



ZHEJIANG UNIÜ-NE Technology CO., LTD

浙江宇力微新能源科技有限公司



U3401/2 Data Sheet

V 1.2

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■ General Description

The U3401/2 600V synchronous buck controller regulates from a high input voltage source or from an input rail subject to high voltage transients, minimizing the need for external surge suppression components. A high-side switch minimum on-time of 60 ns gives large step-down ratios, enabling the direct step-down conversion from a 100V nominal input to low-voltage rails for reduced system complexity and solution cost. The U3401/2 continues to operate during input voltage dips as low as 16.5V, at nearly 100% duty cycle if needed, making it an excellent choice for high-performance 100V battery automotive applications, ADAS (surround view ECU) and HEV/EV systems.

Forced-PWM (FPWM) operation eliminates switching frequency variation to minimize EMI, while user-selectable diode emulation lowers current consumption at light-load conditions. Measuring the voltage drop across the low-side MOSFET or with an optional current sense resistor gives cycle-by-cycle overcurrent protection. The adjustable switching frequency as high as 0.5MHz can be synchronized to an external clock source to eliminate beat frequencies in noise-sensitive applications.

■ Applications

- High-Power Automotive DC/DC Regulator
- Automotive Motor Drives, ADAS
- HEV/EV Power Compliant to LV-148

■ Key Features

- AEC-Q100 Qualified for Automotive Applications:
 - Device Temperature Grade 1: -40°C to +125°C Ambient Temperature Range
- Versatile Synchronous Buck DC/DC Controller
 - Wide Input Voltage Range of 16.5V to 600V
 - Adjustable Output Voltage From 1.25V to 600V
 - Voltage-mode Control With Line Feedforward
- Meets CISPR 25 EMI Standard
- Lossless $R_{DS(on)}$ or Shunt Current Sensing
- Switching Frequency From 10 kHz to 0.5MHz
 - SYNC In and SYNC Out Capability
- 60ns Minimum On-Time for High V_{IN} / V_{OUT} Ratio
- 180ns Minimum Off-Time for Low Dropout
- 1.2V Reference With $\pm 1\%$ Feedback Accuracy
- 8.5V Gate Drivers for Standard V_{TH} MOSFETs
 - 220ns Adaptive Dead-Time Control
 - 1.5A Source and 1.8A Sink Capability
 - Low-Side Soft Start for Prebiased Start-Up
- Adjustable Soft Start or Optional Voltage Tracking
- Precision Enable Input and Open-Drain Power- Good Indicator for Sequencing and Control
- Inherent Protection Features for Robust Design
 - Hiccup-Mode Overcurrent Protection
 - Input UVLO With Hysteresis
 - VCC and Gate-Drive UVLO Protection
 - Thermal Shutdown Protection With Hysteresis
- 16-Pin SOP Package With Wettable Flanks
- Create a Custom Design Using the U3401/2 With UNI-SEMI® Power Designer

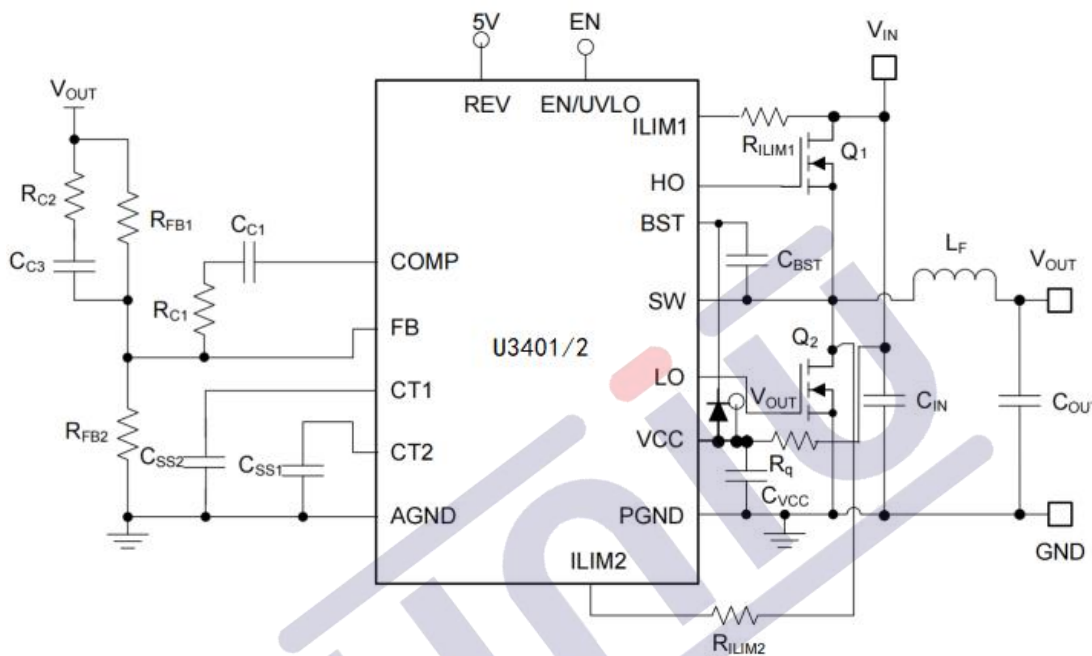
■ Device Information⁽¹⁾

Part Number	Package	Body Size (Nom)
U3401/2	SOP(16)	10mm × 6.3mm

(1) For all available packages, see the orderable addendum at the end of the data sheet

■ Typical Application Circuit and Efficiency Performance

$V_{OUT} = 12\text{ V}$, $F_{SW} = 60\text{ kHz}$



■ Output Power Table

Part Number	Package	VIN	IO+/IO-	OUT
U3401	SOP-16	20~400V	1.5A/1.8A	ADJ
U3402	SOP-16	10~400V	1.5A/1.8A	ADJ

Note:

- 1.Default for Buck Converter Application
- 2.The practical output power is determined by the output voltage and thermal condition

■ Description (continued)

The U3401/2 voltage-mode controller with line feedforward drives external high-side and low-side N-channel power switches with robust 8.5V gate drivers suitable for standard-threshold MOSFETs. Adaptively-timed gate drivers with 1.5A source and 1.8A sink capability minimize body diode conduction during switching transitions, reducing switching losses and improving thermal performance when driving MOSFETs at high input voltage and high frequency. The U3401/2 can be powered from the output of the switching regulator or another available source, further improving efficiency.

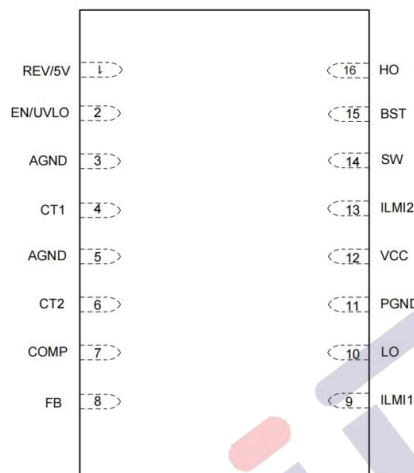
A 180° out-of-phase clock output relative to the internal oscillator at SYNCOUT works well for cascaded or multi-channel power supplies to reduce input capacitor ripple current and EMI filter size. Additional features of the U3401/2 include a configurable soft start, an open-drain power-good monitor for fault reporting and output-monitoring, monotonic start-up into prebiased loads, integrated VCC bias supply regulator and bootstrap diode, external power supply tracking, precision enable input with hysteresis for adjustable line undervoltage lockout (UVLO), hiccup-mode overload protection, and thermal shutdown protection with automatic recovery.

The U3401/2 controller is offered in a 10mm × 6.3mm thermally enhanced, 16-pin SOP package with additional spacing for high-voltage pins and wettable flanks for optical inspection of solder joint fillets.

■ Pin Configuration and Functions

RGY Package 16-Pin SOP With Wettable Flanks

Top View



Connect Exposed Pad on bottom to AGND and PGND on the PCB

■ Pin Functions

Pin		I/O ⁽¹⁾	Description
NO.	Name		
1	REV	O	the REV pin is nominally 0.8 V.
2	EN/UVLO	I	Enable input and undervoltage lockout programming pin. If the EN/UVLO voltage is below 0.4V, the controller is in the shutdown mode with all functions disabled. If the EN/UVLO voltage is greater than 0.4V and less than 1.2V, the regulator is in standby mode with the VCC regulator operational, the SS pin grounded, and no switching at the HO and LO outputs. If the EN/UVLO voltage is above 1.2V, the SS/TRK voltage can ramp and pulse-width modulated gate-drive signals are delivered to the HO and LO pins. A 10μA current source is enabled when EN/UVLO exceeds 1.2V and flows through the external UVLO resistor divider to provide hysteresis. Hysteresis can be adjusted by varying the resistance of the external divider.
3	AGND	P	Analog ground. Return for the internal 0.8V voltage reference and analog circuits.
4	CT1	I	Soft-start and voltage-tracking pin. An external capacitor and an internal 10μA current source set the ramp rate of the error amplifier reference during start-up. When the SS/TRK pin voltage is less than 1.2V, the SS/TRK voltage controls the noninverting input of the error amp. When the SS/TRK voltage exceeds 1.2V, the amplifier is controlled by the internal 1.2V reference. SS/TRK is discharged to ground during standby and fault conditions. After start-up, the SS/TRK voltage is clamped 115mV above the FB pin voltage. If FB falls due to a load fault, SS/TRK is discharged to a level 115mV above FB to provide a controlled recovery when the fault is removed. Voltage tracking can be implemented by connecting a low impedance reference between 0V and 1.2V to the SS/TRK pin. The 10μA SS/TRK charging current flows into the reference and produces a voltage error if the impedance is not low. Connect a minimum capacitance from SS/TRK to AGND of 1uF.

1.版本记录

DATE	REV.	DESCRIPTION
2018/04/19	1.0	First Release
2021/01/02	1.1	Layout adjustment
2021/03/10	1.2	Change parameters

2.免责声明

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