CR-5000

Circuit Adviser

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Chapter 1   Circuit Adviser

Circuit Adviser is software to check mistakes on circuit design. It performs various rule checks based on properties each user set in parts or nets on circuit data and finds out lack of part rating or wrong polarity.

In this chapter, you can see overview of Circuit Adviser.

1.1   Circuit Adviser Overview

Circuit Adviser is optional software for System Designer and a product dedicated to PC version.

In present design environment, in which design data can be processed or diverted in various ways, any mistakes on circuit data give a great influence on lower level from basic design to manufacturing process. Basic quality improvement in circuit data is getting important issue for today's verticality/ horizon integrated CAD/CAM system.

Circuit Adviser is software to check mistakes on the above-mentioned circuit design. It performs various rule checks based on properties each user set in parts or nets on circuit data and finds out lack of part porting or wrong polarity. As simulator is not used here, each user can perform original net voltage setting, so that rule check can be performed even on unfinished circuit where nets is being edited.

Circuit Adviser equips 4 tab menus "Set conditions", "Display results" "Navigation" and "Report" on rule check operation side.
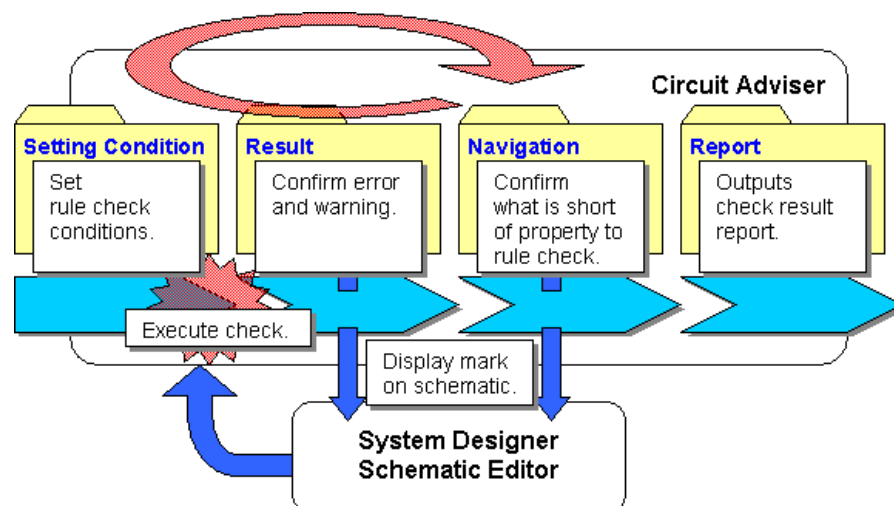
You can perform effective rule check by repeating "Set conditions" and "Display results" with checking lacked information to perform rule check on "Navigation".

Chapter 2   Rule Check

In this chapter, you can see rule check items in Circuit Adviser.

2.1   Rule check items list

Circuit Adviser can perform the following rule checks at present.

Rule check items	Elements					
Simple check items	R	C	CE	D	ZD	IC
Power supply polarity check	x	x	o	x	o	x
Ground polarity check	x	x	o	x	o	x
Net voltage polarity check	x	x	o	x	o	x
Input voltage check	x	x	x	x	x	o
Must Connect Pin Check	x	x	x	x	x	o
Operation check items	R	C	CE	D	ZD	IC
Voltage rating check	o	o	o	o	o	x
Power dissipation rating check	o	x	x	x	x	x
VRRM	x	x	x	o	x	x
Pull up/down resistor check	x	x	x	x	x	o

(Elements symbols)

R=Resistor, C= Non-polar capacitor, CE=Bipolar capacitor, D=Diode

ZD=Zener diode, IC= IC package

2.2   Simple rule check items

Check properties mainly for single pin or net. This is a check item without calculation -checking "Connection / Disconnection" or simply comparing between numerical values.

2.2.1   Power supply polarity check (Single power supply)

This check item is available only for single power supply. Wrong pins for connecting to power supply net [Net Kind (netKind)=POWER], such as -terminal of bipolar capacitor or anode terminal of zener diode, are checked after being registered in resource.
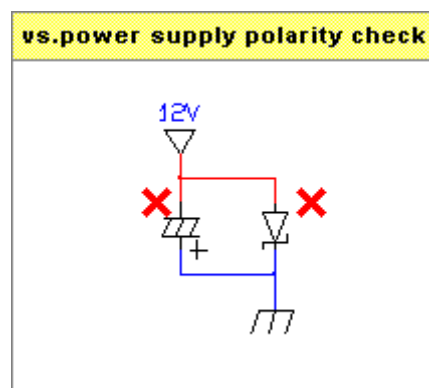
2.2.2   Ground polarity check (Single power supply)

This check item is available only for single power supply. Wrong pins for connecting to ground net [Net Kind (netKind)=GROUND], such as + terminal of bipolar capacitor or cathode terminal of zener diode, are checked after being registered in resource.
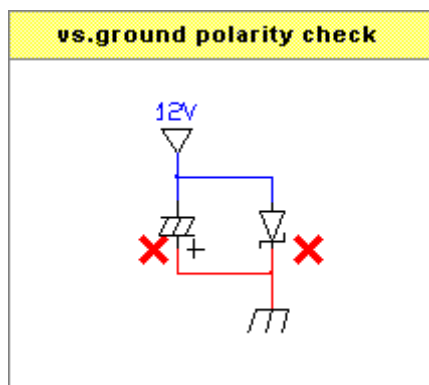
2.2.3   Net voltage polarity check

Error occurs when voltage (voltage) of + terminal net is lower than one of - terminal net for bipolar capacitor. It is the same for cathode/anode of zener diode.

2.2.4   Input voltage check

Error occurs when voltage value, that exceeds input voltage range (range)= numerical value (Max), numerical value (Min) set in pins, is set in connected net voltage (voltage).

2.2.5   Must Connect Pin Check

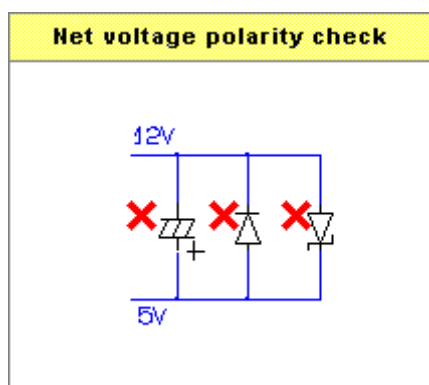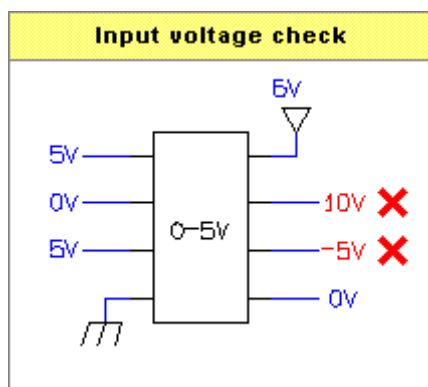Check all pins including input pins for CMOS technology devices for secure connection in order to prevent unstable circuit operation due to faulty connection.
Error may result if the Must Connect Pin Flag set to (advMustConnect)=ON is unconnected. Connection via the sheet connector and the hierarchical connector or another connection with the same net name will also be considered. You can also set the Default Must Connect Pin Flag (defAdvMustConnect) to a component instead of a pin. It takes effect unless the Must Connect Pin Flag is set to a separate pin included in the component.

Must Connect Pin Check executes a check after selecting "Check Target Unit". The range of the check target unit includes COMPONENT and DEVICE.

Simply check the target component residing on the circuit if the check target unit is COMPONENT.

The target will be the component registered in LCDB resident on the circuit directory if the check target unit is DEVICE. Consider the component having the same reference as one device and perform check in consideration of default

ground, power, and open gate. At the same time, the setting of the Must Connect Pin Flag for open gate will conform to the setting of the gate of the same name resident on the circuit directory.

Caution: At present, number of elements for "Total Results" can only be counted in units of component. Note that if the check target unit is DEVICE, it will not be counted as the number of elements for Total Results. (Count of the number of elements for "Rule Check Item-based Details" conforms to both check target ranges.)
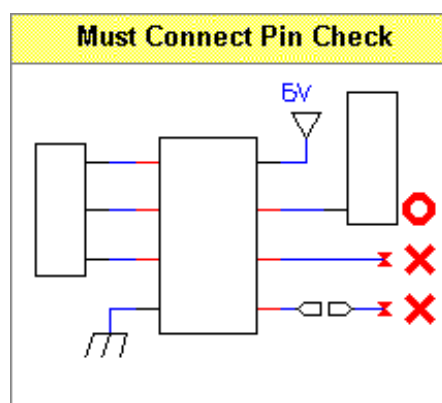
2.3 Operation rule check items

These check items require comparison between operation with multiple properties and value. Operation formula varies depending on element type. In case of operating voltage, for example, resister is calculated as absolute value, diode as reverse voltage.

2.3.1 Voltage rating check

This check item operates operating voltage and compares it with rating value you set. Error occurs when operational value is over 80% of the rating in Over Check.
Warning occurs when operational value is less than 20% of the rating in Lower Check.
You can set de-rating such as 80% and 20% for each element type.
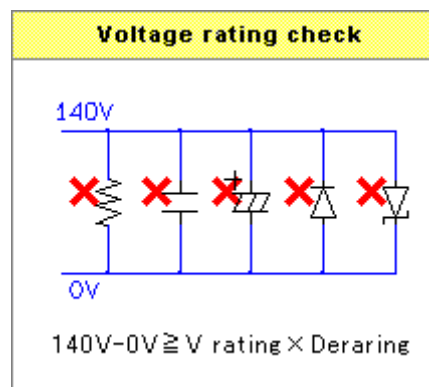
2.3.2   Power dissipation rating check

This check item operates power dissipation and compares it with the rating value you set. Error occurs when perational value is over 80% of the rating in Over Check.

Warning occurs when operational value is less than 20% of the rating in Lower Check.

You can set de-rating such as 80% and 20% for each element type.
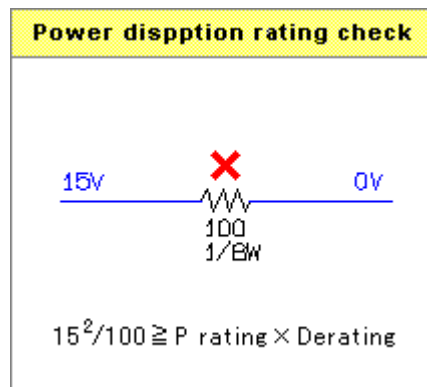
2.3.3   VRRM check

Compares with rating value on the assumption that "3 times of voltage in order of diode = VRRM". You can change a coefficient "3 times" as you like.
Error occurs when assumed value is over 80% of the rating in Over Check.
Warning occurs when assumed value is less than 20% of the rating in Lower Check.
You can set de-rating such as 80% and 20% for each element type.
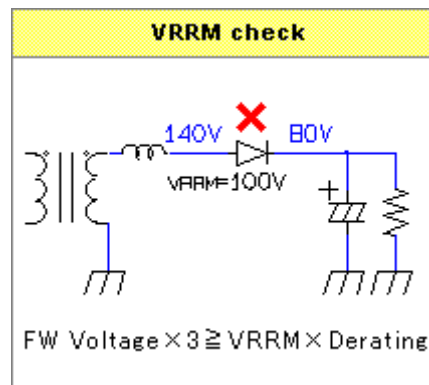
2.3.4   Pull up/down resistor check

This checks the connection to pull-up/pull-down resistor, and compares voltage value and input voltage range.
You can change which connection is necessary.
If pull-up resistor is necessary then the voltage of power net must be lower than the range. If pull-down resistor is necessary then the voltage of ground net must be upper than the range. And If pull-up or pull-down resistor is necessary then

the voltage of power/ground net must be within the range.
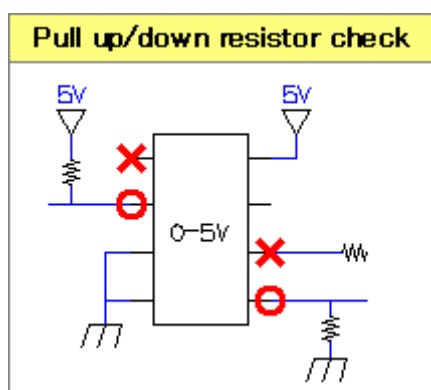
Chapter 3　Properties

In this chapter, you can see properties used in Circuit Adviser.

3.1   Property list used in Circuit Adviser

In Circuit Adviser, the following properties are used as default.

Properties used in Circuit Adviser			
Component properties	Property name	Input value	Category
Rule check discrimination	rcDiscrimination	R/L/C/CE/D/ZD/IC/JP	Dedicated
Value	Value	Numerical value	SD standard
MAX Voltage	maxV	Numerical value	SD standard
Power Dissipation	powerDiss	Numerical value	SD standard
VRRM	Vrrm	Numerical value	Dedicated
Default Input Voltage Range	defaultRange	Numerical value (Min): Numerical value (Max)	Dedicated
Default Output Voltage	defaultVolt	Numerical Value	Dedicated
Default Must Connect Flag	defAdvMustConnent	OFF/ON	Dedicated
Pin properties	Property name	Input value	Category
Pin number	pinNumber	Numerical value	SD standard
Circuit Adviser Pin Number	advPinNumber	Numerical value	Dedicated
Input Voltage Range	range	Numerical value (Min): Numerical value (Max)	Dedicated
Must Connect Flag	defAdvMustConnent	OFF/ON	Dedicated
Pin Type	pinType	String	SD standard
Circuit Adviser Pin Type	advpinType	String	Dedicated
Net properties	Property name	Input value	Category

Properties used in Circuit Adviser			
Voltage	voltage	Numerical value	SD standard
Voltage2	voltage2	Numerical value	Dedicated
Net Kind	netKind	Nomal/Power/ Ground	SD standard

3.2   Customizing properties

To customize properties, edit resource file ($ZDSROOT/info/jpn/ciradviser.rsc) for Circuit Adviser. You can set user definition properties instead of default properties on the above list.

For properties except the rule check discrimination, you can set "Equivalent definition properties". For example, if there is no value on property A, you can use property B instead. You can also change the order of priority of equivalent definition properties as you like.

3.3   How to set properties

It is convenient to register component properties or pin properties in LCDB.
Because, you can set each property at the same time by entering or exchanging
parts and that allow you to operate Circuit Adviser more smoothly.
As an alternative operation, you can set each property one by one when creating
symbol or circuit data.

At present, voltage such as net properties must be set one by one using Net
Brower when creating circuit data.
However, if you need to divert the data frequently, you can raise operation
efficiency step by step as follows. It is also effective to integrate with "Output
difference between circuit data" utility (System Designer option).

(1)   Enter design voltage as far as you can make out and check it.

(2)   Enter measured voltage in circuit data when trial product or real product
is completed.

(3)   When diverting your design data, modify voltage setting focusing on a
part you changed design.

Using Analog Designer (option), you can enter operating point voltage, which is the simulation results of Star-Hspice or PSpice, in circuit data. Since operating point voltage is specified as equivalent definition property as default in Circuit Adviser, you can use it for rule check. If you cannot simulate whole circuit, operate as follows.

(1)   [Edit]-[Copy] a part available for simulation in circuit data.

(2)   Open new circuit data sheet and set that data can be pasted retaining net name or references in [Environment]-[Command default] setting. After that, perform [Edit]-[Paste].

(3)   Set input signal or terminator required for simulation in pasted circuit data.

(4)   Select [Utility]-[Analog Designer]-[Simulation Manager] and perform simulation.

(5)   Select [Utility]-[Analog Designer]-[Operating point voltage display dialog] and display operating point voltage on circuit data. If you delete the operating point voltage, its value remains even though display is OFF.

(6)   Return the circuit after simulation to the original circuit data with copy & paste (Perform 1 and 2).

3.4   Component properties

The following component properties are used as default in Circuit Adviser. You can set each property one by one when creating symbol or circuit data. However, it is more convenient to register them in LCDB, as they can be set together when entering or exchanging parts and that allow you to operate Circuit Adviser more smoothly.

3.4.1   Rule check discrimination (rcDiscrimination)

This property is dedicated to the Circuit Adviser and used for distinguishing parts.
R=Resistor, L=Coil, C=Non-polar capacitor, CE=bipolar capacitor, D=Diode, ZD=Zener diode, IC=IC package, JP=Jumper.
Although coil and jumper are out of rule check at this point, they are target of short auto-manipulation when outputting net.

3.4.2   Value (value)

This is a default property for System Designer and used for calculating resistor power in "2.3.2. Power dissipation rating check".

3.4.3   MAX voltage (maxV)

This is a default property for System Designer and used in "2.3.1. Voltage rating check".

3.4.4   MAX power dissipation

This is a default property for System Designer and used in "2.3.2. Power dissipation rating check". MAX dissipation power is specified as an equivalent definition.

3.4.5   VRRM (Vrrm)

This property is dedicated to Circuit Adviser and used in "2.3.3. VRRM check".

3.4.6   Default input voltage range (defaultRange)

This property is dedicated to Circuit Adviser and used in "2.2.4. Input voltage check" and "2.3.4 Pull up/down resistor check".

3.4.7   Default Output Voltage (defaultVolt)

This property is dedicated to Circuit Adviser and used in the function of "Automatically setting voltage".

3.4.8   Default Must Connect Flag (defAdvMustConnect)

This property is dedicated to Circuit Adviser and used in "2.2.5. Must Connect Pin Check".

3.5   Pin properties

The following pins are used as default in Circuit Adviser. You can set each property one by one when creating symbol or circuit data. However, it is more convenient to register them in LCDB, as they can be set together when entering or exchanging parts and that allow you to operate Circuit Adviser more smoothly.

3.5.1   Pin number (pinNumber)

This is a default property for System Designer and used for distinguishing polarities of bipolar elements and for calculating operating voltage in each rule check.

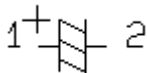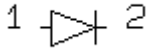## 3.5.2   Circuit Adviser pin number (advPinNumber)

To support existing symbols in which pin number cannot be changed, prepare "Circuit Adviser Pin Number (advPinNumber)" property as pin number property for Circuit Adviser.

The Circuit Adviser Pin Number and pin number are specified as equivalent definition. The order of priority is as follows.

(1)   Circuit Adviser Pin Number

(2)   Pin number

Polarities of capacitor and diode are as follows.

Elements type		Circuit Adviser Pin Number / Pin number / Pin ID	
		1	2
	Capacitor	+	-
	Diode	Anode	Cathode

3.5.3   Input voltage range (range)

This property is dedicated to Circuit Adviser and used in "2.2.4. Input voltage check" and "2.3.4 Pull up/down resistor check".

3.5.4   Must Connect Flag(advMustConnect)

This property is dedicated to Circuit Adviser and used in "2.2.5. Must Connect Pin Check".

3.5.5   Pin Type

This is a default property for System Designer and used in "2.3.4 Pull up/down resistor check".

3.5.6   Circuit Adviser pin type(advpinType)

This property is dedicated to Circuit Adviser and used in "2.3.4 Pull up/down resistor check".

3.6 Net properties

The following net properties are used as default in Circuit Adviser. Each property is set in each net on circuit data.

3.6.1 Voltage (voltage)

This is a default property for System Designer. It is used for comparing with pin input voltage range and calculating operating voltage. Operating point voltage value (asimOpResult) dedicated to Analog Designer is specified as equivalent definition. (Since rule check voltage value (rcVolt) is used in alpha version, it is specified as an equivalent definition).

3.6.2 Voltage2 (voltage2)

This property is dedicated to Circuit Adviser and used the same as the above "Voltage (voltage)". You can set design value in voltage (Voltage) and measured value in voltage2 (voltage2). You can select which property should be used in rule check.

How to manipulate "Net voltage":

In Circuit Adviser resource file ($ZDSROOT/info/jpn/ciradviser.rsc), first, list of "Which should be used for calculating voltage among System Designer net properties" is defined. Then, "Which should be used as default" among the above list is stated.

You can add "Voltage3", "Voltage4" and "Voltage5" as user definition properties to the list.

3.6.3 Net Kind (netKind)

This is a default property for System Designer and has 3 kinds of values (Normal, Power, Ground). It is used in "2.2.1. Power supply polarity check" and "2.2.2. Ground polarity check".

Chapter 4　Operation Procedure

In this chapter, you can see basic operation procedure of Circuit Adviser.

Note: Since this product is being developed, finished product may slightly differ from image expressed in this chapter.

4.1   **Starting Circuit Adviser**

Set properties required for rule check (See chapter 3) in circuit data.
Select [Utility] - [Circuit Adviser] in System Designer Schematic Editor.
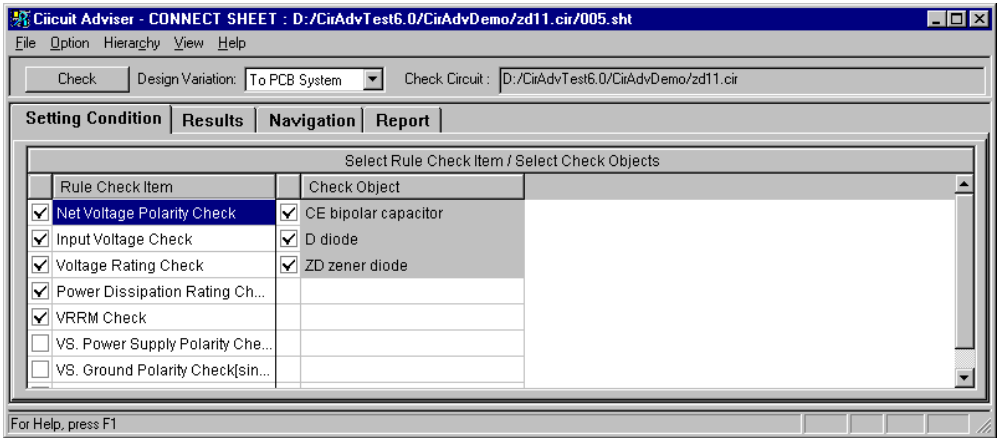
Circuit Adviser creates netlist to perform rule check referring to component
properties, pin properties and net properties set in circuit data.

When Circuit Adviser starts, it checks renewal date of circuit data (*.sht), Circuit
Adviser resource and netlist.
If the date of circuit data and resource are newer than that of netlist, netlist
output is performed automatically.

Circuit Adviser checks renewal date of circuit data (*.sht) and netlist when you
click "Check" button as well. If the date of circuit data is newer than that of netlist,
netlist output is performed automatically.

4.2   Setting conditions

Circuit Adviser equips 4 tab menus "Set conditions", "Display results" and "Navigation","Report" on rule check operation side.

You can select rule check item and target element in "Set conditions" tab. Rule check is performed when you click [Check] button.

Position of [Check] button is common to all tab menus. You can perform rule check with this button whenever you want to do it.

You can set parameter required for rule check.

Select rule check item.

List display changes according to your selecting rule check item.
You can select target element for each rule check item.
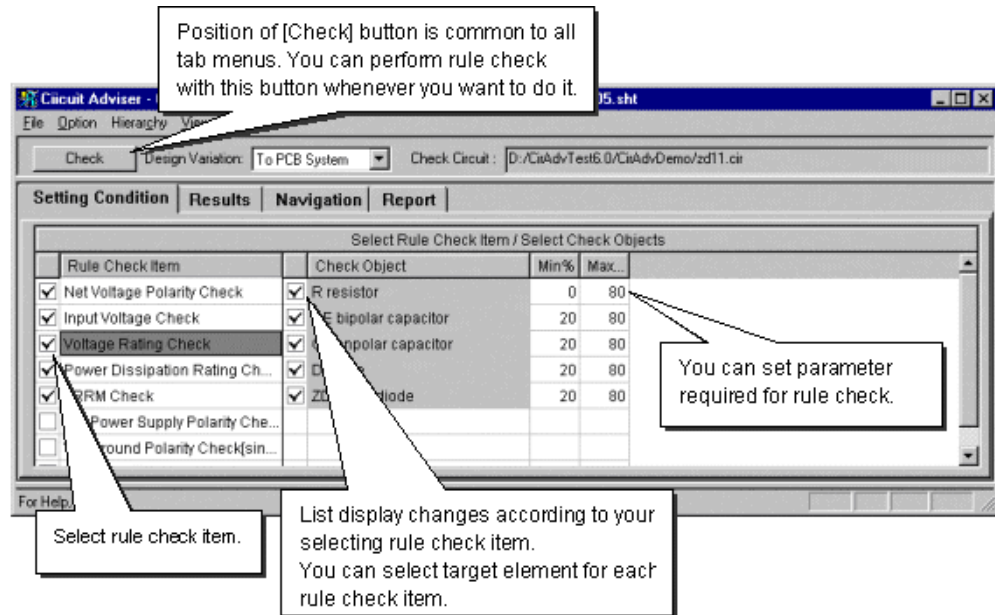
4.3   Displaying results

In "Display results" tab, number of elements, which turned out to be error or warning as a result of rule check, is displayed You can check each error or warning object with [Mark], [Error Object List] and [Warning Object List] button.
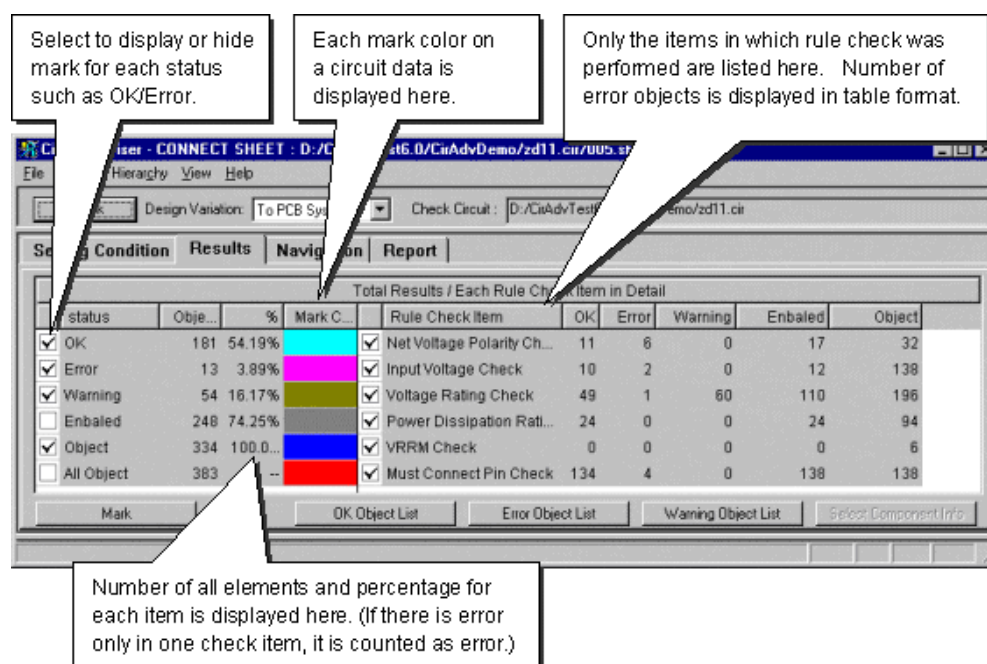
Type of Status

| Status	Meaning in total evaluation	Mark color (Default)	Arrow Message	Bitmap Mark
OK	No error or warning	* 8 Cyan	None	None
Error	Counted if only there is one error in check items	*11 Magenta	Exist	Exist
Warning	Counted if only there is one warning.	* 14 Orange	Exist	Exist

Status	Meaning in total evaluation	Mark color (Default)	Arrow Message	Bitmap Mark
Checkable	Checkable element without having undefined properties. Counted if only there is one checkable object. This is basically the sum of OK, Error and Warning.	* 12 Green	None	None
Check object	Element selected as check object in "Set conditions" when performing "Check". Counted if only there is one check object.	* 4 Blue	None	None
All elements	All symbols on circuit data.	* 99 None	None	None

Mark color is displayed in the following order.

"Check object" > "Checkable" > "OK" > "Warning" > "Error".
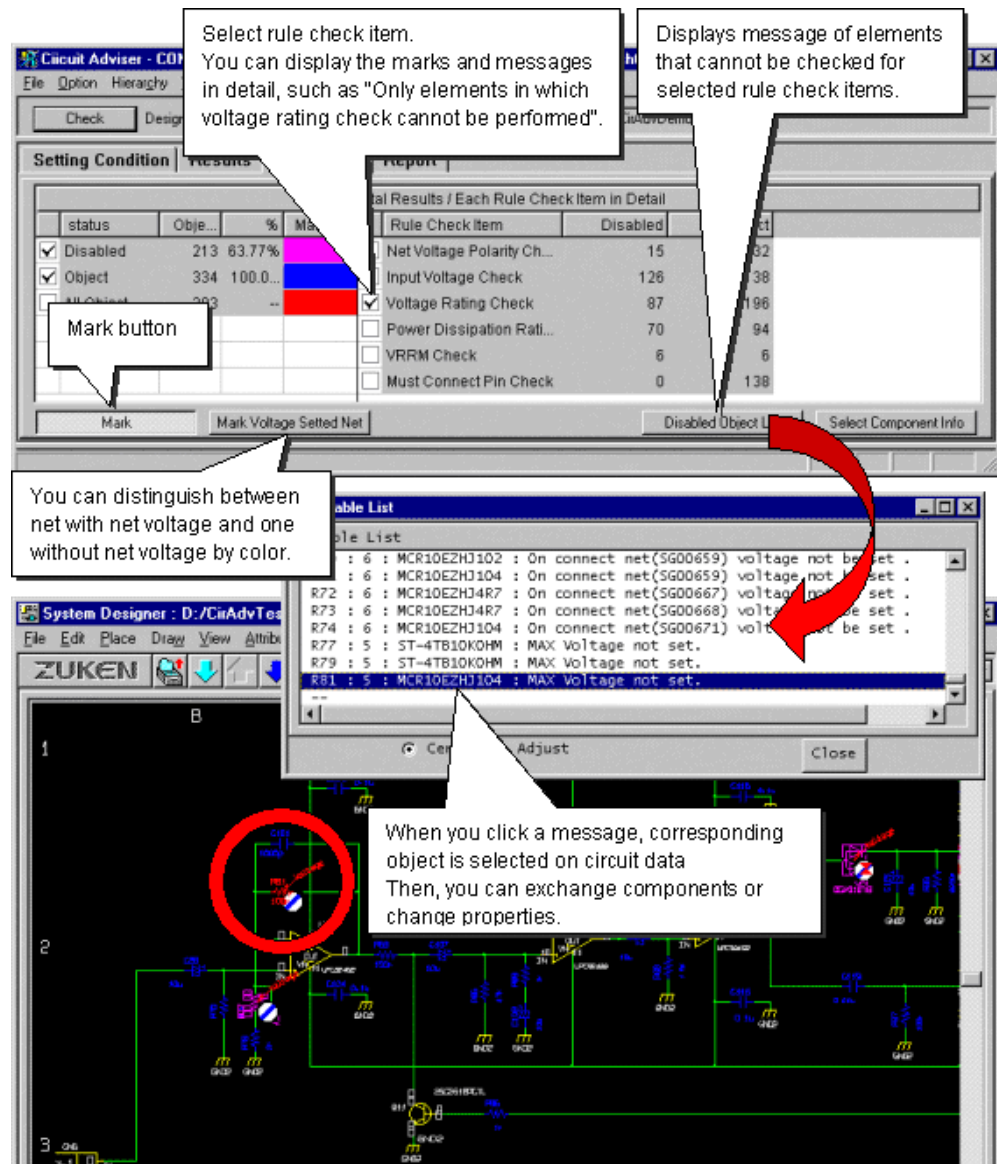
This results in mark display giving priority in error.

For error or warning, an arrow that explains simple contents or a bitmap mark is displayed.
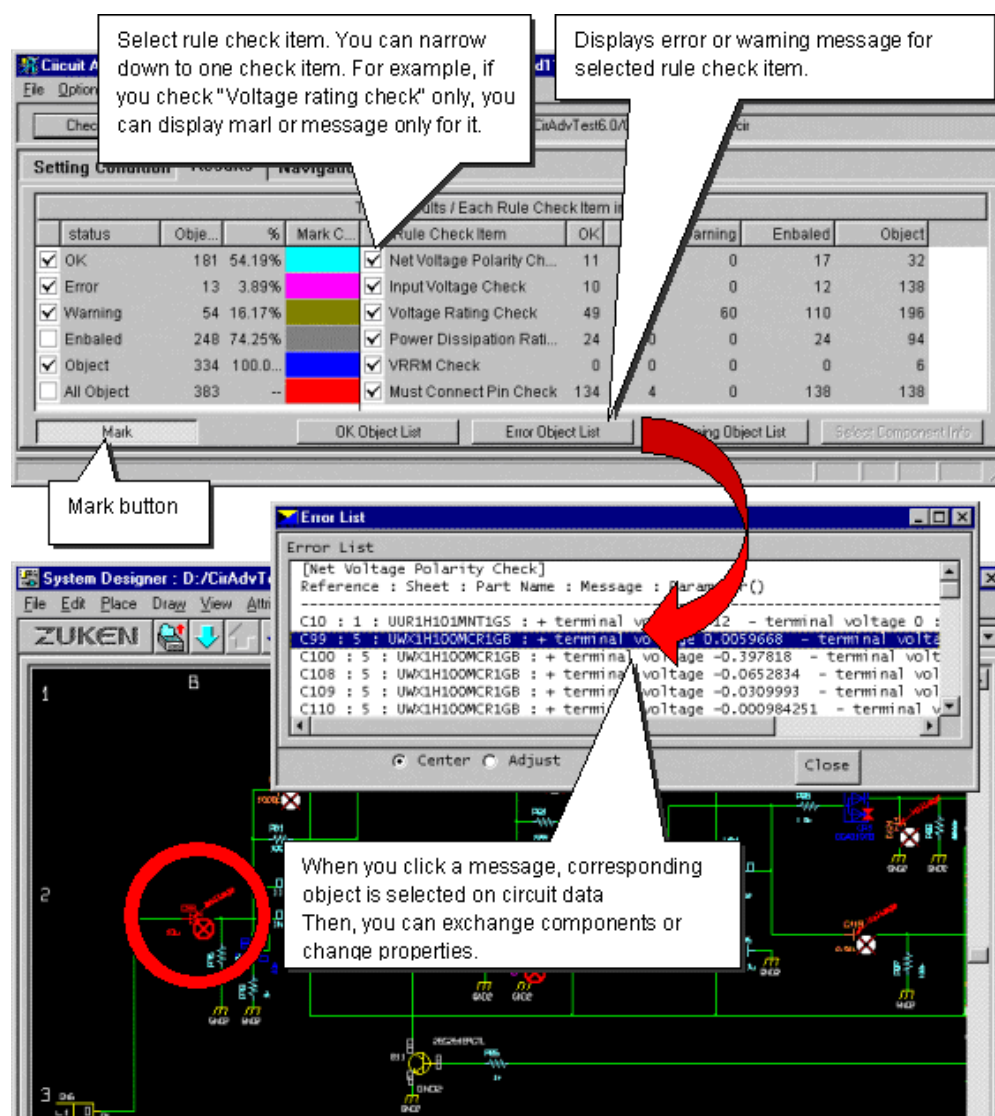
4.4   Navigation

In "Navigation" tab, elements in which rule check was not performed because of some reason, such as required property value was not set in it, are displayed. You can check each cause by clicking [Unchecked object list].


Select rule check item.
You can display the marks and messages in detail, such as "Only elements in which voltage rating check cannot be performed".

Displays message of elements that cannot be checked for selected rule check items.

Mark button

You can distinguish between net with net voltage and one without net voltage by color.

When you click a message, corresponding object is selected on circuit data
Then, you can exchange components or change properties.

Type of Status

Status	Meaning in total evaluation
Disable to check	Element in which rule check was not performed for some reasons, such as required property value was not set in it. Counted if only there is one item disabled to check.
Check object	Element selected as check object in "Set conditions" when performing "Check". Counted if only there is one check object.
All elements	All symbols on circuit data.

4.5   Report

In "Report" tab, you can save "Total Results", "Each Rule Check Item in Datail", and error/warning message lists as a CSV(devided by comma) format file.
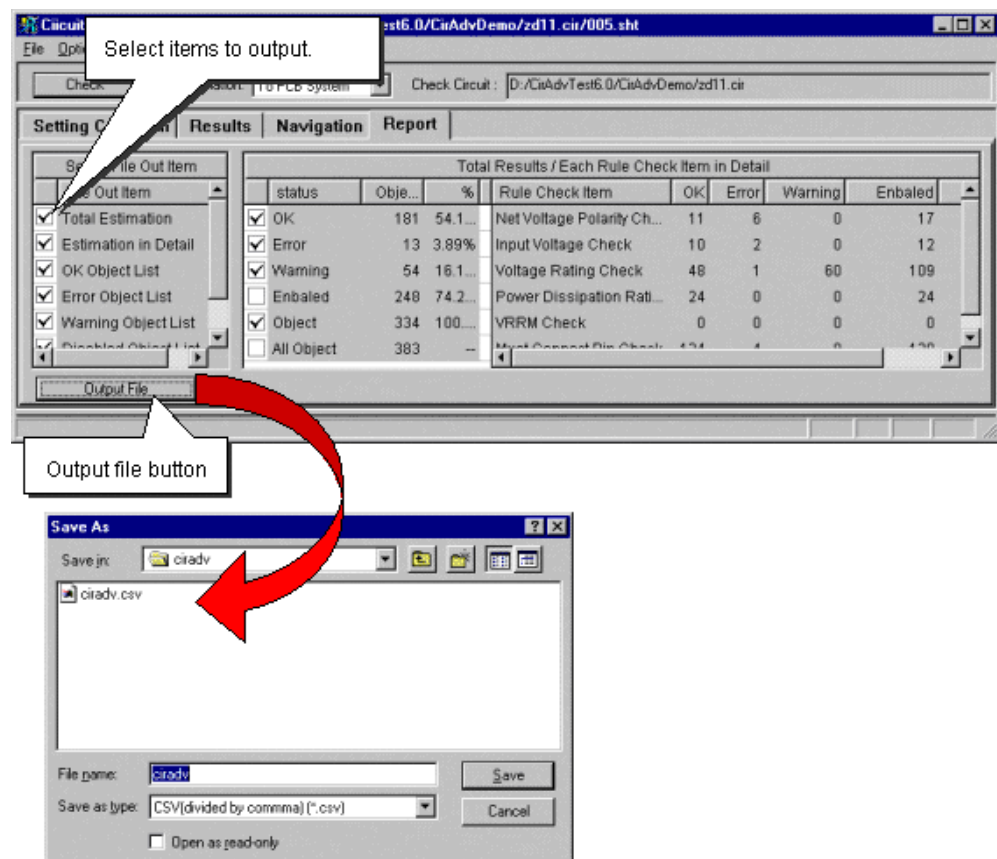
CSV file output example

```
CR-5000/System Designer
Circuit Adviser Check Result
Circuit Path :, zd11.cir, :, C:/TEMP/CirAdvTest/CirAdvDemo
Executed Date :, 2003/01/23

Total Estimation
status,Object Count,%
OK,33,44.59%
Error,22,29.73%
Warning,10,13.51%
Enbaled,65,87.84%
Object,74,100.00%
All Object,383,--

Error Object List
[Voltage Rating Check]
Reference,Sheet,Part Name,Message,Parameter(Min% Max%),objectId
C97,5,UUR1H101T1GS,Voltage 12  MAX Voltage 15  80.00% for rated
value.,(20% 80%),sht5.cmp298
C98,5,UUR1H101T1GS,Voltage 12  MAX Voltage 15  80.00% for rated
value.,(20% 80%),sht5.cmp299
C102,5,GR40C102J50PT,Voltage 9.50262  MAX Voltage 5  190.05% for
rated value.,(20% 80%),sht5.cmp310
```
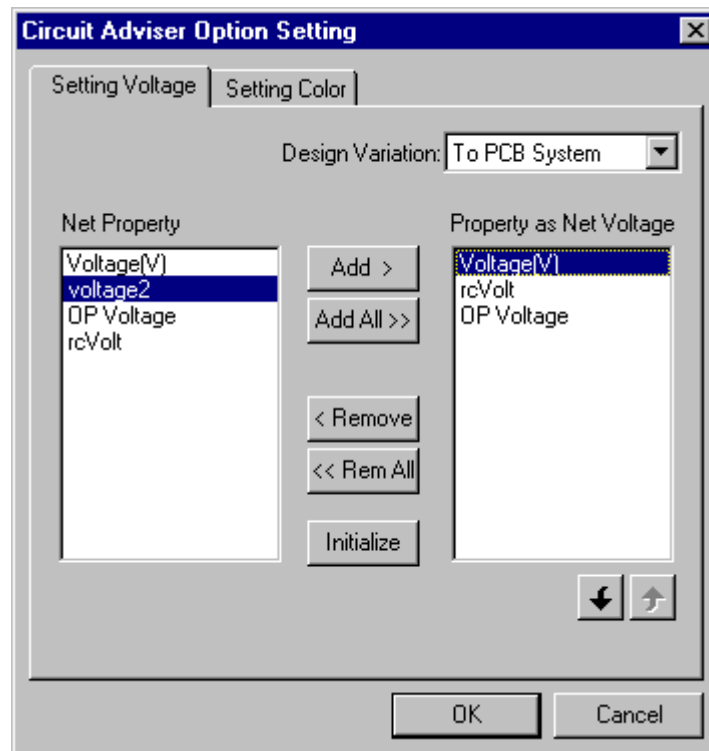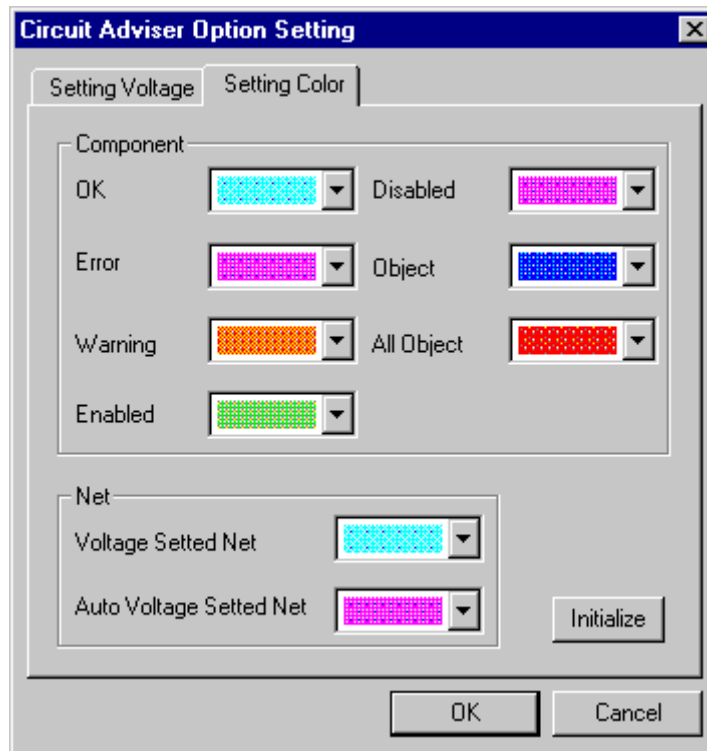
4.6   Option setting

If you click [Option] - [Option setting], you can display "option setting" dialog.

In "Setting Voltage" tab, you can select which net property should be set , and can set the priority of these net properties.
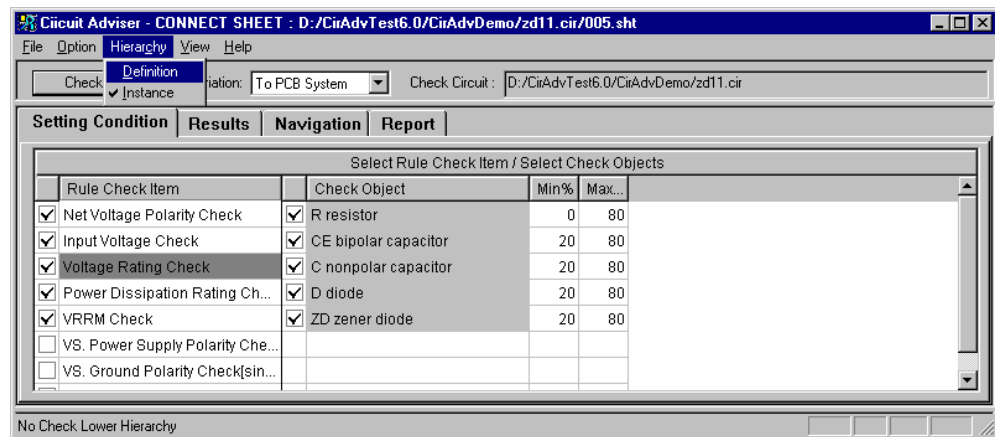
In "Setting Color" tab, You can change the mark color settings.

4.7   Hierarchical setting

The circuit adviser conforms to the hierarchical setting for the circuit directory. In [Hierarchy] menu, you can select whether check is performed at the definition hierarchy level or at the instance hierarchical level.

4.8   Design variation setting

The circuit adviser conforms to the design variation of the circuit directory.
In [Design variation:] combo box, you can select the design variation set in the
circuit directory. If you set different net voltage property for each design variation
in the Setting Voltage tab in "4.6 Option setting", you can perform rule check
corresponding to the circuit configuration and net voltage to be changed at the
design variation.