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SEMICONDUCTORS

DS 3286 -1

SL6654

LOWER POWER IF/AF CIRCUIT (WITH RSSI) FOR FM CELLULAR RADIO

The SL6654 is a complete single chip mixer/oscillator, IF amplifier and detector for FM cellular radio, cordless telephones and low power radio applications. It features an exceptionally stable RSSI (Received Signal Strength Indicator) output using a unique system of detection. Supply current is less than 2mA from a supply voltage in the range 2.5V to 7.5V.

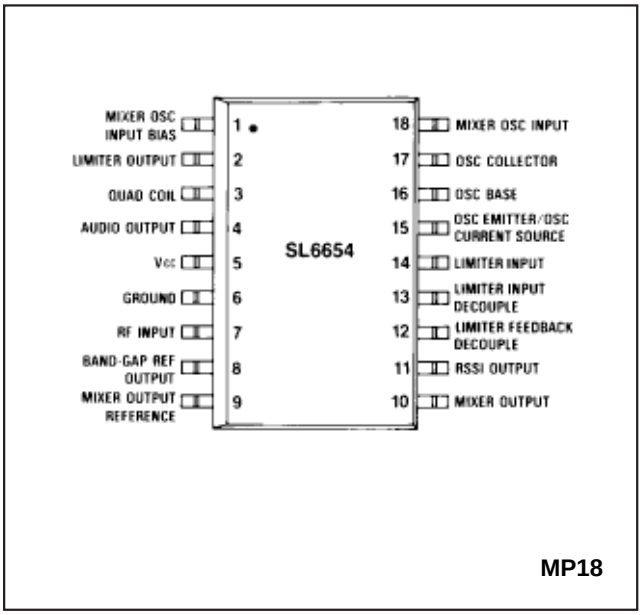

Fig. 1 Pin connections (top view)

FEATURES

- Low Power Consumption (1.5mA)
- Single Chip Solution
- Guaranteed 100MHz Operation
- Exceptionally Stable RSSI

APPLICATIONS

- Cellular Radio Telephones
- Cordless Telephones

QUICK REFERENCE DATA

- Supply Voltage 2.5V to 7 5V
- Sensitivity 3µV
- Co-Channel Rejection 7dB

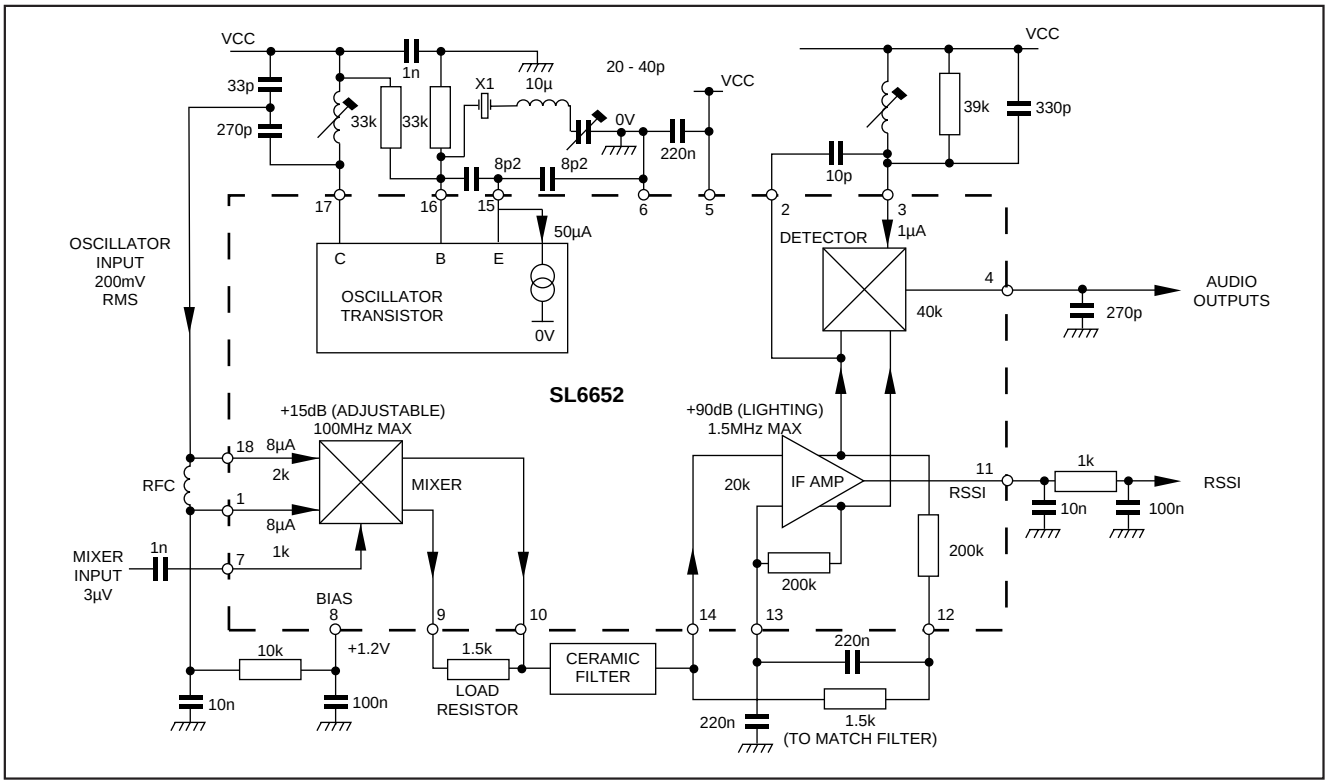

Fig. 2 block diagram

ABSOLUTE MAXIMUM RATINGS

Supply voltage	8V
Storage temperature	-55°C to +150°C
Operating temperature	-55°C to +125°C
Mixer input	1V rms

ELECTRICAL CHARACTERISTICS

Test conditions (unless otherwise stated):

V_{CC} = 2.5V to 7.5V, T_{amb} = -30°C to +85°C, IF = 455kHz, RF = 50MHz, Quad Coil Working Q = 30

Characteristics	Value			Units	Conditions
	Min.	Typ.	Max.		
Overall					
Supply current		1.5	20	mA	
Sensitivity		5	10	µV	20dB SINAD
		3		µV	12dB SINAD
AM rejection		40		dB	RF input <500µV
V_{bias}	1.0	1.2	1.4	V	T_{amb} = 25°C
Co-channel rejection		7		dB	See Note 2
Mixer					
RF input impedance		1		kohm	
OSC input impedance		2		kohm	
OSC input bias		5		µA	At V_{bias}
Mixer gain		15		dB	Rload = 1.5k
3rd order input intercept		-10		dBm	
OSC input level	180		300	mV	
OSC frequency	100			MHz	
Oscillator					
Current sink	40		70	µA	T_{amb} = 25°C
H_{fe}	30				40 ... 70µA
f_T		500		MHz	40 ... 70µA
IF Amplifier					
Gain		90		dB	
Frequency	455	1500		kHz	
Diff. input impedance		20		kohm	
Detector					
Audio output level	75		125	mV	} 5mV into pin 14
Ultimate S/N ratio		60		dB	
THD		0.5	5	%	
Output impedance		40		kohm	
Inter-output isolation		65		dB	1kHz
RSSI Output (T_{amb} = +25°C)					
Output current			20	µA	No input pin 14
Output current	50		80	µA	Pin 14 = 2.5mV
Current change	0.9	1.22	1.5	µA/dB	See Note 1
Linear dynamic range	70			dB	See Note 1

NOTES

1. The RSSI output is 100% dynamically tested at 5V and +20° C over a 70dB range. First the input to pin 14 is set to 2.5mV and the RSSI current recorded Then for each step of 10dB from -40 to +30dB the current is measured again. The current change in each step must meet the specified figure for current change. The RSSI output is guaranteed monotonic and free from discontinuities over this range.

2. Co-channel rejection is measured by applying a 3kHz deviation, 1 kHz modulated signal at an input level to give a 20dB SINAD ratio. Then a 3kHz deviation, 400Hz modulated signal on the same frequency is also applied and its level increased to degrade the SINAD to 14dB.

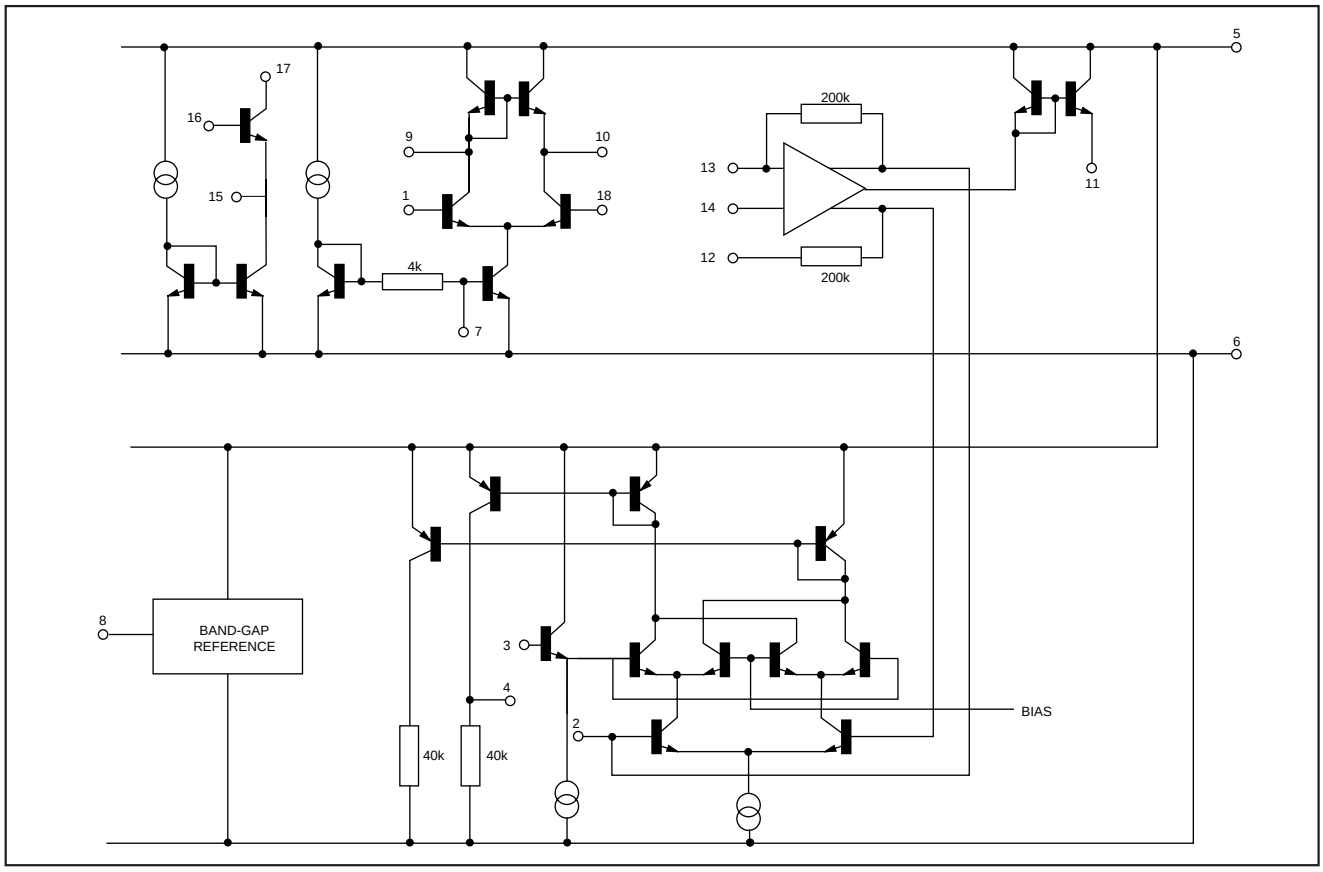

Fig. 3 Internal schematic

GENERAL DESCRIPTION

The SL6654 is a very low power, high performance integrated circuit intended for IF amplification and demodulation in FM radio receivers. It comprises:

- A mixer stage for use up to lOOMHz
- An uncommitted transistor for use as an oscillator
- A current sink for biasing this transistor
- A limiting amplifier operating up to 1.5MHz
- A quadrature detector with differential AF output
- An RSSI (Received Signal Strength Indicator) output

Mixer

The mixer is single balanced with an active load. Gain is set externally by the load resistor although the value is normally determined by that required for matching into the ceramic filter. It is possible to use a tuned circuit but an increase in mixer gain will result in a corresponding reduction of the mixer input intercept point.

The RF input is a diode-biased transistor with a bias current of typically 300µA. The oscillator input is differential but would normally be driven single-ended. Special care should be taken to avoid accidental overload of the oscillator input.

Oscillator

The oscillator consists of an uncommitted transistor and a separate current sink. The user should ensure that the design of oscillator is suitable for the type of crystal and frequency required; it may not always be adequate to duplicate the design shown in this data sheet.

IF amplifier

The limiting amplifier is capable of operation to at least 1 MHz and the input impedance is set by an external resistor to match the ceramic filter. Because of the high gain, pins 12 and 13 must be adequately bypassed.

Detector

A conventional quadrature detector is fed internally from the IF amplifier; the quadrature input is fed externally using an appropriate capacitor and phase shift network. A differential output is provided to feed a comparator for digital use, although it can also be used to provide AFC.

RSSI output

The RSSI output is a current source with value proportional to the logarithm of the IF input signal amplitude. There is a small residual current due to noise within the amplifier (and mixer) but beyond this point there is a measured and guaranteed 70dB dynamic range. The typical range extends to 92dB, independent of frequency, and with exceptionally good temperature and supply voltage stability.

Supply voltage

The SL6652 will operate reliably from 2.5V to 7.5V The supply line must be decoupled with 470nF using short leads.

Detector

The internal band gap reference must be externally decoupled. It can be used as an external reference but must not be loaded heavily; the output impedance is tyically 14 ohms.

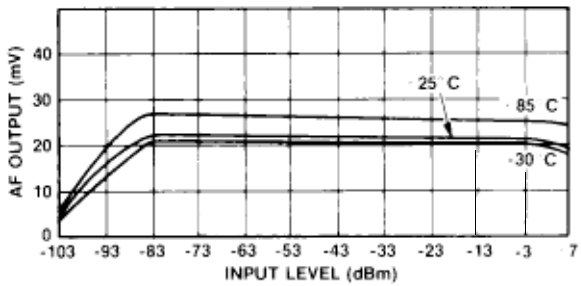

Fig. 4 Audio output vs input and temperature at 2.5V

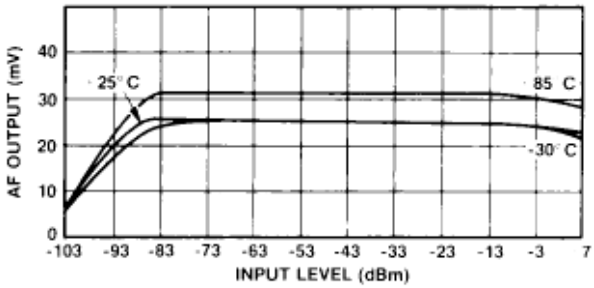

Fig. 5 Audio output vs input and temperature at 5.0V

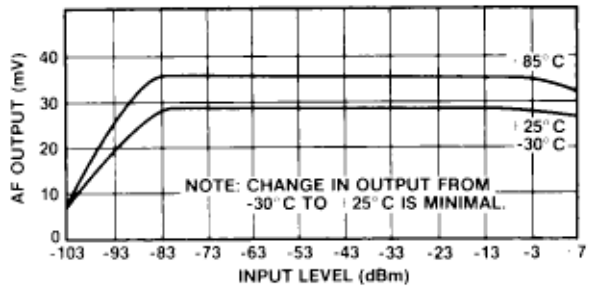

Fig. 6 Audio output vs input and temperature at +7.5V

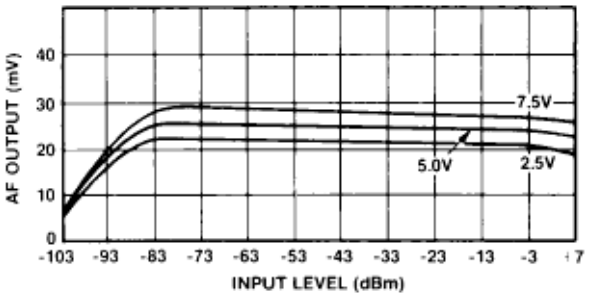

Fig. 7 Audio output vs input and supply voltage at +25°C

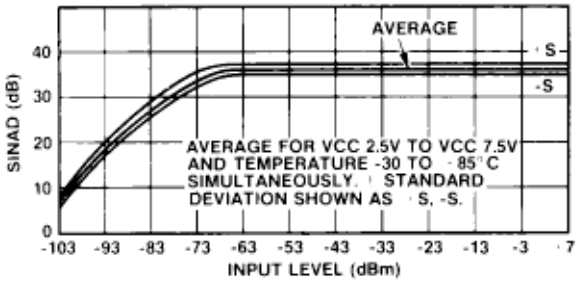

Fig. 8 SINAD and input level

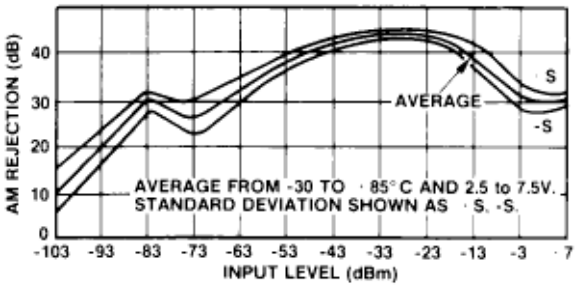

Fig. 9 AM rejection and input level

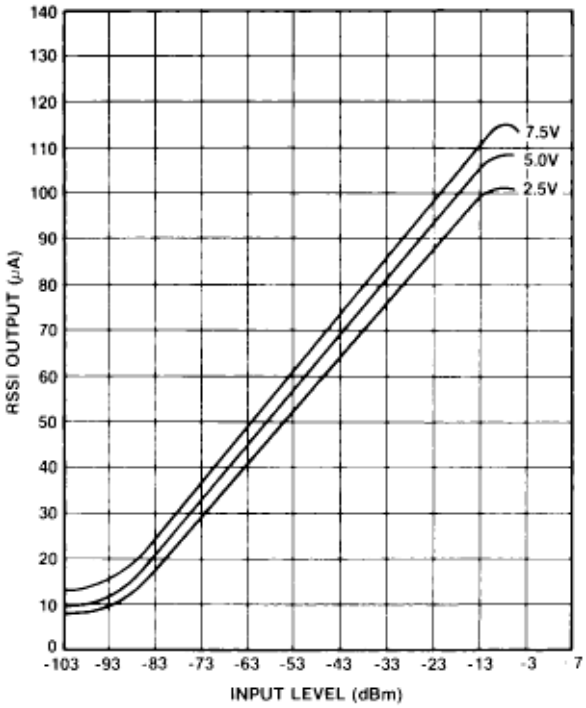

Fig. 10 RSSI output vs input and supply voltage (T_{amb} = 20°C)

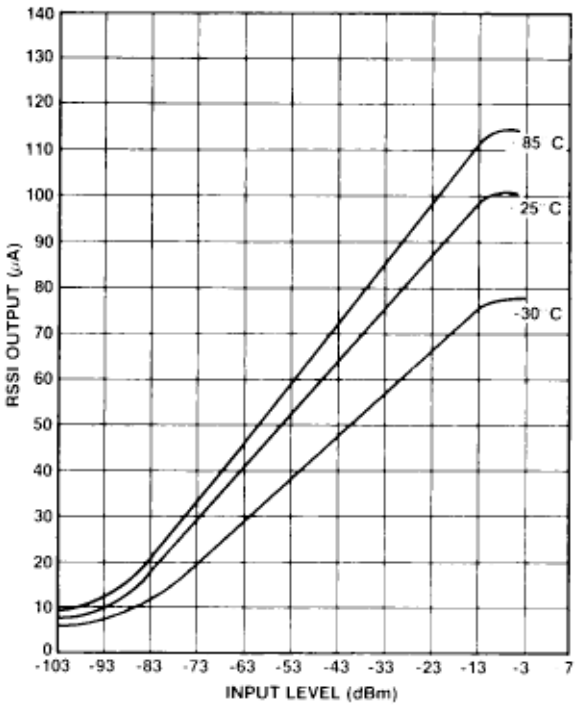

Fig. 11 RSSI output vs input level and temperature (V_{CC} = 2.5V)

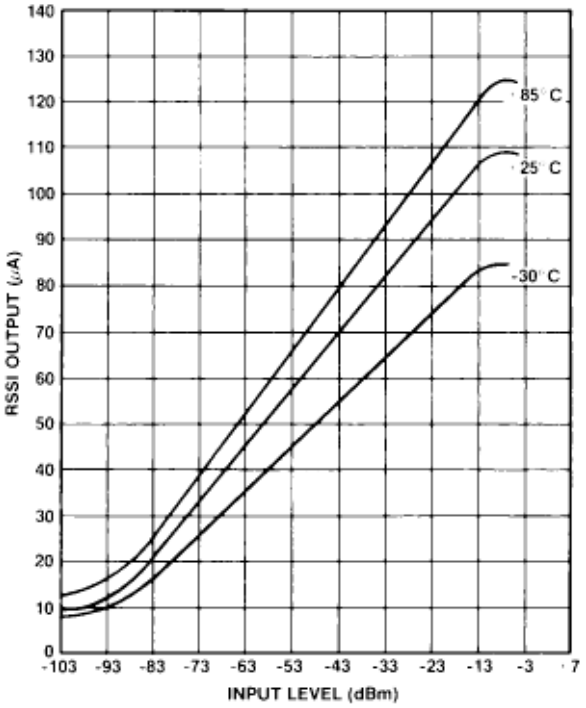

Fig. 12 RSSI output vs input level and temperature (T_{CC} = 5V)

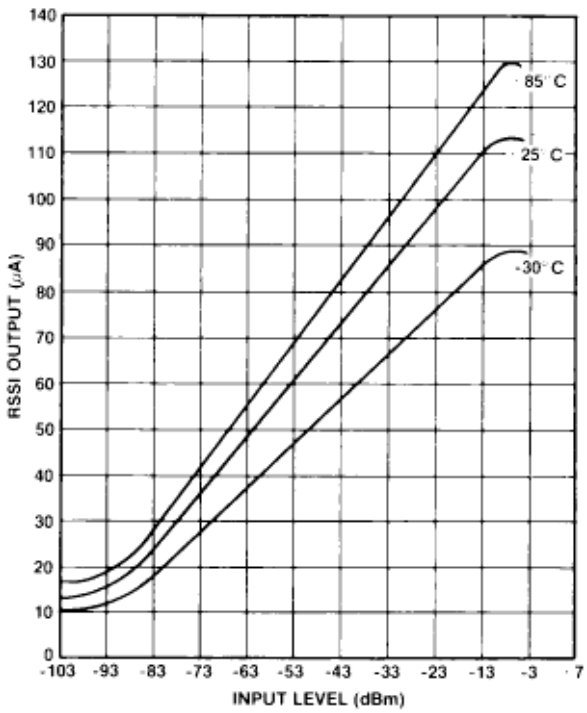

Fig. 13 RSSI output vs input level and temperature (V_{CC} = 7.5V)

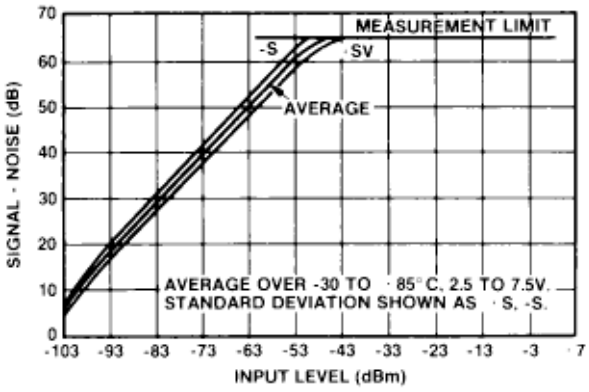

Fig. 14 Signal + noise to noise ratio vs input level

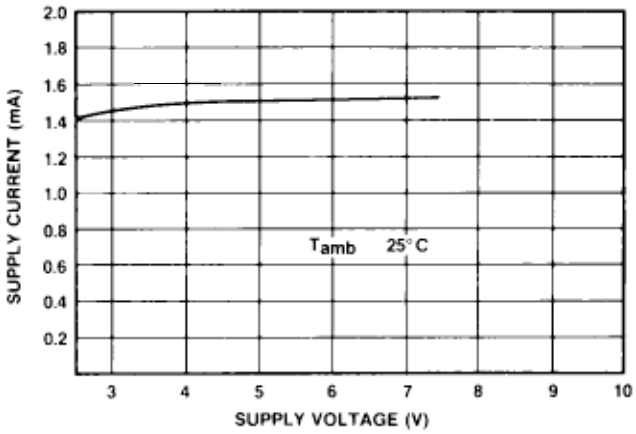

Fig. 15 Supply current vs supply voltage

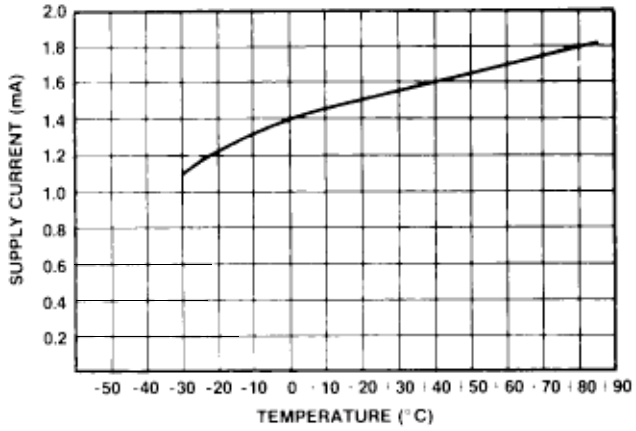

Fig. 16 Supply current vs temperature (V_{CC} = 5V)

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