



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



NCN4555EVB

Evaluation Board Manual for NCN4555



ON Semiconductor®

<http://onsemi.com>

INTRODUCTION

This document gives a detailed description of the NCN4555 evaluation board with the Bill Of Material (BOM), board schematic and layout. The appropriate lab test setups are also provided. The NCN4555 Evaluation Board has been designed to help for a quick evaluation of the NCN4555 SIM card interface device. Among its main characteristics this evaluation board has been constructed to be easily interfaced with a customer's systems through an HE10 16-pin connector and an embedded SIM card socket. It can also be evaluated as a standalone demo board. The test procedure considers that last mode of evaluation only through two different portions: primarily the linear DC-DC converter (LDO) and then the level shifter function. This document is used with the NCN4555 device data sheet available on the ON Semiconductor web site (<http://www.onsemi.com>). The data sheet contains full technical details regarding the NCN4555 specifications and operation. The board (FR4 material) is implemented in two metal layers. The Top and Bottom layers have thicknesses of 35 μm . The PCB thickness is 1.6 mm with dimensions of 71 mm by 49 mm (see Figure 1, real size picture).

This evaluation board can be used to evaluate the device performance or should allow the user to place the NCN4555 device in a real application environment. When the intention is to evaluate the device considering the specifications given in the data sheet, it is important to take into account the additional circuitry which may introduce additional power consumption.

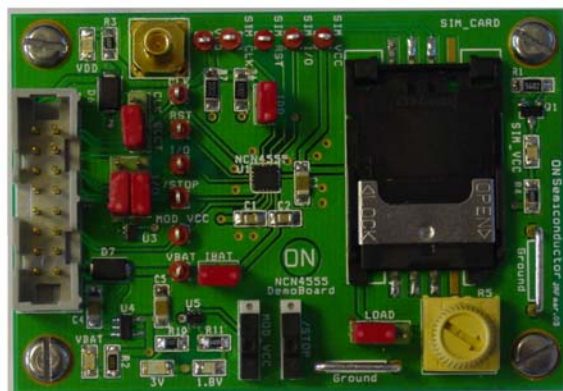


Figure 1. Demo Board (to scale)

EQUIPMENT

Description	Main Features	Example of Equipment (Note 1)	Qty.
Regulated Power Supply	200 mA DC Current Capability	Tektronix PS2520G	2
Multimeter		Keitley 2000 or 2001	2
Sourcemeater		Keitley 2400	1
Oscilloscope	500 MHz Bandwidth, four channel scope, min. 1.0 Mbit memory per channel (Note 2)	Tektronix TDS744, 754 or 784/TDS5054 series or Lecroy WR5060	1
Voltage Probe	Four Probes 500 MHz Bandwidth	Tektronix or Lecroy	4
Waveform Generator	10 MHz, CMOS Logic Signals	Agilent 81104A 80 MHz or HP8110A 150 MHz Two outputs	1
SMB Cable		External Clock Input	1

1. Equipment used in the context of this Application Note Manual.
2. Greater Scope memory per channel offers better resolution.

TEST PROCEDURE

(See Figure 2, all the positions of the switches given below referred strictly to the logical positions (High or Low) indicated in Figure 2)

Initial Setups (Figure 2)

The initial setups given here are recommended before starting measurements on the board.

- Turn-off the /STOP switch (position LOW)
- Set the MOD_VCC switch also in a position LOW (SIM_VCC = 1.8 V)
- As a precaution, turn the 100 Ω potentiometer button fully to the right. The resistor output value is 100 Ω in that case.
- Jumpers:
 - Jumper 1: As shown in Figure 2, internal clock selected (through HE10 connector).
 - Jumper 2 and 3: Jumpers in position Off contrarily to Figure 2 where the position is On. The Open Drain will then be unconnected and the I/O signal will be applied directly to the I/O NCN4555 input through the HE10 connector.
 - Jumper 4: Plugged like Figure 2.
 - Jumper 5: Plugged like Figure 2.
 - Jumper 6: As shown in Figure 2, 100 Ω potentiometer is not connected.

Connect DC Powers

Two power supplies are used to bias the demo board. V_{bat} is the input voltage of the DC-DC converter, V_{DD} is the

“digital” power supply which bias the input stages of the NCN4555 device (control and signal inputs).

V_{DD} and V_{bat}, must be connected to the board for a correct full operation.

- Connect the ground of the V_{DD} and V_{BAT} power supplies to the ground of the board (two GND jumpers available on the board).
- Connect the V_{DD} power supply using the HE10 connector or the V_{DD} test point.
- Connect the V_{BAT} power supply through the HE10 connector or using the V_{BAT} test point.
- **Warning:** If V_{DD} and V_{BAT} are applied through the HE10 connector, the operating power supply voltages must be checked on the test points because of the dropout voltages (~0.6 V/0.7 V) introduced by the protection diodes D6 and D7.
- Power up V_{DD} in the range 1.8 V–5.5 V. The corresponding red LED lights on.
- Power up V_{BAT} in the range 2.7 V–5.5 V. The corresponding red LED lights on.
- The MOD_VCC switch selects CRD-VCC 1.8 V or 3.0 V. When CRD_VCC delivers 1.8 V, the yellow LED is turned on and the MOD_VCC switch is in the logical position LOW. When CRD_VCC provides 3.0 V, the green LED is turned on and the MOD_VCC switch is HIGH.
- By using the /STOP switch, you select either the operating mode or the shutdown mode. In this last case, the SIM_VCC voltage being null, the SIM_VCC green LED is off.

NCN4555EVB

Power Supply Section Evaluation

With this eval board, the following measurements can be made (see NCN4555 data sheet):

- Operating and shutdown currents both on V_{DD} and V_{bat}
- Undervoltage Lockout (V_{DD})
- Short Circuit Current ($I_{SIM_VCC_SC}$)
- Max I_{SIM_VCC} Current
- DC-DC Converter Turn-on and Turn-off times

Measurement implementation:

- The eval board is powered up at the V_{BAT} and V_{DD} voltages specified by the application
- The switch/STOP is in position HIGH (operating mode)
- The switch MOD_VCC is fixed according to the value required by the application
- **Connect CLK and RST inputs to GND in order to avoid floating nodes**

- Connect the oscilloscope probe and the voltmeter as follows:

Analog ground (voltmeter and scope)
to
Demo board's GROUND jumper

Channel 1, 1.0 M Ω , and voltmeter
to
Test point SIM_VCC (Smart card operating voltage)

- Connect the amp meters using jumpers 4 and 5 respectively to measure I_{DD} and I_{bat}
- Using the SIM_VCC load jumper, the user can connect the SIM_VCC output to a 100 Ω potentiometer, and this way, pull the nominal I_{SIM_VCC} current up to 50 mA. This potentiometer can also be used to measure the I_{SIM_VCC} Short Circuit and max allowable currents.

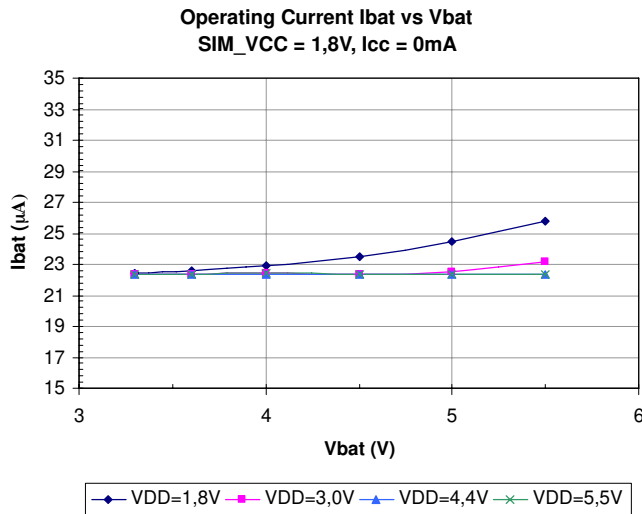


Figure 3. Typical Operating Current I_{bat} vs. V_{bat} / $SIM_Vcc = 1.8$ V, $I_{cc} = 0$ mA and Temp = 25°C. (Additional power consumption of about 21 μ A subtracted here to the actual measurements.)

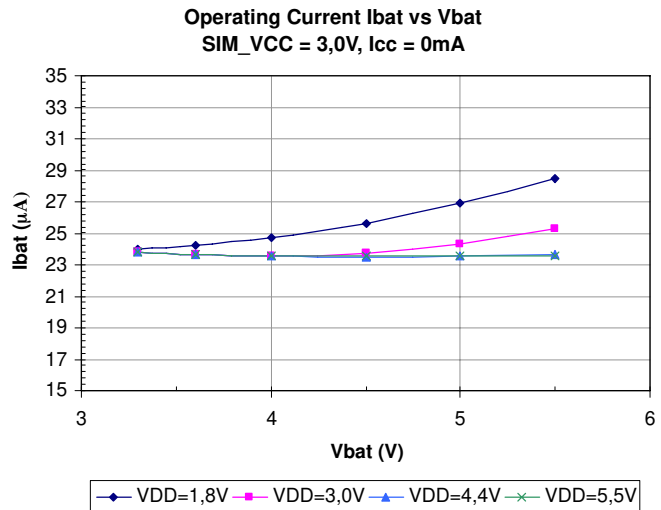


Figure 4. Typical Operating Current I_{bat} vs. V_{bat} / $SIM_Vcc = 3.0$ V, $I_{cc} = 0$ mA and Temp = 25°C. (Additional power consumption of about 42 μ A subtracted here to the actual measurements.)

NCN4555EVB

Short Circuit Current – ICCsc vs Vbat

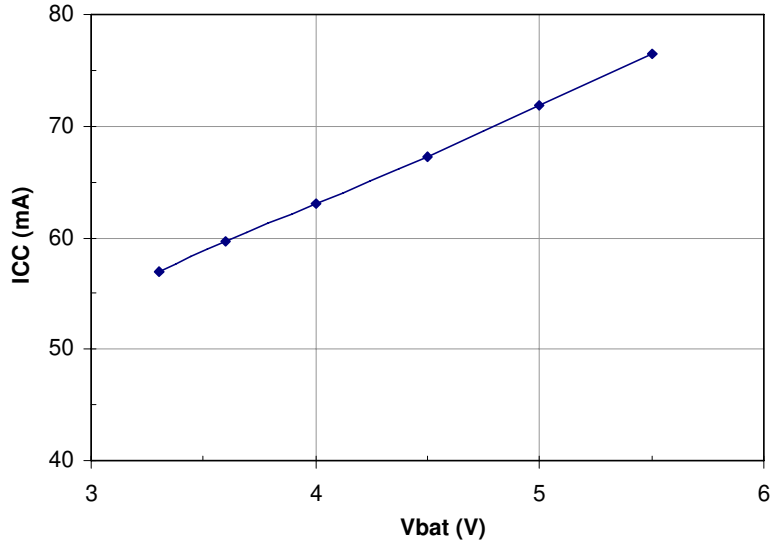


Figure 5. Short-Circuit Current/SIM_Vcc = 3.0 V (same for 1.8 V), Temp = 25°C

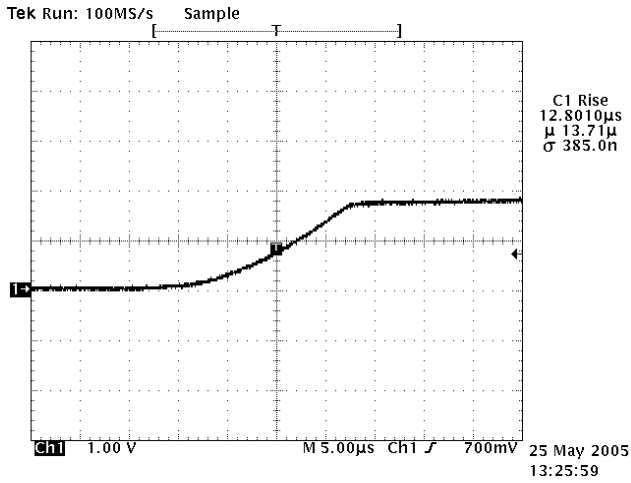


Figure 6. LDO's Turn-on Time/SIM_Vcc = 1.8 V, VDD = 1.8 V, Vbat = 5.5 V and Temp = 25°C

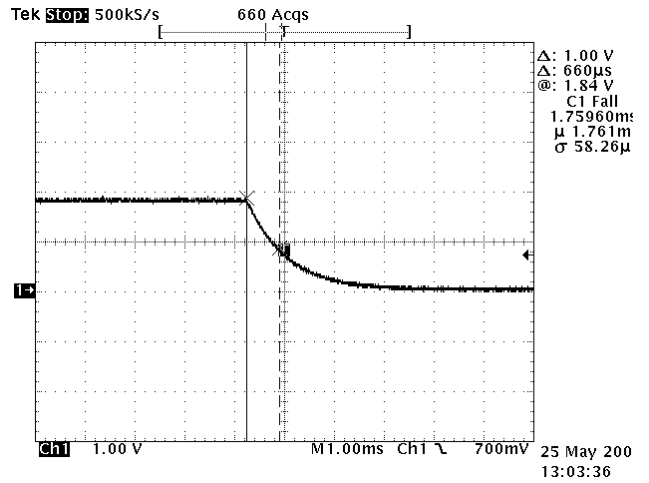


Figure 7. LDO's Turn-off Time to 1.0 V/SIM_Vcc = 1.8 V, VDD = 1.8 V, Vbat = 5.5 V and Temp = 25°C

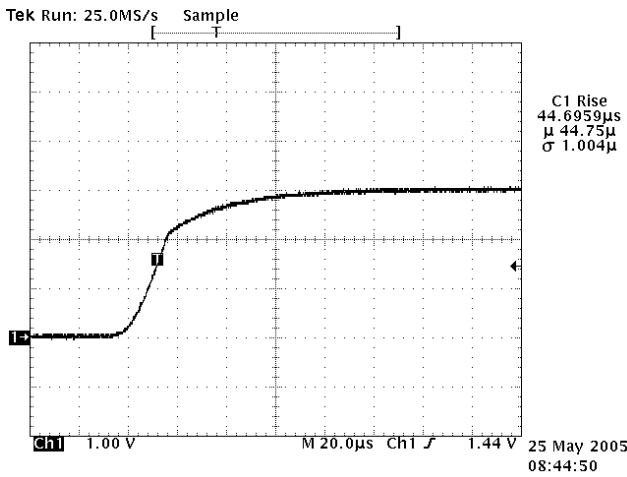


Figure 8. LDO's Turn-on Time/SIM_Vcc = 3.0 V, VDD = 1.8 V, Vbat = 5.5 V and Temp = 25°C

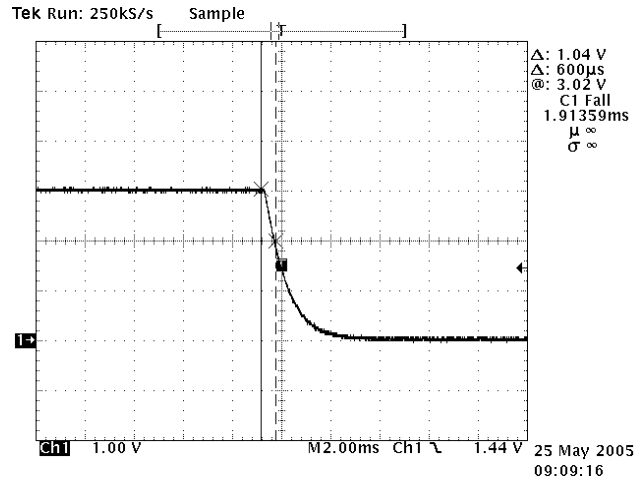


Figure 9. LDO's Turn-off Time to 1.0 V/SIM_Vcc = 3.0 V, VDD = 1.8 V, Vbat = 5.5 V and Temp = 25°C

Level Shifter Test

Considering the level shifter function with this evaluation board, the following measurements can be made.

- Signal rise and fall times
- Signal levels High and Low
- Clock duty cycle
- Frequency performance

Measurement implementation:

- The eval board is powered up at the V_{BAT} and V_{DD} voltages specified by the application
- The switch/STOP is in position HIGH (operating mode)
- The switch MOD_V_{CC} is fixed according to the value required by the application

SIM_CLK Signal:

CLK and SIM_CLK are clock signals.

Connect the RST input to the Ground or to V_{DD} in order to avoid floating nodes.

To evaluate SIM_CLK a clock signal has to be connected either using the external clock input (SMB connector) or through the HE10 connector. The selection is done using the corresponding jumper (see Figure 2). The max clock frequency will be 5.0 MHz, and the signal will have to accommodate the specifications provided in the data sheet.

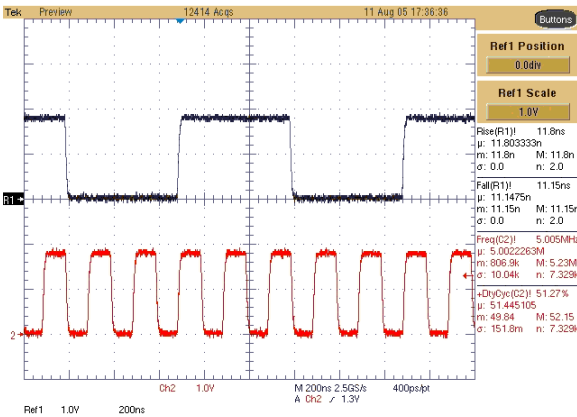


Figure 10. SIM_CLK Waveforms at 1.0 MHz (Top) and 5.0 MHz (Bottom)/SIM_Vcc = 1.8 V and Cout > 33 pF

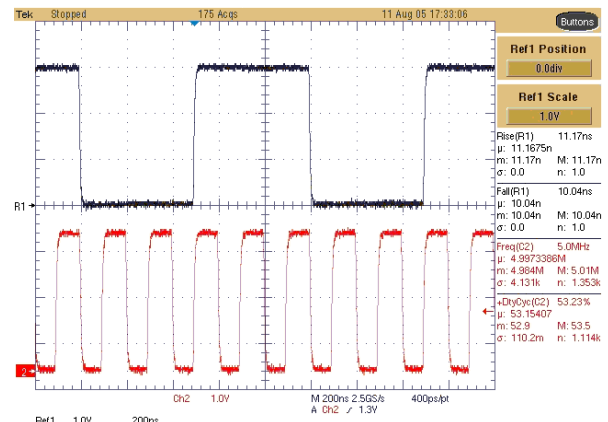


Figure 11. SIM_CLK Waveforms at 1.0 MHz (Top) and 5.0 MHz (Bottom)/SIM_Vcc = 3.0 V and Cout > 33 pF

SIM_RST Signal:

RST and SIM_RST are Boolean-like signals.

Connect the CLK input to the Ground or to V_{DD} in order to avoid floating nodes.

To evaluate SIM_RST, an RST signal accommodating the data sheet specifications will be applied either using the HE10 connector or through the corresponding test point.

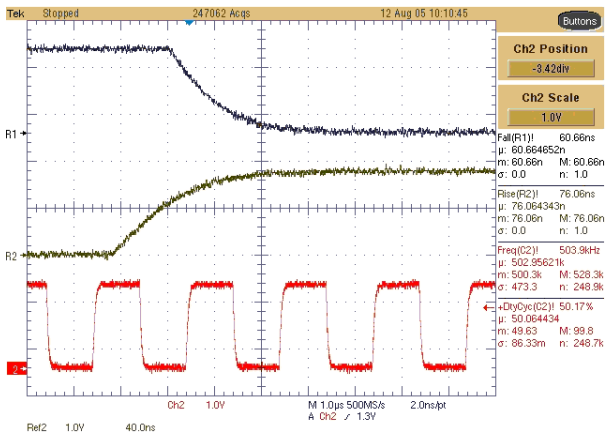


Figure 12. SIM_RST Waveforms/SIM_Vcc = 1.8 V and Cout > 33 pF

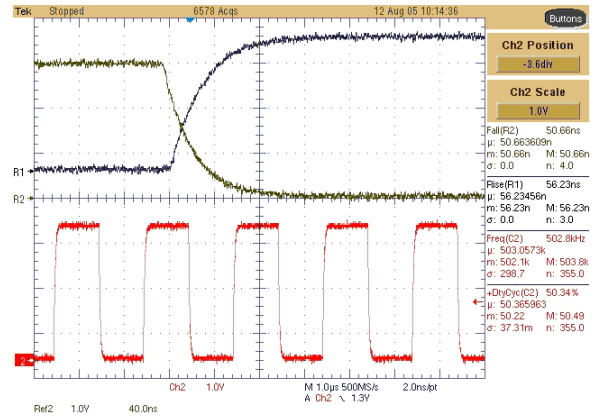


Figure 13. SIM_RST Waveforms/SIM_Vcc = 3.0 V and Cout > 33 pF

• **SIM_I/O Signal:**

I/O and SIM_I/O are data signals.

To evaluate SIM_I/O, an I/O signal accommodating the data sheet specifications will be applied directly to the NCN4555 I/O device input (using either the HE10 connector or the corresponding test point and placing

jumpers 2 and 3 in position OFF) or through the open drain circuit (using the HE10 connector only and placing the I/O jumpers in position ON). Typically 9600 bauds data are used through the I/O – SIM_I/O bidirectional channel. The open drain condition on the input corresponds to a worst–case situation regarding the rise and fall times and frequency performance.

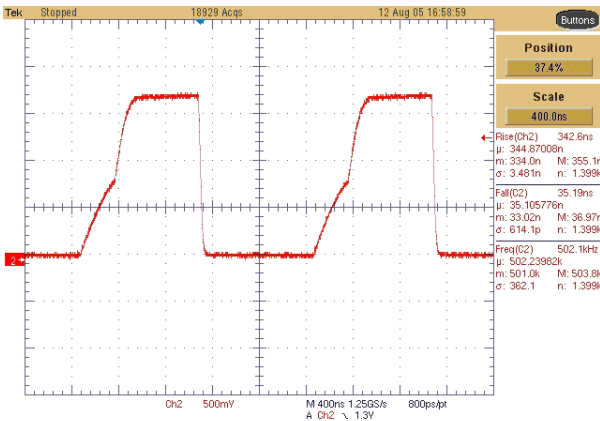


Figure 14. SIM_I/O Waveforms On–board Open–Drain Configuration, SIM_Vcc = 1.8 V and Cout > 33 pF

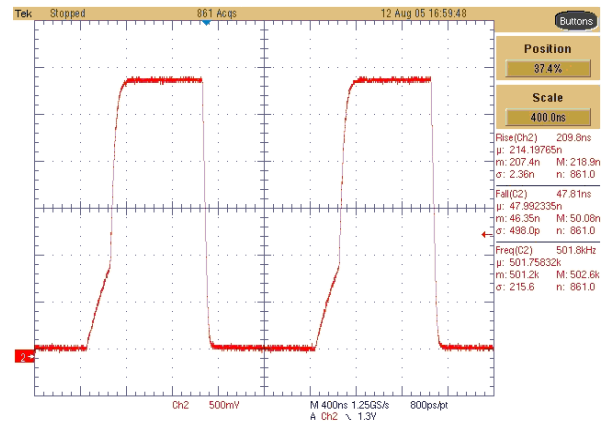


Figure 15. SIM_I/O Waveforms/On–board Open–Drain Configuration, SIM_Vcc = 1.8 V and Cout > 33 pF

- For the three different signals, connect the oscilloscope probe as follows. These signals can be considered independently (in that case be careful with the floating nodes) or together. SIM_VCC will be connected to the oscilloscope’s channel 1.

Analog ground
to
GROUND jumper on the demo board

Channel 2, Channel 3, Channel 4, 1.0 MΩ
to
Corresponding test points

- Switch MOD_VCC to obtain alternatively 1.8 V CMOS logic levels or 3.0 V CMOS logic levels on SIM_I/O, SIM_CLK and SIM_RST.

NCN4555EVB

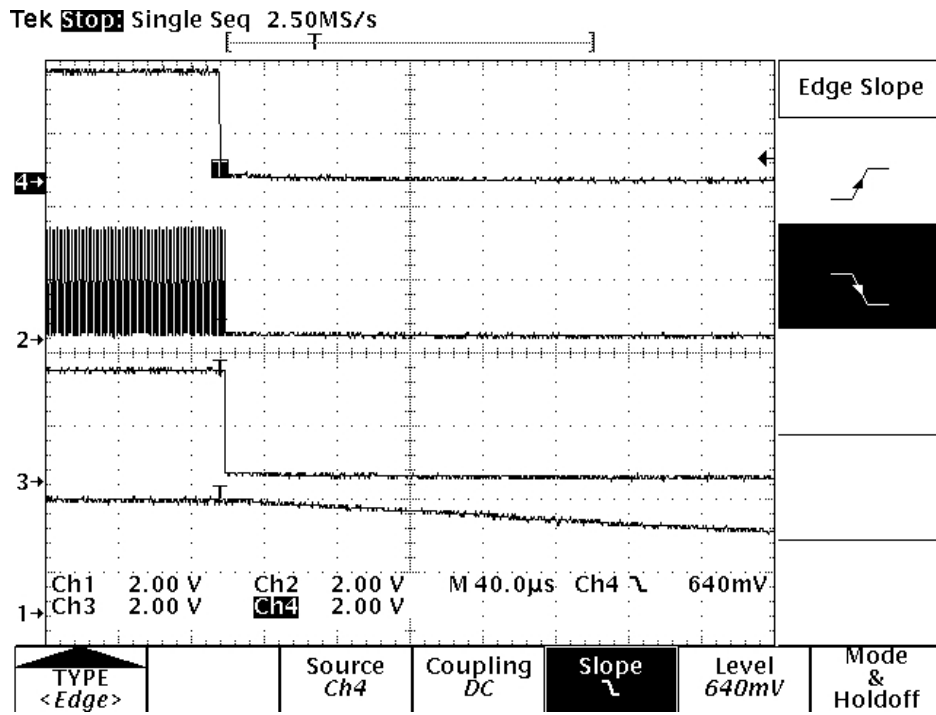


Figure 16. Example of deactivation sequence generated with a Microcontroller board directly connected to the NCN4555 demo board through the HE10 connector. (CH1 = SIM_RST, CH2 = SIM_CLK, CH3 = SIM_I/O and CH4 = SIM_Vcc)

NCN4555EVB

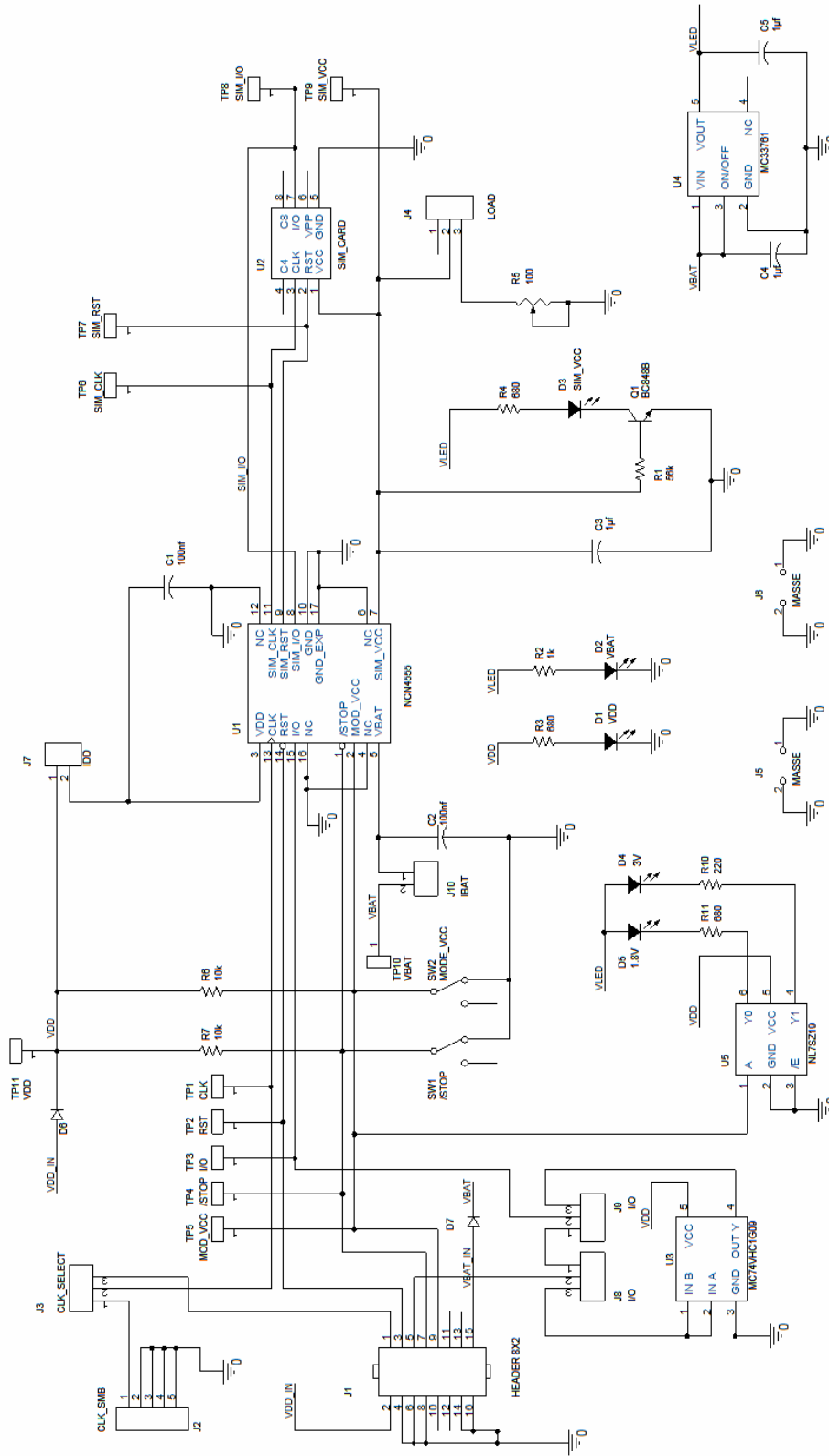


Figure 17. Evaluation Board Schematic

NCN4555EVB

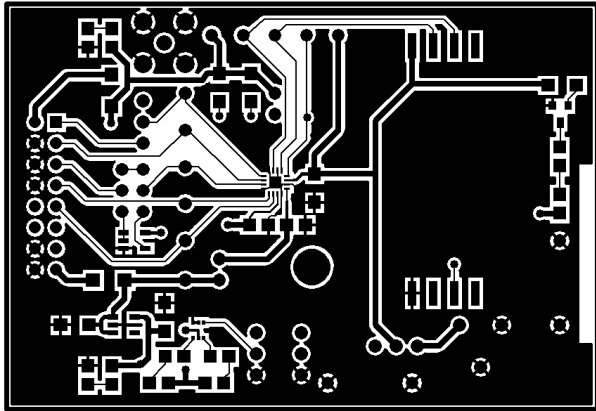
Table 1. NCN4555 Evaluation Board Bill Of Material, BOM

#	Qty	Designator	Description	Footprint	Preferred Suppliers	Part Number
1	2	C1,C2	100 nF, Y5V, 50 V	0805	Murata	GRM219F51H104ZA01D
2	3	C3, C4, C5	1.0 μ F, X7R, 25 V	1206	Murata	GRM31MF51E105ZA01L
3	1	D1 (V _{DD})	LED CMS, red, 15mcd	0805	OSRAM	LHR974
4	1	D2 (V _{bat})	LED CMS, red, 15mcd	0805	OSRAM	LHR974
5	1	D3 (SIM_Vcc)	LED CMS, orange, 60mcd	0805	OSRAM	LYR976
6	1	D4 (3.0 V)	LED CMS, green, 9mcd	0805	Agilent	HSMGC670
7	1	D5 (1.8 V)	LED CMS, orange, 60mcd	0805	OSRAM	LYR976
8	2	D6, D7	Protection diodes	SMA	ON Semiconductor	MMSD4148T1
9	1	J1	0.100" Low Profile Box Headers 16P	HE8*2	3M	2516-6002UG
10	1	J2	SMB male connector	SMB/V	IMS	11.1510.001
11	1	J3, J4, J8, J9	Breakable single row header (3 pins)	CON3-2.54	TYCO Amp	5-826629-0
12	2	J7, J10	Breakable single row header (2 pins) (I _{dd} , I _{bat})	CON2-2.54	TYCO Amp	5-826629-0
13	2	J5, J6	Ground: strap, brass, \varnothing 1.0 mm, pitch 10.16 mm, height 9.9 mm	GND_STRP	HARWIN	
14	1	Q1	NPN transistor	SOT23	ON Semiconductor	BC849TL
15	2	R2	1.0 k, CMS resistor 1%	0805	Vishay	D12P/CRCW0805P
16	1	R3, R4, R11	680R, CMS resistor 1%	0805	Vishay	D12P/CRCW0805P
17	1	R1	56 k, CMS resistor 1%	1206	Vishay	D25P/CRCW1206P
18	1	R5	Single turn Cermet trimmer 100 Ω , 0.5 W, 10%, 63M100R	CERMET-72PT	Vishay Spectrol	63M-T607-101
19	2	R6, R7	10 k, CMS resistor 1%	1206	Vishay	D25P/CRCW1206P
20	2	R10	220R, CMS resistor 1%	0805	Vishay	D12P/CRCW0805P
21	1	SW1, SW2	/STOP, MOD_Vcc, PCB tact switches 1k2	INTER3-2.54	Secme	090329001
22	3	TP1, TP2, TP3	CLK, RST, I/O clip test point, hole \varnothing 1.0 mm	TP2	APW	203
23	2	TP4, TP5	/STOP, MOD_Vcc, clip test point, hole \varnothing 1.0 mm	TP2	APW	203
24	1	TP6, TP7, TP8	SIM_CLK, SIM_RST, SIM_Vcc, clip test point, hole \varnothing 1.0 mm	TP2	APW	203
25	1	TP9	SIM_VCC, clip test point, hole \varnothing 1.0 mm	TP2	APW	203
26	1	TP10, TP11	Vbat, Vdd, clip test point, hole \varnothing 1.0 mm	TP2	APW	203
27	1	U1	NCN4555, 1.8 V/3.0 V Smart Card Interface	QFN-16	ON Semiconductor	NCN4555
28	1	U2	SIM Card Connector	SIM1	ITT Cannon	CCM030

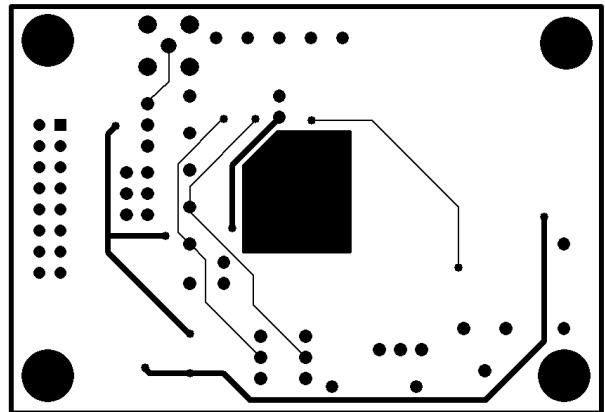
NCN4555EVB

Table 1. NCN4555 Evaluation Board Bill Of Material, BOM (continued)

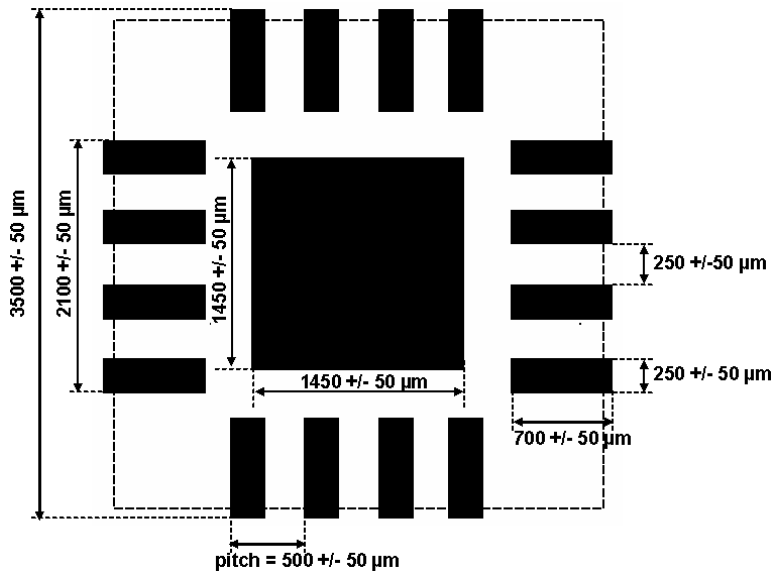
29	1	U3	2-Input AND Gate with Open Drain Output	TSOP-5	ON Semiconductor	MC74VHC1G09
30	1	U4	Ultra Low Noise LDO voltage regulator with 1.0 V On/Off Control	TSOP-5	ON Semiconductor	MC33761SNT1-025
31	1	U5	1 of 2 Decoder/ Demultiplexer	SC-88	ON Semiconductor	NL7SZ19



Top Layer



Bottom Layer



QFN-16 3 x 3 x 0.75 mm Package Solder Footprint Pattern

Figure 18. PCB Layout Details

ON Semiconductor and **ON** are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
P.O. Box 61312, Phoenix, Arizona 85082-1312 USA
Phone: 480-829-7710 or 800-344-3860 Toll Free USA/Canada
Fax: 480-829-7709 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada

Japan: ON Semiconductor, Japan Customer Focus Center
2-9-1 Kamimeguro, Meguro-ku, Tokyo, Japan 153-0051
Phone: 81-3-5773-3850

ON Semiconductor Website: <http://onsemi.com>

Order Literature: <http://www.onsemi.com/litorder>

For additional information, please contact your
local Sales Representative.