

DUAL 1.2A 1.5MHz SYNCHRONOUS BUCK CONVERTER

DESCRIPTION

The UTC **UD06122** is a dual high-efficiency Pulse-Width-Modulated (PWM) step-down DC-DC converter. It is capable of delivering 1.2A output current over a wide input voltage range from 2.5V to 6.0V, the UTC **UD06122** is ideally suited for portable electronic devices that are powered from 1-cell Li-ion battery or from other power sources within the range such as cellular phones, PDAs and other handheld devices.

Two operational modes are available: PWM/Low-Dropout auto-switch and shutdown modes.

Two operational modes are available: PWM/Low-Dropout auto-switch and shutdown modes. Internal synchronous rectifier with low $R_{DS (ON)}$ dramatically reduces conduction loss at PWM mode. No external Schottky diode is required in practical application.

The UTC **UD06122** enters Low-Dropout mode when normal PWM cannot provide regulated output voltage by continuously turning on the upper PMOS. The UTC **UD06122** enter shutdown mode and consumes less than 0.1µA when EN pin is pulled low.

The switching ripple is easily smoothed-out by small package filtering elements due to a fixed operation freq uency of 1.5MHz. Other features include soft start, lower internal reference voltage with 2% accuracy, over t emperature protection, and over current protection.

FEATURES

- * 2.5V~6.0V input voltage range
- * Output Adjustable from 0.6V to VIN
- * 200/160mΩ Internal Power MOSFET Switch
- * Stable with Low ESR Output Ceramic Capacitors
- * Up to 95% Efficiency

ORDERING INFORMATION

- * Less than 1µA Shutdown Current
- * 1.5MHz Switching Frequency
- * Thermal Shutdown Protection
- * Current limit and short circuit protections.
- * Build-in soft start function

Ordering Number	Package	Packing
UD06122G-K10-3030-R	DFN3030-10	Tape Reel

	UD06122 <u>G</u> - <u>K10-303(</u>	<u>0-R</u>		
			(1) Packing Type	(1) R: Tape Reel
			(2) Package Type	(2) K10-3030: DFN3030-10
			(3) Green Package	(3) G: Halogen Free and Lead Free, L: Lead Free
	MARKING			· 标子 / 688.CO.
	UD 06122		Ret no	ENIN9+
	• DDD > Date	Code	- CWW	
ww	w.unisonic.com.tw			1 of 10
Co	pyright © 2017 Uniso	nic Tech	nologies Co., Ltd	QW-R115-013.B



PIN CONFIGURATION



PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	EN1	Chip Enable of Channel 1 (Active High). VEN1≤VIN1.
2	FB1	Feedback of Channel 1.
3	V _{IN} 2	Power Input of Channel 2.
4	GND2	Ground. The exposed pad must be soldered to a large PCB and connected to GND for maximum power dissipation.
5	SW2	
6	EN2	Chip Enable of Channel 2 (Active High). VEN2≤VIN2.
7	FB2	Feedback of Channel 2.
8	V _{IN} 1	Power Input of Channel 1.
9	GND1	Ground. The exposed pad must be soldered to a large PCB and connected to GND for maximum power dissipation.
10	SW1	



BLOCK DIAGRAM





ABSOLUTE MAXIMUM RATING (at T_A=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Input Voltage	V _{IN1} / V _{IN2}	-0.3 ~ 7	V
EN1, FB1, LX1, EN2, FB2 and LX2 Pin Voltage		-0.3 ~ V _{IN} +0.3	V
Power Dissipation	PD	2.2	W
Junction Temperature	TJ	+150	°C
Storage Temperature Range	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.

THERMAL CHARACTERISTICS

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

Note: θ_{JA} is measured with the PCB copper area of approximately 1 in² (Multi-layer). That need connect to exposed pad.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Input Voltage	V _{IN}	2.5 ~ 6.0	V
Junction Temperature Range	TJ	-40 ~ 125	°C
Ambient Temperature Range	T _A	-40 ~ 85	°C
Ambient Temperature Range	T _A	-40 ~ 85	°C

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

ELECTRICAL CHARACTERISTICS (VIN=5V, VEN=5V, VOUT=3.3V, TA=25°C)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Channel 1 and Channel 2						
Input Voltage Range	V _{IN}	(Note1)	2.5		6.0	V
Input UVLO	UVLO	I _{OUT} =0A	1.8	2.2	2.5	V
Input OVLO	OVLO	I _{OUT} =0A		6.0		V
Quiescent Current (per channel)	Ι _Q	I _{OUT} =0mA, V _{FB} =1V		250	350	μA
Shutdown Current	I _{SD}	V _{EN1} =V _{EN2} =0V		0.1	1	μA
Feedback Voltage	V _{FB}		0.588	0.600	0.612	V
Load Regulation		0A <i<sub>OUT<1.2A</i<sub>		0.5		%
Line Regulation		2.5V <v<sub>IN<5.5V</v<sub>		0.3		%/V
FB Input Current	I _{FB}	V _{FB} =V _{IN}	-50		50	nA
P-Switch R _{DS (ON)}	R _{DS (ON)} P	I _{OUT} =500mA		0.2		Ω
N-Switch R _{DS (ON)} (Note2)	R _{DS (ON)} N	I _{OUT} =500mA		0.16		Ω
Low Side Discharger				60		Ω
P-Channel Current Limit	I _{LIM_P}		1.4	2.0		Α
EN High-Level Input Voltage	V _{EN_H}		1.5			V
EN Low-Level Input Voltage	V _{EN_L}				0.4	V
Oscillator Frequency	f _{OSC}	LX Pin	1.1	1.5	1.9	MHz
Maximum Duty Cycle		V _{FB} =0.5V	100			%
Thermal Shutdown Temperature	T _{SD}	~	27	155		°C
Thermal Shutdown Hysteresis	Thermal Shutdown Hysteresis T _{SH} 30			°C		
Notes: 1. V_{IN} 5.5 ~ 6.0V Power on ok,	Notes: 1. V_{IN} 5.5 ~ 6.0V Power on ok, that can't for Enable on.					
2. Guarantee by design.						
T WWW						
UTC UNISONIC TECHNOL	OGIES CO., L	TD				4 of 10



FUNCTION DESCRIPTIONS

Operation

UTC **UD06122** is a dual channel, monolithic switching mode Step-Down DC-DC converter. It utilizes internal MOSFETs to achieve high efficiency and can generate very low output voltage by using internal reference at 0.6V. It operates at a fixed switching frequency, and uses the slope compensated current mode architecture. This Step-Down DC-DC Converter supplies 1.2A output current by each channel with input voltage range from 2.5V to 6.0V.

Current Mode PWM Control

Slope compensated current mode PWM control provides stable switching and cycle-by-cycle current limit for excellent load and line responses and protection of the internal main switch (P-CH MOSFET) and synchronous rectifier (N-CH MOSFET). During normal operation, the internal P-CH MOSFET is turned on for a certain time to ramp the inductor current at each rising edge of the internal oscillator, and switched off when the peak inductor current is above the error voltage. The current comparator, I_{COMP} limits the peak inductor current. When the main switch is off, the synchronous rectifier will be turned on immediately and stay on until either the inductor current starts to reverse, beginning of the next clock cycle.



APPLICATION INFORMATION

Setting the Output Voltage

Application circuit item shows the basic application circuit with UTC UD06122 adjustable output version. The external resistor sets the output voltage according to the following equation:

$$V_{OUT1} = 0.6V \times (1 + \frac{R1}{R2}), V_{OUT2} = 0.6V \times (1 + \frac{R3}{R4})$$

R2/R4	R1/R3
150K	100K
100K	100K
100K	150K
100K	200K
150K	470K
100K	450K
	R2/R4 150K 100K 100K 100K 150K 100K

Table 1 Resistor select for output voltage setting

Inductor Selection

For most designs, the UTC UD06122 operates with inductors of 2.2µH to 3.3µH. Low inductance values are physically smaller but require faster switching, which results in some efficiency loss. The inductor value can be derived from the following equation:

$$L = \frac{V_{OUT} \times (V_{IN} - V_{OUT})}{V_{IN} \times \Delta I_L \times f_{OSC}}$$

Where is inductor Ripple Current, Large value inductors lower ripple current and small value inductors result in high ripple currents. Choose inductor ripple current approximately 20% of the maximum load current 1200mA, ∆l_L=400mA.

For optimum voltage-positioning load transients, choose an inductor with DC series resistance in the $50m\Omega$ to 150m Ω range. For higher efficiency at heavy loads (above 200mA), or minimal load regulation (but some transient overshoot), the resistance should be kept below 100m . The DC current rating of the inductor should be at least equal to the maximum load current plus half the ripple current to prevent core saturation (1200mA+200mA).

Compensation Capacitor Selection

The compensation capacitors for increasing phase margin provide additional stability. It is required 22pF, Please refer to Demo Board Schematic to design.

Input Capacitor Selection

The input capacitor reduces the surge current drawn from the input and switching noise from the device. The input capacitor impedance at the switching frequency shall be less than input source impedance to prevent high frequency switching current passing to the input. A low ESR input capacitor sized for maximum RMS current must be used. Ceramic capacitors with X5R or X7R dielectrics are highly recommended because of their low ESR and small temperature coefficients. A 4.7µF ceramic capacitor for most applications is sufficient.

Output Capacitor Selection

The output capacitor is required to be 10 ~ 47µF to keep the output voltage ripple small and to ensure regulation loop stability. The output capacitor must have low impedance at the switching frequency. Ceramic capacitors with X5R or X7R dielectrics are recommended due to their low ESR and high ripple current.



■ APPLICATION INFORMATION (Cont.)

Thermal Considerations

The maximum power dissipation depends on the thermal resistance of IC package, PCB layout, the rate of surroundings airflow and temperature difference between junctions to ambient. The maximum power dissipation can be calculated by following formula:

$$\mathsf{P}_{\mathsf{D}(\mathsf{MAX})} = (\mathsf{T}_{\mathsf{J}(\mathsf{MAX})} - \mathsf{T}_{\mathsf{A}}) / \theta_{\mathsf{J}\mathsf{A}}$$

Where $T_{J (MAX)}$ is the maximum junction temperature, T_A is the ambient temperature and the θ_{JA} is the junction to ambient thermal resistance. For recommended operating conditions specification of UTC **UD06122** DC/DC converter, where $T_{J (MAX)}$ is the maximum junction temperature of the die and T_A is the ambient temperature. The junction to ambient thermal resistance θ_{JA} is layout dependent. For DFN3030-10 packages, the thermal resistance θ_{JA} is 60°C/W on the 1 in² Multi-layer PCB copper area (The IC exposed pad must be connected to the PCB Copper area) two-layers thermal test board. The maximum power dissipation at $T_A=25^{\circ}C$ can be calculated by following formula:

$P_{D(MAX)} = (125^{\circ}C - 25^{\circ}C)/(45^{\circ}C/W) = 2.2W$ for DFN3030 - 10 package

The maximum power dissipation depends on operating ambient temperature for fixed $T_{J (MAX)}$ and thermal resistance θ_{JA} .



TYPICAL APPLICATION CIRCUIT

1.7V≤V_{OUT}≤4.4V



1.0V≤V_{OUT}≤1.6V



TYPICAL CHARACTERISTICS



TYPICAL CHARACTERISTICS



UTC assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all UTC products described or contained herein. UTC products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice.

