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## Features

- $BV_{CEO} > -40V$
- $I_c = -200mA$  Collector Current
- Epitaxial Planar Die Construction
- Ultra-Small Surface Mount Package
- Complementary NPN Type: MMBT3904T
- **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**

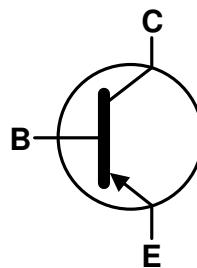
## Mechanical Data

- Case: SOT523
- Case Material: Molded Plastic. "Green" Molding Compound.
- UL Flammability 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)

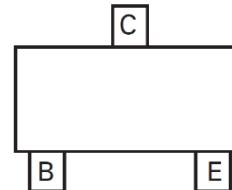
SOT523



Top View



Device Symbol



Pin-out Top View

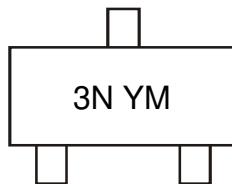
## Ordering Information (Note 4)

Product	Status	Compliance	Marking	Reel Size (inches)	Tape Width (mm)	Quantity per Reel
MMBT3906T-7-F	Active	AEC-Q101	3N	7	8	3,000
MMBT3906T-13-F	Active	AEC-Q101	3N	13	8	10,000

Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) 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 <http://www.diodes.com/products/packages.html>.

## Marking Information



3N = Product Type Marking Code

YM = Date Code Marking

Y or  $\bar{Y}$  = Year (ex: D = 2016)

M or  $\bar{M}$  = Month (ex: 9 = September)

### Date Code Key

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
Code	C	D	E	F	G	H	I	J	K	L	M	
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	$V_{CBO}$	-40	V
Collector-Emitter Voltage	$V_{CEO}$	-40	V
Emitter-Base Voltage	$V_{EBO}$	-5	V
Collector Current	$I_C$	-200	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)	$R_{JJA}$	833	°C/W
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	°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: 5. 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.  
 6. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

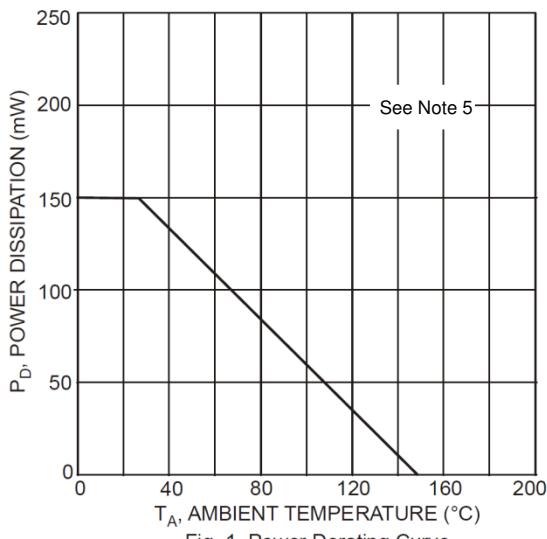
**Thermal Characteristics and Derating Information**


Fig. 1 Power Derating Curve

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

Characteristic	Symbol	Min	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 7)</b>					
Collector-Base Breakdown Voltage	$\text{BV}_{\text{CBO}}$	-40	—	V	$I_C = -10\mu\text{A}, I_E = 0$
Collector-Emitter Breakdown Voltage	$\text{BV}_{\text{CEO}}$	-40	—	V	$I_C = -1\text{mA}, I_B = 0$
Emitter-Base Breakdown Voltage	$\text{BV}_{\text{EBO}}$	-5	—	V	$I_E = -10\mu\text{A}, I_C = 0$
Collector Cutoff Current	$I_{\text{CEX}}$	—	-50	nA	$V_{\text{CE}} = -30\text{V}, V_{\text{EB(OFF)}} = -3\text{V}$
Base Cutoff Current	$I_{\text{BL}}$	—	-50	nA	$V_{\text{CE}} = -30\text{V}, V_{\text{EB(OFF)}} = -3\text{V}$
<b>ON CHARACTERISTICS (Note 7)</b>					
DC Current Gain	$h_{\text{FE}}$	60	—		$I_C = -100\mu\text{A}, V_{\text{CE}} = -1\text{V}$
		80	—		$I_C = -1\text{mA}, V_{\text{CE}} = -1\text{V}$
		100	300	—	$I_C = -10\text{mA}, V_{\text{CE}} = -1\text{V}$
		60	—		$I_C = -50\text{mA}, V_{\text{CE}} = -1\text{V}$
		30	—		$I_C = -100\text{mA}, V_{\text{CE}} = -1\text{V}$
Collector-Emitter Saturation Voltage	$V_{\text{CE}(\text{SAT})}$	—	-0.25 -0.40	V	$I_C = -10\text{mA}, I_B = -1\text{mA}$ $I_C = -50\text{mA}, I_B = -5\text{mA}$
Base-Emitter Saturation Voltage	$V_{\text{BE}(\text{SAT})}$	-0.65 —	-0.85 -0.95	V	$I_C = -10\text{mA}, I_B = -1\text{mA}$ $I_C = -50\text{mA}, I_B = -5\text{mA}$
<b>SMALL SIGNAL CHARACTERISTICS</b>					
Output Capacitance	$C_{\text{obo}}$	—	4.5	pF	$V_{\text{CB}} = -5\text{V}, f = 1.0\text{MHz}, I_E = 0$
Input Capacitance	$C_{\text{ibo}}$	—	10	pF	$V_{\text{EB}} = -0.5\text{V}, f = 1.0\text{MHz}, I_C = 0$
Input Impedance	$h_{\text{ie}}$	2	12	k $\Omega$	
Voltage Feedback Ratio	$h_{\text{re}}$	0.1	10	$\times 10^{-4}$	$V_{\text{CE}} = -10\text{V}, I_C = -10\text{mA}, f = 1.0\text{MHz}$
Small Signal Current Gain	$h_{\text{fe}}$	100	400	—	
Output Admittance	$h_{\text{oe}}$	3	60	$\mu\text{S}$	
Current Gain-Bandwidth Product	$f_T$	250	—	MHz	$V_{\text{CE}} = -20\text{V}, I_C = -10\text{mA}, f = 100\text{MHz}$
Noise Figure	NF	—	5	dB	$V_{\text{CC}} = 5\text{V}, I_C = 100\mu\text{A}, R_S = 1\text{k}\Omega, f = 1\text{MHz}$
<b>SWITCHING CHARACTERISTICS</b>					
Delay Time	$t_D$	—	35	ns	$V_{\text{CC}} = -3\text{V}, I_C = -10\text{mA},$
Rise Time	$t_R$	—	35	ns	$V_{\text{BE(OFF)}} = -0.5\text{V}, I_{B1} = -1\text{mA}$
Storage Time	$t_S$	—	225	ns	$V_{\text{CC}} = -3.0\text{V}, I_C = -10\text{mA}$
Fall Time	$t_F$	—	75	ns	$I_{B1} = -I_{B2} = -1.0\text{mA}$

Note: 7. 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.)

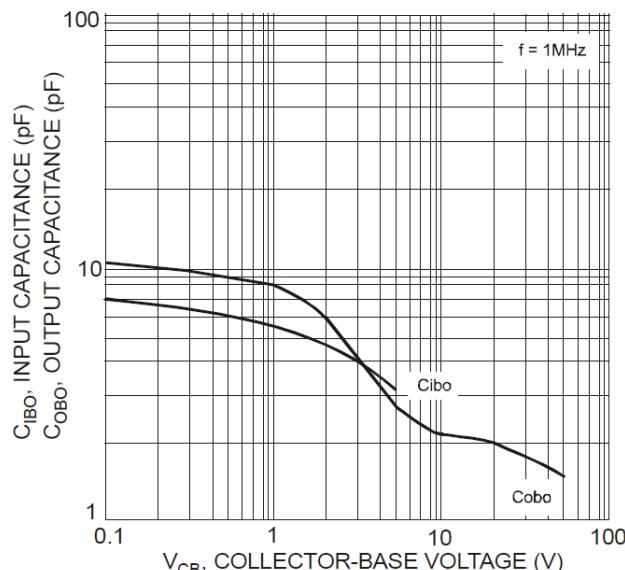


Fig. 2 Typical Input and Output Capacitance vs.  
Collector-Base Voltage

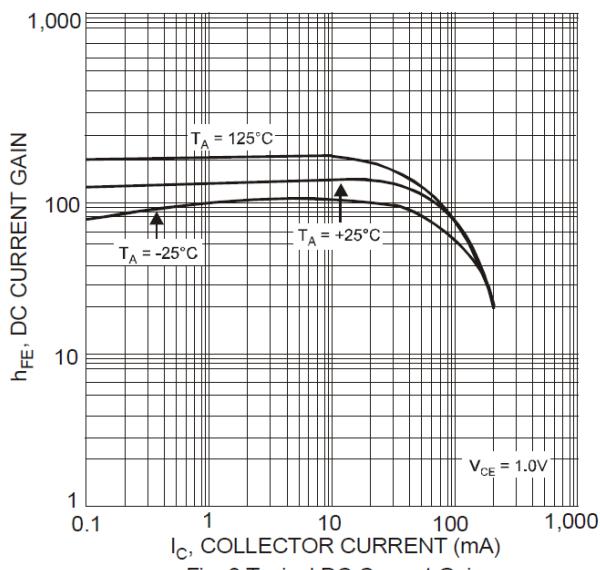


Fig. 3 Typical DC Current Gain  
vs. Collector Current

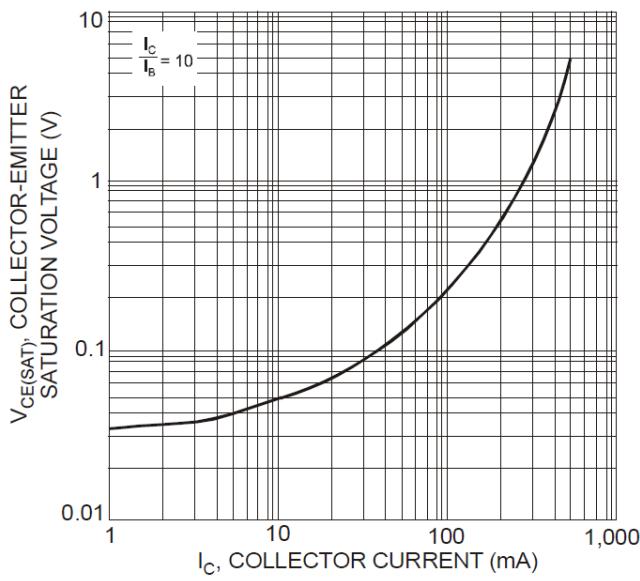


Fig. 4 Typical Collector-Emitter Saturation Voltage  
vs. Collector Current

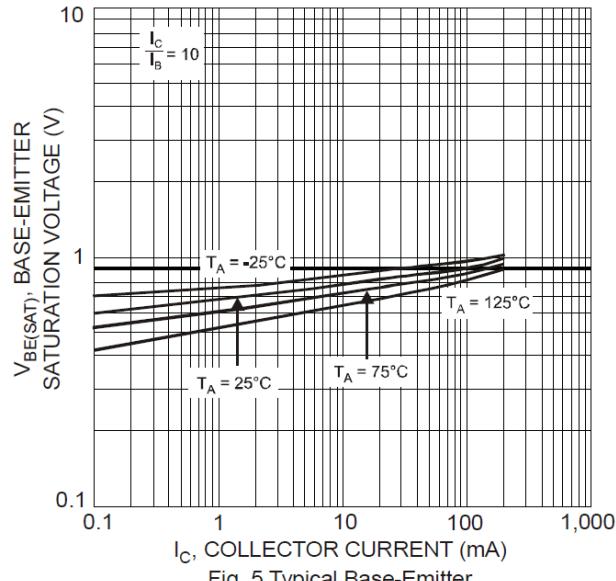
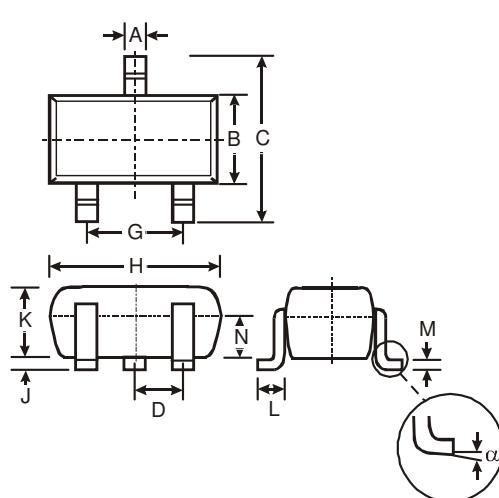


Fig. 5 Typical Base-Emitter  
Saturation Voltage vs. Collector Current

## Package Outline Dimensions

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

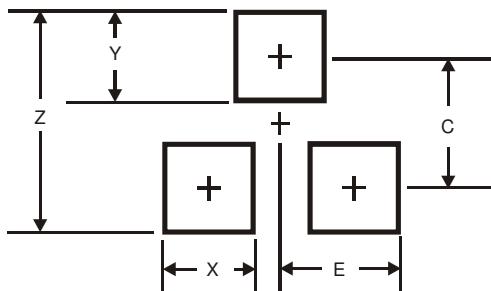


SOT523			
Dim	Min	Max	Typ
<b>A</b>	0.15	0.30	0.22
<b>B</b>	0.75	0.85	0.80
<b>C</b>	1.45	1.75	1.60
<b>D</b>	—	—	0.50
<b>G</b>	0.90	1.10	1.00
<b>H</b>	1.50	1.70	1.60
<b>J</b>	0.00	0.10	0.05
<b>K</b>	0.60	0.80	0.75
<b>L</b>	0.10	0.30	0.22
<b>M</b>	0.10	0.20	0.12
<b>N</b>	0.45	0.65	0.50
$\alpha$	0°	8°	—

All Dimensions in mm

## Suggested Pad Layout

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



Dimensions	Value (in mm)
<b>Z</b>	1.8
<b>X</b>	0.4
<b>Y</b>	0.51
<b>C</b>	1.3
<b>E</b>	0.7

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