Using the IEC 60730 Standard for Safe and Reliable Operation of Stellaris® Microcontrollers

Application Note

AN01272-01

Copyright

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Introduction

The International Electrotechnical Commission (IEC) has introduced the IEC 60730 standard which requires manufacturers of household appliances to take additional steps to ensure safe and reliable operation of their products. The IEC 60730 standard covers mechanical, electrical, electronic, EMC, and abnormal operation of household appliances.

The IEC 60730 standard encompasses all aspects of appliance design, but Annex H of the standard covers the aspects most relevant to microcontrollers (MCUs). Annex H details the tests and diagnostics which are intended to ensure safe operation of embedded control hardware and software. Three software Classifications for automatic electronic controls are defined:

- Class A – Control functions which are not intended to be relied upon for safety of the equipment.
- Class B – Control functions intended to prevent unsafe operation of the controlled equipment.
- Class C – Control functions intended to prevent special hazards such as explosions.

The Class B Classification applies to most home appliances including washing machines, dishwashers, dryers, refrigerators, freezers, and cookers/stoves. This application note covers the Class B compliance requirements along with the IEC 60730 Class B Library provided by Texas Instruments intended to assist in Class B compliance for products controlled by Stellaris microcontrollers.

Class B Compliance

The electronic controls of most home appliances are single MCU solutions. The IEC 60730 standard specifies two test structures for single MCU designs along with a checklist of MCU components to be tested.

Test Structures

The two test structures specified by the IEC 60730 standard for single MCU solutions are:

- Single channel with functional test
- Single channel with periodic self-test

The single channel with functional test structure is the most commonly used structure today and is the easiest to implement. The functional test is performed prior to shipment to ensure that all critical features are performing safely and reliably. The drawback to this structure is that problems cannot be detected once the appliance is in the field.

Single channel with periodic self-test is the structure that most manufacturers are implementing when designing today's new products. As the name suggests, this test structure provides for the tests to be performed periodically. The self-test is built in with the application allowing the application to call the test at a regular interval. The benefit of this structure is that problems can be detected once the appliance is in the field. Single channel with periodic self-test offers the highest level of protection at a low cost.

Test Components

To fulfill Class B compliance, manufacturers must test specific components of the design. Table H.11.12.7 in Annex H of the IEC 60730 standard lists the MCU components to be tested, the faults to be detected, and the appropriate reactive measures. The components include the CPU, interrupts, clocking, memory, external communications, analog-to- digital converters, and internal address and data paths.

IEC 60730 Class B Library

Texas Instruments provides an IEC 60730 Class B Library to support its customers in the certification process. This library, along with an example application that uses the library, is provided in the accompanying ZIP file. The contents of this ZIP file should be extracted to the same directory to which StellarisWare™ was installed. For example, if the StellarisWare™ package was installed to the C:\ directory, then these ZIP files should also be extracted to the C:\ directory. This creates a C:\StellarisWare\AppNotes\sw01272 directory that contains the source code for the library and example application.

Table 1-1 shows the modules that comprise the IEC 60730 Class B Library along with a brief description of the tests performed by that module. See the software reference manual, SW01272-SRM-nnnn.pdf (where nnnn is replaced by the version number), found in the same directory as the source code for full details of the functions, global variables, defines, and so on, in the source code.

Table 1-1. IEC 60730 Class B Library Modules

Module	Description
Reset Handler	Performs basic register and memory test out of reset.
CPU Test	Performs stuck bit testing on the CPU PC and registers.
SRAM Test	Performs stuck bit testing on the SRAM.
Flash Test	Performs a CRC test on the Flash.
ADC Test	Performs a conversion test on an ADC channel connected to a known voltage reference.
	Performs ADC temperature sensor test.
GPIO Test	Performs GPIO input/output plausibility test.
Clock/Interrupt Test	Performs tests to check the clock frequency, interrupt handling, and execution.

Conclusion

Manufacturers of household appliances must take steps to ensure safe and reliable operation of their products in order to meet the IEC 60730 standard. Annex H of this standard covers the aspects most relevant to microcontrollers including the three software classifications defined for automatic electronic controls. Most home appliances including washing machines, dryers, refrigerators, freezers, and cookers/stoves fall into the Class B classification. The IEC 60730 Class B Test Library is provided to support customers in the Class B certification process.

References

Documents used in the generation of this application note include:

- *StellarisWare® Driver Library User's Manual*, publication number SW-DRL-UG

Important Notice