High Efficiency Boost Converter

General Description

The RT4813 is a boost regulator designed to provide a minimum output voltage from a single-cell Li-Ion battery or two alkaline battery series, even when the battery voltage is below system minimum. Quiescent current in shutdown mode is less than 1μA, which maximizes battery life. In boost mode, output voltage regulator is guaranteed to supply 3.1A for maxium loading.

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Performance Specification Summary

The boost conveter has an input voltage range from 1.8V to 5.5V, and the output voltage range is from 1.8V to 5.5V. It can operate in PFM mode and PWM mode in boost operation. And the power-on inrush current and current limit are implemented serval setting for difference application. The RT4813 is available in a UQFN-9L 2x2 (FC) package.

Table 1. RT4813 Evaluation Board Performance Specification Summary

Specification	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range		1.8	--	5.5	V
Output Current		2.5	--	3.25	A
Default Output Voltage	Setting by FB pin	1.8	5	5.5	V
Operation Frequency		--	500	--	kHz
Output Ripple Voltage	V_{IN} = 2.5V, V_{OUT} = 5V, I_{OUT} = 1A	--	60	--	mVp-p
Line Regulation	CCM, V_{IN} = 2.7V to 4.5V, V_{OUT} = 5V, I_{OUT} = 0.5A	--	0.5	--	%
Load Regulation	CCM, V_{IN} = 3.6V, V_{OUT} = 5V, I_{OUT} < 3.1A	--	0.5	--	%
Load Transient Response	V_{IN} = 3.7V, V_{OUT} = 5V, I_{OUT} = 1.5A to 3A	–10	--	10	%
Maximum Efficiency	V_{IN} = 1.8V to 4.2V, V_{OUT} = 5V, I_{OUT} = 0A to 3A	--	96	--	%

Power-up Procedure

Suggestion Required Equipments

- Connect input voltage (1.8V < V_{IN} < 5.5V) to VIN pin.
- Setting output voltage by FB pin.(formula shown in below section)
- Setting BOOST pre-charge current and BOOST_LIMIT for power on inrush current. (setting 0x01 and 0x03 by I^2C)
- To enable Boost converter by external EN pin.
- To connect an external load to output and verify the output voltage versus applied current.

Output Voltage Setting

The output voltage set by external feedback resistors expressed in the following equation.

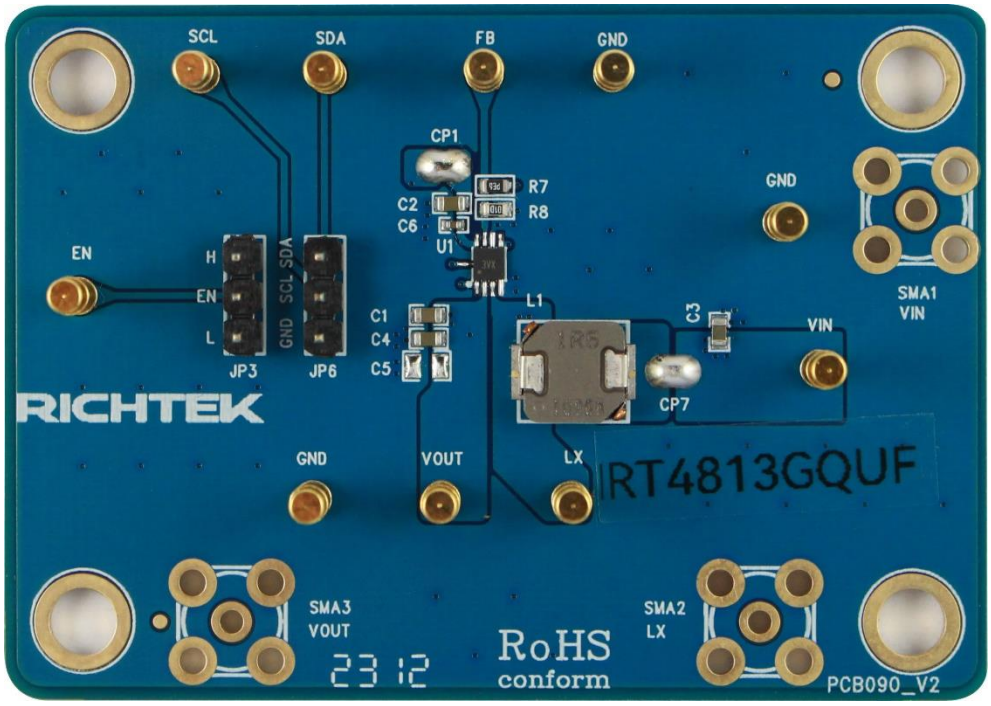
$$V_{OUT} = \left(1 + \frac{R1}{R2}\right) \times V_{FB}$$

Where the reference voltage V_{FB} is 0.5V (typ.)

The placement of the resistive divider should be as close as possible to the FB pin. For better output voltage accuracy, the divider resistors with ±1% tolerance or better should be used.

Detailed Description of Hardware

Headers Description and Placement



Carefully inspect all the components used in the EVB according to the following Bill of Materials table, and then make sure all the components are undamaged and correctly installed. If there is any missing or damaged component, which may occur during transportation, please contact our distributors or e-mail us at evb_service@richtek.com.

Test Points

The EVB is provided with the test points and pin names listed in the table below.

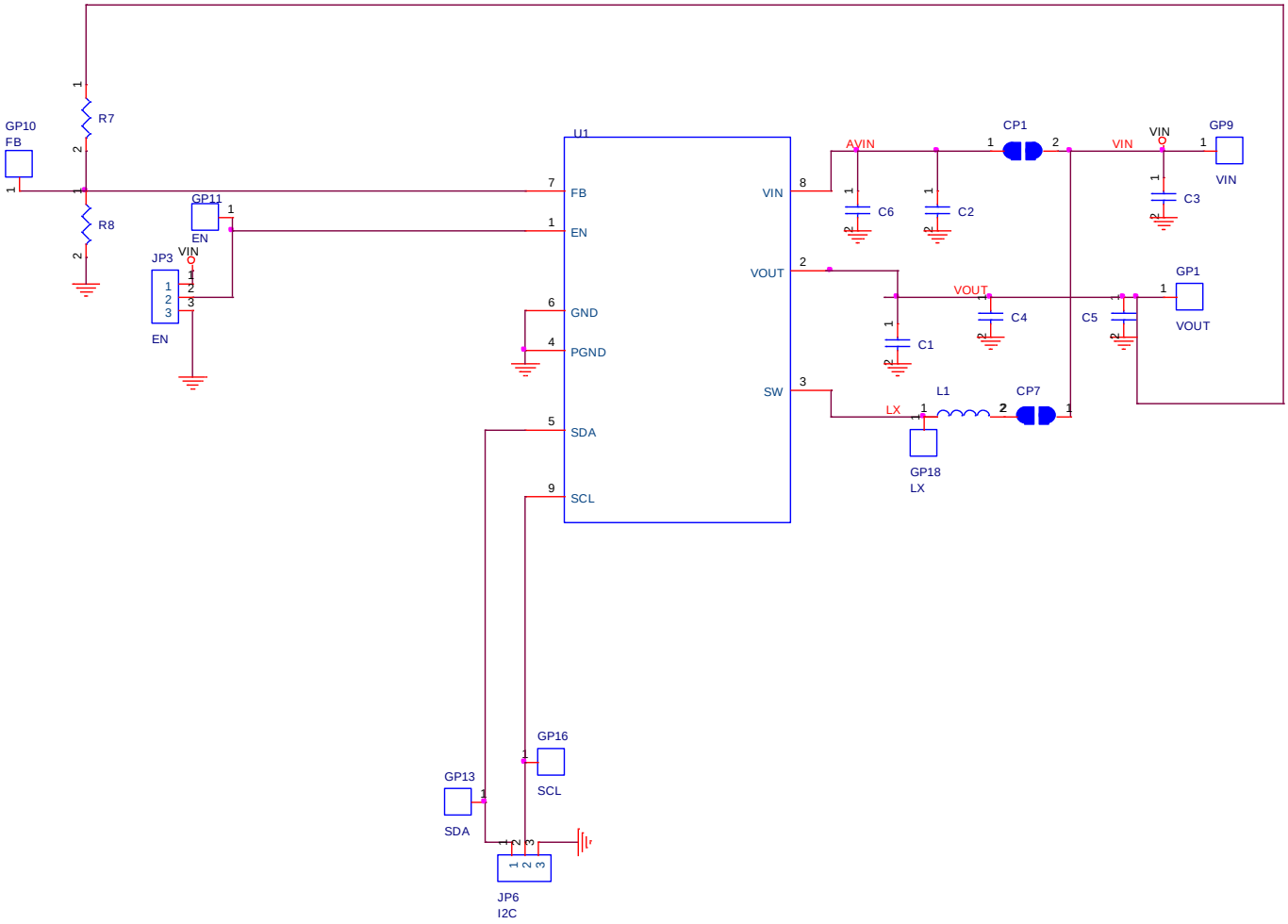
Test Point/ Pin Name	Function
VIN	Input voltage.
VOUT	Output voltage.
GND	Ground.
EN	Enable test point.
LX	Switch node test point.
SCL	I^2C interface clock input.
SDA	I^2C interface clock input.
FB	Voltage feedback.
PGND	Power ground.

Bill of Materials

V_{IN} = 12V, V_{OUT} = 5.0V, I_{OUT} = 0.5A, f_{SW} = 500kHz						
Reference	Count	Part Number	Value	Description	Package	Manufacturer
U1	1	RT4813GQUF	RT4813GQUF	Step-Up Converter	UQFN-9L 2x2 (FC)	RICHTEK
C1, C2, C3, C4	4	JMK107BBJ226MA-T	22µF	22µF/6.3V/X5R	0603	TAIYO YUDEN
C6	1	0402X105K100CT	1µF	1µF/10V/X5R	0402	WALSIN
L1	1	SPM6530T-1R5M100	1.5µH	1.5µH/11A	6.5x7.1x3mm	TDK
R7	1	WR06X9093FTL	909k	909k	0603	WALSIN
R8	1	WR06X1003FTL	100k	100k	0603	WALSIN

Typical Applications

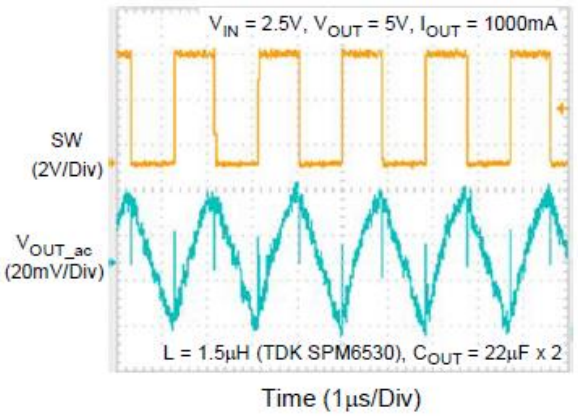
EVB Schematic Diagram



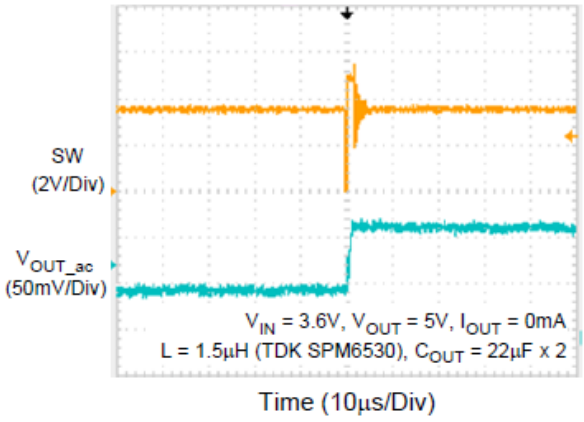
1. The capacitance values of the input and output capacitors will influence the input and output voltage ripple.
2. MLCC capacitors have degrading capacitance at DC bias voltage, and especially smaller size MLCC capacitors will have much lower capacitance.

Measure Result

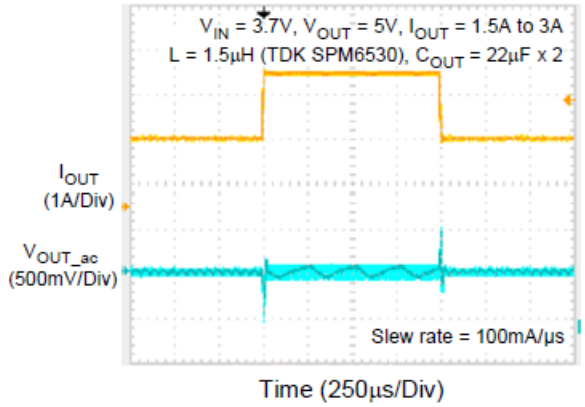
Output Ripple Measurement



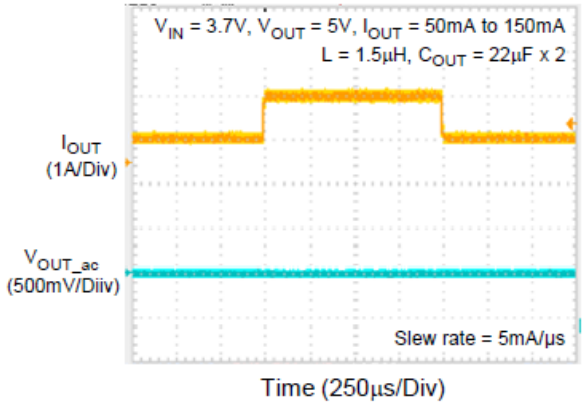
Output Ripple Measurement



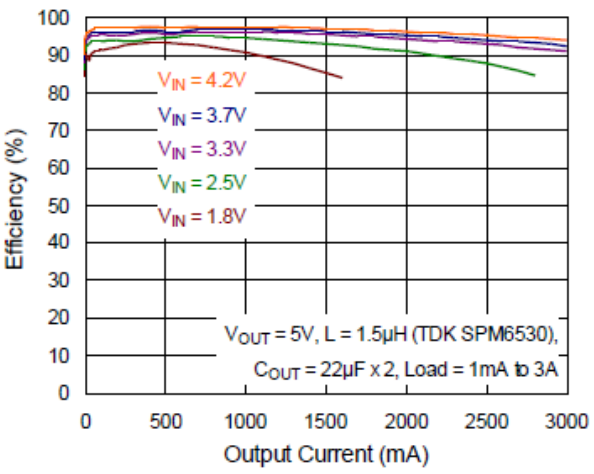
Load Transient



Load Transient



Efficiency vs. Output Current



Note: When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the output voltage ripple by touching the probe tip directly across the output capacitor.

Evaluation Board Layout

Figure 1 to Figure 4 are RT4813GQUF Evaluation Board layout. This board size is 70mm x 50mm and is constructed on four-layer PCB, outer layers with 2 oz. Cu and inner layers with 1 oz. Cu.

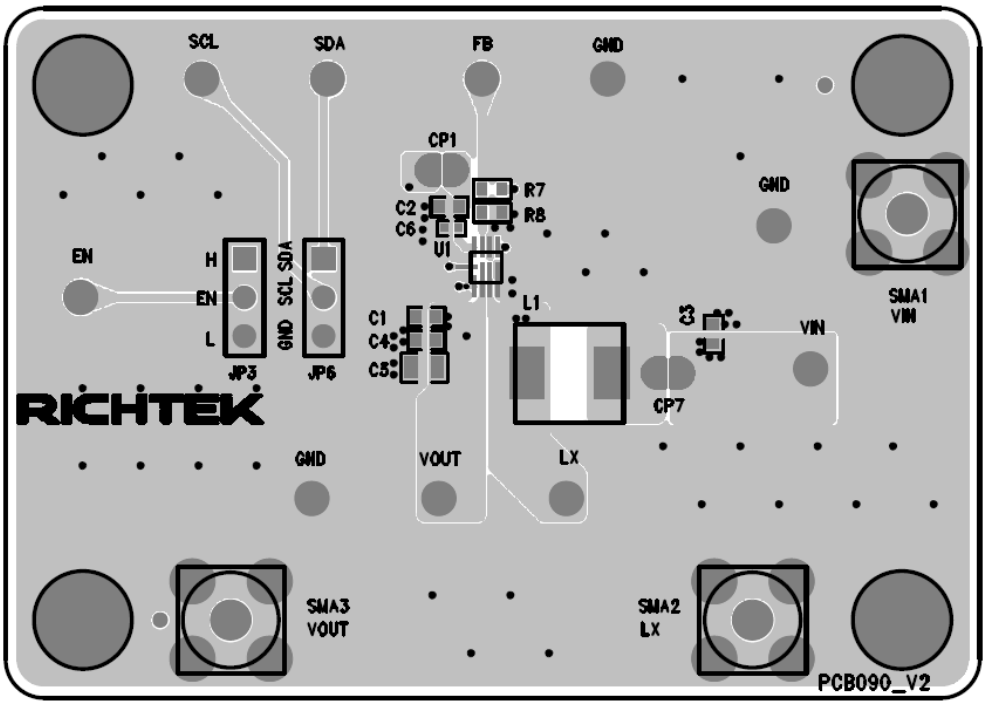


Figure 1. Top View (1st layer)

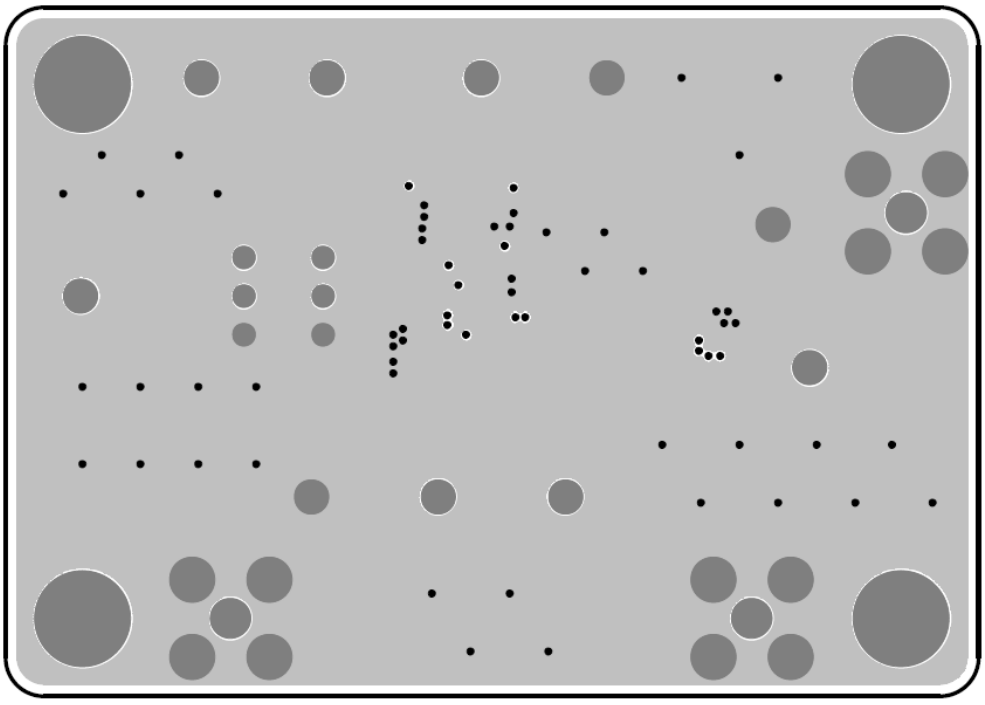


Figure 2. PCB Layout—Inner Side (2nd Layer)

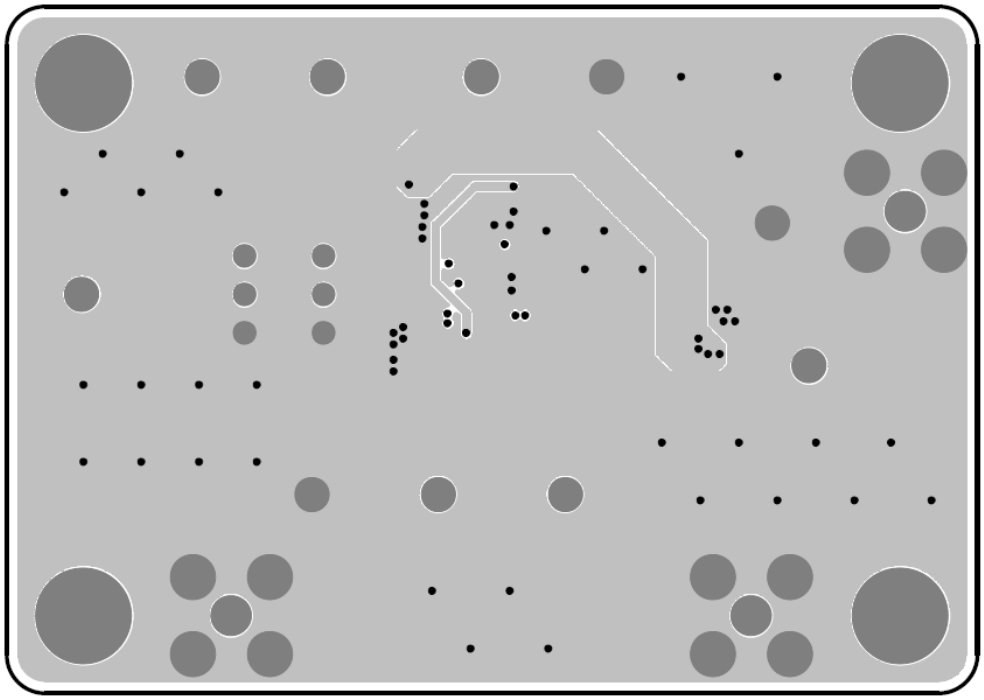


Figure 3. PCB Layout—Inner Side (3rd Layer)

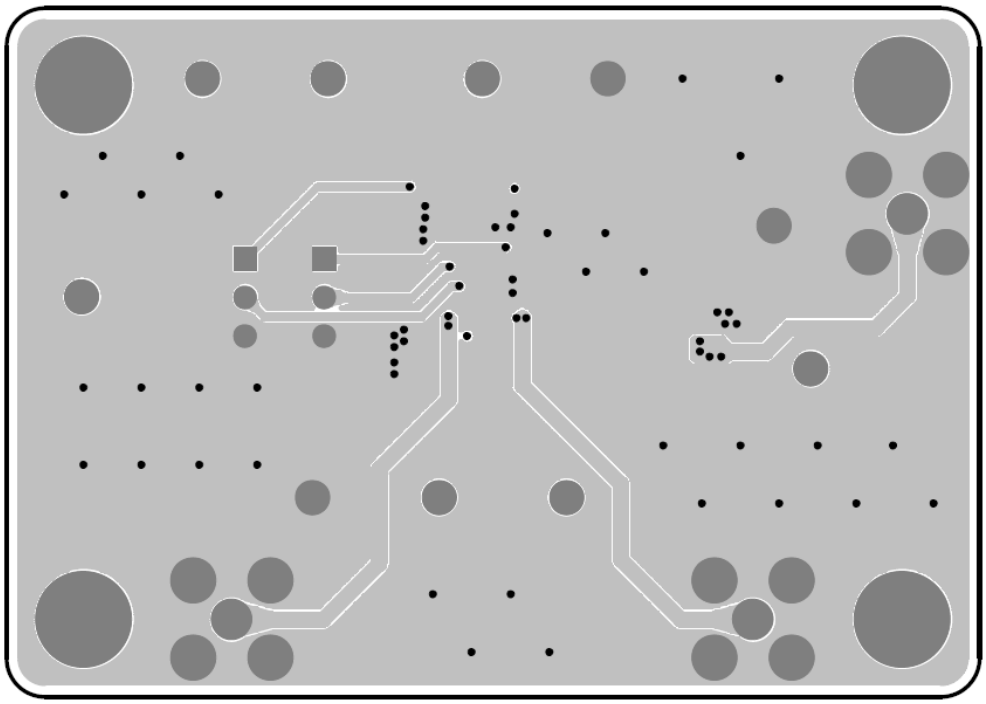


Figure 4. Bottom View (4th Layer)

More Information

For more information, please find the related datasheet or application notes from Richtek website http://www.richtek.com.

Important Notice for Richtek Evaluation Board