

HV Buck Power Switch

FEATURES

- ◆ Built-in 800V Power BJT and start resistance
- ◆ Direct Drive of Low Cost BJT
- ◆ CV Mode Control
- ◆ Work at BCM
- ◆ Cycle-by-Cycle Current Limiting
- ◆ Leading Edge Blanking (LEB)
- ◆ Pin Floating Protection
- ◆ VDD UVLO, Clamp

APPLICATIONS

- ◆ Emergency lamp
- ◆ Home appliance

GENERAL DESCRIPTION

WT2601 is a high precision, highly integrated BCM HV buck power switch for offline small power converter applications. It has built-in power BJT, which can further lower system cost.

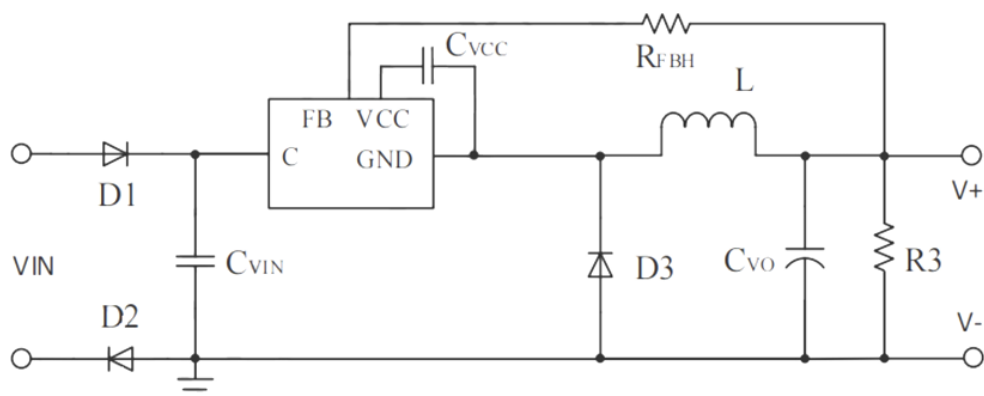
WT2601 has built-in proprietary **NC-Cap/HV buck-ITM** control for CV control, which eliminates external compensation or filtering capacitor. It has built-in cable drop compensation function, which can provide excellent CV performance. The IC uses Multi Mode Control to improve efficiency and reliability and to decrease audio noise energy @ light loadings.

WT2601 integrates proprietary **"Audio Noise Cancellation"** control for audio noise free operation. The IC has built-in **"Fast Dynamic Response"** control to meet USB Charge requirements. WT2601 also integrates proprietary **"Zero-Output Startup"** control to achieve startup when output is near zero voltage. The IC has proprietary **"Smart Output Short Protection"**, which can protect the system with large leakage inductance when output is short circuit.

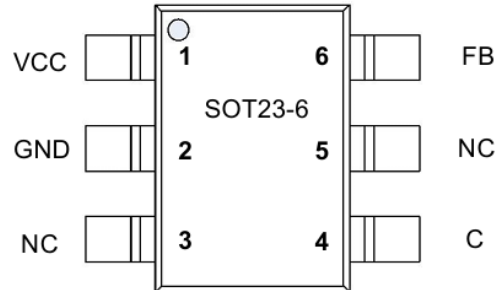
WT2601 integrates functions and protections of FB Short Protection, Under Voltage Lockout (UVLO), VDD Over Voltage Protection (VDD OVP), Soft Start, Cycle-by-cycle Current Limiting (OCP), Pin Floating Protection, VDD Clamping.

WT2601 is available SOT23-6 packages.

TYPICAL APPLICATION



Pin Configuration

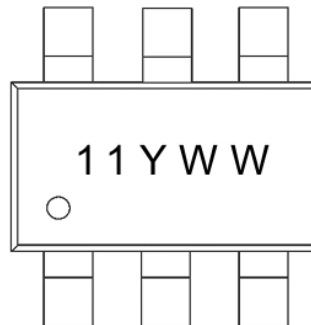


Ordering Information

Part Number	Top Mark	Package		Tape & Reel
WT2601LRT	.11YWW	SOT23-6 (*)	Green	Yes

(*) MSL(Moisture Sensitivity Level) is level 3. Absorbed moisture could be sensitive to damage during solder reflow, so it's recommended to take floor life into consideration, according to IPC/JEDEC J-SMD-020E(Moisture/Reflow Sensitivity Classification for Non-hermetic Surface Mount Devices).

Marking Information



Dot: Pin1 Mark
11:Part number WT2601
YWW: Year&Week Code

Pin Description

Pin Num	Pin Name	I/O	Description
1	VCC	P	IC power supply pin.
2	GND	P	Ground
3	NC	I	NC
4	C	P	High voltage power BJT collector pin.
5	NC	I	NC
6	FB	I	System feedback pin.



Absolute Maximum Ratings (Note 2)

19902965566

ELECTRICAL CHARACTERISTICS(T_A = 25°C, VDD = 18V, if not otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Supply Voltage (VDD) Section						
I _{Startup}	VDD Start up Current	VDD = UVLO(ON) - 1V			1	uA
I _{VDD_Op}	Operation Current	VDD = 4.6V		0.25		mA
UVLO(OFF)	VDD Under Voltage Lockout Exit (Startup)		4.0	4.2	4.4	V
UVLO(ON)	VDD Under Voltage Lockout Enter		2.6	2.8	3.0	V
V _{DD_Clamp}	VDD Zener Clamp Voltage	I(V _{DD}) = 10 mA		5.1		V
Feedback Input Section(FB Pin)						
V _{FB_EA_Ref}	Internal Error Amplifier(EA) reference input			1.1		V
R _{FBin}	FB to Ground resistance			11K		Ω
V _{FB_DEM}	Demagnetization comparator threshold			25		mV
T _{min_OFF}	Minimum OFF time			2.5		uSec
T _{max_OFF}	Maximum OFF time			8		mSec
V _{FB_OVP}	Output Voltage Protection Threshold			1.4		V
T _{CC/TDEM}	Ratio between switching period in CC mode and demagnetization time			2		
I _{Cable_max}	Max Cable compensation current			8		uA
Current Sense Input Section						
T _{blanking}	CS Input Leading Edge Blanking Time			450		nSec
I _{pk}	Max. Current limiting threshold			360		mA
T _{D_OC}	Over Current Detection and Control Delay			100		nSec
Power BJT Section						
V _{CEO}	Collector-emitter breakdown voltage	I _c = 10mA, I _b = 0	450			V
V _{CBO}	Collector- base breakdown voltage	I _c = 10mA	800			V
H _{fe}	DC current gain	V _{ce} = 5V, I _c = 0.5A	10		30	
V _{CE_sat}	Collector-emitter saturation voltage	I _c = 0.5A, I _b = 0.1A			0.5	V

Note 1. Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Note 2. The device is not guaranteed to function outside its operating conditions.

OPERATION DESCRIPTION

WT2601 is a high performance, highly integrated BCM (HV buck) power switch. The built-in high precision CV control makes it very suitable for offline small power converter applications. WT2601 is a non isolated step-down switch with high efficiency and accuracy source constant voltage control driver chip. Constant voltage control mode is adopted and works in BCM mode, high-voltage power tube is integrated internally, with high reliability. Within set the fixed peak current without CS sampling resistor; Built in high pressure starter dynamic circuit, without starting resistance. The scheme requires only a few peripheral groups the component can achieve excellent constant voltage characteristics.

CV (Constant Voltage) Control Scheme

CV control should sample the plateau of auxiliary winding voltage in flyback phase, as shown in Fig.1. The CV control has many implementations, for example, PWM, or PFM, or a combination of both one. In WT2601, the CV control adopts proprietary multi mode control, as mention below.

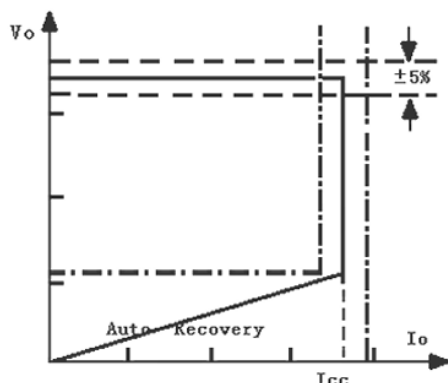


Fig.1. Typical CC/CV Curve

◆ Constant voltage control, output voltage setting

The constant voltage control is set by the threshold

voltage of the feedback input terminal FB, and the

$$V_o = V_{ref} * \frac{R_{FBH} + R_{FBIN}}{R_{FBIN}} - V_d$$

Among them, V_{out} is the output voltage to be set, V_{ref} is the threshold voltage set inside the chip of 1.1V, R_{FBH} is the voltage dividing resistor on FB (considering the withstand voltage, it is recommended to use two resistors in series), R_{FBIN} is the fixed down bias resistor built in FB, and V_d is the on voltage drop of freewheel D3.

Buck structure inductance setting

When WT2601 operates in BCM mode and the power tube is on, the current flowing through the energy storage inductor rises from zero, and the on time is:

$$T_{on} = \frac{L * I_{pk}}{V_{in} - V_o}$$

Where L is the inductance; I_{pk} is the built-in fixed peak current; V_{in} is the rectified bus voltage; V_o is the output voltage. When the power tube is turned off and the current flowing through the energy storage inductor drops from the peak value to zero, the internal logic of the chip turns on the power tube again.

The off time of the power tube is:

$$T_{off} = \frac{L * I_{pk}}{V_o - V_d}$$

The calculation formula of inductance is obtained as follows:

$$L = \frac{(V_{in} - V_o) * (V_o + V_d)}{f * I_{pk} * (V_{in} + V_d)}$$

Where f is the operating frequency of the system.

◆ Multi Mode HV buck Control for High Reliability , High Efficiency

Conventional pure PFM controlled HV buck system may suffer transformer saturation issue when heavy loading. In WT2601, a proprietary multi mode control is adopted to suppress this issue, as shown in Fig.1. Around the full load, the system operates in PFM mode, which improve the system reliability. Under normal to light load conditions, the IC operates in PFM mode to achieve excellent regulation and high efficiency.

◆ Leading Edge Blanking (LEB)

Each time the power BJT is switched on, a turn-on spike occurs across the sensing resistor. To avoid premature termination of the switching pulse, an internal leading edge blanking circuit is built in. During this blanking period (450ns, typical), the cycle-by-cycle current limiting comparator is disabled and cannot switch off the base driver.

◆ Minimum and Maximum OFF Time

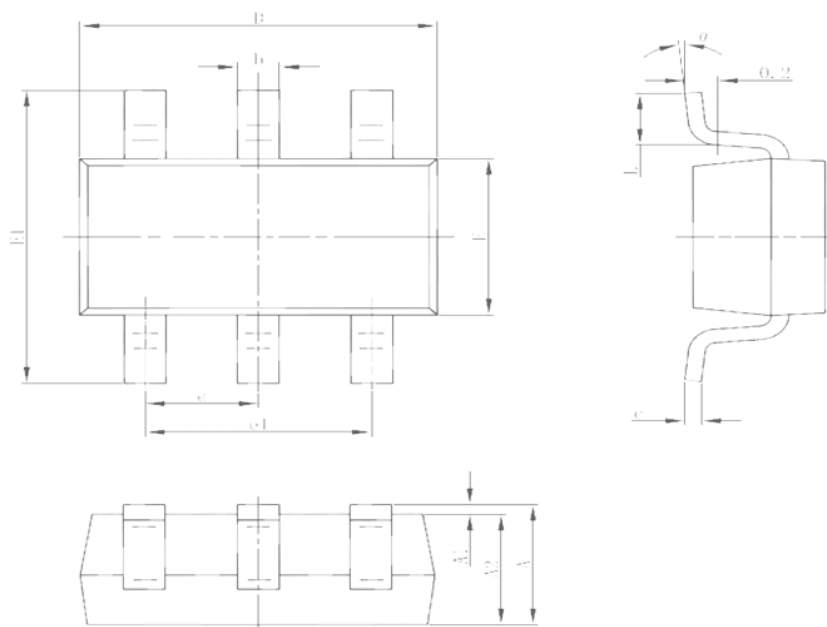
In WT2601, a minimum OFF time (typically 2us) is implemented to suppress ringing when BASE drive is pull off. The maximum OFF time in WT2601 is typically 8ms, which provides a large range for frequency reduction. In this way, low standby power can be achieved.

◆ Pin Floating Protection

In WT2601, if pin floating situation occurs, the IC is designed to have no damage to system.

PACKAGE MECHANICAL DATA

SOT-23-6L PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.000	1.300	0.039	0.051
A1	0.000	0.150	0.000	0.006
A2	1.000	1.200	0.039	0.047
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.800	3.020	0.110	0.119
E	1.500	1.700	0.059	0.067
E1	2.600	3.000	0.102	0.118
e	0.950 (BSC)		0.037 (BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°