NCV73830V1GEVB

NCV7383 FlexRay® Bus Driver Evaluation Board User’s Manual

Introduction

This document describes the NCV7383EVB Evaluation board for the ON Semiconductor NCV7383 FlexRay Bus Driver. The functionality and major parameters can be evaluated with the NCV7383EVB board.

The NCV7383 is a single-channel FlexRay bus driver compliant with the FlexRay Electrical Physical Layer Specification Version 3.0.1, capable of communicating at speeds of up to 10 Mb/s. It provides differential transmit and receive capability between a wired FlexRay communication medium on one side and a protocol controller and a host on the other side.

NCV7383 mode control functionality is optimized for nodes without the need of extended power management provided by transceivers with permanent connection to the car battery as is on NCV7381.

NCV7383 is primarily intended for nodes switched off by ignition. Additional details can be found in the NCV7383 datasheet.

Figure 1. Evaluation Board Photo

The NCV7383EVB Evaluation board is a reference design for stand-alone 2-channel FlexRay node. The board is intended to give designers easy, quick and convenient means for evaluation of NCV7383 FlexRay bus drivers. The design incorporates complete node solution with possibility of modifications and small board size. A set of two boards allows users immediately start with the NCV7383 FlexRay Bus Driver. The MCU is preprogrammed with a firmware which provides simple mode control and FlexRay communication. With use of Freescale™ BDM programmer and a suitable development environment, the MCU firmware can be freely modified and reprogrammed.

Figure 2. NCV7383 Pin Connections

Board Hardware

The board consists of MCU with integrated 2-channel FlexRay communication controller interconnected with two separate FlexRay bus drivers (NCV7383), two voltage regulators and peripherals. The board is prepared for various modifications in power supply concept and FlexRay bus termination, and allows simple extension of the system by unused MCU pins. USB interface provides compatibility with standard PC. The address of each board can be easily modified by address switch what allows to create complex FlexRay network without the need of reprogramming the MCU. Implemented High Speed CAN interface can be used as a diagnostic interface in a network built from several nodes. For evaluation purposes NCV7383 is populated with several LED diodes and most of the bus driver signals are comfortable accessible to oscilloscope probes.
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GENERAL FEATURES

FlexRay Transceiver
- Two separate FlexRay channels with NCV7383 Bus Driver compliant with the FlexRay Electrical Physical Layer Specification Version 3.0.1,
- Reconfigurable bus termination – End node / Middle node
- Common mode Choke and additional ESD protection footprint
- SUBD-9 connectors – FlexRay bus

MCU
- Freescale™ 16-bit MC9S12XF family MCU
- Integrated FlexRay Communication Controller (Protocol Specification Rev. 2.1)
- Integrated CAN 2.0 A, B Controller
- Background Debug Module – single-wire communication with host development system
- 512 k byte Flash
- 32 k byte RAM
- 50 MHz maximum CPU bus frequency
- Relatively small 112-pin LQFP package

Peripherals
- Optical isolated USB interface (USB to UART converter)
- Additional CAN interface
- All NCV7383 digital I/O pins connected to test points – easy connection to Logic Analyzer
- 8 general purpose LEDs
- Address switch
- External Interrupt switch

Other
- Two Automotive Voltage regulators (Input battery voltage up to 42 V)
- Power supplies voltage monitoring
- Instant 2-nodes FlexRay network with running communication by connecting two NCV7383 EVBs.
- PC configuration software under development (available upon request)

PCB Layout
- The FlexRay transceiver, the ESD protection and the common mode choke are placed near to the FlexRay the ECU connector
- The FlexRay signal lines (BP, BM) are decoupled from disturbances on the ECU board
- The routing of the FlexRay lines (BP, BM, TxD and TxEN) is symmetric
- The distance between the lines BP and BM resp. TxD and TxEN is minimized

GETTING STARTED

The NCV7383EVB board is fully assembled, pre-programmed and can be immediately used for evaluation. Only a few steps need be proceeded to get fully working simple FlexRay network.

Connect the evaluation boards as follows:
1. Set the boards to default configuration according to Jumpers and Default Configuration section.
2. Select one of the bus termination type (Bus Termination Configuration section) and adapt the respective devices. End node termination type is recommended for 2-node network.
3. Set a different board address on each board. One of the boards must be set with address 1 and is considered as Master Board. Node address is configured by address switch SW12 – see Address Switch for details.
4. Connect the boards according to Figure 3. Up to 5 boards with addresses 1 to 5 can be connected together.
5. Connect the oscilloscope to any test-point as needed.
6. When power supply is applied, MCU automatically configures the FlexRay Communication Controller setting based on the current node address and initiates FlexRay communication.

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Power Modes
The nodes can operate in two different power modes:
- Normal mode – all the nodes continuously communicates over the FlexRay bus.
- Standby mode – the communication is suspended. Both NCV7383 FlexRay transceivers are switched to Low Power Standby operating mode. Indication LEDs are switched off. The MCU is operating in low power STOP mode where the oscillator is stopped and the current consumption is substantially reduced.

Enter Standby Mode Sequence
A transition to Standby mode can be initiated by the node with address 1:
- Press and hold the Node1 #IRQ button for more than 3 seconds. The GO_TO_STANDBY signal is transmitted over the FlexRay bus. All the nodes then synchronously stop the communication and switch to Standby mode.

Wakeup Sequence
The network operating in Standby mode can be woken-up by any node:
- Press the #IRQ button on any node connected to the network. The MCU is woken-up from STOP mode by an external interrupt (#IRQ button pressed), resume operation in Normal mode and automatically wake up the rest of the network by the FlexRay Remote Wakeup Pattern sent over the bus. Once all the nodes are initialized, the FlexRay communication is restarted.

Normal Mode LED Signaling
The properly running setup should signal following (Figure 4):
- LED8 - LED4 Toggling LED signals data was received correctly in the particular slot (Slot 1 – Slot 5)
- LED3 Each node transmits its own #IRQ Button status (BTN_IRQ_DOWN signal). This LED signals that one of the nodes in the network detected the #IRQ button pressed.
- LED2 When the #IRQ button is pressed and held down, the LED2 is gradually decreasing intensity indicating the time remaining to ENTER STANDBY MODE event (100% to 0% in 2.4 seconds).
- LED1 LED1 changes intensity according to input battery voltage.
  - The LED intensity is directly proportional to the battery voltage in range of 10 V to 14V.
Battery voltage being below 10 V is indicated by LED1 OFF state.
- Battery voltage exceeding 14 V is indicated by LED1 full intensity (Figure 5).

**Standby Mode LED Signaling**
In Standby mode, all the LEDs except LED8 are switched OFF. The LED8 is turned ON with very low intensity, signaling the MCU is correctly operating in the low power STOP mode and is ready to be woken-up.

**FlexRay Communication Cycle Configuration**
- Cycle Length: 10000 us
- Number of Static Slots: 10 (5 slots active)
- Static Slot Length: 31 us
- Static Slot Payload Length: 6 Words
- Dynamic Segment: Not used
- Symbol Window Length: 14 us

Each node is assigned to one communication slot. The Slot number corresponds to particular Node address.
BOARD OVERVIEW

Basic Interface

Legend:
1. Power supply input connector
2. Aux digital I/O connector
3. CAN backbone connector 1
4. CAN backbone connector 2
5. USB interface
6. MCU Interrupt Request connector
7. Address switch
8. FlexRay CC Strobe output signals
9. BDM Connector (MCU debugging interface)
10. Power supply input connector
11. Aux digital I/O connector
12. CAN backbone connector 1
13. CAN backbone connector 2
14. USB interface
15. MCU Interrupt Request connector
16. Address switch
17. FlexRay CC Strobe output signals

Power Supply Input Connector
Power supply input socket. Plug diameter 2.1 mm, length 14 mm. Maximum input voltage 42 V (Limited by onboard voltage regulators input voltage range).

Aux Digital I/O Connector
These pin header contains 8 auxiliary MCU signals – one complete SPI interface (4 pins), one UART interface (2 pins) and 2 signals connected to MCU ADC interface. These signals can be also used as general Input / Output signals for debugging or other purposes.

CAN Backbone Connectors
CAN backbone network is created as parallel connection of several boards. Each board contains two equivalent

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connectors in parallel, so whole network can be prepared using only simple point-to-point twisted pair.

![Figure 10. CAN Backbone Connectors](image)

**USB Interface**
Standard B type USB socket is used for connection to PC. USB interface is bus powered and electrically isolated from the rest of the board, so it is not possible to supply this board via USB.

**FlexRay CC Strobe Output Signals**
The MCU FlexRay block provides a number of strobe signals for observing internal protocol timing related signals in the protocol engine.

![Figure 11. FlexRay CC Strobe Output Signals](image)

**BDM Connector (MCU Debugging Interface)**
The BDM module provides a single-wire communication with host development system (Programming and debugging interface).

![Figure 12. BDM Connector](image)

**FlexRay BD Digital Signals Test Points Headers**
These headers are intended to be used as a test points for digital probes. Headers contain all FlexRay BD digital input and output signals.

Test points for both FlexRay channel A and channel B are placed on separated headers (J73 – channel A, J83 – channel B).

![Figure 13. FlexRay BD Digital Signals Test Points](image)

**FlexRay BD Analog Signals Test Points**
There are 6 analog test points on the board:
- BP – FlexRay Bus Plus terminal (Channel A)
- BM – FlexRay Bus Minus terminal (Channel A)
- VIO – Bus Driver VIO Power Supply input
- BP – FlexRay Bus Plus terminal (Channel B)
- BM – FlexRay Bus Minus terminal (Channel B)
- VCC – Bus Driver VCC Power Supply input

**FlexRay Bus Connectors**
FlexRay EPL Specification [2] does not prescribe certain connectors for FlexRay systems. Common used 9-pin D-Sub connectors were chosen as a suitable connector, whose electrical characteristics satisfy the specification.

### Table 1. FLEXRAY CONNECTOR

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Signal</th>
<th>Description</th>
<th>Connection</th>
<th>ESD Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-</td>
<td>Reserved</td>
<td>Not Connected</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>FR_BM</td>
<td>BM bus line</td>
<td>BM</td>
<td>Yes (Optional)</td>
</tr>
<tr>
<td>3</td>
<td>FR_GND</td>
<td>Ground</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>Reserved</td>
<td>Not Connected</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>-</td>
<td>Reserved</td>
<td>Not Connected</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>-</td>
<td>Reserved</td>
<td>Not Connected</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>FR_BP</td>
<td>BP bus line</td>
<td>BP</td>
<td>Yes (Optional)</td>
</tr>
<tr>
<td>8</td>
<td>-</td>
<td>Reserved</td>
<td>Not Connected</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>(FR_Vbat)</td>
<td>Optional FR external supply</td>
<td>Main supply line</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**NOTE:** Connector Type: 9-pin D-sub (DIN 41652 or corresponding international standard), plug (male)
Jumpers and Default Configuration

Table 2. 2-PIN JUMPER

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Open</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Closed</td>
</tr>
</tbody>
</table>

Table 3. 3-PIN JUMPER

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Open</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Closed position 1–2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Closed position 2–3</td>
</tr>
</tbody>
</table>

Figure 14. Jumpers and Soldering Straps
<table>
<thead>
<tr>
<th>Jumper</th>
<th>Function</th>
<th>Configuration</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>J3</td>
<td>Bus Driver VIO supply</td>
<td>Open</td>
<td>Bus Driver VIO unsupplied</td>
<td>Closed (3V3 – 3V3_BD)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Closed</td>
<td>Bus Driver VIO connected to voltage regulator output</td>
<td></td>
</tr>
<tr>
<td>J4</td>
<td>Bus Driver VCC supply</td>
<td>Open</td>
<td>Bus Driver VCC unsupplied</td>
<td>Closed (5V – 5V_BD)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Closed</td>
<td>Bus Driver VCC connected to voltage regulator output</td>
<td></td>
</tr>
<tr>
<td>J40</td>
<td>CAN bus termination</td>
<td>Open</td>
<td>CAN bus without termination</td>
<td>Closed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Closed</td>
<td>CAN bus with 120 Ω termination</td>
<td></td>
</tr>
<tr>
<td>J52</td>
<td>General purpose LED</td>
<td>Open</td>
<td>LEDs Disabled</td>
<td>Closed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Closed</td>
<td>LEDs Enabled</td>
<td></td>
</tr>
<tr>
<td>J53</td>
<td>UART power supply</td>
<td>Open</td>
<td>UART Disabled</td>
<td>Open</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Closed</td>
<td>UART Enabled</td>
<td></td>
</tr>
<tr>
<td>J54</td>
<td>MCU output mcu_PP0 function</td>
<td>Open</td>
<td>LED D101 not used</td>
<td>Closed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Closed</td>
<td>LED D101 connected to PWM0 output</td>
<td></td>
</tr>
<tr>
<td>J87</td>
<td>Channel B SCK pin connection</td>
<td>Open</td>
<td>SCK_B disconnected</td>
<td>Closed 1-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Closed 1-2</td>
<td>SCK_B connected to common hardware SPI interface</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Closed 2-3</td>
<td>SCK_B connected to separated software SPI interface</td>
<td></td>
</tr>
<tr>
<td>J89</td>
<td>Channel B SDO pin connection</td>
<td>Open</td>
<td>SDO_B disconnected</td>
<td>Closed 1-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Closed 1-2</td>
<td>SDO_B connected to common hardware SPI interface</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Closed 2-3</td>
<td>SDO_B connected to separated software SPI interface</td>
<td></td>
</tr>
<tr>
<td>J75</td>
<td>Channel A Bus Driver digital input pull-ups</td>
<td>Open</td>
<td>TxEN, SCN and SCK pull-ups disconnected from VIO</td>
<td>Closed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Closed</td>
<td>TxEN, SCN and SCK pull-ups connected to VIO</td>
<td></td>
</tr>
<tr>
<td>J85</td>
<td>Channel B Bus Driver digital input pull-ups</td>
<td>Open</td>
<td>TxEN, SCN and SCK pull-ups disconnected from VIO</td>
<td>Closed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Closed</td>
<td>TxEN, SCN and SCK pull-ups connected to VIO</td>
<td></td>
</tr>
</tbody>
</table>

**Bus Termination Configuration**

![Figure 15. FlexRay Bus Termination Assembly Drawing (R72, R82, C77, C87 placed on the BOTTOM side)](image-url)
Table 5. FLEXRAY BUS TERMINATION CONFIGURATION AND PARAMETERS

<table>
<thead>
<tr>
<th>Component</th>
<th>End node (Low-Ohmic termination)</th>
<th>Middle node – Variant 1 (High-Ohmic termination)</th>
<th>Middle node – Variant 2 (Custom termination)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ch. A: C75, C76</td>
<td>Short</td>
<td>Short</td>
<td>100 pF</td>
</tr>
<tr>
<td>Ch. B: C85, C86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch. A: R70, R71</td>
<td>47 Ω</td>
<td>1300 Ω</td>
<td>24 Ω</td>
</tr>
<tr>
<td>Ch. B: R80, R81</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch. A: R72, R82</td>
<td>Not Assembled</td>
<td>Not Assembled</td>
<td>47 Ω</td>
</tr>
<tr>
<td>Ch. A: C77, C77</td>
<td>4.7 nF</td>
<td>4.7 nF</td>
<td>4.7 pF</td>
</tr>
<tr>
<td>Ch. B: C87, C87</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Switches and Pushbuttons

- SW10...MCU Reset button
- SW11...MCU External interrupt button
- SW12...8-way DIP switch. The function depends on the MCU program. As default it is used for setting a node address.
Address Switch
This switch is used for setting a node number. Each board is programmed with the same firmware, so every node in the network must be configured with different unique number.

Be careful:

- LSB is situated on the left.
- ON means the particular switch is closed and output is Logical 0!
- OFF means the particular switch is open and output is Logical 1!

The switch configuration shown in this figure means binary 0b00000010 (Node address is set to 2).

MCU Reset Button
This button is connected directly to MCU RESET pin.

MCU External Interrupt Button
The MCU interrupt module support one maskable interrupt input. This input is connected to SW11.

LEDs
Three power LEDs indicate proper function of voltage regulators. In case the MCU and the NCV7381 bus drivers IO cells use the same power supply (as by default) MCU VCC LED and BD VIO LED signalling is also the same.

The board contains a bank of eight general purpose LEDs (Green). Their function depends on the MCU program.

There is also USB indication LED which is used to signal ongoing USB data transmission.
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BLOCK DIAGRAM

Figure 20. NCV7383 Evaluation Board Block Diagram

NCV7383 TYPICAL APPLICATION DIAGRAM

Figure 21. NCV7383 FlexRay Bus Driver Typical Application Diagram
### Table 6. RECOMMENDED EXTERNAL COMPONENTS FOR THE APPLICATION DIAGRAM

<table>
<thead>
<tr>
<th>Component</th>
<th>Function</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVCC</td>
<td>Decoupling capacitor on VCC supply line, ceramic</td>
<td>100</td>
<td>nF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CVIO</td>
<td>Decoupling capacitor on VIO supply line, ceramic</td>
<td>100</td>
<td>nF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RBUS1</td>
<td>Bus termination resistor</td>
<td>47.5</td>
<td>Ω</td>
<td>(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RBUS2</td>
<td>Bus termination resistor</td>
<td>47.5</td>
<td>Ω</td>
<td>(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CBUS</td>
<td>Common-mode stabilizing capacitor, ceramic</td>
<td>4.7</td>
<td>nF</td>
<td>(2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMC</td>
<td>Common-mode choke</td>
<td>100</td>
<td>μH</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Tolerance ±1%, type 0805. The value $R_{BUS1} + R_{BUS2}$ should match the nominal cable impedance.
2. Tolerance ±20%, type 0805.

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### SPECIFICATIONS

#### Power Supply

The Evaluation board can be powered either via DC power supply input socket with plug diameter 2.1 mm and length 14 mm or by one of the FlexRay bus connectors (See the connector description Table 1). Maximum input voltage (42 V) is limited by on-board voltage regulators input voltage range.

#### Split Termination

In order to achieve a better EMC performance, it is recommended to make use of a so-called split termination in all ECUs, where the Termination resistance $R_T$ is split into two equal parts $R_{TA}$ and $R_{TB}$ [2].

The serial RC combination (R1; C1) at the centre tap of the split termination provides a termination to GND for common mode signals. R1 is preferably omitted. Typical values are given in the following table:

### Table 7. TERMINATION PARAMETERS

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Typ</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Resistor</td>
<td>&lt; 10</td>
<td>Ω</td>
</tr>
<tr>
<td>C1</td>
<td>Capacitor</td>
<td>4700</td>
<td>pF</td>
</tr>
<tr>
<td>$2 \times \frac{</td>
<td>R_{TA} - R_{TB}</td>
<td>}{(R_{TA} + R_{TB})}$</td>
<td>Matching of termination resistors</td>
</tr>
</tbody>
</table>

For $R_{TA}$ and $R_{TB}$ the use of 1% tolerated resistors leads to a matching of 2%.

The better the matching of the split termination resistors $R_{TA}$ and $R_{TB}$, the lower the electromagnetic emission.

#### Standard Termination

Recommended bus split termination is shown in the Figure 23. Considering passive network, without active stars, proper termination should be applied at the two nodes that have the maximum electrical distance on the bus. The sum of termination resistors values should match the nominal cable impedance. At other nodes a high-ohmic split termination should be applied.

---

Figure 22. ECU with Split Termination [2]

The serial RC combination (R1; C1) at the centre tap of the split termination provides a termination to GND for common mode signals. R1 is preferably omitted. Typical values are given in the following table:

Figure 23. Basic Split Termination
Table 8. BASIC SPLIT TERMINATION PARAMETERS

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{TA}, R_{TB}$</td>
<td>Termination resistors</td>
<td>47</td>
<td>1300</td>
</tr>
<tr>
<td>C1</td>
<td>Capacitor</td>
<td>4700</td>
<td>4700</td>
</tr>
</tbody>
</table>

Custom Termination

In some cases a specific termination topology is required for middle modes. Such a termination connection and typical values are shown in Figure 25 and Table 9.

Table 9. CUSTOM SPLIT TERMINATION PARAMETERS

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{TA}, R_{TB}$</td>
<td>Termination resistors</td>
<td>47</td>
<td>24</td>
</tr>
<tr>
<td>C1</td>
<td>Capacitor</td>
<td>4700</td>
<td>4.7</td>
</tr>
<tr>
<td>R1</td>
<td>Resistor</td>
<td>–</td>
<td>47</td>
</tr>
<tr>
<td>$C_{TA}, C_{TB}$</td>
<td>Termination capacitors</td>
<td>–</td>
<td>100</td>
</tr>
</tbody>
</table>

Common Mode Choke

A common mode choke is used to improve the emission and immunity performance. The function of the common mode choke is to force the current in both signal wires to be of the same strength, but opposite direction. Therefore, the choke represents high impedance for common mode signals. The parasitic stray inductance should be as low as possible in order to keep oscillations on the bus low. The common mode choke is placed between transceiver and split termination [2].
Table 10. COMMON-MODE CHOKE REQUIREMENTS [2]

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Typ</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>( R_{CMC} )</td>
<td>Resistance per line</td>
<td>( \leq 1 )</td>
<td>( \Omega )</td>
</tr>
<tr>
<td>( L_{CMC} )</td>
<td>Main inductance</td>
<td>( \geq 100 )</td>
<td>( \mu H )</td>
</tr>
<tr>
<td>( L_s )</td>
<td>Stray inductance</td>
<td>( &lt; 1 )</td>
<td>( \mu H )</td>
</tr>
</tbody>
</table>

**MCU PROGRAMMING INTERFACE**

The NCV7383 EVB firmware can be freely reprogrammed using MCU programming and debugging interface (J10). The used Freescale MC9S12XF Family MCU can be programmed with P&E USB Multilink BDM module.

![P&E USB Multilink BDM module](image)

**P&E USB MULTILINK BDM MODULE DISTRIBUTORS:**

<table>
<thead>
<tr>
<th>Distributor</th>
<th>Telephone</th>
<th>Email</th>
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<tbody>
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<td>Arrow Electronics</td>
<td>(877) 237-8621</td>
<td><a href="mailto:onlinesales@arrow.com">onlinesales@arrow.com</a></td>
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<tr>
<td>Avnet Electronics</td>
<td>(800) 408-8353</td>
<td><a href="mailto:customer.care@avnet.com">customer.care@avnet.com</a></td>
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<td>Newark</td>
<td>(800) 463-9275</td>
<td><a href="mailto:sales@newarkinone.com">sales@newarkinone.com</a></td>
</tr>
</tbody>
</table>

Suitable development tool allowing programming and debugging Freescale microcontrollers is CodeWarrior™ Development Studio (www.freescale.com). The P&E USB Multilink BDM module is directly supported.
The NCV7383 EVB firmware can be downloaded from ON Semiconductor web site (www.onsemi.com).
Assembly Drawings

Figure 29. NCV7383 EVB PCB Top Assembly Drawing

Figure 30. NCV7383 EVB PCB Bottom Assembly Drawing
NCV73830V1GEVB

Assembly Drawings

Figure 31. NCV7383 EVB PCB Top Composite Drawing

Figure 32. NCV7383 EVB PCB Bottom Composite Drawing (Mirrored)

PCB General Parameters

- Material: FR4
- Cu Plating Thickness: 18 μm | 0.5 oz
- Surface Treatment: Au
- Solder Resist: Green, both sides

Dimensions

- Length: 107.2 mm | 4220 mil
- Width: 70.4 mm | 2770 mil
- Thickness: 1.5 mm
- Minimum Clearance: 0.25 mm | 9.842 mil

http://onsemi.com
REFERENCES


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