

SANYO

2SA221, 2SA222  
2SA223

Semiconductors

GERMANIUM P-N-P DRIFT TYPE

SANYO 2SA221, 2SA222 and 2SA223, P-N-P drift type germanium transistors, have the excellent characteristics in the short wave frequency band.

2SA221 is suitable for the frequency conversion or the oscillation in the frequency range from 3.8 MHz to 12MHz and to the mixer in the frequency range under 22MHz.

2SA222 and 2SA223 are suitable for the separate-type frequency converter in the frequency range from 3.8 MHz to 27 MHz. The conversion power gain is 23 dB at 12MHz and the mixer power gain is 25 dB at 20MHz.

2SA222 is used for the mixer and 2SA223 for the oscillator circuit. The mixer power gain is 13 dB at 27MHz. Moreover, 2SA223 may also be used for the TV video amplifier.

ABSOLUTE MAXIMUM RATINGS

Ta = 25°C

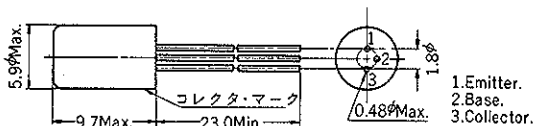
Parameter	Symbol	2SA221	2SA222	2SA223	Unit
Collector to Base Voltage	V <sub>CB0</sub>	20	20	20	V
Emitter to Base Voltage	V <sub>EB0</sub>	1.5	1.5	1.5	V
Collector Current	I <sub>c</sub>	15	15	15	mA
Collector Power Dissipation	P <sub>c</sub>	70	70	70	mW
Junction Temperature	T <sub>j</sub>	75	75	75	°C
Storage Temperature	T <sub>stg</sub>	-55 ~ +85	-55 ~ +85	-55 ~ +85	°C

ELECTRICAL CHARACTERISTICS

Ta = 25°C

Parameter	Symbol	2SA221			2SA222			2SA223			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Collector Cutoff Current (V <sub>CB</sub> = -15V, I <sub>E</sub> = 0)	I <sub>cbo</sub>			1.5			1.5			1.5	μA
Emitter Cutoff Current (V <sub>EB</sub> = -1.5V, I <sub>C</sub> = 0)	I <sub>ebo</sub>			40			40			40	μA
Small Signal Forward Current Transfer Ratio (V <sub>CE</sub> = -6V, I <sub>C</sub> = -1mA, f = 1KHz)	h <sub>fe</sub>		30			90			120		
Small Signal Forward Current Transfer Ratio (V <sub>CE</sub> = -6V, I <sub>C</sub> = -1mA, f = 6MHz)			6	13.5	6		13.5	6		13.5	
Alpha Cutoff Frequency (V <sub>CB</sub> = -6V, I <sub>C</sub> = -1mA)	f <sub>αb</sub>		55			60			65		MHz
Output Capacitance (V <sub>CB</sub> = -6V, I <sub>E</sub> = 0, f = 1MHz)	C <sub>ob</sub>		3.5	7		3.5	7		3.5	7	pF
Base Spreading Resistance (V <sub>CE</sub> = -6V, I <sub>C</sub> = -1mA, f = 50MHz)	r <sub>bb'</sub>		35	90		35	90		30	90	Ω

OUTLINE DRAWING (Unit: mm)

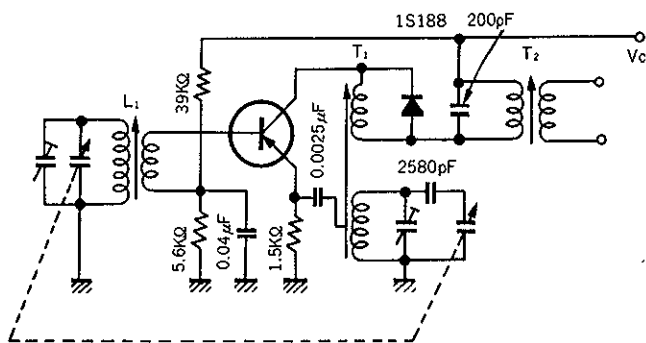


## OPERATION CHARACTERISTICS

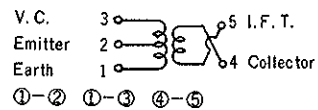
Parameter	Symbol	2SA221 Converter	2SA222 Mixer	2SA223 Oscillator	Unit
Collector Power Supply Voltage	V <sub>cc</sub>			6	V
Collector Current	I <sub>c</sub>			10	mA
Signal Frequency	f				MHz
Oscillation Frequency	f <sub>osc</sub>			27.65	MHz
Intermediate Frequency	IF	455	455		KHz
Injection Voltage	V <sub>osc</sub>	20 (10-20)	20 (10-20)		mV
Oscillation Voltage	V <sub>o</sub>			0.5	V
Input Resistance (Output Short)	r <sub>i</sub>	100	100		Ω
Output Resistance (Input Short)	r <sub>o</sub>	100	100		Ω
Conversion Power Gain	CG				dB
Mixer Power Gain	MG		15		dB

\* See 2SA221 Application Circuit \*\* See 2SA222 Application Circuit

**2SA221 Converter Application**



T<sub>1</sub> Oscillator coil

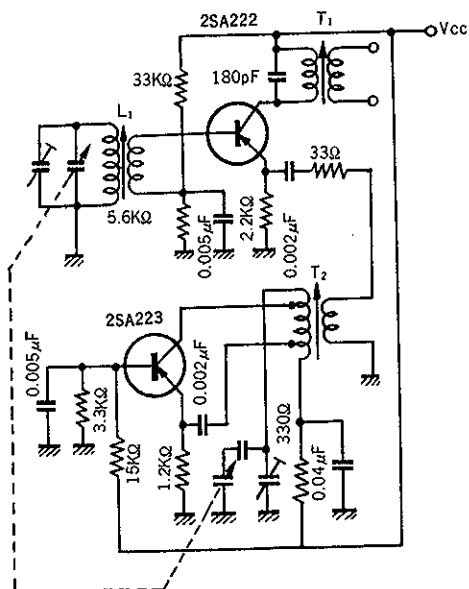


Turns 2T 18T 8T  
Primary inductance=4.4μH, Unloaded Q=90

L<sub>1</sub> Antenna coil; Primary turns=8½; Secondary turns=1½  
10φmm×180mm ferrite core; Primary inductance=4.8μH,  
Primary unloaded Q=130

T<sub>2</sub> IF 1st Transformer f=455KHz.  
Turns ratio=9.5:1, Unloaded Q=100  
Loaded Q=35

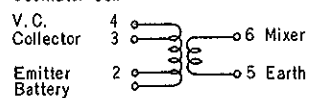
**2SA222 Mixer, 2SA223 Oscillator Application**



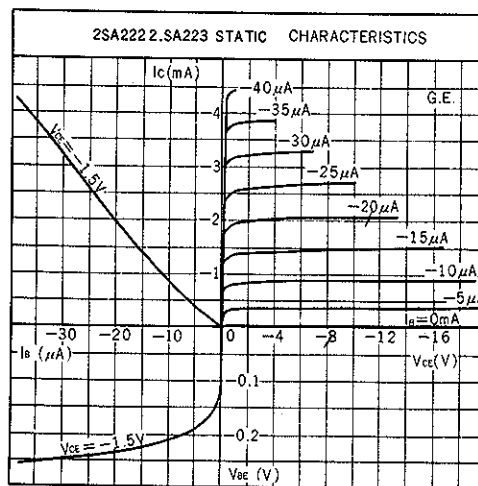
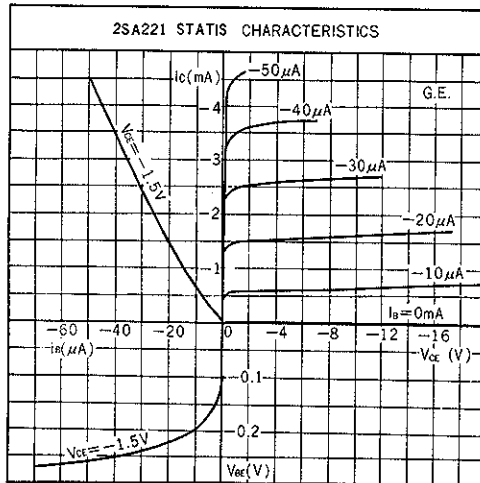
L<sub>1</sub> Antenna Coil.  
Turns ratio=5:1.  
Primary inductance=0.87μH  
Primary unloaded Q=90

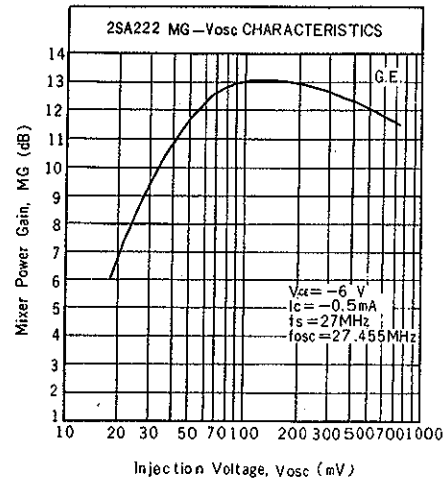
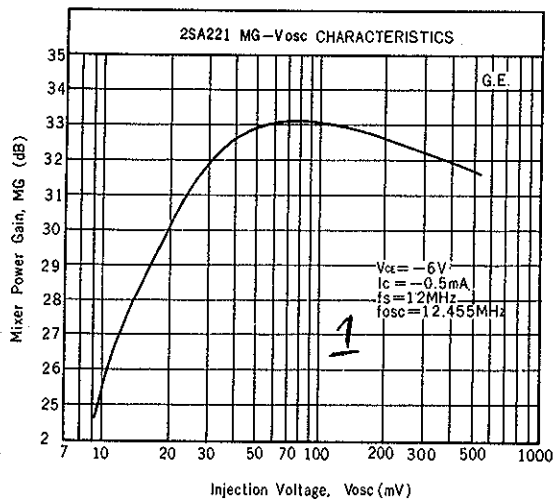
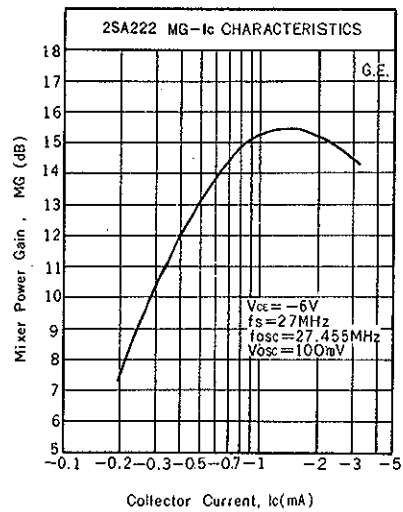
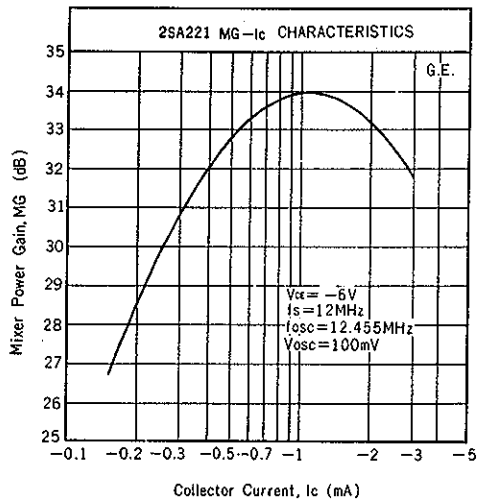
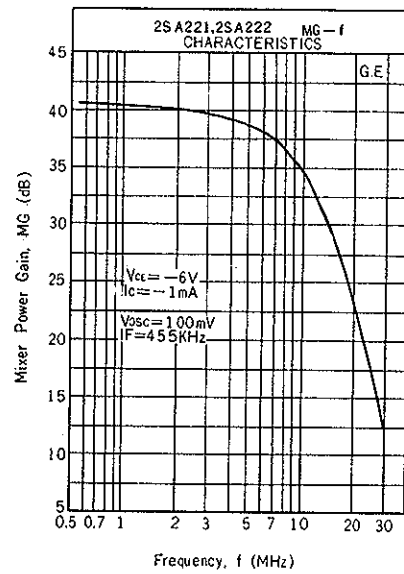
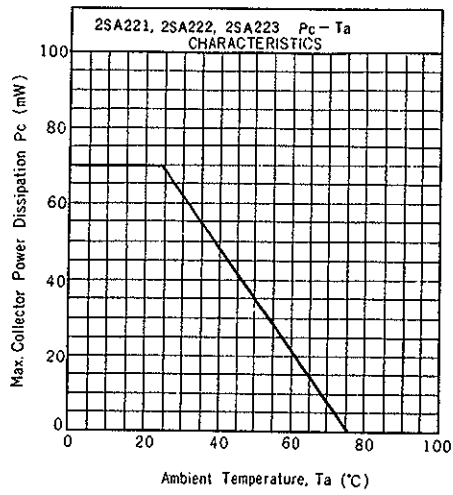
T<sub>1</sub> IF 1st Transformer  
f=455KHz.  
Turns ratio=9.5:1  
Primary unloaded Q=100  
Primary loaded Q=35

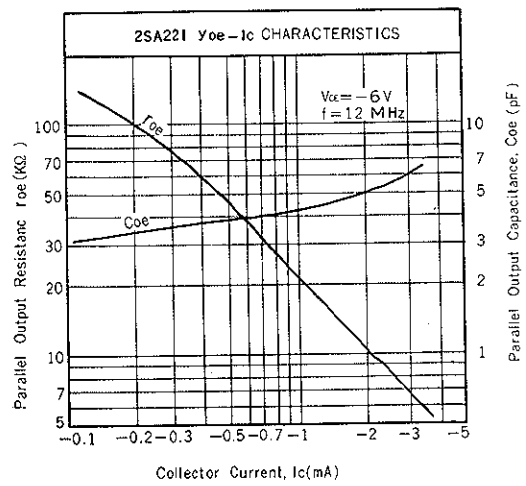
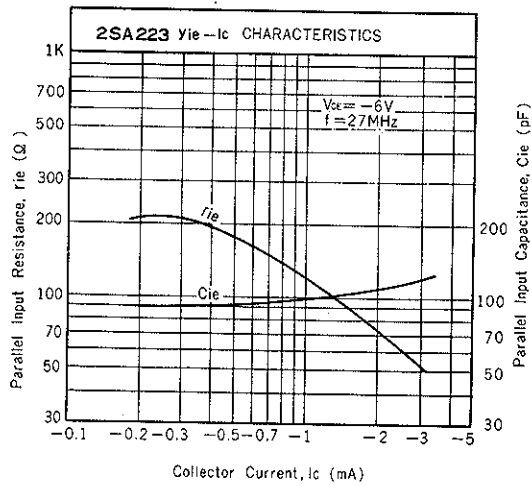
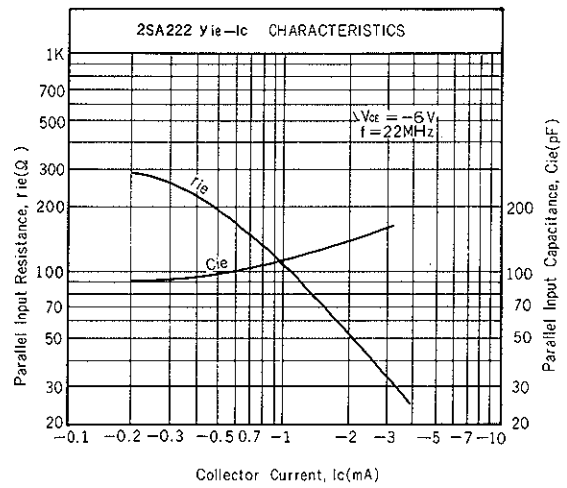
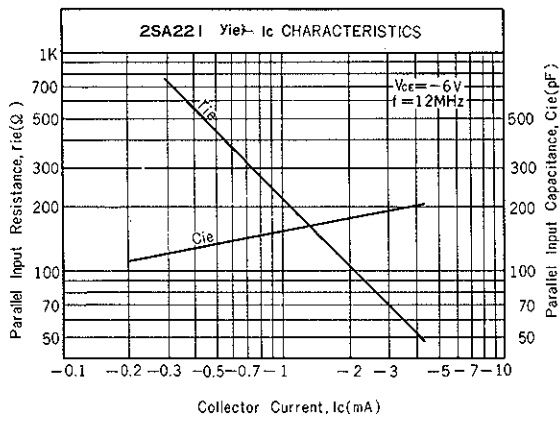
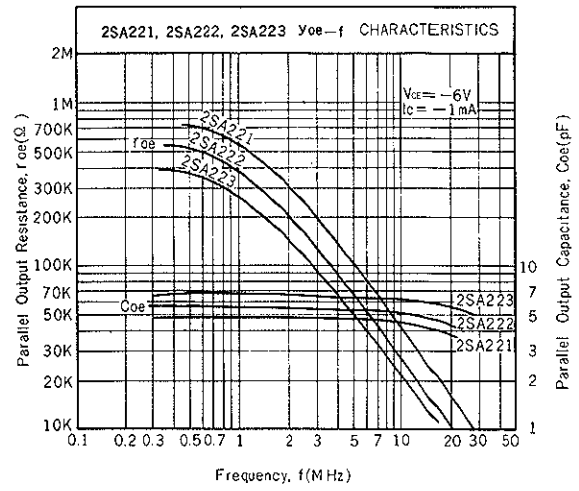
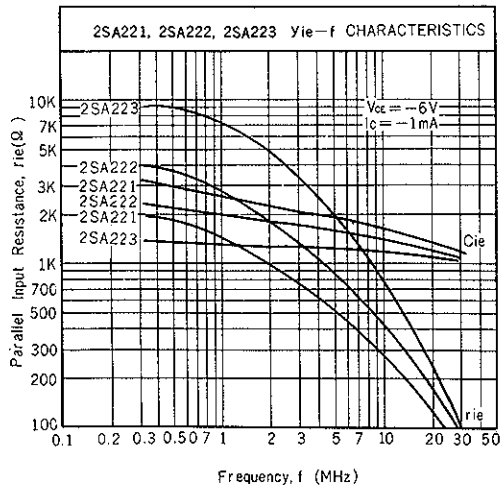
T<sub>2</sub> Oscillator coil

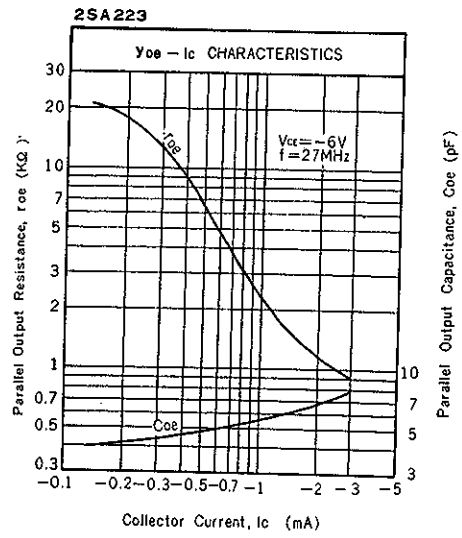
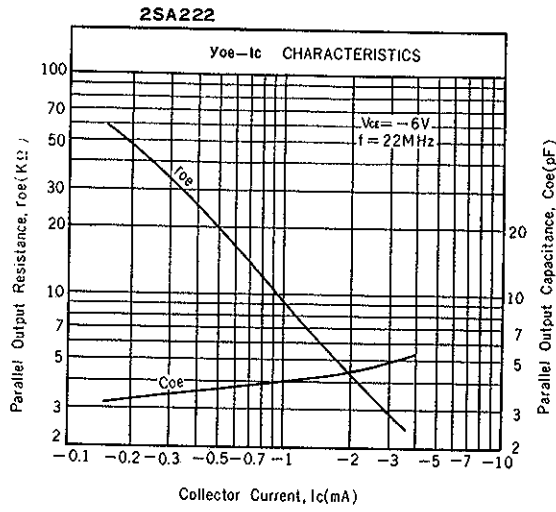


Turns 1T 3½T 5T 1T  
Unloaded Q=80









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