

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

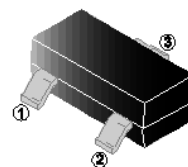
FEATURES

- Switching Transistor

SOT-23

MARKING

2X

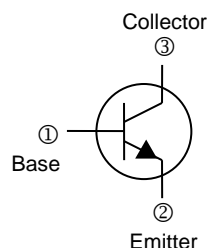


PACKAGE INFORMATION

Package	MPQ	Leader Size
SOT-23	3K	7 inch

ORDER INFORMATION

Part Number	Type
MMBT4401-C	Lead (Pb)-free and Halogen-free



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

Parameter	Symbol	Ratings	Unit
Collector-Emitter Voltage	V _{CEO}	40	V
Collector-Base Voltage	V _{CB0}	60	V
Emitter-Base Voltage	V _{EBO}	6	V
Collector Current-Continuous	I _c	600	mA
Total Device Dissipation FR-5 Board ¹ , T _A =25°C	P _D	300	mW
Total Device Dissipation FR-5 Board, Derate above 25°C		1.8	mW/°C
Thermal Resistance, Junction-Ambient	R _{θJA}	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-Ambient	R _{θJA}	417	°C/W
Junction, Storage Temperature Range	T _J , T _{STG}	-55~150	°C

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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Collector-Emitter Breakdown Voltage ³	$V_{(BR)CEO}$	40	-	-	V	$I_C=1\text{mA}, I_B=0$
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	60	-	-	V	$I_C=10\mu\text{A}, I_E=0$
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	6	-	-	V	$I_E=10\mu\text{A}, I_C=0$
Base Cut-off Current	I_{BEV}	-	-	0.1	μA	$V_{CE}=35\text{V}, V_{EB}=0.4\text{V}$
Collector Cut-off Current	I_{CEX}	-	-	0.1	μA	$V_{CE}=35\text{V}, V_{EB}=0.4\text{V}$
DC Current Gain ³	h_{FE}	20	-	-		$I_C=0.1\text{mA}, V_{CE}=1\text{V}$
		40	-	-		$I_C=1\text{mA}, V_{CE}=1\text{V}$
		80	-	-		$I_C=10\text{mA}, V_{CE}=1\text{V}$
		100	-	300		$I_C=150\text{mA}, V_{CE}=1\text{V}$
		40	-	-		$I_C=500\text{mA}, V_{CE}=2\text{V}$
Collector-Emitter Saturation Voltage ³	$V_{CE(sat)}$	-	-	0.4	V	$I_C=150\text{mA}, I_B=15\text{mA}$
		-	-	0.75		$I_C=500\text{mA}, I_B=50\text{mA}$
Base-Emitter Saturation Voltage ³	$V_{BE(sat)}$	-	-	0.95	V	$I_C=150\text{mA}, I_B=15\text{mA}$
		-	-	1.2		$I_C=500\text{mA}, I_B=50\text{mA}$
Current-Gain-Bandwidth Product	f_T	250	-	-	MHz	$I_C=20\text{mA}, V_{CE}=10\text{V}, f=100\text{MHz}$
Collector-Base Capacitance	C_{cb}	-	6.5	-	pF	$V_{CB}=5\text{V}, I_E=0, f=1\text{MHz}$
Emitter-Base Capacitance	C_{eb}	-	30	-	pF	$V_{EB}=0.5\text{V}, I_C=0, f=1\text{MHz}$
Input Impedance	h_{ie}	1	-	15	k Ω	$V_{CE}=10\text{V}, I_C=1\text{mA}, f=1\text{kHz}$
Voltage Feedback Ratio	h_{re}	0.1	-	8	$\times 10^{-4}$	$V_{CE}=10\text{V}, I_C=1\text{mA}, f=1\text{kHz}$
Small-Signal Current Gain	h_{fe}	40	-	500		$V_{CE}=10\text{V}, I_C=1\text{mA}, f=1\text{kHz}$
Output Admittance	h_{oe}	1	-	30	μmhos	$V_{CE}=10\text{V}, I_C=1\text{mA}, f=1\text{kHz}$
Delay Time	t_d	-	15	-	nS	$V_{CC}=30\text{V}, V_{EB}=2\text{V}$ $I_C=150\text{mA}, I_{B1}=15\text{mA}$
Rise Time	t_r	-	20	-		
Storage Time	t_s	-	225	-		
Fall Time	t_f	-	60	-		$V_{CC}=30\text{V}$ $I_C=150\text{mA}, I_{B1}=I_{B2}=15\text{mA}$

Notes:

- FR-5=1x0.75x0.062 in.
- Alumina=0.4x0.3x0.024 in. 99.5% alumina.
- Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$.

CHARACTERISTIC CURVES

SWITCHING TIME EQUIVALENT TEST CIRCUITS

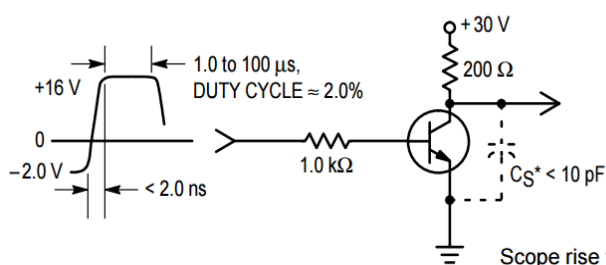


Figure 1. Turn-On Time

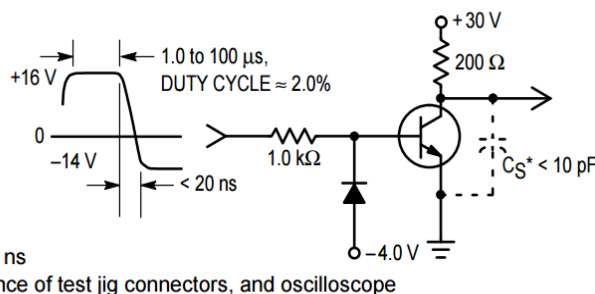


Figure 2. Turn-Off Time

CHARACTERISTIC CURVES

TRANSIENT CHARACTERISTICS

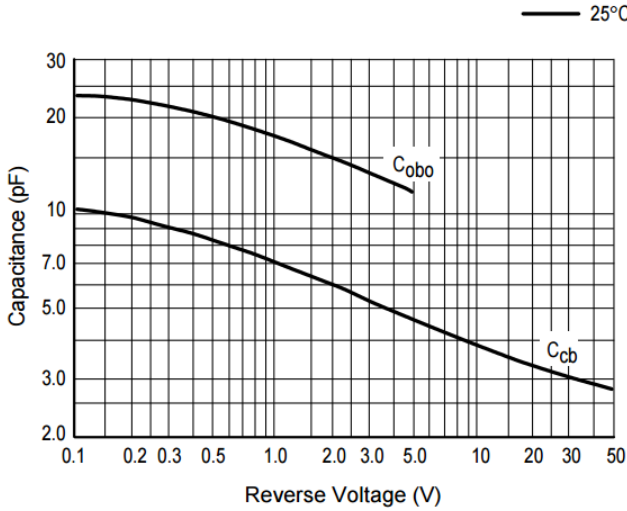


Figure 3. Capacitances

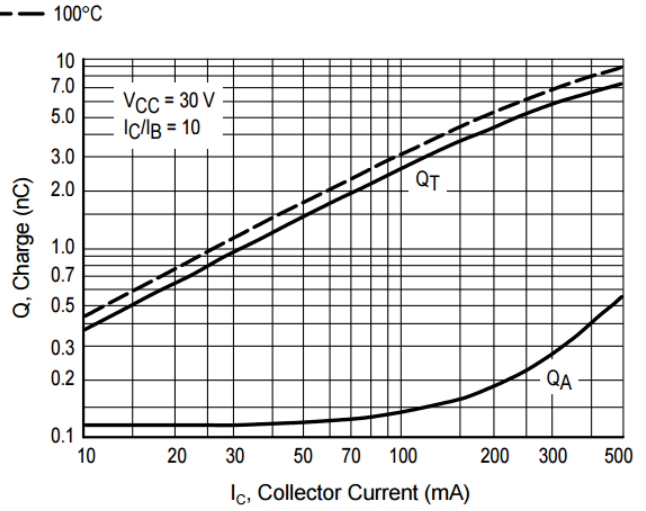


Figure 4. Charge Data

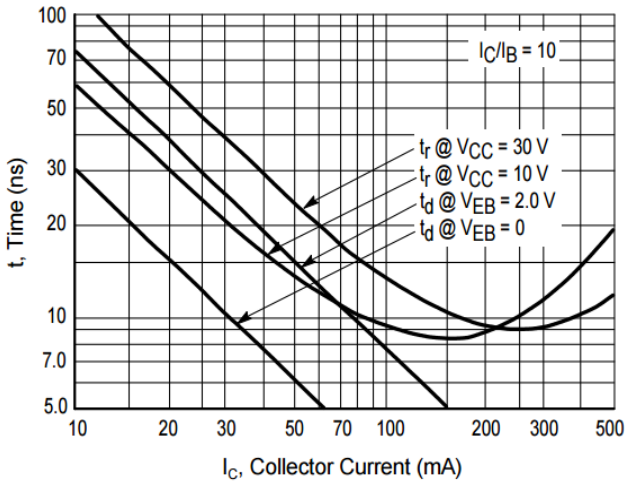


Figure 5. Turn-On Time

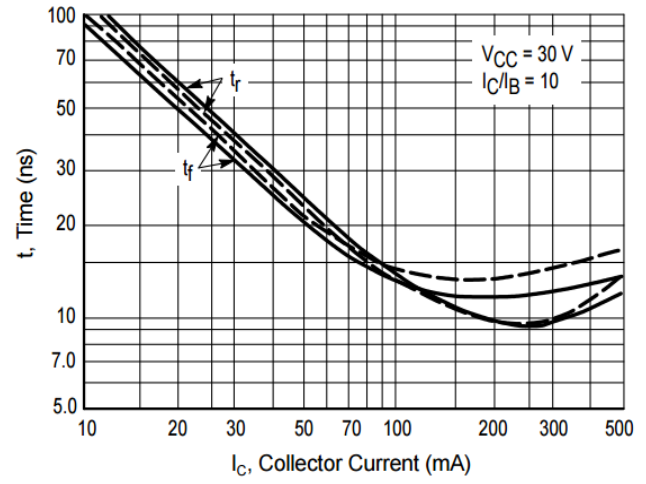


Figure 6. Rise and Fall Times

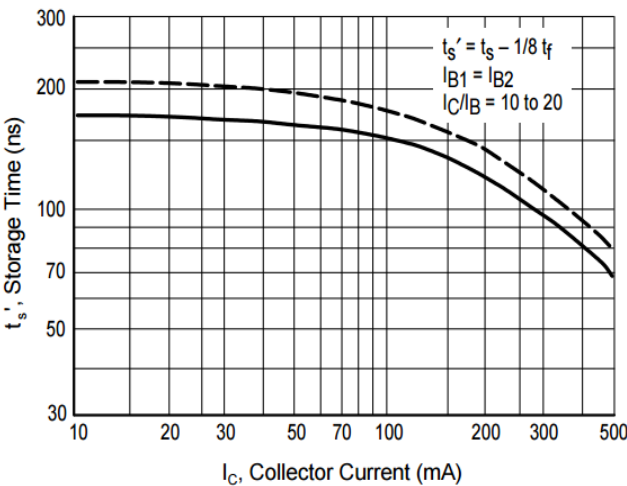


Figure 7. Storage Time

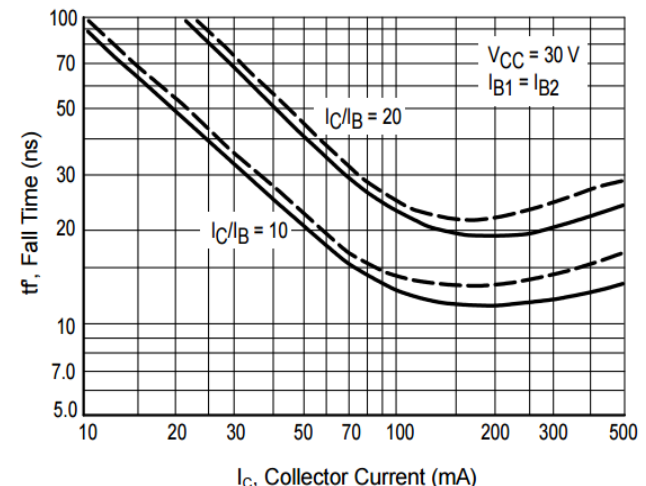


Figure 8. Fall Time

CHARACTERISTIC CURVES

SMALL-SIGNAL CHARACTERISTICS

NOISE FIGURE

$V_{CE} = 10 \text{ Vdc}$, $T_A = 25^\circ\text{C}$

Bandwidth = 1.0 Hz

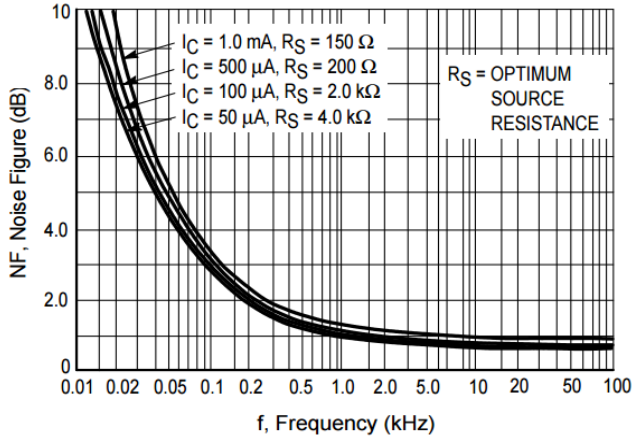


Figure 9. Frequency Effects

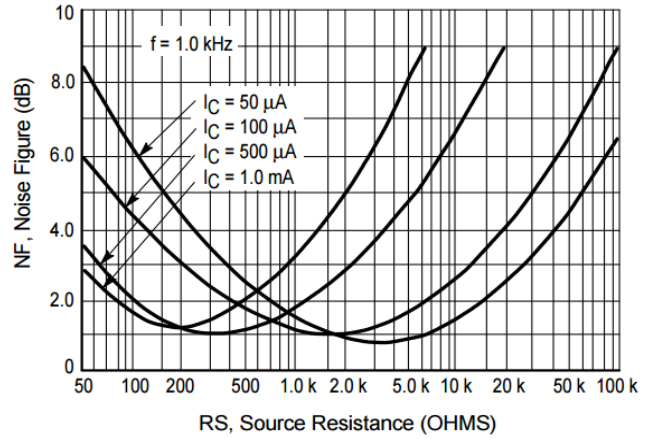


Figure 10. Source Resistance Effects

h PARAMETERS

$V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$, $T_A = 25^\circ\text{C}$

This group of graphs illustrates the relationship between h_{fe} and other "h" parameters for this series of transistors. To obtain these curves, a high±gain and a low±gain unit were

selected from the MMBT4401 lines, and the same units were used to develop the correspondingly numbered curves on each graph.

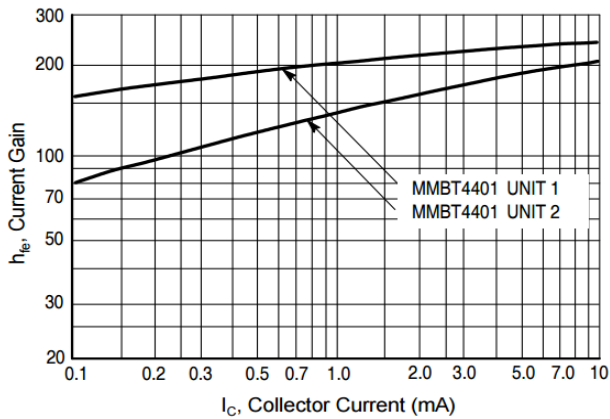


Figure 11. Current Gain

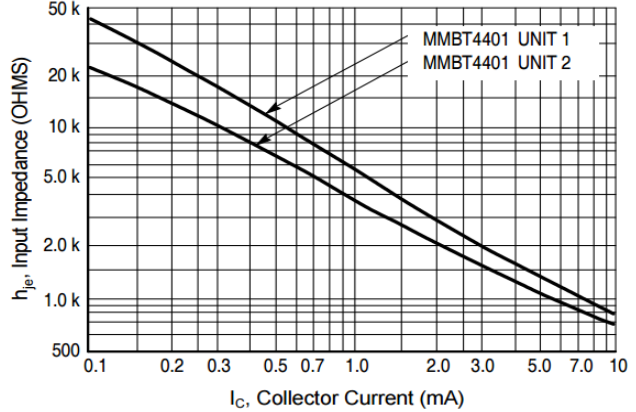


Figure 12. Input Impedance

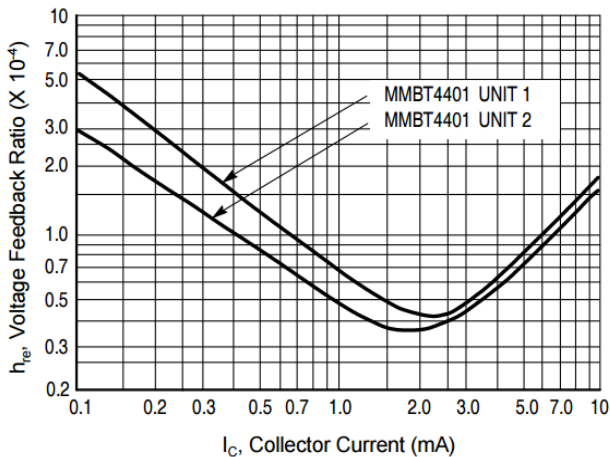


Figure 13. Voltage Feedback Ratio

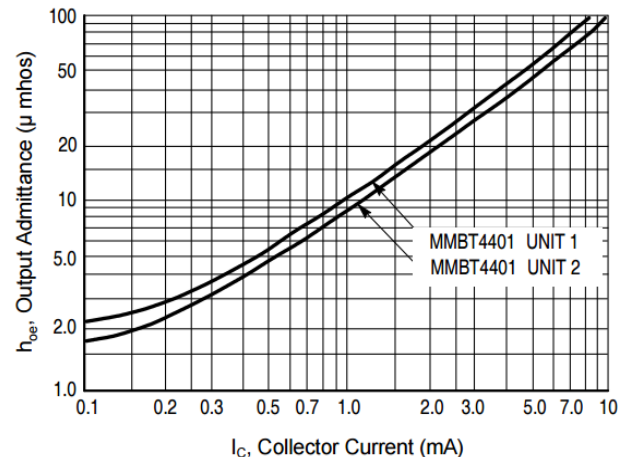


Figure 14. Output Admittance

CHARACTERISTIC CURVES

STATIC CHARACTERISTICS

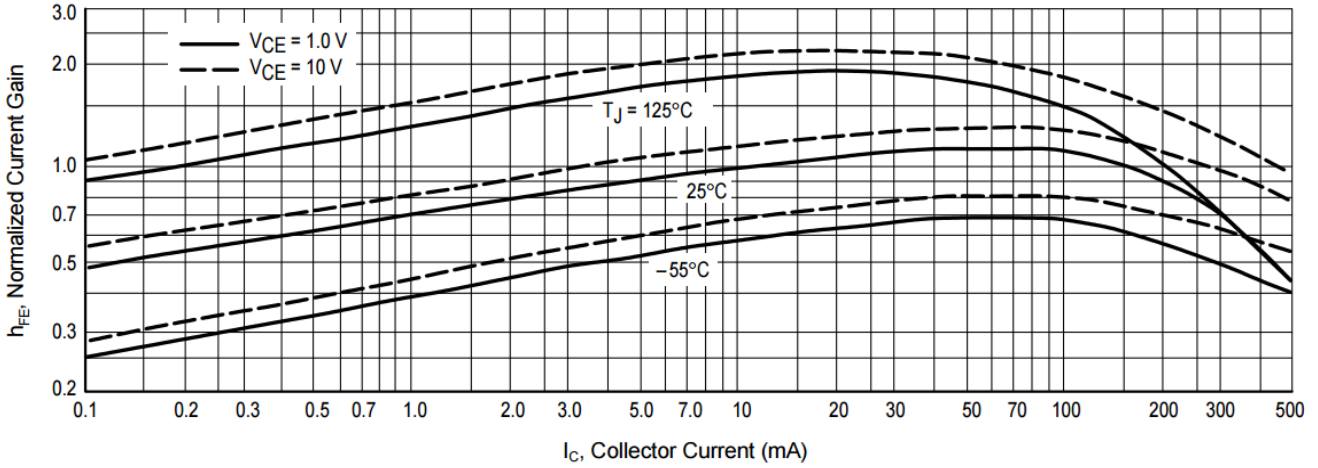


Figure 15. DC Current Gain

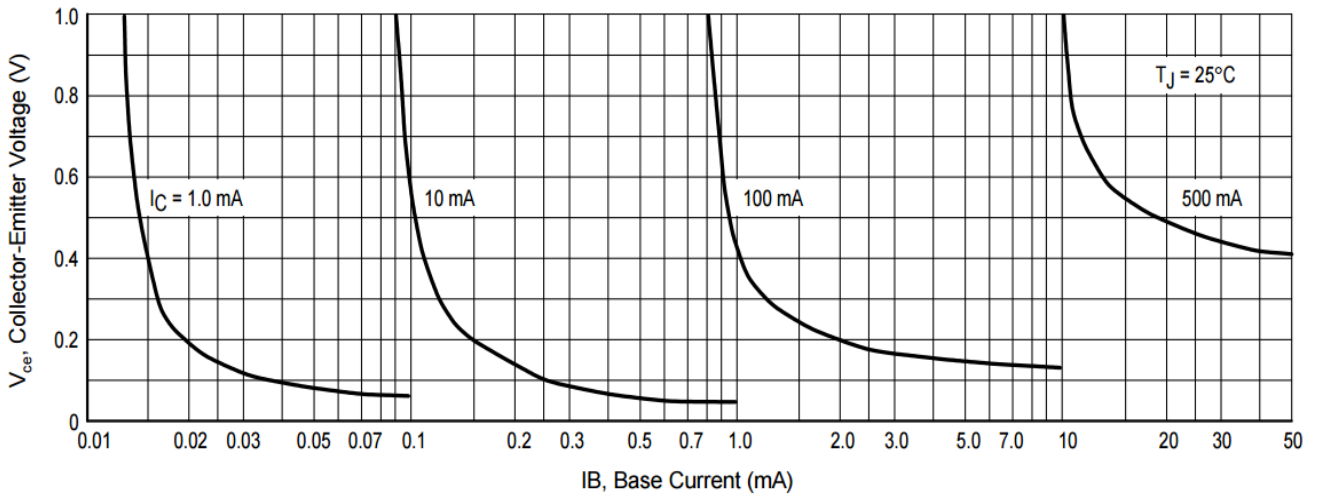


Figure 16. Collector Saturation Region

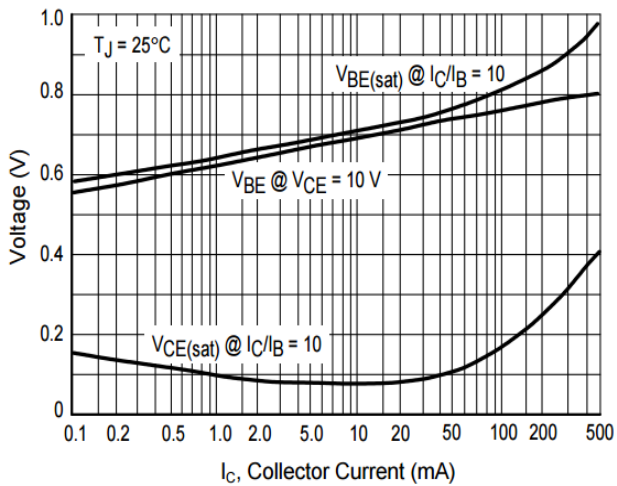


Figure 17. "On" Voltages

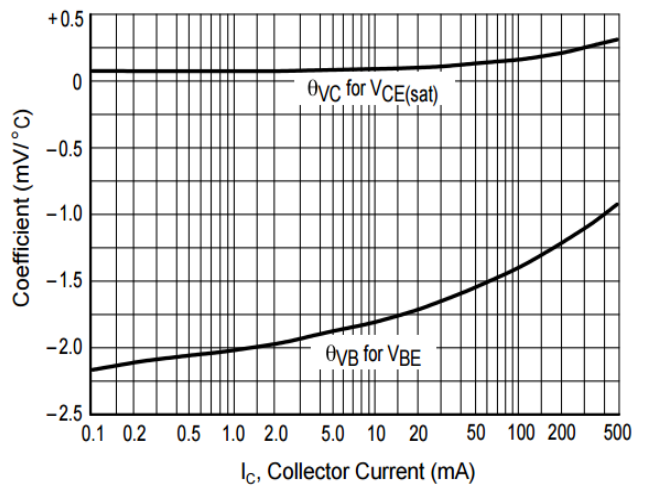
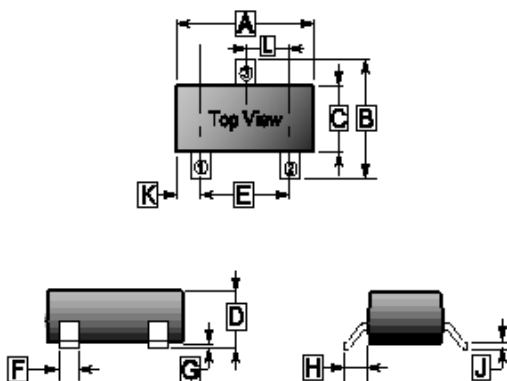


Figure 18. Temperature Coefficients

PACKAGE OUTLINE DIMENSIONS

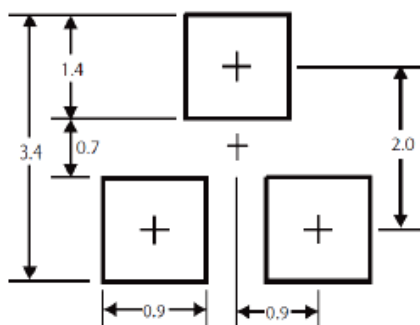
SOT-23



REF.	Millimeter	
	Min.	Max.
A	2.65	3.10
B	2.10	3.00
C	1.10	1.80
D	0.89	1.40
E	1.70	2.30
F	0.28	0.55
G	-	0.18
H	0.55 REF.	
J	0.05	0.26
K	0.60 REF.	
L	0.95 TYP.	

MOUNTING PAD LAYOUT

SOT-23



*Dimensions in millimeters