



**THE DATASHEET OF  
MMBT2222AQ-7-F**



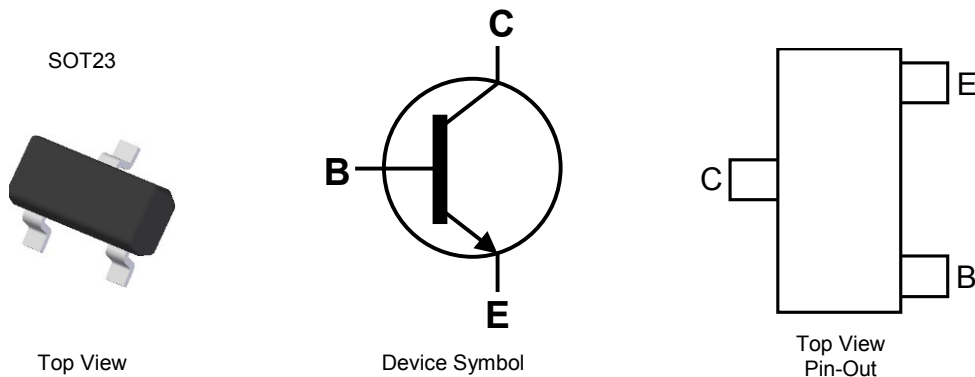
## Features

- Epitaxial Planar Die Construction
- Low Saturation Voltage  $V_{CE(sat)} < 300\text{mV}$  @ 150mA
- Complementary PNP Type: MMBT2907A
- Ideal for Low Power Amplification and Switching
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen- and Antimony-Free. "Green" Device (Note 3)**
- **The MMBT2222AQ-7-F is suitable for automotive applications requiring specific change control; this part is AEC-Q101 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.**

<https://www.diodes.com/quality/product-definitions/>

## Mechanical Data

- Case: SOT23
- Case Material: Molded Plastic, "Green" Molding Compound; UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Matte Tin Finish; Solderable per MIL-STD-202, Method 208 @3
- Weight: 0.008 grams (Approximate)

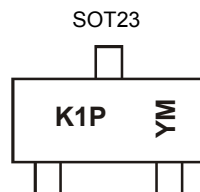


## Ordering Information (Note 4)

Product	Compliance	Marking	Reel Size (inches)	Tape Width (mm)	Quantity per Reel
MMBT2222A-7-F	Standard	K1P	7	8	3,000
MMBT2222A-13-F	Standard	K1P	13	8	10,000
MMBT2222AQ-7-F	Automotive	K1P	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



K1P = Product Type Marking Code  
 YM = Date Code Marking  
 Y or  $\bar{Y}$  = Year (ex: H = 2020)  
 M or  $\bar{M}$  = Month (ex: 9 = September)

### Date Code Key

Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Code	H	I	J	K	L	M	N	O	P	R

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	$V_{CBO}$	75	V
Collector-Emitter Voltage	$V_{CEO}$	40	V
Emitter-Base Voltage	$V_{EBO}$	6.0	V
Collector Current	$I_C$	600	mA
Peak Pulse Collector Current (single pulse)	$I_{CM}$	800	mA
Peak Pulse Base Current	$I_{BM}$	200	mA

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

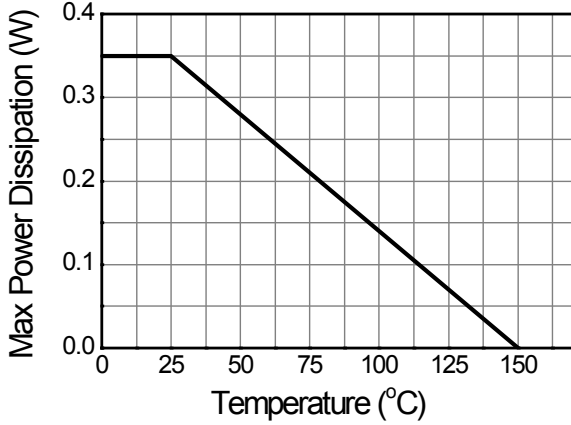
Characteristic	Symbol	Value	Unit
Collector Power Dissipation	$P_D$	(Note 5)	310
		(Note 6)	350
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	(Note 5)	403
		(Note 6)	357
Thermal Resistance, Junction to Leads	$R_{\theta JL}$	350	$^\circ\text{C}/\text{W}$
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$

**ESD Ratings** (Note 8)

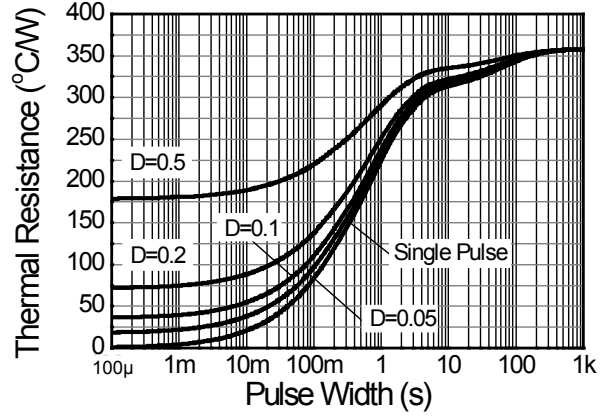
Characteristic	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge - Human Body Model	ESD HBM	4,000	V	3A
Electrostatic Discharge - Machine Model	ESD MM	400	V	C

- Notes:
5. For a device mounted on minimum recommended pad layout 1oz copper that is on a single-sided FR-4 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 15 mm 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 and JESD22-A115.

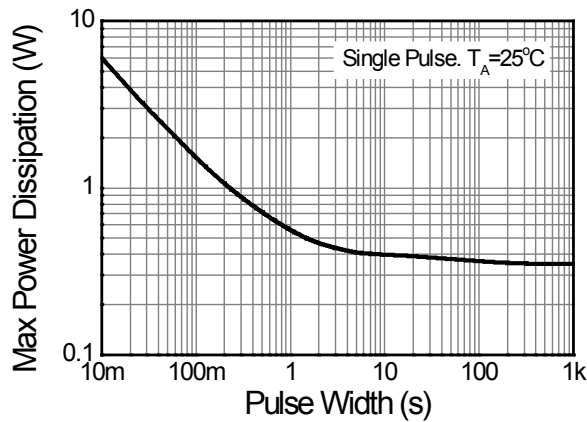
**Thermal Characteristics and Derating Information**



**Derating Curve**



**Transient Thermal Impedance**

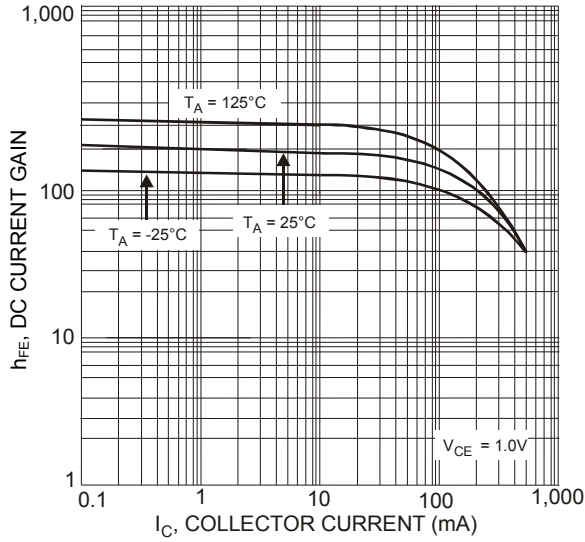


**Pulse Power Dissipation**

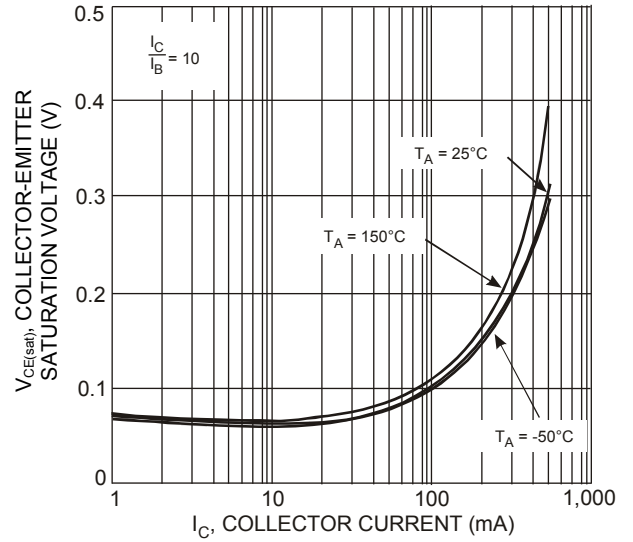
**Electrical Characteristics** (@  $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Min	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b>					
Collector-Base Breakdown Voltage	$BV_{CBO}$	75	—	V	$I_C = 100\mu\text{A}$ , $I_E = 0$
Collector-Emitter Breakdown Voltage (Note 9)	$BV_{CEO}$	40	—	V	$I_C = 10\text{mA}$ , $I_B = 0$
Emitter-Base Breakdown Voltage	$BV_{EBO}$	6.0	—	V	$I_E = 100\mu\text{A}$ , $I_C = 0$
Collector Cut-Off Current	$I_{CBO}$	—	10	nA $\mu\text{A}$	$V_{CB} = 60\text{V}$ , $I_E = 0$ $V_{CB} = 60\text{V}$ , $I_E = 0$ , $T_A = +150^\circ\text{C}$
Collector Cut-Off Current	$I_{CEX}$	—	10	nA	$V_{CE} = 60\text{V}$ , $V_{EB(\text{off})} = 3.0\text{V}$
Collector Cut-Off Current	$I_{CEV}$	—	10	nA	$V_{CE} = 60\text{V}$ , $V_{BE} = \pm 0.25\text{V}$
Emitter Cut-Off Current	$I_{EBO}$	—	10	nA	$V_{EB} = 5.0\text{V}$ , $I_C = 0$
Base Cut-Off Current	$I_{BL}$	—	20	nA	$V_{CE} = 60\text{V}$ , $V_{EB(\text{off})} = 3.0\text{V}$
<b>ON CHARACTERISTICS (Note 9)</b>					
DC Current Gain	$h_{FE}$	35 50 75 100 40 50 35	— — — 300 — — —	—	$I_C = 100\mu\text{A}$ , $V_{CE} = 10\text{V}$ $I_C = 1.0\text{mA}$ , $V_{CE} = 10\text{V}$ $I_C = 10\text{mA}$ , $V_{CE} = 10\text{V}$ $I_C = 150\text{mA}$ , $V_{CE} = 10\text{V}$ $I_C = 500\text{mA}$ , $V_{CE} = 10\text{V}$ $I_C = 10\text{mA}$ , $V_{CE} = 10\text{V}$ , $T_A = -55^\circ\text{C}$ $I_C = 150\text{mA}$ , $V_{CE} = 1.0\text{V}$
Collector-Emitter Saturation Voltage	$V_{CE(\text{sat})}$	—	0.3 1.0	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	$V_{BE(\text{sat})}$	0.6 —	1.2 2.0	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	$C_{obo}$	—	8	pF	$V_{CB} = 10\text{V}$ , $f = 1.0\text{MHz}$ , $I_E = 0$
Input Capacitance	$C_{ibo}$	—	25	pF	$V_{EB} = 0.5\text{V}$ , $f = 1.0\text{MHz}$ , $I_C = 0$
Transition frequency	$f_T$	300	—	MHz	$V_{CE} = 20\text{V}$ , $I_C = 20\text{mA}$ , $f = 100\text{MHz}$
Noise Figure	$N_F$	—	4.0	dB	$V_{CE} = 10\text{V}$ , $I_C = 100\mu\text{A}$ , $R_S = 1.0\text{k}\Omega$ , $f = 1.0\text{kHz}$
<b>SWITCHING CHARACTERISTICS</b>					
Delay Time	$t_d$	—	10	ns	$V_{CC} = 30\text{V}$ , $I_C = 150\text{mA}$ , $V_{BE(\text{off})} = -0.5\text{V}$ , $I_{B1} = 15\text{mA}$
Rise Time	$t_r$	—	25	ns	$V_{CC} = 30\text{V}$ , $I_C = 150\text{mA}$ , $I_{B1} = 15\text{mA}$ , $V_{BE(\text{off})} = 0.5\text{V}$
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	$t_f$	—	60	ns	$V_{CC} = 30\text{V}$ , $I_C = 150\text{mA}$ , $I_{B1} = -I_{B2} = 15\text{mA}$

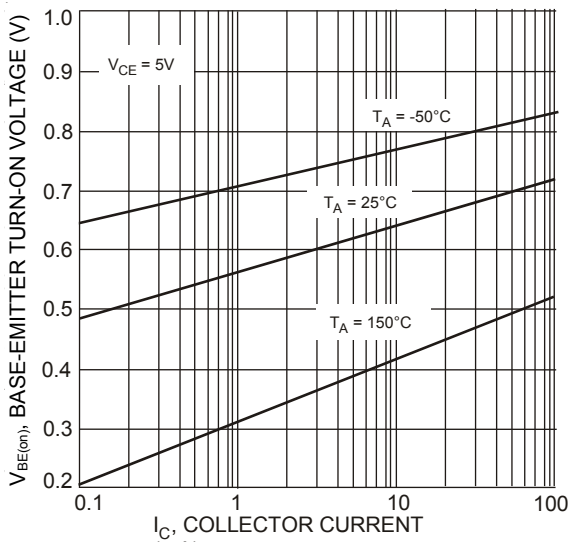
 Note: 9. Measured under pulsed conditions. Pulse width  $\leq 300\mu\text{s}$ . Duty cycle  $\leq 2\%$ .



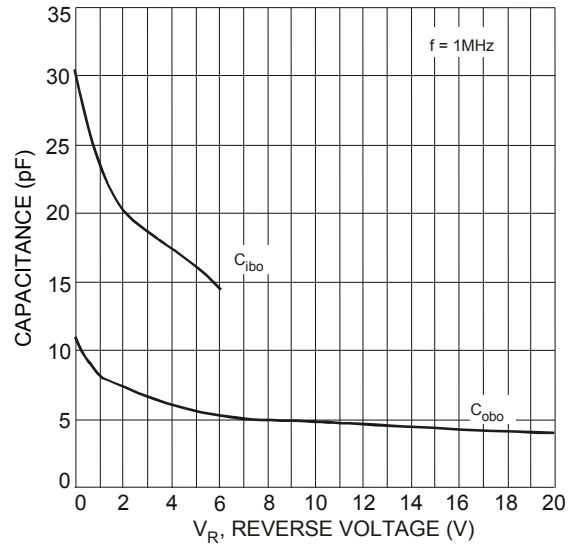
**hFE v IC**



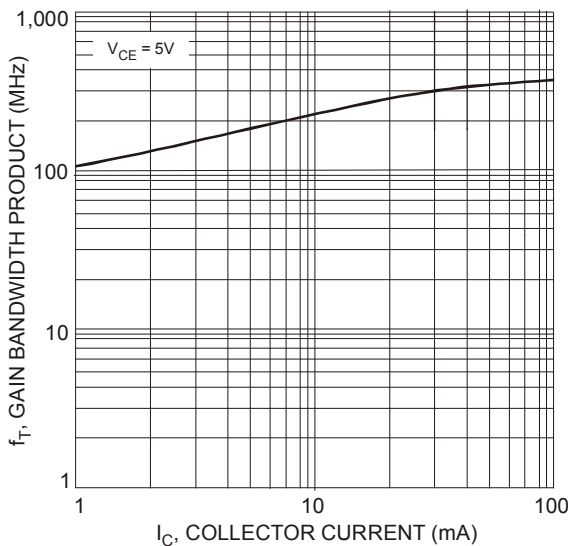
**VCE(sat) v IC**



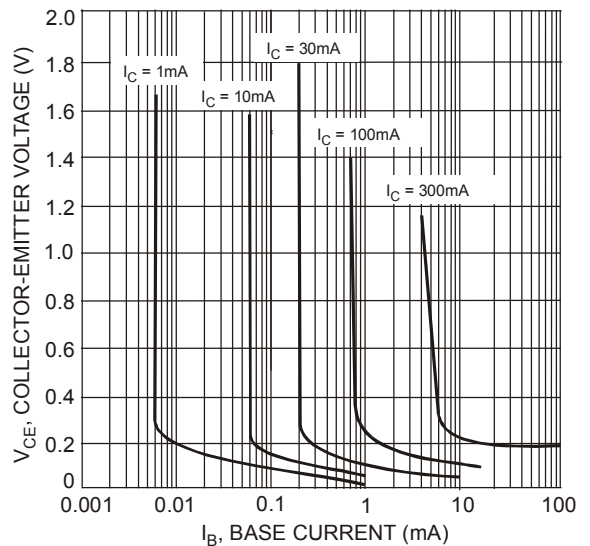
**VBE(on) v IC**



**C v VR**



**fT v IC**

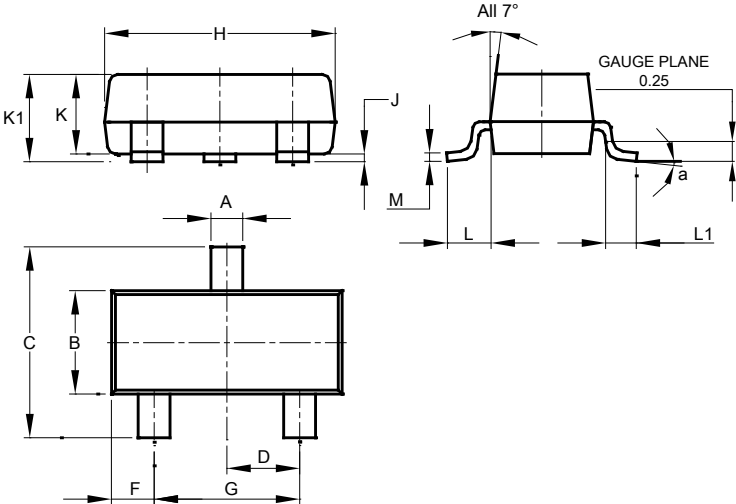


**VCE v IB**

**Package Outline Dimensions**

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

**SOT23**

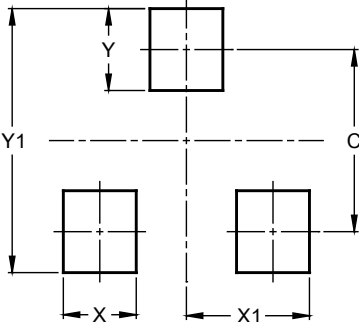


SOT23			
Dim	Min	Max	Typ
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	0°	8°	--
All Dimensions in mm			

**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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