

GX0011

2-Pin Digital Temperature Sensor With Pulse Count Interface

1 Features

- Alternative to the NTC thermistor
- Accuracy : $\pm 1.0^{\circ}\text{C}$ ($-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$)
- Supply Voltage : 1.4V ~ 5.5V
- Operating Temperature : $-50^{\circ}\text{C} \sim +150^{\circ}\text{C}$
- Quiescent current : 30uA (typ)
- Resolution : 12-bits (0.0625°C)
- Digital Output : Pulse Count

2 Applications

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

3 Description

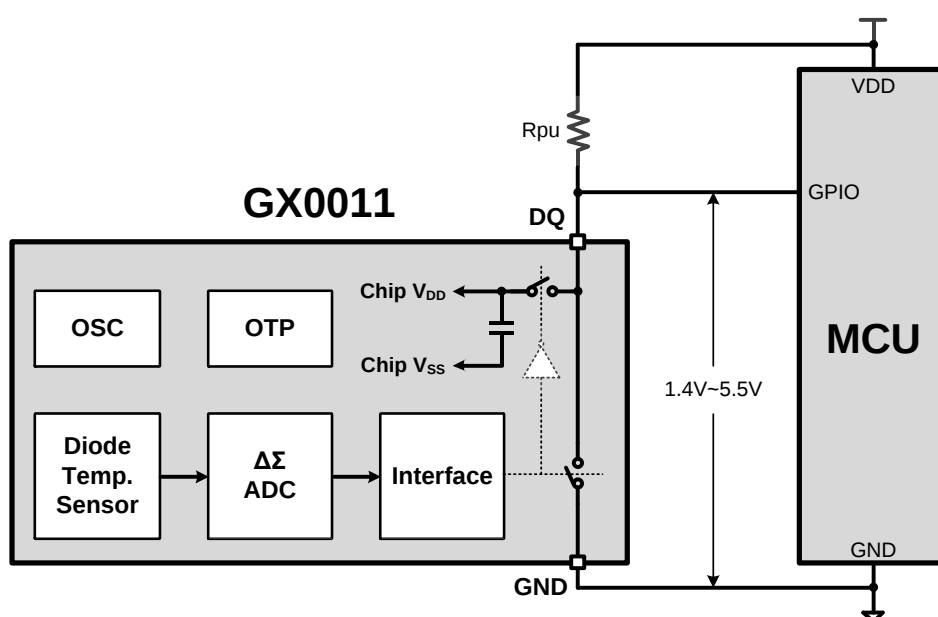
GX0011 is a fully integrated digital temperature sensor, which can achieve 12-bit (0.0625°C) temperature output without any external temperature sensing unit.

The GX0011 comes in the DFN-2 and TO-92S packages, making it a direct replacement for the NTC thermistor and much easier to use.

The GX0011 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 Information

Part Number	Package	Body Size (NOM)
GX0011D	DFN (2)	1.60 mm × 0.80 mm
GX0011S	TO-92S (3)	4.00 mm × 3.00 mm
GX0011WS	TO-92S-2 (2)	4.00 mm × 3.00 mm



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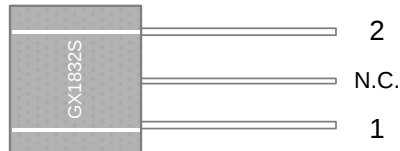
4 Pin Configuration and Functions

DFN-2



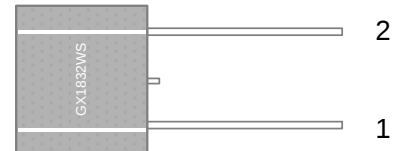
BOTTOM VIEW

TO-92S



FRONT VIEW

TO-92S-2



FRONT VIEW

Pin				Description
Name	DFN-2	TO-92S	TO-92S-2	
DQ	1	1	1	Positive voltage pin
GND	2	2	2	Negative voltage pin
N.C.	-	N.C.	-	No connection

5 Specifications

5.1 Absolute Maximum Ratings

	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 ESD Ratings

		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

5.3 Electrical Characteristics

At $T_A = -40^{\circ}\text{C} \sim +125^{\circ}\text{C}$ and $V_+ = 1.4\text{ V} \sim 5.5\text{ V}$, unless otherwise noted. Typical values at $T_A = 25^{\circ}\text{C}$ and $V_+ = 3.3\text{ V}$.

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

Note: 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 Detailed Description

The GX0011 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 GX0011 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 formula:

$$Temp = Num * 0.0625^{\circ}\text{C} - 50.0625^{\circ}\text{C}$$

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

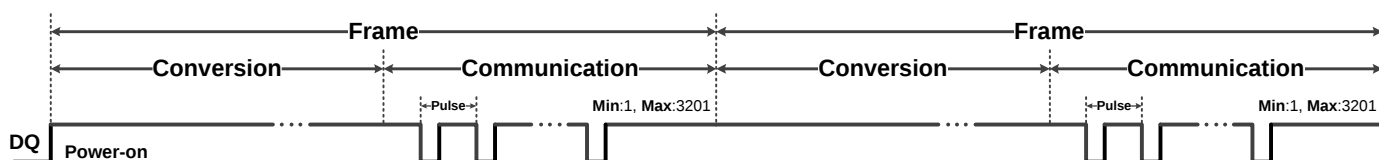


Table 1. Pulse Timing

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	us
single pulse low time	1.75	2.5	3.25	us

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 and Implementation

NOTE

The following contents are notes and suggestions for the use of GX0011 in specific applications. GXCAS 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.

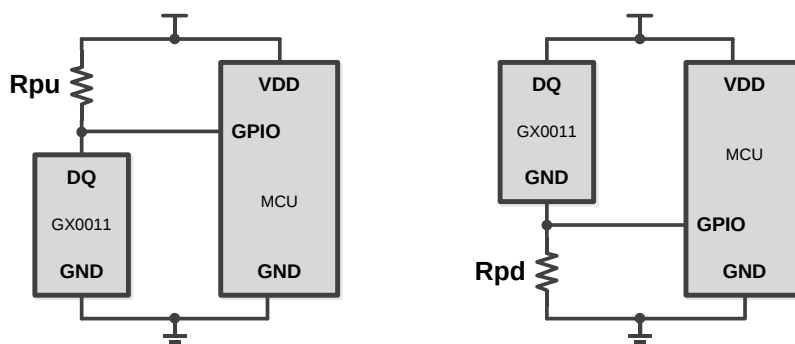


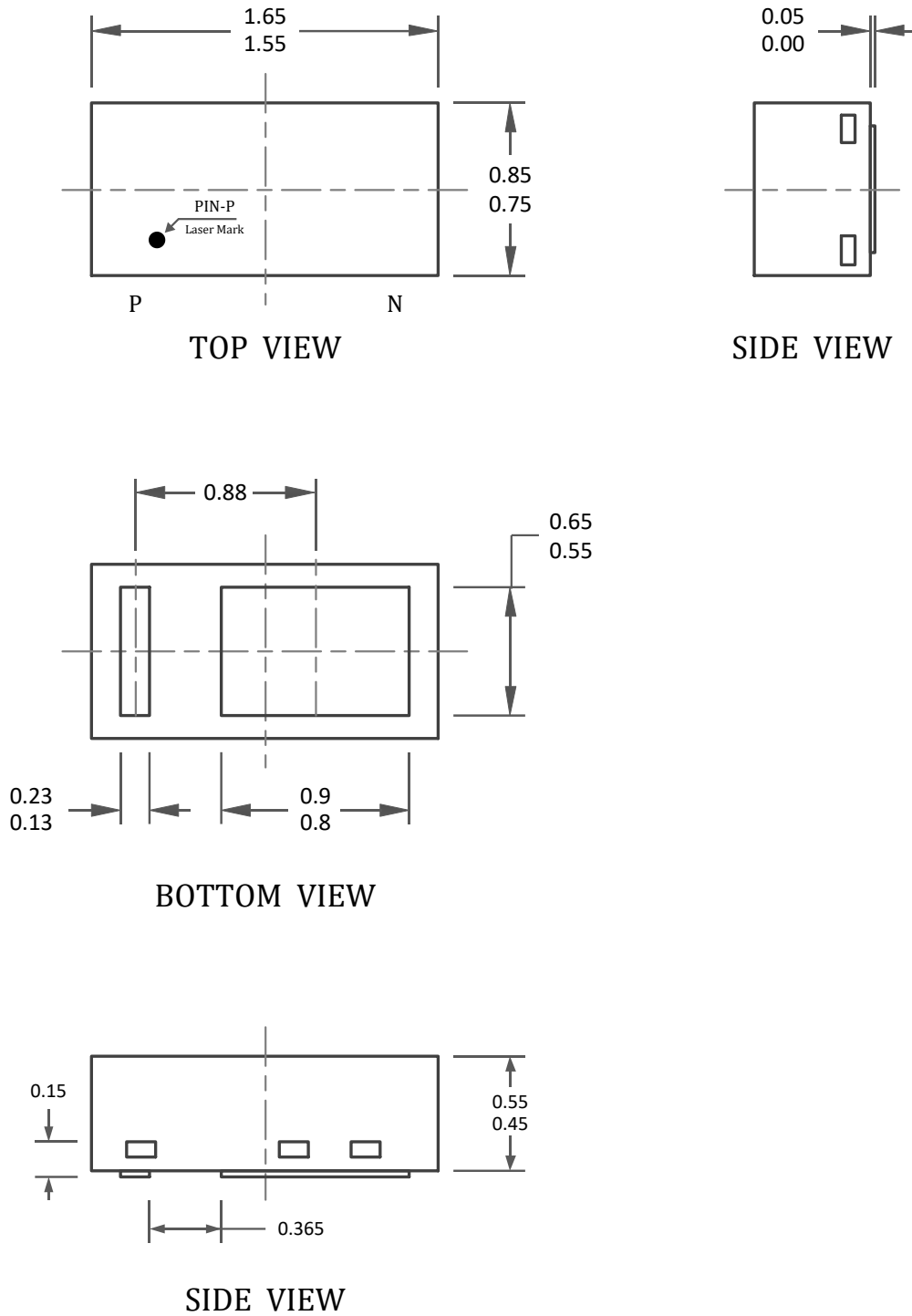
Figure 2 Single-Device : pull-up (left), pull-down (right)

GX0011 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.

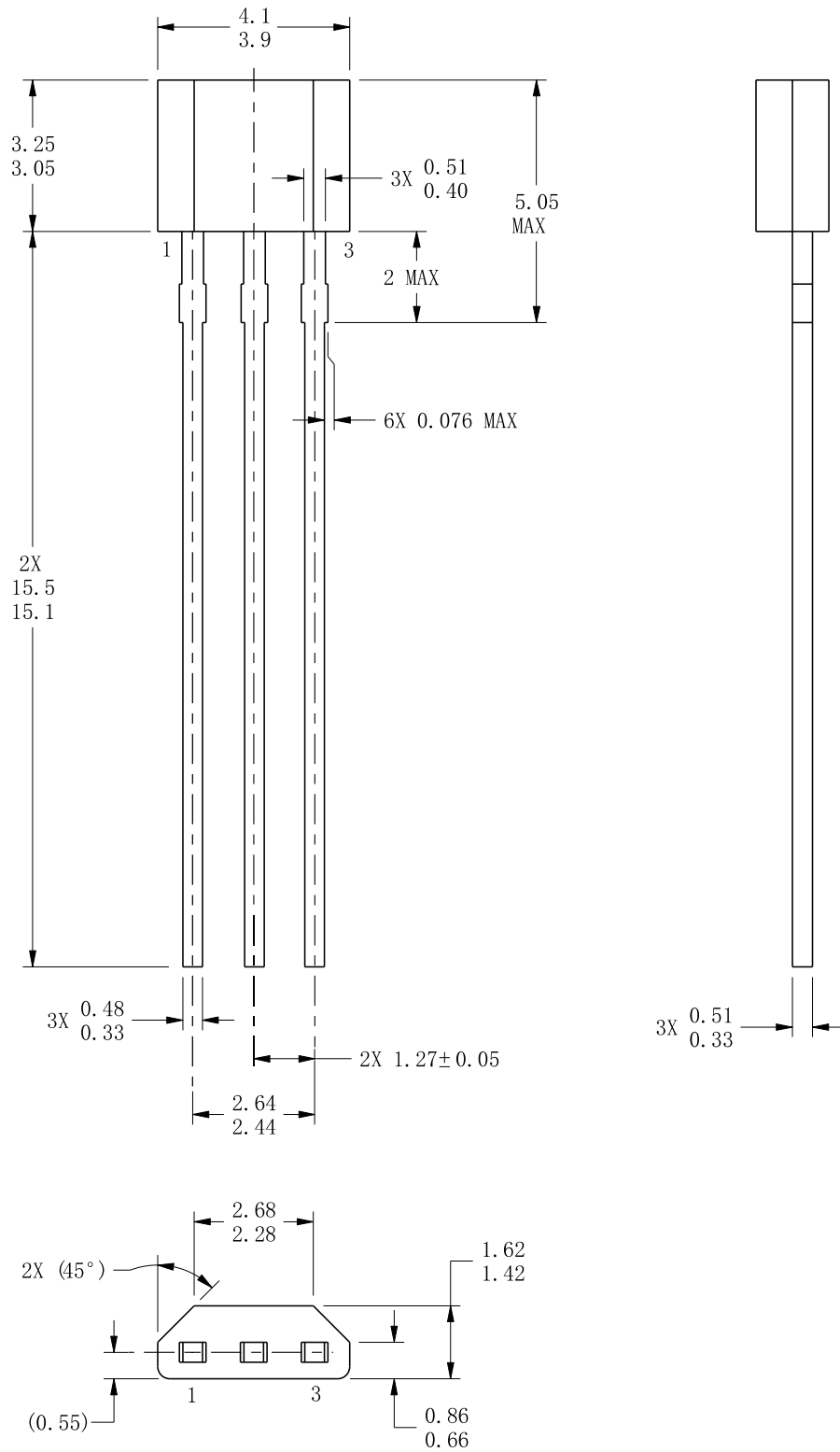
Only one GPIO is required in this application. Short-circuit the DQ and GND pins for more than 5ms to perform a power-down reset operation.

8 Package Information

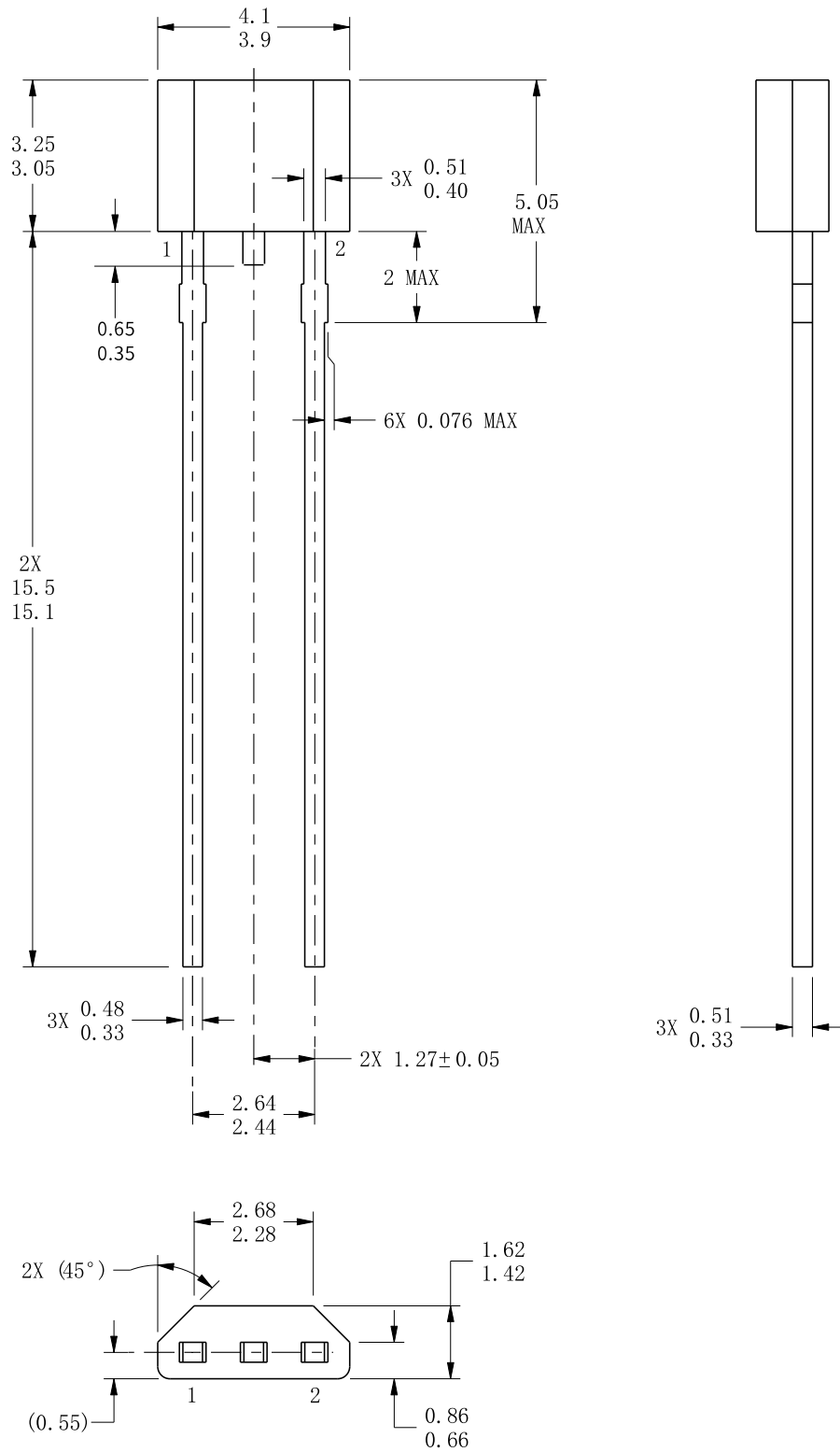
8.1 Package Outline (DFN-2)



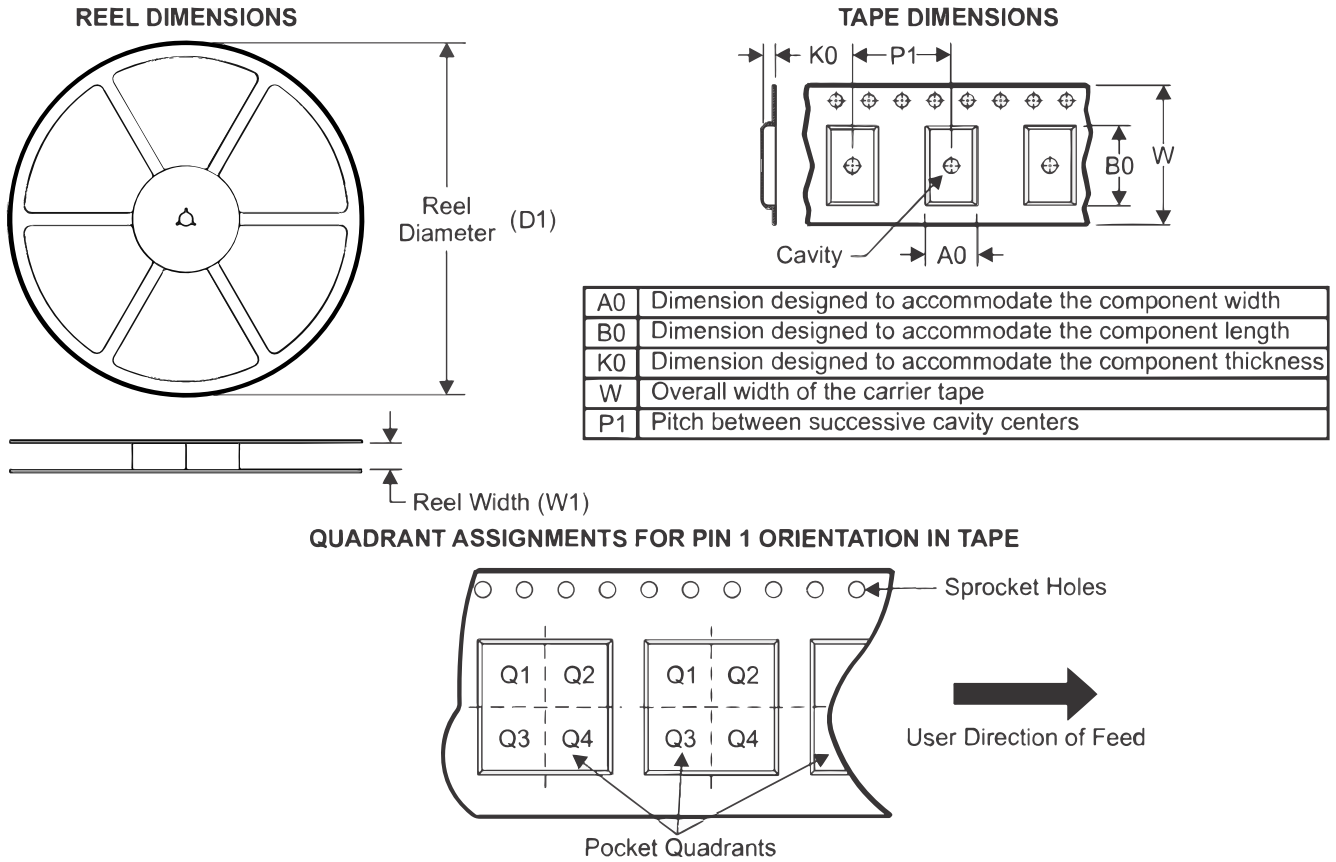
8.2 Package Outline (TO-92S)



8.3 Package Outline (TO-92S-2)



8.4 Tape and Reel Information



Package Type	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
DFN	180	8.6	1.00	1.80	0.62	4.00	8.00	Q1

Note : all of the above dimensions are in millimeters.

9 Order Information

Order PN	Device	Package	SPQ	Remark
GX0011D-T&R	GX0011D	DFN (2)	4000	tape and reel
GX0011S-Bu	GX0011S	TO-92S (3)	2000	bulk
GX0011WS-Bu	GX0011WS	TO-92S-2 (2)	2000	bulk