

Dual Operational Amplifiers and Voltage Reference

DESCRIPTION

The TS103 is a monolithic IC specifically designed to control the output current and voltage levels of switch mode battery chargers and power supplies. The device contains two operational amplifiers and a precision shunt regulator. OP AMP 1 is designed for voltage control, whose 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.

FEATURES

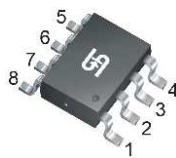
- Input Offset Voltage: 0.5mV
- Supply Current: 250μA per OP AMP @ 5V
- Unity Gain Bandwidth: 1MHz
- Output Voltage Swing: 0~($V_{CC} - 1.5$) V
- Power Supply Voltage: 3~18V
- Fixed Output Voltage Reference: $2.5V \pm 1\%$
- Sink Current Capability from 0.2~80mA
- Compliant to RoHS Directive 2011/65/EU and in accordance to WEEE 2002/96/EC.
- Halogen-free according to IEC 61249-2-21

APPLICATION

- Battery chargers
- Switch-Mode Power Supplies
- Linear voltage regulation



SOP-8

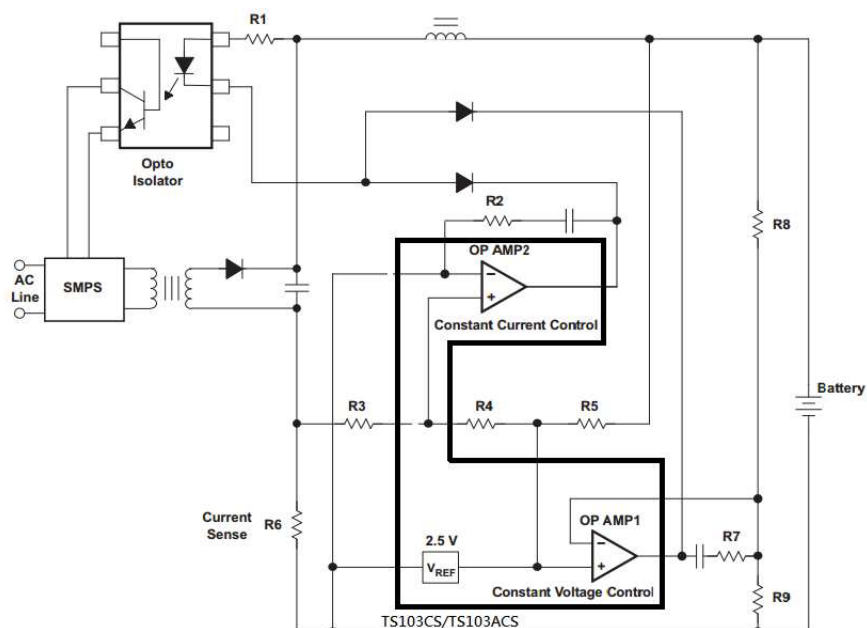


Pin Definition:

- | | |
|---------------------------|----------------|
| 1. Output A | 8. V_{CC} |
| 2. Input A (-) | 7. Output B |
| 3. Input A (+) / V_{KA} | 6. Input B (-) |
| 4. GND | 5. Input B (+) |

Note: MSL 3 (Moisture Sensitivity Level) per J-STD-020

TYPICAL APPLICATION CIRCUIT



ABSOLUTE MAXIMUM RATINGS (Note 1)

PARAMETER	SYMBOL	LIMIT	UNIT
Power Supply Voltage (V_{CC} to GND)	V_{CC}	20	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}	20	V
Voltage Reference Cathode Current (Pin 3)	I_K	100	mA
Power Dissipation	P_D	500	mW
Storage Temperature Range	T_{STG}	-65 to 150	°C
ESD Protection Voltage (Machine Model)	--	≥200	V

RECOMMENDED OPERATING CONDITIONS (Note 3)

PARAMETER	SYMBOL	CONDITIONS	UNIT
Supply Voltage	V_{CC}	3 ~ 18	V
Operating Ambient Temperature Range	T_{OPA}	-40 to +85	°C

ELECTRICAL SPECIFICATIONS ($V_{CC} = 18V$, $T_A = 25^\circ C$ unless otherwise noted)

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNIT
Total Supply Current, excluding Current in Voltage Reference		V _{CC} = 5V, no load, -40°C ≤ T _A ≤ 85°C	--	0.5	0.8	mA
		V _{CC} = 18V, no load, -40°C ≤ T _A ≤ 85°C	--	0.6	1.2	
Voltage Reference Section						
Reference Voltage	TS103	I _{KA} = 10mA	2.475	2.500	2.525	V
		I _{KA} = 10mA @ -40°C ≤ T _A ≤ 85°C	2.45	2.500	2.55	
	TS103A	I _{KA} = 10mA	2.490	2.500	2.510	
		I _{KA} = 10mA @ -40°C ≤ T _A ≤ 85°C	2.475	2.500	2.525	
Reference Voltage Deviation Over Full Temperature Range		I _{KA} = 10mA, T _A = -40 to 85°C	-- --	5 5	24 17	mV
Minimum Cathode Current for Regulation			--	0.2	1.0	mA
Dynamic Impedance		V _{CC} = 1.0 to 80mA, f<1kHz		0.3	0.5	Ω
OP AMP 1 Section (V _{CC} = 5V, V _O = 1.4V, T _A = 25°C, unless otherwise noted)						
Input Offset Voltage		T _A = 25°C (TS103)	--	0.5	3	mV
		T _A = 25°C (TS103A)	--	0.5	2	
		T _A = -40 to 85°C	--	--	5	
Input Offset Voltage Temperature Drift		T _A = -40 to 85°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

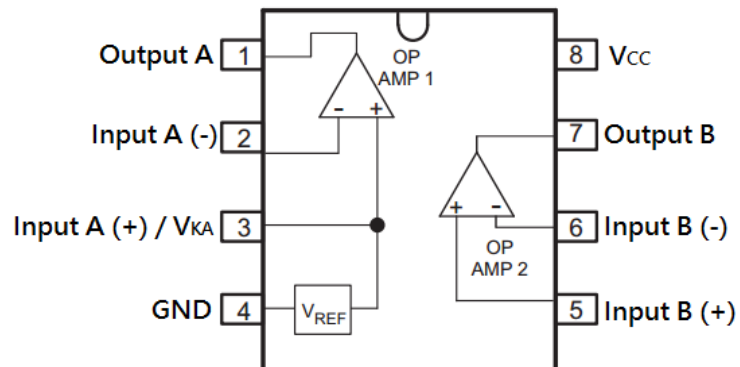
ELECTRICAL SPECIFICATIONS ($V_{CC} = 18V$, $T_A = 25^\circ C$ unless otherwise noted)

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNIT
Power Supply Rejection Ratio		$V_{CC} = 5 \text{ to } 18V$	70	90	--	dB
Output Current	Source	$V_{CC} = 15V$, $V_{ID} = 1V$, $V_O = 2V$	20	40	--	mA
	Sink	$V_{CC} = 15V$, $V_{ID} = -1V$, $V_O = 2V$	10	20	--	mA
Output Voltage Swing (High)		$V_{CC} = 18V$, $R_L = 10k\Omega$, $V_{ID} = 1V$	16	16.5	--	V
Output Voltage Swing (Low)		$V_{CC} = 18V$, $R_L = 10k\Omega$, $V_{ID} = -1V$	--	17	100	mV
Slew Rate		$V_{CC} = 18V$, $R_L = 2k\Omega$, $A_V = 1$, $V_{IN} = 0.5 \text{ to } 2V$, $C_L = 100pF$	0.2	0.5	--	V/ μs
Gain Bandwidth Product		$V_{CC} = 18V$, $R_L = 2k\Omega$, $C_L = 100pF$ $V_{IN} = 10mV$, $f = 100kHz$	0.5	1	--	MHz
OP AMP 2 Section ($V_{CC} = 5V$, $V_O = 1.4V$, $T_A = 25^\circ C$, unless otherwise noted)						
Input Offset Voltage	$T_A = 25^\circ C$ (TS103)		--	0.5	3	mV
	$T_A = 25^\circ C$ (TS103A)		--	0.5	2	
	$T_A = -40 \text{ to } 85^\circ C$		--	--	5	
Input Offset Voltage Temperature Drift		$T_A = -40 \text{ to } 85^\circ C$	--	7	--	$\mu V/^\circ C$
Input Bias Current		$T_A = 25^\circ C$	--	20	150	nA
Input Voltage Range		$V_{CC} = 0 \sim 18V$	0	00	$V_{CC} - 1.5$	V
Large Signal Voltage Gain		$V_{CC} = 15V$, $R_L = 2k\Omega$, $V_O = 1.4 \text{ to } 11.4V$	85	100	--	dB
Power Supply Rejection Ratio		$V_{CC} = 5 \text{ to } 18V$	70	90	--	dB
Output Current	Source	$V_{CC} = 15V$, $V_{ID} = 1V$, $V_O = 2V$	20	40	--	mA
	Sink	$V_{CC} = 15V$, $V_{ID} = -1V$, $V_O = 2V$	10	20	--	mA
Output Voltage Swing (High)		$V_{CC} = 18V$, $R_L = 10k\Omega$, $V_{ID} = 1V$	16	16.5	--	V
Output Voltage Swing (Low)		$V_{CC} = 18V$, $R_L = 10k\Omega$, $V_{ID} = -1V$	--	17	100	mV
Slew Rate		$V_{CC} = 18V$, $R_L = 2k\Omega$, $A_V = 1$, $V_{IN} = 0.5 \text{ to } 2V$, $C_L = 100pF$	0.2	0.5	--	V/ μs
Gain Bandwidth Product		$V_{CC} = 18V$, $R_L = 2k\Omega$, $C_L = 100pF$ $V_{IN} = 10mV$, $f = 100kHz$	0.5	1	--	MHz

ORDERING INFORMATION

PART NO.	PACKAGE	PACKING
TS103CS RLG	SOP-8	2,500pcs / 13"Reel
TS103ACS RLG	SOP-8	2,500pcs / 13"Reel

BLOCK DIAGRAM

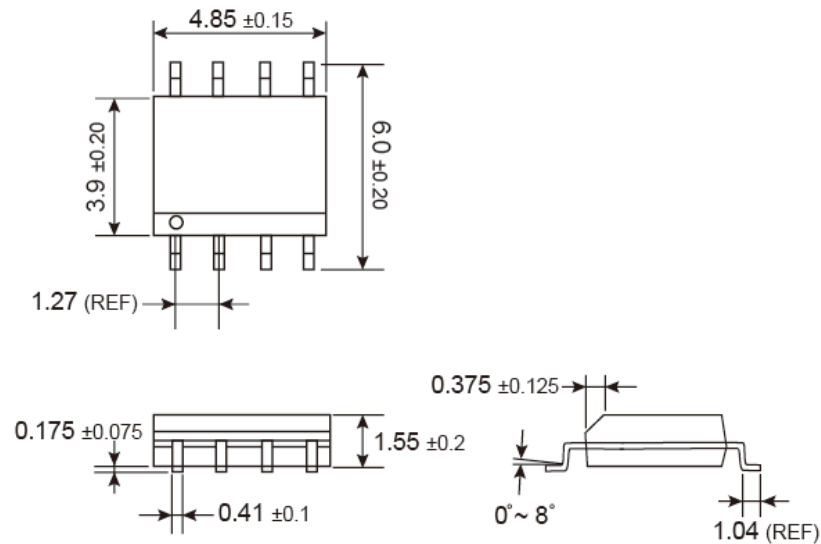


PIN DESCRIPTION

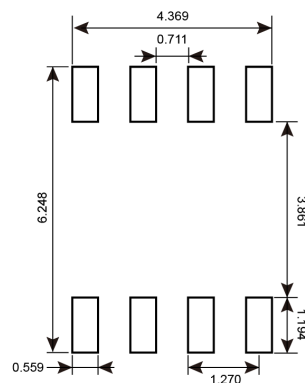
PIN NO.	NAME	FUNCTION
1	Output A	OP AMP 1 output
2	Input A (-)	OP AMP 1 inverting input
3	Input A (+) / V_{KA}	OP AMP 1 non-inverting input and shunt reference cathode terminal
4	GND	Negative supply voltage
5	Input B (+)	OP AMP 2 output
6	Input B (-)	OP AMP 2 non-inverting input
7	Output B	OP AMP 2 output
8	V_{CC}	Positive supply voltage

PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

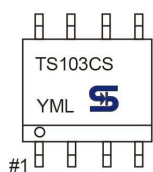
SOP-8



SUGGESTED PAD LAYOUT (Unit: Millimeters)



MARKING DIAGRAM



Y = Year Code

M = Month Code for Halogen Free Product

O =Jan **P** =Feb **Q** =Mar **R** =Apr

S =May **T** =Jun **U** =Jul **V** =Aug

W =Sep **X** =Oct **Y** =Nov **Z** =Dec

L = Lot Code (1~9, A~Z)

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