



UD05121

LINEAR INTEGRATED CIRCUIT

1.2A 1.5MHZ SYNCHRONOUS BUCK CONVERTER

■ DESCRIPTION

The UTC **UD05121** is a monolithic synchronous buck regulator with a built in internal power MOSFET. It achieves 1.2A continuous output current fix switching frequency with excellent load and line regulation.

Current mode operation provides fast transient response and eases of loop stabilization.

Fault condition protection includes cycle-by-cycle current limiting, output short circuit protection and thermal shutdown. In shutdown mode the regulator draws less than 1μA of supply current. Internal soft-start minimizes the inrush supply current at initial startup.

The UTC **UD05121** requires a minimum number of readily available standard external components.

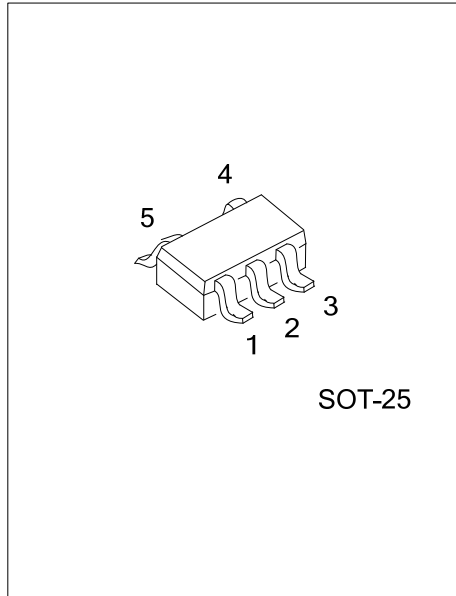
■ FEATURES

- * 2.5V~5.5V input voltage range
- * Up to 1.2A Output Current
- * 300/200mΩ 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.
- * Output Adjustable from 0.6V to V_{IN}
- * Build-in soft start function

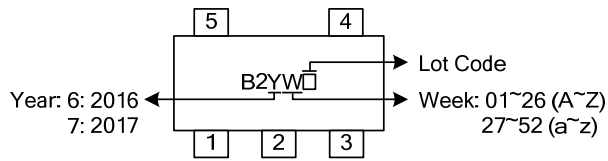
■ ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
UD05121L-AF5-R	UD05121G-AF5-R	SOT-25	Tape Reel

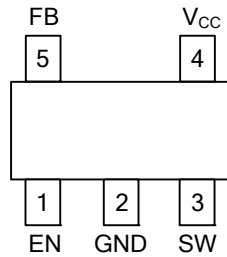
<p>UD05121G-AF5-R</p> <p>(1)Packing Type (2)Package Type (3)Green Package</p>	<p>(1) R: Tape Reel (2) AF5: SOT-25 (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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MARKING



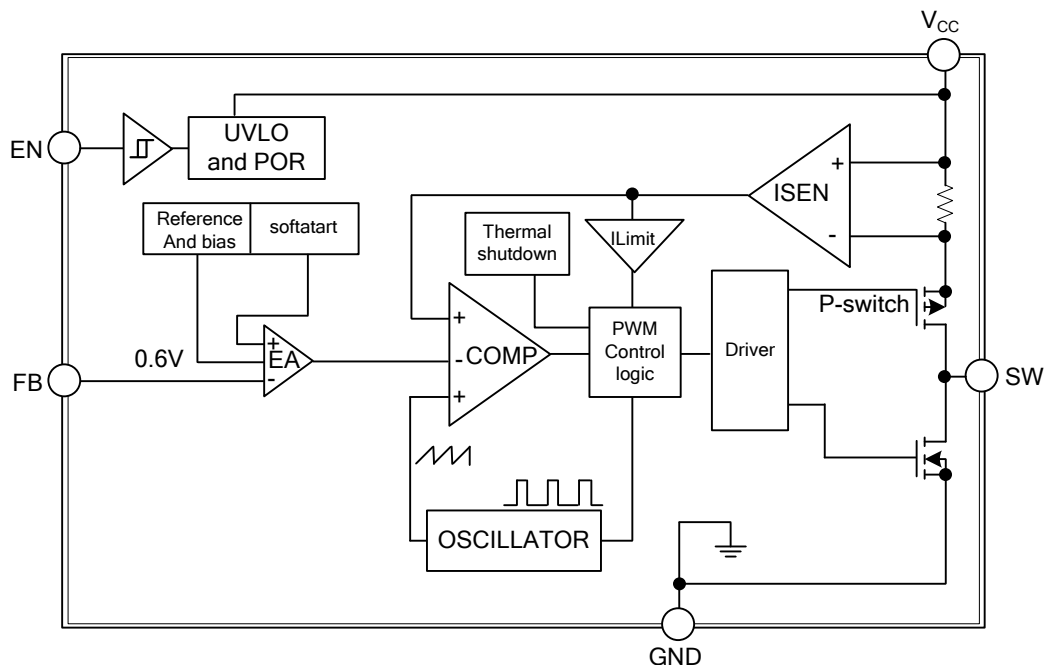
PIN CONFIGURATION



PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	EN	Chip enable pin. Active high.
2	GND	Ground pin
3	SW	Switching pin
4	V _{CC}	V _{CC} input pin
5	FB	Feedback pin

BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING ($T_A=25^\circ\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
V _{CC} Pin Voltage	V _{IN}	-0.3~7	V
SW Pin Voltage	V _{SW}	-0.7 ~ V _{IN} +0.3	V
EN, FB Pins Voltage		-0.3 ~ V _{IN} +0.3	V
Continuous Power Dissipation	P _D	370	mW
Junction Temperature	T _J	-40~125	°C
Storage Temperature	T _{STG}	-65~150	°C

Notes: 1. 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.
2. Stresses exceed those ratings may damage the device.

■ THERMAL CHARACTERISTICS

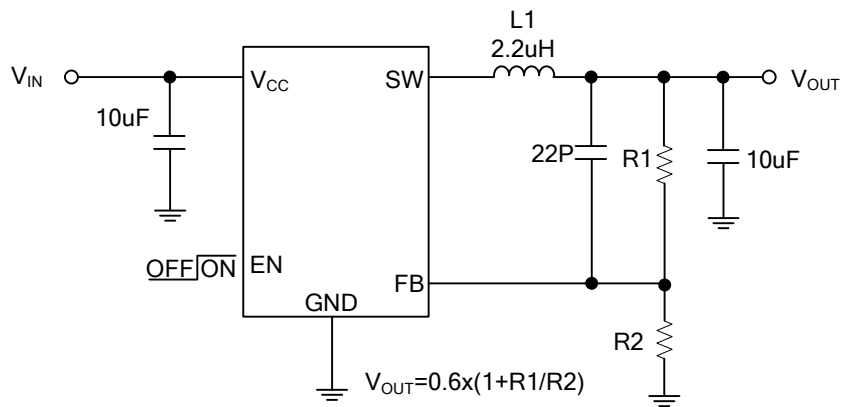
PARAMETER	SYMBOL	RATINGS	UNIT
Junction to Ambient	θ_{JA}	270	°C/W
Junction to Case	θ_{JC}	85	°C/W

Note: θ_{JA} is measured with the PCB copper are of approximately 1 in² (Multi-layer).

■ ELECTRICAL CHARACTERISTICS ($V_{IN}=5\text{V}$, $V_{EN}=5\text{V}$, $V_{OUT}=1.8\text{V}$, $T_A=25^\circ\text{C}$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage	V _{IN}		2.5		5.5	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	I _{CCQ}	V _{FB} =1V		250	350	μA
Shutdown Current	I _{SD}	V _{EN} =0V		0.1	1	μA
FB Pin Voltage	V _{FB}		0.588	0.6	0.612	V
FB Pin Current	I _{FB}				±50	nA
Load Regulation		0A<I _{OUT} <1.2A		0.6		%
Load Regulation		2.5A<V _{IN} <5.5V		0.3		%/V
EN Pin Voltage High	V _{ENH}		1.5			V
EN Pin Voltage Low	V _{ENL}				0.4	V
EN Pin Leakage Current		V _{EN} =3V		0.1	1	uA
Switching Frequency	F _{OSC}		1.1	1.5	1.9	MHz
Current Limit	C _L	V _{IN} =3V, V _{FB} =0.5V or V _{OUT} =90%, Duty Cycle<35%	1.4	1.7		A
Switching Maximum Duty	D _{max}				100	%
Minimum Duty	D _{min}		0			%
P-Switch R _{DS(ON)}	R _{DS(ON)-P}			300		mΩ
N-Switch R _{DS(ON)}	R _{DS(ON)-N}			200		mΩ
Low Side Discharger				60		Ω
Thermal Shutdown	T _{SD}			160		°C
Thermal Shutdown Protection hysteresis	T _{SH}			30		°C

■ TYPICAL APPLICATION CIRCUIT



$V_{OUT} = V_{FB} \times (1 + R1/R2)$, $V_{FB} = 0.6V$, $R2$ suggest $60k \sim 300k\Omega$

■ FUNCTION DESCRIPTION

Normal Operation

The **UD05121** uses a user adjustable frequency, current mode, synchronous step-down architecture with internal paver switch. During normal operation, the internal power switch is turned on each cycle when the oscillator sets the SR latch, and turned off when the comparator resets the SR latch. The peak inductor current at which comparator resets the SR latch is controlled by the output of error amplifier EA. While the high-side switch is off, the external schottky diode turns on until either the inductor current starts to reverse or the beginning of the next switching cycle.

Setting the Output Voltage

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

$$V_{OUT} = V_{FB} \times \left(1 + \frac{R1}{R2}\right), \quad V_{FB} = 0.6V, \quad R2 \text{ suggest } 60k \sim 300k\Omega$$

Table 1. Resistor select for output voltage setting

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

Dropout Operation

As the input supply voltage decreases to a value approaching the output voltage, the duty cycle increases toward the maximum on-time. Further reduction of the supply voltage forces the high-side switch to remain on for more than one cycle until it reaches 100% duty cycle.

The output voltage is dropped from the input supply for the voltage which across the high-side switch.

Over Temperature Protection

In most applications the **UD05121** does not dissipate much heat due to high efficiency. But, in applications where the **UD05121** is running at high ambient temperature with low supply voltage and high duty cycles, such as in dropout, the heat dissipated may exceed the maximum junction temperature of the part. If the junction temperature reaches approximately 160°C, the internal high-side power switch will be turned off and the LX node will become high impedance.

Over Current Protection

The **UD05121** cycle-by-cycle limits the peak inductor current to protect embedded switch from damage. Hence the maximum output current (the average of inductor current) is also limited. In case the load increases, the inductor current is also increase. Whenever the current limit level is reached, the output voltage cannot be regulated and starting to drop.

Soft-Start

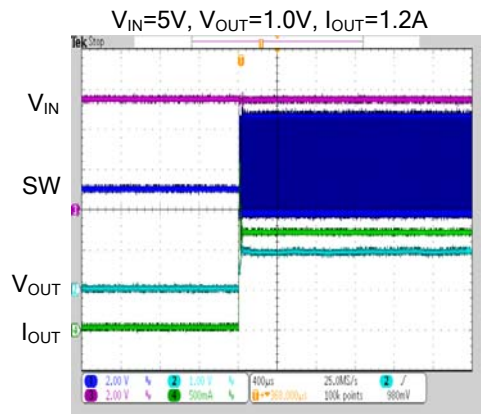
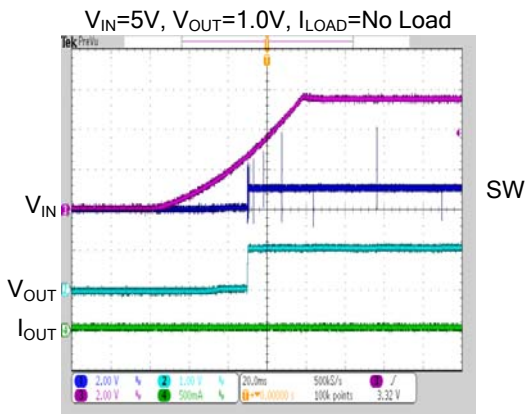
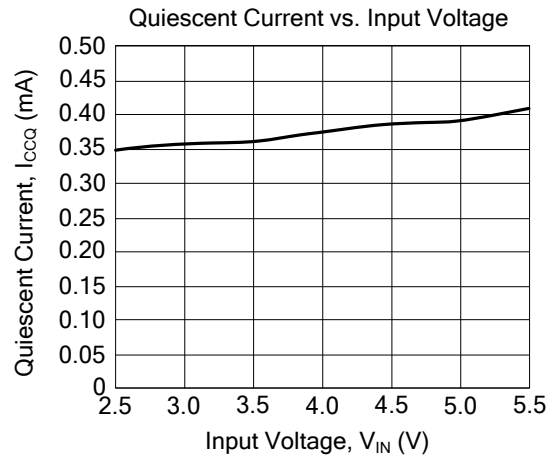
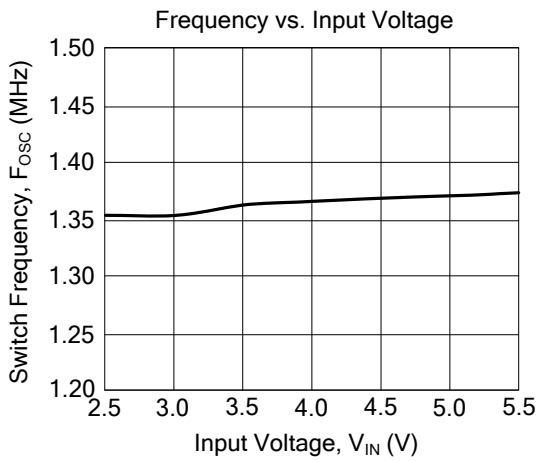
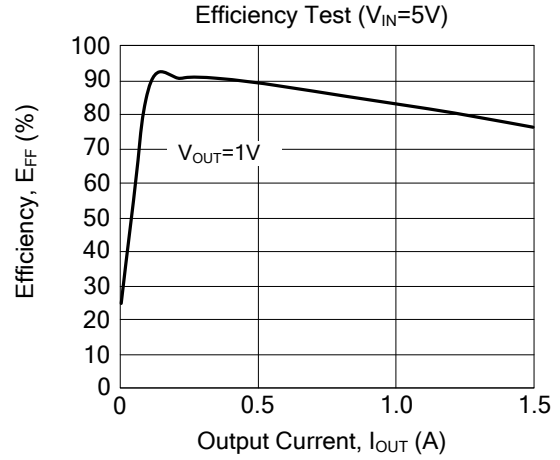
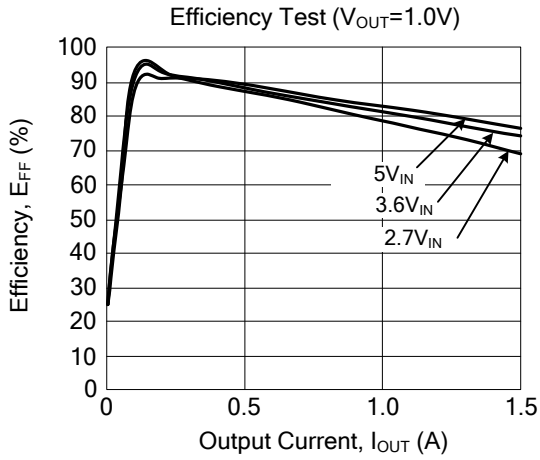
The **UD05121** employs internal soft-start circuitry to reduce supply inrush current during startup conditions. When the device exits under-voltage lockout or shut-down mode, the soft-start circuitry will slowly ramp up the output voltage.

Short-circuit Protection

Short-circuit protection will activate once the feedback voltage falls below, and the operating frequency will be reducing normal switching frequency to reduce power delivered from input to output.

TYPICAL CHARACTERISTICS

C1=100μF, C2=330μF, L1=33μH, T_A=25°C



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