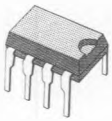
SGS-THOMSON MICROELECTRONICS

TS271

CMOS SINGLE OPERATIONAL AMPLIFIERS

- OFFSET NULL CAPABILITY (by external compensation)
- SYMMETRICAL OUTPUT CURRENTS
- HIGH GAIN BANDWIDTH PRODUCT
- THE TRANSFER FUNCTION IS LINEAR
- CONSUMPTION CURRENT AND DYNAMIC PARAMETERS ARE STABLE REGARDING THE VOLTAGE POWER SUPPLY VARIATIONS
- DYNAMIC CHARACTERISTICS ADJUSTABLE BY I_{set}
- VERY LARGE I_{set} RANGE
- PIN COMPATIBLE TO SINGLE OPERATIONAL AMPLIFIER (UA776)
- 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)



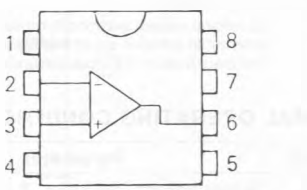
N
DIP8
(Plastic Package)

J
CERDIP8
(Cerdip Package)

D
SO8
(Plastic Micropackage)

(Ordering Information at the end of the datasheet)

PIN CONNECTIONS (top view)



E88TS271-01

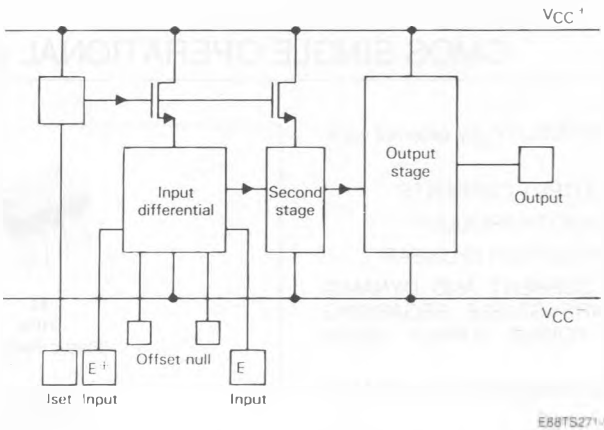
1 – Offset null 1
2 – Inverting input
3 – Non-inverting input
4 – V_{CC}^-
5 – Offset null 2
6 – Output
7 – V_{CC}^+
8 – I_{set}

DESCRIPTION

The TS271 is a low cost, low power single operational amplifier designed to operate with single or dual supplies. This operational amplifier uses the SGS-THOMSON Microelectronics silicon gate LIN MOS process giving it an excellent consumption-speed ratio. This amplifier is ideally suited for low consumption applications.
The power supply is externally programmable with a resistor connected between pins 8 and 4. It allows to choose the best consumption-speed ratio and the consumption can be minimized according to the needed speed. These devices are specified for the following I_{set} current values : 1.5 µA, 25 µA, 130 µA.

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.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

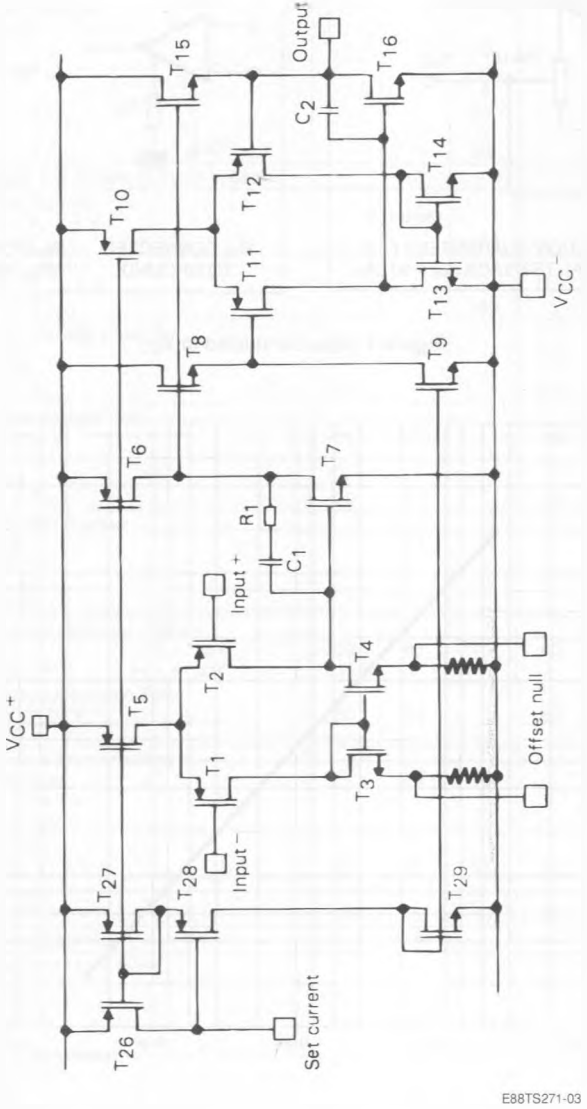
Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage (note 1)	12	V
V_{id}	Differential Input Voltage (note 2)	± 12	V
V_i	Input Voltage (note 3)	- 0.3 to 12	V
T_{oper}	Operating Free-air Temperature TS271C TS271I TS271M	0 to 70 - 40 to 105 - 55 to 125	°C
T_{stg}	Storage Temperature	- 65 to 150	°C
I_{set}	I_{set} Range	1 to 200	µA

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.

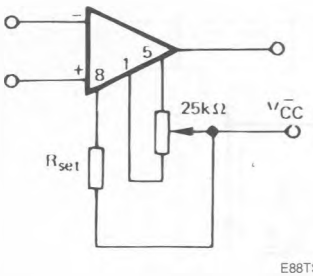
OPTIMAL OPERATING CONDITIONS

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



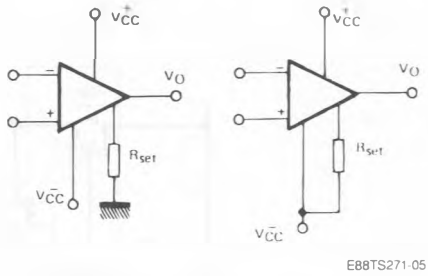
OFFSET VOLTAGE NULL CIRCUIT



E88TS271-04

OFFSET COMPENSATION GUARANTEED FOR TS271BCX (I_{set} > 25 µA), TS271ACX (I_{set} > 90 µA)

RESISTOR BIASING

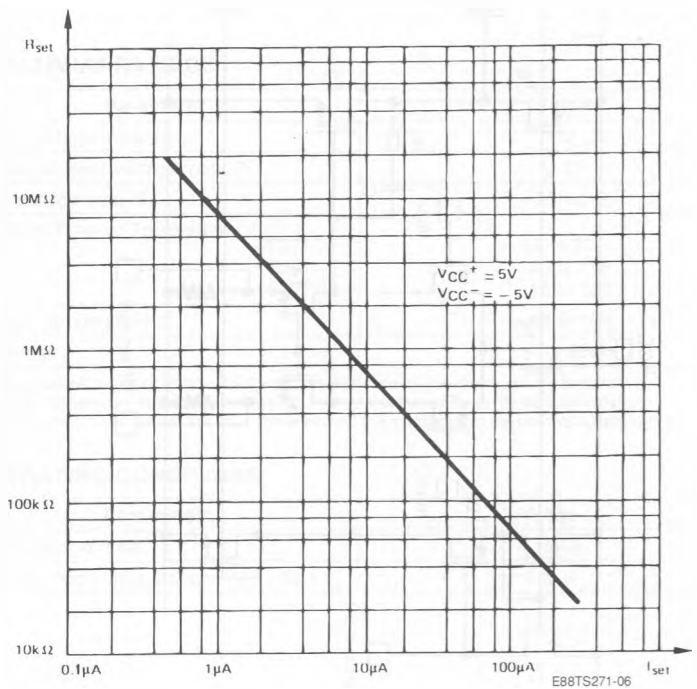


E88TS271-05

R_{set} CONNECTED TO GROUND

R_{set} CONNECTED TO V_{CC}^- (R_{set} VALUE : SEE FIG. 1)

Figure 1 : R_{set} Connected to V_{CC}^-.



E88TS271-06

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C, V_{CC} = 10 V, I_{set} = 1.5 µA (unless otherwise specified)
R_L Connected to V_{CC} ⁻

Symbol	Parameter	TS271C			TS271I, TS271M			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input Offset Voltage V_o = 1.4 V TS271 $T_{min} < T < T_{max}$ TS271A $T_{min} < T < T_{max}$ TS271B $T_{min} < T < T_{max}$			 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	 100		1	 200	pA
I_b	Input Bias Current V_i = 5 V, V_o = 5 V $T_{min} < T < T_{max}$		1	 150		1	 300	pA
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 V_i = 5 V R_L = 1 mΩ $T_{min} < T < T_{max}$	30 20	100		30 20	100		V/mV
G_{wr}	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	60	80		60	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, V_i = 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 = 10 pF C_L = 100 pF		 35 10			 35 10		Degrees
K_{OV}	Overshoot Factor C_L = 10 pF C_L = 100 pF		 40 70			 40 70		%
V_n	Input Equivalent Noise Voltage F = 1 KHz R_S = 10 Ω		70			70		nV/√Hz

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

ELECTRICAL CHARACTERISTICS

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

Symbol	Parameter	TS271C			TS271I, TS271M			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input Offset Voltage V_o = 1.4 V TS271 $T_{min} < T < T_{max}$ TS271A $T_{min} < T < T_{max}$ TS271B $T_{min} < T < T_{max}$			 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	 100		1	 200	pA
I_b	Input Bias Current V_i = 5 V, V_o = 5 V $T_{min} < T < T_{max}$		1	 150		1	 300	pA
V_{DH}	High Output Voltage (note 1) V_i = 10 mV R_L = 100KΩ $T_{min} < T < T_{max}$	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 V_i = 5 V R_L = 100 KΩ $T_{min} < T < T_{max}$	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 fin = 100 KHz		0.7			0.7		MHz
CMR	Common-mode Rejection Ratio V_o = 1.4 V V_i = 1 V to 7.4 V	60	80		60	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, V_i = 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_{VO}	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 = 10 pF C_L = 100 pF		 50 30			 50 30		Degrees
K_{OV}	Overshoot Factor C_L = 10 pF C_L = 100 pF		 30 50			 30 50		%
V_n	Input Equivalent Noise Voltage F = 1 KHz R_S =10 Ω		38			38		nV/√Hz

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

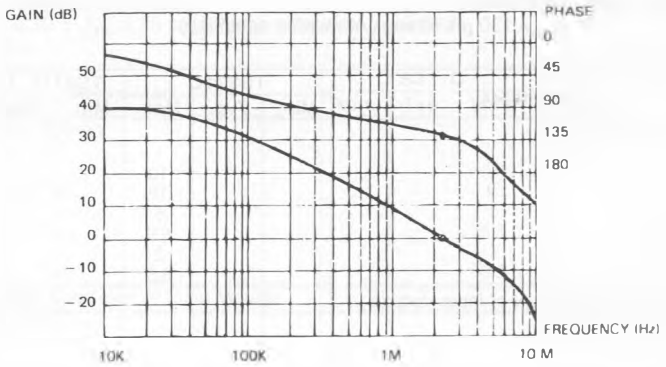
ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C, V_{CC} = 10 V, I_{set} = 130 µA (unless otherwise specified)
R_L Connected to V_{CC} -

Symbol	Parameter	TS271C			TS271I, TS271M			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input Offset Voltage V_o = 1.4 V TS271 $T_{min} < T < T_{max}$ TS271A $T_{min} < T < T_{max}$ TS271B $T_{min} < T < T_{max}$			 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	 100		1	 200	pA
I_b	Input Bias Current V_i = 5 V, V_o = 5 V $T_{min} < T < T_{max}$		1	 150		1	 300	pA
V_{OH}	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 V_i = 5 V R_L = 10 KΩ $T_{min} < T < T_{max}$	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		2.3			2.3		MHz
CMR	Common-mode Rejection Ratio V_o = 1.4 V V_i = 1 V to 7.4 V	60	80		60	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, V_i = 5 V $T_{min} < T < T_{max}$		800	1300 1400		800	1300 1500	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		4.5			4.5		V/µS
ø m	Phase Margin at Unity Gain A_V = 40 dB R_L = 10 KΩ C_L = 10 pF C_L = 100 pF		 56 56			 56 56		Degrees
K_{OV}	Overshoot Factor C_L = 10 pF C_L = 100 pF		 30 30			 30 30		%
V_n	Input Equivalent Noise Voltage F =1 KHz R_S = 10 Ω		30			30		nV/√Hz

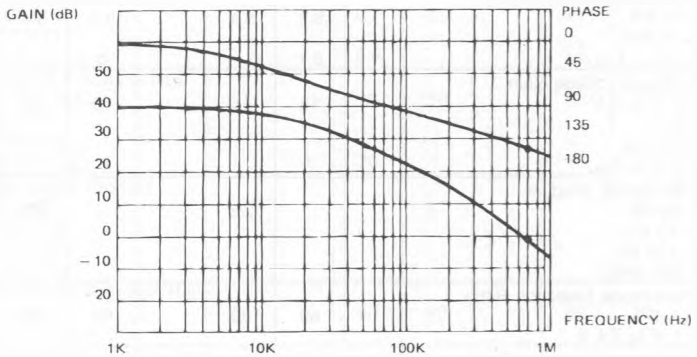
Note : 1. Low output voltage is less than 50mV.

I_{set} = 130 µA



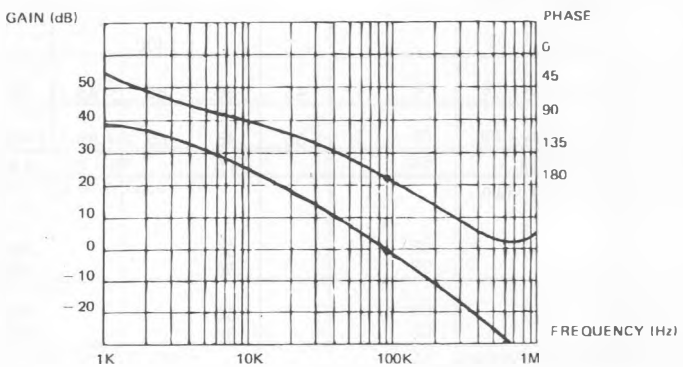
OPEN LOOP FREQUENCY RESPONSE AND PHASE SHIFT
V_{CC} ± 5 V, R_L = 10 KΩ, C_L = 100 pF, T_{amb} = 25°C E88TS271-07

I_{set} = 25 µA



OPEN LOOP FREQUENCY RESPONSE AND PHASE SHIFT
V_{CC} ± 5 V, R_L = 100 KΩ, C_L = 100 pF, T_{amb} = 25°C E88TS271-08

I_{set} = 1.5 µA



OPEN LOOP FREQUENCY RESPONSE AND PHASE SHIFT
V_{CC} ± 5 V, R_L = 1 MΩ, C_L = 100 pF, T_{amb} = 25°C E88TS271-09

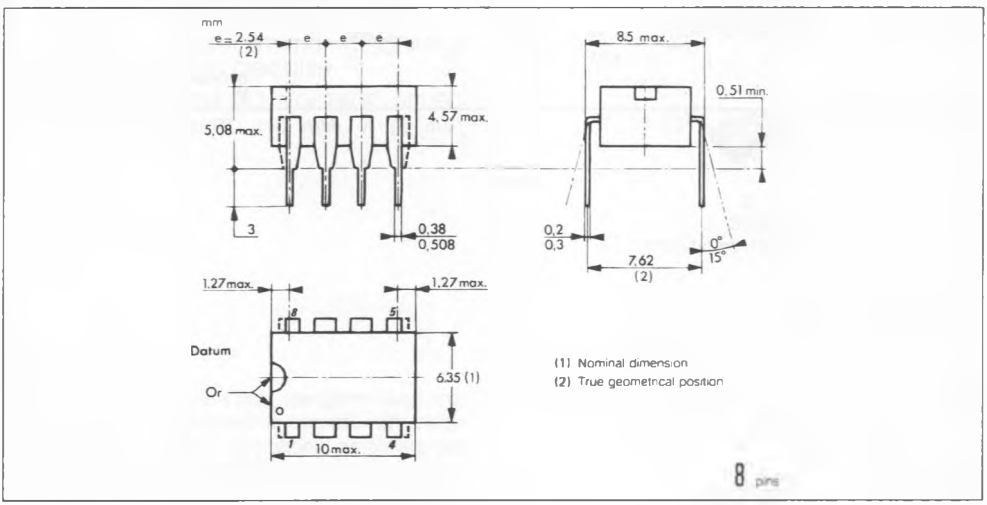
ORDERING INFORMATION

Part Number	Temperature Range °C	Package		
		N	D	J
TS271C	0 to + 70	•	•	
TS271AC	0 to + 70	•	•	
TS271BC	0 to + 70	•	•	
TS271I	- 40 to + 105	•	•	
TS271M	- 55 to + 125			•
TS271AI	- 40 to + 105	•	•	
TS271AM	- 55 to + 125			•
TS271BI	- 40 to + 105	•	•	
TS271BM	- 55 to + 125			•

Examples : TS271 ACN, TS271 CD

PACKAGE MECHANICAL DATA

8 PINS – PLASTIC DIP OR CERDIP



PACKAGE MECHANICAL DATA (continued)

8 PINS – PLASTIC MICROPACKAGE SO