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NC 76124

The NCV76124 is an interface chip for rain and light detection in automotive applications. It measures photodiode currents that represent rain and light signals, and transfers the converted signals to a master microcontroller on request via the SPI interface.

The rain measurement data can be used to control the rain wipers. The light intensity signals can be used for e.g. the brightness control of displays, the headlamp control and others. Due to the SPI programmability, one single hardware configuration can support various applications.

Features

- Conversion of Rain and Light Sensor Photodiodes Current to a Voltage through a Programmable Gain Trans Impedance Amplifier (TIA)
- Controlled Pulse Current Amplitude for 2 External LED's
- Periodical Measurement of 4 (Optionally 5) Light Sensor Signals
- Periodical Measurement of 2 (Optionally 1) Rain Sensor Signals with Environment Light Cancellation Circuitry
- Rain Channels Environmental Light Measurement
- Die Temperature Measurement
- Power On Reset and Watchdog-functionality
- Standby and Sleep Modes with Low Current Consumption
- On-chip Oscillator for System Clock
- SPI Interface
- Diagnostics Circuitry according to ASIL-B
- Rain Channels Comply with ASIL-A
- NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC–Q100 Qualified and PPAP Capable
- The device is Pb-Free and RoHS Compliant

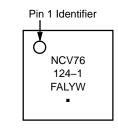
Typical Applications

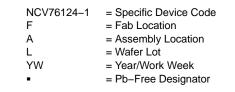
- Rain Sensor for Wipers
- Ambient Light Sensor
- Front Lighting
- Head-up Display



QFNW24 CASE 484AA

MARKING DIAGRAM





SAFETY DESIGN - ASIL B

A SIL B Product developed in compliance with ISO 26262 for which a complete safety package is available.

ORDERING INFORMATION

See detailed ordering and shipping information on page 12 of this data sheet.

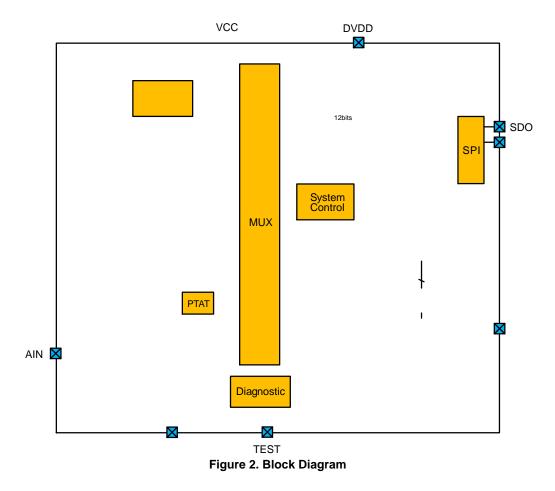
Non–NDA Data Sheet

Interested in what you see? If you would like more detailed information, please request the full version of our data sheet.

Request Full Data Sheet

1

BLOCK DIAGRAM & ESD SCHEMATIC



PACKAGE AND PIN DESCRIPTION

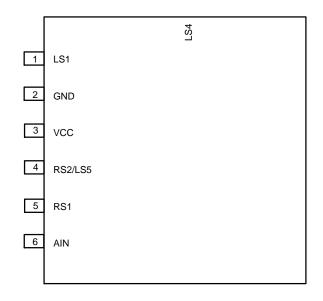


Figure 3. Pin Connections – QFNW24 4x4 0.5P (Top View)

Table 3. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Analog DC Supply			•	

ELECTRICAL CHARACTERISTICS

(All Min and Max parameters are guaranteed over full junction temperature (T_J) range (-40°C; 135°C), unless otherwise specified.)

Table 6. CURRENT CONSUMPTION (VCC = DVDD = 3.3 V)

Parameter	Symbol	Conditions	Min	Тур	Max	Unit
Current Consumption in Active Mode (Note 7)	ICONS	Configuration mode of one rain channel and 5 light channels	-	9	12	mA
Sleep Current*	I _{SLEEP}	T = 27°C	-	7	10	μΑ
Standby Current*	I _{STBY}	T = 27°C	-	-	350	μΑ

7. Without photodiodes DC current and NPN base current or LED current.

Table 7. LED DRIVER

Parameter	Symbol	Conditions	Min	Тур	Max	Unit
DC GAIN of External NPN	h _{FE}		100	-	-	
Minimum LED Current Pulse Setting (Note 8)	ILED_MIN		-	-	0.3	mA
Maximum LED Current Pulse Setting	I _{LED_MAX}		800	-	-	mA
Minimum LED Current Pulse Period Setting	T _{PP_LED_MIN}		-	150	-	μs
Maximum LED Current Pulse Period Setting	T _{PP_LED_MAX}		-	300	-	μs
DC LED Current Deviation from the Programmed Current	I _{LED_DCERR}		-10	-	10	%
VRLED Reference Threshold Voltage	V		•			•

Table 10. RS1, RS2: RAIN SENSOR

Parameter	Symbol	Conditions	Min	Тур	Max	Unit
Average Reverse Voltage on Photodetector (between RSx and LSGND)	V _{R_RAIN}		1	1.65	2.3	V
Total Capacitance Value Connected between Pins RSx and LSGND	C _{IN_RAIN}		1	-	50	pF aL1

Table 13. DIAGNOSTIC

Parameter	Symbol	Conditions	Min	Тур	Max	Unit
Open PD Threshold Voltage (for RSx and LSx)	V _{DIAG_RefL}		GND + 0.35	_	GND + 0.45	V
Short PD Threshold Voltage (for RSx and LSx)	V _{DIAG_Ref} H	LSGND short to VCC by internal switch	V _{CC} – 0.22	-	V _{CC} – 0.14	V
LSGND Threshold Voltage	V _{Ref_GND}		1.1	-	1.3	V

Table 14. DIGITAL INPUTS (SCLK, NCS, SDI, EN)

Parameter	Symbol	Conditions	Min	Тур	Max	Unit
High Level Input Voltage	V _{IH}		0.7 * DVDD	-	DVDD	V
Low Level Input Voltage	V _{IL}		0	-		

Table 16. SPI INTERFACE (continued)

Parameter	Symbol	Conditions	Min	Тур	Max	Unit
Input Fall Time	T_fall		-	-	100	ns
Min NCS High Time	Tncs_high		900	-	-	ns
Max SDO Enable Time after Falling Edge of NCS	Tsdo_ena_tri_X	CL = 30 pF	-	-	30	ns
Output Rise Time	Tsdo_rise	CL = 30 pF	-	-	40	ns
Output Fall Time	Tsdo_rise	CL = 30 pF	-	-	30	ns
Max SDO Disable Time after Rising Edge of NCS	Tsdo_dis_X_tri	CL = 30 pF	-	-	30	ns
SPI Read Command Delay Time	Tstby_delay	Only for STBY mode	-	80	-	μs

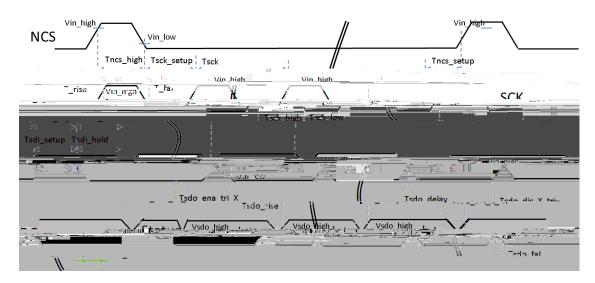


Figure 4. SPI Communication Timing

DIAGNOSTICS

The diagnostic cycle is 1.2 ms. It is advised to launch the diagnostic as first action in Active mode after leaving standby mode. Especially the diagnostic that is related to Photodiode, LED and the light channel measurement.

The diagnostic can be launched by the MCU via the RDIAG SPI command. Before launching the diagnostics, the MCU shall configure the diagnostics register "DIAG_SET_REG" to select which of the diagnostics are needed. By default all diagnostics are disabled.

SPI INTERFACE

General

The serial peripheral interface (SPI) is used to allow an external microcontroller (MCU) to communicate with the device. NCV76124 acts always as a slave and it cannot initiate any transmission.

The NCV76124 SPI architecture is CRC-Secured.

The SPI interface consists of four wires:

- 1. NCS: (Chip Select, active low). An input signal, when set to low, the reception and transmission are enabled.
- 2. SCLK: (Shift Clock). An input clock, driving the communication.
- 3. SDI (Serial Data In): The input data (MOSI), input bits are captured at falling edge of the SCLK.
- SDO (Serial Data Out): The output data (MISO), output data is set during the rising edge of SCLK. The SDO output pin is in tri-state when NCS is high.

SPI Transfer Format

Three types of SPI commands can be distinguished:

- "Command Instruction" 16 bit
- "Write control register" 32 bit
- "Read control or status register" 32 bit

Command Structure:

CMD	INSTRUCTION
0x	COMMAND
10	WRITE
11	READ

SPI Command Instruction

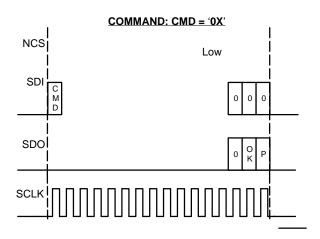


Figure 7. SPI Command Instruction Frame

SPI Write Instruction

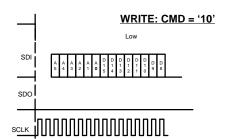
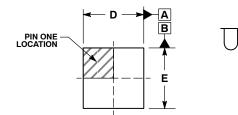
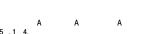


Figure 8. SPI Write Frame

QFNW24 4x4, 0.5P CASE 484AA **ISSUE A**

1 24 SCALE 2:1



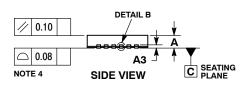


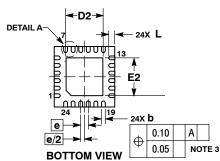
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ALTERNATE CONSTRUCTION DETAIL A

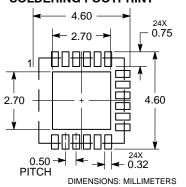


TOP VIEW





RECOMMENDED SOLDERING FOOTPRINT



GENERIC **MARKING DIAGRAM***

°xxxxxx
XXXXXX
ALYW=
•

XXXXXX = Specific Device Code А

= Assembly Location

= Wafer Lot

= Year

L Υ

W

= Work Week

= Pb-Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot " •", may or may not be present. Some products may not follow the Generic Marking.

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