BFP650F

Low profile linear silicon NPN RF bipolar transistor

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Product description

The BFP650F is a RF bipolar transistor based on SiGe:C technology that is part of Infineon's established sixth generation transistor family. Its transition frequency f_T of 42 GHz along with its linearity characteristics make the device suitable for oscillators. It remains cost competitive without compromising on ease of use.

Feature list

- Minimum noise figure NF_{min} = 0.8 dB at 1.8 GHz, 3 V, 10 mA
- High gain G_{ma} = 21.5 dB at 1.8 GHz, 3 V, 80 mA
- OIP_3 = 31 dBm at 1.8 GHz, 3 V, 80 mA

Product validation

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

Potential applications

- Low noise, high linearity amplifiers in SDARS receivers
- Low noise, high linearity amplifiers for ISM band applications
- Low noise, high linearity amplifiers for multimedia applications such as CATV

Device information

Table 1　　　　Part information

Product name / Ordering code	Package	Pin configuration				Marking	Pieces / Reel
BFP650F / BFP650FH6327XTSA1	TSFP-4-1	1 = B	2 = E	3 = C	4 = E	R5s	3000

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

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1 Absolute maximum ratings

Table 2 **Absolute maximum ratings at T_A = 25 °C (unless otherwise specified)**

Parameter	Symbol	Values		Unit	Note or test condition
		Min.	Max.		
Collector emitter voltage	V_{CEO}	–	4.0	V	Open base
			3.7		T_A = -55 °C, open base
Collector emitter voltage	V_{CES}		13		E-B short circuited
Collector base voltage	V_{CBO}		13		Open emitter
Emitter base voltage	V_{EBO}		1.2		Open collector
Base current	I_B		10	mA	–
Collector current	I_C		150		
Total power dissipation [1]	P_{tot}		500	mW	$T_S \leq$ 85 °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.*
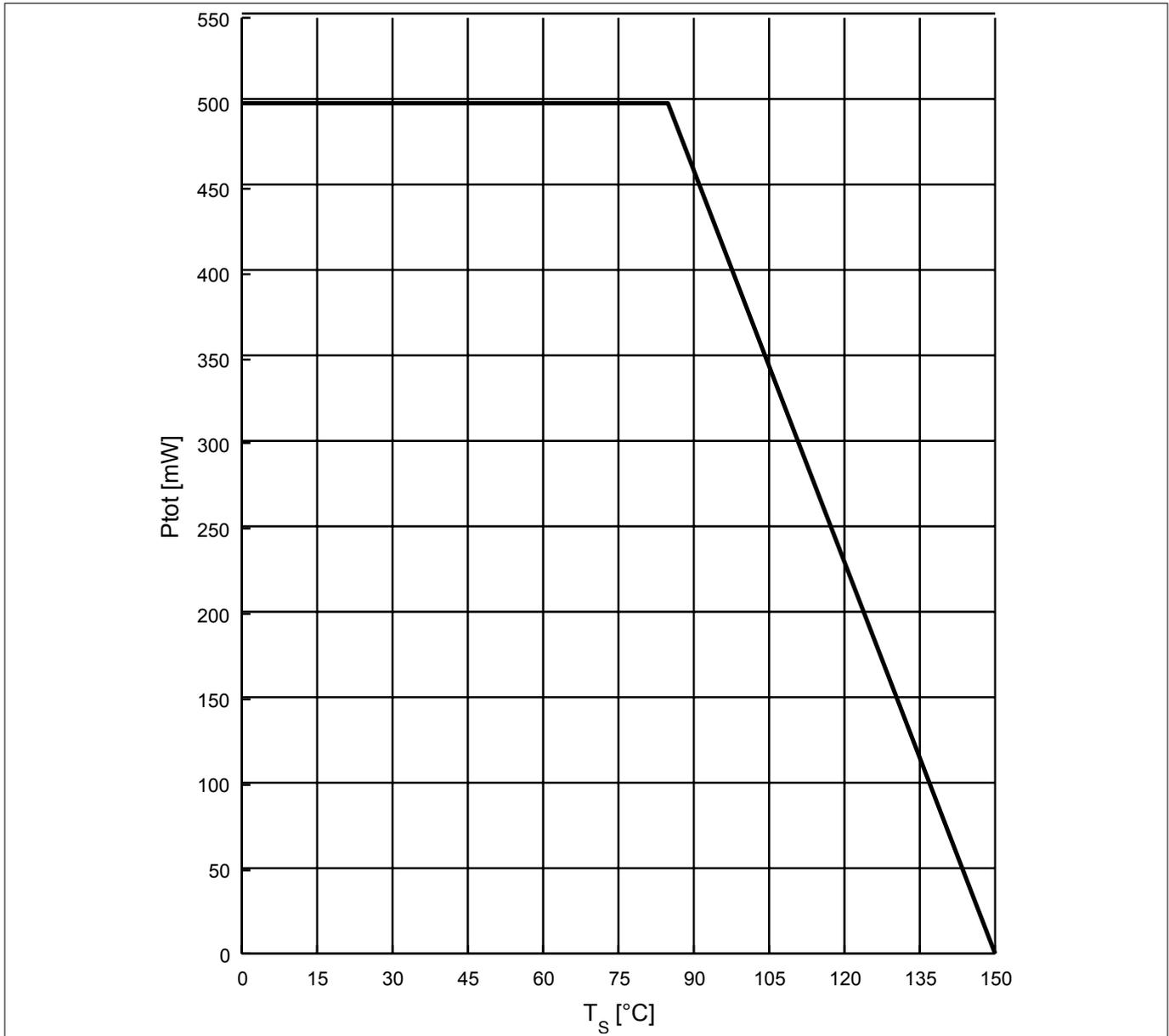
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1 T_S is the soldering point temperature. T_S is measured on the emitter lead at the soldering point of the PCB.

2 Thermal characteristics

Table 3 **Thermal resistance**

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Junction - soldering point	R_{thJS}	–	130	–	K/W	–

Figure 1 **Total power dissipation $P_{\text{tot}} = f(T_{\text{s}})$**

3 Electrical characteristics

3.1 DC characteristics

Table 4   DC characteristics at T_A = 25 °C

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Collector emitter breakdown voltage	$V_{(BR)CEO}$	4	4.5	–	V	I_C = 3 mA, I_B = 0, open base
Collector emitter leakage current	I_{CES}	–	–	100 [2]	μA	V_{CE} = 13 V, V_{BE} = 0, E-B short circuited
Collector base leakage current	I_{CBO}			100 [2]	nA	V_{CB} = 5 V, I_E = 0, open emitter
Emitter base leakage current	I_{EBO}			10 [2]	μA	V_{EB} = 0.5 V, I_C = 0, open collector
DC current gain	h_{FE}	110	180	270		V_{CE} = 3 V, I_C = 80 mA, pulse measured

3.2 General AC characteristics

**Table 5**   General AC characteristics at T_A = 25 °C

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Transition frequency	f_T	–	42	–	GHz	V_{CE} = 3 V, I_C = 80 mA, f = 1 GHz
Collector base capacitance	C_{CB}		0.26		pF	V_{CB} = 3 V, V_{BE} = 0, f = 1 MHz, emitter grounded
Collector emitter capacitance	C_{CE}		0.45			V_{CE} = 3 V, V_{BE} = 0, f = 1 MHz, base grounded
Emitter base capacitance	C_{EB}		1.3			V_{EB} = 0.5 V, V_{CB} = 0, f = 1 MHz, collector grounded

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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 °C.
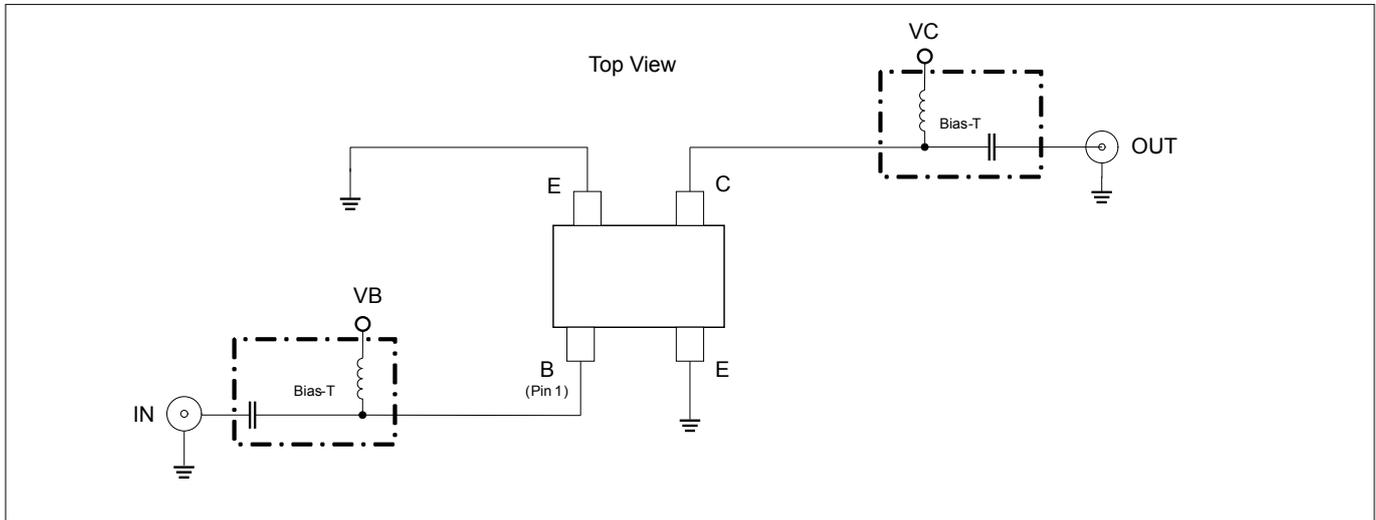
Figure 2   **Testing circuit**

Table 6   **AC characteristics, V_{CE} = 3 V, f = 1.8 GHz**

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Power gain				–	dB	
• Maximum power gain	G_{ms}	–	21.5			I_C = 80 mA
• Transducer gain	$|S_{21}|^2$	15	17.5			
Noise figure		–				
• Minimum noise figure	NF_{min}		0.8			I_C = 10 mA
Linearity					dBm	
• 3rd order intercept point at output	OIP_3		31			I_C = 80 mA, Z_S = Z_L = 50 Ω
• 1 dB gain compression point at output	OP_{1dB}		17.5			

Table 7   **AC characteristics, V_{CE} = 3 V, f = 6 GHz**

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Power gain		–		–	dB	
• Maximum power gain	G_{ms}		11			I_C = 80 mA
• Transducer gain	$|S_{21}|^2$		7.5			
Noise figure						
• Minimum noise figure	NF_{min}		1.9			I_C = 10 mA

*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 0.2 MHz to 12 GHz.*

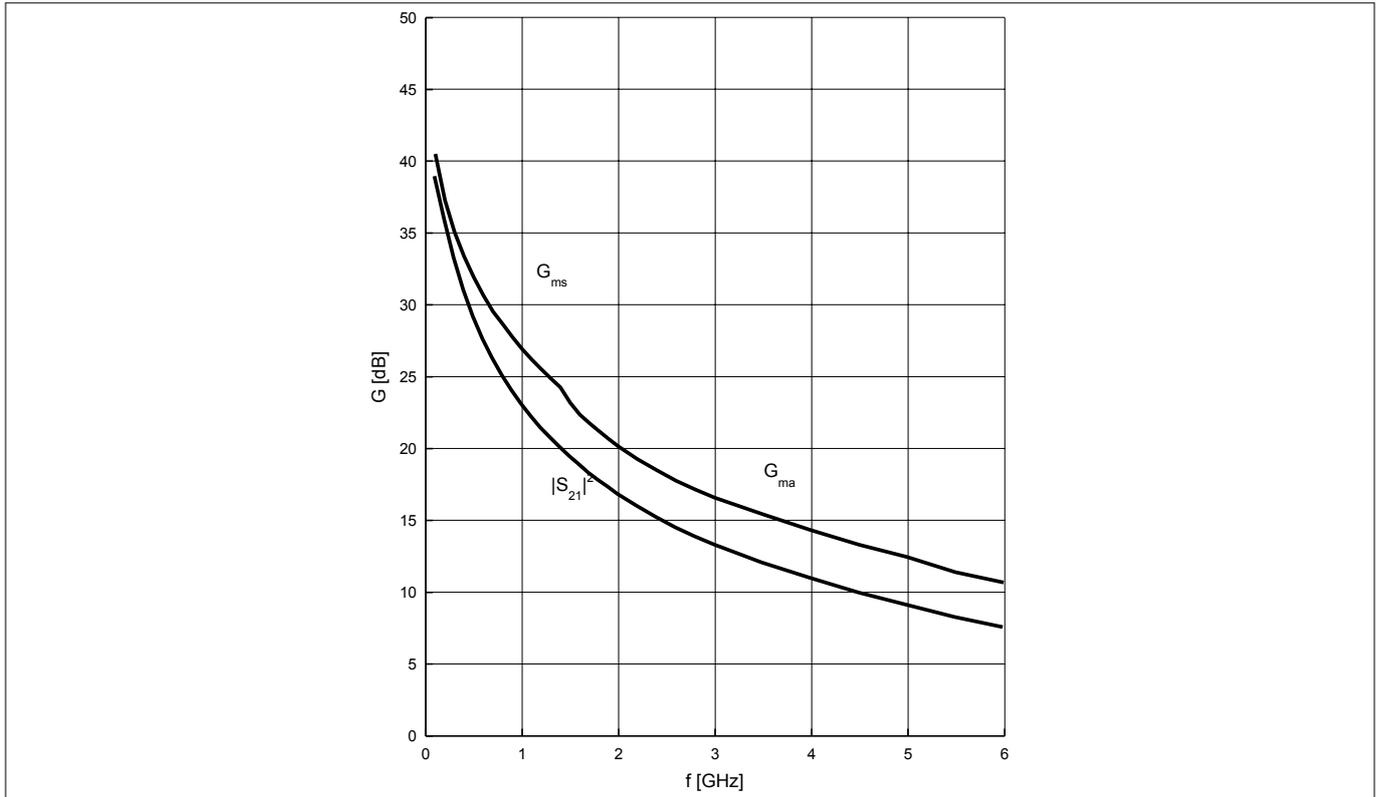## 3.4 Characteristic AC diagrams
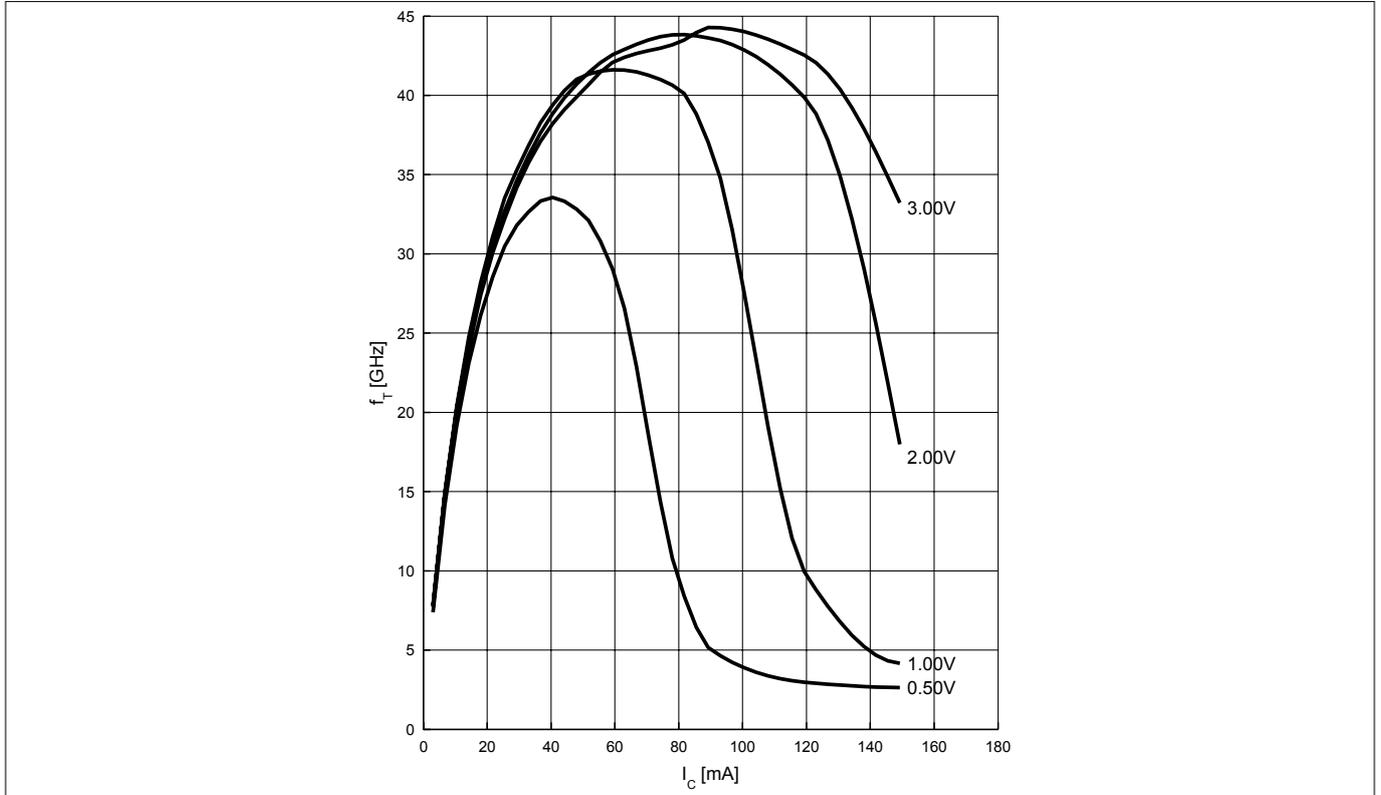
Figure 3   Transition frequency $f_T = f(I_C)$, $f = 1$ GHz, V_{CE} = parameter
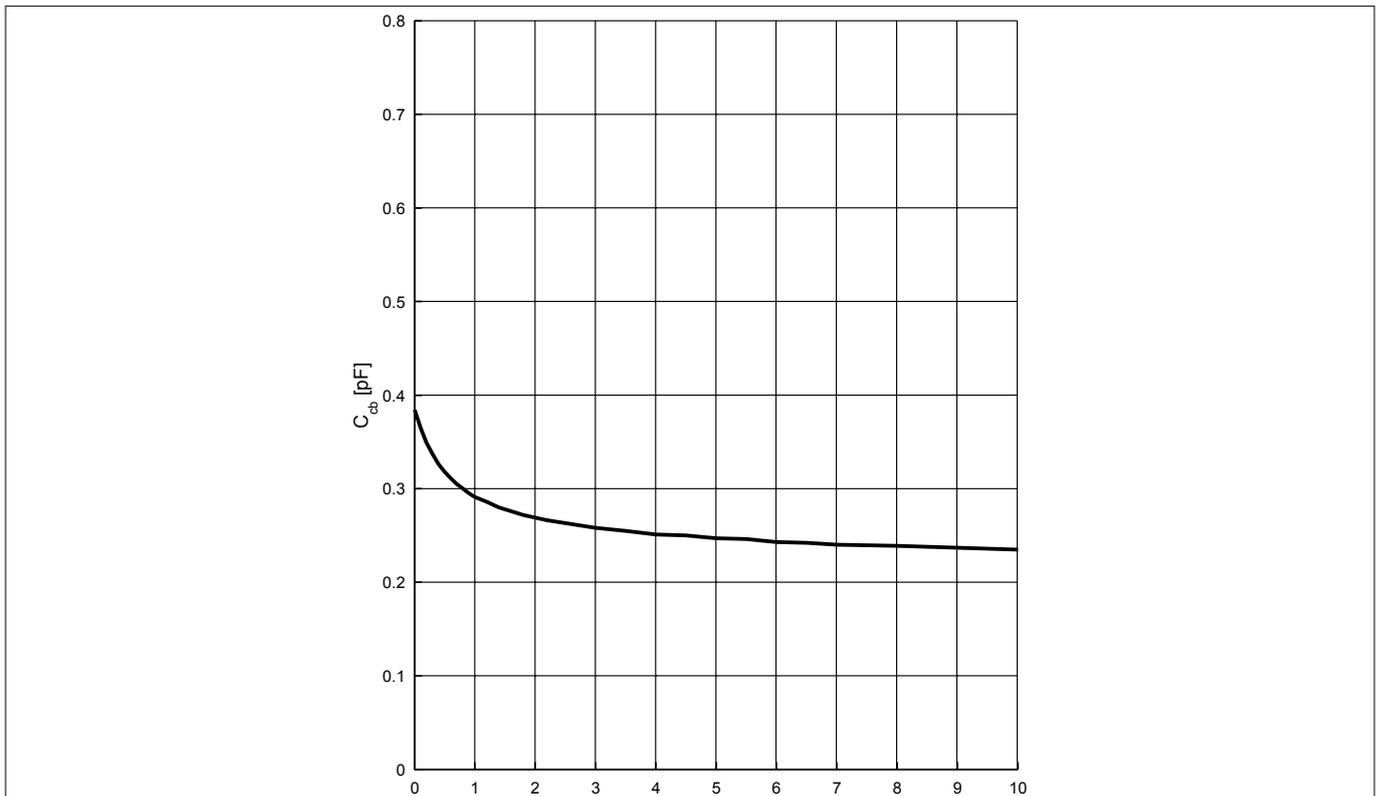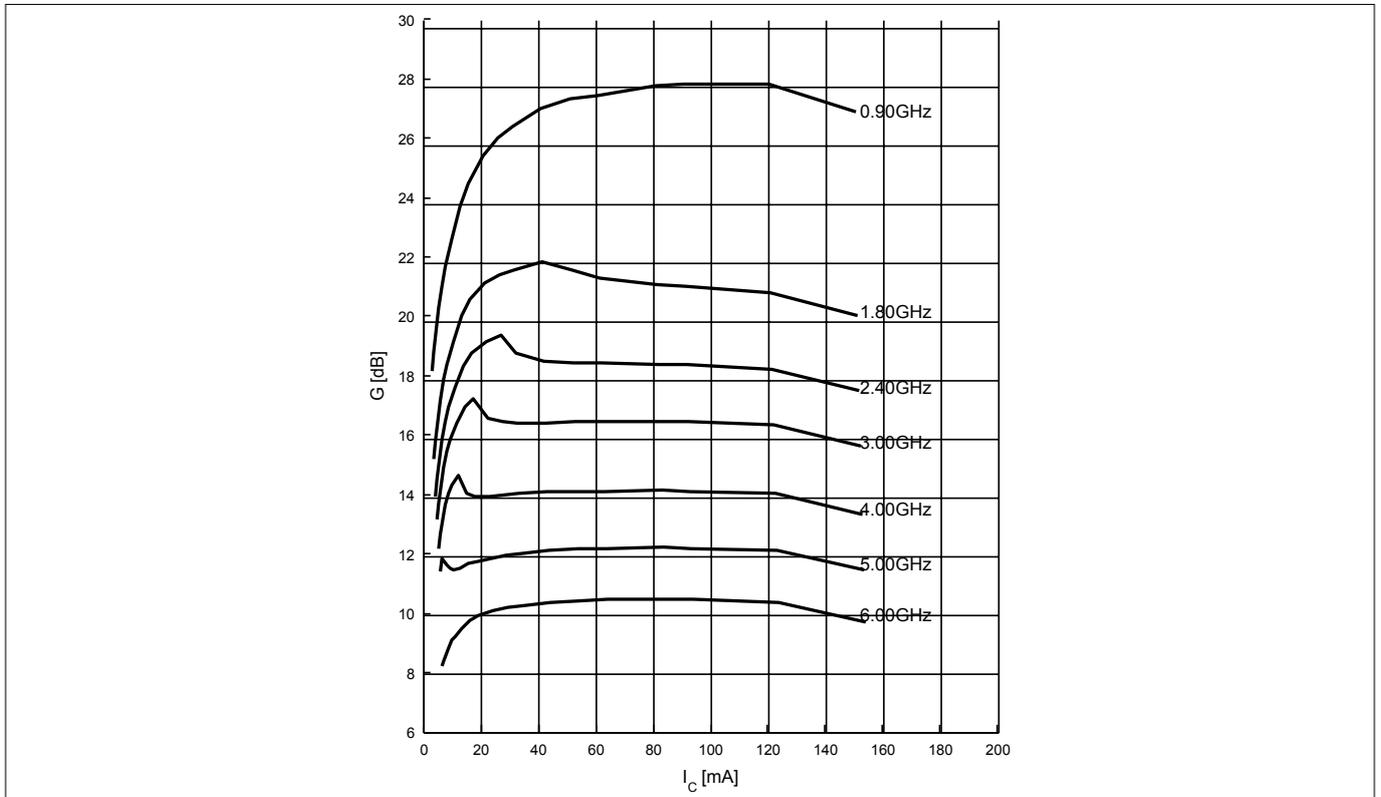

Figure 4   Collector base capacitance $C_{CB} = f(V_{CB})$, $f = 1$ MHz
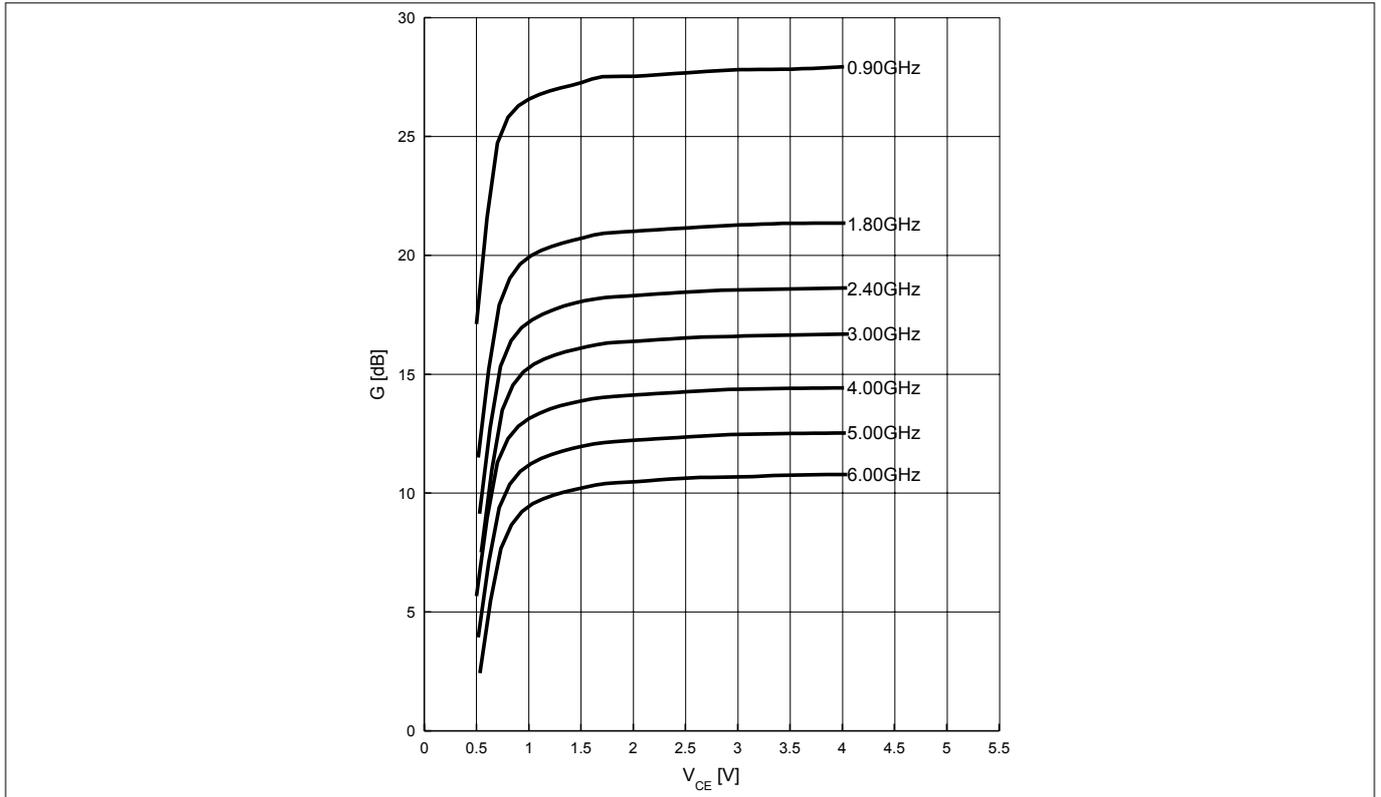
Electrical characteristics

Figure 5   Gain G_{ma}, G_{ms}, $|S_{21}|^2$ = f(f), V_{CE} = 3 V, I_C = 80 mA

Figure 6   Maximum power gain G_{max} = f(I_C), V_{CE} = 3 V, f = parameter in GHz

Electrical characteristics

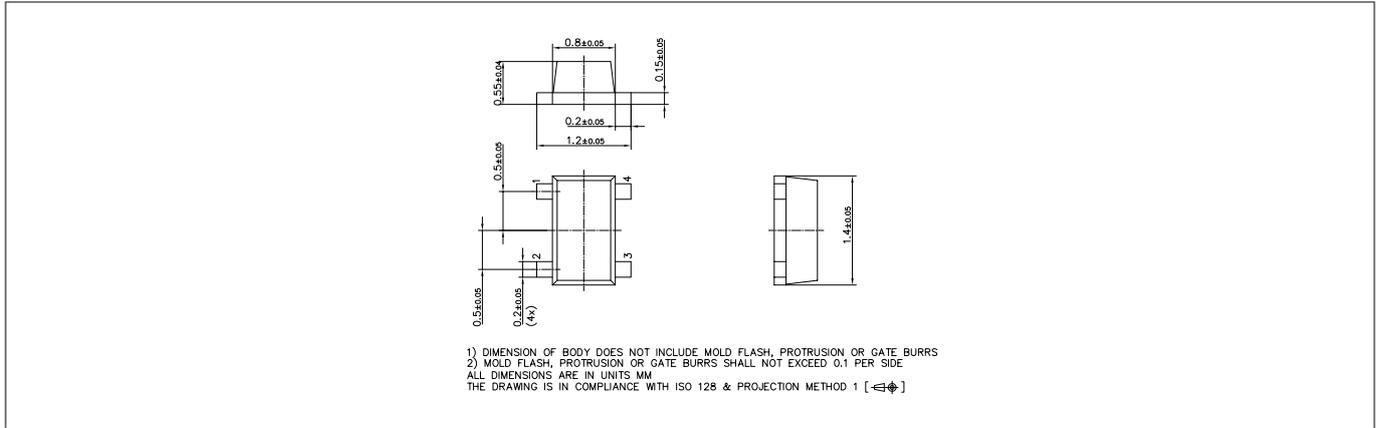

Figure 7   **Maximum power gain $G_{max} = f(V_{CE})$, I_C = 80 mA, f = parameter in GHz**
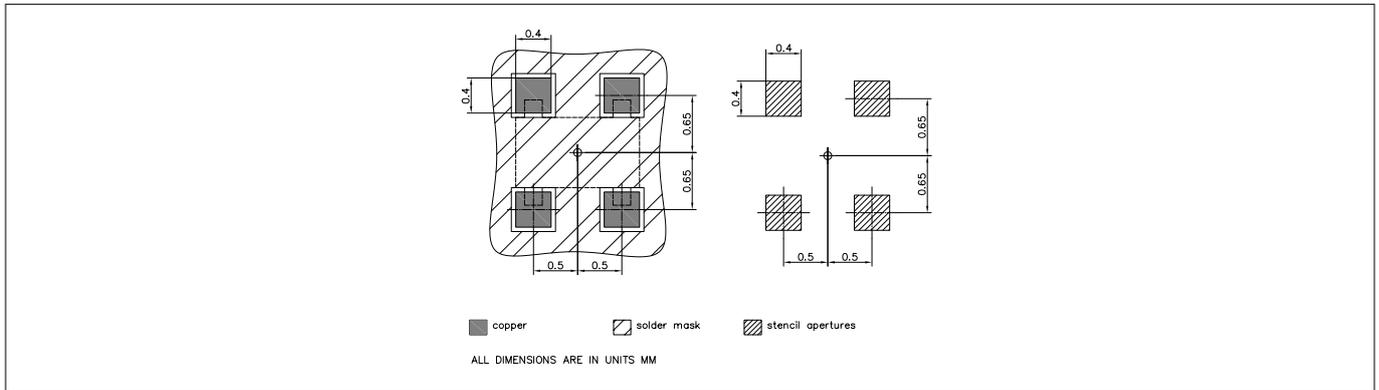
Note: *The curves shown in this chapter have been generated using typical devices but shall not be considered as a guarantee that all devices have identical characteristic curves. T_A = 25 °C.*
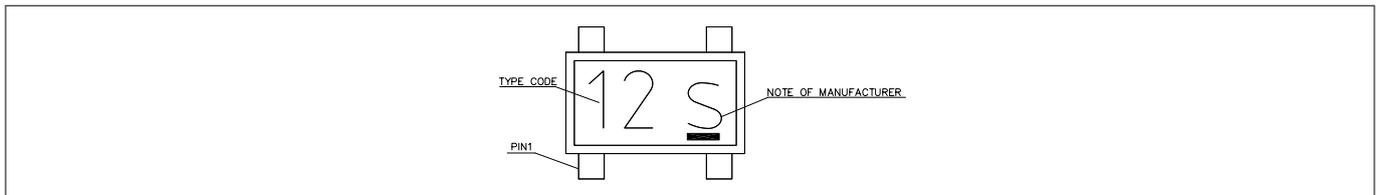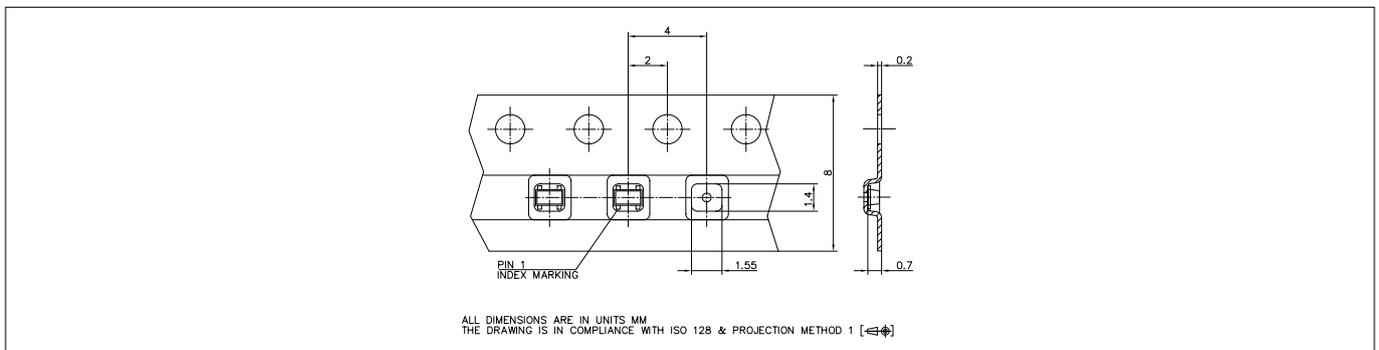
4 Package information TSFP-4-1

Figure 8 Package outline

Figure 9 Foot print

Figure 10 Marking layout example

Figure 11 Tape dimensions

Revision history

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

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