HN1232
Microprocessor Monitor

DESCRIPTION

The HN1232 microprocessor (µP) supervisory circuit provides “housekeeping” and power supervision functions. The HN1232 enhances circuit reliability in µP systems by monitoring the power supply, monitoring software execution, and providing a debounced manual reset input.

First, a precision temperature–compensated reference and comparator circuit monitors the status of V_{CC}. When an out–of–tolerance condition occurs, an internal power fail signal is generated which forces reset to the active state. When V_{CC} returns to an in–tolerance condition, the reset signals are kept in the active state for a minimum of 250 ms to allow the power supply and system microprocessor to stabilize. The trip point tolerance signal, TOL, selects the trip level tolerance to be either 5- or 10-percent.

The second function the HN1232 performs is manual reset control. A debounced manual reset input activates the reset outputs for a minimum period of 250 ms.

The third function is a watchdog timer. The HN1232 has an internal timer that forces the reset signals to the active state if the strobe input is not driven low prior to time–out. The watchdog timer function can be set to operate on time–out settings of approximately 150 ms, 600 ms, and 1.2 seconds.

Devices are available in 8-pin DIP, 8/16-pin SO and compact 8-pin MicroSO packages, and requires no external components.

FEATURES

- Precision voltage monitor - adjustable +4.5V or +4.75V
- Halts and restarts an out–of–control microprocessor
- Holds microprocessor in check during power transients
- Automatically restarts microprocessor after power failure
- Reset pulse width – 250ms min.
- Debounced manual reset input for external override
- Adjustable watchdog timer – 150ms, 600ms, or 1.2sec
- Precision temperature-compensated voltage reference and comparator
- No external components
- The HN1232 is a plug-in replacement of the Max1232, DS1232, IMP1232, etc.

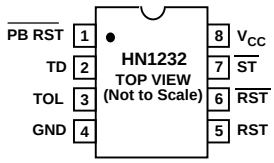
APPLICATIONS

- Microprocessor Systems
- Portable Equipment
- Computers
- Controllers
- Intelligent Instruments
- Automotive Systems
- Critical µP Power Monitoring

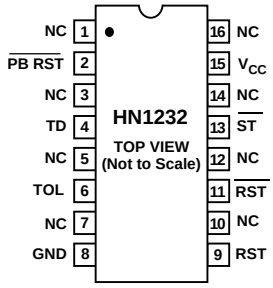
ORDERING INFORMATION

PART NO.	TEMP. RANGE (°C)	PACKAGE
HN1232CN	0 – 70 °C	8-Pin DIP
HN1232CM	0 – 70 °C	8-Pin SO
HN1232CU	0 – 70 °C	8-Pin MicroSO
HN1232CWM	0 – 70 °C	16-Pin Wide SO
HN1232CX	0 – 70 °C	Dice
HN1232EN	-40 – 85 °C	8-Pin DIP
HN1232EM	-40 – 85 °C	8-Pin SO
HN1232EU	-40 – 85 °C	8-Pin MicroSO
HN1232EWM	-40 – 85 °C	16-Pin Wide SO

PIN CONFIGURATION



DIP / SO / MicroSO

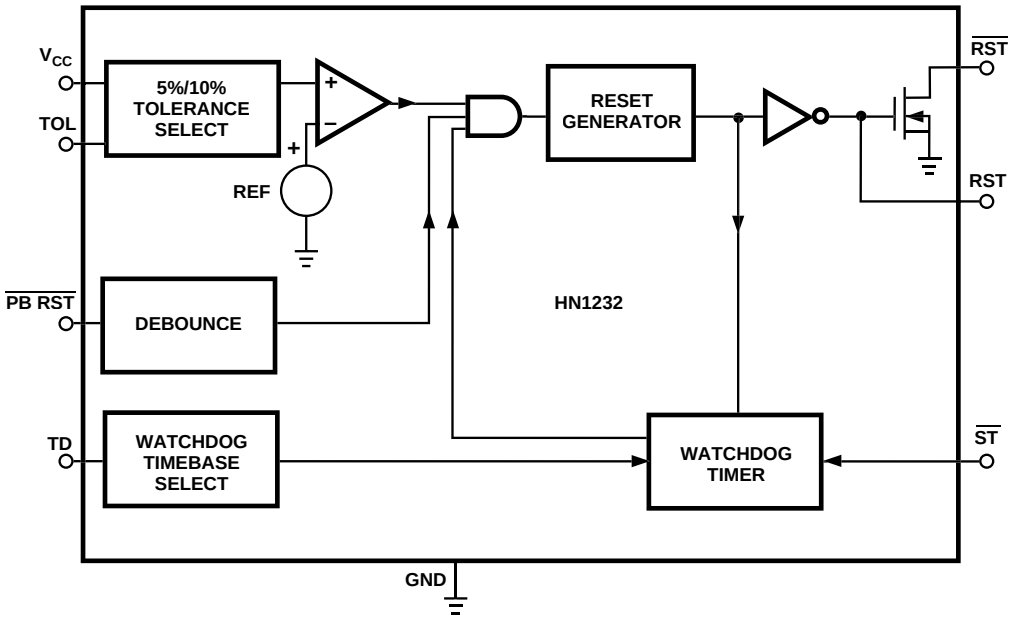


Wide SO

PIN CONFIGURATION

Pin Number 8-Pin	Pin Number 16-Pin	Name	Function
1	2	$\overline{\text{PBRST}}$	Debounced manual pushbutton RESET input
2	4	TD	Watchdog time delay selection. (t_{TD} = 150ms for TD = GND, t_{TD} = 600ms for TD = Open, and t_{TD} =1.2sec for TD = V_{CC})
3	6	TOL	Tolerance Input. Connect to GND for 5% tolerance or to V_{CC} for 10% tolerance.
4	8	GND	Ground
5	9	RST	Active HIGH reset output. RESET is active: 1. If V_{CC} falls below the reset voltage trip point. 2. If $\overline{\text{PB}}$RST is LOW. 3. If $\overline{\text{ST}}$ is not strobed LOW before the timeout period set by TD expires. 4. During power-up.
6	11	$\overline{\text{RST}}$	Active LOW reset output. (See RST)
7	13	$\overline{\text{ST}}$	Strobe Input. Input for watchdog timer.
8	15	Vcc	5V power supply input
-	1, 3, 5, 7, 10, 12, 14, 16	NC	No internal connection

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS*

Voltage on V_{CC} Pin Relative to Ground	–0.5V to +7.0V
Voltage on I/O Relative to Ground	–0.5V to V_{CC} + 0.5V
Operating Temperature	0°C to 70°C
Operating Temperature (Industrial Version)	–40°C to +85°C
Storage Temperature	–55°C to +125°C
Soldering Temperature	260°C for 10 seconds

* This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

RECOMMENDED DC OPERATING CONDITIONS

(0°C to 70°C)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Supply Voltage	V_{CC}	4.5	5.0	5.5	V	1
$\overline{ST}$ and $\overline{PBRST}$ Input High Level	V_{IH}	2.0		V_{CC}+0.3	V	1
$\overline{ST}$ and $\overline{PBRST}$ Input Low Level	V_{IL}	–0.3		+0.8	V	1

DC ELECTRICAL CHARACTERISTICS

(0°C to 70°C; Vcc=4.5 to 5.5V)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Input Leakage	I_{IL}	–1.0		+1.0	µA	3
Output Current @ 2.4V	I_{OH}	–8	–10		mA	5
Output Current @ 0.4V	I_{OL}	8	10		mA	
Low Level @ RST	V_{OL}			0.4	V	1
Output Voltage @ –500 µA	V_{OH}	V_{CC}–0.5V	V_{CC}–0.1V		V	1,7
Operating Current	I_{CC}		0.5	2.0	mA	2
V_{CC} Trip Point (TOL = GND)	V_{CCTP}	4.50	4.62	4.74	V	1
V_{CC} Trip Point (TOL = V_{CC})	V_{CCTP}	4.25	4.37	4.49	V	1

CAPACITANCE

(t_A = 25°C)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Input Capacitance	C_{IN}			5	pF	
Output Capacitance	C_{OUT}			7	pF	

AC ELECTRICAL CHARACTERISTICS

(0°C to 70°C; Vcc=5V ± 10%)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
$\overline{PBRST}$ = V_{IL}	t_{PB}	Figure 3 (Note 4)	20			ms
$\overline{PBRST}$ Stable Low to RST and $\overline{RST}$	t_{PDLY}	Figure 3			20	ms
RESET Active Time	t_{RST}		250	610	1000	ms
$\overline{ST}$ Pulse Width	t_{ST}	Figure 4 (Note 6, 8)	20			ns
V_{CC} Slew Rate 4.75V to 4.25V	t_F	Figure 5	300			µs
V_{CC} Slew Rate 4.25V to 4.75V	t_R	Figure 6	0	5		µs
V_{CC} Fail Detect to RST and $\overline{RST}$	t_{RPD}	Figure 5. V_{CC} falling		100	175	µs
V_{CC} Detect to RST and $\overline{RST}$ Transition	t_{RPU}	Figure 6. V_{CC} rising. t_R = 5 µs	250	610	1000	ms

NOTES:

1. All voltages referenced to ground.
2. Measured with outputs open.
3. $\overline{PBRST}$ is internally pulled up to V_{CC} with an internal impedance of 10K typical.
4. $\overline{PBRST}$ must be held low for a min. of 20ms to guarantee a reset.
5. $\overline{RST}$ is an open drain output.
6. Must not exceed t_{TD} minimum. See Table 1.
7. RST remains within 0.5V of V_{CC} on power–down until V_{CC} drops below 2.0V. RST remains within 0.5V of GND on power–down until V_{CC} drops below 2.0V.
8. Watchdog can not be disabled. It must be strobed to avoid resets.

DETAILED DESCRIPTON

Power Monitor

The HN1232 detects out–of–tolerance power supply conditions and warns a processor–based system of impending power failure. When V_{CC} falls below a preset level as defined by TOL (Pin 3), the V_{CC} comparator outputs the signals RST (Pin 5) and $\overline{RST}$ (Pin 6). When TOL is connected to ground, the RST and $\overline{RST}$ signals become active as V_{CC} falls below 4.75 volts. When TOL is connected to V_{CC}, the RST and $\overline{RST}$ signals become active as V_{CC} falls below 4.5 volts. The RST and $\overline{RST}$ are excellent control signals for a microprocessor, as processing is stopped at the last possible moments of valid V_{CC}. On power–up, RST and $\overline{RST}$ are kept active for a minimum of 250 ms to allow the power supply and processor to stabilize.

Pushbutton Reset Input

The debounced manual reset input ($\overline{PBRST}$) manually forces the reset outputs into their active states (Figure 1). Once $\overline{PBRST}$ has been low for a time $t_{PDLY,}$ the push-button delay time, the reset outputs go active. The reset outputs remain in their active states for a minimum of 250ms after $\overline{PBRST}$ rises above V_{IH} (Figure 3).

A mechanical push-button or active logic signal can drive the $\overline{PBRST}$ input. The debounced input ignores input pulses less than 1ms and is guaranteed to recognize pulses of 20ms or greater. No external pull-up resistor is required because the $\overline{PBRST}$ input has an internal pull-up to V_{CC} of approximately 100µA.

Watchdog Timer

A watchdog timer function forces RST and $\overline{RST}$ signals to the active state when the $\overline{ST}$ input is not stimulated for a predetermined time period. The time period is set by the TD input to be typically 150 ms with TD connected to ground, 600 ms with TD left unconnected, and 1.2 seconds with TD connected to V_{CC}. The watchdog timer starts timing out from the set time period as soon as RST and $\overline{RST}$ are inactive. If a high–to–low transition occurs on the $\overline{ST}$ input pin prior to time–out, the watchdog timer is reset and begins to time–out again. If the watchdog timer is allowed to time-out, then the RST and $\overline{RST}$ signals are driven to the active state for 250 ms minimum.

The $\overline{ST}$ input can be derived from microprocessor address signals, data signals, and / or control signals. When the microprocessor is functioning normally, these signals would, as a matter of routine, cause the watch-dog to be reset prior to time–out. To guarantee that the watchdog timer does not time–out, a high–to–low transition must occur at or less than the minimum shown in Table 1. A typical circuit example is shown in Figure 2.

Watchdog Timeouts Table 1

TD Pin Voltage Level	Watchdog Time-Out Period (ms)		
	Min	Typ	Max
GND	62.5	150	250
Floating	250	600	1000
V_{CC}	500	1200	2000

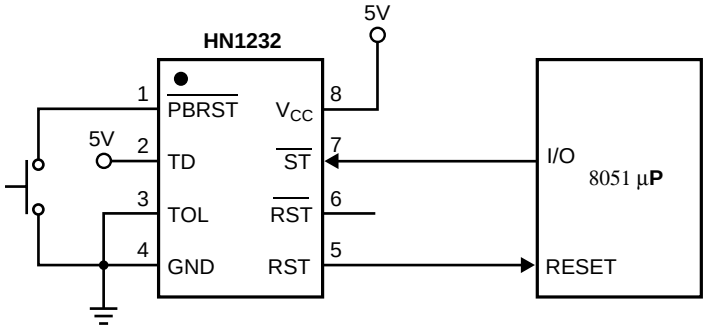


Figure 1. Application Circuit: Pushbutton Reset

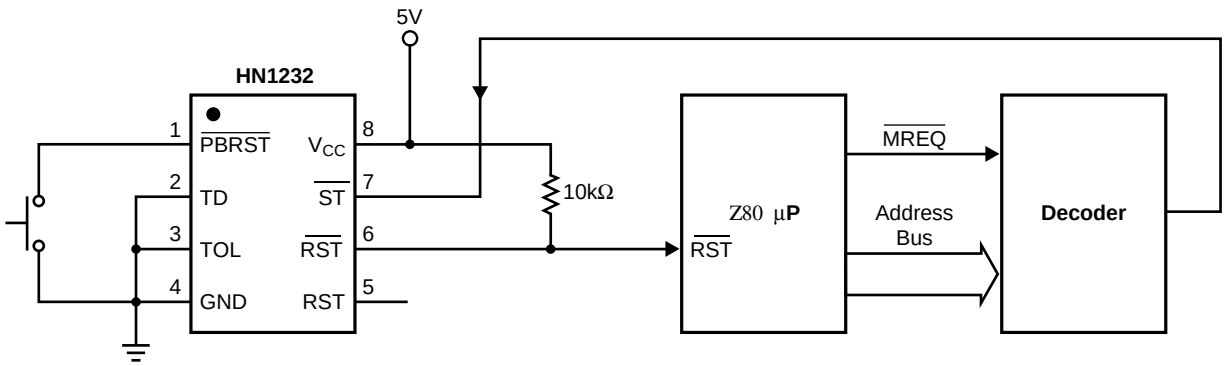


Figure 2. Application Circuit: Watchdog Timer

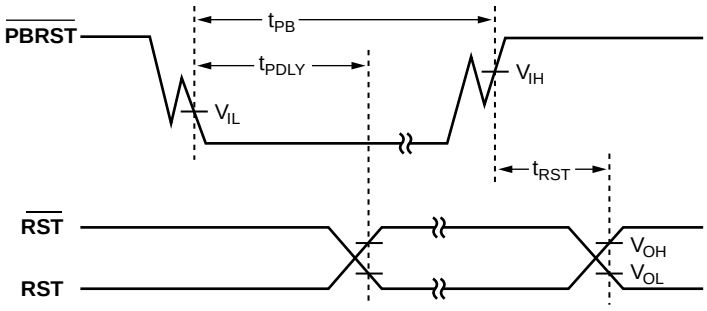


Figure 3. Timing Diagram: Pushbutton Reset

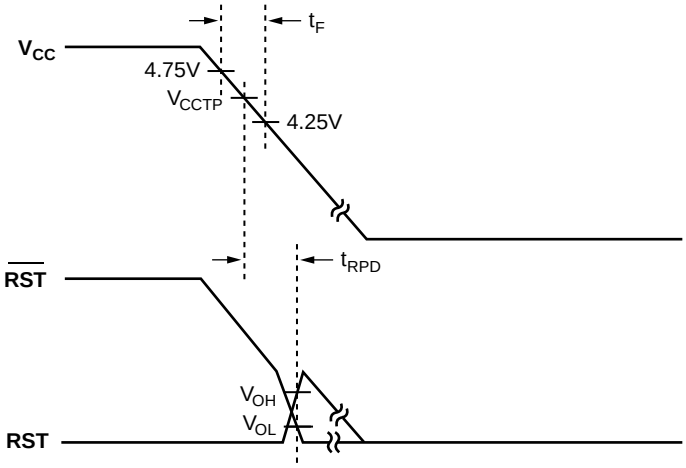
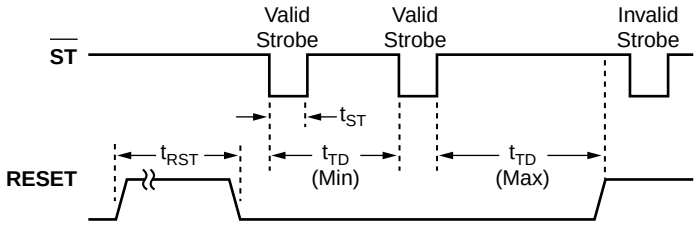


Figure 5. Timing Diagram: Power Down



Note: $\overline{ST}$ is ignored whenever a reset is active.

Figure 4. Timing Diagram: Strobe Input

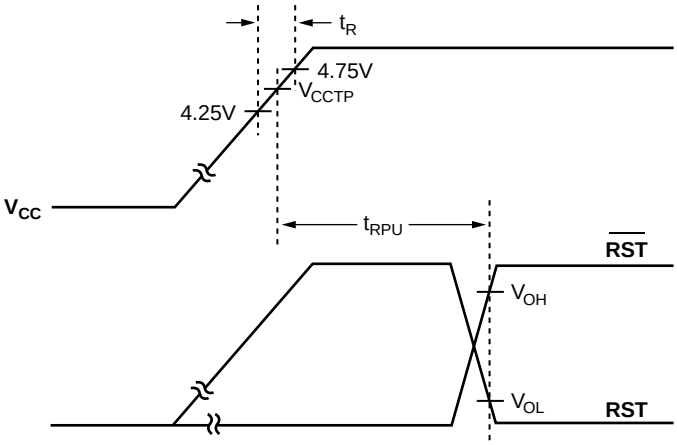
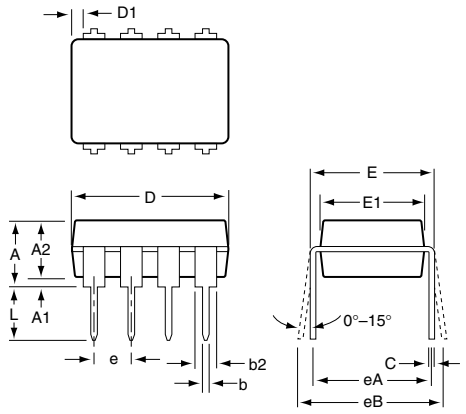


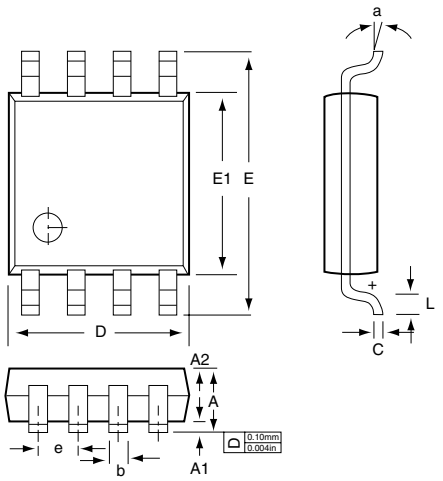
Figure 6. Timing Diagram: Power Up

Package Dimensions

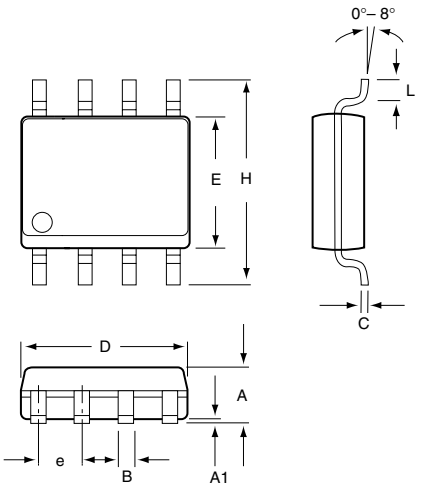
Plastic DIP (8-Pin)



MicroSO (8-Pin)

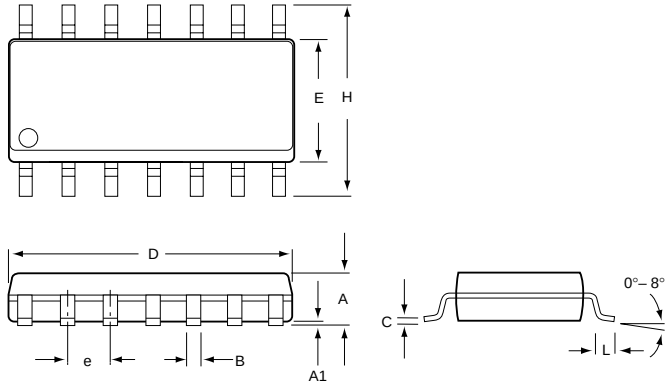


SO (8-Pin)



	Inches		Millimeters	
	Min	Max	Min	Max
Plastic DIP (8-Pin)				
A	———	0.210	——	5.33
A1	0.015	———	0.38	———
A2	0.115	0.195	2.92	4.95
b	0.014	0.022	0.36	0.56
b2	0.045	0.070	1.14	1.78
b3	0.030	0.045	0.80	1.14
D	0.355	0.400	9.02	10.16
D1	0.005	———	0.13	———
E	0.300	0.325	7.62	8.26
E1	0.240	0.280	6.10	7.11
e	0.100	———	2.54	
eA	0.300	———	7.62	
eB	———	0.430	———	10.92
eC	———	0.060		
L	0.115	0.150	2.92	3.81
MicroSO (8-Pin)				
A	———	0.0433	——	1.10
A1	0.0020	0.0059	0.050	0.15
A2	0.0295	0.0374	0.75	0.95
b	0.0098	0.0157	0.25	0.40
C	0.0051	0.0091	0.13	0.23
D	0.1142	0.1220	2.90	3.10
e	0.0256 BSC		0.65 BSC	
E	0.193 BSC		4.90 BSC	
E1	0.1142	0.1220	2.90	3.10
L	0.0157	0.0276	0.40	0.70
a	0°	6°	0°	6°
SO (8-Pin)				
A	0.053	0.069	1.35	1.75
A1	0.004	0.010	0.10	0.25
B	0.013	0.020	0.33	0.51
C	0.007	0.010	0.19	0.25
e	0.050		1.27	
E	0.150	0.157	3.80	4.00
H	0.228	0.244	5.80	6.20
L	0.016	0.050	0.40	1.27
D	0.189	0.197	4.80	5.00

SO (16-Pin)



	Inches		Millimeters	
	Min	Max	Min	Max
SO (16-Pin)*				
A	0.926	0.1043	2.35	2.65
A1	0.0040	0.0118	0.10	0.30
B	0.013	0.020	0.33	0.51
C	0.0091	0.0125	0.23	0.32
D	0.3977	0.4133	10.10	10.50
E	0.2914	0.2662	7.40	7.60
e	0.050 BSC		1.27 BSC	
H	0.394	0.419	10.00	10.65
L	0.016	0.050	0.40	1.27