

RoHS Compliant Product
A suffix of "-C" indicates halogen-free.

FEATURE

- Complementary Pair
- One 3904-Type NPN
- One 3906-Type PNP
- Epitaxial Planer Die Construction
- Ideal for Low Power Amplification and Switching

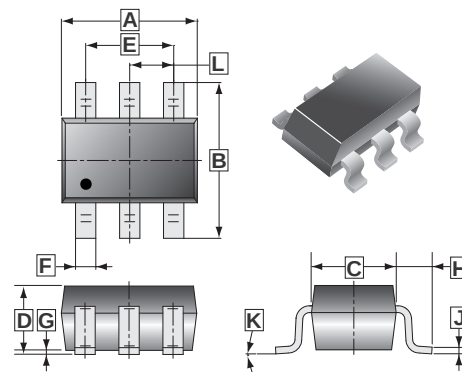
MARKING

46

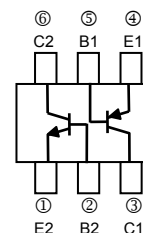
PACKAGE INFORMATION

Package	MPQ	Leader Size
SOT-363	3K	7 inch

SOT-363



REF.	Millimeter		REF.	Millimeter	
	Min.	Max.		Min.	Max.
A	1.80	2.20	G	0.100 REF.	
B	2.00	2.45	H	0.525 REF.	
C	1.15	1.35	J	0.08	0.25
D	0.80	1.10	K	8°	
E	1.10	1.50	L	0.650 TYP.	
F	0.10	0.35			



E1, B1, C1 = PNP3906
E2, B2, C2 = NPN3904

ABSOLUTE MAXIMUM RATINGS ($T_A=25^{\circ}\text{C}$)

PARAMETER		SYMBOL	VALUE	UNITS
Collector to Base Voltage	NPN	V_{CBO}	60	V
	PNP		-40	
Collector to Emitter Voltage	NPN	V_{CEO}	40	V
	PNP		-40	
Emitter to Base Voltage	NPN	V_{EBO}	6	V
	PNP		-5	
Collector Current – Continuous	NPN	I_C	0.2	A
	PNP		-0.2	
Collector Power Dissipation ¹		P_D	150	mW
Thermal Resistance, Junction to Ambient		$R_{\theta JA}$	833	$^{\circ}\text{C/W}$
Junction Temperature		T_J	150	$^{\circ}\text{C}$
Storage Temperature		T_{STG}	-55~150	$^{\circ}\text{C}$

Note:

1. Device Mounted on FR4 glass epoxy printed circuit board using the minimum recommend footprint.
2. Pulse Test: Pulse Width 300 μs , Duty Cycle 2.0%.

ELECTRICAL CHARACTERISTICS OF NPN 3904 ($T_A=25^{\circ}\text{C}$)

CHARACTERISTIC	TEST CONDITION	SYMBOL	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	$I_C=10\mu\text{A}$, $I_E=0$	$V_{(BR)CBO}$	60		V
Collector-Emitter Breakdown Voltage	$I_C = 1 \text{ mA}$, $I_B = 0$	$V_{(BR)CEO}$	40		V
Emitter-Base Breakdown Voltage	$I_E=10\mu\text{A}$, $I_C=0$	$V_{(BR)EBO}$	6		V
Base Cutoff Current	$V_{CE}=30\text{Vdc}$, $V_{EB}=3\text{Vdc}$	I_{BL}		50	nAdc
Collector Cutoff Current	$V_{CE}=30\text{Vdc}$, $V_{EB}=3\text{Vdc}$	I_{CEX}		50	nAdc
DC Current Gain	$V_{CE}=1\text{V}$, $I_C=0.1\text{mA}$	$h_{FE(1)}$	40		
	$V_{CE}=1\text{V}$, $I_C=1\text{mA}$	$h_{FE(2)}$	70		
	$V_{CE}=1\text{V}$, $I_C=10\text{mA}$	$h_{FE(3)}$	100	300	
	$V_{CE}=1\text{V}$, $I_C=50\text{mA}$	$h_{FE(4)}$	60		
	$V_{CE}=1\text{V}$, $I_C=100\text{mA}$	$h_{FE(5)}$	30		
Collector-emitter Saturation Voltage	$I_C=10\text{mA}$, $I_B=1\text{mA}$	$V_{CE(sat)1}$		0.2	V
	$I_C=50\text{mA}$, $I_B=5\text{mA}$	$V_{CE(sat)2}$		0.3	V
Base-Emitter Saturation Voltage	$I_C=10\text{mA}$, $I_B=1\text{mA}$	$V_{BE(sat)1}$	0.65	0.85	V
	$I_C=50\text{mA}$, $I_B=5\text{mA}$	$V_{BE(sat)2}$		0.95	V
Output Capacitance	$V_{CB}=5\text{V}$, $I_E=0$, $f=1\text{MHz}$	C_{obo}		4	pF
Input Capacitance	$V_{EB}=0.5\text{V}$, $I_C=0$, $f=1\text{MHz}$	C_{ibo}		8	pF
Transition Frequency	$V_{CE}=20\text{V}$, $I_C=10\text{mA}$, $f=100\text{MHz}$	f_T	300		MHz
Input Impedance	$V_{CE}=10\text{Vdc}$, $I_C=1\text{mAdc}$, $f=1.0 \text{ kHz}$	h_{ie}	1	10	k ohms
Voltage Feedback Ratio	$V_{CE}=10\text{Vdc}$, $I_C=1\text{mAdc}$, $f=1.0 \text{ kHz}$	h_{re}	0.5	8	$\times 10^{-4}$
Small-Signal Current Gain	$V_{CE}=10\text{Vdc}$, $I_C=1\text{mAdc}$, $f=1.0 \text{ kHz}$	h_{fe}	100	400	
Output Admittance	$V_{CE}=10\text{Vdc}$, $I_C=1\text{mAdc}$, $f=1.0 \text{ kHz}$	h_{oe}	1	40	μmhos
Noise Figure	$V_{CE}=5\text{V}$, $I_C=0.1\text{mA}$, $f=1\text{kHz}$ $R_s=1\text{K}\Omega$	NF		5	dB
Delay Time	$V_{CC}=3\text{V}$, $V_{BE}=0.5\text{V}$, $I_C=10\text{mA}$, $I_{B1}=1\text{mA}$	T_d		35	nS
Rise Time		T_r		35	nS
Storage Time	$V_{CC}=3\text{V}$, $I_C=10\text{mA}$, $I_{B1}=I_{B2}=1\text{mA}$	T_s		200	nS
Fall Time		T_f		50	nS

ELECTRICAL CHARACTERISTICS OF PNP 3906 ($T_A=25^\circ\text{C}$)

CHARACTERISTIC	TEST CONDITION	SYMBOL	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	$I_C = -10\mu\text{A}$, $I_E = 0$	$V_{(BR)CBO}$	-40		V
Collector-Emitter Breakdown Voltage	$I_C = -1\text{mA}$, $I_B = 0$	$V_{(BR)CEO}$	-40		V
Emitter-Base Breakdown Voltage	$I_E = -10\mu\text{A}$, $I_C = 0$	$V_{(BR)EBO}$	-5		V
Base Cutoff Current	$V_{CE} = -30\text{Vdc}$, $V_{EB} = -3\text{Vdc}$	I_{BL}		-50	nAdc
Collector Cutoff Current	$V_{CE} = -30\text{Vdc}$, $V_{EB} = -3\text{Vdc}$	I_{CEX}		-50	nAdc
DC Current Gain	$V_{CE} = -1\text{V}$, $I_C = -0.1\text{mA}$	$h_{FE(1)}$	60		
	$V_{CE} = -1\text{V}$, $I_C = -1\text{mA}$	$h_{FE(2)}$	80		
	$V_{CE} = -1\text{V}$, $I_C = -10\text{mA}$	$h_{FE(3)}$	100	300	
	$V_{CE} = -1\text{V}$, $I_C = -50\text{mA}$	$h_{FE(4)}$	60		
	$V_{CE} = -1\text{V}$, $I_C = -100\text{mA}$	$h_{FE(5)}$	30		
Collector-emitter Saturation Voltage	$I_C = -10\text{mA}$, $I_B = -1\text{mA}$	$V_{CE(sat)1}$		-0.25	V
	$I_C = -50\text{mA}$, $I_B = -5\text{mA}$	$V_{CE(sat)2}$		-0.4	V
Base-Emitter Saturation Voltage	$I_C = -10\text{mA}$, $I_B = -1\text{mA}$	$V_{BE(sat)1}$	-0.65	-0.85	V
	$I_C = -50\text{mA}$, $I_B = -5\text{mA}$	$V_{BE(sat)2}$		-0.95	V
Collector Output Capacitance	$V_{CB} = -5\text{V}$, $I_E = 0$, $f = 1\text{MHz}$	C_{ob}		4.5	pF
Input Capacitance	$V_{EB} = -0.5\text{V}$, $I_C = 0$, $f = 1\text{MHz}$	C_{ibo}		10	pF
Transition Frequency	$V_{CE} = -20\text{V}$, $I_C = -10\text{mA}$, $f = 100\text{MHz}$	f_T	250		MHz
Input Impedance	$V_{CE} = -10\text{Vdc}$, $I_C = -1\text{mAdc}$, $f = 1.0\text{ kHz}$	h_{ie}	2	12	k ohms
Voltage Feedback Ratio	$V_{CE} = -10\text{Vdc}$, $I_C = -1\text{mAdc}$, $f = 1.0\text{ kHz}$	h_{re}	0.1	10	$\times 10^{-4}$
Small-Signal Current Gain	$V_{CE} = -10\text{Vdc}$, $I_C = -1\text{mAdc}$, $f = 1.0\text{ kHz}$	h_{fe}	100	400	
Output Admittance	$V_{CE} = -10\text{Vdc}$, $I_C = -1\text{mAdc}$, $f = 1.0\text{ kHz}$	h_{oe}	3	60	μmhos
Noise Figure	$V_{CE} = -5\text{V}$, $I_C = -0.1\text{mA}$, $f = 1\text{kHz}$ $R_s = 1\text{K}\Omega$	NF		4	dB
Delay Time	$V_{CC} = -3\text{V}$, $V_{BE} = -0.5\text{V}$, $I_C = -10\text{mA}$, $I_{B1} = -1\text{mA}$	T_d		35	nS
Rise Time		T_r		35	nS
Storage Time	$V_{CC} = -3\text{V}$, $I_C = -10\text{mA}$, $I_{B1} = -I_{B2} = -1\text{mA}$	T_s		225	nS
Fall Time		T_f		75	nS

CHARACTERISTIC CURVES(NPN)

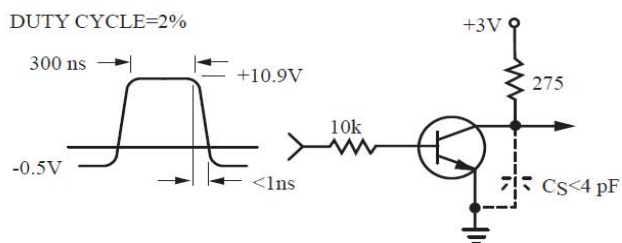


Figure 1. Delay and Rise Time
Equivalent Test Circuit

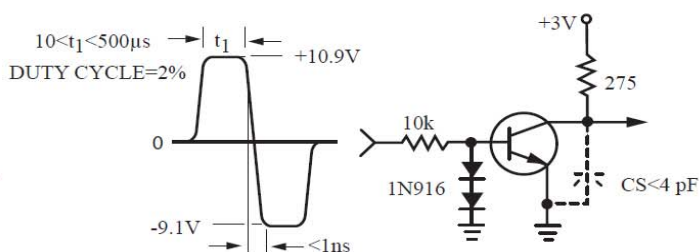


Figure 2. Storage and Fall Time
Equivalent Test Circuit

*Total shunt capacitance of test jig and connectors

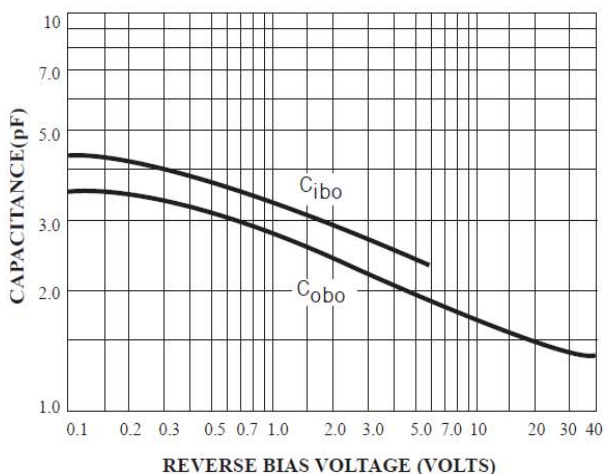


Figure 3. Capacitance

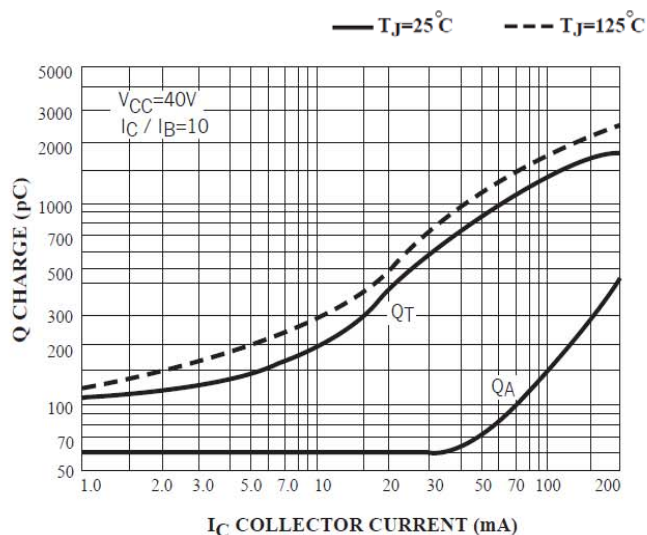


Figure 4. Charge Data

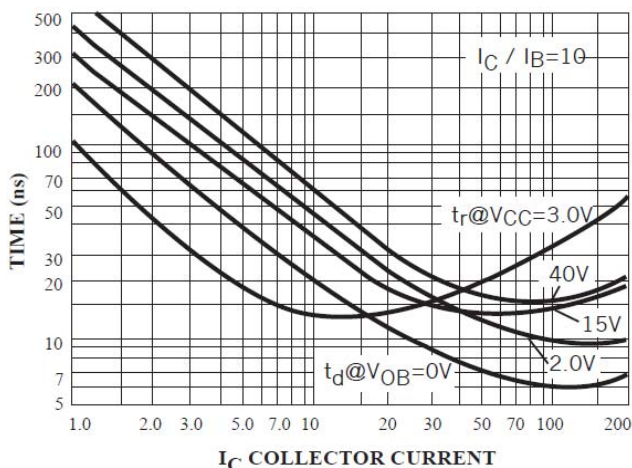


Figure 5. Turn-On Time

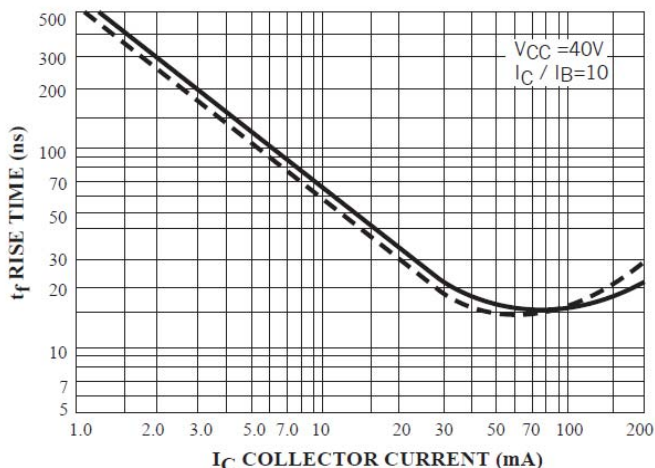


Figure 6. Rise Time

CHARACTERISTIC CURVES(NPN)

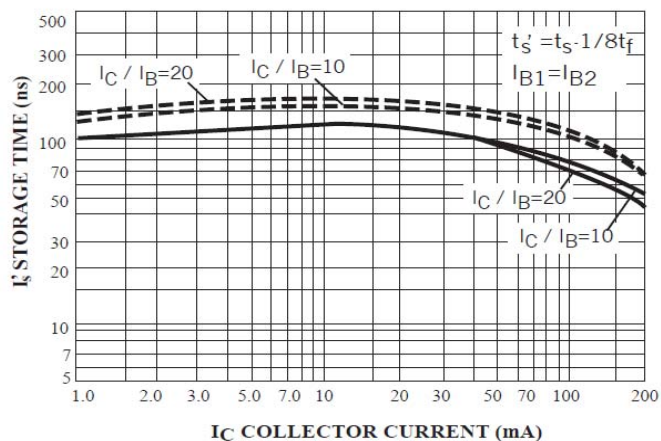


Figure 7. Storage Time

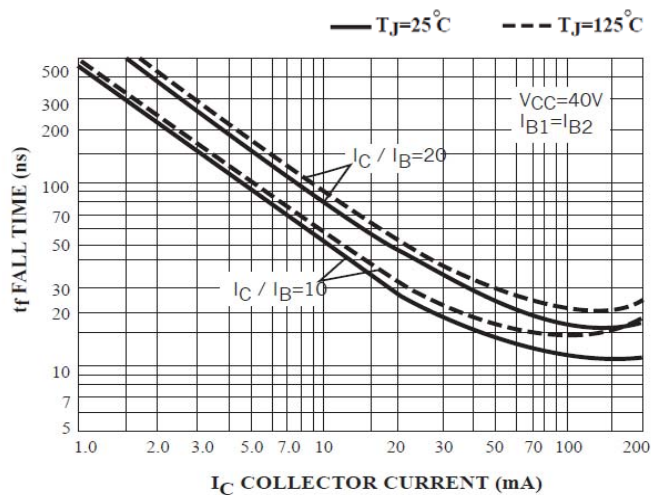


Figure 8. Fall Time

TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS ($V_{CE} = 5.0 V_{dc}$, $T_A = 25^\circ C$, Bandwidth = 1.0Hz)

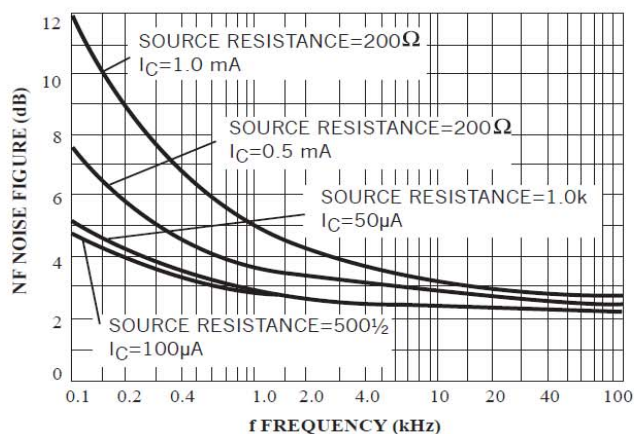


Figure 9.

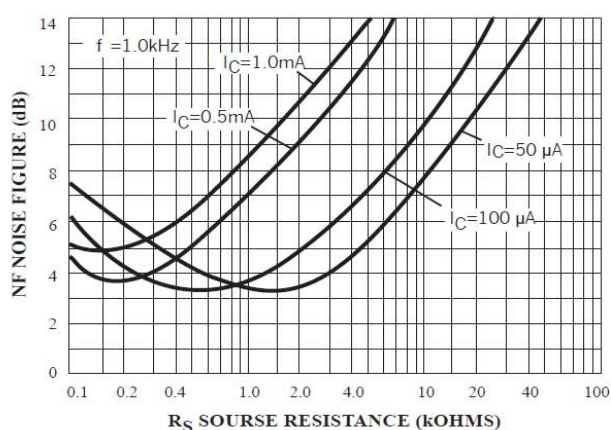


Figure 10.

h PARAMETERS ($V_{CE} = 10 V_{dc}$, $f = 1.0 kHz$, $T_A = 25^\circ C$)

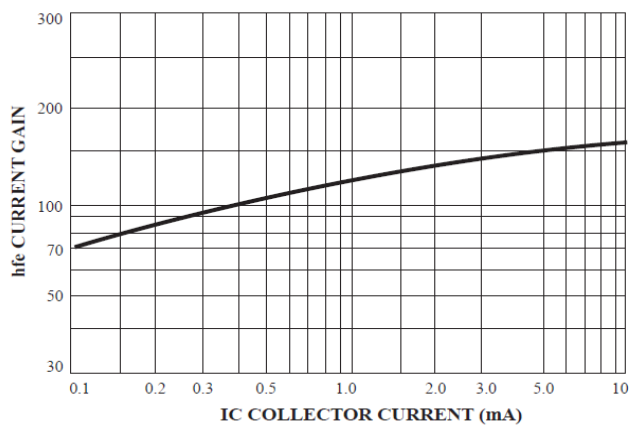


Figure 11. Current Gain

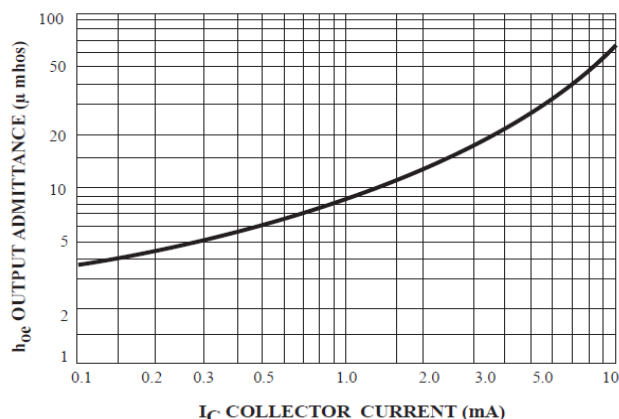


Figure 12. Output Admittance

CHARACTERISTIC CURVES(NPN)

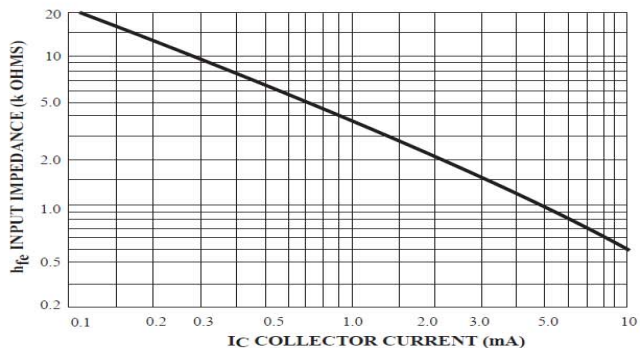


Figure 13. Input Impedance

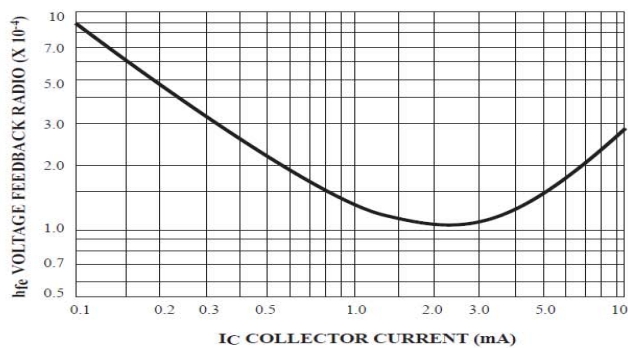


Figure 14. Voltage Feedback Ratio

TYPICAL STATIC CHARACTERISTICS

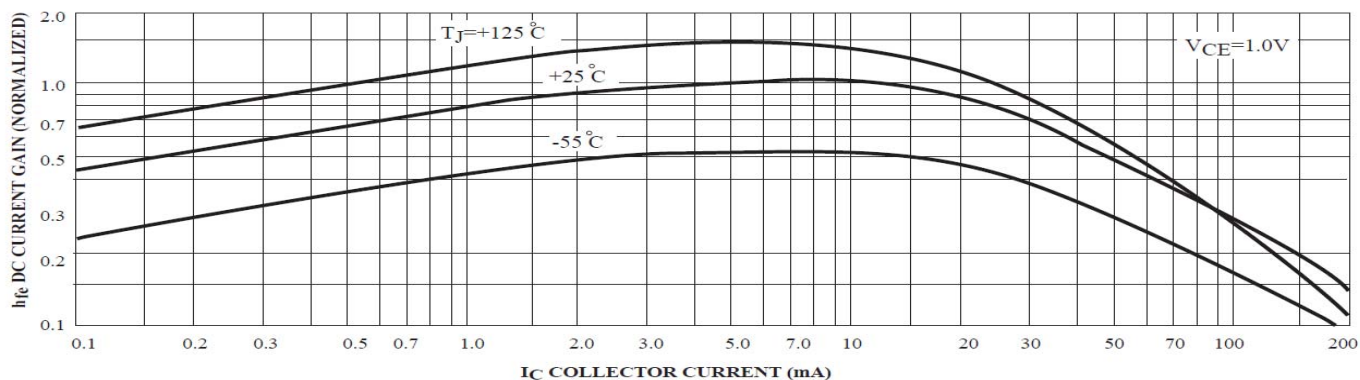


Figure 15. DC Current Gain

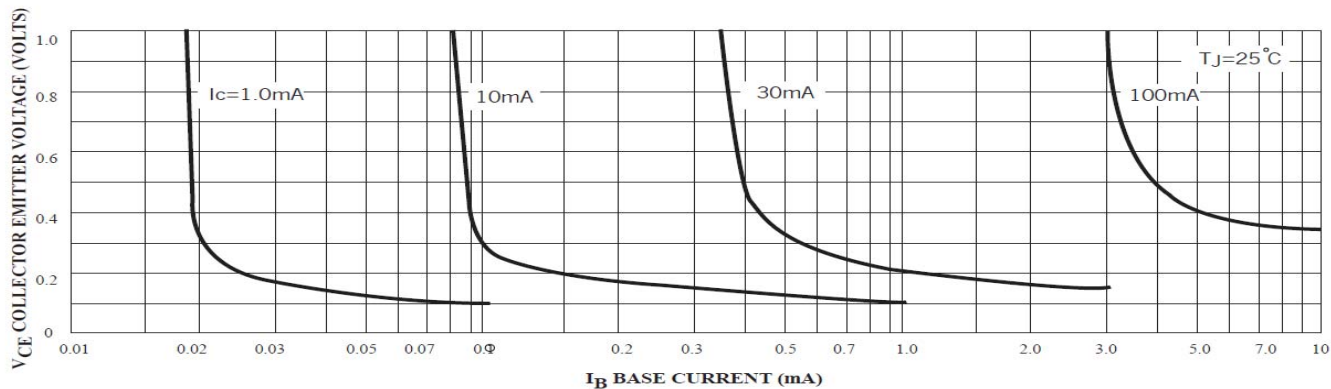


Figure 16. Collector Saturation Region

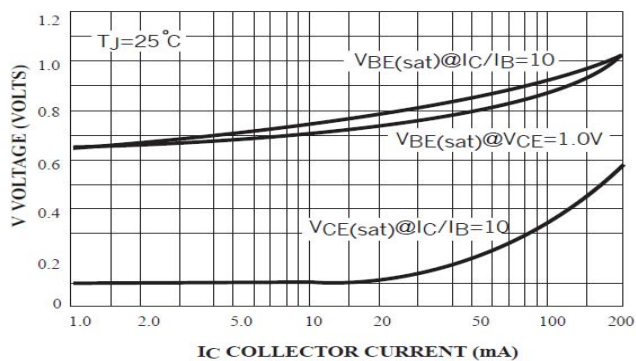


Figure 17. "ON" Voltage

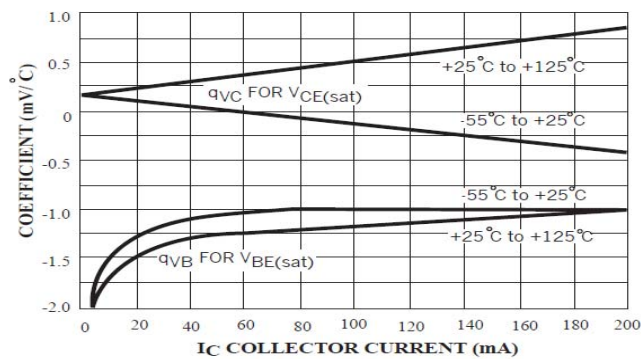
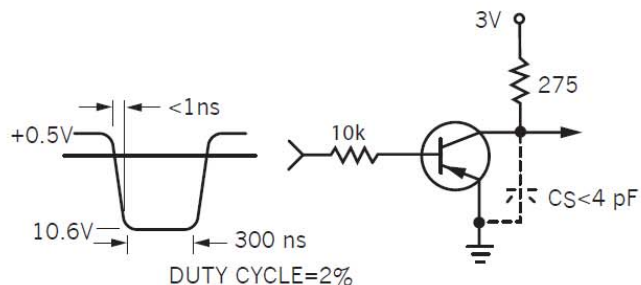


Figure 18. Temperature Coefficients

CHARACTERISTIC CURVES(PNP)



*Total shunt capacitance of test jig and connectors

Figure 19. Delay and Rise Time
Equivalent Test Circuit

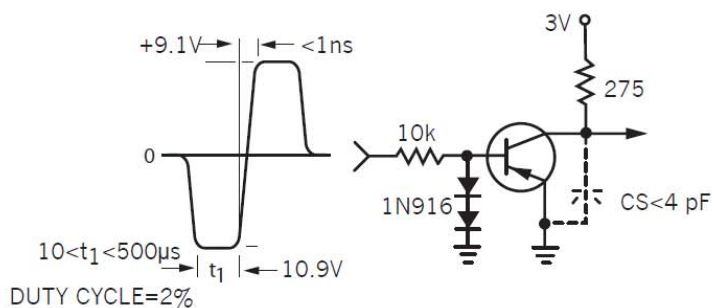


Figure 20 . Storage and Fall Time
Equivalent Test Circuit

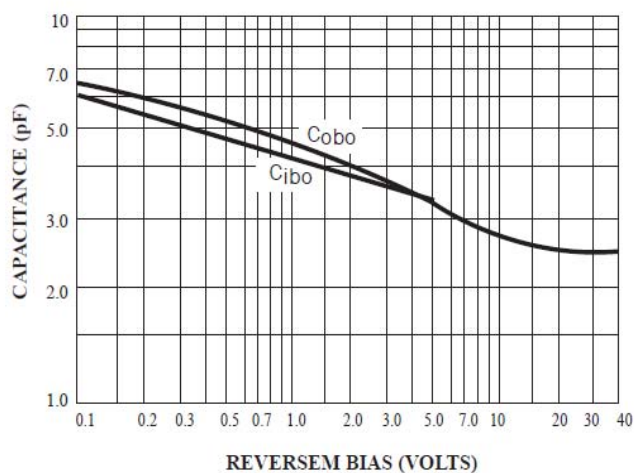


Figure 21. Capacitance

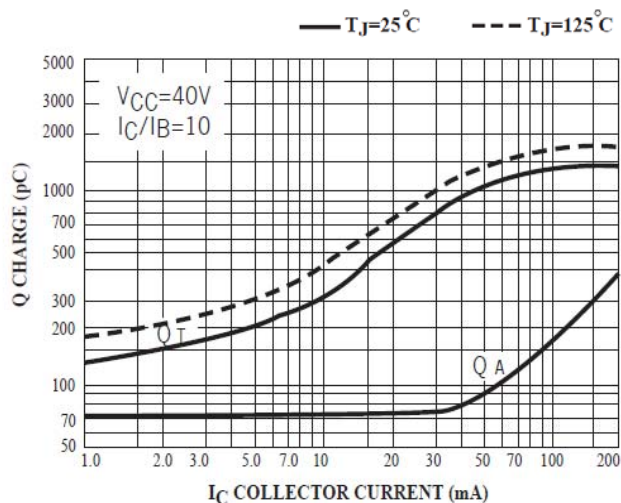


Figure 22. Charge Data

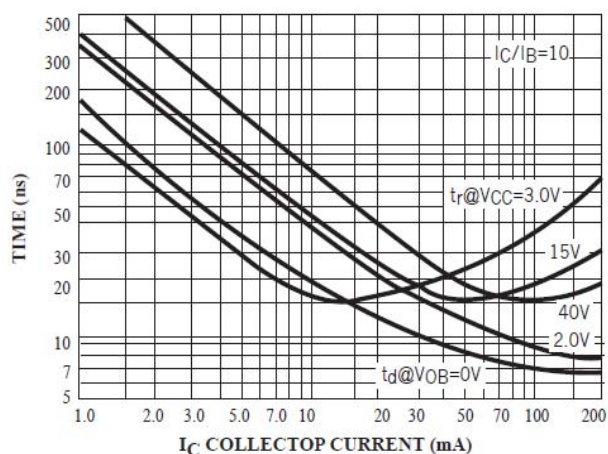


Figure 23. Turn-On Time

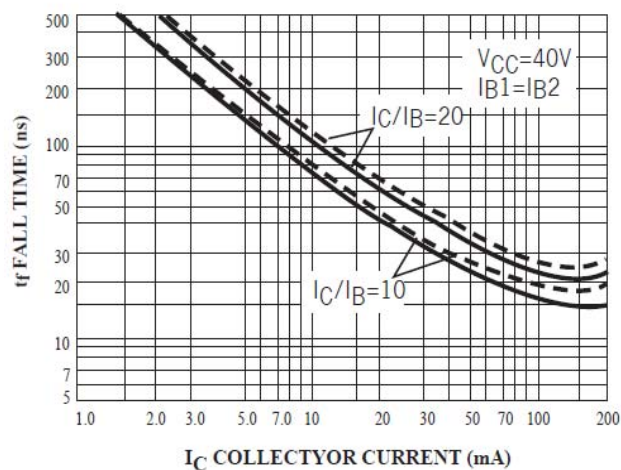


Figure 24. Fall Time

CHARACTERISTIC CURVES(PNP)

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

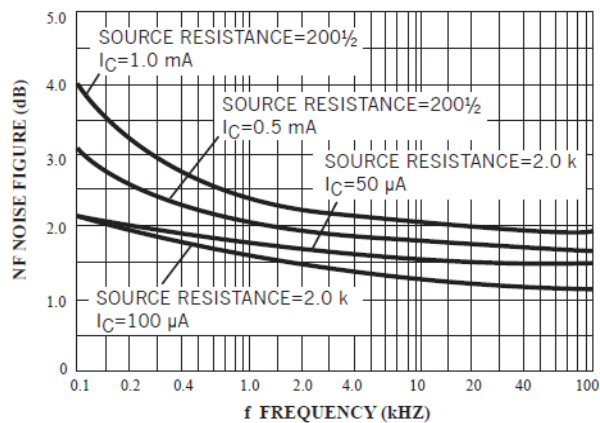


Figure 25.

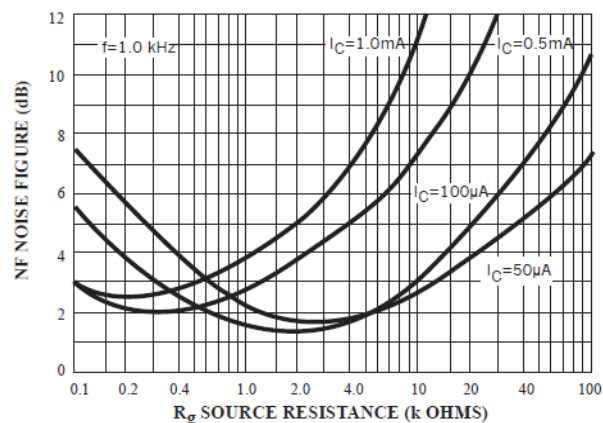


Figure 26.

h PARAMETERS

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

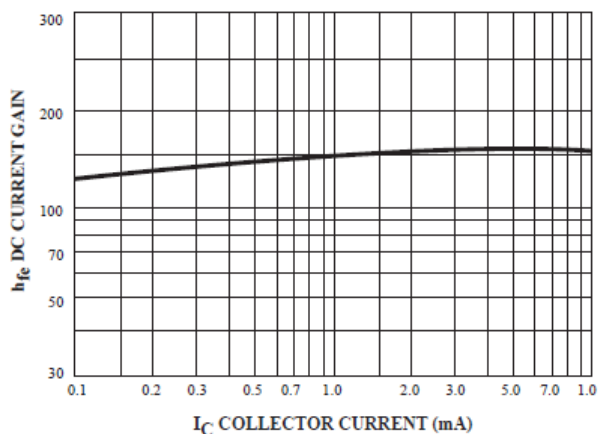


Figure 27. Current Gain

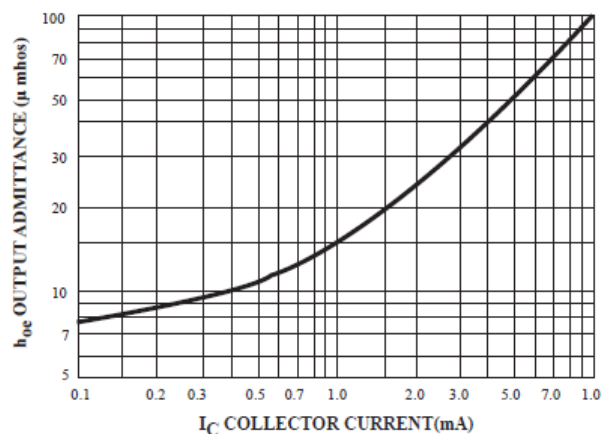


Figure 28. Input Impedance

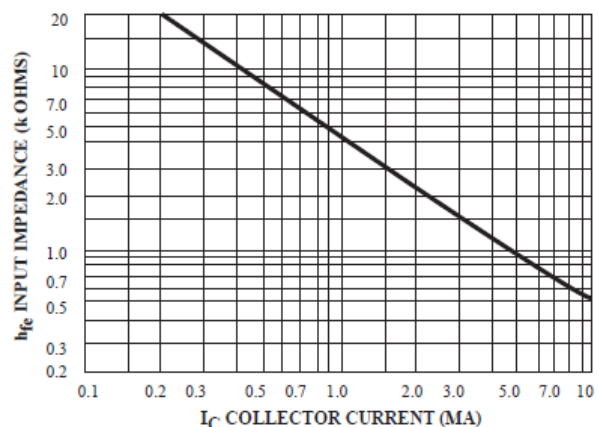


Figure 29. Input Impedance

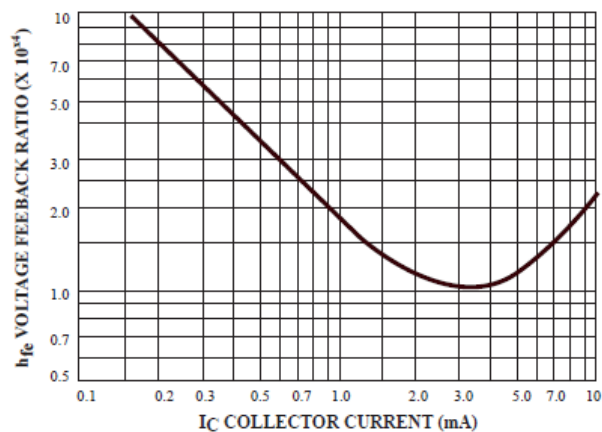


Figure 30. Votage Feedback Ratio

CHARACTERISTIC CURVES(PNP)

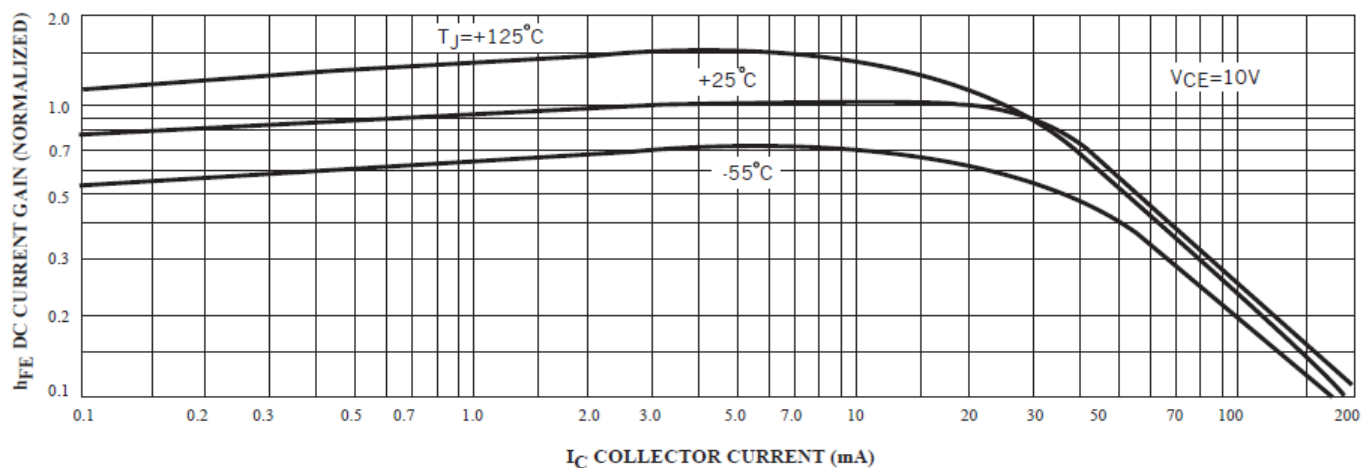


Figure 31. DC Current Gain

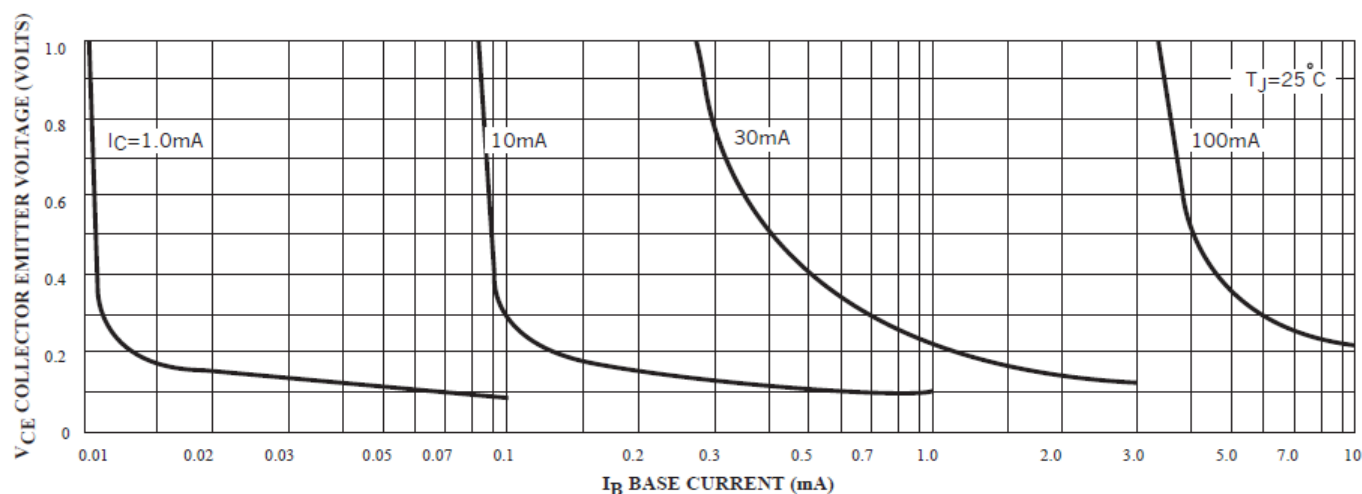


Figure 32. Collector Saturation Region

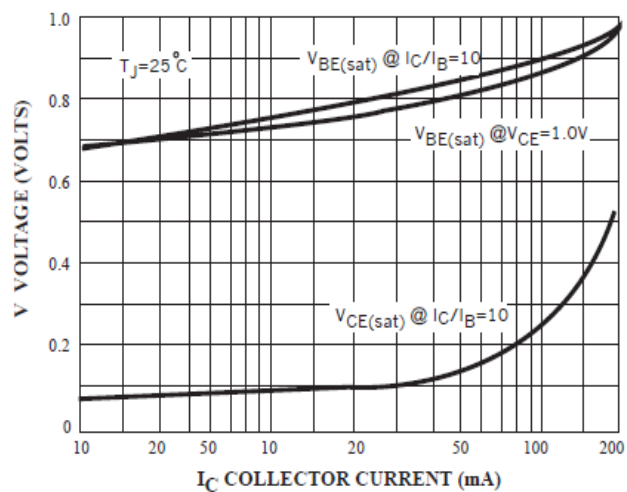


Figure 33. "ON" Voltages

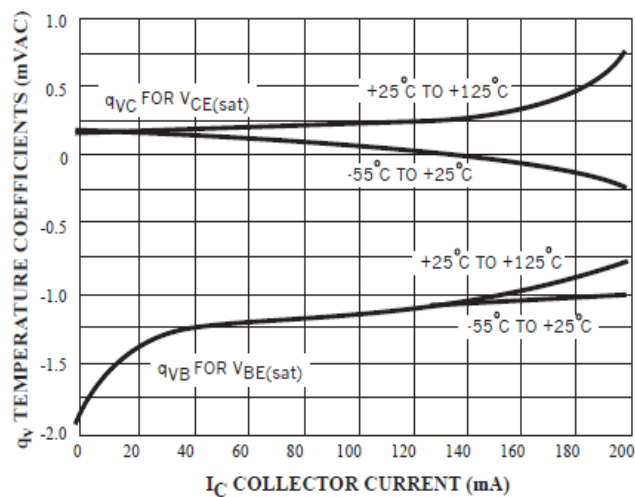


Figure 34. Temperature Coefficients