MBT3946DW1T1

Dual General Purpose Transistor

The MBT3946DW1T1 device is a spin−off of our popular SOT−23/SOT−323 three−leaded device. It is designed for general purpose amplifier applications and is housed in the SOT−363−6 surface mount package. By putting two discrete devices in one package, this device is ideal for low−power surface mount applications where board space is at a premium.

- h_{FE}, 100−300
- Low $V_{CE(sat)}$, ≤ 0.4 V
- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- Available in 8 mm, 7−inch/3,000 Unit Tape and Reel
- Device Marking: MBT3946DW1T1 = 46
- Pb−Free Package May be Available. The G−Suffix Denotes a Pb−Free Lead Finish

ON Semiconductor®

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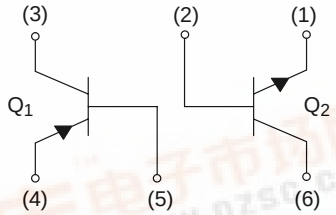
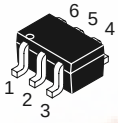


MBT3946DW1T1*

*Q1 PNP
Q2 NPN



SOT−363−6/SC−88
CASE 419B
Style 1

MAXIMUM RATINGS

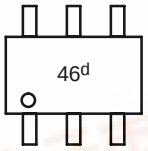
Rating	Symbol	Value	Unit
Collector−Emitter Voltage (NPN) (PNP)	V_{CEO}	 40 −40	Vdc
Collector−Base Voltage (NPN) (PNP)	V_{CBO}	 60 −40	Vdc
Emitter−Base Voltage (NPN) (PNP)	V_{EBO}	 6.0 −5.0	Vdc
Collector Current − Continuous (NPN) (PNP)	I_C	 200 −200	mAdc
Electrostatic Discharge	ESD	HBM>16000, MM>2000	V

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Package Dissipation (Note 1) T_A = 25°C	P_D	150	mW
Thermal Resistance Junction−to−Ambient	$R_{\theta JA}$	833	°C/W
Junction and Storage Temperature Range	T_J, T_{stg}	−55 to +150	°C

1. Device mounted on FR4 glass epoxy printed circuit board using the minimum recommended footprint.

MARKING DIAGRAM



46 = Specific Device Code
d = Date Code

ORDERING INFORMATION

Device	Package	Shipping†
MBT3946DW1T1	SOT−363	3000/Tape & Reel
MBT3946DW1T1G	SOT−363	3000/Tape & Reel
MBT3946DW1T2	SOT−363	3000/Tape & Reel
MBT3946DW1T2G	SOT−363	3000/Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

Publication Order Number:

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

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector−Emitter Breakdown Voltage (Note 2)		$V_{(BR)CEO}$			Vdc
(I_C = 1.0 mAdc, I_B = 0)	(NPN)		40	−	
(I_C = −1.0 mAdc, I_B = 0)	(PNP)		−40	−	
Collector−Base Breakdown Voltage		$V_{(BR)CBO}$			Vdc
(I_C = 10 μAdc, I_E = 0)	(NPN)		60	−	
(I_C = −10 μAdc, I_E = 0)	(PNP)		−40	−	
Emitter−Base Breakdown Voltage		$V_{(BR)EBO}$			Vdc
(I_E = 10 μAdc, I_C = 0)	(NPN)		6.0	−	
(I_E = −10 μAdc, I_C = 0)	(PNP)		−5.0	−	
Base Cutoff Current		I_{BL}			nAdc
(V_{CE} = 30 Vdc, V_{EB} = 3.0 Vdc)	(NPN)		−	50	
(V_{CE} = −30 Vdc, V_{EB} = −3.0 Vdc)	(PNP)		−	−50	
Collector Cutoff Current		I_{CEX}			nAdc
(V_{CE} = 30 Vdc, V_{EB} = 3.0 Vdc)	(NPN)		−	50	
(V_{CE} = −30 Vdc, V_{EB} = −3.0 Vdc)	(PNP)		−	−50	
ON CHARACTERISTICS (Note 2)					
DC Current Gain		h_{FE}			−
(I_C = 0.1 mAdc, V_{CE} = 1.0 Vdc)	(NPN)		40	−	
(I_C = 1.0 mAdc, V_{CE} = 1.0 Vdc)			70	−	
(I_C = 10 mAdc, V_{CE} = 1.0 Vdc)			100	300	
(I_C = 50 mAdc, V_{CE} = 1.0 Vdc)			60	−	
(I_C = 100 mAdc, V_{CE} = 1.0 Vdc)			30	−	
(I_C = −0.1 mAdc, V_{CE} = −1.0 Vdc)	(PNP)		60	−	
(I_C = −1.0 mAdc, V_{CE} = −1.0 Vdc)			80	−	
(I_C = −10 mAdc, V_{CE} = −1.0 Vdc)			100	300	
(I_C = −50 mAdc, V_{CE} = −1.0 Vdc)			60	−	
(I_C = −100 mAdc, V_{CE} = −1.0 Vdc)			30	−	
Collector−Emitter Saturation Voltage		$V_{CE(sat)}$			Vdc
(I_C = 10 mAdc, I_B = 1.0 mAdc)	(NPN)		−	0.2	
(I_C = 50 mAdc, I_B = 5.0 mAdc)			−	0.3	
(I_C = −10 mAdc, I_B = −1.0 mAdc)	(PNP)		−	−0.25	
(I_C = −50 mAdc, I_B = −5.0 mAdc)			−	−0.4	
Base−Emitter Saturation Voltage		$V_{BE(sat)}$			Vdc
(I_C = 10 mAdc, I_B = 1.0 mAdc)	(NPN)		0.65	0.85	
(I_C = 50 mAdc, I_B = 5.0 mAdc)			−	0.95	
(I_C = −10 mAdc, I_B = −1.0 mAdc)	(PNP)		−0.65	−0.85	
(I_C = −50 mAdc, I_B = −5.0 mAdc)			−	−0.95	
SMALL−SIGNAL CHARACTERISTICS					
Current−Gain − Bandwidth Product		f_T			MHz
(I_C = 10 mAdc, V_{CE} = 20 Vdc, f = 100 MHz)	(NPN)		300	−	
(I_C = −10 mAdc, V_{CE} = −20 Vdc, f = 100 MHz)	(PNP)		250	−	
Output Capacitance		C_{obo}			pF
(V_{CB} = 5.0 Vdc, I_E = 0, f = 1.0 MHz)	(NPN)		−	4.0	
(V_{CB} = −5.0 Vdc, I_E = 0, f = 1.0 MHz)	(PNP)		−	4.5	
Input Capacitance		C_{ibo}			pF
(V_{EB} = 0.5 Vdc, I_C = 0, f = 1.0 MHz)	(NPN)		−	8.0	
(V_{EB} = −0.5 Vdc, I_C = 0, f = 1.0 MHz)	(PNP)		−	10.0	

2. Pulse Test: Pulse Width ≤ 300 μs; Duty Cycle ≤ 2.0%.

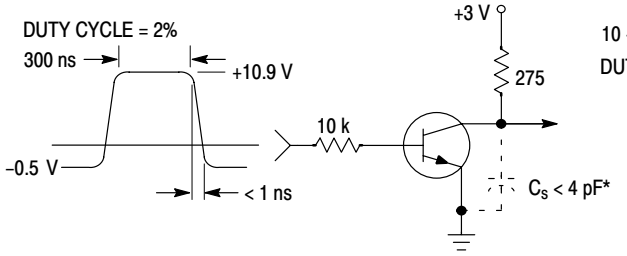
ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (Continued)

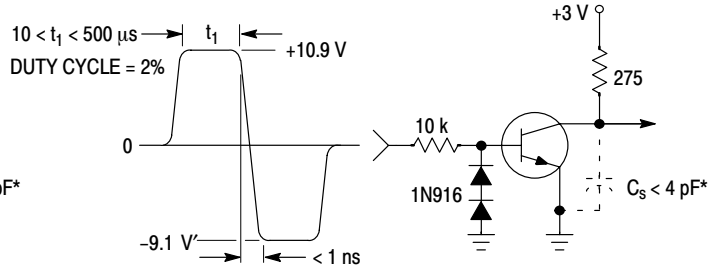
Characteristic		Symbol	Min	Max	Unit
Input Impedance		h_{ie}			kΩ
(V_{CE} = 10 Vdc, I_C = 1.0 mAdc, f = 1.0 kHz)	(NPN)		1.0	10	
(V_{CE} = −10 Vdc, I_C = −1.0 mAdc, f = 1.0 kHz)	(PNP)		2.0	12	
Voltage Feedback Ratio		h_{re}			X 10^{-4}
(V_{CE} = 10 Vdc, I_C = 1.0 mAdc, f = 1.0 kHz)	(NPN)		0.5	8.0	
(V_{CE} = −10 Vdc, I_C = −1.0 mAdc, f = 1.0 kHz)	(PNP)		0.1	10	
Small−Signal Current Gain		h_{fe}			−
(V_{CE} = 10 Vdc, I_C = 1.0 mAdc, f = 1.0 kHz)	(NPN)		100	400	
(V_{CE} = −10 Vdc, I_C = −1.0 mAdc, f = 1.0 kHz)	(PNP)		100	400	
Output Admittance		h_{oe}			μmhos
(V_{CE} = 10 Vdc, I_C = 1.0 mAdc, f = 1.0 kHz)	(NPN)		1.0	40	
(V_{CE} = −10 Vdc, I_C = −1.0 mAdc, f = 1.0 kHz)	(PNP)		3.0	60	
Noise Figure		NF			dB
(V_{CE} = 5.0 Vdc, I_C = 100 μAdc, R_S = 1.0 kΩ, f = 1.0 kHz)	(NPN)		−	5.0	
(V_{CE} = −5.0 Vdc, I_C = −100 μAdc, R_S = 1.0 kΩ, f = 1.0 kHz)	(PNP)		−	4.0	

SWITCHING CHARACTERISTICS

Delay Time	(V_{CC} = 3.0 Vdc, V_{BE} = −0.5 Vdc)	(NPN)	t_d	−	35	ns
	(V_{CC} = −3.0 Vdc, V_{BE} = 0.5 Vdc)	(PNP)		−	35	
Rise Time	(I_C = 10 mAdc, I_{B1} = 1.0 mAdc)	(NPN)	t_r	−	35	
	(I_C = −10 mAdc, I_{B1} = −1.0 mAdc)	(PNP)		−	35	
Storage Time	(V_{CC} = 3.0 Vdc, I_C = 10 mAdc)	(NPN)	t_s	−	200	ns
	(V_{CC} = −3.0 Vdc, I_C = −10 mAdc)	(PNP)		−	225	
Fall Time	(I_{B1} = I_{B2} = 1.0 mAdc)	(NPN)	t_f	−	50	
	(I_{B1} = I_{B2} = −1.0 mAdc)	(PNP)		−	75	

(NPN)





* Total shunt capacitance of test jig and connectors

Figure 1. Delay and Rise Time Equivalent Test Circuit

Figure 2. Storage and Fall Time Equivalent Test Circuit

TYPICAL TRANSIENT CHARACTERISTICS

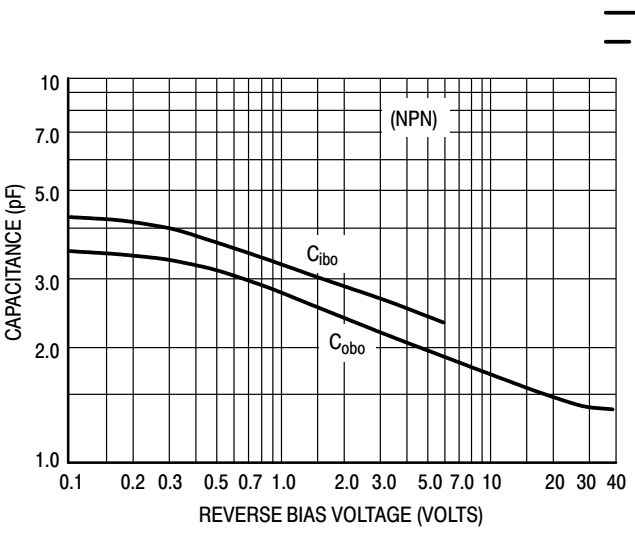


Figure 3. Capacitance

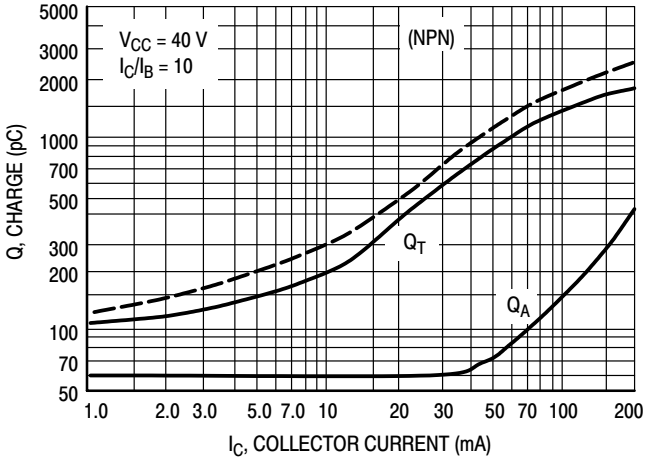


Figure 4. Charge Data

(NPN)

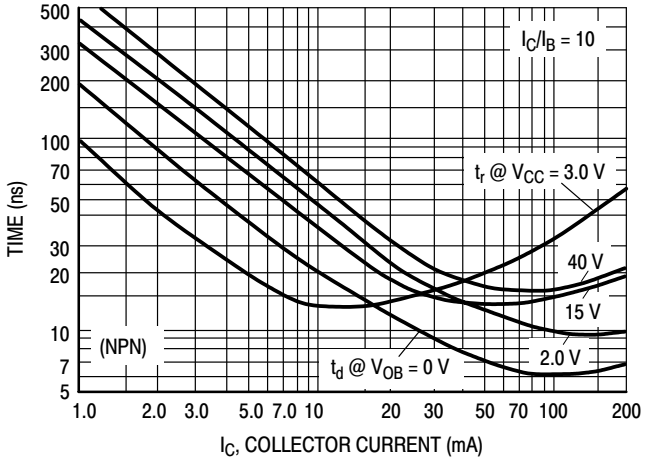


Figure 5. Turn−On Time

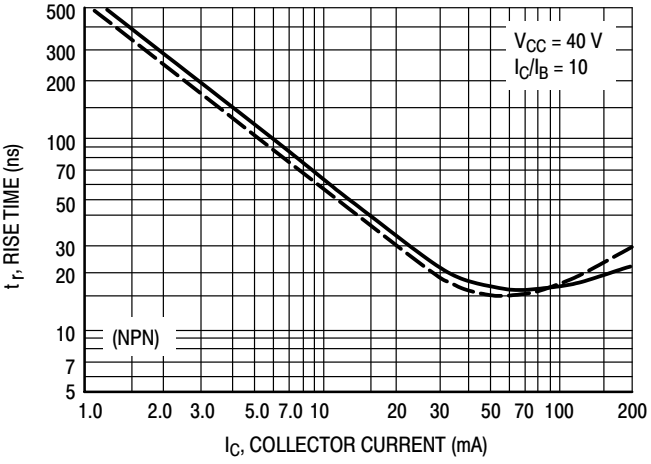


Figure 6. Rise Time

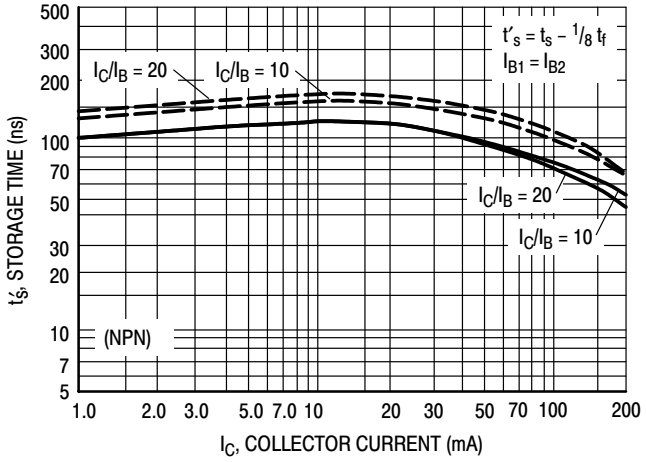


Figure 7. Storage Time

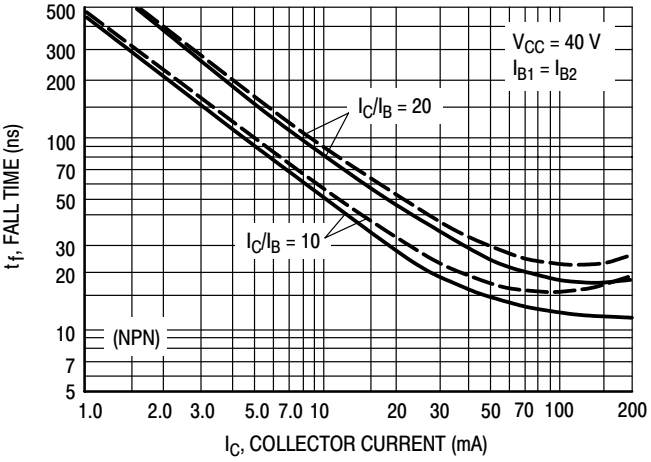


Figure 8. Fall Time

TYPICAL AUDIO SMALL−SIGNAL CHARACTERISTICS
NOISE FIGURE VARIATIONS

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

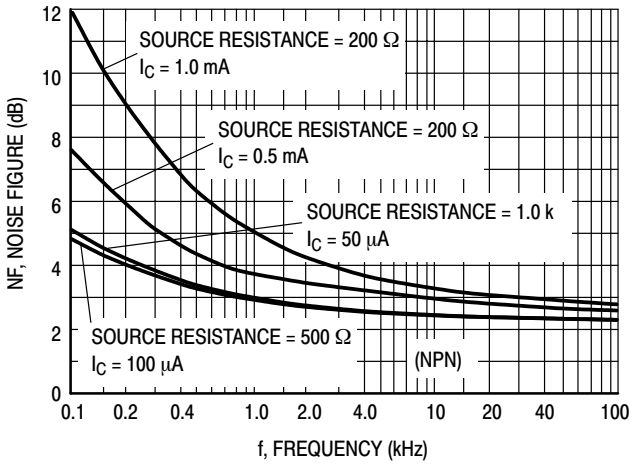


Figure 9. Noise Figure

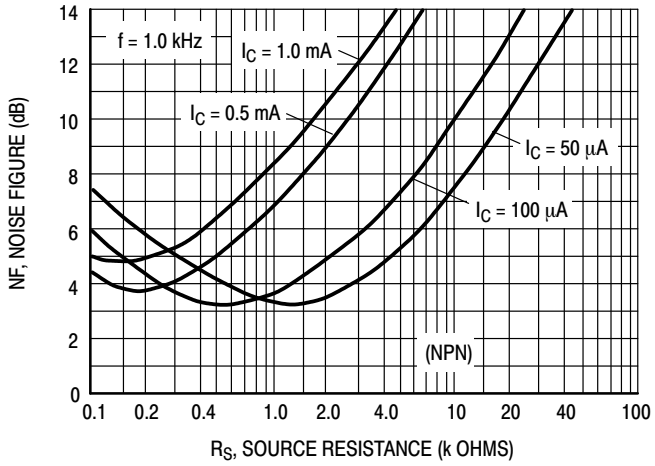


Figure 10. Noise Figure

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

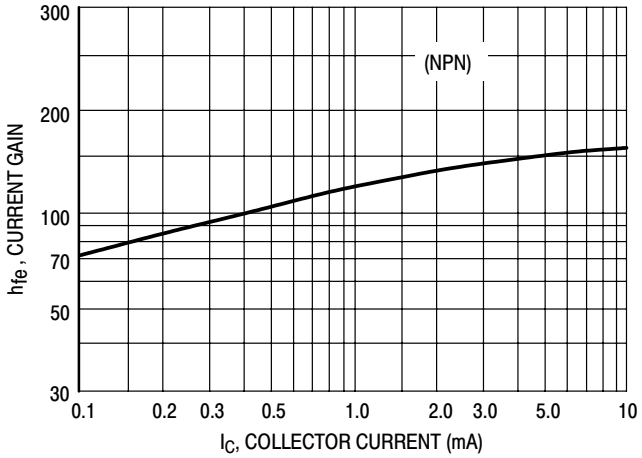


Figure 11. Current Gain

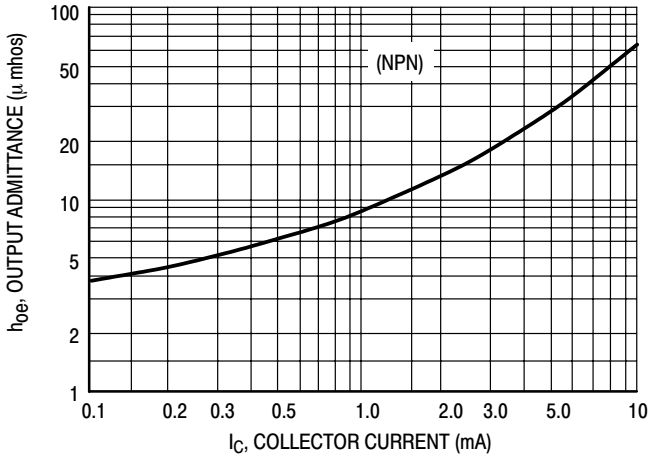


Figure 12. Output Admittance

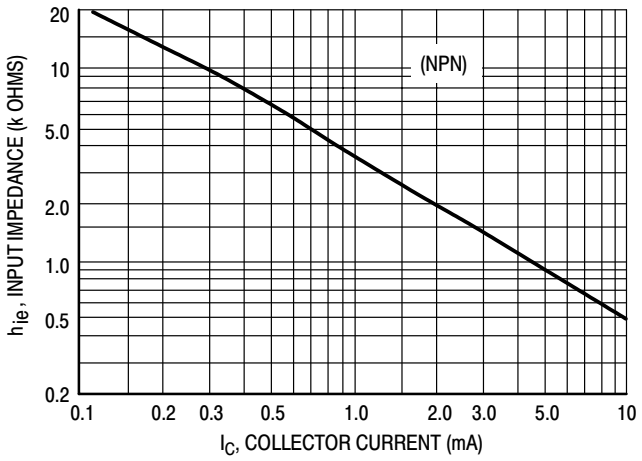


Figure 13. Input Impedance

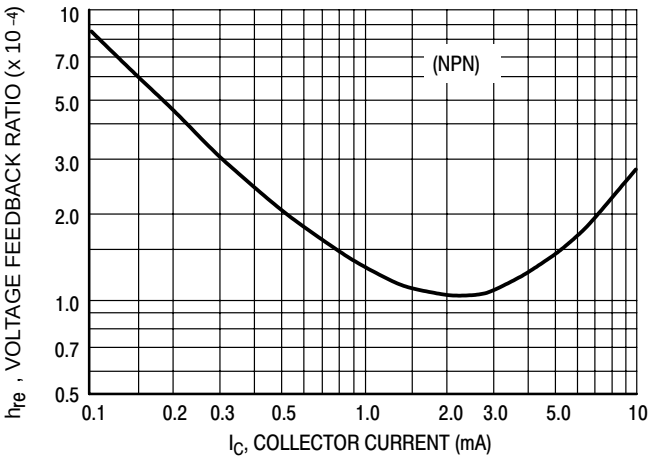


Figure 14. Voltage Feedback Ratio

(NPN)
TYPICAL STATIC CHARACTERISTICS

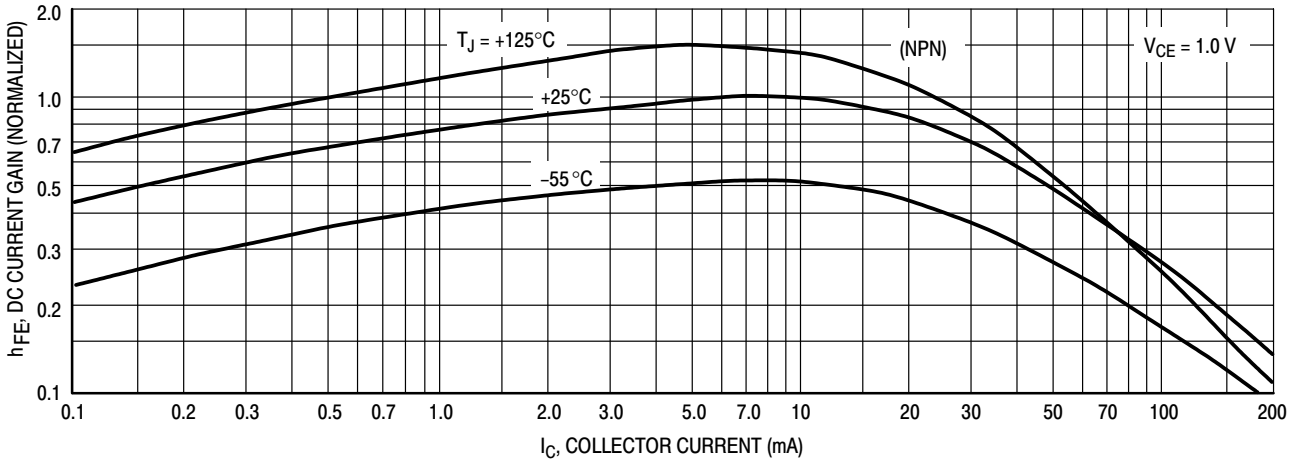


Figure 15. DC Current Gain

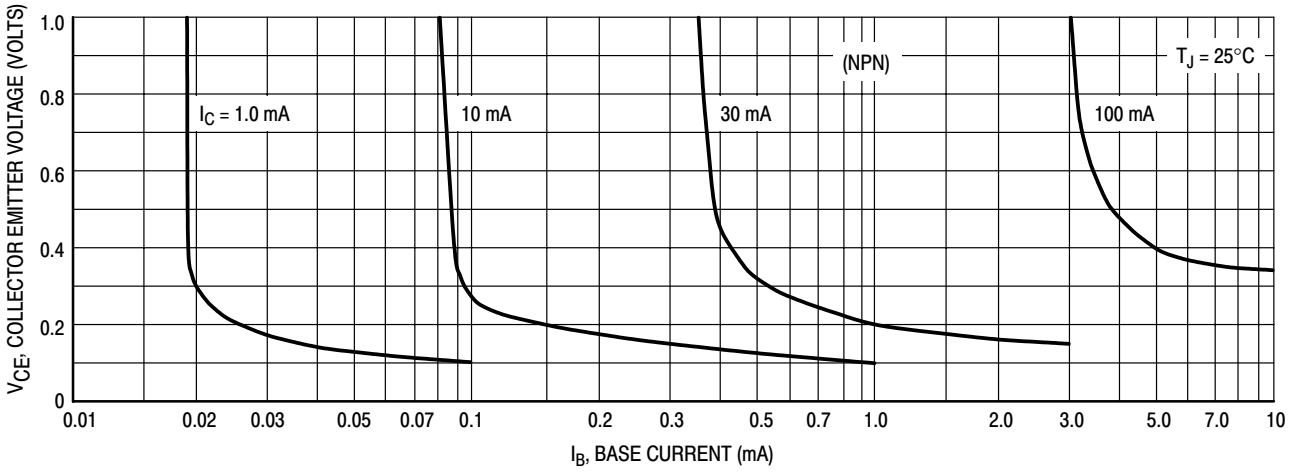


Figure 16. Collector Saturation Region

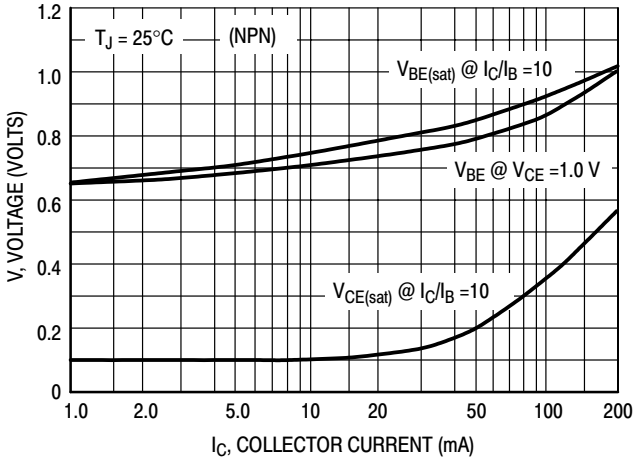


Figure 17. “ON” Voltages

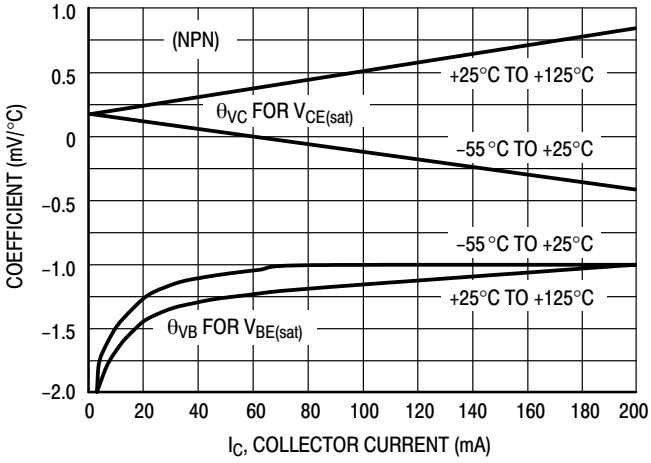


Figure 18. Temperature Coefficients

(PNP)

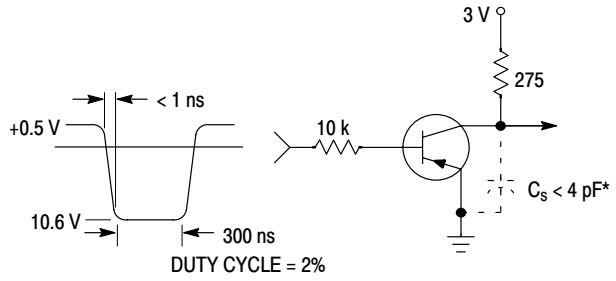


Figure 19. Delay and Rise Time Equivalent Test Circuit

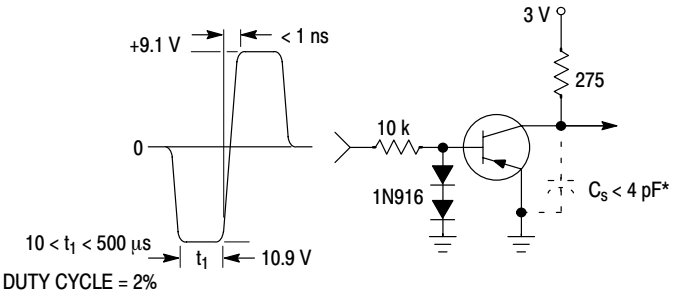


Figure 20. Storage and Fall Time Equivalent Test Circuit

* Total shunt capacitance of test jig and connectors

TYPICAL TRANSIENT CHARACTERISTICS

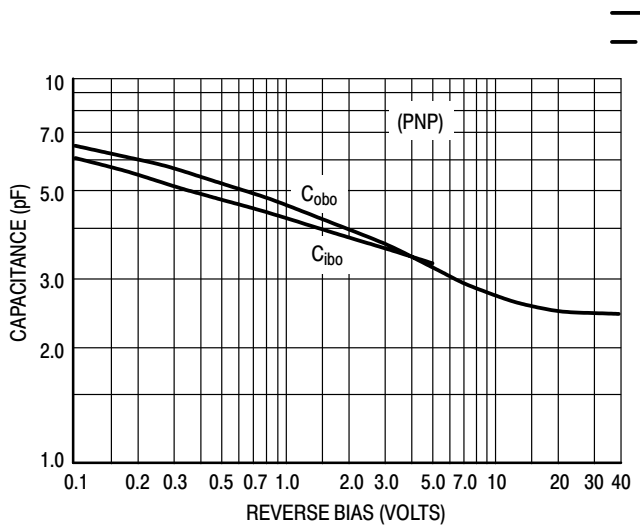


Figure 21. Capacitance

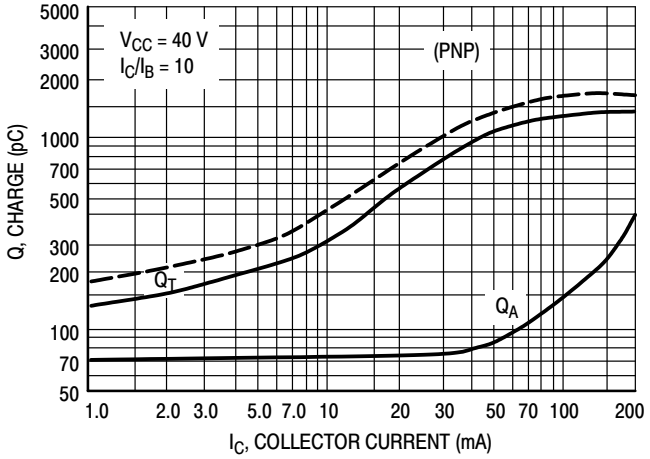


Figure 22. Charge Data

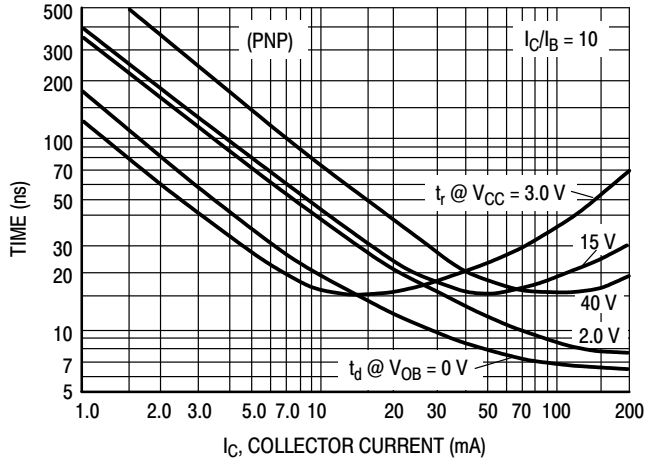


Figure 23. Turn−On Time

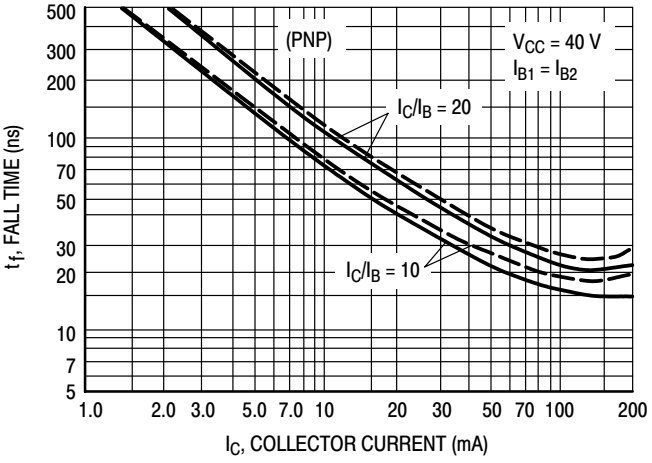


Figure 24. Fall Time

(PNP)

TYPICAL AUDIO SMALL−SIGNAL CHARACTERISTICS
NOISE FIGURE VARIATIONS

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

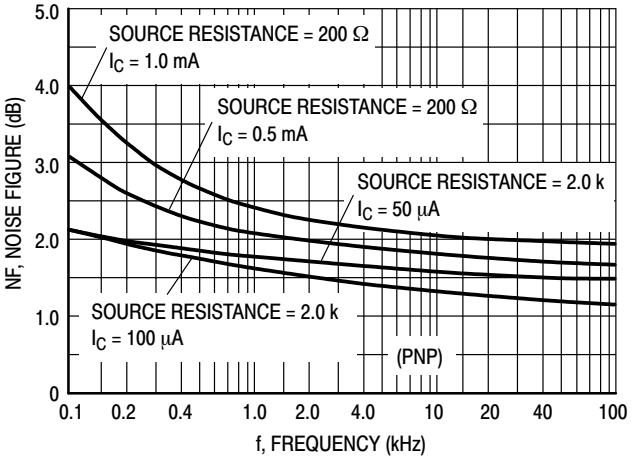


Figure 25.

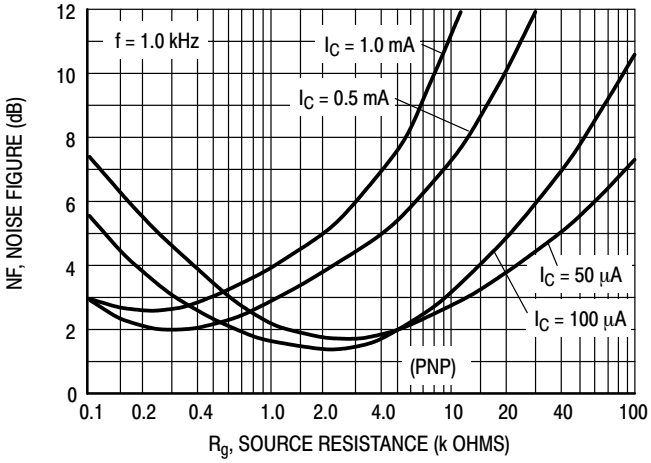


Figure 26.

h PARAMETERS

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

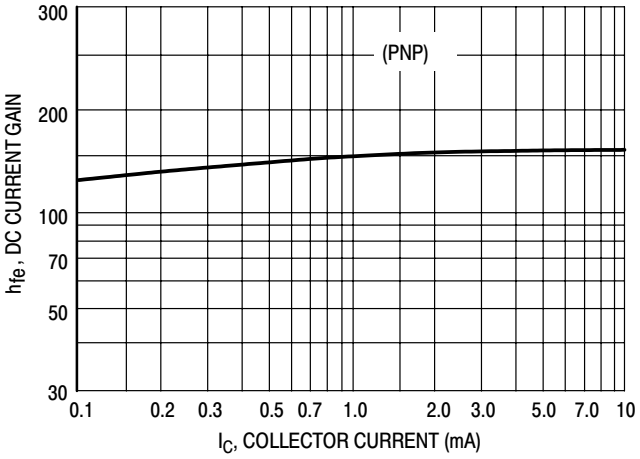


Figure 27. Current Gain

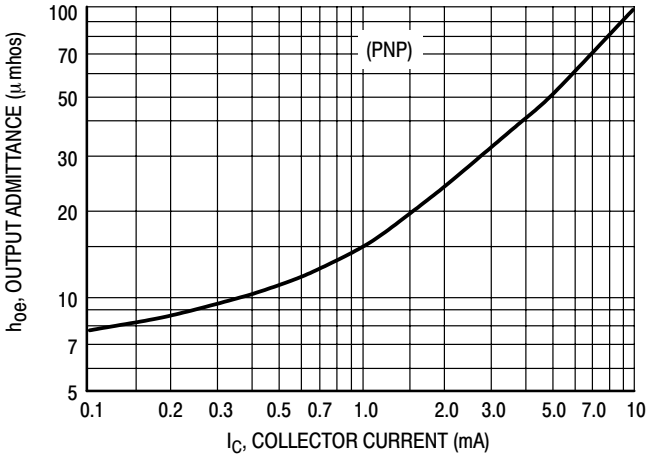


Figure 28. Output Admittance

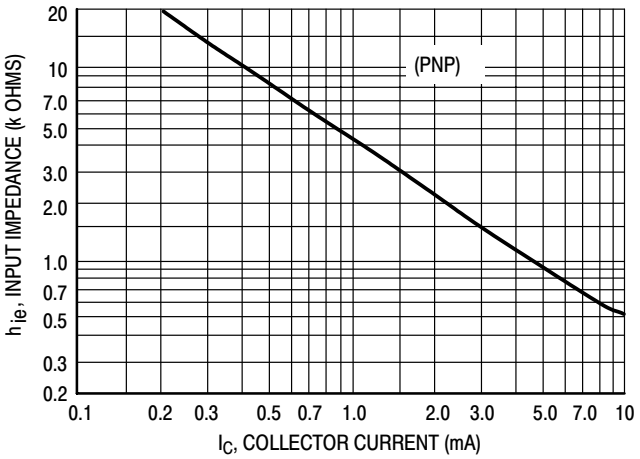


Figure 29. Input Impedance

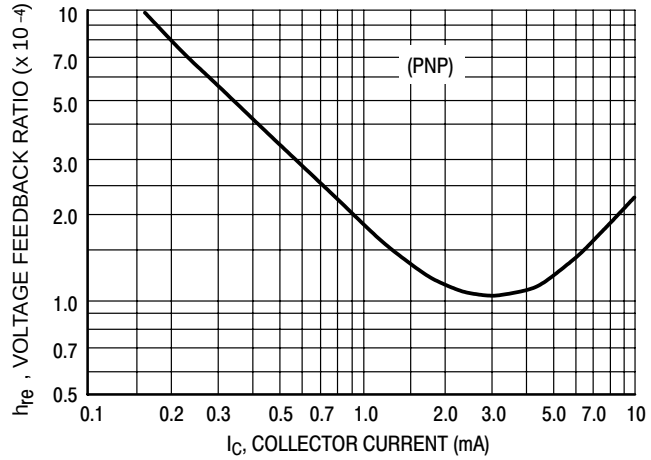


Figure 30. Voltage Feedback Ratio

(PNP)

TYPICAL STATIC CHARACTERISTICS

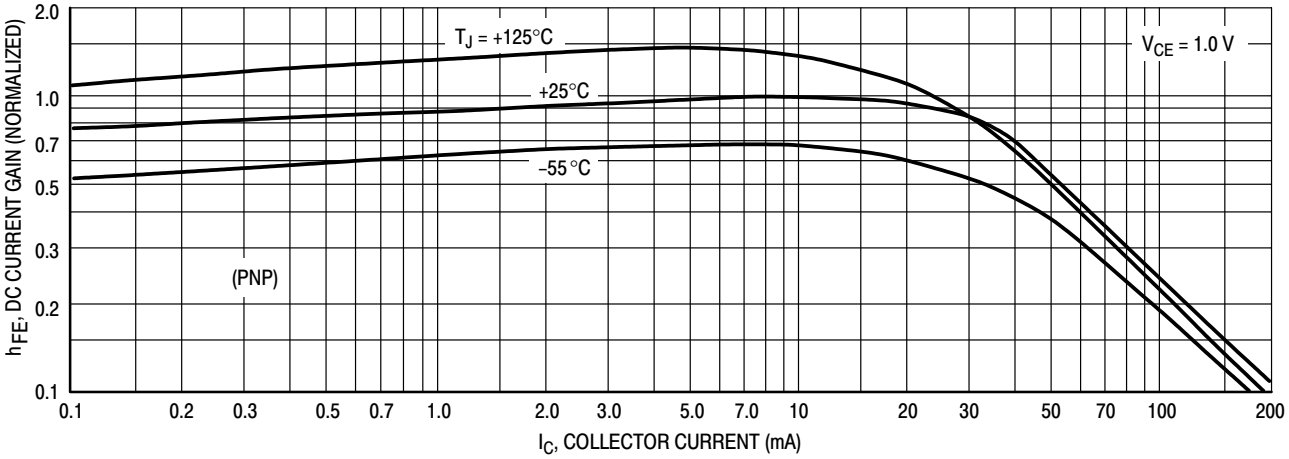


Figure 31. DC Current Gain

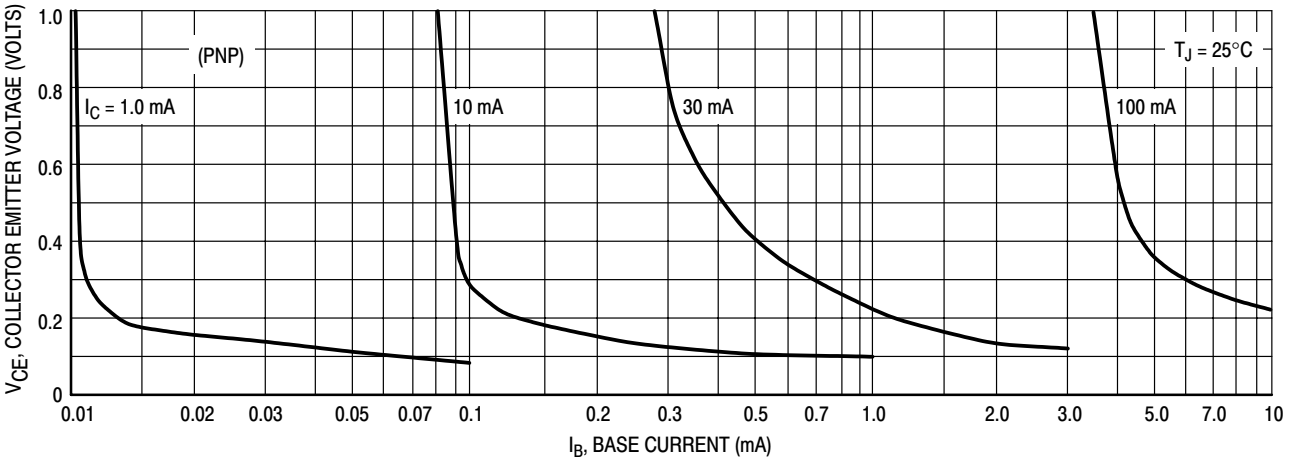


Figure 32. Collector Saturation Region

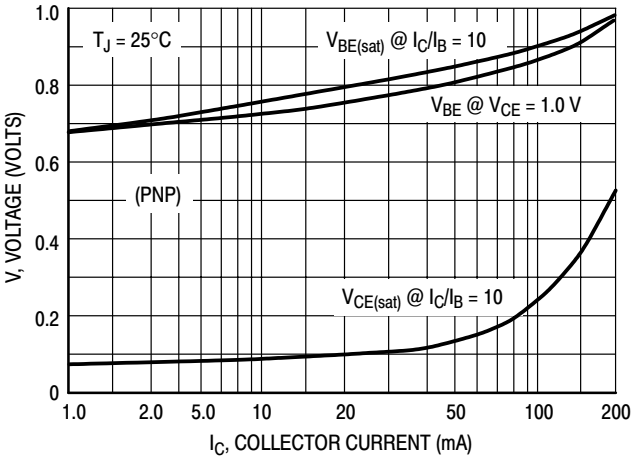


Figure 33. “ON” Voltages

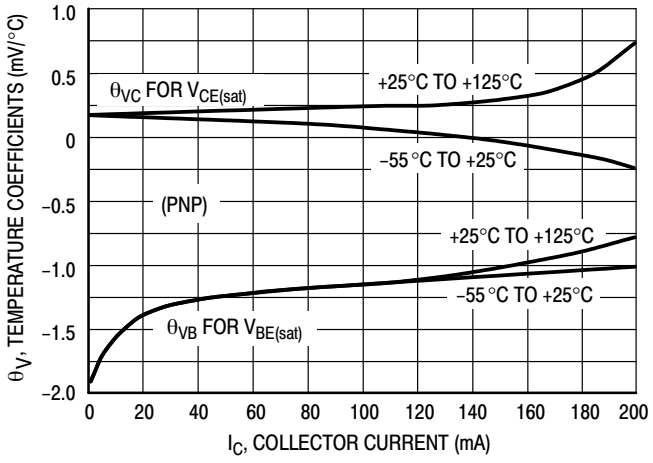
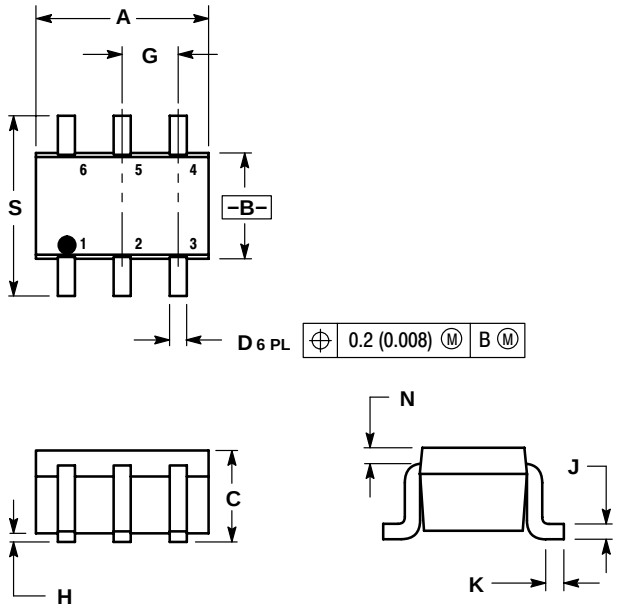


Figure 34. Temperature Coefficients

PACKAGE DIMENSIONS

SOT−363−6/SC−88
CASE 419B−02
ISSUE L



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419B−01 OBSOLETE, NEW STANDARD 419B−02.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC		0.65 BSC	
H	---	0.004	---	0.10
J	0.004	0.010	0.10	0.25
K	0.004	0.012	0.10	0.30
N	0.008 REF		0.20 REF	
S	0.079	0.087	2.00	2.20

STYLE 1:
PIN 1. EMITTER 2
2. BASE 2
3. COLLECTOR 1
4. EMITTER 1
5. BASE 1
6. COLLECTOR 2

SOLDERING FOOTPRINT*

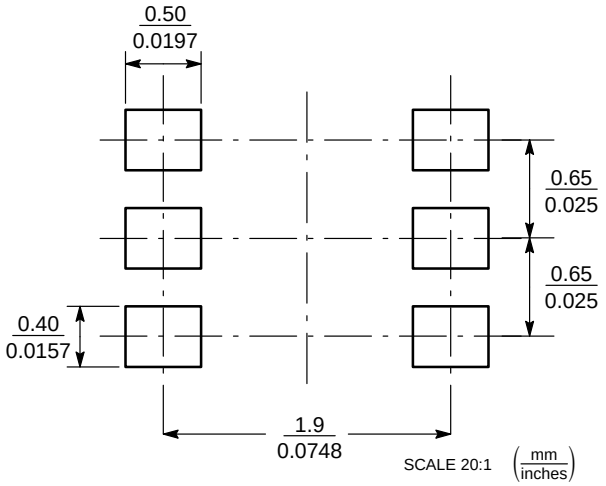


Figure 35. SC−88/SC70−6

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

MBT3946DW1T1

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