2 GHz to 43.5 GHz 500 MHz BW Envelope Detector

Preliminary Technical Data

ADL6012

FEATURES

- **Microwave Envelope tracking detector**
- **Envelope output bandwidth: 500 MHz**
- **Broadband 50 Ω input impedance**
- **Accurate response from 2 GHz to 43.5 GHz with minimal slope variation**
- **Input range of −15 dBm to +15 dBm**
- **Flexible supply voltage: 3.3 to 5V**
- **Low current consumption: 33 mA**
- **3 mm × 2 mm, 10-lead LFCSP package**

APPLICATIONS

- **Microwave point to point links**
- **Microwave instrumentation**
- **Radar-based measurement systems**

FUNCTIONAL BLOCK DIAGRAM

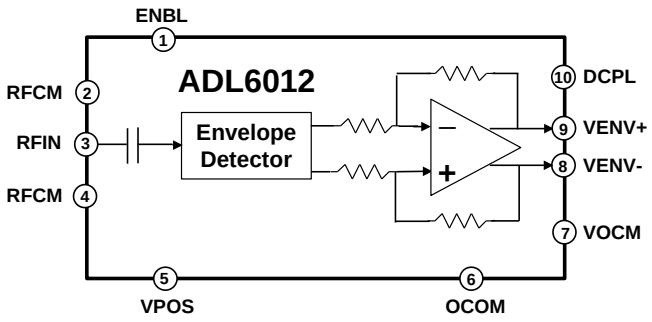

Figure 1.

GENERAL DESCRIPTION

The ADL6012 is a versatile, broadband Envelope detector covering the microwave frequencies from 2 to 43.5 GHz. It provides state-of-the-art accuracy with low power consumption (110 mW at 3.3V) in a simple, easy to use 10-lead LFCSP package. The envelope output is pseudo-differential with 500 MHz BW and variable common-mode capability.

The detector cell uses a proprietary Schottky diode array to extract both the positive and the negative envelopes of the RF signal. These two envelope voltages are buffered and level shifted using an externally applied VOCM voltage and presented on the VENV+ and VENV- pins. The envelope outputs are designed to drive 400 Ω differential load and up to 2pF of capacitance to ground on each output. The envelope output bears the signature of typical diode non-linearity and has 20dB linear range at the top end.

The input power can range from −15 dBm to +15 dBm.

A subtle aspect of the balanced detector topology used in ADL6012 is that even-order distortion, caused by nonlinear source loading, at the input is substantially reduced compared with a simple diode detector. This is an important benefit in applications where a low ratio coupler is used to extract a signal sample. This is a significant improvement over traditional diode detectors.

The Envelope output can be used to detect and correct LO leakage in IQ modulators in point-to-point Microwave radios, employing higher order QAM modulations, where LO leakage in the transmit signal causes EVM degradation. The ADL6012 envelope detector outputs can also be used in extremely fast signal detection applications where log or RMS responding detection capability, is not needed.

The ADL6012 is specified for operation from −40°C to +85°C. The ADL6012 is available in a 10-lead, 3 mm × 2 mm LFCSP package.

Rev. PrC

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781.329.4700
Technical Support **www.analog.com**

SPECIFICATIONS

VPOS = 5.0 V, T_A = 25°C, VOCM=1.65V, 50 Ω source impedance, P_{IN} = +10 dBm, F = 10 GHz, unless otherwise stated. Envelope output loaded with 400 Ω differential.

Table 1.

Parameter	Test Conditions/Comments	Min	Typ	Max	Unit
RF INPUT INTERFACE	RFIN pin				
Operating Frequency Range		2		43.5	GHz
Operating Input Power Range		-15		15	dBm
Temperature Drift	RFIN = +10 dBm		±1		dB
Input Return Loss	Reference Zo = 50 ohm		10		dB
ENVELOPE OUTPUT INTERFACE	Pins VENV+, VENV-				
Output Impedance	Differential		100		Ω
Output Bandwidth (-3 dB)			500		MHz
Output Rise Time	10% to 90 %		0.7		ns
Output Fall Time	90% to 10%		0.7		ns
Detector Gain	(VENV+ - VENV-) / $V_{RFINp-p}$ (Pin = 10 dBm)		0.75		V/V
Output Offset	No signal at RFIN		± 10		mV
Common-mode Voltage Range	Operating input range, VOCM Pin	0.9	1.65	VPOS/2	V
Common-mode Input Impedance	VOCM Pin		10		k Ω
ENBL Input	ENBL pin				
Logic High voltage V_{IH}		1.5		VPOS + 0.2	V
Logic Low voltage V_{IL}		-0.2		0.5	V
Input current			50		uA
POWER SUPPLY	VPOS Pin				
Supply Voltage		3.15	5.0	5.25	V
Quiescent Current	No signal at RFIN		33		mA
Standby Current			2		mA

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

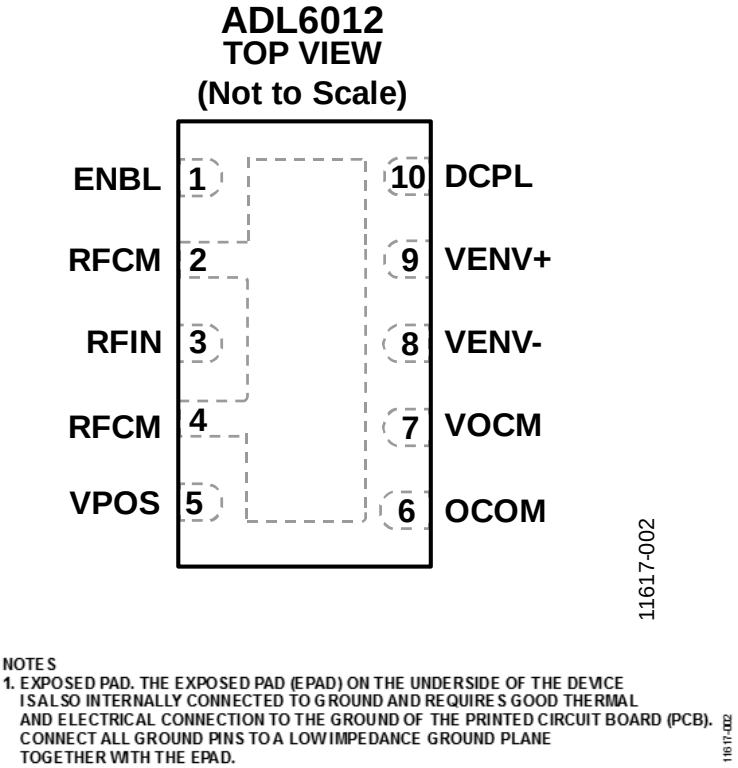

Figure 2. Pin Configuration

Table 2. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	ENBL	Device Enable. Connect to VPOS for enabled state. Connect to ground to disable state. This pin can also be driven from a 3V logic output.
2, 4	RFCM	RF Input Grounds. The RFCM pins are connected to the exposed pad at the bottom of the package. Connect the RFCM pins to the system ground using a low impedance ground plane together with the exposed pad (EPAD).
3	RFIN	Signal Input. The RFIN pin is ac-coupled and has a nominal 50 Ω RF input impedance.
5	VPOS	Supply Voltage. The operational range is from 3.15 V to 5.25 V. Decouple the power supply using the suggested capacitor values of 100 pF and 0.1 µF and locate these capacitors as close as possible to the VPOS pin.
6	OCOM	Output Common. This pin should be connected to a low impedance ground plane together with the exposed pad (EPAD).
7	VOCM	Output Common-mode control Input. Internally biased to VPOS/2 nominal. Acceptable range is from 0.9V to VPOS/2.
8, 9	VENV-, VENV+	Envelope detector Pseudo-differential outputs. VENV- and VENV+ are the negative and positive outputs, respectively, for the envelope detector output. 50Ω output impedance per pin forms a 100Ω differential output impedance. 400Ω differential load and 2pF to ground per pin drive capability.
10	DCPL	Bypass pin for an internal bias node. Connect this pin through a 0.1uF cap to ground for best common-mode noise rejection.
	EPAD	Exposed Pad. The exposed pad (EPAD) on the underside of the device is also internally connected to ground and requires good thermal and electrical connection to the ground of the printed circuit board (PCB). Connect all ground pins to a low impedance ground plane together with the EPAD.

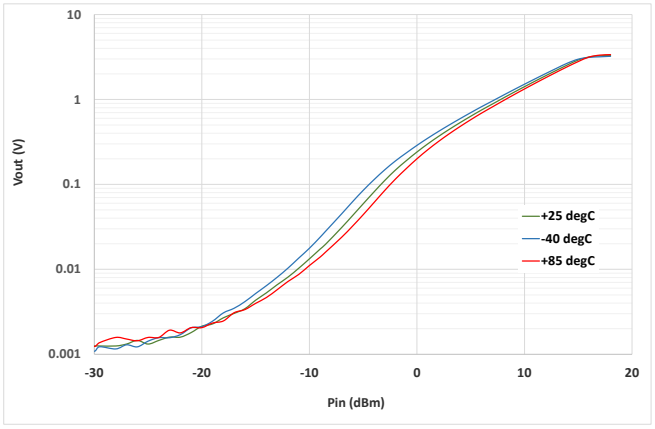

Figure 3. VENV+ - VENV- vs. RFIN and Temperature at 2 GHz

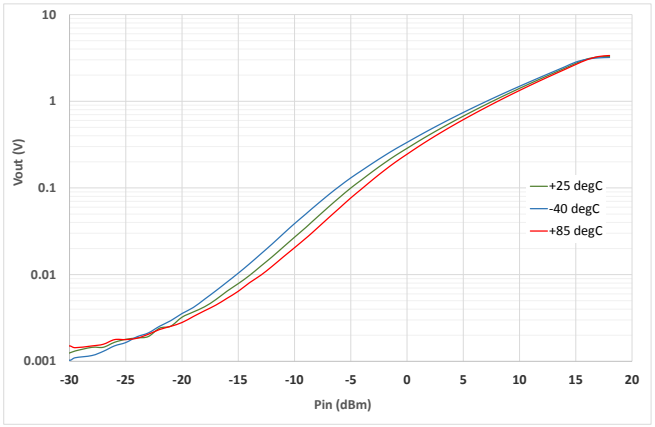

Figure 4. VENV+ - VENV- vs. RFIN and Temperature at 5 GHz

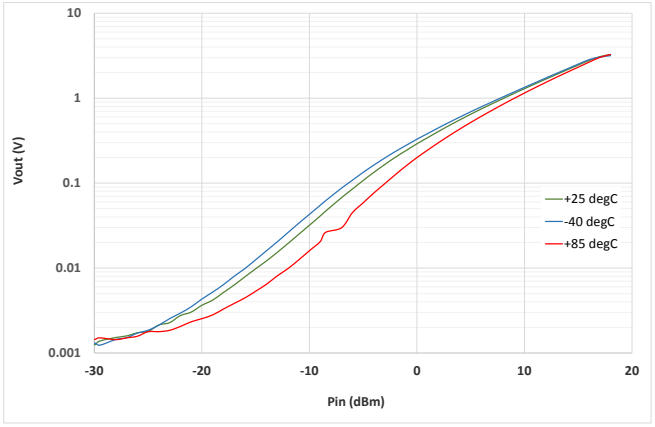

Figure 5. VENV+ - VENV- vs. RFIN and Temperature at 10 GHz

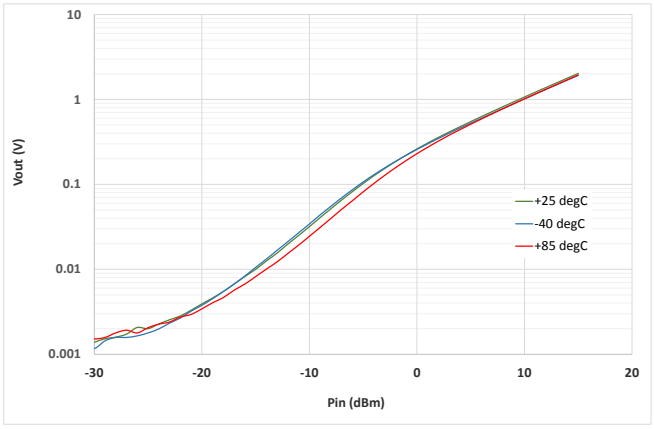

Figure 6. VENV+ - VENV- vs. RFIN and Temperature at 20 GHz

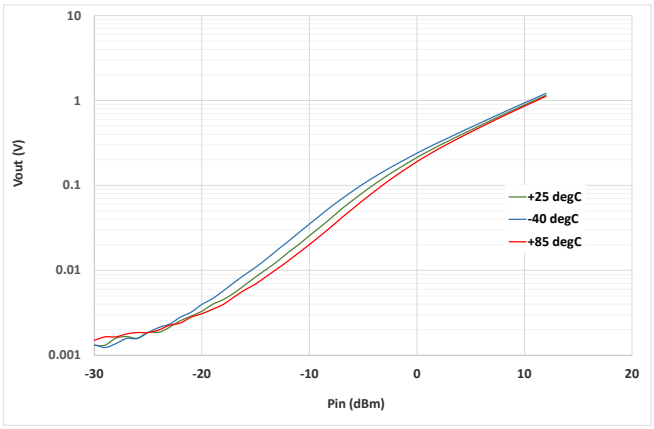

Figure 7. VENV+ - VENV- vs. RFIN and Temperature at 30 GHz

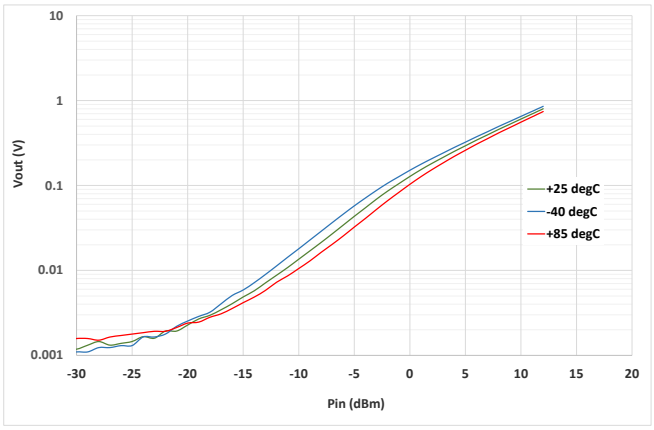

Figure 8. VENV+ - VENV- vs. RFIN and Temperature at 40 GHz

Figure 9. VENV+ Pulse Response.

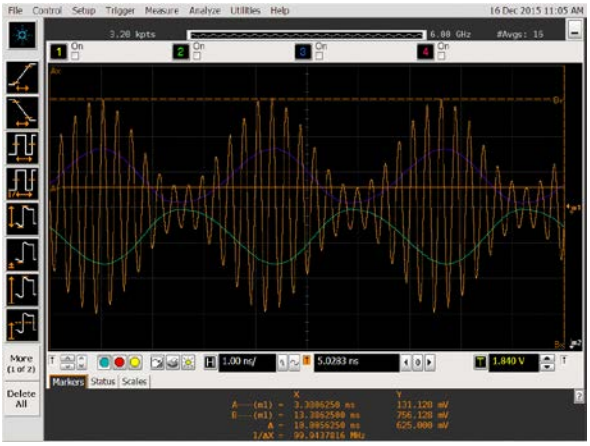

Figure 10. VENV+ (purple) and VENV- (green) response to 300 MHz AM modulation on RFIN (orange). VOCM = 1.65 V.

EVALUATION BOARD

ADL6012-EVALZ a fully populated, 4-layer, Rogers 4003A and FR4- based evaluation board. For normal operation, it requires a 3.3 to 5 V power supply. The power supply should be connected to the VPOS and GND test loops. The RF input and should be applied to the RFIN 2.92 mm connector. The differential envelope output signal is available on the connectors labelled VENV+ and VENV-.

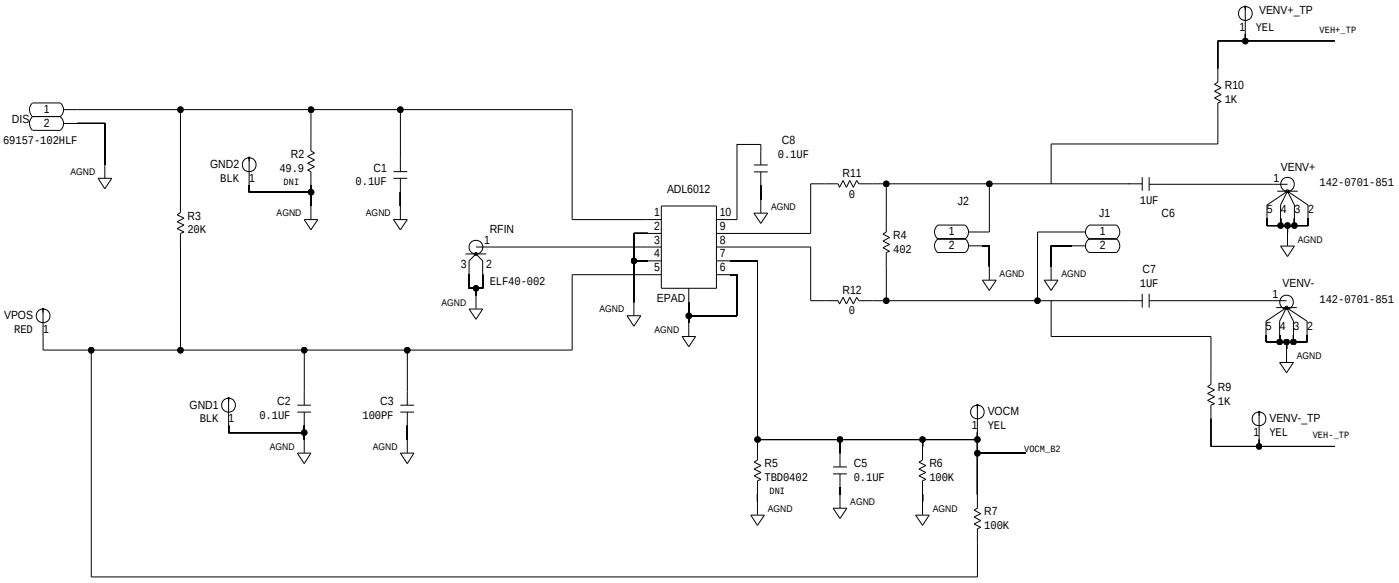

Figure 11. Evaluation Board Schematic (Rev. C)

NOTES

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