TelCom Semiconductor, Inc.

EVALUATION KIT AVAILABLE

TC1029

LINEAR BUILDING BLOCK – DUAL LOW-POWER OP AMP

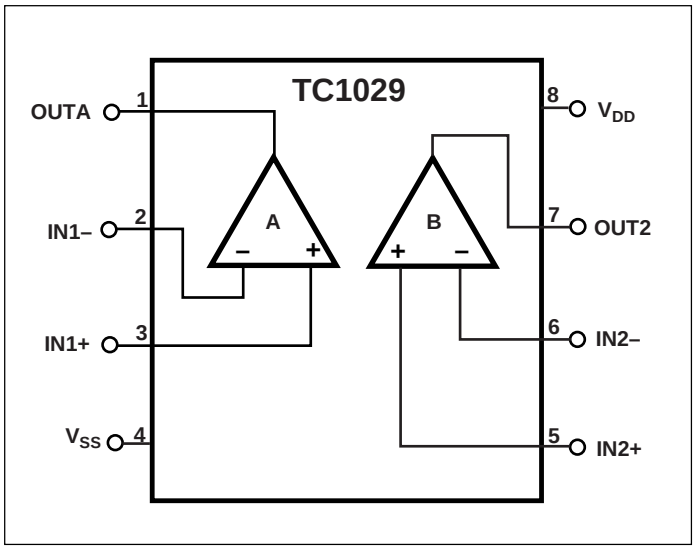
FEATURES

- **Optimized for Single-Supply Operation**
- **Small Package .....8-Pin MSOP (Occupies Only Half the Area of an 8-Pin SOIC), 8-Pin DIP, and 8-Pin SOIC**
- **Ultra Low Input Bias Current ..... Less than 100 pA**
- **Low Quiescent Current ..... 12 μA (Typ.)**
- **Rail-to-Rail Inputs and Outputs (Operates From Low Supply Voltage While Accomodating Large Input Signals — Yields Larger Output Signals)**
- **Operates Down to 1.8V**

APPLICATIONS

- **Power Management Circuits**
- **Battery Operated Equipment**
- **Consumer Products**

PIN CONFIGURATION (DIP, MSOP, and SOIC)



GENERAL DESCRIPTION

The TC1029 is a dual, CMOS operational amplifier designed for low-power applications.

It is designed specifically for operation from a single supply, however, operation from dual supplies is also possible, and the power supply current drain is independent of the magnitude of the power supply voltage. The TC1029 operates from two 1.5V alkaline cells down to V_{DD} = 1.8V. Supply current is only typically 12 μA, which significantly extends battery life.

Rail-to-rail inputs and outputs allow operation from low supply voltages while accommodating large input signals, yielding larger output signals.

Packaged in an 8-pin MSOP, SOIC, or DIP, the TC1029 is ideal for battery-operated applications.

ORDERING INFORMATION

Part No.	Package	Temp. Range
TC1029EPA	8-Pin DIP	– 40°C to +85°C
TC1029EUA	8-Pin MSOP	– 40°C to +85°C
TC1029EOA	8-Pin SOIC	– 40°C to +85°C

TC1043EV Evaluation Kit for Linear Building Block Family

TC1029

ABSOLUTE MAXIMUM RATINGS*

Supply Voltage 6.0V
Voltage on Any Pin:
(With Respect to Supplies) ..... (V_{SS} – 0.5V) to (V_{DD} +0.5V)
Operating Temperature Range: ..... – 40°C to + 85°C
Storage Temperature Range ..... – 55°C to +150°C
Lead Temperature (Soldering, 10 sec) ..... +260°C

* Static-sensitive device. Unused devices must be stored in conductive material. Protect devices from static discharge and static fields. Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to Absolute Maximum Rating Conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS:

Typical values apply at 25°C, V_{DD} = 3.0V. T_A = –40°C to +85°C, V_{DD} = 1.8V to 5.5V, unless otherwise specified.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{DD}	Supply Voltage		1.8	—	5.5	V
I_Q	Supply Current, Operating	All Outputs Open	—	12	16	µA
A_{VOL}	Large Signal Voltage Gain	R_L = 10 KΩ, V_{DD} = 5V	—	100	—	V/mV
V_{ICMR}	Common Mode Input Voltage Range		V_{SS} – 0.2	—	V_{DD} +0.2	V
V_{OS}	Input Offset Voltage	V_{DD} = 3V, V_{CM} = 1.5V, T_A = 25°C, T_A = –40°C to 85°C		±100 ±0.3	±500 ±1.5	µV mV
I_B	Input Bias Current	T_A = 25°C, V_{CM} = V_{DD} to V_{SS}	–100	50	100	pA
$V_{OS\ (DRIFT)}$	Average Input Offset Voltage Drift	V_{DD} = 3V, V_{CM} = 1.5V	—	4	—	µV/°C
GBWP	Gain-Bandwidth Product	V_{DD} = 1.8V to 5.5V; V_O = V_{DD} to V_{SS}	—	90	—	KHz
SR	Slew Rate	C_L = 100pF R_L = 1M to GND Gain = 1 V_{IN} = V_{SS} to V_{DD}	—	35	—	mV/µsec
V_{OUT}	Output Signal Swing	R_L = 10 KΩ,	V_{SS}+ 0.05	—	V_{DD}– 0.05	V
CMRR	Common Mode Rejection Ratio	T_A = 25°C, V_{DD} = 5V; V_{CM} = V_{DD} to V_{SS}	70	—	—	dB
PSRR	Power Supply Rejection Ratio	T_A = 25°C, V_{CM} = V_{SS} V_{DD} = 1.8 to 5V	80	—	—	dB
I_{SRC}	Output Source Current	V_{IN} = V_{DD} Output Shorted to V_{SS} V_{DD} = 1.8V, Gain = 1	3	—	—	mA
I_{SINK}	Output Sink Current	V_{IN} = V_{SS} Output Shorted to V_{DD} V_{DD} = 1.8V, Gain = 1	4	—	—	mA
en	Input Noise Voltage	0.1 Hz to 10 Hz	—	10	—	µVpp
	Input Noise Density	1KHz	—	125	—	nV/$\sqrt{Hz}$

DETAILED DESCRIPTION

The TC1029 is one of a series of very low power, Linear Building Block products for low voltage single supply operations. The TC1029 contains two rail to rail op amps which operate down to 1.8V with a maximum supply current of 16 µA. The amplifier's input range extends beyond both supplies by 200 mV and the outputs will swing to within several millivolts of the supplies depending on the load current being driven.

The amplifier design is such that large signal gain, slew rate and bandwidth are largely independent of supply voltage. The low input bias current and offset voltage of the TC1029 make it suitable for precision applications.

TYPICAL APPLICATIONS

The TC1029 lends itself to a wide variety of applications, particularly in battery-powered systems. It typically finds application in power management, processor supervisory, and interface circuitry.

Voice Band Receive Filter

The majority of spectral energy for human voices is found to be in a 2.7 KHz frequency band from 300 Hz to 3 KHz. To properly recover a voice signal in applications such as radios, cellular phones, and voice pagers, a low-power bandpass filter matched to the human voice spectrum can be implemented using TelCom's CMOS op amps. Figure 1 shows a unity gain multi-pole Butterworth filter with ripple less than 0.15 dB in the human voice band. The lower 3 dB cut-off frequency is 70 Hz (single order response) while the upper cut-off frequency is 3.5 KHz (fourth order response).

Supervisory Audio Tone (SAT) Filter for Cellular

Supervisory Audio Tones (SAT) provide a reliable transmission path between cellular subscriber units and base stations. The SAT tone functions much like the current/voltage used in land line telephone systems to indicate that a phone is off the hook. The SAT tone may be one of three frequencies: 5970, 6000, or 6030 Hz. A loss of SAT implies that channel conditions are impaired and if SAT is interrupted for more than 5 seconds a cellular call is terminated.

Figure 2 shows high Q (30) second order SAT detection bandpass filter using TelCom's CMOS op amp architecture. This circuit nulls all frequencies except the three SAT tones of interest.

EVALUATION KIT

The TC1043EV consists of a four-inch by six-inch prewired application circuit board. Pre-configured circuits include a pulse width modulator, wake-up timer, function generator, and others. On-board current meter terminals, voltage regulator, and a user-prototyping area speed circuit development. Please contact your local TelCom Semiconductor representative for more information.

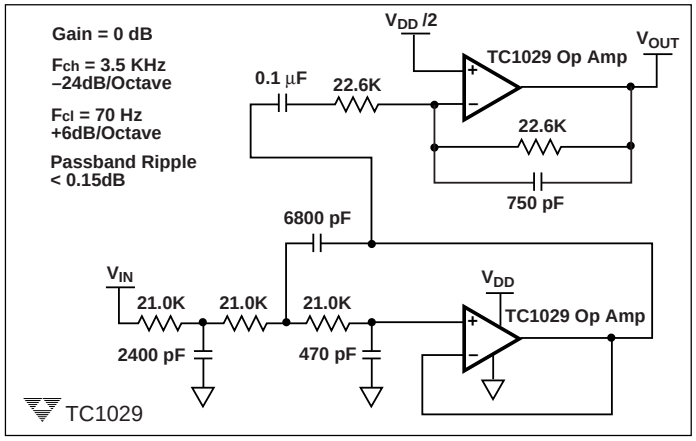


Figure 1. Multi-Pole Butterworth Voice Band Receive Filter

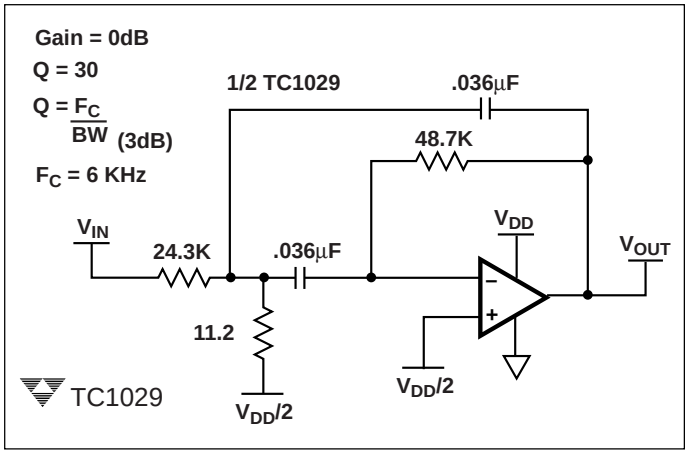
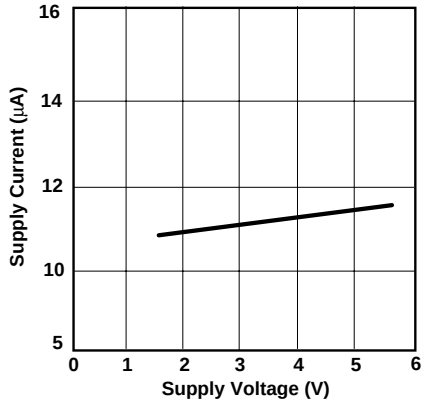


Figure 2. Second Order SAT Bandpass Filter

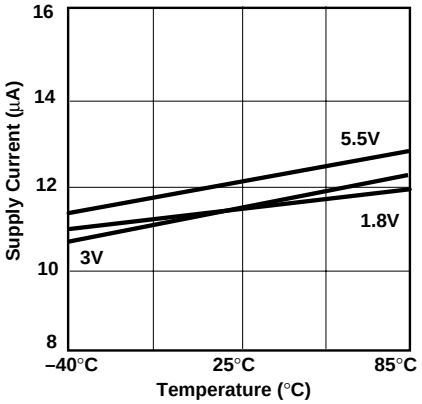
TC1029

TYPICAL CHARACTERISTICS CURVES

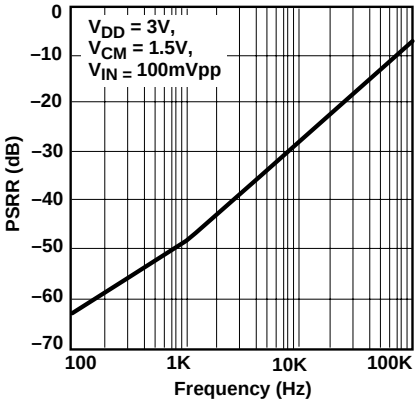
Op-Amp Supply Voltage vs. Supply Current



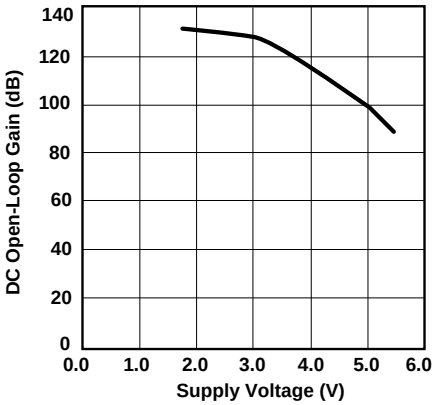
Op-Amp Supply Current vs. Temperature



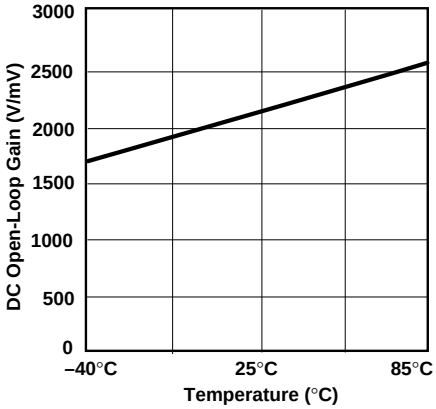
Op-Amp Power Supply Rejection Ratio(PSRR) vs. Frequency



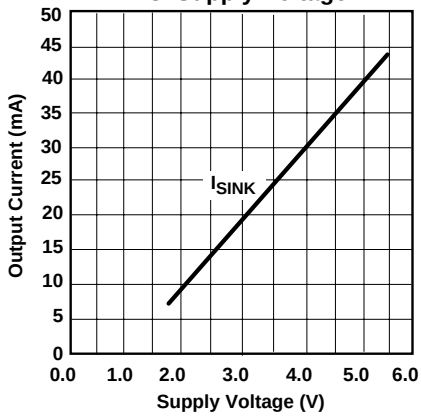
Op-Amp DC Open-Loop Gain vs. Supply Voltage



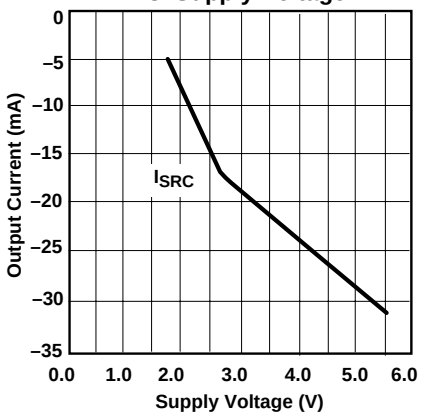
Op-Amp DC Open-Loop Gain vs. Temperature



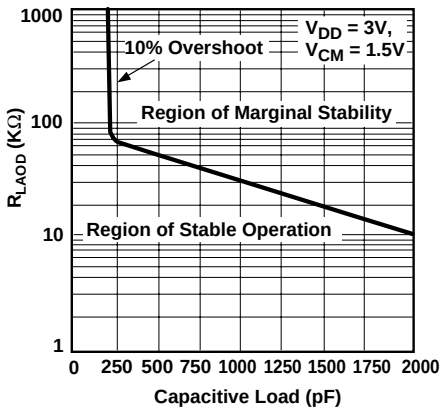
Op-Amp Short-Circuit Current vs. Supply Voltage



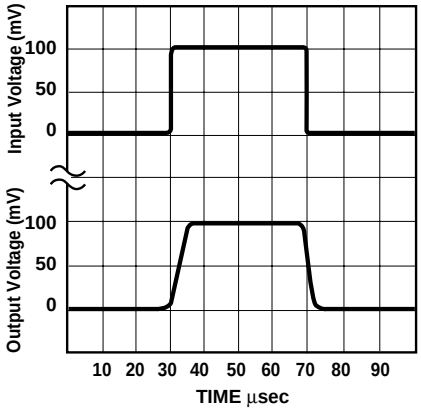
Op-Amp Short-Circuit Current vs. Supply Voltage



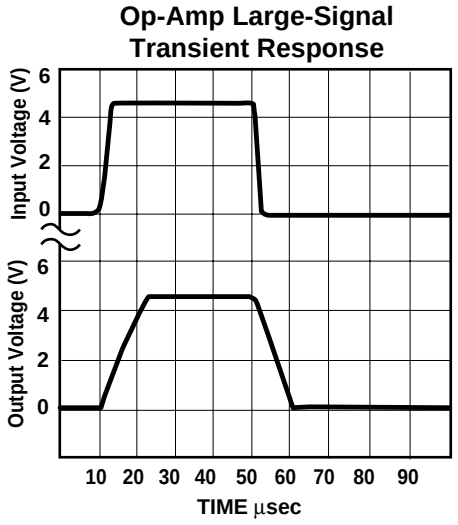
Op-Amp Load Resistance vs. Load Capacitance



Op-Amp Small-Signal Transient Response

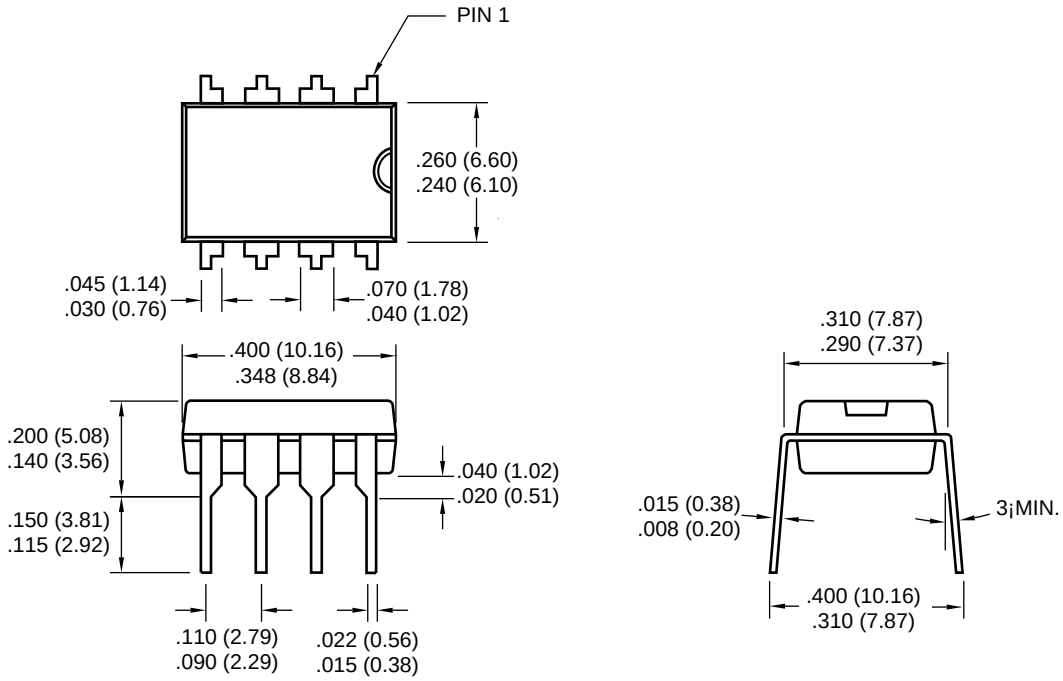


TYPICAL CHARACTERISTICS CURVES



PACKAGE DIMENSIONS

8-Pin Plastic DIP

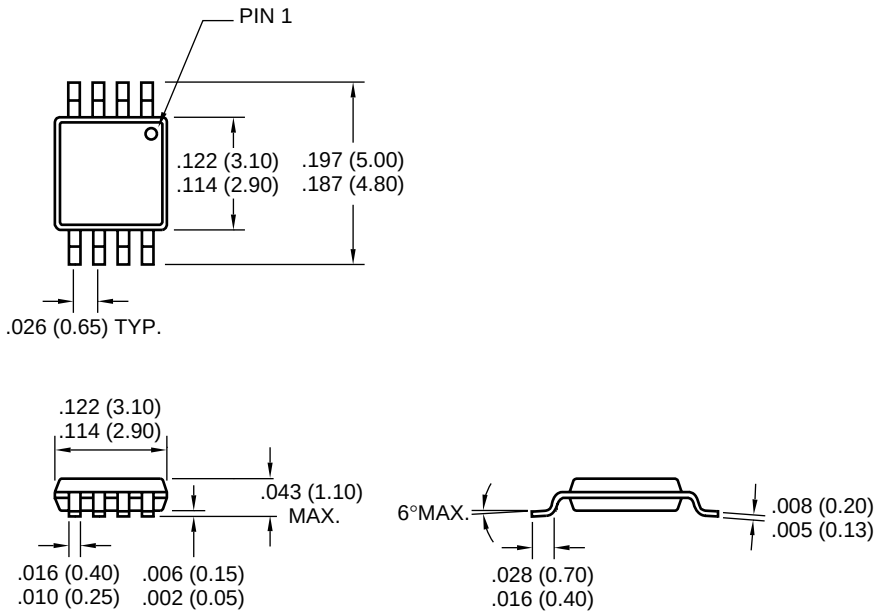


Dimensions: inches (mm)

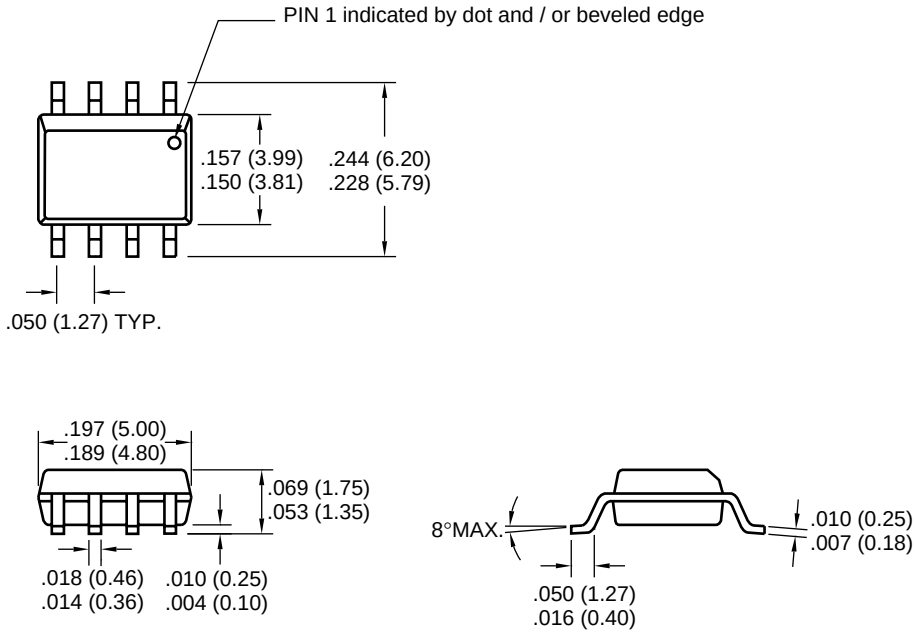
TC1029

PACKAGE DIMENSIONS (CONT.)

8-Pin MSOP



8-Pin SOIC



Dimensions: inches (mm)

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