16V Dual Channel, Load Switch and LDO

1 Description

The AL783 is a power management unit that integrates a load switch and a low noise, low dropout linear regulator for 12V input power supplies. The load switch is capable of supporting up to 1A output current, while the LDO provides 160mA output current with adjustable output voltage. The AL783 ensures reliability with independent output short-circuit protection for each channel, thermal protection and input under-voltage lockout function, and input over-voltage protection.

The AL783 is available in SOT23-6 and SOP8 packages. A compact solution is available with minimal external components.

2 Features

- Low power consumption: quiescent current: 125uA
- Wide input voltage range: 5-16V
- Channel Ⅰ: Adjustable Current Limit Load Switch
- Channel Ⅱ: 160mA current limited LDO with adjustable output voltage
- Channel Ⅱ output voltage accuracy of 2%
- Input overvoltage protection: 22.5V
- Overcurrent protection for dual channel independent hiccup mode
- Short circuit protection for dual channel independent hiccup mode
- Thermal shutdown
- Supports SOP8 and SOT23-6 packages.

3 Applications

- Smart Meters
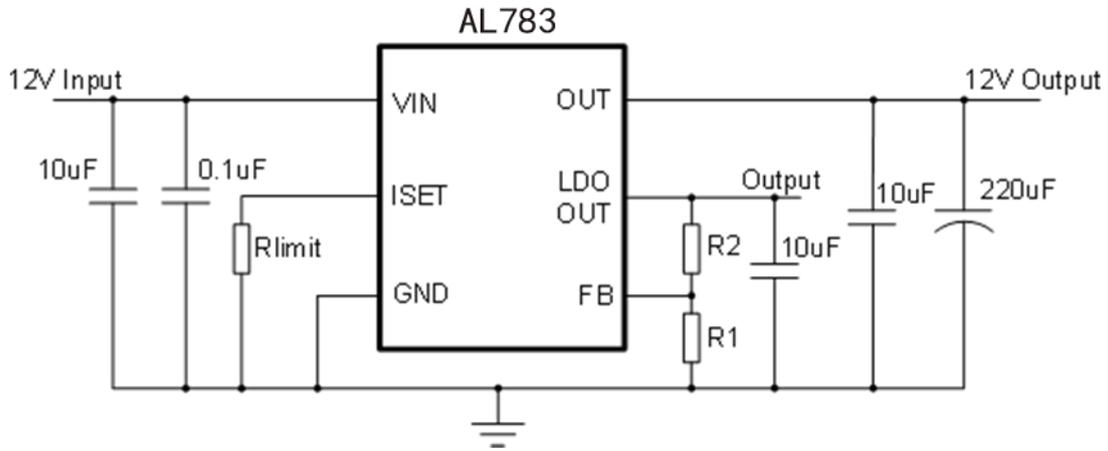- Portable Battery Powered Devices
- IP camera

4 Pinout

Top view

AL783S（SOP8）
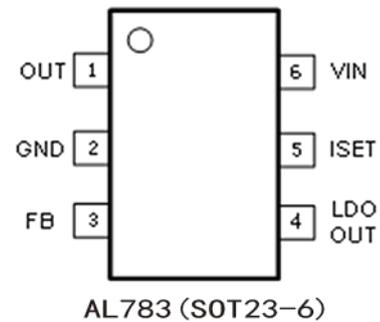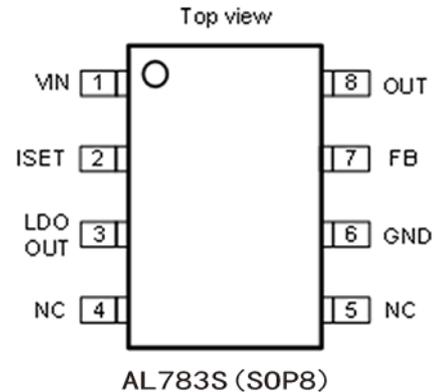
AL783（SOT23-6）

5 Ordering information

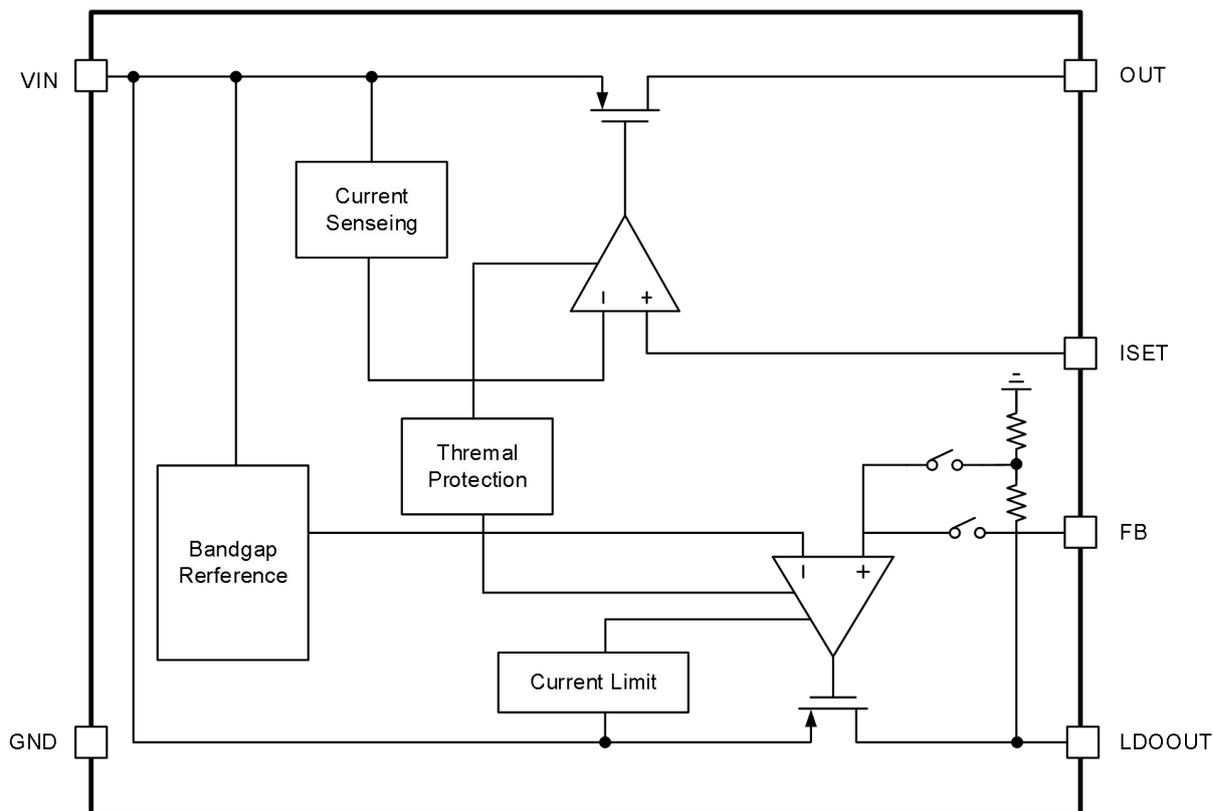| Product Number	Package	Quantity/Tape
AL783S	SOP8	4000/Tape
AL783	SOT23-6	3000/Tape

备注：丝印第一行表示规格型号，第二行表示批号（如2115，表示2021年15周）

6 Typical Application

7 Pin Descriptions

Pin No.		Pin Name	Descriptions
SOT23-6	SOP8		
1	8	OUT	Load switch output pin.
2	6	GND	Ground.
3	7	FB	AL783: LDO output voltage feedback pin.FB detects the output voltage of the LDO, which is regulated to 1.1V by the control loop, and a resistor divider is connected at FB.
4	3	LDOOOUT	LDO output pin.
5	2	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 530mA when ISET is short to ground or floated.
6	1	VIN	Input pin.
	4	NC	No connect.
	5	NC	No connect.

8 Block Diagram

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
FB voltage	V_{FB}	-0.3-6	V
LDO Output Voltage	V_{LDOOUT}	-0.3-12	V
Storage temperature	T_{stg}	-55~+150	°C

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	16	V
LDO Output Voltage Range	VLDOOUT	1.8	7	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
Junction to ambient thermal resistance(θ_{JA})	SOP8	110	°C/W

上 海 翱 龙 电 子 科 技 有 限 公 司
Shanghai Along Electronic Technology Co.,Ltd

9.5 Electrical Characteristics

Test conditions: V_{IN}=12V, T_A=25°C, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage Range	V_{IN}		5		16	V
Quiescent Current	I_Q			125		uA
Input UVLO Threshold	V_{IN_UVLO}	VIN rising		4.6		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_{DSON}	IOUT=1A，OCP threshold setting greater than 1.2A		370		mΩ
Load Switch Current Limit	I_{LIM_OUT}	Rlimit=200KΩ		0.15		A
		Rlimit=10KΩ		1.1		A
		Float ISET pin		0.53		A
Load Switch Short Circuit Current Limit		OUT short to GND		0.09		A
LDO Output Voltage Accuracy		Internal integrated voltage divider resistor	-2		2	%
FB Voltage Accuracy		AL783	1.1*0.98	1.1	1.1*1.02	V
LDO Dropout Voltage	V_{DROP}	I_{LDOOUT}=100mA@V_{OUT}=5V		90		mV
LDO Current Limit	I_{LIMIT_LDO}		160	220		mA
OUT Short Circuit Detection Time	T_{dect_OUT}			211		ms
OUT short-circuit hiccup interval	T_{hicup_OUT}			3.24		s
LDOOUT short-circuit detection time	T_{dect_LDOOUT}			53		ms
LDOOUT short-circuit hiccup interval time	T_{hicup_LDOOUT}			0.81		s
Overtemperature protection point	T_{TSD_OUT}			160		°C
Over-temperature protection hysteresis	T_{TSD_HYST}			30		°C

9.6 Characteristics Curve（AL783）

Test conditions: V_{IN}=12V, T_A=25°C, unless otherwise specified.

LDOOUT Voltage vs Temperature

FB Voltage vs Temperature
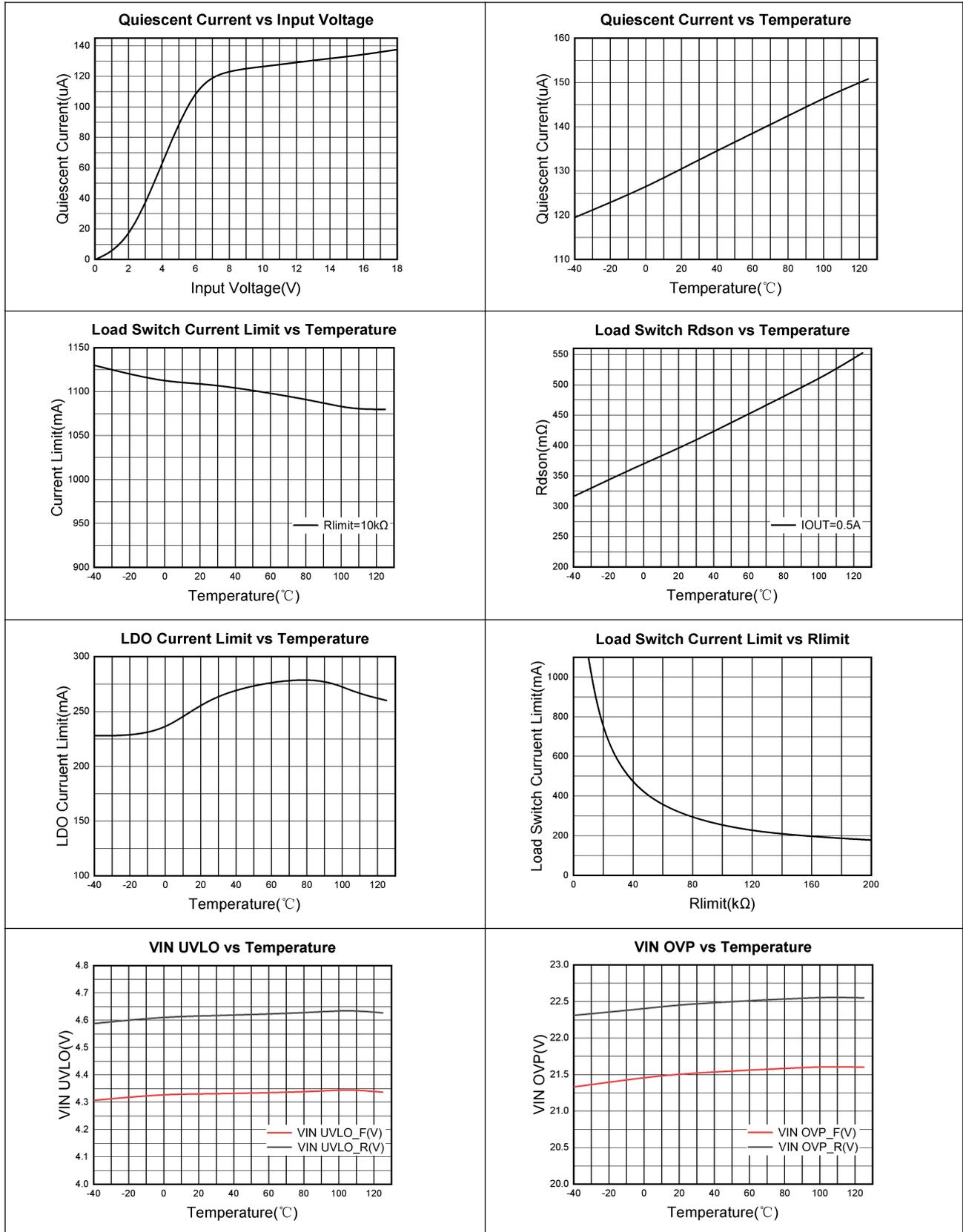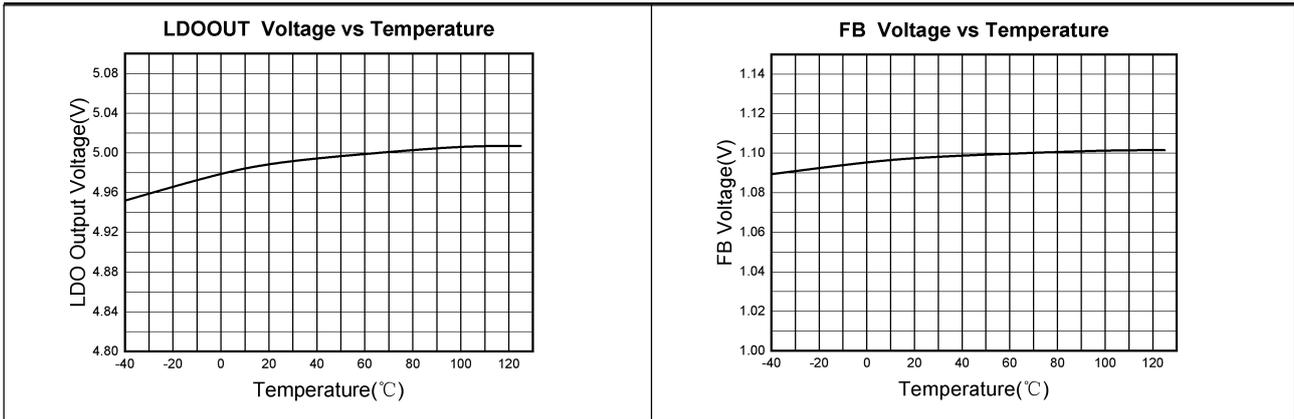
10 Detailed Description

10.1 Overview

The AL783 is a PMU that integrates a load switch and a low noise LDO, with the Channel I load switch providing up to 1A output current and the Channel II LDO regulator providing up to 160mA output current.

The AL783 is available in LDO fixed output version AL783XX and LDO adjustable output version AL783

10.2 Current Limit Protection

The AL783 contains two independent current limit circuits for monitoring and controlling the gate voltage of the pass transistors to limit the output current to a certain value. The current limit of the LDO is fixed at 220mA, and the current limit of the load switch can be set by the external resistor Rlimit 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 15μs, during which a small overshoot of the output current may occur. the AL783 allows the ILIMIT pin to be floated or shorted to ground during operation. The AL783 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 530mA.

10.3 Short Circuit Protection

The AL783 incorporates an independent 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 AL783 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. If a short-circuit condition at the LDOOUT pin is maintained for more than 50 ms, the IC enters hiccup mode and the power FET is forced off and re-enabled after 0.8s.

10.4 Load Switch Fold Back Function

The AL783'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.
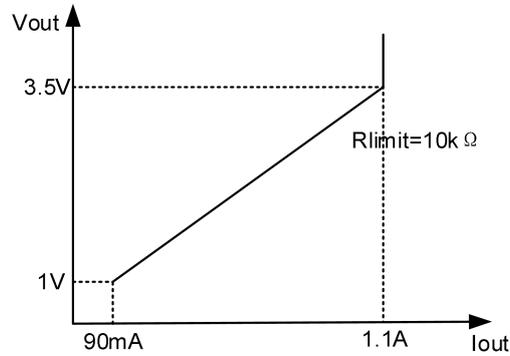
10.5 Input Overvoltage Protection

The AL783 will be disabled when the input voltage is greater than the protection threshold (typically 22.5 V) and will be enabled again when the input voltage drops below 21.5 V. The AL783 will be disabled when the input voltage falls below the protection threshold (typically 22.5 V).

10.6 Thermal Shutdown

The AL783 will go into thermal shutdown when its temperature rises above 160°C. It will only go into thermal shutdown when the temperature drops below 130°C. The device will only be reactivated when the temperature drops below 130°C. The AL783 will not be reactivated until the temperature has dropped to 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 AL783.
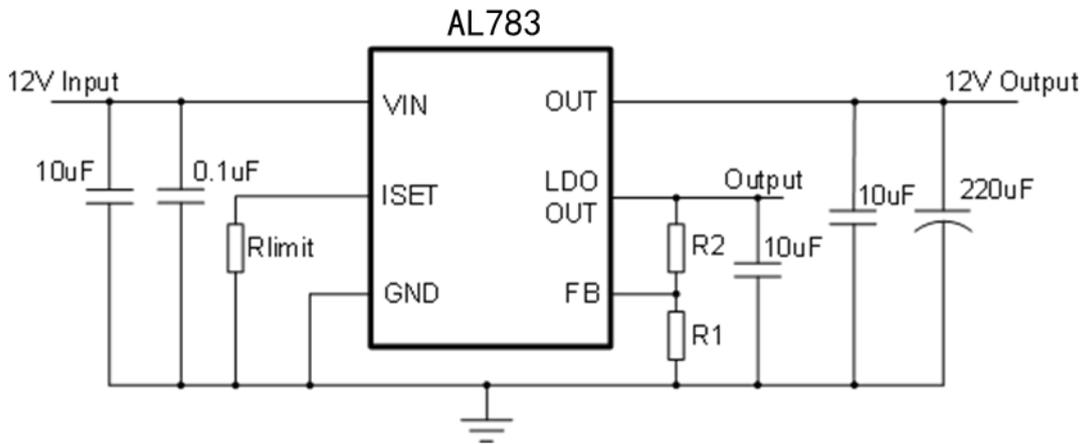
11.2 LDO Output Voltage Setting

For AL783 version, its LDO channel output voltage can be set by external feedback resistor, and the output voltage is calculated as follows:

$$V_{OUT} = V_{FB} \times \left(1 + \frac{R_2}{R_1}\right)$$

where VFB is typically 1.1V typical (internal reference voltage).

11.3 Load Switch Current Limit Setting

The current limit value of the load switch can be set by the external resistor Rlimit on the ISET pin.The formula for calculating ILIMIT is as follows:

$$ILIMIT = \frac{10K}{Rlimit} + ILIMT\_SHORT$$

Where ILIMT_SHORT is the short-circuit current limit, typical value is 90mA.
When the ISET pin is floating or shorted to ground, the current limit is set internally to 530mA.

11.4 PCB Layout

An efficient layout is essential for stable operation. For best results, refer to the diagram below and follow these guidelines
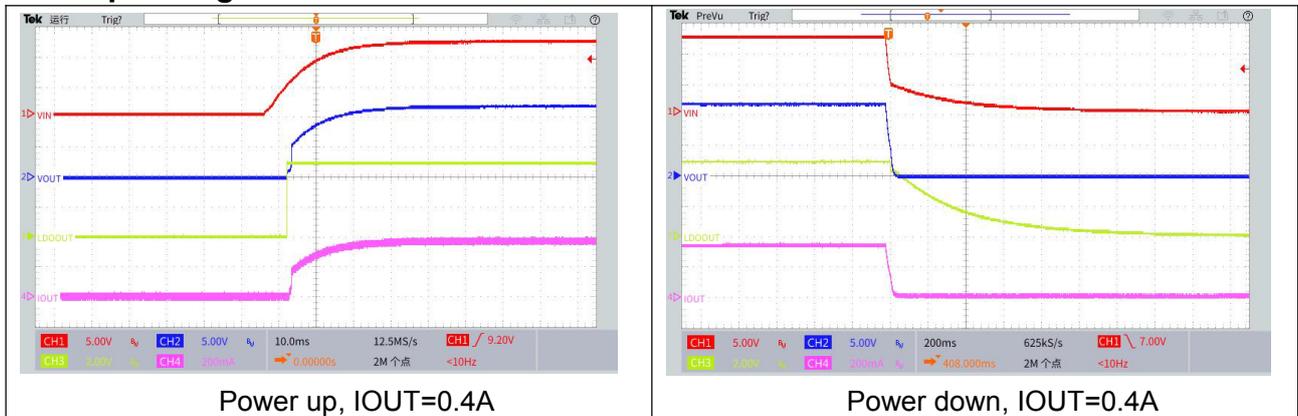
● Place the high current paths (VIN and VOUT) close to the device, using short, straight and wide leads.

● 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.

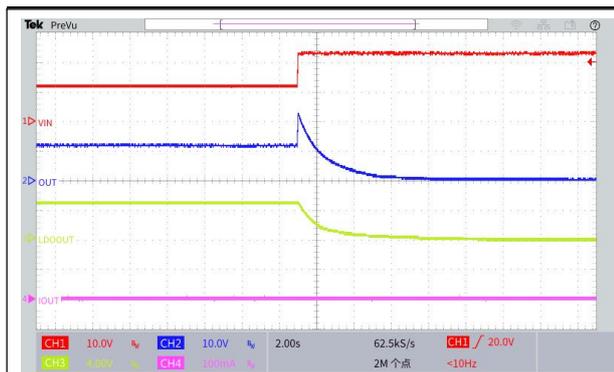● Place a current limiting resistor externally near the ISET pin pads.

11.5 Basic Performance

Test conditions: V_{IN}=12V, T_A=25°C, unless otherwise specified.

LDO Load Transient, IOUT=1-160-1mA

LDO Line Transient, VIN=6-12-6V, IOUT=0.01A
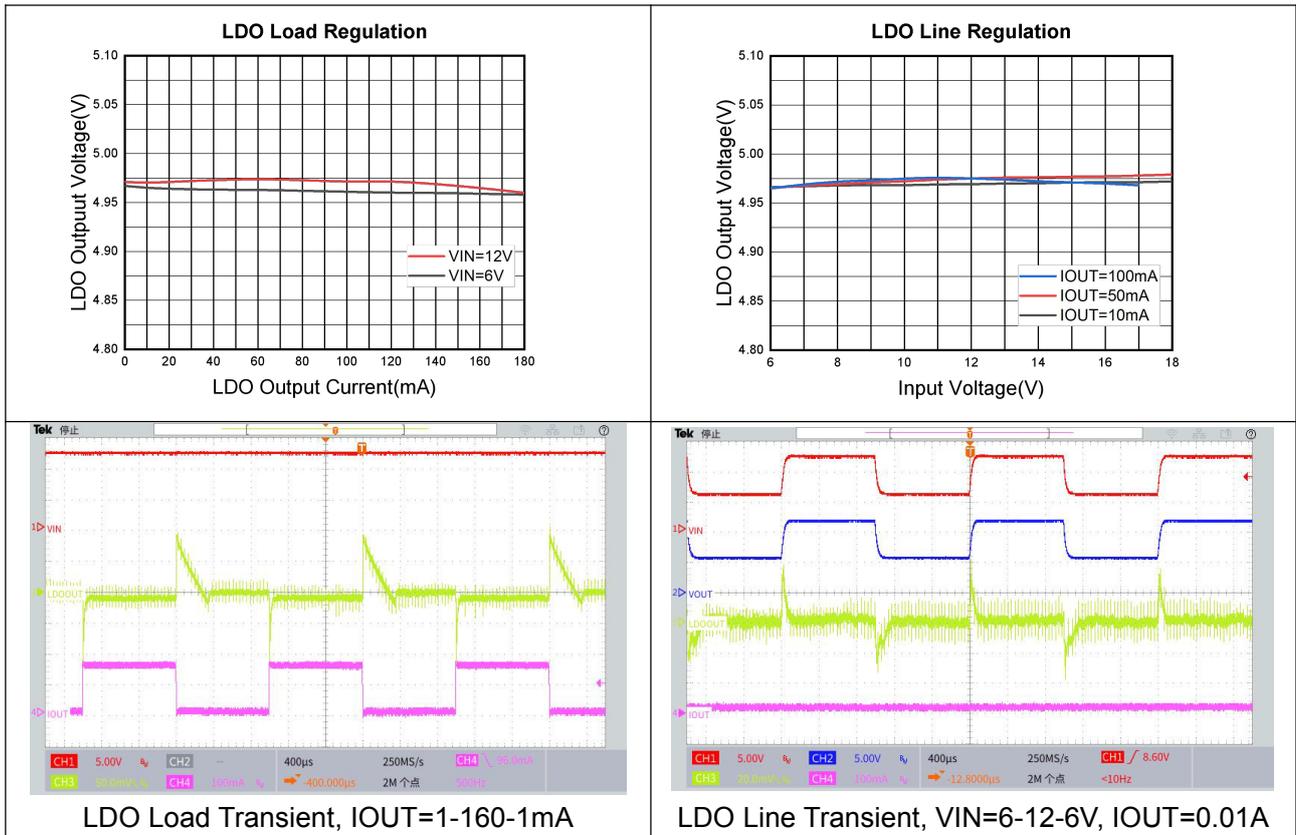
11.6 Operating waveforms

Power up, IOUT=0.4A
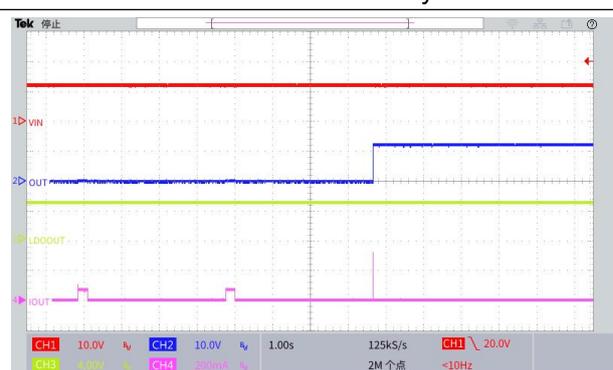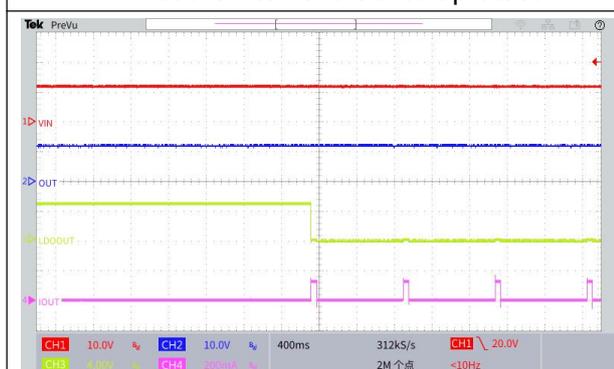

Power down, IOUT=0.4A
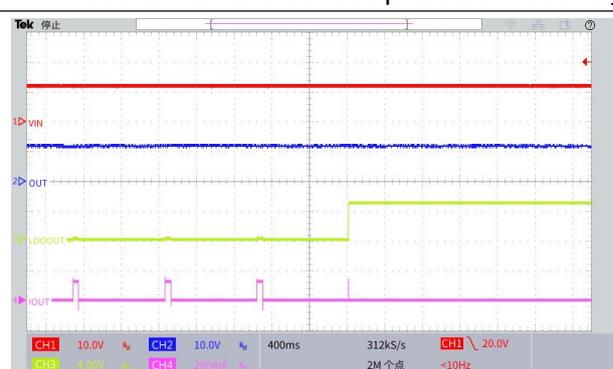
OVP

OVP recovery

Load Switch short circuit protection

Load Switch short circuit protection recovery

LDO short circuit protection

LDO short circuit protection recovery

12 Package Information

SOT23-6
unit：mm

SOP-8L

unit：mm

① span 6.0±0.15

3.90

0～0.08

0.40

1.27

1.40±0.05

④ PIN width

0.40

② PIN length 0.6±0.1

0.254

0°～8°

3.90

③ stand tall
0.11±0.05