Features

- 100 mΩ High Side MOSFET
- Distribution Voltages: 2.5V to 5.5V
- Over Temperature Shutdown and Automatic Retry
- Reverse Blocking (no body diode)
- At shutdown, OUT can be forced higher than IN
- Fault flag (OCB) output if over current, thermal shut down, reverse blocking happens.
- Automatic output discharge at shutdown
- Built-in softstart
- 0.4ms rise time
- Enable polarity High
- ESD HBM 6KV

Applications

- USB peripherals and USB 2.0/3.0 compatible
- DTV/STB
- Notebooks and Consumer Electronics
- General-purpose power distribution
- High-Side Power Protection Switches

General Description

The RUC9288 is an Ultra-low $R_{DS(ON)}$ Power Distribution Switch designed for USB applications. The 100mΩ N-channel MOSFET power switch satisfies the voltage drop requirements of the USB specification.

The protection features include current-limit protection, short-circuit protection, and over-temperature protection. The device limits the output current at current limit threshold level. When V_{OUT} drops below V_{IN} -1V, the devices limit the current to a lower and safe level. The over-temperature protection circuit limits the junction temperature below 140ºC in case of short circuit or over load conditions. Other features include a deglitched OCB output to indicate the fault condition and an enable input to enable or disable the device.

Typical application

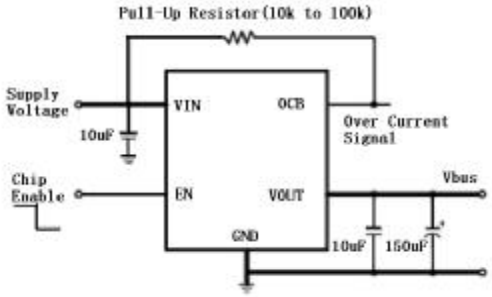


Figure 1 Application Circuit

Pin Description

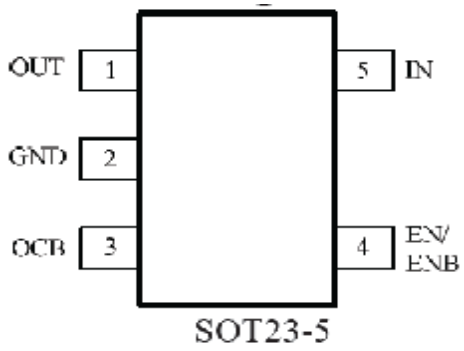


Figure 2 Pin Configuration

OUT	1	Output pin
GND	2	Ground pin
OCB	3	Open Drain Fault Flag
EN/ENB	4	ON/OFF Control. Don't float. EN: High Enable. ENB: Low Enable
IN	5	Supply Voltage Input pin

Absolute Maximum Ratings

All pins----------6V
Power Dissipation, Pd @ TA = 25ºC----------0.4W
Package Thermal Resistance (Note 2)
θ_{JA}----------250 ºC/W
θ_{JC}----------130 ºC/W
Junction Temperature Range---------- 150 ºC
Lead Temperature (Soldering, 10 sec.)---------- 260 ºC
Storage Temperature Range---------- -65 ºC to 150 ºC

Recommended Operating Conditions (Note 3)
IN---------- 2.5V to 5.5V
EN/ENB---------- -0.3V to VIN +0.3V
All other pins---------- 0-5.5V
Junction Temperature Range---------- -40 ºC to 125 ºC
Ambient Temperature Range---------- -40 ºC to 85 ºC

Electrical Characteristics:

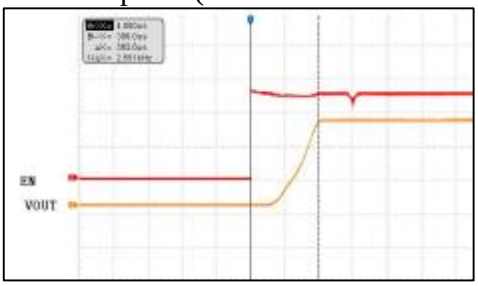
(VIN =5V, CL =1μF, per channel, TA = 25ºC unless otherwise specified)

Parameters	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range	VIN		2.5		5.5	V
Shutdown Input Current	ISHDN	Open load, switch off		0.1	1	μA
		Output grounded,		0.1	1	μA

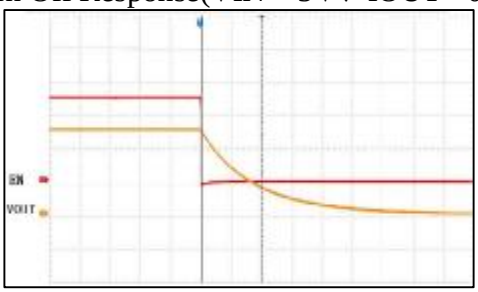
			switch off				
Quiescent Supply Current		IQ	Open load, switch on		30		μA
FET RON		RDS(ON)	SOT23-5 (C3003A)		100		mΩ
Current Limit		ILIM	C3003A	0.8	1.2	1.6	A
Short Circuit Output Current		IOS	OUT connected to GND device enabled.		0.6		A
EN/ENB Threshold	Logic-Low Voltage	VIL				0.8	V
	Logic-High Voltage	VIH		2			
IN UVLO Threshold		VIN,UVLO				2.4	V
IN UVLO Hysteresis		VIN,HYS			0.1		V
Turn-ON Time		TON	RL =5Ω, CL =1μF		400		μs
OCB Low Resistance		ROCB					
OCB Delay Time		TOCB_Delay			10		ms
OUT Shutdown Discharge Resistance		RDIS			10		Ω
Thermal Shutdown Temperature		TSHD			150		ºC
Thermal Shutdown Hysteresis					20		ºC
ESD			HBM	6			KV

Typical Operating Characteristics

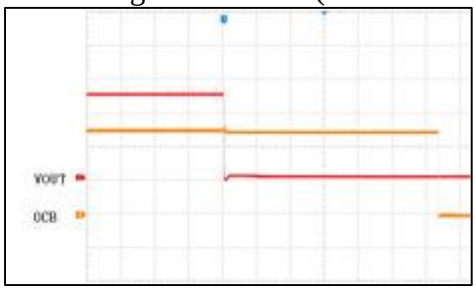
Turn On Response(VIN = 5V、IOUT = 0A)



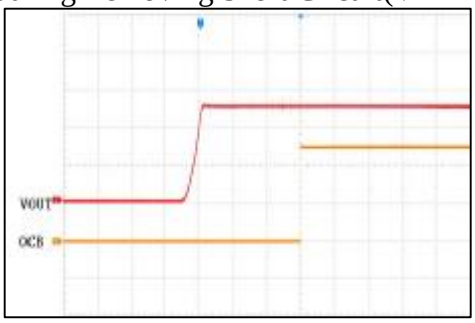
Turn Off Response(VIN = 5V、IOUT =0A)



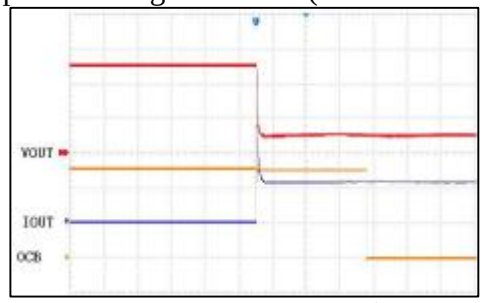
OCB Response during Short Circuit(VIN = 5V、CL = 0Ω)



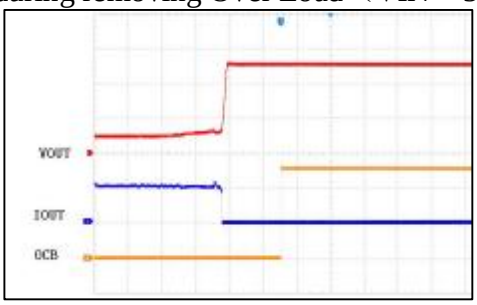
OCB Response during Removing Short Circuit(VIN = 5V、CL = 0Ω)



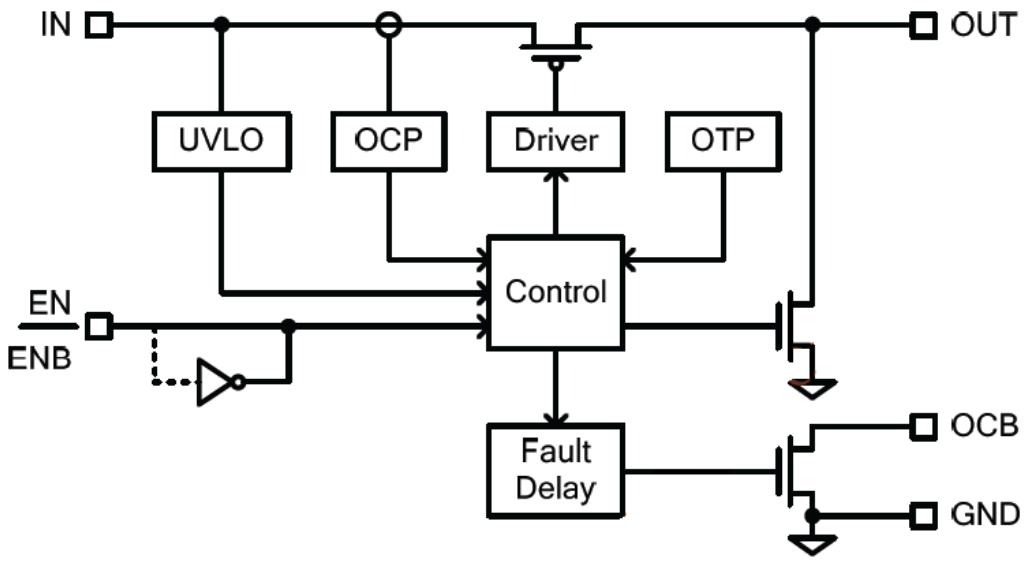
OCB Response during Over Load(VIN = 5V、CL = 2Ω)



OCB Response during removing Over Load（VIN = 5V、CL = 2Ω）



Block Diagram



Function Description

Operation
The C3003A is a current limited P-channel MOSFET power switch designed for high-side load-switching applications. There is no parasitic body diode between the Drain and Source of the MOSFET, hence the C3003A prevents the current flow from OUT to IN when OUT being externally forced to a higher voltage than VIN when the chip is disabled.

VIN Under-Voltage Lockout (UVLO)
The RUC9288 consists of a built-in under-voltage lockout circuit to keep the output shutting off until the internal circuitry is operating properly. The UVLO circuit has hysteresis and a de-glitch feature so that it will typically ignore undershoot transients on the input. When input voltage exceeds the UVLO threshold, the output voltage starts a soft-start to reduce the inrush current.

Over-current protection
The RUC9288C5 provides the current-limit protection function. During current limit, the devices limit output current at current limit threshold. For reliable operation, the device should not be operated in current limit for extended period.

Over-current protection
When the over-current condition is sensed, the Gate of the pass switch is modulated to achieve constant output current. Under output short-circuit conditions; the normal current limit is folded back to 50%. If the over-current condition persists for a long enough time, the junction temperature may exceed 150ºC , and the over-temperature protection will shut down the part. Once the chip temperature drops to 130ºC , the part will restart.

Short-Circuit Protection
When the Output Voltage drops below V_{IN} -1V, which is caused by an over-load or a short-circuit, the devices limit the output current down to a safe level. The short-circuit current limit is used to reduce the power dissipation during short-circuit conditions. If the junction temperature reaches over-temperature threshold, the devices will enter the thermal shutdown.

Fault Flag (OCB)
The OCB output is asserted (active low) when an over-temperature shutdown condition is encountered. The OCB will also be pulled if over-current or reverse blocking happens and persists for 10ms. The output remains asserted until the fault status is removed. Connecting a heavy capacitive load to an enabled device can cause a momentary over-current condition; however, no false reporting on OCB occurs due to the 10-ms deglitch circuit. OCB is not deglitched when the switch is turned OFF due to an over-temperature shutdown.

EN/ENB

Pull the ENB above 2V or EN below 0.8V will disable the device, and pull ENB below 0.8V or EN above 2V will enable the device. When the IC is disabled, the supply current is reduced to less than 1μA. The enable input is compatible with both TTL and CMOS logic levels. The EN/ENB pin cannot be left floating.

Over-Temperature Protection

When the junction temperature exceeds 140ºC, the internal thermal sense circuit turns off the power FET and allows the device to cool down. When the device's junction temperature cools down by 20ºC, the internal thermal sense circuit will enable the device, resulting in a pulsed output during continuous thermal protection. Thermal protection is designed to protect the IC in the event of over temperature conditions. For normal operation, the junction temperature cannot exceed T_J = +125 ºC.

Supply Filter Capacitor

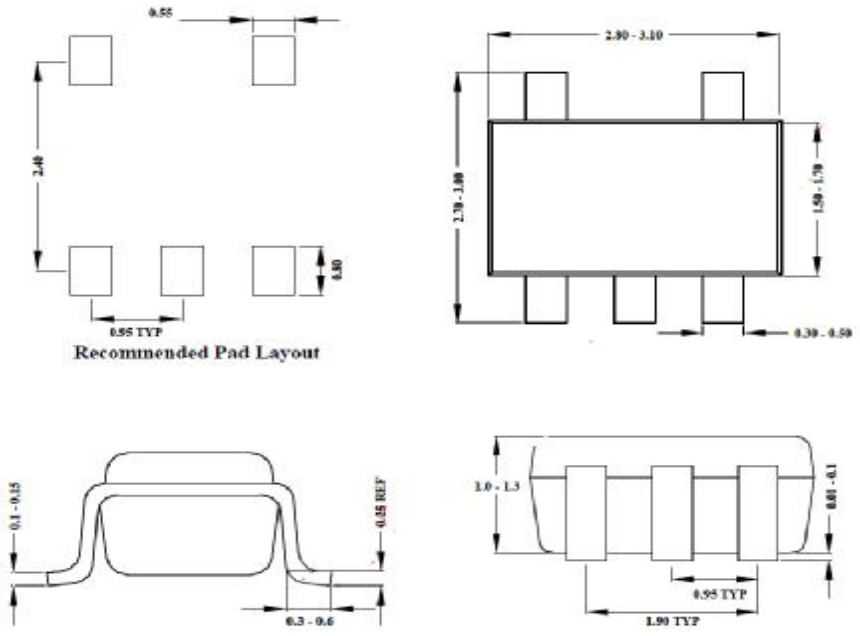
In order to prevent the input voltage drooping during hot-plug events, a 10μF ceramic capacitor from VIN to GND is strongly recommended. However, higher capacitor values could reduce the voltage droop on the input further. Furthermore, an output short will cause ringing on the input without the input capacitor. It could destroy the internal circuitry when the input transient exceeds 6V which is the absolute maximum supply voltage even for a short duration.

Output Filter Capacitor

Between VOUT and GND, a low-ESR 150μF aluminum electrolytic or tantalum capacitor is strongly recommended to meet the 330mv maximum droop requirement. Standard bypass methods should be used to minimize inductance and resistance between the bypass capacitor and the down stream connector. This will reduce EMI and improve the transient performance. If long cables are connected to the output terminals, an anti-parallel schottky diode such as BAT54 is suggested to be placed in parallel with the output terminals to absorb the negative ringing due to the cable inductance.

Package Information

SOT23-5 package mechanical drawing



Recommended Pad Layout

Notes: All dimensions are in millimeters.