MAS8444A

OCTAL 6-BIT TRIMMER IC

- **Eight discrete DACs**
- **I²C-bus slave receiver**
- **Voltage output**

DESCRIPTION

The MAS8444a comprises eight digital to analog converters (DACs) each controlled by a two-wire I²C bus. The DACs are individually programmed using an 6-bit word to select an output from one of 64 voltage steps. The maximum output voltage of all DACs is set by Vmax. At power-on all outputs are set to their lowest value. The I²C-bus slave receiver has 3 programmable address pins (2 in the SO16 package).

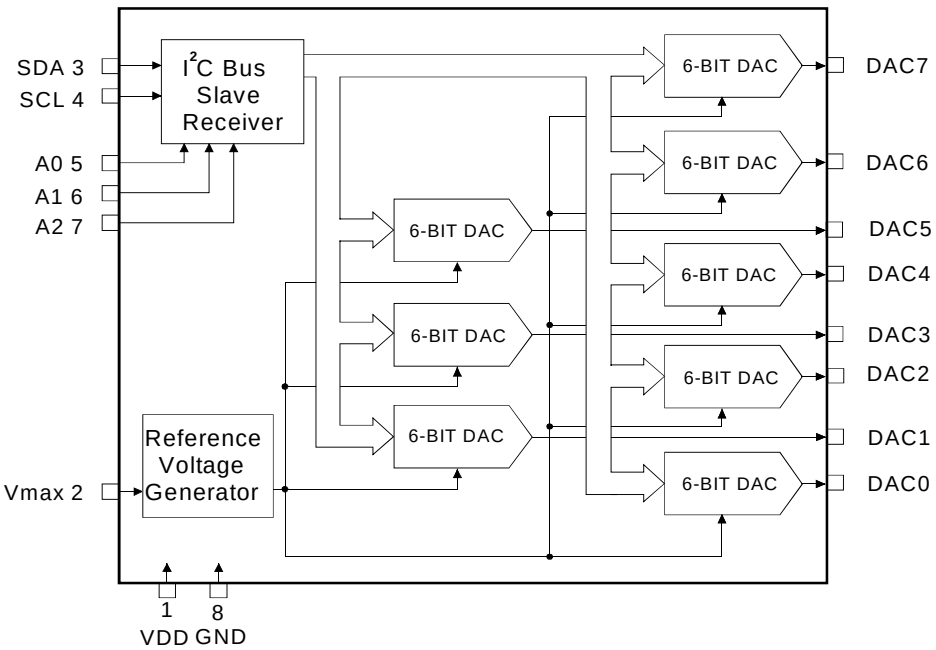
FEATURES

- Rail to rail output stages
- Octal 6-bit DACs on a single monolithic chip
- Power supply range from +5V to +12V
- -25°C to +85°C temperature range
- 16-pin PDIL and SO package
- pin to pin compatibility with TDA8444

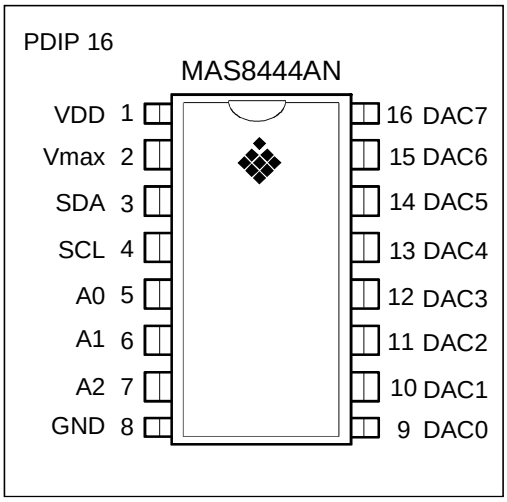
APPLICATION

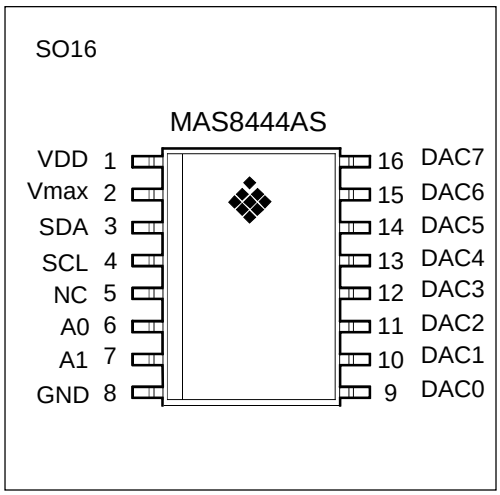
- Trimmer replacement
- Automatic gain control
- High resolution monitors

BLOCK DIAGRAM



PIN CONFIGURATION





PIN DESCRIPTION

Pin name	Pin no.		I/O	Function
	PDIP16	SO16		
VDD	1	1	P	Positive supply voltage
Vmax	2	2	I	Control input for DAC maximum output voltage
SDA	3	3	I/O	I^2C bus serial data input/output
SCL	4	4	I	I^2C bus serial data clock
A_0	5	6	I	Programmable address bits for I^2C bus slave receiver
A_1	6	7	I	Programmable address bits for I^2C bus slave receiver
A_2	7	NC	I	Programmable address bits for I^2C 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

ABSOLUTE MAXIMUM RATINGS

(conditions)

Parameter	Symbol	Conditions	Min	Max	Unit
Supply Voltage	VDD		-0.5	18	V
Supply current	IDD		-10	40	mA
I^2C-bus line voltage	V(3),V(4)		-0.5	5.9	V
Input voltage	Vin		-0.5	VDD+0.5	V
Output voltage	Vo		-0.5	VDD+0.5	V
Maximum current on any pin (except pins 1 and 8)	Imax			10	mA
Total power dissipation	Ptot			500	mW
Operating ambient temperature range	Tamb		-20	+70	°C
Storage temperature range	Tstg		-65	+150	°C

RECOMMEDED OPERATION CONDITIONS

(All voltages are with respect to GND; Tamb = -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	No loads	6.0	10.0	17.0	mA
Voltage level from power	V1		1		4	V
Total power dissipation	Ptot	No loads, Vmax=VDD		120		mW

ELECTRICAL CHARACTERISTICS

◆ **Inputs**
SDA, SCL input (pins 3, 4)

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

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input voltage range	V_I		0		5.5	V
Input low voltage	V_{IL}				1.0	V
Input high voltage	V_{IH}		3.0			V
Input current low	I_{IL}	V(3),V(4) = -0.3V			-10	µA
Input current high	V_{IH}	V(3),V(4) = 6.0V			+10	µA

ELECTRICAL CHARACTERISTICS

Address Input (pins 5, 6, 7)

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

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input voltage range	V_I		0		VDD	V
Input low voltage	V_{IL}				1.0	V
Input high voltage	V_{IH}		2.2			V
Input current low	I_{IL}			-7	-10	µA
Input current high	I_{IH}				1	µA

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

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input current	I_2			7	10	µA
Effective voltage range	Vmax		1.0		VDD-2.0	V

◆ DAC Outputs (pin 9 to 16)

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

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage range	Vo		0.1		VDD-0.5	V
Minimum output voltage	Vomin	data = 00; Io = +2mA	0.1	0.4	0.5	V
Max output voltage	Vomax	data = 3f; Io = -2mA; Vmax =	10	11.1	11.5	V
		data = 3f; Io = -2mA;	see note 1			
Temperature coefficient	Tc				1	mV/K
Gain error		data = 3F			2	%
Output impedance	Zo	data = 1F; -2mA < Io < +2mA		50		Ω
Output capacitive load	Co				2	nF

note 1: Vomax = Vmax + Vo(00)

SDA Output (pin 3)

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

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage low	V_{OL}	I_3 = 3.0 mA		0.2	0.4	V
Sink current	Isink		3	8		mA

ELECTRICAL CHARACTERISTICS CONT.

Linearity

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

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Differential nonlinearity	DNL	Io = -2mA; Vmax = VDD	-0.5	0.1	0.5	LSB
Integral nonlinearity	INL	Io = -2mA; Vmax = VDD	-0.5	0.1	0.5	LSB

FUNCTIONS

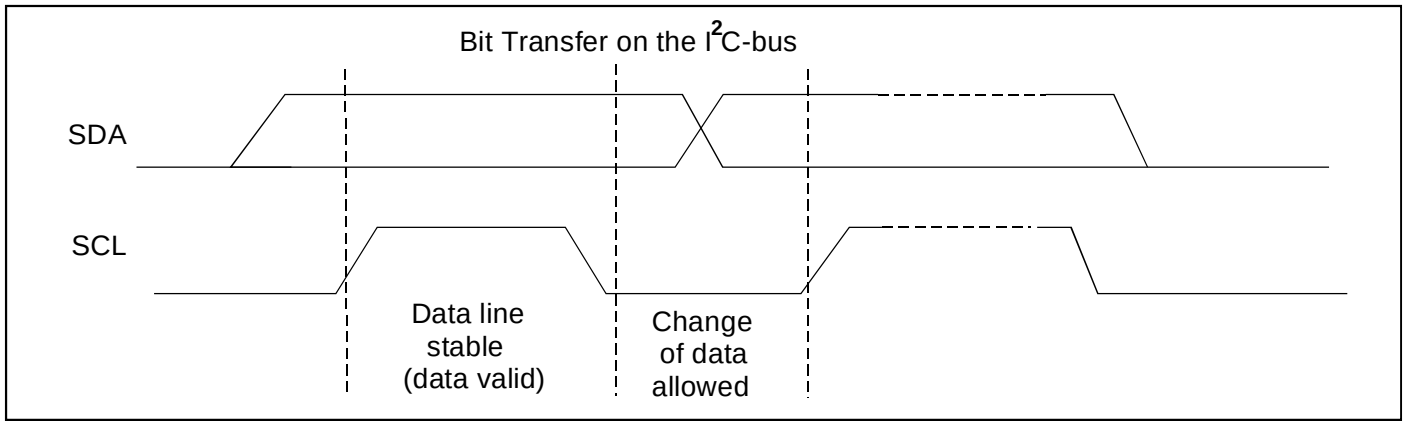
◆ I²C - bus

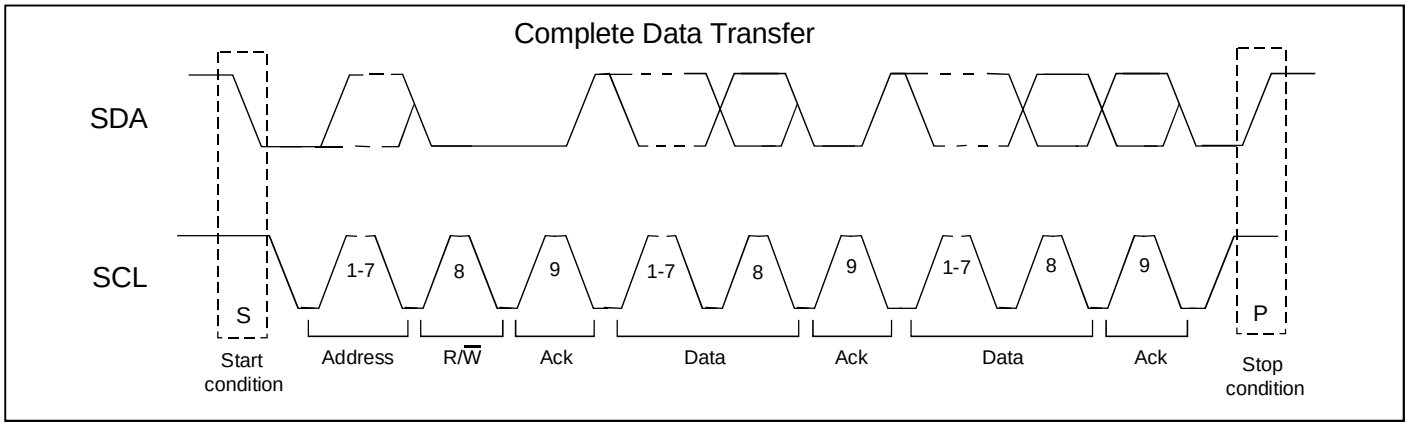
The MAS8444A I²C-bus interface is a receiver-only slave. Data is accepted from the I²C-bus in the following format.

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	sub-address bits
		D7, D6, D5, D4, D3, D2, D2, D1, D0	data bits

◆ I²C - bus timing





FUNCTIONS

◆ 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 MAS8444A ICs can be operated independently from one I^2C-bus. No other addresses are acknowledged by the MAS8444A. The address inputs A0, A1 and 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 MAS8444AS, A2 is always 1.

◆ Instruction and data bytes

Valid instructions from 00 to 0F and F0 to FF (hex); MAS8444A will not respond to other instruction value, but will still generate an acknowledgement. Instructions 00 to0F cause auto-incrementing of the sub-address (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 addessed by bits SD to SA and then the sub-address is automatically incremented by one position for the next databyte in the series. Auto-incrementing does not occur with instructions F0 to FF. Valid sub-addresses (bits SD to SA) are 0 to 7 (hex) relating numerically to DAC0 to DAC7. When the auto-incrementing function is used, the sub-address will sequence through all possible values (0 to F, 0 to F, etc.). While the sub-address is between 8 and F no DAC outputs change.

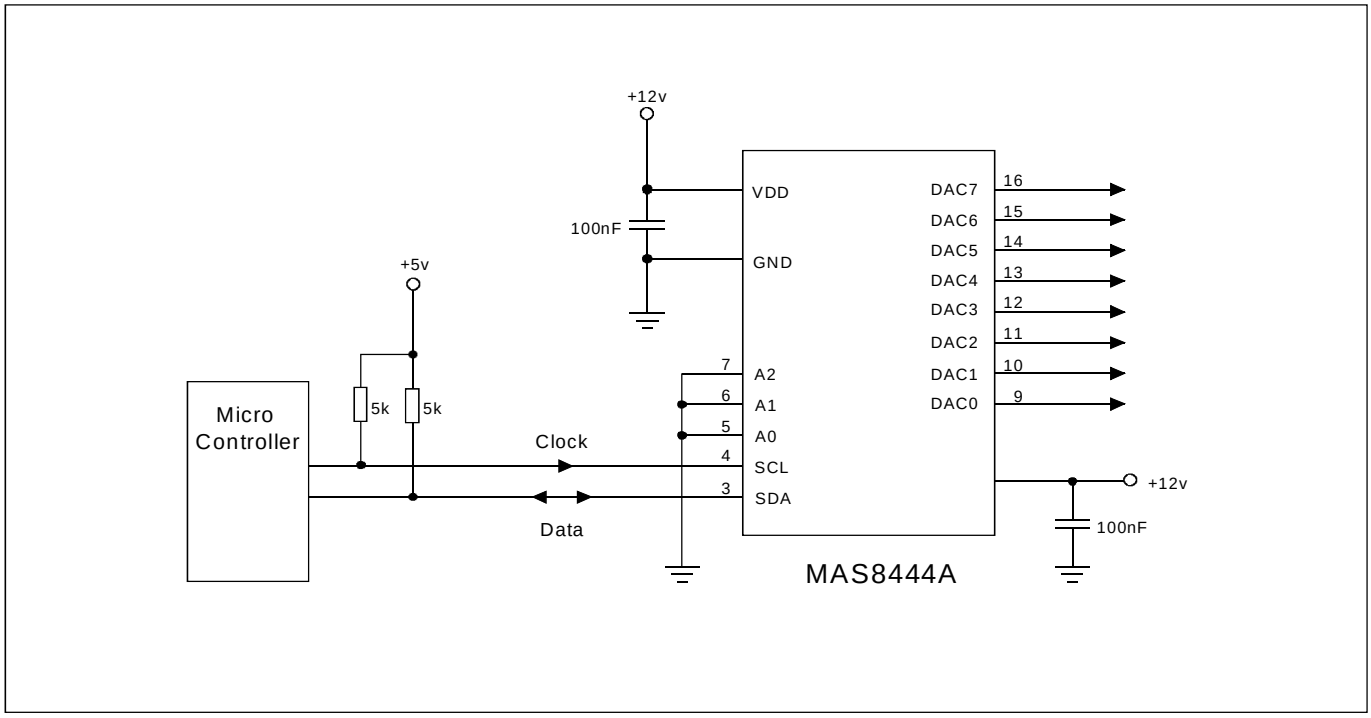
◆ I^2C - bus

Input SCL (pin 4) and input/output SDA (pin 3) conform to I^2C-bus specifications. Pins 3 and 4 are protected against voltage pulses by internal zener diodes connected to the ground plane and therefore the normal bus line voltage shall not exceed 5.5v.

◆ Input Vmax

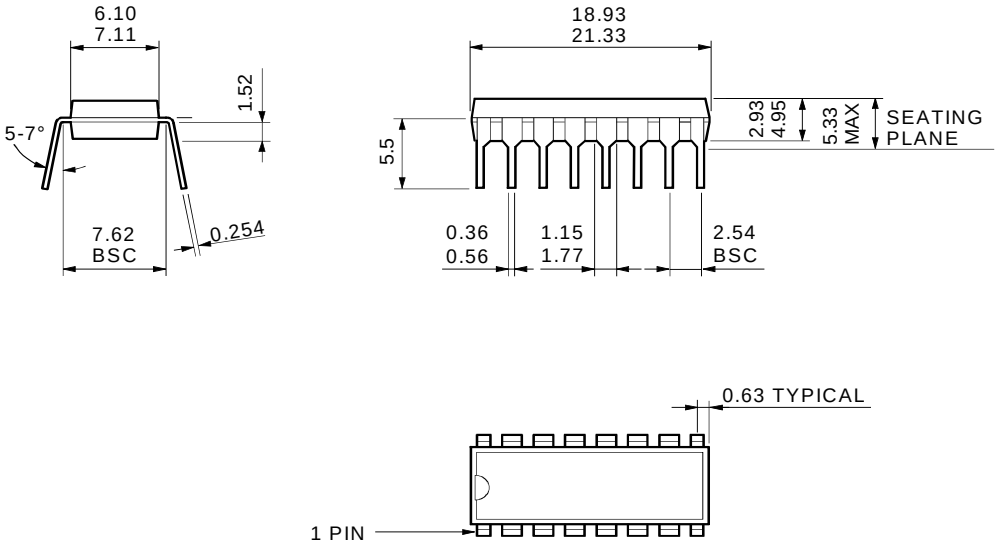
Input Vmax (pin 2) provides a means of comprising the output voltage swing of the DACs. The maximum DAC output voltage is restricted to approximately Vmax+VDACmin while the 6-bit resolution is maintained, therefore giving a finer voltage resolution of smaller output swings.

APPLICATION INFORMATION



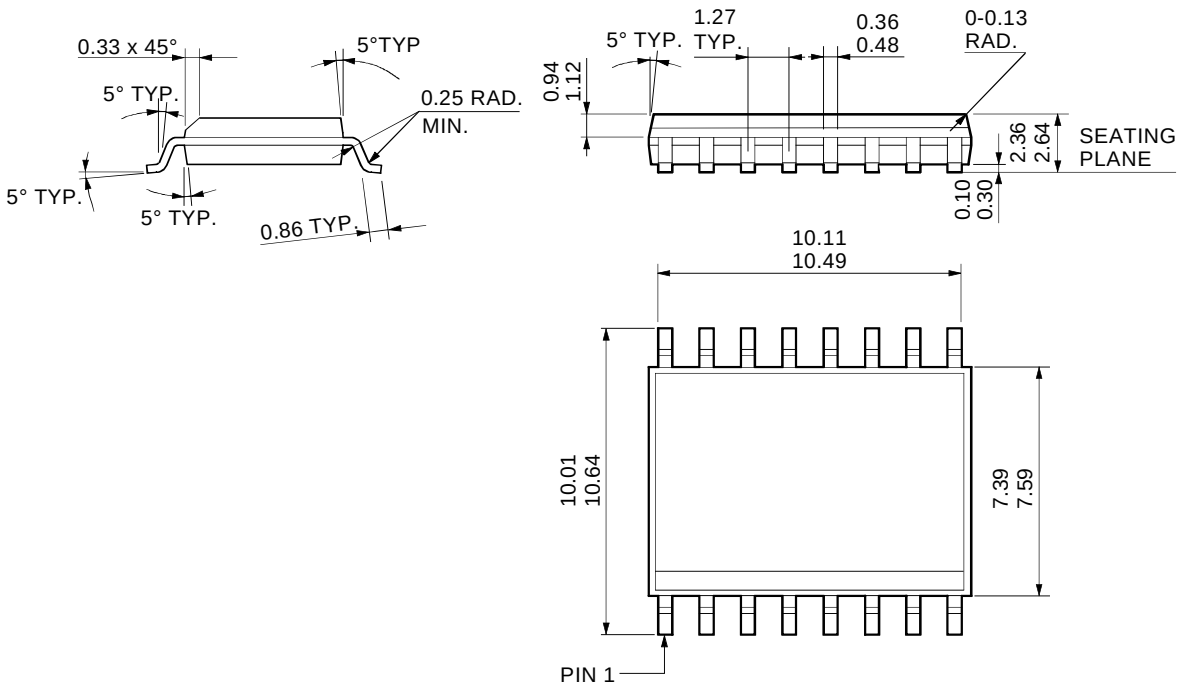
PACKAGE OUTLINES

16 LEAD PDIP OUTLINE (300 MIL BODY)



ALL MEASUREMENTS IN mm

16 LEAD SO OUTLINE (300 MIL BODY)



ALL MEASUREMENTS IN mm

ORDERING INFORMATION

Product Code	Product	Package	Comments
MAS8444AN	OCTAL 6-BIT TRIMMER-IC	16 Pin PDIP 0.3"	
MAS8444AS	OCTAL 6-BIT TRIMMER-IC	16 Pin SO 0.3"	

LOCAL DISTRIBUTOR

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