

# LCD DISPLAY DRIVER SOLUTIONS

## OVERVIEW

### Seeing Is Believing

NXP's standalone LCD display drivers bring high reliability and low power consumption to a broad range of applications. They require no external components for operation, they operate over a wide temperature range, support a wide range of supply voltages, and integrate vital interfaces. They are available in several different formats, can support various assembly technologies, and can be used in conjunction with the PCA9633 RGB LED driver for LED backlighting.

Our portfolio includes segment, character, and graphic display drivers. Our segment display drivers lead the industry in terms of the number of segments that can be driven per device. That means more information can be displayed at a lower cost. For automotive applications, we even have options that are AEC-Q100 compliant, ensuring reliable operation under the harshest conditions. Our character display drivers can be configured to drive almost any character set, including Japanese, and support a large number of icons. Our graphic display driver, for use with monochrome, dot-matrix LCDs, is available in 34 x 128 resolution.

### KEY FEATURES

- Standalone LCD controllers/drivers
- No external components required
- Low power consumption
- Wide temperature range
- Wide supply-voltage range
- Various interfaces, including I<sup>2</sup>C-bus, SPI, and parallel
- Suitable packages for different assembly technologies
  - TSSOP, QFP, and surface-mount for standard assembly
  - Bare die for chip-on-board (COB) modules



- Bumped die for chip-on-glass (COG) modules
- Bumped die for chip-on-flexfoil (COF) modules
- Add PCA9633 RGB LED driver for LED backlighting in any color

### APPLICATIONS

- eMetering (electricity, gas, water)
- Automotive display clusters
- Consumer electronics
- White goods
- Medical equipment
- Telecommunication equipment
- Industrial

For more information log on to: [www.nxp.com/LCDDrivers](http://www.nxp.com/LCDDrivers)

## SEGMENT DRIVERS

These peripheral devices can be interfaced to almost any LCD with low multiplex rates. They generate the drive signals for any static or multiplexed LCD, with up to four backplanes and up to 160 segments, making it possible to drive up to 640 segments at once. Some devices can be used to drive eight or 16 backplanes. Most drivers are easy to cascade together for use with larger LCDs. Most of the devices communicate via a two-line I<sup>2</sup>C-bus; a driver for the SPI bus is also available. Several features minimize communication overhead, including a display RAM with auto-incremented addressing, hardware sub-addressing, and display memory switching (in static and duplex drive modes).

## KEY FEATURES

- Standalone LCD controller/driver
- Lead industry in terms of number of segments that can be driven per device
- Internal LCD bias generation with voltage follower buffers
- Internal oscillator, with external clock also possible
- On-chip RAM with auto-incremental addressing for storing display data
- Cascadable with auto-incremented display data loading across device sub-address boundaries
- Versatile blinking modes
- AEC-Q100 compliant options for automotive applications
- Low power consumption
- I<sup>2</sup>C-bus or SPI-bus interface
- Wide range of packages for different assembly technologies, including chip-on-glass (COG)

## SEGMENT DRIVER SELECTION GUIDE

Type	Multiplex rate versus number of segments						VDD [V]	Effective VLCD [V]	I <sub>dd</sub> , typ [μA]	I <sub>lcd</sub> , typ [μA]	Interface	Frame frequency [Hz]	Special features	Packages	Operating temperature [°C]	AEC-Q100 compliant
	1:1	1:2	1:3	1:4	1:8	1:16										
PCA85132	160	320	480	640	-	-	1.8 - 5.5	1.8 - 8.0	4	30	I <sup>2</sup> C Fast Mode	60...90 (prog.)	Cascadable	U (chip with 197 bumps)	-40 to +95	Grade 3
PCA85133	80	160	240	320	-	-	1.8 - 5.5	2.5 - 8.0	8	24	I <sup>2</sup> C Fast Mode	82 or 110	Cascadable	U (chip with 110 bumps)	-40 to +95	Grade 3
PCA85134	60	120	180	240	-	-	1.8 - 5.5	1.8 - 8.0	8	24	I <sup>2</sup> C Fast Mode	82 (typ.)	Cascadable	LQFP80	-40 to +95	Grade 3
PCA85162	32	64	96	128	-	-	1.8 - 5.5	2.5 - 8.0	8	24	I <sup>2</sup> C Fast Mode	110 (typ.)	Cascadable	TSSOP48	-40 to +95	Grade 3
PCA85176	40	80	120	160	-	-	1.8 - 5.5	2.5 - 8.0	8	24	I <sup>2</sup> C Fast Mode	82 or 110	Cascadable	TSSOP56, TQFP64	-40 to +95	Grade 3
PCA85232	160	320	480	640	-	-	1.8 - 5.5	1.8 - 8.0	4	65	I <sup>2</sup> C Fast Mode	117...176 (prog.)	Cascadable	U (chip with 197 bumps)	-40 to +95	Grade 3
PCA85233	80	160	240	320	-	-	1.8 - 5.5	2.5 - 8.0	3	22	I <sup>2</sup> C Fast Mode	150 or 220	Cascadable	U (chip with 110 bumps)	-40 to +105	Grade 2
PCA85262	32	64	96	128	-	-	1.8 - 5.5	2.5 - 8.0	2.7	13	I <sup>2</sup> C Fast Mode	200	Cascadable	TSSOP48	-40 to +105	Grade 2
PCA85276	40	80	120	160	-	-	1.8 - 5.5	2.5 - 8.0	2.7	13	I <sup>2</sup> C Fast Mode	200	Cascadable	TSSOP56	-40 to +105	Grade 2
PCA8534A	60	120	180	240	-	-	1.8 - 5.5	2.5 - 6.5	8	24	I <sup>2</sup> C Fast Mode	64	Cascadable	LQFP80	-40 to +85	-
PCA8536	-	-	-	176	320	-	1.8 - 5.5	2.5 - 9.0	30	55	I <sup>2</sup> C Fast Mode SPI 5MHz	60 to 300 steps of 10	Cascadable	TSSOP56	-40 to +95	Grade 3
PCA8537	44	88	-	176	352	-	1.8 - 5.5	2.5 - 9.0	90, 200	85	I <sup>2</sup> C Fast Mode	60 to 300 steps of 10	Cascadable	TQFP64	-40 to +95	Grade 3
PCA8546	-	-	-	176	-	-	1.8 - 5.5	2.5 - 9.0	30	55	I <sup>2</sup> C Fast Mode SPI 5MHz	60 to 300 steps of 10	Cascadable	TSSOP56	-40 to +95	Grade 3
PCA8547	44	88	-	176	-	-	1.8 - 5.5	2.5 - 9.0	90, 250	85	I <sup>2</sup> C Fast Mode	60 to 300 steps of 10	Cascadable	TQFP64	-40 to +95	Grade 3
PCA8551	36	72	108	144	-	-	1.8 - 5.5	1.8 - 5.5	0.6	4.5	I <sup>2</sup> C Fast Mode SPI 5MHz	32...256 (prog.)	Cascadable	TSSOP48	-40 to +105	Grade 2
PCA8553	40	80	120	160	-	-	1.8 - 5.5	1.8 - 5.5	0.6	5	I <sup>2</sup> C Fast Mode SPI 5MHz	32...256 (prog.)	Cascadable	TSSOP56	-40 to +105	Grade 2
PCA8561	18	36	54	74	-	-	1.8 - 5.5	1.8 - 5.5	0.6	3.5	I <sup>2</sup> C Fast Mode SPI 5MHz	32...256 (prog.)	Cascadable	HVQFN32	-40 to +105	Grade 2
PCA8576C <sup>(1)</sup>	40	80	120	160	-	-	2.0 - 6.0	V <sub>dd</sub> - 6.0 V <sub>dd</sub> - 2.0	120	60	I <sup>2</sup> C Standard Mode	69 (typ.)	Cascadable	VSO56 LQFP64	-40 to +85	Auto Qual Q100
PCA8576F	40	80	120	160	-	-	1.8 - 5.5	2.5 - 8.0	2.7	17.5	I <sup>2</sup> C Fast Mode	200 (typ.)	Cascadable	U (chip with 59 bumps)	-40 to +105	Grade 2
PCA9620	60	120	-	240	480	-	2.5 - 5.5	2.5 - 9.0	60	incl. in I <sub>dd</sub>	I <sup>2</sup> C Fast Mode SPI 5MHz	60 to 300 steps of 10	int. VLED	U, LQFP80	-40 to +105	Grade 2

SEGMENT DRIVER SELECTION GUIDE Cont.

Type	Multiplex rate versus number of segments						VDD [V]	Effective VLCD [V]	I <sub>dd</sub> , typ [µA]	I <sub>lcd</sub> , typ [µA]	Interface	Frame frequency [Hz]	Special features	Packages	Operating temperature [°C]	AEC-Q100 compliant
	1:1	1:2	1:3	1:4	1:8	1:16										
PCF85132	160	320	480	640	-	-	1.8 - 5.5	1.8 - 8.0	60	70	I <sup>2</sup> C Fast Mode	600...90 (prog.)	Cascadable	U (chip with 197 bumps)	-40 to +85	-
PCF85133	80	160	240	320	-	-	1.8 - 5.5	2.5 - 6.5	8	25	I <sup>2</sup> C Fast Mode SPI 5MHz	82 or 110 (sel.)	Cascadable	U (chip with 110 bumps)	-40 to +85	-
PCF85134	60	120	180	240	-	-	1.8 - 5.5	2.5 - 6.5	8	24	I <sup>2</sup> C Fast Mode	82 (typ.)	Cascadable	LQFP80	-40 to +85	-
PCF85162	32	64	96	128	-	-	1.8 - 5.5	2.5 - 6.0	8	24	I <sup>2</sup> C Fast Mode	82 (typ.)	Cascadable	TSSOP48	-40 to +85	-
PCF85176	40	80	120	160	-	-	1.8 - 5.5	2.5 - 6.5	8	24	I <sup>2</sup> C Fast Mode	82 (typ.)	Cascadable	TSSOP56, TQFP64	-40 to +85	-
PCF8532 <sup>(1)</sup>	160	320	480	640	-	-	1.8 - 5.5	1.8 - 8.0	18	30	I <sup>2</sup> C Fast Mode	60 to 90 steps of 5	Cascadable	U (chip with 197 bumps)	-40 to +85	-
PCF8533 <sup>(1)</sup>	80	160	240	320	-	-	1.8 - 5.5	2.5 - 6.0	8	24	I <sup>2</sup> C Fast Mode	64 (typ.)	Cascadable	U (chip with 99 bumps)	-40 to +85	-
PCF8534A <sup>(1)</sup>	60	120	180	240	-	-	1.8 - 5.5	2.5 - 6.0	8	24	I <sup>2</sup> C Fast Mode	64 (typ.)	Cascadable	U	-40 to +85	-
PCF8536	36	72	108	144	-	-	1.8 - 5.5	1.8 - 5.5	0.6	5	I <sup>2</sup> C Fast Mode SPI 5MHz	32...128 (prog.)	Cascadable	TSSOP56	-40 to +85	-
PCF8537	44	88	-	176	352	-	1.8 - 5.5	2.5 - 9.0	90	85	I <sup>2</sup> C Fast Mode	60 to 300 steps of 10	Cascadable	TQFP64	-40 to +85	-
PCF8545	-	-	-	176	320	-	1.8 - 5.5	2.5 - 5.5	30	55	I <sup>2</sup> C Fast Mode SPI 5MHz	200 (typ.)	Cascadable	TSSOP56	-40 to +85	-
PCF8551	102	204	-	408	816	-	1.8 - 5.5	1.8 - 5.5	0.6	4.5	I <sup>2</sup> C Fast Mode SPI 5MHz	32...128 (prog.)	Cascadable	TSSOP48	-40 to +85	-
PCF8553	40	80	120	160	-	-	1.8 - 5.5	1.8 - 5.5	0.6	5	I <sup>2</sup> C Fast Mode SPI 5MHz	32...128 (prog.)	Cascadable	TSSOP56	-40 to +85	-
PCF8562	32	64	96	128	-	-	1.8 - 5.5	2.5 - 6.5	8	24	I <sup>2</sup> C Fast Mode	64 (typ.)	Cascadable	TSSOP48	-40 to +85	-
PCF8576C	40	80	120	160	-	-	2.0 - 6.0	2.0 - 6.0	40	18	I <sup>2</sup> C Standard Mode	64 (typ.)	Cascadable	VSO56	-40 to +85	-
PCF8576D	40	80	120	160	-	-	1.8 - 5.5	2.5 - 6.5	8	24	I <sup>2</sup> C Fast Mode	64 (typ.)	Cascadable	U, TSSOP56	-40 to +85	-
PCF8576E	40	80	120	160	-	-	1.8 - 5.5	2.5 - 6.5	2.7	17.5	I <sup>2</sup> C Fast Mode	fclk /24	Cascadable	U (chip with 59 bumps)	-40 to +85	-

<sup>(1)</sup> = Not recommended for new designs



## CHARACTER DRIVERS

The low-power CMOS LCD controller/driver is designed to drive dot-matrix LCD displays. The PCF2119x controls up to two lines of 16 or one line of 32 characters, with a dot format of 5 x 8, and supports up to 160 icons. The icon-driving feature can also be used to drive a number of segments, such as a line of 7- or 14-segment digits. Standalone IC with an on-chip generation of LCD bias voltages, including temperature compensation. The result is fewer external components and lower current consumption. Interface to most microcontrollers using a 4- or 8-bit parallel bus or the two-wire I<sup>2</sup>C-bus. Includes a character generator and display alphanumeric and kana (Japanese) characters. The "x" in the part number indicates the ROM character set. Combining a number of digits results in a full-graphic block with up to 16 x 40 pixels. The block can be controlled by the 16-digit CGRAM, which can also be used to generate custom, user-specific characters. To reduce power consumption during idle time, the icon mode can be used to show device activity status on the display.

## KEY FEATURES

- Single-chip LCD controller/driver
- 5 x 7 character format plus cursor; 5 x 8 for kana (Japanese) and user-defined symbols.
- Very low power consumption (20 to 200  $\mu$ A), in icon mode < 25  $\mu$ A, in power-down mode < 2  $\mu$ A
- Integrated generation of VLCD with temperature compensation (external supply also possible)
- Icon and display blinking mode
- Display shift or static display modes
- Display data RAM: 80 characters
- Character generator ROM: 240 characters
- User-defined characters: 16
- Multiplex rates 1:18 (normal operation), 1:9 (single line operation) and 1:2 (for icon mode only)
- I<sup>2</sup>C-bus and parallel interfaces
- Internal oscillator, with external clock also possible

## CHARACTER DRIVER SPECIFICATIONS

Type	Matrix size	V <sub>DD</sub> [V] logic	V <sub>DD2</sub> [V] V <sub>LCD</sub> gen.	Effective V <sub>LCD</sub> [V]	I <sub>DD</sub> , typ [uA] (int. V <sub>LCD</sub> gen.)	On-chip bias/ V <sub>LCD</sub> generator	Temp comp	Interface	Frame frequency [Hz] (internal osc)	Packages	Operating temperature [°C]	AEC-Q100 compliant
PCF2119x	2 lines by 16 + 160 icons or 1 line by 32 + 160 icons	1.5 - 5.5	2.2 - 4.0	2.2 - 6.5	190	Yes	Yes	I <sup>2</sup> C Fast Mode and 4/8-bit parallel	95, typ.	U	-40 to +85	-



## GRAPHICS DRIVERS

Also known as dot-matrix drivers, these are low-power CMOS LCD row/column drivers, designed to drive dot-matrix graphic displays at multiplex rates up to 80. They can drive a large number of icons, and can drive a series of 7- or 14-segment digits. Each driver is a standalone IC, including on-chip generation of VLCD and the LCD bias voltages. The result is fewer external components and lower power consumption. The drivers communicate with a microcontroller using the two-wire, bidirectional I<sup>2</sup>C-bus. Large display matrixes—such as 65 x 133 or 80 x 128—make it possible to display more text, and ensure that fonts are sharp and easy to read, with almost invisible pixels.

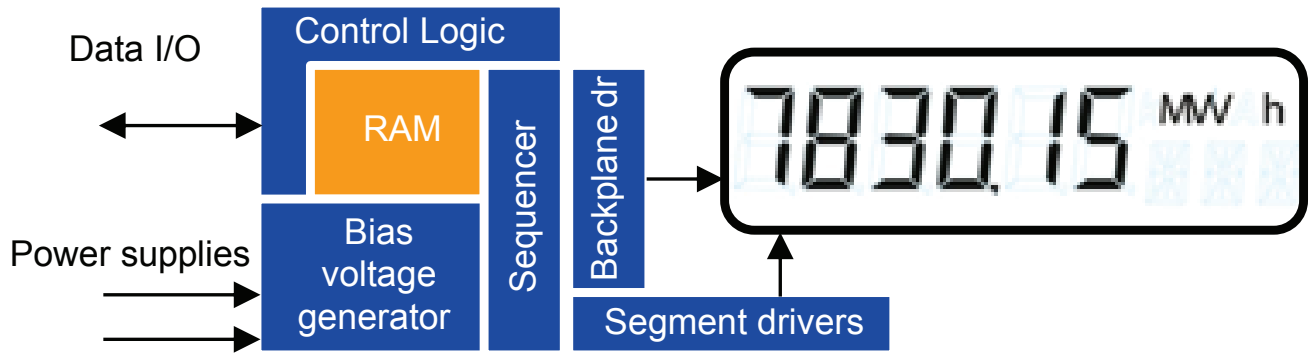
## KEY FEATURES

- Standalone LCD controller/driver
- Low power consumption, suitable for battery-operated systems
- Display data RAM with one-to-one pixel correspondence
- Can also drive icons
- Software-selectable multiplex rates
- Integrated generation of VLCD with temperature compensation (external supply also possible)
- No external components required
- I<sup>2</sup>C-bus interfaces

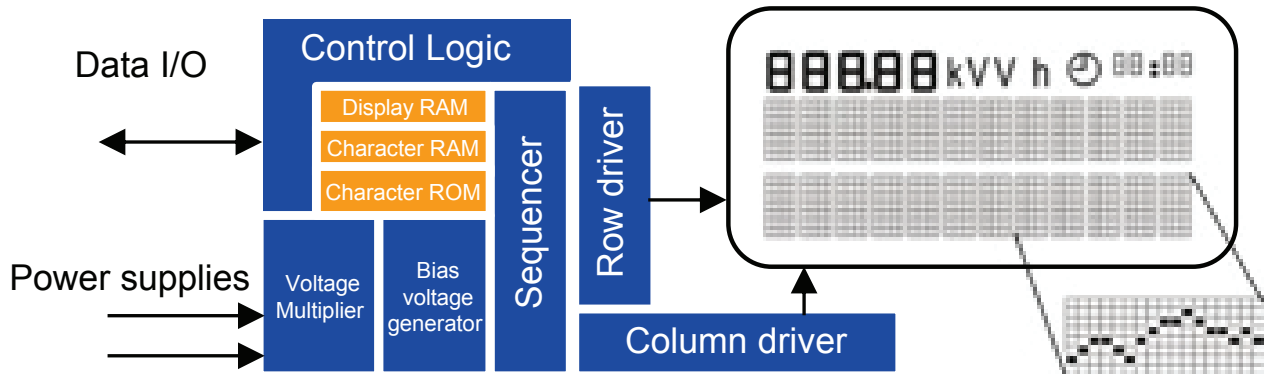
## GRAPHIC DRIVER SELECTION GUIDE

Type	Rows	Columns	Matrix size	V <sub>DD</sub> [V] logic	V <sub>DD2</sub> [V] V <sub>LCD</sub> gen.	Effective V <sub>LCD</sub> [V]	On-chip V <sub>LCD</sub> generator	Temp comp	Interface	Frame frequency [Hz] (internal osc)	Packages	Operating temperature [°C]	AEC-Q100 compliant
PCF8531	34, 26, 17	128	34 x 128 or 33 x 128 plus 128 icons	1.8 - 5.5	2.5 - 4.5	4.0 - 9.0	Yes	Yes	I <sup>2</sup> C Fast Mode	66 (typ.)	U (chip with bumps)	-40 to +85	-

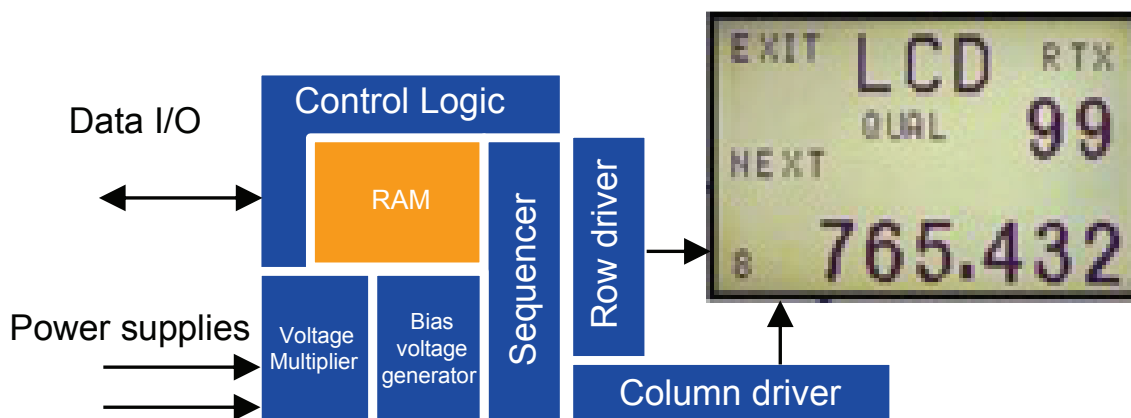
### BLOCK DIAGRAM SEGMENT DRIVER



### BLOCK DIAGRAM CHARACTER DRIVER



### BLOCK DIAGRAM GRAPHIC DRIVER



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