JC70XX SERIES Voltage Detector

Features

- Low power consumptionz
- Low temperature coefficient
- Built-in high-stability reference source
- Built-in hysteresis characteristic
- TO-92 package
- SOT-89 package

Applications

- Battery checkers
- Level selectors
- Power failure detectors
- Microcomputer reset
- Battery memory backup
- Non-volatileRAMsignal storage protectors

General Description

The JC70XX series is a set of three-terminal low power voltage detectors implemented in CMOS technology. Each voltage detector in the series detects a particular fixed voltage ranging from 1.9V to 7V. The voltage detectors consist of a high-precision and low power consumption standard voltage source, a comparator, hysteresis circuit, and an output driver. CMOS technology ensures low power consumption.

Although designed primarily as fixed voltage detectors, these devices can be used with external components to detect user specified threshold voltages (NMOS open drain type only).

Selection Table

| Part No.	Detectable Voltage	Hysteresis Width	Tolerance
JC7015A	1.5V	0.075V	± 3%
JC7019A	1.9V	0.095V	± 3%
JC7021A	2.1V	0.105V	± 3%
JC7022A	2.2V	0.110V	± 3%
JC7024A	2.4V	0.120V	± 3%
JC7027A	2.7V	0.135V	± 3%
JC7028A	2.8V	0.140V	± 3%
JC7030A	3.0V	0.150V	± 3%
JC7033A	3.3V	0.165V	± 3%
JC7039A	3.9V	0.195V	± 3%
JC7042A	4.2V	0.210V	± 3%
JC7044A	4.4V	0.220V	± 3%
JC7050A	5.0V	0.250V	± 3%
JC7070A	7.0V	0.350V	± 3%

NMOS open drain normal open, active low
For example: The JC7044 is a 4.4V, NMOS open drain active low output
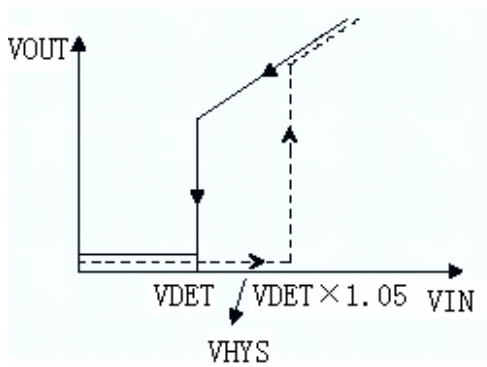For semi-custom parts,selectable regulated voltage range is from 2.1V to 12V in 0.1V increment.
For semi-custom parts,selectable output type CMOS .

Block Diagram
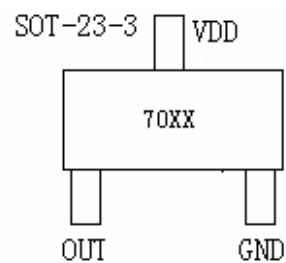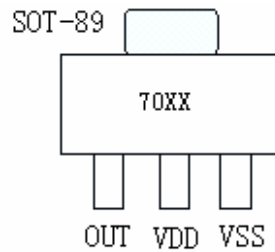**N channel open drain output (normal open; active low)**
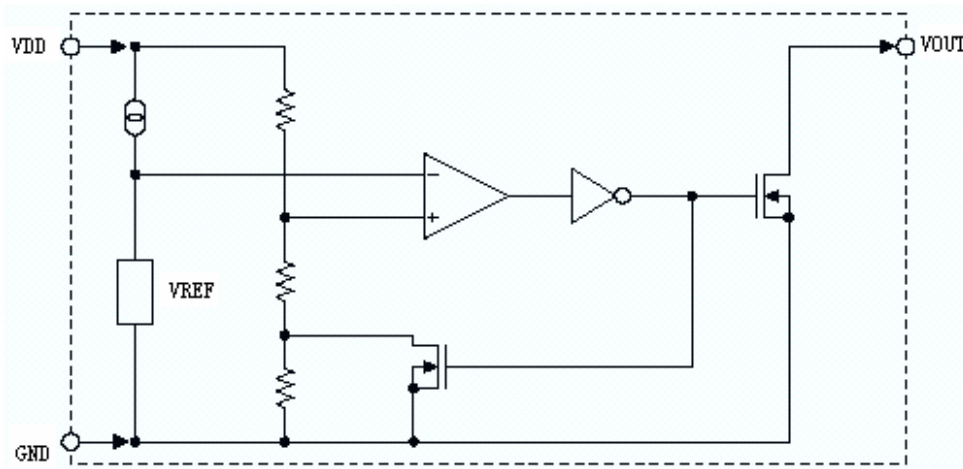
A type

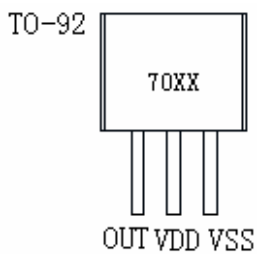**Dash Line ......VIN from Lo   Hi**
Solid Line ......VIN from Hi   Lo

Pin Assigment

Absolute Maximum Ratings

Supply Voltage...-0.3V to 18V
Output Voltage ....V_{SS}-0.3V to V_{DD}+0.3V   Output Current.......................................50mA
Storage Temperature..................-50　to 125   Power Consumption................200Mw　TO_92
Operating Temperature ....-40　to 85   Power Consumption................250Mw　SOT_89
Note: These are stress ratings only. Stresses exceeding the range specified under _Absolute Maximum
Ratings _may cause substantial damage to the device. Functional operation of this device
at other conditions beyond those listed in the specification is not implied and prolonged
exposure to extreme conditions may affect device reliability.

Electrical Characteristic
JC7015A

T_A=25

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
V_{DET}	Hi　Lo Detectable Voltage	--	--	1.455	1.5	1.545	V
V_{HYS}	Hysteresis Width	--	--	0.02 V_{DET}	0.05 V_{DET}	0.07 V_{DET}	%
I_{DD}	Operating Current	2.5	No load	--	1.2	2	uA
V_{DD}	Operating Voltage	--	--	1.0	--	15	V
I_{OL}	Output Sink Current	1.45	V_{OUT}=0.2V	1	1.5	--	mA
$\frac{V_{DET}}{T_A}$	Temperature Coefficient	--	0　<Ta<70	--	± 0.4	--	mV/

Electrical Characteristic
JC7019A

T_A=25

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
V_{DET}	Hi　Lo Detectable Voltage	--	--	1.843	1.9	1.957	V
V_{HYS}	Hysteresis Width	--	--	0.02 V_{DET}	0.05 V_{DET}	0.07 V_{DET}	%
I_{DD}	Operating Current	2.9	No load	--	1.2	2	uA
V_{DD}	Operating Voltage	--	--	1.5	--	15	V
I_{OL}	Output Sink Current	1.8	V_{OUT}=0.2V	1	2	--	mA
$\frac{V_{DET}}{T_A}$	Temperature Coefficient	--	0　<Ta<70	--	± 0.5	--	mV/

Electrical Characteristic
JC7021A

T_A=25

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
V_{DET}	Hi　Lo Detectable Voltage	--	--	2.037	2.1	2.163	V
V_{HYS}	Hysteresis Width	--	--	0.02 V_{DET}	0.05 V_{DET}	0.07 V_{DET}	%
I_{DD}	Operating Current	3.1	No load	--	1.2	2	uA
V_{DD}	Operating Voltage	--	--	1.5	--	15	V
I_{OL}	Output Sink Current	2	V_{OUT}=0.2V	1	2	--	mA
$\frac{V_{DET}}{T_A}$	Temperature Coefficient	--	0　<Ta<70	--	± 0.5	--	mV/

JC7022A

T$_A$=25

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V$_{DD}$	Conditions				
V$_{DET}$	Hi Lo Detectable Voltage	--	--	2.134	2.2	2.266	V
V$_{HYS}$	Hysteresis Width	--	--	0.02 V$_{DET}$	0.05 V$_{DET}$	0.07 V$_{DET}$	%
I$_{DD}$	Operating Current	3.2	No load	--	1.2	2	uA
V$_{DD}$	Operating Voltage	--	--	1.5	--	15	V
I$_{OL}$	Output Sink Current	2	V$_{OUT}$=0.2V	1.5	3	--	mA
$\frac{V_{DET}}{T_A}$	Temperature Coefficient	--	0 <Ta<70	--	± 0.5	--	mV/

JC7024A

T$_A$=25

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V$_{DD}$	Conditions				
V$_{DET}$	Hi Lo Detectable Voltage	--	--	2.328	2.4	2.472	V
V$_{HYS}$	Hysteresis Width	--	--	0.02 V$_{DET}$	0.05 V$_{DET}$	0.07 V$_{DET}$	%
I$_{DD}$	Operating Current	3.4	No load	--	1.2	2	uA
V$_{DD}$	Operating Voltage	--	--	1.5	--	15	V
I$_{OL}$	Output Sink Current	2.2	V$_{OUT}$=0.2V	1.5	3	--	mA
$\frac{V_{DET}}{T_A}$	Temperature Coefficient	--	0 <Ta<70	--	± 0.5	--	mV/

JC7027A

T$_A$=25

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V$_{DD}$	Conditions				
V$_{DET}$	Hi Lo Detectable Voltage	--	--	2.619	2.7	2.781	V
V$_{HYS}$	Hysteresis Width	--	--	0.02 V$_{DET}$	0.05 V$_{DET}$	0.07 V$_{DET}$	%
I$_{DD}$	Operating Current	3.7	No load	--	1.2	2	uA
V$_{DD}$	Operating Voltage	--	--	1.5	--	15	V
I$_{OL}$	Output Sink Current	2.5	V$_{OUT}$=0.2V	2	4	--	mA
$\frac{V_{DET}}{T_A}$	Temperature Coefficient	--	0 <Ta<70	--	± 0.5	--	mV/

JC7028A

T$_A$=25

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V$_{DD}$	Conditions				
V$_{DET}$	Hi Lo Detectable Voltage	--	--	2.716	2.8	2.884	V
V$_{HYS}$	Hysteresis Width	--	--	0.02 V$_{DET}$	0.05 V$_{DET}$	0.07 V$_{DET}$	%
I$_{DD}$	Operating Current	3.8	No load	--	1.2	2	uA
V$_{DD}$	Operating Voltage	--	--	1.5	--	15	V
I$_{OL}$	Output Sink Current	2.7	V$_{OUT}$=0.2V	2	4	--	mA
$\frac{V_{DET}}{T_A}$	Temperature Coefficient	--	0 <Ta<70	--	± 0.5	--	mV/

JC7030A $T_A=25$

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
V_{DET}	Hi Lo Detectable Voltage	--	--	2.91	3.0	3.09	V
V_{HYS}	Hysteresis Width	--	--	0.02 V_{DET}	0.05 V_{DET}	0.07 V_{DET}	%
I_{DD}	Operating Current	4.0	No load	--	1.2	2	uA
V_{DD}	Operating Voltage	--	--	1.5	--	15	V
I_{OL}	Output Sink Current	2.7	$V_{OUT}=0.2V$	2	4	--	mA
$\frac{V_{DET}}{T_A}$	Temperature Coefficient	--	0 <Ta<70	--	± 0.5	--	mV/

JC7033A $T_A=25$

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
V_{DET}	Hi Lo Detectable Voltage	--	--	3.201	3.3	3.399	V
V_{HYS}	Hysteresis Width	--	--	0.02 V_{DET}	0.05 V_{DET}	0.07 V_{DET}	%
I_{DD}	Operating Current	4.3	No load	--	1.2	2	uA
V_{DD}	Operating Voltage	--	--	1.5	--	15	V
I_{OL}	Output Sink Current	3.1	$V_{OUT}=0.2V$	2	4	--	mA
$\frac{V_{DET}}{T_A}$	Temperature Coefficient	--	0 <Ta<70	--	± 0.5	--	mV/

JC7039A $T_A=25$

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
V_{DET}	Hi Lo Detectable Voltage	--	--	3.783	3.9	4.017	V
V_{HYS}	Hysteresis Width	--	--	0.02 V_{DET}	0.05 V_{DET}	0.07 V_{DET}	%
I_{DD}	Operating Current	4.9	No load	--	.22	2	uA
V_{DD}	Operating Voltage	--	--	1.5	--	15	V
I_{OL}	Output Sink Current	3.7	$V_{OUT}=0.2V$	3	6	--	mA
$\frac{V_{DET}}{T_A}$	Temperature Coefficient	--	0 <Ta<70	--	± 0.5	--	mV/

JC7042A $T_A=25$

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
V_{DET}	Hi Lo Detectable Voltage	--	--	4.074	4.2	4.326	V
V_{HYS}	Hysteresis Width	--	--	0.02 V_{DET}	0.05 V_{DET}	0.07 V_{DET}	%
I_{DD}	Operating Current	5.2	No load	--	.12	2	uA
V_{DD}	Operating Voltage	--	--	1.5	--	15	V
I_{OL}	Output Sink Current	3.8	$V_{OUT}=0.2V$	3	6	--	mA
$\frac{V_{DET}}{T_A}$	Temperature Coefficient	--	0 <Ta<70	--	± 0.6	--	mV/

JC7044A

T$_{A}$=25

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V$_{DD}$	Conditions				
V$_{DET}$	Hi Lo Detectable Voltage	--	--	4.368	4.4	4.532	V
V$_{HYS}$	Hysteresis Width	--	--	0.02 V$_{DET}$	0.05 V$_{DET}$	0.07 V$_{DET}$	%
I$_{DD}$	Operating Current	5.4	No load	--	1.2	2	uA
V$_{DD}$	Operating Voltage	--	--	1.5	--	15	V
I$_{OL}$	Output Sink Current	4.0	V$_{OUT}$=0.2V	4	8	--	mA
$\frac{V_{DET}}{T_A}$	Temperature Coefficient	--	0 <Ta<70	--	± 0.6	--	mV/

JC7050A

T$_{A}$=25

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V$_{DD}$	Conditions				
V$_{DET}$	Hi Lo Detectable Voltage	--	--	4.850	5.0	5.150	V
V$_{HYS}$	Hysteresis Width	--	--	0.02 V$_{DET}$	0.05 V$_{DET}$	0.1 V$_{DET}$	%
I$_{DD}$	Operating Current	6.0	No load	--	1.2	2	uA
V$_{DD}$	Operating Voltage	--	--	1.5	--	15	V
I$_{OL}$	Output Sink Current	4.8	V$_{OUT}$=0.2V	4	8	--	mA
$\frac{V_{DET}}{T_A}$	Temperature Coefficient	--	0 <Ta<70	--	± 0.6	--	mV/

JC7070A

T$_{A}$=25

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V$_{DD}$	Conditions				
V$_{DET}$	Hi Lo Detectable Voltage	--	--	6.790	7.0	7.210	V
V$_{HYS}$	Hysteresis Width	--	--	0.02 V$_{DET}$	0.05 V$_{DET}$	0.07 V$_{DET}$	%
I$_{DD}$	Operating Current	8.0	No load	--	1.2	2	uA
V$_{DD}$	Operating Voltage	--	--	1.0	--	15	V
I$_{OL}$	Output Sink Current	6.7	V$_{OUT}$=0.2V	5	8	--	mA
$\frac{V_{DET}}{T_A}$	Temperature Coefficient	--	0 <Ta<70	--	± 0.8	--	mV/

Functional Description

The JC70XX series is a set of voltage detectors equipped with a high stability voltage reference which is connected to the negative input of a comparator----denoted as V_{REF} in the following figure for NMOS output voltage detector.

When the voltage drop to the positive input of the comparator (i,e, V_B) is higher than V_{REF}, VOUT goes high, M1 turns off, and V_B is expressed as $V_{BH} = VDD \times (RB+RC)/(RA+RB+RC)$.

If VDD is decreased so that V_B falls to a value less than V_{REF}, the comparator output inverts from high to low, VOUT goes low, V_C is high, M1 turns on, RC is bypassed, and V_B becomes: $V_{BL} = VDD \times RB/(RA+RB)$, which is less than V_{BH}. By so doing, the comparator output will stay low to prevent the circuit from oscillating when $V_B \quad V_{REF}$.

If VDD falls below the minimum operating voltage, the output becomes undefined. When VDD goes from low to $VDD \times RB/(RA+RB) > V_{REF}$, the comparator output and VOUT goes high.

The detectable voltage is defined as:
$$V_{DET}(-) = \frac{RA + RB + RC}{RB + RC} \times V_{REF}$$
The release voltage is defined as:
$$V_{DET}(+) = \frac{RA + RB}{RB} \times V_{REF}$$
The hysteresis width is:
$$V_{HYS} = V_{DET}(+) - V_{DET}(-)$$
The figure demonstrates the NMOS output type with positive output polarity (VOUT is normally open, active low). The JC70XX series also supplies options for other output types with active high outputs. Application circuits shown are examples of positive output polarity (normally open, active low) unless otherwise specified.
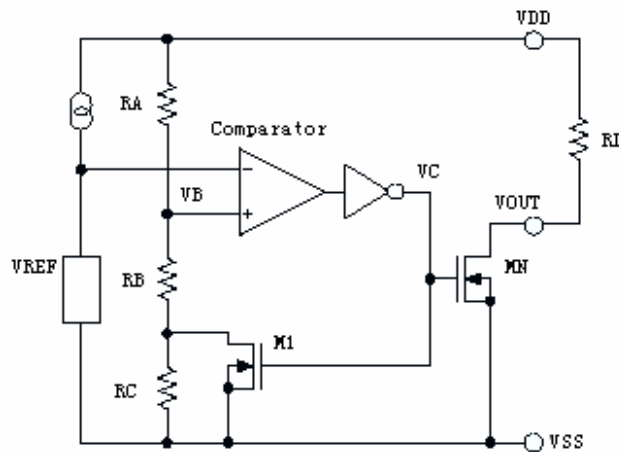
NMOS output voltage detector (JC70XXA)

Application Circuits

Microcomputer reset circuit

Normally a reset circuit is required to protect the microcomputer system from malfunctions due to power line interruptions. The following examples show how different output configurations perform a reset function in various systems.

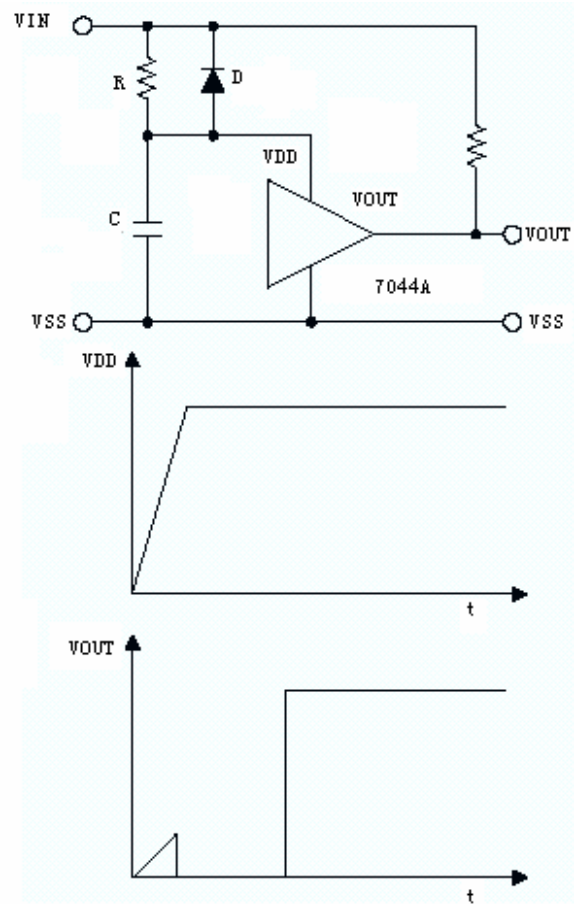· NMOS open drain output application for separate power supply
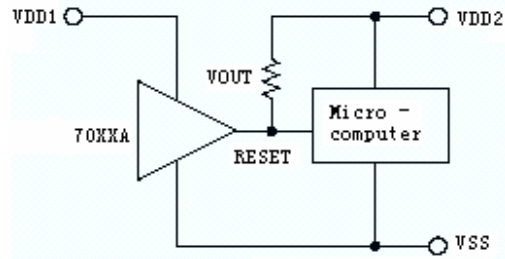
· NMOS open drain output application with R-C delay
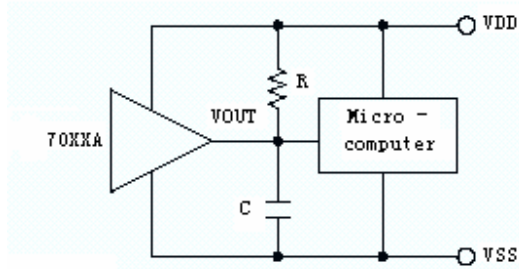

Power-on reset circuit

With several external components, the NMOS open drain type of the JC70XX series can be used to perform a power-on reset function as shown:

5V power line monitoring circuit
Generally, a minimum operating voltage of
4.5V is guaranteed in a 5V power line system.
The JC7044A is recommended for use as 5V
power line monitoring circuit.
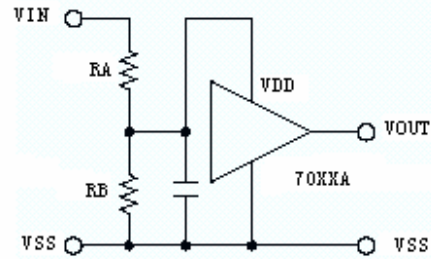
· 5V power line monitor with power-on reset
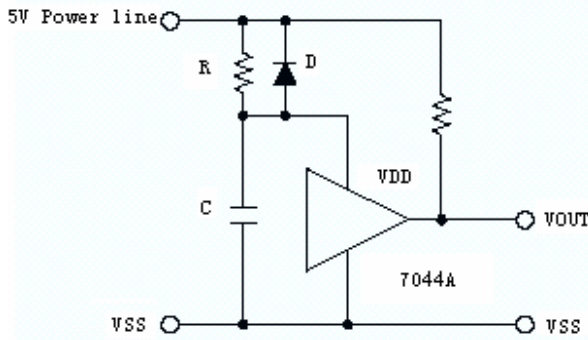
· with 5V voltage regulator
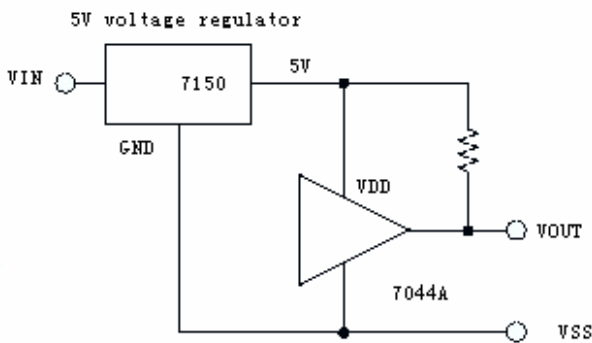
Change of detectable voltage
If the required voltage is not found in the standard
product selection table, it is possible to
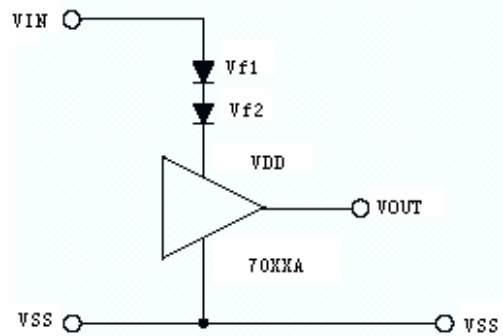change it by using external resistance dividers
or diodes.

· Varying the detectable voltage with a resistance
  divider

$$\text{Detectable voltage} = \frac{RA \times RB}{RB} \times V_{DET}$$
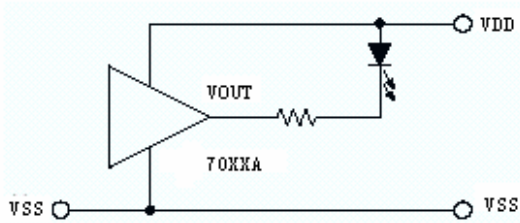$$\text{Hysteresis width} = \frac{RA \times RB}{RB} \times V_{HYS}$$

· Varying the detectable voltage with a diode

$$\text{Detectable Voltage} = V_{f1} + V_{f2} + V_{DET}$$

Malfunction analysis

The following circuit demonstrates the way a circuit analyzes malfunctions by monitoring the variation or spike noise of power supply voltage.

Charge monitoring circuit

The following circuit shows a charged monitor for protection against battery deterioration by overcharging. When the voltage of the battery is higher than the set detectable voltage, the transistor turns on to bypass the charge current, protecting the battery from overcharging.
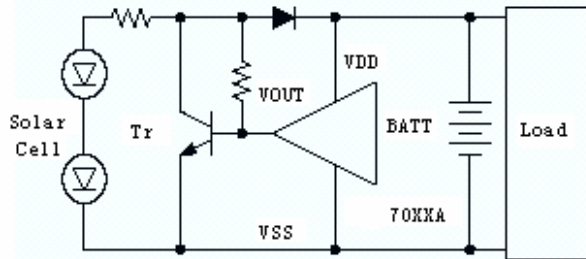
Level selector

The following diagram illustrates a logic level selector.