

# BFP540FESD

## Low profile robust silicon NPN RF bipolar transistor



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## Product description

The BFP540FESD is a low noise device based on a grounded emitter (SIEGET™) that is part of Infineon's established fifth generation RF bipolar transistor family. Its high gain and ESD structure make the device suitable for applications that requires highly robustness and high performance. It remains cost competitive without compromising on ease of use.



## Feature list

- Minimum noise figure  $NF_{min} = 0.9$  dB at 1.8 GHz, 2 V, 5 mA
- High gain  $G_{ms} = 20$  dB at 1.8 GHz, 2 V, 20 mA
- $OIP_3 = 24.5$  dBm at 1.8 GHz, 2 V, 20 mA
- High ESD robustness, typical 1 kV (HBM)

## Product validation

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

## Potential applications

- Radio-frequency oscillators such as local oscillator in LNB
- Broadband low noise amplifiers (LNAs) for CATV, DVB-T, DAB/DMB and FM/AM radio
- LNAs for wireless communications such as cordless phones

## Device information

**Table 1** Part information

| Product name / Ordering code      | Package  | Pin configuration |       |       |       | Marking | Pieces / Reel |
|-----------------------------------|----------|-------------------|-------|-------|-------|---------|---------------|
| BFP540FESD / BFP540FESDH6327XTSA1 | TSFP-4-1 | 1 = B             | 2 = E | 3 = C | 4 = E | AUs     | 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    |      | $T_A = -55\text{ °C}$ , open base |
| Collector emitter voltage             | $V_{CES}$ |        | 10   |      | E-B short circuited               |
| Collector base voltage                | $V_{CBO}$ |        | 10   |      | Open emitter                      |
| Emitter base voltage                  | $V_{EBO}$ |        | 1    |      | Open collector                    |
| Base current                          | $I_B$     |        | 8    | mA   | -                                 |
| Collector current                     | $I_C$     |        | 80   |      |                                   |
| Total power dissipation <sup>1)</sup> | $P_{tot}$ |        | 250  | mW   | $T_S \leq 80\text{ °C}$           |
| 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.*

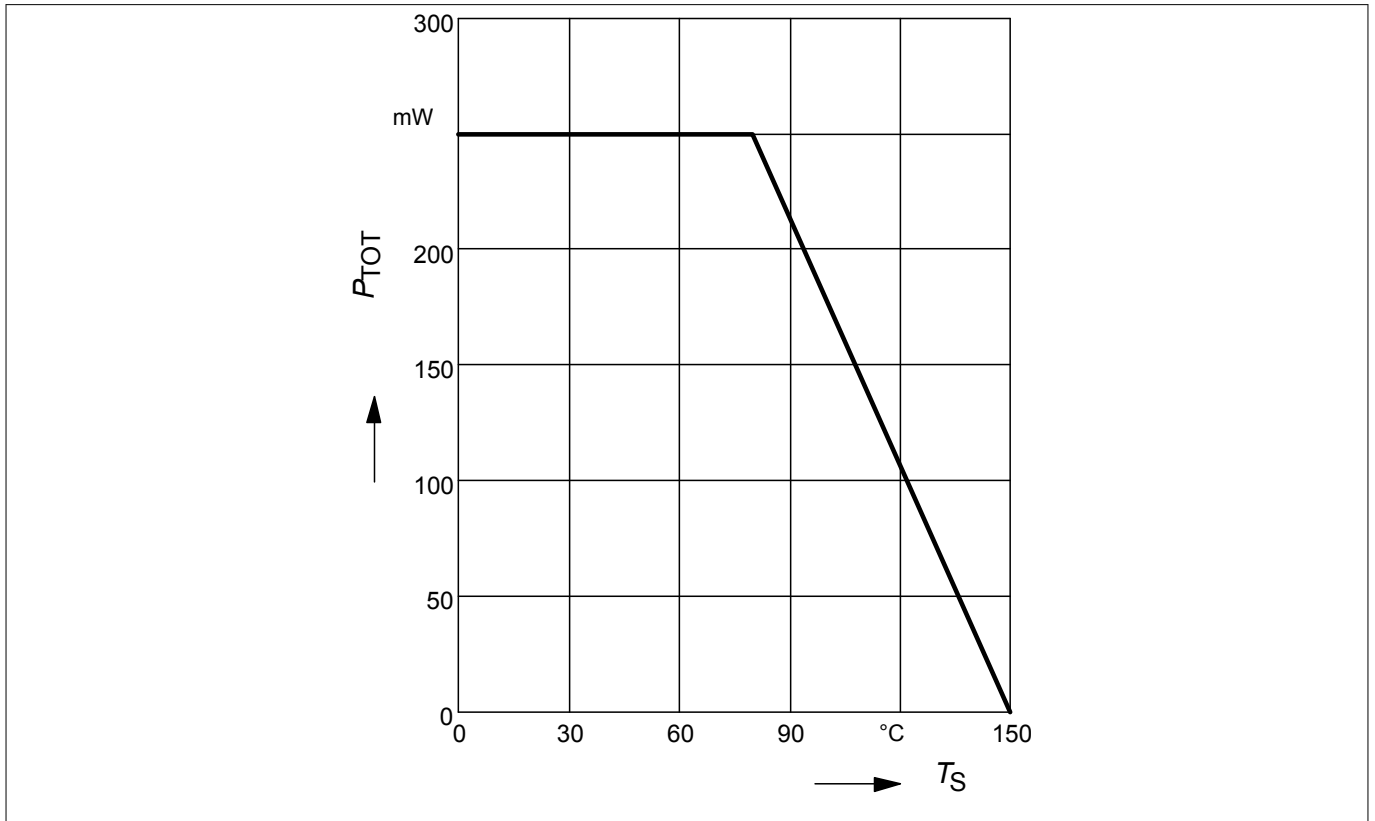
<sup>1</sup>  $T_S$  is the soldering point temperature.  $T_S$  is measured on the emitter lead at the soldering point of the PCB.

Thermal characteristics

## 2 Thermal characteristics

**Table 3 Thermal resistance**

| Parameter                  | Symbol     | Values |      |      | Unit | Note or test condition |
|----------------------------|------------|--------|------|------|------|------------------------|
|                            |            | Min.   | Typ. | Max. |      |                        |
| Junction - soldering point | $R_{thJS}$ | -      | 280  | -    | 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    | 5    | –                 | V    | $I_C = 1\text{ mA}$ , $I_B = 0$ ,<br>open base                     |
| Collector emitter leakage current   | $I_{CES}$     | –      | –    | 10 <sup>2)</sup>  | μA   | $V_{CE} = 10\text{ V}$ , $V_{BE} = 0$ ,<br>E-B short circuited     |
| Collector base leakage current      | $I_{CBO}$     |        |      | 100 <sup>2)</sup> | nA   | $V_{CB} = 5\text{ V}$ , $I_E = 0$ ,<br>open emitter                |
| Emitter base leakage current        | $I_{EBO}$     |        |      | 10 <sup>2)</sup>  | μA   | $V_{EB} = 0.5\text{ V}$ , $I_C = 0$ ,<br>open collector            |
| DC current gain                     | $h_{FE}$      | 50     | 110  | 170               |      | $V_{CE} = 3.5\text{ V}$ , $I_C = 20\text{ mA}$ ,<br>pulse measured |

**3.2 General AC characteristics**

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

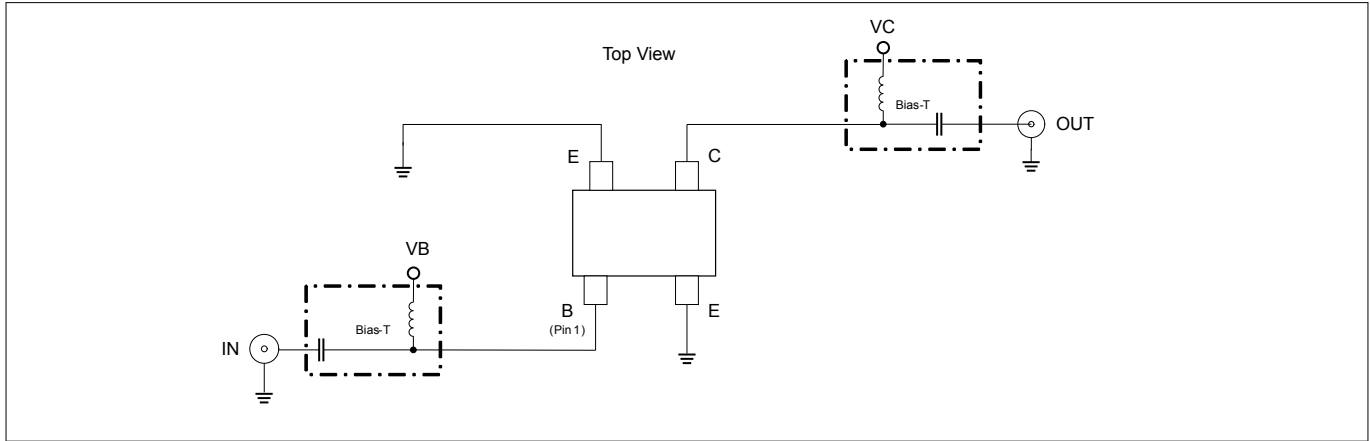
| Parameter                     | Symbol   | Values |      |      | Unit | Note or test condition   |
|-------------------------------|----------|--------|------|------|------|--|
|                               |          | Min.   | Typ. | Max. |      |  |
| Transition frequency          | $f_T$    | 21     | 30   | –    | GHz  | $V_{CE} = 4\text{ V}$ , $I_C = 50\text{ mA}$ ,<br>$f = 1\text{ GHz}$                   |
| Collector base capacitance    | $C_{CB}$ | –      | 0.16 | 0.26 | pF   | $V_{CB} = 2\text{ V}$ , $V_{BE} = 0$ ,<br>$f = 1\text{ MHz}$ ,<br>emitter grounded     |
| Collector emitter capacitance | $C_{CE}$ |        | 0.4  | –    |      | $V_{CE} = 2\text{ V}$ , $V_{BE} = 0$ ,<br>$f = 1\text{ MHz}$ ,<br>base grounded        |
| Emitter base capacitance      | $C_{EB}$ |        | 0.55 |      |      | $V_{EB} = 0.5\text{ V}$ , $V_{CB} = 0$ ,<br>$f = 1\text{ MHz}$ ,<br>collector grounded |

<sup>2</sup> 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   | $I_C = 20\text{ mA}$                                  |
| <ul style="list-style-type: none"> <li>Maximum stable power gain</li> <li>Transducer gain</li> </ul>                                 | $G_{ms}$<br>$ S_{21} ^2$ | –<br>15.5 | 20<br>18   | –    |      |   |
| Noise figure   |                          |           |            |      | dBm  | $I_C = 5\text{ mA}$                                   |
| <ul style="list-style-type: none"> <li>Minimum noise figure</li> </ul>   | $NF_{min}$               | –         | 0.9        | 1.4  |      |   |
| Linearity  |                          |           |            |      | dBm  | $I_C = 20\text{ mA}$ , $Z_S = Z_L = 50\text{ }\Omega$ |
| <ul style="list-style-type: none"> <li>3rd order intercept point at output</li> <li>1 dB gain compression point at output</li> </ul> | $OIP_3$<br>$OP_{1dB}$    |           | 24.5<br>11 | –    |      |   |

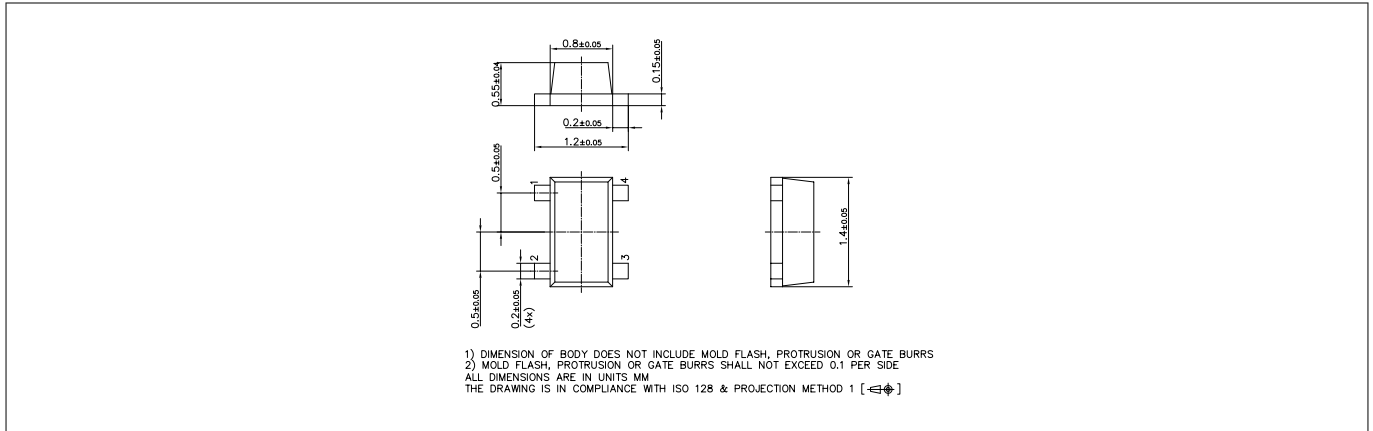
**Table 7 AC characteristics,  $V_{CE} = 2\text{ V}$ ,  $f = 3\text{ GHz}$**

| Parameter   | Symbol                   | Values |            |      | Unit | Note or test condition |
|---|--------------------------|--------|------------|------|------|------------------------|
|   |                          | Min.   | Typ.       | Max. |      |                        |
| Power gain  |                          |        |            |      | dB   | $I_C = 20\text{ mA}$   |
| <ul style="list-style-type: none"> <li>Maximum available power gain</li> <li>Transducer gain</li> </ul> | $G_{ma}$<br>$ S_{21} ^2$ | –      | 14.5<br>13 | –    |      |                        |
| Noise figure  |                          |        |            |      | dBm  | $I_C = 5\text{ mA}$    |
| <ul style="list-style-type: none"> <li>Minimum noise figure</li> </ul>                                  | $NF_{min}$               |        | 1.3        |      |      |                        |

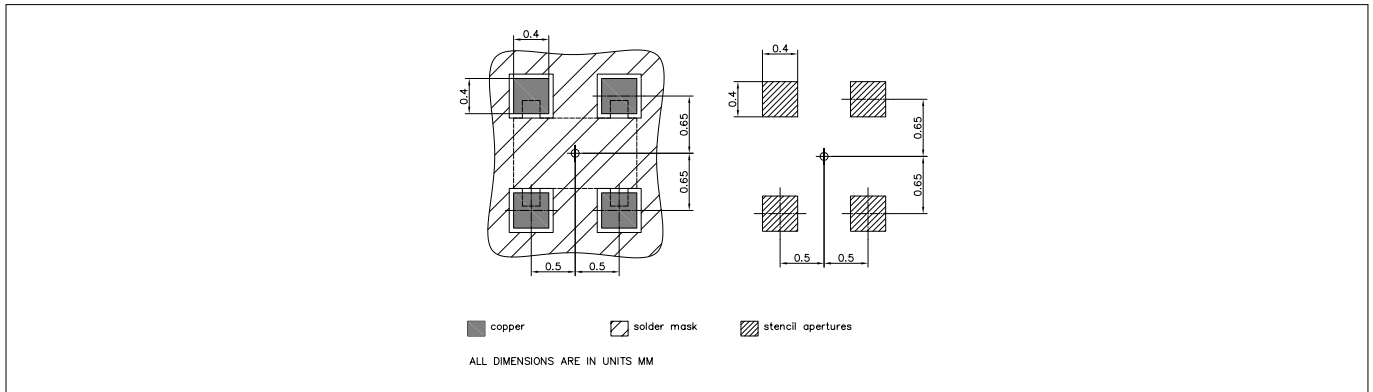
Note:  $G_{ms} = |S_{21} / S_{12}|$  for  $k < 1$ ;  $G_{ma} = |S_{21} / S_{12}| (k - (k^2 - 1)^{1/2})$  for  $k > 1$ . In order to get the  $NF_{min}$  values stated in this chapter, the test fixture losses have been subtracted from all measured results.  $OIP_3$  value depends on termination of all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

**Package information TSFP-4-1**

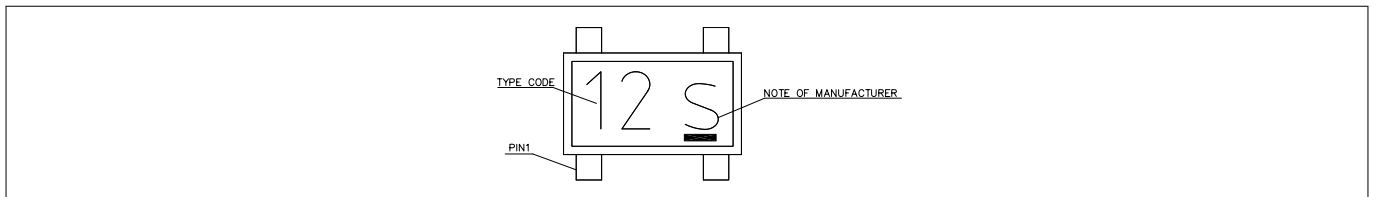
**4 Package information TSFP-4-1**



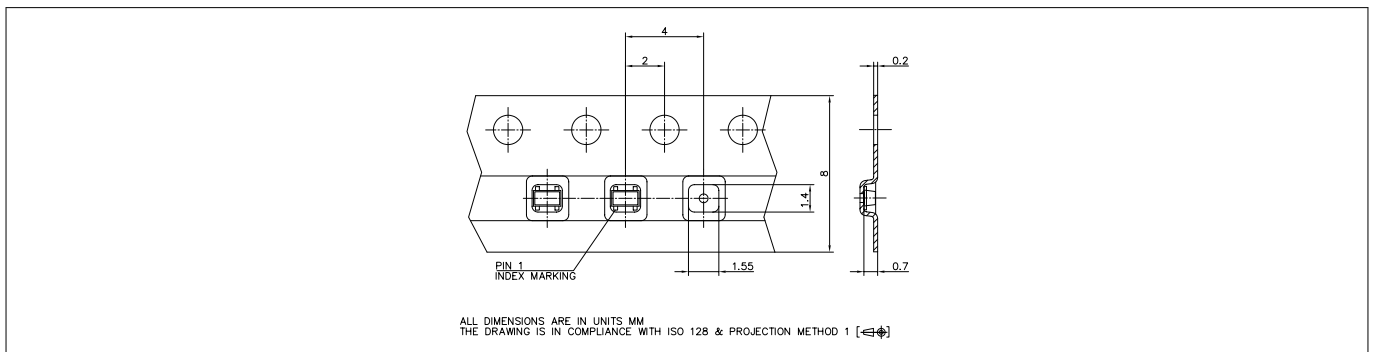
**Figure 3 Package outline**



**Figure 4 Foot print**



**Figure 5 Marking layout example**



**Figure 6 Tape dimensions**

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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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