Adjustable Current-Limit Load Switch with OVP

General Description

ET2095S load switch features True Reverse-Current Blocking (TRCB) capability to isolate the output from the system., the internal switch features low 100mΩ (typ) on-resistance and operate from a +2.5V to +5.5V input voltage range. The slew-rate controlled switch is also ideal for a large load capacitor as well as high-current load switching applications. ET2095S has over-voltage protection and over-temperature protection.

The ET2095S is available in SOT23-5(2.926mm × 2.8mm) package and is specified over the -40°C to +85°C ambient temperature range.

Features

- Wide Input Voltage Range from 2.5V to 5.5V
- Max Current Capability:2.8A
- Absolute maximum voltage of V_{OUT} up to 28V
- Adjustable Current Limit Set Range : 0.1A~2.5A
  - -- 0.1A~2.0A with 10% Accuracy
  - -- 2.0A with 12% Accuracy
- Integrated Typical 100mΩ MOSFET Switch
- Over-Voltage Lockout at V_{OUT} = 5.8V Typical
- Fault Flag Open Drain Output
- Thermal Shutdown Protection (OTP)
- Under-Voltage Lockout (UVLO)
- True Reverse-Current Blocking (TRCB)
- ESD Protected:
  - -- HBM ESDA/JEDEC JS-001-2024 All pins: ±2.0kV Pass
  - -- CDM ESDA/JEDEC JS-002-2025 All pins: ±1.0kV Pass
- Part No. and Package

Part No.	Package	Packing Option	MSL
ET2095S	SOT23-5(2.926mm × 2.8mm)	Tape and Reel, 3K/Reel	3

Applications

- Smart Phones, Tablet PCs
- HDD, Storage, and Solid State Memory Devices
- Portable Media Devices, Laptop & MID
- SLR Digital Cameras

Pin Configuration

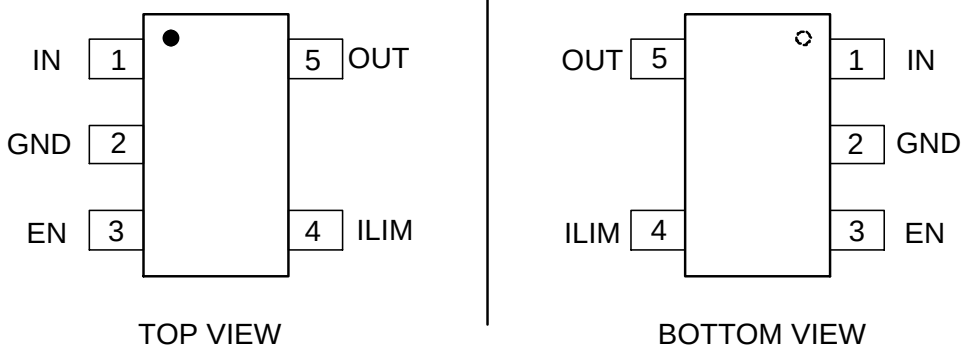


Figure 1. Pin Configuration

Pin Function

Pin No.	Pin Name	Pin Function
1	IN	Input of the load switch.
2	GND	Ground.
3	EN	Active HIGH - GPIO compatible Enable input. EN high to turn on the load switch.
4	ILIM	Current limit set pin. Connect a resistor between this pin and ground to program the desired current limit point.
5	OUT	Output of the load switch.

Block Diagram

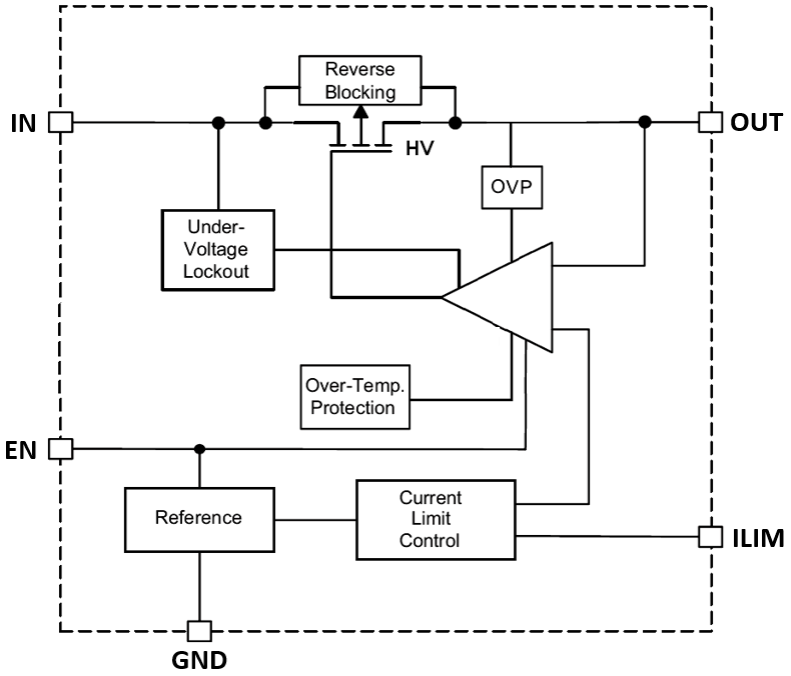


Figure 2. Block Diagram

Functional Description

Input Capacitor

The input capacitor C_{IN} protects the power supply from current transients generated by the load attached to the ET2095S. C_{IN} should be located as close to the device V_{IN} pin as practically possible. A high-value capacitor on C_{IN} can be used to reduce the voltage drop in high-current applications.

Output Capacitor

An output capacitor should be placed between the V_{OUT} and GND pins. This capacitor prevents parasitic board inductance from dorcing V_{OUT} below GND when the switch is on. This capacitor also prevents reverse inrush current from creating a voltage spike that could damage the device in the case of a V_{OUT} short.

Current Limiting

The current limit ensures that the current through the switch does not exceed the maximum set value, while not limiting the minimum value. The current at which the part's limit is adjustable through the selection of the external resistor connected to the I_{LIM} pin. Information for selecting the resistor is found in the section below. The device acts as a constant-current source when the load draws more than the maximum value set by the device until thermal shutdown occurs. The device recovers if the die temperature drops below the threshold temperature. If current limit is not used, the I_{LIM} pin could be connected with GND, but the maximum current must be less than the maximum current capability of 2.8A.

Under-Voltage Lockout (UVLO)

The under-voltage lockout turns the switch off if the input voltage drops below the lockout threshold. With the EN pin active, the input voltage rising above the UVLO threshold releases the lockout and enables the switch.

True Reverse-Current Blocking

The true reverse-current blocking feature protects the input source against current flow from output to input when the load switch is off.

Thermal Shutdown

The thermal shutdown protects the die from internally or externally generated excessive temperature. During an over-temperature condition, the switch is turned off. The switch automatically turns on again if the temperature of the die drops below the threshold temperature.

Setting Current Limit

The current limit is set with an external resistor connected between the SET and GND pins. The resistor is selected using the following Table. Resistor tolerance of 1% is recommended.

R_{ILIM} (Ω)	Current Limit_Typ (mA)	Current Limit Curve
11500	100	
7550	150	
5540	200	
4390	250	
3600	300	
3080	350	
2670	400	
2360	450	
2100	500	
1750	600	
1480	700	
1285	800	
1135	900	
1020	1000	
800	1250	
660	1500	
560	1750	
490	2000	
385	2500	

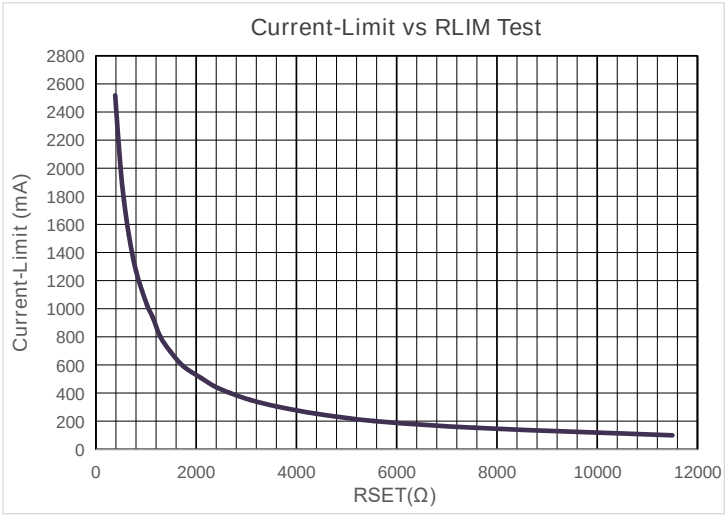


Figure 3. Current Limit Curve

Note: Table values based on 1% tolerance resistor.

Board Layout

For best performance, all traces should be as short as possible. To be most effective, the input and output capacitors should be placed close to the device to minimize the effect that parasitic trace inductance may have on normal and short-circuit operation. Using wide traces for V_{IN}, V_{OUT}, GND helps minimize parasitic electrical effects along with minimizing the case-to-ambient thermal impedance.

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.

Part No.	Parameters		Min	Max	Unit
V_{PIN}	OUT to GND, OUT to IN		-0.3	28	V
	EN,IN,ILIM to GND		-0.3	7.0	V
I_{SW}	Maximum Continuous Switch Current			2.8	A
T_J	Operating Junction Temperature		-40	+150	°C
T_{STG}	Storage Junction Temperature		-65	+150	°C
θ_{JA}	Thermal Resistance, Junction-to-Ambient (1-inch Square Pad of 2 oz.copper)			95	°C/W
P_D	Total Power Dissipation at T_A=25°C			1.0	W
V_{ESD}	HBM	Human Body Model(JS-001-2024)	-2.0	2.0	kV
	CDM	Charged Device Model (JS-002-2025)	-1.0	1.0	

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. ET2095S does not recommend exceeding them or designing to Absolute Maximum Ratings.

Part No.	Parameters	Min	Max	Unit
V_{PIN}	OUT to GND, OUT to IN	-0.3	28	V
	EN,IN,ILIM to GND	-0.3	5.5	V
I_{SW}	Maximum Continuous Switch Current		2.5	A

Electrical Characteristics

(V_{IN}=2.5 to 5.5 V, T_A= -40 to +85°C, typical values are at V_{IN}=5V and T_A=25°C, unless otherwise stated).

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Basic Operation						
V_{IN}	Input Voltage		2.5		5.5	V
$I_{Q(OFF)}$	Off Supply Current	V_{EN}=GND,V_{OUT}=Open		0.1	2	μA
$I_{SD(OFF)}$	Shutdown Current	V_{IN}=5.5V,V_{OUT}=0V, V_{EN}=GND		0.1	4	μA
I_Q	Quiescent Current	I_{OUT}=0mA		75	100	μA
R_{ON}	On Resistance	V_{IN}=5.0V, I_{OUT}=1A, T_A=25℃		100		mΩ
V_{IH}	EN Input Logic HIGH Voltage	V_{IN}=2.5V to 5.5V	1.20			V
V_{IL}	EN Input Logic LOW Voltage	V_{IN}=2.5V to 5.5V			0.4	V
I_{EN}	EN Input Leakage	V_{EN}=0V to V_{IN}			1	μA
R_{EN_PD}	Pull-Down Resistance at EN Pin	V_{IN}=2.5~5.5V, V_{EN}=HIGH, T_A=-40 to 85°C		14		MΩ
Over-Voltage Protection						
V_{OV_TRIP}	Output OVP Lockout	V_{OUT} Rising Threshold	5.5	5.8	6.0	V
		V_{OUT} Falling Threshold		5.5		
V_{OVP_HYS}	Output OVP Hysteresis		0.1	0.3	0.5	V
t_{OVP}	Response Time	V_{OUT}=5.5V to 7.0V, T_A=25°C, EN=5V,C_{IN}=0μF,R_{IN}=100Ω		0.5	2	μs
I_{LIM}	Current Limit[1]	V_{IN}=5.0V,R_{ILIM}=2100Ω, V_{OUT}=1.68V to 5.0V with 10% Accuracy	450	500	550	mA
		V_{IN}=5.0V,R_{ILIM}=1020Ω, V_{OUT}=1.68V to 5.0V with 10% Accuracy	900	1000	1100	
V_{UVLO}	Under-Voltage Lockout	V_{IN} Increasing	1.9	2.3	2.5	V
		V_{IN} Decreasing	1.8	2.1	2.4	
I_{RCB}	RCB Current	V_{EN}=0V,V_{OUT}=5.5V		0.5	3	uA
t_{HOCP}	Hard Over-Current Response Time	Moderate Over-Current Condition, I_{OUT}≥I_{LIM} V_{OUT}=0V		6		μs
T_{SD}	Thermal Shutdown[2]	Shutdown Threshold		155		°C
		Return from Shutdown		135		
		Hysteresis		20		

Electrical Characteristics (Continued)

(V_{IN}=2.5 to 5.5 V, T_A= -40 to +85°C, typical values are at V_{IN}=5V and T_A=25°C, unless otherwise stated).

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Dynamic Characteristics						
t_{DON}	Turn-On Delay[2,3]	V_{IN}=5V, R_L=100Ω, C_L=1μF, T_A=25°C, R_{ILIM}=1020Ω		0.65		ms
t_R	V_{OUT} Rise Time[2,3]			0.35		
t_{ON}	Turn-On Time[2,4]			1.00		
t_{DOFF}	Turn-Off Delay[2,3]			0.01		
t_F	V_{OUT} Fall Time[2,3]			0.22		
t_{OFF}	Turn-Off Time[2,5]			0.23		

Note1: Characterization based on 1% tolerance resistor.

Note2: This parameter is guaranteed by design and characterization; not production tested.

Note3: t_{DON}/t_{DOFF}/t_R/t_F are defined in Timing Diagrm below.

Note4: t_{ON}=t_R + t_{DON}.

Note5: t_{OFF}=t_F + t_{DOFF}.

Note6: The relationship between V_{IH}/V_{IL} and V_{IN} is as shown below. Please follow EC table when using ET2095S.

Timing Diagram

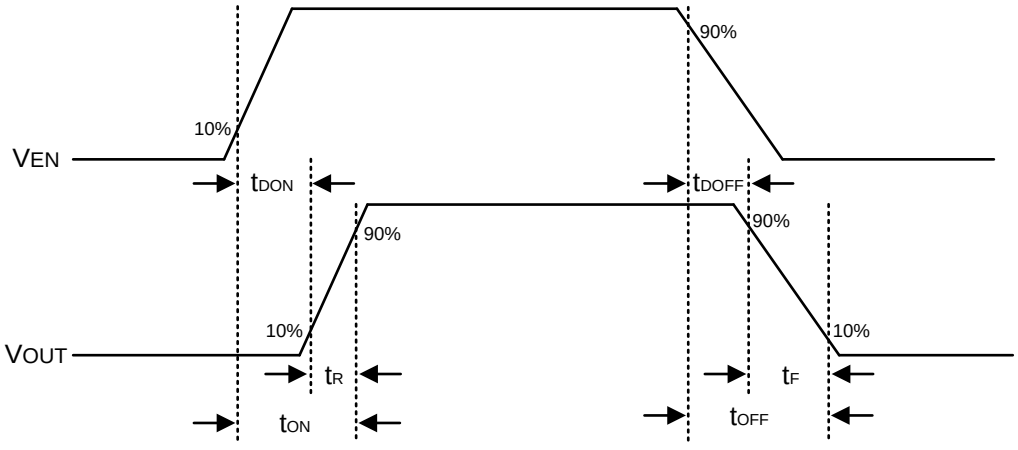
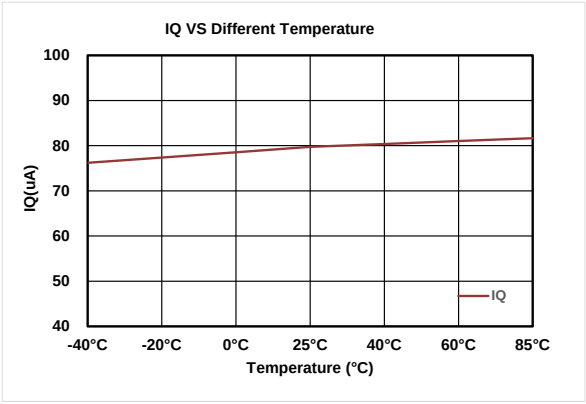


Figure 4. Timing Diagram

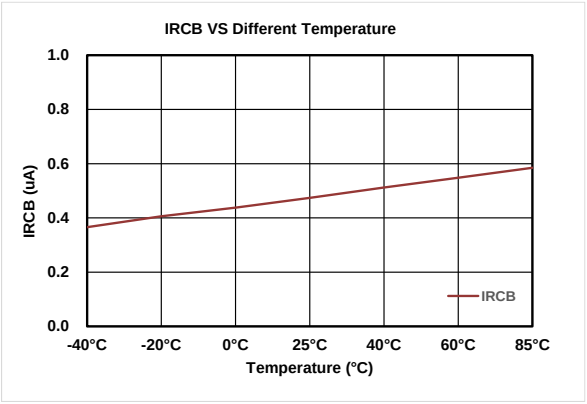
Typical Characteristics

Unless otherwise noted, typical values are at V_{IN}=5V, EN=5V, R_{ILIM}=1kΩ, C_{IN}=C_{OUT}=1μF and T_A=25°C.



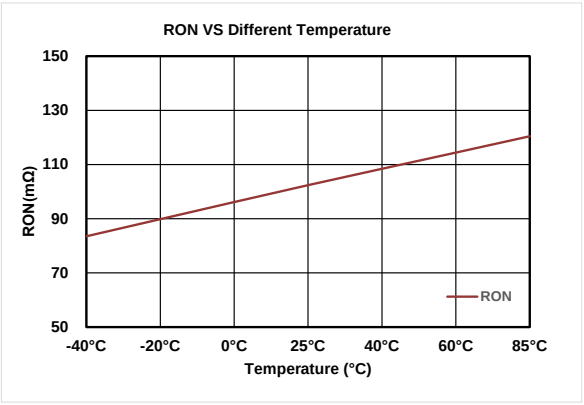
V_{IN}=5V, EN=5V, I_{OUT}=0mA

Figure 5. Input Quiescent Current VS Temperature



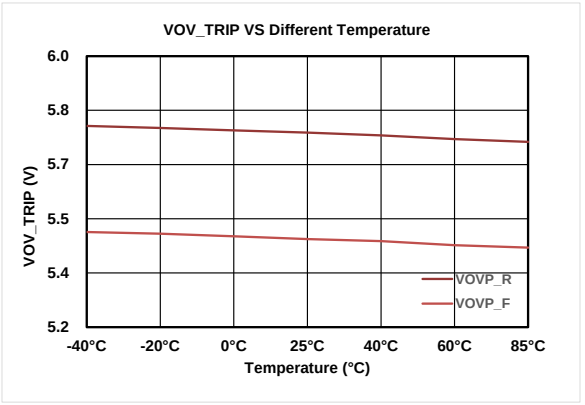
V_{EN}=0V, V_{OUT}=5.5V

Figure 6. RCB Current VS Temperature



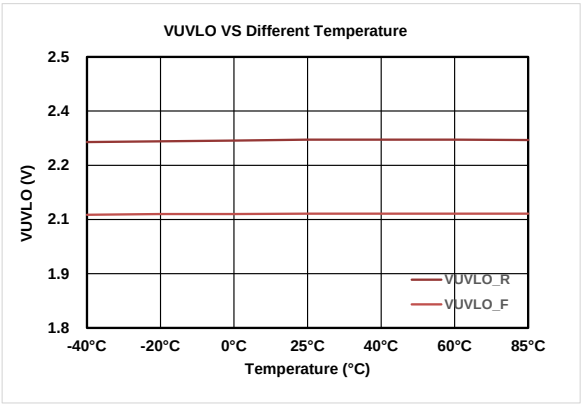
V_{IN}=5V, EN=5V, I_{OUT}=1A

Figure 7. On Resistance VS Temperature



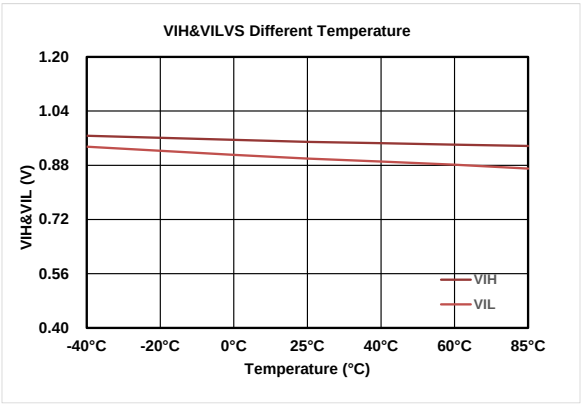
V_{OUT} Rising, EN=5V, I_{OUT}=0mA

Figure 8. Output OVP Lockout VS Temperature



EN=5V, I_{OUT}=0mA

Figure 9. Under-Voltage Lockout VS Temperature

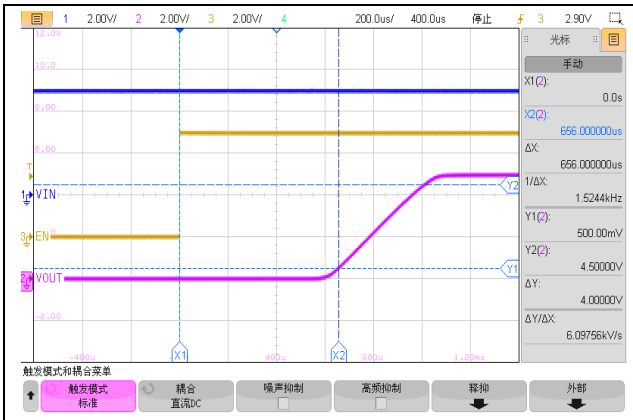


V_{IN}=5V, I_{OUT}=0mA

Figure 10. EN Input Logic Voltage VS Temperature

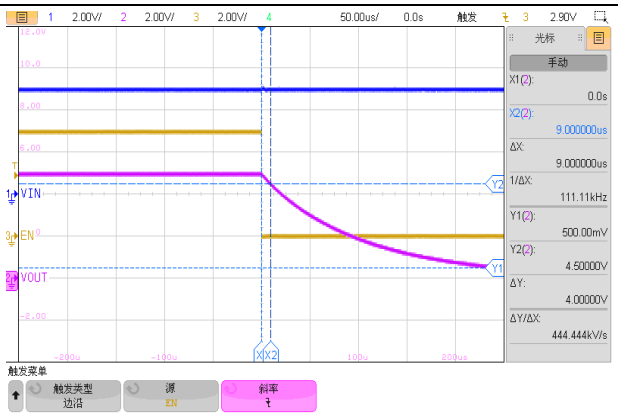
Typical Characteristics (Continued)

Unless otherwise noted, typical values are at V_{IN}=5V, EN=5V, R_{ILIM}= R_{ILIM}=1kΩ, C_{IN}=C_{OUT}=1μF and T_A=25°C.



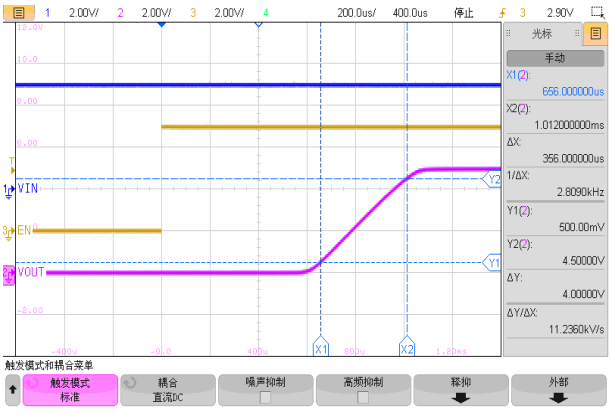
V_{IN}=5V, EN=0V to 5V, R_{LOAD}=100Ω

Figure 11. Turn-On Delay Time



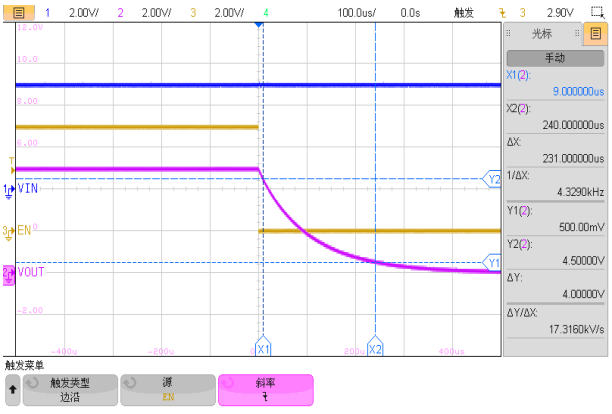
V_{IN}=5V, EN=5V to 0V, R_{LOAD}=100Ω

Figure 12. Turn-Off Delay Time



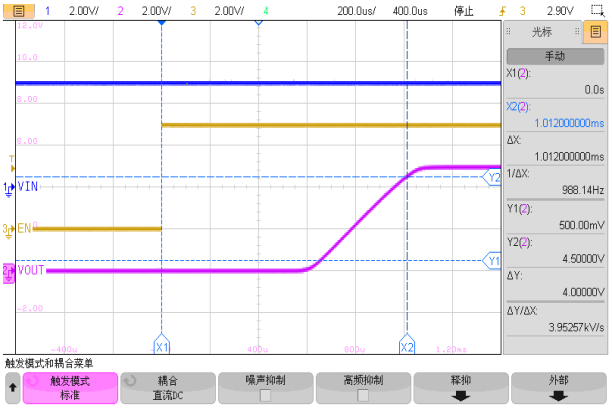
V_{IN}=5V, EN=0V to 5V, R_{LOAD}=100Ω

Figure 13. V_{OUT} Rise Time



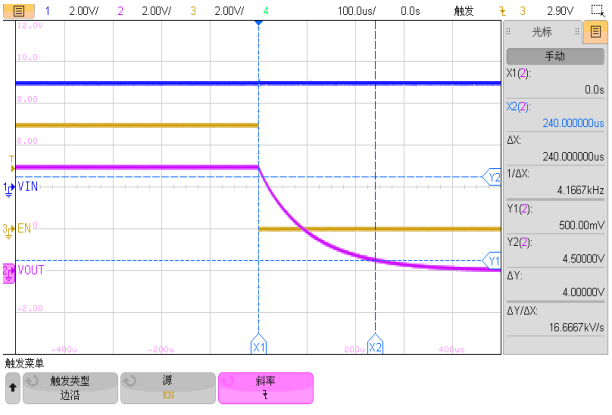
V_{IN}=5V, EN=5V to 0V, R_{LOAD}=100Ω

Figure 14. Turn-Fall Delay Time



V_{IN}=5V, EN=0V to 5V, R_{LOAD}=100Ω

Figure 15. Turn-On Time

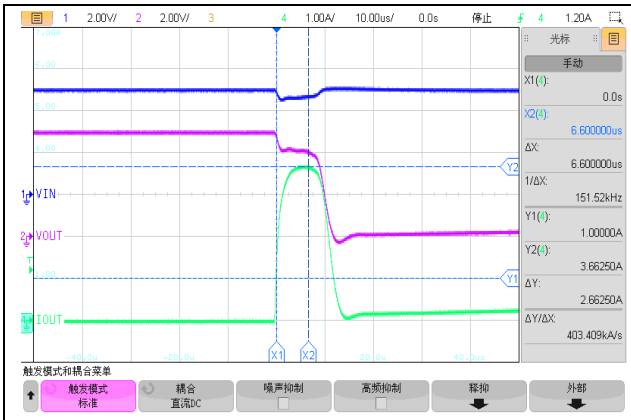


V_{IN}=5V, EN=5V to 0V, R_{LOAD}=100Ω

Figure 16. Turn-Off Time

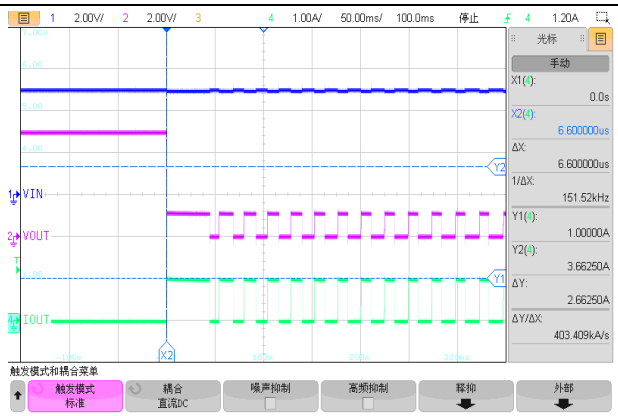
Typical Characteristics (Continued)

Unless otherwise noted, typical values are at V_{IN}=5V,EN=5V,R_{ILIM}=1kΩ,C_{IN}=C_{OUT}=1μF and T_A=25°C.



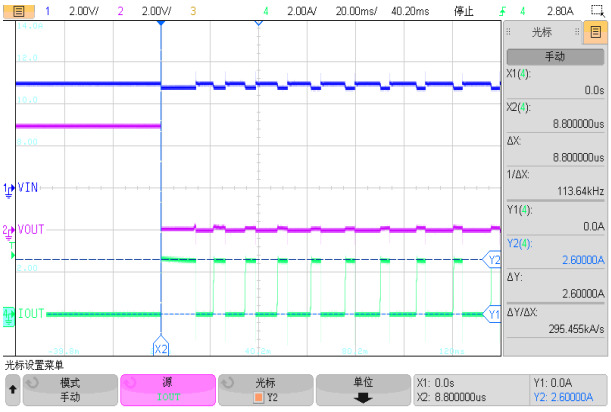
V_{IN}=5V, EN=5V, R_{ILIM}=1kΩ

Figure 17. Hard Over-Current Response Time



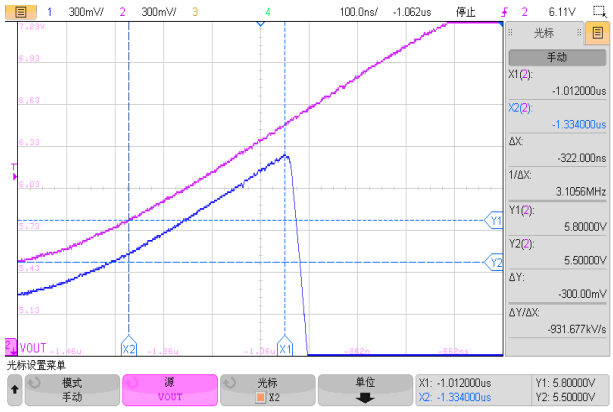
V_{IN}=5V, EN=5V, R_{ILIM}=1kΩ

Figure 18. Over-Current Protection



V_{IN}=5V, EN=5V, R_{ILIM}=390Ω

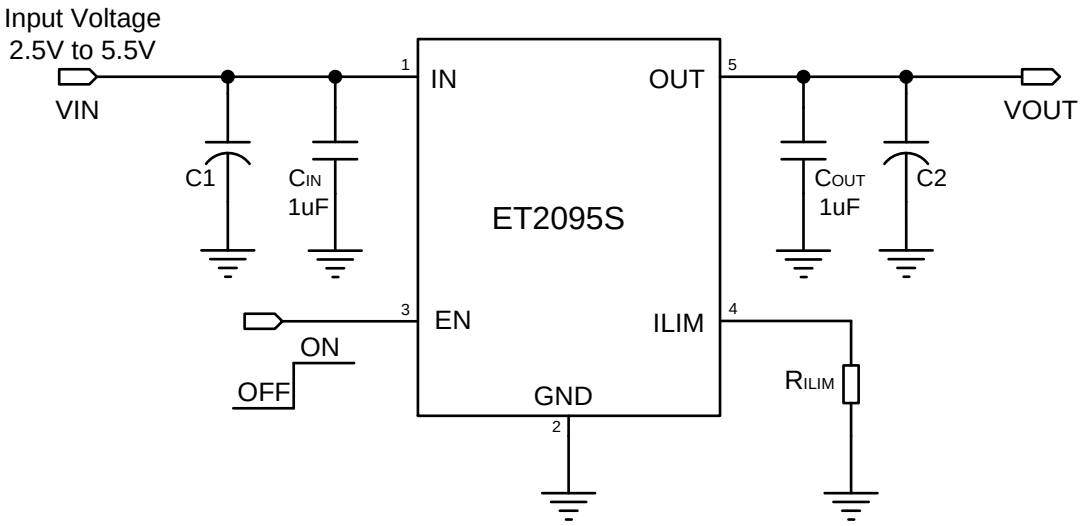
Figure 19. Short Circuit Protection



V_{OUT}=5.5V to 7.0V, EN=5V,C_{IN}=0μF,R_{IN}=100Ω

Figure 20. Output OVP Response Time

Application Circuits

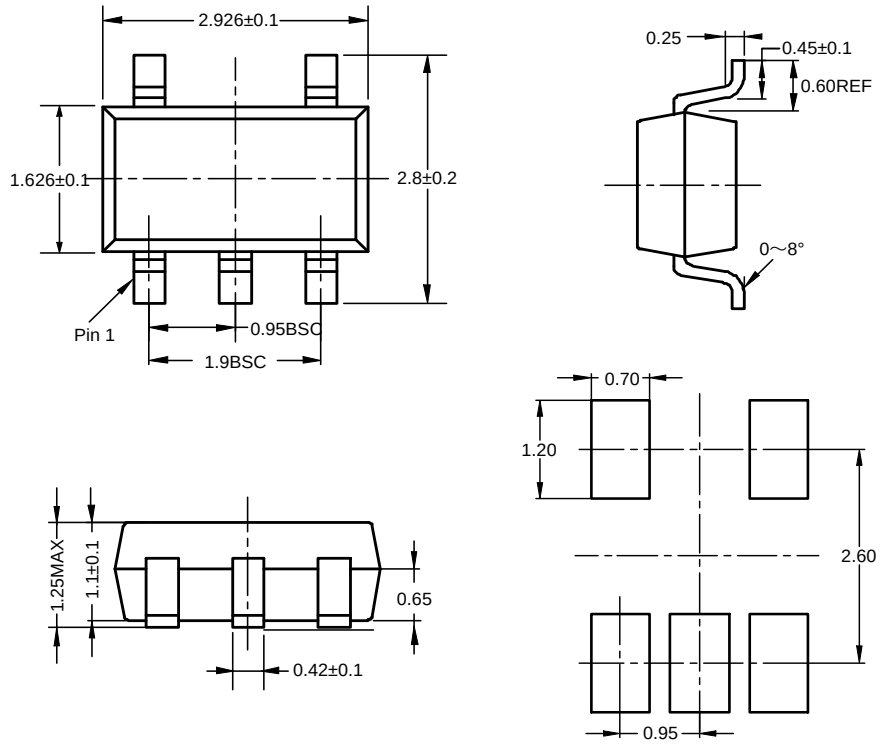


This electric circuit only supplies for reference.

Note: C_{IN} and C_{OUT} capacitors recommended for improvement of device stability.

Package Dimension

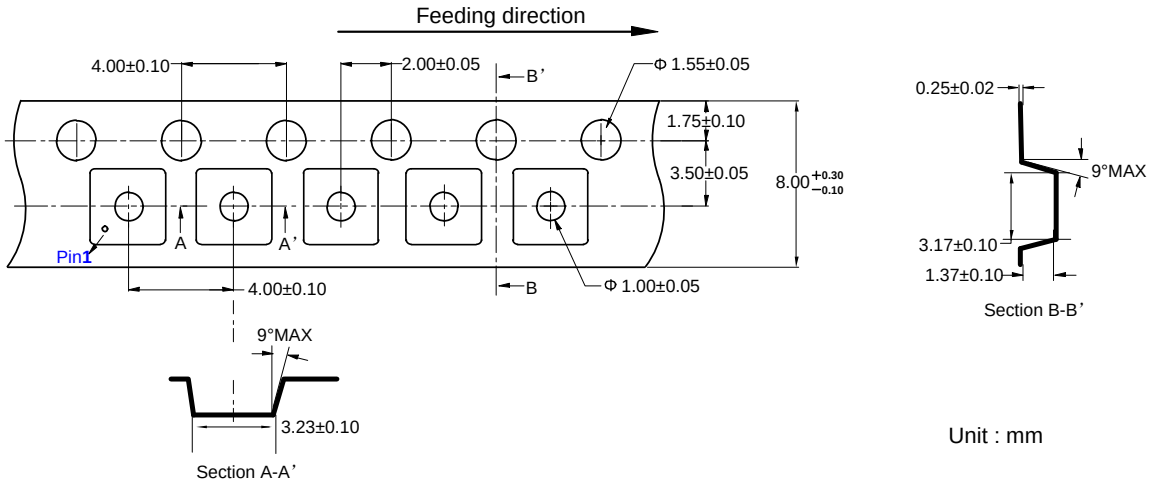
SOT23-5



Recommended Land Pattern

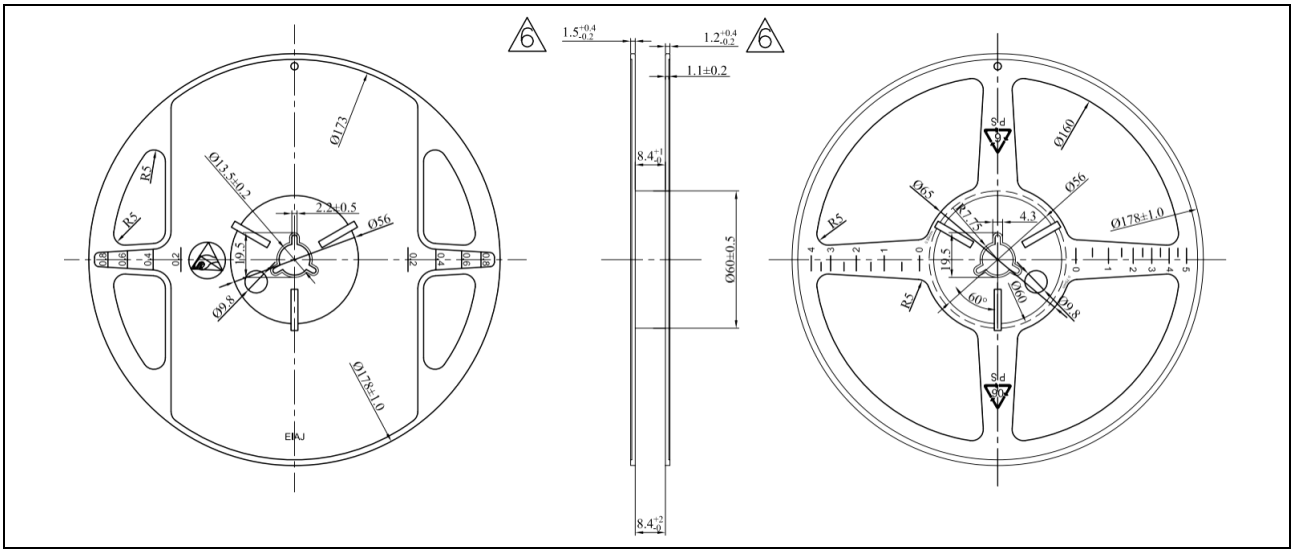
Unit: mm

Tape Information

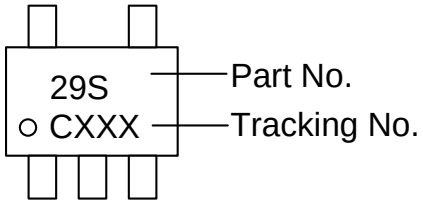


Unit : mm

Reel Information



Marking



Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2026-01-26	Initial Version	Caojc	Wum	Liujy