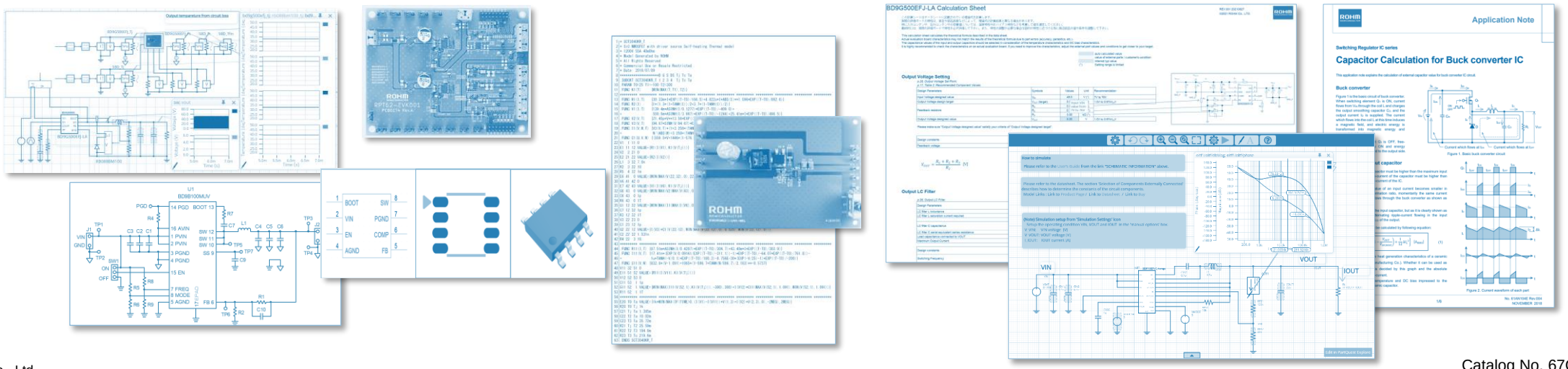
Linear Regulators, Switching Regulator ICs

LDO, DC-DC Converter Design Tool Selection Guide

Using the Design Tools on the ROHM Website

Ver. 2.0



Catalog No. 67G7391E 07.2024

Linear Regulators, Switching Regulator ICs

LDO, DC-DC Converter Design Tool Selection Guide

Using the Design Tools on the ROHM Website

On the ROHM website, we provide technical data including application notes, online simulators, various simulation models, and other design tools such as spreadsheets for calculation of constants. This guide explains how to use various design tools throughout the development steps for LDO and DC-DC converters.

How to use this guide:

- Since the guide requires access to the ROHM website, ensure you have a reliable Internet connection.
- Do not use the functions of your PDF browser to move back and forth between pages. Use the buttons on the pages instead.
- This guide may not display correctly if the PDF file is viewed with a web browser. Use a PDF reader such as Adobe Acrobat.

Notes

Tools for each development step

Initial Study	Circuit Design	PCB Design	Evaluation
- Topology Selection	- Reference Design	- Package Information	- Application Note
- Reference Design	- DATA SHEET	- PCB Library	
- DATA SHEET	- Calculation Sheet	- 3D Model	
- Evaluation Board (EVK)	- Application Note	- Application Note	
- Web Simulation	- Evaluation Board (EVK)	- DATA SHEET	
	- Web Simulation		
	- Design Model		

Start Here

Tools

1 Topology Selection

Shows the devices best suited for the respective topologies.

www

2 Reference Design

Evaluation results on the system level and design data are provided as reference designs.

www

3 DATA SHEET

Specification documents describing the electrical characteristics of products, precautions, pin layouts, examples of application circuits, etc.

4 Evaluation Board (EVK: Evaluation Kit)

Evaluation board to perform initial considerations and characterizations, which can be purchased from online distributors.

5 Web Simulation (ROHM Solution Simulator)

Free online simulator allowing you to easily design the constants of peripheral parts.

Catalog www

6 Calculation Sheet

Design calculation tool in Excel to assist you in designing the constants of peripheral parts.

7 Application Note

Application notes have been published to help circuit design, thermal design, PCB design, and evaluation methods.

Catalog

8 Design Model

Provides models for SPICE and other CAE tools including thermal analysis.

9 Package Information

Information including reference land patterns and mounting conditions is provided.

10 PCB Library

Footprints and symbol data for PCB CAD are provided.

11 3D Model

Models representing outline images on 3D CAD are provided as STEP data.

Click the button for the tool you want to view

Button descriptions

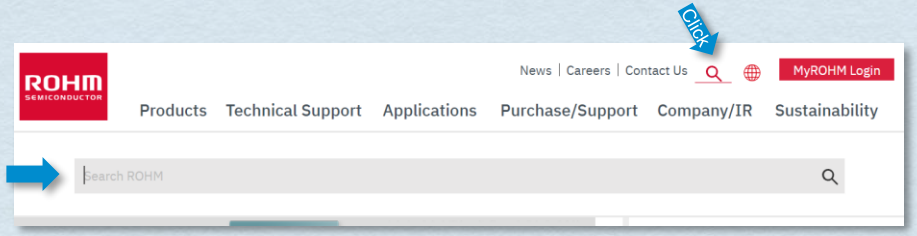
- Tool introduction
- www Displays the website
- Catalog Displays the catalog

How to obtain a data sheet

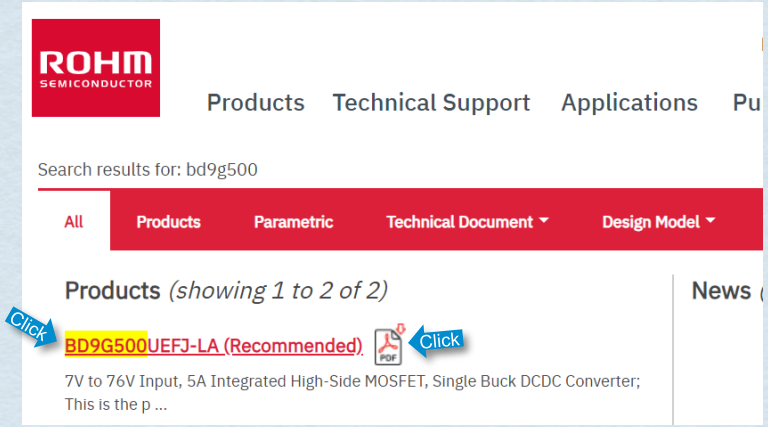
Obtain through one of the following methods:

Method 1. If the product name is known

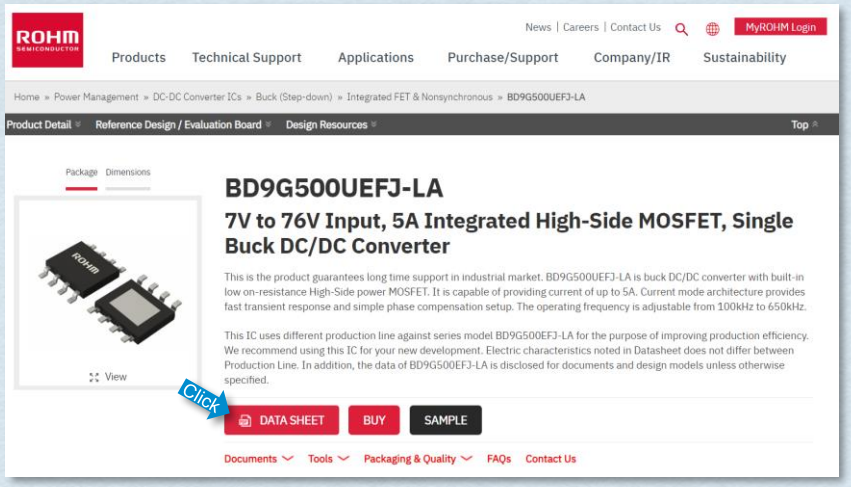
Step 1: Click the search icon in the upper right of the ROHM website and enter the product name into the search window.

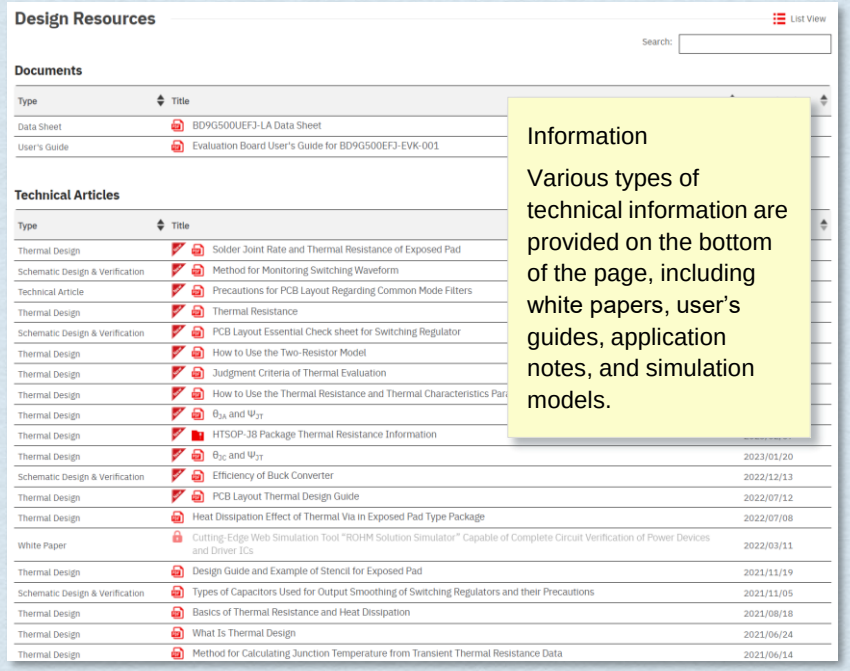


Step 2: To take a shortcut, click the PDF icon.
Usually, click the product name (recommended).



Step 3: When the product page is displayed, click the [DATA SHEET] button. In addition, you can obtain further technical information by scrolling down the product page.





Information

Various types of technical information are provided on the bottom of the page, including white papers, user's guides, application notes, and simulation models.

Information

DATA SHEET

Next page

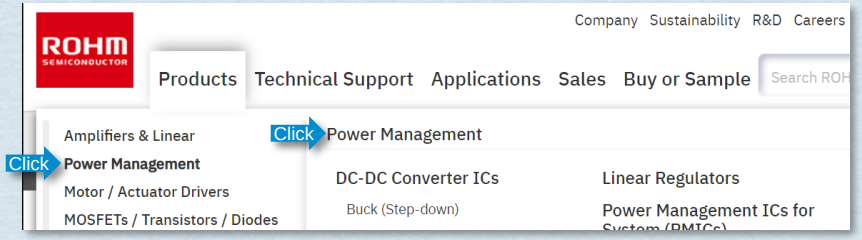
How to obtain a data sheet (continued)

Information
DATA SHEET
Page 2 / 2

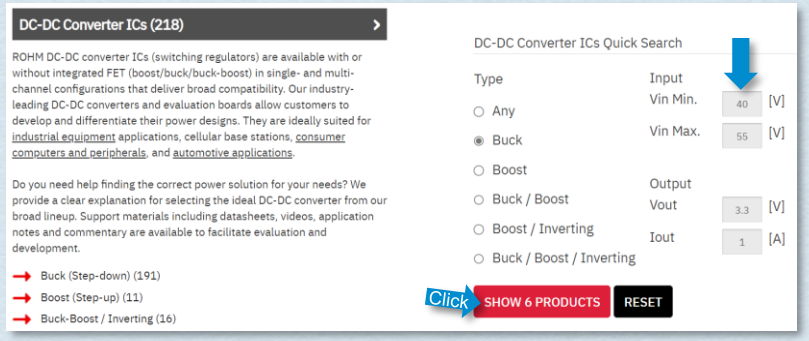
Previous page

Method 2. If the product name is not certain

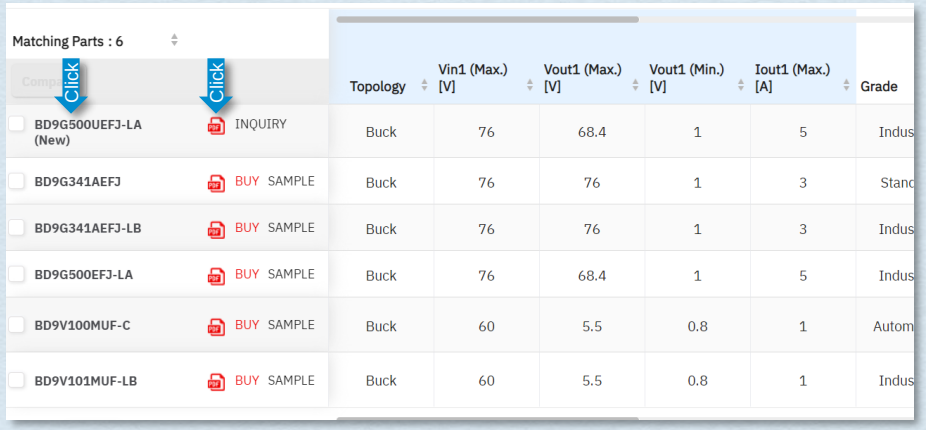
Step 1: Select “Power Management” in “Products” on the ROHM website.



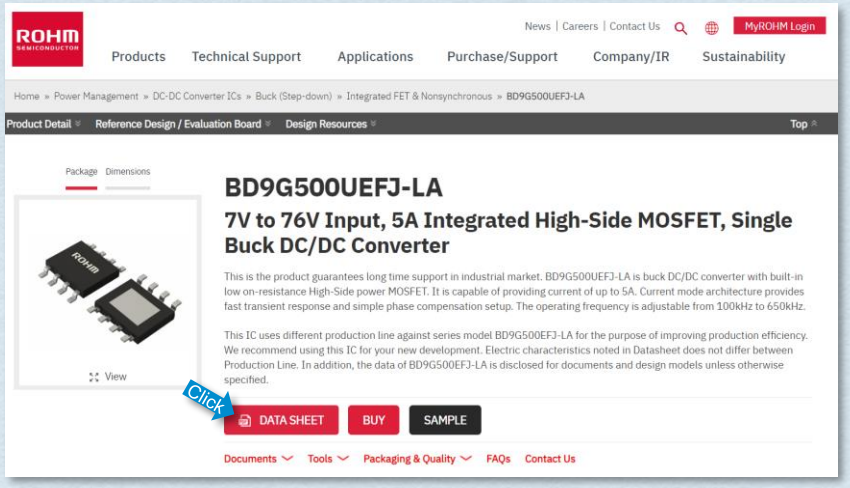
Step 2: Enter the conditions and click the [SHOW] button.

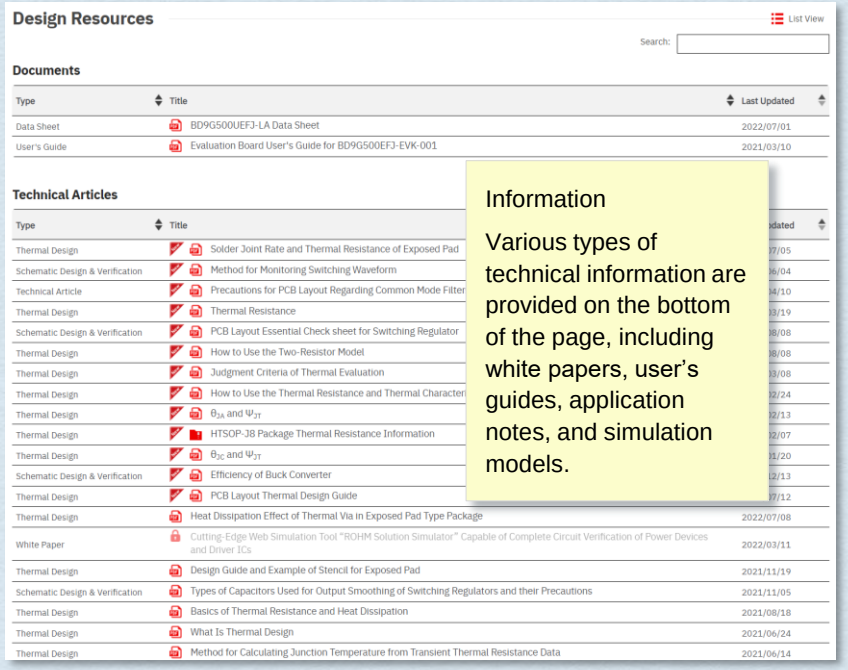


Step 3: The search result is displayed. To take a shortcut, click the PDF icon.
Usually, click the product name (recommended).



Step 4: When the product page is displayed, click the [DATA SHEET] button. In addition, you can obtain further technical information by scrolling down the product page.



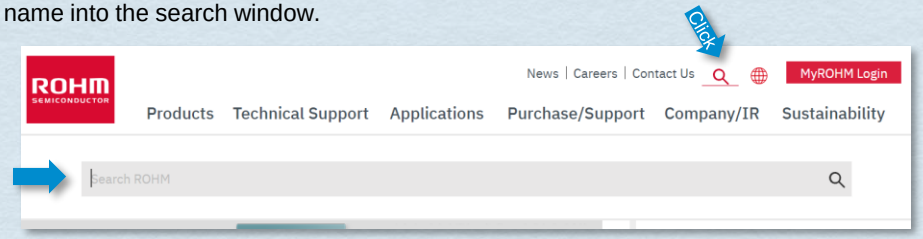


Information

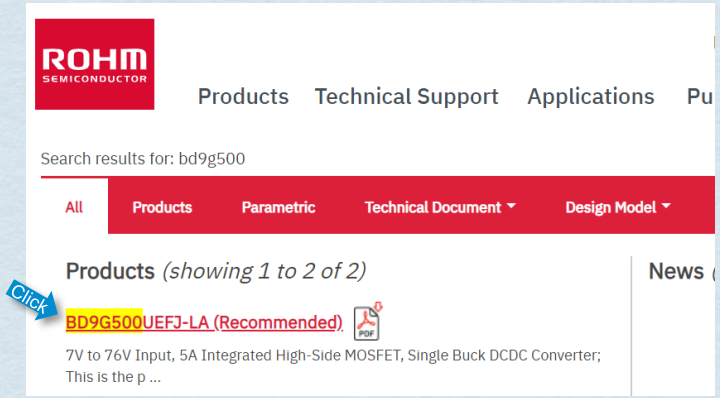
Various types of technical information are provided on the bottom of the page, including white papers, user’s guides, application notes, and simulation models.

How to obtain EVK

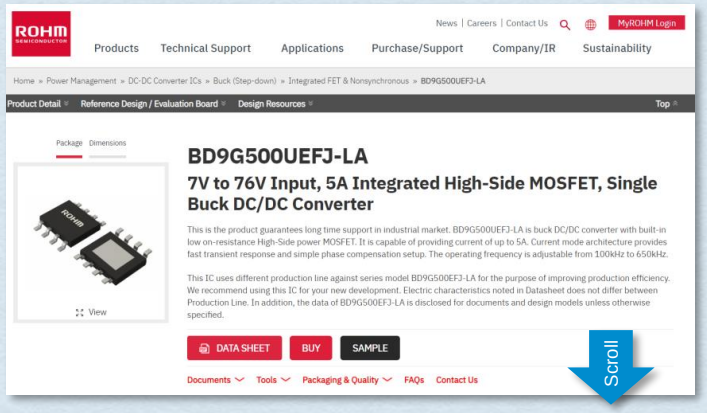
Step 1: Click the search icon in the upper right of the ROHM website and enter the product name into the search window.



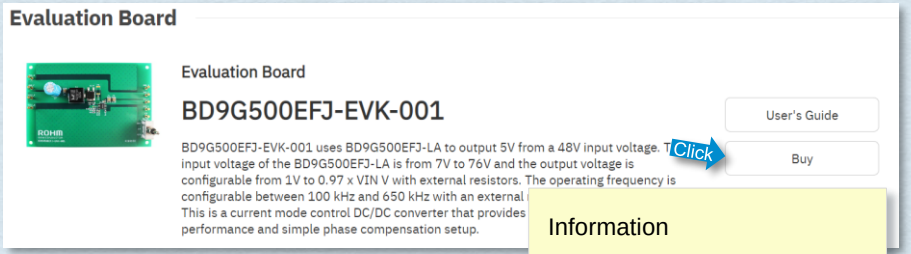
Step 2: Click the product name.



Step 3: When the product page is displayed, scroll down the page.



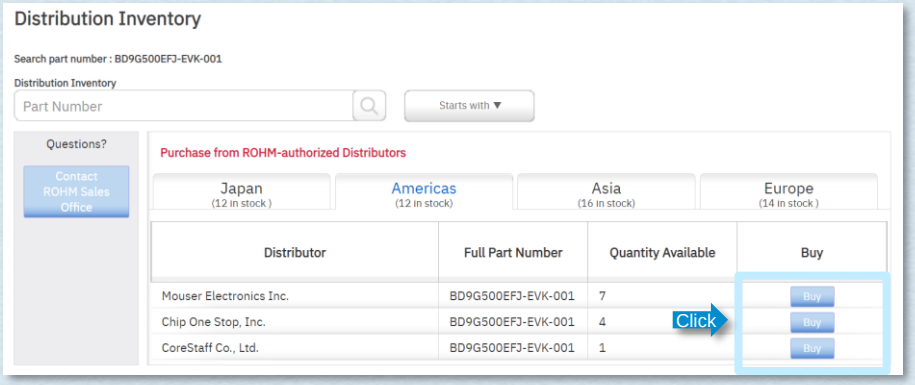
Step 4: If the “Evaluation Board” section is displayed, the board is available for purchase. Click the [Buy] button.



Information

If the product is not available from the online distributor, the [Purchase Inquiry] button is displayed instead of the [Buy] button. Contact the distributor to make an inquiry.

Step5: The availability from online distributors is displayed. Purchase the product through their website.



Information

No document is supplied with the purchased EVK. Obtain the document by clicking the [User’s Guide] button in Step 4.

Information

EVK

Information

ROHM Solution Simulator

What is the ROHM Solution Simulator?

- ✓ Simulation tool you can run on the website
- ✓ Can verify the designs using circuits close to applications
- ✓ Can select from an extensive range of solution circuits, including mainly power devices and gate drivers
- ✓ High reproducibility of simulations achieved by incorporating high precision SPICE models. Coordination with certain evaluation boards
- ✓ Exportable to external simulators. Can be developed to customer's simulator circuits

Advanced power devices (SiC, etc.)

Driver IC and peripheral parts (Gate drivers, etc.)

To realize the maximum potential of power devices, know-how for tuning between parts is required

While tuning, ideal circuit parameters can be derived

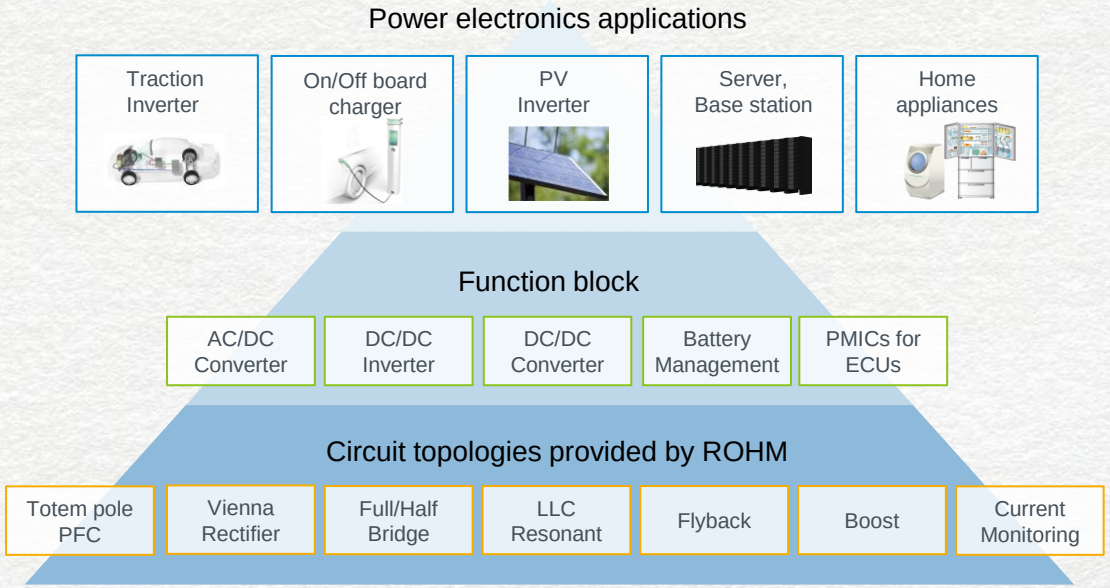
Using the ROHM Solution Simulator

Utilizing the solutions provided by ROHM

From the steps for selecting parts and considering the validity of circuits, system level simulations can be repeatedly performed for analysis. Therefore, critical problems are less likely to occur after a trial, reducing the number of retrials and the hours for development.

Provides solution circuits suited for various applications

Simulation circuit diagrams cover various power electronics applications



Next page

What can be done with the ROHM Solution Simulator

Information

ROHM Solution Simulator

Previous page

Step 1:

www

Select a solution circuit

Select a solution circuit suited for the application from the solution circuit list

Simulation Circuit

【Power Device Solution Circuit】

- AC-DC PFC
- DC-AC Inverter
- DC-DC Converter
- NEW Other Application

【ICs Solution Circuit】

- Automotive Power Tree
- Click Switching Regulators
- LED Drivers
- Click Linear Regulators
- NEW Operational Amplifiers

【Optical Devices Solution Circuit】

- NEW Laser Diode

Step 4:

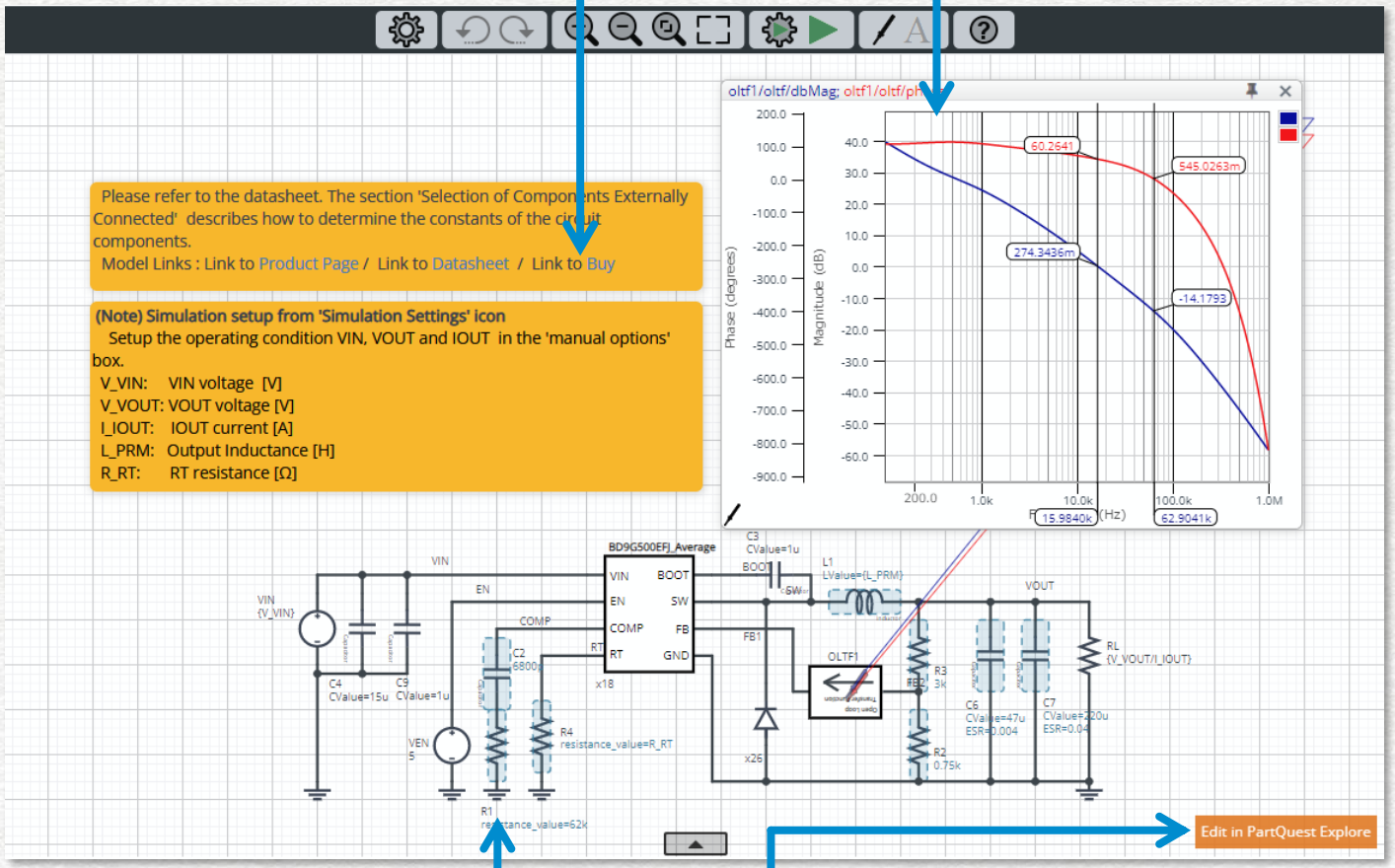
Order samples

You can purchase samples for trial evaluation and evaluation boards via the links of the distribution partners shown in the circuit diagrams.

Step 3:

Perform simulations and monitor results

You can set and operate simulations intuitively. After performing simulations, you can check the results easily with the powerful waveform analysis tool.



Step 2:

Select devices and change values

The simulation screen is displayed. The constants recommended by ROHM have been entered in advance. Use these as base values for adjusting the parameters.

Step 5:

Expand circuits in an external environment

In addition to adjusting the parameters, you can export the circuit data to PartQuest Explore to expand system circuits and develop original circuits by changing the circuit types or adding different circuits.

Design calculation tool
What is the Calculation Sheet?

ROHM has published the Calculation Sheet that assists you in designing peripheral circuits for DC-DC and AC-DC converter ICs.

The Calculation Sheet is a design tool for application circuits based on the method of selecting parts described in product data sheets. Since the tool is equipped with calculation formulas required for determining the peripheral parts and other tasks, you can easily determine the circuit parameters that satisfy desired characteristics by setting values according to the instructions.

This tool is provided in a Microsoft Excel file format.

Information

Calculation Sheet

DC-DC converter

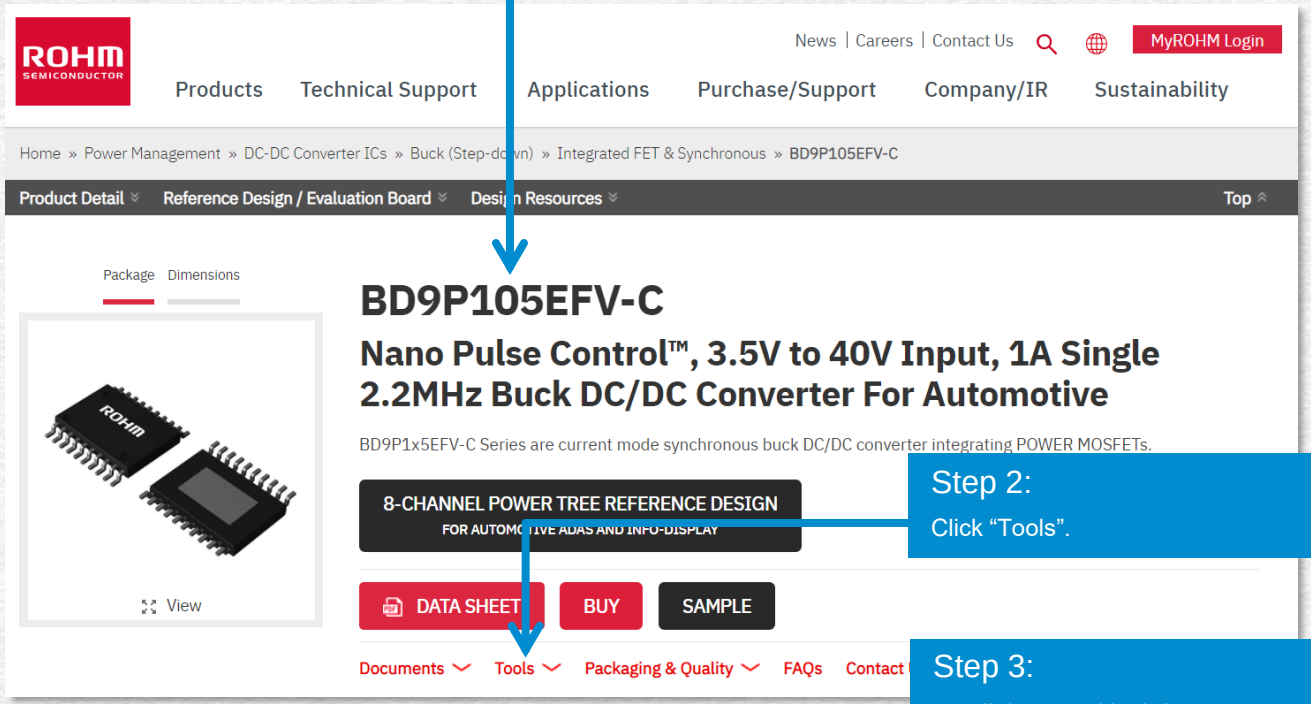
- ✓ Automatically calculates the theoretical equation for the peripheral circuit design described in the data sheet, and automatically judges whether or not the value is within the setting range
- ✓ Outputs the BOM list and summary sheet of the design result

AC-DC converter

- ✓ Can calculate coils, transformers, and other peripheral parts of flyback converters and buck converters
- ✓ Main components, including IC and peripheral parts such as Schottky barrier diodes, fast recovery diodes, electrolytic capacitors, and transformers, are compiled into a database, allowing you to sort the parts and select them on the spot.

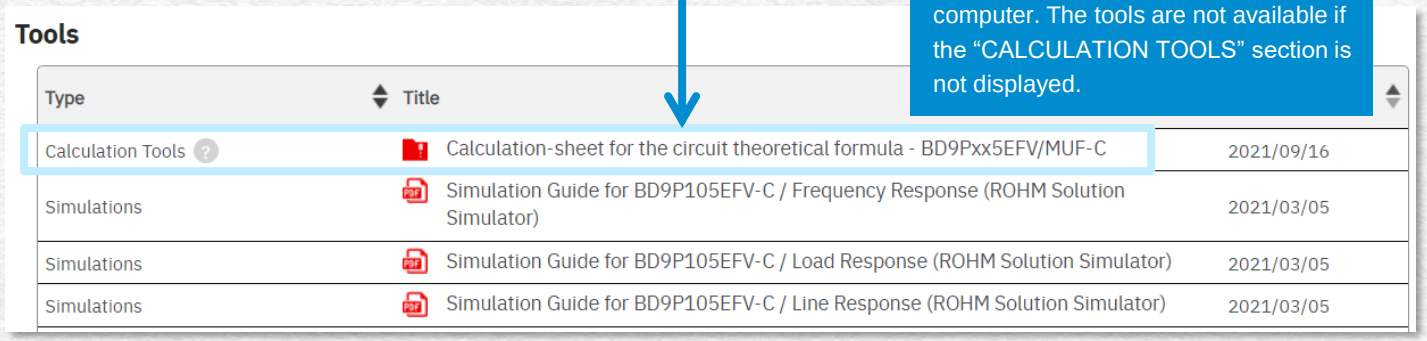
How to obtain the Calculation Sheet

Step 1:
Display the product page of the product name you want.



Step 2:
Click “Tools”.

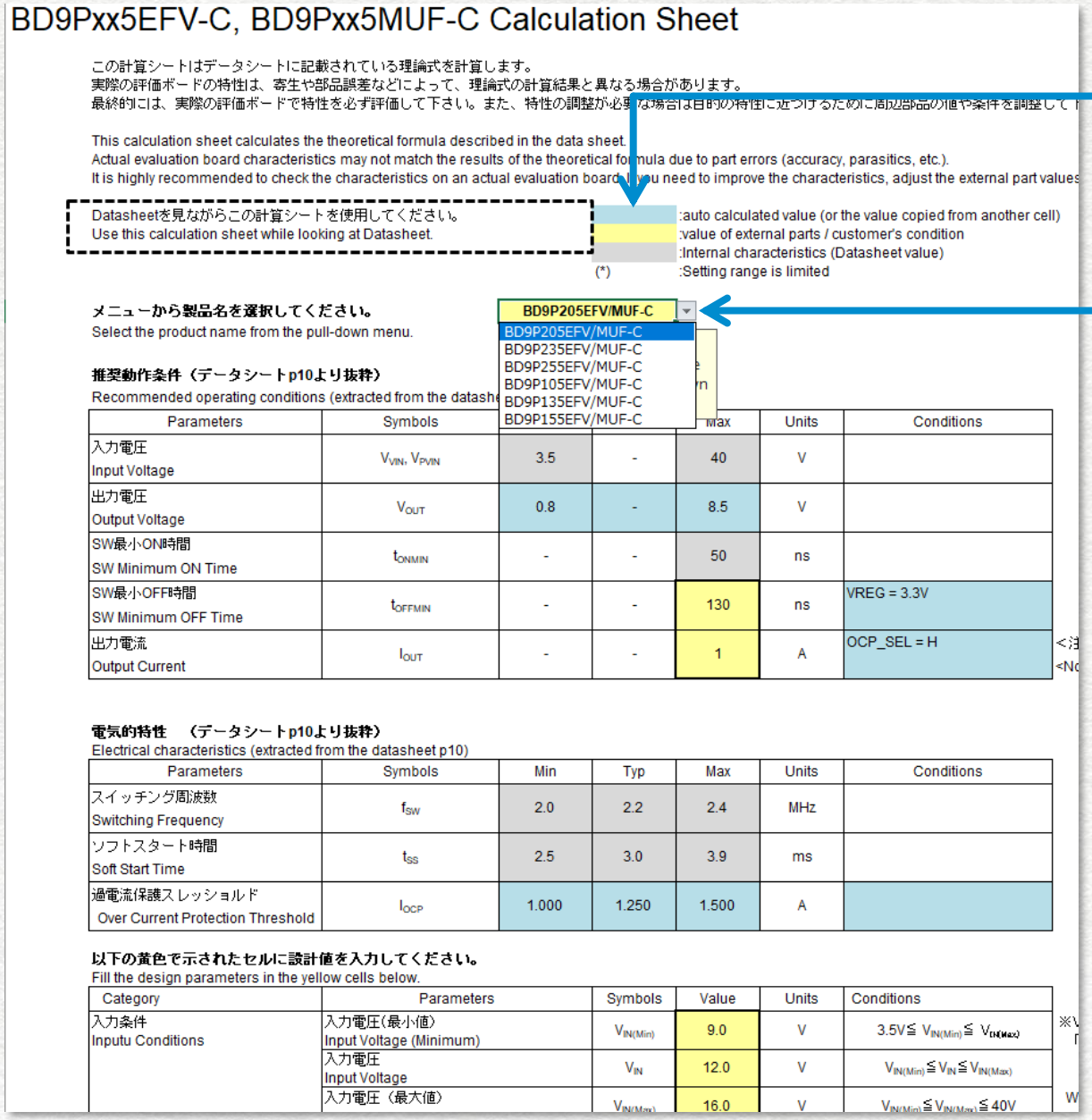
Scroll



Step 3:
Scroll down and look for “CALCULATION TOOLS”. Clicking the file name downloads the tools to your computer. The tools are not available if the “CALCULATION TOOLS” section is not displayed.

Next page

How to use



BD9Pxx5EFV-C, BD9Pxx5MUF-C Calculation Sheet

この計算シートはデータシートに記載されている理論式を計算します。
実際の評価ボードの特性は、寄生や部品誤差などによって、理論式の計算結果と異なる場合があります。
最終的には、実際の評価ボードで特性を必ず評価して下さい。また、特性の調整が必要な場合は目的の特性に近づけるために周辺部品の値や条件を調整して下

This calculation sheet calculates the theoretical formula described in the data sheet.
Actual evaluation board characteristics may not match the results of the theoretical formula due to part errors (accuracy, parasitics, etc.).
It is highly recommended to check the characteristics on an actual evaluation board. If you need to improve the characteristics, adjust the external part values

Datasheetを見ながらこの計算シートを使用してください。
Use this calculation sheet while looking at Datasheet.

:auto calculated value (or the value copied from another cell)
:value of external parts / customer's condition
:Internal characteristics (Datasheet value)
(*) :Setting range is limited

メニューから製品名を選択してください。
Select the product name from the pull-down menu.

BD9P205EFV/MUF-C
BD9P205EFV/MUF-C
BD9P235EFV/MUF-C
BD9P255EFV/MUF-C
BD9P105EFV/MUF-C
BD9P135EFV/MUF-C
BD9P155EFV/MUF-C

推奨動作条件（データシートp10より抜粋）
Recommended operating conditions (extracted from the datashe

Parameters	Symbols			Max	Units	Conditions
入力電圧 Input Voltage	V_{VIN}, V_{PVIN}	3.5	-	40	V	
出力電圧 Output Voltage	V_{OUT}	0.8	-	8.5	V	
SW最小ON時間 SW Minimum ON Time	t_{ONMIN}	-	-	50	ns	
SW最小OFF時間 SW Minimum OFF Time	t_{OFFMIN}	-	-	130	ns	VREG = 3.3V
出力電流 Output Current	I_{OUT}	-	-	1	A	OCP_SEL = H

電気的特性　（データシートp10より抜粋）
Electrical characteristics (extracted from the datasheet p10)

Parameters	Symbols	Min	Typ	Max	Units	Conditions
スイッチング周波数 Switching Frequency	f_{SW}	2.0	2.2	2.4	MHz	
ソフトスタート時間 Soft Start Time	t_{SS}	2.5	3.0	3.9	ms	
過電流保護スレッショルド Over Current Protection Threshold	I_{OCP}	1.000	1.250	1.500	A	

以下の黄色で示されたセルに設計値を入力してください。
Fill the design parameters in the yellow cells below.

Category	Parameters	Symbols	Value	Units	Conditions
入力条件 Inputu Conditions	入力電圧(最小値) Input Voltage (Minimum)	$V_{IN(Min)}$	9.0	V	3.5V≦ $V_{IN(Min)}$ ≦ $V_{IN(Max)}$
	入力電圧 Input Voltage	V_{IN}	12.0	V	$V_{IN(Min)}$ ≦ V_{IN} ≦ $V_{IN(Max)}$
	入力電圧（最大値）	$V_{IN(Max)}$	16.0	V	$V_{IN(Min)}$ ≦ $V_{IN(Max)}$ ≦ 40V

Step 1:

The cells are color-coded according to their functions. The yellow cells are for selecting or inputting values. The blue cells display the calculation results. The gray cells display the setting values on the data sheet.

Step 2:

If the Calculation Sheet supports the series of models, selecting a product automatically sets the relevant entries such as recommended operation conditions.

Information

Calculation Sheet

Page 2 / 5

Previous page

Next page

How to use (continued)

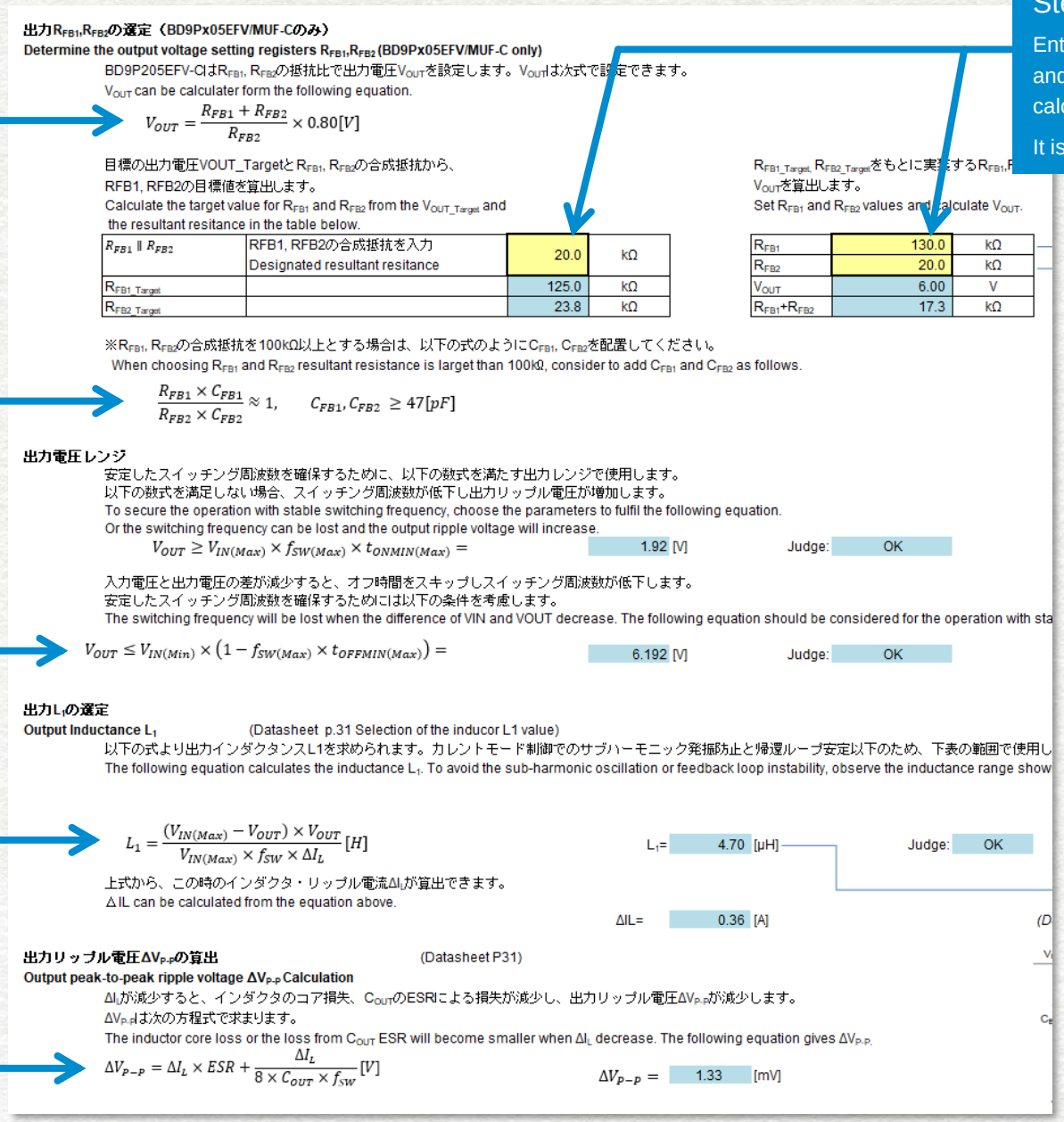
Step 3:

The Calculation Sheet provides calculation formulas and instructions on how to determine values.

Step 4:

Entering values according to the data sheet and the instructions updates the entire calculation result immediately.

It is also easy to make changes repeatedly.



出力R_{FB1},R_{FB2}の選定（BD9Px05EFV/MUF-Cのみ）

Determine the output voltage setting registers R_{FB1},R_{FB2} (BD9Px05EFV/MUF-C only)

BD9P205EFV-CはRFB1, RFB2の抵抗比で出力電圧V_{OUT}を設定します。V_{OUT}は次式で設定できます。

V_{OUT} can be calculater form the following equation.

$$V_{OUT} = \frac{R_{FB1} + R_{FB2}}{R_{FB2}} \times 0.80[V]$$

目標の出力電圧VOUT_TargetとRFB1, RFB2の合成抵抗から、RFB1, RFB2の目標値を算出します。

Calculate the target value for R_{FB1} and R_{FB2} from the V_{OUT_Target} and the resultant resitance in the table below.

$R_{FB1} \parallel R_{FB2}$	RFB1, RFB2の合成抵抗を入力 Designated resultant resitance	20.0	kΩ
R_{FB1_Target}		125.0	kΩ
R_{FB2_Target}		23.8	kΩ

R_{FB1_Target}, R_{FB2_Target}をもとに実装するR_{FB1},R_{FB2}とV_{OUT}を算出します。

Set R_{FB1} and R_{FB2} values and calculate V_{OUT}.

R_{FB1}	130.0	kΩ
R_{FB2}	20.0	kΩ
V_{OUT}	6.00	V
R_{FB1}+R_{FB2}	17.3	kΩ

※R_{FB1}, R_{FB2}の合成抵抗を100kΩ以上とする場合は、以下の式のようにCFB1, CFB2を配置してください。

When choosing R_{FB1} and R_{FB2} resultant resistance is larget than 100kΩ, consider to add C_{FB1} and C_{FB2} as follows.

$$\frac{R_{FB1} \times C_{FB1}}{R_{FB2} \times C_{FB2}} \approx 1, \quad C_{FB1}, C_{FB2} \geq 47[pF]$$

出力電圧 レンジ

安定したスイッチング周波数を確保するために、以下の数式を満たす出力レンジで使用します。
以下の数式を満足しない場合、スイッチング周波数が低下し出力リップル電圧が増加します。
To secure the operation with stable switching frequency, choose the parameters to fulfil the following equation.
Or the switching frequency can be lost and the output ripple voltage will increase.

$$V_{OUT} \geq V_{IN(Max)} \times f_{SW(Max)} \times t_{ONMIN(Max)} =$$ 1.92 [V] Judge: OK

入力電圧と出力電圧の差が減少すると、オフ時間をスキップしスイッチング周波数が低下します。
安定したスイッチング周波数を確保するためには以下の条件を考慮します。
The switching frequency will be lost when the difference of VIN and VOUT decrease. The following equation should be considered for the operation with sta

$$V_{OUT} \leq V_{IN(Min)} \times \left(1 - f_{SW(Max)} \times t_{OFFMIN(Max)}\right) =$$ 6.192 [V] Judge: OK

出力L_1の選定

Output Inductance L_1 (Datasheet p.31 Selection of the inducor L1 value)

以下の式より出力インダクタンスL1を求められます。カレントモード制御でのサブハーモニック発振防止と帰還ループ安定以下のため、下表の範囲で使用し
The following equation calculates the inductance L_1. To avoid the sub-harmonic oscillation or feedback loop instability, observe the inductance range show

$$L_1 = \frac{(V_{IN(Max)} - V_{OUT}) \times V_{OUT}}{V_{IN(Max)} \times f_{SW} \times \Delta I_L}[H]$$

L_1= 4.70 [µH] Judge: OK

上式から、この時のインダクタ・リップル電流ΔI_Lが算出できます。
ΔIL can be calculated from the equation above.

ΔIL= 0.36 [A]

出力リップル電圧ΔV_{P-P}の算出 (Datasheet P31)

Output peak-to-peak ripple voltage ΔV_{P-P} Calculation

ΔI_Lが減少すると、インダクタのコア損失、C_{OUT}のESRによる損失が減少し、出力リップル電圧ΔV_{P-P}が減少します。
ΔV_{P-P}は次の方程式で求まります。
The inductor core loss or the loss from C_{OUT} ESR will become smaller when ΔI_L decrease. The following equation gives ΔV_{P-P}.

$$\Delta V_{P-P} = \Delta I_L \times ESR + \frac{\Delta I_L}{8 \times C_{OUT} \times f_{SW}}[V]$$

ΔV_{P-P} = 1.33 [mV]

Information

Calculation Sheet

Page 3 / 5

Previous page
Next page

How to use (continued)

Using the Calculation Sheet prevents overlooking the design constraints and allows you to select parts that satisfy the operating conditions.

Step 5:

If an input value is outside the working range, the tool outputs an error message and urges you to correct the value.

Step 6:

Judges the calculation result and reports the results If the calculation result does not comply with the specifications, review and reset the input values.

Information

Calculation Sheet

Page 4 / 5

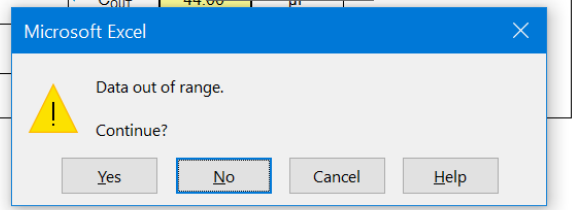
Previous page

Next page

以下の黄色で示されたセルに設計値を入力してください。
Fill the design parameters in the yellow cells below.

Category	Parameters	Symbols	Value	Units	Conditions
入力条件 Inputu Conditions	入力電圧(最小値) Input Voltage (Minimum)	$V_{IN(Min)}$	9.0	V	3.5V≦ $V_{IN(Min)}$≦ $V_{IN(Max)}$
	入力電圧 Input Voltage	V_{IN}	12.0	V	$V_{IN(Min)}$≦V_{IN}≦$V_{IN(Max)}$
	入力電圧（最大値） Input Voltage (Maximum)	$V_{IN(Max)}$	16.0	V	$V_{IN(Min)}$≦$V_{IN(Max)}$≦40V
出力条件 Output Conditions	出力電圧目標値 Target of the output voltage V_{OUT}	V_{OUT_Target}	10	V	0.8V<=VOUT_Target<=8.5V
	起動時負荷による出力電流最大値 Maximum load current during startup	$I_{OUT\_START(Max)}$	0.5		$_{CP}$(Min)
出力インダクタ Output Inductance	インダクタンス Indcutance	L_1	4.7		µH to 15µH
出力キャパシタ Output Capacitor	容量 Capacitance	C_{OUT}	44.0	µF	
	等価直列抵抗 Equivalent Series Resistor				
	定格リップル電流 Ripple Current Rating				

Vout range is shown as the output voltage range above.



出力R_{FB1},R_{FB2}の選定（BD9Px05EFV/MUF-Cのみ）
Determine the output voltage setting registers R_{FB1},R_{FB2} (BD9Px05EFV/MUF-C only)

出力R_{FB1},R_{FB2}の選定（BD9Px05EFV/MUF-Cのみ）
Determine the output voltage setting registers R_{FB1},R_{FB2} (BD9Px05EFV/MUF-C only)

BD9P205EFV-CはR_{FB1}, R_{FB2}の抵抗比で出力電圧V_{OUT}を設定します。V_{OUT}は次式で設定できます。
V_{OUT} can be calculater form the following equation.

$$V_{OUT} = \frac{R_{FB1} + R_{FB2}}{R_{FB2}} \times 0.80[V]$$

目標の出力電圧VOUT_TargetとR_{FB1}, R_{FB2}の合成抵抗から、
RFB1, RFB2の目標値を算出します。
Calculate the target value for R_{FB1} and R_{FB2} from the V_{OUT_Target} and the resultant resitance in the table below.

$R_{FB1} \parallel R_{FB2}$	RFB1, RFB2の合成抵抗を入力 Designated resultant resitance	20.0	kΩ
R_{FB1_Target}		125.0	kΩ
R_{FB2_Target}		23.8	kΩ

R_{FB1_Target}, R_{FB2_Target}をもとに実装するR_{FB1},R_{FB2}を
V_{OUT}を算出します。
Set R_{FB1} and R_{FB2} values and calculate V_{OUT}.

R_{FB1}	10.0	kΩ
R_{FB2}	20.0	kΩ
V_{OUT}	1.20	V
R_{FB1}+R_{FB2}	6.7	kΩ

※R_{FB1}, R_{FB2}の合成抵抗を100kΩ以上とする場合は、以下の式のようににC_{FB1}, C_{FB2}を配置してください。
When choosing R_{FB1} and R_{FB2} resultant resistance is larget than 100kΩ, consider to add C_{FB1} and C_{FB2} as follows.

$$\frac{R_{FB1} \times C_{FB1}}{R_{FB2} \times C_{FB2}} \approx 1, \quad C_{FB1}, C_{FB2} \geq 47[pF]$$

出力電圧レンジ
安定したスイッチング周波数を確保するために、以下の数式を満たす出力レンジで使用します。
以下の数式を満足しない場合、スイッチング周波数が低下し出力リップル電圧が増加します。
To secure the operation with stable switching frequency, choose the parameters to fulfil the following equation.
Or the switching frequency can be lost and the output ripple voltage will increase.

$V_{OUT} \geq V_{IN(Max)} \times f_{SW(Max)} \times t_{ONMIN(Max)} =$ 1.92 [V] Judge: NG

入力電圧と出力電圧の差が減少すると、オフ時間をスキップしスイッチング周波数が低下します。
安定したスイッチング周波数を確保するためには以下の条件を考慮します。
The switching frequency will be lost when the difference of VIN and VOUT decrease. The following equation should be considered for the operation with sta

$V_{OUT} \leq V_{IN(Min)} \times \left(1 - f_{SW(Max)} \times t_{OFFMIN(Max)}\right) =$ 6.192 [V] Judge: OK

出力L_1の選定
Output Inductance L_1 (Datasheet p.31 Selection of the inducor L1 value)
以下の式より出力インダクタンスL1を求められます。カレントモード制御でのサブハーモニック発振防止と帰還ループ安定以下のため、下表の範囲で使用し
The following equation calculates the inductance L_1. To avoid the sub-harmonic oscillation or feedback loop instability, observe the inductance range show

$$L_1 = \frac{(V_{IN(Max)} - V_{OUT}) \times V_{OUT}}{V_{IN(Max)} \times f_{SW} \times \Delta I_L}[H]$$

L_1= 4.70 [µH] Judge: OK

How to use (continued)

A summary sheet showing the design result is prepared. You can use it directly in the design report.

Information

Calculation Sheet

Page 5 / 5

Previous page

Step 7:
Displays the parts constants of the application circuit.

Step 8:
Displays the list of design values, including the characteristic values.

Summary : BD9Pxx5EFV-C, BD9Pxx5MUF-C Calculation Sheet

REV.002 20210911

この計算シートはデータシートに記載されている理論式を計算します。
実際の評価ボードの特性は、寄生や部品誤差などによって、理論式の計算結果と異なる場合があります。
最終的には、実際の評価ボードで特性を必ず評価して下さい。また、特性の調整が必要な場合は目的の特性に近づけるために周辺部品の値や条件を調整して下さい。

This calculation sheet calculates the theoretical formula described in the data sheet.
Actual evaluation board characteristics may not match the results of the theoretical formula due to part errors (accuracy, parasitics, etc.).
It is highly recommended to check the characteristics on an actual evaluation board. If you need to improve the characteristics, adjust the external part values and conditions to get closer to your target.

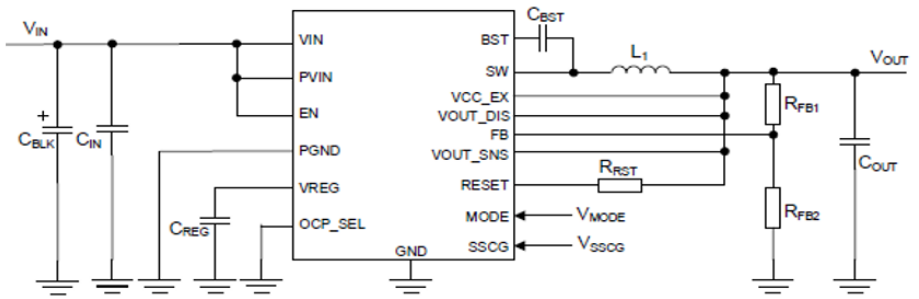
(1) BOM

Product No. BD9P205EFV/MUF-C

:Value from 1. Calculation sheet

Components parameters		Value	Units	Conditions
R_{FB1}		130.0	kΩ	
R_{FB2}		20.0	kΩ	
R_{RST}		10	kΩ	
C_{BLK}		220	µF	Electrolytic capacitor
C_{IN}		0.1	µF	Ceramic Capacitor
C_{REG}		1	µF	Ceramic Capacitor
C_{BST}		0.1	µF	Ceramic Capacitor
C_{OUT}	C_{OUT}	44.00	µF	
	ESR	2.370E-03	Ω	
	Ripple Current	1.0	A	
L_1		4.7	µH	

(Datasheet p.30, Fig.47 Application Circuit)



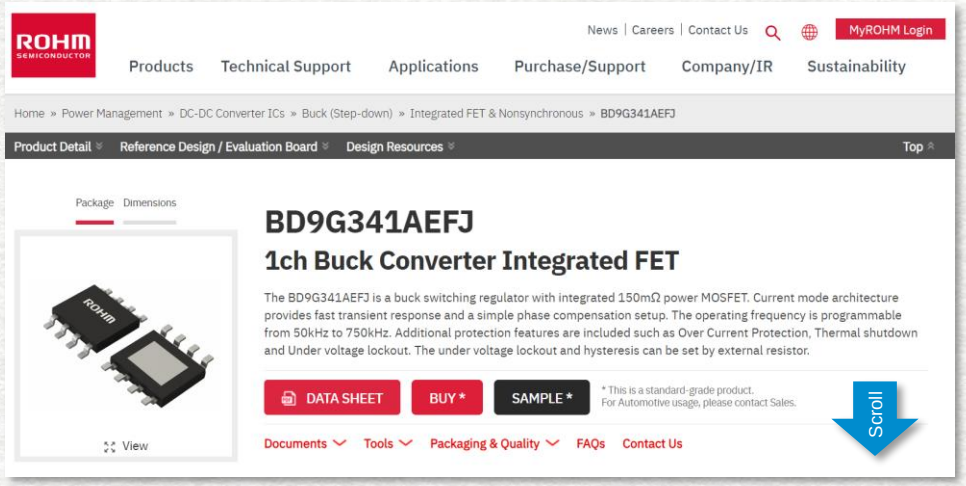
(2) 計算結果
(2) Parameter calculation results

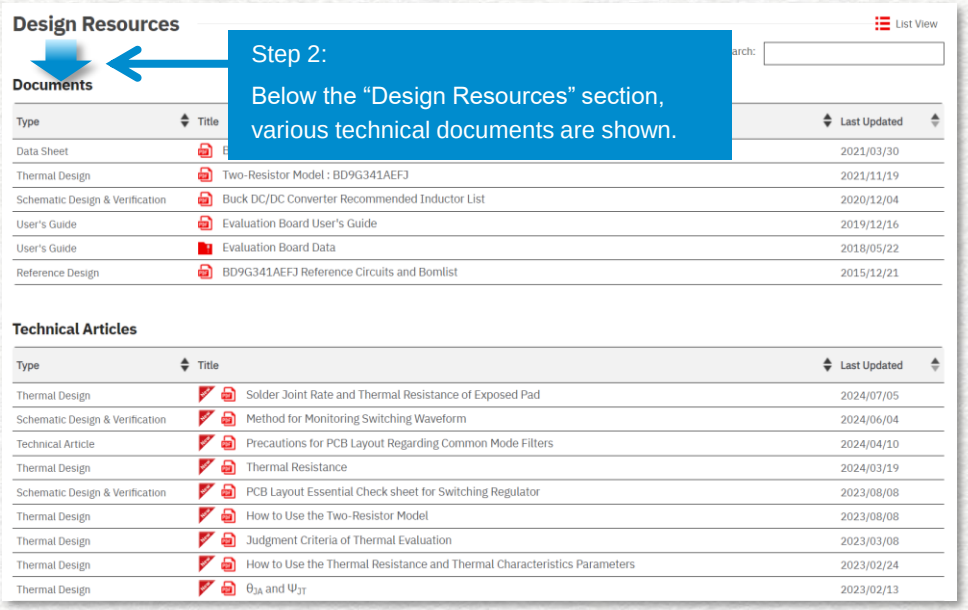
	Parameters	Symbols	Value	Units	Judge	Condition
設計値	Input Voltage (Minimum)	$V_{IN(Min)}$	9.0	V	OK	
	Input Voltage	V_{IN}	12.0	V	-	3.5V to 40V
	Input Voltage (Maximum)	$V_{IN(Max)}$	16.0	V	OK	
Desigin parameters	Output Voltage	V_{OUT_Target}	5.00	V	OK	0.8V to 8.5V
	SW minimum OFF time	t_{OFFMIN}	130	ns	-	VREG = 3.3V
	Maximum load current during startup	$I_{OUT\_Start(Max)}$	0.50	A	-	
	Output Current	I_{OUT}	1.00	A	-	OCP_SEL = H
計算結果	Output voltage	V_{OUT}	6.00	V	OK	1.92 ≦ V_{OUT} ≦ 6.192
Calculation Results	Output Inductor	L_1	4.70	µH	OK	4.7µH to 15µH
	Inductor ripple current	ΔI_L	0.36	A	-	
	Output ripple voltage	ΔV_{P-P}	1.33	mV	-	
	Cout capacitance	C_{OUT}	44.00	µF	OK	C_{OUT} ≧ 44.00 µF
	Minimum C_{OUT} capacitance	C_{OUT_WORST}	44.00	µF	OK	C_{OUT_WORST} ≧ 18.17 µF
	Maximum C_{OUT} capacitance	$C_{OUT(Max)}$	260.42	µF	OK	$C_{OUT(Max)}$ ≧ 44.00 µF
	RMS value of ripple current	$I_{COUT(RMS)}$	0.10	A	OK	$I_{COUT(RMS)}$ < 1.00 A
	Input ripple current (RMS)	$I_{CIN(RMS)}$	0.51	A	-	

*1 The results of theoretical calculations with ideal parts may not match the part values in the recommended parts list (or the simulation results).
The results of the theoretical calculations are temporary values. The component values must be adjusted by evaluation of the actual board to determine the final value.
理想的な部品を用いた理論計算の結果は、推奨部品リストの部品値（またはシミュレーション結果）と一致しない場合があります。
理論計算の結果は仮の値です。最終的な値を決定するには、実際の基板の評価で部品値を調整する必要があります。

How to obtain application notes (various technical documents)

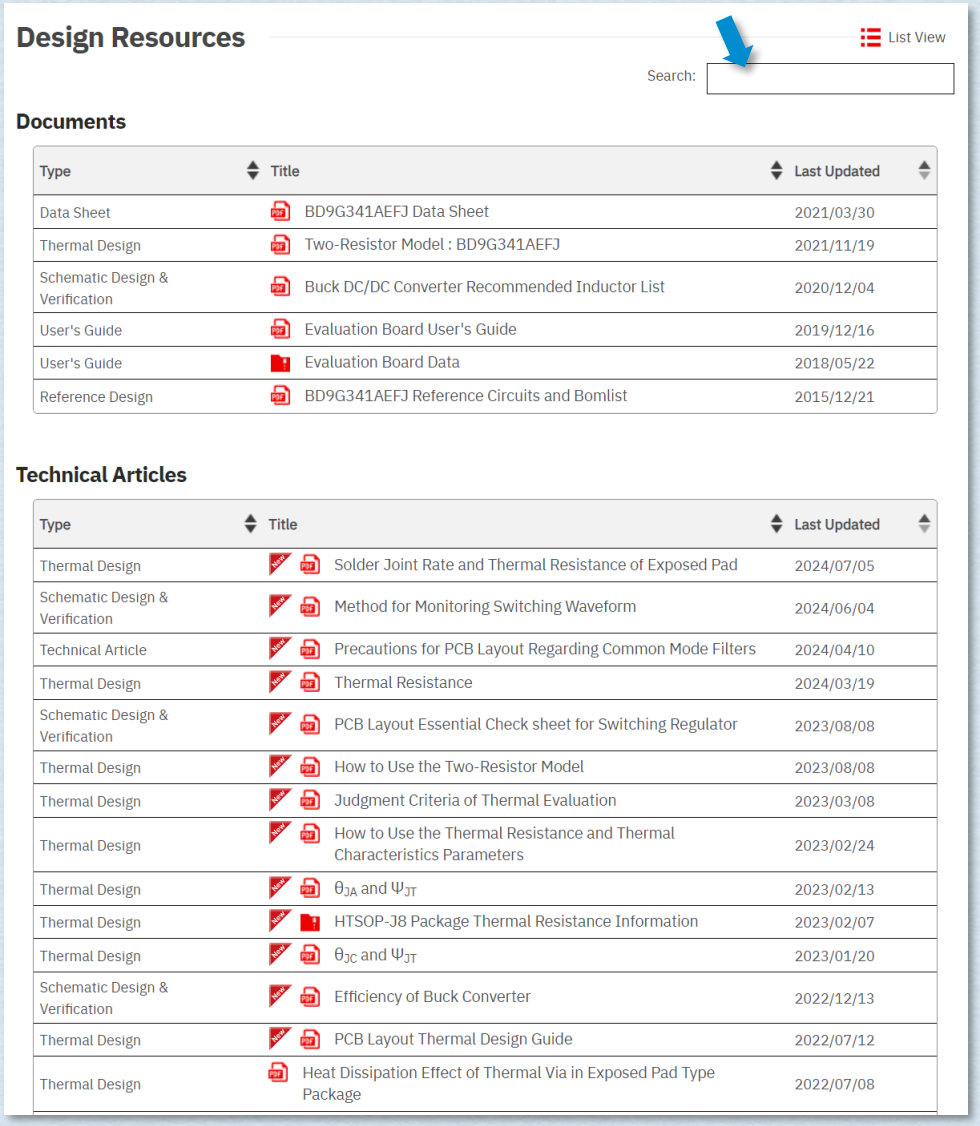
Obtain through one of the following methods:





Step 2:
Below the “Design Resources” section, various technical documents are shown.

Step 3: The “Documents” section shows documents highly relevant to this product name. The “Technical Articles” section shows documents related to this product name. With the “Search” feature on the upper right of the display, you can easily search for document titles.



Information

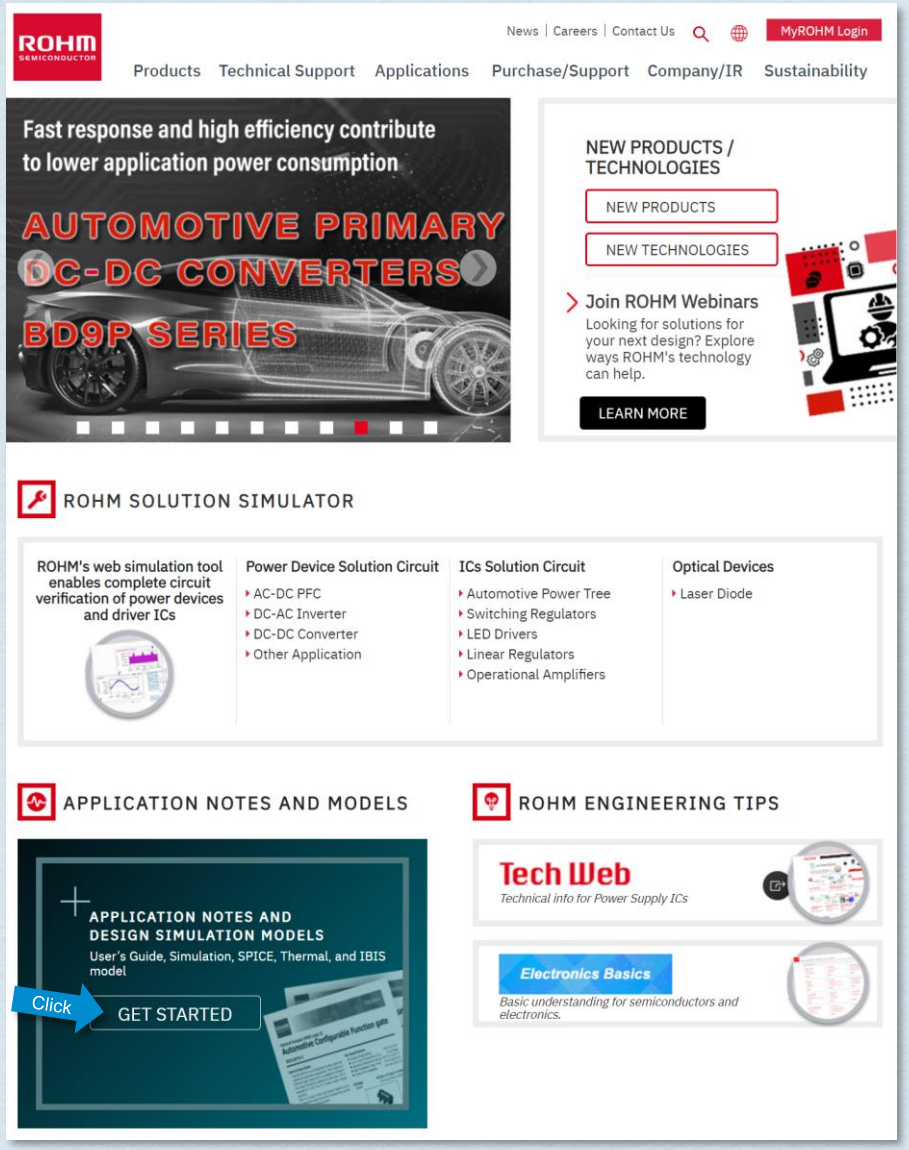
Application Note

Next page

How to obtain application notes (various technical documents) (continued)

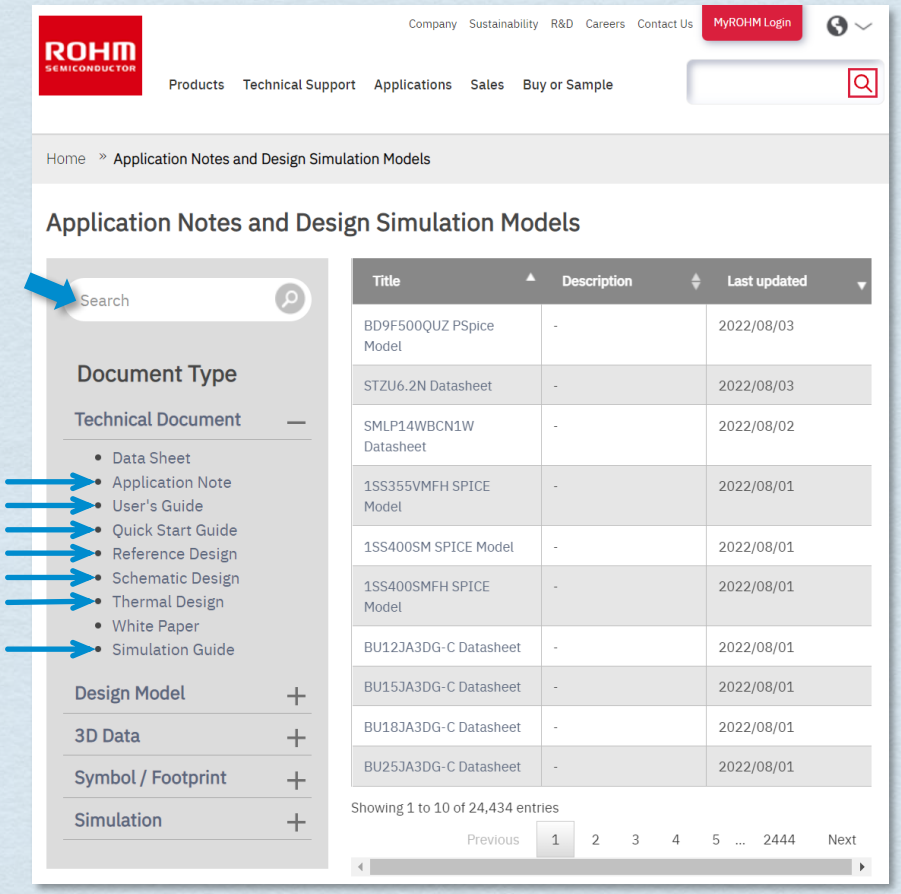
Method 2. Using keywords to search through the website

Step 1: From the home page, access the document search page.



Step 2: Entering a keyword into the “Search” area on the left side of the screen displays the results in a window on the right. Do not confuse the area with the search field on the upper right of the display. With the default setting, all documents and design models including data sheets are targets of the search. As a result, many unnecessary results may be displayed, hiding necessary information.

In such a case, select the type of documents in the list on the left. This displays filtered results. In case of application notes, they may be contained in different categories, such as Schematic Design or Thermal Design. Select the categories sequentially.



How to obtain design models

The design models include the following. Different models are provided depending on the product names.

Electrical simulation models for IC

- PSpice Model: encrypted model file for PSpice.
- Unencrypted SPICE Model: unencrypted model file.
- Spice Modeling Report: modeling report for models listed above.

Electrical simulation models for discrete devices

- SPICE Model: unencrypted model file.
- SPICE Thermal Model: thermal model to be used by electrical simulators.
- PLECS Model: model file for PLECS.

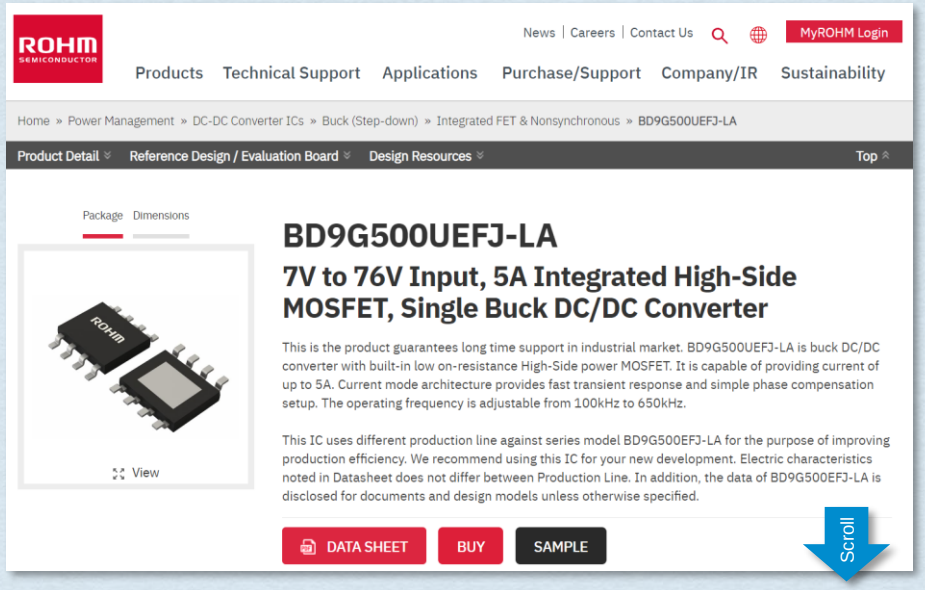
For thermal simulations

- Tow-Resistor Model Report: document describing the values of the two-resistor model.

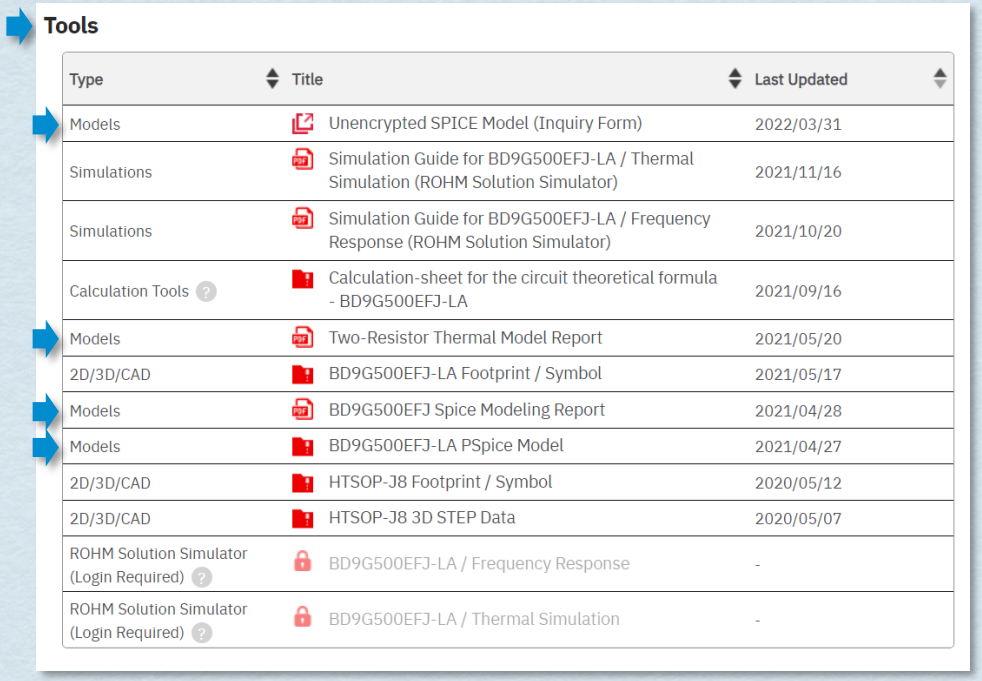
Information

Design Model

Step 1: Display the product page of the product name you want and scroll down the page.



Step 2: “MODELS” is located below the “Tools” section. Models for electrical and thermal simulations are provided. Click the necessary items to download them.

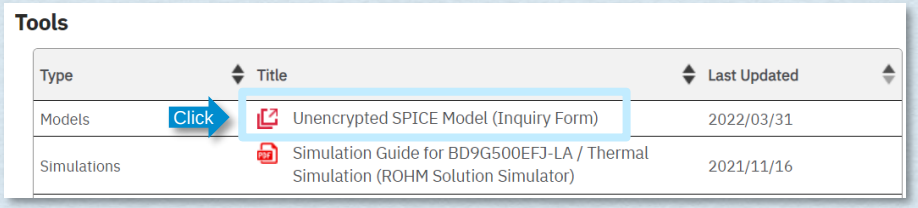


Next page

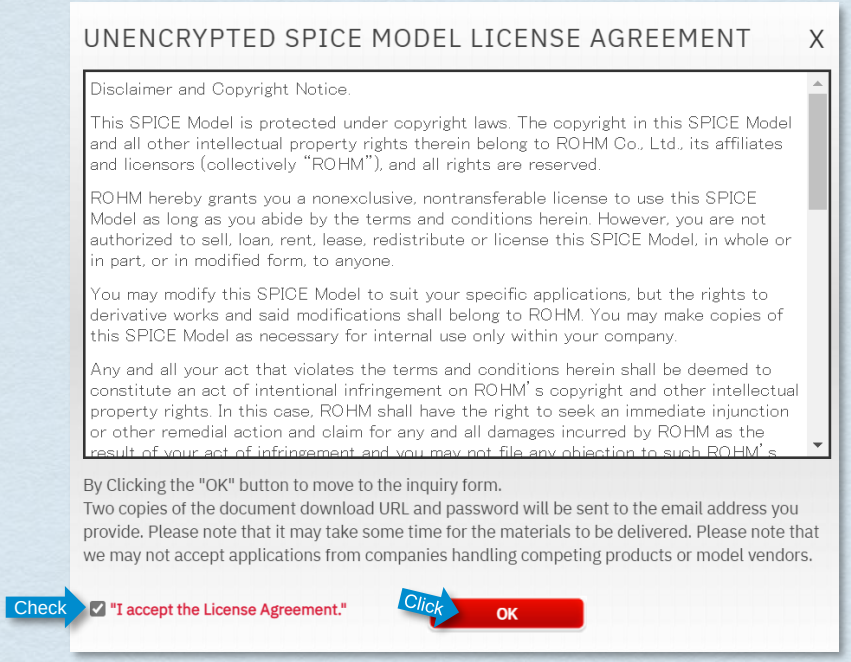
How to obtain design models (continued)

How to obtain Unencrypted SPICE Model

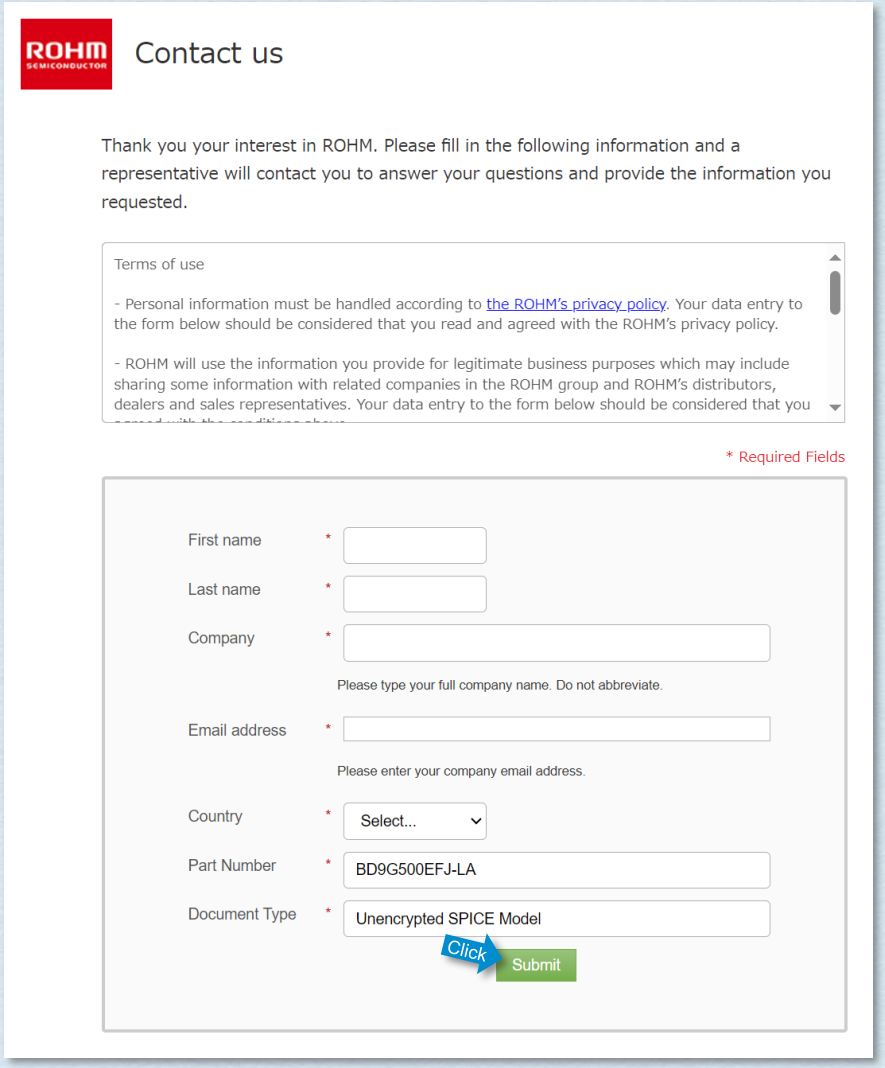
Step 1: Click “Unencrypted SPICE Model (Inquiry Form)”.



Step 2: Read the licensing agreement. If you accept, check “I accept the License Agreement.” and click the [OK] button.



Step 3: When the “Contact us” form is displayed, enter the required details and click the [Submit] button.



Step 4: The URL and password for download are sent to the email address entered. Follow the procedure described in the email to obtain the SPICE Model.

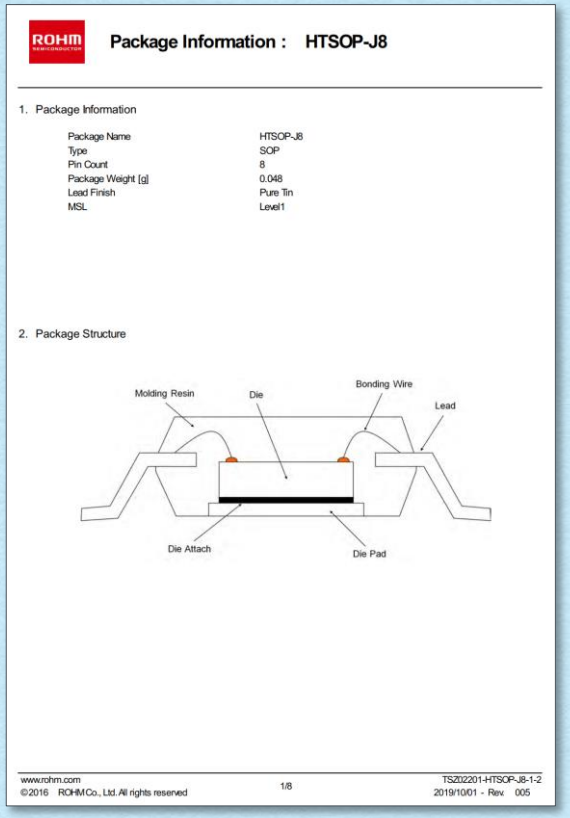
Information
Previous page

Design Model

How to obtain package information

The package information contains the following details.

- Package Structure
- Packing Specification
- Footprint dimensions
- Marking Specification
- Storage conditions
- Soldering conditions



ROHM

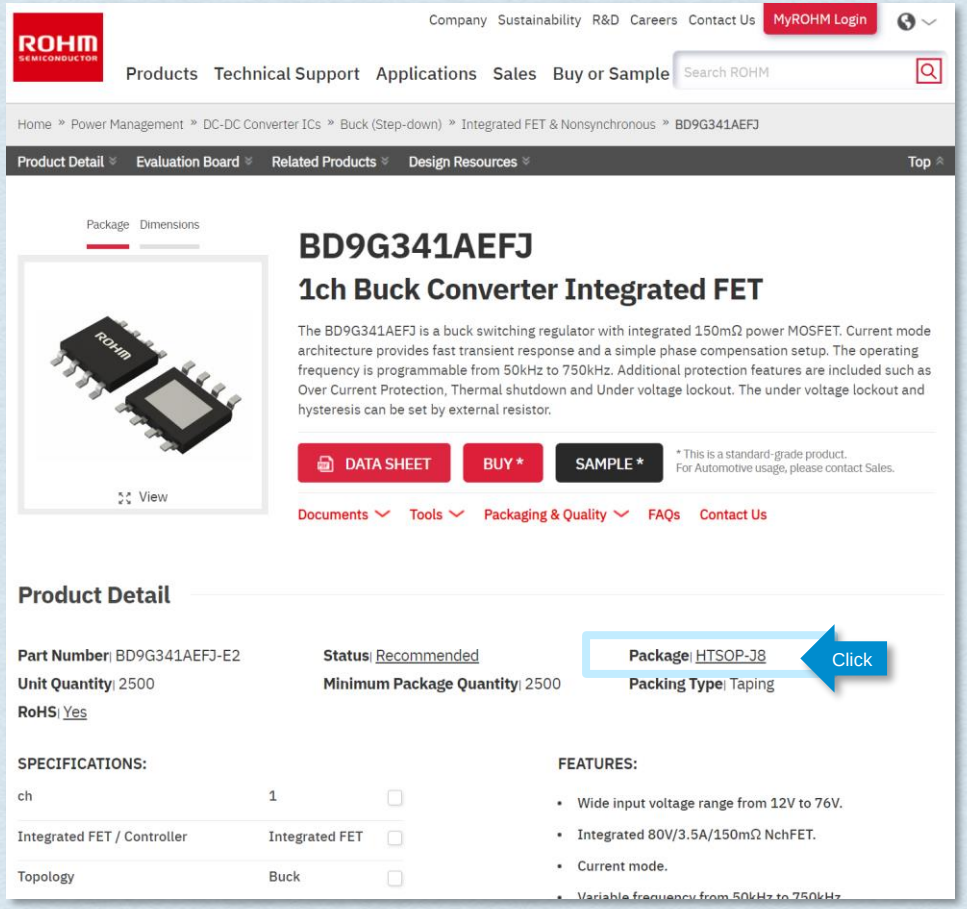
Package Information : HTSOP-J8

1. Package Information

Package Name	HTSOP-J8
Type	SOP
Pin Count	8
Package Weight [g]	0.048
Lead Finish	Pure Tin
MSL	Level1

2. Package Structure

Step 1: Display the product page of the product name you want. Clicking the package name displays the package information.



Information

Package Information

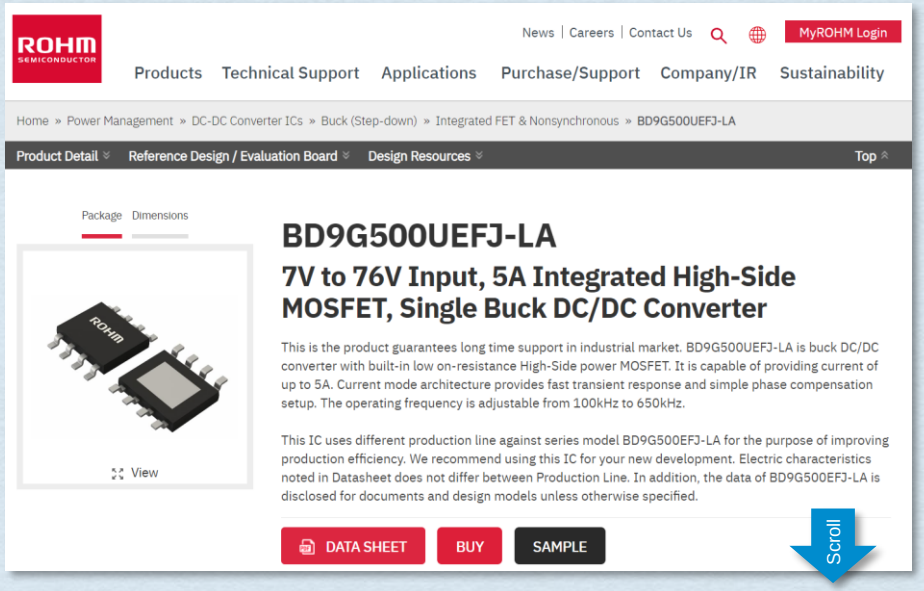
How to obtain PCB library data

The PCB library data (.bxl file) is neutral CAD data independent of CAD tools.
You can import this file into Ultra Librarian® Free Reader and export symbols and footprints in a specific CAD tool format.

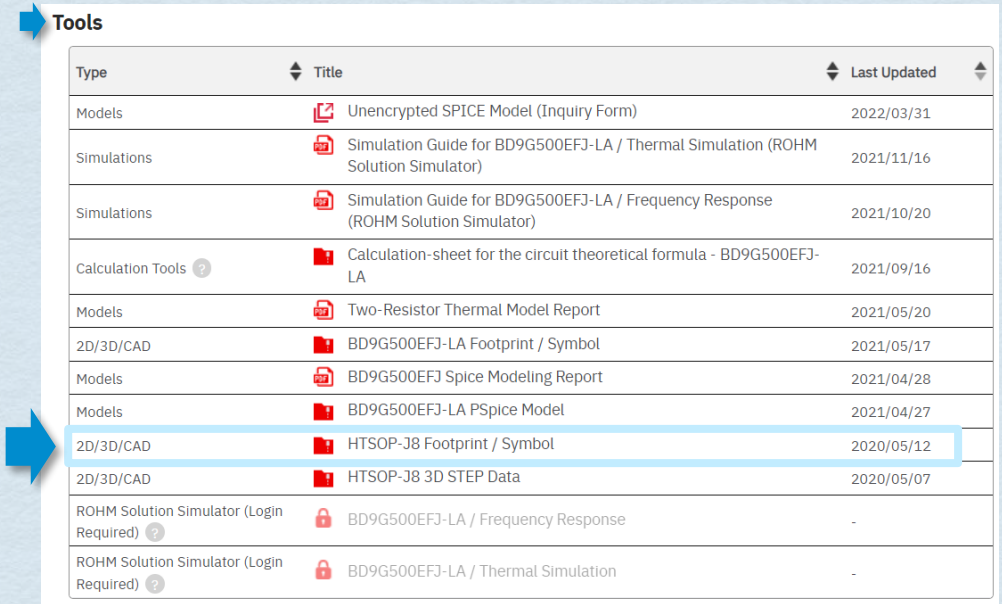
Ultra Librarian® Free Reader supports 30 types of CAD formats and more.

- Accel EDA 14 & 15
- Altium 6 to current version
- Autodesk Fusion 360
- Cadence Allegro
- DesignSpark
- Eagle Libraries
- KiCad
- Mentor Graphics
- BoardStation
- Mentor Graphics Design Architect
- Mentor Graphics Design
- Expedition 99 and 2000
- OrCAD 9.X PCB and Capture
- PADS PowerPCB 3, 3.5, 4.X, and 5.X
- PADS PowerPCB and PowerLogic 3.0
- PCAD 2000, 2001, 2002, 2004, and 2006
- Pulsonix 8.5 or newer
- STL
- 3D STEP
- TARGET 3001!
- View Logic ViewDraw
- Quadcept
- Zuken CadStar 3 and 4
- Zuken CR-5000 and CR-8000
- Zuken eCADSTAR 2020 and 2021

Step 1: Display the product page of the product name you want and scroll down the page.



Step 2: “2D/3D/CAD” is located below “Tools”. Clicking “Footprint /Symbol” starts downloading the library.



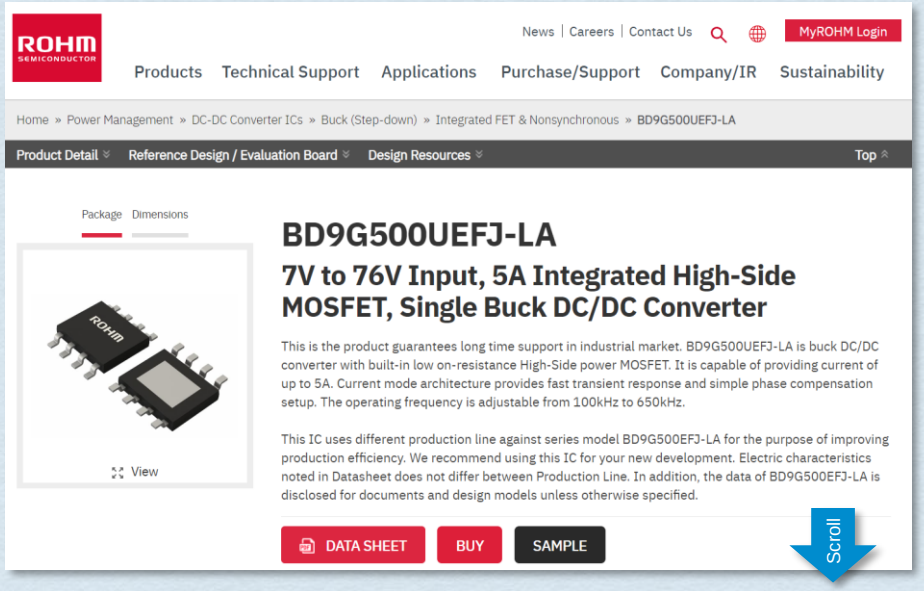
How to obtain 3D models

The 3D package model data representing the 3D outline images of electronic components is provided as a STEP (Standard for the Exchange of Product data) file. The STEP files comply with the international standard, ISO 10303. They can be imported into many CAD systems. In addition, they are saved in the text format so that various CAD systems can interpret them. The data published on the website are outline models in which internal structures cannot be viewed.

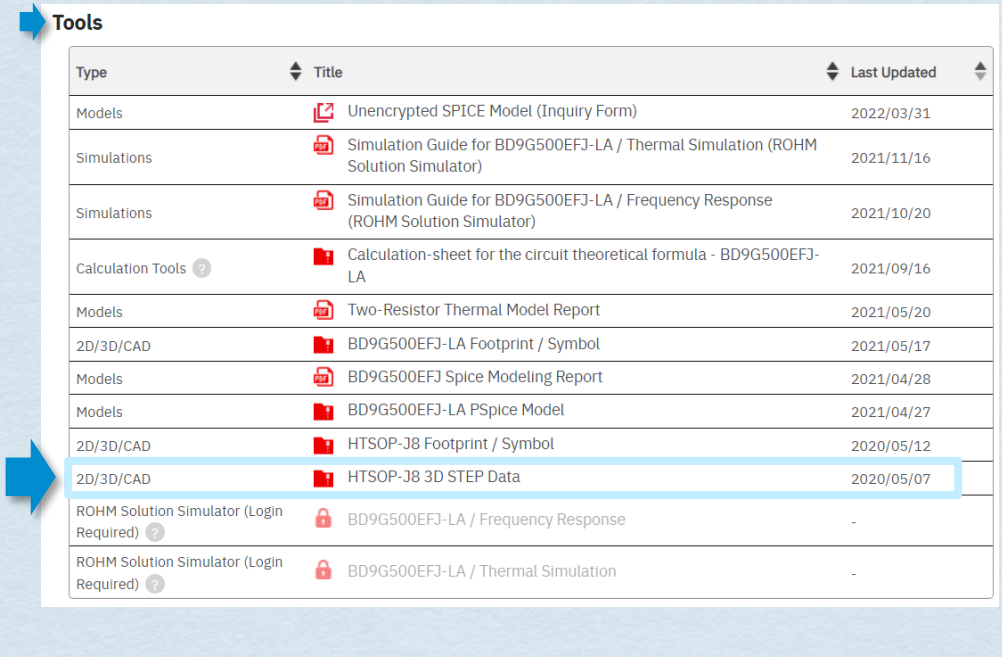
Information

3D Model

Step 1: Display the product page of the product name you want and scroll down the page.



Step 2: “2D/3D/CAD” is located below “Tools”. Clicking “3D STEP Data” starts downloading the model.



Simulation Circuit

Select a circuit to be simulated

Switching Regulator ICs : Automotive

Part number	I_{OUT} [A]	V_{IN} [V]	V_{OUT} [V]	Package	Simulation Circuit			
					Frequency Response	Start Up	Load Response	Line Response
BD9P105EFV-C	1	3.5 to 40	0.8 to 8.5	HTSSOP-B20	Online	-	Online	Online
BD9P105MUF-C				VQFN20FV4040	Online	-	Online	Online
BD9P135EFV-C			3.3	HTSSOP-B20	Online	-	Online	Online
BD9P135MUF-C				VQFN20FV4040	Online	-	Online	Online
BD9P155EFV-C			5.0	HTSSOP-B20	Online	-	Online	Online
BD9P155MUF-C				VQFN20FV4040	Online	-	Online	Online
BD9P205EFV-C	2	3.5 to 40	0.8 to 8.5	HTSSOP-B20	Online	-	Online	Online
BD9P205MUF-C				VQFN20FV4040	Online	-	Online	Online
BD9P235EFV-C			3.3	HTSSOP-B20	Online	-	Online	Online
BD9P235MUF-C				VQFN20FV4040	Online	-	Online	Online
BD9P255EFV-C			5.0	HTSSOP-B20	Online	-	Online	Online
BD9P255MUF-C				VQFN20FV4040	Online	-	Online	Online
BD9P108MUF-C	1	3.5 ～ 40	0.8 ～ 8.5	VQFN24FV4040	Online	-	-	-
BD9P208MUF-C	2			VQFN24FV4040	Online	-	-	-
BD9P308MUF-C	3			VQFN24FV4040	Online	-	-	-
BD9P608MFF-C	6			VFN20FV4535	Online	-	-	-
BD9S200MUF-C	2	2.7 to 5.5	0.8 to 4.4	VQFN16FV3030	Online	-	-	-
BD9S300MUF-C	3			VQFN16FV3030	Online	-	-	-
BD9S400MUF-C	4			VQFN16FV3030	Online	-	-	-
BD9S201NUX-C	2	2.7 to 5.5	0.8 to 5.5	VSON008X2020	Online	-	-	-
BD9S402MUF-C	4	2.7 ～ 5.5	0.6 ～ 4.125	VQFN16FV3030	Online	-	-	-
BD9G201(U)EFJ-M	1.5	4.5 to 42	0.8 to 42	HTSOP-J8ES	Online	-	-	-
BD9G401(U)EFJ-M	3.5			HTSOP-J8ES	Online	-	-	-

Catalog

ROHM Solution Simulator

Page 1 / 4

Next page

Information

For the latest lineup of simulation circuits, check our website.

www

Simulation Circuit (Continued)

Select a circuit to be simulated

Switching Regulator ICs : Automotive (Continued)

Part number	I_{OUT} [A]	V_{IN} [V]	V_{OUT} [V]	Package	Simulation Circuit			
					Frequency Response	Start Up	Load Response	Line Response
BD8P250MUF-C	2	3.5 to 36	5.0	VQFN24FV4040	Online	-	-	-
BD90610EFJ-C	1.25	3.5 to 36	0.8 to 36	HTSOP-J8	Online	Online	-	-
BD90620EFJ-C	2.5			HTSOP-J8	Online	Online	-	-
BD90620HFP-C				HRP7	Online	Online	-	-
BD90640EFJ-C	4			HTSOP-J8	Online	Online	-	-
BD90640HFP-C				HRP7	Online	Online	-	-
BD8P250MUF-C + BD90302NUF-C	2	2.7 to 36	5.0	VQFN24FV4040 + VSON10FV3030	Online	-	-	-

Switching Regulator ICs : Industrial

Part number	I_{OUT} [A]	V_{IN} [V]	V_{OUT} [V]	Package	Simulation Circuit				
					Frequency Response	Start Up	Load Response	Line Response	Thermal
BD9A201FP4-LBZ	2	2.7 to 5.5	0.8 to 3.85	TSOT23-8L	Online	-	-	-	-
BD9E100FJ-LB	1	7.0 to 36	1.0 to 25.2	SOP-J8	Online	-	-	-	-
BD9E101FJ-LB					Online	-	-	-	-
BD9E300EFJ-LB	2.5			HTSOP-J8	Online	-	-	-	-
BD9E301EFJ-LB					Online	-	-	-	-
BD9E303EFJ-LB	3		1.0 to 28.8	HTSOP-J8	Online	-	-	-	-
BD9E304FP4-LBZ	3	4.5 to 36	0.7 to 28	TSOT23-8L	Online	-	-	-	-
BD9G102G-LB	0.5	6.0 to 42	0.75 to 33.6	SSOP6	Online	-	-	-	-
BD9G201(U)EFJ-LB	1.5	4.5 to 42	0.8 to 42	HTSOP-J8ES	Online	-	-	-	-
BD9G341AEFJ-LB	3	12 to 76	1.0 to 76	HTSOP-J8	Online	-	Online	Online	-
BD9G500EFJ-LA	5	7.0 to 76	1.0 to 68.4	HTSOP-J8	Online	-	-	-	Online
BD9615MUV-LB	-	3.5 ～ 60	-	VQFN16KV3030	Online	-	-	-	-

Previous page
Next page

Information

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Simulation Circuit (Continued)

Select a circuit to be simulated

Switching Regulator ICs : Standards

Part number	I_{OUT} [A]	V_{IN} [V]	V_{OUT} [V]	Package	Simulation Circuit			
					Frequency Response	Start Up	Load Response	Line Response
BD9A300MUV	3	2.7 to 5.5	0.8 to 3.85	VQFN016V3030	Online	-	-	-
BD9D300MUV	3	4.0 to 17	0.9 to 5.25	VQFN016V3030	Online	-	-	-
BD9E104FJ	1	7.0 to 26	1.0 to 13	SOP-J8	Online	-	-	-
BD9E105FP4-Z	1	4.5 ～ 28	0.7 ～ 22	TSOT23-6L	Online	-	-	-
BD9E200FP4-Z	2	4.5 to 26	0.7 to 20.8	TSOT23-6L	Online	-	Online	-
BD9E201FP4-Z	2	4.5 to 28	0.7 to 22	TSOT23-6L	Online	-	Online	-
BD9E202FP4-Z	2	4.5 ～ 28	0.7 ～ 22.4	TSOT23-6CJ	Online	-	Online	-
BD9E302EFJ	3	7.0 to 28	1.0 to 19.6	HTSOP-J8	Online	-	-	-
BD9F500QUZ	5	4.5 to 36	0.6 to 14	VMMP16LZ3030	Online	-	-	-
BD9F800MUX-Z	8	4.5 to 28	0.765 to 13.5	VQFN11X3535A	Online	-	-	-
BD9611MUV	-	10 ～ 56	1.0 ～ 44.8	VQFN020V4040	Online	-	-	-

Previous page
Next page
Catalog
ROHM Solution Simulator
Page 3 / 4

Information

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Simulation Circuit (Continued)

Select a circuit to be simulated

Linear Regulators : Automotive

Part number	I_{OUT} [A]	V_{IN} [V]	V_{OUT} [V]	Package	Simulation Circuit		
					Load Response	Line Response	Thermal
BD433M2EFJ-C	0.2	3.9 to 42	3.3	HTSOP-J8	Online	Online	Online
BD433M2FP3-C				SOT223-4F	Online	Online	-
BD433M5FP-C	0.5	4.0 to 42		TO252-3	Online	Online	Online
BD433M5FP2-C				TO263-3	Online	Online	Online
BD450M2EFJ-C	0.2	5.5 to 42	5.0	HTSOP-J8	Online	Online	Online
BD450M2FP3-C				SOT223-4F	Online	Online	-
BD450M5FP-C	0.5	5.5 to 42		TO252-3	Online	Online	Online
BD450M5FP2-C				TO263-3	Online	Online	Online
BD733L2EFJ-C	0.2	4.37 to 45	3.3	HTSOP-J8	Online	Online	-
BD733L5FP-C	0.5	4.17 to 45		TO252-3	Online	Online	-
BD750L2EFJ-C	0.2	5.8 to 45	5.0	HTSOP-J8	Online	Online	-
BD750L5FP-C	0.5	5.6 to 45		TO252-3	Online	Online	-
BD933N1G-C	0.15	4.5 to 42	3.3	SSOP5	Online	Online	Online
BD933N1WG-C					Online	Online	Online
BD933N1EFJ-C				HTSOP-J8	Online	Online	Online
BD933N1WEFJ-C					Online	Online	Online
BD950N1G-C		6.0 to 42	5.0	SSOP5	Online	Online	Online
BD950N1WG-C					Online	Online	Online
BD950N1EFJ-C				HTSOP-J8	Online	Online	Online
BD950N1WEFJ-C					Online	Online	Online
BD00C0AWFP-C	1	4.0 to 26.5	1.0 to 15	TO252-5	Online	Online	-
BD80C0AWFP-C			8.0		Online	Online	-

Previous page

Catalog

ROHM Solution Simulator

Information

For the latest lineup of simulation circuits, check our website.

www

Application Note

A. Linear Regulators

A-1. Circuit Design

Online Browsing	Title
[EN] [JP] [CN] [KR]	Basics of Linear Regulators
[EN] [JP] [CN]	Linear Regulator Specifications
[EN] [JP]	Table of resistance for output voltage setting on linear regulator ICs
[EN] [JP]	Reverse Voltage Protection
[EN] [JP]	Power Source ON/OFF Characteristics for Linear Regulator
[EN] [JP]	Connecting LDOs in Parallel
[EN] [JP]	Problem Situations: Power Supply Does Not Start
[EN] [JP]	BAxxCC0 Series Circuit Using a Ceramic Output Capacitor
[EN] [JP]	Suppression Method of Switching Noise Using Linear Regulator and Low Pass Filter
[EN] [JP] [CN] [KR]	Impedance Characteristics of Bypass Capacitor
[EN] [JP] [CN]	How to Select Reverse Current Protection Diodes for LDO Regulators

A-2. Thermal Design

Online Browsing	Title
[EN] [JP] [CN]	What Is Thermal Design?
[EN] [JP] [CN]	Basics of Thermal Resistance and Heat Dissipation
[EN] [JP] [CN] [KR]	Thermal resistance and thermal characterization parameter
[EN] [JP] [CN]	θ_{JA} and Ψ_{JT}
[EN] [JP] [CN]	θ_{JC} and Ψ_{JT}
[EN] [JP] [CN]	How to Use the Thermal Resistance and Thermal Characteristics Parameters
[EN] [JP] [CN]	Judgment Criteria of Thermal Evaluation
[EN] [JP]	Thermal Design for Three-Terminal Voltage Regulators
[EN] [JP]	Thermal Calculation for Linear Regulator
[EN] [JP] [CN]	Two-Resistor Model for Thermal Simulation
[EN] [JP]	How to Use the Two-Resistor Model
[EN] [JP] [CN]	Method for Calculating Junction Temperature from Transient Thermal Resistance Data
[EN] [JP] [CN]	Calculating Junction Temperature from Inrush Current
[EN] [JP] [CN]	Solder Joint Rate and Thermal Resistance of Exposed Pad

Catalog

Application Note

Page 1 / 10

Next page

Information

For new titles, check the product pages and the document search page.

Application Note

A. Linear Regulators (Continued)

A-3. Simulation

Online Browsing	Title
[EN] [JP]	Usage of SPICE MacroModel (for LDO)

A-4. EMC

Online Browsing	Title
[EN] [JP] [CN]	EMC Measures for LDOs

A-5. PCB Design

Online Browsing	Title
[EN] [JP] [CN]	Design Guide and Example of Stencil for Exposed Pad
[EN] [JP] [CN]	PCB Layout Thermal Design Guide
[EN] [JP] [CN]	Heat Dissipation Effect of Thermal Via in Exposed Pad Type Package

A-6. Evaluation

Online Browsing	Title
[EN] [JP]	Measurement Method for Phase Margin with Frequency Response Analyzer (FRA)
[EN] [JP]	Simple Test Method for Estimating the Stability of Linear Regulators
[EN] [JP]	Problem Situations: Power Supply Does Not Start

A-7. Thermal Measurement

Online Browsing	Title
[EN] [JP]	Notes for Temperature Measurement Using Thermocouples
[EN] [JP]	Notes for Temperature Measurement Using Forward Voltage of PN Junction
[EN] [JP] [CN] [KR]	Precautions When Measuring the Rear of the Package with a Thermocouple

Previous page
Next page
Catalog
Application Note

Information

For new titles, check the product pages and the document search page.

A-8. Design Data

	Part number	Application Information Provides hints for IC mounting	Reference Circuit	Dropout Voltage Design reference values	Typical Performance Curves	PCB Layout
BA	BA178xx series	[EN] [JP]	-	[EN] [JP]	[EN] [JP]	[EN] [JP]
	BA178Mxx series	[EN] [JP]	-	[EN] [JP]	[EN] [JP]	
	BA1117 series	[EN] [JP]	-	[EN] [JP]	-	[EN] [JP]
	BAxxBC0 series	[EN] [JP]	-	[EN] [JP]	[EN] [JP]	[EN] [JP]
	BAxxCC0 series	[EN] [JP]	-	[EN] [JP]	[EN] [JP]	
	BAxxDD0 series	[EN] [JP]	-	[EN] [JP]	[EN] [JP]	
	BAxxJC5 series	-	-	[EN] [JP]	-	
BD	BDxxGC0 series	[EN] [JP]	[EN] [JP]	[EN] [JP]	-	[EN] [JP]
	BDxxGA5 series	[EN] [JP]	[EN] [JP]	[EN] [JP]	-	
	BDxxGA3 series	[EN] [JP]	[EN] [JP]	[EN] [JP]	-	
	BDxxHC5 series	[EN] [JP]	[EN] [JP]	[EN] [JP]	-	
	BDxxHC0 series	[EN] [JP]	[EN] [JP]	[EN] [JP]	-	
	BDxxHA5 series	[EN] [JP]	[EN] [JP]	[EN] [JP]	-	
	BDxxHA3 series	[EN] [JP]	[EN] [JP]	[EN] [JP]	-	
	BDxxIC0 series	[EN] [JP]	[EN] [JP]	[EN] [JP]	-	
	BDxxIA5 series	[EN] [JP]	[EN] [JP]	[EN] [JP]	-	
	BDxxKA5 series	[EN] [JP]	[EN] [JP]	[EN] [JP]	-	[EN] [JP]
	BD00D0A series	-	-	[EN] [JP]	-	-
	BD00EA5 series	-	-	[EN] [JP]	-	-
	BDxxFC0 series	-	[EN] [JP]	[EN] [JP]	-	[EN] [JP]
	BDxxFD0 series	-	-	[EN] [JP]	-	-

Previous page
Next page
Catalog
Application Note
Page 3 / 10

Information

For new titles, check the product pages and the document search page.

A-8. Design Data (Continued)

	Part number	Application Information Provides hints for IC mounting	Reference Circuit	Dropout Voltage Design reference values	Typical Performance Curves	PCB Layout
BD	BDxxC0A series	-	[EN] [JP]	-	-	[EN] [JP]
	BDxxD0A series	-	[EN] [JP]	-	-	
	BDxxFA1MG-M series	[EN] [JP]	-	[EN] [JP]	-	[EN] [JP]
	BDxxFA1FP3 series	[EN] [JP]	-	[EN] [JP]	-	
	BD35395FJ	-	-	-	-	[EN] [JP]
BU	BUxxJA2MNVX-C series	-	-	[EN] [JP]	-	[EN] [JP]
	BUxxJA2DG,VG series	-	-	[EN] [JP]	-	-
	BUxxTD2 series	-	-	[EN] [JP]	-	[EN] [JP]
	BUxxTD3 series	[EN] [JP]	-	[EN] [JP]	-	[EN] [JP]
	BUxxSA4 series	-	-	[EN] [JP]	-	[EN] [JP]
	BUxxSA5 series	-	-	[EN] [JP]	-	[EN] [JP]
	BUxxTA2 series	-	-	[EN] [JP]	-	[EN] [JP]
	BUxxSD2 series	-	-	[EN] [JP]	-	[EN] [JP]
	BUxxSD5 series	-	-	[EN] [JP]	-	[EN] [JP]
BH	BHxxM0A series	-	-	-	-	[EN] [JP]
	BHxxMA3 series	-	-	-	-	[EN] [JP]
	BHxxNB1 series	-	-	-	-	[EN] [JP]
	BHxxPB1 series	-	-	-	-	[EN] [JP]
	BHxxRB1 series	-	-	-	-	[EN] [JP]
	BHxxSA3 series	-	-	-	-	[EN] [JP]

Previous page
Next page
Catalog
Application Note
Page 4 / 10

Information

For new titles, check the product pages and the document search page.

A-9. Thermal Resistance Data

Online Browsing	Title
[EN] [JP] [CN]	TO252 Package Thermal Resistance Information
[EN] [JP] [CN]	HTSOP-J8 Package Thermal Resistance Information
[EN] [JP]	Thermal Resistance Data: TO220CP-V5
[EN][JP]	Thermal Resistance Data: TO263-5 (BD4xxM5WFP2-C)
[EN] [JP]	Thermal Resistance Data: SSOP5 (BUxxJA2DC-C, VG-C)
[EN] [JP]	Thermal Resistance Data: SSOP5 (BUxxJA3DC-C)
[EN] [JP]	Thermal Resistance Data: SSOP5 (BUxxTD3WG)
[EN] [JP]	Thermal Resistance Data: SSOP5 (BD7xxL05G-C)
[EN] [JP]	Thermal Resistance Data: SSOP5 (BD9xxN1G-C)
[EN] [JP]	Thermal Resistance Data: VSON008X2030 (BDxxGA3WNUX)
[EN] [JP]	Thermal Resistance Data: HVSOF6 (BD00IA5MHFV-M)
[EN] [JP]	Thermal Resistance Data: SSON004X1010 (BUxxTD2WNVX)
[EN] [JP]	Thermal Resistance Data: HRP7 (BD8374HFP LED driver) [Reference data]

Previous page
Next page
Catalog
Application Note
Page 5 / 10

Information

For new titles, check the product pages and the document search page.

Application Note

B. Switching Regulator ICs

B-1. Circuit Design

Online Browsing	Title
[EN] [JP] [CN]	Precautions When Measuring the Rear of the Package with a Thermocouple
[EN] [JP] [CN]	Capacitor Calculation for Buck converter IC
[EN] [JP] [CN]	The Important Points of Multi-layer Ceramic Capacitor Used in Buck Converter circuit
[EN] [JP] [CN]	Calculation of Power Loss (Synchronous)
[EN] [JP] [CN]	Considerations for Power Inductors Used for Buck Converters
[EN] [JP] [CN]	Snubber Circuit for Buck Converter IC
[EN] [JP] [CN]	Efficiency of Buck Converter
[EN] [JP] [CN] [KR]	Phase Compensation Design for Current Mode Buck Converter
[EN] [JP]	Bootstrap Circuit in the Buck Converter
[EN] [JP] [CN]	Method for Determining Constants of Peripheral Parts of Buck DC/DC Converter
[EN] [JP] [CN]	Resistor Value Table to set Output Voltage of Buck Converter IC
[EN] [JP]	Power Supply Sequence Circuit with General Purpose Power Supply IC
[EN] [JP]	Suppression Method of Switching Noise Using Linear Regulator and Low Pass Filter
[EN] [JP] [CN] [KR]	Impedance Characteristics of Bypass Capacitor
[EN] [JP]	Types of Capacitors Used for Output Smoothing of Switching Regulators and their Precautions
[EN] [JP]	Diode Selection Method for Asynchronous Converter

B-2. Thermal Design

Online Browsing	Title
[EN] [JP] [CN]	What Is Thermal Design?
[EN] [JP] [CN]	Basics of Thermal Resistance and Heat Dissipation
[EN] [JP] [CN] [KR]	Thermal resistance and thermal characterization parameter
[EN] [JP] [CN]	θ_{JA} and Ψ_{JT}
[EN] [JP] [CN]	θ_{JC} and Ψ_{JT}
[EN] [JP] [CN]	How to Use the Thermal Resistance and Thermal Characteristics Parameters
[EN] [JP] [CN]	Judgment Criteria of Thermal Evaluation
[EN] [JP] [CN]	Two-Resistor Model for Thermal Simulation
[EN] [JP]	How to Use the Two-Resistor Model
[EN] [JP] [CN]	Method for Calculating Junction Temperature from Transient Thermal Resistance Data
[EN] [JP] [CN]	Solder Joint Rate and Thermal Resistance of Exposed Pad
[EN] [JP] [CN]	HTSOP-J8 Package Thermal Resistance Information
[EN] [JP] [CN]	TO252 Package Thermal Resistance Information

Previous page
Next page

Information

For new titles, check the product pages and the document search page.

Application Note

B. Switching Regulator ICs (Continued)

B-3. Simulation

Online Browsing	Title
[EN] [JP] [CN] [KR]	Usage of SPICE MacroModel (for DC/DC)

B-4. EMC

Online Browsing	Title
[EN] [JP]	Design and Application Considerations of Input Filter to reduce Conducted Emissions caused by DC/DC converter
[EN]	Considerations for Power Inductors: How Flux Orientation Can Reduce Radiated Emission
[EN] [JP]	Precautions for PCB Layout Regarding Common Mode Filters

B-5. PCB Design

Online Browsing	Title
[EN] [JP] [CN] [KR]	PCB Layout Techniques of Buck Converter
[JP]	PCB Layout Techniques of Boost Converter
[EN] [JP]	PCB Layout Essential Check sheet for Switching Regulator
[EN] [JP] [CN]	Design Guide and Example of Stencil for Exposed Pad
[EN] [JP] [CN]	PCB Layout Thermal Design Guide
[EN] [JP] [CN]	Heat Dissipation Effect of Thermal Via in Exposed Pad Type Package

B-6. Evaluation

Online Browsing	Title
[EN] [JP]	Measurement Method for Phase Margin with Frequency Response Analyzer (FRA)
[EN] [JP] [CN]	Method for Monitoring Switching Waveform
[EN] [JP] [CN] [KR]	Calculation of Power Dissipation in Switching Circuit
[EN] [JP] [CN] [KR]	Calculating Power Loss from Measured Waveforms
[EN] [JP] [CN] [KR]	Importance of Probe Calibration When Measuring Power: Deskew

B-7. Thermal Measurement

Online Browsing	Title
[EN] [JP]	Notes for Temperature Measurement Using Thermocouples
[EN] [JP]	Notes for Temperature Measurement Using Forward Voltage of PN Junction
[EN] [JP] [CN] [KR]	Precautions When Measuring the Rear of the Package with a Thermocouple

Information

For new titles, check the product pages and the document search page.

Application Note

B. Switching Regulator ICs (Continued)

B-8. Design Data

	Part number	Reference Circuit	PCB Layout
BD9Axxx series	BD9A100MUV	[EN] [JP]	[EN] [JP]
	BD9A101MUV-LB		
	BD9A300MUV	[EN] [JP]	
	BD9A301MUV-LB		
	BD9A400MUV	[EN] [JP]	
	BD9A600MUV	[EN] [JP]	
BD9Bxxx series	BD9B100MUV	[EN] [JP]	[EN] [JP]
	BD9B200MUV	[EN] [JP]	
	BD9B300MUV	[EN] [JP]	
	BD9B301MUV		
	BD9B400MUV	[EN] [JP]	
	BD9B500MUV	[EN] [JP]	
	BD9B600MUV	[EN] [JP]	
BD9Cxxx series	BD9C301FJ	[EN] [JP]	[EN] [JP]
	BD9C401EFJ	[EN] [JP]	
	BD9C501EFJ	[EN] [JP]	
	BD9C601EFJ	[EN] [JP]	
BD9Dxxx series	BD9D320EFJ	[EN] [JP]	[EN] [JP]
	BD9D321EFJ	[EN] [JP]	
BD9Exxx series	BD9E100FJ	[EN] [JP]	[EN] [JP]
	BD9E101FJ	[EN] [JP]	
	BD9E104FJ	-	
	BD9E300EFJ	[EN] [JP]	[EN] [JP]
	BD9E301EFJ	[EN] [JP]	
	BD9E302EFJ	[EN] [JP]	-
	BD9E303EFJ	[EN] [JP]	[EN] [JP]
BD9Fxxx series	BD9F800MUX	[EN] [JP]	-
BD9Gxxx series	BD9G101G	[EN] [JP]	-
	BD9G201EFJ-M	[EN] [JP]	-
	BD9G341AEFJ	[EN] [JP]	-
	BD9G401EFJ-M	[EN] [JP]	-
others	BD9106FVM	[EN] [JP]	-
	BD9130NV	[EN] [JP]	-
	BD9137MUV	[EN] [JP]	-
	BD9139MUV	[EN] [JP]	-
	BD9141MUV	[EN] [JP]	-
	BD9611MUV	[EN] [JP]	-
	BD9851EFV	[EN] [JP]	-
	BD70522GUL	[EN] [JP]	-
	BD95821NUV	[EN] [JP]	-
	BD95831NUV	[EN] [JP]	-
	BD95841NUV	[EN] [JP]	-
	BD95861NUV	[EN] [JP]	-
Buck DC/DC Converter Recommended Inductor List		[EN] [JP]	

Information

For new titles, check the product pages and the document search page.

B-9. Thermal Resistance Data

Online Browsing	Title
[EN] [JP] [CN]	TO252 Package Thermal Resistance Information
[EN] [JP] [CN]	HTSOP-J8 Package Thermal Resistance Information

Catalog

Application Note

Page 9 / 10

Previous page

Next page

Information

For new titles, check the product pages and the document search page.

Application Note
C. Power Devices

C-1. Circuit Design

Online Browsing	Title
[EN] [JP] [CN]	SiC Power Devices and Modules Application Note
[EN] [JP] [CN]	Calculation of Power Dissipation in Switching Circuit
[EN] [JP] [CN]	Impedance Characteristics of Bypass Capacitor
[EN] [JP] [CN]	Gate-Source Voltage Behavior in a Bridge Configuration
[EN] [JP] [CN]	Gate-Source Voltage Surge Suppression Methods
[EN] [JP] [CN]	SiC MOSFET Snubber Circuit Design Methods
[EN] [JP] [CN]	5 kW High-Efficiency Fan-less Inverter
[EN] [JP] [CN]	800 V Three-Phase Output LLC DC-DC Resonant Converter
[EN] [JP] [CN]	5 kW Inverter Circuit Using 4th Generation SiC MOSFETs
[EN] [JP] [CN]	4th Gen SiC MOSFETs Discrete Package: Characteristics and Precautions for Circuit Design Application Note
[EN] [JP] [CN]	Design Method for Comparator-less Miller Clamp Circuits
[EN] [JP] [CN]	Basics and Design Guidelines for Gate Drive Circuits
[EN] [JP] [CN]	Oscillation Countermeasures for MOSFETs in Parallel
[EN] [JP] [CN]	Improvement of Switching Loss by Driver Source
[EN] [JP] [CN]	Application Benefits of Using 4th Generation SiC MOSFETs

C-2. Thermal Design

Online Browsing	Title
[EN] [JP] [CN]	Notes for Calculating Power Consumption: Static Operation
[EN] [JP] [CN]	Example of Heat Dissipation Design for TO Packages: Effect of Heat Dissipation Materials
[EN] [JP] [CN]	Precautions for Thermal Resistance of Insulation Sheet

C-3. Simulation

Online Browsing	Title
[EN] [JP]	How to Create Symbols for PSpice Models
[EN] [JP]	How to Use LTspice Models
[EN] [JP]	How to Use LTspice Models: Tips for Improving Convergence
[EN] [JP] [CN] [KR]	What is a Thermal Model?
[EN] [JP] [CN] [KR]	How to Use Thermal Models

C-4. Evaluation

Online Browsing	Title
[EN] [JP] [CN]	Precautions During Gate-Source Voltage Measurement
[EN] [JP] [CN]	Importance of Probe Calibration When Measuring Power: Deskew
[EN] [JP] [CN]	Calculating Power Loss from Measured Waveforms

C-5. Thermal Measurement

Online Browsing	Title
[EN] [JP] [CN] [KR]	Measurement Method and Usage of Thermal Resistance RthJC

Information

For new titles, check the product pages and the document search page.

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