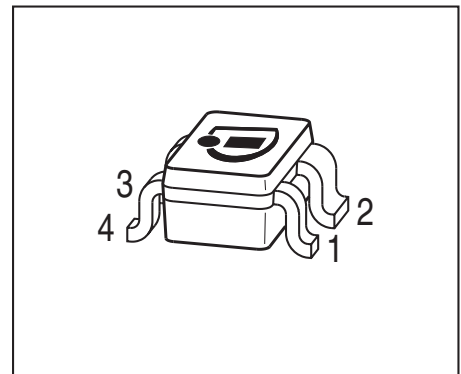


Low Noise Silicon Bipolar RF Transistor

- For ESD protected high gain low noise amplifier
- High ESD robustness
typical value 1000 V (HBM)
- Outstanding $G_{ms} = 21.5 \text{ dB @ } 1.8 \text{ GHz}$
Minimum noise figure $NF_{min} = 0.9 \text{ dB @ } 1.8 \text{ GHz}$
- Pb-free (RoHS compliant) and halogen-free package
with visible leads
- Qualification report according to AEC-Q101 available



ESD (Electrostatic discharge) sensitive device, observe handling precaution!

Type	Marking	Pin Configuration						Package
BFP540ESD	AUs	1=B	2=E	3=C	4=E	-	-	SOT343

Maximum Ratings at $T_A = 25 \text{ °C}$, unless otherwise specified

Parameter	Symbol	Value	Unit
Collector-emitter voltage $T_A = 25 \text{ °C}$ $T_A = -55 \text{ °C}$	V_{CEO}	4.5 4	V
Collector-emitter voltage	V_{CES}	10	
Collector-base voltage	V_{CBO}	10	
Emitter-base voltage	V_{EBO}	1	
Collector current	I_C	80	mA
Base current	I_B	8	
Total power dissipation ¹⁾ $T_S \leq 77 \text{ °C}$	P_{tot}	250	mW
Junction temperature	T_J	150	°C
Ambient temperature	T_A	-65 ... 150	
Storage temperature	T_{Stg}	-65 ... 150	

¹⁾ T_S is measured on the emitter lead at the soldering point to the pcb

Thermal Resistance

Parameter	Symbol	Value	Unit
Junction - soldering point ¹⁾	R_{thJS}	290	K/W

Electrical Characteristics at $T_A = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

DC Characteristics

Collector-emitter breakdown voltage $I_C = 1\text{ mA}$, $I_B = 0$	$V_{(BR)CEO}$	4.5	5	-	V
Collector-emitter cutoff current $V_{CE} = 10\text{ V}$, $V_{BE} = 0$	I_{CES}	-	-	10	μA
Collector-base cutoff current $V_{CB} = 5\text{ V}$, $I_E = 0$	I_{CBO}	-	-	100	nA
Emitter-base cutoff current $V_{EB} = 0.5\text{ V}$, $I_C = 0$	I_{EBO}	-	-	10	μA
DC current gain $I_C = 20\text{ mA}$, $V_{CE} = 3.5\text{ V}$, pulse measured	h_{FE}	50	110	170	-

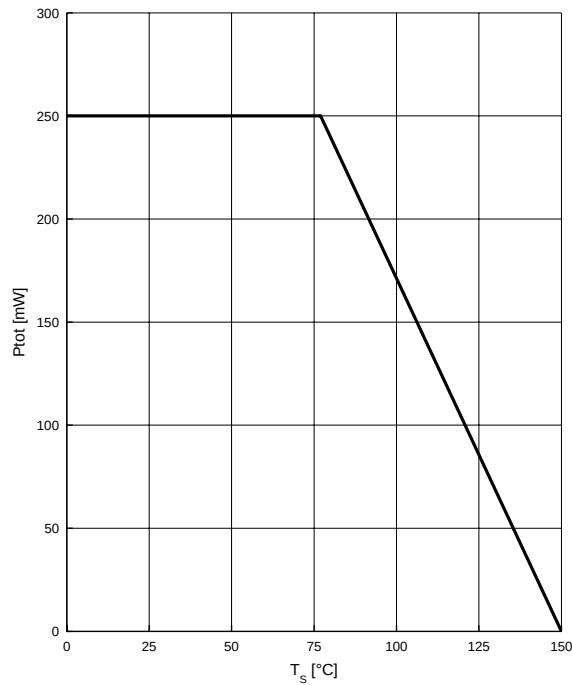
¹⁾For the definition of R_{thJS} please refer to Application Note AN077 (Thermal Resistance Calculation)

Electrical Characteristics at $T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise specified

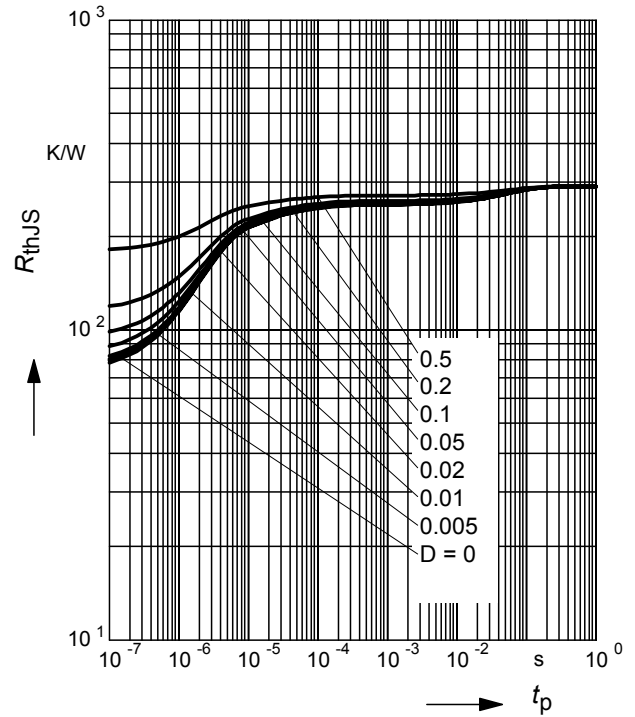
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics (verified by random sampling)					
Transition frequency $I_C = 50\text{ mA}$, $V_{CE} = 4\text{ V}$, $f = 1\text{ GHz}$	f_T	21	30	-	GHz
Collector-base capacitance $V_{CB} = 2\text{ V}$, $f = 1\text{ MHz}$, $V_{BE} = 0$, emitter grounded	C_{cb}	-	0.14	0.24	pF
Collector emitter capacitance $V_{CE} = 2\text{ V}$, $f = 1\text{ MHz}$, $V_{BE} = 0$, base grounded	C_{ce}	-	0.41	-	
Emitter-base capacitance $V_{EB} = 0.5\text{ V}$, $f = 1\text{ MHz}$, $V_{CB} = 0$, collector grounded	C_{eb}	-	0.59	-	
Minimum noise figure $I_C = 5\text{ mA}$, $V_{CE} = 2\text{ V}$, $f = 1.8\text{ GHz}$, $Z_S = Z_{Sopt}$ $I_C = 5\text{ mA}$, $V_{CE} = 2\text{ V}$, $f = 3\text{ GHz}$, $Z_S = Z_{Sopt}$	NF_{min}	- -	0.9 1.3	1.4 -	dB
Power gain, maximum stable ¹⁾ $I_C = 20\text{ mA}$, $V_{CE} = 2\text{ V}$, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$, $f = 1.8\text{ GHz}$	G_{ms}	-	21.5	-	dB
Power gain, maximum available ¹⁾ $I_C = 20\text{ mA}$, $V_{CE} = 2\text{ V}$, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$, $f = 3\text{ GHz}$	G_{ma}	-	16	-	dB
Transducer gain $I_C = 20\text{ mA}$, $V_{CE} = 2\text{ V}$, $Z_S = Z_L = 50\Omega$, $f = 1.8\text{GHz}$ $I_C = 20\text{ mA}$, $V_{CE} = 2\text{ V}$, $Z_S = Z_L = 50\Omega$, $f = 3\text{GHz}$	$ S_{21e} ^2$	16 -	18.5 14	- -	dB
Third order intercept point at output ²⁾ $V_{CE} = 2\text{ V}$, $I_C = 20\text{ mA}$, $Z_S = Z_L = 50\Omega$, $f = 1.8\text{GHz}$	$IP3$	-	24.5	-	dBm
1dB compression point at output $I_C = 20\text{ mA}$, $V_{CE} = 2\text{ V}$, $Z_S = Z_L = 50\Omega$, $f = 1.8\text{GHz}$	P_{-1dB}	-	11	-	

¹⁾ $G_{ma} = |S_{21e} / S_{12e}| (k - (k^2 - 1)^{1/2})$, $G_{ms} = |S_{21e} / S_{12e}|$
²⁾ IP3 value depends on termination of all intermodulation frequency components.
Termination used for this measurement is 50Ω from 0.1 MHz to 6 GHz

Total power dissipation $P_{\text{tot}} = f(T_S)$

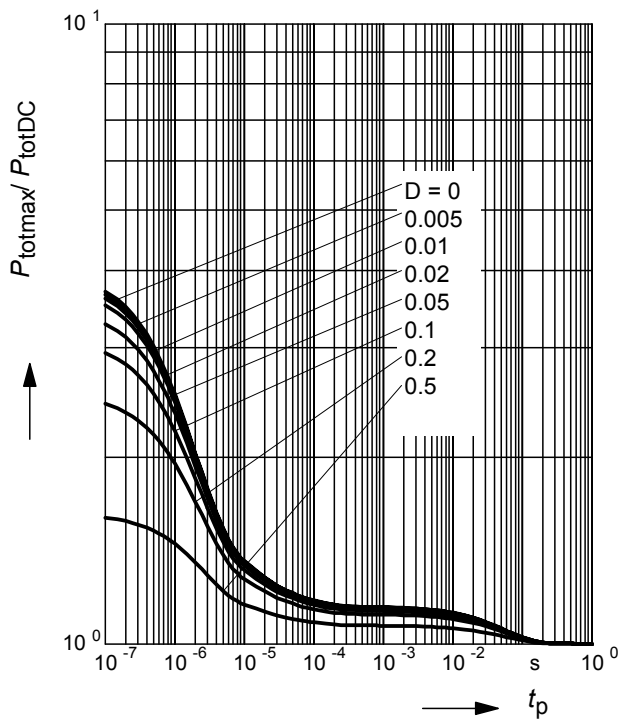


Permissible Pulse Load $R_{\text{thJS}} = f(t_p)$



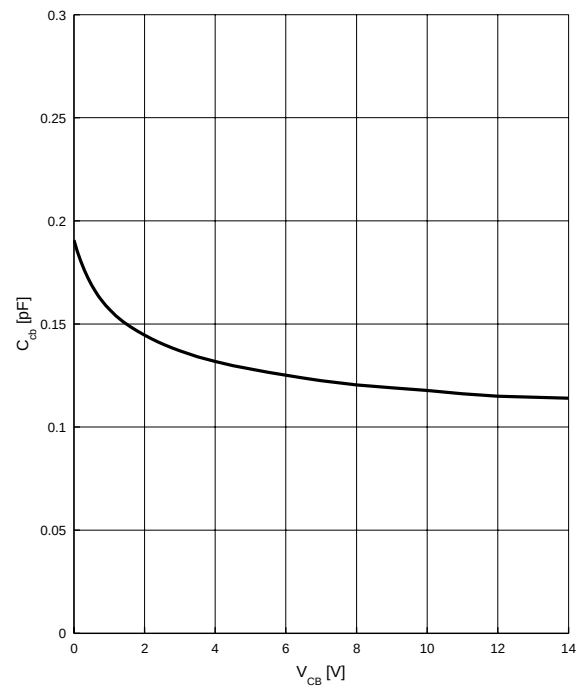
Permissible Pulse Load

$$P_{\text{totmax}}/P_{\text{totDC}} = f(t_p)$$



Collector-base capacitance $C_{\text{cb}} = f(V_{\text{CB}})$

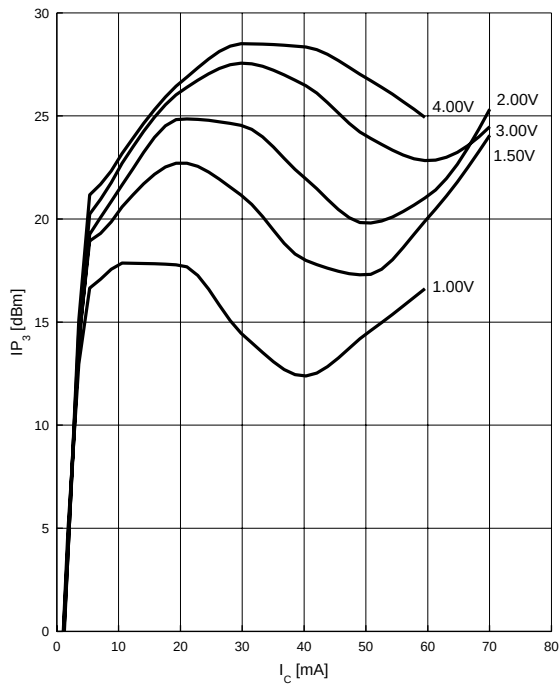
$f = 1 \text{ MHz}$



Third order Intercept Point $IP_3 = f(I_C)$

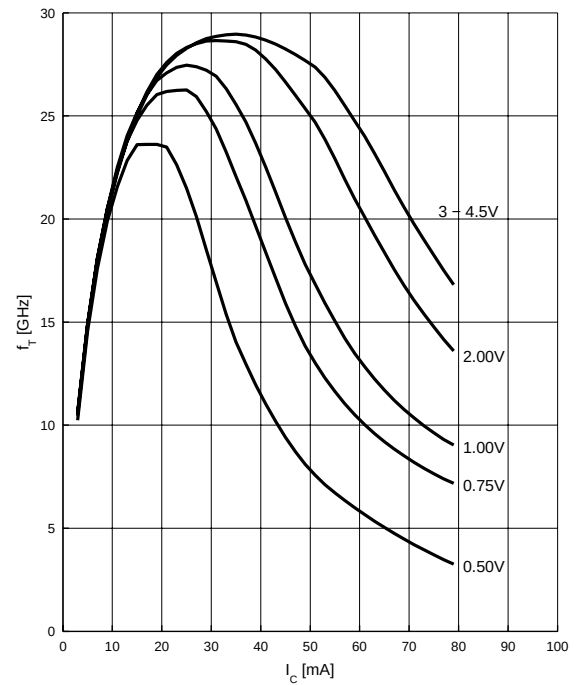
(Output, $Z_S = Z_L = 50 \Omega$)

V_{CE} = parameter, $f = 900 \text{ MHz}$



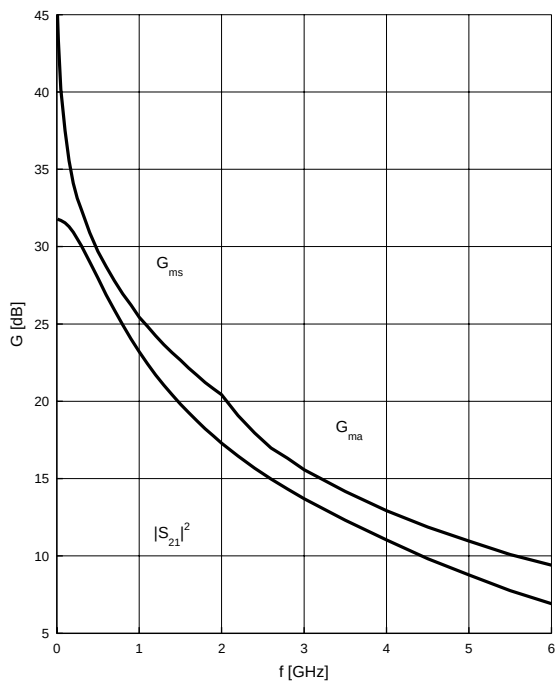
Transition frequency $f_T = f(I_C)$

V_{CE} = parameter in V, $f = 2 \text{ GHz}$



Power gain $G_{ma}, G_{ms} = f(f)$

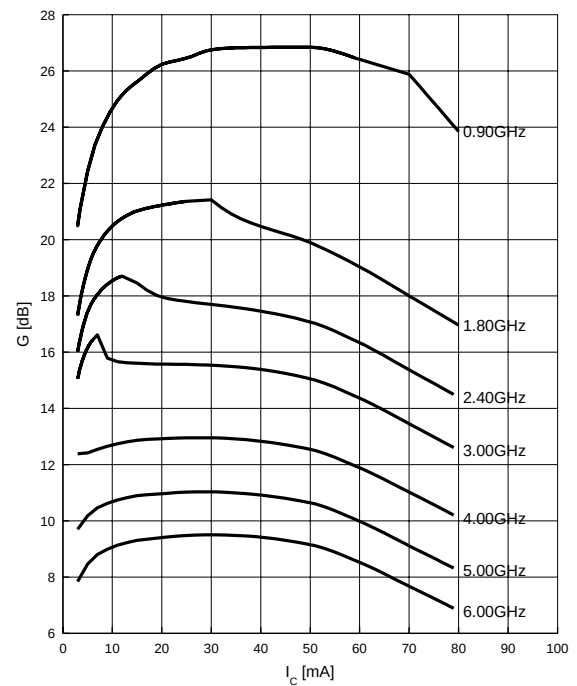
$V_{CE} = 3 \text{ V}$, $I_C = 25 \text{ mA}$



Power gain $G_{ma}, G_{ms} = f(I_C)$

$V_{CE} = 3 \text{ V}$

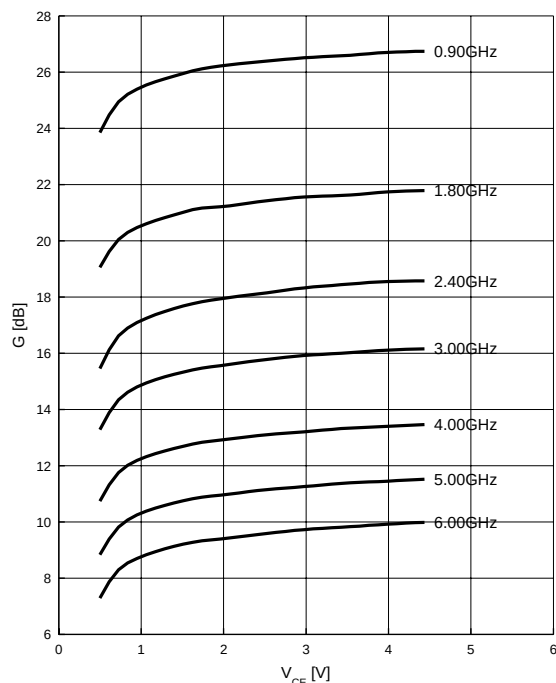
f = parameter in GHz



Power gain G_{ma} , $G_{ms} = f(V_{CE})$

$I_C = 20 \text{ mA}$

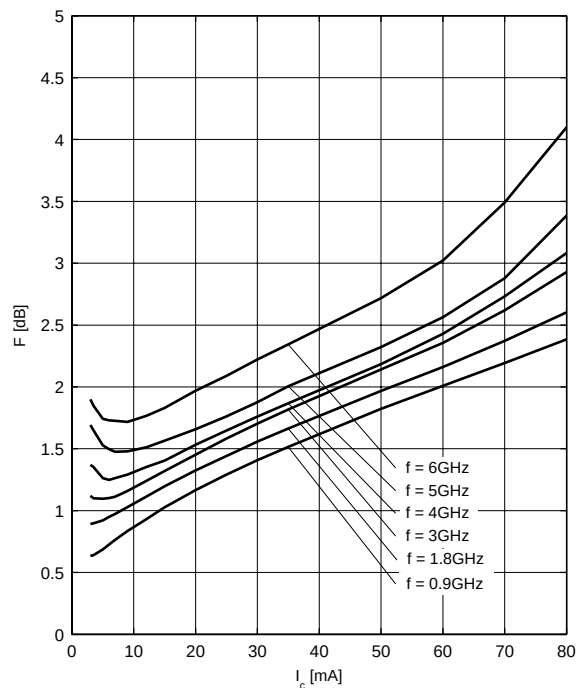
$f = \text{parameter in GHz}$



Noise figure $F = f(I_C)$

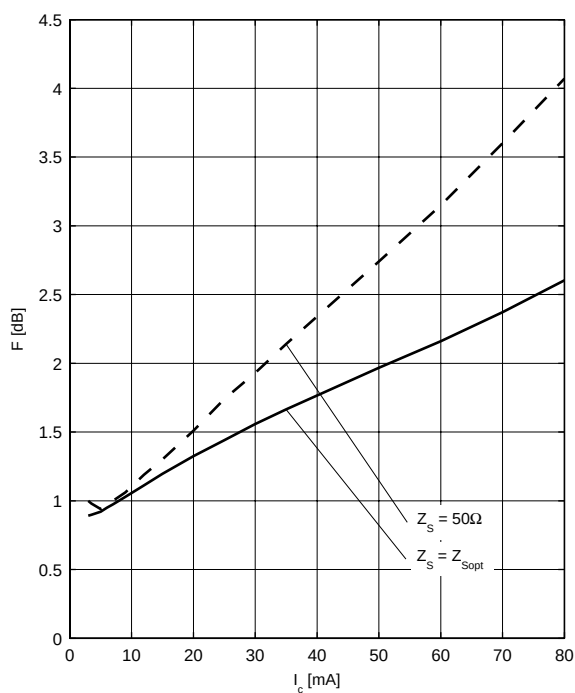
$V_{CE} = 3 \text{ V}$, $f = \text{parameter in GHz}$

$Z_S = Z_{Sopt}$



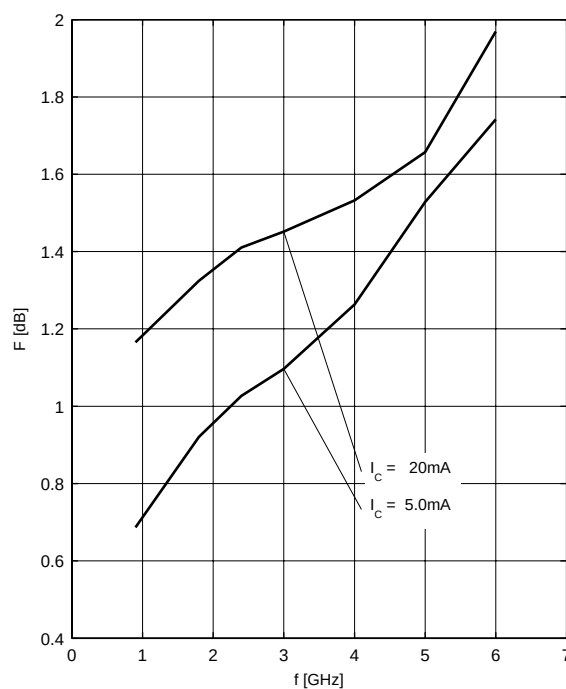
Noise figure $F = f(I_C)$

$V_{CE} = 3 \text{ V}$, $f = 1.8 \text{ GHz}$



Noise figure $F = f(f)$

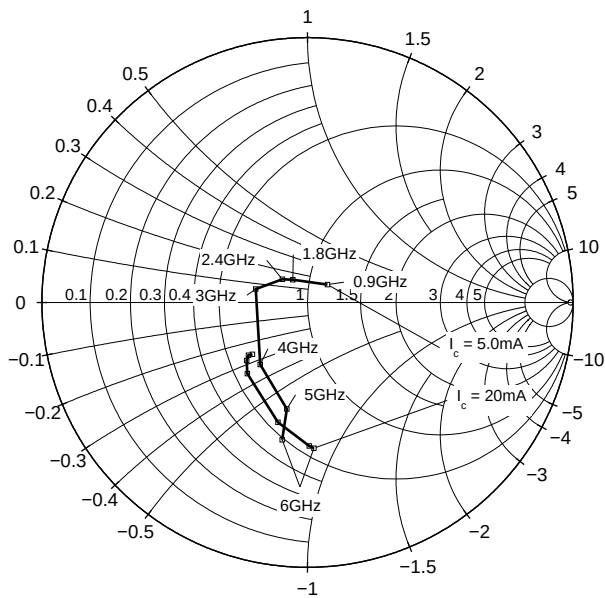
$V_{CE} = 3 \text{ V}$, $Z_S = Z_{Sopt}$



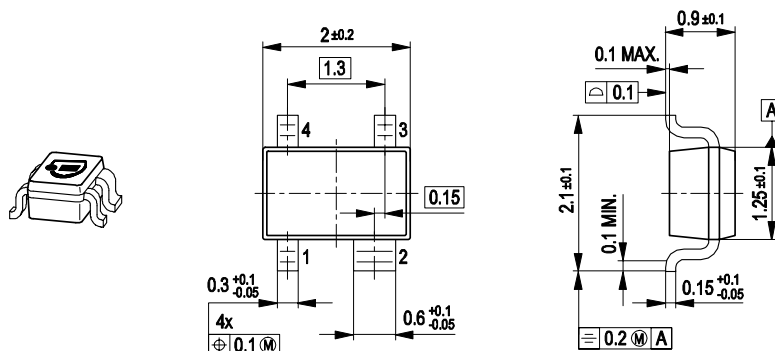
Source impedance for min.

noise figure vs. frequency

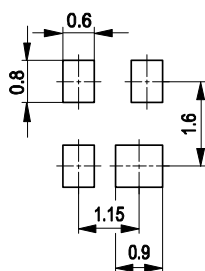
$V_{CE} = 3\text{ V}$, $I_C = 5\text{ mA} / 20\text{ mA}$



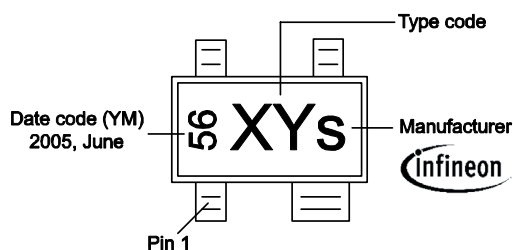
Package Outline



Foot Print

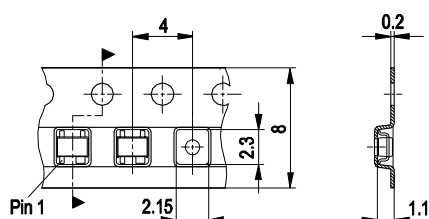


Marking Layout (Example)



Standard Packing

Reel $\varnothing 180 \text{ mm}$ = 3.000 Pieces/Reel
 Reel $\varnothing 330 \text{ mm}$ = 10.000 Pieces/Reel



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