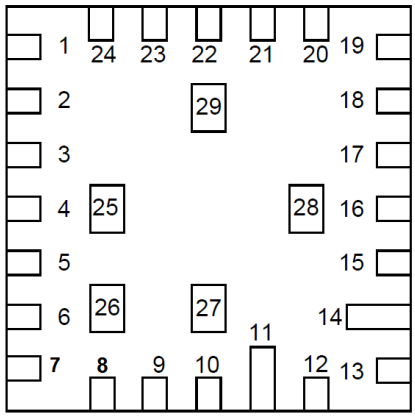
General Description

Renesas SLG7RN46111 is a low power and small form device. The SoC is housed in a 3mm x 3mm MSTQFN package which is optimal for using with small devices.

Features

- Low Power Consumption
- Pb - Free / RoHS Compliant
- Halogen - Free
- MSTQFN - 29 Package

Pin Configuration

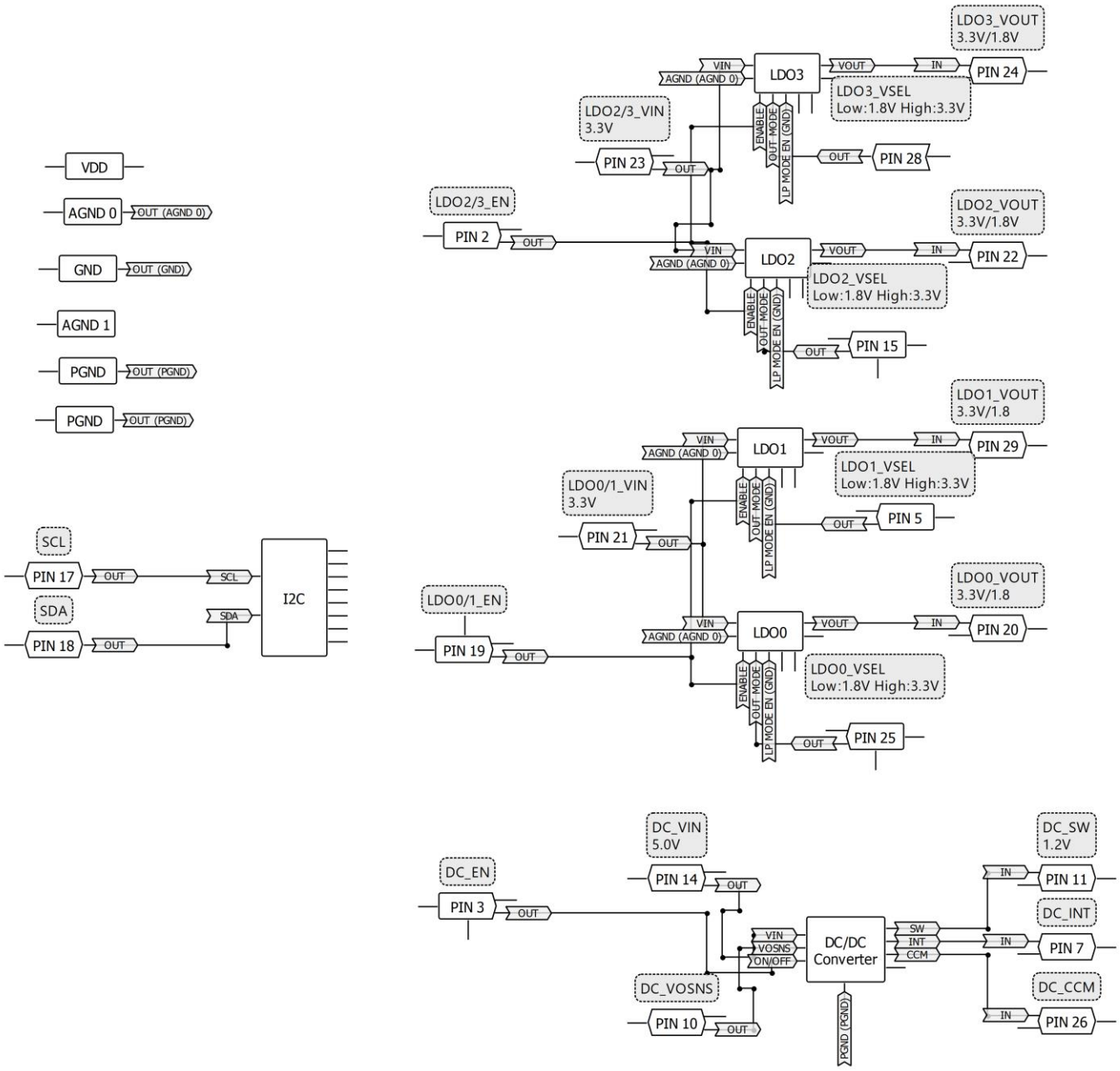


MSTQFN-29 (Top View)

Pin name

Pin #	Pin name	Pin #	Pin name
1	AGND	16	VDD
2	LDO2/3_EN	17	SCL
3	DC_EN	18	SDA
4	GND	19	LDO0/1_EN
5	LDO1_VSEL Low:1.8V High:3.3V	20	LDO0_VOUT 3.3V/1.8
6	AGND	21	LDO0/1_VIN 3.3V
7	DC_INT	22	LDO2_VOUT 3.3V/1.8V
8	NC	23	LDO2/3_VIN 3.3V
9	NC	24	LDO3_VOUT 3.3V/1.8V
10	DC_VOSNS	25	LDO0_VSEL Low:1.8V High:3.3V
11	DC_SW 1.2V	26	DC_CCM
12	PGND	27	NC
13	PGND	28	LDO3_VSEL Low:1.8V High:3.3V
14	DC_VIN 5.0V	29	LDO1_VOUT 3.3V/1.8
15	LDO2_VSEL Low:1.8V High:3.3V		

Block Diagram



Pin Configuration

Pin #	Pin Name	Type	Pin Description	Internal Resistor
1	AGND	AGND	Ground	--
2	LDO2/3_EN	Digital Input	Low Voltage Digital Input	1MΩ pulldown
3	DC_EN	Digital Input	Low Voltage Digital Input	1MΩ pulldown
4	GND	GND	Ground	--
5	LDO1_VSEL Low:1.8V High:3.3V	Digital Input	Low Voltage Digital Input	1MΩ pulldown
6	AGND	AGND	Ground	--
7	DC_INT	Analog Input/Output	DC INT Analog Input/Output	floating
8	NC	--	Keep Floating or Connect to GND	--
9	NC	--	Keep Floating or Connect to GND	--
10	DC_VOSNS	Analog Input/Output	DC VOSNS Analog Input/Output	floating
11	DC_SW 1.2V	Analog Input/Output	DC SW Analog Input/Output	floating
12	PGND	PGND	Ground	--
13	PGND	PGND	Ground	--
14	DC_VIN 5.0V	Analog Input/Output	DC VIN Analog Input/Output	floating
15	LDO2_VSEL Low:1.8V High:3.3V	Digital Input	Low Voltage Digital Input	1MΩ pulldown
16	VDD	PWR	Supply Voltage	--
17	SCL	Digital Input	Low Voltage Digital Input	floating
18	SDA	Digital Input	Low Voltage Digital Input	floating
19	LDO0/1_EN	Digital Input	Low Voltage Digital Input	1MΩ pulldown
20	LDO0_VOUT 3.3V/1.8	Analog Input/Output	LDO0 VOUT Analog Output	floating
21	LDO0/1_VIN 3.3V	Analog Input/Output	LDO0/1 VIN Analog Input	floating
22	LDO2_VOUT 3.3V/1.8V	Analog Input/Output	LDO2 VOUT Analog Output	floating
23	LDO2/3_VIN 3.3V	Analog Input/Output	LDO2/3 VIN Analog Input	floating
24	LDO3_VOUT 3.3V/1.8V	Analog Input/Output	LDO3 VOUT Analog Output	floating
25	LDO0_VSEL Low:1.8V High:3.3V	Digital Input	Low Voltage Digital Input	1MΩ pulldown
26	DC_CCM	Analog Input/Output	DC CCM Analog Input/Output	floating
27	NC	--	Keep Floating or Connect to GND	--
28	LDO3_VSEL Low:1.8V High:3.3V	Digital Input	Low Voltage Digital Input	1MΩ pulldown
29	LDO1_VOUT 3.3V/1.8	Analog Input/Output	LDO1 VOUT Analog Output	floating

Ordering Information

Part Number	Package Type
SLG7RN46111M	29-pin MSTQFN
SLG7RN46111MTR	29-pin MSTQFN - Tape and Reel (3k units)

Absolute Maximum Conditions

Parameter	Min.	Max.	Unit
Supply Voltage on VDD relative to GND	-0.3	7	V
DC Input Voltage	GND - 0.5V	VDD + 0.5V	V
Current at Input Pin	-1.0	1.0	mA
Input leakage (Absolute Value)	--	1000	nA
Storage Temperature Range	-65	150	°C
Junction Temperature	--	150	°C
ESD Protection (Human Body Model)	2000	--	V
ESD Protection (Charged Device Model)	1300	--	V
Moisture Sensitivity Level	1		

Electrical Characteristics

Symbol	Parameter	Condition/Note	Min.	Typ.	Max.	Unit
V_{DD}	Supply Voltage (Note 2)		3.3	5	5.5	V
T_A	Operating Temperature		15	25	30	°C
C_{VDD}	Capacitor Value at VDD		--	0.1	--	µF
C_{IN}	Input Capacitance		--	4	--	pF
I_Q	Quiescent Current	Static inputs and floating outputs	--	17	--	µA
V_O	Maximal Voltage Applied to any PIN in High-Impedance State		--	--	VDD+0.3	V
I_{VDD}	Maximum Average or DC Current Through VDD Pin (Per chip side, see Note 2)	T_J = 85°C	--	--	73	mA
		T_J = 110°C	--	--	35	mA
I_{GND}	Maximum Average or DC Current Through GND Pin (Per chip side, see Note 2)	T_J = 85°C	--	--	152	mA
		T_J = 110°C	--	--	72	mA
V_{IH}	HIGH-Level Input Voltage	Low-Level Logic Input	1.25	--	VDD+0.3	V
V_{IL}	LOW-Level Input Voltage	Low-Level Logic Input	GND-0.3	--	0.5	V
R_{PULL_DOWN}	Internal Pull Down Resistance	Pull down on PINs 2, 3, 5, 15, 19, 25, 28	--	1	--	MΩ
T_{SU}	Startup Time	From VDD rising past PON_{THR}	--	1.3	--	ms
PON_{THR}	Power On Threshold	V_{DD} Level Required to Start Up the Chip	1.34	1.55	1.74	V
$POFF_{THR}$	Power Off Threshold	V_{DD} Level Required to Switch Off the Chip	1.05	1.25	1.45	V

Note:
1. DC or average current through any pin should not exceed value given in Absolute Maximum Conditions.
2. The GreenPAK's power rails are divided in two sides. PINs 2, 5, 15, 19, 25 and 28 are connected to one side, PINs 3, 17 and 18 to another.
3. Guaranteed by Design.

I²C Specifications

Symbol	Parameter	Condition/Note	Min.	Typ.	Max.	Unit
F_{SCL}	Clock Frequency, SCL	V_{DD} = (2.3...5.5) V	--	--	400	kHz
t_{LOW}	Clock Pulse Width Low	V_{DD} = (2.3...5.5) V	1300	--	--	ns
t_{HIGH}	Clock Pulse Width High	V_{DD} = (2.3...5.5) V	600	--	--	ns

t_I	Input Filter Spike Suppression (SCL, SDA)	V_{DD} = 3.3V ± 10%	--	--	95	ns
		V_{DD} = 5.0V ± 10%	--	--	111	ns
t_{AA}	Clock Low to Data Out Valid	V_{DD} = (2.3...5.5) V	--	--	900	ns
t_{BUF}	Bus Free Time between Stop and Start	V_{DD} = (2.3...5.5) V	1300	--	--	ns
t_{HD_STA}	Start Hold Time	V_{DD} = (2.3...5.5) V	600	--	--	ns
t_{SU_STA}	Start Set-up Time	V_{DD} = (2.3...5.5) V	600	--	--	ns
t_{HD_DAT}	Data Hold Time	V_{DD} = (2.3...5.5) V	0	--	--	ns
t_{SU_DAT}	Data Set-up Time	V_{DD} = (2.3...5.5) V	100	--	--	ns
t_R	Inputs Rise Time	V_{DD} = (2.3...5.5) V	--	--	300	ns
t_F	Inputs Fall Time	V_{DD} = (2.3...5.5) V	--	--	300	ns
t_{SU_STO}	Stop Set-up Time	V_{DD} = (2.3...5.5) V	600	--	--	ns
t_{DH}	Data Out Hold Time	V_{DD} = (2.3...5.5) V	50	--	--	ns

DC/DC Converter Electrical Specifications

Symbol	Parameter	Condition/Note	Min.	Typ.	Max.	Unit
Typical values are at T_A = 25°C						
V_{IN}	Operating Input Voltage		2.7	--	5.5	V
I_{DD}	Power Supply Current	when OFF	--	0.17	--	µA
		when ON, No load	--	79	--	µA
V_{OUT}	Output Voltage	sel_vo [2:0] = 000; V_{IN} = 2.7 to 5.5 V	1.16	1.20	1.24	V
		sel_vo [2:0] = 001; V_{IN} = 2.7 to 5.5 V	1.46	1.50	1.55	V
		sel_vo [2:0] = 010; V_{IN} = 2.7 to 5.5 V	1.75	1.80	1.85	V
		sel_vo [2:0] = 011; V_{IN} = 3.0 to 5.5 V	1.94	2.50	2.06	V
		sel_vo [2:0] = 100; V_{IN} = 3.5 to 5.5 V	2.53	3.00	2.58	V
		sel_vo [2:0] = 101; V_{IN} = 3.8 to 5.5 V	3.20	3.30	3.40	V
V_{RIPPLE}	Output Voltage Ripple	V_{IN}=3.3V; V_{OUT}=1.2V; in CCM Mode	--	10	--	mV
RDS_{ON_P}	HS Switch ON Resistance		--	90	--	mΩ
RDS_{ON_N}	LS Switch ON Resistance		--	51	--	mΩ
I_{LIMIT}	Current Limit Threshold	Default sel_ocp<1:0> = 00	--	2.5	--	A
η_{EF}	Efficiency	V_{IN}=5V, V_{OUT}=1.2V; I_{LOAD}=0.5A; Temp=27˚C, f_{SW}=1.5MHz; Inductor DCR=10mΩ	--	88	--	%
f_{SW}	Switching Frequency	Default sel_fsw<1:0> = 00	--	1.5	--	MHz
		Default sel_fsw<1:0> = 01	--	2	--	MHz
T_{Total_ON}	Total Turn-on Time from Enable to DC_VOUT		--	0.6	--	ms
T_{SS}	Soft Start Time		--	0.5	--	ms
DC_{MAX}	Maximum Duty Cycle	V_{OUT}=3.3V, f_{SW}=1.5MHz	--	85	--	%
		V_{OUT}=3.3V, f_{SW}=2.0MHz	--	80	--	%
DC_{MIN}	Minimum Duty Cycle		--	20	--	%
$I_{SW(LKG)}$	SW Leakage Current	Set on/off=0, V_{IN}=5.5V, V_{SW}=0V and 5.5V	--	0	--	µA

$T_{INT(Low)}$	INT De-assertion Time	V_{IN}=3.3V, Temp=27˚C	--	60	--	ns
$T_{INT(High)}$	INT Assertion Time	V_{IN}=3.3V, Temp=27˚C	--	2	--	µs
$V_{UVLO(TH)}$	Undervoltage Lockout Threshold Voltage	Low to High Transition	TBD	TBD	TBD	V
		High to Low Transition	TBD	TBD	TBD	V
$THERM_{ON}$	Thermal Protection Restart Threshold		--	125	--	˚C
$THERM_{OFF}$	Thermal Protection Shutdown Threshold		--	100	--	˚C

Note:
1. INT Interrupt is an open-drain output.Logic high level becomes asserted within $T_{INT(HIGH)}$ when an over-current condition has been detected. After the over-current event no longer persist the INT becomes de-asserted after $T_{INT(LOW)}$.
2.CCM - Continuous Conduction Mode Indicator Output. CCM is an open-drain digital output that becomes Low when the load is high and the converter switches to the continuous conduction mode (CCM). The CCM output continues to toggle when the converter is in non-CCM mode. Customers might use LP filter to convert the toggling signal to a DC signal, and based on DC level to identify the converter operation mode.

Chip address

HEX	BIN	DEC
0x28	0101000	40

I2C Description

1. I2C Basic Command Structure

Each command to the I2C Serial Communications block begins with a Control Byte. The bits inside this Control Byte are shown in Figure 1. After the Start bit, the first four bits are a control code, which can be set by the user in reg<1867:1864>. The Block Address is the next three bits (A10, A9, A8), which will define the most significant bits in the addressing of the data to be read (“1”) or written (“0”) by the command. This Control Byte will be followed by an Acknowledge bit (ACK).

With the exception of the Current Address Read command, all commands will have the Control Byte followed by the Word Address. The Word Address, in conjunction with the three address bits in the Control Byte, will define the specific data byte to be read or written in the command. Figure 1 shows this basic command structure.

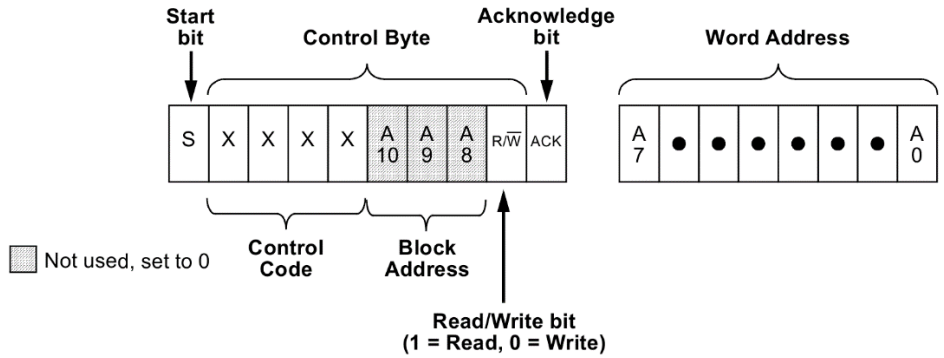


Figure1. I2C Basic Command Structure

2. I2C Serial General Timing

Shown in Figure 2 is the general timing characteristics for the I2C Serial Communications block.

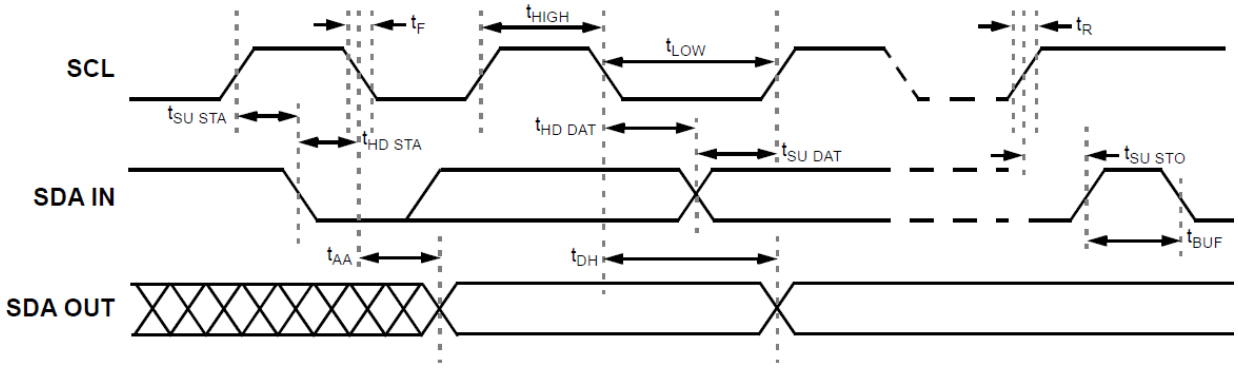


Figure2. I2C Serial General Timing

3. I2C Serial Communications: Read and Write Commands

Following the Start condition from the master, the Control Code [4 bits], the block address [3 bits] and the R/W bit (set to “0”), is placed onto the bus by the Bus Master. After the I2C Serial Communications block has provided an Acknowledge bit (ACK) the next byte transmitted by the master is the Word Address. The Block Address is the next three bits, and is the higher order addressing bits (A10, A9, A8), which when added to the Word Address will together set the internal address pointer in the SLG7RN46111 to the correct data byte to be written. After the SLG7RN46111 sends another Acknowledge bit, the Bus Master will transmit the data byte to be written into the addressed memory location. The SLG7RN46111 again provides an Acknowledge bit and then the Bus Master generates a Stop condition. The internal write cycle for the data will take place at the time that the SLG7RN46111 generates the Acknowledge bit.

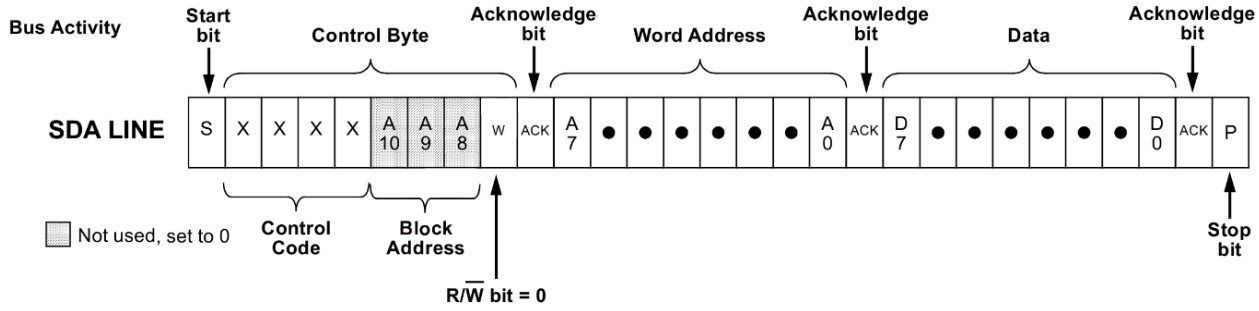


Figure3. I2C Write Command

The Random Read command starts with a Control Byte (with R/$\overline{W}$ bit set to “0”, indicating a write command) and Word Address to set the internal byte address, followed by a Start bit, and then the Control Byte for the read (exactly the same as the Byte Write command). The Start bit in the middle of the command will halt the decoding of a Write command, but will set the internal address counter in preparation for the second half of the command. After the Start bit, the Bus Master issues a second control byte with the R/$\overline{W}$ bit set to “1”, after which the SLG7RN46111 issues an Acknowledge bit, followed by the requested eight data bits.

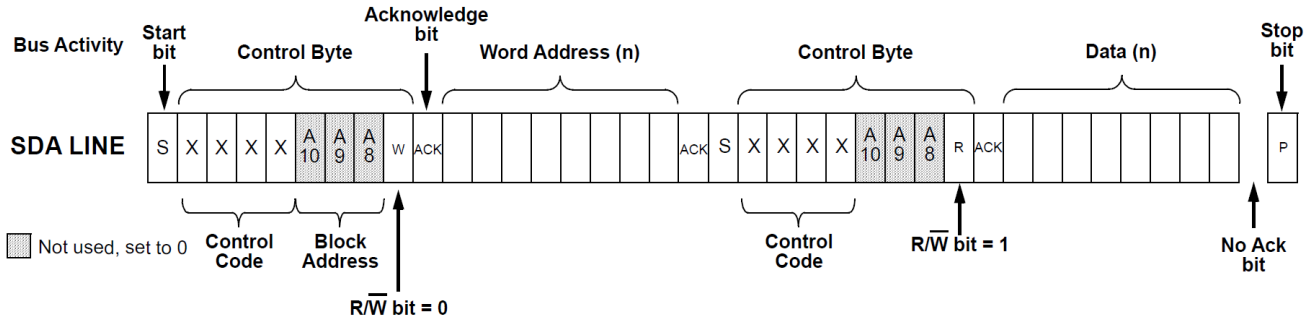
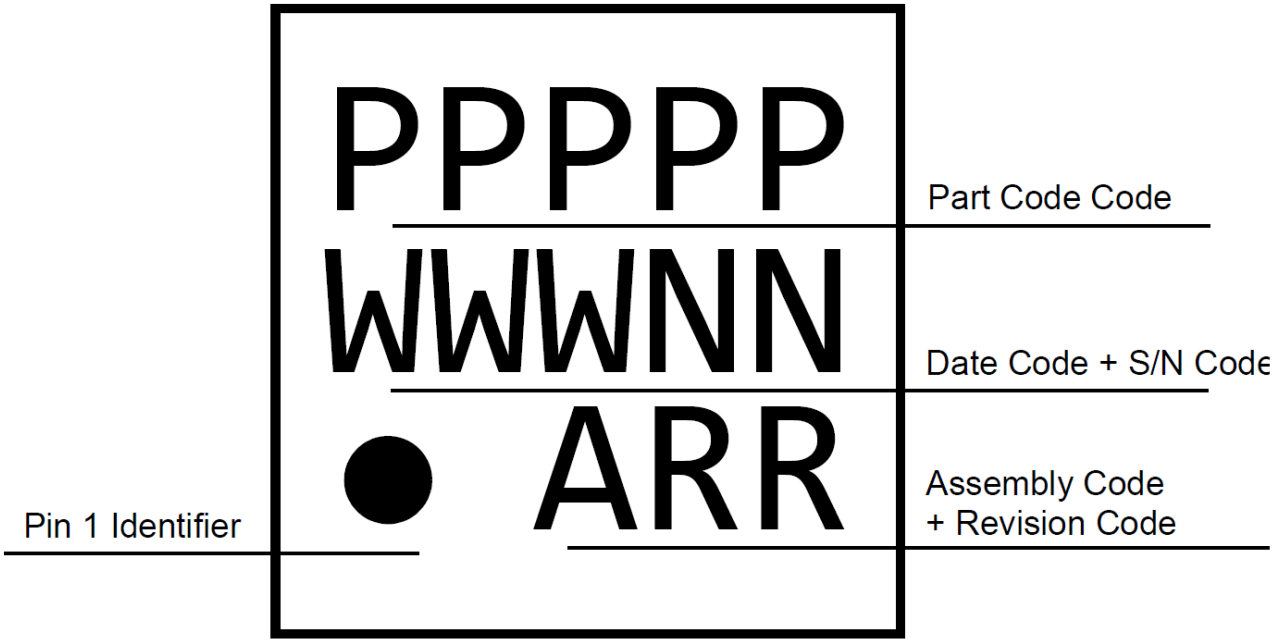


Figure4. I2C Random Read Command

Package Top Marking



Datasheet Revision	Programming Code Number	Lock Status	Checksum	Part Code	Revision	Date
0.13	002	U	0xF127BEF0	46111	AB	03/17/2023

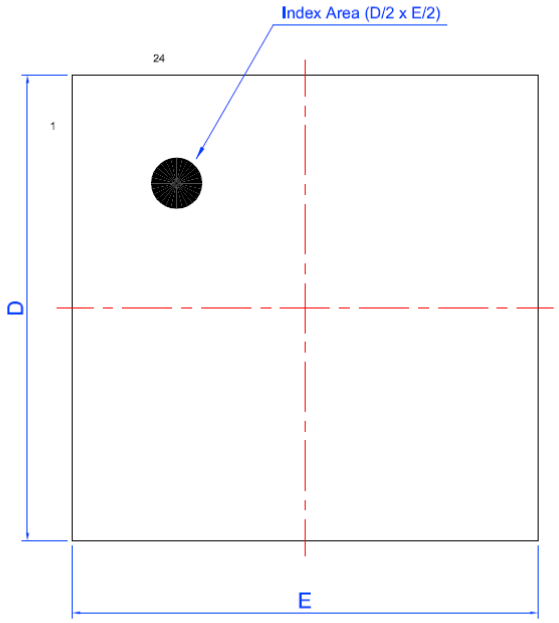
Lock coverage for this part is indicated by √, from one of the following options:

√	Unlocked
	Locked for read, bits <1535:0>
	Locked for write, bits <1535:0>
	Locked for write all bits
	Locked for read and write bits <1535:0>
	Locked for read bits <1535:0> and write of all bits

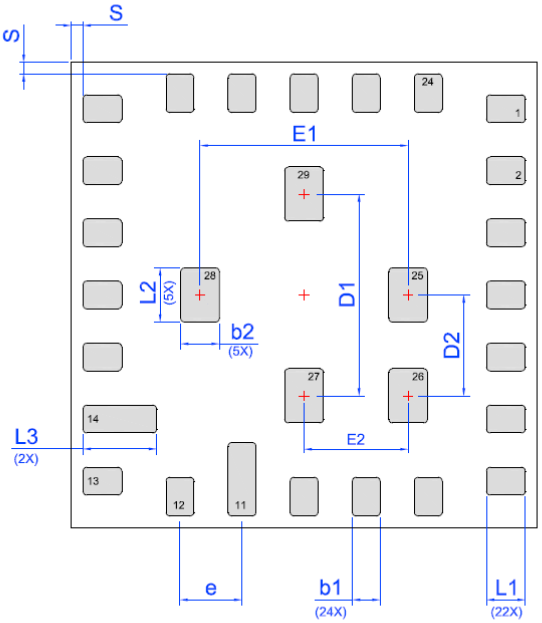
The IC security bit is locked/set for code security for production unless otherwise specified. The Programming Code Number is not changed based on the choice of locked vs. unlocked status.

Package Drawing and Dimensions

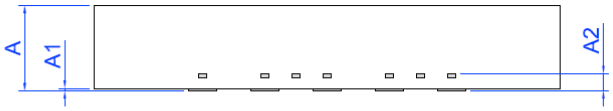
MSTQFN 29L 3x3mm 0.4P FC Package
JEDEC MO-220, Variation WECE



Laser Marking View



BTM View



Side View

UNIT: mm

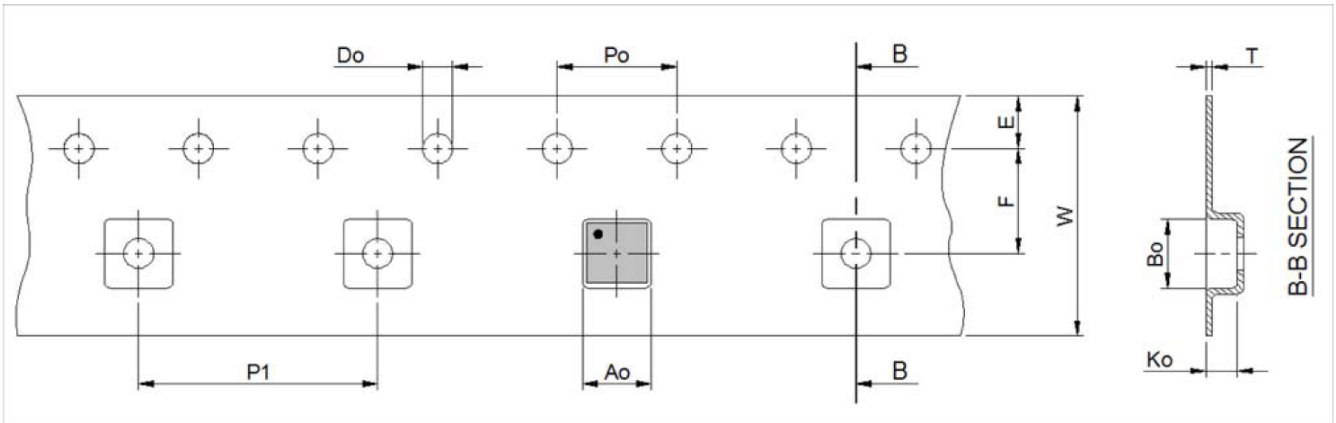
Symbol	Min	Nom.	Max	Symbol	Min	Nom.	Max
A	0.50	0.55	0.60	D	2.95	3.00	3.05
A1	0.00	-	0.01	E	2.95	3.00	3.05
A2	0.11 REF			e	0.40 BSC		
b1	0.13	0.18	0.23	L1	0.20	0.25	0.30
b2	0.20	0.25	0.30	L2	0.30	0.35	0.40
S	0.075 REF			L3	0.425	0.475	0.525
D1	1.30 BSC			E1	1.34 BSC		
D2	0.65 BSC			E2	0.67 BSC		

Tape and Reel Specification

Package Type	# of Pins	Nominal Package Size [mm]	Max Units		Reel & Hub Size [mm]	Leader (min)		Trailer (min)		Tape Width [mm]	Part Pitch [mm]
			per Reel	per Box		Pockets	Length [mm]	Pockets	Length [mm]		
MSTQFN 29L 3x3mm 0.4P FC Green	29	3 x 3 x 0.55	5000	10000	330 / 100	42	336	42	336	12	8

Carrier Tape Drawing and Dimensions

Package Type	Pocket BTM Length	Pocket BTM Width	Pocket Depth	Index Hole Pitch	Pocket Pitch	Index Hole Diameter	Index Hole to Tape Edge	Index Hole to Pocket Center	Tape Width	Tape Thickness
	A0	B0	K0	P0	P1	D0	E	F	W	T
MSTQFN 29L 3x3mm 0.4P FC Green	3.3	3.3	0.8	4	8	1.55	1.75	5.5	12	0.3



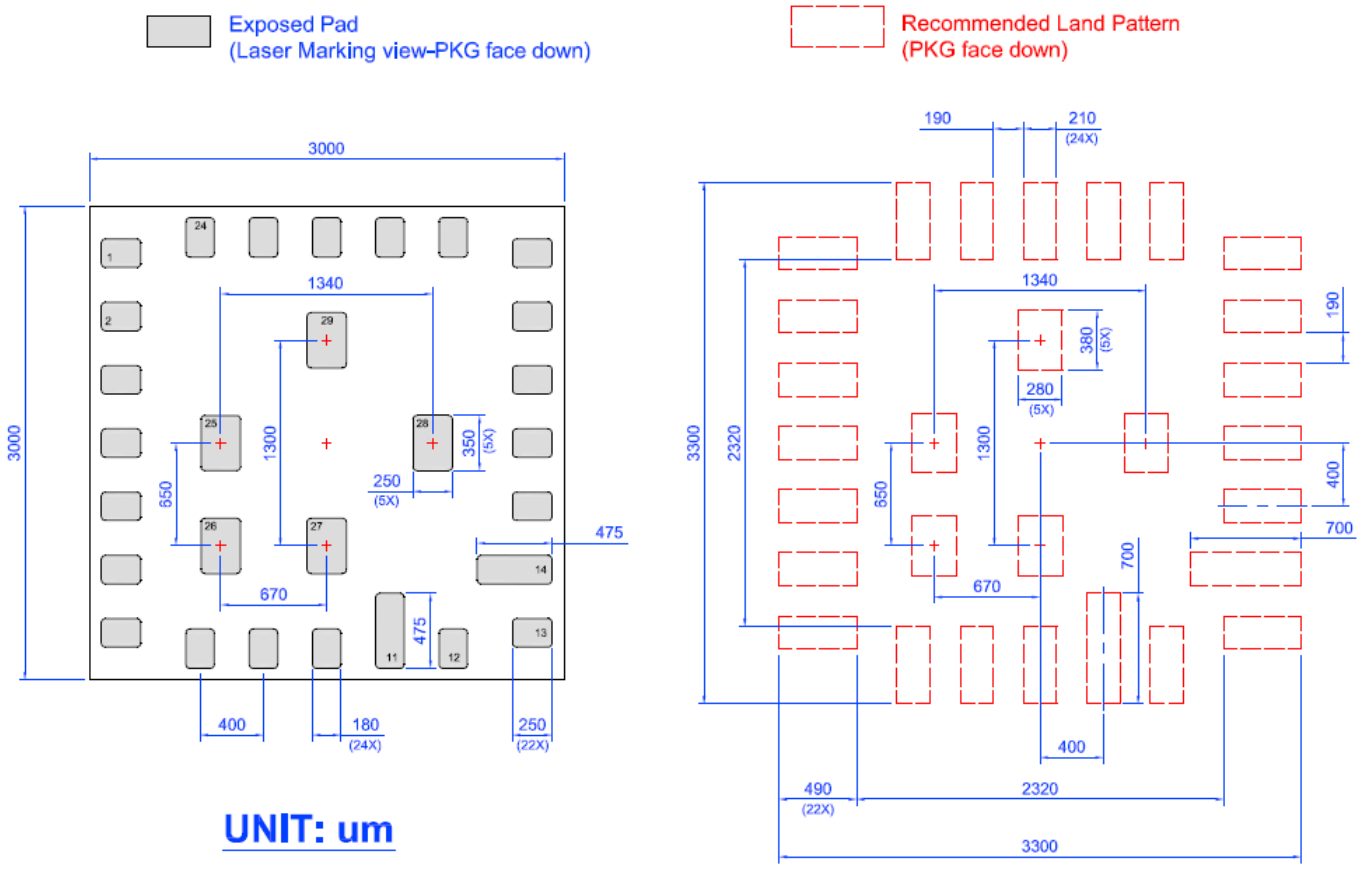
Note: Orientation in carrier: Pin1 is at upper left corner (Quadrant 1).

Refer to EIA-481 specification

Recommended Reflow Soldering Profile

Please see IPC/JEDEC J-STD-020: latest revision for reflow profile based on package volume of 3.3 mm^3 (nominal). More information can be found at www.jedec.org.

Recommended Land Pattern



UNIT: um

Datasheet Revision History

Date	Version	Change
10/28/2022	0.10	New design for SLG46585M chip
11/04/2022	0.11	Updated Device Revision Table
12/01/2022	0.12	Change the Pin name
12/01/2022	0.12	Change the Pin name
03/17/2023	0.13	Updated Device Revision Table

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