# Modsemi ECC CryptoAuthentication Secure Elements

## Revision history

| Document version | Date of release | Description of changes |
|---|---|---|
| 1.34 | 2022-06-05 | |
| 1.33 | 2022-05-05 | |
| 1.32 | 2022-03-05 | Add Part numbering |
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| 1.00 | 2019-05-01 | Initial Version |
| 0.51 | 2017-03-19 | Draft Version |
| 0.50 | 2017-03-05 | Initial Version (Internal release) |

# MOD8ID

## Modsemi ECC CryptoAuthentication Secure Elements

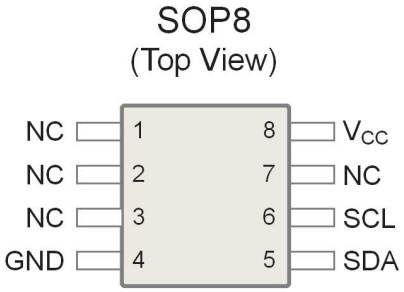
## Key features

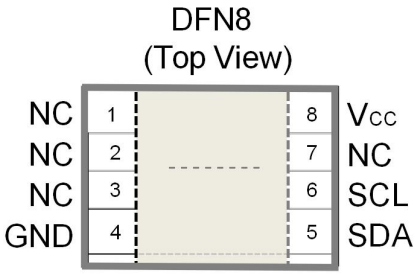
- Security co-processor with cryptographic algorithm and key storage
  - > High-end security controller
  - > Protected Storage for Keys, Certificates or Data
- Hardware Support for Asymmetric Sign,Verify,authentication,Key Agreement:
  - > Hardware cryptographic algorithm processor: SM2, ECC-P256, SHA-256, TRNG
  - > ECDSA: Elliptic Curve Digital Signature
  - > ECDH: Elliptic Curve Diffie-Hellman
  - > SM2: Diffie-Hellman Ephemeral (ECDHE) over the SM2 elliptic curve
- Hardware Support for Symmetric Algorithms:
  - > SHA-256 & HMAC
  - > SM4: Block-cipher symmetric algorithm Encrypt/Decrypt
  - > AES-128/256: Encrypt/Decrypt,AES-GCM/ECB/CBC
- Networking Key Management Support:
  - > security key generation and key agreement
  - > Communication data encryption with protected
  - > Turnkey PRF/HKDF calculation for TLS
- Security update and firmware Support:
  - > High security ECDSA firmware signature validation
  - > Full life cycle secure boot validation
  - > Firmware upgrade protection and data encryption protection
- Internal High-Quality NIST Standard Random Number Generator(RNG)
- Up to 5kB of user security storage to store extended security information
- Unique Serial Number
- High-Endurance Monotonic Counters
- Interface Options Available400k/1 MHz Standard I2C Interface
- Fast and easy integration
- DFN8 and SOP8 Packages

## Benefits

- IoT network endpoint key management & exchange/IoT Node Crypto-Protection
- Encryption protection and key protection of IoT nodes
- Protect the authenticity, integrity and confidentiality of your products, data and intellectual property
- Secure communication and communication data encryption
- Data storage protection
- Lifecycle management
- Platform integrity protection
- Security update and firmware protection
- Electronic accessories protection

## Description of PIN




| Pin | Function |
|---|---|
| GND | Ground |
| SDA | Serial Data |
| SCL | Serial Clock Input |
| $V_{CC}$ | Power Supply |
| NC | No Connect |

# Table of Contents

**Intended audience**

This Datasheet is intended for device integrators and board manufacturers.

# 1. Introduction

## 1.1 Introduction

The MOD8ID is a high-security authenticator that provides a core set of cryptographic accelerators derived from integrated asymmetric (ECC-P256/SM2) and symmetric (SHA-256/AES/SM4) security functions. In addition to the security services provided by the hardware implemented crypto engines,the device integrates a FIPS/NIST true random number generator (RNG), 5Kb of secured NVM,a decrement-only counter,The MOD8ID combine key storage with advanced hardware cryptographic accelerators to implement various authentication applications.

## 1.2 Features

The MOD8ID based on an advanced security controller with built-in tamper proof NVM for secure storage and Symmetric/Asymmetric crypto engines to support SM2, SM4,ECC 256 and AES/SHA-256. The MOD8ID includes an security NVM which can be used for storage keys, certificates and private data，security read/write, read-only or secret data, consumption logging, and security configurations.This new security technology greatly enhances your overall system security.

MO8ID has an I2C interface that supports secure communication, which can easily and fast integrate with host microcontroller software.

MOD8ID covers a broad range of use cases necessary for many types of security applications that include the following:：

- IoT node/edge computing node equipment
- Smart home
- Electronic Accessories
- Mobile devices
- Webcam
- smart Lock

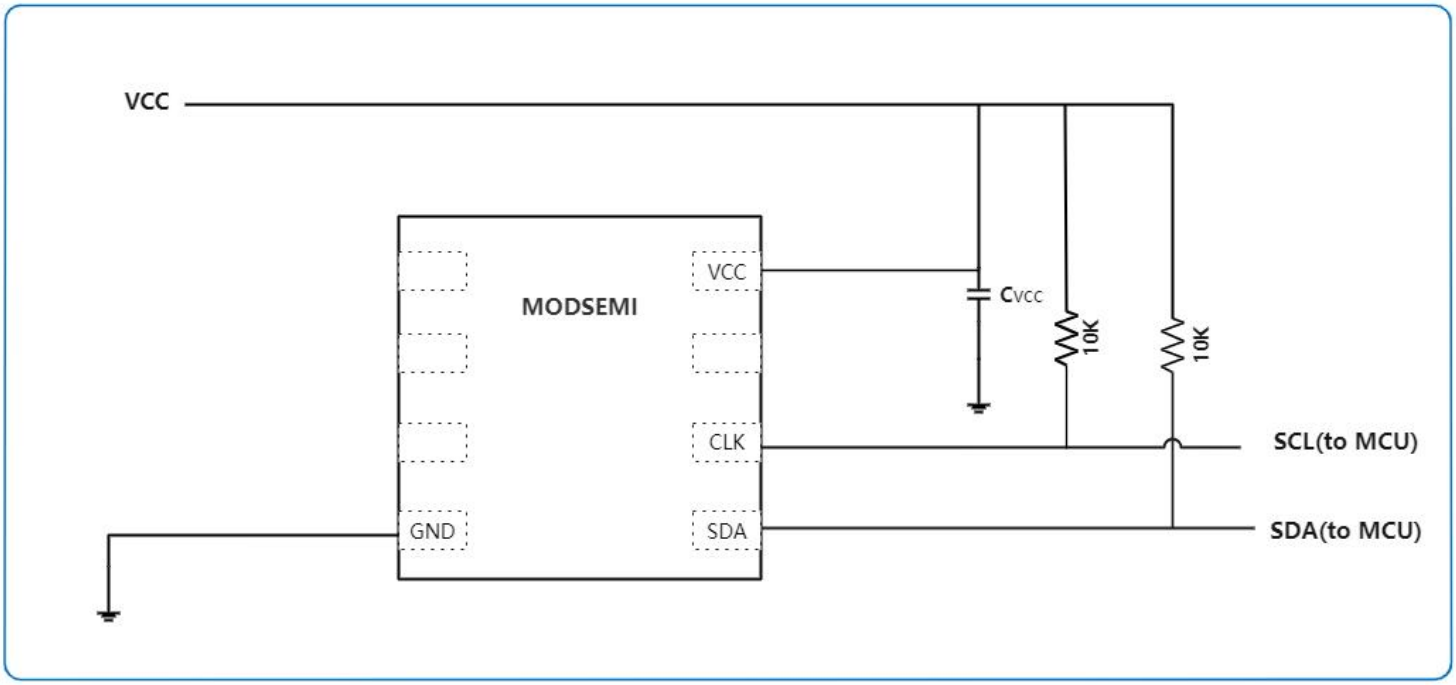
# 2. Interface and Schematics

This section explains the schematics of the product and gives some recommendations as to how the controller should be externally connected.

## 2.1 System Integration Schematics

The following figure illustrates how to integrate MOD8ID with your local host.

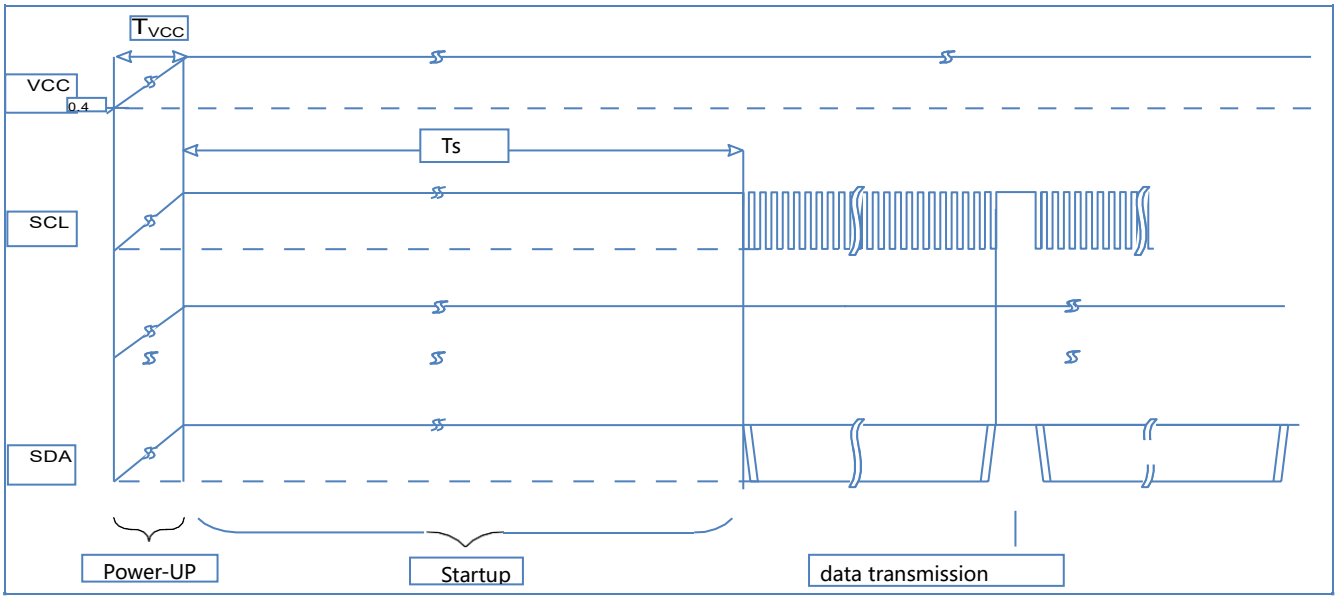
Figure 2 -1 System Integration Schematic Diagram




**Note:** Value of the pull up resistors and Cvcc depend on the target application circuit and the targeted I2C frequency.

## 2.2 interface timing

The following figure shows the startup timing of the I2C interface for this case




Interface timing

| Parameter | Symbol | Values | | | Unit | Note or Test Condition |
|---|---|---|---|---|---|---|
| | | Min | TYPE | MAX | | |
| Startup time | Ts | 25 | | | mS | Power up to the first command execution time |
| VCC power-up time | Tvcc | 0.1 | | 1 | mS | power-up time |

# 3. Electrical Characteristics

## 3.1 Absolute Maximum Ratings

| Parameter | Description | Min. | Max. | Units |
|---|---|---|---|---|
| TS | Storage Temperature | -55 | 125 | ℃ |
| TA | Operating Temperature | -40 | 85 | ℃ |
| VCC | Operating Voltage | 1.62 | 3.5 | V |
| VESD | Human Body Model(HBM) ESD | - | 4000 | V |

**Note:** Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions

beyond those indicated in the operational sections of this specification are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## 3.2 Reliability

The MOD8ID is fabricated with high reliability NVM manufacturing technology.

Table 3-1. FLASH Reliability

| Parameter | Min. | Typ. | Max. | Units |
|---|---|---|---|---|
| Write Endurance | 100,000 | — | — | Write Cycles |
| Data Retention | 10 | — | — | Years |
| Read Endurance | Unlimited | | | Read Cycles |

## 3.3 DC Parameters: All I/O Interfaces

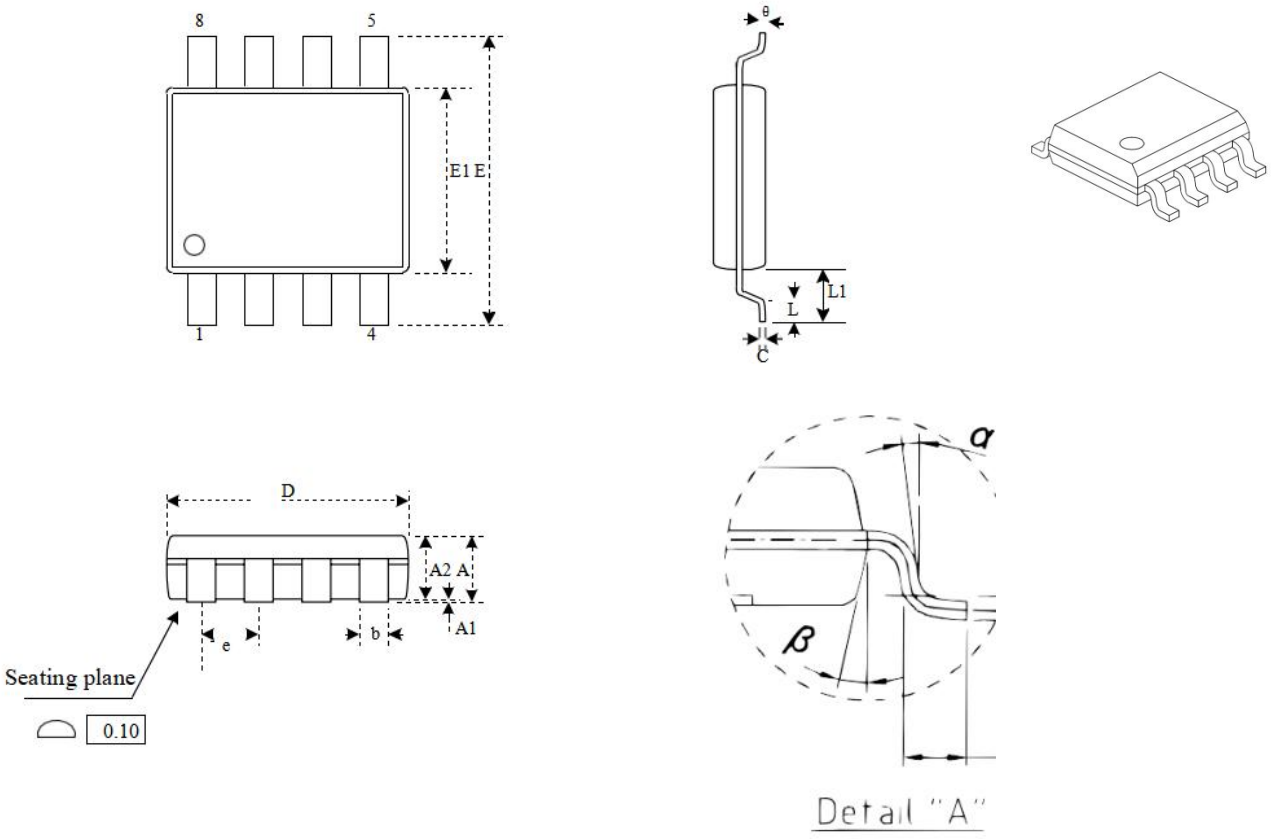
Table 3-2 DC Parameters on All I/O Interfaces

| Parameter | Condition | VCC | Min | Type | Max | Units |
|---|---|---|---|---|---|---|
| VIH | Input high voltage, all standard inputs and bidirectional ports | 3.3V | 2.0 | - | - | V |
| | | 1.8V | 1.2 | - | - | V |
| VIL | Input low voltage, all standard inputs and bidirectional ports | 3.3V | - | - | 0.8 | V |
| | | 1.8V | - | - | 0.6 | V |
| VOH | All standard inputs and bidirectional ports | 3.3V | VCC-0.4 | - | - | V |
| | | 1.8V | VCC-0.4 | - | - | V |
| VOL | Output low voltage, all standard inputs and two-way ports | 3.3V | - | - | 0.4 | V |
| | | 1.8V | - | - | 0.4 | V |
| IIL | IO pad force -0.2V @VDDIO=3.6V, IIL= -120~-70uA | | | | | |
| IIH | IO pad force 3.8V @VDDIO=3.6V, IIH = 8uA~16uA | | | | | |
| Icc | Waiting for I/O during I/O transfers or execution of non-ECC/SM2 commands. Independent of Clock Divider value. | 3.3V | - | 1.6 | - | mA |

# 4. Package Drawings

## 4.1 SOP8

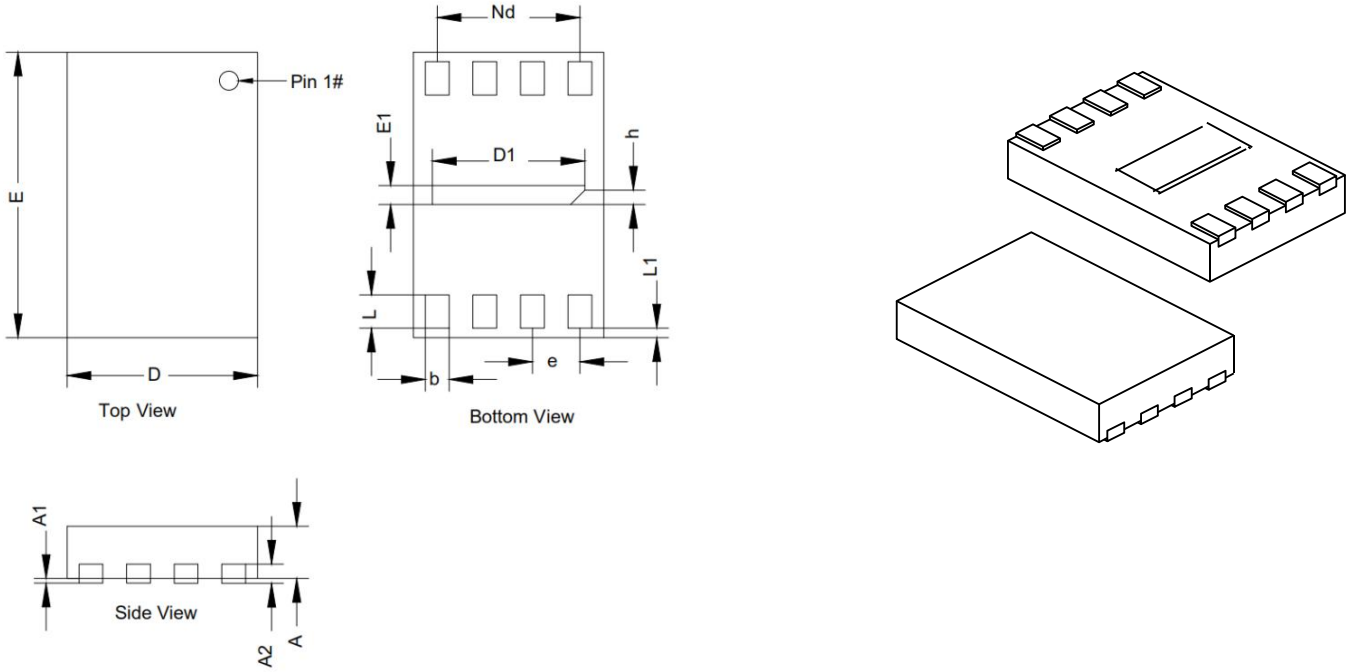
**Narrow, 3.90 mm (.150 In.) Body [SOP8]**




| COMMON DIMENSIONS (UNITS OF MEASURE=MILLIMETERS) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Symbol** / **Unit** | | **A** | **A1** | **A2** | **b** | **C** | **D** | **E** | **E1** | **e** | **L** | **L1** | **θ** | **α** | **β** |
| **mm** | **Min** | 1.35 | 0.05 | 1.35 | 0.31 | 0.15 | 4.77 | 5.80 | - | - | 0.40 | 0.85 | 0° | 6° | 11° |
| | **Nom** | - | - | - | - | - | 4.90 | 6.00 | 3.90 | 1.27 | - | 1.06 | - | 7° | 12° |
| | **Max** | 1.75 | 0.25 | 1.55 | 0.51 | 0.25 | 5.03 | 6.20 | - | - | 0.90 | 1.27 | 8° | 8° | 13° |
| **Inch** | **Min** | 0.053 | 0.002 | 0.053 | 0.012 | 0.006 | 0.188 | 0.228 | - | - | 0.016 | 0.033 | 0° | 6° | 11° |
| | **Nom** | - | - | - | 0.016 | - | 0.193 | 0.236 | 0.154 | 0.050 | - | 0.042 | - | 7° | 12° |
| | **Max** | 0.069 | 0.010 | 0.061 | 0.020 | 0.010 | 0.198 | 0.244 | - | - | 0.035 | 0.050 | 8° | 8° | 13° |

## 4.2 DFN8

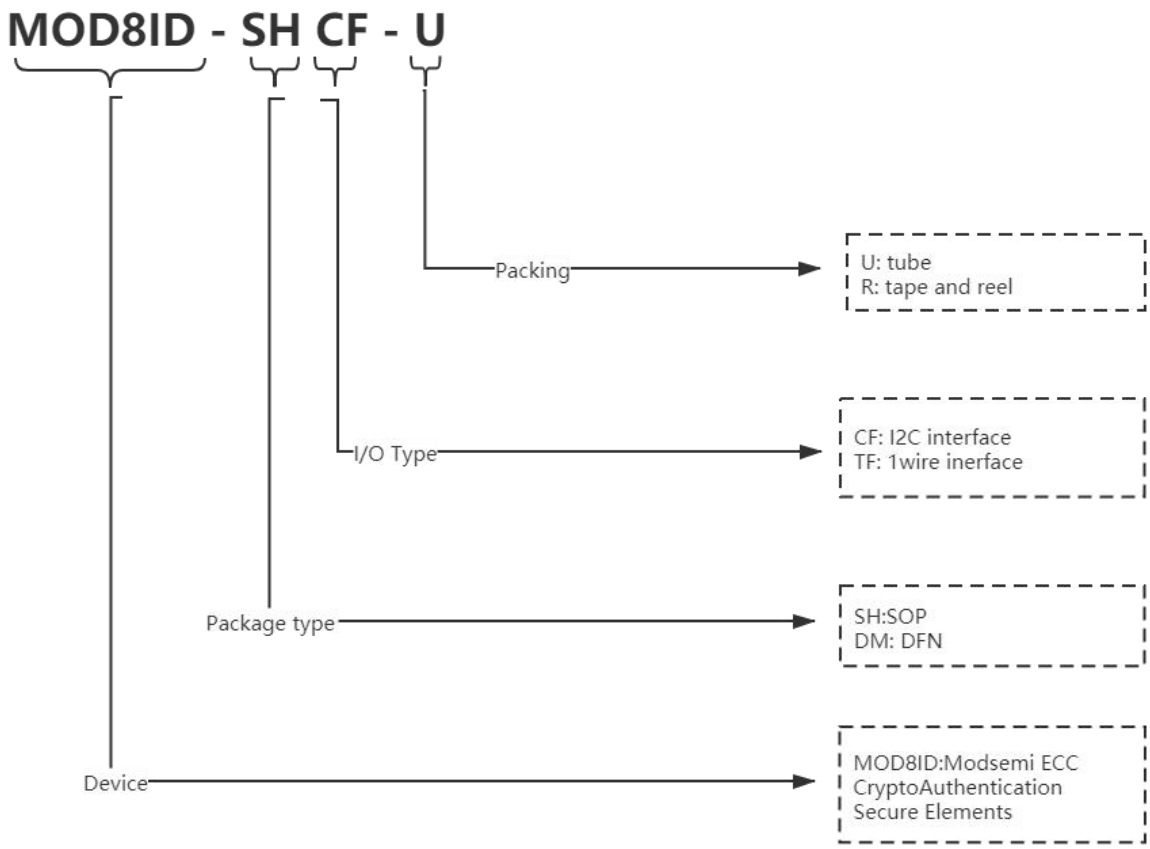
### 2x3mm body [DFN8]




| COMMON DIMENSIONS (UNITS OF MEASURE=MILLIMETERS) | | | |
|---|---|---|---|
| SYMBOL | MILLMETERS | | |
| | MIN | NOM | MAX |
| A | 0.50 | 0.55 | 0.60 |
| A1 | 0.00 | 0.02 | 0.05 |
| A2 | 0.152REF | | |
| b | 0.20 | 0.25 | 0.30 |
| D | 1.95 | 2.00 | 2.05 |
| E | 2.95 | 3.00 | 3.05 |
| D1 | 1.50 | 1.60 | 1.70 |
| E1 | 0.10 | 0.20 | 0.30 |
| e | 0.50BSC | | |
| Nd | 1.50BSC | | |
| L | 0.30 | 0.35 | 0.40 |
| L1 | 0.05 | 0.10 | 0.15 |
| h | 0.10 | 0.15 | 0.20 |

# 5. Part numbering

To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.




Examples:

- **MOD8ID-SHCF-U**: SOP8 (0.150” Wide Body), $I^2C$, Tube
- **MOD8ID-DMCF-R**: DFN(2 x 3 x 0.6 mm Body), $I^2C$, Type and Reel

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