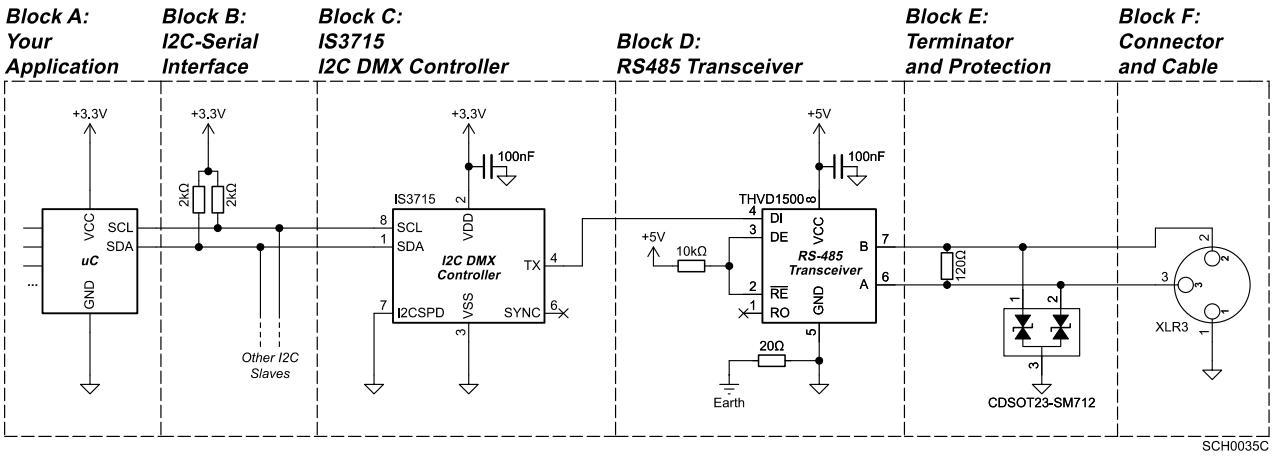
6 Hardware Examples

The following chapter represents an application design example for explanation proposals and is not part of the product standard. The customer must design his own solution, choose its most appropriate components and validate the final product according to the legislation and the DMX512 specifications.

6.1 DMX Controller

This example shows the design of a standard non-isolated DMX Controller.



Block A: Your Application

This is usually the main part of your product, where you read sensors, potentiometers, or acquire data that needs to be converted to DMX.

Typically, a microcontroller interfaces with the IS3715, but a microprocessor or a single-board computer, such as a Raspberry Pi, can also be used as long as they are equipped with an I2C-Serial Interface.

Block B: I2C-Serial Interface

For proper operation of the I2C-Serial Interface, pull-up resistors to 3.3 V or 5 V are necessary. Typical resistor values are 4.7 kΩ for Standard Mode (100 kHz) and 2 kΩ for both Fast Mode (400 kHz) and Fast Mode Plus (1 MHz).

Block C: IS3715

The IS3715 is very simple to integrate into your design.

A decoupling capacitor should be placed on the power pins (VDD and VSS). It is recommended to use a 100 nF ceramic capacitor.

The I2CSPD pin defines the I2C speed. Connect this pin to GND for a speed of 100 kHz. For 400 kHz, it should be pulled to 1.65 V, which is half of 3.3 V. This can be achieved with a simple resistor voltage divider using 3.3 V and GND. For 1 MHz, the pin must be connected to 3.3 V. This pin is not 5 V tolerant.

Block D: Transceiver

DMX operates over the RS485 electrical standard. Therefore, an RS485 transceiver or driver is required to convert the TTL-compatible voltage levels to differential RS485 signals before sending them to the DMX bus.

Since a DMX controller never receives data, the DE and RE pins of the transceiver can be tied to VCC to keep it always in transmit mode.

Even if the transceiver is only used as a driver and therefore the receiver part will never be used, it is sometimes preferred because it can be cheaper than a receiver-only device. Compare distributor prices to validate your preferred option.

Either 3.3 V or 5 V transceivers and drivers can be used, but 5 V ones are preferred, as they offer better noise immunity on the DMX bus.

Isolation

Isolation is a complex topic, especially in long cable runs, where ground potentials can differ significantly, or when all the equipment is not powered from the same source, e.g., mixing mains line and a gasoline generator.

This example is a Ground Referenced Transmitter (non-isolated), which is the recommended by the DMX512-A standard.

For a non-isolated transmitter, the standard does not require product labeling. For an isolated transmitter, the standard requires it to be labeled as either “ISO” or “ISOLATED”.

Block E: Terminator and Protection

Terminator

Reflections on a transmission line occur whenever there’s an impedance mismatch that a traveling wave encounters as it moves along the line. To reduce reflections at the ends of a DMX cable, a line termination

should be placed near each end of the bus. Terminating both ends is crucial because signals travel in both directions, but no more than two terminators should be used on the same bus. The line terminator connects across the balanced lines (cable A and B) and is a 120 Ω resistor rated at 1 W.

On the controller, which normally only has a DMX Out connector, the terminator resistor is usually integrated on the PCB. On the receivers, it is not integrated, as they have a DMX Out connector to daisy-chain another receiver. Therefore, on the receivers, you terminate the line by placing a special terminator connector, which contains nothing but a 120 Ω resistor.

Protection

The protection stage is influenced by several factors, including the intrinsic robustness and protection features of the transceiver or driver chip, the product's budget, and its required reliability, among other considerations. Refer to your transceiver's documentation to determine the appropriate protection requirements.

In the schematic, a bidirectional 400-W transient suppressor diodes (CDSOT23-SM712) are used to protect against surge transients.

Block F: Connector and Cable

Connector

The official DMX connector is the XLR-5. Exceptions include RJ45, miniature connectors, and screw terminal connectors. However, despite its popularity and widespread use, XLR-3 is not part of the DMX standard and should not be used. But what happens in the real world and in this example?

Generally, XLR-3 connectors are cheaper than XLR-5 connectors. Therefore, XLR-5 connectors are typically found in professional equipment, while XLR-3 connectors are more common in cost-sensitive devices.

In this example, an XLR-3 connector has been used due to its widespread popularity and clarity of implementation, but we strongly encourage product designers to follow the standard and use XLR-5 connectors.

Using an XLR-3 connector has the drawback of making your product compatible with standard microphone cables, which are specifically designed for low-frequency analog audio—not digital signals. As a result, microphone cables are not suitable for DMX, as they degrade the DMX signal, reducing the maximum cable length and increasing the chances of flickering.

DMX controllers usually only feature a DMX Out connector (female), while DMX receivers have both DMX In (male) and DMX Out (female) connectors for daisy-chaining—that is, two DMX connectors.

- DMX Out: Female connector
- DMX In: Male connector

In both XLR-3 and XLR-5, and in both male and female connectors, the pinout is as follows:

- Pin 1: Singal-Common, this connects to the cable screen.
- Pin 2: Data – (Also called ‘B’)
- Pin 3: Data + (Also called ‘A’)

Cable

The DMX cable screen must be connected to the pin 1 of the XLR-3 or XLR-5 connector and not to its shell. Do not connect the cable screen to the connector shell.

Use only twister pair cable to carry the DMX signal.

Do not use microphone cable, as it has been designed to carry low-frequency signals, and it will degrade the DMX signal, increasing the chances of spurious flickers on the LED fixtures.

	DMX In (Male)	DMX Out (Female)
XLR-3		
XLR-5