TSM103/A

DUAL OPERATIONAL AMPLIFIER AND VOLTAGE REFERENCE

OPERATIONAL AMPLIFIER
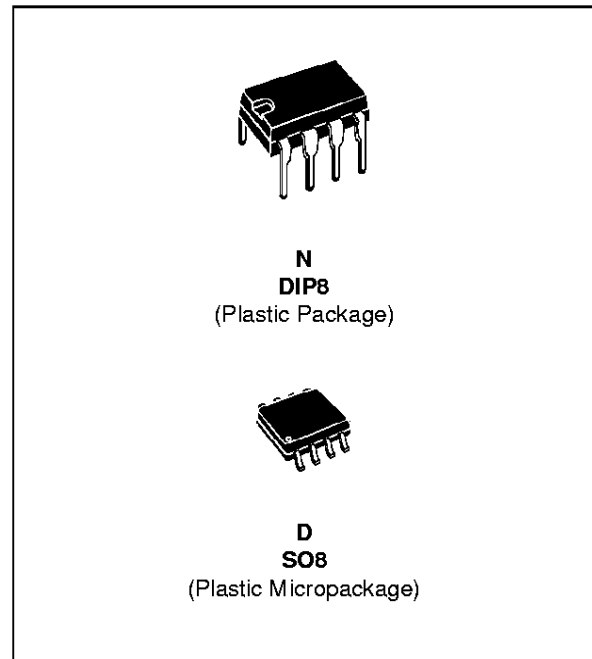
- LOW INPUT OFFSET VOLTAGE : 0.5mV typ.for TSM103A
- LOW SUPPLY CURRENT : 350µA/op. (@ V_{CC} = 5V)
- MEDIUM BANDWIDTH (unity gain) : 0.9MHz
- LARGE OUTPUT VOLTAGE SWING : 0V to (V_{CC} - 1.5V)
- INPUT COMMON MODE VOLTAGE RANGE INCLUDES GROUND
- WIDE POWER SUPPLY RANGE : 3 to 32V
                              ±1.5 to œ16V

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
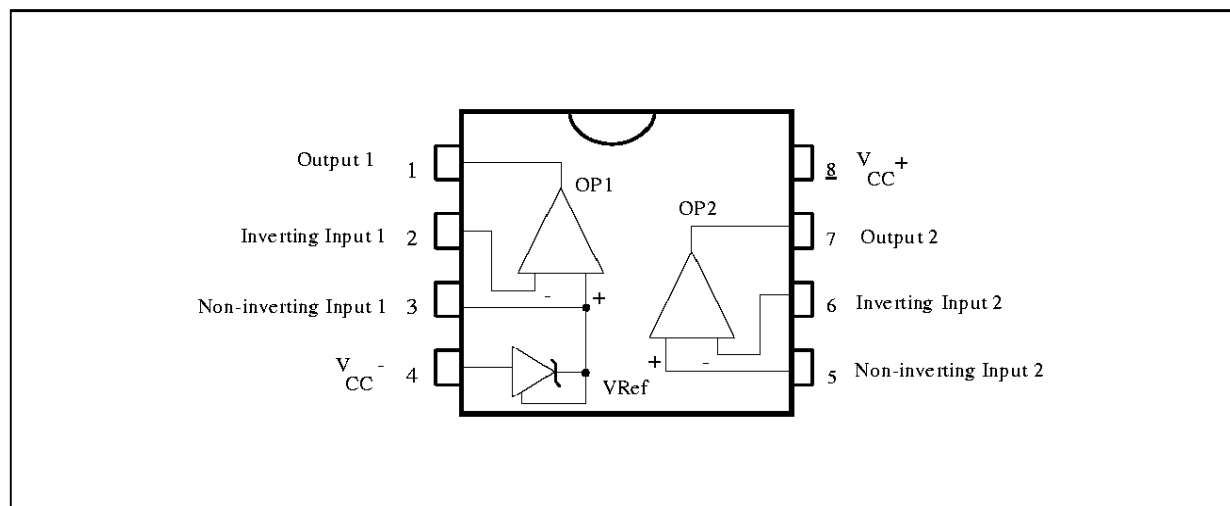
DESCRIPTION

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.

N
DIP8
(Plastic Package)

D
SO8
(Plastic Micropackage)

ORDER CODES

Part number	Temperature Range	Package	
		N	D
TSM103I/AI	-40°C, +105°C	●	●

PIN CONNECTIONS

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 +36	V
T_{oper}	Operating Free-air Temperature Range	-55 to +125	^oC
T_j	Maximum Junction Temperature	150	^oC
R_{thja}	Thermal Resistance Juction to Ambient (SO package)	175	$^oC/W$

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, $V_o = 1.4V$, $T_{amb} = 25^oC$ (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage TSM103, $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$ TSM103A, $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$		1 0.5	4 5 2 3	mV
DV_{io}	Input Offset Voltage Drift		7		$\mu V/^oC$
I_{io}	Input Offset Current $T_{min.} \leq T_{amb} \leq T_{max.}$		2	30 50	nA
I_{ib}	Input Bias Current $T_{min.} \leq T_{amb} \leq T_{max.}$		20	150 200	nA
A_{vd}	Large Signal Voltage Gain $V_{CC} = 15V$, $R_L = 2k$, $V_o = 1.4V$ to $11.4V$ $T_{min.} \leq T_{amb} \leq T_{max.}$	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 $T_{min.} \leq T_{amb} \leq T_{max.}$	0 0		(VCC^+) -1.5 (V_{CC}^+) -2	V
CMR	Common Mode Rejection Ratio $T_{min.} \leq T_{amb} \leq T_{max.}$	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 $V_{id} = -1V$, $V_{CC} = +15V$, $V_o = 2V$	10	20		mA
V_{OH}	High Level Output Voltage $V_{CC}^+ = 30V$ $T_{amb} = 25^oC$, $R_L = 10k$ $T_{min.} \leq T_{amb} \leq T_{max.}$	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		%

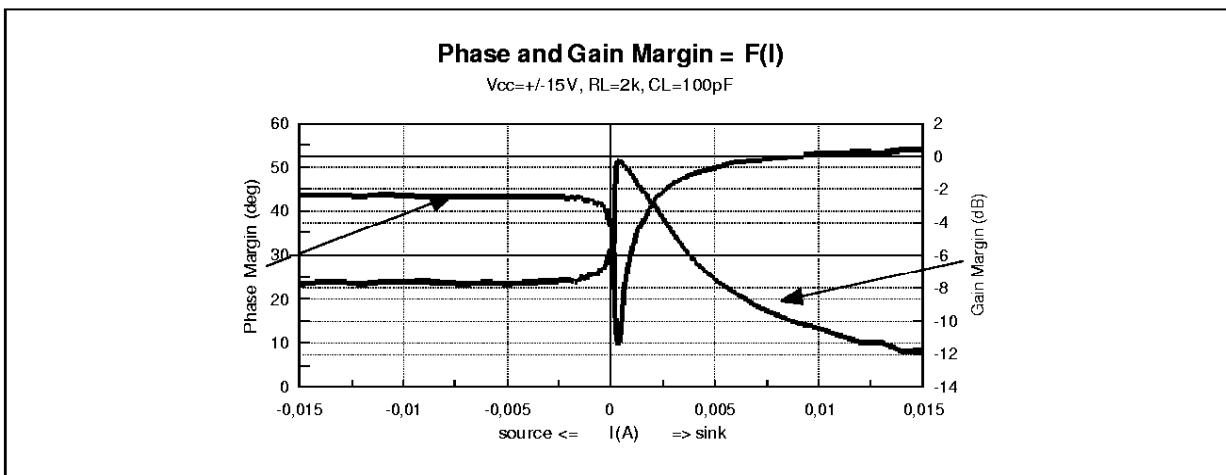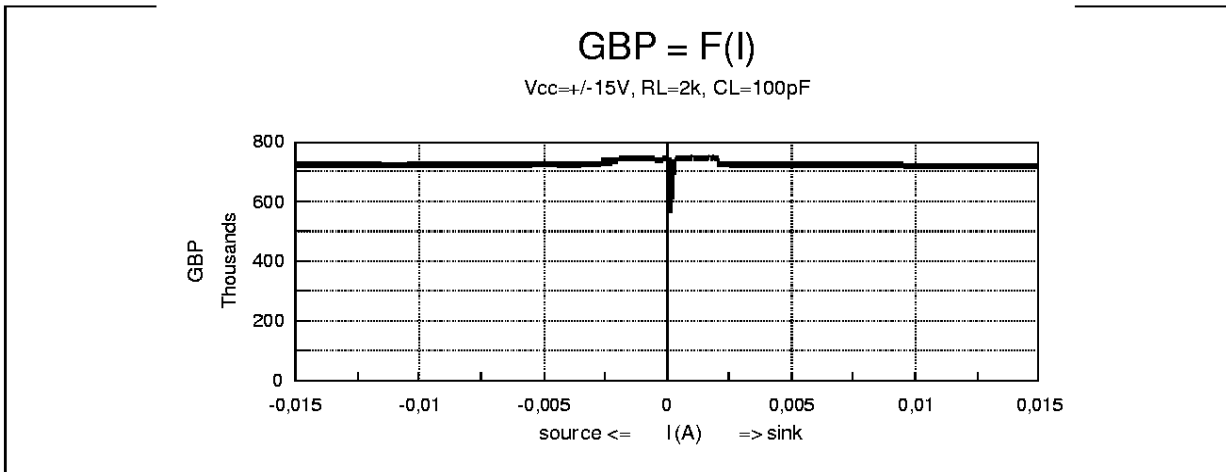**Note 1 :** The input common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is V_{CC}^+ -1.5V
But either of both inputs can go to +36V without damage.

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

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

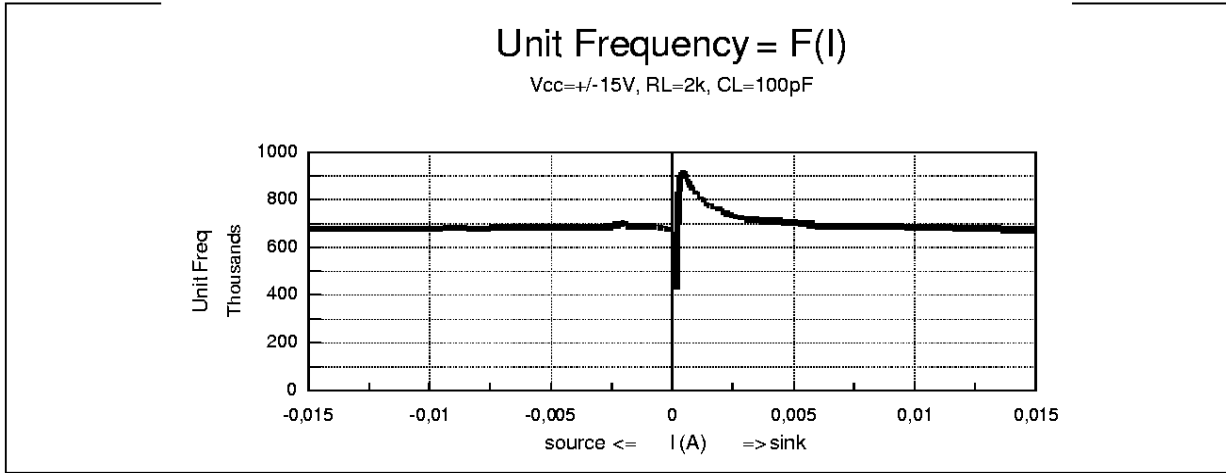| Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage $V_{icm} = 0V$ TSM103, $T_{amb} = 25^\circ C$ $T_{min.} \le T_{amb} \le T_{max.}$ TSM103A, $T_{amb} = 25^\circ C$ $T_{min.} \le T_{amb} \le T_{max.}$		1 0.5	4 5 2 3	mV
DV_{io}	Input Offset Voltage Drift		7		$\mu V/^\circ C$
I_{ib}	Input Bias Current negative input		20		nA
A_{vd}	Large Signal Voltage Gain $V_{icm} = 0V$ $V_{CC} = 15V$, $R_L = 2k$		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 $V_{CC}^+ = 30V$ $T_{amb} = 25^\circ C$, $R_L = 10k$ $T_{min.} \le T_{amb} \le T_{max.}$	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, $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$ TSM103A, $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$	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 $V_{KA} = V_{ref}$, $I_K = 10mA$ $T_{min.} \leq T_{amb} \leq T_{max.}$		7	30	mV
I_{min}	Minimum Cathode Current for Regulation $V_{KA} = V_{ref}$		0.5	1	mA
$|Z_{KA}|$	Dynamic Impedance - (note 1) $V_{KA} = V_{ref}$, $\Delta I_K = 1$ to $100mA$, $f < 1kHz$		0.2	0.5	Ω

Note 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
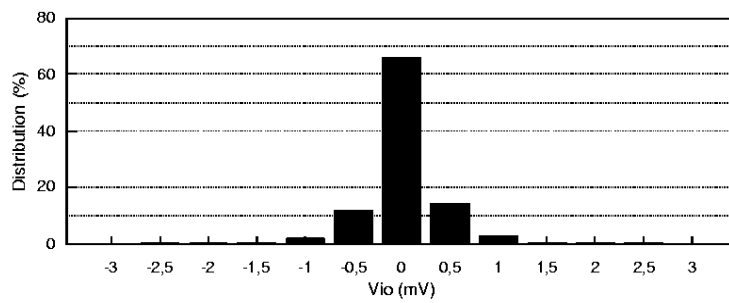
Total Harmonic Distorsion THD = F(freq)
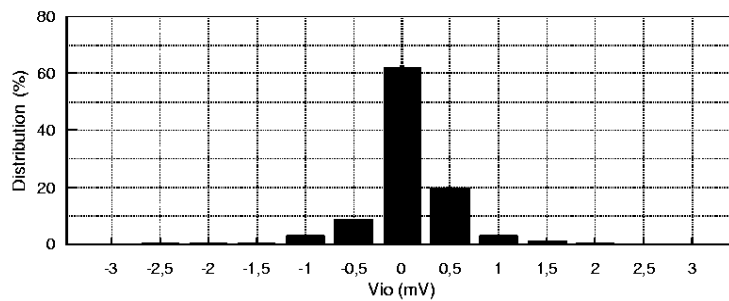

Noise = F(frequency)

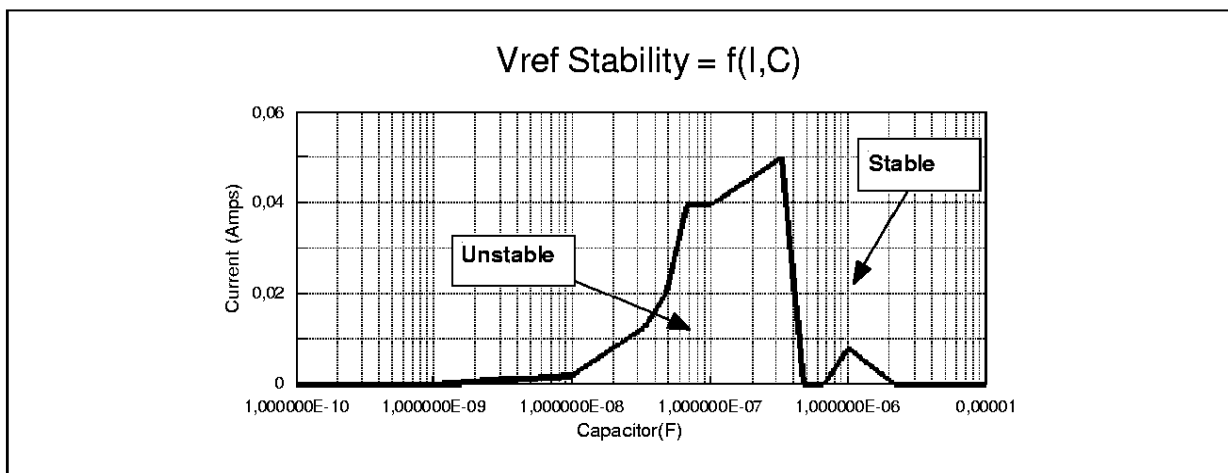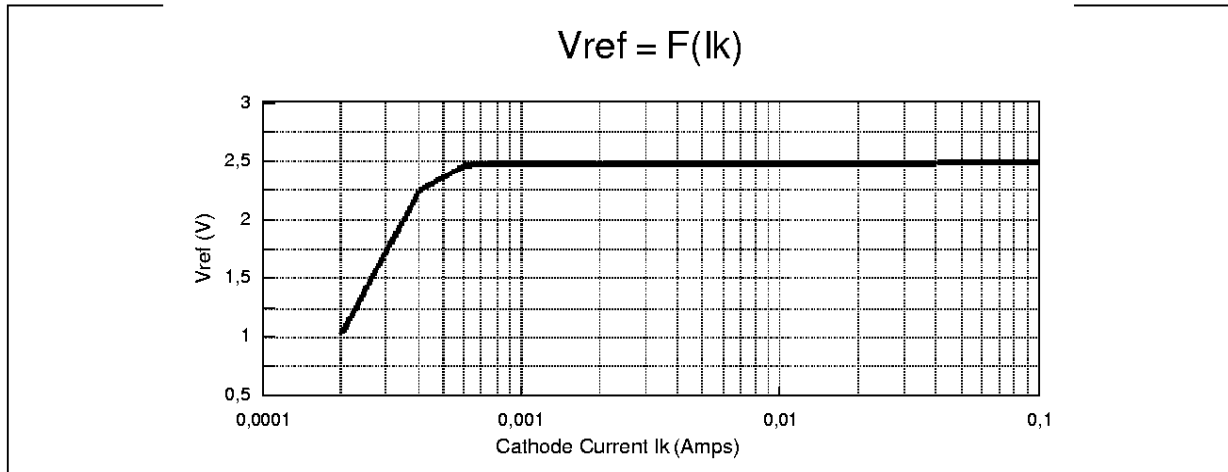
Vio Distribution - Operator 1

Vcc+=5V, Vcc-=0V
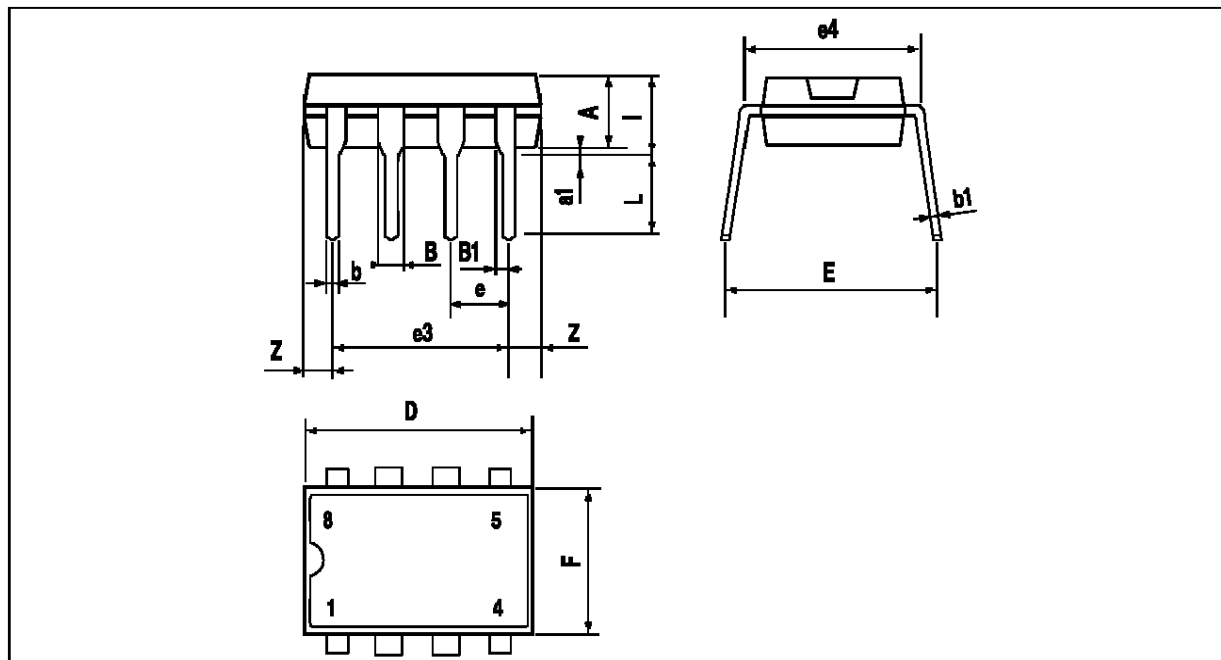

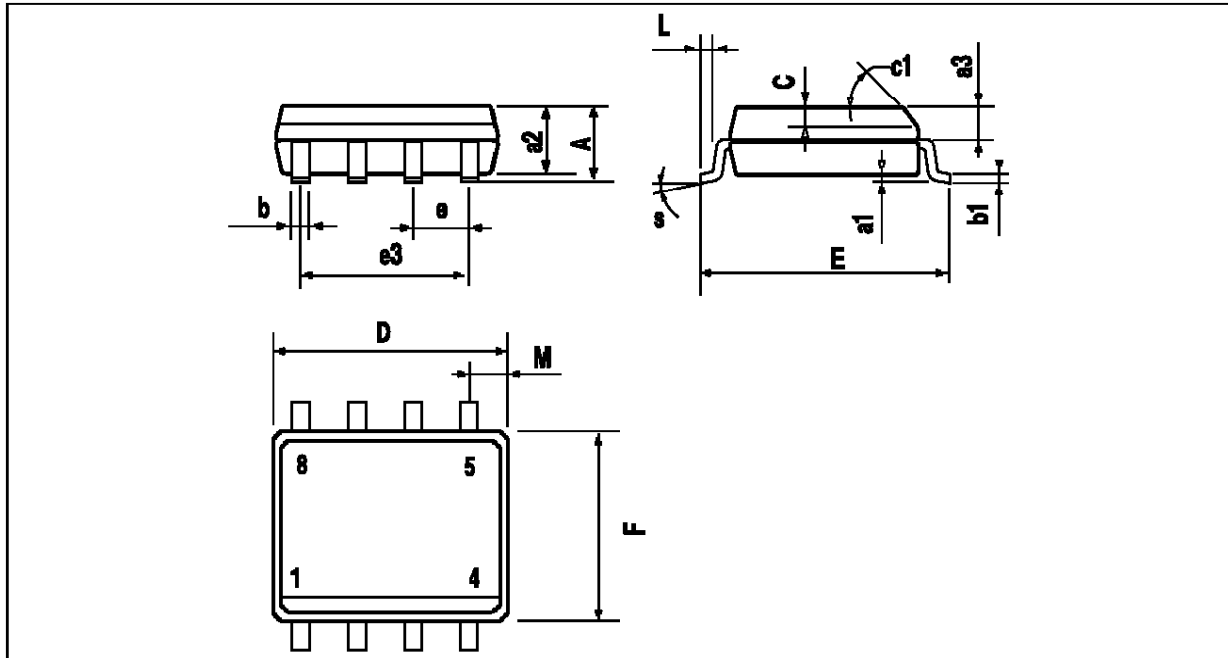## Vio Distribution - Operator 2

Vcc+=5V, Vcc-=0V

VOLTAGE REFERENCE

Vref = F(Ik)

Vref Stability = f(I,C)

PACKAGE MECHANICAL DATA
8 PINS - PLASTIC PACKAGE

Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A		3.32			0.131	
a1	0.51			0.020		
B	1.15		1.65	0.045		0.065
b	0.356		0.55	0.014		0.022
b1	0.204		0.304	0.008		0.012
D			10.92			0.430
E	7.95		9.75	0.313		0.384
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			6.6			0260
i			5.08			0.200
L	3.18		3.81	0.125		0.150
Z			1.52			0.060

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.)					