NEC

SILICON TRANSISTOR
2SC3356

MICROWAVE LOW NOISE AMPLIFIER
NPN SILICON EPITAXIAL TRANSISTOR

DESCRIPTION

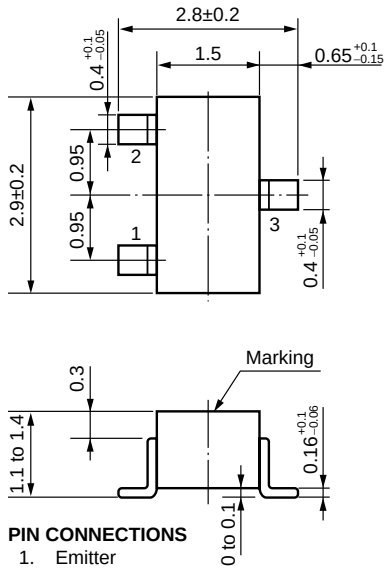
The 2SC3356 is an NPN silicon epitaxial transistor designed for low noise amplifier at VHF, UHF and CATV band.

It has dynamic range and good current characteristic.

FEATURES

- Low Noise and High Gain
  NF = 1.1 dB TYP., G_a = 11 dB TYP. @V_{CE} = 10 V, I_C = 7 mA, f = 1.0 GHz
- High Power Gain
  MAG = 13 dB TYP. @V_{CE} = 10 V, I_C = 20 mA, f = 1.0 GHz

PACKAGE DIMENSIONS
(Units: mm)



PIN CONNECTIONS
1. Emitter
2. Base
3. Collector

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

Collector to Base Voltage	V_{CBO}	20	V
Collector to Emitter Voltage	V_{CEO}	12	V
Emitter to Base Voltage	V_{EBO}	3.0	V
Collector Current	I_C	100	mA
Total Power Dissipation	P_T	200	mW
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	–65 to +150	°C

ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Collector Cutoff Current	I_{CBO}			1.0	μA	V_{CB} = 10 V, I_E = 0
Emitter Cutoff Current	I_{EBO}			1.0	μA	V_{EB} = 1.0 V, I_C = 0
DC Current Gain	h_{FE}*	50	120	300		V_{CE} = 10 V, I_C = 20 mA
Gain Bandwidth Product	f_T		7		GHz	V_{CE} = 10 V, I_C = 20 mA
Feed-Back Capacitance	C_{re}**		0.55	1.0	pF	V_{CB} = 10 V, I_E = 0, f = 1.0 MHz
Insertion Power Gain	$\|S_{21e}\|^2$		11.5		dB	V_{CE} = 10 V, I_C = 20 mA, f = 1.0 GHz
Noise Figure	NF		1.1	2.0	dB	V_{CE} = 10 V, I_C = 7 mA, f = 1.0 GHz

* Pulse Measurement PW ≤ 350 μs, Duty Cycle ≤ 2 %

** The emitter terminal and the case shall be connected to the guard terminal of the three-terminal capacitance bridge.

h_{FE} Classification

Class	R23/Q *	R24/R *	R25/S *
Marking	R23	R24	R25
h_{FE}	50 to 100	80 to 160	125 to 250

* Old Specification / New Specification

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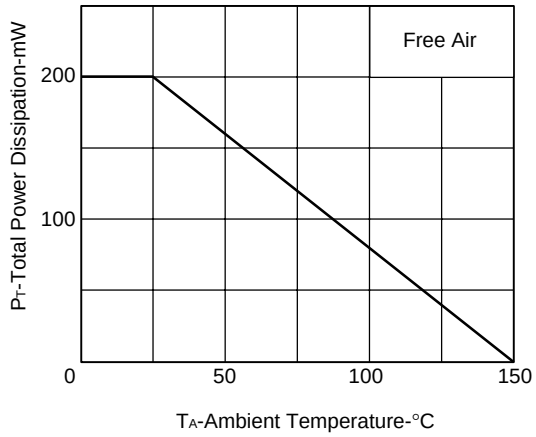
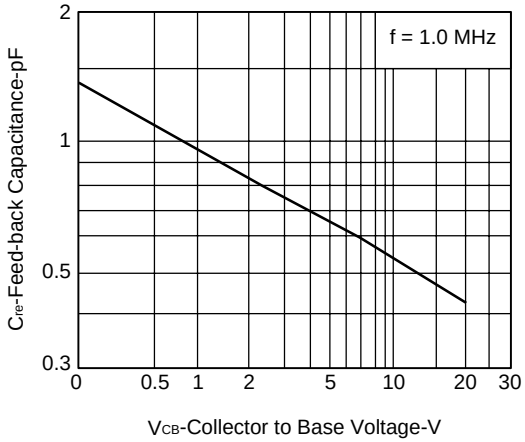
TYPICAL CHARACTERISTICS (T_A = 25 °C)

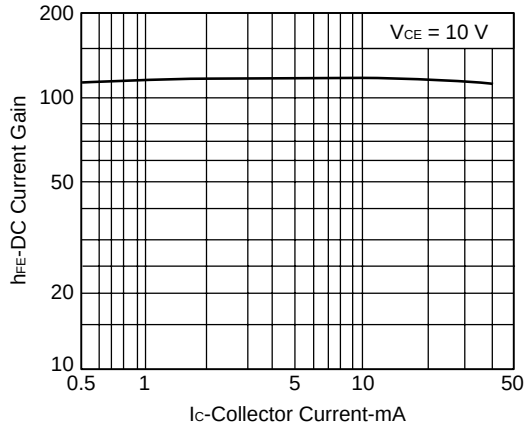
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



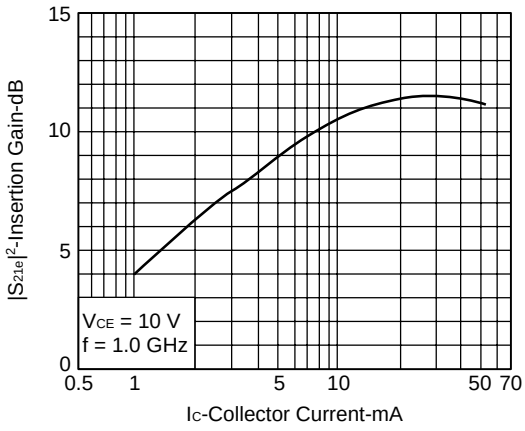
FEED-BACK CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



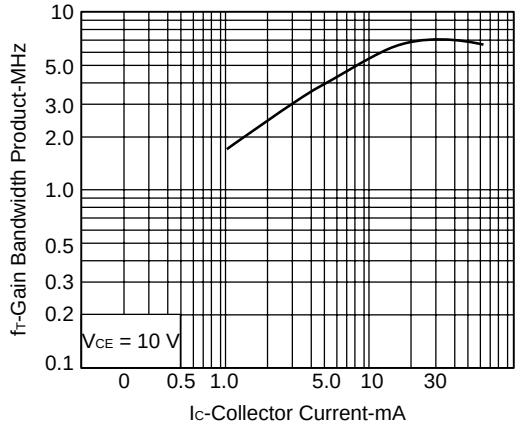
DC CURRENT GAIN vs. COLLECTOR CURRENT



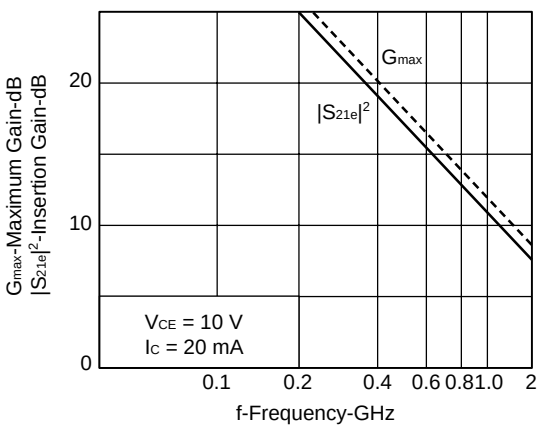
INSERTION GAIN vs. COLLECTOR CURRENT



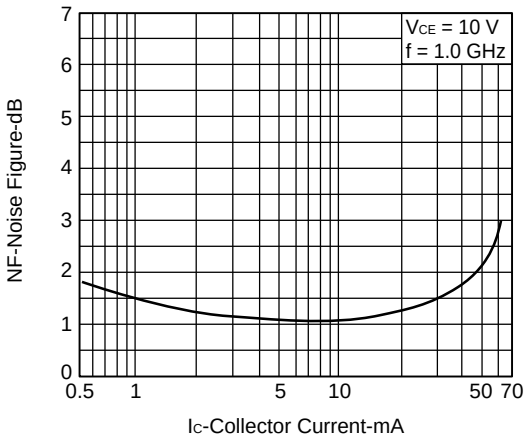
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



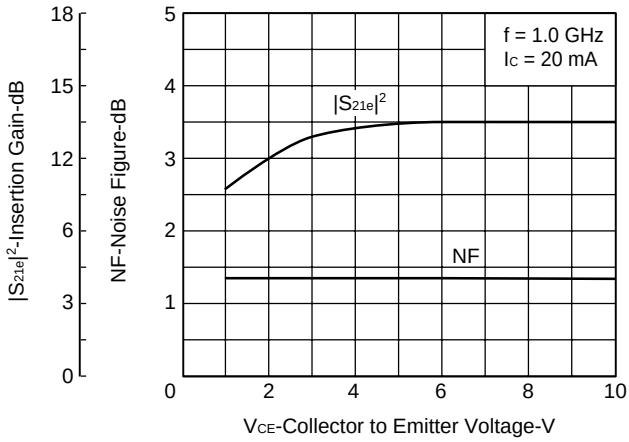
INSERTION GAIN, MAXIMUM GAIN vs. FREQUENCY



NOISE FIGURE vs.
COLLECTOR CURRENT



NOISE FIGURE, FORWARD INSERTION
GAIN vs. COLLECTOR TO EMITTER VOLTAGE



S-PARAMETER

V_{CE} = 10 V, I_C = 5 mA, Z_O = 50 Ω

f (MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
200	0.651	−69.3	10.616	129.3	0.051	59.2	0.735	−28.1
400	0.467	−113.3	6.856	104.4	0.071	54.4	0.550	−34.1
600	0.391	−139.3	4.852	90.9	0.086	56.0	0.468	−33.9
800	0.360	−159.2	3.802	81.2	0.101	59.1	0.426	−33.6
1000	0.360	−176.9	3.098	72.9	0.118	61.0	0.397	−35.7
1200	0.361	172.7	2.646	67.3	0.137	63.5	0.373	−38.3
1400	0.381	160.3	2.298	59.3	0.157	63.3	0.360	−43.0
1600	0.398	152.2	2.071	55.2	0.180	64.1	0.337	−45.9
1800	0.423	143.3	1.836	49.0	0.203	63.7	0.320	−52.3
2000	0.445	137.6	1.689	46.2	0.220	64.7	0.302	−52.2

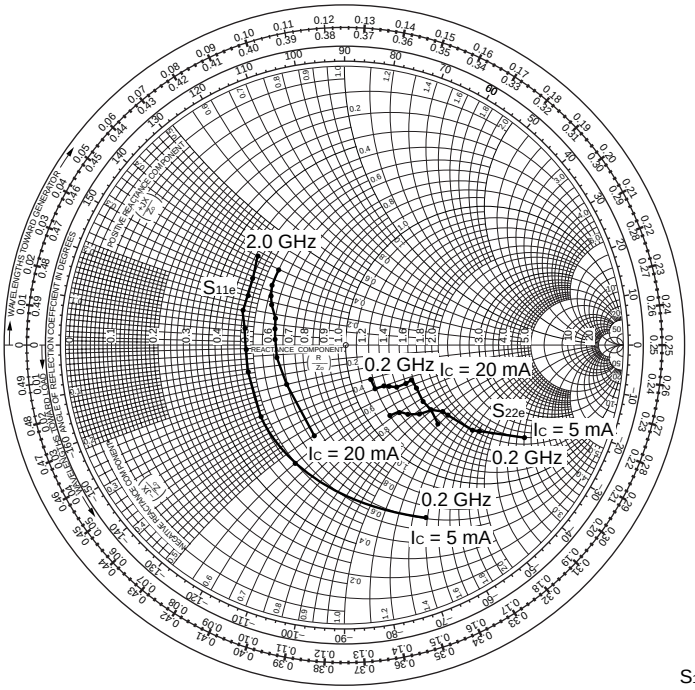
V_{CE} = 10 V, I_C = 5 mA, Z_O = 50 Ω

f (MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
200	0.339	−107.0	16.516	108.7	0.035	66.1	0.459	−36.6
400	0.258	−147.3	8.928	92.1	0.060	71.0	0.343	−32.9
600	0.243	−167.7	6.022	83.0	0.085	71.9	0.305	−29.9
800	0.242	177.0	4.633	76.2	0.109	72.2	0.284	−29.4
1000	0.260	164.5	3.744	69.9	0.136	70.4	0.266	−31.7
1200	0.269	157.6	3.193	65.7	0.160	69.9	0.246	−35.0
1400	0.294	148.7	2.750	58.8	0.187	66.7	0.233	−40.4
1600	0.314	143.1	2.479	55.5	0.212	65.2	0.208	−43.6
1800	0.343	136.5	2.185	50.1	0.238	62.4	0.190	−50.5
2000	0.367	131.4	2.016	47.8	0.254	61.6	0.173	−48.3

S-PARAMETER

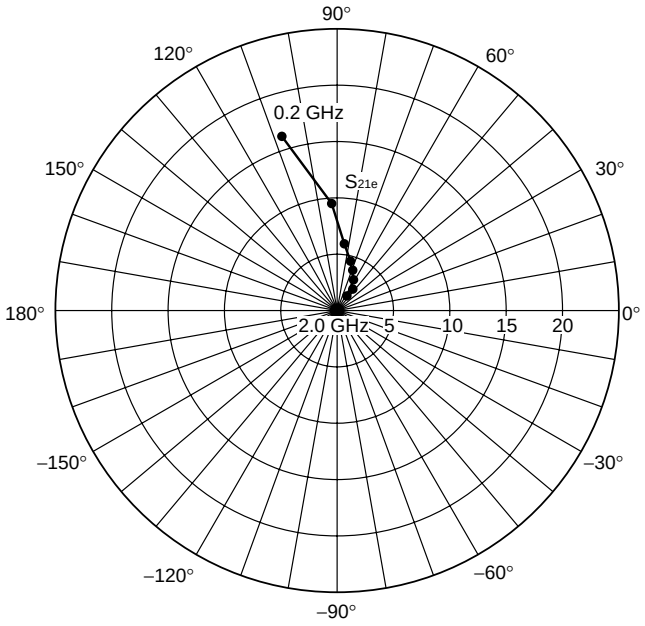
S_{11e}, S_{22e}-FREQUENCY

CONDITION V_{CE} = 10 V
200 MHz Step



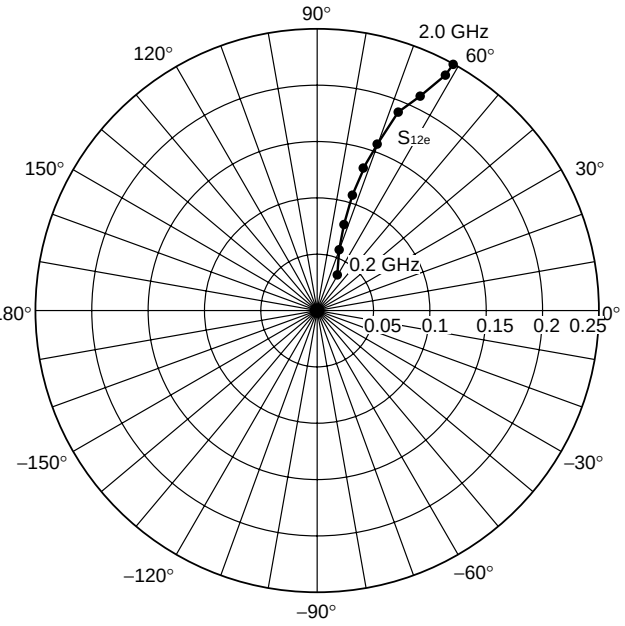
S_{21e}-FREQUENCY

CONDITION V_{CE} = 10 V
I_C = 20 mA



S_{12e}-FREQUENCY

CONDITION V_{CE} = 10 V
I_C = 20 mA



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