

WT14570

IF IC For Communication Equipment

MAY 2012

1. DESCRIPTION

The WT14570 is a wide band IF IC with a maximum IF frequency band of 15MHz. It includes an IF limiter amplifier, RSSI and Detector. The WT14570 is available in the very small SOT-23-8L package.

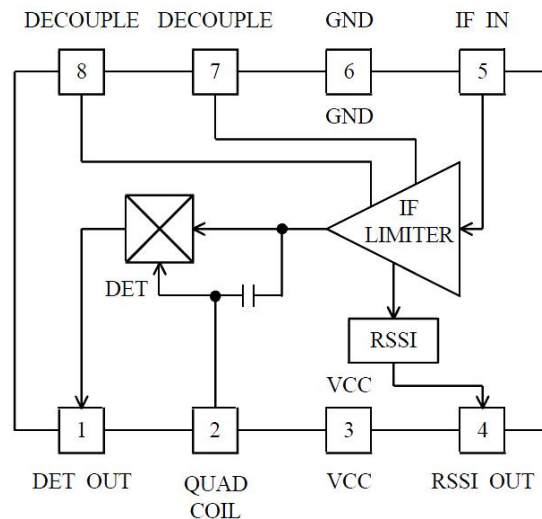
2. FEATURES

- Very Small Package: SOT-23-8L
- Wide Operating Voltage: 1.8~ 8.5V
- Wide Band Demodulator: up to 1MHz

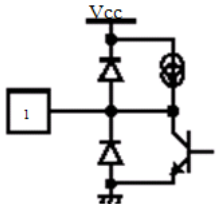
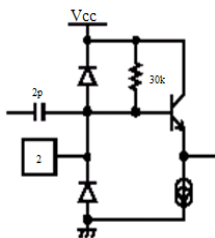
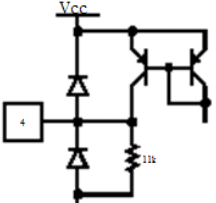
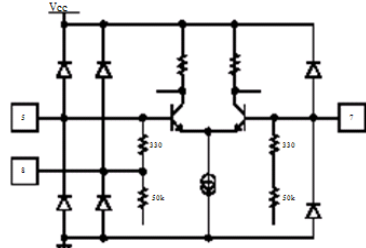
3. APPLICATIONS

- Any Communications Equipment

4. PIN CONFIGURATION / BLOCK DIAGRAM



5. PIN DESCRIPTION

Pin No.	Pin Name	Internal Equivalent Circuit	Description
1	DETECTOR OUT		FM Detector Output.
2	QUAD COIL		FM Detector Input. Connection for the phase shift circuit.
3	VCC		Power Supply Terminal.
4	RSSI OUTPUT		RSSI Output.
5 7 8	IF INPUT DECOUPLE DECOUPLE		5: IF Limiter Amplifier Input. 7, 8: The terminal to connect the bypass capacitor of the IF limiter amplifier.
6	GND		GND Terminal

6. ABSOLUTE MAXIMUM RATINGS

Ta=25°C

Parameter	Symbol	Rating	Units	Conditions
Supply Voltage	V _{CC}	10.0	V	
Power Dissipation	P _D	150	mW	*
Storage Temperature Range	T _{stg}	-55 ~ +150	°C	
Operating Temperature Range	T _{op}	-40~85	°C	
IF Limiter Operating Frequency Range	f _{IF}	3~15	MHz	
Demodulation Operating Frequency Range	f _{DB}	~1	MHz	
Operating Voltage Range	V _{op}	1.8~8.5	V	

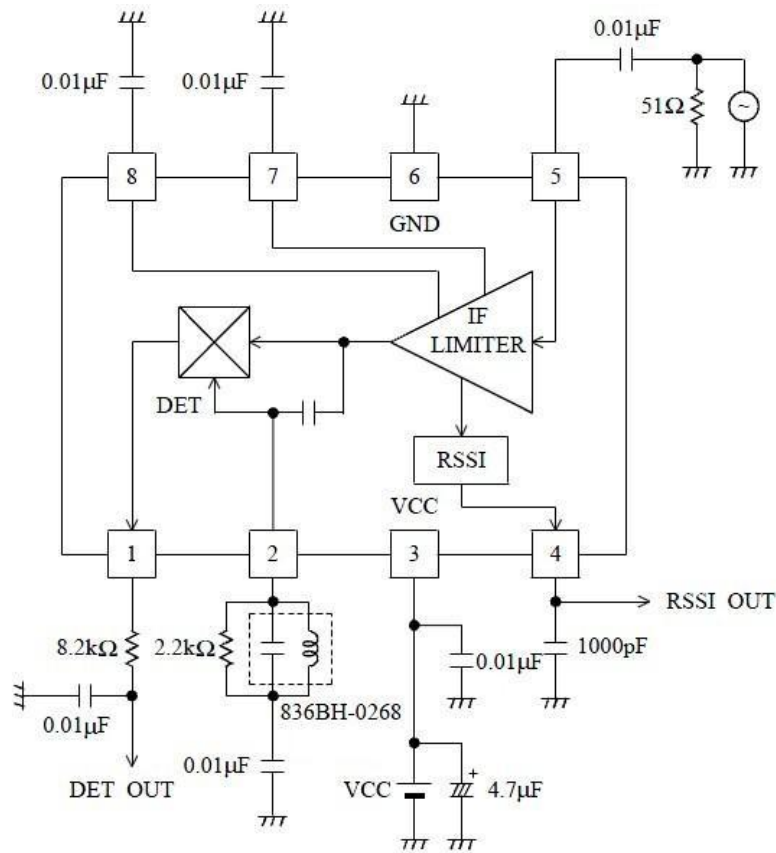
* P_D must be decreased at rate of 1.2mW/°C for operation at 25°C.

7. ELECTRICAL CHARACTERISTICS

VCC=3V, Ta=25°C, fin=10.7MHz, fm=1kHz, dev.=±50kHz

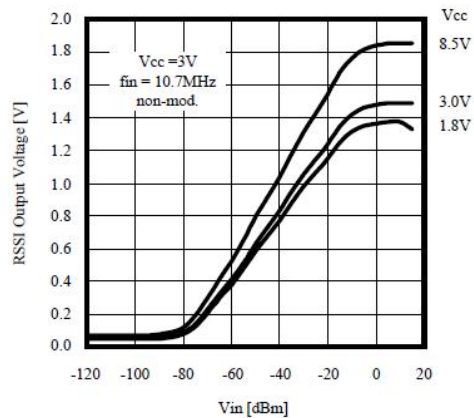
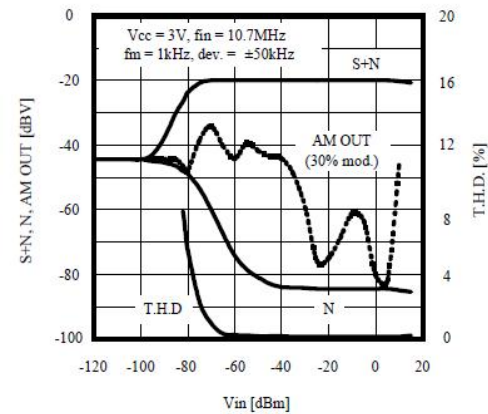
Parameter	Symbol	Value			Units	Conditions
		MIN	TYP	MAX		
Supply Current	I _{CC}		2.9	4.1	mA	No input
FM Demodulation						
Output Voltage	V _{out}	60	100	160	mVrms	-30 dBm input
Total Harmonic Distortion	THD		0.5	2	%	-30 dBm input
Signal-to-Noise Ratio	S/N	54	60		dB	-30 dBm input
12dB SINAD	SINAD		-87	-81	dBm	
Limiter Input Resistance	R _{lin}		330			DC measurement
RSSI						
RSSI Output Voltage 1	V _{RSSI 1}	0.00	0.05	0.3	V	No input
RSSI Output Voltage 2	V _{RSSI 2}	0.20	0.40	0.60	V	-60 dBm non-mod. input
RSSI Output Voltage 3	V _{RSSI 3}	0.80	1.05	1.3	V	-30 dBm non-mod. input
RSSI Output Voltage 4	V _{RSSI 4}	1.20	1.50	1.80	V	0 dBm non-mod. input

8. TEST CIRCUIT

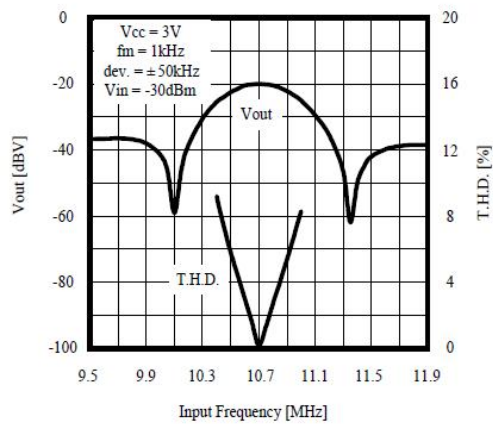


9. TYPICAL CHARACTERISTICS

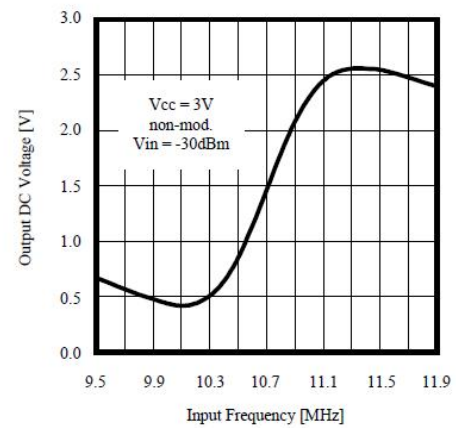
- S+N, N, T.H.D., AM OUT vs. IF Input Level
- RSSI Output Voltage vs. IF Input Level



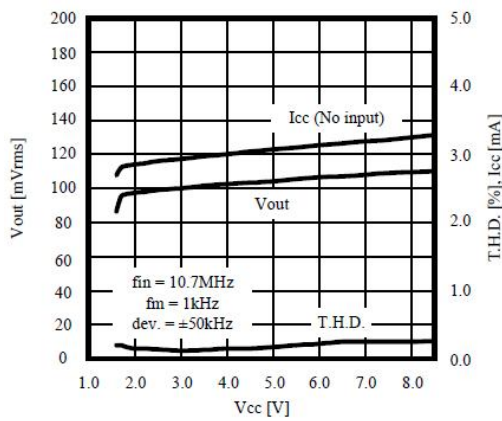
- Vout, T.H.D. vs. IF Input Frequency



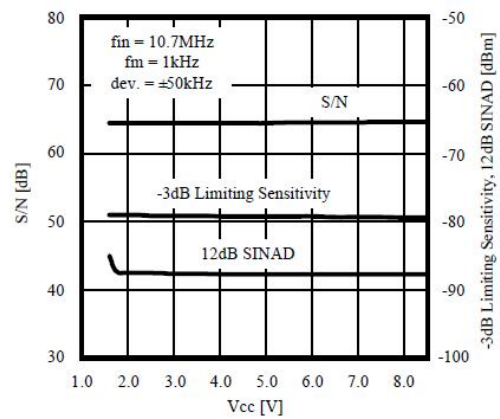
- S Curve Characteristics



- Vout, T.H.D., Icc vs. Vcc

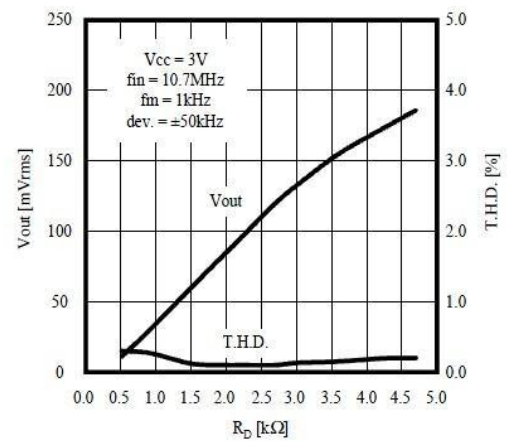
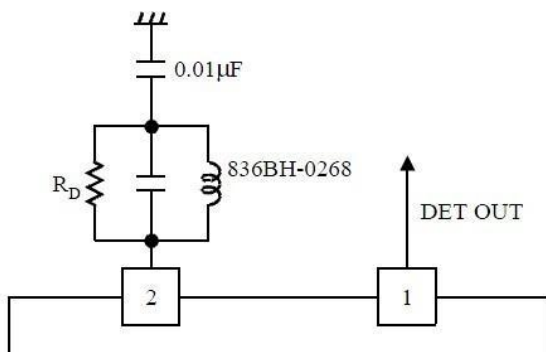


- Signal-to-Noise Ratio, -3dB Limiting Sensitivity, 12dB SINAD vs. Vcc

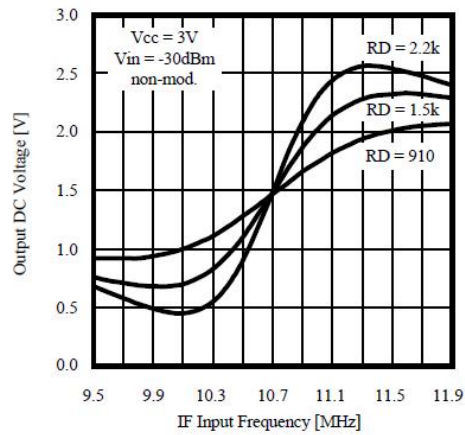


Electrical characteristics by changing damping resistor R_D

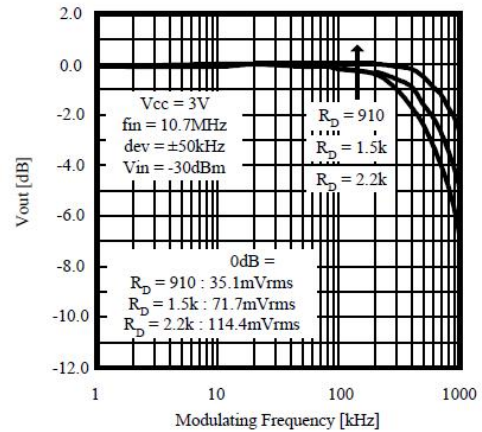
- Vout, T.H.D. vs. R



- **S Curve Characteristics**

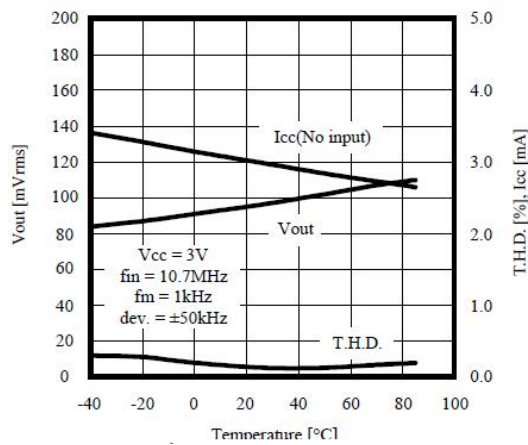


- **Demodulation Output Voltage vs. Demodulating Frequency**

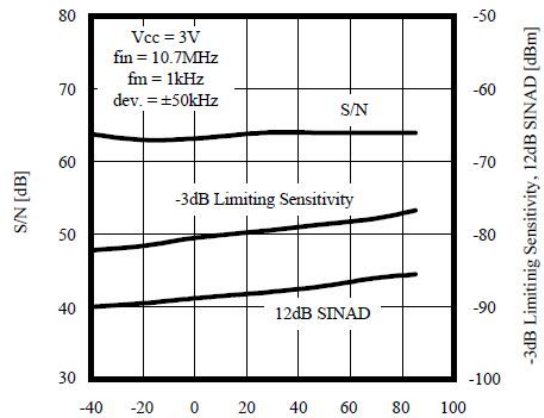


Ambient Temperature Characteristics

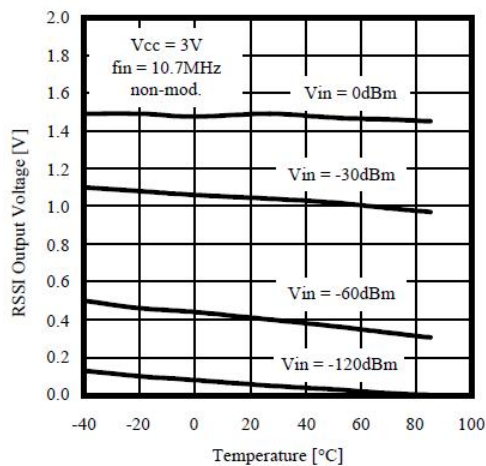
- **I_{CC} , V_{out} , T.H.D. vs. Temperature**



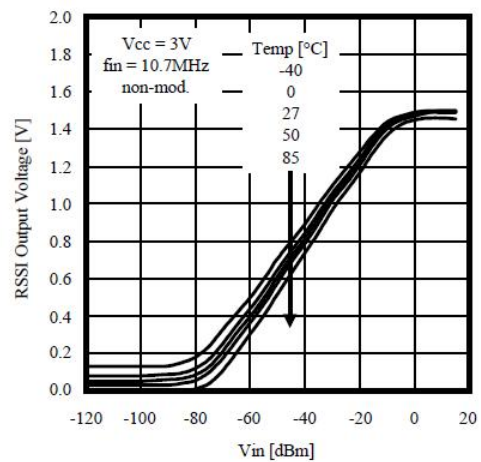
- **Signal-to-Noise Ratio, -3dB Limiting Sensitivity, 12dB SINAD vs. Temperature**



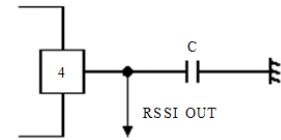
- **RSSI Output Voltage vs. Temperature**



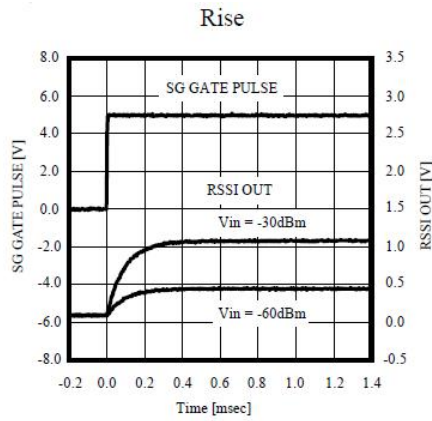
- **RSSI Output Voltage vs. IF Input Level (Temperature Characteristic)**



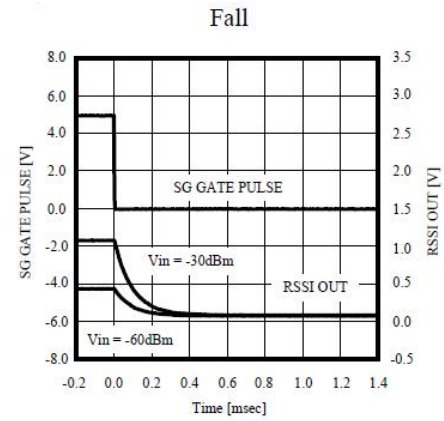
RSSI Output Transient Response (IF input ON/ OFF)



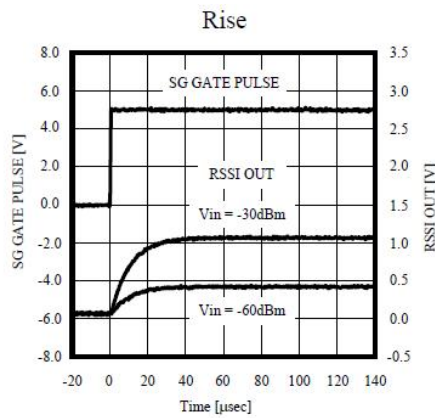
- C=0.01uF



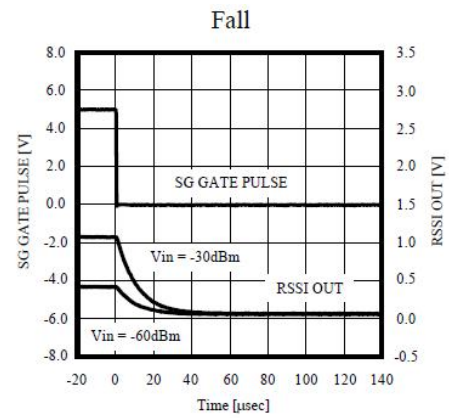
- C=0.01uF



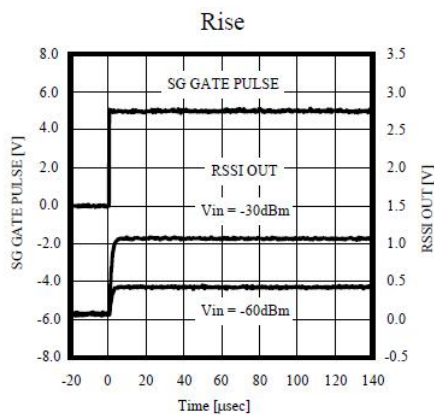
- C=1000pF



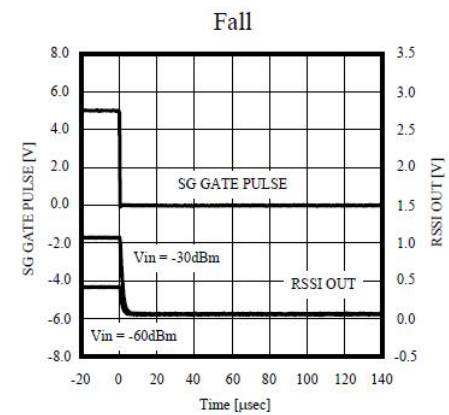
- C=1000pF



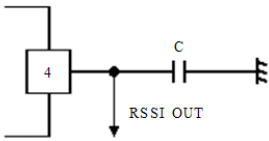
- C=100pF



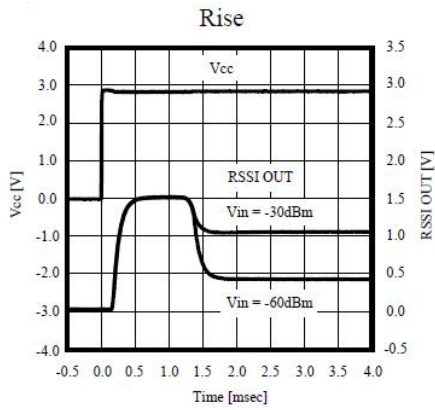
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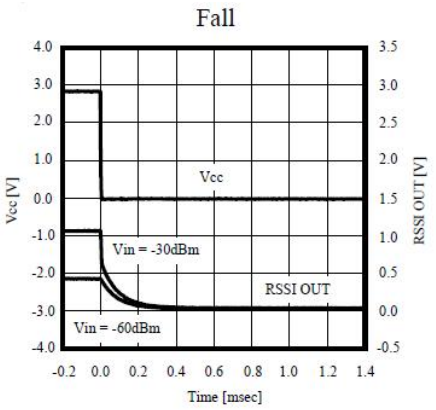
RSSI Output Transient Response (Vcc ON/ OFF)



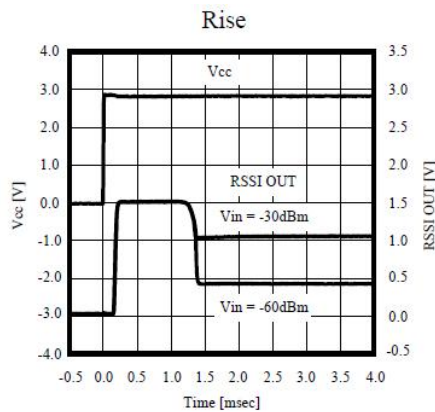
- C=0.01uF



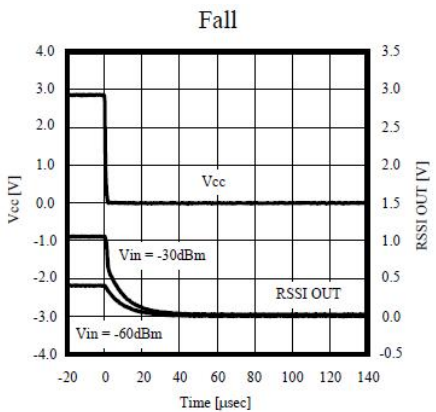
- C=0.01uF



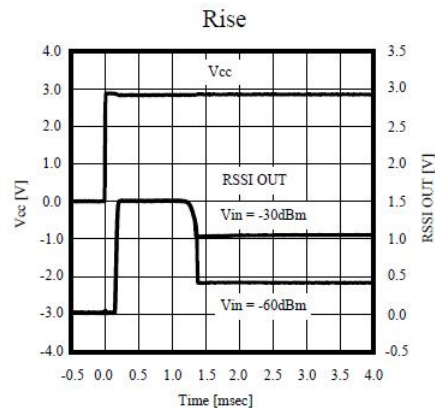
- C=1000pF



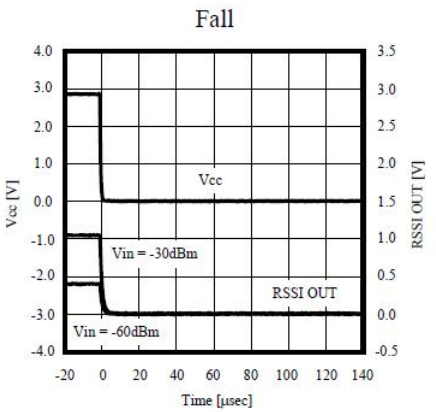
- C=1000pF



- C=100pF



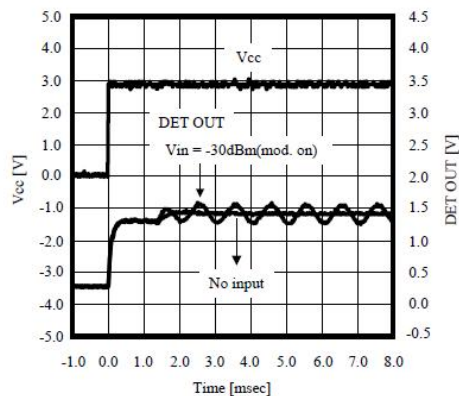
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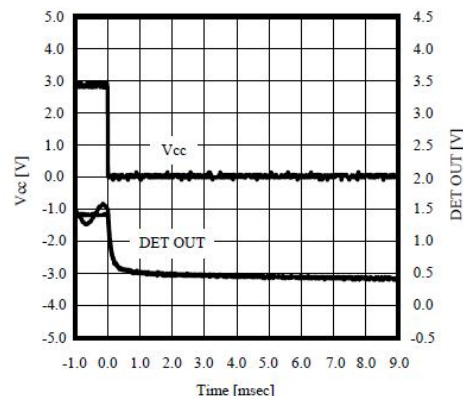
DETECTOR Output Transient Response

$f_{in}=10.7\text{MHz}$, $f_m=1\text{kHz}$, $\text{dev.}=\pm 50\text{kHz}$

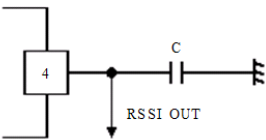
■ Rise



■ Fall

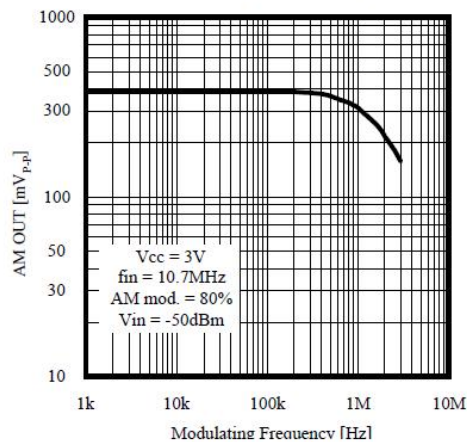


AM Demodulation output characteristics by using the RSSI output



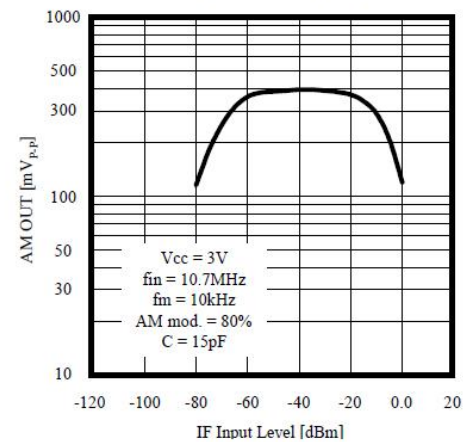
■ Logarithmic Detection

AM Demodulation Voltage vs. Modulating Frequency

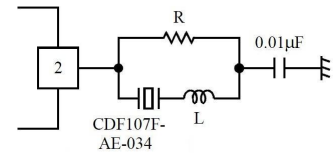


■ Logarithmic Detection

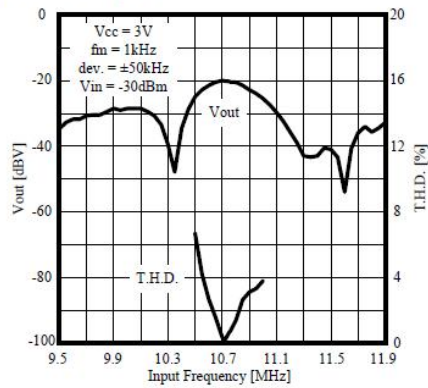
AM Demodulation Voltage vs. IF Input Level



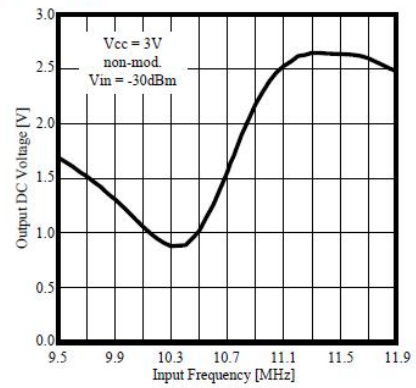
Electrical characteristics by using a ceramic discriminator



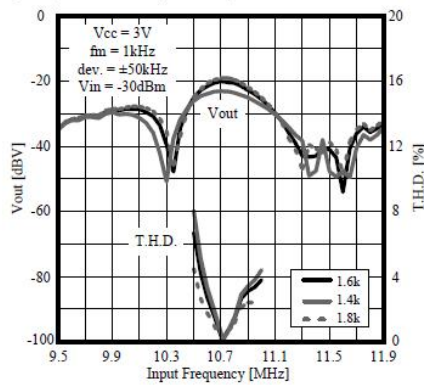
■ Vout, T.H.D. vs. IF Input Frequency
(R=1.6kΩ, L=12μH)



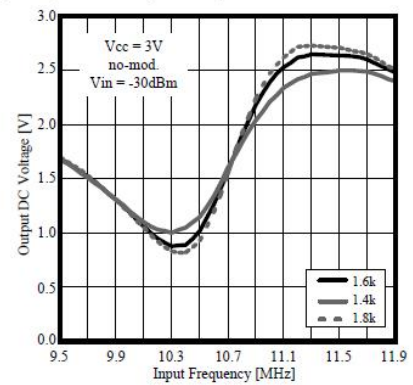
■ S Curve Characteristics
(R=1.6kΩ, L=12μH)



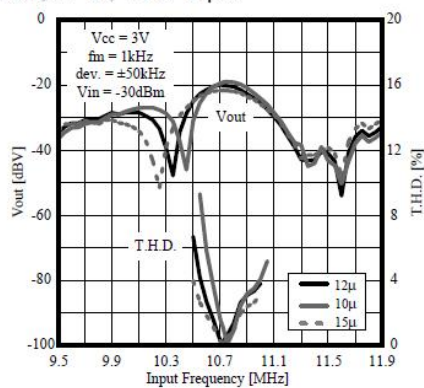
■ Vout, T.H.D. vs. IF Input Frequency
R=1.4, 1.6, or 1.8kΩ, L=12μH



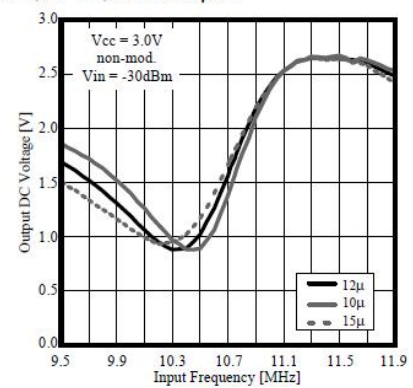
■ S Curve Characteristics
R=1.4, 1.6, or 1.8kΩ, L=12μH



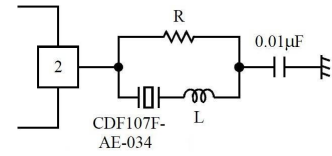
■ Vout, T.H.D. vs. IF Input Frequency
R=1.6kΩ, L=10, 12 or 15μH



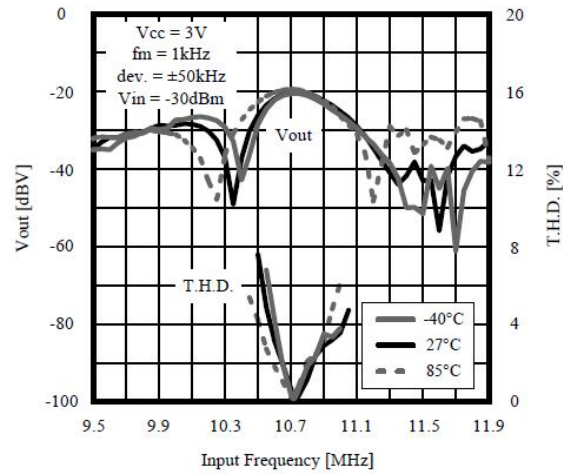
■ S Curve Characteristics
R=1.6kΩ, L=10, 12 or 15μH



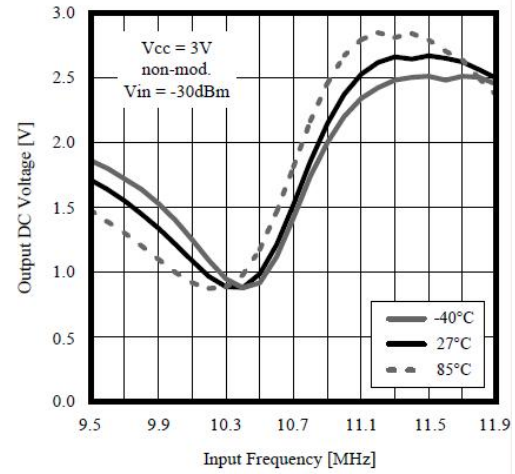
Electrical characteristics by using a ceramic discriminator



■ Vout, T.H.D. vs. IF Input Frequency



■ S Curve Characteristics



10. APPLICATIONS INFORMATION

1.1. IF Limiter Amplifier

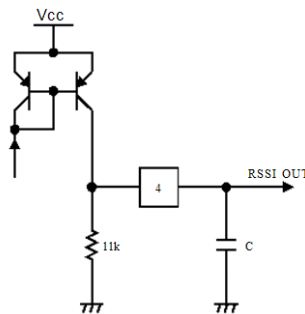
The IF limiter amplifier is composed of five differential amplifier stages. The total gain of the IF limiter is approximately 77 dB at an input frequency of 10.7MHz.

1.2. RSSI

The RSSI output of this product is a voltage output. It converts to voltage by an internal 11k resistor between Pin 4 and GND. The time constant of the RSSI output is determined by the product of the internal converting resistor and the external parallel capacitor.

When the time constant is longer, the RSSI output is more immune to disturbances or the component of amplitude modulation, but the RSSI output response is lower. Determine the internal resistor and external capacitor with this in mind. The dynamic range of the RSSI output voltage is approximately 70 dB

Figure 1: Internal equivalent circuit (RSSI Output)



1.3. AM Demodulation by using the RSSI output

Although the distortion of the RSSI output is high because it is a logarithmic detection of the envelope to the IF input, AM can be demodulated simply by using the RSSI output. In this case, the input dynamic range that can demodulate AM is the inside of the linear portion of the RSSI curve characteristic. This method does not have a feedback loop to control the gain because an AGC amplifier is not necessary (unlike the popularly used AM demodulation method). Therefore, it is a very useful application for some uses because it doesn't have the response time problem.

Figure 2: AM Demodulation Waveform

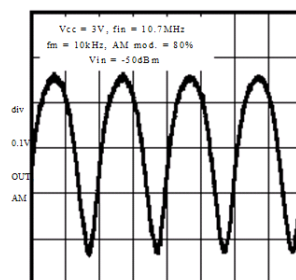
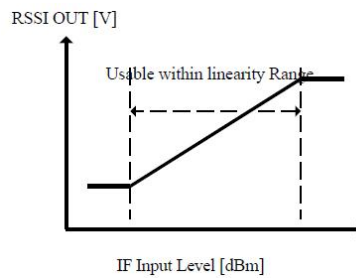


Figure 3: AM Demodulating Range with RSSI

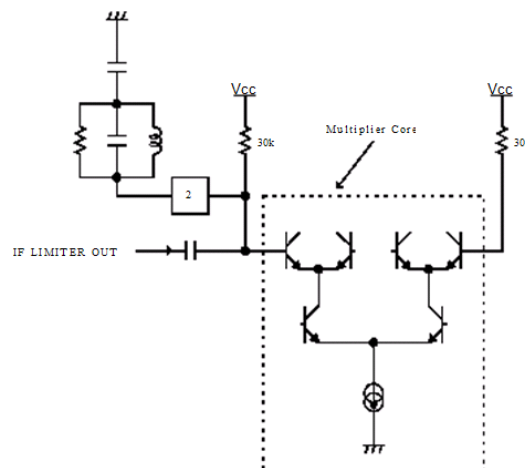


1.4. FM Detector

The FM detector is included in the quadrature FM detector using a Gilbert multiplier. It is suitable for high speed data communication because the demodulation bandwidth is over 1 MHz. The phase shifter is connected to Pin 2. Any available phase shifter can be used: a LC resonance circuit or a ceramic discriminator.

Figure 11.4.1 shows the internal equivalent circuit of the detector. The Pin 2 input level should be saturated at the multiplier; if this level is lower, it is easy to disperse the modulation output level. Therefore, to have stable operation, Pin 2 should be higher than 100 mV

Figure 4: Detector Internal Equivalent Circuit

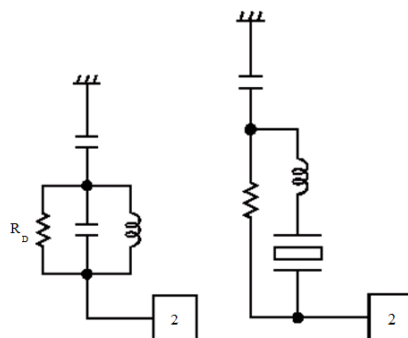


The following figures show examples of the phase shifter

Figure 5: Examples of Phase Shifters

LC resonance circuit

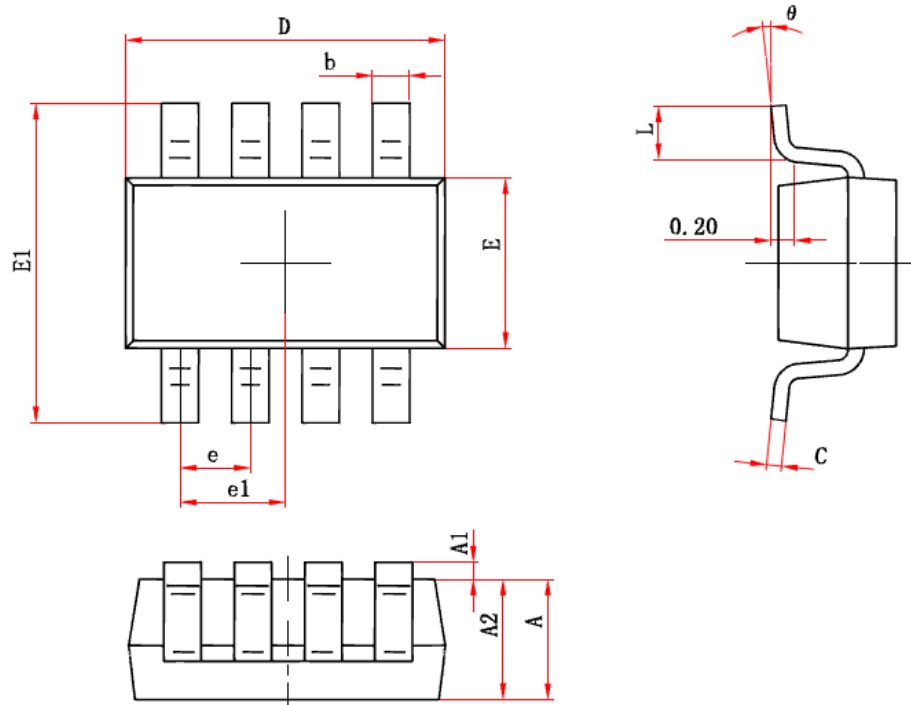
Ceramic discriminator



R_D : Damping Resistor

11. PACKAGE INFORMATION

SOT-23-8L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.65 (BSC)		0.026(BSC)	
e1	0.975 (BSC)		0.038(BSC)	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°