Tiny Package, High Efficiency, Step-Up DC/DC Converter

General Description

The RT9266B is a compact, high efficiency, and low voltage step-up DC/DC converter with an Adaptive Current Mode PWM control loop, includes an error amplifier, ramp generator, comparator, switch pass element and driver in which providing a stable and high efficient operation over a wide range of load currents. It operates in stable waveforms without external compensation.

The low start-up input voltage below 1V makes RT9266B suitable for 1 to 4 battery cells applications with a 500mA internal switch. The 550kHz high switching rate minimized the size of external components. Besides, the 25µA low quiescent current together with high efficiency maintains long battery lifetime.

Ordering Information

RT9266B □ □

- Package Type
  E : SOT-23-6
- Operating Temperature Range
  P : Pb Free with Commercial Standard
  G : Green (Halogen Free with Commercial Standard)

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.

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.

Features

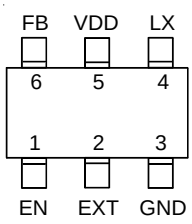
- **1.0V Low Start-up Input Voltage at 1mA Load**
- **25µA Quiescent (Switch-off) Supply Current**
- **Zero Shutdown Mode Supply Current**
- **90% Efficiency**
- **550kHz Switching Frequency at 3.3V V_{DD}**
- **Providing Flexibility for Using Internal and External Power Switches**
- **Small SOT-23-6 Package**
- **RoHS Compliant and 100% Lead (Pb)-Free**

Applications

- PDA
- DSC
- LCD Panel
- RF-Tags
- MP3
- Portable Instrument
- Wireless Equipment

Pin Configurations

(TOP VIEW)



SOT-23-6

Note : There is no pin1 indicator on top mark for SOT-23-6 type, and pin 1 will be lower left pin when reading top mark from left to right.

Typical Application Circuit

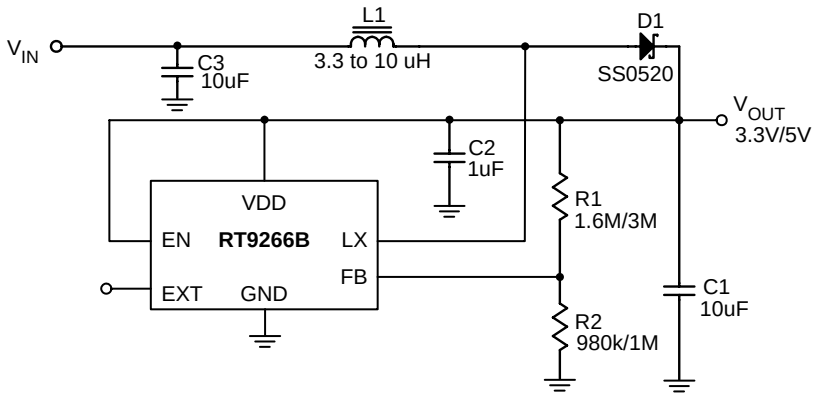


Figure 1. RT9266B Typical Application for Portable Instruments

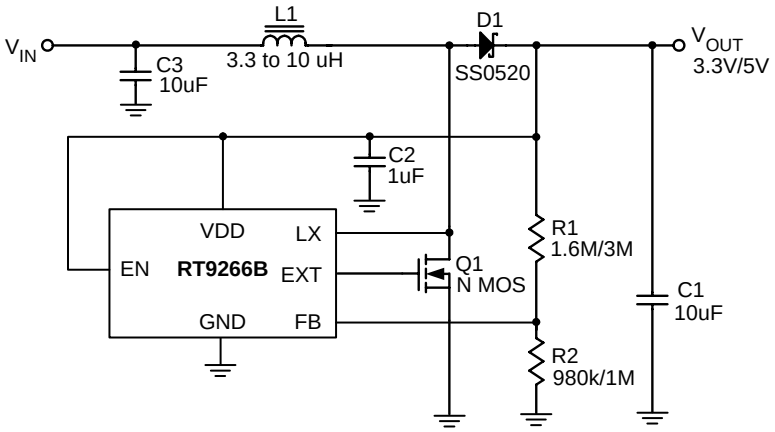
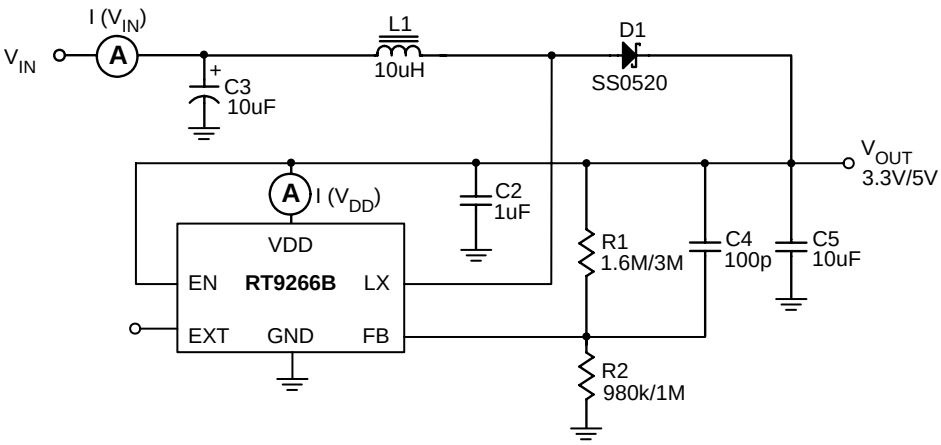


Figure 2. RT9266B for Higher Current Applications

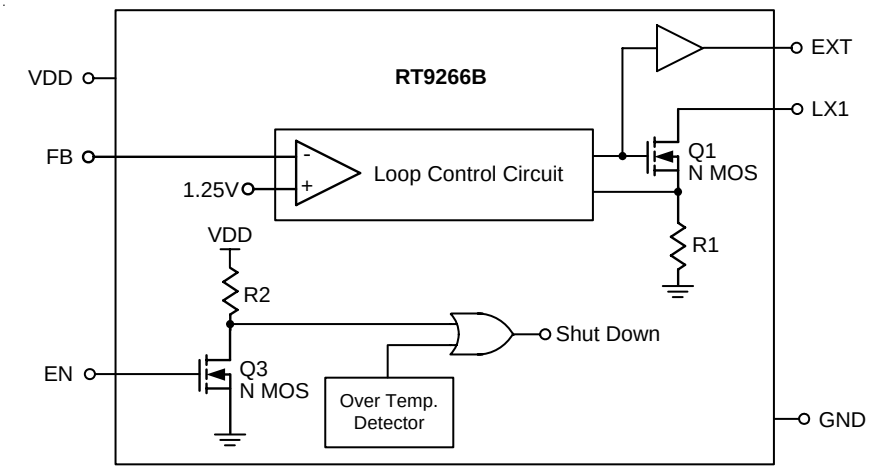
Test Circuit



Functional Pin Description

Pin Name	Pin Function
EN	Chip Enable (Active High)
EXT	Output Pin for Driving External NMOS
GND	Ground
LX	Pin for Switching
VDD	Input Positive Power Pin of RT9266B
FB	Feedback Input Pin Internal Reference Voltage for the Error Amplifier is 1.25V.

Function Block Diagram



Absolute Maximum Ratings

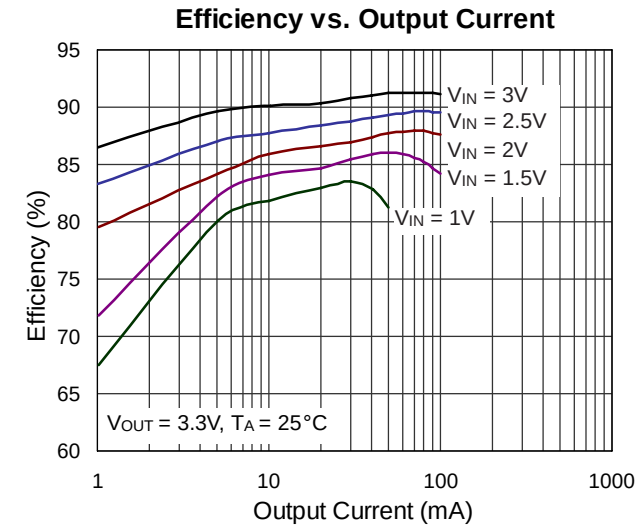
- Supply Voltage ---------- –0.3V to 7V
- LX Pin Switch Voltage ---------- –0.3V to 6.5V
- Other I/O Pin Voltages ---------- –0.3V to (V_{DD} + 0.3V)
- LX Pin Switch Current ---------- 2.5A
- EXT Pin Driver Current ---------- 200mA
- Package Thermal Resistance
  SOT-23-6, θ_{JC} ---------- 145°C/W
- Operating Junction Temperature ---------- 125°C
- Storage Temperature Range ---------- –65°C to +150°C

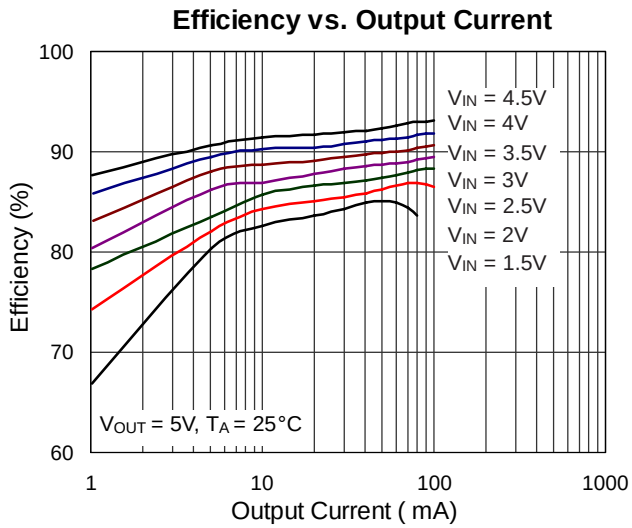
Electrical Characteristics

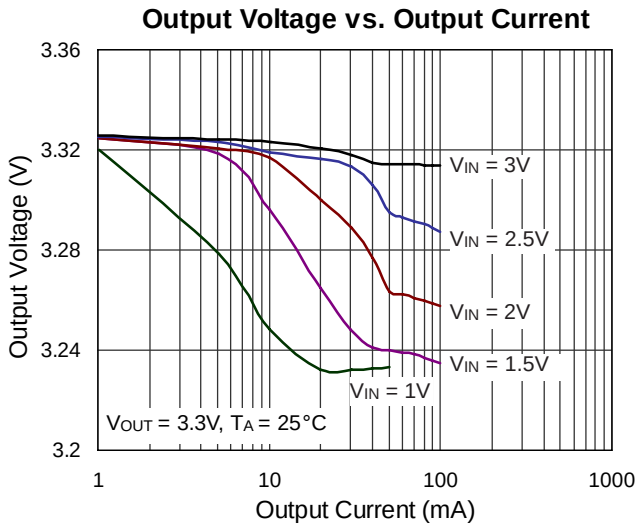
(V_{IN} = 1.5V, V_{DD} set to 3.3V, Load Current = 0, T_A = 25°C, unless otherwise specified)

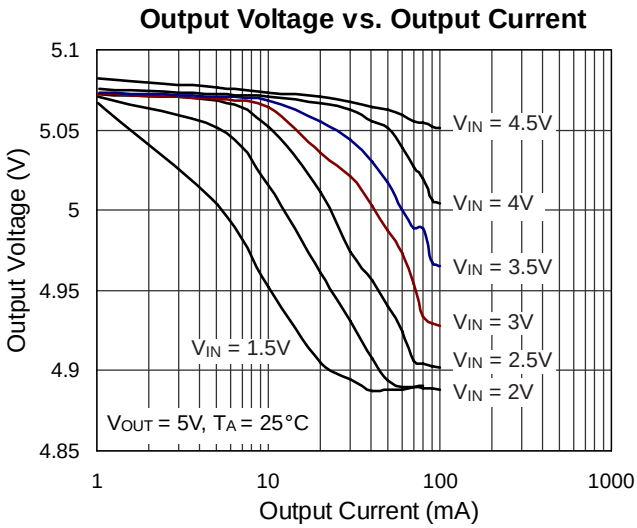
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Start-UP Voltage	V_{ST}	I_L = 1mA	--	0.98	1.05	V
Operating VDD Range	V_{DD}	VDD pin voltage	2	--	6.5	V
No Load Current I (V_{IN})	$I_{NO\ LOAD}$	V_{IN} = 1.5V, V_{OUT} = 3.3V	--	150	--	μA
Switch-off Current I (V_{DD})	$I_{SWITCH\ OFF}$	V_{IN} = 6V	--	25	--	μA
Shutdown Current I (V_{IN})	I_{OFF}	EN Pin = 0V, V_{IN} = 4.5V	--	0.01	1	μA
Feedback Reference Voltage	V_{REF}	Close Loop, V_{DD} = 3.3V	1.225	1.25	1.275	V
Switching Frequency	F_S	V_{DD} = 3.3V	--	550	--	kHz
Maximum Duty	D_{MAX}	V_{DD} = 3.3V	--	95	--	%
LX ON Resistance		V_{DD} = 3.3V	--	0.35	--	Ω
Current Limit Setting	I_{LIMIT}	V_{DD} = 3.3V	--	0.5	--	A
Current Limit Delay Time		V_{DD} = 3.3V	--	300	--	ns
EXT ON Resistance to V_{DD}		V_{DD} = 3.3V	--	5	--	Ω
EXT ON Resistance to GND		V_{DD} = 3.3V	--	5	--	Ω
Line Regulation (refer to V_{FB})	ΔV_{LINE}	V_{IN} = 1.5 ~ 2.5V, I_L = 50mA	--	12	--	mV/V
Load Regulation (refer to V_{FB})	ΔV_{LOAD}	V_{IN} = 2.5V, I_L = 1 ~ 100mA	--	0.25	--	mV/mA
EN Pin Trip Level		V_{DD} = 3.3V	0.4	0.8	1.2	V
Temperature Stability for Vout	T_S		--	50	--	ppm/°C
Thermal Shutdown	T_{SD}		--	165	--	°C
Thermal Shutdown Hysterises	ΔT_{SD}		--	10	--	°C

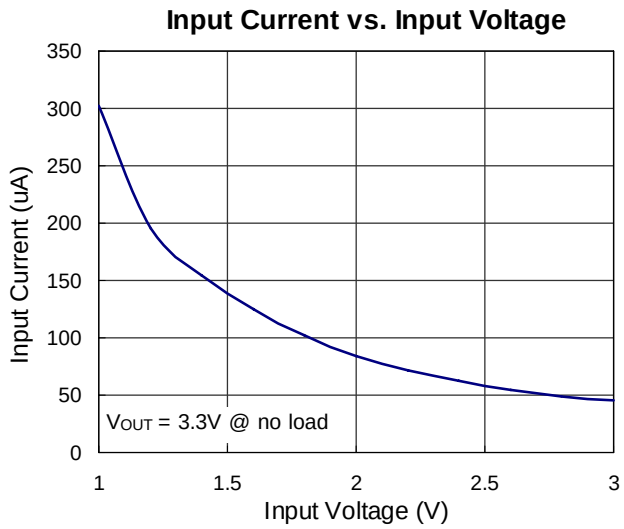
Typical Operating Characteristics

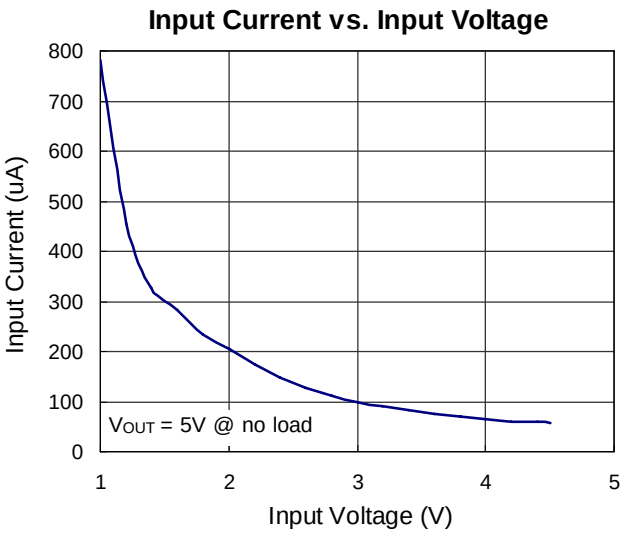




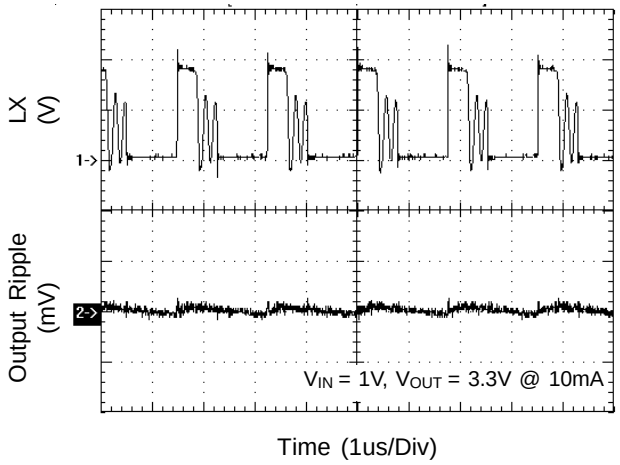








LX & Output Ripple



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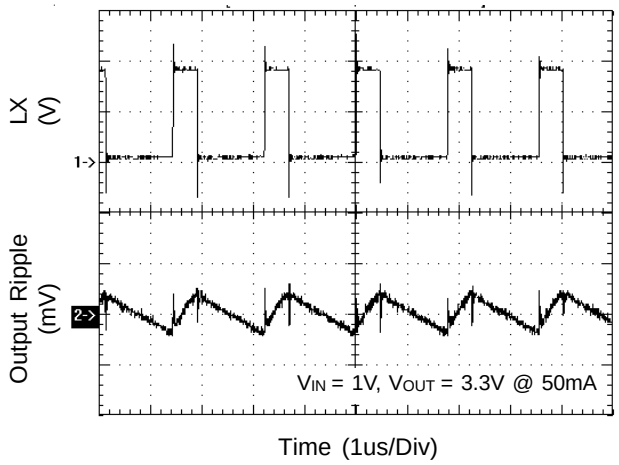

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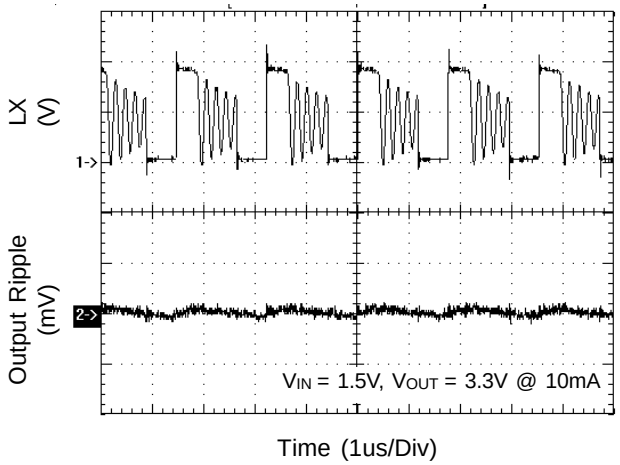

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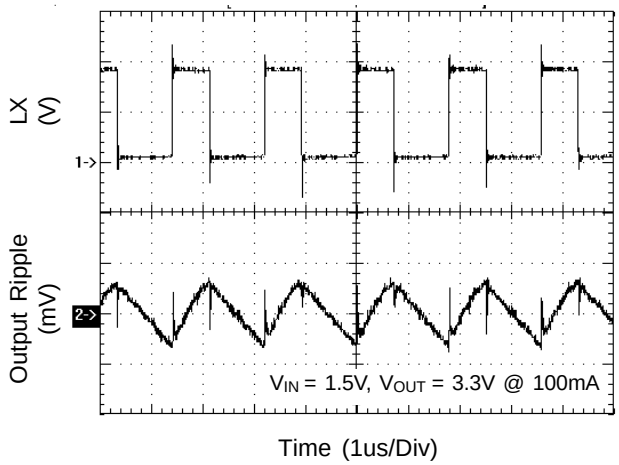

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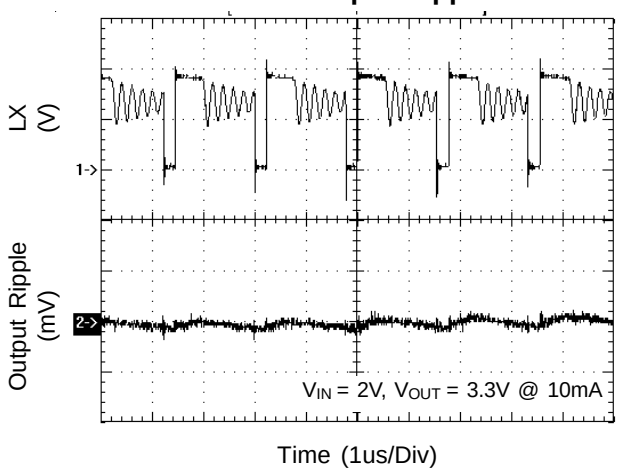

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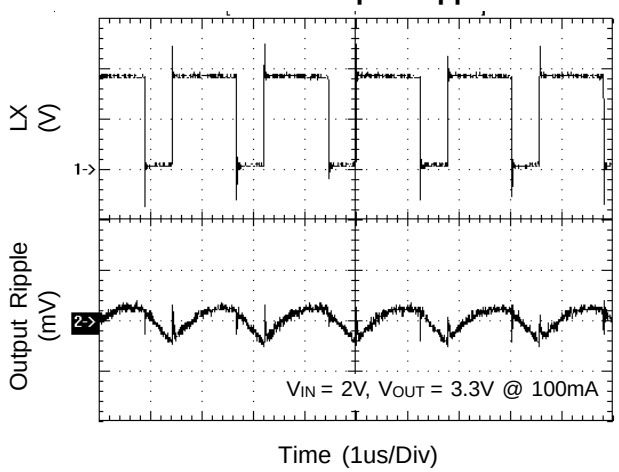
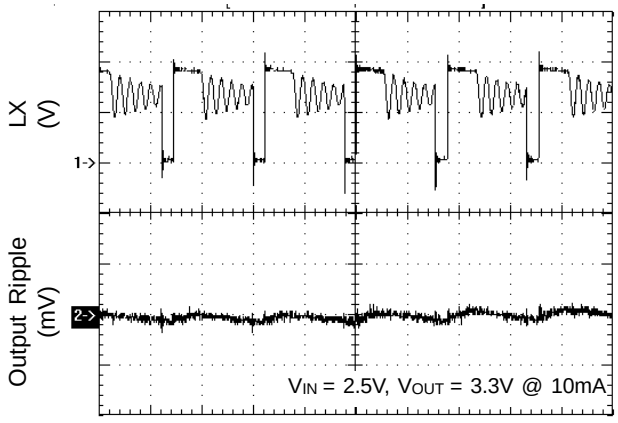
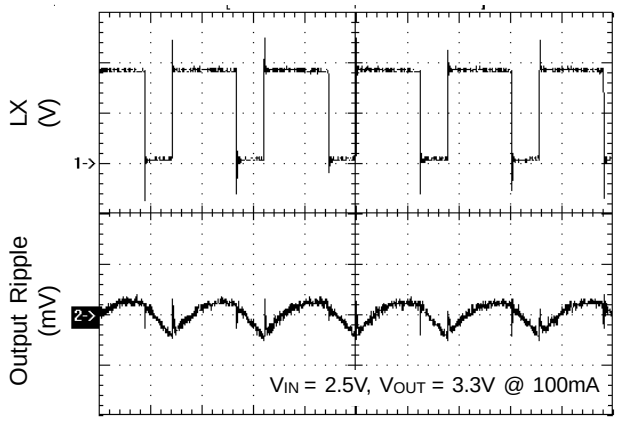


LX & Output Ripple



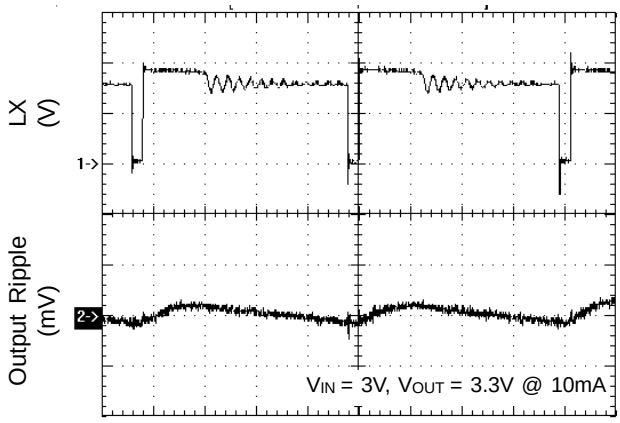
Time (1us/Div)

LX & Output Ripple



Time (1us/Div)

LX & Output Ripple



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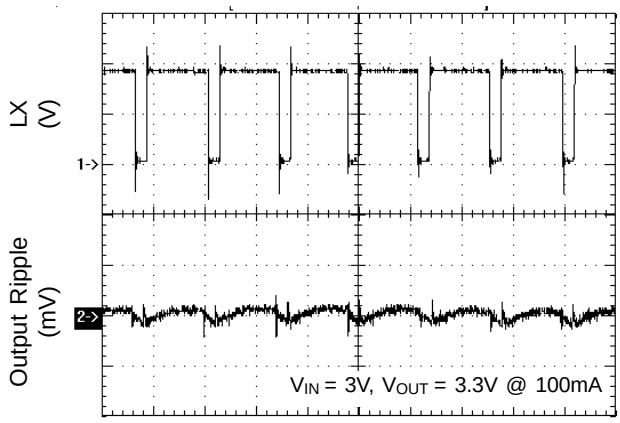
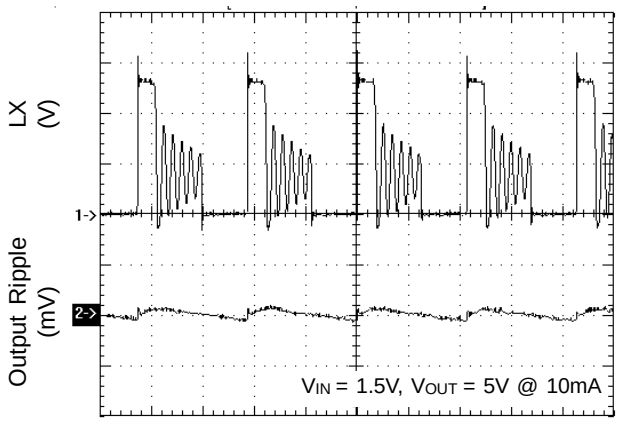


Time (1us/Div)

LX & Output Ripple



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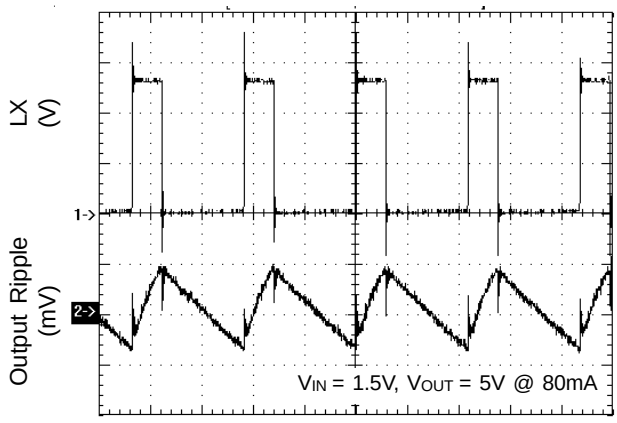
LX & Output Ripple



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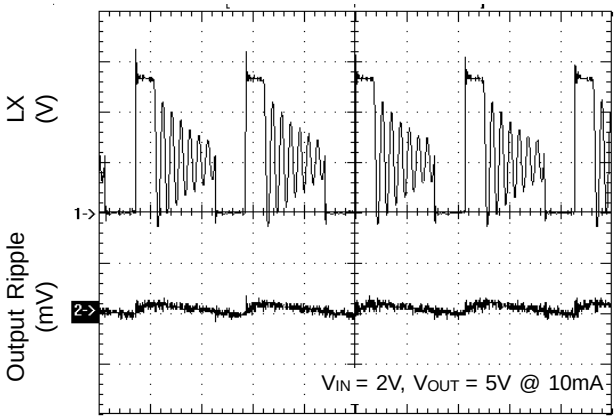
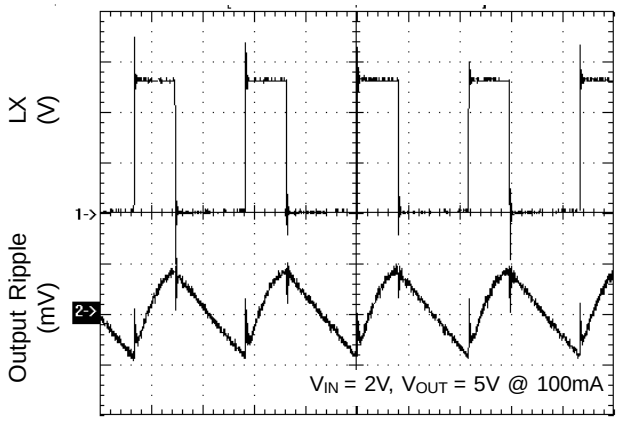
LX & Output Ripple



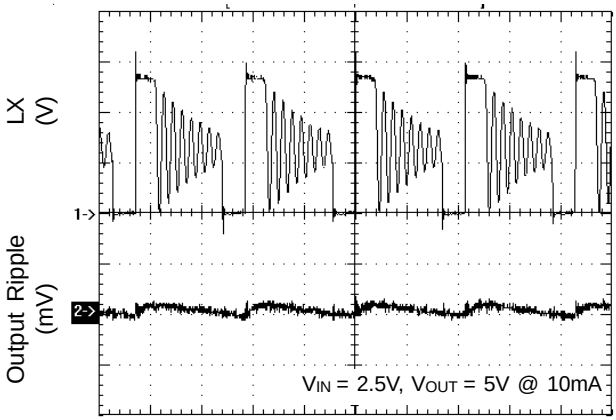
Time (1us/Div)

LX & Output Ripple



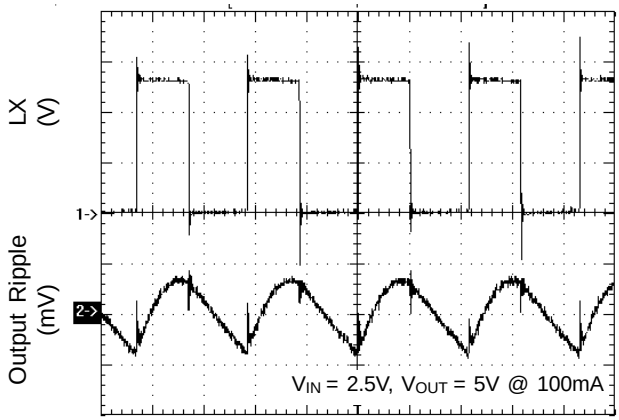
Time (1us/Div)

LX & Output Ripple



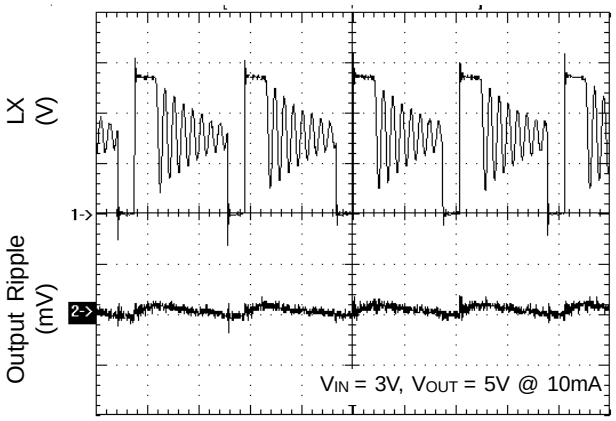
Time (1us/Div)

LX & Output Ripple



Time (1us/Div)

LX & Output Ripple



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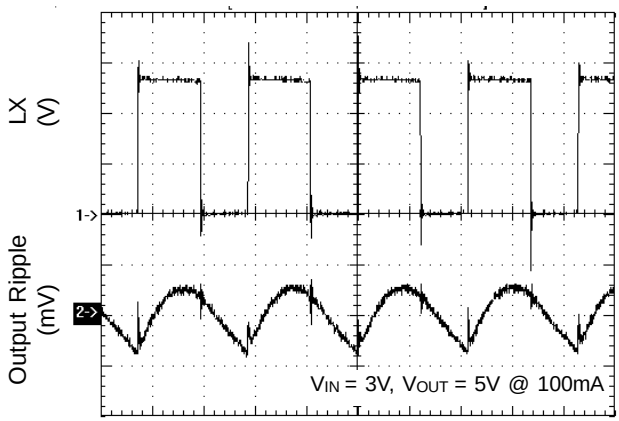
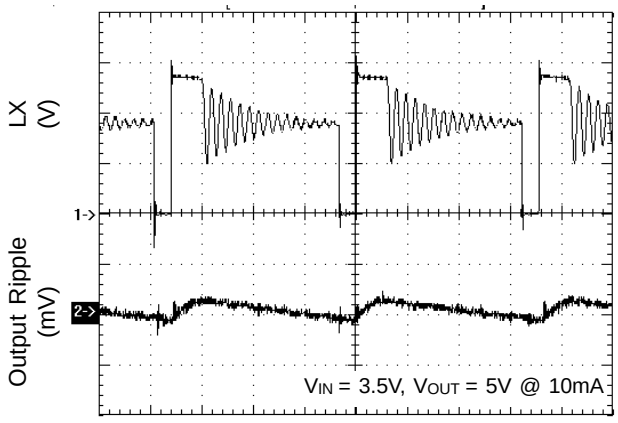
LX & Output Ripple



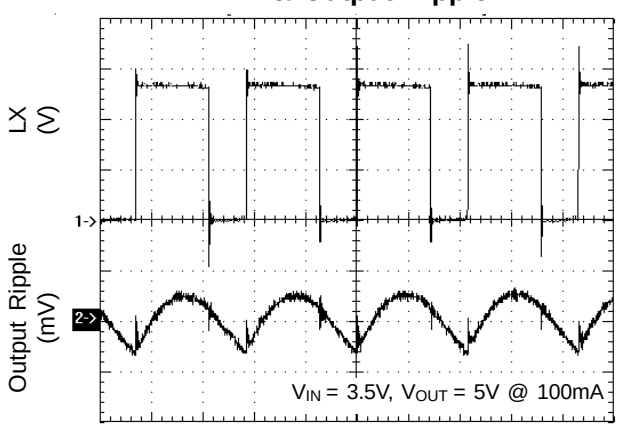
Time (1us/Div)

LX & Output Ripple



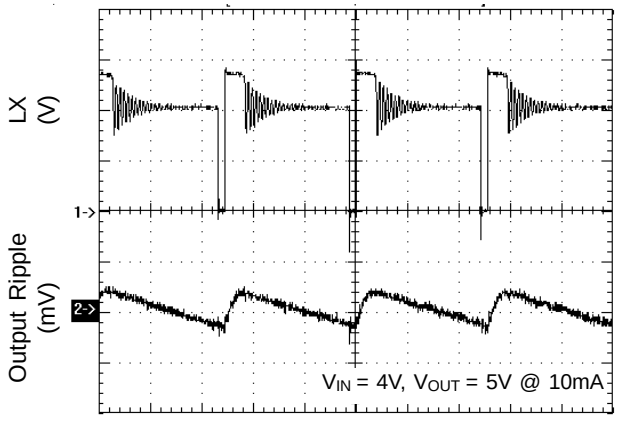
Time (1us/Div)

LX & Output Ripple



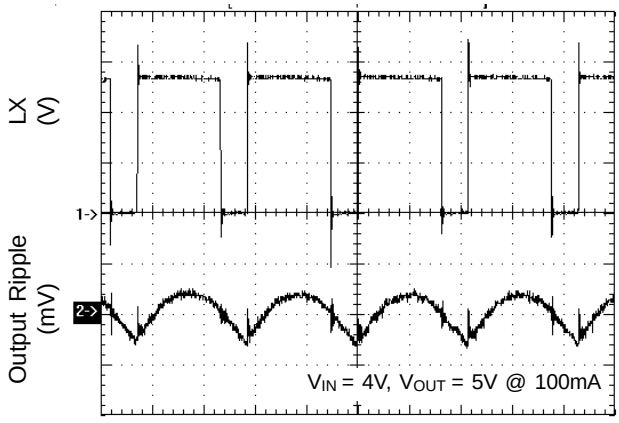
Time (1us/Div)

LX & Output Ripple



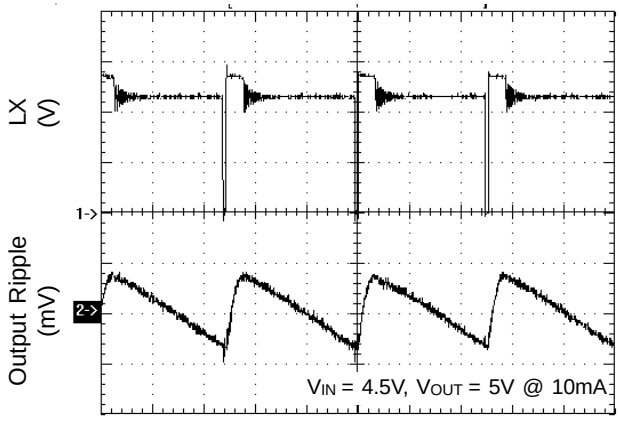
Time (2.5us/Div)

LX & Output Ripple



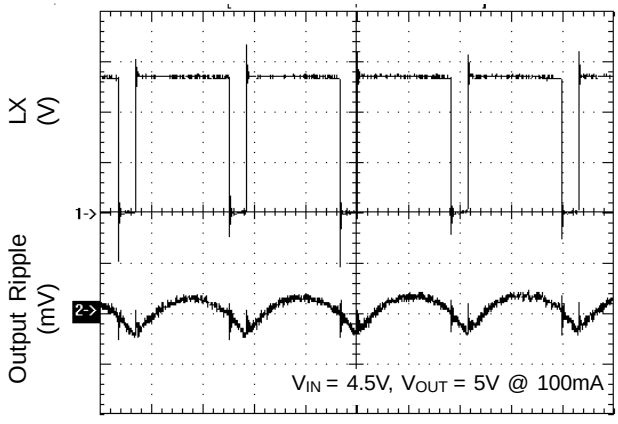
Time (1us/Div)

LX & Output Ripple



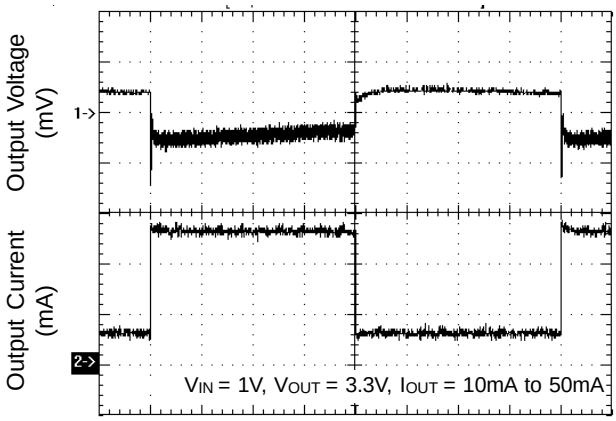
Time (5us/Div)

LX & Output Ripple



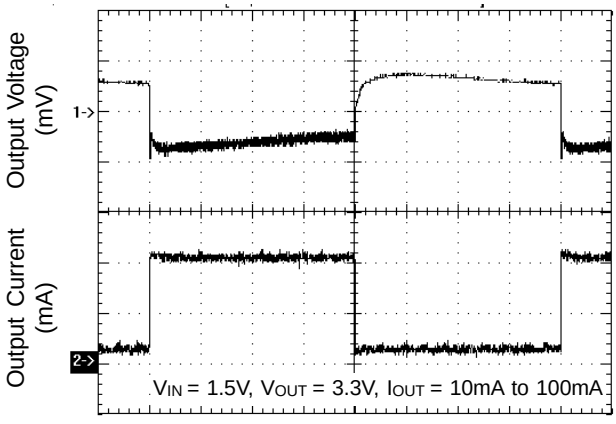
Time (1us/Div)

Load Transient Respones



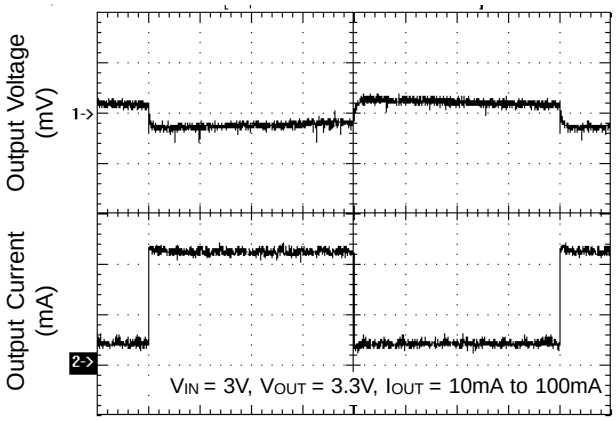
Time (2.5ms/Div)

Load Transient Respones



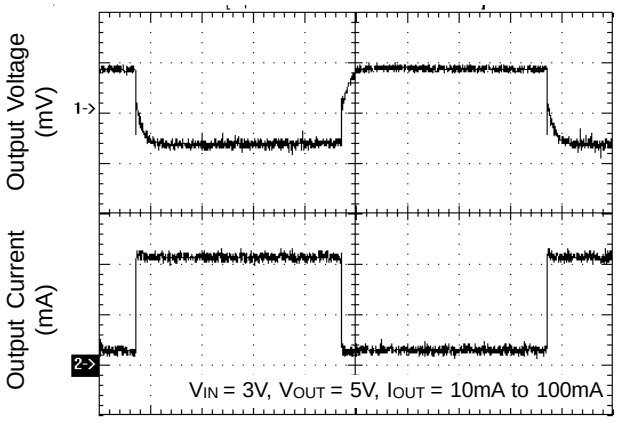
Time (2.5ms/Div)

Load Transient Respones



Time (2.5ms/Div)

Load Transient Respones



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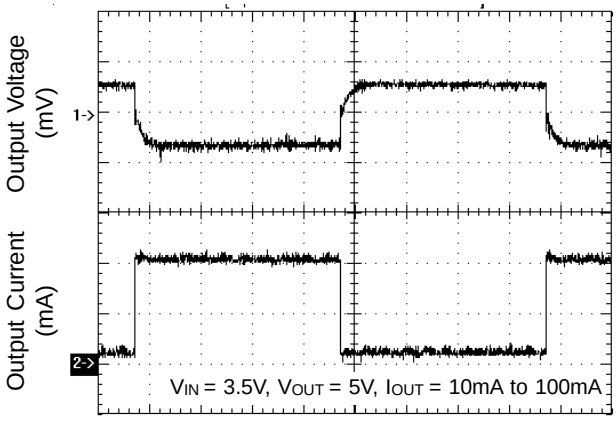
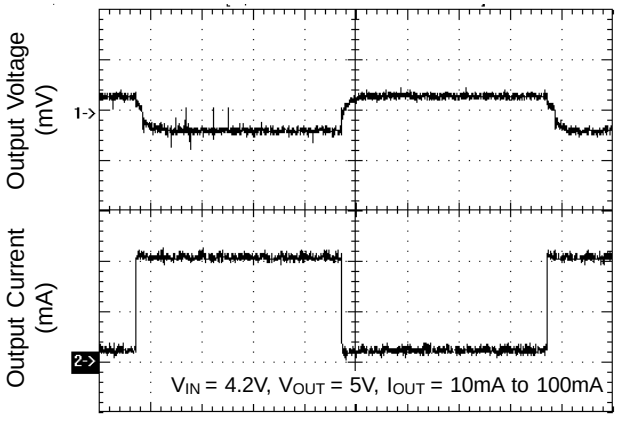
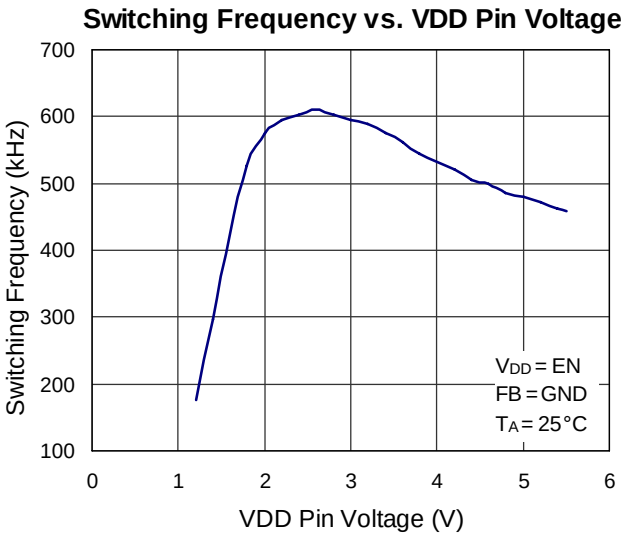


Time (2.5ms/Div)

Load Transient Respones



Time (2.5ms/Div)


Switching Frequency vs. VDD Pin Voltage
Switching Frequency (kHz)
700
600
500
400
300
200
100
0
1
2
3
4
5
6
VDD Pin Voltage (V)
VDD = EN
FB = GND
TA = 25°C

Application Information

Output Voltage Setting

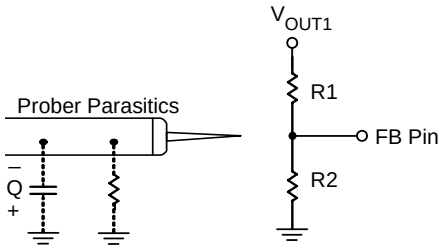
Referring to application circuits, the output voltage of the switching regulator (V_{OUT}) can be set with Equation (1).

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

Feedback Loop Design

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

- Follow Equation (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 can improve the noise immunity of the feedback loops, especially in an improper layout. An empirical suggestion is around 0~33pF for feedback resistors of MΩ, and 10nF~0.1μF for feedback resistors of tens to hundreds kΩ.

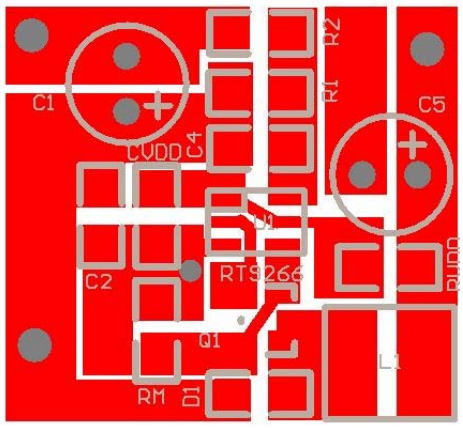
For applications without standby or suspend modes, lower values of R1 and R2 are preferred. For applications concerning the current consumption in standby or suspend modes, the higher values of R1 and R2 are needed. Such "high impedance feedback loops" are sensitive to any interference, which require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

Layout Guide

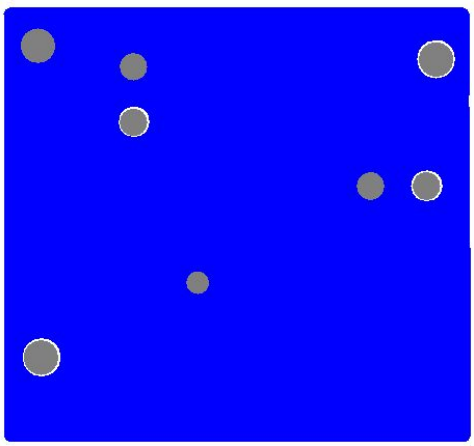
- A full GND plane without gap break.
- V_{DD} to GND noise bypass – Short and wide connection for the 1mF MLCC capacitor between Pin5 and Pin3.
- V_{IN} to GND noise bypass – Add a capacitor close to L1 inductor, when VIN is not an idea voltage source.
- Minimized FB node copper area and keep far away from noise sources.
- Minimized parasitic capacitance connecting to LX and EXT nodes, which may cause additional switching loss.

Board Layout Example (2-Layer Board)

(Refer to Application Circuit Figure 2 for the board)

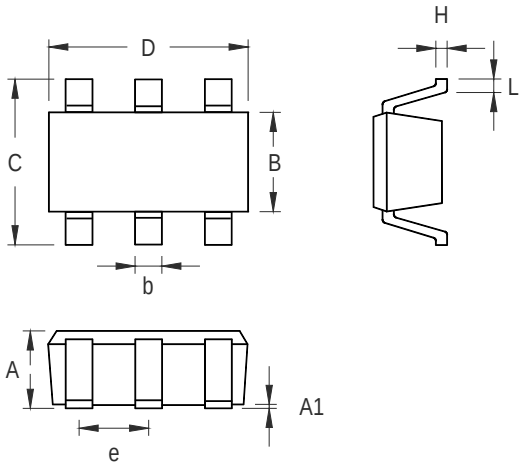


- Top Layer -



- Bottom Layer -

Outline Dimension



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.889	1.295	0.031	0.051
A1	0.000	0.152	0.000	0.006
B	1.397	1.803	0.055	0.071
b	0.250	0.560	0.010	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-23-6 Surface Mount Package

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