AS1080

8 Channels Capacitive Touch Sensor IC

From Santa Clara, United States of America

Leading Performance: ESD HBM >8k Volts (Directly Applied to All IC Pins)
Operating Temperature up to >+95^{0}C

Features

- Analog and Digital – Mixed Mode IC
- Support Capacitive Touch Screen Applications
  - Low Cost Single Layer ITO Touch Screen
- Support Capacitive Touch Key Applications
- Support Capacitive Proximity Sensing Applications
- 8 and 12 independent electrode inputs
- 8 and 12 individual outputs (with QFN package)
- Simultaneous multi-electrode sensing
- I2C compatible interface with interrupt IRQ_L
- Selectable I2C address
- Multiple devices in a system allow for up to 24 keys
- Build-in algorithm for ease of use
  - Sensitivity control per key
  - Auto calibration
  - Auto drift compensation
  - Noise filtering and rejection

Reduce BOM Cost

- Internal oscillator – no external crystal or oscillators
- Internal LDO – no external LDO or regulator
- No external tuning components
- Direct drive LED (2mA to 5mA)

Environment Specification

Operation Temperature: -40^{0}C to +95^{0}C

- Leading Performance in Capacitive Touch Sensor IC

ESD: HBM 8k volts (Directly applied to all IC pins)

- Leading Performance in Capacitive Touch Sensor IC

Electrical Specification

Operating voltage:	2.0V to 5.5V
Low-power operating mode:	7uA to 15uA
Standby mode:	5uA

Standby: wakes up to normal mode in less than 32ms

Overview

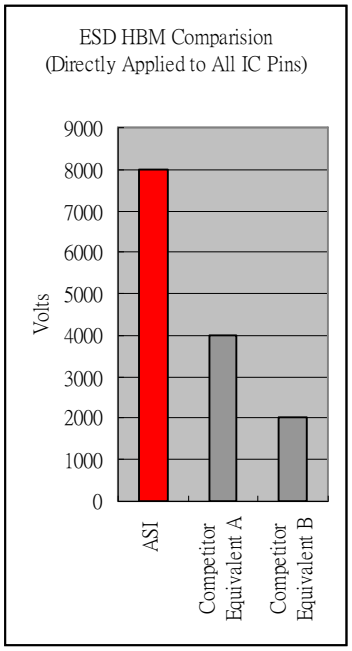
AS1080 is a 8 channels touch sensor IC capable of detecting near-proximity or touch on 8 electrodes. It allows electrodes to project independent sense field through any dielectric like glass, plastic, ceramic and wood. It can accommodate a wide range of implementations due to its rich feature set.

Implementations

- Touch Screen
- Touch Keys
- Touch Pads
- Switch Replacements
- Slider Replacements

Typical Applications

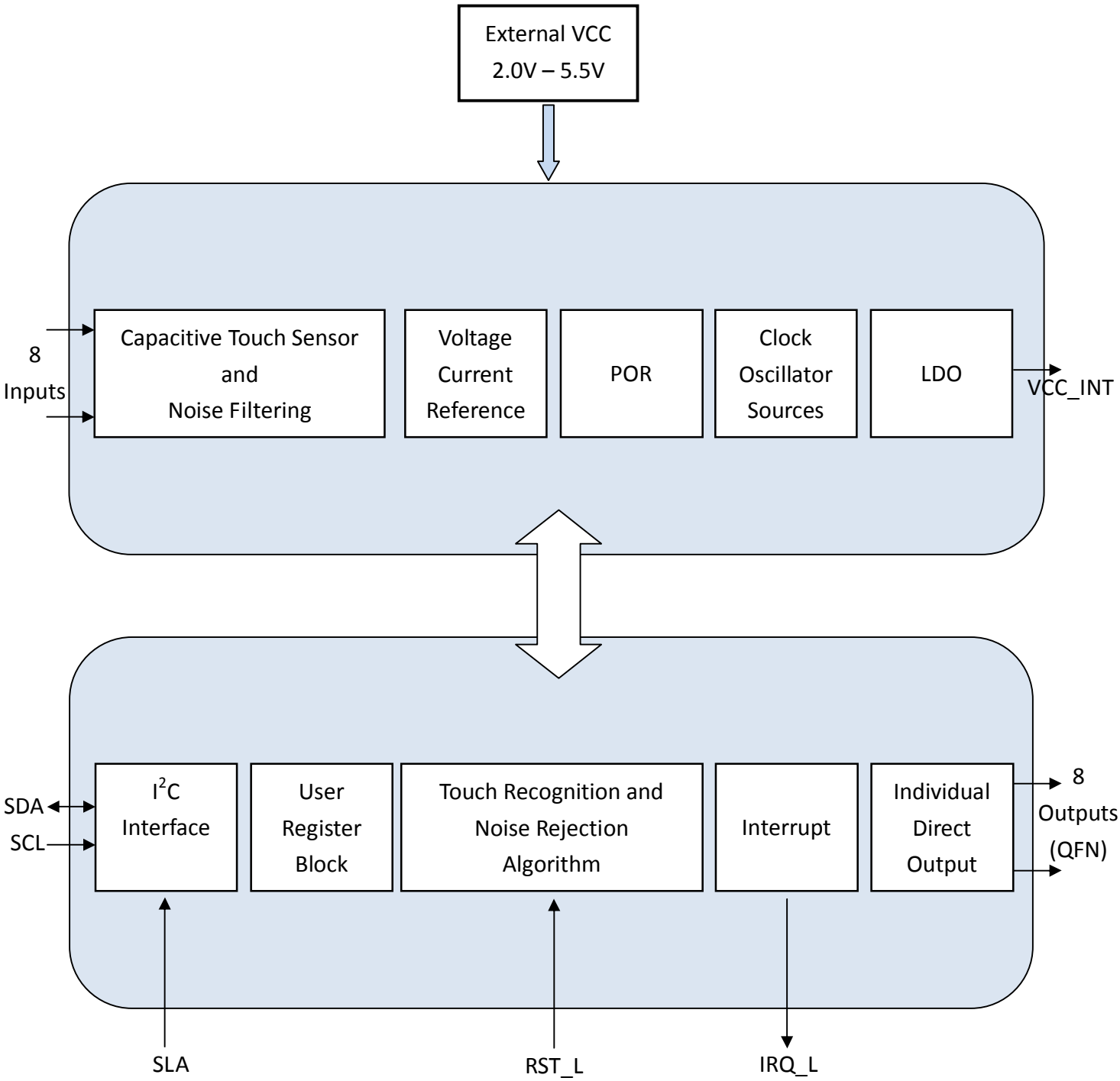
- Audio/Video
- PC peripherals
- Home appliance
- Gaming machine/console
- Security systems
- Instruments panels
- Access system
- Remote controls
- Lighting controls
- Single Layer ITO Glass
- MP3 and MP4



Package Types (Lead Free and Green Packages)

Package Types	Part No.	Channel	(Size mm)
QFN28	AS1080	8	5 x 5 x 0.8
TSSOP20	AS1080	8	6.5 x 4.4 x 0.9

Block Diagram

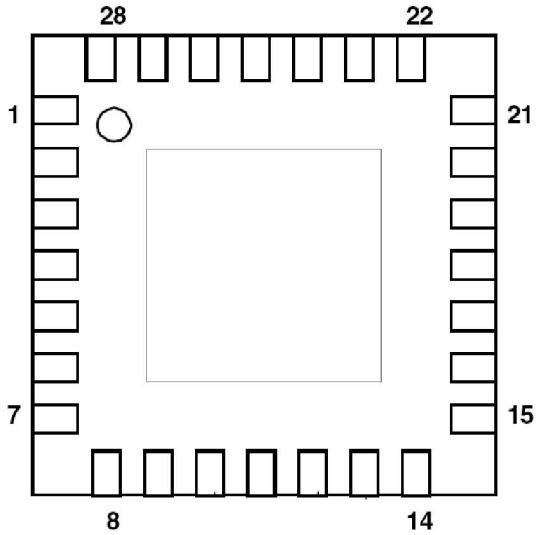


Pin Assignment and Package

The AS1080 device is available in two types of packages that are listed and shown in the following tables:

28-Pin QFN Part:

Figure 1. AS1080 28-Pin QFN Device



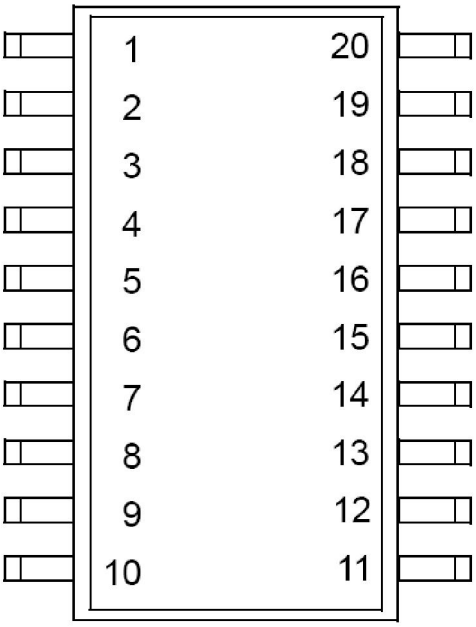
28-Pin QFN Pinout:

Table 1. Pin Descriptions

Pin Number	Name	Pin Description
2, 1, 27, 26, 23, 22, 21, 20	Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8	Sense pin 1, Sense pin2, Sense pin3, Sense pin4, Sense pin 5, Sense pin6, Sense pin7, Sense pin8
4, 5, 6, 10, 12, 13, 17, 18	Out1, Out2, Out3, Out4, Out5, Out6, Out7, Out8,	Key 1 out, Key 2 out, Key 3 out, Key 4 out, Key 5 out, Key 6 out, Key 7 out, Key 8 out
19	VCC	Power
3	VSS	Ground
9	SCL	SCL – I^2C clock input
8	SDA	SDA – I^2C open drain data I/O pin
11	RST_L	Reset pin, active low
14	IRQ_L	Interrupt Request Output, active low
28	VCC_INT	Power Internal regulator
7	SLA	I^2C slave address selection
24	R_EXT	External Reference Resistor
15	Reserved	Connect to VSS
16, 25	NC	NC – Connect to VSS

20-Pin TSSOP Part:

Figure 2. AS1080 20-Pin TSSOP Device



20-Pin TSSOP Pinout:

Table 2. Pin Descriptions

Pin Number	Name	Pin Description
15, 14, 12, 11, 9, 8, 7, 6	Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8	Sense pin 1, Sense pin2, Sense pin3, Sense pin4, Sense pin 5, Sense pin6, Sense pin7, Sense pin8
5	VCC	Power
16	VSS	Ground
20	SCL	SCL – I^2C clock input
19	SDA	SDA – I^2C open drain data I/O pin
1	RST_L	Reset pin, active low
2	IRQ_L	Interrupt Request Output, active low
13	VCC_INT	Power Internal regulator
18	SLA	I^2C slave address selection
10	R_EXT	External Reference Resistor
3	Reserved	Connect to VSS
4, 17	NC	NC – Connect to VSS

Technology Overview

Introduction

The ASI Touch sensor devices are charging a sense electrode of unknown capacitance to a known current. The electrode is typically a metal area on a printed circuit board. The resulting potential is transferred into a measurement circuit. By measuring the potential after one or more charge-and-discharge cycles, the capacitance of the sense plate can be determined.

By controlling the charging and discharging current, together with a proprietary sensing method, the result is a very low power consumption operation.

Placing a finger on the touch surface introduces external capacitance. This represents as a finger touch or as proximity detection. Signal processing in the decision logic makes ASI Touch sensor robust and reliable. False triggering due to AC power noise, electrostatic spikes or sudden unintentional touch or proximity is eliminated.

ASI Touch sensors provide truly independent single or multiple keys sensing. Where multiple keys are used, each key is individually sensed and measured. Each key can be set for an individual sensitivity level. Keys of different sizes and shapes can be used to meet different requirements.

ASI Touch sensors can be deployed in many ways, normal or 'touch' mode and high-sensitivity or 'proximity' mode. The highly sensitive proximity sensing is used to detect an end-user's approaching finger, and have the user interface interrupt the electronic equipment or electrical appliance to initiate a system function. The sensors can also be programmed into a 'toggle' mode, which is very useful for implementing a press-ON/press-OFF ON/OFF switch function.

Thanks to the proprietary low power sensing method, the charging pulses are kept at a very low energy level. The benefits of this approach include lower cross-sensor interference, reduced RF emissions and susceptibility.

ASI Touch sensors feature automatic drift compensation to account for slow changes due to ageing or changing environmental conditions. They have a dynamic range of several decades and do not require coils, oscillators, RF components, special cable, RC networks, or a lot of discrete parts. The ASI Touch sensor solution is simple, robust, elegant, and affordable.

Device Overview

Introduction

The AS1080 is a low power, low voltage touch sensor controller which manages up to 8 touch pad electrodes. An I^2C interface communicates with the host controller at data rates up to 400kbits/sec. An interrupt output, IRQ_L, is available to advice the host MCU of electrode status changes. For QFN package, there are 8 individual output available for direct drive usage. The AS1080 has an easy to use, sophisticated built-in multi-level touch recognition filtering to detect pad input condition changes due to a true touch without any processing by the application.

The AS1080 Capacitive Touch Sensor IC does not required external components. For maximum EMI rejection in noisy application, an option low cost resister can be added to the input pin.

A bypass capacitor of 1uF should be used between VCC_INT and VSS lines and a 4.7Kohm pull-up resistor should be included on the IRQ_L. The IRQ_L can be used to connect to an external MCU for interrupt request. The remaining connections are SCL and SDA. Depending on the specific application, each of these control lines can be used by connecting them to a host controller. In the most minimal system, the SCL and SDA must be connected to a master I^2C interface to communicate with the AS1080.

Serial Interface

The AS1080 uses an I^2C Serial Interface. The I^2C protocol implementation and the specifics of communicating with the Touch Sensor IC can be referred to the "I^2C protocol standard document".

The Slave Address

The AS1080 has a 7-bit long slave address. The bit following the 7-bit slave address (bit eight) is the R/W_L bit, which is low for a write command and high for a read command.

The AS1080 monitors the bus continuously, waiting for a data communication with its slave address. When an AS1080 recognizes its slave address, it acknowledges and is then ready for continued communication.

The AS1080 slave addresses are shown in Table 3.

Table 3. Pin Descriptions

SLA Pin	I^2C Slave Address
SLA pin is Low	7'h17
SLA pin is High	7'h44

Functional Overview

Introduction

The AS1080 has an analog front end, digital touch recognition, and a noise rejection algorithm. This data interpretation can be done in many different ways. The AS1080 simplify the usage and shorten the design-in cycle by predefining the sophisticated built-in algorithm. The user can simply fine tune the performance by setting the registers through I^2C interface.

Understanding the Basics

AS1080 is a capacitive Touch sensor IC which manages 8 touch pad electrodes. An I^2C interface communicates with the host, and an interrupt output advices the host of electrode status changes. The primary application for AS1080 is the management of user interface touch electrodes. Monitoring touch electrodes involves detecting small changes of input capacitance. AS1080 incorporates a self calibration function which continually adjusts the baseline capacitance for each 8 individual channel. Therefore, the host only has to define the detection sensitivity to interpret a touch or release.

AS1080 uses a unique upfront noise filtering capacitance sensor, together with a state machine and a digital signal algorithm engine to analyze the input data and determine whether a key has been touched or released.

AS1080 has very low power consumption in its class for normal operating mode. It can be programmed into pulse mode to reduce the power consumption even further. The AS1080 also offers a standby mode, which draws very minimal power consumption.

Implementation

The AS1080 can be tailored to specific applications by varying the combination of settings: sampling rate, capacitance sensing range, capacitance detector, baseline management system, and the touch detection system.

Absolute Maximum Ratings

Table 5. Absolute Maximum Ratings

Symbol	Description	Min	Typ	Max	Units	Notes
T_{STG}	Storage Temperature	-55	25	+125	C	
T_A	Ambient Temperature with Power Applied	-40	25	+95	C	
V_{CC}	Supply Voltage on V_{CC} relative to V_{SS}	-0.5	-	+6.0	V	
V_{IO}	DC Input Voltage	V_{SS} - 0.5V	-	V_{CC} + 0.5V	V	

Operating Temperature

Table 6. Operating Temperature

Symbol	Description	Min	Typ	Max	Units	Notes
T_A	Ambient Temperature	-40	25	+95	C	
T_J	Junction Temperature	-40	25	+105	C	

DC Characteristics

This section includes information about power supply requirements

Table 5. DC Characteristics (Temperature Range = -40C to 95C Ambient)

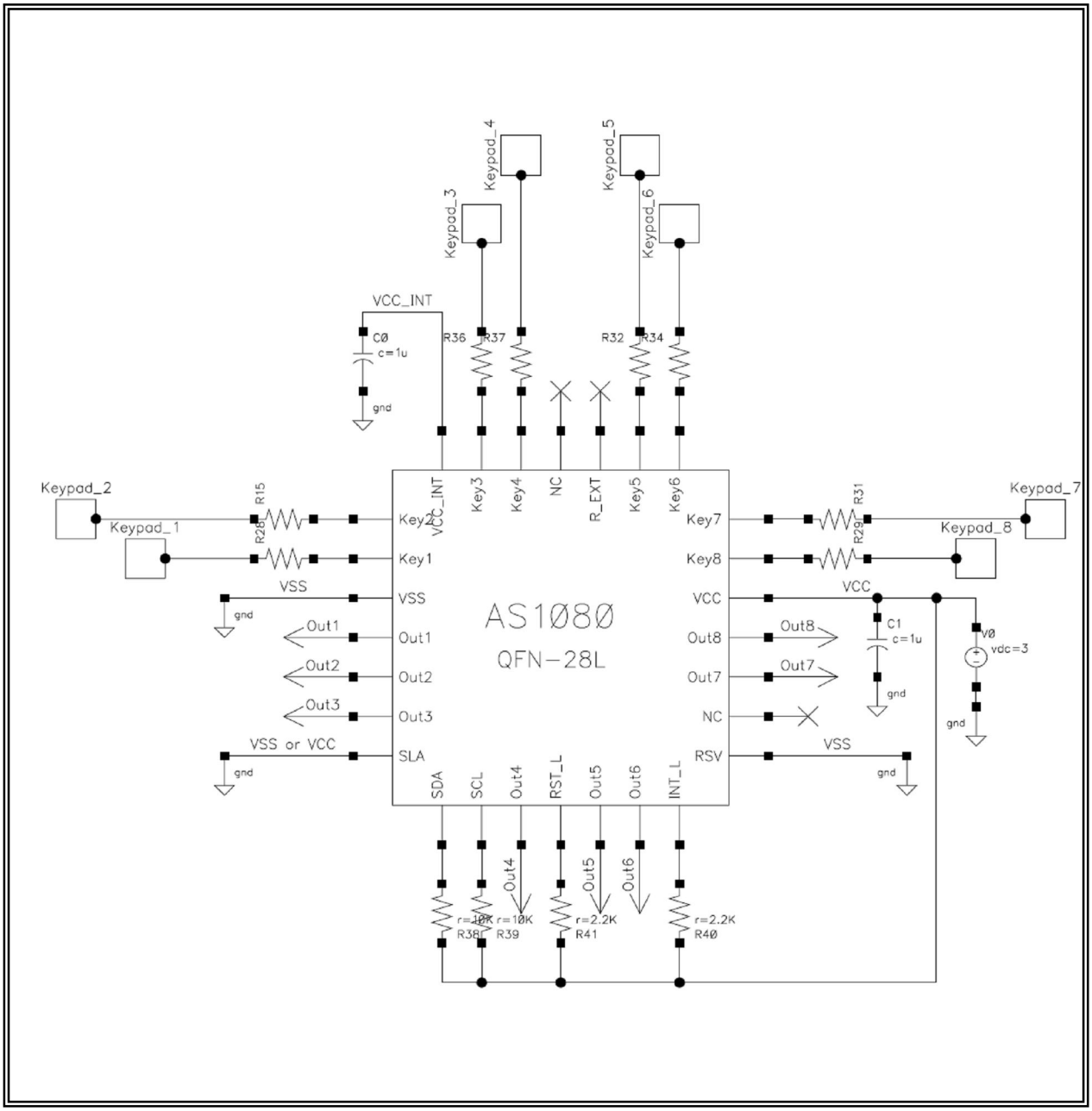
(Typical Operating Circuit, V_{CC} = 2.0V to 5.5V, $T_A = T_{MIN}$ to T_{MAX}, unless otherwise notes. Typical current values are at V_{CC} = 2.5V, T_A = +25C)

Symbol	Description	Min	Typ	Max	Units	Notes
V_{CC}	Operating Supply Voltage	2.0	2.5	5.5	V	
I_{DD}	Average Supply Current		18		µA	Low power mode
I_{DD}	Average Supply Current		35		µA	Normal mode
I_{DD}	Average Supply Current		80		µA	High Speed mode
I_{DD}	Standby Supply Current		4.5		µA	Standby mode
V_{CC}	Supply Voltage on V_{CC} relative to V_{SS}	-0.5	-	+6.0	V	
V_{IH}	Input High Voltage SDA, SCL	$0.7V_{CC}$			V	
V_{IL}	Input Low Voltage SDA, SCL			$0.3V_{CC}$	V	
V_{OL}	Output Low Voltage SDA, IRQ_L			0.5	V	I_{OL} = 5mA

REFERENCE SCHEMATIC

AS1080 QFN

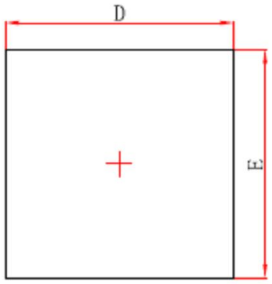
Reference Schematic Diagram



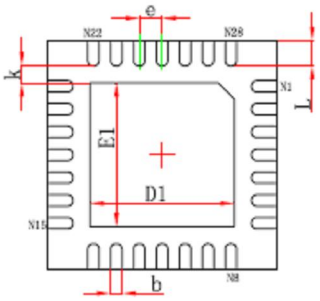
Package Dimensions

QFN28 PACKAGE OUTLINE DIMENSIONS

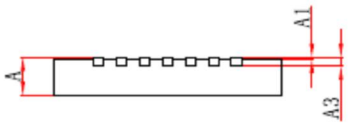
QFNWB5×5-28L(P0.50T0.75/0.85) PACKAGE OUTLINE DIMENSIONS



Top View



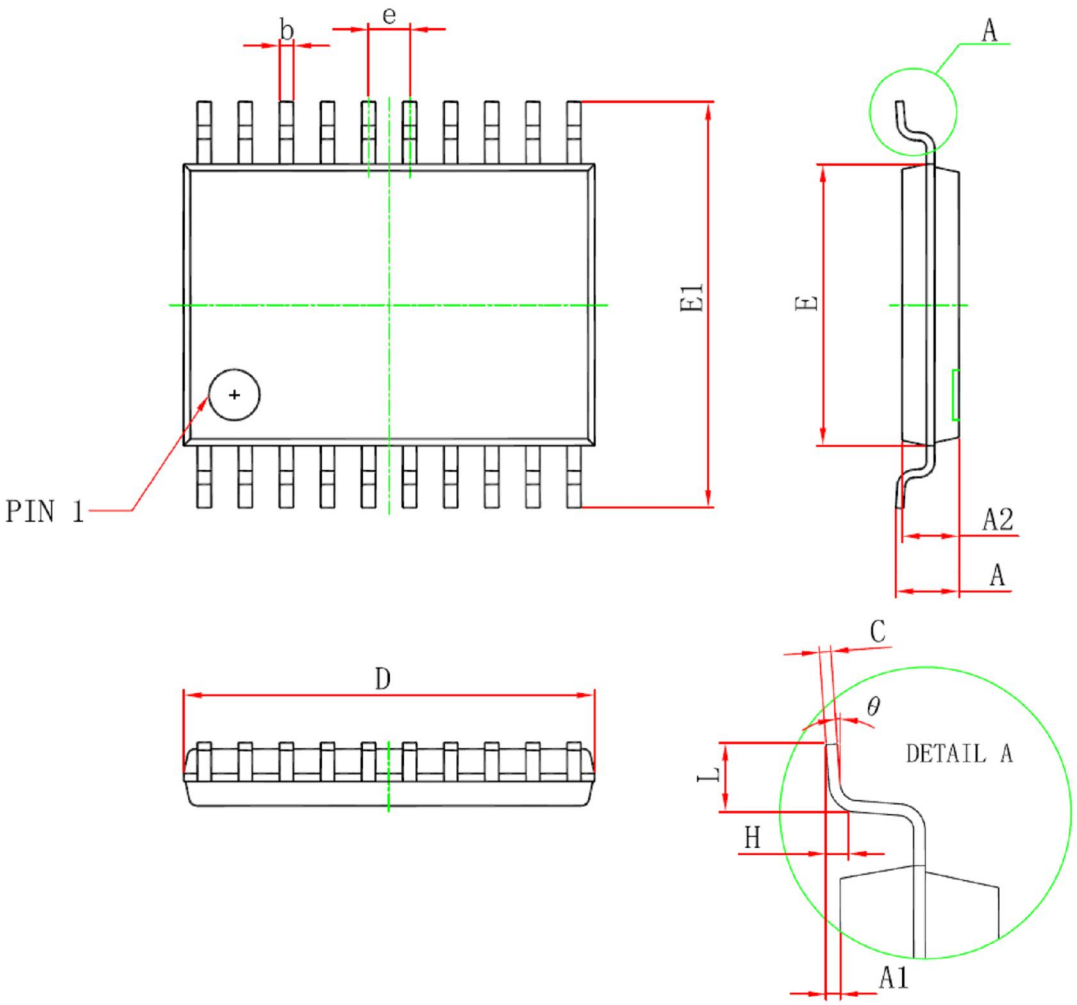
Bottom View



Side View

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	4.900	5.100	0.193	0.201
E	4.900	5.100	0.193	0.201
D1	3.050	3.250	0.120	0.128
E1	3.050	3.250	0.120	0.128
k	0.200MIN.		0.008MIN.	
b	0.180	0.300	0.007	0.012
e	0.500TYP.		0.020TYP.	
L	0.450	0.650	0.018	0.026

TSSOP20 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	**Max**	**Min**	**Max**
D	6.400	6.600	0.252	0.259
E	4.300	4.500	0.169	0.177
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
E1	6.250	6.550	0.246	0.258
A		1.100		0.043
A2	0.800	1.000	0.031	0.039
A1	0.020	0.150	0.001	0.006
e	0.65 (BSC)		0.026(BSC)	
L	0.500	0.700	0.02	0.028
H	0.25(TYP)		0.01(TYP)	
θ	1°	7°	1°	7°