TSM106

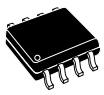
Dual Operational Amplifier and Voltage Reference

Operational Amplifier:

- **Low input offset voltage: 1mV typ.**
- **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: 4 to 32V ±2 TO ±16V**
- **1.5kV ESD protection (HBM)**

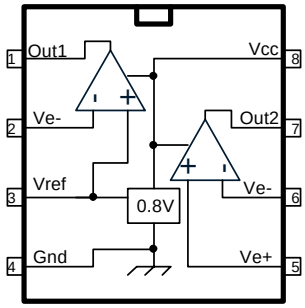
Voltage Reference:

- **Fixed output voltage reference 0.83V**
- **±1% Voltage precision**



D
SO-8
(Plastic Micropackage)

PIN CONNECTIONS (top view)



DESCRIPTION

The TSM106 is a monolithic IC that includes one independent op-amp and another op-amp for which the non-inverting input is wired to a 0.83V fixed voltage reference. This device offers both space and cost savings in many applications such as power supply management or data acquisition systems.

ORDER CODES

Part Number	Temperature Range	Package	Packaging	Marking
TSM106ID	-40°C, +105°C	SO	Tube	M106
TSM106IDT		SO	Tape & Reel	

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1 Absolute Maximum Ratings

Table 1: Key parameters and their absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	36	V
V_{id}	Differential Input Voltage	36	V
V_i	Input Voltage	-0.3 to Vcc + 0.3V	V
T_{oper}	Operating Free-air Temperature Range	-40 to +105	°C
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

2 Electrical Characteristics

Table 2: General electrical characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit
I_{CC}	Total Supply Current Vcc+ = 5V, no load Tmin. < Tamb < Tmax. Vcc+ = 30V, no load Tmin. < Tamb < Tmax		2.5 5.5	4.5 6 8.5 10	mA

Table 3: Electrical characteristics for operator 2 (independant op-amp): VCC+ = +5V, VCC = Ground, Vo = 1.4V,Tamb = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage V_{icm} = 0V T_{amb} = 25° $T_{min.} \le T_{amb} \le T_{max.}$		 1	 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

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Table 3: Electrical characteristics for operator 2 (independant op-amp): VCC+ = +5V, VCC = Ground, Vo = 1.4V,Tamb = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
I_{sink}	Output Current Sink V_{id} = -1V, V_{CC} = +15V, V_o = 2V	10	20		mA
V_{OH}	High Level Output Voltage $T_{min.} \leq T_{amb} \leq T_{max}$ T_{amb} = 25°C, R_L = 10k $T_{min.} \leq T_{amb} \leq T_{max.}$	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 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		%
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.

Table 4: Electrical characteristics for operator 1 (op-amp with non-inverting input connected to the internal Vref): VCC+ = +5V, VCC- = Ground, Tamb = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage V_{icm} = 0.83V Vcc = 5V or 30V T_{amb} = 25° $T_{min.} \leq T_{amb} \leq T_{max.}$		1	4 5	mV
DV_{io}	Input Offset Voltage Drift		7		µV/°C
I_{ib}	Input Bias Current negative input		20		nA
SVR	Supply Voltage Rejection Ratio V_{icm} = 0.83V 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

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Table 4: Electrical characteristics for operator 1 (op-amp with non-inverting input connected to the internal Vref): VCC+ = +5V, VCC- = Ground, Tamb = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
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
THD	Total Harmonic Distortion f = 1kHz A_V = 20dB,R_L = 2k, V_{CC} = 30V C_L = 100pF, V_o = $2V_{pp}$		0.02		%

Table 5: Electrical characteristics for voltage reference

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{ref}	Reference Input Voltage T_{amb} = 25°C $T_{min.} \le T_{amb} \le T_{max.}$	0.822	0.83V	0.838	V
Regline	Reference Input Voltage over Vcc range Vicm = 3.7V to 30V T_{amb} = 25°C $T_{min.} \le T_{amb} \le T_{max.}$		3	6 10	mV
Regload	Reference Input Voltage over Ioutref current Ioutref = 1mA to 10mA T_{amb} = 25°C $T_{min.} \le T_{amb} \le T_{max.}$		10	20 25	mV
ΔV_{ref}	Reference Input Voltage Deviation Over Temperature Range $T_{min.} \le T_{amb} \le T_{max.}$		7	30	mV

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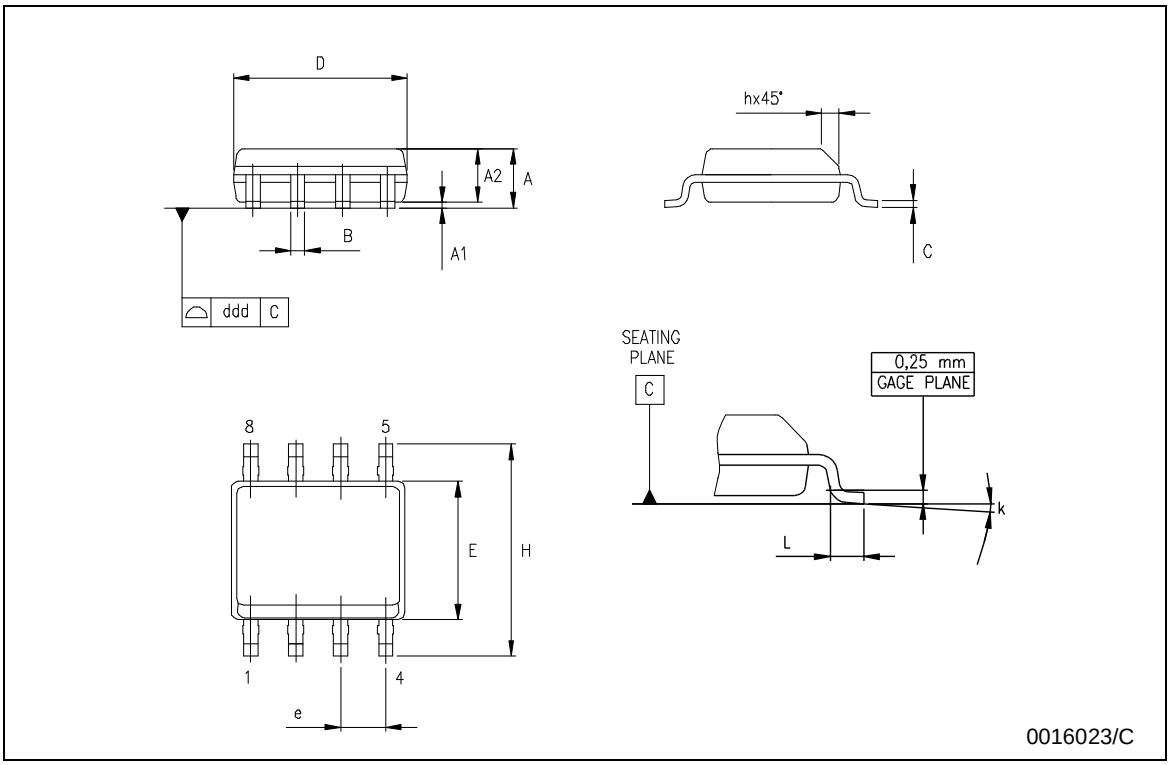
3 Package Mechanical Data

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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4 Revision History

Date	Revision	Description of Changes
July 2004	1	First Release
September 2004	2	Modifications on first page: Vio = 1mV Curves will be added in the future

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