

## Introduction

Intersil has recently introduced a new family of Real Time Clock (RTC) devices (the “ISL1202x” family), which include 4k of EEPROM. These devices are pin-to-pin compatible and include enhancements over an older family of devices (the “x122x” family). These enhancements include:

- Lower supply and battery backup current
- Reliable battery switchover
- Accurate Reset voltage trip points
- Oscillator functionality detection

Other enhancements are detailed in the data sheets. This Technical Brief provides information for an engineer wishing to use the new devices to replace the older devices in their system.

## Replacing the x1226 with the ISL12026 and ISL12026A

The ISL12026, ISL12026A is an RTC device with 4k of EEPROM and includes an  $\overline{\text{IRQ}}/\text{F}_{\text{OUT}}$  pin for outputting an alarm interrupt or constant frequency clock. The ISL12026, ISL12026A can drop into an x1226 socket with no hardware changes required, but certain changes to the battery switchover and battery operation should be reviewed. **Note that the ISL12026 cannot drop into applications where normal operation requires  $V_{\text{BAT}} > V_{\text{DD}}$**  (such as when  $V_{\text{DD}} = 3.0\text{V}$  and  $V_{\text{BAT}} = 3.2\text{V}$ ). The default register setup only allows reading registers using the I<sup>2</sup>C bus with  $V_{\text{BAT}} > V_{\text{DD}}$ , not writing. **For full I<sup>2</sup>C read and write operation with  $V_{\text{BAT}} > V_{\text{DD}}$ , the ISL12026A is available** with the correct default setting for this operation.

There are only two changes that affect microcode or software. First, the change in general purpose EEPROM memory page size from 64 bytes to 16 bytes will require changes to the memory writing procedure. Second, the RTC registers require a full page write at a time instead of allowing a single byte write. A single byte write to the RTC registers will result in no update to those registers at all.

Note that there are additional status and control bits added to the registers of the ISL12026 and ISL12026A. Review their function thoroughly before substituting the ISL12026 or ISL12026A for the x1226. Table 1 lists the complete hardware and register changes. If the additional functionality is not needed, however, the ISL12026A default factory setting emulates the older device functionality.

## Replacing the x1227 with the ISL12027

The ISL12027 is an RTC device with 4k of EEPROM and includes a  $\overline{\text{RESET}}$  pin for outputting a hardware Reset signal for microcontroller or logic system reset, or a watchdog timer reset. The Reset function was improved in the ISL12027 to perform a Reset even if the oscillator has not started or has been stopped. The x1227 device would not issue a Reset with a stopped oscillator. The ISL12027 can drop into an x1227 socket with no hardware changes required, but certain changes to the battery switchover and battery operation should be reviewed. See the ISL12027 data sheet for more details.

There are only two changes that affect microcode or software. First, the change in general purpose EEPROM memory page size from 64 bytes to 16 bytes will require changes to the memory writing procedure. Second, the RTC registers require a full page write at a time instead of allowing a single byte write. A single byte write to the RTC registers will result in no update to those registers at all.

Note that there are additional status and control bits added to the registers of the ISL12027, and their function should be reviewed as well. Review their function thoroughly before substituting the ISL12027 for the x1227. Table 2 lists the complete hardware and register changes. If the additional functionality is not needed, however, the device default setting from the factory emulates the older device functionality.

## Replacing the x1228 with the ISL12028

The ISL12028 is an RTC device with 4k of EEPROM and includes an  $\overline{\text{IRQ}}/\text{F}_{\text{OUT}}$  pin for outputting an alarm interrupt or constant frequency clock, and a  $\overline{\text{RESET}}$  pin for outputting a hardware Reset signal for microcontroller or logic system reset or a watchdog timer reset. The Reset function was improved in the ISL12028 to perform a Reset even if the oscillator has not started or has been stopped. The x1228 device would not issue a Reset with a stopped oscillator. The ISL12028 can drop into an x1228 socket with no hardware changes required, but certain changes to the battery switchover and battery operation should be reviewed. See the ISL12028 data sheet for more details.

There are only two changes that affect microcode or software. First, the change in general purpose EEPROM memory page size from 64 bytes to 16 bytes will require changes to the memory writing procedure. Second, the RTC registers require a full page write at a time instead of allowing a single byte write. A single byte write to the RTC registers will result in no update to those registers at all.

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Note that there are additional status and control bits added to the registers of the ISL12027, and their function should be reviewed as well. Review their function thoroughly before substituting the ISL12028 for the x1228. Table 3 lists the complete hardware and register changes. If the additional functionality is not needed, however, the device default setting from the factory emulates the older device functionality.

Note that the ISL12029 device has been introduced as well, and is the same as the ISL12028 in all respects except for an open drain  $\overline{IRQ}/F_{OUT}$  pin instead of the CMOS output pin found on the ISL12028. This change will reduce battery current drain in applications where the circuitry that connect to this pin is powered down in battery backup mode.

**TABLE 1. REPLACING THE x1226 WITH THE ISL12026 AND ISL12026A**

FUNCTION	OLD X1226	NEW ISL12026 or ISL12026A	AFFECTS SOFTWARE?
Battery Switchover	Device switches to battery mode once $V_{CC} < V_{BAT}$	Default mode is called "LP Mode" whereby the device switches to battery when $V_{DD} < V_{BAT}$ . An option exists called "Normal Mode" which requires 1) $V_{CC} < V_{BAT}$ <b>AND</b> 2) $V_{CC} < V_{TRIP}$ .	NO
Battery Switchover	Hysteresis on $V_{CC}$ negative transition only in legacy mode	Hysteresis on both $V_{DD}$ negative and positive transitions	NO
Battery Current	1.25 $\mu$ A battery backup current	800nA battery backup current	NO
Power Supply	Min rise/fall times for $V_{CC}$ only	Max slew rate for $V_{DD}$	NO
I <sup>2</sup> C Operation with $V_{BAT} > V_{DD}$	Device could work in battery backup as long as $V_{BAT} > V_{TRIP}$ and $V_{BAT} > V_{CC}$ , including I <sup>2</sup> C operation with $V_{BAT} > V_{CC}$ .	ISL12026 will <b>NOT</b> allow I <sup>2</sup> C writes in default mode in applications where $V_{BAT} > V_{DD}$ . The <b>ISL12026A</b> is needed for performing I <sup>2</sup> C writes with $V_{BAT} > V_{DD}$ . This operation is register selectable	NO. Selecting the correct device should not require changing a register setting.
EEPROM	64-byte page write	16-byte page write	<b>YES</b>
Status Register	(None)	Status bit to indicate oscillator stopped	NO - Optional additional functionality
Status Register	Legacy switchover only	BSW mode bit to change from legacy to standard mode for battery switchover	NO - Optional additional functionality
Control Registers	(None)	Memory map to expand slightly from addition of bits	NO - Optional additional functionality
RTC Registers	Byte write or page write	Page write ONLY	<b>YES</b>
Pin Names	$\overline{IRQ}/PHZ$	$\overline{IRQ}/F_{OUT}$	NO
Pin Names	$V_{BACK}$	$V_{BAT}$	NO
Pin Names	$V_{CC}$	$V_{DD}$	NO
Clock Inputs	External clocking on X1 with special input	No external clocking	NO

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**TABLE 2. REPLACING THE x1227 WITH THE ISL12027**

FUNCTION	OLD X1227	NEW ISL12027	AFFECTS SOFTWARE?
Battery Switchover	Device switches to battery mode once $V_{CC} < V_{BAT}$	Device switches to battery when 1) $V_{CC} < V_{BAT}$ <b>AND</b> 2) $V_{CC} < V_{RESET}$ with option to work the old way (called "LP Mode")	NO
Battery Switchover	Hysteresis on $V_{DD}$ negative transition only in legacy mode	Hysteresis on both $V_{DD}$ negative and positive transitions	NO
Battery Current	1.25 $\mu$ A battery backup current	800nA battery backup current	NO
Power Supply	Min rise/fall times for $V_{CC}$ only	Max slew rate for $V_{DD}$	NO
Reset Trip Voltages	4 available reset thresholds with $\pm 2.5\%$ accuracy (old floating gate reference)	5 available reset thresholds with $\pm 1.5\%$ accuracy (more accurate bandgap)	NO
Reset Trip Voltages	Thresholds adjusted using complicated analog voltage setting procedure	Thresholds programmed (1 of 5) using EEPROM register	NO
I <sup>2</sup> C Operation with Battery	Device could work as long as $V_{BAT} > V_{DD} > V_{RESET}$	Selectable operation whether I <sup>2</sup> C is active in battery backup	NO
Operation with NO Oscillator	No reset, no I <sup>2</sup> C communication	Reset will occur with no battery, I <sup>2</sup> C can communicate	NO
EEPROM	64-byte page write	16-byte page write	<b>YES</b>
Status Register	(None)	Status bit to indicate oscillator stopped	NO - Optional additional functionality
Status Register	Legacy switchover only	BSW mode bit to change from legacy to standard mode for battery switchover	NO - Optional additional functionality
Control Registers	(None)	Memory map to expand slightly from addition of bits	NO - Optional additional functionality
RTC Registers	Byte write or page write	Page write ONLY - No single byte writes to setup RTC registers	<b>YES</b>
Pin Names	$V_{BACK}$	$V_{BAT}$	NO
Pin Names	$V_{CC}$	$V_{DD}$	NO
Clock Inputs	External clocking on X1 with special input	No external clocking	NO

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**TABLE 3. REPLACING THE X1228 WITH THE ISL12028**

FUNCTION	OLD X1228	NEW ISL12028	AFFECTS SOFTWARE?
Battery Switchover	Device switches to battery mode once $V_{CC} < V_{BAT}$	Device switches to battery when 1) $V_{CC} < V_{BAT}$ <b>AND</b> 2) $V_{CC} < V_{RESET}$ with option to work the old way (called "LP Mode")	NO
Battery Switchover	Hysteresis on $V_{DD}$ negative transition only in legacy mode	Hysteresis on both $V_{DD}$ negative and positive transitions	NO
Battery Current	1.25 $\mu$ A battery backup current	800nA battery backup current	NO
Power Supply	Min rise/fall times for $V_{CC}$ only	Max slew rate for $V_{DD}$	NO
Reset Trip Voltages	4 available reset thresholds with $\pm 2.5\%$ accuracy (old floating gate reference)	5 available reset thresholds with $\pm 1.5\%$ accuracy (more accurate bandgap)	NO
Reset Trip Voltages	Thresholds adjusted using complicated analog voltage setting procedure	Thresholds programmed (1 of 5) using EEPROM register	NO
I <sup>2</sup> C Operation with Battery	Device could work as long as $V_{BAT} > V_{DD} > V_{RESET}$	Selectable operation whether I <sup>2</sup> C is active in battery backup	NO
Operation with NO Oscillator	No reset, no I <sup>2</sup> C communication	Reset will occur with no battery, I <sup>2</sup> C can communicate	NO
EEPROM	64-byte page write	16-byte page write	<b>YES</b>
Status Register	(None)	Status bit to indicate oscillator stopped	NO - Optional additional functionality
Status Register	Legacy switchover only	BSW mode bit to change from legacy to standard mode for battery switchover	NO - Optional additional functionality
Control Registers	(None)	Memory map to expand slightly from addition of bits	NO - Optional additional functionality
RTC Registers	Byte write or page write	Page write ONLY - No single byte writes to setup RTC registers	<b>YES</b>
Pin Names	$\overline{IRQ}/PHZ$	$\overline{IRQ}/F_{OUT}$	NO
Pin Names	$V_{BACK}$	$V_{BAT}$	NO
Pin Names	$V_{CC}$	$V_{DD}$	NO
Clock Inputs	External clocking on X1 with special input	No external clocking	NO

Intersil Corporation reserves the right to make changes in circuit design, software and/or specifications at any time without notice. Accordingly, the reader is cautioned to verify that the Application Note or Technical Brief is current before proceeding.

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