CPS135B-700D

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Data Sheet

Digital Barometer

CPS135B-700D

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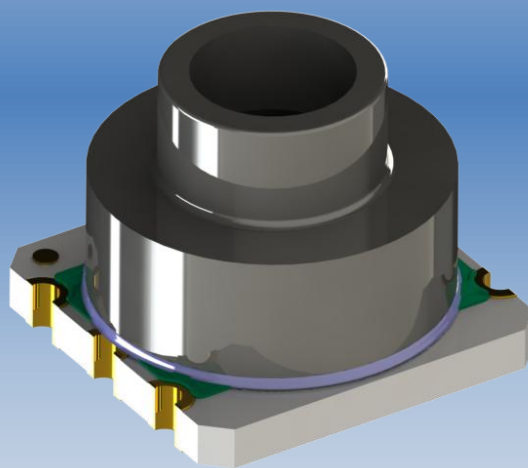
Overview

The CPS135B-700D SIP (System-in-a-Package) solution comprises of aresistive bridge type pressure sensor and a 24-bit ADC for high resolution and accurate pressure measurements. The fully calibrated pressure and temperature compensated digital output makes the CPS135B-700D solution simple to use.The CPS135B-700D comprises of an internal calibration logic that provides accurate pressure and temperature measurements to the application via I²C interface.There is no need to separately download internal calibration coefficients and have the host micro-controller conduct complicated compensation calculations.

Applications

- Altimeters
- Portable and Stationary Barometers
- Weather Stations
- GPS Applications
- Hard Disk Drives(HDD)
- Industrial Equipment
- Air Control Systems
- Vacuum Systems

Benefits

- Low Power Consumption. Excellent for Battery and Other Low-Power Applications
- External Clock not Required
- High Resistance to Sensing Media

Features

- Factory Calibrated Pressure and Temperature Sensor
- Supply Voltage: 2V to 5.5V(3V @typical)
- Current Consumption: <5uA(One Measurement)
- Sleep State Current: <200nA (25°C)
- Operating Temperature Range: -20°C to +85°C
- Pressure Accuracy: ±1.5kPa (±20.0mbar) @ 25°C
- Temperature Accuracy: ±1.0°C

Interfaces

- I²C™* Compatible (≤400kHz)

Physical Characteristics

- Small Form Factor, 4.5 x 4.5 x 3.5mm (w x l x h)
- SMD, 6 Lead
- Ceramic Substrate

*I²C ™ is a registered trademark of NXP
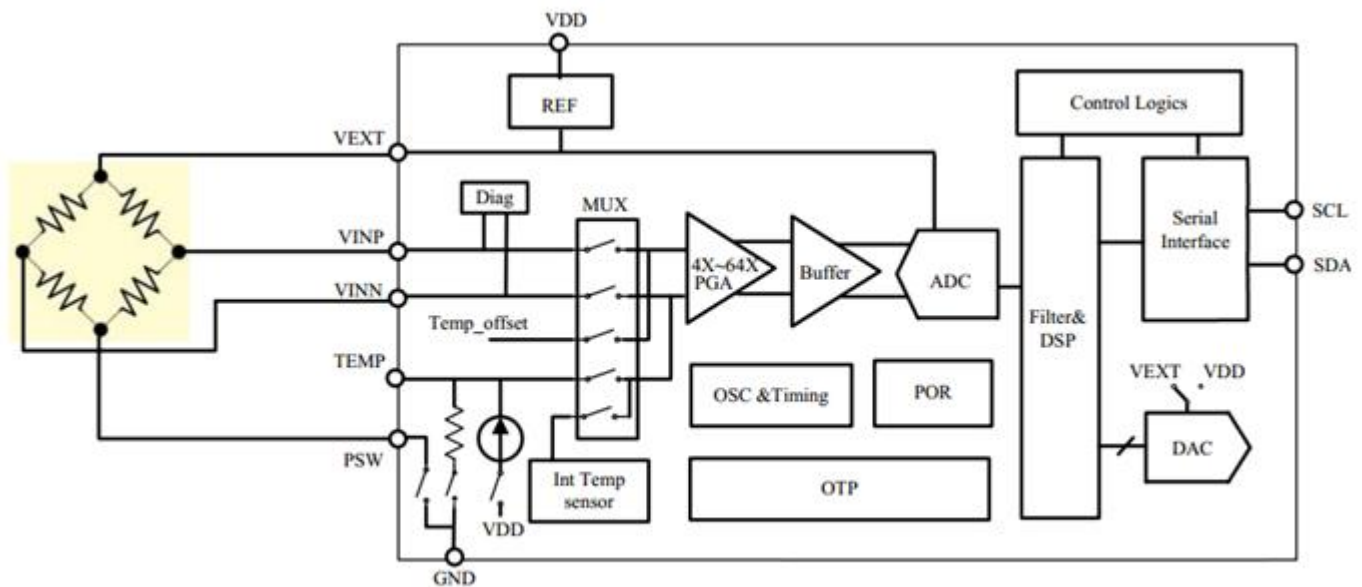
RoHS Compliant

CPS135B-700D BLOCK DIAGRAM

TABLE1:   ORDERING INFORMATION

PART NUMBER	OUTPUT MODE	OPERATION MODE	PACKAGE
CPS135B-700D	I²C	Sleep	6-Lead SMD
SALES and CONTACT INFORMATION sales@consensic.com			
			www.consensic.com
United States Consensic, Inc. 1900 Powell Street,Suite 600 Emeryville California, 94608, USA Ph: +1 510.588.8735	**China** Wuxi Consensic Electronics Co., Ltd. No.86,Dicui Road,B5Building, Fourth Floor,Room 401, Wuxi, Jiangsu Province, 214072 Ph: +86 510.85122279 Fax: +86 510.85122259	无锡康森斯克电子科技有限公司 无锡市滨湖区滴翠路 86 号太湖智谷科技园 北门 B5 栋 4 楼 401 室 邮编:214072 电话: +86 510.85122279 传真: +86 510.85122259	

CPS135B-700D
Digital Barometer

CONTENTS

LIST OF TABLES

LIST OF FIGURES

CPS135B-700D
Digital Barometer

1 OPERATING CHARACTERISTICS

1.1 ABSOLUTE RATINGS

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Over Pressure					2X FS	kPa (bar)
Supply Voltage (with respect to GND)	V_{DD}		-0.3		6.5	V
Voltages at Analog and Digital I/O Pins	V_{A_IO} V_{D_IO}		-0.3		V_{DD} +0.3	V
Storage Temperature	T_{STOR}		-60		150	°C

1.2 OPERATING CONDITIONS

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
PRESSURE SENSOR						
Range			50 (500)		700 (7000)	kPa (mbar)
Resolution[1]				0.01 (0.1)		kPa (mbar)
Accuracy		50 to 700kPa (-20°C to 0°C)	-2.5 (-25)	±2 (±20)	+2.5 (+25)	kPa (mbar)
		50 to 700kPa (0°C to 65°C)	-2 (-20)	±1.5 (±15)	+2 (+20)	kPa (mbar)
Solder Drifts				±2		kPa
Long-term stability				±2		kPa/yr
TEMPERATURE SENSOR						
Range			-20		85	°C
Resolution				0.003		°C
Accuracy		-20°C to 85°C	-1	±0.75	+1	°C
OPERATION						
Supply Voltage to GND[2]	V_{SUPPLY}		2	3.0	5.5	V
Operating Temperature Range			-20		85	°C
I²C Pull-Up Resistors	R_{PU}		1	2.2		kΩ

[1]Guaranteed by design of 24bits ADC, and calculated according to the range in application.

[2] Factory calibrated for Pressure and Temperature at 3.0V±10%. Output accuracy will be affected if used outside this range. Other ranges available upon request.

CPS135B-700D
Digital Barometer

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1.3 ELECTRICAL PARAMETERS

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
SUPPLY CURRENT						
Supply Current, average(1) during conversion(2) standby(no conversion)	Iavg Isc Iss	VDD=3V		3.95 1.5	0.2	µA mA uA
ANALOG TO DIGITAL CONVERTER						
Resolution	r_{ADC}				24	Bit
I²C Clock Frequency	$F_{C,I2C}$				400	kHz

Notes

1) Under the assumption of one conversion every second. Conversion means either a pressure or a temperature measurement

2) During conversion, the sensor will be switched on to VDD, and after conversion ended, the sensor will automatically be switched off from VDD.

2 OPERATION MODES

The CPS135B-700D is factory programmed to Sleep Mode. In this mode, the CPS135B-700D remains asleep until the master/host sends a measurement request (MR) before taking sensor measurements. After the CPS135B-700Dreceives an MR command, it wakes up, runs a full measurement cycle, stores the measurement data in internal registers and then returns to sleep mode again.

3 OUTPUT MODES

3.1 I²C Slave

Two-wire I²C is available for reading sensor measurement data from the CPS135B-700D.

The factory setting for the I²C slave address is 0x6D and the communication is restricted to this address only.

- I²C Address = 0x6D

DAT-0041, Rev1.0

3.2   I²C COMMANDS

Table 2 details the commands to interface with the device in the I²C mode.

TYPE	DESCRIPTION
Get Data (GD)	Retrieves the sensor measurement data from the internal CPS135B-700D registers*.
Measurement Request (MR)	Wakes up the CPS135B-700D, performs a sensor measurement, stores the sensor measurement data in internal registers and returns to sleep

*Note: GD does not initiate a new measurement. Repeated GD commands will return the same (or stale) sensor measurement data. An MR is required to perform a full sensor measurement cycle to refresh the sensor register data.

The Get Data (GD) command is used to read out data from the CPS135B-700D. With the start of communication (for I²C after reading the slave address) the entire sensor measurement output packet will be loaded in a serial output register. The register will be updated after the communication is finished. The output is always scaled to 24-bits.

The ordering of the bits is "big-endian".

3.2.1   I²C GET DATA

An I²C Get Data command starts with the 7-bit slave address and the 8th bit = 1 (READ). The device then sends acknowledge (ACK), indicating I²C communication success. The number of data bytes returned by the device is determined by the master, which controls NACK and stop conditions.

Figure 1 displays and example forsending three bytes followed by readingfive bytes. The first byte contains the I²C address followed by internal register address(0x06). Then theI²C address is repeated, followed by the slave sending out three pressure bytes and two temperature bytes.

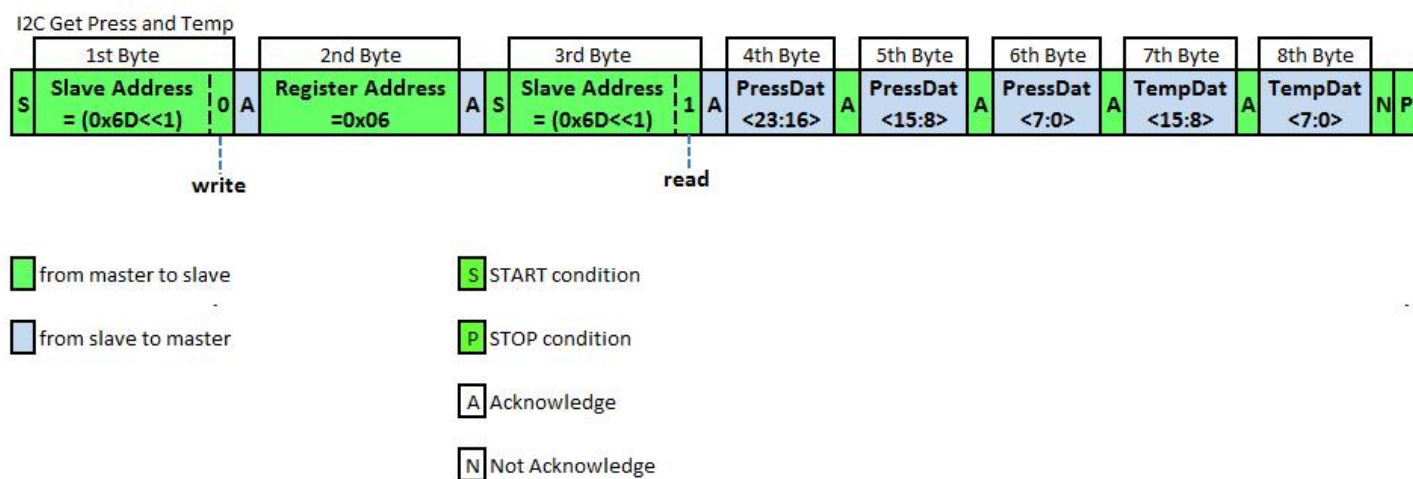**The GD command is used to retrieve the pressure and temperature sensor data after an MR command has been executed.**

FIGURE 1: 7-BIT SLAVE ADDRESS FOLLOWED BY THREE PRESSURE AND TWO TEMPERATURE BYTES

Note that the two temperature byte codes are formatted in 2's complement.

I2C Get Press and Temp

1st Byte			2nd Byte		3rd Byte			4th Byte	5th Byte	6th Byte	7th Byte	8th Byte		
S	Slave Address = (0x6D<<1)	0	A	Register Address =0x06	A	S	Slave Address = (0x6D<<1)	1	A	PressDat <23:16>	A	PressDat <15:8>	A	PressDat <7:0>	A	TempDat <15:8>	A	TempDat <7:0>	N	P

write   read

- [green] from master to slave
- [blue] from slave to master
- **S** START condition
- **P** STOP condition
- **A** Acknowledge
- **N** Not Acknowledge

FIGURE 2: 7-BIT SLAVE ADDRESS FOLLOWED BY THREE PRESSURE BYTES

For Pressure data only, the data stream can be terminated after the sixth pressure byte. See Figure 2 below.
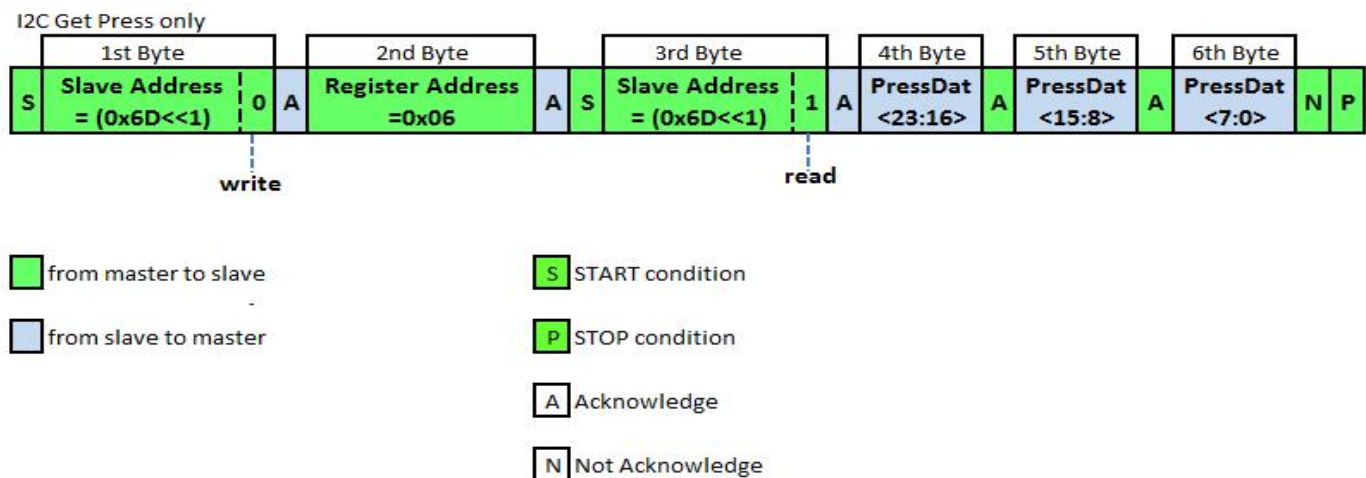
3.2.2   I²C MEASUREMENT REQUEST

The I²C MR is used to wake up the device from Sleep Mode and start a complete sensor measurement cycle, before the device returns to Sleep Mode again. The measurement cycles starts with apressure measurement followed by a temperature measurement. The sensor measurements are digitized and run through an onboard compensation algorithm before the final measurement values are written to the digital output register. As shown in Figure 3, the communication requires the slave address (0x6D) and a WRITE bit (0) to initiate the MR. This is followed by two bytes; register address (0x30) and measurement (0xA). After the CPS135B-700D responds with the slave ACK, the master terminates the communication with a stop condition.
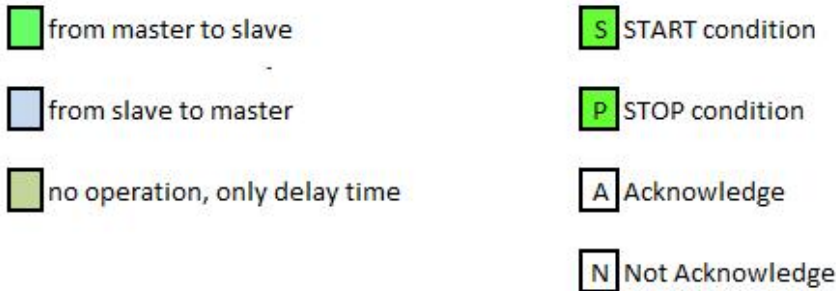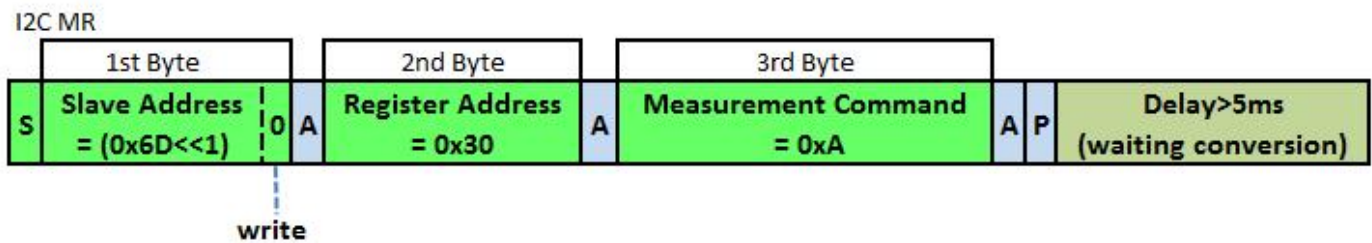
Sensor measurement conversion time takes approximately 5ms, so MRs should not be sent faster than every 5ms.

FIGURE 3: I²C MEASUREMENT REQUEST COMMAND (0xA)

4   CALCULATING OUTPUT

After retrieving the data, the compensated output can be scaledto real world values by following the equations below.

4.1   PRESSURE OUTPUT

An example of the 24-bit compensated pressure with a full scale range of 50 to 700kPa can be calculated as follows:

Pressure [kPa] = (Pressure 3rd Byte [23:16] x 65536+Pressure 2nd Byte [15:8] x 256 + Pressure1st Byte [7:0]) / 2^3/1000

4.2   TEMPERATURE OUTPUT

The 16-bit compensated temperature can be calculated as follows:

Positive Temperature [°C] = (Temperature High Byte [15:8] x 256 + Temperature Low Byte [7:0]) / 2^8

Negative Temperature [°C] = (Temperature High Byte [15:8] x 256 + Temperature Low Byte [7:0]-65536) / 2^8

DAT-0041, Rev1.0

CPS135B-700D
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5 PACKAGE AND ASSEMBLY

The CPS135B-700D is available in a 6-pin SMD package.
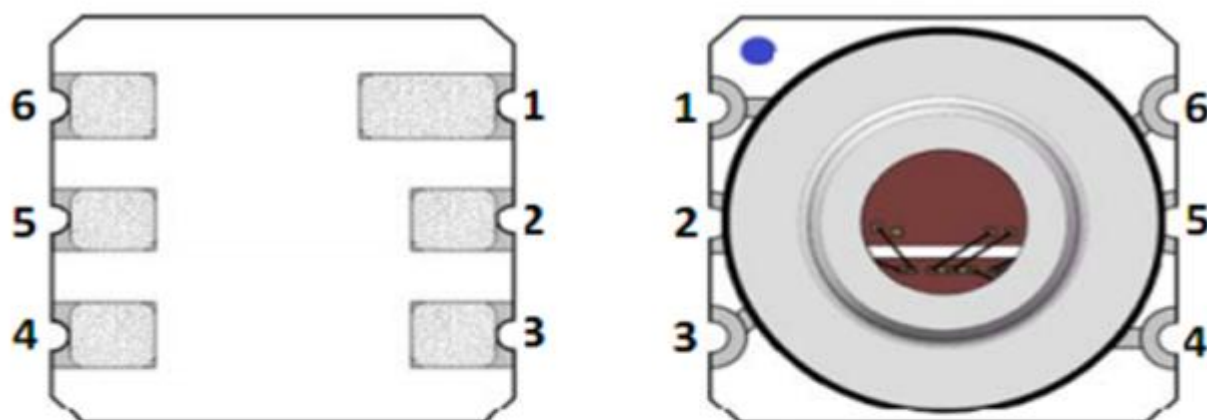
5.1 PIN ASSEMBLY AND MECHANICAL DRAWING

Figure 1. Pin Configuration

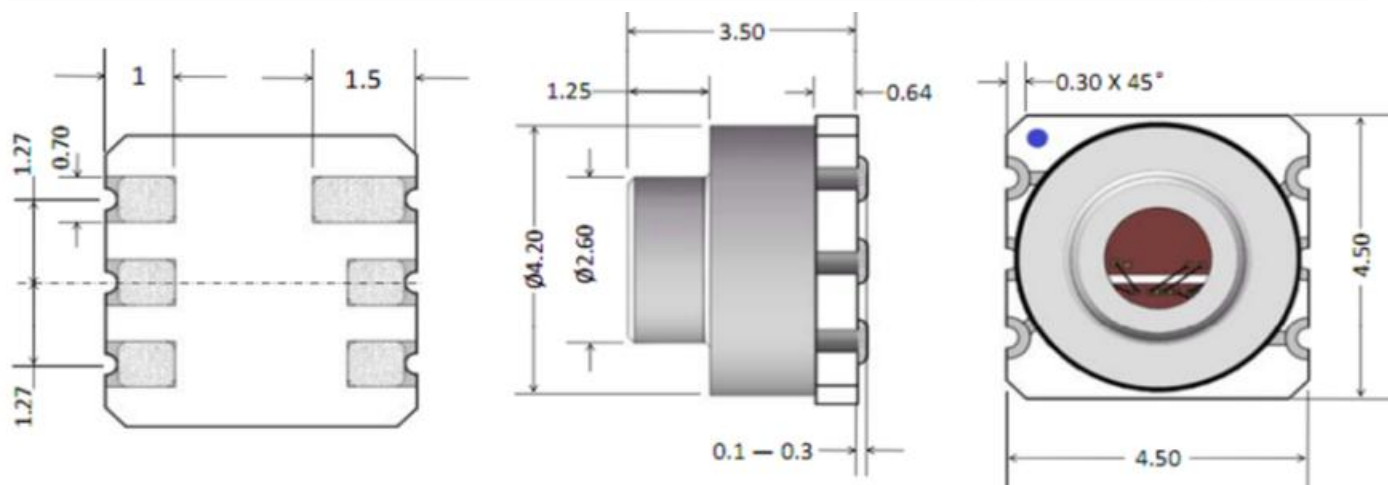| PIN	Name	Type	Function
1	VDD	P	Positive Supply Voltage
2	NC	---	---
3	SCL	I	Serial Data Clock
4	SDA	I/O	I^2C Data IO
5	NC	---	---
6	GND	P	Ground

Figure2. Package Outline

Note: 1. Dimensions in mm

2. Interpret Dim and tolerance per ASME Y14.5M-1994

3. Angular Dimensions ±0.3°

4. Hole Locations ±0.1

5. Linear Dimension ±0.04

6. Cap centering ±0.15 from center of ceramic

5.2   SOLDERING CONDITIONS
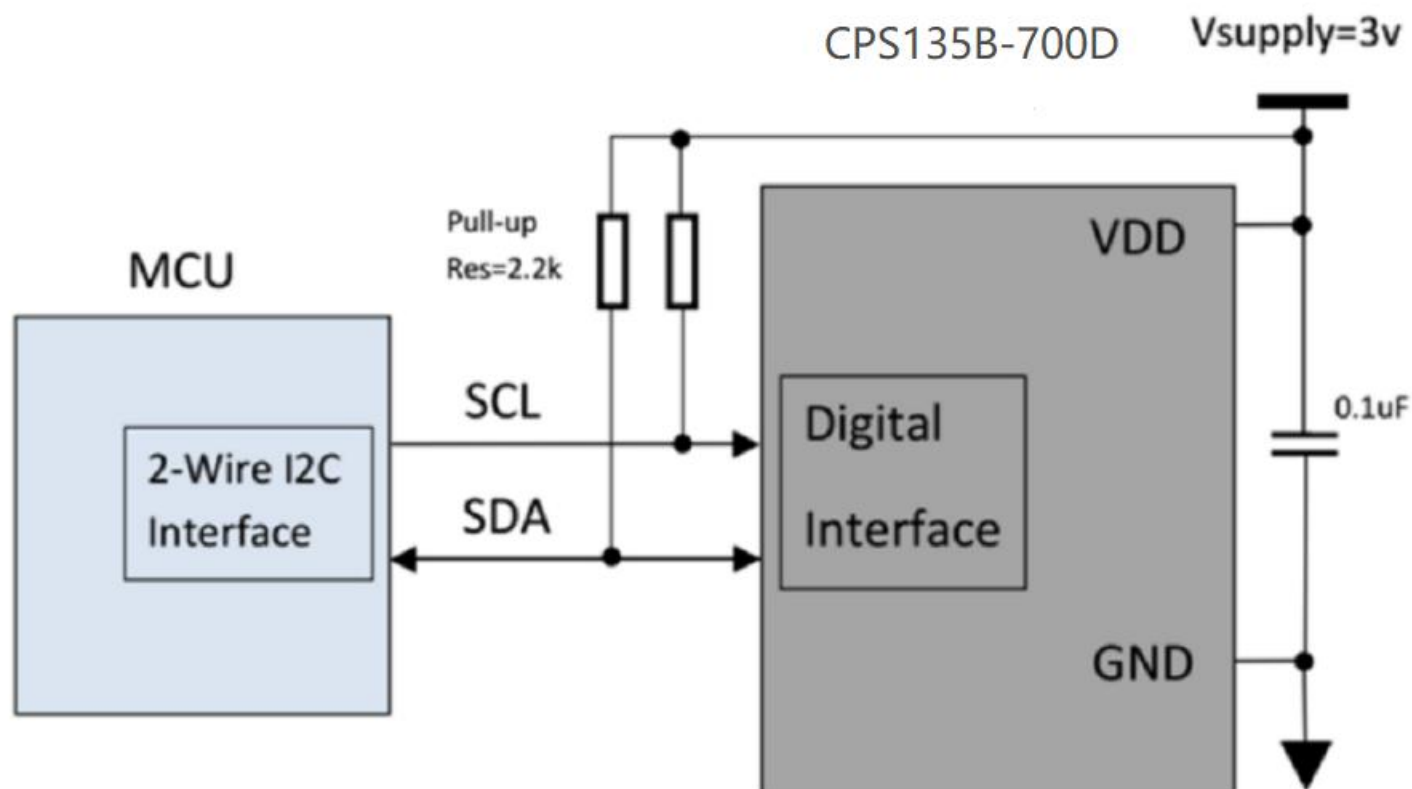
TABLE4:   PACKAGE REFLOW TEMPERATURE

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Soldering Peak Temperature	Less than 30 seconds (JEDEC-STD-020 Standard)			260	°C

6 APPLICATION DIAGRAM

7 DOCUMENT HISTORY

REVISION	DATE	DESCRIPTION
1.0	10-March-2022	Preliminary

8   DISCLAIMER

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