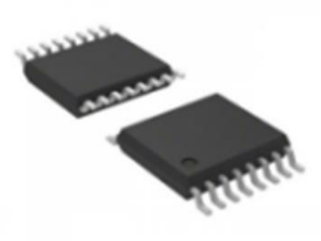
Low Noise, Low Power Dissipation, 16/24-Bit ∑-Δ ADC

PRODUCT DESCRIPTION

The MS5196T/MS5197T is a 16bit/24bit ADC featured by low power dissipation, low noise, differential inputs and it is suitable for high-precision measurement application.

The MS5196T/MS5197T integrates low noise input buffer, low noise instrumentation amplifier and temperature sensor for temperature compensation in test. And it also could adopt external or internal clock. The output data rate can be set from 4.17Hz to 123Hz by software. The power supply ranges from 2.7V to 5.25V and the typical power dissipation is 320μA. The MS5196T/MS5197T is available in TSSOP16 package.



TSSOP16

FEATURES

- RMS Noise: 65nV
- Power Dissipation: 320μA (Typ)
- Integrated Low Noise, Gain Instrumentation Amplifier
- Integrated Temperature Sensor
- Integrated Internal Clock Oscillator
- Update Rate: 4.17Hz to 123Hz
- Integrated 50Hz/60Hz Rejection Filter
- Power Supply: 2.7V to 5.25V
- Operating Temperature Range: -40°C to 120°C

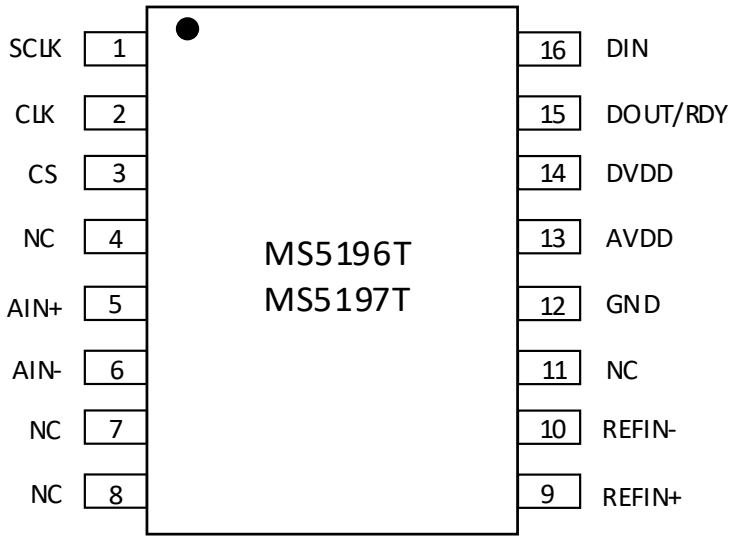
APPLICATIONS

- RTD Measurement
- Stress Detection
- Gas Analysis and Blood Analysis
- Industrial Process Control and Instrumentation
- Liquid and Gas Chromatograph
- Smart Transmitter
- 6-bit DVM

PRODUCT SPECIFICATION

Part Number	Package	Marking
MS5196T	TSSOP16	MS5196T
MS5197T	TSSOP16	MS5197T

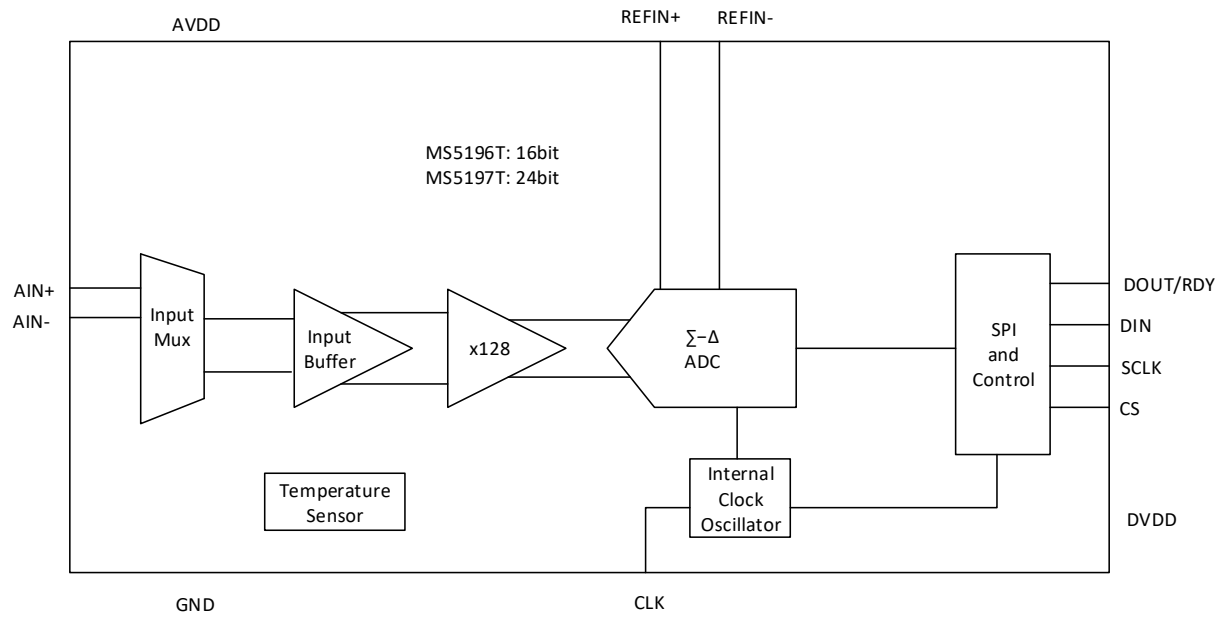
PIN CONFIGURATION



PIN DESCRIPTION

Pin	Name	Type	Description
1	SCLK	I	Serial Clock Input
2	CLK	I	Clock Input/Clock Output. Provide or Disable Internal Clock. When internal clock is disabled, apply external clock to drive the ADC. Therefore, several ADCs could be driven by same clock to execute synchronous conversion.
3	CS	I	Chip Select Input
4	NC	-	Not Connection
5	AIN+	I	Analog Channel Positive Input Pin
6	AIN-	I	Analog Channel Negative Input Pin
7	NC	-	Not Connection
8	NC	-	Not Connection
9	REFIN+	I	Positive Reference Voltage Input Pin
10	REFIN-	I	Negative Reference Voltage Input Pin
11	NC	-	Not Connection
12	GND	-	Ground
13	AVDD	-	Analog Power Supply Voltage (2.7V to 5.25 V)
14	DVDD	-	Digital Interface Power Pin
15	DOUT/RDY	O	Serial Data Output/Data Ready Output Pin
16	DIN	I	Serial Data Input

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Any exceeding absolute maximum rating application causes permanent damage to device. Because long-time absolute operation state affects device reliability. Absolute ratings just conclude from a series of extreme tests. It doesn't represent chip can operate normally in these extreme conditions.

Parameter	Symbol	Range	Unit
Analog Power Supply	AVDD	-0.3 ~ +7.0	V
Digital Power Supply	DVDD	-0.3 ~ +7.0	V
Analog Input Voltage	AIN	-0.3 ~ AVDD+0.3	V
Reference Voltage	VREFIN	-0.3 ~ AVDD+0.3	V
Digital Input Voltage		-0.3 ~ DVDD+0.3	V
Digital Output Voltage	V(LE)	-0.3 ~ DVDD+0.3	V
Input Port Current		10	mA
Operating Temperature		-40 ~ 125	°C
Storage Temperature	T_{stg}	-65~ 150	°C
Lead Temperature (10 sec)		260	°C
ESD (HBM)		4000	V

ELECTRICAL CHARACTERISTICS

AVDD=2.7V to 5.25V, DVDD=2.7V to 5.25V, GND=0V, REFIN(+)=AVDD, REFIN(-)=0V.

Unless otherwise noted, parameters are in full temperature range.

Parameter	Condition	Min	Typ	Max	Unit
ADC Channel					
Output Rate			4.17-123		Hz
No Missing Codes Accuracy			24/16		Bits
Resolution	See Page 8				
Output Noise and Rate	See Page 8				
Integral Nonlinearity				±15	ppm of FSR
Offset Error			±1		μV
Offset Error Temperature Drift			±10		nV/°C
Full-Scale Error			±10		μV
Gain Temperature Drift			±3		ppm/°C
Power Supply Rejection Ratio	AIN=1V/128	75			dB
Analog Input					
Differential Input Voltage Range		±VREF/128			V
Common-Mode Voltage	VCM= (AINP + AINN)/2, Gain= 4 to 128	0.5			V
Analog Input Voltage		GND+ 300mV		AVDD- 1.1	V
Analog Input Current	Update Rate < 100Hz			±250	pA
Analog Input Current Temperature Drift			±2		pA/°C
Common-mode Rejection (Internal Clock)	DC, AIN = 1 V/128	90			dB
	50 ± 1 Hz, 60 ± 1 Hz (FS[3:0] = 1010)	80			dB
	50 ± 1 Hz (FS[3:0] = 1001), 60 ± 1 Hz (FS[3:0] = 1000)	90			dB
External Reference Voltage					
Reference Voltage		0.1	2.5	AVDD	V
Average Current, Reference Voltage Input			400		nA/V
Average Current Temperature Drift, Reference Voltage Input			±0.03		nA/V/°C

Parameter	Condition	Min	Typ	Max	Unit
Common-mode Rejection			100		dB
Temperature Sensor					
Accuracy			±2		°C
Sensitivity			0.9		mV/°C
Clock					
Internal Clock Frequency			64±3%		kHz
Internal Clock Duty Cycle			50:50		%
External Clock Frequency			64		kHz
External Clock Duty Cycle		45:55		55:45	%
Logic Input					
CS Input Low Voltage	DVDD=5V			0.8	V
	DVDD=3V			0.4	V
CS Input High Voltage		2.0			V
SCLK and DIN Input High-level Threshold	DVDD=5V	1.4		2	V
	DVDD=3V	0.9		2	V
SCLK and DIN Input Low-level Threshold	DVDD=5V	0.8		1.7	V
	DVDD=3V	0.4		1.35	V
SCLK and DIN Input Hysteresis	DVDD=5V	0.1		0.17	V
	DVDD=3V	0.06		0.13	V
Input Current				±10	μA
Input Capacitance			10		pF
Digital Logic Output					
Output High-level Voltage	DVDD=3 V, ISOURCE=100μA	DVDD-0.6			V
	DVDD=5 V, ISOURCE=200μA	4			V
Output Low-level Voltage	DVDD=3 V, ISINK=100μA			0.4	V
	DVDD=5 V, ISINK=1.6mA			0.4	V
Leakage Current, Floating-State				±10	μA
Output Capacitance, Floating-State			10		pF

Parameter		Condition	Min	Typ	Max	Unit
System Calibration						
Full-Scale Calibration					1.05×FS	V
Zero-Scale Calibration			-1.05×FS		1.05×FS	V
Power Dissipation						
Power Supply Voltage		AVDD	2.7		5.25	V
		DVDD	2.7		5.25	V
Power Supply Current	AVDD=3V			300	340	µA
	AVDD=5V			320	350	
Shut-down Current					1	µA

OUTPUT NOISE and RESOLUTION (EXTERNAL REFERENCE)

The table below gives the output RMS noise for the MS5197T with some update rates and gain settings. These data are for bipolar input range and 2.5V external reference voltage. These values are typical when the differential input voltage is 0V. It is important to note that the effective resolution is calculated from root mean square noise.

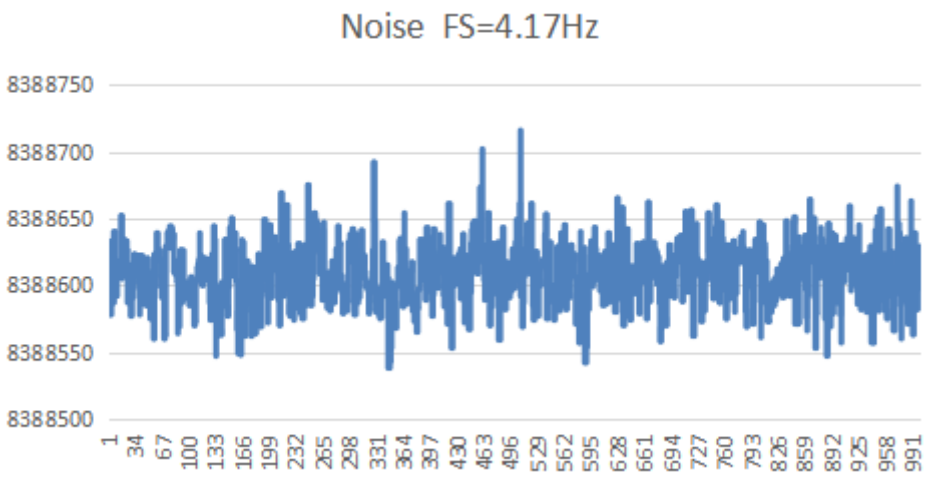
Table 1. Output RMS Noise (μV) VS. Gain and Update Rate for the MS5197T (2.5V Reference Voltage)

Update Rate	RMS Noise (μV)
4.17Hz	0.043
8.33Hz	0.054
16.7Hz	0.102
33.2Hz	0.157
62Hz	0.181
123Hz	0.263

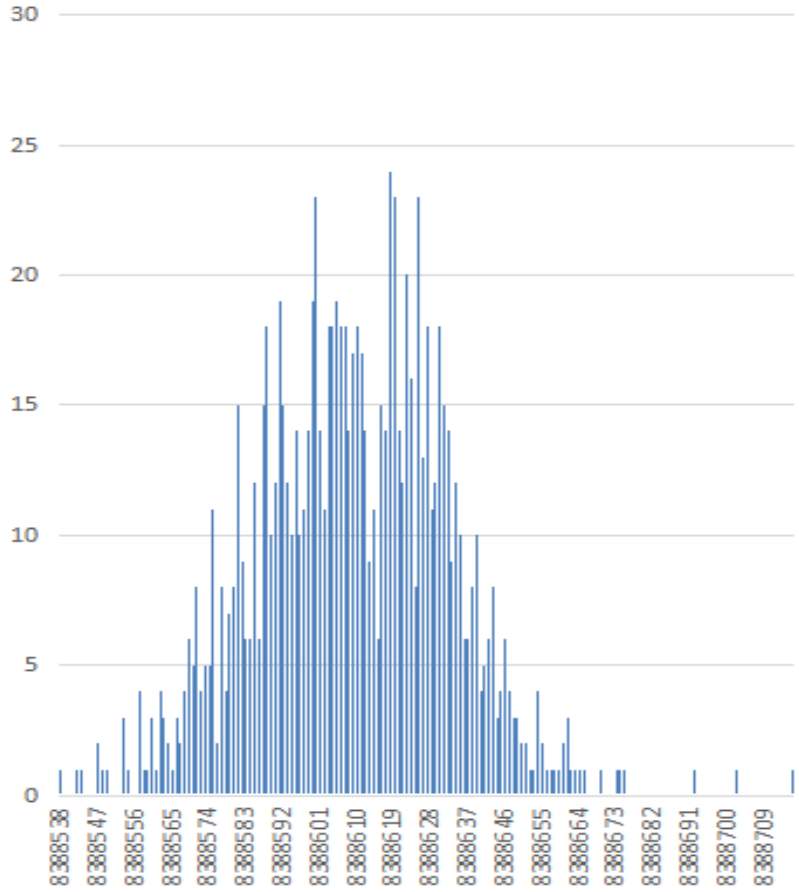
Table 2. Effective Resolution VS. Gain and Update Rate for the MS5197T (2.5V Reference Voltage)

Update Rate	Effective Resolution
4.17Hz	18.4
8.33Hz	18.1
16.7Hz	17.2
33.2Hz	16.5
62Hz	16.3
123Hz	15.8

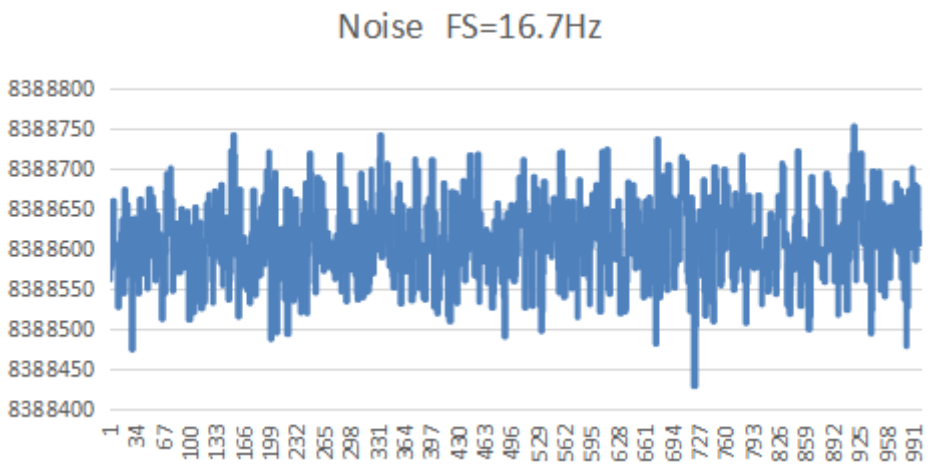
TYPICAL CHARACTERISTICS CURVES



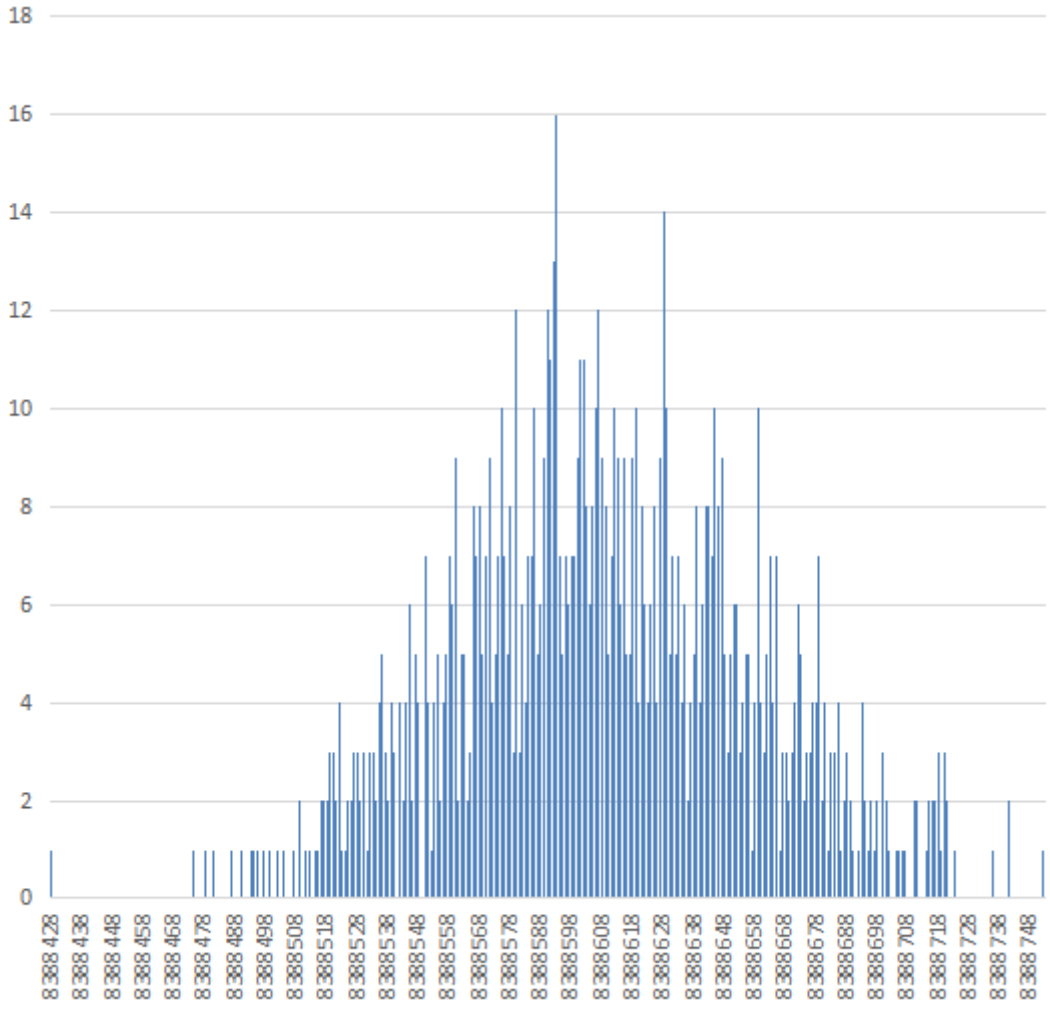
MS5197T Noise (AVDD=4V,VREF=2.048, Update Rate=4.17Hz)



MS5197T Noise Distribution Histogram (AVDD=4V, VREF=2.048, Update Rate =4.17Hz)



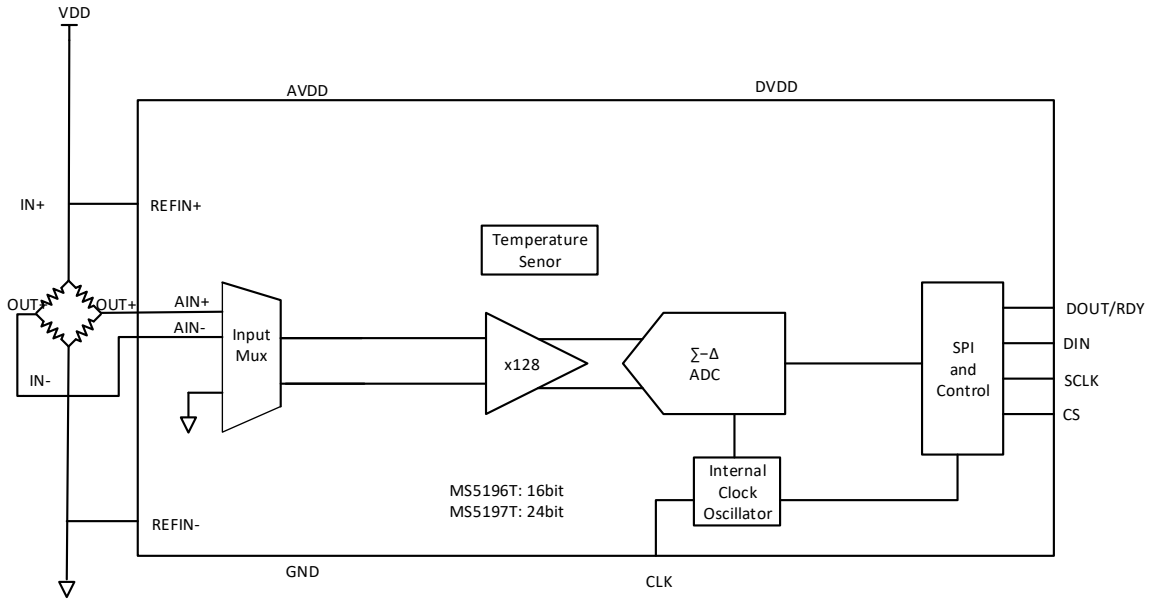
MS5197T Noise (AVDD=4V, VREF=2.048, Update Rate=16.7Hz)



MS5197T Noise Distribution Histogram (AVDD=4V, VREF=2.048, Update Rate=16.7Hz)

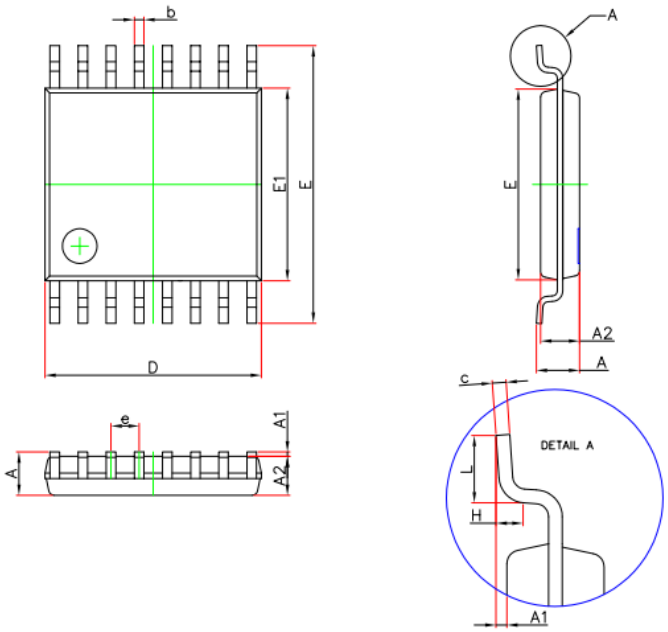
TYPICAL APPLICATION DIAGRAM

The figure is a connection diagram for weigh scale measurement application for the MS5196T/MS5197T.



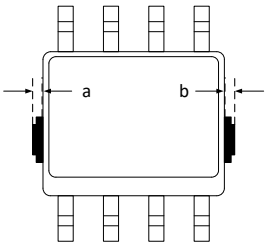
PACKAGE OUTLINE DIMENSIONS

TSSOP16



Note: In addition to the package size, a and b are allowed to have the maximum size of 0.15mm for waste glue simultaneously.

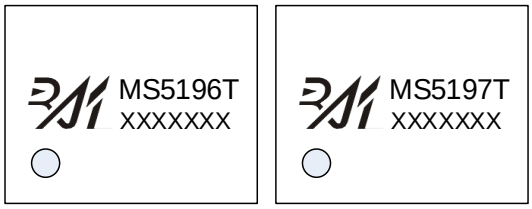
The diagram is as follows: taking SOP8 package as an example.



Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	-	1.200	-	0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.000	0.031	0.039
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.900	5.100	0.193	0.201
E	6.250	6.550	0.246	0.258
E1	4.300	4.500	0.169	0.177
e	0.650(BSC)		0.026(BSC)	
L	0.500	0.700	0.020	0.028
H	0.250(TYP)		0.010(TYP)	
θ	1°	7°	1°	7°

MARKING and PACKAGING SPECIFICATION

1. Marking Drawing Description



Product Name: MS5196T, MS5197T

Product Code: XXXXXXX

2. Marking Drawing Demand

Laser printing, contents in the middle, font type Arial.

3. Packaging Specification

Device	Package	Piece/Reel	Reel/Box	Piece/Box	Box/Carton	Piece/Carton
MS5196T	TSSOP16	3000	1	3000	8	24000
MS5197T	TSSOP16	3000	1	3000	8	24000

STATEMENT

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MOS CIRCUIT OPERATION PRECAUTIONS

Static electricity can be generated in many places. The following precautions can be taken to effectively prevent the damage of MOS circuit caused by electrostatic discharge:

1. The operator shall ground through the anti-static wristband.
2. The equipment shell must be grounded.
3. The tools used in the assembly process must be grounded.
4. Must use conductor packaging or anti-static materials packaging or transportation.

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