

Features

- Low power consumption
- · Low temperature coefficient
- High input voltage range (up to 30V)
- Quiescent current 3µA
- Output voltage accuracy: tolerance $\pm 3\%$
- Built-in hysteresis characteristic
- 3-pin SOT89, 3-pin SOT23 and 5-pin SOT23 package

Applications

- Battery checkers
- Level selectors
- Power failure detectors
- Microcomputer reset

Selection Table

- Battery memory backup
- Non-volatile RAM signal storage protectors

General Description

The HT70xxA-1 series devices area 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 2.2V to 8.2V. The voltage detectors consist of a high-precision and low power consumption standard voltage source as well as 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.

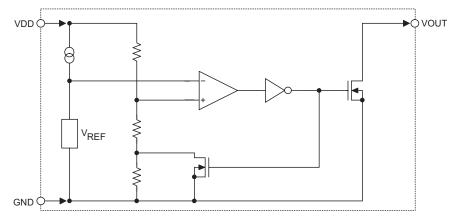
Part No.	Detectable Voltage	Hysteresis Width	Tolerance	Package	Marking	
HT7022A-1	2.2V	0.110V				
HT7024A-1	2.4V	0.120V				
HT7027A-1	2.7V	0.135V	SOT89			
HT7033A-1	3.3V	0.165V		±3%		
HT7039A-1	3.9V	0.195V	I370		0xxA (for SOT23) 0xxA (for SOT23-5)	
HT7044A-1	4.4V	0.220V				
HT7050A-1	5.0V	0.250V				
HT7082A-1	8.2V	0.410V				

Note: "xx" stands for detectable voltages.

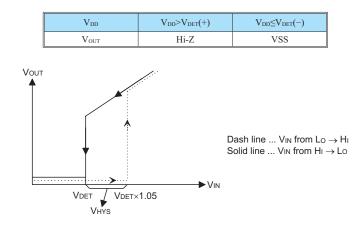


Block Diagram

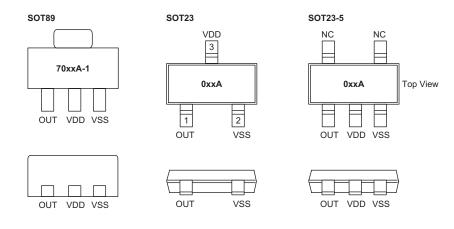
N Channel Open Drain Output (Normal Open; Active Low)



Output Table & Curve



Pin Assignment





Absolute Maximum Ratings

Supply VoltageVss-0.3V to Vss+33V	Power Consumption
Output Voltage V_{SS} -0.3V to V_{DD} +0.3V	Storage Temperature60°C to 150°C
Output Current	Operating Temperature40°C to 85°C

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 Characteristics

HT7022A-1

							Ta=25°C
Symbol	Parameter	Tes	t Conditions	Min.	Turn	Max.	Unit
Symbol	Parameter	V _{DD}	Conditions		Тур.	wax.	Unit
Vdet	Detection Voltage	—	—	2.134	2.200	2.266	V
V _{HYS}	Hysteresis Width	_	—	0.02VDET	0.05Vdet	0.10V _{DET}	V
IDD	Operating Current	3.2V	No load		3	6	μA
V _{DD}	Operating Voltage	—	—	1.5	_	30	V
IOL	Output Sink Current	V _{DET} -0.2V	V _{OUT} =0.2V	1	2	—	mA
$\frac{\Delta V_{OUT}}{\Delta T_a \times V_{DET}}$	Temperature Coefficient		-40°C <ta<85°c< td=""><td></td><td>±100</td><td>_</td><td>ppm/°C</td></ta<85°c<>		±100	_	ppm/°C
t _{DELAY}	Output Delay Time	—	$R_L=100k\Omega$ (see fig 1)	—	—	200	μs

HT7024A-1

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Turn	Max.	Unit
Symbol	Parameter	VDD	Conditions	IVIIII.	Тур.	wax.	Unit
Vdet	Detection Voltage	—	—	2.328	2.400	2.472	V
V _{HYS}	Hysteresis Width	—	—	$0.02V_{\text{DET}}$	0.05Vdet	0.10V _{DET}	V
IDD	Operating Current	3.4V	No load	_	3	6	μA
V _{DD}	Operating Voltage	—	—	1.5	—	30	V
IOL	Output Sink Current	VDET– 0.2V	V _{OUT} =0.2V	1	2		mA
$\frac{\Delta V_{OUT}}{\Delta T_a \times V_{DET}}$	Temperature Coefficient		-40°C <ta<85°c< td=""><td>_</td><td>±100</td><td></td><td>ppm/°C</td></ta<85°c<>	_	±100		ppm/°C
t _{DELAY}	Output Delay Time		$R_L=100k\Omega$ (see fig 1)			200	μs



HT7027A-1

Symbol	Parameter	Tes	t Conditions	Min.	Ture	Max.	Unit
Symbol	Parameter	V _{DD}	Conditions	IVIII.	Тур.	wax.	Unit
Vdet	Detection Voltage	—	_	2.619	2.700	2.781	V
V _{HYS}	Hysteresis Width	—	_	$0.02V_{\text{DET}}$	0.05V _{DET}	0.10V _{DET}	V
IDD	Operating Current	3.7V	No load	—	3	6	μA
V _{DD}	Operating Voltage		_	1.5	_	30	V
Iol	Output Sink Current	V _{DET} -0.2V	Vout=0.2V	1	2	_	mA
$\frac{\Delta V_{OUT}}{\Delta T_a \times V_{DET}}$	Temperature Coefficient	_	-40°C <ta<85°c< td=""><td></td><td>±100</td><td>_</td><td>ppm/°C</td></ta<85°c<>		±100	_	ppm/°C
tDELAY	Output Delay Time	_	R₋=100kΩ (see fig 1)	—	_	200	μs

HT7033A-1

							Ta=25°C
Symbol	Parameter	Tes	t Conditions	Min	Turn	Max.	l Imit
Symbol	Parameter	VDD	Conditions	Min.	Тур.	IVIAX.	Unit
Vdet	Detection Voltage	—		3.201	3.300	3.399	V
V _{HYS}	Hysteresis Width	_	_	0.02V _{DET}	0.05V _{DET}	0.10Vdet	V
I _{DD}	Operating Current	4.3V	No load	_	3	6	μA
Vdd	Operating Voltage	_	_	1.5	_	30	V
I _{OL}	Output Sink Current	V _{DET} -0.2V	V _{OUT} =0.25V	2	4	—	mA
$\frac{\Delta V_{OUT}}{\Delta T_a \times V_{DET}}$	Temperature Coefficient		-40°C <ta<85°c< td=""><td></td><td>±100</td><td>_</td><td>ppm/°C</td></ta<85°c<>		±100	_	ppm/°C
t _{DELAY}	Output Delay Time	_	$R_L=100k\Omega$ (see fig 1)	_	—	200	μs

HT7039A-1

Ta=25°C

Symbol	Deremeter	Parameter Test Conditions Min.		Min	Turn	Max.	Unit
Symbol	Fardifieter	V _{DD}	Conditions	IVIII.	Тур.	WidX.	Unit
V _{DET}	Detection Voltage	_		3.783	3.900	4.017	V
V _{HYS}	Hysteresis Width	—	—	$0.02V_{\text{DET}}$	$0.05V_{\text{DET}}$	0.10V _{DET}	V
IDD	Operating Current	4.9V	No load	—	3	6	μA
V _{DD}	Operating Voltage	_	_	1.5	_	30	V
Iol	Output Sink Current	V _{DET} -0.2V	Vout=0.25V	2	4	—	mA
$\frac{\Delta V_{OUT}}{\Delta T_a \times V_{DET}}$	Temperature Coefficient	_	-40°C <ta<85°c< td=""><td>_</td><td>±100</td><td>_</td><td>ppm/°C</td></ta<85°c<>	_	±100	_	ppm/°C
t _{DELAY}	Output Delay Time		$R_L=100k\Omega$ (see fig 1)		—	200	μs



HT7044A-1

Ta=25°C

Symbol	Parameter	Tes	t Conditions	Min.	Turn	Max.	Unit
Symbol	Parameter	V _{DD}	Conditions		Тур.	wax.	Unit
Vdet	Detection Voltage	—	—	4.268	4.400	4.532	V
V _{HYS}	Hysteresis Width	—	—	0.02V _{DET}	$0.05V_{\text{DET}}$	$0.10V_{\text{DET}}$	V
IDD	Operating Current	5.4V	No load	_	3	6	μA
V _{DD}	Operating Voltage	—	—	1.5	—	30	V
Iol	Output Sink Current	V _{DET} -0.2V	Vout=0.36V	4	7	—	mA
$\frac{\Delta V_{OUT}}{\Delta T_a \times V_{DET}}$	Temperature Coefficient		-40°C <ta<85°c< td=""><td></td><td>±100</td><td>_</td><td>ppm/°C</td></ta<85°c<>		±100	_	ppm/°C
tDELAY	Output Delay Time	_	$R_L=100k\Omega$ (see fig 1)		_	200	μs

HT7050A-1

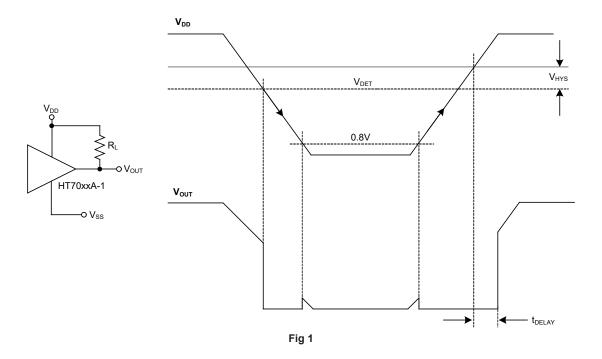
							Ta=25°C
Symbol	Parameter	Tes	t Conditions	Min.	Turn	Max.	linit
Symbol	Parameter	VDD	Conditions		Тур.	wax.	Unit
Vdet	Detection Voltage	—	—	4.850	5.000	5.150	V
V _{HYS}	Hysteresis Width	_	_	0.02Vdet	0.05V _{DET}	0.10V _{DET}	V
IDD	Operating Current	6.0V	No load		3	6	μA
Vdd	Operating Voltage	_	_	2.1	_	30	V
Iol	Output Sink Current	V _{DET} -0.2V	Vout=0.36V	4	7	_	mA
$\frac{\Delta V_{OUT}}{\Delta T_a \times V_{DET}}$	Temperature Coefficient	_	-40°C <ta<85°c< td=""><td></td><td>±100</td><td></td><td>ppm/°C</td></ta<85°c<>		±100		ppm/°C
t _{DELAY}	Output Delay Time	—	$R_L=100k\Omega$ (see fig 1)	_		200	μs

HT7082A-1

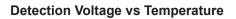
Ta=25°C

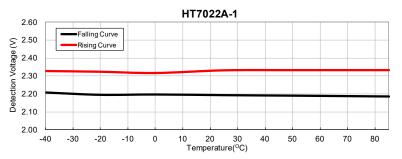
Symbol	Parameter	Tes	t Conditions	Min.	Turn	Max.	Unit
Symbol	Parameter	V _{DD}	Conditions	IVIII.	Тур.	wax.	Unit
VDET	Detection Voltage	_	_	7.954	8.200	8.446	V
V _{HYS}	Hysteresis Width	_	_	0.02V _{DET}	0.05Vdet	0.10Vdet	V
IDD	Operating Current	9.2V	No load	—	3	6	μA
Vdd	Operating Voltage	_	_	2.1		30	V
IOL	Output Sink Current	V _{DET} -0.2V	V _{OUT} =0.36V	4	7	_	mA
$\frac{\Delta V_{OUT}}{\Delta T_a \times V_{DET}}$	Temperature Coefficient		-40°C <ta<85°c< td=""><td></td><td>±100</td><td></td><td>ppm/°C</td></ta<85°c<>		±100		ppm/°C
t DELAY	Output Delay Time	_	R₋=100kΩ see fig 1)	—	_	200	μs



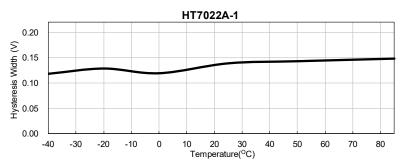


Typical Performance Characteristics



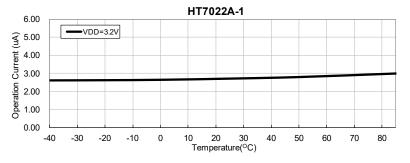


Hysteresis Width vs Temperature

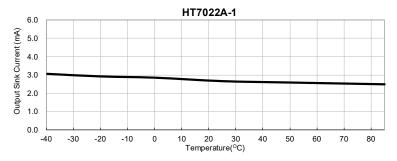




Operating Current vs Temperature



Output Sink Current vs Temperature



Functional Description

The HT70xxA-1 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}, V_{OUT} goes high, M1 turns off, and V_B is expressed as $V_{BH}=V_{DD}\times(R_B+R_C)/(R_A+R_B+R_C)$. If V_{DD} is decreased so that V_B falls to a value less than V_{REF}, the comparator output inverts from high to low, V_{OUT} goes low, V_C is high, M1 turns on, R_C is bypassed, and V_B becomes: $V_{BL}=V_{DD}\times R_B/(R_A+R_B)$, which is less than V_{BH}. By so doing, the comparator output will stay low to prevent the circuit from oscillating when V_B \approx V_{REF}.

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

The detectable voltage is defined as:

 $V_{DET}(-) = (R_A + R_B + R_C) / (R_B + R_C) \times V_{REF}$

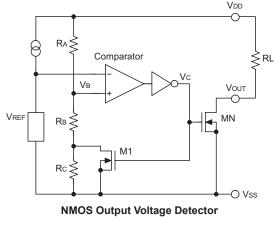
The release voltage is defined as:

$$V_{DET}(+) = (R_A+R_B) / R_B \times V_{REF}$$

The hysteresis width is:

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$$V_{HYS} = V_{DET}(+) - V_{DET}(-)$$



The figure demonstrates the NMOS output type with positive output polarity (V_{OUT} is normally open, active low). Application circuits shown are examples of positive output polarity (normally open, active low) unless otherwise specified.

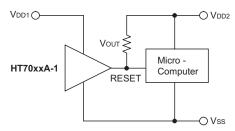


Application Circuits

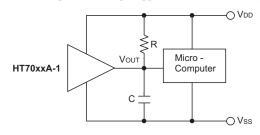
Microcomputer Reset Circuit

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

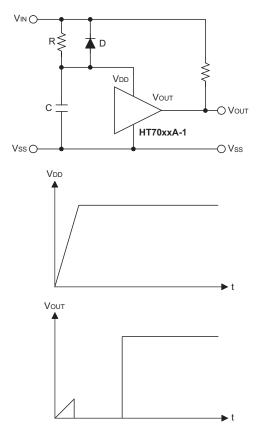


• NMOS open drain output application with R-C delay



Power-on Reset Circuit

With several external components, the NMOS open drain type of the HT70xxA-1 series can be used to perform a power-on reset function as shown:

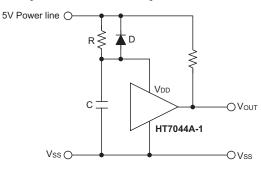




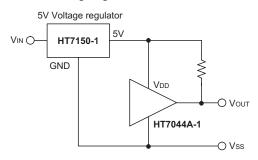
5V Power Line Monitoring Circuit

Generally, a minimum operating voltage of 4.5V is guaranteed in a 5V power line system. The HT7044A-1 is recommended for use as 5V power line monitoring circuit.

• 5V power line monitor with power-on reset



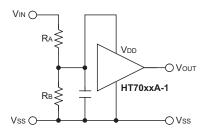
· with 5V voltage regulator



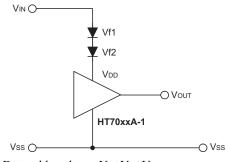
Change of Detectable Voltage

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



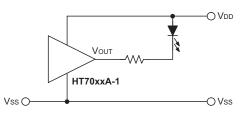
Detectable voltage= $(R_A+R_B)/R_B \times V_{DET}$ Hysteresis width= $(R_A+R_B)/R_B \times V_{HYS}$ • Varying the detectable voltage with a diode



Detectable voltage=V_{f1}+V_{f2}+V_{DET}

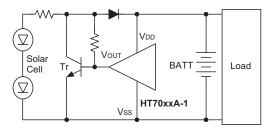
Malfunction Analysis

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



Charge Monitoring Circuit

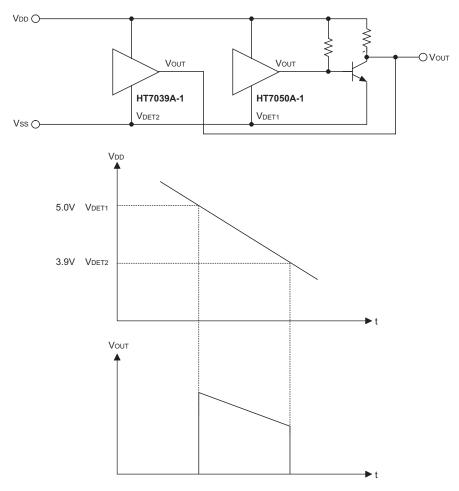
The following circuit shows a charged monitor for protection against battery deterioration by overcharging. When the voltage of the battery is higher than the set detectable voltage, the transistor turns on to bypass the charge current, protecting the battery from overcharging.





Level Selector

The following diagram illustrates a logic level selector.





Package Information

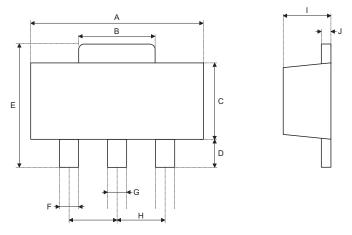
Note that the package information provided here is for consultation purposes only. As this information may be updated at regular intervals users are reminded to consul

Additional supplementary information with regard to packaging is listed below. Click on the relevant section to be transferred to the relevant website page.

- Package Information (include Outline Dimensions, Product Tape and Reel Specifications)
- The Operation Instruction of Packing Materials
- Carton information



3-pin SOT89 Outline Dimensions

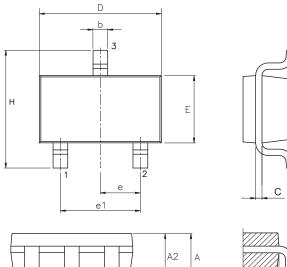


Symbol		Dimensions in inch	
Symbol	Min.	Nom.	Max.
A	0.173	_	0.181
В	0.053	—	0.072
С	0.090	_	0.102
D	0.035	—	0.047
E	0.155	_	0.167
F	0.014	—	0.019
G	0.017	—	0.022
Н	_	0.059 BSC	—
I	0.055		0.063
J	0.014	—	0.017

Symbol	Dimensions in mm				
Symbol	Min.	Nom.	Max.		
A	4.40	—	4.60		
В	1.35	_	1.83		
С	2.29	—	2.60		
D	0.89	_	1.20		
E	3.94	—	4.25		
F	0.36	_	0.48		
G	0.44	_	0.56		
Н	—	1.50 BSC	—		
I	1.40	—	1.60		
J	0.35	_	0.44		



3-pin SOT23 Outline Dimensions



				A2	А
				A1	-



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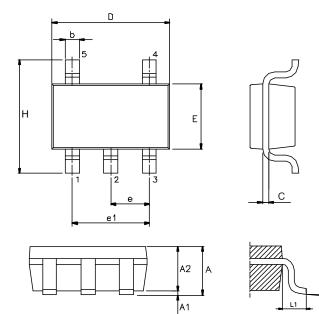
Symbol	Dimensions in inch			
Symbol	Min.	Nom.	Max.	
A	_	_	0.057	
A1	_	_	0.006	
A2	0.035	0.045	0.051	
b	0.012	_	0.020	
С	0.003	_	0.009	
D	_	0.114 BSC	—	
E	_	0.063 BSC	_	
е	_	0.037 BSC	_	
e1	_	0.075 BSC	—	
Н	_	0.110 BSC	—	
L1	_	0.024 BSC	_	
θ	0°	_	8°	

Symbol	Dimensions in mm				
	Min.	Nom.	Max.		
A	—	—	1.45		
A1	—	_	0.15		
A2	0.90	1.15	1.30		
b	0.30	_	0.50		
С	0.08	_	0.22		
D	_	2.90 BSC	_		
E	—	1.60 BSC	_		
е	_	0.95 BSC	_		
e1	_	1.90 BSC	_		
Н	_	2.80 BSC	_		
L1	_	0.60 BSC	_		
θ	0°	_	8°		



e

5-pin SOT23 Outline Dimensions



Symbol	Dimensions in inch				
	Min.	Nom.	Max.		
А	_	_	0.057		
A1	_	_	0.006		
A2	0.035	0.045	0.051		
b	0.012	_	0.020		
С	0.003	_	0.009		
D	_	0.114 BSC	_		
E	_	0.063 BSC	—		
е	_	0.037 BSC	_		
e1	_	0.075 BSC	_		
Н	_	0.110 BSC	_		
L1	_	0.024 BSC	—		
θ	0°	_	8°		

Symbol	Dimensions in mm				
	Min.	Nom.	Max.		
A	—	—	1.45		
A1	—	—	0.15		
A2	0.90	1.15	1.30		
b	0.30	—	0.50		
С	0.08	—	0.22		
D	_	2.90 BSC	—		
E	_	1.60 BSC	_		
е	_	0.95 BSC	—		
e1	_	1.90 BSC	_		
Н	_	2.80 BSC	_		
L1	—	0.60 BSC	_		
θ	0°	—	8°		



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