Elektronische Bauelemente

MMBT3904

200 mA, 40 V

NPN Plastic Encapsulated Transistor

RoHS Compliant Product
A suffix of "-C" specifies halogen and lead free

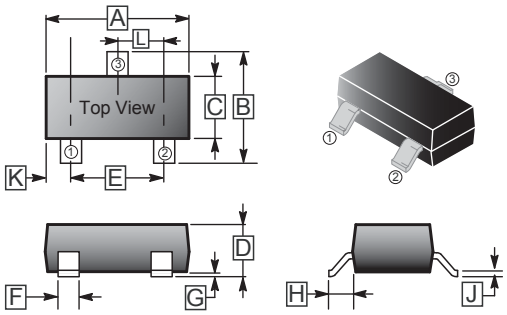
FEATURES

- Collector current capability I_C=200mA
- Collector-emitter voltage V_{CEO}=40V.

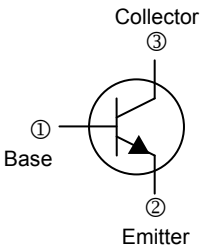
SOT-23

APPLICATION

- General switching and amplification.

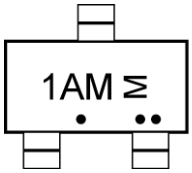


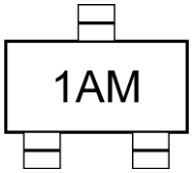
PACKAGING DIMENSION



REF.	Millimeter		REF.	Millimeter	
	Min.	Max.		Min.	Max.
A	2.80	3.00	G	0.10 REF.	
B	2.25	2.55	H	0.55 REF.	
C	1.20	1.40	J	0.08	0.15
D	0.90	1.15	K	0.5 REF.	
E	1.80	2.00	L	0.95 TYP.	
F	0.30	0.50			

MARKING





ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

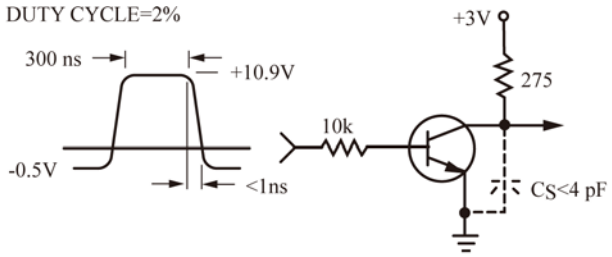
PARAMETER	SYMBOL	RATINGS	UNIT
Collector - Emitter Voltage	V_{CEO}	40	Vdc
Collector - Base Voltage	V_{CBO}	60	Vdc
Emitter - Base Voltage	V_{EBO}	6.0	Vdc
Collector Current - Continuous	I_C	200	mAdc
Total Device Dissipation FR-5 Board[1], T_A=25°C	P_D	225	mW
Total Device Dissipation FR-5 Board, Derate above 25°C		1.8	mW/°C
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	556	°C / W
Total Device Dissipation Alumina Substrate[2], T_A=25°C	P_D	300	mW
Total Device Dissipation Alumina Substrate, Derate above 25°C		2.4	mW/°C
Thermal Resistance, Junction to Ambien	$R_{\theta JA}$	417	°C / W
Junction, Storage Temperature	T_J, T_{STG}	-55 ~ +150	°C

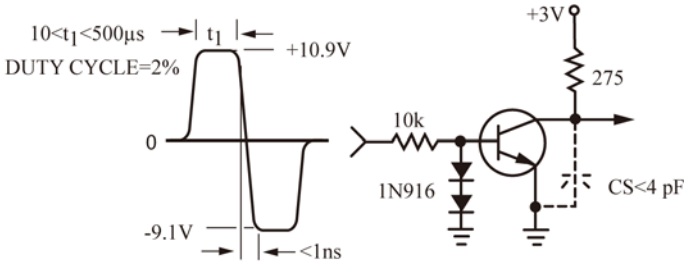
ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)(Continued)

PARAMETER	SYMBOL	MIN.	MAX.	UNIT	TEST CONDITIONS
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage(3)	$V_{(BR)CEO}$	40	-	Vdc	I_C= 1mAdc, I_B=0
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	60	-	Vdc	I_C = 10μAdc, I_E = 0
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	6.0	-	Vdc	I_E = 10μAdc, I_C=0
Base Cut-Off Current	I_{BL}	-	50	nAdc	V_{CE}= 30Vdc, V_{EB}= 3.0Vdc
Collector Cut-Off Current	I_{CEX}	-	50	nAdc	V_{CE}= 30Vdc, V_{EB}= 3.0Vdc
ON CHARACTERISTICS(3)					
DC Current Gain	$h_{FE(1)}$	40	-		I_C= 0.1mAdc, V_{CE}= 1Vdc
	$h_{FE(2)}$	70	-		I_C= 1.0mAdc, V_{CE}= 1Vdc
	$h_{FE(3)}$	100	300		I_C= 10mAdc, V_{CE}= 1Vdc
	$h_{FE(4)}$	60	-		I_C= 50mAdc, V_{CE}= 1Vdc
	$h_{FE(5)}$	30	-		I_C= 100mAdc, V_{CE}= 1Vdc
Collector-Emitter Saturation Voltage(3)	$V_{CE(sat)}$	-	0.2	Vdc	I_C= 10mAdc, I_B =1mAdc
		-	0.3		I_C = 50mAdc, I_B = 5mAdc
Base-Emitter Saturation Voltage(3)	$V_{BE(sat)}$	0.65	0.85	Vdc	I_C= 10mAdc, I_B =1mAdc
		-	0.95		I_C = 50mAdc, I_B =5mAdc
SMALL-SIGNAL CHARACTERISTICS					
Current-Gain-Bandwidth Product	f_T	300	-	MHz	I_C= 10mAdc, V_{CE}= 20Vdc, f=100MHz
Output Capacitance	C_{obo}	-	4.0	pF	V_{CB}=5.0Vdc, I_E=0, f=1.0MHz
Input Capacitance	C_{ibo}	-	8.0	pF	V_{EB}= 0.5Vdc, I_C=0, f=1.0MHz
Input Impedance	h_{ie}	1.0	10	kΩ	V_{CE}= 10 Vdc, I_C= 1.0mAdc, f=1.0kHz
Voltage Feedback Radio	h_{re}	0.5	8.0	x 10^{-4}	V_{CE}= 10 Vdc, I_C= 1.0mAdc, f=1.0kHz
Small-Signal Current Gain	h_{fe}	100	400		V_{CE}= 10 Vdc, I_C= 1.0mAdc, f=1.0kHz
Output Admittance	H_{oe}	1.0	40	μmhos	V_{CE}= 10 Vdc, I_C= 1.0mAdc, f=-1.0kHz
Noise Figure	NF	-	5.0	dB	V_{CE}= 5.0 Vdc, I_C= 100μAdc, R_S=1.0KΩ, f=1.0kHz
SWITCHING CHARACTERISTICS					
Delay Time	td	-	35	nS	V_{CC}=3Vdc,V_{BE}=-0.5Vdc
Rise Time	tr	-	35		I_C=10mAdc, I_{B1} =1mAdc
Storage Time	ts	-	200		V_{CC}=3Vdc,
Fall Time	tf	-	50		I_C=10mAdc,I_{B1}= I_{B2}=1mAdc

NOTE:

1. FR-5=1.0 x 0.75 x 0.062 in.
2. Alumina=0.4 x 0.3 x 0.024 in. 99.5% alumina.
3. Pulse Test: Pulse Width ≦ 300μS, Duty Cycle ≦ 2.0%





*Total shunt capacitance of test jig and connectors

FIG.1 Delay and Rise Time Equivalent Test Circuit

FIG.2 Storage and Fall Time Equivalent Test Circuit

TYPICAL TRANSIENT CHARACTERISTICS

—— T_J=25°C - - - T_J=125°C

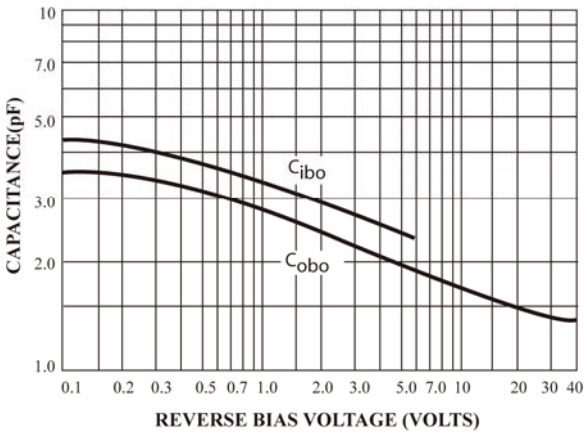


FIG.3 Capacitance

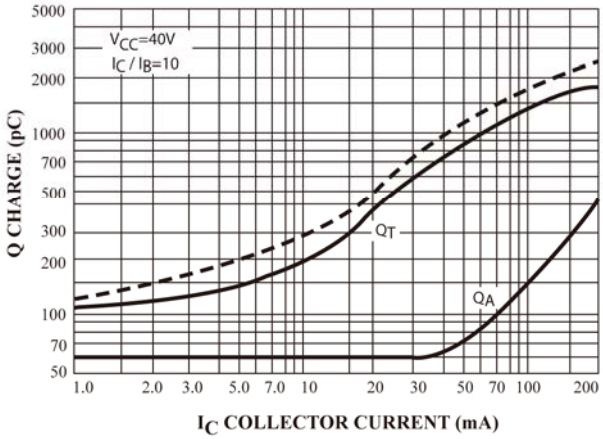


FIG.4 Charge Data

TYPICAL TRANSIENT CHARACTERISTIC CURVES

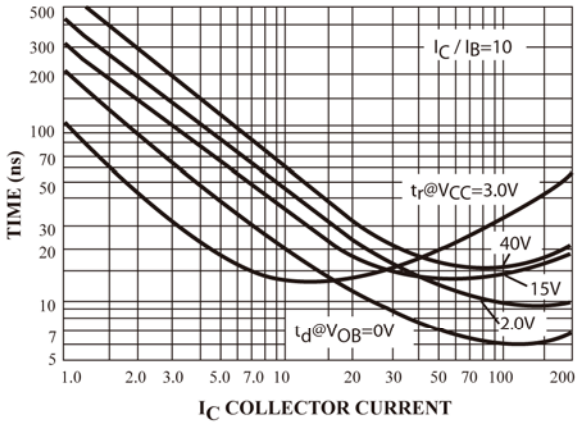


FIG.5 Turn-On Time

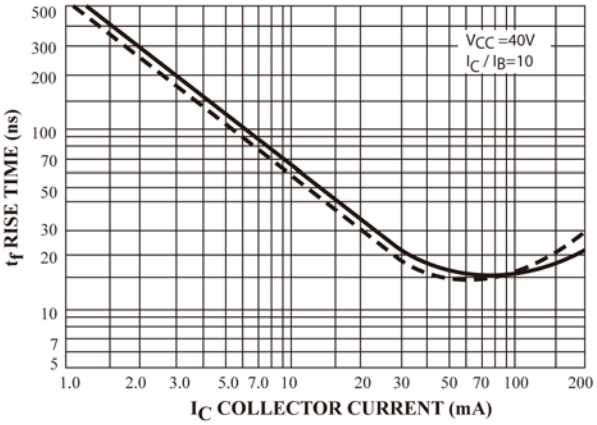


FIG.6 Rise Time

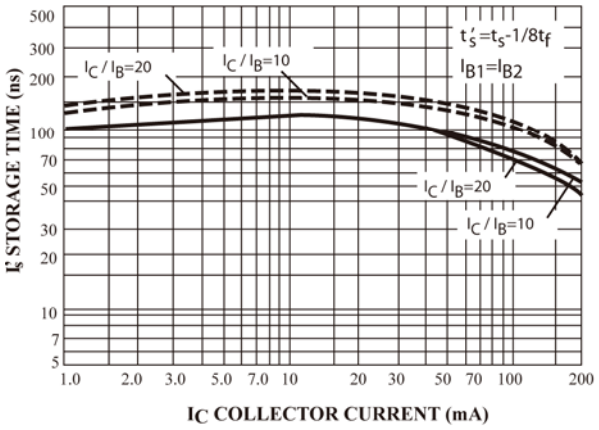


FIG.7 Storage Time

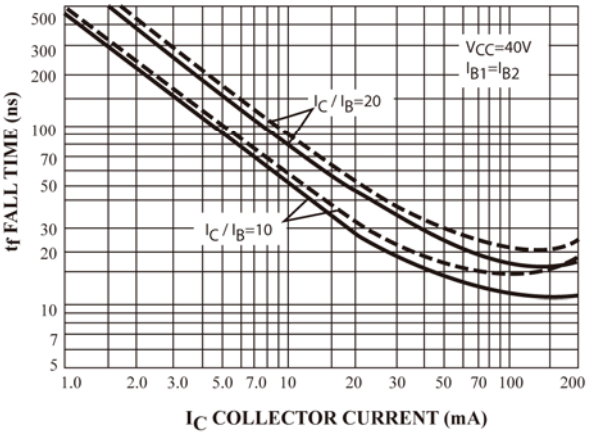


FIG.8 Fall Time

TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

(V_{CE}=5.0 Vdc. T_A=25°C, Bandwidth=1.0Hz)

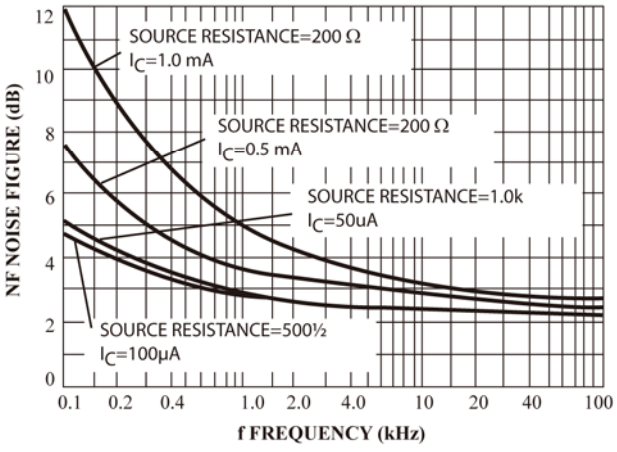


FIG.9

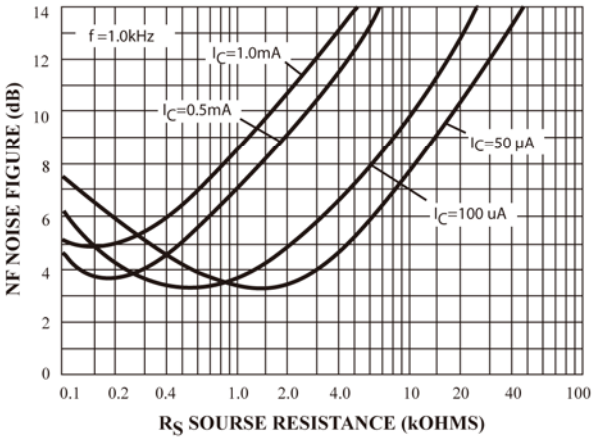


FIG.10

(NPN)

h PARAMETERS (V_{CE}=10 Vdc,m f=1.0 kHz, T_A=25°C)

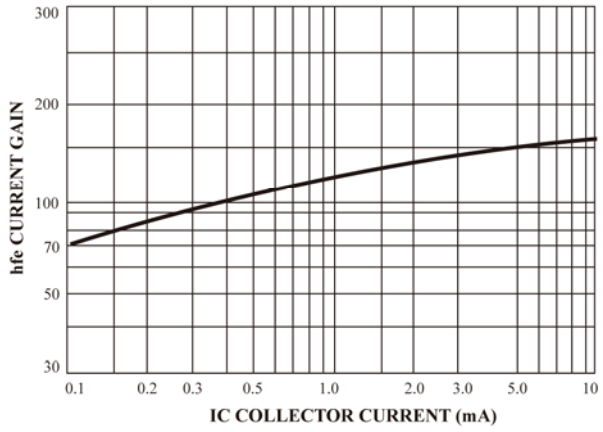


FIG.11 Current Gain

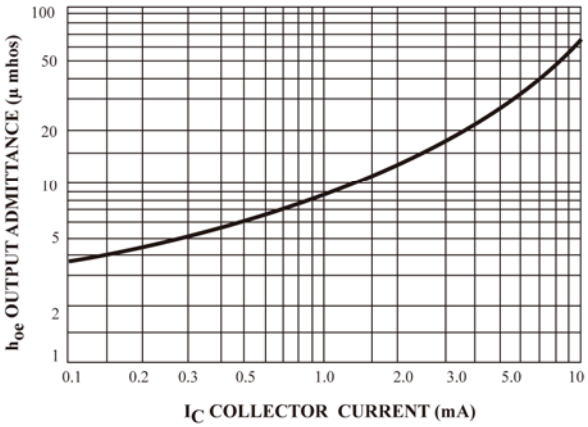


FIG.12 Output Admittance

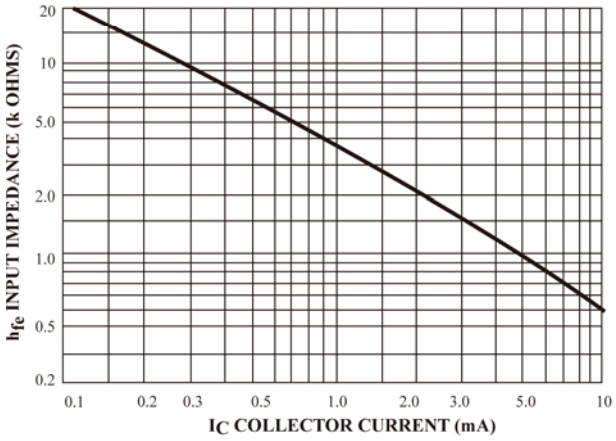


FIG.13 Input Impedance

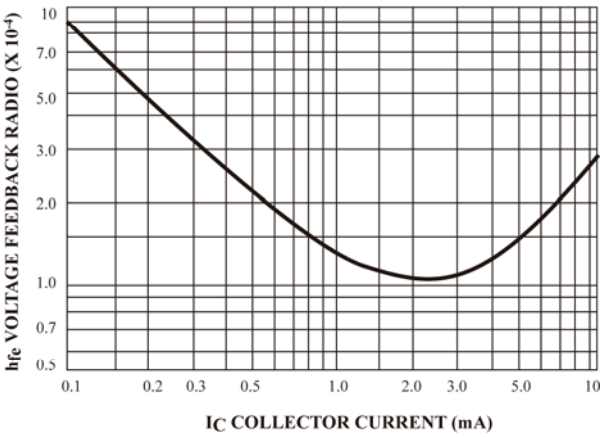


FIG.14 Voltage Feedback Radio

TYPICAL STATIC CHARACTERISTICS

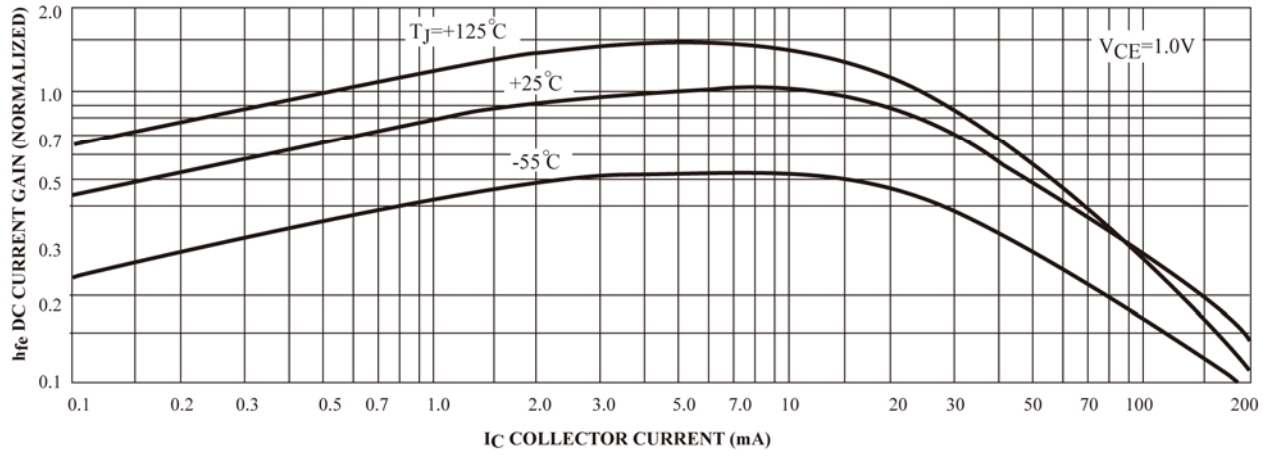


FIG.15 DC Current Gain

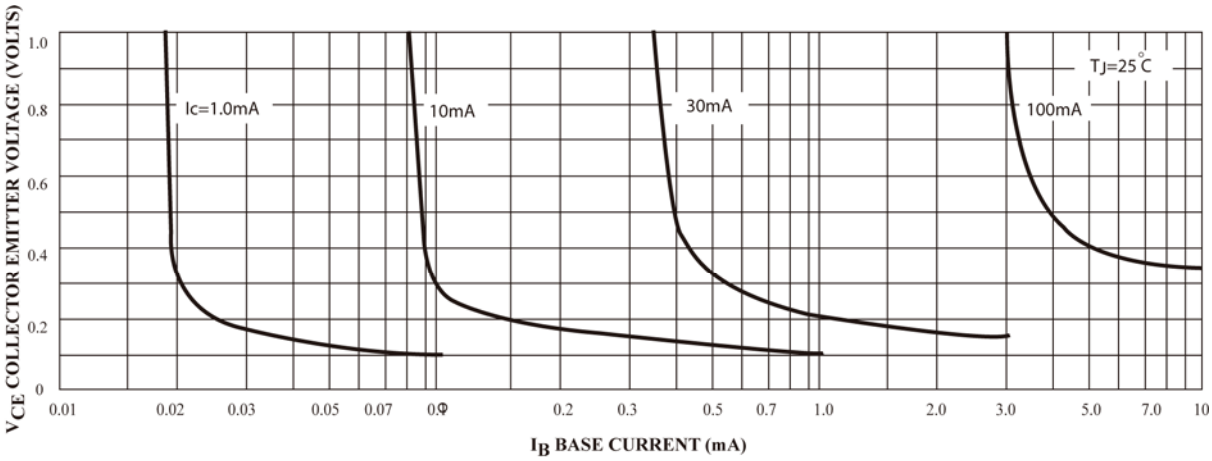


FIG.16 Collector Saturation Ragion

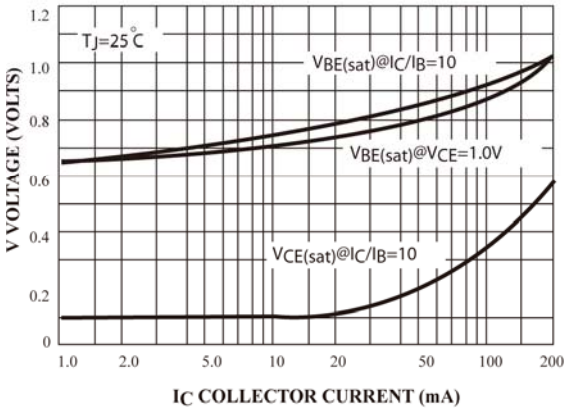


FIG.17 "ON" Voltage

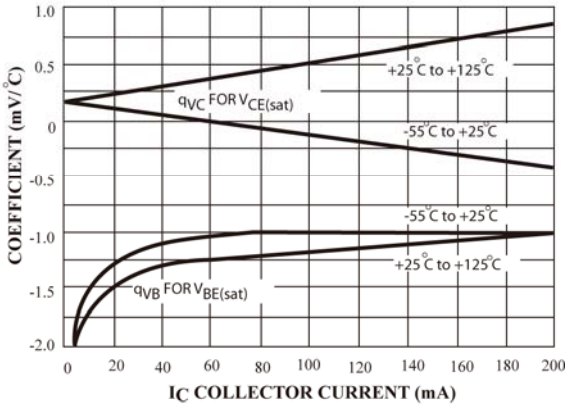


FIG.18 Temperature Coefficients