

2-Pin Digital Temperature Sensor with Pulse Count Interface

1 Features

- Alternative to the NTC thermistor
- Accuracy: $\pm 1.0^{\circ}\text{C}$ (-40°C to $+125^{\circ}\text{C}$)
- Supply voltage: 1.4V to 5.5V
- Operating temperature: -50°C to $+150^{\circ}\text{C}$
- Quiescent current: 30 μA (typical)
- Resolution: 12-bits (0.0625°C)
- Digital output: Pulse Count

2 Applications

- Digital Output Wired Probes
- Consumer Electronics
- White Goods
- Industrial Controls

3 Description

GD30TS0011 is a fully integrated digital temperature sensor, which can achieve 12-bit (0.0625°C) temperature output without any external temperature sensing unit.

The GD30TS0011 comes in the DFN-2 and TO-92S/TO-92S-2 packages, making it a direct replacement for the NTC thermistor and much easier to use.

The GD30TS0011 supports one-line pulse counting communication. Only a single signal line is needed to complete the chip power supply and communication output function at the same time.

Device Information¹

PART NUMBER	PACKAGE	BODY SIZE (NOM)
GD30TS0011	DFN-2	1.60 mm \times 0.80 mm
	TO-92S	4.00 mm \times 3.15 mm
	TO-92S-2	4.00 mm \times 3.15 mm

1. For packaging details, see [Package Information](#) section.

Simplified Application Schematic

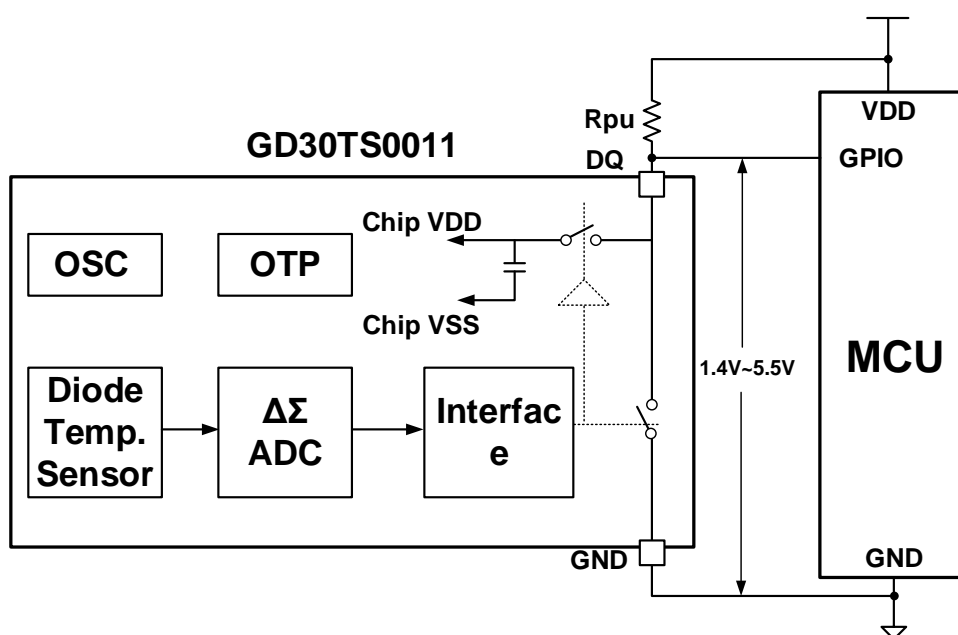


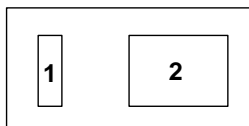
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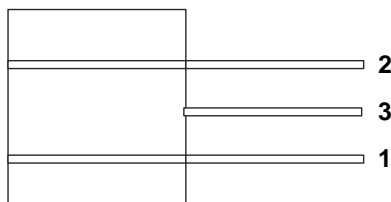
4 Pin Configuration and Functions

4.1 Pinout and Pin Assignment

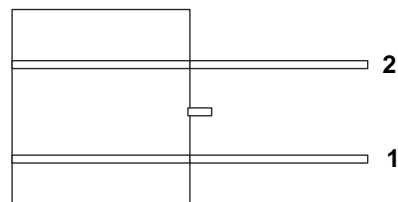
**DFN-2
Bottom View**



**TO-92S
Front View**



**TO-92S-2
Front View**



4.2 Pin Functions

NAME	PINS			PIN TYPE ¹	FUNCTION
	DFN-2	TO-92S	TO-92S-2		
DQ	1	1	1	O	Positive voltage pin.
GND	2	2	2	G	Negative voltage pin.
NC		3			No connection.

1. G = Ground, O = Output.

5 Parameter Information

5.1 Absolute Maximum Ratings

PARAMETER	MIN	MAX	UNIT
DQ Voltage	-0.5	6	V
Operating Temperature	-55	150	°C
Junction Temperature		150	°C
Storage Temperature	-60	150	°C

- Over operating free-air temperature range (unless otherwise noted). Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device.

5.2 Recommended Operation Conditions

SYMBOL ¹	PARAMETER	MIN	TYP	MAX	UNIT
V _{DQ}	Operating voltage	1.4	3.3	5.5	V
T _A	Operating Temperature	-50		150	°C

- Unless otherwise noted, the specifications in the above table apply within the atmospheric temperature range.

5.3 Electrical Sensitivity

SYMBOL	CONDITIONS	VALUE	UNIT
Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001-2017	±5000	V
Latch-up	Latch-up (LU), per JESD 78F (2022)	±200	mA

5.4 Electrical Characteristics

At T_A = -0°C to +125°C and V₊ = 1.4V to 5.5V, unless otherwise noted. Typical values at T_A = 25°C and V₊ = 3.3V.

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
V _{DQ}	Operating Voltage (DQ - GND)		1.4	3.3	5.5	V
T _A	Operating Temperature Range		-50		150	°C
T _{ACC}	Temperature Accuracy	-25°C to +55°C, 3.3V		±0.4	±0.6	°C
		-40°C to 125°C		±0.6	±1	
	Supply Voltage Sensitivity	-40°C to +125°C		0.0625	±0.25	°C/V
	Resolution			0.0625		°C
				12		Bits
t _{CONV}	Conversion Time			26	35	ms
I _Q	Quiescent Current	Conversion		30	45	µA
		Communication		1	5	
	Pull up/down Resistor	Conversion	0.5	3	10	kΩ

- The pull-up or pull-down resistors will affect the minimum supply voltage of the system. Taking the typical working current of 30uA as an example, when the pull-up resistor is 3kΩ, the pull-up power supply should not be less than 1.49V.

6 Functional Description

The GD30TS0011 has only two pins: DQ and GND. When DQ is high, the built-in energy storage capacitor is charged; when DQ is low, the capacitor provides temporary power for the internal circuit.

The GD30TS0011 performs temperature conversion and pulse communication alternately when powered on. The communication process is illustrated in Figure 1. During the conversion, the DQ bus remains high; during the communication, the DQ bus will transmit low pulses continuously. The number of pulses represents temperature information, and each pulse has a weight value of 0.0625°C. The final temperature measurement output can be calculated by the following Equation(1):

$$\text{Temp} = \text{Num} \times 0.0625^{\circ}\text{C} - 50.0625^{\circ}\text{C} \quad (1)$$

One pulse corresponds to a temperature less than -50°C while a pulse count of 3201 corresponds to a temperature greater than 150°C.

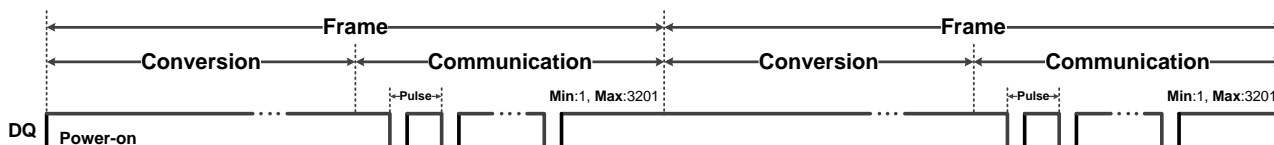


Figure 1. Communication Process

Table 1. Pulse Timing

PARAMETER	MIN	TYP	MAX	UNIT
frame period	42	60	78	ms
conversion period	20	28	36	ms
communication period	22	32	42	ms
single pulse high time	5.25	7.5	9.75	μs
single pulse low time	1.75	2.5	3.25	μs

Table 2. Temperature Data Format

TEMPERATURE (°C)	NUMBER of PULSES
-50	1
-20	481
0	801
30	1281
50	1601
100	2401
150	3201

7 Application Information

The following contents are notes and suggestions for the use of GD30TS0011 in specific applications. GD does not warrant its accuracy or completeness. Customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

7.1 Single-Device

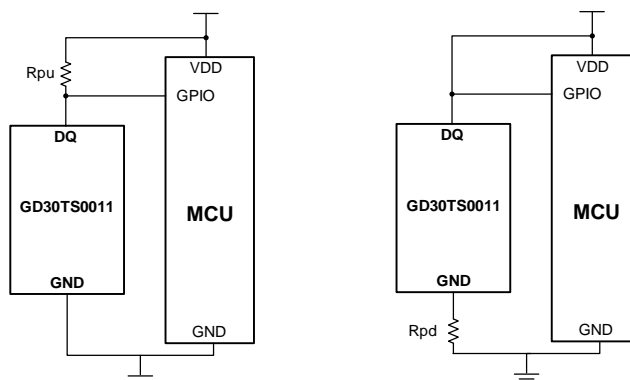


Figure 2. Single-Device: Pull-Up (Left), Pull-Down (Right)

GD30TS0011 supports two connection methods: pull-up connection and pull-down connection. The previous text adopts the pull-up connection method by default. It should be noted that when the pull-down connection is used, the pulse will be output from the GND pin, and the bus polarity is opposite to that of the pull-up connection. During the conversion, the GND pin remains low; during the communication, the GND pin will transmit high pulses continuously.

Only one GPIO is required in this application. Short-circuit the DQ and GND pins for more than 5ms to perform a power-down reset operation.

7.2 Single-Device (zero standby current)

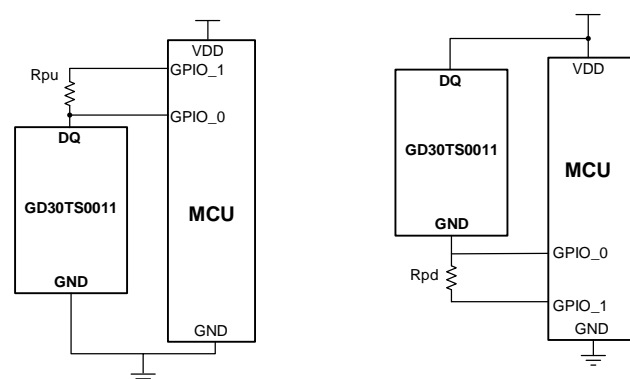


Figure 3. Single-Device (Zero Standby Current): Pull-Up (Left), Pull-Down (Right)

Only two GPIOs are needed in this application. The GPIO1 is used to enable and disable GD30TS0011. The GPIO0 is set to input mode for counting pulses. When the GPIO1 is pulled high (pulled low in pull-down connection), the GD30TS0011 is enabled and starts to work normally; when the GPIO1 is pulled low (pulled high in pull-down connection), the GD30TS0011 is turned off to achieve zero standby power consumption.

7.3 Multi-Devices

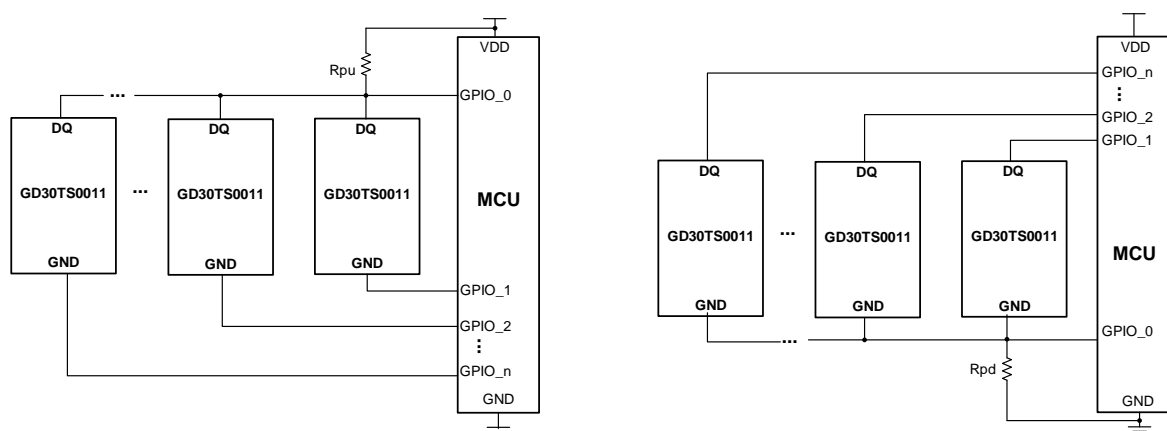
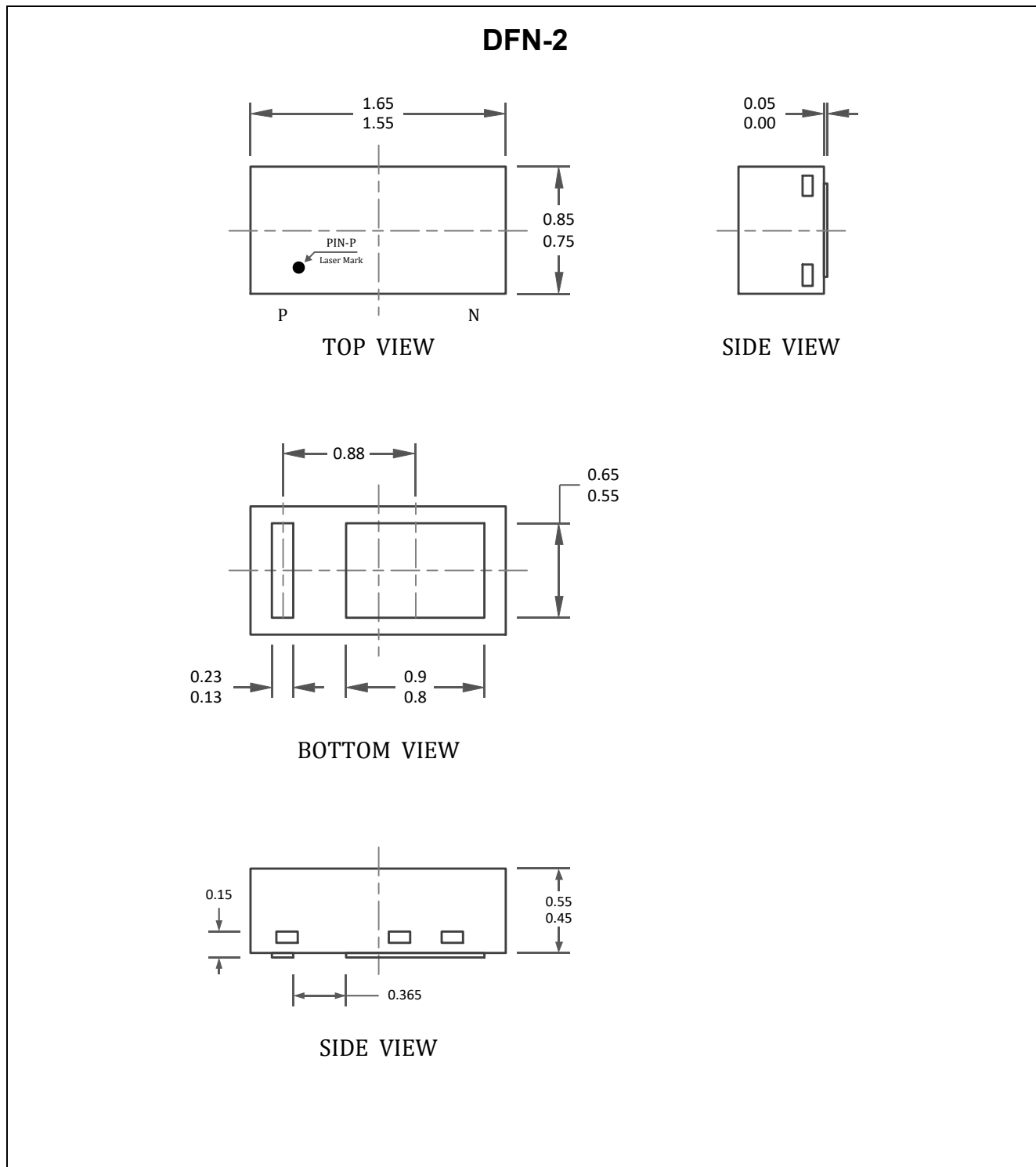


Figure 4. Multi-Devices: Pull-Up (Left), Pull-Down (Right)

The GPIO0 is shared by all devices as the count port. The GPIO1 to GPIO_n are used to enable and disable the corresponding device. The unused devices must be set to high-impedance or short-circuited. It should be noted that if more than one device is enabled at the same time, a data conflicts will occur at the GPIO0.

8 Package Information

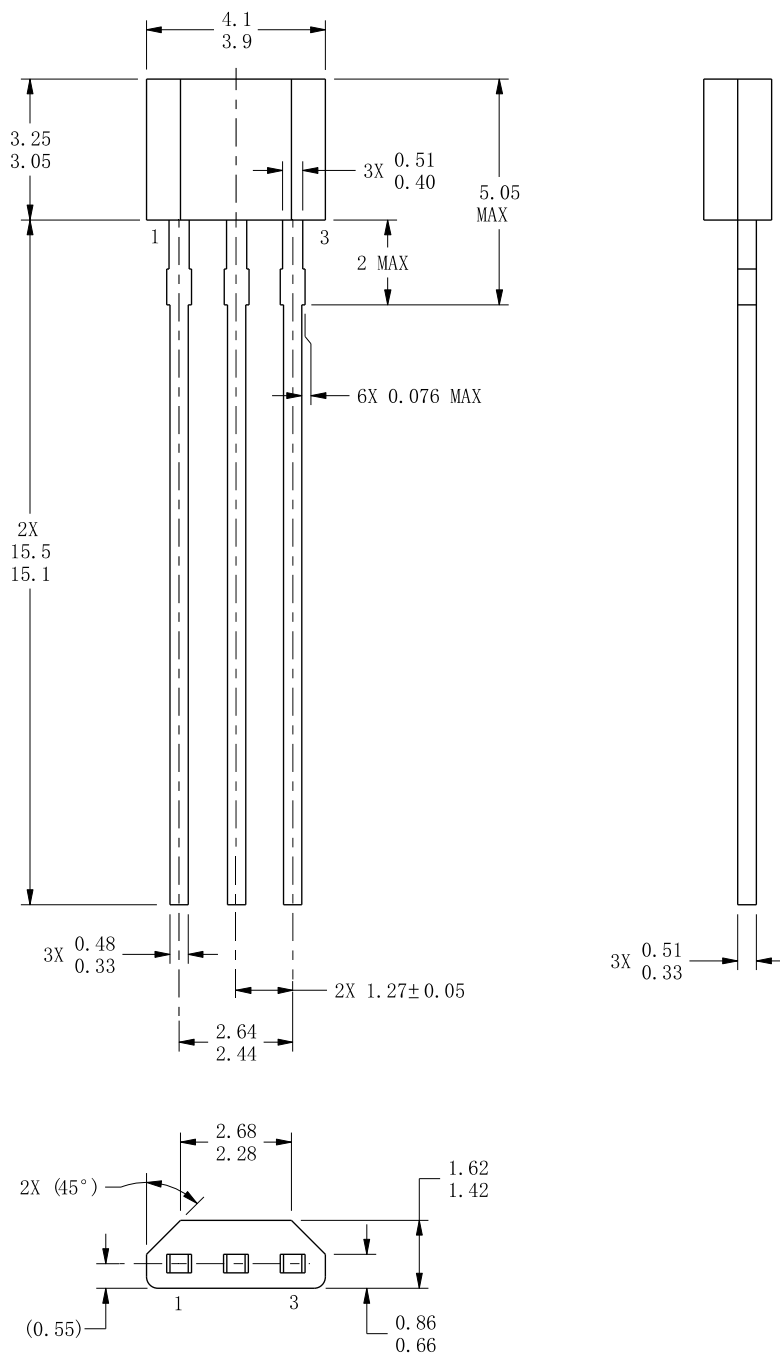
8.1 Outline Dimensions



NOTES:

1. All dimensions are in millimeters.
2. Package dimensions does not include mold flash, protrusions, or gate burrs.

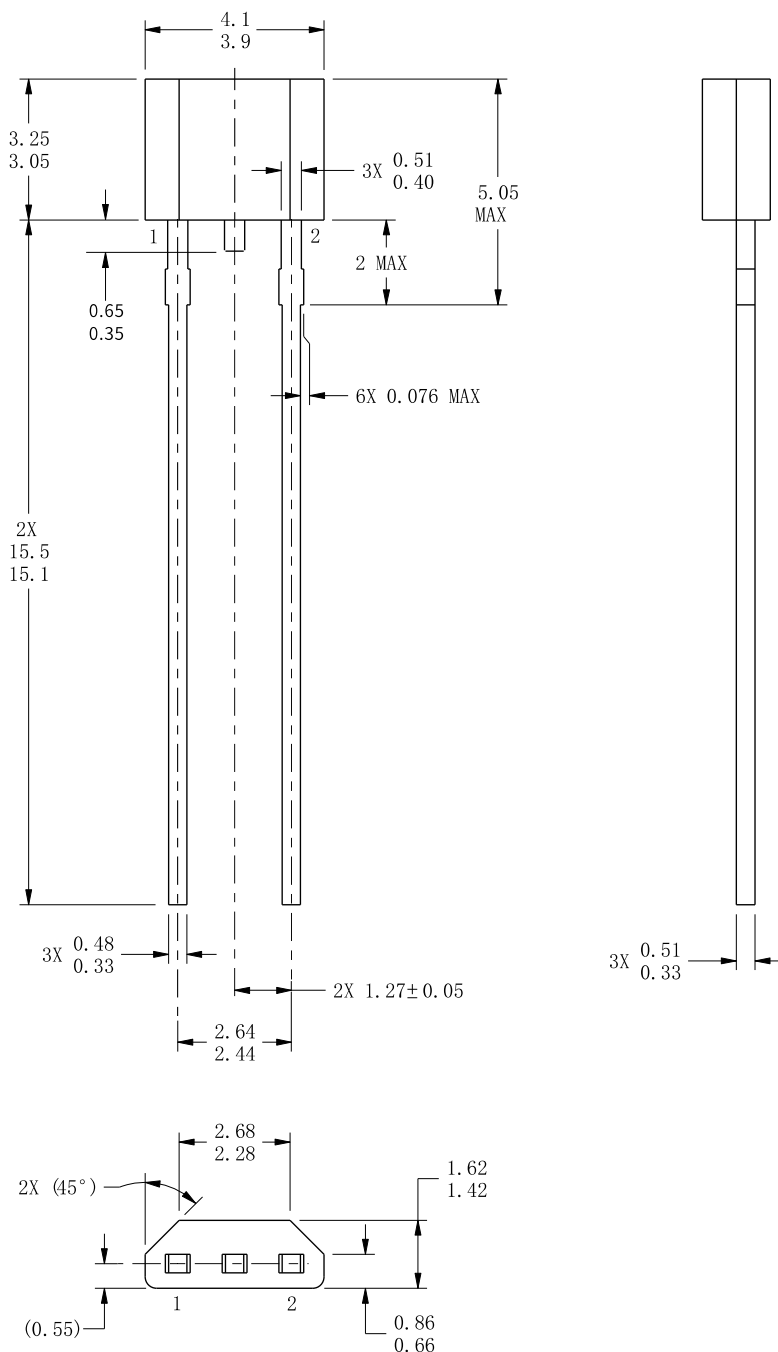
TO-92S



NOTES: (continued)

1. All dimensions are in millimeters.
2. Package dimensions does not include mold flash, protrusions, or gate burrs.

TO-92S-2



NOTES: (continued)

1. All dimensions are in millimeters.
2. Package dimensions does not include mold flash, protrusions, or gate burrs.

9 Ordering Information

Ordering Code	Package Type	ECO Plan	Packing Type	MOQ	OP Temp(°C)
GD30TS0011UETR-I	DFN-2	Green	Tape & Reel	4000	-50°C to +150°C
GD30TS0011BNBU-I	TO-92S	Green	Bulk	2000	-50°C to +150°C
GD30TS0011UNBU-I	TO-92S-2	Green	Bulk	2000	-50°C to +150°C

10 Revision History

REVISION NUMBER	DESCRIPTION	DATE
1.0	Initial release and device details	2024

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