1.5MHz, 600mA Synchronous Step-Down Regulator

Features

• High Efficiency: Up to 96%
• Very Low Quiescent Current: 300μA
• 600mA Output Current
• 2.5V to 6.5V Input Voltage Range
• 1.5MHz Constant Frequency Operation
• No Schottky Diode Required
• Low Dropout Operation: 100% Duty Cycle
• 0.6V Reference Allows Low Output Voltages
• Shutdown Mode Draws ≤ 1μA Supply Current
• Current Mode Operation for Excellent Line and Load Transient Response
• Over temperature Protected

General Description

The RCR2001 series are a high efficiency monolithic synchronous buck regulator using a constant frequency, current mode architecture. The device is available in an adjustable version and fixed output voltages of 1.2V, 1.5V and 1.8V. Supply current during operation is only 300μA and drops to ≤ 1μA in shutdown. The 2.5V to 6.5V input voltage range makes the RCR2001 ideally suited for single Li-Ion battery-powered applications. 100% duty cycle provides low dropout operation, extending battery life in portable systems. Automatic Burst Mode operation increases efficiency at light loads, further extending battery life.

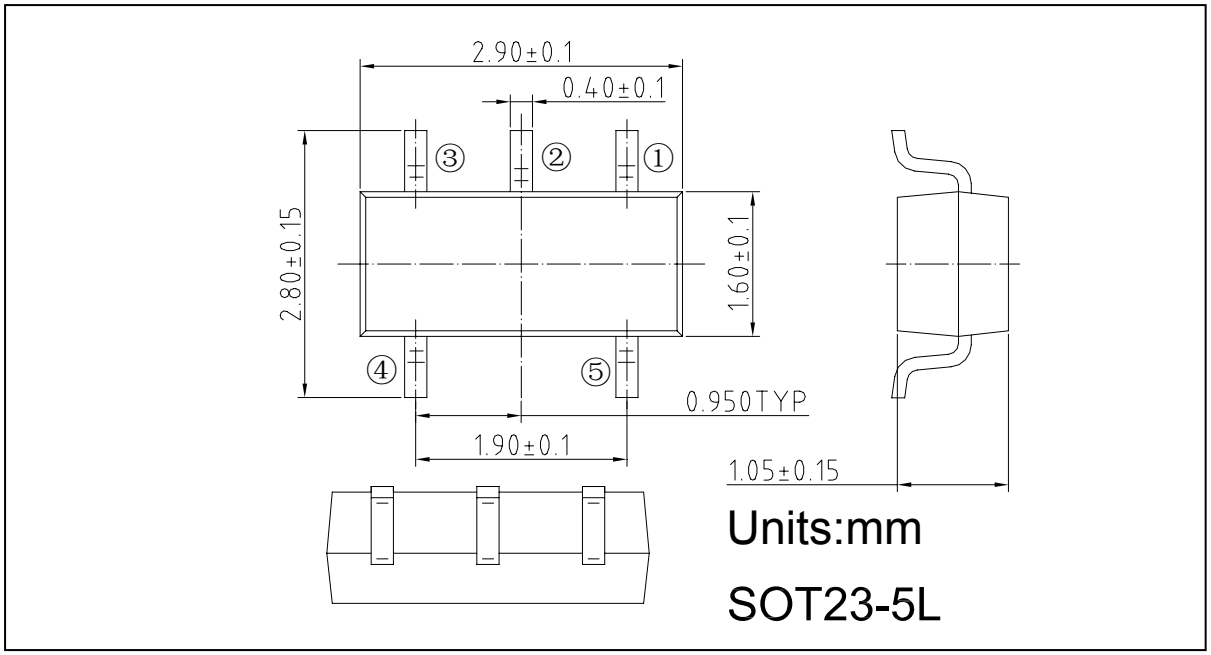
Switching frequency is internally set at 1.5MHz, allowing the use of small surface mount inductors and capacitors.

The internal synchronous switch increases efficiency and eliminates the need for an external Schottky diode. Low output voltages are easily supported with the 0.6V feedback reference voltage. The RCR2001 is available in a low profile (1mm) Thin SOT23-5L package.

Applications

• Cellular Telephones
• Personal Information Appliances
• Wireless and DSL Modems
• Digital Still Cameras
• MP3 Players
• Portable Instruments

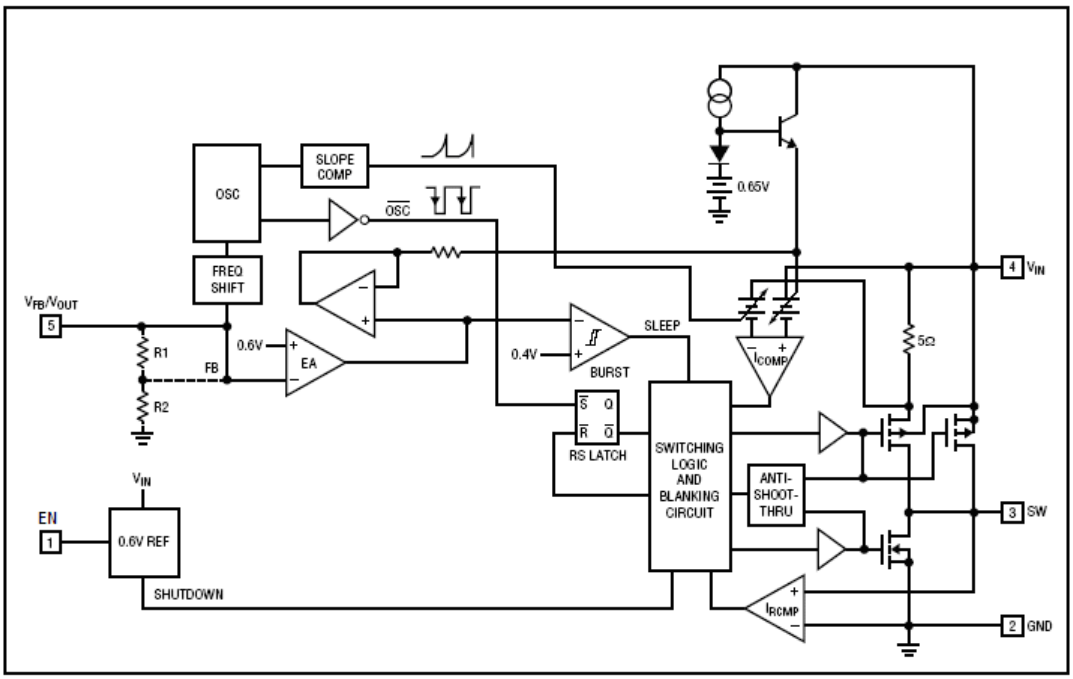
Package Information



- **Pin Configurations**

Pin Configurations Code						
Pin Type	A(Initialization)		…	E		
Pin Name	SOT23-5L			Pin Name	SOT23-5L	
	RCR2001-AD	RCR2001-FIXED			RCR2001-AD	RCR2001-FIXED
①	EN	EN	…	①	VIN	VIN
②	GND	GND	…	②	GND	GND
③	SW	SW	…	③	EN	EN
④	VIN	VIN	…	④	VFB	VOUT
⑤	VFB	VOUT	…	⑤	SW	SW

- **Functional Block Diagram**



- **Ordering Information**

RCR2001 - □ □ □ □ □

Package Type :

SK: SOT23-5L

Pin Assignment

A; E Refer to the Pin Configuration (A Initialization, To Be Neglect)

Output Voltage

12 = 1.2V; 15 = 1.5V; 18 = 1.8V; AD = ADJ

Indicate the product number

- **Absolute Maximum Ratings**

Parameter	Symbol	Ratings	Unit
Supply Voltage	V_{IN}	-0.3 to 7	V
EN,VFB Voltages	V_{EN}	-0.3 to V_{IN}	V
SW Voltage	V_{SW}	-0.3 to V_{IN} +0.3	V
P-Channel Switch Source Current (DC)		800	mA
N-Channel Switch Sink Current (DC)		800	mA
Peak SW Sink and Source Current	I_{PK}	1.3	A
Operation Temperature	T_{OPR}	-40 to +85	℃
Storage Temperature Range	T_{STG}	-65 to +150	℃

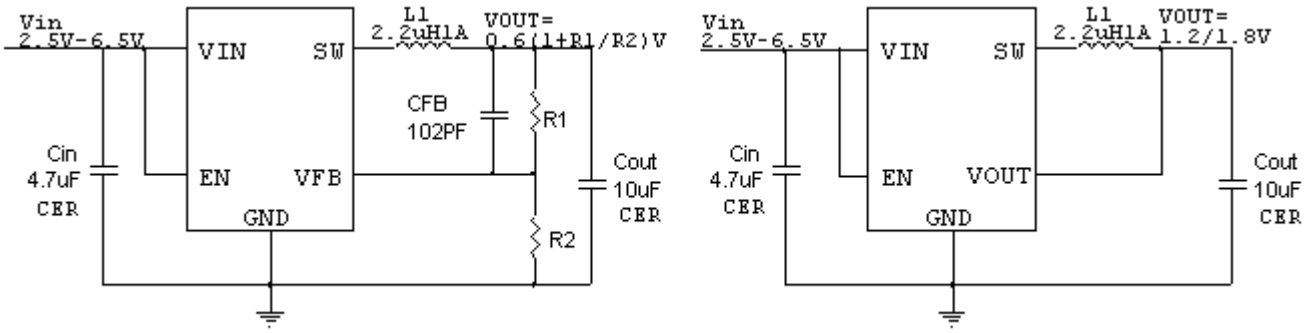
- **Electrical Characteristics**

TA = 25°C. V_{IN} = 3.6V unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Feedback Current	I_{FB}		--	--	±30	nA
Regulated Feedback Voltage	V_{FB}	T_A = 25°C 0°C ≤ TA ≤ 85°C –40°C ≤ T_A ≤ 85°C	0.588 0.586 0.585	0.6 0.6 0.6	0.612 0.613 0.615	V V V
Reference Voltage Line Regulation	ΔV_{FB}	V_{IN} = 2.5V to 5.5V	--	0.04	0.4	%/V
Regulated Output Voltage	V_{OUT}	RCR2001 - 1.2, I_{OUT} = 100mA RCR2001 - 1.5, I_{OUT} = 100mA RCR2001 - 1.8, I_{OUT} = 100mA	1.164 1.455 1.746	1.2 1.500 1.800	1.236 1.545 1.854	V
Output Voltage Line Regulation	ΔV_{OUT}	V_{IN} = 2.5V to 5.5V	--	0.04	0.4	%/V
Peak Inductor Current	I_{PK}	V_{IN} = 3V, V_{FB} = 0.5V or V_{OUT} = 90%, Duty Cycle < 35%	0.75	1	1.25	A
Output Voltage Load Regulation	$V_{LOADREG}$		--	0.5	--	%
Input Voltage Range	V_{IN}		2.5	--	6.5	V
Input DC Bias Current Active Mode Sleep Mode Shutdown	I_S	V_{FB} = 0.5V or V_{OUT} = 90%, I_{LOAD} = 0A V_{FB} = 0.62V or V_{OUT} = 103%, I_{LOAD} = 0A V_{EN} = 0V, V_{IN} = 4.2V	--	300 20 0.1	400 35 1	μA μA μA
Oscillator Frequency	F_{OSC}	V_{FB} = 0.6V or V_{OUT} = 100%	1.2	1.5	1.8	MHz
RDS (ON) of P-Channel FET	R_{PFET}	I_{SW} = 300mA	--	0.4	0.5	Ω
RDS (ON) of N-Channel FET	R_{NFET}	I_{SW} = –300mA	--	0.35	0.45	Ω
SW Leakage	I_{LSW}	V_{EN} = 0V, V_{SW} = 0V or 5V, V_{IN} = 5V	--	±0.01	±1	μA
EN Input Logic Low Threshold	V_{IL} *	T_J = -40℃ to 125℃	--	--	0.3	V
EN Input Logic High Threshold	V_{IH}	T_J = -40℃ to 125℃	1.5	--	--	V
EN Leakage Current	I_{EN}		--	±0.01	±1	μA

* If need to use the EN pin to close output, please make sure the EN level lower than 0.3V, otherwise may not be able to turn-off.

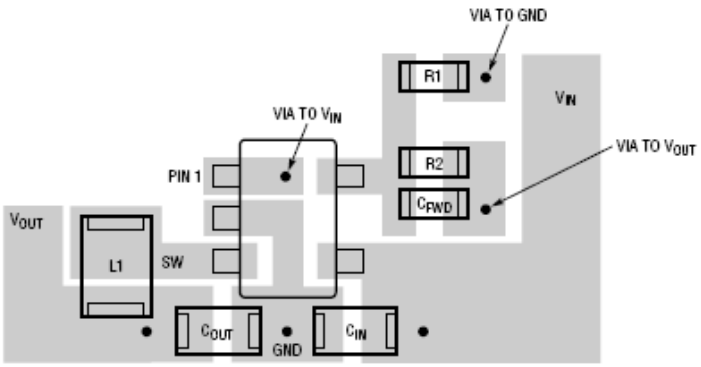
- **Typical Application Circuit**



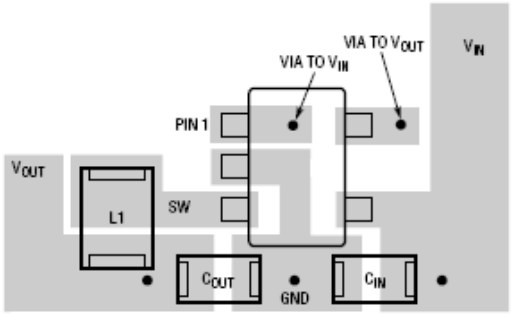
PCB Layout Checklist

When laying out the printed circuit board, the following checklist should be used to ensure proper operation of the RCR2001. Check the following in your layout:

1. The power traces, consisting of the GND trace, the SW trace and the V_{IN} trace should be kept short, direct and wide.
2. Does the V_{FB} pin connect directly to the feedback resistors? The resistive divider R1/R2 must be connected between the (+) plate of C_{OUT} and ground.
3. Does the (+) plate of C_{IN} connect to V_{IN} as closely as possible? This capacitor provides the AC current to the internal power MOSFETs.
4. Keep the switching node, SW, away from the sensitive V_{FB} node.
5. Keep the (–) plates of C_{IN} and C_{OUT} as close as possible.



RCR2001-ADJ Suggested Layout



RCR2001-1.8V Suggested Layout

- **Typical Performance Characteristics**

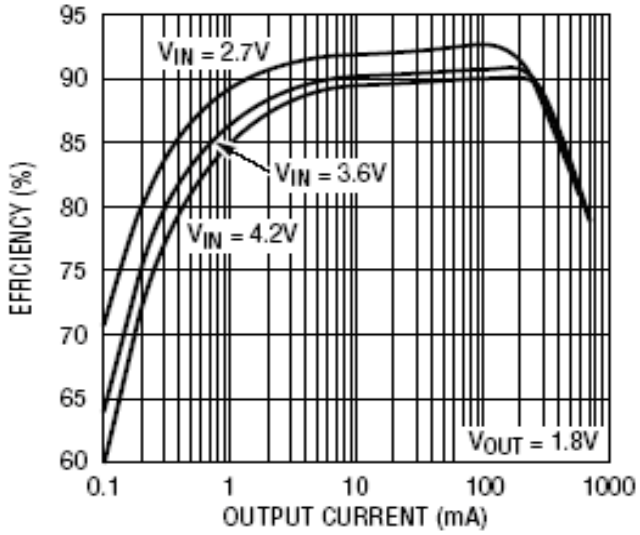


Figure 1. Efficiency vs. Output Current

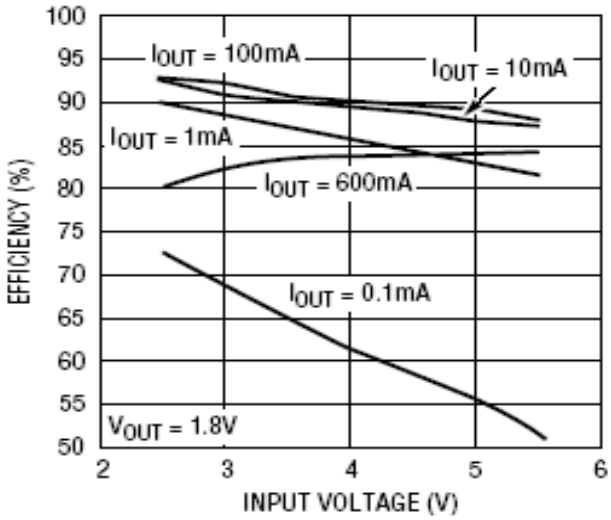


Figure 2. Efficiency vs. Input Voltage

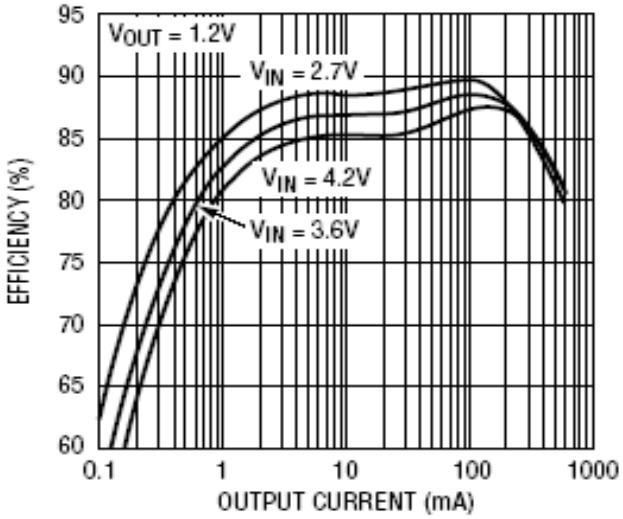


Figure 3. Efficiency vs. Output Current

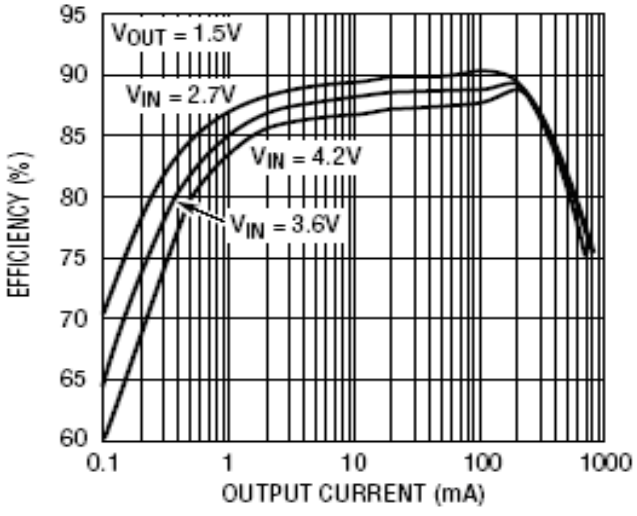


Figure 4. Efficiency vs. Output Current

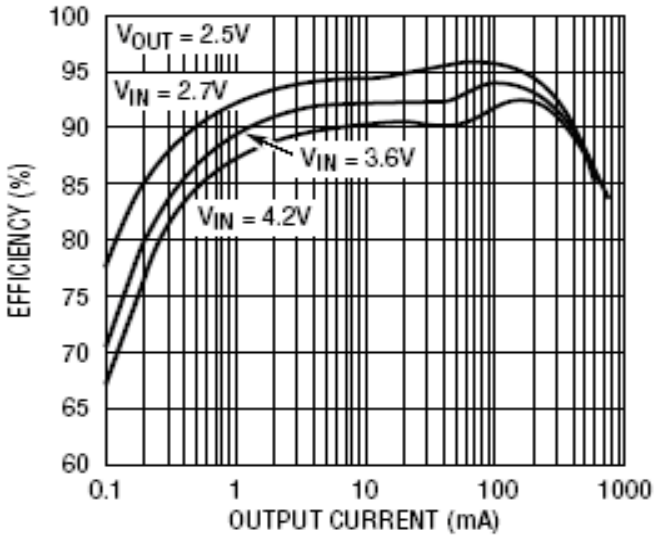


Figure 5. Efficiency vs. Output Current

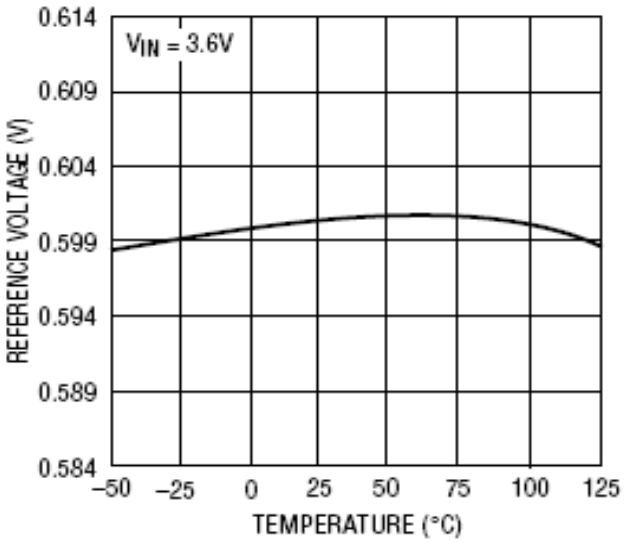


Figure 6. REF Voltage vs. Temperature

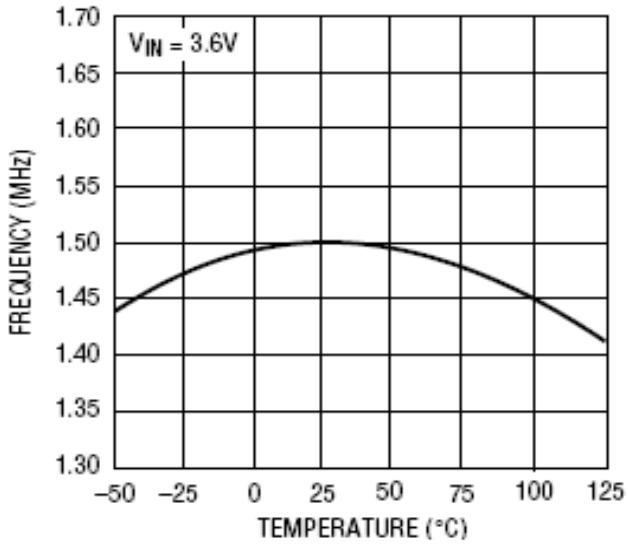


Figure 7. Frequency vs. Temperature

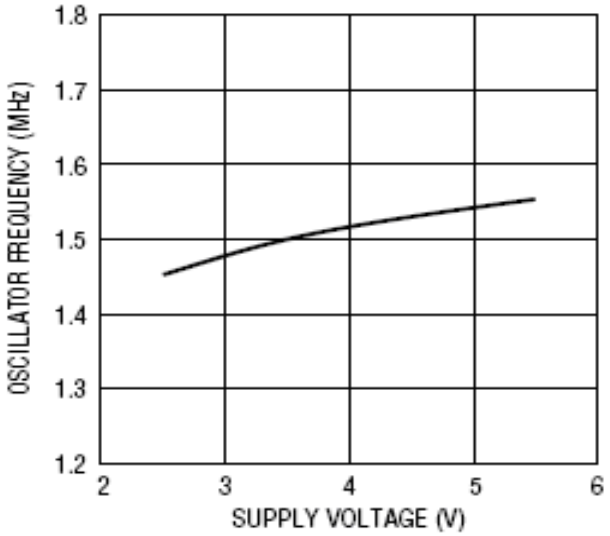


Figure 8. OSC Frequency vs. Supply Voltage

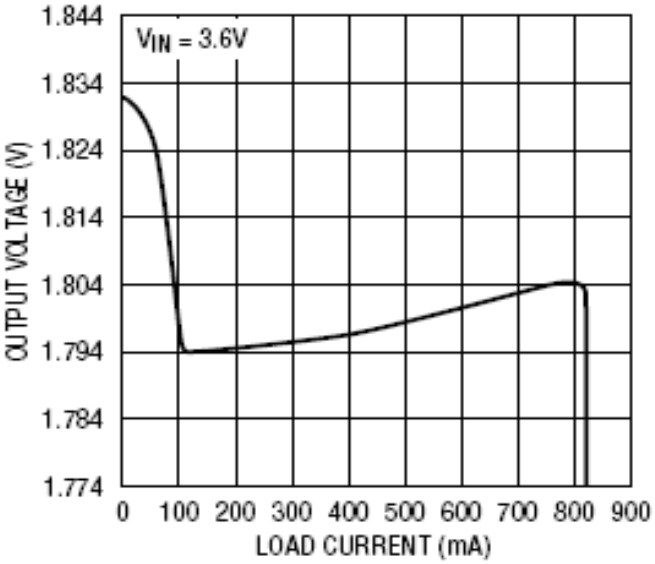


Figure 9. Output Voltage vs. Load Current

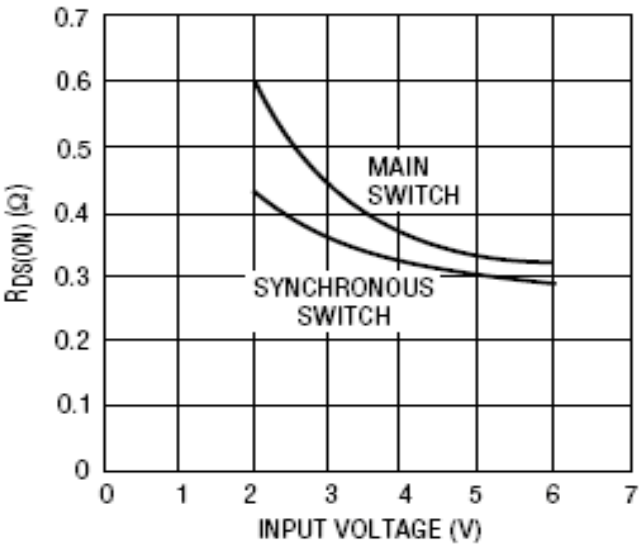


Figure 10. Rds(on) vs. Input Voltage

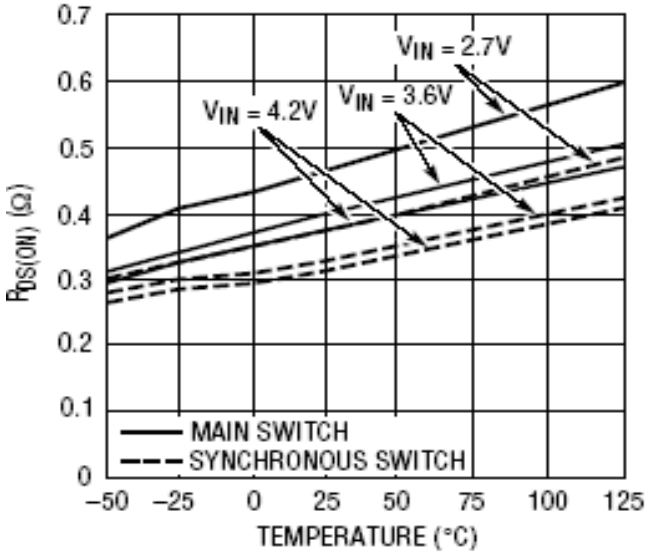


Figure 11. Rds(on) vs. Temperature

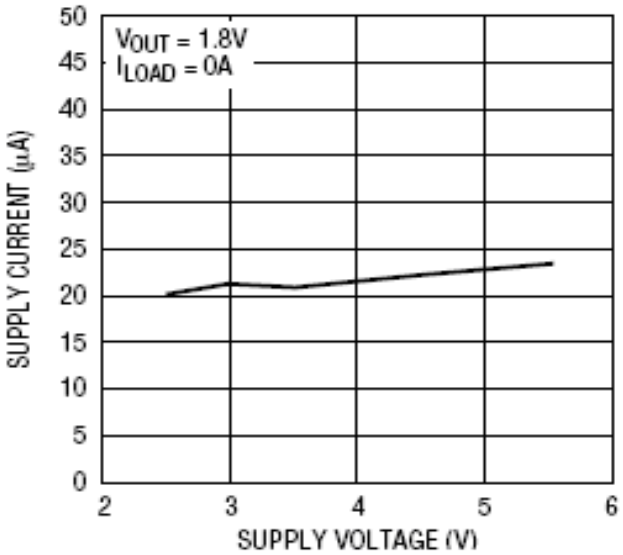


Figure 12. Supply Current vs. Supply Voltage

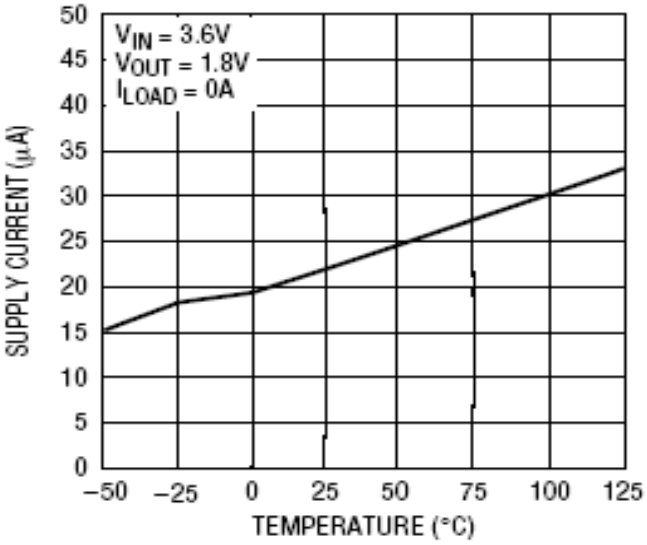


Figure 13. Supply Current vs. Temperature

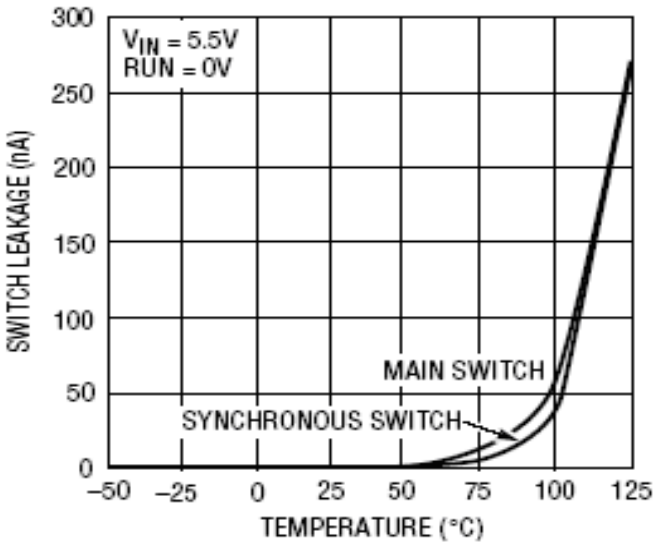


Figure 14. Switch Leakage vs. Temperature

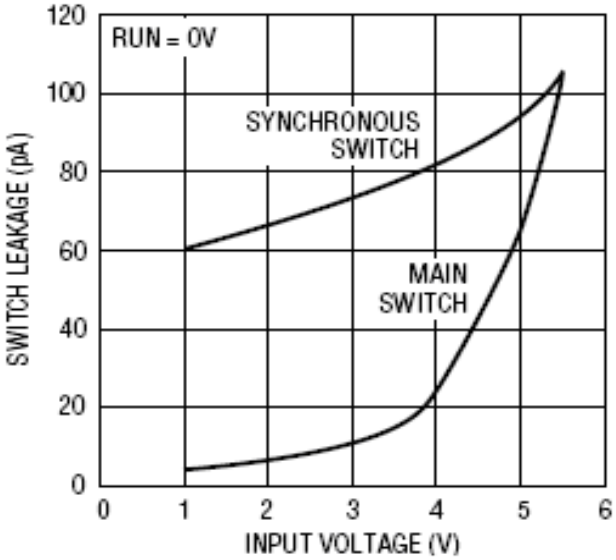


Figure 15. Switch Leakage vs. Input Voltage

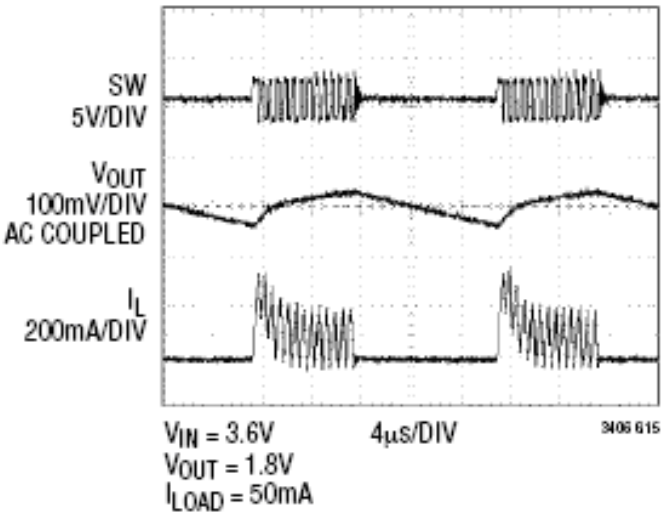


Figure 16. Boost Mode Operation

DISCLAIMER

YUKUN SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. YUKUN DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENCE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.