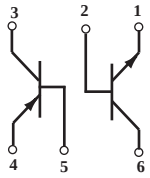
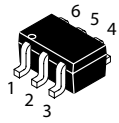
MBT3946

Dual General Purpose Transistor
NPN+PNP Silicon



NPN+PNP



SOT-363(SC-88)

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

Thermal Characteristics

Characteristics	Symbol	Max	Unit
Total Package Dissipation (1) TA=25℃	P_D	150	mW
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	833	℃/W
Junction and Storage, Temperature	$T_{J,Tstg}$	-55 to +150	℃

Off Characteristics

Collector-Emitter Breakdown Voltage(2) (I_C=1.0mAdc.I_B=0) (NPN) (I_C=-1.0mAdc.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}=30Vdc, V_{EB}=3.0Vdc) (NPN) (V_{CE}=-30Vdc, V_{EB}=-3.0Vdc) (PNP)	I_{CEX}	- -	50 -50	nAdc

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

Electrical Characteristics (T_A=25°C unless otherwise noted) (Countinued)

Characteristics	Symbol	Min	Max	Unit
On Characteristics (2)				
DC Current Gain (I_C= 0.1 mAdc, V_{CE}=1.0Vdc) (NPN) (I_C= 1.0 mAdc, V_{CE}= 1.0 Vdc) (I_C= 10 mAdc, V_{CE}= 1.0Vdc) (I_C= 50 mAdc, V_{CE}= 1.0Vdc) (I_C= 100 mAdc, V_{CE}= 1.0Vdc) (I_C= -0.1 mAdc, V_{CE}=-1.0Vdc) (PNP) (I_C= -1.0 mAdc, V_{CE}= -1.0 Vdc) (I_C= -10 mAdc, V_{CE}= -1.0Vdc) (I_C= -50 mAdc, V_{CE}= -1.0Vdc) (I_C= -100 mAdc, V_{CE}= -1.0Vdc)	H_{FE}	40 70 100 60 30 60 80 100 60 30	- - 300 - - - - 300 - -	- -
Collector-Emitter Saturation Voltage (I_C= 10 mAdc, I_B= 1.0mAdc) (NPN) (I_C= 50 mAdc, I_B= 5.0mAdc) (I_C= -10 mAdc, I_B= -1.0mAdc) (PNP) (I_C=-50 mAdc, I_B= -5.0mAdc)	$V_{CE(sat)}$	- - - -	0.20 0.30 -0.25 -0.40	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

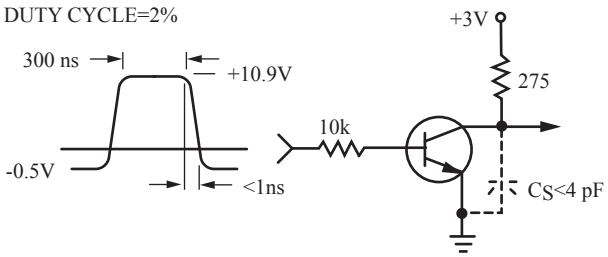
Small-signal Characteristics

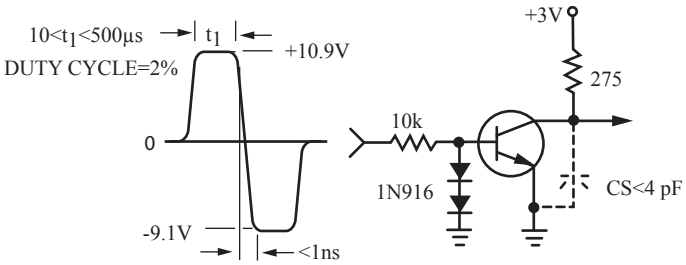
Current-Gain-Bandwidth Product (I_C= 10 mAdc, V_{CE}= 20 Vdc, f=100MHz) (NPN) (I_C= -10 mAdc, V_{CE}= -20 Vdc, f=100MHz) (PNP)	f_T	300 250	- -	MHz
Output Capacitance (V_{CB}= 5.0 Vdc, I_E=0, f=1.0MHz) (NPN) (V_{CB}= -5.0 Vdc, I_E=0, f=1.0MHz) (PNP)	C_{obo}	- -	4.0 4.5	pF
Input Capacitance (V_{EB}= 0.5 Vdc, I_C=0, f=1.0MHz) (NPN) (V_{EB}= -0.5 Vdc, I_C=0, f=1.0MHz) (PNP)	C_{ibo}	- -	8.0 10.0	pF
Input Impedance (VCE= 10 Vdc, IC=1.0 mAdc, f=1.0 kHz) (NPN) (VCE= -10 Vdc, IC=-1.0 mAdc, f=1.0 kHz) (PNP)	h_{ie}	1.0 2.0	10 12	k ohms
Voltage Feeback Radio (V_{CE}= 10Vdc, I_C=1.0 mAdc, f=1.0 kHz) (NPN) (V_{CE}= -10Vdc, I_C=-1.0 mAdc, f=1.0 kHz) (PNP)	h_{re}	0.5 0.1	8.0 10	x 10^{-4}
Small-Signal Current Gain (V_{CE}= 10Vdc, I_C=1.0 mAdc, , f=1.0 kHz) (NPN) (V_{CE}= -10Vdc, I_C=-1.0 mAdc, , f=1.0 kHz) (PNP)	h_{fe}	100 100	400 400	-
Output Admittance (V_{CE}= 10Vdc, I_C=1.0 mAdc, f=1.0kHz) (NPN) (V_{CE}= -10Vdc, I_C=-1.0 mAdc, f=1.0kHz) (PNP)	h_{oe}	1.0 3.0	40 60	µmhos
Noise Figure (V_{CE}= 5.0Vdc, I_C= 100 µAdc, , R_S=1.0k ohms, f=1.0kHz) (NPN) (V_{CE}= -5.0Vdc, I_C= -100 µAdc, , R_S=1.0k ohms, f=1.0kHz) (PNP)	NF	- -	5.0 4.0	dB

Switching Characteristics

Delay Time	(Vcc= 3.0 Vdc, VBE= -0.5 Vdc) (NPN) (Ic= 10 mAdc, IB1= 1.0 mAdc)	td	-	35 35	ns
Rise Time	(Vcc= -3.0 Vdc, VBE= 0.5 Vdc) (PNP) (Ic= -10 mAdc, IB1= -1.0 mAdc)	tr	-	35 35	ns
Storage Time	(Vcc= 3.0 Vdc,Ic= 10 mAdc) (NPN) (Ic= 10 mAdc, IB1=IB2= 1.0 mAdc)	ts	-	200 225	ns
Fall Time	(Vcc= -3.0 Vdc,Ic= -10 mAdc) (PNP) (Ic= -10 mAdc, IB1=IB2= -1.0 mAdc)	tf	-	50 75	ns

(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

—— T_J=25°C - - - T_J=125°C

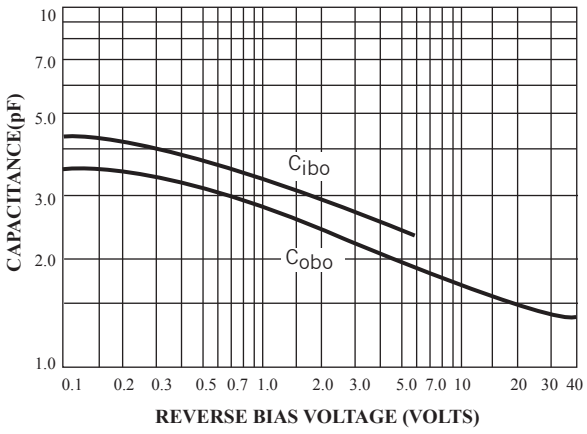


Figure 3. Capacitance

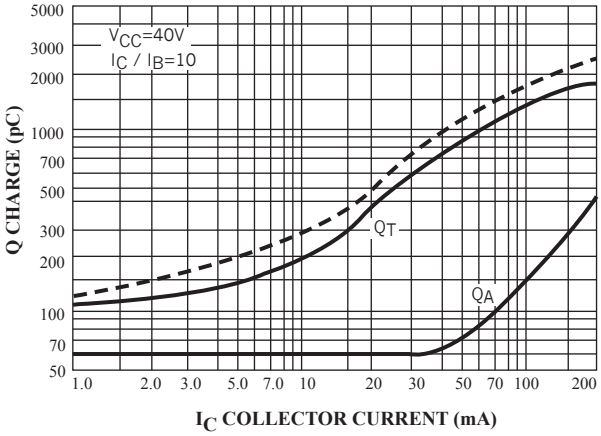


Figure 4. Charge Data

(NPN)

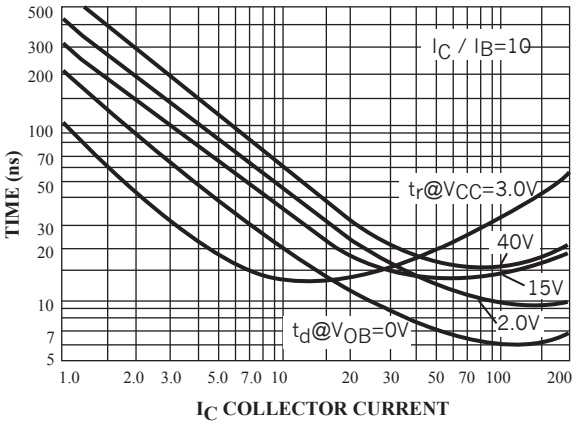


Figure 5.Turn-On Time

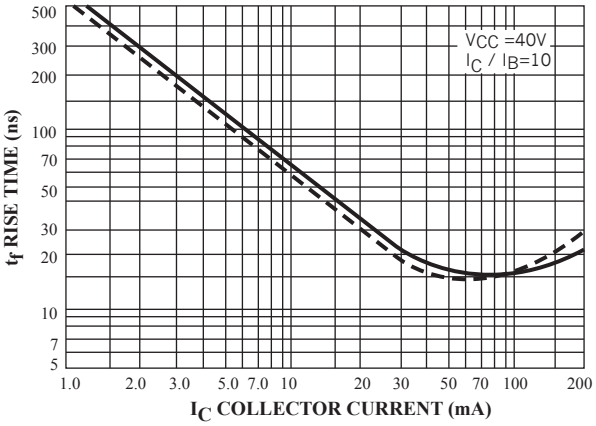


Figure 6. Rise Time

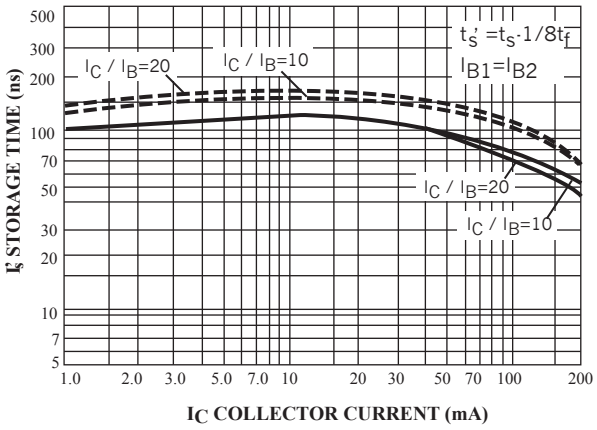


Figure 7. Storage Time

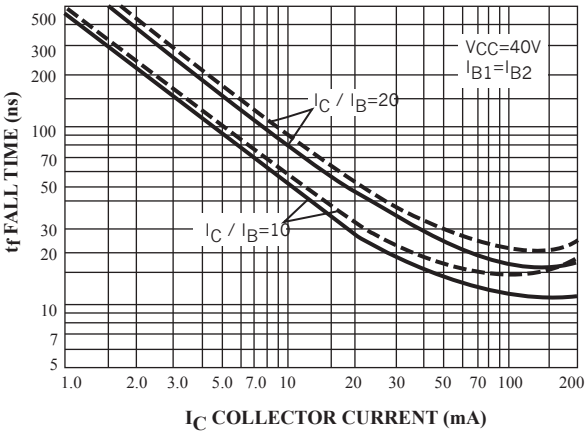


Figure 8. Fall Time

TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

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

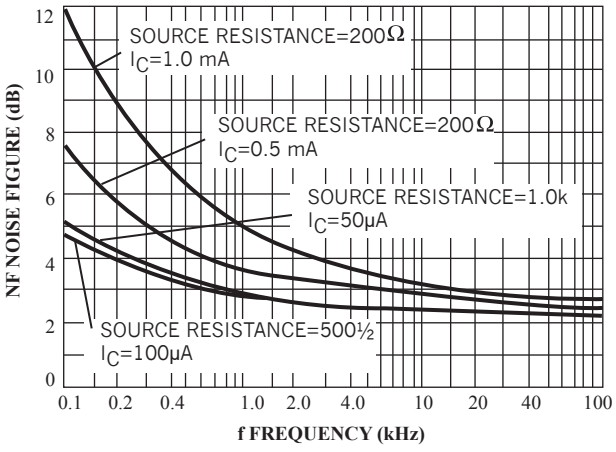


Figure 9.

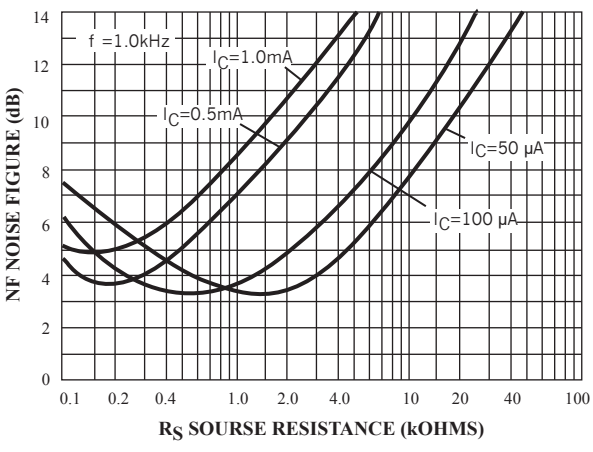


Figure 10.

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

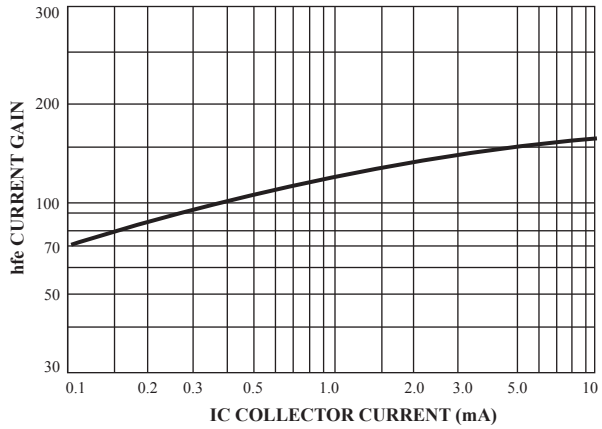
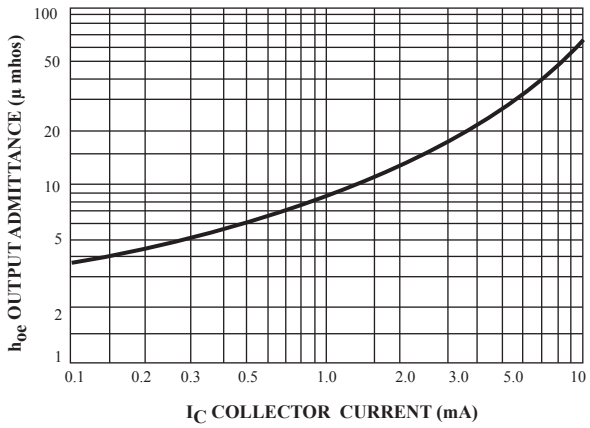


Figure 11. Current Gain



Fiugure 12. Output Admittance

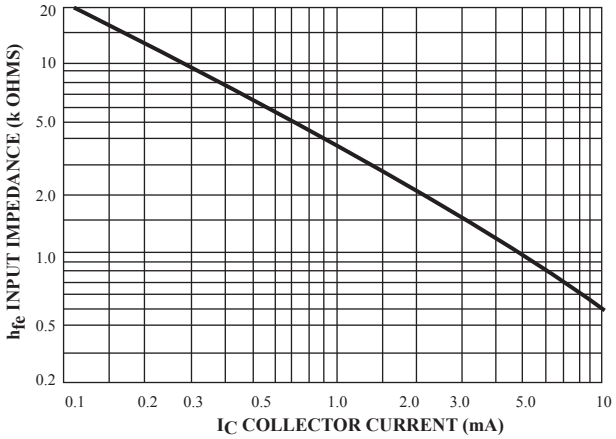


Figure 13. Input Impedance

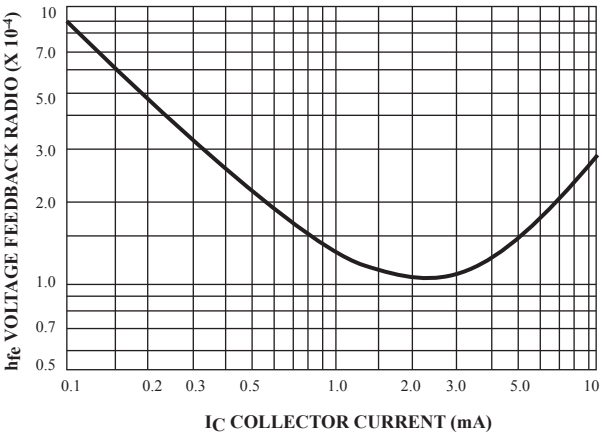


Figure 14. Voltage Feedback Radio

TYPICAL STATIC CHARACTERISTICS

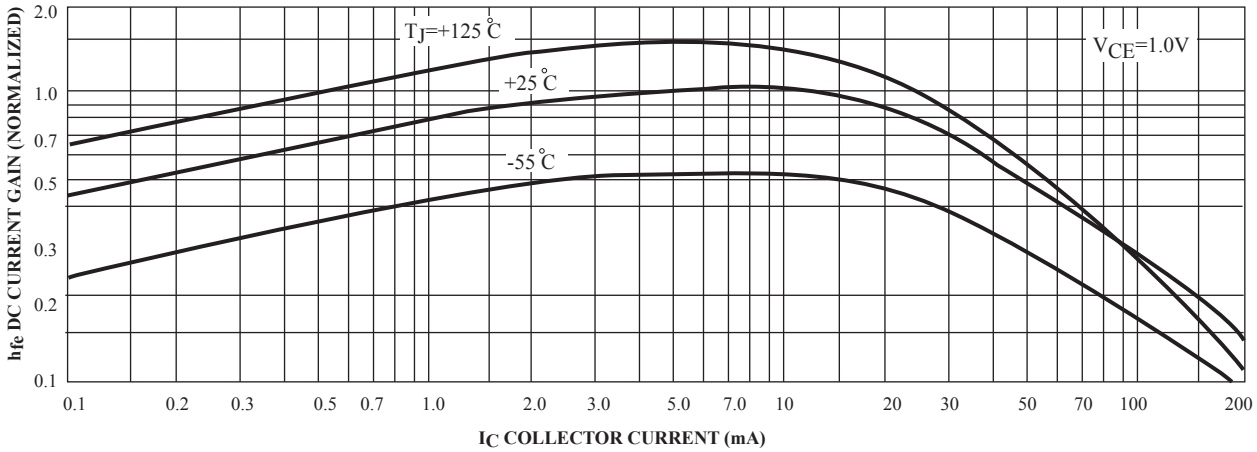


Figure 15. DC Current Gain

(NPN)

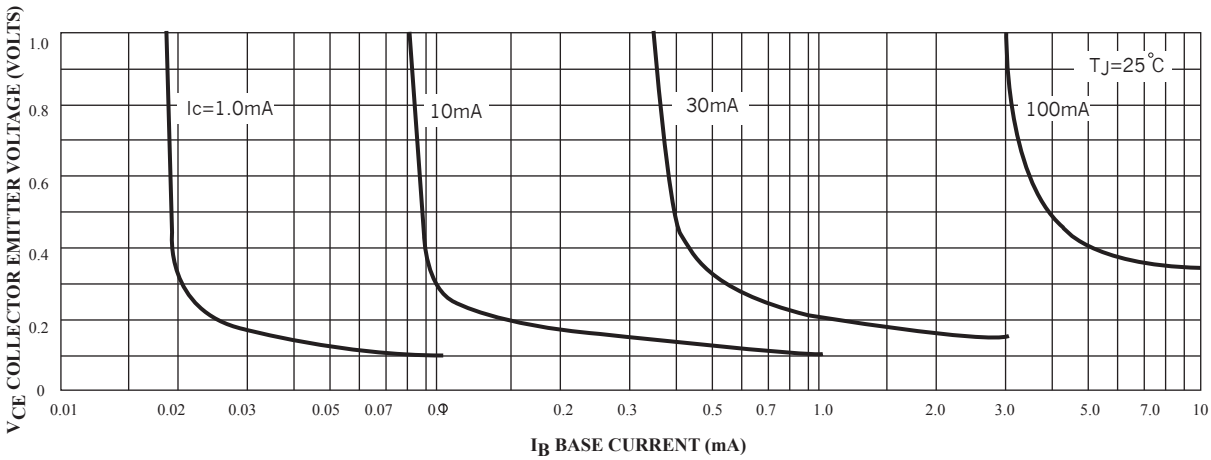


Figure 16. Collector Saturation Region

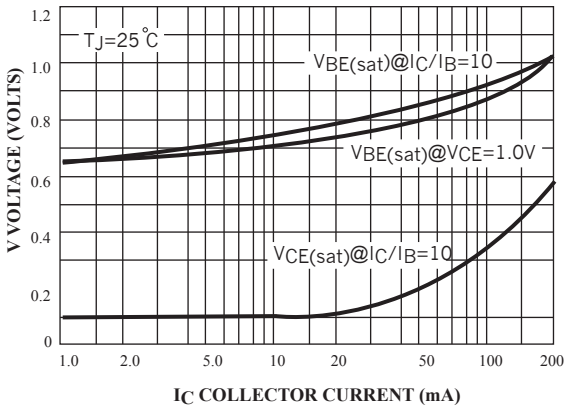


Figure 17. "ON" Voltage

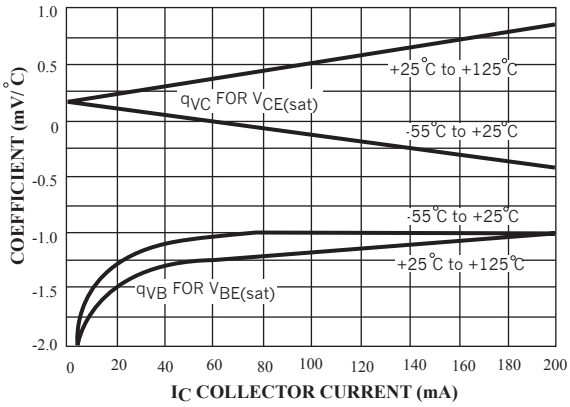
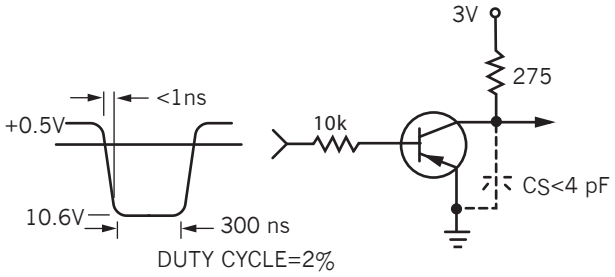
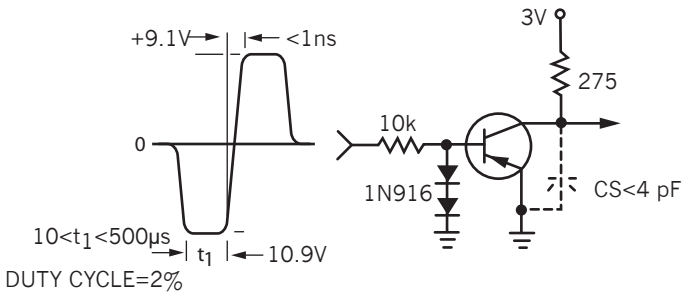


Figure 18. Temperature Coefficients

(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

——— T_J=25°C - - - - - T_J=125°C

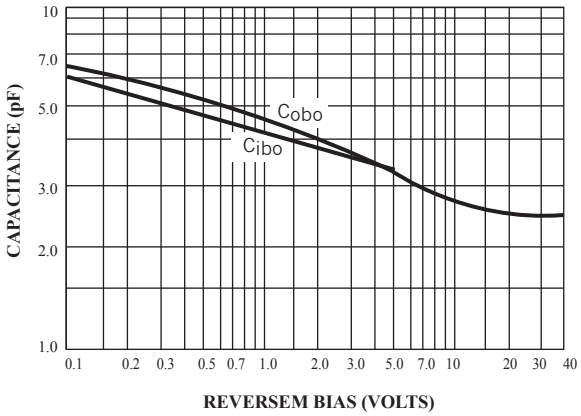


Figure 21. Capacitance

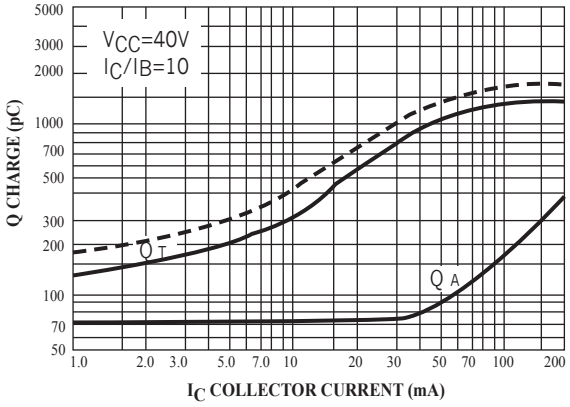


Figure 22. Charge Data

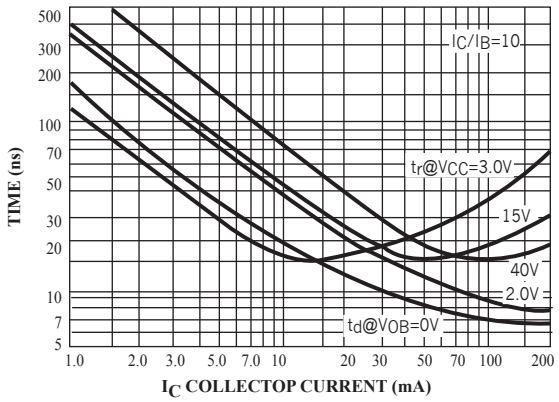


Figure 23. Turn-On Time

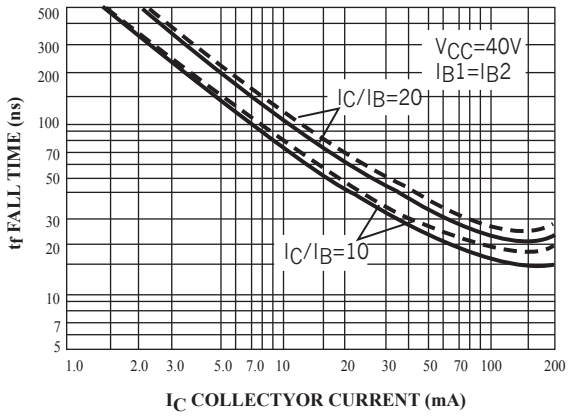


Figure 24.Fall Time

(PNP)

TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

(V_{CE}= -5.0 Vdc, T_A= 25℃, Bandwidth= 1.0Hz)

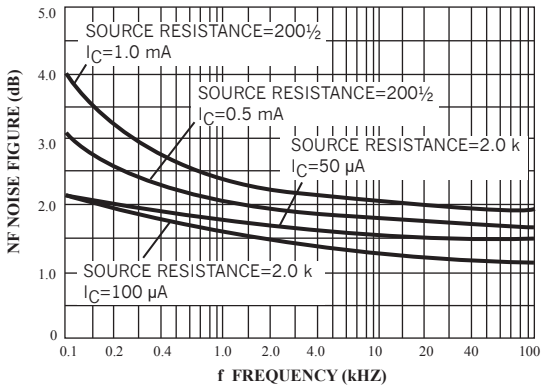


Figure 25.

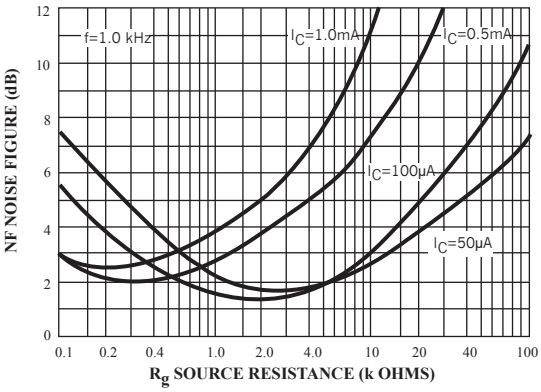


Figure 26.

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

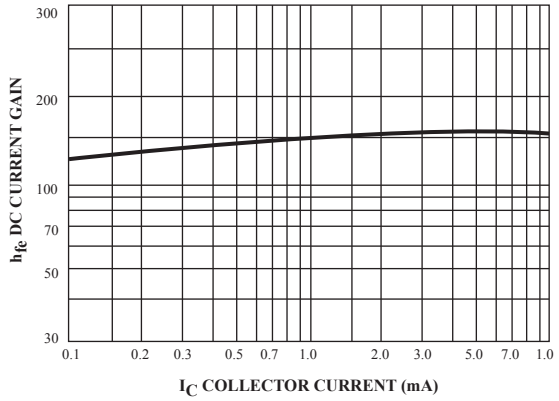


Figure 27. Current Gain

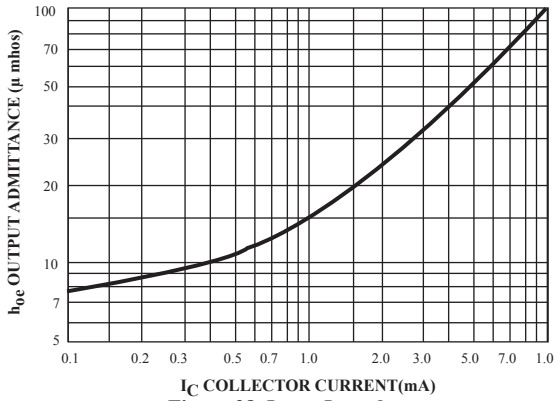


Figure 28. Input Impedance

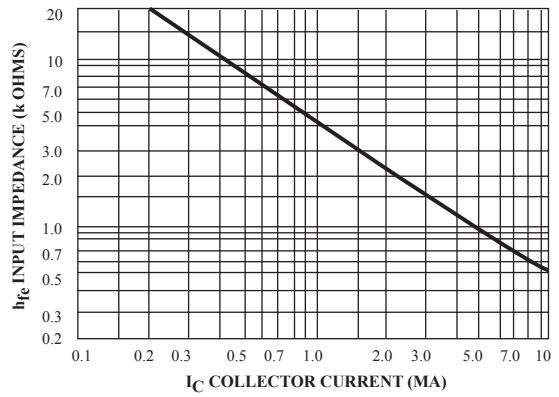


Figure 29. Input Impedance

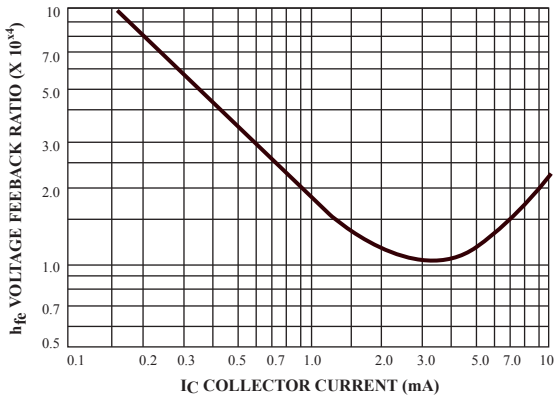
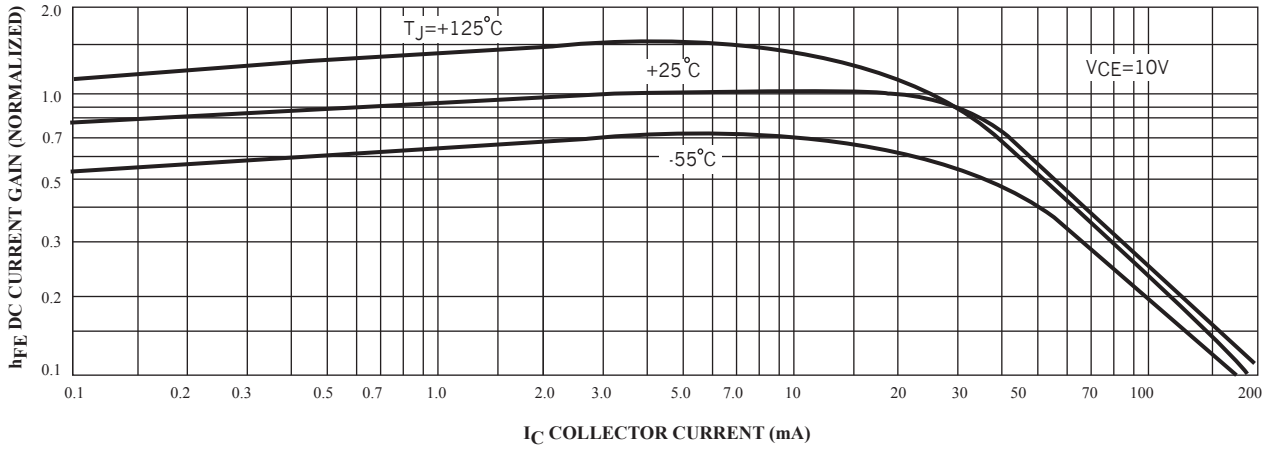


Figure 30. Votage Feeback Ratio

(PNP)

TYPICAL STATIC CHARACTERISTICS



Figurer 31. DC Current Gain

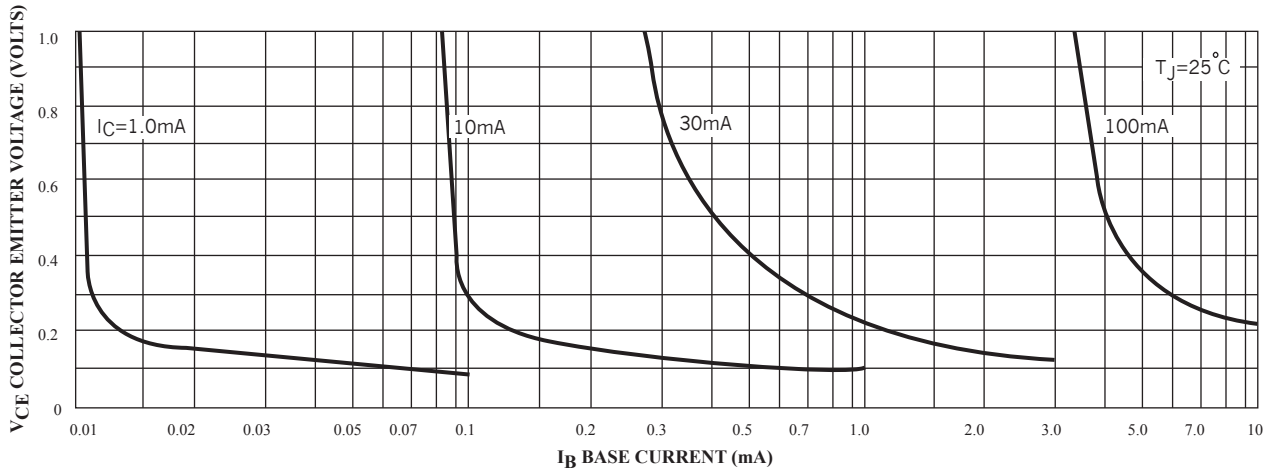


Figure 32. Collector Saturation Region

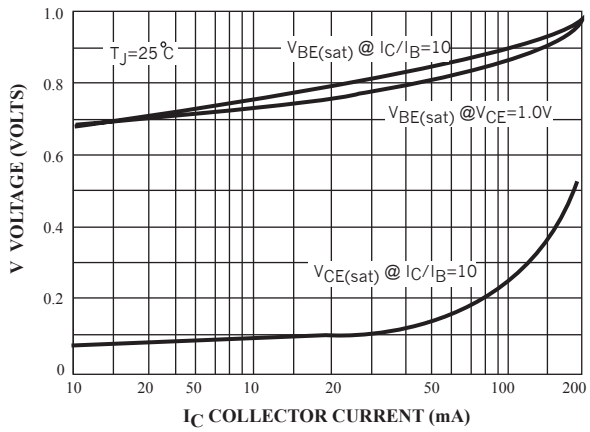


Figure 33. "ON" Voltages

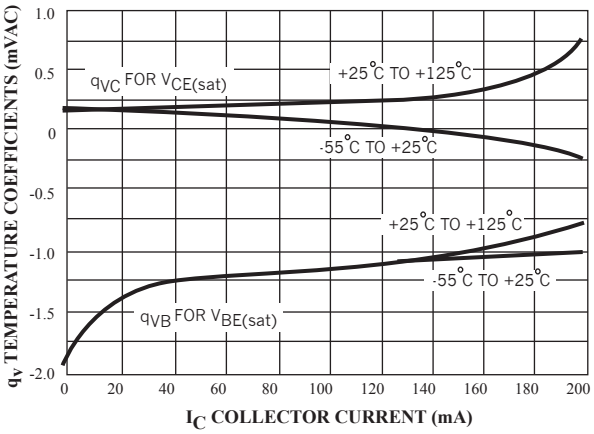
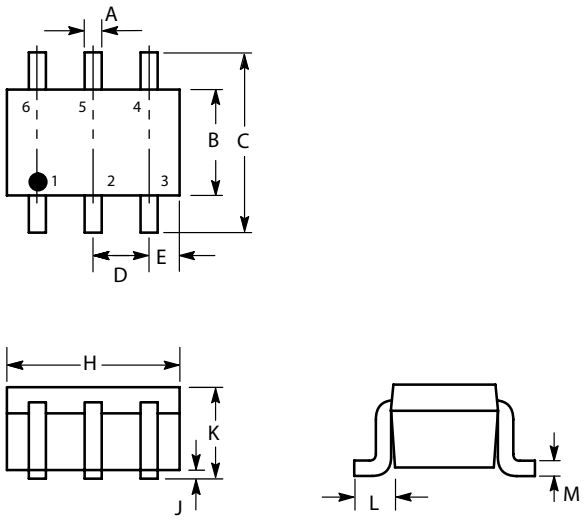


Figure 34.Temperature Coefficients

SOT-363 Package Outline Dimensions

Unit:mm



SOT-363		
Dim	**Min**	**Max**
A	0.10	0.30
B	1.15	1.35
C	2.00	2.20
D	0.65 REF	
E	0.30	0.40
H	1.80	2.20
J	-	0.10
K	0.80	1.10
L	0.25	0.40
M	0.10	0.25