DESCRIPTION

The A4776A is available in SOT25 Package

The A4776A is a USB output protection chip with adjustable current limit threshold for 5V applications. The device integrates over current protection, short protection, over temperature protection, under voltage lock-out protection functions, etc. It can limit output current when short event happens or heavy capacitive load is applied to the USB output, so as to protect the supply voltage source from collapsing.

FEATURES

- Low on resistance: 70mΩ
- Current-limit threshold adjustable by external resistor
- Current limit accuracy over full operating conditions : ±15%
- Output short fast response and protection
- No parasitic substrate diode, and reverse current blocking when switch is off.

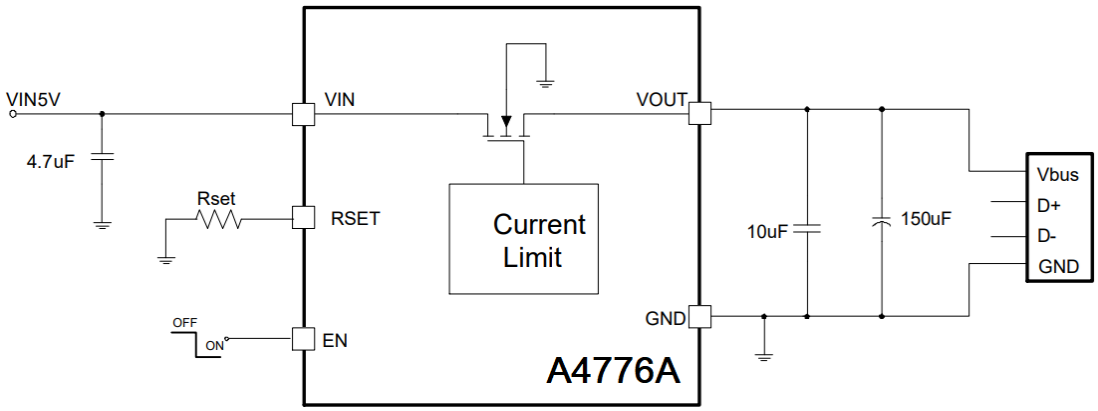
ORDERING INFORMATION

Package Type	Part Number	
SOT-25 SPQ: 3,000pcs/Reel	E5	A4776AE5R
		A4776AE5VR
Note	V: Halogen free Package R: Tape & Reel	
AiT provides all RoHS products		

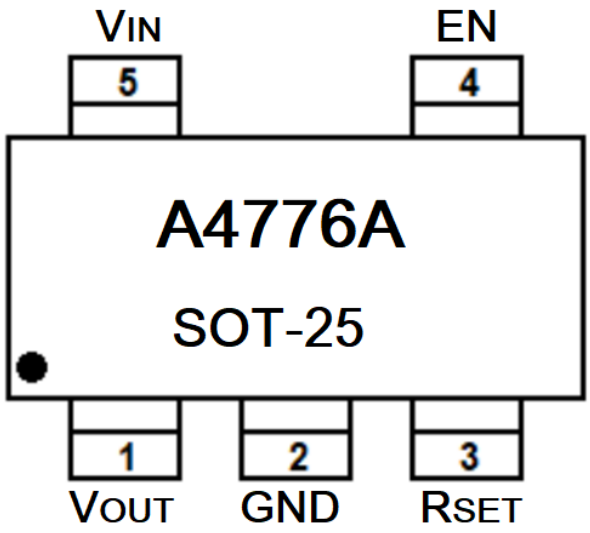
APPLICATION

- USB hub
- USB periphery
- Notebook and tablet
- Charger and adapter

TYPICAL APPLICATION



PIN DESCRIPTION



SOT25, E5

Top View

Pin #	Symbol	Function
1	V_{OUT}	Output, Connected To USB Port VBUS.
2	GND	Chip Ground.
3	R_{SET}	Current Limit Threshold Setting Pin, External Resistance To Ground To Set The Current Limit Threshold. Ioc=60K/R_{SET}
4	EN	Chip Enable Pin, Active High.
5	V_{IN}	Power Supply Pin.

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Ratings	Units
Power Supply	V_{IN}	6	V
Output Voltage	V_{OUT}	-0.3 to V_{IN}	V
Dissipation Power SOT-25	P_D	600	mW
Thermal Resistance (Junction to air) SOT-25	θ_{JA}	210	℃/W
Junction Temperature	T_J	-40~+150	℃
Storage Temperature	T_{STG}	-55~+150	℃
Soldering Temperature (5 seconds)	T_{LEAD}	260	℃

Stress beyond above listed “Absolute Maximum Ratings” may lead permanent damage to the device. These are stress ratings only and operations of the device at these or any other conditions beyond those indicated in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

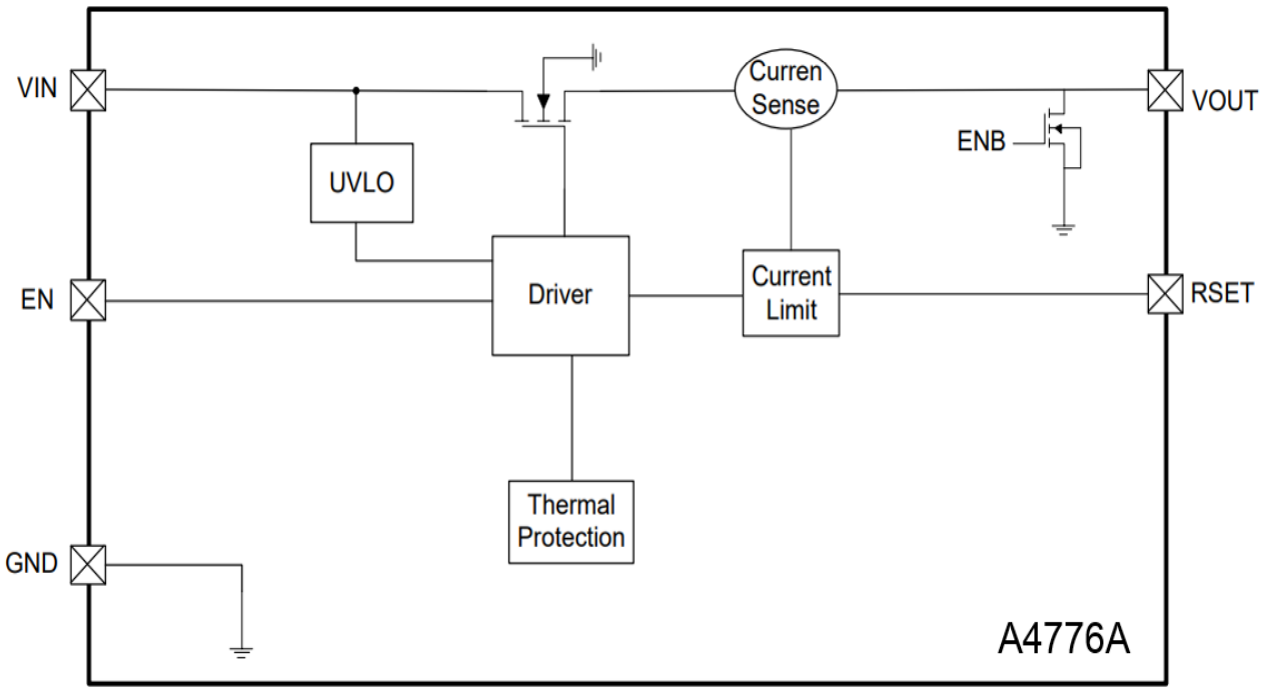
Parameter	Symbol	Min.	Typ.	Max.	Units
Power supply	V_{IN}	2.7	5.0	5.5	V
Operating ambient temperature	T_A	-40	25	85	℃

ELECTRICAL CHARACTERISTICS

Unless otherwise noticed, Ta=25℃, VIN=5V , Rset=30K

Parameter	Conditions	Min	Typ.	Max	Units
Supply Voltage Range		2.7		5.5	V
Quiescent Current	EN =0	30	50	80	uA
Shutdown Current	EN =5V	0	0.01	1.0	uA
On Resistance	Iout=500mA		70		mΩ
Current Limit Threshold	Current ramping (<0.1/mS) V_{IN} : 2.7~ 5V T_A : -40℃~ 85℃ R_{SET}=30K	1.7	2.0	2.3	A
Short Current	R_{SET}=30K , V_{OUT} short to GND		1.2		A
UVLO	V_{IN} Increasing	1.8	2.2	2.6	V
UVLO Hysteresis	V_{IN} Decreasing		0.2		V
EN high level		1.6			V
EN low level				0.4	V
Over temperature protection threshold			155		℃
Over temperature protection Hysteresis			20		℃

BLOCK DIAGRAM



DETAILED INFORMATION

Startup / Shutdown / On Resistance

When the EN pin is connected to the enable level，and V_{IN} voltage is higher than UVLO threshold. When device is enabled, the power NMOS between V_{IN} and V_{OUT} is turned on, and exhibits low resistance. The typical on resistance is 70 mΩ.

When the EN pin is connected to the shutdown level, or V_{IN} voltage decreases to lower than UVLO hysteresis voltage, the device is shut down, and the power NMOS is turned off, which exhibits high resistance. When device is shutdown, the output discharge function accelerates V_{OUT} voltage decreasing. The current limit circuit takes effect during startup, which will limit the inrush current caused by attaching to a large capacitive load.

Current limiting

When output current is larger than current limit threshold, the internal power NMOS resistance increases, which makes V_{OUT} to decrease, and the output current is limited. The internal current limit circuit will set the output current value according to V_{OUT} voltage. If V_{OUT} keep decreasing, the output current will decrease as well, and reaches to short current if V_{OUT} is shorted to GND. The current-limit threshold can be set through the RSET pin external resistor to ground. The relationship between the current-limit threshold I_{OC} and the R_{SET} resistor value is: I_{OC} = 60K / R_{SET}.

Over temperature protection

In current limiting status, the internal power dissipation of the device increases due to V_{OUT} decreasing, which makes junction temperature increase. When the junction temperature exceeds over temperature threshold, the device is shut down, which will cool down the device. When junction temperature decreases to lower than OT hysteresis threshold, the device is auto restarted.

Under voltage lock out protection

When power on, the device is turned on when V_{IN} voltage ramps to higher than UVLO threshold. When power off, the device is shut down when V_{IN} voltage decreases to lower than UVLO hysteresis threshold.

Application Information

- C_{IN} and C_{OUT} capacitor should be placed as near as device pin.
- V_{IN} and V_{OUT} routings should be as wide as possible on PCB.
- The R_{SET} resistor should be placed as close as possible to the R_{SET} pin to reduce parasitic resistance and capacitance.
- Makes copper area as large as possible.

TYPICAL OPERATING CHARACTERISTICS

Unless otherwise noticed: T_A=25℃,V_{IN}=5V,R_{SET}=22K

Fig.1 Quiescent Current vs. Input Voltage

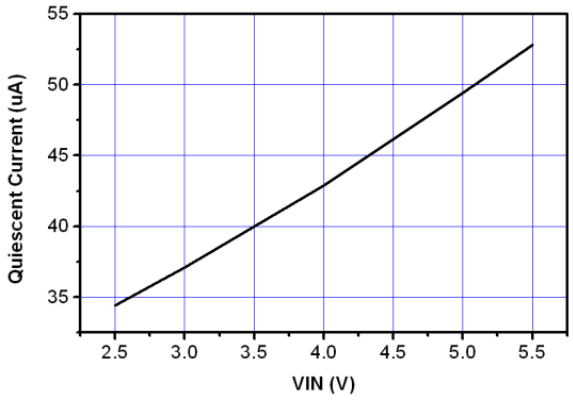


Fig.2 Quiescent Current vs. Temperature

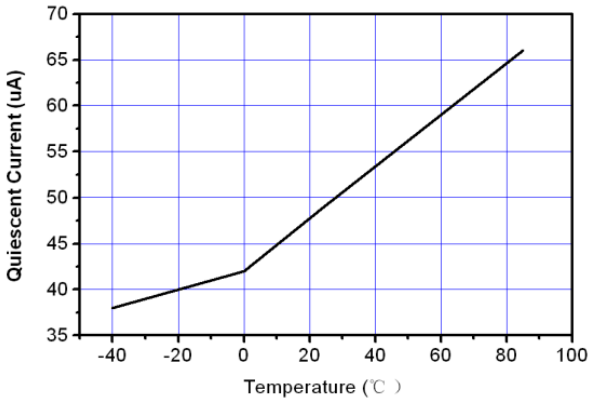


Fig.3 Ron vs. Input Voltage

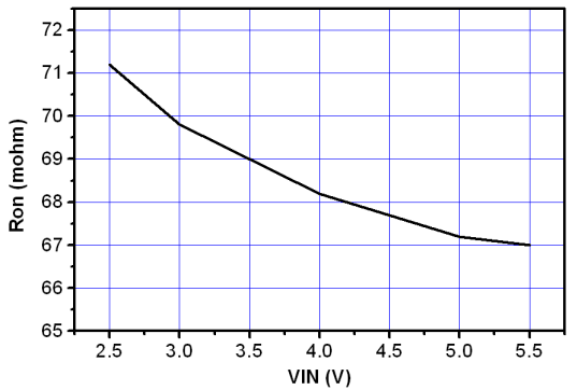


Fig.4 Ron vs. Temperature

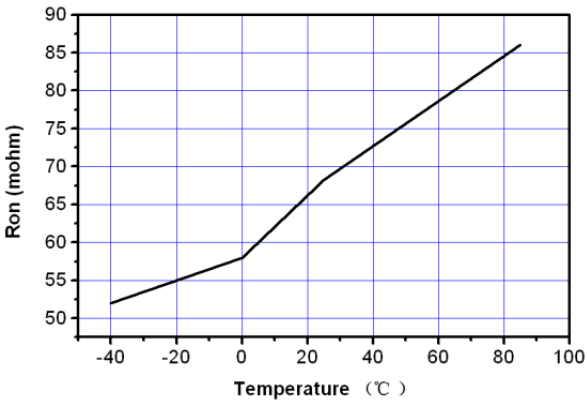


Fig.5 Current Limit vs. Input Voltage

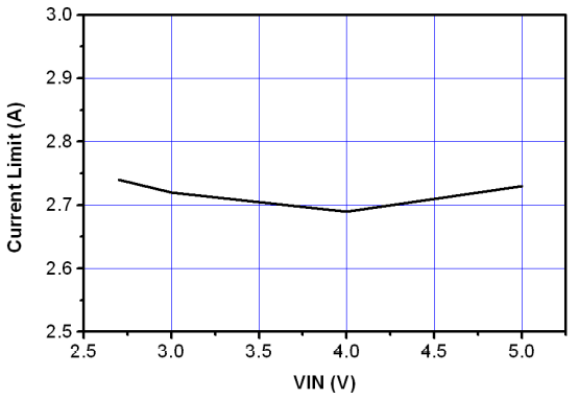
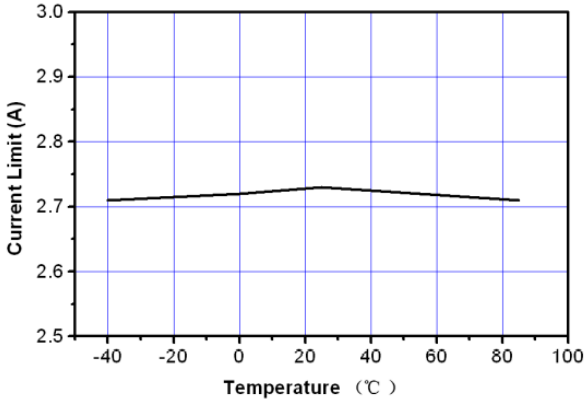
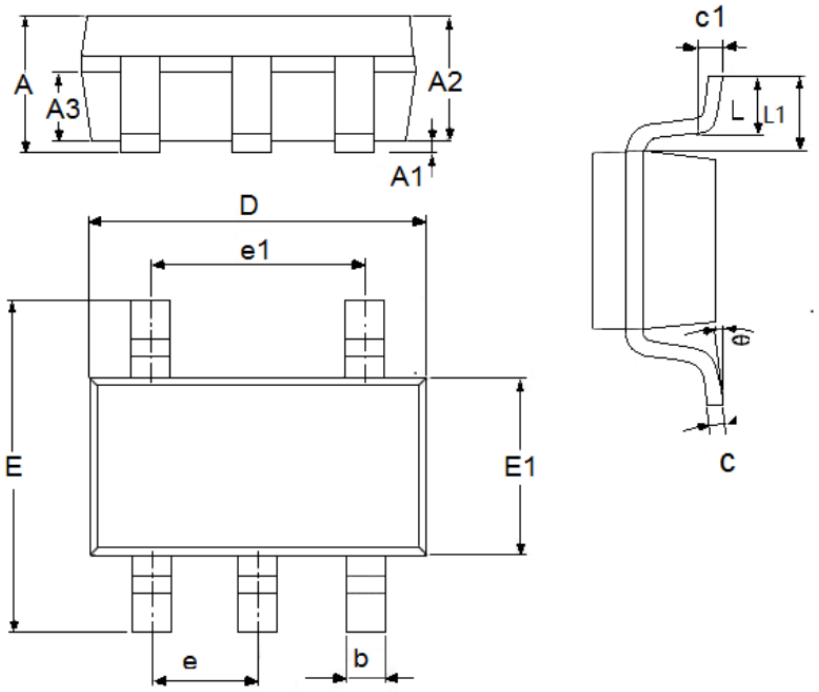


Fig.6 Current Limit vs. Temperature



PACKAGE INFORMATION

Dimension in SOT-25 (Unit: mm)



Symbol	Min.	Max.
A	1.050	1.450
A1	0	0.150
A2	0.900	1.300
A3	0.600	0.700
b	0.250	0.500
c	0.100	0.230
D	2.820	3.050
e1	1.900(TYP)	
E	2.600	3.050
E1	1.500	1.750
e	0.950(TYP)	
L	0.250	0.600
L1	0.590(TYP)	
θ	0	8°
c1	0.200(TYP)	

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