10Gb/s Linear AGC Receive Module TGA2950-SL

Key Features and Performance

- 40kHz - 7GHz Bandwidth
- 36dB Small Signal Gain
- >50 dB Gain Adjustment
- Single-Ended Input, Differential Linear Output up to 2Vpp
- Peak Power Detector
- Surface Mount Package
- Low Power Dissipation
- V_{dd} = +5V, V_{ss} = -5.2V
  I_{dd} = 183mA, I_{ss} = -3mA
- Package Dimensions:
  0.450 x 0.350 x 0.090 inches

Primary Applications

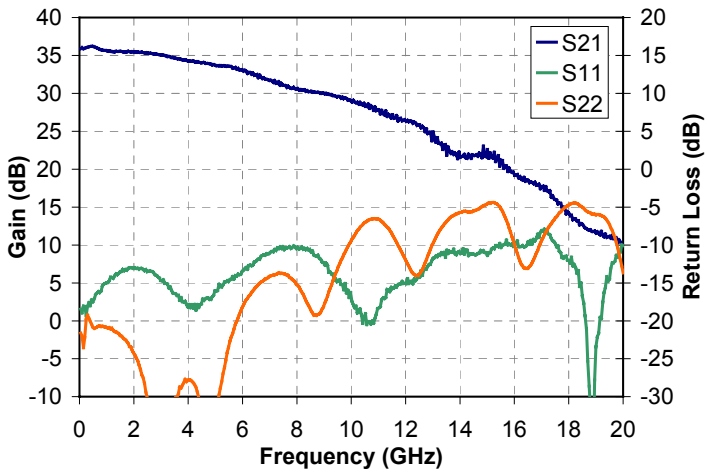
- Linear Receive
- AGC

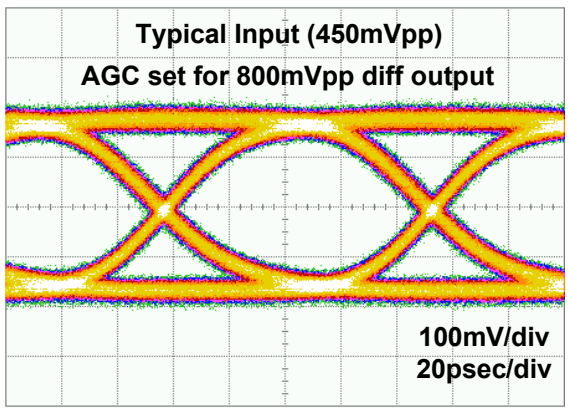
Description

The TriQuint TGA2950-SL is a surface mount, broad band AGC amplifier suitable for linear Fiber-Optic receive applications. The TGA2950 consists of multiple high performance wideband amplifier MMICs and off-chip components assembled in laminate surface mount package. The amplifier converts a single-ended input signal to differential outputs and provides up to 36dB of single-ended linear gain with 50dB of gain adjustment. Through proper use of the AGC function, the device can maintain a linear single-ended output signal up to $1V_{PP}$ for input signals as large as $1V_{PP}$. The TGA2950 dissipates less than 1W of DC power from MSA compatible +5.0V and -5.2V supplies. The amplifier also features an output power detect function and internal DC blocks on all RF ports. The TGA2950-SL is available on an evaluation board.

Preliminary Measured Performance

V_{dd}=+5V; V_{ss}=-5.2V; V_{g1}=-0.9V; V_{g2}=-0.7V;
AGC=0V; XOVR=1.9V





Note: This device is early in the characterization process prior to finalizing all electrical specifications. Specifications are subject to change without notice.

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TABLE I
MAXIMUM RATINGS

Symbol	Parameter	Value	Notes
V_{dd}	Positive Supply Voltage	8 V	1/ 2/
V_{ss}	Negative Supply Voltage	-6 V	1/
I_{dd}	Positive Supply Current (Quiescent)	TBD	1/ 2/
$\| I_{ss} \|$	Negative Supply Current	TBD	1/
V_g	Gate Voltage Range	TBD	1/
AGC	AGC Voltage Range	TBD	1/
XOVR	Crossover Voltage Range	TBD	1/
V_{IN}	Input Continuous Wave Voltage	2 V_{pp}	1/ 2/
P_D	Power Dissipation	TBD	1/ 2/ 3/
T_{CH}	Operating Channel Temperature	150 ^{0}C	4/
T_M	Mounting Temperature (10 seconds)	260^{0}C	
T_{STG}	Storage Temperature	-65 to 150 ^{0}C	

1/ These ratings represent the maximum operable values for this device

2/ Combinations of supply voltage, supply current, input power, and output power shall not exceed P_D at a package base temperature of 70°C

3/ When operated at this bias condition with a baseplate temperature of 70°C, the MTTF is reduced to 1.0E+6 hours

4/ Junction operating temperature will directly affect the device median time to failure (MTTF). For maximum life, it is recommended that junction temperatures be maintained at the lowest possible levels.

TABLE II
THERMAL INFORMATION

Parameter	Test Conditions	T_{CH} (°C)	$R_{\Theta JC}$ (°C/W)	MTTF (hrs)
$R_{\Theta JC}$ Thermal Resistance (Channel to Backside of Package)	V_{dd} = 5V I_{dd} = 250mA P_{DISS} = 1.27W T_{BASE} = 70°C	76.9	5.4	1.8E9

Note: Thermal transfer is conducted through the bottom of the TGA2950-EPU-SL package into the motherboard. The motherboard must be designed to assure adequate thermal transfer to the base plate.

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TABLE III
RF CHARACTERIZATION TABLE
(T_A = 25°C, Nominal)
(Vdd = 5V, Idd = 183mA ±5%)

Symbol	Parameter	Test Conditions	Typ	Units	Notes
Gain	Maximum Small Signal Gain	F = 1 GHz	36	dB	
Gain	Minimum Small Signal Gain	F = 1 GHz	-12	dB	
BW	Small Signal 3dB Bandwidth		7	GHz	1/
IRL	Input Return Loss	F = 40 kHz – 6 GHz F = 6 – 10 GHz	13 10	dB	1/
ORL	Output Return Loss	F = 40 kHz – 6 GHz F = 6 – 10 GHz	15 8	dB	1/

Note: Table III Lists the RF Characteristics of typical devices as determined by fixtured measurements.

1/ Parameters measured at maximum gain bias

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Measured Performance

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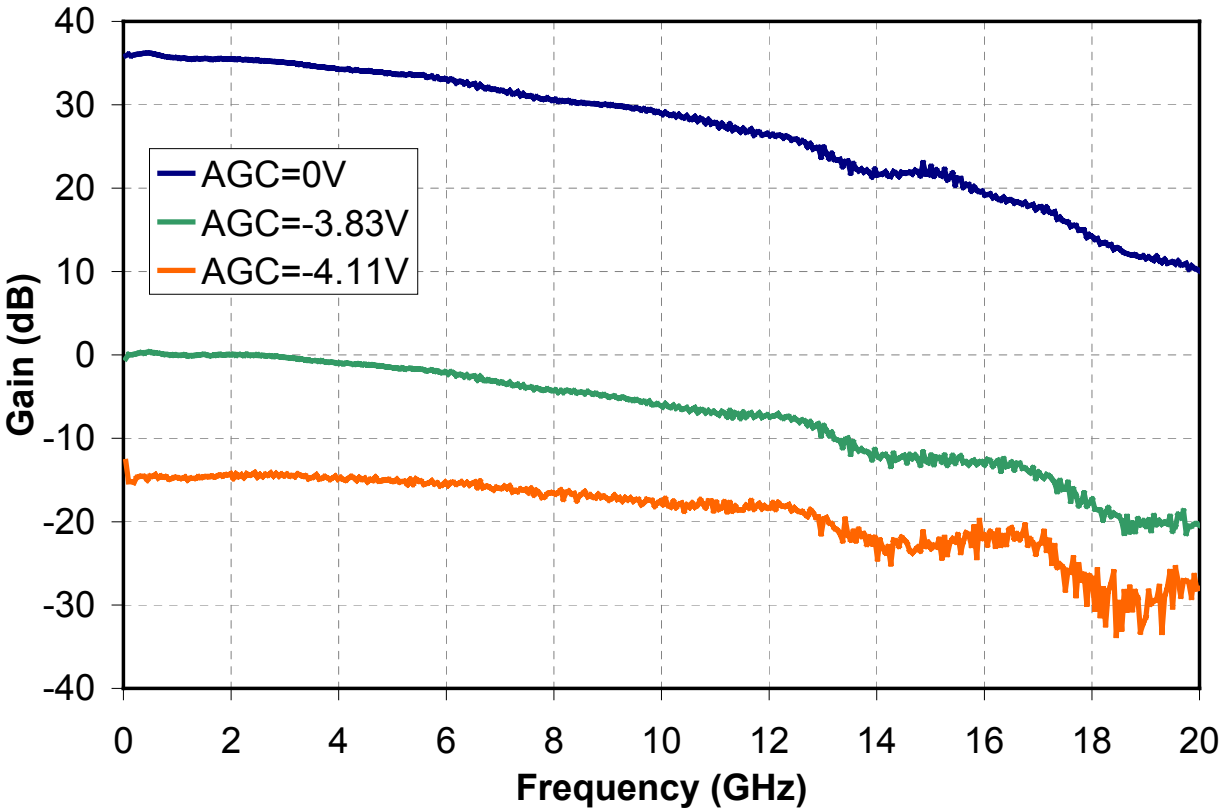

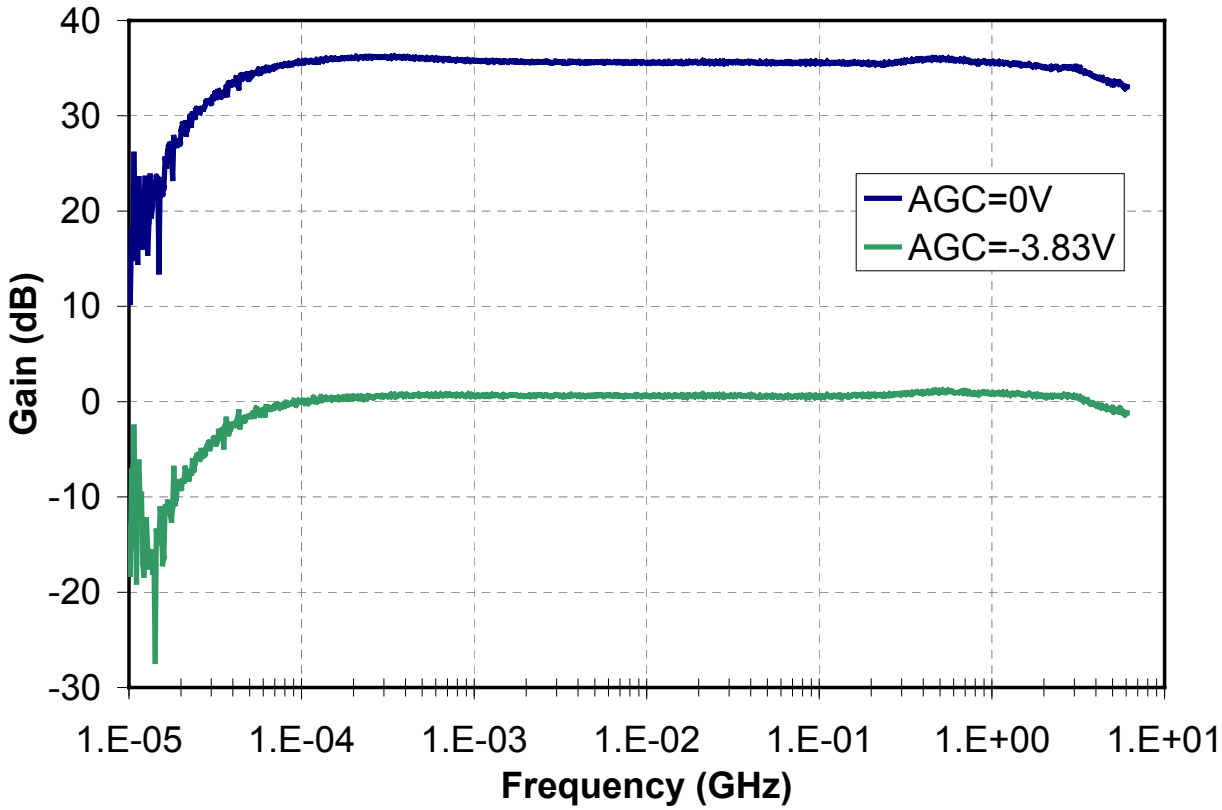

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Measured Performance

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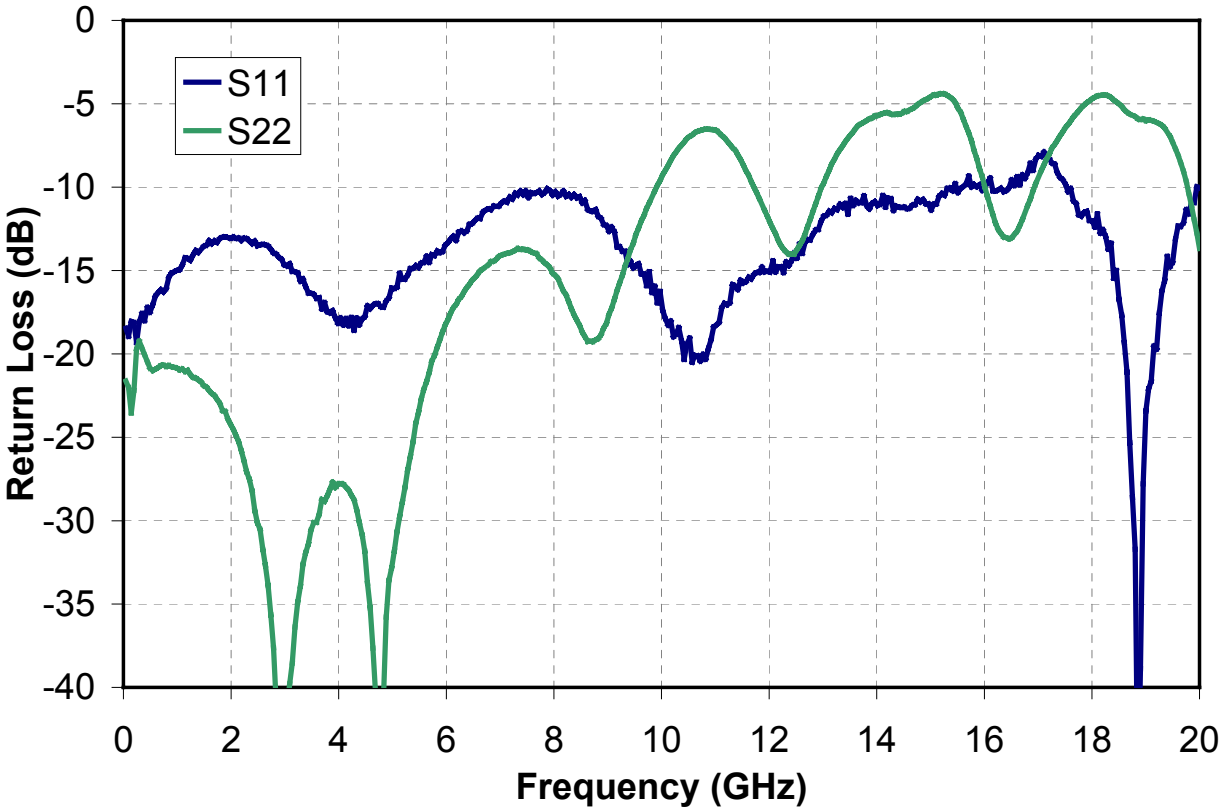

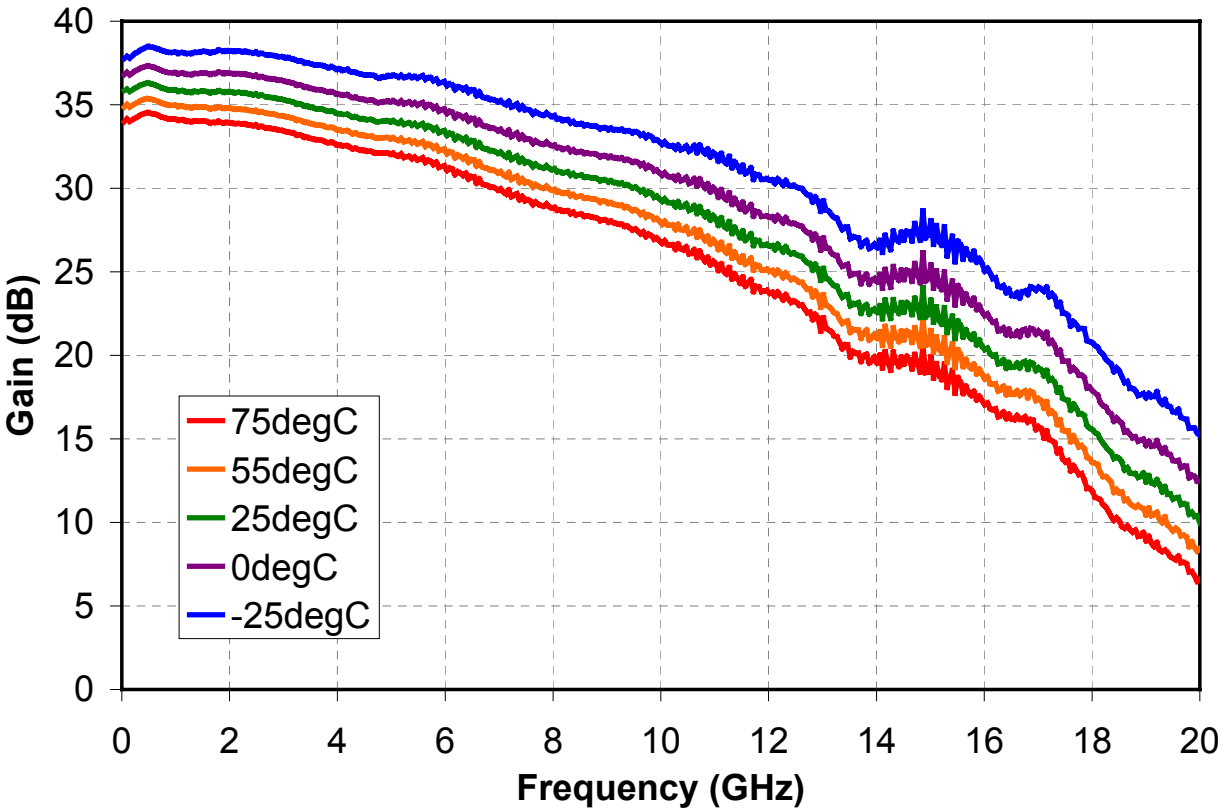

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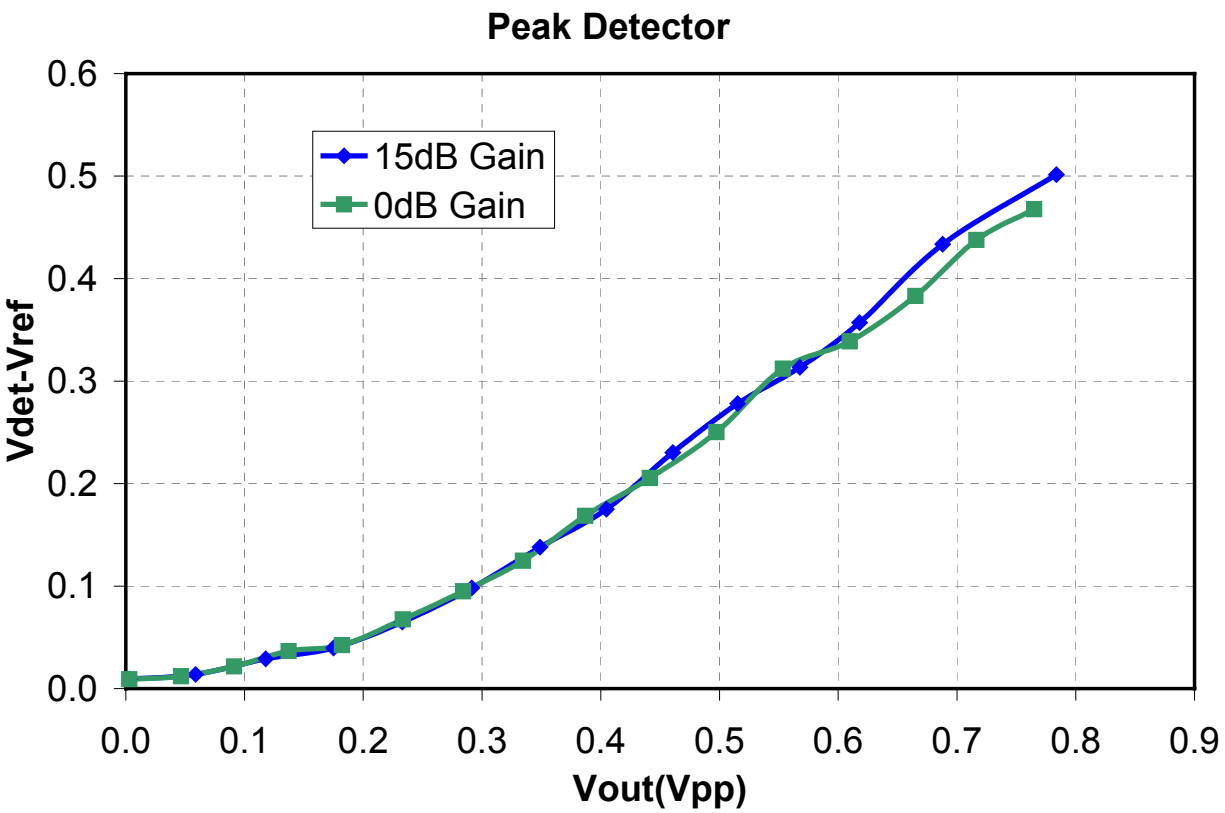
Measured Performance



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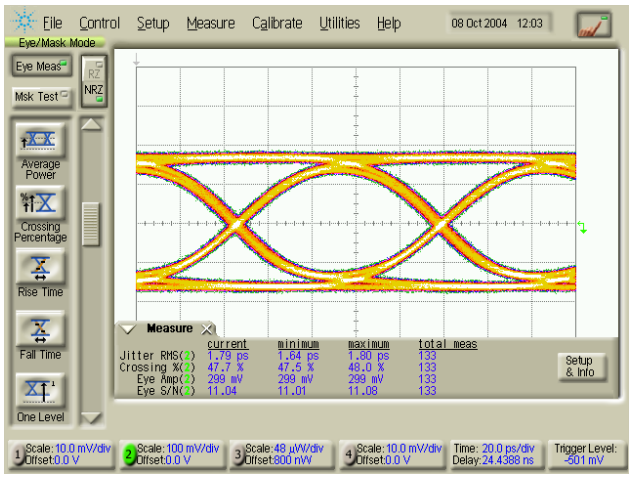
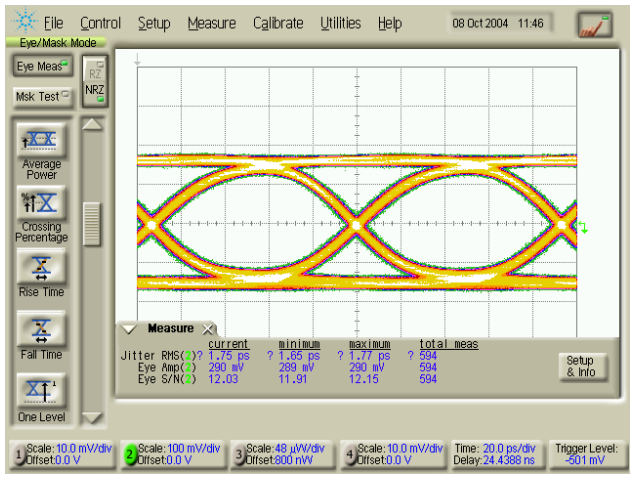
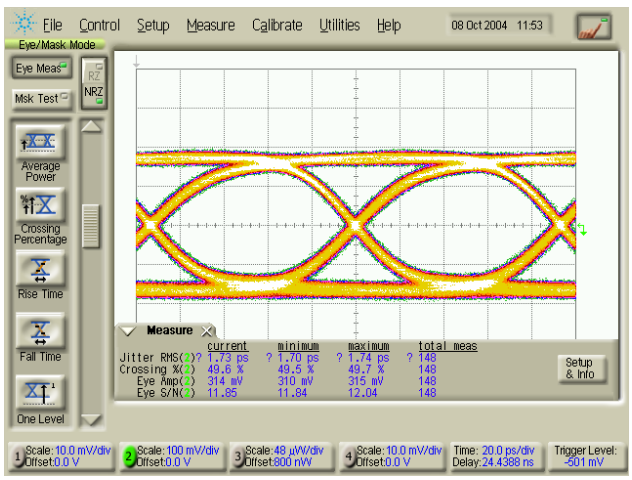
Measured Performance



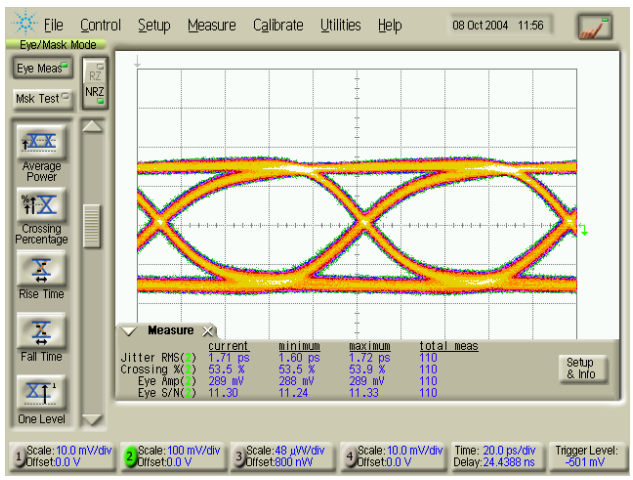
Vin=25mVpp; Vout=300mVpp



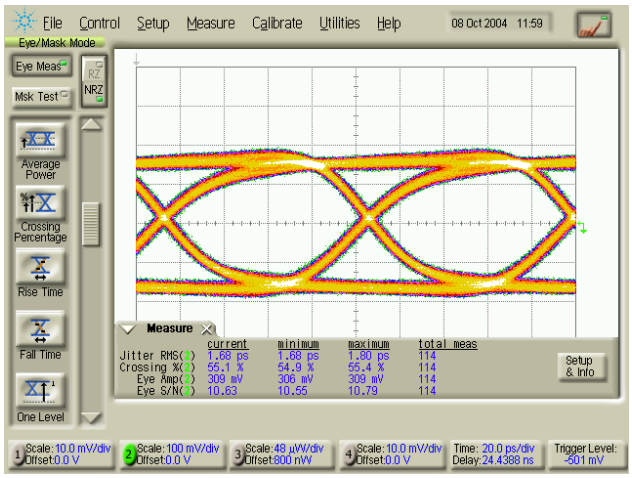
Vin=250mVpp; Vout=300mVpp



Vin=500mVpp; Vout=300mVpp



Vin=800mVpp; Vout=300mVpp



Vin=1000mVpp; Vout=300mVpp

Bias Procedure

Bias Up

- Start with all voltages at 0V
- Set AGC to 0V
- Adjust V_{g1} to -4V & V_{g2} to -3V
- Adjust V_{dd} to +5V (I_{dd} should be ~78mA)
- Adjust V_{ss} to -5.2V (I_{ss} should be ~ -3mA)
- Adjust V_{g1} for I_{dd}=130mA (~ -2.8V)
- Adjust V_{g2} for I_{dd}=183mA (~ -1.2V)
- XOVR should be ~+1.9V
- Adjust AGC for desired gain level (I_{dd} will decrease as AGC is adjusted more negative)
- Adjust XOVR, if needed, for desired eye crossing

Bias Down

- Disconnect XOVR
- Set AGC to 0V
- Set V_{ss} to 0V
- Set V_{dd} to 0V
- Set V_{g1} & V_{g2} to 0V

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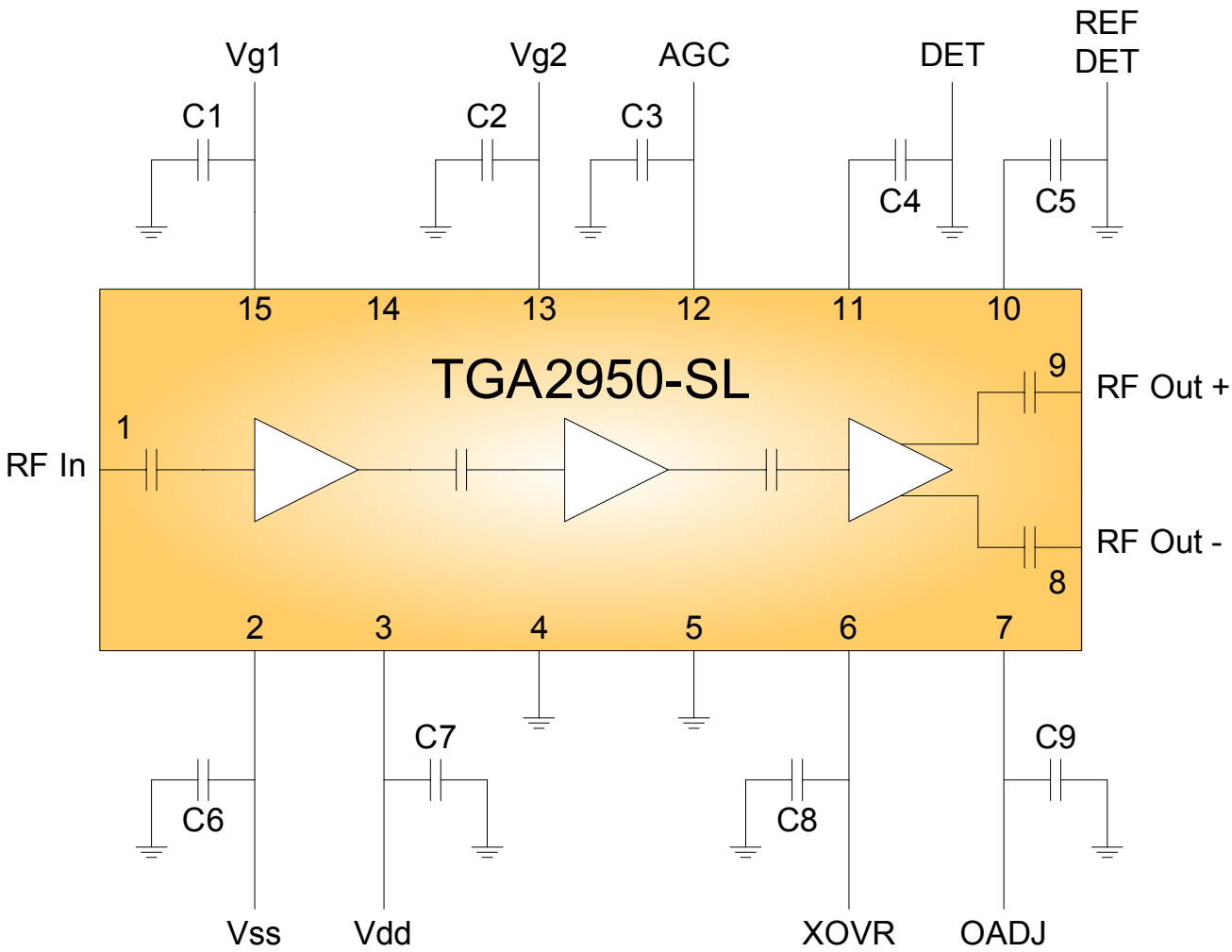
Demonstration Board Schematic



Designation	Value	Vendor	Part Number
C1, C2, C3, C6, C7	4.7uF	AVX	TACR475K010R
C4, C5, C8, C9	1.0uF	AVX	0805ZC105KA12A

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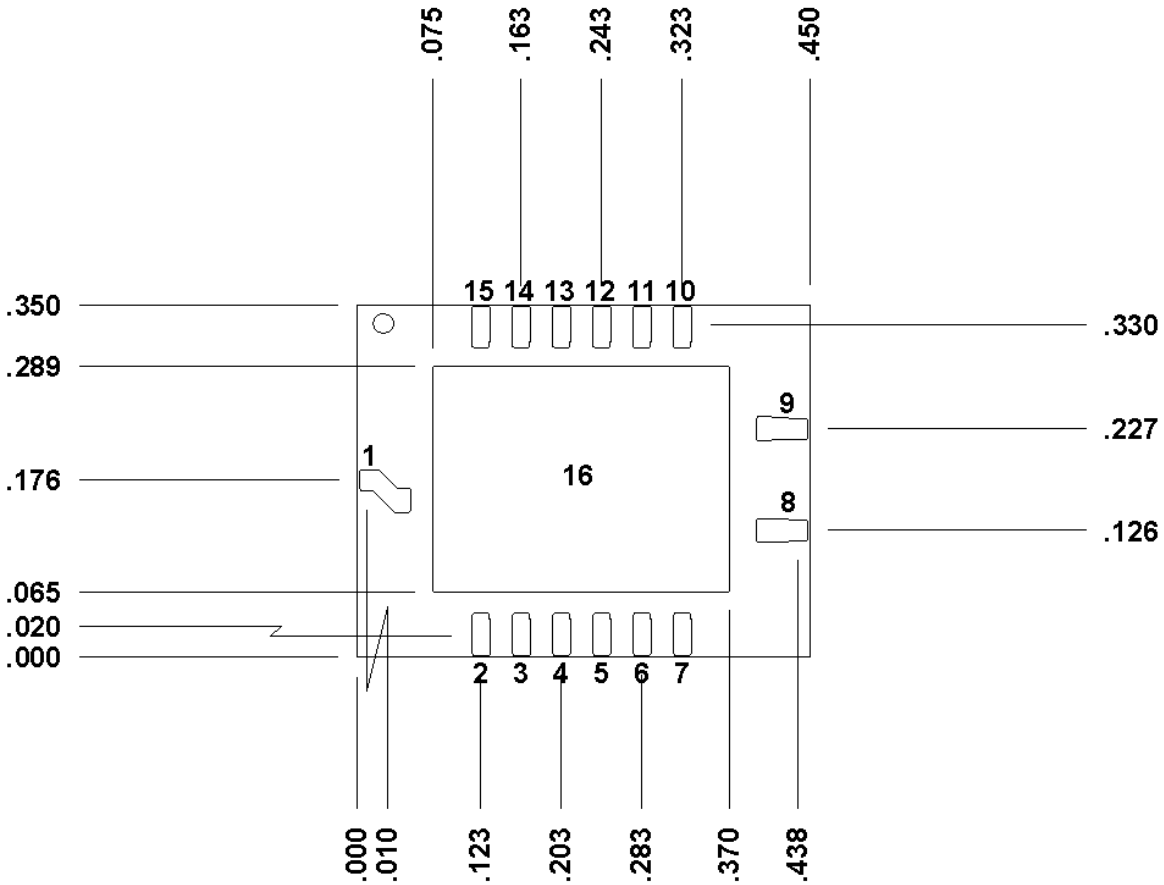
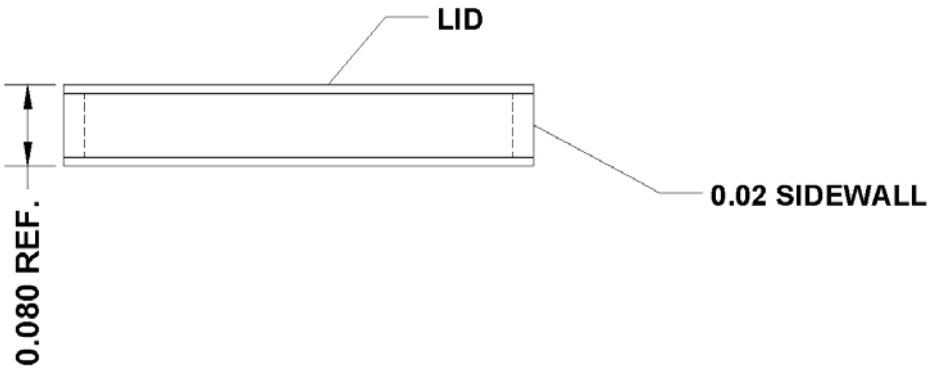
Mechanical Drawing

(View Through Top of Package)



Bond Pad #1	RF In	0.020 x 0.020	Bond Pad #9	RF Out +	0.019 x 0.020
Bond Pad #2	Vss	0.018 x 0.036	Bond Pad #10	REF DET	0.018 x 0.036
Bond Pad #3	Vdd	0.018 x 0.036	Bond Pad #11	DET	0.018 x 0.036
Bond Pad #4	GND	0.018 x 0.036	Bond Pad #12	AGC	0.018 x 0.036
Bond Pad #5	GND	0.018 x 0.036	Bond Pad #13	Vg2	0.018 x 0.036
Bond Pad #6	XOVR	0.018 x 0.036	Bond Pad #14	N/C	0.018 x 0.036
Bond Pad #7	OADJ	0.018 x 0.036	Bond Pad #15	Vg1	0.018 x 0.036
Bond Pad #8	RF Out -	0.019 x 0.020	Bond Pad #16	GND	



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Assembly of a TGA2950-SL Package onto a Motherboard

Manual Assembly for Prototypes

1. Clean the motherboard with Acetone and rinse with alcohol and DI water. Allow the motherboard to fully dry.

2. Using a standard SN63 solder paste, such as Kester SN63 R-560, dispense solder paste dots of 5 to 15 mil in diameter to the motherboard. Assure that there is a minimum of 5 mils and a maximum of 10 mils between the edge of each solder paste area and the closest edge of the ground pad.

3. Manually place a TGA2950-SL on the motherboard with correct orientation and good alignment. The alignment can be determined manually by centering the package on the motherboard. The RF traces (pin 1 and pin 10) are located along the center horizontal axis of the package.

4. Reflow the assembly on a hot plate with the surface temperature of the plate near 230 ^{o}C for 5 to 6 seconds.

5. Let the assembly completely cool down. *This package has little or no tendency to self- align during the reflow.*

6. Clean the assembly with acetone and rinse with alcohol and DI water.

High Volume Assembly of the Package

The TGA2950-SL is a standard surface mount component compatible with standard high volume assembly processes using standard SN63 solder paste, such as Kester R560. Refer to Kester R560 manufacture data sheet for recommended reflow profile, cleaning, and handling. Dispense solder paste using standard solder printing techniques such as stencil solder printing. Pick-and-place using a standard machine such as MRSI machine. Perform solder reflow using a Sikama Reflow System. Recommended solder stencil and motherboard interface layout are available upon request.

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