

## VFM Step-Up DC/DC Converter

### General Description

The RT9261B Series are VFM Step-up DC/DC converter ICs with ultra low supply current by CMOS process and suitable for use with battery-powered instruments.

The RT9261B 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 with the RT9261B IC and only three external components.

The EN pin enables the circuit to set the standby supply current at a maximum of 0.5µA.

### Ordering Information

RT9261B-□□□□	
	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

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

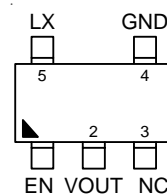
- Minimal Number of External Components (Only an Inductor, a Diode, and a Capacitor)
- Ultra Low Input Current (6.5µA at Switch Off)
- Capable of Supplying 50mA Output Current with Internal Switch
- ± 2% Output Voltage Accuracy
- Low Ripple and Low Noise
- Low Start-up Voltage, 0.8V at 1mA
- 80% Efficiency 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

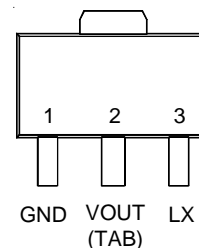
- Power source for battery-powered equipment
- Power source for cameras, camcorders, VCRs, PDAs, pagers, electronic data banks, and hand-held communication equipment
- Power source for appliances, which require higher voltage than that of batteries used in the appliances

### Pin Configurations

(TOP VIEW)

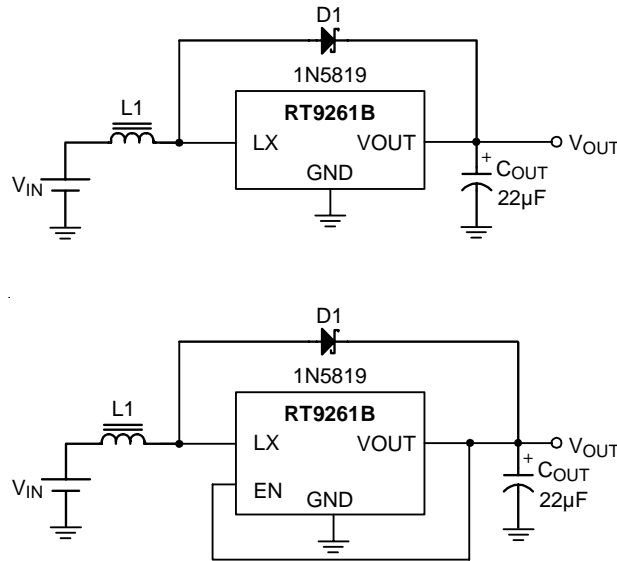


SOT-23-5



SOT-89

## Typical Application Circuit

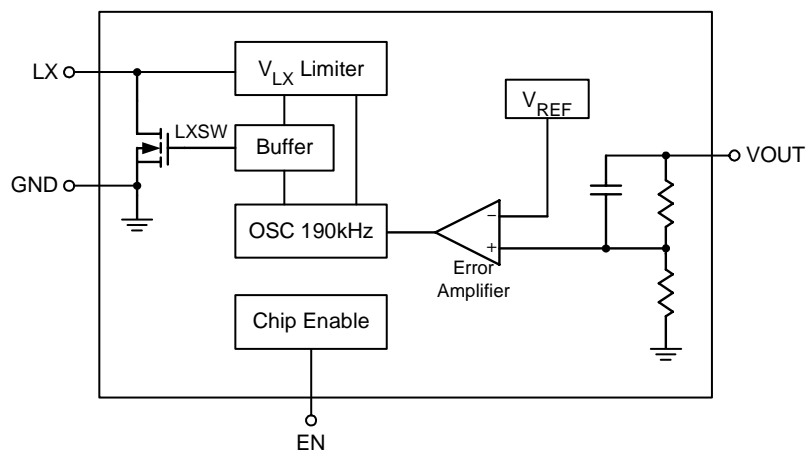


\* L1 ranges from 27µH to 120µH

## Functional Pin Description

Pin No.		Pin Name	Pin Function
SOT-23-5	SOT-89		
1	--	EN	Chip Enable (Active High).
2	2	VOUT	Output Voltage.
3	--	NC	No Internal Connection.
4	1	GND	Ground.
5	3	LX	Pin for Switching.

## Function Block Diagram



**Absolute Maximum Ratings**

- Output Voltage ----- 8V
- LX Pin Voltage ----- 8V
- EN Pin Voltage<sup>(1)</sup> ----- -0.3 to V<sub>OUT</sub> +0.3V
- LX Pin Output Current ----- 400mA
- Power Dissipation, P<sub>D</sub> @ T<sub>A</sub> = 25°C
  - SOT-89 ----- 0.5W
  - SOT-23-5 ----- 0.25W
- Package Thermal Resistance
  - SOT-89, θ<sub>JC</sub> ----- 100°C/W
  - SOT-89, θ<sub>JA</sub> ----- 300°C/W
  - SOT-23-5, θ<sub>JA</sub> ----- 250°C/W
- Operating Temperature Range ----- -20 to +85°C
- Storage Temperature Range ----- -65°C to 150°C
- Lead Temperature (Soldering, 10 sec.) ----- 260°C

Notes: (1) Applicable to RT9261B-xxCB

**Electrical Characteristics** (Refer to Figure 1)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
Output Voltage Accuracy	ΔV <sub>OUT</sub>		-2	--	+2	%	
Input Voltage	V <sub>IN</sub>		--	--	7	V	
Start-up Voltage	V <sub>ST</sub>	I <sub>OUT</sub> = 1mA, V <sub>IN</sub> : 0 → 2V	--	0.8	1	V	
Hold-on Voltage	V <sub>HO</sub>	I <sub>OUT</sub> = 1mA, V <sub>IN</sub> : 2 → 0V	0.7	--	--	V	
Input Current 1		V <sub>IN</sub> in continuous switching	V <sub>OUT</sub> ≤ 3.5V <sup>(1)</sup>	--	24	36	μA
			3.5V < V <sub>OUT</sub> ≤ 5V <sup>(2)</sup>	--	36	45	
Input Current 2 <sup>(1) (2)</sup>		V <sub>OUT</sub> in switch off condition	--	6.5	10	μA	
Input Current 3 (guaranteed by I <sub>1</sub> and I <sub>2</sub> )		V <sub>IN</sub> in no load	V <sub>OUT</sub> ≤ 3.5V <sup>(1)</sup>	--	18	36	μA
			3.5V < V <sub>OUT</sub> ≤ 5V <sup>(2)</sup>	--	20	45	
LX Switching Current	I <sub>SWITCHING</sub>	V <sub>LX</sub> = 0.4V	V <sub>OUT</sub> ≤ 3.5V <sup>(1)</sup>	120	--	--	mA
			3.5V < V <sub>OUT</sub> ≤ 5V <sup>(2)</sup>	160	--	--	
LX Leakage Current	I <sub>LEAKAGE</sub>	V <sub>LX</sub> = 6V	--	--	0.5	μA	
Maximum Oscillator Frequency	F <sub>MAX</sub>	V <sub>OUT</sub> = 2.5V to 5V	140	190	240	kHz	
		V <sub>OUT</sub> = 1.5V to 2.4V	140	190	320		
Oscillator Duty Cycle	D <sub>OSC</sub>	On (V <sub>LX</sub> "L" side)	V <sub>OUT</sub> = 2.5V to 5V	65	75	85	%
			V <sub>OUT</sub> = 1.5V to 2.4V	60	70	80	
Efficiency			--	80	--	%	
V <sub>LX</sub> Voltage Limit		LX switch on	0.65	0.8	1.0	V	

Notes:

(1) V<sub>IN</sub> = 1.8V, V<sub>SS</sub> = 0V, I<sub>OUT</sub> = 1mA, T<sub>opt</sub> = 25°C, and use External Circuit of Typical Application

(2) V<sub>IN</sub> = 3V, V<sub>SS</sub> = 0V, I<sub>OUT</sub> = 1mA, T<sub>opt</sub> = 25°C, and External Circuit of Typical Application

**Electrical Characteristics** (Refer to Figure 2)

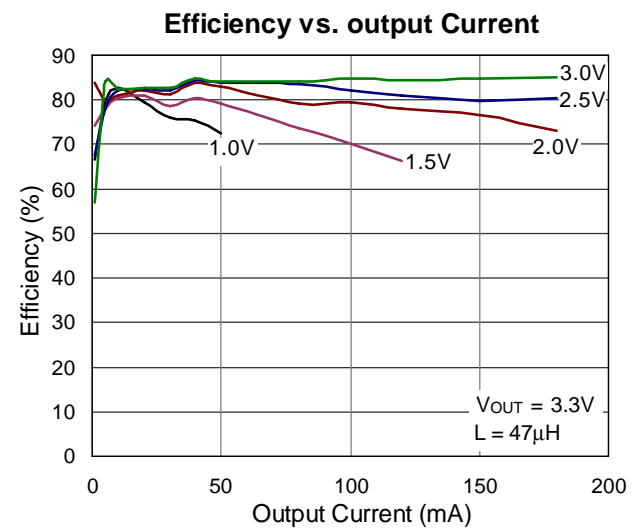
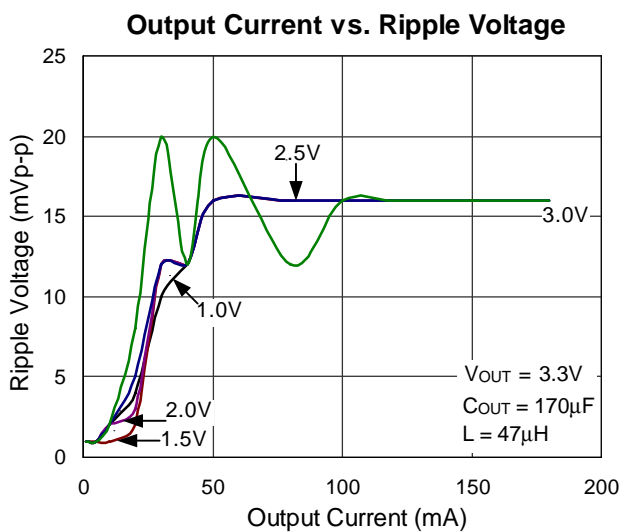
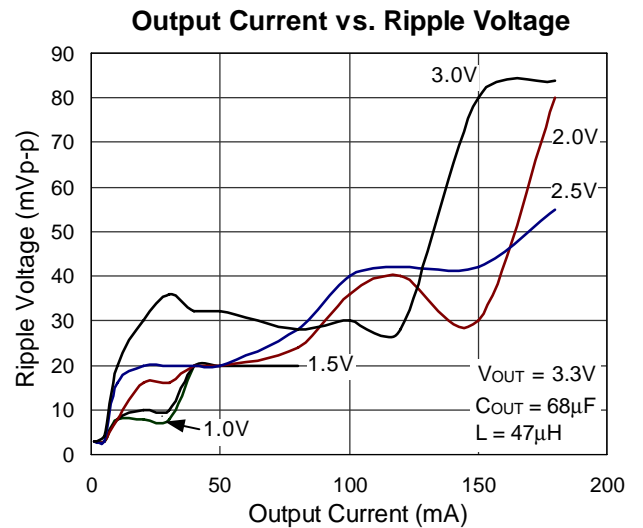
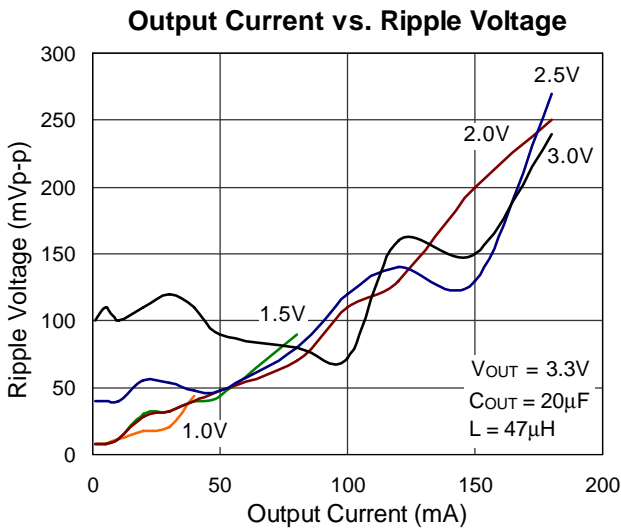
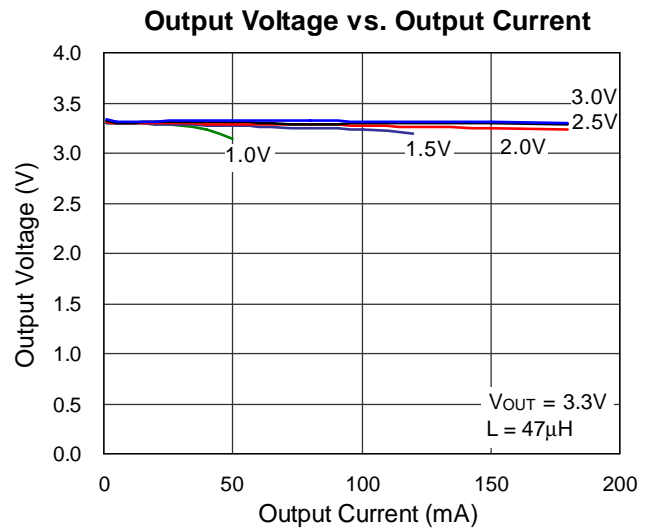
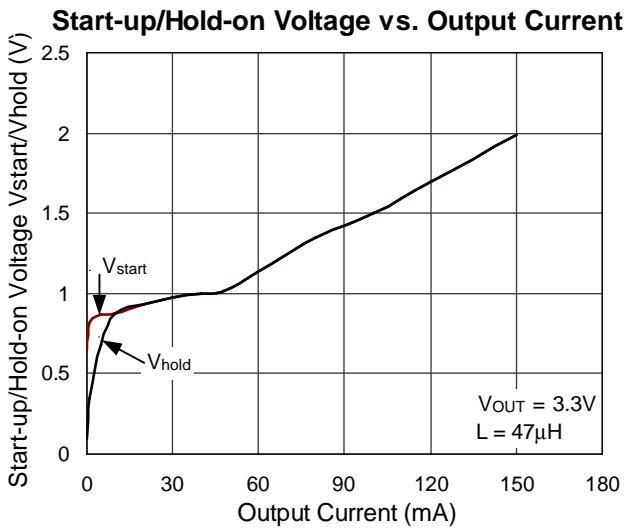
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
Output Voltage Accuracy	$\Delta V_{OUT}$		-2	--	+2	%	
Input Voltage	$V_{IN}$		--	--	7	V	
Start-up Voltage	$V_{ST}$	$I_{OUT} = 1mA, V_{IN}: 0 \rightarrow 2V$	--	0.8	1	V	
Hold-on Voltage	$V_{HO}$	$I_{OUT} = 1mA, V_{IN}: 2 \rightarrow 0V$	0.7	--	--	V	
Efficiency			--	80	--	%	
Input Current 1		$V_{IN}$ in continuous switching	$V_{OUT} \leq 3.5V^{(1)}$	--	24	36	$\mu A$
			$3.5V < V_{OUT} \leq 5V^{(2)}$	--	36	45	
Input Current 2 <sup>(1)(2)</sup>		$V_{OUT}$ in switch off condition	--	6.5	10	$\mu A$	
Input Current 3 (guaranteed by $I_1$ and $I_2$ )		$V_{IN}$ in no load	$V_{OUT} \leq 3.5V^{(1)}$	--	18	36	$\mu A$
			$3.5V < V_{OUT} \leq 5V^{(2)}$	--	20	45	
LX Switching Current	$I_{SWITCHING}$	$V_{LX} = 0.4V$	$V_{OUT} \leq 3.5V^{(1)}$	120	--	--	mA
			$3.5V < V_{OUT} \leq 5V^{(2)}$	160	--	--	
LX Leakage Current	$I_{LEAKAGE}$	$V_{LX} = 6V$	--	--	0.5	$\mu A$	
EN "H" Level		$V_{IN} = V_{OUT} * 0.9$	0.4 x $V_{OUT}$	--	--	V	
EN "L" Level		$V_{IN} = V_{OUT} * 0.9$	--	--	0.2	V	
EN "H" Input Current		$EN = V_{OUT}$	--	--	0.5	$\mu A$	
EN "L" Input Current		$EN = 0V$	-0.5	--	--	$\mu A$	
Maximum Oscillator Frequency	$F_{MAX}$	$V_{OUT} = 2.5V$ to $5V$	140	190	240	kHz	
		$V_{OUT} = 1.5V$ to $2.4V$	140	190	320		
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:

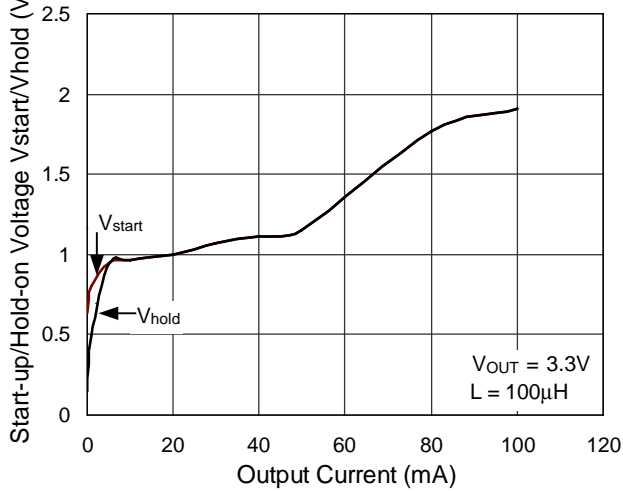
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(2)  $V_{IN} = 3V, V_{SS} = 0V, I_{OUT} = 1mA, T_{opt} = 25^\circ C$ , and External Circuit of Typical Application

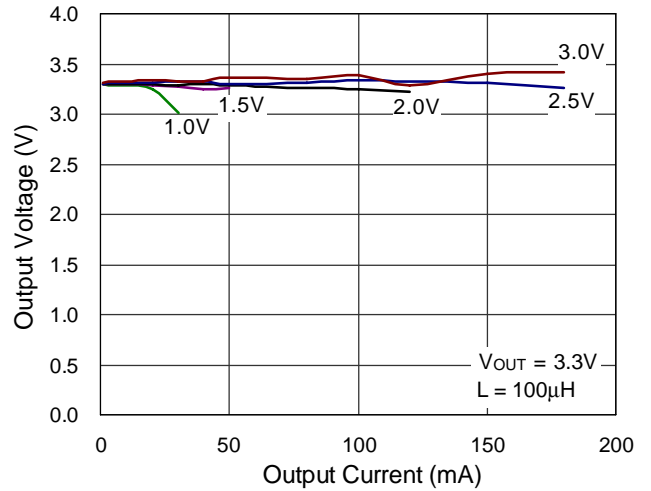
Typical Operating Characteristics



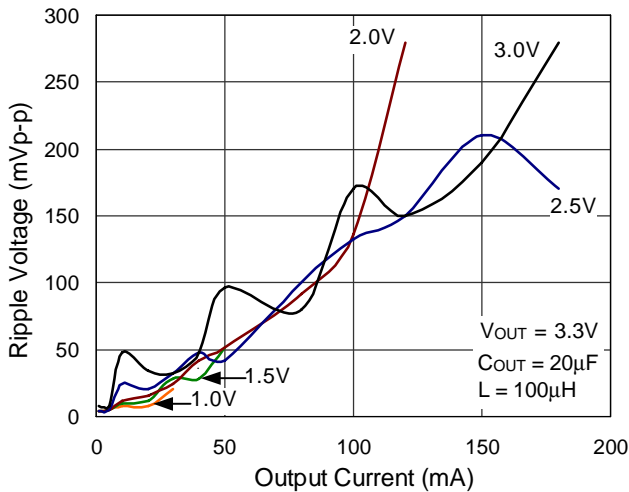
Start-up/Hold-on Voltage vs. Output Current



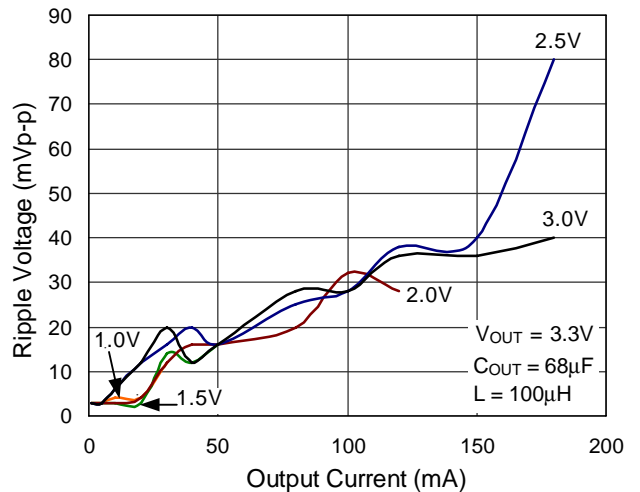
Output Voltage vs. Output Current



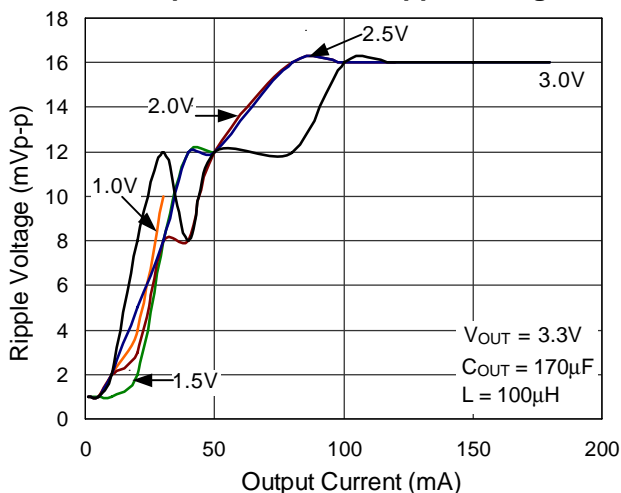
Output Current vs. Ripple Voltage



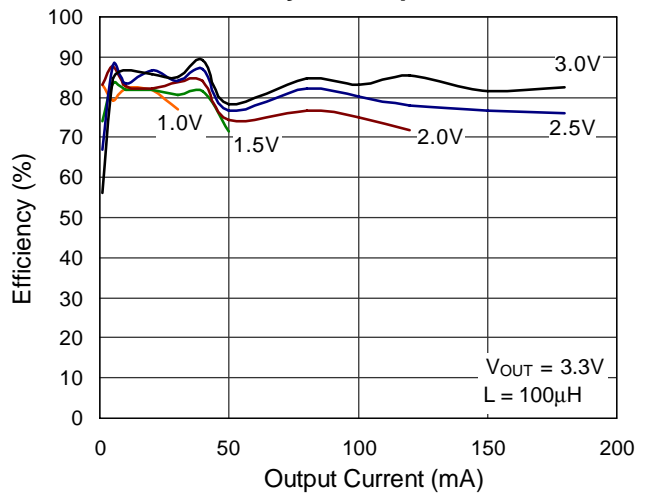
Output Current vs. Ripple Voltage



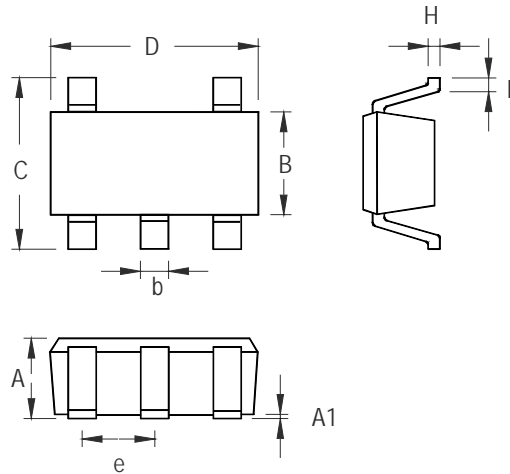
Output Current vs. Ripple Voltage



Efficiency vs. output Current

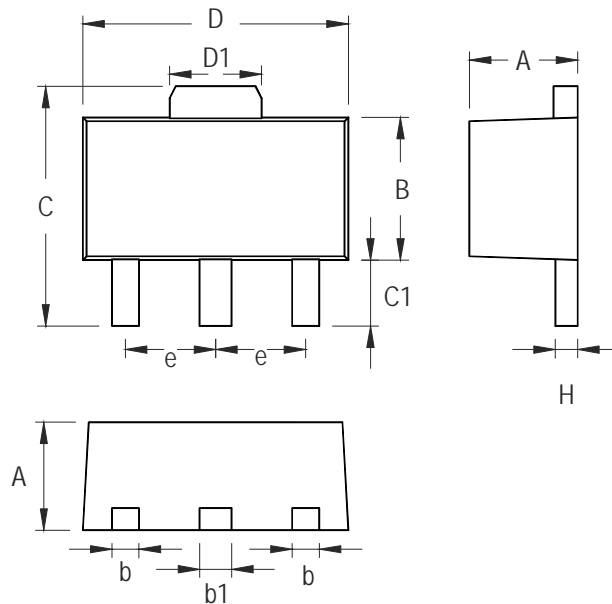


**Outline Dimension**



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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