

VIN High Withstand Voltage Single Cell Lithium Battery Synchronous Switching Buck Charging IC

1 Features

- ✧ Synchronous switching buck charging
- ✧ Buck charging efficiency 93%
- ✧ Battery side charging current can be set to 500mA/700mA/900mA/1100mA by external resistor.
- ✧ Automatically adjusts charging current to match adapter output capability
- ✧ Support customized 4.20V/4.30V/4.35V/4.4V battery
- ✧ Supports 2-Light LED Charging Status Indication Function
- ✧ Power MOS built in
- ✧ 800KHz switching frequency, can support 1uH inductor
- ✧ Input overvoltage, undervoltage, and overcharge protection
- ✧ IC over-temperature protection
- ✧ Charging timeout protection
- ✧ ESD 4KV
- ✧ VIN DC withstand voltage 12V, transient withstand voltage up to 18V
- ✧

2 Typical Applications

- Single-cell Li/Li-Ion battery charging management

3 Description

The P2311 is a 5V input, VIN high withstand voltage IC that supports synchronous switching buck charge management for a single lithium battery.

The IP2311 integrated power MOS with synchronous switching architecture allows it to be applied with very few peripheral devices and effectively reduces the overall solution size and BOM cost.

The synchronous switching buck charge converter of the IP2311 operates at 800 KHz; the conversion efficiency is 93% at 5V input, battery voltage of 3.7V, and charging current of 500mA.

The IP2311 input voltage is 5V and the input can automatically adjust the charging current to match the adapter load capacity.

The IP2311 is available in a DFN8(0303) package.

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4 Modify records

NOTE: The page numbers of the previous version may differ from the page numbers of the current version.

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5 Simplify the application schematic

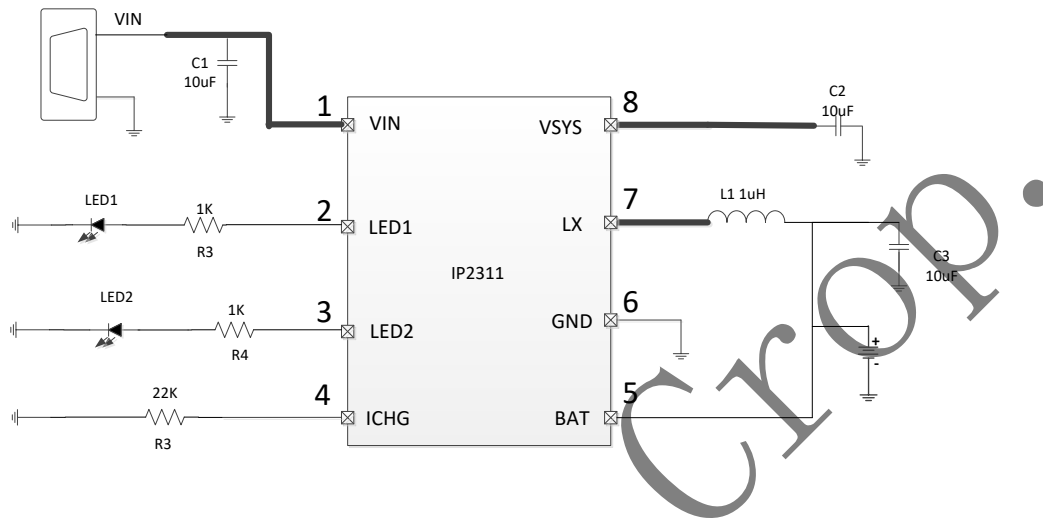


Figure 1 IP2311 Simplify the application schematic

6 PIN Description

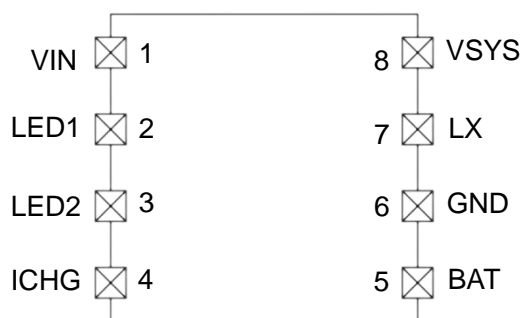


Figure 2 Pin of IP2311

6.1 PIN Description

Pin Name	Pin Num	Pin Description
1	VIN	Charge input 5V terminal
2	LED1	LED driver pin 1
3	LED2	LED driver Pin 2
4	ICHG	External resistor setting charge current pin
5	BAT	Li-ion battery power supply pin, connect to the positive side of the Li-ion battery
6	GND	GND
7	LX	DC-DC switching node
8	VSYS	Input intermediate node, need to connect capacitor

7 Functional Block Diagram

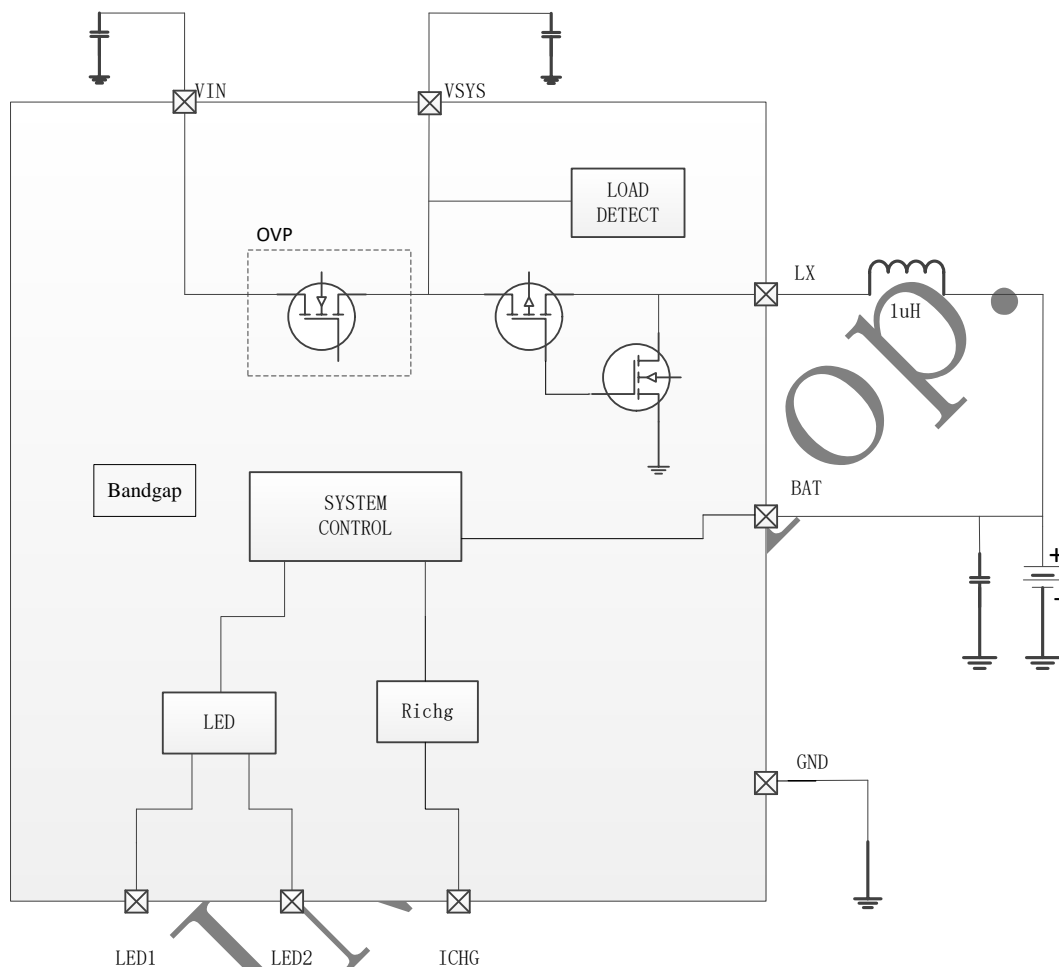


Figure 3 IP2311 Functional Block Diagram

8 Limit parameters

Parameters	Symbol	Value	Unit
Voltage Range	VIN	-0.3 ~ 18	V
Junction Temperature Range	T _J	-40 ~ 140	°C
Storage Temperature Range	T _{stg}	-60 ~ 140	°C
Junction Temperature(junction to ambient)	θ _{JA}	70	°C/W
Human Body Model (HBM)	ESD	4	KV

*Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to Absolute Maximum Rated conditions for extended periods may affect device reliability.

9 Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Input Voltage	Vin	4.5	5	5.7	V
Working environment temperature	T _A	-20	--	85	°C

*Devices' performance cannot be guaranteed when working beyond those Recommended Operating Conditions

10 Electrical Characteristics

Unless otherwise specified, T_A=25°C, L=1μH

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Charging System						
Input Voltage	VIN	V _{BAT} =3.7V	4.4	5.0	5.7	V
Input over-voltage threshold	VIN-OV	VIN voltage	5.55	5.7	5.85	V
Input under-voltage threshold	VIN-UV	V _{OUT} voltage	4.4	4.5	4.6	V
Charge Voltage Target	CV _{4.2V}	Different CV voltages need to be customized, the default is CV4.2V	4.18	4.22	4.25	V
	CV _{4.30V}		4.28	4.32	4.35	V
	CV _{4.35V}		4.32	4.38	4.40	V
	CV _{4.4V}		4.38	4.42	4.45	V
Charge Cut-off Current	I _{vinstop}	Input VIN = 5V, current at VIN, Richg = 100K	40	60	100	mA
Input Current	I _{vin}	Charge current at VIN input, V _{BAT} =3.7V, Richg=15K	400	500	600	mA
		Charge current at VIN input, V _{BAT} =3.7V, Richg=43K	600	700	800	mA

		Charge current at VIN input, VBAT=3.7V, Richg=68K	800	900	1000	mA
		Charge current at VIN input, VBAT=3.7V, Richg=100K	1000	1100	1200	mA
Trickle Charge Current	I _{TRKL}	VIN=5V, BAT=2.7V, Richg=15K	20	30	50	mA
		VIN=5V, BAT=2.7V, Richg=43K	20	30	50	mA
		VIN=5V, BAT=2.7V, Richg=68K	40	60	80	mA
		VIN=5V, BAT=2.7V, Richg=100K	60	80	100	mA
Trickle over constant current voltage	V _{TRKL}	BAT voltage	2.9	3.0	3.1	V
Charging voltage after full charge	V _{RCH}	BAT voltage	4.00	4.05	4.10	V
Charging Deadline	T _{END}			24		Hour
Charge switching frequency	f _s		700	800	900	KHz
PMOS on-resistance	R _{DSON}	VBAT=3.7V		150		mΩ
NMOS on-resistance		VBAT=3.7V		200		mΩ
VIN to VSYS OVP Protection Tube				170		mΩ
Battery input standby current	I _{STB}	VIN=0V, VBAT=3.7V		8	20	uA
LED drive Current	IL1 IL2			5		mA
Thermal shutdown temperature	TOTP	rising temperature	130	140	150	°C
Thermal shutdown temperature hysteresis	ΔT _{TOTP}		30	40	50	°C

11 Function Description

11.1 Charging efficiency

IP2311 Integrates a synchronous switching buck charge controller, switching frequency of 800 KHz. With 5V input, 3.7V battery voltage and 500mA charging current, the charging efficiency is close to 93%.

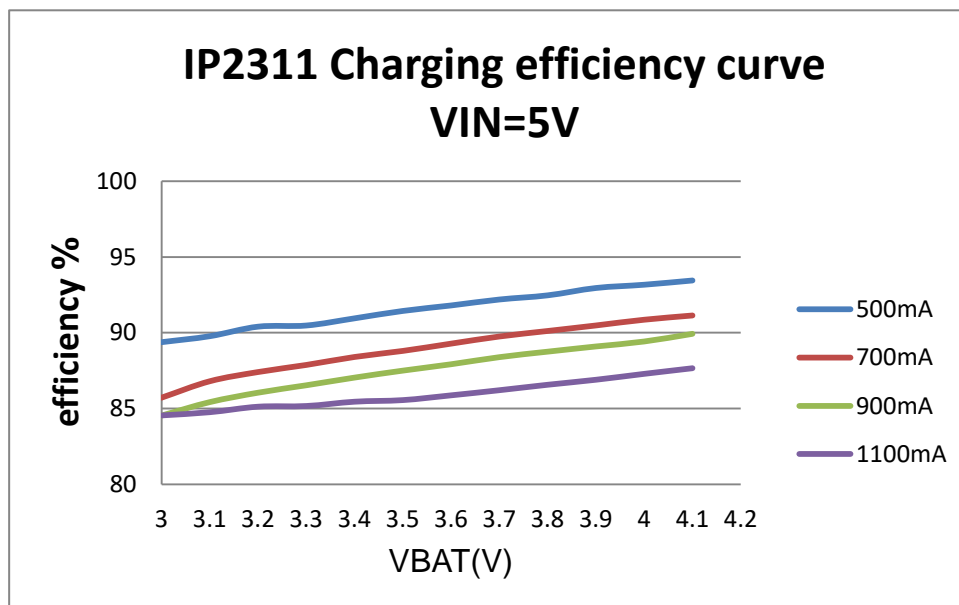


Figure 4 IP2311 Efficiency chart

11.2 Charge Process

IP2311 integrates trickle, constant current and constant voltage Li-ion battery charge management system with synchronized switching structure, which supports matching different battery voltage specifications:

When the battery voltage is less than 3V, trickle charge is used to charge the battery with 30mA/60mA/80mA charging current;

When the battery voltage is greater than 3V, it enters CC constant current charging;

When the battery voltage approaches 4.20V/4.30V/4.35V/4.40V, it enters constant voltage charging;

After charging is complete, if the battery voltage is below 4.05V/4.16V/4.21V/4.25V, turn charging back on.

11.3 Charge protection

IP2311 has perfect protection function. Built-in soft-start function prevents faults caused by excessive inrush current during startup, and integrated input over-voltage, under-voltage, over-temperature and other protection functions ensure stable and reliable operation of the system.

- The IP2311 has a VIN input regulator loop. The VIN input loop automatically adjusts the charging current, and when the IP2311 detects that the input voltage is close to the undervoltage threshold of 4.5V, it automatically adjusts to reduce the charging current so that the input voltage stabilizes at 4.5V, ensuring that the adapter does not stop charging.
- The IP2311 integrates VIN input overvoltage protection, which stops charging when the IP2311 detects that

the input voltage is above the 5.7V overvoltage threshold.

- IP2311 integrates an over-temperature protection function, when IP2311 detects that the chip temperature reaches 140°C, it will stop charging; when the temperature drops to 100°C, IP2311 will only consider that the temperature is back to normal and start charging again
- The IP2311 integrates charging timeout protection, which forces charging to stop when the charging time exceeds 24 hours.

11.4 Charging LED indication

The IP2311 supports 2 LED light displays.

Can be customized to achieve 1-light mode (flashing light while charging, full light off);

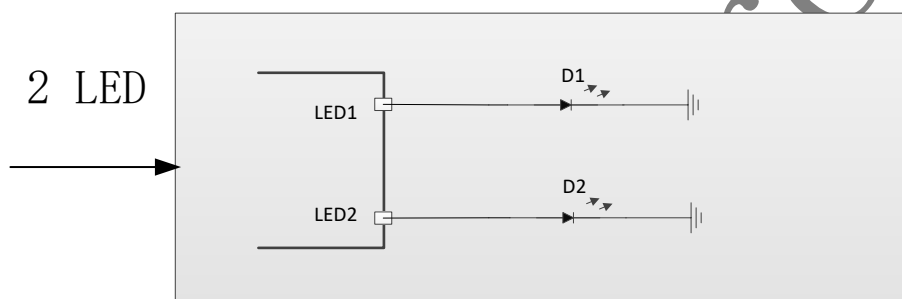


Figure 5 LED Display Configuration Circuit Diagram

■ 2-Light Mode

charging state	D1	D2
Charging process	on	off
Full	off	on

11.5 Setting the constant current charging current with an external resistor

The IP2311 supports pin series Richg resistors to regulate the charging current.

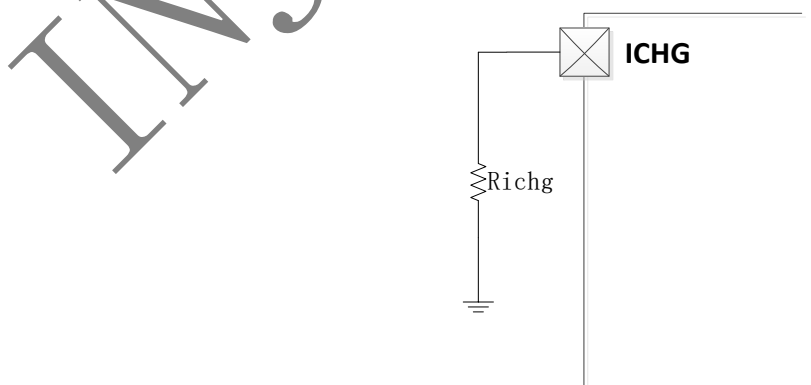


Figure 6 External resistor to regulate charging current

Typical charging current recommended resistance::

ICHG Resistors Kohm	Corresponding charging input current
15K	500mA
43K	700mA
68K	900mA
100K	1100mA

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12 Typical Application Schematic

The IP2311 requires only inductors, capacitors, resistors, etc. to realize a fully functional charging solution.

12.1 Typical schematic for 2 LED mode

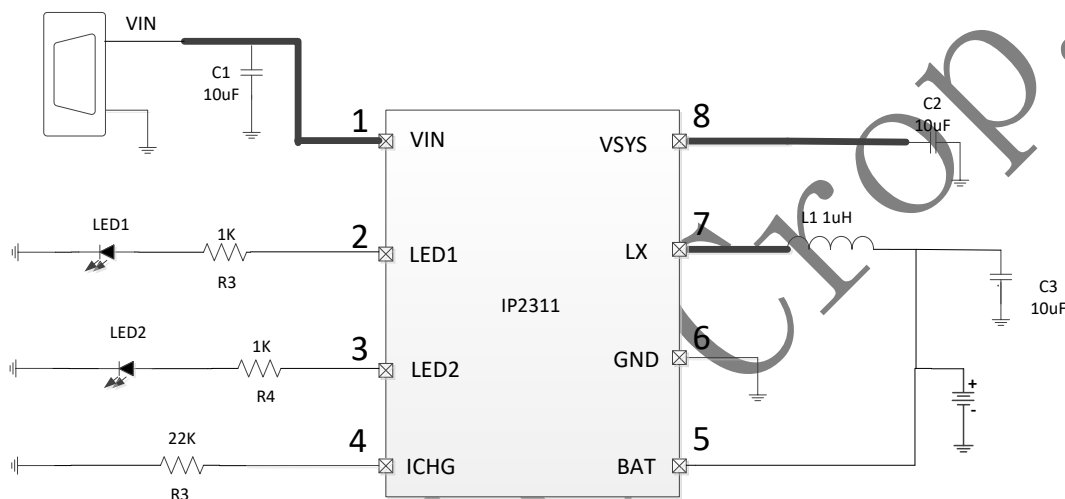


Figure 7 IP2311 Typical schematic for 2 LED mode

12.2 BOM

Typical application schematic section component specification requirements:

No.	Part Name	Type & Specification	Units	Quantity	Location	Note
1	IC	IP2311	PCS	1	U1	
2	Inductance	CD54	PCS	1	L1	Inductance 1uH
3	SMD capacitors	0603 10uF 16V 10%	PCS	4	C1、C2、C3	Capacitor's voltage higher than 16V, SMD ceramic capacitor is required
4	SMD resistors	0603 1K 5%	PCS	1	R1、R2	
7	SMD resistors	0603 15K 5%	PCS	1	R3	Setting the charging current
9	LED	0603	PCS	2	LED1、LED2	LED indicator, maximum drive capacity 5mA
10	USB	SMD-TYPE-C	PCS	1	USBC1	

VSYS pin must be added 10uF ceramic capacitor, can not be omitted or replaced with electrolytic capacitors, 10uF capacitor should be close to the chip VSYS pin and the power ground;

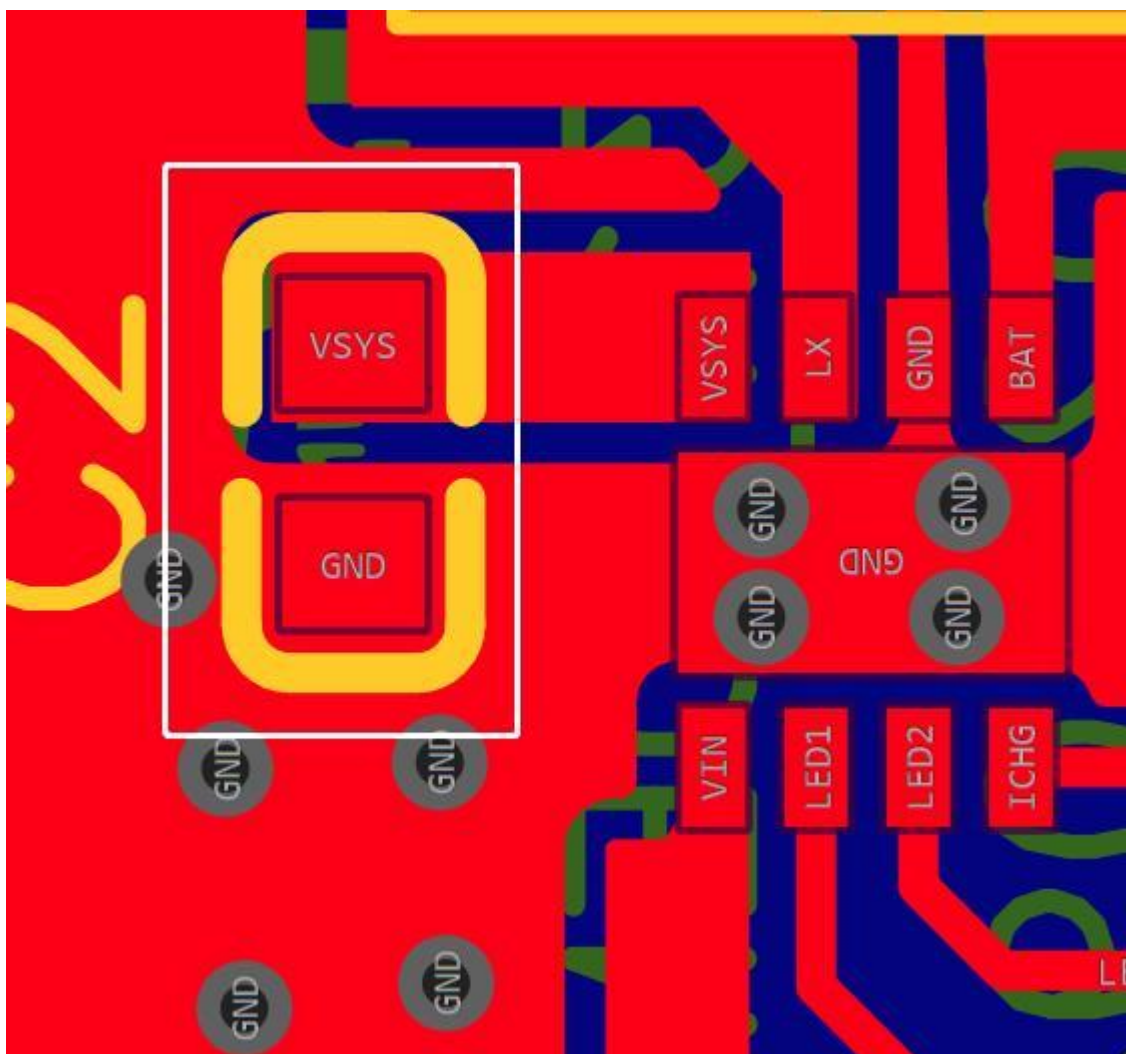


Figure 8 VSYS capacitor LAYOUT

14 Silkscreen



Instruction:



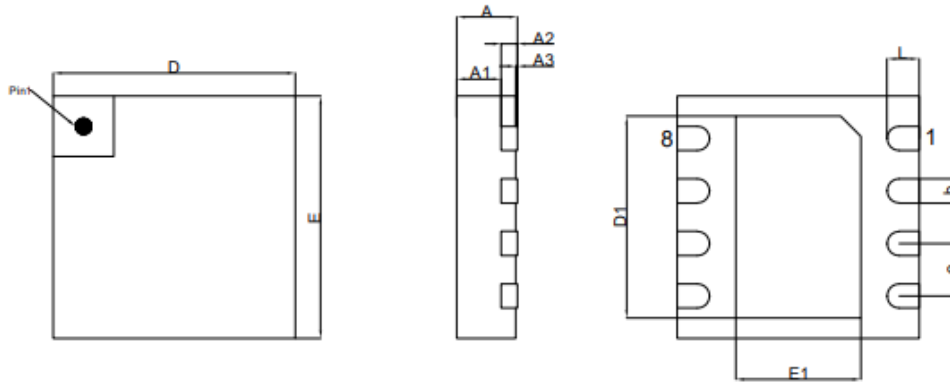
- 1、 --Injoinic Logo
- 2、IP2311 --Product name
- 3、XXXXXXXXX --Product number
- 4、 --PIN1 Position

Figure 9 IP2311 Silkscreen

15 Package



	POD	DFN-8L-3X3X0.75-A_P0.65		
		Size unit: mm		
	Symbol	Minimum	Normal	Maximum
Total Thickness	A	0.70	0.75	0.80
Molding Thickness	A1	-	0.55	-
LF Thickness	A2	-	0.203	-
Stand Off	A3	0.00	0.02	0.05
Body Size	D	-	3.00	-
	E	-	3.00	-
Exposed Pad Size	D1	2.20	2.30	2.40
	E1	1.40	1.50	1.60
Lead Width	b	0.25	0.30	0.35
Lead Length	L	0.30	0.40	0.50
Lead Pitch	e	0.65 BSC		

DFN-8L-3X3X0.75-A_P0.65

IN

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