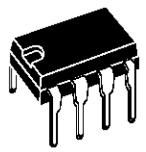
SGS-THOMSON MICROELECTRONICS

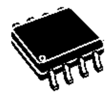
TS3V912

3V INPUT/OUTPUT RAIL TO RAIL DUAL CMOS OPERATIONAL AMPLIFIER

- DEDICATED TO **3.3V** OR **BATTERY SUPPLY** (specified at 3V and 5V)
- RAIL TO RAIL INPUT AND OUTPUT VOLTAGE RANGES
- SINGLE SUPPLY OPERATION FROM **2.7V TO 16V**
- EXTREMELY LOW INPUT BIAS CURRENT : **1pA** TYP
- LOW INPUT OFFSET VOLTAGE : **2mV max.**
- SPECIFIED FOR **600Ω** AND **100Ω** LOADS
- LOW SUPPLY CURRENT : 200µA/Ampli (VCC = 3V)
- ESD TOLERANCE : 3KV
- LATCH-UP IMMUNITY



N
DIP8
(Plastic Package)

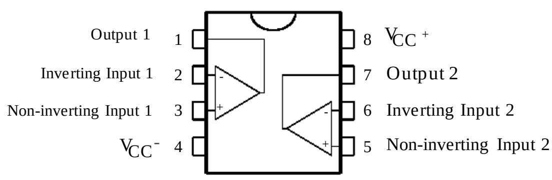


D
SO8
(Plastic Micropackage)

ORDER CODES

Part Number	Temperature Range	Package	
		N	D
TS3V912I/AI/BI	-40, +125°C	•	•

PIN CONNECTIONS (top view)



DESCRIPTION

The TS3V912 is a RAIL TO RAIL dual CMOS operational amplifier designed to operate with a single 3V supply voltage.

The input voltage range V_{icm} includes the two supply rails V_{CC}^{+} and V_{CC}^{-}.

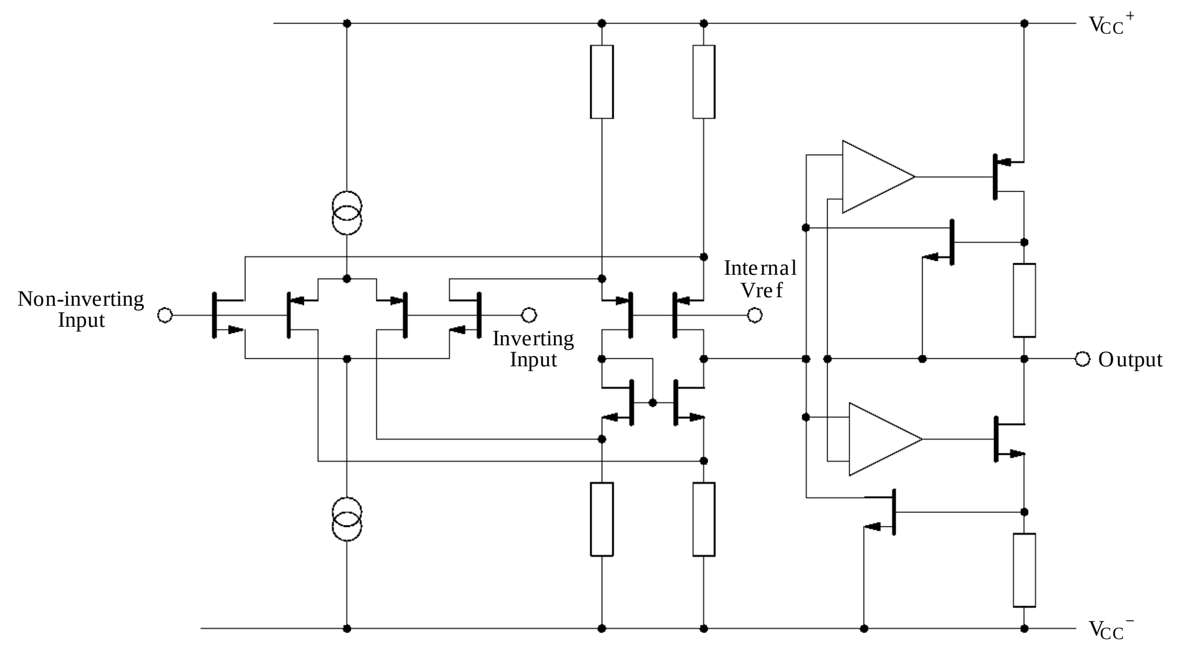
The output reaches :

- V_{CC}^{-} +50mV V_{CC}^{+} -50mV   with R_L = 10kΩ
- V_{CC}^{-} +350mV V_{CC}^{+} -350mV   with R_L = 600Ω

This product offers a broad supply voltage operating range from 2.7V to 16V and a supply current of only 200µA/amp. (V_{CC} = 3V).

Source and sink output current capability is typically 40mA (at V_{CC} = 3V), fixed by an internal limitation circuit.

SCHEMATIC DIAGRAM (1/2 TS3V912)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage - (note 1)	18	V
V_{id}	Differential Input Voltage - (note 2)	±18	V
V_i	Input Voltage - (note 3)	-0.3 to 18	V
I_{in}	Current on Inputs	±50	mA
I_o	Current on Outputs	±130	mA
T_{oper}	Operating Free Air Temperature Range TS3V912I/AI/BI	-40 to +125	^oC
T_{stg}	Storage Temperature	-65 to +150	^oC

Notes :
1. All voltage values, except differential voltage are with respect to network ground terminal.
2. Differential voltages are the non-inverting input terminal with respect to the inverting input terminal.
3. The magnitude of input and output voltages must never exceed V_{CC}^+ +0.3V.

OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	2.7 to 16	V
V_{icm}	Common Mode Input Voltage Range	V_{CC}^- -0.2 to V_{CC}^++0.2	V

ELECTRICAL CHARACTERISTICS

$V_{CC}^{+} = 3V$, $V_{CC}^{-} = 0V$, R_L,C_L connected to $V_{CC}/2$, $T_{amb} = 25^oC$ (unless otherwise specified)

Symbol	Parameter		TS3V912I/AI/BI			Unit
			Min.	Typ.	Max.	
V_{io}	Input Offset Voltage ($V_{ic} = V_o = V_{CC}/2$) $T_{min.} \leq T_{amb} \leq T_{max.}$	TS3V912 TS3V912A TS3V912B TS3V912 TS3V912A TS3V912B			10 5 2 12 7 3	mV
DV_{io}	Input Offset Voltage Drift			5		µV/°C
I_{io}	Input Offset Current - (note 1) $T_{min.} \leq T_{amb} \leq T_{max.}$			1	100 200	pA
I_{ib}	Input Bias Current - (note 1) $T_{min.} \leq T_{amb} \leq T_{max.}$			1	150 300	pA
I_{CC}	Supply Current (per amplifier, $A_{VCL} = 1$, no load) $T_{min.} \leq T_{amb} \leq T_{max.}$			200	300 400	µA
CMR	Common Mode Rejection Ratio	$V_{ic} = 0$ to $3V$, $V_o = 1.5V$	50	80		dB
SVR	Supply Voltage Rejection Ratio ($V_{CC}^{+} = 2.7$ to $3.3V$, $V_O = V_{CC}/2$)		50	80		dB
A_{vd}	Large Signal Voltage Gain ($R_L = 10k\Omega$, $V_O = 1.2V$ to $1.8V$) $T_{min.} \leq T_{amb} \leq T_{max.}$		3 3	10		V/mV
V_{OH}	High Level Output Voltage ($V_{id} = 1V$) $T_{min.} \leq T_{amb} \leq T_{max.}$	$R_L = 100k\Omega$ $R_L = 10k\Omega$ $R_L = 600\Omega$ $R_L = 100\Omega$ $R_L = 10k\Omega$ $R_L = 600\Omega$	2.95 2.9 2.3 2.8 2.1	 2.96 2.6 2 		V
V_{OL}	Low Level Output Voltage ($V_{id} = -1V$) $T_{min.} \leq T_{amb} \leq T_{max.}$	$R_L = 100k\Omega$ $R_L = 10k\Omega$ $R_L = 600\Omega$ $R_L = 100\Omega$ $R_L = 10k\Omega$ $R_L = 600\Omega$		 30 300 900 	50 70 400 100 600	mV
I_o	Output Short Circuit Current ($V_{id} = \pm1V$)	Source ($V_o = V_{CC}^{-}$) Sink ($V_o = V_{CC}^{+}$)	20 20	40 40		mA
GBP	Gain Bandwidth Product ($A_{VCL} = 100$, $R_L = 10k\Omega$, $C_L = 100pF$, $f = 100kHz$)			0.8		MHz
SR^{+}	Slew Rate ($A_{VCL} = 1$, $R_L = 10k\Omega$, $C_L = 100pF$, $V_i = 1.3V$ to $1.7V$)			0.3		V/µs
SR^{-}	Slew Rate ($A_{VCL} = 1$, $R_L = 10k\Omega$, $C_L = 100pF$, $V_i = 1.3V$ to $1.7V$)			0.4		V/µs
$\varnothing m$	Phase Margin			30		Degrees
e_n	Equivalent Input Noise Voltage ($R_s = 100\Omega$, $f = 1kHz$)			30		$\frac{nV}{\sqrt{Hz}}$
V_{O1}/V_{O2}	Channel Separation ($f = 1kHz$)			120		dB

Note 1 : Maximum values including unavoidable inaccuracies of the industrial test.

ELECTRICAL CHARACTERISTICS

$V_{CC}^+ = 5V$, $V_{CC}^- = 0V$, R_L,C_L connected to $V_{CC}/2$, $T_{amb} = 25^oC$ (unless otherwise specified)

Symbol	Parameter		TS3V912I/AI/BI			Unit
			Min.	Typ.	Max.	
V_{io}	Input Offset Voltage ($V_{ic} = V_o = V_{CC}/2$) $T_{min.} \leq T_{amb} \leq T_{max.}$	TS3V912 TS3V912A TS3V912B TS3V912 TS3V912A TS3V912B			10 5 2 12 7 3	mV
DV_{io}	Input Offset Voltage Drift			5		$\mu V/^oC$
I_{io}	Input Offset Current - (note 1) $T_{min.} \leq T_{amb} \leq T_{max.}$			1	100 200	pA
I_{ib}	Input Bias Current - (note 1) $T_{min.} \leq T_{amb} \leq T_{max.}$			1	150 300	pA
I_{CC}	Supply Current (per amplifier, $A_{VCL} = 1$, no load) $T_{min.} \leq T_{amb} \leq T_{max.}$			230	350 450	µA
CMR	Common Mode Rejection Ratio $V_{ic} = 1.5$ to $3.5V$, $V_o = 2.5V$		60	85		dB
SVR	Supply Voltage Rejection Ratio ($V_{CC}^+ = 3$ to $5V$, $V_O = V_{CC}/2$)		55	80		dB
A_{vd}	Large Signal Voltage Gain ($R_L = 10k\Omega$, $V_O = 1.5V$ to $3.5V$) $T_{min.} \leq T_{amb} \leq T_{max.}$		10 7	50		V/mV
V_{OH}	High Level Output Voltage ($V_{id} = 1V$) $T_{min.} \leq T_{amb} \leq T_{max.}$	$R_L = 100k\Omega$ $R_L = 10k\Omega$ $R_L = 600\Omega$ $R_L = 100\Omega$ $R_L = 10k\Omega$ $R_L = 600\Omega$	4.95 4.9 4.25 4.8 4.1	 4.95 4.55 3.7		V
V_{OL}	Low Level Output Voltage ($V_{id} = -1V$) $T_{min.} \leq T_{amb} \leq T_{max.}$	$R_L = 100k\Omega$ $R_L = 10k\Omega$ $R_L = 600\Omega$ $R_L = 100\Omega$ $R_L = 10k\Omega$ $R_L = 600\Omega$		 40 350 1400	50 100 500 150 750	mV
I_o	Output Short Circuit Current ($V_{id} = \pm 1V$)	Source ($V_o = V_{CC}^-$) Sink ($V_o = V_{CC}^+$)	45 45	65 65		mA
GBP	Gain Bandwidth Product ($A_{VCL} = 100$, $R_L = 10k\Omega$, $C_L = 100pF$, $f = 100kHz$)			1		MHz
SR^+	Slew Rate ($A_{VCL} = 1$, $R_L = 10k\Omega$, $C_L = 100pF$, $V_i = 1V$ to $4V$)			0.8		V/µs
SR^-	Slew Rate ($A_{VCL} = 1$, $R_L = 10k\Omega$, $C_L = 100pF$, $V_i = 1V$ to $4V$)			0.6		V/µs
e_n	Equivalent Input Noise Voltage ($R_s = 100\Omega$, $f = 1kHz$)			30		$\frac{nV}{\sqrt{Hz}}$
V_{O1}/V_{O2}	Channel Separation ($f = 1kHz$)			120		dB
∅m	Phase Margin			30		Degrees

Note 1 : Maximum values including unavoidable inaccuracies of the industrial test.

TYPICAL CHARACTERISTICS

Figure 1 : Supply Current (each amplifier) versus Supply Voltage

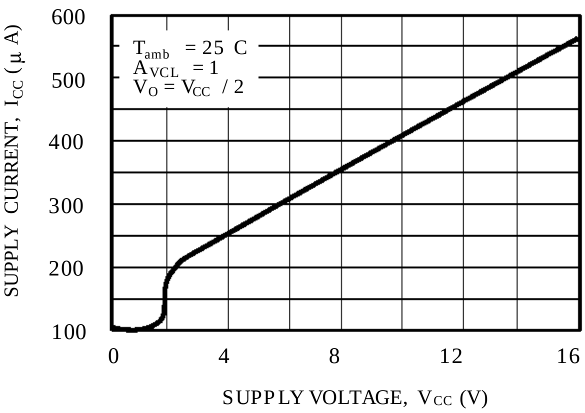


Figure 2 : Input Bias Current versus Temperature

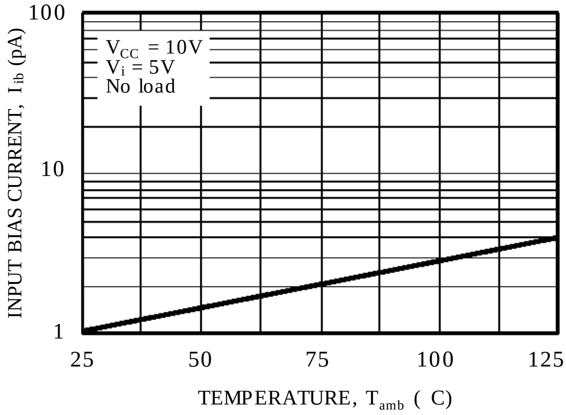


Figure 3a : High Level Output Voltage versus High Level Output Current

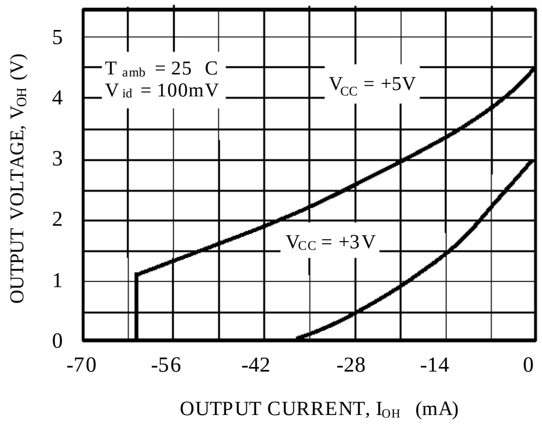


Figure 3b : High Level Output Voltage versus High Level Output Current

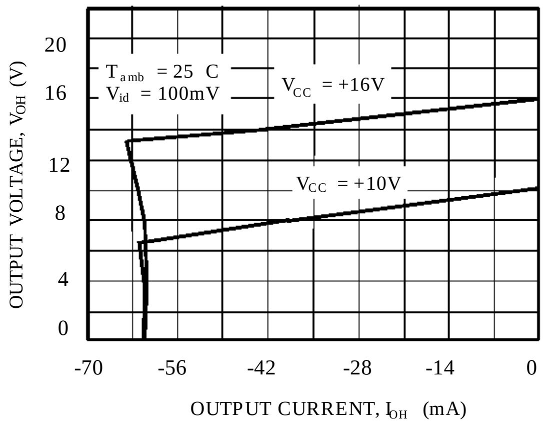


Figure 4a : Low Level Output Voltage versus Low Level Output Current

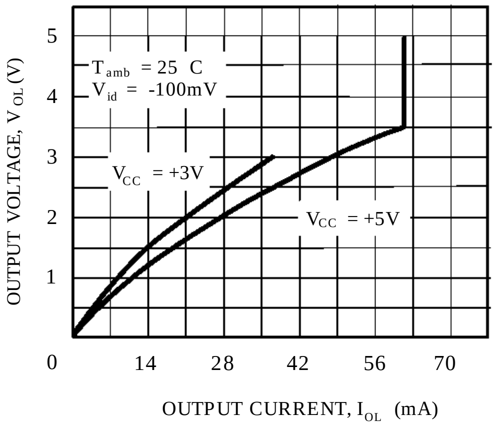


Figure 4b : Low Level Output Voltage versus Low Level Output Current

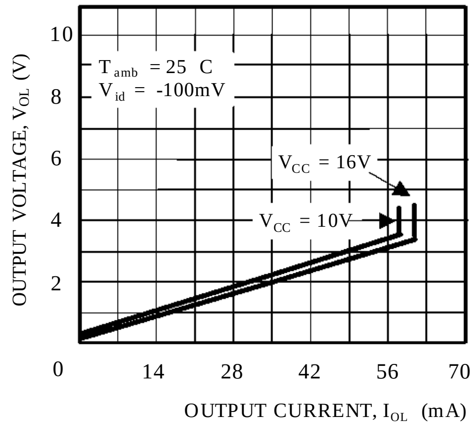


Figure 5a : Open Loop Frequency Response and Phase Shift

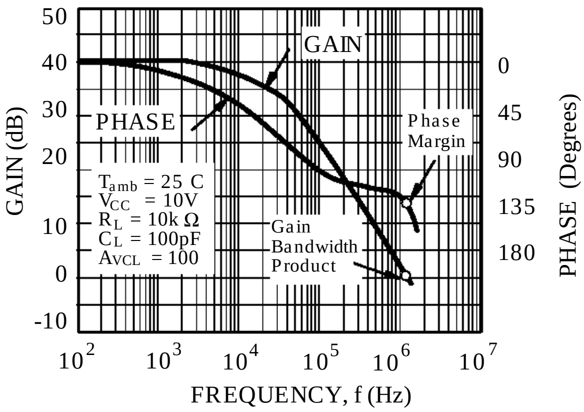


Figure 5b : Open Loop Frequency Response and Phase Shift

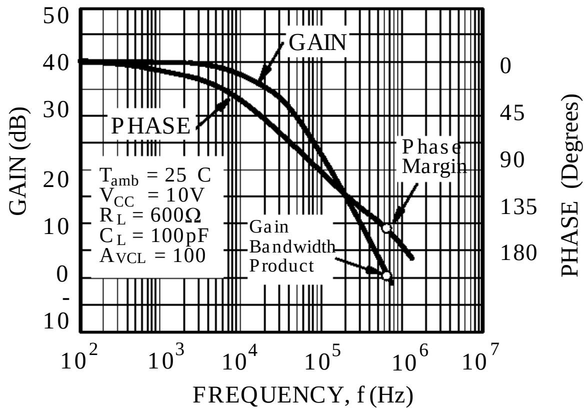


Figure 6a : Gain Bandwidth Product versus Supply Voltage

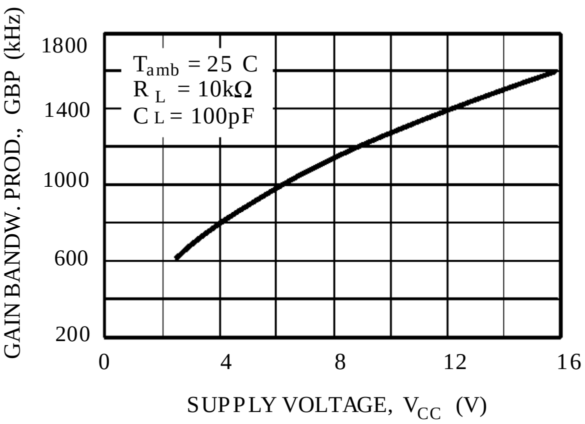


Figure 6b : Gain bandwidth Product versus Supply Voltage

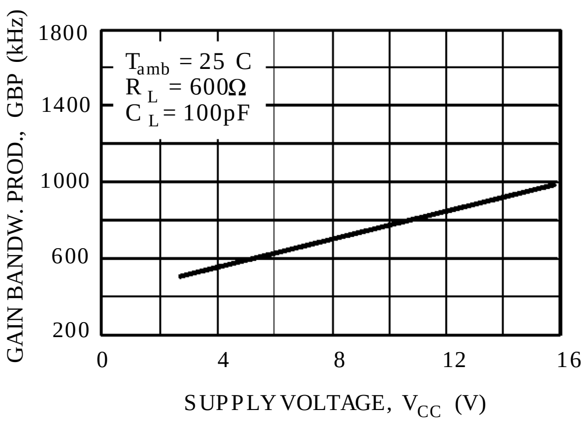


Figure 7a : Phase Margin versus Supply Voltage

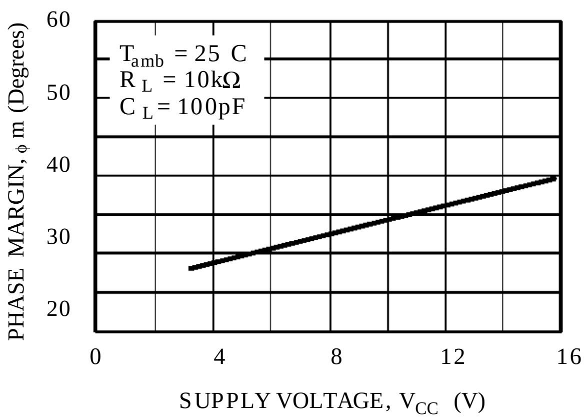


Figure 7b : Phase Margin versus Supply Voltage

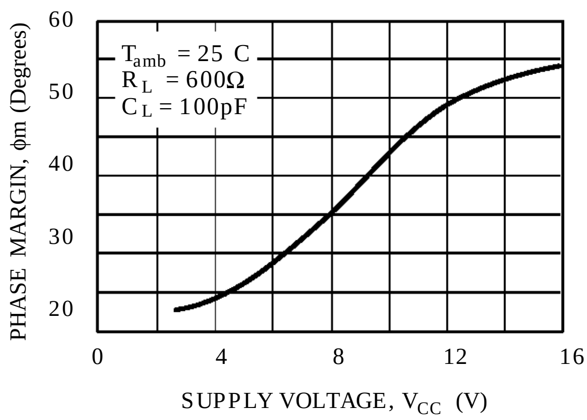
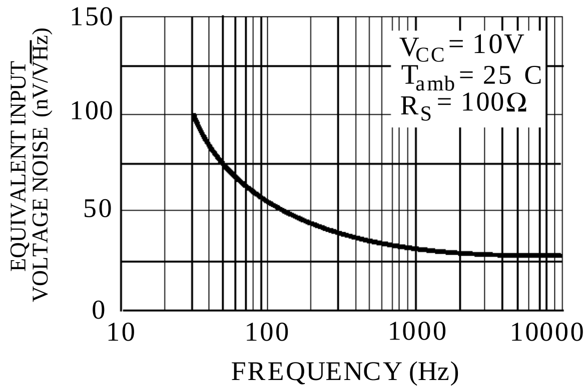
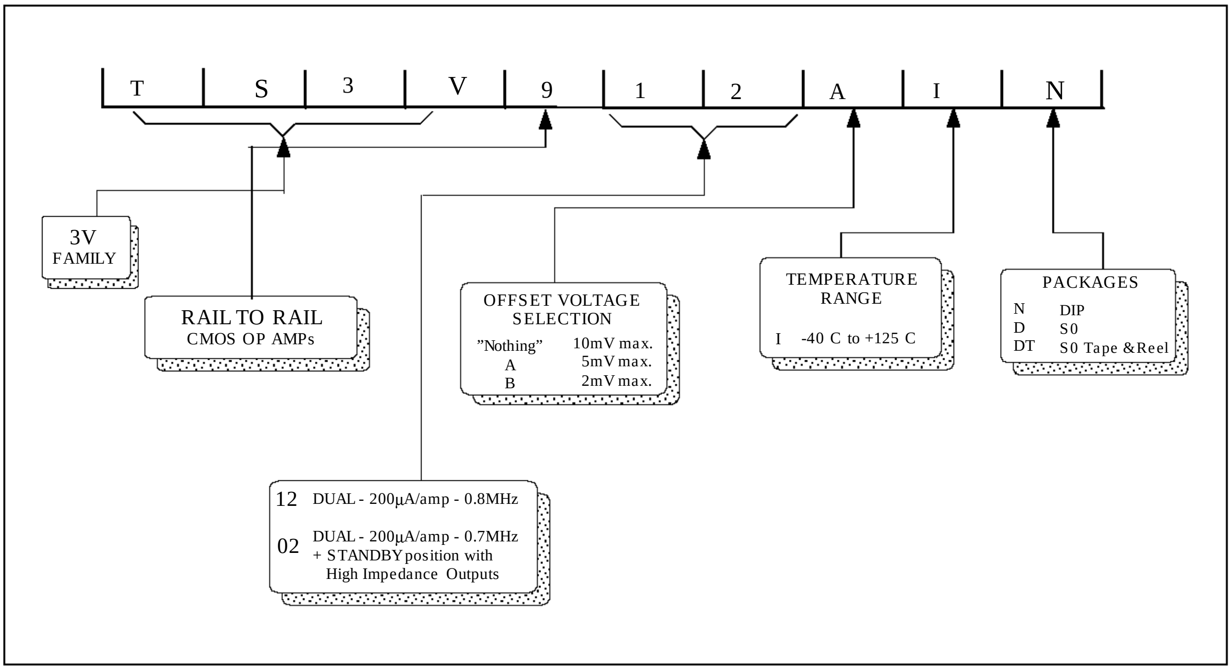


Figure 8 : Input Voltage Noise versus Frequency

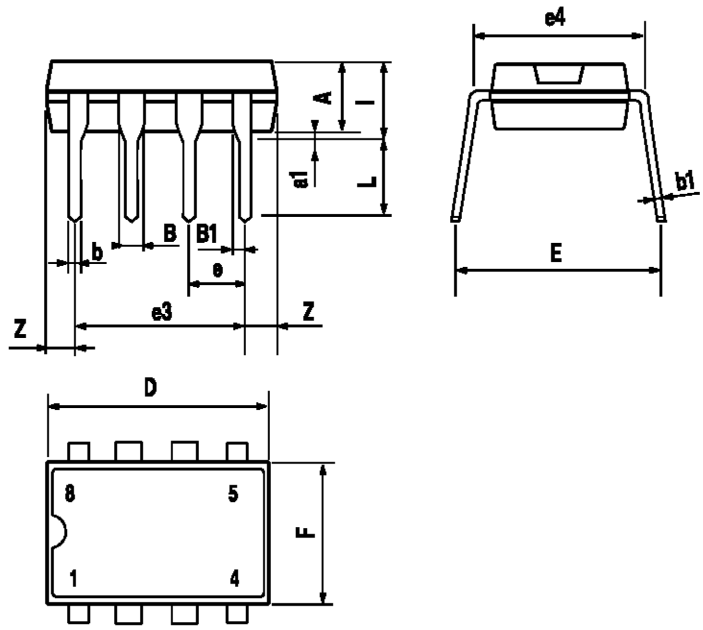


ORDERING INFORMATION



PACKAGE MECHANICAL DATA

8 PINS - PLASTIC DIP

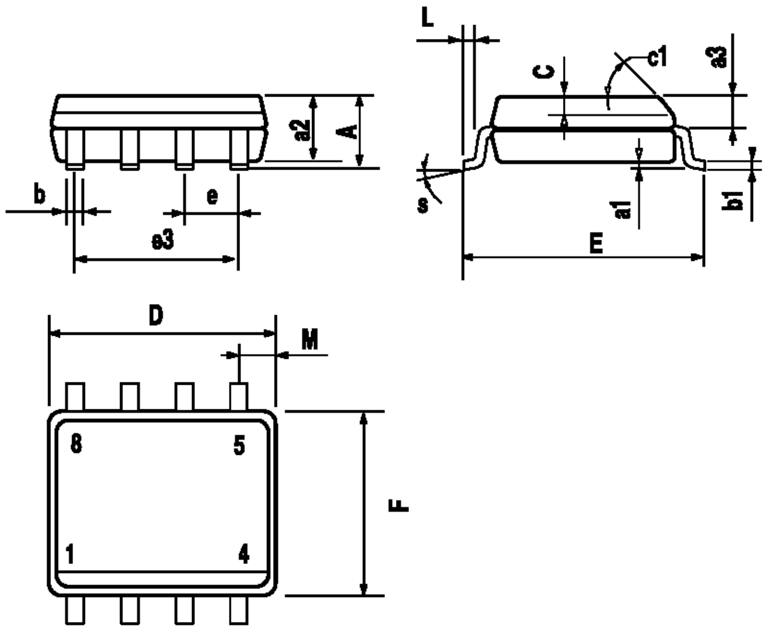


Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A		3.32			0.131	
a1	0.51			0.020		
B	1.15		1.65	0.045		0.065
b	0.356		0.55	0.014		0.022
b1	0.204		0.304	0.008		0.012
D			10.92			0.430
E	7.95		9.75	0.313		0.384
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			6.6			0260
i			5.08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

DIP8.TBL

PACKAGE MECHANICAL DATA

8 PINS - PLASTIC MICROPACKAGE (SO)



PM-SO8.EPS

Dimensions	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^{o} (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^{o} (max.)					

SO8.TBL

ORDER CODE :