

MMBT4401-7 Datasheet



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DiGi Electronics Part Number	MMBT4401-7-DG
Manufacturer	Diodes Incorporated
Manufacturer Product Number	MMBT4401-7
Description	TRANS NPN 40V 0.6A SOT23-3
Detailed Description	Bipolar (BJT) Transistor NPN 40 V 600 mA 250MHz 300 mW Surface Mount SOT-23-3



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Purchase and inquiry

Manufacturer Product Number:

MMBT4401-7

Series:

-

Transistor Type:

NPN

Voltage - Collector Emitter Breakdown (Max):

40 V

Current - Collector Cutoff (Max):

100nA

Power - Max:

300 mW

Operating Temperature:

-55°C ~ 150°C (TJ)

Qualification:

AEC-Q101

Package / Case:

TO-236-3, SC-59, SOT-23-3

Base Product Number:

MMBT4401

Manufacturer:

Diodes Incorporated

Product Status:

Discontinued at Digi-Key

Current - Collector (Ic) (Max):

600 mA

Vce Saturation (Max) @ Ib, Ic:

750mV @ 50mA, 500mA

DC Current Gain (hFE) (Min) @ Ic, Vce:

100 @ 150mA, 1V

Frequency - Transition:

250MHz

Grade:

Automotive

Mounting Type:

Surface Mount

Supplier Device Package:

SOT-23-3

Environmental & Export classification

RoHS Status:

RoHS non-compliant

REACH Status:

REACH Unaffected

HTSUS:

8541.21.0075

Moisture Sensitivity Level (MSL):

1 (Unlimited)

ECCN:

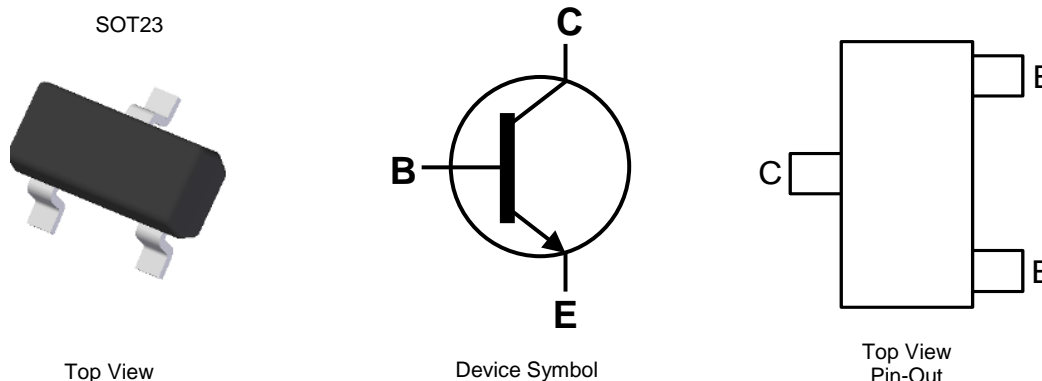
EAR99

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)

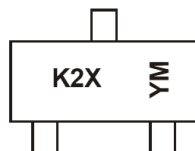


Ordering Information (Note 4)

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



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Absolute Maximum Ratings (@ T_A = +25°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}	6.0	V
Collector Current	I _C	600	mA
Peak Collector Current	I _{CM}	1	A
Peak Base Current	I _{BM}	200	mA

Thermal Characteristics (@ T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Power Dissipation	P _D	(Note 5)	310
		(Note 6)	350
Thermal Resistance, Junction to Ambient	R _{θJA}	(Note 5)	403
		(Note 6)	357
Thermal Resistance, Junction to Leads	R _{θJL}	350	°C/W
Thermal Resistance, Junction to Case	R _{θJC}	120	°C/W
Operating and Storage Temperature Range	T _J , T _{STG}	-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

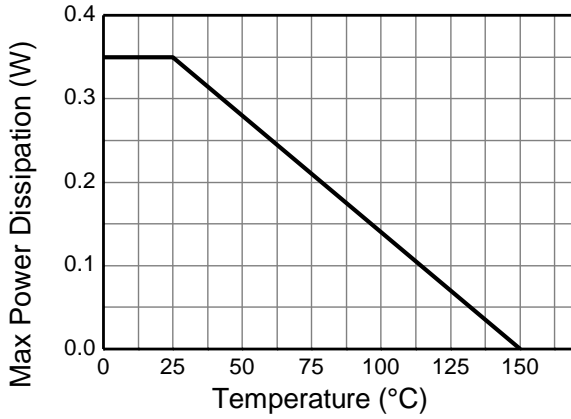


Figure 1. Derating Curve

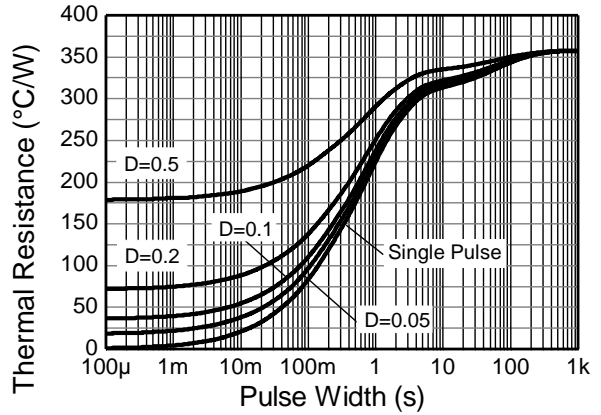


Figure 2. Transient Thermal Impedance

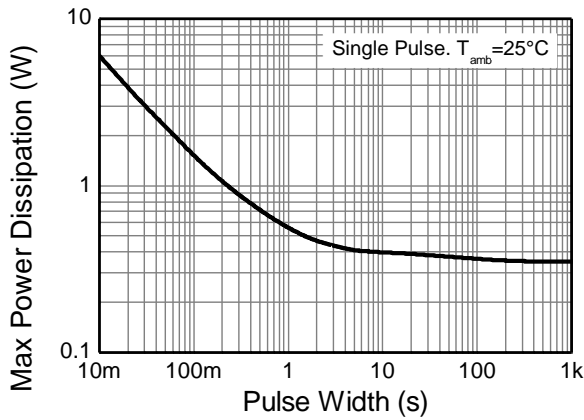


Figure 3. Pulse Power Dissipation

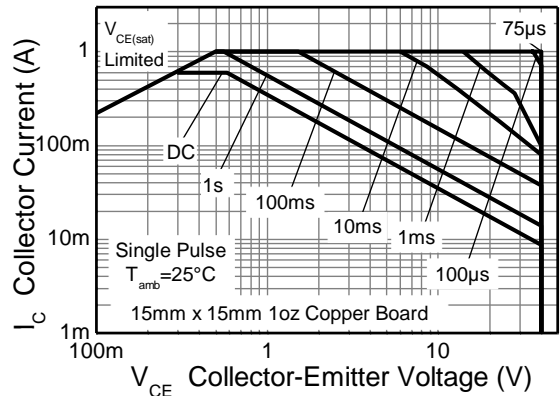


Figure 4. Safe Operating Area



MMBT4401

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

Characteristic	Symbol	Min	Max	Unit	Test Condition	
OFF CHARACTERISTICS						
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	$V_{CE} = 35\text{V}$, $V_{EB(off)} = 0.4\text{V}$	
ON CHARACTERISTICS (Note 9)						
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	$I_C = 150\text{mA}$, $I_B = 15\text{mA}$ $I_C = 500\text{mA}$, $I_B = 50\text{mA}$	
SMALL SIGNAL CHARACTERISTICS						
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 Ω	$V_{CE} = 10\text{V}$, $I_C = 1\text{mA}$, $f = 1\text{kHz}$	
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	μS		
Current Gain-Bandwidth Product	f_T	250	—	MHz		$V_{CE} = 10\text{V}$, $I_C = 20\text{mA}$, $f = 100\text{MHz}$
SWITCHING CHARACTERISTICS						
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 $\leq 2\%$.



MMBT4401

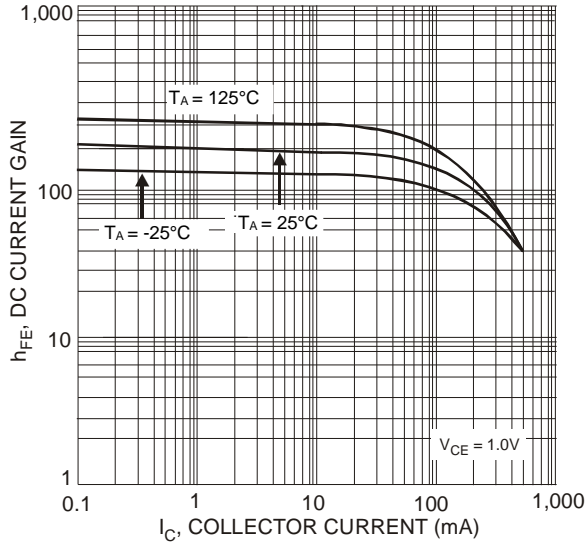


Figure 5 Typical DC Current Gain vs. Collector Current

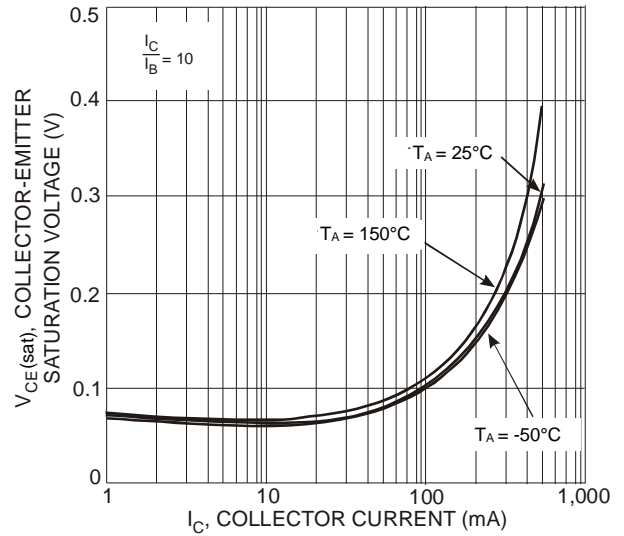


Figure 6 Collector-Emitter Saturation Voltage vs. Collector Current

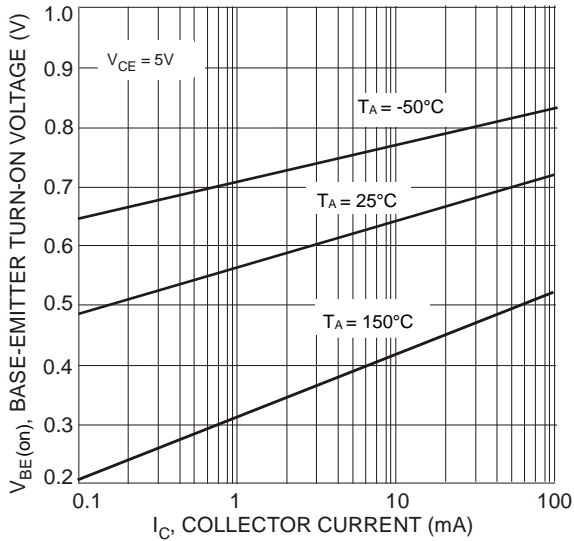


Figure 7 Typical Base-Emitter Turn-On Voltage vs. Collector Current

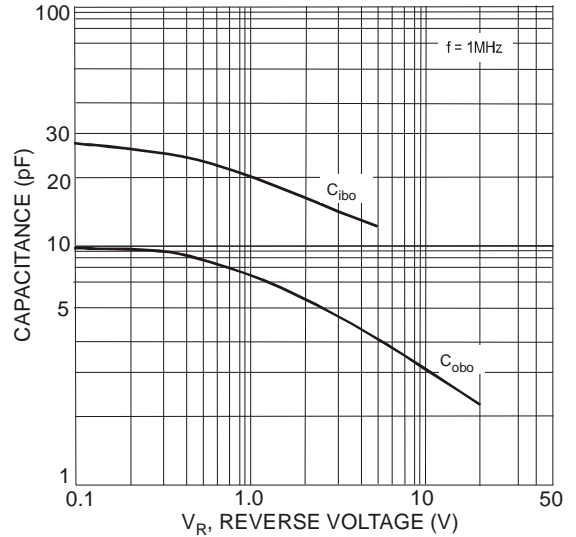


Figure 8 Typical Capacitance Characteristics

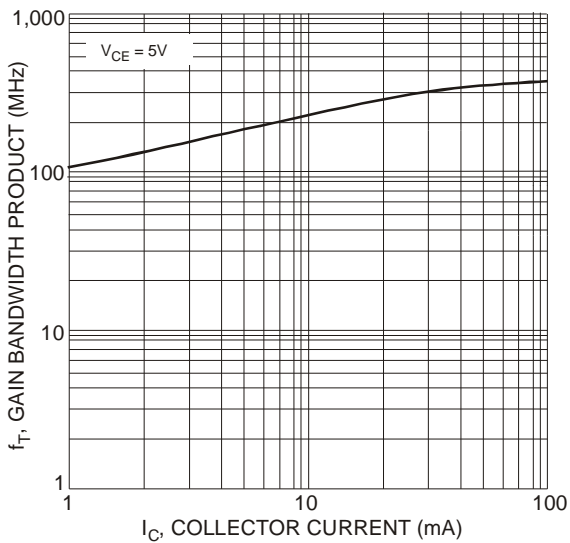


Figure 9 Typical Gain Bandwidth Product vs. Collector Current

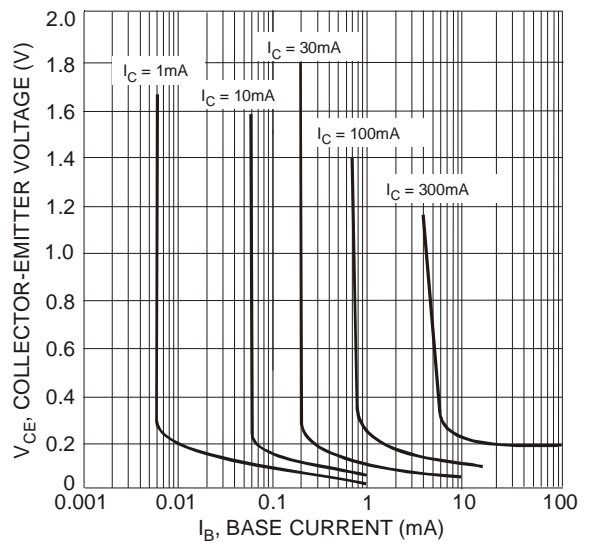
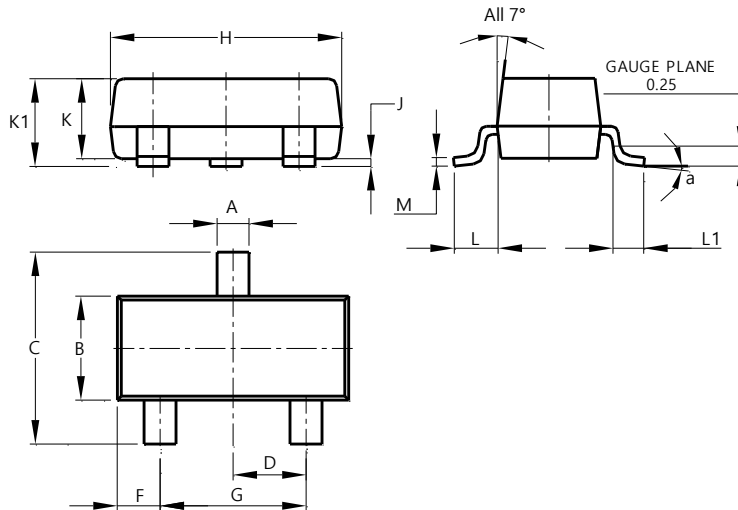


Figure 10 Typical Collector Saturation Region

Package Outline Dimensions

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

SOT23

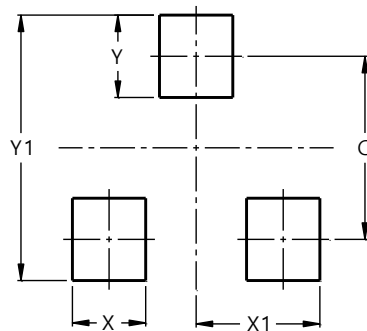


SOT23			
Dim	Min	Max	Typ
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	0°	8°	--
All Dimensions in mm			

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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