

Kappa3750Ard

IS3750 Arduino Shield

Presentation

The **Kappa3750Ard** is an **evaluation board** for the **IS3750** Addressable LED controller chip. It enables engineers to easily evaluate the IS3750 without the need for soldering or developing their own prototype—offering a **ready-to-use solution**. The board features 36x WS2813 Addressable LEDs to test your code. The IS3750 is **LED-agnostic**, meaning it can control GRB, RGB, GRBW, or any other color combination.

The board also features two selection jumpers: one to set the **I2C speed** (100 kHz, 400 kHz, or 1 MHz), and another to select the **I2C pull-up voltage** (3.3 V, 5 V, or floating).

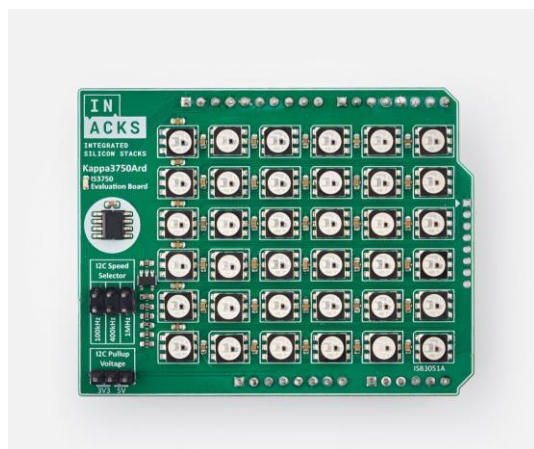
Designed as a shield with the **Arduino form factor**, the Kappa3750Ard benefits from its widespread popularity, ensuring compatibility with various microcontroller boards, including **Arduino** and **STM32 Nucleo Boards**, among others.

The IS3750 is an ideal solution for **ensuring Addressable LED protocol timing constraints**, reducing CPU load, RAM usage and eliminating the need for a dedicated pin. It can control up to 1200 LEDs.




Characteristics

IS3750 Characteristics	
Total LEDs to control:	1200 3-color LEDs or 900 4-color LEDs
LED Channels:	1
LED Color Type:	LED Agnostic: GRB, RGB, GRBW, etc.
Compatible LEDs:	WS2811, WS2812 / WS2812B / WS2812C, WS2813, WS2815, NeoPixel, SK6812, GS8208, Works with any LED using the compatible Addressable LED protocol
Max Frame Refresh Rate:	27.77 Hz
I2C Compatible Speed:	100 kHz, 400 kHz, 1 MHz

Shield Characteristics	
Form Factor	Arduino Uno/Nucleo Compatible
I2C Configurable Voltage Levels:	3.3V, 5V or floating
I2C Configurable Speed:	100 kHz, 400 kHz, 1 MHz
LEDs:	28 LEDs on PCB or connector for external LED strip

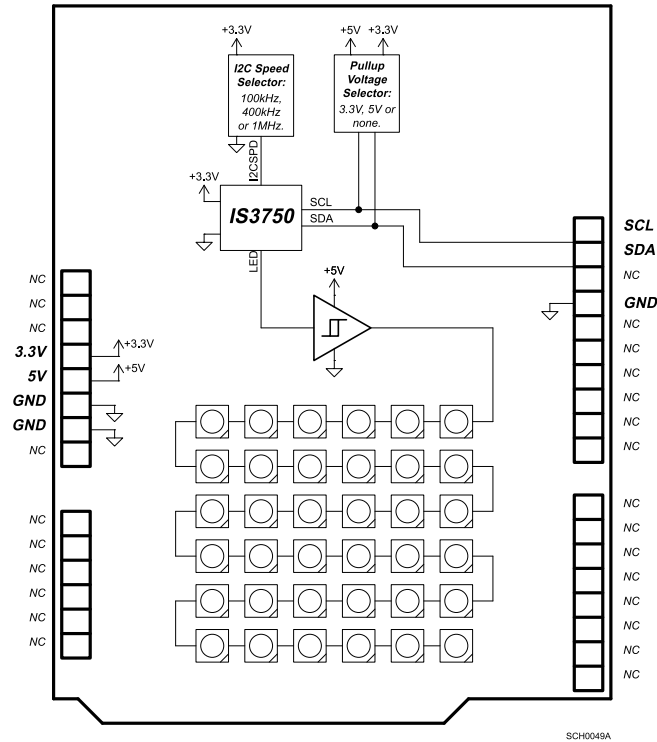


Product Selection Guide

Part Number		Form Factor	Stack	Description
Only Stack	IS3750-S8		SO8N	Addressable LED WS2811, WS2812, WS2812B, WS2812C, WS2813, WS2815, and compatible protocol LEDs. Addressable LED Controller Stack Chip. [Visit Product Page]
Evaluation Boards	Kappa3750Ard		Arduino Compatible	Evaluation board for the IS3750 with Arduino form factor. It features the IS3750 mounted on a PCB compatible with Arduino and other commercial microcontroller boards, such as the STMicroelectronics Nucleo. The board includes a series of LEDs, allowing you to easily test the IS3750 without any need for soldering. [Visit Product Page]
	Kappa3750Rasp		Raspberry Pi Compatible	Evaluation board for the IS3750 with Raspberry Pi form factor. It features the IS3750 mounted on a PCB compatible with Raspberry Pi and other commercial embedded computer boards. The board includes a series of LEDs, allowing you to easily test the IS3750 without any need for soldering. [Visit Product Page]

1. Description

1.1. General Description



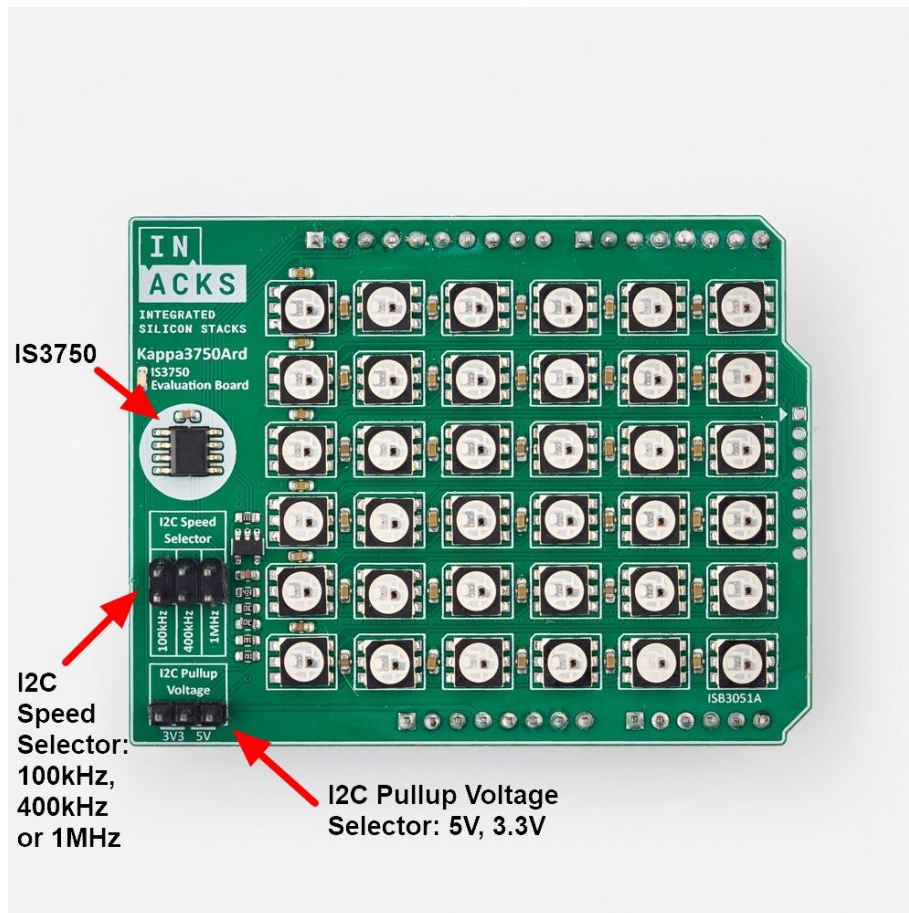
The core of the Kappa3750Ard is the IS3750 I2C Addressable LED controller chip, which is connected to a 5V Schmitt trigger. The Schmitt trigger converts the 3.3 V LED data output to 5 V LED. Generally, addressable LEDs operate at 5 V, so the Schmitt trigger matches the 3.3 V output of the IS3750 to the 5 V level required by the LEDs.

The IS3750 I2C-Serial Interface connects to the I2C pins of the shield. The shield includes a jumper that allows selection of the I2C pull-up voltage: 5V, 3.3V, or Floating. The Floating option is useful when the pull-up resistors are located outside the Kappa3750Ard.

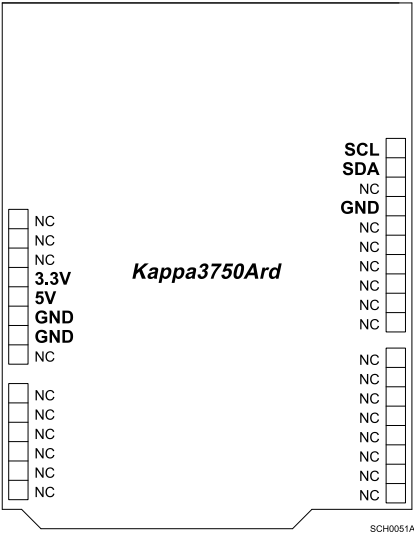
It is crucial to ensure that pull-up resistors are present either on the shield or elsewhere in the circuit. Without pull-up resistors, the I2C-Serial Interface will not function.


Since the IS3750 I2C-Serial Interface is 5V tolerant, it can operate with I2C pull-up voltages of 5V.

The shield has 36 WS2813 addressable LEDs and a green LED to indicate power status.

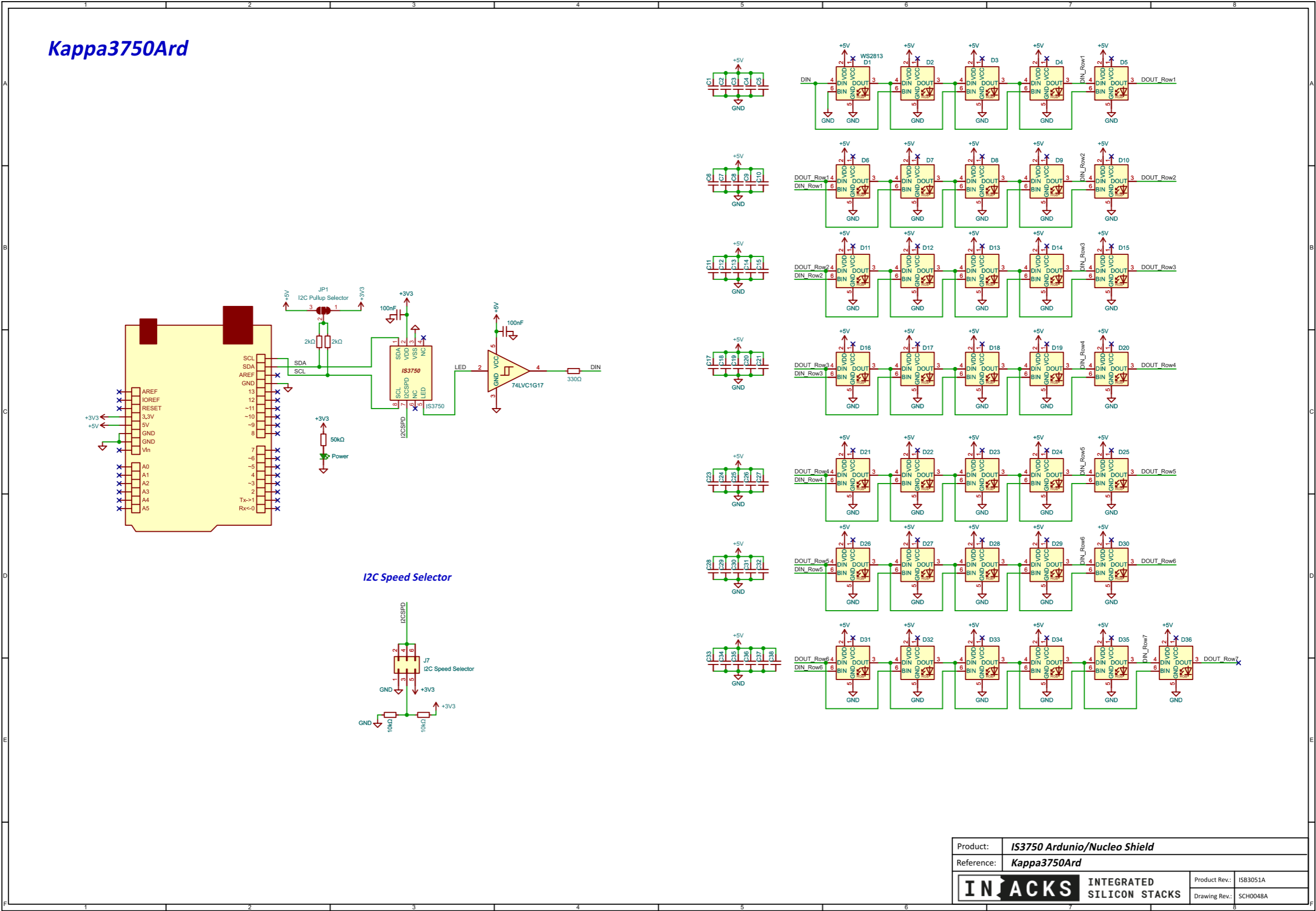


1.2. Module Pinout



Name	Type	Description
NC	Not Connected	These pins have no electrical connection on the shield. They can be used by other shields or by your own proposal.
3.3V	3.3V Power In	The shield needs 3.3V and 5V to operate.
5V	5V Power In	
GND	Ground	Ground reference.
SCL and SDA	Open Drain 5V Tolerant	<div>SCL and SDA pin of the IS3750 I2C-Serial Interface pins. Ensure the proper jumper pull-up configuration on the shield:  <ul style="list-style-type: none">Placing the jumper on 3V3 sets the SCL and SDA pull-up voltage to 3.3V.Placing the jumper on 5V sets the SCL and SDA pull-up voltage to 5V.Leaving the jumper off leaves SCL and SDA floating. This option is useful when pull-up resistors are located elsewhere in the circuit.</div>

1.3. Schematic



2. Firmware Implementation Guide

2.1. STM32 Example

This example (ISXMPL3750B) demonstrates how to use the IS3750 Addressable LED Controller chip with a STM32 microcontroller using the HAL I2C functions.

For clarity and brevity, all extra HAL definitions have been removed, leaving only the code related with the IS3750.

You can find the complete example at: <http://www.inacks.com/isxmpl3750b>

You can get the IS3750 evaluation board (Kappa3750Ard) compatible with STM32 Nucleo boards at:

www.inacks.com/kappa3750ard

```
#define IS3750_REGISTER_SHOW          0x00
#define IS3750_REGISTER_LED1_RED      0x01
#define IS3750_REGISTER_LED1_GREEN    0x02
#define IS3750_REGISTER_LED1_BLUE     0x03
#define IS3750_REGISTER_LED2_RED      0x04
#define IS3750_REGISTER_LED2_GREEN    0x05
#define IS3750_REGISTER_LED2_BLUE     0x06
#define IS3750_REGISTER_LED3_RED      0x07
#define IS3750_REGISTER_LED3_GREEN    0x08
#define IS3750_REGISTER_LED3_BLUE     0x09

// Sends brightness value to a specific register of the IS3750.
void writeLedRegister(uint16_t registerAddress, uint8_t bright) {
    uint8_t IS3750_I2C_Chip_Address = 0x12 << 1; // STM32 HAL expects 8-bit I2C address
    HAL_I2C_Mem_Write(&hi2c1, IS3750_I2C_Chip_Address, registerAddress, I2C_MEMADD_SIZE_16BIT,
    &bright, 1, 1000);
}

// Triggers the IS3750 to update the LED outputs.
void showLEDs(void) {
    uint8_t IS3750_I2C_Chip_Address = 0x12 << 1;
    uint8_t dataToWrite[1] = {1}; // Command to show updated values
    HAL_I2C_Mem_Write(&hi2c1, IS3750_I2C_Chip_Address, IS3750_REGISTER_SHOW,
    I2C_MEMADD_SIZE_16BIT, dataToWrite, 1, 1000);
}

// Sets all LED registers to 0 (turns off all LEDs).
void clearAllLedRegisters(void) {
    uint8_t IS3750_I2C_Chip_Address = 0x12 << 1;
    uint8_t dataToWrite[1200 * 3] = {0}; // 3600 zeroed bytes
    HAL_I2C_Mem_Write(&hi2c1, IS3750_I2C_Chip_Address, IS3750_REGISTER_LED1_RED,
    I2C_MEMADD_SIZE_16BIT, dataToWrite, sizeof(dataToWrite), 1000);
}

int main(void)
{
    while (1)
    {
        // Show green on LED1
        clearAllLedRegisters();
        writeLedRegister(IS3750_REGISTER_LED1_GREEN, 5);
        showLEDs();
        HAL_Delay(500);

        // Show yellow on LED2 (Red + Green)
        clearAllLedRegisters();
        writeLedRegister(IS3750_REGISTER_LED2_RED, 5);
        writeLedRegister(IS3750_REGISTER_LED2_GREEN, 5);
        showLEDs();
        HAL_Delay(500);

        // Show blue on LED3
        clearAllLedRegisters();
        writeLedRegister(IS3750_REGISTER_LED3_BLUE, 5);
        showLEDs();
        HAL_Delay(500);
    }
}
```

2.2. Arduino Example

This example (ISXMPL3750A) demonstrates how to use the IS3750 Addressable LED Controller chip with an Arduino microcontroller board using the Arduino functions.

You can find the complete example at: <http://www.inacks.com/isxmpl3750a>

You can get the IS3750 evaluation board (Kappa3750Ard) compatible with Arduino UNO form factor boards at: www.inacks.com/kappa3750ard

```
#include <Wire.h>

// I2C device address of the IS3750 chip:
#define IS3750_I2C_ADDRESS 0x12

// Memory Map:
#define IS3750_REGISTER_SHOW 0x00
#define IS3750_REGISTER_LED1_RED 0x01
#define IS3750_REGISTER_LED1_GREEN 0x02
#define IS3750_REGISTER_LED1_BLUE 0x03
#define IS3750_REGISTER_LED2_RED 0x04
#define IS3750_REGISTER_LED2_GREEN 0x05
#define IS3750_REGISTER_LED2_BLUE 0x06
#define IS3750_REGISTER_LED3_RED 0x07
#define IS3750_REGISTER_LED3_GREEN 0x08
#define IS3750_REGISTER_LED3_BLUE 0x09

void writeLedRegister(uint16_t registerAddress, uint8_t bright) {
    // Start the I2C communications to the IS3750 chip.
    Wire.beginTransmission(IS3750_I2C_ADDRESS);

    // Send the 16-bit Holding Register address (2 bytes).
    Wire.write((registerAddress >> 8) & 0xFF); // High byte.
    Wire.write(registerAddress & 0xFF); // Low byte.

    // Send the 8-bit data (the brightness).
    Wire.write(bright);

    // End the I2C communications.
    Wire.endTransmission();
}

// This routine updates the LEDs.
void showLeds(void) {
    // Write a '1' to the SHOW register (address 0x00)
    // to trigger rendering based on the current memory map contents.
    writeLedRegister(IS3750_REGISTER_SHOW, 1);
}

// This routine sets all the LED registers to 0.
void clearAllLedRegisters(void) {
    uint16_t i;

    // Write 0 to all LED control registers.
    for (i = 1; i <= 1200; i++) {
        writeLedRegister(i, 0);
    }
}

void setup() {
    Wire.begin(); // Initialize the I2C interface.
}

void loop() {

    // Let's do color green:
    clearAllLedRegisters(); // Clear all memory map.
    writeLedRegister(IS3750_REGISTER_LED1_GREEN, 5); // Set LED1 to green (brightness = 5)
    showLeds();
    delay(500);

    // Let's do color yellow:
    clearAllLedRegisters(); // Clear all memory map.
    // Set LED2 to yellow by combining red and green (brightness = 5 each)
    writeLedRegister(IS3750_REGISTER_LED2_RED, 5);
}
```

```
writeLedRegister(IS3750_REGISTER_LED2_GREEN, 5);  
showLeds();  
delay(500);  
  
// Let's do color blue:  
clearAllLedRegisters();// Clear all memory map.  
writeLedRegister(IS3750_REGISTER_LED3_BLUE, 5); // Set LED3 to blue (brightness = 5)  
showLeds();  
delay(500);  
}
```

Content

Presentation.....	1	Content.....	10
1. Description	3	Appendix	11
1.1. General Description.....	3	Revision History	11
1.2. Module Pinout.....	5	Documentation Feedback	11
2. Schematic	6	Sales Contact.....	11
3. Firmware Implementation Guide	7	Customization	11
3.1. STM32 Example	7	Independence and Trademarks Notice	11
3.2. Arduino Example	8	Disclaimer	12

Appendix

Revision History

Document Revision

Date	Revision Code	Description
July 2025	ISDOC138B	- Added Kappa3750Rasp image on the Product Selection Guide. - Presentation table correction.
June 2025	ISDOC138A	- Initial Release

Shield Revision

Date	Revision Code	Description
June 2025	ISB3051A	- Initial Release

Documentation Feedback

Feedback and error reporting on this document are very much appreciated.

feedback@inacks.com

Sales Contact

For special order requirements, large volume orders, or scheduled orders, please contact our sales department at:

sales@inacks.com

Customization

INACKS can develop new products or customize existing ones to meet specific client needs. Please contact our engineering department at:

engineering@inacks.com

Independence and Trademarks Notice

This company and the products provided herein are developed independently and are not affiliated with, endorsed by, or associated with any official protocol or standardization entity.

All trademarks, names, and references to specific protocols remain the property of their respective owners.

Disclaimer

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, INACKS does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. INACKS takes no responsibility for the content in this document if provided by an information source outside of INACKS.

In no event shall INACKS be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, INACKS's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of INACKS.

Right to make changes — INACKS reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — INACKS products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an INACKS product can reasonably be expected to result in personal injury, death or severe property or environmental damage. INACKS and its suppliers accept no liability for inclusion and/or use of INACKS products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Quick reference data — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. INACKS makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using INACKS products, and INACKS accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the INACKS product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

INACKS does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using INACKS products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). INACKS does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — INACKS products are sold subject to the general terms and conditions of commercial sale, as published at <http://www.inacks.com/commercialsaleterms>, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. INACKS hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of INACKS products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Non-automotive qualified products — This INACKS product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. INACKS accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

Protocol Guidance Disclaimer: The information provided herein regarding the protocol is intended for guidance purposes only. While INACKS strive to provide accurate and up-to-date information, this content should not be considered a substitute for official protocol documentation. It is the responsibility of the client to consult and adhere to the official protocol documentation when designing or implementing systems based on this protocol.

INACKS make no representations or warranties, either expressed or implied, as to the accuracy, completeness, or reliability of the information contained in this document. INACKS shall not be held liable for any errors, omissions, or inaccuracies in the information or for any user's reliance on the information.

The client is solely responsible for verifying the suitability and compliance of the provided information with the official protocol standards and for ensuring that their implementation or usage of the protocol meets all required specifications and regulations. Any reliance on the information provided is strictly at the user's own risk.

Certification and Compliance Disclaimer: Please be advised that the product described herein has not been certified by any competent authority or organization responsible for protocol standards. INACKS do not guarantee that the chip meets any specific protocol compliance or certification standards.

It is the responsibility of the client to ensure that the final product incorporating this product is tested and certified according to the relevant protocol standards before use or commercialization. The certification process may result in the product passing or failing to meet these standards, and the outcome of such certification tests is beyond our control.

INACKS disclaim any liability for non-compliance with protocol standards and certification failures. The client acknowledges and agrees that they bear sole responsibility for any legal, compliance, or technical issues that arise due to the use of this product in their products, including but not limited to the acquisition of necessary protocol certifications.