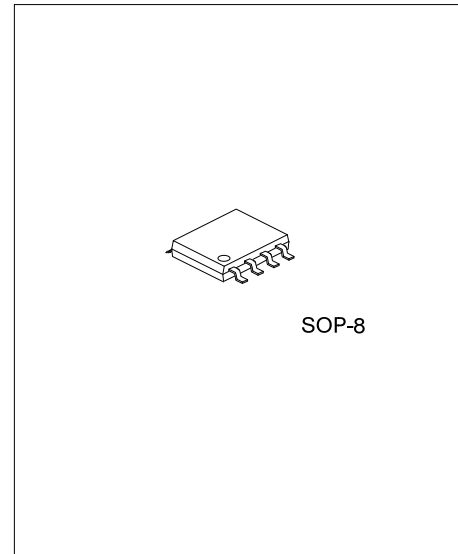**UNISONIC TECHNOLOGIES CO., LTD**

US2075C

CMOS IC

DUAL-CHANNEL POWER DISTRIBUTION CONTROL SWITCH FOR USB

SOP-8

■ **DESCRIPTION**

The UTC **US2075C** is a dual channel power switch with independent enable and flag functions, optimized for bus-powered Universal Serial Bus (USB) and self-powered applications.

This product satisfies USB voltage drop requirement with soft start, which eliminates the momentary voltage drop on the upstream port that may occur.

In addition, the UTC **US2075C** is equipped with over-temperature and over-current detectors, each flag output is available to indicate fault conditions independently to the USB controller. The UTC **US2075C** is available in active-high versions.
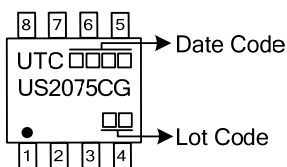
■ **FEATURES**

* 100 µA MAX operating current
* 5µA MAX standby current
* 3.5V ~ 5.5V operating range
* Two P-channel power MOSFET control switch
* Over-current protection
* Under-voltage lockout circuit
* Thermal shutdown circuit
* Soft-start circuit
* Flag indicates fault conditions

■ **ORDERING INFORMATION**

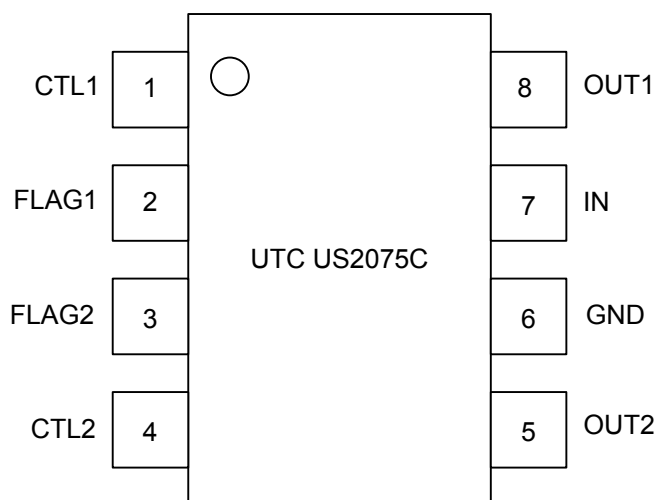| Ordering Number	Package	Packing
US2075CG-S08-R	SOP-8	Tape Reel

US2075CG-S08-R

(1)Packing Type

(2)Package Type

(3)Green Package

(1) R: Tape Reel

(2) S08: SOP-8

(3) G: Halogen Free and Lead Free

■ **MARKING**

UTC ☐☐☐☐ → Date Code
US2075CG
☐☐ → Lot Code

US2075C

CMOS IC

■ PIN CONFIGURATION

```
CTL1   1  ( )        8   OUT1

FLAG1  2             7   IN

            UTC US2075C

FLAG2  3             6   GND

CTL2   4             5   OUT2
```

■ PIN DESCRIPTION

PIN NO	PIN NAME	DESCRIPTION
1	CTL1	Switch1Control Input: Logic-compatible, active-high. TTL input
2	FLAG1	Fault Detection Flag 1 (OUTPUT): Active-low. N-ch open-drain. Indicates over-current, thermal shutdown, or UVLO conditions
3	FLAG2	Fault Detection Flag 2 (OUTPUT): Active-low. N-ch open-drain. Indicates over-current, thermal shutdown, or UVLO conditions
4	CTL2	Switch2 Control Input: Logic-compatible, active-high. TTL input
5	OUT2	Switch2 Output: Drain of MOSFET for output. Usually, connected to Load
6	GND	Ground
7	IN	Power Input: Source of MOSFET for output. Power supply to Internal circuit
8	OUT1	Switch1 Output: Drain of MOSFET for output. Usually, connected to Load

■ **TRUTH TABLE** (H: High, L: Low, ON: Turn on, OFF: Turn off, X: H or L)

CTL1 (IN)	FLAG1 (OUT)	OUT1 (OUT)	CTL2 (IN)	FLAG2 (OUT)	OUT2 (OUT)	Operation Mode
H	H	ON	H	H	ON	Normal Operation
H	H	ON	L	H	OFF	Only OUT1 is ON.
L	H	OFF	H	H	ON	Only OUT2 is ON.
L	H	OFF	L	H	OFF	Standby Mode
H	L	ON	H	H	ON	Over current Detection Only for OUT1
H	H	ON	H	L	ON	Over current Detection Only for OUT2
X	L	OFF	X	L	OFF	Thermal Shutdown Circuit Operation
X	L	OFF	X	L	OFF	Under voltage Lockout Circuit Operation

US2075C

■ **BLOCK DIAGRAM**
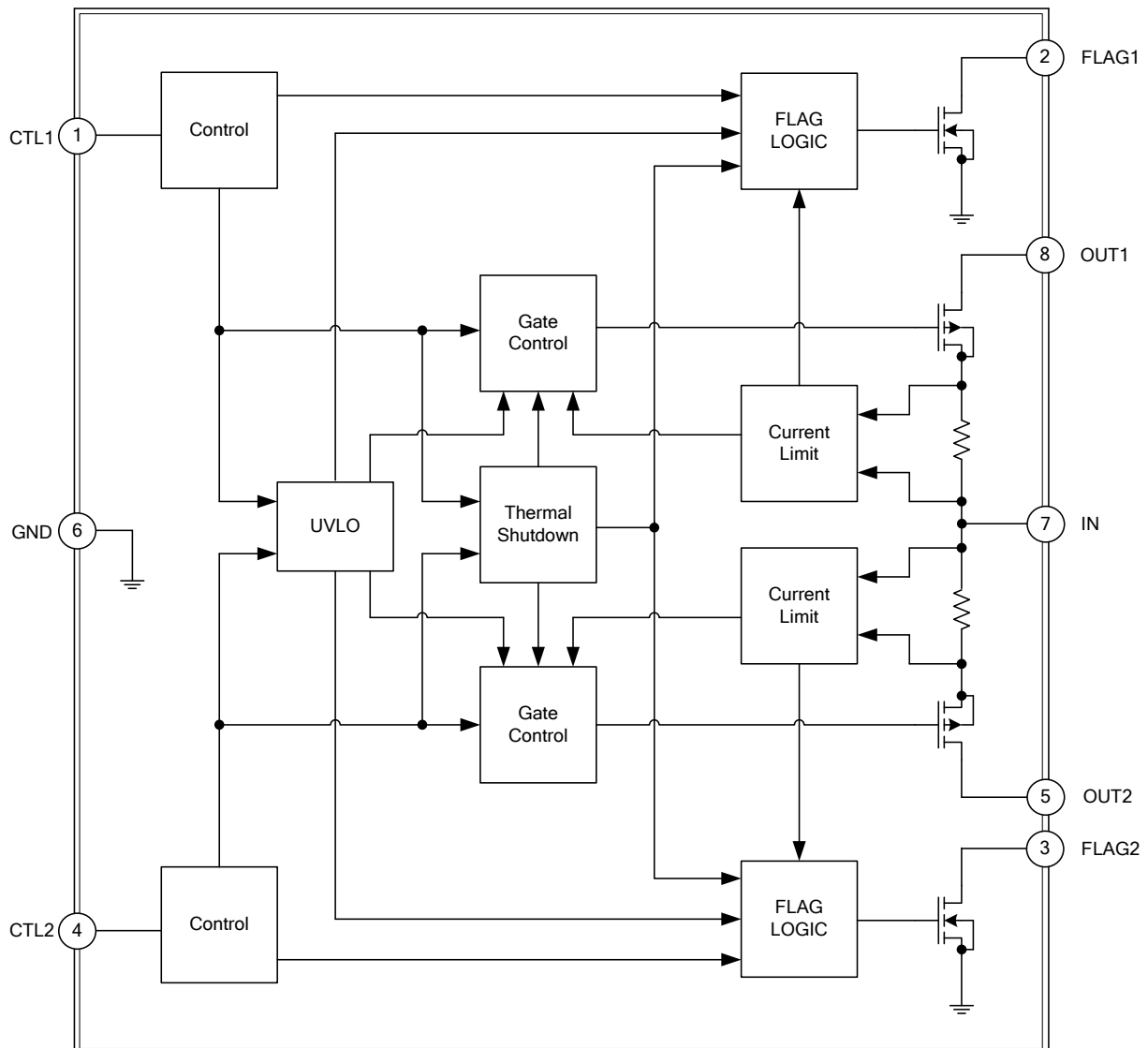
■ **ABSOLUTE MAXIMUM RATINGS** (T_A=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Input Voltage	V_{IN}	-0.3 ~ +6	V
Flag Voltage	V_{FLAG}	-0.3 ~ +6	V
Flag Current	I_{FLAG}	50	mA
Output Voltage	V_{OUT}	V_{IN}+0.3	V
Output Current	I_{OUT}	-0.1 ~ +0.5	A
Control Input	V_{CTL}	-0.3 ~ +6	V
Total Power Dissipation	P_D	300	mW
Junction Temperature	T_J	+150	°C
Operating Temperature	T_{OPR}	0 ~ +85	°C
Storage Temperature	T_{STG}	-55 ~ +150	°C

Note: 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.

■ **RECOMMENDED OPERATING RANGE**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Thermal Shutdown Protection	T_{SHDN}	Temperature Rising		150		°C
		Temperature Hysteresis		5	10	°C

■ **DC ELECTRICAL CHARACTERISTICS** (V_{IN}=+5V, T_{OPR}=+25°C, Unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage	V_{IN}		3.5	5	5.5	V
CTL Voltage, Low	V_{IL}	CTL Pin (Note)			1.0	V
CTL Voltage, High	V_{IH}	CTL Pin (Note)	2.0			V
Under-Voltage Lockout	V_{UVLO}	V_{IN}=Increasing	2.2	2.5	2.8	V
		V_{IN}=Decreasing	2.0	2.3	2.6	V
		Hysteresis Voltage	0.05		0.25	V
Supply Current	I_{SW_ON}	V_{CTL} = V_{IN}, V_{OUT1}=V_{OUT2}=Open			100	µA
	I_{SW_OFF}	V_{CTL} = GND, V_{OUT1}=V_{OUT2}=Open		1	5	µA
Output Leakage Current	$I_{O(LEAK)}$	V_{CTL} = GND			10	µA
Flag Leakage Current	$I_{F(LEAK)}$	V_{FLAG}=5V		0.1	1	µA
Current Limit	I_{LIMIT}	T_a=0~80°C	0.6	0.9	1.25	A
Flag Output Resistance	R_{OUT}	I_L=10mA		10	20	Ω
Output MOSFET on-Resistance	R_{ON}	I_{OUT}=500mA		105	145	mΩ

Note: ON is CTL>2.0V and OFF is CTL<1.0V.

■ **AC ELECTRICAL CHARACTERISTICS**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Turn-on Rise Time	t_R	R_L=10Ω, Per Output	2.5	5	8	ms
Output Turn-off Fall Time	t_F	R_L=10Ω, Per Output			10	µs
Over-Current Detection Delay Time	t_{DELAY}			20		µs
Over-Current Detection Output Rise Time	t_{DECR}	R_L=10Ω, Per Output	2.5	5	8	ms

■ **TEST CIRCUIT**

■ TIMING DIAGRAM

US2075C

CMOS IC
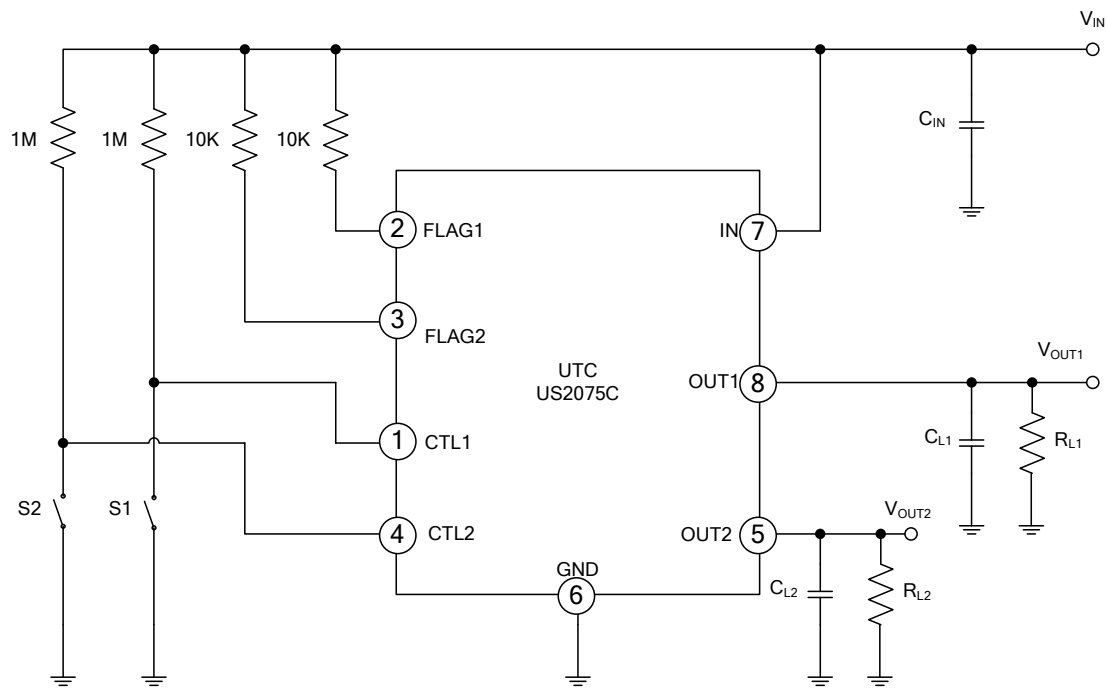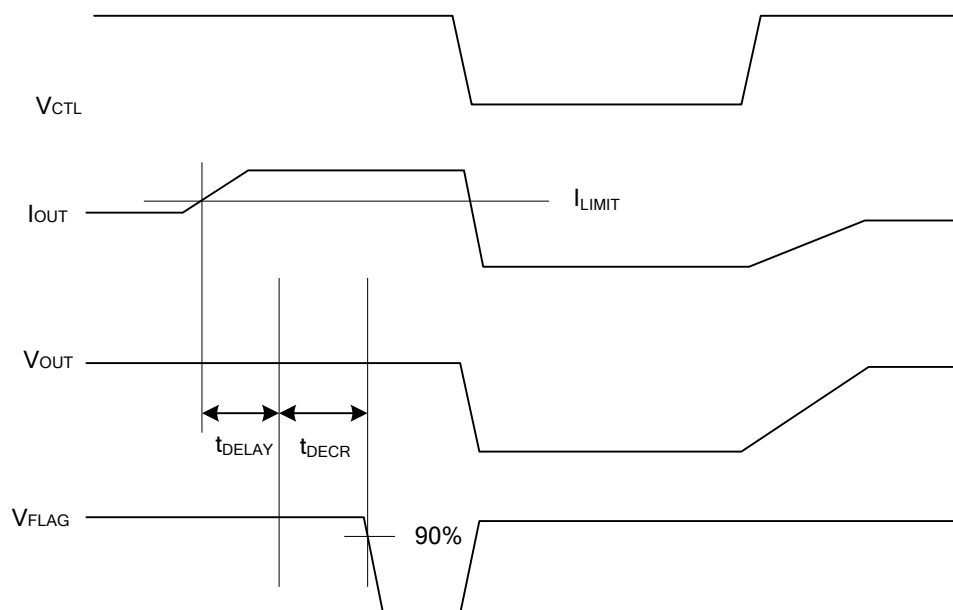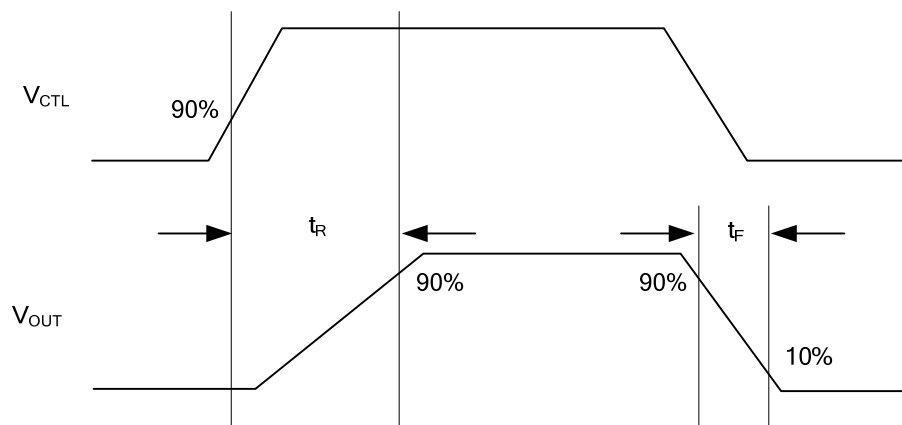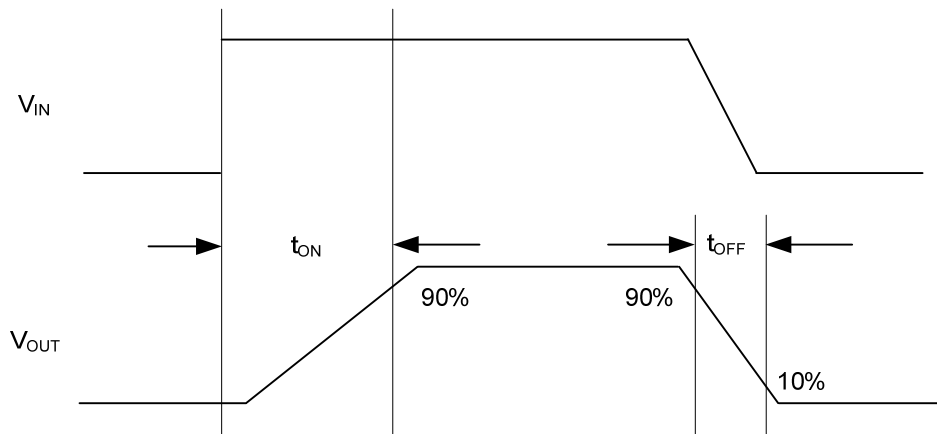
■ **FUNCTIONAL DESCRIPTION**

The UTC **US2075C** is dual P-Channel switch with active-low and active-high enable inputs, respectively. Fault conditions (such as UVLO, thermal shutdown and over-current) that appear will turn off the power switch, and the FLAG pin will go low. Of course, the two internal FLAG circuitₛ also operate respectively.

INPUT AND OUTPUT

IN (Input) is the power supply connection to the control circuitry and the source of the output MOSFET. OUTX (Output) is the connection to the drain of the output MOSFET. In a typical application circuit, current flows through the switch from IN to OUTX towards the load. If V_{OUT} is greater than V_{IN} when the switch is enabled, current will flow from OUTX to IN since the MOSFET is bi-directional.

POWER ON AND OFF

The UTC **US2075C** performs a soft-start operation on power application, which is to prevent an over-current or inrush-current from flowing through the switch from IN to OUTX towards to the load, while the high-capacity capacitor is connected to the OUTX.

THERMAL SHUTDOWN

The UTC **US2075C** is internally protected against excessive power dissipation by thermal shutdown protection circuit. If device junction temperature rise above approximately 150°C, both switches are turned off, both fault FLAG outputs are activated, and they goes low. Hysteresis ensures that both switches turned off by thermal shutdown will not be turned on again until the die temperature is reduced to 145°C. When the thermal shutdown circuit is activated, the output pins are in the OFF status. However, the UTC **US2075C** enters the standby status when CTL pins are all inactive.

CURRENT LIMIT

The current limit circuit is designed to protect the output MOSFET, the load and the IC supply from damage caused by excessive currents. The current limit threshold is preset internally, If an over-current is detected, the IC performs a slow-start operation again, it is assumed that output is short circuit, and FLAG pin will go low, FLAG output is available to indicate fault conditions independently to the USB controller.
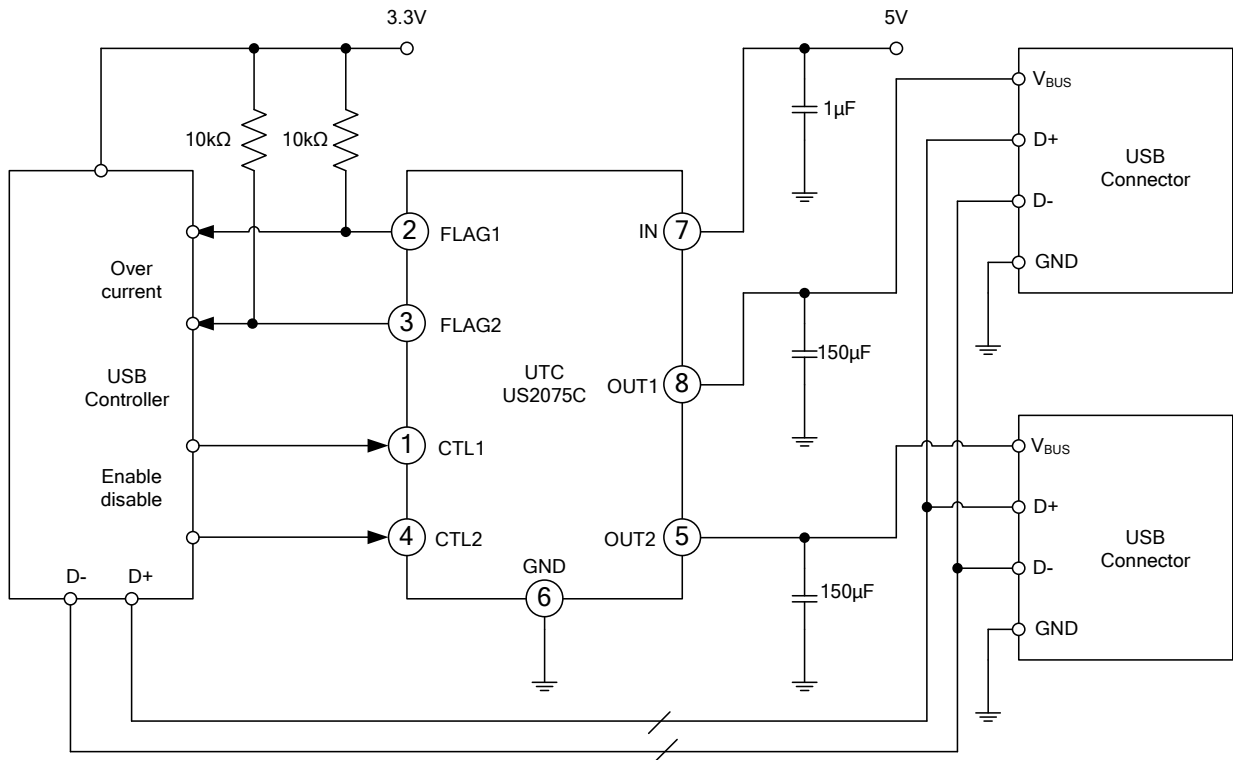
UNDER-VOLTAGE LOCKOUT

UVLO prevents the output MOSFET switch from turning on until input voltage exceeds 2.5V (typical). If input voltage drops below 2.3V (typical), UVLO shuts off the both output MOSFET switches and signals the FLAG.

FAULT FLAG

The fault FLAG is an output with open-drain of N-channel. The fault FLAG is pulled down when any of the conditions such as under-voltage, current limit and thermal shutdown. In a typical application circuit, the FALG pin has a pull-up resistor of 10kΩ to input voltage.
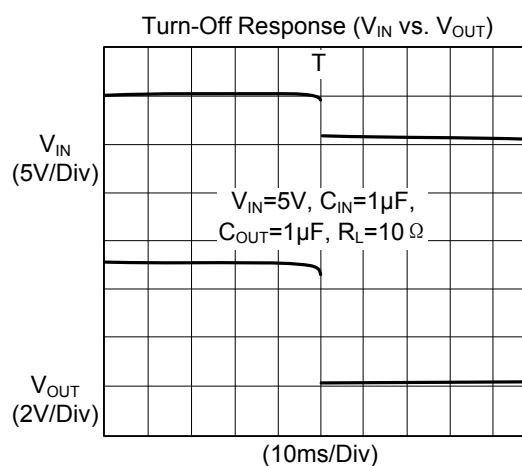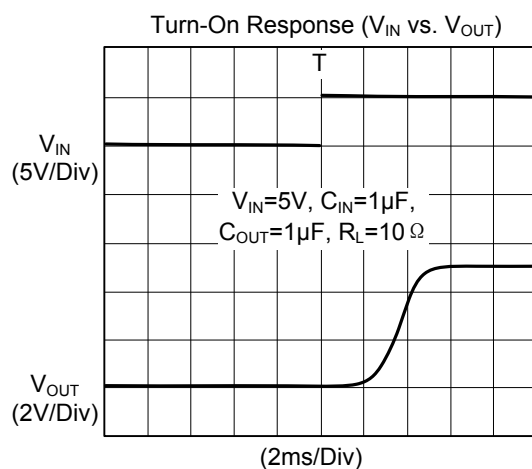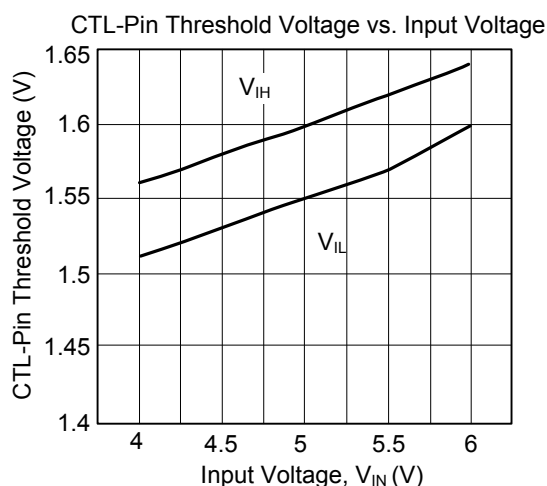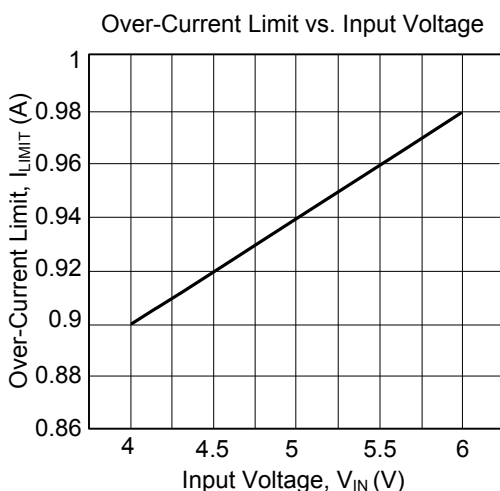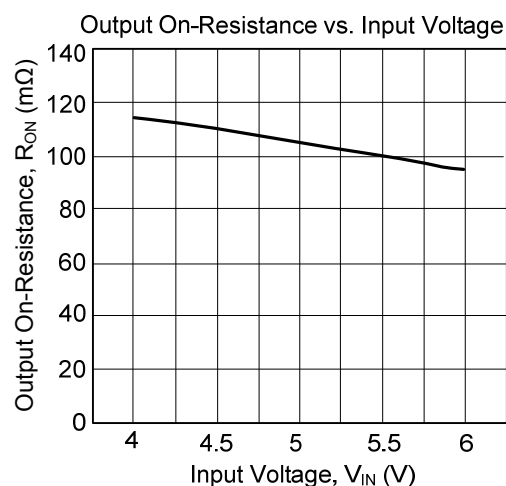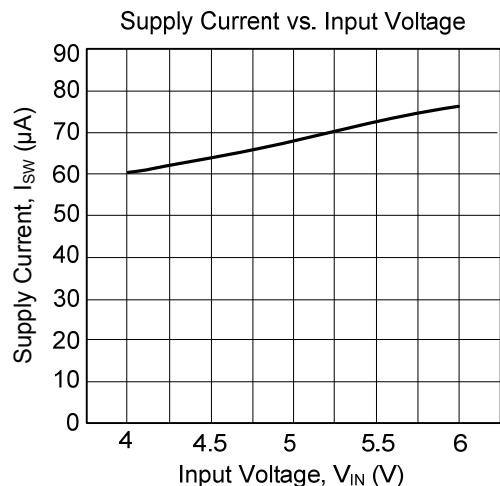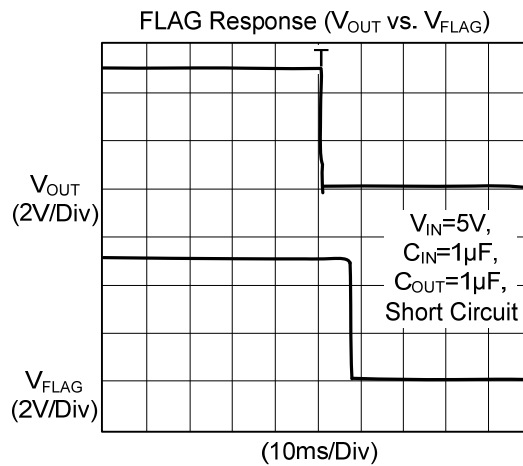
■ TYPICAL APPLICATION CIRCUIT

TWO USB output ports controllable by USB controller

■ **TYPICAL CHARACTERISTICS**

Supply Current vs. Input Voltage

Output On-Resistance vs. Input Voltage

Over-Current Limit vs. Input Voltage

CTL-Pin Threshold Voltage vs. Input Voltage

Turn-On Response (V_{IN} vs. V_{OUT})

V_{IN}=5V, C_{IN}=1μF, C_{OUT}=1μF, R_L=10 Ω

Turn-Off Response (V_{IN} vs. V_{OUT})

V_{IN}=5V, C_{IN}=1μF, C_{OUT}=1μF, R_L=10 Ω

■ TYPICAL CHARACTERISTICS(Cont.)

Turn-On Response (V_{CTL} vs. V_{OUT})

V_{CTL} (5V/Div)

$V_{IN}=5V, C_{IN}=1\mu F, C_{OUT}=1\mu F, R_L=10\Omega$

V_{OUT} (2V/Div)

(2ms/Div)

Turn-Off Response (V_{CTL} vs. V_{OUT})

V_{CTL} (5V/Div)

$V_{IN}=5V, C_{IN}=1\mu F, C_{OUT}=1\mu F, R_L=10\Omega$

V_{OUT} (2V/Div)

(4ms/Div)

FLAG Response (V_{OUT} vs. V_{FLAG})

V_{OUT} (2V/Div)

$V_{IN}=5V, C_{IN}=1\mu F, C_{OUT}=1\mu F,$ Current Limit

V_{FLAG} (2V/Div)

(10ms/Div)

FLAG Response (V_{OUT} vs. V_{FLAG})

V_{OUT} (2V/Div)

$V_{IN}=5V, C_{IN}=1\mu F, C_{OUT}=1\mu F,$ Short Circuit

V_{FLAG} (2V/Div)

(10ms/Div)