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
- Operating Temperature Range
  - P : Pb Free with Commercial Standard
  - G : Green (Halogen Free with Commercial Standard)
- Output Voltage
  - 15 : 1.5V
  - 16 : 1.6V
  - :
  - 49 : 4.9V
  - 50 : 5.0V
- Use external switch
- Use internal switch

Note :

RichTek Pb-free and Green 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.
- 100% matte tin (Sn) plating.

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

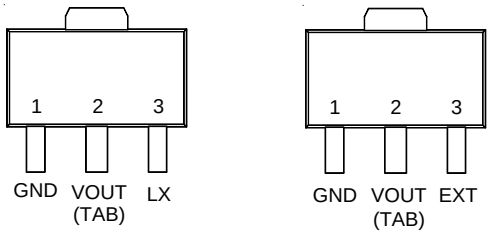
- Power source for battery-powered equipment
- Power source for cameras, camcorders, VCRs, PDAs, pagers, electronic data banks, and hand-held communication equipment
- Power source for applications, which require higher voltage than that of batteries used in the appliances

Marking Information

For marking information, contact our sales representative directly or through a RichTek distributor located in your area, otherwise visit our website for detail.

Pin Configurations

(TOP VIEW)



SOT-89

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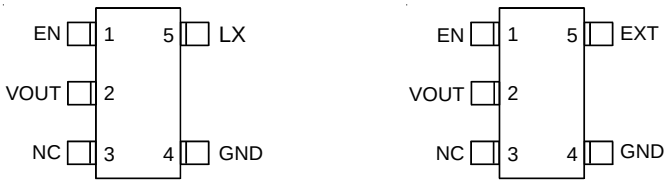

SOT-23-5

Typical Application Circuit

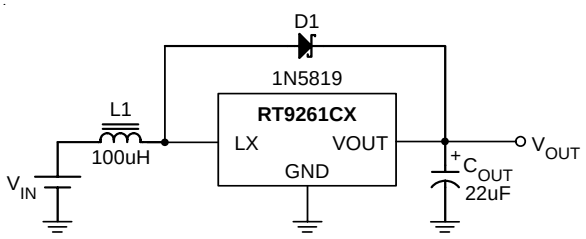

Figure 1

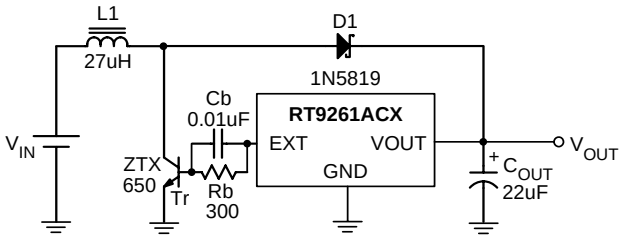

Figure 2

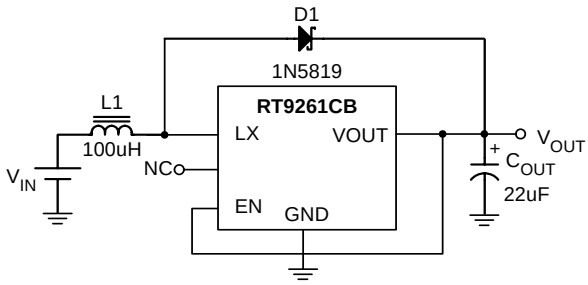

Figure 3

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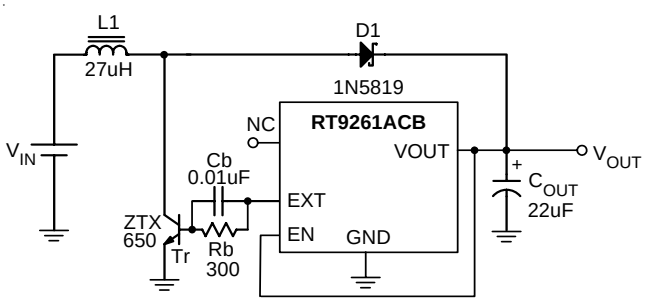

Figure 4

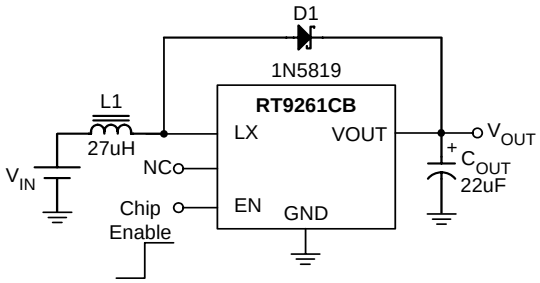

Figure 5

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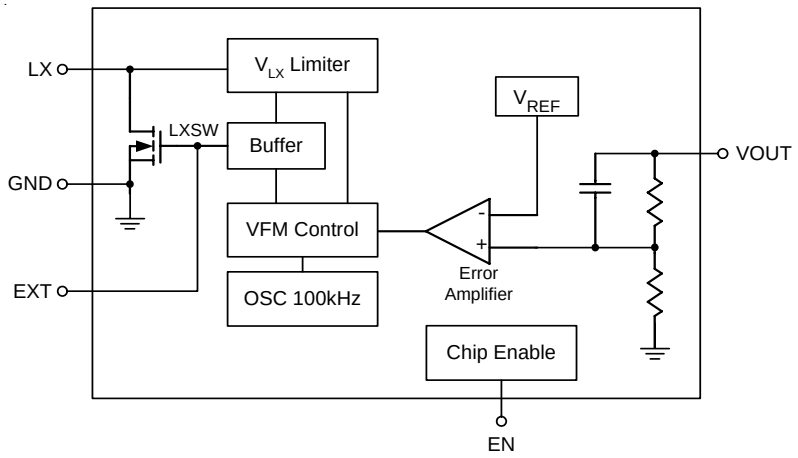
Functional Pin Description

Pin No.				Pin Name	Pin Function
-xxCX	A-xxCX	-xxCB	A-xxCB		
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 Connected

Function Block Diagram



Notes:

(1) LX Pin..... only for 9261-□□CX and 9261-□□CB

(2) EXT Pin.... only for 9261A-□□CX and 9261A-□□CB

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

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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-□□X and RT9261-□□CB

(2) Applicable to RT9261A-□□X and RT9261A-□□CB

(3) Applicable to RT9261-□□CB and RT9261A-□□CB

Electrical Characteristics (Refer to Figure 1)

Parameter		Symbol	Test Conditions	Min	Typ	Max	Units
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
Input Current 1	$V_{OUT} \leq 3.5V$ (1)		To be measured at V_{IN} at no load	--	15	18	μA
	$3.5V < V_{OUT} \leq 5V$ (2)			--	18	24	
Input Current 2			To be measured at V_{OUT} in switch off condition	--	5	8	μA
LX Switching Current	$V_{OUT} \leq 3.5V$ (1)	$I_{SWITCHING}$	V_{LX} = 0.4V	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	65	75	85	%
Efficiency				--	75	--	%
V_{LX} Voltage Limit			L_X 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 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

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Electrical Characteristics (Refer to Figure 2)

Parameter		Symbol	Test Conditions	Min	Typ	Max	Units
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	$V_{OUT} \leq 3.5V$ (1)		To be measured at V_{IN} at no load	--	30	50	μA
	$3.5V < V_{OUT} \leq 5V$ (2)			--	60	90	
Input Current 2	$V_{OUT} \leq 3.5V$ (1)		To be measured at V_{OUT} in switch off condition	--	6	10	μA
	$3.5V < V_{OUT} \leq 5V$ (2)						
EXT "H" Output Current	$V_{OUT} \leq 3.5V$ (1)		$V_{EXT} = V_{OUT} - 0.4V$	-1.5	--	--	mA
	$3.5V < V_{OUT} \leq 5V$ (2)			-2	--	--	
EXT "L" Output Current	$V_{OUT} \leq 3.5V$ (1)		V_{EXT} = 0.4V	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	65	75	85	%

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

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Electrical Characteristics (Refer to Figure 3)

Parameter		Symbol	Test Conditions	Min	Typ	Max	
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	$V_{OUT} \leq 3.5V$ (1)		To be measured at V_{IN} at no load	--	15	18	μA
	$3.5V < V_{OUT} \leq 5V$ (2)			--	18	24	
Input Current 2	$V_{OUT} \leq 3.5V$ (1)		To be measured at V_{OUT} in switch off condition	--	5	8	μA
	$3.5V < V_{OUT} \leq 5V$ (2)			--	6	10	
LX Switching Current	$V_{OUT} \leq 3.5V$ (1)	$I_{SWITCHING}$	V_{LX} = 0.4V	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× 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	65	75	85	%
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

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Electrical Characteristics (Refer to Figure 4)

Parameter		Symbol	Test Conditions	Min	Typ	Max	Units
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	$V_{OUT} \leq 3.5V$ (1)		To be measured at V_{IN} at no load	--	30	50	μA
	$3.5V < V_{OUT} \leq 5V$ (2)			--	60	90	
Input Current 2	$V_{OUT} \leq 3.5V$ (1)		To be measured at V_{OUT} in switch off condition	--	6	10	μA
	$3.5V < V_{OUT} \leq 5V$ (2)						
EXT "H" Output Current	$V_{OUT} \leq 3.5V$ (1)		$V_{EXT} = V_{OUT} - 0.4V$	-1.5	--	--	mA
	$3.5V < V_{OUT} \leq 5V$ (2)			-2	--	--	
EXT "L" Output Current	$V_{OUT} \leq 3.5V$ (1)		V_{EXT} = 0.4V	1.5	--	--	mA
	$3.5V < V_{OUT} \leq 5V$ (2)			2	--	--	
EN "H" Level			$V_{IN} = V_{OUT} \times 0.9$	0.4× 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	65	75	85	%
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}

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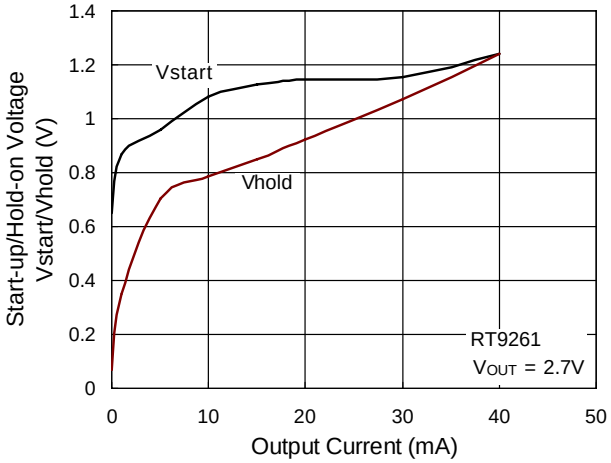
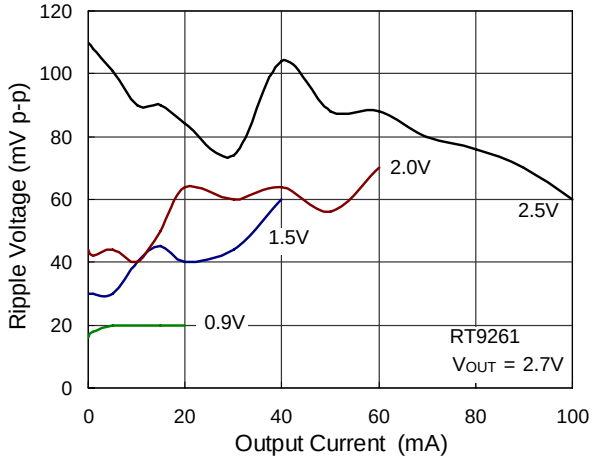
Typical Operating Characteristics

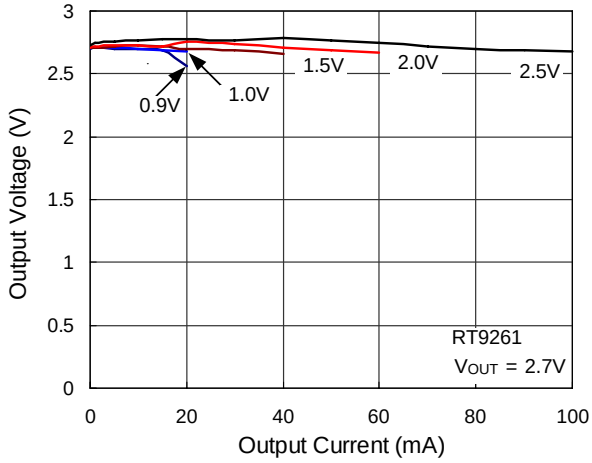
Start-up/Hold-on Voltage vs. Output Current



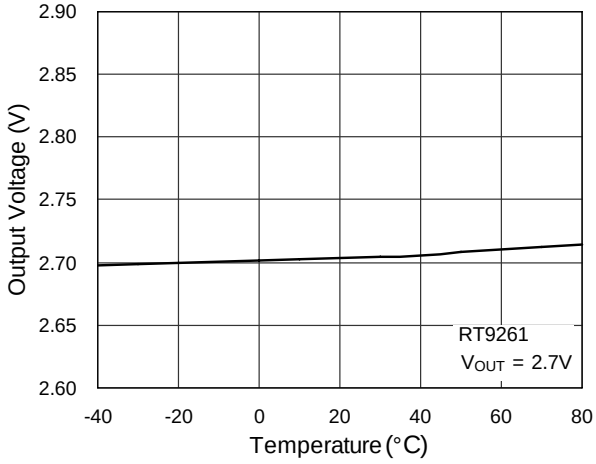
Output Current vs. Ripple Voltage



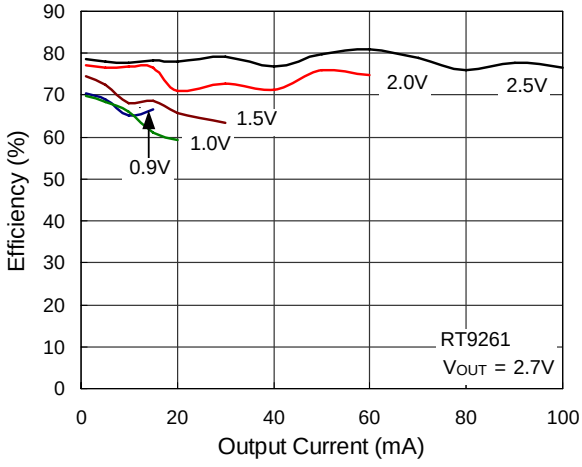
Output Voltage vs. Output Current



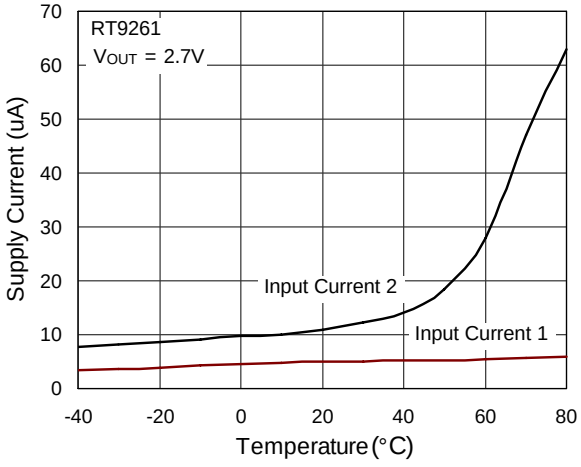
Output Voltage vs. Temperature



Efficiency vs. Output Current



Supply Current vs. Temperature



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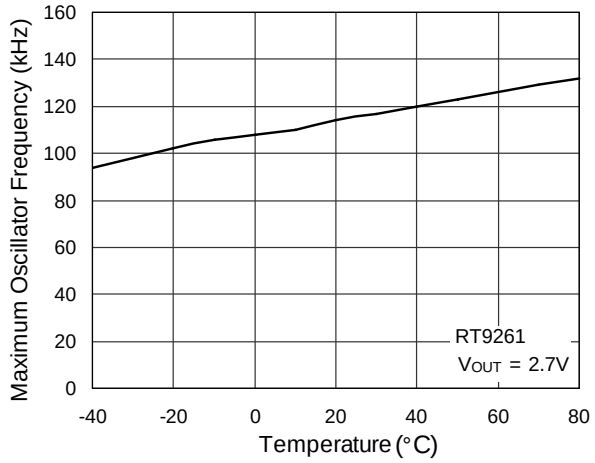
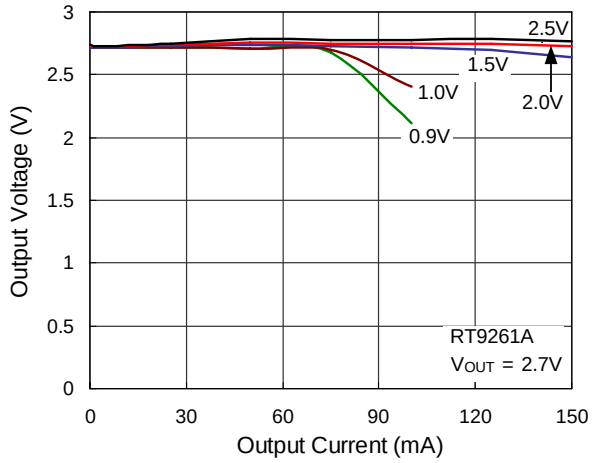
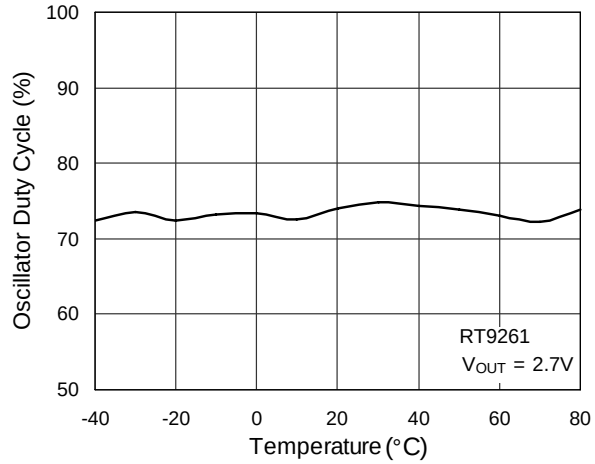
Maximum Oscillator Frequency vs. Temperature



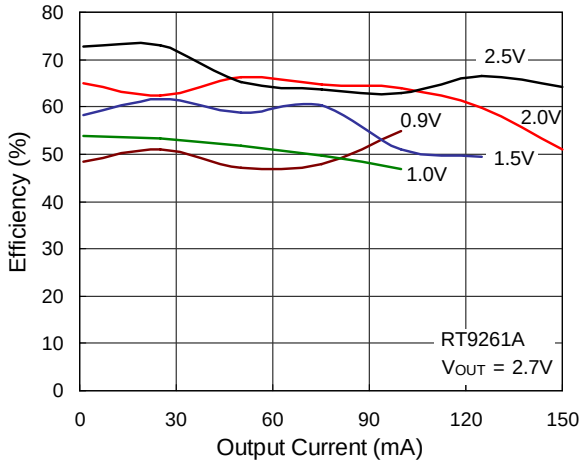
Output Voltage vs. Output Current



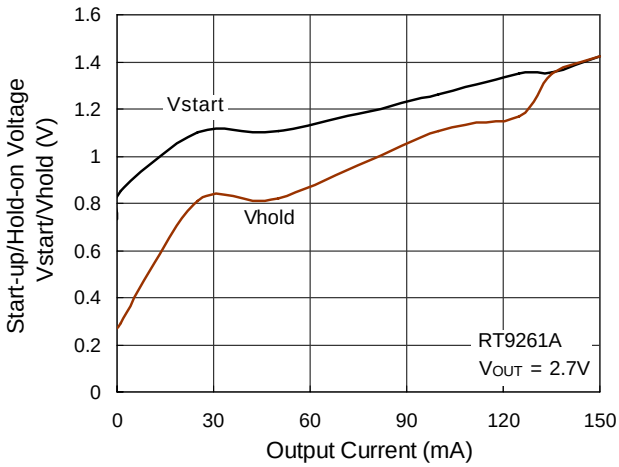
Oscillator Duty Cycle vs. Temperature



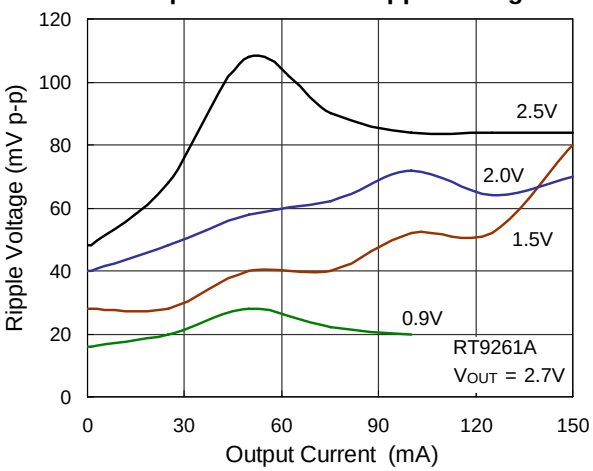
Efficiency vs. Output Current



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



Output Current vs. Ripple Voltage



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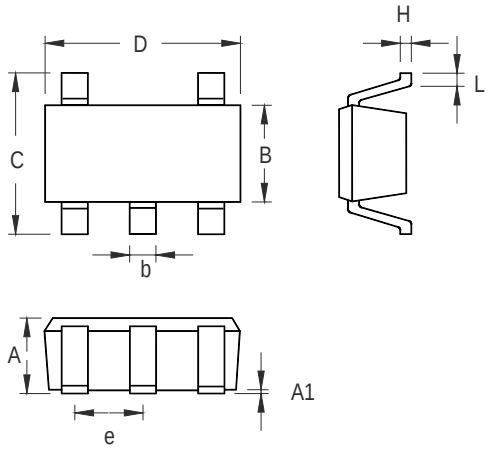
Outline Dimension



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

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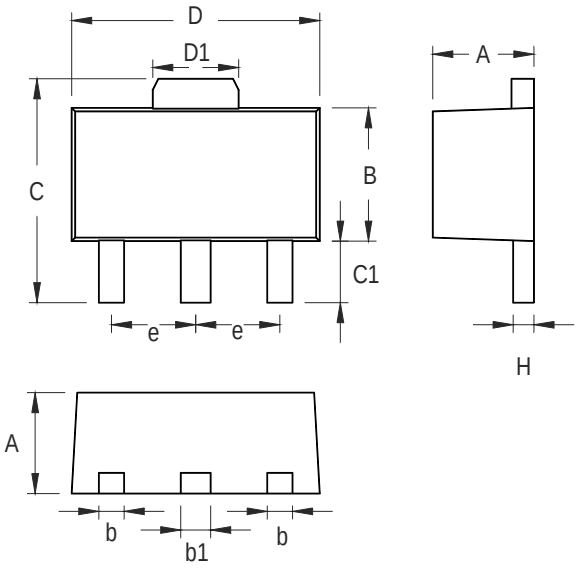

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.397	1.600	0.055	0.063
b	0.356	0.483	0.014	0.019
B	2.388	2.591	0.094	0.102
b1	0.406	0.533	0.016	0.021
C	3.937	4.242	0.155	0.167
C1	0.787	1.194	0.031	0.047
D	4.394	4.597	0.173	0.181
D1	1.397	1.753	0.055	0.069
e	1.448	1.549	0.057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

3-Lead SOT-89 Surface Mount

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