

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±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

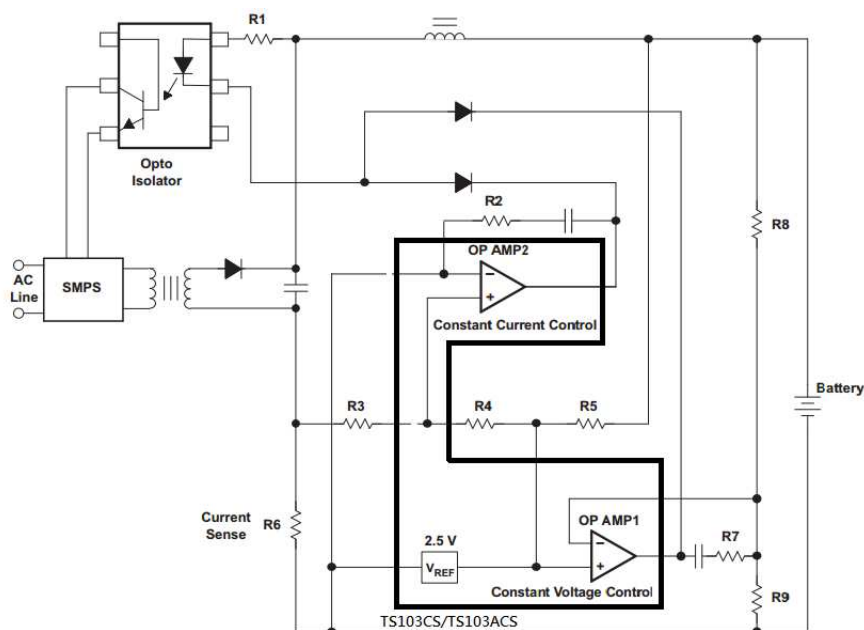


Pin Definition:

- | | |
|----------------------------------|--------------------|
| 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

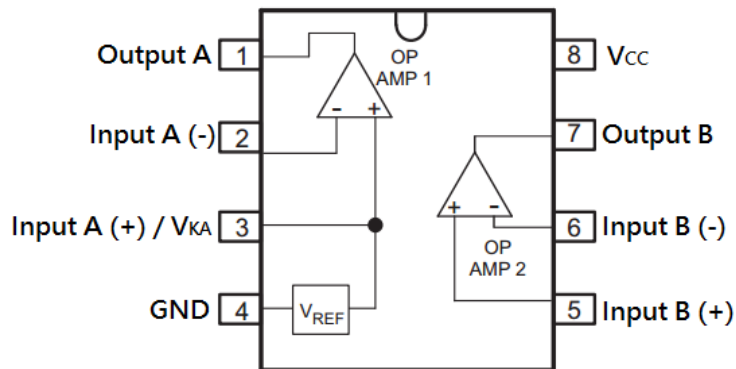
ELECTRICAL SPECIFICATIONS ($V_{CC} = 18V$, $T_A = 25^\circ C$ unless otherwise noted)						
PARAMETER	CONDITIONS		MIN	TYP	MAX	UNIT
Total Supply Current, excluding Current in Voltage Reference	$V_{CC} = 5V$, no load, $-40^\circ C \leq T_A \leq 85^\circ C$		--	0.5	0.8	mA
	$V_{CC} = 18V$, no load, $-40^\circ C \leq T_A \leq 85^\circ C$		--	0.6	1.2	
Voltage Reference Section						
Reference Voltage	TS103	$I_{KA} = 10mA$	2.475	2.500	2.525	V
		$I_{KA} = 10mA @ -40^\circ C \leq T_A \leq 85^\circ C$	2.45	2.500	2.55	
	TS103A	$I_{KA} = 10mA$	2.490	2.500	2.510	
		$I_{KA} = 10mA @ -40^\circ C \leq T_A \leq 85^\circ C$	2.475	2.500	2.525	
Reference Voltage Deviation Over Full Temperature Range	$I_{KA} = 10mA$, $T_A = -40$ to $85^\circ C$		--	5	24	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 ($V_{CC} = 5V$, $V_O = 1.4V$, $T_A = 25^\circ C$, 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	
	$T_A = -40$ to $85^\circ C$		--	--	5	
Input Offset Voltage Temperature Drift	$T_A = -40$ to $85^\circ C$		--	7	--	$\mu V/^\circ C$
Input Bias Current (Inverting Input Only)	$T_A = 25^\circ C$		--	20	150	nA
Large Signal Voltage Gain	$V_{CC} = 15V$, $R_L = 2k\Omega$, $V_O = 1.4$ 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	$V_{CC} = 5$ 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	$V_{CC} = 18V, R_L = 2k\Omega, A_V = 1,$ $V_{IN} = 0.5$ 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	
	$T_A = -40$ to $85^\circ C$		--	--	5	
Input Offset Voltage Temperature Drift	$T_A = -40$ 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	$V_{CC} = 15V, R_L = 2k\Omega,$ $V_O = 1.4$ to 11.4V		85	100	--	dB
Power Supply Rejection Ratio	$V_{CC} = 5$ 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	$V_{CC} = 18V, R_L = 2k\Omega, A_V = 1,$ $V_{IN} = 0.5$ 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

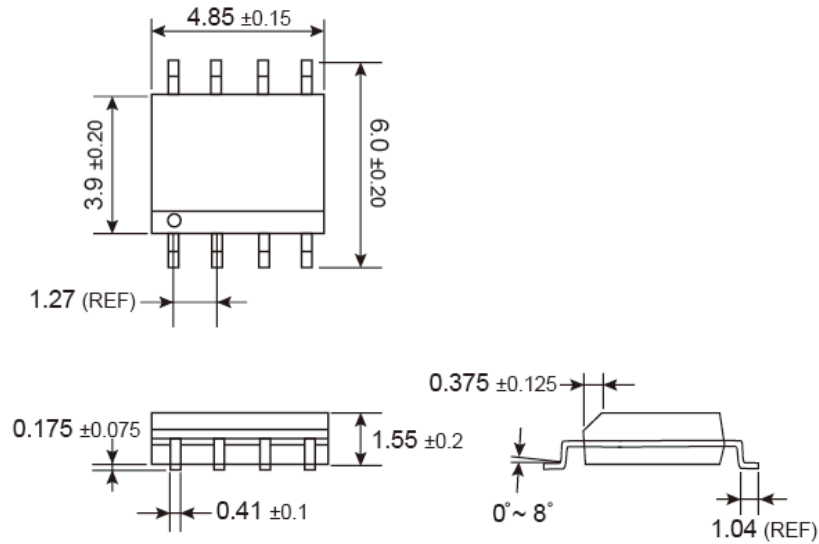


PIN DESCRIPTION

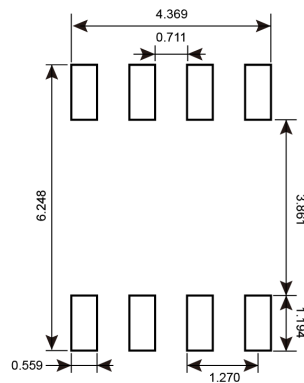
PIN NO.	NAME	FUNCTION
1	Output A	OP AMP 1 output
2	Input A (-)	OP AMP 1 inverting input
3	Input A (+) / V_{KA}	OP AMP 1 non-inverting input and shunt reference cathode terminal
4	GND	Negative supply voltage
5	Input B (+)	OP AMP 2 output
6	Input B (-)	OP AMP 2 non-inverting input
7	Output B	OP AMP 2 output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

PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

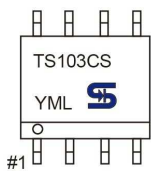
SOP-8



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)

Notice

Specifications of the products displayed herein are subject to change without notice. TSC or anyone on its behalf, assumes no responsibility or liability for any errors or inaccuracies.

Information contained herein is intended to provide a product description only. No license, express or implied, to any intellectual property rights is granted by this document. Except as provided in TSC's terms and conditions of sale for such products, TSC assumes no liability whatsoever, and disclaims any express or implied warranty, relating to sale and/or use of TSC products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright, or other intellectual property right.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify TSC for any damages resulting from such improper use or sale.