CY580 Datasheet

300M-450MHz ASK Receiver

General Description

The CY580 is an UHF ASK receiver IC in a small SOP-8 package which operates at 300MHz to 450MHz with typical receiving sensitivity of -109dBm.

The CY580 is a single chip receiver for ASK and OOK modulation such as pulse width modulation, variable pulse modulation, Manchester modulation and so on. Especially, the CY580 provides image rejection function to remove the image band and selects the desired signal compared to CY801.

All IF filtering and post-detection (demodulator) data filtering is provided within the CY580, no external filters are necessary. One of four demodulator filter bandwidths may be selected externally by the user.

The high integrated CY580 uses the low cost 8-Lead Small Outline Package (SOP-8), no extra external component is required except two capacitors (CTH and CAGC), reference crystal and antenna matching network.

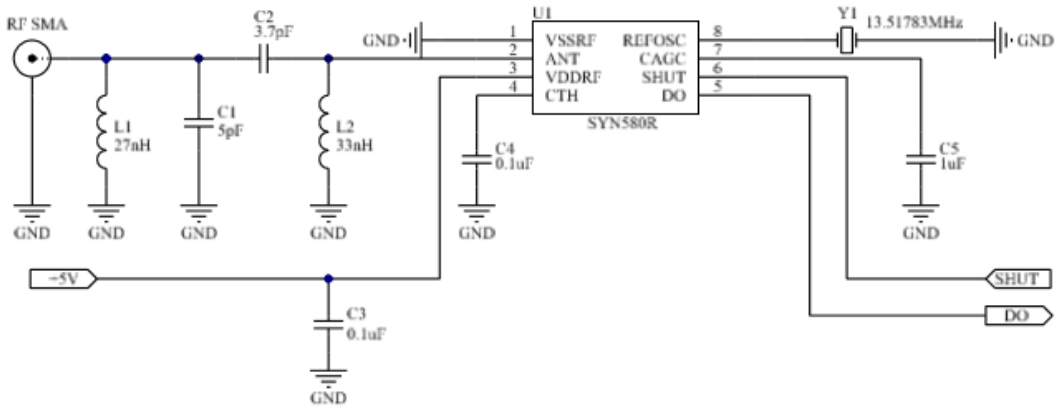
Features

- 300MHz to 450MHz Frequency Range
- -109dBm High Sensitivity, 1Kbps and BER 10E-2 @ 315MHz and 433.92MHz
- Image Rejection Function
- Low Power Consumption
- Excellent Selectivity and Noise Rejection
- No External IF Filter Required
- Low External part count
- SOP-8 Package Type

Applications

- Automotive Remote Keyless Entry (RKE)
- Remote Control System
- Access Control System
- Home Automation
- Toys

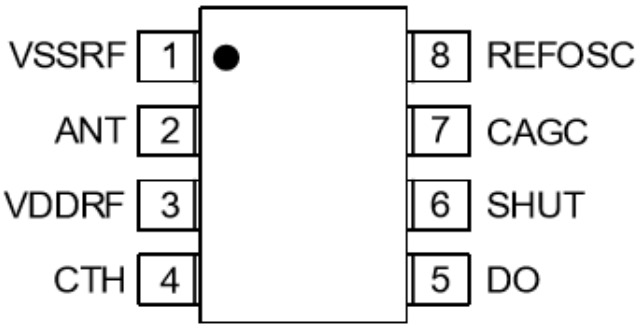
Typical Application



433.92MHz, 1KHz Baud Rate Application Circuit

CY580 requires only three components to operate: two capacitors (CTH and CAGC) and the reference frequency device, usually a quartz crystal. Additional five components may be used to improve performance. These are: power supply decoupling capacitor, two components for the matching network, and two components for the pre-selector band pass filter.

Pin Configuration



CY580 SOP-8

Pin Description

Pin	Number	I/O	Pin Function
1	VSSRF	GND	Ground
2	ANT	I	RF Input
3	VDDRF	POWER	Power Supply
4	CTH	I	Slicing Level Capacitor
5	DO	O	Data Output
6	SHUT	I	Shut Down
7	CAGC	I	Filter capacitor connected to AGC
8	REFOSC	I	Reference crystal oscillator

Absolute Maximum Ratings

Supply Voltage	+7V
Input Voltage	+7V
Junction Temperature (T_J)	+150 ℃
Storage Temperature Range (T_S)	-65 ℃ to +150 ℃
Lead Temperature (soldering, 10 sec.)	+260 ℃
ESD Rating	Note 1

Operating Ratings

Supply Voltage	3.6V to 5.5V
Input Voltage (Max.)	5.5V
Ambient Temperature (T_A)	-40 ℃ to 85 ℃

Electrical Characteristics

Unless otherwise noted, VDDRF = 5V, CAGC = 1μF, CTH = 0.1μF, 1Kbps data rate (Manchester encoded, BER =10E-2), all test at TA = 25 ℃.

Receiver

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
f_{RX}	Frequency Input Range		300 to 450			MHz
P_{IN}, MAX	Max. Input Power				10	dBm
P_{SENS}	Receiver Sensitivity (Note 2)	f_{RX}=315MHz		-109		dBm
		f_{RX}=433.92MHz		-109		dBm
	Image Rejection	f_{RX}=315MHz		20		dB
		f_{RX}=433.92MHz		20		dB
f_{IF}	1st IF Center Frequency	f_{RX}=315MHz		0.86		MHz
		f_{RX}=433.92MHz		1.2		MHz
	IF Bandwidth	f_{RX}=315MHz		235		KHz
		f_{RX}=433.92MHz		330		KHz
	Receive Modulation Duty Cycle	Note 3	20		80	%
V_{AGC}	AGC Dynamic Voltage	P_{IN} = -40dBm		1.15		V
		P_{IN} = -40dBm		1.7		V

Reference Oscillator

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
f_{OSC}	Frequency	f_{RX} = 315MHz		9.8131		MHz
		f_{RX} = 433.92MHz		13.51783		MHz
	Input Range		0.2		1.5	V_{PP}
I_{OSCSC}	Source Current	V(RRFOSC) = 0V		3.5		uA

DO Drive

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
	DO pin Output Current	Source @ 0.8VDD		260		uA
		Sink @ 0.2 VDD		600		uA
T_{RISE}	Output Rise and Fall Times	C_L = 15pF, pin DO, 10-90%		2		µsec
T_{FALL}				2		µsec

Power Supply

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
I_{CC}	Supply Current @ VDDRF = 5V	fRX = 315MHz		4.5		mA
		fRX = 433.92MHz		7.0		mA
I_{OFF}	Shut Down Current	SHUT = High		0.5		µA

Note 1: Device is ESD sensitive. Use appropriate ESD precautions. Exceeding the absolute maximum rating may damage the device.

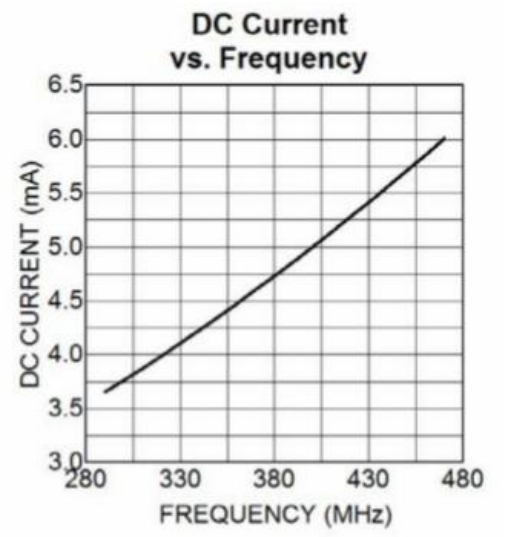
Note 2: Sensitivity is defined as the average signal level measured at the input necessary to achieve 10-2 BER (bit error rate). The input signal is defined as a return-to-zero (RZ) waveform with 50% average duty cycle (Manchester encoded) at a data rate of 1kbps.

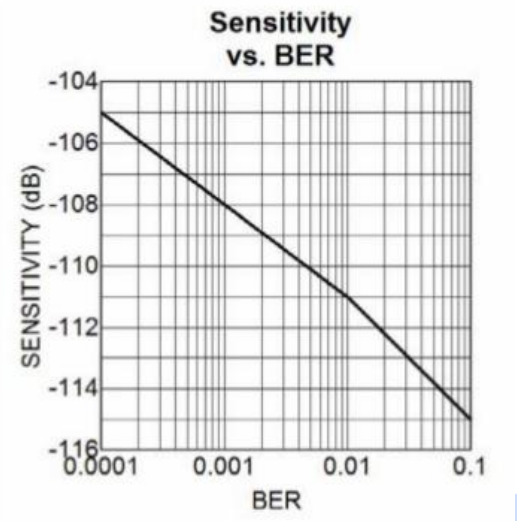
Note 3: When data burst does not contain preamble, duty cycle is defined as total duty cycle, including any "quiet" time between data bursts. When data bursts contain preamble sufficient to charge the slice level on capacitor CTH, then duty cycle is the effective duty cycle of the burst alone.

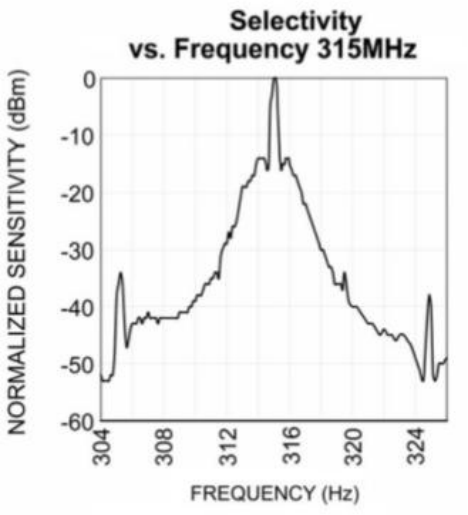
[For example, 100msec burst with 50% duty cycle, and 100msec "quiet" time between bursts. If burst includes preamble, duty cycle is $T_{ON}/(T_{ON} + T_{OFF})$ = 50%; without preamble, duty cycle is $T_{ON}/(T_{ON} + T_{OFF} + T_{QUIET})$ = 50msec/(200msec) = 25%. T_{ON} is the (Average number of 1's/burst) × bit time, and $T_{OFF} = T_{BURST} – T_{ON}$.]

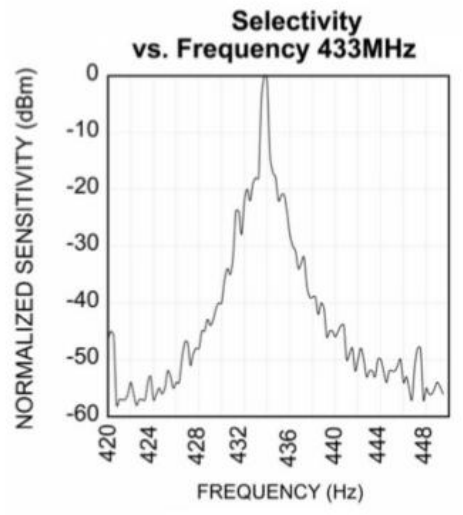
Typical Characteristics

Unless otherwise noted, VDDRF = 5V, CAGC = 1µF, CTH = 0.1µF, 1Kbps data rate (Manchester encoded, BER =10E-2), all test at TA = 25 ℃.


DC Current
vs. Frequency
DC CURRENT (mA)
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
280
330
380
430
480
FREQUENCY (MHz)


Sensitivity
vs. BER
SENSITIVITY (dB)
-104
-106
-108
-110
-112
-114
-116
0.0001
0.001
0.01
0.1
BER


Selectivity
vs. Frequency 315MHz
NORMALIZED SENSITIVITY (dBm)
0
-10
-20
-30
-40
-50
-60
304
308
312
316
320
324
FREQUENCY (Hz)


Selectivity
vs. Frequency 433MHz
NORMALIZED SENSITIVITY (dBm)
0
-10
-20
-30
-40
-50
-60
420
424
428
432
436
440
444
448
FREQUENCY (Hz)

Block Diagram

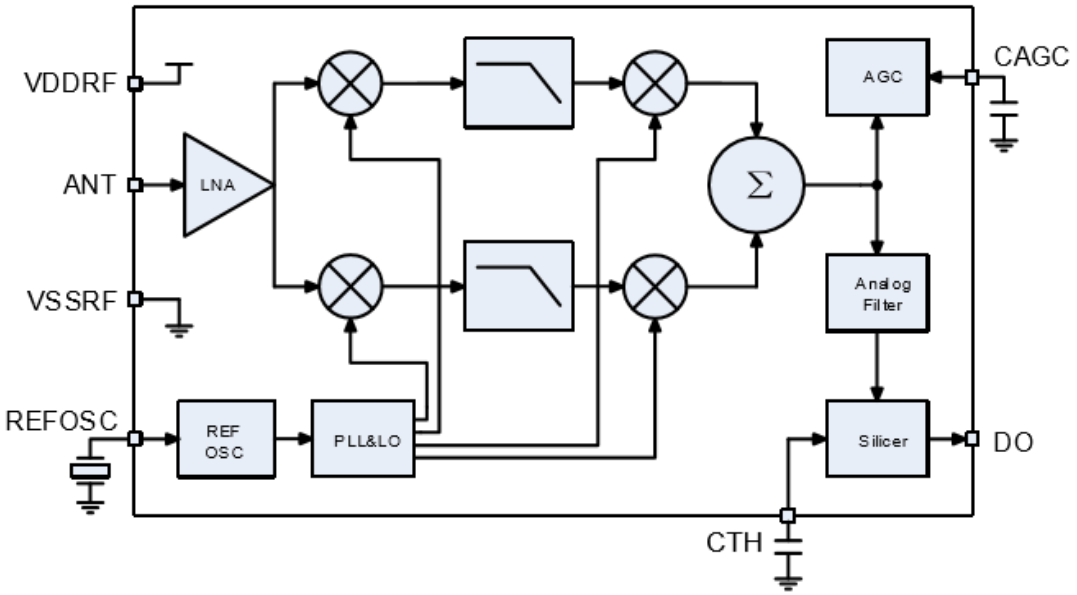


Figure 1 Simplified Block Diagram

Functional Description

Figure 1 Simplified Block Diagram that illustrates the basic structure of the CY580. It is composed of five modules; Low Noise Amplifier, Weaver architecture receiver, the Slicer, Auto Gain Control and Reference and Control Logics

LNA

The RF input signal is AC-coupled into the gate circuit of the grounded source LNA input stage.

The LNA uses a Cascoded NMOS structure circuit, and the output is converted to differential signals for next stage mixers.

Weaver Receiver

The LNA output signals are first mixed with quadrature phases of the local oscillator signal. After filtering both mixer output with a low-pass filter, the output signals are mixed again by another set of mixing operation in both signal paths, the sum of the two final signals cancels the image band to yield the desired signal, while the subtraction removes the desired signal and selects the image band.

Slicer

The signal prior to slicer is still linear demodulated AM. Data slicer converts this signal into digital “1” and “0” by comparing with the threshold voltage built up on the CTH capacitor. This threshold is determined by detecting the positive and negative peaks of the data signal and storing the mean value. Slicing threshold is at 50%. After the slicer, the signal is now digital OOK data. During long periods of “0” or no data period, threshold voltage on the CTH capacitor may be very low. Large random noise spikes during this time may cause erroneous “1” at DO pin.

AGC

The AGC comparator monitors the signal amplitude from the output of the Weaver receiver.

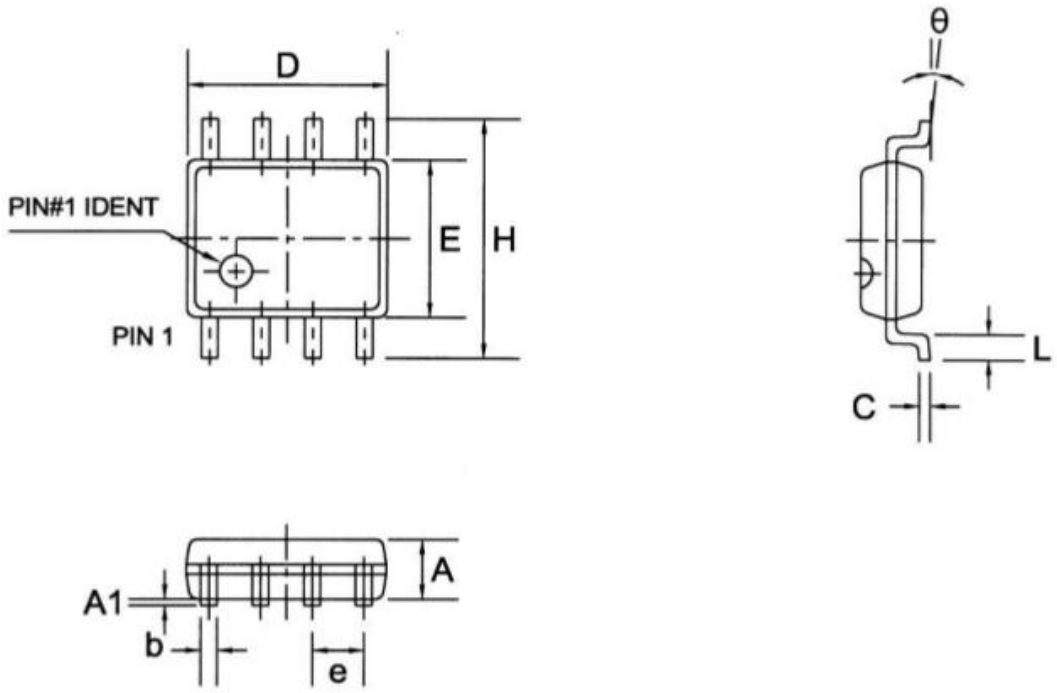
When the output signal is less than 750mV, the threshold 1.5μA current is sourced into the external CAGC capacitor. When the output signal is greater than 750mV, a 15μ A current sink discharges the CAGC capacitor. The voltage developed on the CAGC capacitor acts to adjust the gain of the mixers of Weaver receiver to compensate for RF input signal level variation.

Reference Oscillator

The reference oscillator in the CY580 uses a basic Colpitts crystal oscillator configuration with MOS transconductor to provide negative resistance. The RO pin external capacitor is integrated inside CY580. User only needs to connect reference oscillation crystal.

Reference oscillator crystal frequency can be calculated: $F_{OSC} = F_{RF}/(32 + 1.198/12)$
For 433.92 MHz, F_{OSC} = 13.51783 MHz.

Package Description



Symbol	Dimensions In Millmeters			Dimensions In Inches		
	Min	Nom	Max	Min	Nom	Max
A	1.30	1.50	1.70	0.051	0.059	0.067
A1	0.06	0.16	0.26	0.002	0.006	0.010
b	0.30	0.40	0.55	0.012	0.016	0.022
C	0.15	0.25	0.35	0.006	0.010	0.014
D	4.72	4.92	5.12	0.186	0.194	0.202
E	3.75	3.95	4.15	0.148	0.156	0.163
e	—	1.27	—	—	0.050	—
H	5.70	6.00	6.30	0.224	0.236	0.248
L	0.45	0.65	0.85	0.018	0.026	0.033
θ	0°	—	8°	0°	—	8°

SOP-8 Package Outline Dimensions shown in millimeters and (inches)