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GEC PLESSEY
SEMICONDUCTORS

DS3224 2.3

SL6444

1GHz AMPLIFIER / MIXER

The SL6444 Amplifier and Mixer is designed for use in Cordless Telephones, Cellular Radios, Pagers and Low Power receivers operating at frequencies up to 1GHz. It contains a low noise amplifier and mixer. Operating from a single supply it draws a current of 9.5mA and has a power down facility.

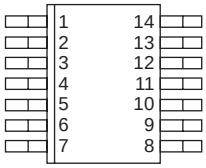
FEATURES

- 1GHz Operation
- Low Power Consumption
- Low Noise Figure
- Suitable for Superheterodyne Architectures
- Power Down Facility for Battery Economy
- Balun for Balanced Mixer Drive

ORDERING INFORMATION

SL6444 KG MPAS Miniature Plastic Dil Package

NOTE. This device has static sensitive terminations, sensitivity typically measured as 200V using MIL-STD-883 method 3015. ESD handling precautions are essential to avoid degradation of performance or permanent damage to this device.



MP14

Pin	Function	Pin	Function
1	Battery Economy	14	Bandgap Ref.
2	Bias Supply	13	LO Input
3	RF Input	12	Ground
4	RF Ground	11	Mixer Output 180˚
5	VCC decouple	10	Mixer Output 0˚
6	RF Output	9	Mixer Current
7	VCC	8	Mixer Input

Fig. 1 Pin connections - top view

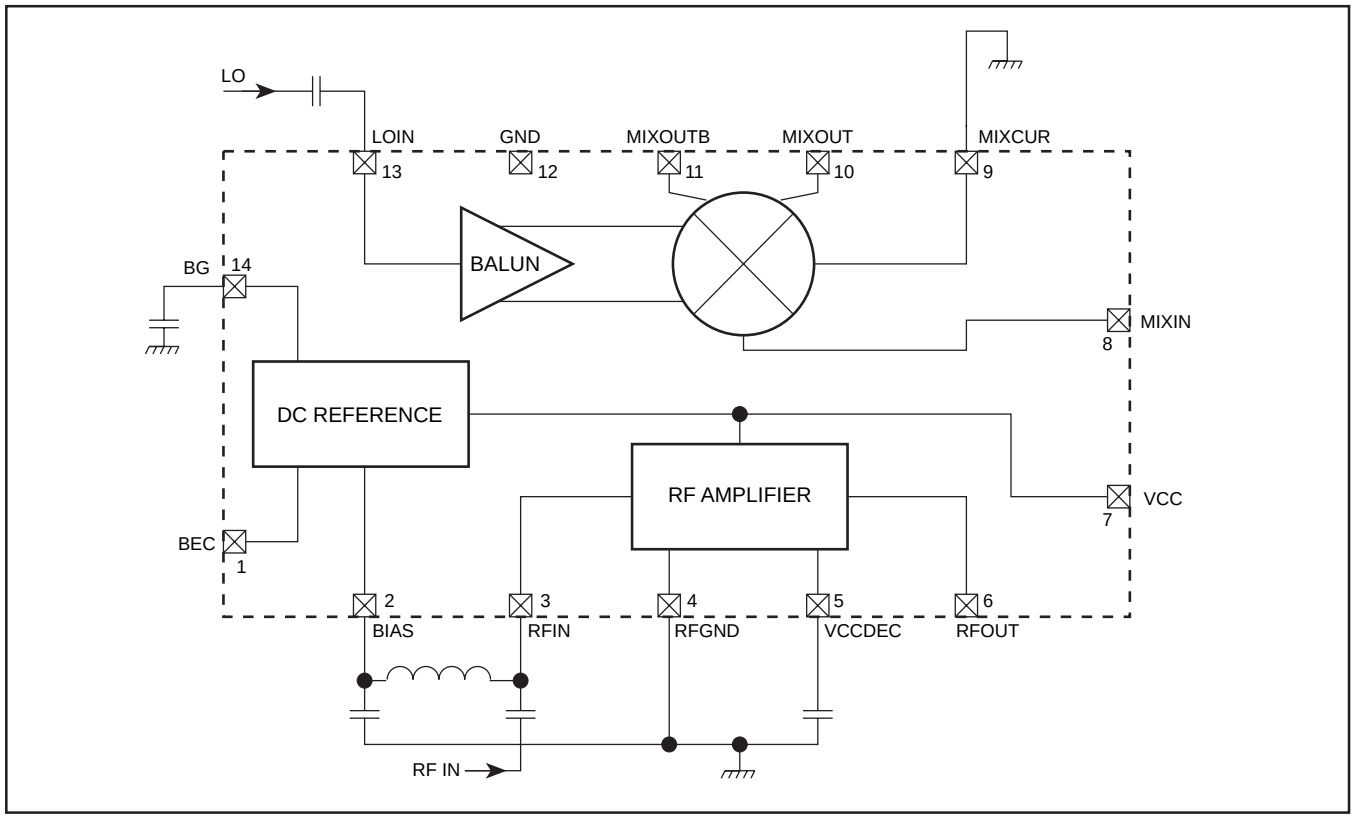


Fig. 2 Block diagram

ELECTRICAL CHARACTERISTICS

These characteristics are guaranteed over the following conditions unless otherwise stated.
T_{amb} = 25°C, V_{CC} = 2.7V and at V_{CC} = 6.0V

Characteristic	Pin	Value			Units	Conditions
		Min	Typ	Max		.
DC CHARACTERISTICS						
Supply voltage	V_{CC}	2.7	5.0	6.0	V	
Supply current, I_{CC} Note 1		7.0	7.8	8.5	mA	Battery economy low V_{CC} = 2.7
		8.7	9.7	10.7	mA	Battery economy low V_{CC} = 6.0
			0.5	1.0	µA	Battery economy high
Bandgap reference	VBG	1.15	1.17	1.20	V	No external load V_{CC} = 2.7
	VBG	1.19	1.22	1.25	V	No external load V_{CC} = 6.0
Battery economy high	BEC	V_{CC}-0.5		V_{CC}	V	
Battery economy low	BEC	0		0.5	V	
Battery economy sink current	BEC		0.1	2.0	µA	Battery economy high
Battery economy source current	BEC		1.0	2.0	µA	Battery economy low
RFAMPLIFIER (COMMON EMITTER)						
Supply current	RFOUT	2.1	2.5	2.8	mA	V_{CC} = 6.0V
MIXER						
Optimum frequency range	MIXIN	0.1			GHz	
Supply current Note 2.		3.5	3.9	4.3	mA	V_{CC} = 2.7
		4.2	4.6	5.0		V_{CC} = 6.0V
Mixer conversion	MIXOUT	10.3	11.0	11.7	dB	V_{CC} = 6.0V Note 3
Voltage gain	MIXOUTB	10.0	10.6	11.2	dB	V_{CC} = 2.7V Note 3
Mixer output gain match				-/+ 0.5	dB	

NOTES: (1) Total device supply current
(2) Half mixer current in each of MIXOUT and MIXOUTB
(3) conditions:- LOIN = 100MHz, -15dBm
MIXIN = 100.01MHz, -30dBm
MIXOUT and MIXOUTB 470Ω load
IF = 10kHz

TYPICAL ELECTRICAL CHARACTERISTICS

These characteristics are guaranteed by design.
T_{amb} = 25°C, V_{CC} = 5 Volts.

Characteristics	Pin	Value			Units	Conditions
		Min	Typ	Max		.
RF AMPLIFIER (COMMON EMITTER)						
Input Impedance						50Ω system see fig 3
Output Impedance						50Ω system see fig 3
Gain (RF_{IN} to RF_{OUT})						50Ω system see fig 3
Reverse isolation (RF_{IN} to RF_{OUT})						50Ω system see fig 3
MIXER						
Input Impedance						50Ω system see fig 4
Output Impedance						50Ω system see fig 4

PERFORMANCE CHARACTERISTICS (GPS Demonstration boards)

Test conditions (unless otherwise stated): VCC = 2.7V; T_{amb} = 25°C
Input frequency 915MHz; Local oscillator frequency 765MHz;
Intermediate frequency 150MHz; Local oscillator amplitude 80mV r.m.s.

Characteristics	Pin	Value			Units	Conditions
		Min	Typ	Max		.
RF AMPLIFIER COMMON EMITTER (NOTE 1)						Application circuit Fig. 5
Power gain			16		dB	
Third order intercept point			-12		dBm	At input
Noise figure			2.7		dB	
Output power at 1dB gain compression			-6		dBm	
SINGLE BALANCED MIXER (Note 1)						Application circuit Fig. 6
Power conversion gain			4.5		dB	
Third order intercept point			-5.5		dBm	At input
Double sideband noise figure			10		dB	
LO to RF isolation			28		dB	
LO to IF isolation			39		dB	

PERFORMANCE CHARACTERISTICS (GPS Demonstration boards) continued

Test conditions (unless otherwise stated): VCC = 2.7V; T_{amb} = 25˚C
Input frequency 915MHz; Local oscillator frequency 765MHz;
Intermediate frequency 150MHz; Local oscillator amplitude 80mV r.m.s.

Characteristics	Pin	Value			Units	Conditions
		Min	Typ	Max		.
RF to IF isolation			18		dB	
DOUBLE BALANCED MIXER (Note 1)						Application circuit Fig. 7
Power conversion gain			10			
Third order intercept point			-8		dBm	At input
Double sideband noise figure			10		dB	
LO to RF isolation			26		dB	
LO to IF isolation			42		dB	
RF to IF isolation			32		dB	

NOTE.

1. Application circuits have been optimised for minimum noise figure and maximum gain. Typical performance across temp at 2.7V and 6.0V are shown in graphs 1 to 6.

ABSOLUTE MAXIMUM RATINGS

Supply voltage	8V
Storage temperature	-55˚C to + 150˚C
Operating temperature	-10˚C to + 85˚C

PIN NO	NAME	TITLE	DESCRIPTION
1	BEC	Battery Economy	Turns device OFF when "HIGH", on when "LOW".
2	BIAS	Bias Supply	Controls the bias current in the RF amplifier. Must be decoupled externally to ground through 1nF capacitor.
3	RFIN	RFInput	This is the common emitter input to the base of the RF transistor. It is DC biased externally through a suitable inductor to the bias pin, pin 2.
4	RFGND	R.F. Ground	Must be connected to the system ground with minimum inductance.
5	VCCDEC	VCC Decouple	This pin allows the VCC supply at the RF Amplifier to be effectively decoupled.
6	RFOUT	RF Output	The collector of the RF amplifier output transistor. Must be returned toVCC through a load in which the DC bias current can flow.
7	VCC	Power Supply	Positive supply.
8	MIXIN	Mixer Input	Input port of mixer, should be AC coupled externally.
9	MIXCUR	Mixer Current	A resistor may be placed between this pin and ground to reduce mixer current. Otherwise connect to GND.
10	MIXOUT	Mixer Output 0°	Output port of the mixer. An open collector output which must be returned to VCC through a suitable load. Half of the total Mixer current will flow from this port.
11	MIXOUTB	Mixer Output l80°	Output port of the mixer. An open collector output which must be returned to VCC through a suitable load. Half the total mixer current will flow from this port.
12	GND	Ground	Must be connected to the system ground with minimum inductance.
13	LOIN	LO Input	Local Oscillator input to mixer, should be AC coupled externally.
14	VBG	Bandgap	Temperature compensated voltage reference. Must be decoupled externally to ground through a 1nF capacitor.

VCC = 5V Amplifer current 2.2mA

FREQ-MHz	MAG[S11]	ANG[S21]	MAG [S21]	ANG [S21]	MAG [S12]	ANG [12]	MAG [S22]	ANG [S22]
100.000	0.91	-10	5.89	167	0.016	158	0.99	-5
200.000	0.89	-21	5.86	151	0.010	-75	0.99	-11
300.000	0.86	-30	5.60	136	0.004	55	0.99	-16
400.000	0.81	-39	5.19	121	0.003	118	0.98	-21
500.000	0.77	-47	4.86	108	0.004	-102	0.97	-25
600.000	0.72	-55	4.48	95	0.005	154	0.98	-32
700.000	0.67	-63	4.11	84	0.004	134	0.97	-38
800.000	0.62	-70	3.73	73	0.008	165	0.97	-44
900.000	0.58	-77	3.35	61	0.008	150	0.94	-52
1000.000	0.55	-83	2.97	52	0.010	117	0.91	-59
1100.000	0.52	-87	2.64	43	0.014	97	0.87	-66
1200.000	0.49	-92	2.32	34	0.013	82	0.82	-73
1300.000	0.47	-95	2.06	28	0.010	78	0.76	-79
1400.000	0.45	-98	1.85	22	0.009	59	0.71	-85
1500.000	0.45	-101	1.71	16	0.004	80	0.67	-89

SL6444 Typical RF Amplifer scattering parameters

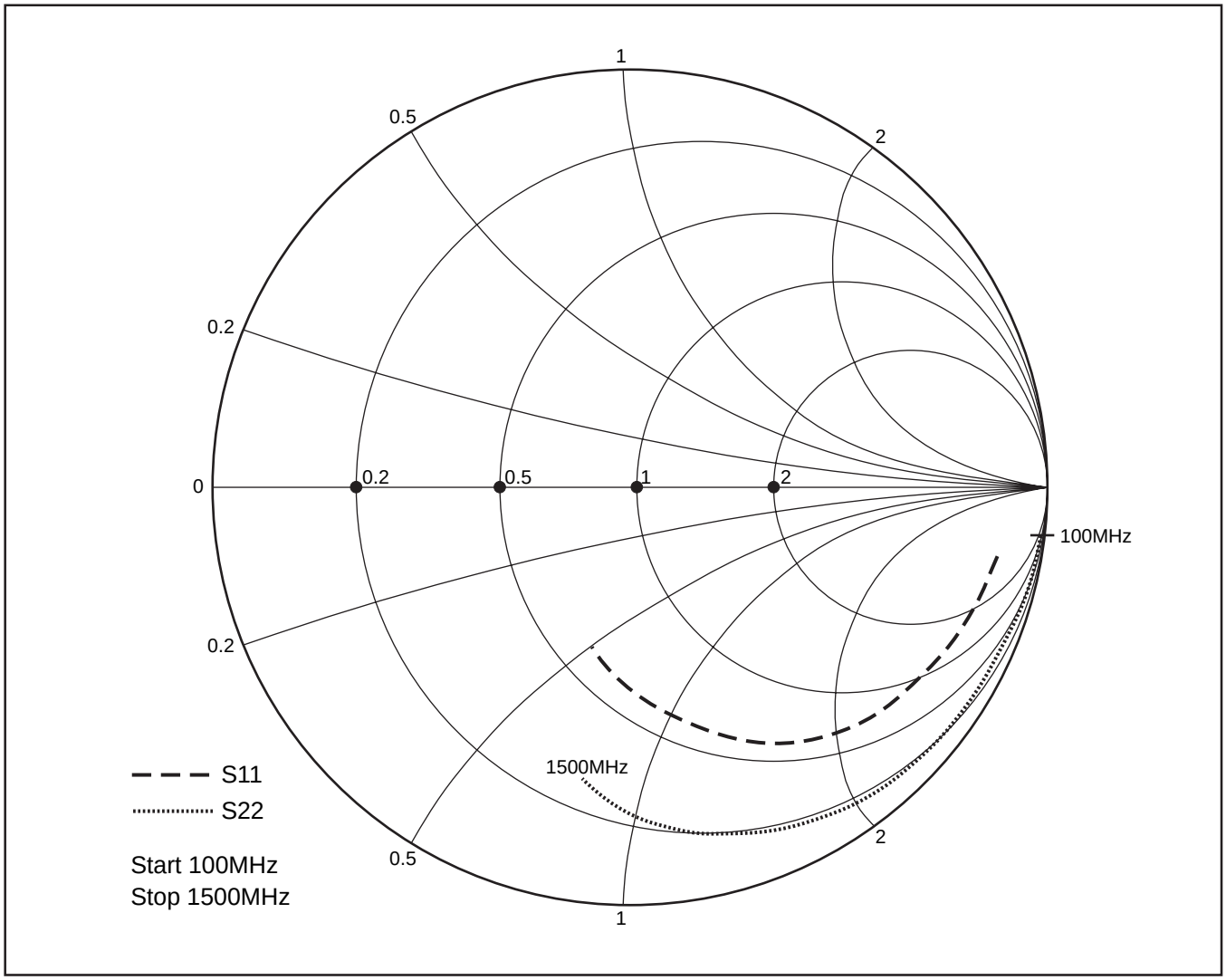


Fig. 3 Typical Input and Output Impedance of SL6444 RF Amplifier (Normalised to 50Ω)

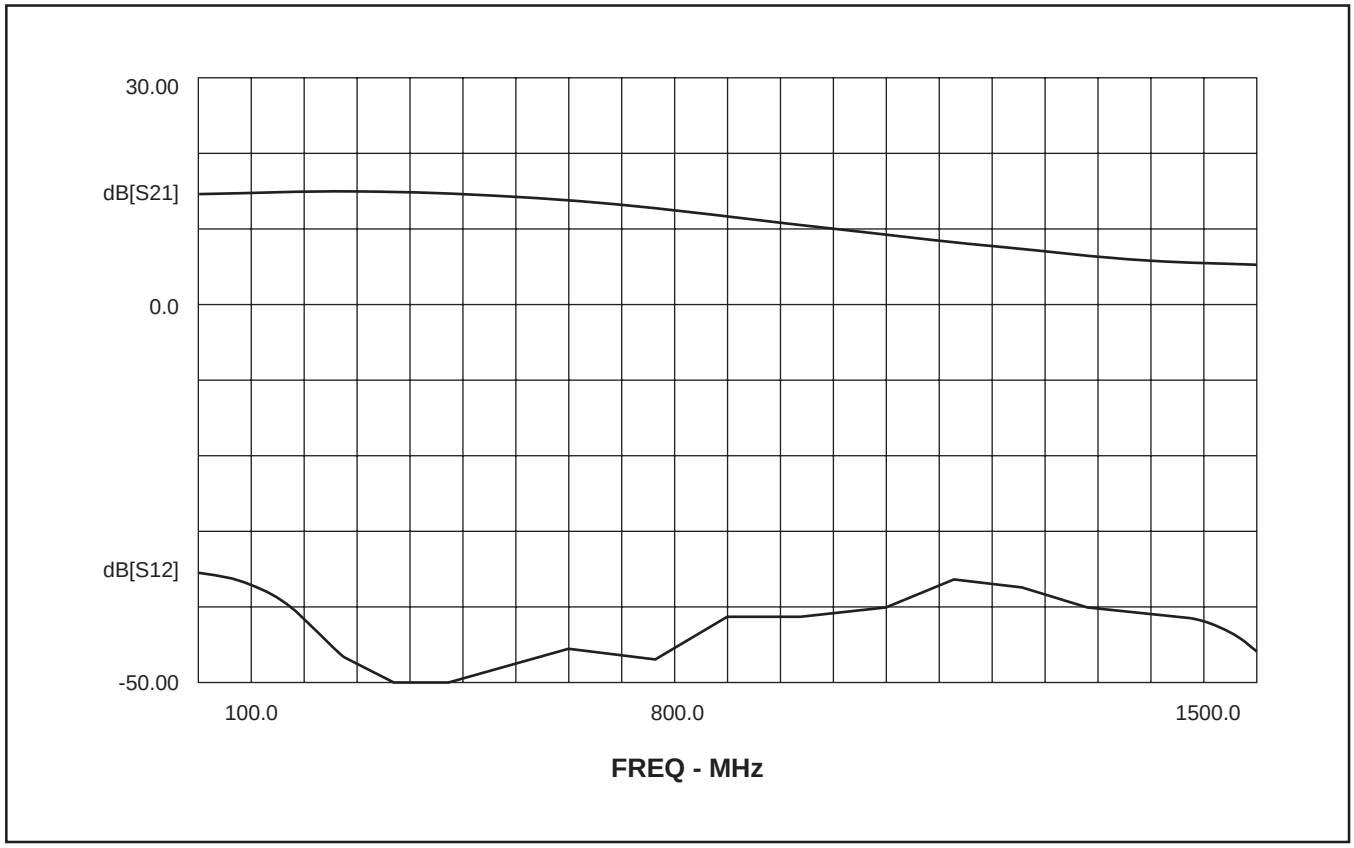


Fig. 3b Typical gain and reverse isolation of SL6444 RF Amplifier in a 50 Ohm test system

VCC = 5V Mixer current 4.4mA. S22 is measured at either MIXOUT or MIXOUTB. S11 is measured at MIXIN.

FREQ-MHz	MAG[S11]	ANG[S11]	MAG [S22]	ANG [S21]
100.000	0.79	-6	1.00	-6
200.000	0.78	-13	0.99	-12
300.000	0.77	-20	0.99	-16
400.000	0.76	-28	0.97	-22
500.000	0.77	-34	0.96	-28
600.000	0.78	-41	0.97	-35
700.000	0.70	-50	0.94	-40
800.000	0.70	-58	0.91	-47
900.000	0.68	-67	0.88	-54
1000.000	0.64	-76	0.86	-60
1100.000	0.61	-86	0.83	-67
1200.000	0.58	-95	0.79	-74
1300.000	0.55	-105	0.75	-82
1400.000	0.51	-117	0.71	-89
1500.000	0.49	-129	0.68	-96

SL6444 Typical Mixer port impedance

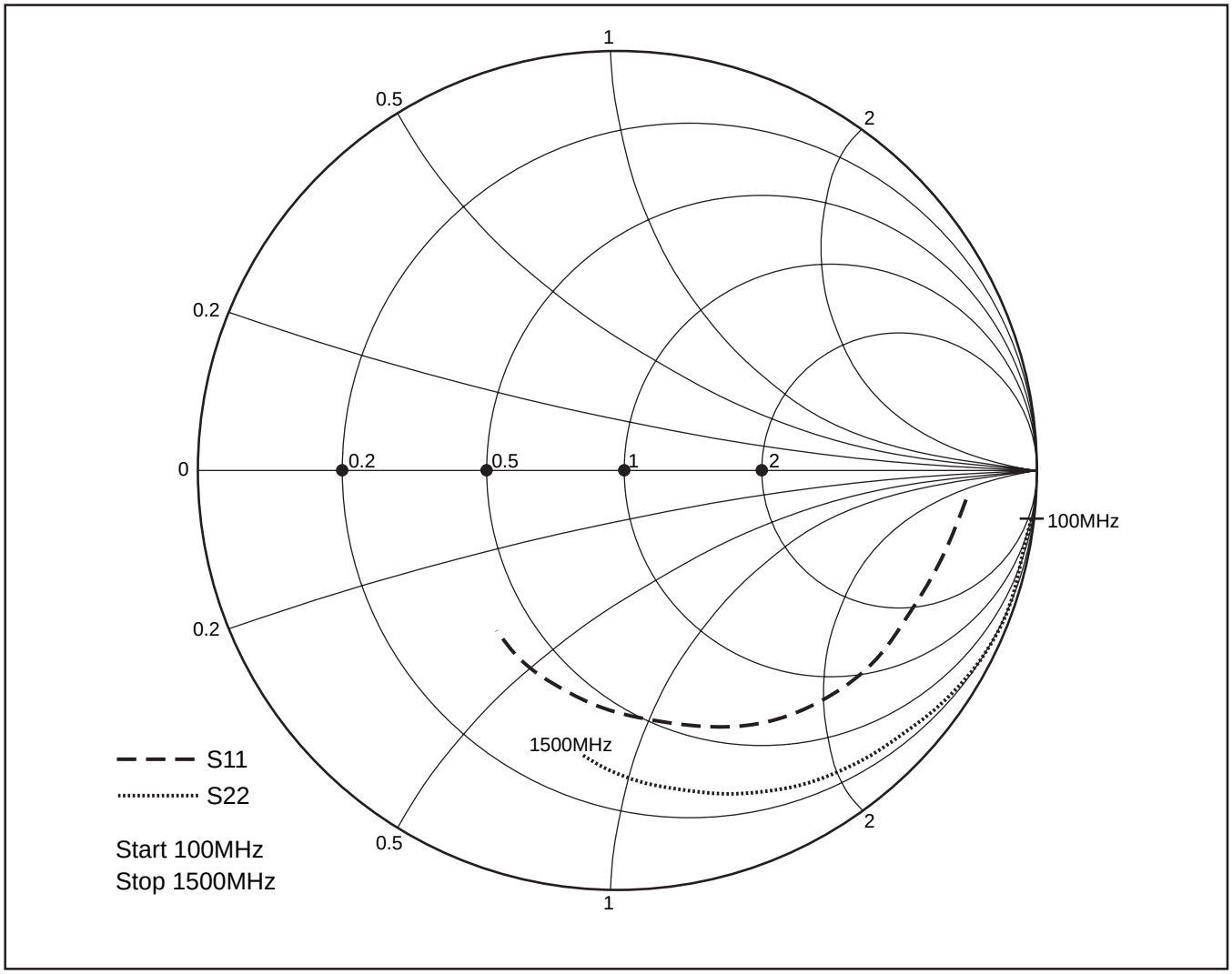
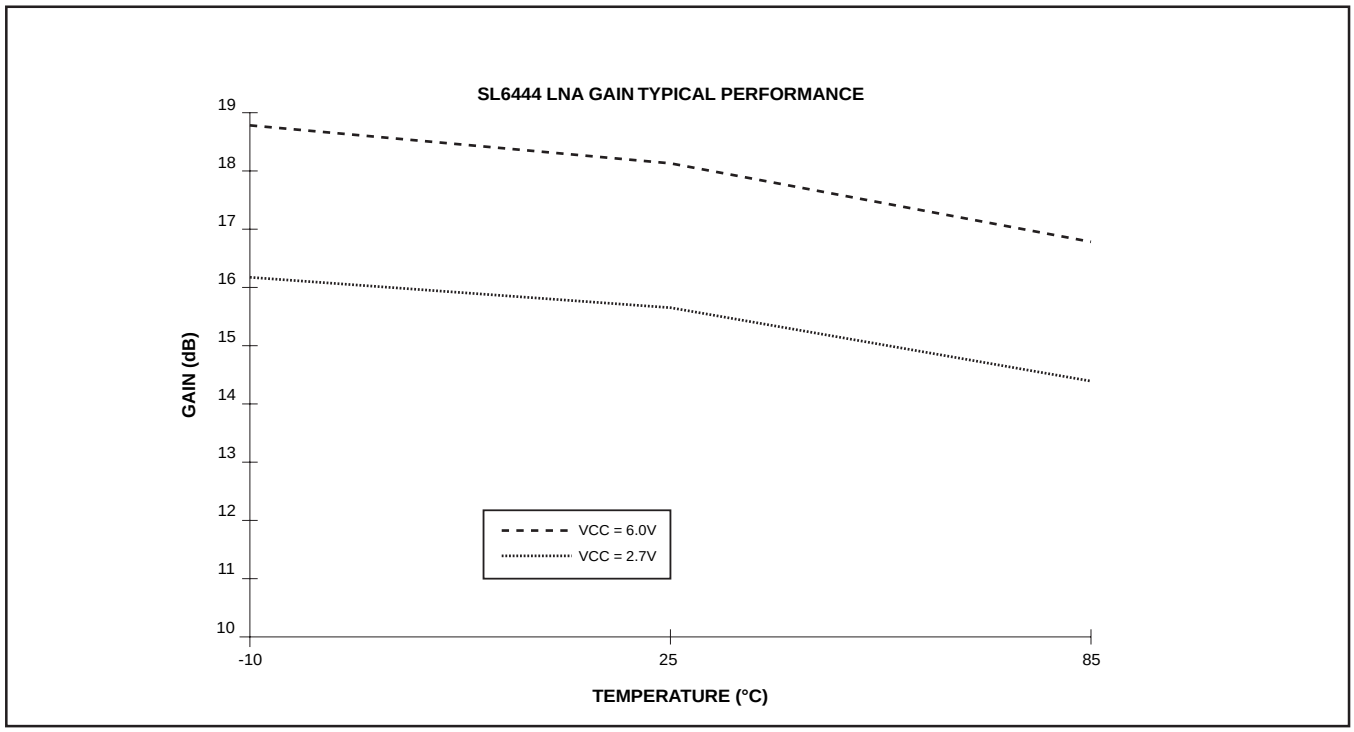


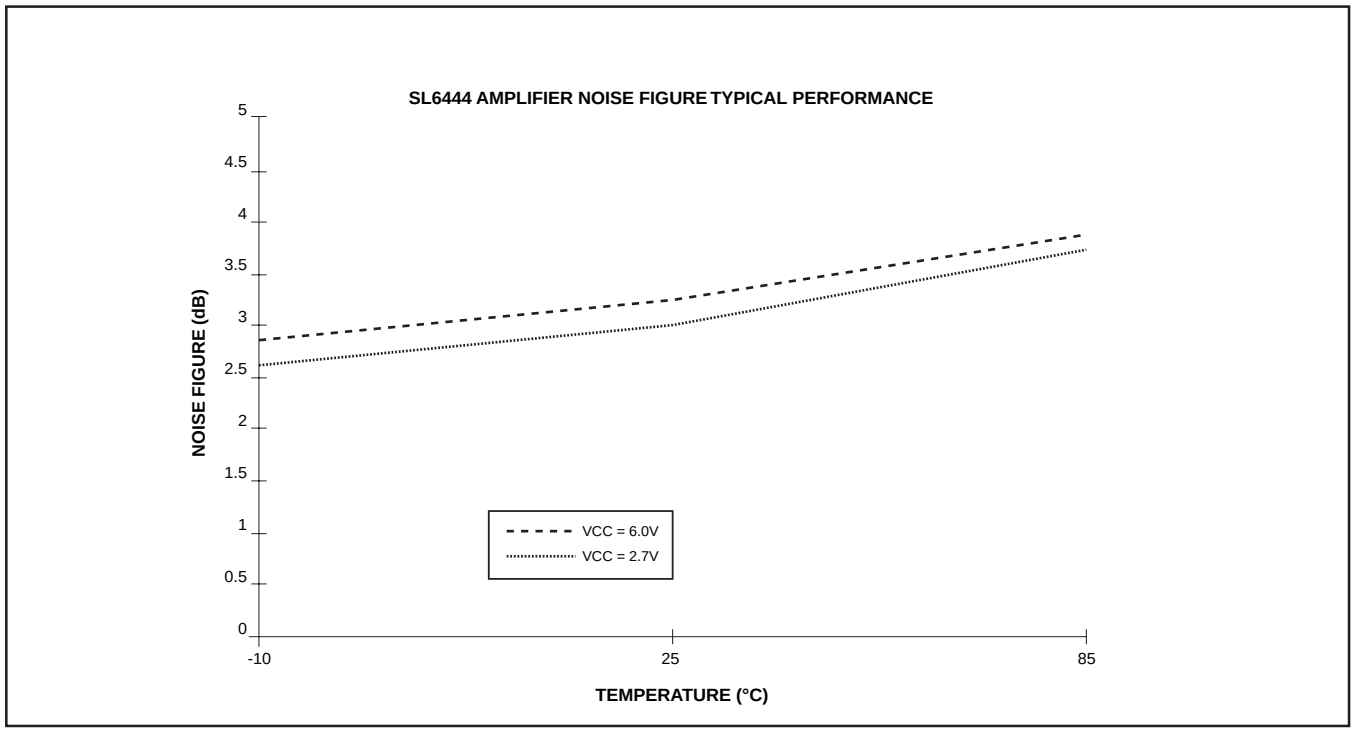
Fig. 4 Typical Input and Output Impedance of SL6444 Mixer (Normalised to 50Ω)

PERFORMANCE CHARACTERISTICS (GPS Demonstration boards)

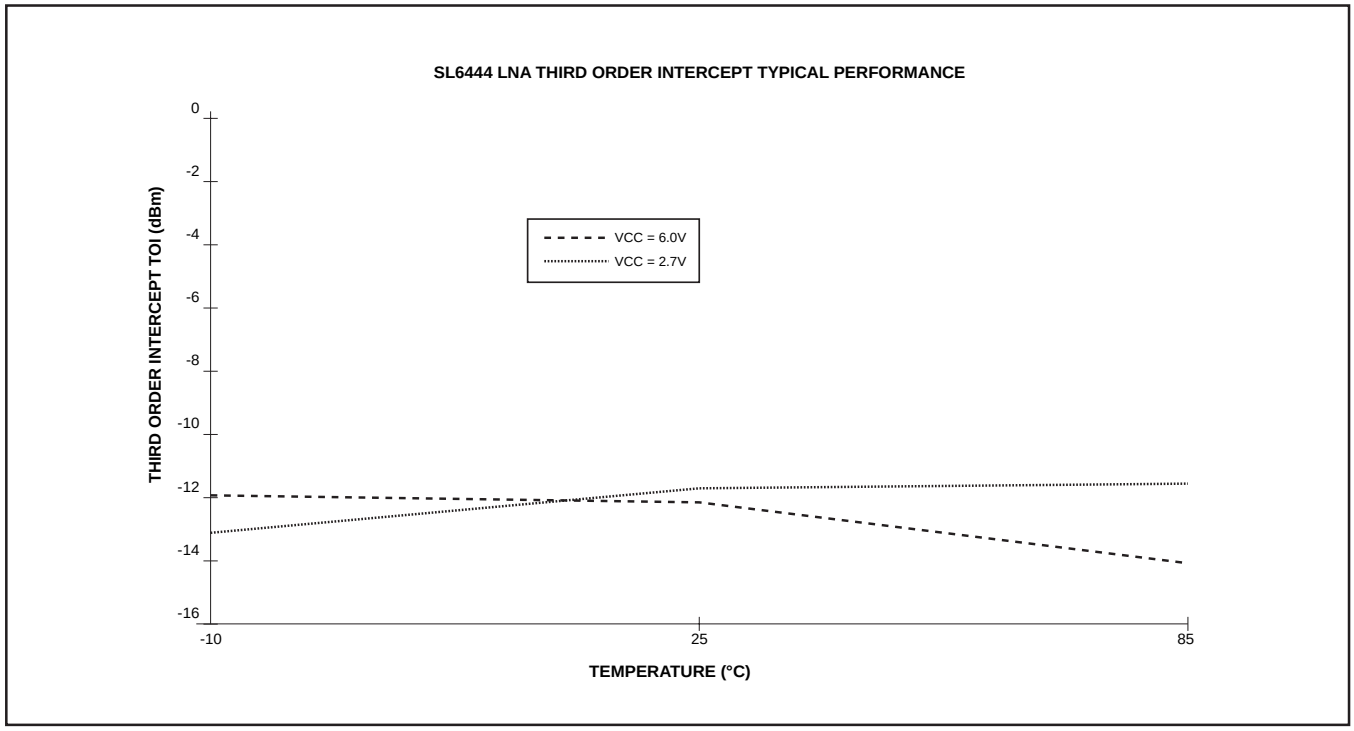
Test conditions (unless otherwise stated)
Input frequency 915MHz; Local oscillator frequency 765MHz;
Intermediate frequency 150MHz; Local oscillator amplitude 80mV r.m.s.



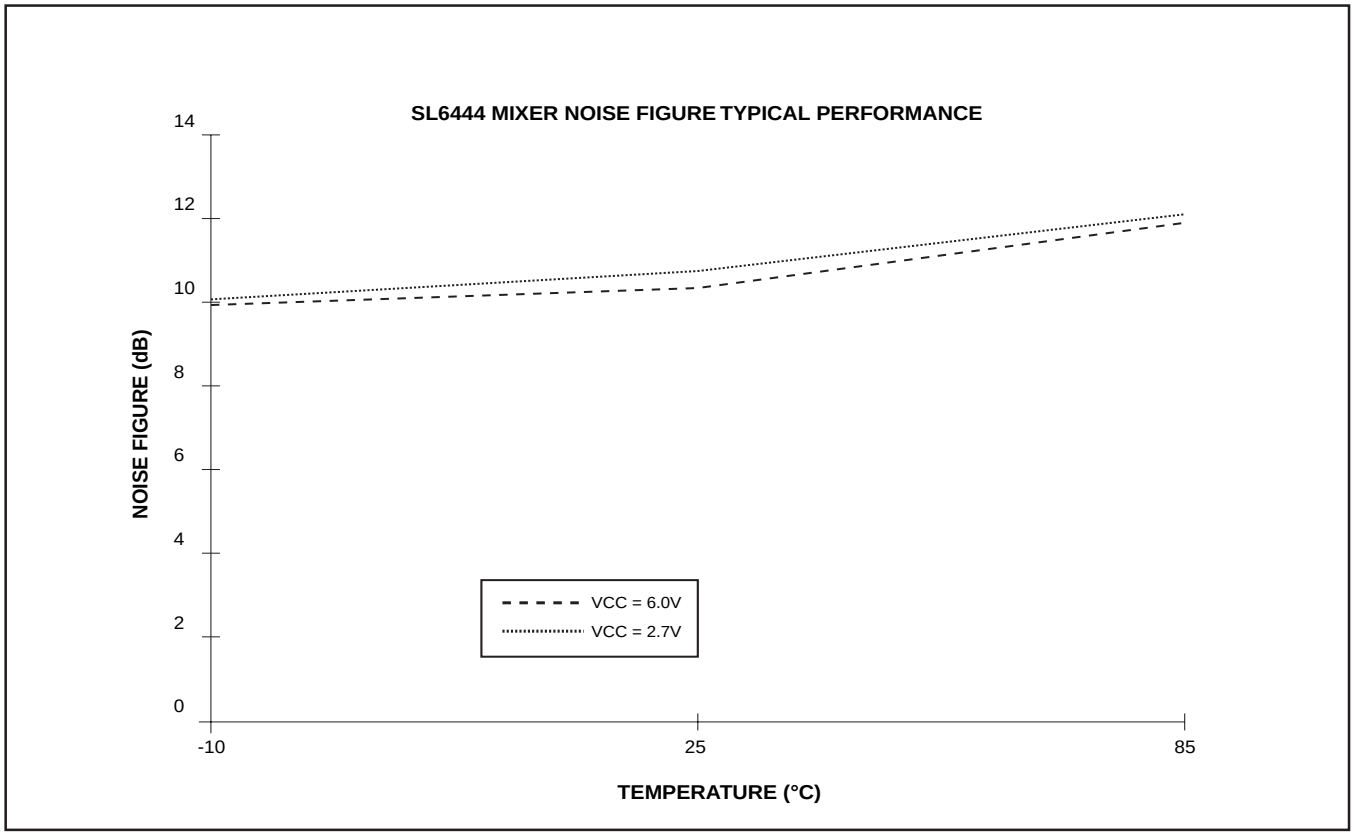
Graph 1



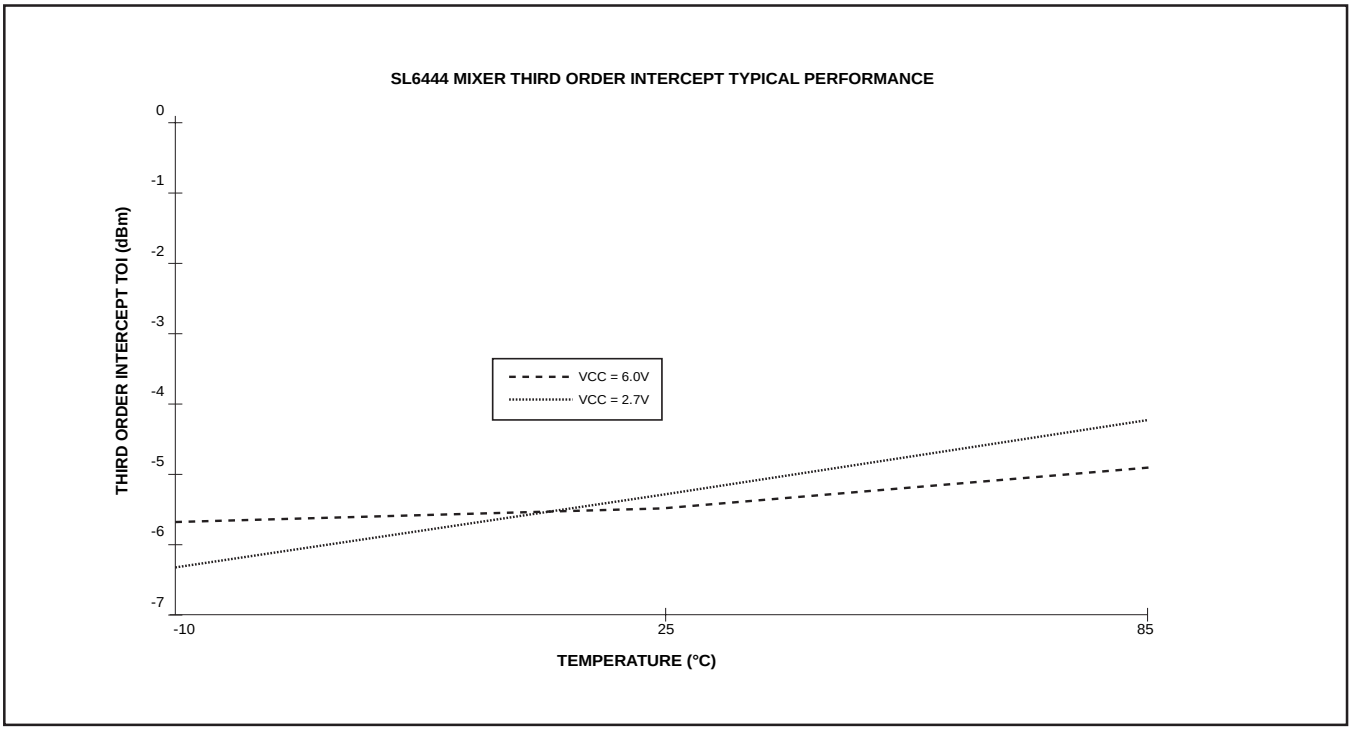
Graph 2



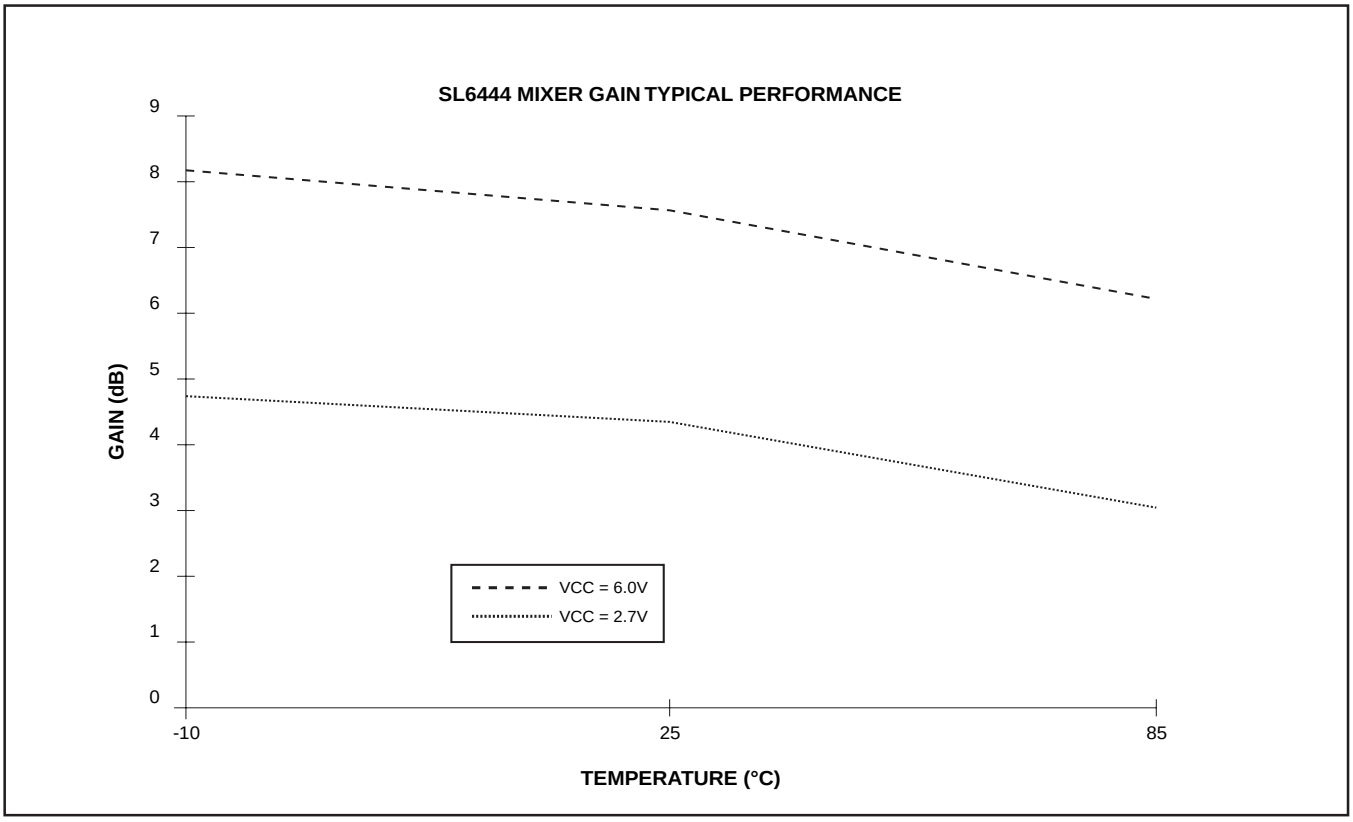
Graph 3



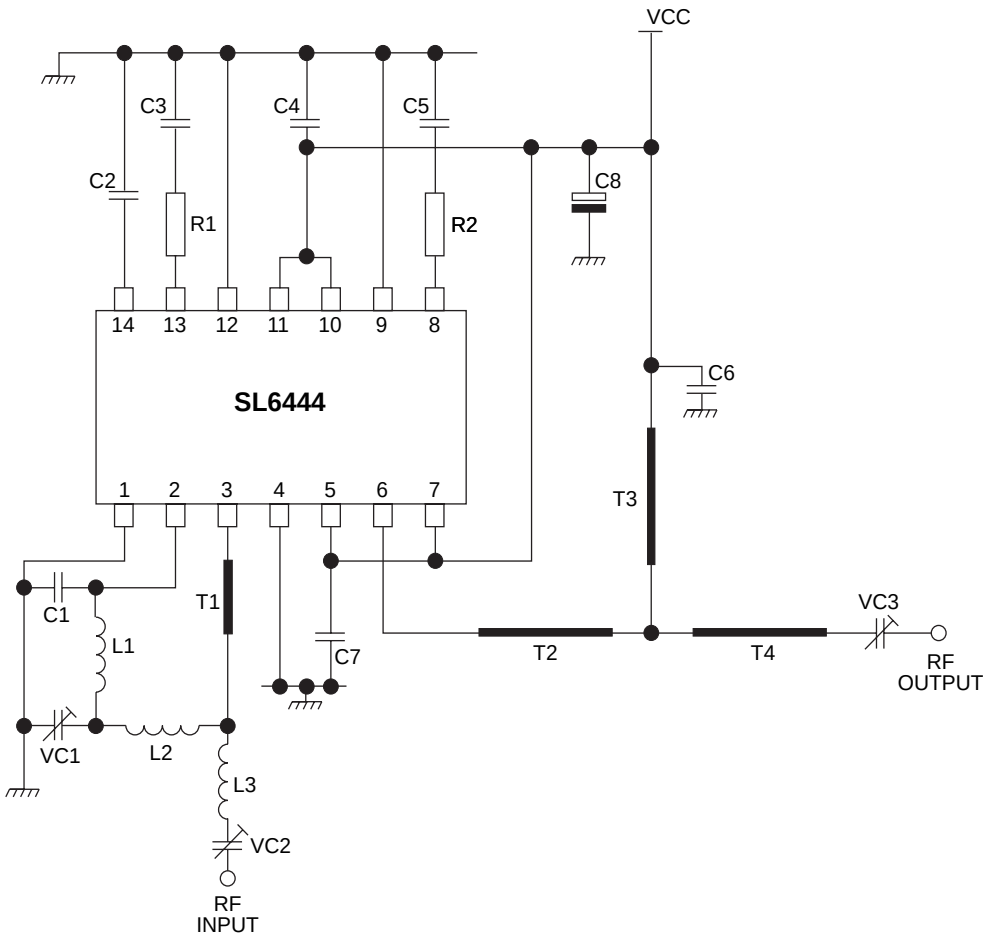
Graph 4



Graph 5



Graph 6



NOTES

1. Double sided board should be used
2. Low inductive resistors should be used
3. Good quality capacitors with high self resonant frequency should be used
4. Components should be placed in close proximity to device

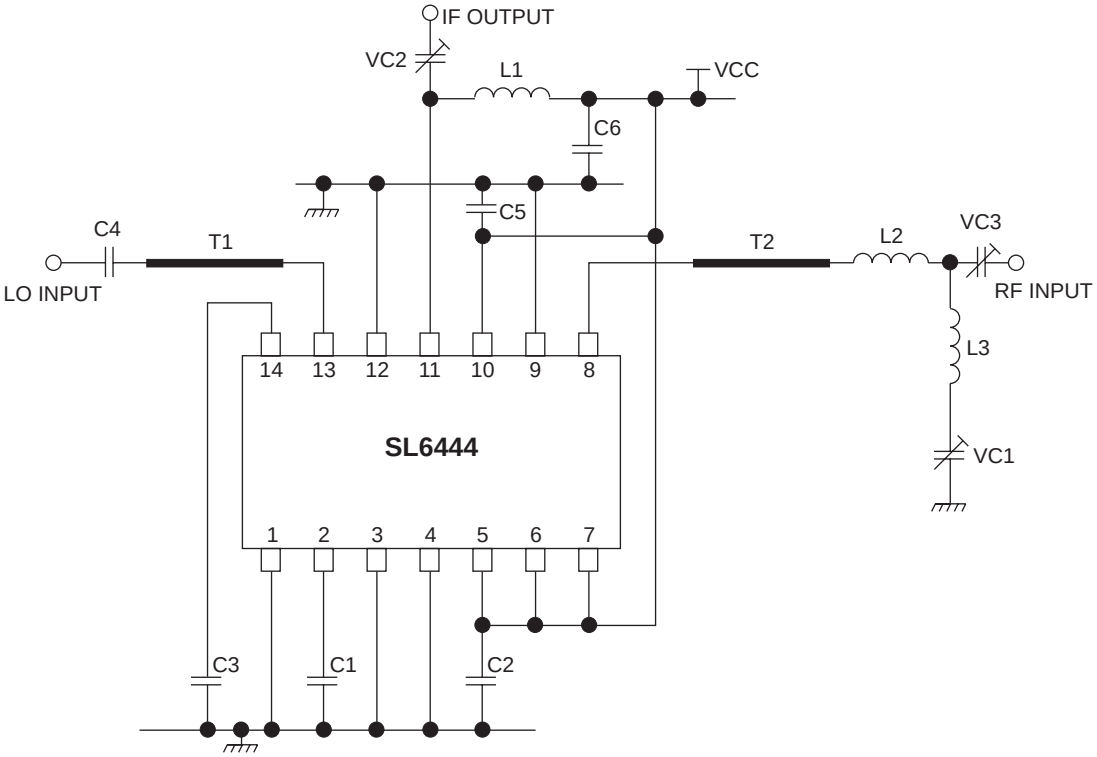
COMPONENT LIST

R1, R2	47 Ohm
C1, C2, C3, C4, C5, C7	1nF
C6	270pF
C8	1µF
VC1, VC2, VC3	20pF Trimmer
L1	56nH
L2	39nH
L3	6nH 1 Turn 24SWG 8mm diameter

Microstrip lines 0.5mm wide on 1.6mm thick glass fibre PCB and the following lengths.

T1	5mm
T2	16mm
T3	8mm
T4	15mm

Fig. 5 SL6444 RF amplifier demonstration circuit

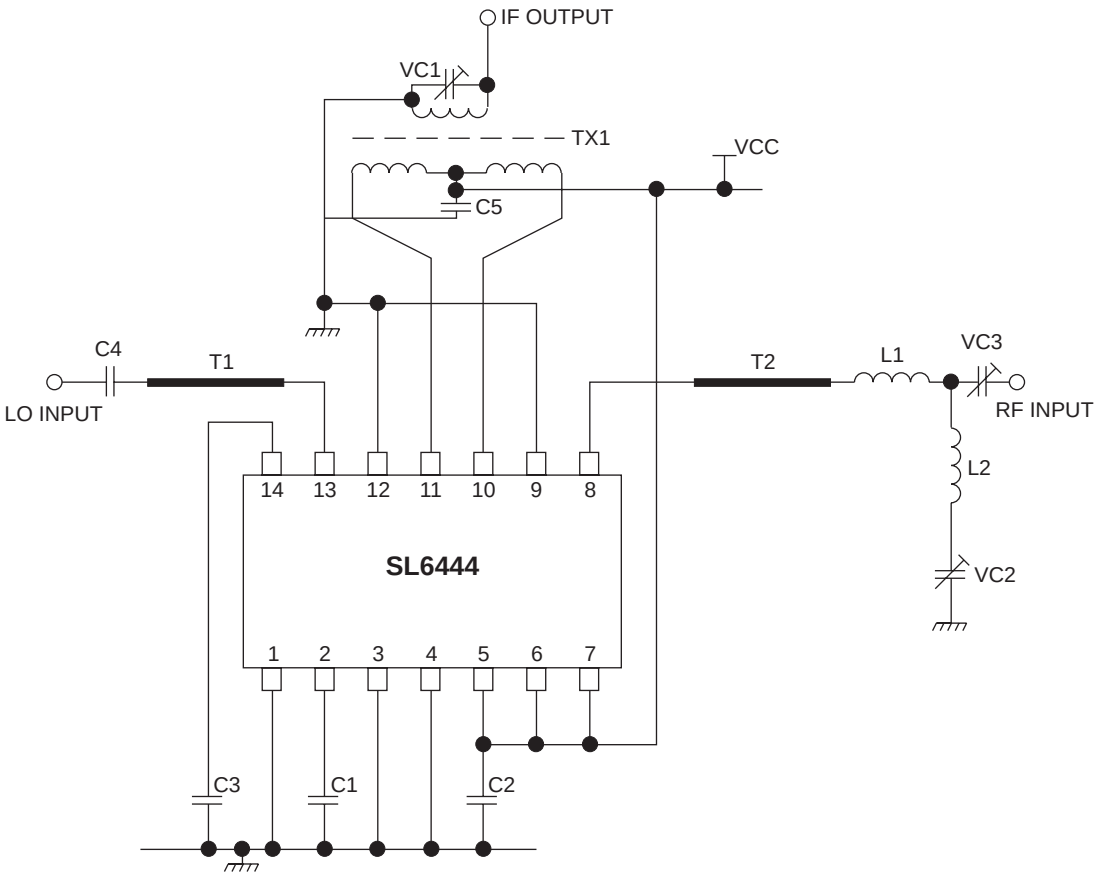


COMPONENT LIST

C1, C2, C3, C4, C5, C6	1nF
VC1, VC2, VC3	20pF Trimmer
L1	220nH
L2	6nH 1 Turn 24SWG 8mm diameter
L3	39nH
T1	50 Ohm line

Microstrip line T2 is 0.5mm wide on 1.6mm thick glass fibre PCB and of 5mm length.

Fig. 6 Single balanced mixer demonstration circuit



COMPONENT LIST

CI, C2, C3, C4, C5	1nF
VC1, VC2, VC3	20pF Trimmer
L1	6nH 1 Turn 24SWG 8mm diameter
L2	39nH
T1	50 Ohm line
TX1	4 + 4:1

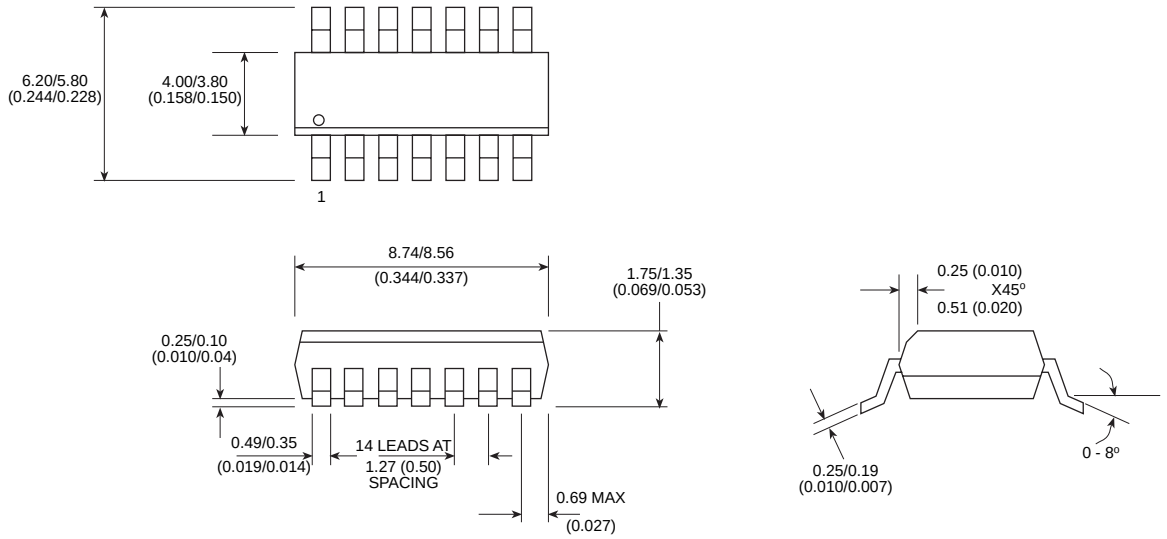
Transformer wound on a 2.5mm long double aperture ferrite bead. The material having an initial permeability of approximately 15.

Microstrip line T2 is 0.5mm wide on 1.6mm thick glass fiber PCB and of length 5mm.

Fig. 7 Double balanced mixer demonstration circuit

PACKAGE DETAILS

Dimensions are shown thus: mm (in). For further package information please contact your local Customer Service Centre.



14 - LEAD MINIATURE PLASTIC DIL- MP14

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