ANALOG DEVICES

250 MHz Demodulating Logarithmic Amplifier

AD641

FEATURES

Logarithmic Amplifier Performance
- Usable to 250 MHz
- 44 dB Dynamic Range
- ±2.0 dB Log Conformance
- 37.5 mV/dB Voltage Output
- Stable Slope and Intercepts

2.0 nV/√Hz Input Noise Voltage
50 μV Input Offset Voltage
Low Power
- ±5 V Supply Operation
- 9 mA (+V_S), 35 mA (−V_S) Quiescent Current

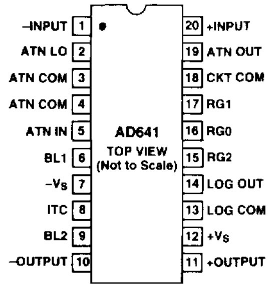
Onboard Resistors
Onboard 10X Attenuator
Dual Polarity Current Outputs
Direct Coupled Differential Signal Path

APPLICATIONS

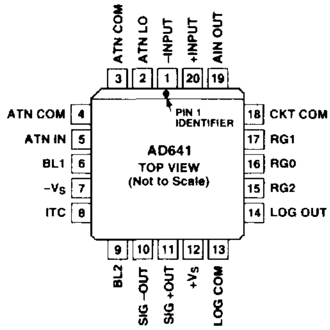
IF/RF Signal Processing
Received Signal Strength Indicator (RSSI)
High Speed Signal Compression
High Speed Spectrum Analyzer
ECM/Radar

PIN CONFIGURATIONS

20-Lead Plastic DIP (N)
20-Lead Cerdip (Q)



20-Lead PLCC (P)



PRODUCT DESCRIPTION

The AD641 is a 250 MHz, demodulating logarithmic amplifier with an accuracy of ±2.0 dB and 44 dB dynamic range. The AD641 uses a successive detection architecture to provide an output current that is logarithmically proportional to its input voltage. The output current can be converted to a voltage using one of several on-chip resistors to select the slope. A single AD641 provides up to 44 dB of dynamic range at speeds up to 250 MHz, and two cascaded AD641s together can provide 58 dB of dynamic range at speeds up to 250 MHz. The AD641 is fully stable and well characterized over either the industrial or military temperature ranges.

The AD641 is not a logarithmic building block, but rather a complete logarithmic solution for compressing and measuring wide dynamic range signals. The AD641 is comprised of five stages and each stage has a full wave rectifier, whose current depends on the absolute value of its input voltage. The output of these stages are summed together to provide the demodulated output current scaled at 1 mA per decade (50 μA/dB).

Without utilizing the 10× input attenuator, log conformance of 2.0 dB is maintained over the input range −44 dBm to 0 dBm. The attenuator offers the most flexibility without significantly impacting performance.

The 250 MHz bandwidth and temperature stability make this product ideal for high speed signal power measurement in RF/IF systems. ECM/Radar and Communication applications are routinely in the 100 MHz–180 MHz range for power measurement. The bandwidth and accuracy, as well as dynamic range, make this part ideal for high speed, wide dynamic range signals.

The AD641 is offered in industrial (−40°C to +85°C) and military (−55°C to +125°C) package temperature ranges. Industrial versions are available in plastic DIP and PLCC; MIL versions are packaged in cerdip.

ORDERING GUIDE

Model	Package Description	Package Option*
AD641AN	Plastic DIP	N-20
AD641AP	Plastic Leaded Chip Carrier	P-20A
5962-9559801MRA	Cerdip	Q-20

*For outline information see Package Information section.

To obtain the most recent version or complete data sheet, call our fax retrieval system at 1-800-446-6212 or visit our World Wide Web site at http://www.analog.com.

AD641–SPECIFICATIONS

ELECTRICAL CHARACTERISTICS (V_S = ±5 V; T_A = +25°C, unless otherwise noted)

Parameter	Conditions	AD641A Min	AD641A Typ	AD641A Max	AD641S Min	AD641S Typ	AD641S Max	Units
TRANSFER FUNCTION[1]		(I_{OUT} = I_Y LOG V_{IN}/V_X for V_{IN} = 0.75 mV to ±200 mV dc)						
LOG AMPLIFIER PERFORMANCE								
3 dB Bandwidth			250			250		MHz
Voltage Compliance Range		0.3		$+V_S$ 1	-0.3		$+V_S - 1$	V
Slope Current, I_Y		0.98	1.00	1.02	0.98	1.00	1.02	mA
Accuracy vs. Temperature			0.002			0.002		%/°C
Over Temperature	T_{MIN} to T_{MAX}				0.98		1.02	mA
Intercept dBm	250 MHz	40.84	40.43	39.96	-40.84	40.43	-39.96	dBm
Over Temperature	T_{MIN} to T_{MAX}, 250 MHz				-40.59		-39.47	dBm
Zero Signal Output Current[2]			0.2			0.2		mA
ITC Disabled	Pin 8 to COM		0.27			0.27		mA
Maximum Output Current				2.3			2.3	mA
DYNAMIC RANGE								
Single Configuration			44			44		dB
Over Temperature	T_{MIN} to T_{MAX}		40			38		dB
Dual Configuration			58			58		dB
Over Temperature	T_{MIN} to T_{MAX}		52			52		dB
LOG CONFORMANCE	f = 250 MHz							
Single Configuration	44 dBm to 0 dBm		±0.5	±2.0		±0.5	±2.0	dB
Over Temperature	S: 42 dBm to 4 dBm; A: 42 dBm to −2 dBm, T_{MIN} to T_{MAX}		±1.0	±2.5		±1.0	±2.5	dB
Dual Configuration	S: -60 dBm to 2 dBm;		±0.5	±2.0		±0.5	±2.0	dB
Over Temperature	A: 56 dBm to 4 dBm, T_{MIN} to T_{MAX}		±1.0	±2.5		±1.0	±2.5	dB
LIMITER CHARACTERISTICS								
Flatness	44 dBm to 0 dBm @ 10.7 MHz		±1.6			±1.6		dB
Phase Variation	44 dBm to 0 dBm @ 10.7 MHz		±2.0			±2.0		Degrees
INPUT CHARACTERISTICS								
Input Resistance	Differential		500			500		kΩ
Input Offset Voltage	Differential		50	200		50	200	μV
vs. Temperature			0.8			0.8		μV/°C
Over Temperature	T_{MIN} to T_{MAX}						300	μV
vs. Supply			2			2		μV/V
Input Bias Current			7	25		7	25	μA
Input Bias Offset			1			1		μA
Common Mode Input Range		-2		+0.3	-2		+0.3	V
SIGNAL INPUT (Pins 1, 20)								
Input Capacitance	Either Pin to COM		2			2		pF
Noise Spectral Density	1 kHz to 10 MHz		2			2		nV/√Hz
Tangential Sensitivity	BW = 100 MHz		72			72		dBm
INPUT ATTENUATOR (Pins 2, 3, 4, 5 & 19)								
Attenuation[3]	Pins 5 to Pin 19		20			20		dB
Input Resistance	Pins 5 to 3/4		300			300		Ω
APPLICATION RESISTORS (Pins 15, 16, 17)		0.995	1.000	1.005	0.995	1.000	1.005	kΩ
OUTPUT CHARACTERISTICS (Pins 10, 11)								
Peak Differential Output[4]			±180			±180		mV
Output Resistance	Either Pin to COM		75			75		Ω
Quiescent Output Voltage	Either Pin to COM		-90			90		mV
POWER SUPPLY								
Voltage Supply Range		±4.5		±7.5	±4.5		±7.5	V
Quiescent Current								
$+V_S$ (Pin 12)	T_{MIN} to T_{MAX}		9	15		9	15	mA
$-V_S$ (Pin 7)	T_{MIN} to T_{MAX}		35	60		35	60	mA

NOTES

[1]Logarithms to base 10 are used throughout. The response is independent of the sign of V_{IN}.

[2]The zero-signal current is a function of temperature unless internal temperature compensation (ITC) pin is grounded.

[3]Attenuation ratio trimmed to calibrate intercept to 10 mV when in use. It has a temperature coefficient of +0.3%/°C.

[4]The fully limited signal output will appear to be a square wave; its amplitude is proportional to absolute temperature.

Specifications subject to change without notice.