



UM10573

PCA9633 demo board OM6276

Rev. 1 — 17 October 2012

User manual

Document information

Info	Content
Keywords	LED driver, FET, I ² C-bus
Abstract	The PCA9633 OM6276 demo board demonstrates the NXP Semiconductors PCA9633 Fast-mode Plus 4-bit I ² C-bus LED driver IC



Revision history

Rev	Date	Description
1	20121017	first issue

Contact information

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1. Introduction

The PCA9633 OM6276 demo board demonstrates the NXP Semiconductors PCA9633 Fast-mode Plus 4-bit I²C-bus LED driver IC. The PCA9633 controls four LEDs and through individual pulse width modulation (PWM) each LED show different levels of intensity.

The board supports six different modes of operation including color wash and random color. The on-board Flash microcontroller is also user reprogrammable for endless variations of functionality.

The board:

- Has 6 Different Modes of Operation:
 - Auto Demonstration Mode
 - Color Wash Mode
 - Random Color Mode
 - User Color Mode
 - Multiple Card Chase Mode
 - Output Enable Control Mode
- Includes high-current FET drivers for off board LED circuitry
- Can be powered by either the on-board 9 V (DC) battery or through the external power connector
- Can be daisy-chained with additional boards for synchronous control by a single I²C master

2. Description

[Figure 1](#) is a photograph of the PCA9633 (Philips legacy) demo board showing the PCA9633 chip (U2) and LPC925 microcontroller (U1) installed. [Figure 3](#) shows a block diagram of the demo board. [Figure 4](#) shows the board power and mode switch.

The board can be powered by either the on-board 9 V (DC) battery on the underside of the board ([Figure 2](#)), or by an external power supply. There are 4 software programmable I²C addresses which allow the control of groups of devices with a single software command sequence.

The board features:

- 1 MHz and 30 mA output allows faster data updates and/or more capacitive buses
- 4 individually controlled 25 mA open-drain or push-pull outputs OFF, ON, DIM, or DIM with Global Control for LED dimming/blinking
- \overline{OE} input pin also allows hardware dimming/blinking
- Up to 7 address pins allows 128 I²C addresses
- 4 software programmable I²C addresses allows controlling groups of devices with single software command sequence
- If the battery is low, the red LED will flash every 3 seconds as a warning.

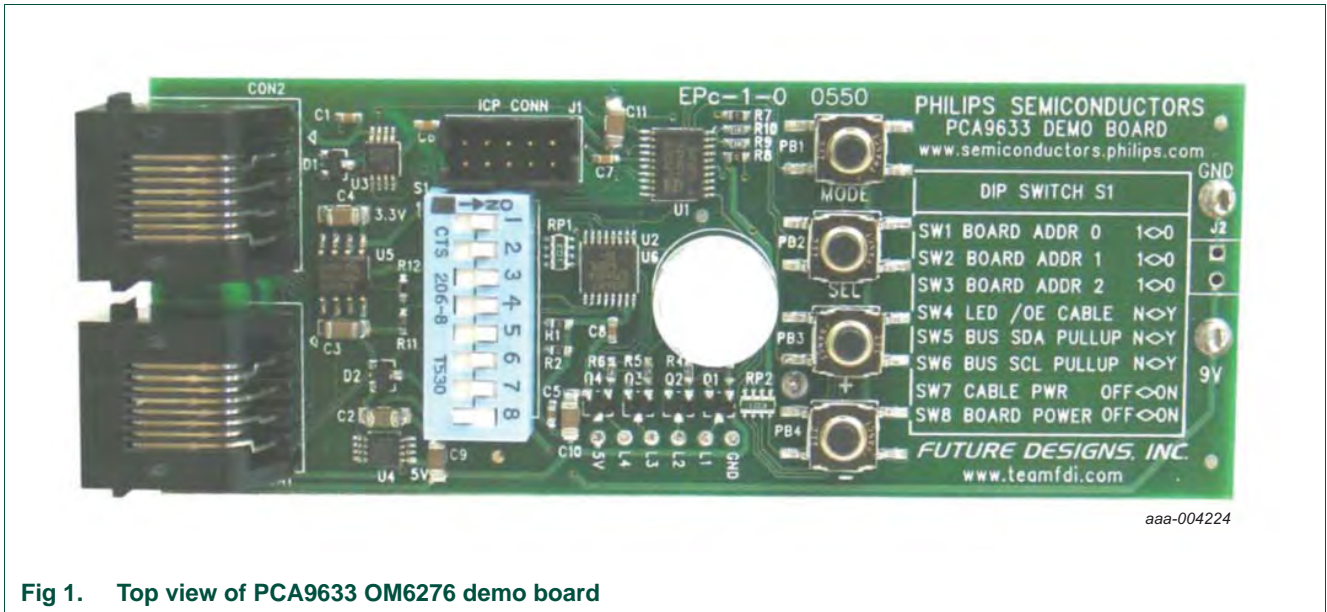


Fig 1. Top view of PCA9633 OM6276 demo board



Fig 2. Battery placement

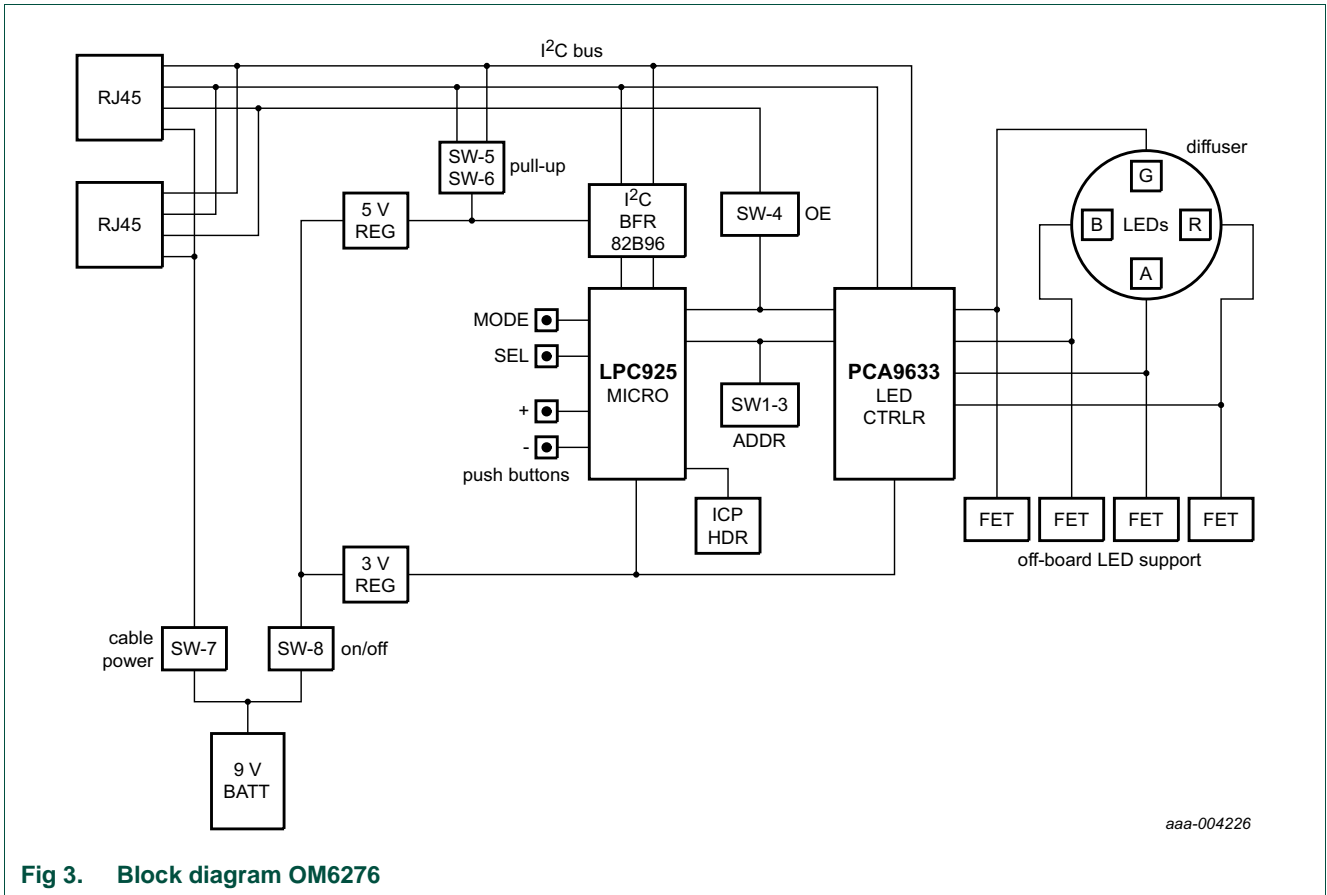


Fig 3. Block diagram OM6276

2.1 Power connectivity

The PCA9633 OM6276 demo board requires input power of 6 V (DC) to 9 V (DC) at 100 mA. This power may be supplied via the 9 V battery holder, or via the external power connector, J2. Take care to observe correct polarity when connecting an external power source to the board.

2.2 Board power and mode DIP switch (SW1)

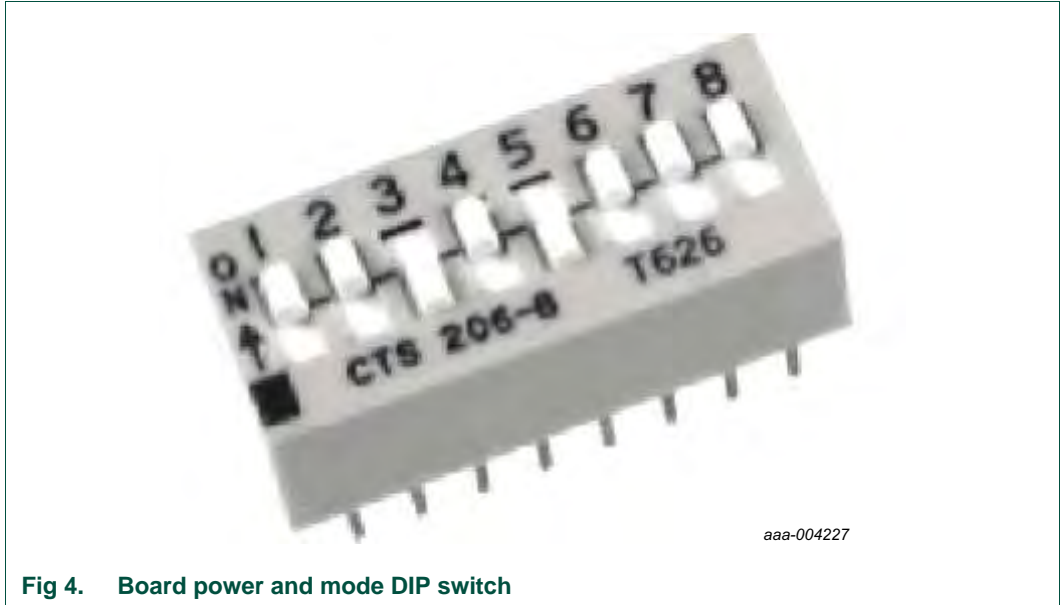


Fig 4. Board power and mode DIP switch

This DIP switch comprises 8 slider switches that connect board power, set slaved boards and set cable functions.

2.3 DIP switch settings

Table 1. DIP switch settings

Slider switch	Function	Switch position	Description
1	board address 0	1<>0	[1] board address input to μ processor and PCA9633
2	board address 1	1<>0	[1] board address input to μ processor and PCA9633
3	board address 2	1<>0	[1] board address input to μ processor and PCA9633
4	cable LED \overline{OE}	N<>Y	connect the \overline{OE} of the PCA9633 to the cable
5	bus SDA pull-up enable	N<>Y	enable pull-up of the SDA signal on the cable
6	bus SCL pull-up enable	N<>Y	enable pull-up of the SCL signal on the cable
7	cable power OFF/ON	OFF/ON	connect the battery to the cable
8	board power OFF/ON	OFF/ON	board power control

[1] See [Section 2.4](#).

2.3.1 Board power OFF/ON

Slider switch 8 of the DIP switch turns power OFF/ON for the board. Switch the board power OFF whenever the board is not in use to avoid battery drain. Remove the battery from the board when not in use, to avoid battery drain should the OFF/ON switch be inadvertently switched ON. Place the battery in the holder with the contacts “away” from each other as a storage method ([Figure 2](#)).

2.3.2 Bus SDA pull-up enable and bus SCL pull-up enable

Slider switches 5 and 6 (see [Table 1](#)) disable/enable the cable side pull-ups for the I²C-bus. These switches must be ON for the MASTER Board (0) and the LAST SLAVE board in the chain. All other boards between, must have these switches set to OFF. If there are only two boards connected (MASTER and SLAVE), both boards must have these switches set to ON.

2.3.3 Cable power OFF/ON

Slider switch 7 enables the battery power connection to the RJ45 cable on pin 1 of the RJ45 Ethernet socket. It allows a single power source for the complete chain of boards when all the boards have this switch set to ON. When a chain of boards is utilized, use a single bench or wall power supply and remove the 9 V battery from each board. This action is necessary as the typical 9 V battery cannot supply enough current to power multiple boards.

The input power requirements are: 6 V (DC) to 12 V (DC), 100 mA per board maximum.

2.4 Board selection

Table 2. Board address

SW3	SW2	SW1	Board	Description
ON	ON	ON	0	master (default) ^{[1][2]}
ON	ON	OFF	1	slave 1
ON	OFF	ON	2	slave 2
ON	OFF	OFF	3	slave 3
OFF	ON	ON	4	slave 4
OFF	ON	OFF	5	slave 5
OFF	OFF	ON	6	slave 6
OFF	OFF	OFF	7	slave 7

[1] Only one board can be set as Master.

[2] The MASTER board must be at one end of the Ethernet cable for proper operation of the I²C-bus. Subsequent SLAVE boards are not required to be in any certain order. Also, there may be gaps in the SLAVE board addresses (e.g., it is possible to have SLAVE Boards 2, 4, 6 and no SLAVE Board 3 or 5).

2.5 Off-board LED drivers

The PCA9633 OM6276 demo board includes four NXP Semiconductors BSH112 high-current FET drivers for off-board LED circuitry. These devices, Q1 to Q4, are capable of switching up to 60 V at 300 mA. Their outputs are connected to solder pads L1 to L4 with adjacent 5 V and GND connections. They are connected as “low side” switches to ground configuration.

3. Operation

On the DIP switch push slider switch 8 to the ON position. The LEDs will immediately flash and glow. To select a different mode of operation, press the MODE button (PB1). The LED will flash amber a number of times to denote which mode has been entered. Use the other three buttons (SELECT, PLUS, MINUS) to change the settings. The six different available modes of operation are described in [Table 3](#).

If the battery is low, the red LED will flash every three seconds.

Table 3. Modes

Switch selection	Action
Mode 1: Auto demonstration	First shows Mode 2 for 10 seconds, then shows Mode 3 for 10 seconds, and then repeats
Mode	next mode
Select	does nothing
Plus	does nothing
Minus	does nothing
Mode 2: Color wash	Goes through blends of different colors continuous
Mode	next mode
Select	toggle between smooth transitions and sharp transitions
Plus	does nothing
Minus	does nothing
Mode 3: Random color	Randomly shows different colors without blending transitions
Mode	next mode
Select	toggle between two color sets: darker and lighter
Plus	faster
Minus	slower
Mode 4: User color	Allows a color to be chosen by selecting the amount of each LED's PWM output. It also selects the fifth group PWM that is used to dim or blink the combined colors at the same time
Mode	next mode
Select	select color PWM component: red, green, blue, amber or white; fifth group PWM flashes as that PWM is selected
Plus	more of that color component
Minus	less of that color component
Mode 5: Multiple card chase	Uses multiple cards and the group call feature of the PCA9633 to generate a chase pattern of 2 (yellow/red), 3 (yellow/red/green), or 4 (yellow/red/green/blue) colors. It can be done for up to 8 boards (master plus seven slave boards) connected via the RJ45 Ethernet sockets.
Mode	next mode
Select	select color PWM component: red, green, blue, amber or white; fifth group PWM flashes as that PWM is selected
Plus	more of that color component
Minus	less of that color component
Mode 6: Output Enable control	Demonstrates the \overline{OE} control pin input that sets the LED outputs to high impedance. This mode changes the LED diffuser color to purple and blinks all LEDs at the same rate.
Mode	next mode

Table 3. Modes

Switch selection	Action
Select	selects frequency (duty cycle fixed at 50 %/50 %) or duty cycle (frequency fixed at XX)
Plus	faster frequency (double each push) or longer ON duty cycle
Minus	slower frequency (halves each push) or shorter ON duty cycle

4. Application information

4.1 Schematics

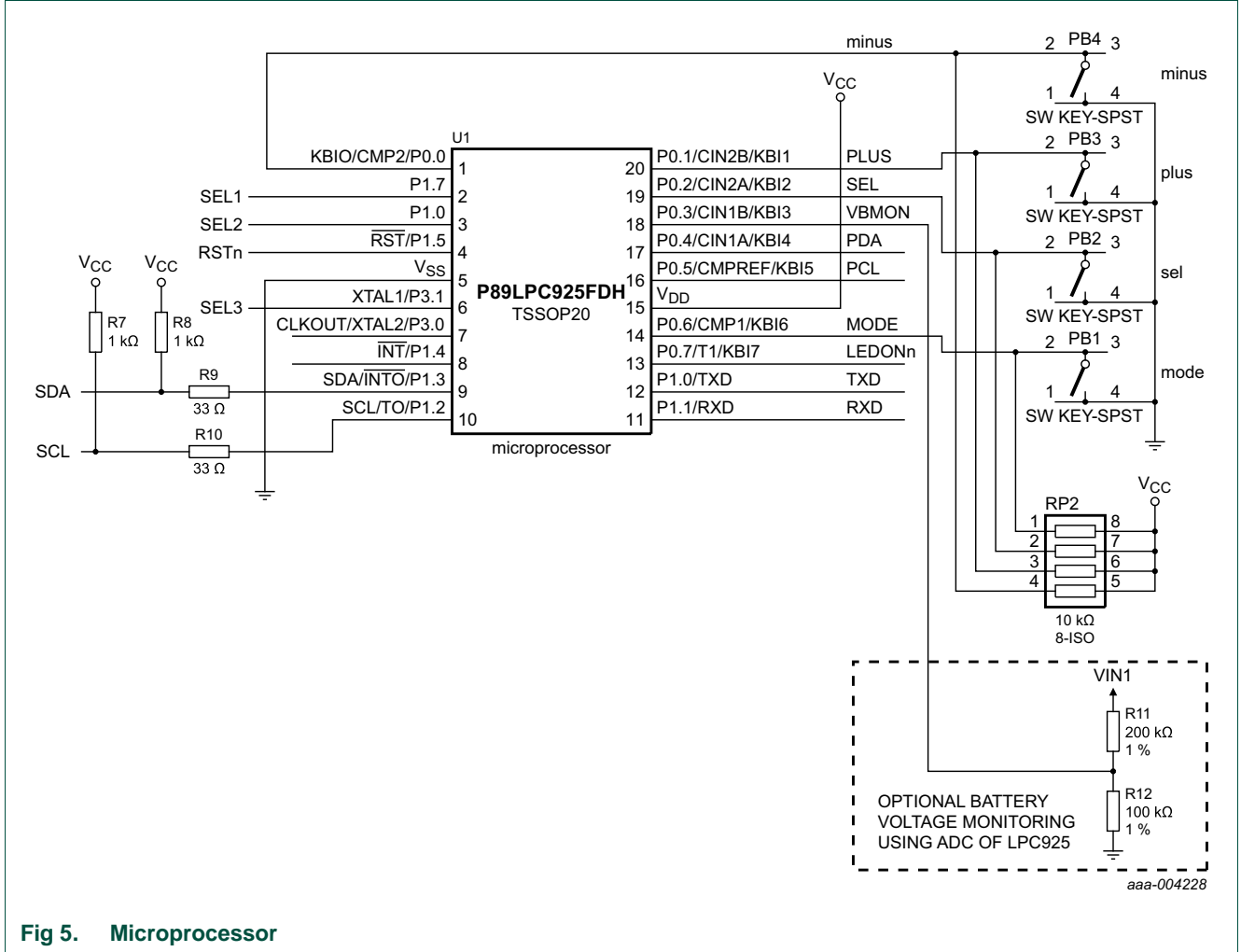
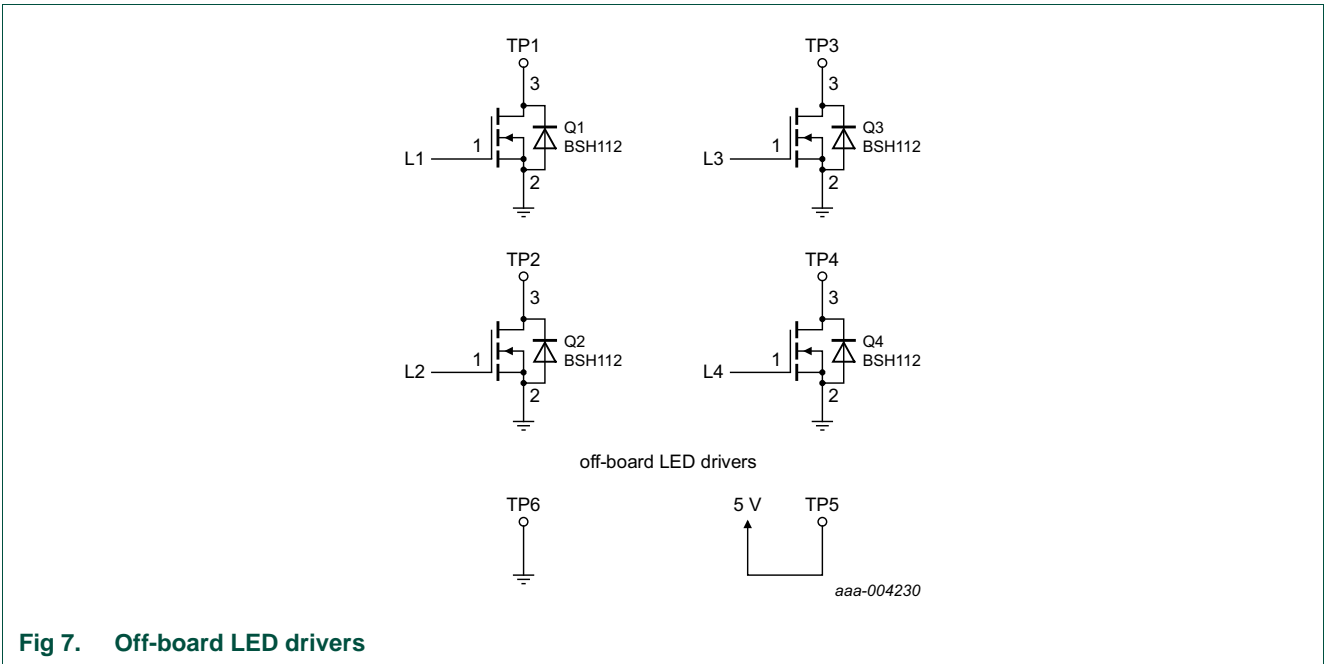
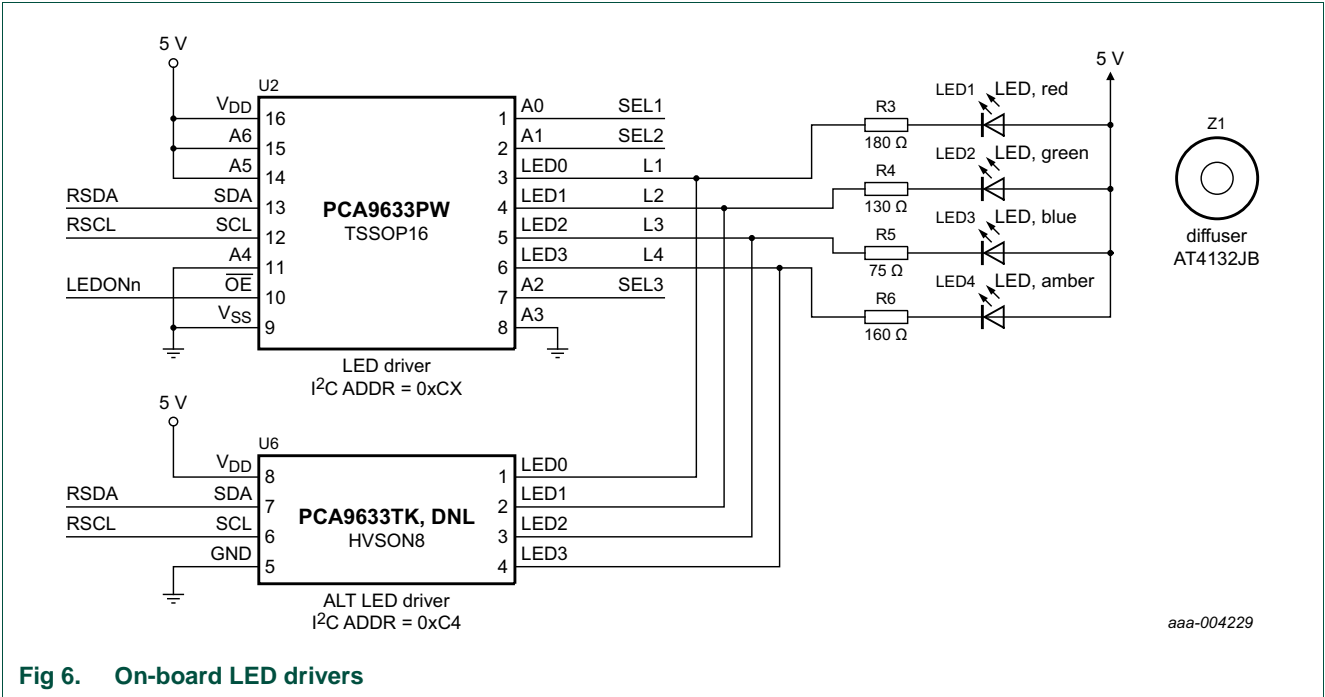


Fig 5. Microprocessor



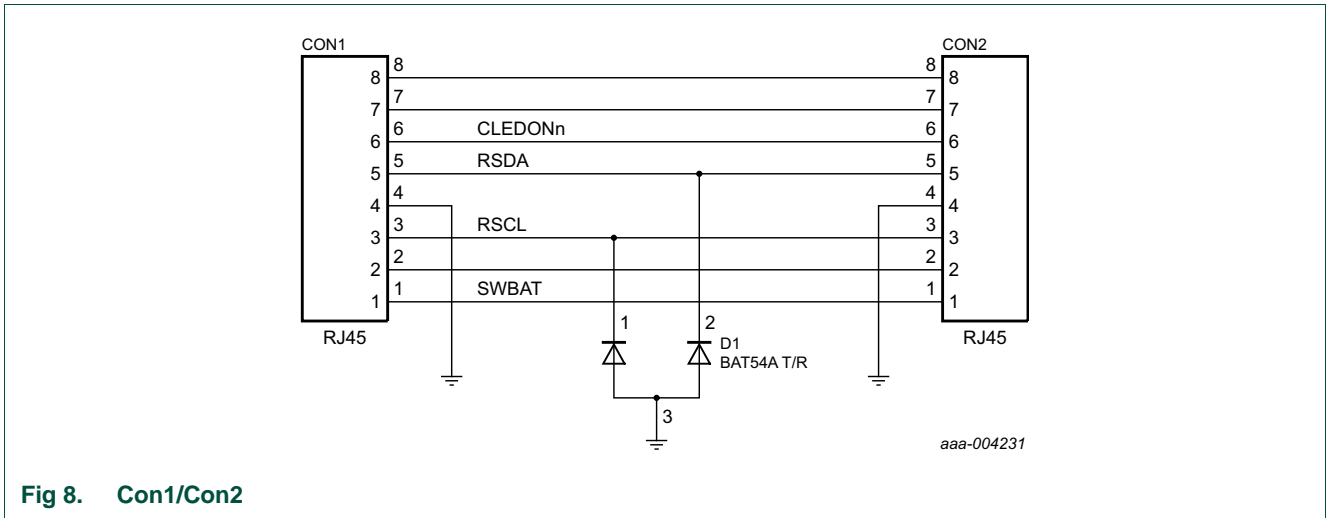


Fig 8. Con1/Con2

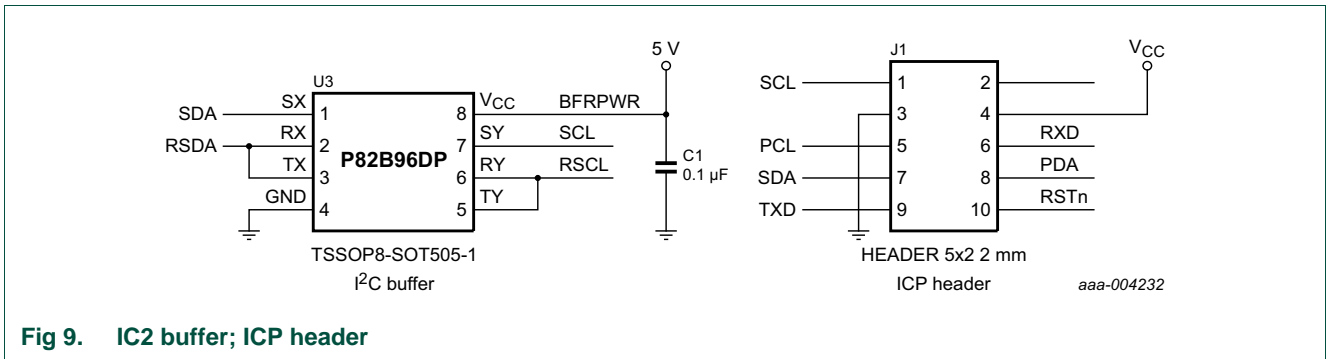


Fig 9. IC2 buffer; ICP header

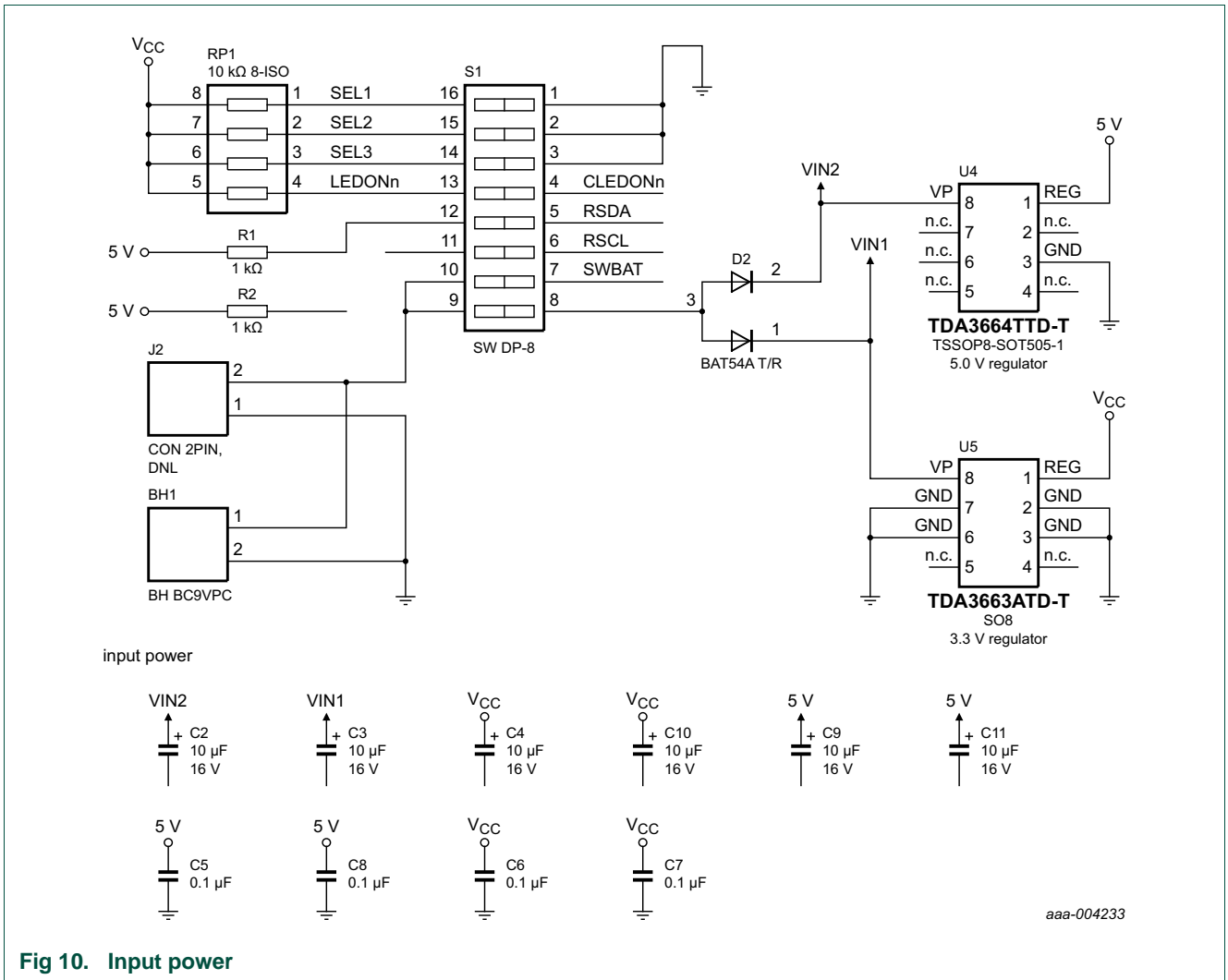


Fig 10. Input power

5. Abbreviations

Table 4. Abbreviations

Acronym	Description
DIP	Dual In-line Package
FET	Field Effect Transistor
I ² C-bus	Inter-Integrated Circuit bus
LED	Light Emitting Diode

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