

MAS9181

OCTAL 8 – BIT TRIMMER – IC

PRELIMINARY

- Eight discrete DACs
- I²C – bus slave receiver
- Voltage Output

DESCRIPTION

The MAS9181 comprises eight digital-to-analog converters (DACs) each controlled via the two-wire I²C bus. The DACs are individually programmed using an 8-bit word to select an output from one of 256 voltage steps. The maximum output voltage of all DACs is set by V_{max} and the resolution is $V_{max}/256$. At power-on all outputs are set to their lowest value. The I²C-bus slave receiver has 3 programmable address pins (2 for MAS9181 BS).

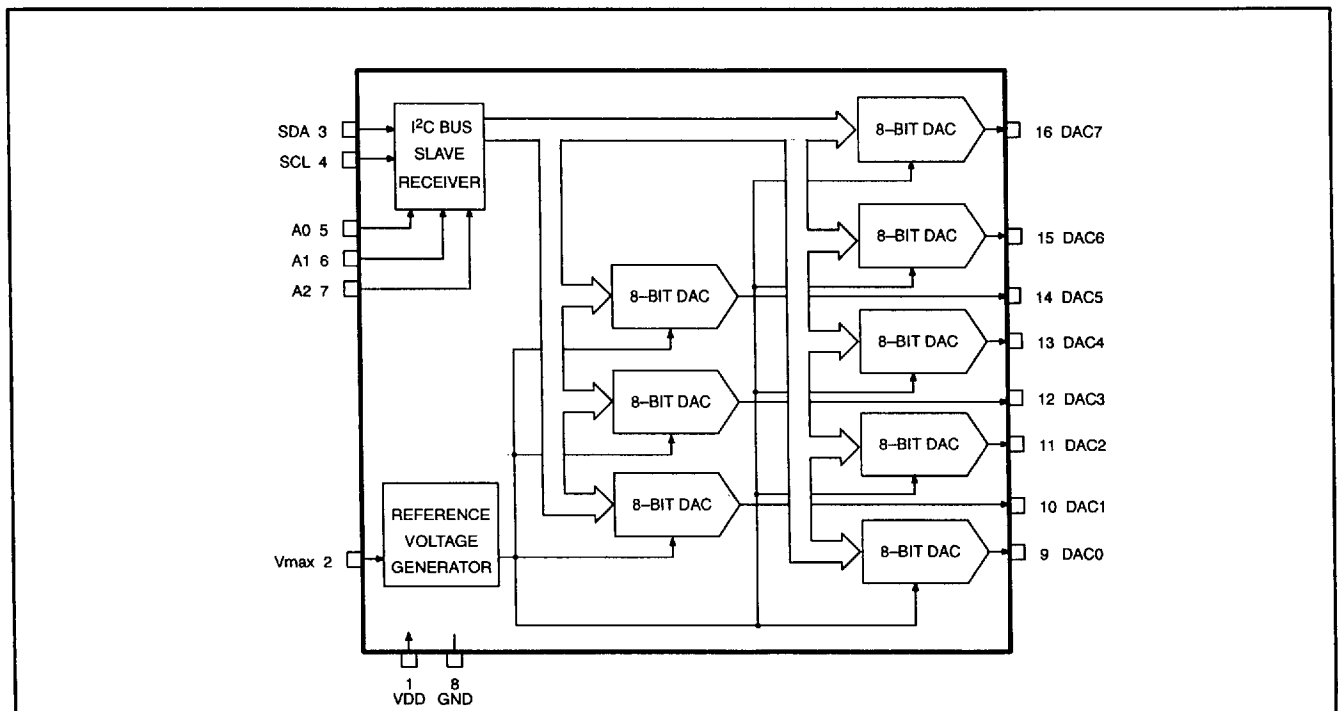
FEATURES

- Rail to rail output stages
- Octal 8-bit DAC's on a single monolithic chip
- Voltage output
- I²C – bus slave receiver
- 16-pin DIL- or SO-package
- Guaranteed 8-bit monotonic
- Power supply range from 5V to 12V

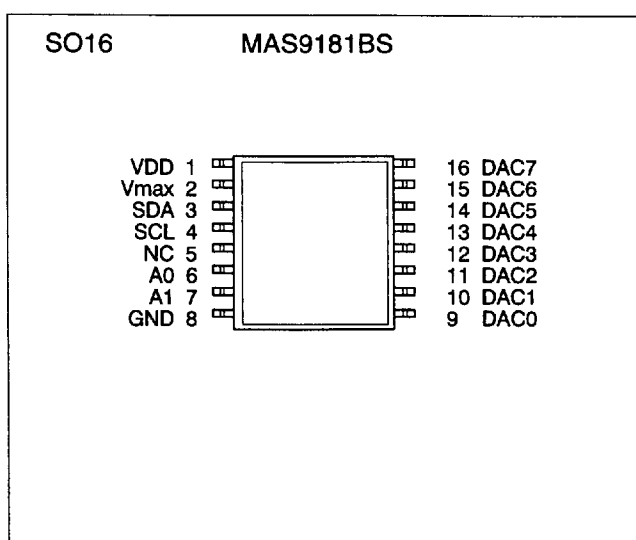
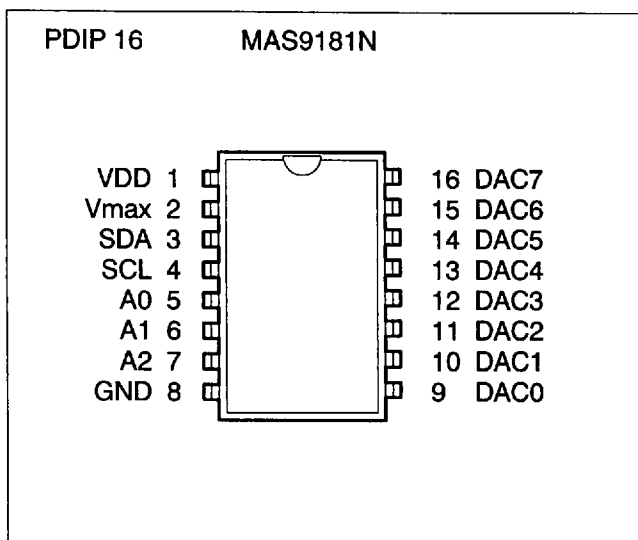
APPLICATION

- Trimmer replacement
- AGC / AFT or TV's and VCR's
- Graphic equalizers
- High resolution monitors

BLOCK DIAGRAM



PIN CONFIGURATION



PIN DESCRIPTION

Pin Name	Pin no.		I/O	Function
	*1	*2		
VDD	1	1	P	Positive Supply Voltage
V _{MAX}	2	2	I	Control Input for DAC maximum Output Voltage
SDA	3	3	I/O	I ² C bus serial data input/output
SCL	4	4	I	I ² C bus serial data clock
A ₀	5	6	I	Programmable address bits for I ² C bus slave receiver
A ₁	6	7	I	Programmable address bits for I ² C bus slave receiver
A ₂	7	NC	I	Programmable address bits for I ² C bus slave receiver
GND	8	8	G	Ground
DAC0	9	9	O	Analog voltage output
DAC1	10	10	O	Analog voltage output
DAC2	11	11	O	Analog voltage output
DAC3	12	12	O	Analog voltage output
DAC4	13	13	O	Analog voltage output
DAC5	14	14	O	Analog voltage output
DAC6	15	15	O	Analog voltage output
DAC7	16	16	O	Analog voltage output

*1 MAS9181N (PDIP16), MAS9181S (SO16)

*2 MAS9181BS (SO16)

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Min	Max	Unit
Supply Voltage	VDD		-0.5	18	V
Supply Current (source)	IDD		-10	40	mA
I ² C – bus line voltage	V(3),V(4)		-0.5	5.9	V
Input Voltage	V _{IN}		-0.5	VDD+0.5	V
Output Voltage	V _O		-0.5	VDD+0.5	V
Maximum current on any pin (except pins 1 and 8)	I _{MAX}			10	mA
Total power dissipation	P _{tot}			500	mW
Operating ambient temperature range	T _{amb}		-20	+70	°C
Storage temperature range	T _{stg}		-65	+150	°C

ELECTRICAL CHARACTERISTICS

◆ **Electrical characteristics, power supplies**

(All voltages are with respect to GND; T_{amb} = 25°C; VDD = 12V unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage	VDD		4.5	12	13.2	V
Supply Current	IDD = I ₁	No loads V _{MAX} = VDD = 12V All data = 00 _{OCT}		3.0	5.0	mA
Total power dissipation	P _{tot}	No loads V _{MAX} = VDD = 12V All data = 00 _{OCT}		40	60	mW

◆ **Electrical characteristics, inputs**

SDA, SCL Input (pin 3 and 4)

(All voltages are with respect to GND; T_{amb} = -20°C to 70°C; VDD = 5V to 12V unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input voltage range	V _I		-0.5		5.5	V
Input voltage LOW	V _{IL}				1.0	V
Input voltage HIGH	V _{IH}		3.0			V
Input leakage current		V _{in} = 0V or VDD	-1		+1	µA

Address Input (pin 5, 6, 7)

(All voltages are with respect to GND; T_{amb} = -20°C to 70°C; VDD = 5V to 12V unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input voltage range	V _I		0		VDD	V
Input voltage LOW	V _{IL}				1.0	V
Input voltage HIGH	V _{IH}		3.0			V
Input current LOW	I _{IL}			-10	-15	µA
Input current HIGH	I _{IH}				1	µA

ELECTRICAL CHARACTERISTICS

V_{MAX} Control Input for DAC maximum Output Voltage (pin2)

(All voltages are with respect to GND; Tamb = -20°C to 70°C; VDD = 5V to 12V unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Pin 2 current	I ₂			7	10	μA

◆ Electrical characteristics, outputs

(All voltages are with respect to GND; Tamb = -20°C to 70°C; VDD = 5V to 12V unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
DAC output (pin 9 to 16) Output voltage range	V _o	I _o = ±100μA I _o = ±500μA	0.1 0.2		VDD-0.1 VDD-0.2	V
Output impedance	Z _o	Data = 7F		30		Ω
DAC Output drive range	I _o	Upper side saturation voltage = 0.2V Low side saturation voltage = 0.2V	-1		1	mA
Output capacitive load	C _o				2	nF

SDA Output (pin 3)

(All voltages are with respect to GND; Tamb = -20°C to 70°C; VDD = 5V to 12V unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage LOW	V _{OL}	I ₃ = 3.0mA			0.4	V

◆ Electrical characteristics, linearity

(All voltages are with respect to GND; Tamb = -20°C to 70°C; VDD = 5V to 12V unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Differential Nonlinearity	DNL	I _o = 0 (without load) V _{max} = VDD-1.0	-1		1	LSB
Integral Nonlinearity	INL	I _o = 0 (without load) V _{max} = VDD-1.0	-1.5		1.5	LSB
Zero code error ¹	ZCE	Data = 00		10	30	mV
Power supply rejection ¹	PSRR				5	mV/V
Zero code temperature ¹ coefficient	TC0		-200		200	μV/°C

Notes: 1. Guaranteed by design but not production tested.

FUNCTIONS

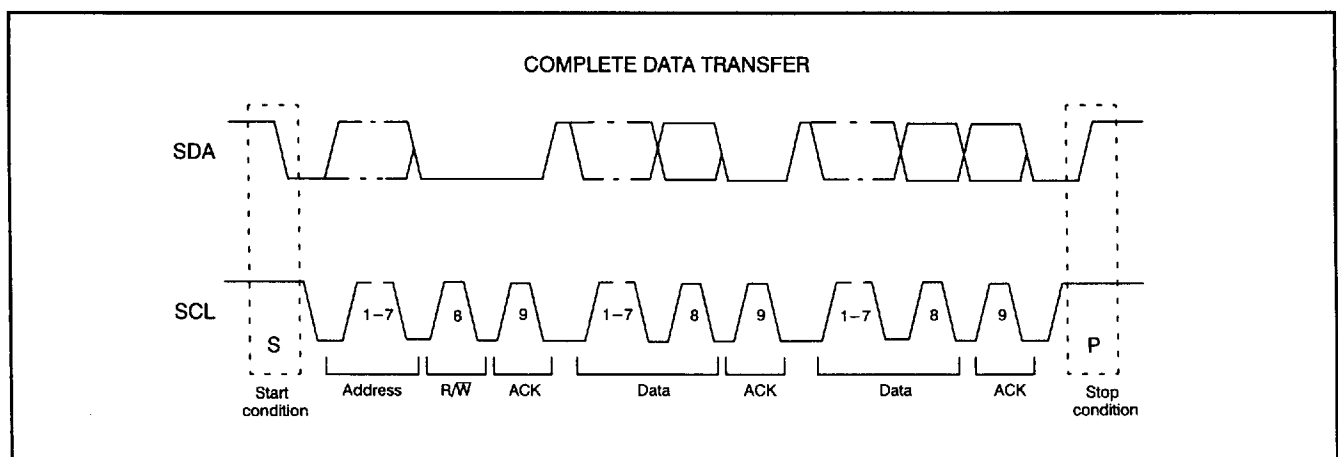
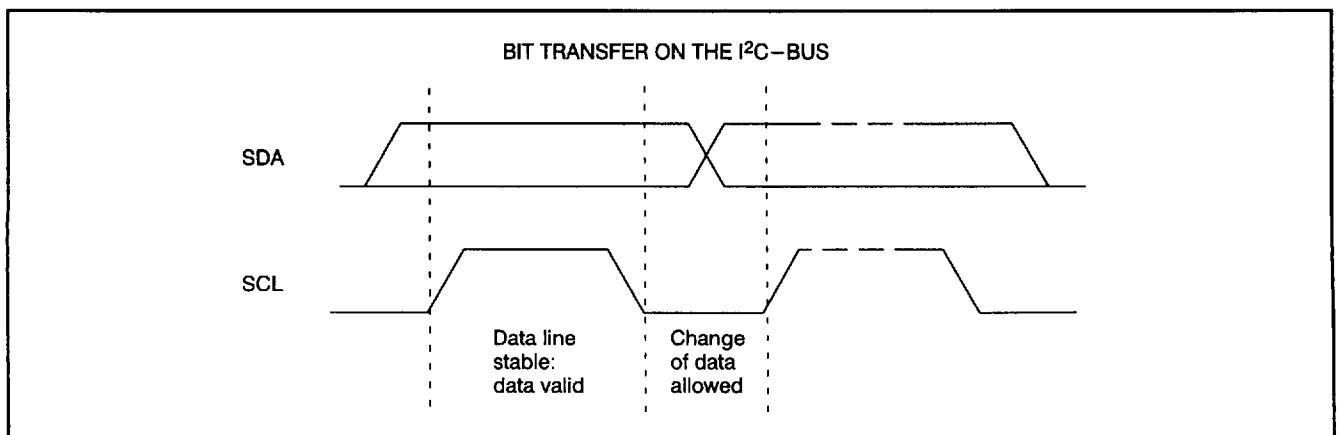
◆ I²C – bus

The MAS9181 I²C–bus interface is a receiver–only slave. Data is accepted from the I²C –bus in the following format.

S	0	1	0	0	A2	A1	A0	0	A	I3	I2	I1	I0	SD	SC	SB	SA	A	D7	D6	D5	D4	D3	D2	D1	D0	A	P
Address byte									Instruction byte									First data byte										

S	start condition	A2, A1, A0	programmable address bits
P	stop condition	I3, I2, I1, I0	instruction bits
A	acknowledgement	SD, SC, SB, SA	subaddress bits
		D7, D6, D5, D4, D3, D2, D1, D0	data bits

◆ I²C – bus timing



◆ Address byte

Valid addresses are 40, 42, 44, 46, 48, 4A, 4C, 4E (hex), depending on the programming of bits A2, A1 and A0. With these addresses, up to eight MAS9181 ICs can be operated independently from one I²C–bus. No other addresses are acknowledged by the MAS9181.

The address inputs A0, A1, A2 are programmed by connection to GND for An = 0 or to VDD for An = 1. If the inputs are left floating, An = 1 will result. For MAS9181BS A2 is always 1.

FUNCTIONS

Cont.

◆ **Instruction and data bytes**

Valid instructions 00 to 0F and F0 to FF (hex); the MAS9181 will not respond to other instruction value, but still generate an acknowledgement.

Instructions 00 to 0F cause auto-incrementing of the subaddress (bits SD to SA) when more than one data byte is sent within one transmission. With auto-incrementing, the first data byte is written into the DAC addressed by bits SD to SA and then the subaddress is automatically incremented by one position for the next data byte in the series.

Auto-incrementation does not occur with instructions F0 to FF. The DAC addressed by the subaddress will always receive the data if more than one data byte is sent.

Valid subaddresses (bits SD to SA) are 0 to 7 (hex) relating numerically to DAC0 to DAC7. When the auto-incrementing function is used, the subaddress will sequence through all possible values (0 to F, 0 to F etc.) While the subaddress is between 8 and F no DAC Output changes.

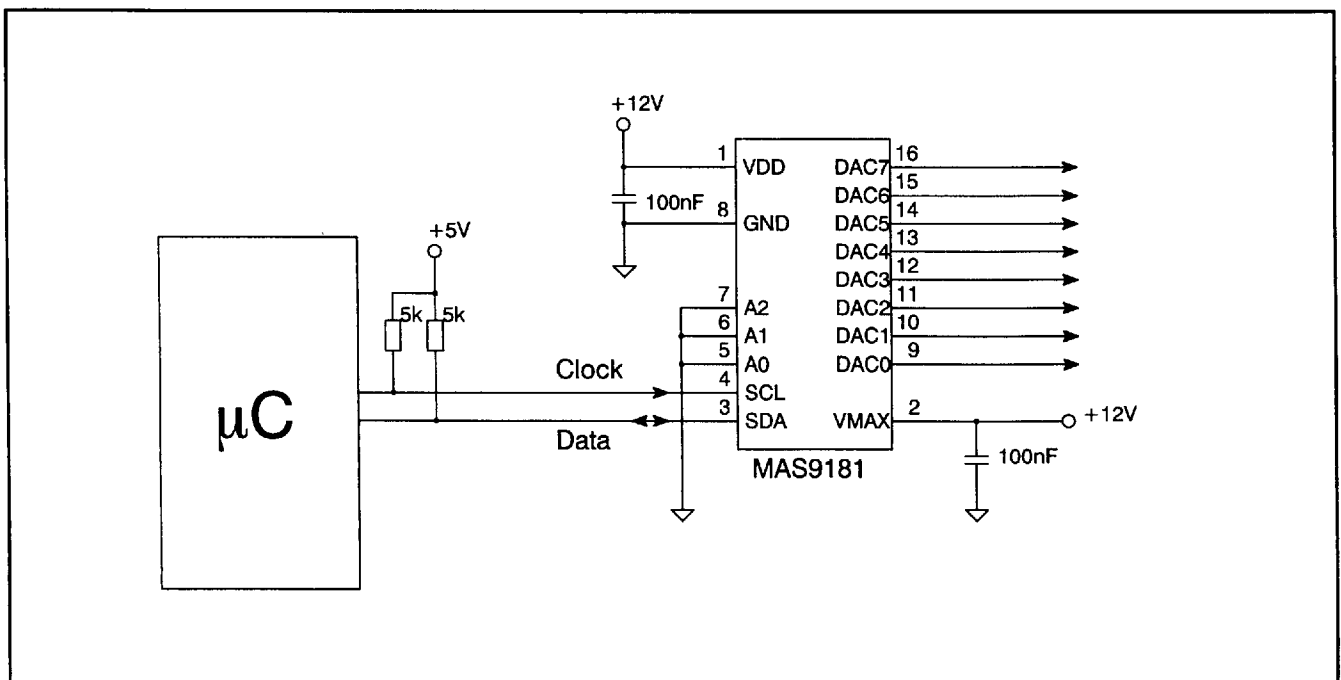
◆ **I²C – bus**

Input SCL (pin 4) and input/output SDA (pin 3) conform to I²C-bus specifications. Pins 3 and 4 are protected against positive voltage pulses by internal zener diodes connected to the ground plane and therefore the normal bus line voltage shall not exceed 5.5V.

◆ **Input V_{max}**

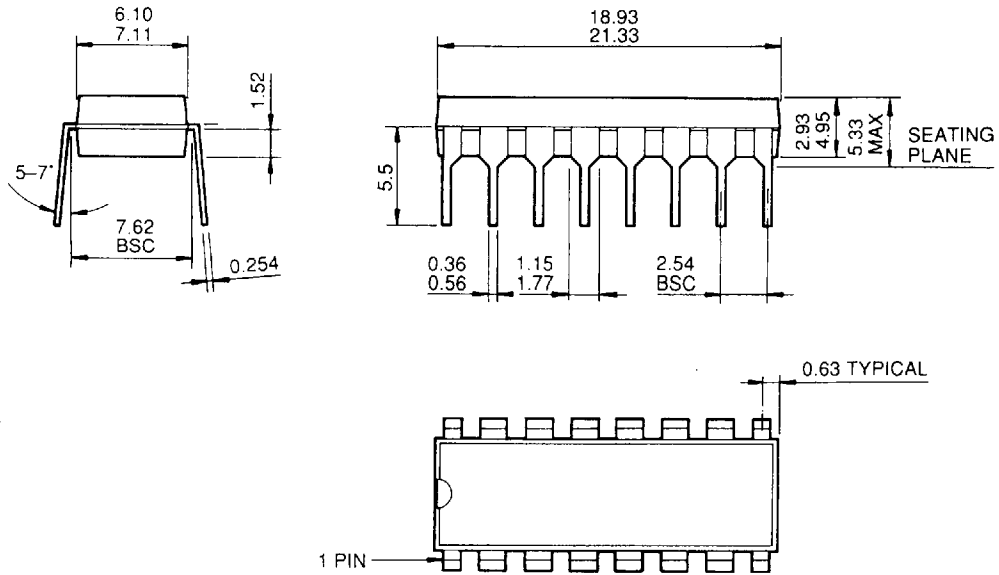
Input V_{max} (pin 2) provides a means of compressing the output voltage swing of the DACs. The maximum DAC output voltage is restricted to approximately V_{max} while the 8-bit resolution is maintained, so giving a finer voltage resolution of smaller output swings.

APPLICATION INFORMATION



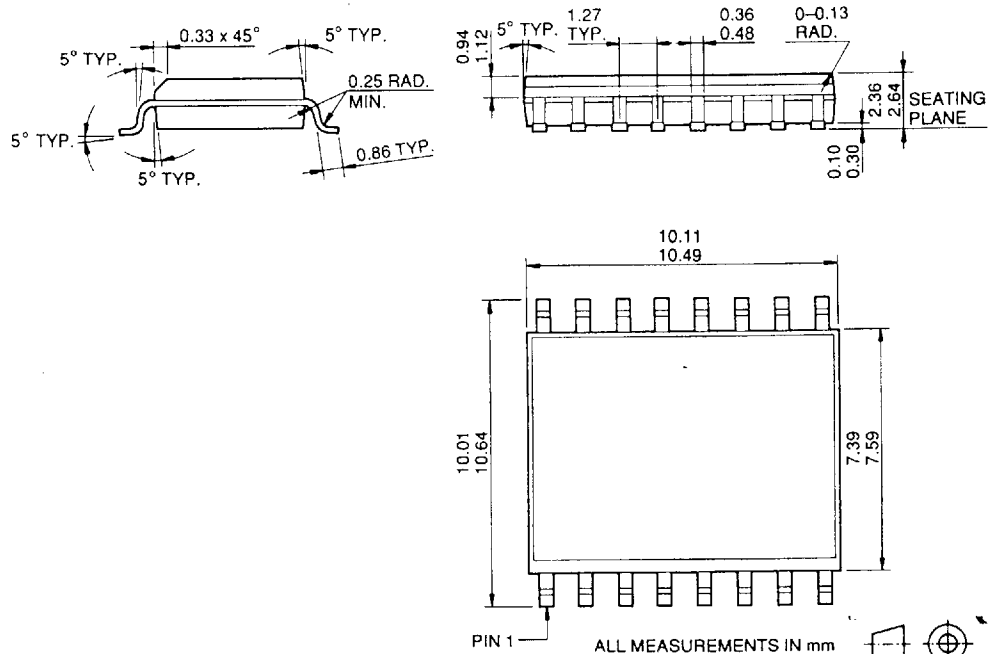
PACKAGE OUTLINES

16 LEAD PDIP OUTLINE (300 MIL BODY)



ALL DIMENSIONS IN mm

16 LEAD SO OUTLINE (300 MIL BODY)

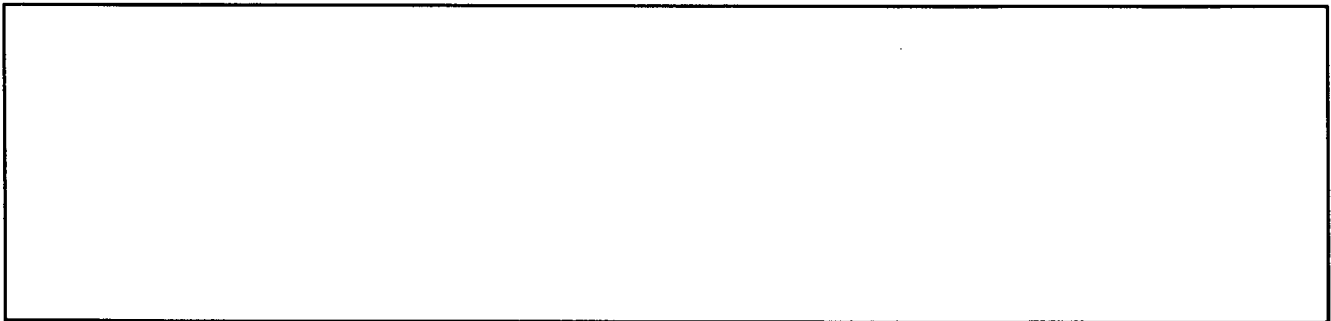


ALL MEASUREMENTS IN mm

ORDERING INFORMATION

Product Code	Product	Package	Comments
MAS9181N	OCTAL 8-BIT TRIMMER-IC	16 Pin PDIP 0.3"	
MAS9181S	OCTAL 8-BIT TRIMMER-IC	16 Pin SO 0.3"	
MAS9181BS	OCTAL 8-BIT TRIMMER-IC	16 Pin SO 0.3"	2 Address Pins

LOCAL DISTRIBUTOR



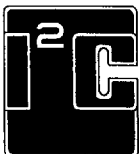
MICRONAS CONTACTS

◆ SALES OFFICE

Micronas Semiconductor GmbH Hanns-Braun-Strasse 52 D-85375 NEUFAHRN, GERMANY	Tel. (08165) 95 210 Tel. Int. + 49 8165 95 210 Telefax + 49 8165 952 199
--	--

◆ HEAD OFFICE / FACTORY

	<p>MICRONAS INC. Kamreerintie 2, P.O.Box 51 FIN-02771 ESPOO, FINLAND Tel. (90) 80 521 Tel. Int. + 358 0 80 521 Telefax + 358 0 805 3213</p>
--	---



NOTICE

Purchase of I²C components of Micronas Inc., Kamreerintie 2, FIN-02770 Espoo, Finland, conveys a license under the Philips I²C Patent Rights to use these components in an I²C system, provided that the system conforms to the I²C Standard Specification as defined by Philips.

NOTICE

Micronas reserves the right to make changes to the products contained in this data sheet in order to improve the design or performance and to supply the best possible products. Micronas assumes no responsibility for the use of any circuits shown in this data sheet, conveys no license under any patent or other rights unless otherwise specified in this data sheet, and makes no claim that circuits are free from patent infringement. Applications for any devices shown in this data sheet are for illustration only and Micronas makes no claim or warranty that such applications will be suitable for the use specified without further testing or modification.