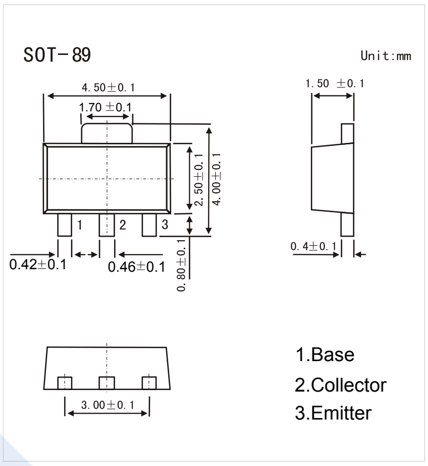
NPN Wideband Silicon RF Transistor

BFU590Q



■ Features

- Medium power, high linearity, high breakdown voltage RF transistor
- Maximum stable gain 11 dB at 900 MHz
- $P_{L(1dB)}$ 22 dBm at 900 MHz
- 8GHz f_T silicon technology

■ Absolute Maximum Ratings (Ta = 25℃)

Parameter	Symbol	Rating	Unit
Collector - Base Voltage	V_{CBO}	30	V
Collector - Emitter Voltage open base	V_{CEO}	16	
Collector - Emitter Voltage shorted base	V_{CES}	30	
Emitter - Base Voltage	V_{EBO}	3	
Collector Current - Continuous	I_C	300	mA
Total power dissipation Ts≤ 85 °C *1	P_{tot}	1	W
Electrostatic discharge voltage Human Body Model (HBM) According to JEDEC standard 22-A114E Charged Device Model (CDM) According to JEDEC standard 22-C101B	V_{ESD}	±250 ±2	V kV
Thermal resistance from junction to solder point *2	$R_{th(j-sp)}$	30	℃/W
Junction Temperature	T_J	150	℃
Storage Temperature Range	T_{stg}	-65 to 150	

*1: T_{sp} is the temperature at the solder point of the collector lead.

*2: Tsp is the temperature at the solder point of the collector lead.

T_{sp} has the following relation to the ambient temperature Tamb:

$T_{sp}=T_{amb}+P \times R_{th(sp-a)}$

With P being the power dissipation and $R_{th(sp-a)}$ being the thermal resistance between the solder point and ambient. $R_{th(sp-a)}$ is determined by the heat transfer properties in the application.

The heat transfer properties are set by the application board materials, the board layout and the environment e.g. housing.

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BFU590Q

■ Electrical Characteristics Ta = 25℃, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector- base breakdown voltage	V_{CBO}	I_C= 100 μA， I_E= 0	30			V
Collector- emitter breakdown voltage	V_{CEO}	I_C= 1m A， I_B= 0	16			
Emitter - base breakdown voltage	V_{EBO}	I_E= 100 μA， I_C= 0	3			
Collector-base cut-off current	I_{CBO}	V_{CB}= 8 V , I_E= 0		<1		nA
DC current gain	h_{FE}	V_{CE}= 8V, I_C= 80mA	60		130	
Emitter capacitance	C_e	V_{EB}=0.5V; f=1MHz		3.6		pF
Feedback capacitance	C_{re}	V_{CE}=8V; f=1MHz		1.3		
Collector capacitance	C_c	V_{CB}=8V; f=1MHz		2		
Maximum power gain *1	$G_{p(max)}$	f=433MHz; V_{CE}=8V; I_C=10mA		17		dB
		f=433MHz; V_{CE}=8V; I_C=50mA		17.5		
		f=433MHz; V_{CE}=8V; I_C=80mA		17.5		
		f=900MHz; V_{CE}=8V; I_C=10mA		11		
		f=900MHz; V_{CE}=8V; I_C=50mA		11		
		f=900MHz; V_{CE}=8V; I_C=80mA		11		
		f=1800MHz; V_{CE}=8V; I_C=10mA		6		
		f=1800MHz; V_{CE}=8V; I_C=50mA		6.5		
		f=1800MHz; V_{CE}=8V; I_C=80mA		6.5		
Insertion power gain	$\|s_{21}\|^2$	f=433MHz; V_{CE}=8V; I_C=10mA		14.5		
		f=433MHz; V_{CE}=8V; I_C=50mA		16		
		f=433MHz; V_{CE}=8V; I_C=80mA		16		
		f=900MHz; V_{CE}=8V; I_C=10mA		9		
		f=900MHz; V_{CE}=8V; I_C=50mA		10		
		f=900MHz; V_{CE}=8V; I_C=80mA		10		
		f=1800MHz; V_{CE}=8V; I_C=10mA		3.5		
		f=1800MHz; V_{CE}=8V; I_C=50mA		4.5		
		f=1800MHz; V_{CE}=8V; I_C=80mA		4.5		
Output power at 1dB gain compression	$P_{L(1dB)}$	f=433MHz; V_{CE}=8V; Z_S=Z_L=50Ω; I_C=50mA		20.5		dBm
		f=433MHz; V_{CE}=8V; Z_S=Z_L=50Ω; I_C=80mA		23		
		f=900MHz; V_{CE}=8V; Z_S=Z_L=50Ω; I_C=50mA		20		
		f=900MHz; V_{CE}=8V; Z_S=Z_L=50Ω; I_C=80mA		22		
		f=1800MHz; V_{CE}=8V; Z_S=Z_L=50Ω; I_C=50mA		19.5		
		f=1800MHz; V_{CE}=8V; Z_S=Z_L=50Ω; I_C=80mA		22		

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BFU590Q

■ Electrical Characteristics Ta = 25℃, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Output third-order intercept point	$IP3_o$	f_1=433MHz; f_2=434MHz; V_{CE}=8V; Z_S=Z_L=50Ω				dBm
		I_C = 50mA		30		
		I_C = 80mA		32.5		
		f_1=900MHz; f_2=901MHz; V_{CE}=8V; Z_S=Z_L=50Ω				
		I_C = 50mA		29.5		
		I_C = 80mA		31.5		
		f_1=1800MHz; f_2=1801MHz; V_{CE}=8V; Z_S=Z_L=50Ω				
		I_C = 50mA				
		I_C = 80mA				
Transition frequency	f_T	I_C=50mA; V_{CE}=8V; f=900 MHz		8		GHz

*1: If K>1 then $G_{p(max)}$ is the maximum power gain. If K<1 then $G_{p(max)}$=MSG.

■ Marking

Marking	S59

■ Typical Characterisitics

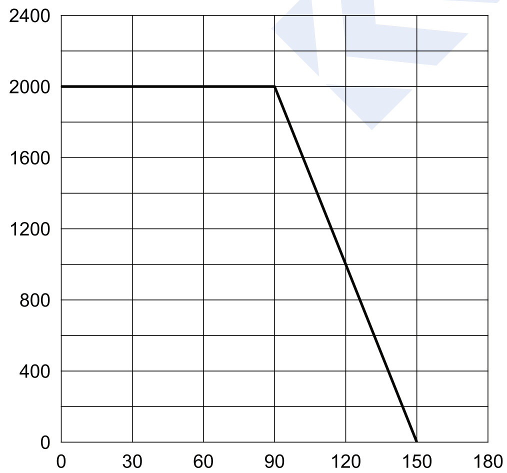
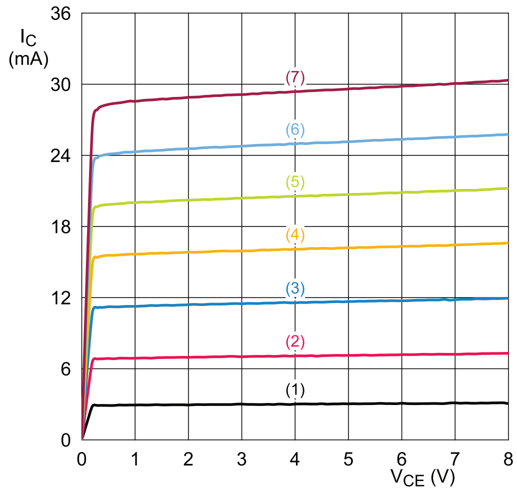


Fig 1. Power derating curve



T_{amb} = 25℃.

(1) I_B = 25μA (5) I_B = 225μA

(2) I_B = 75μA (6) I_B = 275 μA

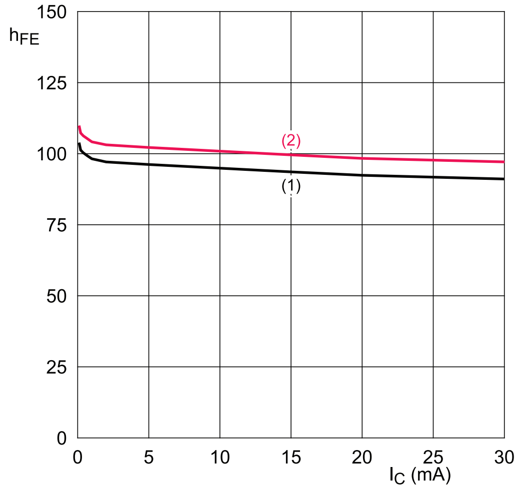
(3) I_B = 125μA (7) I_B = 325 μA

(4) I_B = 175μA

Fig 2. Collector current as a function of collector-emitter voltage; typical values

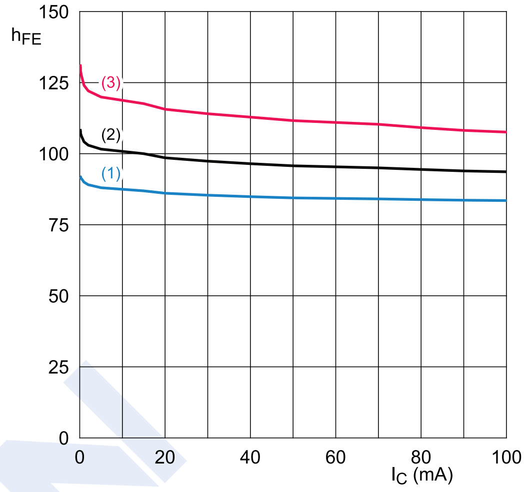
NPN Wideband Silicon RF Transistor

BFU590Q



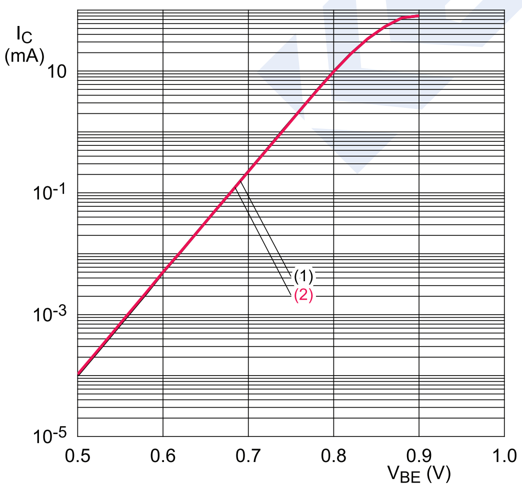
T_{amb} = 25℃
(1) V_{CE} = 3.0 V
(2) V_{CE} = 8.0 V

Fig 3. DC current gain as a function of collector current; typical values



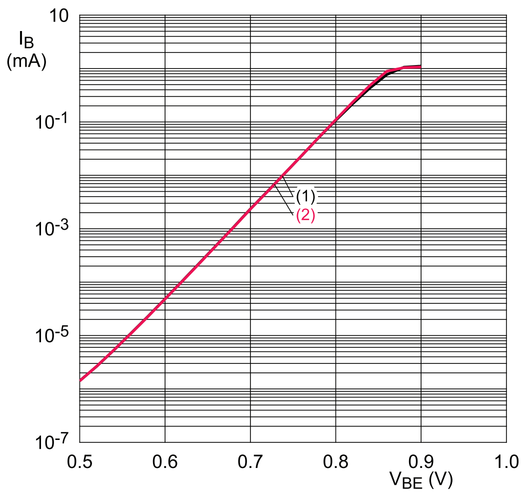
V_{CE} = 8 V.
(1) T_{amb} = - 40℃
(2) T_{amb} = +25 ℃
(3) T_{amb} = +125℃

Fig 4. DC current gain as a function of collector current; typical values



T_{amb} = 25 ℃.
(1) V_{CE} = 3.0 V
(2) V_{CE} = 8.0 V

Fig 5. Collector current as a function of base-emitter voltage; typical values

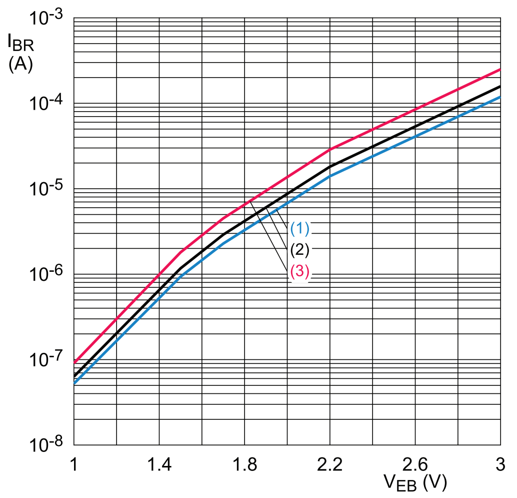


T_{amb} = 25℃.
(1) V_{CE} = 3.0 V
(2) V_{CE} = 8.0 V

Fig 6. Base current as a function of base-emitter voltage; typical values

NPN Wideband Silicon RF Transistor

BFU590Q



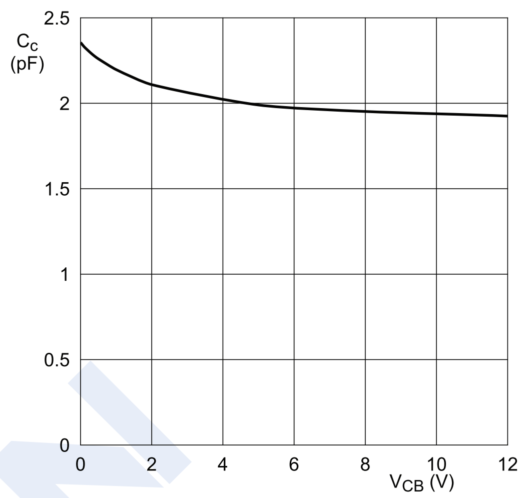
V_{CE} = 3 V.

(1) T_{amb} = - 40℃

(2) T_{amb} = +25 ℃

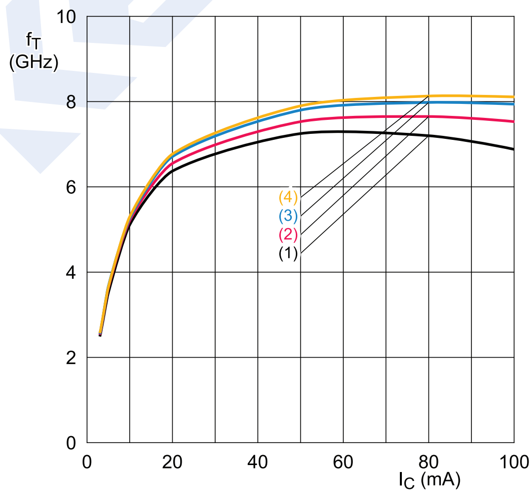
(3) T_{amb} = +125℃

Fig 7. Reverse base current as a function of emitter-base voltage; typical values



I_C = 0 mA; f = 1 MHz; T_{amb} = 25 ℃.

Fig 8. Collector capacitance as a function of collector-base voltage; typical values



T_{amb} = 25℃.

(1) V_{CE} = 3.3 V

(2) V_{CE} = 5.0 V

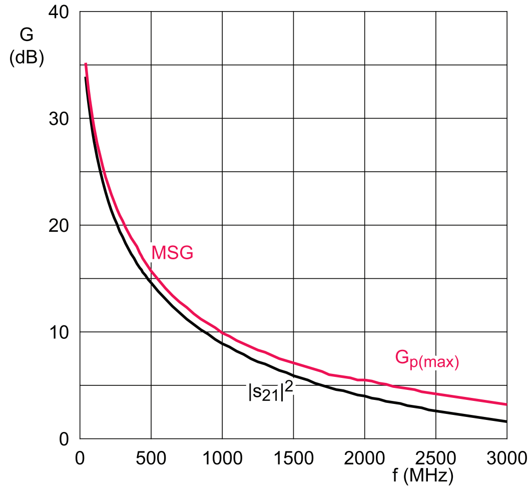
(3) V_{CE} = 8.0 V

(4) V_{CE} = 12.0 V

Fig 9. Transition frequency as a function of collector current; typical values

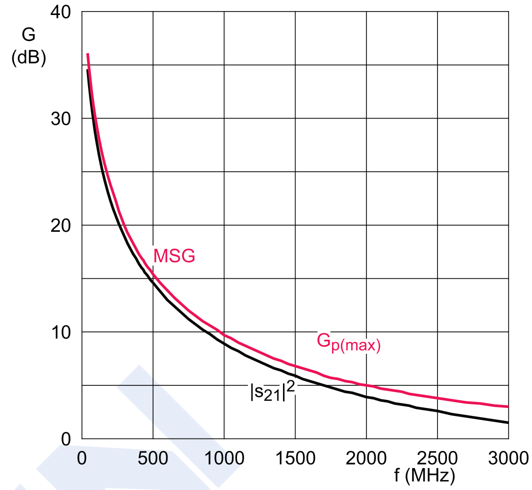
NPN Wideband Silicon RF Transistor

BFU590Q



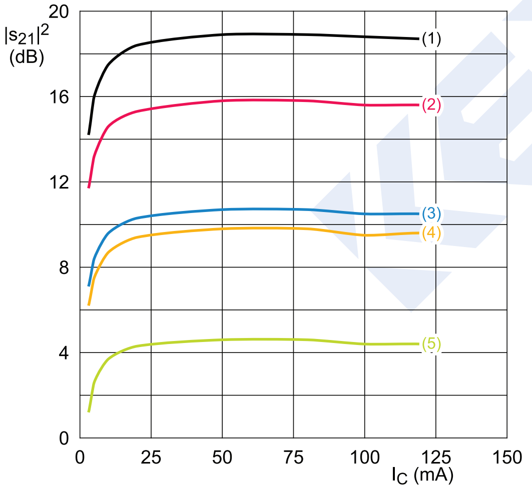
I_C = 50 mA; V_{CE} = 8 V; T_{amb} = 25℃.

Fig 10. Gain as a function of frequency; typical values



I_C = 80 mA; V_{CE} = 8 V; T_{amb} = 25℃.

Fig 11. Gain as a function of frequency; typical values



V_{CE} = 8 V; T_{amb} = 25℃.

(1) f = 300 MHz

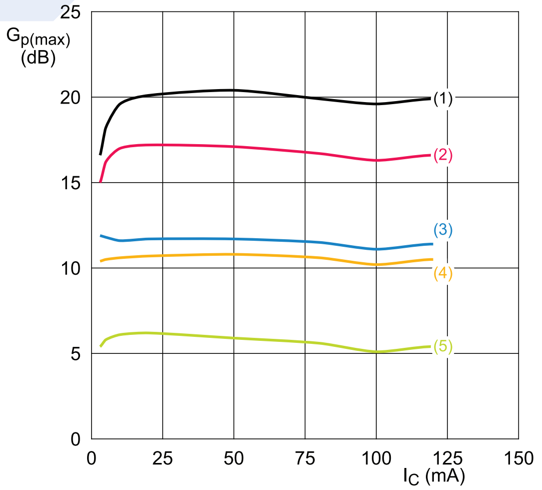
(2) f = 433 MHz

(3) f = 800 MHz

(4) f = 900 MHz

(5) f = 1800 MHz

Fig 12. Insertion power gain as a function of collector current; typical values



V_{CE} = 8 V; T_{amb} = 25℃.

If K >1 then $G_{p(max)}$ = maximum power gain. If K < 1 then $G_{p(max)}$ = MSG.

(1) f = 300 MHz

(2) f = 433 MHz

(3) f = 800 MHz

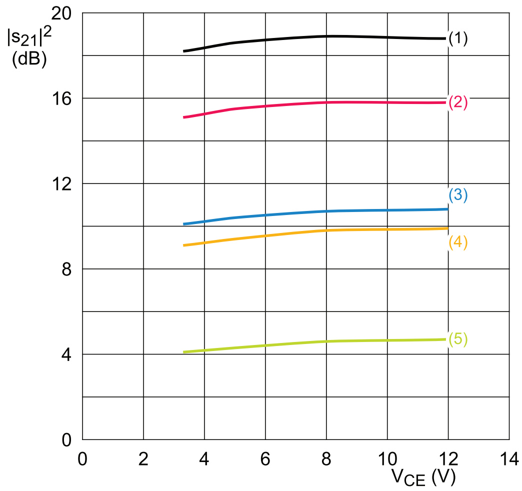
(4) f = 900 MHz

(5) f = 1800 MHz

Fig 13. Maximum power gain as a function of collector current; typical values

NPN Wideband Silicon RF Transistor

BFU590Q



I_C = 50 mA; T_{amb} = 25℃.

(1) f = 300 MHz

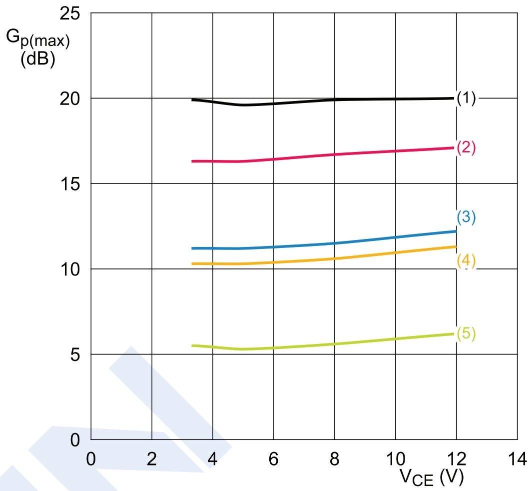
(2) f = 433 MHz

(3) f = 800 MHz

(4) f = 900 MHz

(5) f = 1800 MHz

Fig 14. Insertion power gain as a function of collector-emitter voltage; typical values



I_C = 80 mA; T_{amb} = 25℃.

If K >1 then $G_{p(max)}$ = maximum power gain. If K < 1 then $G_{p(max)}$ = MSG.

(1) f = 300 MHz

(2) f = 433 MHz

(3) f = 800 MHz

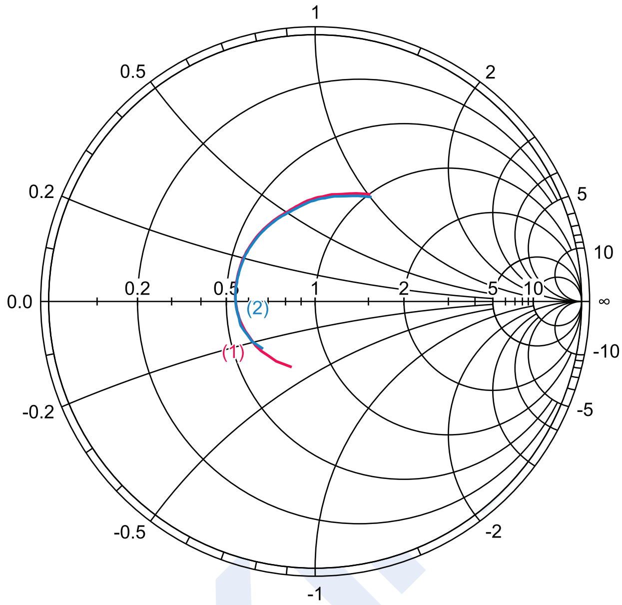
(4) f = 900 MHz

(5) f = 1800 MHz

Fig 15. Maximum power gain as a function of collector-emitter voltage; typical values

NPN Wideband Silicon RF Transistor

BFU590Q

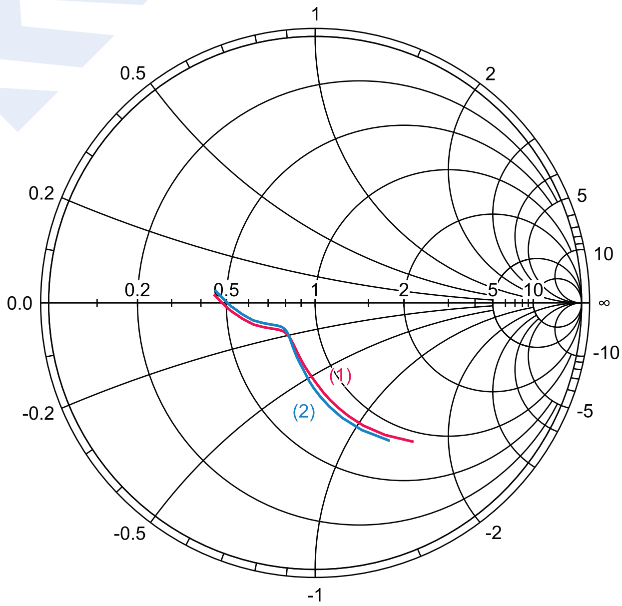


V_{CE} = 8 V; 40 MHz≤ f≤ 3 GHz.

(1) I_C = 50 mA

(2) I_C = 80 mA

Fig 16. Input reflection coefficient (s_{11}); typical values



V_{CE} = 8 V; 40 MHz≤ f ≤ 3 GHz.

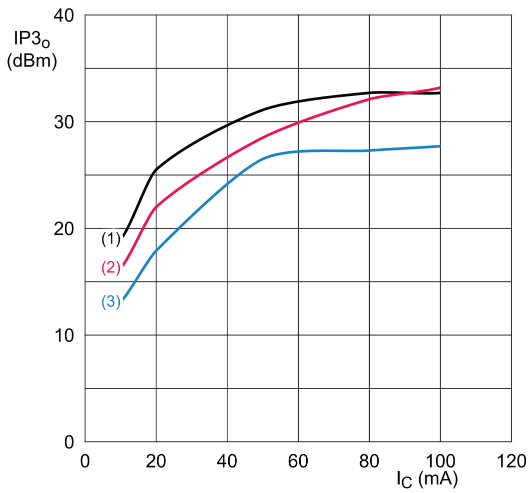
(1) I_C = 50 mA

(2) I_C = 80 mA

Fig 17. Output reflection coefficient (s_{22}); typical values

NPN Wideband Silicon RF Transistor

BFU590Q



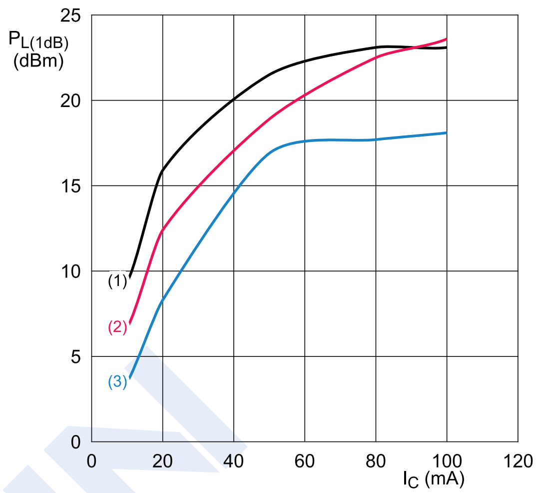
V_{CE} = 8 V; T_{amb} = 25℃.

(1) f_1 = 433 MHz; f_2 = 434 MHz

(2) f_1 = 900 MHz; f_2 = 901 MHz

(3) f_1 = 1800 MHz; f_2 = 1801 MHz

Fig 18. Output third-order intercept point as a function of collector current; typical values



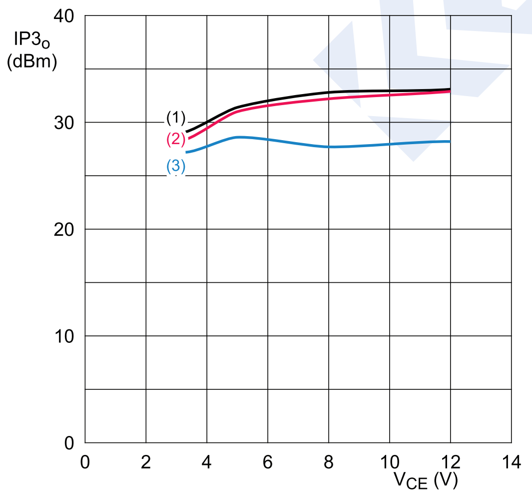
V_{CE} = 8 V; T_{amb} = 25℃.

(1) f = 433 MHz

(2) f = 900 MHz

(3) f = 1800 MHz

Fig 19. Output power at 1 dB gain compression as a function of collector current; typical values



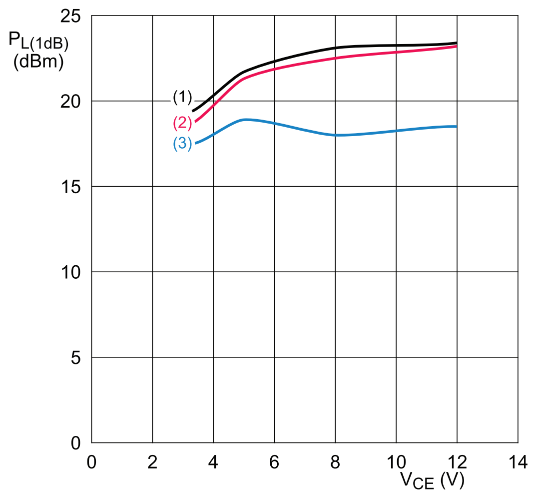
I_C = 80 mA; T_{amb} = 25℃.

(1) f_1 = 433 MHz; f_2 = 434 MHz

(2) f_1 = 900 MHz; f_2 = 901 MHz

(3) f_1 = 1800 MHz; f_2 = 1801 MHz

Fig 20. Output third-order intercept point as a function of collector-emitter voltage; typical values



I_C = 80 mA; T_{amb} = 25℃.

(1) f = 433 MHz

(2) f = 900 MHz

(3) f = 1800 MHz

Fig 21. Output power at 1 dB gain compression as a function of collector-emitter voltage; typical values