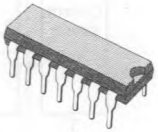
SGS-THOMSON MICROELECTRONICS

TS274
TS27M4/TS27L4

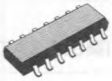
CMOS QUAD OPERATIONAL AMPLIFIERS

- EXCELLENT PHASE MARGIN ON CAPACITIVE LOADS
- SYMMETRICAL OUTPUT CURRENTS
- HIGH GAIN BANDWIDTH PRODUCT FOR TS274
- LOW OUTPUT DYNAMIC IMPEDANCE
- THE TRANSFER FUNCTION IS LINEAR
- PIN COMPATIBLE TO STANDARD QUAD OPERATIONAL AMPLIFIERS (TL084-LM324)
- 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)



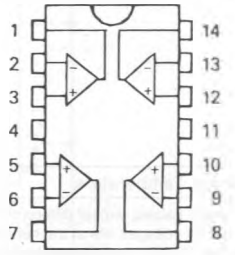
N
DIP14
(Plastic Package)

J
CERDIP14
(Cerdip Package)



D
SO14
(Plastic Micropackage)
(Order Codes at the end of the datasheet)

PIN CONNECTIONS (top view)



E88TS274-01

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 - Output 3
9 - Inverting input 3
10 - Non-inverting input 3
11 - V_{CC}^-
12 - Non-inverting input 4
13 - Inverting input 4
14 - Output 4

DESCRIPTION

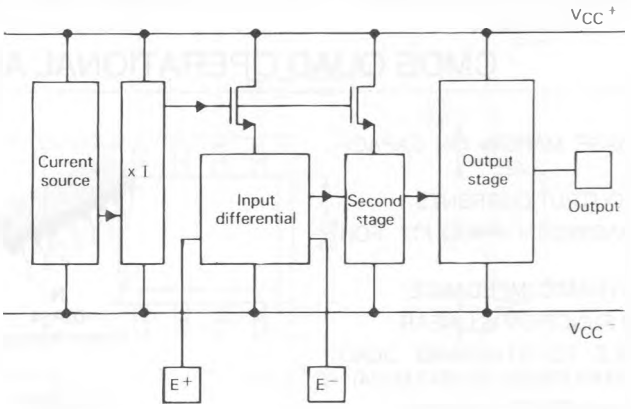
The TS274 series are low cost, low power quad operational amplifiers designed to operate with single or dual supplies. These operational amplifiers use the SGS-THOMSON Microelectronics silicon gate LIN MOS process giving them an excellent consumption-speed ratio. These series are ideally suited for low consumption applications.

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

- I_{CC} = **10** µA per amplifier : TS27L4 (Low bias versions)
- I_{CC} = **150** µA per amplifier : TS27M4 (Medium bias versions)
- I_{CC} = **1 mA** per amplifier : TS274 (High bias versions)

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

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

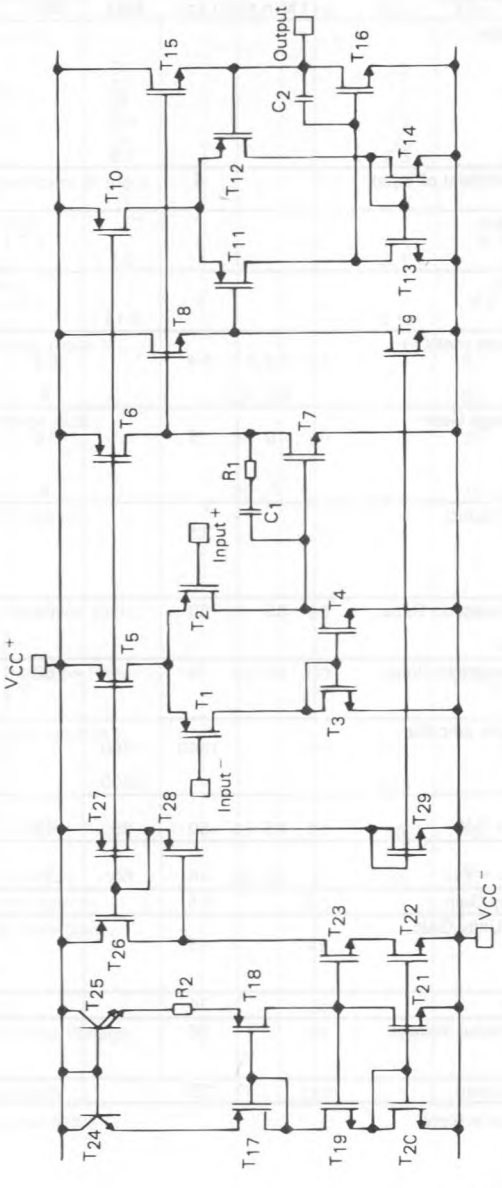
Symbol	Parameter		Value	Unit
V_{CC}	Supply Voltage (note 1)		12	V
V_{id}	Differential Input Voltage (note 2)		± 12	V
V_i	Input Voltage (note 3)		- 0.3 to 12	V
T_{oper}	Operating Free-air Temperature			°C
		TS274C	0 to 70	
		TS274I	- 40 to 105	
		TS274M	- 55 to 125	
		TS27M4C	0 to 70	
		TS27M4I	- 40 to 105	
		TS27M4M	- 55 to 125	
		TS27L4C	0 to 70	
		TS27L4I	- 40 to 105	
		TS27L4M	- 55 to 125	
T_{stg}	Storage Temperature		- 65 to 150	°C

Notes : 1. All voltage values, except differential voltages, are with respect to network ground terminal.
2. Differential voltages are at the noninverting input terminal with respect to the input 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 1/4 TS27 x 4)



E88TS272-03

ELECTRICAL CHARACTERISTICS FOR TS274

T_{amb} = 25 °C, V_{CC} = 10 V (unless otherwise specified)
R_L Connected to V_{CC} ⁻

Symbol	Parameter	TS274C			TS274I/TS274M			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input Offset Voltage V_o = 1.4 V TS274 $T_{min} < T < T_{max}$ TS274A $T_{min} < T < T_{max}$ TS274B $T_{min} < T < T_{max}$			 10 12 5 6.5 2 3.5			 10 12 5 6.5 2 3.5	mV
αV_{io}	Temperature Coefficient of Input Voltage		5			5		µV/°C
I_{io}	Input Offset Current V_i = 5 V , V_o = 5 V $T_{min} < T < T_{max}$		1	 0.1		1	 0.2	pA nA
I_b	Input Bias Current V_i = 5 V , V_o = 5 V $T_{min} < T < T_{max}$		1	 0.15		1	 0.3	pA nA
V_{DH}	High Output Voltage (note 1) V_i = 10 mV R_L = 10 kΩ $T_{min} < T < T_{max}$	8.2 8.1	8.4		8.2 8	8.4		V
A_{vd}	Large Signal Voltage Gain V_o = 1 V to 6 V R_L = 10 kΩ V_i = 5 V $T_{min} < T < T_{max}$	10 7	15		10 6	15		V/mV
G_{wr}	Gain Bandwidth Product A_v = 40 dB R_L = 10 kΩ C_L = 100 pF fin = 200 KHz		3.5			3.5		MHz
CMR	Common Mode Rejection Ratio V_o = 1.4 V V_i = 1 V to 7.4 V	65	80		65	80		dB
SVR	Supply Voltage Rejection Ratio V_{CC} = 5 V to 10 V V_o = 1.4 V	60	70		60	70		dB
I_{CC}	Supply Current (per amplifier) A_V = 1, no Load V_o = 5 V $T_{min} < T < T_{max}$		1000	1500 1600		1000	1500 1700	µA
I_s	Output Current V_i = 10 mV, V_o = 0 V	45	60	85	45	60	85	mA
I_s (Sink)	Output Current V_i = - 10 mV, V_o = V_{CC}	35	45	65	35	45	65	mA
S_{VO}	Slew Rate at Unity Gain		5.5			5.5		V/µS
ø m	Phase Margin at Unity Gain A_V = 40 dB R_L = 10 kΩ C_L = 100 pF		45			45		Degrees
K_{OV}	Overshoot Factor		30			30		%
V_n	Input Equivalent Noise Voltage f = 1 KHz R_S = 10 Ω		30			30		nV/√Hz
V_{O1}/V_{O2}	Cross Talk Attenuation		120			120		dB

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

ELECTRICAL CHARACTERISTICS FOR TS27M4

T_{amb} = 25 °C, V_{CC} = 10 V (unless otherwise specified)
R_L Connected to V_{CC} -

Symbol	Parameter	TS27M4C			TS27M4I/TS27M4M			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input Offset Voltage V_o = 1.4 V TS27M4 $T_{min} < T < T_{max}$ TS27M4A $T_{min} < T < T_{max}$ TS27M4B $T_{min} < T < T_{max}$			 10 12 5 6.5 2 3.5			 10 12 5 6.5 2 3.5	mV
αV_{io}	Temperature Coefficient of Input Voltage		2			2		µV/°C
I_{io}	Input Offset Current V_i = 5 V, V_o = 5 V $T_{min} < T < T_{max}$		1	 0.1		1	 0.2	pA nA
I_b	Input Bias Current V_i = 5 V, V_o = 5 V $T_{min} < T < T_{max}$		1	 0.15		1	 0.3	pA nA
V_{OH}	High Output Voltage (note 1) V_i = 10 mV R_L = 100 kΩ $T_{min} < T < T_{max}$	8.7 8.6	8.9		8.7 8.5	8.9		V
A_{vd}	Large Signal Voltage Gain V_o = 1 V to 6 V R_L = 100 kΩ V_i = 5 V $T_{min} < T < T_{max}$	30 20	50		30 10	50		V/mV
G_{wr}	Gain Bandwidth Product A_v = 40 dB R_L = 100 kΩ C_L = 100 pF f_{in} = 100 KHz		1			1		MHz
CMR	Common Mode Rejection Ratio V_o = 1.4 V V_i = 1 V to 7.4 V	65	80		65	80		dB
SVR	Supply Voltage Rejection Ratio V_{CC} = 5 V to 10 V V_o = 1.4 V	60	80		60	80		dB
I_{CC}	Supply Current (per amplifier) A_V = 1, no Load V_o = 5 V $T_{min} < T < T_{max}$		150	200 250		150	200 300	µA
I_s	Output Current V_i = 10 mV, V_o = 0 V	45	60	85	45	60	85	mA
I_s (Sink)	Output Current V_i = - 10 mV, V_o = V_{CC}	35	45	65	35	45	65	mA
$S_{V\,O}$	Slew Rate at Unity Gain		0.6			0.6		V/µS
ø m	Phase Margin at Unity Gain A_V = 40 dB R_L = 100 kΩ C_L = 100 pF		45			45		Degrees
K_{OV}	Overshoot Factor		30			30		%
V_n	Input Equivalent Noise Voltage f = 1 KHz R_S = 10 Ω		38			38		nV/√Hz
V_{01}/V_{02}	Cross Talk Attenuation		120			120		dB

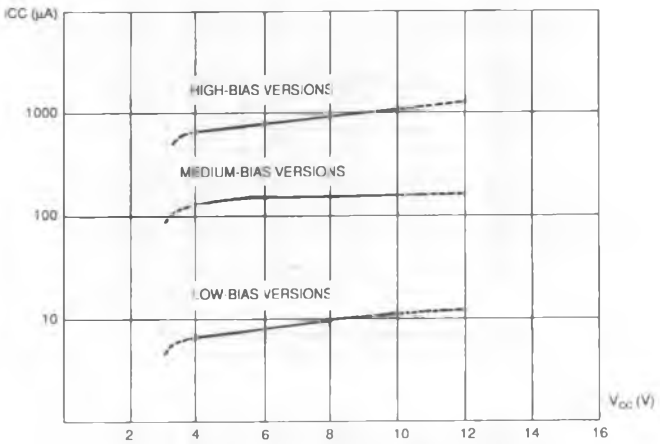
Note : 1. Low output voltage is less than 50mV.

ELECTRICAL CHARACTERISTICS FOR TS27L4

T_{amb} = 25 °C, V_{CC} = 10 V (unless otherwise specified)
R_L Connected to V_{CC} -

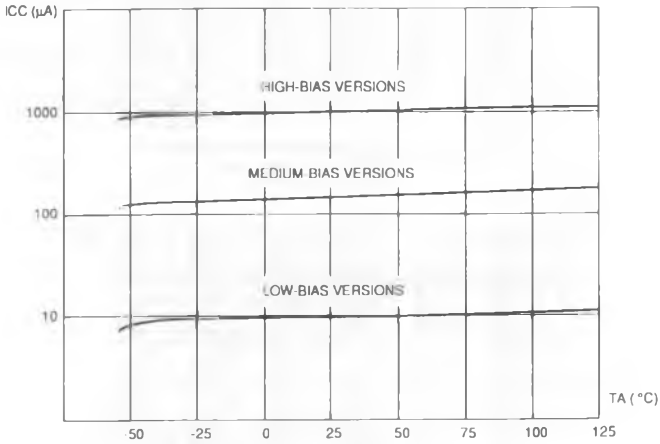
Symbol	Parameter	TS27L4C			TS27L4I/TS27L4M			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input Offset Voltage V_o = 1.4 V TS27L4 $T_{min} < T < T_{max}$ TS27L4A $T_{min} < T < T_{max}$ TS27L4B $T_{min} < T < T_{max}$			 10 12 5 6.5 2 3.5			 10 12 5 6.5 2 3.5	mV
αV_{io}	Temperature Coefficient of Input Voltage		0.7			0.7		µV/°C
I_{io}	Input Offset Current V_i = 5 V, V_o = 5 V $T_{min} < T < T_{max}$		1	 0.1		1	 0.2	pA nA
I_b	Input Bias Current V_i = 5 V, V_o = 5 V $T_{min} < T < T_{max}$		1	 0.15		1	 0.3	pA nA
V_{OH}	High Output Voltage (note 1) V_i = 10 mV R_L = 1 MΩ $T_{min} < T < T_{max}$	8.8 8.7	9		8.8 8.6	9		V
A_{vd}	Large Signal Voltage Gain V_o = 1 V to 6 V R_L = 100 kΩ V_i = 5 V $T_{min} < T < T_{max}$	60 45	100		60 40	100		V/mV
G_{wi}	Gain Bandwidth Product A_v = 40 dB R_L = 1 MΩ C_L = 100 pF fin = 10 KHz		0.1			0.1		MHz
CMR	Common Mode Rejection Ratio V_o = 1.4 V V_i = 1 V to 7.4 V	65	80		65	80		dB
SVR	Supply Voltage Rejection Ratio V_{CC} = 5 V to 10 V V_o = 1.4 V	60	80		60	80		dB
I_{CC}	Supply Current (per amplifier) A_V = 1, no Load V_o = 5 V $T_{min} < T < T_{max}$		10	15 17		10	15 18	µA
I_s	Output Current V_i = 10 mV, V_o = 0 V	45	60	85	45	60	85	mA
I_s (Sink)	Output Current V_i = - 10 mV, V_o = V_{CC}	35	45	65	35	45	65	mA
S_{VO}	Slew Rate at Unity Gain		0.04			0.04		V/µS
ø m	Phase Margin at Unity Gain A_V = 40 dB R_L = 1 MΩ C_L = 100 pF		45			45		Degrees
K_{OV}	Overshoot Factor		30			30		%
V_n	Input Equivalent Noise Voltage f = 1 KHz R_S = 10 Ω		70			70		nV/√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
$V_O = V_{IC} = 0.2\ V_{CC}$, $T_{amb} = 25$ °C, NO LOAD

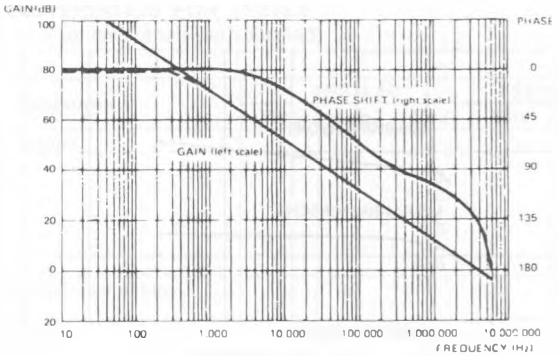
E88TS274 02



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

E88TS274 03

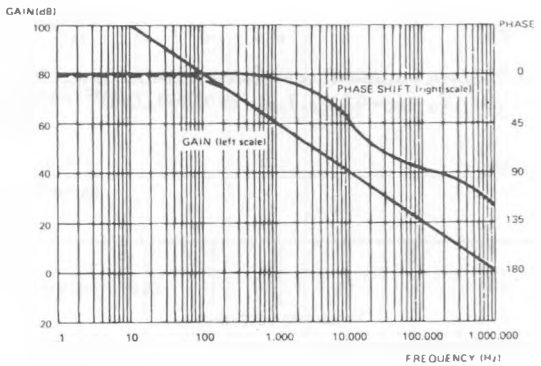
TS274



OPEN LOOP FREQUENCY RESPONSE AND PHASE SHIFT
V_{CC} = 10V, R_L = 10kΩ, C_L = 100pF, T_{amb} = 25°C

E88TS274-04

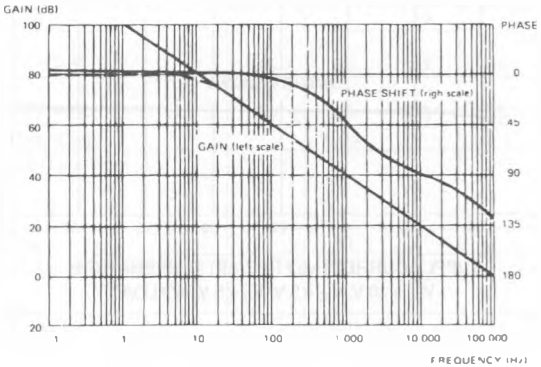
TS27M4



OPEN LOOP FREQUENCY RESPONSE AND PHASE SHIFT
V_{CC} = 10V, R_L = 100kΩ, C_L = 100pF, T_{amb} = 25°C

E88TS274-05

TS27L4



OPEN LOOP FREQUENCY RESPONSE AND PHASE SHIFT
V_{CC} = 10V, R_L = 1MΩ, C_L = 100pF, T_{amb} = 25°C

E88TS274-06

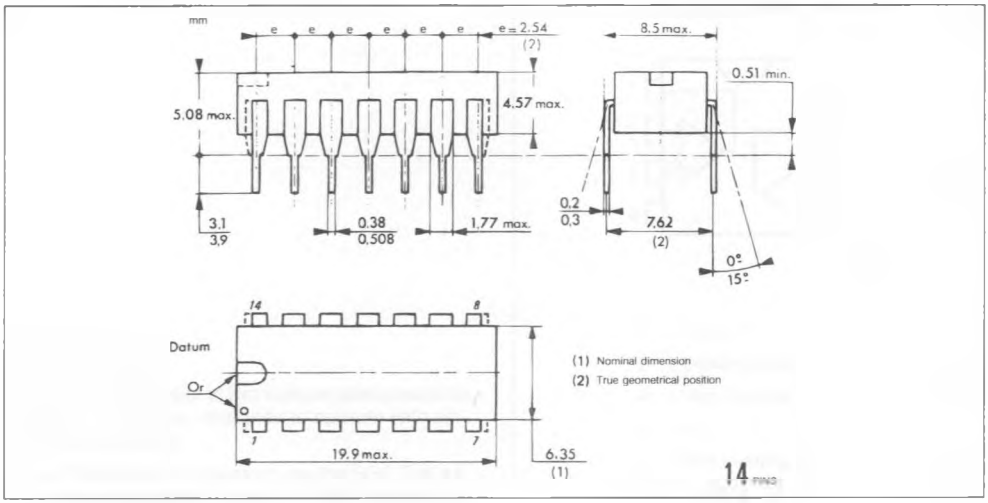
ORDER CODES

Part Number	Temperature Range °C	Package		
		N	D	J
TS274C	0 to + 70	•	•	
TS274AC	0 to + 70	•	•	
TS274BC	0 to + 70	•	•	
TS274I	- 40 to + 105	•	•	
TS274M	- 55 to + 125			•
TS27M4C	0 to + 70	•	•	
TS27M4AC	0 to + 70	•	•	
TS27M4BC	0 to + 70	•	•	
TS27M4I	- 40 to + 105	•	•	
TS27M4M	- 55 to + 125			•
TS27L4C	0 to + 70	•	•	
TS27L4AC	0 to + 70	•	•	
TS27L4BC	0 to + 70	•	•	
TS27M4I	- 40 to + 105	•	•	
TS27L4M	- 55 to + 125			•
TS27M4AI	- 40 to + 105	•	•	
TS27M4AM	- 55 to + 125			•
TS27M4BI	- 40 to + 105	•	•	
TS27M4BM	- 55 to + 125			•
TS27L4AI	- 40 to + 105	•	•	
TS27L4AM	- 55 to + 125			•
TS27L4BI	- 40 to + 105	•	•	
TS27L4BM	- 55 to ± 125			•

Examples : TS27L4ACN, TS274CD

PACKAGE MECHANICAL DATA

14 PINS - PLASTIC DIP OR CERDIP



PACKAGE MECHANICAL DATA (continued)

14 PINS - PLASTIC MICROPACKAGE SO