Raytheon

Synchronous Detector

RC4260

Features

- 10μS switching
- TTL compatible
- Low distortion — .01% typical
- Wide supply voltage range — to ±3V typical
- Low gain differential — 1.0% maximum
- On-board op amp

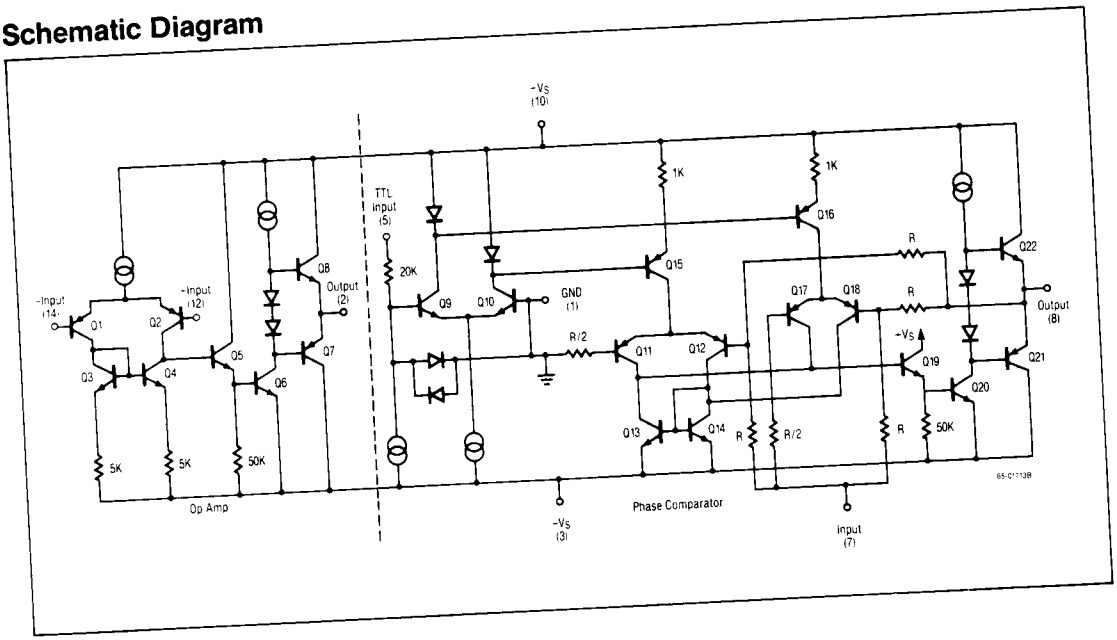
Applications

- Suppressed carrier modulation
- Synchronous detection
- Frequency doubling/chopping
- Precision rectification with switchable polarity
- Phase comparison

Description

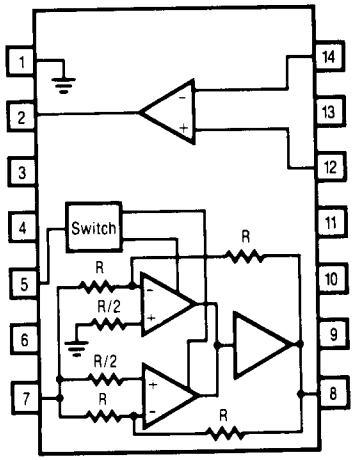
The 4260 is a unity gain amplifier with logic switchable phase inversion. A TTL high state on the reference (logic) input will force the amplifier into non-inverting operation; a TTL low state will force inverting operation. Excellent matching between inverting and non-inverting AC performance is achieved through careful design and layout. Included with the phase comparator is an uncommitted 4558 type op amp, which can be used for gain, filtering, or other applications.

Schematic Diagram



Connection Information

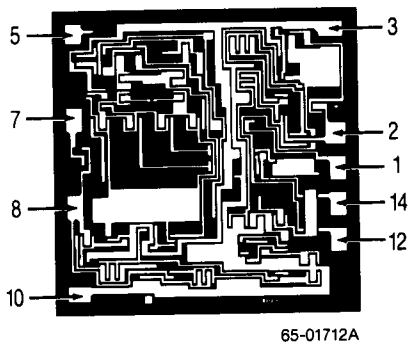
14-Lead
Dual In-Line Package
(Top View)



65-01711A

Pin	Function
1	Ground
2	Op Amp Output
3	$-V_S$
4	NC
5	Reference Input (TTL)
6	NC
7	Amplifier Input
8	Amplifier Output
9	NC
10	$+V_S$
11	NC
12	Op Amp +Input
13	NC
14	Op Amp -Input

Mask Pattern



65-01712A

Die Size: 00 x 00 mils
Min. Pad Dimension: 4 x 4 mils

Absolute Maximum Ratings

Supply Voltage
- RM4260 ..... ±22V
- RC4260 ..... ±18V

Internal Power Dissipation 500mW
Differential Input Voltage 30V
Input Voltage ..... ±15V
Output Short Circuit to Ground .. Continuous
Storage Temperature
- Range ..... -65°C to +150°C

Operating Temperature Range
- RM4260 ..... -55°C to +125°C
- RC4260 ..... 0°C to +70°C

Lead Soldering Temperature
- (10 Sec) ..... +300°C

Ordering Information

Part Number	Package	Operating Temperature Range
RC4260DB	Plastic	0°C to +70°C
RC4260DC	Ceramic	0°C to +70°C
RM4260DC	Ceramic	-55°C to +125°C
RM4260DC/883B*	Ceramic	-55°C to +125°C

*MIL-STD-883, Level B Processing

Thermal Characteristics

	14-Lead Ceramic DIP	14-Lead Plastic DIP
Max. Junction Temp.	175°C	125°C
Max. P_D $T_A < 50°C$	1042mW	468mW
Therm. Res. θ_{JC}	60°C/W	—
Therm. Res. θ_{JA}	120°C/W	160°C/W
For $T_A > 50°C$ Derate at	8.33mW per °C	6.25mW per °C

Electrical Characteristics

(V_S = ±15V, over full operating temperature range unless otherwise noted)

Parameters	Test Conditions	RM4260 Min	RM4260 Typ	RM4260 Max	RC4260 Min	RC4260 Typ	RC4260 Max	Units
Supply Current	$R_L = \infty$		6.0	11		4.0		mA
Op Amp Section								
Input Offset Voltage	$R_S \leq 10k\Omega$		4.5	7.0		3.5		mV
Input Offset Current			250	500		250		nA
Input Bias Current			600	1500		600		nA
Large Signal Voltage Gain	$R_L \geq 2k\Omega$, V_O = ±10V	25	100			100		V/mV
Output Voltage Swing	$R_L \geq 2k\Omega$	±10	±13			±13		V
Common Mode Rejection Ratio	V_{CM} = 24V	70	100			100		dB
Power Supply Rejection Ratio	ΔV = 20V	76	92			92		dB
Comparator Section								
Large Signal Voltage Gain	Pin 7 = ±7.5V	±0.95	±1.0	±1.05				V/V
Input Offset Voltage			5.0	12		5.0		mV
Input Resistance (Differential Mode)		10	25			25		kΩ
Output Voltage Swing	R_L = 10kΩ	±12	±13.5			±13.5		V
Power Supply Rejection Ratio	ΔV = 10V	76	92			92		dB
Reference Input Threshold			1.25			1.25		V
Reference Input Current	Pin 5 = 2V		150			150		μA
Gain Differential	$\frac{A_{V(+1)} - A_{V(-1)}}{A_{V(+1)} + A_{V(-1)}} \times 100$		1.0			1.0		%

Electrical Characteristics ($V_S = \pm 15V$ and $T_A = +25°C$ unless otherwise noted)

Parameters	Test Conditions	RM4260			RC4260			Units
		Min	Typ	Max	Min	Typ	Max	
Supply Current	$R_L = \infty$		4.0	9.0		5.0	10	mA
Op Amp Section								
Input Offset Voltage	$R_S \leq 10k\Omega$		3.5	5.0		3.5	6.0	mV
Input Offset Current			75	200		75	200	nA
Input Bias Current			175	500		175	500	nA
Large Signal Voltage Gain	$R_L \geq 2k\Omega$, $V_O = \pm 10V$	50	300		20	300		V/mV
Output Voltage Swing	$R_L \geq 2k\Omega$	±10	±13		±10	±13		V
Common Mode Rejection Ratio	$V_{CM} = 24V$	70	100		70	100		dB
Power Supply Rejection Ratio	$\Delta V = 20V$	76	100		76	100		dB
Slew Rate	$A_V = +1$		0.8			0.8		V/μS
Unity Gain Bandwidth			3.0			3.0		MHz
Comparator Section								
Large Signal Voltage Gain	Pin 7 = ±7.5V	±0.95	±1.0	±1.05	±0.95	±1.0	±1.05	V/V
Input Offset Voltage			4.0	7.0		4.0	10	mV
Input Resistance		10	25		10	25		kΩ
Output Voltage Swing	$R_L = 10k\Omega$	±12			±12			V
Power Supply Rejection Ratio	$\Delta V = 10V$	76	94		76	94		dB
Reference Input Threshold			1.25			1.25		V
Reference Input Current	Pin 5 = 2V		75			75		μA
Gain Differential	$\frac{A_{V(+1)} - A_{V(-1)}}{A_{V(+1)} + A_{V(-1)}} \times 100$		1.0			1.0		%
Carrier Suppression	$V_{IN} = 2V_{PP}$ at 10kHz		50			50		dB
Slew Rate			1.25			1.25		V/μS
Switching Speed			10			10		μS

Synchronous Detector

Principles of Operation

The 4260 is made up of two circuit functions: an op amp (pins 2,12,14), which is independent, and a synchronous detector consisting of a differential switch (Q9,10,15,16), two differential amplifiers (Q11,12 and Q17,18), an active load (Q13,14), and an output stage with gain. The switch selects between the diff amps; one diff amp (Q11,12) is inverting, the other is non-inverting. The resistors R set the gain from pin 7 to 8 at unity. When the switch changes from supplying bias current into Q11,12 to supplying bias current to Q17,18, the gain will change from -1 to +1, and the phase shift will change from 180° to 0°. Both diff amps feed the same active load and output stage; the amplifier that is switched off is isolated from the active load by reverse biased PN junctions. Aside from the switching function, the amplifier design is similar to the uncommitted 4558 type op amp.

Figure 1 shows a balanced modulator application. Figure 2 is a spectral plot of the output, depicting the sine frequency, the reference frequency, the sum of the sine and reference frequencies, and all of the harmonics for one decade.

The reference (TTL) input is attenuated typically 50dB below the sine and sum frequencies. Best suppression will be achieved at input amplitudes from 1V to 10V peak-to-peak.

Typical Applications

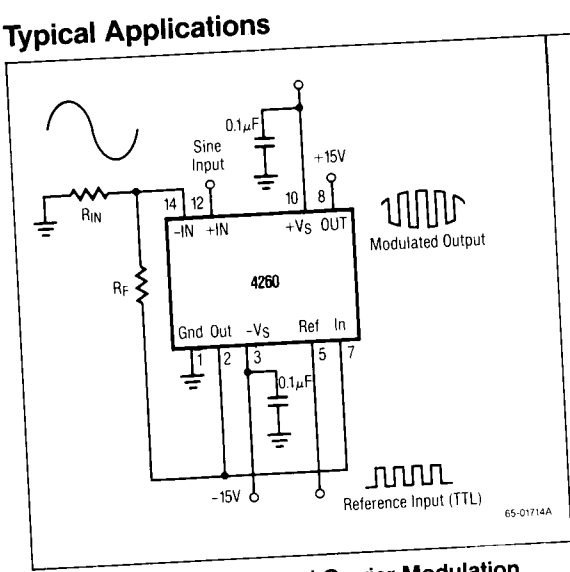


Figure 1. Suppressed Carrier Modulation

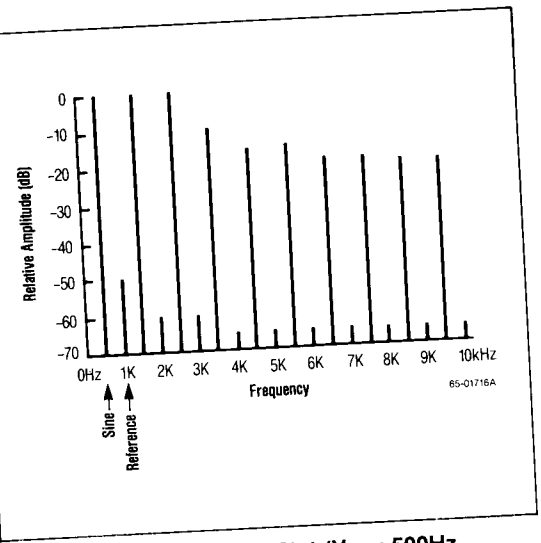


Figure 2. Spectral Plot (V_{IN} = 500Hz, TTL Ref = 1kHz)

Typical Applications (Continued)

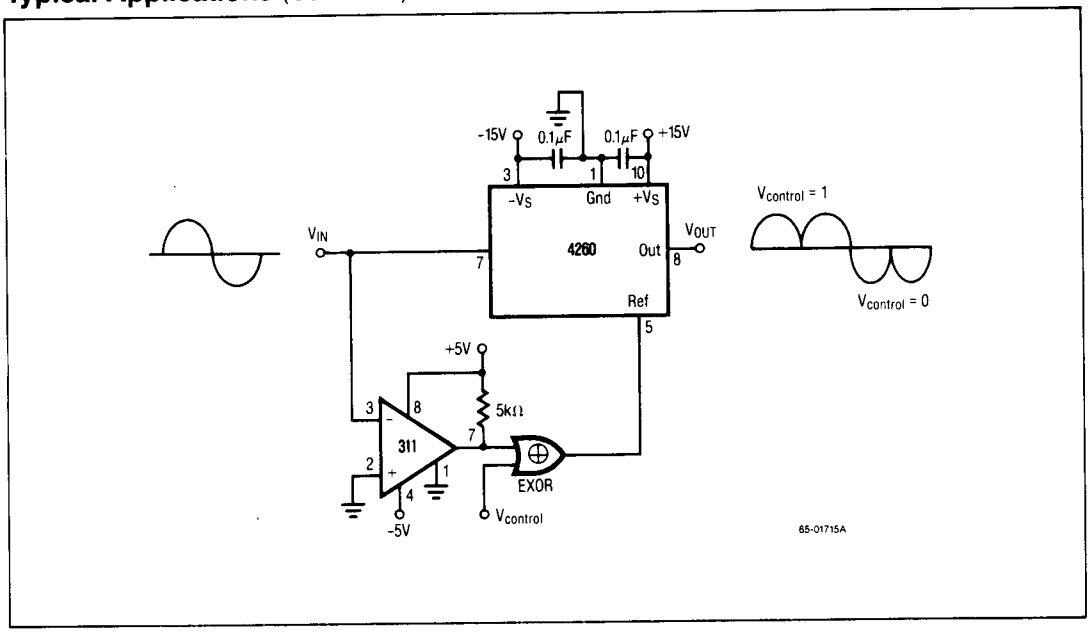


Figure 3. Precision Rectifier With Logic Switchable Output Polarity

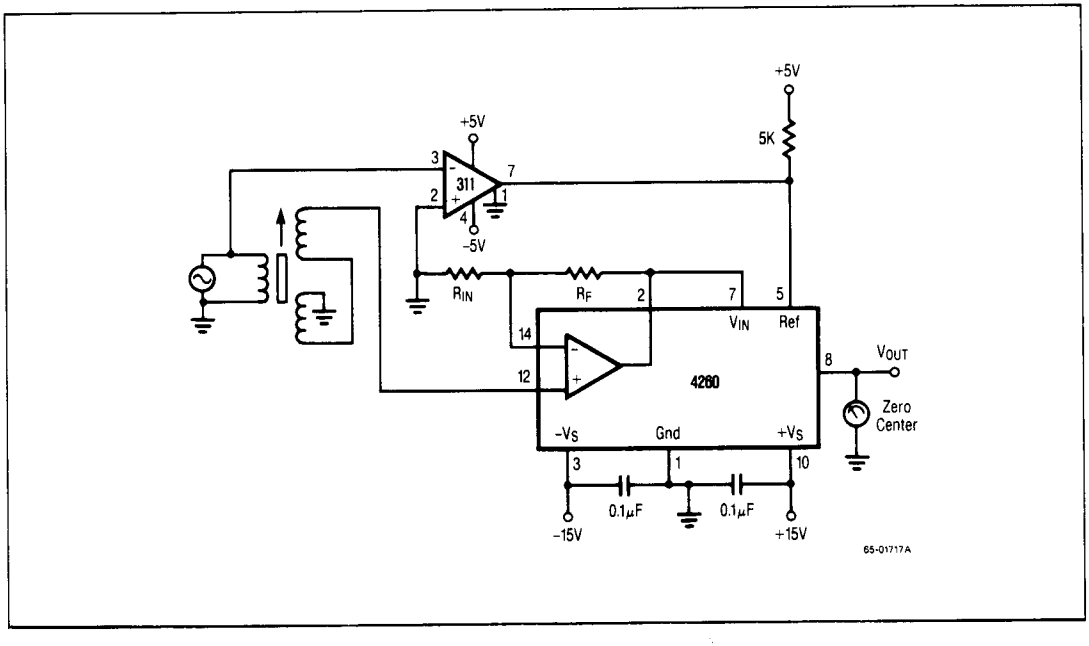


Figure 4. Linear Variable Differential Transformer With Phase Sensitive Detector

Synchronous Detector

Typical Applications (Continued)

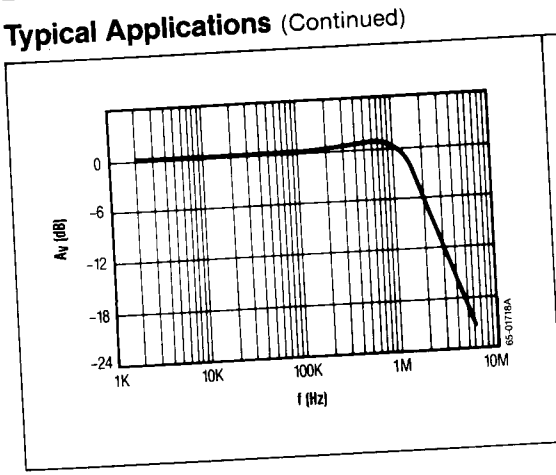


Figure 5. Gain vs. Frequency

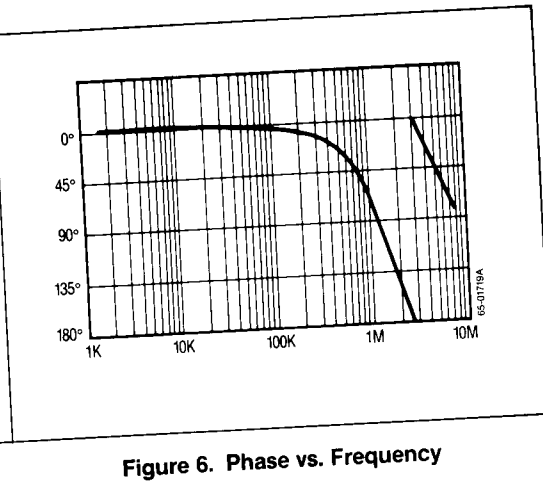


Figure 6. Phase vs. Frequency