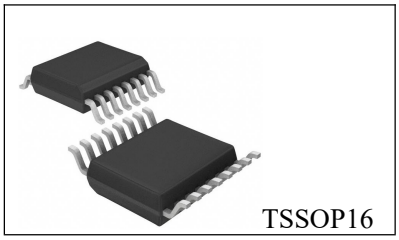
D31136

FM IF Detector IC For Cordless Telephone

General Description

The D31136 is a low operation voltage FM IF detector IC that includes an Oscillator, Mixer, Limiting Amplifier, Quadrature Detector and Noise Detector, it is suitable for cordless telephone.

D31136 is available in TSSOP16 package.


TSSOP16

Features

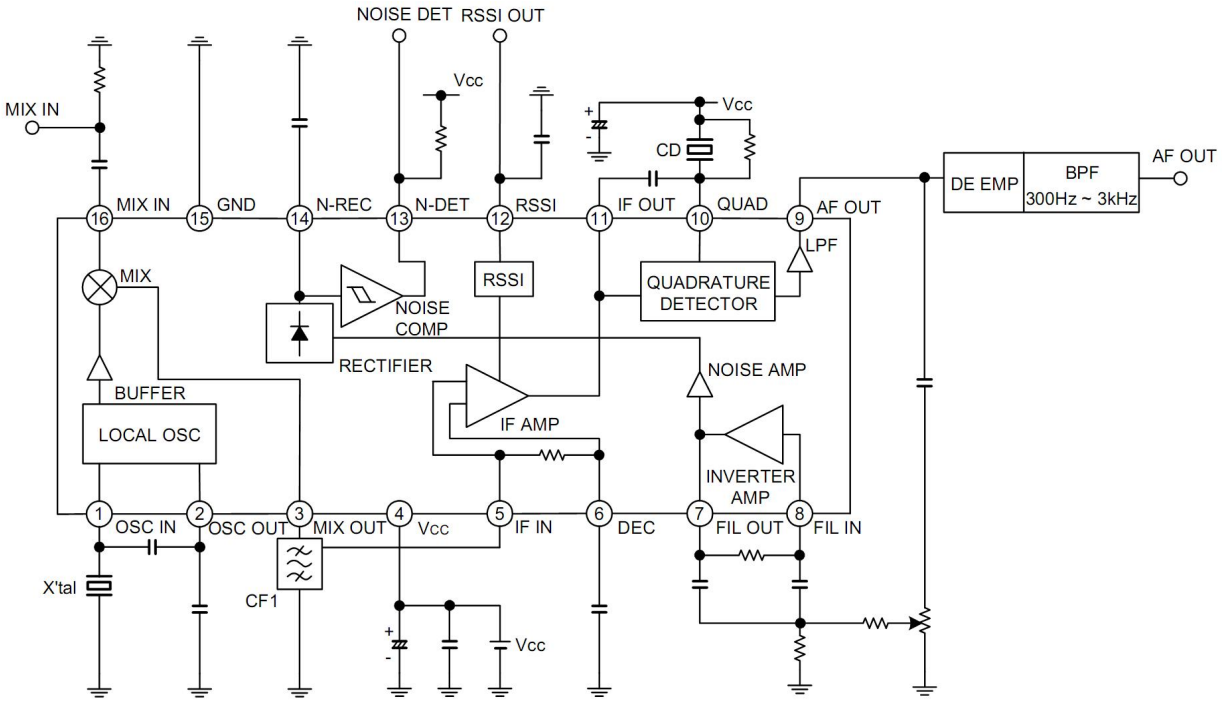
- Low operation voltage: VCC = 1.8 ~ 5.5V
- Excellent temperature characteristics
- High sensitivity: 12dB sensitivity: 11dBμV EMF (Input 50Ω)
- High intercept point: 96dBμV (Input 50Ω)
- Quadrature detector, both ceramic and coil discriminators are usable.
- Built-in 2nd MIX
- Operating frequency: 10 ~ 100MHz
- Built-in noise detection circuit
- RSSI function

Package Information

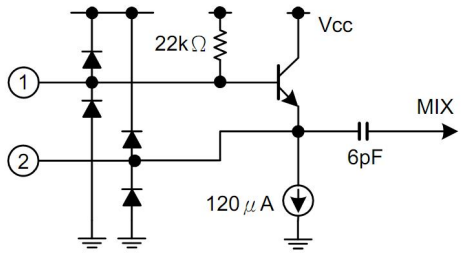
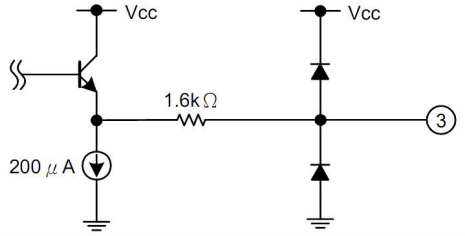
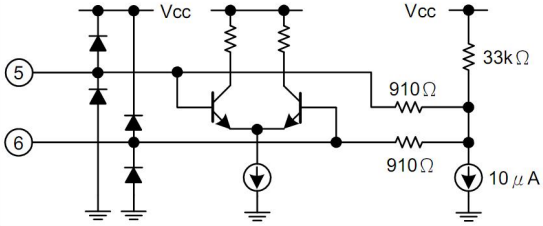
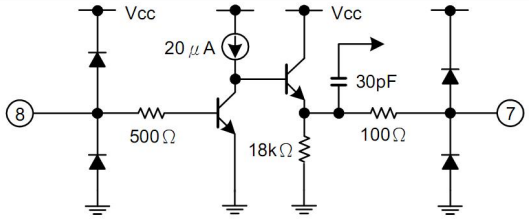
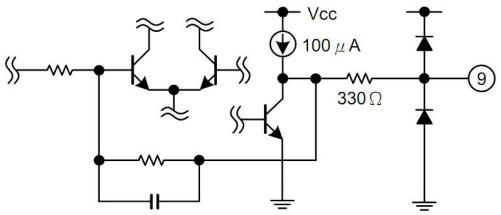
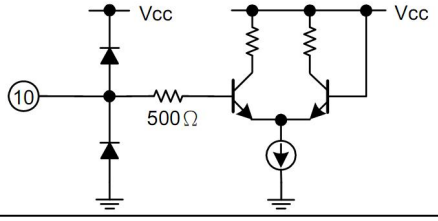
Part NO.	Package Description	Package Marking	Package Option
D31136	TSSOP16	CHMC D31136 SXXXX	96/Tube 3000/Reel

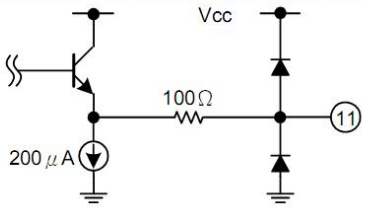
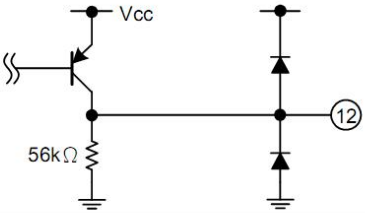
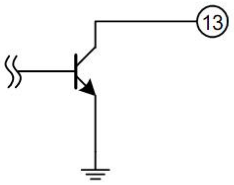
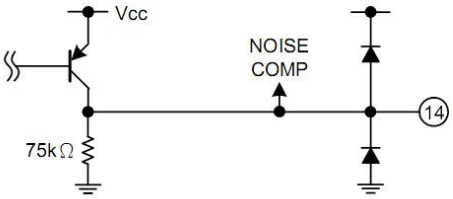
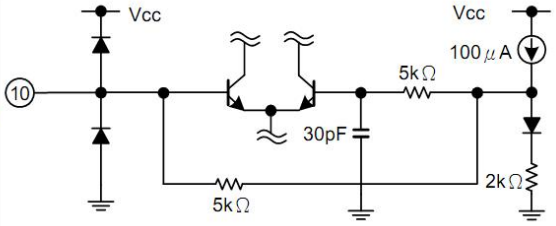
CHMC:Trademark D31136:Part NO. SXXXX:Lot NO.

Block Diagram and Pin Connection



Pin Descriptions (The values of resistor and capacitor are typical.)

PIN No.	PIN NAME	FUNCTION	INTERNAL EQUIVALENT CIRCUIT	VOLTAGE
1	OSC IN	Local oscillator input and output terminals. Colpitts oscillator is formed by internal emitter follower and external X' tal. And external injection is possible from pin 2 or pin 1.		1.98
2	OSC OUT			1.33
3	MIX OUT	MIX output terminal. Output impedance is around 1.8kΩ.		0.74
4	V_{CC}	Power supply		2.0
5	IF IN	2nd IF input and decoupling for bias. Input impedance is around 1.8kΩ.		1.67
6	DEC			1.67
7	FIL OUT	INVERTER AMP input and output terminals. BPF is composed of external capacitors and resistors. Connected internally to rectifier circuit by coupling capacitor.		0.67
8	FIL IN			0.65
9	AF OUT	Demodulate signal output terminal. Carrier leak is small as LPF is built-in. Output impedance is around 360Ω.		
10	QUAD	Phase shift signal input terminal of FM demodulator.		2.0

PIN No.	PIN NAME	FUNCTION	INTERNAL EQUIVALENT CIRCUIT	VOLTAGE
11	IF OUT	Output terminal of IF AMP.		1.14
12	RSSI	This terminal outputs DC level according to input signal level to IF AMP. Dynamic range is around 70dB.		
13	N-DET	The result of noise detection is output by comparing output voltage of N-REC terminal with internal reference. Hysteresis range is about 100mV and output is open collector.		
14	N-REC	After output of INVERTER AMP amplified around 20dB, noise signal is rectified by external capacitor.		
15	GND	GND terminal.		0.0
16	MIX IN	1st IF signal input terminal. Input impedance is around 4kΩ at 21.7MHz.		0.94

Absolute Maximum Ratings（Tamb=25℃）

Characteristic	Symbol	Value	Unit
Supply Voltage	Vcc	7	V
Power Dissipation	P_D	560	mW
Junction Temperature	Tj	125	°C
Operating Temperature	Topr	-30~+85	°C
Storage Temperature	Tstg	-50~+150	°C

* Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

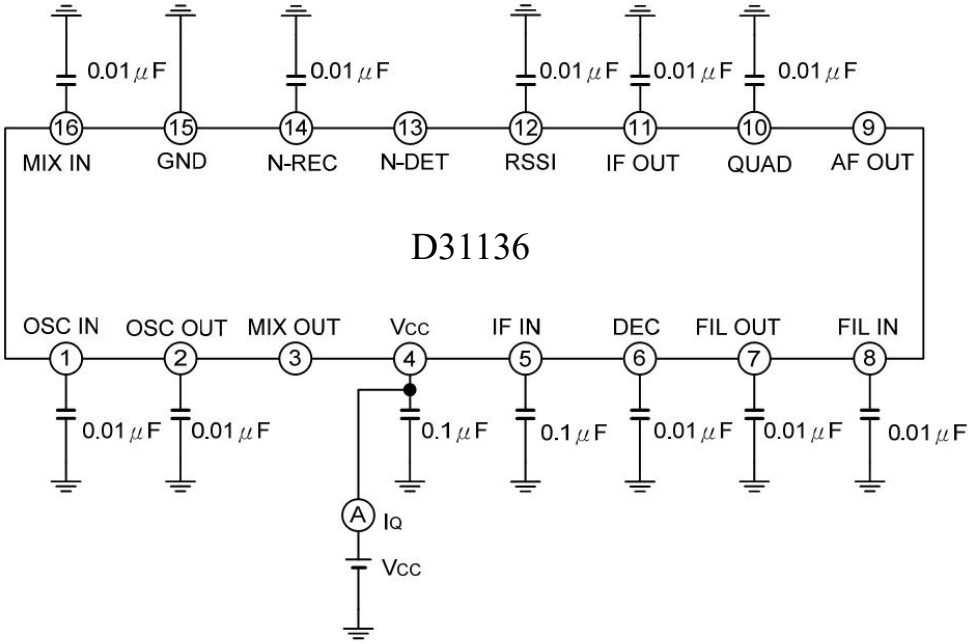
Electrical Characteristics

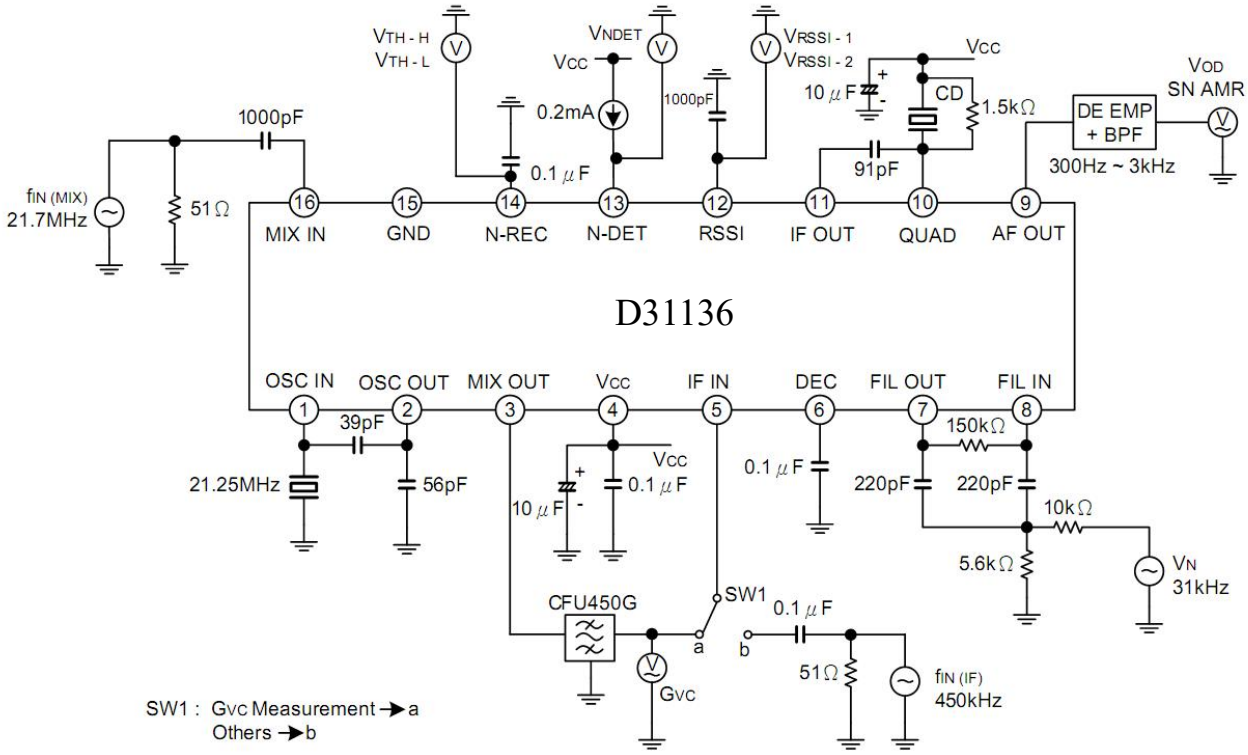
(V_{CC} = 2.0V, $f_{IN\ (MIX)}$ = 21.7MHz, $f_{IN\ (IF)}$ = 450kHz, Δf = ±1.5kHz, f_{MOD}= 1kHz, Ta= 25°C, unless otherwise specified.)

PARAMETER		SYMBOL	TEST CIRCUIT	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Power Supply Voltage		V_{CC}				1.8	2.0	5.5	V
Noise Detection Output Voltage		V_{NDET}	2	I_{SINK} = 0.2mA			0.1	0.5	V
Noise Detection Level	High	V_{TH}	2				0.5	0.7	V
	Low	V_{TL}				0.3	0.4		
RSSI Output Voltage		$V_{RSSI\ 1}$	2	V_{CC} = 3V	$V_{IN(IF)}$ = 30dBμV	200	360	520	mV
		$V_{RSSI\ 2}$	2		$V_{IN(IF)}$ = 100dBμV	1.4	2.0	2.6	V
Demodulation Output Level		V_{OD}	2	$V_{IN\ (IF)}$ = 80dBμV		80	100	120	mV
Current Consumption		I_Q	1				3.2	4.6	mA
Noise Detection Output Leak Current		$I_{O(LEAK)}$		V_{NREC} = 0.6V, V_{NDET} = 2V			0	5	μA
IF AMP. Input Resistance		$R_{IN(IF)}$				1.2	1.8	2.4	kΩ
Mixer Output Resistance		$R_{O(MIX)}$				1.2	1.8	2.4	kΩ
Mixer Input Impedance		$R_{IN\ (MIX)}$					5.5		kΩ
		$C_{IN\ (MIX)}$					2.8		pF
SN Ratio		SN	2	$V_{IN\ (IF)}$ = 80dBμV		43	65		dB
Rejection Ratio		RR	2	$V_{IN\ (IF)}$ = 80dBμV, AM = 30%			40		dB
Mixer Conversion Gain		G_{VC}	2	Measured via ceramic filter. $V_{IN\ (MIX)}$ = 46dBμV		15	18	21	dB
Mixer Intercept Point		P_{IM}		Input 50Ω			96		dBμV
12dB Sensitivity		12dB SN					11		dBμV

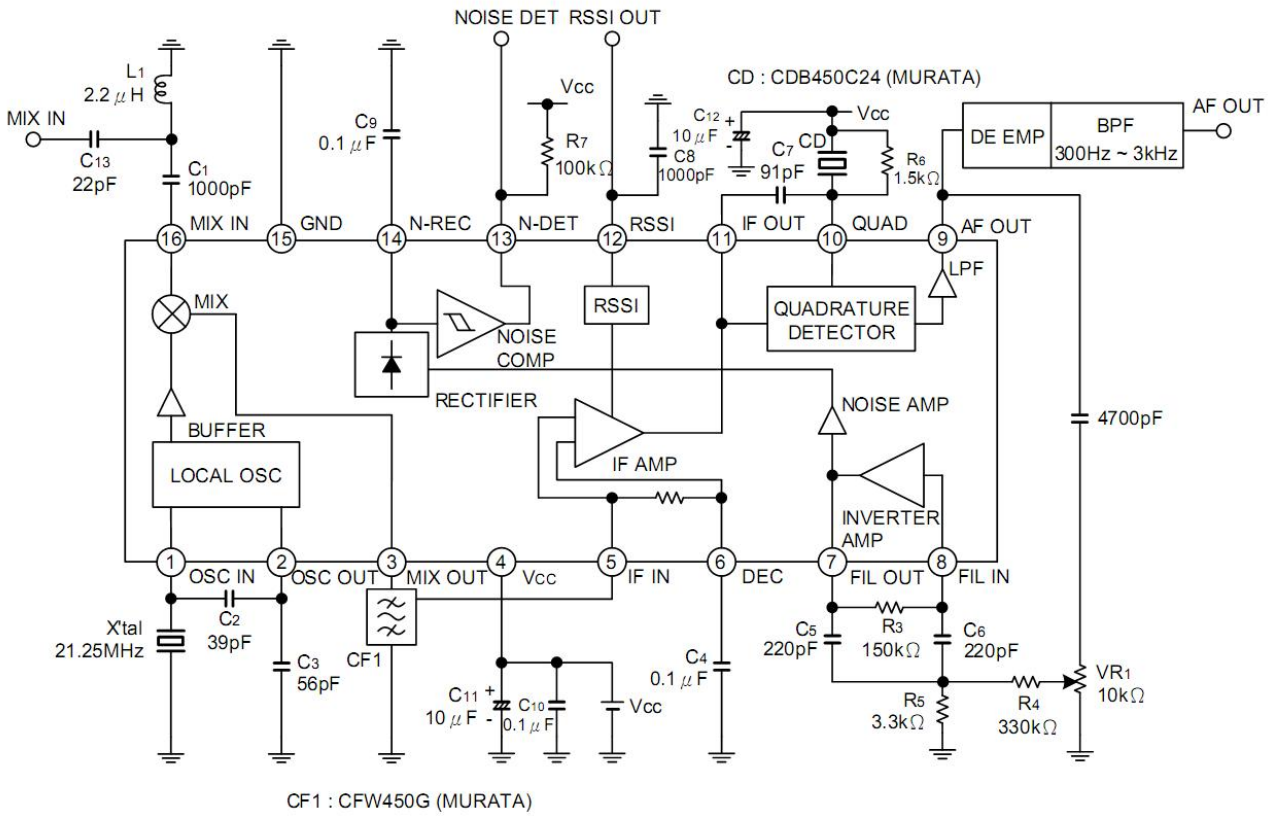
* All AC levels are indicated by open lever (EMF).

Test Circuit





Application Circuit



Application Information

Local oscillator external injection method

Figure 1 and Figure 2 show external injection from pin 2 or pin 1 is possible. In both case, the level at PIN 2 is between 95dBμV and 100dBμV. When Local oscillator injected from PIN 1, then the input frequency is increased, the level on pin 2 may not be sufficient, causing a decrease in sensitivity. In such a case, add resistor R51. A built-in BUFFER amp. minimizes leakage from the mixer.

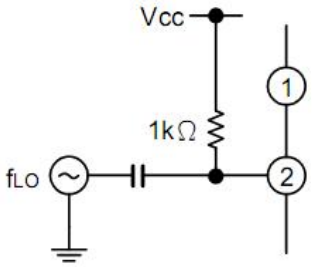


Figure 1

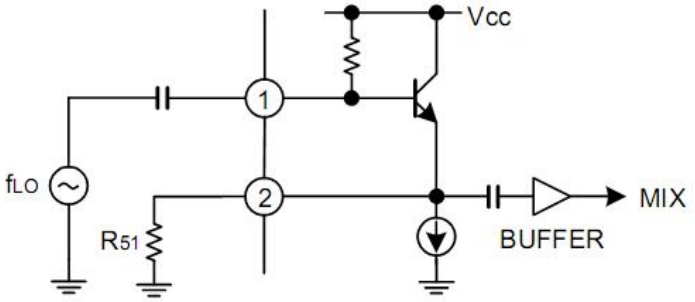


Figure 2

Overtone oscillation

The basic configuration of the local oscillation circuit using overtone oscillation is showed as Fig 3. The C51 and L1 tuning circuits prevent crystal fundamental oscillation. Therefore, set C51 and L1 to inductive at the fundamental frequency and capacitive at the overtone frequency.

Since the level at pin 2 may decrease and the sensitivity may fall at high frequency as with external injection, adjust the oscillation level using R51.

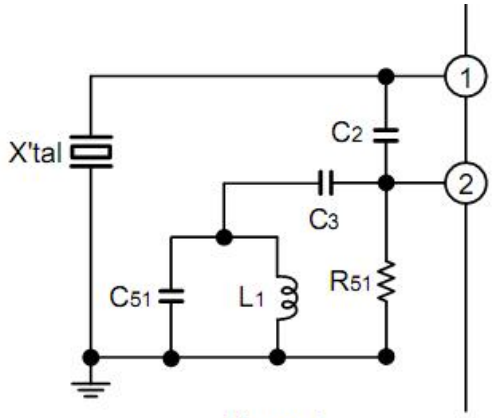


Figure 3

Detection circuit

Detection stage is quadrature method. Both ceramic and coil discriminator are suitable. The case of using coil is shown in Figure 4, in this case, L1 and C101 composing a phase shifter, demodulation output VOD is about 80mVrms. VOD will be increased as raising damping resistance R6. Center frequency f0 and demodulation output depends largely on phase shifter and C7. For C7 and C101 use a capacitor with good temperature characteristics.

Detector is ceramic discriminator on reference application.

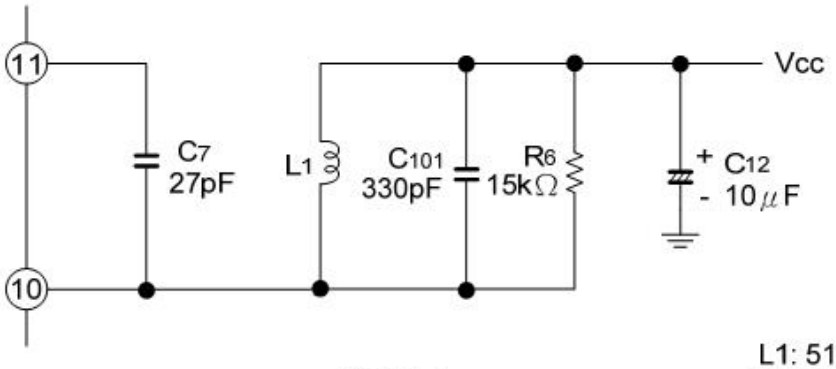


Figure 4

L1: 5114-JPS-010
(SUMIDA)

INVERTER AMP usage

Figure 5 shows the INVERTER AMP can be used to from a band pass filter. Set constants as in equations (1) ~ (3). However, because a low pass filter and a high pass filter are built in, it is recommended that center frequency f0 be about 30kHz.

(1) $f_0 = \frac{1}{2\pi\sqrt{R3(R4//R5)C^2}}$

(2) $G_V = R_3 / 2R_4$

(3) $Q^2 = \frac{R3}{4(R4//R5)}$

at $R_4 \gg R_p$

Example R_3 = 150kΩ, R_4 = 330kΩ,
R_5 = 3.3kΩ, R_p = 20kΩ (VR)
C = 220pF provide;
$f_0 \approx$ 31kHz, $G_V \approx$ -13dB
Q ≈12

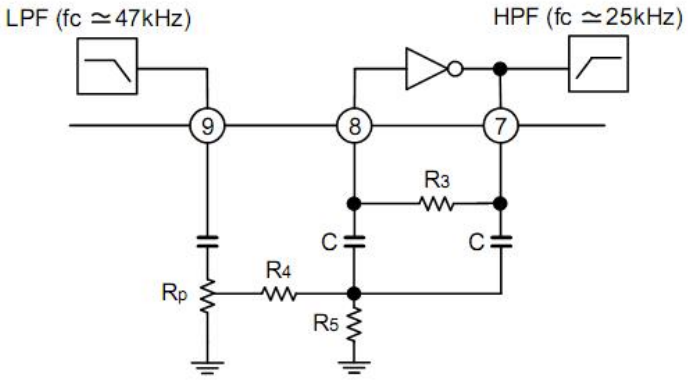
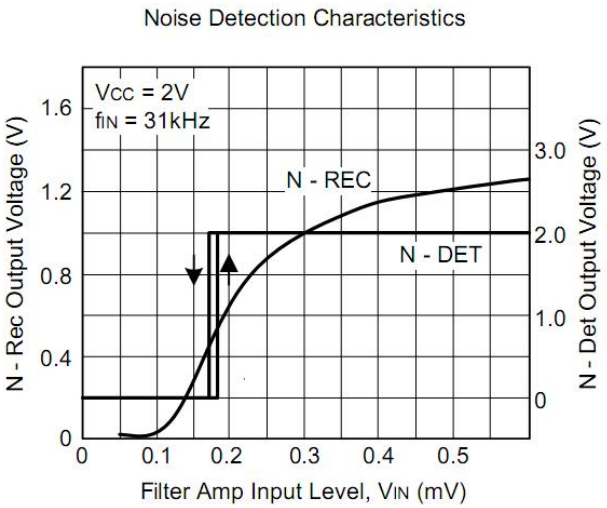
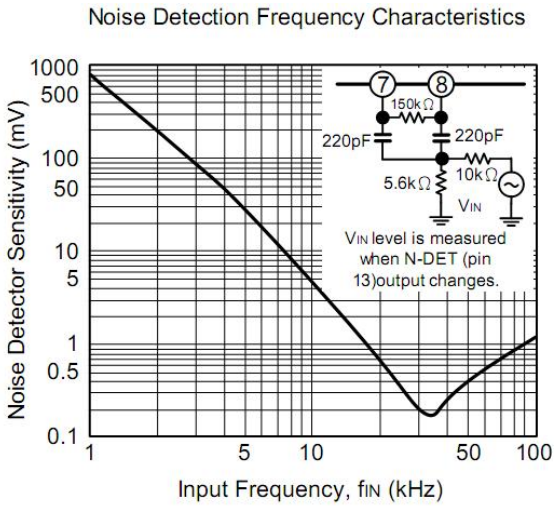


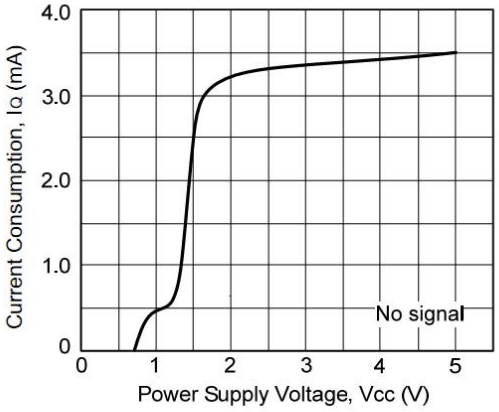
Figure 5

Characteristics Curve

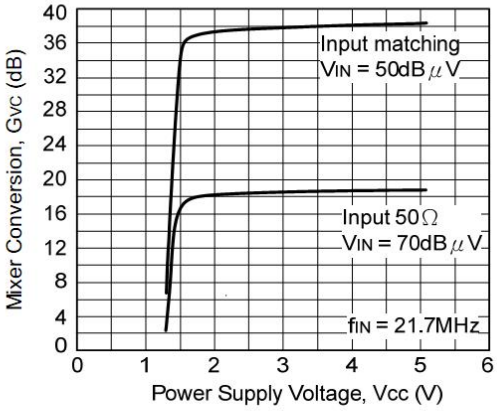




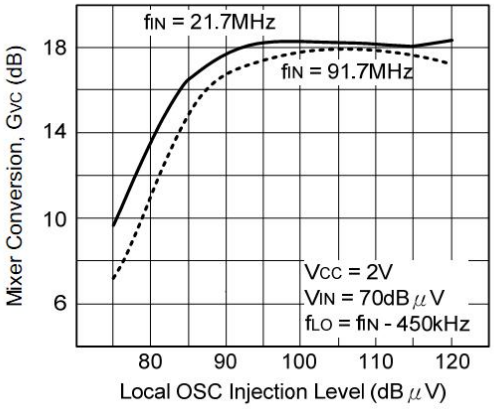
Current Consumption- Power Supply Voltage



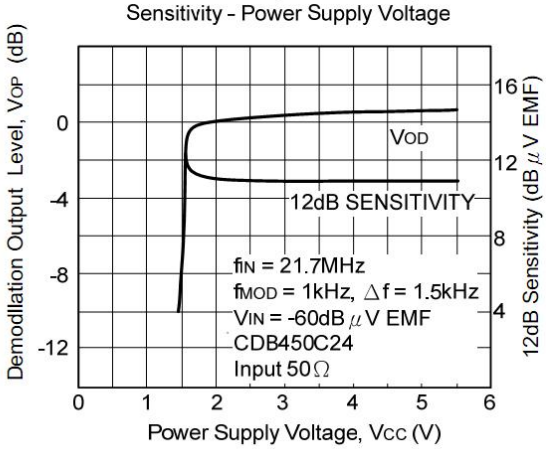
Mixer Conversion Gain- Power Supply Voltage



Mixer Conversion Gain- Local OSC Injection Level



Demodulation Output Level VOD, 12dB Sensitivity - Power Supply Voltage



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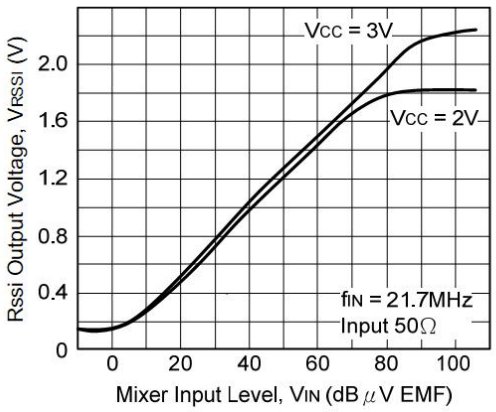
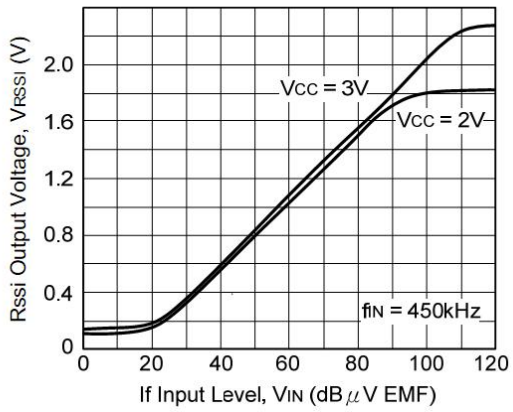
Mixer Input Rssi Characteristics

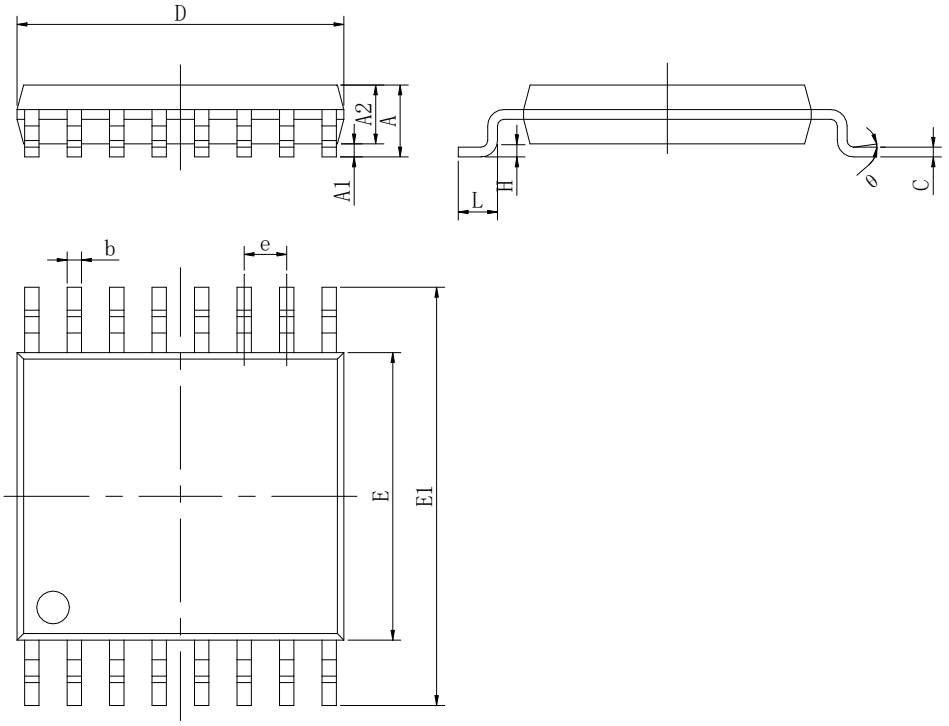


If Input Rssi Characteristics



Outline Dimensions

TSSOP16： Unit:mm



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
D	4.900	5.100	0.193	0.201
D1	2.900	3.100	0.114	0.122
E	4.300	4.500	0.169	0.177
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
E1	6.250	6.550	0.246	0.258
E2	2.200	2.400	0.087	0.094
A		1.100		0.043
A2	0.800	1.000	0.031	0.039
A1	0.020	0.150	0.001	0.006
e	0.65（BSC）		0.026(BSC)	
L	0.500	0.700	0.02	0.028
H	0.25(TYP)		0.01(T YP)	
θ	1°	7°	1°	7°

Statements

- Silicore Technology reserves the right to make changes without further notice to any products or specifications herein. Before customers place an order, customers need to confirm whether datasheet obtained is the latest version, and to verify the integrity of the relevant information.

- Failure or malfunction of any semiconductor products may occur under particular conditions, customers shall have obligation to comply with safety standards when customers use Silicore Technology products to do their system design and machine manufacturing, and take corresponding safety measures in order to avoid potential risk of failure that may cause personal injury or property damage.

- The product upgrades without end, Silicore Technology will wholeheartedly provide customers integrated circuits that have better performance and better quality.