NST3946DXV6T1G, NST3946DXV6T5G

Complementary General Purpose Transistor

The NST3946DXV6T1 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−563 six-leaded 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
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Table 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

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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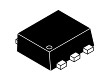
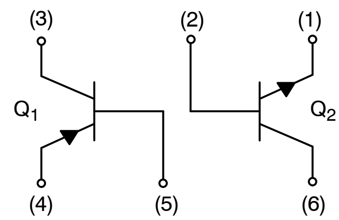


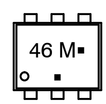
SOT−563
CASE 463A



NST3946DXV6T1*

*Q1 PNP
Q2 NPN

MARKING DIAGRAM



46 = Specific Device Code
M = Date Code
▪ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
NST3946DXV6T1G	SOT−563 (Pb-Free)	4,000/Tape & Reel
NST3946DXV6T5G	SOT−563 (Pb-Free)	8,000/Tape & Reel

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

Table 2. THERMAL CHARACTERISTICS

Characteristic (One Junction Heated)	Symbol	Max	Unit
Total Device Dissipation $T_A = 25°C$ Derate above 25°C	P_D	357 (Note 1) 2.9 (Note 1)	mW mW/°C
Thermal Resistance Junction-to-Ambient	$R_{\theta JA}$	350 (Note 1)	°C/W
Characteristic (Both Junctions Heated)	**Symbol**	**Max**	**Unit**
Total Device Dissipation $T_A = 25°C$ Derate above 25°C	P_D	500 (Note 1) 4.0 (Note 1)	mW mW/°C
Thermal Resistance Junction-to-Ambient	$R_{\theta JA}$	250 (Note 1)	°C/W
Junction and Storage Temperature Range	T_J, T_{stg}	55 to +150	°C

1. FR−4 @ Minimum Pad

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

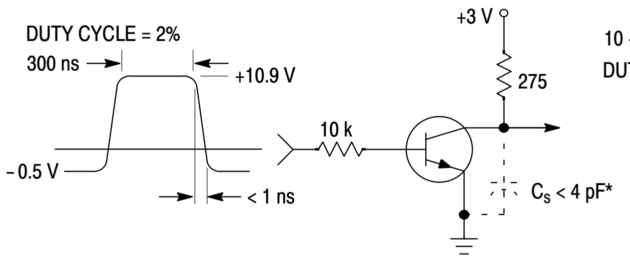
Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector−Emitter Breakdown Voltage (Note 2) (I_C = 1.0 mAdc, I_B = 0) (NPN) (I_C = −1.0 mAdc, I_B = 0) (PNP)	$V_{(BR)CEO}$	 40 −40	 − −	Vdc
Collector−Base Breakdown Voltage (I_C = 10 μAdc, I_E = 0) (NPN) (I_C = −10 μAdc, I_E = 0) (PNP)	$V_{(BR)CBO}$	 60 −40	 − −	Vdc
Emitter−Base Breakdown Voltage (I_E = 10 μAdc, I_C = 0) (NPN) (I_E = −10 μAdc, I_C = 0) (PNP)	$V_{(BR)EBO}$	 6.0 −5.0	 − −	Vdc
Base Cutoff Current (V_{CE} = 30 Vdc, V_{EB} = 3.0 Vdc) (NPN) (V_{CE} = −30 Vdc, V_{EB} = −3.0 Vdc) (PNP)	I_{BL}	 − −	 50 −50	nAdc
Collector Cutoff Current (V_{CE} = 30 Vdc, V_{EB} = 3.0 Vdc) (NPN) (V_{CE} = −30 Vdc, V_{EB} = −3.0 Vdc) (PNP)	I_{CEX}	 − −	 50 −50	nAdc
ON CHARACTERISTICS (Note 2)				
DC Current Gain (I_C = 0.1 mAdc, V_{CE} = 1.0 Vdc) (NPN) (I_C = 1.0 mAdc, V_{CE} = 1.0 Vdc) (I_C = 10 mAdc, V_{CE} = 1.0 Vdc) (I_C = 50 mAdc, V_{CE} = 1.0 Vdc) (I_C = 100 mAdc, V_{CE} = 1.0 Vdc) (I_C = −0.1 mAdc, V_{CE} = −1.0 Vdc) (PNP) (I_C = −1.0 mAdc, V_{CE} = −1.0 Vdc) (I_C = −10 mAdc, V_{CE} = −1.0 Vdc) (I_C = −50 mAdc, V_{CE} = −1.0 Vdc) (I_C = −100 mAdc, V_{CE} = −1.0 Vdc)	h_{FE}	 40 70 100 60 30 60 80 100 60 30	 − − 300 − − − − 300 − −	−
Collector−Emitter Saturation Voltage (I_C = 10 mAdc, I_B = 1.0 mAdc) (NPN) (I_C = 50 mAdc, I_B = 5.0 mAdc) (I_C = −10 mAdc, I_B = −1.0 mAdc) (PNP) (I_C = −50 mAdc, I_B = −5.0 mAdc)	$V_{CE(sat)}$	 − − − −	 0.2 0.3 −0.25 −0.4	Vdc
Base−Emitter Saturation Voltage (I_C = 10 mAdc, I_B = 1.0 mAdc) (NPN) (I_C = 50 mAdc, I_B = 5.0 mAdc) (I_C = −10 mAdc, I_B = −1.0 mAdc) (PNP) (I_C = −50 mAdc, I_B = −5.0 mAdc)	$V_{BE(sat)}$	 0.65 − −0.65 −	 0.85 0.95 −0.85 −0.95	Vdc

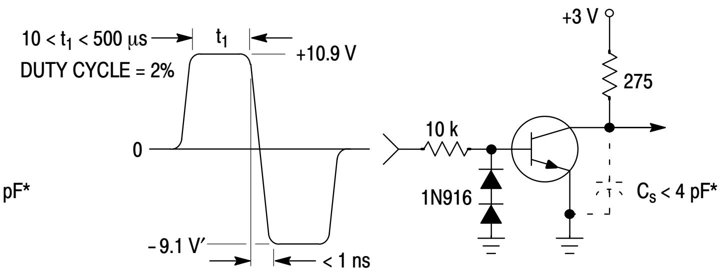
ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (continued)

Characteristic		Symbol	Min	Max	Unit
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	
Input Impedance		h_{ie}			k Ω
(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 k Ω, f = 1.0 kHz)	(NPN)		–	5.0	
(V_{CE} = −5.0 Vdc, I_C = −100 μAdc, R_S = 1.0 k Ω, f = 1.0 kHz)	(PNP)		–	4.0	
SWITCHING CHARACTERISTICS					
Delay Time		t_d			ns
(V_{CC} = 3.0 Vdc, V_{BE} = −0.5 Vdc)	(NPN)		–	35	
(V_{CC} = −3.0 Vdc, V_{BE} = 0.5 Vdc)	(PNP)		–	35	
Rise Time		t_r			
(I_C = 10 mAdc, I_{B1} = 1.0 mAdc)	(NPN)		–	35	
(I_C = −10 mAdc, I_{B1} = −1.0 mAdc)	(PNP)		–	35	
Storage Time		t_s			ns
(V_{CC} = 3.0 Vdc, I_C = 10 mAdc)	(NPN)		–	200	
(V_{CC} = −3.0 Vdc, I_C = −10 mAdc)	(PNP)		–	225	
Fall Time		t_f			
(I_{B1} = I_{B2} = 1.0 mAdc)	(NPN)		–	50	
(I_{B1} = I_{B2} = −1.0 mAdc)	(PNP)		–	75	

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

(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

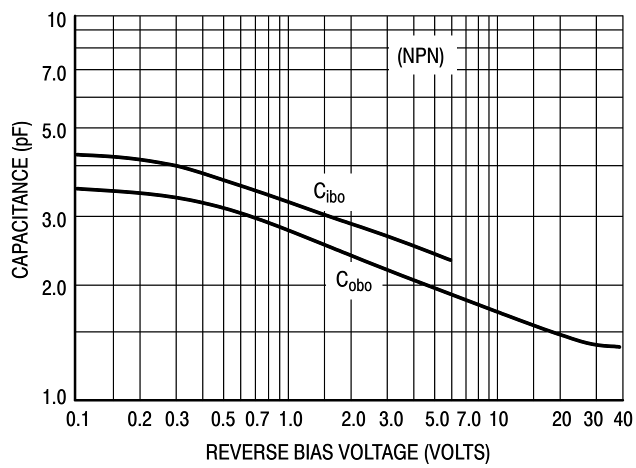


Figure 3. Capacitance

(NPN)

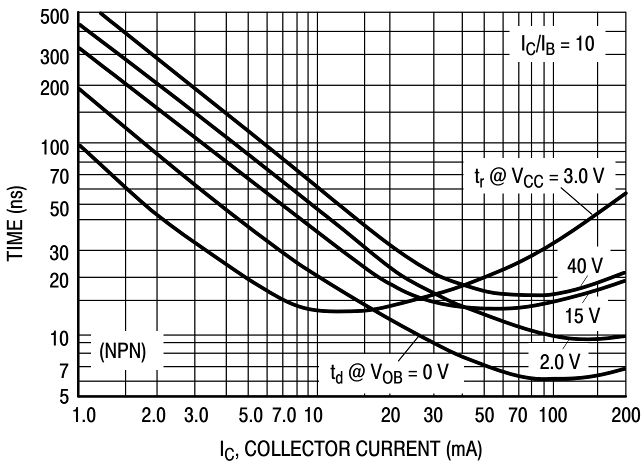


Figure 4. Turn-On Time

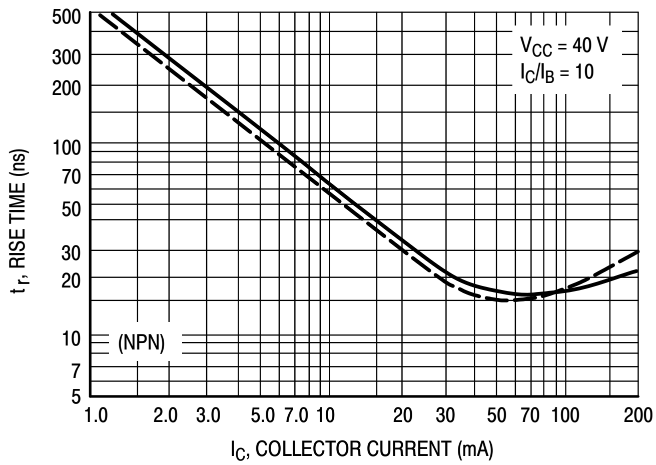


Figure 5. Rise Time

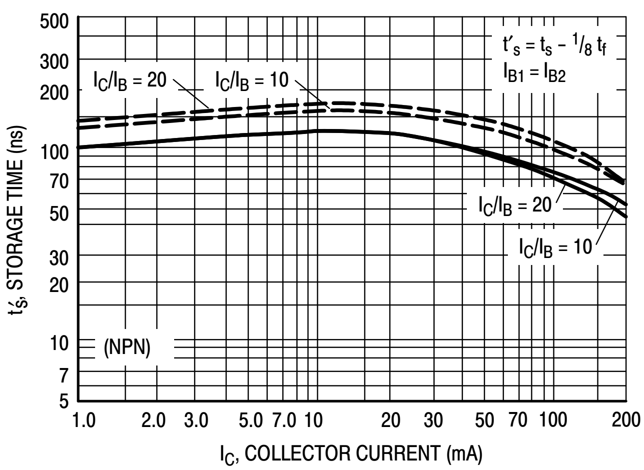


Figure 6. Storage Time

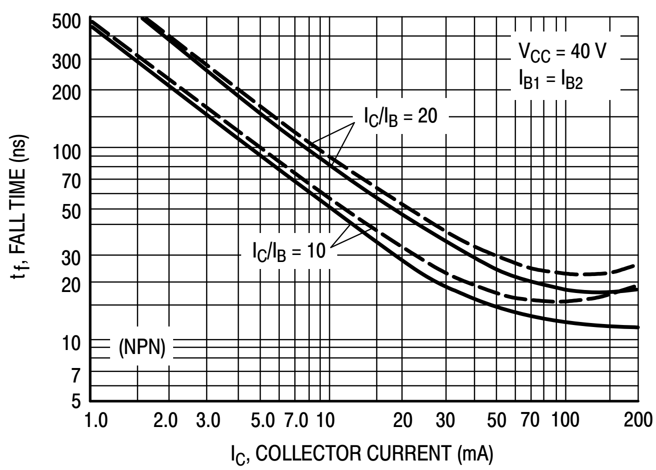


Figure 7. Fall Time

TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS
NOISE FIGURE VARIATIONS

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

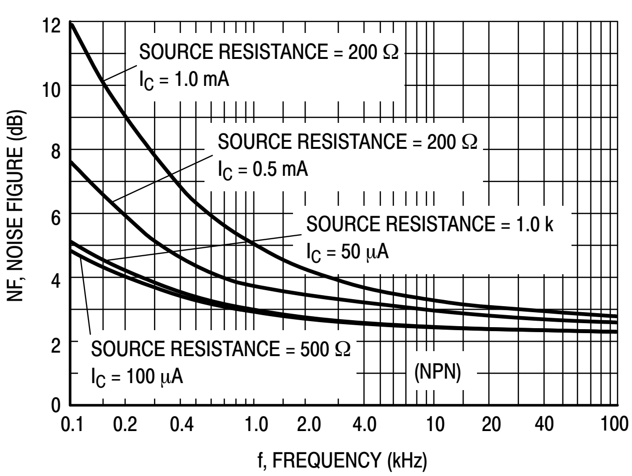


Figure 8. Noise Figure

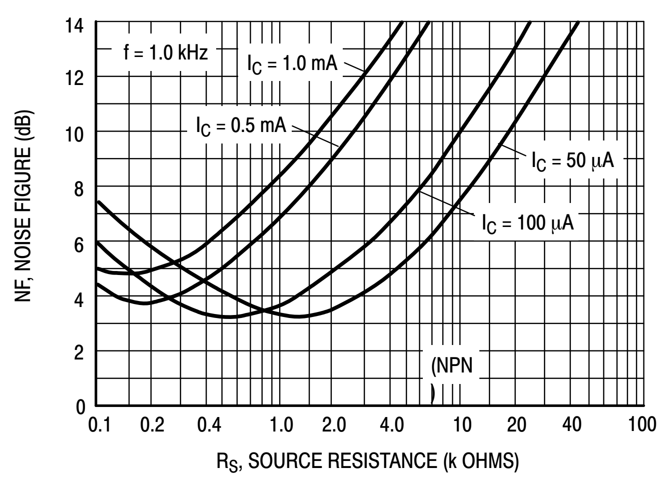


Figure 9. Noise Figure

(NPN)

h PARAMETERS

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

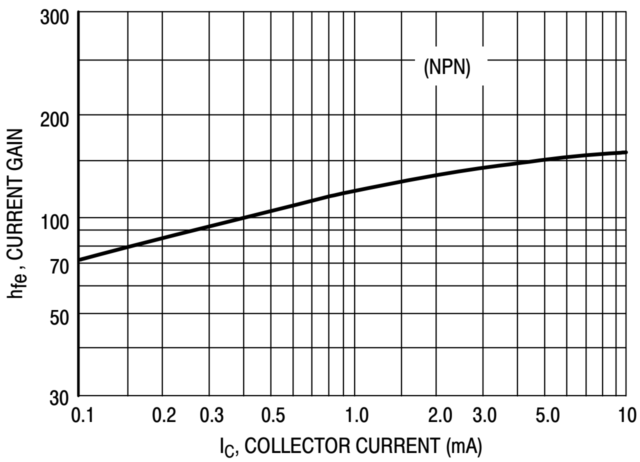


Figure 10. Current Gain

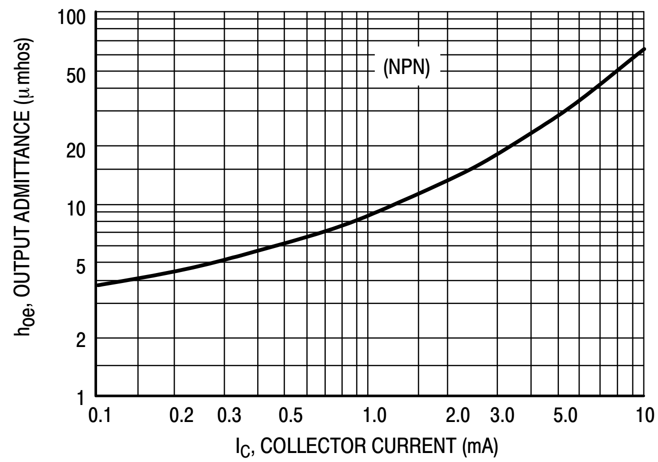


Figure 11. Output Admittance

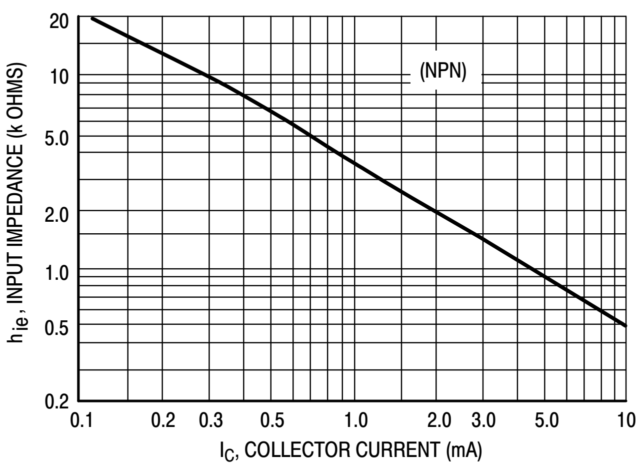


Figure 12. Input Impedance

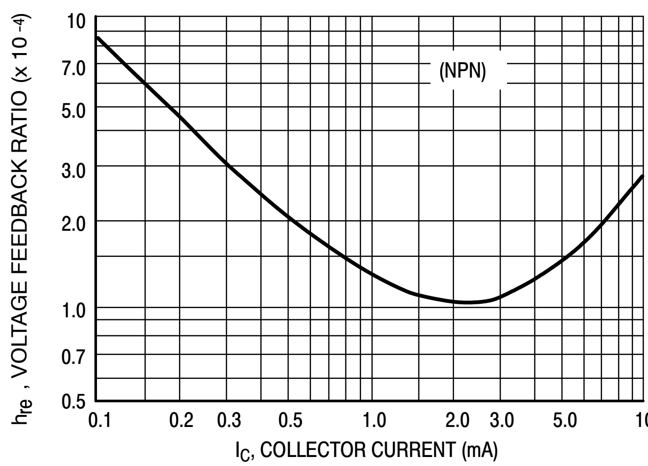


Figure 13. Voltage Feedback Ratio

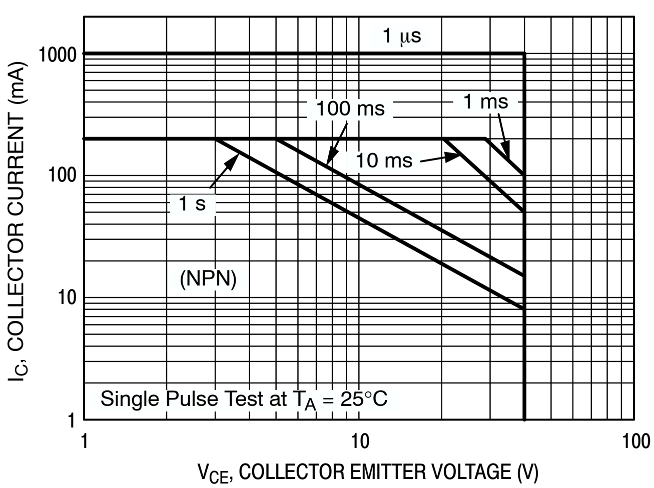


Figure 14. Safe Operating Area

(NPN)

TYPICAL STATIC CHARACTERISTICS

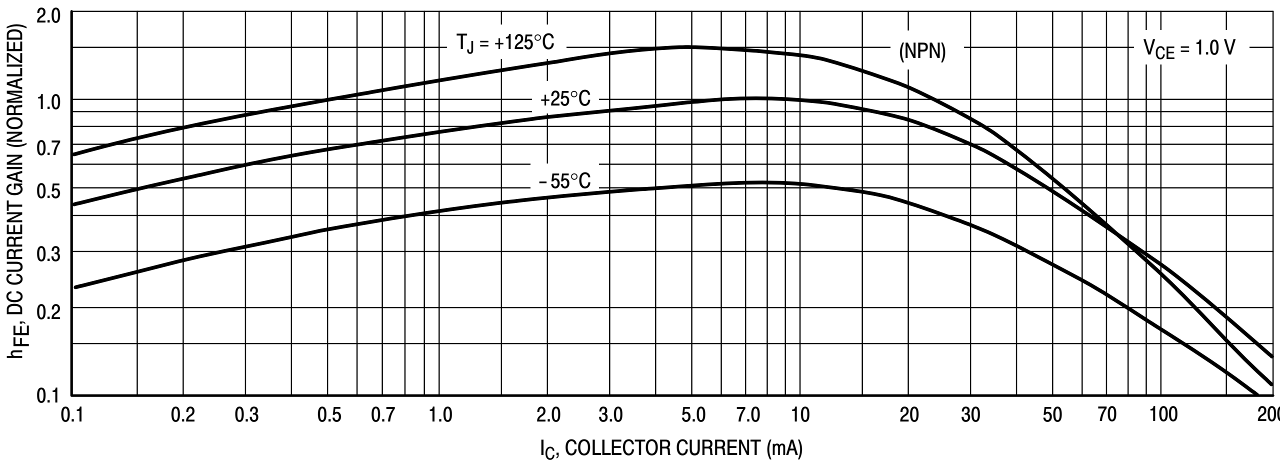


Figure 15. DC Current Gain

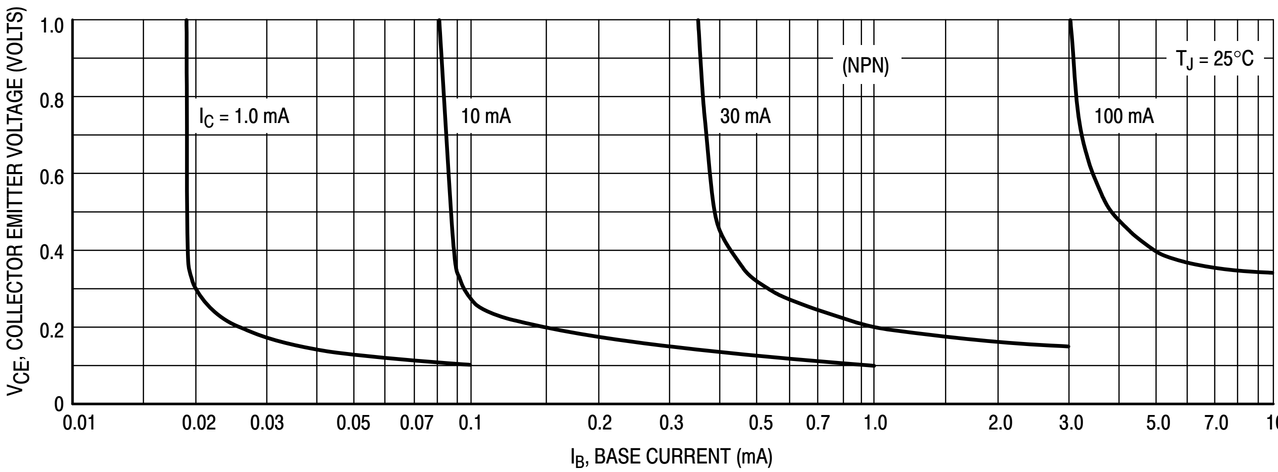


Figure 16. Collector Saturation Region

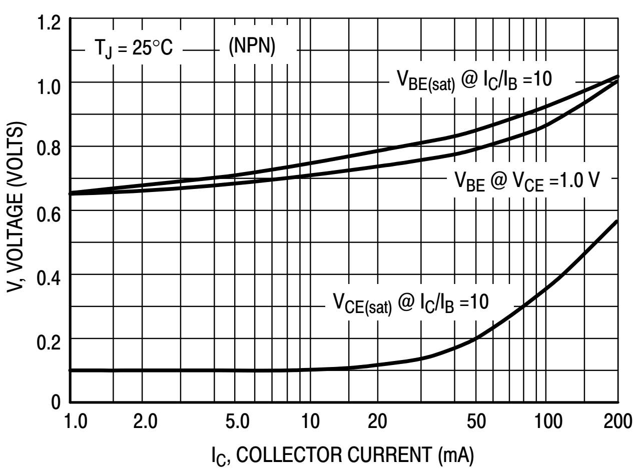


Figure 17. "ON" Voltages

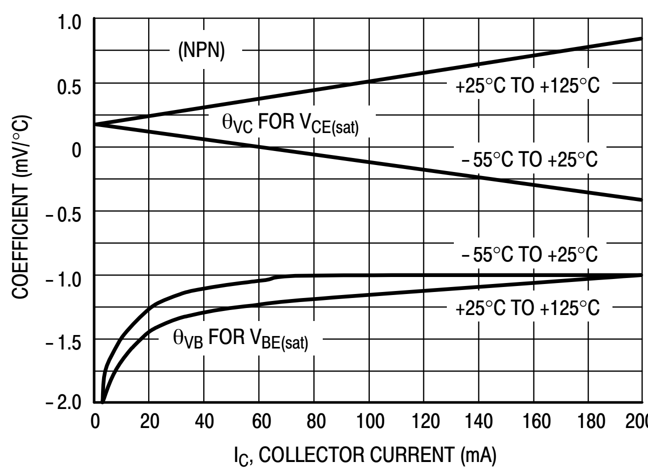
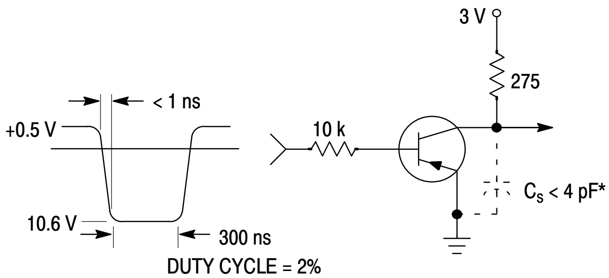
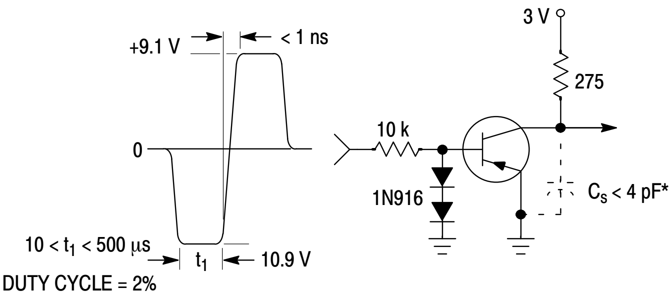


Figure 18. Temperature Coefficients

(PNP)





* Total shunt capacitance of test jig and connectors

Figure 19. Delay and Rise Time Equivalent Test Circuit

Figure 20. Storage and Fall Time Equivalent Test Circuit

TYPICAL TRANSIENT CHARACTERISTICS

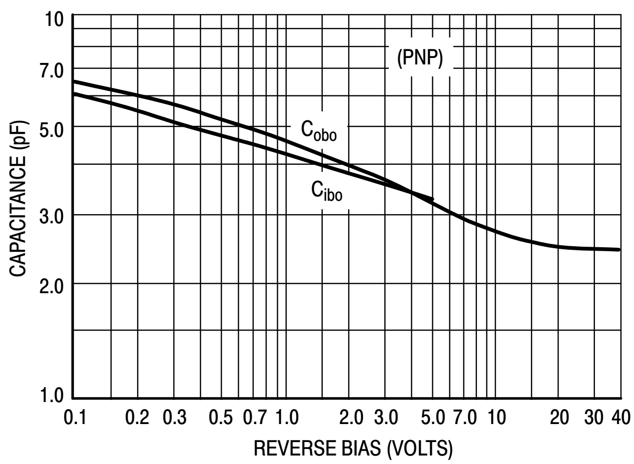


Figure 21. Capacitance

T_J = 25°C
T_J = 125°C

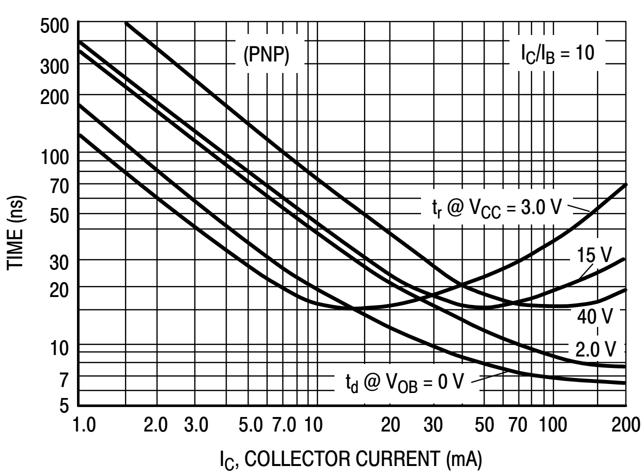


Figure 22. Turn-On Time

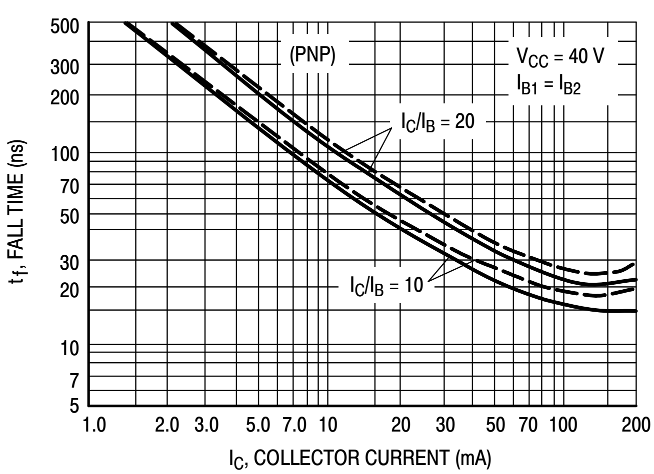


Figure 23. Fall Time

(PNP)

TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

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

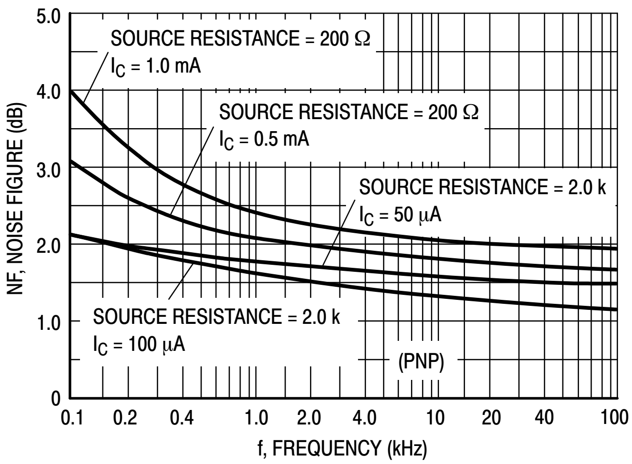


Figure 24.

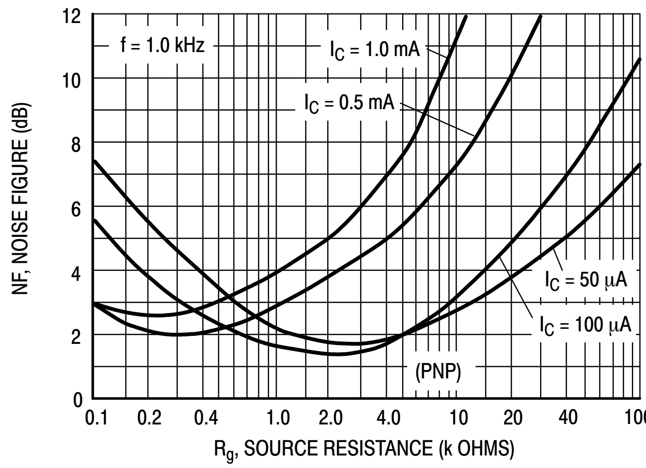


Figure 25.

h PARAMETERS

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

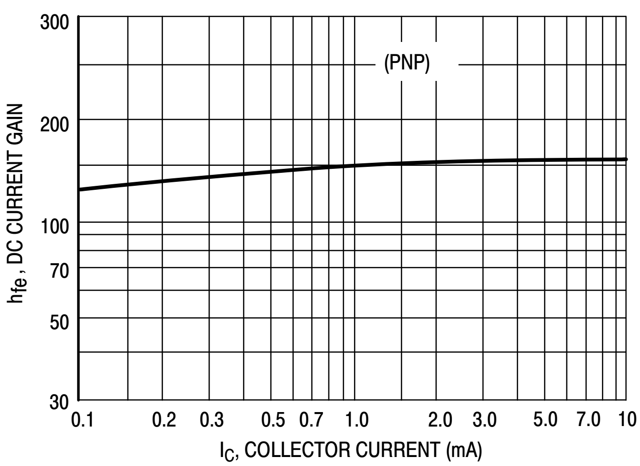


Figure 26. Current Gain

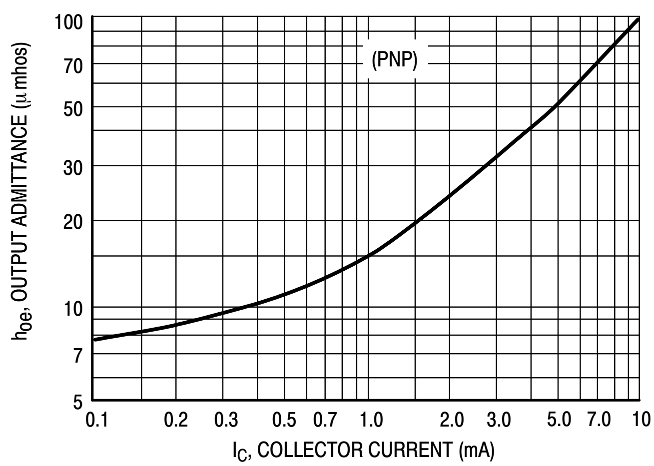


Figure 27. Output Admittance

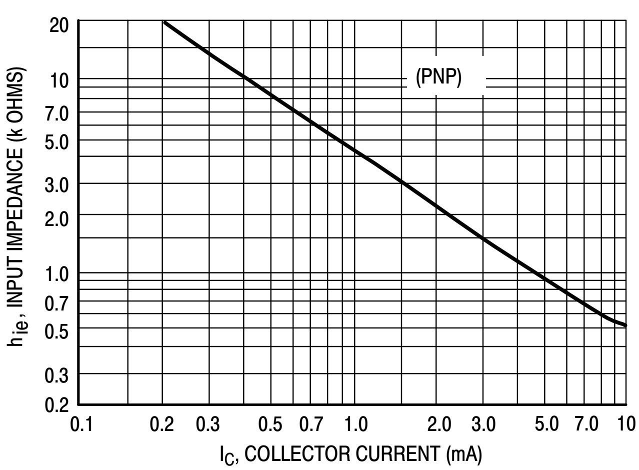


Figure 28. Input Impedance

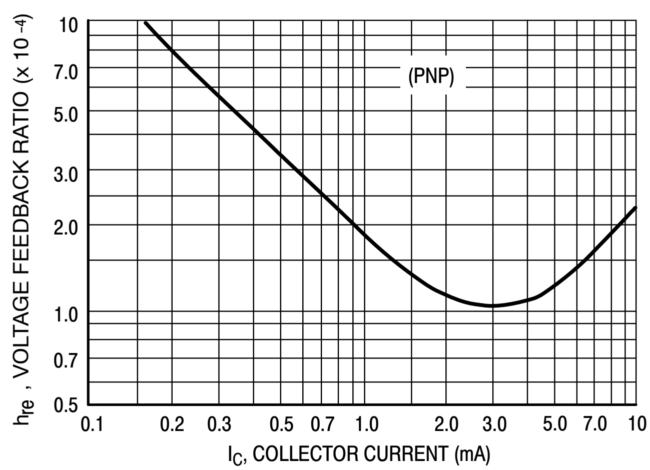


Figure 29. Voltage Feedback Ratio

(PNP)

TYPICAL STATIC CHARACTERISTICS

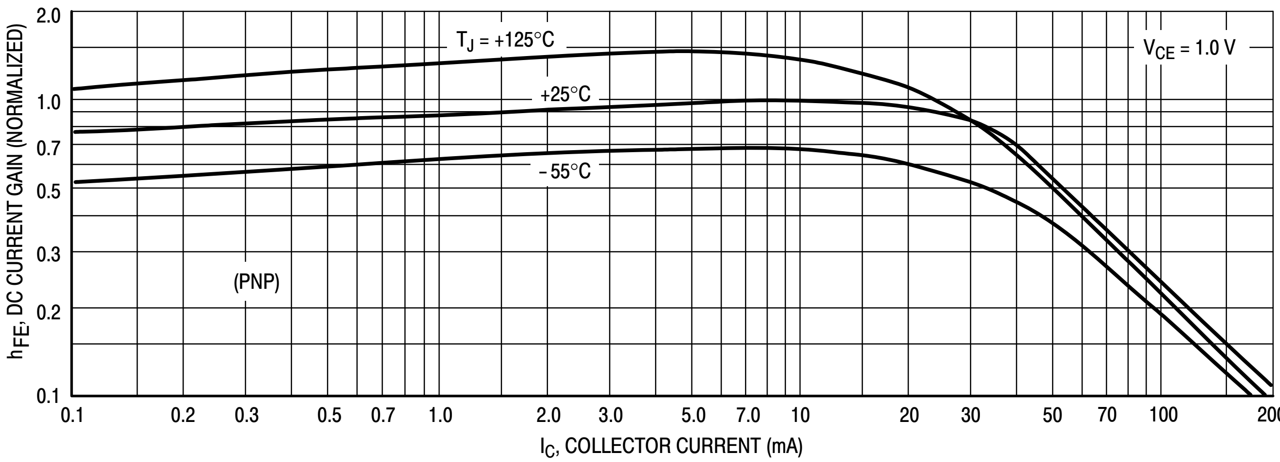


Figure 30. DC Current Gain

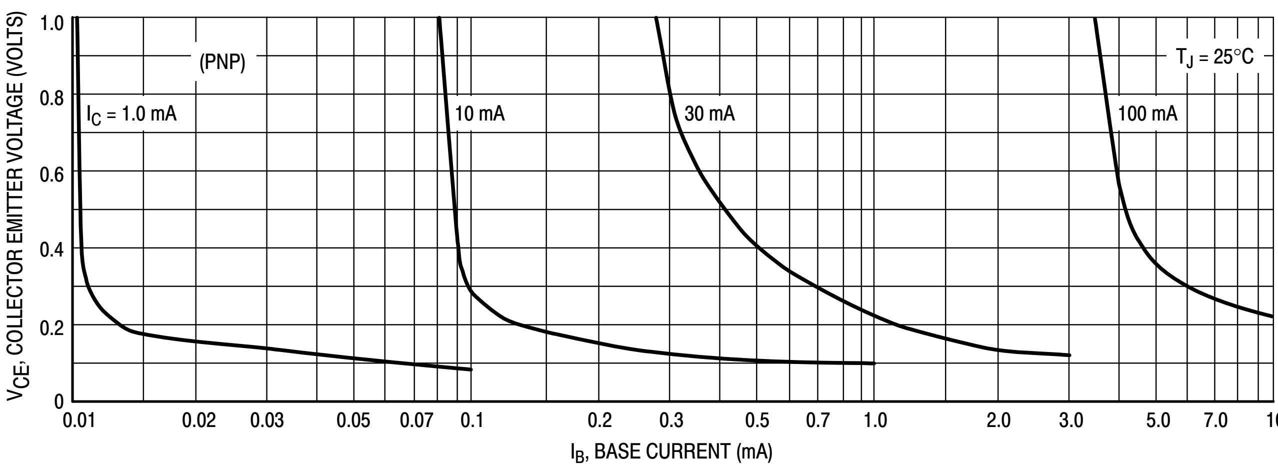


Figure 31. Collector Saturation Region

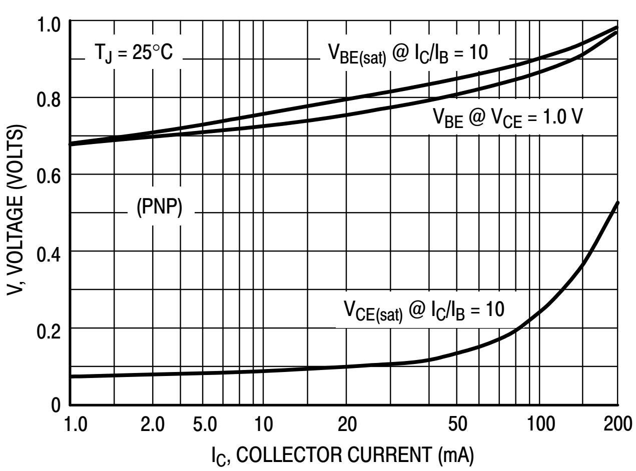


Figure 32. "ON" Voltages

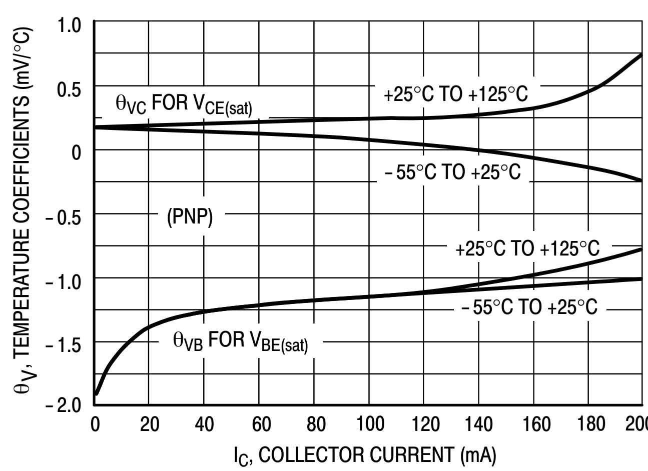


Figure 33. Temperature Coefficients

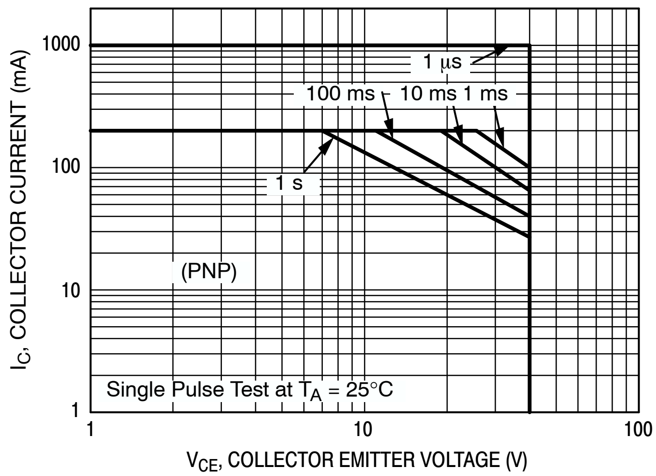
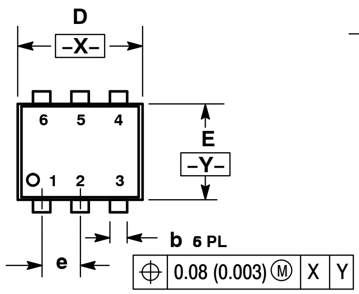


Figure 34. Safe Operating Area

PACKAGE DIMENSIONS

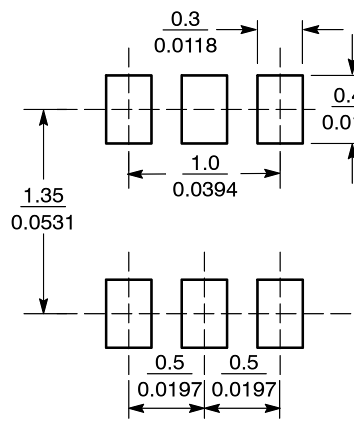
SOT−563, 6 LEAD
CASE 463A
ISSUE F



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.50	0.55	0.60	0.020	0.021	0.023
b	0.17	0.22	0.27	0.007	0.009	0.011
C	0.08	0.12	0.18	0.003	0.005	0.007
D	1.50	1.60	1.70	0.059	0.062	0.066
E	1.10	1.20	1.30	0.043	0.047	0.051
e	0.5 BSC			0.02 BSC		
L	0.10	0.20	0.30	0.004	0.008	0.012
H_E	1.50	1.60	1.70	0.059	0.062	0.066

SOLDERING FOOTPRINT*



SCALE 20:1 (mm / inches)

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

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