THIS DOCUMENT IS FOR MAINTENANCE PURPOSES ONLY AND IS NOT RECOMMENDED FOR NEW DESIGNS

GEC PLESSEY
SEMICONDUCTORS

SL6440

HIGH LEVEL MIXER

The SL6440 is a double balanced mixer intended for use in radio systems up to 150MHz. A special feature of the circuit allows external selection of the DC operating conditions by means of a resistor connected between pin 11 (bias) and Vcc When biased for a supply current of 50mA the SL6440 offers a 3rd order intermodulation intercept point of typically +30dBm, a value previously unobtainable with integrated circuits. This makes the device suitable for many applications where diode ring mixers had previously been used and offers the advantages of a voltage gain, low local oscillator drive requirement and superior isolation.

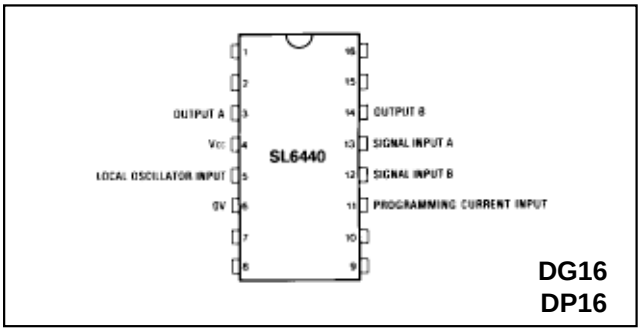

Fig.1 Pin connections - top view

FEATURES

- +30dBm Input Intercept Point
- +15dBm Compression Point (1dB)
- Programmable Performance
- Full Military Temperature Range (SL644A)

APPLICATIONS

- Mixers in Radio Transceivers
- Phase Comparators
- Modulators

ORDERING INFORMATION

SL6440 A DG
SL6440 C DP

ABSOLUTE MAXIMUM RATINGS

Supply voltage and output pins	15V
Maximum power dissipation	1200mW
(Derate above 25°C: 8mW/°C)	
Storage temperature range	-65°C to +150°C
Programming current into pin 11	50mA

THERMAL CHARACTERISTICS

Thermal resistance: θ_{JA}	125°C/W
θ_{JC}	
Time constant: Junction-Ambient	1.9 mins
Maximum chip temperature	150°C

ELECTRICAL CHARACTERISTICS

Test condltions (unless otherwise stated):

$V_{CC}1$ = 12V; $V_{CC}2$ = 10V; I_P = 25mA; T_{amb} = -55°C to +125°C (SL64440A), -30°C to +85°C (SL6440C)
Local oscillator input level = 0dBm; Test circuit Fig.2.

Characteristic	Value			Units	Conditions
	Min.	Typ.	Max.		
Signal frequency 3dB point	100	150		MHz	
Oscillator frequency 3dB point	100	150		MHz	
3rd order input intercept point		+30		dBm	
Third order intermodulation distortion		-60		dB	Two 0dBm input
Second order intermodulation distortion		-75		dB	Signals
1dB compression point		15		dBm	$V_{CC}1$ = 15V $V_{CC}2$ = 12V
					$V_{CC}1$ = 12V $V_{CC}2$ = 10V
Noise figure		11		dB	Fig.8 test circuit
Conversion gain		-1		dB	50Ω load Fig.2
Carrier leak to signal input	-40			dB	Test circuit Fig.8
Level of carrier at IF output		-25		dBm	See applications information
Supply current		7		mA	I_P = 0
Supply current (total from $V_{CC}1$ & $V_{CC}2$)		60		mA	
Local oscillator input	100	250	500	mV rms	I_P = 35mA
Local oscillator input impedance		1.5		kΩ	
Signal input impedance		500		Ω	Single ended
		1000		Ω	Differential

NOTE Supply current in Pin 3 is equal to that in Pin 14 and is equal to I_P See over. $V_{pin}11$ $3V_{be}$ 2.1V.

CIRCUIT DESCRIPTION

The SL6440 is a high level mixer designed to have a linear RF performance. The linearity can be programmed using the IP pin (11).

The output pins are open collector outputs so that the conversion gain and output loads can be chosen for the specific application.

Since the outputs are open collectors they should be returned to a supply $V_{CC}1$ through a load.

The choice of $V_{CC}1$ is important since it must be ensured that the voltage on pins 3 and 14 is not low enough to saturate the output transistors and so limit the signal swing unnecessarily. If the voltage on pins 3 and 14 is always greater than $V_{CC}2$ the outputs will not saturate. The output frequency response will reduce as the output transistors near saturation.

Minimum $V_{CC}1$ = (IP x RL) + VS + VCC2
where I_P = programmed current
RL = DC load resistance
V_S = max signal swing at output
if the signal swing is not known:
minimum $V_{CC}1 = 2 (I_P \times RL) + V_{CC}2$

In this case the signal will be limiting at the input before the output saturates.

The device has a separates supply ($V_{CC}2$) for the oscillator buffer (pin 4).

The current (I_P) programmed into pin 11 can be supplied via a resistor from $V_{CC}1$ or form a current source.

The conversion gain is equal to

$$GdB = 20 \text{ Log } \frac{RL\ I_P}{56.61\ I_P + 0.0785} \quad \text{for single-ended output}$$

$$GdB = 20 \text{ Log } \frac{2RL\ I_P}{56.61\ I_P + 0.0785} \quad \text{for differential output}$$

Device dissipation is calculated using the formula
mW diss = $2\ I_P\ V_O + V_P I_P + V_{CC}2$ Diss
where V_O = voltage on pin 3 or pin 14
V_P = voltage on pin 11
I_P = programming current (mA)
$V_{CC}2$ Diss = dissipation obtained from graph (Fig.6)

As an example Fig.7 shows typical dissipations assuming $V_{CC}1$ and V_O are equal. This may not be the case in pratice and the device dissipation will have to be calculated for any particular application.

Fig.5 shows the intermodulation performance against I_P. The curves are independent of $V_{CC}1$ and $V_{CC}2$ but if $V_{CC}1$ becomes too low the output signal swing cannot be accommodated, and if $V_{CC}2$ becomes too low the circuit will not provide enough drive to sink the programmed current. Examples are shown of performance at various supply voltages.

The current in pin 14 is equal to the current in pin 3 which is equal to the current in pin 11.

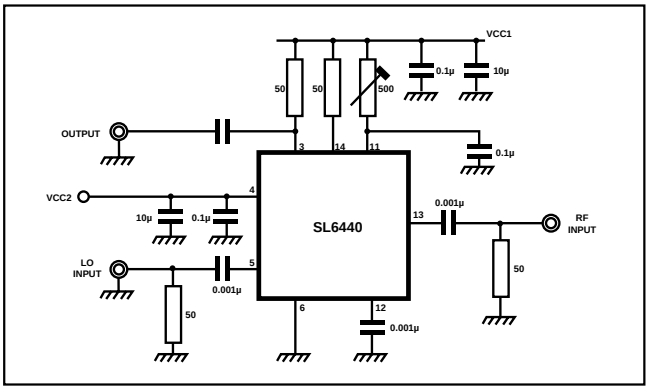

Fig.2 Typical application and test circuit

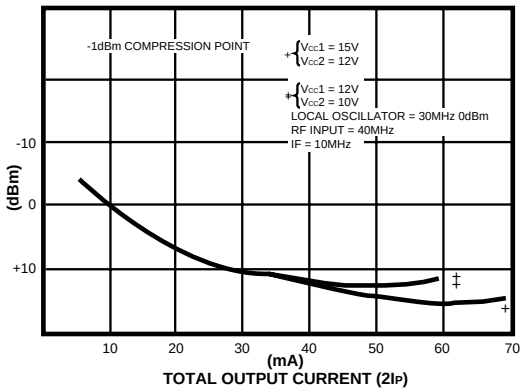

Fig.3 Compression point v. total output current

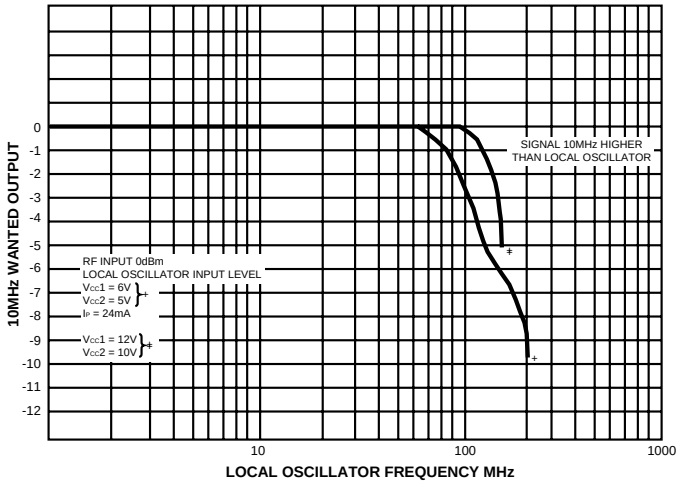

Fig.4 Frequency response at constant output IF

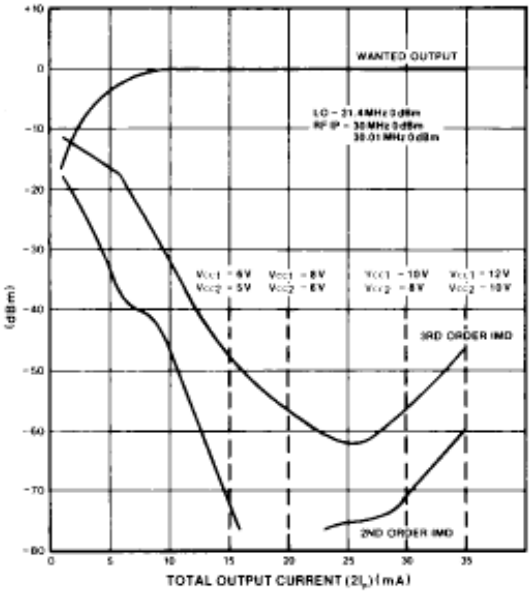

Fig.5 Intermodulation v. programming current

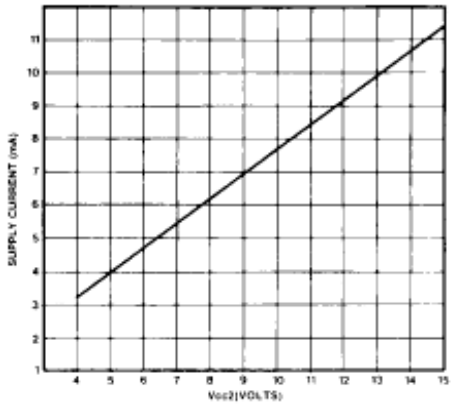

Fig.6 Supply current v. $V_{CC}2$ (I_P = 0)

APPLICATIONS

The SL6440 can be used with differential or singleended inputs and outputs. A balanced input will give bettercarrier leak The high input impedanceallowsstepup transformers to be used if desired, whilst high output impedance allows a choice of output impedance and conversion gain.

Fig. 2 shows the simplest application circuit. The input and output are single-ended and Ip is supplied from $V_{CC}1$ via a resistor. Increasing RL will increase the conversion gain, care being taken to choose a suitable value for $V_{CC}1$.

Fig. 8 shows an application with balanced input, for improved carrier leak, and balanced output for increased conversion gain. A lower $V_{CC}1$ giving lower device dissipation can be used with this arrangement.

DESIGN PROCEDURE

1. Decide on input configuration using local oscillator data. If using transformer on input, decide on ratio from noise considerations.
2. Decide on output configuration and value of conversion gain required.
3. Decide on value of I_P and $V_{CC}2$ using intermodulation and compression point graphs.
4. Using values of conversion gain, $V_{CC}2$, load and Ip already chosen, decide on value of $V_{CC}1$.
5. Calculate device dissipation and decide whether heatsink is required from maximum operating temperature conslderatlons.

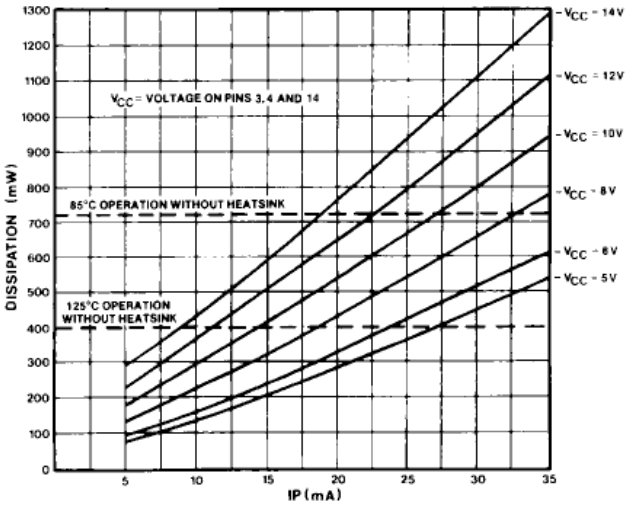

Fig.7 Device dissipation v. I_P

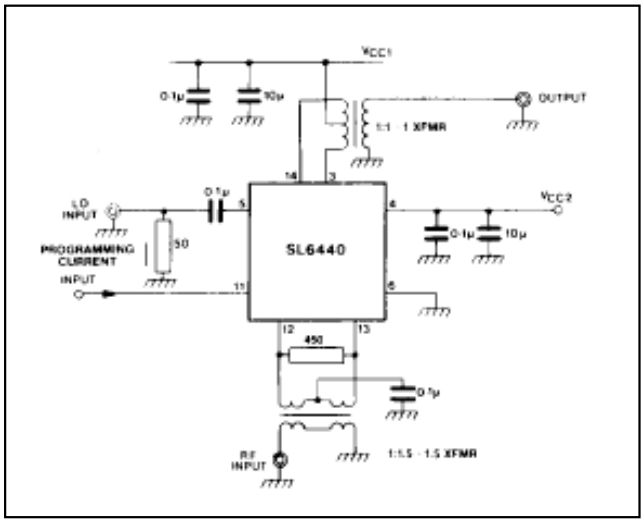

Fig.8 Typical application circuit for highest performance

For more information about all Zarlink products visit our Web Site at

www.zarlink.com

Information relating to products and services furnished herein by Zarlink Semiconductor Inc. trading as Zarlink Semiconductor or its subsidiaries (collectively "Zarlink") is believed to be reliable. However, Zarlink assumes no liability for errors that may appear in this publication, or for liability otherwise arising from the application or use of any such information, product or service or for any infringement of patents or other intellectual property rights owned by third parties which may result from such application or use. Neither the supply of such information or purchase of product or service conveys any license, either express or implied, under patents or other intellectual property rights owned by Zarlink or licensed from third parties by Zarlink, whatsoever. Purchasers of products are also hereby notified that the use of product in certain ways or in combination with Zarlink, or non-Zarlink furnished goods or services may infringe patents or other intellectual property rights owned by Zarlink.

This publication is issued to provide information only and (unless agreed by Zarlink in writing) may not be used, applied or reproduced for any purpose nor form part of any order or contract nor to be regarded as a representation relating to the products or services concerned. The products, their specifications, services and other information appearing in this publication are subject to change by Zarlink without notice. No warranty or guarantee express or implied is made regarding the capability, performance or suitability of any product or service. Information concerning possible methods of use is provided as a guide only and does not constitute any guarantee that such methods of use will be satisfactory in a specific piece of equipment. It is the user's responsibility to fully determine the performance and suitability of any equipment using such information and to ensure that any publication or data used is up to date and has not been superseded. Manufacturing does not necessarily include testing of all functions or parameters. These products are not suitable for use in any medical products whose failure to perform may result in significant injury or death to the user. All products and materials are sold and services provided subject to Zarlink's conditions of sale which are available on request.

Purchase of Zarlink's I^2C components conveys a licence under the Philips I^2C Patent rights to use these components in an I^2C System, provided that the system conforms to the I^2C Standard Specification as defined by Philips.

Zarlink, ZL and the Zarlink Semiconductor logo are trademarks of Zarlink Semiconductor Inc.

Copyright 2003, Zarlink Semiconductor Inc. All Rights Reserved.

TECHNICAL DOCUMENTATION - NOT FOR RESALE