

40V NPN SMALL SIGNAL TRANSISTOR

Features

- ✧ Epitaxial Planar Die Construction
- ✧ Totally Lead-Free & Fully RoHS compliant
- ✧ Halogen and Antimony Free
- ✧ NPN

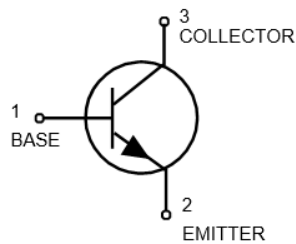
V_{CBO}	60V
V_{CEO}	40V
V_{EBO}	6.0V
I_c	200mA

Applications

- ✧ Medium Power Amplification and Switching

Mechanical Data

- ✧ Package : SOT-23



Circuit Diagram



SOT-23

Absolute Maximum Rating ($T_a=25^{\circ}\text{C}$, unless otherwise noted)

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) $T_A = 25^{\circ}\text{C}$	P_D	225	mW
Derate above 25°C		1.8	mW/ $^{\circ}\text{C}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	556	$^{\circ}\text{C}/\text{W}$
Total Device Dissipation Alumina Substrate, (2) $T_A = 25^{\circ}\text{C}$	P_D	300	mW
Derate above 25°C		2.4	mW/ $^{\circ}\text{C}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	417	$^{\circ}\text{C}/\text{W}$
Junction and Storage Temperature	T_J, T_{stg}	–55 to +150	$^{\circ}\text{C}$

Electronics Characteristics ($T_a=25^{\circ}\text{C}$, unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
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OFF CHARACTERISTICS

Collector–Emitter Breakdown Voltage(3) ($I_C = 1.0\text{ mA}$)	$V_{(BR)CEO}$	40	—	Vdc
Collector–Base Breakdown Voltage ($I_C = 10\text{ }\mu\text{A}$)	$V_{(BR)CBO}$	60	—	Vdc
Emitter–Base Breakdown Voltage ($I_E = 10\text{ }\mu\text{A}$)	$V_{(BR)EBO}$	6.0	—	Vdc
Base Cutoff Current ($V_{CE} = 30\text{ Vdc}$, $V_{EB} = 3.0\text{ Vdc}$)	I_{BL}	—	50	nAdc
Collector Cutoff Current ($V_{CE} = 30\text{ Vdc}$, $V_{EB} = 3.0\text{ Vdc}$)	I_{CEX}	—	50	nAdc

- FR-5 = $1.0 \times 0.75 \times 0.062\text{ in.}$
- Alumina = $0.4 \times 0.3 \times 0.024\text{ in.}$ 99.5% alumina.
- Pulse Test: Pulse Width $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2.0\%$.

ON CHARACTERISTICS (3)

DC Current Gain(1) ($I_C = 0.1\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$) ($I_C = 1.0\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$) ($I_C = 10\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$) ($I_C = 50\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$) ($I_C = 100\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$)	h_{FE}	40 70 100 60 30	— — 300 — —	—
Collector–Emitter Saturation Voltage ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$)(3) ($I_C = 50\text{ mA}$, $I_B = 5.0\text{ mA}$)	$V_{CE(sat)}$	— —	0.2 0.3	Vdc
Base–Emitter Saturation Voltage(3) ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$) ($I_C = 50\text{ mA}$, $I_B = 5.0\text{ mA}$)	V_{BE}	0.65 —	0.85 0.95	Vdc

SMALL-SIGNAL CHARACTERISTICS

Current–Gain — Bandwidth Product ($I_C = 10\text{ mA}$, $V_{CE} = 20\text{ Vdc}$, $f = 100\text{ MHz}$)	f_T	300	—	MHz
Output Capacitance ($V_{CB} = 5.0\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$)	C_{obo}	—	4.0	pF
Input Capacitance ($V_{EB} = 0.5\text{ Vdc}$, $I_C = 0$, $f = 1.0\text{ MHz}$)	C_{ibo}	—	8.0	pF
Input Impedance ($V_{CE} = 10\text{ Vdc}$, $I_C = 1.0\text{ mA}$, $f = 1.0\text{ kHz}$)	h_{ie}	1.0	10	k Ω
Voltage Feedback Ratio ($V_{CE} = 10\text{ Vdc}$, $I_C = 1.0\text{ mA}$, $f = 1.0\text{ kHz}$)	h_{re}	0.5	8.0	$\times 10^{-4}$
Small–Signal Current Gain ($V_{CE} = 10\text{ Vdc}$, $I_C = 1.0\text{ mA}$, $f = 1.0\text{ kHz}$)	h_{fe}	100	400	—
Output Admittance ($V_{CE} = 10\text{ Vdc}$, $I_C = 1.0\text{ mA}$, $f = 1.0\text{ kHz}$)	h_{oe}	1.0	40	μmhos
Noise Figure ($V_{CE} = 5.0\text{ Vdc}$, $I_C = 100\text{ }\mu\text{A}$, $R_s = 1.0\text{ k}\Omega$, $f = 1.0\text{ kHz}$)	NF	—	5.0	dB

SWITCHING CHARACTERISTICS

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

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

Electronics Characteristics ($T_a=25^\circ\text{C}$, unless otherwise noted)

— $T_J = 25^\circ\text{C}$
- - $T_J = 125^\circ\text{C}$

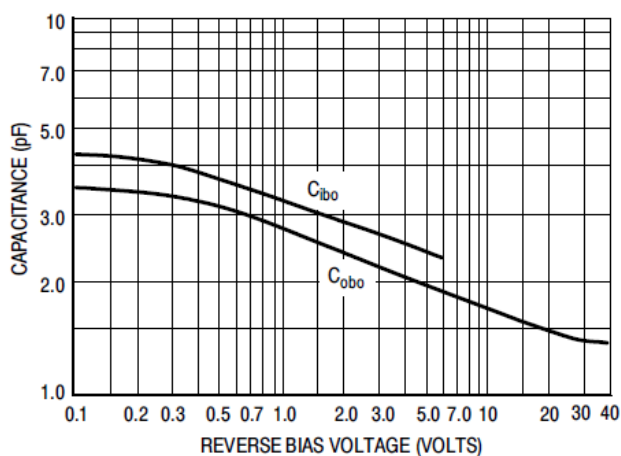


Figure 1. Capacitance

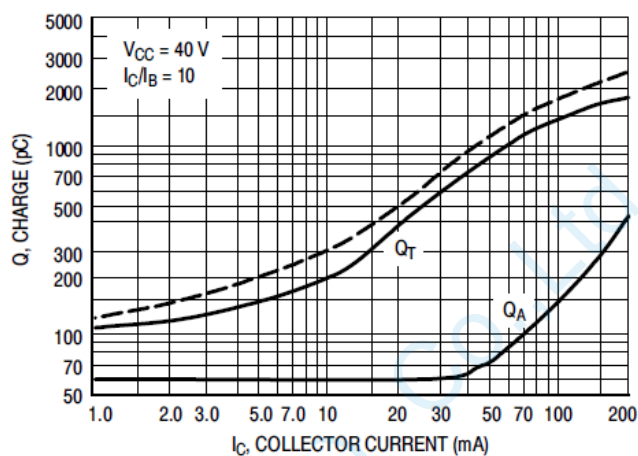


Figure 2. Charge Data

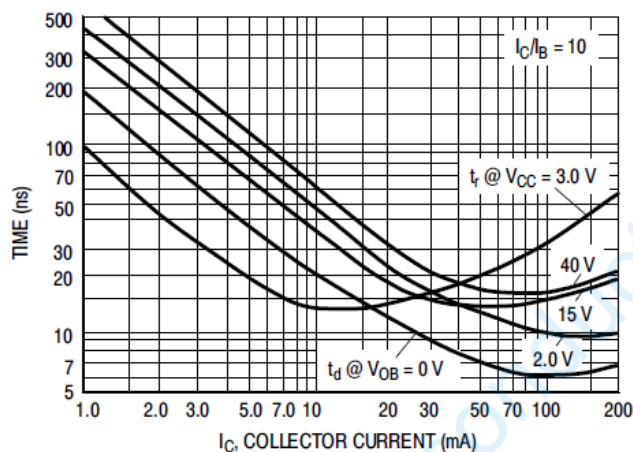


Figure 3. Turn-On Time

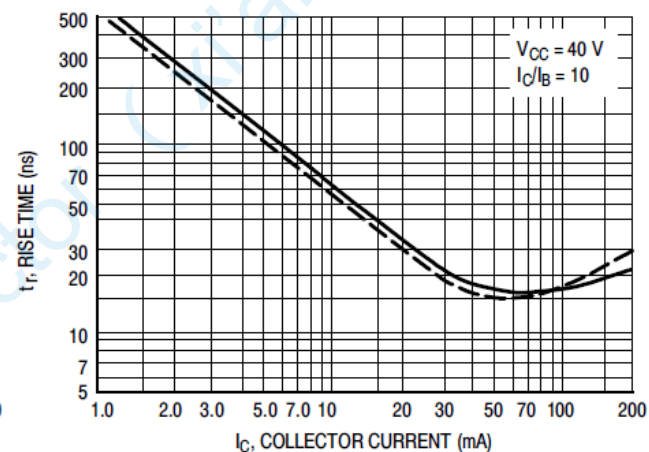


Figure 4. Rise Time

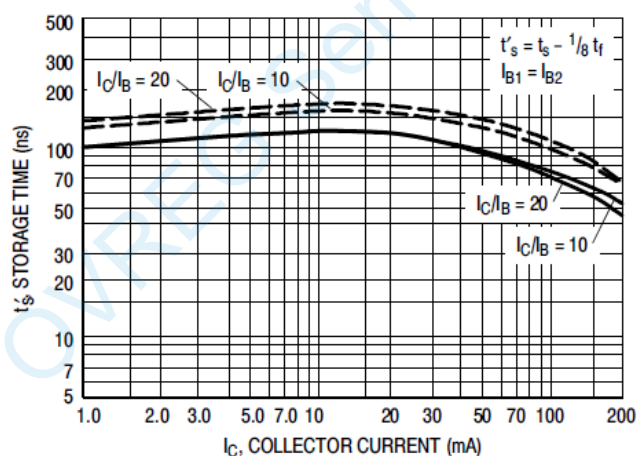


Figure 5. Storage Time

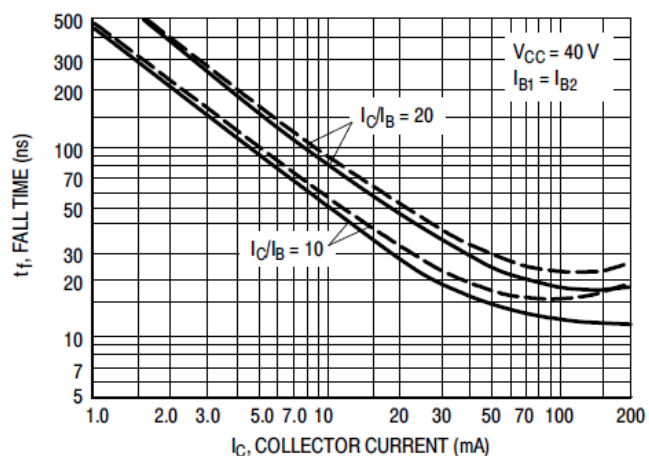


Figure 6. Fall Time

TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS **NOISE FIGURE VARIATIONS**

($V_{CE} = 5.0 \text{ Vdc}$, $T_A = 25^\circ\text{C}$, Bandwidth = 1.0 Hz)

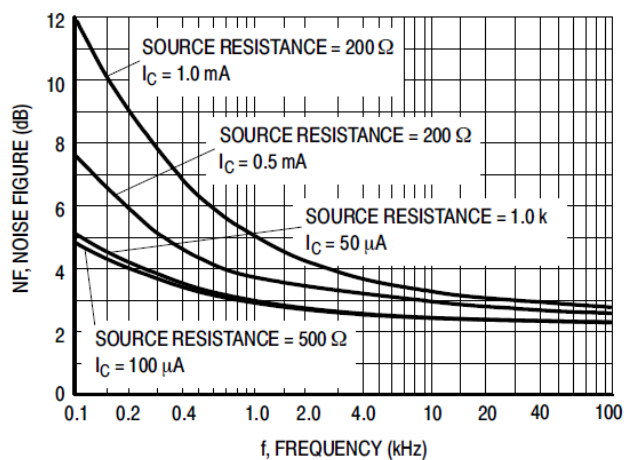


Figure 7.

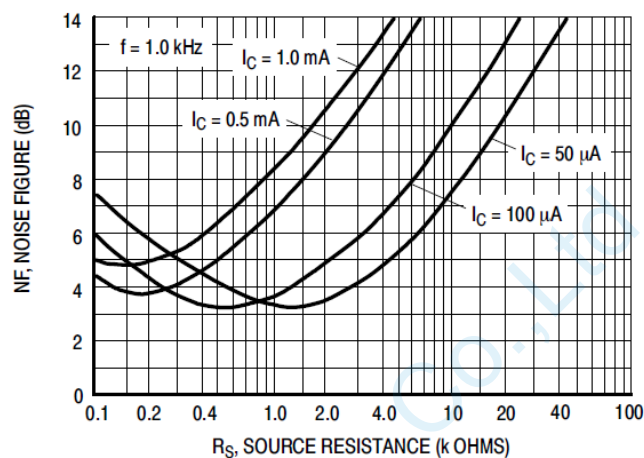


Figure 8.

h PARAMETERS

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

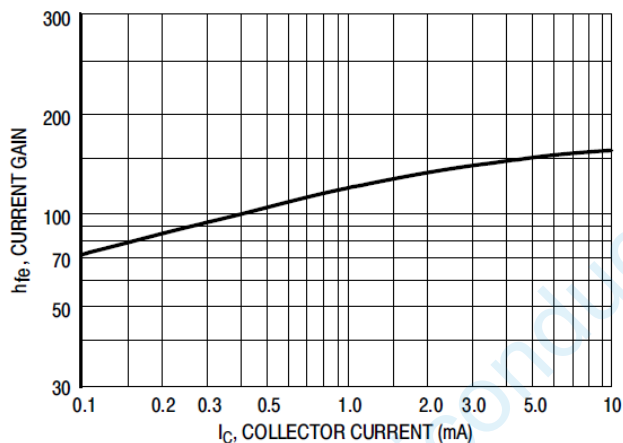


Figure 9. Current Gain

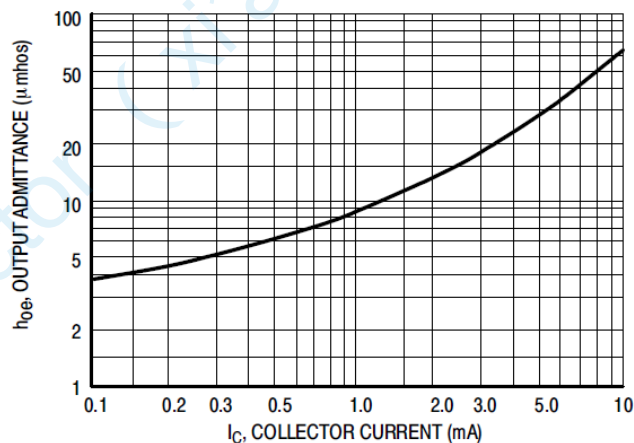


Figure 10. Output Admittance

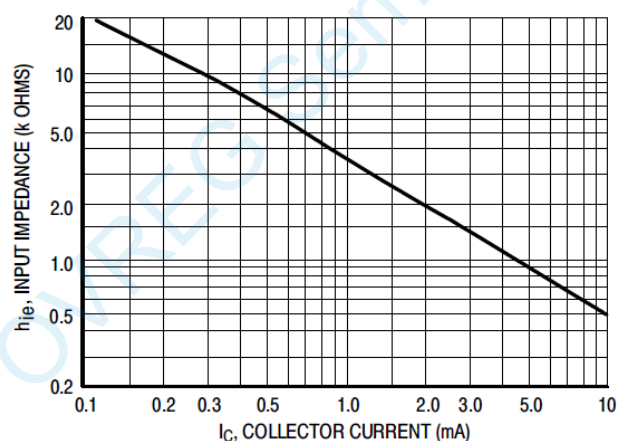


Figure 11. Input Impedance

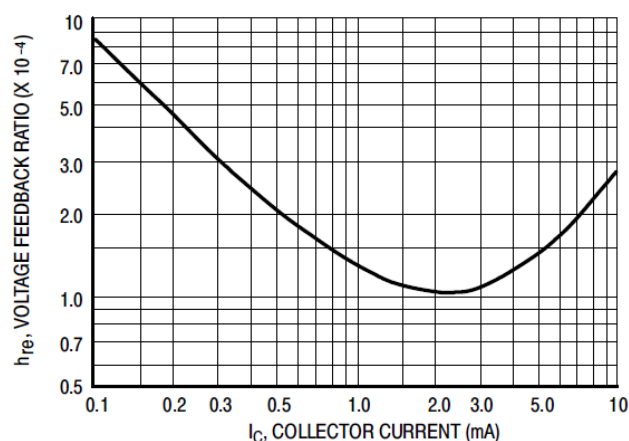


Figure 12. Voltage Feedback Ratio

TYPICAL STATIC CHARACTERISTICS

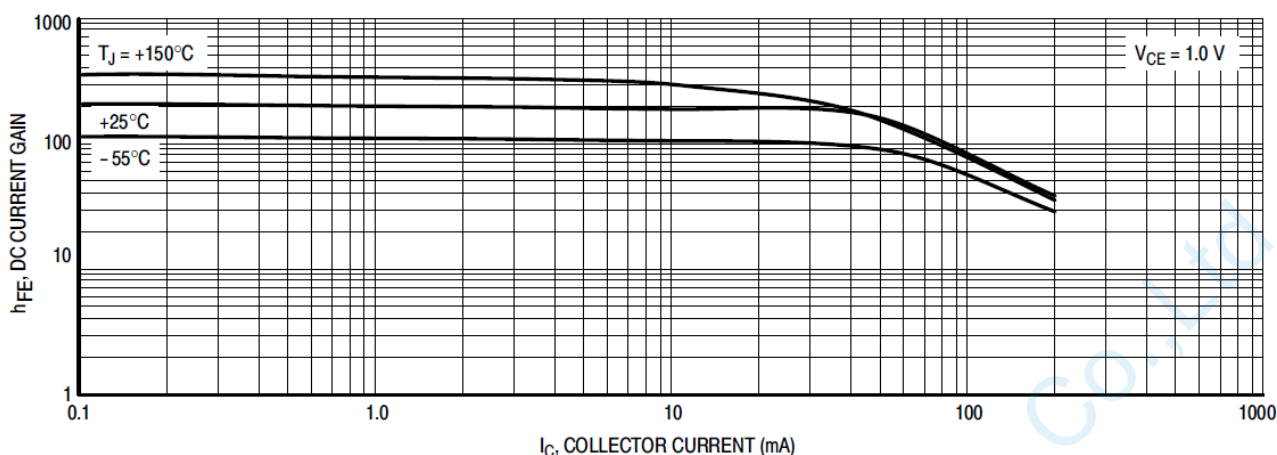


Figure 13. DC Current Gain

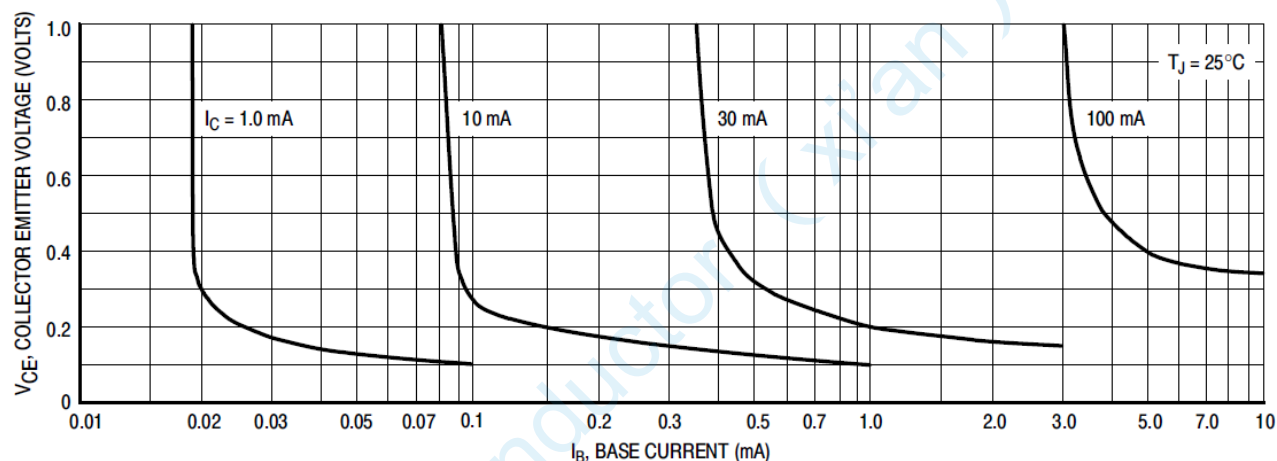


Figure 14. Collector Saturation Region

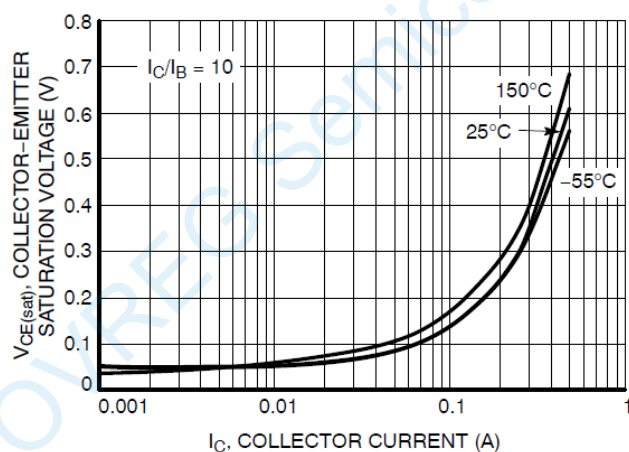


Figure 15. Collector Emitter Saturation Voltage vs. Collector Current

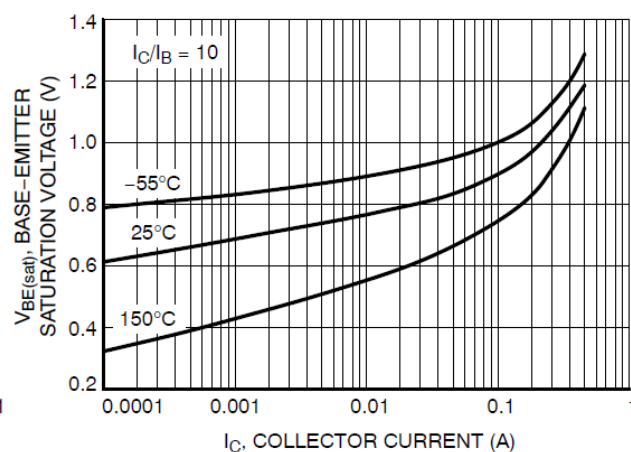


Figure 16. Base Emitter Saturation Voltage vs. Collector Current

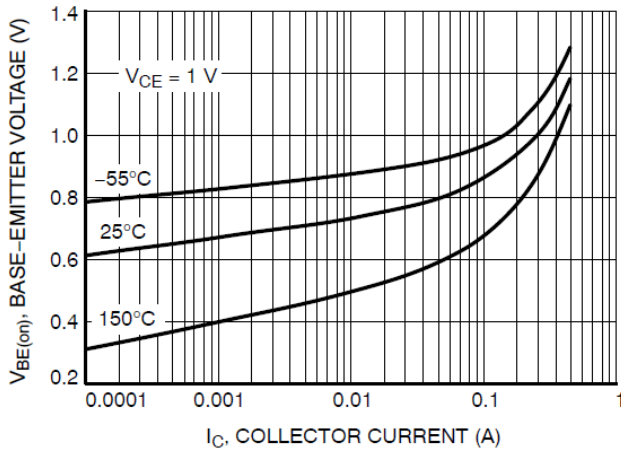


Figure 17. Base-Emitter Voltage vs. Collector Current

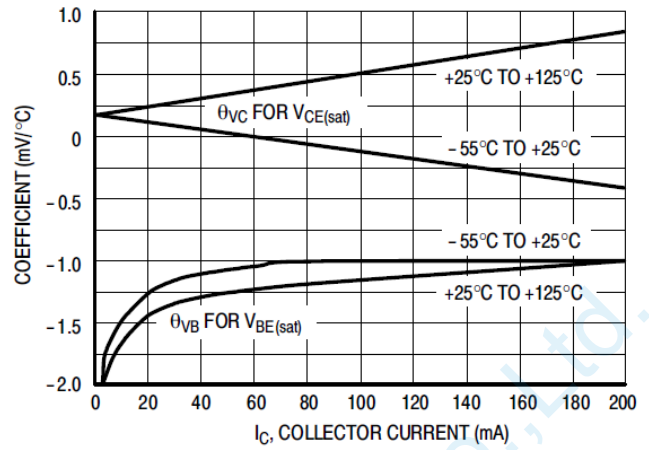


Figure 18. Temperature Coefficients

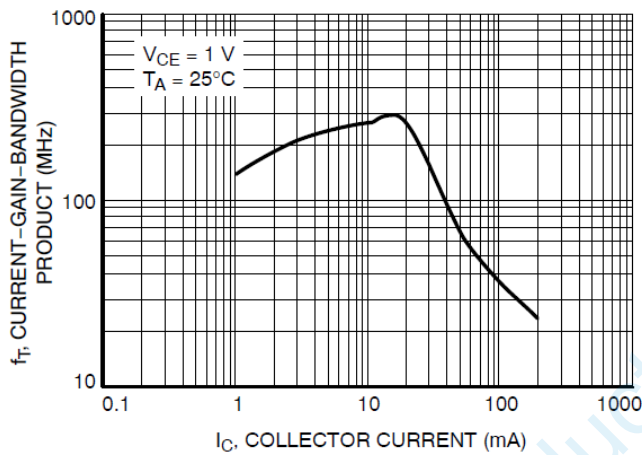


Figure 19. Current Gain Bandwidth vs. Collector Current

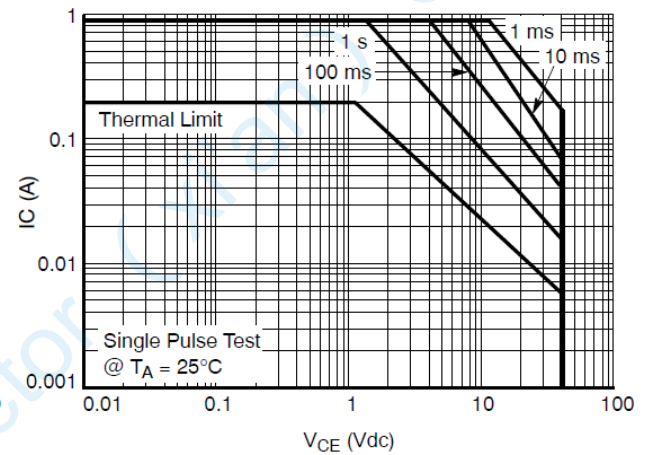
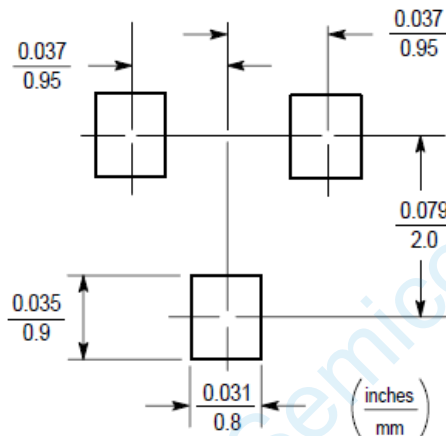
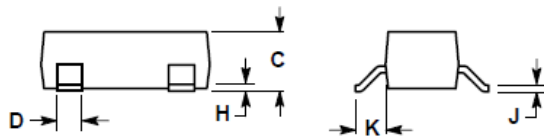
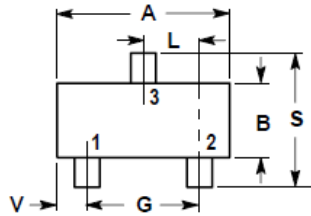


Figure 20. Safe Operating Area

Package information

SOT-23



NOTES:

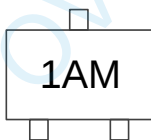
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

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

PIN 1. BASE
2. EMITTER
3. COLLECTOR

Notes: This Pcb Layout Is For Reference Purposes Only

Marking



Ordering Information

Part number	Material	Type	Reel size	MOQ	MOQ/internal box	MOQ/carton
OVS3904ST3R	GREEN	T/R	7 inch	3k/reel	10reel= 30k/box	4boxes=120k/carton