



## US201/A/B/C

CMOS IC

### HIGH-SIDE POWER SWITCHES WITH FLAG

#### DESCRIPTION

The UTC **US201/A/B/C** series are 80mΩ high-side power switches. There's internal single low voltage N-Channel MOSFET which makes it an ideal for all USB applications. This MOSFET should be driven by a charge pump circuitry inside. Its switch on resistance is as low as 80mΩ which we know specially meets the drop voltage for USB applications.

The flag pin can output an open-drain fault flag to next controller.

There're lots internal special ways for protecting the chip's operation.

When in hot-plug events, there's large current which can create the upstream voltage droop to match the USB's voltage droop requirements and soft-start for isolating the power source.

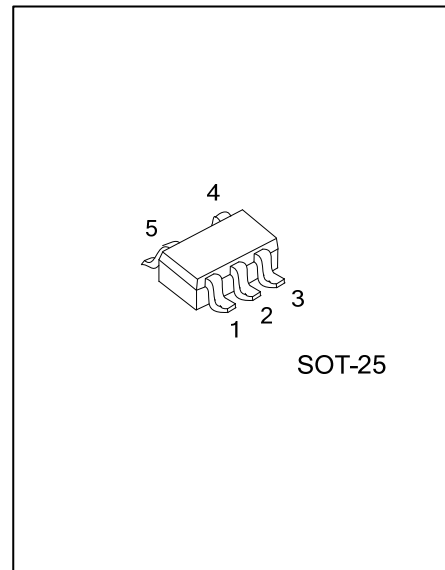
As soon as the die temperature is higher than 130°C, the internal shutdown circuit will work.

Only when there's a normal input voltage in the V<sub>IN</sub> pin, the UVLO (under-voltage lockout, 1.3V/2.5V typ.) can make sure the chip is till in the off state.

Because of the requirement of USB power the fault current should be ensured less than 0.6A/1.1A (UTC **US201/A**, single port) and 1.3A /1.5A (UTC **US201B/C**, dual ports).

#### FEATURES

- \* 80mΩ(Typ) N-Channel MOSFET
- \* Supply Current:
  - Switch On : 25μA(Typ)
  - Switch Off : 1μA (Typ)
- \* Load Current 500mA for US201 and 1.0A for US201A/B/C
- \* Input Voltage from 2V ~ 5.5V
- \* In Off-State: Output Voltage can be Higher than Input

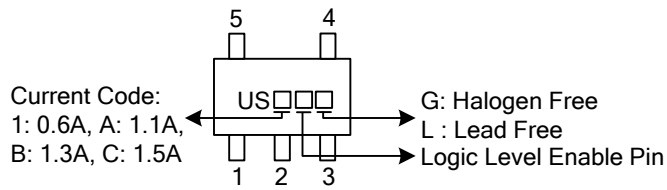


#### ORDERING INFORMATION

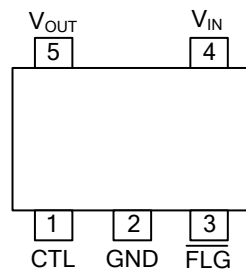
Ordering Number		Package	Packing
Lead Free	Halogen Free		
US201XXL-AF5-R	US201XXG-AF5-R	SOT-25	Tape Reel

<p>US201XXL-AF5-R</p> <ul style="list-style-type: none"> <li>(1)Packing Type</li> <li>(2)Package Type</li> <li>(3)Lead Free</li> <li>(4) Logic Level Enable Pin</li> <li>(5)Current Code</li> </ul>	<ul style="list-style-type: none"> <li>(1) R: Tape Reel</li> <li>(2) AF5: SOT-25</li> <li>(3) G: Halogen Free, L: Lead Free</li> <li>(4) H: Active High, L: Active Low</li> <li>(5) Blank: 0.6A, A: 1.1A , B: 1.3A, C: 1.5A</li> </ul>
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## MARKING



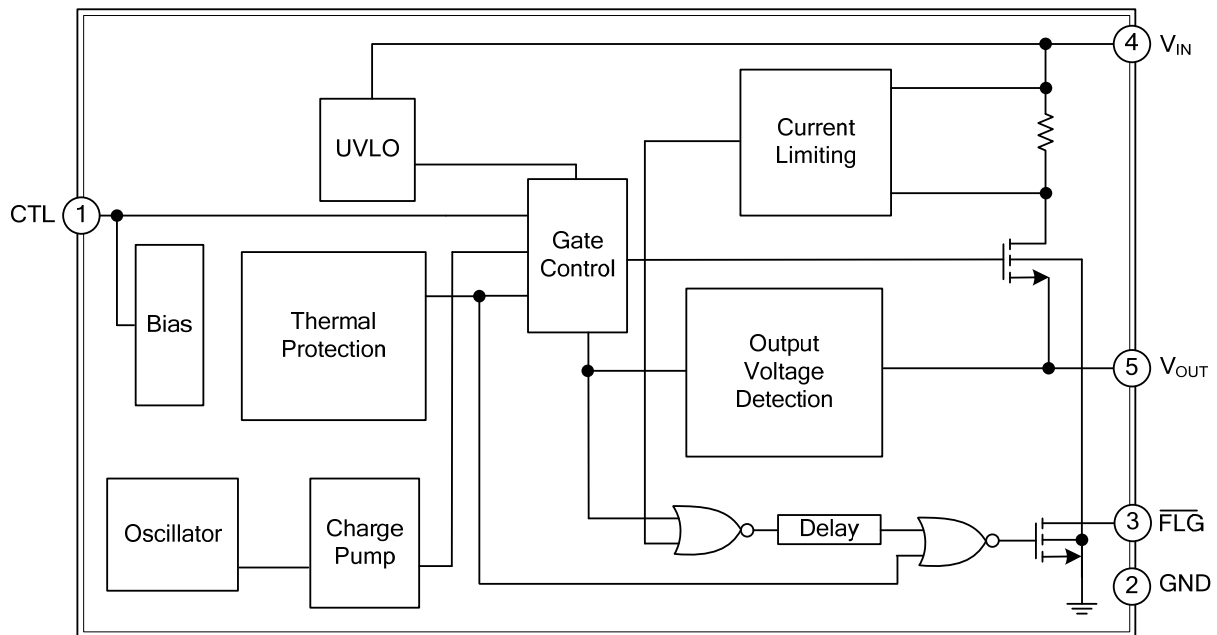
## PIN CONFIGURATION



## PIN DESCRIPTION

PIN NO	PIN NAME	DESCRIPTION
1	CTL	Enable Input pin, H: High active, L: Low active
2	GND	Ground
3	FLG	Open-drain fault flag output
4	$V_{IN}$	Power input voltage
5	$V_{OUT}$	Output voltage

## BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING( $T_A=25^{\circ}\text{C}$ , unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Supply Voltage		$V_{CC}$	6.5	V
			+2 ~ +5.5 (Note 2)	V
Input/Output Pins		$V_{CTL}$	-0.3~ +6.5	V
			0 ~ +5.5 (Note 2)	V
		$V_{FLG}$	6.5	V
Junction Temperature		$T_J$	150	$^{\circ}\text{C}$
			-20 ~ +100 (Note 2)	$^{\circ}\text{C}$
Storage Temperature		$T_{STG}$	-65 ~ +150	$^{\circ}\text{C}$

Notes:1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. The device is not guaranteed to function when it's beyond its operating conditions.

■ THERMAL DATA

PARAMETER	SYMBOL	RATINGS	UNIT
Junction to Ambient	$\theta_{JA}$	260	$^{\circ}\text{C}/\text{W}$
Junction to Case	$\theta_{JC}$	81	$^{\circ}\text{C}/\text{W}$

■ ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
<b>ENABLE INPUT</b>							
CTL Threshold	Low	$V_{IL}$	$V_{IN}=2\text{V}\sim 5.5\text{V}$ , Switch OFF		0.8	V	
	High	$V_{IH}$	$V_{IN}=2\text{V}\sim 5.5\text{V}$ , Switch ON		2.0	V	
CTL Input Current	$I_{I(CTL)}$	$V_{CTL}=0\text{V}\sim 5.5\text{V}$		0.01		$\mu\text{A}$	
<b>UNDER VOLTAGE LOCK</b>							
Under-Voltage Lockout	$V_{UVLO}$	$V_{IN}$ increasing	US201/ US201A	1.0	2.1	2.9	V
			US201B/ US201C		2.5		
Under-Voltage Hysteresis	$\Delta V_{UVLO}$	$V_{IN}$ decreasing		0.1		V	
<b>SUPPLY CURRENT</b>							
Supply Current	$I_{SW(ON)}$	Switch on, $V_{OUT}=\text{OPEN}$		25	45	$\mu\text{A}$	
	$I_{SW(OFF)}$	Switch off, $V_{OUT}=\text{OPEN}$		0.1	1	$\mu\text{A}$	
Output Leakage Current	$I_{O(LEAK)}$	$V_{CTL}=0\text{V}$ , $R_{LOAD}=0\Omega$		0.5	10	$\mu\text{A}$	
<b>CURRENT LIMIT</b>							
Current Limit	$I_{LIMIT}$		US201	0.6	0.8	1.1	A
			US201A	1.1	1.5	1.9	A
			US201B	1.3	1.7	2.1	A
			US201C	1.5	2.0	2.4	A
Short Circuit Fold-Back Current	$I_{SC(FB)}$	$V_{OUT}=0\text{V}$ , measured prior to thermal shutdown	US201		0.8		A
			US201A		1.0		A
			US201B		1.0		A
			US201C		1.3		A
<b>POWER SWITCH</b>							
Switch ON Resistance	$R_{DS(ON)}$	$I_{OUT}=500\text{mA}$	US201		80	110	$\text{m}\Omega$
		$I_{OUT}=1.0\text{A}$	US201A/B/C		80	110	$\text{m}\Omega$
Output Turn-ON Rise Time	$t_{ON(RISE)}$	10% ~ 90% of $V_{OUT}$ rising		400		$\mu\text{s}$	
<b>OVER CURRENT FLAG</b>							
FLAG OFF Current	$I_{FLG(OFF)}$	$V_{FLG}=5\text{V}$		0.01	1	$\mu\text{A}$	
FLAG Output Resistance	$R_{FLG}$	$I_{SINK}=1\text{mA}$		20	400	$\Omega$	
FLAG Delay Time	$t_D$	From fault condition to $\overline{FLG}$ assertion	2	10	15	ms	
<b>THERMAL SHUTDOWN</b>							

Thermal Shutdown Protection	$T_{SD}$			130		°C
Thermal Shutdown Hysteresis	$\Delta T_{SD}$			20		°C

## ■ TEST CIRCUIT

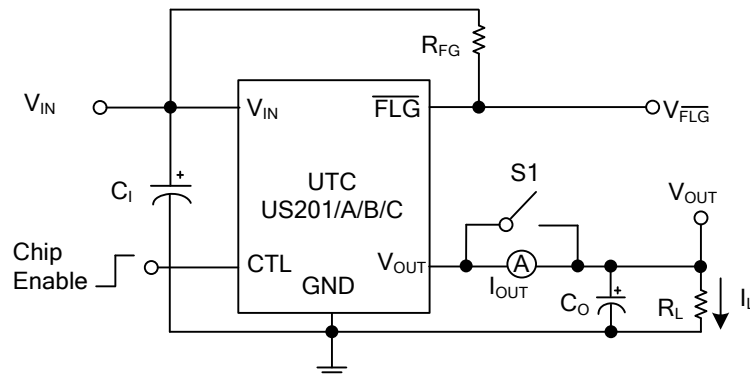


Fig.1 Turn-On & Off Response, Flag Response

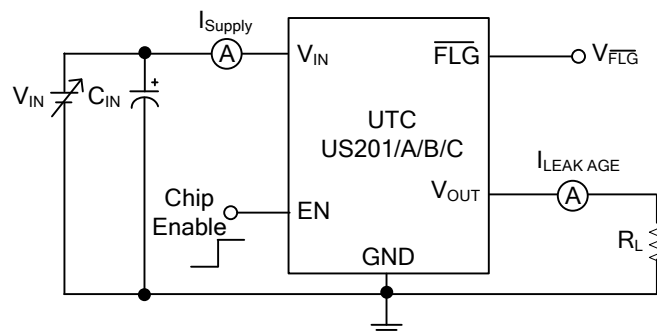


Fig.2 Supply Current

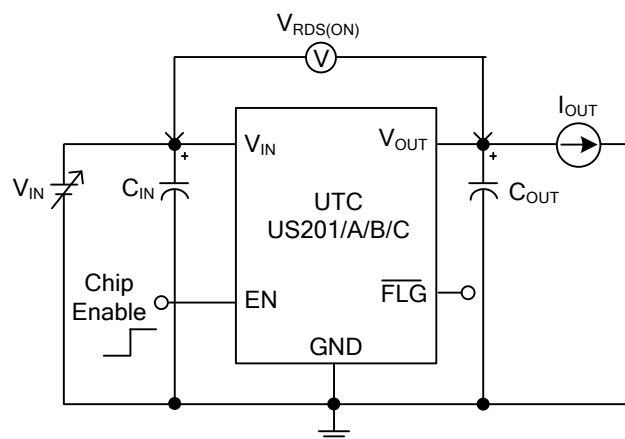


Fig.3 On-Resistance

## ■ TEST CIRCUIT

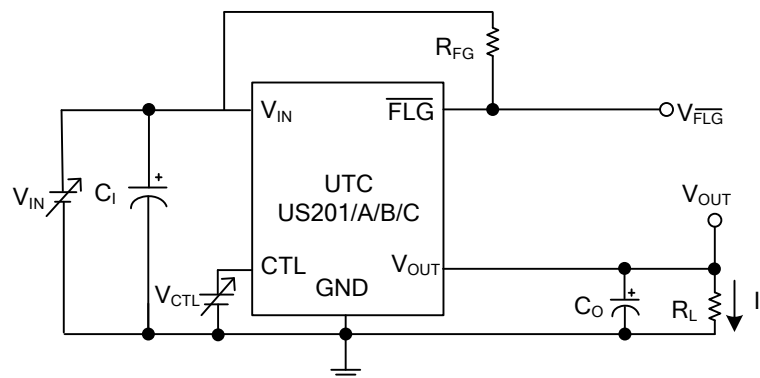


Fig.4 UVLO at Rising & Falling

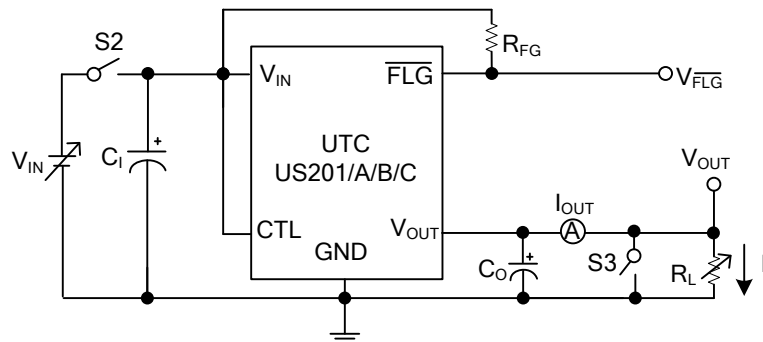
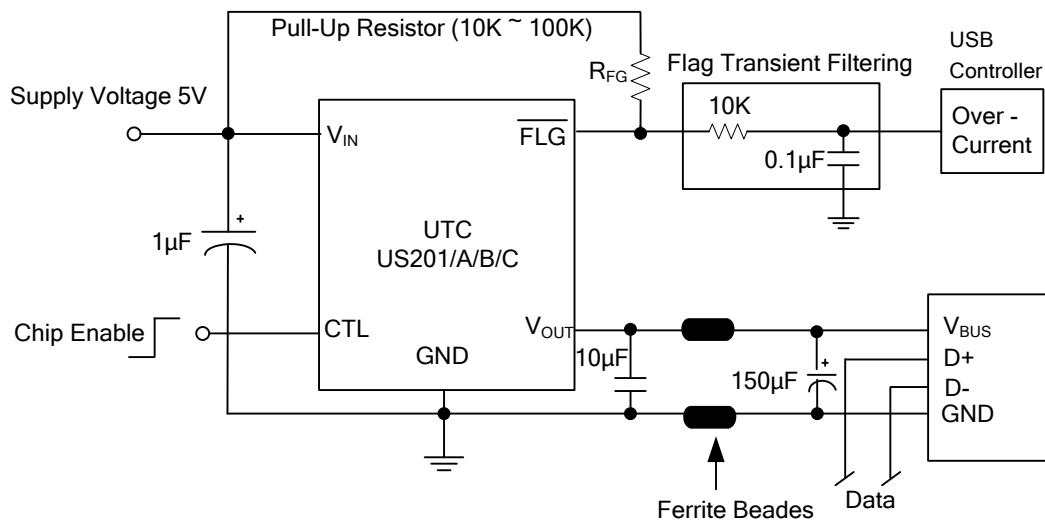


Fig.5 Current Limit vs. Input Voltage, Inrush Current Response, Current Limit Transient Response

Note: Above test circuits reflected the graphs shown on “Typical Operating Characteristics” are as follows:

- Fig.1 Turn-On Rising & Falling Time vs. Temperature, Turn-On & Off Response, Flag Response.
- Fig.2 Supply Current vs. Input Voltage & Temperature, Switch Off Supply Current vs. Temperature, Turn-Off Leakage Current vs. Temperature.
- Fig.3 On-Resistance vs. Input Voltage & Temperature.
- Fig.4 EN Threshold Voltage vs. Input Voltage & Temperature, Flag Delay Time vs. Input Voltage & Temperature, UVLO Threshold vs. Temperature, UVLO at Rising & Falling.
- Fig.5 Current Limit vs. Input Voltage/Temperature, Short Circuit Current Response, Short Circuit Current vs. Temperature, Inrush Current Response, Soft-start Response, Ramped Load Response, Current Limit Transient Response, Thermal Shutdown Response.

■ TYPICAL APPLICATION CIRCUIT



Note. A low-ESR 150µF aluminum electrolytic or tantalum between V<sub>OUT</sub> and GND is strongly recommended to meet the 330mV maximum droop requirement in the hub V<sub>BUS</sub>.

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