High Efficiency, Low Supply Current, Step-up DC/DC Converter

General Description

The RT9263 is a compact, high efficient, step-up DC/DC converter with an adaptive current mode PWM control loop, providing a stable and high efficient operation over a wide range of load currents. It operates in both continuous and discontinuous current modes in stable waveforms without external compensation.

The low start-up input voltage below 1V makes RT9263 suitable for 1 to 4 battery cell applications providing up to 400mA output current. The 550KHz high switching rate minimized the size of external components. Besides, the 17μA low quiescent current together with high efficiency maintains long battery lifetime.

Ordering Information

RT9263□ □ □□

- Package type
  X5 : SOT89-5
- Operating temperature range
  C: Commercial standard
- C : Chip enable control
  E : Driver for external power devices

Marking Information

Part Number	Marking
RT9263CCX5	CH
RT9263ECX5	CJ

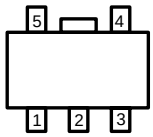
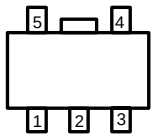
Features

- **1.0V Low Start-up Input Voltage**
- **High Supply Capability to Deliver 3.3V 100mA with 1V Input Voltage**
- **17μA Quiescent (Switch-off) Supply Current**
- **90% Efficiency**
- **550KHz Fixed Switching Rate**
- **Providing Flexibility for Using Internal and External Power Switches**
- **SOT89-5 Package**

Applications

- PDA
- Portable Instrument
- DSC

Pin Configurations

Part Number	Pin Configurations
RT9263CCX5 (Plastic SOT89-5)	 TOP VIEW 1. CE 2. VDD 3. FB 4. LX 5. GND
RT9263ECX5 (Plastic SOT89-5)	 TOP VIEW 1. EXT 2. VDD 3. FB 4. LX 5. GND

Typical Application Circuit

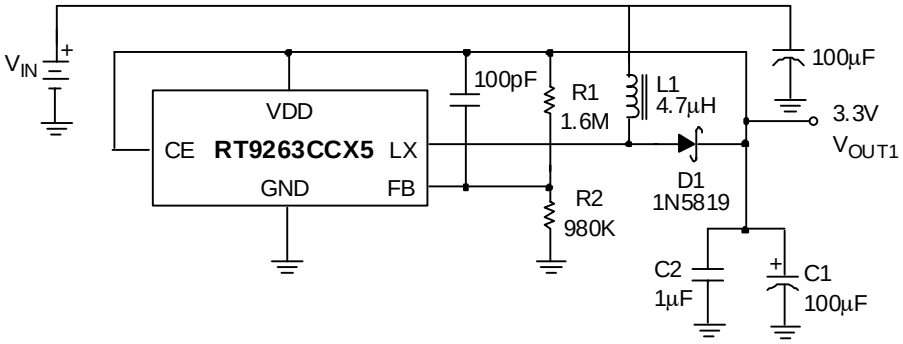


Fig. 1 RT9263CCX5 Typical Application for Portable Instruments below 400mA

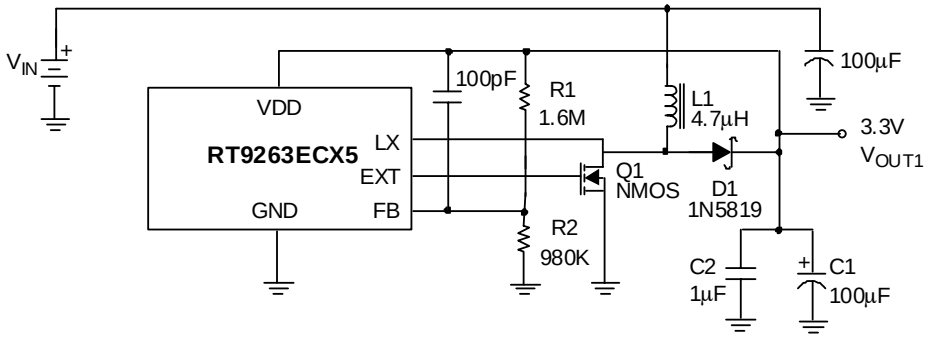


Fig. 2 0.4A ~ 1A Output Current Application

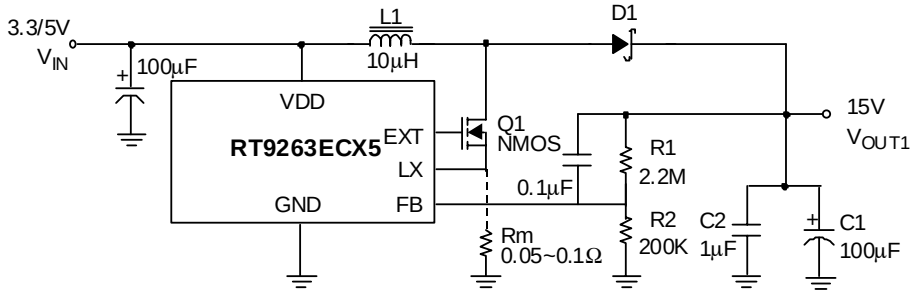


Fig. 3 High Voltage Application (Rm should be added when IL > 100mA)

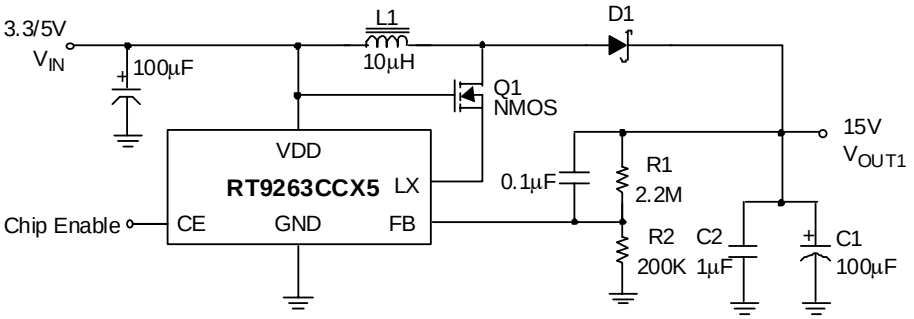
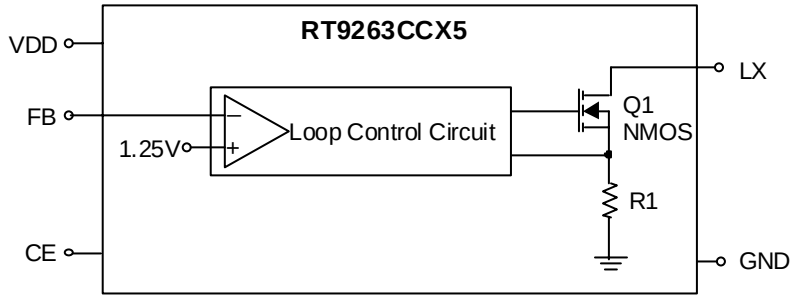
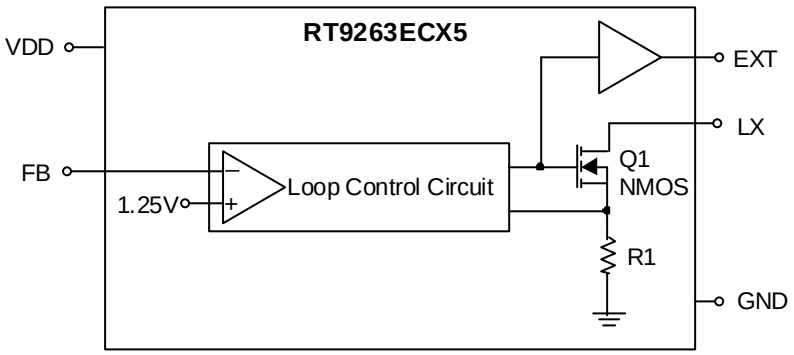


Fig.4 High Voltage Application with Shutdown Control

Function Block Diagram





Pin Description

Pin No.		Pin Name	Pin Function
RT9263CCX5	RT9263ECX5		
--	1	EXT	Output pin for driving external NMOS or NPN When driving an NPN, a resistor should be added for limiting base
1	--	CE	Chip enable RT9263CCX5 gets into shutdown mode when CE pin set to low.
2	2	VDD	Input positive power pin of RT9263
3	3	FB	Feedback input pin Internal reference voltage for the error amplifier is 1.25V.
4	4	LX	Pin for switching
5	5	GND	Ground

Absolute Maximum Ratings

- Supply Voltage ---------- -0.3V to 7V
- LX Pin Switch Voltage ---------- -0.3V to (VDD + 0.8V)
- Other I/O Pin Voltages ---------- -0.3V to (VDD + 0.3V)
- LX Pin Switch Current ---------- 2.5A
- EXT Pin Driver Current ---------- 30mA
- Power Dissipation, P_D @ T_A = 25°C
  SOT89-5 ---------- 0.5W
- Package Thermal Resistance
  SOT89-5, θ_{JA} ---------- 300°C/W
- Operating Junction Temperature ---------- 150°C
- Storage Temperature Range ---------- -65°C ~ +150°C

Electrical Characteristics

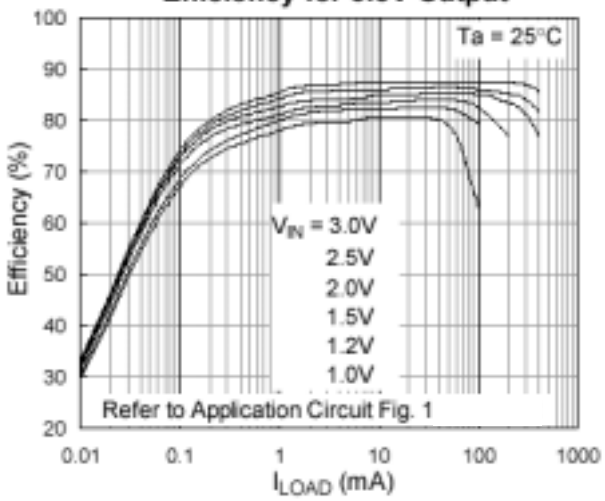
(V_{IN} = 1.5V, VDD set to 3.3V, Load Current = 0, T_A = 25°C, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Start-UP Voltage	V_{ST}	I_L = 1mA	--	0.98	1.05	V
Operating VDD Range	V_{DD}	Start-up to I_{DD1} > 250μA	0.8	--	6.5 *	V
No Load Current I (V_{IN})	$I_{NO\ LOAD}$	V_{IN} = 1.5V, V_{OUT} = 3.3V	--	47	--	μA
Switch-off Current I (VDD)	$I_{SWITCH\ OFF}$	V_{IN} = 6V	--	17	--	μA
Shutdown Current I (V_{IN})	I_{OFF}	CE Pin = 0V, V_{IN} = 4.5V	--	0.1	1	μA
Feedback Reference Voltage	V_{REF}	Close Loop, VDD = 3.3V	1.225	1.25	1.275	V
Switching Rate	F_S	VDD = 3.3V	--	550	--	KHz
Maximum Duty	D_{MAX}	VDD = 3.3V	--	92	--	%
LX ON Resistance		VDD = 3.3V	--	0.25	--	Ω
Current Limit Setting	I_{LIMIT}	VDD = 3.3V	--	2	--	A
EXT ON Resistance to VDD		VDD = 3.3V	--	40	--	Ω
EXT ON Resistance to GND		VDD = 3.3V	--	30	--	Ω
Line Regulation	ΔV_{LINE}	V_{IN} = 1.5 ~ 2.5V, I_L = 1mA	--	10	--	mV/V
Load Regulation	ΔV_{LOAD}	V_{IN} = 2.5V, I_L = 1 ~ 100mA	--	0.25	--	mV/mA
CE Pin Trip Level		VDD = 3.3V	0.2	0.8	1.4	V
Temperature Stability for FB, LFB, LBI	T_S	Guaranteed by Design	--	50	--	ppm/°C
Thermal Shutdown	T_{SD}	Guaranteed by Design	--	165	--	°C
Thermal Shutdown Hysterises	ΔT_{SD}	Guaranteed by Design	--	10	--	°C

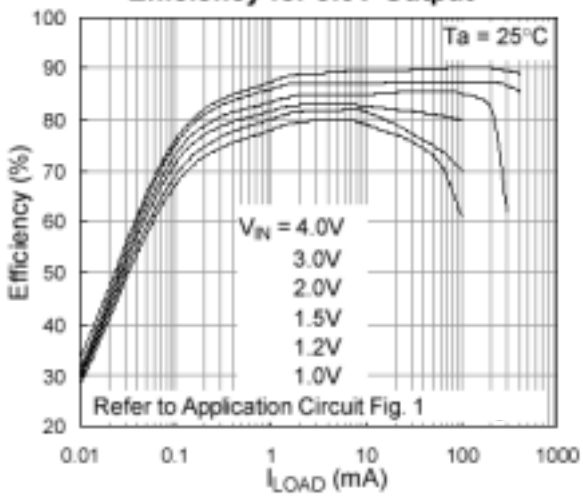
* Note: The CE pin shall be tied to VDD pin and inhibit to act the ON/OFF state whenever the VDD pin voltage may reach to 5.5V or above.

Typical Operating Charateristics

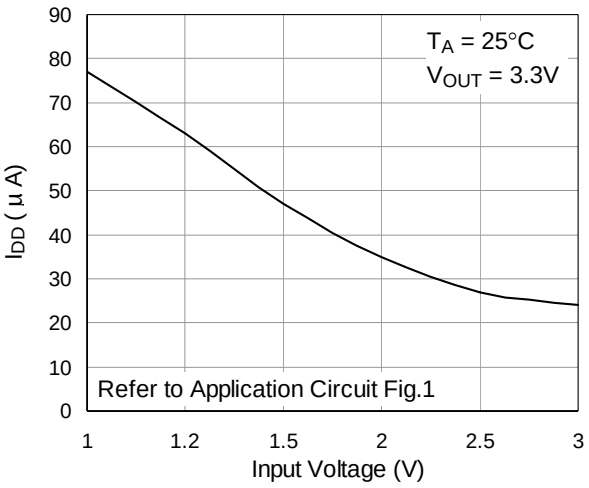
Efficiency for 3.3V Output



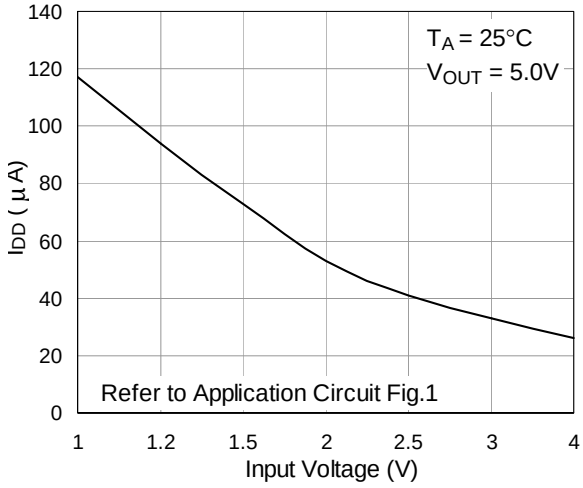
Efficiency for 5.0V Output



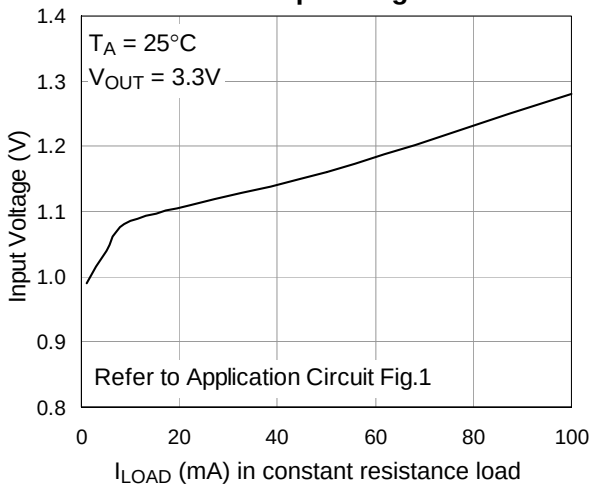
No Load Current



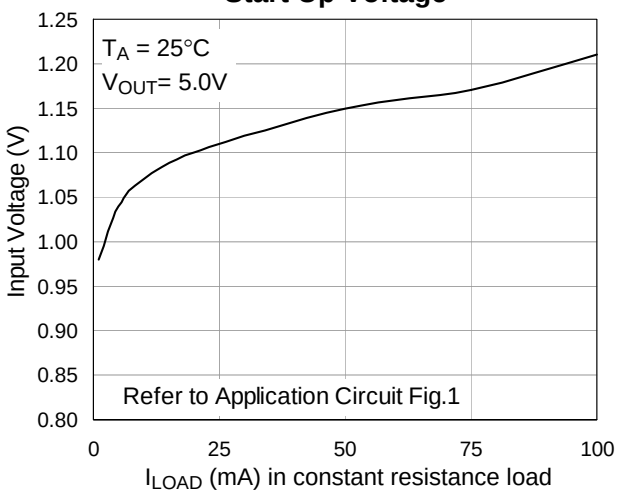
No Load Current



Start Up Voltage



Start Up Voltage



Application Note

Output Voltage Setting

Referring to application circuits Fig.1 to Fig.4, the output voltage of the switching regulator (V_{OUT1}) can be set with Eq.1.

$$V_{OUT1} = (1 + \frac{R1}{R2}) \times 1.25V \quad \text{Eq.1}$$

Feedback Loop Design

Referring to application circuits Fig.1 to Fig.4, The selection of R1 and R2 based on the trade-off between quiescent current consumption and interference immunity is stated below:

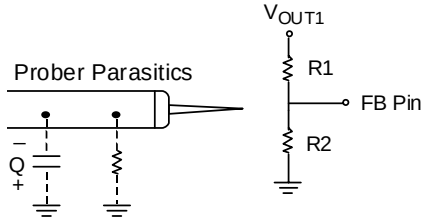
- Follow Eq.1
- Higher R reduces the quiescent current (Path current = 1.25V/R2), however resistors beyond 5MΩ are not recommended.
- Lower R gives better noise immunity, and is less sensitive to interference, layout parasitics, FB node leakage, and improper probing to FB pins.
- A proper value of feed forward capacitor parallel with R1 on Fig.1 to Fig.4 can improve the noise immunity of the feedback loops, especially in an improper layout. An empirical suggestion is around 100pF ~ 1nF for feedback resistors of MΩ, and 10nF ~ 0.1μF for feedback resistors of tens to hundreds KΩ.

For applications without standby or suspend modes, lower values of R1, and R2 are preferred. For applications concerning the current consumption in standby or suspend modes, the higher values of R1, and R2 are needed. Such “high impedance feedback loops” are sensitive to any interference, which require careful layout and avoid any interference, e.g. probing to FB pins.

PRECAUTION 1: Improper probing to FB pin will cause fluctuation at V_{OUT1}. It may damage RT9263 and system chips because V_{OUT1} may drastically rise to an over-rated level due to unexpected interference or parasitics being added to FB pin.

PRECAUTION 2: Disconnecting R1 or short circuit across R2 may also cause similar IC damage as described in precaution 1.

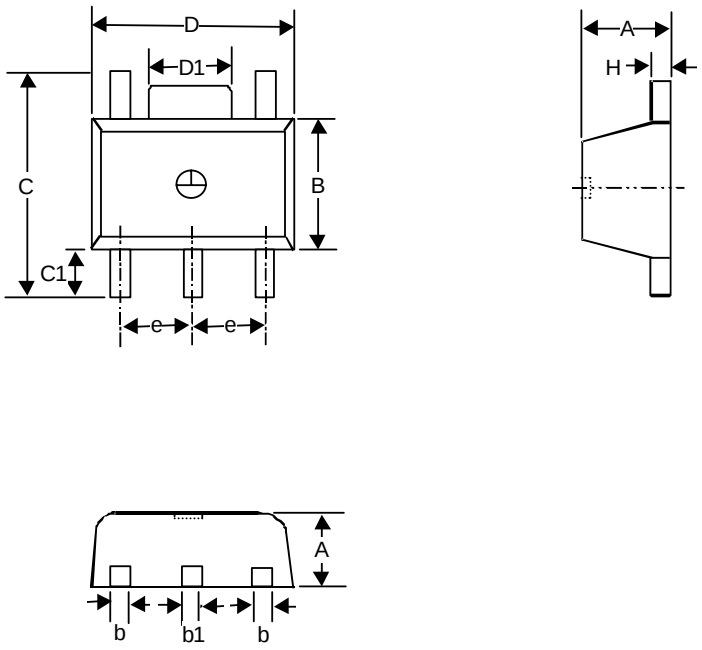
PRECAUTION 3: When large R values were used in feedback loops, any leakage in FB node may also cause V_{OUT1} voltage fluctuation, and IC damage. To be especially highlight here is when the air moisture frozen and re-melt on the circuit board may cause several μA leakage between IC or component pins. So, when large R values are used in feedback loops, post coating, or some other moisture-preventing processes are recommended.



Layout Guide

- A full GND plane without gap break.
- V_{OUT1} to GND noise bypass – Short and wide connection for C2 to Pin2 and Pin5.
- V_{IN} to GND noise bypass – Add a 100μF capacitor close to L1 inductor, when VIN is not an idea voltage source.
- Minimized FB node copper area and keep far away from noise sources.
- Minimized parasitic capacitance connecting to LX and EXT nodes, which may cause additional switching loss.

Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.360	0.520	0.014	0.020
B	2.400	2.600	0.094	0.102
b1	0.406	0.533	0.016	0.021
C	--	4.250	--	0.167
C1	0.800	--	0.031	--
D	4.400	4.600	0.173	0.181
D1	--	1.700	--	0.067
e	1.400	1.600	0.055	0.063
H	0.380	0.430	0.014	0.017

5-Lead SOT-89 Surface Mount

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