



SQ7101/SQ7103

Brief Datasheet V1.7

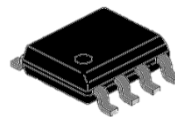
No. : TDDS01-S7101-EN(B)	Name : SQ7101/SQ7103 Brief Datasheet	Version : V1.7
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SQ7101/SQ7103 , Secure ASIC, AES-128/AES-256, SHA-256,TRNG

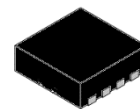
◆ Basic Information

- Operating Voltage : 2.0V ~ 5.5V
- Operating Temperature : -40°C ~ 85°C

Package Type



SOP8



8Lead-DFN(3x3)

◆ Communication

- SQ7101 support I2C interface (max. 400Ksps)
- SQ7103 support SPI interface (max. 5MHz)

◆ High-Security Features

- AES-128/AES-256
- SHA-256
- True Random Number Generator (TRNG)
- Inclosure Intrusion Protection
- Simple/Differential Power Analysis (SPA/DPA)
- Individual Internal Clock to Prevent Glitch Attack
- 128-bit Unique ID
- NIST CAVP Certification

◆ Support Sixteen 128-bit , or Eight 256-bit keys

◆ 256 Bytes User Data

◆ 768 Bytes Small Zone

◆ Sixteen Monotonic Counters, Protect replay and man in the middle attack

◆ Low Power

- Deep Sleep Current 250nA

◆ Applications

- Accessory Authentication
- System Anti-Clone
- Security Smart Lock
- Session Key Exchange
- Chain of Trust
- Device Authentication
- Sensitive Data Protection and Encryption
- Firmware Protection

No. : TDDS01-S7101-EN(B)	Name : SQ7101/SQ7103 Brief Datasheet	Version : V1.7
--------------------------	--------------------------------------	----------------

Content

1. PIN ASSIGNMENT/ DESCRIPTION.....	4
1.1 SQ7101 ASSIGNMENT / DESCRIPTION.....	4
1.2 SQ7103 ASSIGNMENT/ DESCRIPTION.....	5
2. ELECTONIC CHARACTERISTICS.....	6
2.1 ABSOLUTE MAXIMUM RATINGS.....	6
2.2 OPERATION CONDITIONS.....	7
2.2.1 Operation Conditions.....	7
2.2.2 I/O Characteristics.....	7
2.3 DC CHARACTERISTICS.....	8
2.4 POWER-ON RESET CHARACTERISTICS.....	9
2.5 BROR CHARATERISTICS.....	10
2.6 AC CHARACTERISTICS.....	11
2.6.1 AC Parameters.....	11
2.6.2 I2C Characteristics.....	12
2.6.3 SPI Characteristics.....	13
2.7 EEPROM CHARACTERISTICS.....	15
APPENDIX A. PACKAGE INFORMATION.....	16
REVISION HISTORY.....	18

No. : TDDS01-S7101-EN(B)	Name : SQ7101/SQ7103 Brief Datasheet	Version : V1.7
--------------------------	--------------------------------------	----------------

1. Pin Assignment/ Description

1.1 SQ7101 Assignment / Description

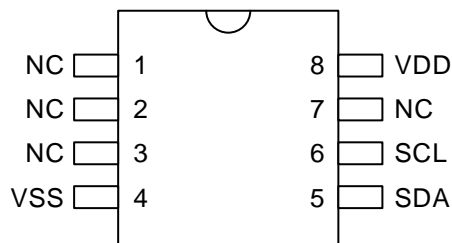


Figure 1-1 Pin Assignment of SQ7101 SOP8

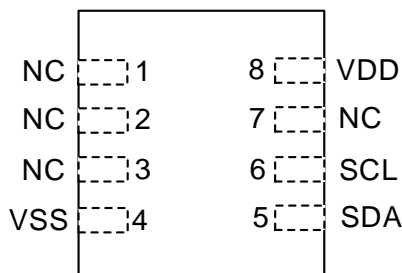


Figure 1-2 Pin Assignment of SQ7101 8L-DFN

Pin No.	Pin Name/Pin Option	I/O Type	Function Description
1	NC	-	No Connect
2	NC	-	No Connect
3	NC	-	No Connect
4	VSS	GND	Ground
5	SDA	I/O	SDA, I2C bus data input/output
6	SCL	I	SCL, I2C bus clock input/output
7	NC	-	No Connect
8	VDD	Power	Positive Power Supply

No. : TDDS01-S7101-EN(B)	Name : SQ7101/SQ7103 Brief Datasheet	Version : V1.7
--------------------------	--------------------------------------	----------------

1.2 SQ7103 Assignment/ Description

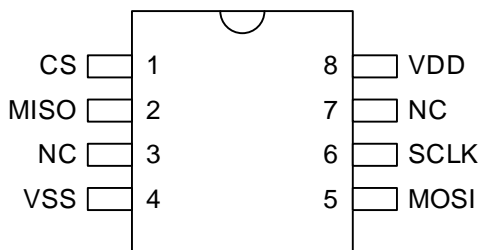


Figure 1-3 Pin Assignment of SQ7103 SOP8

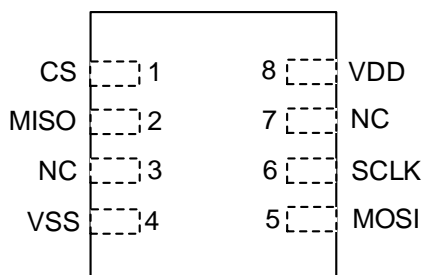


Figure 1-4 Pin Assignment of SQ7103 8L-DFN

Pin No.	Pin Name/Pin Option	I/O Type	Function Description
1	CS	I	SPI, Chip Select
2	MISO	O	SPI, Master In Slave Out
3	NC	-	No Connect
4	VSS	GND	Ground
5	MOSI	I	SPI, Master Out Slave In
6	SCLK	I	SPI, SPI Clock
7	NC	-	No Connect
8	VDD	Power	Positive Power Supply

No. : TDDS01-S7101-EN(B)	Name : SQ7101/SQ7103 Brief Datasheet	Version : V1.7
--------------------------	--------------------------------------	----------------

2. Electronic Characteristics

2.1 Absolute Maximum Ratings

The absolute maximum ratings are rated values which must not be exceeded during operation, even for an instant. Any one of the ratings must not be exceeded. If any absolute maximum rating is exceeded, a device may break down or its performance may be degraded, causing it to catch fire or explode resulting in injury to the user. Thus, when designing products which include this device, ensure that no absolute maximum rating value will ever be exceeded

($V_{SS} = 0V$)

Parameter	Symbol	Pins	Ratings	Unit
Supply Voltage	V_{DD}		-0.3 to 6.0	V
Input Voltage	V_{IN}	All I/O pins	-0.3 to $V_{DD}+0.3V$	V
Output Current (total)	I_{OL}	All I/O pins	50	mA
Storage Temperature	T_{STG}		-50 to 125	°C

No. : TDDS01-S7101-EN(B)	Name : SQ7101/SQ7103 Brief Datasheet	Version : V1.7
--------------------------	--------------------------------------	----------------

2.2 Operation Conditions

The following defines the electrical characteristics of the device when it is operated at voltage and temperature maximum/minimum values. Unless otherwise stated, the standard conditions were determined at "operating temperature 25 °C and operating voltage VDD = 3.3 V".

2.2.1 Operation Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	V _{DD}	2.0	3.3	5.5	V
Operating Temperatures	T _a	-40	25	85	°C

2.2.2 I/O Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input Low Voltage	V _{IL}		0		0.3 VDD	V
Input High Voltage	V _{IH}		0.7 VDD		VDD	V
Output Low Voltage	V _{OL}	I _{OL} = 3 mA	0		0.1VDD	V
Output High Voltage	V _{OH}	I _{OH} = -3 mA	0.9VDD		VDD	V

No. : TDDS01-S7101-EN(B)	Name : SQ7101/SQ7103 Brief Datasheet	Version : V1.7
--------------------------	--------------------------------------	----------------

2.3 DC Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Operation Mode	I _{DD_N1}		3		mA
Deep Sleep Mode	I _{DD_DS}		250		nA

No. : TDDS01-S7101-EN(B)	Name : SQ7101/SQ7103 Brief Datasheet	Version : V1.7
--------------------------	--------------------------------------	----------------

2.4 Power-on Reset Characteristics

Ta=40~85°C					
Symbol	Description	Min	Typ	Max	Unit
tPPW	Power-on reset minimum pulse width	1	-	-	ms
tPWUP	Warming-up time after a reset is clear and CPU ready	-	4	-	ms
tVDD	Power supply rise time	0.5	-	5	ms

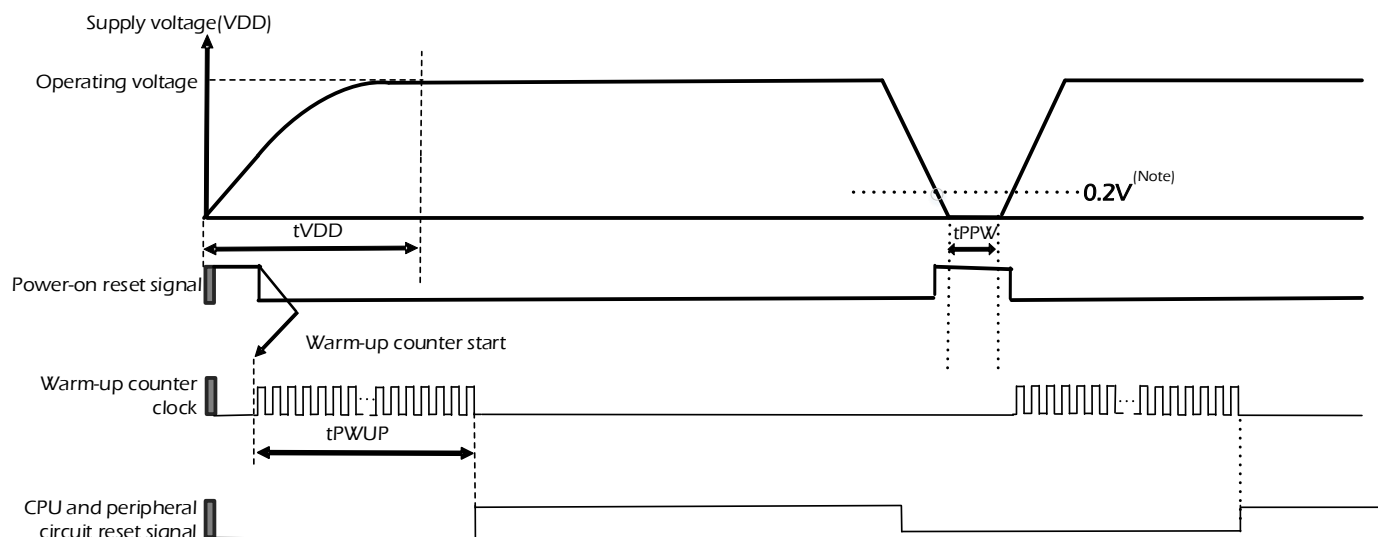


FIGURE 2- 1 OPERATION TIMING OF POWER-ON RESET

Note : In power-down process, the VDD must be 0.2V, then re-power-on to ensure the IC operating normal.

No. : TDDS01-S7101-EN(B)	Name : SQ7101/SQ7103 Brief Datasheet	Version : V1.7
--------------------------	--------------------------------------	----------------

2.5 BROR Charateristics

Ta=40~85°C						
Parameter	Symbol	Condition	Min	Typ	Max	Unit
BROR detect voltage	VBROR_Rising	VDD rise time and fall time > tVDD (tVDD please refer to CH2.4 Power-on Reset Characteristics)	1.95	2.0	2.05	V
	VBROR_Falling		1.85	1.90	1.95	V

No. : TDDS01-S7101-EN(B)	Name : SQ7101/SQ7103 Brief Datasheet	Version : V1.7
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2.6 AC Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
User Data Write Cycle Time (Note)	TWC ₁	6.0	-	9.0	mS
128-bit Key Write Cycle Time (Note)	TWC ₂	6.0		9.0	mS

Note: Writer cycle time is including data update.

2.6.1 AC Parameters

Parameter	Symbol	Min	Typ	Max	Unit
Power-Up Ready Time	T _{PU_RDY}		1200 ^(Note1)	1500	μS
Standby Time, Entering the deep sleep mode	T _{STB}		55	90	μS
Wake-Up Ready Time, deep sleep mode	T _{WDS_RDY}		300	-	μS

Note1: Power-Up Ready Time does not include the executing time for BOOTROM code. The BOOTROM code executing time is around 10ms.

Note2: The typ. value is under perating temperature 25 °C and operating voltage VDD = 3.3 V".

No. : TDDS01-S7101-EN(B)	Name : SQ7101/SQ7103 Brief Datasheet	Version : V1.7
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2.6.2 I2C Characteristics

Parameter	Symbol	Min	Max	Unit
Clock Frequency	f_{SCL}	0	400	kHz
Hold Time Repeated START Condition	$t_{HD;STA}$	0.6	-	us
Low Period of SCL Clock	t_{LOW}	1.3	-	us
High Period of SCL Clock	t_{HIGH}	0.6	-	us
Setup Time for a Repeated START Condition	$t_{SU;STA}$	0.6	-	us
Data Hold Time	$t_{HD;DAT}$	0	0.8	us
Data Setup Time)	$t_{SU;DAT}$	0.1	-	us
Rise time of both SDA and SCL	t_r	20	300	ns
Fall Time of Both SDA and SCL)	t_f	20	300	ns
Setup Time of STOP Condition	$t_{SU;STO}$	0.6	-	us
Bus Free Time between a STOP and START Condition	t_{BUF}	1.3	-	us
Capacitive Load for Each Bus line)	C_b	-	400	pF

Note: Guaranteed by characteristic, not tested in production.

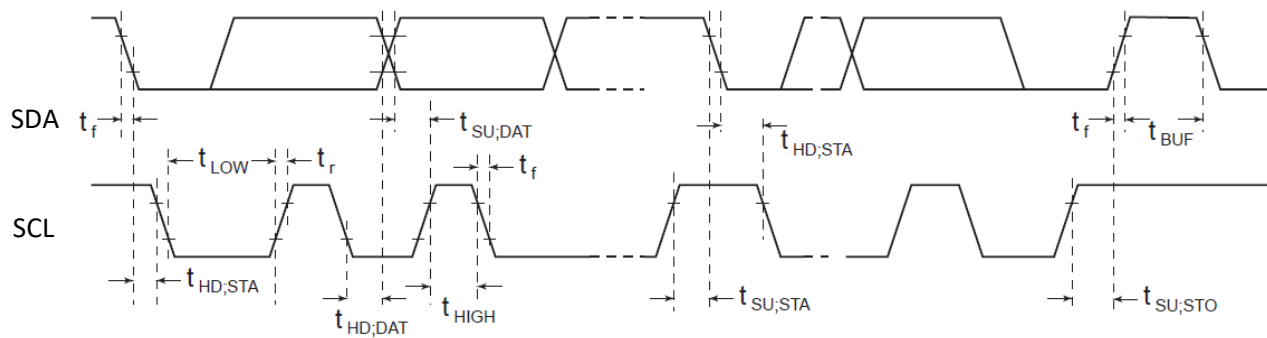


Figure 2-2 I2C Timing Sequence

No. : TDDS01-S7101-EN(B)	Name : SQ7101/SQ7103 Brief Datasheet	Version : V1.7
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2.6.3 SPI Characteristics

Parameter	Symbol	Min	Max	Unit
SPI Frequency	f_{SPI}		5	MHz
SPI Period	t_{SPI}	200		ns
High period of the SCLK pin	t_{CLKH}	90		ns
Low period of the SCLK pin	t_{CLKL}	90		ns
From SPICS active to first edge	t_{CS_SU}	40		ns
From last SCLK edge to SPICS inactive	t_{CS_HD}	40		ns
Time between SPI transaction	t_{CS_WA}	1		us
Data Input Setup Time	t_{SI_SU}	10		ns
Data Input Hold time	t_{SI_HD}	10		ns
Data Output Valid Time	t_{SO_VD}		80	ns
Data Output Hold Time	t_{SO_HD}	0		ns

Table 2-2 SPI AC Characteristics

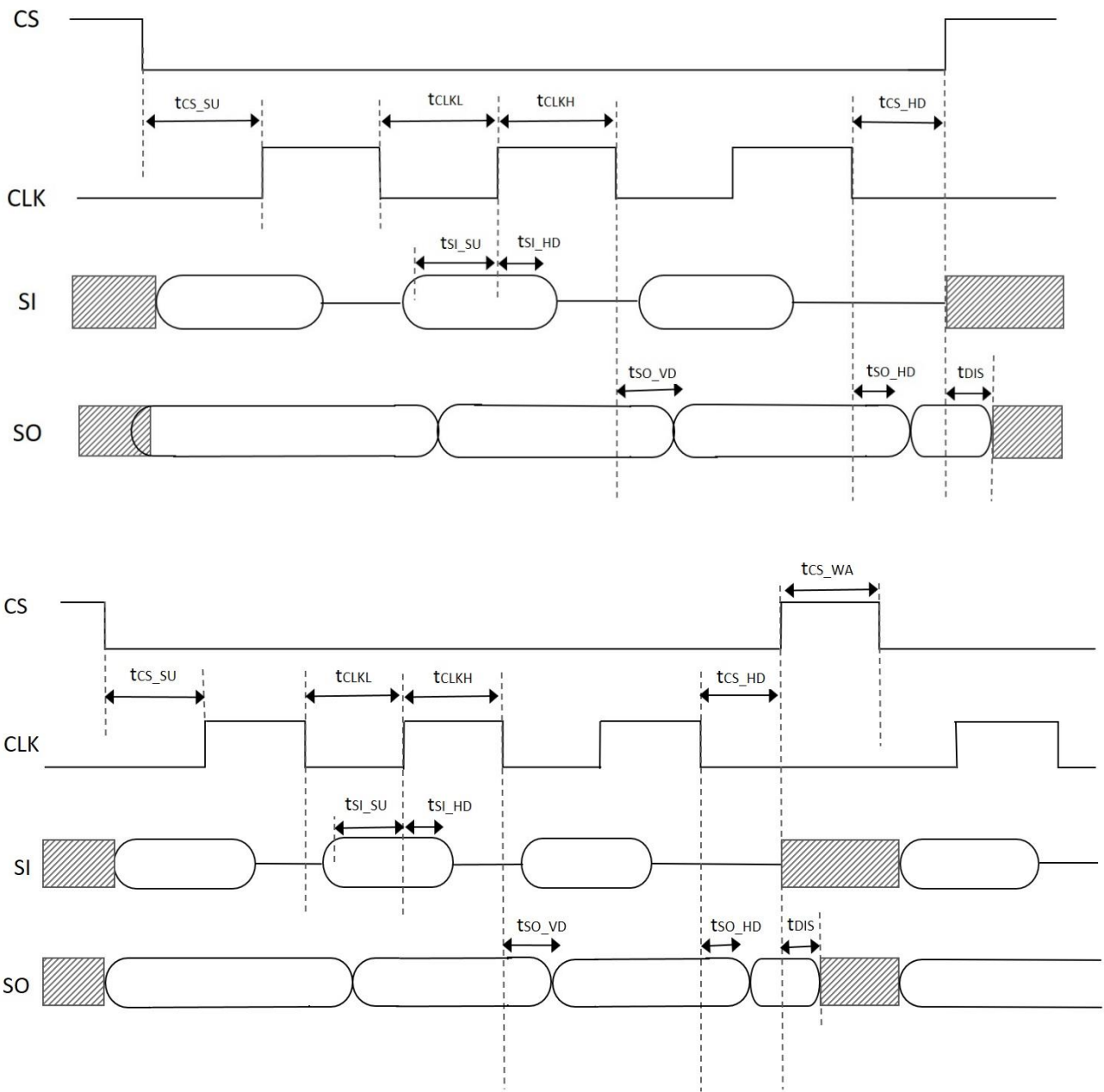


Figure 2-3 SPI Sequence

No. : TDDS01-S7101-EN(B)	Name : SQ7101/SQ7103 Brief Datasheet	Version : V1.7
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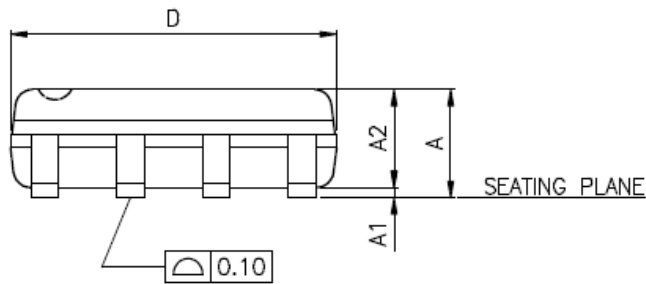
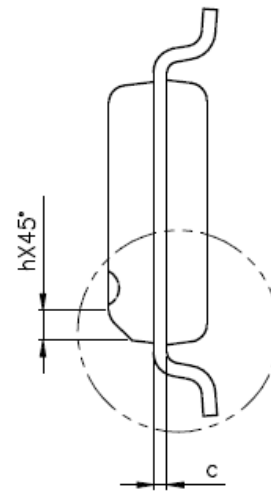
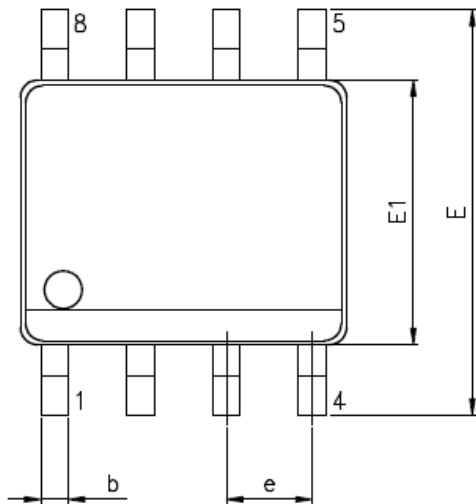
2.7 EEPROM Characteristics

Parameter	Min	Typ	Max	Unit
Write Endurance (Sector Endurance)	100,000	-	-	Cycles
Data Retention(at 25°C)	100	-	-	Years
Data Retention(at 85°C)	20	-	-	Years

No. : TDDS01-S7101-EN(B)	Name : SQ7101/SQ7103 Brief Datasheet	Version : V1.7
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Appendix A. Package Information

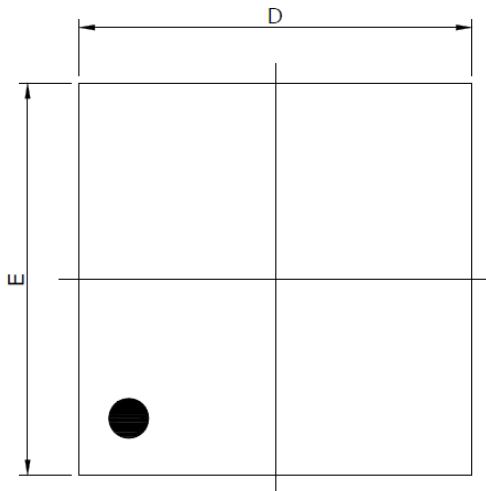
SOP8



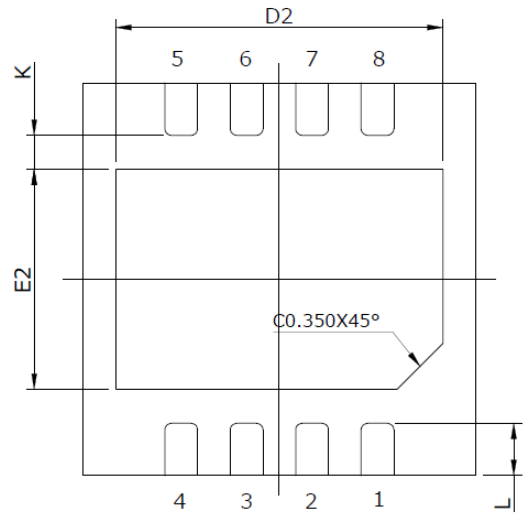
Symbol	Mm		
	Min	Normal	Max.
A	-	-	1.75
A1	0.10	-	0.25
A2	1.25	-	-
b	0.31	-	0.51
c	0.10	-	0.25
D	4.90 BSC		
E	6.00 BSC		
E1	3.90 BSC		
e	1.27 BSC		
L	0.40	-	1.27
L1	1.00 REF		
h	0.25	-	0.50
θ	0°	-	8°

No. : TDDS01-S7101-EN(B)	Name : SQ7101/SQ7103 Brief Datasheet	Version : V1.7
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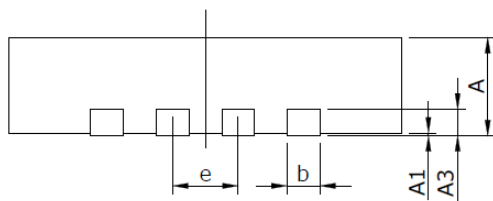
8L DFN (3x3)



TOP VIEW



BOTTOM VIEW



Symbol	Mm		
	Min		Min
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A3	0.203 REF.		
b	0.20	0.25	0.30
D	2.90	3.00	3.10
E	2.90	3.00	3.10
e	0.50 BSC		
L	0.35	0.40	0.45
D2	2.45	2.50	2.55
E2	1.63	1.68	1.73
K	0.20	-	-

No. : TDDS01-S7101-EN(B)	Name : SQ7101/SQ7103 Brief Datasheet	Version : V1.7
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Revision History

Version	Approved Date	Description
V1.7	2023/4/20	<ol style="list-style-type: none"> Operating voltage change to 2.0~5.5V, modify "2.1 Absolute Maximum Ratings." And "2.2.1 Operation Conditions." Update "figure 2-1 Operation Timing of power-on reset" and add note. "2.6.1 AC Parameters "add note"Power-Up Ready Time does not include the executing time for BOOTROM code. The BOOTROM code executing time is around 10ms. "3.6.2 I2C Characteristics " update the figure of $t_{HD, DAT}$ Add SDA and SCL to "figure 2-2 I2C Timing Sequence."
V1.6	2023/3/30	1.Modify "CH Power-on Reset Characteristics"
V1.5	2022/7/21	<ol style="list-style-type: none"> Modify the description of small zone Add package type "8L DFN 3x3 " to "1.1 pin assignment/description" and "Appendix A
V1.4	2021/12/29	<ol style="list-style-type: none"> Modify "2.4 Power-on Reset Characteristics" Add " CH2.5. BROR Characteristics"
V1.3	2021/6/24	<ol style="list-style-type: none"> Solve DecRead issue that Param2 of command is not matched with FirstBlock.Param2. Add : "4.2 SQ7103 Pin Assignment/ Description Add : "5.4.3 SPI Characteristics" Add " CH5.5 EEPROM Characteristics" description. Add " CH 7.1 Command Introduction" description. Add "CH 7.3.13 INFO Command "selector for CountStatus. Renew "CH7.3.25 SHA Input Parameters" Mode Add "Appendix A. Package Information"