CP103

Dual OP Amp And Voltage Reference

General Description

The CP103 is a monolithic IC specifically designed to regulate the output current and voltage levels of switching battery chargers and power supplies.

The device contains two Op Amps and a 2.5V precision shunt voltage reference. Op Amp 1 is designed for voltage control with its non-inverting input internally connects to the output of the shunt regulator. Op Amp 2 is for current control with both inputs uncommitted. The IC offers the power converter designer a control solution that features increased precision with a corresponding reduction in system complexity and cost.

The CP103 is available in standard packages of DIP-8 and SOP-8.

Features

Op Amp

- Input Offset Voltage: 0.5mV
- Supply Current: 75μA per Op Amp at 5.0V Supply Voltage
- Unity Gain Bandwidth: 1MHz
- Output Voltage Swing: 0 to (V_{CC} - 1.5) V
- Power Supply Range: 3 to 36V

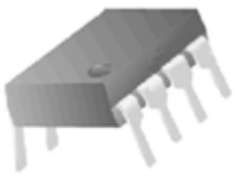
Voltage Reference

- Fixed Output Voltage Reference: 2.5V
- Voltage Tolerance: ± 0.5%, ± 1%
- Sink Current Capability from 0.05 to 80mA
- Typical Output Impedance: 0.2Ω

Applications

- Battery Charger
- Switching Power Supply

SOP-8



DIP-8

Figure 1. Package Types of CP103

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Pin Configuration

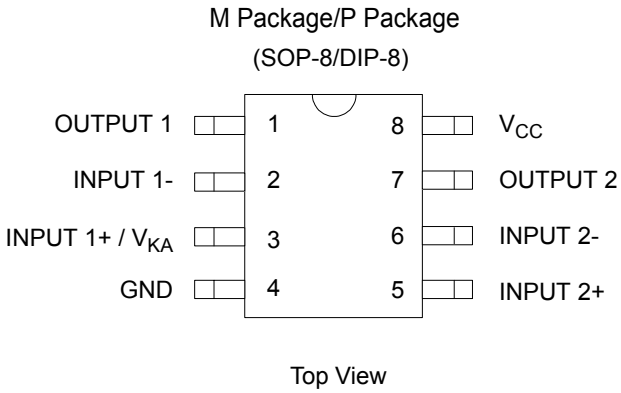

Figure 2. Pin Configuration of CP103

Functional Block Diagram

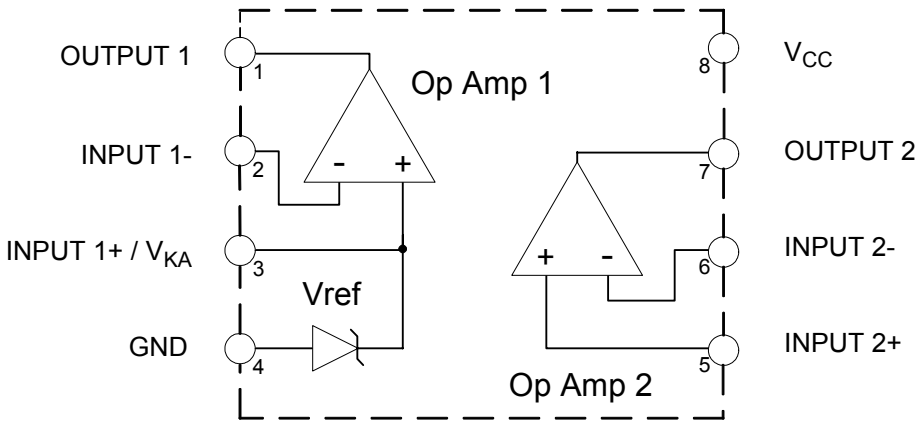

Figure 3. Functional Block Diagram of CP103

Ordering Information

CP103 X X

- Blank: SOP-8, Tube
- A: SOP-8, Taping
- N: DIP-8, Tube

- Blank: V_{REF}±1%
- G: V_{REF}±0.5%

Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value		Unit
Power Supply Voltage (V_{CC} to GND)	V_{CC}	40		V
Op Amp 1 and 2 Input Voltage Range (Pins 2, 5, 6)	V_{IN}	- 0.3 to V_{CC} + 0.3		V
Op Amp 2 Input Differential Voltage (Pins 5, 6)	V_{ID}	40		V
Voltage Reference Cathode Current (Pin 3)	I_K	30		mA
Power Dissipation	P_D	DIP-8	800	mW
		SOP-8	500	
Storage Temperature Range	T_{STG}	-65 to 150		°C
ESD Protection Voltage (Human Body Model)		≥ 2000		V

Note 1: Stresses greater than 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 beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings " for extended periods may affect device reliability.

Recommended Operating Conditions

Parameter	Min	Max	Unit
Supply Voltage	3	36	V
Ambient Temperature	-40	105	°C

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Electrical Characteristics

Operating Conditions: V_{CC} = +5V, T_A= 25°C unless otherwise specified.

Parameter		Conditions		Min	Typ	Max	Unit
Total Supply Current, excluding Current in Voltage Reference		V_{CC} = 5V, no load, -40°C ≤T_A ≤105°C			0.15	0.25	mA
		V_{CC} = 30V, no load, -40°C ≤T_A ≤105°C			0.20	0.30	
Voltage Reference Section							
Reference Voltage	CP103G	I_K = 10mA	T_A = 25°C	2.49	2.50	2.51	V
			-40°C ≤T_A ≤105°C	2.48	2.50	2.52	
	CP103		T_A = 25°C	2.475	2.50	2.525	V
			-40°C ≤T_A ≤105°C	2.45	2.50	2.55	
Reference Voltage Deviation Over Full Temperature Range		I_K = 10mA, T_A = -40 to 105°C			5	24	mV
Minimum Cathode Current for Regulation					0.5	1	mA
Dynamic Impedance		I_K = 1.0 to 80mA, f<1kHz			0.2	0.5	Ω
Op Amp 1 Section (VCC = 5V, VO = 1.4V, TA = 25°C, unless otherwise noted)							
Input Offset Voltage		T_A = 25°C			0.5	3	mV
		T_A = -40 to 105°C				5	
Input Offset Voltage Temperature Drift		T_A = -40 to 105°C				7	μV/°C
Input Bias Current (Inverting Input Only)		T_A = 25°C			20	150	nA
Large Signal Voltage Gain		V_{CC} = 15V, R_L = 2KΩ, V_O = 1.4 to 11.4V		85	100		dB
Power Supply Rejection Ratio		V_{CC} = 5 to 30V		70	90		dB
Output Current	Source	V_{CC} = 15V, V_{ID} = 1V, V_O =2V		20	40		mA
	Sink	V_{CC} = 15V, V_{ID} = -1V, V_O = 2V		7	20		mA
Output Voltage Swing (High)		V_{CC} = 30V, R_L = 10KΩ, V_{ID} = 1V		27	28		V
Output Voltage Swing (Low)		V_{CC} = 30V, R_L = 10KΩ, V_{ID} = -1V			17	100	mV
Slew Rate		V_{CC} = 18V, R_L = 2kΩ, A_V = 1, V_{IN} = 0.5 to 2V, C_L = 100pF		0.2	0.5		V/μ s
Unity Gain Bandwidth		V_{CC} = 30V, R_L = 2kΩ, C_L = 100pF		0.7	1.0		MHz

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Electrical Characteristics (Continued)

Operating Conditions: V_{CC} = +5V, T_A= 25°C unless otherwise specified.

Parameter		Conditions	Min	Typ	Max	Unit
Op Amp 2 Section (VCC = 5V, VO = 1.4V, TA = 25oC, unless otherwise noted)						
Input Offset Voltage		T_A = 25°C		0.5	3	mV
		T_A = -40 to 105°C			5	
Input Offset Voltage Temperature Drift		T_A = -40 to 105°C			7	µV/oC
Input Offset Current		T_A = 25°C		2	30	nA
Input Bias Current		T_A = 25°C		20	150	nA
Input Voltage Range		V_{CC} = 0 to 36V	0		V_{CC} - 1.5	V
Common Mode Rejection Ratio		T_A = 25°C, V_{CM} = 0 to 3.5V	70	85		dB
Large Signal Voltage Gain		V_{CC} = 15V, R_L = 2kΩ, V_O = 1.4 to 11.4V	85	100		dB
Power Supply Rejection Ratio		V_{CC} = 5 to 30V	70	90		dB
Output Current	Source	V_{CC} = 15V, V_{ID} = 1V, V_O = 2V	20	40		mA
	Sink	V_{CC} = 15V, V_{ID} = -1V, V_O = 2V	7	20		mA
Output Voltage Swing (High)		V_{CC} = 30V, R_L = 10kΩ, V_{ID} = 1V	27	28		V
Output Voltage Swing (Low)		V_{CC} = 30V, R_L = 10kΩ, V_{ID} = -1V		17	100	mV
Slew Rate		V_{CC} = 18V, R_L = 2kΩ, A_V = 1, V_{IN} = 0.5 to 2V, C_L = 100pF	0.2	0.5		V/µ s
Unity Gain Bandwidth		V_{CC} = 30V, R_L = 2kΩ, C_L = 100pF	0.7	1.0		MHz

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Typical Performance Characteristics

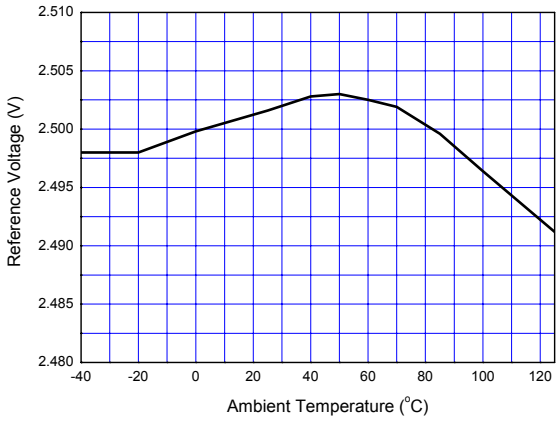

Figure 4. Reference Voltage vs. Ambient Temperature

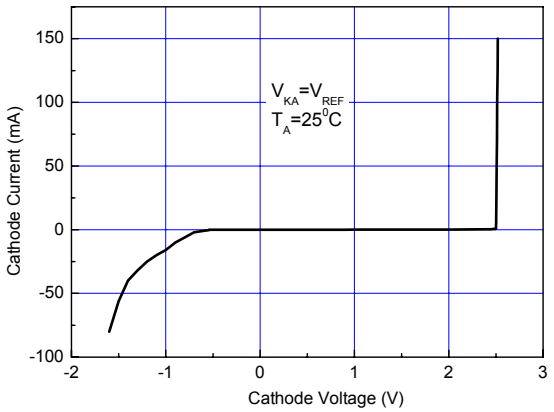

Figure 5. Cathode Current vs. Cathode Voltage

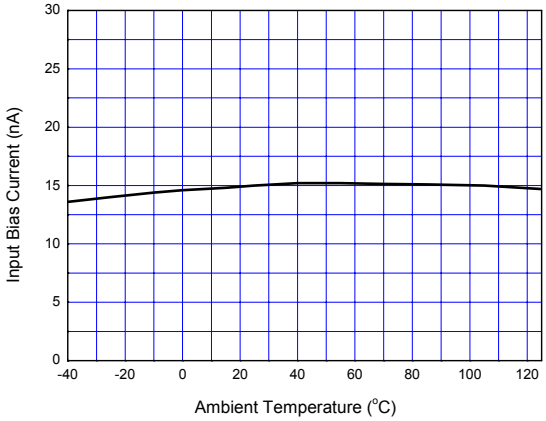

Figure 6. Input Bias Current vs. Ambient Temperature

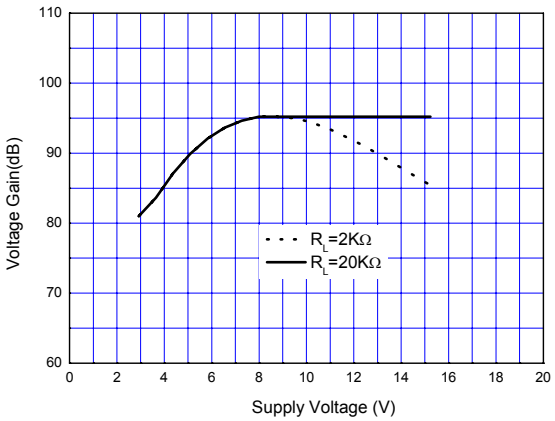

Figure 7. Op Amp Voltage Gain

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Typical Application

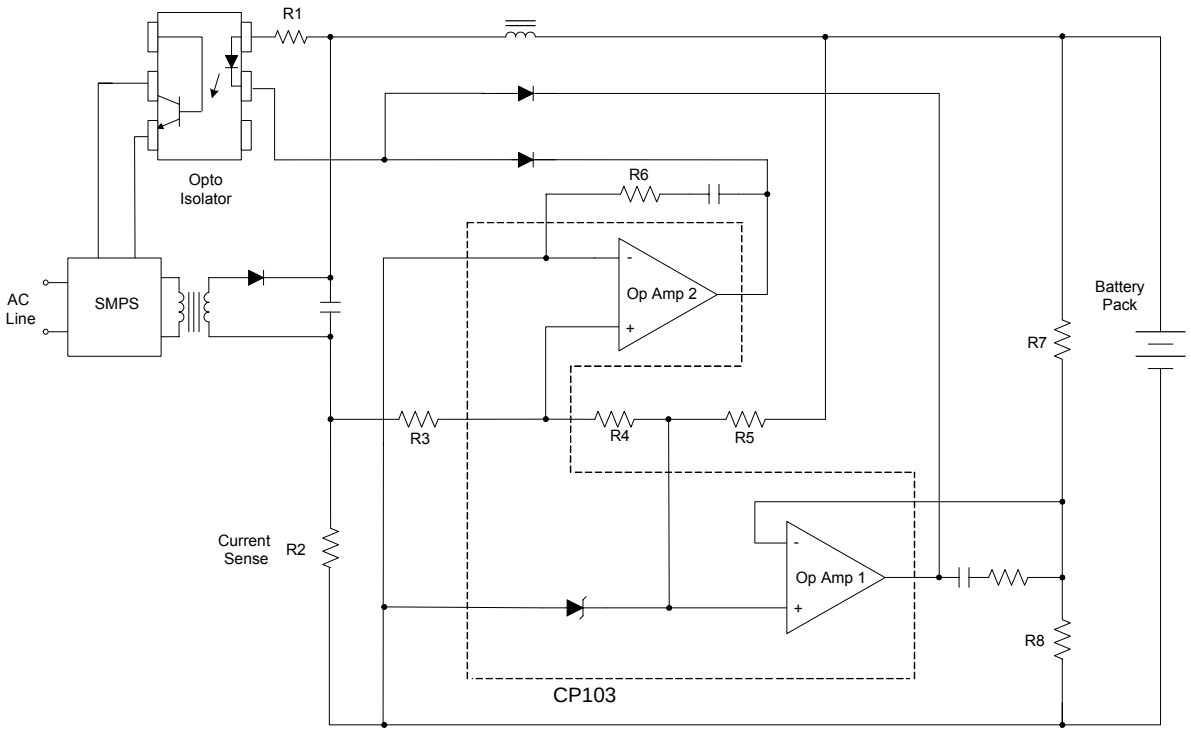
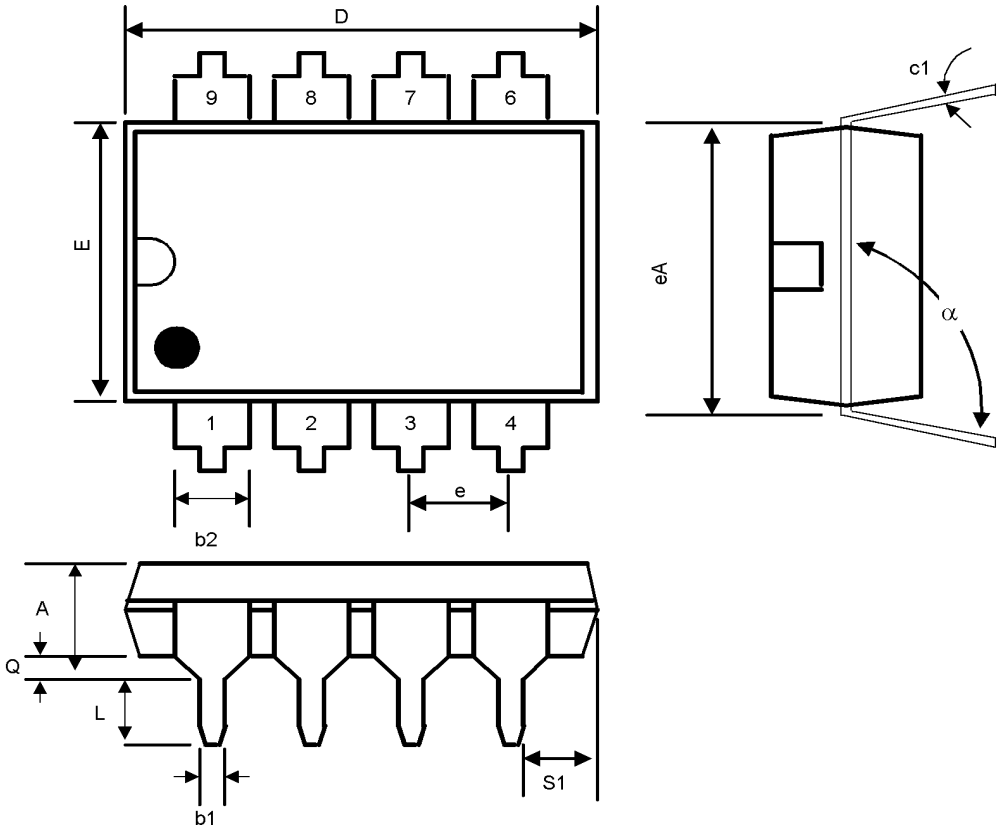


Figure 8. Application of CP103 in a Constant Current and Constant Voltage Charger

Mechanical Dimensions:

DIP-8 **Unit: mm**



SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	-	0.200	-	5.08	-
b1	0.014	0.023	0.36	0.58	-
b2	0.045	0.065	1.14	1.65	-
c1	0.008	0.015	0.20	0.38	-
D	0.355	0.400	9.02	10.16	-
E	0.220	0.310	5.59	7.87	-
e	0.100 BSC		2.54 BSC		-
eA	0.300 BSC		7.62 BSC		
L	0.125	0.200	3.18	5.08	-
Q	0.015	0.060	0.38	1.52	-
s1	0.005	-	0.13	-	-
α	90^0	105^0	90^0	105^0	-

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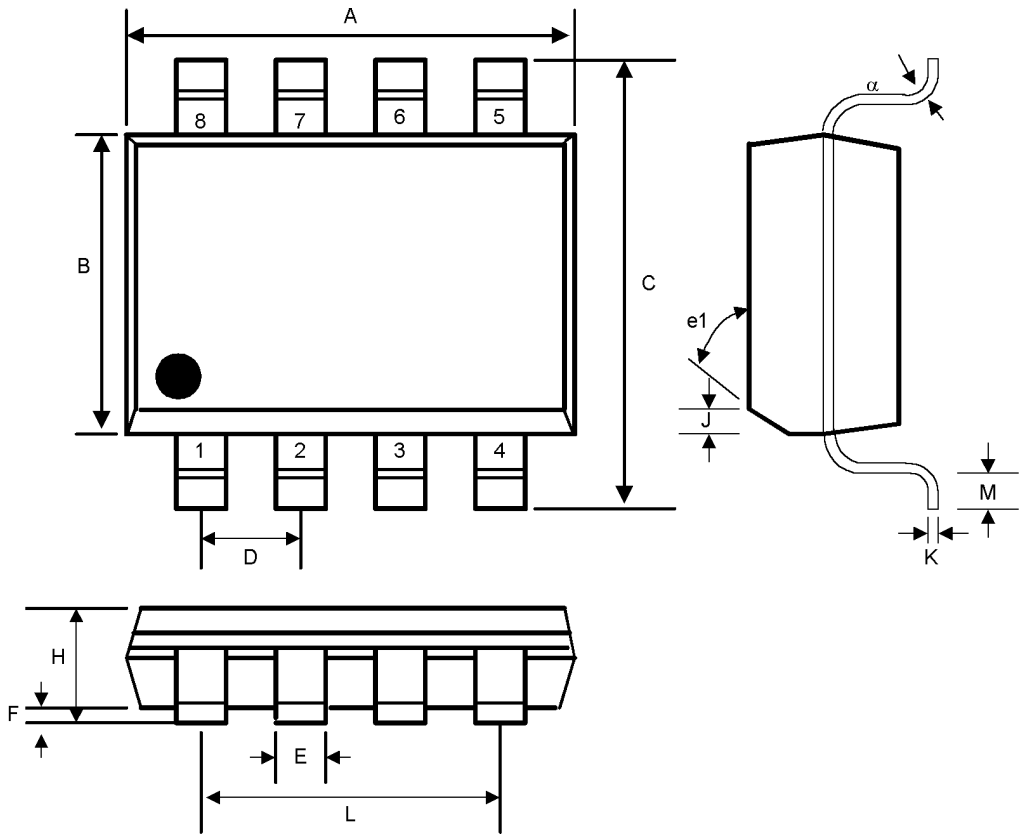
Mechanical Dimensions (Continued):

SOP-8 **Unit: mm**



SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.188	0.197	4.80	5.00	-
B	0.149	0.158	3.80	4.00	-
C	0.228	0.244	5.80	6.20	-
D	0.050 BSC		1.27 BSC		-
E	0.013	0.020	0.33	0.51	-
F	0.004	0.010	0.10	0.25	-
H	0.053	0.069	1.35	1.75	-
J	0.011	0.019	0.28	0.48	
K	0.007	0.010	0.19	0.25	-
M	0.016	0.050	0.40	1.27	
L	0.150 REF		3.81 REF		-
e1	45^0		45^0		-
α	0^0	8^0	0^0	8^0	-

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