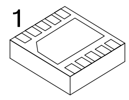
DUAL 1.2A 1.5MHz SYNCHRONOUS BUCK CONVERTER



DFN3030-10

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

■ ORDERING INFORMATION

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

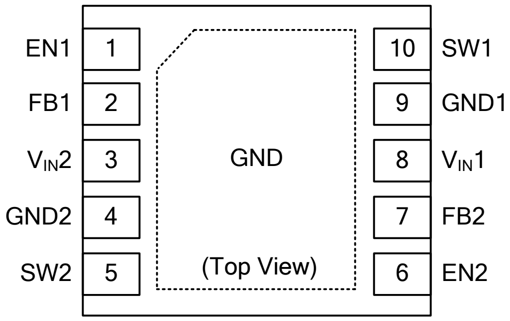
UD06122G-K10-3030-R

(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

UD
06122
• □□□□ → Date Code

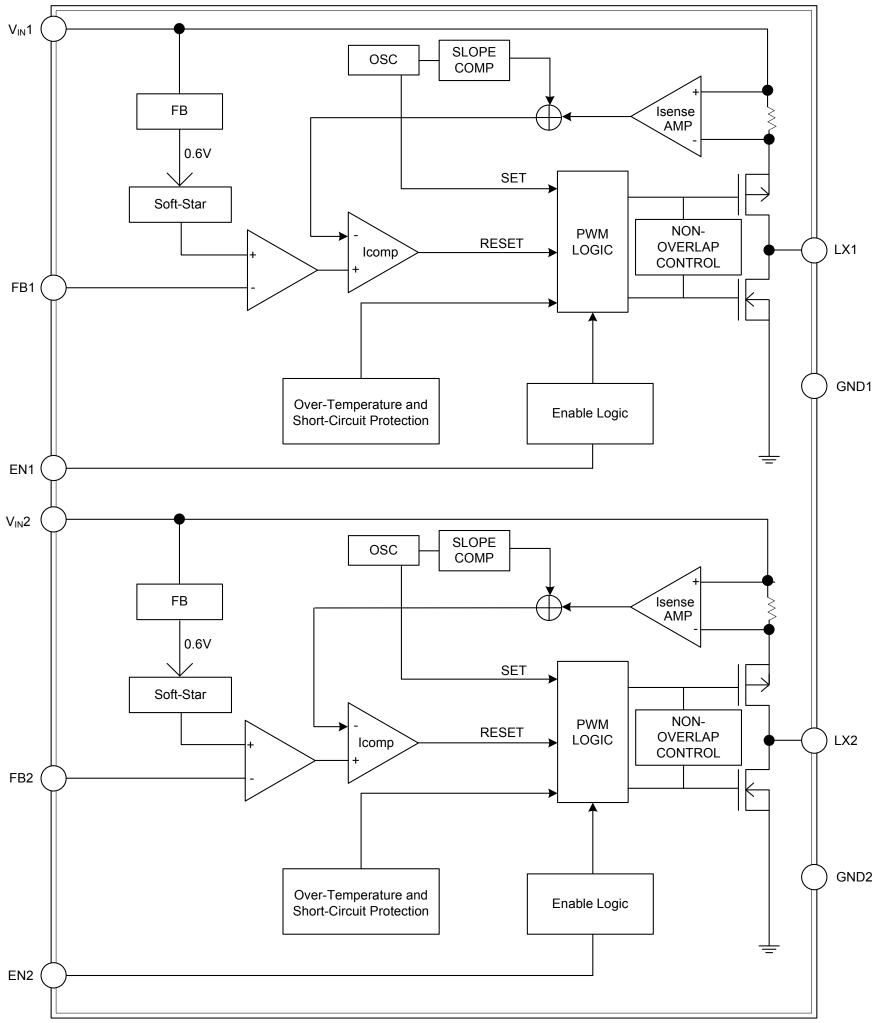
■ PIN CONFIGURATION



■ 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	P_D	2.2	W
Junction Temperature	T_J	+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 in^2 (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	T_J	-40 ~ 125	°C
Ambient Temperature Range	T_A	-40 ~ 85	°C

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

■ ELECTRICAL CHARACTERISTICS (V_{IN}=5V, V_{EN}=5V, V_{OUT}=3.3V, T_A=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)	I_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_{OUT}<1.2A		0.5		%
Line Regulation		2.5V<V_{IN}<5.5V		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		A
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}			155		°C
Thermal Shutdown Hysteresis	T_{SH}			30		°C

Notes: 1. V_{IN} 5.5 ~ 6.0V Power on ok, that can't for Enable on.
2. Guarantee by design.

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:

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

Table 1 Resistor select for output voltage setting

V_{OUT}	R2/R4	R1/R3
1.0V	150K	100K
1.2V	100K	100K
1.5V	100K	150K
1.8V	100K	200K
2.5V	150K	470K
3.3V	100K	450K

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, ΔI_L=400mA.

For optimum voltage-positioning load transients, choose an inductor with DC series resistance in the 50mΩ to 150mΩ range. For higher efficiency at heavy loads (above 200mA), or minimal load regulation (but some transient overshoot), the resistance should be kept below 100mΩ. 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:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$$

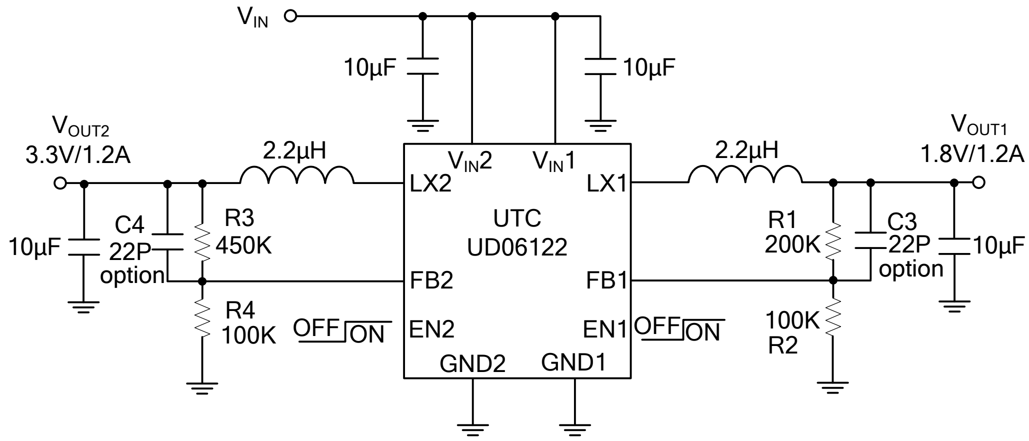
Where $T_{J\,(MAX)}$ is the maximum junction temperature, T_A is the ambient temperature and the θ_{JA} is the junction to ambient thermal resistance. For recommended operating conditions specification of UTC **UD06122** DC/DC converter, where $T_{J\,(MAX)}$ is the maximum junction temperature of the 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 in^2 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°C can be calculated by following formula:

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

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

■ TYPICAL APPLICATION CIRCUIT

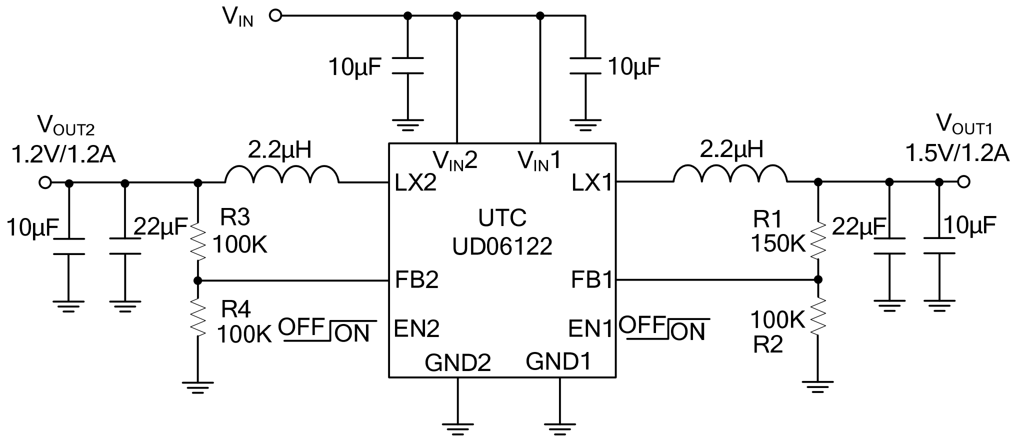
1.7V≤V_{OUT}≤4.4V



$V_{OUT1}=V_{FB1}\times(1+\frac{R1}{R2})$, $V_{OUT2}=V_{FB2}\times(1+\frac{R3}{R4})$

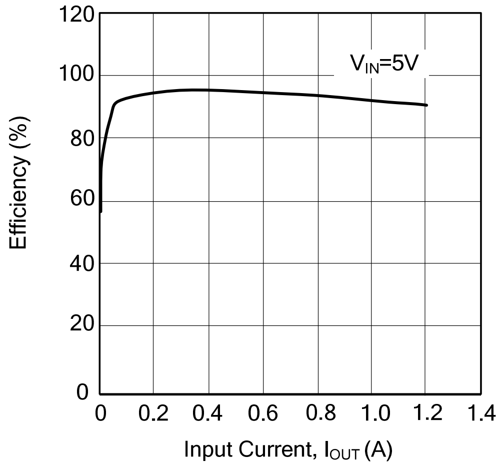
R2, R4: Rang=50K~300K

1.0V≤V_{OUT}≤1.6V

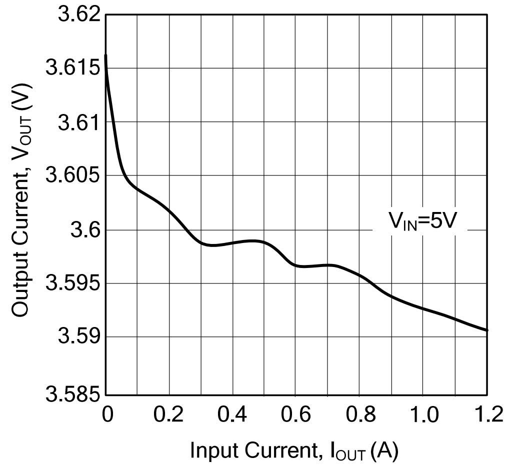


■ TYPICAL CHARACTERISTICS

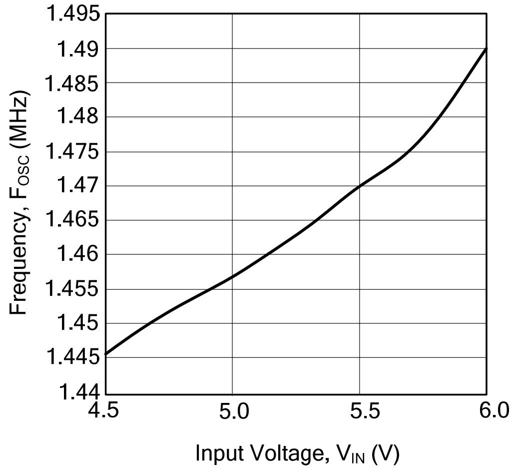
Efficiency vs. Output Current



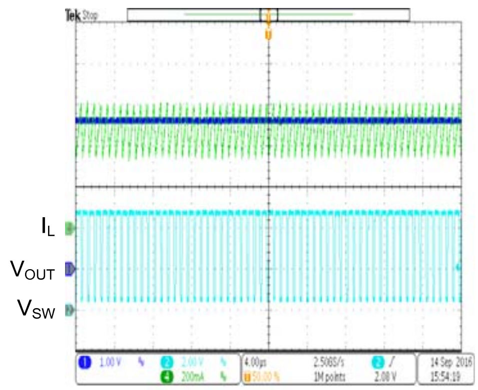
Output Voltage vs. Output Current



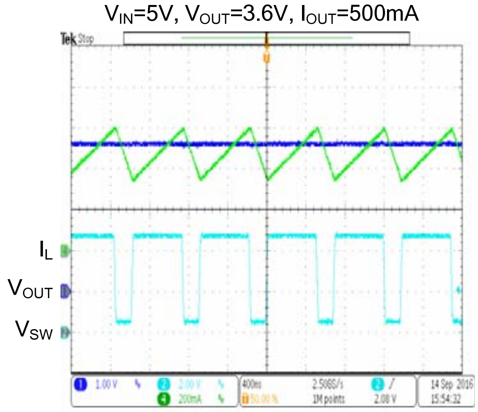
Frequency vs. Input Voltage



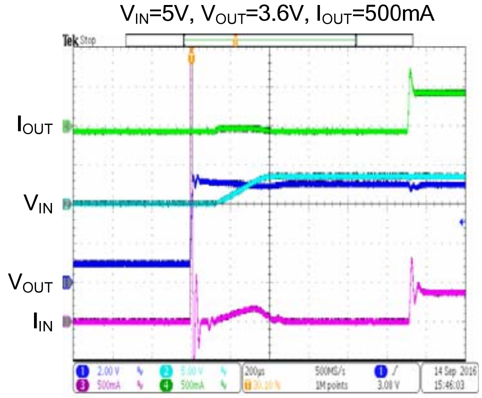
Switching
V_{IN}=5V, V_{OUT}=3.6V, I_{OUT}=500mA



Switching
V_{IN}=5V, V_{OUT}=3.6V, I_{OUT}=500mA



Power On/Off from V_{IN}
V_{IN}=5V, V_{OUT}=3.6V, I_{OUT}=500mA



■ TYPICAL CHARACTERISTICS

Power On/Off from V_{IN}

V_{IN}=5V, V_{OUT}=3.6V, I_{OUT}=500mA