IS3751: DMX to Addressable LED

Control up to 170 3-color or 128 4-color Addressable LEDs

Applications

- Custom Lighting
- LED Strips, Panels and Bars
- Floodlights and Wall Washers
- Building Facades, Bridges and Monuments
- Interior Design Lighting
- Water Fountains
- Museum Lighting
- Stage and Entertainment Lighting
- Digital Art Installations
- Animatronics
- OEM / Device Manufacturers

Main Advantages

- Autonomous operation, no need of microcontroller
- Reduces engineering time and costs
- Reduces product time-to-market
- Provides a low-cost solution
- Compact, easy-to-solder SO8N package

Characteristics

- Compatible with LED protocols:
  - WS2811
  - WS2812 / WS2812B / WS2812C
  - WS2813
  - WS2815
  - NeoPixel
  - SK6812
  - GS8208
  - And similar types
- Controls up to 170 3-color or 128 4-color LEDs
- Addressable LEDs update rate: 40 Hz
- DMX signal detection indicator pin

General Description

The IS3751 is a DMX512-to-addressable-LED protocol converter chip. It operates fully autonomously, requiring no microcontroller or processor, thereby reducing engineering costs and accelerating the product's time-to-market.

It can control up to 170 3-color or 128 4-color addressable LEDs at a refresh rate of 40 Hz.

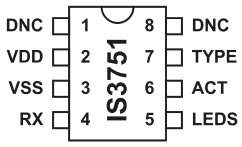
An RS485 receiver or transceiver converts the DMX differential signaling to TTL-compatible levels for the IS3751, which then directly generates data stream for the addressable LEDs.

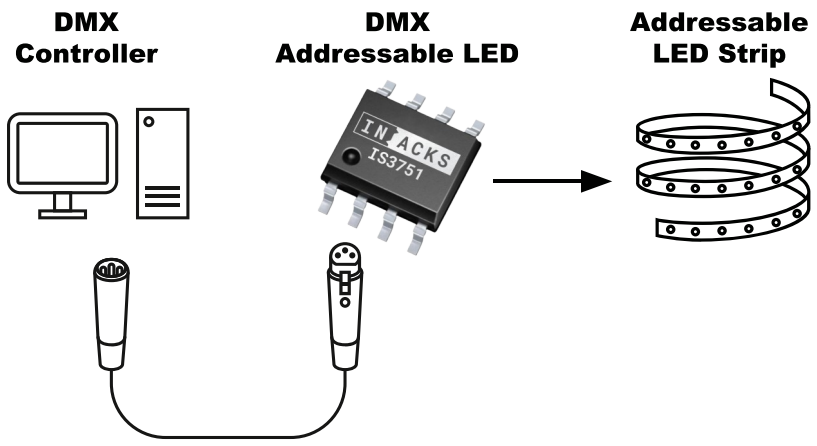
The chip includes a pin for selecting between 3-color and 4-color addressable LEDs, and a blinking indicator pin to show when a DMX signal is present.

The device operates at 3.3 V, with 5 V-tolerant open-collector LEDs control pin and with 5 V-tolerant RX pin for DMX input, allowing compatibility with both 3.3 V and 5 V RS485 receivers or transceivers.

It is available in Industrial (-40 °C to +85 °C) and Extended (-40 °C to +125 °C) temperature ranges. Smaller package options are available, contact sales for details.

Part Number	Package	Op. Temperature
IS3751-S8-I	SO8N	-40ºC to +85ºC
IS3751-S8-E	SO8N	-40ºC to +125ºC





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1 Electrical Specification

Absolute Maximum Ratings

Parameter			Min	Max	Unit
Input Voltage	VDD Pin		-0.3	4	V
	RX, LEDS, ACT, and TYPE Pins		-0.3	5.5	
Current Sourced/Sunk by any I/O or Control Pin				±20	mA
Temperature	Operating Temperature	IS3751-S8-I	-40	+85	ºC
		IS3751-S8-E	-40	+125	
	Storage Temperature		-65	+150	
Electrostatic Discharge (TA = 25ºC)	Human-body model (HBM), Class 1C		-2000	+1500	V
	Charged-device model (CDM), Class C2a		-500	+500	

Exceeding the specifications outlined in the Absolute Maximum Ratings could potentially lead to irreversible harm to the device. It's important to note that these ratings solely indicate stress limits and don't guarantee the device's functionality under such conditions, or any others not specified in the Recommended Operating Conditions. Prolonged exposure to conditions at or beyond the absolute maximum ratings might compromise the reliability of the device.

Recommended Operation Conditions

Parameter	Symbol	Min	Nom	Max	Unit
Supply Voltage	V_{DD}	2.0	3.3	3.6	V
Input Voltage at RX and TYPE Pins	$V_{I/O-IN}$	-0.3	3.3	5.5	
Source/Sink Current at LEDS and ACT Pins	$I_{I/O-SS}$	-	-	±6	mA

Electrical Characteristics

Parameter		Symbol	Min	Nom	Max	Unit
Current Consumption (T_A = 25ºC)		I_{OP}	-	4.75	-	mA
Input Voltage	Logical High-Level	V_{IH}	$0.7xV_{DD}$	-	-	V
	Logical Low-Level	V_{IL}	-	-	$0.3xV_{DD}$	

Electrical Specifications Revision A

2 Detailed Description

2.1 IS3751 Description

The IS3751 is a DMX512 protocol-specialized integrated circuit that continuously generates addressable LED data from the received DMX data. It operates fully autonomously and does not require any external commands from a microcontroller or processor.

The chip operates at 3.3 V and supports both 3-color and 4-color addressable LEDs.

The addressable LED refresh rate is directly tied to the DMX refresh rate, typically around 40 Hz.

When controlling 3-color addressable LED, the chip groups every 3 DMX channels into one LED. For example, channel 1, 2 and 3 control the colors of the first LED; channels 4, 5 and 6 control the second LED, and so on, up to LED 170.

When controlling 4-color addressable LED, the chip groups every four DMX channels into one LED. For example, channels 1, 2, 3 and 4 control the 4 colors of the first LED; channels 5, 6, 7 and 8 control the second LED, and so on, up to LED 128.

The chip is color-agnostic, DMX channel 1 will be mapped to the first color of the first LED, which may be red in some LEDs or green in others.

The maximum number of 3-color LEDs that can be controlled is 170, corresponding to DMX channels 1–510 (channels 511 and 512 remain unused).

The maximum number of 4-color LEDs that can be controlled is 128, corresponding to the full range of DMX channels 1–512.

This addressable LED driver IC is designed for developing custom LED fixtures compatible with the DMX protocol—without any need for firmware development—significantly reducing engineering costs and achieving a faster time-to-market..

The chip applications include:

- Custom lighting
- LED strips, panels and bars
- Floodlights and wall washers
- Building facades, bridges and monuments
- Interior design lighting
- Water fountains
- Museum lighting
- Stage and entertainment lighting
- Digital art installations
- Animatronics
- OEM / Device Manufacturers

According to the DMX512 standard, this protocol must never be used to control pyrotechnics or stage robotics, as it has no intrinsic error checking. Therefore, this chip should not be used for those applications either.

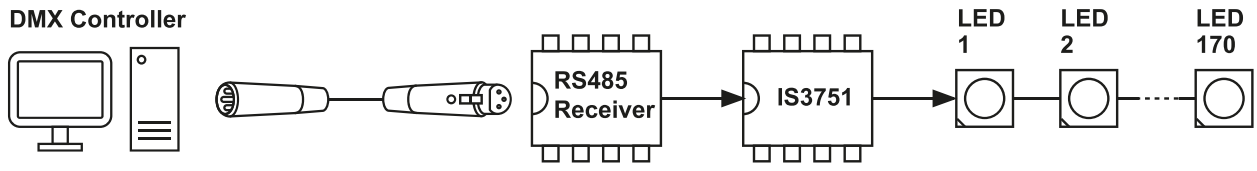
A minimum of approximately 130 DMX channels must be received to allow all addressable LED data to be fully transmitted. Receiving DMX data for a shorter duration than the addressable LED frame generation time is not allowed.

The DMX data enters the chip through the RX pin at TTL-compatible voltage levels. Since DMX uses differential signaling, an RS485 transceiver or receiver must be used to convert the differential DMX signal to TTL-compatible voltage levels. The RX pin operates at 3.3 V and is 5 V-tolerant, allowing the use of either 3.3 V or 5 V transceivers or receivers.

The LEDS pin outputs the addressable LED data. This pin is open-collector and must be pulled up to 5 V with a 500 Ω resistor to generate the 5 V data required by the addressable LEDs.

The TYPE pin selects whether the connected addressable LEDs are 3-color or 4-color, and the ACT pin can drive a standard LED that blinks when DMX data is detected on the RX pin. Its purpose is to easily indicate that the device is properly connected and receiving data.

The chip is compatible with addressable LEDs such as WS2811, WS2812 / WS2812B / WS2812C, WS2813, WS2815, NeoPixel, SK6812, GS8208, and any other LEDs that implement a compatible protocol.



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2.2 Usage

The usage of the IS3751 is very straightforward.

Place an RS485 receiver or transceiver (3.3 V or 5 V) between the DMX connector and the IS3751 RX pin.

Add a pull-up resistor of 500 Ω to 5 V on IS3751 LEDS pin, and connect this pin to the addressable LEDs.

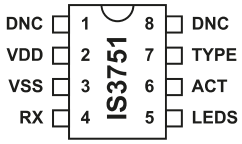
Connect the TYPE pin to GND when using 3-color addressable LEDs, or to 3.3 V when using 4-color addressable LEDs.

Optionally, connect a standard LED with a current-limiting resistor to the ACT pin to indicate that the IS3751 is receiving valid DMX data.

Keep pins 1 and 8 either unconnected or tied to GND.

The IS3751 automatically starts converting DMX data to addressable LED data immediately after receiving power-up.

3 Pin Description



Pin	Name	Type	Description
1	DNC	Do Not Connect	Leave this pin unconnected or to GND.
2	VDD	Supply	3.3V power supply pin. Bypass this pin to GND with a 100 nF ceramic capacitor.
3	VSS	Ground	Ground reference pin.
4	RX	Digital Input 5 V Tolerant	DMX UART Receiver Pin in TTL voltage levels. Attention: Use an RS485 receiver or transceiver to adapt the DMX voltage levels to TTL-compatible voltage levels.
5	LEDS	Digital Output Open-Collector	Addressable LEDs pin. Pull-up this pin to 5 V with a 500 Ω resistor.
6	ACT	Digital Output Push-Pull	Optional use. Connect an LED to indicate DMX signal detection on RX pin.
7	TYPE	Digital Input	LED Type Selector pin: • Connect to GND for 3-color addressable LED. • Connect to VDD (3.3 V) for 4-color addressable LED.
8	DNC	Do Not Connect	Leave this pin unconnected or to GND.

3.1 RX Pin

DMX UART Receiver Pin.

This pin receives DMX512 data from an RS485 receiver or transceiver. It operates at 3.3V and it is 5 V tolerant.

Use an RS485 receiver or transceiver (e.g., THVD1400) to convert DMX (RS485) differential signals to TTL voltage levels. See Hardware Examples section for more details.

Important: Connecting this pin directly to DMX bus without the receiver or transceiver will permanently damage the device.

3.2 LEDS Pin

Addressable LEDs Output Pin, Open-Collector.

This pin outputs the data that will get into the addressable LED data input (DIN) pin.

The pin is open-collector, and since most addressable LEDs expect 5 V logic, it should be pulled up to 5 V with a 500 Ω resistor. Using a lower resistor value will generate a stronger data signal. The minimum admissible value for this resistor is 250 Ω; going below this may cause permanent damage to the device. A value of 500 Ω is recommended and provides a strong and reliable signal, while environments with long cable runs or electrical noise may benefit from a slightly lower value.

3.3 ACT Pin

DMX Activity Pin.

The usage of this pin is optional. A standard LED (typically green, with series resistor) can be connected to indicate DMX activity. When DMX data is detected on the RX pin, this pin toggles between 0 V and 3.3 V, causing the LED to blink.

If unused, it is recommended to pull this pin down to GND with a 10 kΩ resistor.

3.4 TYPE Pin

Addressable LED Type Selection Pin.

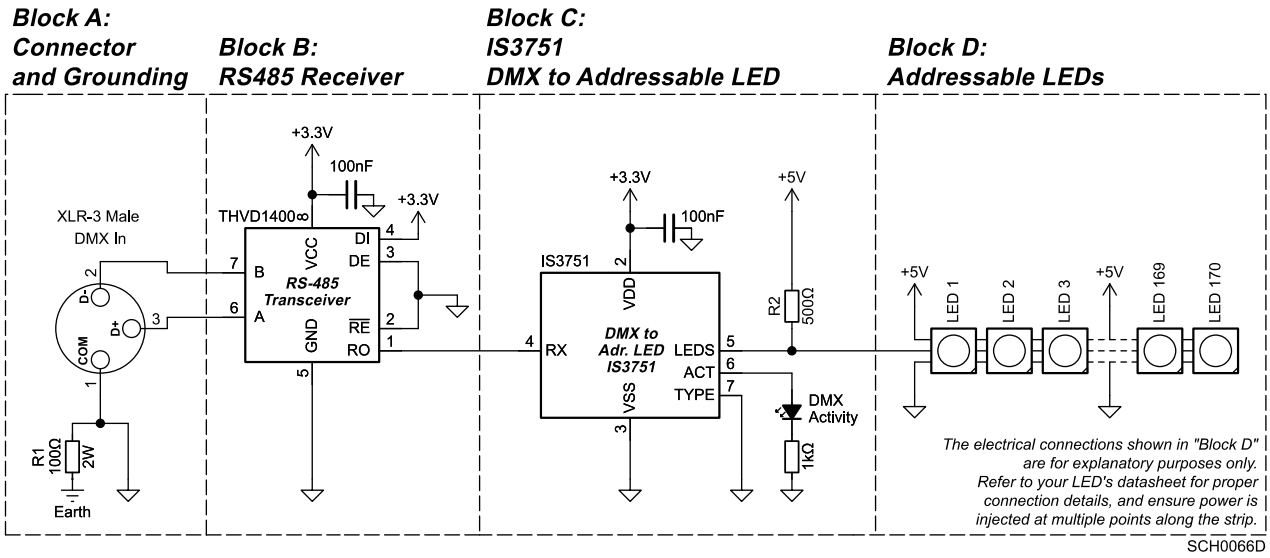
- Connect to GND for 3 color addressable LEDs. In this case 170 LEDs will be addressed (512 channels ÷ 3 colors).
- Connect to VDD for 4 color addressable LEDs. In this case 128 LEDs will be addressed (512 channels ÷ 4 colors).

This pin can be changed during operation. It features an internal weak pull-down resistor.

4 Hardware Example

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.

This example shows the design of a standard DMX to Addressable LED schematic using the IS3751.



Block A: Connector and Grounding

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 receivers usually feature two DMX connectors: a DMX In (male) and a DMX Out connector (female) for daisy-chaining. However, since the IS3751 uses all the 512 DMX channels, no free channels remain. Therefore including a DMX Out connector has no practical purpose, and only a DMX In connector is shown in the example.

Grounding and Isolation

Grounding and isolation are 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. High currents can flow through the shield of the DMX cable under these conditions, which can be dangerous. To limit this, a resistor (R1) of 100 Ω or less should be placed between the cable shield and Earth.

This example shows a design of a non-isolated receiver, which is the most popular design due its low cost and ease to design, although DMX standards recommend that DMX receivers be isolated.

For a non-isolated receiver, the standard requires the product to be labeled as “NON-ISO”.

Cable

Use only twister pair cable to carry the DMX signal.

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 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.

Block B: RS485 Receiver

DMX operates over the RS485 electrical standard. Therefore, an RS485 transceiver or receiver is required to convert the differential signals to TTL-compatible voltage levels before connecting them to the IS3751.

Since IS3751 never sends DMX data, the DE and RE pins of the transceiver can be tied to GND to keep it always in receive mode.

Even if the transceiver is only used as a receiver and therefore the driver 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 receivers can be used, as the RX pin of the IS3751 is 5 V tolerant.

Block C: IS3751

The IS3751 is very simple to integrate into your design.

The LEDS pin outputs the converted data for the addressable LEDs. This pin is open-collector, and since most addressable LEDs expect 5 V logic, it should be pulled up to 5 V with a 500 Ω resistor (see R2 in the example circuit). Using a lower resistor value will generate a stronger data signal. The minimum admissible value for this resistor is 250 Ω; going below this may cause permanent damage to the IS3751. A value of 500 Ω is recommended and provides a strong and reliable signal, while environments with long cable runs or electrical noise may benefit from a slightly lower value.

The RX pin receives the DMX data at TTL-compatible voltage levels.

The TYPE pin selects between 3-color (connect to GND) and 4-color (connect to VDD) addressable LEDs.

ACT pin indicates when DMX data is being received.

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

Block D: Addressable LEDs

The IS3751 can control up to 170 3-color addressable LEDs or 128 4-color addressable LEDs.

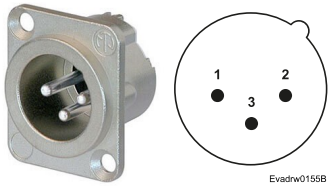
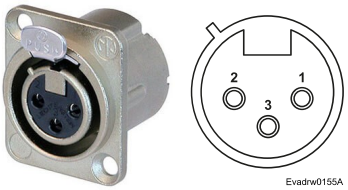
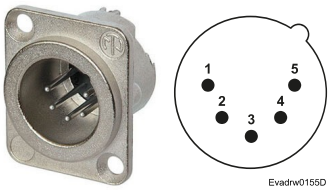
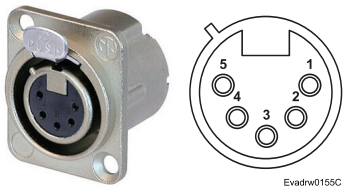
When using more than a few LEDs, special attention must be given to the power supply design. Poor PCB layout or cabling in the power domain can lead to burnt traces or wires, voltage drops, and incorrect LED brightness or spurious flickering.

Always calculate the total current draw of all LEDs to properly size the power supply. Do not assume that certain colors won't be used and therefore a smaller supply is sufficient. Always assume the worst case: all LED colors on at 100% brightness.

When powering LEDs from an external power supply, make sure the LEDs and the rest of the circuitry controlling the LEDs share the same voltage reference. The GND of the LEDs and the GND of your control circuit must be connected. Poor GND connections will cause LED flickering.

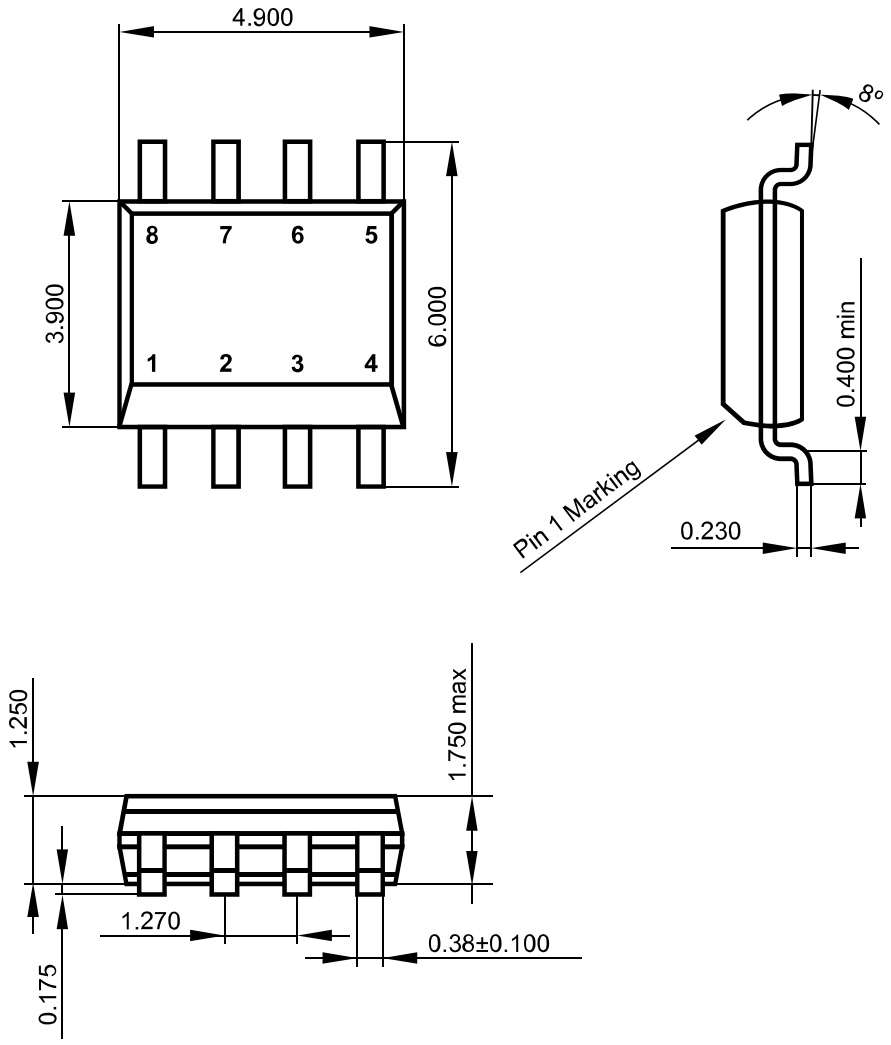
When the IS3751 and the first addressable LED are separated by more than 20 cm, add a 220 Ω to 470 Ω series resistor to the data line. This resistor protects the first LED from voltage spikes, reduces signal reflections, and helps ensure clean and reliable data transmission.

4.1 DMX Pinout

	DMX In (Male)	DMX Out (Female)	Pinout (Male and Female)
XLR-3			• Pin 1: Signal Common • Pin 2: Data – (B) • Pin 3: Data + (A)
XLR-5			

5 Mechanical

SO8N Package



Units: millimeters

Notes:
This drawing is for general information only.
Drawing not to scale.

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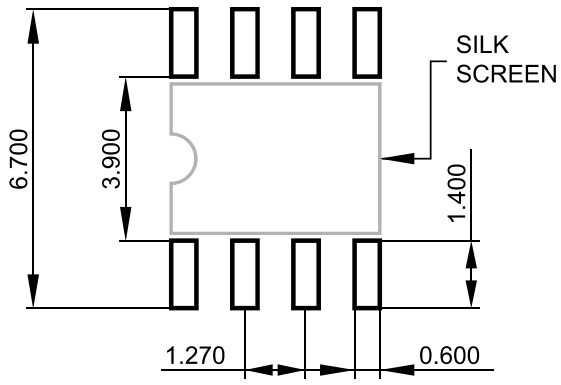
SO8N Recommended Footprint



Units: millimeters

Notes:
This drawing is for general information only.
Drawing not to scale.

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Content

Appendix

Revision History

Document Revision

Date	Revision Code	Description
October 2025	ISDOC143**B**	- Header title correction.
September 2025	ISDOC143**A**	- Initial Release

Chip Revision

Date	Revision Code	Description
September 2025	**0**	- Initial Release

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