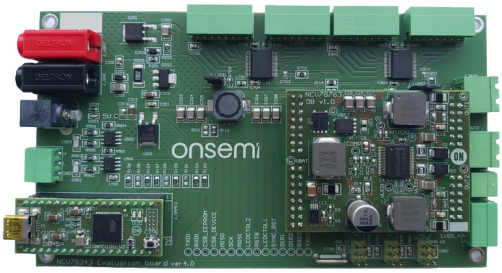
NCV78343 Series Pixel Controller Evaluation Board User's Manual

NCV78343EVBUM

The NCV78343 Evaluation kit demonstrates functionality of the NCV78343 pixel controller. The board supports two devices (with possibility to chain up to 32 devices) and up to 24 individual pixels. UART as a communication protocol is available on both CAN and M-LVDS physical layers, which allows to simulate different system architectures directly on the board. On board slot for LED driver can optionally be fitted with boost-buck converter NCV78763R1DAGEVB.

Both devices are controlled by the dedicated ONMCU board which is connected to the PC via USB cable. The evaluation kit is supplied from either banana or power jack connectors. Two I/O communication connectors for CAN and M-LVDS physical layers can be utilized to connect several pixel controller devices in a chain.



Evaluation Board Photo

Evaluation Board Features

- Up to 24 LED Pixels
- Fully Controllable by the SW GUI via USB Cable
- Supports Two Interfaces: CAN and M-LVDS
- Supports Different System Architectures
- Possibility to Connect More Pixel Controllers in a Chain
- Wide Supply Voltage Range
- Test Points for Important Signals
- Single Side PCB Assembly
- Optional BOOST-BUCK Convertor to Supply LEDs

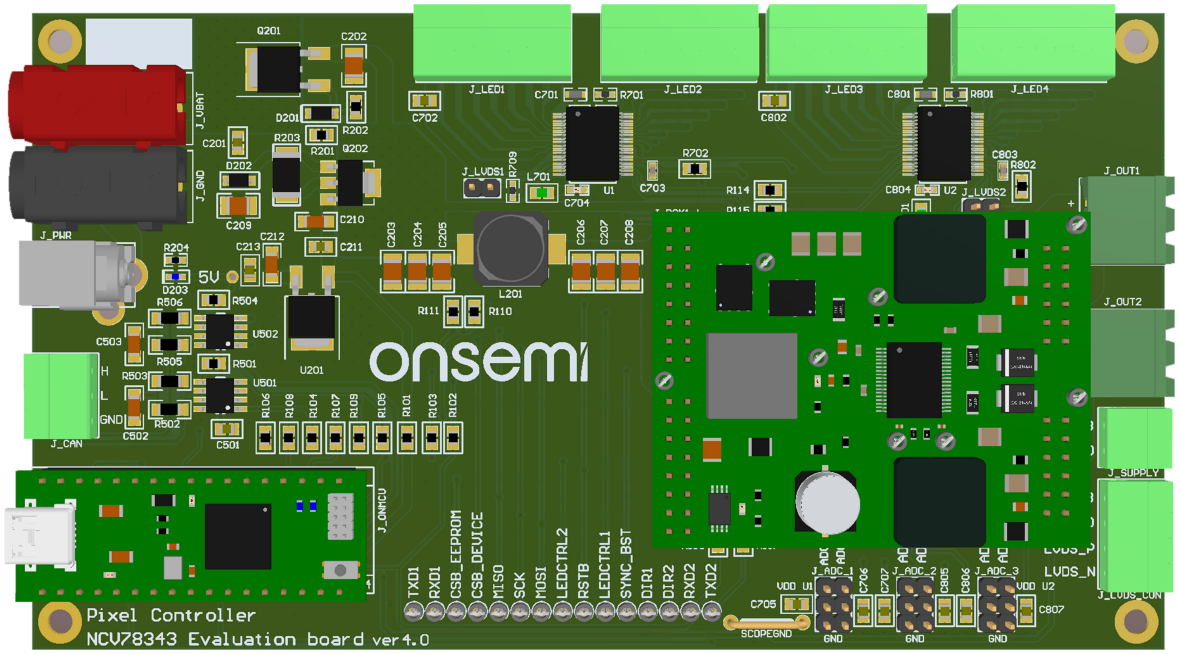


Figure 1. Board Layout

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Table 1. NCV78343 ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Min	Max	Unit
Battery Supply Voltage	V_{BB}	−0.3	60	V
Maximum LED Strings Current	I_{string}	0	1.4	A
Switch Differential Voltage (Note 1)	V_{SWxx_DIFF}	−0.3	12	V
Junction Temperature	$T_{junction}$	−45	170	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Absolute maximum rating for pins: SWx_(y+1) − SWxy for x={4 ÷ 1} & y={2 ÷ 0}

Table 2. RECOMMENDED BOARD OPERATING CONDITIONS

Characteristic	Symbol	Min	Typical	Max	Unit
Battery Supply Voltage	V_{BB}	8	12	40	V
Maximum LED Strings Current	I_{string}	0	–	1.4	A
LED String Voltage	V_{string}	0	–	60	V
Switch Differential Voltage	V_{SW_DIFF}	0	–	10	V
Typical Board Current Consumption	I_{board}	45	–	55	mA

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

Table 3. INTERFACE FUNCTION DESCRIPTION

Connector Name	Description / Function
J_VBAT / J_PWR	Input supply connectors, DC 12 V Typical
J_CAN	Input / Output CAN connector
J_OUT1 / J_OUT2	Output buck current connectors
J_SUPPLY	Output supply connector for supplying next drivers
J_LVDS_CON	Input / Output M-LVDS connector
J_ADX_xA	Input connectors with all ADC inputs
J_LVDS1 / J_LVDS2	Shorting jumpers for connecting 100 Ω resistors at M-LVDS A and B pins
J_LED1 ... J_LED4	LED output connectors

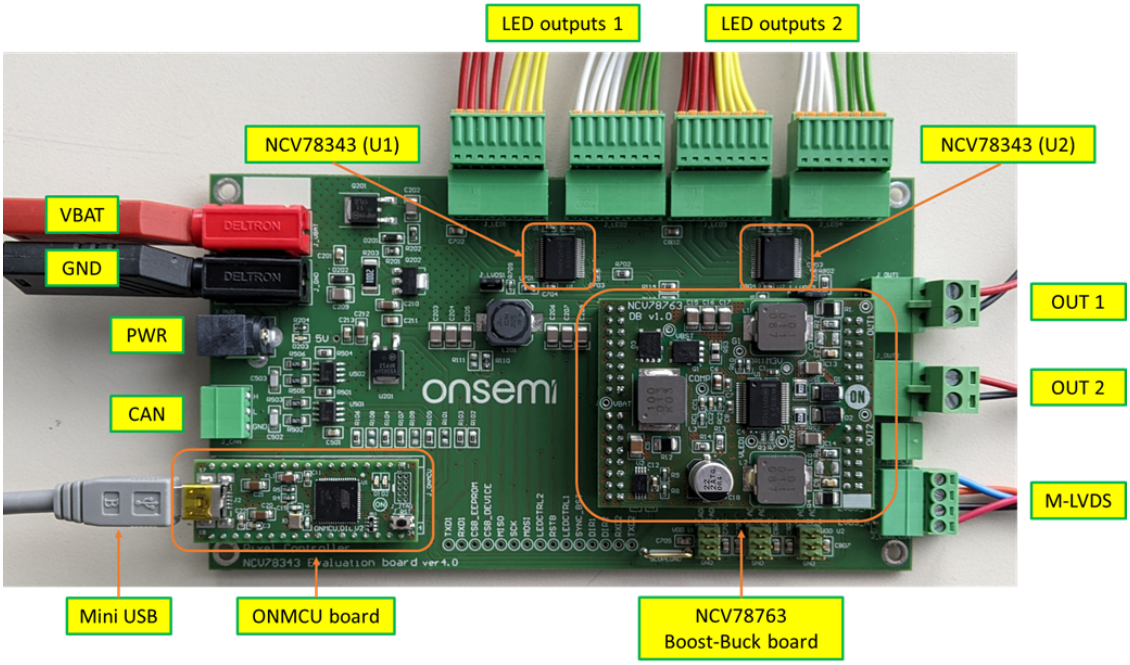

Figure 2. Picture of the NCV78343R1GEVB Mother Board

GETTING STARTED

Detailed installation guide is provided in Quick Start Guide that should be supplied together with the Evaluation Kit. The evaluation board is supplied through either banana or standard 5.5 x 2.5 mm DC connectors. Recommended supply voltage range is in range from 8 to 40 V. LEDs can be optionally powered from boost−buck converter board NCV78763R1DAGEVB in the slot position J.BCKx.y. The default system architecture uses repeater−slave device at U1 position and slave device at U2 position. Local M−LVDS bus which requires two 100 Ω terminating resistors is also used in this configuration. To ensure proper termination please short both J_LVDS1 and J_LVDS2 connectors.

Plug-in the USB cable to the ONMCU board and start the PC SW GUI application. The COM port should be loaded automatically, otherwise please click on Refresh button and then on Connect. If the COM port is not available, please check installed drivers (see below).

SYSTEM ARCHITECTURE

The evaluation kit supports different system architectures. The main differences are how the devices communicate with the MCU.

1. **UART → CAN (default configuration)**
ONMCU UART → CAN → 1st NCV78343 → M−LVDS → 2nd NCV78343 → M−LVDS

2. **MCU UART through M−LVDS**
ONMCU UART → 1st NCV78343 → M−LVDS → 2nd NCV78343 → M−LVDS

3. **Only M−LVDS**
ONMCU UART → M−LVDS →1st NCV78343 → M−LVDS → 2nd NCV78343 → M−LVDS

4. **Only MCU UART**
ONMCU UART → 1st NCV78343 and 2nd NCV78343 (common UART)

5. **CAN UART through M−LVDS**
External CAN → 1st NCV78343 → M−LVDS → 2nd NCV78343 → M−LVDS

6. **Only CAN UART**
External CAN → 1st NCV78343 and 2nd NCV78343 (common UART)

It is possible to change the system architecture just by replacing 0 Ω resistors following the configuration sheet in the schematic document. The default configuration uses UART communication over CAN physical layer. The CAN loop is made by two NCV7344 CAN transceivers. This simulates real application, where the CAN physical layer is used in the headlamp. In this configuration the first NCV78343 device U1 must be configured as a repeater-slave and the second device U2 has to be configured as a slave and also both J_LVDS pin headers must be shorted.

ADC Inputs

Each NCV78343 has three ADC inputs which share two functions. ADC0 and ADC1 share the functionality with I2C and ADC2 shares the functionality with input address resistor divider. All three ADC inputs are available at J_ADC_xA connectors. The first U1 device has by default external I2C EEPROM memory connected to pins SDA and SCL, while the second U2 device has all three ADC inputs connected to the resistor divider.

Addressing

NCV78343 devices are by default supplied without content in customer OTP memory bank (not zapped). This allows full configuration flexibility. When using not zapped devices, it is possible to address them by resistor divider connected to ADC2/ADR pin or by the auto-addressing process (described below). Default addresses determined by voltage divider on ADC2/ADR pin are ‘4’ for U1 and ‘7’ for U2.

Zapped devices have their address determined by the contents of OTP memory bank.

First LED control

Run the SW GUI and click on Connect button in the bottom menu. If the COM port is not recognized, click on Refresh button, or check installed drivers (see below). An application window will automatically pop up. Devices should be addressed using address from OTP memory, resistor divider or auto−addressing.

The read OPMODE command should return “direct” OPMODE for both devices with zapped OTP memory. Devices without zapped customer OTP memory will return “OTP config” OPMODE and must first transition into normal operating mode before LED brightness can be controlled. This can be done by clicking “Go to normal mode” button on the main screen.

Enable “Autoupdate” checkbox and both BUCKx EN if the NCV78763 BOOST−BUCK module is available. Now, it is possible to independently move with each slider, and according to this the LED brightness should be changing.

Satellite Board NCV78343R1DAGEVB

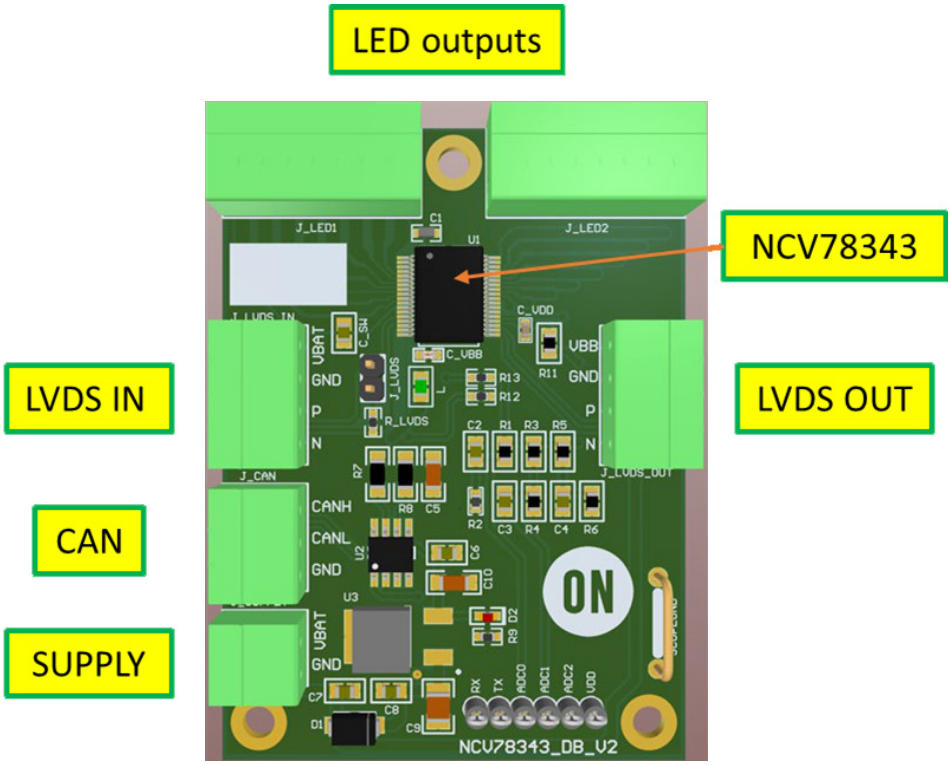

Figure 3. Satellite Board

The satellite (daughter) board extends the main Evaluation kit board. It allows to chain up to 32 pixel controller devices. Each satellite board contains one pixel controller that can control 12 additional LED pixels. Connection between Mother board and Satellite board can be established using either M-LVDS or CAN bus. Each board contains two M-LVDS connectors, which serve as an input and output, and one connector for CAN bus.

When using multiple boards connected by M−LVDS bus, keep in mind to short J_LVDS jumper on the first and last board (PCB that is the furthest away) only. This is important for proper termination of the bus with 100 Ω load connected at both ends of M−LVDS cable.

Table 4. INTERFACE FUNCTION DESCRIPTION

Connector Name	Description / Function
J_SUPPLY	Input supply connectors, DC 12 V Typical
J_CAN	Input / Output CAN connector
J_LVDS_IN	Input M-LVDS connector
J_LVDS_OUT	Output M-LVDS connector
J_LED1 / J_LED2	LED output connectors
J_LVDS	Shorting jumpers for connecting 100 Ω resistors at M-LVDS A and B pins

LED Board

A LED board contains 24 LEDs with a possibility to connect them either in series or parallel connection.

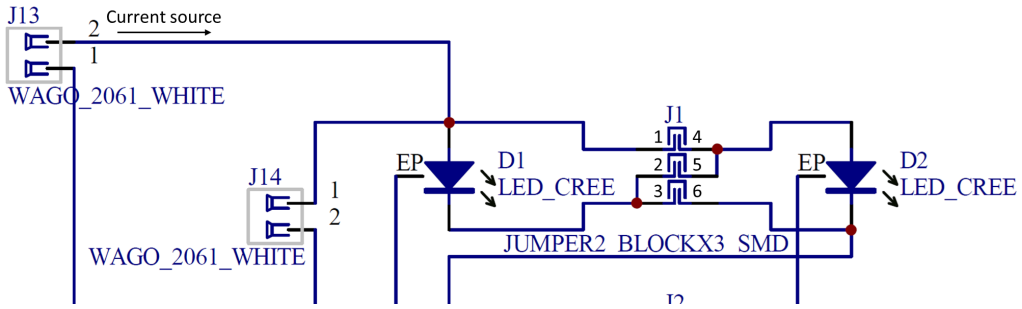

Figure 4. One LED Pair (Block) on LED Board

Each LED pair is connected to a separated WAGO connector through which is connected to a transistor in the pixel controller. Possible LED board configurations are described in Table 5. Header pin numbering refers to Figure 4.

Table 5. LED BOARD CONFIGURATIONS

Pins Shorted on Header J_X			Function
1 & 4	2 & 5	3 & 6	
No	No	No	Open LED
No	No	Yes	Single LEDs with odd designator enabled (D1, D3, ...)
No	Yes	No	2 LEDs in series (D1 + D2)
Yes	No	No	Single LEDs with even designator enabled (D2, D4, ...)
Yes	No	Yes	2 LEDs in parallel (D1 || D2)
Yes	Yes	Yes	Short LED

Auto-addressing

Auto-addressing process sets addresses for all not configured devices. The idea is in selective enabling of buck outputs and measuring the voltage drop across an LED string. When the LED string is connected to a device and the current source for this LED string is enabled, the voltage drop across the LED string will occur. The LED string voltage VLED is measured by the device, thus the address may be assigned to a specific device. In general, the MCU sends a broadcast frame to enable auto-addressing to all devices and a second broadcast frame with the VLED threshold and new device address parameters. After this, a device with VLED higher than set threshold will assign new address.

The following manual is valid for two devices, where the first behaves as a repeater-slave (address 1) connected to the MCU over CAN PHY and second device behaves as a slave (address 2) connected to the first device over M-LVDS PHY layer. The LED string voltage is 33 V (127 ADC code).

1. Enable buck 1 output
2. Set address for device 1 (e.g. 1)
3. Go to Configuration window and set bits “B”, “AAC” to 1 in Auto-addressing control section. Click on Write. Then go to CF5 Assign Address section and set bits “B” to 1, “AA_THR” (threshold voltage value) to e.g. 80 and “AA_ADR” (address) to 1 and click on Write.
4. Read OPMODE from address 1– device should be in OPMODE2 (auto-addressing).
5. Set bits “B” and “AAC” to 0 in Auto-addressing section and click on Write. Read OPMODE again – returned OPMODE should be 1 (OTP Config).
6. Go to CF13 command and set bit “NMD” to 1 and click on Write.
7. In PXN Mode section CF7, set bit “PMC” to 1 and click on Write. After wards read CF8 – “PMS” – should be 1 (repeater-slave). This step is valid only for the repeater-slave device.
8. Close the Configuration window, turn off the buck 1 and enable buck 2.
9. Repeat steps 2, 3, 4, 5, 6 with a different address (e.g. 2).

Please note that this guide is valid for default configuration, where the first device is connected through the UART and others are connected through the M-LVDS.

Software

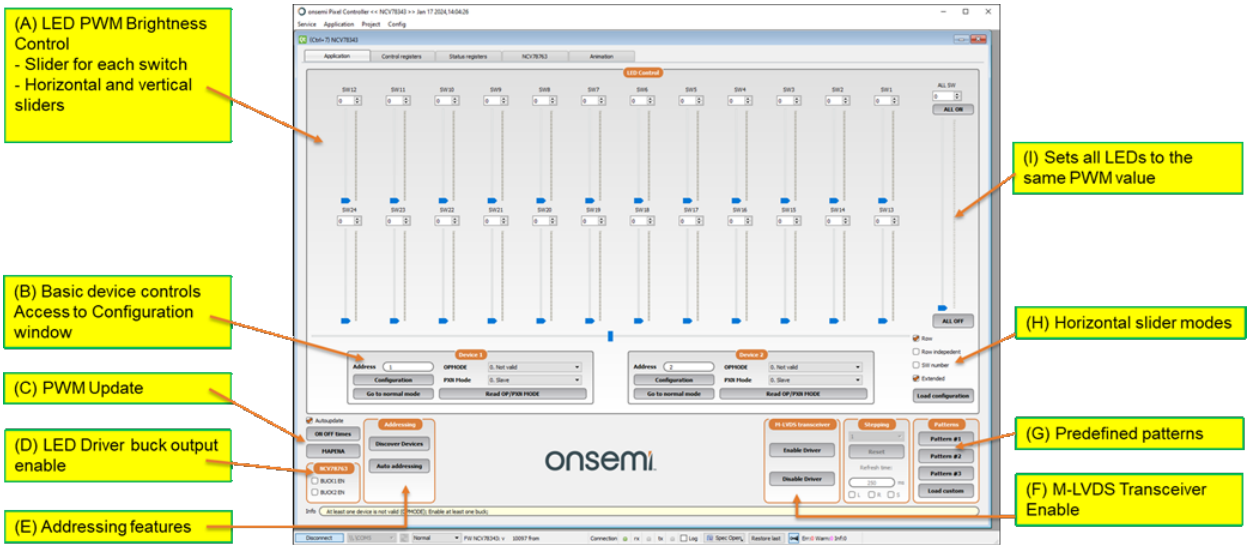

Figure 5. Main Application Tab

A. Individual access to each LED. It is possible to change the LED brightness by moving the slider up/down or move the whole pattern by moving the horizontal or vertical slider.
B. Address for each device and access to the configuration menu.
C. It is necessary to send an update after each switch brightness change – calculate the ON, OFF and TR values and send MAPENA to devices. By enabling the Autoupdate checkbox, this is done automatically.
D. Access to the first and second buck output of the NCV78763. The buck settings are available from the NCV78763 tab.
E. Start Device Discovery or Auto-addressing process.
F. Enable onboard M-LVDS transceiver for PCBs with M-LVDS connection only.
G. Set one of the predefined patterns.
H. Different modes for switch sliders.
    a. Row – all switches will be merged into one row. It means that after last switch of the first row the pattern will continue in first switch of the second row.
    b. Row independent – each row will behave independently, so it is possible to set different pattern for each row.
    c. SW – the pattern will be moved according to the SW numbers.
    d. Extended – this will add imaginary leading and trailing zeroes, so it is possible to move the whole pattern behind the visible range.
I. Sets the same value for all PWM sliders.

Auto-addressing and Address Discovery Windows

User can utilize auto addressing script implemented in GUI Software. This window is invoked upon selecting Auto Addressing from Dropdown Application menu or clicking Auto addressing button in the main window. Please set two addresses to be assigned to the devices (AA_ADR), thresholds (AA_THR), buck outputs (1 and 2 is reserved for on-board NCV78763; please use 3+ for a different current source) and click on Execute.

Address Discovery window runs a script that sweeps all addresses and PXN bus and lists devices that are responding. This is useful feature if there are devices with unknown address connected.

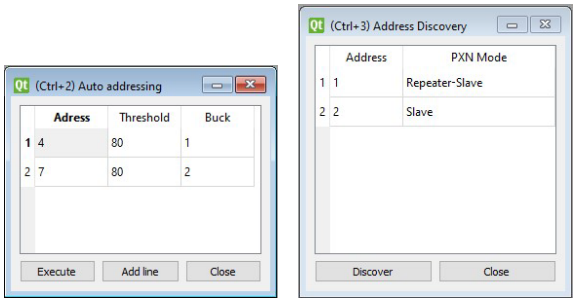

Figure 6. Auto Addressing and Address Discovery Windows

LED Driver Control

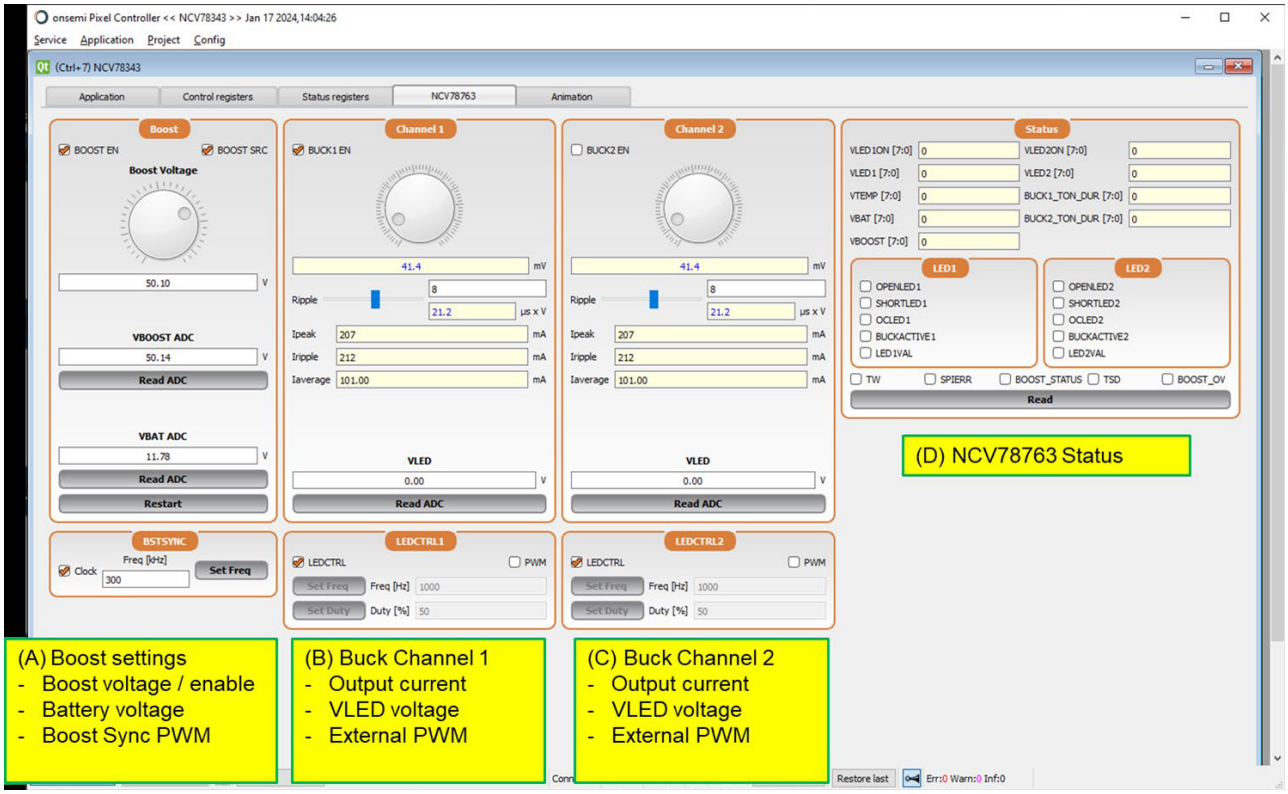

Figure 7. NCV78763 Tab

A. Boost settings – set boost voltage and PWM frequency. Read battery and set boost voltages.
B. Buck 1 settings – set buck current and enable pin. Set LEDCTRL pin or PWM. Read VLED voltage.
C. Buck 2 settings – set buck current and enable pin. Set LEDCTRL pin or PWM. Read VLED voltage.
D. NCV78763 status registers – access to all read status registers.

Troubleshooting

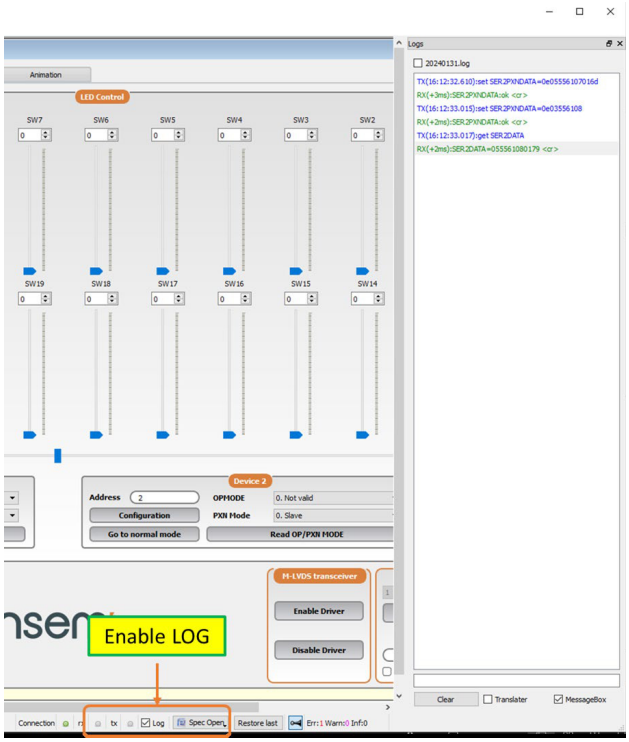

Figure 8. Log window

1. Enable log window (bottom menu)
2. Whenever any frame is sent or received, the communication is displayed in the log window.

Set part:
AABBCCDDEEFF
AA – the break pulse length
BB – number of sent bytes
CC – SYNC byte (0x55)
DD – PID1
EE – PID2
FF – data (write 3 – 12 bytes)

Get part:
AABBCCDDEEFF
AA – number of read bytes
BB – SYNC byte (0x55)
CC – PID1
DD – PID2
EE – data (3 – 12 bytes)
FF – CRC

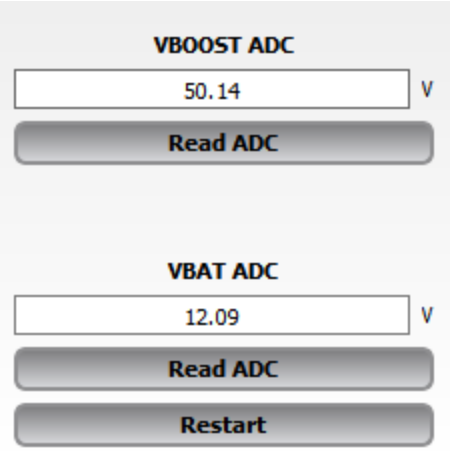

Figure 9. BOOST Parameters

Check the VBAT and VBOOST voltages. The VBAT voltage should be voltage connected to the input connector minus voltage drop on the reverse polarity protection. The VBOOST voltage should be automatically set to 50 V after power on.

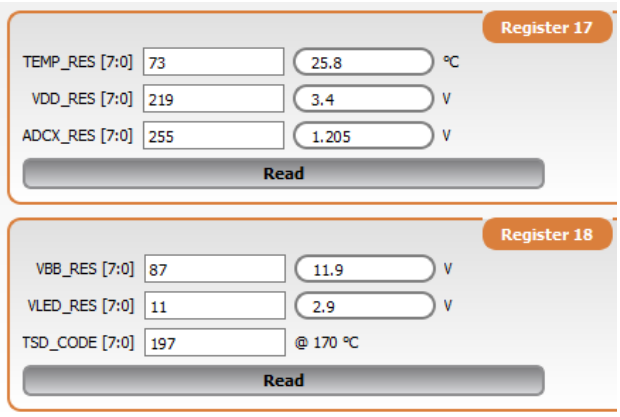

Figure 10. VDD Voltage

Read the VDD and VBB voltages and compare them with directly measured voltages on the board.

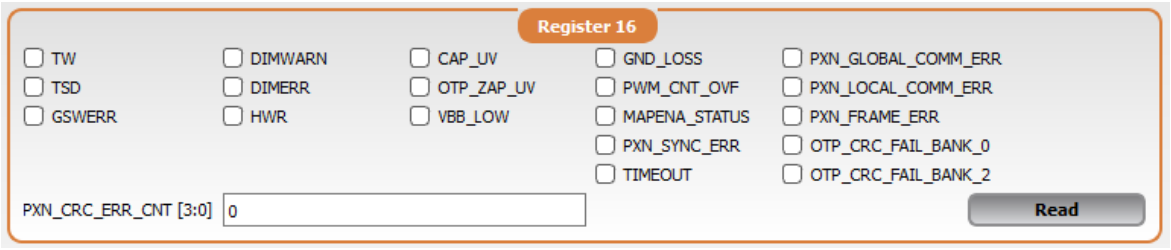

Figure 11. Device Status Registers

TW/TSD – there is a higher power dissipation in the device
GSWERR – there is something wrong with at least one switch
DIMWARN/DIRERR – there is wrong dimming pattern applied, adjust ON/OFF/TR values
CAP_UV – there is something wrong with the external capacitor at C2P/C2N pins
PXN_GLOBAL_COMM_ERR – there is some data mismatch at UART bus
PXN_LOCAL_COMM_ERR – there is some data mismatch at M-LVDS bus
PXN_SYNC_ERR – wrong UART baudrate
PXN_FRAME_ERR – a received PXN frame is corrupted (either parity or CRC or stop bit error)
TIMEOUT – watchdog timeout occured

USB Driver Installation

If the SW GUI does not recognize connected board, please check installed drivers.

A. Open Device manager (press Win+R and type devmgmt.msc).

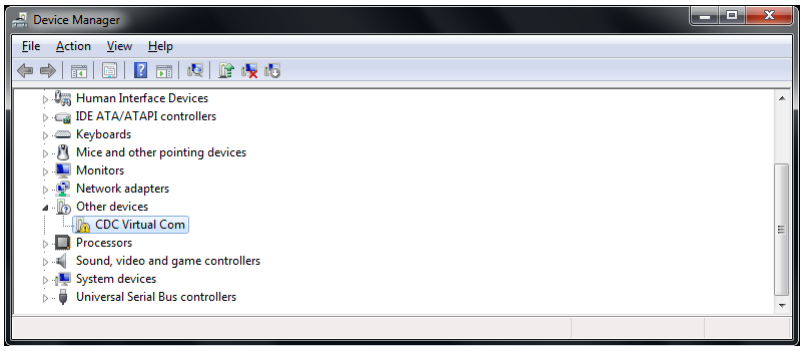

Figure 12. Device Manager

B. If the CDC Virtual COM is not installed properly, right click on CDC Virtual Com and select “Update Driver Software”.

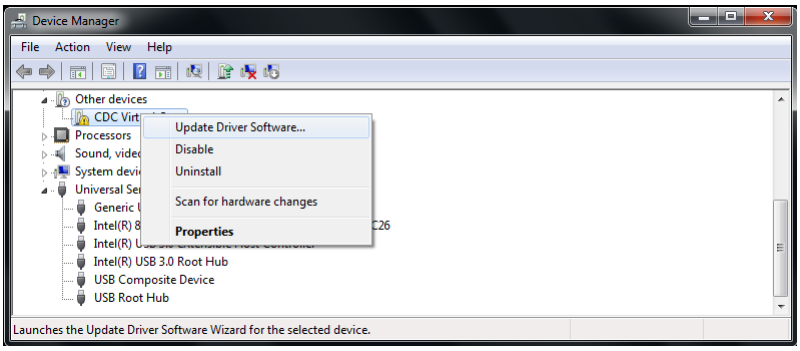

Figure 13. Update Driver Software

C. Select “Browse my computer.” and then “Let me pick from a list…”

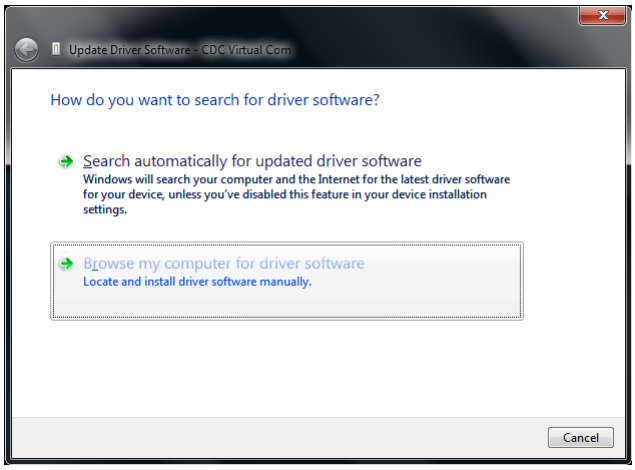

Figure 14. Browse My Computer

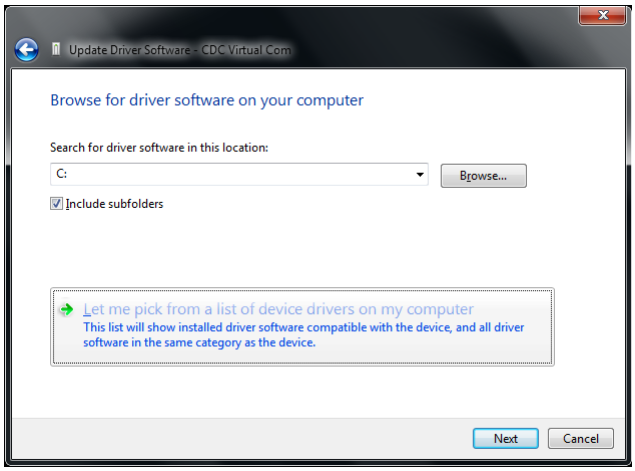

Figure 15. Let Me Pick from a List

D. Click on “Next” and “Have Disk…”

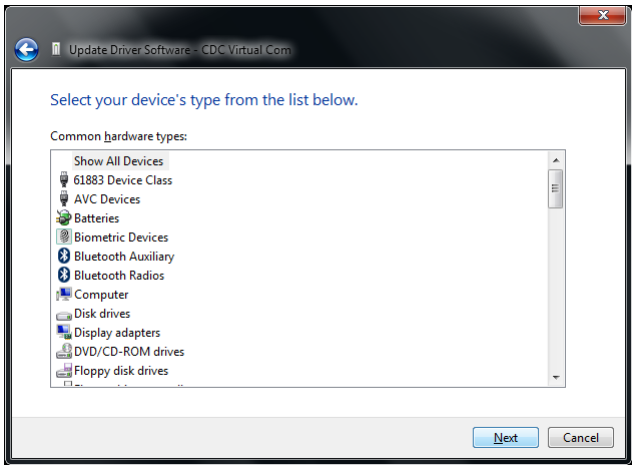

Figure 16. Select Your Device’s Type

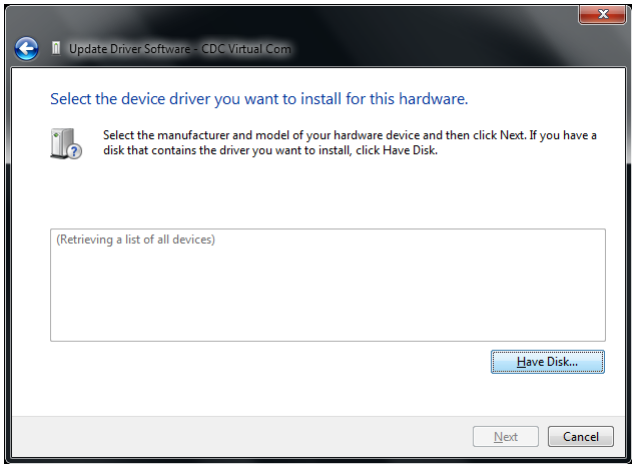

Figure 17. Select the Device Driver

E. Click on “Browse” and select path to driver – default location is the folder with installed PC SW GUI

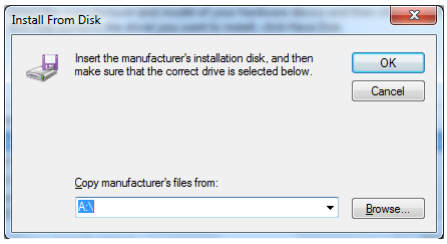

Figure 18. Install From Disk

F. Click on “Ok”, “Next” and “Install”

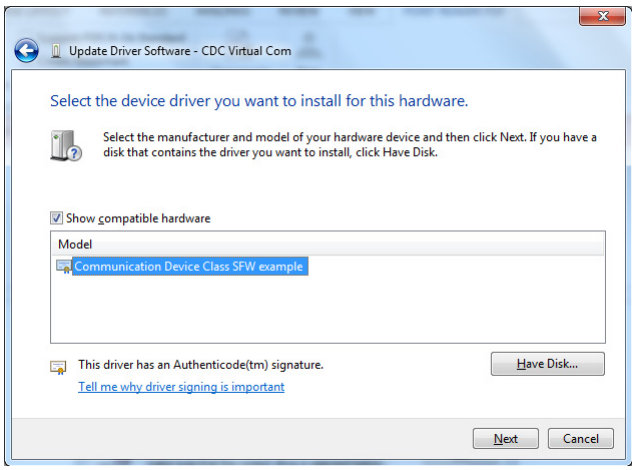

Figure 19. Update Driver Software

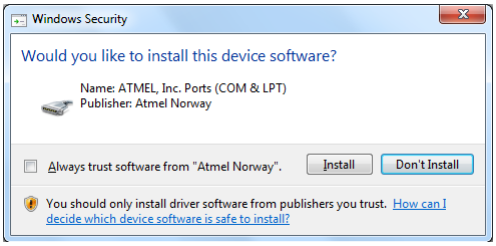

Figure 20. Windows Security Question

G. Finish USB Driver update by click on “Close”

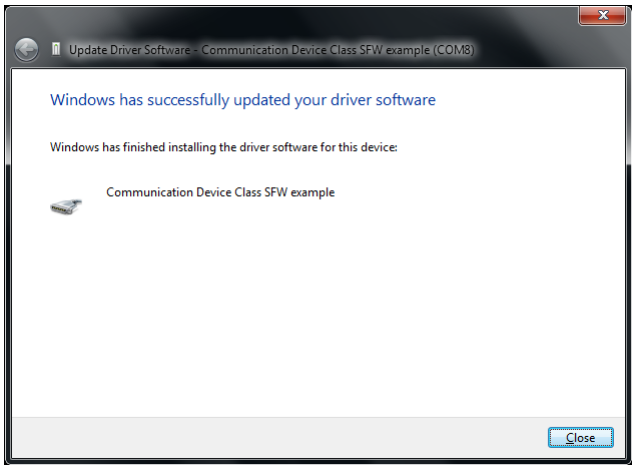

Figure 21. Successfully Updated Driver

H. Verify COM port device “Communication Device Class SFW example”

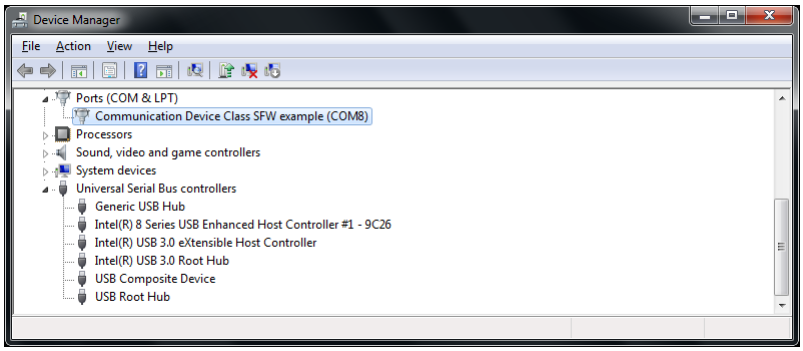

Figure 22. Verify Installed COM Port Driver

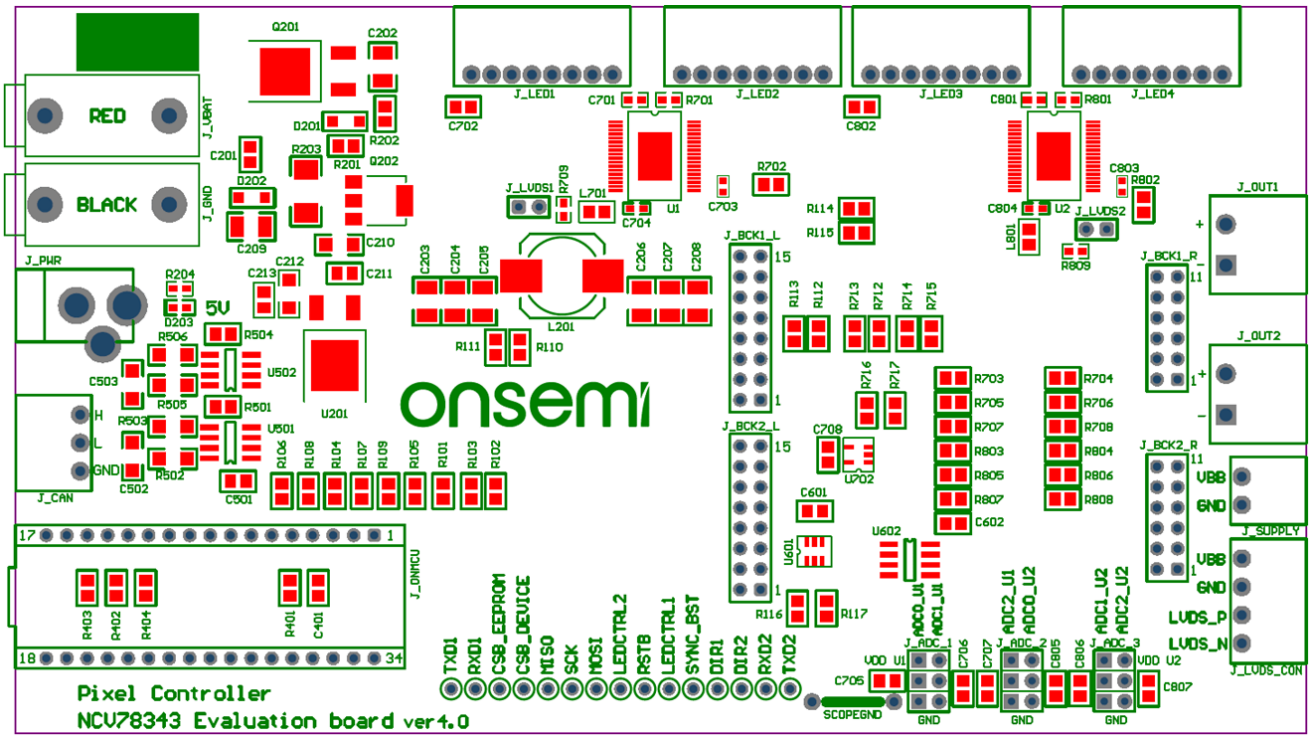

Figure 23. NCV78343R1GEVB Evaluation Board Assembly Drawing

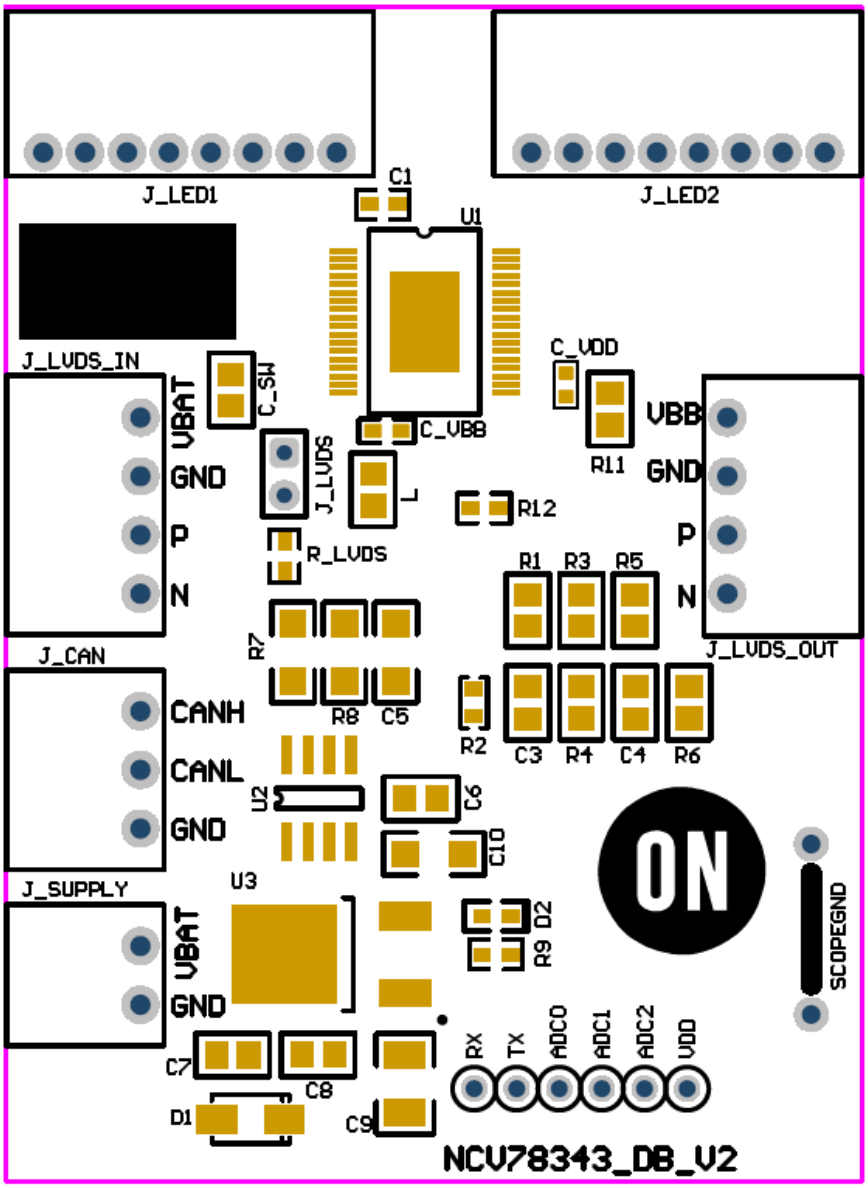

Figure 24. NCV78343R1DAGEVB Satellite Board Assembly Drawing

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