PRELIMINARY | Data Sheet | May 25, 2006 | FN8114.1

Triple Voltage Monitor with Integrated CPU Supervisor

FEATURES

- **Triple voltage detection and reset assertion**
  - **—Standard reset threshold settings see selection table on page 5.**
  - **—Adjust low voltage reset threshold voltages using special programming sequence**
  - **—Reset signal valid to V_{CC} = 1V**
  - **—Monitor three seperate voltages**
- **Fault detection register**
- **Selectable power on reset timeout (0.05s, 0.2s, 0.4s, 0.8s)**
- **Selectable watchdog timer interval (25ms, 200ms, 1.4s or off)**
- **Debounced manual reset input**
- **Low power CMOS**
  - **—25µA typical standby current, watchdog on**
  - **—6µA typical standby current, watchdog off**
- **400kHz 2-wire interface**
- **2.7V to 5.5V power supply operation**
- **Available in 14 Ld SOIC, TSSOP packages**
- **Monitor voltages: 5V to 0.9V**
- **Independent core voltage monitor**
- **Pb-free plus anneal available (RoHS compliant)**

APPLICATIONS

- **Communication equipment**
  - **—Routers, hubs, switches**
  - **—Disk arrays, network storage**
- **Industrial systems**
  - **—Process control**
  - **—Intelligent instrumentation**
- **Computer systems**
  - **—Computers**
  - **—Network servers**

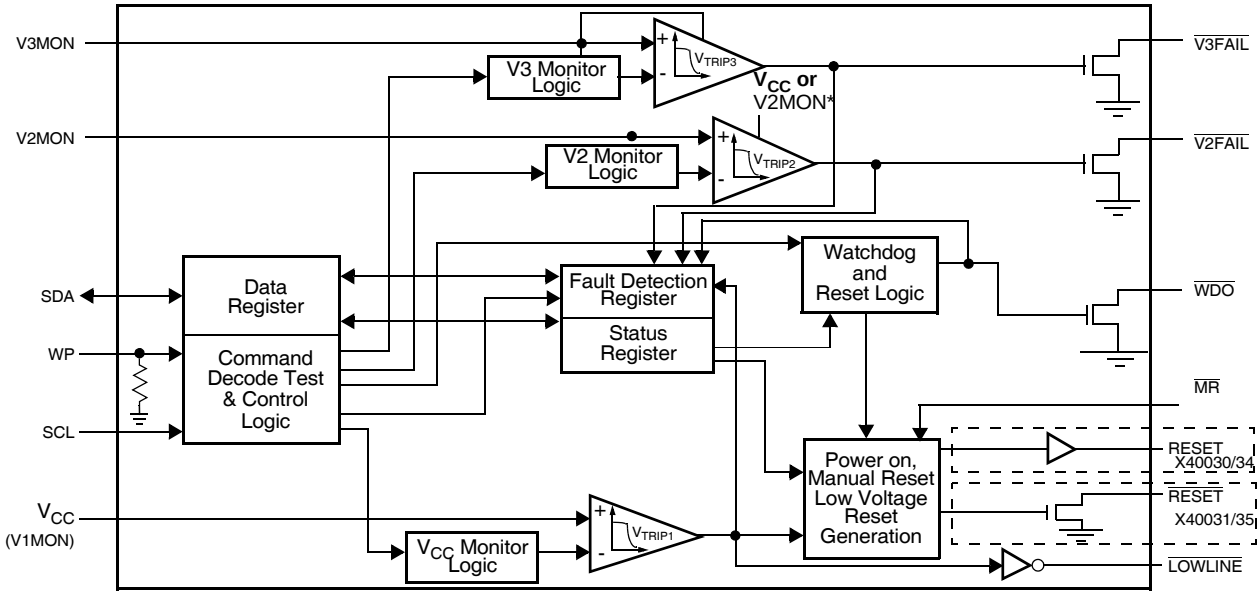
DESCRIPTION

The X40030, X40031, X40034, X40035 combine power-on reset control, watchdog timer, supply voltage supervision, second and third voltage supervision, and manual reset, in one package. This combination lowers system cost, reduces board space requirements, and increases reliability.

Applying voltage to V_{CC} activates the power on reset circuit which holds RESET/$\overline{\text{RESET}}$ active for a period of time. This allows the power supply and system oscillator to stabilize before the processor can execute code.

Low VCC detection circuitry protects the user's system from low voltage conditions, resetting the system when VCC falls below the minimum VTRIP1 point. RESET/RESET is active until VCC returns to proper operating level and stabilizes. A second and third voltage monitor circuit tracks the unregulated supply to provide a power fail warning or monitors different power supply voltage. Three common low voltage combinations are available, however, Intersil's unique circuits allows the threshold for either voltage monitor to be reprogrammed to meet specific system level requirements or to fine-tune the threshold for applications requiring higher precision.

BLOCK DIAGRAM



Ordering Information

PART NUMBER	PART MARKING	MONITORED V_{CC} RANGE	V_{TRIP1} RANGE	V_{TRIP2} RANGE	V_{TRIP3} RANGE	TEMP. RANGE (°C)	PACKAGE	PKG. DWG. #
PART NUMBER WITH RESET								
X40034S14-A	X40034S A	1.3 to 5.5	4.6V ±50mV	1.3V ±50mV	3.1V ±50mV	0 to 70	14 Ld SOIC (150 mil)	M14.15
X40034S14Z-A (Note)	X40034S ZA					0 to 70	14 Ld SOIC (150 mil) (Pb-free)	M14.15
X40034S14-B	X40034S B				2.9V ±50mV	0 to 70	14 Ld SOIC (150 mil)	M14.15
X40034S14Z-B (Note)	X40034S ZB					0 to 70	14 Ld SOIC (150 mil) (Pb-free)	M14.15
X40034S14-C	X40034S C	1.0 to 3.6		1.0V ±50mV		0 to 70	14 Ld SOIC (150 mil)	M14.15
X40034S14I-A	X40034S IA	1.3 to 5.5		1.3V ±50mV	3.1V ±50mV	-40 to +85	14 Ld SOIC (150 mil)	M14.15
X40034S14IZ-A (Note)	X40034S ZIA					-40 to +85	14 Ld SOIC (150 mil) (Pb-free)	M14.15
X40034S14I-B	X40034S IB				2.9V ±50mV	-40 to +85	14 Ld SOIC (150 mil)	M14.15
X40034S14IZ-B (Note)	X40034S ZIB					-40 to +85	14 Ld SOIC (150 mil) (Pb-free)	M14.15
X40034S14I-C	X40034S IC	1.0 to 3.6		1.0V ±50mV		-40 to +85	14 Ld SOIC (150 mil)	M14.15
X40034V14-A	X4003 4VA	1.3 to 5.5		1.3V ±50mV	3.1V ±50mV	0 to 70	14 Ld TSSOP (4.4mm)	M14.173
X40034V14Z-A (Note)	X4003 4VZA					0 to 70	14 Ld TSSOP (4.4mm) (Pb-free)	M14.173
X40034V14-B	X4003 4VB				2.9V ±50mV	0 to 70	14 Ld TSSOP (4.4mm)	M14.173
X40034V14Z-B (Note)	X4003 4VZB					0 to 70	14 Ld TSSOP (4.4mm) (Pb-free)	M14.173
X40034V14-C	X4003 4VC	1.0 to 3.6		1.0V ±50mV		0 to 70	14 Ld TSSOP (4.4mm)	M14.173
X40034V14I-A	X4003 4VIA	1.3 to 5.5		1.3V ±50mV	3.1V ±50mV	-40 to +85	14 Ld TSSOP (4.4mm)	M14.173
X40034V14IZ-A (Note)	X4003 4VZIA					-40 to +85	14 Ld TSSOP (4.4mm) (Pb-free)	M14.173
X40034V14I-B	X4003 4VIB				2.9V ±50mV	-40 to +85	14 Ld TSSOP (4.4mm)	M14.173
X40034V14IZ-B (Note)	X4003 4VZIB					-40 to +85	14 Ld TSSOP (4.4mm) (Pb-free)	M14.173
X40034V14I-C	X4003 4VIC	1.0 to 3.6		1.0V ±50mV		-40 to +85	14 Ld TSSOP (4.4mm)	M14.173
X40030S14-C	X40030S C	1.7 to 3.6	2.9V ±50mV	2.2V ±50mV	1.7V ±50mV	0 to 70	14 Ld SOIC (150 mil)	M14.15
X40030S14I-C	X40030S IC					-40 to +85	14 Ld SOIC (150 mil)	M14.15
X40030V14-C	X4003 0VC					0 to 70	14 Ld TSSOP (4.4mm)	M14.173
X40030V14I-C	X4003 0VIC					-40 to +85	14 Ld TSSOP (4.4mm)	M14.173
X40030S14-B	X40030S B	1.7 to 5.5	4.4V ±50mV	2.6V ±50mV		0 to 70	14 Ld SOIC (150 mil)	M14.15
X40030S14Z-B (Note)	X40030S ZB					0 to 70	14 Ld SOIC (150 mil) (Pb-free)	M14.15
X40030S14I-B	X40030S IB					-40 to +85	14 Ld SOIC (150 mil)	M14.15
X40030S14IZ-B (Note)	X40030S ZIB					-40 to +85	14 Ld SOIC (150 mil) (Pb-free)	M14.15
X40030V14-B	X4003 0VB					0 to 70	14 Ld TSSOP (4.4mm)	M14.173
X40030V14Z-B (Note)	X4003 0VZB					0 to 70	14 Ld TSSOP (4.4mm) (Pb-free)	M14.173

Ordering Information (Continued)

PART NUMBER	PART MARKING	MONITORED V_{CC} RANGE	V_{TRIP1} RANGE	V_{TRIP2} RANGE	V_{TRIP3} RANGE	TEMP. RANGE (°C)	PACKAGE	PKG. DWG. #
X40030V14I-B	X4003 0VIB	1.7 to 5.5	4.4V ±50mV	2.6V ±50mV	1.7V ±50mV	-40 to +85	14 Ld TSSOP (4.4mm)	M14.173
X40030V14IZ-B (Note)	X4003 0VZIB					-40 to +85	14 Ld TSSOP (4.4mm) (Pb-free)	M14.173
X40030S14-A	X40030S A		4.6V ±50mV	2.9V ±50mV		0 to 70	14 Ld SOIC (150 mil)	M14.15
X40030S14Z-A (Note)	X40030S ZA					0 to 70	14 Ld SOIC (150 mil) (Pb-free)	M14.15
X40030S14I-A	X40030S IA					-40 to +85	14 Ld SOIC (150 mil)	M14.15
X40030S14IZ-A (Note)	X40030S ZIA					-40 to +85	14 Ld SOIC (150 mil) (Pb-free)	M14.15
X40030V14-A	X4003 0VA					0 to 70	14 Ld TSSOP (4.4mm)	M14.173
X40030V14Z-A (Note)	X4003 0VZA					0 to 70	14 Ld TSSOP (4.4mm) (Pb-free)	M14.173
X40030V14I-A	X4003 0VIA					-40 to +85	14 Ld TSSOP (4.4mm)	M14.173
X40030V14IZ-A (Note)	X4003 0VZIA					-40 to +85	14 Ld TSSOP (4.4mm) (Pb-free)	M14.173
PART NUMBER WITH $\overline{\text{RESET}}$								
X40035S14-A	X40035S A	1.3 to 5.5	4.6V ±50mV	1.3V ±50mV	3.1V ±50mV	0 to 70	14 Ld SOIC (150 mil)	M14.15
X40035S14Z-A (Note)	X40035S ZA					0 to 70	14 Ld SOIC (150 mil) (Pb-free)	M14.15
X40035S14-B	X40035S B				2.9V ±50mV	0 to 70	14 Ld SOIC (150 mil)	M14.15
X40035S14Z-B (Note)	X40035S ZB					0 to 70	14 Ld SOIC (150 mil) (Pb-free)	M14.15
X40035S14-C	X40035S C	1.0 to 3.6		1.0V ±50mV		0 to 70	14 Ld SOIC (150 mil)	M14.15
X40035S14I-A	X40035S IA	1.3 to 5.5		1.3V ±50mV	3.1V ±50mV	-40 to +85	14 Ld SOIC (150 mil)	M14.15
X40035S14IZ-A (Note)	X40035S ZIA					-40 to +85	14 Ld SOIC (150 mil) (Pb-free)	M14.15
X40035S14I-B	X40035S IB				2.9V ±50mV	-40 to +85	14 Ld SOIC (150 mil)	M14.15
X40035S14IZ-B (Note)	X40035S ZIB					-40 to +85	14 Ld SOIC (150 mil) (Pb-free)	M14.15
X40035S14I-C	X40035S IC	1.0 to 3.6		1.0V ±50mV		-40 to +85	14 Ld SOIC (150 mil)	M14.15
X40035V14-A	X4003 5VA	1.3 to 5.5		1.3V ±50mV	3.1V ±50mV	0 to 70	14 Ld TSSOP (4.4mm)	M14.173
X40035V14-B	X4003 5VB				2.9V ±50mV	0 to 70	14 Ld TSSOP (4.4mm)	M14.173
X40035V14Z-B (Note)	X4003 5VZB					0 to 70	14 Ld TSSOP (4.4mm) (Pb-free)	M14.173
X40035V14-C	X4003 5VC	1.0 to 3.6		1.0V ±50mV		0 to 70	14 Ld TSSOP (4.4mm)	M14.173
X40035V14Z-AT1 (Note)	X4003 5VZA	1.3 to 5.5		1.3V ±50mV	3.1V ±50mV	0 to 70	14 Ld TSSOP Tape and Reel (4.4mm) (Pb-free)	M14.173
X40035V14I-A	X4003 5VIA					-40 to +85	14 Ld TSSOP (4.4mm)	M14.173
X40035V14IZ-A (Note)	X4003 5VZIA					-40 to +85	14 Ld TSSOP (4.4mm) (Pb-free)	M14.173
X40035V14I-B	X4003 5VIB				2.9V ±50mV	-40 to +85	14 Ld TSSOP (4.4mm)	M14.173
X40035V14IZ-B (Note)	X4003 5VZIB					-40 to +85	14 Ld TSSOP (4.4mm) (Pb-free)	M14.173
X40035V14I-C	X4003 5VIC	1.0 to 3.6		1.0V ±50mV		-40 to +85	14 Ld TSSOP (4.4mm)	M14.173

Ordering Information (Continued)

PART NUMBER	PART MARKING	MONITORED V_{CC} RANGE	V_{TRIP1} RANGE	V_{TRIP2} RANGE	V_{TRIP3} RANGE	TEMP. RANGE (°C)	PACKAGE	PKG. DWG. #
X40031S14-C	X40031S C	1.7 to 3.6	2.9V ±50mV	2.2V ±50mV	1.7V ±50mV	0 to 70	14 Ld SOIC (150 mil)	M14.15
X40031S14I-C	X40031S IC					-40 to +85	14 Ld SOIC (150 mil)	M14.15
X40031V14-C	X4003 1VC					0 to 70	14 Ld TSSOP (4.4mm)	M14.173
X40031V14I-C	X4003 1VIC					-40 to +85	14 Ld TSSOP (4.4mm)	M14.173
X40031S14-B	X40031S B	1.7 to 5.5	4.4V ±50mV	2.6V ±50mV		0 to 70	14 Ld SOIC (150 mil)	M14.15
X40031S14Z-B (Note)	X40031S ZB					0 to 70	14 Ld SOIC (150 mil) (Pb-free)	M14.15
X40031S14I-B	X40031S IB					-40 to +85	14 Ld SOIC (150 mil)	M14.15
X40031S14IZ-B (Note)	X40031S ZIB					-40 to +85	14 Ld SOIC (150 mil) (Pb-free)	M14.15
X40031V14-B	X4003 1VB					0 to 70	14 Ld TSSOP (4.4mm)	M14.173
X40031V14Z-B (Note)	X4003 1VZB					0 to 70	14 Ld TSSOP (4.4mm) (Pb-free)	M14.173
X40031V14I-B	X4003 1VIB					-40 to +85	14 Ld TSSOP (4.4mm)	M14.173
X40031V14IZ-B (Note)	X4003 1VZIB					-40 to +85	14 Ld TSSOP (4.4mm) (Pb-free)	M14.173
X40031S14-A	X40031S A		4.6V ±50mV	2.9V ±50mV		0 to 70	14 Ld SOIC (150 mil)	M14.15
X40031S14Z-A (Note)	X40031S ZA					0 to 70	14 Ld SOIC (150 mil) (Pb-free)	M14.15
X40031S14I-A	X40031S IA					-40 to +85	14 Ld SOIC (150 mil)	M14.15
X40031S14IZ-A (Note)	X40031S ZIA					-40 to +85	14 Ld SOIC (150 mil) (Pb-free)	M14.15
X40031V14-A	X4003 1VA					0 to 70	14 Ld TSSOP (4.4mm)	M14.173
X40031V14Z-A (Note)	X4003 1VZA					0 to 70	14 Ld TSSOP (4.4mm) (Pb-free)	M14.173
X40031V14I-A	X4003 1VIA					-40 to +85	14 Ld TSSOP (4.4mm)	M14.173
X40031V14IZ-A (Note)	X4003 1VZIA					-40 to +85	14 Ld TSSOP (4.4mm) (Pb-free)	M14.173

*Add "T1" suffix for tape and reel.

NOTE: Intersil Pb-free plus anneal products employ special Pb-free material sets; molding compounds/die attach materials and 100% matte tin plate termination finish, which are RoHS compliant and compatible with both SnPb and Pb-free soldering operations. Intersil Pb-free products are MSL classified at Pb-free peak reflow temperatures that meet or exceed the Pb-free requirements of IPC/JEDEC J STD-020.

A manual reset input provides debounce circuitry for minimum reset component count.

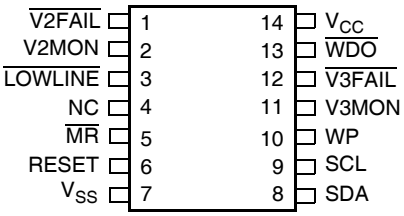
The Watchdog Timer provides an independent protection mechanism for microcontrollers. When the microcontroller fails to restart a timer within a selectable time out interval, the device activates the $\overline{WDO}$ signal. The user selects the interval from three preset values. Once selected, the interval does not change, even after cycling the power.

Device	Expected System Voltages	V_{trip1} (V)	V_{trip2} (V)	V_{trip3} (V)	POR (system)
X40030, X40031		2.0-4.75*	1.70-4.75	1.70-4.75	
-A	5V; 3V or 3.3V; 1.8V	4.55-4.65*	2.85-2.95	1.65-1.75	RESET = X40030
-B	5V; 3V; 1.8V	4.35-4.45*	2.55-2.65	1.65-1.75	RESET = X40031
-C	3.3V; 2.5V; 1.8V	2.95-3.05*	2.15-2.25	1.65-1.75	
X40034, X40035		2.0-4.75*	0.90-3.50	1.70-4.75	
-A	5V; 3.3V; 1.5V	4.55-4.65*	1.25-1.35	3.05-3.15	RESET = X40030
-B	5V; 3V or 3.3V; 1.5V	4.55-4.65*	1.25-1.35	2.85-2.95	RESET = X40031
-C	5V; 3V or 3.3V; 1.2V	4.55-4.65*	0.95-1.05	2.85-2.95	

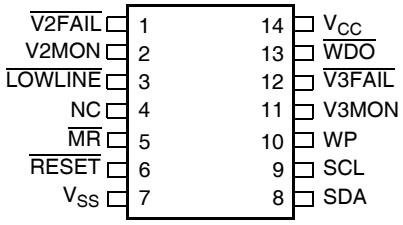
*Voltage monitor requires V_{CC} to operate. Others are independent of V_{CC}

PIN CONFIGURATION

X40030, X40034
14-Pin SOIC, TSSOP



X40031, X40035
14-Pin SOIC, TSSOP



PIN DESCRIPTION

Pin	Name	Function
1	$\overline{V2FAIL}$	**V2 Voltage Fail Output.** This open drain output goes LOW when V2MON is less than V_{TRIP2} and goes HIGH when V2MON exceeds V_{TRIP2}. There is no power up reset delay circuitry on this pin.
2	V2MON	**V2 Voltage Monitor Input.** When the V2MON input is less than the V_{TRIP2} voltage, $\overline{V2FAIL}$ goes LOW. This input can monitor an unregulated power supply with an external resistor divider or can monitor a second power supply with no external components. Connect V2MON to V_{SS} or V_{CC} when not used. The V2MON comparator is supplied by V2MON (X40030, X40031) or by the V_{CC} input (X40034, X40035).
3	$\overline{LOWLINE}$	**Early Low V_{CC} Detect.** This CMOS output signal goes LOW when $V_{CC} < V_{TRIP1}$ and goes high when $V_{CC} > V_{TRIP1}$.
4	NC	No connect.
5	$\overline{MR}$	**Manual Reset Input.** Pulling the $\overline{MR}$ pin LOW initiates a system reset. The RESET/$\overline{RESET}$ pin will remain HIGH/LOW until the pin is released and for the t_{PURST} thereafter.
6	$\overline{RESET}$/ RESET	**$\overline{RESET}$ Output.** (X40031, X40035) This open drain pin is an active LOW output which goes LOW whenever V_{CC} falls below V_{TRIP1} voltage or if manual reset is asserted. This output stays active for the programmed time period (t_{PURST}) on power up. It will also stay active until manual reset is released and for t_{PURST} thereafter. **RESET Output.** (X40030, X40034) This pin is an active HIGH CMOS output which goes HIGH whenever V_{CC} falls below V_{TRIP1} voltage or if manual reset is asserted. This output stays active for the programmed time period (t_{PURST}) on power up. It will also stay active until manual reset is released and for t_{PURST} thereafter.

PIN DESCRIPTION (Continued)

Pin	Name	Function
7	V_{SS}	Ground
8	SDA	**Serial Data.** SDA is a bidirectional pin used to transfer data into and out of the device. It has an open drain output and may be wire ORed with other open drain or open collector outputs. This pin requires a pull up resistor and the input buffer is always active (not gated). **Watchdog Input.** A HIGH to LOW transition on the SDA (while SCL is toggled from HIGH to LOW and followed by a stop condition) restarts the Watchdog timer. The absence of this transition within the watchdog time out period results in $\overline{WDO}$ going active.
9	SCL	**Serial Clock.** The Serial Clock controls the serial bus timing for data input and output.
10	WP	**Write Protect.** WP HIGH prevents writes to any location in the device (includung all the registers). It has an internal pull down resistor. (>10MΩ typical)
11	V3MON	**V3 Voltage Monitor Input.** When the V3MON input is less than the V_{TRIP3} voltage, $\overline{V3FAIL}$ goes LOW. This input can monitor an unregulated power supply with an external resistor divider or can monitor a third power supply with no external components. Connect V3MON to V_{SS} or V_{CC} when not used. The V3MON comparator is supplied by the V3MON input.
12	V3FAIL	**V3 Voltage Fail Output.** This open drain output goes LOW when V3MON is less than V_{TRIP3} and goes HIGH when V3MON exceeds V_{TRIP3}. There is no power up reset delay circuitry on this pin.
13	WDO	**$\overline{WDO}$ Output.** $\overline{WDO}$ is an active LOW, open drain output which goes active whenever the watchdog timer goes active.
14	V_{CC}	Supply Voltage.

PRINCIPLES OF OPERATION

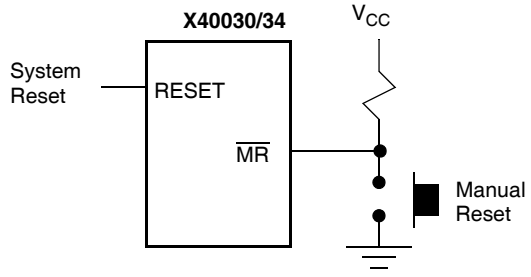
Power On Reset

Applying power to the X40030, X40031, X40034, X40035 activates a Power On Reset Circuit that pulls the RESET/$\overline{RESET}$ pins active. This signal provides several benefits.

- It prevents the system microprocessor from starting to operate with insufficient voltage.
- It prevents the processor from operating prior to stabilization of the oscillator.
- It allows time for an FPGA to download its configuration prior to initialization of the circuit.
- It prevents communication to the EEPROM, greatly reducing the likelihood of data corruption on power up.

When V_{CC} exceeds the device V_{TRIP1} threshold value for t_{PURST} (selectable) the circuit releases the $\overline{RESET}$ (X40031, X40035) and RESET (X40030, X40034) pin allowing the system to begin operation.

Figure 1. Connecting a Manual Reset Push-Button



Manual Reset

By connecting a push-button directly from $\overline{MR}$ to ground, the designer adds manual system reset capability. The $\overline{MR}$ pin is LOW while the push-button is closed and RESET/$\overline{RESET}$ pin remains HIGH/LOW until the push-button is released and for t_{PURST} thereafter.

Low Voltage V_{CC} (V1 Monitoring)

During operation, the X40030, X40031, X40034, X40035 monitors the V_{CC} level and asserts RESET/$\overline{RESET}$ if supply voltage falls below a preset minimum V_{TRIP1}. The RESET signal prevents the microprocessor from operating in a power fail or brownout condition. The RESET/$\overline{RESET}$ signal remains active until the voltage drops below 1V. It also remains active until V_{CC} returns and exceeds V_{TRIP1} for t_{PURST}.

Low Voltage V2 Monitoring

The X40030 also monitors a second voltage level and asserts $\overline{V2FAIL}$ if the voltage falls below a preset minimum V_{TRIP2}. The $\overline{V2FAIL}$ signal is either ORed with RESET to prevent the microprocessor from operating in a power fail or brownout condition or used to interrupt the microprocessor with notification of an impending power failure.

For the X40030 and X40031 the $\overline{V2FAIL}$ signal remains active until the V2MON drops below 1V (V2MON falling). It also remains active until V2MON

returns and exceeds V_{TRIP2}.This voltage sense circuitry monitors the power supply connected to V2MON pin. If V_{CC} = 0, V2MON can still be monitored.

For the X40034 and X40035, the $\overline{V2FAIL}$ signal remains active until V_{CC} drops below 1V and remains active until V2MON returns and exceeds V_{TRIP2}.This sense circuitry is powered by V_{CC}. If V_{CC} = 0, V2MON cannot be monitored.

Low Voltage V3 Monitoring

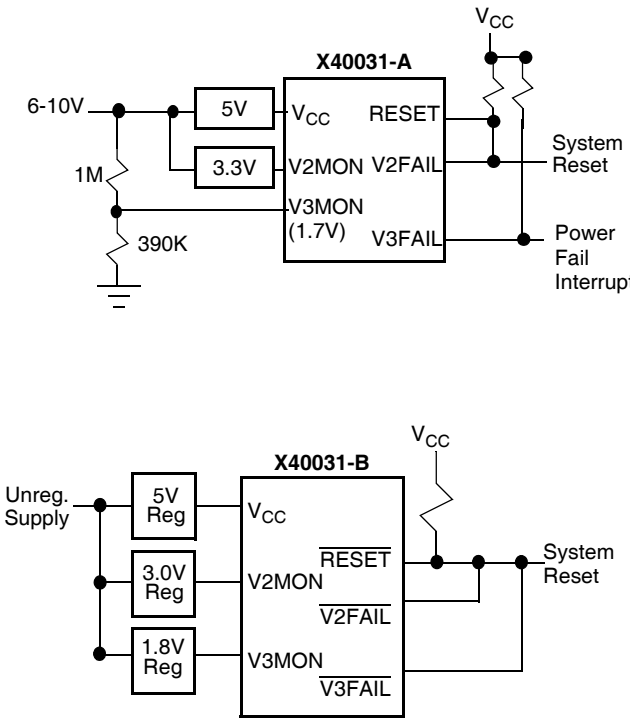
The X40030, X40031, X40034, X40035 also monitors a third voltage level and asserts $\overline{V3FAIL}$ if the voltage falls below a preset minimum V_{TRIP3}. The $\overline{V3FAIL}$ signal is either ORed with RESET to prevent the microprocessor from operating in a power fail or brownout condition or used to interrupt the microprocessor with notification of an impending power failure. The $\overline{V3FAIL}$ signal remains active until the V3MON drops below 1V (V3MON falling). It also remains active until V3MON returns and exceeds V_{TRIP3}.

This voltage sense circuitry monitors the power supply connected to V3MON pin. If V_{CC} = 0, V3MON can still be monitored.

Early Low V_{CC} Detection ($\overline{LOWLINE}$)

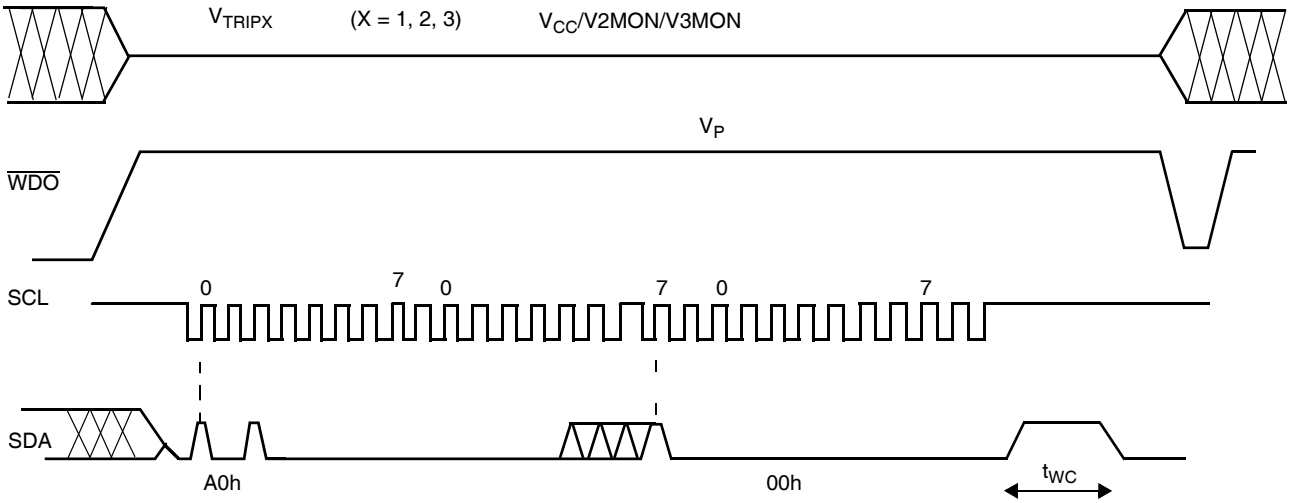
This CMOS output goes LOW earlier than RESET/$\overline{RESET}$ whenever V_{CC} falls below the V_{TRIP1} voltage and returns high when V_{CC} exceeds the V_{TRIP1} voltage. There is no power up delay circuitry (t_{PURST}) on this pin.

Figure 2. Two Uses of Multiple Voltage Monitoring



Notice: No external components required to monitor three voltages.

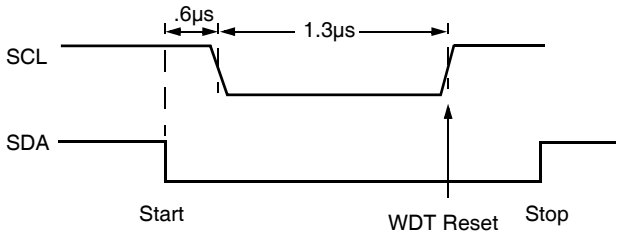
Figure 3. V_{TRIPX} Set/Reset Conditions



WATCHDOG TIMER

The Watchdog Timer circuit monitors the microprocessor activity by monitoring the SDA and SCL pins. A standard read or write sequence to any slave address byte restarts the watchdog timer and prevents the $\overline{WDO}$ signal going active. A minimum sequence to reset the watchdog timer requires four microprocessor instructions namely, a Start, Clock Low, Clock High and Stop. The state of two nonvolatile control bits in the Status Register determine the watchdog timer period. The microprocessor can change these watchdog bits by writing to the X40030, X40031, X40034, X40035 control register (also refer to page 21).

Figure 4. Watchdog Restart



V1, V2 AND V3 THRESHOLD PROGRAM PROCEDURE (OPTIONAL)

The X40030 is shipped with standard V1, V2 and V3 threshold (V_{TRIP1}, V_{TRIP2}, V_{TRIP3}) voltages. These values will not change over normal operating and storage conditions. However, in applications where the standard thresholds are not exactly right, or if higher precision is needed in the threshold value, the X40030, X40031, X40034, X40035 trip points may be adjusted. The procedure is described below, and uses the application of a high voltage control signal.

Setting a V_{TRIPx} Voltage (x=1, 2, 3)

There are two procedures used to set the threshold voltages (V_{TRIPx}), depending if the threshold voltage to be stored is higher or lower than the present value. For example, if the present V_{TRIPx} is 2.9 V and the new V_{TRIPx} is 3.2 V, the new voltage can be stored directly into the V_{TRIPx} cell. If however, the new setting is to be lower than the present setting, then it is necessary to "reset" the V_{TRIPx} voltage before setting the new value.

Setting a Higher V_{TRIPx} Voltage (x=1, 2, 3)

To set a V_{TRIPx} threshold to a new voltage which is higher than the present threshold, the user must apply the desired V_{TRIPx} threshold voltage to the corresponding input pin (Vcc(V1MON), V2MON or V3MON). Then, a programming voltage (Vp) must be applied to the $\overline{WDO}$ pin before a START condition is set up on SDA. Next, issue on the SDA pin the Slave Address A0h, followed by the Byte Address 01h for V_{TRIP1}, 09h for V_{TRIP2}, and 0Dh for V_{TRIP3}, and a 00h Data Byte in order to program V_{TRIPx}. The STOP bit following a valid write operation initiates the programming sequence. Pin $\overline{WDO}$ must then be brought LOW to complete the operation. To check if the V_{TRIPX} has been set, set VXMON to a value slightly greater than V_{TRIPX} (that was previously set). Slowly ramp down VXMON and observe when the corresponding outputs ($\overline{LOWLINE}$, $\overline{V2FAIL}$ and $\overline{V3FAIL}$) switch. The voltage at which this occurs is the V_{TRIPX} (actual).

CASE A

Now if the desired V_{TRIPX} is greater than the V_{TRIPX} (actual), then add the difference between V_{TRIPX} (desired) – V_{TRIPX} (actual) to the original V_{TRIPX} desired. This is your new V_{TRIPX} that should be applied to VXMON and the whole sequence should be repeated again (see Figure 5).

CASE B

Now if the V_{TRIPX} (actual), is higher than the V_{TRIPX} (desired), perform the reset sequence as described in the next section. The new V_{TRIPX} voltage to be applied to VXMON will now be: V_{TRIPX} (desired) – (V_{TRIPX} (actual) – V_{TRIPX} (desired)).

Note: This operation does not corrupt the memory array.

Setting a Lower V_{TRIPx} Voltage (x=1, 2, 3)

In order to set V_{TRIPx} to a lower voltage than the present value, then V_{TRIPx} must first be "reset" according to the procedure described below. Once V_{TRIPx} has been "reset", then V_{TRIPx} can be set to the desired voltage using the procedure described in "Setting a Higher V_{TRIPx} Voltage".

Resetting the V_{TRIPx} Voltage

To reset a V_{TRIPx} voltage, apply the programming voltage (Vp) to the $\overline{WDO}$ pin before a START condition is set up on SDA. Next, issue on the SDA pin the Slave Address A0h followed by the Byte Address 03h for V_{TRIP1}, 0Bh for V_{TRIP2}, and 0Fh for V_{TRIP3}, followed by 00h for the Data Byte in order to reset V_{TRIPx}. The STOP bit following a valid write operation initiates the programming sequence. Pin $\overline{WDO}$ must then be brought LOW to complete the operation.

After being reset, the value of V_{TRIPx} becomes a nominal value of 1.7V or lesser.

Notes: 1.This operation does not corrupt the memory array.

2. Set $V_{CC} \cong 1.5$(V2MON or V3MON), when setting V_{TRIP2} or V_{TRIP3} respectively

CONTROL REGISTER

The Control Register provides the user a mechanism for changing the Block Lock and Watchdog Timer settings. The Block Lock and Watchdog Timer bits are nonvolatile and do not change when power is removed.

The Control Register is accessed with a special preamble in the slave byte (1011) and is located at address 1FFh. It can only be modified by performing a byte write operation directly to the address of the register and only one data byte is allowed for each register write operation. Prior to writing to the Control Register, the WEL and RWEL bits must be set using a two step process, with the whole sequence requiring 3 steps. See "Writing to the Control Registers" on page 11.

The user must issue a stop, after sending this byte to the register, to initiate the nonvolatile cycle that stores WD1, WD0, PUP1, PUP0 and BP. The X40030, X40031, X40034, X40035 will not acknowledge any data bytes written after the first byte is entered.

The state of the Control Register can be read at any time by performing a random read at address 1FFh, using the special preamble. Only one byte is read by each register read operation. The master should supply a stop condition to be consistent with the bus protocol.

7	6	5	4	3	2	1	0
PUP1	WD1	WD0	BP	0	RWEL	WEL	PUP0

RWEL: Register Write Enable Latch (Volatile)

The RWEL bit must be set to “1” prior to a write to the Control Register.

Figure 5. Sample V_{TRIP} Reset Circuit

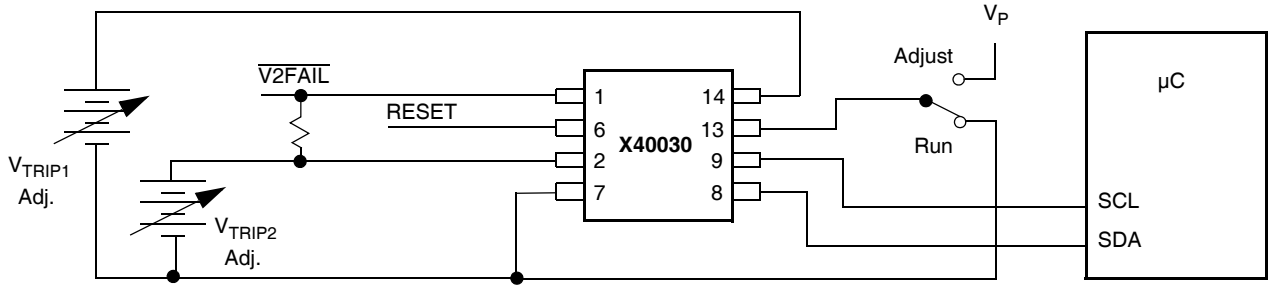
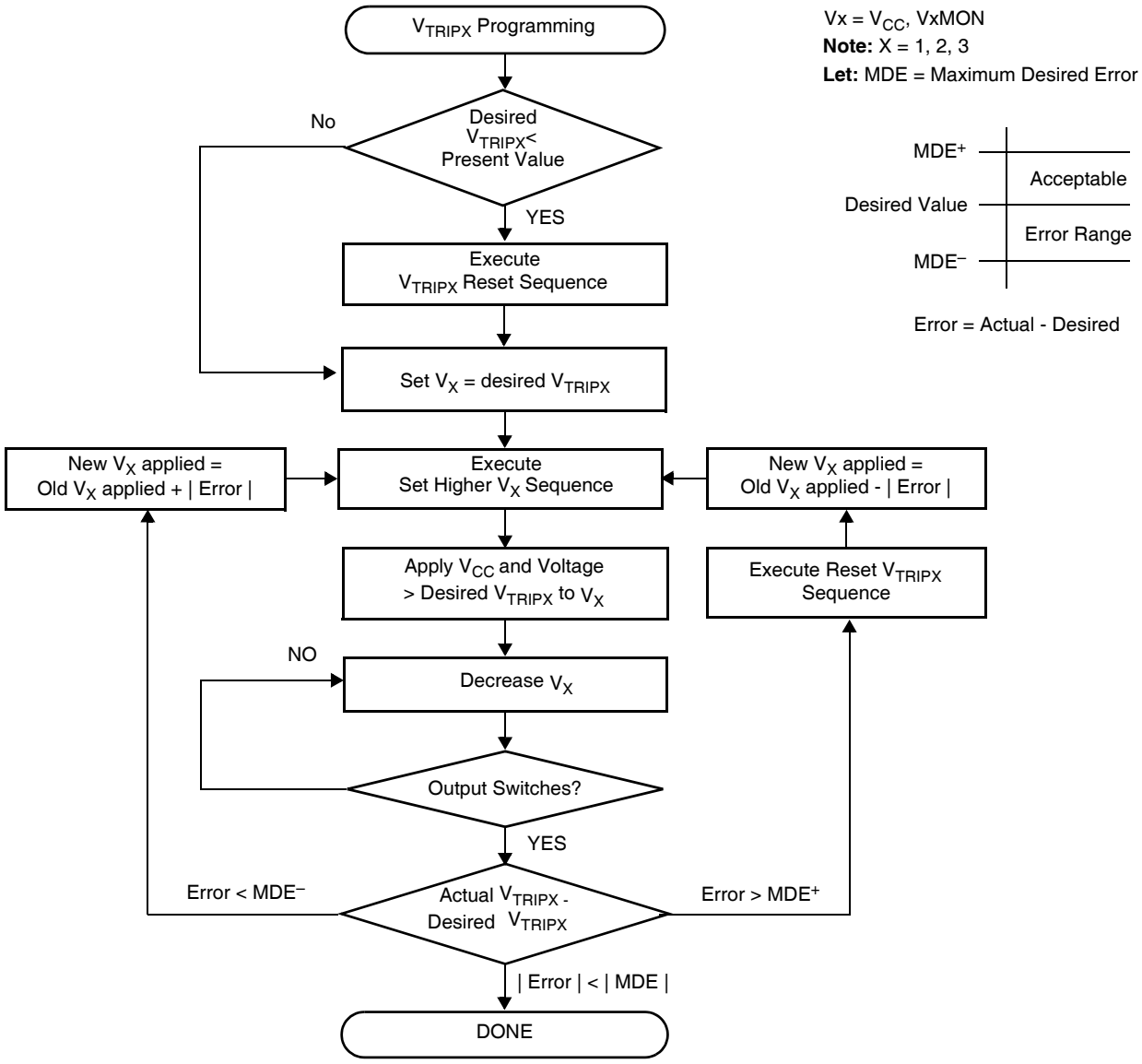


Figure 6. V_{TRIPX} Set/Reset Sequence (X = 1, 2, 3)



WEL: Write Enable Latch (Volatile)

The WEL bit controls the access to the memory and to the Register during a write operation. This bit is a volatile latch that powers up in the LOW (disabled) state. While the WEL bit is LOW, writes to any address, including any control registers will be ignored (no acknowledge will be issued after the Data Byte). The WEL bit is set by writing a “1” to the WEL bit and zeroes to the other bits of the control register.

Once set, WEL remains set until either it is reset to 0 (by writing a “0” to the WEL bit and zeroes to the other bits of the control register) or until the part powers up again. Writes to the WEL bit do not cause a high voltage write cycle, so the device is ready for the next operation immediately after the stop condition.

PUP1, PUP0: Power Up Bits (Nonvolatile)

The Power Up bits, PUP1 and PUP0, determine the t_{PURST} time delay. The nominal power up times are shown in the following table.

PUP1	PUP0	Power on Reset Delay (t_{PURST})
0	0	50ms
0	1	200ms (factory setting)
1	0	400ms
1	1	800ms

WD1, WD0: Watchdog Timer Bits (Nonvolatile)

The bits WD1 and WD0 control the period of the Watchdog Timer. The options are shown below.

WD1	WD0	Watchdog Time Out Period
0	0	1.4 seconds
0	1	200 milliseconds
1	0	25 milliseconds
1	1	disabled (factory setting)

Writing to the Control Registers

Changing any of the nonvolatile bits of the control and trickle registers requires the following steps:

– Write a 02H to the Control Register to set the Write Enable Latch (WEL). This is a volatile operation, so there is no delay after the write. (Operation preceded by a start and ended with a stop).

– Write a 06H to the Control Register to set the Register Write Enable Latch (RWEL) and the WEL bit. This is also a volatile cycle. The zeros in the data byte are required. (Operation proceeded by a start and ended with a stop).

– Write one byte value to the Control Register that has all the control bits set to the desired state. The Control register can be represented as *qxys* 001*r* in binary, where *xy* are the WD bits, *s* is the BP bit and *qr* are the power up bits. This operation proceeded by a start and ended with a stop bit. Since this is a nonvolatile write cycle it will take up to 10ms (max.) to complete. The RWEL bit is reset by this cycle and the sequence must be repeated to change the nonvolatile bits again. If bit 2 is set to '1' in this third step (*qxys 0*11*r*) then the RWEL bit is set, but the WD1, WD0, PUP1, PUP0, and BP bits remain unchanged. Writing a second byte to the control register is not allowed. Doing so aborts the write operation and returns a NACK.

– A read operation occurring between any of the previous operations will not interrupt the register write operation.

– The RWEL bit cannot be reset without writing to the nonvolatile control bits in the control register, or power cycling the device or attempting a write to a write protected block.

To illustrate, a sequence of writes to the device consisting of [02H, 06H, 02H] will reset all of the nonvolatile bits in the Control Register to 0. A sequence of [02H, 06H, 06H] will leave the nonvolatile bits unchanged and the RWEL bit remains set.

Notes: 1. t_{PURST} is set to 200ms as factory default.

2. Watch Dog Timer bits are shipped disabled.

FAULT DETECTION REGISTER (FDR)

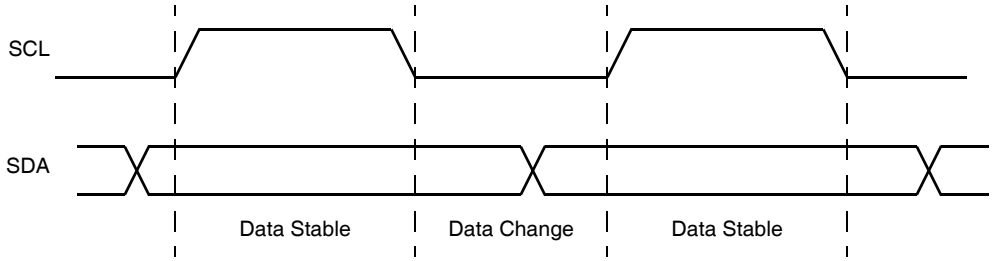
The Fault Detection Register provides the user the status of what causes the system reset active. The Manual Reset Fail, Watchdog Timer Fail and Three Low Voltage Fail bits are volatile

7	6	5	4	3	2	1	0
LV1F	LV2F	LV3F	WDF	MRF	0	0	0

The FDR is accessed with a special preamble in the slave byte (1011) and is located at address 0FFh. It can only be modified by performing a byte write operation directly to the address of the register and only one data byte is allowed for each register write operation.

There is no need to set the WEL or RWEL in the control register to access this FDR.

Figure 7. Valid Data Changes on the SDA Bus



At power-up, the FDR is defaulted to all “0”. The system needs to initialize this register to all “1” before the actual monitoring can take place. In the event of any one of the monitored sources fail. The corresponding bit in the register will change from a “1” to a “0” to indicate the failure. At this moment, the system should perform a read to the register and note the cause of the reset. After reading the register the system should reset the register back to all “1” again. The state of the FDR can be read at any time by performing a random read at address 0FFh, using the special preamble.

The FDR can be read by performing a random read at 0FFh address of the register at any time. Only one byte of data is read by the register read operation.

MRF: Manual Reset Fail Bit (Volatile)

The MRF bit will be set to “0” when Manual Reset input goes active.

WDF: Watchdog Timer Fail Bit (Volatile)

The WDF bit will be set to “0” when the $\overline{WDO}$ goes active.

LV1F: Low V_{CC} Reset Fail Bit (Volatile)

The LV1F bit will be set to “0” when V_{CC} (V1MON) falls below V_{TRIP1}.

LV2F: Low V2MON Reset Fail Bit (Volatile)

The LV2F bit will be set to “0” when V2MON falls below V_{TRIP2}.

LV3F: Low V3MON Reset Fail Bit (Volatile)

The LV3F bit will be set to “0” when the V3MON falls below V_{TRIP3}.

SERIAL INTERFACE

Interface Conventions

The device supports a bidirectional bus oriented protocol. The protocol defines any device that sends data onto the bus as a transmitter, and the receiving device as the receiver. The device controlling the transfer is called the master and the device being controlled is called the slave. The master always initiates data transfers, and provides the clock for both transmit and receive operations. Therefore, the devices in this family operate as slaves in all applications.

Serial Clock and Data

Data states on the SDA line can change only during SCL LOW. SDA state changes during SCL HIGH are reserved for indicating start and stop conditions. See Figure 7.

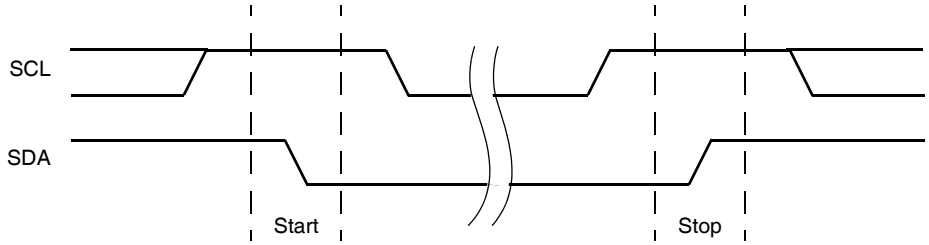
Serial Start Condition

All commands are preceded by the start condition, which is a HIGH to LOW transition of SDA when SCL is HIGH. The device continuously monitors the SDA and SCL lines for the start condition and will not respond to any command until this condition has been met. See Figure 8.

Serial Stop Condition

All communications must be terminated by a stop condition, which is a LOW to HIGH transition of SDA when SCL is HIGH. The stop condition is also used to place the device into the Standby power mode after a read sequence. A stop condition can only be issued after the transmitting device has released the bus. See Figure 8.

Figure 8. Valid Start and Stop Conditions



Serial Acknowledge

Acknowledge is a software convention used to indicate successful data transfer. The transmitting device, either master or slave, will release the bus after transmitting eight bits. During the ninth clock cycle, the receiver will pull the SDA line LOW to acknowledge that it received the eight bits of data. See Figure 9.

The device will respond with an acknowledge after recognition of a start condition and if the correct Device Identifier and Select bits are contained in the Slave Address Byte. If a write operation is selected, the device will respond with an acknowledge after the receipt of each subsequent eight bit word. The device will acknowledge all incoming data and address bytes, except for the Slave Address Byte when the Device Identifier and/or Select bits are incorrect.

In the read mode, the device will transmit eight bits of data, release the SDA line, then monitor the line for an acknowledge. If an acknowledge is detected and no stop condition is generated by the master, the device will continue to transmit data. The device will terminate further data transmissions if an acknowledge is not detected. The master must then issue a stop condition to return the device to Standby mode and place the device into a known state.

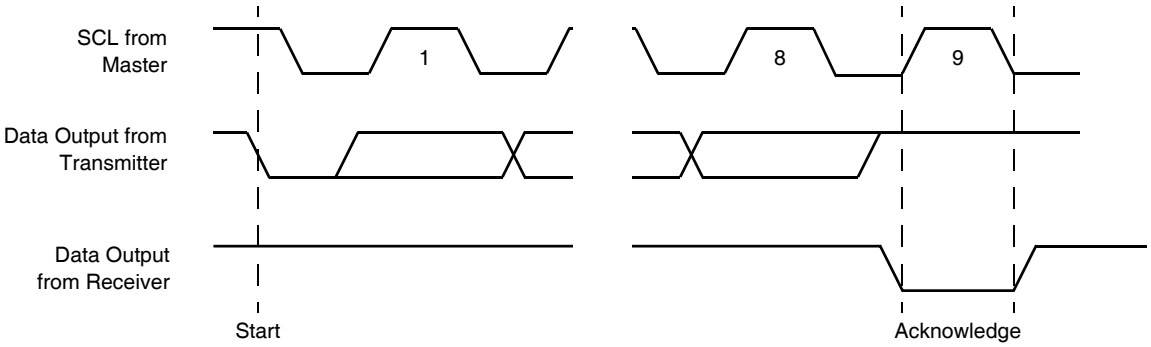
Serial Write Operations

Byte Write

For a write operation, the device requires the Slave Address Byte and a Word Address Byte. This gives the master access to any one of the words in the array. After receipt of the Word Address Byte, the device responds with an acknowledge, and awaits the next eight bits of data. After receiving the 8 bits of the Data Byte, the device again responds with an acknowledge. The master then terminates the transfer by generating a stop condition, at which time the device begins the internal write cycle to the nonvolatile memory. During this internal write cycle, the device inputs are disabled, so the device will not respond to any requests from the master. The SDA output is at high impedance. See Figure 10.

A write to a protected block of memory will supress the acknowledge bit.

Figure 9. Acknowledge Response from Receiver



Stops and Write Modes

Stop conditions that terminate write operations must be sent by the master after sending at least 1 full data byte plus the subsequent ACK signal. If a stop is issued in the middle of a data byte, or before 1 full data byte plus its associated ACK is sent, then the device will reset itself without performing the write. The contents of the array will not be effected.

Acknowledge Polling

The disabling of the inputs during high voltage cycles can be used to take advantage of the typical 5ms write cycle time. Once the stop condition is issued to indicate the end of the master's byte load operation, the device initiates the internal high voltage cycle. Acknowledge polling can be initiated immediately. To do this, the master issues a start condition followed by the Slave Address Byte for a write or read operation. If the device is still busy with the high voltage cycle then no ACK will be returned. If the device has completed the write operation, an ACK will be returned and the host can then proceed with the read or write operation. See Figure 10.

Serial Read Operations

Read operations are initiated in the same manner as write operations with the exception that the R/$\overline{W}$ bit of the Slave Address Byte is set to one. There are three basic read operations: Current Address Reads, Random Reads, and Sequential Reads.

Read Operation

Random read operation allows the master to access any memory location in the array. Prior to issuing the Slave Address Byte with the R/$\overline{W}$ bit set to one, the master must first perform a "dummy" write operation. The master issues the start condition and the Slave Address Byte, receives an acknowledge, then issues the Word Address Bytes. After acknowledging receipts of the Word Address Bytes, the master immediately issues another start condition and the Slave Address Byte with the R/$\overline{W}$ bit set to one. This is followed by an acknowledge from the device and then by the eight bit word. The master terminates the read operation by not responding with an acknowledge and then issuing a stop condition. See Figure 11 for the address, acknowledge, and data transfer sequence.

Figure 10. Acknowledge Polling Sequence

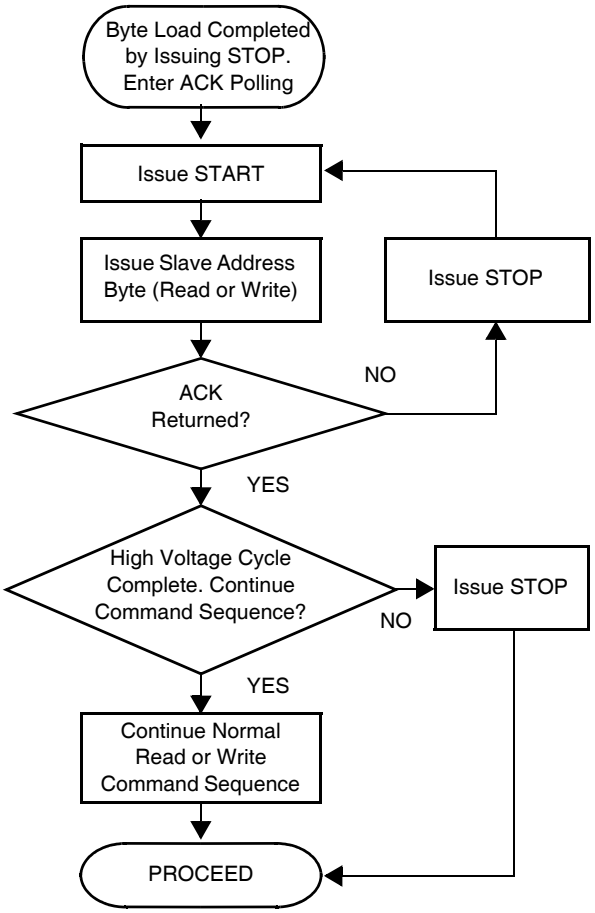
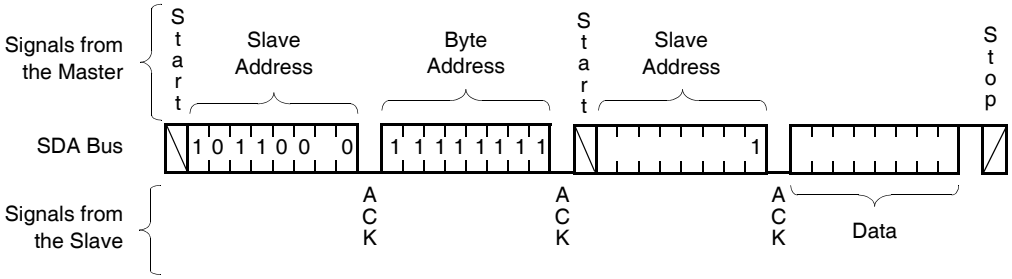


Figure 11. Random Address Read Sequence



SERIAL DEVICE ADDRESSING

Slave Address Byte

Following a start condition, the master must output a Slave Address Byte. This byte consists of several parts:

– a device type identifier that is always ‘1011’.

– one bit (AS) that provides the device select bit. AS bit is set-to “0” as factory default.

– next bit is ‘0’.

Figure 12. X40030, X40031, X40034, X40035 Addressing

	Slave Byte							
Control Register	1	0	1	1	0	0	1	R/$\overline{W}$
Fault Detection Register	1	0	1	1	0	0	0	R/$\overline{W}$

	Word Address							
Control Register	1	1	1	1	1	1	1	1
Fault Detection Register	1	1	1	1	1	1	1	1

– last bit of the slave command byte is a R/$\overline{W}$ bit. The R/$\overline{W}$ bit of the Slave Address Byte defines the operation to be performed. When the R/$\overline{W}$ bit is a one, then a read operation is selected. A zero selects a write operation.

Word Address

The word address is either supplied by the master or obtained from an internal counter. The internal counter is undefined on a power up condition.

Operational Notes

The device powers-up in the following state:

– The device is in the low power standby state.

– The WEL bit is set to ‘0’. In this state it is not possible to write to the device.

– SDA pin is the input mode.

– RESET/$\overline{RESET}$ Signal is active for t_{PURST}.

Data Protection

The following circuitry has been included to prevent inadvertent writes:

– The WEL bit must be set to allow write operations.

– The proper clock count and bit sequence is required prior to the stop bit in order to start a nonvolatile write cycle.

– A three step sequence is required before writing into the Control Register to change Watchdog Timer or Block Lock settings.

– The WP pin, when held HIGH, prevents all writes to the array and all the Register.

ABSOLUTE MAXIMUM RATINGS

Temperature under bias ..... -65°C to +135°C
Storage temperature ..... -65°C to +150°C
Voltage on any pin with
respect to V_{SS} ..... -1.0V to +7V
D.C. output current 5mA
Lead temperature (soldering, 10s) ..... 300°C

COMMENT

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only; functional operation of the device (at these or any other conditions above those listed in the operational sections of this specification) is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

Temperature	Min.	Max.
Commercial	0°C	70°C
Industrial	-40°C	+85°C

Version	Chip Supply Voltage	Moitored* Voltages
X40030, X40031	2.7V to 5.5V	1.7V to 5.5V
X40034, X40035	2.7V to 5.5V	1.0V to 5.5V

*See Ordering Info

D.C. OPERATING CHARACTERISTICS

(Over the recommended operating conditions unless otherwise specified)

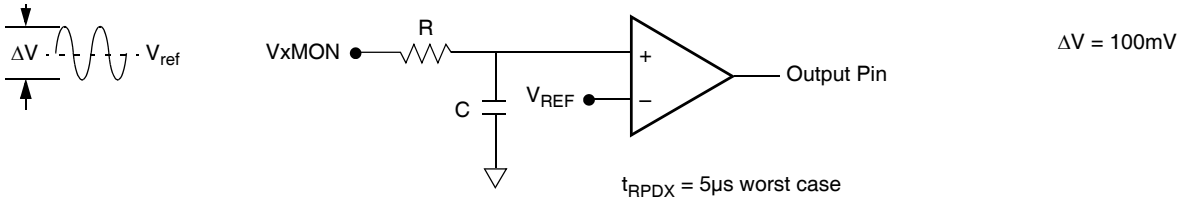
Symbol	Parameter	Min.	Typ.(4)	Max.	Unit	Test Conditions
I_{CC1}(1)	Active Supply Current (V_{CC}) Read			1.5	mA	$V_{IL} = V_{CC}$ x 0.1 $V_{IH} = V_{CC}$ x 0.9, f_{SCL} = 400kHz
I_{CC2}(1)	Active Supply Current (V_{CC}) Write			3.0	mA	
I_{SB1}(1)	Standby Current (V_{CC}) AC (WDT off)		6	10	µA	$V_{IL} = V_{CC}$ x 0.1 VIH = V_{CC} x 0.9 f_{SCL}, f_{SDA} = 400kHz
I_{SB2}(2)	Standby Current (V_{CC}) DC (WDT on)		25	30	µA	$V_{SDA} = V_{SCL} = V_{CC}$ Others = GND or V_{CC}
I_{LI}	Input Leakage Current (SCL, $\overline{MR}$, WP)			10	µA	V_{IL} = GND to V_{CC}
I_{LO}	Output Leakage Current (SDA, $\overline{V2FAIL}$, $\overline{V3FAIL}$, $\overline{WDO}$, $\overline{RESET}$)			10	µA	V_{SDA} = GND to V_{CC} Device is in Standby(2)
V_{IL}(3)	Input LOW Voltage (SDA, SCL, $\overline{MR}$, WP)	-0.5		V_{CC} x 0.3	V	
V_{IH}(3)	Input HIGH Voltage (SDA, SCL, $\overline{MR}$, WP)	V_{CC} x 0.7		V_{CC} + 0.5	V	
V_{HYS}(6)	Schmitt Trigger Input Hysteresis • Fixed input level • V_{CC} related level	 0.2 .05 x V_{CC}			 V V	
V_{OL}	Output LOW Voltage (SDA, RESET/$\overline{RESET}$, $\overline{LOWLINE}$, $\overline{V2FAIL}$, $\overline{V3FAIL}$, $\overline{WDO}$)			0.4	V	I_{OL} = 3.0mA (2.7-5.5V) I_{OL} = 1.8mA (2.7-3.6V)
V_{OH}	Output (RESET, $\overline{LOWLINE}$) HIGH Voltage	V_{CC} – 0.8 V_{CC} – 0.4			V	I_{OH} = -1.0mA (2.7-5.5V) I_{OH} = -0.4mA (2.7-3.6V)
V_{CC} Supply						
V_{TRIP1}(5)	V_{CC} Trip Point Voltage Range	2.0		4.75	V	
		4.55	4.6	4.65	V	X40030, X40031-A, X40034, X40035
		4.35	4.4	4.45	V	X40030, X40031-B
		2.85	2.9	2.95	V	X40030, X40031-C
Second Supply Monitor						
I_{V2}	V2MON Current			15	µA	

D.C. OPERATING CHARACTERISTICS (Continued)
(Over the recommended operating conditions unless otherwise specified)

Symbol	Parameter	Min.	Typ.(4)	Max.	Unit	Test Conditions
V_{TRIP2}(5)	V2MON Trip Point Voltage Range	1.7 0.9		4.75 3.5	V V	X40030, X40031 X40034, X40035
		2.85	2.9	2.95	V	X40030, X40031-A
		2.55	2.6	2.65	V	X40030, X40031-B
		2.15	2.2	2.25	V	X40030, X40031-C
		1.25	1.3	1.35	V	X40034, X40035-A&B
		0.95	1.0	1.05	V	X40034, X40035-C
t_{RPD2}(6)	V_{TRIP2} to $\overline{V2FAIL}$			5	µs	
Third Supply Monitor						
I_{V3}	V3MON Current			15	µA	
V_{TRIP3}(5)	V3MON Trip Point Voltage Range	1.7		4.75	V	
		1.65	1.7	1.75	V	X40030, X40031
		3.05	3.1	3.15	V	X40034, X40035-A
		2.85	2.9	2.95	V	X40034, X40035-B&C
t_{RPD3}(6)	V_{TRIP3} to $\overline{V3FAIL}$			5	µs	

Notes: (1) The device enters the Active state after any start, and remains active until: 9 clock cycles later if the Device Select Bits in the Slave Address Byte are incorrect; 200ns after a stop ending a read operation; or t_{WC} after a stop ending a write operation.
(2) The device goes into Standby: 200ns after any stop, except those that initiate a high voltage write cycle; t_{WC} after a stop that initiates a high voltage cycle; or 9 clock cycles after any start that is not followed by the correct Device Select Bits in the Slave Address Byte.
(3) V_{IL} Min. and V_{IH} Max. are for reference only and are not tested.
(4) At 25°C, V_{CC} = 3V
(5) See ordering information for standard programming levels. For custom programmed levels, contact factory.
(6) Based on characterization data.

EQUIVALENT INPUT CIRCUIT FOR VxMON (x = 1, 2, 3)

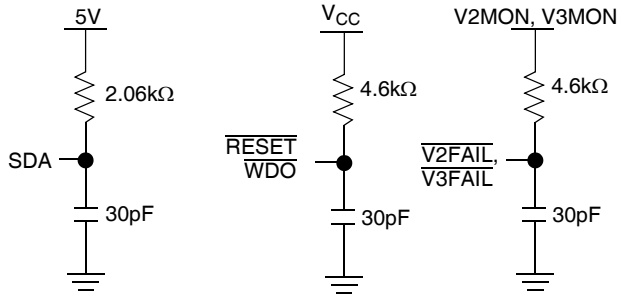


CAPACITANCE

Symbol	Parameter	Max.	Unit	Test Conditions
C_{OUT}(1)	Output Capacitance (SDA, RESET/$\overline{RESET}$, $\overline{LOWLINE}$, $\overline{V2FAIL}$,$\overline{V3FAIL}$, $\overline{WDO}$)	8	pF	V_{OUT} = 0V
C_{IN}(1)	Input Capacitance (SCL, WP, $\overline{MR}$)	6	pF	V_{IN} = 0V

Note: (1) This parameter is not 100% tested.

EQUIVALENT A.C. OUTPUT LOAD CIRCUIT FOR V_{CC} = 5V



SYMBOL TABLE

WAVEFORM	INPUTS	OUTPUTS
	Must be steady	Will be steady
	May change from LOW to HIGH	Will change from LOW to HIGH
	May change from HIGH to LOW	Will change from HIGH to LOW
	Don't Care: Changes Allowed	Changing: State Not Known
	N/A	Center Line is High Impedance

A.C. TEST CONDITIONS

Input pulse levels	V_{CC} x 0.1 to V_{CC} x 0.9
Input rise and fall times	10ns
Input and output timing levels	V_{CC} x 0.5
Output load	Standard output load

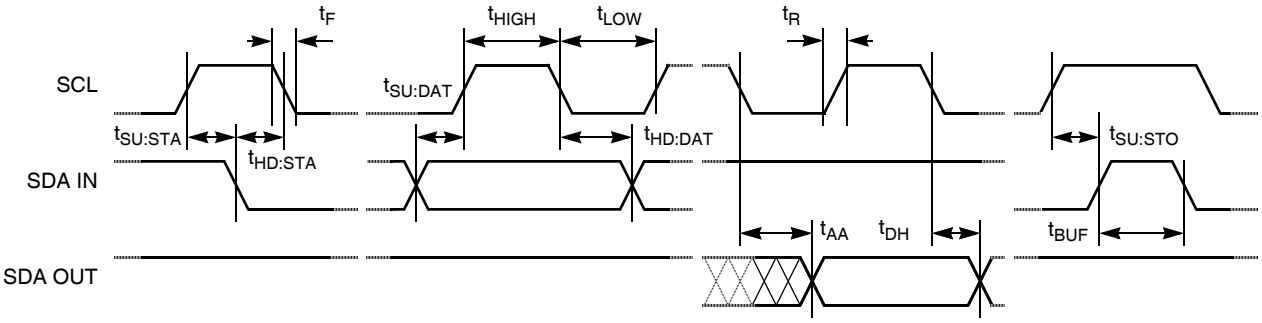
A.C. CHARACTERISTICS

Symbol	Parameter	Min.	Max.	Unit
f_{SCL}	SCL Clock Frequency		400	kHz
t_{IN}	Pulse width Suppression Time at inputs	50		ns
t_{AA}	SCL LOW to SDA Data Out Valid	0.1	0.9	µs
t_{BUF}	Time the bus free before start of new transmission	1.3		µs
t_{LOW}	Clock LOW Time	1.3		µs
t_{HIGH}	Clock HIGH Time	0.6		µs
$t_{SU:STA}$	Start Condition Setup Time	0.6		µs
$t_{HD:STA}$	Start Condition Hold Time	0.6		µs
$t_{SU:DAT}$	Data In Setup Time	100		ns
$t_{HD:DAT}$	Data In Hold Time	0		µs
$t_{SU:STO}$	Stop Condition Setup Time	0.6		µs
t_{DH}	Data Output Hold Time	50		ns
t_R	SDA and SCL Rise Time	20 +.1Cb(1)	300	ns
t_F	SDA and SCL Fall Time	20 +.1Cb(1)	300	ns
$t_{SU:WP}$	WP Setup Time	0.6		µs
$t_{HD:WP}$	WP Hold Time	0		µs
Cb	Capacitive load for each bus line		400	pF

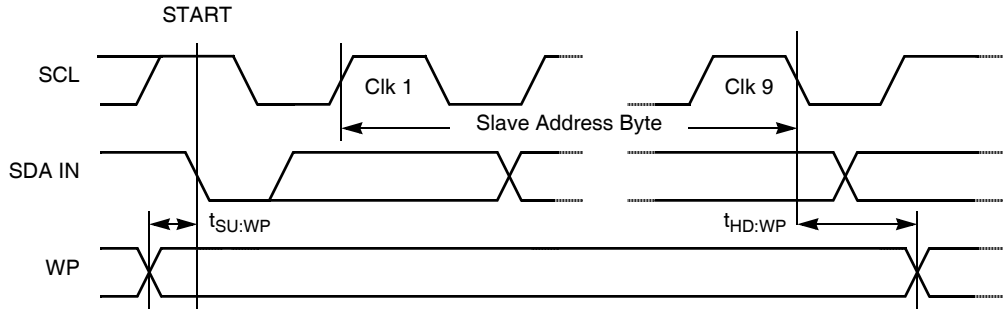
Note: (1) Cb = total capacitance of one bus line in pF

TIMING DIAGRAMS

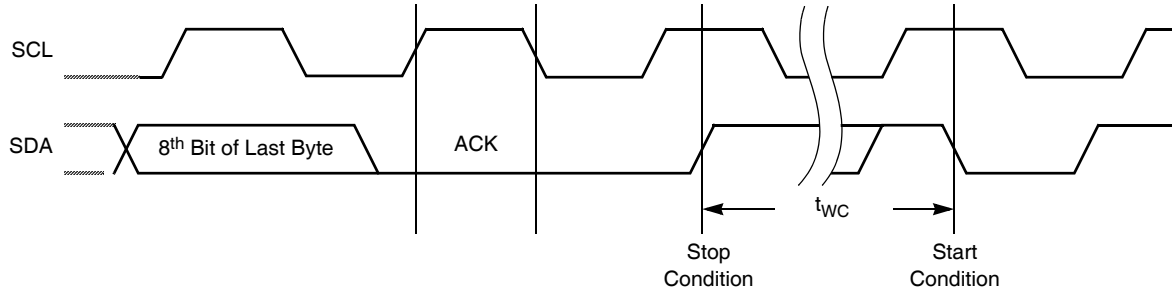
Bus Timing



WP Pin Timing



Write Cycle Timing

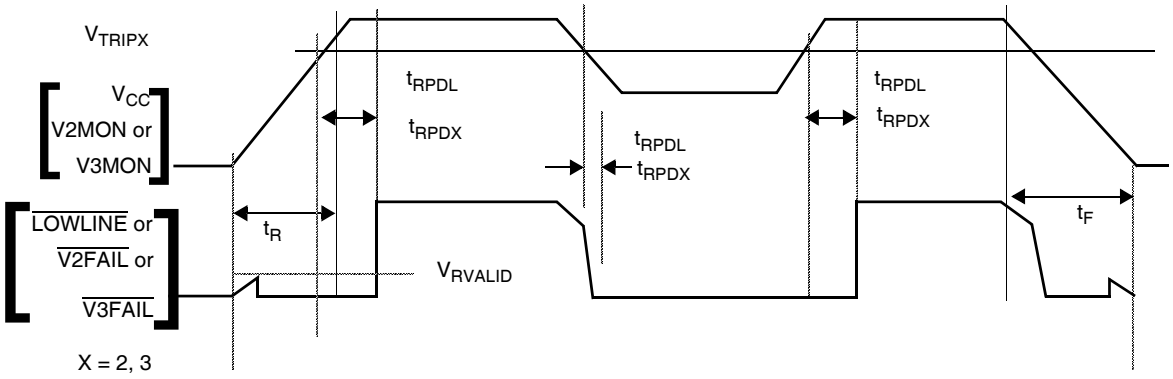


Nonvolatile Write Cycle Timing

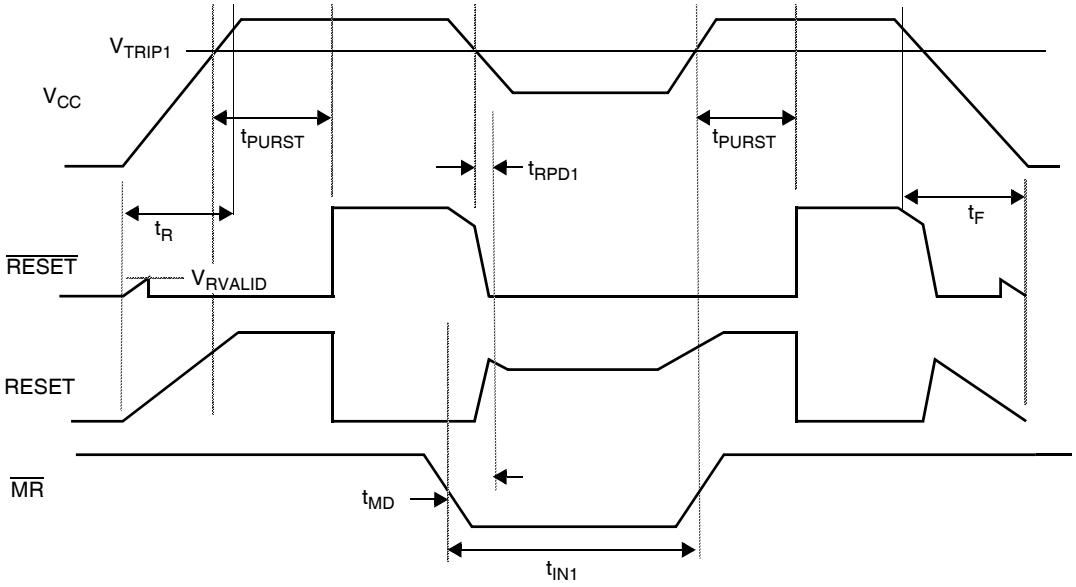
Symbol	Parameter	Min.	Typ.	Max.	Unit
t_{WC}(1)	Write Cycle Time		5	10	ms

Note: (1) t_{WC} is the time from a valid stop condition at the end of a write sequence to the end of the self-timed internal nonvolatile write cycle. It is the minimum cycle time to be allowed for any nonvolatile write by the user, unless Acknowledge Polling is used.

Power Fail Timings



RESET/$\overline{\text{RESET}}$/$\overline{\text{MR}}$ Timings

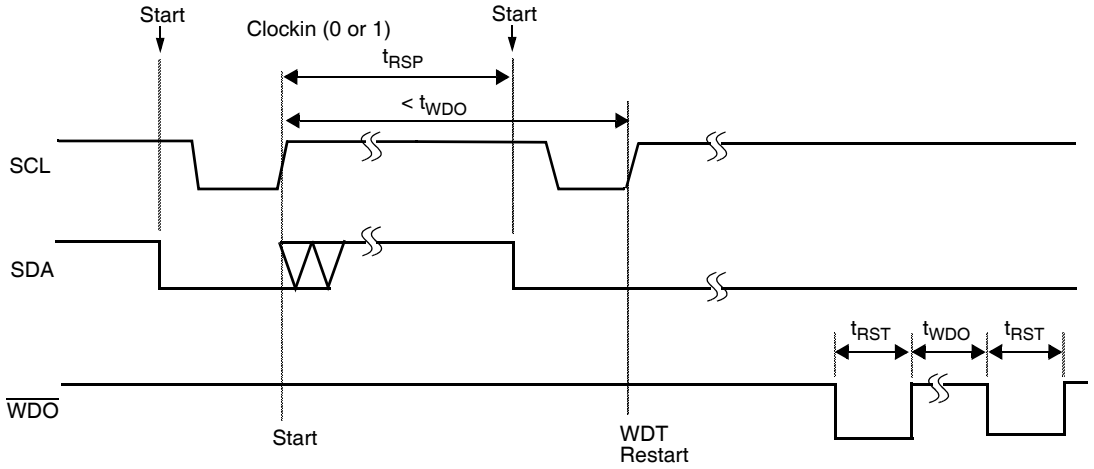


LOW VOLTAGE AND WATCHDOG TIMINGS PARAMETERS (@25°C, V_{CC} = 5V)

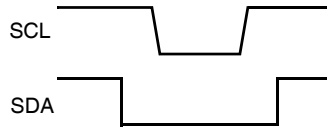
Symbol	Parameters	Min.	Typ.(1)	Max.	Unit
t_{RPD1}(2) t_{RPDL}	V_{TRIP1} to $\overline{RESET}$/RESET (Power down only) V_{TRIP1} to $\overline{LOWLINE}$			5	µs
t_{LR}	$\overline{LOWLINE}$ to RESET/$\overline{RESET}$ delay (Power down only) [= t_{RPD1}-t_{RPDL}]		500		ns
t_{RPDX}(2)	V_{TRIP2} to $\overline{V2FAIL}$, or V_{TRIP3} to $\overline{V3FAIL}$ (x = 2, 3)			5	µs
t_{PURST}	Power On Reset delay: PUP1=0, PUP0=0 PUP1=0, PUP0=1 (factory setting) PUP1=1, PUP0=0 PUP1=1, PUP0=1		 50(2) 200 400(2) 800(2)		 ms ms ms ms
t_F	V_{CC}, V2MON, V3MON, Fall Time	20			mV/µs
t_R	V_{CC}, V2MON, V3MON, Rise Time	20			mV/µs
V_{RVALID}	Reset Valid V_{CC}	1			V
t_{MD}	$\overline{MR}$ to RESET/ $\overline{RESET}$ delay (activation only)	500			ns
t_{in1}	Pulse width for $\overline{MR}$	5			µs
t_{WDO}	Watchdog Timer Period: WD1=0, WD0=0 WD1=0, WD0=1 WD1=1, WD0=0 WD1 = 1, WD0 = 1 (factory setting)		 1.4(2) 200(2) 25 OFF		 s ms ms
t_{RST1}	Watchdog Reset Time Out Delay WD1=0, WD0=0 WD1=0, WD0=1	100	200	300	ms
t_{RST2}	Watchdog Reset Time Out Delay WD1=1, WD0=0	12.5	25	37.5	ms
t_{RSP}	Watchdog timer restart pulse width	1			µs

Notes: (1) V_{CC} = 5V at 25°C. (2) Values based on characterization data only.

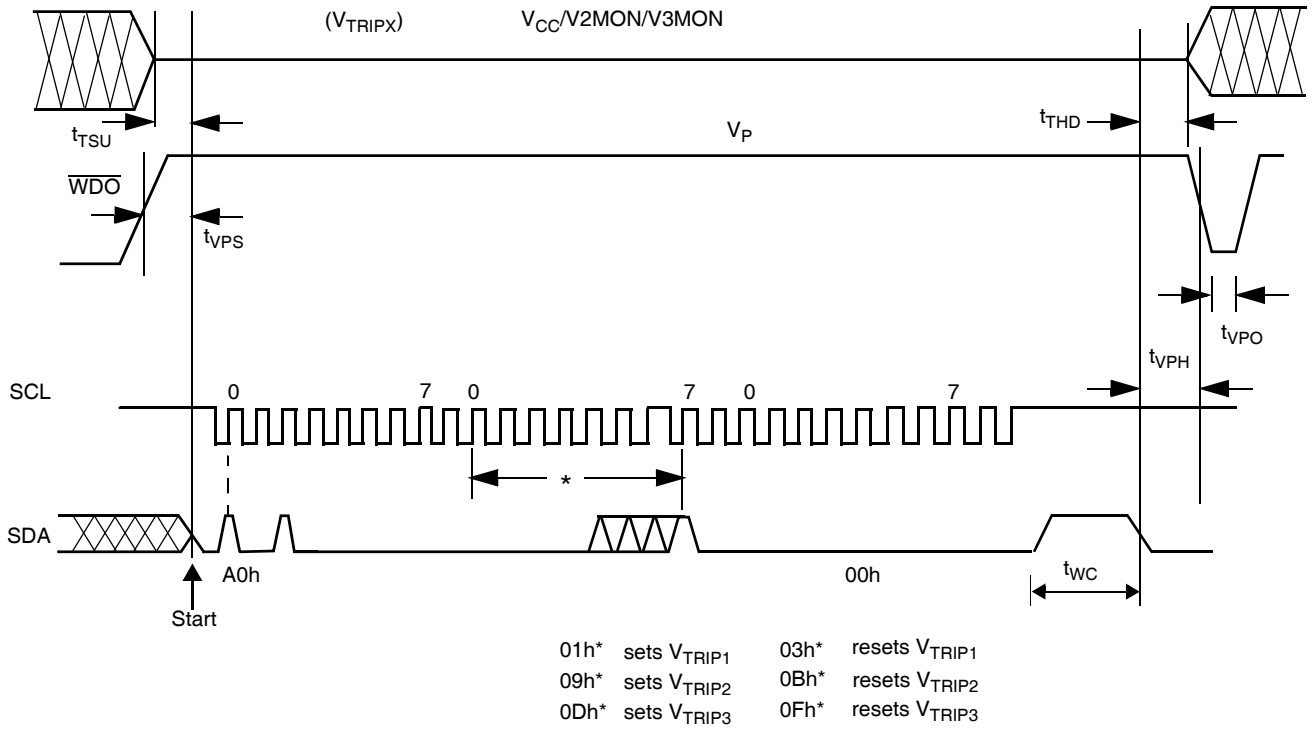
Watchdog Time Out for 2-Wire Interface



Minimum Sequence to Reset WDT



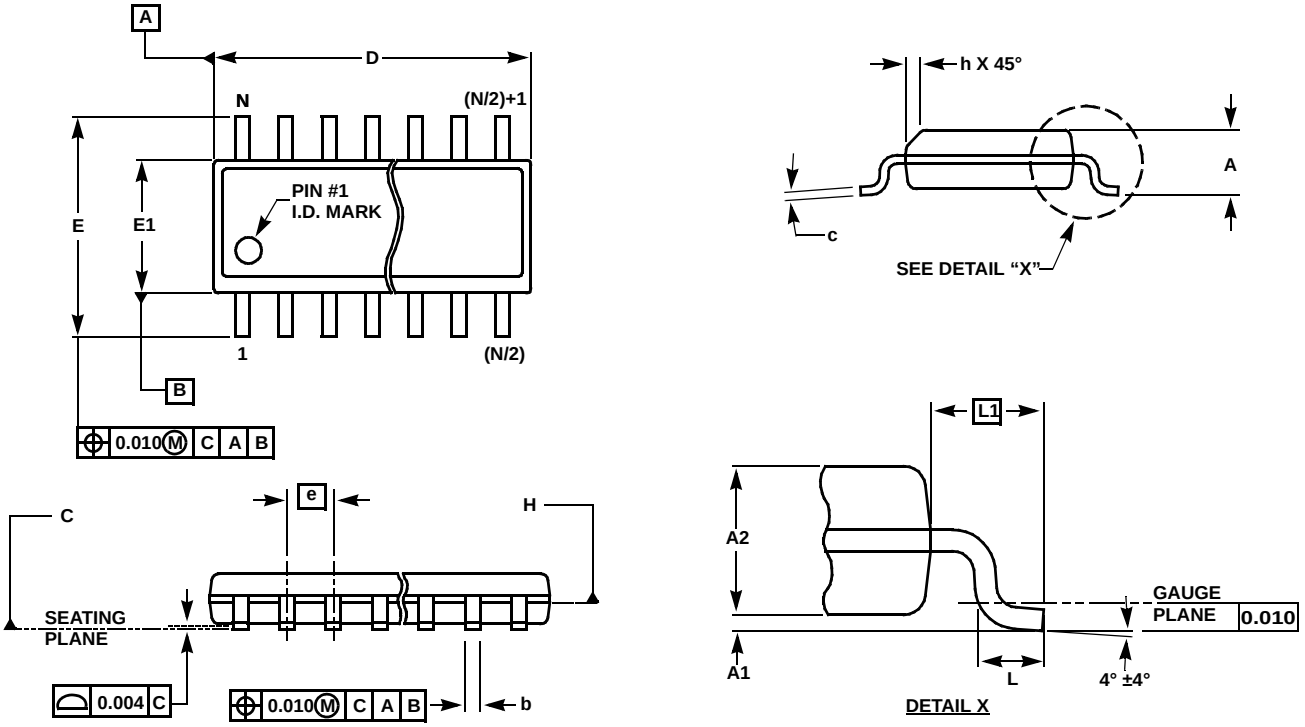
V_{TRIPX} Set/Reset Conditions



V_{TRIP1}, V_{TRIP2}, V_{TRIP3} Programming Specifications: V_{CC} = 2.0–5.5V; Temperature = 25°C

Parameter	Description	Min.	Max.	Unit
t_{VPS}	$\overline{WDO}$ Program Voltage Setup time	10		µs
t_{VPH}	$\overline{WDO}$ Program Voltage Hold time	10		µs
t_{TSU}	V_{TRIPX} Level Setup time	10		µs
t_{THD}	V_{TRIPX} Level Hold (stable) time	10		µs
t_{WC}	V_{TRIPX} Program Cycle	10		ms
t_{VPO}	Program Voltage Off time before next cycle	1		ms
V_P	Programming Voltage	15	18	V
V_{TRAN1}	V_{TRIP1} Set Voltage Range	2.0	4.75	V
V_{TRAN2}	V_{TRIP2} Set Voltage Range - X40030, X40031	1.7	4.75	V
V_{TRAN2A}	V_{TRIP2} Set Voltage Range - X40034, X40035	0.9	3.5	V
V_{TRAN3}	V_{TRIP3} Set Voltage Range	1.7	4.75	V
V_{tv}	V_{TRIPX} Set Voltage variation after programming (-40 to +85°C).	-25	+25	mV
t_{VPS}	$\overline{WDO}$ Program Voltage Setup time	10		µs

Small Outline Package Family (SO)



MDP0027

SMALL OUTLINE PACKAGE FAMILY (SO)

SYMBOL	SO-8	SO-14	SO16 (0.150")	SO16 (0.300") (SOL-16)	SO20 (SOL-20)	SO24 (SOL-24)	SO28 (SOL-28)	TOLERANCE	NOTES
A	0.068	0.068	0.068	0.104	0.104	0.104	0.104	MAX	-
A1	0.006	0.006	0.006	0.007	0.007	0.007	0.007	±0.003	-
A2	0.057	0.057	0.057	0.092	0.092	0.092	0.092	±0.002	-
b	0.017	0.017	0.017	0.017	0.017	0.017	0.017	±0.003	-
c	0.009	0.009	0.009	0.011	0.011	0.011	0.011	±0.001	-
D	0.193	0.341	0.390	0.406	0.504	0.606	0.704	±0.004	1, 3
E	0.236	0.236	0.236	0.406	0.406	0.406	0.406	±0.008	-
E1	0.154	0.154	0.154	0.295	0.295	0.295	0.295	±0.004	2, 3
e	0.050	0.050	0.050	0.050	0.050	0.050	0.050	Basic	-
L	0.025	0.025	0.025	0.030	0.030	0.030	0.030	±0.009	-
L1	0.041	0.041	0.041	0.056	0.056	0.056	0.056	Basic	-
h	0.013	0.013	0.013	0.020	0.020	0.020	0.020	Reference	-
N	8	14	16	16	20	24	28	Reference	-

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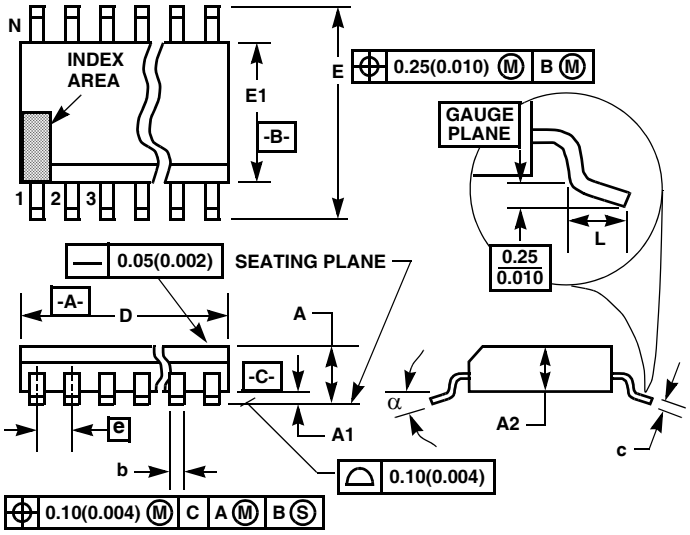
NOTES:

1. Plastic or metal protrusions of 0.006" maximum per side are not included.
2. Plastic interlead protrusions of 0.010" maximum per side are not included.
3. Dimensions "D" and "E1" are measured at Datum Plane "H".
4. Dimensioning and tolerancing per ASME Y14.5M-1994

Thin Shrink Small Outline Plastic Packages (TSSOP)



NOTES:

1. These package dimensions are within allowable dimensions of JEDEC MO-153-AC, Issue E.
2. Dimensioning and tolerancing per ANSI Y14.5M-1982.
3. Dimension “D” does not include mold flash, protrusions or gate burrs. Mold flash, protrusion and gate burrs shall not exceed 0.15mm (0.006 inch) per side.
4. Dimension “E1” does not include interlead flash or protrusions. Interlead flash and protrusions shall not exceed 0.15mm (0.006 inch) per side.
5. The chamfer on the body is optional. If it is not present, a visual index feature must be located within the crosshatched area.
6. “L” is the length of terminal for soldering to a substrate.
7. “N” is the number of terminal positions.
8. Terminal numbers are shown for reference only.
9. Dimension “b” does not include dambar protrusion. Allowable dambar protrusion shall be 0.08mm (0.003 inch) total in excess of “b” dimension at maximum material condition. Minimum space between protrusion and adjacent lead is 0.07mm (0.0027 inch).
10. Controlling dimension: MILLIMETER. Converted inch dimensions are not necessarily exact. (Angles in degrees)

M14.173

14 LEAD THIN SHRINK SMALL OUTLINE PLASTIC PACKAGE

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	-	0.047	-	1.20	-
A1	0.002	0.006	0.05	0.15	-
A2	0.031	0.041	0.80	1.05	-
b	0.0075	0.0118	0.19	0.30	9
c	0.0035	0.0079	0.09	0.20	-
D	0.195	0.199	4.95	5.05	3
E1	0.169	0.177	4.30	4.50	4
e	0.026 BSC		0.65 BSC		-
E	0.246	0.256	6.25	6.50	-
L	0.0177	0.0295	0.45	0.75	6
N	14		14		7
α	0°	8°	0°	8°	-

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