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 board comes with 36 **WS2813** addressable LEDs for testing 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).

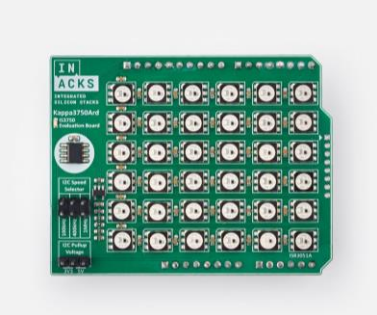
Designed as a shield with the **Arduino form factor**, the Kappa3750Ard benefits from its widespread popularity, ensuring compatibility with various microcontroller boards, including **Arduino** and **STM32 Nucleo Boards**, among others.

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.

Shield Characteristics

Modbus Characteristics	
Supported Function Codes:	3 (0x03) - Read Holding Registers
Holding Registers:	500
Operating Mode:	RTU
Electrical Interface:	RS485
Default Modbus Configuration:	19200

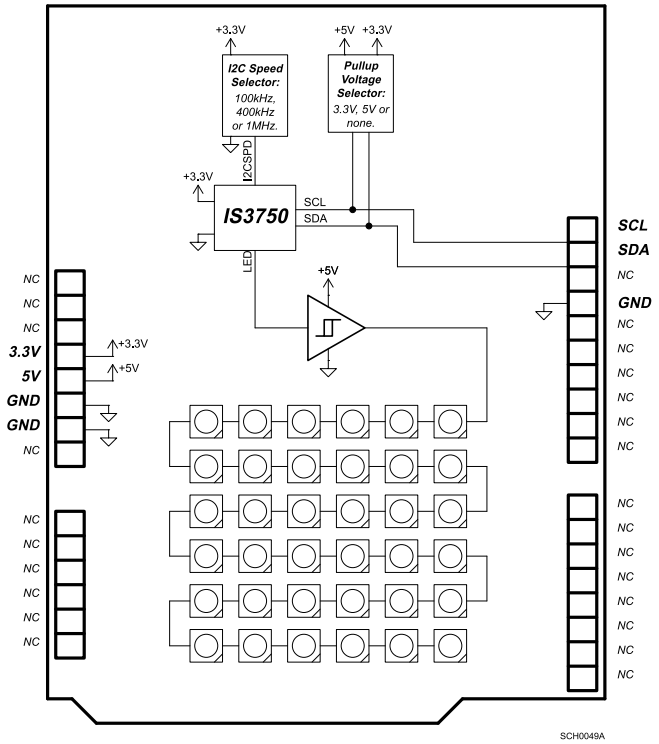
Electrical Characteristics	
I2C Compatible Voltage Levels	3.3V and 5V



	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. [Vist 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



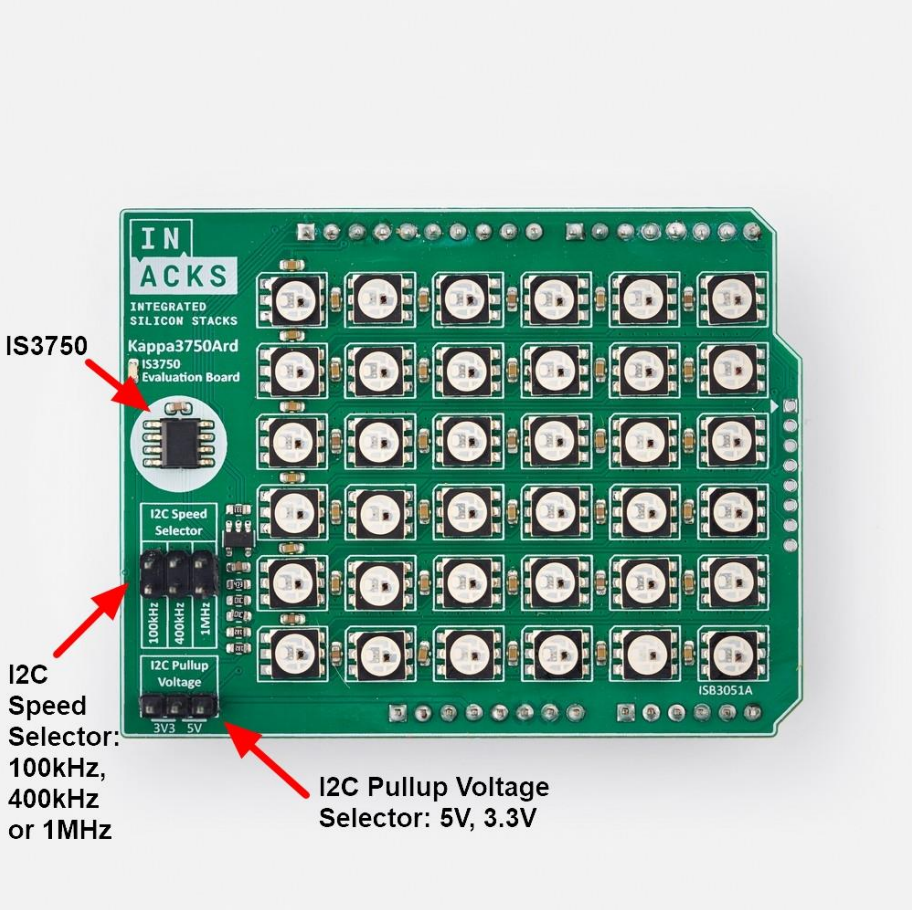
The core of the Kappa3750Ard is the IS3750 I2C Addressable LED controller chip, which is connected to a 5V Schmitt trigger. The Schmitt trigger converts the 3.3 V LED data output to 5 V LED. Generally, addressable LEDs operate at 5 V, so the Schmitt trigger matches the 3.3 V output of the IS3750 to the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

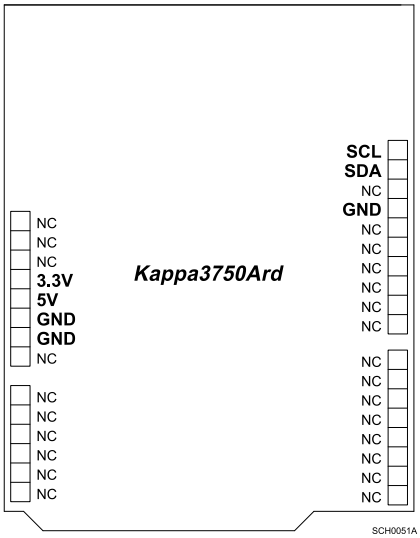
It is crucial to ensure that pull-up resistors are present either on the shield or elsewhere in the circuit. Without pull-up resistors, the I2C-Serial Interface will not function.

Since the IS3750 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.

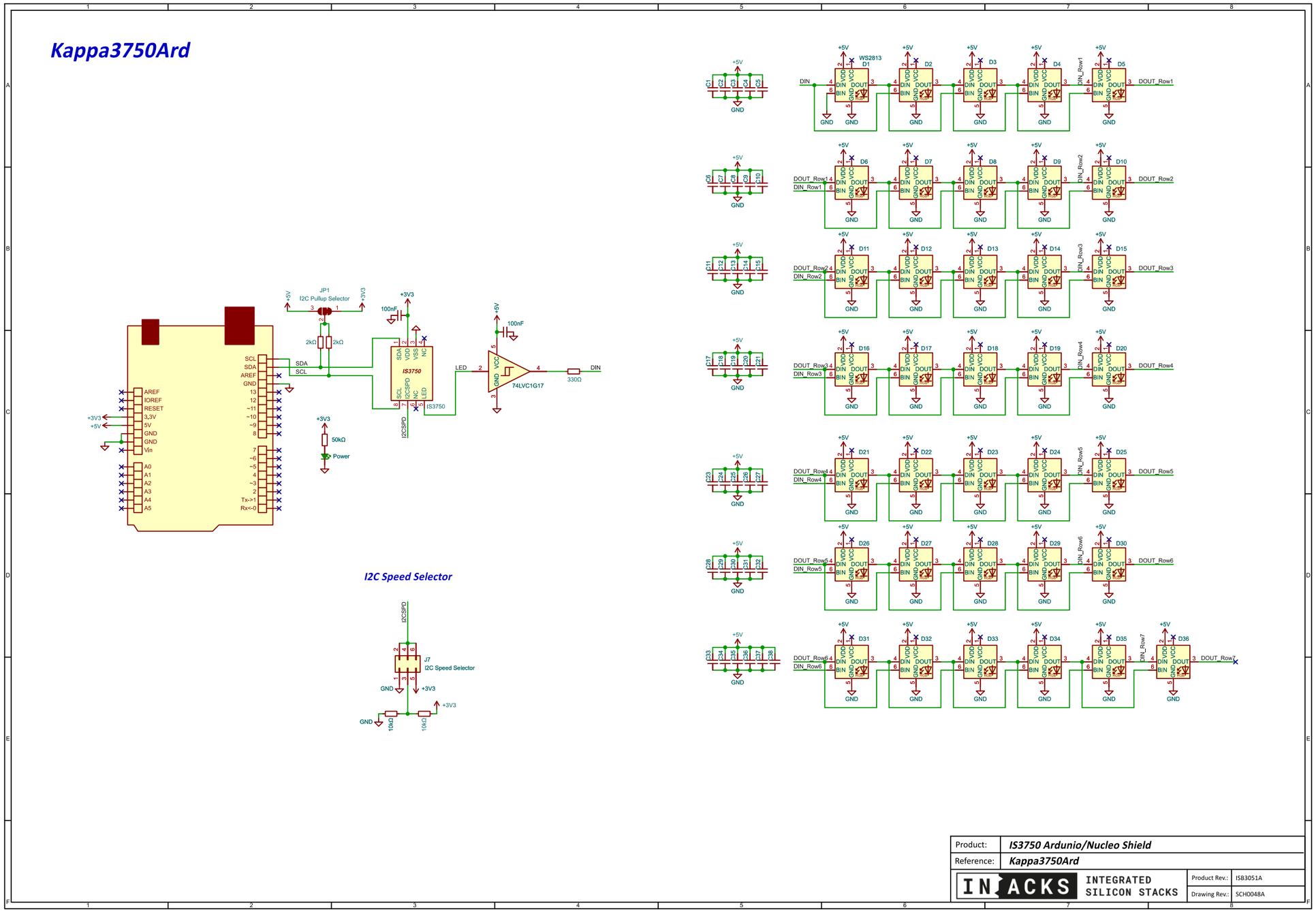

IS3750
I2C Speed Selector: 100kHz, 400kHz or 1MHz
I2C Pullup Voltage Selector: 5V, 3.3V
IN ACKS
INTEGRATED SILICON STACKS
Kappa3750Ard
IS3750 Evaluation Board
I2C Speed Selector
100kHz
400kHz
1MHz
I2C Pullup Voltage
3V3
5V
ISB3051A

1.2. Module Pinout



Name	Type	Description
NC	Not Connected	These pins have no electrical connection. 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. GND is connected to the “Common” of the RS485 bus. GND is NOT connected to the shield of the RJ45 connector. Refer to section “Bus Topology” for more details.
SCL and SDA	Open Drain 5V Tolerant	SCL and SDA pin of the IS3750 I2C-Serial Interface pins. Ensure the proper jumper pull-up configuration on the shield:  • 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.

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);

}
```

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Appendix

Revision History

Document Revision

Date	Revision Code	Description
June 2025	ISDOC138**A**	- Initial Release

Shield Revision

Date	Revision Code	Description
June 2025	ISB3051**A**	- Initial Release

Documentation Feedback

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

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