



TS912

RAIL TO RAIL CMOS DUAL OPERATIONAL AMPLIFIER

- RAIL TO RAIL INPUT AND OUTPUT VOLTAGE RANGES
- SINGLE (OR DUAL) 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 ($V_{CC} = 3V$)
- LATCH-UP IMMUNITY
- ESD TOLERANCE : 3KV
- SPICE MACROMODEL INCLUDED IN THIS-SPECIFICATION

DESCRIPTION

The TS912 is a RAIL TO RAIL CMOS dual operational amplifier designed to operate with a single or dual supply voltage.

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

At 3V, the output reaches :

- $V_{CC}^- + 30mV$ $V_{CC}^+ - 40mV$ with $R_L = 10k\Omega$
- $V_{CC}^- + 300mV$ $V_{CC}^+ - 400mV$ with $R_L = 600\Omega$

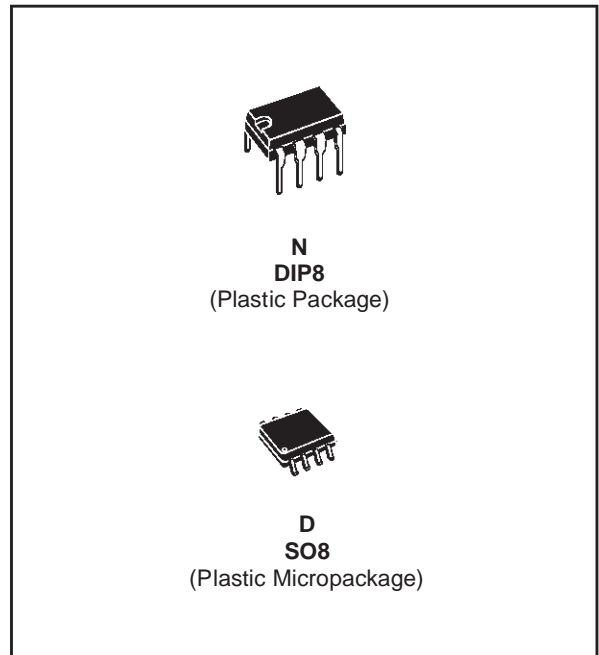
This product offers a broad supply voltage operating range from 2.7V to 16V and a supply current of only 200μA/amp @ $V_{CC} = 3V$.

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

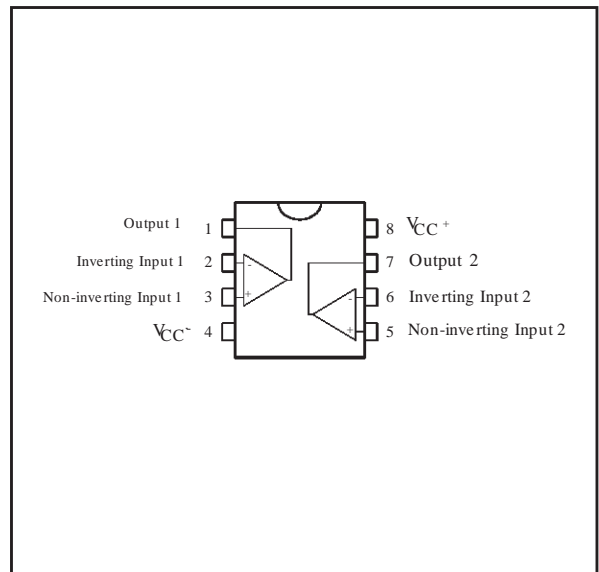
ORDER CODE

| Part Number | Temperature Range | Package | |
|--------------|-------------------|---------|---|
| | | N | D |
| TS912I/AI/BI | -40, +125°C | • | • |

N = Dual in Line Package (DIP)
D = Small Outline Package (SO) - also available in Tape & Reel (DT)

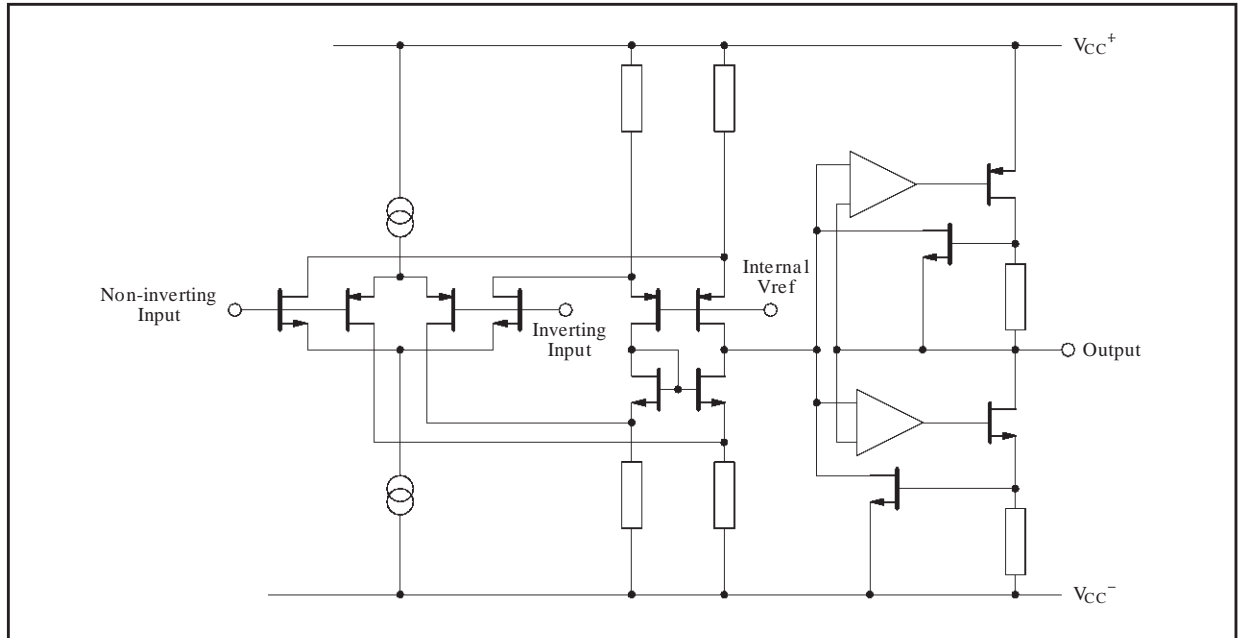


PIN CONNECTIONS (top view)



TS912

SCHEMATIC DIAGRAM (1/2 TS912)



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|------------|---|--------------|--------------------|
| V_{CC} | Supply voltage ¹⁾ | 18 | V |
| V_{id} | Differential Input Voltage ²⁾ | ± 18 | V |
| V_i | Input Voltage 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 TS912/AI/BI | -40 to + 125 | $^{\circ}\text{C}$ |
| T_{stg} | Storage Temperature | -65 to +150 | $^{\circ}\text{C}$ |

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

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 $V_{CC/2}$, $T_{amb} = 25^\circ C$ (unless otherwise specified)

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|-----------------|---|---|------------------|------------------------------|------------------|
| V_{io} | Input Offset Voltage ($V_{ic} = V_o = V_{CC/2}$) $T_{min.} \leq T_{amb} \leq T_{max.}$ | | | 10 5 2 12 7 3 | mV |
| ΔV_{io} | Input Offset Voltage Drift | | 5 | | $\mu V/^\circ C$ |
| I_{io} | Input Offset Current ¹⁾ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 1 | 100 200 | pA |
| I_{ib} | Input Bias Current 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 $3V$, $V_o = 1.5V$ | | 70 | | 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 2 | 10 | | V/mV |
| V_{OH} | High Level Output Voltage ($V_{id} = 1V$) $T_{min.} \leq T_{amb} \leq T_{max.}$ | $R_L = 100k\Omega$ 2.95 $R_L = 10k\Omega$ 2.9 $R_L = 600\Omega$ 2.3 $R_L = 100\Omega$ | 2.96 2.6 2 | | V |
| V_{OL} | Low Level Output Voltage ($V_{id} = -1V$) $T_{min.} \leq T_{amb} \leq T_{max.}$ | $R_L = 100k\Omega$ $R_L = 10k\Omega$ $R_L = 600\Omega$ $R_L = 100\Omega$ | 30 300 900 | 50 70 400 | mV |
| I_o | Output Short Circuit Current ($V_{id} = \pm 1V$) 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 $1.7V$) | | 0.4 | | V/ μs |
| SR ⁻ | Slew Rate ($A_{VCL} = 1$, $R_L = 10k\Omega$, $C_L = 100pF$, $V_i = 1.3V$ to $1.7V$) | | 0.3 | | V/ μs |
| ϕ_m | Phase Margin | | 30 | | Degrees |
| en | Equivalent Input Noise Voltage ($R_s = 100\Omega$, $f = 1kHz$) | | 30 | | nV/ \sqrt{Hz} |

1. Maximum values including unavoidable inaccuracies of the industrial test

TS912

ELECTRICAL CHARACTERISTICS

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

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|-----------------|---|--|---------------------------------|------------------------------|------------------|
| V_{io} | Input Offset Voltage ($V_{ic} = V_o = V_{CC/2}$) $T_{min.} \leq T_{amb} \leq T_{max.}$ | | | 10 5 2 12 7 3 | mV |
| ΔV_{io} | Input Offset Voltage Drift | | 5 | | $\mu V/^\circ C$ |
| I_{io} | Input Offset Current ¹⁾ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 1 | 100 200 | pA |
| I_{ib} | Input Bias Current 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 | 40 | | V/mV |
| V_{OH} | High Level Output Voltage ($V_{id} = 1V$) $T_{min.} \leq T_{amb} \leq T_{max.}$ | $R_L = 100k\Omega$ 4.95 $R_L = 10k\Omega$ 4.9 $R_L = 600\Omega$ 4.25 $R_L = 100\Omega$ 4.8 $R_L = 10k\Omega$ 4.1 $R_L = 600\Omega$ | 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 150 750 | 50 100 500 | 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 | | |
| SR^- | Slew Rate ($A_{VCL} = 1$, $R_L = 10k\Omega$, $C_L = 100pF$, $V_i = 1V$ to $4V$) | | 0.6 | | V/ μs |
| en | Equivalent Input Noise Voltage ($R_s = 100\Omega$, $f = 1kHz$) | | 30 | | nV/ \sqrt{Hz} |
| V_{O1}/V_{O2} | Channel Separation ($f = 1kHz$) | | 120 | | dB |
| ϕm | Phase Margin | | 30 | | Degrees |

1. Maximum values including unavoidable inaccuracies of the industrial test

ELECTRICAL CHARACTERISTICS
 $V_{CC^+} = 10V$, $V_{CC^-} = 0V$, R_L , C_L connected to $V_{CC/2}$, $T_{amb} = 25^\circ C$ (unless otherwise specified)

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|-------------------|--|--------------------|------|------|------------------|
| V_{io} | Input Offset Voltage ($V_{ic} = V_o = V_{CC/2}$) $T_{min.} \leq T_{amb} \leq T_{max.}$ | TS912 | | 10 | mV |
| | | TS912A | | 5 | |
| | | TS912B | | 2 | |
| | | TS912 | | 12 | |
| | | TS912A | | 7 | |
| TS912B | | 3 | | | |
| ΔV_{io} | Input Offset Voltage Drift | | 5 | | $\mu V/^\circ C$ |
| I_{io} | Input Offset Current ¹⁾ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 1 | 100 | pA |
| | | | | 200 | |
| I_{ib} | Input Bias Current ¹⁾ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 1 | 150 | pA |
| | | | | 300 | |
| I_{CC} | Supply Current (per amplifier, $A_{VCL} = 1$, no load) $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 400 | 600 | μA |
| | | | | 700 | |
| CMR | Common Mode Rejection Ratio $V_{ic} = 3$ to $7V$, $V_o = 5V$ $V_{ic} = 0$ to $10V$, $V_o = 5V$ | 60 | 90 | | dB |
| | | 50 | 75 | | |
| SVR | Supply Voltage Rejection Ratio ($V_{CC^+} = 5$ to $10V$, $V_o = V_{CC/2}$) | 60 | 90 | | dB |
| A_{vd} | Large Signal Voltage Gain ($R_L = 10k\Omega$, $V_o = 2.5V$ to $7.5V$) $T_{min.} \leq T_{amb} \leq T_{max.}$ | 15 | 50 | | V/mV |
| | | 10 | | | |
| V_{OH} | High Level Output Voltage ($V_{id} = 1V$) $T_{min.} \leq T_{amb} \leq T_{max.}$ | $R_L = 100k\Omega$ | 9.95 | | V |
| | | $R_L = 10k\Omega$ | 9.85 | 9.95 | |
| | | $R_L = 600\Omega$ | 9 | 9.35 | |
| | | $R_L = 100\Omega$ | | 7.8 | |
| | | $R_L = 10k\Omega$ | 9.8 | | |
| $R_L = 600\Omega$ | 8.8 | | | | |
| V_{OL} | Low Level Output Voltage ($V_{id} = -1V$) $T_{min.} \leq T_{amb} \leq T_{max.}$ | $R_L = 100k\Omega$ | | 50 | mV |
| | | $R_L = 10k\Omega$ | | 150 | |
| | | $R_L = 600\Omega$ | | 800 | |
| | | $R_L = 100\Omega$ | | 2300 | |
| | | $R_L = 10k\Omega$ | | 150 | |
| $R_L = 600\Omega$ | | 900 | | | |
| I_o | Output Short Circuit Current ($V_{id} = \pm 1V$) Source ($V_o = V_{CC^-}$) Sink ($V_o = V_{CC^+}$) | 45 | 65 | | mA |
| | | 50 | 75 | | |
| GBP | Gain Bandwidth Product ($A_{VCL} = 100$, $R_L = 10k\Omega$, $C_L = 100pF$, $f = 100kHz$) | | 1.4 | | MHz |
| SR^+ | Slew Rate ($A_{VCL} = 1$, $R_L = 10k\Omega$, $C_L = 100pF$, $V_i = 2.5V$ to $7.5V$) | | 1.3 | | V/ μs |
| SR^- | Slew Rate ($A_{VCL} = 1$, $R_L = 10k\Omega$, $C_L = 100pF$, $V_i = 2.5V$ to $7.5V$) | | 0.8 | | |
| ϕ_m | Phase Margin | | 40 | | Degrees |
| en | Equivalent Input Noise Voltage ($R_s = 100\Omega$, $f = 1kHz$) | | 30 | | nV/ \sqrt{Hz} |
| THD | Total Harmonic Distortion ($A_{VCL} = 1$, $R_L = 10k\Omega$, $C_L = 100pF$, $V_o = 4.75V$ to $5.25V$, $f = 1kHz$) | | 0.02 | | % |
| C_{in} | Input Capacitance | | 1.5 | | pF |

1. Maximum values including unavoidable inaccuracies of the industrial test

TYPICAL CHARACTERISTICS

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

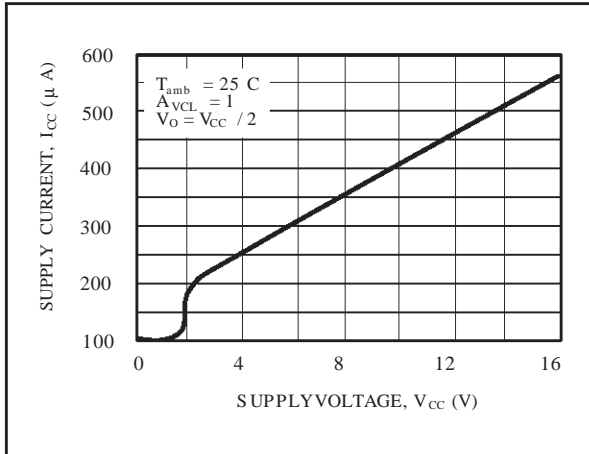


Figure 2 : Input Bias Current vs Temperature

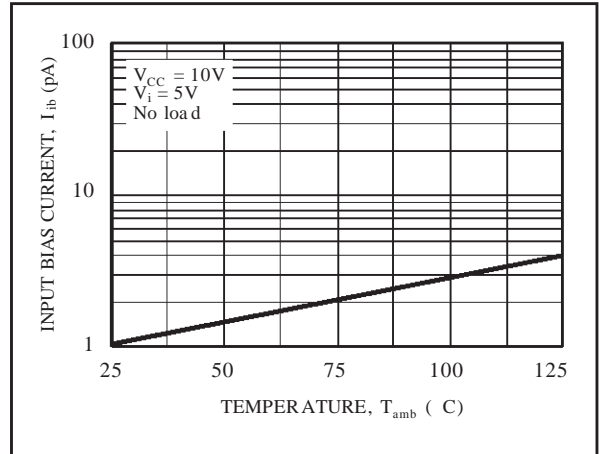


Figure 3a : High Level Output Voltage vs High Level Output Current

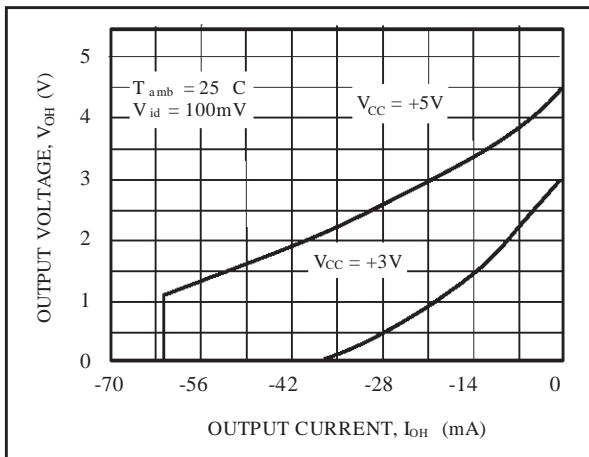


Figure 3b : High Level Output Voltage vs High Level Output Current

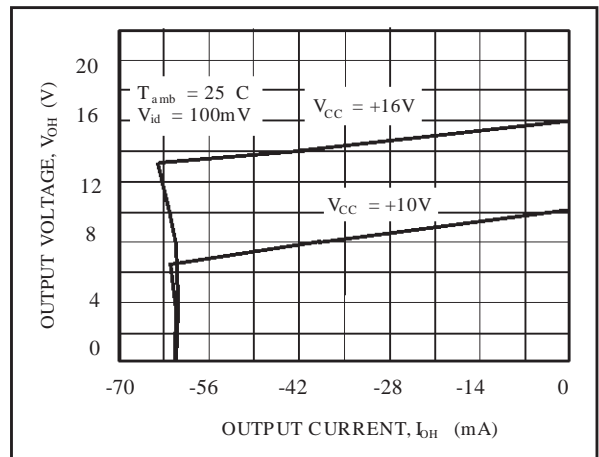


Figure 4a : Low Level Output Voltage vs Low Level Output Current

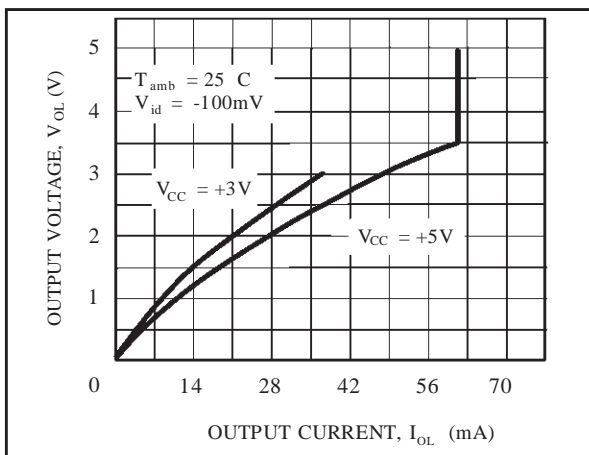


Figure 4b : Low Level Output Voltage vs Low Level Output Current

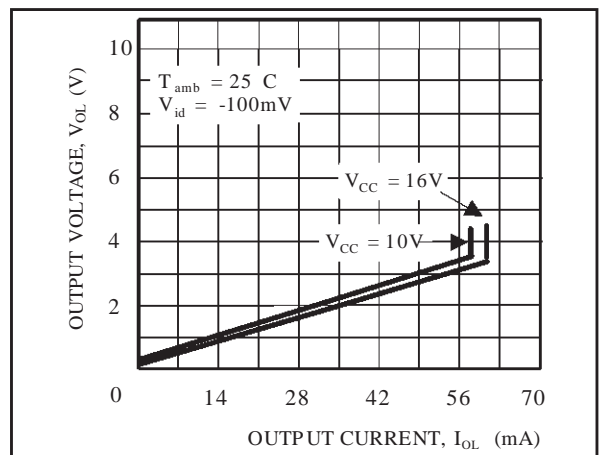


Figure 5a : Gain and Phase vs Frequency

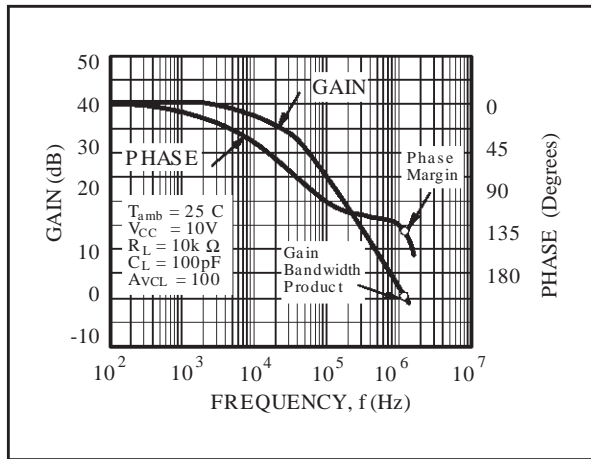


Figure 5b : Gain and Phase vs Frequency

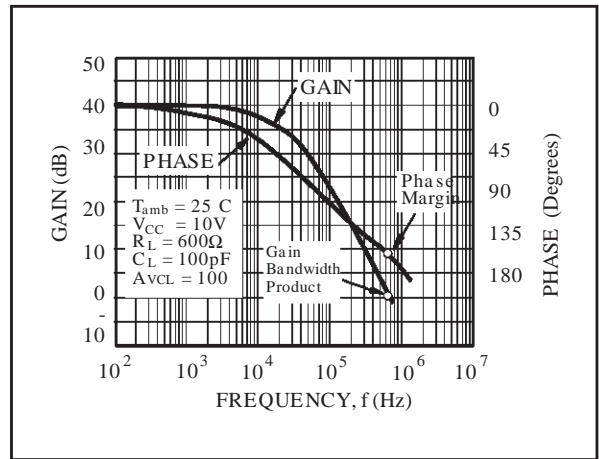


Figure 6a : Gain Bandwidth Product vs Supply Voltage

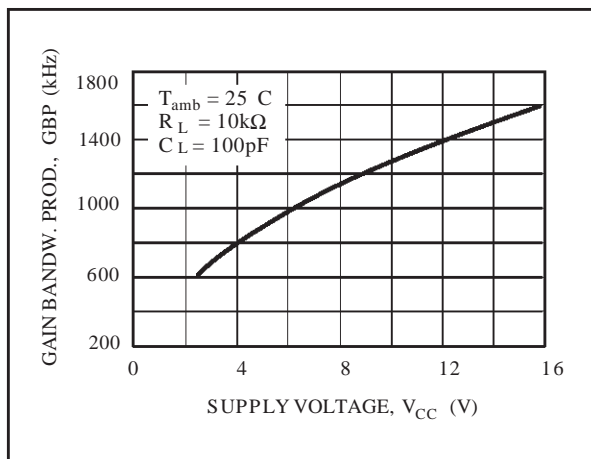


Figure 6b : Gain Bandwidth Product vs Supply Voltage

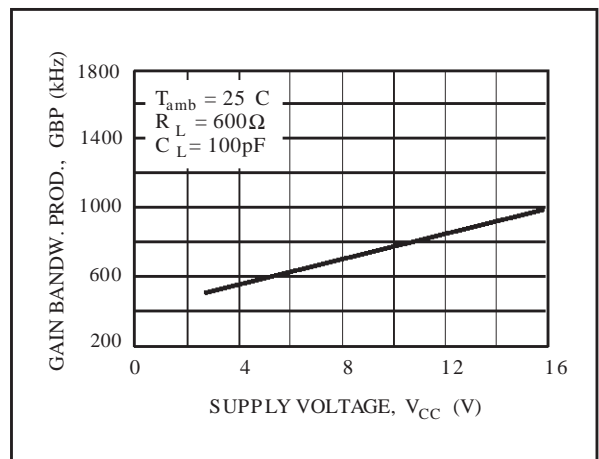


Figure 7a : Phase Margin vs Supply Voltage

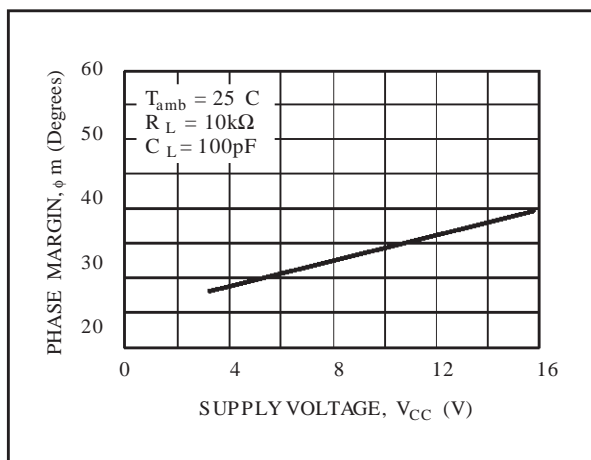


Figure 7b : Phase Margin vs Supply Voltage

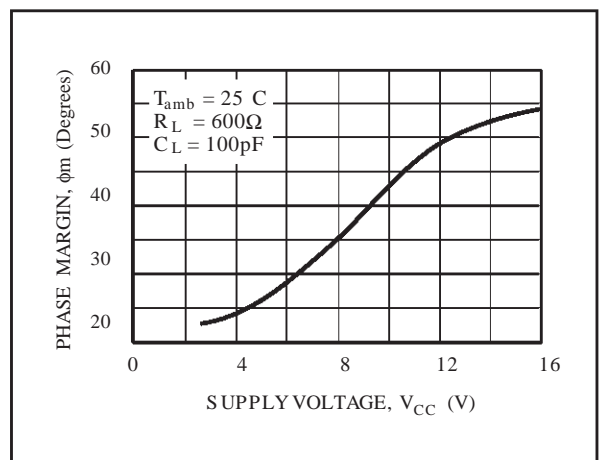
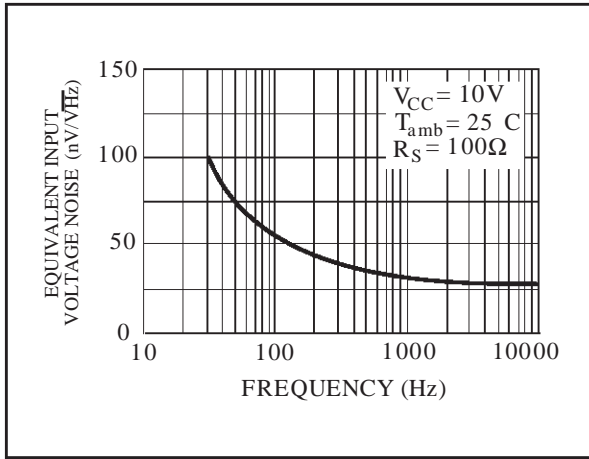


Figure 8 : Input Voltage Noise vs Frequency



MACROMODEL**Applies to : TS912 (V_{CC} = 3V)**

** Standard Linear Ics Macromodels, 1993.

** CONNECTIONS :

* 1 INVERTING INPUT

* 2 NON-INVERTING INPUT

* 3 OUTPUT

* 4 POSITIVE POWER SUPPLY

* 5 NEGATIVE POWER SUPPLY

.SUBCKT TS912_3 1 3 2 4 5 (analog)

.MODEL MDTH D IS=1E-8 KF=6.564344E-14 CJO=10F

* INPUT STAGE

CIP 2 5 1.000000E-12

CIN 1 5 1.000000E-12

EIP 10 5 2 5 1

EIN 16 5 1 5 1

RIP 10 11 6.500000E+00

RIN 15 16 6.500000E+00

RIS 11 15 1.271505E+01

DIP 11 12 MDTH 400E-12

DIN 15 14 MDTH 400E-12

VOFP 12 13 DC 0.000000E+00

VOFN 13 14 DC 0

IPOL 13 5 4.000000E-05

CPS 11 15 2.125860E-08

DINN 17 13 MDTH 400E-12

VIN 17 5 0.000000E+00

DINR 15 18 MDTH 400E-12

VIP 4 18 0.000000E+00

FCP 4 5 VOFP 5.000000E+00

FCN 5 4 VOFN 5.000000E+00

* AMPLIFYING STAGE

FIP 5 19 VOFP 2.750000E+02

FIN 5 19 VOFN 2.750000E+02

RG1 19 5 1.916825E+05

RG2 19 4 1.916825E+05

CC 19 29 2.200000E-08

HZTP 30 29 VOFP 1.3E+03

HZTN 5 30 VOFN 1.3E+03

DOPM 19 22 MDTH 400E-12

DONM 21 19 MDTH 400E-12

HOPM 22 28 VOUT 3800

VIPM 28 4 150

HONM 21 27 VOUT 3800

VINM 5 27 150

EOUT 26 23 19 5 1

VOUT 23 5 0

ROUT 26 3 75

COUT 3 5 1.000000E-12

DOP 19 68 MDTH 400E-12

VOP 4 25 1.724

HSCP 68 25 VSCP1 0.8E8

DON 69 19 MDTH 400E-12

VON 24 5 1.7419107

HSCN 24 69 VSCN1 0.8E+08

VSCTHP 60 61 0.0875

** VSCTHP = le seuil au dessus de vio * 500

** c.a.d 275U-000U dus a l'offset

DSCP1 61 63 MDTH 400E-12

VSCP1 63 64 0

ISCP 64 0 1.000000E-8

DSCP2 0 64 MDTH 400E-12

DSCN2 0 74 MDTH 400E-12

ISCN 74 0 1.000000E-8

VSCN1 73 74 0

DSCN1 71 73 MDTH 400E-12

VSCTHN 71 70 -0.55

** VSCTHN = le seuil au dessous de vio * 2000

** c.a.d -375U-000U dus a l'offset

ESCP 60 0 2 1 500

ESCN 70 0 2 1 -2000

.ENDS

ELECTRICAL CHARACTERISTICSV_{CC}⁺ = 3V, V_{CC}⁻ = 0V, R_L, C_L connected to V_{CC/2}, T_{amb} = 25°C (unless otherwise specified)

| Symbol | Conditions | Value | Unit |
|---------------------|---|-------------|------|
| V _{io} | | 0 | mV |
| A _{vd} | R _L = 10kΩ | 10 | V/mV |
| I _{CC} | No load, per operator | 200 | μA |
| V _{icm} | | -0.2 to 3.2 | V |
| V _{OH} | R _L = 10kΩ | 2.96 | V |
| V _{OL} | R _L = 10kΩ | 30 | mV |
| I _{sink} | V _O = 3V | 40 | mA |
| I _{source} | V _O = 0V | 40 | mA |
| GBP | R _L = 10kΩ, C _L = 100pF | 0.8 | MHz |
| SR | R _L = 10kΩ, C _L = 100pF | 0.3 | V/μs |

TS912

MACROMODEL

Applies to : TS912 ($V_{CC} = 5V$)

** Standard Linear Ics Macromodels, 1993.

** CONNECTIONS :

* 1 INVERTING INPUT

* 2 NON-INVERTING INPUT

* 3 OUTPUT

* 4 POSITIVE POWER SUPPLY

* 5 NEGATIVE POWER SUPPLY

* 6 STANDBY

.SUBCKT TS912_5 1 3 2 4 5 (analog)

.MODEL MDTH D IS=1E-8 KF=6.564344E-14 CJO=10F

* INPUT STAGE

CIP 2 5 1.000000E-12

CIN 1 5 1.000000E-12

EIP 10 5 2 5 1

EIN 16 5 1 5 1

RIP 10 11 6.500000E+00

RIN 15 16 6.500000E+00

RIS 11 15 7.322092E+00

DIP 11 12 MDTH 400E-12

DIN 15 14 MDTH 400E-12

VOFP 12 13 DC 0.000000E+00

VOFN 13 14 DC 0

IPOL 13 5 4.000000E-05

CPS 11 15 2.498970E-08

DINN 17 13 MDTH 400E-12

VIN 17 5 0.000000E+00

DINR 15 18 MDTH 400E-12

VIP 4 18 0.000000E+00

FCP 4 5 VOFP 5.750000E+00

FCN 5 4 VOFN 5.750000E+00

ISTB0 5 4 500N

* AMPLIFYING STAGE

FIP 5 19 VOFP 4.400000E+02

FIN 5 19 VOFN 4.400000E+02

RG1 19 5 4.904961E+05

RG2 19 4 4.904961E+05

CC 19 29 2.200000E-08

HZTP 30 29 VOFP 1.8E+03

HZTN 5 30 VOFN 1.8E+03

DOPM 19 22 MDTH 400E-12

DONM 21 19 MDTH 400E-12

HOPM 22 28 VOUT 3800

VIPM 28 4 230

HONM 21 27 VOUT 3800

VINM 5 27 230

EOUT 26 23 19 5 1

VOUT 23 5 0

ROUT 26 3 82

COU 3 5 1.000000E-12

DOP 19 68 MDTH 400E-12

VOP 4 25 1.724

HSCP 68 25 VSCP1 0.8E+08

DON 69 19 MDTH 400E-12

VON 24 5 1.7419107

HSCN 24 69 VSCN1 0.8E+08

VSCTHP 60 61 0.0875

** VSCTHP = le seuil au dessus de vio * 500

** c.a.d 275U-000U dus a l'offset

DSCP1 61 63 MDTH 400E-12

VSCP1 63 64 0

ISCP 64 0 1.000000E-8

DSCP2 0 64 MDTH 400E-12

DSCN2 0 74 MDTH 400E-12

ISCN 74 0 1.000000E-8

VSCN1 73 74 0

DSCN1 71 73 MDTH 400E-12

VSCTHN 71 70 -0.55

** VSCTHN = le seuil au dessous de vio * 2000

** c.a.d -375U-000U dus a l'offset

ESCP 60 0 2 1 500

ESCN 70 0 2 1 -2000

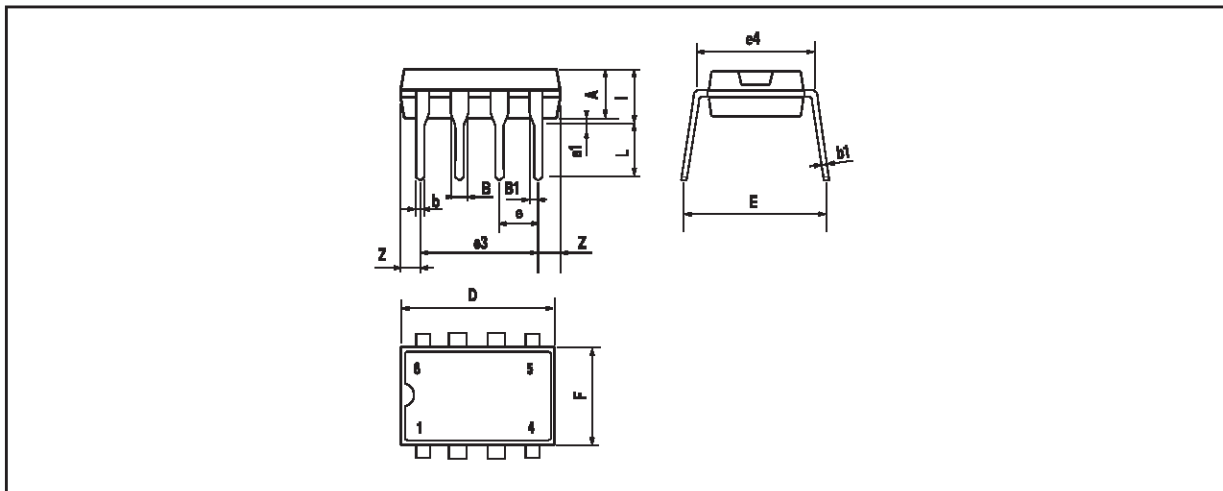
.ENDS

ELECTRICAL CHARACTERISTICS

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

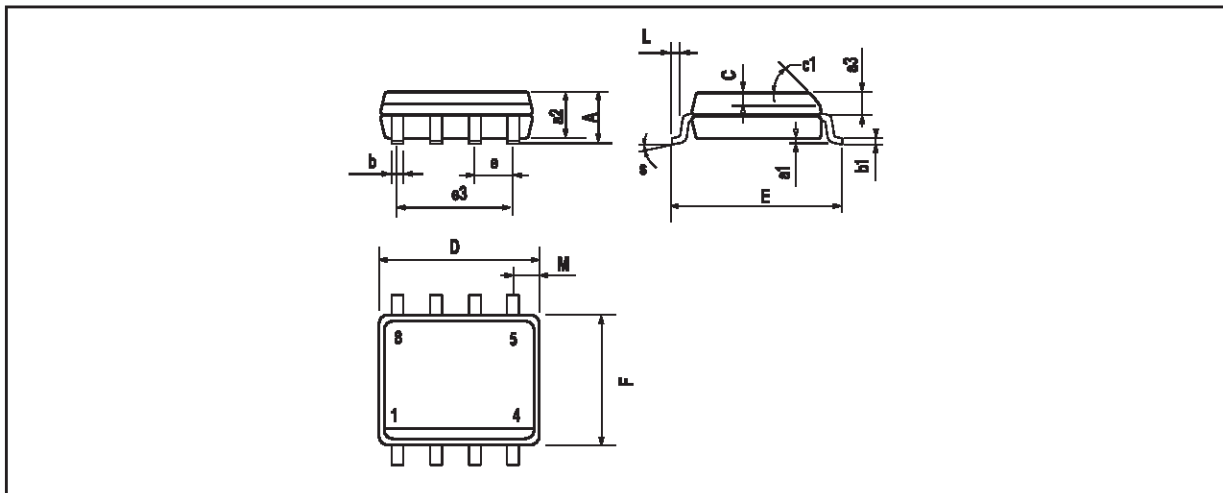
| Symbol | Conditions | Value | Unit |
|--------------|-----------------------------------|-------------|------------|
| V_{io} | | 0 | mV |
| A_{vd} | $R_L = 10k\Omega$ | 50 | V/mV |
| I_{CC} | No load, per operator | 230 | μA |
| V_{icm} | | -0.2 to 5.2 | V |
| V_{OH} | $R_L = 10k\Omega$ | 4.95 | V |
| V_{OL} | $R_L = 10k\Omega$ | 40 | mV |
| I_{sink} | $V_O = 5V$ | 65 | mA |
| I_{source} | $V_O = 0V$ | 65 | mA |
| GBP | $R_L = 10k\Omega$, $C_L = 100pF$ | 1 | MHz |
| SR | $R_L = 10k\Omega$, $C_L = 100pF$ | 0.8 | V/ μs |

PACKAGE MECHANICAL DATA
8 PINS - PLASTIC DIP



| 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 | | | 0.260 |
| 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.) | | | | | |

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