

DESCRIPTION

The A4771 Smart Switch is a current limited P-channel MOSFET power switch designed for high-side load switching applications. This switch operates with inputs ranging from 2.4V to 5.5V, making it ideal for both 3V and 5V systems. An integrated current-limiting circuit protects the input supply against large currents which may cause the supply to fall out of regulation. The A4771 is also protected from thermal overload which limits power dissipation and junction temperatures. It can be used to control loads that require up to 1A. Current limit threshold is programmed with a resistor from SET to ground. The quiescent supply current is typically a low $9\mu A$. In shutdown mode, the supply current decreases to less than $1\mu A$.

The A4771 is available in SOT-25 package.

ORDERING INFORMATION

Package Type	Part Number		
COT 25	E5	A4771E5R-X	
SOT-25		A4771E5VR-X	
	X: H: High Level Active		
Note	L: Low Level Active		
	V: Halogen free Package		
	R: Tape & Reel		
AiT provides all RoHS products			
Suffix " V " means Halogen free Package			

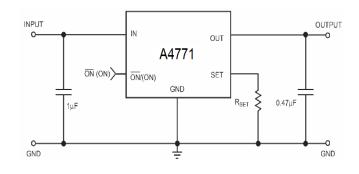
FEATURES

- Input Voltage Range: 2.4V to 5.5V
- Programmable Over-Current Threshold
- Fast Transient Response:
 400ns Response to Short Circuit
- Low Quiescent Current9μA Typical
 - 1µA Max with Switch Off
- 200mΩ Typical R_{DS(ON)}
- Only 2.5V Needed for ON/OFF Control
- Under-Voltage Lockout
- Thermal Shutdown
- 4kV ESD Rating
- Temperature Range: -40°C to +85°C
- Available in SOT-25 Package

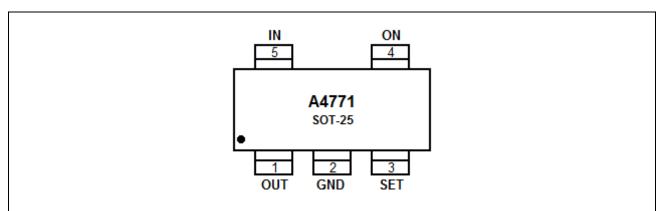
APPLICATION

- Hot Swap Supplies
- Notebook Computers
- Peripheral Ports
- Personal Communication Devices

TYPICAL APPLICATION



PIN DESCRIPTION



Top View

Pin#	Symbol	Function
1	OUT	P-channel MOSFET drain. Connect a 0.47µF capacitor from OUT to GND.
2	GND	Ground connection.
3	SET	Current limit set input. A resistor from SET to ground sets the current limit for the switch.
4	ON	Enable input. Two versions are available, active-high and active-low. See Ordering Information for details.
5	IN	P-channel MOSFET source. Connect a 1µF capacitor from IN to GND.



ABSOLUTE MAXIMUM RATINGS

 $T_A = 25$ °C, unless otherwise noted

TA - 25 C, unless otherwise noted	
V _{IN} , IN to GND	-0.3V~ 7V
V_{ON} , $ON(\overline{ON})$ to GND	-0.3V ~V _{IN} + 0.3V
V _{SET} , V _{OUT} , SET, OUT to GND	-0.3V ~V _{IN} + 0.3V
I _{MAX} , Maximum Continuous Switch Current	2A
T _J , Operating Junction Temperature Range	-40~150°C
T _{LEAD} , Soldering Temperature (Soldering, 10s)	260°C
V _{ESD} , ESD Rating ^{NOTE1} - HBM	4kV

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.

NOTE1: Human body model is a 100pF capacitor discharged through a 1.5k Ω resistor into each pin.

THERMAL CHARACTERISTICSNOTE2

Parameter	Symbol	Value	Units
Thermal Resistance	θја	150	°C/W
Power Dissipation	P _D	667	mW

NOTE2: Mounted on a demo board.



ELECTRICAL CHARACTERISTICS

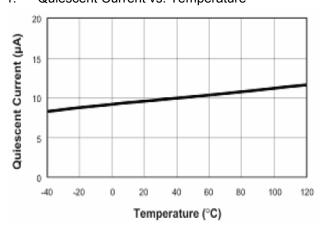
 V_{IN} = 5V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = 25°C

Parameter	Symbol	Conditions		Min	Тур	Max	Units
Operation Voltage	V _{IN}			2.4		5.5	٧
Quiescent Current	lα	$V_{IN} = 5V$, $ON(\overline{ON}) = Active$, $I_{OUT} = 0$			7	25	μΑ
Off Supply Current	I _{Q(OFF)}	ON(ON)	= Inactive, V _{IN} = 5.5V			1	μΑ
Off Switch Current	I _{SD(OFF)}	ON(ON)	= Inactive, V _{IN} =5.5V,V _{OUT} =0		0.01	1	μΑ
Under-Voltage Lockout	V _{UVLO}	Rising Ed	ge, 1% Hysteresis		1.8	2.4	٧
		V _{IN} = 5.0V	′, T _A = 25°C		200		
On Resistance	R _{DS(ON)}	V _{IN} = 4.5V, T _A = 25°C 210		210		mΩ	
		V _{IN} = 3.0V, T _A = 25°C 250		250			
On Resistance	ТС				2000		ppm/
Temperature Coefficient	TC _{RDS}				2800		$^{\circ}$ C
Current Limit	I _{LIM}	R _{SET} = 7.2kΩ		0.75	1	1.25	Α
Minimum Current Limit	I _{LIM(MIN)}				130		mA
ON(ON) Input Low	Vova	V _{IN} = 2.7\	/ to 5 5 V			0.8	
Voltage	$V_{ON(L)}$	VIN - 2.7 V	7 (0 5.5)			0.6	V
ON (ON) Input High	Marrie	V _{IN} = 2.7V to < 4.2V		2.0			V
Voltage	V _{ON(H)}	V _{IN} ≥4.2V	V _{IN} ≥4.2V to 5.0V				
ON (ON) Input Leakage	Ion(sink)	V _{ON} = 5.5V			0.01	1	μΑ
Current Limit Response	-	\/ - E\/			50		
Time	T_{RESP}	V _{IN} = 5V			50		μs
Turn-Off Time	Toff	V_{IN} = 5V, R_L = 10 Ω			10	16	μs
Turn-On Time	Ton	$V_{IN} = 5V$, $R_L = 10\Omega$			14	200	μs
Over-Temperature	т	T _J Increasing			125		°C
Threshold	T_{SD}	V _{IN} = 5V	T _J Decreasing		115		°C

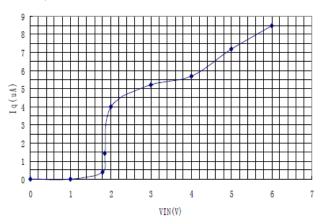
TYPICAL PERFORMANCE CHARACTERISTICS

 V_{IN} = 5V, T_A = 25°C, unless otherwise noted

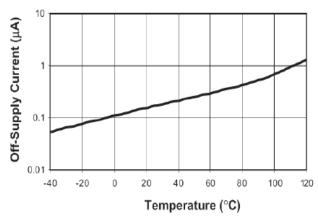
Quiescent Current vs. Temperature



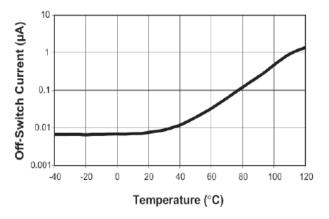
2. Quiescent Current vs. VIN



3. Off-Supply Current vs. Temperature

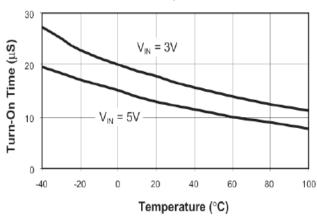


Off-Switch Current vs. Temperature 4.



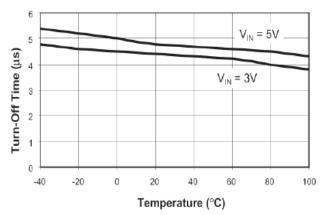
Turn-On vs. Temperature 5.

 R_{LOAD} =10 Ω , C_{LOAD} =0.47 μ F



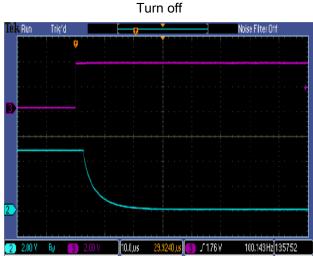
Turn-Off vs. Temperature 6.

 R_{LOAD} =10 Ω , C_{LOAD} =0.47 μ F

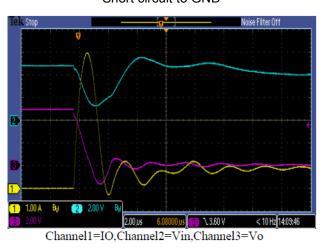


7. $V_{IN}=5V,R_L=10\Omega,R_C=0.47uF(Channel3=V_{EN},Channel2=V_O)$

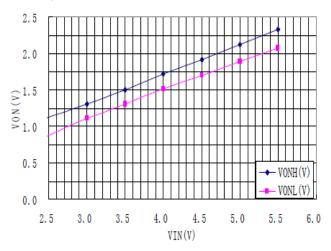




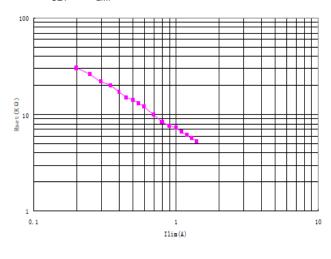
Short circuit to GND



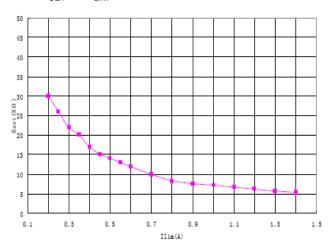
8. Von vs. Vin



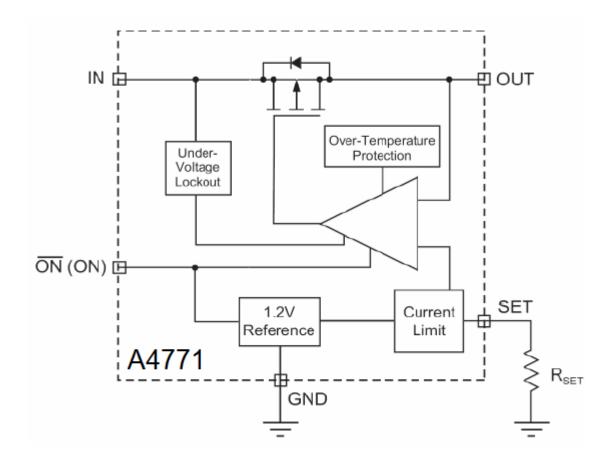
9. R_{SET} vs. I_{LIM}



10. R_{SET} vs. I_{LIM}



BLOCK DIAGRAM



DETAILED INFORMATION

Application Information

Setting Current Limit

In most applications, the variation in I_{LIM} must be taken into account when determining R_{SET} . The I_{LIM} variation is due to processing variations from part to part, as well as variations in the voltages at IN and OUT, plus the operating temperature. These three factors add up to a $\pm 25\%$ tolerance Figure 1 illustrates a cold device with a statistically higher current limit and a hot device with a statistically lower current limit, both with R_{SET} equal to $10\text{k}\Omega$. While the chart, " R_{SET} vs. I_{LIM} " indicates an I_{LIM} of 0.7A with an R_{SET} of $10\text{k}\Omega$, this figure shows that the actual current limit will be at least 0.525A and no greater than 0.880A.

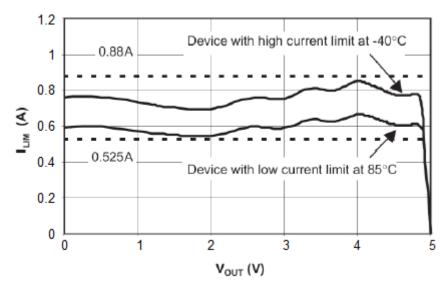


Figure 1: Current Limit Using $10k\Omega$.

To determine R_{SET} , start with the maximum current drawn by the load and multiply it by 1.33 (typical I_{LIM} = minimum I_{LIM} / 0.75). This is the typical current limit value. Next, refer to " R_{SET} vs. I_{LIM} " and find the R_{SET} that corresponds to the typical current limit value. Choose the largest resistor available that is less than or equal to it. For greater precision, the value of R_{SET} may also be calculated using the I_{LIM} , R_{SET} product found in the chart " R_{SET} Coefficient vs. I_{LIM} ." The maximum current is derived by multiplying the typical current for the chosen R_{SET} in the chart by 1.25. A few standard resistor values are listed in the table "Current Limit R_{SET} Values."

Current Limit RSET Values

Post (KO)	Course and Line it Tour (no A)	Device Will not	Device Always		
R _{SET} (KΩ)	Current Limit Typ. (mA)	Current Limit Below (mA)	Current Limits Below (mA)		
30	200	150	250		
26	250	188	313		
22	300	225	375		
20	350	263	438		
17	400	300	500		
15	450	338	563		
14	500	375	625		
13	550	413	688		
12	600	450	750		
10	700	525	875		
8.3	800	600	1000		
7.8	900	675	1125		
7.2	1000	750	1250		
6.6	1100	825	1375		
6.1	1200	900	1500		
5.6	1300	975	1625		
5.3	1400	1050	1750		

Example: A USB port requires 0.5A. 0.5A multiplied by 1.33 is 0.665A. From the chart named " R_{SET} vs. I_{LIM} ," R_{SET} should be less than $12k\Omega$. $10k\Omega$ is a standard value that is a little less than $12k\Omega$ but very close. The chart reads approximately 0.700A as a typical I_{LIM} value for $10k\Omega$. Multiplying 0.700A by 0.75 and 1.25 shows that the A4771 will limit the load current to greater than 0.525A but less than 0.875A.

Operation in Current Limit

When a heavy load is applied to the output of the A4771, the load current is limited to the value of I_{LIM} determined by R_{SET} . See Figure 2, "Overload Operation." Since the load is demanding more current than I_{LIM} , the voltage at the output drops. This causes the A4771 to dissipate a larger than nor-mal quantity of power, and its die temperature to increase. When the die temperature exceeds an over-temperature limit, the A4771 will shut down until is has cooled sufficiently, at which point it will startup again.

The A4771 will continue to cycle on and off until the load is removed, power is removed, or until a logic high level is applied to ON.



Enable Input

In many systems, power planes are controlled by integrated circuits which run at lower voltages than the power plane itself. The enable input ON of the A4771 has low and high threshold voltages that accommodate this condition. The threshold voltages are compatible with 5V TTL and 2.5V to 5V CMOS.

Reverse Voltage

The A4771 is designed to control current flowing from IN to OUT. If a voltage is applied to OUT which is greater than the voltage on IN, large currents may flow. This could cause damage to the A4771

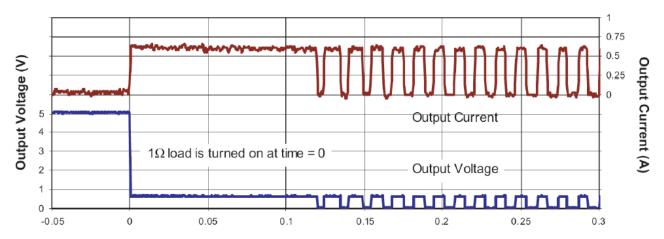
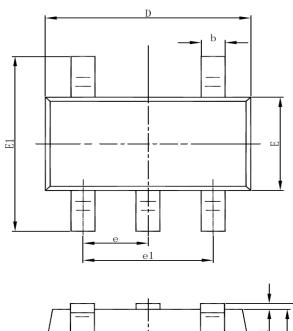
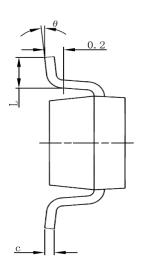


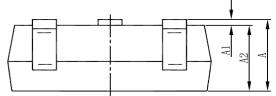
Figure 2: Overload Operation

PACKAGE INFORMATION

Dimension in SOT-25 (Unit: mm)







Symbol	Min	Max	
Α	1.050	1.250	
A1	0.000	0.100	
A2	1.050	1.150	
b	0.300	0.500	
С	0.100	0.200	
D	2.820	3.020	
E	1.500	1.700	
E1	2.650	2.950	
е	0.950(BSC)		
e1	1.800	2.000	
L	0.300	0.600	
θ	0°	8°	



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