

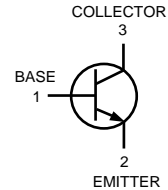
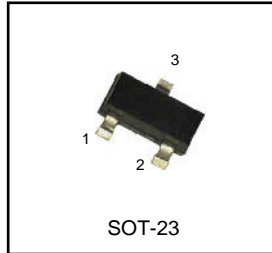
General Purpose Transistor

NPN Silicon

Halogen-free type

Lead free product

MMBT3904GH



MAXIMUM RATINGS

Rating	Symbol	Value	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

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max.	Unit
Total Device Dissipation FR-5 Board ⁽¹⁾ TA=25°C Derate above 25°C	P _D	225 1.8	mW mW / °C
Thermal Resistance Junction to Ambient	R _{θJA}	556	°C / W
Total Device Dissipation Alumina Substrate, ⁽²⁾ TA=25°C Derate above 25°C	P _D	300 2.4	mW mW / °C
Thermal Resistance Junction to Ambient	R _{θJA}	417	°C / W
Junction and Storage Temperature	T _J , T _{STG}	-55 to +150	°C

ELECTRICAL CHARACTERISTICS (TA=25°C unless otherwise noted)

Characteristic	Symbol	Min.	Max.	Unit
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OFF CHARACTERISTICS

Collector-Emitter Breakdowe Voltage ⁽³⁾ (I _C =1.0mAdc, I _B =0)	V _{(BR)CEO}	40	-	Vdc
Collector-Base Breakdowe Voltage (I _C =10 uAdc, I _E =0)	V _{(BR)CBO}	60	-	Vdc
Emitter-Base Breakdowe Voltage (I _E =10 uAdc, I _C =0)	V _{(BR)EBO}	6.0	-	Vdc
Base Cutoff Current (V _{CE} =30 Vdc, V _{EB} =3.0 Vdc)	I _{BL}	-	50	nAdc
Collector Cutoff Current (V _{CE} =30 Vdc, V _{EB} =3.0 Vdc)	I _{CEX}	-	50	nAdc

ELECTRICAL CHARACTERISTICS ($T_A=25^{\circ}\text{C}$ unless otherwise noted) (Continued)

Characteristic	Symbol	Min.	Max.	Unit
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ON CHARACTERISTICS⁽³⁾

DC Current Gain ($I_C=0.1\text{ mAdc}$, $V_{CE}=1.0\text{ Vdc}$) ($I_C=1.0\text{ mAdc}$, $V_{CE}=1.0\text{ Vdc}$) ($I_C=10\text{ mAdc}$, $V_{CE}=1.0\text{ Vdc}$) ($I_C=50\text{ mAdc}$, $V_{CE}=1.0\text{ Vdc}$) ($I_C=100\text{ mAdc}$, $V_{CE}=1.0\text{ Vdc}$)	HFE	40 70 100 60 30	- - 300 - -	-
Collector-Emitter Saturation Voltage ⁽³⁾ ($I_C=10\text{ mAdc}$, $I_B=1.0\text{ mAdc}$) ($I_C=50\text{ mAdc}$, $I_B=5.0\text{ mAdc}$)	$V_{CE(sat)}$	- -	0.2 0.3	Vdc
Base-Emitter Saturation Voltage ⁽³⁾ ($I_C=10\text{ mAdc}$, $I_B=1.0\text{ mAdc}$) ($I_C=50\text{ mAdc}$, $I_B=5.0\text{ mAdc}$)	$V_{BE(sat)}$	0.65 -	0.85 0.95	Vdc

SMALL-SIGNAL CHARACTERISTIC

Current-Gain-Bandwidth Product ($I_C=10\text{ mAdc}$, $V_{CE}=20\text{ Vdc}$, $f=100\text{ MHz}$)	f_T	300	-	MHz
Output Capacitance ($V_{CB}=5.0\text{ Vdc}$, $I_E=0$, $f=1.0\text{ MHz}$)	C_{ob0}	-	4.0	pF
Input Capacitance ($V_{EB}=0.5\text{ Vdc}$, $I_C=0$, $f=1.0\text{ MHz}$)	C_{ib0}	-	8.0	pF
Input Impedance ($V_{CE}=10\text{ Vdc}$, $I_C=1.0\text{ mAdc}$, $f=1.0\text{ kHz}$)	h_{ie}	1.0	10	k ohms
Voltage Feedback Ratio ($V_{CE}=10\text{ Vdc}$, $I_C=1.0\text{ mAdc}$, $f=1.0\text{ kHz}$)	h_{re}	0.5	8.0	$\times 10^{-4}$
Small-Signal Current Gain ($V_{CE}=10\text{ Vdc}$, $I_C=1.0\text{ mAdc}$, $f=1.0\text{ kHz}$)	h_{fe}	100	400	-
Output Admittance ($V_{CE}=10\text{ Vdc}$, $I_C=1.0\text{ mAdc}$, $f=1.0\text{ kHz}$)	h_{oe}	1.0	40	$\mu\text{ mhos}$
Noise Figure ($V_{CE}=5.0\text{ Vdc}$, $I_C=100\text{ uAdc}$, $R_S=1.0\text{ k ohm}$, $f=1.0\text{ kHz}$)	NF	-	5.0	dB

SWITCHING CHARACTERISTICS

Delay Time	($V_{CC}=3.0\text{ Vdc}$, $V_{BE}=-0.5\text{ Vdc}$, $I_C=10\text{ mAdc}$, $I_{B1}=1.0\text{ mAdc}$)	t_d	-	35	nS
Rise Time		t_r	-	35	
Storage Time	($V_{CC}=3.0\text{ Vdc}$, $I_C=10\text{ mAdc}$, $I_{B1}=I_{B2}=1.0\text{ mAdc}$)	t_s	-	200	nS
Fall Time		t_f	-	50	

(1) FR-5=1.0 x 0.75 x 0.062in.

(2) Alumina=0.4 x 0.3 x 0.024in. 99.5% alumina.

(3) Pulse Test : Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2.0\%$.

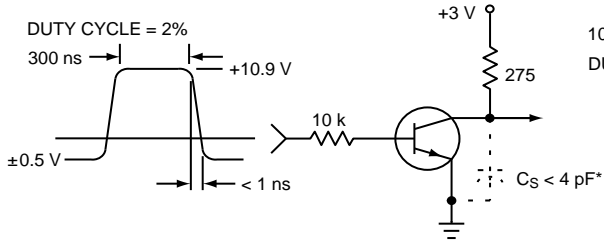


Figure 1. Delay and Rise Time Equivalent Test Circuit

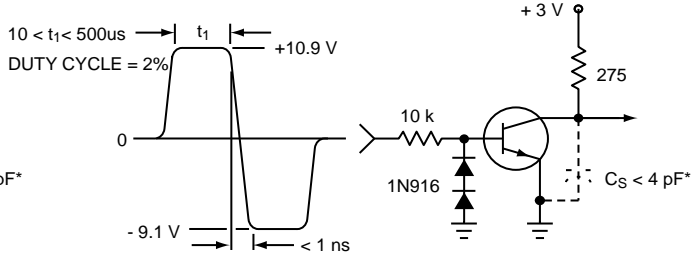


Figure 2. Storage and Fall Time Equivalent Test Circuit

* Total shunt capacitance of test jig and connectors

TYPICAL TRANSIENT CHARACTERISTICS

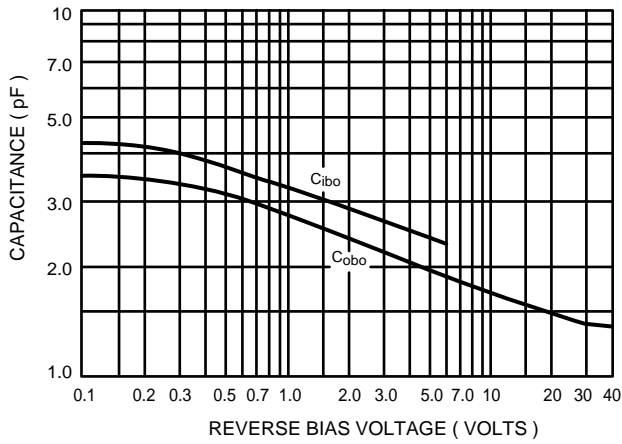


Figure 3. Capacitance

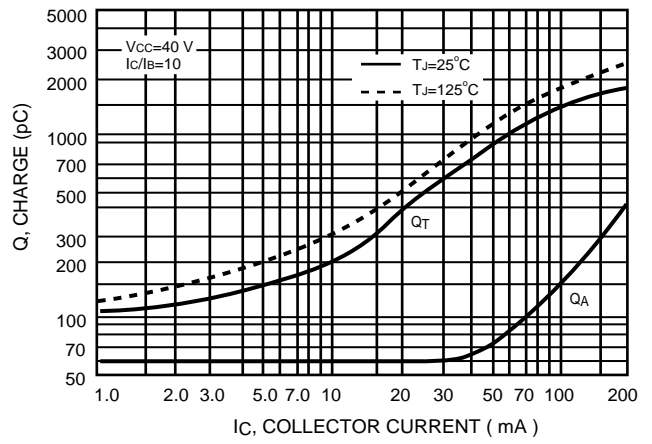


Figure 4. Charge Data

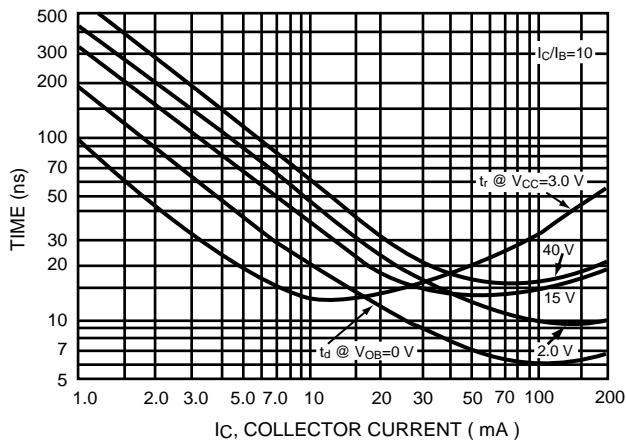


Figure 5. Turn-On Time

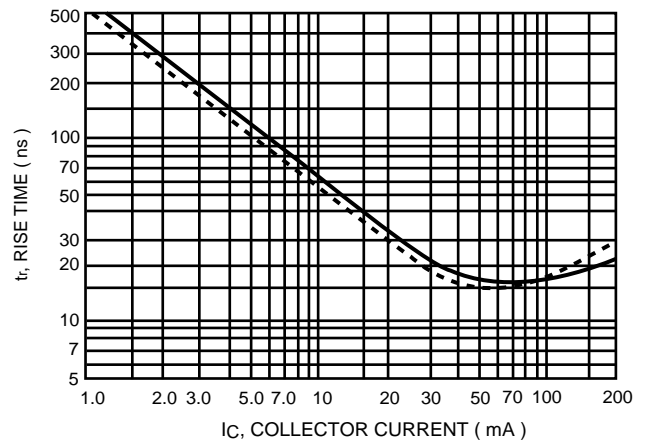


Figure 6. Rise Time

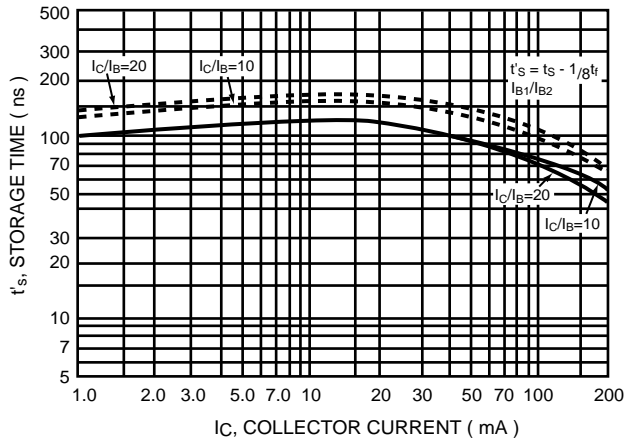


Figure 7. Storage Time

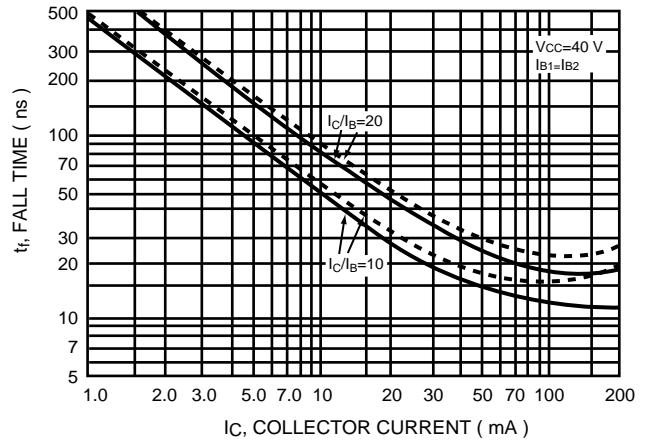


Figure 8. Fall Time

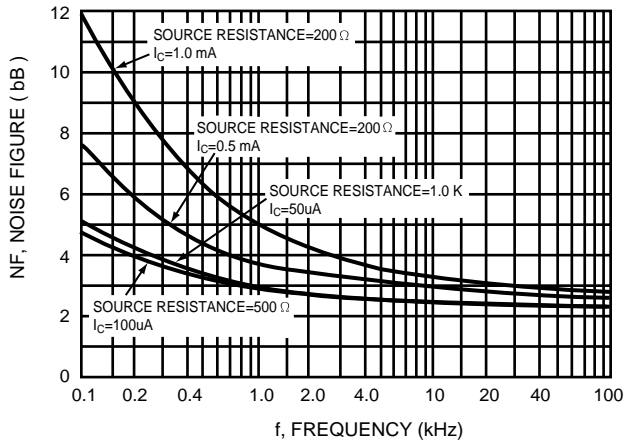


Figure 9.

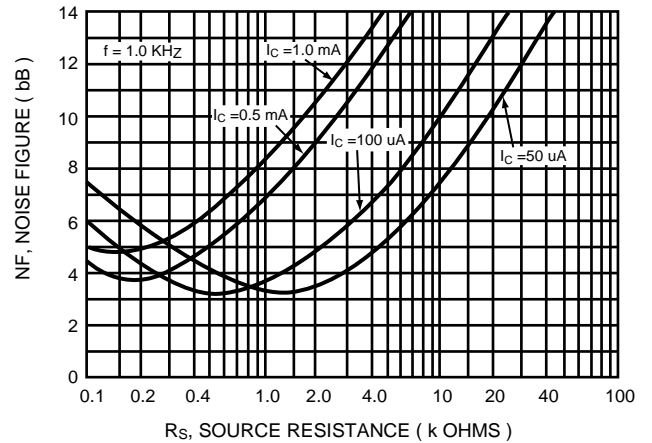


Figure 10.

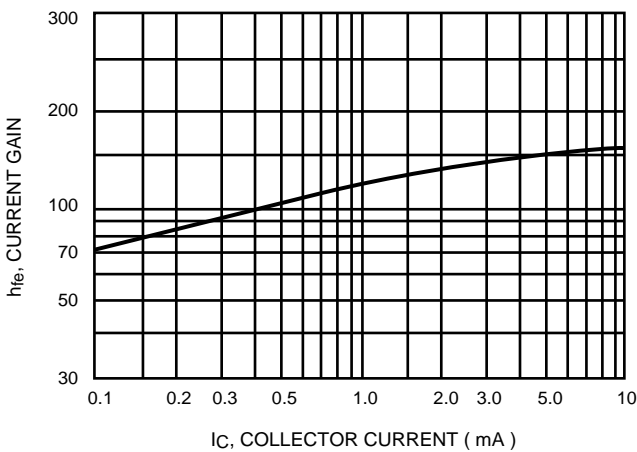


Figure 11. Current Gain

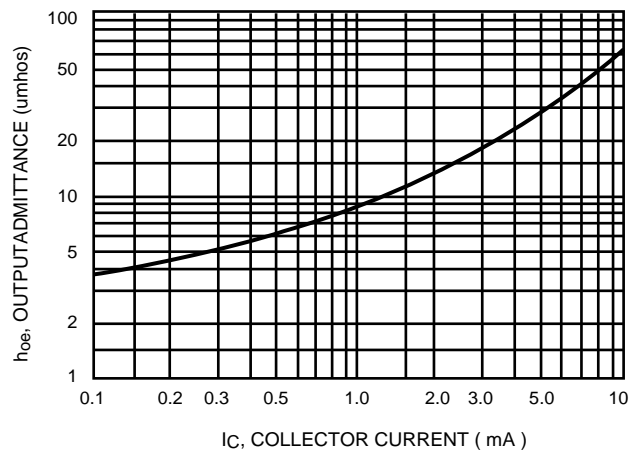


Figure 12. Output Admittance

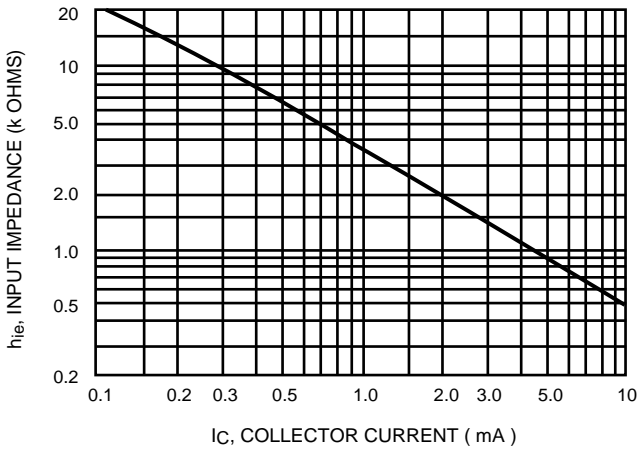


Figure 13. Input Impedance

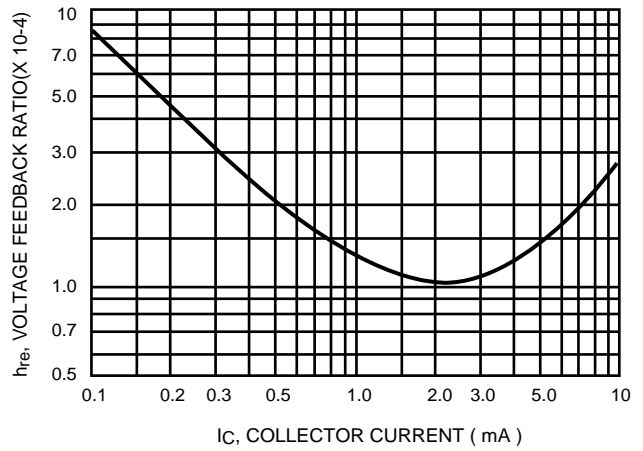


Figure 14. Voltage Feedback Ratio

TYPICAL STATIC CHARACTERISTICS

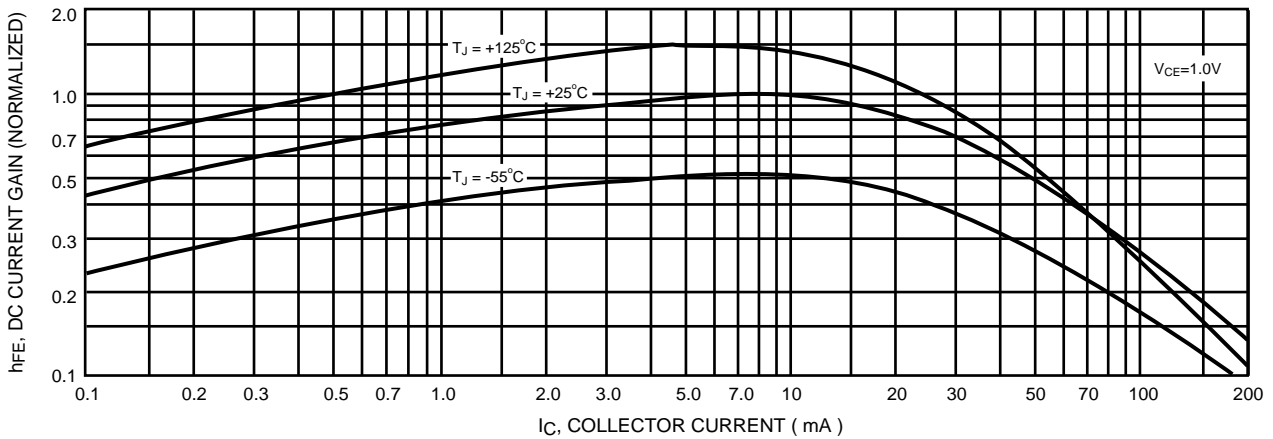


Figure 15. DC Current Gain

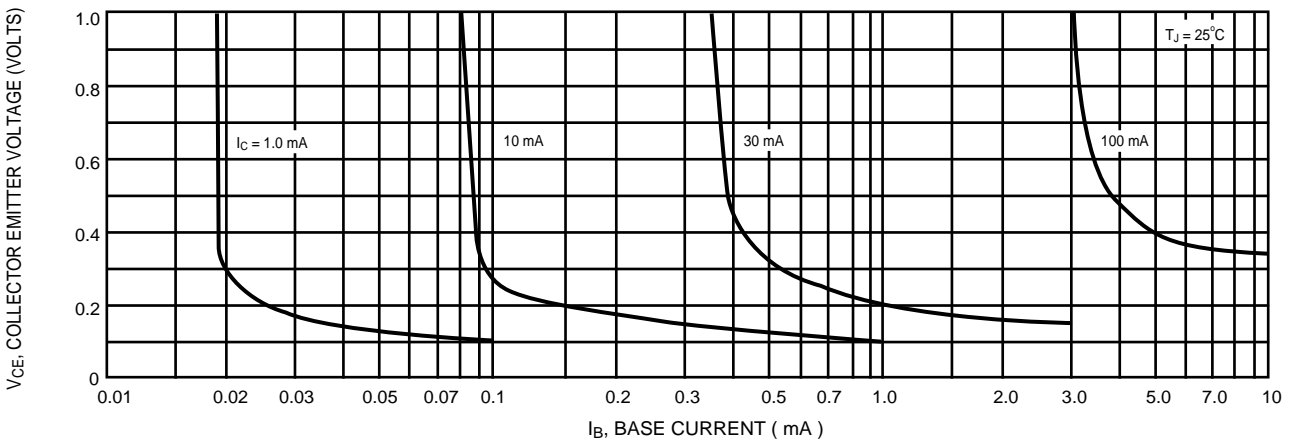


Figure 16. Collector Saturation Region

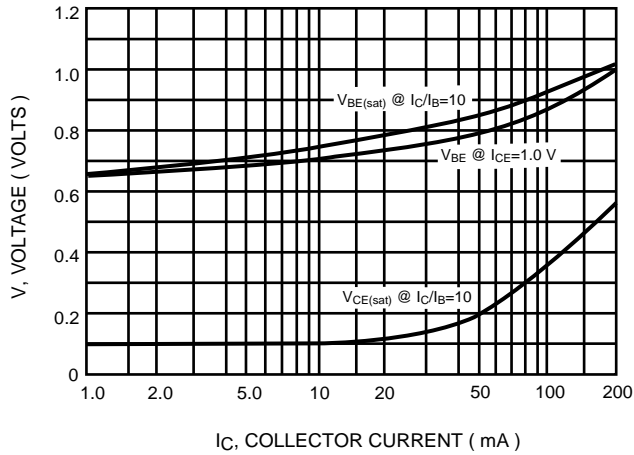


Figure 17. " ON " Voltage

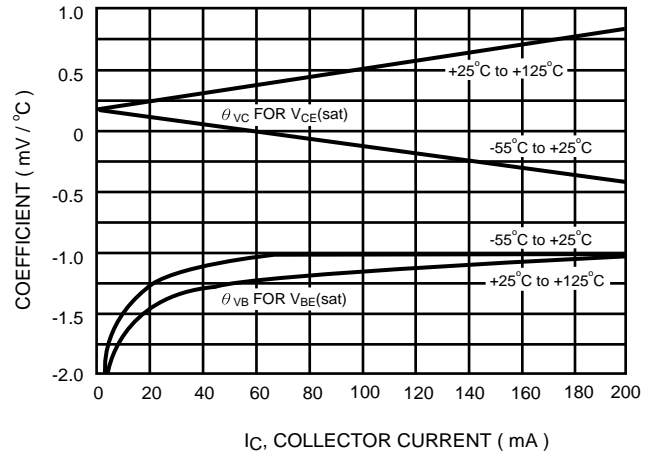


Figure 18. Temperature Coefficients

CASE DRAWINGS

SOT-23

Unit : mm

