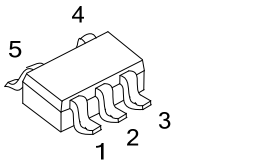
100mΩ POWER DISTRIBUTION SWITCHES



SOT-25

■ DESCRIPTION

The **US202** is a power distribution switch. It is particularly suitable for self-powered and bus-powered USB (Universal Series bus) applications. It has 23μA low quiescent supply current that meets the requirements of battery-powered portable equipments.

A built-in charge pump is used to drive the N-channel N-MOSFET that is free of parasitic body diode to eliminate any reversed current flow across the switch when it is powered off.

The **US202** incorporates some protection circuits such as current limit and short protection circuits, soft start circuit, thermal shutdown and UVLO (Under-voltage Lockout) protection circuits. The thermal shutdown circuits protect this device from damage when over current occurs, and the soft start circuits are used to prevent inrush current when plug-in event occurs.

The **US202** can be used in such applications such as battery-powered equipments, motherboard USB power switchs, USB device power switchs, hot-plug power supplies, battery-charger circuits and so on.

■ FEATURES

* Input Voltage Varies From 2.2V to 6V
* Guaranteed Continuous Current: 1.1A
* High-Side NMOSFET: 100mΩ (TYP)
* Soft Start
* Current Limit:1.5A
* Thermal Protection
* Low Supply Current: 23μA

■ ORDERING INFORMATION

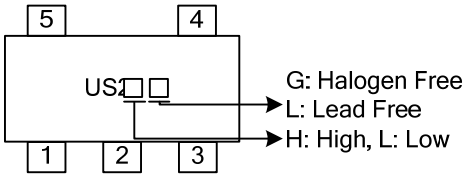
Ordering Number		Package	Packing
Lead Free	Halogen Free		
US202XL-AF5-R	US202XG-AF5-R	SOT-25	Tape Reel

US202X L-AF5-R
- (1)Packing Type
- (2)Package Type
- (3)Lead Free
- (4)Logic Level Enable Pin

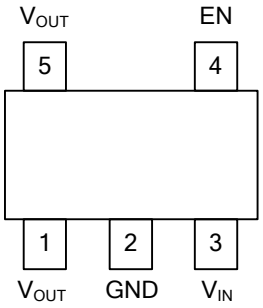
(1) R: Tape Reel
(2) AF5: SOT-25
(3) G: Halogen Free, L: Lead Free
(4) H: Active High, L: Active Low

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■ MARKING



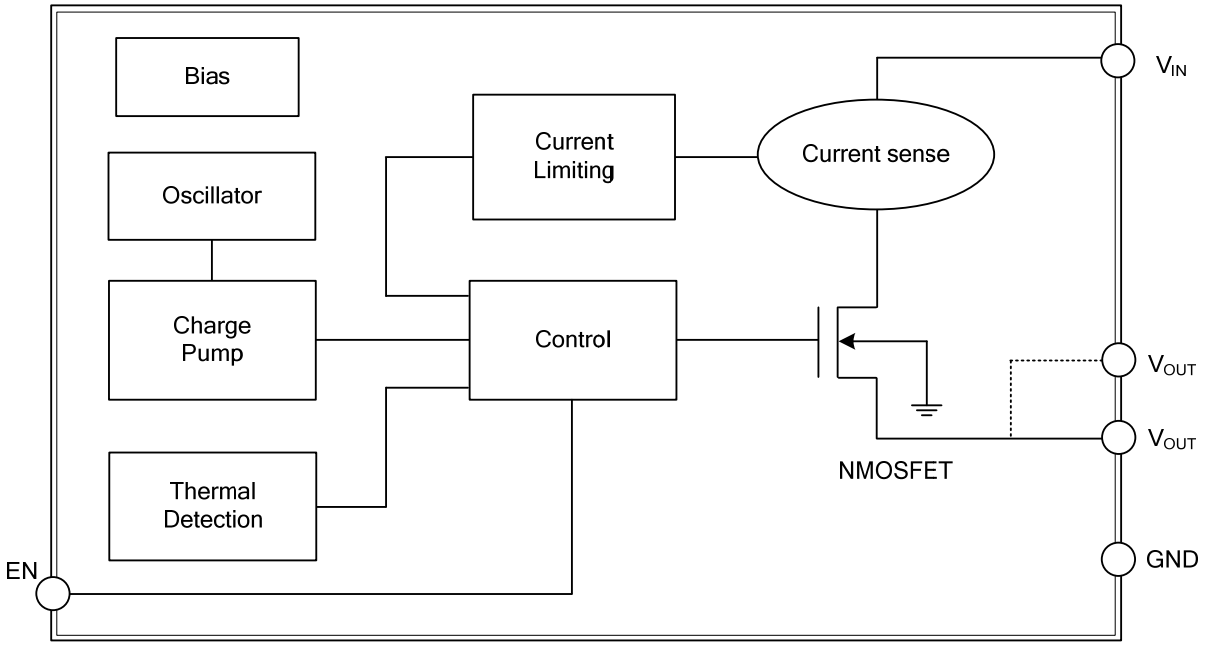
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1, 5	V_{OUT}	Output Voltage
2	GND	Ground
3	V_{IN}	Power Input
4	EN	Chip Enable (Active High)

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V_{IN}	7	V
Chip Enable	V_{EN}	-0.3~7	V
Power Dissipation (T_A = 25°C)	P_D	0.25	W
Junction Temperature	T_J	-20~100	°C
Storage Temperature	T_{STG}	-65~150	°C

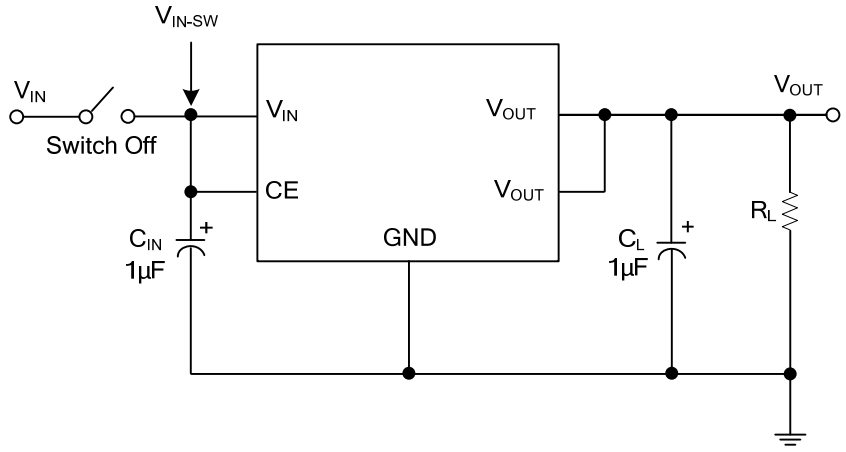
Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ ELECTRICAL CHARACTERISTICS

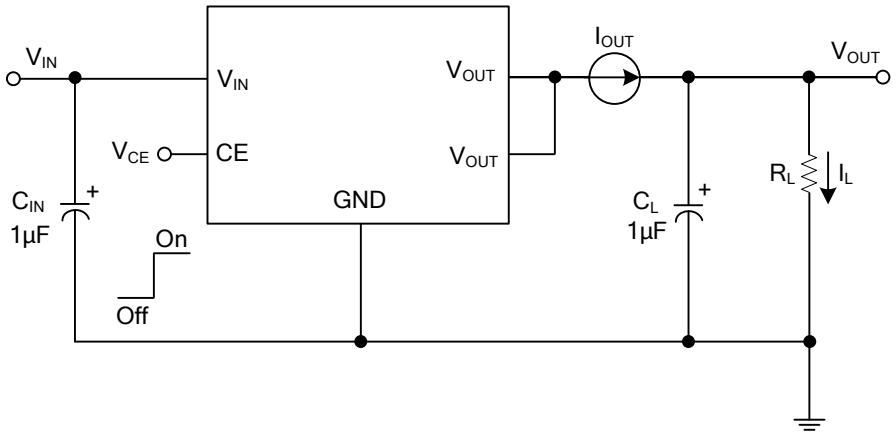
(V_{IN} = 5V, C_{IN} = C_{OUT} = 1μF, T_A = 25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage Range	V_{IN}		2.2		6	V
Output NMOSFET $R_{DS(ON)}$	$R_{DS(ON)}$	I_L = 1A		85	100	mΩ
Supply Current		V_{IN}= 3V		19	40	μA
		V_{IN}= 5V		23	45	
Output Turn-On Rising Time	T_R	R_L= 10Ω, 90% Settling		400		μS
Current Limit Threshold	I_{LIMIT}		1.1	1.5	2	A
Short-Circuit Fold Back Current	I_{OS}	V_{OUT} = 0V, measured prior to thermal shutdown		1.0		A
CE Input High Threshold	V_{IH}		2.0			V
CE Input Low Threshold	V_{IL}				0.8	V
Shutdown Supply Current	I_{OFF}	CE = “0”		0.1	1	μA
Output Leakage Current	$I_{I(LEAK)}$	CE = “0”, V_{OUT} = 0V		0.5	10	μA
V_{IN} Under Voltage Lockout	UVLO		1.3	1.8		V
V_{IN} Under Voltage Hysteresis				100		mV
Thermal Limit	T_{SD}			130		°C
Thermal Limit Hysteresis	ΔT_{SD}			20		°C

■ TEST CIRCUIT



Test Circuit 1



Test Circuit 2

Test Circuit 1 is performed by charging an external tank of bulk capacitor to the input then applying this voltage to the input of the unit.

■ APPLICATION INFORMATION

The UTC **US202** is a high-side single N-Channel MOSFET switch with active-high enable input.

Input and Output

V_{IN} pin (input) is the power supply connection to the circuitry and the drain of the output MOSFET. V_{OUT} pin (output) is the source of the output MOSFET. In a typical circuit, current flows through the switch from V_{IN} to V_{OUT} toward the load. Both V_{OUT} pins must be short on the board and connected to the load and so do both V_{IN} pins but connected to the power source.

Thermal Shutdown

Thermal shutdown is used to turn off the output MOSFET when the if the temperature is higher than130°C, 20°C of hysteresis prevents the switch turn on until the die temperature drops to 110°C.

Soft Start

When hot-plug events occur, the soft start is used to eliminate the upstream voltage droop due to the inrush current. The soft-start protects power supplies from damage caused by highly capacitive loads.

Under-Voltage Lockout

UVLO (Under voltage Lockout) turn off the MOSFET switch once the input voltage falls below 1.8V (TYP.) and if the input voltage exceeds 1.8V, the switch will be turned on.

Current Limiting and Short Protection

The current limit threshold is preset internally. The minimum value is 1.1A. The current limit circuit protects this device from damage resulting from undesired excess inrush current, which is encountered during hot plug-in events. The output current is limited to approximately 1.5A (TYP). When the output is short to ground, it will limit to a constant current 1A until thermal shutdown or short condition removed.

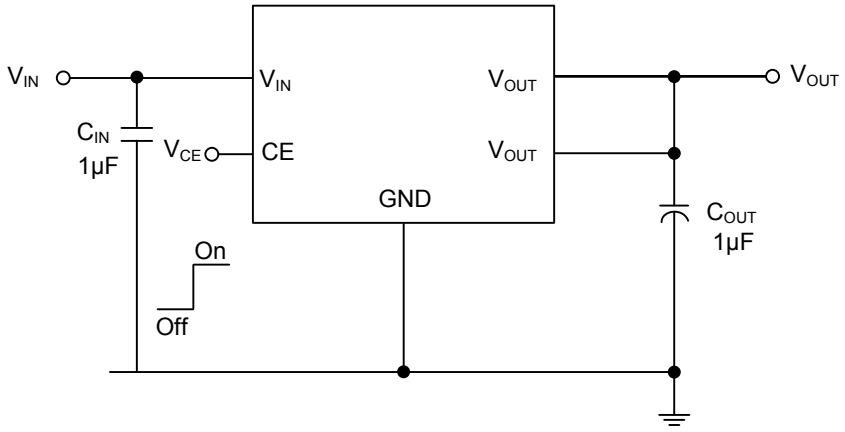


Figure 1. High Side Power Switch with Chip Enable Control

Filtering

During the hot-plug events, in order to limit the input voltage drop, a 1µF ceramic capacitor is recommended to be placed between V_{IN} to GND. However special care must be taken to the values of the capacitor, because higher capacitor values will further reduce the voltage drop at the input.

In order to prevent inductive parasitic from pulling V_{OUT} negative during turn-off or EMI damage to other components during the hot detachment, it's better to connect a sufficient capacitor from V_{OUT} to GND. This capacitor is also necessary for meeting the USB specification during hot plug-in operation.

If the UTC **US202** is implanted in device and application, minimum 1µF capacitor from V_{OUT} to GND is recommended and higher capacitor values are also preferred.

Choosing these capacitors properly is critical. A lower ESR on the capacitor can get a lower IR drop during the operation, so the Effective Series Resistance (ESR) of the capacitors must be considered.

For ferrite beads, if they are in series with all power and ground lines, the EMI will be eliminated or reduced. The DC resistance of the wire kept to a minimum to reduce the voltage drop should be considered in choosing ferrite beads.

Reverse Current Preventing

Since the UTC **US202**'s MOSFET is bi-directional, it allows the voltage on V_{OUT} pin is higher than that on V_{IN} pin. In order to avoid reverse current occur, turn off this switch or connect V_{IN} to a fixed voltage less than 1.3V.

■ APPLICATION INFORMATION (Cont.)

Layout and Thermal Dissipation

The switch should be placed as close to the USB connector as possible and all traces should be as short as possible to reduce the effect of undesirable parasitic inductance.

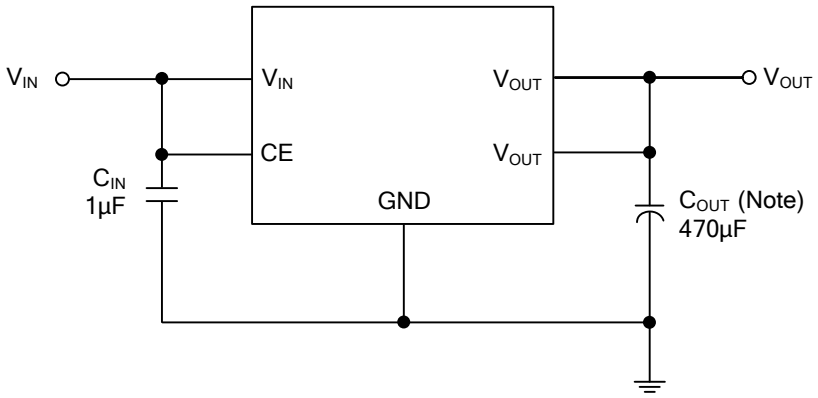
Also, place the output capacitor and ferrite beads to the USB connector as close to as possible.

If ferrite beads are used, use wires kept to a minimum resistance and large solder pads to minimize connection resistance.

If the package is with dual V_{OUT} or V_{IN} pins, short both the same function pins as Fig.1 or Fig.2 to reduce the internal turn-on resistance. If the output power is delivered to two individual ports, it is specially necessary to short both V_{OUT} pin at the switch output side in order to protect the switch when each port are plug-in separately.

Under normal operating conditions, the package can dissipate the channel heat away. Wide power bus planes connected to VIN and V_{OUT} and a ground plane in contact with the device will help dissipate additional heat.

■ TYPICAL APPLICATION CIRCUIT



Note: 470μF, Low ESR Electrolytic

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