

#### 40V PNP SMALL SIGNAL TRANSISTOR IN SOT23

#### **Features**

- Epitaxial Planar Die Construction
- Ideal for Medium Power Amplification and Switching
- Complementary NPN Type: MMBT3904
- 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
- PPAP Capable (Note 4)

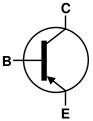
#### **Mechanical Data**

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

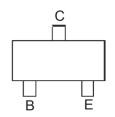








Device Symbol



Top View Pin-Out

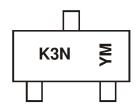
#### Ordering Information (Notes 4 & 5)

Product	Status	Compliance	Marking	Reel Size (inches)	Tape Width (mm)	Quantity per Reel
MMBT3906-7-F	Active	AEC-Q101	K3N	7	8	3000
MMBT3906Q-7-F	Active	Automotive	K3N	7	8	3000
MMBT3906Q-13-F	Active	Automotive	K3N	13	8	10,000
MMBT3906-13-F	Active	AEC-Q101	K3N	13	8	10,000

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. Automotive products are AEC-Q101 qualified and are PPAP capable. Refer to https://www.diodes.com/quality/.
- 5. For packaging details, go to our website at http://www.diodes.com/products/packages.html.

#### **Marking Information**



K3N = Product Type Marking Code YM = Date Code Marking

Y or  $\overline{Y}$  = Year (ex: E= 2017)

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

Date Code Kev

Year	2015	20	016	2017	2	018	2019		2020	2021		2022
Code	С		D	Е		F	G		Н			J
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Code	1	2	3	4	5	6	7	8	9	0	N	D



### **Absolute Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	V <sub>CBO</sub>	-40	V
Collector-Emitter Voltage	V <sub>CEO</sub>	-40	V
Emitter-Base Voltage	V <sub>EBO</sub>	-6.0	V
Collector Current	Ic	-200	mA
Peak Collector Current	I <sub>CM</sub>	-200	mA
Peak Base Current	I <sub>BM</sub>	-100	mA

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

Characteristic		Symbol	Value	Unit	
Power Dissipation	(Note 6)	В	310	mW	
Power Dissipation	(Note 7)	$P_{D}$	350	IIIVV	
Thermal Desistance Junction to Ambient	(Note 6)		403		
Thermal Resistance, Junction to Ambient	(Note 7)	$R_{\Theta JA}$	357	°C/W	
Thermal Resistance, Junction to Leads (Note 8)		R <sub>ÐJL</sub>	350	°C/W	
Operating and Storage Temperature Range	$T_{J}$ , $T_{STG}$	-55 to +150	°C		

## ESD Ratings (Note 9)

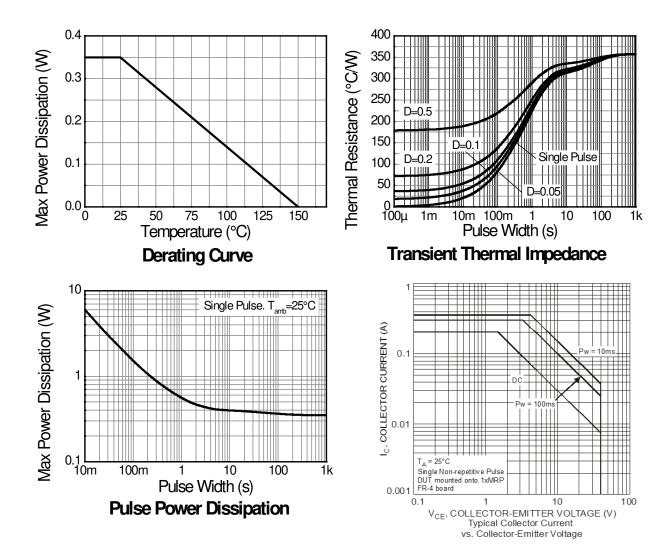
Characteristic	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge—Human Body Model	ESD HBM	4000	V	3A
Electrostatic Discharge—Machine Model	ESD MM	400	V	С

Notes:

- 6. For a device mounted on minimum recommended pad layout 1oz copper that is on a single-sided FR4 PCB; the device is measured under still air conditions while operating in a steady-state.
- 7. Same as Note 6 except the device is mounted on 15 mm × 15mm 1oz copper.
- 8. Thermal resistance from junction to solder-point (at the end of the leads).
- 9. Refer to JEDEC specification JESD22-A114 and JESD22-A115.



### **Thermal Characteristics and Derating Information**





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

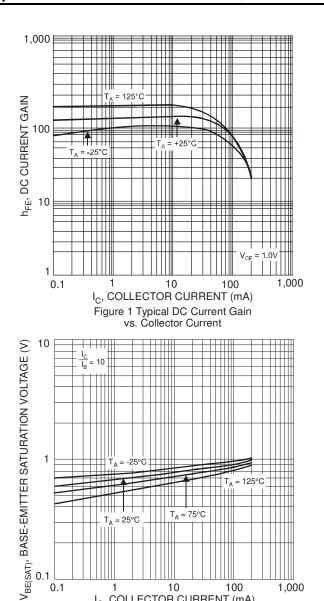
Characteristic	Symbol	Min	Max	Unit	Test Condition
OFF CHARACTERISTICS					
Collector-Base Breakdown Voltage	$BV_{CBO}$	-40	_	V	$I_C = -100\mu A, I_E = 0$
Collector-Emitter Breakdown Voltage (Note 10)	BV <sub>CEO</sub>	-40	_	V	$I_C = -10 \text{mA}, I_B = 0$
Emitter-Base Breakdown Voltage	$BV_{EBO}$	-6.0	_	V	$I_E = -100\mu A, I_C = 0$
Collector Cutoff Current	I <sub>CEV</sub>		-50	nA	$V_{CE} = -30V, V_{BE} = 3.0V$
Concetor Outon Current	ICEV		-50	nA	$V_{CE} = -30V, V_{BE} = -0.25V$
Emitter-Base Cutoff Current	$I_{EBO}$	_	-50	nA	$V_{EB} = -5V$
ON CHARACTERISTICS (Note 10)	· · · · · · · · · · · · · · · · · · ·		ı	ı	
		60	_		$I_C = -100 \mu A, V_{CE} = -1.0 V$
		80			$I_C = -1.0 \text{mA}, V_{CE} = -1.0 \text{V}$
DC Current Gain	$h_{FE}$	100	300	_	$I_C = -10mA, V_{CE} = -1.0V$
		60	_		$I_C = -50 \text{mA}, V_{CE} = -1.0 \text{V}$
		30	_		$I_C = -100 \text{mA}, V_{CE} = -1.0 \text{V}$
Collector-Emitter Saturation Voltage	Vo=(		-0.25	V	$I_C = -10mA$ , $I_B = -1.0mA$
Concetor Emitter Cataration Voltage	V <sub>CE(sat)</sub>		-0.40		$I_C = -50mA$ , $I_B = -5.0mA$
Base-Emitter Saturation Voltage	V <sub>BE(sat)</sub>	-0.65	-0.85	V	$I_C = -10mA$ , $I_B = -1.0mA$
ŭ	V BE(sat)		-0.95	•	$I_C = -50 \text{mA}, I_B = -5.0 \text{mA}$
SMALL SIGNAL CHARACTERISTICS	1		ı	ı	
Output Capacitance	$C_{obo}$	_	4.5	pF	$V_{CB} = -5.0V$ , $f = 1.0MHz$ , $I_E = 0$
Input Capacitance	Cibo	_	10	pF	$V_{EB} = -0.5V$ , $f = 1.0MHz$ , $I_{C} = 0$
Input Impedance	h <sub>ie</sub>	2.0	12	kΩ	
Voltage Feedback Ratio	h <sub>re</sub>	0.1	10	× 10 <sup>-4</sup>	$V_{CE} = 10V, I_{C} = 1.0mA,$
Small Signal Current Gain	h <sub>fe</sub>	100	400	_	f = 1.0kHz
Output Admittance	h <sub>oe</sub>	3.0	60	μS	
Current Gain-Bandwidth Product	f <sub>T</sub>	250	_	MHz	$V_{CE} = -20V$ , $I_{C} = -10mA$ , $f = 100MHz$
Noise Figure	NF	_	4.0	dB	$V_{CE} = -5.0V$ , $I_{C} = -100\mu A$ , $R_{S} = 1.0k\Omega$ , $f = 1.0kHz$
SWITCHING CHARACTERISTICS	l I		I.	II.	
Delay Time	t <sub>d</sub>	_	35	ns	V <sub>CC</sub> = -3.0V, I <sub>C</sub> = -10mA,
Rise Time	t <sub>r</sub>	_	35	ns	$V_{BE(off)} = 0.5V, I_{B1} = -1.0mA$
Storage Time	ts	_	225	ns	V <sub>CC</sub> = -3.0V, I <sub>C</sub> = -10mA,
Fall Time	t <sub>f</sub>	_	75	ns	$I_{B1} = I_{B2} = -1.0 \text{mA}$

Note:

10. Measured under pulsed conditions. Pulse width  $\leq$  300 $\mu$ s. Duty cycle  $\leq$  2%.



### Typical Electrical Characteristics (@TA = +25°C, unless otherwise specified.)



 $_{\rm C}$ , COLLECTOR CURRENT (mA)

Figure 3 Typical Base-Emitter Saturation Voltage vs. Collector Current

0.1

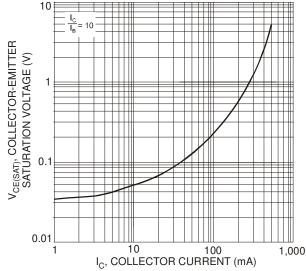


Figure 2 Typical Collector-Emitter Saturation Voltage vs. Collector Current

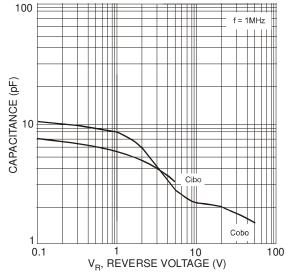


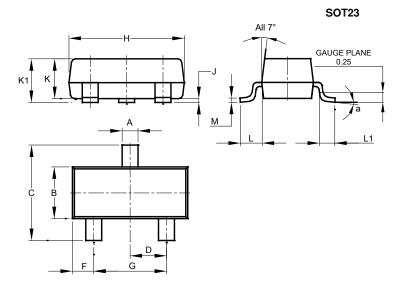
Figure 4 Typical Capacitance Characteristics

1,000



### **Package Outline Dimensions**

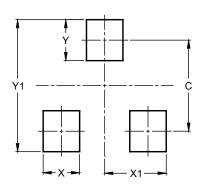
Please see http://www.diodes.com/package-outlines.html for the latest version.



SOT23							
Dim	Min	Max	Тур				
Α	0.37	0.51	0.40				
В	1.20	1.40	1.30				
С	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				
Н	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				
М	0.085	0.150	0.110				
а	0°	8°					
All	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)
С	2.0
Х	0.8
X1	1.35
Υ	0.9
Y1	29



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