

1 Description

The CN1502TER is a load switch with adjustable current limit, suitable for a 12V input power supply and supporting an output current of up to 1A. The CN1502TER is equipped with output short-circuit protection, thermal protection, input undervoltage locking and input overvoltage protection functions, ensuring reliability.

The CN1502TER adopts the SOT23-6 package form, providing a compact solution with very few external components.

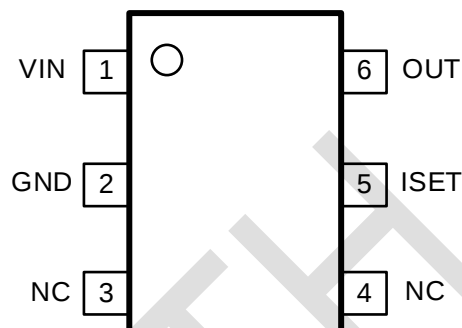
2 Features

- Low power consumption: quiescent current: 125uA
- Wide input voltage range: 5-18V
- Adjustable Current Limit Load Switch: supports a maximum output current of 1A
- Input overvoltage protection: 22.5V
- Overcurrent protection in hiccup mode
- Short circuit protection in hiccup mode
- Thermal shutdown
- Supports SOT23-6 package

3 Applications

- Smart Meters
- 12V Power Interface
- Portable Battery Powered Devices
- IP camera

4 Pinout



CN1502TER(SOT23-6)

5 Ordering information

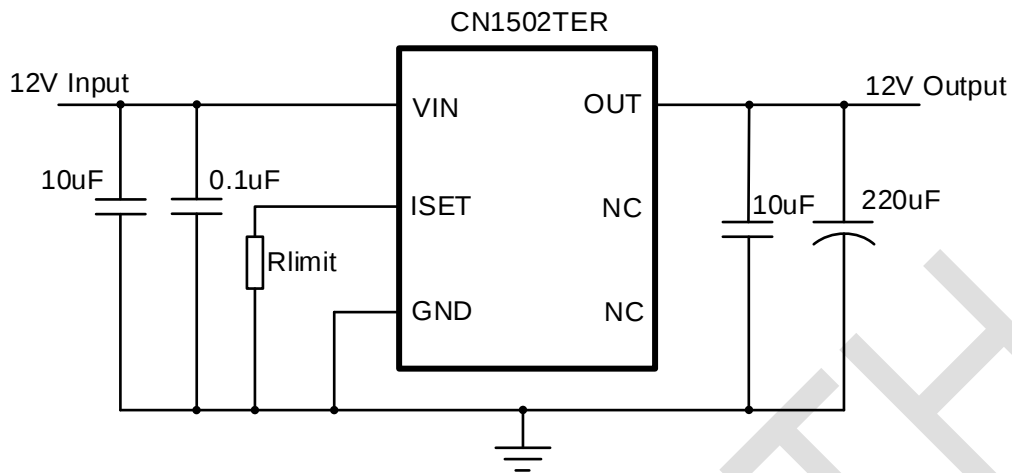
Product Number	Package	Marking	Quantity/Tape
CN1502TER	SOT23-6	1502 YYWW	3000/Tape

Note: YY=Year WW=Week.

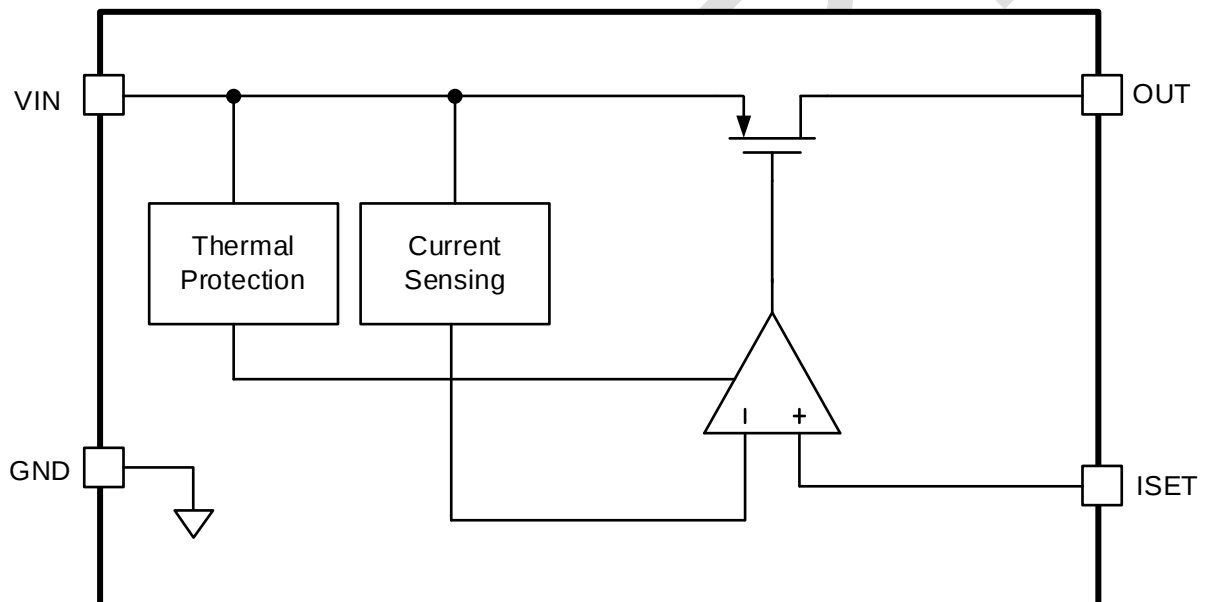
Green (RoHS & HF): CHIPNORTH defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your CHIPNORTH representative directly.

Moisture sensitivity level(MSL):3

6 Typical Application



7 Block Diagram



8 Pin Descriptions

Pin No.	Pin Name	Descriptions
1	VIN	Input pin.
2	GND	Ground.
3、4	NC	Float or connect to GND.
5	ISET	Current Limit Setting Pin. The current limit of the load switch can be programmed by connecting a resistor between the ISET pin and the GND pin. The current limit is typically 480mA when ISET is short to ground or floated.
6	OUT	Load switch output pin.

9 Specifications

9.1 Absolute Maximum Ratings

Parameter	Symbol	Value	Units
Input voltage	V_{IN}	-0.3~24	V
Output voltage Range	V_{OUT}	-0.3~24	V
ISET voltage	V_{ISET}	-0.3~6	V
Storage temperature	T_{stg}	-55~+150	°C

(1) Stresses exceeding the values listed under Absolute Maximum Ratings may cause permanent damage to the device. These listed values are stress ratings only and do not imply that the device will operate properly under these conditions or any other conditions other than the recommended operating conditions. Prolonged operation at maximum absolute rating conditions can affect device reliability.

(2) All voltage values are based on the ground terminal.

9.2 ESD Ratings

Discharge mode	Standard	Value	Units
HBM	ANSI/ESDA/JEDEC JS-001-2024	± 3000	V
CDM	ANSI/ESDA/JEDEC JS-002-2022	± 2000	V
Latch up	JESD78F.02-2023	± 200	mA

9.3 Recommended Operating Range

Parameter	Symbol	Min.	Max.	Units
Input voltage range	V_{IN}	5	18	V
Operating Temperature	T_A	-40	85	°C

9.4 Thermal Information

Parameter	Package	Value	Unit
Junction to ambient thermal resistance(θ_{JA})	SOT23-6	220	°C/W

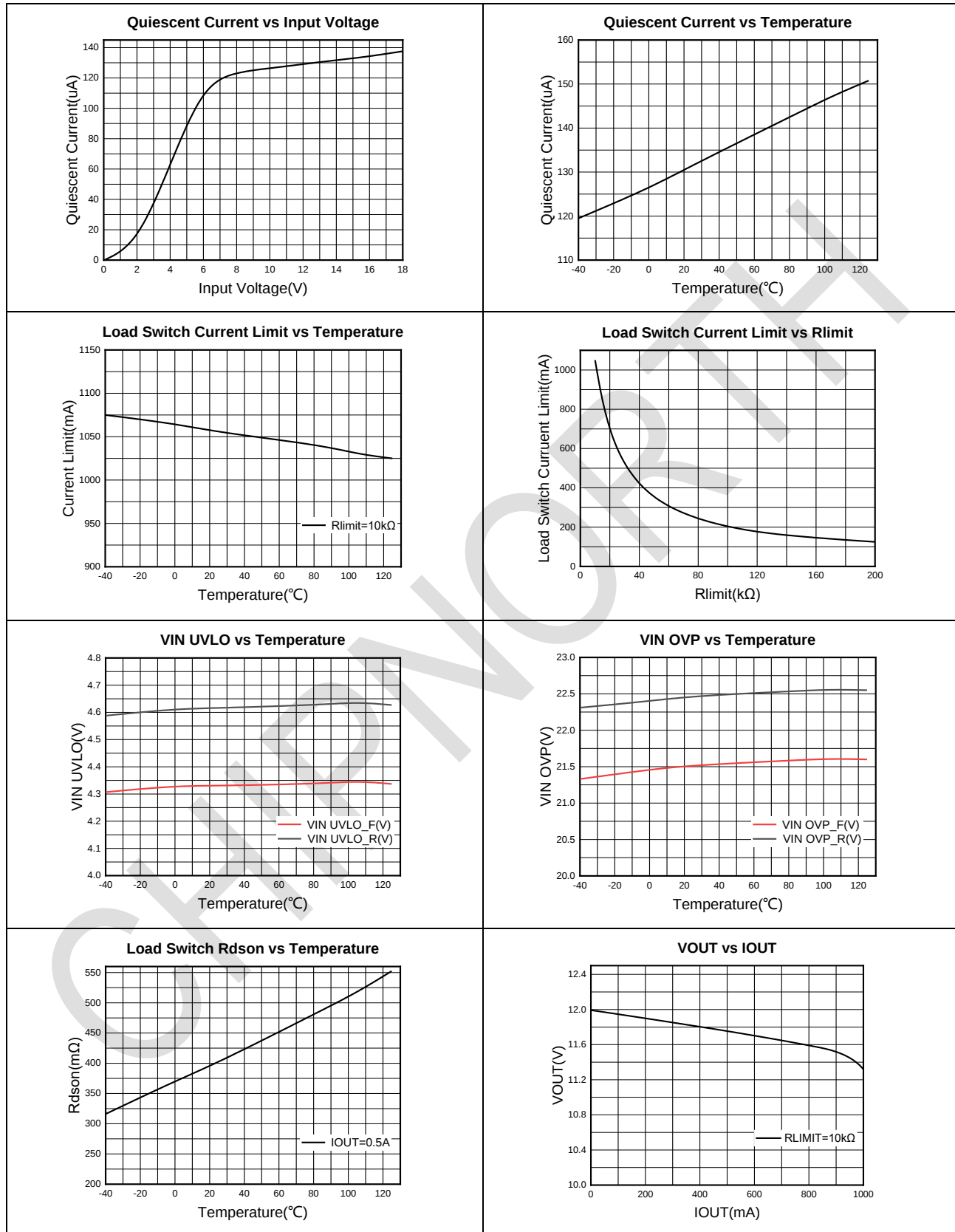
9.5 Electrical Characteristics

Test conditions: $V_{IN}=12V$, $T_A=25^{\circ}C$, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage Range	V_{IN}		5		18	V
Quiescent Current	I_Q		60	125	190	μA
Input UVLO Threshold	V_{IN_UVLO}	VIN rising	4.4	4.6	4.8	V
Input UVLO hysteresis	$V_{IN_UVLO_HYST}$	VIN falling		0.3		V
Input OVP Threshold	V_{IN_OVLO}	VIN rising		22.5		V
Input OVP hysteresis	$V_{IN_OVLO_HYST}$	VIN falling		1		V
Load Switch On-resistance	$R_{DS(on)}$	IOUT=1A, OCP threshold setting greater than 1.2A	200	400	600	m Ω
Load Switch Current Limit	I_{LIM_OUT}	Rlimit=200K Ω		0.1		A
		Rlimit=10K Ω	0.95	1.05	1.15	A
		Float ISET pin	0.42	0.48	0.54	A
Load Switch Short Circuit Current Limit		OUT short to GND		0.09		A
OUT Short Circuit Detection Time	T_{dect_OUT}			211		ms
OUT short-circuit hiccup interval	T_{hicup_OUT}			3.24		s
Over-temperature protection point	T_{TSD_OUT}			160		$^{\circ}C$
Over-temperature protection hysteresis	T_{TSD_HYST}			30		$^{\circ}C$

9.6 Characteristics Curve

Test conditions: $V_{IN}=12V$, $T_A=25^{\circ}C$, unless otherwise specified.



10 Detailed Description

10.1 Overview

The CN1502TER is a load switch with adjustable current limit, suitable for a 12V input power supply and supporting an output current of up to 1A. The CN1502TER is equipped with output short-circuit protection, thermal protection, input undervoltage locking and input overvoltage protection functions.

10.2 Current Limit Protection

The CN1502TER contain current limit circuit for monitoring and controlling the gate voltage of the pass transistors to limit the output current to a certain value, and the current limit of the load switch can be set by the external resistor R_{limit} on the ISET pin.

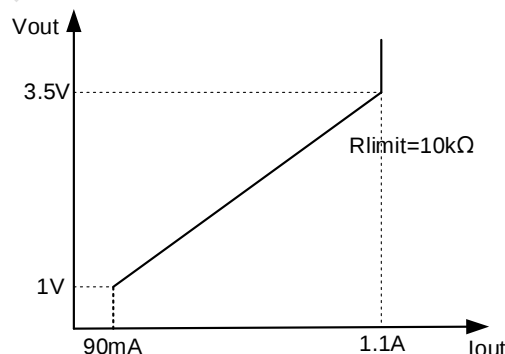
Once the load switch output current reaches the current limit threshold, the internal circuit regulates the gate voltage to maintain a constant power MOSFET current. In order to limit the current, the gate-to-source voltage must be regulated from 5V to about 1V. Typical response time is about 15 μ s, during which a small overshoot of the output current may occur. The CN1502TER allows the ILIMIT pin to be floated or shorted to ground during operation. If the ILIMIT pin is floated or shorted to ground, the current limit is internally set to 480mA.

10.3 Short Circuit Protection

The CN1502TER incorporates short-circuit protection function. If the load current increases rapidly due to a short circuit, the current may exceed the current limit threshold before the control loop reacts. when the current exceeds 1.5 times of the current limit value, the short circuit protection function will be triggered and the fast shutdown circuit will be activated to shut down the power MOSFET. when the chip triggers the short circuit protection, it will be restarted once for checking whether the short circuit exists. If the short circuit still exists when the device is restarted, the CN1502TER will adjust the gate voltage to keep the current at the short-circuit current limit level. If the short-circuit condition at the OUT pin remains for more than 210 ms, the IC enters hiccup mode and the power FETs are forced off and enabled again after 3.2 s.

10.4 Load Switch Fold Back Function

The CN1502TER's load switch current limit protection integrates a fold back protection function. When the OUT voltage is less than 3.5V, the ILIMIT threshold decreases as the VOUT voltage decreases, with a downward slope of 400 mA/V, and the minimum current limit is the short-circuit current limit.



10.5 Input Overvoltage Protection

When the input voltage exceeds the protection threshold (typically 22.5V), the CN1502TER will be disabled. When the input voltage drops below 21.5V, the CN1502TER will be reactivated.

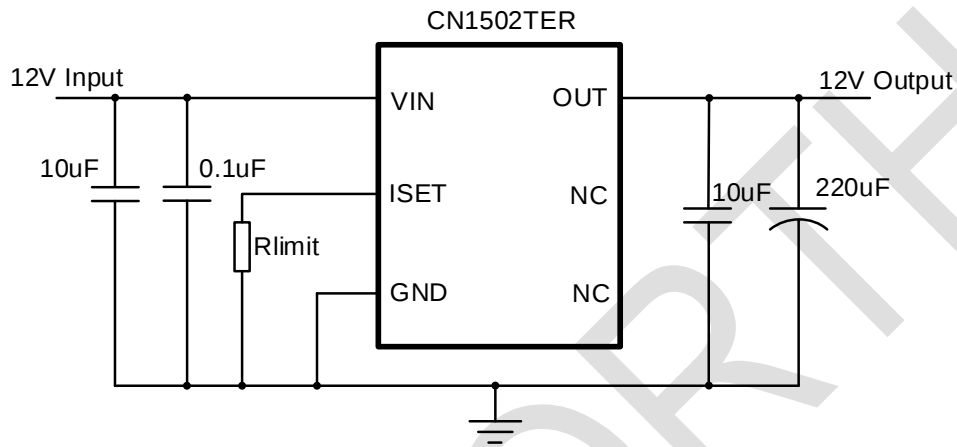
10.6 Thermal Shutdown

When the temperature of CN1502TER rises above 160°C, it will enter a thermal shutdown state. The device can only be reactivated when the temperature drops below 130°C.

11 Application information

11.1 Typical applications

The following figure shows a typical application schematic for a circuit that can be used to evaluate the performance of the CN1502TER.



11.2 Load Switch Current Limit Setting

The current limit value of the load switch can be set by the external resistor R_{limit} on the ISET pin. The formula for calculating I_{LIMIT} is as follows:

$$I_{LIMIT} = \frac{10K}{R_{limit}} + 50mA$$

When the ISET pin is floating or shorted to ground, the current limit is set internally to 480mA.

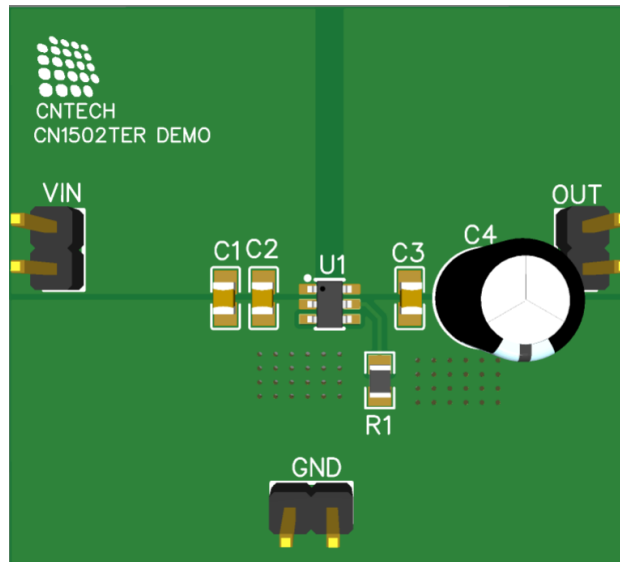
11.3 Input Capacitor Selection

Too small input capacitance will weaken the buffer ability of the chip against transient high-current events, leading to deterioration of power integrity, abnormal voltage and protection failure, and then lead to electrical or thermal damage of the chip. Therefore, placing a reasonable capacitance near the input pin of the chip can improve the system reliability. For example, in the application scenario with VIN=16V, it is recommended to place a capacitor not less than 4.7uF/50V at the input.

11.4 PCB Layout

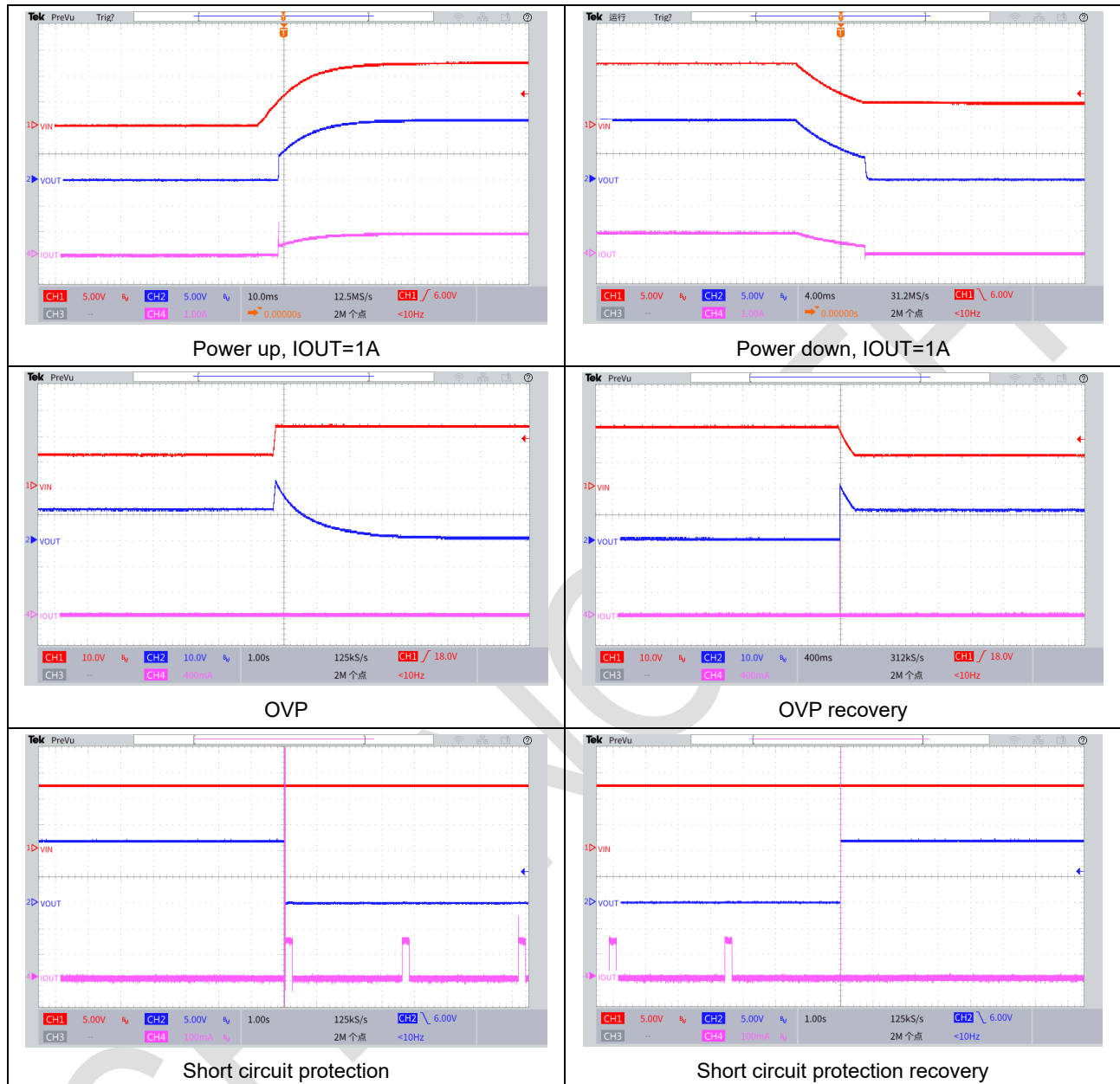
An efficient layout is essential for stable operation. For best results, refer to the diagram below and follow these guidelines

- Place the high current paths (VIN and VOUT) close to the device, using short, straight and wide leads.
- Place the input capacitors close to the VIN and GND pins.
- Connect VIN and VOUT pads to large VIN and VOUT planes to improve thermal performance.
- Place a current limiting resistor externally near the ISET pin pads.



11.5 Operating waveforms

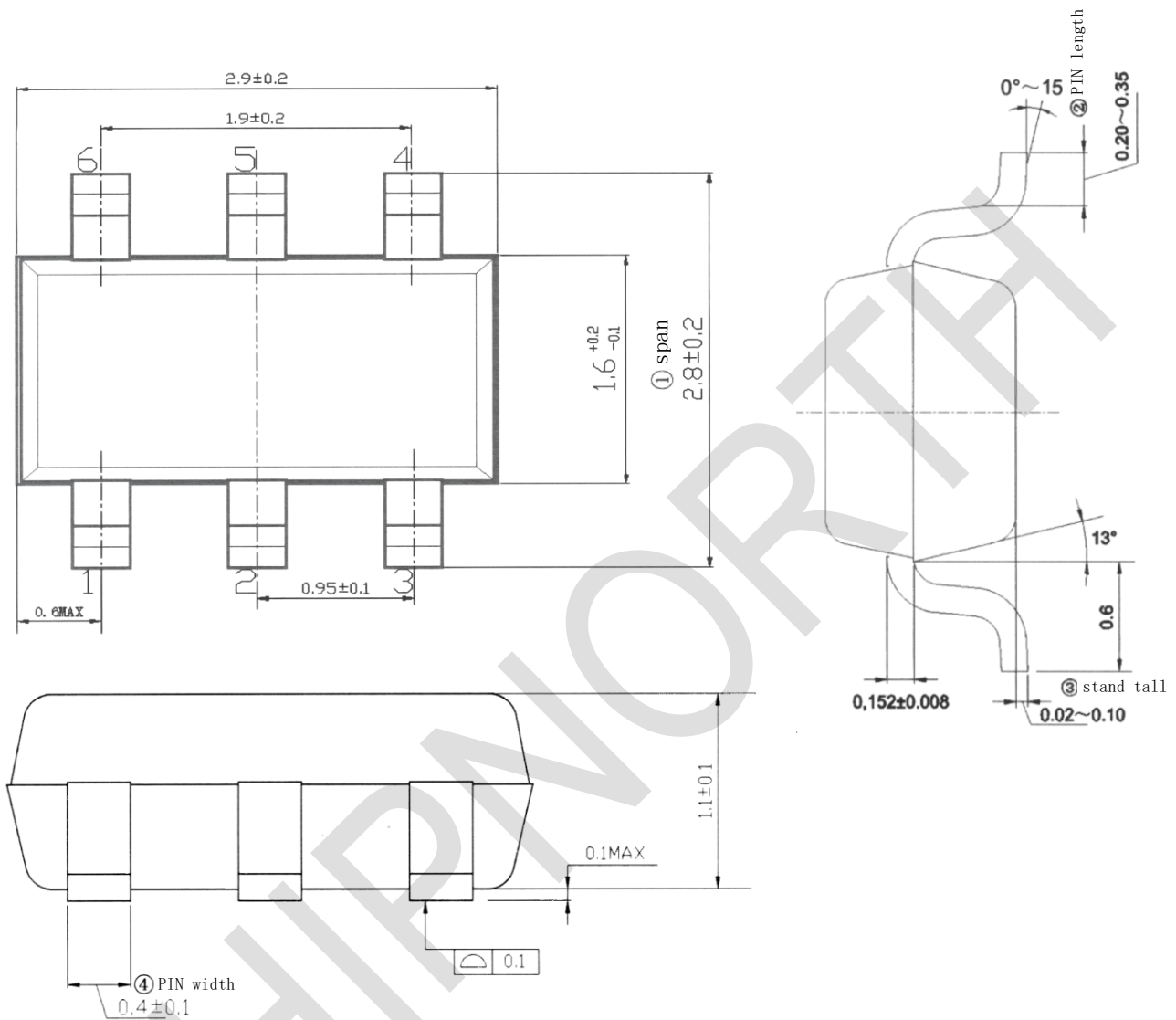
Test conditions: $V_{IN}=12V$, $T_A=25^{\circ}C$, unless otherwise specified.



12 Package Information

SOT23-6

unit: mm



13 Important Statement

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