

Precision, Adjustable Shunt Regulator (600mV Reference)



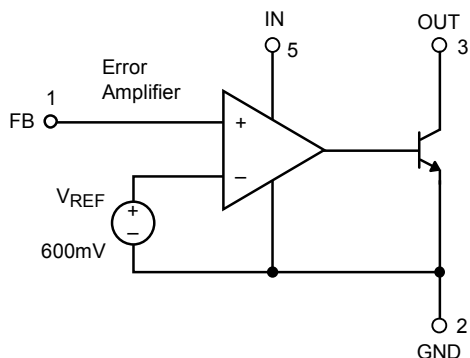
FEATURES

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

APPLICATION

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

FUNCTIONAL DIAGRAM



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.

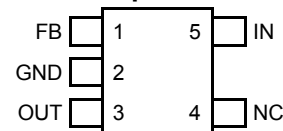
When combined with an optocoupler, the CAT102 can be used as an error amplifier that controls the feedback loop in isolated low-output voltage switching power supplies.

For Ordering Information details, see page 8.

PIN CONFIGURATION

SOT-23 5L

Top View



PIN DESCRIPTION

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

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

Parameters	Ratings	Units
V _{IN} Voltage	20	V
OUT Voltage	20	V
FB Voltage	20	V
V _{IN} , OUT, FB Current	50	mA
Operating Junction Temperature (10s)	150	°C
Lead Soldering Temperature (10s)	260	°C
Storage Temperature Range	-65 to +150	°C

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.

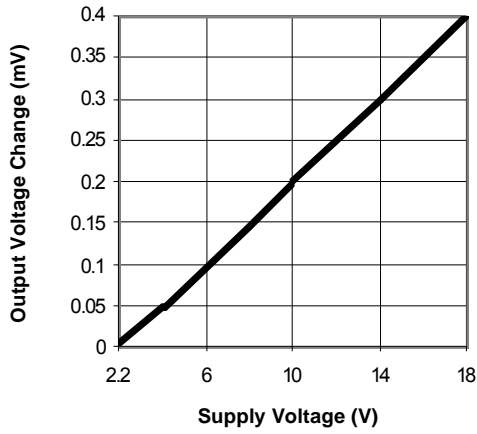
Symbol	Parameter	Conditions	Min	Typ	Max	Units
V _{IN}	Supply Voltage Range		2.2		18	V
I _{IN}	Quiescent Supply Current	V _{OUT} = 1V		0.3	0.5	mA
V _{FB}	FB Threshold Reference Voltage	T _J = 25° C	594	600	606	mV
		-40°C < T _J < 105°C	592		608	
	Line Regulation	V _{IN} = 2.2V to V _{IN} = 18V		0.5	1	mV
	Load Regulation	I _{OUT} = 1mA to 10mA		4	8	mV
T _{CREF}	Reference Temperature Deviation	-40°C < T _J < 105°C		25	50	ppm/°C
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

Notes:

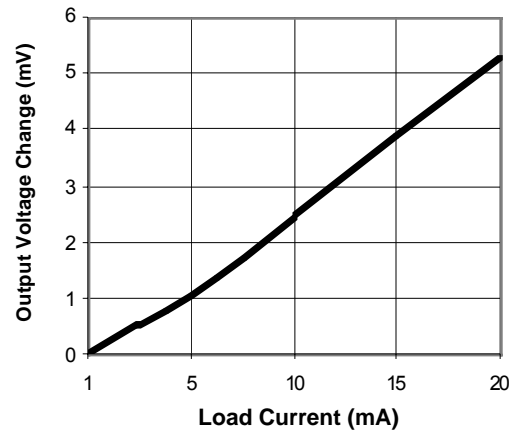
- (1) These are stress ratings only and functional operation is not implied. Exposure to absolute maximum ratings for prolonged time periods may affect device reliability. All voltages are with respect to ground.
- (2) Thermal Characteristics (Θ_{JA}) of SOT-23 5-lead: 255°C/W

TYPICAL PERFORMANCE CHARACTERISTICS

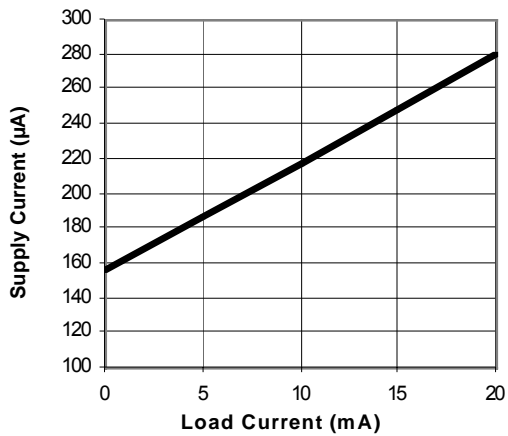
Line Regulation (at 1mA)



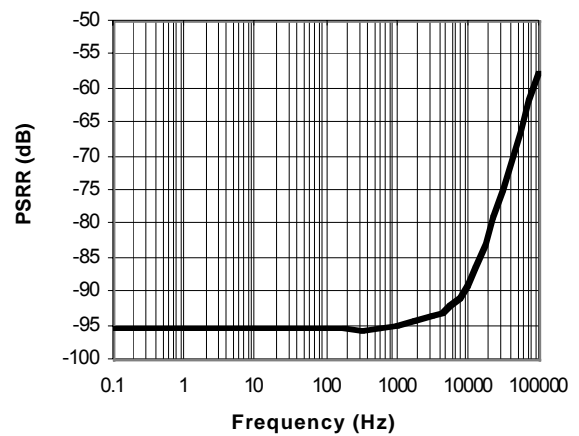
Load Regulation



Supply Current vs. Load Current

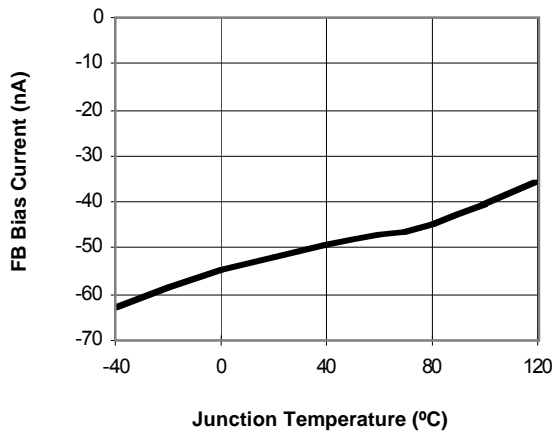


Power-Supply Rejection Ratio vs. Frequency

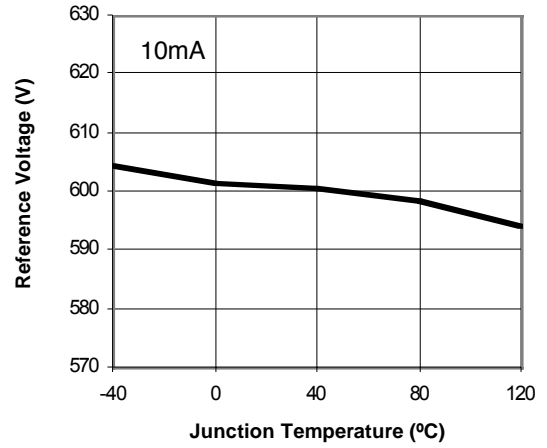


TYPICAL PERFORMANCE CHARACTERISTICS

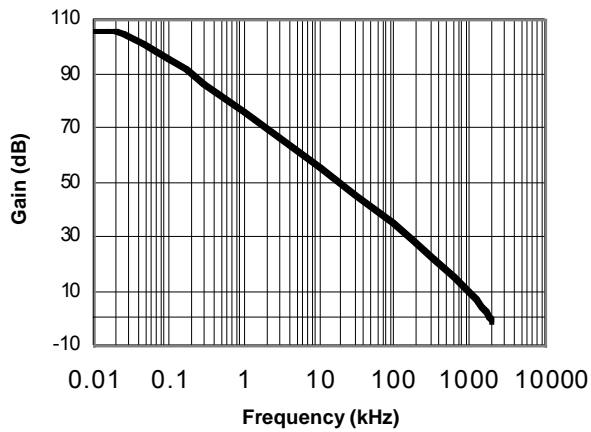
FB Bias Current vs. Temperature ($V_{CC} = 2.5V$)



Reference Voltage



Gain vs. Frequency



APPLICATIONS INFORMATION

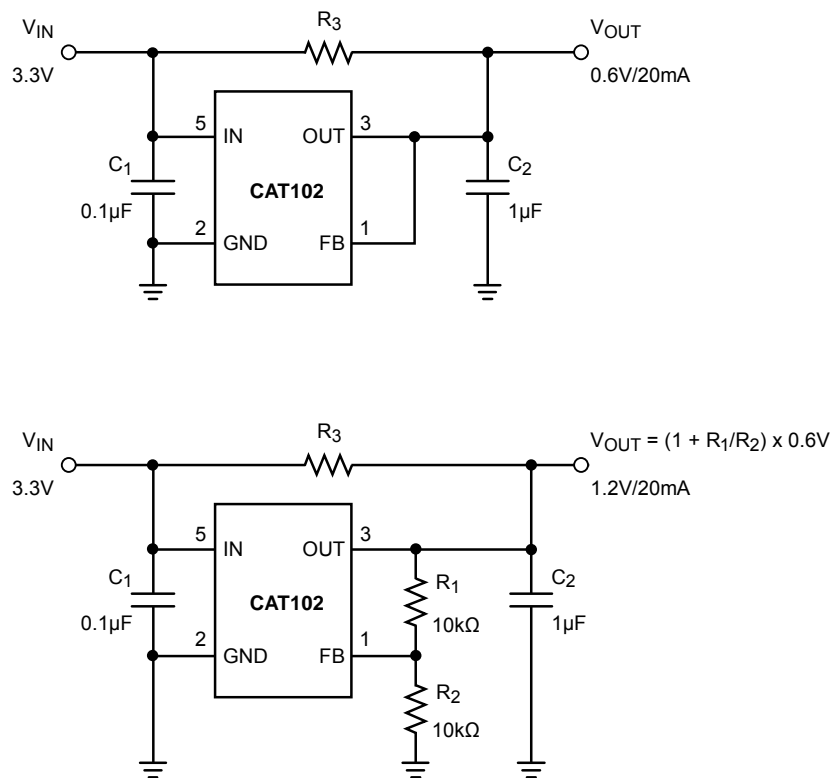
The CAT102 adjustable shunt regulator features isolated supply inputs and outputs, ideal for isolated power-supply applications using an optocoupler in the feedback path. The CAT102 sinks 20mA with V_{OUT} at 0.3V. The wide input supply range allows the device to operate from 2.2V to 18V. The CAT102 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.

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 $R_3 = 135\Omega$, and a 10V supply works best with $R_3 = 470\Omega$. The CAT102 shunt regulator is limited to low-current applications with the OUT pin capable of sinking up to 20mA max.

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 1.0 μ F 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:

$$V_{OUT} = (1 + R_1/R_2) \times 0.6V$$

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



TYPICAL APPLICATION

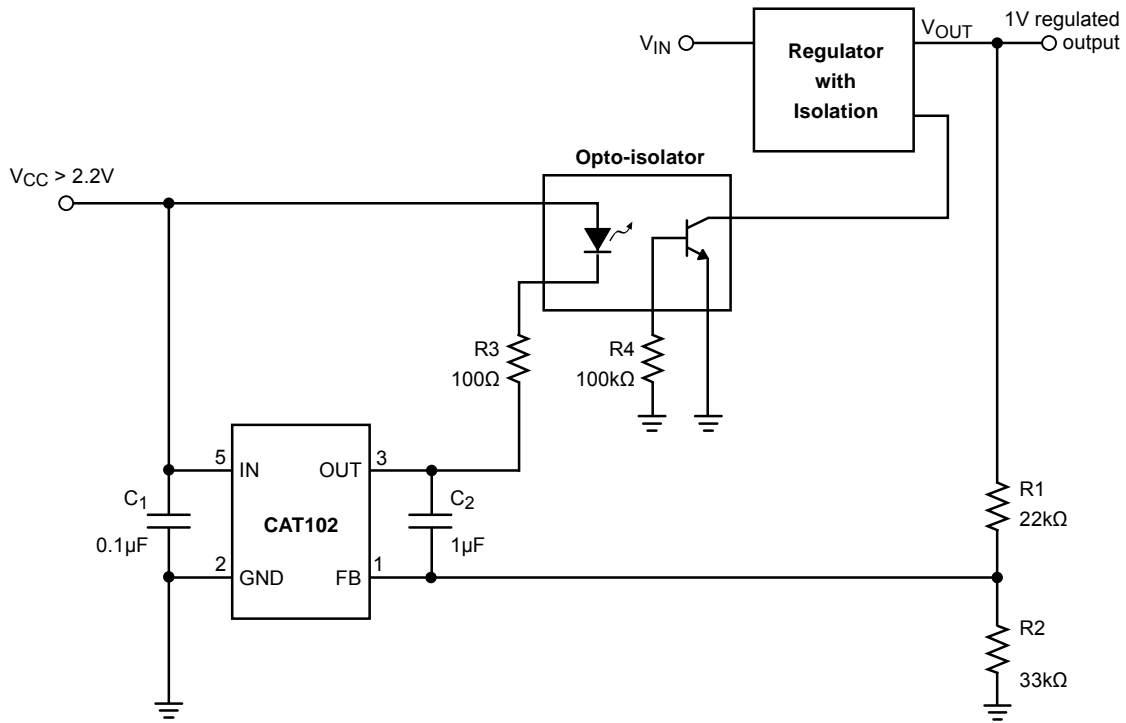
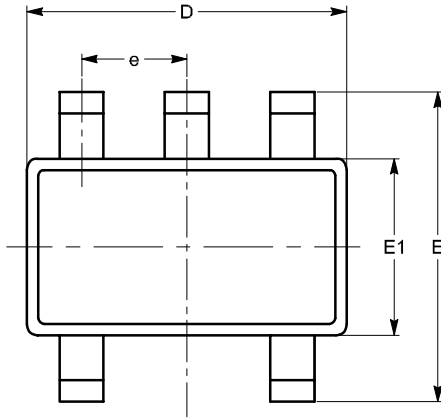


Figure 2. Opto-Feedback Application Circuit

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

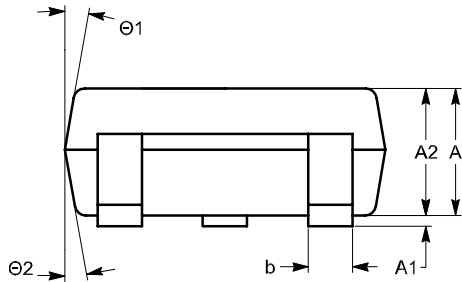
PACKAGE OUTLINES

SOT-23 5 LEAD

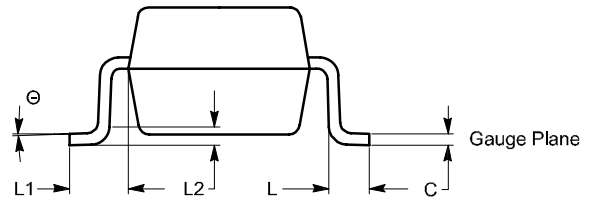


TOP VIEW

SYMBOL	MIN	NOM	MAX
A	1.00	1.15	1.30
A1	0.05		0.15
A2	1.00	1.10	1.20
b	0.35		0.50
C	0.127		
D	2.80	2.90	3.00
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e	0.95 TYP		
L	0.35	0.45	0.55
L1	0.60 REF		
L2	0.20 BSC		
θ	0°		8°
θ_1		10°	
θ_2		10°	



SIDE VIEW



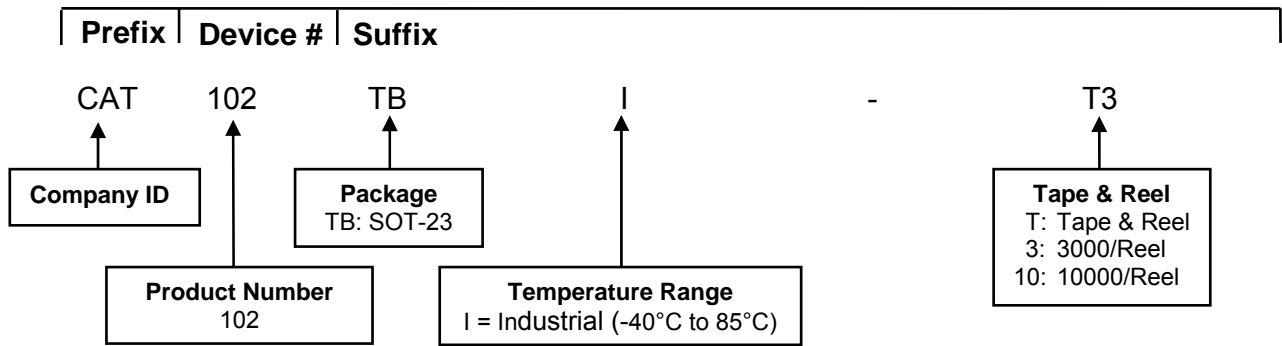
END VIEW

For current Tape and Reel information, download the PDF file from:
<http://www.catsemi.com/documents/tapeandreel.pdf>.

Notes:

- (1) All dimensions in millimeters. Angles in degrees.
- (2) Complies with ANSI Y14.5M.

EXAMPLE OF ORDERING INFORMATION



Notes:

- (1) All packages are RoHS-compliant (Lead-free, Halogen-free)
- (2) The device used in the above example is a CAT102TBI-T3 (SOT-23, Industrial Temperature, Matte-Tin, Tape & Reel)

ORDERING PART NUMBER
CAT102TBI

REVISION HISTORY

Date	Rev.	Reason
01/29/2007	M	Added Ordering Information

Copyrights, Trademarks and Patents

Trademarks and registered trademarks of Catalyst Semiconductor include each of the following:

Beyond Memory™, DPP™, EZDim™, MiniPot™, and Quad-Mode™

Catalyst Semiconductor has been issued U.S. and foreign patents and has patent applications pending that protect its products.

CATALYST SEMICONDUCTOR MAKES NO WARRANTY, REPRESENTATION OR GUARANTEE, EXPRESS OR IMPLIED, REGARDING THE SUITABILITY OF ITS PRODUCTS FOR ANY PARTICULAR PURPOSE, NOR THAT THE USE OF ITS PRODUCTS WILL NOT INFRINGE ITS INTELLECTUAL PROPERTY RIGHTS OR THE RIGHTS OF THIRD PARTIES WITH RESPECT TO ANY PARTICULAR USE OR APPLICATION AND SPECIFICALLY DISCLAIMS ANY AND ALL LIABILITY ARISING OUT OF ANY SUCH USE OR APPLICATION, INCLUDING BUT NOT LIMITED TO, CONSEQUENTIAL OR INCIDENTAL DAMAGES.

Catalyst Semiconductor products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Catalyst Semiconductor product could create a situation where personal injury or death may occur.

Catalyst Semiconductor reserves the right to make changes to or discontinue any product or service described herein without notice. Products with data sheets labeled "Advance Information" or "Preliminary" and other products described herein may not be in production or offered for sale.

Catalyst Semiconductor advises customers to obtain the current version of the relevant product information before placing orders. Circuit diagrams illustrate typical semiconductor applications and may not be complete.



Catalyst Semiconductor, Inc.
Corporate Headquarters
2975 Stender Way
Santa Clara, CA 95054
Phone: 408.542.1000
Fax: 408.542.1200
1Hwww.catsemi.com

Document No: 4007
Revision: M
Issue date: 01/29/07