RYC852x
Single Channel Protected Power Switch

GENERAL DESCRIPTION

The RYC852x is single channel protected power switch designed for USB and other 5 Volt high-side power switched applications. The output MOSFET typically has a low on resistance of 110mΩ. The RYC852x provides current limiting and over-temperature protection. RYC852x has a deglitched fault flag to minimize nuisance tripping when high inrush current devices are plugged into the port. The RYC852x also features under-voltage lockout, soft start and reverse current blocking when disabled.

FEATURES

- Compliant to USB1.1 and USB2.0 specifications
- Low on-resistance, typical 110 mΩ
- Fast overcurrent shut down minimizes peak inrush current
- Built-in flag deglitch to minimize nuisance trip
- Overtemperature shutdown
- Reverse current blocking
- Undervoltage lockout (UVLO)
- Small 6pin SOT-23 package

APPLICATIONS

- USB peripherals
- USB OTG
- Notebook PCs
- PDAs
- PC card hot swap
- General purpose power switches

TYPICAL APPLICATION SCHEMATIC
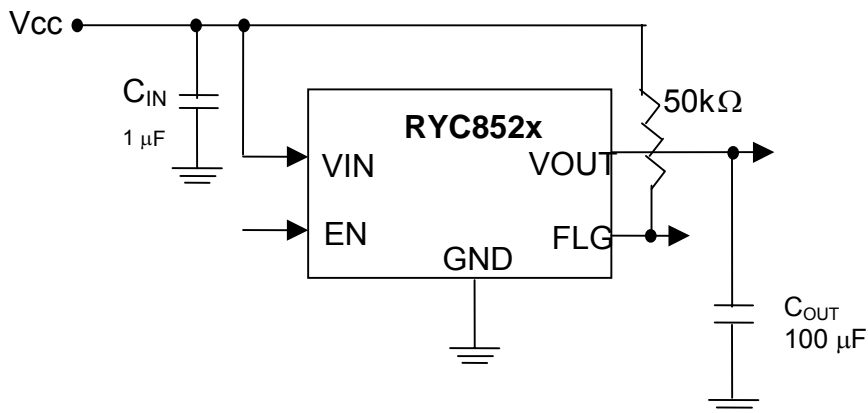
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ORDERING INFORMATION

Part Description	Part Number	Enable Logic	Continuous Current (A)	Package	Tape and Reel Quantity
RYC8520H	A20930-000	Active High	0.6	SOT-23-6	2,500 pcs
RYC8520L	E49332-000	Active Low	0.6	SOT-23-6	2,500 pcs

Note: Other current may be available, please contact factory

MATERIALS INFORMATION
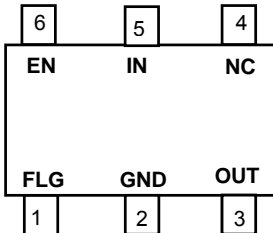
ROHS Compliant

Directive 2002/95/EC Compliant

ELV Compliant

Directive 2000/53/EC Compliant

Pb-Free

PIN CONFIGURATION

```
 6        5        4
 EN       IN       NC


 FLG      GND      OUT
 1        2        3
```

PIN DESCRIPTION

Pin Number	Pin Name	Pin Function
1	FLG	Fault Flag (Output): Active-low open-drain output. Indicate overcurrent, UVLO and thermal shutdown.
2	GND	Ground: Supply return.
3	OUT	Switch Output: Output MOSFET source. Typically connect to switched side of load.
4	NC	No connection.
5	IN	Supply Input: Output MOSFET drain. Also supplies IC's internal circuitry. Connect to positive supply.
6	EN	Enable (Input): Logic-compatible enable input. High input > 2.4V. Low input < 0.8V (H-active high, L-active low). Do not float.

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ABSOLUTE MAXIMUM RATINGS (Notes 1, 2)

Parameter	Symbol	Value	Units
Max main supply voltage	V_{IN}	-0.3 to +6	V
Max voltage, all I/O pins	V_{IN}	-0.3 to +6	V
Output voltage	V_{OUT}	+6	V
Output current	I_{OUT}	Internally limited	A
Control input	V_{EN}	-0.3 to Vin+0.3	V
Storage temperature	T_S	-65 to +150	°C
Max lead temperature during soldering (5 sec.)		260	°C

Note 1. Operation beyond absolute maximum rating or improper use may result in permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods or to conditions beyond absolute maximum rating conditions may adversely affect device reliability. Functional operation under absolute maximum rating conditions is not implied.

Note 2. Devices are ESD sensitive. Handling precautions recommended. .

OPERATING RATINGS (Note 3)

Parameter	Symbol	Value	Units
Supply voltage	V_{IN}	+4.5 to +5.5	V
Continuous output current	I_{OUT}	0.6	A
Ambient operating temperature	T_A	-40 to +85	°C
Thermal resistance (5pin SOT-23), Note 5	$\theta\,J_A$	240	°C/W

Note 3. The device is not designed to function outside its operating rating.

ELECTRICAL CHARACTERISTICS (V_{IN} = +5V; T_A = 25°C; unless noted.)

Power Switch	Condition	Min	Typ	Max	Units
Pin to Pin Resistance	V_{In} = 5V, I_{OUT} = 500mA		110		mΩ
Output Turn-On Time	R_L = 50 Ω, C_L = 1µF, sum of delay+ rise time.		0.5		ms
Output Turn-Off Time	R_L = 50 Ω, C_L = 1µF, sum of delay+ fall time		150		µs

Current Limit	Condition	Min	Typ	Max	Units
Short-circuit Current Limit	RYC8520, Short circuit applied to the output pin of EN device with 0.5Ω load	0.6	1.0	1.25	A
Short-circuit response time	Short-circuit applied to the output pin ('Hot-plugged short') V_{OUT} = 5.0V, R_L = 0.5Ω, Note 5		1		µs

Enable Input	Condition	Min	Typ	Max	Units
Enable Input Threshold	Low-to-high transition, Note 4		1.5	2.4	V
	High-to-low transition, Note 4	0.8	1.5		V
Enable Input Current	V_{EN} = 0V to 5.5V		0.01	1	µA
Enable Input Capacitance	Note 5			5	pF

Leakage Current	Condition	Min	Typ	Max	Units
Supply Current	Switch disabled, OUT =open		6	15	µA
	Switch on, OUT = open		100	200	µA
Output Leakage Current	Output disabled	0.01	1	20	µA

Overtemperature and UVLO	Condition	Min	Typ	Max	Units
Overtemperature Shutdown Threshold	T_J increasing, Note 5		130		°C
	T_J decreasing, Note 5		120		°C
UVLO Threshold	V_{In} = increasing		2.4		V
	V_{In} = decreasing		2.2		V

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Error Flag	Condition	Min	Typ	Max	Units
Error Flag Output Resistance	V_{In} = 5V, I_L = 10mA, open drain		50	100	Ω
Error Flag Off Current	V_{FLAG} = 5V		0.01	1	μA
Error flag output deglitch	Fault on overcurrent, UVLO and thermal shutdown, Note 6		10	20	ms

Note 4. V_{IN} should be within the operating range before the device is enabled.
Note 5. Validated by design, but not production tested.
Note 6. No error flag out deglitch on UVLO and thermal shutdown.

TYPICAL CHARACTERISTICS

Figure 1. Test Circuit and Timing Diagram
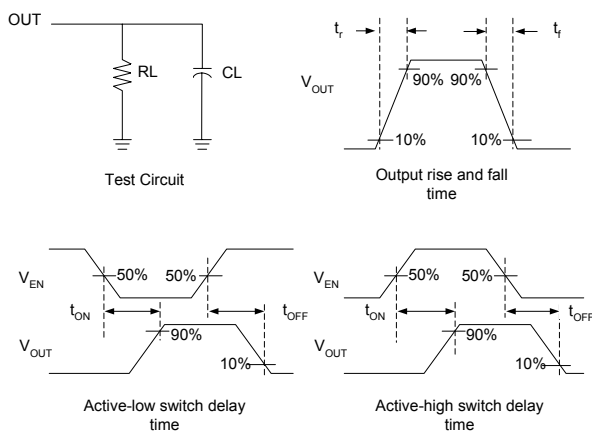
Figure 2. Turn-on Delay Time
V_{IN} = 5V, R_L = 50 Ω
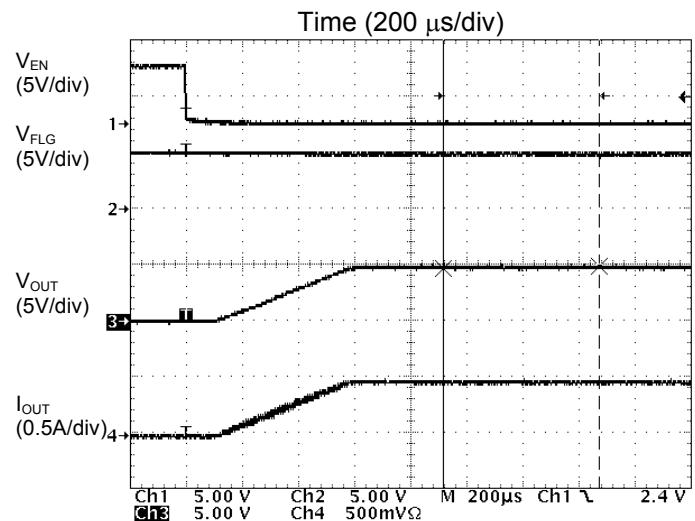
FUNCTIONAL DESCRIPTION

The RYC852x is single channel protected power switches designed for USB and other 5 Volt high-side power switched applications. The output MOSFET has a low on resistance of typical 110mΩ. The RYC852x provides current limiting and over-temperature protection. RYC852x has a deglitched fault flag to minimize nuisance tripping when high inrush current devices are plugged into the port. The RYC852x also features under-voltage lockout, soft start and reverse current blocking when disabled.

Current Limit and Overtemperature

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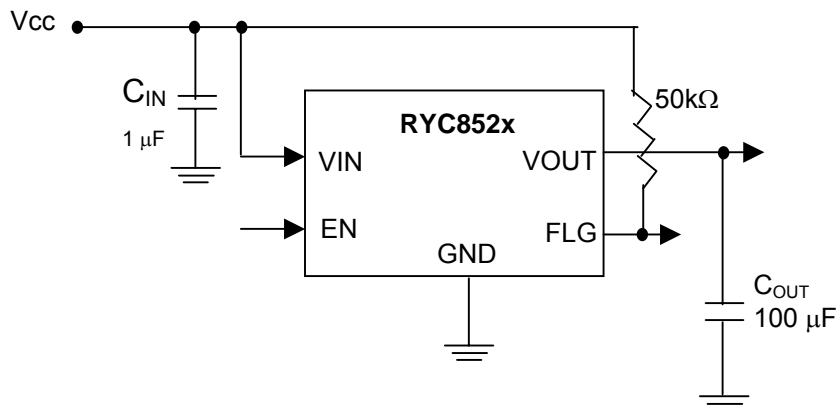Document: SCD 25862
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The current limit is 0.6A minimum and 1.25A maximum for the RYC8520. When the current limit is exceeded, the device will first limit the current and then, if necessary, will go into thermal shutdown when the die temperature reaches approximately 130°C. When the temperature falls 10°C below the thermal shutdown temperature, the device will restart. If the fault has not been removed, the device will continue to cycle on and off. The frequency of the cycle is dependent on the impedance of the fault and the thermal environment.

Enable Pull Up/Down

The EN input is logic level compatible. The enable pin should not be allowed to float; a pull-up/down resistor should be used to tie the pin high/low.

 Fault Flag

The fault flag signal is asserted low when an overcurrent, overtemperature or undervoltage event occurs. In the event of an overcurrent, the fault flag is deglitched for approximately 10 ms to minimize nuisance tripping. The FLAG pin is an open drain design and will require a pull-up resistor.

Undervoltage lockout (UVLO)

If the supply voltage drops below approximately 2.2V the RYC852x will turn off. The undervoltage limit protects the hub from operating at voltages too low to assure reliable logic operation.

Soft Start

When the device is first enabled into a load, the device is turned on slowly and requires 0.5 ms to reach 90% of the maximum voltage.

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APPLICATION INFORMATION

Input Capacitor

Decoupling input capacitors (0.1 μF) should be used to tie the V_{IN} pin to ground to minimize voltage transients.

Input transients which exceed the absolute maximum rating may cause damage to the device.

Output Capacitors

Decoupling capacitors (0.1 μF) between the output and ground are also recommended to reduce the impact of other voltage transients such as ESD. Output capacitors will help minimize negative voltage spikes due to parasitic inductance. USB specifications require 120 μF of low ESR output capacitance per hub.

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PACKAGE INFORMATION

DIMENSIONS (MM)			
SYMBOL	MIN	NOM	MAX
A	–	–	1.45
A1	–	–	0.15
A2	0.90	1.15	1.30
b	0.30	–	0.50
c	0.08	–	0.22
D	2.90 BSC		
E	2.80 BSC		
E1	1.60 BSC		
e	0.95 BSC		
e1	1.90 BSC		
L	0.30	0.45	0.60
L1	0.60 REF		
θ	0°	4°	8°
R	0.10	–	0.25
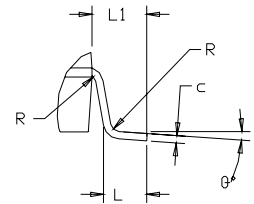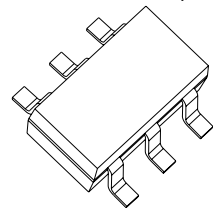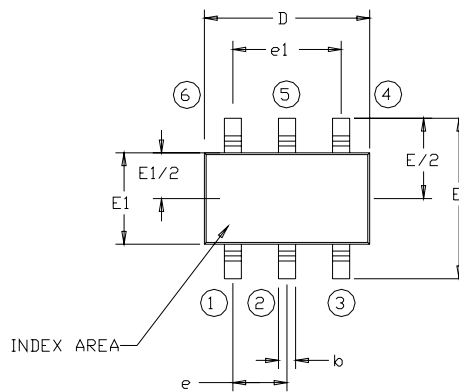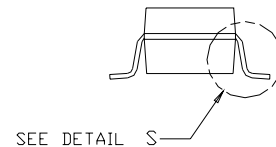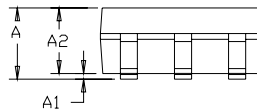
6 Pin SOT-23 PACKAGE NOTES:

1. Dimensions and tolerance per ANSI Y14.5M-1982.
2. Dimensions A and B are datums and T is a datum surface.
3. Controlling dimensions: Millimeters
4. Dimension A and B do not include mold flash. Mold flash shall not exceed 0.15mm [0.006] per side.
5. Dimension D does not include interlead flash. Interlead flash shall not exceed 0.25 mm [0.010].