

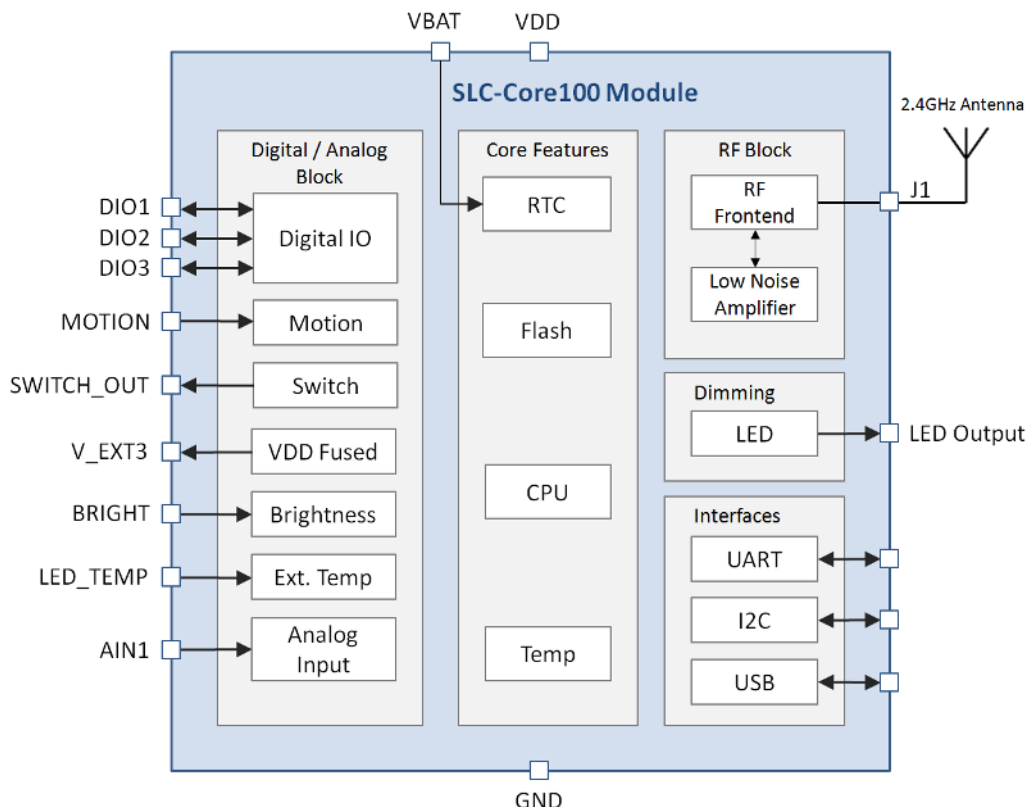
Intelligent Street Light Module

Features

- Fully configurable dim profiles by time, weekdays and/or sensor inputs
- Automatically organizing wireless mesh network
- AES encrypted wireless communication
- Wirelessly configurable and updateable
- Automatic adjustment of daylight and standard saving time
- synchronization (date/time master)
- Automatic wireless distribution of date/time
- Support for most used industry standard dimming interface types (Analog, PWM and Dali)
- Optional sensor support such as motion detector, radar, twilight sensor and LED temperature
- Integrated temperature sensor
- Energy usage determination
- Configurable distribution of twilight sensor and motion detection values
- Support for active monitoring and protection of LED temperature
- Configurable LED luminous flux compensation over lifetime (LFC)
- Custom sensors and extensions support
- Easy to use software for on-site configuration and controlling
- Optional integration into a web based management and control application with on-site gateway devices



Hardware block diagram



Connection Diagram

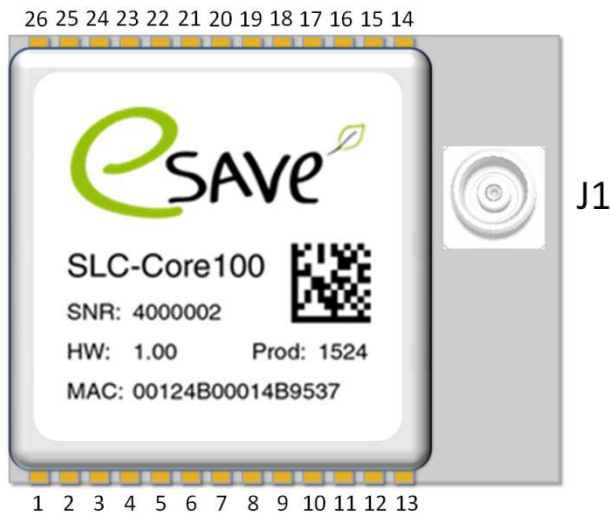


Table 1: Module Pin out

Pin #	Name	I/O	Description
1	GND		Ground
2	VBAT	I	This is a power-supply pin for RTC Optional connect a large-capacity capacitor or an external battery
3	RESET	O	Reset output for external Modules like GPS
4	AIN1	I	Analog Input
5	UART RX	I	UART Input (not supported in current firmware)
6	UART TX	O/I	UART Output (not supported in current firmware) / DALI Input signal
7	BRIGHT	I	Brightness sensor (Twilight)
8	LED_OUTPUT	O	LED Module Output PWM (Analog with low-pass filter)
9	LED_TEMP	I	LED Temperature signal
10	SWITCH_OUT	O	Extension Switch output
11	EXTINT GPS	O	EXTINT signal, only used in combination with an external GPS Module
12	V_EXT3	O	Extension power supply (+3.2V)
13	VDD		Power Supply Pin (+3.2V)
14	GND		Ground
15	VDD		Power Supply Pin (+3.2V)
16	I2C SDA	I/O	I2C data (SLC-Core100 is I2C master with integrated pull-up resistors)
17	I2C SCL	I/O	I2C clock (SLC-Core100 is I2C master with integrated pull-up resistors)
18			Reserved (don't connect this pin, or high impedance)
19			Reserved (don't connect this pin, or high impedance)
20	USB P		USB P (not supported in current firmware)
21	USB N		USB N (not supported in current firmware)
22	MOTION	I	Motion sensor signal input
23	DIO1	I/O	Digital Input/Output 1
24	DIO2	I/O	Digital Input/Output 2
25	DIO3	I/O	Digital Input/Output 3
26	GND		Ground

Table 2: J1 Connector

Designator	Name	Description
J1	MCX Connector	Antenna Connector 50 Ohm

Sensor and Extensions

Motion Detector

The SLC-Core100 modules can optionally be equipped with a motion detector sensor, such as PIR (Passive Infrared) or radar sensors. For reliable operation, please use only sensors supplied or approved by esave ag.

Use the following pins to connect the PIR sensor:

- Pin 22 = Motion detector Signal (MOTION)
- Pin 14 = GND
- Pin 12 = +3.2V (V_EXT3)

The Pin22 (MOTION signal) is fully protected against ESD up to 20kV and short circuit. It can be connected directly to the sensor.

Brightness Sensor (Twilight)

The SLC-Core100 modules can optionally be equipped with an environment brightness sensor (twilight) to detect day / night changes. For reliable operation, please use only sensors supplied or approved by esave ag.

Use the following pins to connect the sensor:

- Pin 12 = +3.2V (V_EXT3)
- Pin 7 = Brightness sensor input (BRIGHT)

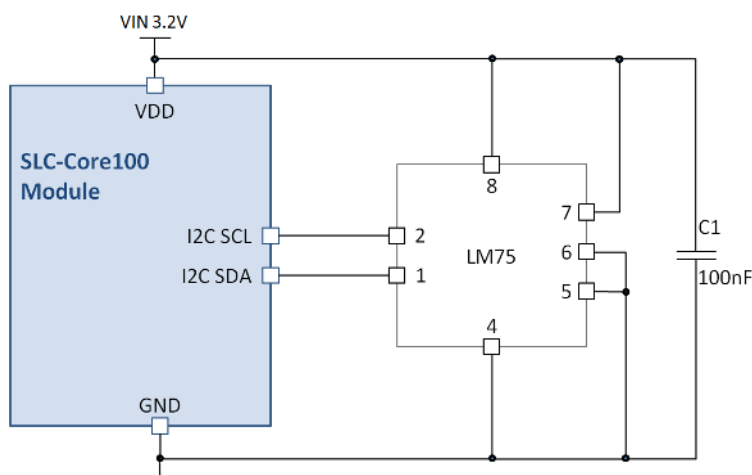
The Pin7 (BRIGHT signal) is fully protected against ESD up to 20kV and short circuit. It can be connected directly to the sensor.

LED Temperature Sensor

The esave SLC-Core100 modules can optionally be equipped with a digital or an analog LED temperature sensor.

Digital Temperature Sensor LM75

A digital temperature sensor can be connected to the I2C bus. It is important to set the device address to 0x49h. In this case the SLC-Core100 will detect the sensor automatically. The I2C lines are pulled up inside of the SLC-Core100, so it is not necessary to do this again.

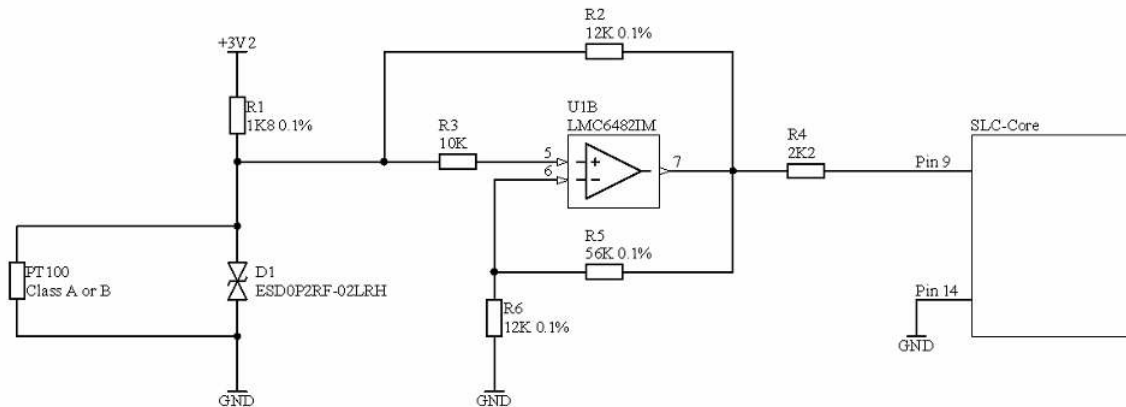


Analogue Temperature Sensor PT100

To measure the LED temperature analog, it will be necessary to provide a measurement amplifier (schematic diagram below). The SLC-Core100 is calibrated to use with PT100 resistance temperature sensors. Please use PT100 sensors of Class A or Class B.

Use the following pins to connect the PT100 sensor:

- Pin 9 = Led temperature sensor input (LED_TEMP)
- Pin 14 = GND



Extension Switch Output

The esave SLC-Core100 offer an optional switch output to drive (electronic) relays or similar. The functionality can be configured in software. A typical application is to completely turn off the LED power supply mains with a relays while the street light is in standby mode (e.g. during the day).

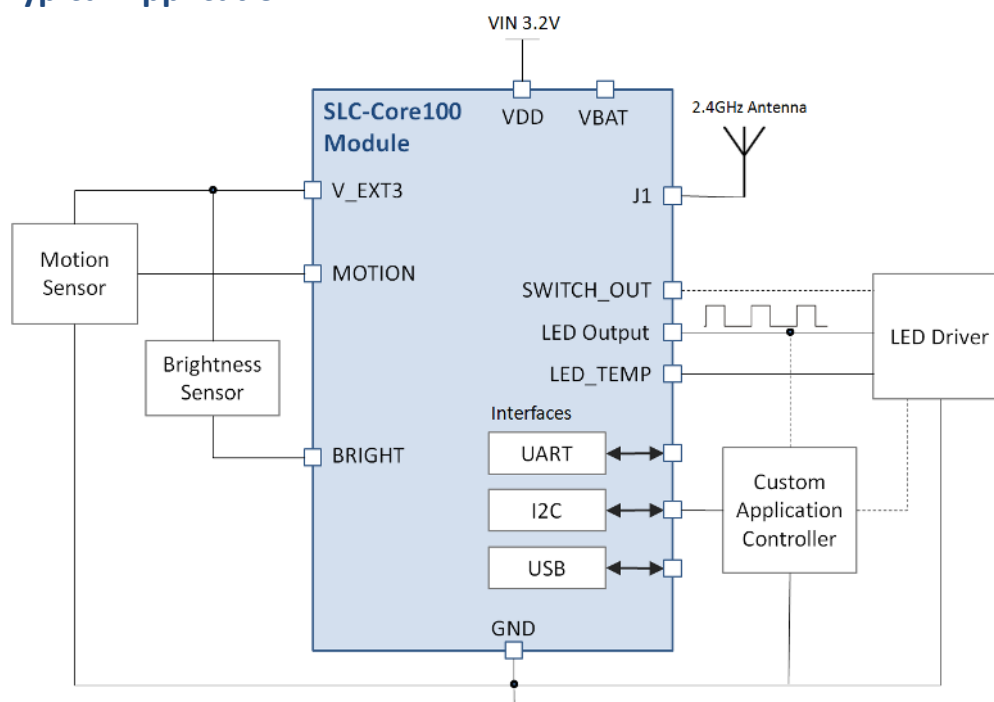
For further information about the usage and configuration, please contact esave ag.

Use to following digital output pin in combination with an external MOSFET or transistor to drive the load:

- Pin 10 = External switch output pin (SWITCH_OUT)

Please ensure that the rated output current of pin 10 is not exceeded (max. 2mA).

Typical Application



LED Output

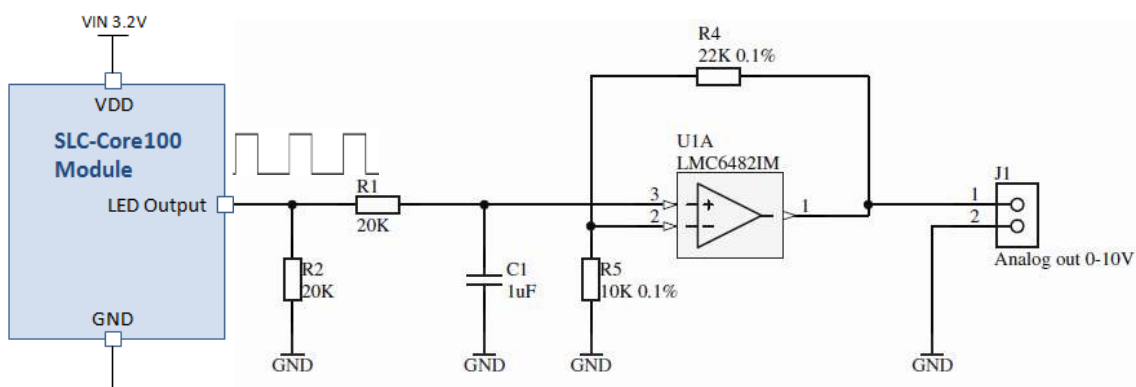
The LED Output pin, provide a PWM signal. The PWM frequency and high/low operation can be configured by the slConfigurator or by the Factory Configurator. The following options are available:

Table 3: Configurable LED output modes

Description	LED on level 100%	PWM Frequency	Output type
PWM for analog signal 0 – 3V	3 V	1300 Hz	Analog
PWM for analog signal 3 – 0V	0 V	1300 Hz	Analog inverted
PWM high active	3 V	500 Hz	PWM inverted
PWM low active	0 V	500 Hz	PWM

Application Note Analog output mode 0 – 10 V

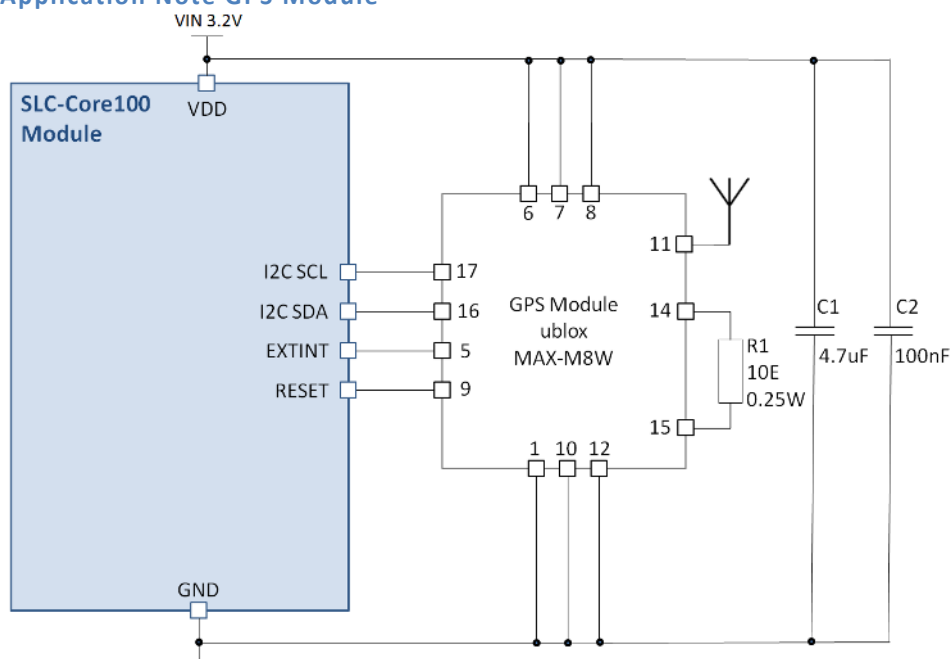
For a standard analog output 0 – 10 V dim interface, you will need an additional amplifier circuit.



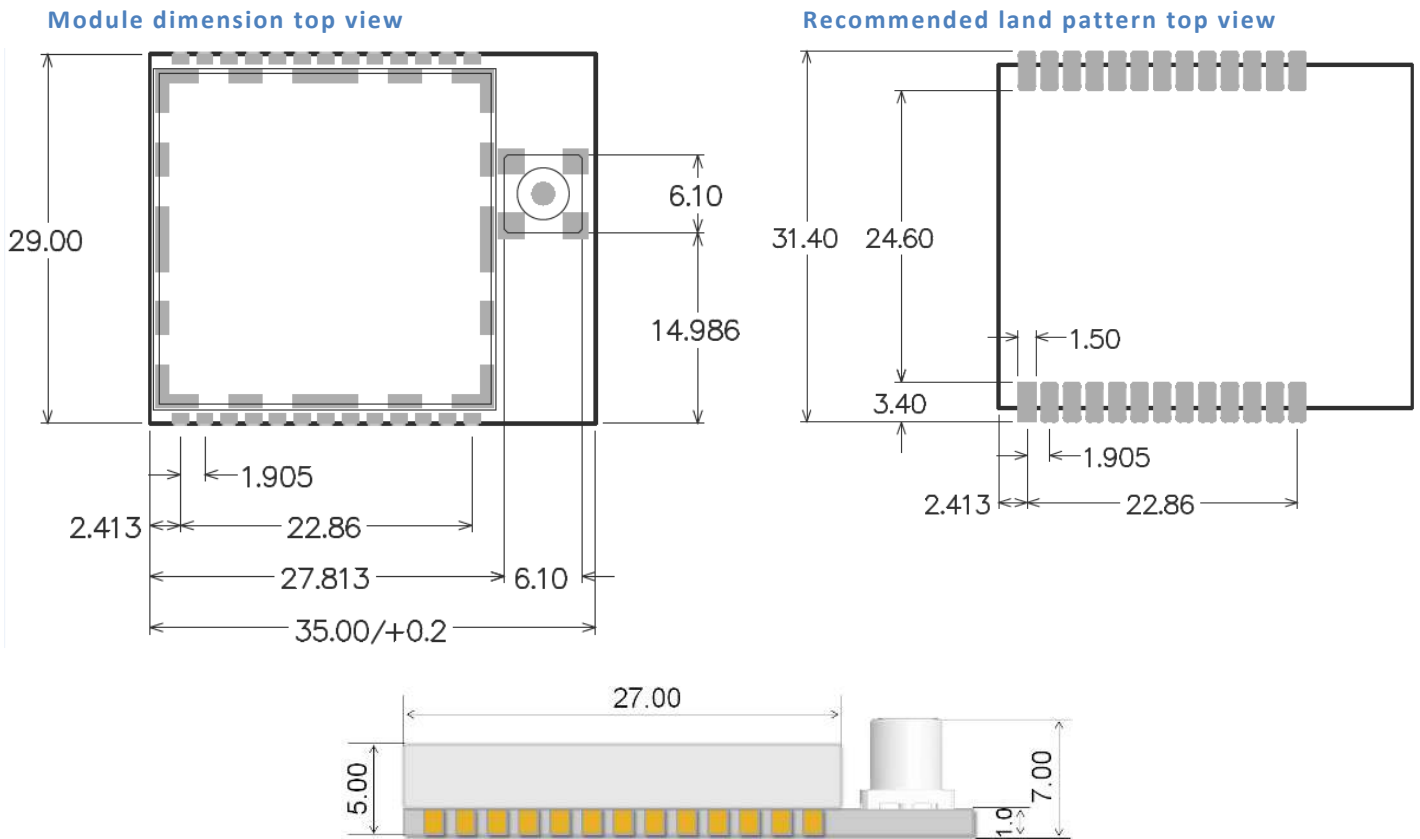
External GPS Module

It is possible to connect a ublox GPS Module MAX-7W or a MAX-M8W directly to the SLC-Core100. The SLC-Core100 will detect the GPS-Module automatically if it is connected like the above application note. Is a GPS-Module connected, the SLC-Core100 synchronizes the time and determines the light Module position automatically.

Application Note GPS Module



Physical Dimensions



Electrical and Thermal Characteristics

Table 3: Maximum ratings

Parameter	Symbol	Min	Max	Unit
Supply voltage	V_{DD}	-0.3	3.9	V
Operating temperature	T_O	-40	+85	°C
Storage temperature	T_S	-40	+125	°C
Extension connector: Motion sensor input voltage (Pin 22)	V_{mot}	-0.2	3.4	V
Extension connector: Brightness (Twilight) sensor input voltage (Pin7)	V_{bright}	-0.2	3.4	V
Extension connector: 3.2V Power supply output current (Pin 12)	I_{ext3}		35	mA
Digital output pins: Source and sink current	I_{DO}		2	mA

Table 4: Operation characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage range	V_{DD}	3.0	3.2	3.6	
Power usage			80		mW
LED output voltage *1 $I_{out} = 2mA$ Output mode: $V_{out} = PWM / Analog$ Min, Max Values @ $V_{DD} 3.2V$	$V_{out Low}$	0.0	0.01	0.1	V
	$V_{out High}$	2.9	3.0	3.1	
PCB temperature range	$T_{PCB R}$	-55°C		+125°C	°C
PCB temperature accuracy	$T_{PCB A}$		+/-0.5°C		°C

*1 for analog 0-10V output or DALI, an external amplifier circuit is required

Table 5: Extension / Sensor connector operation characteristics

Parameter	Connector Pin #	Symbol	Min	Typ	Max	Unit
Extension power output voltage 3.2V	12	V_{ext3}	2.7	2.9	V_{DD}	V
Motion detector inactive high signal	22	$V_{mot H}$	2.5		V_{DD}	V
Motion detector active low signal	22	$V_{mot L}$	-0.2		0.5	V

Table 6: Wireless characteristics

Parameter	Symbol	Min	Typ	Max	Unit
RF frequency range (center frequency)	f_w	2.420		2.480	GHz
RF nominal output power			4.5	8	dBm
Receiver sensitivity			-97	-92	dBm
Antenna impedance on MCX connector			50		Ohm

Labeling information

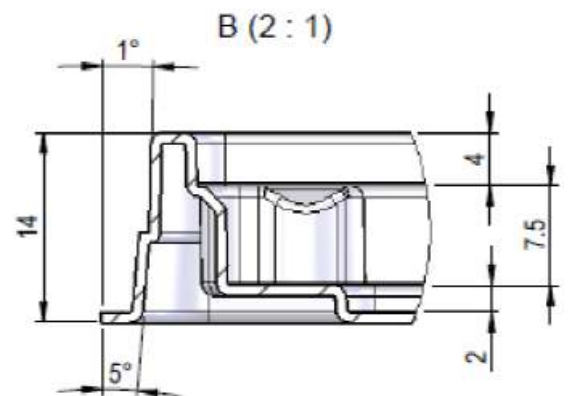
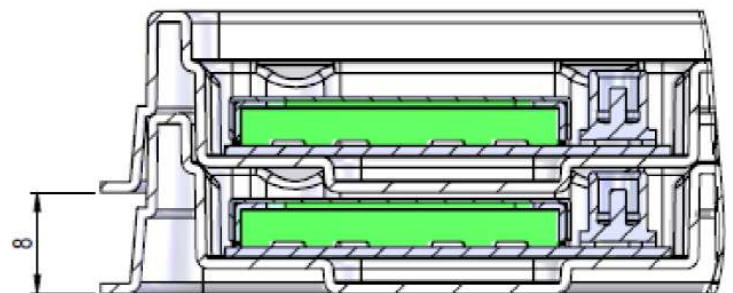
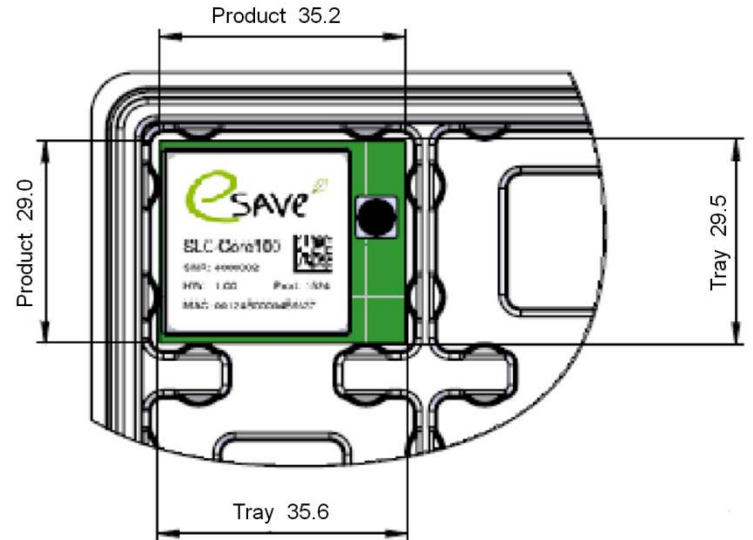
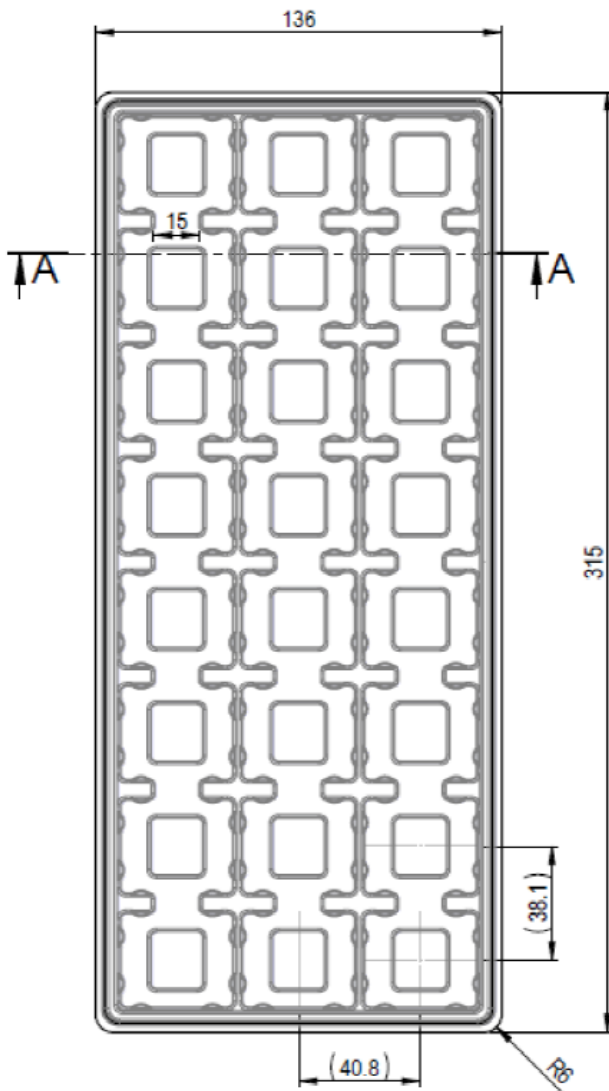
Table 7: Labeling codes

Format	Example on Label	Description
Product Name	SLC-Core100	Street light controller core module 100
SNR	4000002	Serial number of device
HW	1.00	Hardware revision
MAC	00124B00014B9537	Unique MAC address of device



Packaging information

The SLC-Core100 will be delivered in an ESD tray with 24 units or a multiple of 24 units.



Moisture Sensitivity Levels

The Moisture Sensitivity Level (MSL) relates to the packaging and handling precautions required. SLC-Core100 modules are rated at MSL level 5a.

For MSL standard see IPC/JEDEC J-STD-020, which can be downloaded from www.jedec.org

Reflow Soldering Profile

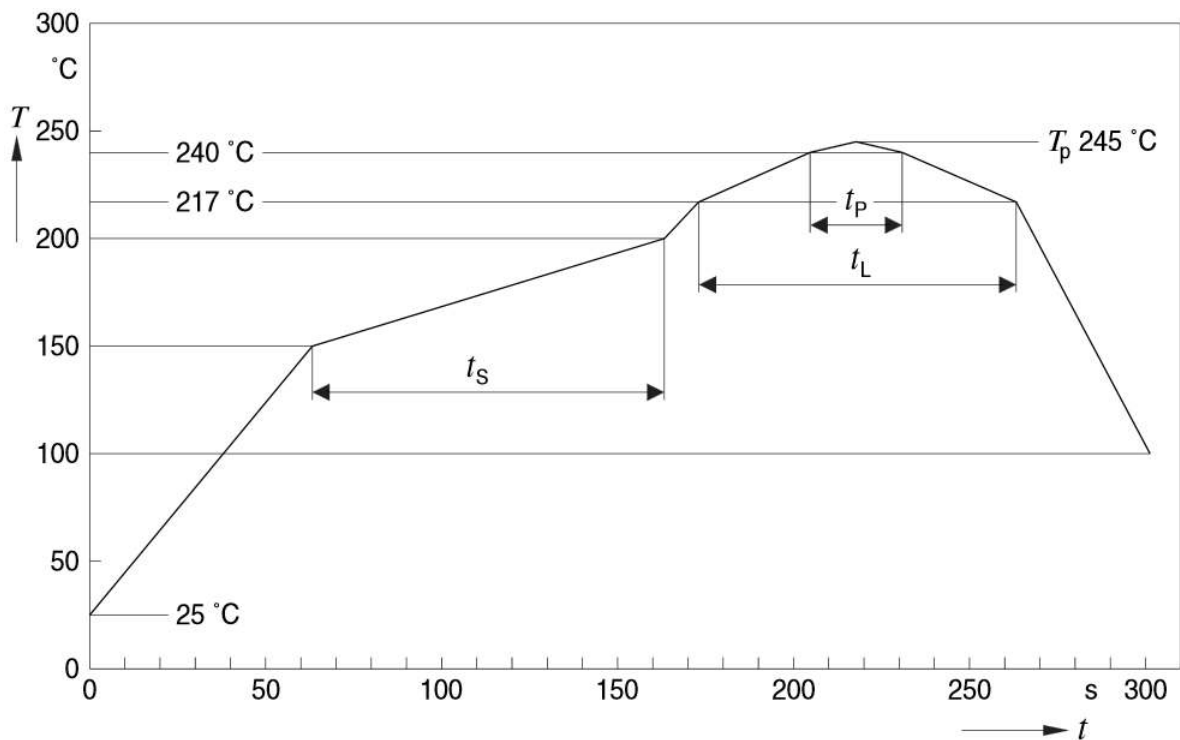


Table 8: Profile Feature

Parameter	Symbol	Min	Typ	Max	Unit
Ramp-up rate to preheat* 25°C to 150°C			2	3	K/s
Time t_s T_{Smin} to T_{Smax}	t_s	60	100	120	s
Ramp-up rate to peak* T_{Smax} to T_p			2	3	K/s
Liquidus temperature	T_L		217		°C
Time above liquidus temperature	t_L		80	100	s
Peak temperature	T_p		245	260	°C
Time within 5°C of the specified peak temperature $T_p - 5K$	t_p	10	20	30	s
Ramp-down rate* T_p to 100°C			3	6	K/s
Time 25°C to T_p				480	s

All temperatures refer to the center of the Module, measured on the top

*slope calculation DT/Dt : Dt max. 5s, fulfillment for the whole T-range

Standards and Legislation

Module has been certified according to following certifications:

Table 9: Approvals

Category	Declaration / Certificates
CE conformity	CE compliant
Radio frequencies and electromagnetic compatibility (EMC / ERM)	<ul style="list-style-type: none">• EN 300 328 V2.1.1 : 2016• EN 301 489-1 V1.9.2 : 2011• EN 301 489-17 V2.2.1 : 2012• EN 61000-6-2 : 2005
Safety	<ul style="list-style-type: none">• EN 60950-1 : 2006

Revision history

Table 10: Revision history

Revision	Date	Comments	Initials
01	03.08.2017	revised	PM

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