NARROW BAND FM/AM IF SYSTEM

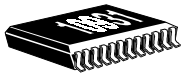
FEATURES

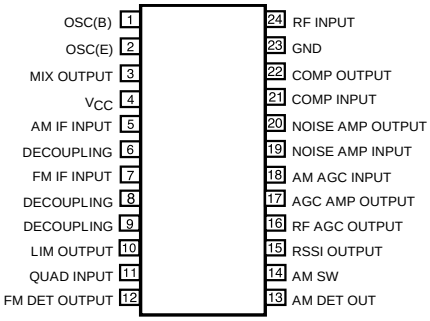
- **Simultaneous Operation (AM Section, FM Section)**
- **AM Section with ON/OFF Control Input**
- **AGC Amplifier Control Input**
- **AGC Amplifier Output**
- **High-speed FM Limiter Amplifier (Up to 11 MHz)**
- **RF AGC Output (for External RF Amplifier)**
- **Built-in Noise Squelch Circuit (Noise Amplifier, Rectifier, Comparator)**
- **Wide Range Voltage Operation (2.5 V to 8.5 V)**
- **Very Small Package (TSSOP-24)**

APPLICATIONS

- **Amateur Radios**
- **CB Radios**
- **Utility Radios**
- **Scanner Receivers**

TK10931V





DESCRIPTION

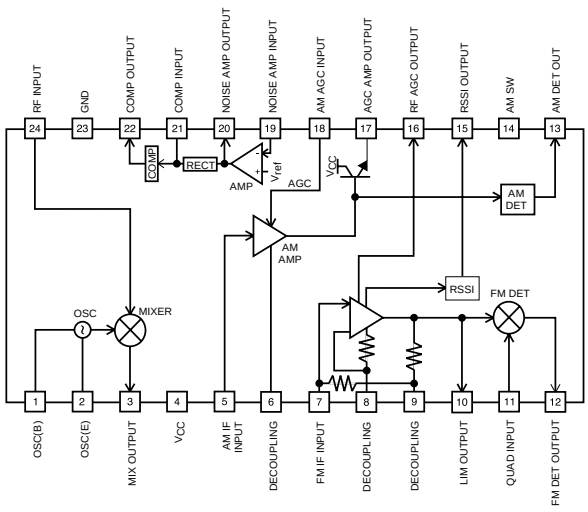
The TK10931V is an IF system IC designed for communications equipment. The TK10931V contains the following functions:

Oscillator	Mixer
FM IF Limiter	Quadrature Detector
AM AGC Amplifier	Squelch Noise Amplifier
AM Detector	Squelch Rectifier
RSSI Output	RF AGC Output
Squelch Comparator	

The TK10931V is suited for Amateur radios, CB radios, and Wide-Band receivers.

The TK10931V is available in the very small TSSOP-24 surface mount package.

BLOCK DIAGRAM



ORDERING INFORMATION

TK10931V□□

Tape/Reel Code

TAPE/REEL CODE
TL: Tape Left

ABSOLUTE MAXIMUM RATINGS

Supply Voltage ..... 10 V
Operating Voltage Range ..... 2.5 to 8.5 V
Power Dissipation (Note 1) ..... 230 mW
FM Limiter Amp Input Frequency ..... 11 MHz
AM AGC Amp Input Frequency ..... 0.5 MHz
Mixer Input Frequency ..... 150 MHz
Storage Temperature Range ..... -55 to +150 °C
Operating Temperature Range ..... -30 to +85 °C

TK10931V ELECTRICAL CHARACTERISTICS

Test Conditions: V_{CC} = 3.0 V, T_A = 25 °C, unless otherwise specified.

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
I_{CC}	Supply Current	No Input, AM ON		5.3	7.1	mA
		No Input, AM OFF		3.7	5.0	mA
G_M	Mixer Conversion Gain	Using CFU455F		22		dB
R_{IM}	Mixer Input Resistance	DC Measurement		3.6		kΩ
FM PORTION						
SINAD	12 dB SINAD	±3 kHz DEV		11	18	dBµ
$V_{OUT(DET)1}$	Demodulation Output Voltage 1	+80 dBµ, ±3 kHz DEV	55	80	105	mVrms
THD1	Total Harmonic Distortion	+80 dBµ		1.0	2.0	%
G_f	Filter Amplifier Gain	f_{IN} = 1 kHz, R_f = 270 kΩ, R_{IN} = 1 kΩ		47		dB
S_H	SCAN Control High Level	Squelch Input 2.5 V	2.5			V
S_L	SCAN Control Low Level	Squelch Input 0 V			0.3	V
HYS	Squelch Hysteresis			67		mV
V_{RSSI}	RSSI Output Voltage	No Input	0.0	0.1	0.5	V
		V_{IN} = +40 dBµ	0.4	0.8	1.2	V
		V_{IN} = +100 dBµ	1.0	1.4	1.8	V
RF_{AGC}	RF Automatic Gain Control	RF AGC OUT V16 = 1 V	62	69	76	dBµ

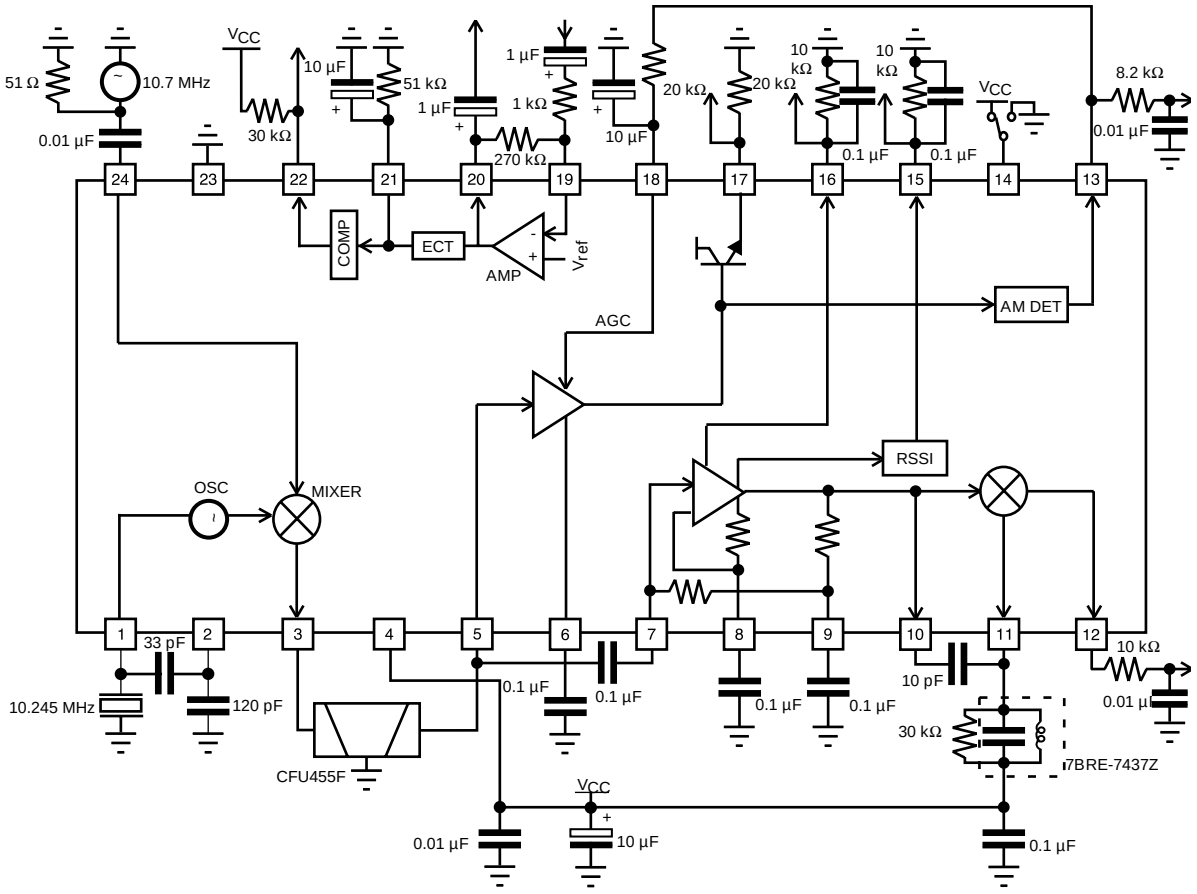
Note 1: Power dissipation is 230 mW in free air. Derate at 1.84 mW/°C for operation above 25 °C.
Note 2: If the ambient temperature falls below -10 °C, the harmonic distortions of the AM detector output are increased; the minimum operation voltage will be set to 2.7 V.

TK10931V ELECTRICAL CHARACTERISTICS (CONT.)

Test Conditions: V_{CC} = 3.0 V, T_A = 25 °C, unless otherwise specified.

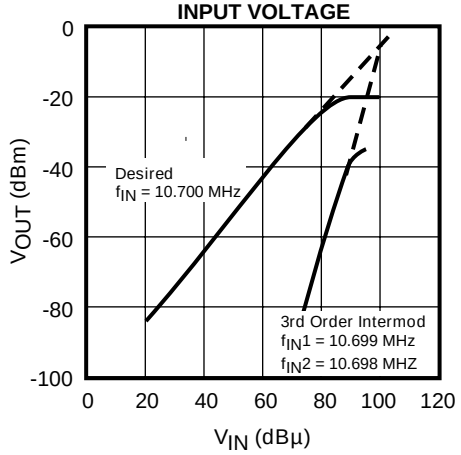
SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
AM PORTION						
S	Sensitivity	Input Level when Output Level = 20 mVrms		16	23	dBµ
$V_{OUT(DET)2}$	Demodulation Output Voltage	1 kHz 30%, V_{IN} = +60 dBµ	35	50	65	mV
THD2	Total Harmonic Distortion 2	1 kHz 30%, V_{IN} = +60 dBµ		1.0	2.0	%
THD3	Total Harmonic Distortion 3	1 kHz 80%, V_{IN} = +60 dBµ		2.0	4.0	%
$vol_{(AGC)}$	AGC Amplifier Output Level	Non Modulation V_{IN} = +60 dBµ	500			mV_{P-P}
V_{OFF}	AM OFF Voltage		-0.3		0.3	V
V_{ON}	AM ON Voltage		$0.8V_{CC}$			

TEST CIRCUIT

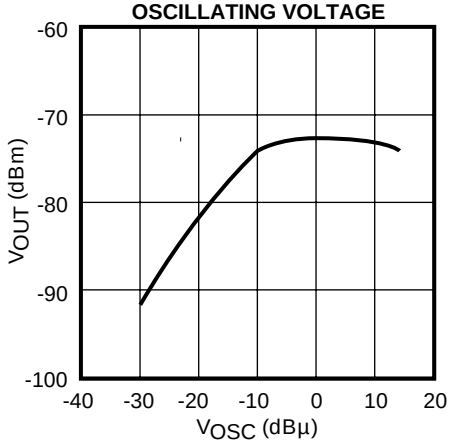


TYPICAL PERFORMANCE CHARACTERISTICS

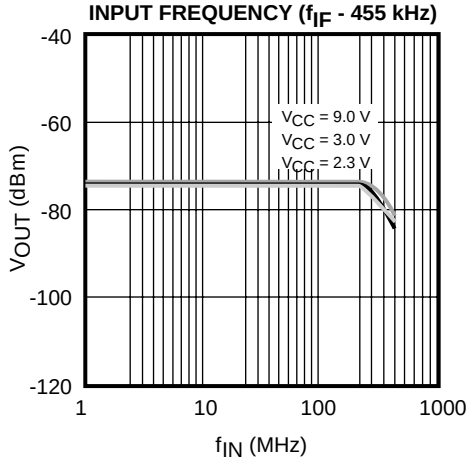
OUTPUT VOLTAGE vs. INPUT VOLTAGE



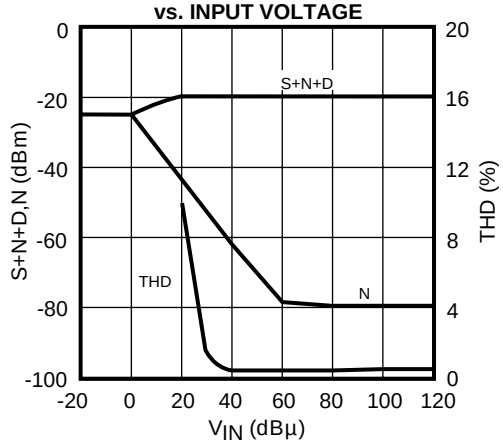
OUTPUT VOLTAGE vs. OSCILLATING VOLTAGE



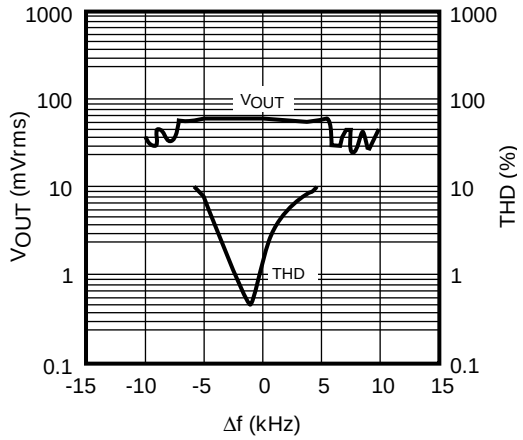
OUTPUT VOLTAGE vs. INPUT FREQUENCY (f_{IF} - 455 kHz)



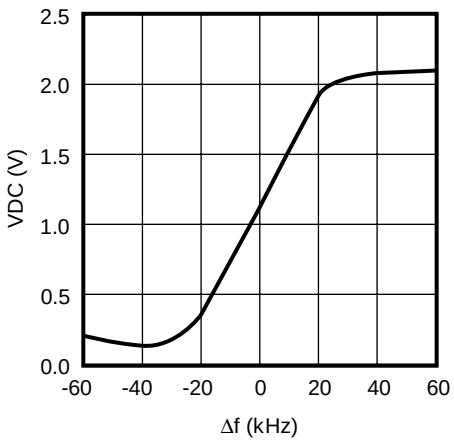
S+N+D, N, and THD vs. INPUT VOLTAGE



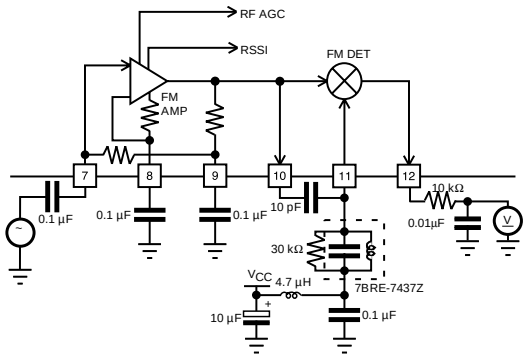
FM DETUNE CHARACTERISTICS



S-CURVE

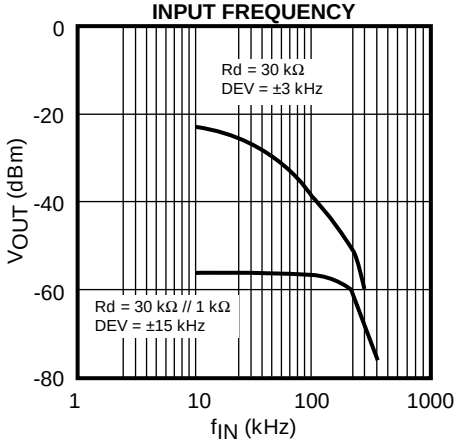


TYPICAL PERFORMANCE CHARACTERISTICS (CONT.)

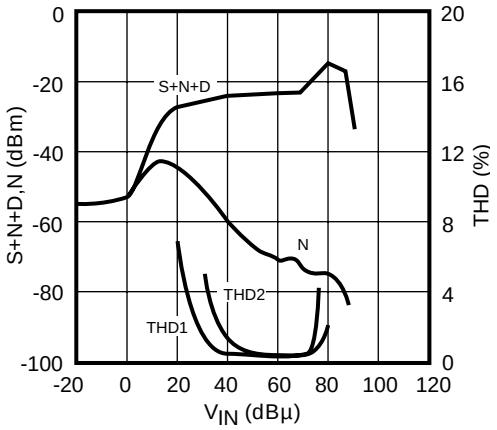


S-CURVE MEASUREMENT CIRCUIT (f_{IN} = 455 kHz)

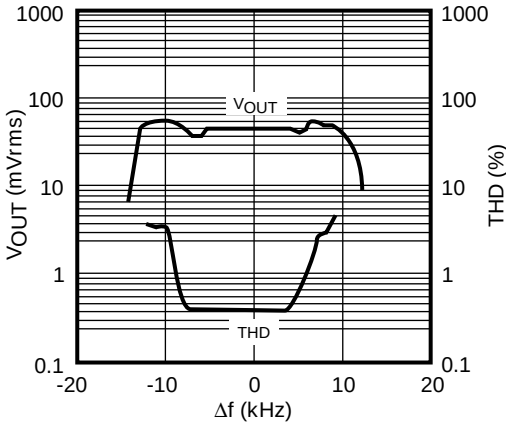
FM OUTPUT VOLTAGE vs. INPUT FREQUENCY



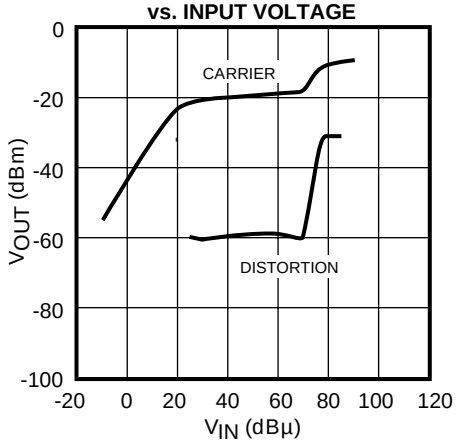
AM DETECTOR OUTPUT vs. MIXER INPUT



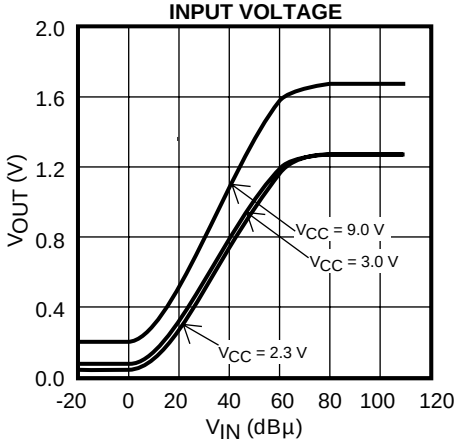
AM DEMODULATION DETUNING



AGC AMP OUTPUT VOLTAGE vs. INPUT VOLTAGE

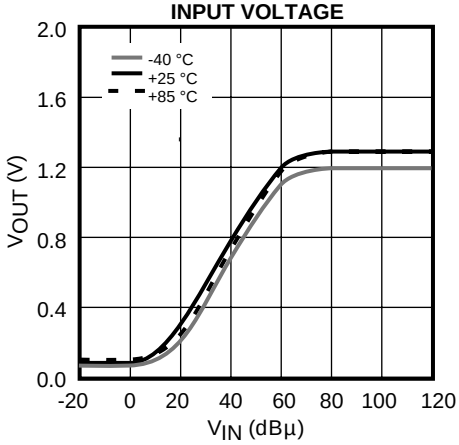


RSSI OUTPUT VOLTAGE vs. INPUT VOLTAGE

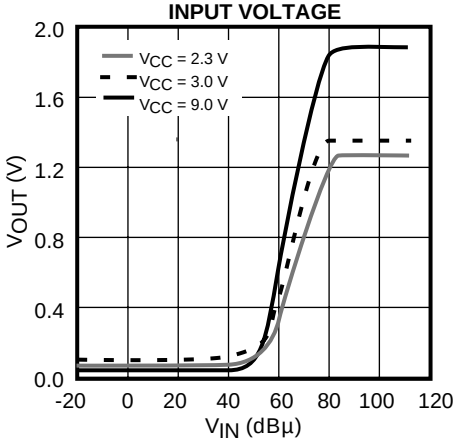


TYPICAL PERFORMANCE CHARACTERISTICS (CONT.)

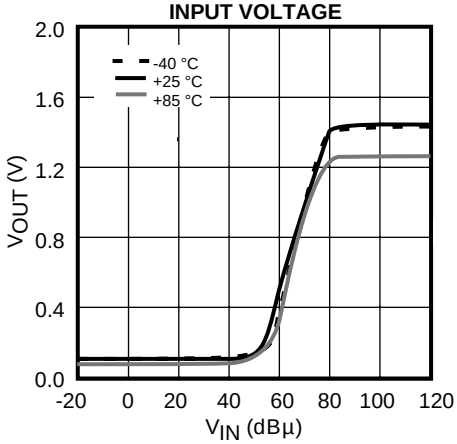
RSSI OUTPUT VOLTAGE vs. INPUT VOLTAGE



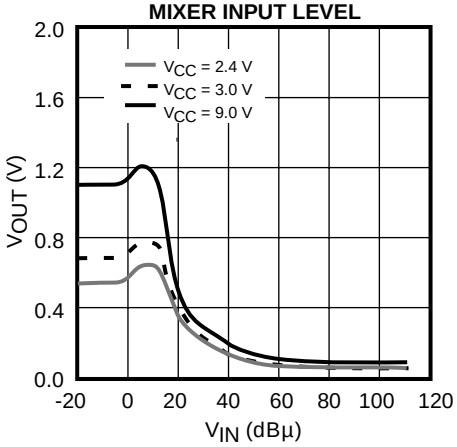
RF AGC OUTPUT VOLTAGE vs. INPUT VOLTAGE

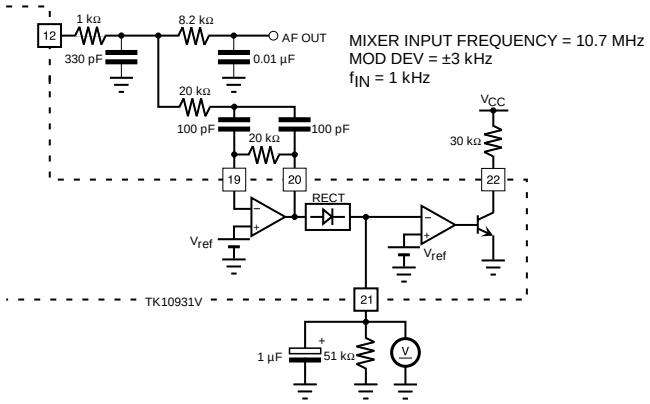


RF AGC OUTPUT VOLTAGE vs. INPUT VOLTAGE



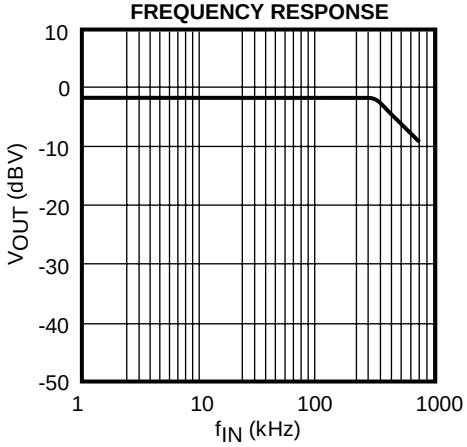
RECTIFIER OUTPUT VOLTAGE vs. MIXER INPUT LEVEL



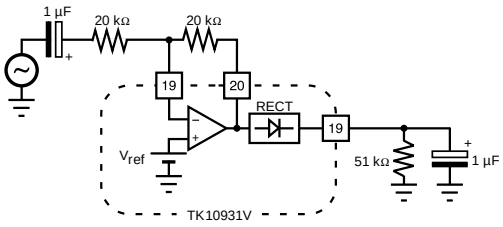


RECTIFIER VOLTAGE MEASUREMENT CIRCUIT

RECTIFIER CIRCUIT FREQUENCY RESPONSE

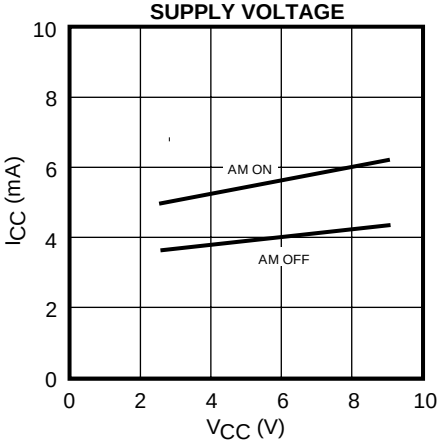


TYPICAL PERFORMANCE CHARACTERISTICS (CONT.)

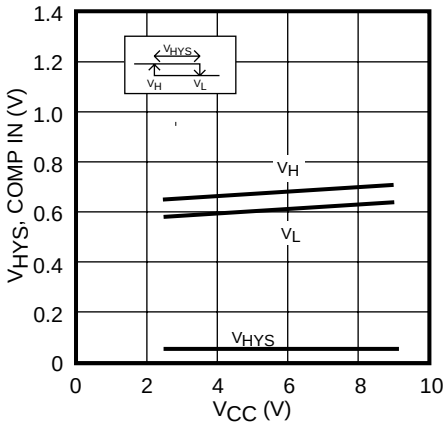


RECTIFIER FREQUENCY MEASUREMENT CIRCUIT

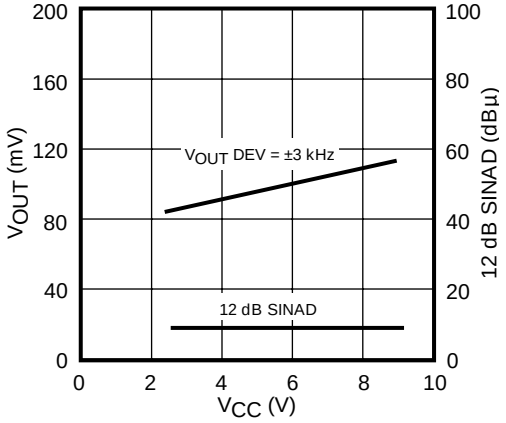
SUPPLY CURRENT vs. SUPPLY VOLTAGE



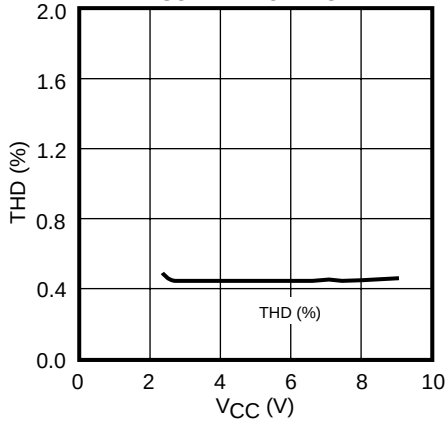
V_{HYS}, COMP IN (V) vs. SUPPLY VOLTAGE



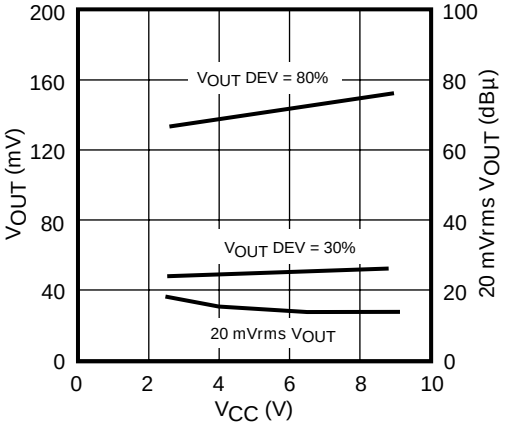
FM OUTPUT VOLTAGE, 12 dB SINAD vs. SUPPLY VOLTAGE



TOTAL HARMONIC DISTORTION vs. SUPPLY VOLTAGE

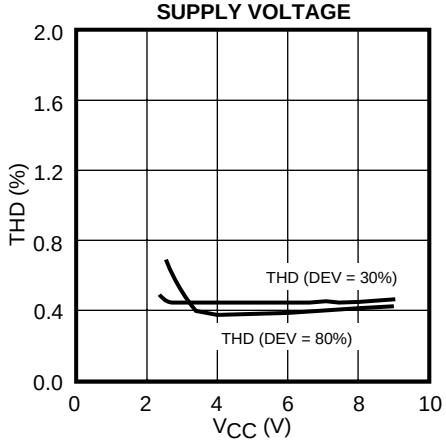


AM OUTPUT VOLTAGE vs. SUPPLY VOLTAGE



TYPICAL PERFORMANCE CHARACTERISTICS (CONT.)

TOTAL HARMONIC DISTORTION vs. SUPPLY VOLTAGE



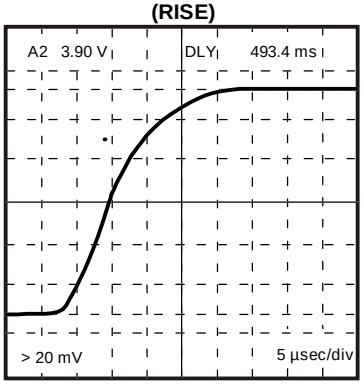
RSSI, RFAGC TRANSIENT RESPONSE

RSSI ON/OFF

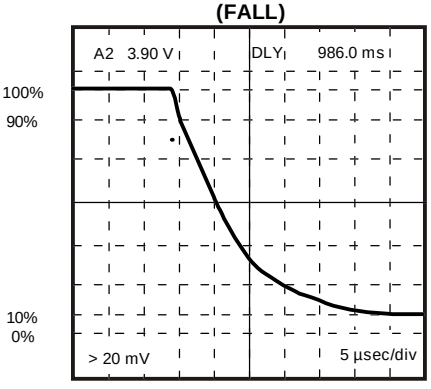
RSSI OUTPUT VOLTAGE TRANSIENT RESPONSE (MIXER INPUT ON/OFF)

- C_L = 560 pF

(RISE)



Rise Time: 12.5 µsec

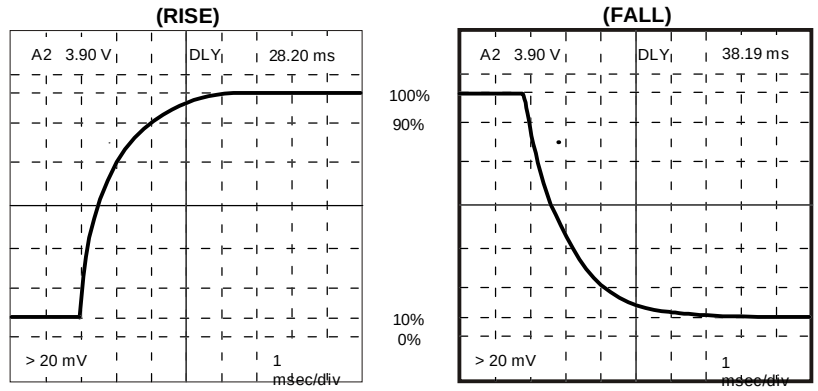


(FALL)

Fall Time: 16.0 µsec

RSSI ON/OFF (CONT)

• C_L = 0.1 µF

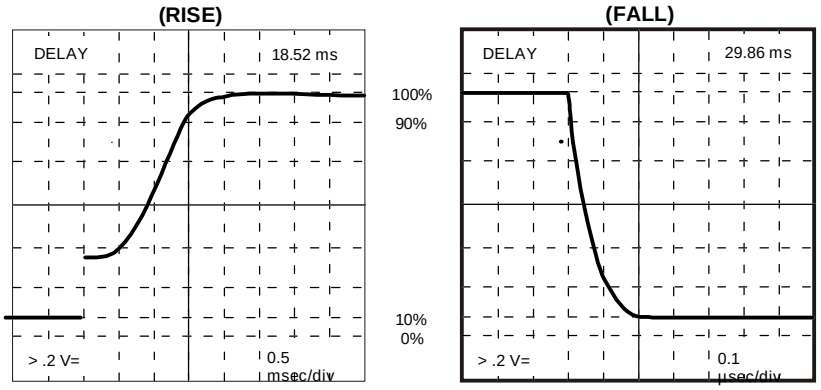


Rise Time: 2.0 msec

Fall Time: 2.2 msec

RSSI OUTPUT VOLTAGE TRANSIENT RESPONSE (POWER SUPPLY VOLTAGE ON/OFF)

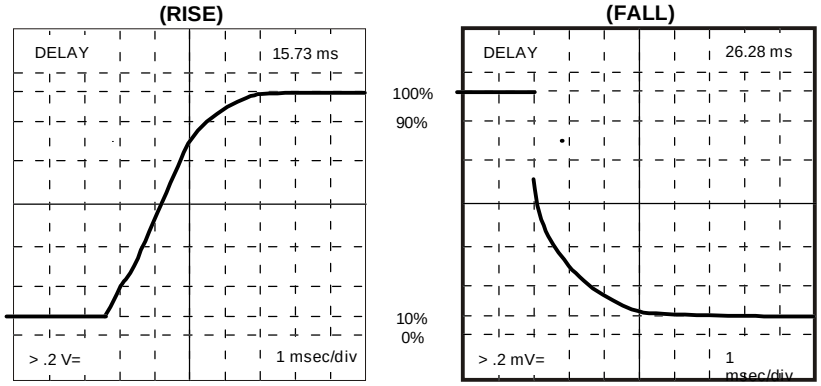
• C_L = 560 pF



Rise Time: 1.1 msec

Fall Time: 12.0 µsec

• C_L = 0.1 µF



Rise Time: 2.6 msec

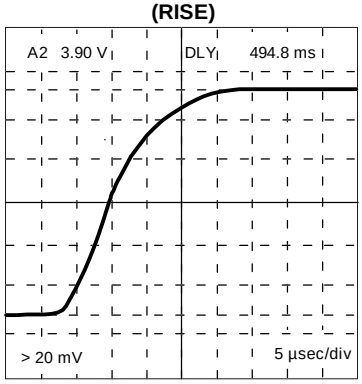
Fall Time: 1.6 msec

RFAGC ON/OFF

RFAGC OUTPUT VOLTAGE TRANSIENT RESPONSE (MIXER INPUT ON/OFF)

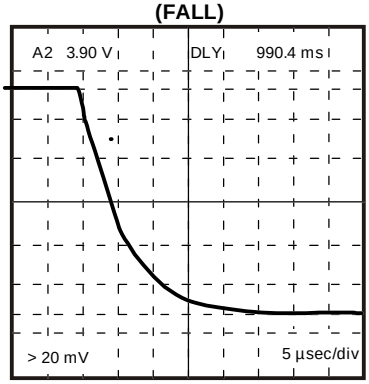
• C_L = 560 pF

(RISE)



Rise Time: 12.5 µsec

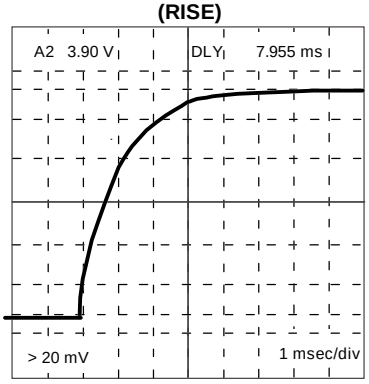
(FALL)



Fall Time: 13.0 µsec

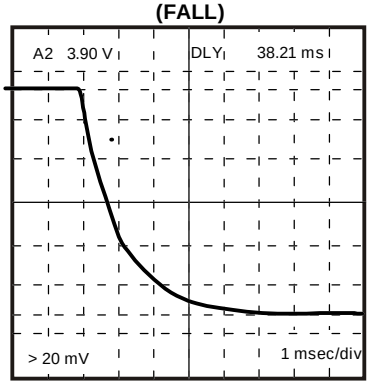
• C_L = 0.1 µF

(RISE)



Rise Time: 2.2 msec

(FALL)

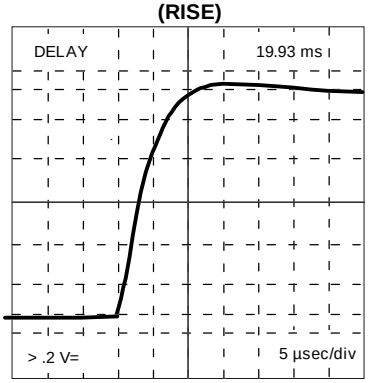


Fall Time: 2.2 msec

RFAGC OUTPUT VOLTAGE TRANSIENT RESPONSE (POWER SUPPLY VOLTAGE ON/OFF)

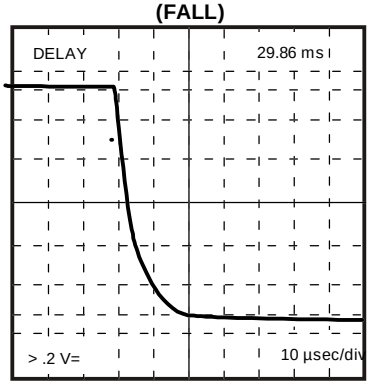
• C_L = 560 pF

(RISE)



Rise Time: 8.0 µsec

(FALL)

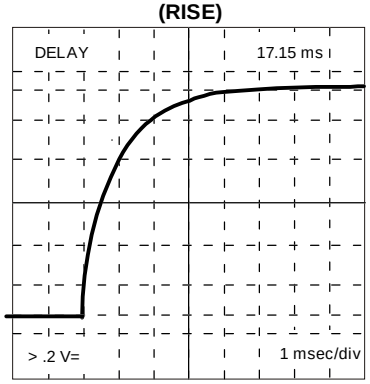


Fall Time: 12.0 µsec

RFAGC ON/OFF (CONT)

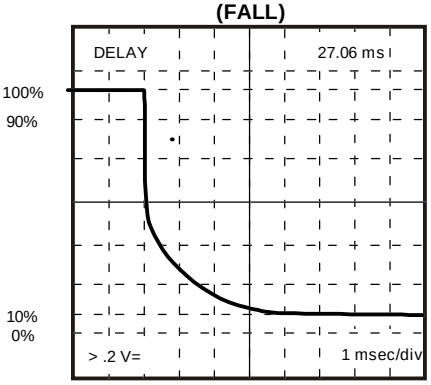
• C_L = 0.1 µF

(RISE)



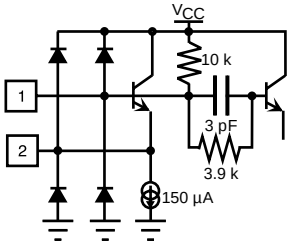
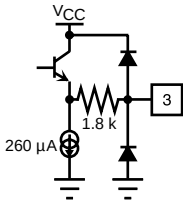
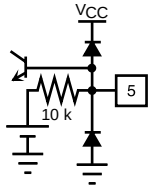
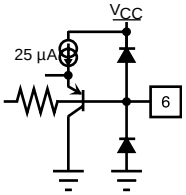
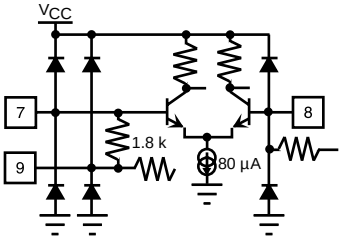
Rise Time: 2.2 msec

(FALL)

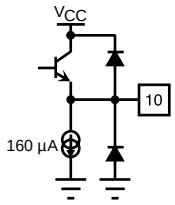
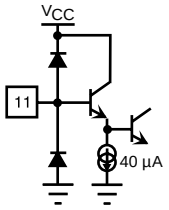
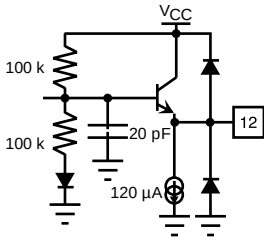
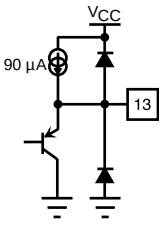
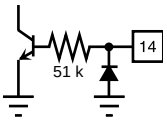
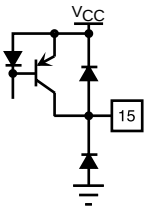


Fall Time: 1.6 msec

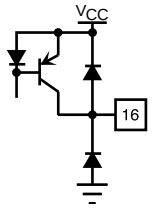
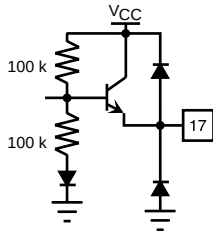
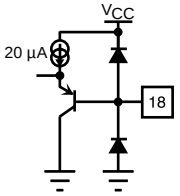
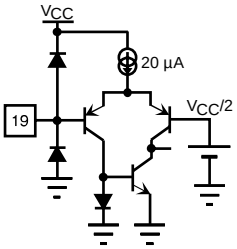
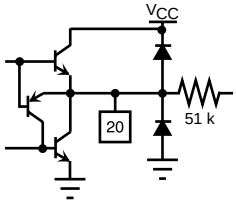
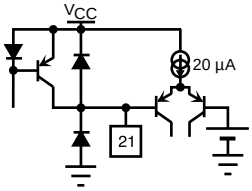
PIN FUNCTION DESCRIPTION

PIN NO.	SYMBOL	VOLTAGE	INTERNAL EQUIVALENT CIRCUIT	DESCRIPTION
1 2	OSC(B) OSC(E)	2.98 V 2.2 V		Pins 1 and 2 can be used to build a colpitts type oscillator. The emitter-follower operating current can be increased by connecting an external resistor between Pin 2 and GND when the load is heavy. Inject the oscillating signal into Pin 1 by capacitive decoupling with Pin 2 OPEN when an external oscillator is used instead of the internal oscillator.
3	MIX OUTPUT	1.6 V		Mixer Output Terminal. The output impedance is approximately 1.8 kΩ.
4	V_{CC}	3.0 V		Power Supply Terminal
5	AM IF INPUT	1.9 V		AM AGC Amplifier Signal Input Terminal
6	DECOUPLING	1.2 V		AM AGC Amplifier Decoupling Terminal
7 8 9	FM IF INPUT DECOUPLING DECOUPLING	2.0 V 2.0 V 2.0 V		Pin 7 is the FM IF Limiter Amplifier Signal Input Terminal. The input impedance is approximately 1.8 kΩ. Pins 8 and 9 are the FM Limiter Amplifier Decoupling Terminals.

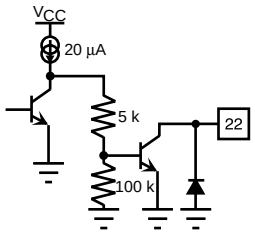
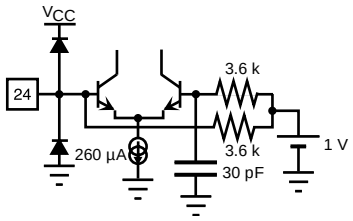
PIN FUNCTION DESCRIPTION (CONT.)

PIN NO.	SYMBOL	VOLTAGE	INTERNAL EQUIVALENT CIRCUIT	DESCRIPTION
10	LIM OUTPUT	2.0 V		FM Limiter Amplifier Signal Output Terminal. This pin connects to the phase shifter circuit.
11	QUAD INPUT	3.0 V		The Phase Shifter Connecting Terminal
12	FM DET OUTPUT	1.3 V		FM Detected Signal Output Terminal
13	AM DET	1.3 V		AM Detected Signal Output Terminal
14	AM SW			AM AGC Amplifier ON/OFF Control Terminal. The AM IF, AGC, and Detector circuits are in the active state when Pin 14 is pulled up to V_{CC}. The AM IF, AGC, and Detector circuits are in the standby state when Pin 14 is pulled down to GND.
15	RSSI OUTPUT			RSSI Signal Output Terminal

PIN FUNCTION DESCRIPTION (CONT.)

PIN NO.	SYMBOL	VOLTAGE	INTERNAL EQUIVALENT CIRCUIT	DESCRIPTION
16	RF AGC OUTPUT			RF AGC Signal Output Terminal
17	AGC AMP OUTPUT	1.1 V		AM AGC Amplifier Signal Output Terminal. Maximum output current is up to 1 mA.
18	AM AGC INPUT			AM AGC Amplifier Gain Control Terminal
19	NOISE AMP INPUT	1.5 V		Noise Amplifier Signal Input Terminal for the Squelch
20	NOISE AMP OUTPUT	1.5 V		Noise Amplifier Signal Output and Rectifier Circuit Signal Input Terminal for the Squelch
21	COMP INPUT			Rectifier Circuit Signal Output and Comparator Signal Input Terminal for Squelch

PIN FUNCTION DESCRIPTION (CONT.)

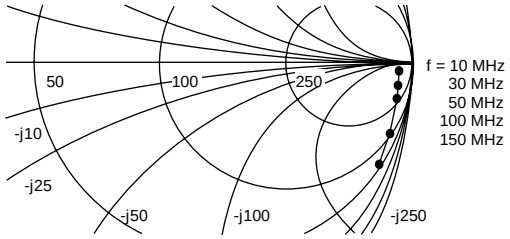
PIN NO.	SYMBOL	VOLTAGE	INTERNAL EQUIVALENT CIRCUIT	DESCRIPTION
22	COMP OUTPUT			Comparator Signal Output Terminal for Squelch
23	GND	0 V		GND Terminal
24	RF INPUT	1.0 V		Mixer Signal Input Terminal

CIRCUIT DESCRIPTION

The TK10931V has various functions that include a mixer up to 150 MHz, and independent AM IF and FM IF stages. This makes the TK10931V suitable for a communications receiver as described in the following.
The FM-IF stage is always in operation, but the AM-IF stage is available with an ON/OFF function.
The AM-IF signal is available from a buffered output in front of the AM detector. Its output signal is available for an external detector such as a product detector.
In addition, the RF AGC output for an external RF stage and a built-in rectifier for noise squelch are available. As a result, the application circuit can be simple.
The RSSI output is implemented with wide dynamic range and excellent temperature characteristics.
The Mixer is implemented with wide dynamic range in spite of high gain.

(1) Mixer, Oscillator

The Mixer consists of a Gilbert multiplier, Oscillator, and IF amplifier.
The Mixer circuit is optimized, resulting in a wide dynamic range in spite of a high transfer gain (22 dB).
The Noise Figure is approximately 10 dB under input impedance matching conditions.
The frequency response as a function of input impedance is shown in Figure 1.



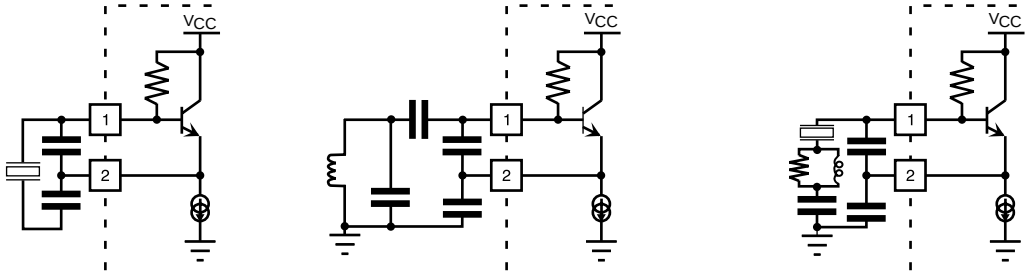
Mixer Input S11

Frequency (MHz)	Input Impedance	
	Rp(Ω)	Cp(pf)
10	3878	3.90
20	3532	3.50
30	2893	3.24
50	2889	3.06
70	2620	3.10
100	2458	3.12
150	2128	3.04

FIGURE 1

The built-in oscillator circuit consists of a general Colpitts type oscillator with the collector grounded. The operating current of the oscillator is 100 µA.
As shown later, operating above tens of MHz is possible by increaing the Gm of the oscillator with an externally connected resistor.
Figure 2 illustrates general Colpitts type oscillators. Various resonators my be used, for instance, L/C, crystal, ceramic, SAW, and others.

CIRCUIT DESCRIPTION (CONT.)



Crystal Resonator LC Resonator SAW Resonator

FIGURE 2: EXAMPLES FOR COLPITTS TYPE OSCILLATOR

External Injection

If an external oscillator is used instead of the internal oscillator, inject the oscillating signal into Pin 1 by a capacitor connection. Pin 2 must be opened, as shown in Figure 3.
In this case, the multiplier sees the oscillator being operated as an emitter follower.

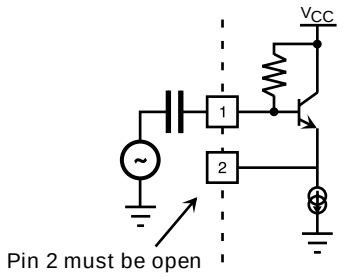


FIGURE 3: EXAMPLE FOR EXTERNAL OSCILLATOR

Overtone Oscillation

When operating an overtone oscillation above 30 MHz using a crystal resonator, design using the circuit shown in Figure 5 to reduce the fundamental mode.
When the operation frequency is higher, it is possible that the Gm of the oscillator may be insufficient and the oscillating amplitude will be down. This can be improved by connecting an external resistor between Pin 2 and GND to increase the operating current.

CIRCUIT DESCRIPTION (CONT.)

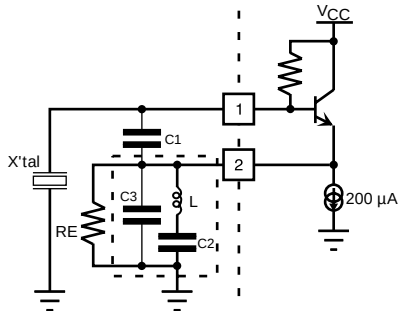


FIGURE 4: EXAMPLE FOR OVERTONE OSCILLATION

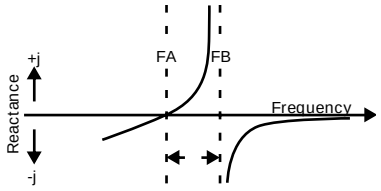


FIGURE 5

The constants of the circuit in the dotted line of Figure 4 establish that the condition of oscillation is met for the 3rd overtone frequency only.
Figure 5 shows the characteristics of the impedance of the two terminals versus frequency of this circuit.
The condition of oscillation is the capacitance at the overtone frequency and the inductance at near-fundamental frequency. Therefore, when it is established that the fundamental frequency is included between FA and FB and that the overtone frequency is above FB, the condition of 3 times overtone is:

$$F(osc) > FA \qquad 3 \times F(osc) > FB,$$

$$FA = \frac{1}{2\pi\sqrt{LC3}} \qquad FB = FA\sqrt{1 + \frac{C2}{C3}}$$

F(osc) is the fundamental frequency of the crystal resonator.
3 x F(osc) is the 3rd overtone frequency of the crystal resonator.

Moreover, it is established that the series value of the equivalent capacitance of the circuit is in the dotted line of Figure 4 and capacitance C1 is the load capacitance of the crystal resonator.
When the operating current of the oscillator is insufficient, increase Gm of the oscillator by the external resistor RE. In this case, the increased operating current (Ie) of the oscillator is calculated by the following:

$$Ie(mA) = \frac{V_{CC}(V) - 0.7}{RE(K\Omega)}$$

(2) RF AGC Output
For manufacturers with equipment requiring external RF amplifiers, etc., the RF-AGC output terminal is readily available. Because this AGC output is picked out from the first stage of the FM-IF portion, the AGC output is not affected by the AM switch when stopping the AM-IF operation. Therefore, when receiving an FM signal, its output contributes to improving strong input characteristics.

Its output is implemented as a current output from the collector of the PNP-transistor. Therefore, its current is converted into a voltage with an external resistor.
A composite example is shown as Figure 6. A receiver circuit example in CB radios is shown at “CB Radio Application” of the Application Information section. The example in Figure 6 controls the gain by changing the bias voltage of the RF-AMP with the output of transistor QA1 that is driven with the RF-AGC output of Pin 16.

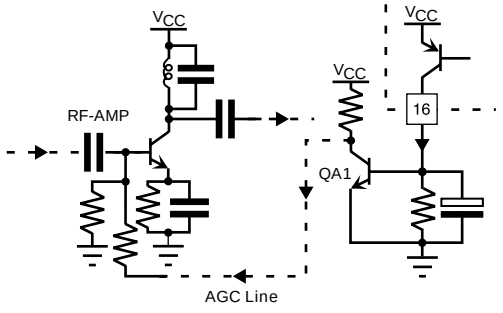


FIGURE 6: EXAMPLE FOR EXTERNAL AGC AMPLIFIER

CIRCUIT DESCRIPTION (CONT.)

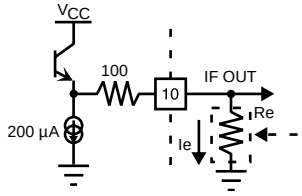
(3) FM-IF Limiter Amplifier, RSSI

The IF limiter amplifier is composed of 6 differential gain stages. The total gain of the IF limiter amplifier is 80 dB at 455 kHz. The output signal of the IF limiter amplifier is provided at Pin 10 through the emitter-follower output stage. The IF limiter amplifier output level is 0.5 V_{P-P}. The operating current of the emitter-follower at the IF limiter amplifier is 200 µA.

If the capacitive load is heavy, the negative half cycle of the output waveform may be distorted. This can be improved by connecting an external resistor between Pin 10 and GND to increase the operating current. The increased operating current by an external resistor is calculated as follows (see Figure 7):

The increased operating current Ie(mA) = (V_{CC} - 1.0)/ Re(kΩ)

The RSSI output is a current output. It is converted to a voltage by an external resistor connected between Pin 15 and GND. The time constant of the RSSI output is determined by the product of the external converting resistance and the parallel capacitance. When the time constant is longer, the RSSI output response is slower. Determine the external resistance and capacitance by the application. The slope of the RSSI curve characteristics can be changed by changing the external resistance. In this case, the maximum range of converted RSSI output voltage is from GND level to about V_{CC}-0.2 V (the supply voltage minus the collector saturation voltage of the output transistor). In addition, the temperature characteristic of the RSSI output voltage can be changed by changing the temperature characteristic of the external resistor. Normally, the temperature characteristic of the RSSI output voltage is very stable when using a carbon resistor or metal film resistor with a temperature characteristic of 0 to 200 ppm/°C.



The emitter-follower operating current can be increased by external resistor Re when the capacitive load is heavy and the waveform distortion will be reduced.

FIGURE 7

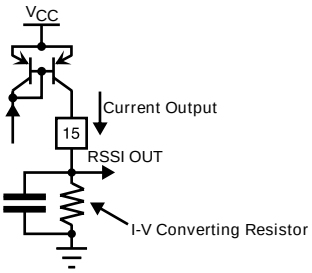


FIGURE 8: RSSI OUTPUT EQUIVALENT CIRCUIT

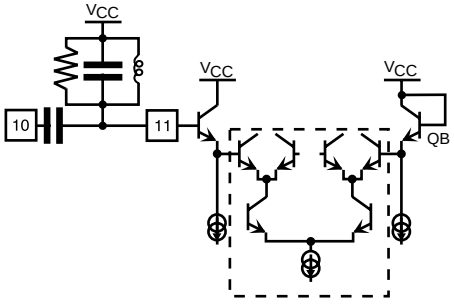


FIGURE 9: FM DETECTOR EQUIVALENT CIRCUIT

(4) FM Detector

The FM detector is included in the Quadrature FM detector using a Gilbert multiplier. The phase shifter is connected between Pin 10 (IF limiter output) and Pin 11 (detector input), with any available phase shifter. A phase shifter can be used such as the LC resonance circuit, the ceramic discriminator, and the delay line. Figure 11 shows the internal equivalent circuit of the detector. The signal from the phase shifter is applied to the multiplier (in the dotted line) through emitter-follower stage QA. Note that Pin 11 must have the bias voltage impressed from an external source, because Pin 11 is connected with the base of QA only. Because the base of QB of the opposite side is connected with the supply voltage, Pin 11 has to be biased with the equivalent voltage. Using an LC resonance circuit is not a problem (see Figure 10), but attention must be paid when using a ceramic discriminator. If the base voltages are different, the DC voltage of the multiplier does not balance. This alters the DC zero point or worsens the distortion of the demodulation output. The Pin 11 input level should be saturated at the multiplier, if this level is lower, it is easy to disperse the detector output. Therefore, to be in stable operation, the Pin 16 input level should be higher than 100 mV_{P-P}. Figure 10 shows examples of phase shifters.

CIRCUIT DESCRIPTION (CONT.)

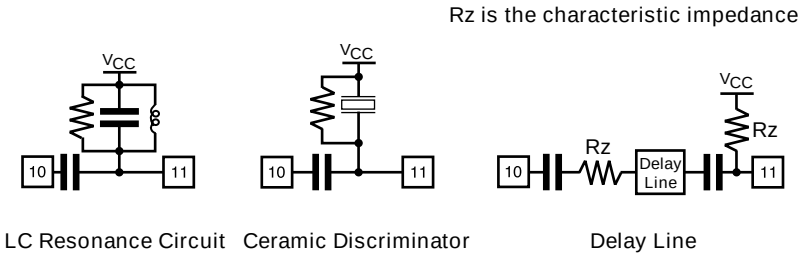


FIGURE 10: EXAMPLES OF PHASE SHIFTERS

(5) AM IF Block

The AM IF block is shown in Figure 11. This block is composed of three blocks: the IF AGC amplifier, the AM IF output, and the AM detector. The AGC range is approximately 50 dB.

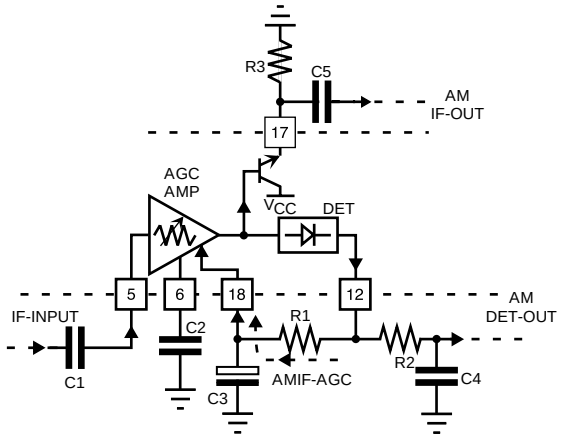


FIGURE 11: AM IF EQUIVALENT CIRCUIT

The AM IF Input Impedance

The AM IF input terminal (Pin 5) is independent of the FM IF input terminal (Pin 7). Respectively different filters for the FM IF and AM IF can be used. The input impedance of the AM IF input terminal (10kΩ) is higher than the FM IF input terminal (1.5 kΩ). Although the AM IF input terminal and the FM IF input terminal are conncected in parallel AC wise, when using common IF filters, it is only necessary to use the FM IF input impedance to determine the termination impedence of the common IF filter.

AM IF-AGC

Pin 18 is the IF AGC control input terminal. Usually this terminal is connected with the AM detector output terminal (Pin 12) through the ripple filter composed of R1 and C3. The time constant (T = R1 x C3) for the ripple filter is generally selected to be 5 to 10 times larger than the lowest cycle of the AM modulation element. Pin 18 can also be controlled by an external DC source instead of the AM detector output signal. Pin 6 is the decoupling capacitor for the AM IF bias circuit.

CIRCUIT DESCRIPTION (CONT.)

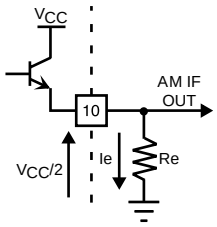


FIGURE 12: AM IF OUTPUT EQUIVALENT CIRCUIT

AM IF-Output

The output from Pin 17 is done through a buffer in front of the AM detector for an AM IF signal that is a fixed amplitude output. Therefore, it is possible to do various applications. This output is an emitter-follower type; the operating current is determined by the resistor connected between the output terminal (Pin 17) and GND. Because the DC voltage at Pin 17 is set up as 1/2 the supply voltage, the operating current can be computed as follows:

$Ie = V_{CC}/2Re$

With 22 kΩ (standard value), the operating current is 70 µA at V_{CC} = 3 V. Connecting a heavy load increases distortion of the minum half cycle side; decrease the resistance to increase the operating current.

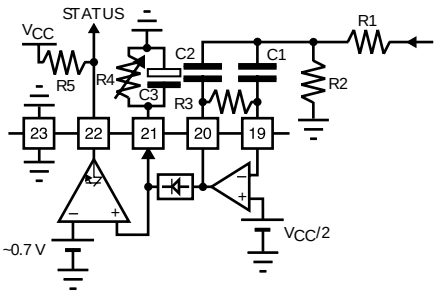


FIGURE 13: NOISE SQUELCH EQUIVALENT CIRCUIT

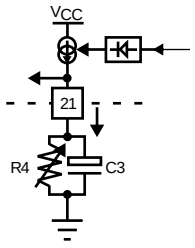


FIGURE 14: FULL-WAVE RECTIFIER EQUIVALENT CIRCUIT

(6) Noise Squelch Circuit

This product is equipped with built-in noise squelch circuitry. It is composed of the Filter amplifier, Full-wave Rectifier circuit, and the Comparator. Figure 13 illustrates the Noise Squelch Equivalent Circuit. Figure 14 illustrates the Full-wave Rectifier Circuit.

First, the FM detector output is amplified and the noise element is selected by the Band-Pass Filter that is composed with the built-in amplifier. The noise element is rectifed by the built-in full-wave recitifier, resulting in a current output from Pin 21. The current output is filtered and converted to a voltage with resistor R4 and capacitor C3 connected between Pin 21 and GND. The rectified voltage is compared with the built-in reference voltage. The comparator output is provided at Pin 22. Because the comparator output is an open collector output, a pull-up resistor is required. To prevent chatter at the output, the comparator has hysteresis of approximately 70 mV.

The Band-Pass Filter is comprised of the built-in filter amplifier for selective noise amplification. Its circuit is the general Sallen-Key type as shown in Figure 13. The constants can be computed as follows.

That is

C1 = C2 = C
F0: Center frequency for BPF
Q: Q for BPF
Av: Gain for BPF center frequency

The rectifier circuit, shown in Figure 14, is implemented with a current output as mentioned previously. The rectification voltage value can be modified by changing the value of the converting resistor R4. The maximum value for its voltage, determined by the power supply voltage, is up to V_{CC}-0.2 V. Since the threshold voltage of the built-in comparator is fixed at 0.7 V, it is possible to adjust the squelch sensitivity by changing the value of R4. In actuality, in order to absorb the deviation for the whole product, the use of a trimmen resistor is recommended. Pick up the noise signal for the detector before the de-emphasis circuit.

CIRCUIT DESCRIPTION (CONT.)

(7) AM-ON/OFF Circuit

This IC provides an ON/OFF function for the AM block. Because this was necessary for the stand-by state for the AM block, it can be used as a power-save operation. The input part equivalent circuit is shown in Figure 15.

By directly controlling the transisor-base as shown in the equivalent circuit, the AM portion ON/OFF input control is possible below a very small current of 50 µA. Regarding Pin 14, the AM portion is in operation at 2 V and above; it is in non-operation at 0.2 V and below. In non-operation, the consumption current is down to approximately 2.4 mA. The circuits that can be non-operational in AM OFF are shown as follows.

Non-operation circuits:
AM IF circuit, AM IF-AGC circuit, AM detector circuit.

Always operating circuits:
RF-AGC output, Noise squelch circuit, Mixer circuit, Local oscillator circuit, FM IF circuit, FM detector circuit.

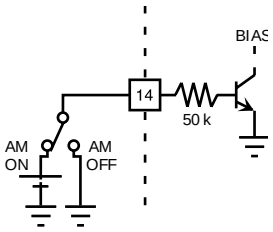


FIGURE 15

(8) Attention to Pattern Layout

This product will provide stable operation. However, when using this product, pay attention to the following (1-3) for stable operation because the operating frequency is high. Moreover, the standard application board of this product is shown on page 25.

1. The V_{CC} terminal capacitor is individually grounded by the shortest distance to a GND terminal.
VCC Terminal (Pin 4) • GND Terminal (Pin 23)

2. Overall, the IF signal level is higher than other points. Also, this point is the final stage in the limiter amplifier. Therefore, this point easily provides positive feedback to the first stage. Since feedback to the pre-stage depends on radiation, use the shortest distance etch patterns possible.

Feedback through the power supply line from the cold side of the phase shifter is common. To keep the signal level of the phase shifter at its highest, treatment of its cold side is very important.

Grounding the cold side with bypass a capacitor is important. Adding a decoupling circuit that uses a CR or LC is effective. An example is shown in Figure 16.

Avoid using high resistance values in the offset of the multiplier in the FM detector. When using under about 1 kΩ, there is no effect because the inflow current in Pin 11 is under several µA.

3. When the signal is returned to the mixer from the detector, the stability is at its worst. It is ideal that these peripheral components are provided with different sides of a double-sided board and that the reverse side is the GND pattern.

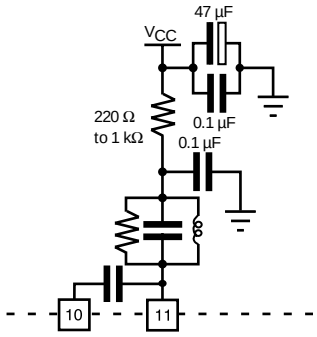
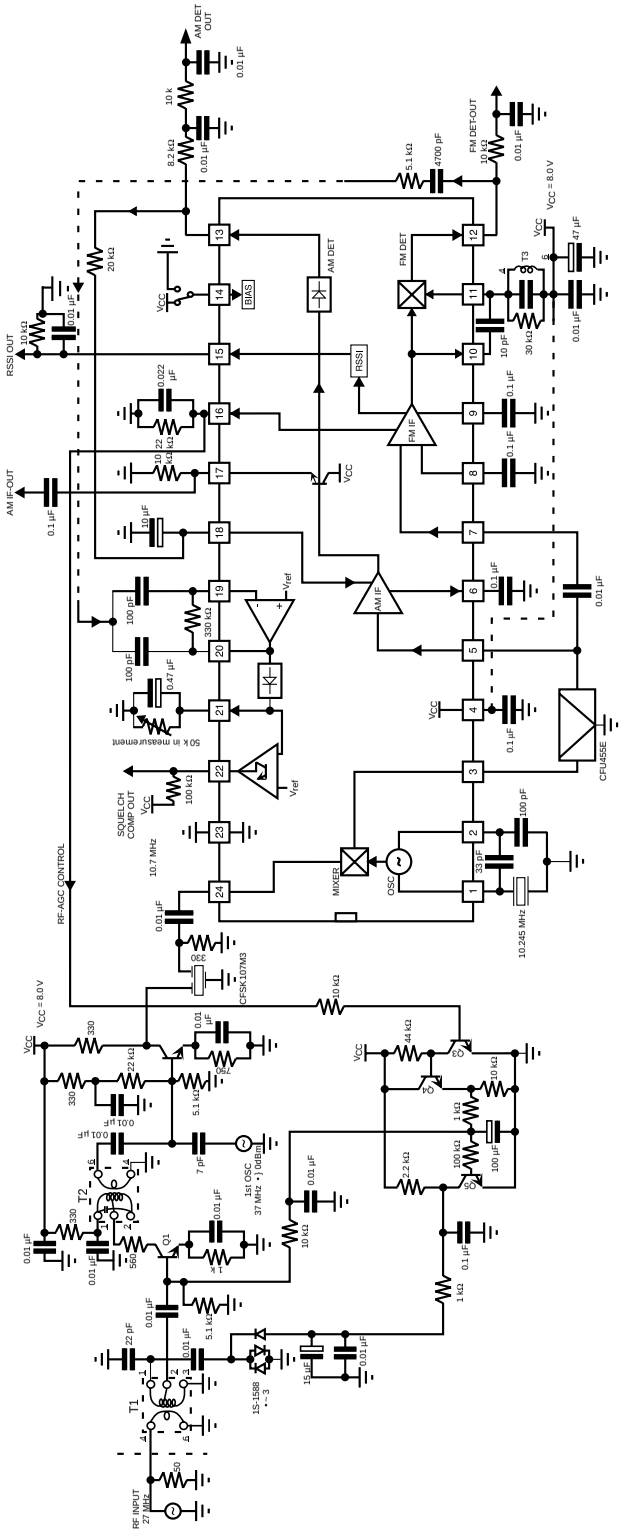


FIGURE 16: EXAMPLE OF STRONG DECOUPLING AROUND THE PHASE SHIFTER

APPLICATION INFORMATION

CB Radio Application



T1 : TXXN-22160BU

T2 : TXXC-16853N

T3 : 7BRE7437Z

Q1 : 2SC585

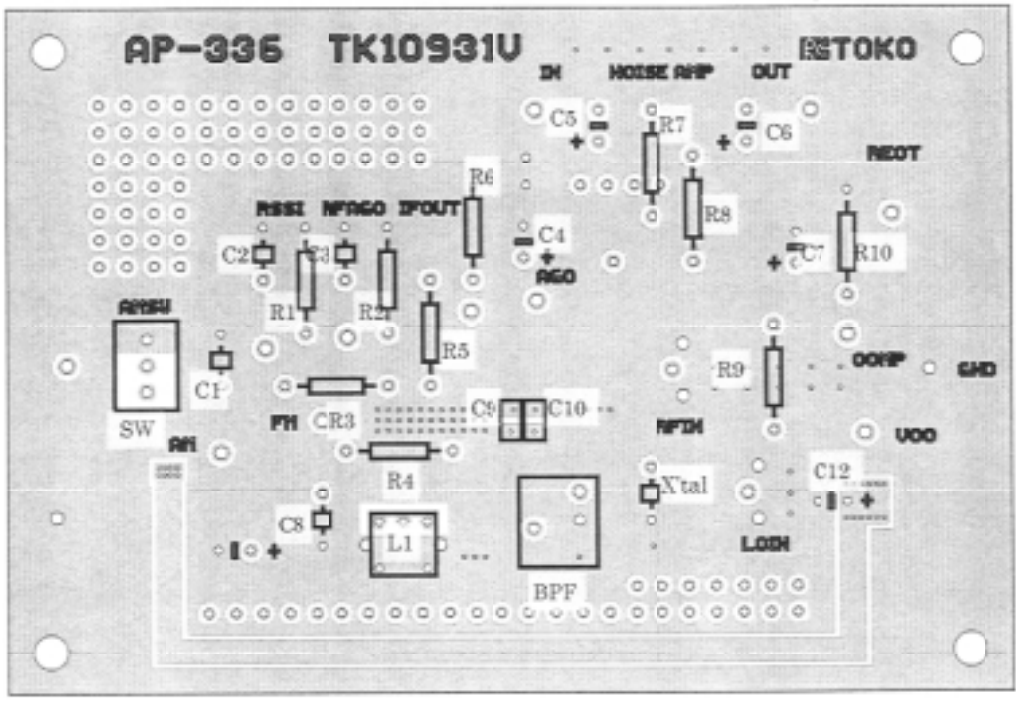
Q2 : 2SC1675

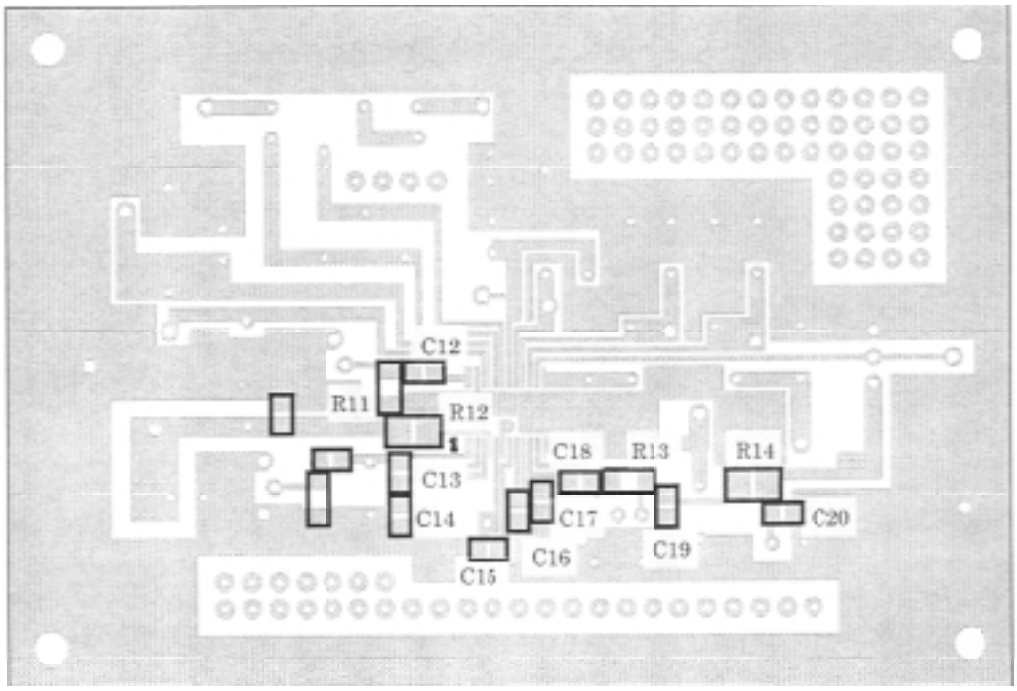
Q3, Q4, Q5 : 2SC945

Any circuits described herein assume no mass-production.

Toko assumes no responsibility for the use of any circuits described herein, conveys no license or other right, and makes no representations that the circuits are free from patent infrigement.

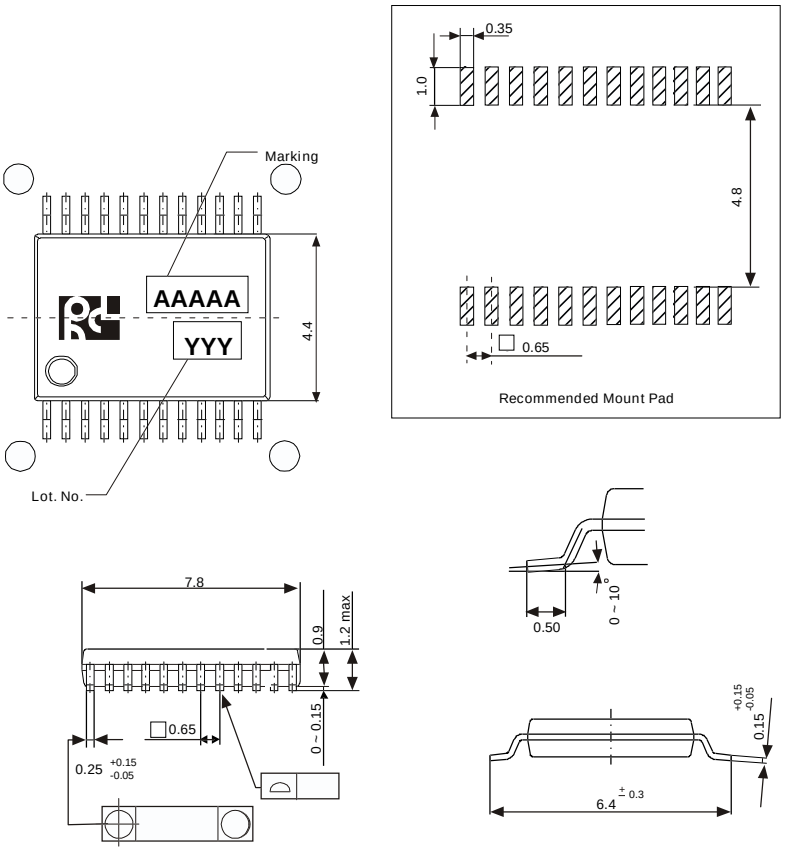
APPLICATION BOARD LAYOUTS





PACKAGE OUTLINE

TSSOP-24



Dimensions are shown in millimeters
Tolerance: x.x = ± 0.2 mm (unless otherwise specified)

Marking Information

	Marking
TK10931V	10931

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