RECTRON SEMICONDUCTOR
TECHNICAL SPECIFICATION

MMBT3904

SOT-23 BIPOLAR TRANSISTORS
TRANSISTOR(NPN)

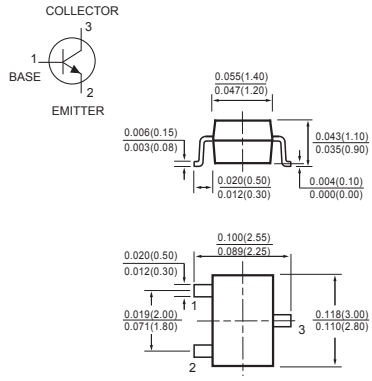
FEATURES

* Power dissipation
  P_{CM} 0.2 W(Tamb=25°C)
* Collector current
  I_{CM} 0.2 A
* Collector-base voltage
  $V_{(BR)CBO}$: 60 V
* Operating and storage junction temperature range
  T_J,Tstg: -55°Cto+150°C

MECHANICAL DATA

* Case: Molded plastic
* Epoxy: UL 94V-O rate flame retardant
* Lead: MIL-STD-202E method 208C guaranteed
* Mounting position: Any
* Weight: 0.008 gram

SOT-23



Dimensions in inches and (millimeters)

MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

Ratings at 25 °C ambient temperature unless otherwise specified.
Single phase, half wave, 60 Hz, resistive or inductive load.
For capacitive load, derate current by 20%.

MAXIMUM RATINGES (@ T_A = 25°C unless otherwise noted)

RATINGS	SYMBOL	VALUE	UNITS
Max. Steady State Power Dissipation (1) @T_A=25°C Derate above 25°C	P_D	300	mW
Max. Operating Temperature Range	T_J	150	°C
Storage Temperature Range	T_{STG}	-55 to +150	°C

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

CHARACTERISTICS	SYMBOL	MIN.	TYP.	MAX.	UNITS
Thermal Resistance Junction to Ambient	R θ_{JA}	-	-	417	°C/W

Notes : 1.Alumina=0.4*0.3*0.024in.99.5% alumina
2." Fully ROHS Compliant "," 100% Sn plating (Pb-free)".

2007-5

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage (I_C= 1mAdc, I_B= 0)	$V_{(BR)CEO}$	40	-	Vdc
Collector-Base Breakdown Voltage (I_C= 10uAdc, I_E= 0)	$V_{(BR)CBO}$	60	-	Vdc
Emitter-Base Breakdown Voltage (I_E= 100uAdc, I_C= 0)	$V_{(BR)EBO}$	6.0	-	Vdc
Base Cutoff Current (V_{CE}= 30Vdc, V_{EB}= 3.0Vdc)	I_{BL}	-	50	nAdc
Collector Cutoff Current (V_{CE}= 30Vdc, V_{EB}= 3.0Vdc)	I_{CEX}	-	50	nAdc
ON CHARACTERISTICS(1)				
DC Current Gain (I_C= 0.1mAdc, V_{CE}= 1.0Vdc)	h_{FE}	40	-	-
(I_C= 1.0mAdc, V_{CE}= 1.0Vdc)		70	-	
(I_C= 10mAdc, V_{CE}= 1.0Vdc)		100	300	
(I_C= 50mAdc, V_{CE}= 1.0Vdc)		60	-	
(I_C= 100mAdc, V_{CE}= 1.0Vdc)		30	-	
Collector-Emitter Saturation Voltage (I_C= 10mAdc, I_B= 1.0mAdc)	$V_{CE(sat)}$	-	0.2	Vdc
(I_C= 50mAdc, I_B= 5.0mAdc)		-	0.3	
Base-Emitter Saturation Voltage (I_C= 10mAdc, I_B= 1.0mAdc)	$V_{BE(sat)}$	0.65	0.85	Vdc
(I_C= 50mAdc, I_B= 5.0mAdc)		-	0.95	
SMALL-SIGNAL CHARACTERISTICS				
Current-Gain-Bandwidth Product (I_C= 10mAdc, V_{CE}= 20Vdc, f= 100MHz)	f_T	300	-	MHz
Output Capacitance (V_{CB}= 5.0Vdc, I_E= 0, f= 1.0MHz)	C_{obo}	-	4.0	pF
Input Capacitance (V_{EB}= 0.5Vdc, I_C= 0, f= 1.0MHz)	C_{ibo}	-	8.0	pF
Input Impedance (V_{CE}= 10Vdc, I_C= 1.0mAdc, f= 1.0kHz)	h_{ie}	1.0	10	kohms
Voltage Feedback Ratio (V_{CE}= 10Vdc, I_C= 1.0mAdc, f= 1.0kHz)	h_{re}	0.5	8.0	X 10^{-4}
Small-Signal Current Gain (V_{CE}= 10Vdc, I_C= 1.0mAdc, f= 1.0kHz)	h_{fe}	100	400	-
Output Admittance (V_{CE}= 10Vdc, I_C= 1.0mAdc, f= 1.0kHz)	h_{oe}	1.0	40	umhos
Noise Figure (V_{CE}= 5.0Vdc, I_C= 100uAdc, R_S= 1.0kohms, f= 1.0kHz)	NF	-	5.0	dB
SWITCHING CHARACTERISTICS				
Delay Time	(V_{CC}= 3.0Vdc, V_{BE}= -0.5Vdc, I_C= 10mAdc, I_{B1}= 1.0mAdc)	t_d	-	35	ns
Rise Time		t_r	-	35	
Storage Time	(V_{CC}= 3.0Vdc, I_C= 10mAdc, I_{B1}= I_{B2}= 1.0mAdc)	t_s	-	200	ns
Fall Time		t_f	-	50	

Note : Pulse Test: Pulse Width≤300ms,Duty Cycle≤2.0%

RATING AND CHARACTERISTICS CURVES (MMBT3904)

—— T_J= 25°C — — T_J=125°C

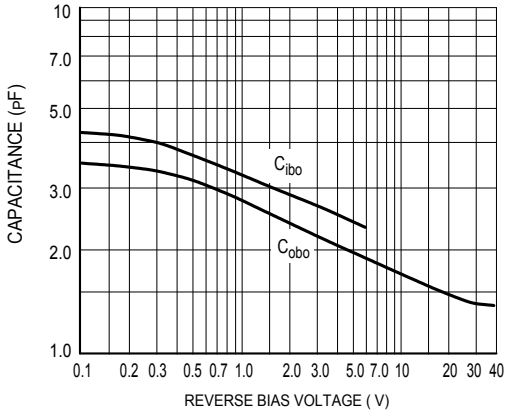


Figure 1. Capacitance

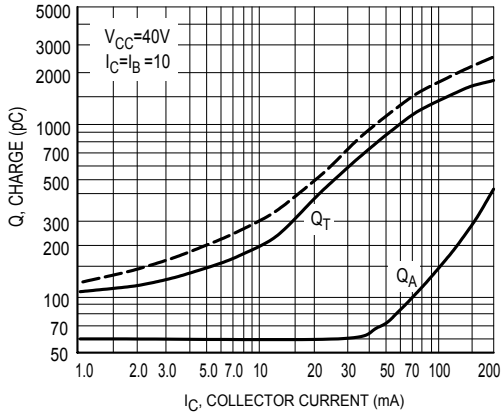


Figure 2. Charge Data

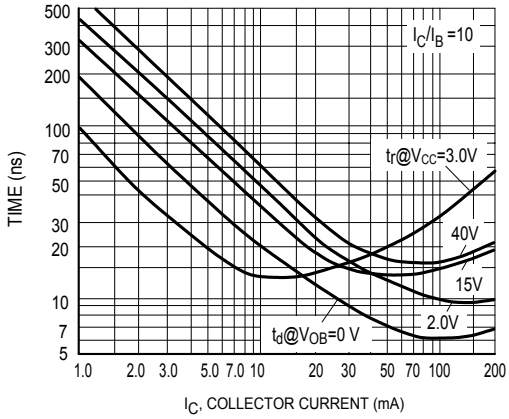


Figure 3. Turn-On Time

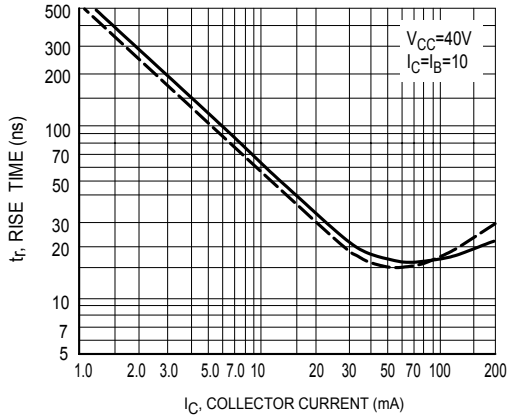


Figure 4. Rise Time

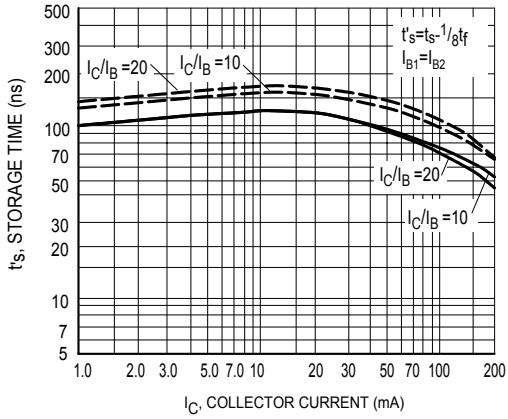


Figure 5. Storage Time

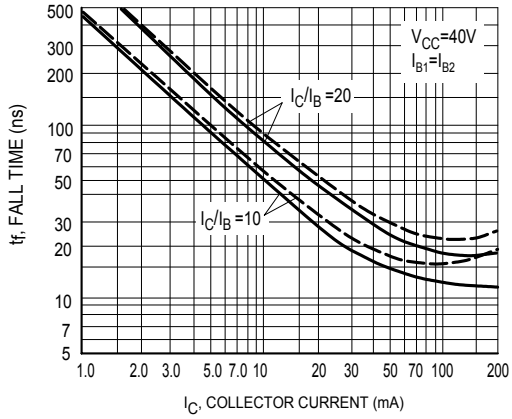


Figure 6. Fall Time

RATING AND CHARACTERISTICS CURVES (MMBT3904)

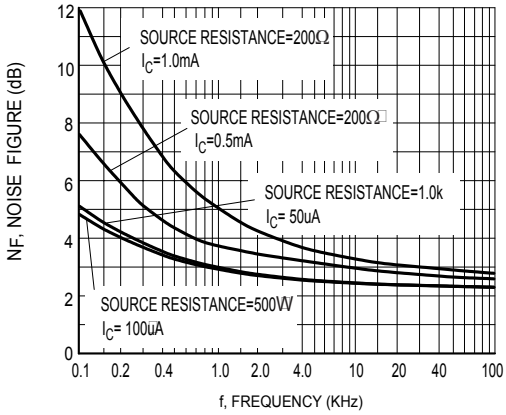


Figure 7.

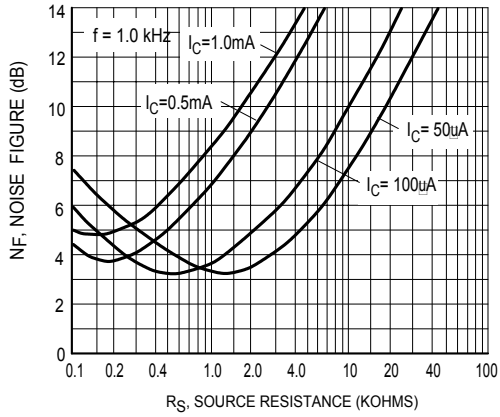


Figure 8.

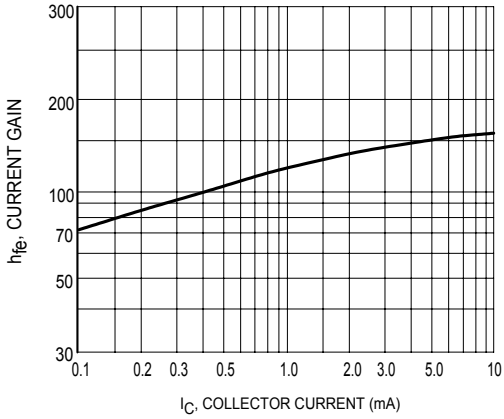


Figure 9. Current Gain

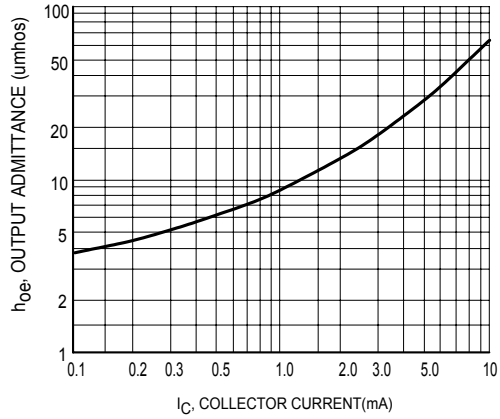


Figure 10. Output Admittance

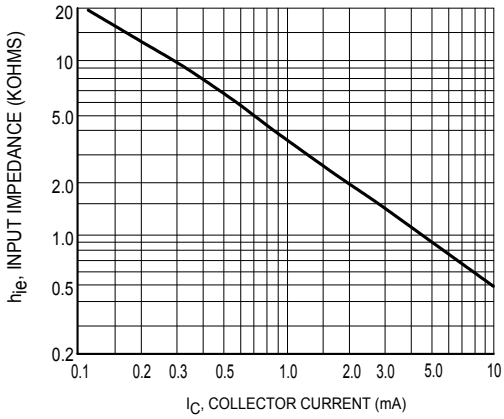


Figure 11. Input Impedance

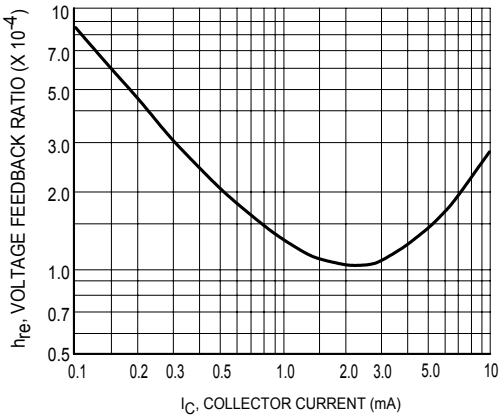


Figure 12.Voltage Feedback Ratio

RATING AND CHARACTERISTICS CURVES (MMBT3904)

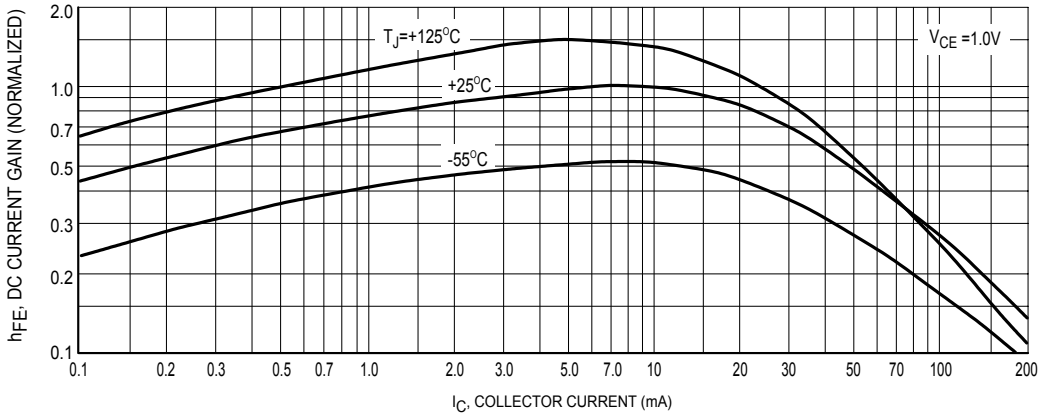


Figure 13.DC Current Gain

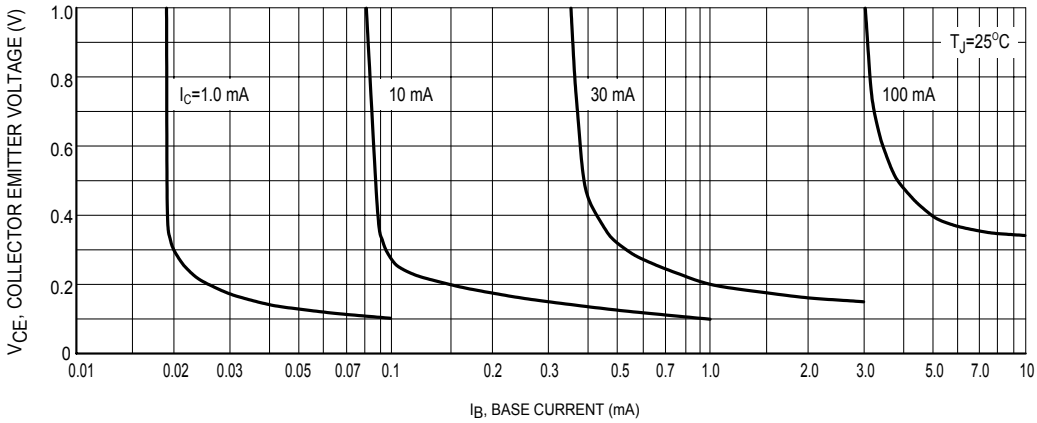


Figure 14.Collector Saturation Region

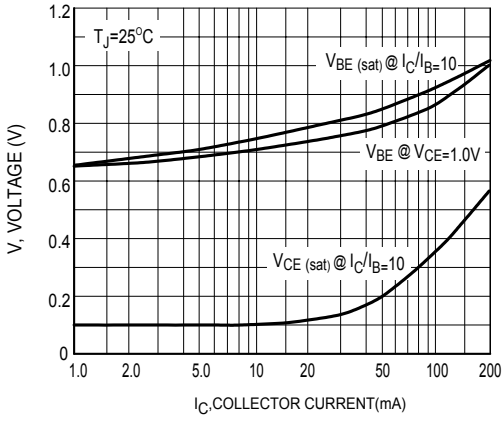


Figure 15."ON" Voltages

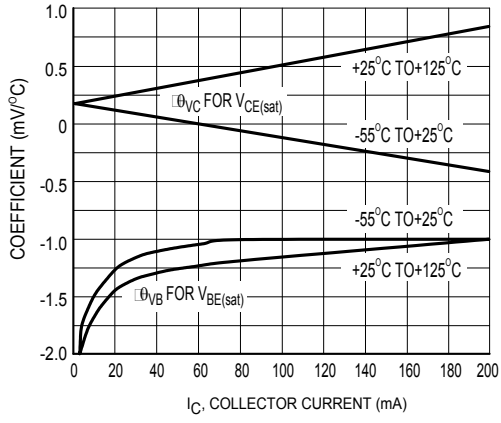


Figure 16.Temperature Coefficients

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