

## NXP LCD driver PCA8536 and PCF8536

# I<sup>2</sup>C/SPI LCD and PWM LED controller for industrial and automotive applications

This advanced, highly integrated LCD controller drives up to eight backplanes, up to 44 segments, and up to 320 elements, and provides an on-chip, 6-channel PWM controller for LED illumination. Compatible with most MCUs, it simplifies design, reduces power, and minimizes communication overhead.

### Key features

- ▶ Single-chip 320 segment LCD controller and driver
- ▶ 6-channel PWM generator for backlight LED illumination
- ▶ AEC Q100 compliant for automotive applications (PCA8536)
- ▶ Selectable display bias configuration
- ▶ Wide digital supply voltage range: 1.8 to 5.5 V
- ▶ Wide LCD supply voltage range: 2.5 to 9.0 V
- ▶ Choice of serial interface: I<sup>2</sup>C (PCx8536AT) or SPI (PCx8536BT)
- ▶ Low power consumption
- ▶ Operating temp up to 85 °C (PCF8536) or 95 °C (PCA8536)
- ▶ Silicon gate CMOS process

### Applications

- ▶ Industrial version (PCF8536)
  - White goods
  - Consumer products
- ▶ Automotive version (PCA8536)
  - Car radio
  - Climate control
  - Dashboard display

The NXP PCx8536 is a peripheral device, equipped with a low-power serial interface (I<sup>2</sup>C- or SPI-bus), that controls and drives almost any LCD display with multiplex rates up to 1:8.

The device is available in two types, one for industrial (PCF8536) and one for automotive applications (PCA8536). The automotive type supports an extended operating temperature range up to 95 °C, and is AEC Q100 compliant.

Both types are also compatible with most microcontrollers and communicate via standard serial interfaces. The AT versions use the two-line bidirectional I<sup>2</sup>C-bus (400 kHz), while the BT versions use the three-line unidirectional SPI-bus (5 MHz). Communication overheads are minimized by using a 320-bit display RAM with auto-incremented addressing.

An on-chip PWM controller for LED backlight illumination is included. The PWM has six outputs with 7-bit resolution (128 steps) ideal to drive external transistors. Up to six independent channels can be configured. The 128 levels



per channel allow to control 2 RGB backlights with a spectrum of more than 2 million colors. Each channel can also be used for static LED drive or as logic output.

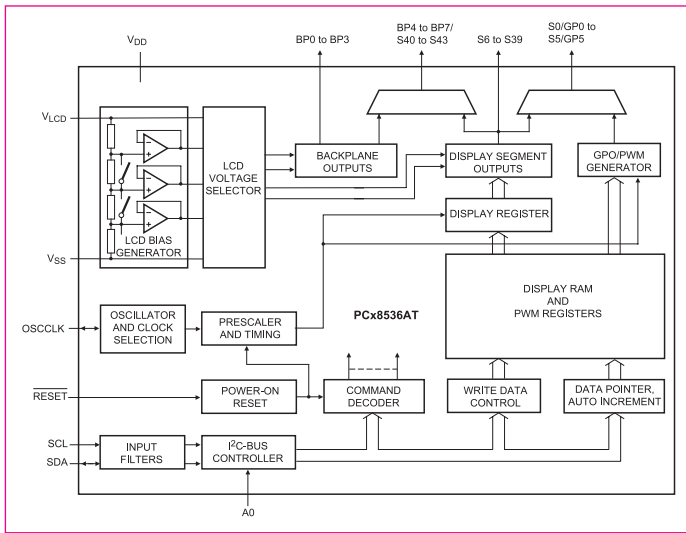
The PCx8536 generates the drive signals for any multiplexed LCD containing up to eight backplanes, up to 44 segments, and up to 320 elements. 4, 6, or 8 backplanes can be driven.

The 320 segments can include up to 40 seven-segment digits, up to 20 fourteen-segment alphanumeric characters, or any graphic of up to 320 elements. The frame frequency can be programmed in the range of 60 to 300 Hz in steps of 10

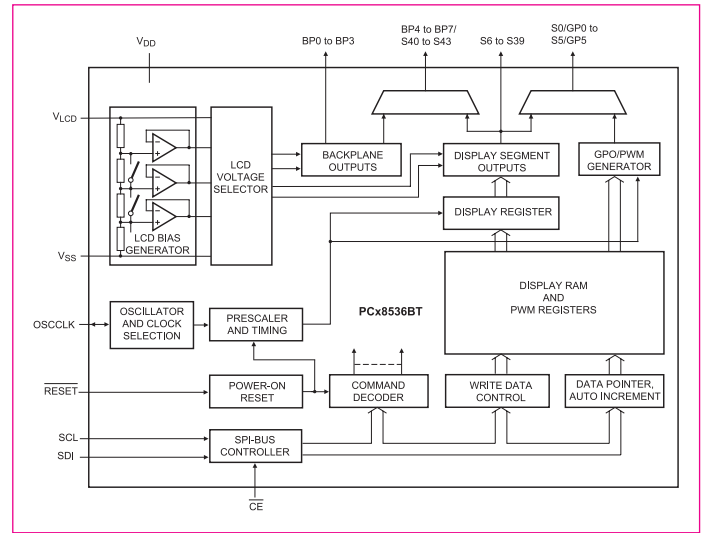
Hz. The reference oscillator is factory calibrated. The device compensates the DC offset voltage across the LCD in line inversion mode, or in frame inversion mode (selectable).

The LCD supply range from 2.5 V, for use with low-threshold LCDs, up to 9.0 V for high-threshold TN LCDs. The digital power supply can be from 1.8 to 5.5 V, and the logic supply can be separated from the LCD supply. Also, to avoid flicker of the display, the PWM and LCD frame frequencies can be set independently. Backplane swapping eases PCB design by making it possible to move the backplane and segment outputs from one side to the other.

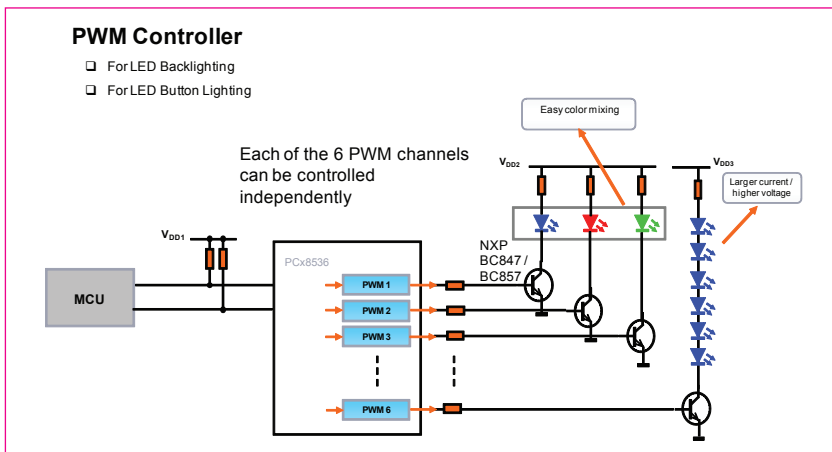
### PCx8536AT (I<sup>2</sup>C version) block diagram



### PCx8536BT (SPI version) block diagram



### Integrated PWM controller for LED backlighting and button lighting



### Ordering information

| Type number      | AEC Q100 Compliant | Interface type       | Package type | Version  |
|------------------|--------------------|----------------------|--------------|----------|
| PCA8536AT/Q900/1 | Yes                | I <sup>2</sup> C-bus | TSSOP56      | SOT364-1 |
| PCA8536BT/Q900/1 | Yes                | SPI-bus              | TSSOP56      | SOT364-1 |
| PCF8536AT/1      | -                  | I <sup>2</sup> C-bus | TSSOP56      | SOT364-1 |
| PCF8536BT/1      | -                  | SPI-bus              | TSSOP56      | SOT364-1 |