To all our customers

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Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

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# 2SC460, 2SC461

Silicon NPN Epitaxial Planar

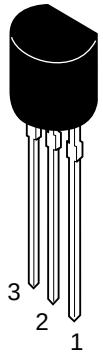
ADE-208-1046 (Z)
1st. Edition
Mar. 2001

## Application

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

## Outline

TO-92 (2)




1. Emitter
2. Collector
3. Base

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

| Item | Symbol | 2SC460 | 2SC461 | Unit |
|---|---|---|---|---|
| Collector to base voltage | $V_{CBO}$ | 30 | 30 | V |
| Collector to emitter voltage | $V_{CEO}$ | 30 | 30 | V |
| Emitter to base voltage | $V_{EBO}$ | 5 | 5 | V |
| Collector current | $I_C$ | 100 | 100 | mA |
| Collector power dissipation | $P_C$ | 200 | 200 | mW |
| Junction temperature | Tj | 150 | 150 | °C |
| Storage temperature | Tstg | –55 to +150 | –55 to +150 | °C |

## Electrical Characteristics (Ta = 25°C)

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

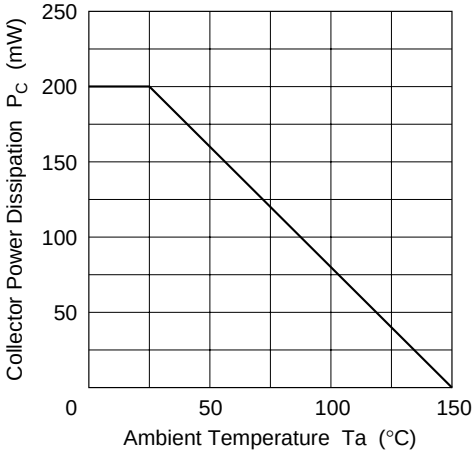
Note: 1. The 2SC460 and 2SC461 are grouped by $h_{FE}$ as follows.

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

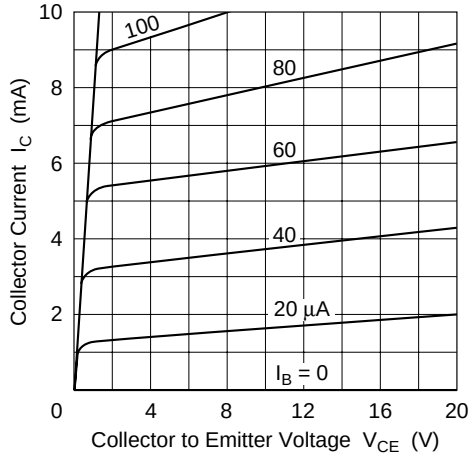
**Small Signal y Parameters** ($V_{CE}$ = 6 V, $I_C$ = 1 mA, Emitter Common)

| Item | Symbol | f | 2SC460A, 2S461A | 2SC460B, 2SC461B | 2SC460C, 2SC461C | Unit |
|---|---|---|---|---|---|---|
| Input admittance | yie | 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 | yre | 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 | yfe | 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 | yoe | 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 | |

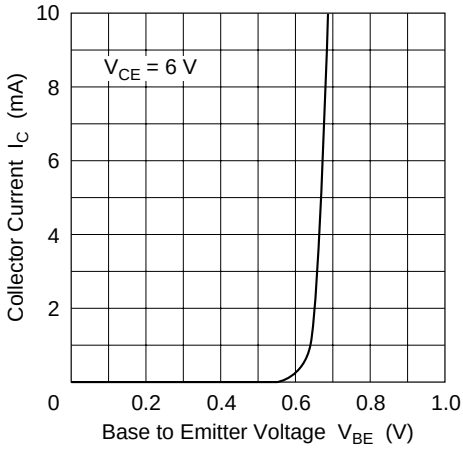
Maximum Collector Dissipation Curve



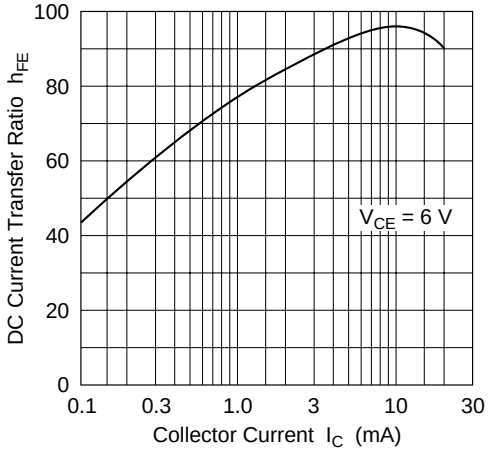

Typical Output Characteristics



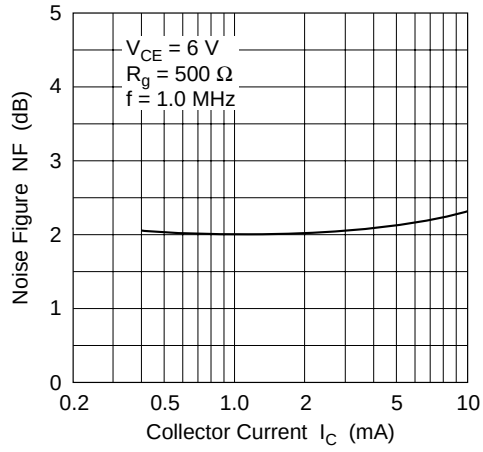

Typical Transfer Characteristics



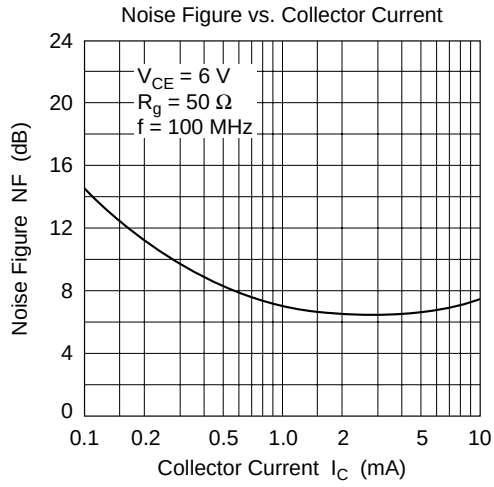

DC Current Transfer Ratio vs. Collector Current



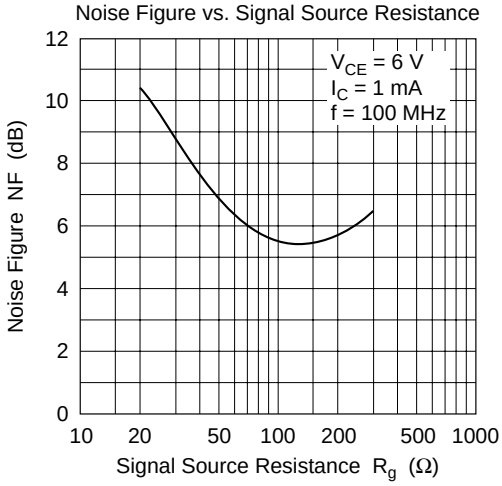
Noise Figure vs. Collector Current



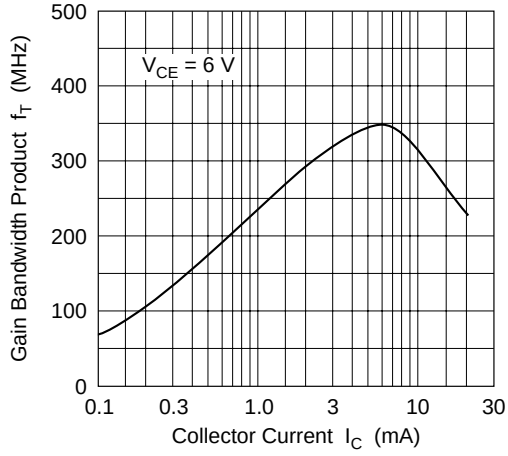

Noise Figure vs. Collector Current



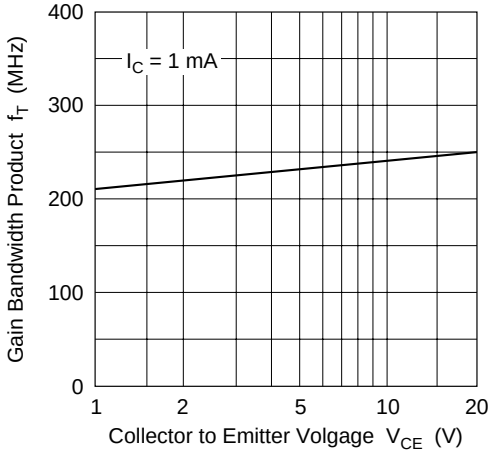

Noise Figure vs. Signal Source Resistance



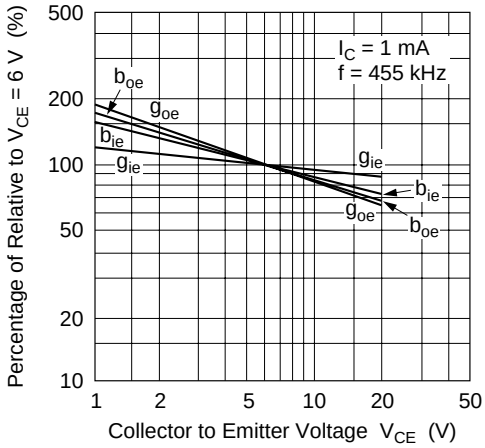

Gain Bandwidth Product vs. Collector Current



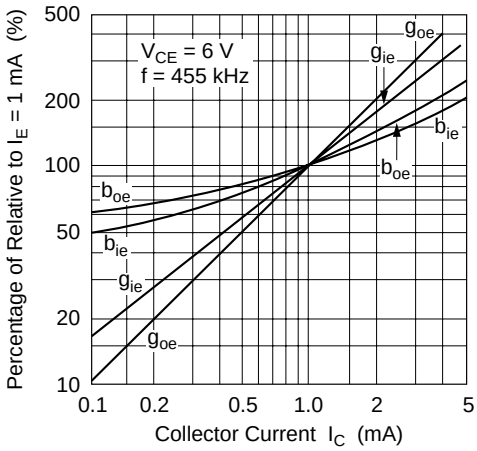
Gain Bandwidth Product vs.
Collector to Emitter Voltage



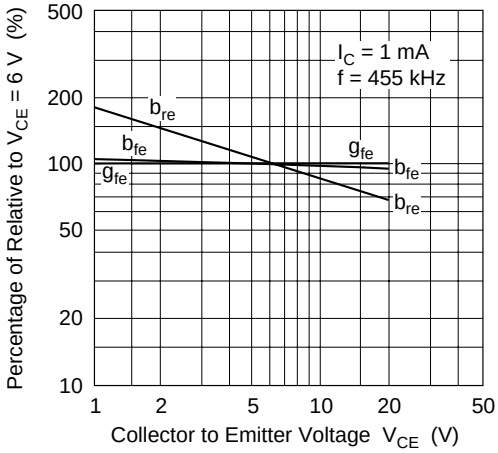

Input/Output Admittance vs.
Collector to Emitter Voltage



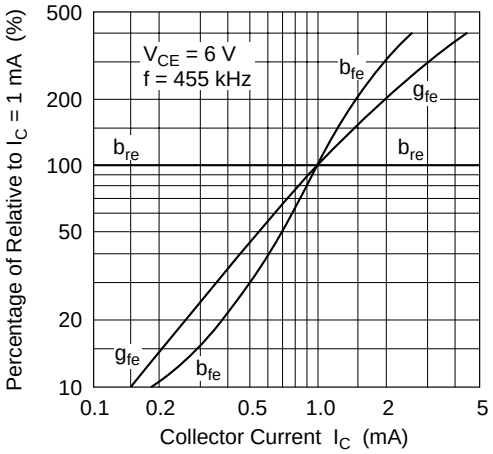

Input/Output Admittance vs.
Collector Current



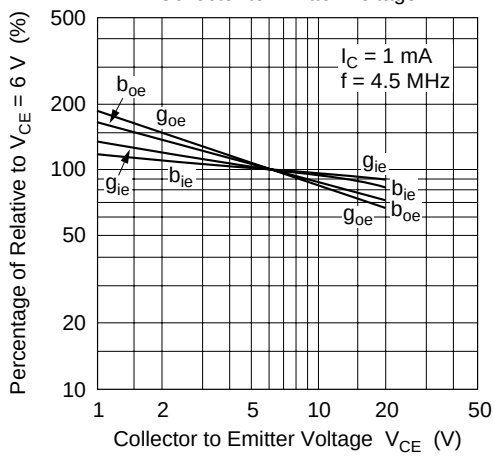

Transfer Admittance vs.
Collector to Emitter Voltage



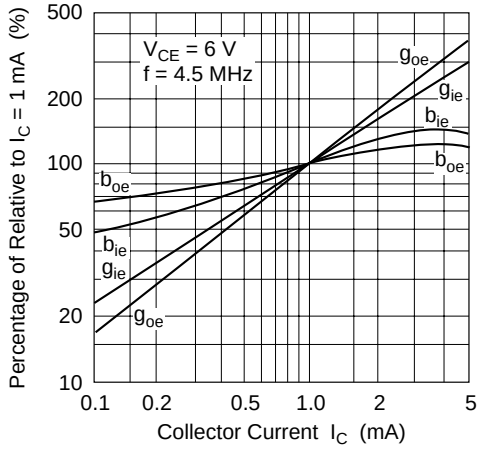
Transfer Admittance vs.
Collector Current



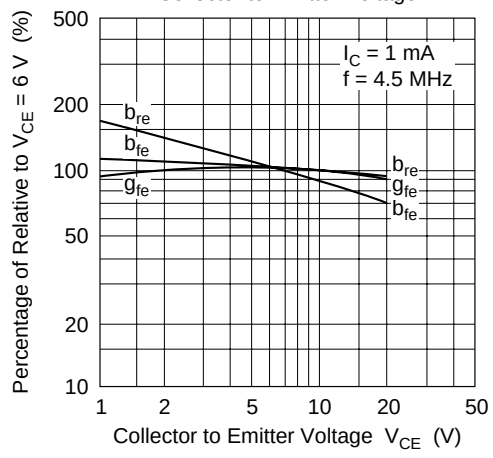

Input/Output Admittance vs.
Collector to Emitter Voltage



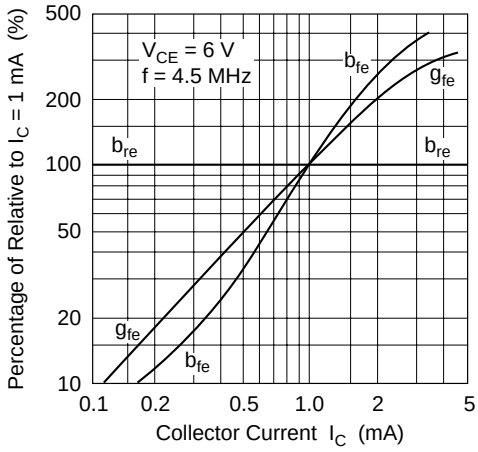

Input/Output Admittance vs.
Collector Current



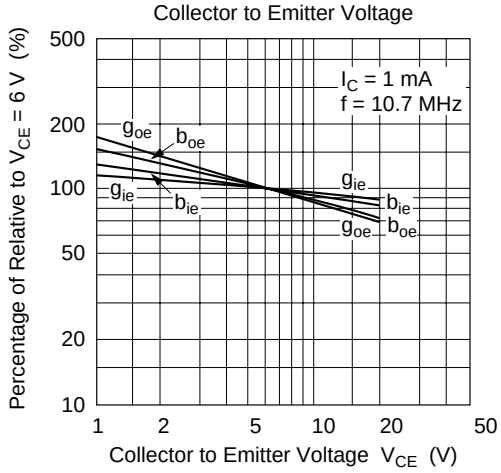

Transfer Admittance vs.
Collector to Emitter Voltage



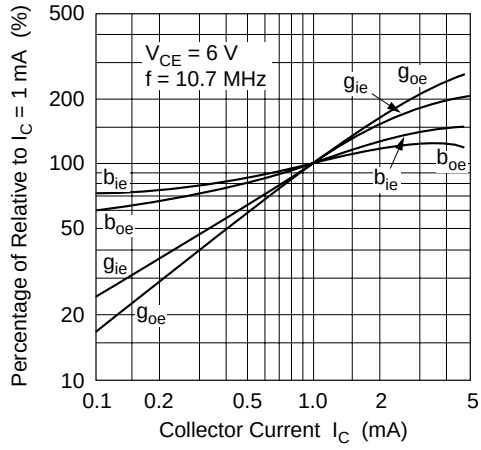
Transfer Admittance vs.
Collector Current



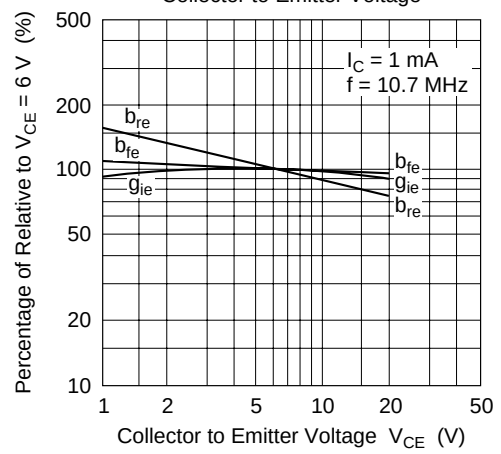

Input/Output Admittance vs.
Collector to Emitter Voltage



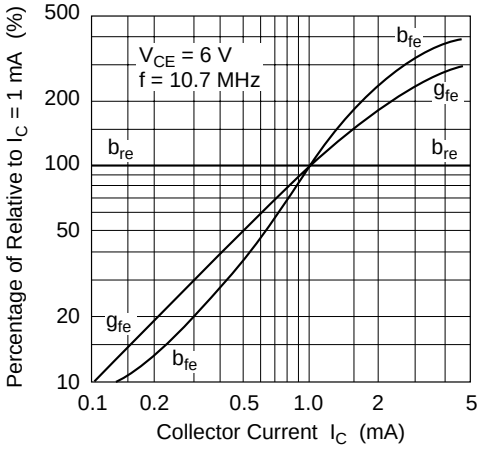

Input/Output Admittance vs.
Collector Current



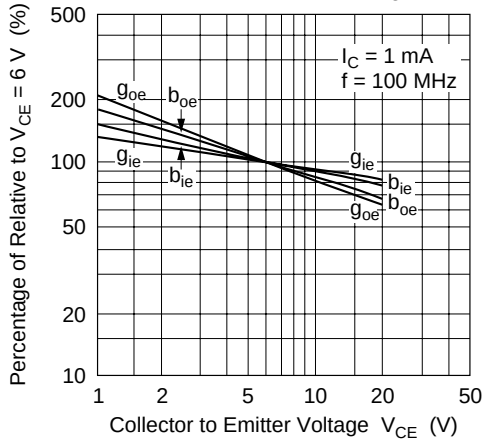

Transfer Admittance vs.
Collector to Emitter Voltage



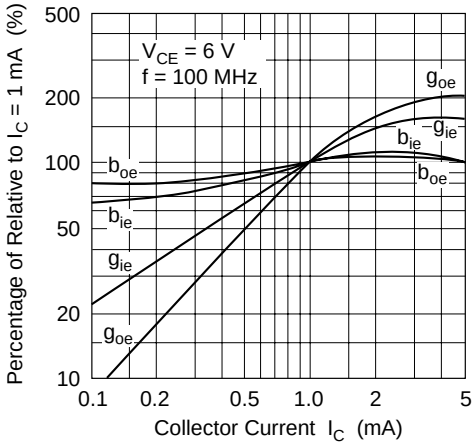
Transfer Admittance vs. Collector Current



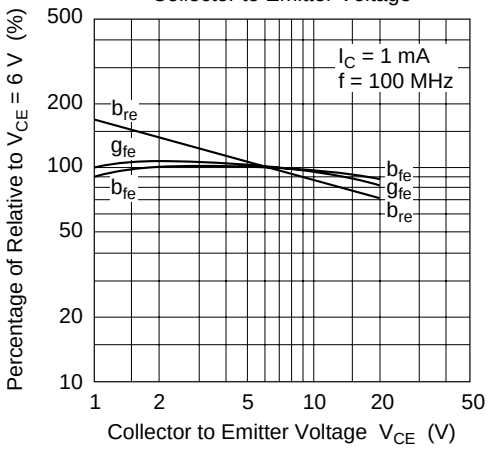

Input/Output Admittance vs. Collector to Emitter Voltage

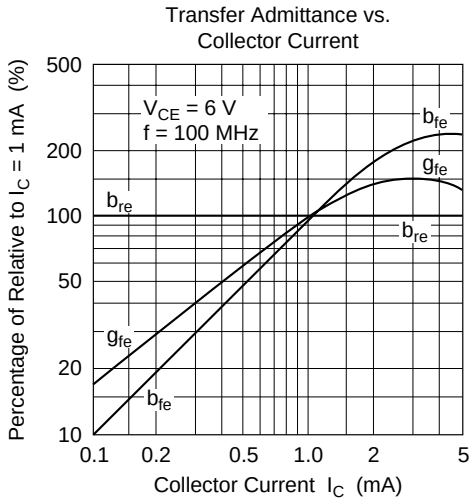



Input/Output Admittance vs. Collector Current




Transfer Admittance vs. Collector to Emitter Voltage

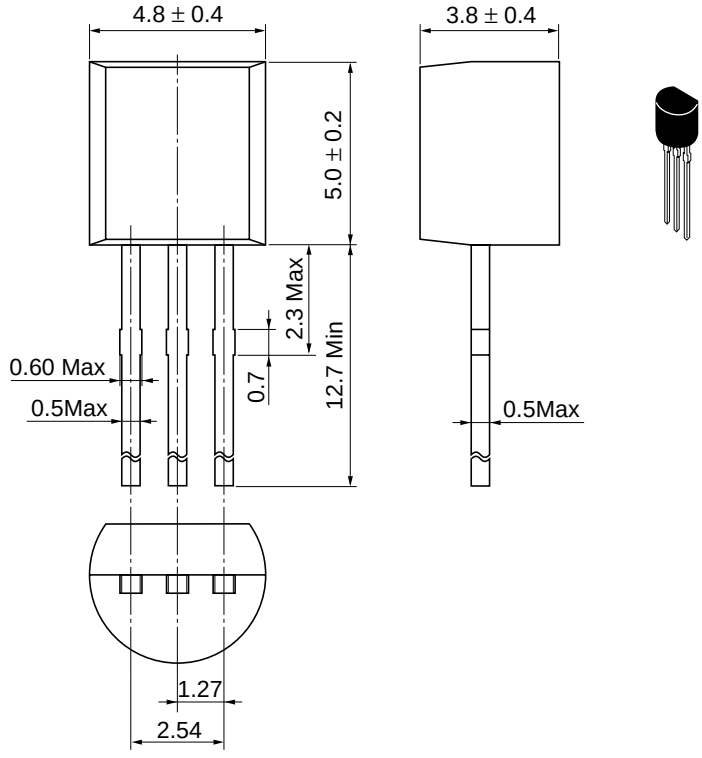



Transfer Admittance vs.
Collector Current
Percentage of Relative to $I_C$ = 1 mA (%)
500
200
100
50
20
10
$V_{CE}$ = 6 V
f = 100 MHz
$b_{fe}$
$g_{fe}$
$b_{re}$
$b_{re}$
$g_{fe}$
$b_{fe}$
0.1
0.2
0.5
1.0
2
5
Collector Current $I_C$ (mA)

## Package Dimensions

As of January, 2001

Unit: mm




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

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Colophon 2.0

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