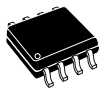
TSM103W

Dual Operational Amplifier and Voltage Reference

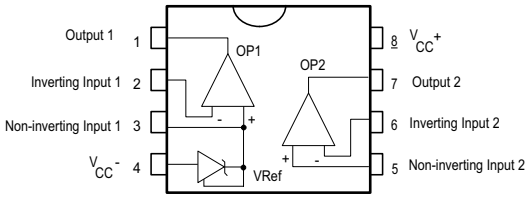
OPERATIONAL AMPLIFIER

- **LOW INPUT OFFSET VOLTAGE : 0.5mV typ.**
- **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**
- **1.5kV ESD PROTECTION**
- **VOLTAGE REFERENCE**
- **FIXED OUTPUT VOLTAGE REFERENCE 2.5V**
- **±0.4% OR ±0.7% VOLTAGE PRECISION**
- **SINK CURRENT CAPABILITY : 1 to 100mA**
- **TYPICAL OUTPUT IMPEDANCE : 0.2Ω**



D
SO-8
(Plastic Micropackage)

PIN CONNECTIONS (top view)



DESCRIPTION

The TSM103W 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 offers both space and cost savings in many applications such as power supply management or data acquisition systems.

ORDER CODE

Part Number	Temperature Range	Package	Packaging
TSM103WID	-40, +105°C	SO-8	Tube
TSM103WIDT			Tape & Ree
TSM103WAID			Tube
TSM103WAIDT			Tape & Reel

1 ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	36	V
V_{id}	Differential Input Voltage	Vcc + 0.6	V
V_i	Input VoltageL	-0.3 to Vcc + 0.3V	V
T_{stg}	Storage temperature range	-65 to + 150	°C
Ik	Continuous cathode current range	-100 to 150	mA
T_j	Maximum Junction Temperature	150	°C
R_{thja}	Thermal Resistance Junction to Ambient (SO package)	175	°C/W
T_l	Maximum Lead Temperature (10 seconds maximum)	260	°C
ESD	Electrostatic Discharge Protection	1.5	kV

OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
Vcc	DC Supply Conditions	3 to 32	V
I_k	Vref Cathode Current	1 to 100	mA
T_{oper}	Operating Free-air Temperature Range	-40°C, +105°C	°C

2 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 V_{icm} = 0V TSM103WA, T_{amb} = 25° $T_{min.} \le T_{amb} \le T_{max.}$ TSM103W, T_{amb} = 25° $T_{min.} \le T_{amb} \le T_{max.}$		 0.5 1	 2 3 4 5	mV
DV_{io}	Input Offset Voltage Drift		7		µV/°C
I_{io}	Input Offset Current $T_{min.} \le T_{amb} \le T_{max.}$		2	75 150	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 V_{CC} = +15V, V_o = 0.2V	 10 12	 20 50		 mA µA
V_{OH}	High Level Output Voltage V_{CC}^+ = 30V T_{amb} = 25°C, R_L = 2k $T_{min.} \le T_{amb} \le T_{max}$ T_{amb} = 25°C, R_L = 10k $T_{min.} \le T_{amb} \le T_{max.}$	 26 26 27 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

Symbol	Parameter	Min.	Typ.	Max.	Unit
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		%
e_n	Equivalent Input Noise Voltage f = 1kHz, Rs = 100Ω Vcc = 30V		50		nV/√Hz

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. Both inputs can go to Vcc+ 0.3V 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 TSM103WA, T_{amb} = 25° $T_{min.} \le T_{amb} \le T_{max.}$ TSM103W, T_{amb} = 25° $T_{min.} \le T_{amb} \le T_{max.}$		0.5 1	2 3 4 5	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_{CC} = 15V, R_L = 2k, Vo = 1.4V to 11.4V $T_{min.} \le T_{amb} \le T_{max}$		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 V_{CC} = +15V, V_o = 0.2V	10 12	20 50		mA µA
V_{OH}	High Level Output Voltage V_{CC}^+ = 30V T_{amb} = 25°C, R_L = 2k $T_{min.} \le T_{amb} \le T_{max.}$ T_{amb} = 25°C, R_L = 10k $T_{min.} \le T_{amb} \le T_{max.}$	26 26 27 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

Symbol	Parameter	Min.	Typ.	Max.	Unit
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

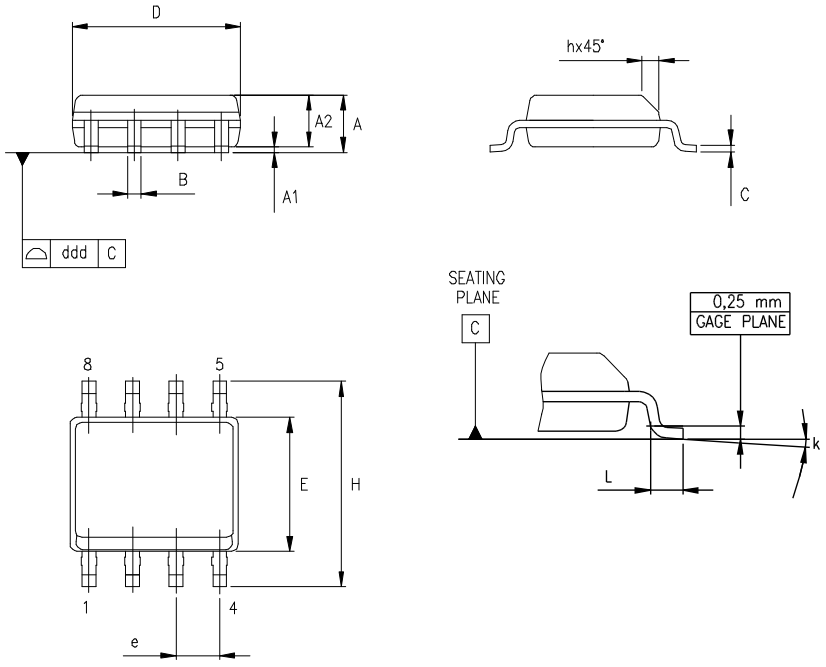
Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{ref}	Reference Input Voltage, Ik=10mA TSM103WA ±0.4% T_{amb} = 25°C $T_{min.} \le T_{amb} \le T_{max.}$ TSM103W ±0.7% T_{amb} = 25°C $T_{min.} \le T_{amb} \le T_{max.}$	 2.49 2.48 2.482 2.465	 2.5 2.500	 2.51 2.52 2.518 2.535	V
ΔV_{ref}	Reference Input Voltage 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 $[Z_{KA}| = \Delta V_{KA}/\Delta I_K$

PACKAGE MECHANICAL DATA

SO-8 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.04		0.010
A2	1.10		1.65	0.043		0.065
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D	4.80		5.00	0.189		0.197
E	3.80		4.00	0.150		0.157
e		1.27			0.050	
H	5.80		6.20	0.228		0.244
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
k	8° (max.)					
ddd			0.1			0.04



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3 SUMMARY OF CHANGES

Date	Revision	Description of Changes
	1-2	First Release
02-April-2004	3	1 - Vid=Vcc+0.6 modified on AMR table - page 2 2 - Add Ik parameter on AMR table - page 2 3 - Avd test condition equal on both tables Operator 1 & Operator 2 - pages 3 & 4