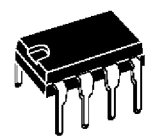
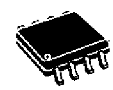
TS271C,I,M

PROGRAMMABLE CMOS SINGLE OPERATIONAL AMPLIFIERS

- OFFSET NULL CAPABILITY (by external compensation)
- DYNAMIC CHARACTERISTICS ADJUSTABLE BY I_{SET}
- CONSUMPTION CURRENT AND DYNAMIC PARAMETERS ARE STABLE REGARDING THE VOLTAGE POWER SUPPLY VARIATIONS
- OUTPUT VOLTAGE CAN SWING TO GROUND
- VERY LARGE I_{SET} RANGE
- STABLE AND LOW OFFSET VOLTAGE
- THREE INPUT OFFSET VOLTAGE SELECTIONS



N
DIP8
(Plastic Package)



D
SO8
(Plastic Micropackage)

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 silicon gate CMOS process giving it an excellent consumption-speed ratio. This amplifier is ideally suited for low consumption applications.

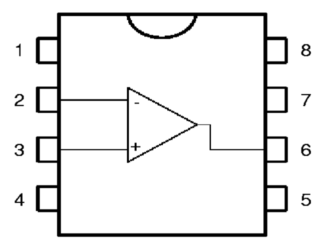
The power supply is externally programmable with a resistor connected between pins 8 and 4. It allows to choose the best consumption-speed ratio and supply current can be minimized according to the required speed. This device is specified for the following I_{SET} current values : 1.5µA, 25µA, 130µA.

This CMOS amplifier offers very high input impedance and extremely low input currents. The major advantage versus JFET devices is the very low input currents drift with temperature (see figure 3).

ORDER CODES

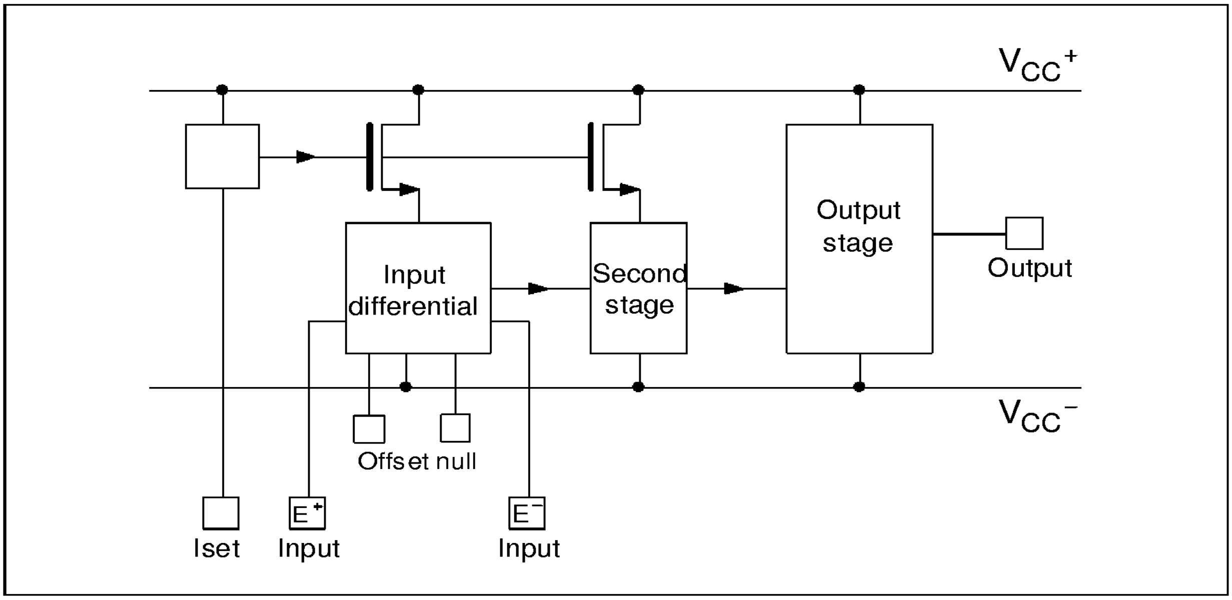
Part Number	Temperature Range	Package	
		N	D
TS271C/AC/BC	0°C, +70°C	•	•
TS271I/AI/BI	-40°C, +125°C	•	•
TS271M/AM/BM	-55°C, +125°C	•	•
Example : TS271ACN			

PIN CONNECTIONS (top view)



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}

BLOCK DIAGRAM



MAXIMUM RATINGS

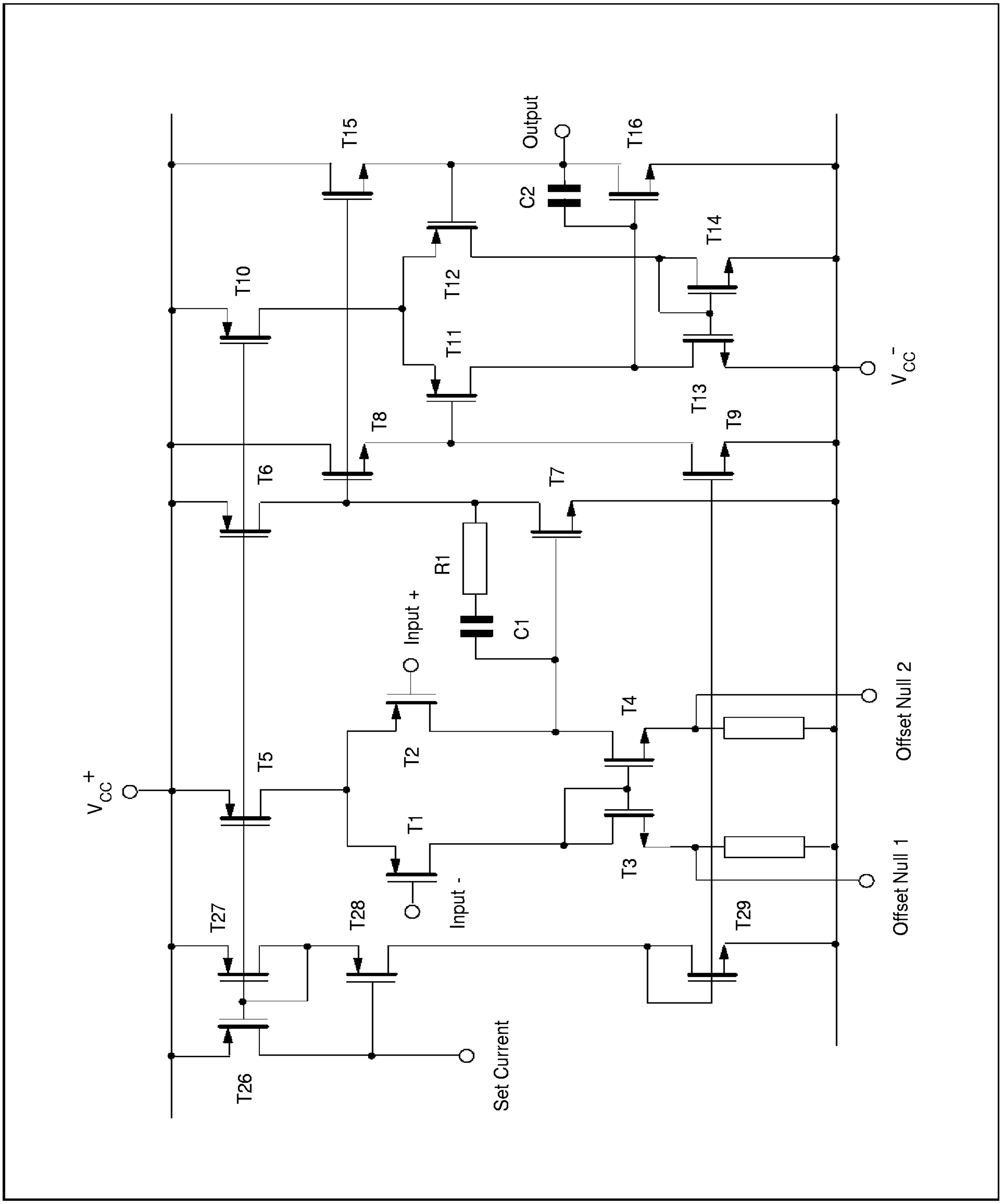
Symbol	Parameter	Value	Unit
V_{CC}^+	Supply Voltage - (note 1)	18	V
V_{id}	Differential Input Voltage - (note 2)	±18	V
V_i	Input Voltage - (note 3)	-0.3 to 18	V
I_O	Output Current for $V_{CC}^+ \geq 15V$	±30	mA
I_{in}	Input Current	±5	mA
T_{oper}	Operating Free-Air Temperature Range TS271C/AC/BC TS271I/AI/BI TS271M/AM/BM	 0 to +70 -40 to +125 -55 to +125	°C
T_{stg}	Storage Temperature Range	-65 to +150	°C

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 the input and the output voltages must never exceed the magnitude of the positive supply voltage.

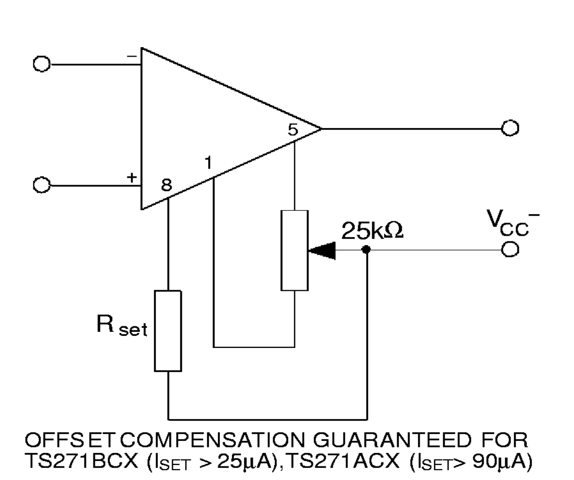
OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{CC}^+	Supply Voltage	3 to 16	V
V_{icm}	Common Mode Input Voltage Range	0 to V_{CC}^+ - 1.5	V

SCHEMATIC DIAGRAM



OFFSET VOLTAGE NULL CIRCUIT



RESISTOR BIASING

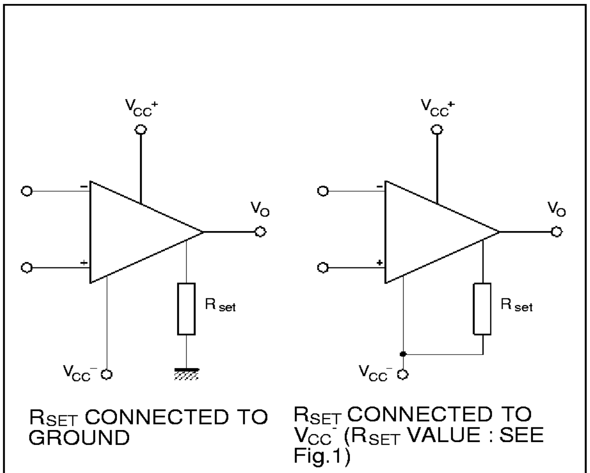
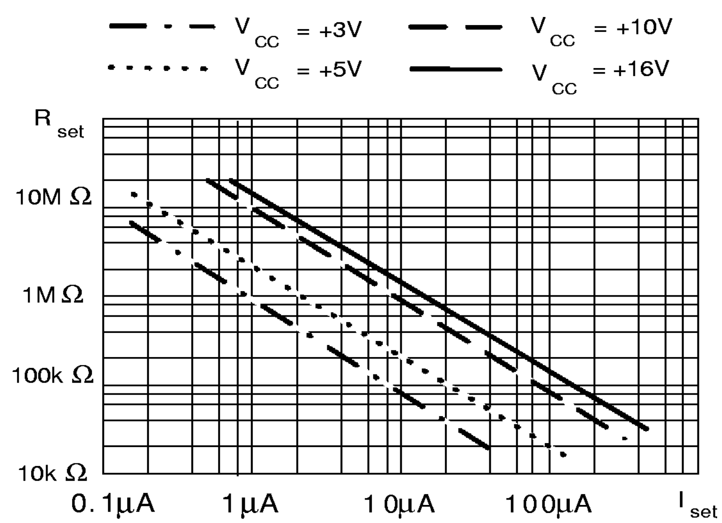


Figure 1 : R_{SET} Connected to V_{CC}^-.



ELECTRICAL CHARACTERISTICS FOR I_{SET} = 1.5μA

V_{CC}^+ = +10V, V_{CC}^- = 0V, T_{amb} = 25°C (unless otherwise specified)

Symbol	Parameter	TS271C/AC/BC			TS271I/AI/BI TS271M/AM/BM			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input Offset Voltage V_O = 1.4V, V_{ic} = 0V TS271C/I/M TS271AC/AI/AM TS271BC/BI/BM $T_{min.} \leq T_{amb} \leq T_{max.}$ TS271C/I/M TS271AC/AI/AM TS271BC/BI/BM		1.1 0.9 0.25	10 5 2 12 6.5 3		1.1 0.9 0.25	10 5 2 12 6.5 3.5	mV
DV_{io}	Input Offset Voltage Drift		0.7			0.7		μV/°C
I_{io}	Input Offset Current - (note 1) V_{ic} = 5V, V_o = 5V $T_{min.} \leq T_{amb} \leq T_{max.}$		1	 100		1	 200	pA
I_{ib}	Input Bias Current - (note 1) V_{ic} = 5V, V_o = 5V $T_{min.} \leq T_{amb} \leq T_{max.}$		1	 150		1	 300	pA
V_{OH}	High Level Output Voltage V_{id} = 100mV, R_L = 1MΩ $T_{min.} \leq T_{amb} \leq T_{max.}$	8.8 8.7	9		8.8 8.6	9		V
V_{OL}	Low Level Output Voltage (V_{id} = -100mV)			50			50	mV
A_{vd}	Large Signal Voltage Gain V_o = 1V to 6V, R_L = 1MΩ, V_{ic} = 5V $T_{min.} \leq T_{amb} \leq T_{max.}$	30 20	100		30 20	100		V/mV
GBP	Gain Bandwidth Product (A_v = 40dB, R_L = 1MΩ, C_L = 100pF, f_{in} = 10kHz)		0.1			0.1		MHz
CMR	Common Mode Rejection Ratio V_o = 1.4V, V_{ic} = 1V to 7.4V	60	80		60	80		dB
SVR	Supply Voltage Rejection Ratio V_{CC}^+ = 5V to 10V, V_o = 1.4V	60	80		60	80		dB
I_{CC}	Supply Current A_v = 1, no load, V_o = 5V $T_{min.} \leq T_{amb} \leq T_{max.}$		10	15 17		10	15 18	μA
I_o	Output Short Circuit Current V_{id} = 100mV, V_o = 0V		60			60		mA
I_{sink}	Output Sink Current V_{id} = -100mV, V_o = V_{CC}		45			45		mA
SR	Slew-Rate at Unity Gain R_L = 1MΩ, C_L= 100pF, V_i = 3 to 7V		0.04			0.04		V/μs
Øm	Phase Margin at Unity Gain A_v = 40dB, R_L = 1MΩ C_L= 10pF C_L= 100pF		35 10			35 10		Degrees
K_{ov}	Overshoot Factor C_L = 10pF C_L = 100pF		40 70			40 70		%
e_n	Equivalent Input Noise Voltage f = 1kHz, R_S = 100Ω		68			68		$\frac{nV}{\sqrt{Hz}}$

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

TYPICAL CHARACTERISTICS FOR I_{SET} = 1.5µA

Figure 2 : Supply Current versus Supply Voltage

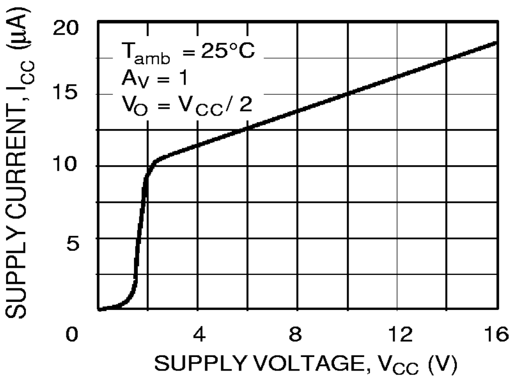


Figure 3 : Input Bias Current versus Free Air Temperature

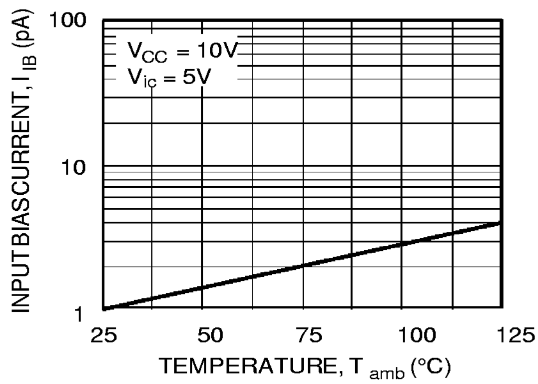


Figure 4a : High Level Output Voltage versus High Level Output Current

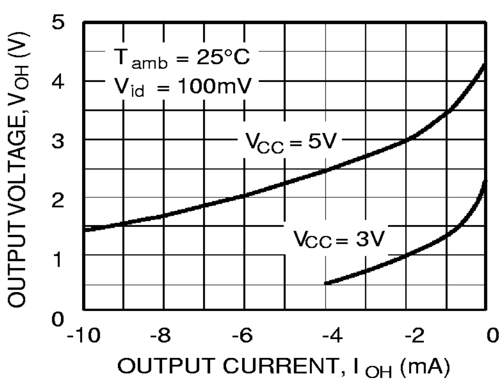


Figure 4b : High Level Output Voltage versus High Level Output Current

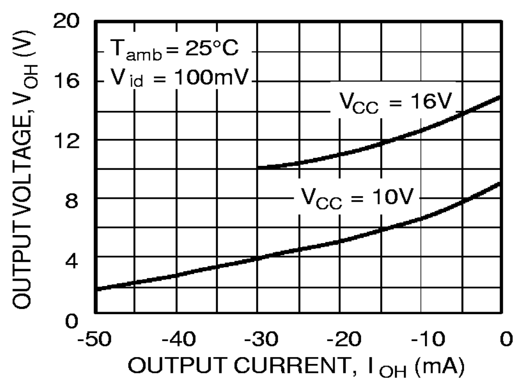


Figure 5a : Low Level Output Voltage versus Low Level Output Current

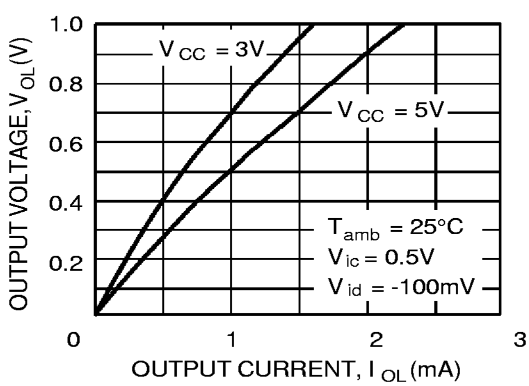
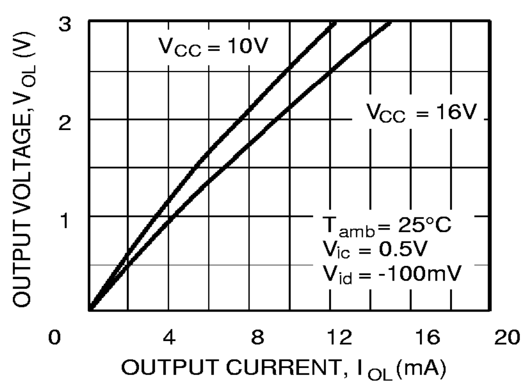


Figure 5b : Low Level Output Voltage versus Low Level Output Current



TYPICAL CHARACTERISTICS FOR I_{SET} = 1.5µA (continued)

Figure 6 : Open Loop Frequency Response and Phase Shift

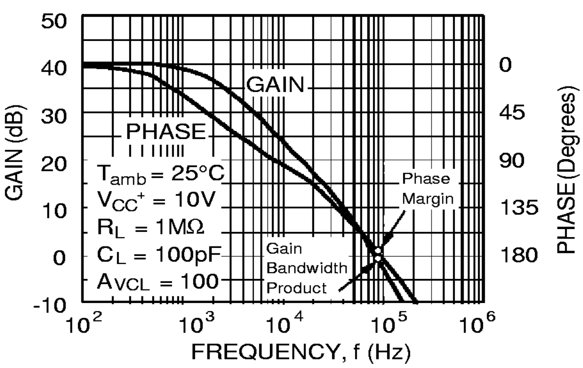


Figure 7 : Gain Bandwidth Product versus Supply voltage

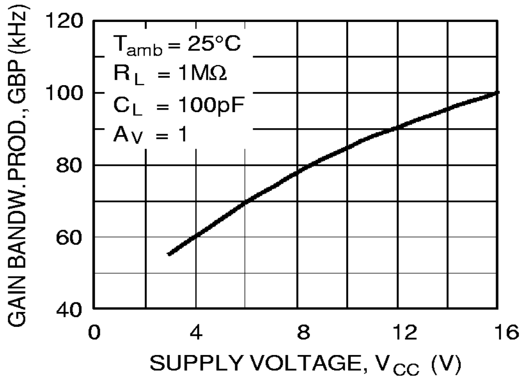


Figure 8 : Phase Margin versus Supply Voltage

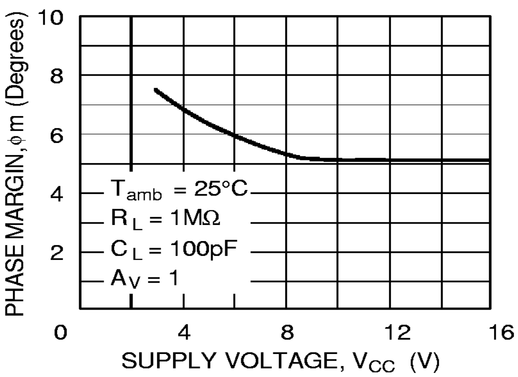


Figure 9 : Phase Margin versus Capacitive Load

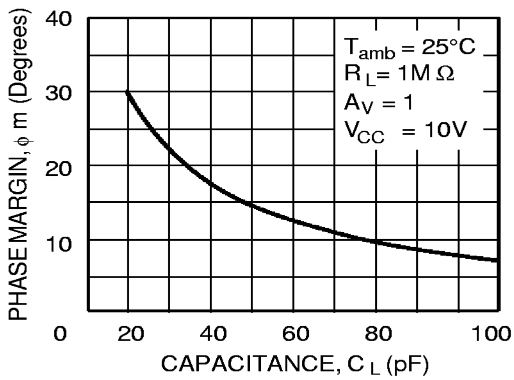
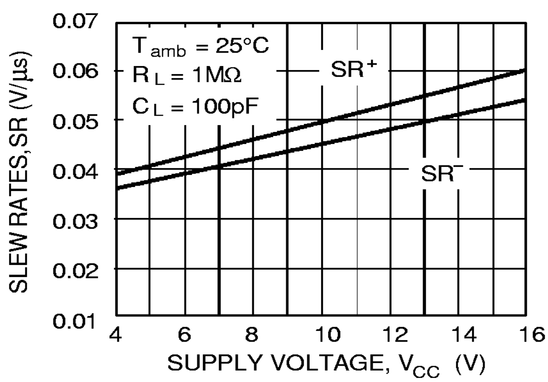


Figure 10 : Slew Rates versus Supply Voltage



ELECTRICAL CHARACTERISTICS FOR I_{SET} = 25μA

V_{CC}^{+} = +10V, V_{CC}^{-} = 0V, T_{amb} = 25°C (unless otherwise specified)

Symbol	Parameter	TS271C/AC/BC			TS271I/AI/BI TS271M/AM/BM			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input Offset Voltage V_O = 1.4V, V_{ic} = 0V TS271C/I/M TS271AC/AI/AM TS271BC/BI/BM $T_{min.} \leq T_{amb} \leq T_{max.}$ TS271C/I/M TS271AC/AI/AM TS271BC/BI/BM		 1.1 0.9 0.25	 10 5 2 12 6.5 3		 1.1 0.9 0.25	 10 5 2 12 6.5 3.5	mV
DV_{io}	Input Offset Voltage Drift		2			2		μV/°C
I_{io}	Input Offset Current - (note 1) V_{ic} = 5V, V_o = 5V $T_{min.} \leq T_{amb} \leq T_{max.}$		 1	 100		 1	 200	pA
I_{ib}	Input Bias Current - (note 1) V_{ic} = 5V, V_o = 5V $T_{min.} \leq T_{amb} \leq T_{max.}$		 1	 150		 1	 300	pA
V_{OH}	High Level Output Voltage V_{id} = 100mV, R_L = 100kΩ $T_{min.} \leq T_{amb} \leq T_{max.}$	 8.7 8.6	 8.9		 8.7 8.5	 8.9		V
V_{OL}	Low Level Output Voltage (V_{id} = -100mV)			50			50	mV
A_{vd}	Large Signal Voltage Gain V_o = 1V to 6V, R_L = 100kΩ, V_{ic} = 5V $T_{min.} \leq T_{amb} \leq T_{max.}$	 30 20	 50		 30 10	 50		V/mV
GBP	Gain Bandwidth Product (A_v = 40dB, R_L = 100kΩ, C_L = 100pF, f_{in} = 100kHz)		 0.7			 0.7		MHz
CMR	Common Mode Rejection Ratio V_o = 1.4V, V_{ic} = 1V to 7.4V	 60	 80		 60	 80		dB
SVR	Supply Voltage Rejection Ratio V_{CC}^{+} = 5V to 10V ,V_o = 1.4V	 60	 80		 60	 80		dB
I_{CC}	Supply Current A_v = 1, no load, V_o = 5V $T_{min.} \leq T_{amb} \leq T_{max.}$		 150	 200 250		 150	 200 300	μA
I_o	Output Short Circuit Current V_{id} = 100mV, V_o = 0V		 60			 60		mA
I_{sink}	Output Sink Current V_{id} = -100mV, V_o = V_{CC}		 45			 45		mA
SR	Slew-Rate at Unity Gain R_L = 100kΩ, C_L= 100pF, V_i = 3 to 7V		 0.6			 0.6		V/μs
∅m	Phase Margin at Unity Gain A_v = 40dB, R_L = 100kΩ C_L = 10pF C_L= 100pF		 50 30			 50 30		degrees
K_{ov}	Overshoot Factor C_L = 10pF C_L = 100pF		 30 50			 30 50		%
e_n	Equivalent Input Noise Voltage f = 1kHz, R_S = 100Ω		 38			 38		$\frac{nV}{\sqrt{Hz}}$

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

TYPICAL CHARACTERISTICS FOR I_{SET} = 25µA

Figure 11 : Supply Current versus Supply Voltage

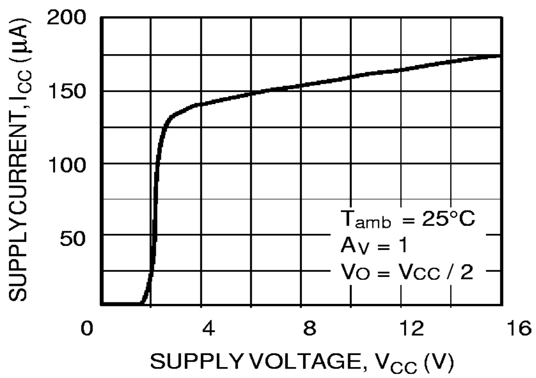


Figure 12 : Input Bias Current versus Free Air Temperature

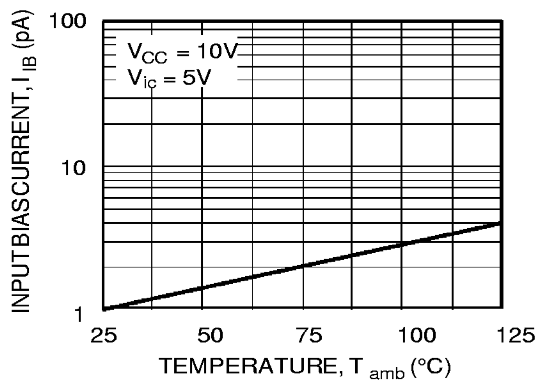


Figure 13a : High Level Output Voltage versus High Level Output Current

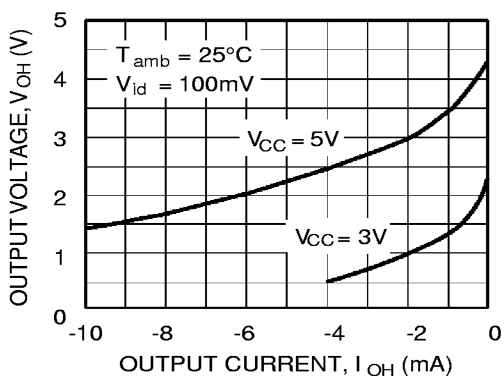


Figure 13b : High Level Output Voltage versus High Level Output Current

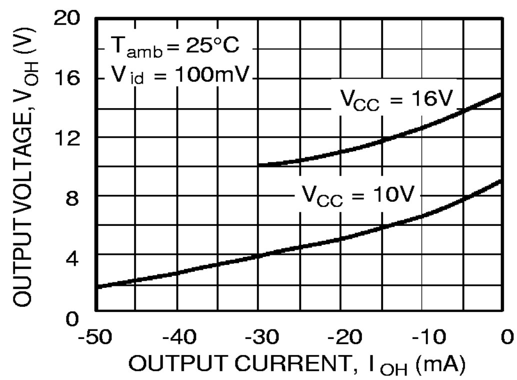


Figure 14a : Low Level Output Voltage versus Low Level Output Current

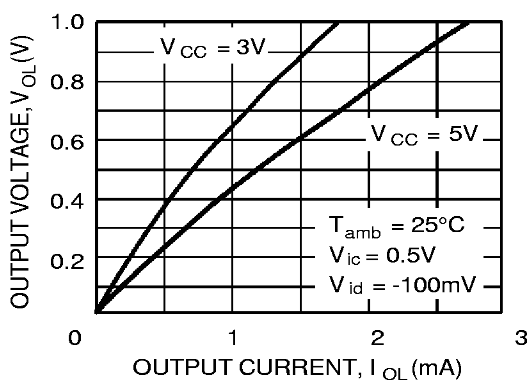
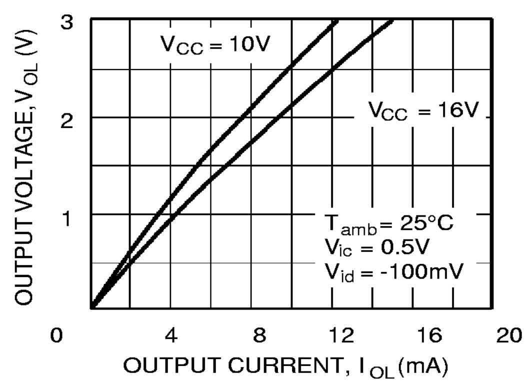


Figure 14b : Low Level Output Voltage versus Low Level Output Current



TYPICAL CHARACTERISTICS FOR I_{SET} = 25µA (continued)

Figure 15 : Open Loop Frequency Response and Phase Shift

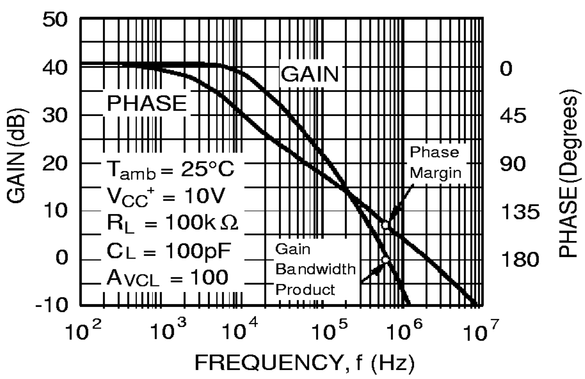


Figure 16 : Gain Bandwidth Product versus Supply voltage

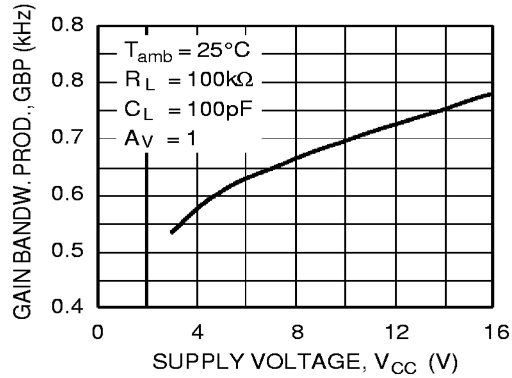


Figure 17 : Phase Margin versus Supply Voltage

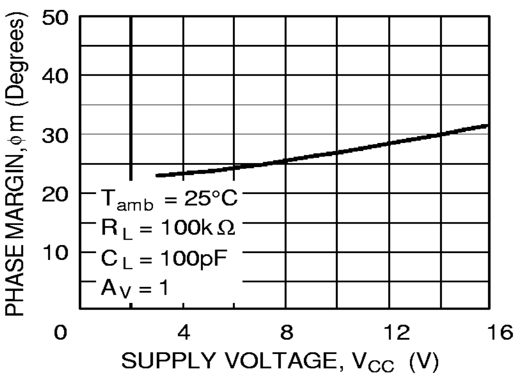


Figure 18 : Phase Margin versus Capacitive Load

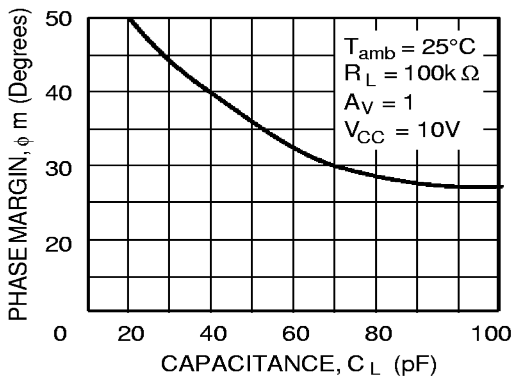
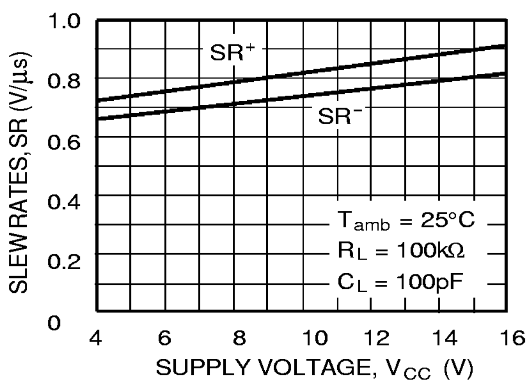


Figure 19 : Slew Rates versus Supply Voltage



ELECTRICAL CHARACTERISTICS FOR I_{SET} = 130µA

V_{CC}^+ = +10V, V_{CC}^- = 0V, T_{amb} = 25°C (unless otherwise specified)

Symbol	Parameter	TS271C/AC/BC			TS271I/AI/BI TS271M/AM/BM			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input Offset Voltage V_O = 1.4V, V_{ic} = 0V TS271C/I/M TS271AC/AI/AM TS271BC/BI/BM $T_{min.} \le T_{amb} \le T_{max.}$ TS271C/I/M TS271AC/AI/AM TS271BC/BI/BM		1.1 0.9 0.25	10 5 2 12 6.5 3		1.1 0.9 0.25	10 5 2 12 6.5 3.5	mV
DV_{io}	Input Offset Voltage Drift		2			2		µV/°C
I_{io}	Input Offset Current - (note 1) V_{ic} = 5V, V_o = 5V $T_{min.} \le T_{amb} \le T_{max.}$		1	100		1	200	pA
I_{ib}	Input Bias Current - (note 1) V_{ic} = 5V, V_o = 5V $T_{min.} \le T_{amb} \le T_{max.}$		1	150		1	300	pA
V_{OH}	High Level Output Voltage V_{id} = 100mV, R_L = 10kΩ $T_{min.} \le T_{amb} \le T_{max.}$	8.2 8.1	8.4		8.2 8	8.4		V
V_{OL}	Low Level Output Voltage (V_{id} = -100mV)			50			50	mV
A_{vd}	Large Signal Voltage Gain V_o = 1V to 6V, R_L = 10kΩ, V_{ic} = 5V $T_{min.} \le T_{amb} \le T_{max.}$	10 7	15		10 6	15		V/mV
GBP	Gain Bandwidth Product (A_v = 40dB, R_L = 10kΩ, C_L = 100pF, f_{in} = 100kHz)		2.3			2.3		MHz
CMR	Common Mode Rejection Ratio V_o = 1.4V, V_{ic} = 1V to 7.4V	60	80		60	80		dB
SVR	Supply Voltage Rejection Ratio V_{CC}^+ = 5V to 10V ,V_o = 1.4V	60	70		60	70		dB
I_{CC}	Supply Current A_v = 1, no load, V_o = 5V $T_{min.} \le T_{amb} \le T_{max.}$		800	1300 1400		800	1300 1500	µA
I_o	Output Short Circuit Current V_{id} = 100mV, V_o = 0V		60			60		mA
I_{sink}	Output Sink Current V_{id} = -100mV, V_o = V_{CC}		45			45		mA
SR	Slew-Rate at Unity Gain R_L = 10kΩ, C_L= 100pF, V_i = 3 to 7V		4.5			4.5		V/µs
∅m	Phase Margin at Unity Gain A_v = 40dB, R_L = 10kΩ C_L= 10pF C_L= 100pF		65 50			65 50		degrees
K_{ov}	Overshoot Factor C_L = 10pF C_L = 100pF		30 30			30 30		%
e_n	Equivalent Input Noise Voltage f = 1kHz, R_S = 100Ω		30			30		$\frac{nV}{\sqrt{Hz}}$

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

TYPICAL CHARACTERISTICS FOR I_{SET} = 130μA

Figure 20 : Supply Current (each amplifier) versus Supply Voltage

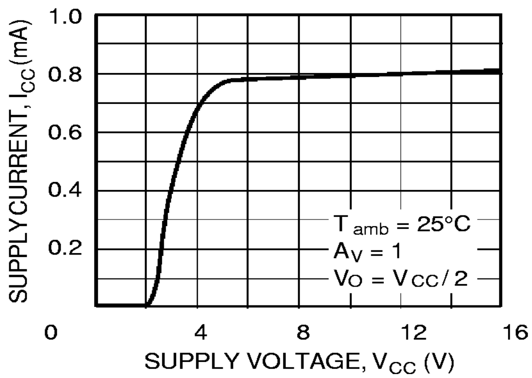


Figure 21 : Input Bias Current versus Free Air Temperature

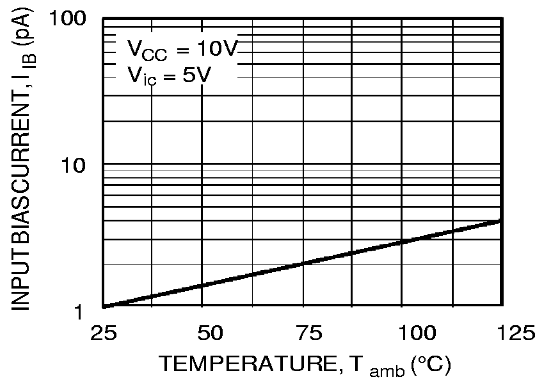


Figure 22a : High Level Output Voltage versus High Level Output Current

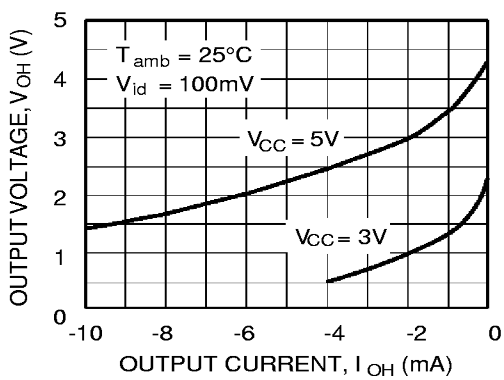


Figure 22b : High Level Output Voltage versus High Level Output Current

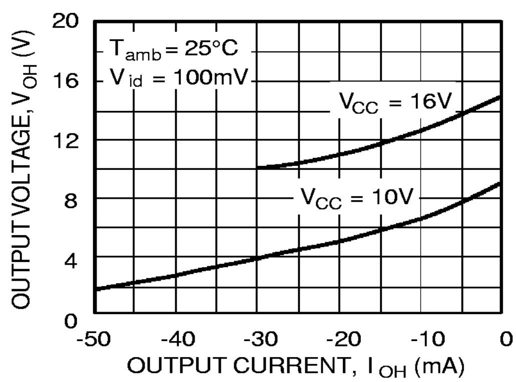


Figure 23a : Low Level Output Voltage versus Low Level Output Current

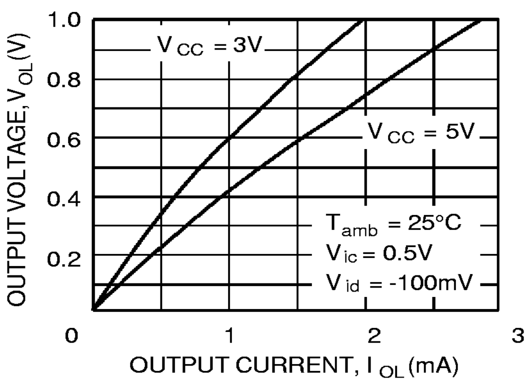
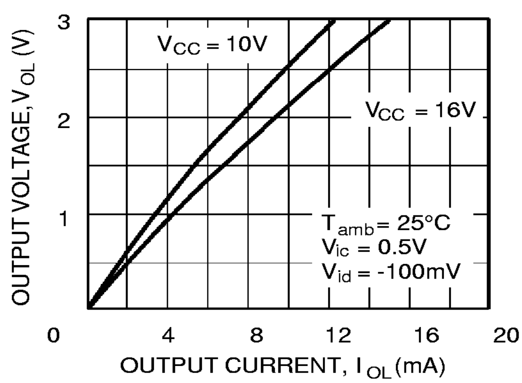


Figure 23b : Low Level Output Voltage versus Low Level Output Current



TYPICAL CHARACTERISTICS FOR I_{SET} = 130μA (continued)

Figure 24 : Open Loop Frequency Response and Phase Shift

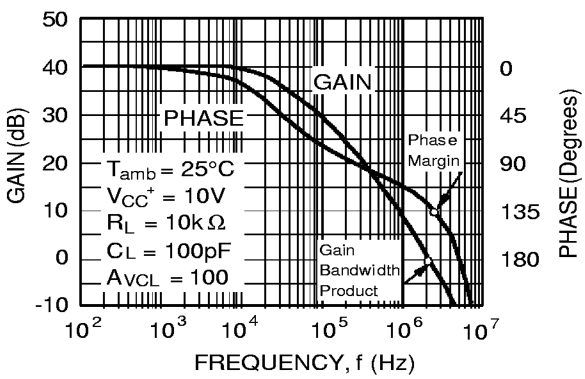


Figure 25 : Gain Bandwidth Product versus Supply voltage

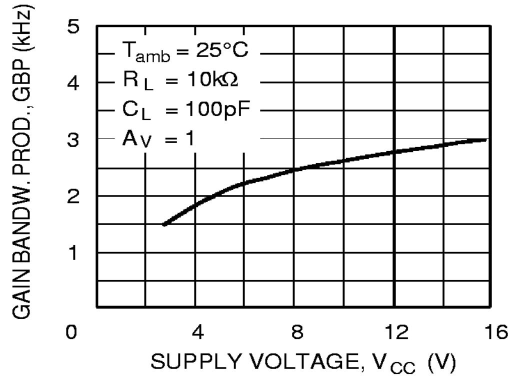


Figure 26 : Phase Margin versus Supply Voltage

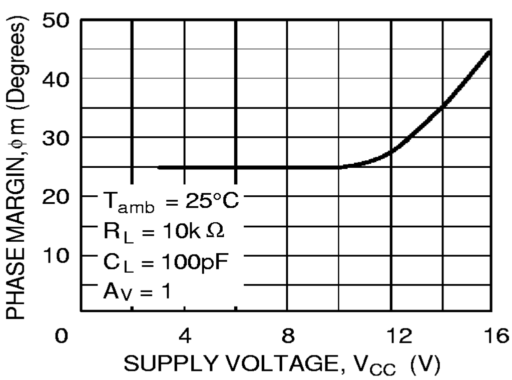


Figure 27 : Phase Margin versus Capacitive Load

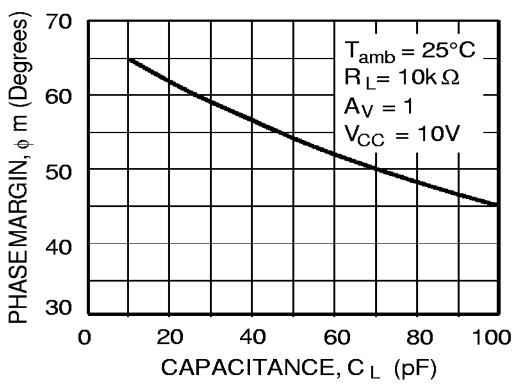
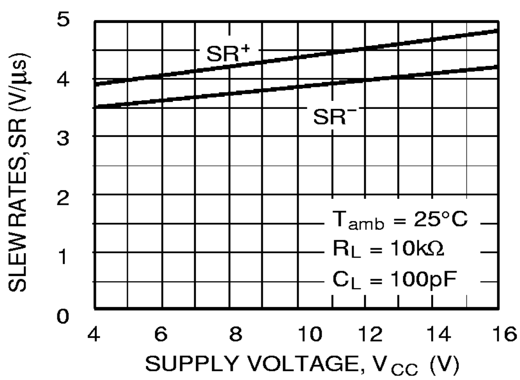
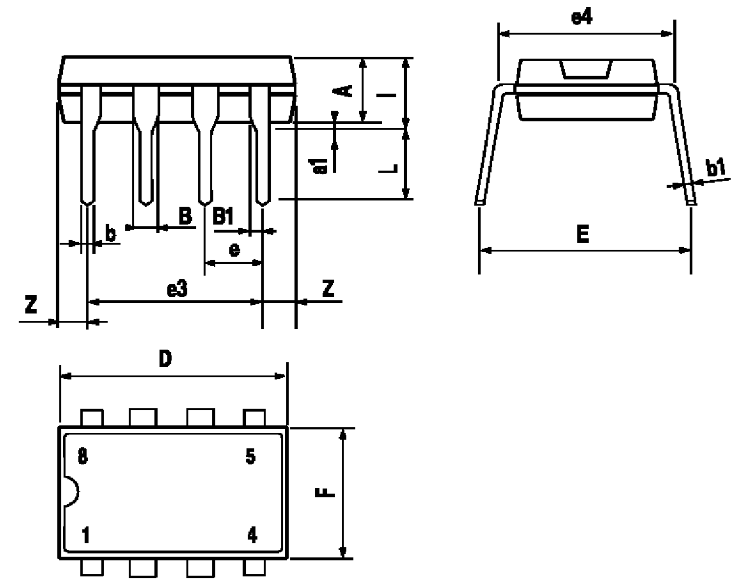


Figure 28 : Slew Rates versus Supply Voltage



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

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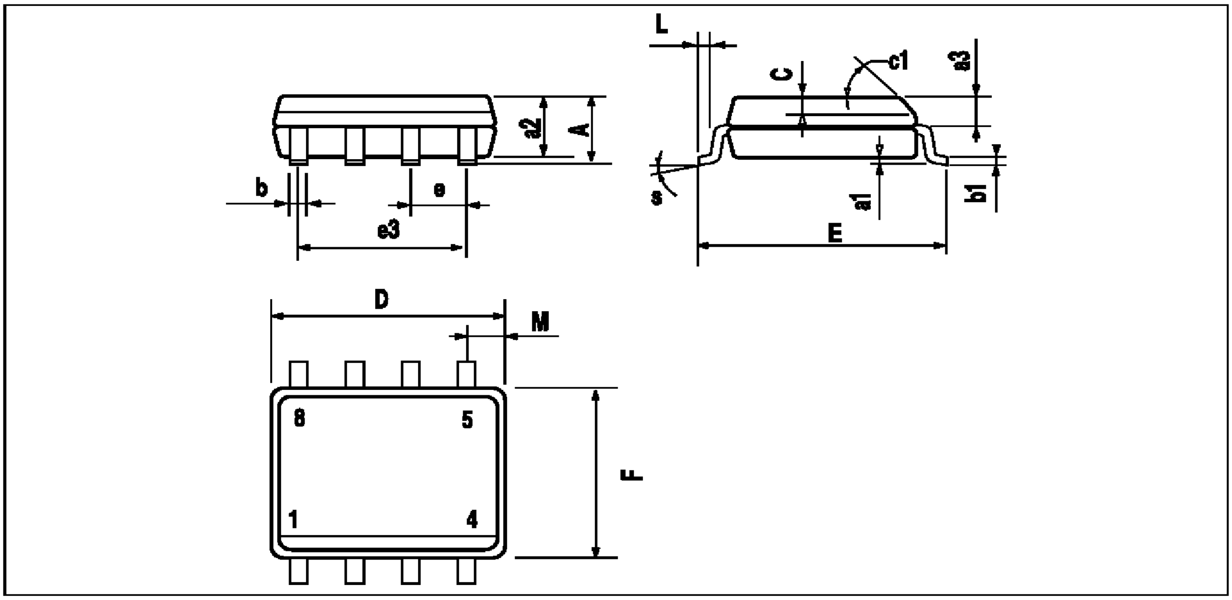
PACKAGE MECHANICAL DATA

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° (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.)					

SO8.TBL

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