VFM Step-Up DC/DC Converter

General Description

The RT9261 Series are VFM Step-up DC/DC ICs with ultra low supply current by CMOS process and suitable for use with battery-powered instruments.

The RT9261 IC consists of an oscillator, a VFM control circuit, a driver transistor (LX switch), a reference voltage unit, an error amplifier, resistors for voltage detection, and a LX switch protection circuit. A low ripple and high efficiency step-up DC/DC converter can be constructed of this RT9261 IC with only three external components.

The RT9261A IC provides with a drive pin (EXT) for an external transistor, so that a power transistor can be externally applied. Therefore, the RT9261A IC is recommended for applications where large currents are required. EN pin enables circuit to set the standby supply current at a maximum of 0.5μA.

Ordering Information

RT9261/A-□□□□

- Package Type
  - B : SOT-23-5
  - X : SOT-89
- Lead Plating System
  - P : Pb Free
  - G : Green (Halogen Free and Pb Free)
- Output Voltage
  - 15 : 1.5V
  - 16 : 1.6V
  - :
  - 49 : 4.9V
  - 50 : 5.0V
- Use external switch
- Use internal switch

Note :

Richtek products are :

- RoHS compliant and compatible with the current requirements of IPC/JEDEC J-STD-020.
- Suitable for use in SnPb or Pb-free soldering processes.

Marking Information

For marking information, contact our sales representative directly or through a Richtek distributor located in your area.

Features

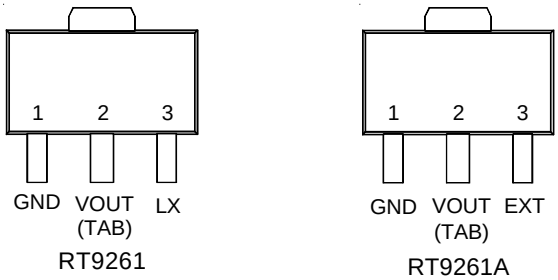
- **Minimal Number of External Components (Only an Inductor, a Diode, and a Capacitor)**
- **Ultra Low Input Current (5μA at Switch Off)**
- **±2% High Output Voltage Accuracy**
- **Low Ripple and Low Noise**
- **Low Start-up Voltage, 0.85V at 1mA**
- **75% Efficiency with Low Cost Inductor**
- **+50 ppm/ °C Low Temperature-Drift**
- **SOT-89 and SOT-23-5 Small Packages**
- **RoHS Compliant and 100% Lead (Pb)-Free**

Applications

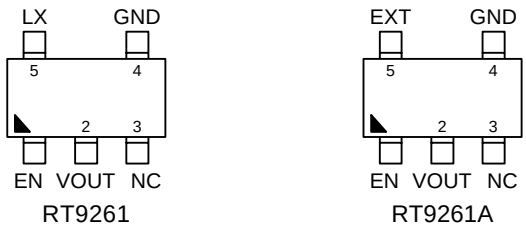
- Power source for battery-powered equipment
- Power source for cameras, camcorders, VCRs, PDAs, pagers, electronic data banks, and hand-held communication equipment
- Power source for applications, which require higher voltage than that of batteries used in the appliances

Pin Configurations

(TOP VIEW)



SOT-89



SOT-23-5

Typical Application Circuit

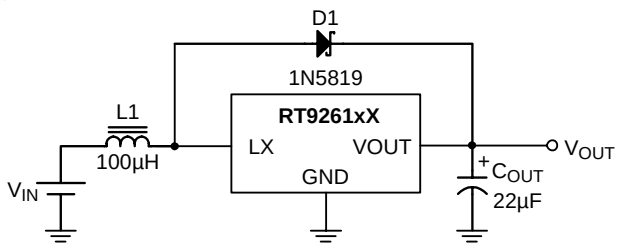


Figure 1

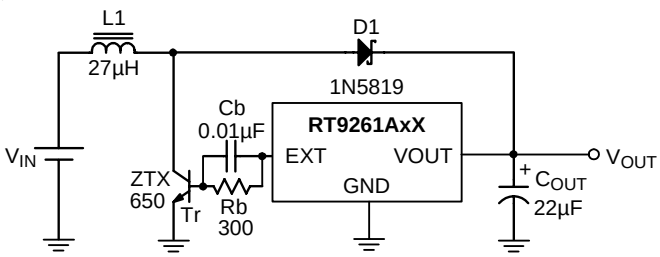


Figure 2

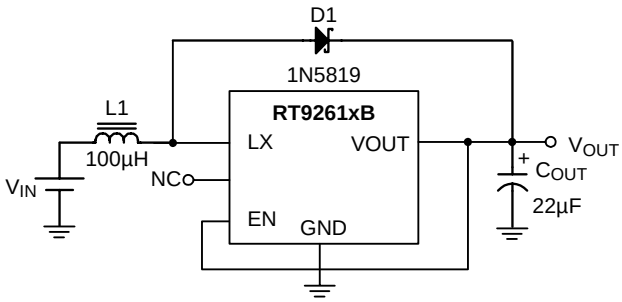


Figure 3

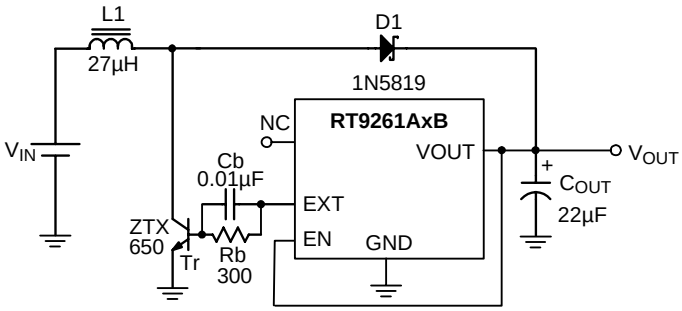


Figure 4

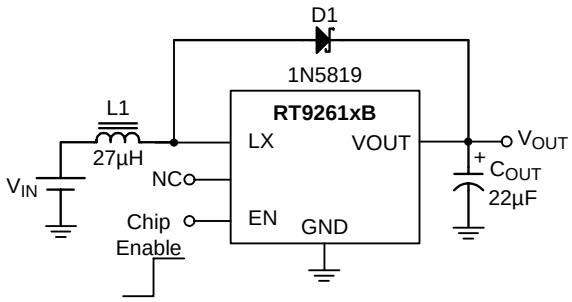
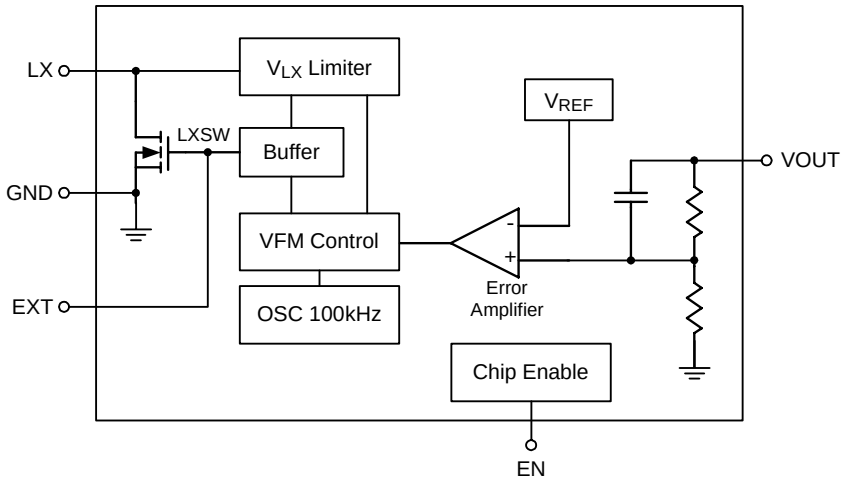


Figure 5

Functional Pin Description

Pin No.				Pin Name	Pin Function
RT9261-□□□X	RT9261A-□□□X	RT9261-□□□B	RT9261A-□□□B		
1	1	4	4	GND	Ground.
2	2	2	2	VOUT	Output Voltage.
3	--	5	--	LX	Pin for Switching.
--	3	--	5	EXT	Drive External Device.
--	--	1	1	EN	Chip Enable (Active High).
--	--	3	3	NC	No Internal Connected.

Function Block Diagram



Notes:

(1) LX Pin..... only for 9261-□□xX and 9261-□□xB

(2) EXT Pin.... only for 9261A-□□xX and 9261A-□□xB

(3) EN Pin..... only for 9261-□□xB and 9261A-□□xB

Absolute Maximum Ratings

- Output Voltage ---------- 8V
- LX Pin Voltage (1) ---------- 8V
- EXT Pin Voltage (2) ---------- −0.3 to V_{OUT} +0.3V
- EN Pin Voltage (3) ---------- −0.3 to V_{OUT} +0.3V
- LX Pin Output Current (1) ---------- 250mA
- EXT Pin Current (2) ---------- ±50mA
- Power Dissipation, P_D @ T_A = 25°C
  - SOT-89 ---------- 0.5W
  - SOT-23-5 ---------- 0.25W
- Package Thermal Resistance
  - SOT-89, θ_{JC} ---------- 100°C/W
  - SOT-89, θ_{JA} ---------- 300°C/W
  - SOT-23-5, θ_{JA} ---------- 250°C/W
- Operating Temperature Range ---------- −20 to +85°C
- Storage Temperature Range ---------- 165°C
- Lead Temperature (Soldering, 10 sec.) ---------- 260°C

Notes:

(1) Applicable to RT9261-☐☐xX and RT9261-☐☐xB

(2) Applicable to RT9261A-☐☐xX and RT9261A-☐☐xB

(3) Applicable to RT9261-☐☐xB and RT9261A-☐☐xB

Electrical Characteristics (Refer to Figure 1)

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage Accuracy	ΔV_{OUT}			−2	--	2	%
Input Voltage	V_{IN}			--	--	7	V
Start-up Voltage	V_{ST}	I_{OUT} = 1mA, V_{IN}: 0 → 2V		--	0.85	1	V
Hold-on Voltage	V_{HO}	I_{OUT} = 1mA, V_{IN}: 2 → 0V		0.7	--	--	V
Input Current 1		V_{IN} at no load	$V_{OUT} \leq 3.5V$ (1)	--	15	18	μA
			$3.5V < V_{OUT} \leq 5V$ (2)	--	18	24	
Input Current 2		V_{OUT} in switch off condition		--	5	8	μA
LX Switching Current	$I_{SWITCHING}$	V_{LX} = 0.4V	$V_{OUT} \leq 3.5V$ (1)	60	--	--	mA
			$3.5V < V_{OUT} \leq 5V$ (2)	80	--	--	
LX Leakage Current	$I_{LEAKAGE}$	V_{LX} = 6V		--	--	0.5	μA
Maximum Oscillator	F_{MAX}			80	120	160	kHz
Oscillator Duty Cycle	D_{OSC}	On (V_{LX} " L ") side	V_{OUT} = 2.5V to 5V	65	75	85	%
			V_{OUT} = 1.5V to 2.4V	60	70	80	%
Efficiency				--	75	--	%
V_{LX} Voltage Limit		L_X switch on		0.65	0.8	1	V

Notes:

(1)Unless otherwise provided, V_{IN} = 1.8V, V_{SS} = 0V, I_{OUT} = 10mA, T_{OPT} = 25°C, and External Circuit of Typical Application

(2)Unless otherwise provided, V_{IN} = 3V, V_{SS} = 0V, I_{OUT} = 10mA, T_{OPT} = 25°C, and External Circuit of Typical Application

Electrical Characteristics (Refer to Figure 2)

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage Accuracy	ΔV_{OUT}			−2	--	+2	%
Input Voltage	V_{IN}			--	--	7	V
Start-up Voltage	V_{ST}	I_{OUT} = 1mA, V_{IN} : 0 → 2V		--	0.85	1.0	V
Input Current 1		V_{IN} at no load	$V_{OUT} \leq 3.5V$ (1)	--	30	50	μA
			$3.5V < V_{OUT} \leq 5V$ (2)	--	60	90	
Input Current 2		V_{OUT} in switch off condition	$V_{OUT} \leq 3.5V$ (1)	--	6	10	μA
			$3.5V < V_{OUT} \leq 5V$ (2)				
EXT “H” Output Current		$V_{EXT} = V_{OUT} - 0.4V$	$V_{OUT} \leq 3.5V$ (1)	−1.5	--	--	mA
			$3.5V < V_{OUT} \leq 5V$ (2)	−2	--	--	
EXT “L” Output Current		V_{EXT} = 0.4V	$V_{OUT} \leq 3.5V$ (1)	1.5	--	--	mA
			$3.5V < V_{OUT} \leq 5V$ (2)	2	--	--	
Maximum Oscillator Frequency	F_{MAX}			80	120	160	kHz
Oscillator Duty Cycle	D_{OSC}	V_{EXT} ” H ” side	V_{OUT} = 2.5V to 5V	65	75	85	%
			V_{OUT} = 1.5V to 2.4V	60	70	80	%

Notes:

(1)Unless otherwise provided, V_{IN} = 1.8V, V_{SS} = 0V, I_{OUT} = 10mA, T_{OPT} = 25°C, and use External Circuit of Typical Application

(2)Unless otherwise provided, V_{IN} = 3V, V_{SS}= 0V, I_{OUT} = 10mA, T_{OPT} = 25°C, and External Circuit of Typical Application

Electrical Characteristics (Refer to Figure 3)

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage Accuracy	ΔV_{OUT}			−2	--	+2	%
Input Voltage	V_{IN}			--	--	7	V
Start-up Voltage	V_{ST}	I_{OUT} = 1mA, V_{IN} : 0 → 2V		--	0.85	1.0	V
Hold-on Voltage	V_{HO}	I_{OUT} = 1mA, V_{IN} : 2 → 0V		0.7	--	--	V
Efficiency		$V_{OUT} \leq 3.5V$ (1)		--	75	--	%
		$3.5V < V_{OUT} \leq 5V$ (2)		--	85	--	
Input Current 1		V_{IN} at no load	$V_{OUT} \leq 3.5V$ (1)	--	15	18	μA
			$3.5V < V_{OUT} \leq 5V$ (2)	--	18	24	
Input Current 2		V_{OUT} in switch off condition	$V_{OUT} \leq 3.5V$ (1)	--	5	8	μA
			$3.5V < V_{OUT} \leq 5V$ (2)	--	6	10	
LX Switching Current	$I_{SWITCHING}$	V_{LX} = 0.4V	$V_{OUT} \leq 3.5V$ (1)	60	--	--	mA
			$3.5V < V_{OUT} \leq 5V$ (2)	80	--	--	
LX Leakage Current	$I_{LEAKAGE}$	V_{LX} = 6V		--	--	0.5	μA
EN “H” Level		$V_{IN} = V_{OUT} \times 0.9$		0.4 x V_{OUT}	--	--	V
EN “ L” Level		$V_{IN} = V_{OUT} \times 0.9$		--	--	0.2	V
EN “ H” Input Current		EN = V_{OUT}		--	--	0.5	μA
EN “ L“ Input Current		EN = 0V		−0.5	--	--	μA
Maximum Oscillator Frequency	F_{MAX}			80	120	160	kHz
Oscillator Duty Cycle	D_{OSC}	On (V_{LX} ” L”) side	V_{OUT} = 2.5V to 5V	65	75	85	%
			V_{OUT} = 1.5V to 2.4V	60	70	80	%
V_{LX} Voltage Limit		LX switch on		0.65	0.8	1.0	V

Notes:

(1)Unless otherwise provided, V_{IN} = 1.8V, V_{SS} = 0V, I_{OUT} = 10mA, T_{OPT} = 25°C, and use External Circuit of Typical Application

(2)Unless otherwise provided, V_{IN} = 3V, V_{SS}= 0V, I_{OUT} = 10mA, T_{OPT} = 25°C, and External Circuit of Typical Application

Electrical Characteristics (Refer to Figure 4)

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage Accuracy	ΔV_{OUT}			–2	--	+2	%
Input Voltage	V_{IN}			--	--	7	V
Start-up Voltage	V_{ST}	I_{OUT} = 1mA, V_{IN} : 0 → 2V		--	0.85	1.0	V
Efficiency		$V_{OUT} \leq 3.5V$ (1)		--	75	--	%
		$3.5V < V_{OUT} \leq 5V$ (2)		--	85	--	
Input Current 1		V_{IN} at no load	$V_{OUT} \leq 3.5V$ (1)	--	30	50	µA
			$3.5V < V_{OUT} \leq 5V$ (2)	--	60	90	
Input Current 2		V_{OUT} in switch off condition	$V_{OUT} \leq 3.5V$ (1)	--	6	10	µA
			$3.5V < V_{OUT} \leq 5V$ (2)				
EXT “H” Output Current		$V_{EXT} = V_{OUT} – 0.4V$	$V_{OUT} \leq 3.5V$ (1)	–1.5	--	--	mA
			$3.5V < V_{OUT} \leq 5V$ (2)	–2	--	--	
EXT “L” Output Current		V_{EXT} = 0.4V	$V_{OUT} \leq 3.5V$ (1)	1.5	--	--	mA
			$3.5V < V_{OUT} \leq 5V$ (2)	2	--	--	
EN “H” Level		$V_{IN} = V_{OUT} \times 0.9$		$0.4\times V_{OUT}$	--	--	V
EN “ L” Level		$V_{IN} = V_{OUT} \times 0.9$		--	--	0.2	V
EN “ H” Input Current		EN = V_{OUT}		--	--	0.5	µA
EN “ L“ Input Current		EN = 0V		–0.5	--	--	µA
Maximum Oscillator Frequency	F_{MAX}			80	120	160	kHz
Oscillator Duty Cycle	D_{OSC}	On (V_{LX} ” L”) side	V_{OUT} = 2.5V to 5V	65	75	85	%
			V_{OUT} = 1.5V to 2.4V	60	70	80	%
V_{LX} Voltage Limit		LX switch on		0.65	0.8	1.0	V

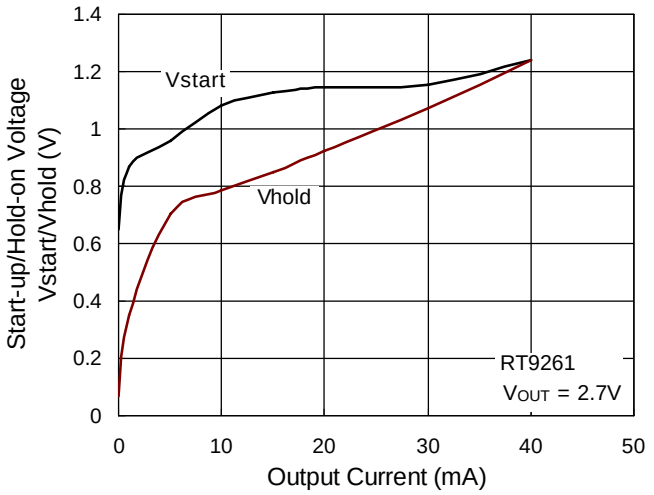
Notes:

(1)Unless otherwise provided, V_{IN} = 1.8V, V_{SS} = 0V, I_{OUT} = 10mA, T_{OPT} = 25°C, and use External Circuit of Typical Application

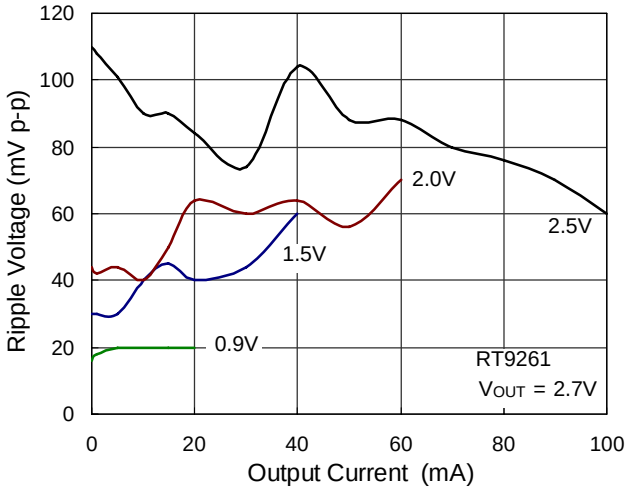
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Typical Operating Characteristics

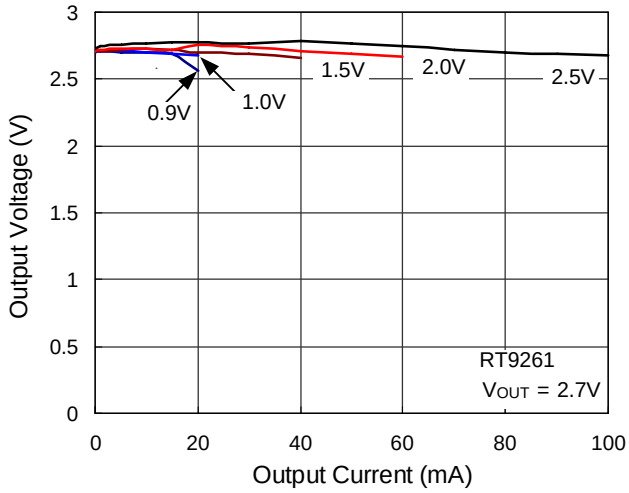
Start-up/Hold-on Voltage vs. Output Current



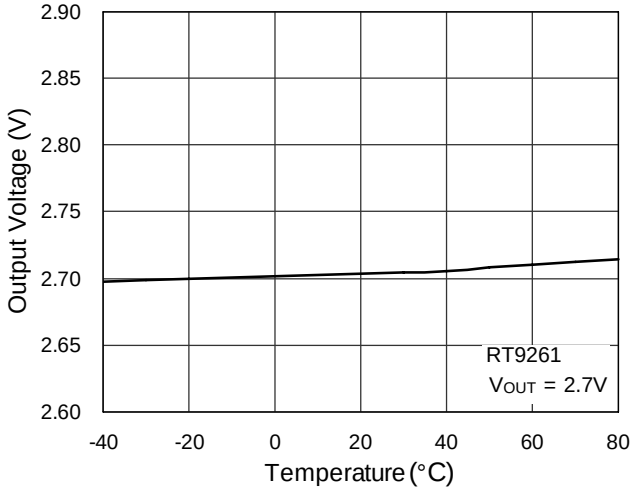
Output Current vs. Ripple Voltage



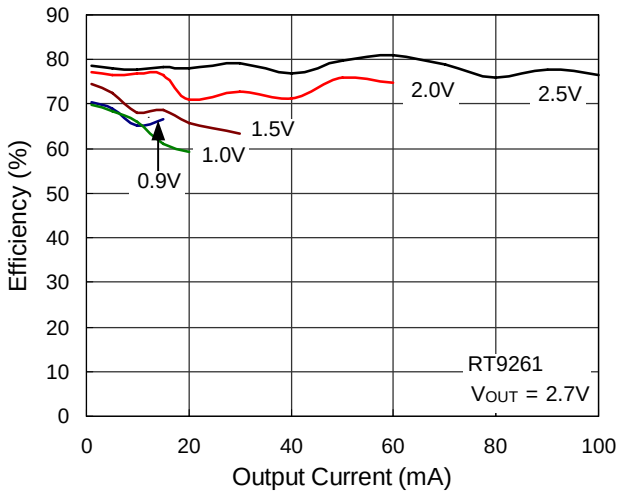
Output Voltage vs. Output Current



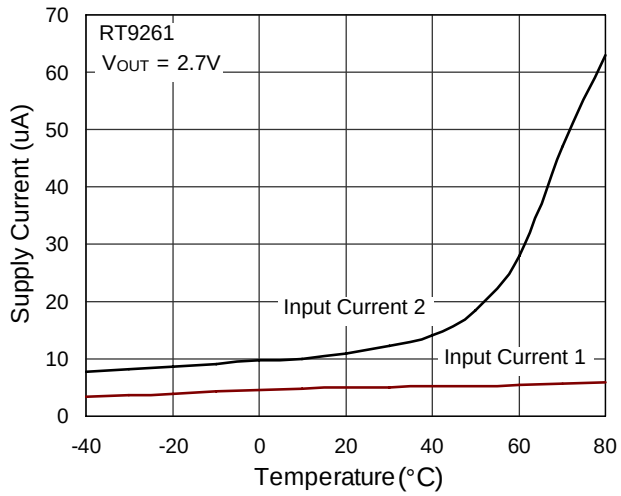
Output Voltage vs. Temperature



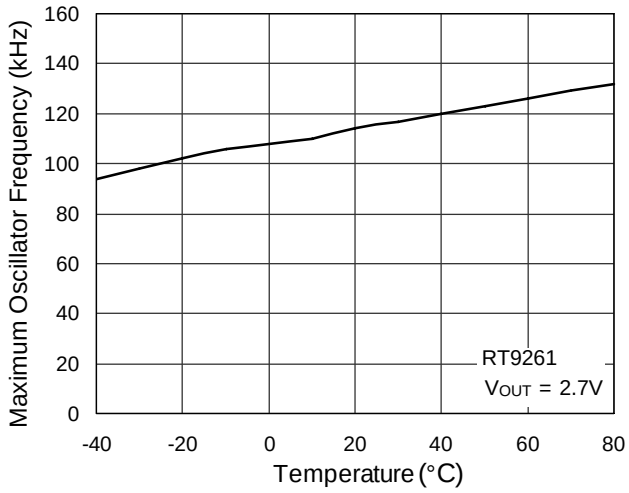
Efficiency vs. Output Current



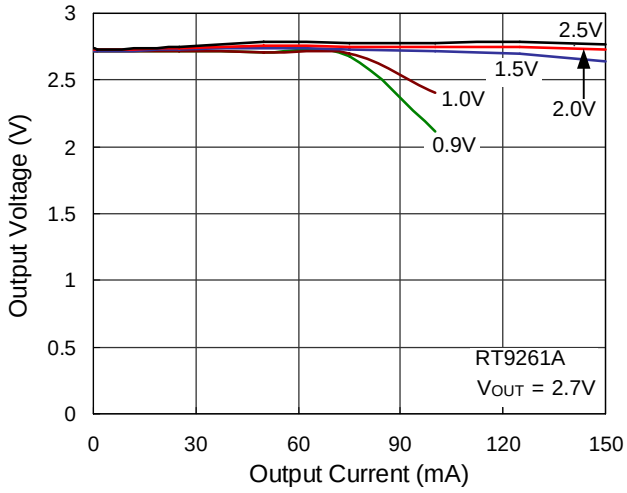
Supply Current vs. Temperature



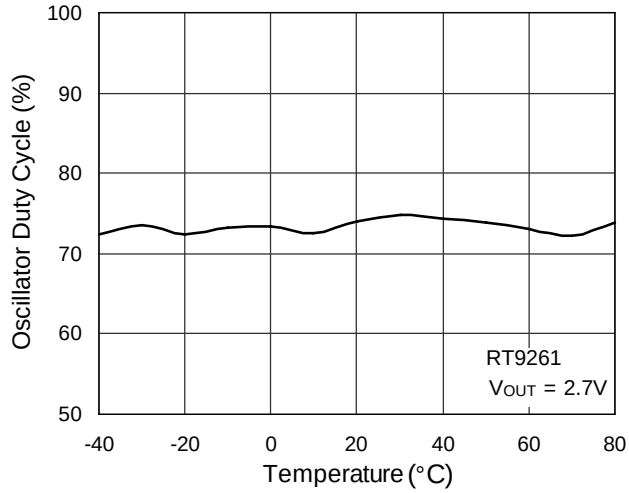
Maximum Oscillator Frequency vs. Temperature



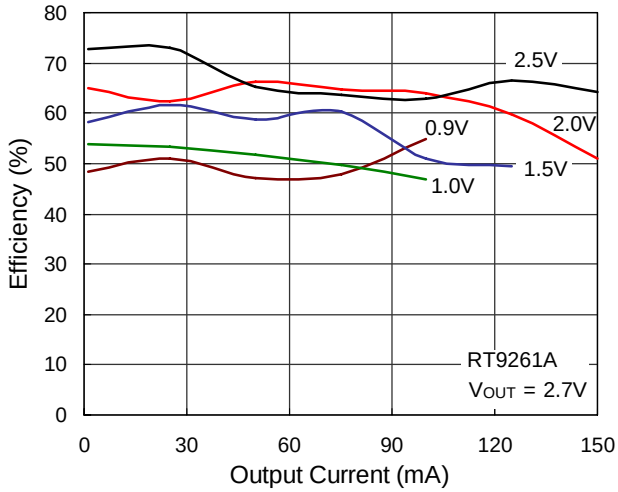
Output Voltage vs. Output Current



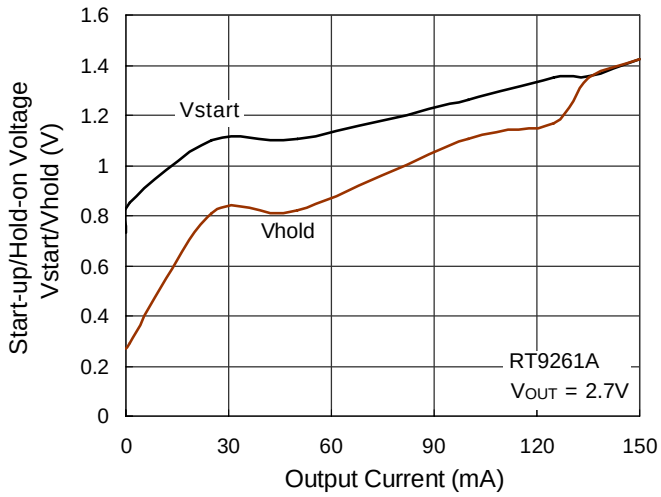
Oscillator Duty Cycle vs. Temperature



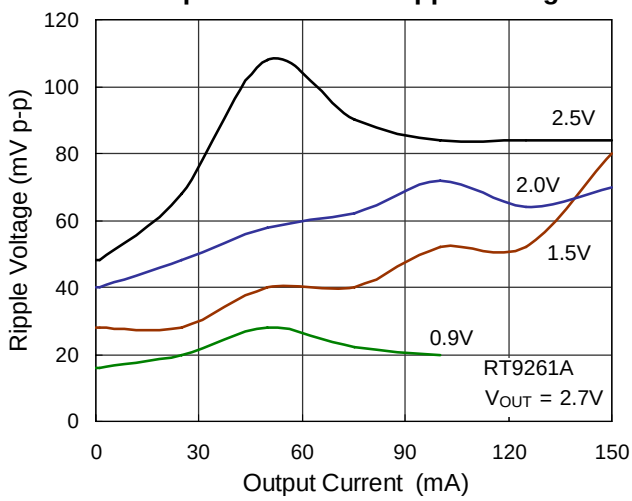
Efficiency vs. Output Current



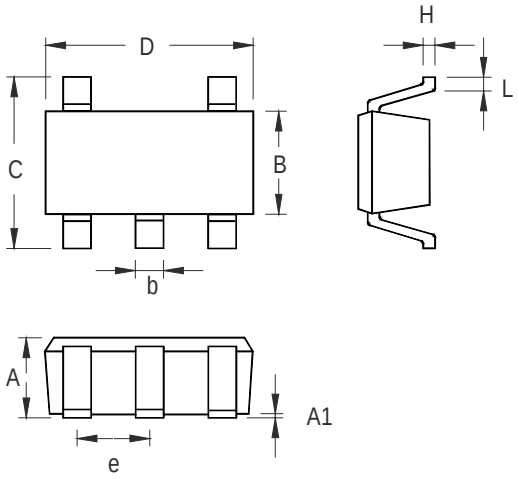
Start-up/Hold-on Voltage vs. Output Current



Output Current vs. Ripple Voltage

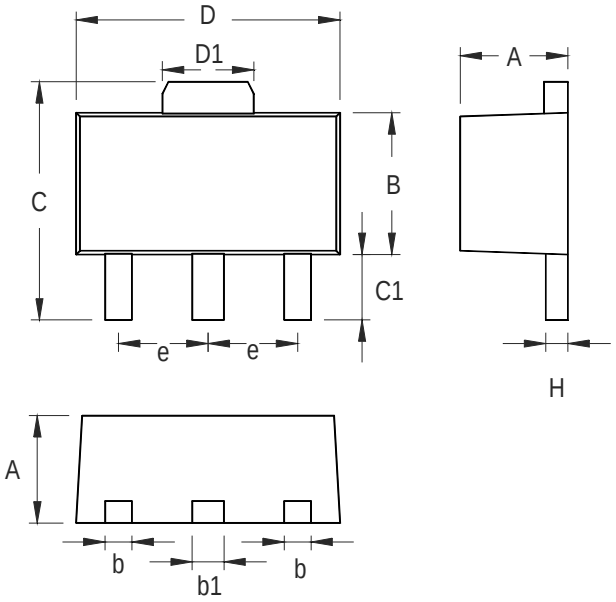


Outline Dimension



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.889	1.295	0.035	0.051
A1	0.000	0.152	0.000	0.006
B	1.397	1.803	0.055	0.071
b	0.356	0.559	0.014	0.022
C	2.591	2.997	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024

SOT-23-5 Surface Mount Package



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.397	1.600	0.055	0.063
b	0.356	0.483	0.014	0.019
B	2.388	2.591	0.094	0.102
b1	0.406	0.533	0.016	0.021
C	3.937	4.242	0.155	0.167
C1	0.787	1.194	0.031	0.047
D	4.394	4.597	0.173	0.181
D1	1.397	1.753	0.055	0.069
e	1.448	1.549	0.057	0.061
H	0.356	0.432	0.014	0.017

3-Lead SOT-89 Surface Mount

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