

To all our customers

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Customer Support Dept.  
April 1, 2003

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# 2SC460, 2SC461

Silicon NPN Epitaxial Planar

**RENESAS**

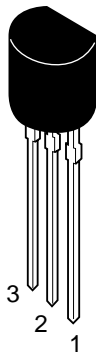
ADE-208-1046 (Z)  
1st. Edition  
Mar. 2001

## Application

- 2SC460 high frequency amplifier, mixer
- 2SC461 VHF amplifier, mixer

## Outline

TO-92 (2)



1. Emitter
2. Collector
3. Base

## 2SC460, 2SC461

### Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	2SC460	2SC461	Unit
Collector to base voltage	V <sub>CBO</sub>	30	30	V
Collector to emitter voltage	V <sub>CEO</sub>	30	30	V
Emitter to base voltage	V <sub>EBO</sub>	5	5	V
Collector current	I <sub>C</sub>	100	100	mA
Collector power dissipation	P <sub>C</sub>	200	200	mW
Junction temperature	T <sub>J</sub>	150	150	°C
Storage temperature	T <sub>stg</sub>	-55 to +150	-55 to +150	°C

## Electrical Characteristics (Ta = 25°C)

Item	Symbol	2SC460			2SC461			Unit	Test conditions
		Min	Typ	Max	Min	Typ	Max		
Collector to base breakdown voltage	$V_{(BR)CBO}$	30	—	—	30	—	—	V	$I_C = 10 \mu A, I_E = 0$
Collector to emitter breakdown voltage	$V_{(BR)CEO}$	30	—	—	30	—	—	V	$I_C = 1 \text{ mA}, R_{BE} =$
Emitter to base breakdown voltage	$V_{(BR)EBO}$	5	—	—	5	—	—	V	$I_E = 10 \mu A, I_C = 0$
Collector cutoff current	$I_{CBO}$	—	—	0.5	—	—	0.5	$\mu A$	$V_{CB} = 18 \text{ V}, I_E = 0$
Emitter cutoff current	$I_{EBO}$	—	—	0.5	—	—	0.5	$\mu A$	$V_{EB} = 2 \text{ V}, I_C = 0$
Base to emitter voltage	$V_{BE}$	—	0.63	0.75	—	0.63	0.75	V	$V_{CE} = 12 \text{ V}, I_C = 2 \text{ mA}$
DC current transfer ratio	$h_{FE}^{*1}$	35	—	200	35	—	200		$V_{CE} = 12 \text{ V}, I_C = 2 \text{ mA}$
Collector to emitter saturation voltage	$V_{CE(sat)}$	—	0.6	1.1	—	0.6	1.1	V	$I_C = 10 \text{ mA}, I_B = 1 \text{ mA}$
Gain bandwidth product	$f_T$	—	230	—	—	230	—	MHz	$V_{CE} = 12 \text{ V}, I_C = 2 \text{ mA}$
Collector output capacitance	$C_{ob}$	—	1.8	3.5	—	1.8	3.5	pF	$V_{CB} = 10 \text{ V}, I_E = 0,$ $f = 1 \text{ MHz}$
10.7 MHz power gain	PG	26	29	—	—	—	—	dB	$V_{CE} = 6 \text{ V}, I_E = -1 \text{ mA}$ $f = 10.7 \text{ MHz}$
100 MHz power gain	PG	—	—	—	13	17	—	dB	$V_{CE} = 6 \text{ V}, I_E = -1 \text{ mA}$ $f = 100 \text{ MHz}$
Noise figure	NF	—	2.0	—	—	—	—	dB	$V_{CE} = 6 \text{ V}, I_E = -1 \text{ mA}$ $f = 1 \text{ MHz}$ $R_g = 500 \Omega$

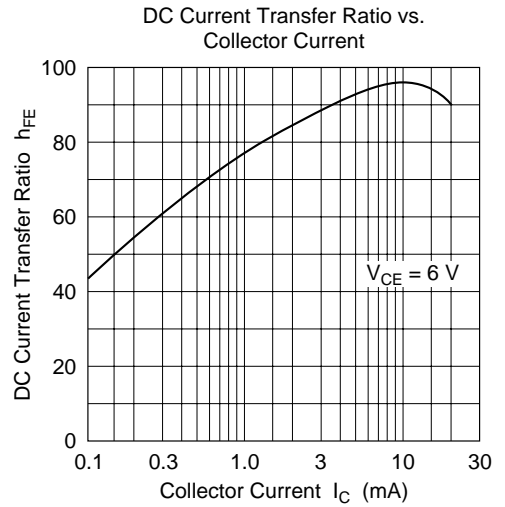
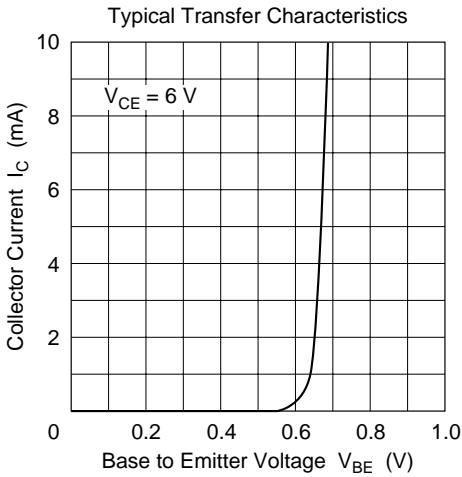
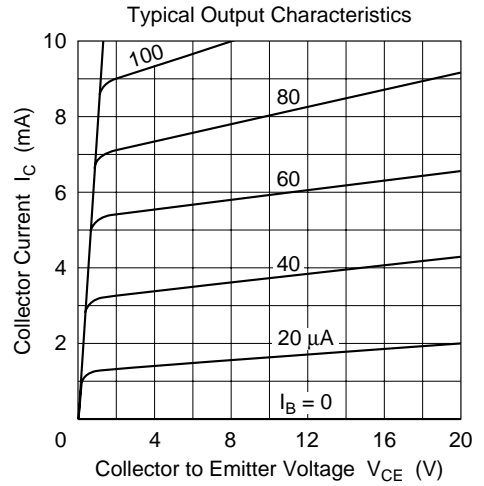
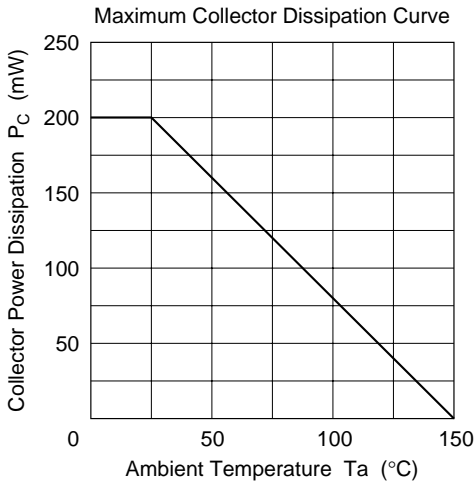
Note: 1. The 2SC460 and 2SC461 are grouped by  $h_{FE}$  as follows.

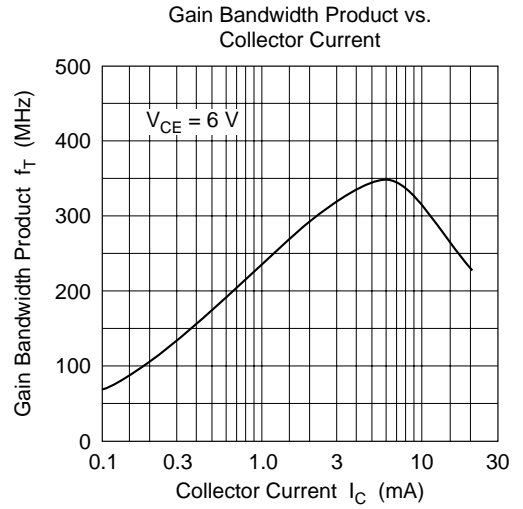
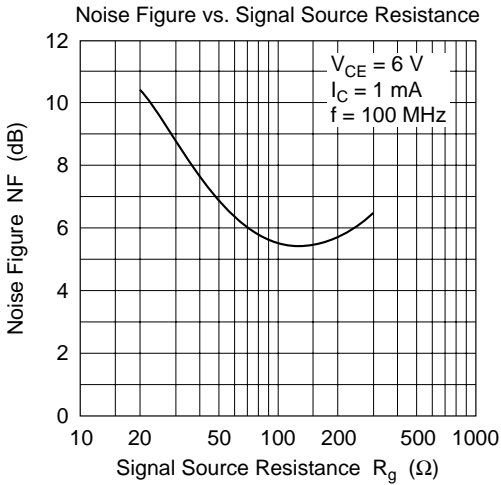
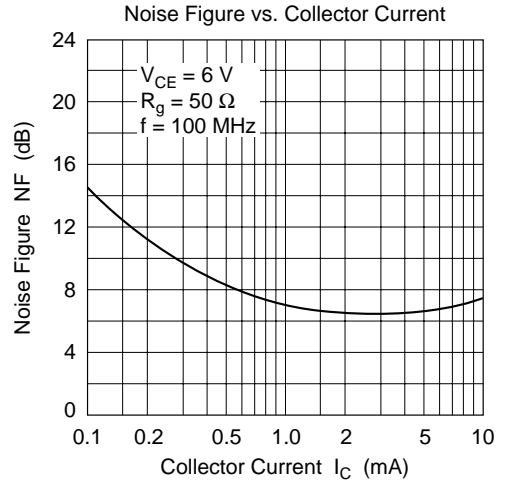
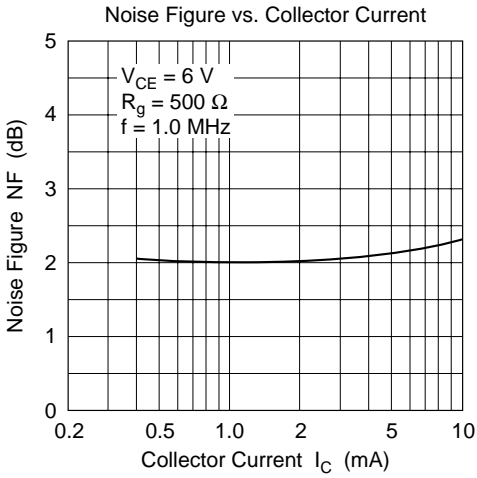
A	B	C
35 to 70	60 to 120	100 to 200

## 2SC460, 2SC461

Small Signal y Parameters ( $V_{CE} = 6\text{ V}$ ,  $I_C = 1\text{ mA}$ , Emitter Common)

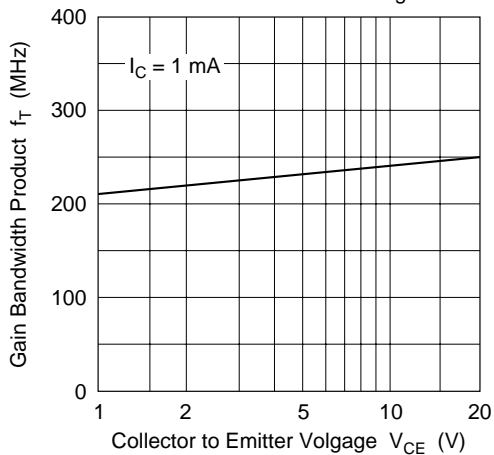
Item	Symbol	f	2SC460A, 2S461A	2SC460B, 2SC461B	2SC460C, 2SC461C	Unit
Input admittance	y <sub>ie</sub>	455 kHz	0.58 + j0.074	0.42 + j0.068	0.30 + j0.051	mS
		4.5 MHz	0.65 + j0.79	0.50 + j0.7	0.35 + j0.57	
		10.7 MHz	0.91 + j2.0	0.61 + j1.9	0.39 + j1.3	
		100 MHz	7.4 + j14	5.6 + j12	3.8 + j6.0	
Reverse transfer admittance	y <sub>re</sub>	455 kHz	-j0.003	-j0.003	-j0.003	mS
		4.5 MHz	-j0.04	-j0.04	-j0.04	
		10.7 MHz	-j0.13	-j0.13	-j0.13	
		100 MHz	-j1.0	-j1.0	-j1.0	
Forward transfer admittance	y <sub>fe</sub>	455 kHz	38 - j0.1	37 - j0.1	37 - j0.2	mS
		4.5 MHz	35 - j1.0	35 - j1.2	34 - j1.8	
		10.7 MHz	34 - j2.5	34 - j2.5	33 - j4.5	
		100 MHz	28 - j20	28 - j19	20 - j19	
Output admittance	y <sub>oe</sub>	455 kHz	0.0098 + j0.009	0.013 + j0.009	0.016 + j0.012	mS
		4.5 MHz	0.02 + j0.09	0.023 + j0.092	0.03 + j0.10	
		10.7 MHz	0.11 + j0.4	0.11 + j0.4	0.12 + j0.4	
		100 MHz	0.40 + j1.7	0.50 + j2.0	0.83 + j2.0	



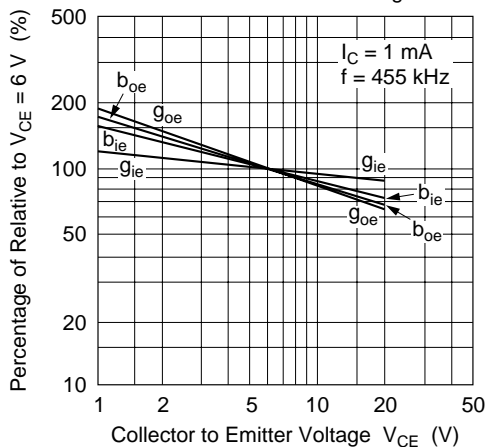




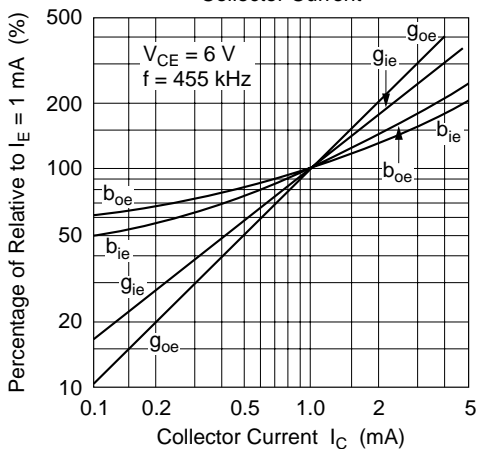
Gain Bandwidth Product vs.  
Collector to Emitter Voltage



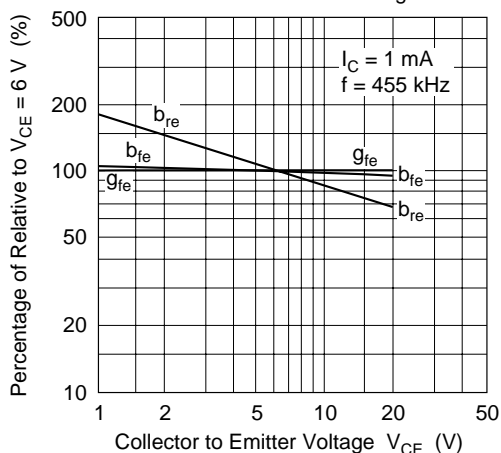
Input/Output Admittance vs.  
Collector to Emitter Voltage



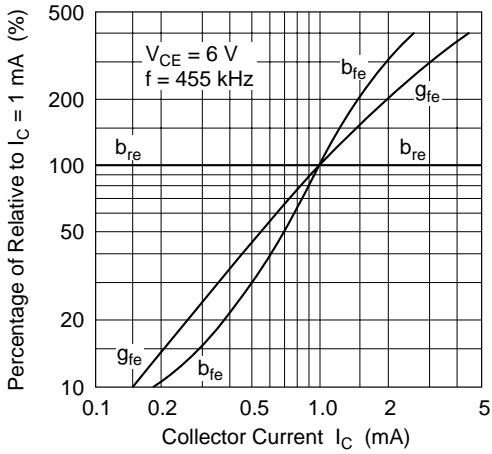
Input/Output Admittance vs.  
Collector Current



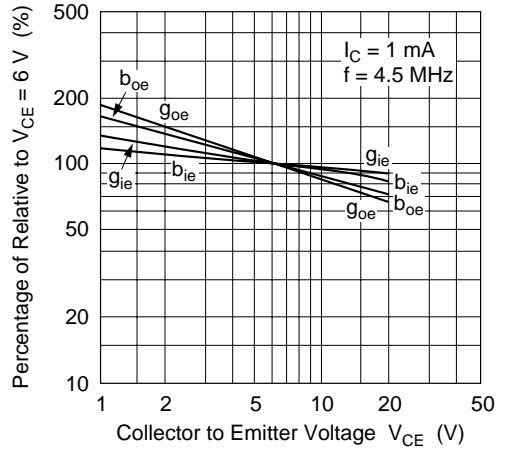
Transfer Admittance vs.  
Collector to Emitter Voltage



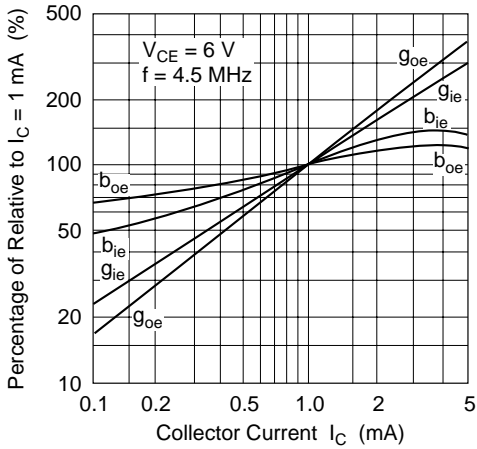
Transfer Admittance vs. Collector Current



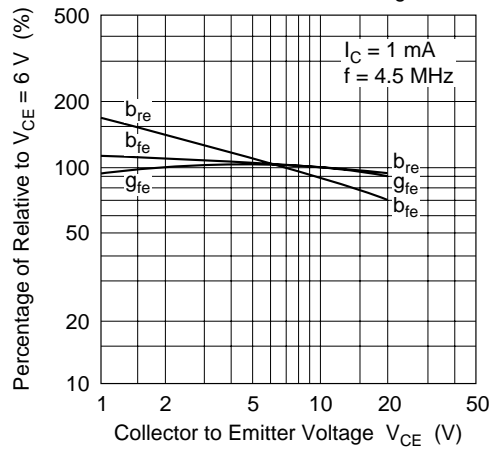
Input/Output Admittance vs. Collector to Emitter Voltage



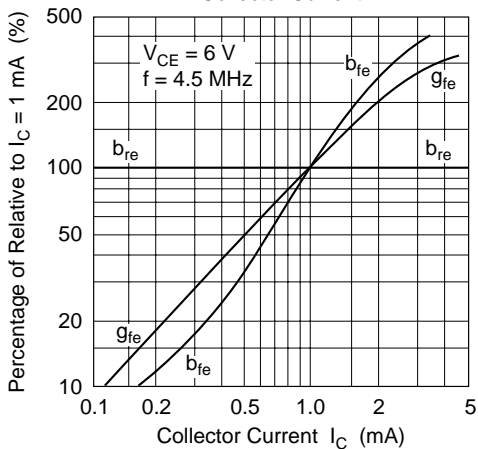
Input/Output Admittance vs. Collector Current



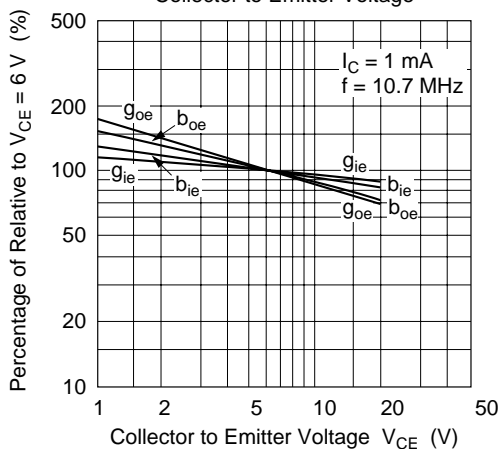
Transfer Admittance vs. Collector to Emitter Voltage



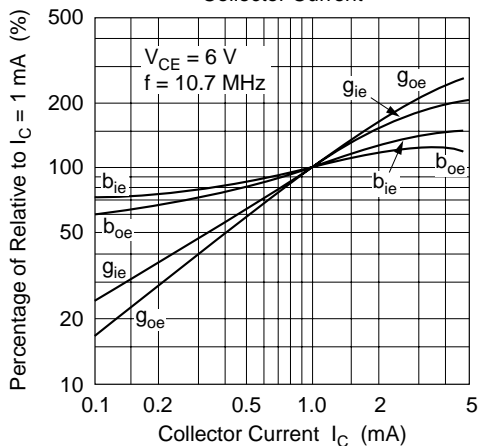
Transfer Admittance vs. Collector Current



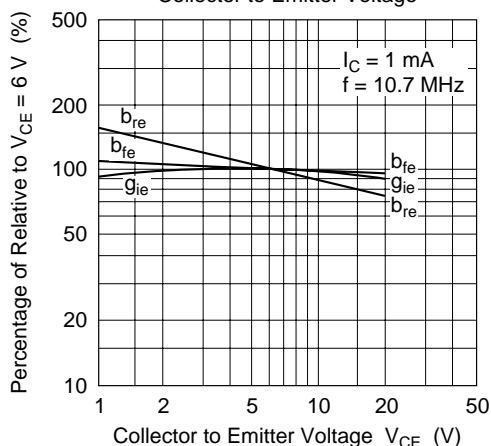
Input/Output Admittance vs. Collector to Emitter Voltage

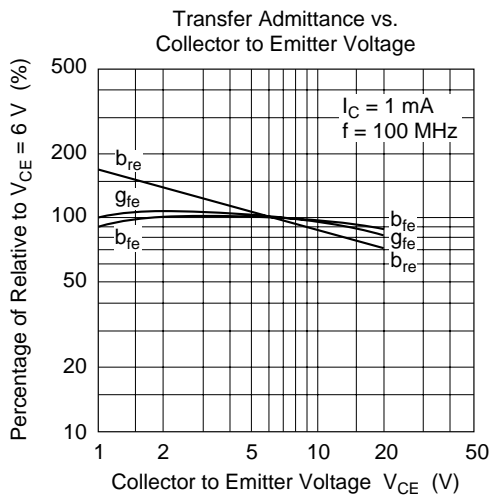
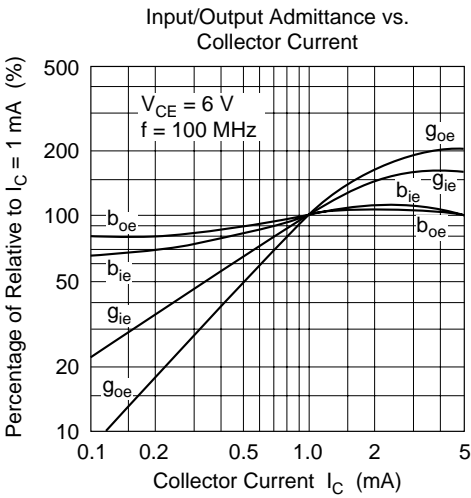
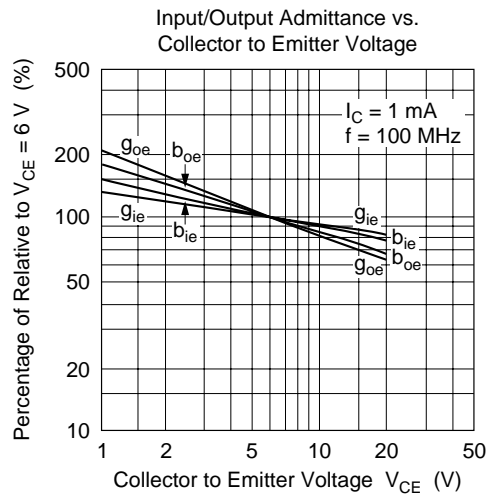
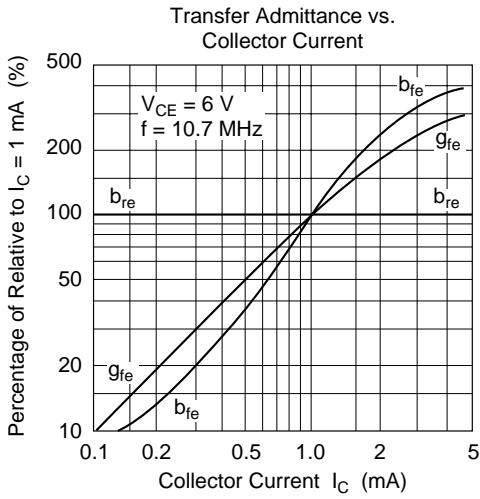


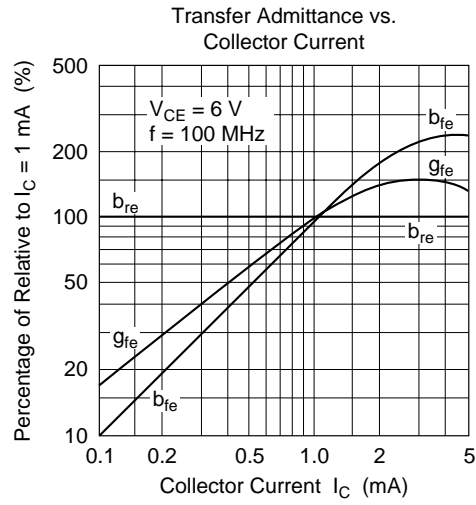
Input/Output Admittance vs. Collector Current



Transfer Admittance vs. Collector to Emitter Voltage



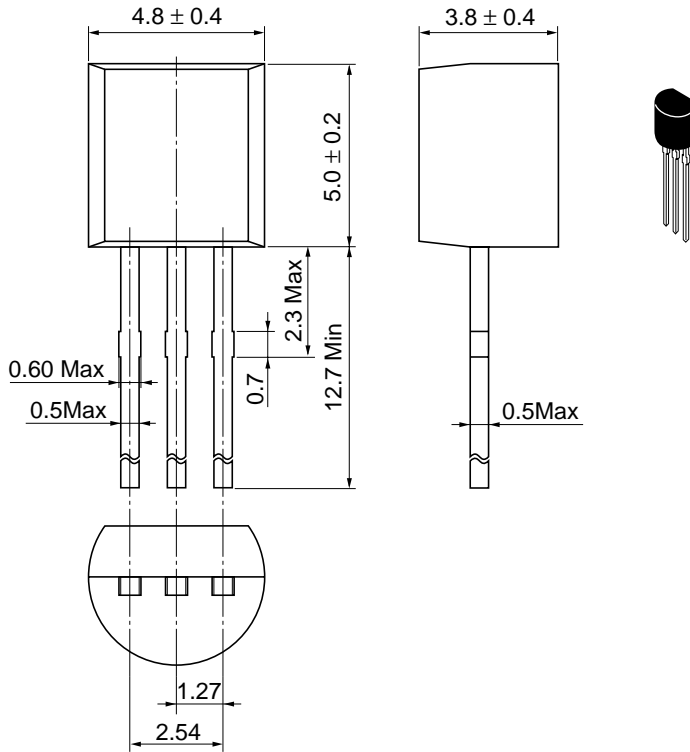




Package Dimensions

As of January, 2001

Unit: mm



Hitachi Code	TO-92 (2)
JEDEC	Conforms
EIAJ	Conforms
Mass (reference value)	0.25 g

## Cautions

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