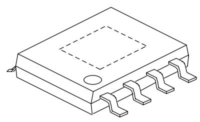
38V 5A SYNCHRONOUS BUCK CONVERTER



HSOP-8

■ DESCRIPTION

The UTC **UD38501** is a monolithic synchronous buck regulator. The device integrates internal high side and external low side power MOSFETs, and provides 5A of continuous load current over a wide input voltage of 8V to 38V. Current mode control provides fast transient response and cycle-by-cycle current limit.

An internal soft-start prevents inrush current at turn-on, provides a very compact solution with minimal external components.

■ FEATURES

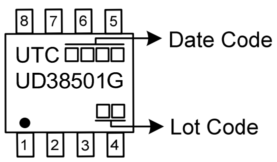
* Wide 8V to 38V Operating Input Range
* Integrated 80mΩ high side Power MOSFET Switches
* Output Adjustable from V_{FB}(1V) to 20V
* Up to 95% Efficiency
* Internal Soft-Start
* Stable with Low ESR Ceramic Output Capacitors
* Fixed 160KHz Frequency
* Cycle-by-Cycle Over Current Protection
* Input Under/Over Voltage Lockout

■ ORDERING INFORMATION

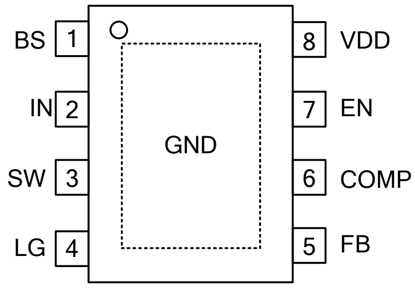
Ordering Number	Package	Packing
UD38501G-SH2-R	HSOP-8	Tape Reel

UD38501G-SH2-R (1)Packing Type (2)Package Type (3)Green Package	(1) R: Tape Reel (2) SH2: HSOP-8 (3) G: Halogen Free and Lead Free

■ MARKING



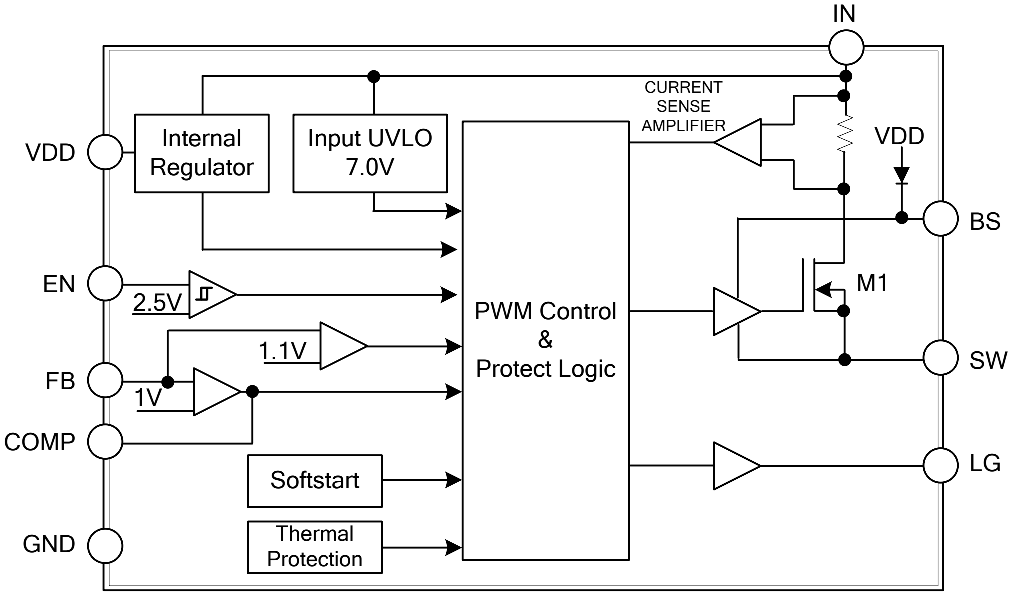
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	BS	Boot-Strap Pin. Supply high side gate driver. Decouple this pin to LX pin with 0.1uF ceramic cap.
2	IN	Power Input pin. Bypass IN to GND with a suitably large capacitor to eliminate noise on the input to the IC.
3	SW	Power Switching Output. SW is the switching node that supplies power to the output. Connect the output LC filter from SW to the output load.
4	LG	Gate drive for external low side N-MOSFET..
	PAD	Ground (Connect to GND).
5	FB	Feedback Input. FB senses the output voltage to regulate that voltage. Drive FB with a resistive voltage divider from the output voltage.
6	COMP	Compensation Node. COMP is used to compensate the regulation control loop. Connect a series RC network from COMP to GND to compensate the regulation control loop.
7	EN	Enable control. Pull high to turn on. Do not float.
8	VDD	Internal regulator pin

■ BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATING (T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V_{IN}	-0.3 ~ +42	V
Switch Node Voltage	V_{SW}	-0.3 ~ V_{IN}+0.3	V
Boost Voltage	V_{BS}	V_{SW}-0.3 ~ V_{SW}+ 6	V
All Other Pins Voltage		-0.3 ~ +6	V
Lead Temperature	T_L	260	°C
Junction Temperature	T_J	150	°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.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	RATINGS	UNIT
Input Supply Voltage	V_{IN}	8 ~ 38	V
Output Voltage	V_{OUT}	V_{FB} ~ 20	V
Ambient Temperature	T_A	-40 ~ +85	°C

THERMAL CHARACTERISTICS

PARAMETER	SYMBOL	RATINGS	UNIT
Junction To Ambient	θ_{JA}	15	°C/W
Junction to Case	θ_{JC}	40	°C/W

Note: θ_{JA} is measured with the PCB copper area of approximately 1 in^2(Multi-layer). That need connect to exposed pad.

ELECTRICAL CHARACTERISTICS (V_{IN}=12V, T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage Range	V_{IN}		8		38	V
Shutdown Supply Current	I_{SD}	V_{EN}= 0V		0.7	1.3	mA
Quiescent Current	I_{CCQ}	V_{EN}=5.0V, V_{FB}=1.05V		0.7	1.5	mA
Feedback Voltage	V_{FB}	8V≤V_{IN}≤38V	0.98	1.00	1.02	V
Feedback Overvoltage Threshold	O_{VP_FB}			1.1X		V_{FB}
High-Side Switch On Resistance (Note)	$R_{DS(ON)}$			80		mΩ
High-Side Switch Leakage Current		V_{EN}=0V, V_{SW}=0V			10	μA
Upper Switch Current Limit		Minimum Duty Cycle	5.1	6.0		A
LG Rise Time	T_{LXR}	C_{LX}=1000pF		40		ns
LG Fall Time	T_{LXF}	C_{LX}=1000pF		40		ns
LG Driver Bias Supply Voltage				5		V
Oscillation Frequency	F_{OSC1}			160		KHz
Short Circuit Oscillation Frequency	F_{OSC2}	V_{FB}=<0.5V		60		KHz
Maximum Duty Cycle	D_{MAX}			90		%
Minimum On Time (Note)	$T_{ON(min)}$			220		ns
EN Lockout Threshold Voltage	$E_{NH(LOCK)}$			2.5		V
EN Lockout Hysterisis				210		mV
Input Under Voltage Lockout Threshold	UVLO	V_{IN} Rising	6.5	7.0	7.5	V
Input Under Voltage Lockout Threshold Hysteresis	UVLO-Hys			800		mV
Input Over Voltage Lockout Threshold	OVLO	V_{IN} Rising		40		V
Input Over Voltage Lockout Threshold Hysteresis	OVLO-Hys			5		V
Soft-Start Period				3		ms
Thermal Shutdown	T_{SD}			150		°C
Thermal Shutdown Hysterisis	T_{SH}			30		°C

Note: Guaranteed by design.

■ FUNCTION DESCRIPTIONS

The UTC **UD38501** is a synchronous rectified, current-mode, step-down regulator. It regulates input voltages from 8V to 38V down to an output voltage as low as V_{FB}, and supplies up to 5A of load current.

The UTC **UD38501** uses current-mode control to regulate the output voltage. The output voltage is measured at FB through a resistive voltage divider and amplified through the internal Tran conductance error amplifier. The voltage at the COMP pin is compared to the switch current measured internally to control the output voltage.

The converter uses internal N-Channel MOSFET switches to step-down the input voltage to the regulated output voltage. Since the high side MOSFET requires a gate voltage greater than the input voltage, a boost capacitor connected between SW and BS is needed to drive the high side gate. The boost capacitor is charged from the internal 5V rail when SW is low.

When the UTC **UD38501** FB pin exceeds 10% of the nominal regulation voltage of V_{FB}, the over voltage comparator is tripped and the COMP pin is discharged to GND, forcing the high-side switch off.

■ APPLICATION INFORMATION

COMPONENT SELECTION

Setting the Output Voltage

The output voltage is set using a resistive voltage divider from the output voltage to FB pin. The voltage divider divides the output voltage down to the feedback voltage by the ratio.

Thus the output voltage is:

$$V_{OUT} = V_{FB} \times \frac{R1 + R2}{R2}$$

For example, V_{FB} =1.00V for a 5.0V output voltage, R2 is 10kΩ, and R1 is 40kΩ.

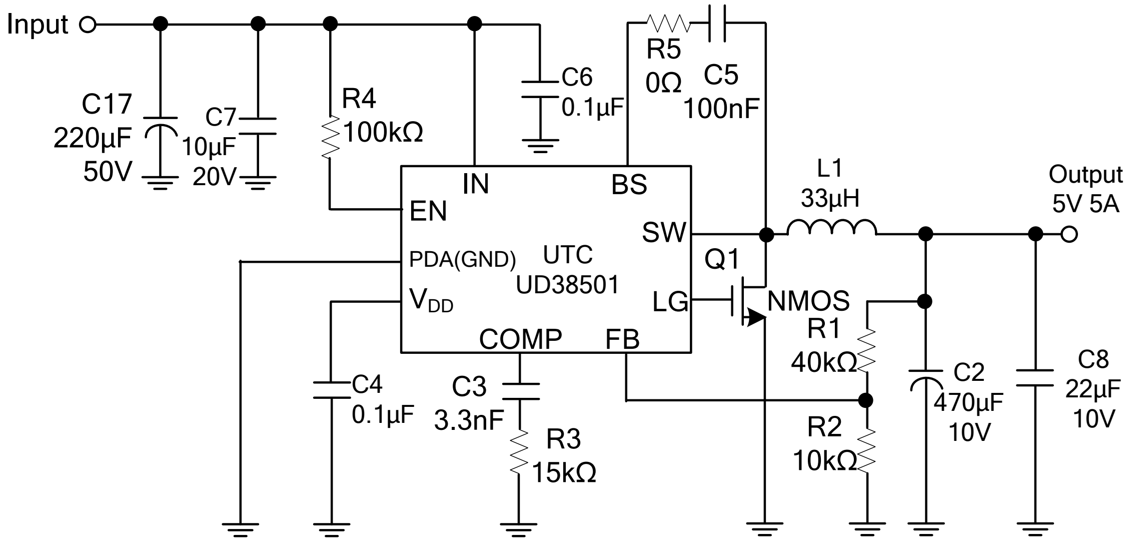
Inductor Selection

The inductor is required to supply constant current to the output load while being driven by the switched input voltage. A larger value inductor will result in less ripple current that will result in lower output ripple voltage. However, the larger value inductor will have a larger physical size, higher series resistance, and/or lower saturation current. A good rule for determining the inductance to use is to allow the peak-to-peak ripple current in the inductor to be approximately 30% of the maximum switch current limit.

V_{IN}	<28V	<35V
Inductor	47uH	33uH

The choice of which style inductor to use mainly depends on the price vs. size requirements and any EMI requirements.

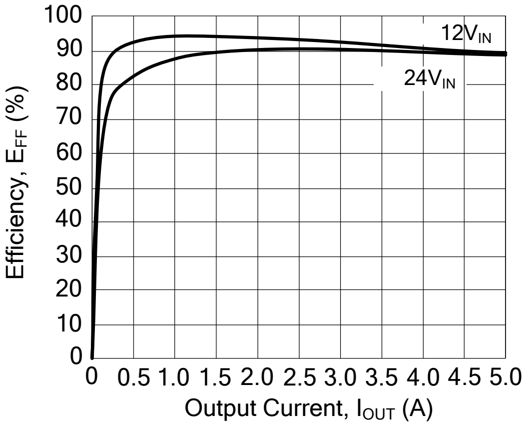
■ TYPICAL APPLICATION CIRCUIT



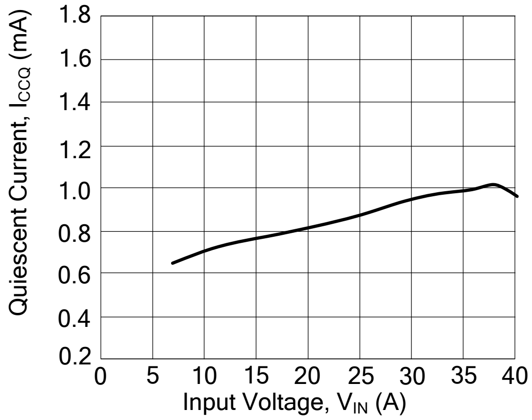
$V_{OUT}=V_{FB} \times (1+R1/R2)$, V_{FB}= 1.00V, R2 suggest 10k~30kΩ

■ TYPICAL CHARACTERISTICS

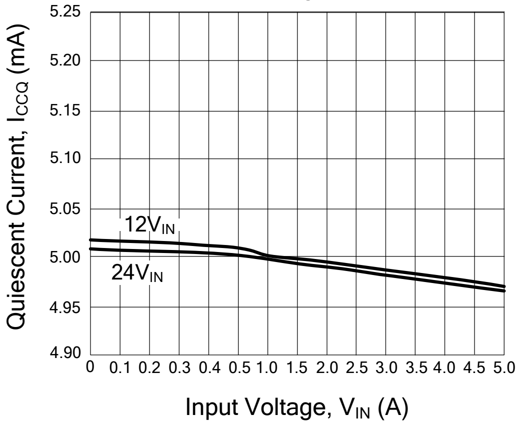
Efficiency Test (V_{OUT}=5V)



Quiescent Current vs. Input Voltage

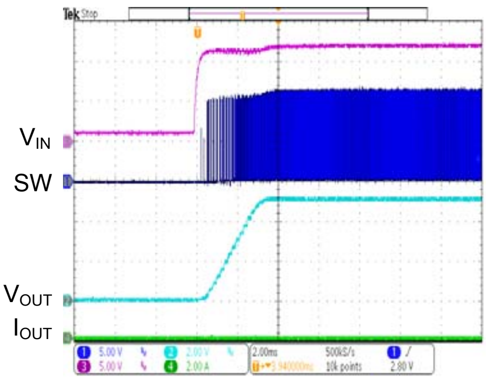


Load Regulation



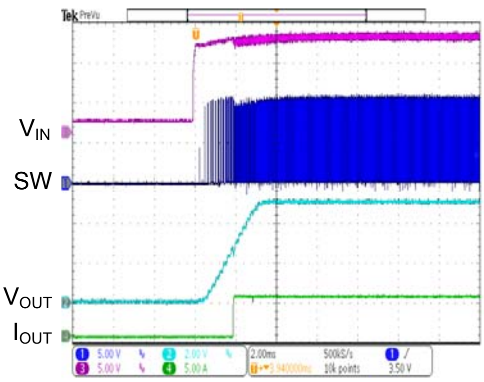
Power On

V_{IN}=12V, V_{OUT}=5V, I_{OUT}=0A



Power On

V_{IN}=12V, V_{OUT}=5V, I_{LOAD}=5A



Enoble On

V_{IN}=12V, V_{OUT}=5V, I_{LOAD}=5A