

1 ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	36	V
V_{id}	Differential Input Voltage	$V_{CC} + 0.6$	V
V_i	Input VoltageL	-0.3 to $V_{CC} + 0.3V$	V
T_{stg}	Storage temperature range	-65 to $+150$	°C
I_k	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
V_{CC}	DC Supply Conditions	3 to 32	V
I_k	Vref Cathode Current	1 to 100	mA
T_{oper}	Operating Free-air Temperature Range	$-40^{\circ}C$, $+105^{\circ}C$	°C

2 ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Min.	Typ.	Max.	Unit
I_{CC}	Total Supply Current, excluding Current in the Voltage Reference V _{CC} = 5V, no load T _{min.} < T _{amb} < T _{max.} V _{CC} = 30V, no load T _{min.} < T _{amb} < T _{max.}		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.} ≤ T _{amb} ≤ T _{max.} TSM103W, T _{amb} = 25° T _{min.} ≤ T _{amb} ≤ 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.} ≤ T _{amb} ≤ T _{max.}		2	75 150	nA
I_{ib}	Input Bias Current T _{min.} ≤ T _{amb} ≤ T _{max.}		20	150 200	nA
A _{vd}	Large Signal Voltage Gain V _{CC} = 15V, R _L = 2k, V _o = 1.4V to 11.4V T _{min.} ≤ T _{amb} ≤ T _{max.}	50 25	100		V/mV
SVR	Supply Voltage Rejection Ratio V _{CC} = 5V to 30V	65	100		dB
V _{icm}	Input Common Mode Voltage Range V _{CC} = +30V - see note ¹ T _{min.} ≤ T _{amb} ≤ T _{max.}	0 0		(V _{CC} ⁺) -1.5 (V _{CC} ⁺) -2	V
CMR	Common Mode Rejection Ratio T _{min.} ≤ T _{amb} ≤ T _{max.}	70 60	85		dB
I_{source}	Output Current Source V _{CC} = +15V, V _o = 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.} ≤ T _{amb} ≤ T _{max.} T _{amb} = 25°C, R _L = 10k T _{min.} ≤ T _{amb} ≤ T _{max.}	26 26 27 27	27 28		V
V_{OL}	Low Level Output Voltage R _L = 10k T _{min.} ≤ T _{amb} ≤ 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 $f = 1kHz, R_s = 100\Omega$ $V_{CC} = 30V$		50		nV/ $\sqrt{Hz}$

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 $V_{CC} + 0.3V$ without damage.

OPERATOR 1 (op-amp with non-inverting input connected to the internal Vref)

$V_{CC}^+ = +5V, V_{CC}^- = \text{Ground}, T_{amb} = 25^\circ C$ (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage $V_{icm} = 0V$ TSM103WA, $T_{amb} = 25^\circ$ $T_{min.} \leq T_{amb} \leq T_{max.}$ TSM103W, $T_{amb} = 25^\circ$ $T_{min.} \leq T_{amb} \leq T_{max.}$		0.5 1	2 3 4 5	mV
DV_{io}	Input Offset Voltage Drift		7		$\mu V/^\circ C$
I_{ib}	Input Bias Current negative input		20		nA
A_{vd}	Large Signal Voltage Gain $V_{CC} = 15V, R_L = 2k, V_o = 1.4V \text{ to } 11.4V$ $T_{min.} \leq T_{amb} \leq T_{max.}$		100		V/mV
SVR	Supply Voltage Rejection Ratio $V_{icm} = 0V$ $V_{CC}^+ = 5V \text{ to } 30V$	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 $V_{CC}^+ = 30V$ $T_{amb} = 25^\circ C, R_L = 2k$ $T_{min.} \leq T_{amb} \leq T_{max.}$ $T_{amb} = 25^\circ C, R_L = 10k$ $T_{min.} \leq T_{amb} \leq T_{max.}$	26 26 27 27	27 28		V
V_{OL}	Low Level Output Voltage $R_L = 10k$ $T_{min.} \leq T_{amb} \leq T_{max.}$		5	20 20	mV
SR	Slew Rate at Unity Gain $V_i = 0.5 \text{ to } 2V, V_{CC} = 15V$ $R_L = 2k, C_L = 100pF, \text{unity gain}$	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

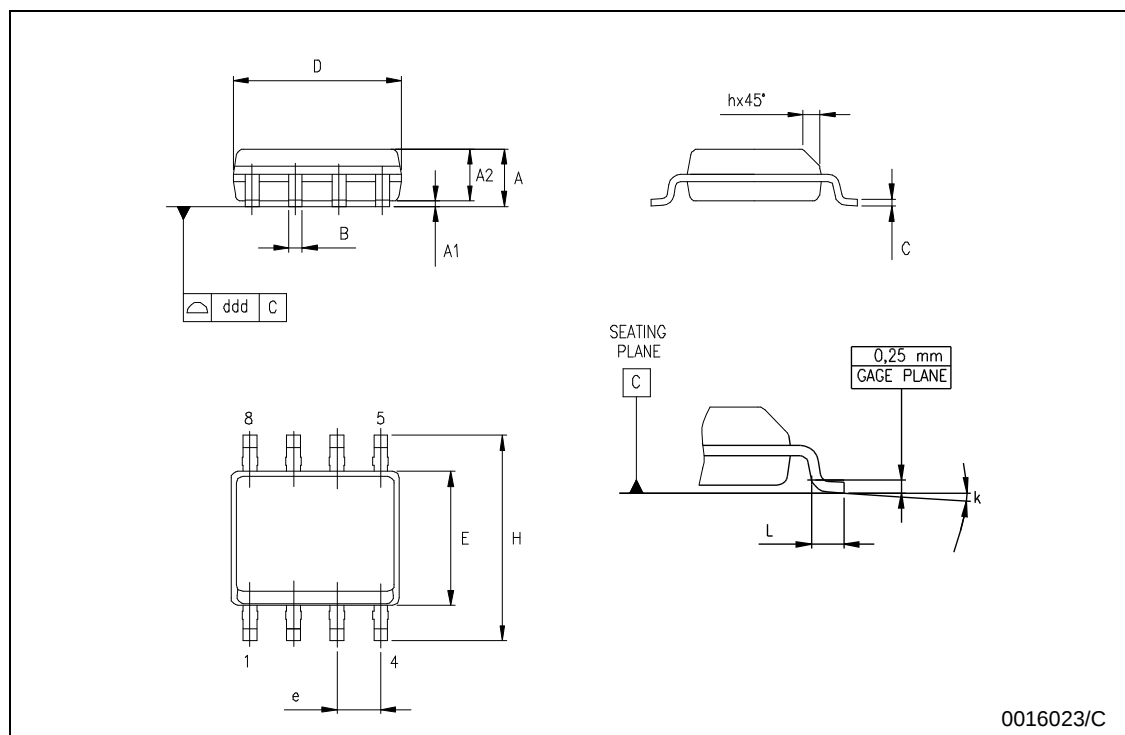
Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{ref}	Reference Input Voltage, $I_k = 10mA$ TSM103WA $\pm 0.4\%$ $T_{amb} = 25^\circ C$ $T_{min.} \leq T_{amb} \leq T_{max.}$ TSM103W $\pm 0.7\%$ $T_{amb} = 25^\circ C$ $T_{min.} \leq T_{amb} \leq T_{max.}$	2.49 2.48 2.482 2.465	2.5 2.500	2.51 2.52 2.518 2.535	V
ΔV_{ref}	Reference Input Voltage Deviation Over Temperature Range $V_{KA} = V_{ref}, I_k = 10mA$ $T_{min.} \leq T_{amb} \leq T_{max.}$		7	30	mV
I_{min}	Minimum Cathode Current for Regulation $V_{KA} = V_{ref}$		0.5	1	mA
$ Z_{KA} $	Dynamic Impedance - note ¹ $V_{KA} = V_{ref}, \Delta I_K = 1 \text{ to } 100mA, f < 1kHz$		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	g° (max.)					
ddd			0.1			0.04



3 SUMMARY OF CHANGES

Date	Revision	Description of Changes
	1-2	First Release
02-April-2004	3	1 - $V_{id}=V_{cc}+0.6$ modified on AMR table - page 2 2 - Add I_k parameter on AMR table - page 2 3 - A_{vd} test condition equal on both tables Operator 1 & Operator 2 - pages 3 & 4

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