DESCRIPTION

The MBT3946D 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 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.

The MBT3946D is available in SC-88 package.

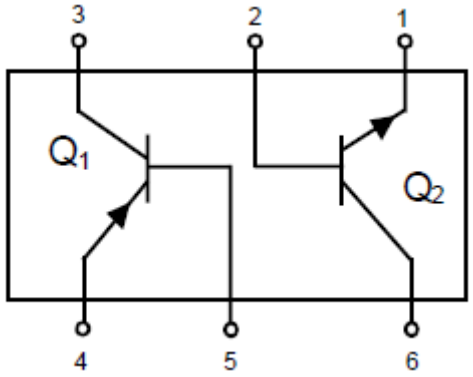
FEATURES

- h_{FE}, 100–300
- Low $V_{CE(sat)}$, < 0.4 V
- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- RoHS compliance
- Available in SC-88 package

ORDERING INFORMATION

Package Type	Part Number
SC-88	MBT3946D
Note	3,000pcs/ Reel
AiT provides all RoHS Compliant Products	

PIN DESCRIPTION



MBT3946D*

*Q1 PNP Q2 NPN

ABSOLUTE MAXIMUM RATINGS

V_{CEO}, Collector-Emitter Voltage	NPN / PNP	40Vdc / -40Vdc
V_{CBO} , Collector-Base Voltage	NPN / PNP	60Vdc / -40Vdc
V_{EBO}, Emitter-Base Voltage	NPN / PNP	6.0Vdc / - 5.0Vdc
I_C, Collector Current-Continuous	NPN / PNP	200mAdc / -200mAdc

Stresses above may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the Electrical Characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

THERMAL CHARACTERISTICS

Parameter	Symbol	Max	Unit
Total Package Dissipation[NOTE1] T_A = 25°C	P_D	150	mW
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	833	°C/W
Junction and Storage Temperature	T_J, T_{STG}	-55 to +150	°C

NOTE1: Device mounted on FR4 glass epoxy printed circuit board using the minimum recommended footprint

ELECTRICAL CHARACTERISTICS

T_A = 25°C, unless otherwise noted

Parameter	Symbol	Conditions		Min	Max	Unit
OFFCHARACTERISTICS						
Collector–Emitter Breakdown Voltage[NOTE2]	$V_{(BR)CEO}$	I_C = 1.0mAdc, I_B = 0	NPN	40	-	Vdc
		I_C = -1.0mAdc, I_B = 0	PNP	-40	-	
Collector–Base Breakdown Voltage	$V_{(BR)CBO}$	I_C =10μAdc, I_E = 0	NPN	60	-	Vdc
		I_C =-10μAdc, I_E = 0	PNP	-40	-	
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E =10μAdc, I_C = 0	NPN	6.0	-	Vdc
		I_E =-10μAdc, I_C = 0	PNP	-5.0	-	
Base Cutoff Current	I_{BL}	V_{CE} = 30Vdc, V_{EB} = 3.0Vdc	NPN	-	50	nAdc
		V_{CE} = -30Vdc, V_{EB} = -3.0Vdc	PNP	-	-50	
Collector Cutoff Current	I_{CEX}	V_{CE} = 30Vdc, V_{EB} = 3.0Vdc	NPN	-	50	nAdc
		V_{CE} = -30Vdc, V_{EB} = -3.0Vdc	PNP	-	-50	
ONCHARACTERISTICS[NOTE2]						
DC Current Gain	h_{FE}	I_C = 0.1mAdc, V_{CE} = 1. 0Vdc	NPN	40	-	-
		I_C = 1.0mAdc, V_{CE} = 1.0Vdc		70	-	
		I_C = 10mAdc,V_{CE} = 1.0Vdc		100	300	
		I_C = 50mAdc, V_{CE} = 1.0Vdc		60	-	
		I_C = 100mAdc,V_{CE} = 1.0Vdc		30	-	
		I_C = –0.1mAdc, V_{CE} = –1. 0Vdc	PNP	60	-	
		I_C = –1.0mAdc, V_{CE} = –1.0Vdc		80	-	
		I_C = –10mAdc,V_{CE} = –1.0Vdc		100	300	
		I_C = –50mAdc, V_{CE} = –1.0Vdc		60	-	
		I_C = –100mAdc,V_{CE} = –1.0Vdc		30	-	
Collector–Emitter Saturation Voltage	$V_{CE(SAT)}$	I_C = 10mAdc,I_B = 1.0mAdc	NPN	-	0.2	Vdc
		I_C = 50mAdc, I_B = 5.0mAdc		-	0.3	
		I_C = –10mAdc,I_B = –1.0mAdc	PNP	-	- 0.25	
		I_C = –50mAdc, I_B = –5.0mAdc		-	-0.4	
Base–Emitter Saturation Voltage	$V_{BE(SAT)}$	I_C = 10mAdc, I_B = 1.0mAdc	NPN	0.65	0.85	Vdc
		I_C = 50mAdc, I_B = 5.0mAdc		-	0.95	
		I_C = –10mAdc, I_B = –1.0mAdc	PNP	-0.65	-0.85	
		I_C = –50mAdc, I_B = –5.0mAdc		-	-0.95	

NOTE2: Pulse Test: Pulse Width≤300μs; Duty Cycle≤2.0%.

T_A = 25°C, unless otherwise noted

Parameter	Symbol	Conditions		Min	Max	Unit
SMALL-SIGNAL CHARACTERISTICS						
Current-Gain-Bandwidth Product	f_T	I_C=10mAdc,V_{CE}=20Vdc,f = 100MHz	NPN	300	-	MHz
		I_C=-10mAdc,V_{CE}=-20Vdc,f = 100MHz	PNP	250	-	
Output Capacitance	C_{obo}	V_{CB}= 5.0Vdc, I_E = 0,f = 1.0MHz	NPN	-	4.0	pF
		V_{CB}= -5.0Vdc, I_E = 0,f = 1.0MHz	PNP	-	4.5	
Input Capacitance	C_{ibo}	V_{EB} = 0.5Vdc, I_C = 0,f = 1.0MHz	NPN	-	8.0	pF
		V_{EB} = -0.5Vdc, I_C = 0,f = 1.0MHz	PNP	-	10.0	
Input Impedance	h_{ie}	V_{CE}= 10Vdc,I_C=1.0mAdc,f = 1.0kHz	NPN	1.0	10	KΩ
		V_{CE}= -10Vdc,I_C=-1.0mAdc,f = 1.0kHz	PNP	2.0	12	
Voltage Feedback Ratio	h_{re}	V_{CE}=10Vdc,I_C=1.0mAdc,f = 1.0kHz	NPN	0.5	8.0	X10^{-4}
		V_{CE}=-10Vdc,I_C=-1.0mAdc,f = 1.0kHz	PNP	0.1	10	
Small–Signal Current Gain	h_{FE}	V_{CE}=10Vdc,I_C=1.0mAdc,f = 1.0kHz	NPN	100	400	-
		V_{CE}=-10Vdc,I_C=-1.0mAdc,f = 1.0kHz	PNP	100	400	
Output Admittance	h_{oe}	V_{CE}=10Vdc,I_C=1.0mAdc,f = 1.0kHz	NPN	1.0	40	μmhos
		V_{CE}=-10Vdc,I_C=-1.0mAdc,f = 1.0kHz	PNP	3.0	60	
Noise Figure	NF	V_{CE}=5.0Vdc,I_C=100μAdc, R_S=1.0kΩ, f =1.0kHz	NPN	5.0	-	dB
		V_{CE}=-5.0Vdc,I_C=-100μAdc, R_S=1.0kΩ, f =1.0kHz	PNP	4.0	-	
SWITCHING CHARACTERISTICS						
Delay Time	t_d	V_{CC} =3.0Vdc, V_{BE} = -0.5Vdc	NPN	-	35	ns
		V_{CC} =-3.0Vdc, V_{BE} = 0.5Vdc	PNP	-	35	
Rise Time	t_r	I_C =10mAdc, I_{B1} =1.0mAdc	NPN	-	35	
		I_C =-10mAdc, I_{B1} =-1.0mAdc	PNP	-	35	
Storage Time	t_s	V_{CC} = 3.0Vdc, I_C =10mAdc	NPN	-	200	ns
		V_{CC} = -3.0Vdc, I_C =-10mAdc	PNP	-	225	
Fall Time	t_f	I_{B1} = I_{B2} = 1.0mAdc	NPN	-	50	
		I_{B1} = I_{B2} = -1.0mAdc	PNP	-	75	

TYPICAL CHARACTERISTICS

NPN

Figure 1. Delay and Rise Time

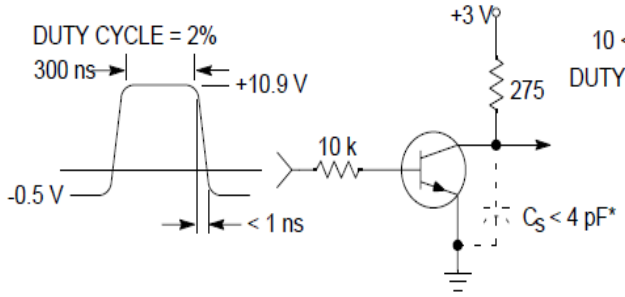
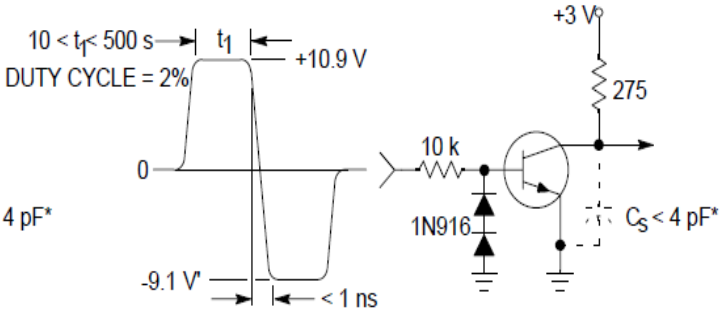


Figure 2. Storage and Fall Time



* Total shunt capacitance of test jig and connectors

T_J = 25°C
T_J = 125°C

Figure 3. Capacitance

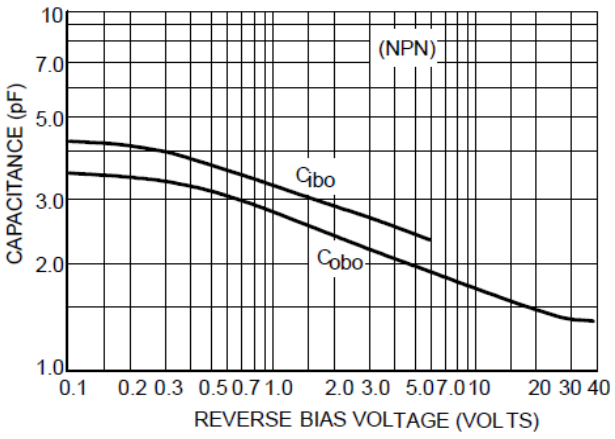


Figure 4. Charge Data

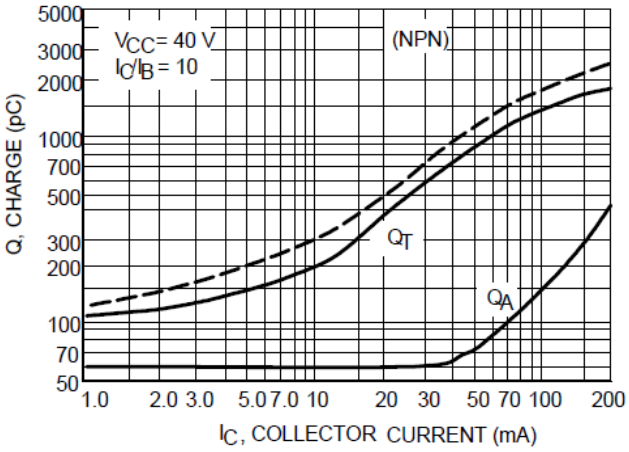


Figure 5. Turn±On Time

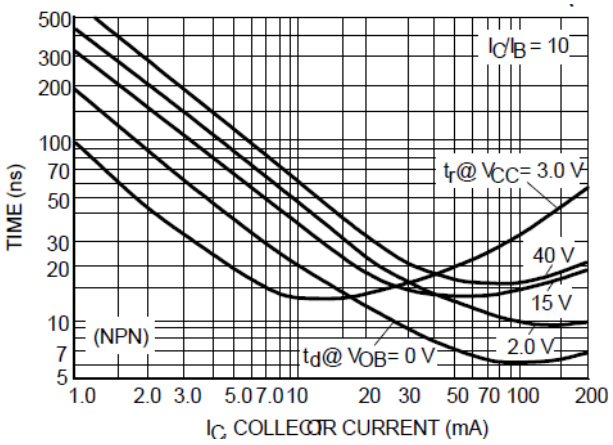


Figure 6. Rise Time

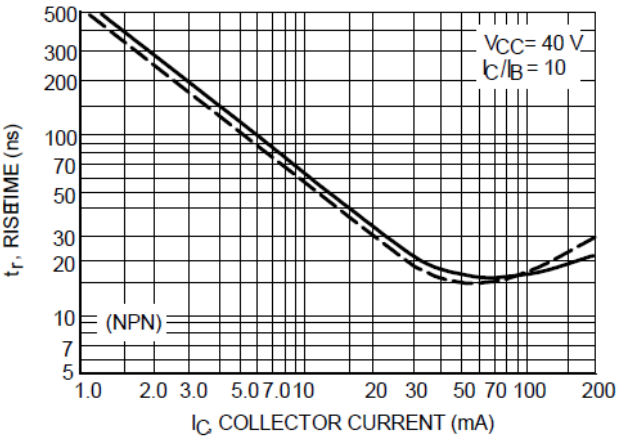


Figure 7 Storage Time

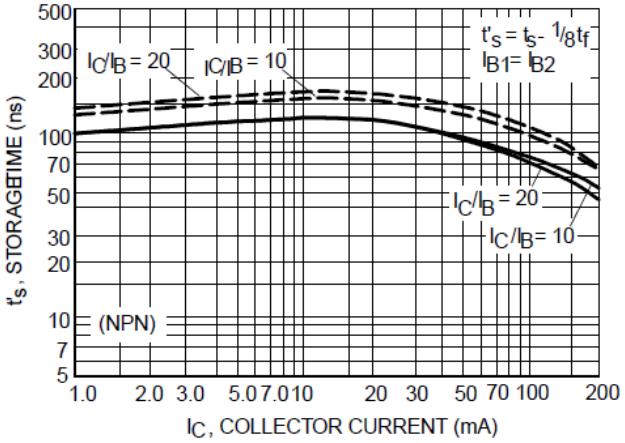
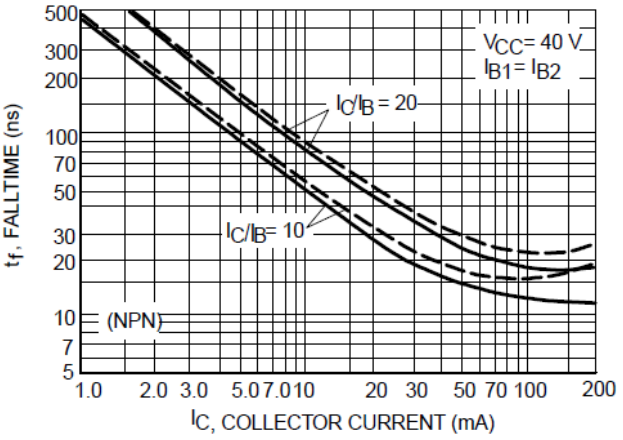


Figure 8 Fall Time



TYPICAL AUDIO SMALL–SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

V_{CE} = 5.0Vdc, T_A = 255°C, Bandwidth =1.0 Hz

Figure 9. Noise Figure

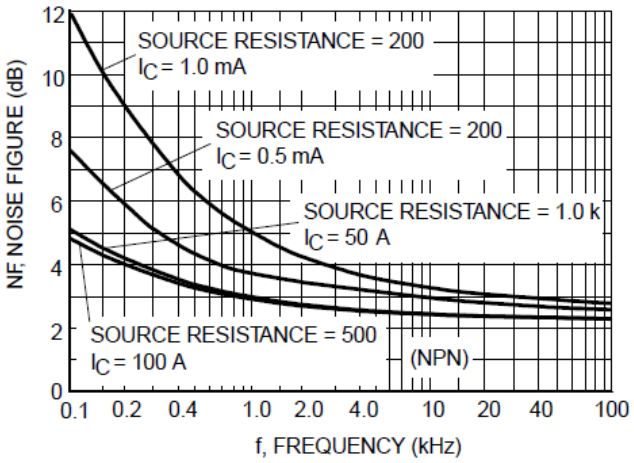
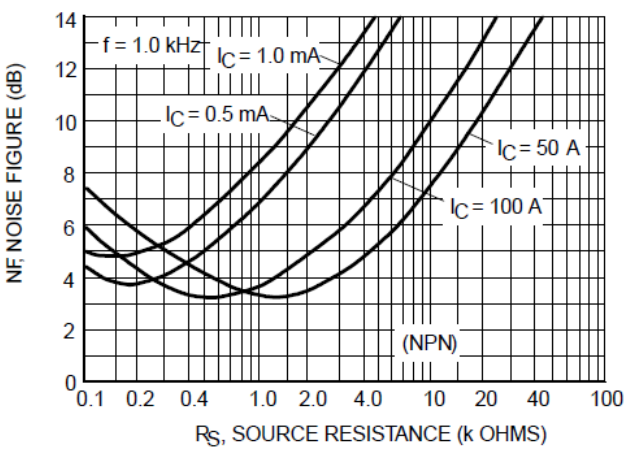


Figure 10. Noise Figure



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

Figure 11. Current Gain

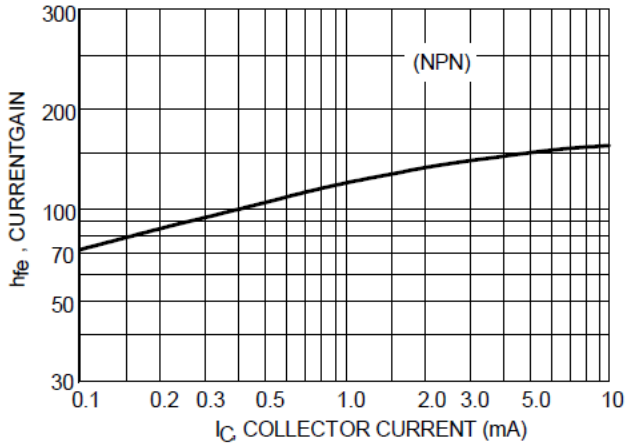


Figure 12. Output Admittance

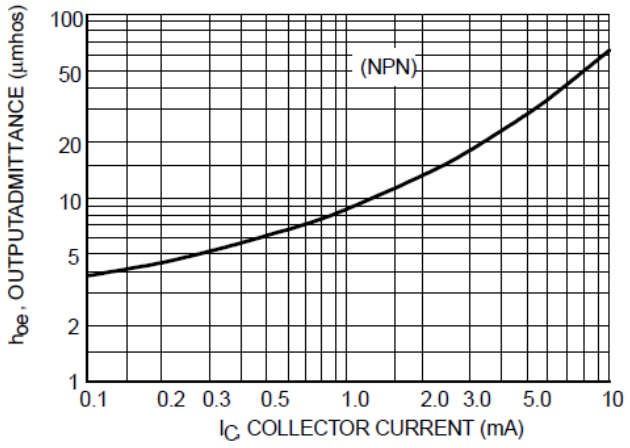


Figure 13. Input Impedance

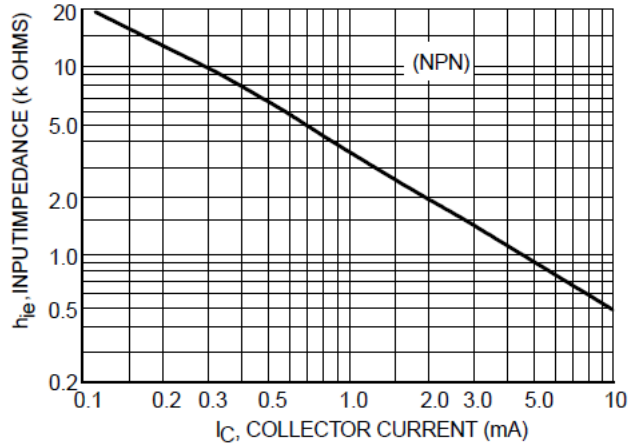


Figure 14. Voltage Feedback Ratio

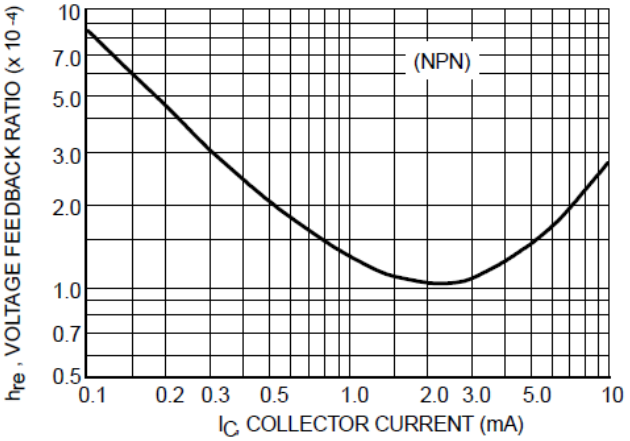


Figure 15. DC Current Gain

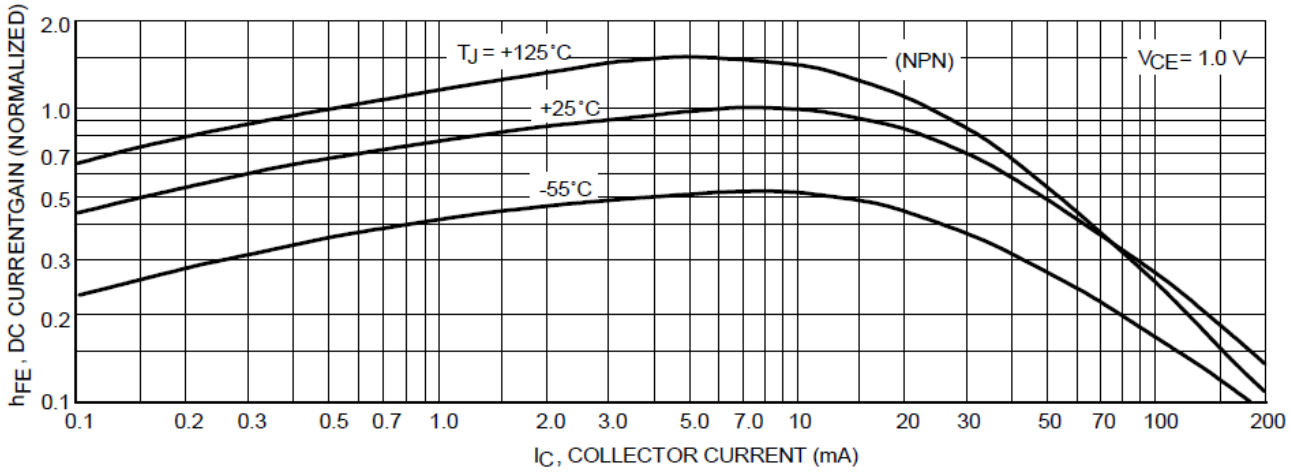


Figure 16. Collector Saturation Region

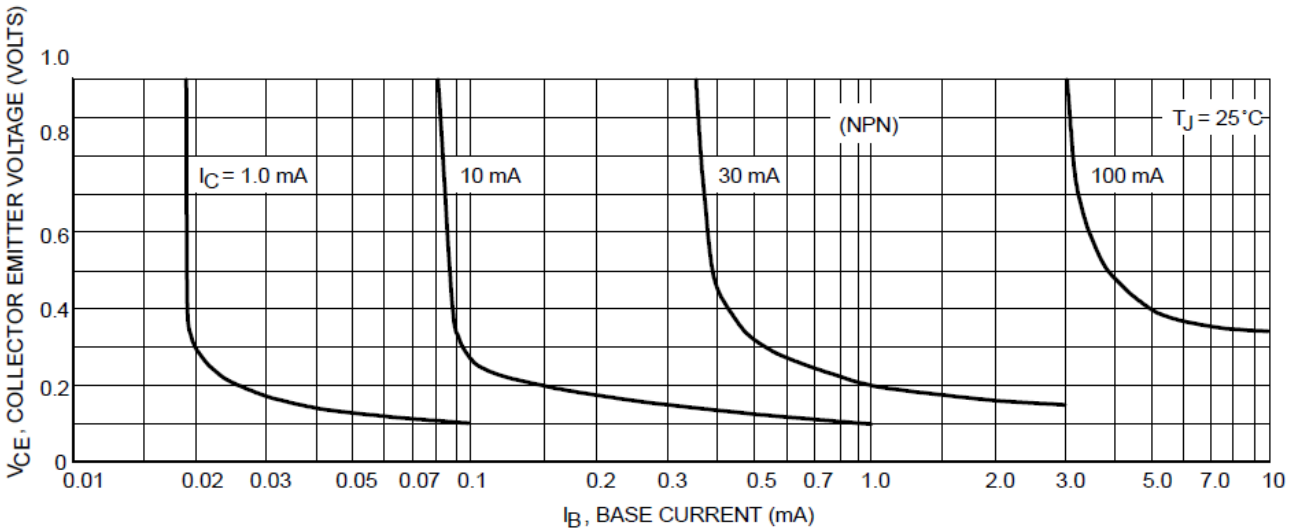


Figure 17. “ON” Voltages

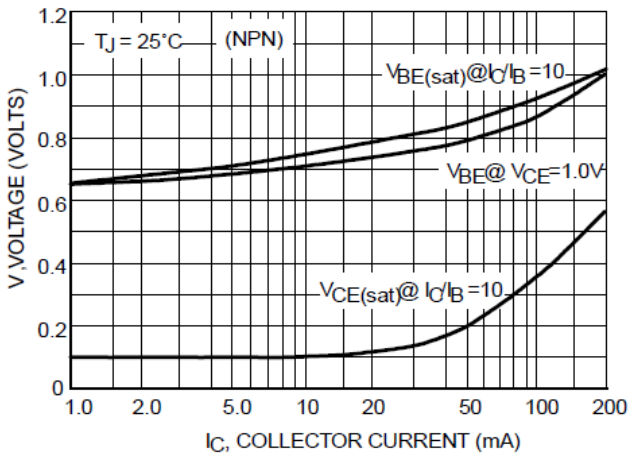
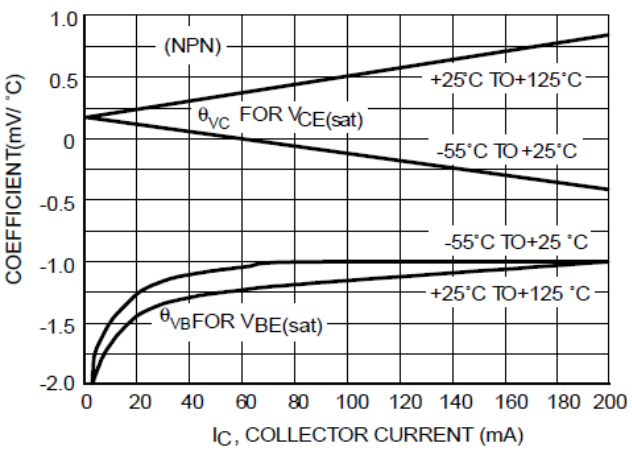


Figure 18. Temperature Coefficients



PNP

Figure 19. Delay and Rise Time Equivalent Test Circuit

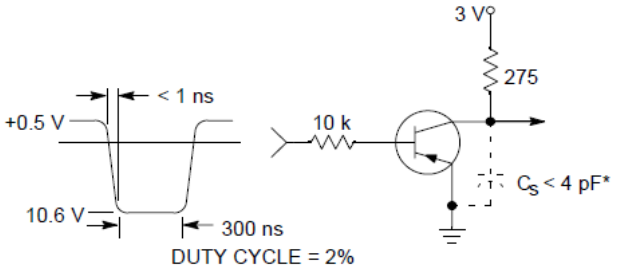
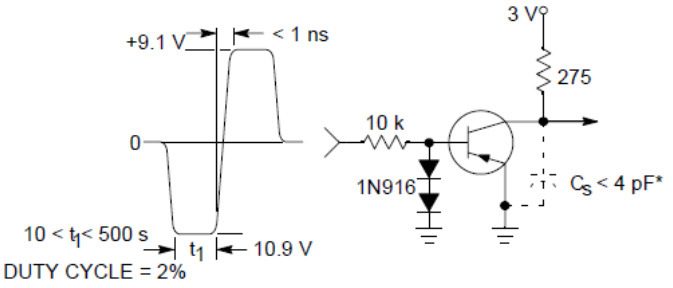


Figure 20. Storage and Fall Time Equivalent Test Circuit



* Total shunt capacitance of test jig and connectors

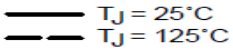


Figure 21. Capacitance

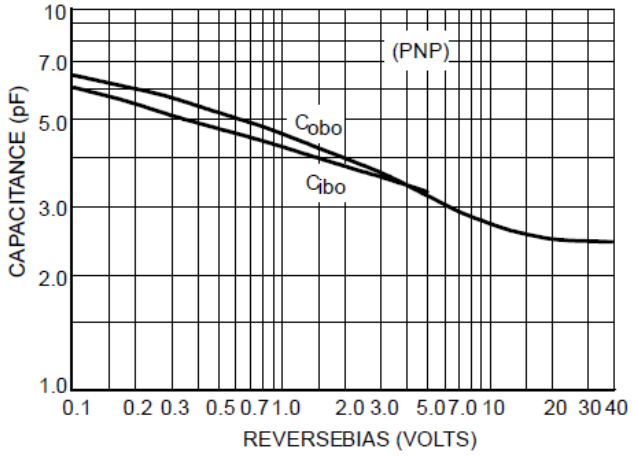


Figure 22. Charge Data

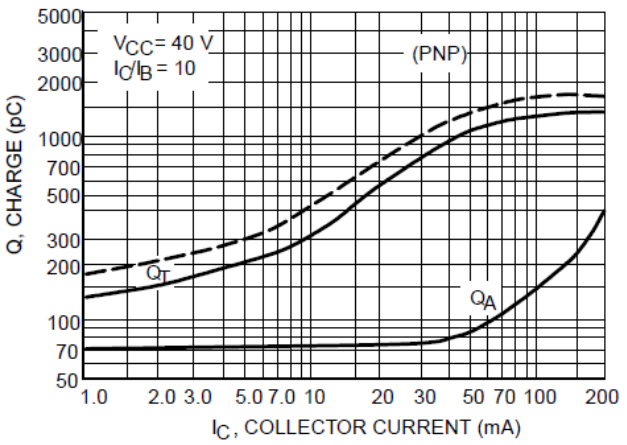


Figure 23. Turn–On Time

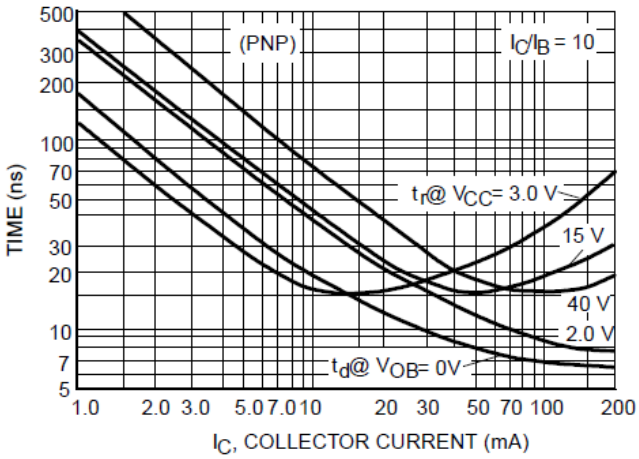
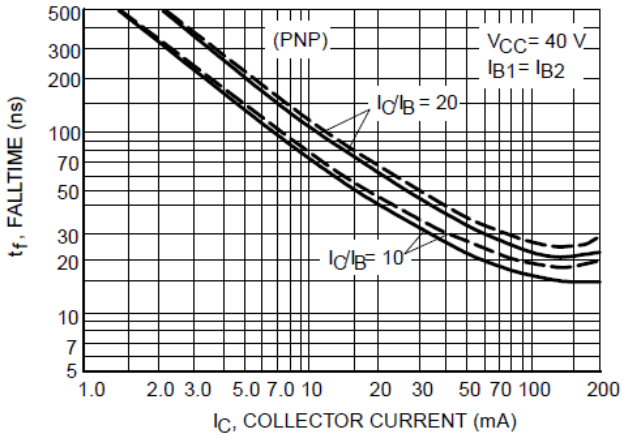


Figure 24. Fall Time



TYPICAL AUDIO SMALL–SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

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

Figure 25

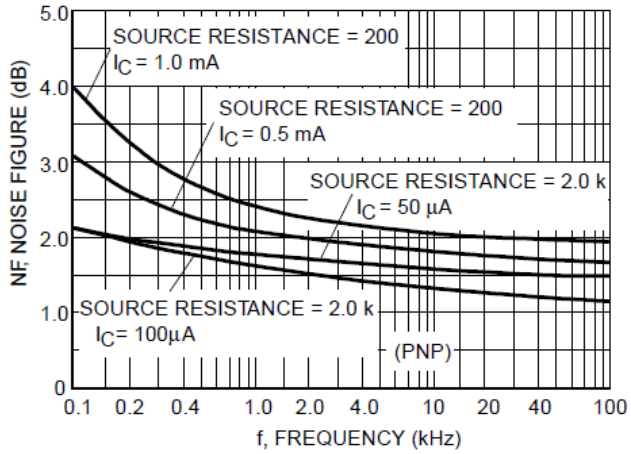
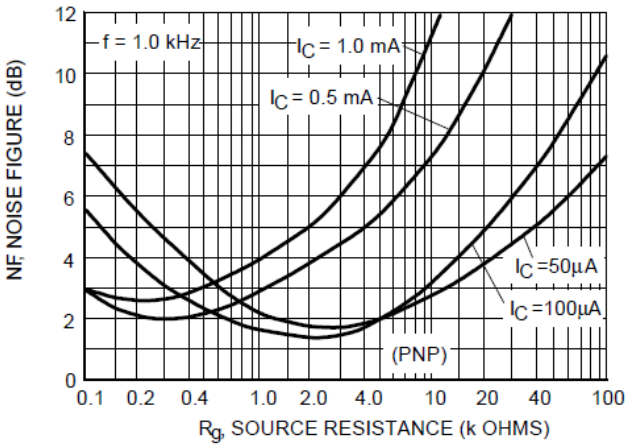


Figure 26



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

Figure 27. Current Gain

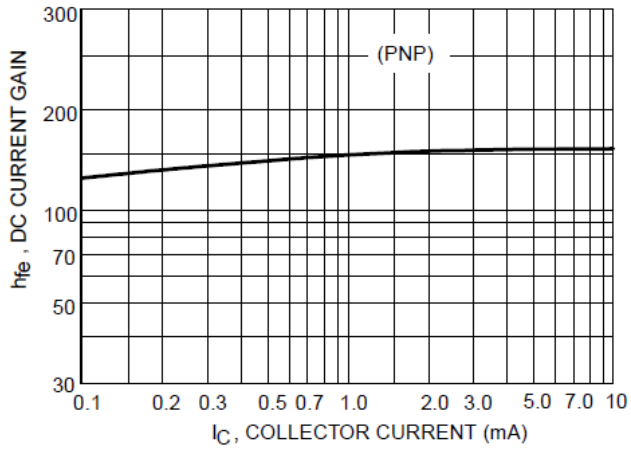


Figure 28. Output Admittance

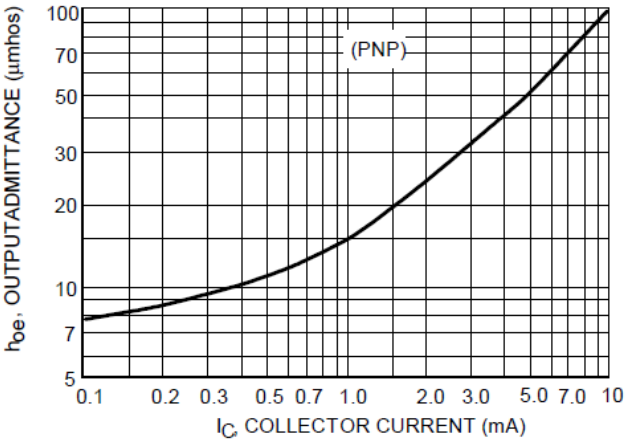


Figure 29. Input Impedance

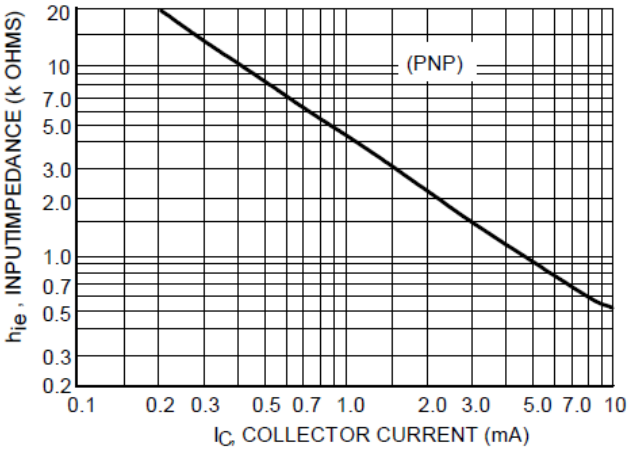


Figure 30. Voltage Feedback Ratio

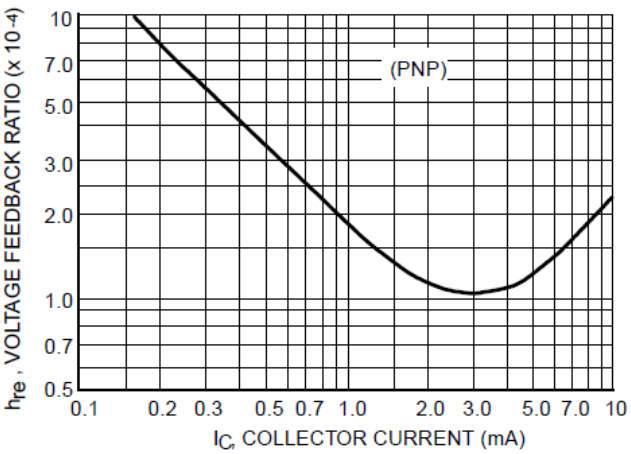


Figure 31. DC Current Gain

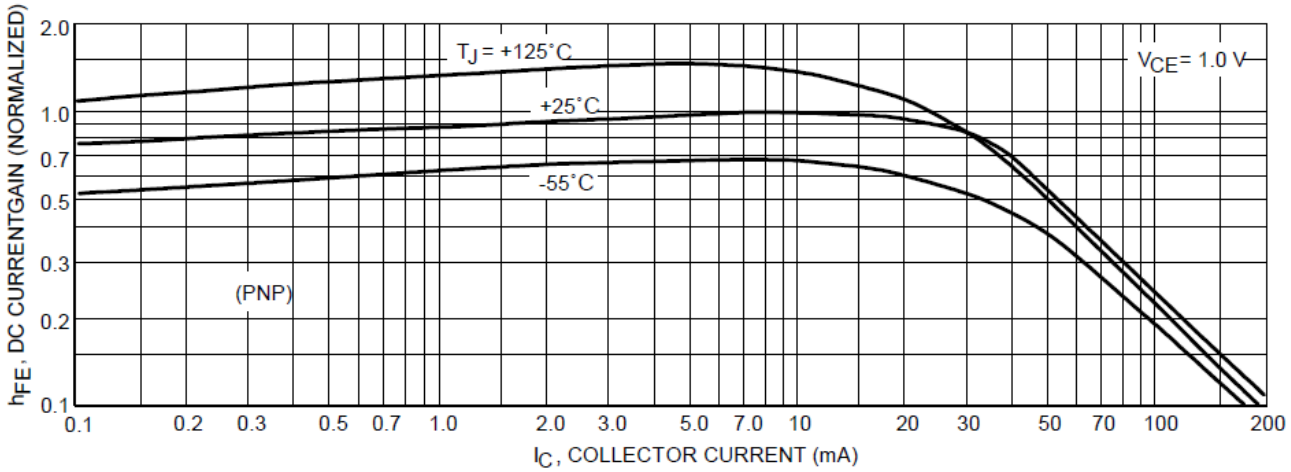


Figure 32. Collector Saturation Region

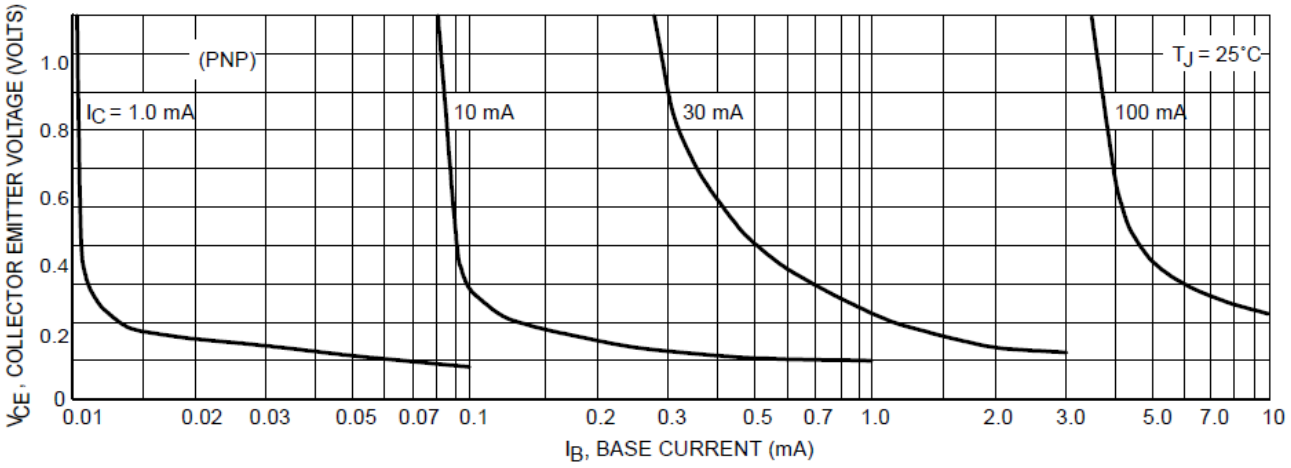


Figure 33. “ON” Voltages

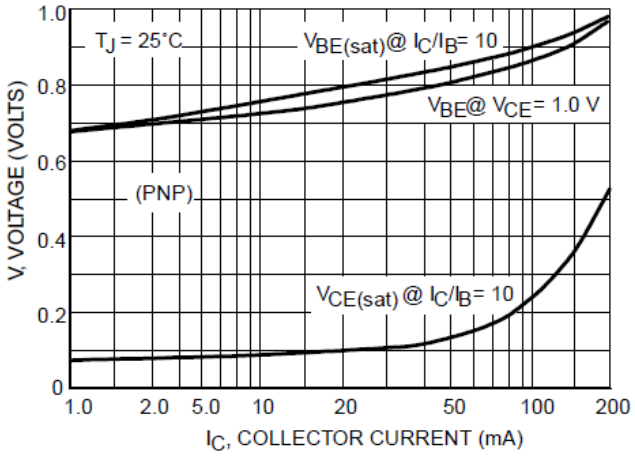
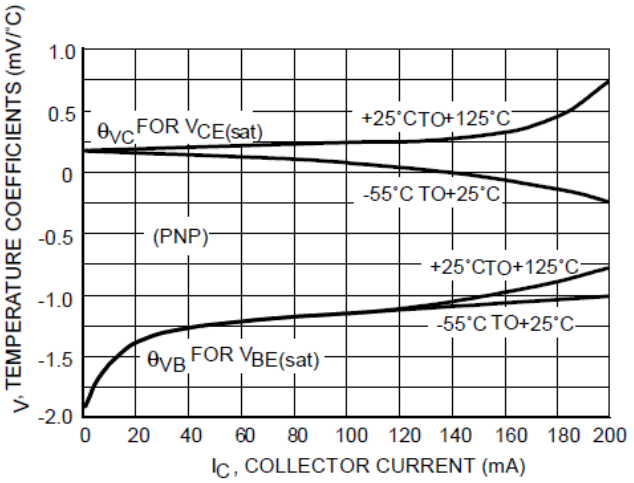
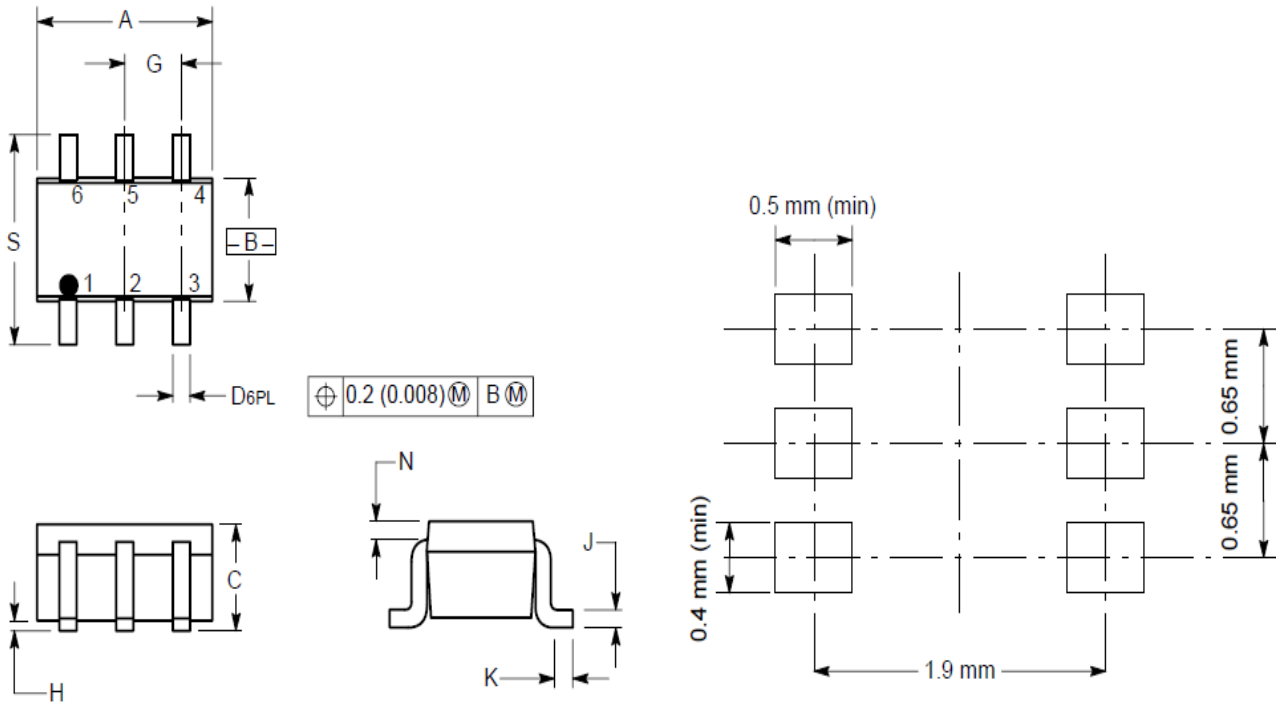


Figure 34. Temperature Coefficients



PACKAGE INFORMATION

Dimension in SC-88 Package (Unit: mm)



DIM	INCHES		MILLIMETERS	
	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

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