TSM103/A

DUAL OPERATIONAL AMPLIFIER AND VOLTAGE REFERENCE

NOT FOR NEW DESIGN - REPLACED BY TSM103W

OPERATIONAL AMPLIFIER

- LOW INPUT OFFSET VOLTAGE : 0.5mV typ.for TSM103A
- LOW SUPPLY CURRENT : 350µA/op. (@ V_{CC} = 5V)
- MEDIUM BANDWIDTH (unity gain) : 0.9MHz
- LARGE OUTPUT VOLTAGE SWING : 0V to (V_{CC} - 1.5V)
- INPUT COMMON MODE VOLTAGE RANGE INCLUDES GROUND
- WIDE POWER SUPPLY RANGE : 3 to 32V ±1.5 TO ±16V

VOLTAGE REFERENCE

- FIXED OUTPUT VOLTAGE REFERENCE 2.5V
- 0.4% AND 1% VOLTAGE PRECISION
- SINK CURRENT CAPABILITY : 1 to 100mA
- TYPICAL OUTPUT IMPEDANCE : 0.2Ω

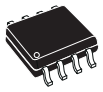
DESCRIPTION

The TSM103 is a monolithic IC that includes one independent op-amp and another op-amp for which the non inverting input is wired to a 2.5V fixed Voltage Reference. This device is offering space and cost saving in many applications like power supply management or data acquisition systems.

ORDER CODE

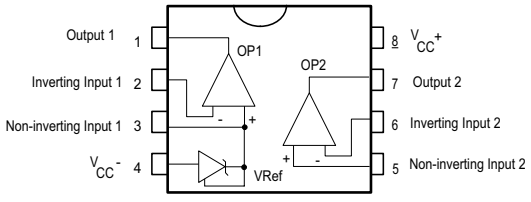
Part Number	Temperature Range	Package
		D
TSM103I/AI	-40°C, +105°C	•

D = Small Outline Package (SO) - also available in Tape & Reel (DT)



D
SO8
(Plastic Micropackage)

PIN CONNECTIONS (top view)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	36	V
V_{id}	Differential Input Voltage	36	V
V_i	Input Voltage	-03. to +36	V
T_{oper}	Operating Free-air Temperature Range	-55 to +125	°C
T_j	Maximum Junction Temperature	150	°C
R_{thja}	Thermal Resistance Junction to Ambient (SO package)	175	°C/W

ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Min.	Typ.	Max.	Unit
I_{CC}	Total Supply Current, excluding Current in the Voltage Reference VCC+ = 5V, no load Tmin. < Tamb < Tmax. VCC+ = 30V, no load Tmin. < Tamb < Tmax		0.7	1.2 2	mA

OPERATOR 2 (independent op-amp)
V_{CC}^+ = +5V, V_{CC} = Ground, V_o = 1.4V,T_{amb} = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage TSM103, T_{amb} = 25°C $T_{min.} \le T_{amb} \le T_{max.}$ TSM103A, T_{amb} = 25°C $T_{min.} \le T_{amb} \le T_{max.}$		 1 0.5	 4 5 2 3	mV
DV_{io}	Input Offset Voltage Drift		7		µV/°C
I_{io}	Input Offset Current $T_{min.} \le T_{amb} \le T_{max.}$		2	30 50	nA
I_{ib}	Input Bias Current $T_{min.} \le T_{amb} \le T_{max}$		20	150 200	nA
Avd	Large Signal Voltage Gain V_{CC} = 15V, R_L = 2k, Vo = 1.4V to 11.4V $T_{min.} \le T_{amb} \le T_{max.}$	 50 25	 100		V/mV
SVR	Supply Voltage Rejection Ratio V_{CC} = 5V to 30V	 65	 100		dB
Vicm	Input Common Mode Voltage Range V_{CC} = +30V - see note [1] $T_{min.} \le T_{amb} \le T_{max.}$	 0 0		 (V_{CC}+) -1.5 (V_{CC}^+) -2	V
CMR	Common Mode Rejection Ratio $T_{min.} \le T_{amb} \le T_{max.}$	70 60	85		dB
I_{source}	Output Current Source V_{CC} = +15V, Vo = 2V, V_{id} = +1V	 20	 40		mA
I_o	Short Circuit to Ground V_{CC} = +15V		 40	 60	mA
I_{sink}	Output Current Sink V_{id} = -1V, V_{CC} = +15V, V_o = 2V	 10	 20		mA
V_{OH}	High Level Output Voltage V_{CC}^+ = 30V T_{amb} = 25°C, R_L = 10k $T_{min.} \le T_{amb} \le T_{max.}$	 27 27	 28		V
V_{OL}	Low Level Output Voltage R_L = 10k $T_{min.} \le T_{amb} \le T_{max.}$		 5	 20 20	mV
SR	Slew Rate at Unity Gain V_i = 0.5 to 3V, V_{CC} = 15V R_L = 2k, C_L = 100pF, unity gain	 0.2	 0.4		V/µs
GBP	Gain Bandwidth Product V_{CC} = 30V,R_L = 2k, C_L = 100pF f = 100kHz, V_{in} = 10mV	 0.5	 0.9		MHz
THD	Total Harmonic Distortion f = 1kHz A_V = 20dB,R_L = 2k, V_{CC} = 30V C_L = 100pF, V_o = $2V_{pp}$		 0.02		%

1. The input common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is V_{CC}^+ - 1.5V.
But either of both inputs can go to +36V without damage.

OPERATOR 1 (op-amp with non-inverting input connected to the internal Vref)
V_{CC}^+ = +5V, V_{CC}^- = Ground, T_{amb} = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage V_{icm} = 0V TSM103, T_{amb} = 25°C $T_{min.} \le T_{amb} \le T_{max.}$ TSM103A, T_{amb} = 25°C $T_{min.} \le T_{amb} \le T_{max.}$		 1 0.5	 4 5 2 3	mV
DV_{io}	Input Offset Voltage Drift		7		µV/°C
I_{ib}	Input Bias Current negative input		 20		nA
Avd	Large Signal Voltage Gain V_{icm} = 0V V_{CC} = 15V, R_L = 2k		 100		V/mV
SVR	Supply Voltage Rejection Ratio V_{icm} = 0V V_{CC}^+ = 5V to 30V	 65	 100		dB
I_{source}	Output Current Source V_o = 2V V_{CC} = +15V, V_{id} = +1V	 20	 40		mA
I_o	Short Circuit to Ground V_{CC} = +15V		 40	 60	mA
I_{sink}	Output Current Sink V_{id} = -1V, V_{CC} = +15V, V_o = 2V	 10	 20		mA
V_{OH}	High Level Output Voltage V_{CC}^+ = 30V T_{amb} = 25°C, R_L = 10k $T_{min.} \le T_{amb} \le T_{max.}$	 27 27	 28		V
V_{OL}	Low Level Output Voltage R_L = 10k $T_{min.} \le T_{amb} \le T_{max.}$		 5	 20 20	mV
SR	Slew Rate at Unity Gain V_i = 0.5 to 2V, V_{CC} = 15V R_L = 2k, C_L = 100pF, unity gain	0.2	0.4		V/µs
GBP	Gain Bandwidth Product V_{CC} = 30V,R_L = 2k, C_L = 100pF f = 100kHz, V_{in} = 10mV	0.5	0.9		MHz
THD	Total Harmonic Distortion f = 1kHz A_V = 20dB,R_L = 2k, V_{CC} = 30V C_L = 100pF, V_o = $2V_{pp}$		 0.02		%

VOLTAGE REFERENCE

Symbol	Parameter	Value	Unit
I_k	Cathode Current	1 to 100	mA

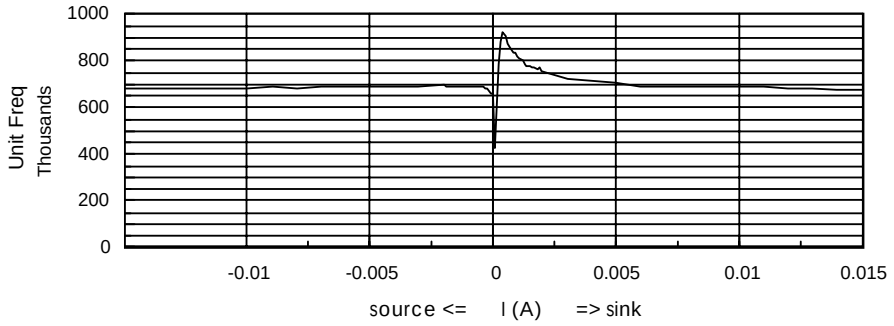
Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{ref}	Reference Input Voltage TSM103, T_{amb} = 25°C $T_{min.} \le T_{amb} \le T_{max.}$ TSM103A, T_{amb} = 25°C $T_{min.} \le T_{amb} \le T_{max.}$	 2.475 2.45 2.49 2.48	 2.5 2.5	 2.525 2.55 2.51 2.52	V
ΔV_{ref}	Reference Input Voltage Deviation Over Temperature Range $V_{KA} = V_{ref}$; I_k = 10mA $T_{min.} \le T_{amb} \le T_{max.}$		 7	 30	mV
I_{min}	Minimum Cathode Current for Regulation $V_{KA} = V_{ref}$		 0.5	 1	mA
$\|Z_{KA}\|$	Dynamic Impedance - note 1) $V_{KA} = V_{ref}$, ΔI_K = 1 to 100mA, f < 1kHz		0.2	0.5	Ω

1. The dynamic impedance is defined as $[Z_{KA}| = \Delta V_{KA}/\Delta I_K$

OPERATIONAL AMPLIFIERS

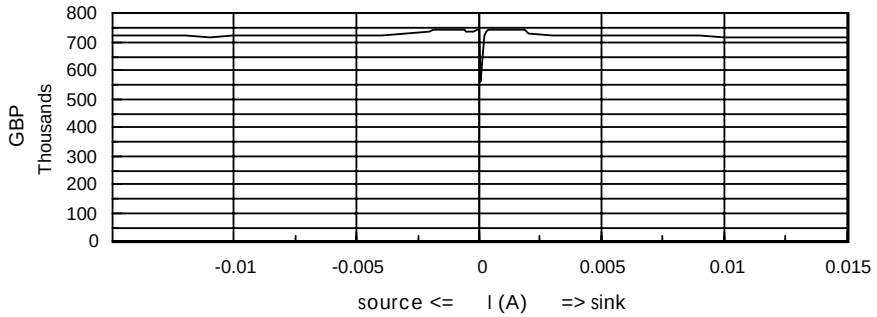
Unit Frequency = F(I)

Vcc=+/-15V, RL=2k, CL=100pF



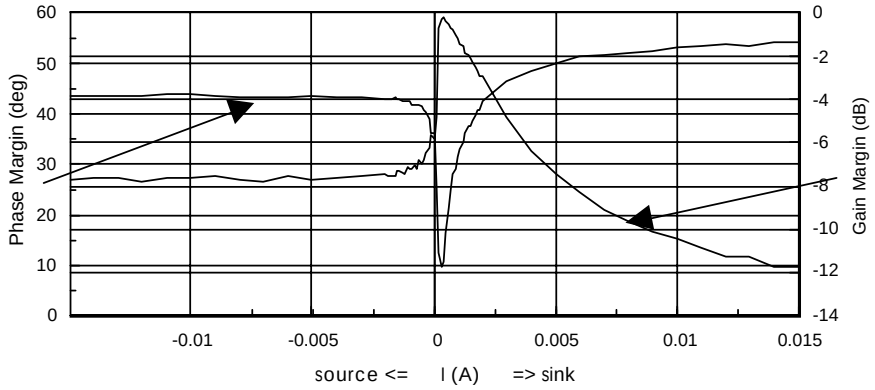
GBP = F(I)

Vcc=+/-15V, RL=2k, CL=100pF

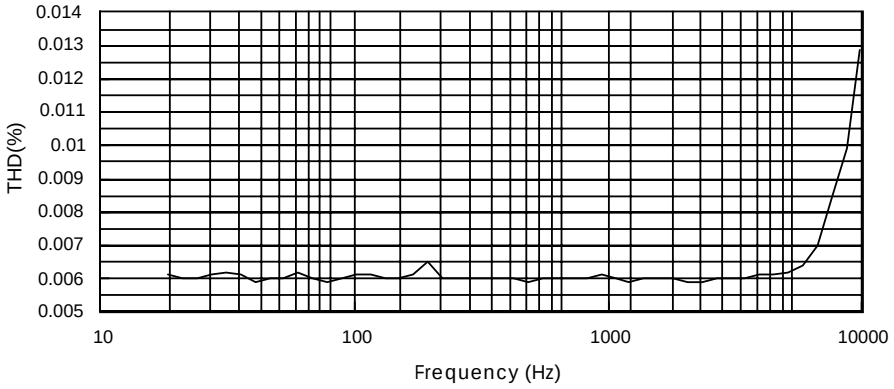


Phase and Gain Margin = F(I)

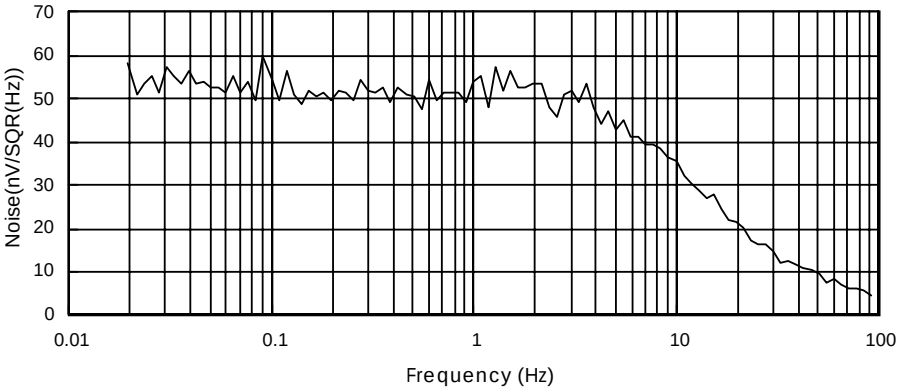
Vcc=+/-15V, RL=2k, CL=100pF



Total Harmonic Distorsion THD = F(freq)

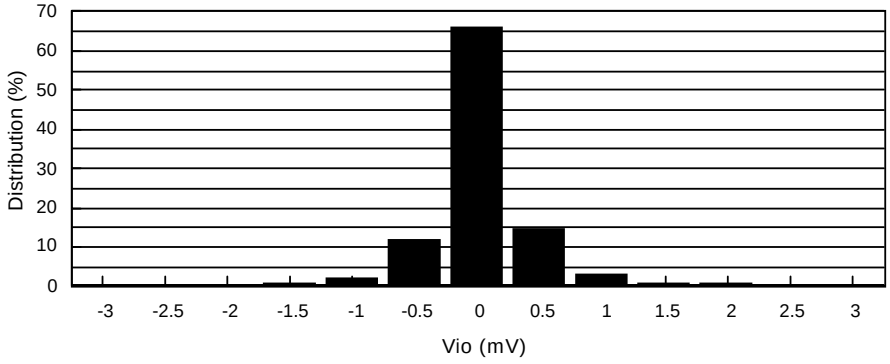


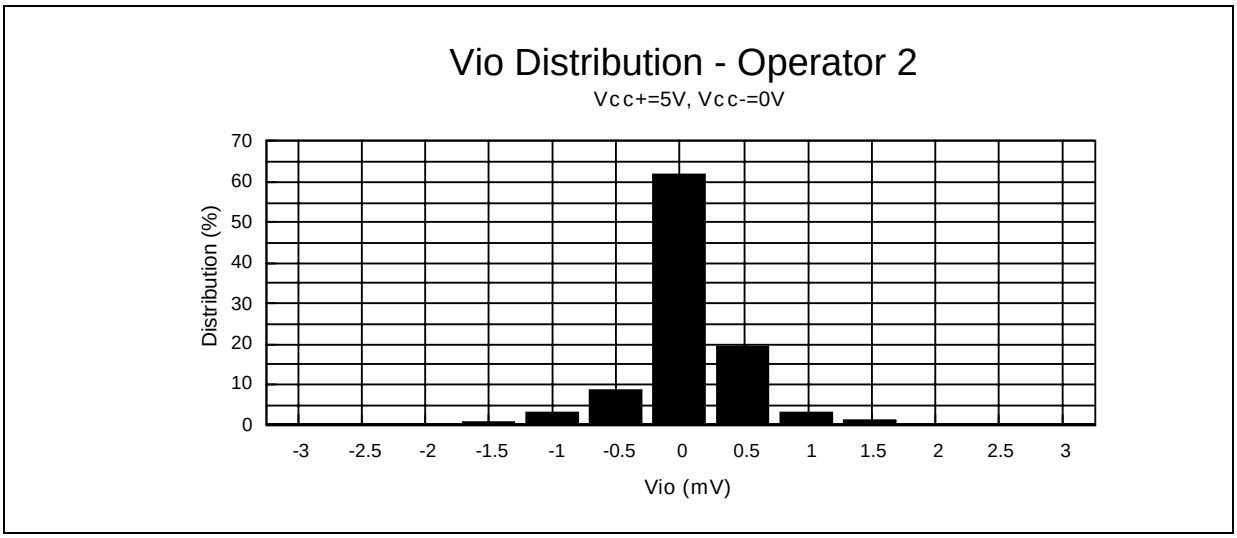
Noise = F(frequency)

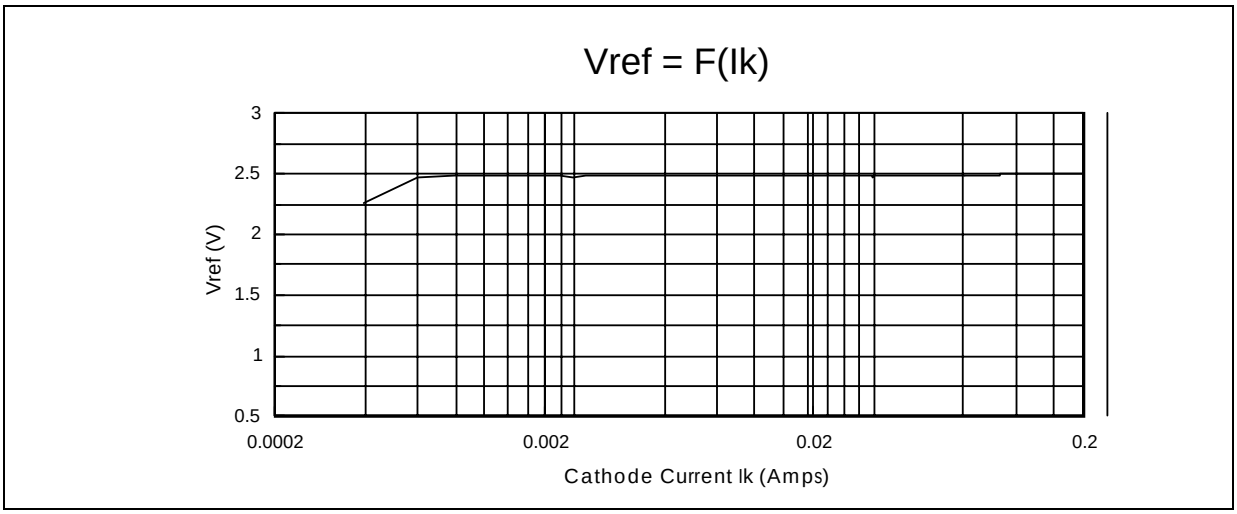


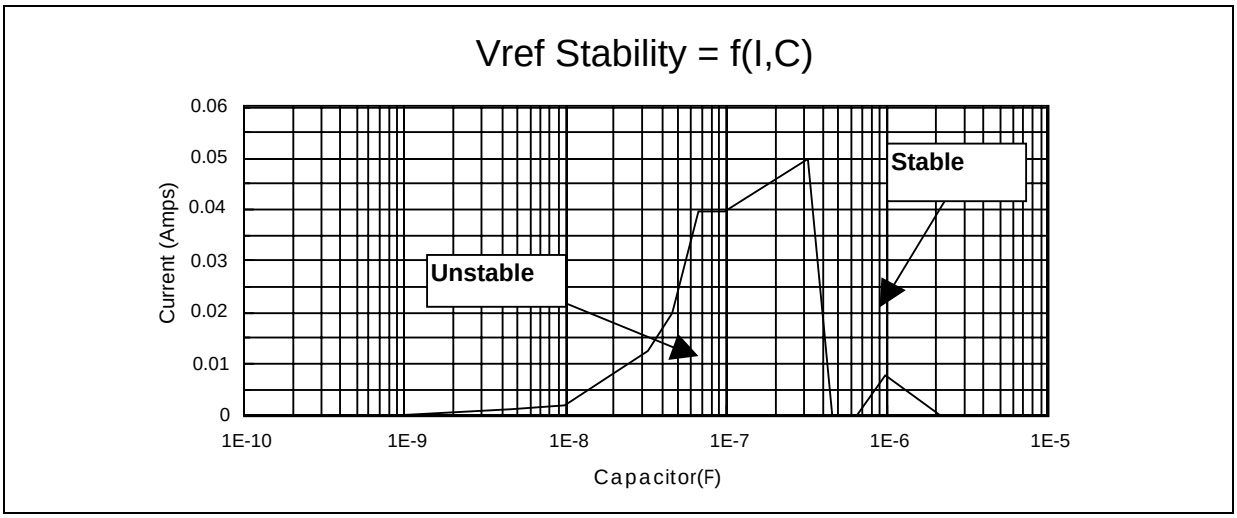
Vio Distribution - Operator 1

Vcc+=5V, Vcc-=0V



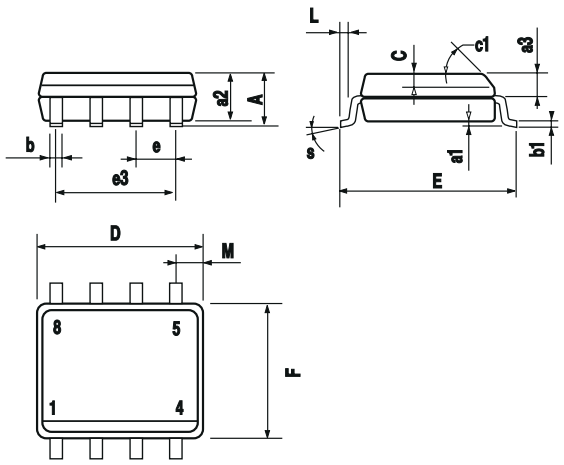

Vio Distribution - Operator 2
Vcc+=5V, Vcc-=0V
Distribution (%)
70
60
50
40
30
20
10
0
-3
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
3
Vio (mV)


Vref = F(Ik)
Vref (V)
3
2.5
2
1.5
1
0.5
0.0002
0.002
0.02
0.2
Cathode Current Ik (Amps)


Vref Stability = f(I,C)
Current (Amps)
0.06
0.05
0.04
0.03
0.02
0.01
0
Stable
Unstable
1E-10
1E-9
1E-8
1E-7
1E-6
1E-5
Capacitor(F)

PACKAGE MECHANICAL DATA

8 PINS - PLASTIC MICROPACKAGE (SO)



Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
a1	0.1		0.25	0.004		0.010
a2			1.65			0.065
a3	0.65		0.85	0.026		0.033
b	0.35		0.48	0.014		0.019
b1	0.19		0.25	0.007		0.010
C	0.25		0.5	0.010		0.020
c1	45° (typ.)					
D	4.8		5.0	0.189		0.197
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		3.81			0.150	
F	3.8		4.0	0.150		0.157
L	0.4		1.27	0.016		0.050
M			0.6			0.024
S	8° (max.)					