Positive and Negative Over-Voltage Protector

General Description

ET9930Y can disconnect the systems from its output pin (OUT) in case wrong input operating conditions are detected. The system is positive over-voltage protected up to 33V. The internal over-voltage threshold(OVLO) is 6.1V. ET9930Y has over current protection, internal thermal shutdown protection and input voltage detection.

The device is packaged in advanced full-Green compliant DFN8(2.0mm × 2.0mm) package.

Features

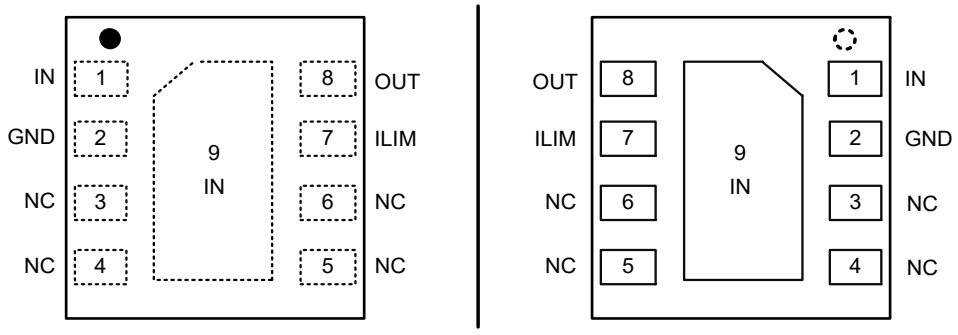
- 2A Continuous Current Capability
- Typical R_{ON}: 105mΩ N-Channel MOSFET
- V_{IN} Operating Range: 3.5V to 30V
- Over-Voltage Protection (OVP) threshold: 6.1V (TYP)
- Over-Voltage Protection Response Time: 50ns (TYP)
- Input Reverse Protection to -15V
- Internal Thermal-Shutdown Protection
- Programmed Over-Current Protection
- ESD Protected: Human Body Model (JS-001-2024) All pins ±2KV Pass
- Package Information

Part No.	Package	Packing Option	MSL
ET9930Y	DFN8 (2.0mm × 2.0mm)	Tape and Reel, 3K/Reel	1

Application

- Smartphones, Tablet PC, TWS
- HDD, Storage and Solid State Memory Devices
- Portable Media Devices, Laptop & MID
- SLR Digital Cameras
- GPS and Navigation Equipment
- Industrial Handheld and Enterprise Equipment

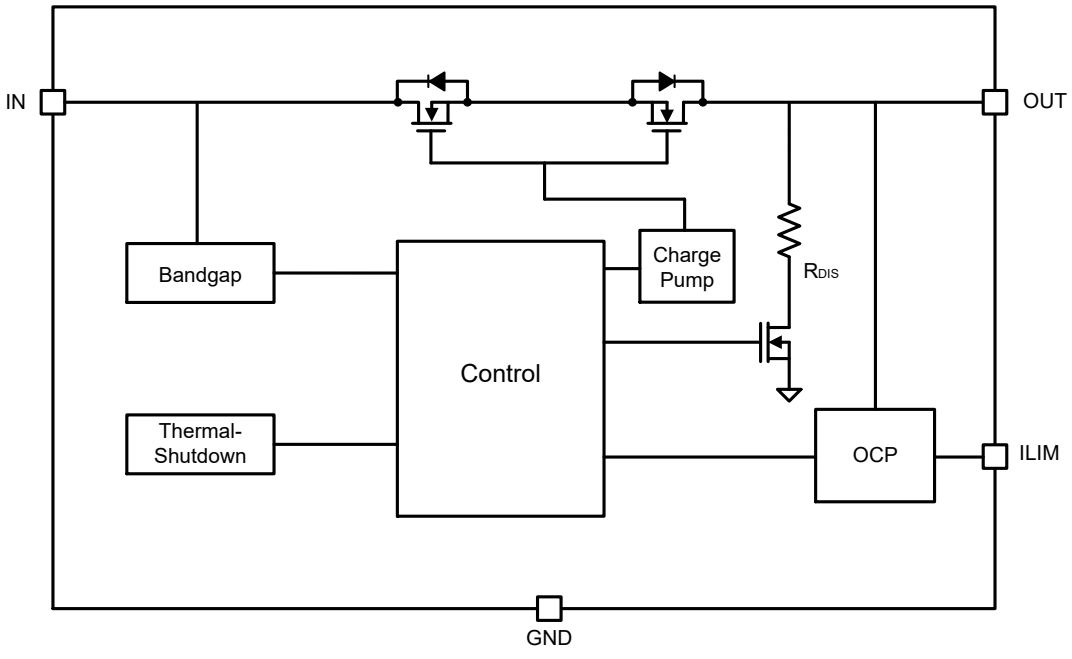
Pin Configuration



Pin Function

Pin	Name	Description
1,9	IN	Voltage Input.
2	GND	Ground.
3,4,5,6	NC	No connected.
7	ILIM	Current limit set pin. Connect a resistor to GND to set over current threshold. $I_{ILIM}=25/R_{ILIM}$. (Current in A, resistance in kΩ). Short ILIM to GND will disable current limitation.
8	OUT	Voltage Output. Output of internal switch.

Block Diagram



Functional Description

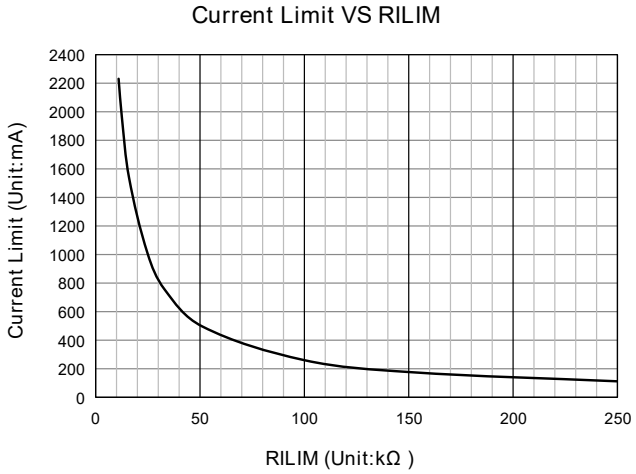
The OVP switch with over-voltage protection feature a low 105mΩ (TYP.) on-resistance (R_{ON}) internal FET and protect low-voltage systems against voltage faults up to 33V DC. If the input voltage (V_{IN}) exceeds 6.1V, the internal FET is quickly turned off to prevent damage to the protected downstream components.

Over Current Protection(OCP)

The over current threshold can adjustable by a external resistor connected from the ILIM pin to GND. The OCP threshold is calculated using Equation 1:

$$I_{ILIM}(A) = \frac{25}{R_{ILIM}(k\Omega)} \quad (1)$$

- R_{ILIM} range is 11kΩ to 250kΩ.

R_{ILIM} (kΩ)	Current Limit_Typ (mA)	Current Limit Curve
11	2272	
12.5	2000	
16	1563	
25	1000	
33	757	
51	490	
75	333	
83	301	
100	250	
125	200	
150	166	
250	100	

Note: Table values based on 1% tolerance resistor.

If the output current exceeds the I_{OCP} threshold and over current condition lasts longer than exceeds the 1ms, the switch will be turned off. The ET9930Y enters hiccup mode. The switch will re-soft start again after 3.3s.

When short ILIM to GND, the normal current limit function is disabled.

Input reverse protection

The IN pin is protected against reverse input voltage up to -15V.

Thermal Protection

The internal FET turns off when the junction temperature exceeds +150°C (TYP). The device exits thermal shutdown after the junction temperature cools by 20°C (TYP).

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameters		Min	Max	Unit
V_{IN}	IN to GND		-20	33	V
V_{OUT}	OUT to GND		-0.3	12	V
V_{ILIM}	ILIM to GND		-0.3	6	V
I_{SW1}	Maximum Continuous Current of Switch IN-OUT			2	A
I_{SW2}	Maximum Peak Current of Switch IN-OUT(10ms)			4	A
P_D	Power Dissipation at T_A= +25°C			1	W
T_{STG}	Storage Junction Temperature		-65	+150	°C
T_L	Soldering Temperature (reflow).			+260	°C
T_{JMAX}	Max Junction Temperature			+150	°C
ESD Capacity	Human Body Model, ANSI/ESDA/JEDEC JS-001-2024	All Pins	-2	+2	KV
	Charged Device Model, JS-002-2022	All Pins	-1.5	+1.5	

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{IN}	Input Voltage	3.5	30	V
I_{SW}	Maximum Continuous Current of Switch IN-OUT		2	A
I_{OCP}	Limit Current	0.1	2.3	A
R_{ILIM}	OCP Programming Resistor	11	250	kΩ
T_A	Operating Temperature Range	-40	+85	°C

Electrical Characteristics

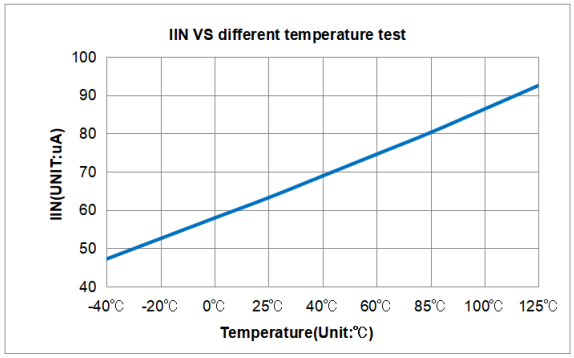
Unless otherwise noted, typical values are at V_{IN}=5V and T_A=25°C.

Symbol	Parameters	Conditions	Min	Typ	Max	Unit
Basic Operation						
V_{IN}	Input Voltage		3.5		30	V
I_{IN}	V_{IN} Quiescent Current	V_{IN}=5V, OUT Floating		70		μA
R_{ON}	On-Resistance of Switch IN-OUT	V_{IN}=5V, I_{OUT}=200mA		105		mΩ
V_{OVLO}	Over-Voltage Protect of V_{IN}	V_{IN} Rising	5.92	6.1	6.28	V
		V_{IN} Falling		5.9		
V_{UVLO}	Under Voltage Lockout Threshold	V_{IN} Rising		2.6		V
		V_{IN} Falling		2.4		V
R_{DIS}	Output Discharge Resistance	V_{IN}=7V		650		Ω
I_{OCP}	OCP Current	Current Rising	100		2300	mA
	OCP Accuracy	I_{OCP}=1A	-10		10	%
t_{OCP}(1)	OCP Active Time	I_{LOAD}=1A		1		ms
t_{OCR}(1)	OCP Recovery Time			3.3		s
T_{SD}(1)	Thermal Shutdown	V_{IN}=5V		150		ºC
T_{SD_HYS}(1)	Thermal Shutdown Hysteresis	V_{IN}=5V		20		ºC
Dynamic Characteristics						
t_{DEB}	Debounce Time	Time from V_{IN}<V_{OVLO} to V_{OUT}=10% of V_{IN}		25		ms
t_{ON}	Switch Turn-On Time	V_{IN}=5V, R_L=100Ω, V_{OUT} from 0.1×V_{IN} to 0.9×V_{IN}		0.15		ms
t_{OFF_RES}(1)	Switch Turn-off Response Time	V_{IN} > V_{OVLO} to V_{OUT} Stop Rising		50		ns

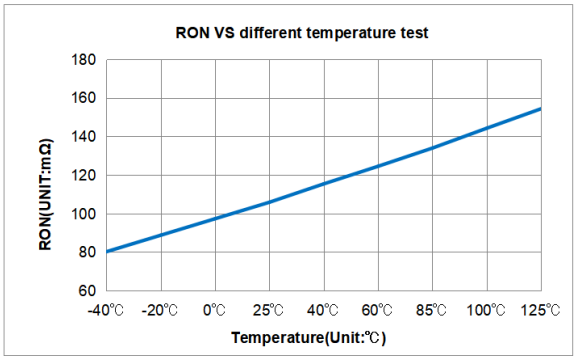
Note1： Guaranteed by characterization and design.

Typical Characteristics

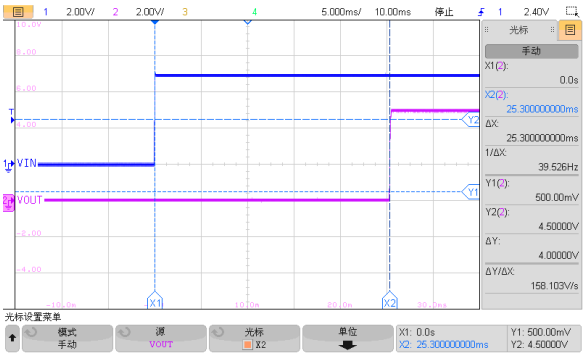
Unless otherwise noted, typical values are at V_{IN}=5V and T_A=25°C.



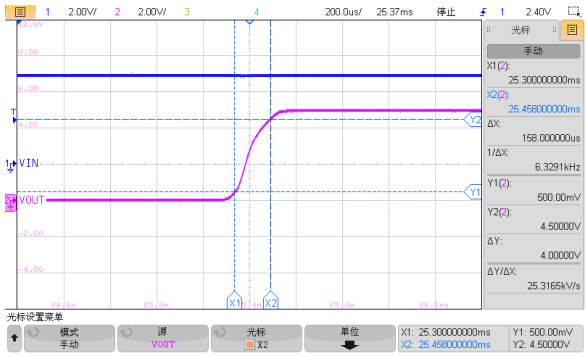
Input Quiescent Current VS Temperature



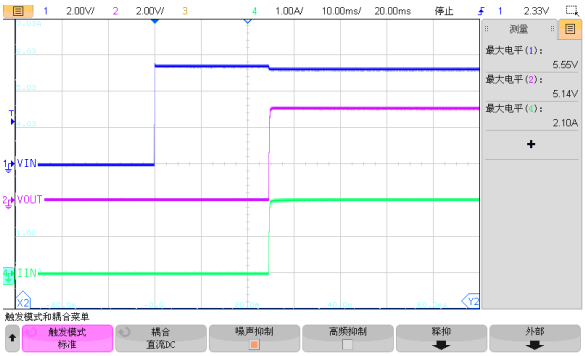
On-Resistance VS Temperature



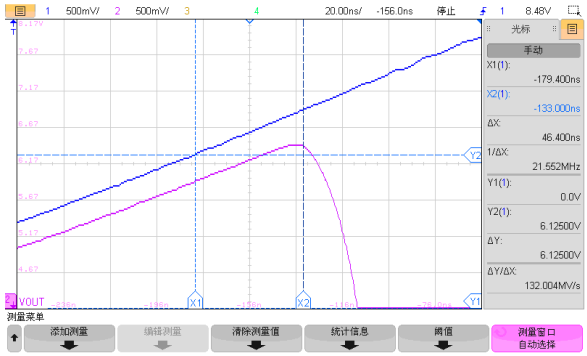
Power ON Debounce Time



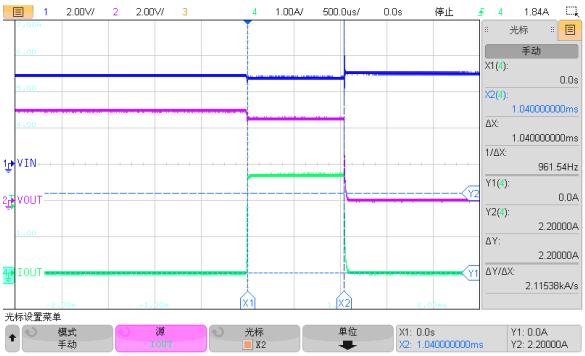
Switch Turn-on Time



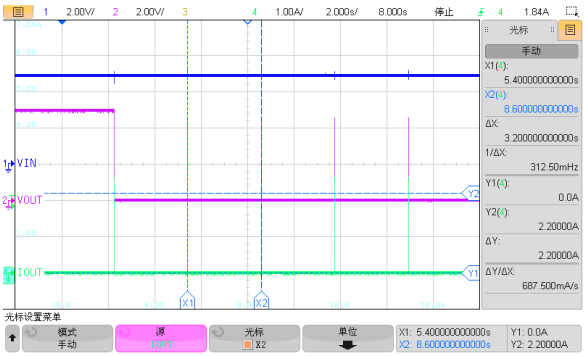
V_{IN}=5.5V,I_{OUT}=2A, Load start



OVP Turn-off Response Time



OCP Active Time



OCP Recovery Time

Timing Waveform

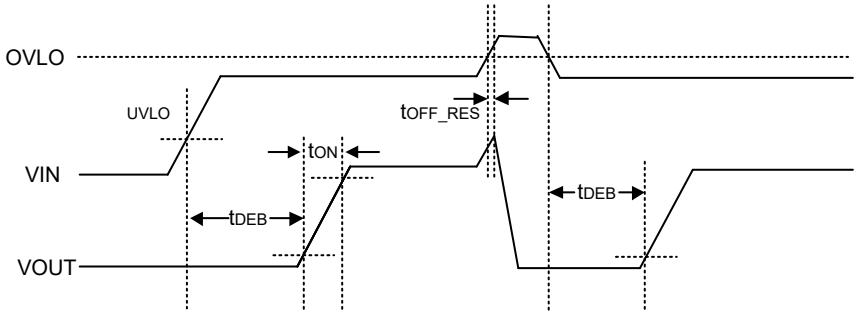


Figure 1. Timing for VIN Power ON and OVP

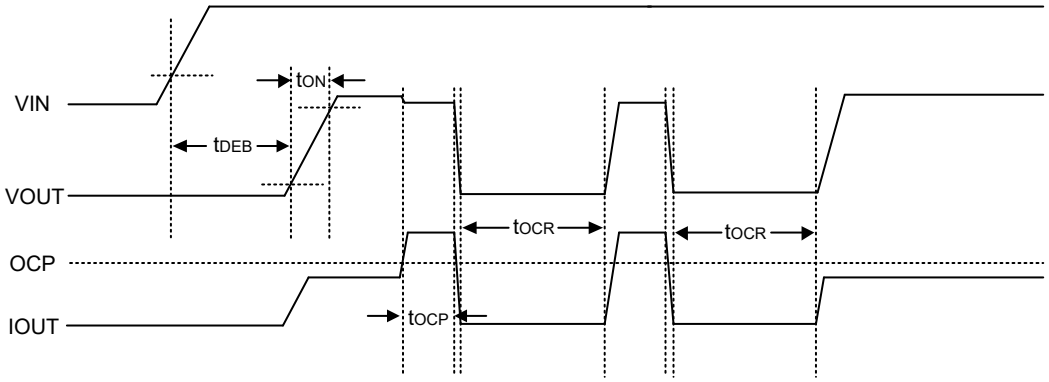
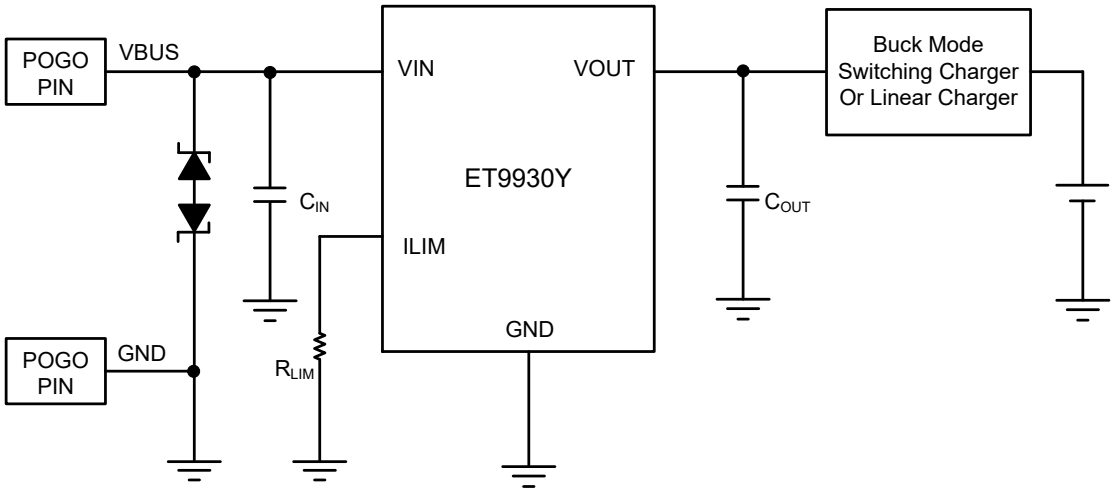


Figure 2. Timing for VIN Power ON and OCP

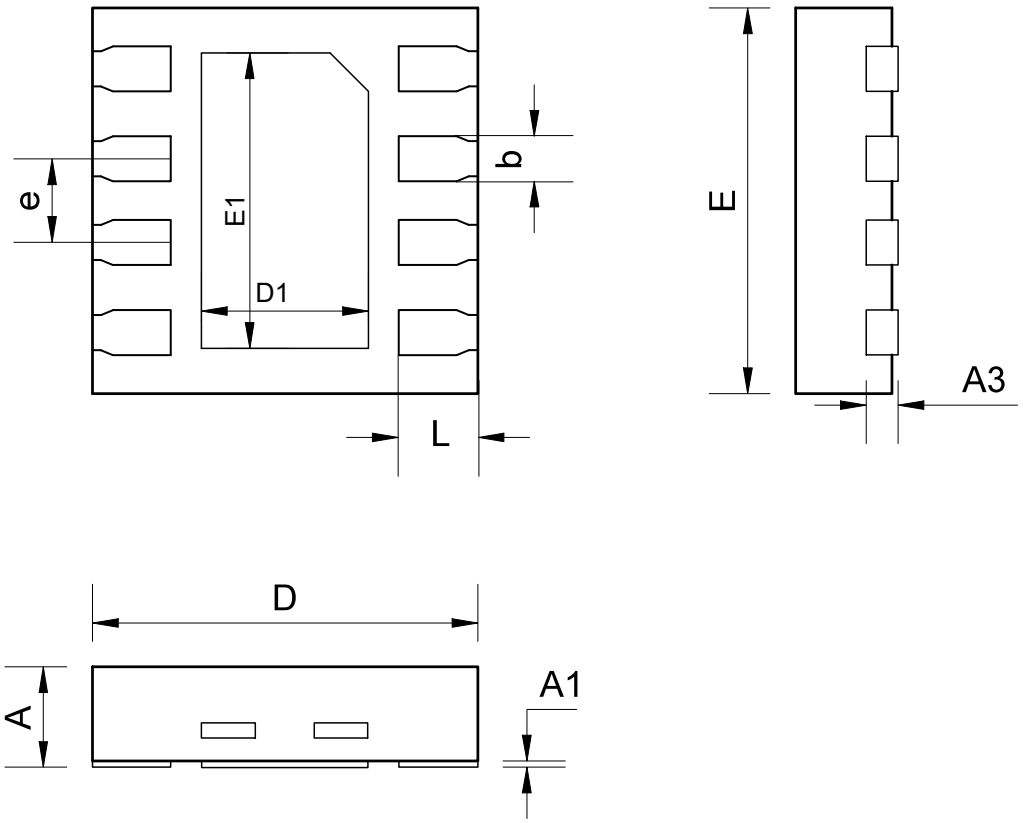
Application Circuits



***Note*:** This electric circuit only supplies for reference. C_{IN}=0.1uF, C_{OUT}=4.7uF for reference.

Package Dimension

DFN8(2.0mm × 2.0mm)

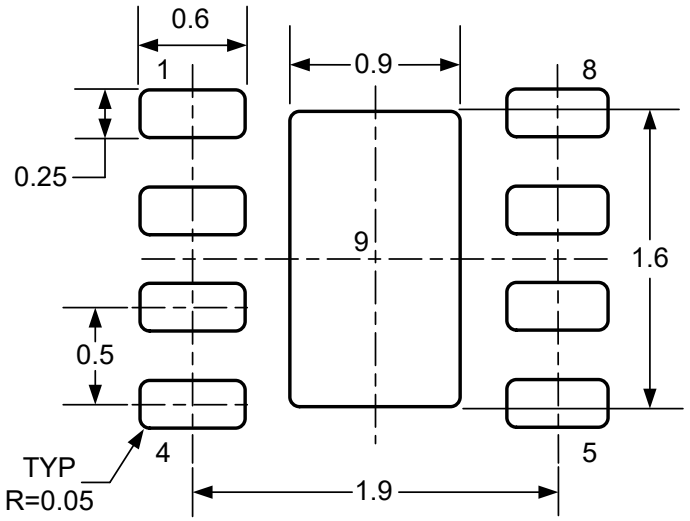


COMMON DIMENSIONS

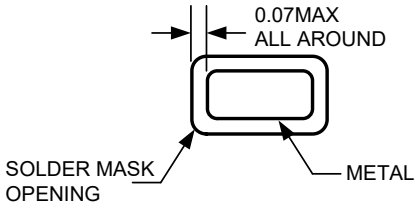
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.50	0.55	0.60
A1	0.00	0.02	0.05
A3		0.152REF	
D	1.95	2.00	2.05
E	1.95	2.00	2.05
D1	0.85	0.90	0.95
E1	1.55	1.60	1.65
b	0.15	0.20	0.25
L	0.30	0.35	0.40
e		0.50BSC	

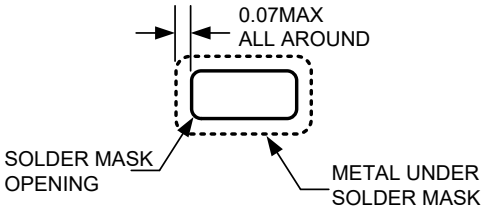
Land Pattern Data



LAND PATTERN EXAMPLE



NON SOLDER MASK
DEFINED
(PREFERRED)

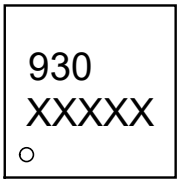


SOLDER MASK
DEFINED

SOLDER MASK DETAILS

Unit:mm

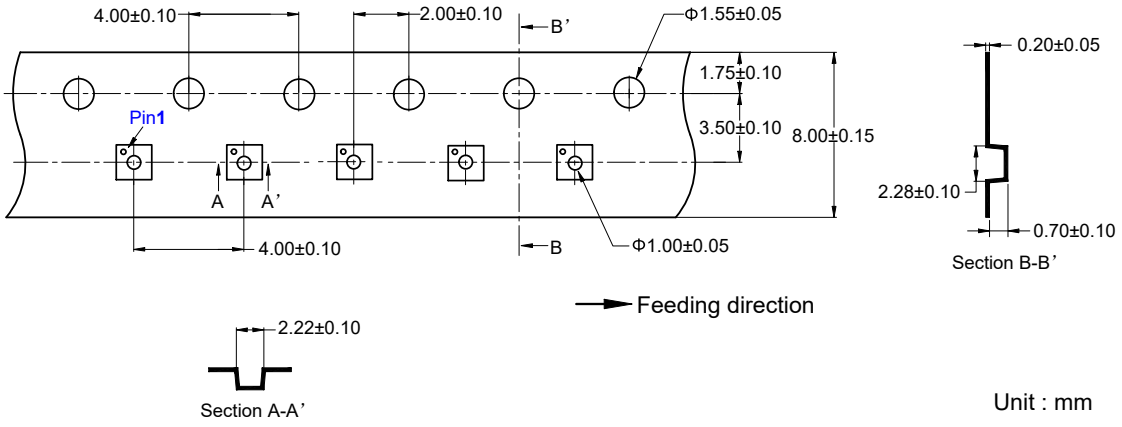
Marking



930 = Part No.

XXXXX = Tracking No.

Tape Information



Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2025.01.15	Officially Version	Caojc	Liuks	Liujy
1.1	2026.09.02	Add Land Pattern Data	Caojc	Liuks	Liujy