

15 Hz to 64 kHz All Silicon Sine Source Data Sheet

Description

The MSLOSC integrated circuit provides a programmable frequency low distortion (0.1%) sine wave output. The level is digitally programmable from 0 dB to -63 dB. Using switched-capacitor filters and dividers the frequency can be controlled from 15 Hz to 64 kHz with no external capacitors. The device can operate from 3.30V up to 5.5 VDC. The frequency accuracy of the MSLOSC is less than 0.01%. Temperature stability is better than discrete solutions using resistors, capacitors and op amps.

A 4 bit DAC is filtered with a programmable switched-capacitor filter followed by a continuous time programmable lowpass filter to reduce distortion to 0.1% (-60 dB) A synchronous serial input sets the desired frequency and level.

The MSLOSC is available in a 8 pin 0.15" SOIC.

Features

- Up to 64 kHz operation
- Provides Low Distortion Sinewave Output
- Programmable level control down to -63 dB

Applications

- LO for Communication Modulation or Demodulation
- Differential Clock for Data Acquisition
- Programmable Sine Source
- Portable Test Equipment

Absolute Maximum Ratings

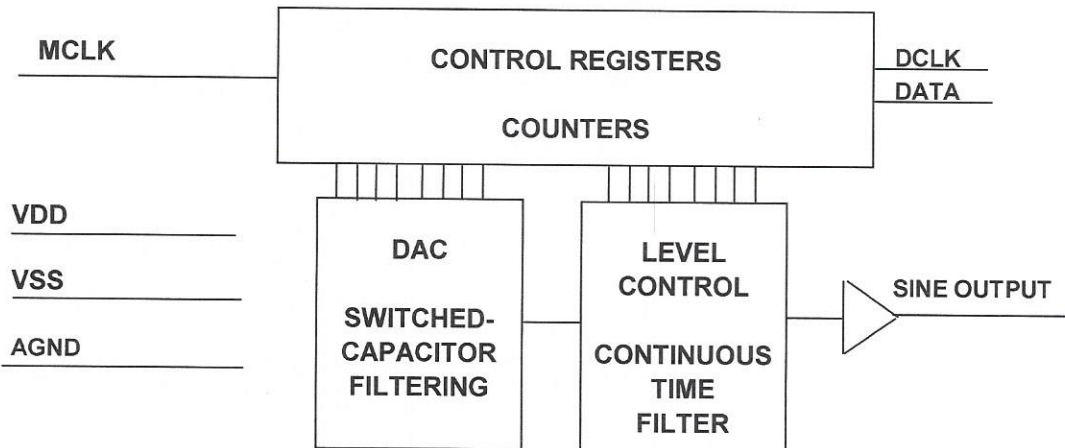
Power Supply Voltage	+6V
Storage Temperature Range	-60 to +150° C
Operating Temperature Range	-40 to +85° C

Ordering Information

MSLOSCN

150 mils wide 8 pin SOIC

MSLOSC



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Electrical Characteristics

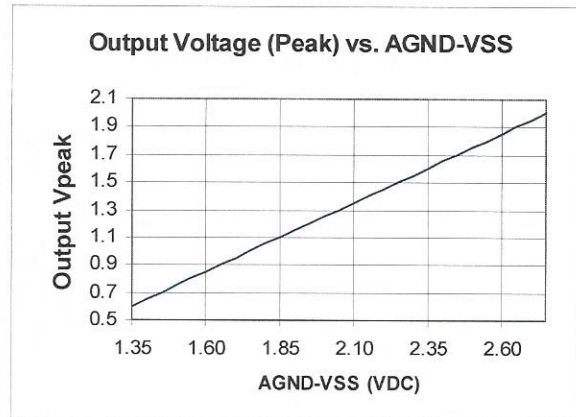
(VDD = 5.0V, T = 25°C fclock=16.384 MHz R_L=5kΩ)

MS1050SC

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC Specifications						
Operating Voltage	VDD		3.3		5.5	V
Supply Current	IDD			2	3	mA
Digital Input Logic 0			0.0	0.5	1	VDC
Digital Input Logic 1			VDD-1	VDD-0.5		VDC
AC Specifications						
Output Level	V _{OUT}	Gain Adjust =0x00 fo=1kHz		2.83		V _{pp}
Coarse Atten. Step Size			7.5	8	8.5	dB
Fine Attenuator Step Size			0.25	0.5	0.75	dB
Total Harmonic Distortion	THD	A weighted 1 kHz		0.1		%
Frequency Accuracy		fo=1kHz		0.01		%
Frequency Range			0.015		64	kHz
Amplitude/Frequency Settling Time		fo=1kHz		15		ms

The formula for calculating the output frequency is given by the equation below, where Do-7 is the decimal equivalent of the setting of bits D0-7 in the frequency range setting and the MCLK DIVIDER range 2⁰⁻¹¹ is controlled by bits D8-D19. Only one bit is set for a given frequency setting for MCLK DIVIDER.

$$f_o = \frac{\text{MCLK}}{9 \cdot 2 \cdot 2^{(0-11)}} \cdot \left(\frac{512}{257 + [D0-7]} \right)$$



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Data Sheet

Pin Descriptions

1	DCLK	the data clock
2	EN	the enable function, voltage HI is enabled
3	AGND	this supply is midpoint between VDD and VSS, typically +2.5 V
4	OUT	the sinewave output
5	VSS	the most negative supply voltage, typically 0V
6	MCLK	the masterclock input
7	DATA	the data input
8	VDD	the most positive supply voltage, typically +5V

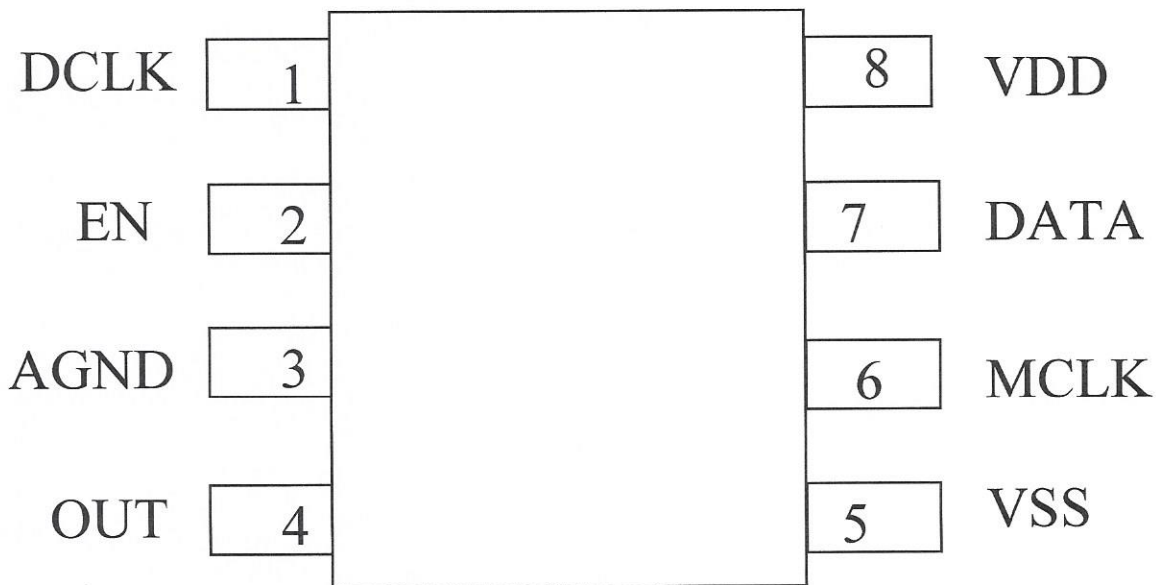


Figure 1: Pin Out

15 Hz to 64 kHz All Silicon Sine Source Data Sheet

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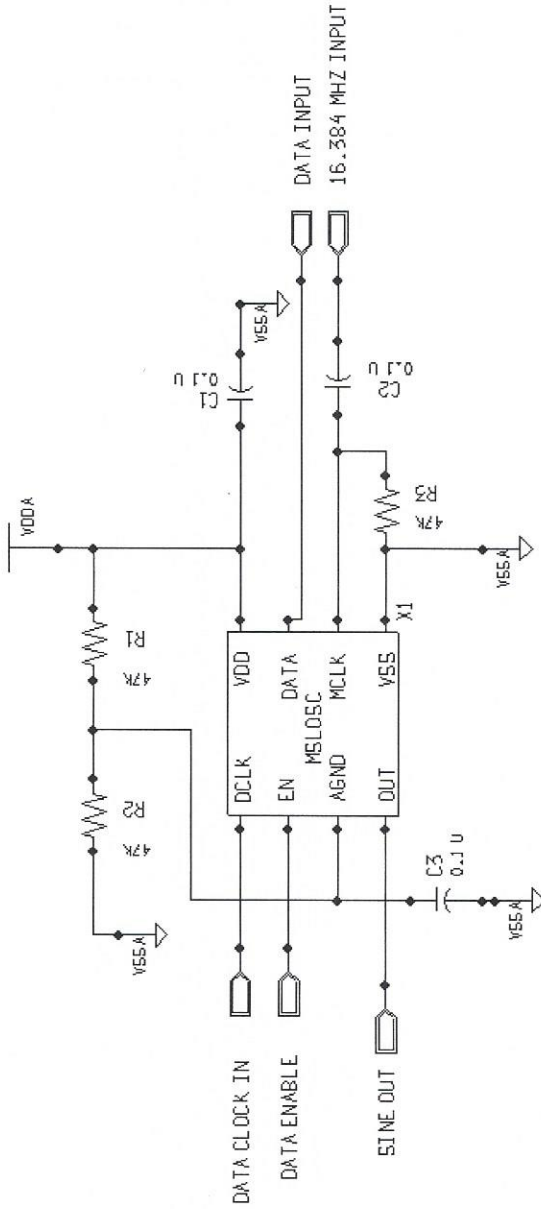


Figure 2: Typical Application Schematic

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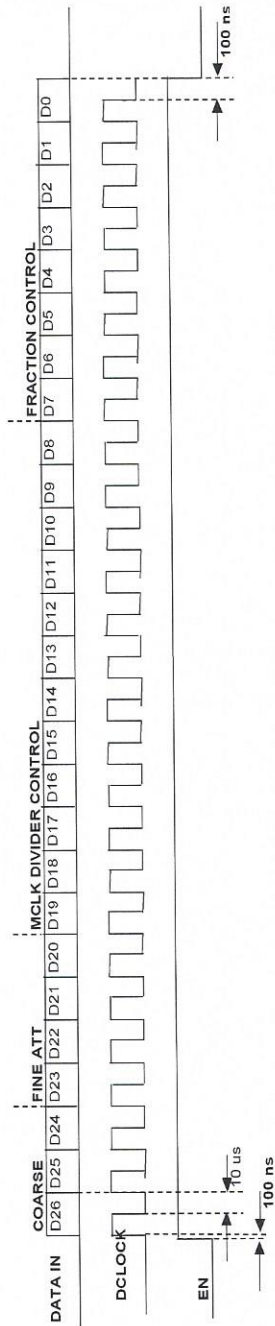


Figure 3: MSLOSC Timing Diagram

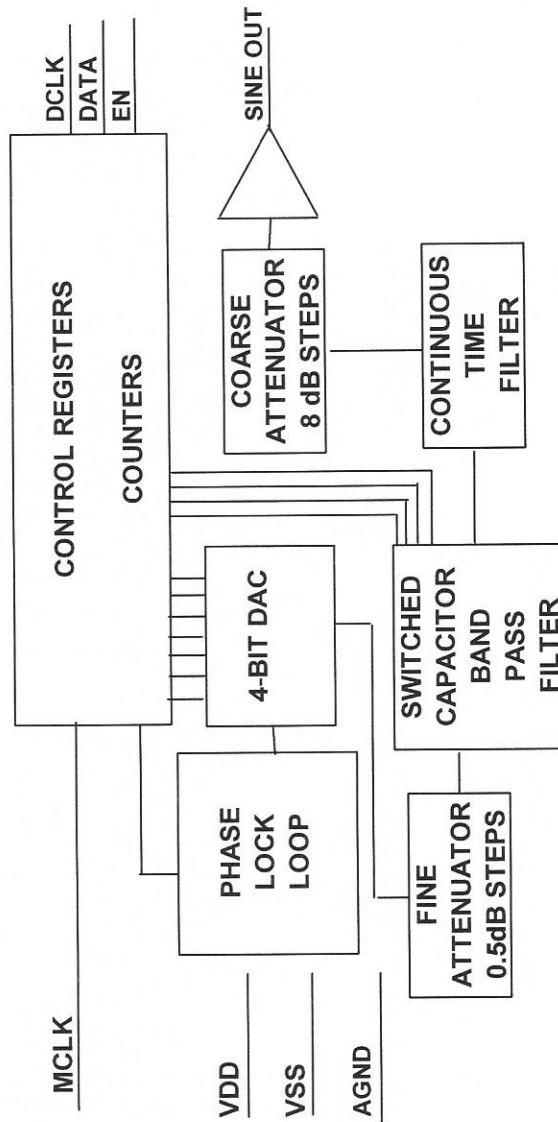


Figure 4: MSLOSC Detailed Block Diagram

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15 Hz to 64 kHz All Silicon Sine Source Data Sheet

<i>MCLK Divider Control</i>																					
	D19	D18	D17	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	Fo (Hz)
	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	15.63
	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31.13
	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	31.25
	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62.26
	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	62.50
	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	124.51
	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	125.00
	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	249.03
	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	250.49
	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	498.05
	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	500.00
	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	996.11
	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	1	1	1	1	1	1000.00
	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1992.22
	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1	1	1	1	1	2000.00
	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3984.44
	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	1	4000.00
	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	7968.87
	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1	1	1	8000.00
	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	15937.74
	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	16000.00
	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	31875.49
	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	32000.00
	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	63750.97

<i>Fractional Frequency Control</i>																			
	D7	D6	D5	D4	D3	D2	D1	D0	FACTOR	D7	D6	D5	D4	D3	D2	D1	D0	FACTOR	
	1	1	1	1	1	1	1	0	1.0020	0	0	1	1	0	0	0	0	1.6787	
	1	1	1	1	1	1	0	0	1.0059	0	0	1	0	0	0	0	0	1.7716	
	1	1	1	1	1	0	0	0	1.0139	0	0	0	1	1	1	1	1	1.7778	
	1	1	1	1	0	0	0	0	1.0302	0	0	0	1	1	1	1	0	1.7840	
	1	1	1	0	0	0	0	0	1.0644	0	0	0	1	1	1	0	0	1.7965	
	1	1	0	0	0	0	0	0	1.1403	0	0	0	1	1	0	0	0	1.8221	
	1	0	0	0	0	0	0	0	1.3299	0	0	0	1	0	0	0	0	1.8755	
	0	1	1	1	1	1	1	1	1.3333	0	0	0	0	1	1	1	1	1.8824	
	0	1	1	1	1	1	1	0	1.3368	0	0	0	0	1	1	1	0	1.8893	
	0	1	1	1	1	1	0	0	1.3438	0	0	0	0	1	1	0	0	1.9033	
	0	1	1	1	1	0	0	0	1.3581	0	0	0	0	1	0	0	0	1.9321	
	0	1	1	1	0	0	0	0	1.3875	0	0	0	0	0	1	1	1	1.9394	
	0	1	1	0	0	0	0	0	1.4504	0	0	0	0	0	1	1	0	1.9468	
	0	1	0	0	0	0	0	0	1.5950	0	0	0	0	0	1	0	1	1.9542	
	0	0	1	1	1	1	1	1	1.6000	0	0	0	0	0	1	0	0	1.9617	
	0	0	1	1	1	1	1	0	1.6050	0	0	0	0	0	0	1	1	1.9692	
	0	0	1	1	1	1	0	0	1.6151	0	0	0	0	0	0	1	0	1.9768	
	0	0	1	1	1	0	0	0	1.6358	0	0	0	0	0	0	0	1	1.9845	

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Bitmap for Commonly Used Frequencies

	D19	D18	D17	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	F ₀ (Hz)
	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	15.63
	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	1	1	16.00
	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	20.00
	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	25.00
	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	1	1	32.00
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	50.00
	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	1	64.00
	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	100.00
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	149.88
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	200.00
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	250.00
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	320.00
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	500.00
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	640.00
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1000.00
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1501.47
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2000.00
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2497.56
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3200.00
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4995.12
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6400.00
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9990.24
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15003.66
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19980.49
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24975.61
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32000.00
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49951.22
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	63750.97

MSOSC

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MSLOSC

Bitmap for Coarse/Fine Attenuator Control (Bits D26-D20)

D26	D25	D24	D23	D22	D21	D20	ATTEN	D26	D25	D24	D23	D22	D21	D20	ATTEN
0	0	0	0	0	0	0	0.00	0	1	0	1	0	0	1	-20.50
0	0	0	0	0	0	1	-0.50	0	1	0	1	0	1	0	-21.00
0	0	0	0	0	1	0	-1.00	0	1	0	1	0	1	1	-21.50
0	0	0	0	0	1	1	-1.50	0	1	0	1	1	0	0	-22.00
0	0	0	0	1	0	0	-2.00	0	1	0	1	1	0	1	-22.50
0	0	0	0	1	0	1	-2.50	0	1	0	1	1	1	0	-23.00
0	0	0	0	1	1	0	-3.00	0	1	0	1	1	1	1	-23.50
0	0	0	0	1	1	1	-3.50	0	1	1	0	0	0	0	-24.00
0	0	0	1	0	0	0	-4.00	0	1	1	0	0	0	1	-24.50
0	0	0	1	0	0	1	-4.50	0	1	1	0	0	1	0	-25.00
0	0	0	1	0	1	0	-5.00	0	1	1	0	0	1	1	-25.50
0	0	0	1	0	1	1	-5.50	0	1	1	0	1	0	0	-26.00
0	0	0	1	1	0	0	-6.00	0	1	1	0	1	0	1	-26.50
0	0	0	1	1	0	1	-6.50	0	1	1	0	1	1	0	-27.00
0	0	0	1	1	1	0	-7.00	0	1	1	0	1	1	1	-27.50
0	0	0	1	1	1	1	-7.50	0	1	1	1	0	0	0	-28.00
0	0	1	0	0	0	0	-8.00	0	1	1	1	0	0	1	-28.50
0	0	1	0	0	0	1	-8.50	0	1	1	1	0	1	0	-29.00
0	0	1	0	0	1	1	-9.50	0	1	1	1	0	1	1	-29.50
0	0	1	0	0	1	0	-9.00	0	1	1	1	1	0	0	-30.00
0	0	1	0	1	0	0	-10.00	0	1	1	1	1	0	1	-30.50
0	0	1	0	1	0	1	-10.50	0	1	1	1	1	1	0	-31.00
0	0	1	0	1	1	0	-11.00	0	1	1	1	1	1	1	-31.50
0	0	1	0	1	1	1	-11.50	1	0	0	0	0	0	0	-32.00
0	0	1	1	0	0	0	-12.00	1	0	0	0	0	0	1	-32.50
0	0	1	1	0	0	1	-12.50	1	0	0	0	0	1	0	-33.00
0	0	1	1	0	1	0	-13.00	1	0	0	0	0	1	1	-33.50
0	0	1	1	0	1	1	-13.50	1	0	0	0	1	0	0	-34.00
0	0	1	1	1	0	0	-14.00	1	0	0	0	1	0	1	-34.50
0	0	1	1	1	0	1	-14.50	1	0	0	0	1	1	0	-35.00
0	0	1	1	1	1	0	-15.00	1	0	0	0	1	1	1	-35.50
0	0	1	1	1	1	1	-15.50	1	0	0	1	0	0	0	-36.00
0	1	0	0	0	0	0	-16.00	1	0	0	1	0	0	1	-36.50
0	1	0	0	0	0	1	-16.50	1	0	0	1	0	1	0	-37.00
0	1	0	0	0	1	0	-17.00	1	0	0	1	0	1	1	-37.50
0	1	0	0	0	1	1	-17.50	1	0	0	1	1	0	0	-38.00
0	1	0	0	1	0	0	-18.00	1	0	0	1	1	0	1	-38.50
0	1	0	0	1	0	1	-18.50	1	0	0	1	1	1	0	-39.00
0	1	0	0	1	1	0	-19.00	1	0	0	1	1	1	1	-39.50
0	1	0	0	1	1	1	-19.50	1	0	1	0	0	0	0	-40.00
0	1	0	1	0	0	0	-20.00	1	0	1	0	0	0	1	-40.50