SL2150D

Cable Tuner Front End LNA with AGC

Data Sheet

September 2005

Features

- Single chip dual output LNA
- Wide dynamic range on both channels
- Independent AGC facility incorporated into all channel paths
- Independent disable facility incorporated into all channel paths
- Full ESD protection. (Normal ESD handling procedures should be observed)

Applications

- Multi-tuner cable set top box and cable modem applications
- Data communications systems
- Terrestrial TV tuner loop though

Ordering Information

SL2150D/KG/LH1S	28 Pin QFN	Tubes
SL2150D/KG/LH2R	28 Pin QFN*	Trays
SL2150D/KG/LH2T	28 Pin QFN*	Tape & Reel

*Pb Free Matte Tin

-20°C to +85°C

Description

The SL2150D is a wide dynamic range front end for tuner applications.

The device offers two buffered outputs from a single input, where both paths contain an independently controllable AGC and disable facility.

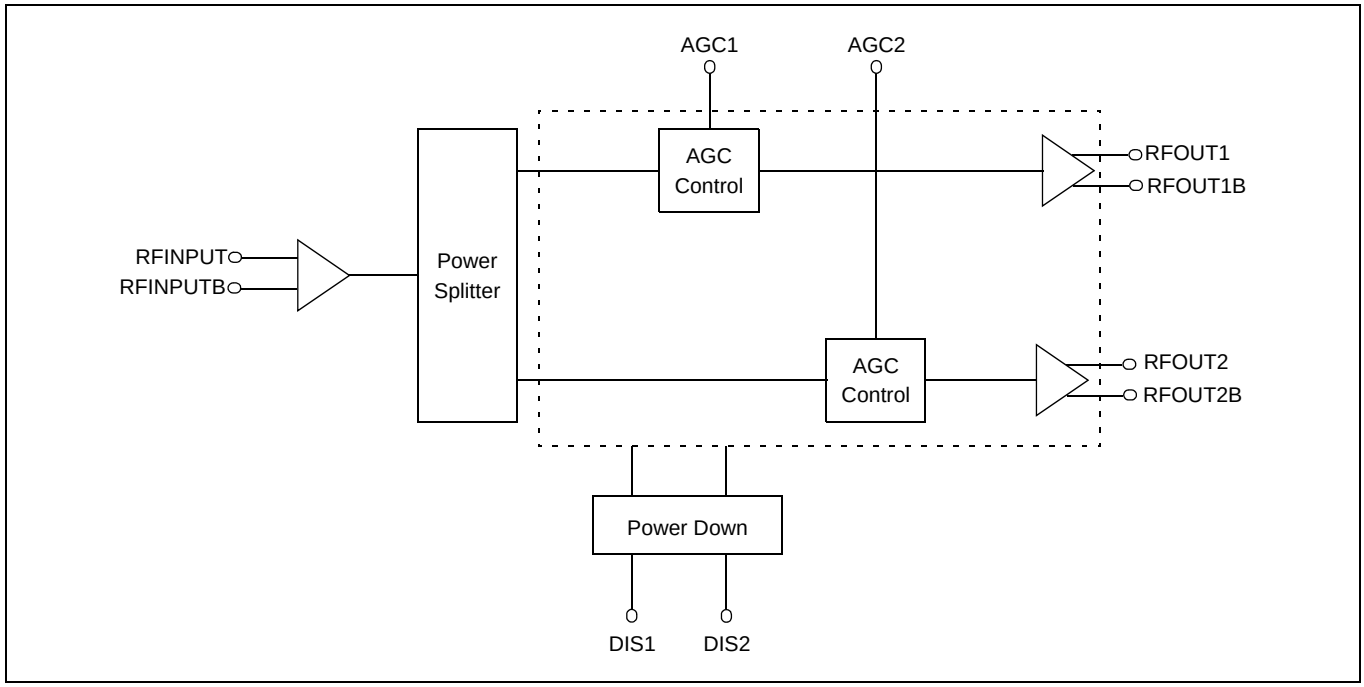


Figure 1 - SL2150D Block Diagram

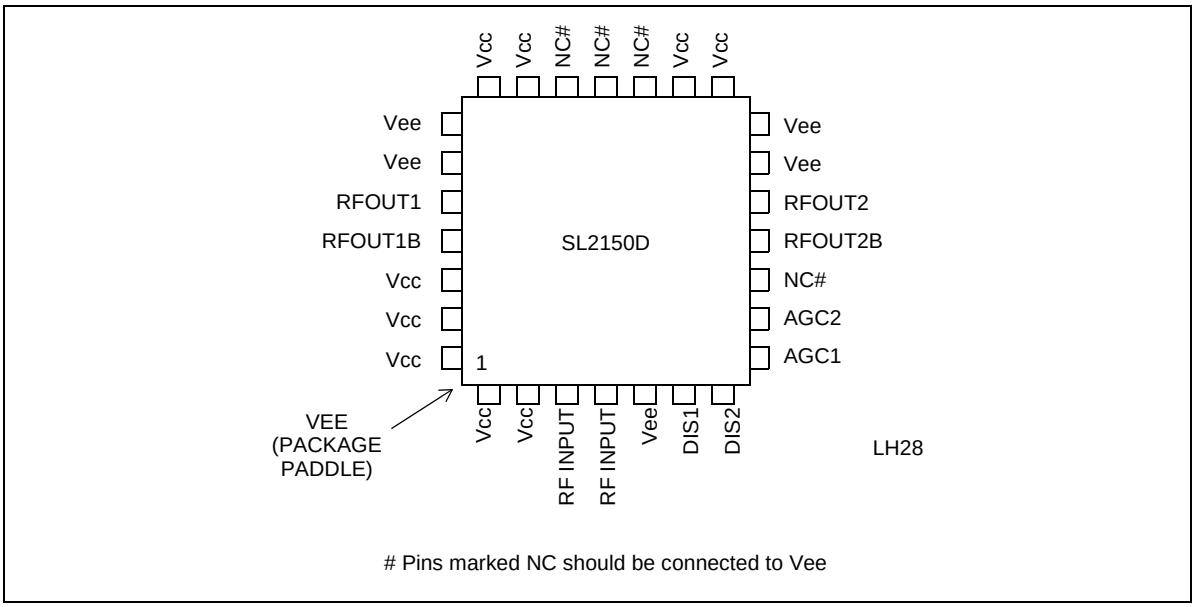


Figure 2 - Pin Allocation

1.0 Quick Reference Data

NB all data applies with differential termination and single ended source both of 75 Ω.

Characteristics		Units
RF input operating range	50-860	MHz
Gain with external load as in Figure 11 maximum minimum	 11 -25	 dB dB
Input NF, both paths enabled at maximum gain	6.4	dB
CTB, both paths enabled, all gain settings *	-66	dBc
CSO, both paths enabled, all gain settings *	-64	dBc
CXM, both paths enabled, all gain settings *	-60	dBc
Input impedance	75	Ω
Input VSWR	8	dB
Output impedance differential, all loops (requires external load for example as in Figure 11)	440	Ω
Input to output isolation (both outputs)	30	dB
Output to output isolation	25	dB

Table 1 - Reference Data

*132 channel matrix at +15 dBmV per channel, 75 Ω source impedance

2.0 Functional Description

The SL2150D is a broadband wide dynamic range dual output tuner front end LNA with AGC. It also has application is any system where a wide dynamic range broadband power splitter is required.

The pin assignment is contained in Figure 2 and the block diagram in Figure 1.The port internal peripheral circuits are contained in Figure 14.

In normal application the RF input is interfaced to the device input. The input preamplifier is designed for low noise figure, within the operating region of 50 to 860 MHz and for high intermodulation distortion intercept so offering good signal to noise plus composite distortion spurious performance when loaded with a multi carrier system. The preamplifier also provides an impedance match to a 75 Ω source; the typical impedance is shown in Figure 4.

The input NF is shown in Figure 6.

The output of the preamplifier is then power split to two independently controlled AGC stages. Each AGC stage provides for a minimum of 30 dB of gain control across the input frequency range. The typical AGC characteristic and NF versus gain setting are contained in Figure 5 and Figure 7 respectively.

Finally each of the AGC stages drive an output buffer of differential output impedance of 440 Ω, which provides a nominal 11 dB of gain when terminated into a differential 75 Ω load, as in Figure 11. Each channel AGC and output buffer can be independently powered down.

In application it is important to avoid saturation of the output stage, therefore it is recommended that the output standing current be sunk to Vcc through an inductor. A resistive pull up can also be used as shown in Figure 13 - "Example Application Driving 100 W Load with Resistive Pull Up", however the resistor values should not exceed 20 ohm single ended.

If an inductive current sink is used the maximum available gain from the device is circa 26 dB. This gain can be reduced by application of an external load between the differential output ports. The gain can be approximately calculated from the following formula:

- GAIN = 20*log ((Parallel combination of 440 ohm and external load between ports)/22 ohm)+2 dB

For example when driving a 100 ohm load as in Figure 12, the gain equals

- GAIN = 20 *log ((440 *100)/(440+100)/22)+2 dB =12 dB.

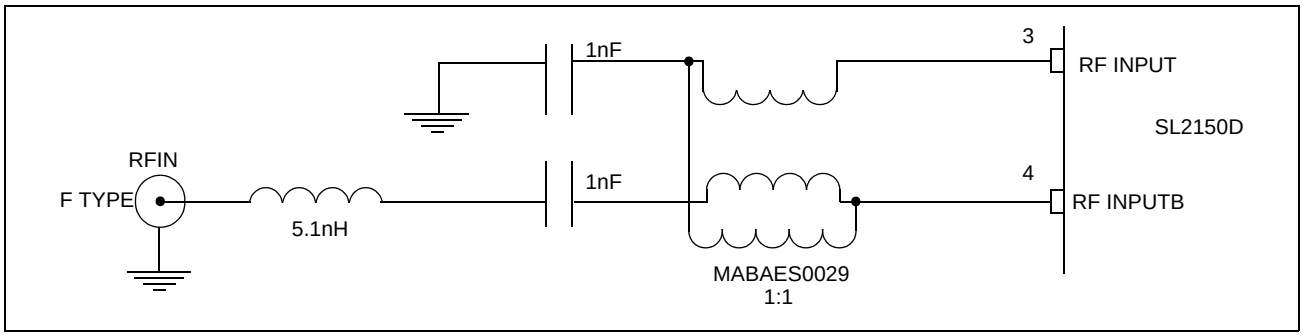


Figure 3 - Input Network

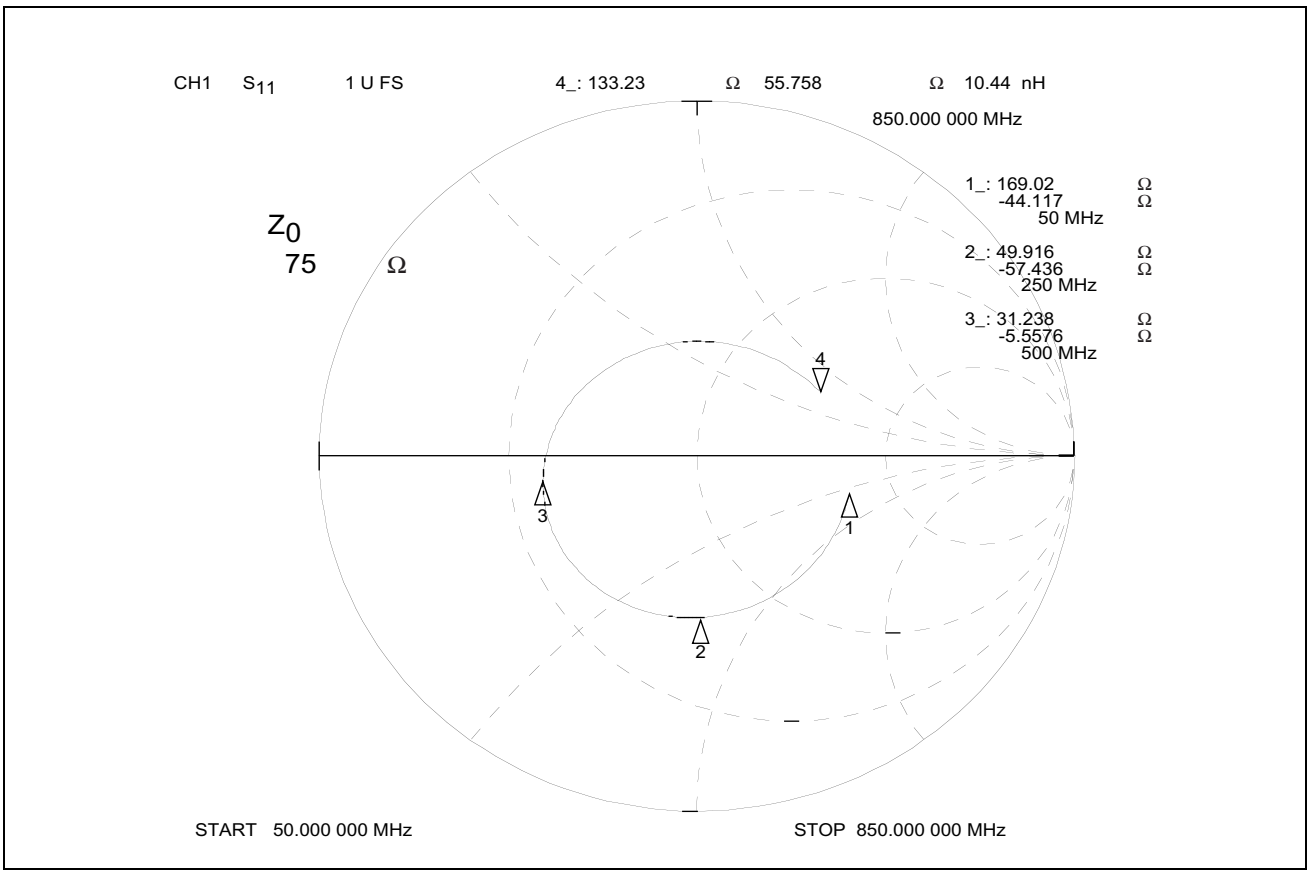


Figure 4 - Typical Single-end Input Impedance

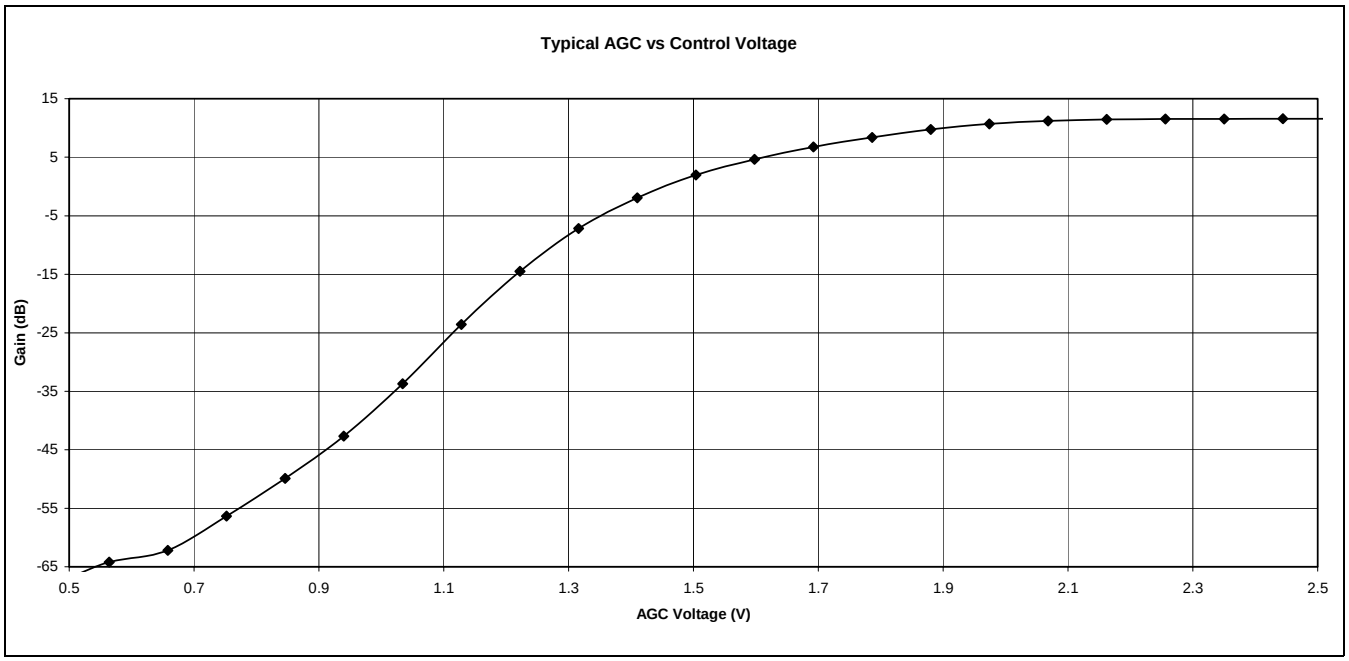


Figure 5 - Typical AGC Characteristic

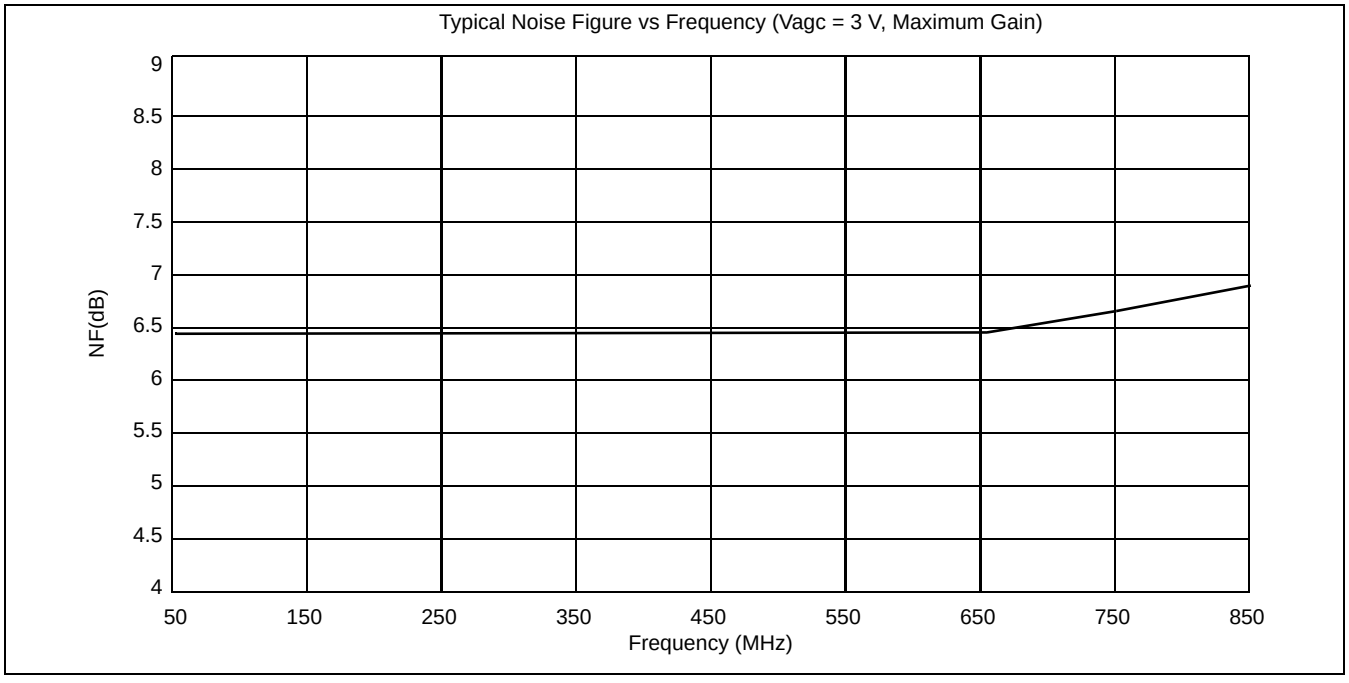


Figure 6 - Input Noise Figure at 25°C

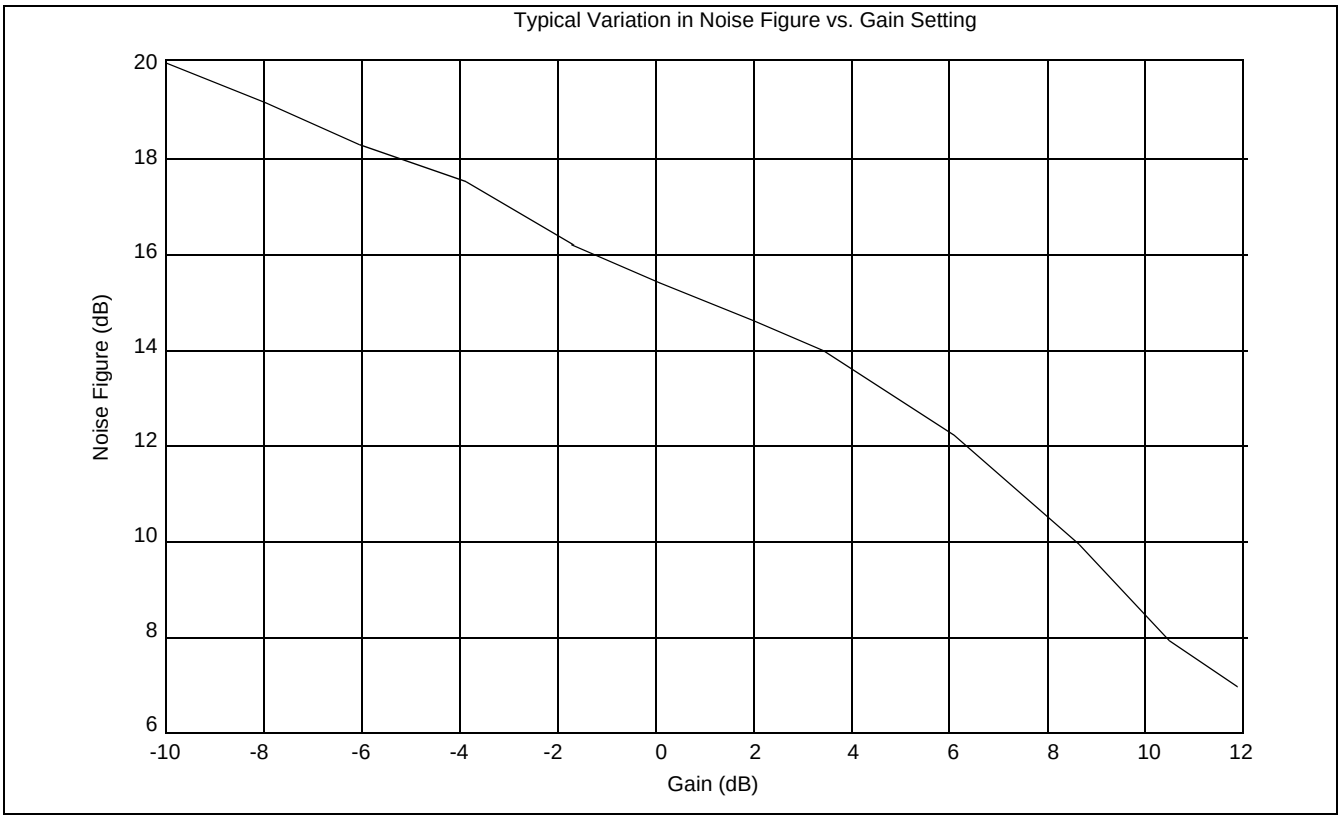


Figure 7 - Typical Variation in NF versus Gain Setting

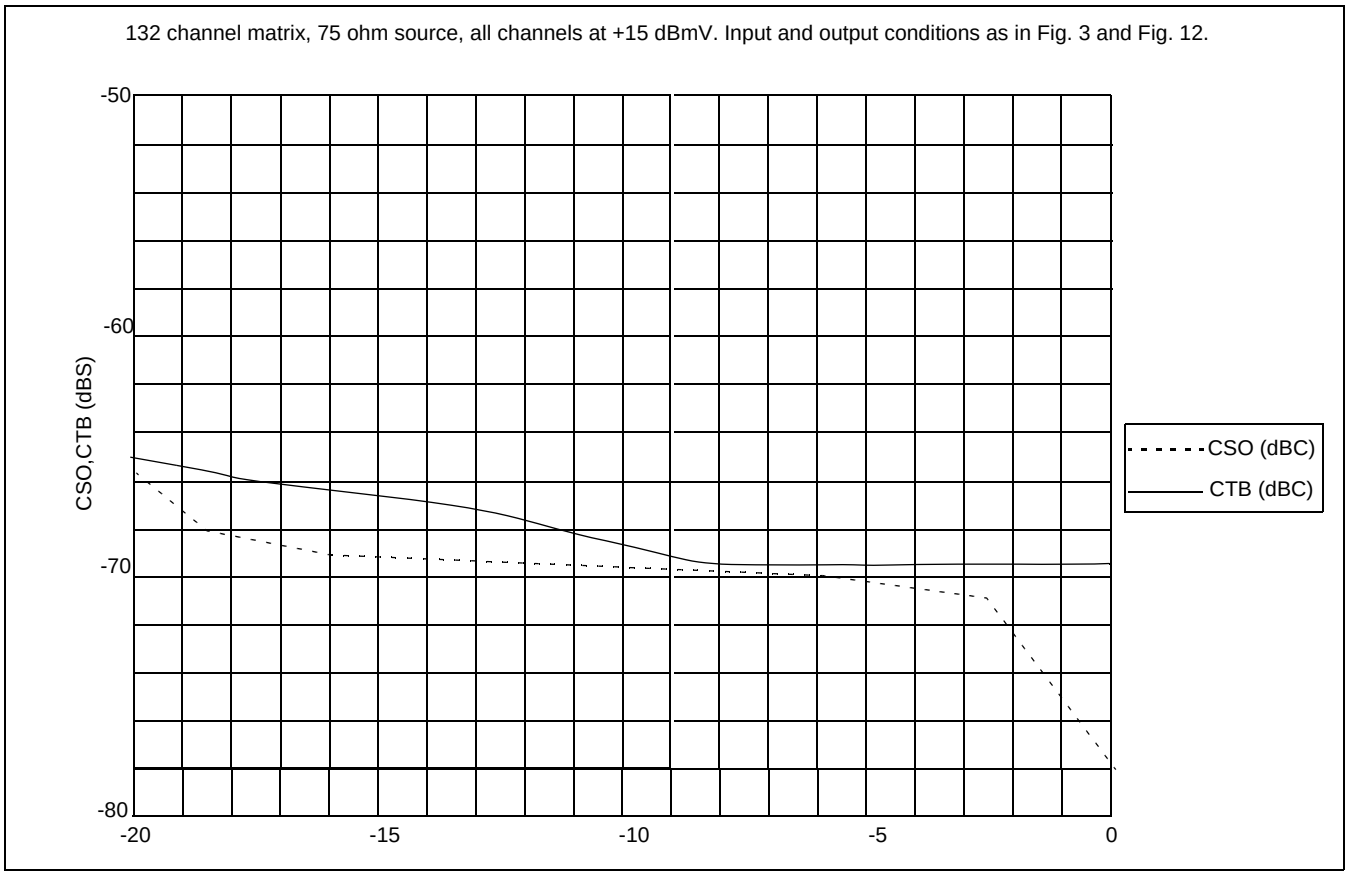


Figure 8 - Typical Variation In CSO and CTB Versus Backoff from Maximum Gain

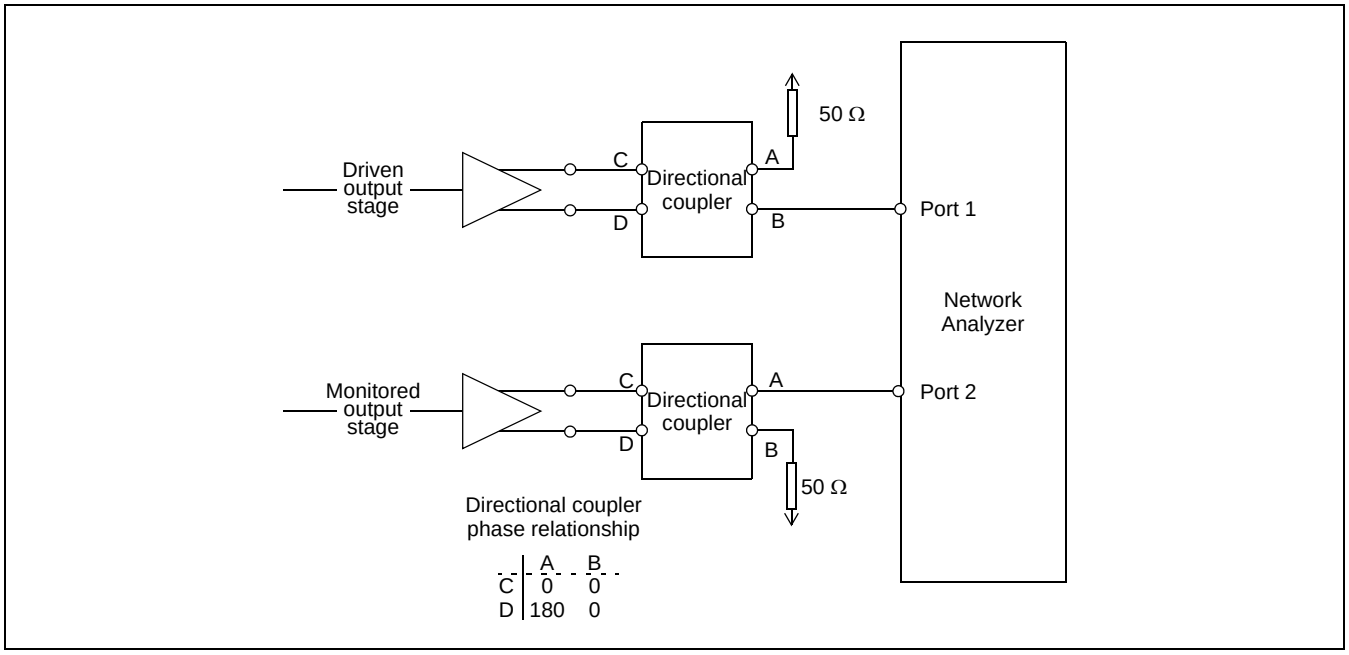


Figure 9 - Test Condition for Output Crosstalk

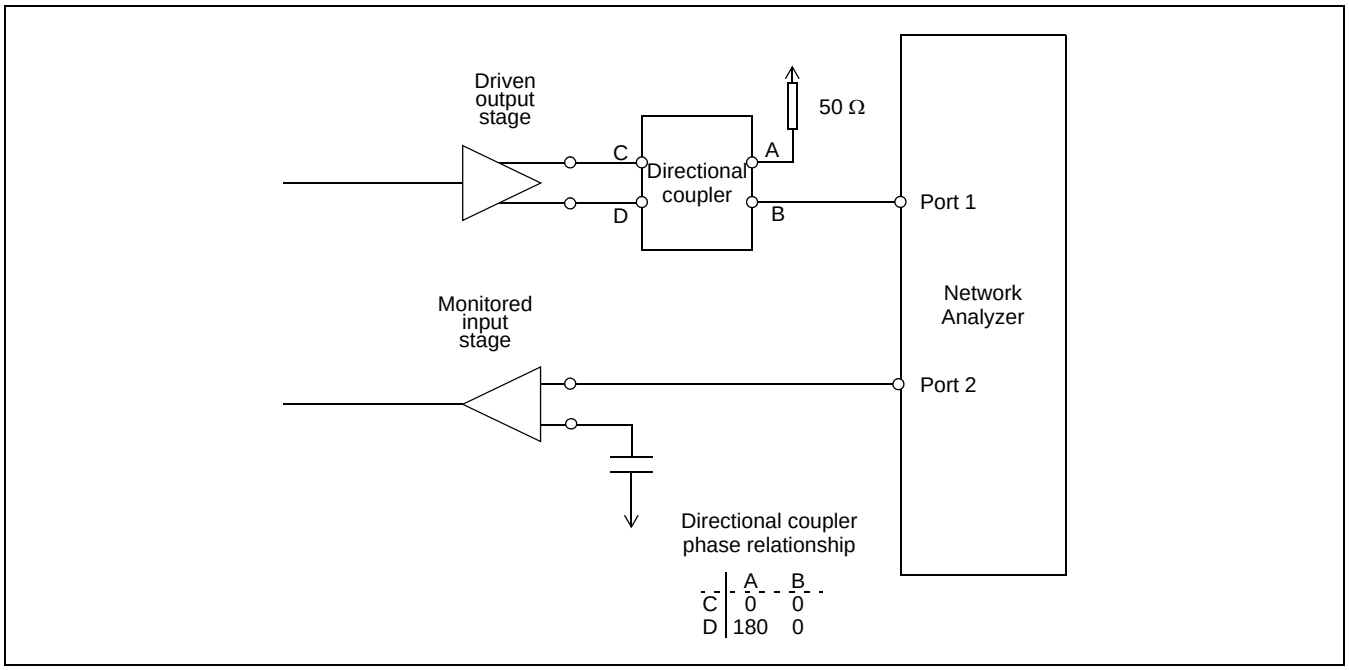


Figure 10 - Test Condition for Output to Input Crosstalk

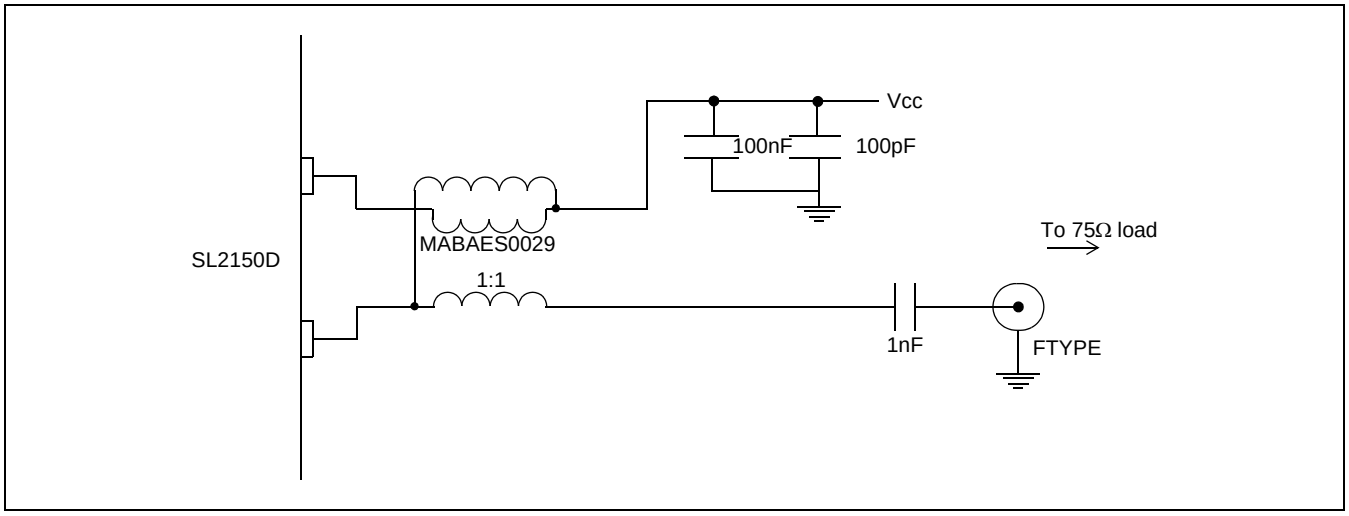


Figure 11 - Example Application Driving 75 Ω Load

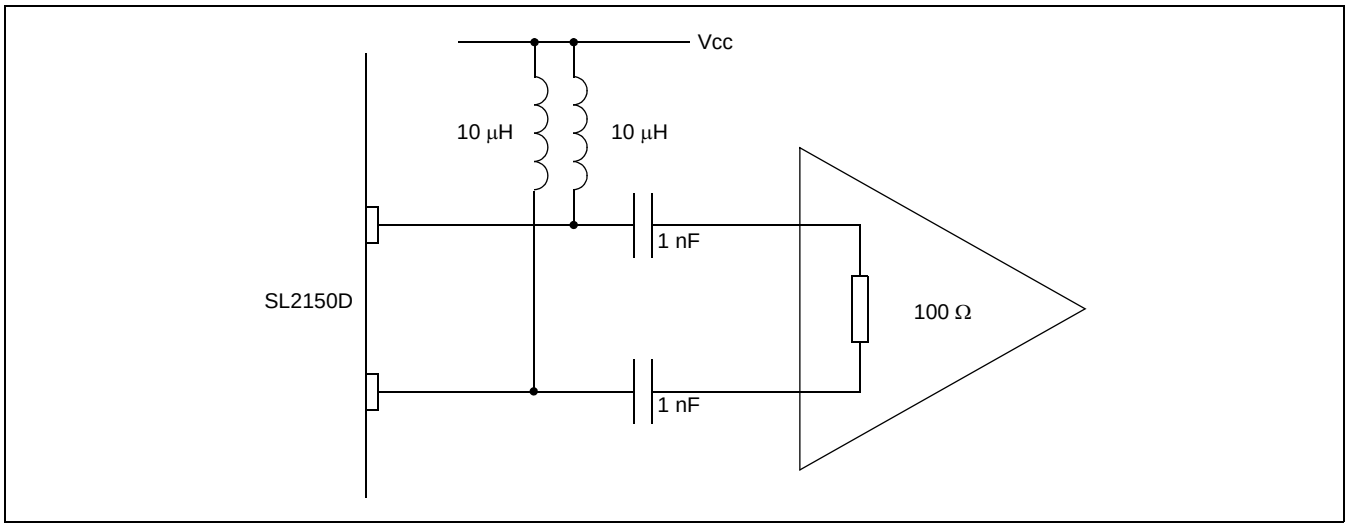


Figure 12 - Example Application Driving 100 Ω Load with Inductive Pull Up

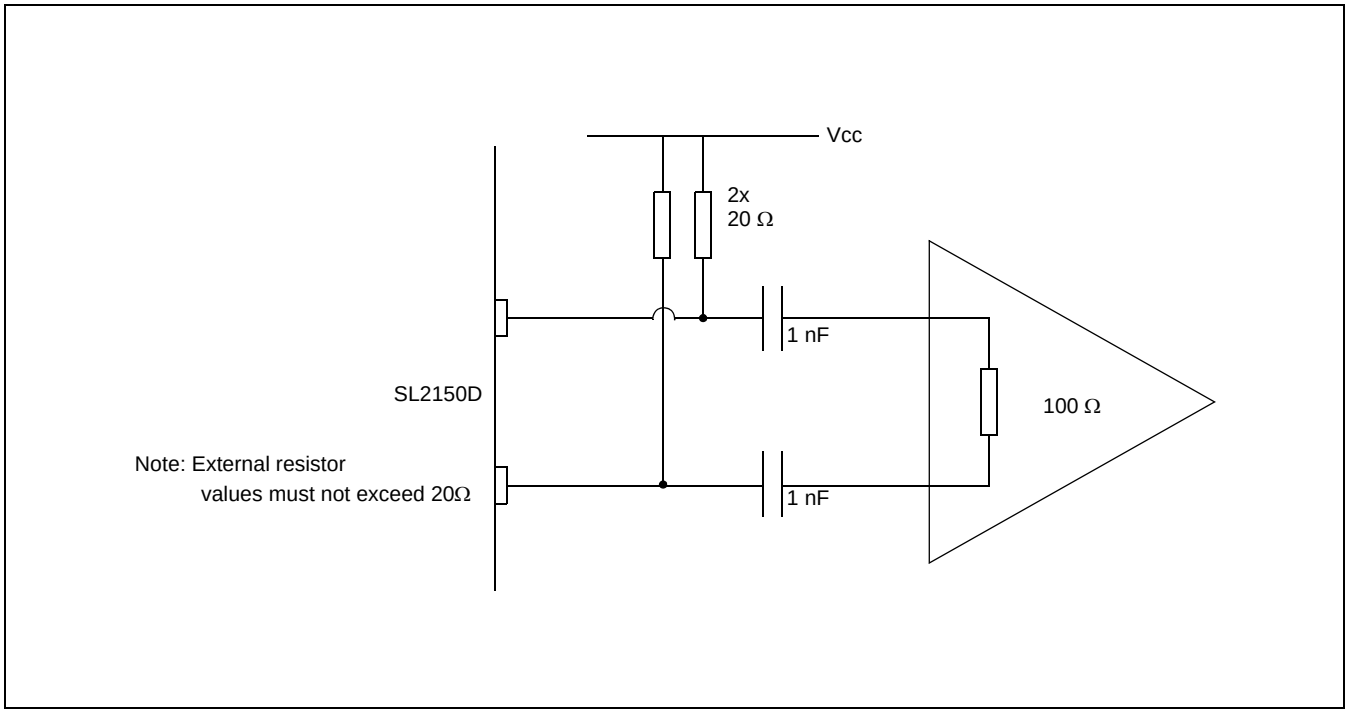


Figure 13 - Example Application Driving 100 Ω Load with Resistive Pull Up

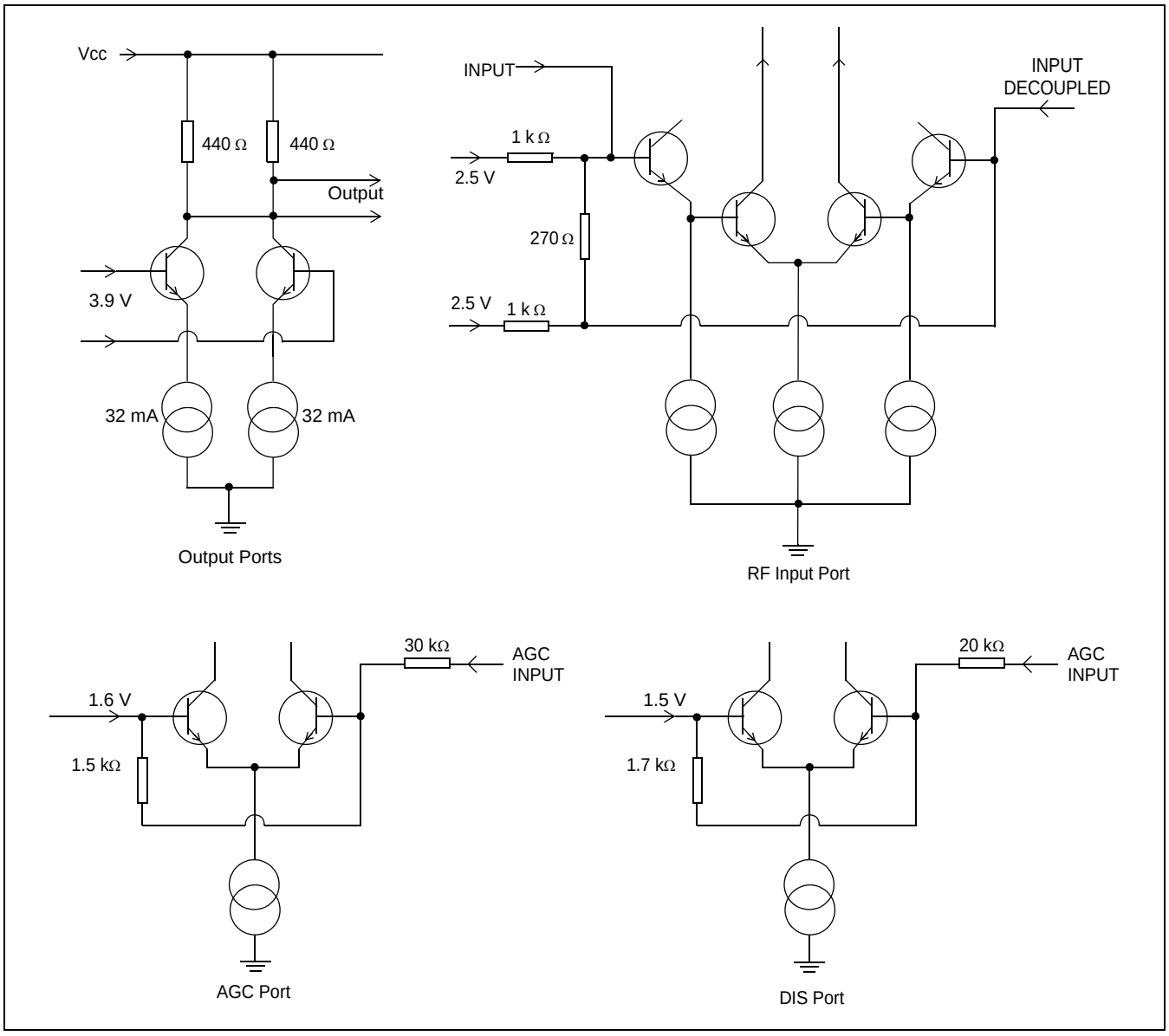


Figure 14 - Port Peripheral Circuitry

3.0 Electrical Characteristics

Test conditions (unless otherwise stated).

T_{amb} = -20° to 85°C, Vee = 0 V, Vcc = 5 V+-5%

These characteristics are guaranteed by either production test or design.

They apply within the specified ambient temperature and supply voltage unless otherwise stated.

Electrical Characteristics

Characteristic	Pin	Min.	Typ.	Max.	Units	Conditions
Supply current			190 110 42	220 140 60	mA mA mA	Both outputs enabled One output enabled Both outputs disabled
Input frequency range		50		860	MHz	
Input impedance	3, 4		75		Ω	See Figure 4
Input return loss		6.8	8		dB	See Figure 4
Input Noise Figure			6.4	7.2	dB	Tamb = 27°C, see Figure 6 All loops at maximum gain
Variation in NF with gain adjust				-1	dB/dB	See Figure 7
Gain maximum minimum minimum		9.5	 11 -50	 12.5 -25	 dB dB dB	Power gain from 75 Ω single ended source to differential 75 Ω load, with application as in Figure 11. Vagcip = 3.0 V Vagcip = 0.5 V Vagcip = Vee AGC monotonic from Vee to Vcc. Refer to Functional description section for information on calculating maximum gain with other load conditions
CSO				-66 -62	dBc dBc	See note (2) See note (3)
CTB				-65 -62	dBc dBc	See note (2) See note (3)
CXM				-60	dBc	See note (2)
Input P1dB			+4.5		dBm	All gain settings, with load as in Figure 11

Electrical Characteristics (continued)

Characteristic	Pin	Min.	Typ.	Max.	Units	Conditions
Gain variation within channel				0.25	dB	Channel bandwidth 8 MHz within operating frequency range, all loops, all gain settings
Output impedance	11,12, 24,25		440		Ω	Differential
Output port DC standing current	11,12, 24,25			50	mA	Standing current that any external load has to sustain.
AGC1, 2 input leakage current	8,9	-200		200	μA	Vagcip = Vee to Vcc
DIS1, 2 input Input high voltage Input low voltage Leakage current	6, 7	 2.8 Vee -200		 Vcc 0.8 200	 V V μA	 Output disabled Output enabled DIS1, 2 = Vee to Vcc
Crosstalk between outputs				-25	dB	All gain settings, measured differential output to differential output, driven ports in phase and monitored ports out of phase, see Figure 9
Crosstalk between outputs and RF input				-30	dB	All gain settings, measured differential output to single ended input, driven ports in phase, see Figure 10

Note 1: All power levels are referred to 75 Ω, and 0 dBm = 109 dBμV.
Note 2: Load as in Figure 11and Figure 12, at maximum gain, 132 channel matrix, 75 ohm source with all channels at +15 dBmV, assuming power match.
Note 3: Load as in Figure 11 and Figure 12, all gain settings, 132 channel matrix, 75 ohm source with all channels at +15 dBmV, assuming power match.

Absolute Maximum Ratings All voltages are referred to Vee at 0V

Characteristic	Min.	Max.	Units	Conditions
Supply voltage	-0.3	6	V	
RF input voltage		8	dBm	Differential
All I/O port DC offsets	-0.3	Vcc+0.3	V	
Storage temperature	-55	150	^{o}C	
Junction temperature		125	^{o}C	Power applied
Package thermal resistance, chip to ambient		35	^{o}C/W	Paddle to be soldered to ground plane
Power consumption at 5.25 V		1155	mW	
ESD protection	1.5		kV	Mil-std 883B method 3015 cat1

4.0 Application Diagram

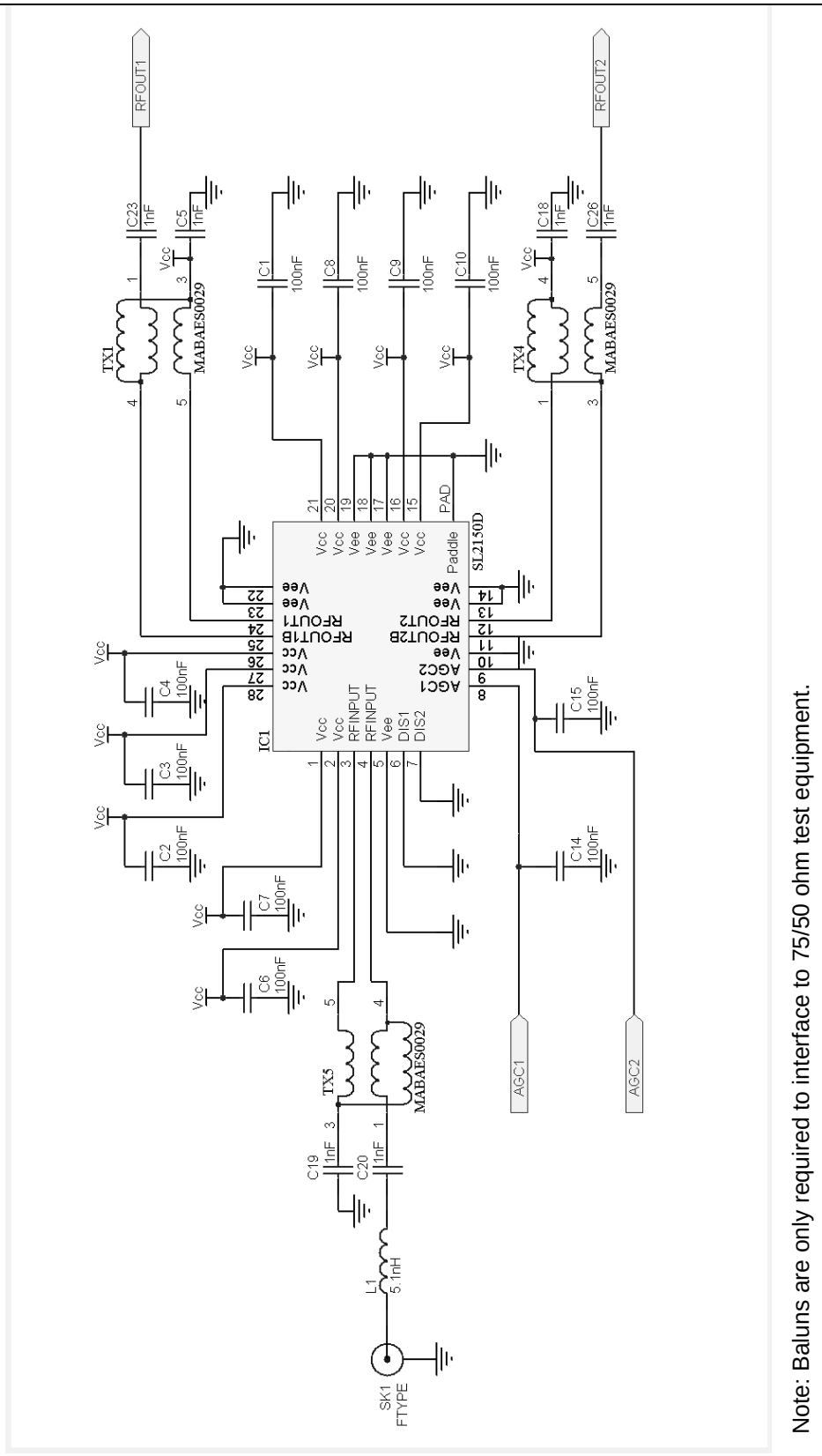
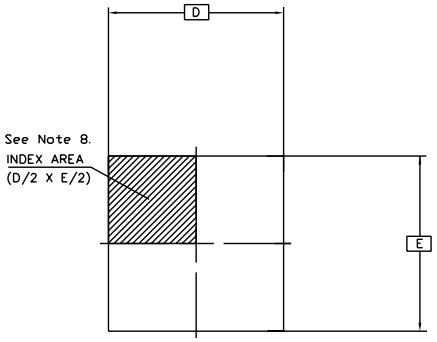
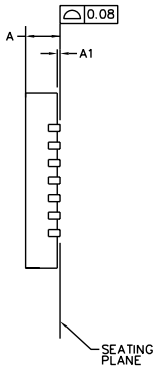
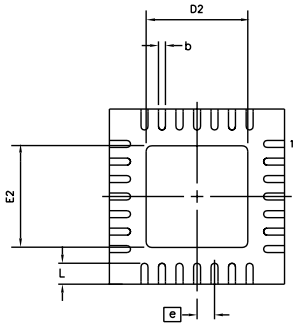


Figure 15 - SL2150D Evaluation PCB Schematic



TOP VIEW





BOTTOM VIEW

SYMBOL	COMMON DIMENSIONS	
	MIN.	MAX.
A	–	1.00
A1	0.00	0.05
b	0.18	0.30
D	5.00 BSC	
D2	3.00	3.25
E	5.00 BSC	
E2	3.00	3.25
N	28	
Nd	7	
Ne	7	
e	0.50 BSC	
L	0.35	0.75

Conforms to JEDEC MO-220 VHHD-1 iss A

NOTES:
1. DIMENSIONING & TOLERANCES CONFORM TO ASME Y14.5M. – 1994.
2. N IS THE NUMBER OF TERMINALS.
   Nd & Ne ARE THE NUMBER OF TERMINALS ON EACH D AND E SIDE RESPECTIVELY
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30mm FROM TERMINAL.
4. ALL DIMENSIONS ARE IN MILLIMETERS.
5. LEAD COUNT IS 28 .
6. PACKAGE WARPAGE MAX 0.08mm.
7. NOT TO SCALE.
8. TERMINAL #1 IDENTIFIER MUST BE LOCATED WITHIN THE ZONE INDICATED AND MAY BE EITHER A MOULD OR MARKED FEATURE.

ISSUE	1	2	3	
ACN	209757	212494	212973	
DATE	26Oct00	8Apr02	21Jun02	
APPRD.				

ZARLINK SEMICONDUCTOR

Previous package codes
LH

Package Code LC

Package Outline for 28 lead MLP (5 x 5mm)

GPD00747

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