

# MAS9186

This is preliminary information on a new product under development. Micro Analog Systems Oy reserves the right to make any changes without notice.

**Preliminary**

## 8 X 8-bit D to A Converter

- 3-pin Serial Data Interface
- Low Voltage Output Buffer

### DESCRIPTION

MAS9186 is 8-channel 8-bit DAC, designed primarily for trimmer replacement. Device is controlled by a simple 3-line input. The output buffers operate in the entire voltage range from ground to the positive power supply rail.

DAC is selected with three first bits in serial input data (SDI-pin) and the DAC output value is set according to the last 8 bits in serial input data.

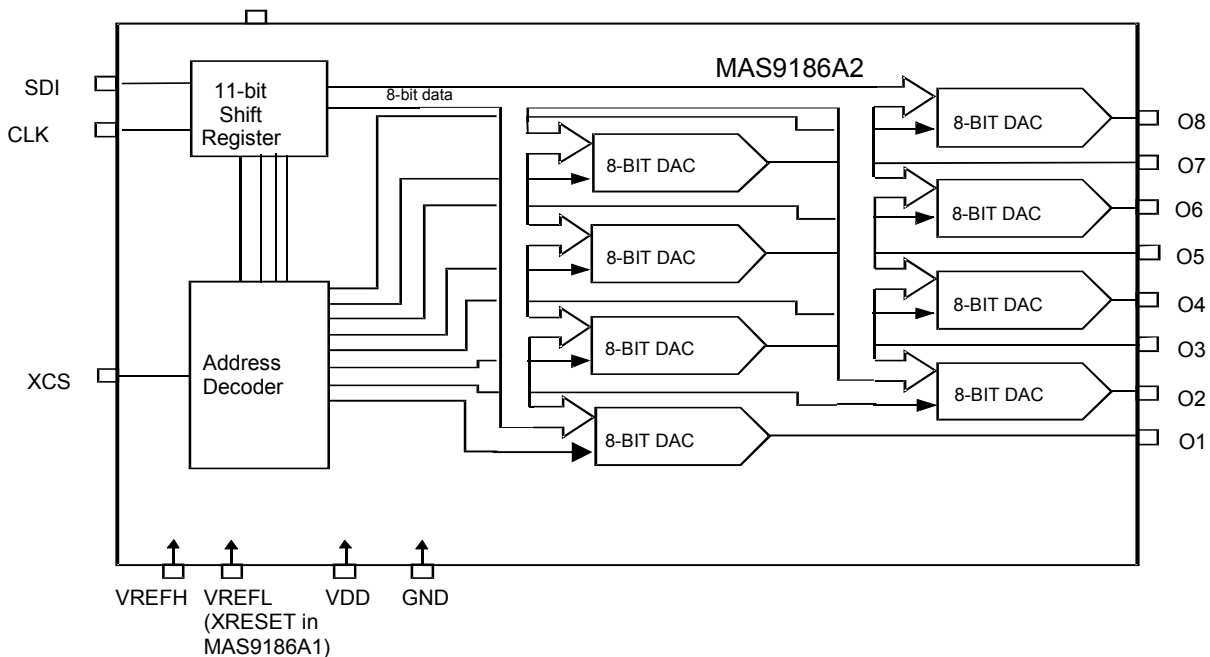
### FEATURES

- Eight 8-bit DACs on a single monolithic chip
- Voltage level output
- TSSOP 16 package
- Single +2.7V supply
- Power-on reset

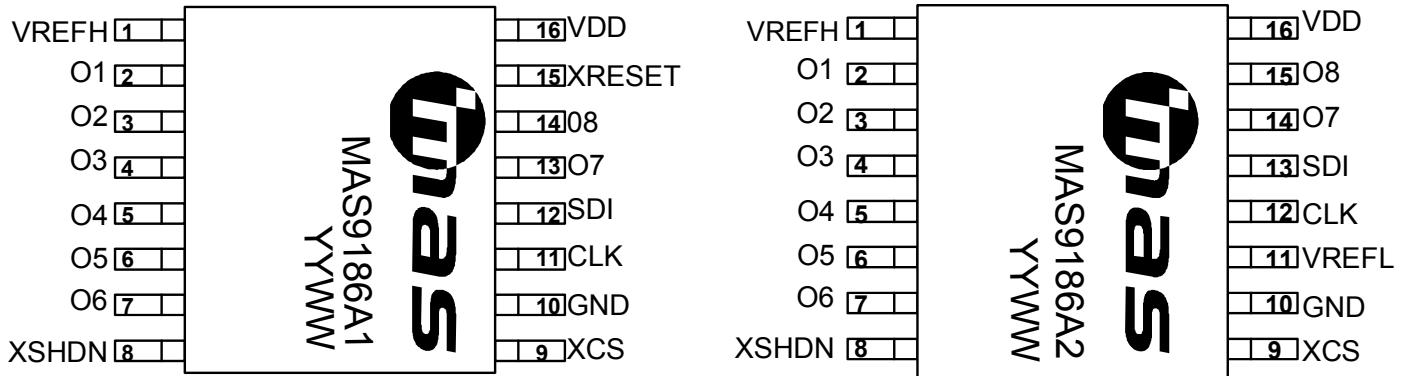
### APPLICATIONS

- High resolution monitors
- Automatic gain control
- Trimmer replacement

### BLOCK DIAGRAM



## PIN CONFIGURATION



Top view  
YYWW = year, week

## PIN DESCRIPTION

Pin Number	MAS9186 A1	MAS9186 A2	Function
1	VREFH	VREFH	DAC output reference high voltage
2	O1	O1	DAC 1, address 0x0
3	O2	O2	DAC 2, address 0x1
4	O3	O3	DAC 3, address 0x2
5	O4	O4	DAC 4, address 0x3
6	O5	O5	DAC 5, address 0x4
7	O6	O6	DAC 6, address 0x5
8	XSHDN	XSHDN	Device analog part power-down signal (active low)
9	XCS	XCS	Device enable signal (rising edge loads data to DAC)
10	GND	GND	Device ground-pin
11	CLK	VREFL	Data clock / DAC output low reference voltage
12	SDI	CLK	Serial input data / Data clock
13	O7	SDI	DAC 7, address 0x6 / Serial input data
14	O8	O7	DAC 8, address 0x7 / DAC 7, address 0x6
15	XRESET	O8	Device Digital part reset – middle code preset pin/DAC 8, address 0xB
16	VDD	VDD	Device power supply pin

MAS9186 has two bonding options available:

- MAS9186A1, where VREFL pin is bonded to GND pin and XRESET pin can be used
- MAS9186A2, where XRESET pin is bonded to VDD pin and VREFL pin can be used

## ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Min	Max	Unit
Power Supply (VDD to GND)	VDD		-0.3	+6.0	V
Input Voltage Range (any other pin)			-0.3	VDD + 0.3	V
Continuous Power Dissipation				1000	mW
Storage Temperature Range			-65	+150	°C

## RECOMMENDED OPERATION CONDITIONS

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage Range	VDD		2.7	3.6	5.5	V
Operating Temperature Range	Temp		-40		+85	°C

## ELECTRICAL CHARACTERISTICS

(VDD = 3.0 V ± 10% or 5.0 V ± 10%, VREFH = VDD, VREFL = 0V, -40°C ≤ T<sub>A</sub> ≤ +85°C unless otherwise noted)

### DC Parameters

#### ◆ Digital Inputs

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
DAC Resolution	N			8		Bits
DAC Differential Nonlinearity Error	DNL		-1		+1	LSB
DAC Integral Nonlinearity Error	INL		-1		+1	LSB
DAC Full-scale Error	GFSE		-1		+1	LSB
DAC Zero Code Error	BZSE		-1		+1	LSB
DAC Output Resistance	ROUT			30	60	Ω

#### ◆ Reference Input

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
REFH Voltage Range	VREFH	V <sub>REFH</sub> > V <sub>REFL</sub>	0		VDD	
REFL Voltage Range (MAS9186A2 only)	VREFL	V <sub>REFH</sub> > V <sub>REFL</sub>	0		VDD	
REFH Input Resistance	RREFH		5	10		kΩ
REFL Input Resistance	RREFL			10		kΩ

### ◆ Digital Input

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Digital Logic High	V <sub>IH</sub>		0.7*V <sub>DD</sub>			
Digital Logic Low	V <sub>IL</sub>				0.3*V <sub>DD</sub>	
Digital Input Current	I <sub>IL</sub>				± 1	uA

### ◆ Power Supplies

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Power Supply Range	V <sub>DD</sub>		2.7		5.5	V
Supply Current	I <sub>DD</sub>	V <sub>DD</sub> = 3.60V		3	6	mA
Supply Current	I <sub>DD</sub>	V <sub>DD</sub> = 5.50V			20	mA
Shutdown Current	I <sub>SHDN</sub>			0.5	5	uA

## AC Parameters

### ◆ AC Characteristics

#### Dynamic Performance

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Power Supply Sensitivity (100Hz)	PSRR			54		dB
V <sub>out</sub> Settling time (±1/2 LSB error band)	T <sub>S</sub>			6		μs
Crosstalk between adjacent outputs	CT			63		dB

#### Switching Characteristics

(Minimum values at +25 °C, V<sub>DD</sub> = 3.60 V)

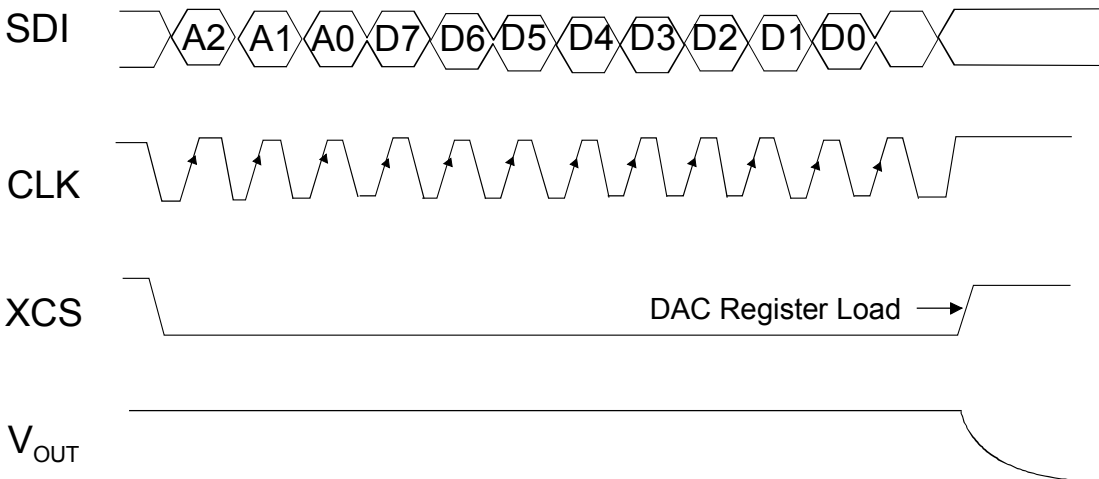
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Clock High Pulse Width	T <sub>CH</sub>			16		ns
Input Clock Low Pulse Width	T <sub>CL</sub>			7		ns
Data Setup Time	T <sub>DS</sub>			-5		ns
Data Hold Time	T <sub>DH</sub>			5		ns
XCS Fall to First Clock Pulse Fall	T <sub>CLCL</sub>			16		ns
XCS High Pulse Width	T <sub>CSW</sub>			22		ns
RESET Pulse Width	T <sub>RS</sub>			28		ns
CLK Rise to XCS Rise Hold Time	T <sub>CSH</sub>			22		ns
XCS Rise to CLOCK Rise Setup	T <sub>CS1</sub>			-5		ns

## OPERATING MODES

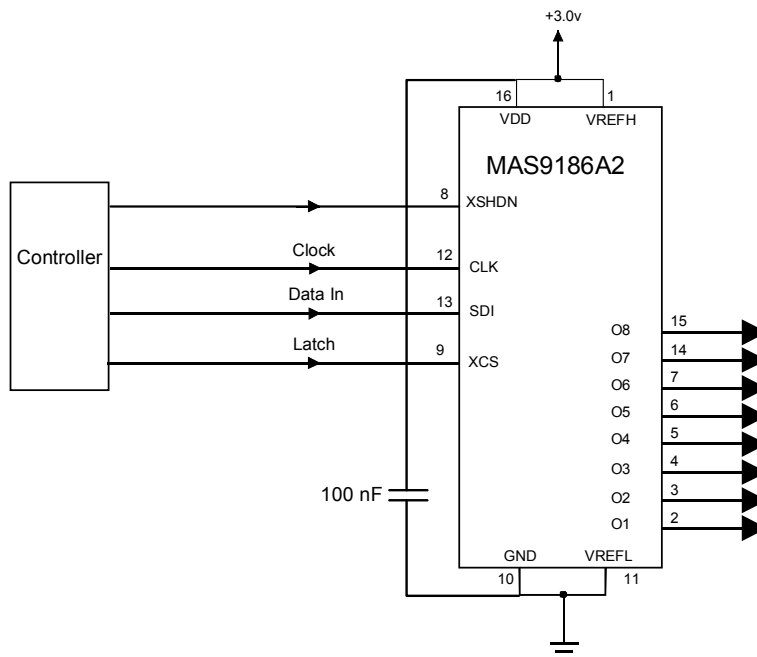
DAC maximum output voltage is set using VREFH and VREFL pins ( $= 255/256 * (VREFH-VREFL)+VREFL$ ) (note: VREFL=GND in case of MAS9186A1). XRESET pin is used for middle code preset: DAC registers are reset and middle code will appear at the DAC output.

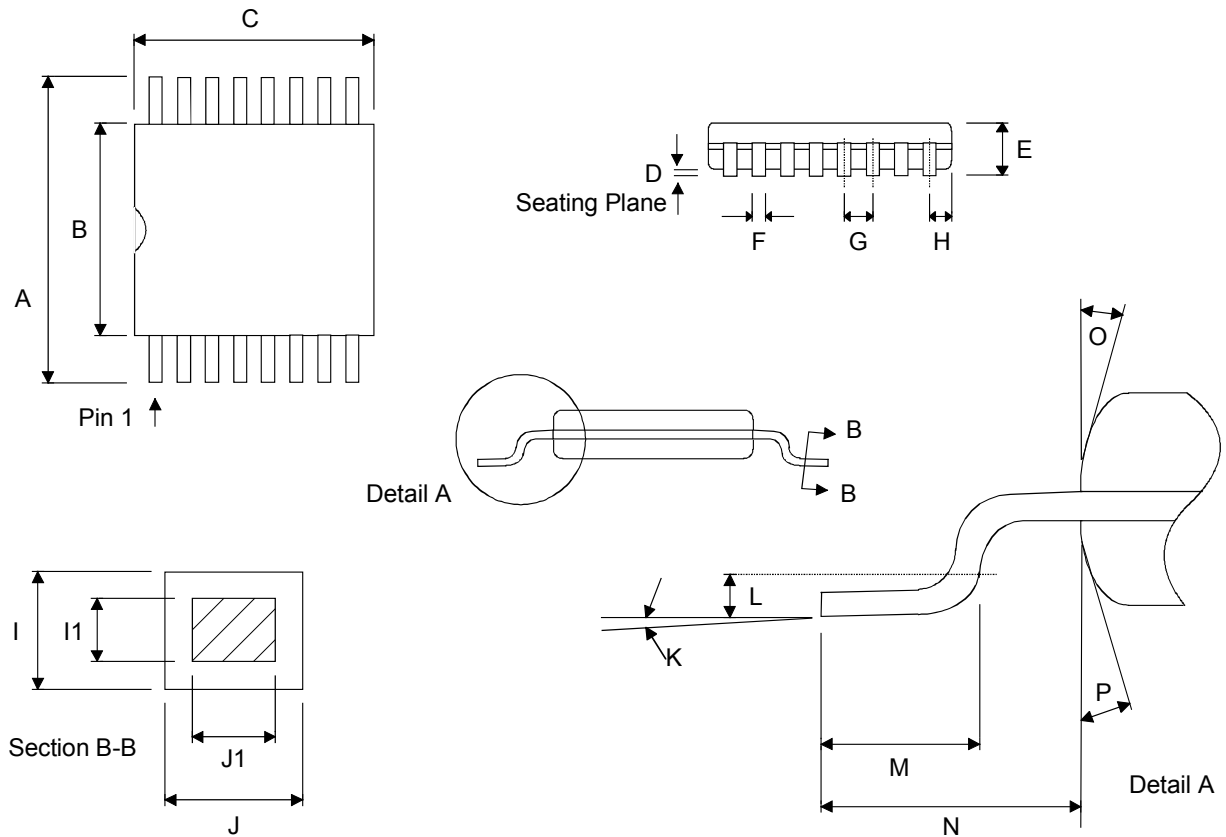
Serial input data is written to SDI while XCS is low. Data is read at CLK rising edge to on-chip shift register. Rising XCS-pin stops data reading and 11 CLK-cycles are used as the input data (3 address bits and 8 data bits). The last 11 bits before rising XCS are used as input data.

### ◆ Timing diagram



## APPLICATION AND TEST CIRCUIT INFORMATION



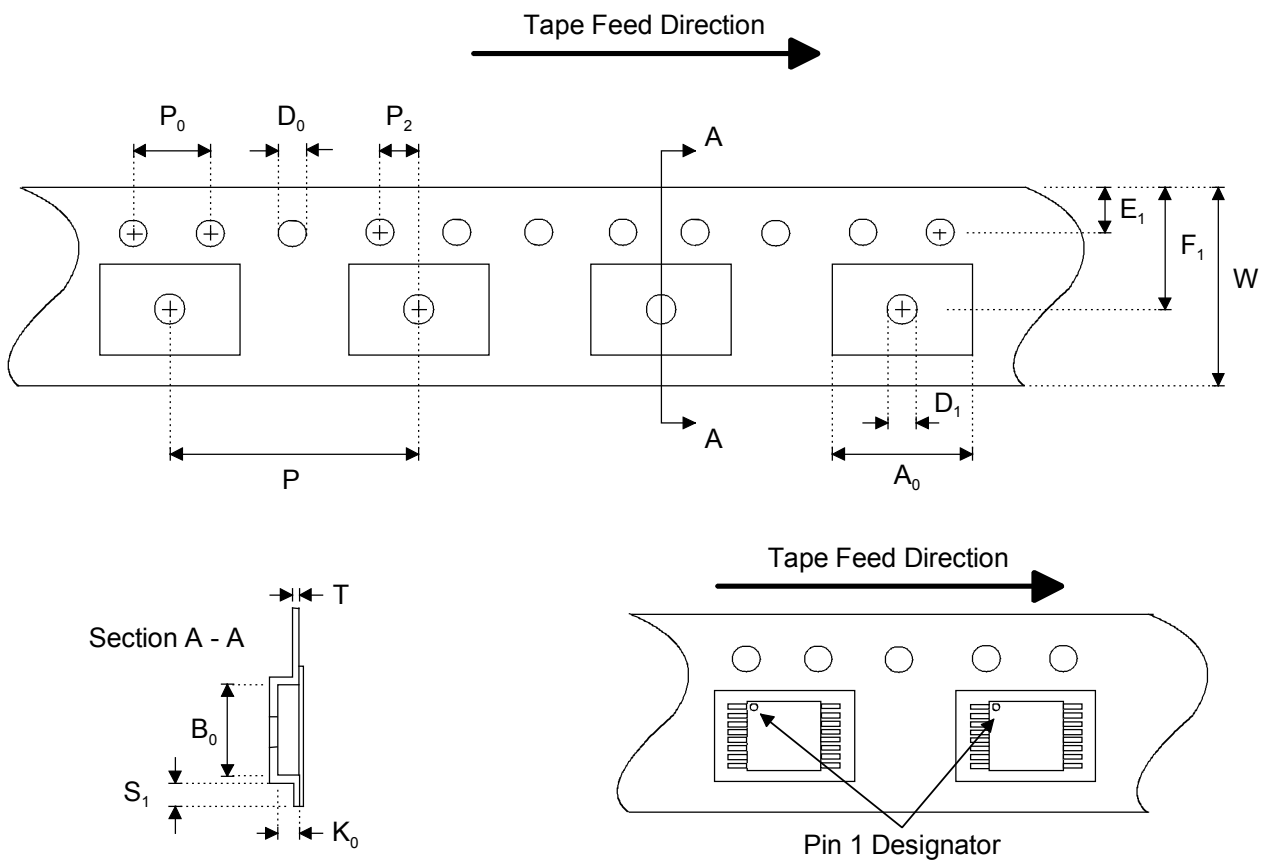
**PACKAGE (TSSOP16) OUTLINES**


Dimension	Min	Max	Unit
A	6.40 BSC		mm
B	4.30	4.50	mm
C	5.00 BSC		mm
D	0.05	0.15	mm
E	1.10		mm
F	0.19	0.30	mm
G	0.65 BSC		mm
H	0.18	0.28	mm
I	0.09	0.20	mm
I1	0.09	0.16	mm
J	0.19	0.30	mm
J1	0.19	0.25	mm
K	0°	8°	
L	0.24	0.26	mm
M	0.50	0.75	mm
(The length of a terminal for soldering to a substrate)			
N	1.00 REF		mm
O	12°		
P	12°		

Dimensions do not include mold flash, protrusions, or gate burrs.  
 All dimensions are in accordance with JEDEC standard MO-153.

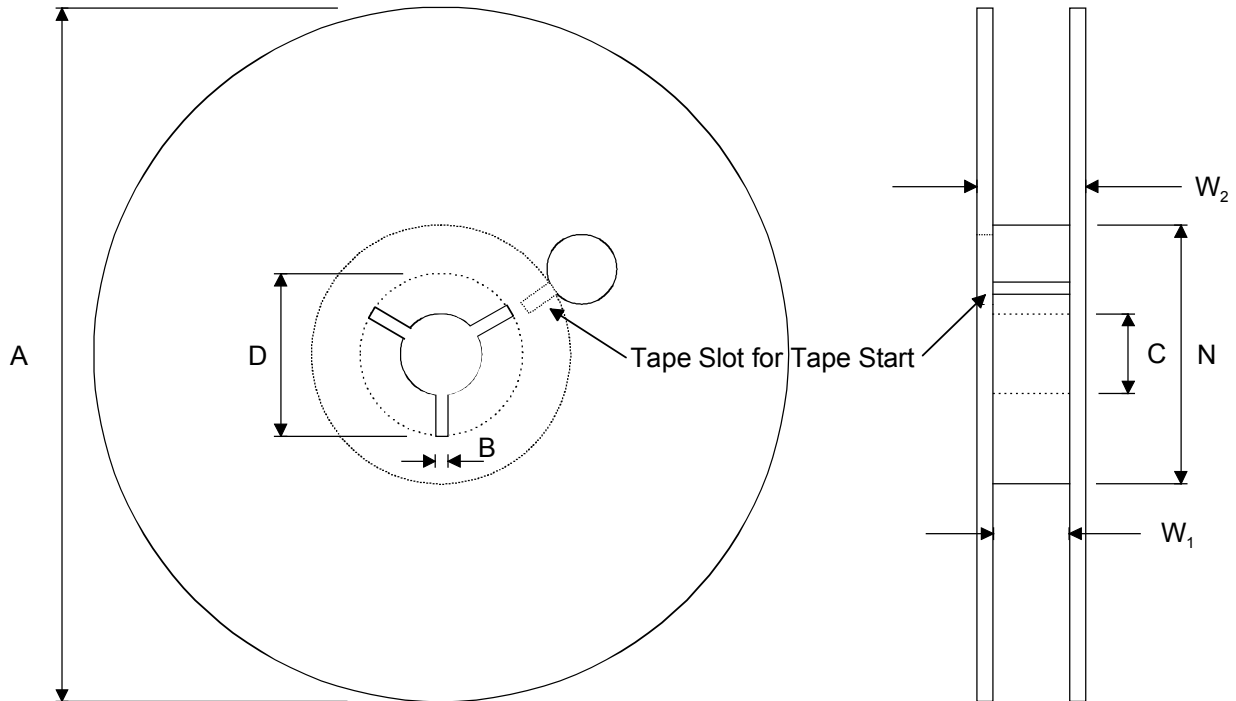
**SOLDERING INFORMATION**

Resistance to Soldering Heat	According to RSH test IEC 68-2-58/20 2*220°C
Maximum Temperature	240°C
Maximum Number of Reflow Cycles	2
Reflow profile	Thermal profile parameters stated in JESD22-A113 should not be exceeded. <a href="http://www.jedec.org">http://www.jedec.org</a>
Seating Plane Co-planarity	max 0.08 mm
Lead Finish	Solder plate 7.62 - 25.4 $\mu\text{m}$ , material Sn 85% Pb 15%

**EMBOSED TAPE SPECIFICATIONS**


Dimension	Min	Max	Unit
A <sub>0</sub>	6.50	6.70	mm
B <sub>0</sub>	5.20	5.40	mm
D <sub>0</sub>	1.50 +0.10 / -0.00		mm
D <sub>1</sub>	1.50		mm
E <sub>1</sub>	1.65	1.85	mm
F <sub>1</sub>	7.20	7.30	mm
K <sub>0</sub>	1.20	1.40	mm
P	11.90	12.10	mm
P <sub>0</sub>	4.0		mm
P <sub>2</sub>	1.95	2.05	mm
S <sub>1</sub>	0.6		mm
T	0.25	0.35	mm
W	11.70	12.30	mm

## REEL SPECIFICATIONS

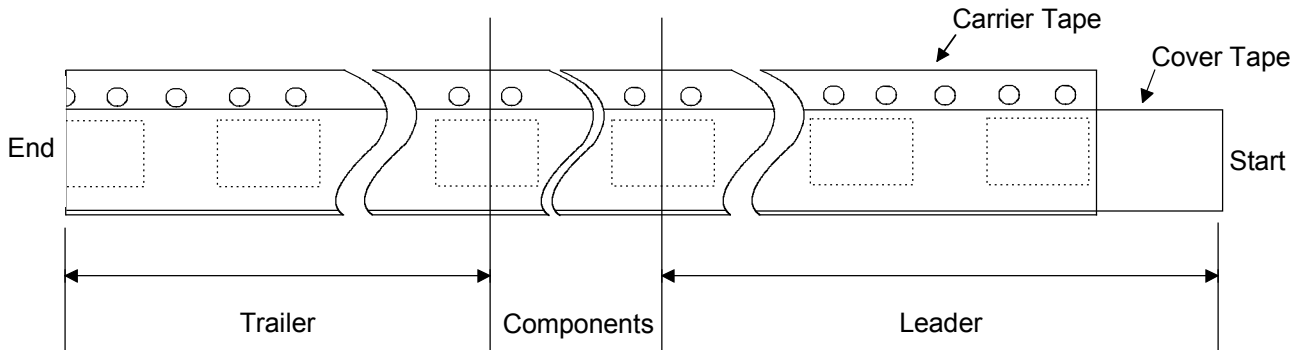


2000 Components on Each Reel

Reel Material: Conductive, Plastic Antistatic or Static Dissipative

Carrier Tape Material: Conductive

Cover Tape Material: Static Dissipative



Dimension	Min	Max	Unit
A		330	mm
B	1.5		mm
C	12.80	13.50	mm
D	20.2		mm
N	50		mm
$W_1$ (measured at hub)	12.4	14.4	mm
$W_2$ (measured at hub)		18.4	mm
Trailer	160		mm
Leader	390, of which minimum 160mm of empty carrier tape sealed with cover tape		mm
Weight		1500	g



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## ORDERING INFORMATION

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Product Code	Product	Package	Comments
MAS9186AUA1	8 x 8-bit D to A Converter	TSSOP-16	0 V Reference Level
MAS9186AUA2	8 x 8-bit D to A Converter	TSSOP-16	Scalable Reference Level

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## LOCAL DISTRIBUTOR

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## MICRO ANALOG SYSTEMS OY CONTACTS

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