

BFP405F

Low profile wideband silicon NPN RF bipolar transistor



Product description

The BFP405F is a low noise device based on a grounded emitter (SIEGET™) that is part of Infineon’s established fourth generation RF bipolar transistor family. Its transition frequency f_T of 25 GHz and low current characteristics make the device suitable for oscillators up to 12 GHz. It remains cost competitive without compromising on ease of use.



Feature list

- Minimum noise figure $NF_{min} = 1.25$ dB at 1.8 GHz, 2 V, 2 mA
- High gain $G_{ms} = 22.5$ dB at 1.8 GHz, 2 V, 5 mA
- $OIP_3 = 14$ dBm at 1.8 GHz, 2 V, 5 mA

Product validation

Qualified for industrial applications according to the relevant tests of JEDEC47/20/22.

Potential applications

- Radio-frequency oscillators
- Broadband low noise amplifiers (LNAs) for CATV, DVB-T, DAB/DMB and FM/AM radio
- LNAs for sub-1 GHz ISM band applications

Device information

Table 1 Part information

| Product name / Ordering code | Package | Pin configuration | | | | Marking | Pieces / Reel |
|------------------------------|----------|-------------------|-------|-------|-------|---------|---------------|
| BFP405F / BFP405FH6327XTSA1 | TSFP-4-1 | 1 = B | 2 = E | 3 = C | 4 = E | ALs | 3000 |

Attention: ESD (Electrostatic discharge) sensitive device, observe handling precautions

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Absolute maximum ratings

1 Absolute maximum ratings

Table 2 Absolute maximum ratings at $T_A = 25\text{ °C}$ (unless otherwise specified)

| Parameter | Symbol | Values | | Unit | Note or test condition |
|---------------------------------------|-----------|--------|------|------|-----------------------------------|
| | | Min. | Max. | | |
| Collector emitter voltage | V_{CEO} | - | 4.5 | V | Open base |
| | | | 4.1 | | $T_A = -55\text{ °C}$, open base |
| Collector emitter voltage | V_{CES} | | 15 | | E-B short circuited |
| Collector base voltage | V_{CBO} | | 15 | | Open emitter |
| Emitter base voltage | V_{EBO} | | 1.5 | | Open collector |
| Base current | I_B | | 3 | mA | - |
| Collector current | I_C | | 25 | | |
| Total power dissipation ¹⁾ | P_{tot} | | 75 | mW | $T_S \leq 112\text{ °C}$ |
| Junction temperature | T_J | | 150 | °C | - |
| Storage temperature | T_{Stg} | -55 | | | |

Attention: *Stresses above the max. values listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Exceeding only one of these values may cause irreversible damage to the integrated circuit.*

¹ T_S is the soldering point temperature. T_S is measured on the emitter lead at the soldering point of the PCB.

Thermal characteristics

2 Thermal characteristics

Table 3 Thermal resistance

| Parameter | Symbol | Values | | | Unit | Note or test condition |
|----------------------------|------------|--------|------|------|------|------------------------|
| | | Min. | Typ. | Max. | | |
| Junction - soldering point | R_{thJS} | - | 500 | - | K/W | - |

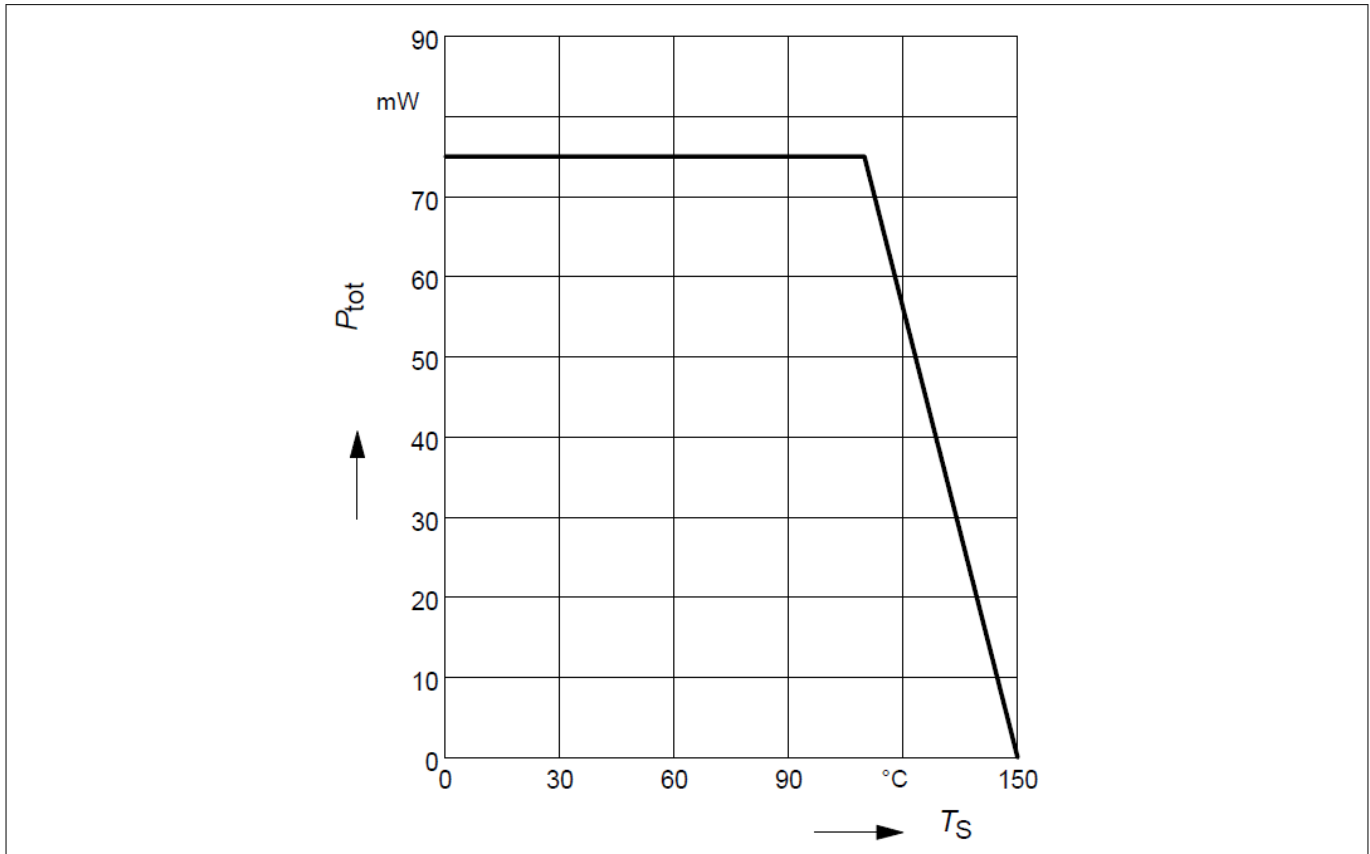


Figure 1 Total power dissipation $P_{tot} = f(T_S)$

Electrical characteristics

3 Electrical characteristics

3.1 DC characteristics

Table 4 DC characteristics at $T_A = 25\text{ °C}$

| Parameter | Symbol | Values | | | Unit | Note or test condition |
|-------------------------------------|---------------|--------|------|-------------------|------|--|
| | | Min. | Typ. | Max. | | |
| Collector emitter breakdown voltage | $V_{(BR)CEO}$ | 4 | 5 | – | V | $I_C = 1\text{ mA}$, $I_B = 0$, open base |
| Collector emitter leakage current | I_{CES} | – | – | 10 ²⁾ | μA | $V_{CE} = 15\text{ V}$, $V_{BE} = 0$, E-B short circuited |
| Collector base leakage current | I_{CBO} | | | 100 ²⁾ | nA | $V_{CB} = 5\text{ V}$, $I_E = 0$, open emitter |
| Emitter base leakage current | I_{EBO} | | | 1 ²⁾ | μA | $V_{EB} = 0.5\text{ V}$, $I_C = 0$, open collector |
| DC current gain | h_{FE} | 60 | 95 | 130 | | $V_{CE} = 4\text{ V}$, $I_C = 5\text{ mA}$, pulse measured |

3.2 General AC characteristics

Table 5 General AC characteristics at $T_A = 25\text{ °C}$

| Parameter | Symbol | Values | | | Unit | Note or test condition |
|-------------------------------|----------|--------|------|------|------|--|
| | | Min. | Typ. | Max. | | |
| Transition frequency | f_T | 18 | 25 | – | GHz | $V_{CE} = 3\text{ V}$, $I_C = 10\text{ mA}$, $f = 2\text{ GHz}$ |
| Collector base capacitance | C_{CB} | – | 0.05 | 0.1 | pF | $V_{CB} = 2\text{ V}$, $V_{BE} = 0$, $f = 1\text{ MHz}$, emitter grounded |
| Collector emitter capacitance | C_{CE} | | 0.2 | – | | $V_{CE} = 2\text{ V}$, $V_{BE} = 0$, $f = 1\text{ MHz}$, base grounded |
| Emitter base capacitance | C_{EB} | | 0.25 | | | $V_{EB} = 0.5\text{ V}$, $V_{CB} = 0$, $f = 1\text{ MHz}$, collector grounded |

² Maximum values not limited by the device but by the short cycle time of the 100% test.

Electrical characteristics

3.3 Frequency dependent AC characteristics

Measurement setup is a test fixture with Bias-T's in a 50 Ω system, $T_A = 25\text{ °C}$.

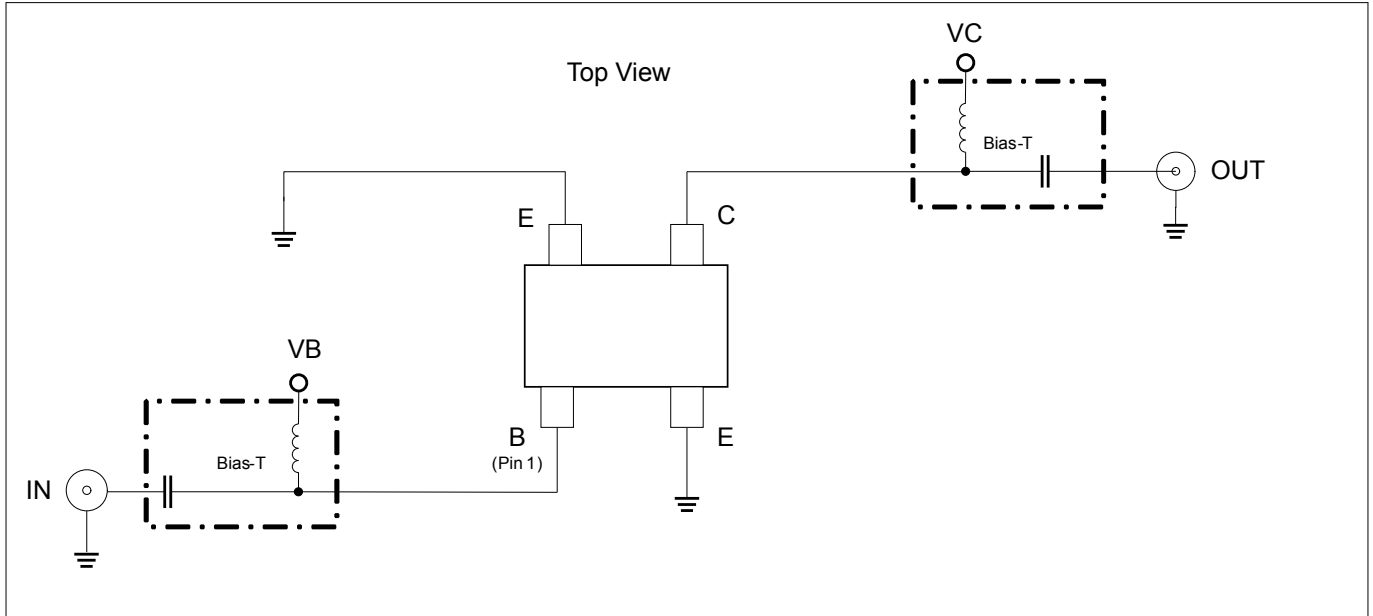


Figure 2 Testing circuit

Table 6 AC characteristics, $V_{CE} = 2\text{ V}$, $f = 1.8\text{ GHz}$

| Parameter | Symbol | Values | | | Unit | Note or test condition |
|---|--------------|--------|------|------|------|--|
| | | Min. | Typ. | Max. | | |
| Power gain | | - | | - | dB | $I_C = 5\text{ mA}$ |
| • Maximum power gain | G_{ms} | | 22.5 | | | |
| • Transducer gain | $ S_{21} ^2$ | | 18 | | | |
| Noise figure | | | | | | |
| • Minimum noise figure | NF_{min} | | 1.25 | | | $I_C = 2\text{ mA}$ |
| Linearity | | | | | | |
| • 3rd order intercept point at output | OIP_3 | | 14 | | dBm | $I_C = 5\text{ mA}$, $Z_S = Z_L = 50\text{ }\Omega$ |
| • 1 dB gain compression point at output | OP_{1dB} | | 0 | | | |

Note: $G_{ms} = |S_{21}/S_{12}|$ for $k < 1$; $G_{ma} = |S_{21}/S_{12}|(k - (k^2 - 1)^{1/2})$ for $k > 1$. In order to get the NF_{min} values stated in this chapter, the test fixture losses have been subtracted from all measured results. OIP_3 value depends on termination of all intermodulation frequency components. Termination used for this measurement is 50 Ω from 0.1 MHz to 6 GHz.

Package information TSFP-4-1

4 Package information TSFP-4-1

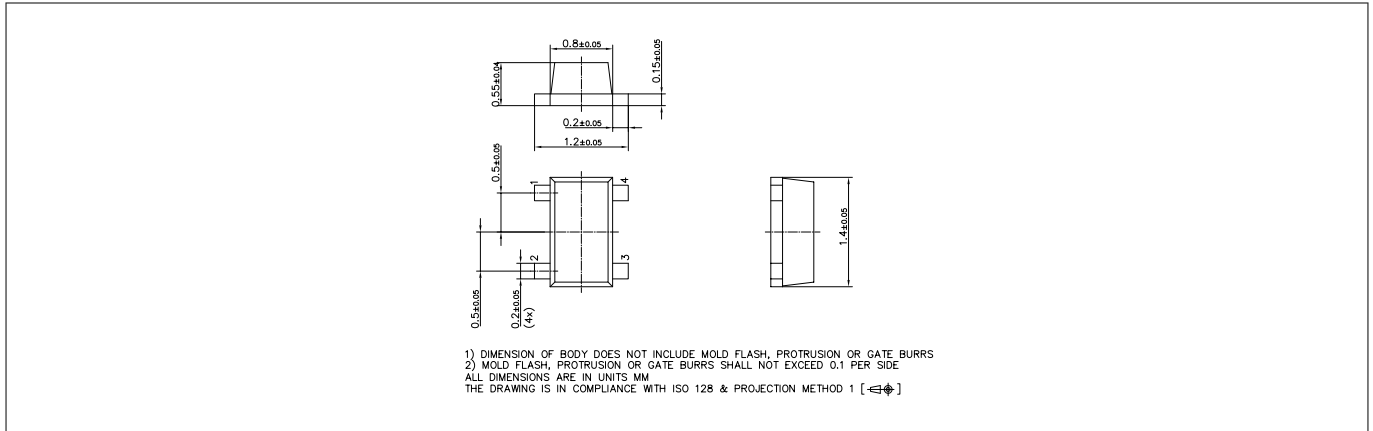


Figure 3 Package outline

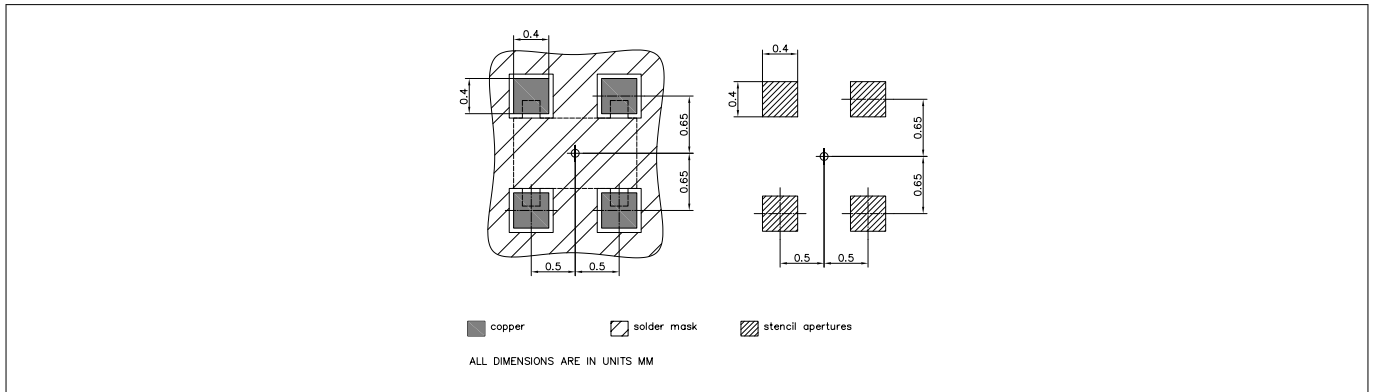


Figure 4 Foot print

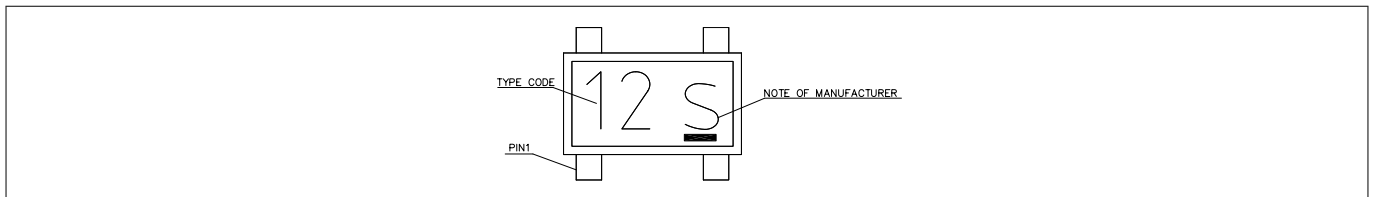


Figure 5 Marking layout example

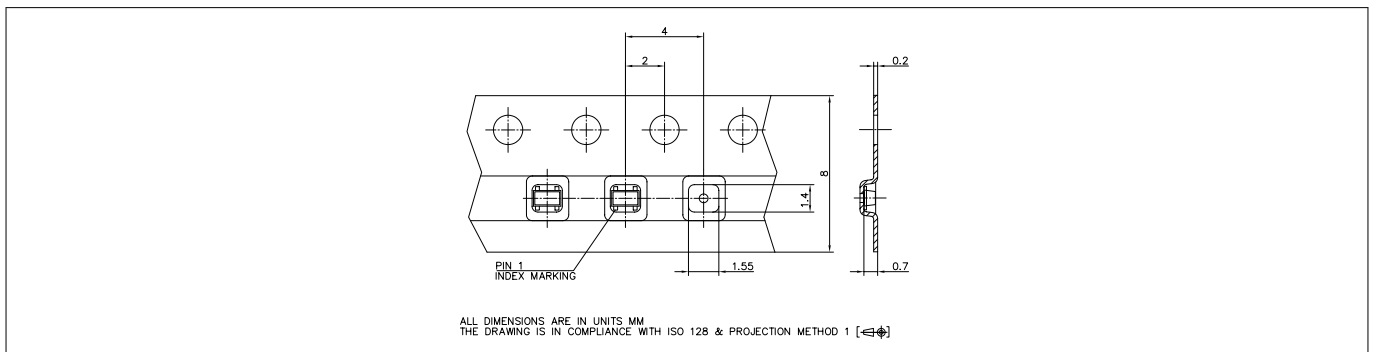


Figure 6 Tape dimensions

Revision history

Revision history

| Document version | Date of release | Description of changes |
|------------------|-----------------|------------------------|
| Revision 2.0 | 2019-01-25 | New datasheet layout. |

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Edition 2019-01-25

Published by
Infineon Technologies AG
81726 Munich, Germany

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Document reference
IFX-pji1524053860431

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