APPLICATION MANUAL

Introduction of IF IC for Communications Equipment
TK14570L

CONTENTS

MEETING YOUR NEEDS
TOKO, INC.

IF IC for Communication Equipment
TK14570L

1. DESCRIPTION

The TK14570L is a wide band IF IC with a maximum IF frequency band of 15 MHz. It includes an IF limiter amplifier, RSSI and Detector. The TK14570L is available in the very small SOT23L-8 package.

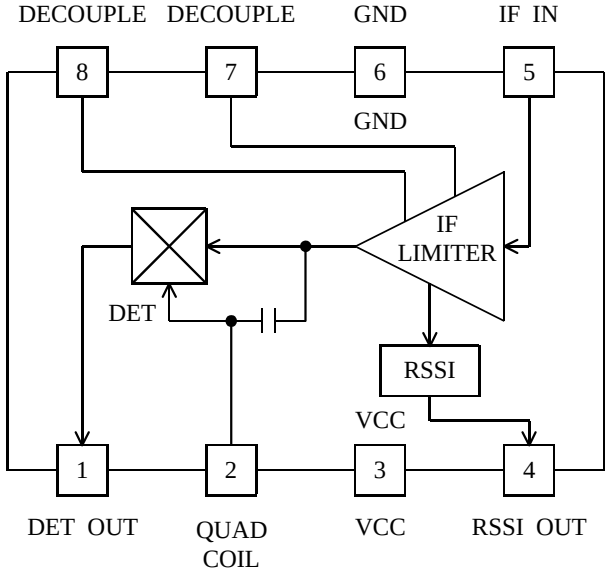
2. FEATURES

- Very Small Package: SOT23L-8
- Wide Operating Voltage: 1.8~8.5V
- Wide Band Demodulator: ~1MHz

3. APPLICATIONS

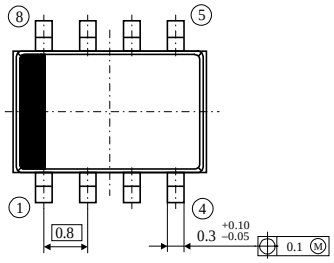
- Any Communications Equipment

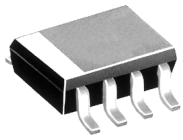
4. PIN CONFIGURATION / BLOCK DIAGRAM

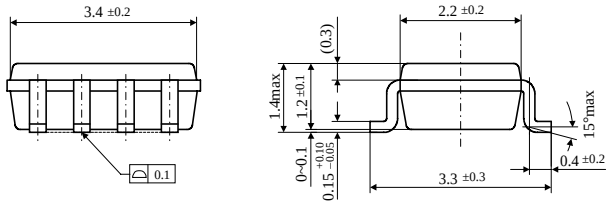


5. PACKAGE OUTLINE

- SOT23L-8







Unit : mm

6. ABSOLUTE MAXIMUM RATINGS

T_a=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	

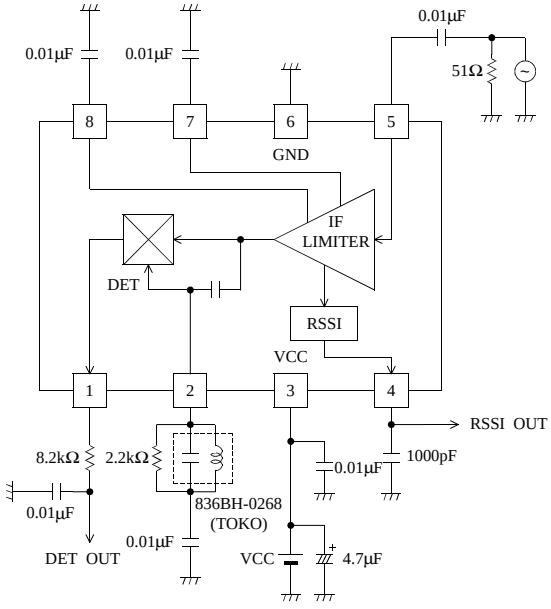
* P_D must be decreased at rate of 1.2mW/°C for operation at 25°C.

7. ELECTRICAL CHARACTERISTICS

V_{CC}=3V, T_a=25°C, fin=10.7MHz, fm=1kHz, dev.=±50kHz

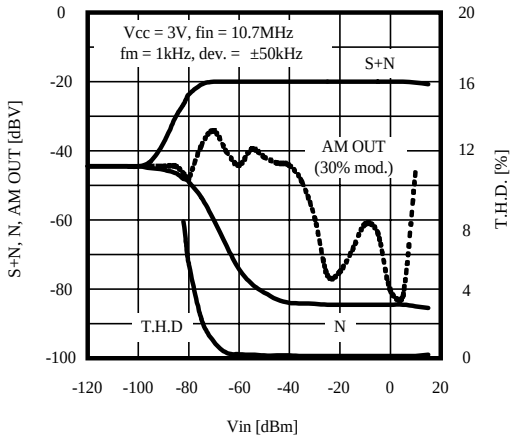
Parameter	Symbol	Value			Units	Conditions
		MIN	TYP	MAX		
Supply Current	I_{CC}		2.9	4.1	mA	No input
FM Demodulation						
Output Voltage	Vout	60	100	160	mVrms	-30 dBm input
Total Harmonic Distortion	THD		0.5	2.0	%	-30 dBm input
Signal-to-Noise Ratio	S/N	54	60		dB	-30 dBm input
12dB SINAD	SINAD		-87	-81	dBm	
Limiter Input Resistance	Rlin		330		Ω	DC measurement
RSSI						
RSSI Output Voltage 1	$V_{RSSI}1$	0.00	0.05	0.30	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	1.30	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

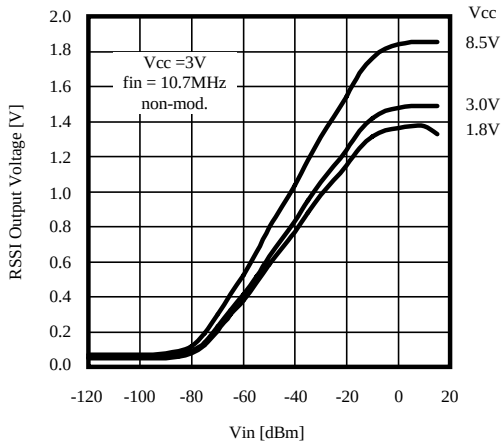


9. TYPICAL CHARACTERISTICS

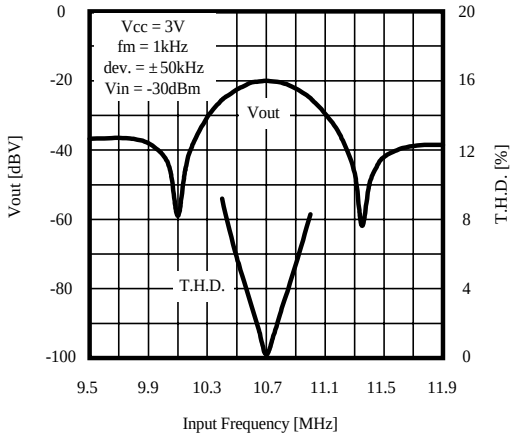
■ S+N, N, T.H.D., AM OUT vs. IF Input Level



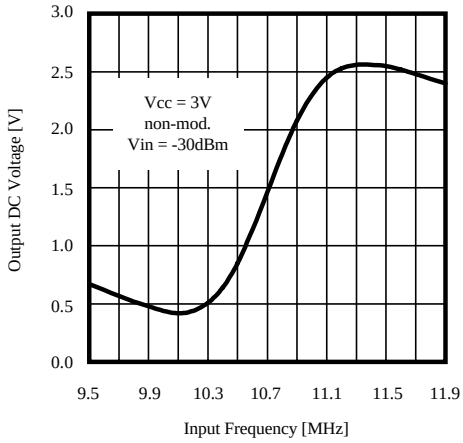
■ RSSI Output Voltage vs. IF Input Level



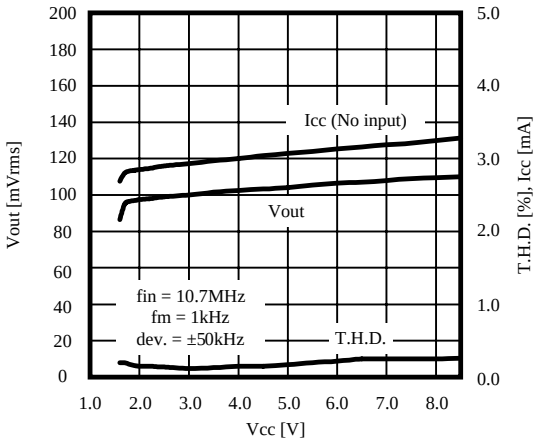
■ Vout, T.H.D. vs. IF Input Frequency



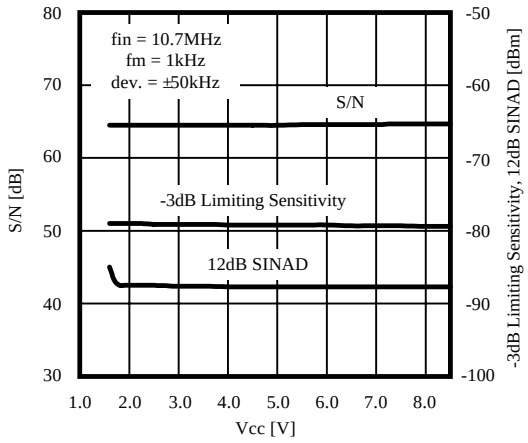
■ S Curve Characteristics



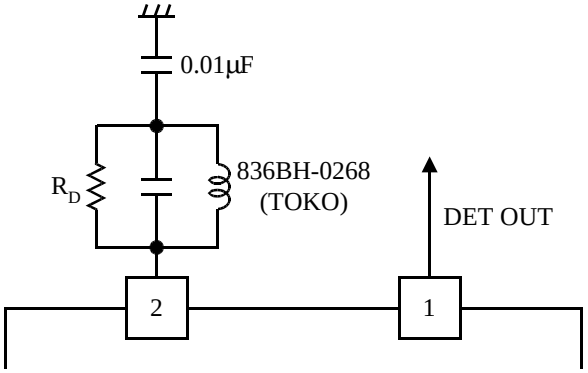
■ Vout, T.H.D., Icc vs. Vcc



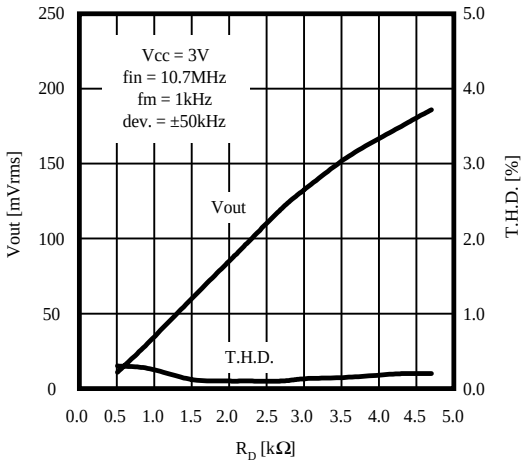
■ Signal-to-Noise Ratio, -3dB Limiting Sensitivity, 12dB SINAD vs. Vcc



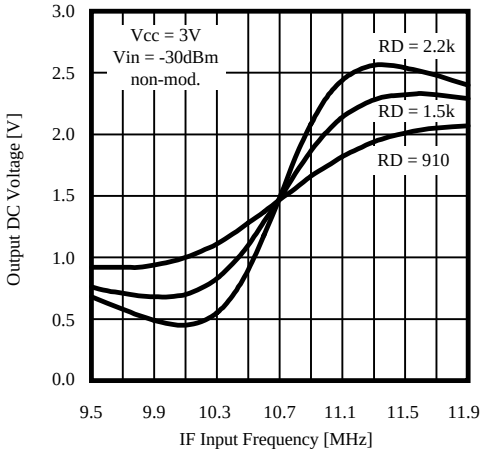
■ Electrical characteristics by changing damping resistor R_D



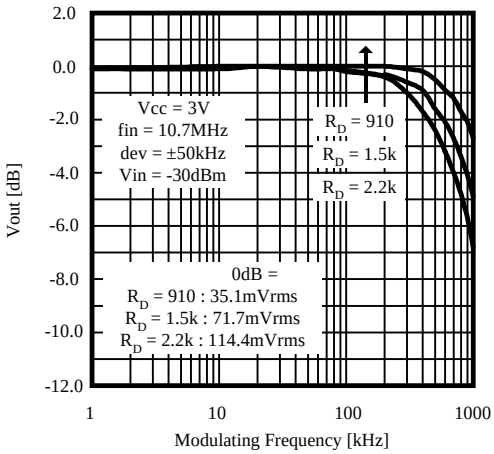
■ Vout, T.H.D. vs. R_D



■ S Curve Characteristics

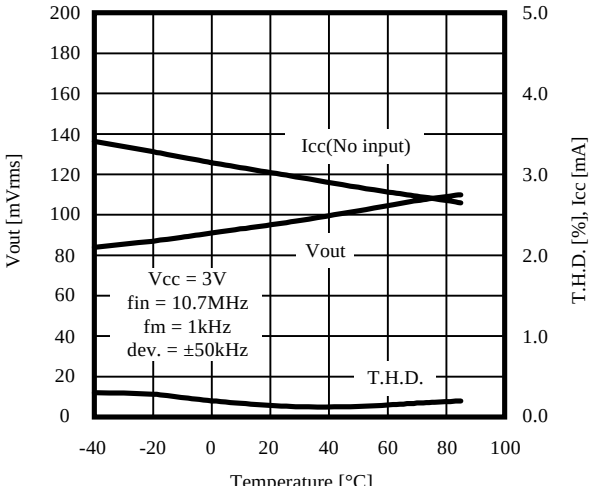


■ Demodulation Output Voltage vs. Demodulating Frequency

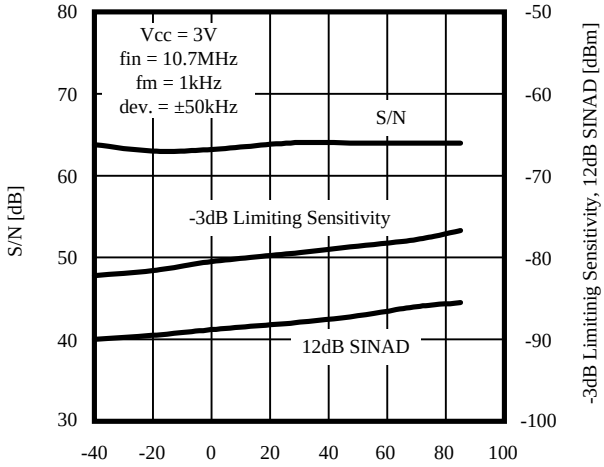


■ Ambient Temperature Characteristics

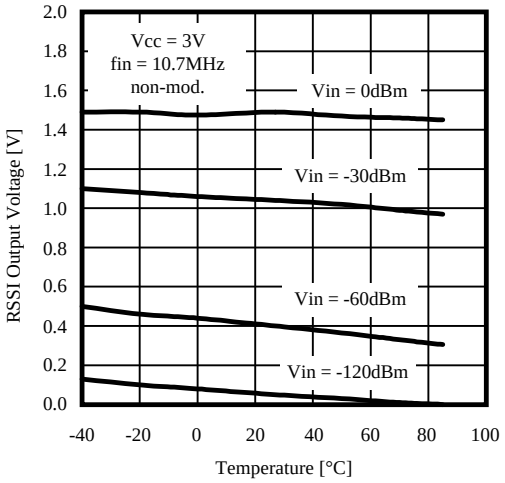
■ Icc, Vout, T.H.D. vs. Temperature



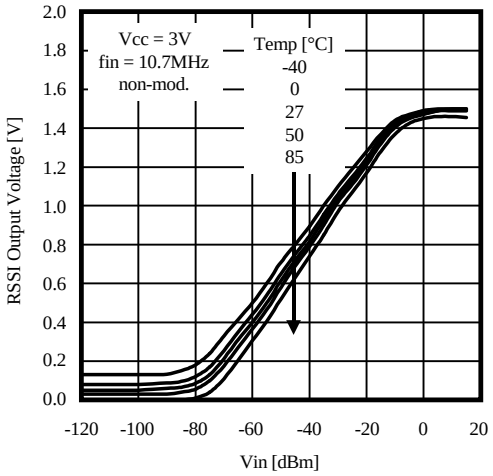
■ Signal-to-Noise Ratio, -3dB Limiting Sensitivity, 12dB SINAD vs. Temperature



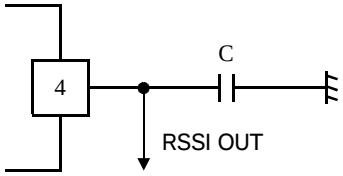
■ RSSI Output Voltage vs. Temperature



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

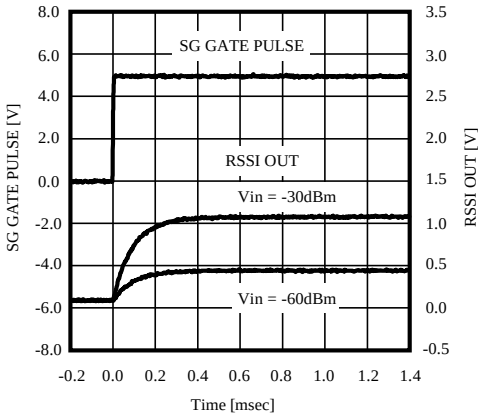


■ RSSI Output Transient Response (IF input ON/ OFF)



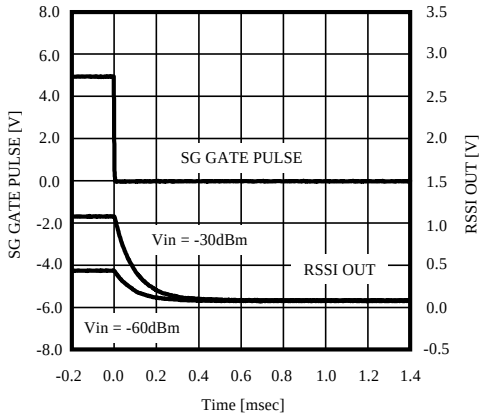
■ C=0.01µF

Rise



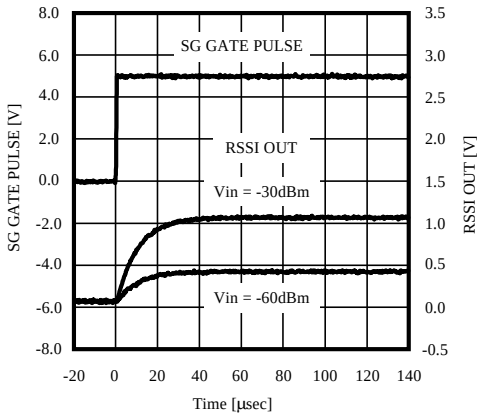
■ C=0.01µF

Fall



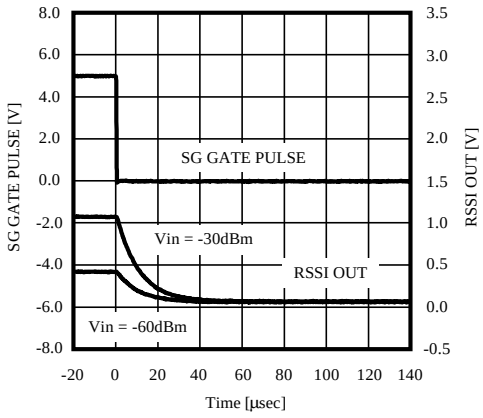
■ C=1000p

Rise



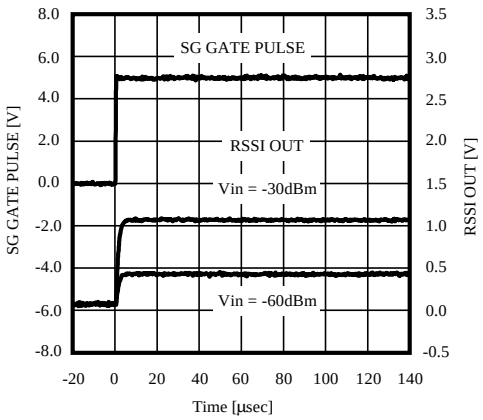
■ C=1000pF

Fall



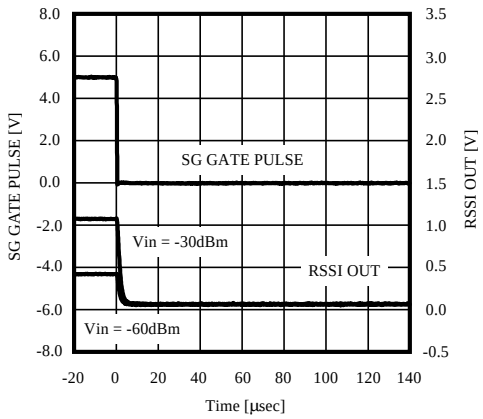
■ C=100p

Rise

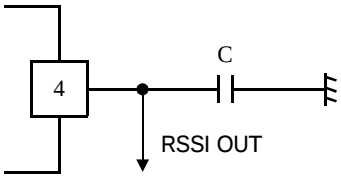


■ C=100pF

Fall

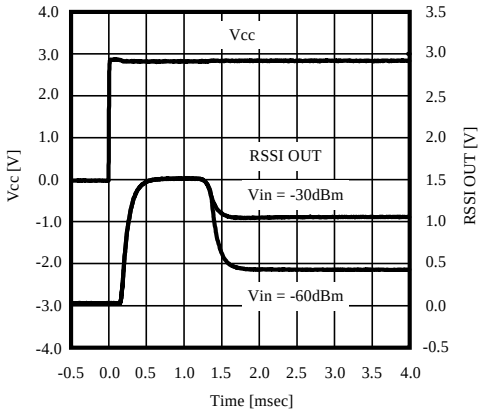


■ RSSI Output Transient Response (Vcc ON/ OFF)



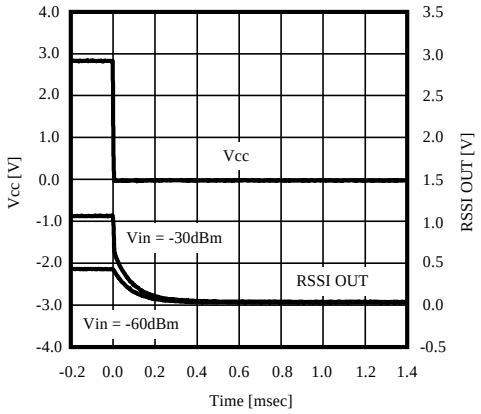
■ C=0.01µF

Rise



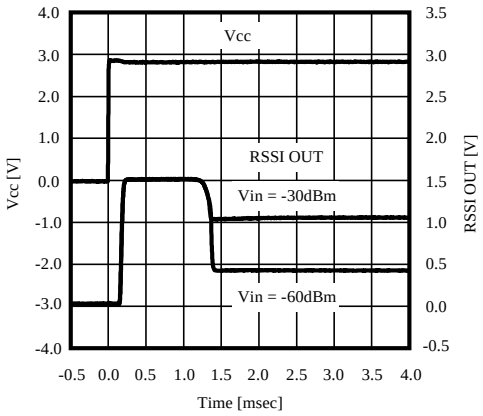
■ C=0.01µF

Fall



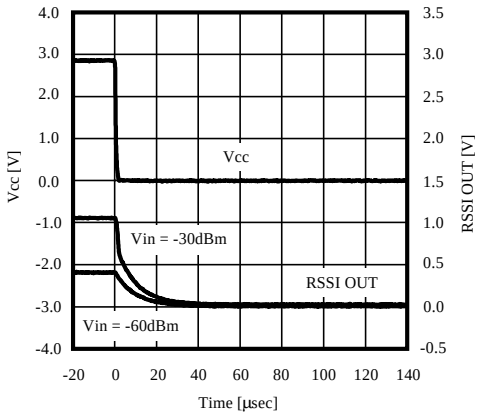
■ C=1000p

Rise



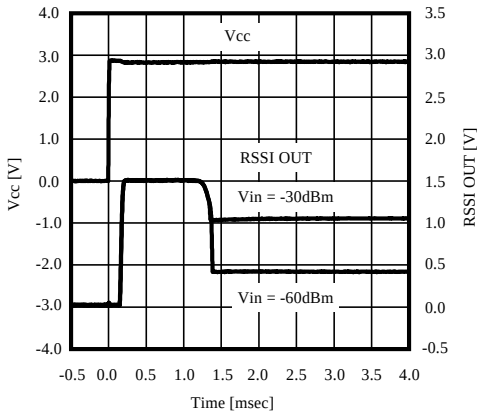
■ C=1000pF

Fall



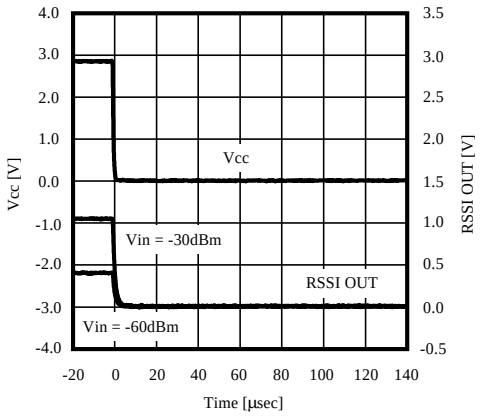
■ C=100p

Rise



■ C=100pF

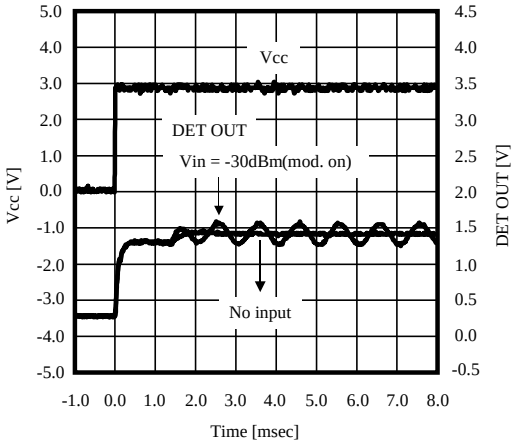
Fall



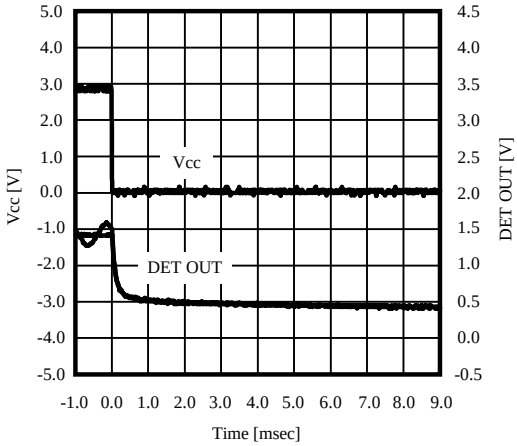
■ DETECTOR Output Transient Response

fin=10.7MHz, fm=1kHz, dev.=±50kHz

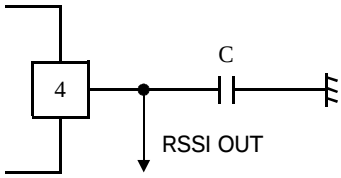
■ Rise



■ Fall

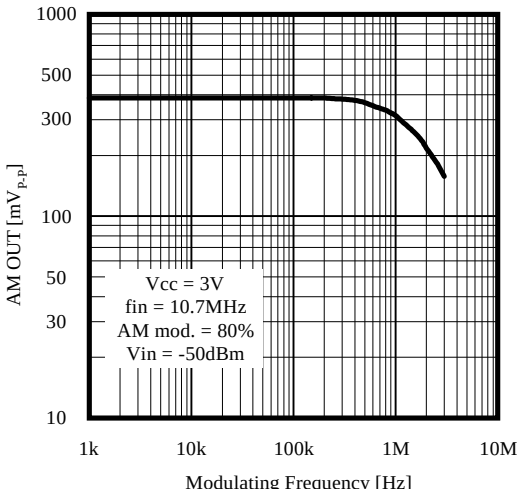


■ AM Demodulation output characteristics by using the RSSI output



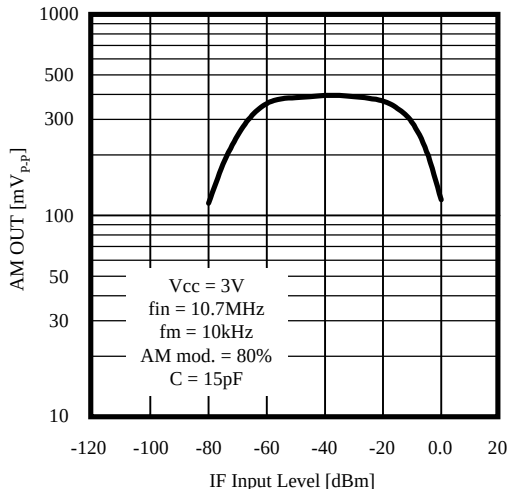
■ Logarithmic Detection

AM Demodulation Voltage vs. Modulating Frequency

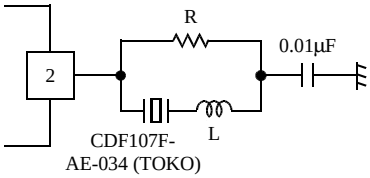


■ Logarithmic Detection

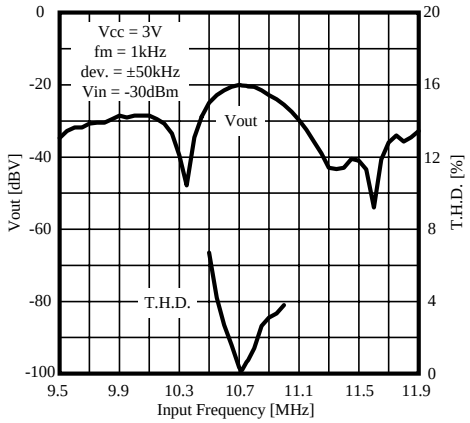
AM Demodulation Voltage vs. IF Input Level



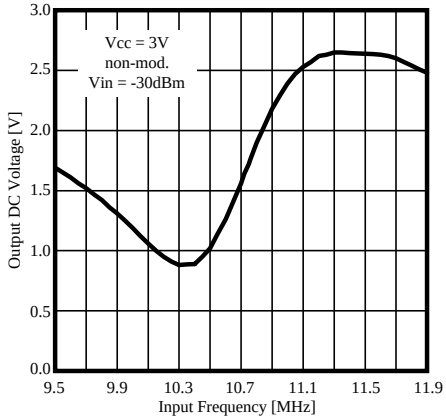
■ Electrical characteristics by using a ceramic discriminator



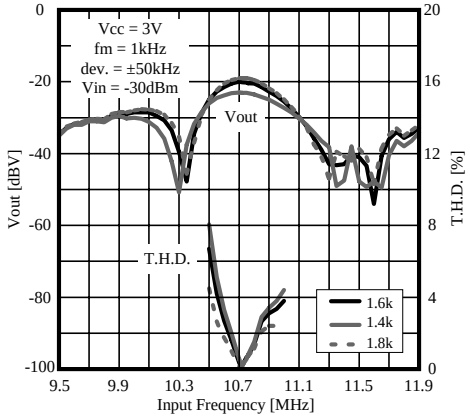
■ Vout, T.H.D. vs. IF Input Frequency
(R=1.6kΩ, L=12µH)



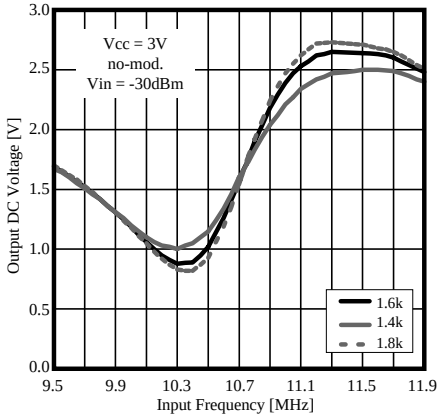
■ S Curve Characteristics
(R=1.6kΩ, L=12µH)



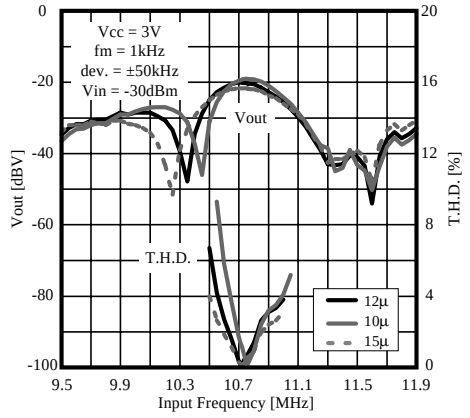
■ Vout, T.H.D. vs. IF Input Frequency
R=1.4, 1.6, or 1.8kΩ, L=12µH



■ 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



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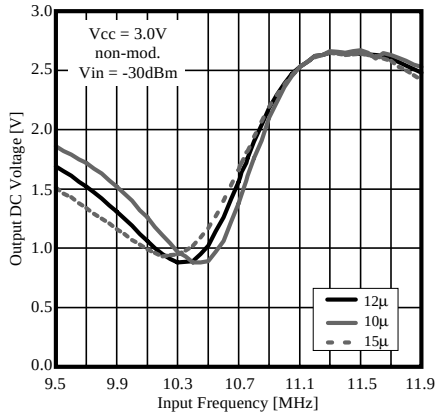
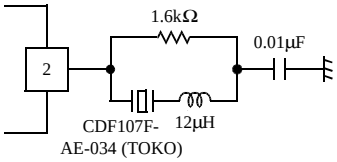
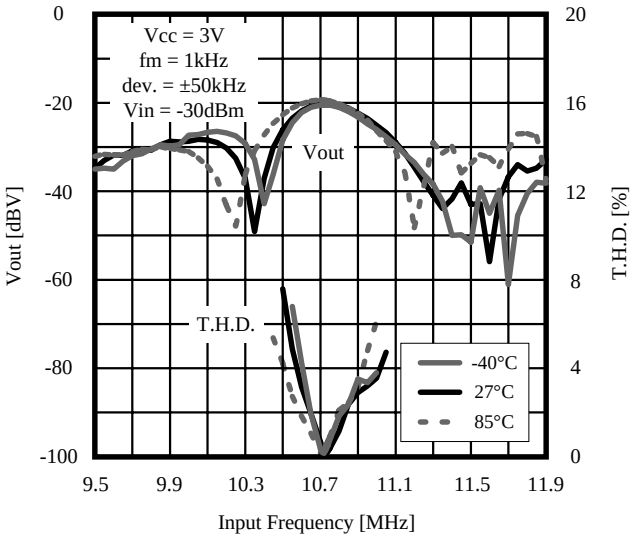


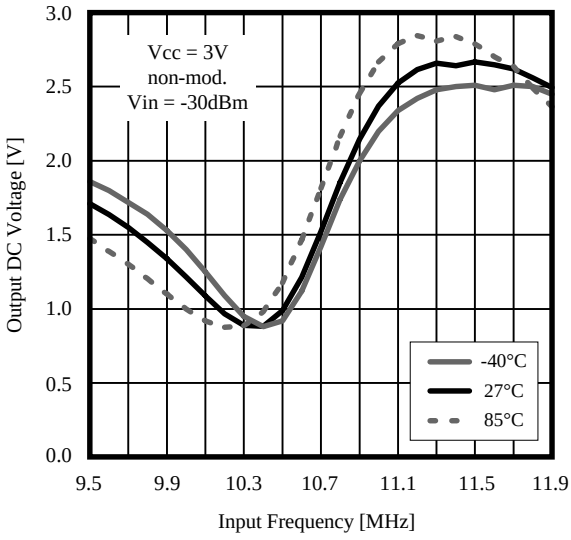
■ Electrical characteristics by using a ceramic discriminator



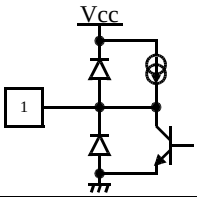
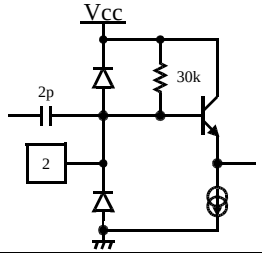
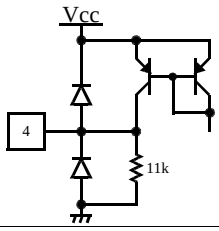
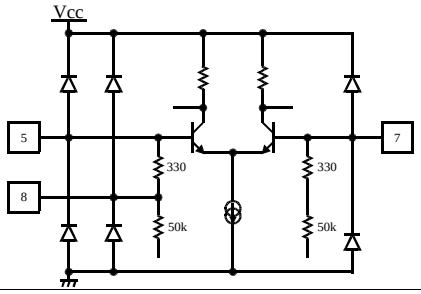
■ Vout, T.H.D. vs. IF Input Frequency



■ S Curve Characteristics

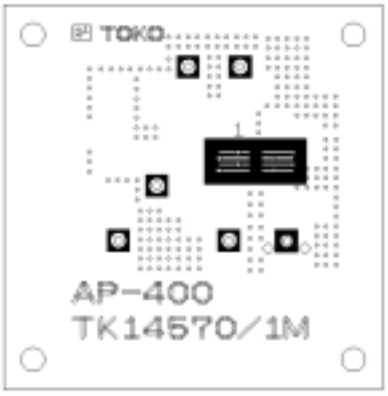


10. PIN DESCRIPTION

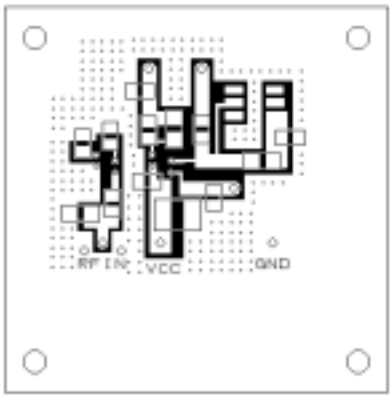
Pin No.	Pin Description	Internal Equivalent Circuit	Description
1	DETECTOR OUT		FM Detector Output.
2	QUAD COIL		FM Detector Input. Connection for the phase shift circuit.
3	V_{CC}		Power Supply Terminal.
4	RSSI OUTPUT		RSSI Output.
5 7 8	IF INPUT DECOUPLE DECOUPLE		5: IF Limiter Amplifier Input. 7,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

11. TEST BOARD

(IC Placement View)



(Component Placement View)



12. APPLICATIONS INFORMATION

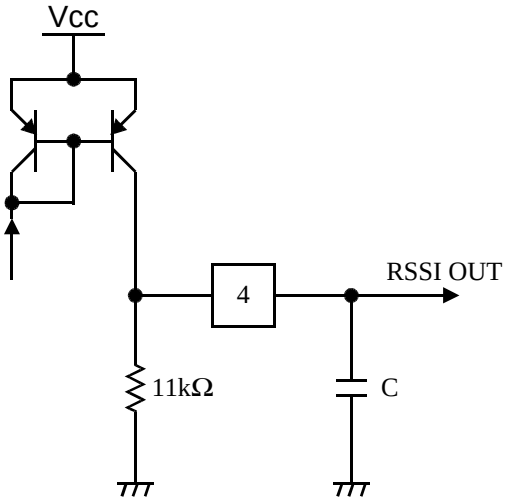
12-1. IF Limiter Amplifier

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.

12-2. RSSI

The RSSI output of this product is a voltage output. It converts to voltage by an internal 11kΩ 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)



12-3. 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

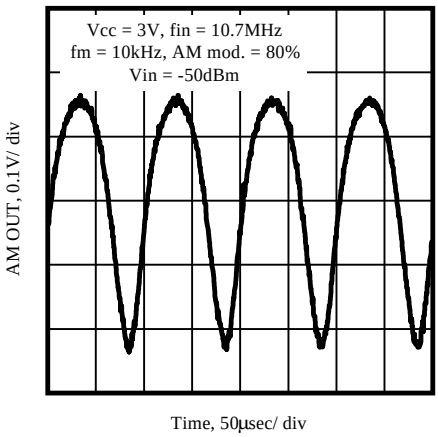
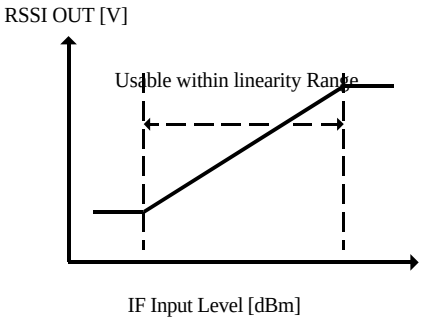


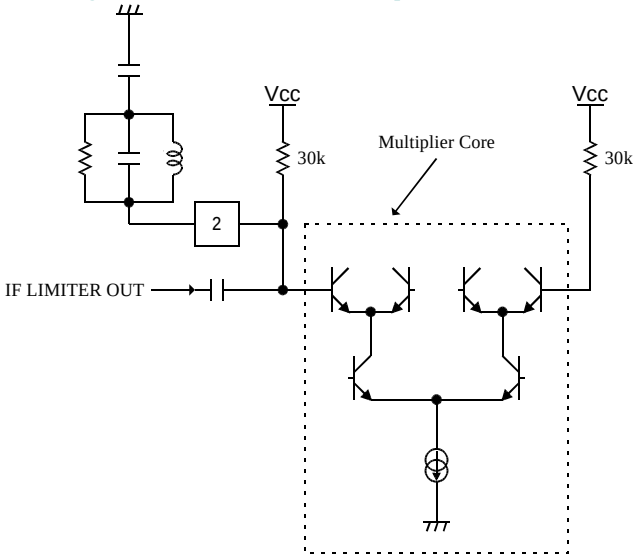
Figure 3: AM Demodulating Range with RSSI



12-4. 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_{P-P}.

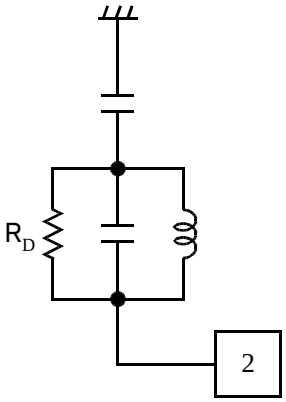
Figure 4: Detector Internal Equivalent Circuit



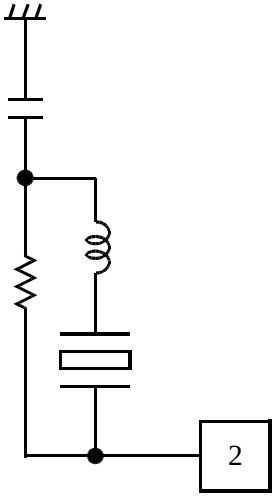
The following figures show examples of the phase shifter.

Figure 5: Examples of Phase Shifters

LC resonance circuit



Ceramic discriminator



R_D: Damping Resistor

13. NOTES

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14. OFFICES

If you need more information on this product and other TOKO products, please contact us.

■ TOKO Inc. Headquarters
1-17, Higashi-yukigaya 2-chome, Ohta-ku, Tokyo,
145-8585, Japan
TEL: +81.3.3727.1161
FAX: +81.3.3727.1176 or +81.3.3727.1169
Web site: http://www.toko.co.jp/

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