# BFQ65

## Silicon NPN Planar RF Transistor

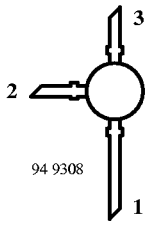
Electrostatic sensitive device.
Observe precautions for handling.

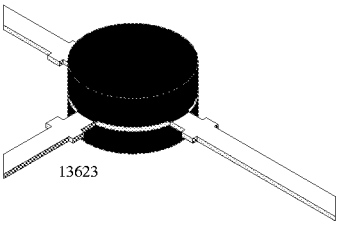
## Applications

RF-amplifier up to GHz range specially for wide band antenna amplifier.

## Features

- High power gain
- Low noise figures
- High transition frequence




Marking: BFQ 65
Plastic case (TO 50)
1 = Collector; 2 = Emitter; 3 = Base

## Absolute Maximum Ratings

| Parameters | Symbol | Value | Unit |
|---|---|---|---|
| Collector-base voltage | $V_{CBO}$ | 20 | V |
| Collector-emitter voltage | $V_{CEO}$ | 10 | V |
| Emitter-base voltage | $V_{EBO}$ | 2.5 | V |
| Collector current | $I_C$ | 50 | mA |
| Total power dissipation $T_{amb} \leq 60°C$ | $P_{tot}$ | 300 | mW |
| Junction temperature | $T_j$ | 150 | °C |
| Storage temperature range | $T_{stg}$ | –65 to +150 | °C |

## Maximum Thermal Resistance

| Parameters | Symbol | Maximum | Unit |
|---|---|---|---|
| Junction ambient on glass fibre printed board (40 x 25 x 1.5) $mm^3$ plated with 35 µm Cu | $R_{thJA}$ | 300 | K/W |

## Electrical DC Characteristics

$T_{amb}$ = 25°C

| Parameters / Test Conditions | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Collector-emitter cut-off current<br>$V_{CE}$ = 20 V, $V_{BE}$ = C | $I_{CES}$ | | | 100 | µA |
| Collector-base cut-off current<br>$V_{CB}$ = 15 V, $I_E$ = 0 | $I_{CBO}$ | | | 100 | nA |
| Emitter-base cut-off current<br>$V_{EB}$ = 1 V, $I_C$ = 0 | $I_{EBO}$ | | | 1 | µA |
| Collector-emitter breakdown voltage<br>$I_C$ = 1 mA, $I_B$ = 0 | $V_{(BR)CEO}$ | 10 | | | V |
| Collector-emitter saturation voltage<br>$I_C$ = 50 mA, $I_B$ = 5 mA | $V_{CEsat}$ | | 0.1 | 0.4 | V |
| DC forward current transfer ratio<br>$I_C$ = 15 mA, $V_{CE}$ = 5 V | $h_{FE}$ | 60 | 100 | 150 | |

## Electrical AC Characteristics

$T_{amb}$ = 25°C

| Parameters / Test Conditions | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Transition frequency<br>$V_{CE}$ = 8 V, $I_C$ = 15 mA, , f = 500 MHz | $f_T$ | | 7.5 | | GHz |
| Collector-base capacitance<br>$V_{CB}$ = 8 V, f = 1 MHz | $C_{cb}$ | | 0.4 | | pF |
| Collector-emitter capacitance<br>$V_{CE}$ = 8 V, f = 1 MHz | $C_{ce}$ | | 0.3 | | pF |
| Emitter-base capacitance<br>$V_{EB}$ = 0.5 V, f = 1 MHz | $C_{eb}$ | | 1.0 | | pF |
| Noise figure<br>$V_{CE}$ = 8 V, $Z_S$ = 50 Ω, f = 800 MHz<br>$I_C$ = 5 mA<br>$I_C$ = 15 mA<br>$V_{CE}$ = 8 V, $Z_S$ = 50 Ω, f = 2 GHz<br>$I_C$ = 5 mA<br>$I_C$ = 15 mA | <br><br>F<br>F<br><br>F<br>F | | <br><br>1.3<br>1.7<br><br>2.5<br>3.0 | | <br><br>dB<br>dB<br><br>dB<br>dB |
| Power gain<br>$I_C$ = 15 mA, $V_{CE}$ = 8 V, f = 2 GHz, $Z_S$ = 50 Ω,<br>$Z_L = Z_{Lopt}$ | $G_{pe}$ | | 8 | | dB |
| Linear output voltage – two tone intermodulation test<br>$V_{CE}$ = 8 V, $I_C$ = 15 mA, $d_{IM}$ = 60 dB,<br>$f_1$ = 806 MHz, $f_2$ = 810 MHz, $Z_S = Z_L$ = 50 Ω | $V_{01} = V_{02}$ | | 160 | | mV |
| Third order intercept point<br>$V_{CE}$ = 8 V, $I_C$ = 15 mA, f = 800 MHz | $IP_3$ | | 26 | | dBm |

## Common Emitter S-Parameters

| $V_{CE}$/V | $I_C$/mA | f/MHz | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | LIN MAG | ANG | LIN MAG | ANG | LIN MAG | ANG | LIN MAG | ANG |
| | | | | deg | | deg | | deg | | deg |
| 8 | 5 | 100 | 0.813 | –27.4 | 13.71 | 157.3 | 0.020 | 76.8 | 0.943 | –13.0 |
| | | 300 | 0.600 | –71.0 | 10.17 | 125.7 | 0.047 | 62.9 | 0.763 | –28.5 |
| | | 500 | 0.447 | –100.9 | 7.39 | 106.9 | 0.063 | 59.4 | 0.652 | –35.2 |
| | | 800 | 0.336 | –133.0 | 5.04 | 89.6 | 0.084 | 60.5 | 0.585 | –41.8 |
| | | 1000 | 0.289 | –149.8 | 4.10 | 81.2 | 0.098 | 61.9 | 0.569 | –46.1 |
| | | 1200 | 0.264 | –164.8 | 3.48 | 74.4 | 0.114 | 62.6 | 0.563 | –50.7 |
| | | 1500 | 0.236 | –175.8 | 2.81 | 65.5 | 0.139 | 63.0 | 0.566 | –57.7 |
| | | 1800 | 0.217 | –157.0 | 2.38 | 57.4 | 0.164 | 62.6 | 0.578 | –65.0 |
| | | 2000 | 0.205 | –147.5 | 2.17 | 52.8 | 0.179 | 61.9 | 0.589 | –69.8 |
| | 10 | 100 | 0.661 | –38.2 | 21.80 | 148.0 | 0.018 | 74.0 | 0.879 | –18.1 |
| | | 300 | 0.398 | –86.9 | 13.04 | 113.8 | 0.039 | 66.1 | 0.636 | –31.3 |
| | | 500 | 0.283 | –114.8 | 8.62 | 98.3 | 0.056 | 67.4 | 0.548 | –35.2 |
| | | 800 | 0.220 | –144.6 | 5.63 | 84.7 | 0.082 | 69.1 | 0.508 | –41.1 |
| | | 1000 | 0.194 | –160.9 | 4.55 | 77.9 | 0.101 | 69.4 | 0.501 | –45.7 |
| | | 1200 | 0.182 | –174.5 | 3.84 | 72.1 | 0.120 | 68.8 | 0.500 | –50.5 |
| | | 1500 | 0.170 | 168.0 | 3.10 | 64.5 | 0.148 | 67.1 | 0.507 | –58.2 |
| | | 1800 | 0.157 | 149.9 | 2.63 | 57.1 | 0.177 | 65.2 | 0.521 | –65.8 |
| | | 2000 | 0.151 | 140.7 | 2.38 | 52.8 | 0.194 | 63.7 | 0.531 | –70.8 |
| | 15 | 100 | 0.551 | –45.6 | 26.77 | 142.0 | 0.016 | 72.9 | 0.828 | –21.1 |
| | | 300 | 0.304 | –96.1 | 14.11 | 108.4 | 0.036 | 69.4 | 0.576 | –31.3 |
| | | 500 | 0.216 | –122.9 | 9.04 | 94.9 | 0.054 | 71.5 | 0.505 | –34.1 |
| | | 800 | 0.177 | –152.2 | 5.82 | 82.6 | 0.083 | 72.3 | 0.477 | –40.3 |
| | | 1000 | 0.160 | –167.4 | 4.69 | 76.4 | 0.102 | 71.9 | 0.474 | –45.2 |
| | | 1200 | 0.153 | 178.8 | 3.96 | 71.1 | 0.123 | 71.0 | 0.476 | –50.3 |
| | | 1500 | 0.144 | 163.0 | 3.20 | 63.9 | 0.152 | 68.7 | 0.484 | –58.3 |
| | | 1800 | 0.136 | 144.9 | 2.71 | 56.8 | 0.182 | 66.0 | 0.498 | –66.2 |
| | | 2000 | 0.133 | 136.3 | 2.47 | 52.7 | 0.200 | 64.2 | 0.508 | –71.2 |
| | 20 | 100 | 0.472 | –51.3 | 29.92 | 137.7 | 0.015 | 72.8 | 0.788 | –22.8 |
| | | 300 | 0.250 | –102.7 | 14.61 | 105.4 | 0.035 | 72.4 | 0.542 | –30.9 |
| | | 500 | 0.183 | –129.7 | 9.22 | 92.9 | 0.054 | 73.9 | 0.484 | –33.3 |
| | | 800 | 0.157 | –156.6 | 5.92 | 81.6 | 0.083 | 74.2 | 0.462 | –39.5 |
| | | 1000 | 0.145 | –171.8 | 4.76 | 75.6 | 0.104 | 73.1 | 0.461 | –44.7 |
| | | 1200 | 0.141 | 174.2 | 4.02 | 70.5 | 0.124 | 71.8 | 0.463 | –50.1 |
| | | 1500 | 0.133 | 159.7 | 3.25 | 63.5 | 0.155 | 69.4 | 0.472 | –58.2 |
| | | 1800 | 0.134 | 140.9 | 2.74 | 56.6 | 0.185 | 66.6 | 0.487 | –66.2 |
| | | 2000 | 0.128 | 135.5 | 2.50 | 52.5 | 0.203 | 64.4 | 0.496 | –71.3 |
| | 30 | 100 | 0.366 | –60.5 | 33.31 | 132.4 | 0.014 | 74.0 | 0.736 | –24.7 |
| | | 300 | 0.197 | –114.6 | 15.00 | 102.0 | 0.034 | 75.0 | 0.506 | –29.8 |
| | | 500 | 0.158 | –141.2 | 9.32 | 90.8 | 0.053 | 76.3 | 0.461 | –32.0 |
| | | 800 | 0.147 | –165.8 | 5.95 | 80.2 | 0.083 | 75.7 | 0.447 | –38.9 |
| | | 1000 | 0.142 | –178.5 | 4.79 | 74.3 | 0.104 | 74.4 | 0.446 | –44.3 |
| | | 1200 | 0.139 | 169.5 | 4.04 | 69.3 | 0.125 | 72.8 | 0.450 | –49.8 |
| | | 1500 | 0.136 | 154.0 | 3.26 | 62.5 | 0.156 | 69.9 | 0.460 | –58.2 |
| | | 1800 | 0.136 | 138.7 | 2.76 | 55.6 | 0.187 | 66.7 | 0.476 | –66.4 |
| | | 2000 | 0.132 | 130.5 | 2.51 | 51.6 | 0.204 | 64.5 | 0.486 | –71.7 |

## Typical Characteristics ($T_j$ = 25°C unless otherwise specified)

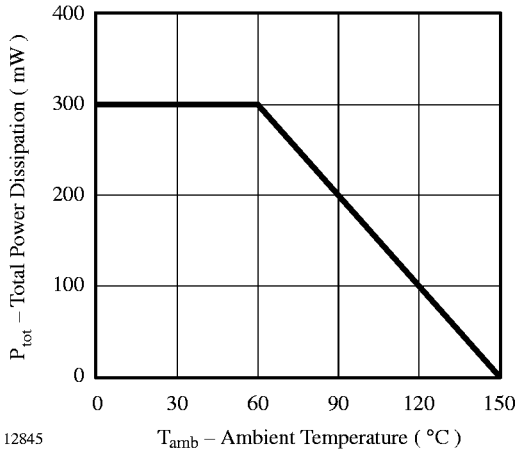



Figure 1. Total Power Dissipation vs. Ambient Temperature

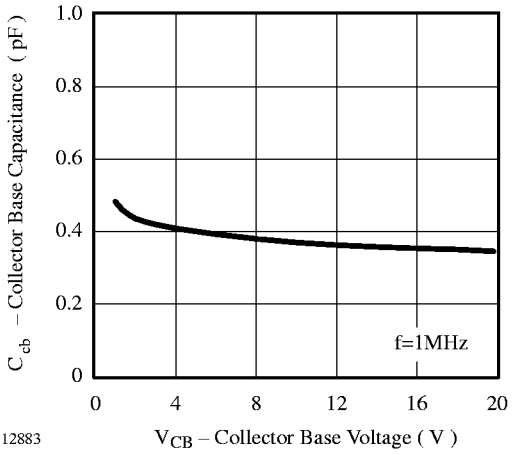



Figure 3. Collector Base Capacitance vs. Collector Base Voltage

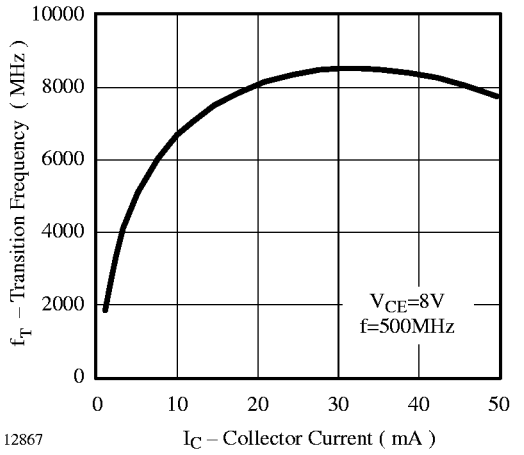



Figure 2. Transition Frequency vs. Collector Current

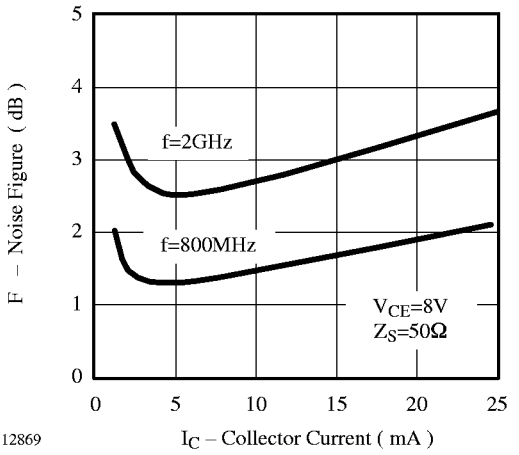



Figure 4. Noise Figure vs. Collector Current

$V_{CE}$ = 8 V; $I_C$ = 15 mA; $Z_0$ = 50 Ω

$S_{11}$

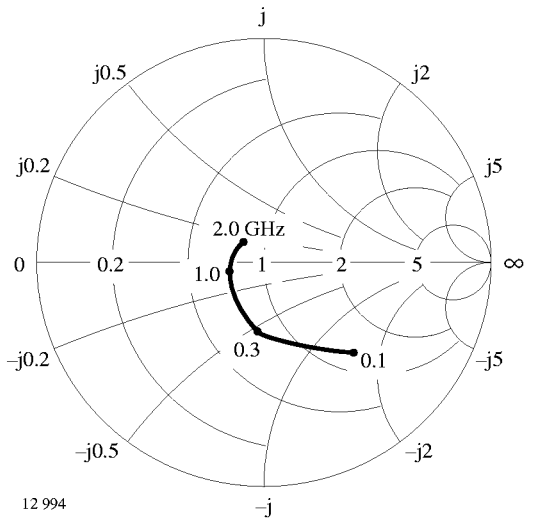



Figure 5. Input reflection coefficient

$S_{12}$

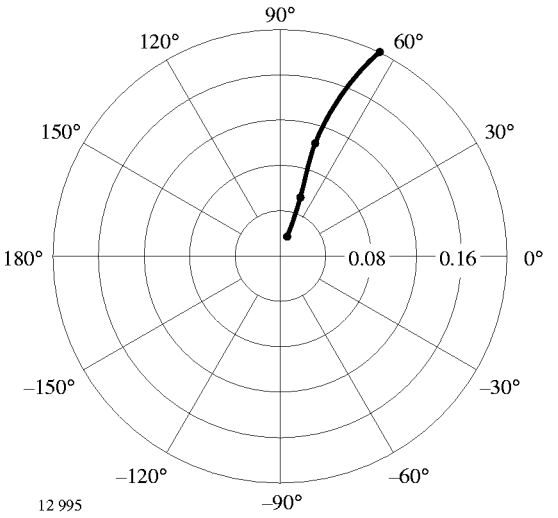



Figure 7. Reverse transmission coefficient

$S_{21}$

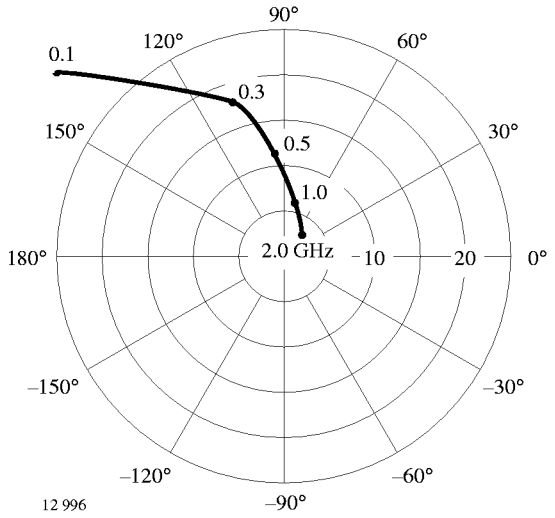



Figure 6. Forward transmission coefficient

$S_{22}$

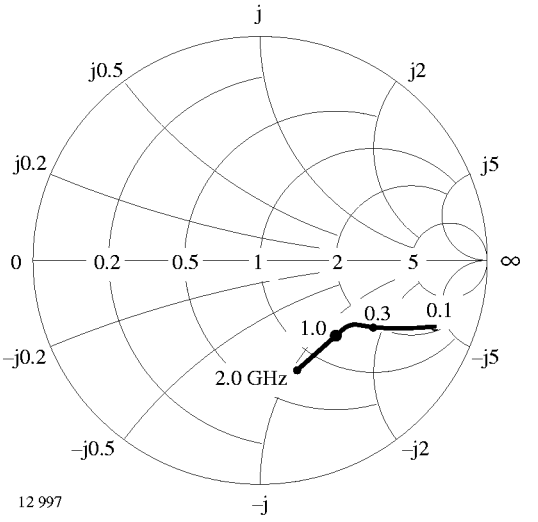
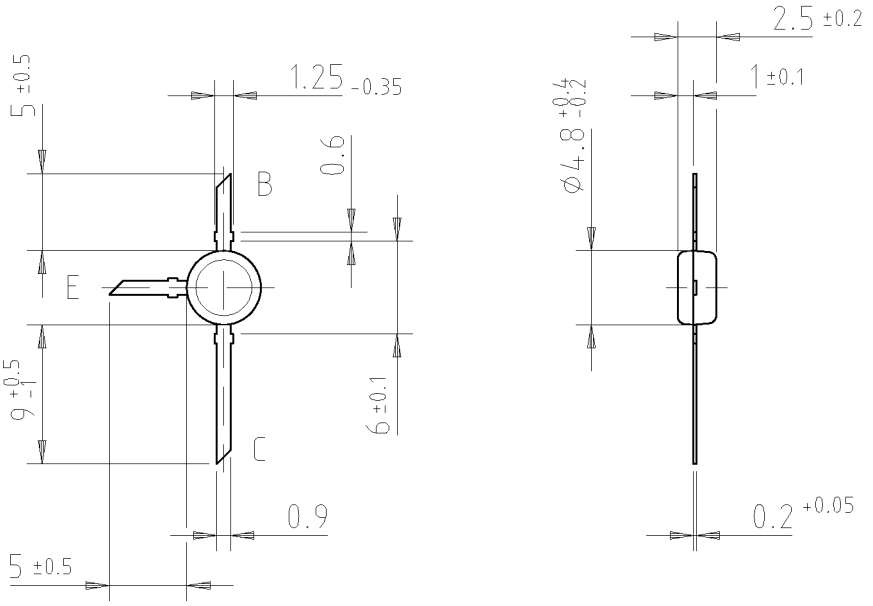



Figure 8. Output reflection coefficient

## Dimensions in mm

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technical drawings according to DIN specifications