

NPN GENERAL PURPOSE TRANSISTOR

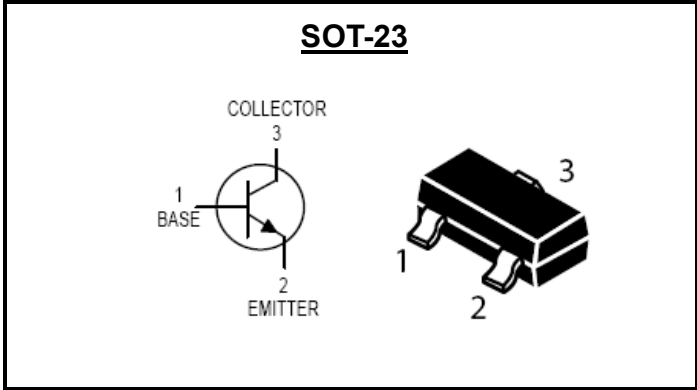
REVERSE VOLTAGE – 60 Volts
FORWARD CURRENT – 0.2 Amperes

FEATURES

- For switching and amplifier applications.
- Complementary PNP type available (MMBT3906)

MECHANICAL DATA

- Case: SOT-23 plastic
- Case material: “Green” molding compound, UL flammability classification 94V-0, (No Br. Sb. Cl)
- Lead free in RoHS 2011/65/EC compliant



ABSOLUTE RATINGS@ T_A = 25°C unless otherwise specified

PARAMETER	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-continuous	I _C	200	mA
Collector power dissipation	P _D	225 (NOTE 1) 300 (NOTE 2)	mW
Thermal resistance junction to ambient	R _{thJA}	556 (NOTE 1) 417 (NOTE 2)	°C/W
Operating temperature range	T _J	-55~+150	°C
Storage temperature range	T _{STG}	-55~+150	°C

Note:

REV.8, Jun.-2018, KSRN11

1. Device mounted on FR-5 board, 1.0 x 0.75 x 0.062 in.
2. Device mounted on Alumina substrate, 0.4 x 0.3 x 0.024 in 99.5% alumina.
3. Pulse Test: pulse width ≤ 300μs, duty cycle ≤ 2.0 %.

ORDER INFORMATION

DEVICE	MARKING	SHIPPING
MMBT3904	1AM	3000/ Tate & reel

ELECTRICAL CHARACTERISTIC
MMBT3904



OFF CHARACTERISTICS @ T_A = 25°C unless otherwise specified

PARAMETER	TEST CONDITION	SYMBOL	MIN.	MAX.	UNIT
Collector-base breakdown voltage	I _C = 10 μA, I _E = 0	V _{CBO}	60	--	V
Collector-emitter breakdown voltage	I _C = 1.0 mA, I _B = 0	V _{CEO}	40	--	V
Emitter-base breakdown voltage	I _E = 10 μA, I _C = 0	V _{EBO}	6.0	--	V
Base cutoff current	V _{CE} =30V, V _{EB} = 3.0V	I _{BL}	--	50	nA
Collector cut-off current	V _{CE} =30V, V _{BE} = 3.0V	I _{CEX}	--	50	nA

ON CHARACTERISTICS @ T_A = 25°C unless otherwise specified

PARAMETER	TEST CONDITION	SYMBOL	MIN.	MAX.	UNIT
DC current gain	V _{CE} =1.0V, I _C =0.1mA	h _{FE}	40	--	--
	V _{CE} =1.0V, I _C =1.0mA		70	--	
	V _{CE} =1.0V, I _C =10mA		100	300	
	V _{CE} =1.0V, I _C =50mA		60	--	
	V _{CE} =1.0V, I _C =100mA		30	--	
Collector-emitter saturation voltage (NOTE 3)	I _C =10mA, I _B =1.0mA	V _{CE(sat)}	--	0.2	V
	I _C =50mA, I _B =5.0mA		--	0.3	
Base-emitter saturation voltage	I _C =10mA, I _B =1.0mA	V _{BE(sat)}	0.65	0.85	V
	I _C =50mA, I _B =5.0mA		--	0.95	

SMALL-SIGNAL CHARACTERISTICS @ T_A = 25°C unless otherwise specified

PARAMETER	TEST CONDITION	SYMBOL	MIN.	MAX.	UNIT
Current-gain-band width product	V _{CE} =20V, I _C =10mA, f=100 MHz	f _T	300	--	MHz
Output capacitance	V _{CB} =5.0V, I _E =0, f=1.0 MHz	C _{obo}	--	4.0	pF
Input capacitance	V _{EB} =0.5V, I _E =0, f=1.0 MHz	C _{ibo}	--	8.0	pF
Input impedances	V _{CE} =10V, I _C =1.0mA, f=1.0 kHz	h _{ie}	1.0	10	KΩ
Voltage feedback ratio	V _{CE} =10V, I _C =1.0mA, f=1.0 kHz	h _{re}	0.5	8.0	X10 ⁻⁴
Small-signal current gain	V _{CE} =10V, I _C =1.0mA, f=1.0 kHz	h _{fe}	100	400	--
Output admittance	V _{CE} =10V, I _C =1.0mA, f=1.0 kHz	h _{oe}	1.0	40	μmhos
Noise figure	V _{CE} =5.0V, I _C =100μA, R _S =1.0kΩ, f=1.0 kHz	NF	--	5.0	dB

SWITCHING CHARACTERISTICS @ T_A = 25°C unless otherwise specified

PARAMETER	TEST CONDITION	SYMBOL	MIN.	MAX.	UNIT
Delay time	V _{CC} =3.0V, V _{BE} = - 0.5V, I _C =10mA, I _{B1} = 1.0mA	t _d	--	35	ns
Rise time		t _R	--	35	
Storage time	V _{CC} =3.0V, I _C =10mA, I _{B1} =I _{B2} =1.0mA	t _S	--	200	
Fall time		t _F	--	50	

FIG. 1 - Delay and rise time equivalent test circuit

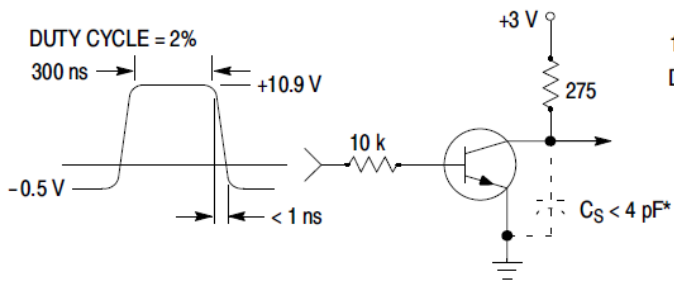
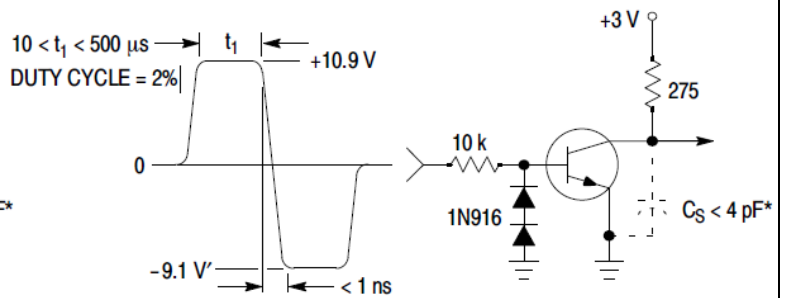


FIG. 2 - Storage and fall time equivalent test circuit



* Total shunt capacitance of test jig and connectors

FIG. 3 - Capacitance

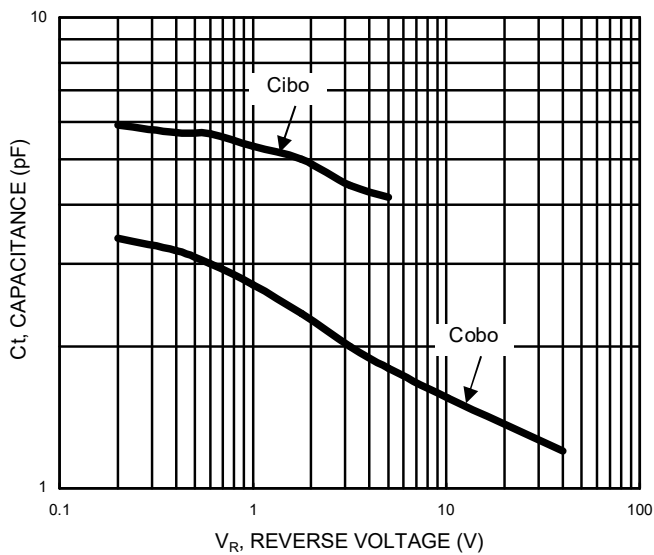


FIG. 4 - Current gain

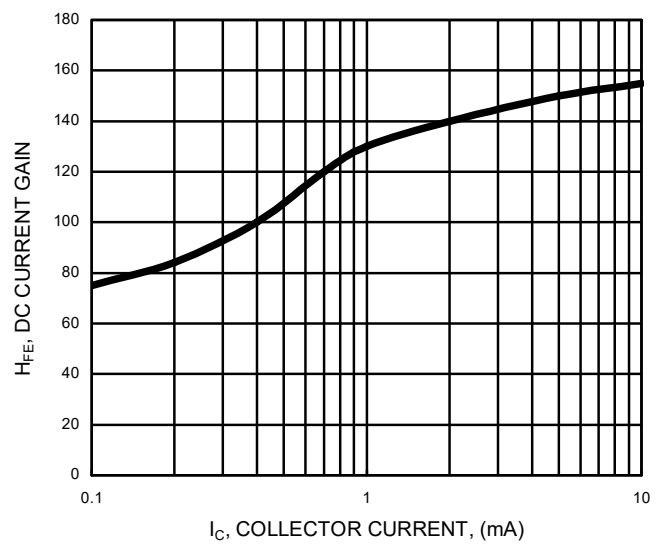


FIG. 5 - DC current gain

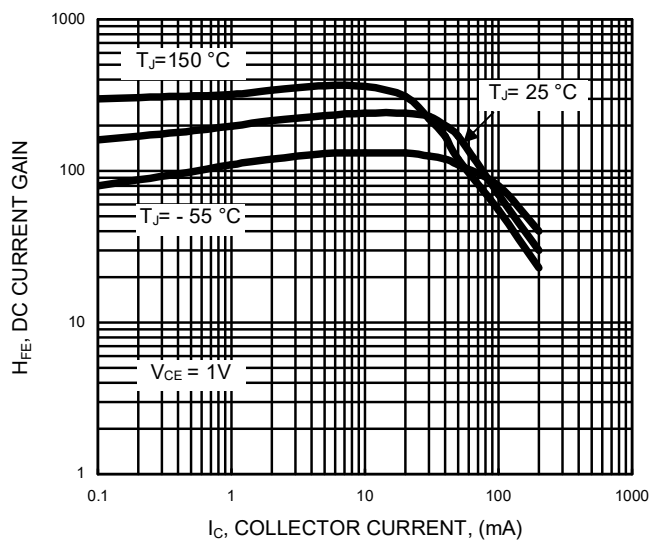


FIG. 6 - Collector saturation region

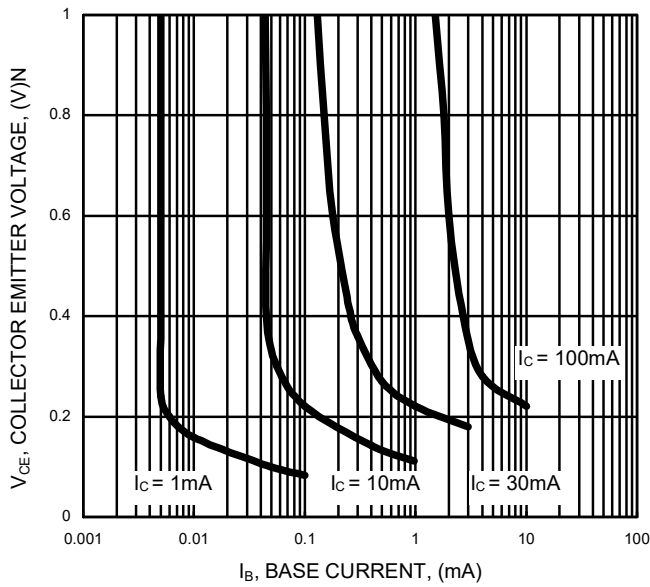


FIG. 7 - $V_{CE(sat)}$ vs. I_C

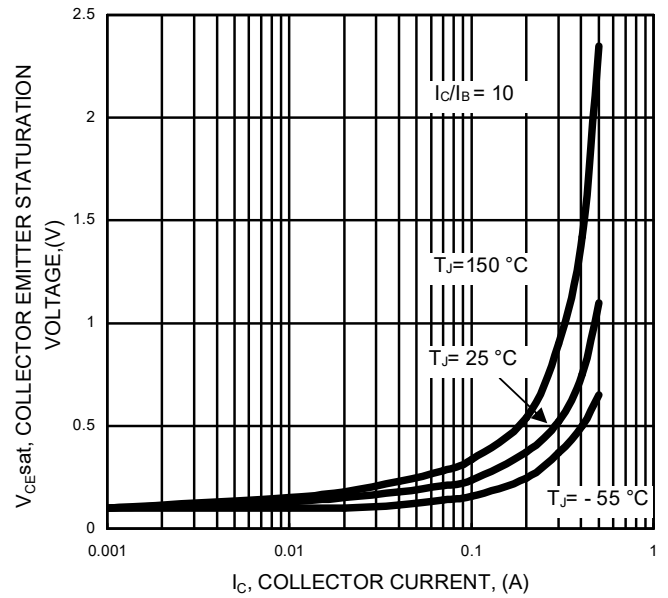


FIG. 8 - $V_{BE(sat)}$ vs. I_C

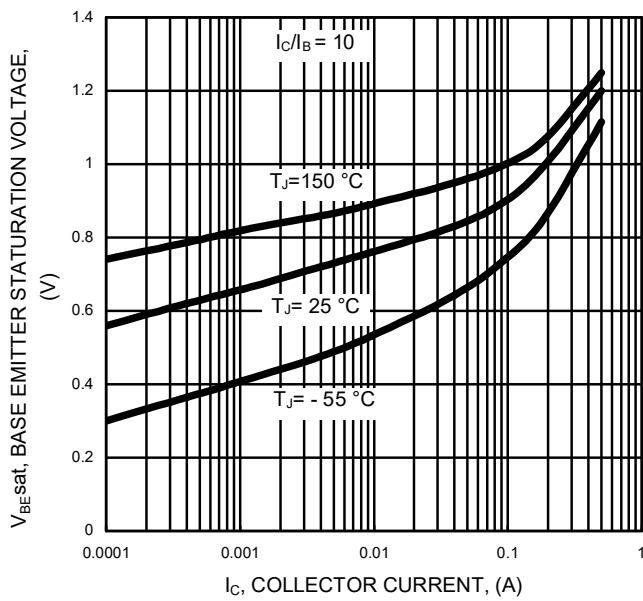
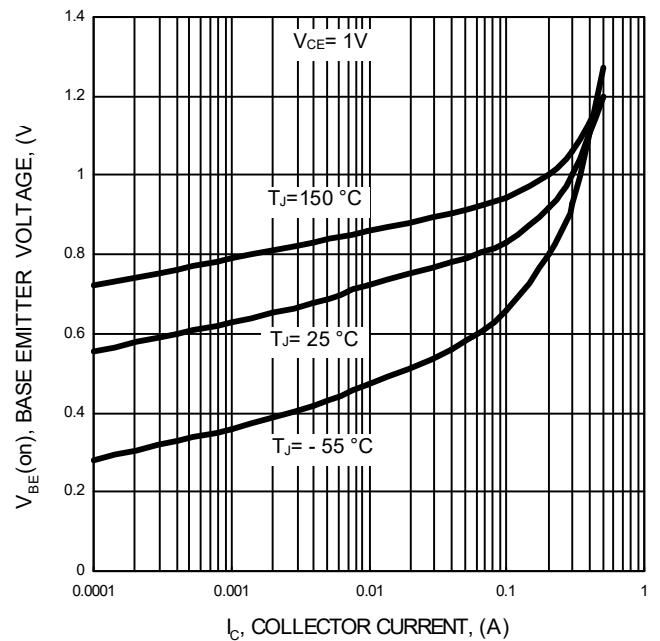
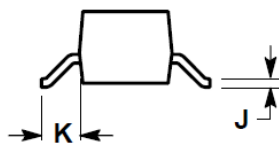
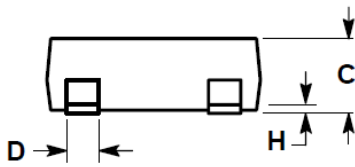
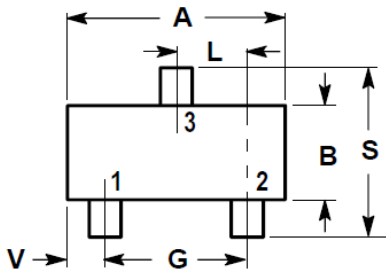


FIG. 9 - $V_{BE(on)}$ vs. I_C



Package Dimensions :

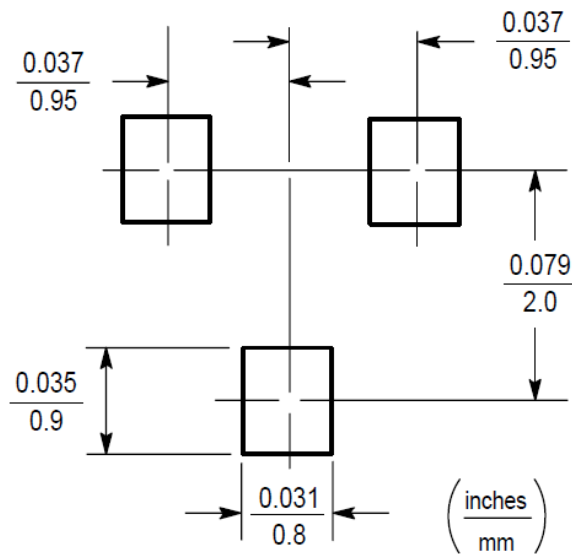
SOT-23



Dim.	INCHES		MILLIMETERS	
	Min.	Max.	Min.	Max.
A	0.1102	0.1197	2.80	3.04
B	0.0472	0.0551	1.20	1.40
C	0.0350	0.0440	0.89	1.11
D	0.0150	0.0200	0.37	0.50
G	0.0701	0.0807	1.78	2.04
H	0.0005	0.0040	0.013	0.100
J	0.0034	0.0070	0.085	0.177
K	0.0140	0.0285	0.35	0.69
L	0.0350	0.0401	0.89	1.02
S	0.0830	0.1039	2.10	2.64
V	0.0177	0.0236	0.45	0.60

Note:
PIN 1. Base
PIN 2. Emitter
PIN 3. Collector

Soldering Pad Layout :



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