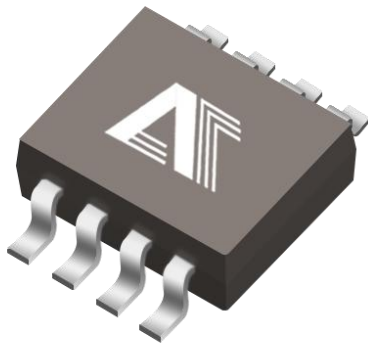




Comparator

LM393DR

Product Data Sheet

AOTE DCC
RELEASE

◆ Summary :

The LM393 is the dual comparator version, and the outputs can be connected to other open-collector outputs to achieve wired-AND relationships. It can operate from 3V to 36V, and have low power consuming 20 μ A(TYP)per channel.

The LM393 consist of two independent voltage comparators that are designed to operate from a single power supply over a wide range of voltages. Quiescent current is independent of the supply voltage. The device is the most cost-effective solutions for applications where low offset voltage, high supply voltage capability , low supply current, and space saving are the primary specifications in circuit design for portable consumer products.

The LM393 is available in Green SOIC-8 packages. It operates over an ambient temperature range of -40°C to +125°C.

◆ Product features

- Micro SIZE PACKAGES: SOIC-8(SOP8)
- Supply Range: +3V to +36V
- Low Supply Current 20 μ A (TYP)per channel at $V_S = 5V$
- Common-Mode Input Voltage Range Includes Ground
- Low Output Saturation Voltage
- Open-Drain Output for Maximum Flexibility
- SPECIFIED UP TO +125°C

◆ Applications

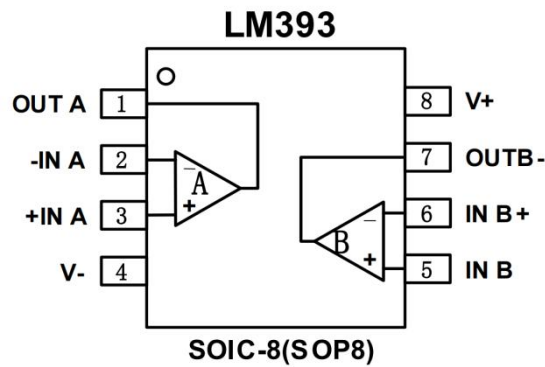
- Hysteresis Comparators
- Factory automation & control
- Industrial Equipment
- Test and Measurement
- Cordless power tool
- Vacuum robot
- Wireless Infrastructure

◆ Encapsulate information

Product Name	Package	Package size
LM393DR	SOIC-8(SOP8)	4.90mm×3.90mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

◆ **Pin definition and function:**



Pin description

Name	Pin	I/O(1)	Description
	SOIC-8(SOP8)		
OUTA	1	O	Output, channel A
-INA	2	I	Inverting input, channel A
+INA	3	I	Noninverting input, channel A
V-	4	P	Negative (lowest) power supply
+INB	5	I	Noninverting input, channel B
-INB	6	I	Inverting input, channel B
OUTB	7	O	Output, channel B
V+	8	P	Positive (highest) power supply

◆ **Absolute maximum rating** Within the natural ventilation temperature range (unless otherwise specified)

		Min	Max	Unit
Voltage	Supply, $V_S=(V^+)-(V^-)$		36	V
	Input pin (IN^+ , IN^-) ⁽²⁾	$(V^-)-0.3$	$(V^+)+0.3$	
	Signal output pin ⁽³⁾	$(V^-)-0.3$	$(V^+)+0.3$	
Current	Signal input pin(IN^+ , IN^-) ⁽²⁾	-10	10	mA
	Signal output pin (3)	-55	55	mA
	Output short-circuit ⁽⁴⁾	Continuous		
Temperature	Operating range, T_A	-40	125	°C
	Junction, T_J		150	
	Storage, T_{stg}	-65	150	

(1) Stresses above these ratings may cause permanent damage.Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.

(2) Input terminals are diode-clamped to the power-supply rails. Input signals that can swing more than 0.3V beyond the supply rails should be current- limited to 10mA or less.

(3) Output terminals are diode-clamped to the power-supply rails. Output signals that can swing more than 0.3V beyond the supply rails should be current- limited to $\pm 10mA$ or less.

(4) Short-circuit to ground, one amplifier per package.

◆ ESD Ratings

			Value	Unit
V _(ESD)	Electrostatic discharge	Human-body model (HBM),per ANSI/ESDA/JEDEC JS-001, all pins ⁽¹⁾	±2000	V
		Charged device model (CDM), per JEDEC specification JESD22 -C101, all pins ⁽²⁾	±1000	

(1) JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250V CDM allows safe manufacturing with a standard ESD control process.

◆ Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

		Min	Nom	Max	Unit
Supply voltage, V _S = (V+) -(V-)	Single-supply	3		36	V
	Dual-supply	±1.5		±18	

◆ Thermal Information

Thermal metric		LM393	Unit
		8Pins	
		SOIC-8(SOP-8)	
R _{θJA}	Junction-to-ambient thermal resistance	116	°C/W
R _{θJC(top)}	Junction-to-case(top) thermal resistance	60	
R _{θJB}	Junction-to-board thermal resistance	56	
Ψ _{JT}	Junction-to-top characterization parameter	12.8	
Ψ _{JB}	Junction-to-board characterization parameter	98.3	
R _{θJC(bot)}	Junction-to-case(bottom) thermal resistance	N/A	

◆ Package/ordering information

Orderable Device	Package Type	Pin	Channel	Op Temp(°C)	Device Marking ⁽¹⁾	Package Qty
LM393DR	SOIC-8(SOP8)	8	2	-40°C~85°C	LM393	Tape and Reel,4000

NOTE:

(1) There may be additional marking, which relates to the lot trace code information(data code and vendor code),the logo or the environmental category on the device.

◆ Electrical characteristics

(At $T_A = +25^\circ\text{C}$, $V_{CM} = (V_S/2)$, $V_S = 5\text{V}$, unless otherwise noted.)

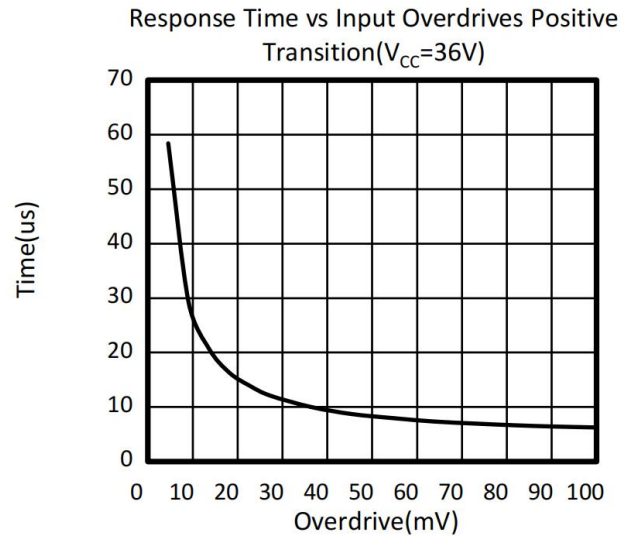
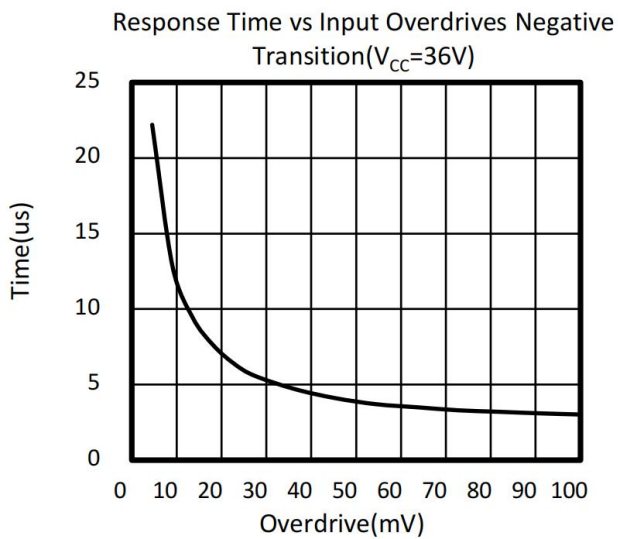
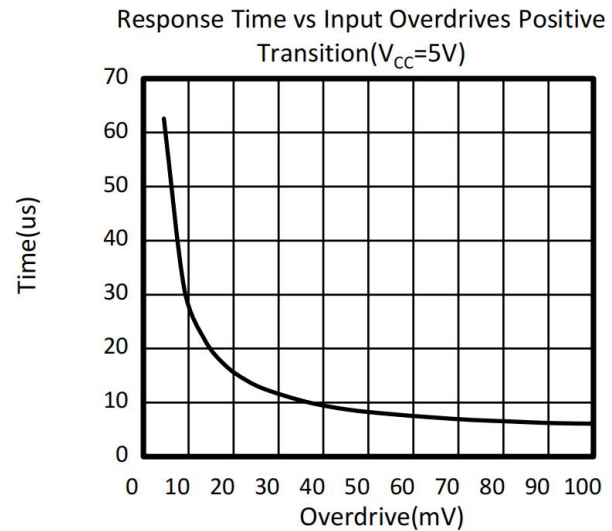
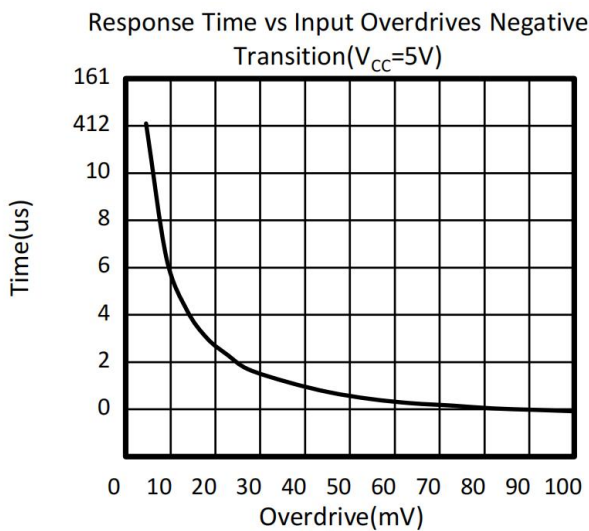
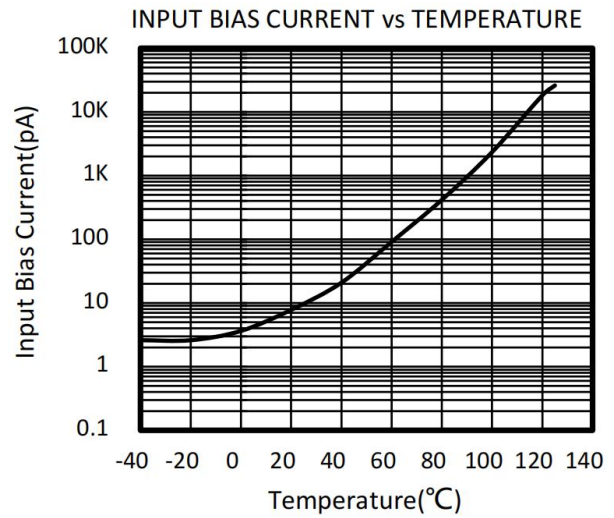
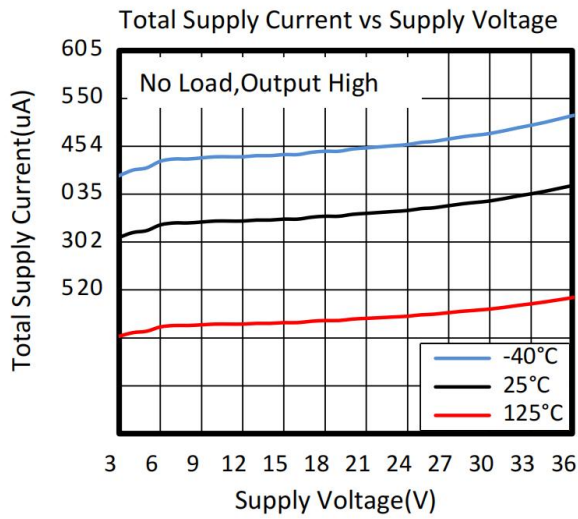
Parameter		Conditions	LM393			UNIT
			MIN	TYP	MAX	
V_S	Operating Voltage Range		3		36	V
I_Q	Quiescent Current	$V_S = 5\text{V}$, no load		40	80	μA
		$V_S = 36\text{V}$, no load, $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$		42	85	
V_{OS}	Input offset voltage	$V_S = 5\text{V}$ to 36V	-4.5	± 1	4.5	mV
		$V_S = 5\text{V}$ to 36V $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$	-5		5	
I_B	Input Bias Current	$T_A = 25^\circ\text{C}$		10	50	pA
		$T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$			100	nA
I_{OS}	Input Offset Current	$T_A = 25^\circ\text{C}$		10	50	pA
		$T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$			100	nA
V_{CM}	Common-Mode Voltage Range	$V_S = 3\text{V}$ to 36V	(V-)		(V+)-1.5	V
		$V_S = 3\text{V}$ to 36V $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$	(V-)		(V+)-2.0	
AV_D	Large signal differential voltage amplification	15V , $V_O = 1.4\text{V}$ $R_L \geq$ to 11.4V (V+) 15k to	50	200		V/mV
V_{OL}	Low-Level output voltage	$I_{sink} \leq 4\text{mA}$, $V_{ID} = -1\text{V}$		210	300	mV
I_{OL}	Output Current(sinking)	$V_O = 1.5\text{V}$; $V_{ID} = -1\text{V}$; $V_S = 5\text{V}$		27		mA
I_{LEAK}	High-Level Output Leakage Current	(V+)= $V_O = 5\text{V}$; $V_{ID} = 1\text{V}$		2	20	nA
		(V+)= $V_O = 36\text{V}$; $V_{ID} = 1\text{V}$		4	50	nA

◆ Switching Characteristics

Parameter			Conditions	LM393			Unit
				Min	Typ	Max	
T _{PHL}	Propagation Delay H To L	V _s =5V	R _{PU} =5.1K Ω , Overdrive =10mV		7.8		us
			R _{PU} =5.1K Ω , Overdrive =100mV		2.0		
		V _s =36V	R _{PU} =5.1K Ω , Overdrive =10mV		11.5		
			R _{PU} =5.1K Ω , Overdrive =100mV		3.0		
T _{PLH}	Propagation Delay L To H	V _s =5V	R _{PU} =5.1K Ω , Overdrive =10mV		28		
			R _{PU} =5.1K Ω , Overdrive =100mV		6.1		
		V _s =36V	R _{PU} =5.1K Ω , Overdrive =10mV		29		
			R _{PU} =5.1K Ω , Overdrive =100mV		7.1		

◆ Typical Characteristics

At $T_A = +25^\circ\text{C}$, $V_S = 5\text{V}$, $R_{\text{PULLUP}} = 5.1\text{K}$, $V_{\text{CM}} = V_S/2$, $C_L = 15\text{pF}$, $V_{\text{OVERDRIVE}} = 100\text{mV}$, unless otherwise noted.



◆ Detailed Description

Overview

The LM393 family of comparators can operate up to 36V on the supply pin. This standard device has proven ubiquity and versatility across a wide range of applications. This is due to its low power and high speed. The open-drain output allows the user to configure the output's logic low voltage (VOL) and can be utilized to enable the comparator to be used in AND functionality.

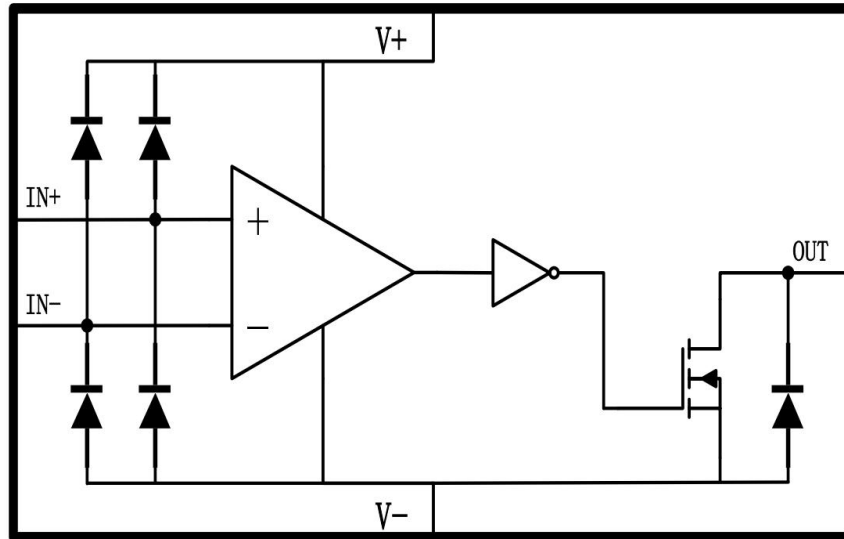


Figure 1. Functional Block Diagram

◆ Application and Implementation

Application Information

LM393 is typically used to compare a single signal to a reference or two signals against each other. Many users take advantage of the open drain output (logic high with pull-up) to drive the comparison logic output to a logic voltage level to an MCU or logic device. The wide supply range and high voltage capability makes this comparator optimal for level shifting to a higher or lower voltage.

Typical Application

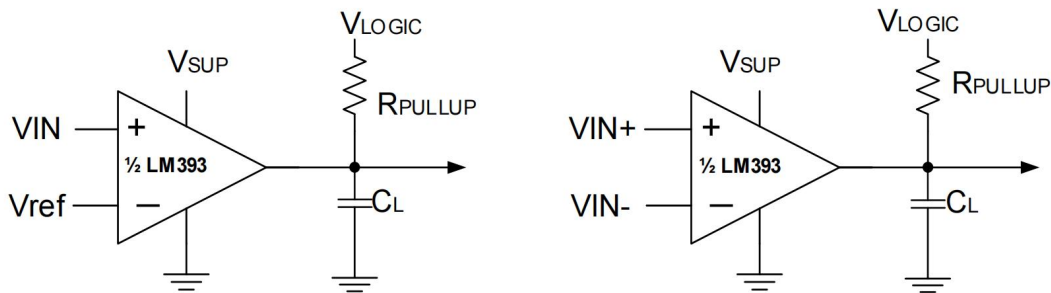


Figure 2. Single-Ended and Differential Comparator Configurations

Detailed Design Procedure

When using the device in a general comparator application, determine the following:

- Input Voltage Range
- Minimum Overdrive Voltage
- Output and Drive Current
- Response Time

Input Voltage Range

When choosing the input voltage range, the input common mode voltage range (V_{ICR}) must be taken into account. If temperature operation is below 25°C the V_{ICR} can range from 0V to $V_{CC} - 2.0$ V. This limits the input voltage range to as high as $V_{CC} - 2.0$ V and as low as 0 V. Operation outside of this range can yield incorrect comparisons.

◆ Layout

Layout Guidelines

For accurate comparator applications without hysteresis it is important maintain a stable power supply with minimized noise and glitches. To achieve this, it is best to add a bypass capacitor between the supply voltage and ground. This should be implemented on the positive power supply and negative supply (if available). If a negative supply is not being used, do not put a capacitor between the IC's GND pin and system ground.

Minimize coupling between outputs and inverting inputs to prevent output oscillations. Do not run output and inverting input traces in parallel unless there is a VCC or GND trace between output and inverting input traces to reduce coupling. When series resistance is added to inputs, place resistor close to the device.

Layout Example

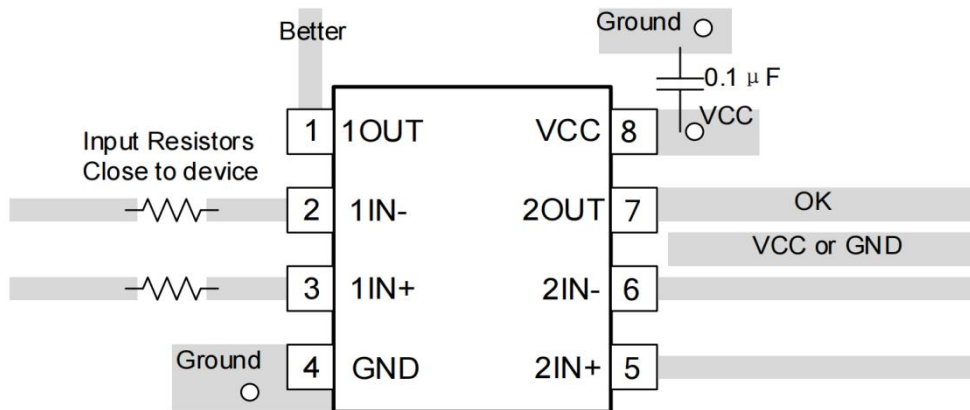
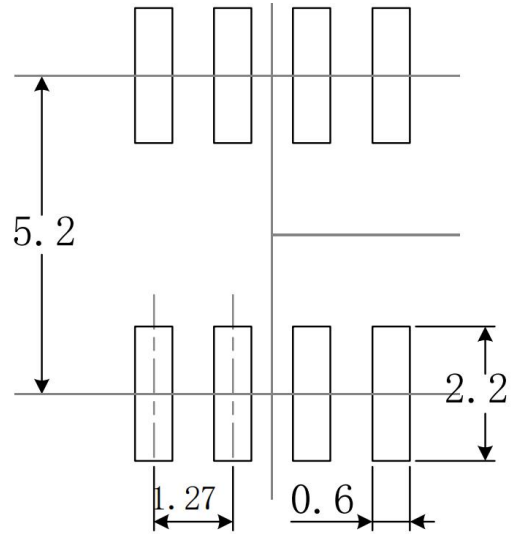
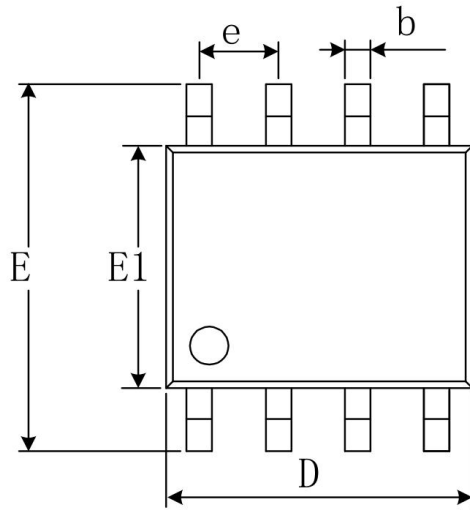


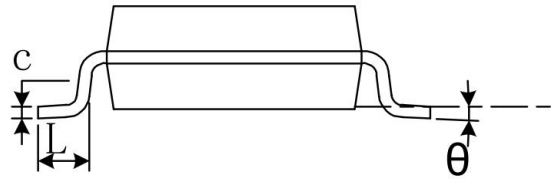
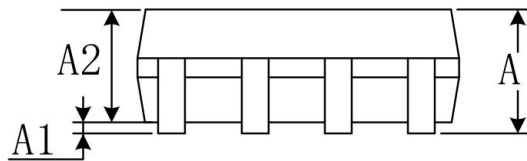
Figure 3. LM393 Layout Example

PACKAGE OUTLINE DIMENSIONS

SOIC-8(SOP8)



RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions (in millimeters)		Dimensions (in inches)	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.800	5.000	0.189	0.197
e	1.270(BSC)		0.050(BSC)	
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

◆ Attention

- AOTE implements dynamic technical updates. Specifications are subject to change. Refer to the official website for the latest version.
- Users must strictly adhere to specified conditions. Failures caused by misuse (overload, high temperature, incompatible circuits) are excluded from warranty.
- Contact technical support for customized validation in critical applications (medical devices, industrial control).
- This document is valid until December 31, 2026. Updates will be notified on the official website.
- For further clarification on technical specifications or application solutions, please contact us through official channels: