

Features

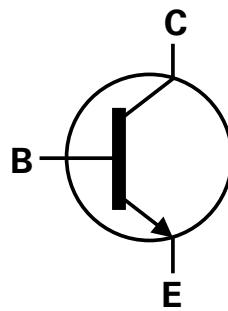
- Complementary PNP Type Available (MMBT3906)
- Ideal for Medium-Power Amplification and Switching
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- Halogen and Antimony Free. "Green" Device (Note 3)
- An automotive-compliant part is available under separate datasheet ([MMBT3904Q](#))

Mechanical Data

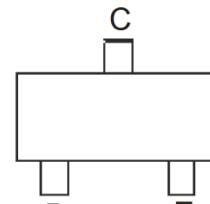
- Package: SOT23
- Package Material: Molded Plastic, "Green" Molding Compound.
- UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads. Solderable per MIL-STD-202, Method 208 (G3)
- Weight: 0.008 grams (Approximate)



Top View



Device Symbol


 Top View
Pinout

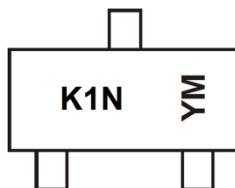
Ordering Information (Note 4)

Orderable Part Number	Package	Marking	Reel Size (inches)	Tape Width (mm)	Packing	
					Qty.	Carrier
MMBT3904-7-F	SOT23	K1N	7	8	3,000	Reel
MMBT3904-13-F	SOT23	K1N	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



K1N = Product Type Marking Code
 YM = Date Code Marking
 Y or \bar{Y} or \underline{Y} = Year (ex: M = 2025)
 M or \bar{M} = Month (ex: 9 = September)

Date Code Key

Year	2003	-	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Code	P	-	M	N	P	R	S	T	U	V	W	X
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	200	mA

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

Characteristic	Symbol	Value	Unit
Power Dissipation	P_D	310	mW
(Note 6)		350	
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	403	°C/W
(Note 5)		357	
Thermal Resistance, Junction to Leads	$R_{\theta JL}$	350	°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

- 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 and JESD22-A115.

Thermal Characteristics and Derating Information

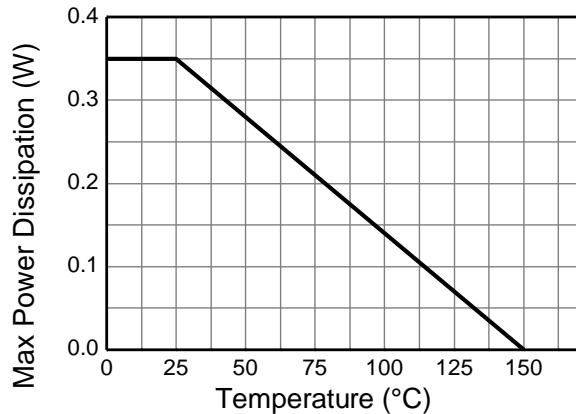


Figure 1. Derating Curve

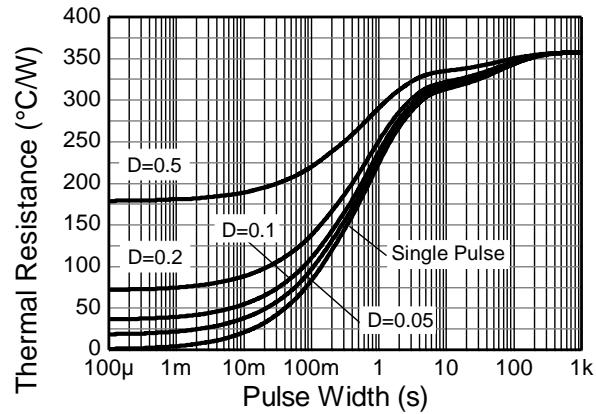


Figure 2. Transient Thermal Impedance

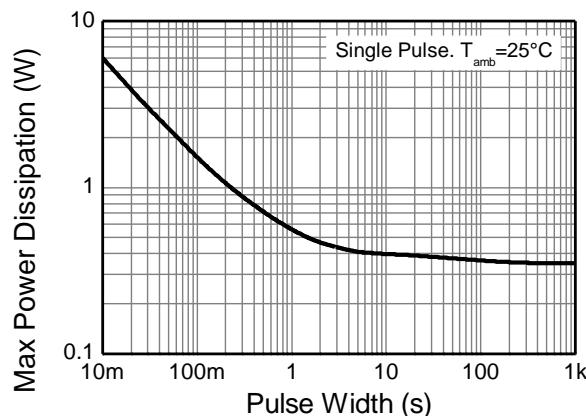


Figure 3. Pulse Power Dissipation

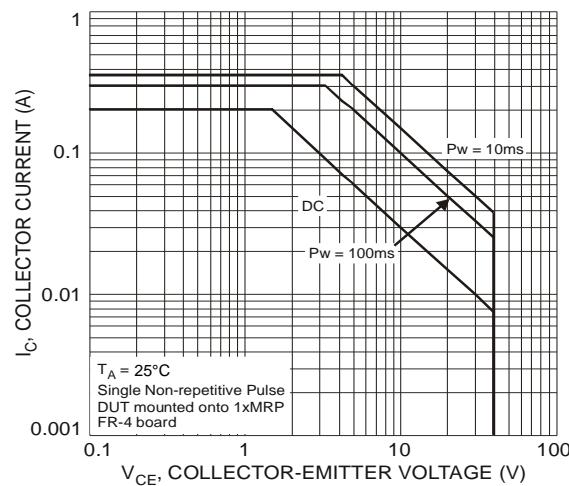


Figure 4. Typical Collector Current vs.
Collector-Emitter Voltage

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	$I_C = 10\mu\text{A}, I_E = 0$
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	$I_E = 10\mu\text{A}, I_C = 0$
Collector Cutoff Current	I_{CEX}	—	50	nA	$V_{\text{CE}} = 30\text{V}, V_{\text{EB}(\text{off})} = 3.0\text{V}$
Base Cutoff Current	I_{BL}	—	50	nA	$V_{\text{CE}} = 30\text{V}, V_{\text{EB}(\text{off})} = 3.0\text{V}$
Emitter Base Cutoff Current	I_{EBO}	—	50	nA	$V_{\text{EB}} = 6\text{V}$
Collector-Base Cutoff Current	I_{CBO}	—	50	nA	$V_{\text{CB}} = 48\text{V}$
ON CHARACTERISTICS (Note 9)					
DC Current Gain	h_{FE}	40	—	—	$I_C = 100\mu\text{A}, V_{\text{CE}} = 1.0\text{V}$
		70	—	—	$I_C = 1.0\text{mA}, V_{\text{CE}} = 1.0\text{V}$
		100	300	—	$I_C = 10\text{mA}, V_{\text{CE}} = 1.0\text{V}$
		60	—	—	$I_C = 50\text{mA}, V_{\text{CE}} = 1.0\text{V}$
		30	—	—	$I_C = 100\text{mA}, V_{\text{CE}} = 1.0\text{V}$
Collector-Emitter Saturation Voltage	$V_{\text{CE}(\text{sat})}$	—	0.20	V	$I_C = 10\text{mA}, I_B = 1.0\text{mA}$
		—	0.30	V	$I_C = 50\text{mA}, I_B = 5.0\text{mA}$
Base-Emitter Saturation Voltage	$V_{\text{BE}(\text{sat})}$	0.65	0.85	V	$I_C = 10\text{mA}, I_B = 1.0\text{mA}$
		—	0.95	V	$I_C = 50\text{mA}, I_B = 5.0\text{mA}$
SMALL-SIGNAL CHARACTERISTICS					
Output Capacitance	C_{obo}	—	4.0	pF	$V_{\text{CB}} = 5.0\text{V}, f = 1.0\text{MHz}, I_C = 0$
Input Capacitance	C_{ibo}	—	8.0	pF	$V_{\text{EB}} = 0.5\text{V}, f = 1.0\text{MHz}, I_C = 0$
Input Impedance	h_{IE}	1.0	10	k Ω	
Voltage Feedback Ratio	h_{RE}	0.5	8.0	$\times 10^{-4}$	$V_{\text{CE}} = 10\text{V}, I_C = 1.0\text{mA}$ $f = 1.0\text{k}\text{Hz}$
Small-Signal Current Gain	h_{FE}	100	400	—	
Output Admittance	h_{OE}	1.0	40	μS	
Current Gain-Bandwidth Product	f_T	300	—	MHz	$V_{\text{CE}} = 20\text{V}, I_C = 10\text{mA}$ $f = 100\text{MHz}$
Noise Figure	NF	—	5.0	dB	$V_{\text{CE}} = 5.0\text{V}, I_C = 100\mu\text{A}$ $R_S = 1.0\text{k}\Omega, f = 1.0\text{k}\text{Hz}$
SWITCHING CHARACTERISTICS					
Delay Time	t_d	—	35	ns	$V_{\text{CC}} = 3.0\text{V}, I_C = 10\text{mA}$
Rise Time	t_r	—	35	ns	$V_{\text{BE}(\text{off})} = -0.5\text{V}, I_{B1} = 1.0\text{mA}$
Storage Time	t_s	—	200	ns	$V_{\text{CC}} = 3.0\text{V}, I_C = 10\text{mA}$
Fall Time	t_f	—	50	ns	$I_{B1} = I_{B2} = 1.0\text{mA}$

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

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

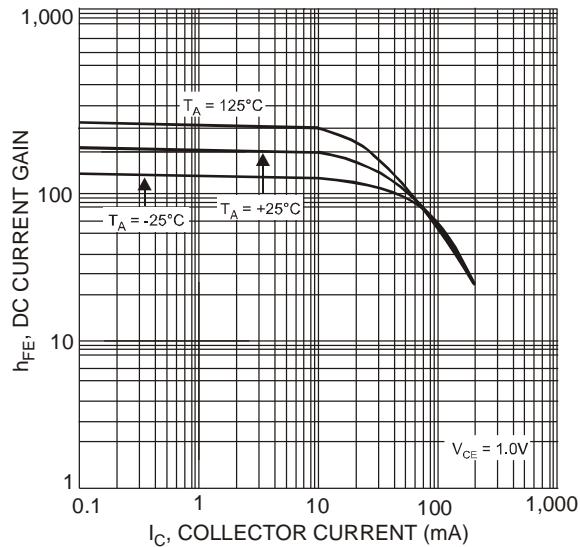


Figure 5. Typical DC Current Gain vs. Collector Current

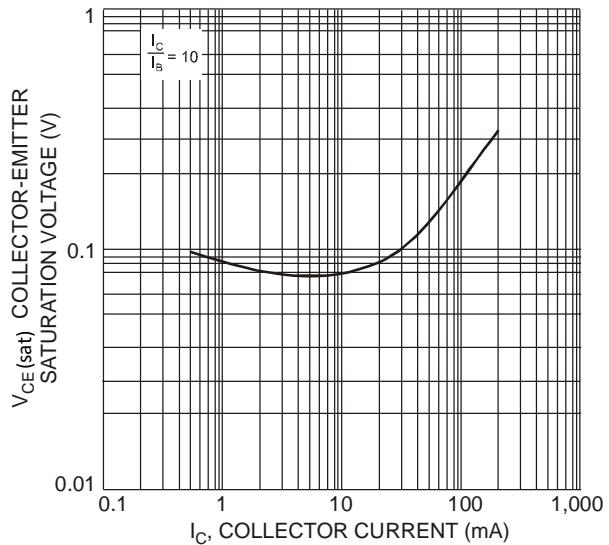


Figure 6. Typical Collector-Emitter Saturation Voltage vs. Collector Current

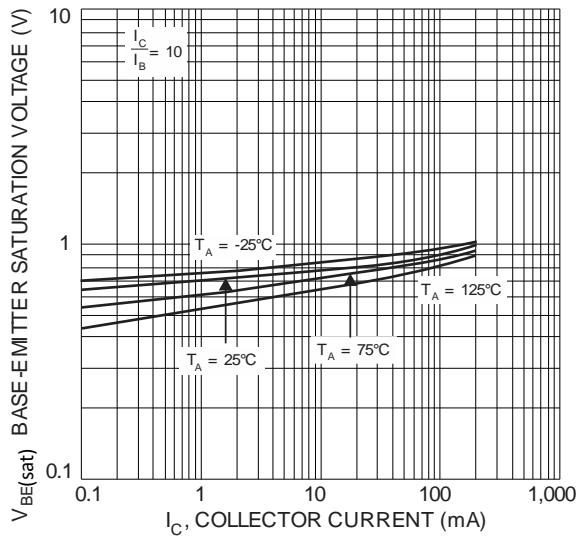


Figure 7. Typical Base-Emitter Saturation Voltage vs. Collector Current

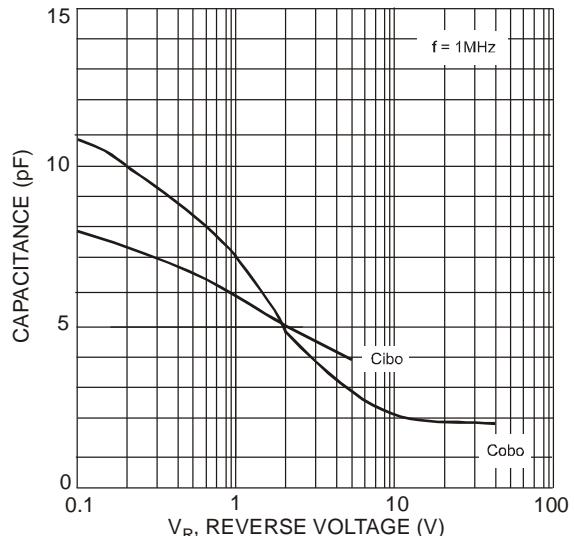
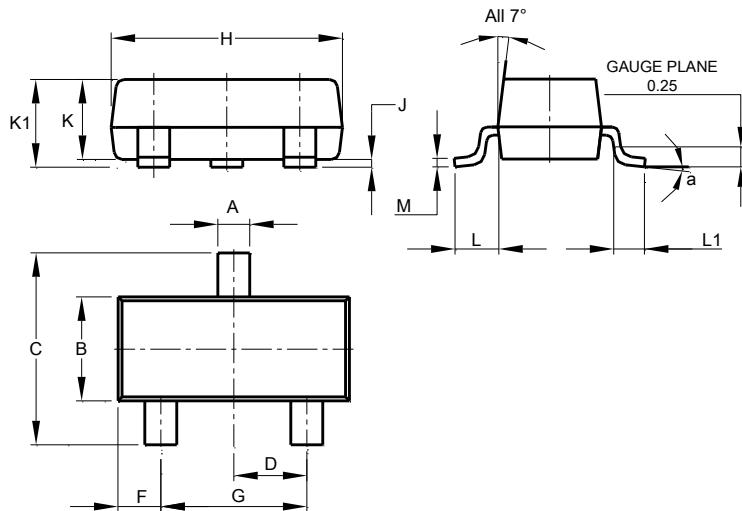


Figure 8. Typical Capacitance Characteristics

Package Outline Dimensions

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

SOT23



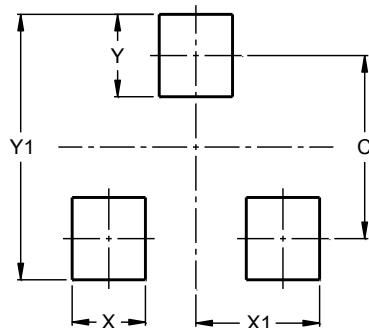
SOT23			
Dim	Min	Max	Typ
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	0°	8°	--

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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