NCV7420EVB

NCV7420 LIN Transceiver with Voltage Regulator Evaluation Board User's Manual

ON Semiconductor®

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EVAL BOARD USER'S MANUAL

Introduction

This document describes the NCV7420EVB board for the ON Semiconductor NCV7420 LIN Transceiver with Voltage Regulator. The functionality and major parameters can be evaluated with the NCV7420EVB board.

The NCV7420 is a fully featured local interconnect network (LIN) transceiver designed to interface between a LIN protocol controller and the physical bus.

The NCV7420 LIN device is a member of the in-vehicle networking (IVN) transceiver family of ON Semiconductor that integrates a LIN v2.1 physical transceiver and a low-drop voltage regulator. It is designed to work in harsh automotive environment and is submitted to the TS16949 qualification flow.

Evaluation Board Features

- One-row Pin Header Connecting to all Circuit Signals Enables Easy Insertion of the Evaluation Board into a more Complex Application Setup. The Header Can be Alternatively Assembled Either Perpendicular or Parallel with the Board Plane
- Oscilloscope Test-points on all Circuit Signals
- Reverse Protection and Decoupling on the Main (Battery) Supply
- Decoupling on VCC Regulator Output
- Filtering Circuit on the Switch-monitoring WAKE Input
- On-board Local Wakeup Switch
- LIN-bus Termination and Optional ESD Protection

NCV7420 Key Features

- LIN-Bus Transceiver
  - LIN Compliant to Specification Revision 2.1 (Backward Compatible to Versions 2.0 and 1.3) and SAE J2602
  - Bus Voltage ±45 V
  - Transmission Rate up to 20 kBaud
  - Integrated Slope Control for Improved EMI Compatibility
- Protection
  - Thermal Shutdown
  - Indefinite Short-circuit Protection on Pins LIN and WAKE Towards Supply and Ground
  - Load Dump Protection (45 V)
  - Bus Pins Protected against Transients in an Automotive Environment
  - ESD Protection Level for LIN, INH, WAKE and Vbb up to ±12 kV
- Voltage Regulator
  - Two Device Versions: Output Voltage 3.3 V or 5 V for Loads up to 50 mA
  - Over-current Limitation
  - INH Output for Auxiliary Purposes (Switching of an External Pull-up or Resistive Divider Towards Battery, Control of an External Voltage Regulator etc.)

Typical Applications

- Automotive
- Industrial Network

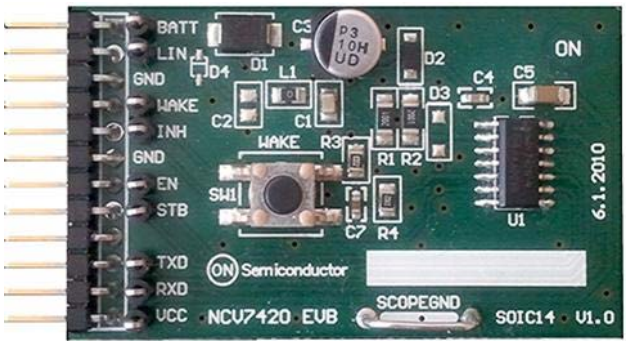
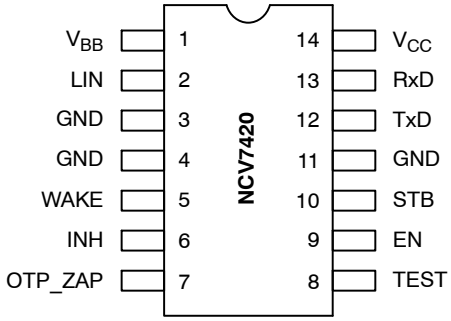


Figure 1. NCV7420EVB

NCV7420 PIN CONNECTIONS



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Getting Started

Master/Slave Configuration

The NCV7420 evaluation board can be configured as Master or Slave node. Furthermore, Master node LIN bus pull-up resistance (R_{LIN}) can be tied to VBB supply line or to INH pin (See the figures below).

The EMC immunity of the Master-node device can be further enhanced by adding a capacitor between the LIN output and ground (C_{LIN}). The optimum value of this capacitor is determined by the length and capacitance of the LIN bus, the number and capacitance of Slave devices, the pull-up resistance of all devices (Master and Slave), and the required time constant of the system.

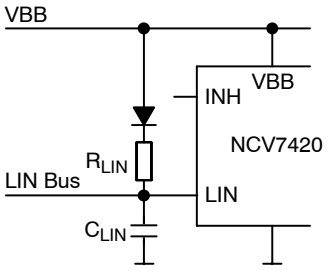

Figure 2. Master with Pull-up to VBB

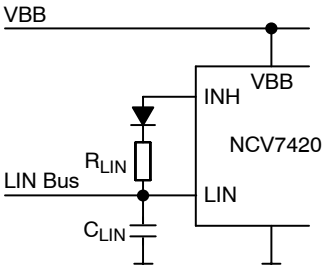

Figure 3. Master with Pull-up to INH

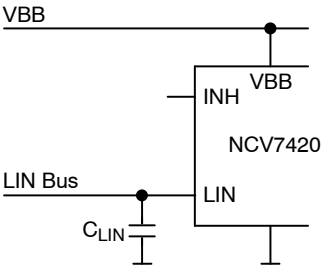

Figure 4. Slave Configuration

Basic Connection

A simple LIN network configuration is shown in the figure below. One Master and one Slave node is required (Master/Slave Configuration).

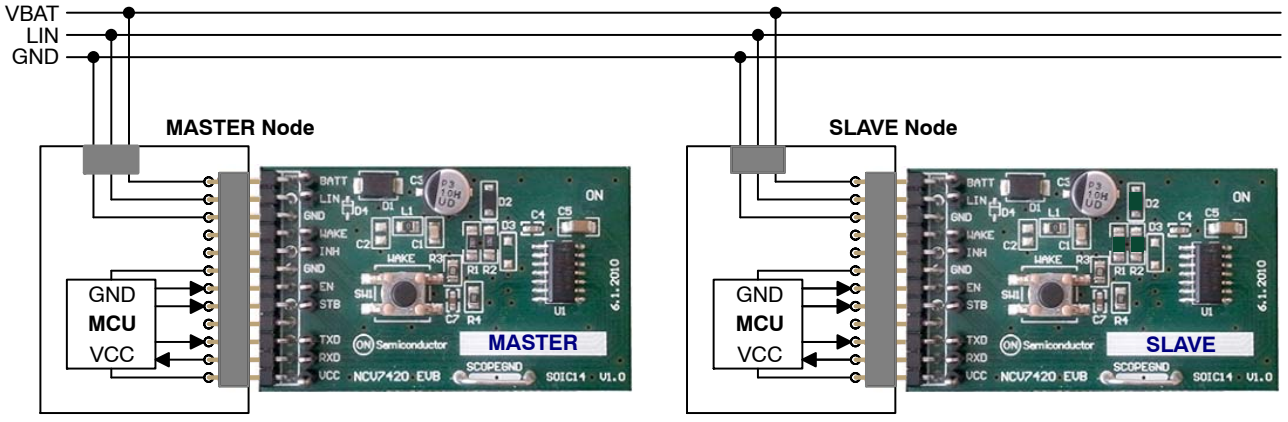

Figure 5. NCV7420 Evaluation Setup Connection

Functional Description

Overall Functional Description

NCV7420 is designed as a master or slave node for the LIN communication interface with an integrated 3.3 V or 5 V voltage regulator having a current capability up to 50 mA for supplying any external components (microcontroller).

NCV7420 contains the LIN transmitter, LIN receiver, voltage regulator, power-on-reset (POR) circuits and thermal shutdown (TSD). The LIN transmitter is optimized for the maximum specified transmission speed of 20 kBaud with EMC performance due to reduced slew rate of the LIN output.

The junction temperature is monitored via a thermal shutdown circuit that switches the LIN transmitter and voltage regulator off when temperature exceeds the TSD trigger level.

NCV7420 has four operating states (normal mode, low slope mode, stand-by mode, and sleep mode) that are determined by the input signals EN, WAKE, STB, and TxD.

Operating States

NCV7420 provides four operating states, two modes for normal operation with communication, one stand-by without communication and one low power mode with very low current consumption - see Figure 6 and Table 1.

Table 1. MODE SELECTION

Mode	Vcc	RxD	INH	LIN transceiver	30 kΩ on LIN
Normal – Slope (Note 1)	ON	Low = Dominant State High = Recessive State	High if STB = High during state transition; Floating otherwise	Normal Slope	ON
Normal – Low Slope (Note 2)	ON	Low = Dominant State High = Recessive State	High if STB = High during state transition; Floating otherwise	Low Slope	ON
Stand-by (Note 3)	ON	Low after LIN wakeup, high otherwise (Note 4)	Floating	OFF	OFF
Sleep	OFF	Clamped to Vcc (Note 4)	Floating	OFF	OFF

1. The normal slope mode is entered when pin EN goes HIGH while TxD is in HIGH state during EN transition.
2. The low slope mode is entered when pin EN goes HIGH while TxD is in LOW state during EN transition. LIN transmitter gets on only after TxD returns to high after the state transition.
3. The stand-by mode is entered automatically after power-up.
4. In Stand-by and Sleep mode, the High state is achieved by internal pull-up resistor to VCC.

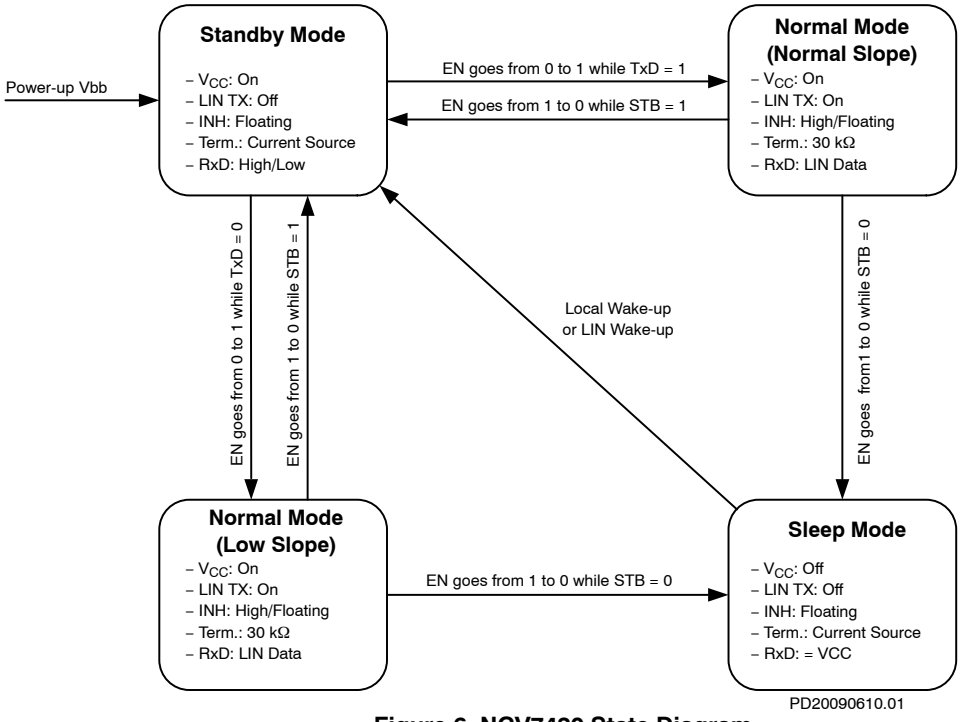

Figure 6. NCV7420 State Diagram

Additional details of the NCV7420 operation and parameters can be found in the corresponding datasheet [1].

Schematic

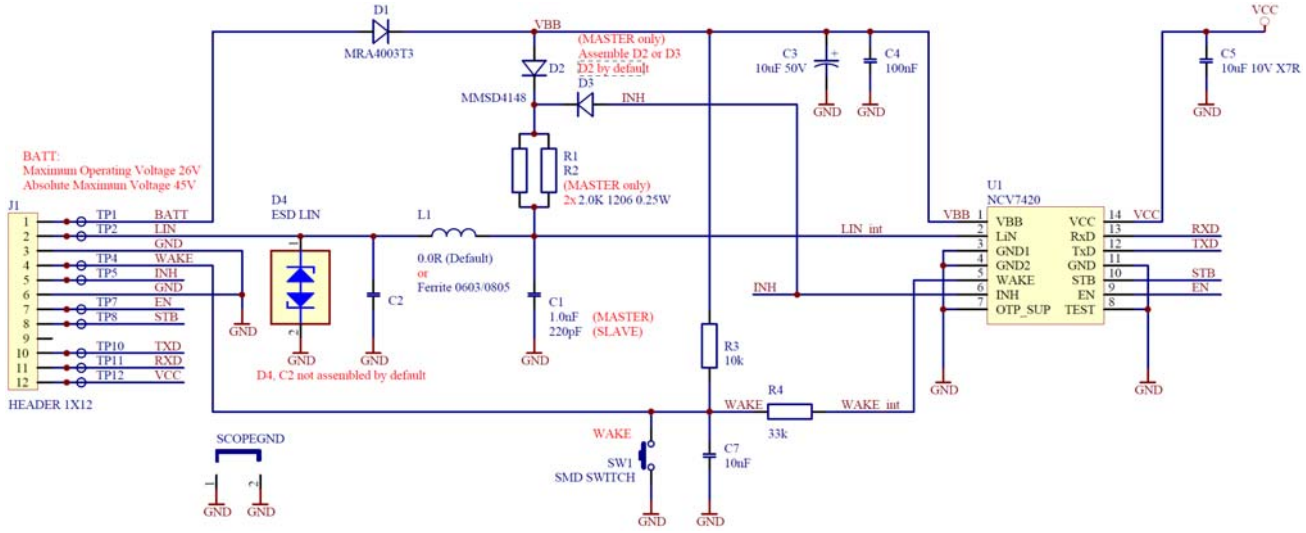

Figure 7. NCV7420 LIN Transceiver with Voltage Regulator Evaluation Board Schematic

Bill of Materials

Table 2. NCV7420 Evaluation Board Bill of Materials

Designator	Description	Value	Footprint	Manufacturer	Manufacturer Part Number
C1	Capacitor SMD	1.0 nF	CAP0805	PHYCOMP	2238 580 15623
R1, R2	Resistor SMD	2.0 kΩ 1206 0.25 W	R1206	WELWYN	WCR 1206 2K 2%
R3	Resistor SMD	10 kΩ	R0805	MULTICOMP	MC 0.1W 0805 1% 10K
C7	Capacitor SMD	10 nF	CAP0603	EPCOS	B37931K5103K60
C5	Capacitor SMD X7R	10 μF 10 V X7R	CAP1206	KEMET	C1206C106K8RAC
C3	Electrolytic Capacitor SMD	10 μF 50 V	6.3 x 6.3 SMD	NICHICON	UUD1H100MCL1GS
R4	Resistor SMD	33 kΩ	R0805	MULTICOMP	MC 0.1W 0805 1% 33K
C4	Capacitor SMD	100 nF	CAP0603	KEMET	C0603C104K5RAC
C2	Capacitor SMD (Optional)	(Optional)	CAP0805	(Optional)	(Optional)
D1	Diode SMD	MRA4003	SMA	ON Semiconductor	MRA4003T3G
D4	LIN bus ESD protection diode	ESD LIN	SOD323	(Optional)	(Optional)
L1	Resistor SMD (Optional Ferrite)	0R	R0805	MULTICOMP	MC 0.1W 0805 0R
J1	SIL HEADER 12 Pins Right Angle	HEADER 1X12	HDR1x12	MOLEX	90121-0772
D2, D3	Switching Diode SMD	MMSD4148	SOD123	ON Semiconductor	MMSD4148T1G
U1	LIN Transceiver with 3.3 V or 5 V Voltage Regulator	NCV7420	SOIC14	ON Semiconductor	3.3 V: NCV7420D24R2G 5 V: NCV7420D26R2G
SCOPEGND	SCOPEGND; Wire Bridge	SCOPEGND	SCOPEGND	-	-
SW1	SWITCH SMD SPNO 6 x 6 mm	SMD SWITCH	PB300	TYCO ELECTRONICS	FSM2JSMA
FT1, FT2, FT3, FT4	Rubber feet 12,7 x 12,7 x 5,8	SUPPORT FEET	FEET 12,7 x 12,7	3M	SJ5018BLACK
TP1, TP2, TP4, TP5, TP7, TP8, TP10, TP11, TP12	Testpin 200 SER. Hole 1.0 Black	TP S200 H1.0 BLACK	TESTPIN2	VERO	20-2137

PCB Drawings

Assembly Drawings

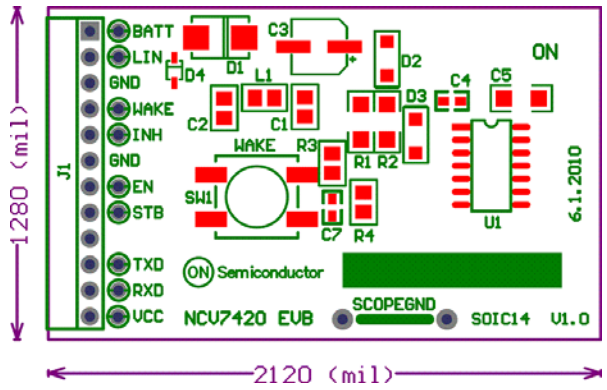

Figure 8. NCV7420EVB PCB
Top Assembly Drawing

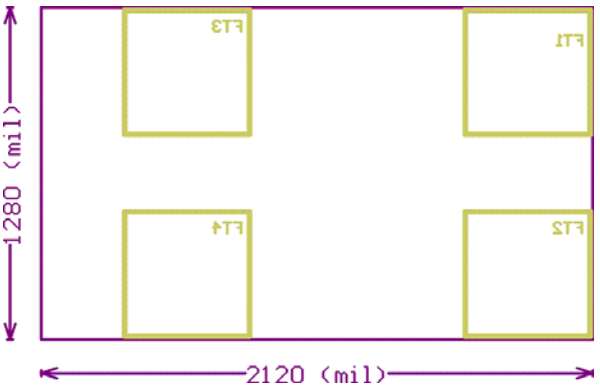

Figure 9. NCV7420EVB PCB
Bottom Assembly Drawing

Composite Drawings

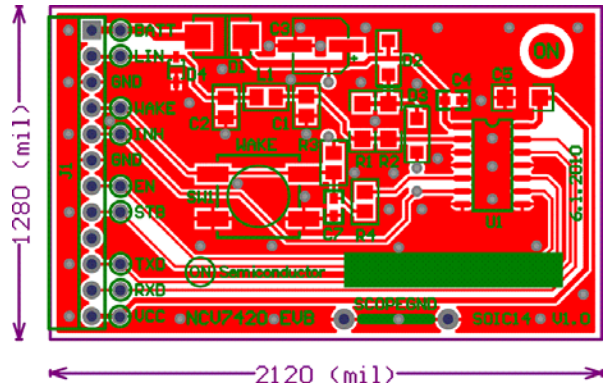

Figure 10. NCV7420EVB PCB
Top Composite Drawing

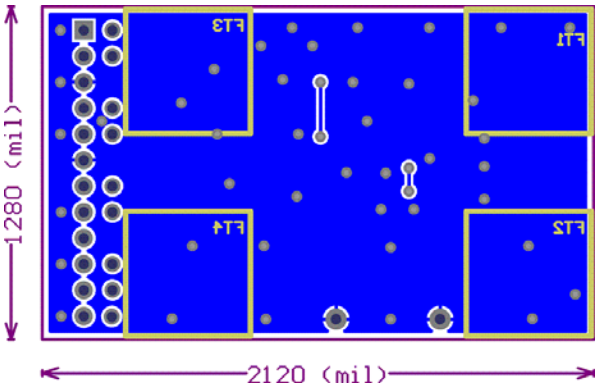

Figure 11. NCV7420EVB PCB
Bottom Composite Drawing (Mirrored)

PCB Preview

Figure 12. NCV7420EVB PCB Top Side View

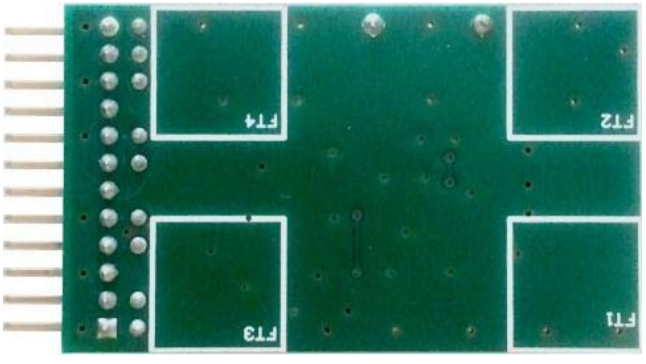

Figure 13. NCV7420EVB PCB Bottom Side View

References

[1] On Semiconductor, NCV7420 Product Preview Revision 0.5, July 2010

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
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