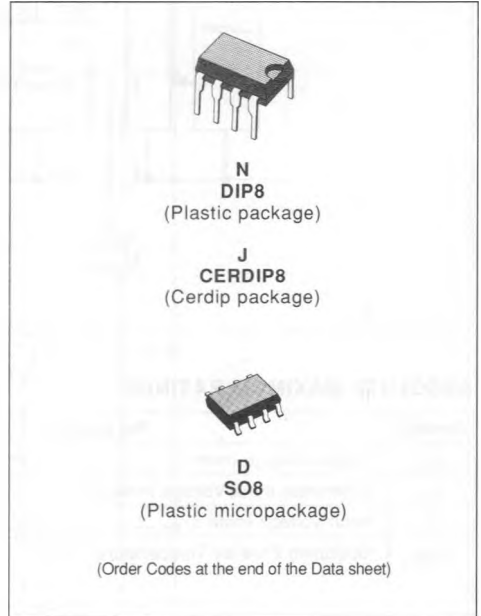


## CMOS DUAL OPERATIONAL AMPLIFIERS

- EXCELLENT PHASE MARGIN ON CAPACITANCE LOADS
- SYMMETRICAL OUTPUT CURRENTS
- HIGH GAIN BANDWIDTH PRODUCT FOR TS272
- LOW OUTPUT DYNAMIC IMPEDANCE
- THE TRANSFER FUNCTION IS LINEAR
- PIN COMPATIBLE TO STANDARD DUAL OPERATIONAL AMPLIFIERS (TL082 - LM358)
- STABLE AND LOW OFFSET VOLTAGE
- INTERNAL ELECTROSTATIC DISCHARGE (ESD) PROTECTION CIRCUITS
- THREE INPUT OFFSET VOLTAGE SELECTIONS : STANDARD (10 mV), A (5 mV), B (2 mV)



### DESCRIPTION

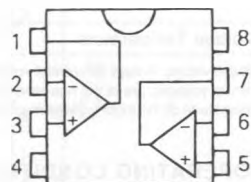
The TS272 series are low cost, low power dual operational amplifiers designed to operate with single or dual supplies. These operational amplifiers use the SGS THOMSON Microelectronics silicon gate LIN MOS process giving them an excellent consumption speed ratio. These series are ideally suited for low consumption applications.

Three power consumptions are available allowing to have always the best consumption-speed ratio.

- $I_{CC} = 10 \mu A$  per amplifier : TS27L2 (Low bias versions)
- $I_{CC} = 150 \mu A$  per amplifier : TS27M2 (Medium bias versions)
- $I_{CC} = 1 mA$  per amplifier : TS272 (High bias versions)

The input impedance is similar to the J-FET input impedance. Very high input impedance and extremely low input offset and bias currents. They allow to minimize the static errors in low impedance applications.

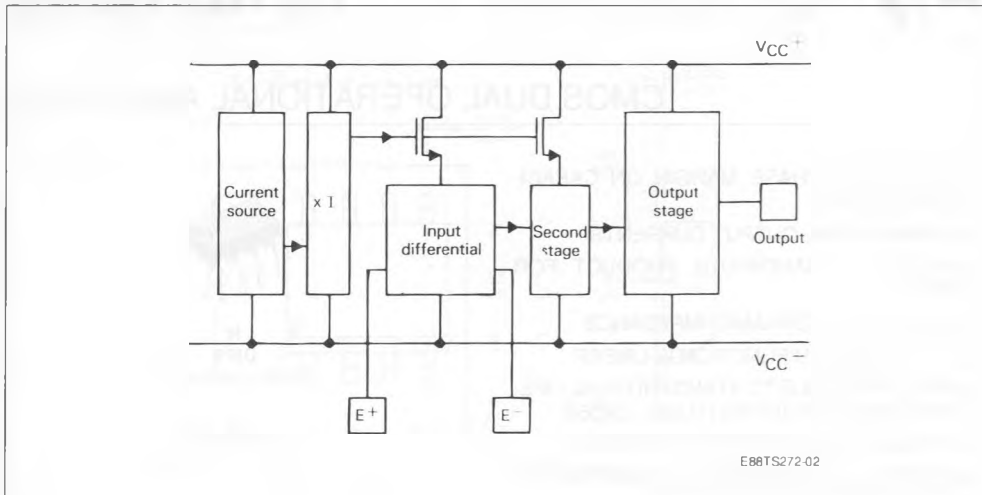
### PIN CONNECTIONS (top view)



E88TS272-01

- 1 - Output 1
- 2 - Inverting input 1
- 3 - Non-inverting input 1
- 4 -  $V_{CC}^-$
- 5 - Non-inverting input 2
- 6 - Inverting input 2
- 7 - Output 2
- 8 -  $V_{CC}^+$

**BLOCK DIAGRAM**



**ABSOLUTE MAXIMUM RATINGS**

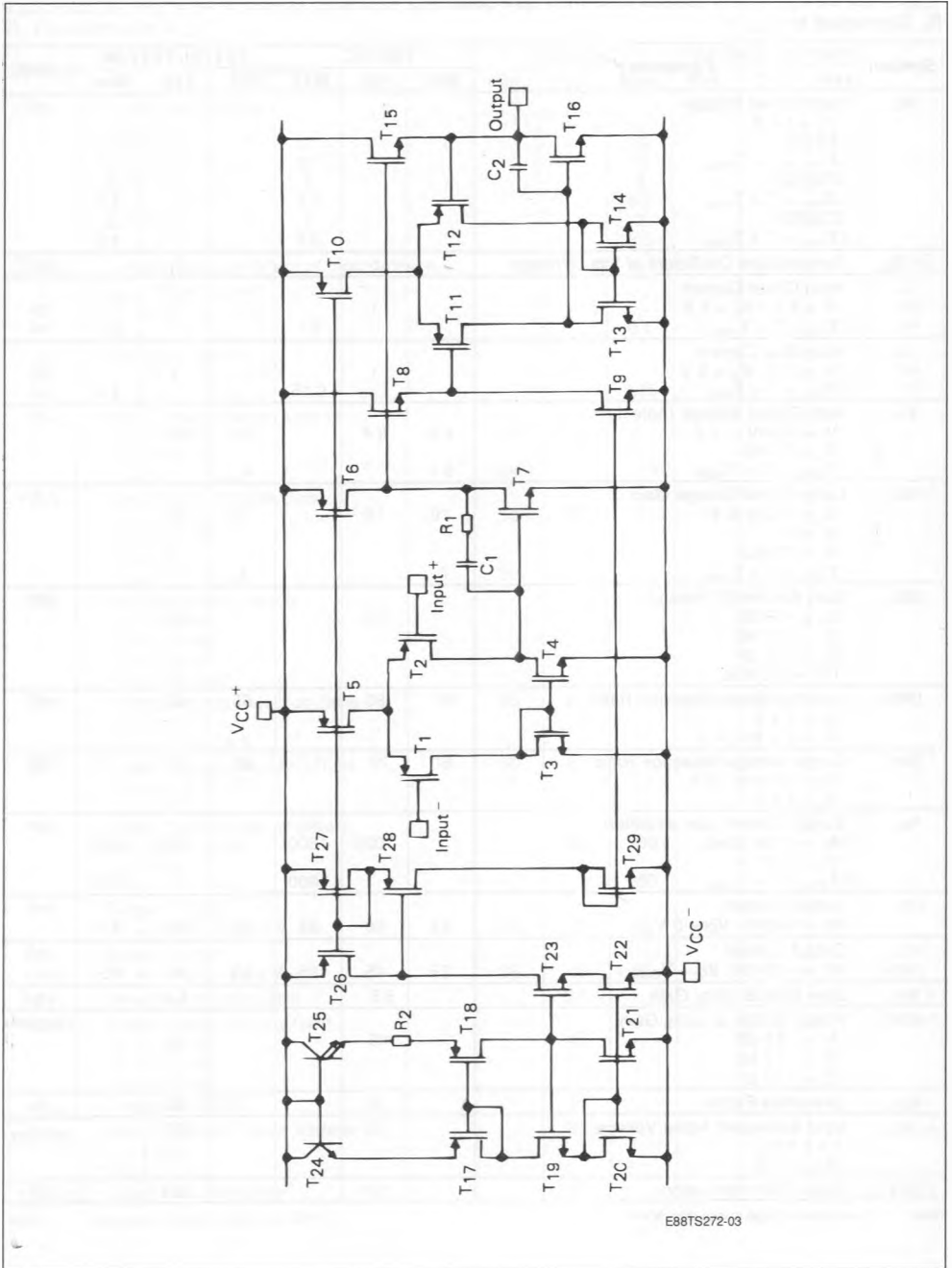
Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage (note 1)	12	V
$V_{id}$	Differential Input Voltage (note 2)	$\pm 12$	V
$V_i$	Input Voltage (note 3)	- 0.3 to 12	V
$T_{oper}$	Operating Free-air Temperature	TS272C 0 to 70 TS272I - 40 to 105 TS272M - 55 to 125 TS27M2C 0 to 70 TS27M2I - 40 to 105 TS27M2M - 55 to 125 TS27L2C 0 to 70 TS27L2I - 40 to 105 TS27L2M - 55 to 125	$^{\circ}$ C
$T_{sig}$	Storage Temperature	- 65 to 150	$^{\circ}$ C

- Notes : 1. All voltage values, except differential voltages, are with respect to network ground terminal  
 2. Differential voltages are at the non-inverting input terminal respect to the terminal  
 3. The magnitude of the input voltage must never exceed the magnitude of the positive supply voltage

**OPTIMAL OPERATING CONDITIONS**

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage (note 1)	4 to 10	V
$V_i$	Common Mode Input Voltage $V_{CC} = 10$ V	0 to 9	V

SCHEMATIC DIAGRAM (For 1/2 TS27x2)



**ELECTRICAL CHARACTERISTICS FOR TS272**

T<sub>amb</sub> = 25 °C, V<sub>CC</sub> = 10 V (unless otherwise specified)

R<sub>L</sub> Connected to V<sub>CC</sub> —

Symbol	Parameter	TS272C			TS272I/TS272M			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V <sub>io</sub>	Input Offset Voltage V <sub>o</sub> = 1.4 V TS272 T <sub>min</sub> < T < T <sub>max</sub> TS272A T <sub>min</sub> < T < T <sub>max</sub> TS272B T <sub>min</sub> < T < T <sub>max</sub>			10 12 5 6.5 2 3.5			10 12 5 6.5 2 3.5	mV
α V <sub>io</sub>	Temperature Coefficient of Input Voltage		5			5		μV/°C
I <sub>io</sub>	Input Offset Current V <sub>i</sub> = 5 V, V <sub>o</sub> = 5 V T <sub>min</sub> < T < T <sub>max</sub>		1	0.1		1	0.2	pA nA
I <sub>IB</sub>	Input Bias Current V <sub>i</sub> = 5 V, V <sub>o</sub> = 5 V T <sub>min</sub> < T < T <sub>max</sub>		1	0.15		1	0.3	pA nA
V <sub>DH</sub>	High Output Voltage (note 1) V <sub>i</sub> = 10 mV R <sub>L</sub> = 10 kΩ T <sub>min</sub> < T < T <sub>max</sub>	8.2 8.1	8.4		8.2 8	8.4		V
A <sub>vd</sub>	Large Signal Voltage Gain V <sub>o</sub> = 1 V to 6 V V <sub>i</sub> = 5 V R <sub>L</sub> = 10 KΩ T <sub>min</sub> < T < T <sub>max</sub>	10 7	15		10 6	15		V/mV
G <sub>wr</sub>	Gain Bandwidth Product A <sub>v</sub> = 40 dB R <sub>L</sub> = 10 kΩ C <sub>L</sub> = 100 pF F <sub>in</sub> = 200 KHz		3.5			3.5		MHz
CMR	Common Mode Rejection Ratio V <sub>o</sub> = 1.4 V V <sub>i</sub> = 1 V to 7.4 V	65	80		65	80		dB
SVR	Supply Voltage Rejection Ratio V <sub>CC</sub> = 5 V to 10 V V <sub>o</sub> = 1.4 V	60	70		60	70		dB
I <sub>CC</sub>	Supply Current (per amplifier) A <sub>v</sub> = 1, no Load V <sub>o</sub> = 5 V T <sub>min</sub> < T < T <sub>max</sub>		1000	1500 1600		1000	1500 1700	μA
I <sub>s</sub>	Output Current V <sub>i</sub> = 10 mV, V <sub>o</sub> = 0 V	45	60	85	45	60	85	mA
I <sub>s</sub> (sink)	Output Current V <sub>i</sub> = -10 mV, V <sub>o</sub> = V <sub>CC</sub>	35	45	65	35	45	65	mA
S <sub>VO</sub>	Slew Rate at Unity Gain		5.5			5.5		V/μS
ø <sub>m</sub>	Phase Margin at Unity Gain A <sub>v</sub> = 40 dB R <sub>L</sub> = 10 kΩ C <sub>L</sub> = 100 pF		45			45		Degrees
K <sub>OV</sub>	Overshoot Factor		30			30		%
V <sub>n</sub>	Input Equivalent Noise Voltage f = 1 KHz R <sub>S</sub> = 10 Ω		30			30		nV/√Hz
V <sub>O1</sub> /V <sub>O2</sub>	Cross Talk Attenuation		120			120		dB

Note : 1. Low output voltage is less than 50mV

## ELECTRICAL CHARACTERISTICS FOR TS27M2

 $T_{amb} = 25\text{ }^{\circ}\text{C}$ ,  $V_{CC} = 10\text{ V}$  (unless otherwise specified) $R_L$  Connected to  $V_{CC}$  —

Symbol	Parameter	TS27M2C			TS27M2I/TS27M2M			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
$V_{io}$	Input Offset Voltage $V_o = 1.4\text{ V}$ TS27M2 $T_{min} < T < T_{max}$ TS27M2A $T_{min} < T < T_{max}$ TS27M2B $T_{min} < T < T_{max}$			10 12 5 6.5 2 3.5			10 12 5 6.5 2 3.5	mV
$\alpha V_{io}$	Temperature Coefficient of Input Voltage		2			2		$\mu\text{V}/^{\circ}\text{C}$
$I_{io}$	Input Offset Current $V_i = 5\text{ V}$ , $V_o = 5\text{ V}$ $T_{min} < T < T_{max}$		1	0.1		1	0.2	pA nA
$I_{B}$	Input Bias Current $V_i = 5\text{ V}$ , $V_o = 5\text{ V}$ $T_{min} < T < T_{max}$		1	0.15		1	0.3	pA nA
$V_{DH}$	High Output Voltage (note 1) $V_i = 10\text{ mV}$ $R_L = 100\text{ k}\Omega$ $T_{min} < T < T_{max}$	8.7 8.6	8.9		8.7 8.5	8.9		V
$A_{vd}$	Large Signal Voltage Gain $V_o = 1\text{ V to }6\text{ V}$ $R_L = 100\text{ k}\Omega$ $V_i = 5\text{ V}$ $T_{min} < T < T_{max}$	30 20	50		30 10	50		V/mV
$G_{wr}$	Gain Bandwidth Product $A_v = 40\text{ dB}$ $R_L = 100\text{ k}\Omega$ $C_L = 100\text{ pF}$ $F_{in} = 100\text{ KHz}$		1			1		MHz
CMR	Common-mode Rejection Ratio $V_o = 1.4\text{ V}$ $V_i = 1\text{ V to }7.4\text{ V}$	65	80		65	80		dB
SVR	Supply Voltage Rejection Ratio $V_{CC} = 5\text{ V to }10\text{ V}$ $V_o = 1.4\text{ V}$	60	80		60	80		dB
$I_{CC}$	Supply Current (per amplifier) $A_v = 1$ , no Load $V_o = 5\text{ V}$ $T_{min} < T < T_{max}$		150	200 250		150 200	300	$\mu\text{A}$
$I_s$	Output Current $V_i = 10\text{ mV}$ , $V_o = 0\text{ V}$	45	60	85	45	60	85	mA
$I_s$ (sink)	Output Current $V_i = -10\text{ mV}$ , $V_o = V_{CC}$	35	45	65	35	45	65	mA
$S_{vg}$	Slew Rate at Unity Gain		0.6			0.6		V/ $\mu\text{s}$
$\phi_m$	Phase Margin at Unity Gain $A_v = 40\text{ dB}$ $R_L = 100\text{ k}\Omega$ $C_L = 100\text{ pF}$		45			45		Degrees
$K_{OV}$	Overshoot Factor		30			30		%
$V_n$	Input Equivalent Noise Voltage $f = 1\text{ KHz}$ $R_S = 10\text{ }\Omega$		38			38		nV/ $\sqrt{\text{Hz}}$
$V_{O1}/V_{O2}$	Cross Talk Attenuation		120			120		dB

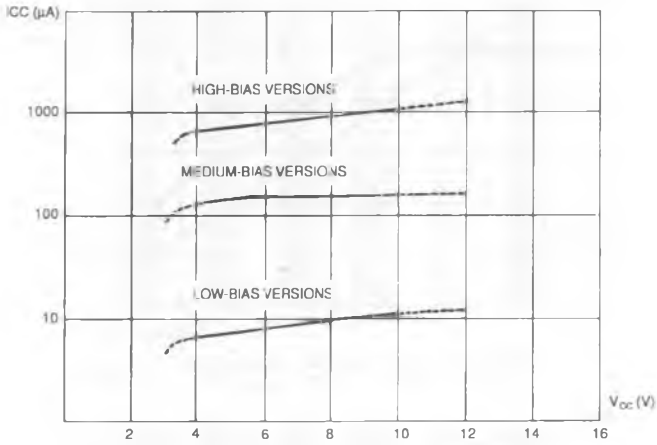
Note : 1. Low output voltage is less than 50mV.

**ELECTRICAL CHARACTERISTICS FOR TS27L2**
 $T_{amb} = 25\text{ }^{\circ}\text{C}$ ,  $V_{CC} = 10\text{ V}$  (unless otherwise specified)

 $R_L$  Connected to  $V_{CC}$ 

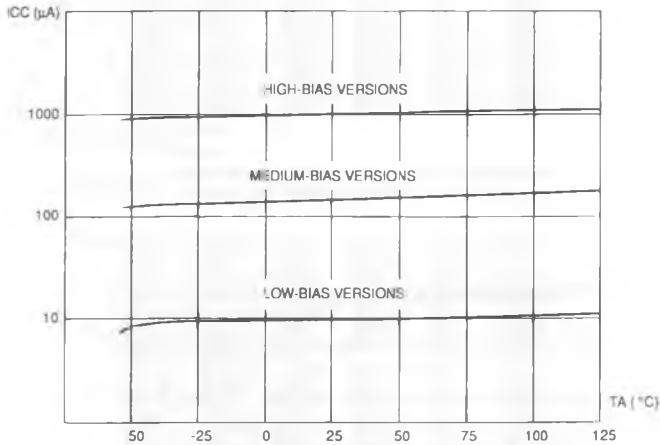
Symbol	Parameter	TS27L2C			TS27L2I/TS27L2M			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
$V_{IO}$	Input Offset Voltage $V_o = 1.4\text{ V}$ TS27L2 $T_{min} < T < T_{max}$ TS27L2A $T_{min} < T < T_{max}$ TS27L2B $T_{min} < T < T_{max}$			10 12 5 6.5 2 3.5			10 5 6.5 2 3.5	mV
$\alpha V_{IO}$	Temperature Coefficient of Input Voltage		0.7			0.7		$\mu\text{V}/^{\circ}\text{C}$
$I_{IO}$	Input Offset Current $V_i = 5\text{ V}$ , $V_o = 5\text{ V}$ $T_{min} < T < T_{max}$		1	0.1		1	0.2	pA nA
$I_{IB}$	Input Bias Current $V_i = 5\text{ V}$ , $V_o = 5\text{ V}$ $T_{min} < T < T_{max}$		1	0.15		1	0.3	pA nA
$V_{DH}$	High Output Voltage (note 1) $V_i = 10\text{ mV}$ $R_L = 1\text{ M}\Omega$ $T_{min} < T < T_{max}$	8.8 8.7	9		8.8 8.6	9		V
$A_{vd}$	Large Signal Voltage Gain $V_o = 1\text{ V to }6\text{ V}$ $R_L = 1\text{ M}\Omega$ $V_i = 5\text{ V}$ $T_{min} < T < T_{max}$	60 45	100		60 40	100		V/mV
$G_{wr}$	Gain Bandwidth Product $A_v = 40\text{ dB}$ $R_L = 1\text{ M}\Omega$ $C_L = 100\text{ pF}$ $F_{in} = 100\text{ KHz}$		0.1			0.1		MHz
CMR	Common Mode Rejection Ratio $V_o = 1.4\text{ V}$ $V_i = 1\text{ V to }7.4\text{ V}$	65	80		65	80		dB
SVR	Supply Voltage Rejection Ratio $V_{CC} = 5\text{ V to }10\text{ V}$ $V_o = 1.4\text{ V}$	60	80		60	80		dB
$I_{CC}$	Supply Current (per amplifier) $A_v = 1$ , no Load $V_o = 5\text{ V}$ $T_{min} < T < T_{max}$		10	15 17		10 15	15 18	$\mu\text{A}$
$I_s$	Output Current $V_i = 10\text{ mV}$ , $V_o = 0\text{ V}$	45	60	85	45	60	85	mA
$I_s$ (Sink)	Output Current $V_i = -10\text{ mV}$ , $V_o = V_{CC}$	35	45	65	35	45	65	mA
$S_{VO}$	Slew Rate at Unity Gain		0.04			0.04		V/ $\mu\text{s}$
$\phi_m$	Phase Margin at Unity Gain $A_v = 40\text{ dB}$ $R_L = 1\text{ M}\Omega$ $C_L = 100\text{ pF}$		45			45		Degrees
$K_{OV}$	Overshoot Factor		30			30		%
$V_n$	Input Equivalent Noise Voltage $f = 1\text{ KHz}$ $R_S = 10\text{ }\Omega$		70			70		nV/ $\sqrt{\text{Hz}}$
$V_{O1}/V_{O2}$	Cross Talk Attenuation		120			120		dB

**Note :** 1. Low output voltage is less than 50mV.



SUPPLY CURRENT vs FREE-AIR TEMPERATURE  
 $V_O = V_{IC} = 0.2 V_{CC}$ ,  $T_{amb} = 25^\circ\text{C}$ , NO LOAD

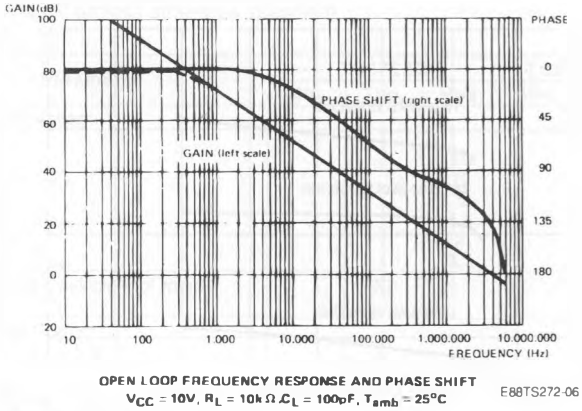
E88TS272-04



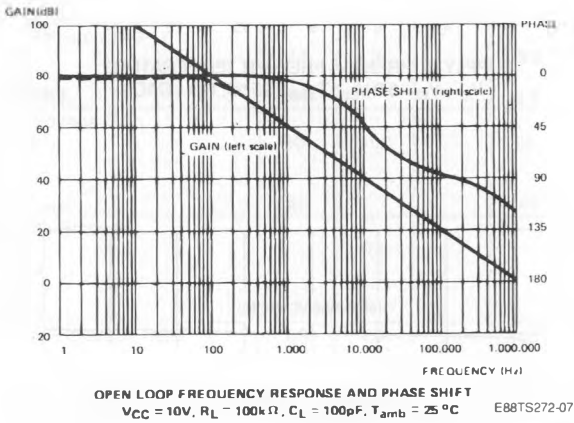
SUPPLY CURRENT vs FREE-AIR TEMPERATURE  
 $V_{CC} = 10\text{ V}$ ,  $V_{IC} = 5\text{ V}$ ,  $V_O = 5\text{ V}$ , NO LOAD

E88TS272-05

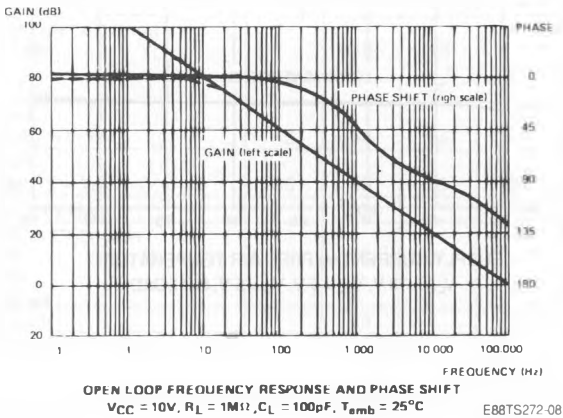
TS272



TS27M2



TS27L2





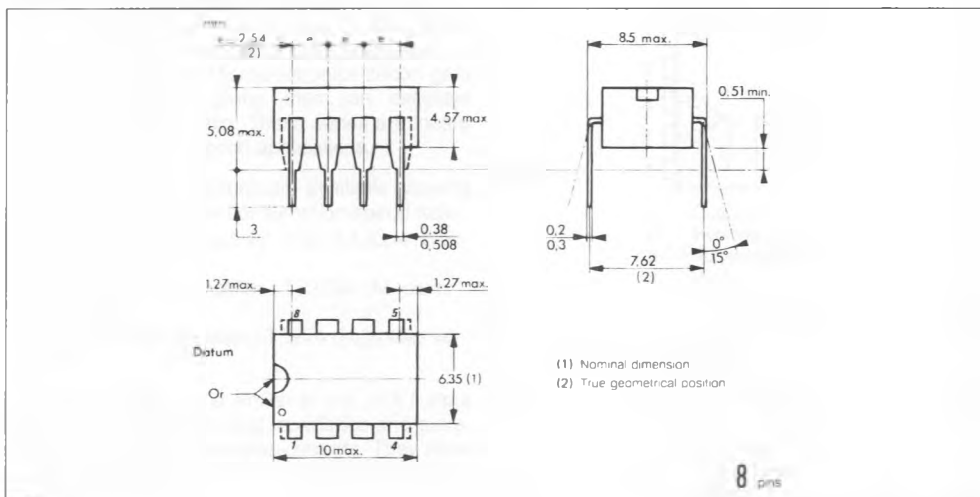
ORDER CODES

Part Number	Temperature Range °C	Package		
		N	D	J
TS272C	0 to 70	•	•	
TS272AC	0 to 70	•	•	
TS272BC	0 to 70	•	•	
TS272I	- 40 to 105	•	•	
TS272M	- 55 to 125			•
TS27M2C	0 to 70	•	•	
TS27M2AC	0 to 70	•	•	
TS27M2BC	0 to 70	•	•	
TS27M2I	- 40 to 105	•	•	
TS27M2M	- 55 to 125			•
TS27L2C	0 to 70	•	•	
TS27L2AC	0 to 70	•	•	
TS27L2BC	0 to 70	•	•	
TS27M2I	- 40 to 105	•	•	
TS27L2M	- 55 to 125			•
TS272AI	- 40 to 105	•	•	
TS272BI	- 40 to 105	•	•	
TS272AM	- 55 to 125			•
TS272BM	- 55 to 125			•
TS27M2AI	- 40 to 105	•	•	
TS27M2BI	- 40 to 105	•	•	
TS27L2AI	- 40 to 105	•	•	
TS27L2BI	- 40 to 105	•	•	
TS27M2AM	- 55 to 125			•
TS27M2BM	- 55 to 125			•
TS27L2AM	- 55 to 125			•
TS27L2BM	- 55 to 125			•

Examples : TS27L2ACN, TS272CD

PACKAGE MECHANICAL DATA

8 PINS - PLASTIC DIP OR CERDIP



PACKAGE MECHANICAL DATA (continued)

8 PINS - PLASTIC MICROPACKAGE SO

