

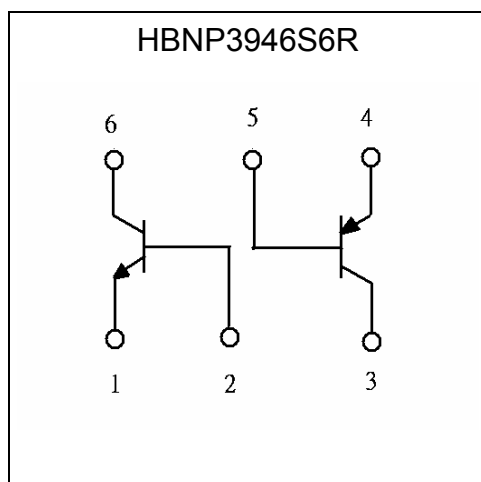
General Purpose NPN / PNP Epitaxial Planar Transistors (dual transistors)

HBNP3946S6R

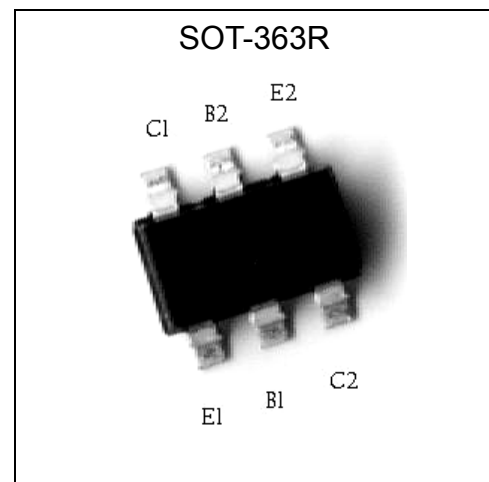
Features

- Includes a 2N3904 chip and 2N3906 chip in a SOT-363R package.
- Mounting possible with SOT-323 automatic mounting machines.
- Transistor elements are independent, eliminating interference.
- Mounting cost and area can be cut in half.

Equivalent Circuit



Outline



Absolute Maximum Ratings (Ta=25°C)

Parameter	Symbol	Limits		Unit
		TR1 (NPN)	TR2 (PNP)	
Collector-Base Voltage	V _{CBO}	60	-40	V
Collector-Emitter Voltage	V _{CEO}	40	-40	V
Emitter-Base Voltage	V _{EBO}	6	-5	V
Collector Current	I _C	200	-200	mA
Power Dissipation	P _d	300(total) *1		mW
Junction Temperature	T _j	150		°C
Storage Temperature	T _{stg}	-55~+150		°C

Note: *1 200mW per element must not be exceeded.



Characteristics (Ta=25°C)

• TR1 (NPN)

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
BV _{CBO}	60	-	-	V	I _C =10μA
BV _{CEO}	40	-	-	V	I _C =1mA
BV _{EBO}	6	-	-	V	I _E =10μA
I _{CBO}	-	-	100	nA	V _{CB} =50V
I _{CEX}	-	-	50	nA	V _{CE} =30V, V _{EB} =3V
I _{EBO}	-	-	100	nA	V _{EB} =5V
V _{CE(sat)}	-	-	0.2	V	I _C =10mA, I _B =1mA
*V _{CE(sat)}	-	-	0.3	V	I _C =50mA, I _B =5mA
V _{BE(sat)}	0.65	-	0.85	V	I _C =10mA, I _B =1mA
*V _{BE(sat)}	-	-	0.95	V	I _C =50mA, I _B =5mA
h _{FE}	40	-	-	-	V _{CE} =1V, I _C =100μA
h _{FE}	70	-	-	-	V _{CE} =1V, I _C =1mA
h _{FE}	100	-	300	-	V _{CE} =1V, I _C =10mA
h _{FE}	60	-	-	-	V _{CE} =1V, I _C =50mA
*h _{FE}	30	-	-	-	V _{CE} =1V, I _C =100mA

*Pulse Test: Pulse Width ≤380μs, Duty Cycle≤2%

• TR2 (PNP)

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
BV _{CBO}	-40	-	-	V	I _C =-10μA
BV _{CEO}	-40	-	-	V	I _C =-1mA
BV _{EBO}	-5	-	-	V	I _E =-10μA
I _{CBO}	-	-	-100	nA	V _{CB} =-40V
I _{CEX}	-	-	-50	nA	V _{CE} =-30V, V _{EB} =-3V
I _{EBO}	-	-	-100	nA	V _{EB} =-4V
V _{CE(sat)}	-	-	-0.25	V	I _C =-10mA, I _B =-1mA
V _{CE(sat)}	-	-	-0.4	V	I _C =-50mA, I _B =-5mA
V _{BE(sat)}	-0.65	-	-0.85	V	I _C =-10mA, I _B =-1mA
V _{BE(sat)}	-	-	-0.95	V	I _C =-50mA, I _B =-5mA
h _{FE}	60	-	-	-	V _{CE} =-1V, I _C =-100μA
h _{FE}	80	-	-	-	V _{CE} =-1V, I _C =-1mA
h _{FE}	100	-	300	-	V _{CE} =-1V, I _C =-10mA
h _{FE}	60	-	-	-	V _{CE} =-1V, I _C =-50mA
*h _{FE}	30	-	-	-	V _{CE} =-1V, I _C =-100mA

*Pulse Test: Pulse Width ≤380μs, Duty Cycle≤2%

Typical Characteristics

• TR1 (NPN)

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

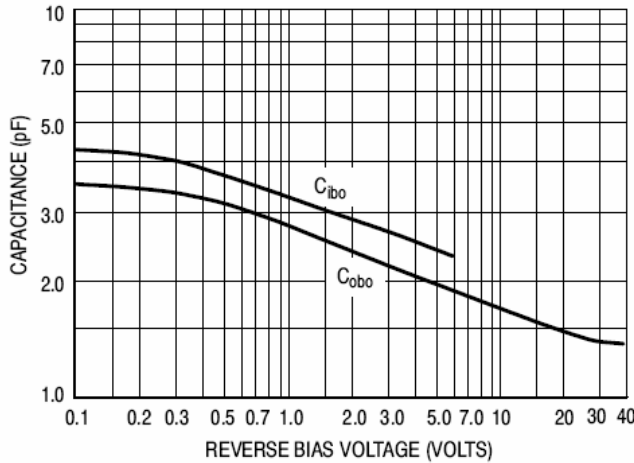


Figure 1. Capacitance

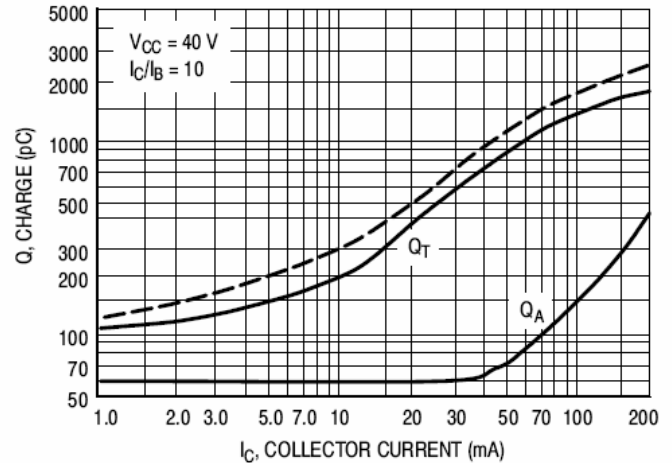


Figure 2. Charge Data

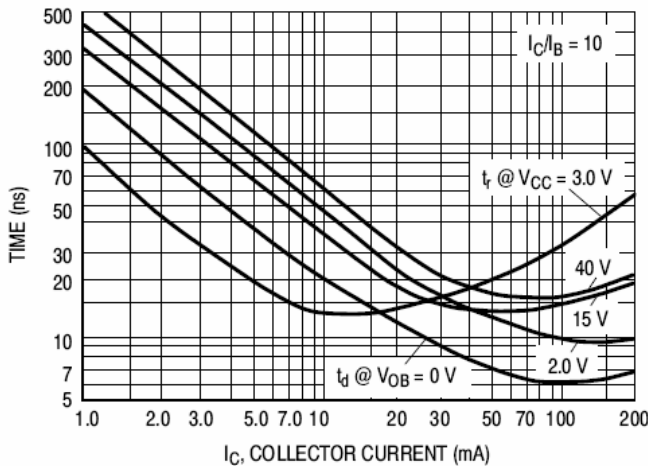


Figure 3. Turn-On Time

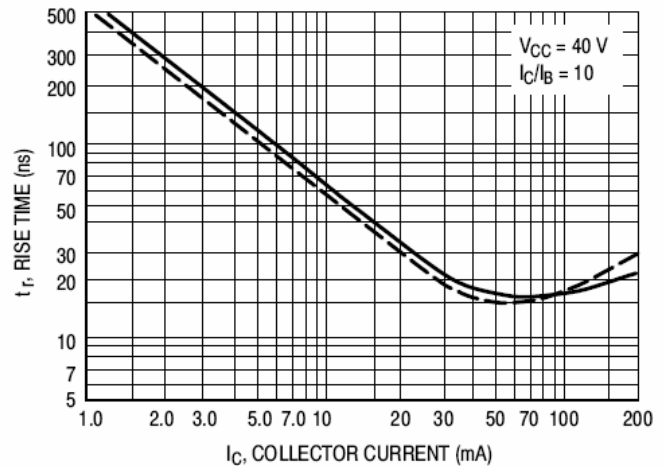


Figure 4. Rise Time

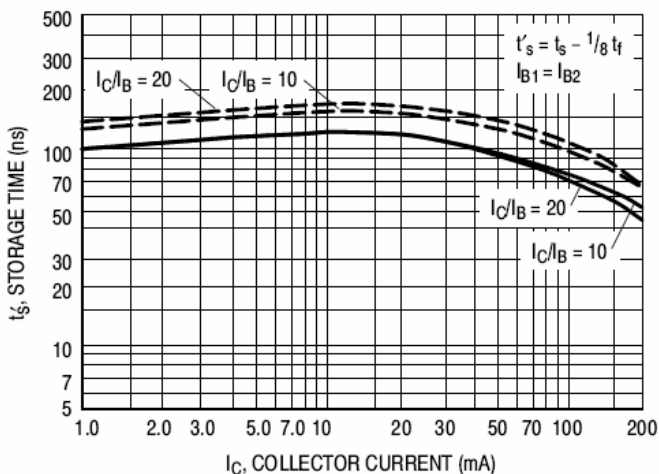


Figure 5. Storage Time

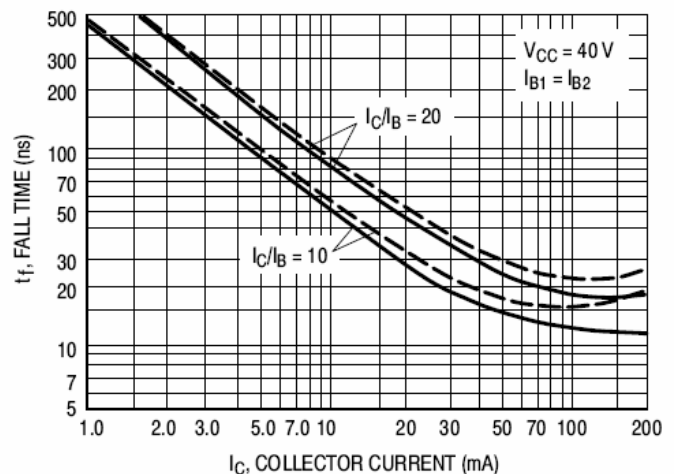


Figure 6. Fall Time

NOISE FIGURE VARIATIONS

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

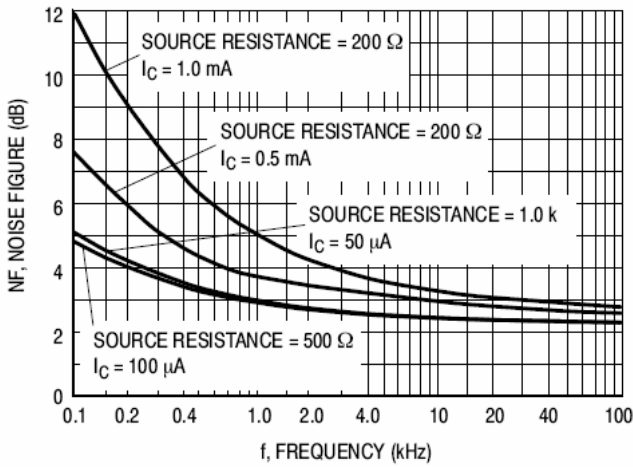


Figure 7.

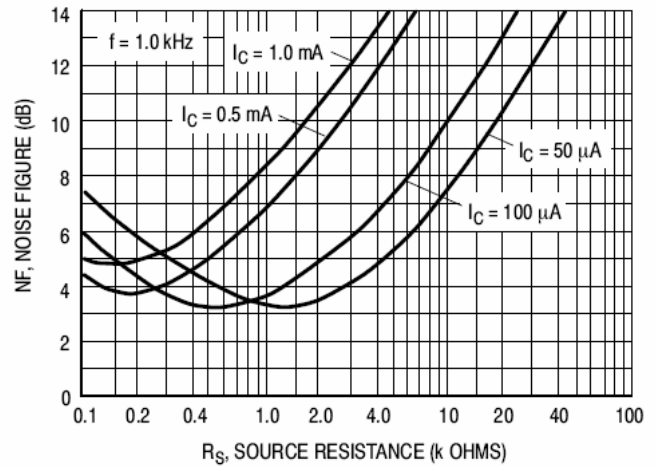


Figure 8.

h PARAMETERS

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

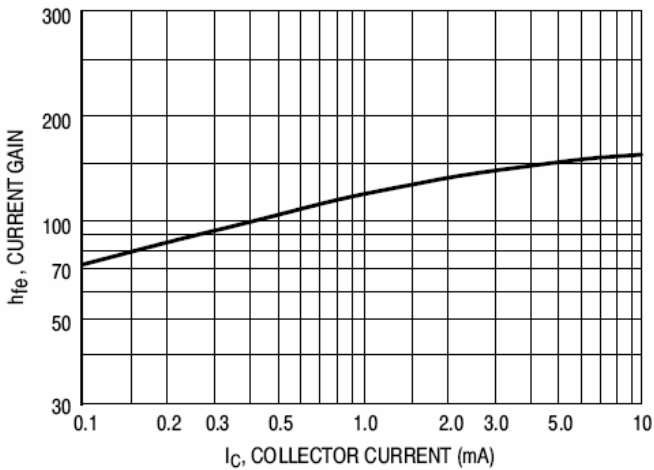


Figure 9. Current Gain

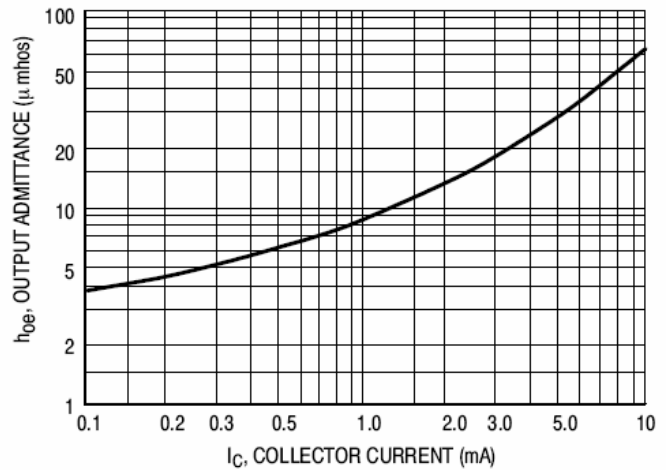


Figure 10. Output Admittance

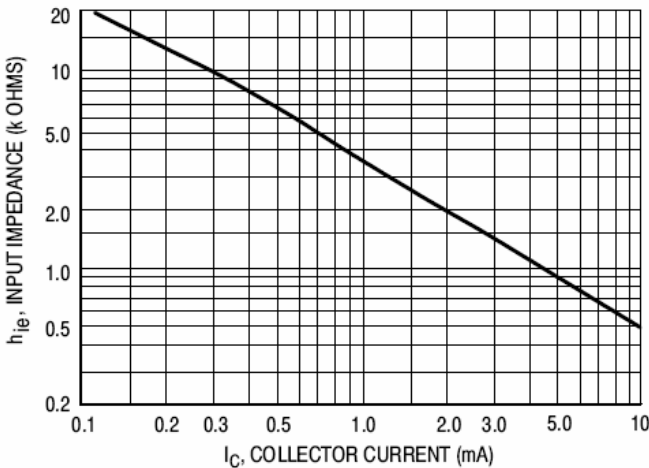


Figure 11. Input Impedance

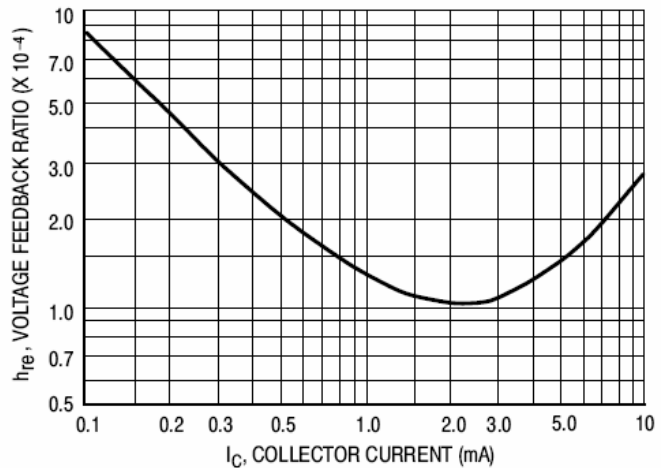


Figure 12. Voltage Feedback Ratio

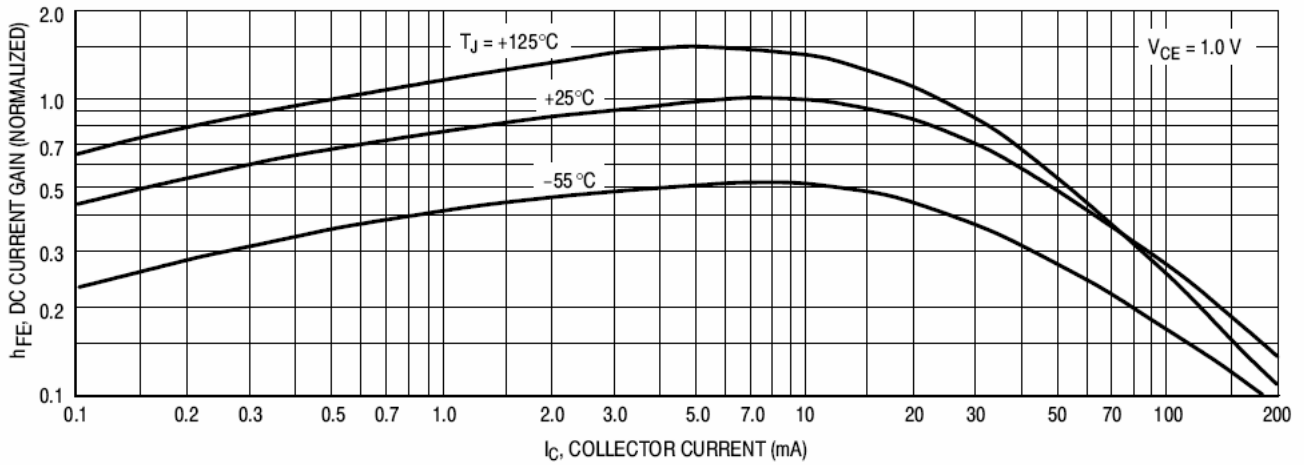


Figure 13. DC Current Gain

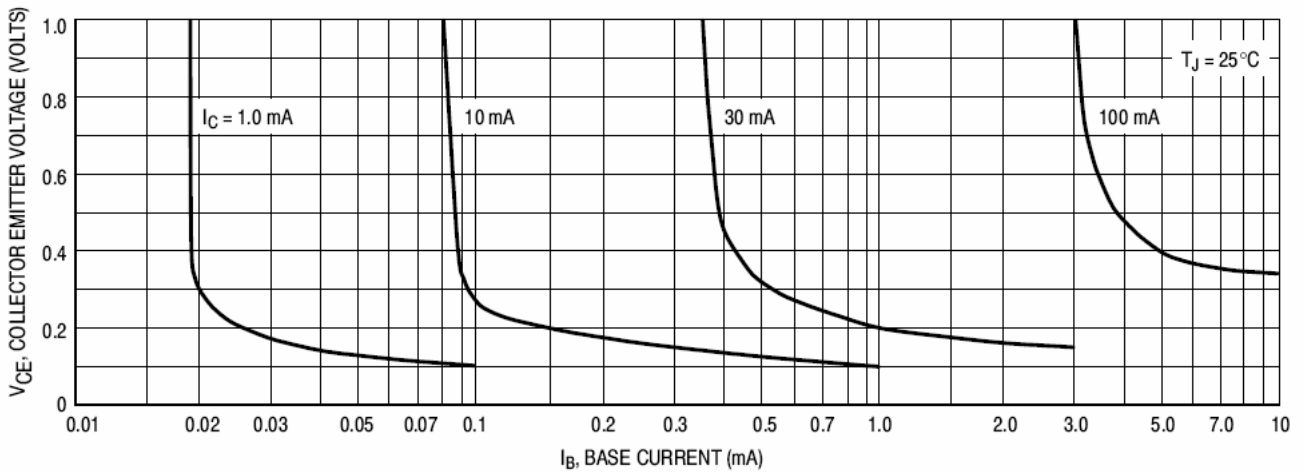


Figure 14. Collector Saturation Region

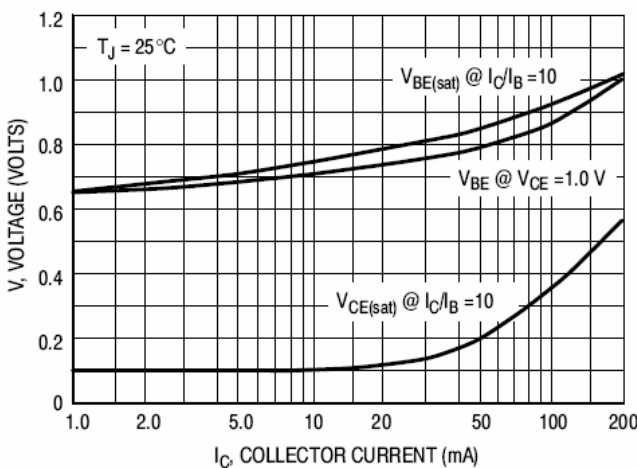


Figure 15. "ON" Voltages

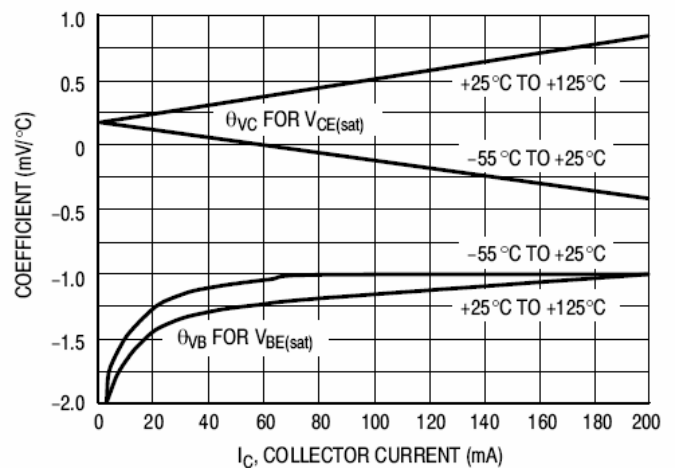


Figure 16. Temperature Coefficients

• TR2 (PNP)

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

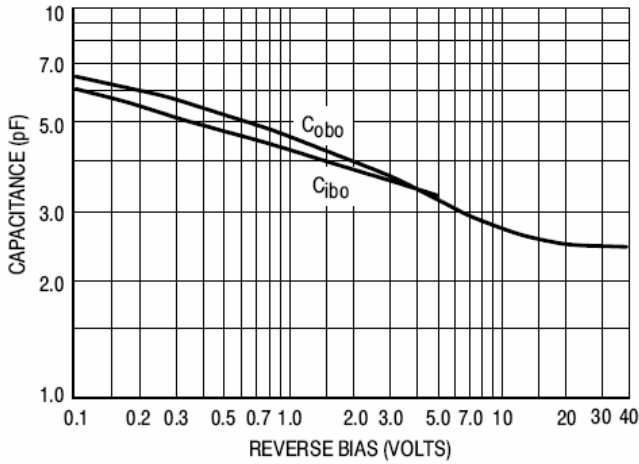


Figure 1. Capacitance

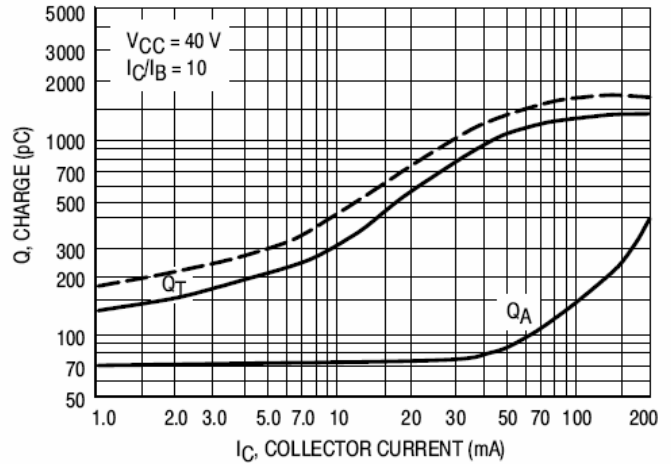


Figure 2. Charge Data

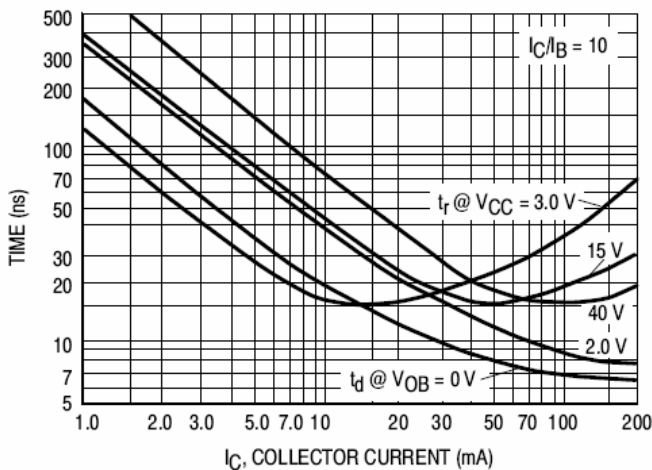


Figure 3. Turn-On Time

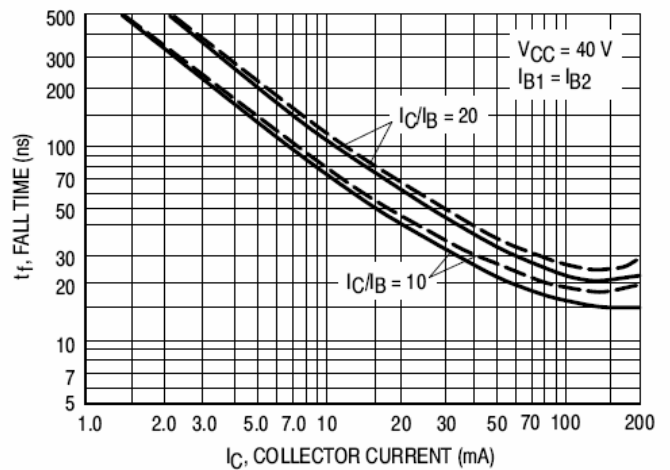


Figure 4. Fall Time

NOISE FIGURE VARIATIONS

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

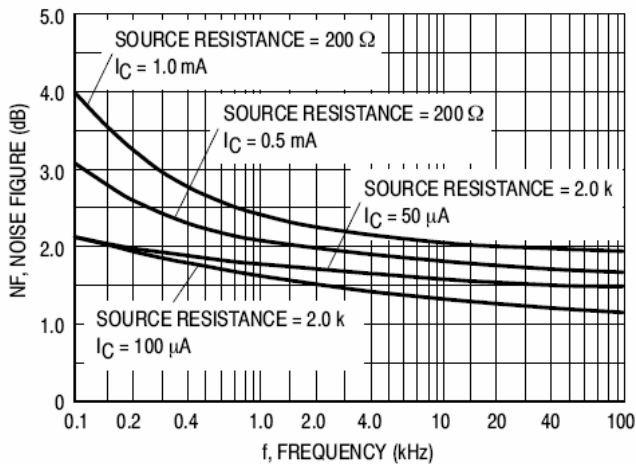


Figure 5.

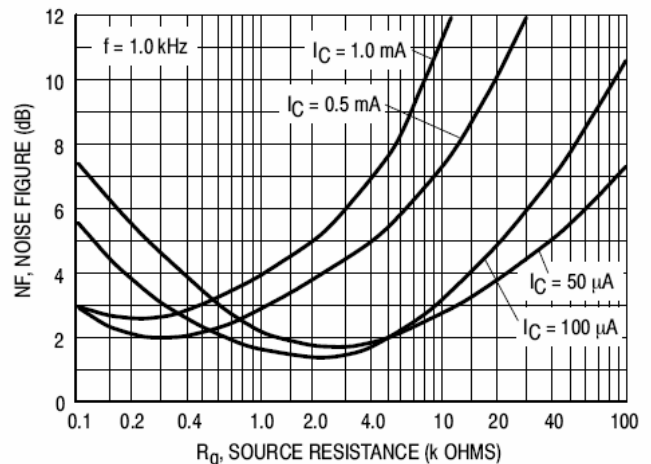


Figure 6.

h PARAMETERS

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

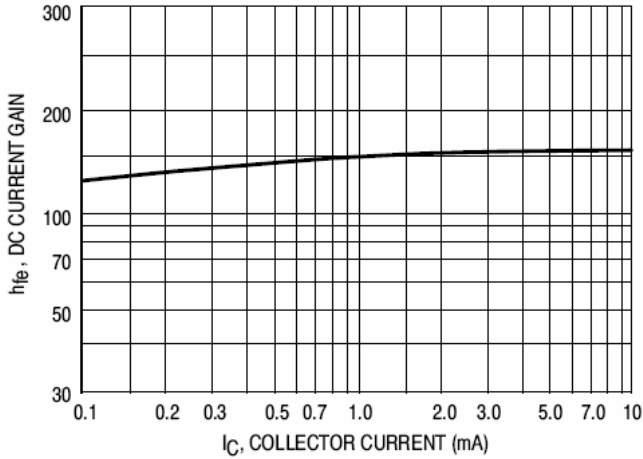


Figure 7. Current Gain

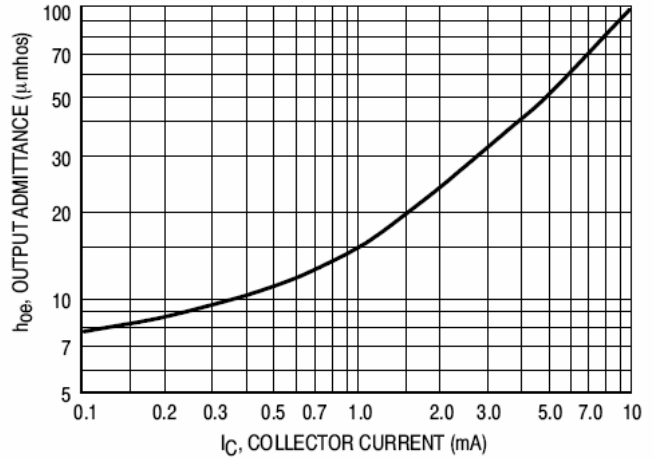


Figure 8. Output Admittance

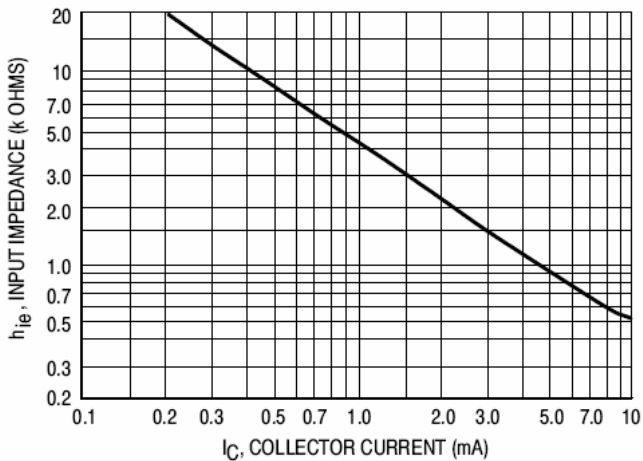


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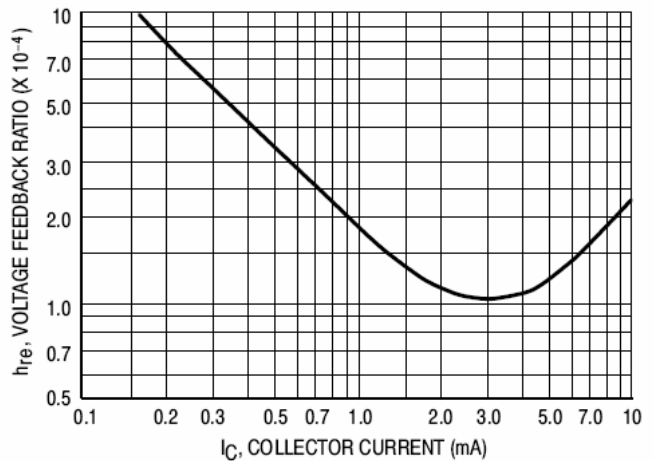


Figure 10. Voltage Feedback Ratio

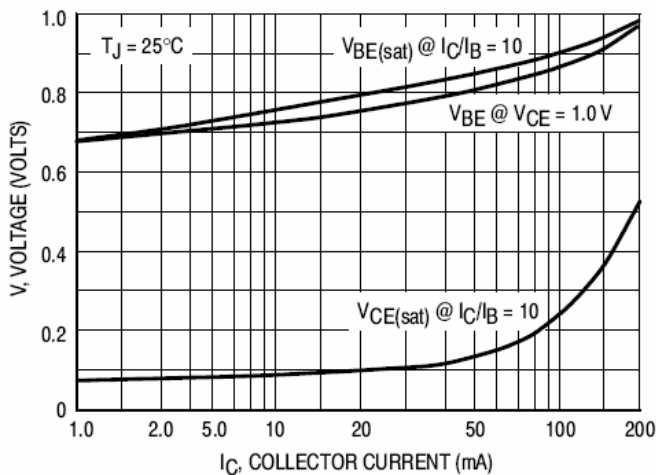


Figure 11. "ON" Voltages

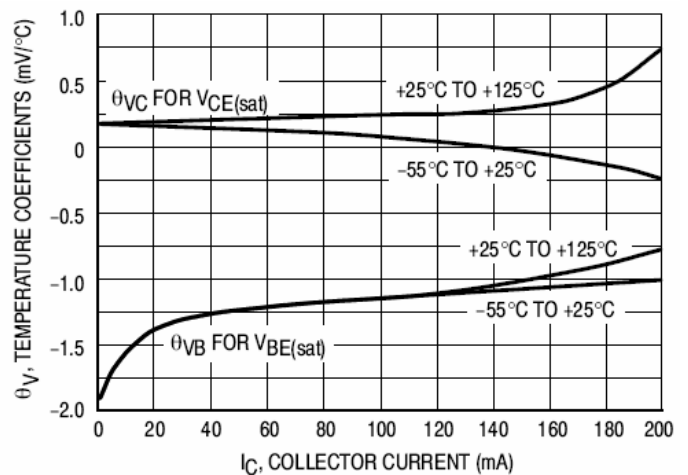


Figure 12. Temperature Coefficients

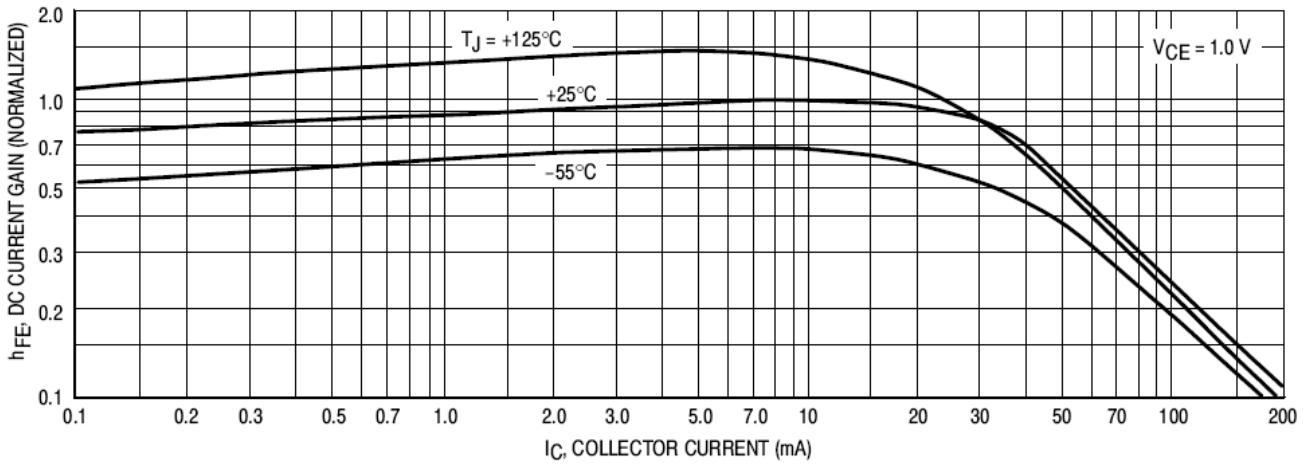


Figure 13. DC Current Gain

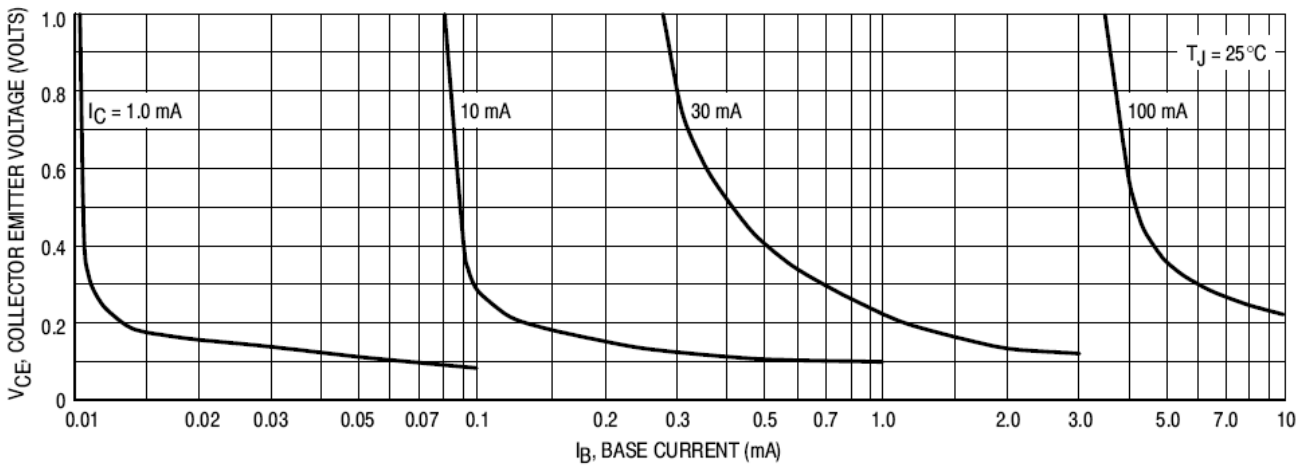
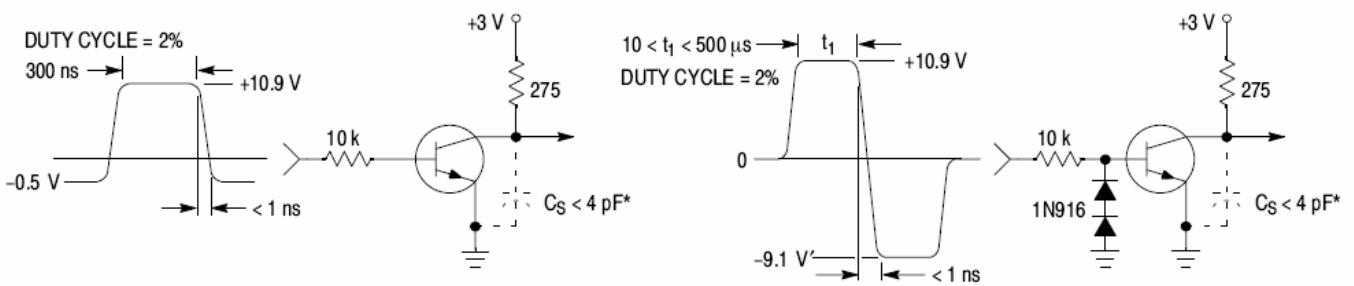


Figure 14. Collector Saturation Region

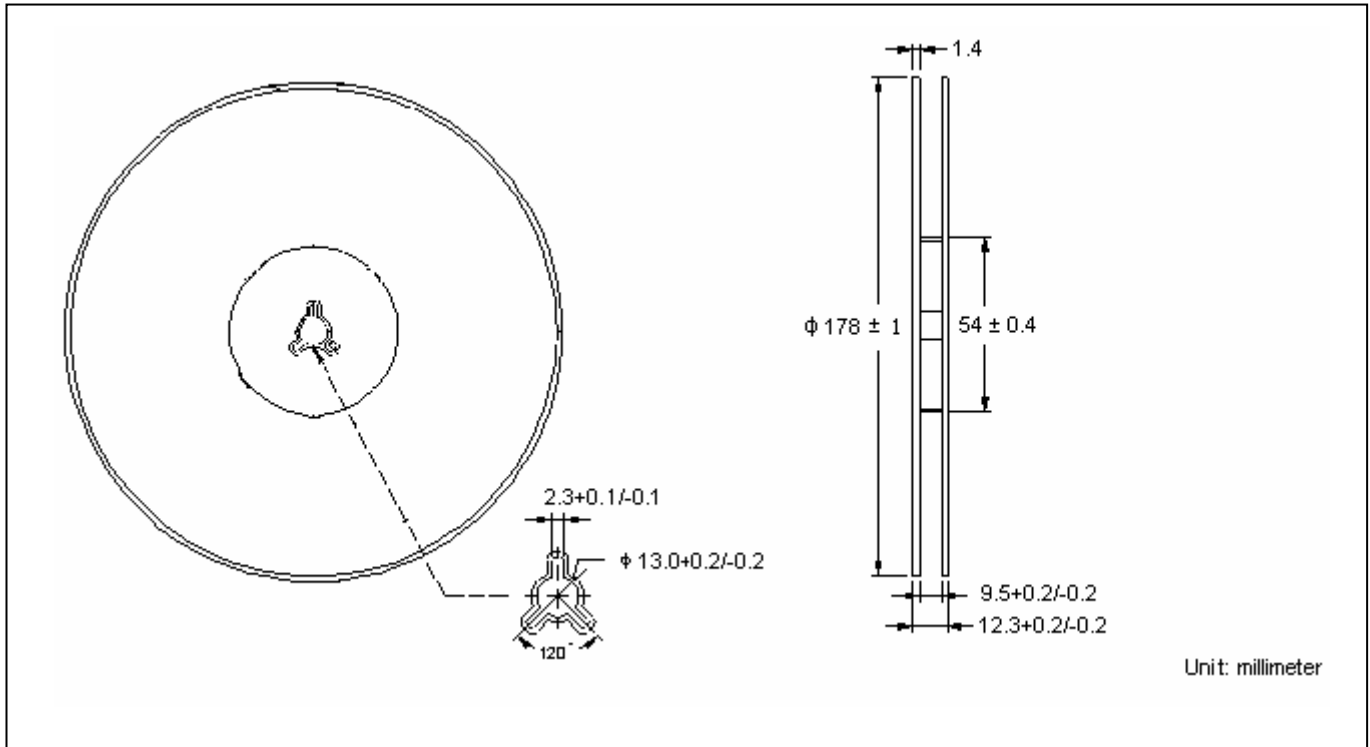


* Total shunt capacitance of test jig and connectors

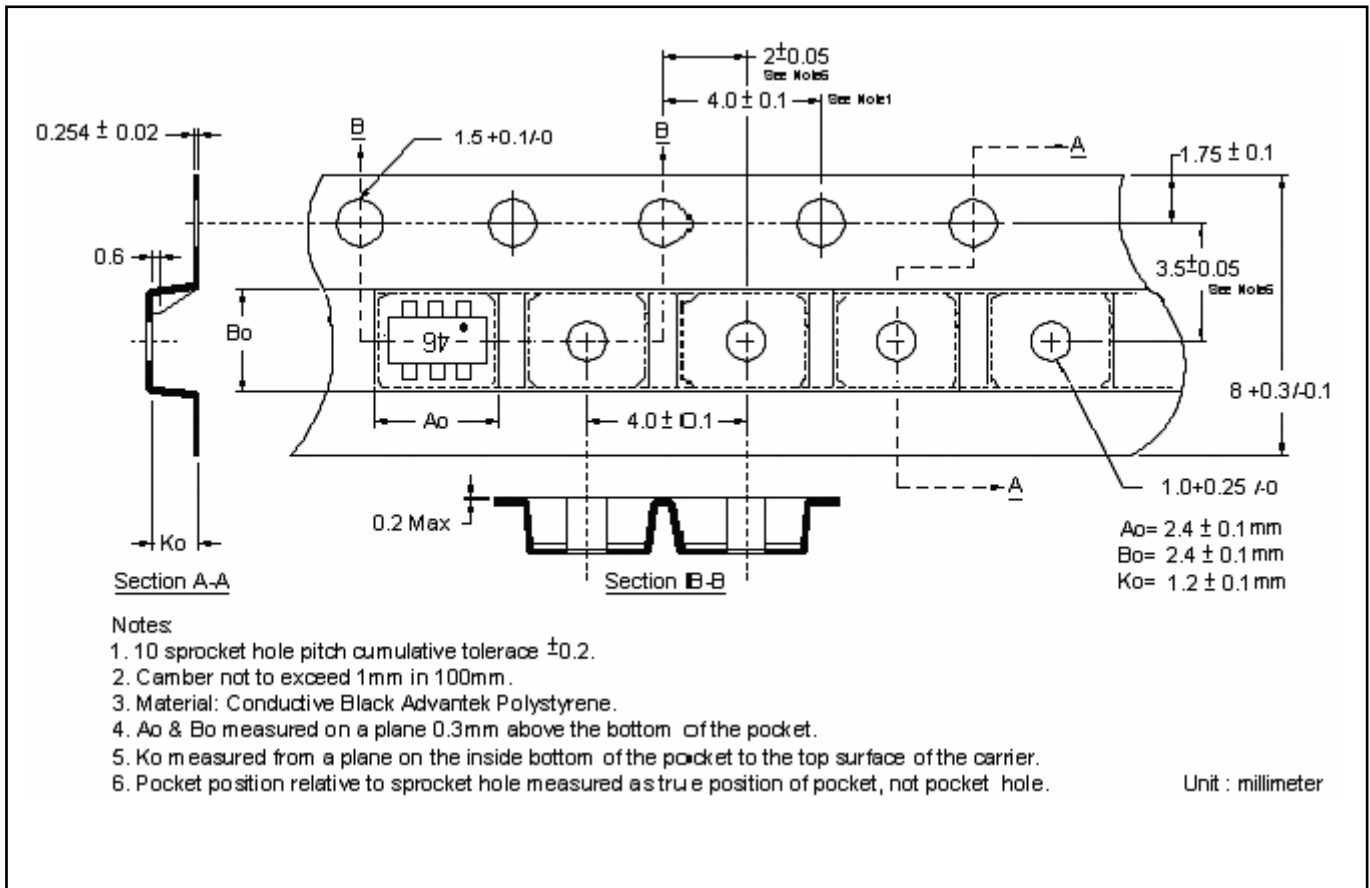
**Delay and Rise Time
 Equivalent Test Circuit**

**Storage and Fall Time
 Equivalent Test Circuit**

Reel Dimension



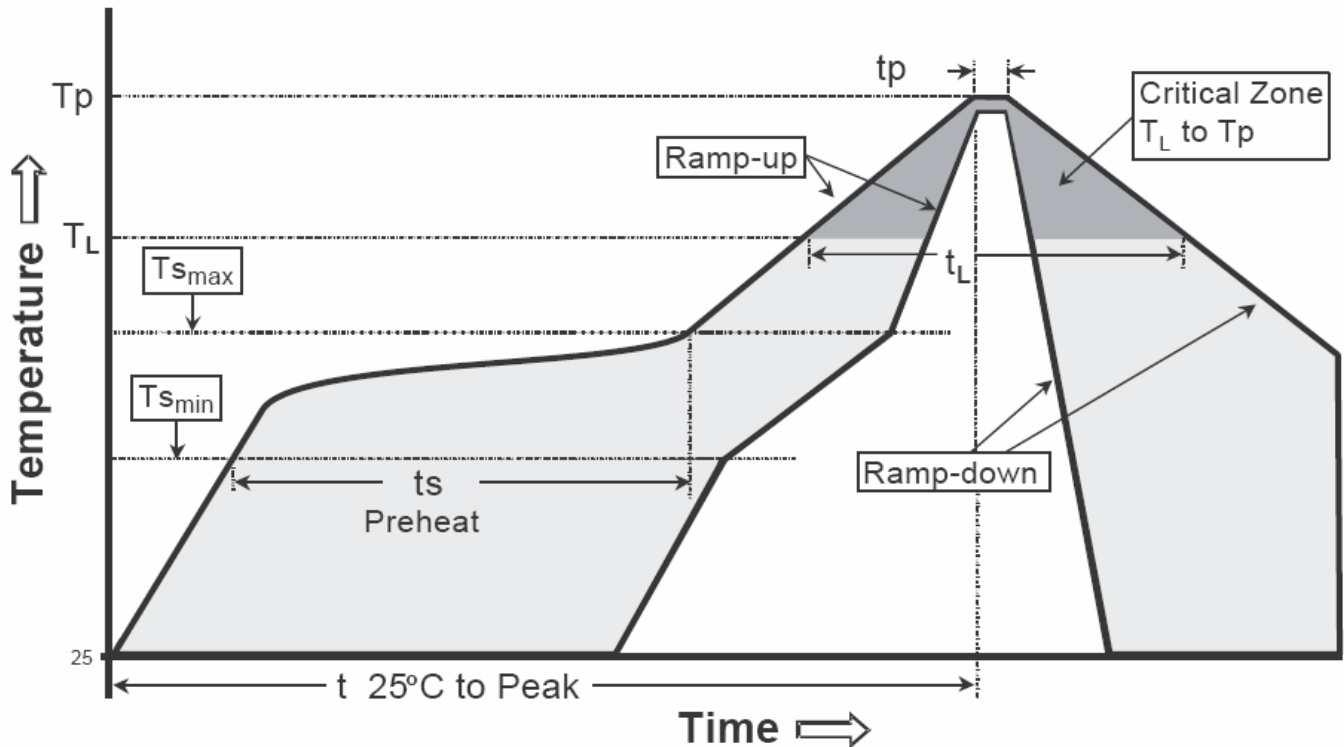
Carrier Tape Dimension



Recommended wave soldering condition

Product	Peak Temperature	Soldering Time
Pb-free devices	260 +0/-5 °C	5 +1/-1 seconds

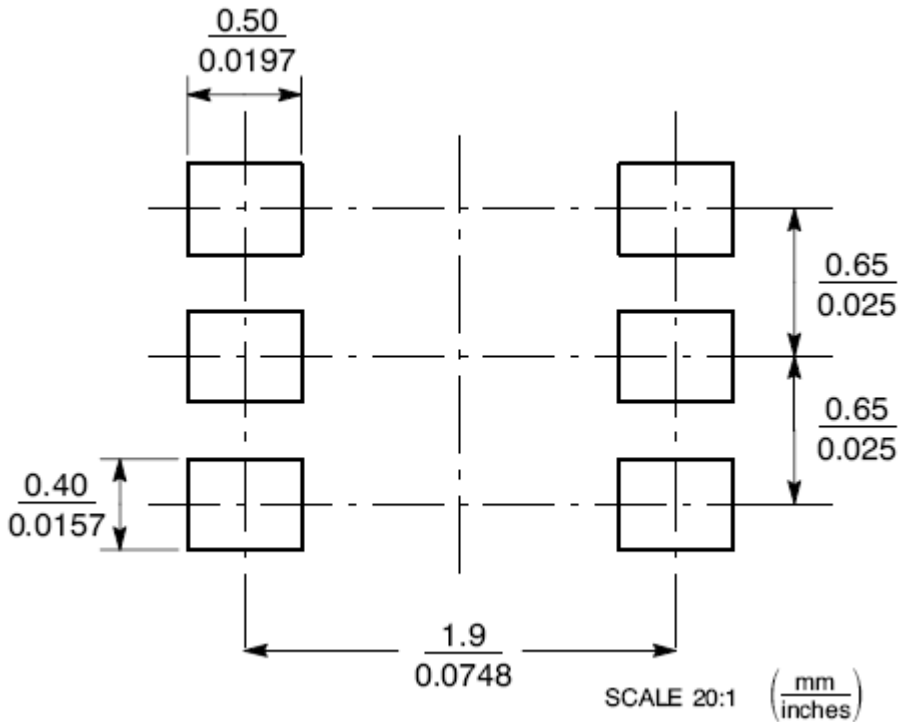
Recommended temperature profile for IR reflow



Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (T _{smax} to T _p)	3°C/second max.	3°C/second max.
Preheat		
-Temperature Min(T _{s min})	100°C	150°C
-Temperature Max(T _{s max})	150°C	200°C
-Time(t _{s min} to t _{s max})	60-120 seconds	60-180 seconds
Time maintained above:		
-Temperature (T _L)	183°C	217°C
- Time (t _L)	60-150 seconds	60-150 seconds
Peak Temperature(T _P)	240 +0/-5 °C	260 +0/-5 °C
Time within 5°C of actual peak temperature(tp)	10-30 seconds	20-40 seconds
Ramp down rate	6°C/second max.	6°C/second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

Note : All temperatures refer to topside of the package, measured on the package body surface.

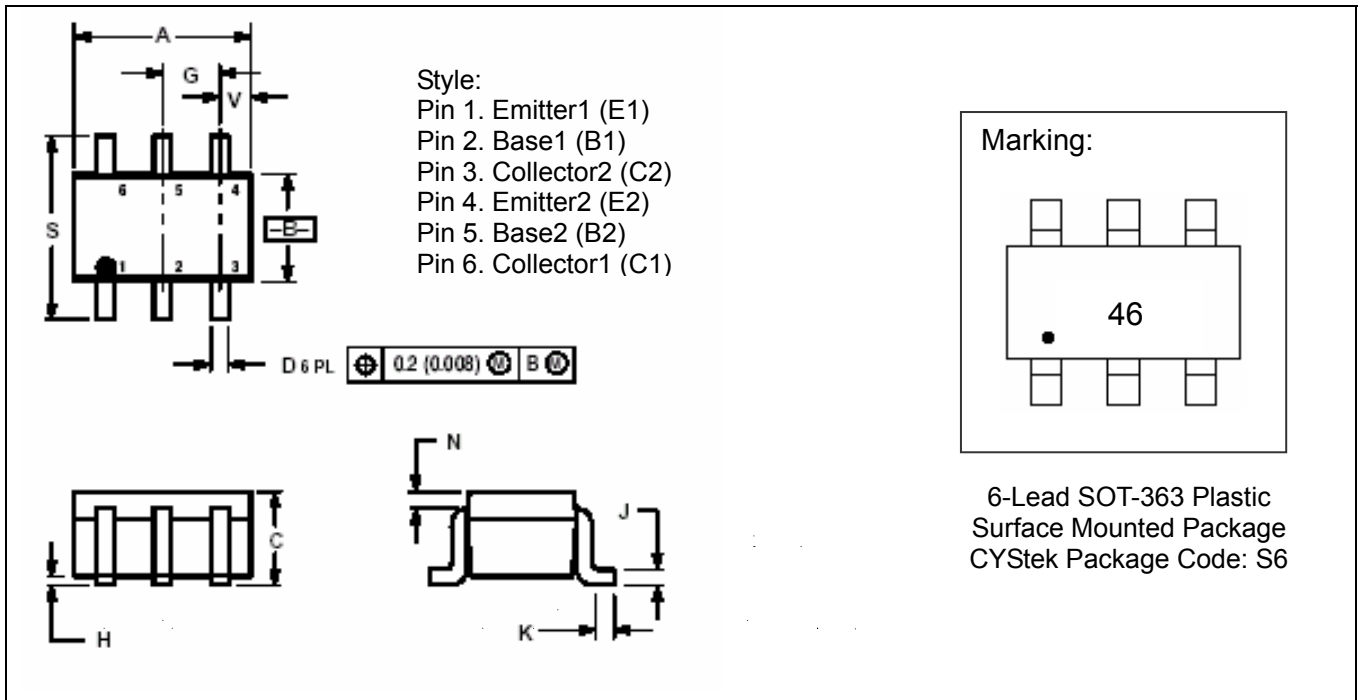
Recommended Soldering Footprint



Ordering Information

Device	Package	Shipping	Marking
HBNP3946S6R	SOT-363 (Pb-free)	3000 pcs / Tape & Reel	46

SOT-363 Dimension



*:Typical

DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.071	0.087	1.8	2.2	J	0.004	0.010	0.1	0.25
B	0.045	0.053	1.15	1.35	K	0.004	0.012	0.1	0.30
C	0.031	0.043	0.8	1.1	N	0.008 REF		0.20 REF	
D	0.004	0.012	0.1	0.3	S	0.079	0.087	2.00	2.40
G	0.026BSC		0.65BSC		Y	0.012	0.016	0.30	0.40
H	-	0.004	-	0.1					

Notes : 1.Controlling dimension : millimeters.
 2.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.
 3.If there is any question with packing specification or packing method, please contact your local CYStek sales office.

Material :

- Lead : Pure tin plated
- Mold Compound : Epoxy resin family, flammability solid burning class:UL94V-0

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