



# IDKT<sup>®</sup>

## AES 512/256/128 CODEC

### 『 Cipher Memory 2KB 』

Data Sheet Version 2.0

深圳市艾迪科泰电子有限公司

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Revision History

| Doc. Rev.  | Date       | Comments                                     |
|------------|------------|--|
| IDKT_v1.13 | 2018/02/01 | Added the Application Circuit of TDFN 1-wire |
| IDKT_v1.12 | 2017/12/26 | Document update                              |
| IDKT_v1.11 | 2017/11/07 | Document update                              |
| IDKT_v1.10 | 2017/03/16 | Document update                              |
| IDKT_v1.00 | 2016/12/06 | Document update.                             |
| IDKT_v0.30 | 2016/05/10 | Change the Application Circuit of 8SOP       |
| IDKT_v0.20 | 2015/12/31 | China Office Update                          |
| IDKT_v0.00 | 2015/9/10  | Initial document release #2                  |
| IDKT_B     | 2015/8/17  | Document update.                             |
| IDKT_A     | 2015/7/20  | Initial document release.                    |

## 1 Introduction

The IDKT is a family of high performance secure memory device providing 2K Bytes of user memory with advanced built-in AES 256 security engine and cryptographic features. The memory is divided into 8 user zones each of which individually set with different security access right or used together to provide space for one or multiple data files. A configuration zone contains registers to define the AES256 secret keys used by security logic of IDKT Global Security IC.

Through dynamic, symmetric mutual authentication, data encryption and the use of data decryption provides a secure place for storage of sensitive information within a system. With its protection circuit, this information remains safely even under attack.

The IDKT also provides high security, low cost and easy implementation of host-client type systems without the needs for a MCU operating system. The embedded AES256 cryptographic engine provides for a dynamic, symmetric mutual authentication between the device and host, as well as performs encryption for all data and passwords exchanged between the device and host. The AES256 unique key set may be used for these operations.

The simplified host library providing to customers and customers can access easily to deal with the IDKT

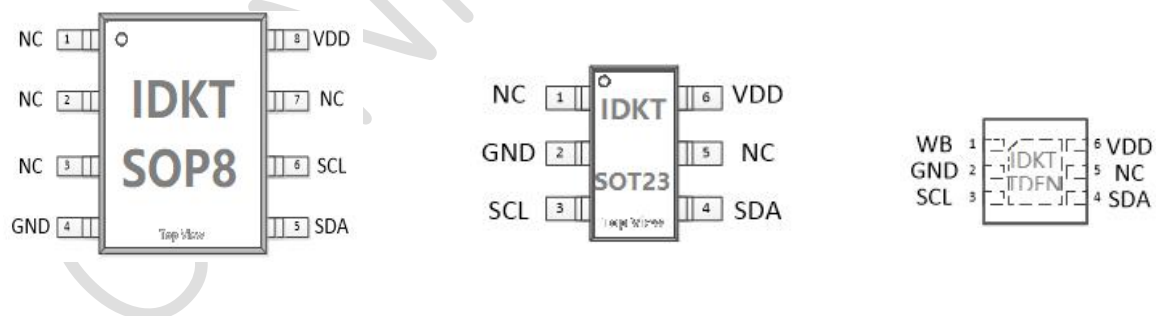


Figure [1.1] available package of IDKT (Top view)

## 1.1 Features

- High security features
  - Symmetric-mutual authentication
  - AES128/192/256 bits encryption and decryption engine
  - I2C or one-wire protocol with random stream encryption and decryption function
  - Unique key set for authentication, encryption and decryption
- 2K Bytes secure EEPROM user memory
  - 15 User Blocks
  - Support OTP/MTP user area
- Embedded application features
  - Support 5 Bytes serial number
  - Support multiple host-client interfaces I2C and One-Wire
  - Support increment only counting function for inkjet printer and cartridge
  - Wide input power range : 1.8V ~ 4.5V (optional)
  - SOT23-6, 8SOP and TDFN-6 packages



## 1.2 Application

I2C interface running at 400KHz is used for fast and efficient communications with up to 127 devices that may be individually addressed. The IDKT is available in industry standard 8-lead or 6-lead packages with the same familiar pin layout as 2-wire serial EEPROM's supporting only the synchronous communication protocol.

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## 2 Pin Information

### 2.1 Application Circuit

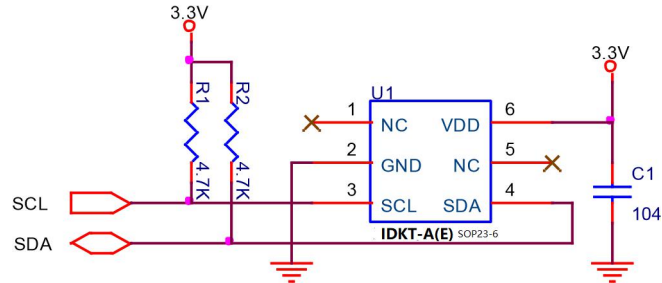


Figure [2.1.1] SOT23-6 Package

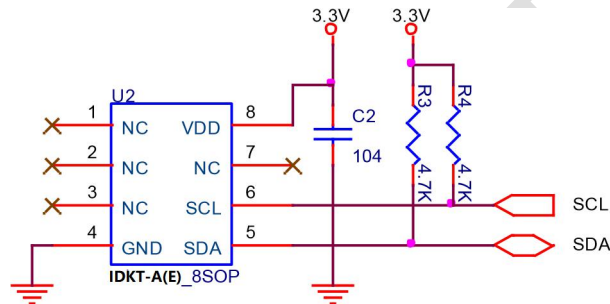


Figure [2.1.2] 8SOP Package

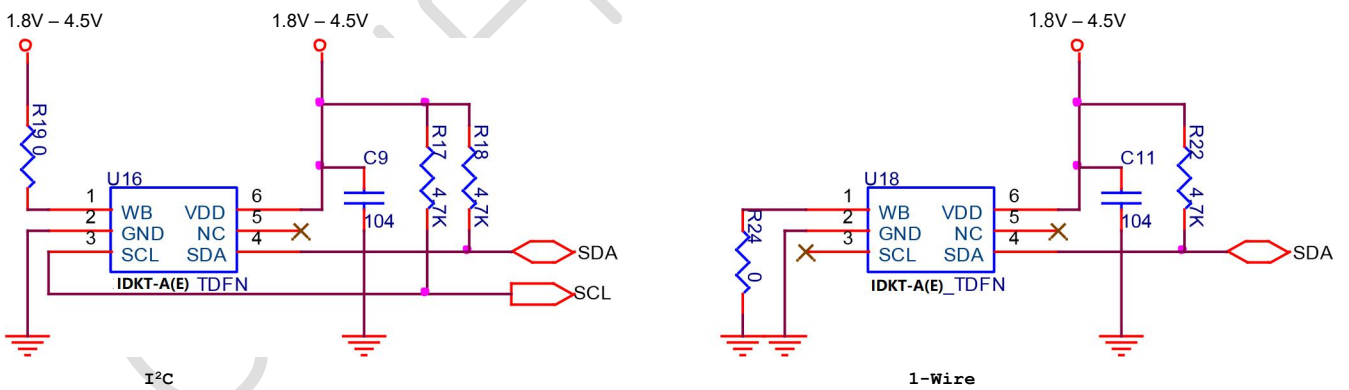


Figure [2.1.3] TDFN-6 Package

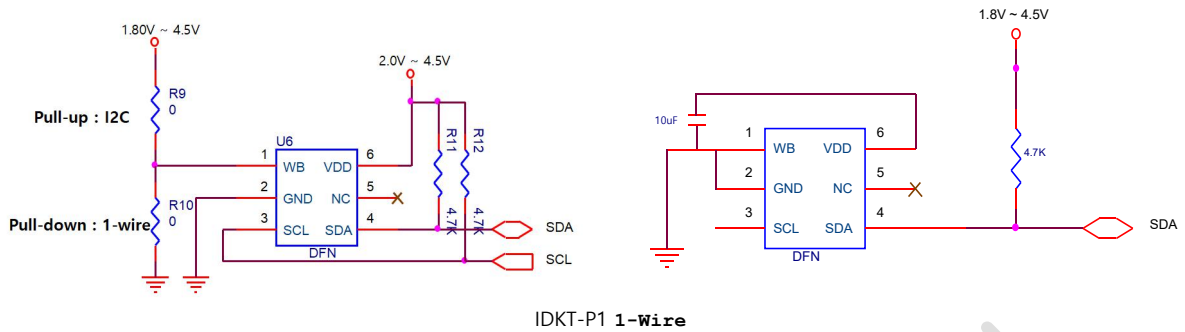


Figure [2.1.4] TDFN-6 Package

### 2.2 Pin configuration (SOT23-6)

| Pin number | Pin name | Direction | Description  |
|------------|----------|-----------|--------------|
| 1          | NC       | -         | Not Connect  |
| 2          | GND      | -         | Ground       |
| 3          | SCL      | I         | Serial Clock |
| 4          | SDA      | I/O       | Serial Data  |
| 5          | NC       | -         | Not Connect  |
| 6          | VCC      | -         | Power Supply |

Table [2.1] SOT23-6 Pin description

### 2.3 Pin configuration (8SOP)

| Pin number | Pin name | Direction | Description  |
|------------|----------|-----------|--------------|
| 1          | NC       | -         | Not Connect  |
| 2          | NC       | -         | Not Connect  |
| 3          | NC       | -         | Not Connect  |
| 4          | GND      | -         | Ground       |
| 5          | SDA      | I/O       | Serial Data  |
| 6          | SCL      | I         | Serial Clock |
| 7          | NC       | -         | Not Connect  |
| 8          | VCC      | -         | Power Supply |

Table [2.2] 8SOP Pin description



## 2.4 Pin configuration (TDFN-6)

| Pin number | Pin name | Direction | Description  |
|------------|----------|-----------|--|
| 1          | WB       | I         | Communication Mode Selection<br>High : I2C<br>Low : One-Wire |
| 2          | GND      | -         | Ground   |
| 3          | SCL      | I         | Serial Clock   |
| 4          | SDA      | I/O       | Serial Data  |
| 5          | NC       | -         | Not Connect  |
| 6          | VCC      | -         | Power Supply   |

Table [2.3] TDFN-6 Pin description

## 2.5 Pin description

### 2.5.1 Supply Voltage (VCC)

The VCC input is 1.8V to 4.5V positive voltage supplied by host

### 2.5.2 SCL

The SCL input used to clock data on the positive clock edge and clock data out on the negative clock edge.

### 2.5.3 SDA

The SDA pin is bi-directional for serial data transfer. This pin is open drain driven and may be wired with any number of other open drain and open collector devices. An external pull up resistor should be connected SDA and VCC, a normal value of 4.7K Ohm may be used. The value of this resistor and the system capacitance loading the SDA bus will determine the rise time of SDA. This rise time will determine the maximum frequency during read operations. Low value pull up resistors will allow higher frequency operations while drawing higher average power supply current.

### 2.5.4 WB

The WB input pin is used for select of interface I2C and One-Wire. If WB pin connected to high(VCC), it select I2C interface. If WB pin connected to low(GND), it select One-Wire interface.

### 3 Block Diagram

## IDKT-A/AE/P1 Block Diagram

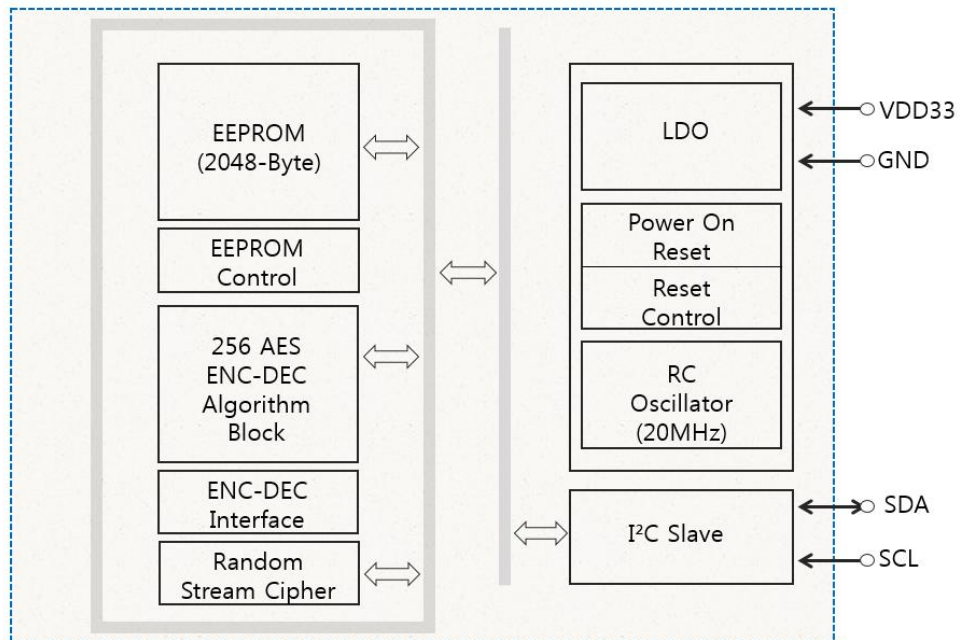


Figure [3.1] Block Diagram

## 4 Operation

### 4.1 Initial : Boot sequence and access wait time

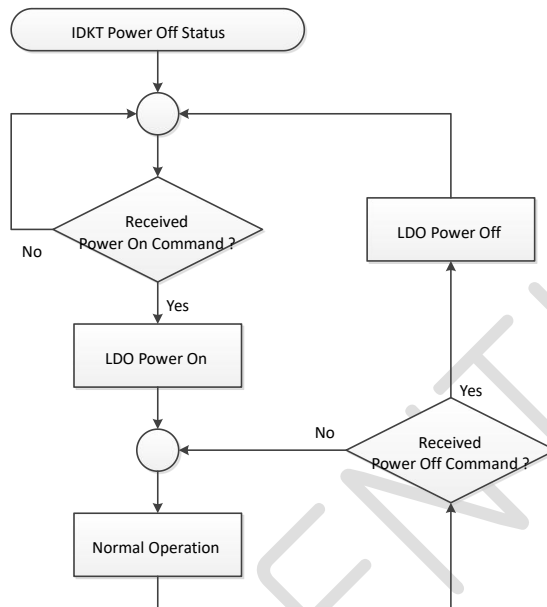


Figure [4.1] Boot sequence flow

The wait time for LDO Power On is about 100us. 4.2

### Authentication

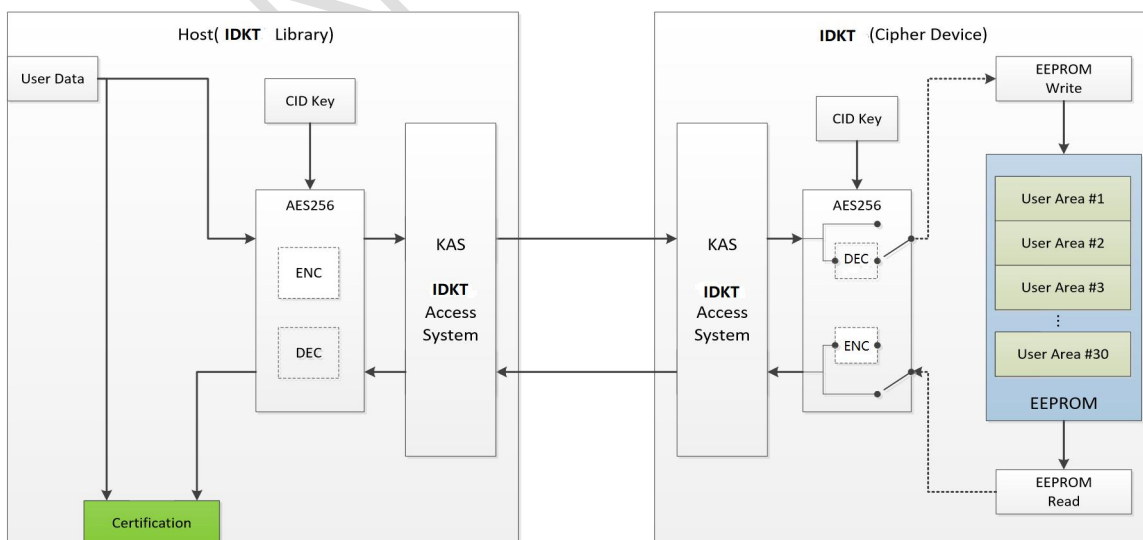


Figure [4.2] Authentication flow

This sequence determines whether the authentication is successful by checking cryptogram which generated by the host and IDKT. If the authentication process of the host is not successful, the authentication of IDKT was failed.

## 5 Communication Protocol

### 5.1 Power On Command I2C bus and one-wire type

#### 5.1.1 Write packet

|   |                 |          |   |
|---|-----------------|----------|---|
| S | Dev Addr        | Data     | P |
|   | 0 0 1 1 1 0 0 0 | (1Bytes) |   |

### 5.2 Normal Command I2C bus and one-wire type

#### 5.2.1 Write packet

|   |                 |          |          |   |
|---|-----------------|----------|----------|---|
| S | Dev Addr        | Sub Addr | Data     | P |
|   | 0 0 1 1 1 0 0 0 | (2Bytes) | (nBytes) |   |

#### 5.2.2 Read packet

|   |                 |          |    |                 |          |   |
|---|-----------------|----------|----|-----------------|----------|---|
| S | Dev Addr        | Sub Addr | Sr | Dev Addr        | Data     | P |
|   | 0 0 1 1 1 0 0 0 | (2Bytes) |    | 0 0 1 1 1 0 0 1 | (nBytes) |   |

## 6 Memory Map

| Block          | Description |   | Access     |
|----------------|-------------|---|------------|
| <b>Block15</b> | Page30      | Block 15 OTP/MTP Data Area<br>(EEPROM Memory) | Read/Write |
|                | Page29      |   |            |
| <omitted...>   |             |   |            |
| <b>Block1</b>  | Page02      | Block 1 OTP/MTP Data Area<br>(EEPROM Memory)  |            |
|                | Page01      |   |            |

Table [6.1] memory map

## 8 DC and AC Characteristics

### 8.1 DC Electrical Characteristics

| Parameter              | Symbol | Condition                      | Min           | Typ | Max     | Unit |
|------------------------|--------|--------------------------------|---------------|-----|---------|------|
| Operation Voltage      | VCC    | Power supply                   | 1.8(Optional) | 3.3 | 4.5     | V    |
|                        | VDD    | Core Power supply(only output) | 1.65          | 1.8 | 1.95    | V    |
| Input<br>Low Voltage   | VIL    | All input pins                 | GND-0.3       | -   | 0.3     | V    |
| Input<br>High Voltage  | VIH    | All input pins                 | VCC-0.3       | -   | VCC+0.3 |      |
| Output<br>High Voltage | VOH    | VCC=3.3V IOH=100uA             | VCC-0.3       | -   | -       |      |
| Output<br>Low Voltage  | VOL    | VDD=3.3V IOL=4mA               | -             | -   | 0.4V    |      |

|                                |        |                                   |   |     |   |    |
|--------------------------------|--------|-----------------------------------|---|-----|---|----|
| Output<br>Low Current          | IOL    | VOL= 0.4V                         | - | -   | 4 | mA |
| Active Power<br>Supply Current | ICC    | Normal operation mode<br>VCC=3.3V | - | 1.3 | 3 | mA |
| Sleep Current                  | ISLEEP | VCC=3.3V                          |   | 150 |   | nA |

Table [8.1] DC electrical characteristics

LDO (Ta=25°C, Vcc=3.3V) Characteristics

| Parameter                 | Condition    | Min           | Typ | Max  | Unit | Note |
|---------------------------|--------------|---------------|-----|------|------|------|
| Operating Voltage         |              | 1.8(Optional) | 3.3 | 4.5  | V    |      |
| Regulation Output Voltage | VCC=2.0~3.6V | 1.65          | 1.8 | 1.95 | V    |      |
| Current Drivability       | VCC=1.5V     | -             | -   | 20   | mA   |      |

Table [8.2] LDO characteristics

EEPROM Reliability

| Parameter       | Min       | Typ | Max | Unit         |
|-----------------|-----------|-----|-----|--------------|
| Write Endurance | 10,000    | -   | -   | Write Cycles |
| Data Retention  | 10        | -   | -   | Years        |
|                 | Unlimited |     |     | Read Cycles  |

Table [8.3] EEPROM reliability

Absolute Maximum Ratings

| Parameter             | Symbol | Condition          | Rating          | Unit |
|-----------------------|--------|--------------------|-----------------|------|
| Supply voltage        | Vdd    | -                  | -0.3 to +4.5    | V    |
| Input voltage         | Vi     | All ports          | -0.3 to Vdd+0.3 | V    |
| Output voltage        | Vo     | All output ports   | -0.3 to Vdd+0.3 | V    |
| Output Current High   | Ioh    | One I/O pin active | -200            | uA   |
| Output Current Low    | Iol    | One I/O pin active | 10              | mA   |
| Operating temperature | Ta     | -                  | -40 to +85      | C    |
| Storage temperature   | Ts     | -                  | -65 to +150     | C    |
| Junction temperature  | Tj     | -                  | 150             | C    |

Table [8.4] absolute maximum ratings

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## 8.2 AC Parameters

### 8.2.1 I2C Interface

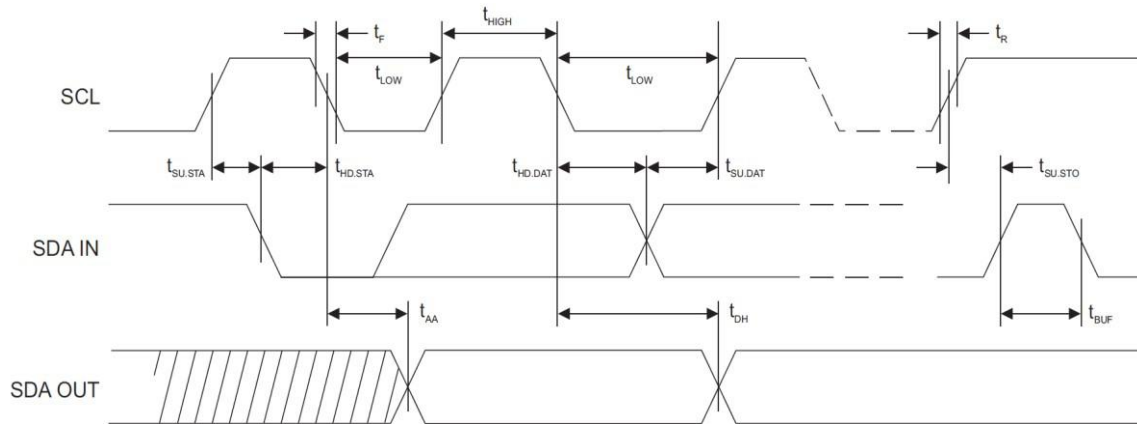


Figure [8.1] I2C interface timing

| Symbol              | Parameter   | Min | Max | Units |
|---------------------|---|-----|-----|-------|
| f <sub>SCK</sub>    | SCK Clock Frequency                                       | -   | 400 | KHz   |
|                     | SCK Clock Duty Cycle                                      | 40  | 60  | %     |
| t <sub>HIGH</sub>   | SCK High Time   | 1   | -   | us    |
| t <sub>LOW</sub>    | SCK Low Time  | 800 | -   | ns    |
| t <sub>SU.STA</sub> | Start Setup Time  | 500 | -   | ns    |
| t <sub>HD.STA</sub> | Start Hold Time   | 500 | -   | ns    |
| t <sub>SU.STO</sub> | Stop Setup Time   | 500 | -   | ns    |
| t <sub>SU.DAT</sub> | Data in Setup Time  | 100 | -   | us    |
| t <sub>HD.DAT</sub> | Data in Hold Time   | 0   | -   | ns    |
| t <sub>R</sub>      | Input rise time   | -   | 300 | ns    |
| t <sub>F</sub>      | Input Fall Time   | -   | 100 | ns    |
| t <sub>AA</sub>     | Clock Low to Data Out Valid                               | 100 | 700 | ns    |
| t <sub>DH</sub>     | Data Out Hold   | 100 | -   | ns    |
| t <sub>BUF</sub>    | Time bus must be free before a new transmission can start | 1   | -   | us    |

Table [8.5] I2C interface parameter



8.2.2 One-wire interface

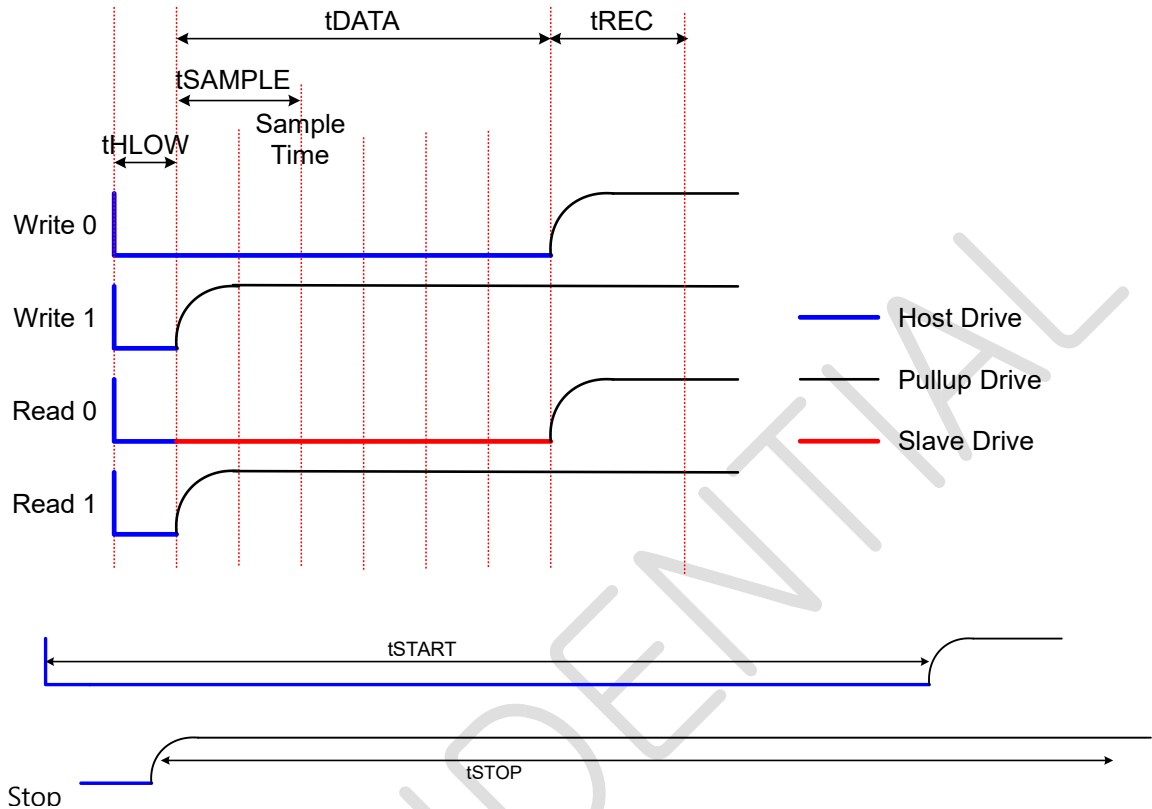


Figure [8.2] one-wire interface timing

| Symbol  | Parameter                        | Min | Typ | Max  | Units |
|---------|----------------------------------|-----|-----|------|-------|
| tHLOW   | Start Pulse Duration             | 4.5 | 5   | 5.5  | us    |
| tDATA   | Data Period                      | 29  | 30  | 31   | us    |
| tREC    | Recovery time for next data      | 9   | 10  | 15   | us    |
| tSAMPLE | Data Sampling Time for data read | 9   | 10  | 11   | us    |
| tSTART  | Single Wire Start (1)            | 100 | -   | 1000 | us    |
| tSTOP   | Single Wire Stop (2)             | 100 | -   | -    | us    |

(Note) 1. If tSTART is over 100us, Single Wire communication will start.

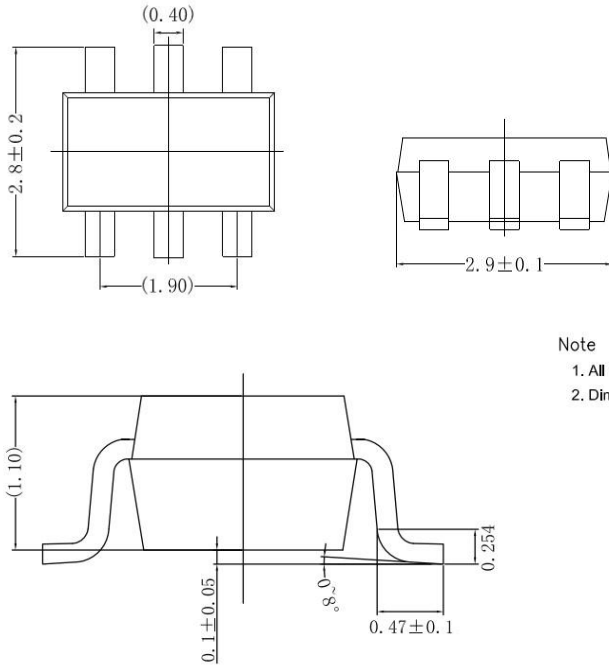
If tSTART is more than Max. 1ms, then Single Wire communication will restart

2. If tSTOP is over 100us, Single Wire communication will be stopped

Table [8.6] one-wire interface parameter

9 Package Dimension

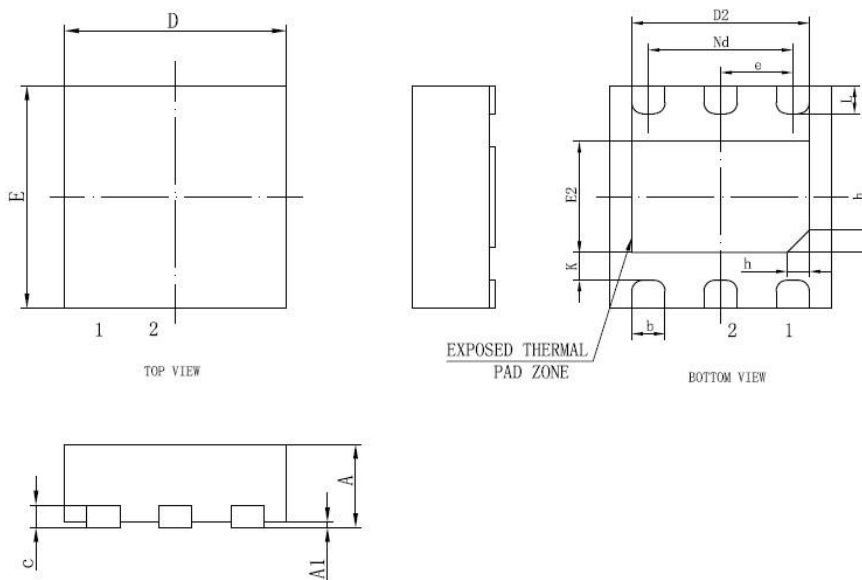
SOT23-6



Note

1. All dimensions are in mm
2. Dimensions marked with a parenthesis are reference dimensions

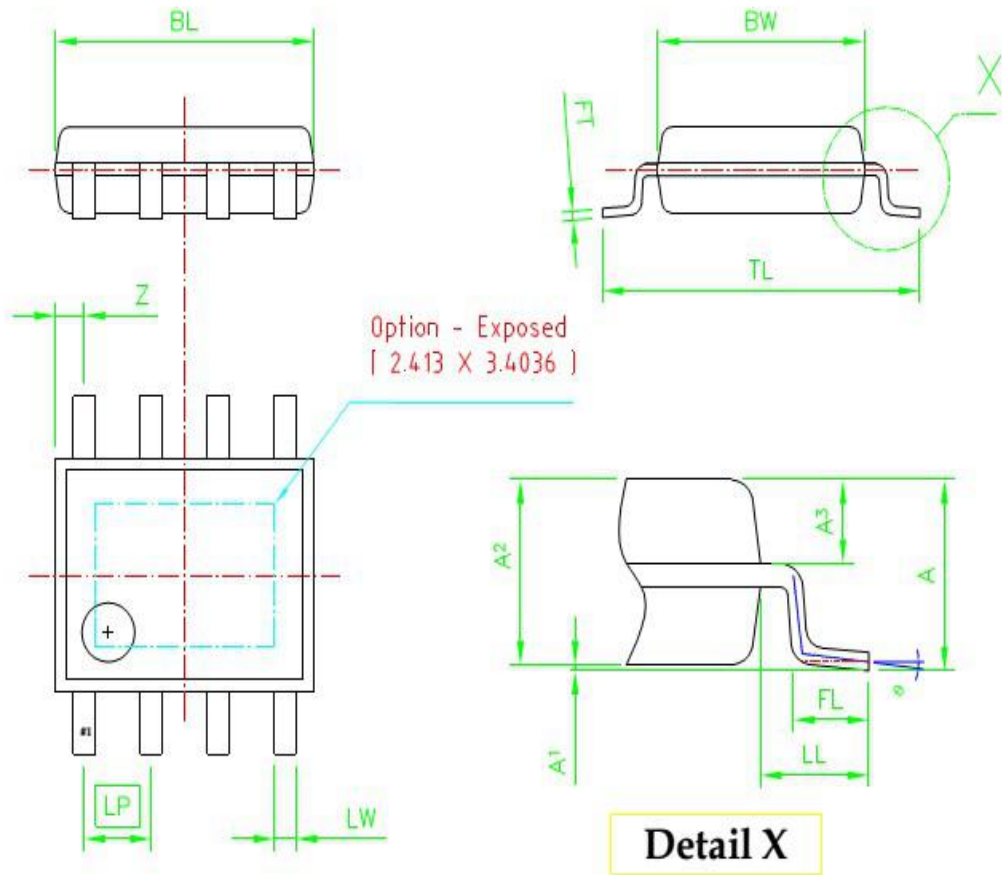
Figure [9.1] package dimension (SOT23-6)



| SYMBOL       | MILLIMETER |      |      |
|--------------|------------|------|------|
|              | MIN        | NOM  | MAX  |
| A            | 0.70       | 0.75 | 0.80 |
| A1           | 0          | 0.02 | 0.05 |
| b            | 0.25       | 0.30 | 0.35 |
| c            | 0.18       | 0.20 | 0.25 |
| D            | 1.90       | 2.00 | 2.10 |
| D2           | 1.50       | 1.60 | 1.70 |
| e            | 0.65BSC    |      |      |
| Nd           | 1.30BSC    |      |      |
| E            | 1.90       | 2.00 | 2.10 |
| E2           | 0.90       | 1.00 | 1.10 |
| K            | 0.20       | -    | -    |
| L            | 0.20       | 0.25 | 0.30 |
| h            | 0.15       | 0.20 | 0.25 |
| 尺寸规格尺寸 (MIL) | 69X47      |      |      |

Figure [9.2] package dimension (DFN6L)

8SOP



### Dimensions

| Unit | BL           | BW           | FT             | TL           | LP          | LW             | A <sub>max.</sub> | A1           | A2          | A3           | LL          | FL           | $\theta$ | Z    |
|------|--------------|--------------|----------------|--------------|-------------|----------------|-------------------|--------------|-------------|--------------|-------------|--------------|----------|------|
| mm   | 5.10<br>4.70 | 4.10<br>3.70 | 0.210<br>0.196 | 6.20<br>5.80 | 1.27<br>BSC | 0.432<br>0.381 | 1.75              | 0.05<br>0.25 | 1.45<br>BSC | 0.623<br>BSC | 1.05<br>BSC | 0.80<br>0.50 | 8<br>0   | 0.55 |

Figure [9.3] package dimension (8SOP)