Application Note

NOVOSENSE

Automotive Bridge Sensor Conditioner Based on NSC9262

AN-12-0025

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ABSTRACT

The NSC9262 is a highly integrated and AEC-Q100 qualified IC for capacitive sensor conditioning. The NSC9262 integrates a C/V converter, a 24-bit capacitance measurement channel, a 24-bit temperature measurement channel and sensor calibration logic. With the calibration algorithm built in the internal MCU, the NSC9262 supports to compensate sensor offset, sensitivity, temperature drift up to 2nd order, and non-linearity up to the 3rd order. The calibration coefficients are stored in a 64-Byte EEPROM that can be programmed multiple times. The NSC9262 also supports Over-voltage and Reverse-voltage protection. The NSC9262 includes a serial digital LIN interface. During normal operation, it provides the read-out of the conditioned sensor signals, including primary signal measurement and the temperature measurement.

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1.Key Features

1.1.Introduction to the Stepping Principle

- Over-voltage and Reverse-voltage protection between -40V~40V
- Directly high voltage supply up to 18V through VDDHV pin
- C/V converter with at most ±16pF differential capacitor input
- 1X~8X ADC digital gain
- 24-bit ADC for primary signal measurement
- 24-bit ADC for temperature measurement
- Sensor connection fault detection supported
- Internal and external temperature sensor supported
- Sensor calibration algorithm embedded in a built-in MCU
- 64-Bytes EEPROM
- Special OWI interface
- LIN interface communication up to 20kbit/s
- Compliant with LIN Specifications 1.3, 2.0, 2.1 and 2.2
- RoHS-compliant package:SSOP16
- Qualified according to AEC-Q100
- Operation temperature: -40℃~150℃

2.Function

2.1.Power Modules

The power module block diagram is shown in the figure below.

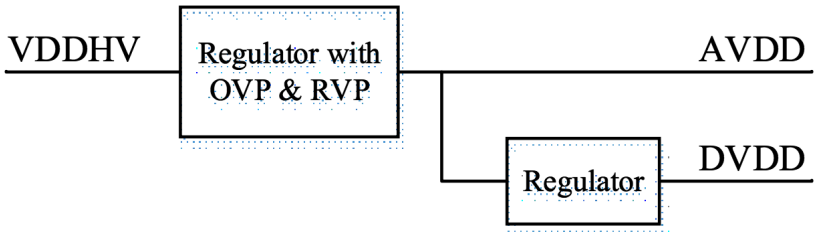

Figure 2.1 Power Block Diagram

VDDHV is the only power input pin with over voltage protection and reverse voltage protection. AVDD and DVDD are internally regulated after VDDHV power on. These two powers should not be used for other circuits. The decoupling capacitors for these two pins can be left reserved.

2.2.Sensor Excitation Module

The capacitor input pins can be used as differential connection or single end connection. The differential input capacitors' common plate is driven by the square wave at EXC pin. CINP and CINN connect to the other plate of those two capacitors of the capacitive sensor. If single end connection is used, connect the capacitor to CINP pin.

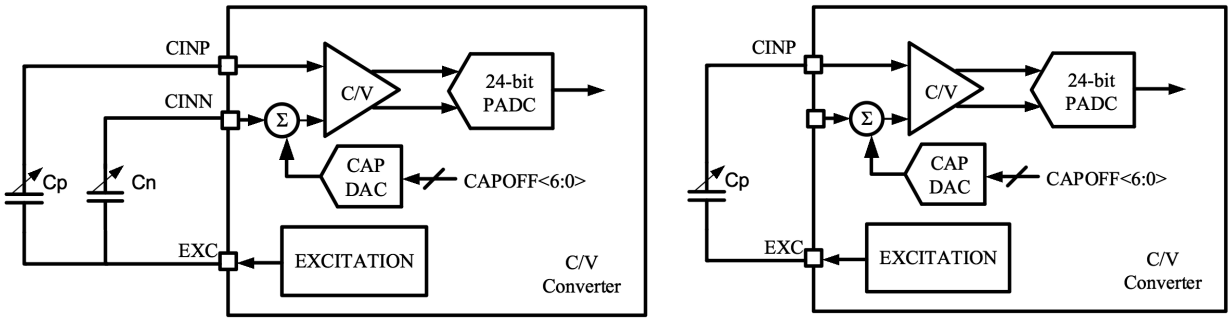

Figure 2.2 Capacitive Sensor Connection Diagram

2.3.LIN Interface

Please refer to LIN related application note provided by NOVOSENSE for more detailed information.

3.Application

3.1.Reference Schematic

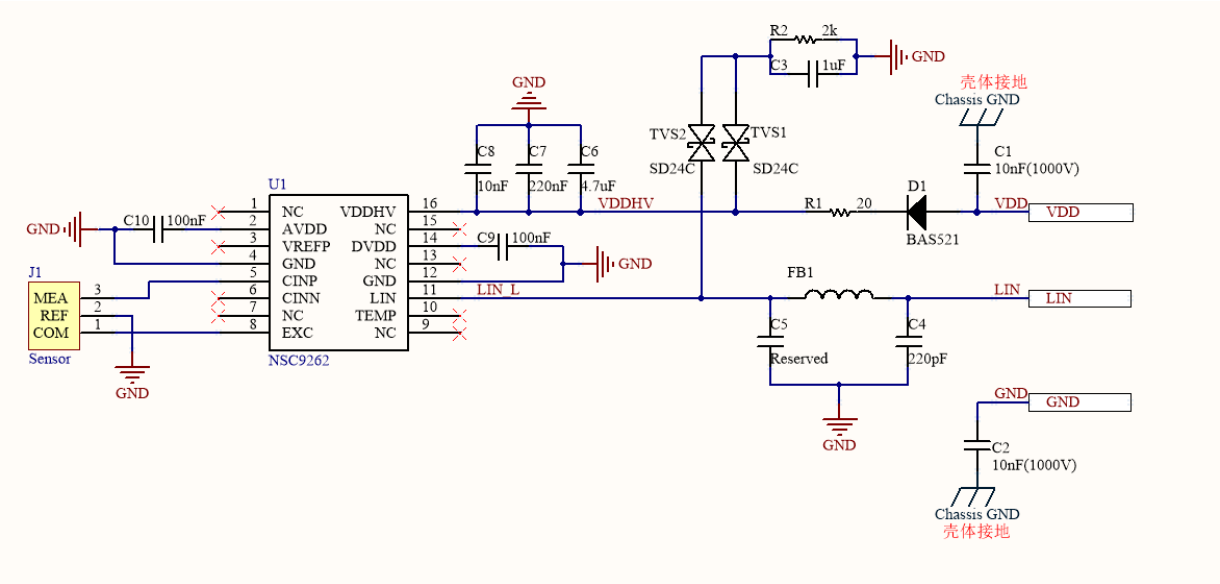

Figure 3.1 Reference Schematic of NSC9262

3.2.Sensor Input

In this application single end capacitor method is selected, so CINN pin is left floating. Sensor pin2 is connected to GND. If differential capacitor method is selected, connect the other capacitor to CINN pin.

3.3.EMC Protection

In this schematic, a large portion of the components are used for EMC consideration.

D1 can help to protect reverse voltage, especially high amplitude reverse voltage which is over VDDHV RVP threshold. This diode is important in ISO 7637-2 test. The reverse voltage specification depends on the ISO-7637-2 test level.

R1 can serve as a current limiter for over voltage at VDDHV. It can also help to filter high frequency noise combining with decoupling capacitors. The value of R1 can be larger for EMC. Recommended value is less than 50Ω.

TVS1 and TVS2 can protect VDDHV and LIN from transient high voltage pulse (such as ESD pulse). These two TVS connect to an exclusive ground region, which is connected to real GND through R2 and C3. R2 and C3 provide transient pulse absorbed by TVS a relief path to GND.

FB1, C4 and C5 are used to filter noise and interference on LIN pin. FB1 type can be adjusted according to EMC experiments. It can be replaced with a resistor less than 50 Ω. C6 C7 in total should not exceed 250 pF.

C6, C7 and C8 are used for voltage stabilization and noise filtering. The value maybe adapted to EMC experiments.

C9, C10 can be reserved. These two capacitors are optional.

C1, C2 are used to restrain noise on VDD and GND. They can bypass noise to the metal chassis.

3.4.BOM

Table 3.1 BOM of Reference Schematic

Comment	Designator	Footprint	Value
Cap	C1	1206	10nF(1000V)
Cap	C2	1206	10nF(1000V)
Cap	C3	0603	1uF
Cap	C4	0603	220pF
Cap	C5	0603	Reserved
Cap	C6	0603	4.7uF
Cap	C7	0603	220nF
Cap	C8	0603	10nF
Cap	C9	0603	100nF
Cap	C10	0603	100nF
Res	R1	0603	20
Res	R2	0603	2k
Bead	FB1	0603	120ohm@100MHz
TVS	TVS1	SOD323	SD24C-01FTG
TVS	TVS2	SOD323	SD24C-01FTG
NSC9260	U1	SSOP16	
Sensor	J1	C-C	

The component values are examples. Some of them, especially mentioned in previous section maybe adapted to the requirements of specific application in particular to EMC experiments.

4.Revision History

Revision	Description	Author	Date
1.0	Initial version	Feifei Sun	30/8/2023

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