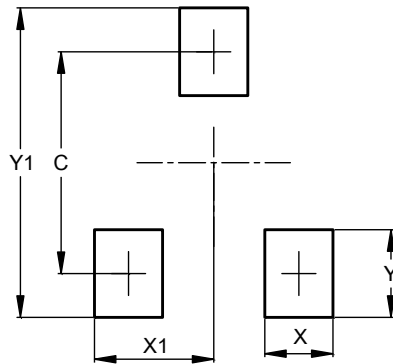


SOT523			
Dim	Min	Max	Typ
A1	0.00	0.10	0.05
A2	0.60	0.80	0.75
A3	0.45	0.65	0.50
b	0.15	0.30	0.22
c	0.10	0.20	0.12
D	1.50	1.70	1.60
E	1.45	1.75	1.60
E1	0.75	0.85	0.80
e	0.50 BSC		
e1	0.90	1.10	1.00
L	0.20	0.40	0.33
a	0°	--	8°
All Dimensions in mm			

**Suggested Pad Layout**

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

**SOT523**



Dimensions	Value (in mm)
C	1.29
X	0.40
X1	0.70
Y	0.51
Y1	1.80

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