CATALYST

CAT102

Precision, Adjustable Shunt Regulator (600mV Reference)

- ±1% Initial Accuracy - SOT23 Package

FEATURES

- Low voltage reference: 600mV
- Low temperature coefficient reference: 25ppm
- Accurate 600mV reference voltage: ±6mV at T_J=25°C
- High PSRR: 45dB at 300kHz
- High line rejection: ±1mV (V_{CC} from 2.2V to 18V)
- Low supply current: 300µA
- Open collector output
- Directly drives optocouplers
- Compact 5-lead SOT23 package
- Industrial temperature range: -40°C to 85°C

APPLICATIONS

- SMPS control loop
- Low temperature coefficient voltage reference
- Power management
- Replaces zener diodes
- Isolated DC-to-DC converters
- Network, telecom and cellular base station power supplies
- Adjustable voltage reference

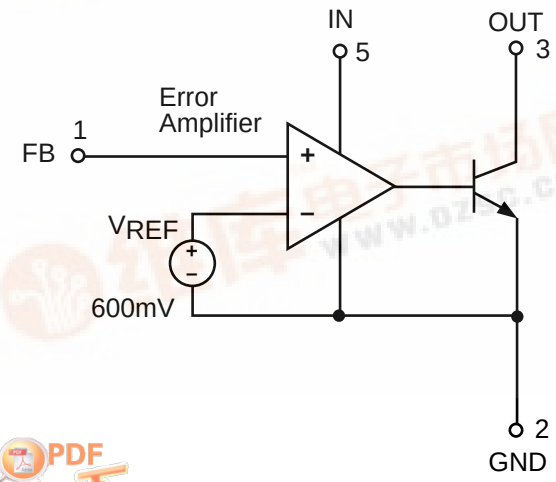
DESCRIPTION

The CAT102 is a low-voltage reference and amplifier. Designed for the control loop of low-voltage power supplies, the reference voltage has been designed for 600mV. Over a junction temperature from -40°C to 105°C the reference voltage is within 8mV of the nominal 600mV. In addition, the error amplifier output and the supply voltage pin are on separate pins.

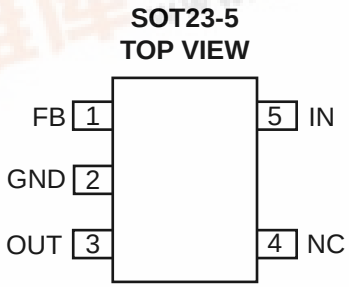
Power supply rejection is a high 45dB at 300kHz. The output, OUT, can sink 20mA at a maximum saturation voltage of 250mV.

When combined with an optocoupler, the CAT102 can be used as an error amplifier that controls the feedback loop in isolated low-output voltage switching power supplies.

FUNCTIONAL DIAGRAM



PIN CONFIGURATION



PIN DESCRIPTIONS

Pin Number	Pin Name	Function
1	FB	Inverting input to error amplifier
2	GND	Ground
3	OUT	Output of error amplifier. Source & sink current capability is 20mA.
4	NC	No connection
5	IN	Positive supply

ORDERING INFORMATION

Part Number	Package	Temperature Range
CAT102EUK-TE7	5-Pin SOT-23	-40° C to 85° C

TE7 = 7" Reel, 3,000 parts per reel.

ABSOLUTE MAXIMUM RATINGS

V_{IN} Voltage 20V
OUT Voltage 20V
FB Voltage 20V
V_{IN}, OUT, FB Current 50mA
Operating Junction Temperature ..... 150°C
Lead Soldering Temperature (10 sec) ..... 260°C
Storage Temperature Range ..... -65°C to +150°C

These are stress ratings only and functional operation is not implied. Exposure to absolute maximum ratings for prolongued time periods may affect device reliability. All voltages are with respect to ground.

ELECTRICAL CHARACTERISTICS

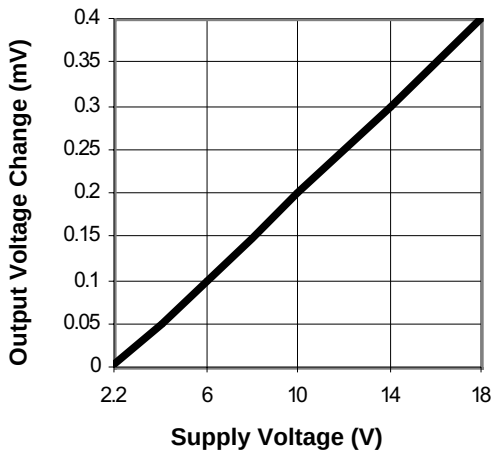
Electrical characteristics are guaranteed over the full operating temperature range of -40°C to +85°C with a junction temperature from -40°C to +105°C unless otherwise specified. Ambient temperature must be de-rated based upon power dissipation and package thermal characteristics.[1] Unless otherwise stated, test conditions are V_{IN}=3V, FB=OUT, I_{OUT}=1mA.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_{IN}	Supply Voltage Range		2.2		18	V
I_{IN}	Quiescent Supply Current	V_{OUT}=1V		0.3	0.5	mA
V_{FB}	FB Threshold Reference Voltage	T_J = 25˚ C	594	600	606	mV
		-40˚ C<T_J<105˚ C	588		612	
	Line Regulation	V_{IN} = 2.2V to V_{IN}=18V		0.5	1	mV
	Load Regulation	I_{OUT} = 1mA to 10mA		4	8	mV
I_{FB}	FB Input Current		-500		500	nA
PSRR	Reference Power Supply Rejection	Frequency = 300kHz	35	45		dB
A_V	Error Amplifier Open Loop Gain	I_{OUT} = 2mA, V_{OUT} = 1V	60	80		dB
BW	Unity Gain Frequency	I_{OUT} = 2mA, V_{OUT} = 1V	1	2		MHz
V_{OUT}	Output Saturation voltage	I_{OUT} = 20mA, V_{FB} = HIGH		100	250	mV
TRANSC	Output Transconductance	I_{OUT} = 1mA to 20mA		2.5		mA/mV
I_{LEAK}	Output Leakage Current	V_{OUT} = 16V, V_{FB} = 0		200	400	nA
$I_{OUT(MAX)}$	Maximum Output Current	V_{OUT} = 0.3V	20			mA

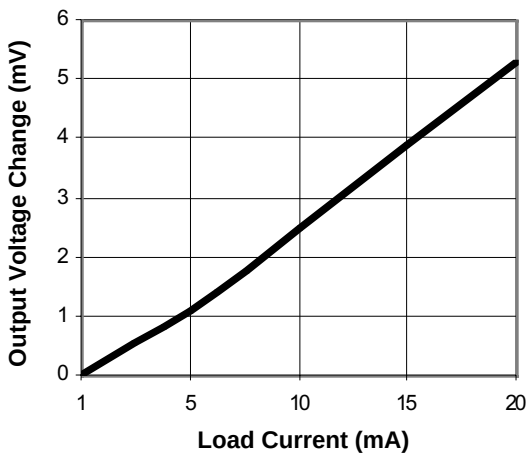
1. Thermal Characteristics (Θ_{JA})
   5-lead, SOT-23: 255°C/W

TYPICAL PERFORMANCE CHARACTERISTICS

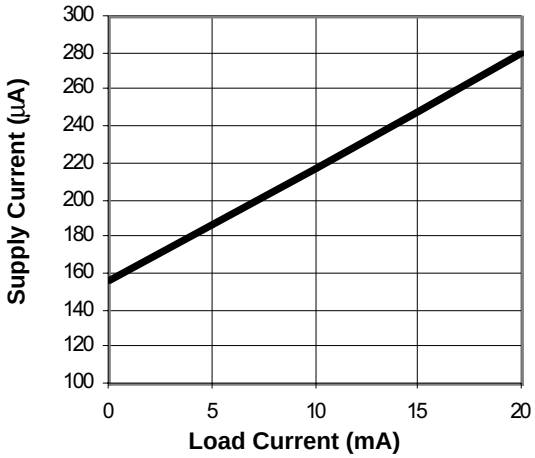
Line Regulation (at 1mA)



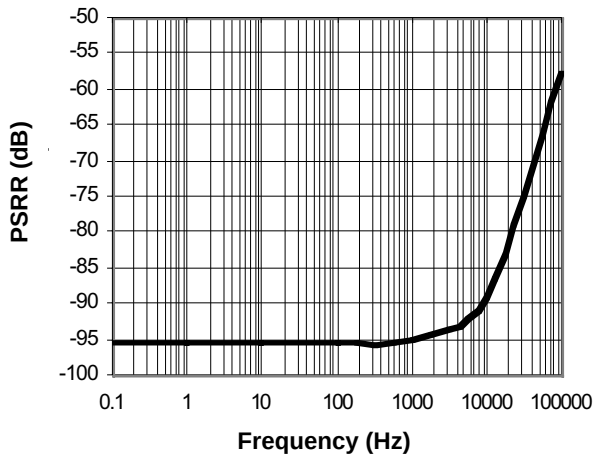
Load Regulation



Supply Current vs. Load Current

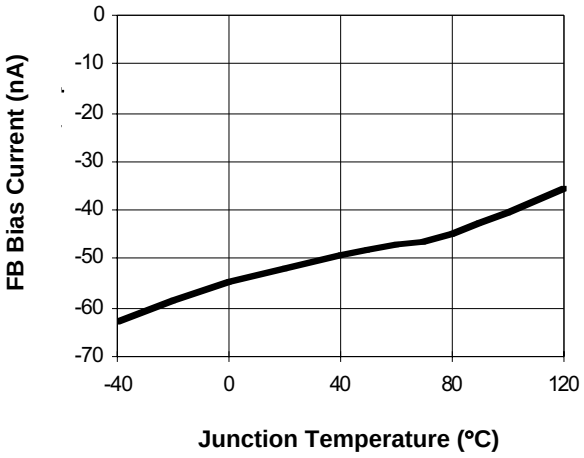


Power-Supply Rejection Ratio vs. Frequency

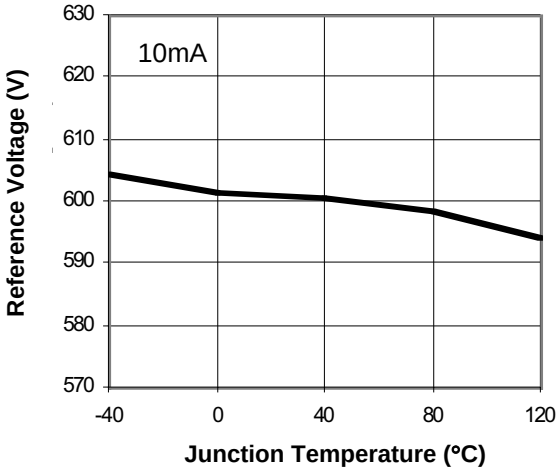


TYPICAL PERFORMANCE CHARACTERISTICS

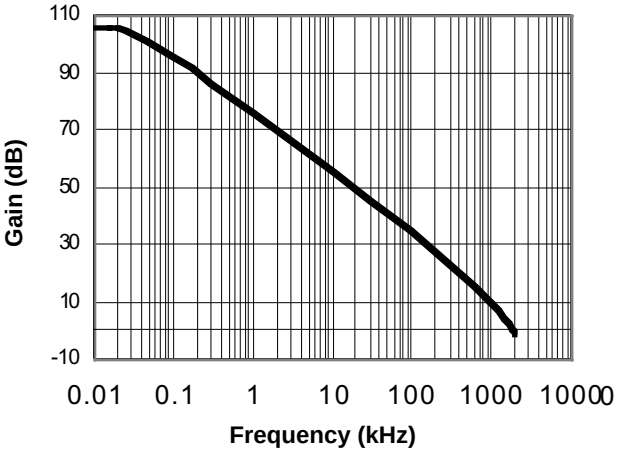
FB Bias Current vs. Temperature (V_{CC}=2.5V)



Reference Voltage



Gain vs. Frequency



APPLICATIONS INFORMATION

The CAT102 adjustable shunt regulator features isolated supply inputs and outputs, ideal for isolated power-supply applications using an optocoupler in the feedback path. The CAT102 sinks 20mA with V_{OUT} at 0.3V. The wide input supply range allows the device to operate from 2.2V to 18V. The CAT102 compares the FB input to a precision 600mv reference. If the FB input is low, the OUT pin sinks no current. If FB rises above 600mV, the OUT pin sinks up to 20mA.

Figure 1 shows the CAT102 configured as a shunt regulator. To generate an output voltage of 0.6V, the FB pin has to be directly connected to the OUT pin. A 1.0µF capacitor from OUT to GND is recommended when the output voltage is 0.6V. A resistor-divider connected from OUT to GND is used to produce a higher output voltage as set by the following equation:

$$V_{OUT} = (1 + R1/R2) \times 0.6V$$

The current limit can be adjusted by using a resistor R3 connected between the IN and OUT pins. For example, a 3.3V supply V_{IN} is associated with R3 = 135Ω, and a 10V supply works best with R3 = 470Ω. The CAT102 shunt regulator is limited to low-current applications with the OUT pin capable of sinking up to 20mA max.

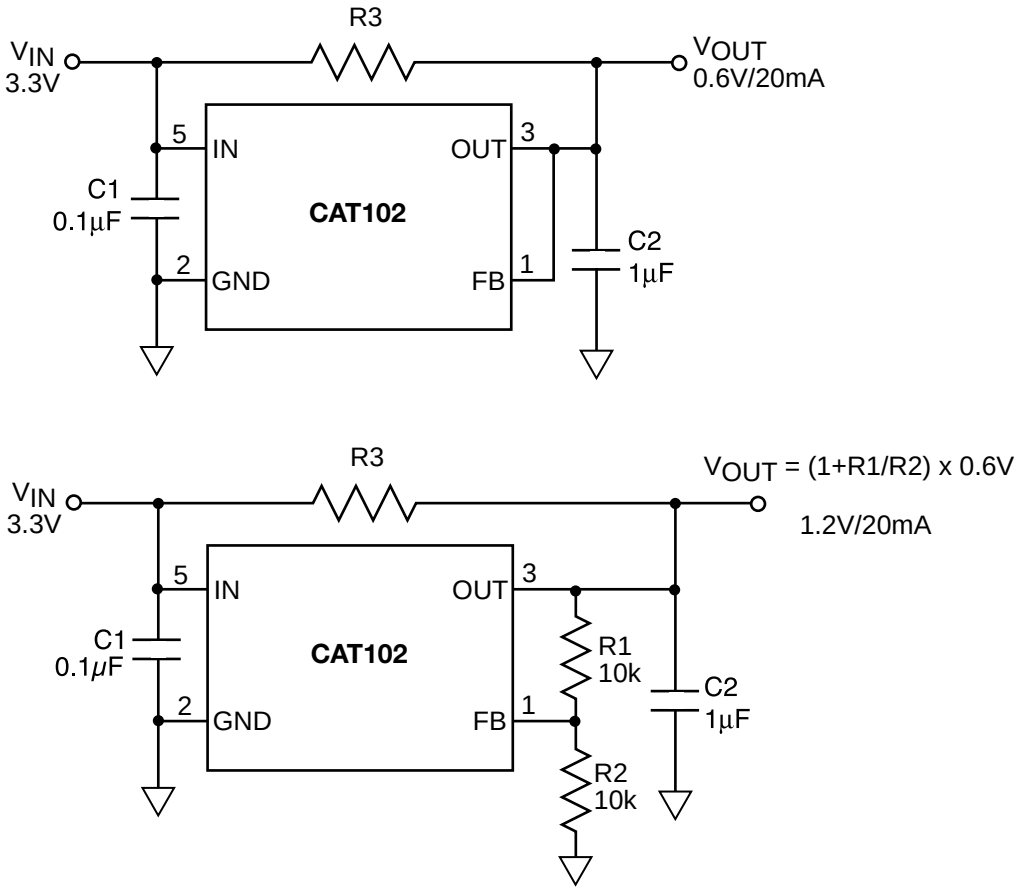


Figure 1. Application circuits for 0.6V output and 1.2V output voltages

TYPICAL APPLICATIONS

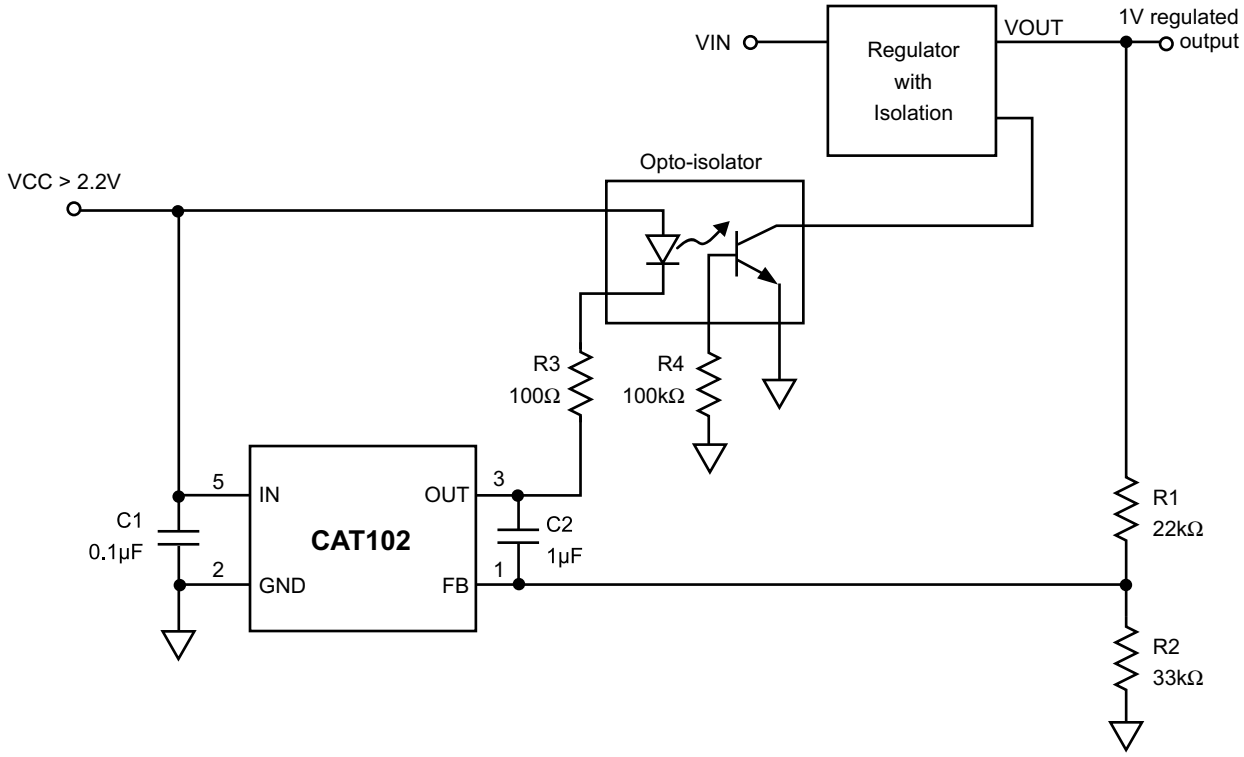
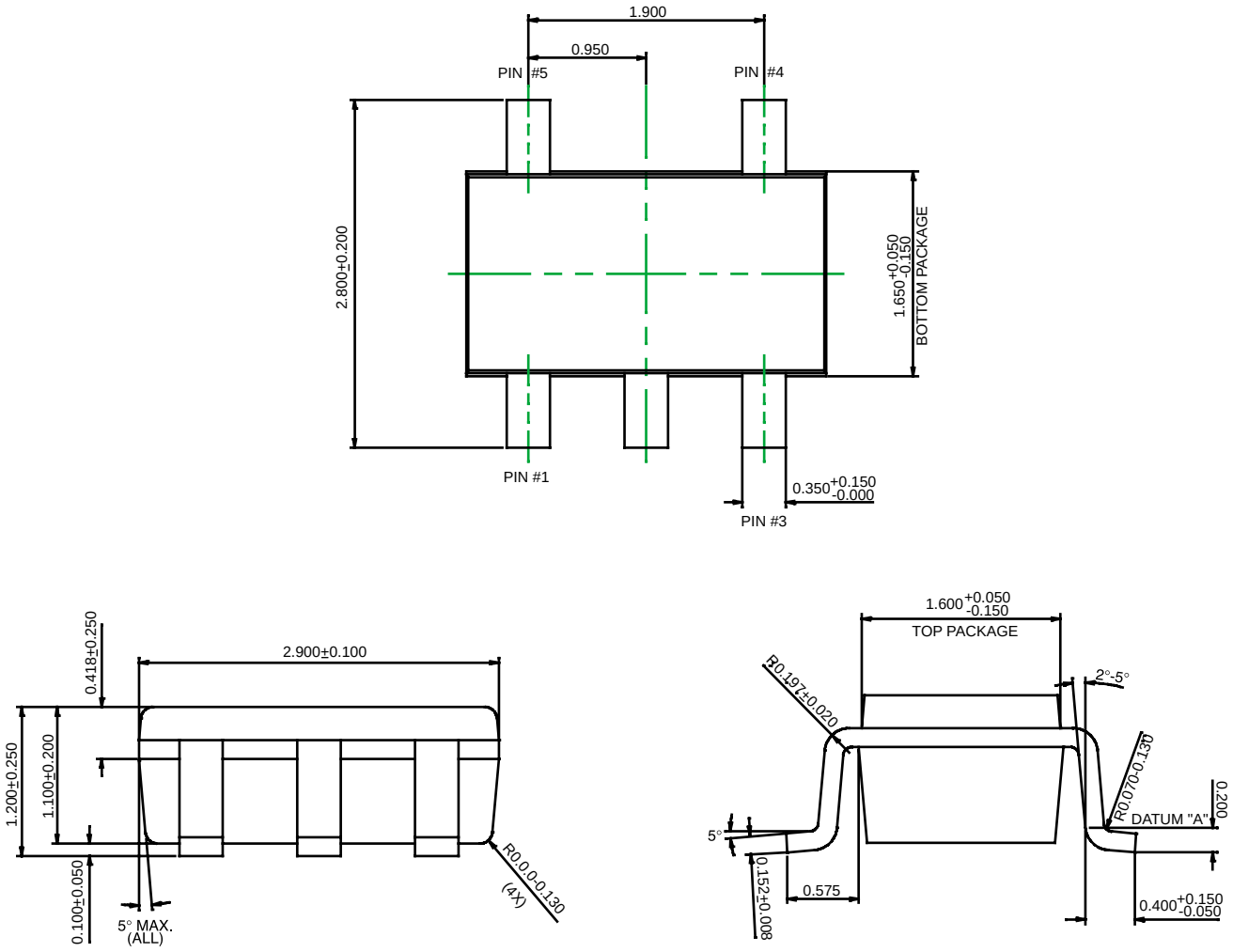


Figure 2. Opto-Feedback Application Circuit

In order to allow proper operation of the optocoupler and the CAT102, the supply voltage VCC must be greater than 2.2V.

PACKAGE OUTLINES

5 LEAD SOT-23



NOTES:

1. ALL DIMENSIONS ARE IN MM.
2. PACKAGE OUTLINE DIMENSIONS INCLUSIVE OF METAL BURR.
3. PACKAGE OUTLINE EXCLUSIVE OF MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.076MM.
4. ALL PACKAGE SURFACE TO BE MIRROR FINISH.
5. MOLDING WITH DIE FACING UP, AND FORMING WITH DIE FACING DOWN.
6. FOOT LENGTH TO BE MEASURED AT THE INTERCEPT POINT OF EXTERNAL LEADS AND DATUM "A".
7. LEADFINISH PLATING: 0.00762MM - 0.0254MM. PACKAGE OUTLINE EXCLUSIVE OF LEADFINISH PLATING.

Catalyst Semiconductor, Inc.
Corporate Headquarters
1250 Borregas Avenue
Sunnyvale, CA 94089
Phone: 408.542.1000
Fax: 408.542.1200
www.catalyst-semiconductor.com

Publication #: 4007
Revison: L
Issue date: 8/20/03
Type: Final