MAS9283

IC FOR 10.00 – 56.00 MHz VCXO

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

- **Low Power**
- **Wide Supply Range**
- **CMOS (Square Wave) Output**
- **Very Low Phase Noise**
- **Low Cost**
- **Divider Function**

DESCRIPTION

MAS9283 is an integrated circuit well suited to build a VCXO for telecommunication and other applications. To build a VCXO only one additional component, a crystal, is needed.

FEATURES

- Very small size
- Minimal current consumption
- Wide operating temperature range
- Phase noise < -130 dBc/Hz at 1 kHz offset
- CMOS (Square wave) output

APPLICATIONS

- VCXO for telecommunications systems
- VCXO for set-top boxes
- VCXO for MPEG

BLOCK DIAGRAM

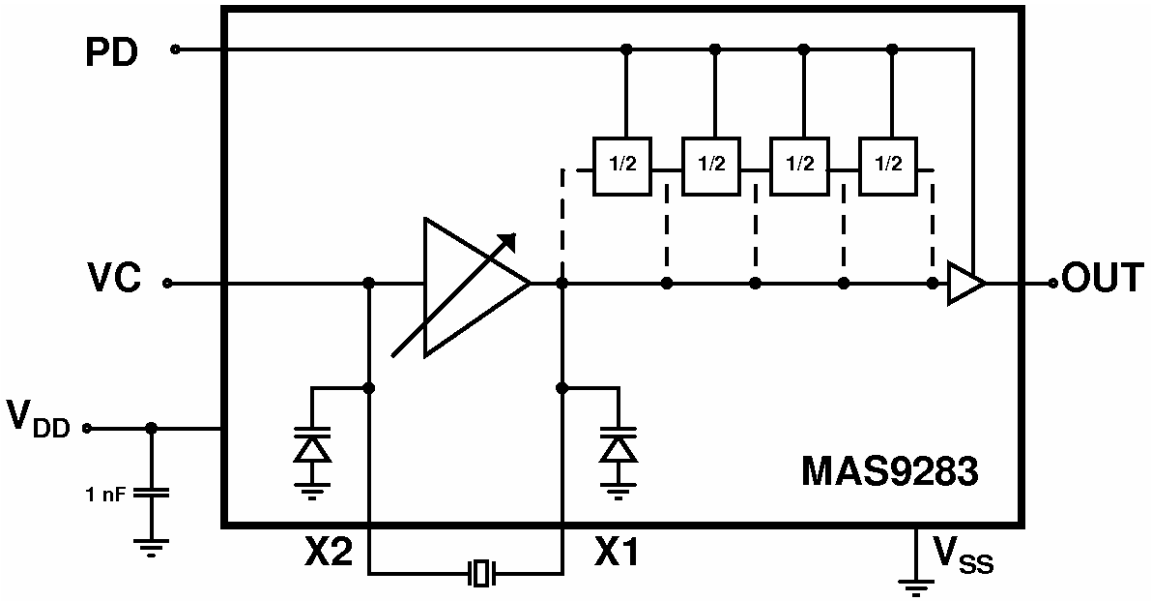


Figure 1. Block diagram of MAS9283.

PIN DESCRIPTION

Pin Description	Symbol	x-coordinate	y-coordinate
Crystal Oscillator Output	X2	186	142
Voltage Control Input	VC	372	142
Power Supply Ground	V_{SS}	543	142
Crystal/Varactor Oscillator Input	X1	149	920
Output Buffer Power Down Control	PD	330	920
Power Supply Voltage	V_{DD}	500	920
Buffer Output	OUT	919	920

Note: Because the substrate of the die is internally connected to GND, the die has to be connected to GND or left floating. Please make sure that GND is the first pad to be bonded. Pick-and-place and all component assembly are recommended to be performed in ESD protected area.
Note: Pad coordinates are measured from the left bottom corner of the chip to the center of the pads. The coordinates may vary depending on sawing width and location. However, the distances between pads are accurate.

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Min	Max	Unit	Note
Supply Voltage	V_{DD} - V_{SS}		-0.3	5.5	V	
Input Pin Voltage			V_{SS} -0.3	V_{DD} + 0.3	V	
Power Dissipation (max)	P_{MAX}			100	mW	
Storage Temperature	T_{ST}		-55	150	°C	
ESD Rating		HBM		2	kV	

RECOMMENDED OPERATION CONDITIONS

Parameter	Symbol	Conditions	Min	Typ	Max	Unit	Note
Supply Voltage	V_{DD}	For 3.3 V / 5.0 V versions For 3.3 V versions	2.5 2.5	3.3 3.3	5.3 4.0	V	1) 1, 2)
Supply Current	I_{DD}	V_{DD} = 2.8 V		3.2		mA	3)
Operating Temperature	T_{OP}		-40		+85	°C	
Voltage Control Line Impedance	$Z_{VC,LINE}$			1		MΩ	
Crystal Pulling Sensitivity	S			30		ppm/pF	
Crystal Load Capacitance	C_L	V_C = 1.65 V		10		pF	4)

Note 1: It is recommended to connect a 1 nF capacitor between the V_{DD} and V_{SS} pins.
Note 2: For 3.3 V versions MAS9283AA-AE, MAS9283AN-AR.
Note 3: Value at 15MHz. At 40MHz I_{DD} is typically 5.8 mA.
Note 4: MAS9283AG – AL has a typical crystal load capacitance of 8.5 pF when V_C = 2.5 V. MAS9283AT – AX has a typical crystal load capacitance of 9 pF when V_C = 2.5 V.

ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Min	Typ	Max	Unit	Note
Crystal Frequency Range	f_o	10.00		56	MHz	1)
Voltage Control Range	V_C	0		V_{DD}	V	
Voltage Control Sensitivity MAS9283AN – AR	V_{CSENS}		90		ppm/V	2)
Voltage Control impedance	Z_{VC}		1.3		MΩ	
Output Current (V_{DD} = 3 V) MAS9283 (R_L=10kΩ) MAS9283 (R_L=1 kΩ) MAS9283 (R_L=250Ω) MAS9283 (R_L=50Ω)	I_{OUT}		 0.3 3.2 12.1 42.6		mA	
Output Current (V_{DD} = 5 V) MAS9283 (R_L=10kΩ) MAS9283 (R_L=1 kΩ) MAS9283 (R_L=250Ω) MAS9283 (R_L=50Ω)	I_{OUT}		 0.5 4.9 18.7 42.6		mA	
Rise and Fall Time (10 - 50 pF)				10	ns	
Output Symmetry		45	48-52	55	%	
Startup Time	T_{START}		2		ms	
Output Buffer Enabled Disabled		 1.6 0		 V_{DD} 0.55	V	3)

Note 1: An R_S < 15 Ω crystal provides 56 MHz maximum frequency (i.e. negative resistance typically 30 Ω). With an R_S = 70 Ω crystal the maximum frequency is typically 40 MHz (i.e. negative resistance typically 110 Ω).
Note 2: VC sensitivity value depends on the crystal used. With a 30 ppm/pF crystal typical values are MAS9283AN – AR > 90 ppm/V, MAS9283AA – AE > 75 ppm/V, MAS9283AG – AL > 60 ppm/V, MAS9283AT – AX > 50 ppm/V.
Note 3: If the PD pin is floating the output buffer is active. Oscillator is always running.

IC OUTLINES

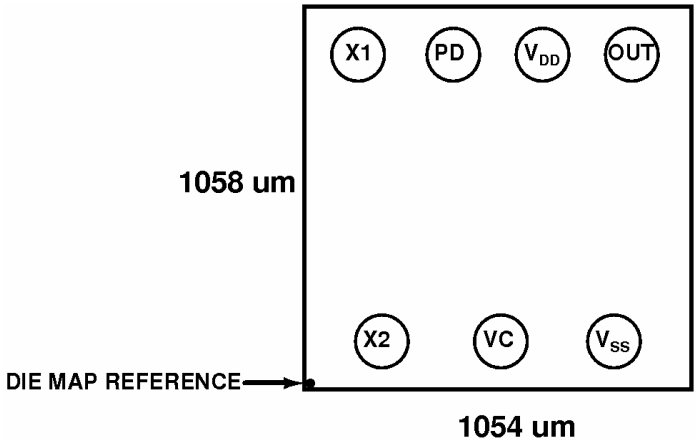


Figure 2. IC outline of MAS9283.

Note 1: MAS9283 pads are round with 80 µm diameter at opening.
Note 2: Die map reference is the actual left bottom corner of the sawn chip.

EXTERNAL COMPONENT SELECTION

MAS9283 requires a minimum number of external components for proper operation.

Quartz Crystal

The MAS9283 VCXO function consists of the external crystal and the integrated VCXO oscillator circuit. To assure the best system performance (frequency pull range) and reliability, a crystal device with the recommended parameters (shown below) must be used, and the layout guidelines in the following section must be followed. The frequency of the oscillation of a quartz crystal is determined by its "cut" and by the load capacitors connected to it. MAS9283 incorporates on-chip variable load capacitors that "pull" (change) the frequency of the crystal. The crystal specified for use with the MAS9283 is designed to have zero frequency error when the total of on-chip + stray capacitance is 10 pF. See Note 3 on page 2 for other capacitance options.

The external crystal must be connected as close to the chip as possible and should be on the same side of the PCB as the MAS9283. There should be no vias between the crystal pins and the X1 and X2 device pins. There should be no signal traces underneath or close to the crystal.

Recommended Crystal Parameters:

Parameter	Symbol	Typ	Unit	Note
Initial Accuracy at 25°C		±20	ppm	
Temperature Stability		±30	ppm	
Crystal Load Capacitance	C_L	10	pF	1)
Crystal Shunt Capacitance (Typical)	C0	2	pF	
C0/C1 Ratio (Typical)		≤ 300		

Note 1. If the crystal with a load other than 10 pF is used with MAS9283, the crystal has to have frequency offset in order to have the nominal frequency at VC = 1.65 V. Please see table below for offset frequencies vs. crystal load. (Values are for a typical crystal with S = 30 ppm/pF.)

Parameter					Unit
Crystal frequency	27	27	27	27	MHz
Crystal load	8	9	12.5	15	pF
Offset / ppm (MAS9283AA – AE, AN – AR, VC=1.65 V)	+30	0	-105	-180	
Offset / ppm (MAS9283AG – AR, VC= 2.5V)	0	-30	-135	-210	

For example:
When the desired nominal frequency of the application and the crystal load are 27.00 MHz and 12.5 pF, the crystal nominal frequency has to be,

$$27.00\ \ MHz + \left[\left(\frac{27.00\ \ MHz}{10^6}\right)\times(-105)\right] = 26.997165\ \ MHz\,.$$

VOLTAGE CONTROL SENSITIVITY

MAS9283AA, MAS9283AG and MAS9283AN Voltage control sensitivity graphs have been measured by using 26.996220MHz crystal (CL 14.6pF, C1 17.0fF, C0 3.9pF). For offset see note 1 page 4.

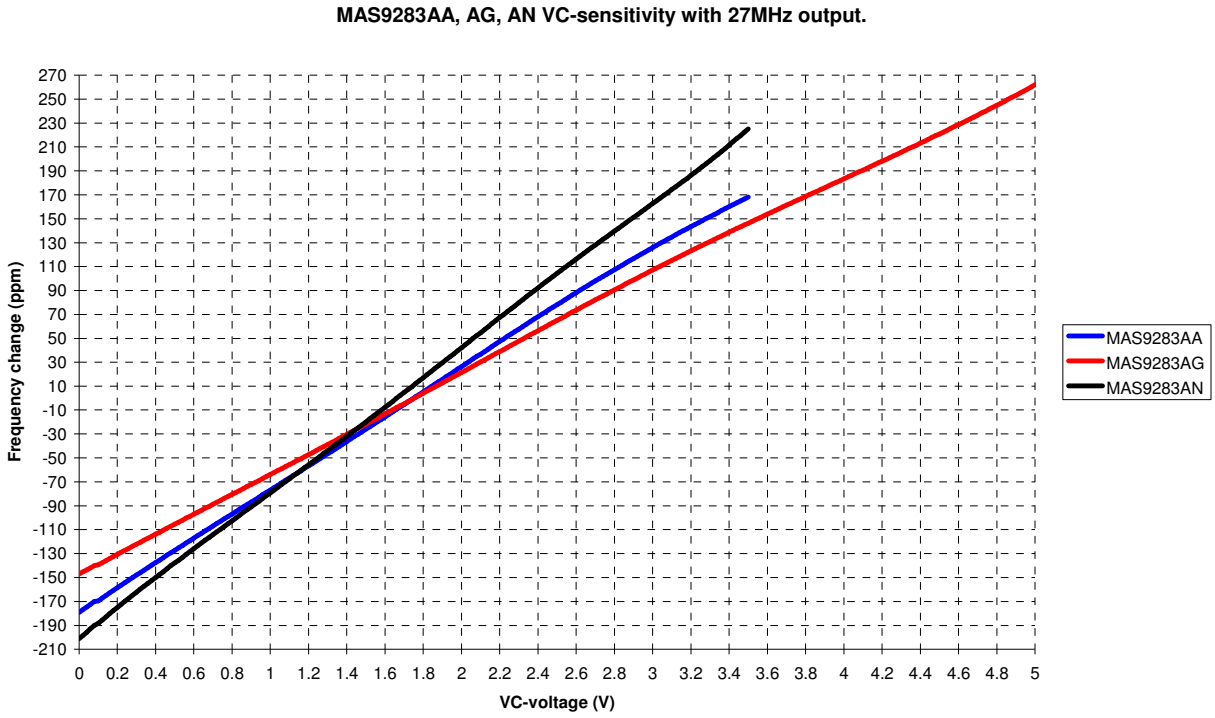


Figure 3. Control voltage sensitivity of MAS9283.

MODULATION RESPONSE

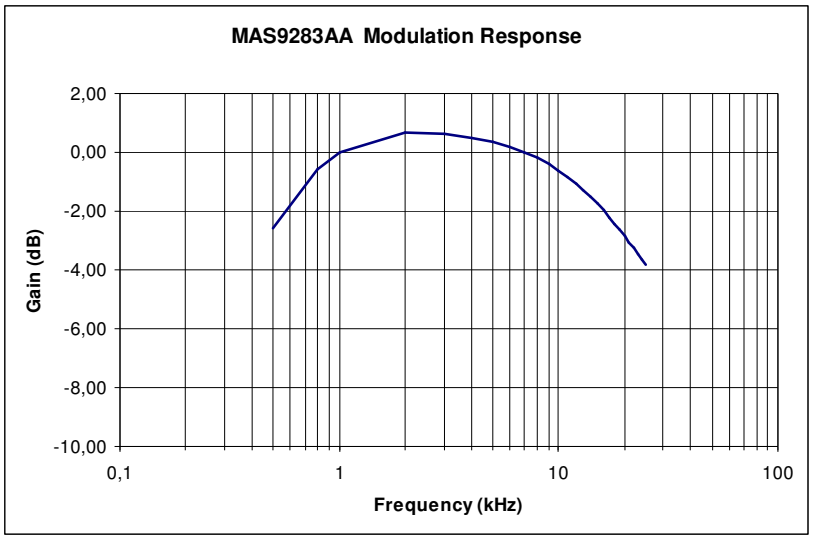


Figure 4. Modulation response of MAS9293.

3dB point is typically at 20.4 kHz. Measurement has been done using typical modulation connection described below.

MODULATION MEASUREMENT

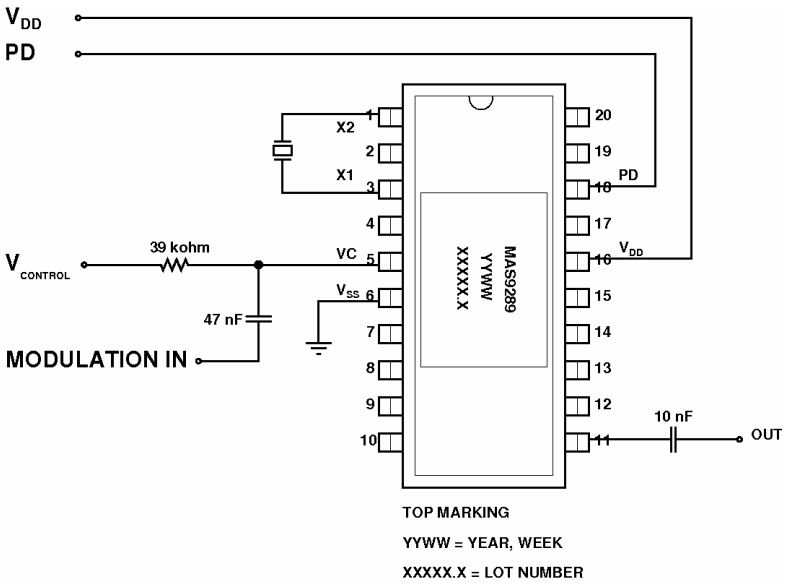
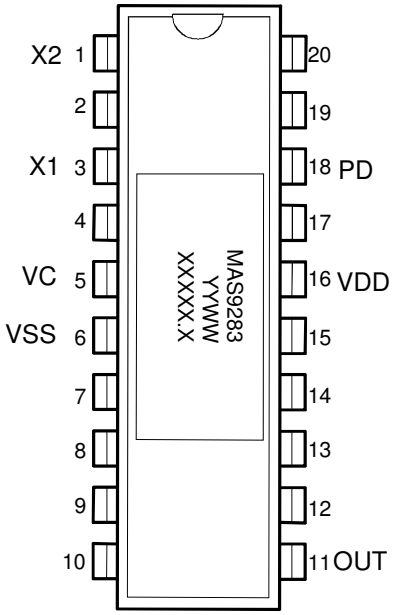


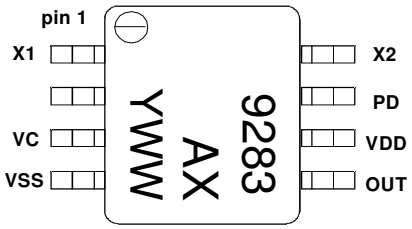
Figure 5. Modulation response measurement setup.

SAMPLES IN SB20 DIL PACKAGE



Top marking:
YYWW = Year, Week
XXXXX.X = Lot number

DEVICE OUTLINE CONFIGURATION

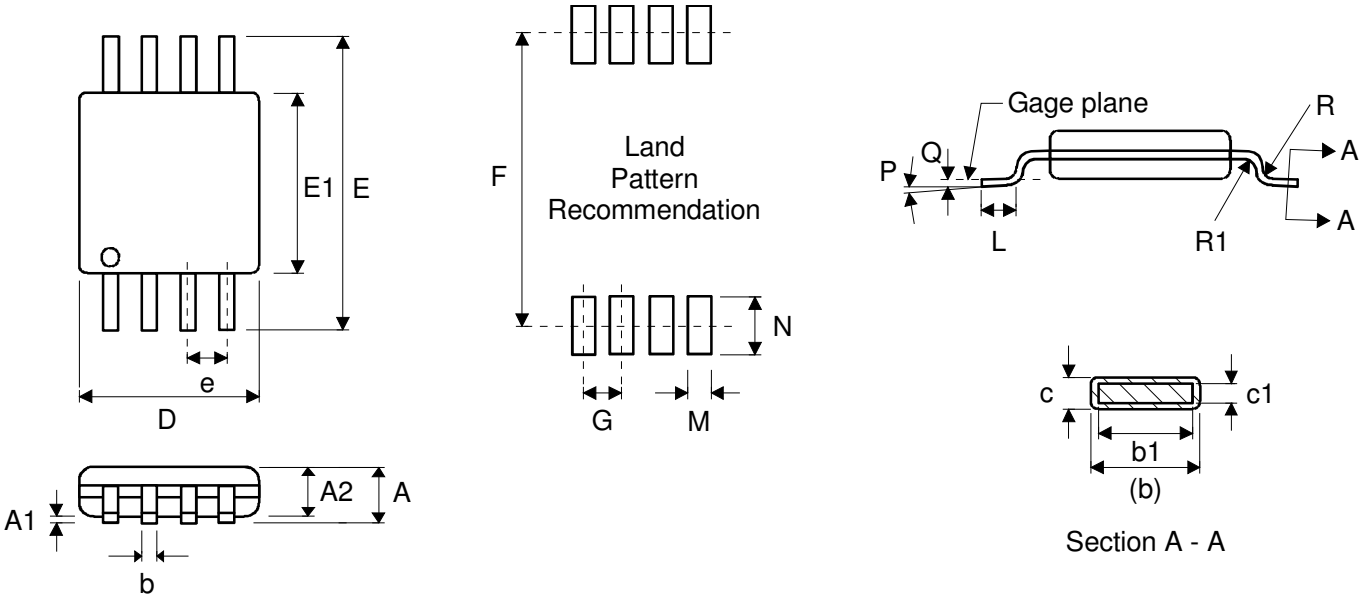


Top View

A = product version
X = MAS internal code
Y = year
WW= week

MSOP8/TSSOP8

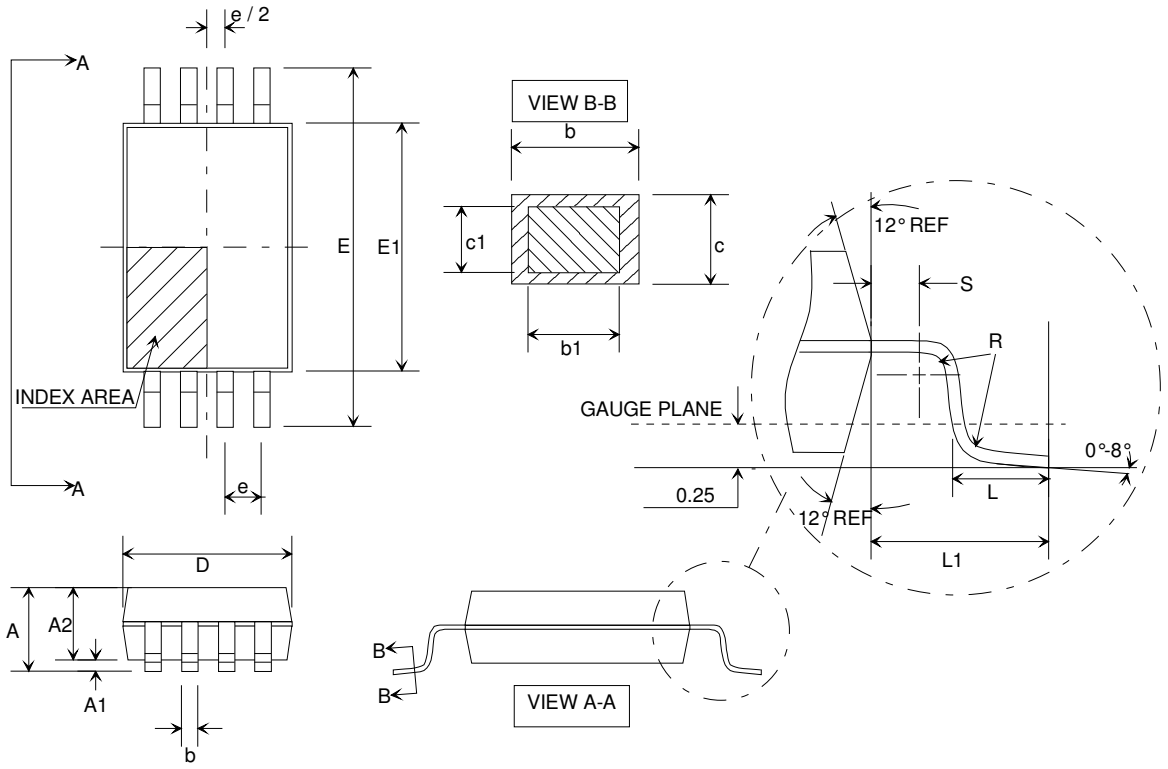
PACKAGE (MSOP-8) OUTLINE



Symbol	Min	Nom	Max	Unit
A			1.10	mm
A1	0		0.15	mm
A2	0.75	0.85	0.95	mm
b	0.22		0.38	mm
b1	0.22	0.30	0.33	mm
c	0.08		0.23	mm
c1	0.08		0.18	mm
D		3.00 BSC		mm
E		4.90 BSC		mm
E1		3.00 BSC		mm
e		0.65 BSC		mm
F		4.8		mm
G		0.65		mm
L (Terminal length for soldering)	0.40	0.60	0.80	mm
M		0.41		mm
N		1.02		mm
P	0°		8°	
Q		0.25 BSC		mm
R	0.07			mm
R1	0.07			mm

Dimensions do not include mold or interlead flash, protrusions or gate burrs.
All measurement according to JEDEC standard MO-187.

PACKAGE (TSSOP-8) OUTLINE



MS/ 21.11.2001

Symbol	Min	Nom	Max	Unit
A	--	--	1.10	mm
A1	0.05	--	0.15	mm
A2	0.85	0.90	0.95	mm
b	0.19	--	0.30	mm
b1	0.19	0.22	0.25	mm
c	0.09	--	0.20	mm
c1	0.09	--	0.16	mm
D	2.90	3.00	3.10	mm
E		6.4 BSC		mm
E1	4.30	4.40	4.50	mm
e		0.65 BSC		mm
L	0.50	0.60	0.75	mm
L1		1.00 REF		
R	0.09	--	--	mm
S	--	0.20	--	mm

Dimensions do not include mold or interlead flash, protrusions or gate burrs.
Reference Standard : JEDEC MO-153.

SOLDERING INFORMATION

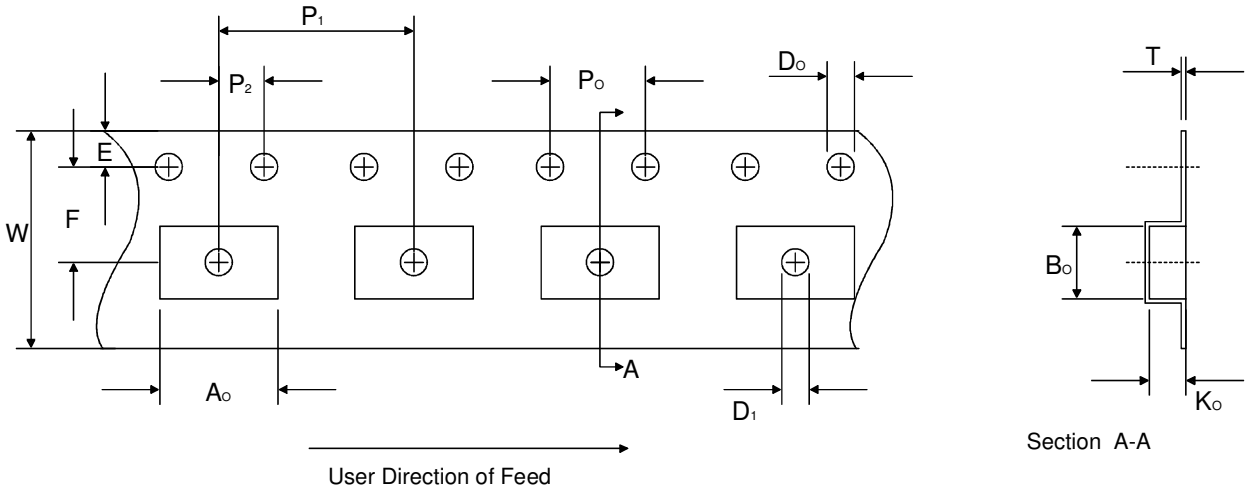
◆ **For Eutectic Sn/Pb**

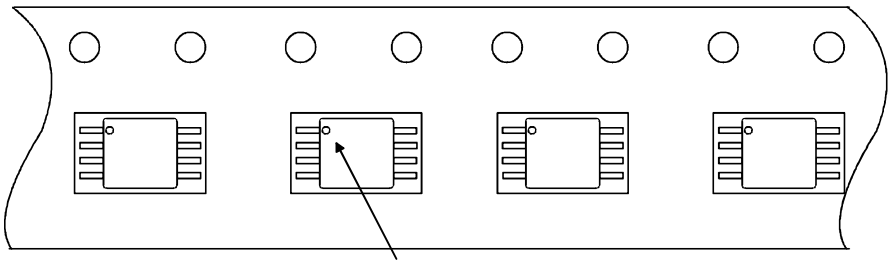
Maximum Reflow Temperature	240°C
Maximum Number of Reflow Cycles	2
Reflow profile	Thermal profile parameters stated in JESD22-A113 should not be exceeded. http://www.jedec.org
Seating Plane Co-planarity	max 0.08 mm
Lead Finish	Solder plate 7.62 - 25.4 µm, material Sn 85% Pb 15%
Moisture Sensitivity Level (MSL)	1

◆ **For Pb-Free**

Maximum Temperature	260°C
Maximum Number of Reflow Cycles	3
Reflow profile	Thermal profile parameters stated in JESD22-A113 should not be exceeded. http://www.jedec.org
Seating Plane Co-planarity	max 0.08 mm
Lead Finish	Solder plate 7.62 - 25.4 µm, material Matte Tin
Moisture Sensitivity Level (MSL)	1

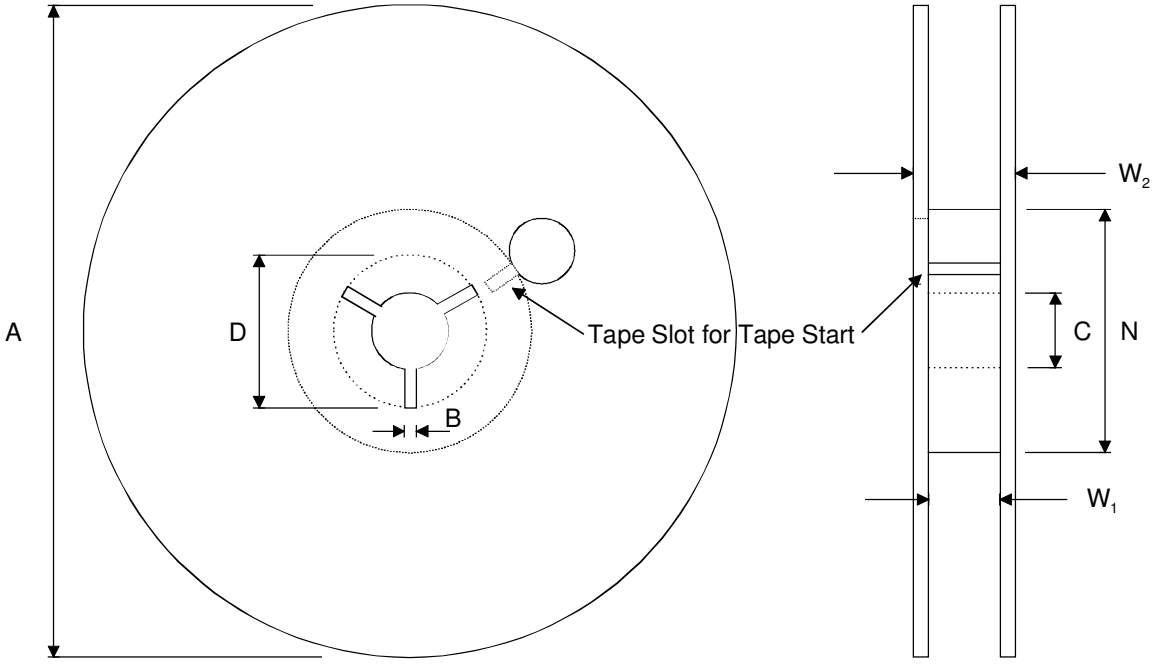
EMBOSSED TAPE SPECIFICATIONS (MSOP-8)





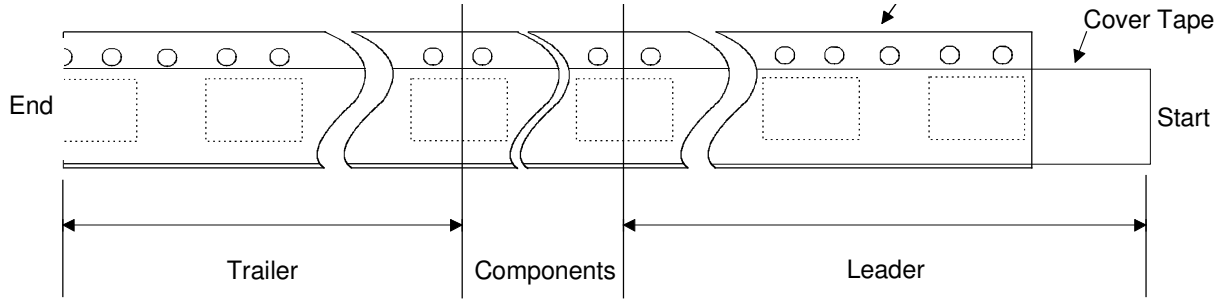
Dimension	Min/Max	Unit
Ao	5.00 ±0.10	mm
Bo	3.20 ±0.10	mm
Do	1.50 +0.1/-0.0	mm
D1	1.50 min	mm
E	1.75	mm
F	5.50 ±0.05	mm
Ko	1.45 ±0.10	mm
Po	4.0	mm
P1	8.0 ±0.10	mm
P2	2.0 ±0.05	mm
T	0.3 ±0.05	mm
W	12.00 +0.30/-0.10	mm

REEL SPECIFICATIONS (MSOP-8)



5000 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 160 mm of empty carrier tape sealed with cover tape		mm
Weight		1500	g

ORDERING INFORMATION

Product Code	Recommended Supply Voltage	Output Frequency	Pulling range 0 V < V_C < 3.3 V	Package
MAS9283AATG00	IC FOR 3.3 V VCXO	f_o	> 250 ppm	EWS tested wafers 215 µm
MAS9283AASM06	IC FOR 3.3 V VCXO	f_o	> 250 ppm	MSOP-8, T&R/5000 pcs/r.
MAS9283AASN06	IC FOR 3.3 V VCXO	f_o	> 250 ppm	MSOP-8, T&R/5000 pcs/r. Pb free RoHS
MAS9283ABTG00	IC FOR 3.3 V VCXO	$f_o/2$	> 250 ppm	EWS tested wafers 215 µm
MAS9283ACTG00	IC FOR 3.3 V VCXO	$f_o/4$	> 250 ppm	EWS tested wafers 215 µm
MAS9283ADTG00	IC FOR 3.3 V VCXO	$f_o/8$	> 250 ppm	EWS tested wafers 215 µm
MAS9283AETG00	IC FOR 3.3 V VCXO	$f_o/16$	> 250 ppm	EWS tested wafers 215 µm
MAS9283AGTG00	IC FOR 3.3 / 5.0 V VCXO	f_o	> 200 ppm	EWS tested wafers 215 µm
MAS9283AGSM06	IC FOR 3.3 / 5.0 V VCXO	f_o	> 200 ppm	MSOP-8, T&R/5000 pcs/r.
MAS9283AGSN06	IC FOR 3.3 / 5.0 V VCXO	f_o	> 200 ppm	MSOP-8, T&R/5000 pcs/r. Pb free RoHS
MAS9283AHTG00	IC FOR 3.3 / 5.0 V VCXO	$f_o/2$	> 200 ppm	EWS tested wafers 215 µm
MAS9283AJTG00	IC FOR 3.3 / 5.0 V VCXO	$f_o/4$	> 200 ppm	EWS tested wafers 215 µm
MAS9283AKTG00	IC FOR 3.3 / 5.0 V VCXO	$f_o/8$	> 200 ppm	EWS tested wafers 215 µm
MAS9283ALTG00	IC FOR 3.3 / 5.0 V VCXO	$f_o/16$	> 200 ppm	EWS tested wafers 215 µm
MAS9283ANTG00	IC FOR 3.3 V VCXO	f_o	> 300 ppm	EWS tested wafers 215 µm
MAS9283ANSN06	IC FOR 3.3 V VCXO	f_o	> 300 ppm	MSOP-8, T&R/5000 pcs/r. Pb free, RoHS
MAS9283APTG00	IC FOR 3.3 V VCXO	$f_o/2$	> 300 ppm	EWS tested wafers 215 µm
MAS9283AQTG00	IC FOR 3.3 V VCXO	$f_o/4$	> 300 ppm	EWS tested wafers 215 µm
MAS9283ARTG00	IC FOR 3.3 V VCXO	$f_o/8$	> 300 ppm	EWS tested wafers 215 µm
MAS9283ATTG00	IC FOR 3.3 / 5.0 V VCXO	f_o	> 165 ppm	EWS tested wafers 215 µm
MAS9283AUTG00	IC FOR 3.3 / 5.0 V VCXO	$f_o/2$	> 165 ppm	EWS tested wafers 215 µm
MAS9283AVTG00	IC FOR 3.3 / 5.0 V VCXO	$f_o/4$	> 165 ppm	EWS tested wafers 215 µm
MAS9283AWTG00	IC FOR 3.3 / 5.0 V VCXO	$f_o/8$	> 165 ppm	EWS tested wafers 215 µm
MAS9283AXTG00	IC FOR 3.3 / 5.0 V VCXO	$f_o/16$	> 165 ppm	EWS tested wafers 215 µm

Contact Micro Analog Systems Oy for other wafer thickness, Power Down logic options and versions in MSOP8 and TSSOP8 packages.

Note 1: Typical Vc Sensitivity values with a 30 ppm/pF crystal.
Note 2: In Recommended Supply Voltage column voltage version is maximum optimized Voltage Control (V_C) value.

LOCAL DISTRIBUTOR

MICRO ANALOG SYSTEMS OY CONTACTS

Micro Analog Systems Oy Kamreerintie 2, P.O. Box 51 FIN-02771 Espoo, FINLAND	Tel. +358 9 80 521 Fax +358 9 805 3213 http://www.mas-oy.com

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