



SimSurfing NTC Thermistor Performance Simulator Operation Manual

September, 2019
Murata Manufacturing Co., Ltd.

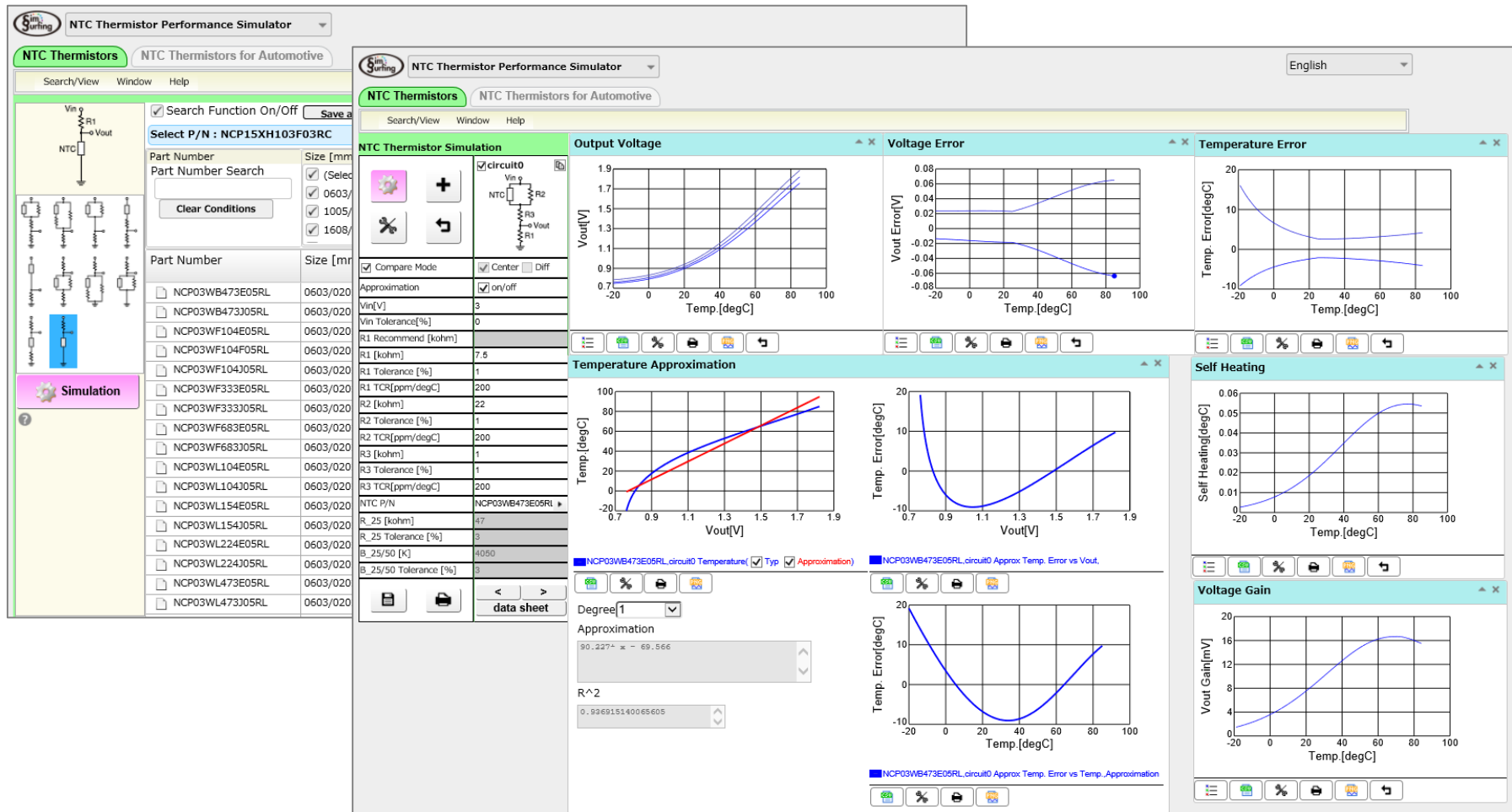


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1. About This Tool

1-1. Outline

The SimSurfing NTC Thermistor Performance Simulator (hereafter called “this software”) is software for simulating the output voltage versus temperature characteristics. Each graph of the output voltage characteristics of the specified circuit, the output voltage error and the temperature error are displayed.

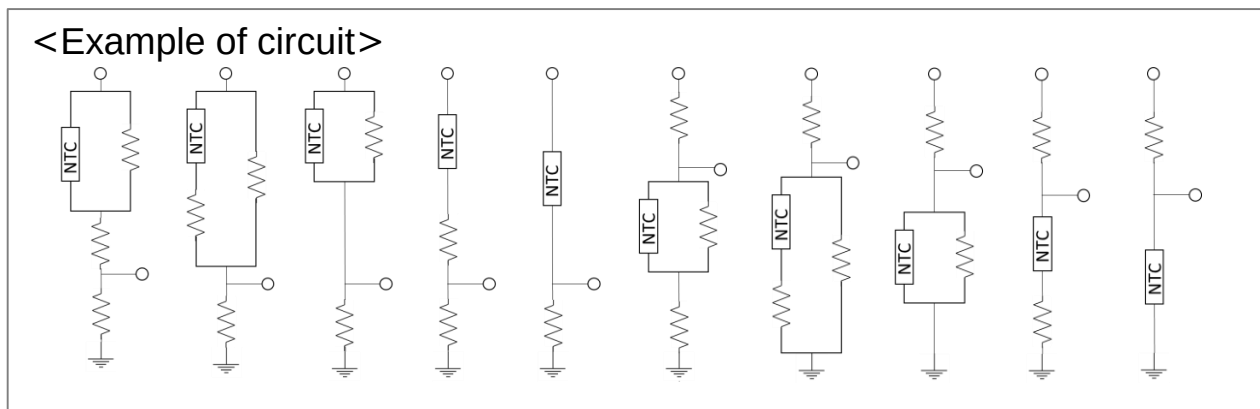


1. About This Tool

1-2. Main Functions (1/2)



- Regarding the grounding circuit of the NTC thermistor and that of the resistor, the output voltage characteristics can be simulated.



- In the default simulation, [Output Voltage (output voltage)], [Voltage Error (output voltage error)] and [Temperature Error (temperature conversion error)] are displayed as graphs.
- In addition to the above 3 graphs, the following graphs can also be displayed.
 - Vout Gain (output voltage per unit temperature)
 - Self Heating (self-heating)
 - Output Voltage Approximation (approximate value of the output voltage)
 - Appropriate Vout Error (error in the approximate value of the voltage)
 - Approximate Temp. Error (error in the approximate value of the voltage (temperature conversion))
 - Temperature Approximation (approximate value of the output temperature)
 - Approximate Temp. Error versus Vout (error in the approximate value of the temperature)
 - Approximate Temp. Error (error in the approximate value of the temperature (with respect to the temperature))

1. About This Tool

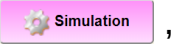
1-2. Main Functions (2/2)

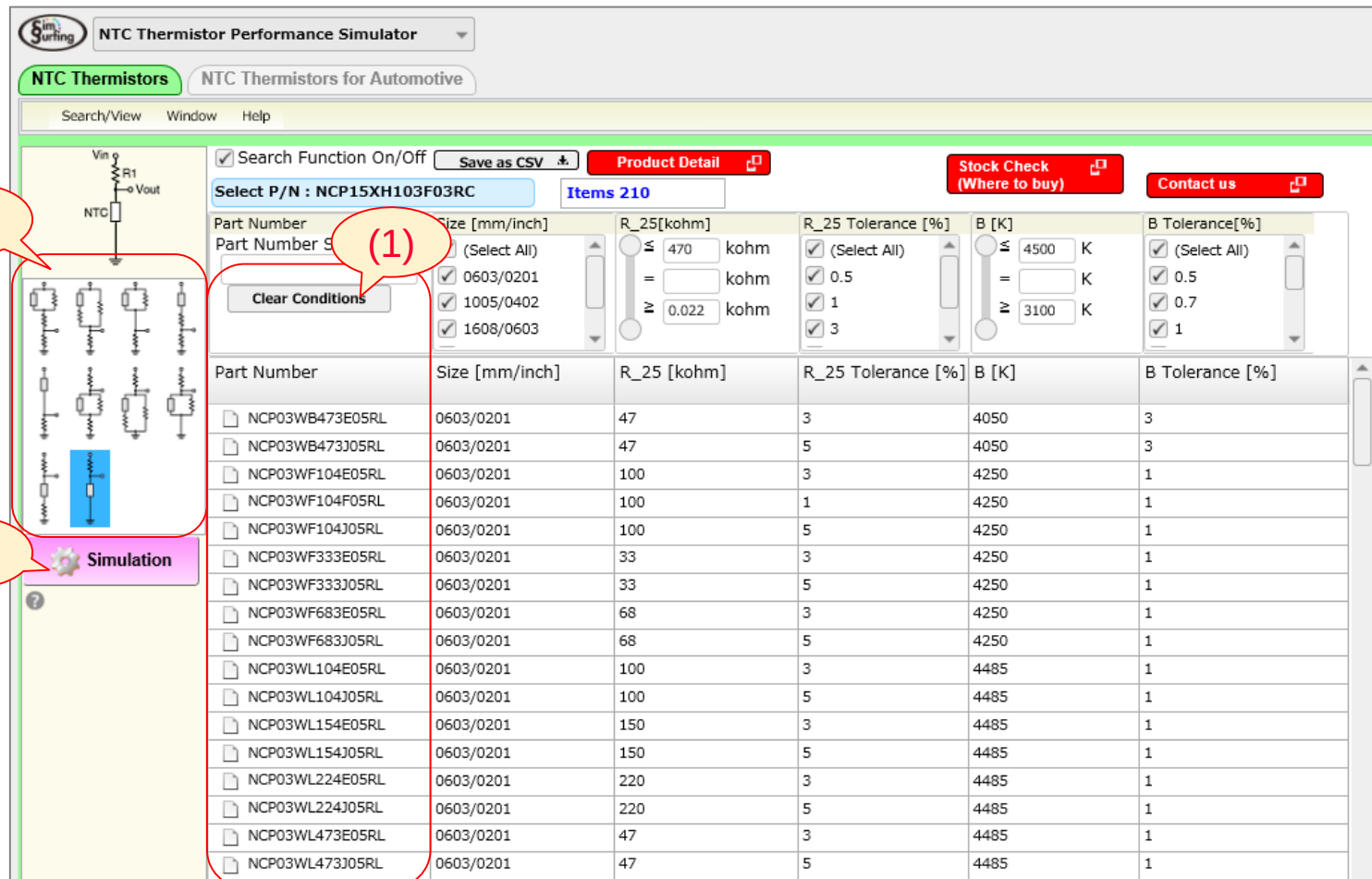


- The characteristics data of each graph can be saved as a CSV file. Also, it can be printed out.
- Multiple circuits (Circuit 0 + Circuit 1 + ...) can be simulated simultaneously, and also the results can be compared under each set of conditions.
- The recommended value of the voltage dividing resistor can be calculated.

2. Quick Operation Guide

2-1. Simulation Graph Display

- Start the software, then select (1) item No. and (2) circuit diagram, and click (3)  , the screen switches over, and, as shown on the next page, graphs representing the results of simulation are displayed.



NTC Thermistor Performance Simulator

NTC Thermistors NTC Thermistors for Automotive

Search/View Window Help

Search Function On/Off Save as CSV Product Detail Stock Check (Where to buy) Contact us

Select P/N : NCP15XH103F03RC Items 210

Part Number Size [mm/inch] R_25 [kohm] R_25 Tolerance [%] B [K] B Tolerance [%]

Part Number Size [mm/inch] R_25 [kohm] R_25 Tolerance [%] B [K] B Tolerance [%]

Part Number	Size [mm/inch]	R_25 [kohm]	R_25 Tolerance [%]	B [K]	B Tolerance [%]
NCP03WB473E05RL	0603/0201	47	3	4050	3
NCP03WB473J05RL	0603/0201	47	5	4050	3
NCP03WF104E05RL	0603/0201	100	3	4250	1
NCP03WF104F05RL	0603/0201	100	1	4250	1
NCP03WF104J05RL	0603/0201	100	5	4250	1
NCP03WF333E05RL	0603/0201	33	3	4250	1
NCP03WF333J05RL	0603/0201	33	5	4250	1
NCP03WF683E05RL	0603/0201	68	3	4250	1
NCP03WF683J05RL	0603/0201	68	5	4250	1
NCP03WL104E05RL	0603/0201	100	3	4485	1
NCP03WL104J05RL	0603/0201	100	5	4485	1
NCP03WL154E05RL	0603/0201	150	3	4485	1
NCP03WL154J05RL	0603/0201	150	5	4485	1
NCP03WL224E05RL	0603/0201	220	3	4485	1
NCP03WL224J05RL	0603/0201	220	5	4485	1
NCP03WL473E05RL	0603/0201	47	3	4485	1
NCP03WL473J05RL	0603/0201	47	5	4485	1

2. Quick Operation Guide

2-2. Overwriting Graphs

- The circuit diagram and the parameters of the NTC thermistor are displayed on [NTC Thermistor Simulation] (the parameter values can be changed).
- Click **+**, then select a different circuit diagram or a product using the same procedure as that indicated on the previous page and click , the results of simulation of the different circuit are added to the existing graphs, enabling a comparison to be made.

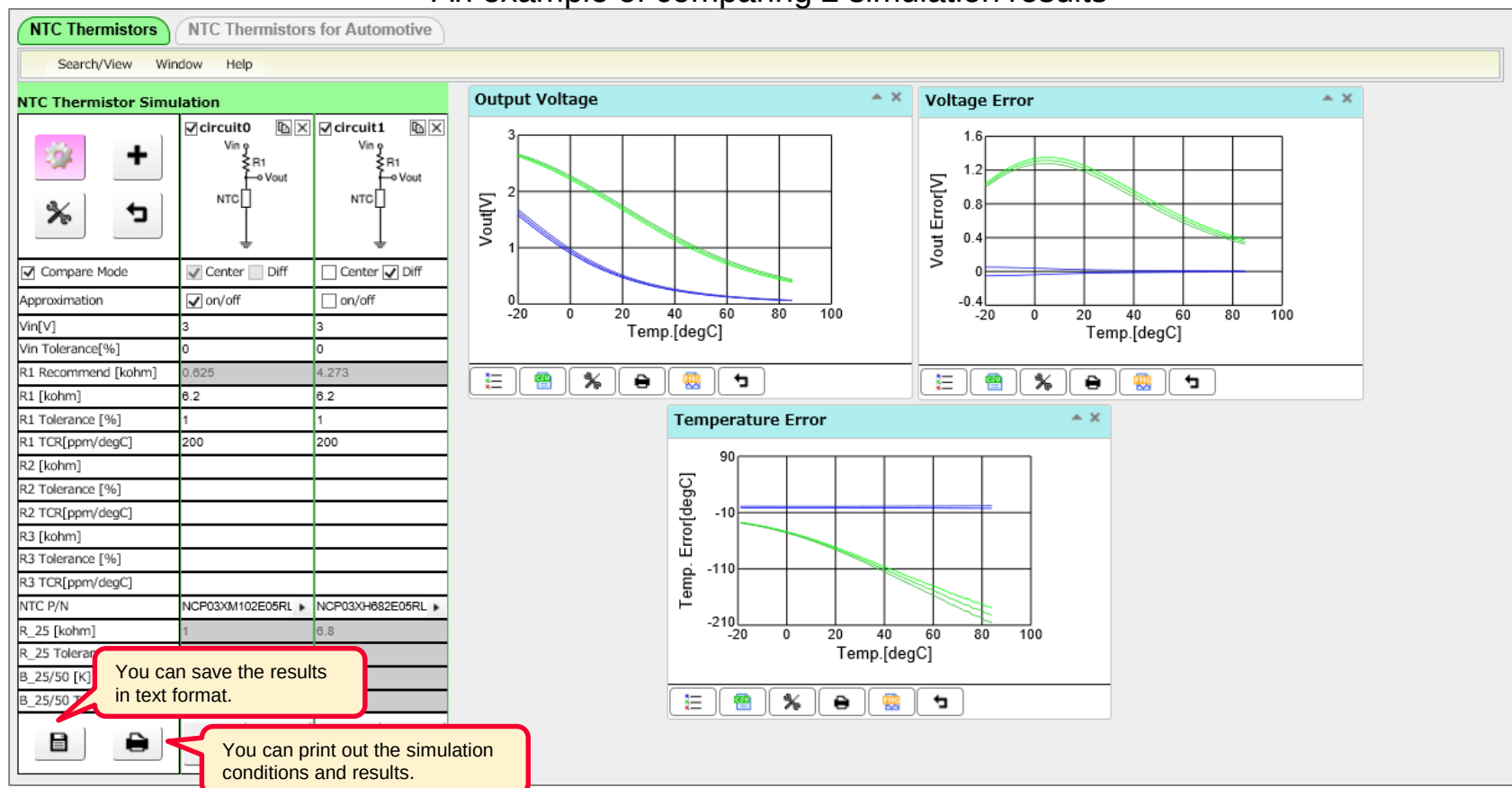


2. Quick Operation Guide

2-3. Comparison and Output of Simulation

- By changing the conditions of Circuit 0, Circuit 1, ..., the results of each simulation can be compared with each other on the same graph (after changing the conditions, click ).
- You can save a curved line on a graph to a text file (CSV format).
- You can print out graphs.

<An example of comparing 2 simulation results>



3. Details of Operation

3-1. Selecting the Desired Type of NTC Thermistor

- You can select an NTC thermistor for general use or an NTC thermistor for automotive. By clicking [NTC Thermistor] or [Automotive NTC Thermistor], the type of thermistor is switched over.

The screenshot displays the 'NTC Thermistor Performance Simulator' interface. The top section has two tabs: 'NTC Thermistors' (active, highlighted in green) and 'NTC Thermistors for Automotive'. Below the tabs is a menu bar with 'Search/View', 'Window', and 'Help'. The main area is divided into a left sidebar and a central panel. The sidebar contains a 'NTC Thermistor Simulation' section with a circuit diagram and a table of parameters. The central panel features a dropdown menu for selecting the thermistor type, currently set to 'NTC Thermistors'.

NTC Thermistor Simulation

☒ circuit0

Vin $\circ$ R1 $\circ$ Vout

NTC

☒ Compare Mode ☒ Center ☐ Diff

Approximation ☒ on/off

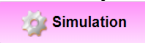
Vin[V]	3
Vin Tolerance[%]	0
R1 Recommend [kohm]	0.625
R1 [kohm]	6.2
R1 Tolerance [%]	1
R1 TCR[ppm/degC]	200
R2 [kohm]	
R2 Tolerance [%]	
R2 TCR[ppm/degC]	
R3 [kohm]	
R3 Tolerance [%]	
R3 TCR[ppm/degC]	
NTC P/N	NCP03XM102E05RL ▶
R_25 [kohm]	1
R_25 Tolerance [%]	3
B_25/50 [K]	3500
B_25/50 Tolerance [%]	1

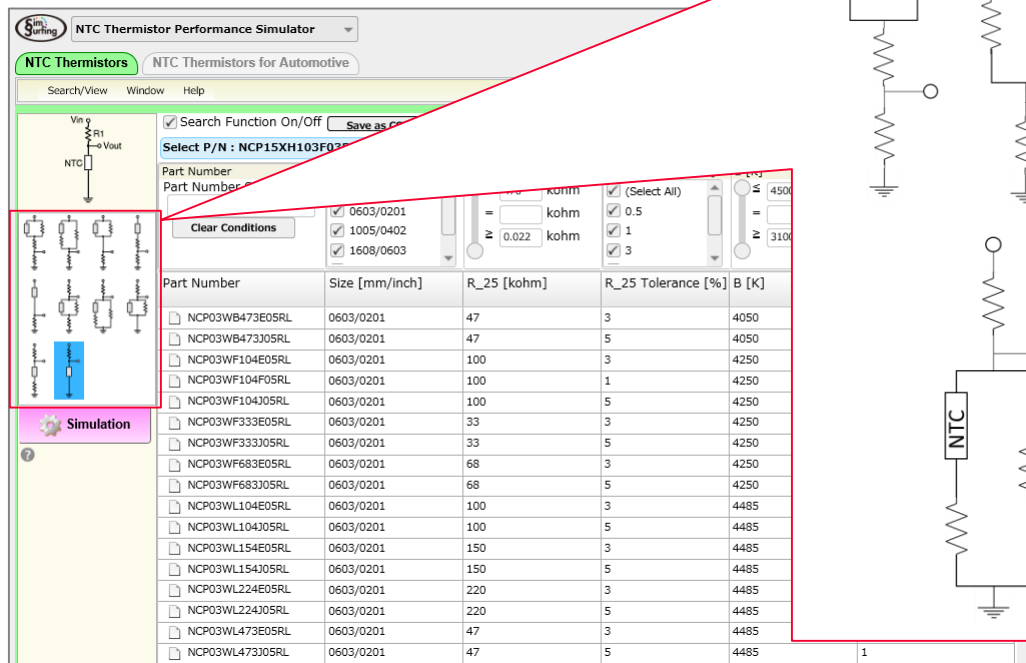
NTC Thermistor Performance Simulator

NTC Thermistors **NTC Thermistors for Automotive**

3. Details of Operation

3-2. Selecting a Simulation Circuit

- Select the item No. and the circuit diagram.
You can select up to 10 circuits (a resistance grounding circuit, 2 NTC thermistor grounding circuits, and 5 circuits at the resistor insertion positions).
After making a selection, click  . The simulation results will be displayed on a graph.



NTC Thermistors NTC Thermistors for Automotive

Search/View Window Help

Search Function On/Off ☒ Save as CSV

Select P/N : NCP15XH103F02

Part Number
Part Number

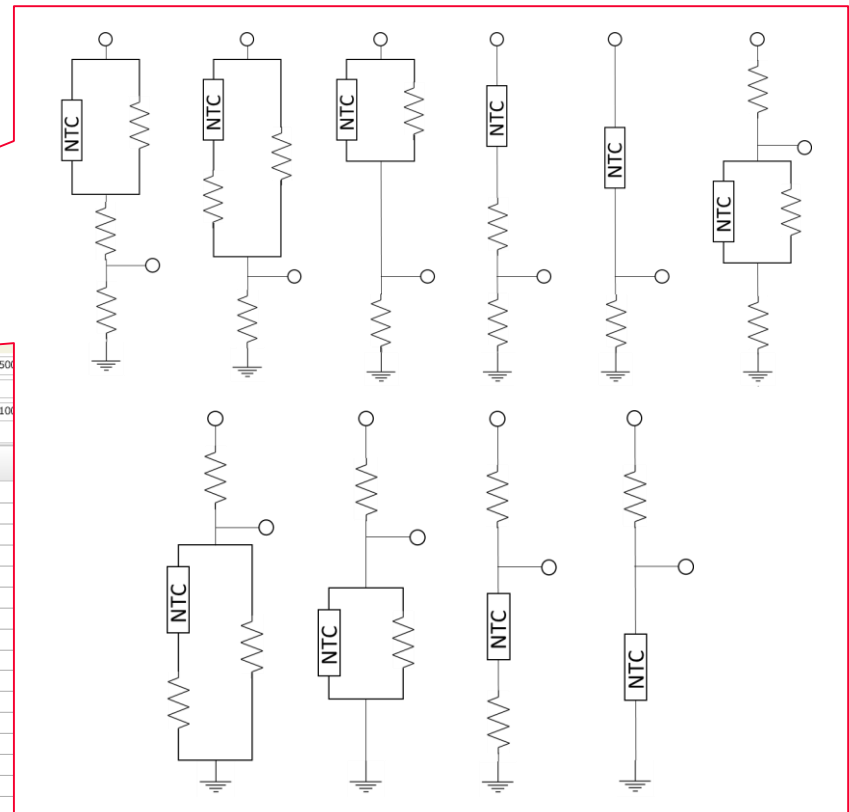
Clear Conditions

0603/0201 ☒ 0.5 kohm ☒ (Select All)
1005/0402 ☒ 1 kohm ☒
1608/0603 ☒ 3 kohm ☒

Part Number Size [mm/inch] R_25 [kohm] R_25 Tolerance [%] B [K]

☐	NCP03WB473E05RL	0603/0201	47	3	4050
☐	NCP03WB473J05RL	0603/0201	47	5	4050
☐	NCP03WF104E05RL	0603/0201	100	3	4250
☐	NCP03WF104F05RL	0603/0201	100	1	4250
☐	NCP03WF104J05RL	0603/0201	100	5	4250
☐	NCP03WF333E05RL	0603/0201	33	3	4250
☐	NCP03WF333J05RL	0603/0201	33	5	4250
☐	NCP03WF683E05RL	0603/0201	68	3	4250
☐	NCP03WF683J05RL	0603/0201	68	5	4250
☐	NCP03WL104E05RL	0603/0201	100	3	4485
☐	NCP03WL104J05RL	0603/0201	100	5	4485
☐	NCP03WL154E05RL	0603/0201	150	3	4485
☐	NCP03WL154J05RL	0603/0201	150	5	4485
☐	NCP03WL224E05RL	0603/0201	220	3	4485
☐	NCP03WL224J05RL	0603/0201	220	5	4485
☐	NCP03WL473E05RL	0603/0201	47	3	4485
☐	NCP03WL473J05RL	0603/0201	47	5	4485

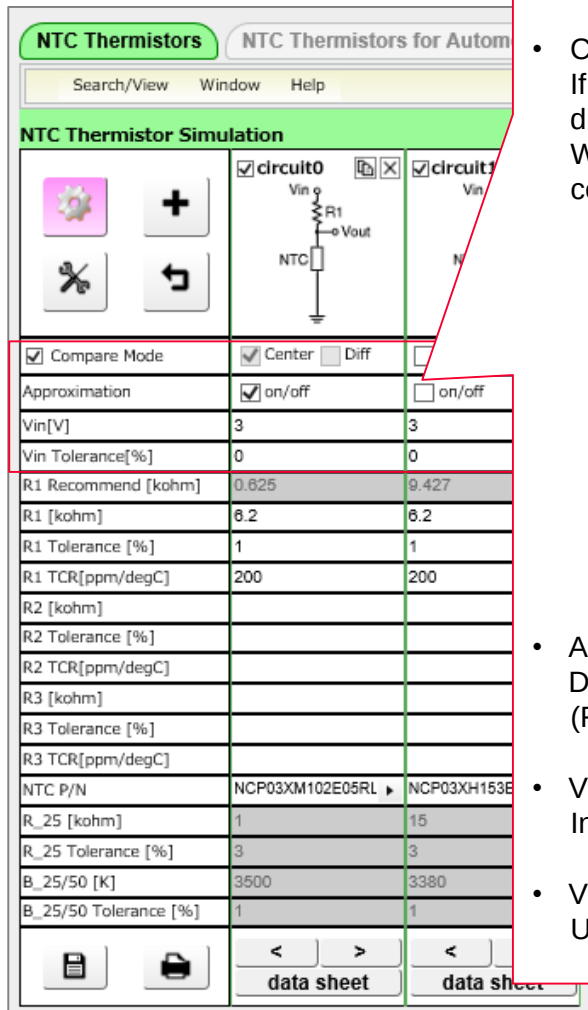
Simulation



3. Details of Operation

3-3. Changing/Setting the Simulation Conditions (1/6)

- You can freely change each item in the [NTC Thermistor Simulation] window.



<About the voltage parameters>

- Compare Mode (comparison mode)

If you click , and then select [Voltage Error] followed by [Diff], the following items will be displayed (this function can be used only when multiple circuits are selected).

When you remove the Compare Mode check, all of the circuits change to Center (the mode ceases to be the comparison mode), and the values of each circuit are displayed.

- Vout Error H : Difference between the upper limit value of the output and the output voltage of Circuit 0 to Circuit n
- Vout Error L : Difference between the lower limit value of the output and the output voltage of Circuit 0 to Circuit n
- Vout Difference+ : Difference between the upper limit value of the output voltage of Circuit n and the output voltage of Circuit (n-1)
- Vout Difference : Difference between the output voltage of Circuit n and the output voltage of Circuit (n-1)
- Vout Difference- : Difference between the lower limit value of the output voltage of Circuit n and the output voltage of Circuit (n-1)
- Approximation
Display/non-display of error graph
(Refer to [3-3 Changing/Setting the Simulation Conditions (6/6)].)
- Vin (V)
Input voltage (The initial value is 3 [V]).
- Vin Tolerance
Used to enter the input voltage tolerance (the initial value is 0.0 [%]).

3. Details of Operation

3-3. Changing/Setting the Simulation Conditions (2/6)

NTC Thermistors NTC Thermistors for Automotive

Search/View Window Help

NTC Thermistor Simulation

☒ circuit0 ☒ circuit1

Vin 9 R1 Vout

NTC

☒ Compare Mode ☒ Center ☐ Diff

Approximation ☒ on/off

Vin[V] 3

Vin Tolerance[%] 0

R1 Recommend [kohm] 0.825 0.427

R1 [kohm] 6.2 6.2

R1 Tolerance [%] 1 1

R1 TCR[ppm/degC] 200 200

R2 [kohm]

R2 Tolerance [%]

R2 TCR[ppm/degC]

R3 [kohm]

R3 Tolerance [%]

R3 TCR[ppm/degC]

NTC P/N NCP03XM102E05RL NCP03X

R_25 [kohm] 1 15

R_25 Tolerance [%] 3 3

B_25/50 [K] 3500 3380

B_25/50 Tolerance [%] 1 1

data sheet data sheet

<About the fixed resistor parameters>

- R1 Recommend (kohm)
Recommended resistance value of R1
If the lower limit temperature is T1, the upper limit temperature is Th, the output voltage at temperature T1 is Vout (T1), and the output voltage at temperature Th is Vout (Th), the value of R1 in the case where the following formula holds will be the recommended value.
- R1 (kohm)
Resistance value (R)
The number of resistors selected differs according to the selected simulation circuit (R1 to R3).
The initial value differs according to the selected simulation circuit.
- R1 Tolerance (%)
Resistance tolerance (R Tolerance)
The number of resistances differs according to the selected simulation circuit (R1 to R3).
The initial value is 1 (%).
- R1 TCR (ppm/deg.C)
Resistor temperature coefficient (R TCR)
The number of resistors differs according to the selected simulation circuit (R1 to R3).
The initial value is 200 [ppm/°C].

3. Details of Operation

3-3. Changing/Setting the Simulation Conditions (3/6)

NTC Thermistors

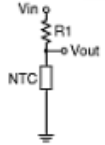
NTC Thermistors for Automotive

Search/View Window Help

NTC Thermistor Simulation



☒ circuit0 



☒ circuit1 



☒ Compare Mode	☒ Center ☐ Diff	☐ Center ☒ Diff
Approximation	☒ on/off	☐ on/off
Vin[V]	3	3
Vin Tolerance[%]	0	0
R1 Recommend [kohm]	0.825	9.427
R1 [kohm]	6.2	6.2
R1 Tolerance [%]	1	1
R1 TCR[ppm/degC]	200	200
R2 [kohm]		
R2 Tolerance [%]		
R2 TCR[ppm/degC]		
R3 [kohm]		
R3 Tolerance [%]		
R3 TCR[ppm/degC]		

NTC P/N

NCP03XM102E05RL

NCP03

R_25 [kohm]	1	1
R_25 Tolerance [%]	3	3
B_25/50 [K]	3500	3380
B_25/50 Tolerance [%]	1	1



< >

data sheet

< >

<Parameters of the selected thermistor>

- NTC P/N

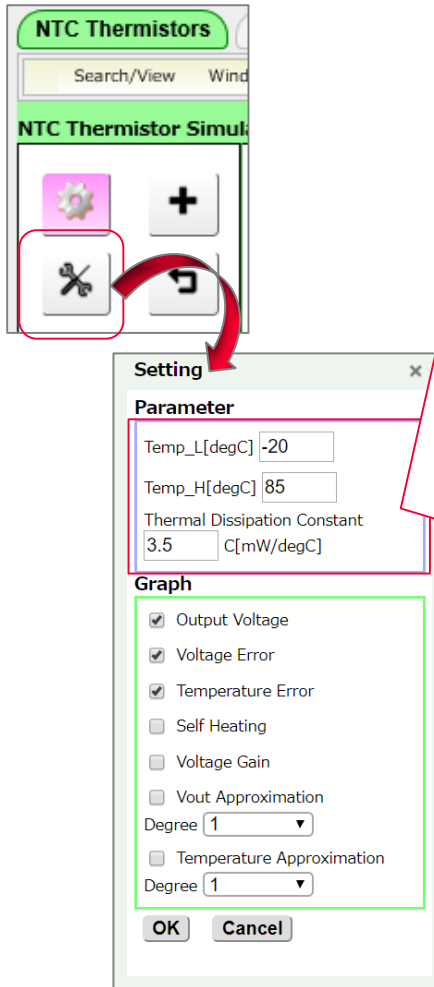
Item No. selected from the item No. list

Below this item No., R25 (kohm), the resistance tolerance, B (25/50) (K), and the B constant coefficient tolerance (%) of the selected item No. are displayed.

3. Details of Operation

3-3. Changing/Setting the Simulation Conditions (4/6)

- You can change the settings of the graph parameters and the displayed graph by clicking  .



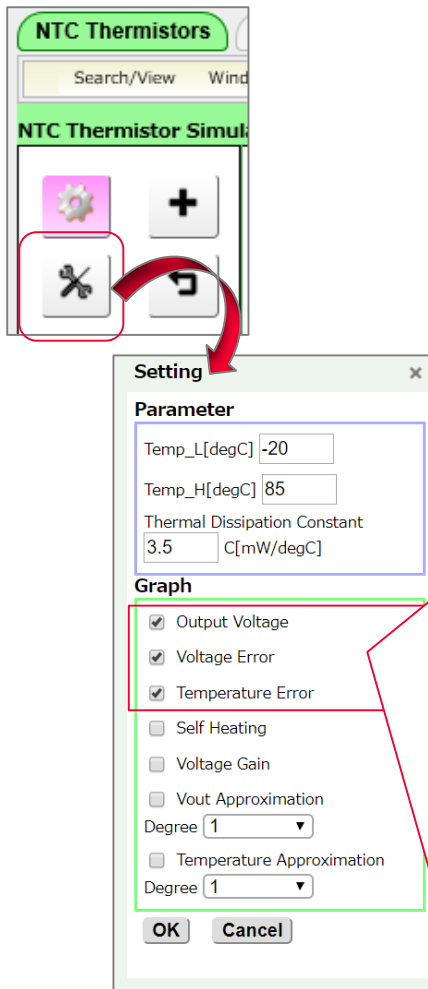
<Setting the parameters>

- Temp L[deg.C]
Lower limit temperature (Temp L). The initial value is -20 (°C).
- Temp H[deg. C]
Upper limit temperature (Temp H). The initial value is 85 (°C).
- Thermal Dissipation Constant
Heat dissipation constant. The initial value is calculated based on the assumption of 3.5 mw/°C (assuming surface mounting of the NTC21 Series).
Heat dissipation constant depends on the size of the NTC element.
Please change the heat dissipation constant as follows depending on the element size.

Series	Heat dissipation constant [mW/°C]
NCP03 Series	2
NCP15,NCU15 Series	2.5
NCP18,NCU18 Series	3
NCP21 Series	3.5

3. Details of Operation

3-3. Changing/Setting the Simulation Conditions (5/6)

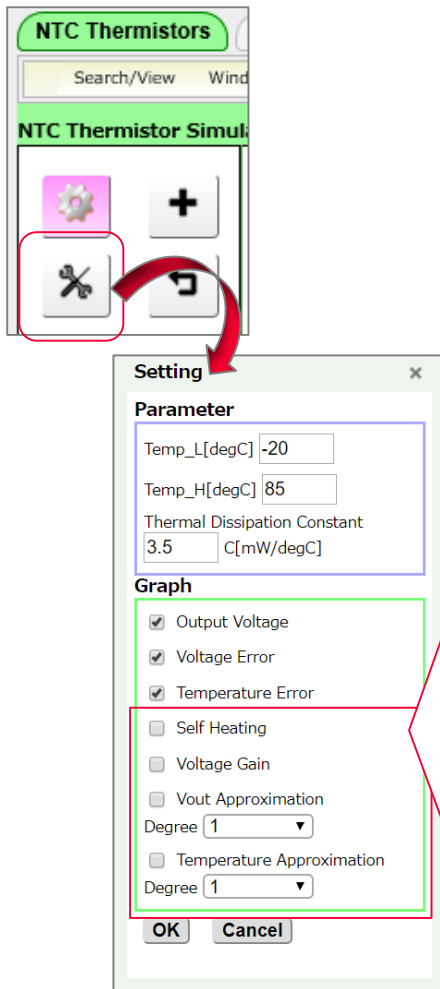


<Graph parameters (1/2)>

- Outline Voltage
Output voltage. When this item is selected, the following items are displayed.
 - Vout_typ : Output voltage at Circuit 0 to Circuit n
 - Vout_max : Upper limit value of the output voltage at Circuit 0 to Circuit n
 - Vout_min : Lower limit value of the output voltage at Circuit 0 to Circuit n
- Voltage Error
Output voltage error graph. When you select [Diff] in the [NTC Thermistor Simulation] window and then select this item, the following items are displayed.
 - Vout Error H : Upper limit value of the output at Circuit 0 to Circuit n
 - Vout Error L : Lower limit value of the output at Circuit 0 to Circuit n
 - Vout Difference+ : Difference between the upper limit value of the output voltage at Circuit n and the output voltage at Circuit (n-1)
 - Vout Difference : Difference between the output voltage at Circuit n and the output voltage at Circuit (n-1)
 - Vout Difference- : Difference between the lower limit value of the output voltage at Circuit n and the output voltage at Circuit (n-1)
- Temperature Error
Temperature conversion error graph. When you select this item, the following items are displayed.
 - Temperature Error L at Circuit 0 to n : temperature conversion graph of Vout Error L
 - Temperature Error H at Circuit 0 to n : temperature conversion graph of Vout Error H
 - Temp Difference+ : Value resulting from the conversion of [Vout Difference+] into the temperature at Circuit (n-1)
 - Temp difference : Value resulting from the conversion of [Vout Difference] into the temperature at Circuit (n-1)
 - Temp Difference- : Value resulting from the conversion of [Vout Difference-] into the temperature at Circuit (n-1)

3. Details of Operation

3-3. Changing/Setting the Simulation Conditions (6/6)



<Graph parameters (2/2)>

- Self Heating
Self-heating graph. When you select this item, self-heating (Self Heating [°C]) at Circuit 0 to n is displayed.
- Voltage Gain
Graph of output voltage per unit temperature. When you select this item, the output voltage per unit temperature (Vout Gain [mV/°C]) at Circuit 0 to n is displayed.
- Vout Approximation
Graph indicating approximate value of the output voltage. When you select [Approximation] in the [NTC Thermistor Simulation] window and then select this item, the following items are displayed.
 - Graph of Vout-type (center value of the output voltage) and Vout Approximation (approximate value of the output voltage) at Circuit n
 - Graph of Approximate Vout Error (error in the approximate value of the voltage)
 - Error in the Approximate Temp. Error (error in the approximate value resulting from temperature conversion)* "Degree" is the order of the above approximation formula
- Temperature Approximation
Graph indicating the approximate value of the temperature versus the output voltage. When you select [Approximation] in the [NTC Thermistor Simulation] window and then select this item, the following items are displayed.
 - Graph of Temp-typ (center value of the voltage) and Temp Approximation (approximate value of the temperature versus the output voltage) of Circuit n.
 - Graph of Approximate Temp. Error versus Vout (error in the approximate value of the temperature with respect to voltage)
 - Graph of Approximate Temp. Error versus Temp (error in the approximate value with respect to temperature)* "Degree" is the order of the above approximation formula

[illegible]

3. Details of Operation

3-5. Printing

You can print out displayed graphs.

NTC Thermistor Simulation

☒ circuit0

Vin $\circ$ R1 $\circ$ Vout
NTC

☒ Compare Mode ☒ Center ☐ Diff

Approximation ☒ on/off

Vin[V] 3

Vin Tolerance[%] 0

R1 Recommend [kohm] 0.625

R1 [kohm] 6.2

R1 Tolerance [%] 1

R1 TCR[ppm/deg.C] 200

R2 [kohm]

R2 Tolerance [%]

R2 TCR[ppm/deg.C]

R3 [kohm]

R3 Tolerance [%]

R3 TCR[ppm/deg.C]

NTC P/N NCP03XM102

R_25 [kohm] 1

R_25 Tolerance [%] 3

B_25/50 [K] 350

B_25/50 Tolerance [%]

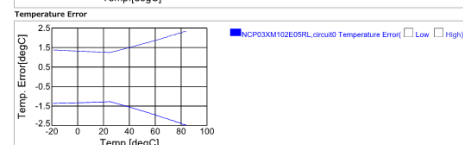
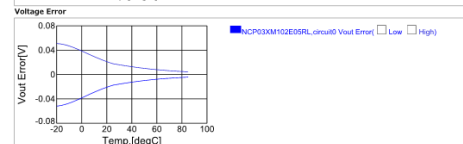
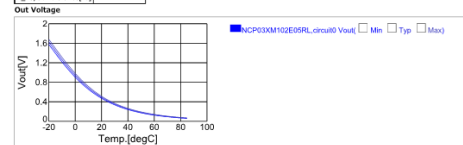
   

data sheet

<Example of printout screen>

Murata Chip Thermistor Output Voltage Simulator Murata Manufacturing Co., Ltd 1/1 ページ

Circuit ID	Value
Vin[V]	3
Vin Tolerance[%]	0
R1 Recommend[kohm]	0.625
R1[kohm]	6.2
R1 Tolerance[%]	1
R1 TCR[ppm/deg.C]	200
R2[kohm]	
R2 Tolerance[%]	
R2 TCR[ppm/deg.C]	
R3[kohm]	
R3 Tolerance[%]	
R3 TCR[ppm/deg.C]	
NTC P/N	NCP03XM102
R_25[kohm]	1
R_25 Tolerance[%]	3
B_25/50[K]	350
B_25/50 Tolerance[%]	



https://ds.murata.co.jp/simurfing/ntcthermistor_print.html

2018/04/27

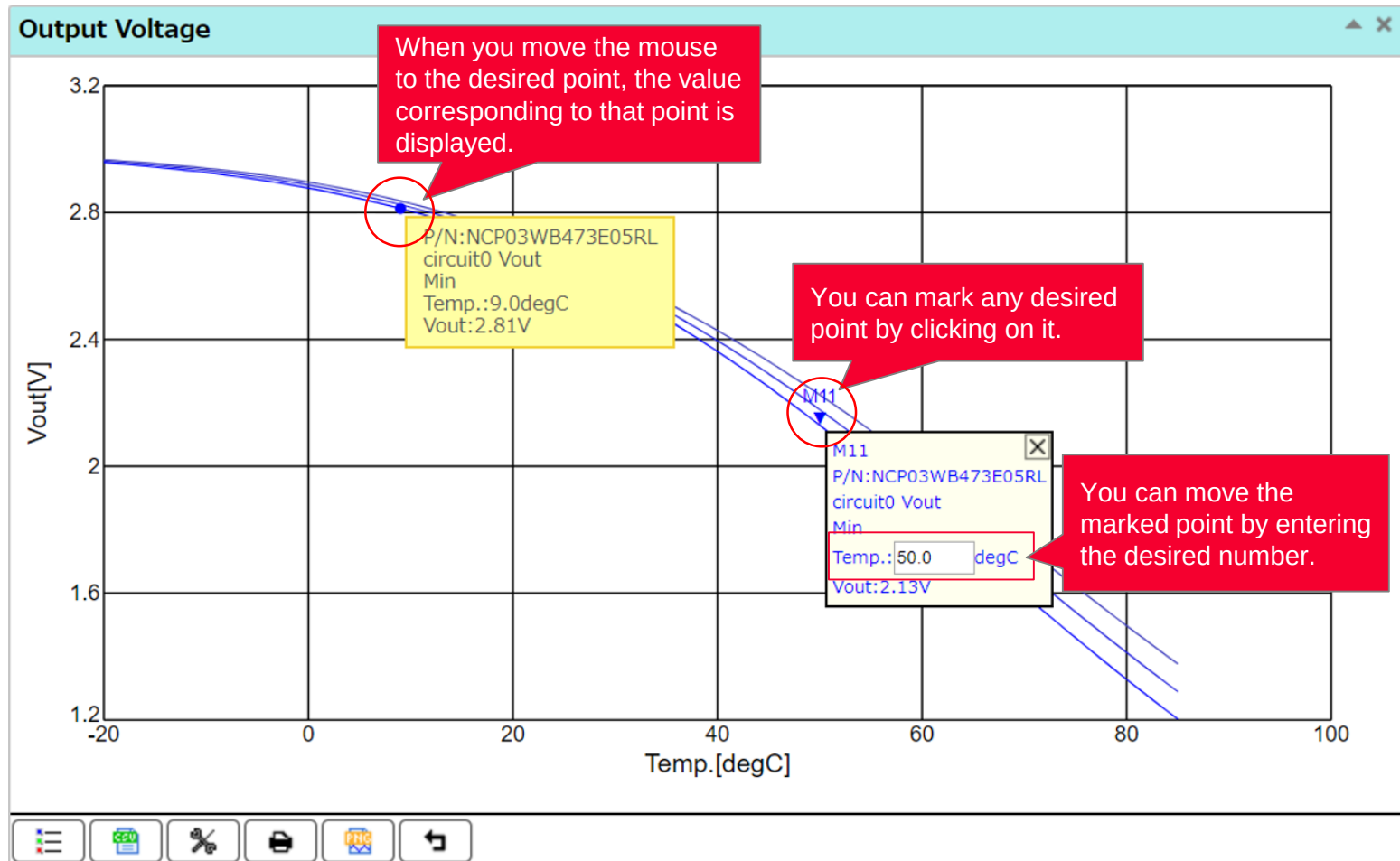
You can also do this by using the icons in each graph.



3. Details of Operation

3-6. Making a Mark on a Graph

- When you move the mouse to the desired point on a graph, the value corresponding to that point is displayed.
- You can mark this point by clicking on it. To cancel the mark, click the mouse once again.



4. How to Confirm the Version and Make Enquiries

- You can access the Contact Form on our website, by using the following link.

The screenshot displays the Murata NTC Thermistors website interface. On the left, there is a sidebar with a circuit diagram of an NTC thermistor and a 'Simulation' button. The main content area shows a table of NTC thermistor products. A red box highlights the 'Version' link in the top navigation bar. A red arrow points from this link to a 'SimSurfing' dialog box that is open in the foreground. The dialog box displays the SimSurfing logo and version 1.12.2, along with copyright information and a list of data versions for various Murata components. A red box highlights the 'Inquiry (Click here)' link at the bottom of the dialog box.

Part Number	Size [mm/inch]
NCP03WB473E05RL	0603/0201
NCP03WB473J05RL	0603/0201
NCP03WF104E05RL	0603/0201
NCP03WF104F05RL	0603/0201
NCP03WF104J05RL	0603/0201
NCP03WF333E05RL	0603/0201
NCP03WF333J05RL	0603/0201
NCP03WF683E05RL	0603/0201
NCP03WF683J05RL	0603/0201
NCP03WL104E05RL	0603/0201
NCP03WL104J05RL	0603/0201
NCP03WL154E05RL	0603/0201
NCP03WL154J05RL	0603/0201

SimSurfing 1.12.2
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Data Version
MLCC Data: 20181204_01
Lead Type Ceramic Capacitors Data: 20180403_01
Medium Voltage Capacitors Data: 20161003_01
Polymer Capacitors Data: 20180404_01
Three Terminal Capacitors Data: 20181004_01
Molded SMD Capacitors Data: 20190227_01
Ferrite Beads Data: 20181116_01
Common Mode Chokes Data: 20181218_01

[Inquiry \(Click here\)](#)

Appendix

Preferred Numbers

E6	E24	E96
10	10	100
		102
		105
		107
	11	110
		113
		115
		118
	12	121
		124
		127
		130
	13	133
		137
		140
		143
15	15	147
		150
		154
		158
	16	162
		165
		169
		174
	18	178
		182
		187
		191
	20	196
		200
		205
		210

E6	E24	E96
22	22	215
		221
		226
		232
	24	237
		243
		249
		255
	27	261
		267
		274
		280
	30	287
		294
		301
		309
33	33	316
		324
		332
		340
	36	348
		357
		365
		374
	39	383
		392
		402
		412
	43	422
		432
		442
		453

E6	E24	E96
47	47	464
		475
		487
		499
	51	511
		523
		536
		549
	56	562
		576
		590
		604
	62	619
		634
		649
		665
68	68	681
		698
		715
		732
	75	750
		768
		787
		806
	82	825
		845
		866
		887
	91	909
		931
		953
		976