UNISONIC TECHNOLOGIES CO., LTD

US16855   Preliminary   *CMOS IC*

DUAL HIGH-SIDE SWITCH FOR USB APPLICATION

■ **DESCRIPTION**

The UTC **US16855** 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 **US16855** is equipped with over-temperature and over-current detectors and each flag output is available to indicate fault conditions independently to the USB controller. The UTC **US16855** is available in active-high versions in 8-pin SOP package.
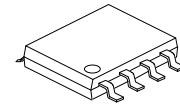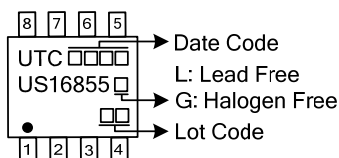
SOP-8

■ **FEATURES**

* 4V ~ 5.5V operating range
* Two P-channel power MOSFET control switch
* Over-current protection
* Under-voltage lockout circuit
* Thermal shutdown circuit
* Soft-start circuit
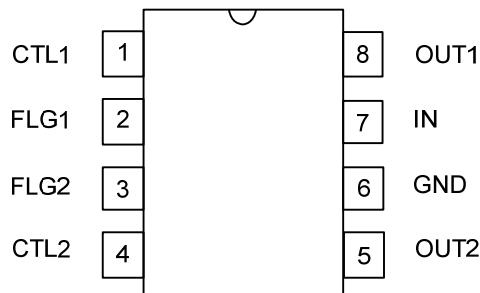* Flag indicates fault conditions

■ **ORDERING INFORMATION**

Ordering Number		Package	Packing
Lead Free	Halogen Free		
US16855L-S08-R	US16855G-S08-R	SOP-8	Tape Reel

US16855G-S08-R

    (1)Packing Type   (1) R: Tape Reel

    (2)Package Type   (2) S08: SOP-8

    (3)Green Package   (3) G: Halogen Free and Lead Free, L: Lead Free

■ **MARKING**

```
 8  7  6  5
UTC □□□□        ──► Date Code
US16855□        L: Lead Free
       □□        G: Halogen Free
●     ──►       Lot Code
 1  2  3  4
```

QW-R502-558.b

■ **PIN CONFIGURATION**

CTL1	1		8	OUT1
FLG1	2		7	IN
FLG2	3		6	GND
CTL2	4		5	OUT2

■ **PIN DESCRIPTION**

| PIN NO.	PIN NAME	DESCRIPTION
1, 4	CTL1/CTL2	Control : TTL Input
2, 3	FLG1/FLG2	Over Current Detect Flag : Active-L, Nch open-drain
6	GND	Ground
7	IN	Power Supply : Source of MOSFET
8, 5	OUT1/OUT2	Output of Switch : Drain of MOSFET

■ **DESCRIPTION of UTC US16855 FUNCTION**

CTL Input Logic	Switch Operation with Over-Current Detect
"H" active	Switch Off regardless of CTL Input

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

CTL1	FLG1	OUT1	CTL2	FLG2	OUT2	Operating mode
H	H	ON	H	H	ON	Normal mode
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	Only OUT1 is over-current detect
H	H	ON	H	L	ON	Only OUT2 is over-current detect
X	L	OFF	X	L	OFF	TSD mode
X	L	OFF	X	L	OFF	UVLO mode
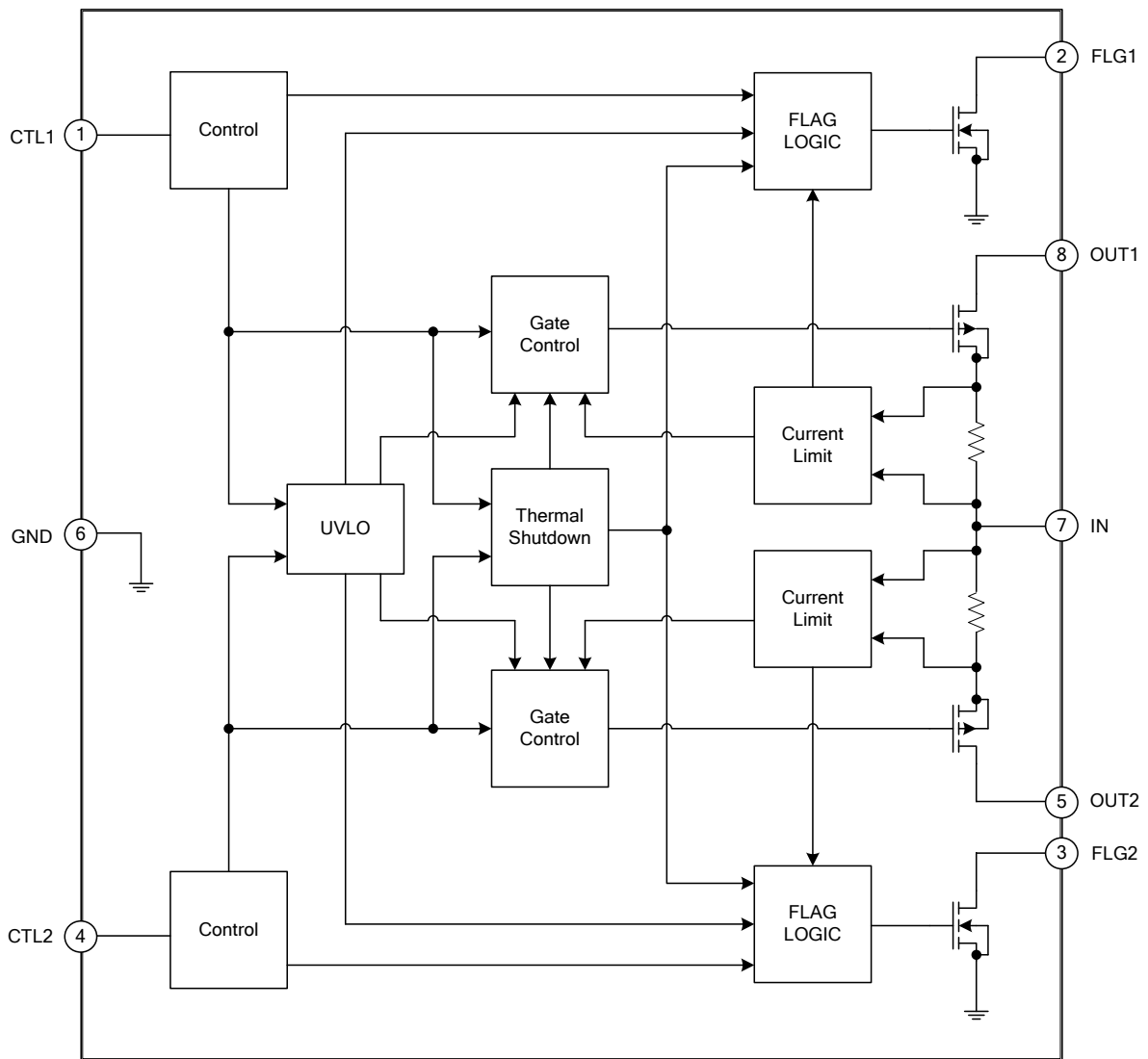
■ **BLOCK DIAGRAM**

■ **ABSOLUTE MAXIMUM RATING** (T_A=25°C, Unless otherwise specified)

PARAMETER		SYMBOL	RATINGS		UNIT
Input Voltage		V_{IN}	−0.3 ~ +6		V
Flag Voltage		V_{FLG}	−0.3 ~ +6		V
Control Input Voltage		V_{CTL}	−0.3 ~ +6		V
Output Voltage		V_{OUT}	V_{IN}+ 0.3		V
Flag Current		I_{FLG}	50		mA
Output Current	DC	I_{OUT}	V_{IN}= V_{CTL}=5 V	+0.5	A
				−0.1	
	Pulse Width ≤100μs Single Pulse		+3		
Power Dissipation		P_D	300		mW
Operating Temperature		T_A	−40 ~ +85		°C
Storage Temperature		T_{STG}	−55 ~ +150		°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 thermal shutdown circuit (operating temperature is more than 150 °C typ.) builds in this product.

■ **RECOMMENDED OPERATING RANGE**

PARAMETER	SYMBOL	RATINGS	UNIT
Input Voltage	V_{IN}	+4 ~ +5.5	V
Operating Temperature	T_A	0 ~ +70	°C

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

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
DC CHARACTERISTICS						
Circuit Current	I_{DD}	V_{CTL}= 0V (both pin 1 & pin 4), OUT = open		1	5	μA
		V_{CTL}= V_{IN}, OUT = open		1	1.5	mA
Low-level Input Voltage	V_{IL}	CTL Pin			1.0	V
High-level Input Voltage	V_{IH}	CTL Pin	2.0			V
Input Current of CTL pin	I_{CTL}	V_{CTL}= 0V		0.01	1	μA
		V_{CTL}= V_{IN}		0.01	1	μA
Output MOSFET On Resistance	R_{ON}	T_A= 0 ~ +70 °C, I_{OUT}= 500 mA		100	130	mΩ
Output Leak Current	$I_{O\ LEAK}$				10	μA
Over Current Detect Threshold	I_{TH}	T_A= 0 ~ +70 °C	0.6	0.9	1.25	A
Flag Output Resistance	R_{ONF}	I_L= 10 mA		10	25	Ω
Flag Leak Current	$I_{O\ LEAK\ F}$	V_{FLAG}= 5 V		0.01	1	μA
Operating Voltage of Under Voltage Locked Out Circuit	V_{UVLO}	V_{IN}: Up	2.2	2.5	2.8	V
		V_{IN}: Down	2.0	2.3	2.6	V
		Hysteresis	0.1	0.2	0.3	V
AC CHARACTERISTICS						
Output Transition Rising Time	t_{RISE}	R_L= 10Ω each output	2.5		12	ms
Output Transition Falling Time	t_{FALL}	R_L= 10Ω each output			10	μs
Over Current Detect Delay Time	t_{OVER}		5		20	μs
CTL Input Low-Level Time	t_{CTL}	CTL : H→L→H	20			μs

■ **TIMING DIAGRAM**

Output Transition Rising Time (at ON)/Output Transition Falling Time (at OFF) at the timing of CTL changing "L" to "H"/"H" to "L" for UTC **US16855**
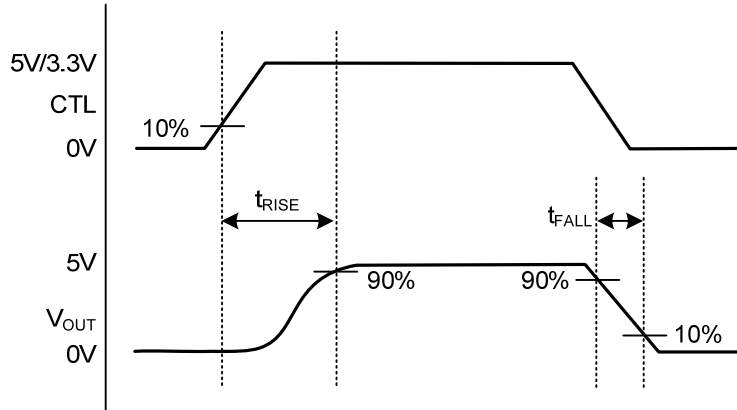
Over Current Detect Delay Time/CTL Input Low-Level Time for UTC **US16855**
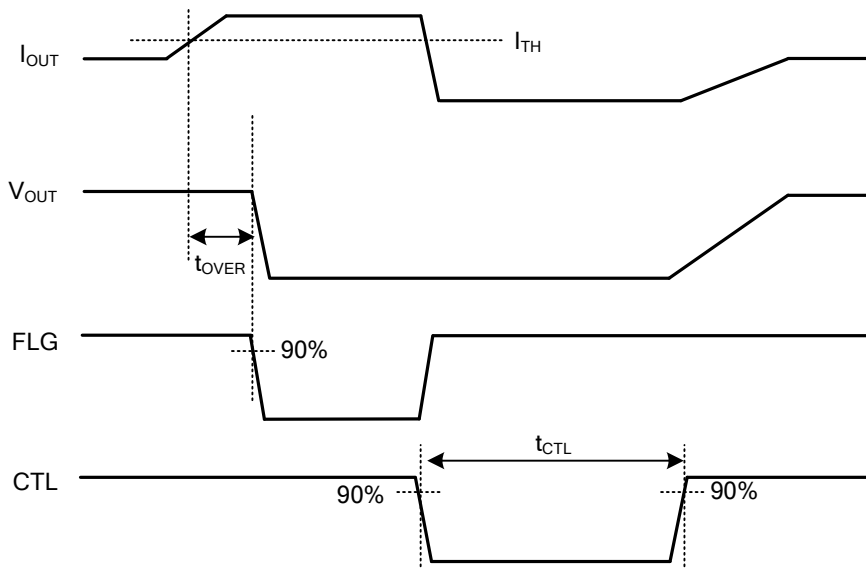
Over Current Detect Delay Time/CTL Input Low-Level Time for UTC US16855

■ FUNCTION DESCRIPTION

UNDER VOLTAGE LOCKED OUT

UVLO prevents malfunction of the switch because of voltage variation. When input voltage exceeds 2.5V (typical), the output MOSFET turns on. If input voltage drops below 2.3V (typical), UVLO shuts off the both output MOSFET switches and signals the FLAG.

POWER ON AND OFF

The UTC **US16855** 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.

OVER CURRENT DETECT

The specification of over current detect is 0.6 ~ 1.25 A (typ. 900mA) in this IC. (500 mA max. in USB standard) This function is that flag-pin turns to Low-level and reports to the USB controller when over current is detected.

At this time, output of IC is operated as followed.

Output turns to off, and isn't based on the state of CTL-pin.

When CTL-pin turns to non-active, FLG-pin returns to High-level and Output-pin turn to OFF-state.

Immediately the controller should be inputted non-active level to CTL-pin after detecting FLG = "L" not to reach to the state of thermal shutdown.

Then, in the case of FLG-pin is High-level and CTL-pin is active level, Output-pin turns to ON-state.

To prevent from detecting wrongly the current to the moment, over current detect delay time is set up.

This delay time is 10 ms (typ.).
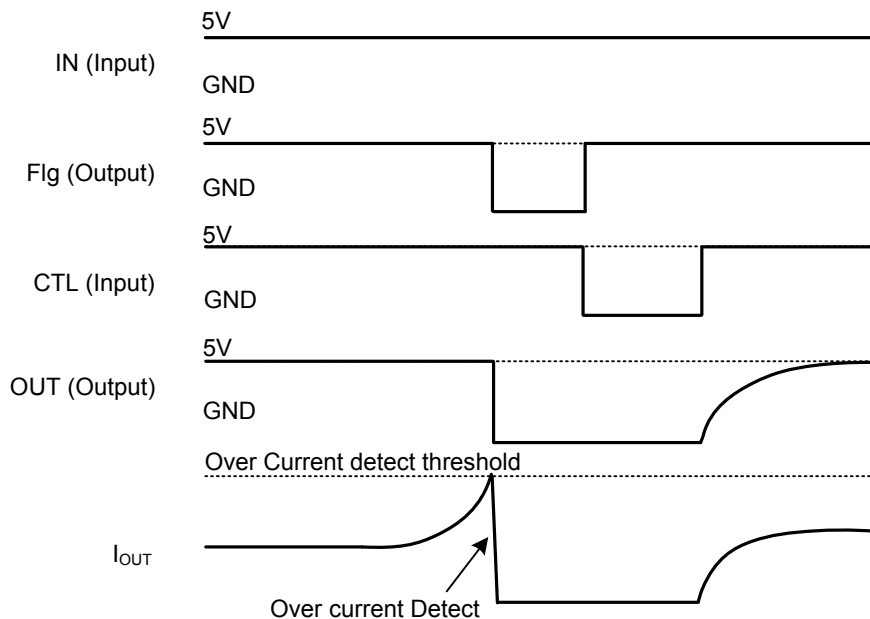
## ■ FUNCTION DESCRIPTION (Cont.)

THERMAL SHUTDOWN

The UTC **US16855** is internally protected against excessive power dissipation by thermal shutdown protection circuit. If device junction temperature rise above approximately 150℃, 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℃. When the thermal shutdown circuit is activated, the output pins are in the OFF status. However, the UTC **US16855** enters the standby status when CTL pins are all inactive.

■ TEST CIRCUIT

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QW-R502-558.b
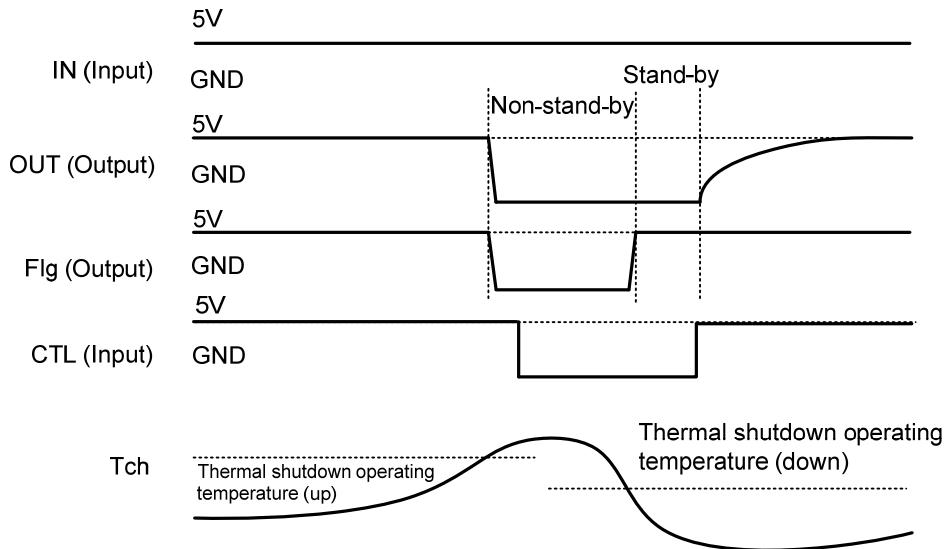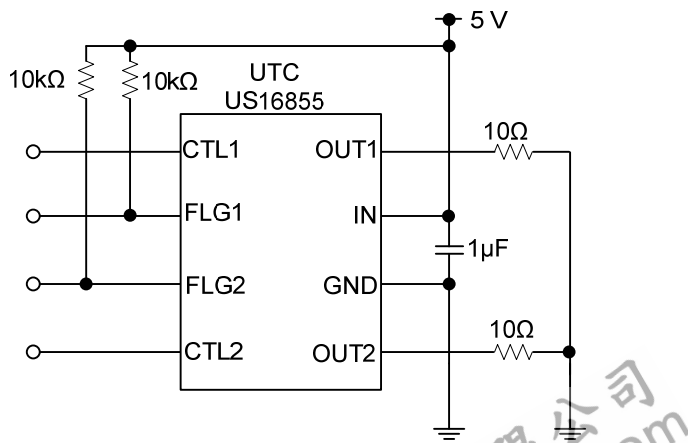
■ **TYPICAL APPLICATION CIRCUIT**
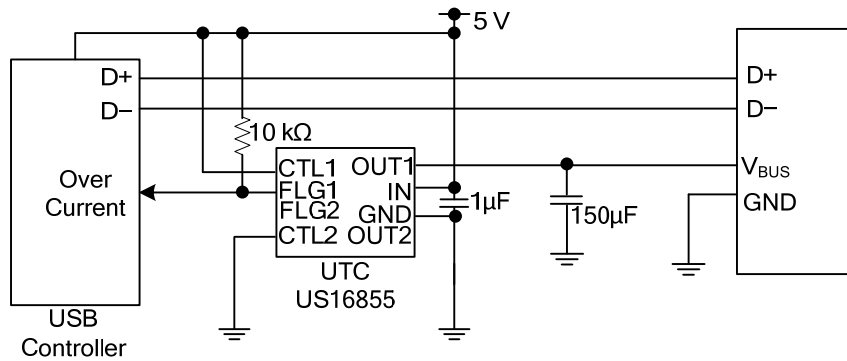
USB OUTPUT Port : 1 port
controllable by USB-controller