Interface Products Automotive Portfolio

December 2012, v5.0

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Business Line Interface Products
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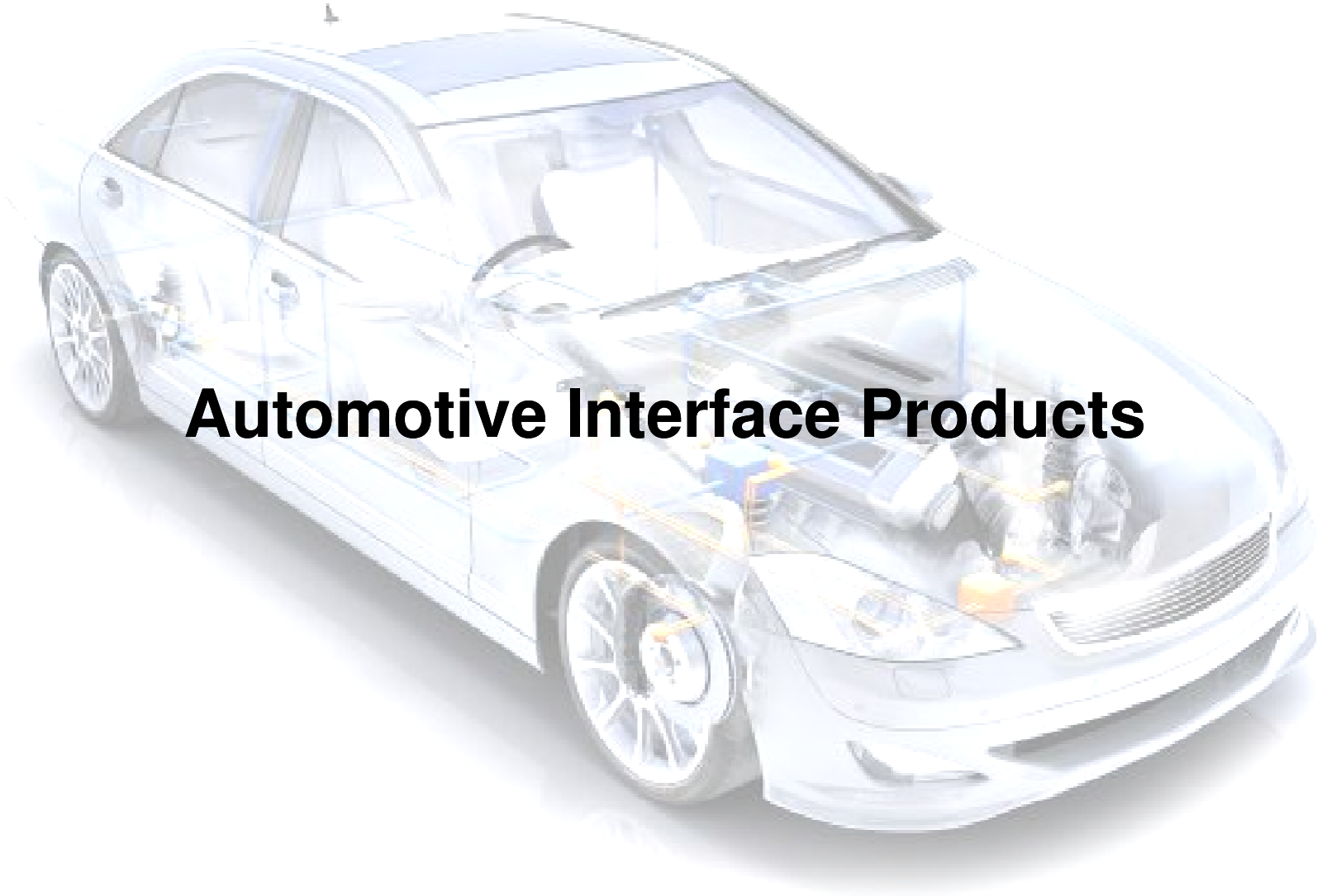
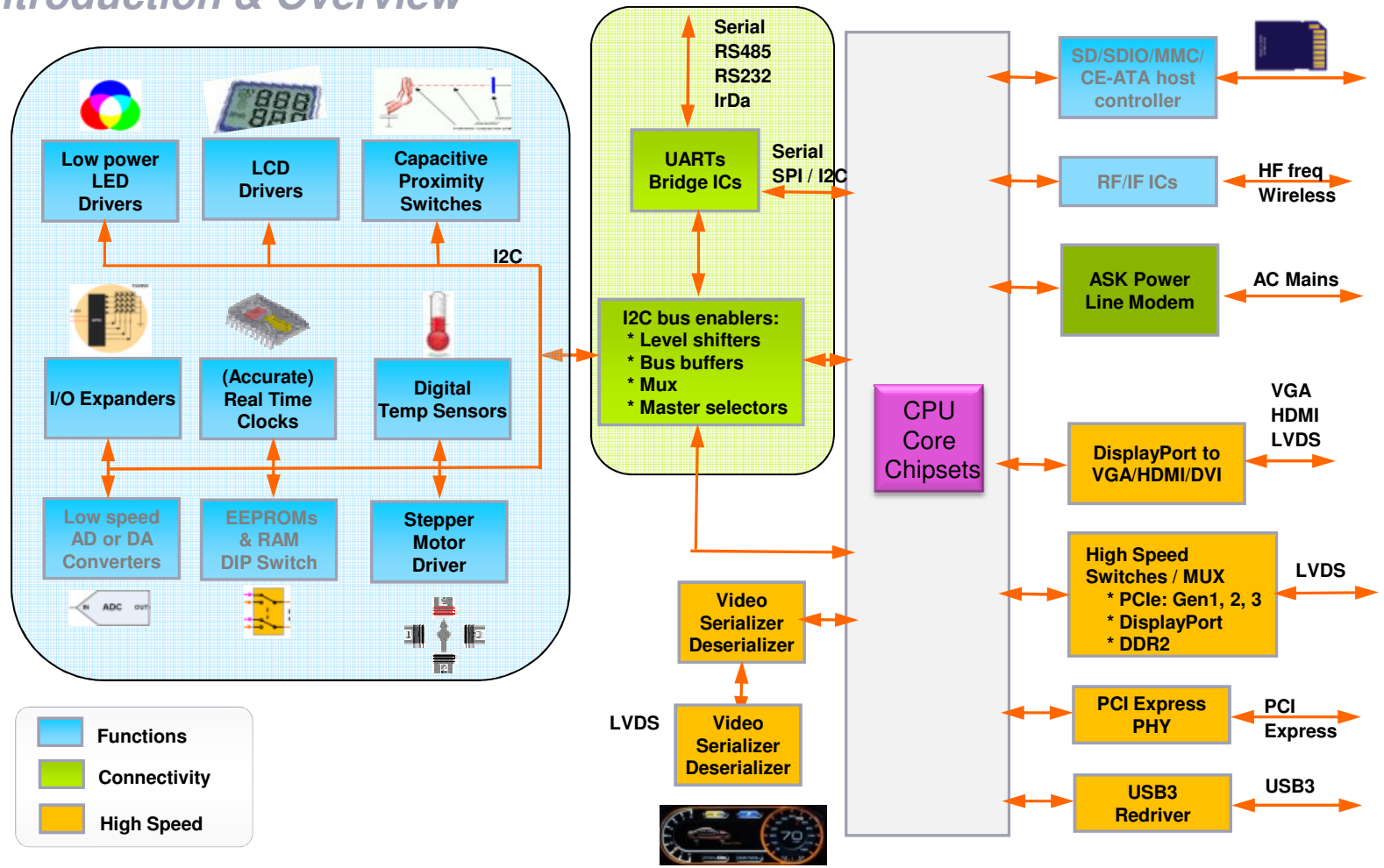


Automotive Interface Products

NXP Interface Products

Introduction & Overview



- a portfolio of more than 700 products and more than 10’000 customers world-wide
- Continuously expanding automotive portfolio by post qualification of existing products
- more than 20 years experience in delivering into automotive industry
- more than 100M units delivered to automotive industry so far

NXP Interface Products

Automotive Building Blocks

LED CONTROLLERS
- Instrument clusters
- Dash boards
- Gauges / Tell Tales
- Car radios
- Climate Controls

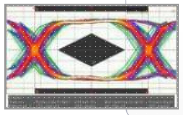
Why NXP?
- Low power (<1µA)
- Voltage source or constant current devices
- Dimming & color mixing
- No external components

LCD DRIVERS
- Instrument clusters
- Climate controls
- Tachographs
- Car radios
- Key fobs

Why NXP?
- up to 105ºC op. Temp.
- up to 16.0V VLCD
- Frame Freq. calibration
- On-chip Charge Pump
- On-chip Temp. Sensor

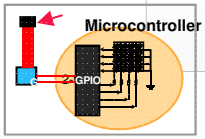
PCI Express PHY
- Infotainment

Why NXP?
- low power consumption
- Wide operating temperature range
- Small package (LFBGA81)



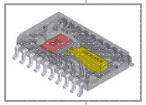
IO EXPANDERS (GPIOs)
- Body Control Units
- Instrument Clusters
- Car radios

Why NXP?
- Large portfolio
- NXP (Philips) has invented the I2C bus



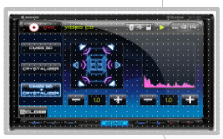
REALTIME CLOCKS
- Instrument Clusters
- Tachographs
- Battery Management Units
- Navigation Systems
- Car Radios

Why NXP?
- up to 125ºC op. Temp.
- Ultra low power (< 1µA)
- Temp. compensation
- integrated quartz crystal



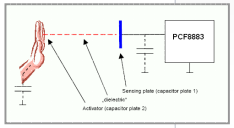
LEVEL SHIFTERS
- Processor Interface in Infotainment Systems

Why NXP?
- market leader in GTL devices used for processor to chipset interface
- wide portfolio of 2-bit, 4-bit, 8-bit and 16-bit devices



CAPACITIVE SENSORS
- Button Touch Displays
- Passive Key-less Entry Systems (PKE)
- Replacement of rotary knobs, push buttons, sliders in car radios or climate control units

Why NXP?
- Configurable as touch or proximity sensor
- self-calibrating
- Low power consumption

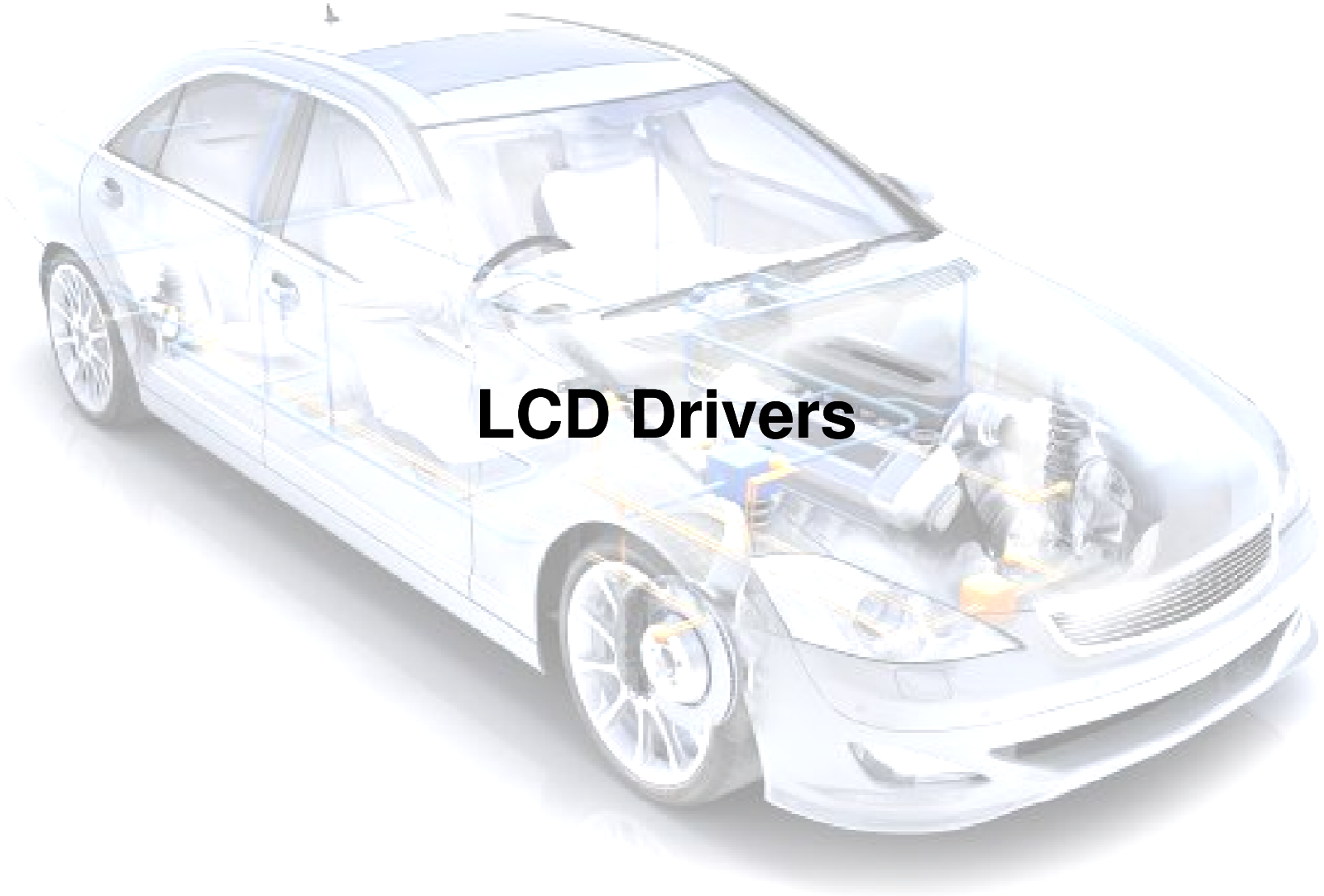


UARTs and BRIDGES
- Telematics
- Nav Radio
- Instrument Clusters

Why NXP?
- number #1 in Industrial UARTs
- committed long-term supplier
- Broad portfolio

TEMPERATURE SENSORS
- Multimedia systems
- Infotainment /cluster displays
- Body Control Unit
- Climate Control Unit

Why NXP?
- High accuracy
- Wide temperature range



LCD Drivers

NXP LCD Drivers for Automotive

Focus Application Areas

Auxiliary Heating System

Key Fob

Climate Control

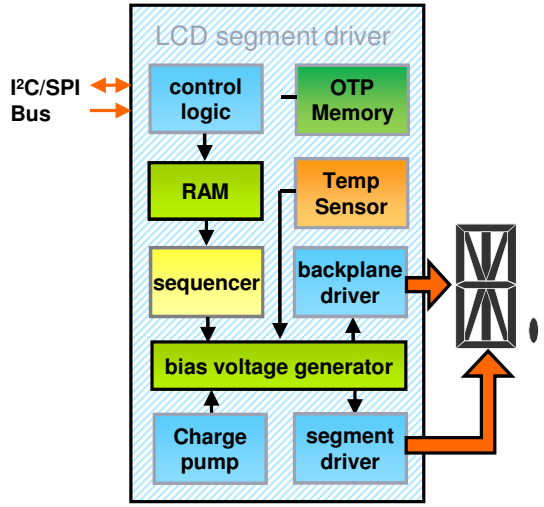
Instrument Cluster

Car Radio

Car Clock

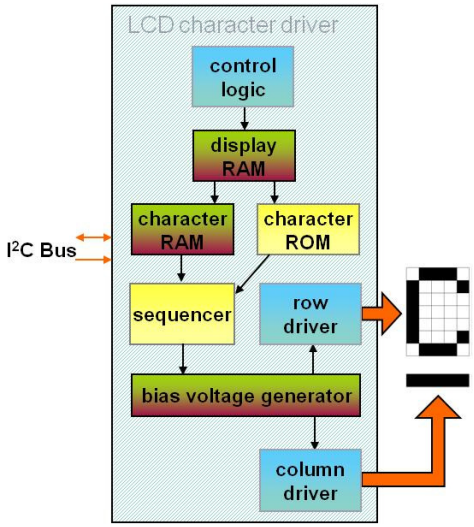
NXP LCD Drivers

Segment Drivers



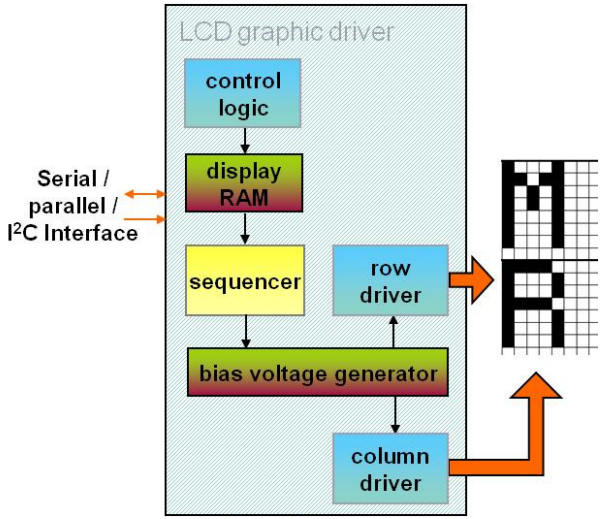
PCA85162	4x32 segments	released
PCA85176	4x40 segments	released
PCA85134	4x60 segments	released
PCA8536	8x40 segments	released
PCA8537	8x44 segments	released
PCA9620	8x60 segments	released
PCA85133	4x80 segments	released
PCA85233	4x80 segments	in design
PCA85132	4x160 segments	released
PCA85232	4x160 segments	released
PCA8538	9x102 segments	sampling
PCA8539	18x100 segments	in design

Character Drivers



PCF2113	2-line by 12 characters plus 120 icons	released
PCF2119	2-line by 16 characters plus 160 icons	released
PCA2117	2-line by 20 characters plus 200 icons	in design

Graphic (Dot Matrix) Drivers



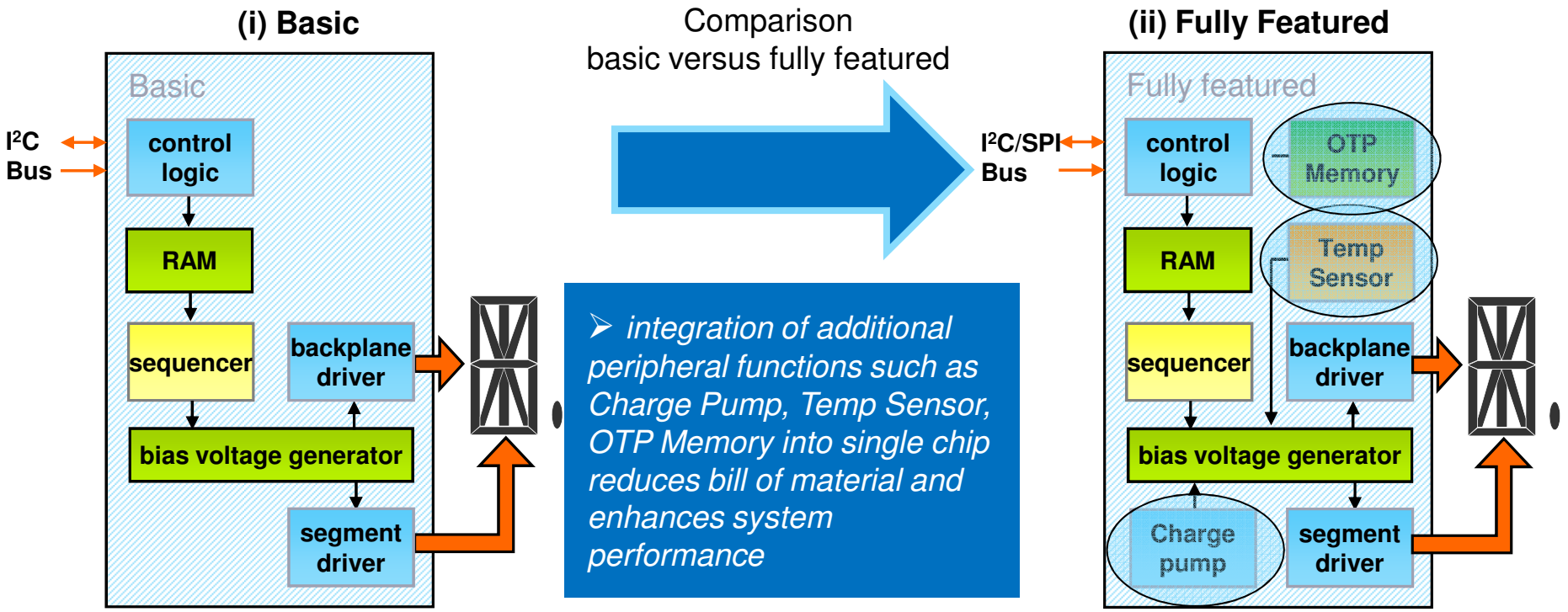
PCA8539	18x100 dots	in design
	→ *see Segment Drivers*	
PCF8531	34x128 dots	released
PCF8811	80x128 dots	released
PCF8578	32x8 (stand-alone)	released
	32x48 (when combined with PCF8579)	
WOLF	88x256 dots	considered

F: non-automotive grade but successfully used for many years in automotive

NXP LCD Drivers for Automotive

Value Proposition

1. Fully featured and highly reliable Automotive LCD Drivers developed in more than 20 years of experience

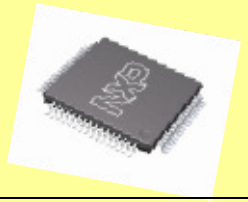


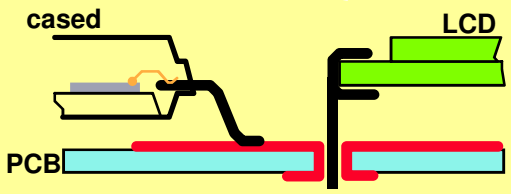
NXP LCD Drivers for Automotive

Value Proposition

2. More than 25 years of experience in the Chip-On-Glass (COG) technology to lower the cost, simplify the PCB layout and improve upgradability, flexibility and reliability

(i) Cased





Pros
+ more robust with respect to mechanical stress
+ display driver can be placed close to µC
+ full flexibility in choosing driver and display supplier

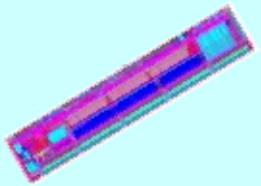
Cons
- higher costs
- high number of tracks required on PCB

Families
Segment Drivers and selected Character drivers

Comparison Cased versus COG

➢ *higher integration by means of Chip-On-Glass technology increases flexibility, enhances reliability and gives prospect for reduced system cost*

(ii) Chip-On-Glass (COG)



Pros
+ lower costs
+ only a few tracks required on PCB
+ higher reliability
+ thinnest module
+ easier to back light

Cons
- driver cannot be placed arbitrarily
- dependency on module maker

Families
Segment Drivers; Character Drivers; Dot-Matrix Drivers

NXP LCD Drivers for Automotive

Value Proposition

3. Highly performing LCD drivers specifically designed for driving the Vertical Alignment Displays

(i) Conventional Display Technology

Comparison conventional vs. vertical alignment

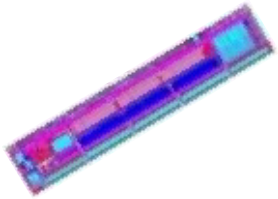
(ii) New Vertical Alignment Display Technology

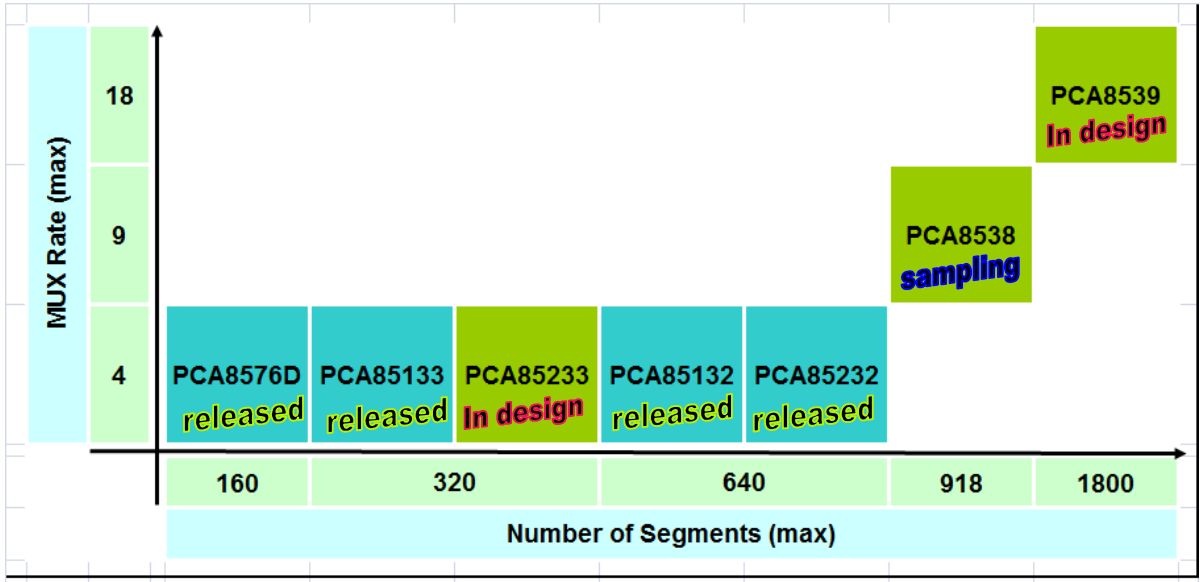
- *New Vertical Alignment (VA) display technology for much higher contrast, improved viewing angle, and true black background*
- *Requires from display driver (1) higher VLCD voltage, (2) higher frame frequency and (3) temperature compensation*

COG Segment Driver Family

NXP LCD *Segment* Drivers for Automotive

Product Overview





Type	PCA8576D	PCA85133	PCA85233	PCA85132	PCA85232	PCA8538	PCA8539
Package	COG	COG	COG	COG	COG	COG	COG
Interface	I²C	I²C	I²C	I²C	I²C	I²C/SPI	I²C/SPI
VLCD (max)	6.5V	8.0V	8.0V	8.0V	8.0V	12.0V	16.0V
Internal Charge Pump	no	no	no	no	no	yes	yes
VLCD temp. compensation	no	no	no	no	no	yes	yes
Frame Freq. (typ.)	64Hz	selectable 82Hz or 110Hz	selectable 150Hz or 220Hz	programmable 60Hz - 90Hz	programmable 117Hz - 176Hz	programmable 45Hz - 300Hz	programmable 45Hz - 360Hz
PWM Control	no	no	no	no	no	no	no
Qualification	AEC-Q100 Grade 3	AEC-Q100 Grade 3	AEC-Q100 Grade 3	AEC-Q100 Grade 3	AEC-Q100 Grade 3	AEC-Q100 Grade 2 *)	AEC-Q100 Grade 3
Temp. Range	-40°C to +85°C	-40°C to +95°C	-40°C to +95°C	-40°C to +95°C	-40°C to +95°C	-40°C to +105°C *)	-40°C to +95°C
Status	released	released	Release Q3'13	released	released	SAMPLING	Release Q3'13

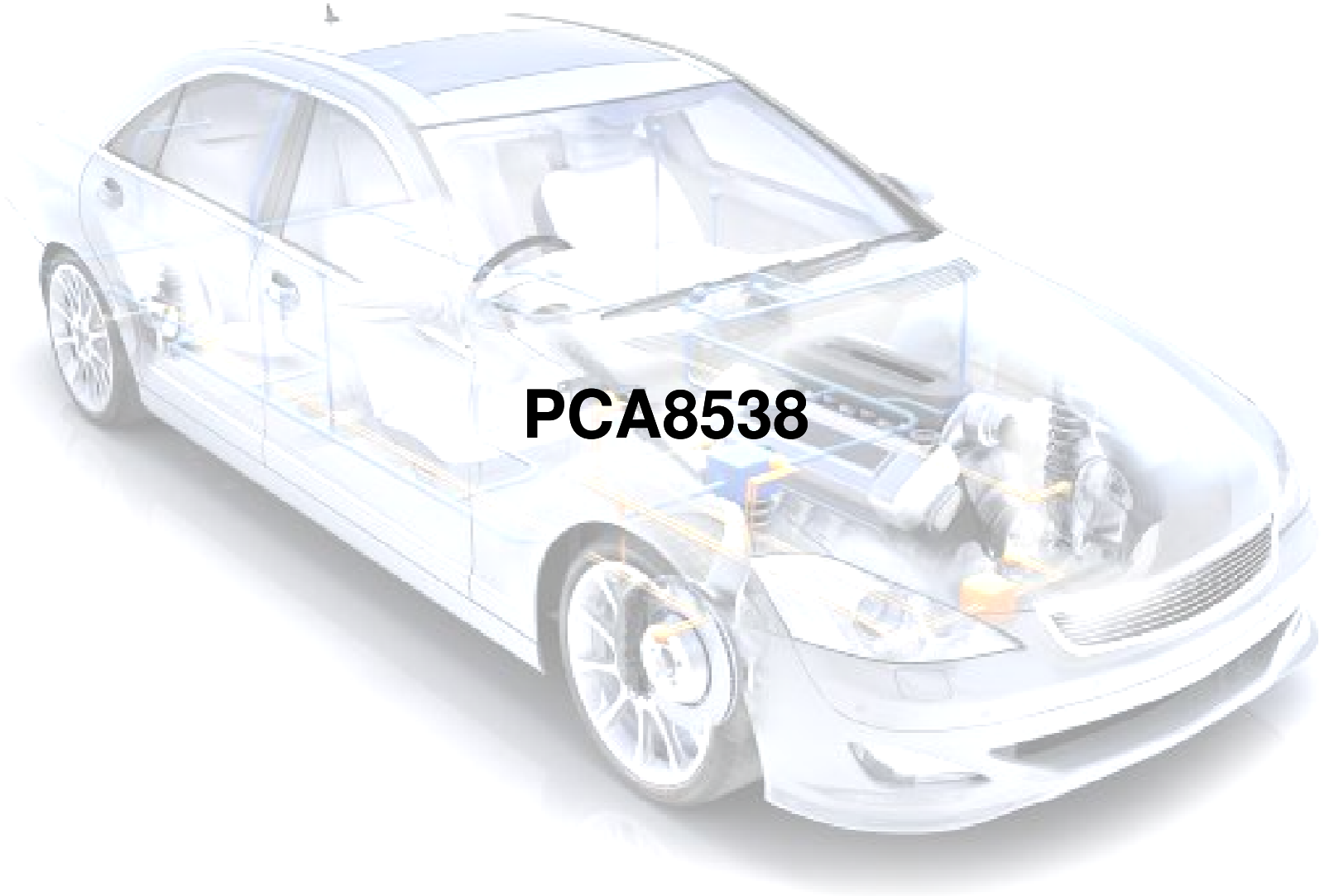
Chip-On-Glass LCD Drivers

Value Proposition

- AEC-Q100 automotive compliant qualification for highest robustness for harshest conditions
- Extended Temperature Range up to 95ºC or even 105ºC (selected devices)
- Wide VLCD range to up to 8.0V or even 16.0V (selected devices)
- Programmable and calibrated frame frequency (selected devices)
- On-chip Charge Pump and on-chip Temperature Sensor (selected devices)

Hi-Lights

*) envisioned

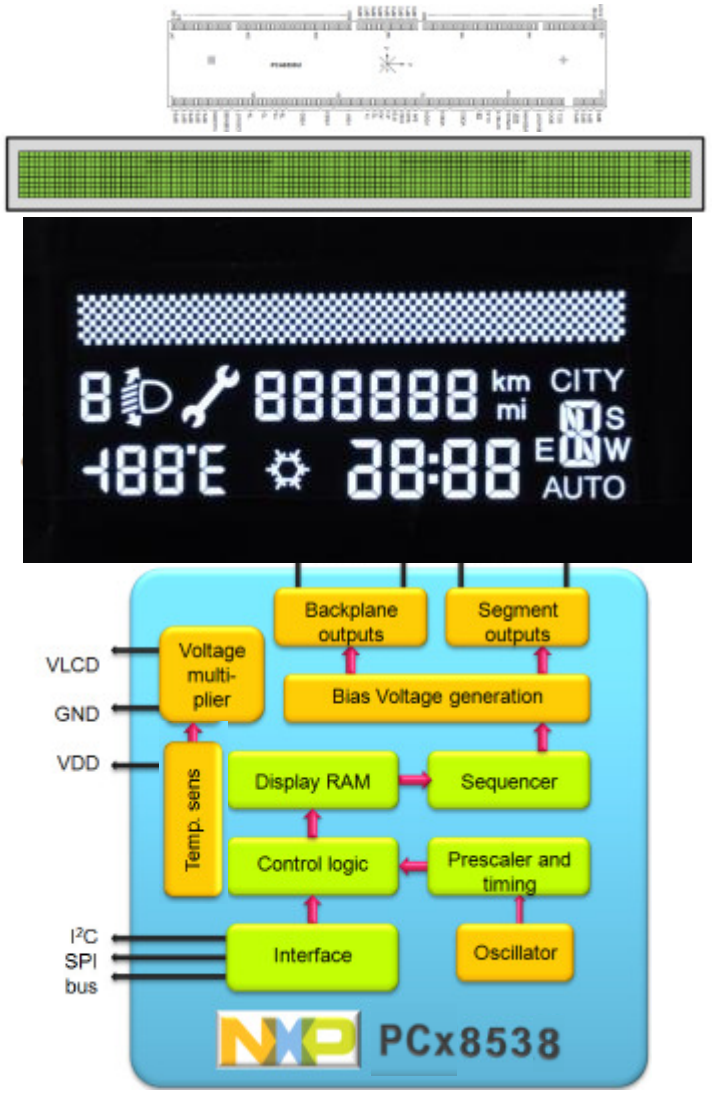


PCA8538

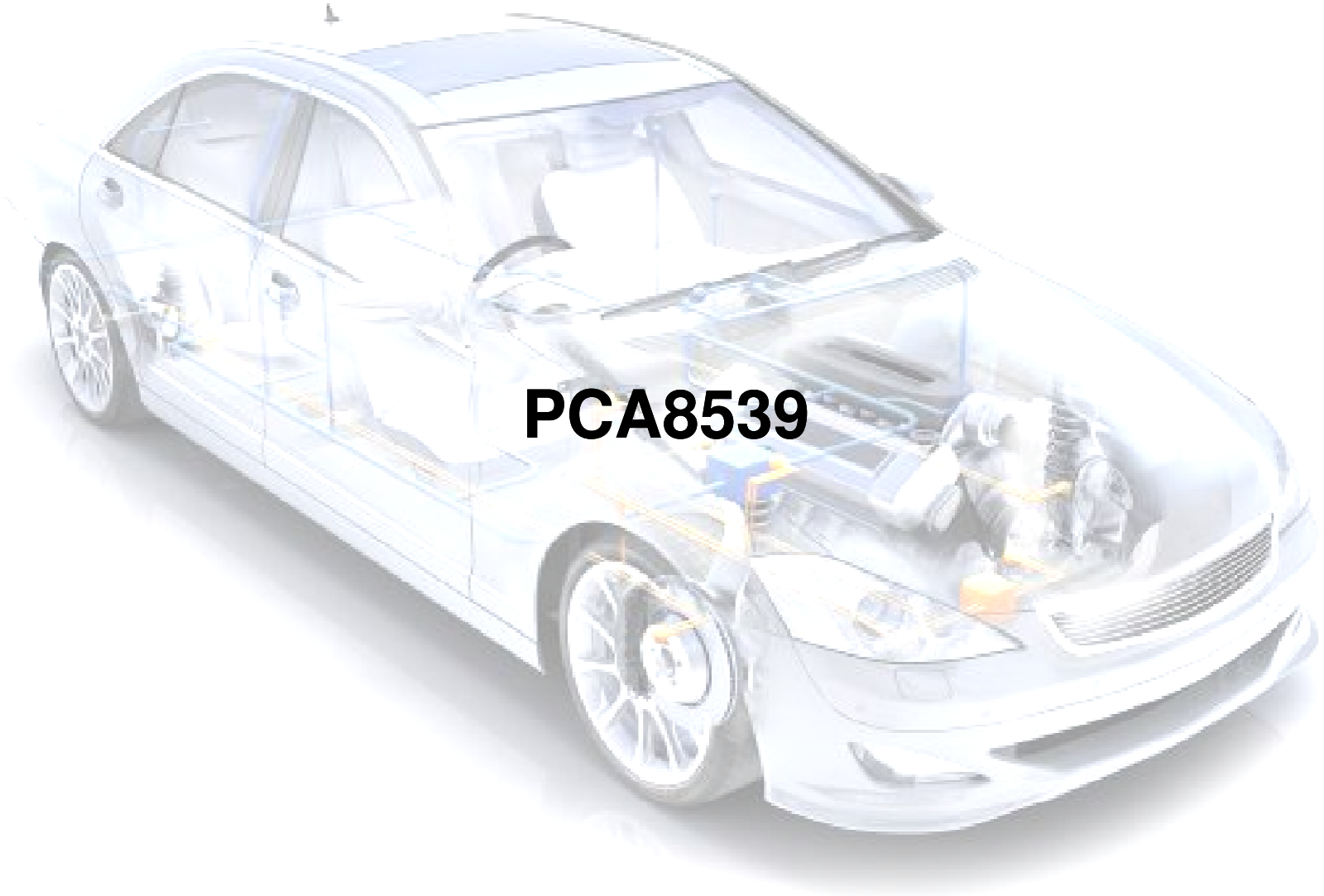
PCA8538 Mux 1:9 LCD Segment Driver for 918 Segments

Key Features

- 9 x 102 segment driver *(918 dots or segments)*
- Programmable Multiplex Rate *(1:1, 1:2, 1:4, 1:6, 1:8, 1:9)*
- Specifically designed for high contrast VA (Vertical Alignment displays
- On-chip Charge pump with integrated capacitors
- VLCD (max) = 12V
- n-line inversion *(includes line and frame inversion)*
- Temperature sensor (readout possible)
- Temperature compensated VLCD voltage
- Programmable frame frequency 45Hz to 300Hz
- I2C-bus and SPI-bus Interface
- Extended temperature range up to +105°C
- AEC-Q100 compliant



Sampling



PCA8539

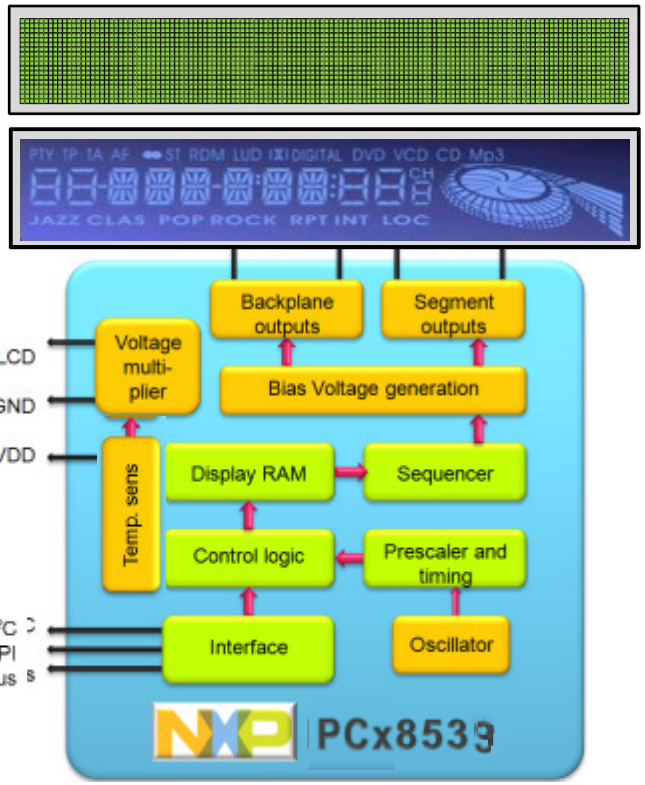
PCA8539 Mux 1:18 LCD Segment Driver for 1800 Segments

Key Features

- 18 x 100 segment driver *(1800 segments or dots)*
- Programmable Multiplex Rate *(1:12, 1:18)*
- Specifically designed for high contrast VA (Vertical Alignment displays
- On-chip Charge pump with integrated capacitors
- VLCD (max) = 16V
- n-line inversion *(includes line and frame inversion)*
- Temperature sensor (readout possible)
- Temperature compensated VLCD voltage
- Programmable frame frequency 45Hz to 360Hz
- I2C-bus and SPI-bus Interface
- Extended temperature range up to +95°C
- AEC-Q100 compliant

(i) 12 Backplanes x 100 Segments

(ii) 18 Backplanes x 100 Segments



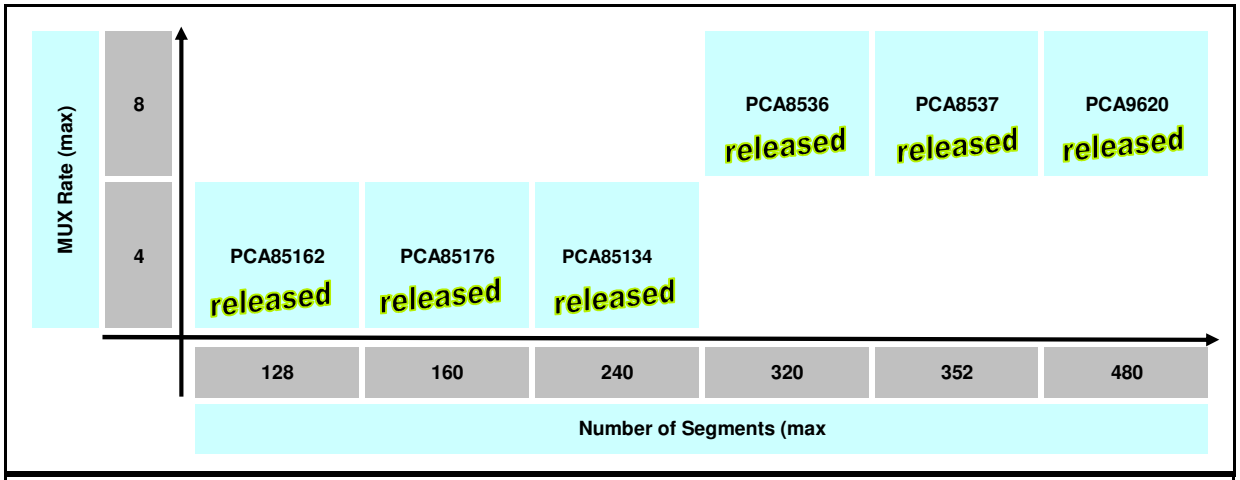
In Development

Cased Segment Driver Family

NXP LCD *Segment* Drivers for Automotive

Product Overview

Cased LCD Drivers

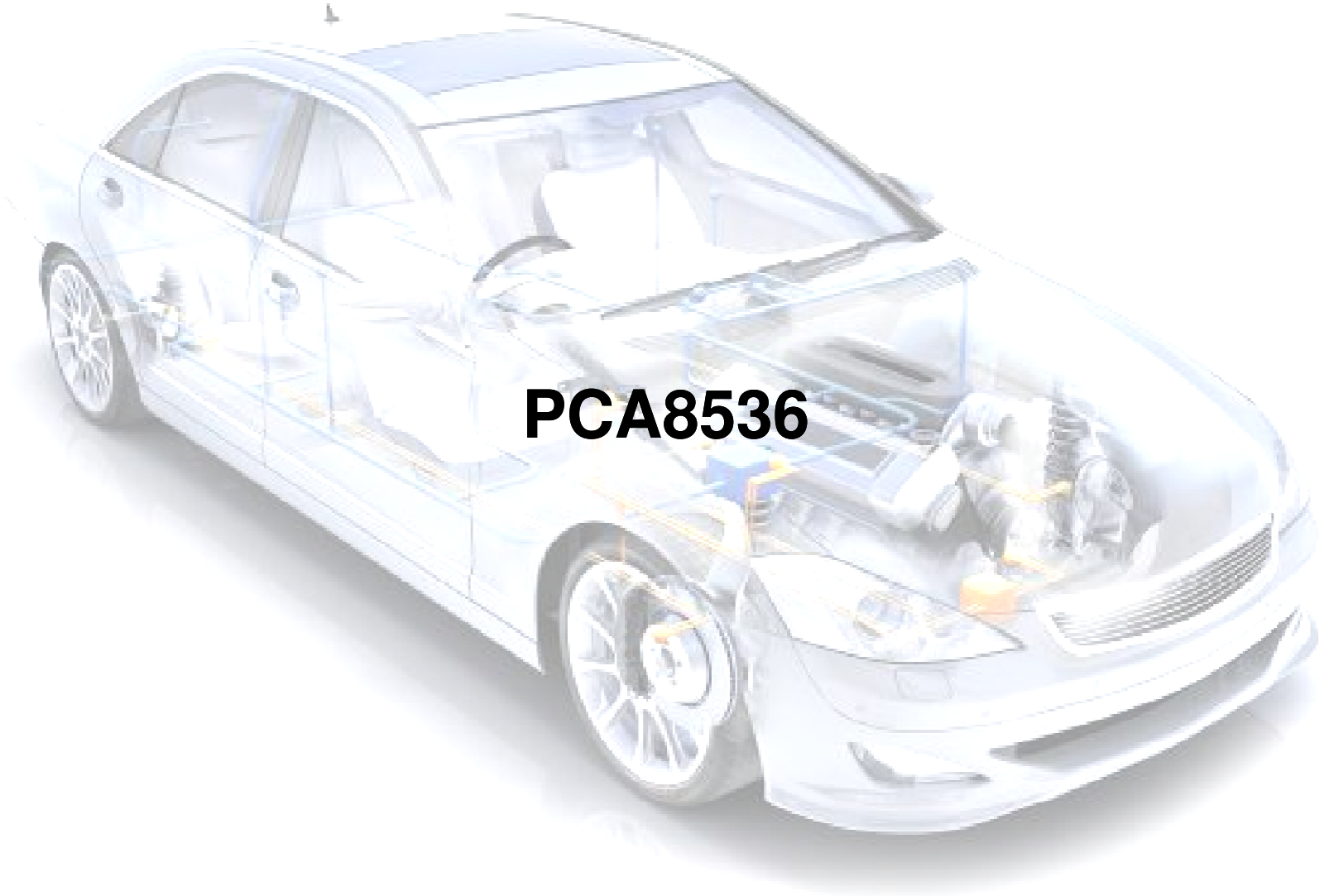


Type	PCA85162	PCA85176	PCA85134	PCA8536	PCA8537	PCA9620
Package	TSSOP48	TSSOP56 TQFP64	LQPF80	TSSOP56	TQFP64	LQFP80
Interface	I^2C	I^2C	I^2C	I^2C/SPI	I^2C/SPI	I^2C
VLCD (max)	8.0V	8.0V	8.0V	9.0V	9.0V	9.0V
Internal Charge Pump	no	no	no	no	yes	yes
VLCD temp. compensation	no	no	no	no	yes	yes
Frame Freq. (typ.)	110Hz	110Hz TSSOP56 82Hz TQFP64	82Hz	programmable 60Hz - 300Hz	programmable 60Hz - 300Hz	programmable 60Hz - 300Hz
PWM Control	no	no	no	yes 6 channels	no	no
Qualification	AEC-Q100 Grade 3	AEC-Q100 Grade 3	AEC-Q100 Grade 3	AEC-Q100 Grade 3	AEC-Q100 Grade 3	AEC-Q100 Grade 2
Temp. Range	-40ºC to +95ºC	-40ºC to +95ºC	-40ºC to +95ºC	-40ºC to +95ºC	-40ºC to +95ºC	-40ºC to +105ºC [1]
Status	released	released	released	released	released	released

Value Proposition

- AEC-Q100 automotive compliant qualification for highest robustness for harshest conditions
- Extended Temperature Range up to 95ºC or even 105ºC (selected devices)
- Wide VLCD range to up to 8.0V or even 9.0V (selected devices)
- Programmable and calibrated frame frequency (selected devices)
- On-chip Charge Pump and on-chip Temperature Sensor (selected devices)
- On-chip PWM Controller for LED back-lighting (selected devices)

Hi-Lights

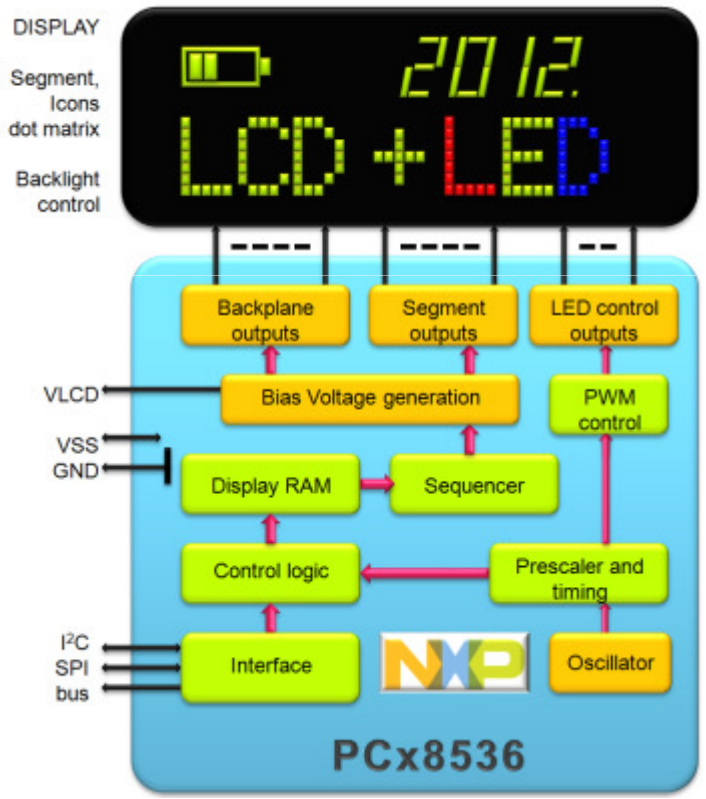


PCA8536

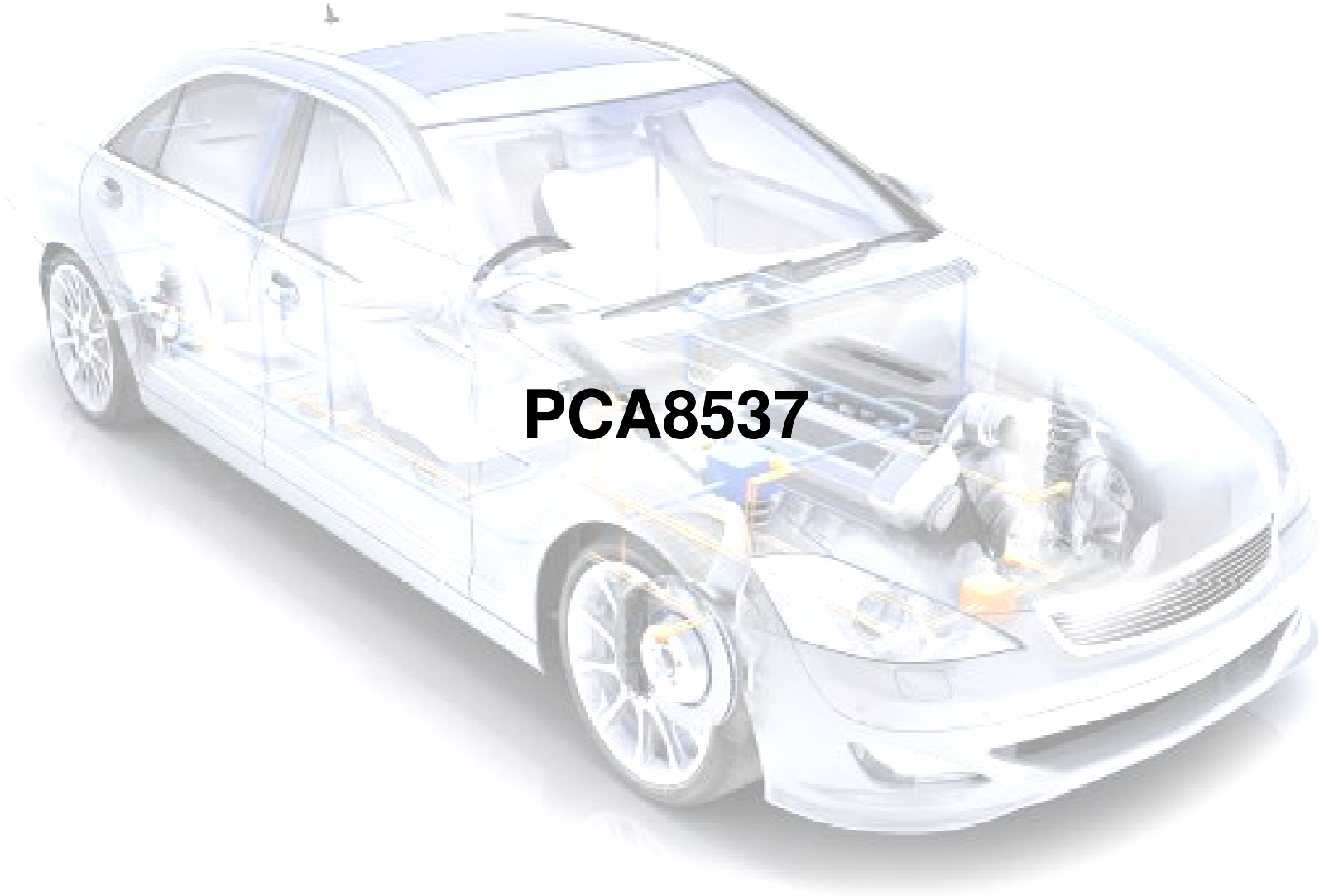
PCA8536 320 (8x40) Segment Driver with PWM Channels

Key Features

- 8 x 40 segment driver *(320 dots or segments)*
- Six PWM channels *(as segment replacement)*
- 7-bit PWM resolution
- Programmable PWM Frequency 50Hz to 250Hz
- Programmable Multiplex Rate *(1:4, 1:6, 1:8)*
- VLCD (max) = 9.0V
- Programmable Line Inversion or Frame Inversion
- Programmable Frame Frequency 60Hz to 300Hz
- Programmable Backplane outputs *(either located in the center of the Segment outputs or at the beginning)*
- I2C-bus or SPI-bus Interface
- Extended temperature range up to +95°C
- AEC-Q100 compliant



Volume Production

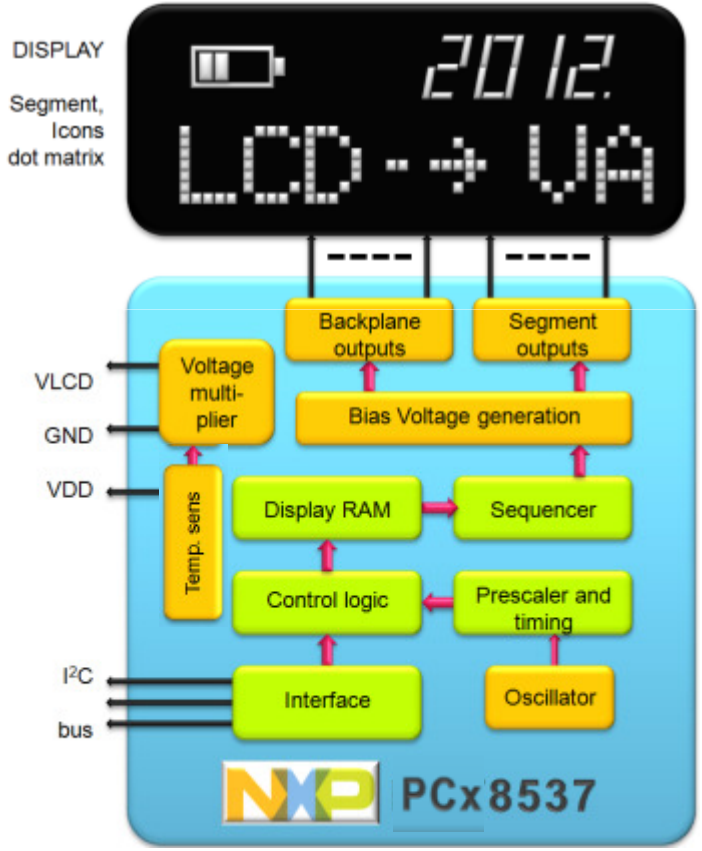


PCA8537

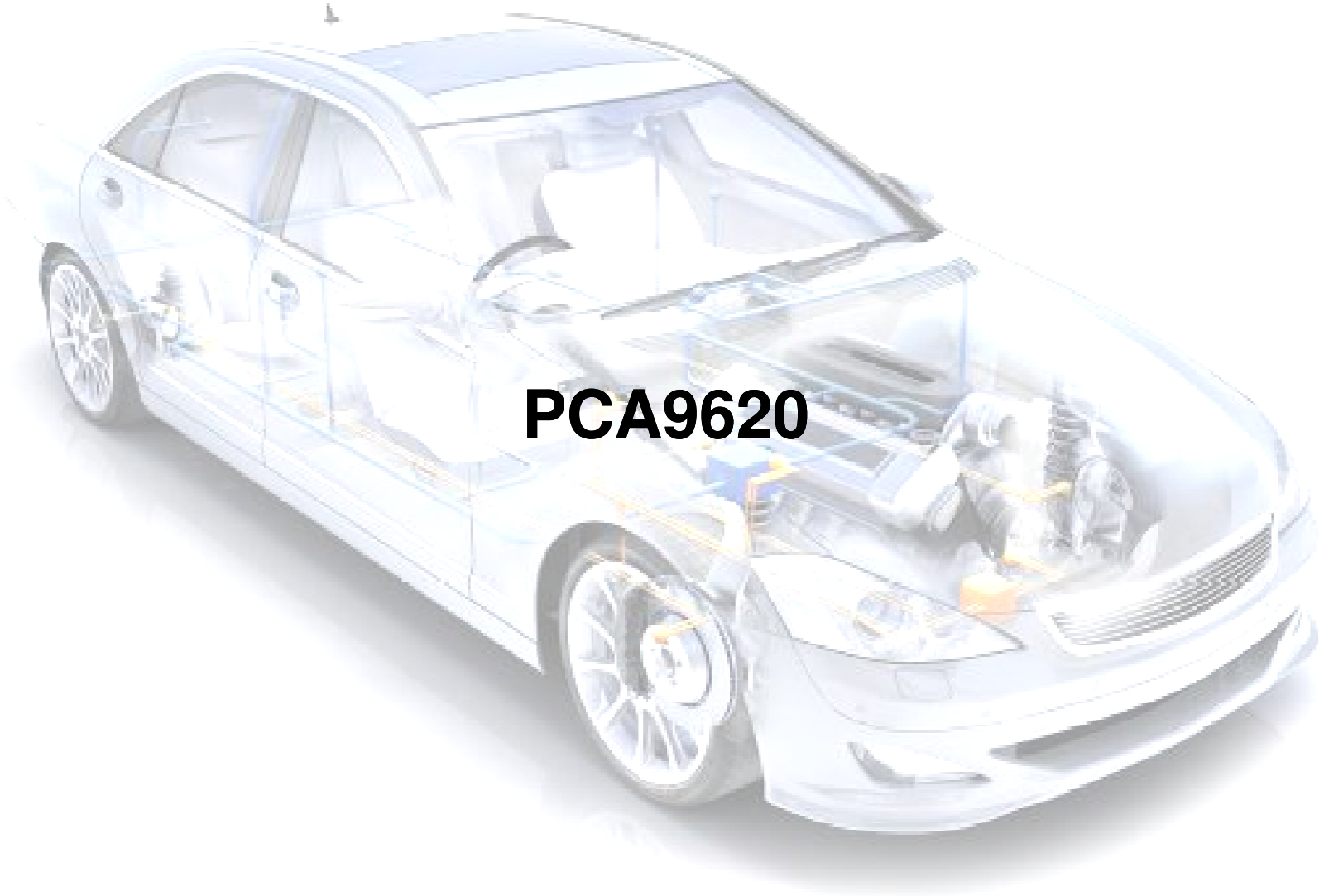
PCA8537 352 (8x44) Segment Driver with Charge Pump

Key Features

- 8 x 44 segment driver *(352 dots or segments)*
- Programmable Multiplex Rate *(1:1, 1:2, 1:4, 1:6, 1:8)*
- Specifically designed for high contrast VA (Vertical Alignment displays
- On-chip Charge pump with integrated capacitors
- VLCD (max) = 9.0V
- line inversion or frame inversion
- Temperature sensor (readout possible)
- Temperature compensated VLCD voltage
- Programmable frame frequency 60Hz to 300Hz
- I2C-bus or SPI-bus Interface
- Extended temperature range up to +95°C
- AEC-Q100 compliant



Volume Production

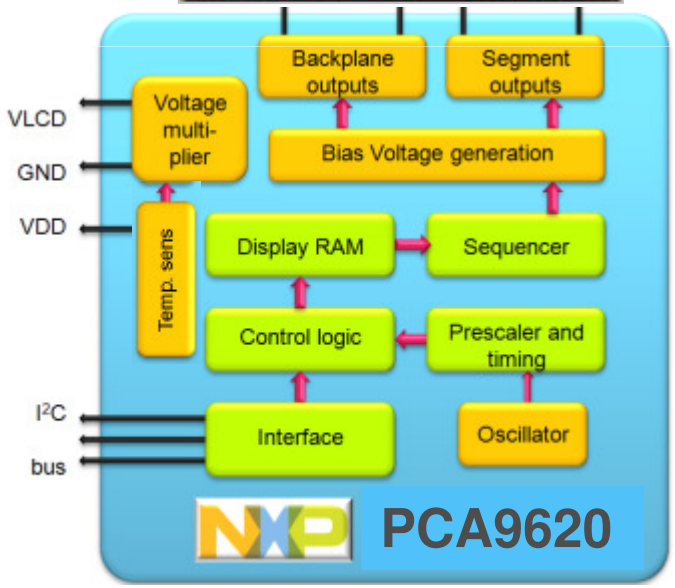


PCA9620

PCA9620 480 (8x60) Segment Driver with Charge Pump

Key Features

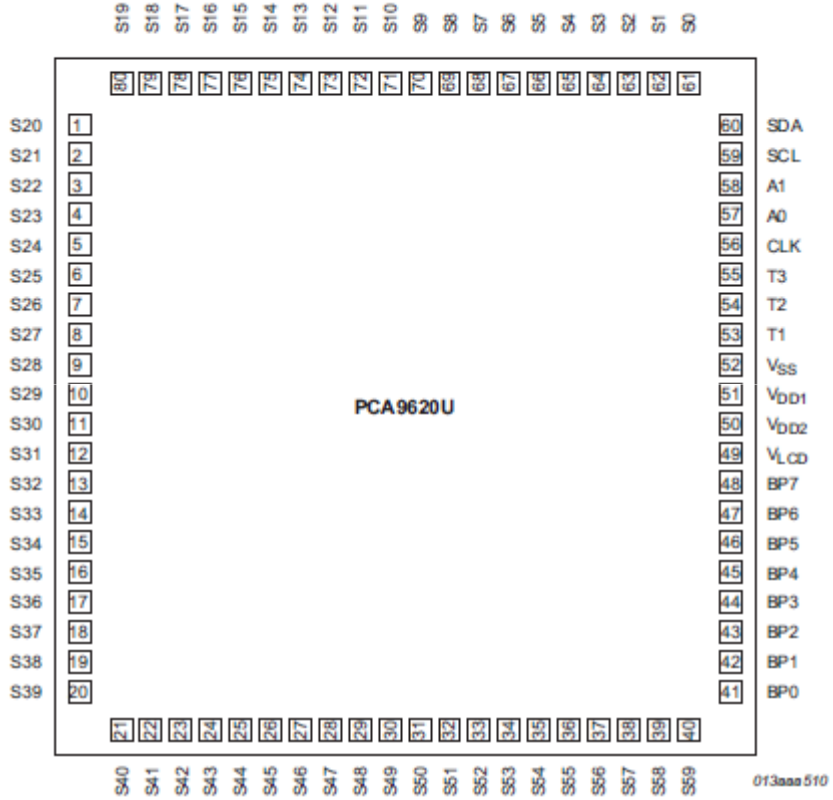
- 8 x 60 segment driver *(480 dots or segments)*
- Programmable Multiplex Rate *(1:1, 1:2, 1:4, 1:6, 1:8)*
- Specifically designed for high contrast VA (Vertical Alignment) displays
- On-chip Charge pump with integrated capacitors
- VLCD (max) = 9.0V
- line inversion or frame inversion
- Temperature sensor (readout possible)
- Temperature compensated VLCD voltage
- Programmable frame frequency 60Hz to 300Hz
- I2C-bus Interface
- Extended temperature range up to +105°C
- AEC-Q100 compliant



Volume Production

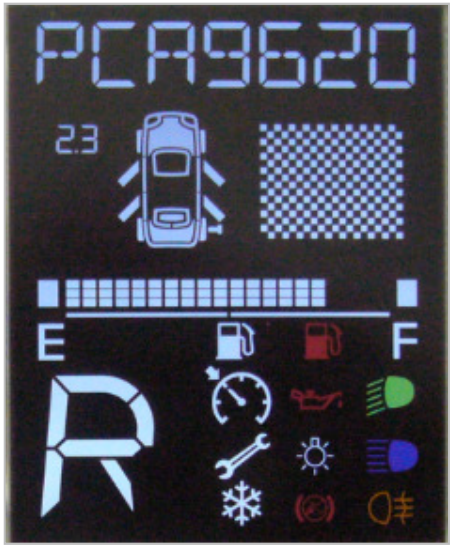
PCA9620U 480 (8x60) Segment Driver with Charge Pump

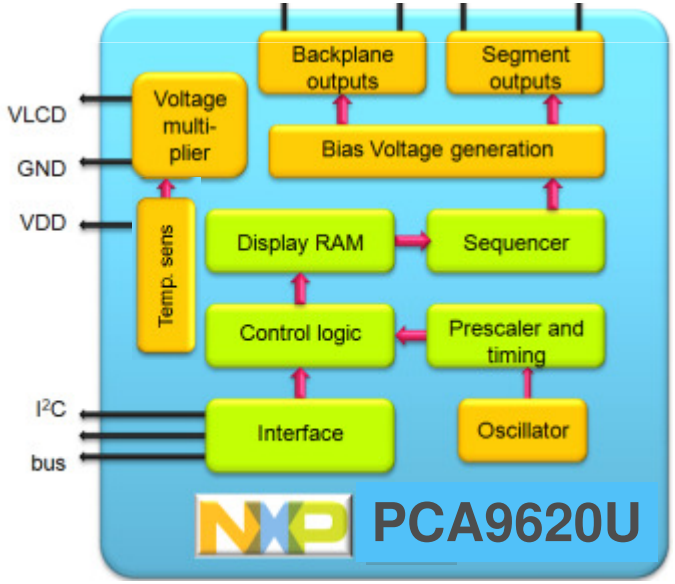
Wire-bond Die Version



Viewed from active side. For mechanical details, see Figure 57 on page 62.

Chip size:
3.166 x 3.166mm



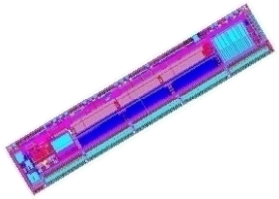


Volume Production

Character Driver Family

NXP LCD *Character* Drivers

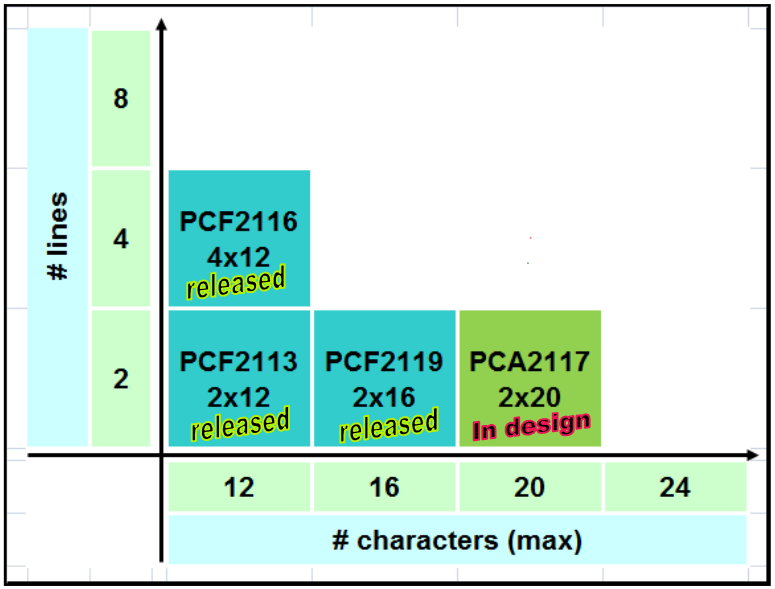
Portfolio Overview



Key products

- PCF2113 2 line by 12 characters + 120 icons
- PCF2116 4 line by 12 characters
- PCF2119 2 line by 16 characters + 160 icons
- PCA2117 2 line by 20 characters + 200 icons *

NOTE: F-versions are non-automotive grade but successfully used for many years in automotive

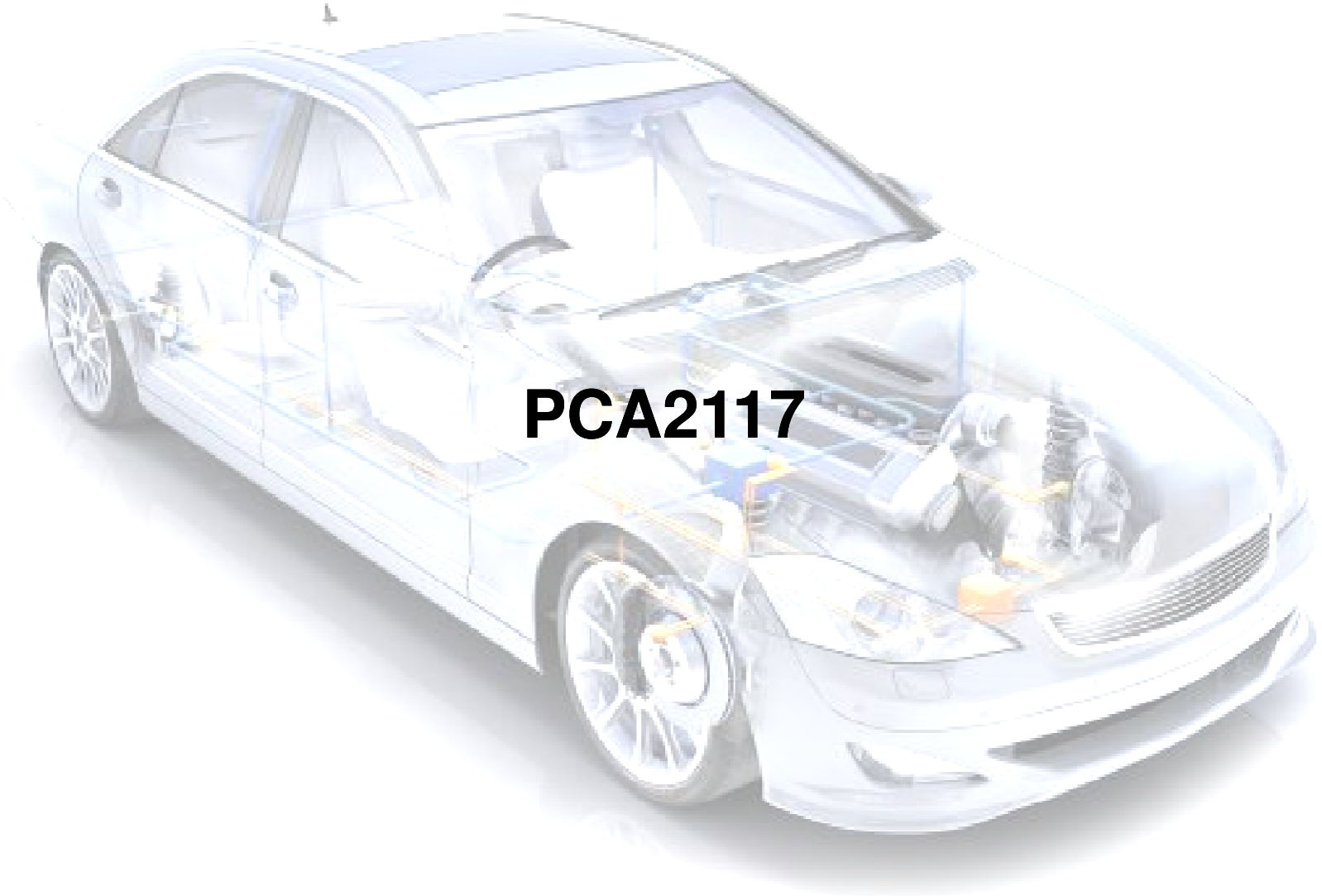


Chip-On-Glass LCD Drivers

Key features

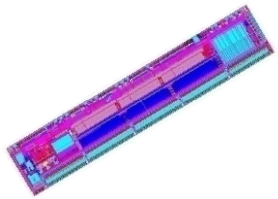
- On-chip character generator
- On-chip temperature compensation
- On-chip character ROM and RAM
- Low power consumption
- On-chip Charge Pump
- Minimum of external components
- Cursor support
- Icon mode, to indicate system is active also during power down
- I2C bus, SPI bus and Parallel Interface (latter not for PCA2117)

** PCA2117 with additional features*
→ see next page



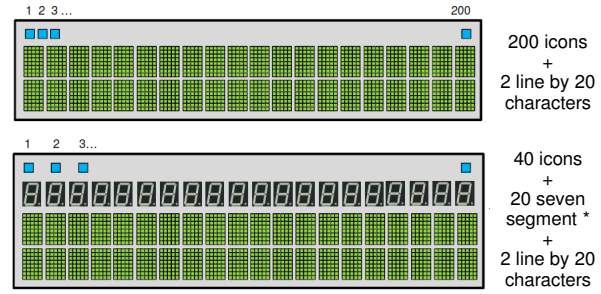
PCA2117

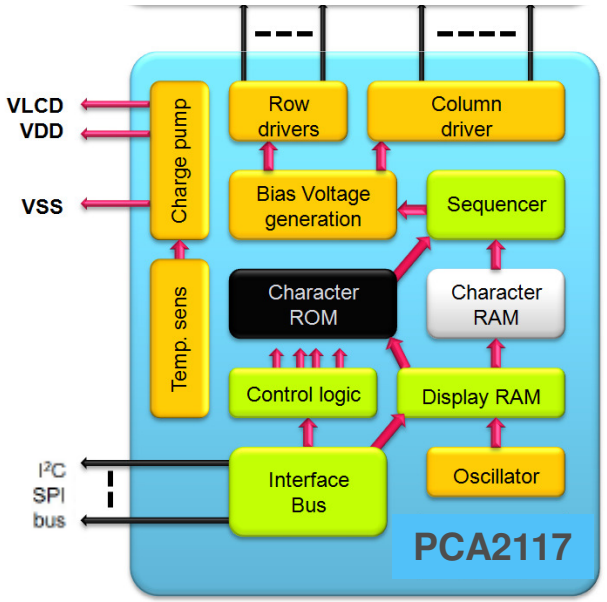
PCA2117 2 line by 20 Character Driver



Key Features

- 2 lines by 20 Characters *(5 x 8 dots per character)*
- Max. 200 icons *(Icons can be used as 7-segment digit)*
- 48 Character RAM
- Line feed function
- Specifically designed for high contrast VA (Vertical Alignment) displays
- On-chip Charge pump with integrated capacitors
- VLCD (max) = 16V
- n-line inversion *(includes line and frame inversion)*
- Temperature sensor (readout possible)
- Temperature compensated VLCD voltage
- Programmable frame frequency 45Hz to 360Hz
- I2C-bus and SPI-bus Interface
- Extended temperature range up to +95°C
- AEC-Q100 compliant





In Development

Demo Boards

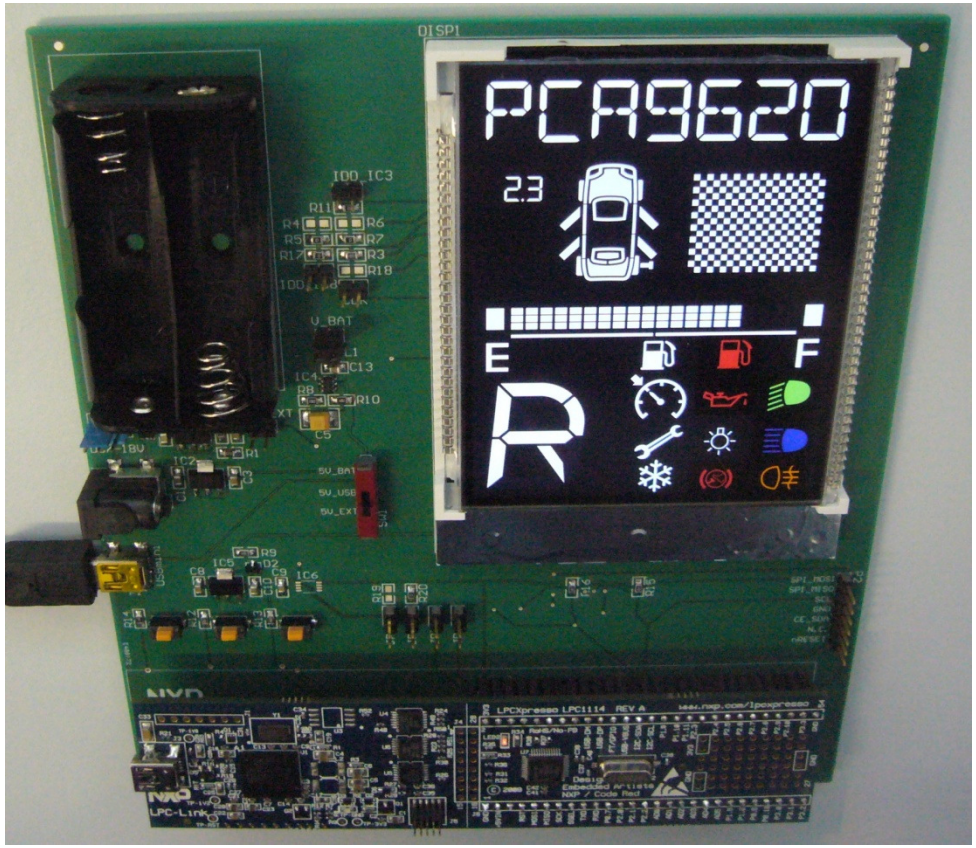
NXP LCD Drivers for Automotive

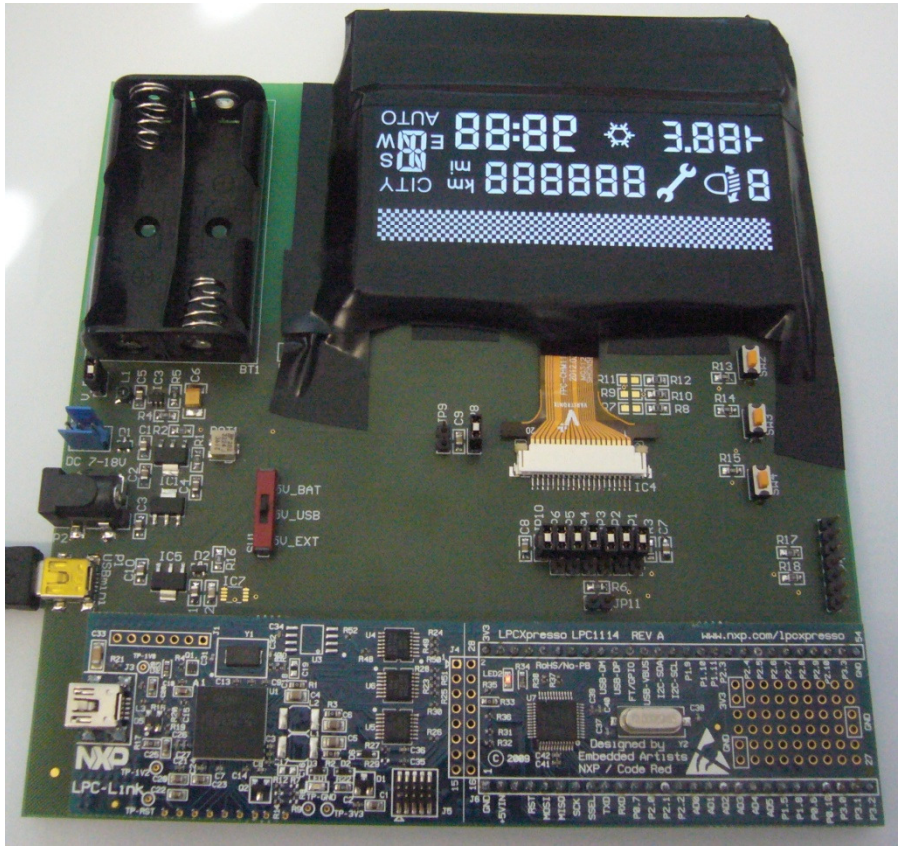
Demo Boards

Available end of Jan 2013

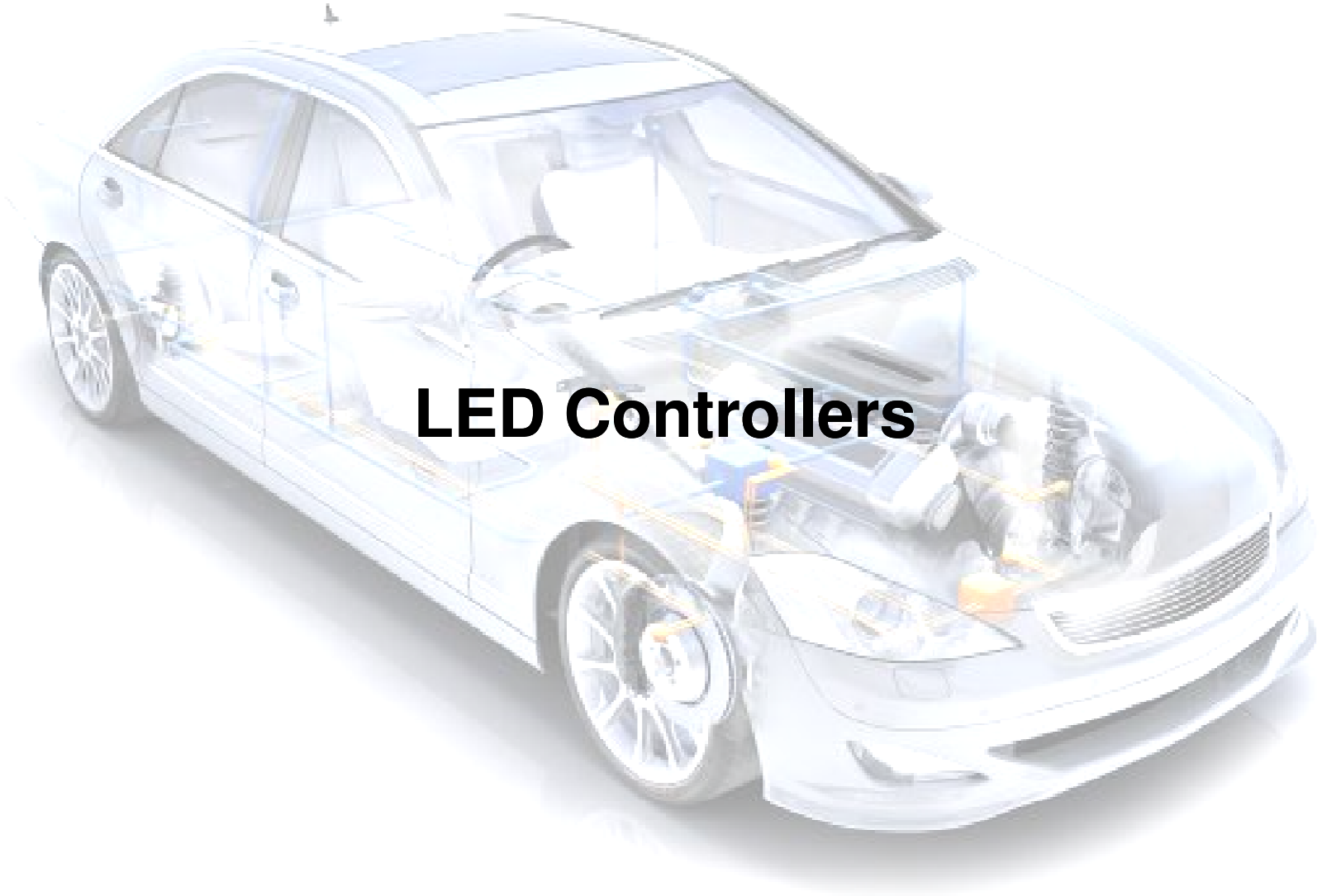
- Demo board integrating the PCA9620:
  - 60 x 8 LCD segment driver in LQFP80 package for automotive and industrial applications

- Demo board integrating the COG PCA8538
  - Chip-On-Glass 102 x 9 LCD segment driver for automotive and industrial applications





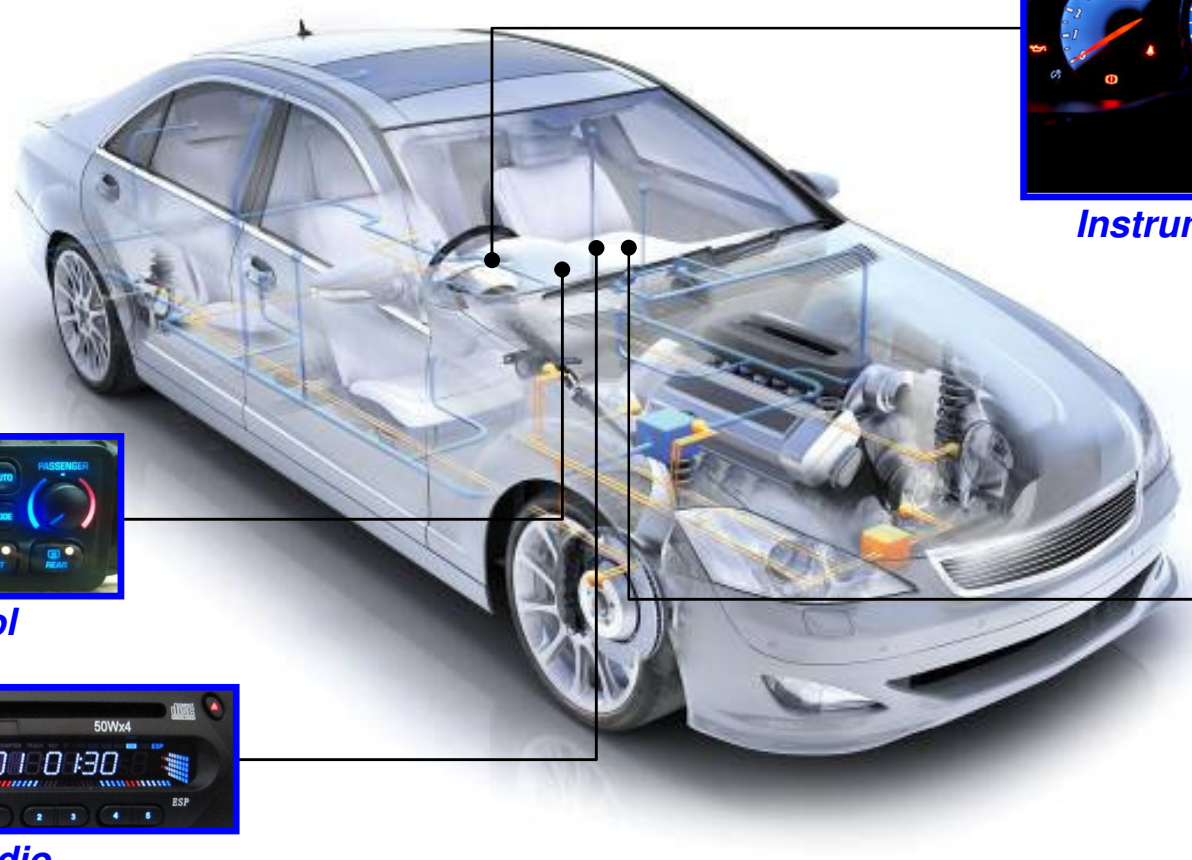
Engineering versions in the pictures already available



LED Controllers

NXP LED Controller for Automotive

Focus Application Areas



Instrument Cluster

Climate Control

Car Radio

Navigation System

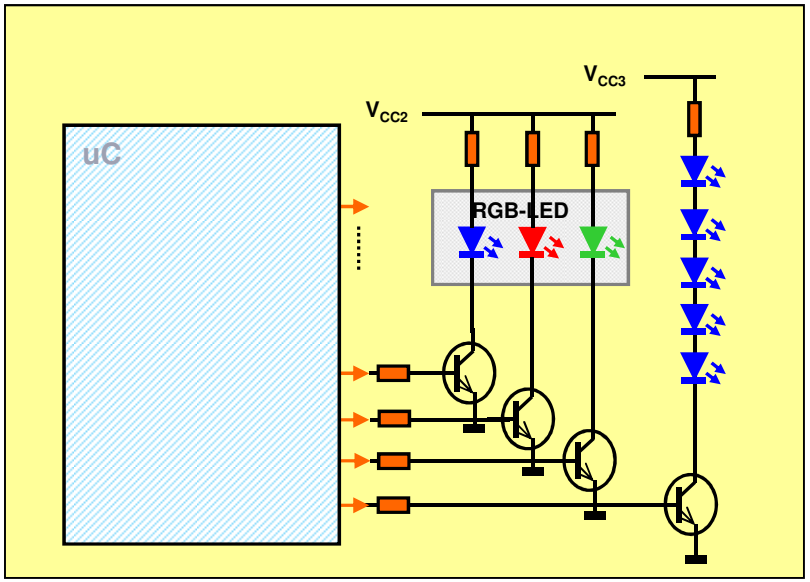
NXP LED Controller for Automotive

Value Proposition (1/2)

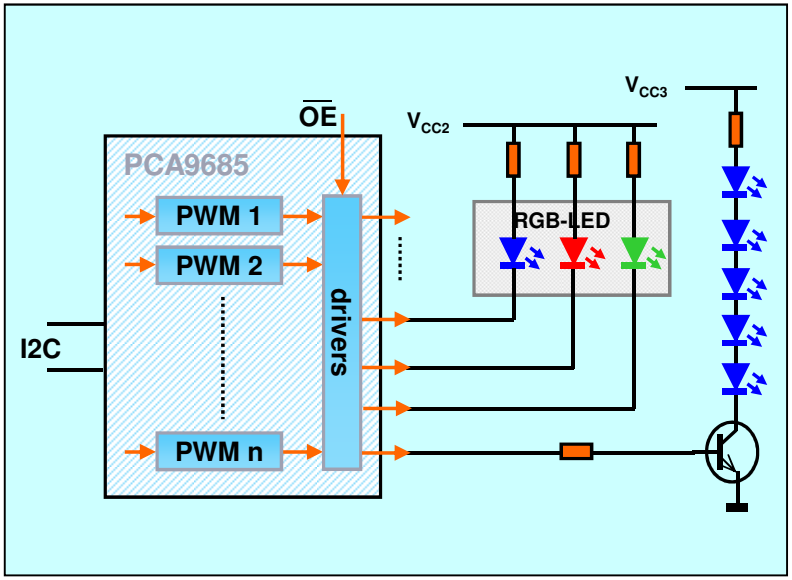
- Fully integrated LED Control with Color Mixing and Dimming

Comparison discrete vs. fully integrated LED Control

(i) Discrete



(ii) Fully Integrated



- *Reduced Bill of Material by integration of up to 16-PWM channels into one single controller*
- *Add value by smart color mixing and global dimming capability*

NXP LED Controller for Automotive

Value Proposition (2/2)

➢ Voltage Source or Constant Current Devices

Comparison Voltage Source vs. Constant Current LED Control

(i) Voltage Source

(ii) Constant Current

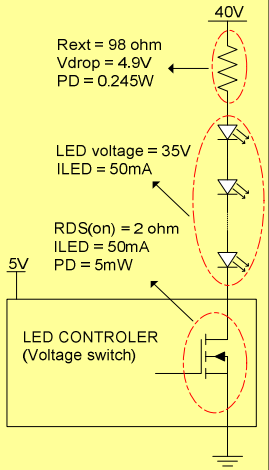
<u>Voltage Source</u>

Advantages

- Less power dissipation in driver (less heat on the IC)

Considerations

- LED current varies with changes of supply voltage and LED voltage
- Need one resistor per channel to limit current



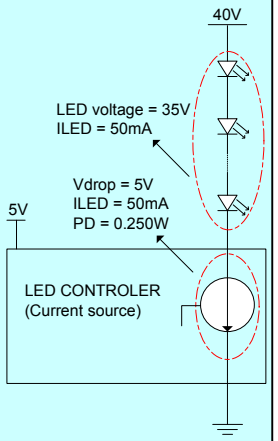
<u>Constant Current</u>

Advantages

- LED current is independent of changes in supply voltage and LED forward voltage
- One resistor sets LED current for all channels

Considerations

- Higher power dissipation in driver (more heat on IC)



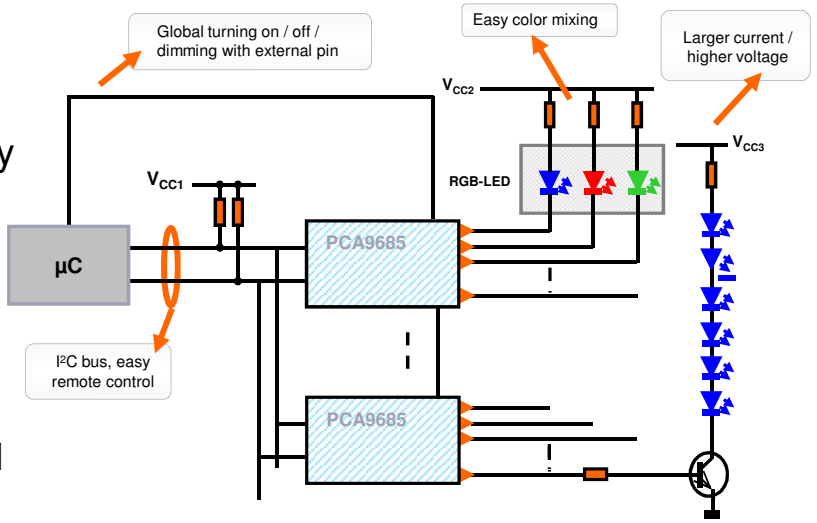
➢ *Voltage source: low power consumption and low heat generation but instead varying LED brightness with varying supply voltage and need for external resistor*

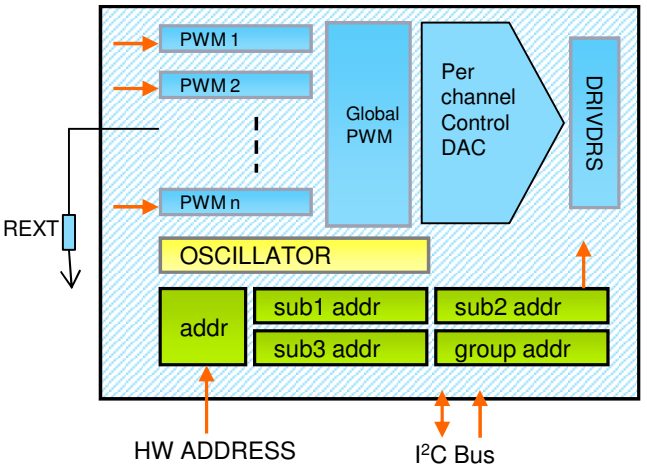
➢ *Constant Current: higher power consumption and higher heat generation but instead constant LED brightness and no need for external resistors*

NXP LED Controller for Automotive

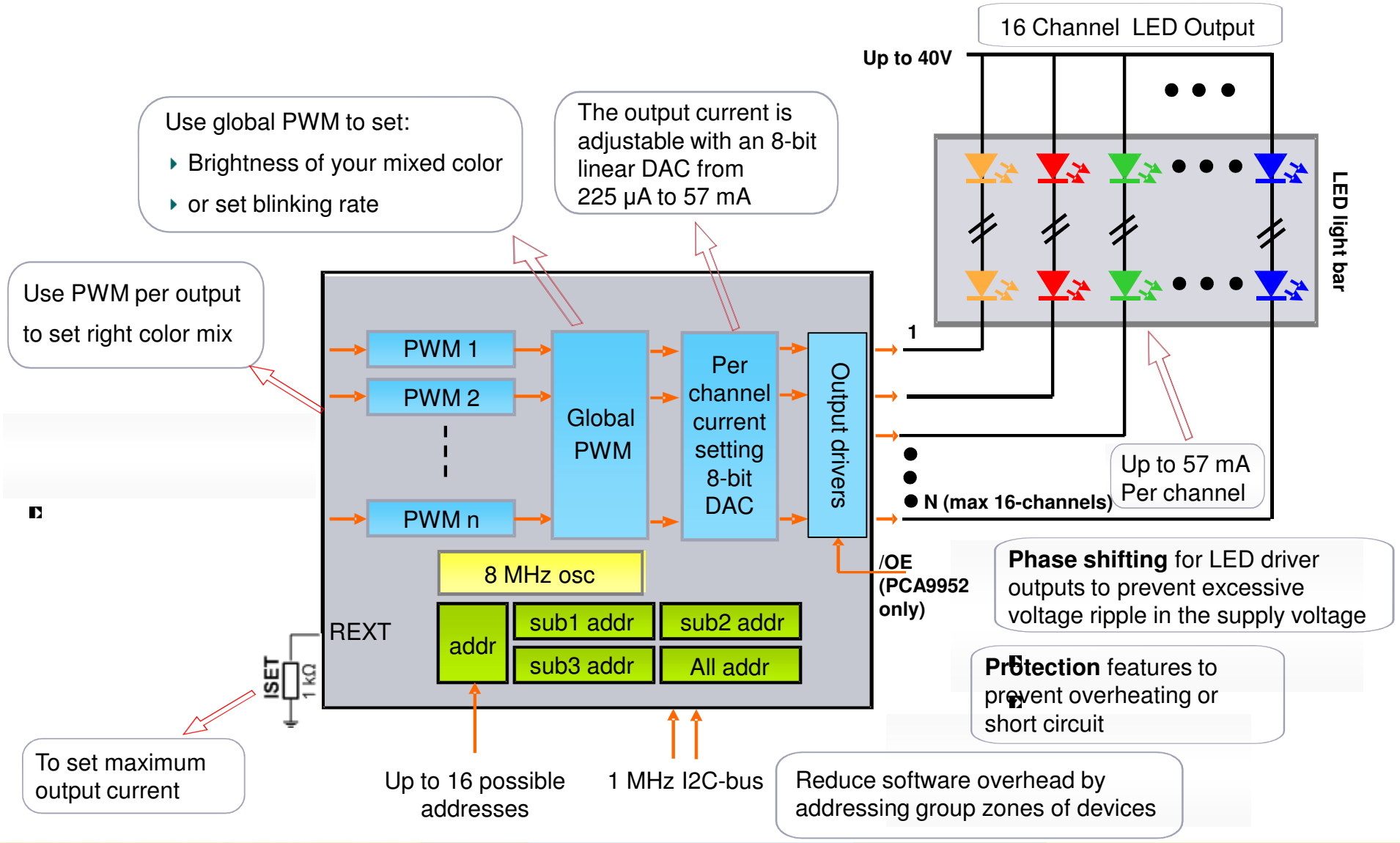
Product Overview

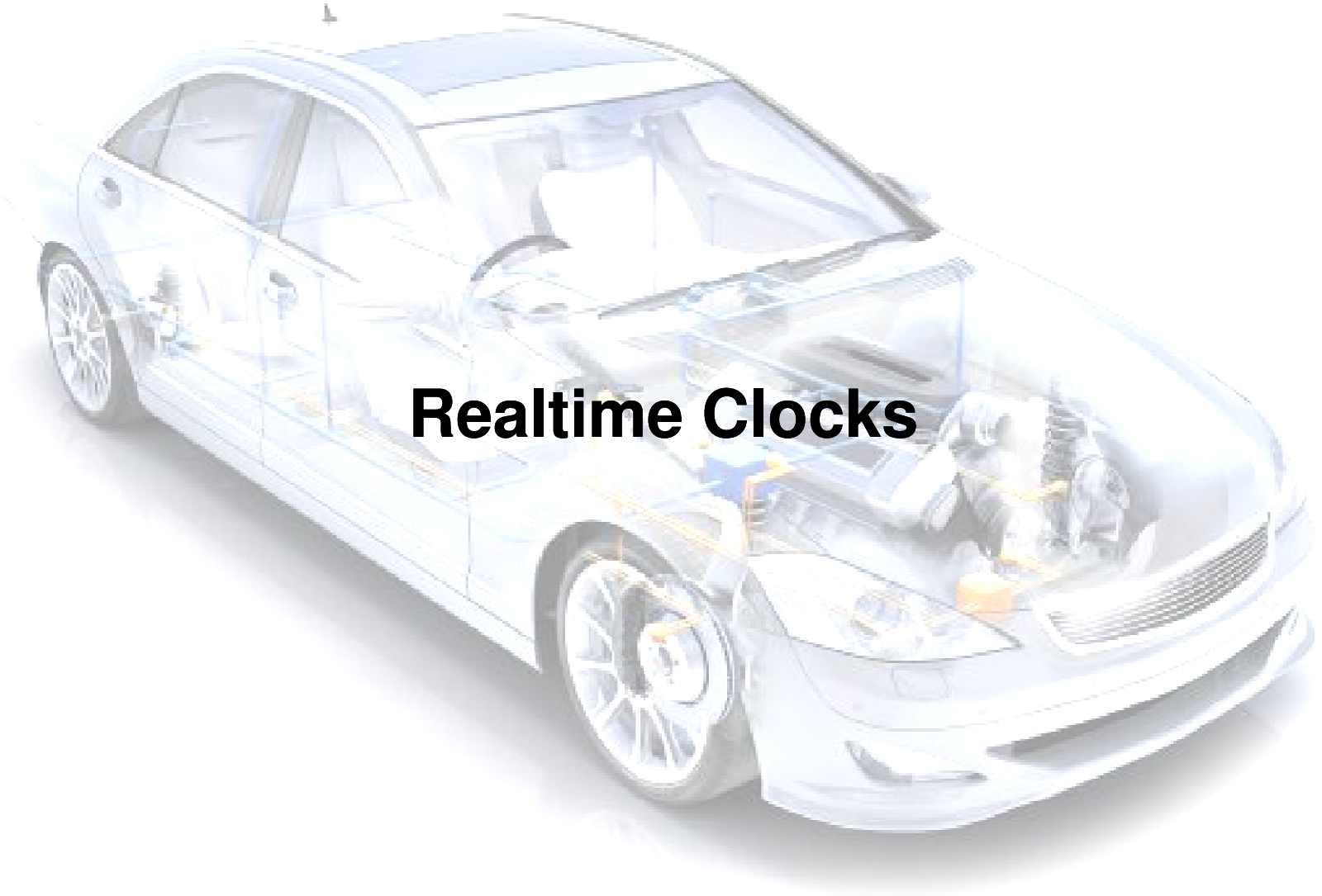
- **PCA9635PW/Q900** released
  - 16 + 1 PWM channels (16 individual, one global)
  - 8-bit PWM resolution (256 steps); 96kHz PWM frequency
  - 25mA output sink current; 5V compliant
  - -40°C, .. , +85°C; TSSOP28 package
  - *AEC-Q100 automotive compliant qualification*
- **PCA9685PW/Q900** released
  - 16 PWM channels, one global Output Enable
  - 12-bit PWM resolution (4096 steps); 40Hz-1000Hz PWM frequency
  - 25mA output sink current; 5V compliant
  - -40°C, .. , +85°C; TSSOP28 package
  - *AEC-Q100 automotive compliant qualification*
- **PCA9955TW/Q900 & PCA9952TW/Q900** In qualification
  - 16 + 1 PWM channels (16 individual, one global)
  - 57mA constant current LED drivers; 40V compliant
  - 8-bit PWM resolution (256 steps); 31.25kHz PWM frequency
  - Per channel 6-bit DAC to set individual output current
  - LED open/short, over-temp, over current detection
  - -40°C to +85°C; HTSSOP28
  - *AEC-Q100 automotive compliant qualification*





PCA9955 & PCA9952 Constant Current LED Controller





Realtime Clocks

NXP Realtime Clocks for Automotive

Focus Application Areas

Car radio

Auxiliary Heating System

Battery management

Instrument Cluster

Navigation System

Car Clock

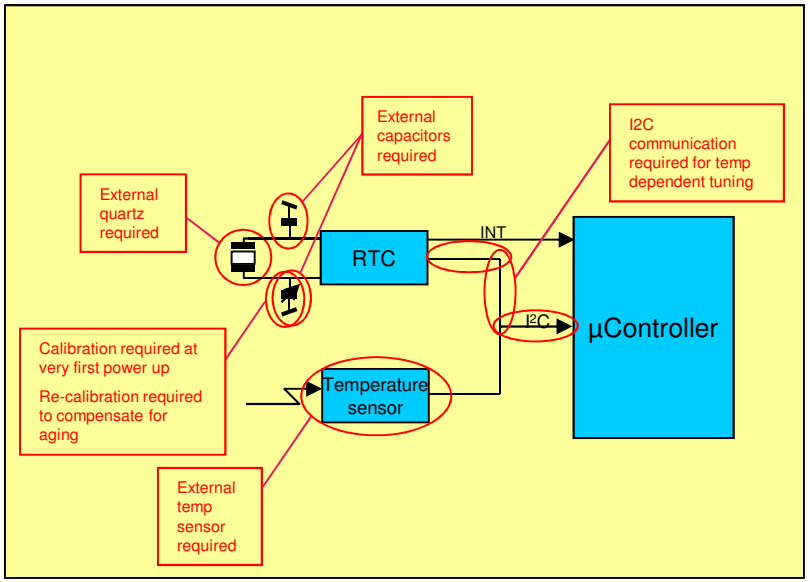
NXP Realtime Clocks for Automotive

Value Proposition (1/3)

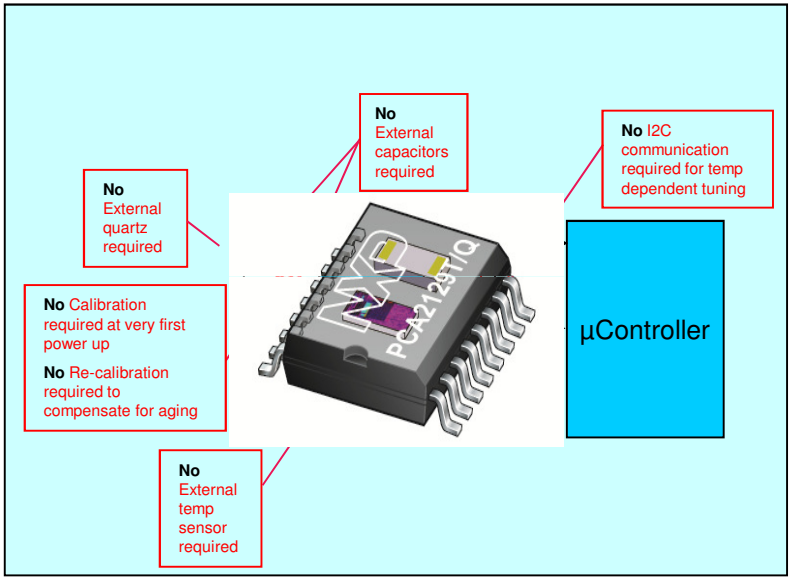
- Fully integrated and factory calibrated Realtime Clock Modules

Comparison discrete vs. fully integrated Realtime Clock

(i) Discrete



(ii) Fully Integrated



- *Reduced Bill of Material by integration of quartz crystal, temperature sensor and RTC in one single package*
- *Redundancy of production line calibration by using factory calibrated Realtime Clock modules*
- *Reduced PCB complexity by moving the quartz crystal into the RTC module*

NXP Realtime Clocks for Automotive

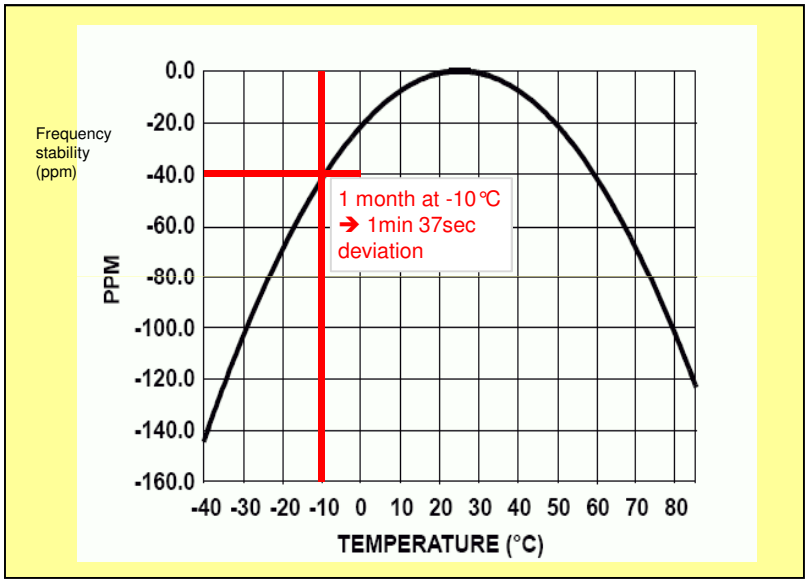
Value Proposition (2/3)

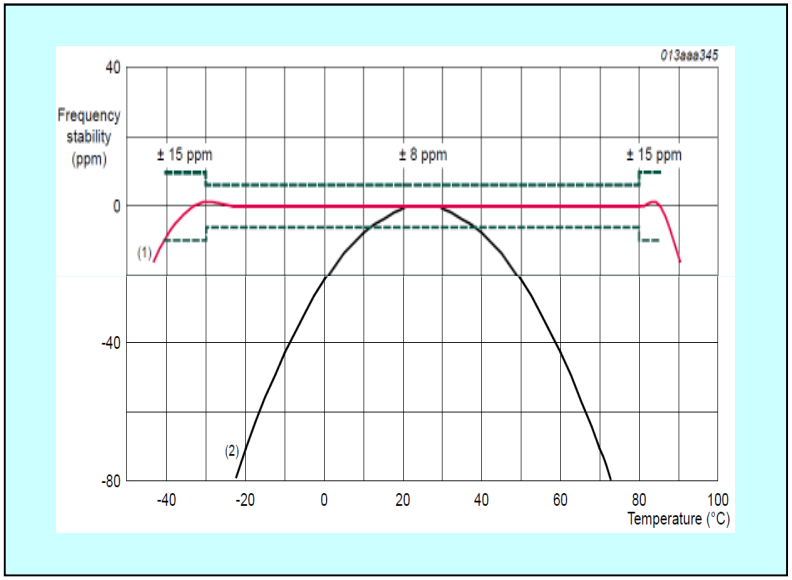
- high frequency stability for accurate time keeping

(i) non-compensated

Comparison non-compansated vs. compensated freqency stability

(ii) compensated





- *temperature compensation over full temperature range from -40 °C to +85 °C for excellent frequency stability*
  - ➔ *[-30 °C to +80 °C]: +/- 3ppm (typ.), +/- 8ppm (max.)*
  - ➔ *[-40 °C to -30 °C & +80 °C to +85 °C]: +/- 5ppm (typ.), +/- 15ppm (max.)*

Note: ***11.5ppm = 1sec/day***

NXP Realtime Clocks for Automotive

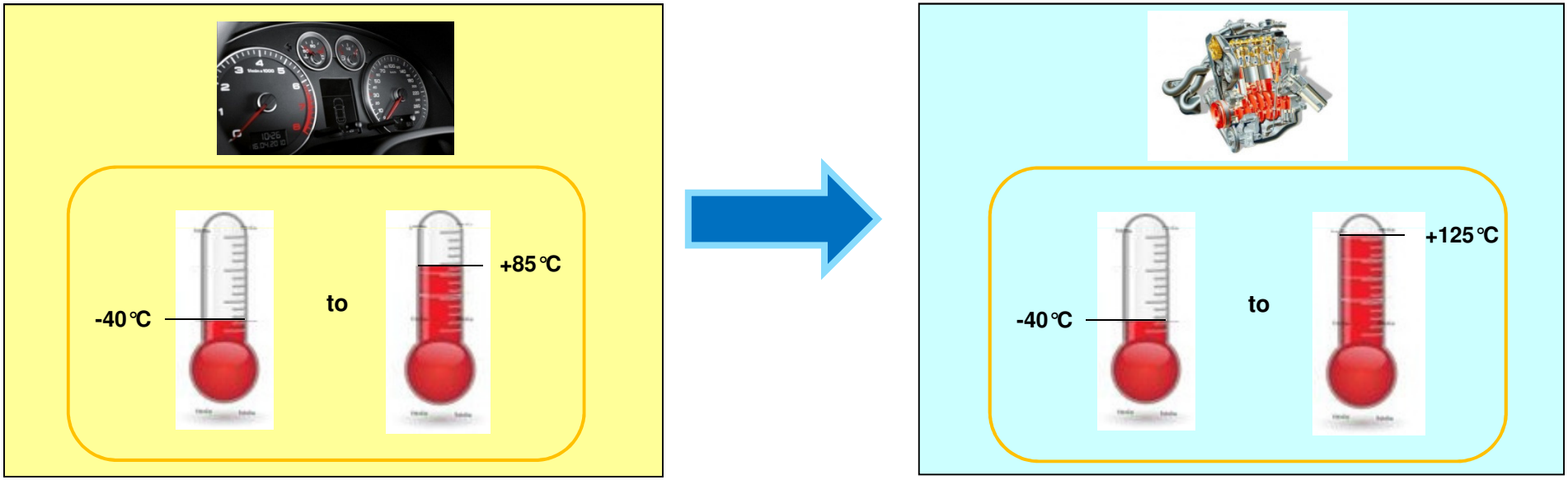
Value Proposition (3/3)

➢ Extended temperature range to +125°C for extremely harsh conditions

(i) -40°C to +85°C

Comparison standard vs. extended temperature range

(ii) -40°C to +125°C

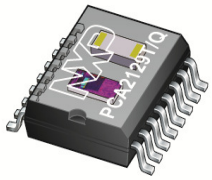


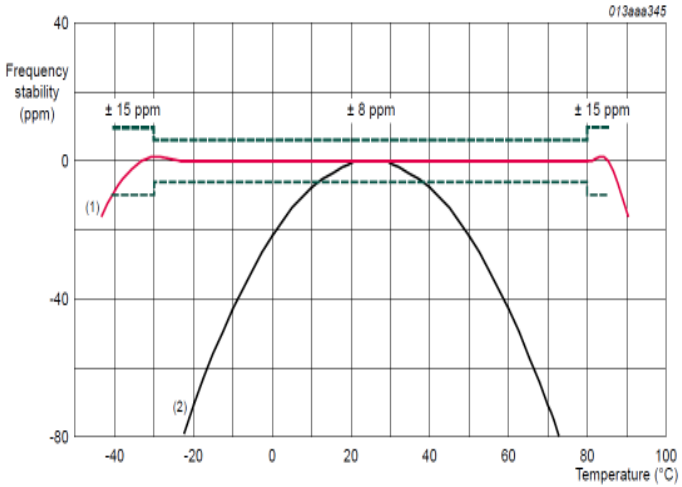
➢ *operating temperature range extended to +125°C for operation in engine compartment*

NXP Realtime Clocks for Automotive

Product Overview

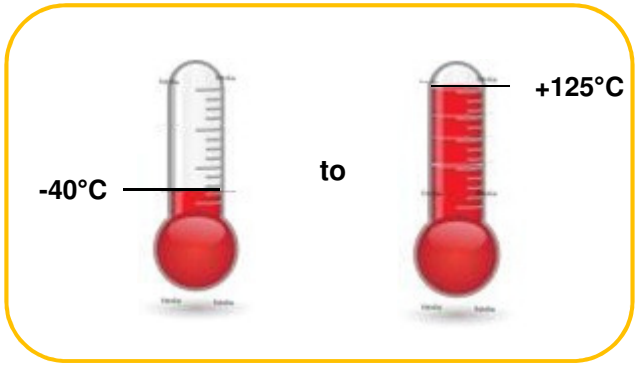
- **PCA2129T/Q900/2** released
  - High accuracy (±3ppm; typ.) for accurate time keeping
  - Integrated TCXO requires no external crystal
  - No external capacitors required; factory calibrated
  - Battery back-up and switchover function ensures reference timekeeping during power down
  - Timestamp function
  - SPI and I²C interfaces
  - -40 °C, .. , +85 °C; SO16 package
  - *AEC-Q100 automotive compliant qualification*

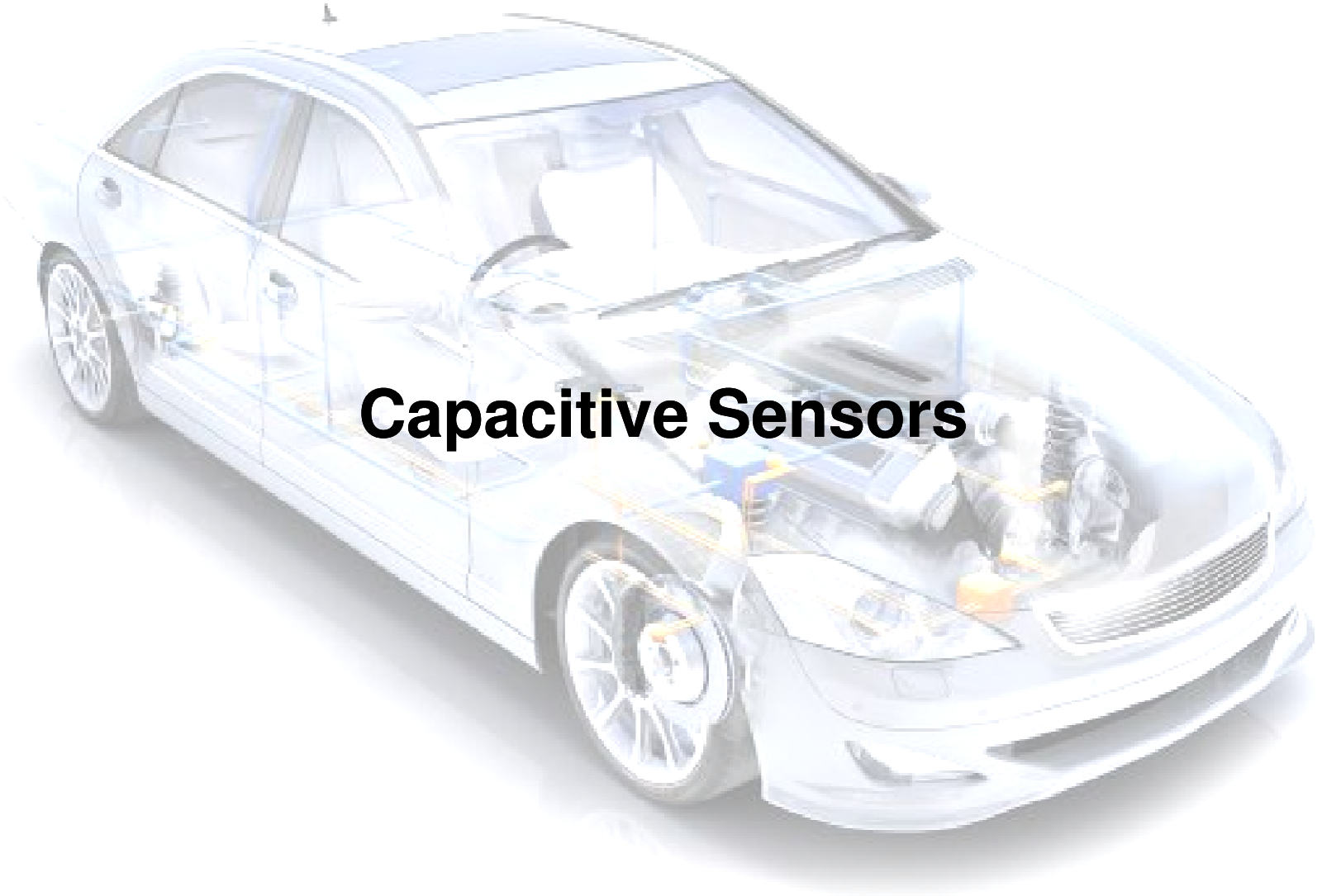




- **PCA21125T/Q900/1** released
  - Operating Temperature Range from –40 °C to +125 °C
  - SPI interface with clock speed up to 6MHz
  - TSSOP14 package
  - *AEC-Q100 automotive compliant qualification*

- **PCA8565TS/1** released
  - Operating Temperature Range from –40 °C to +125 °C
  - I²C interface
  - TSSOP8 package
  - *AEC-Q100 automotive compliant qualification*





Capacitive Sensors

NXP Capacitive Sensor for Automotive

Focus Application Areas

Trunk

Rear view mirror

Roof Control

Steering wheel

Window Control Panel

Car access

Car radio

Instrument Cluster

Climate control

NXP Capacitive Sensors for Automotive

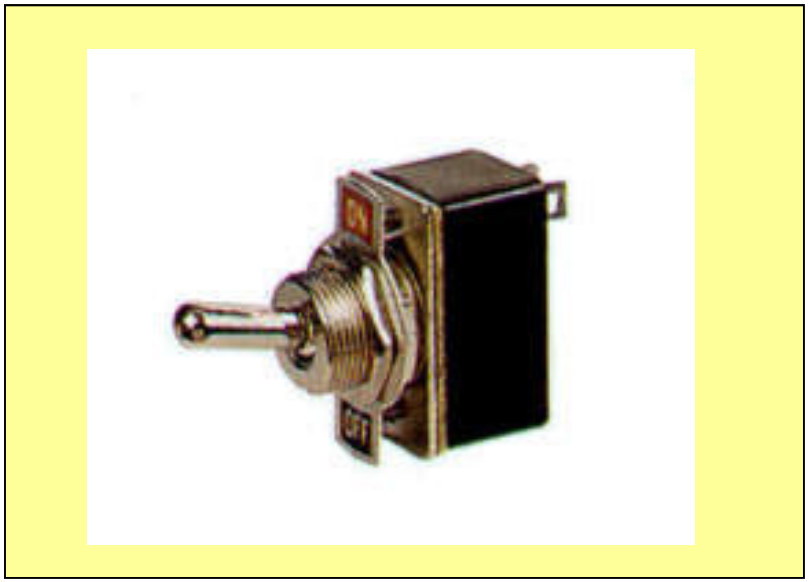
Value Proposition (1/3)

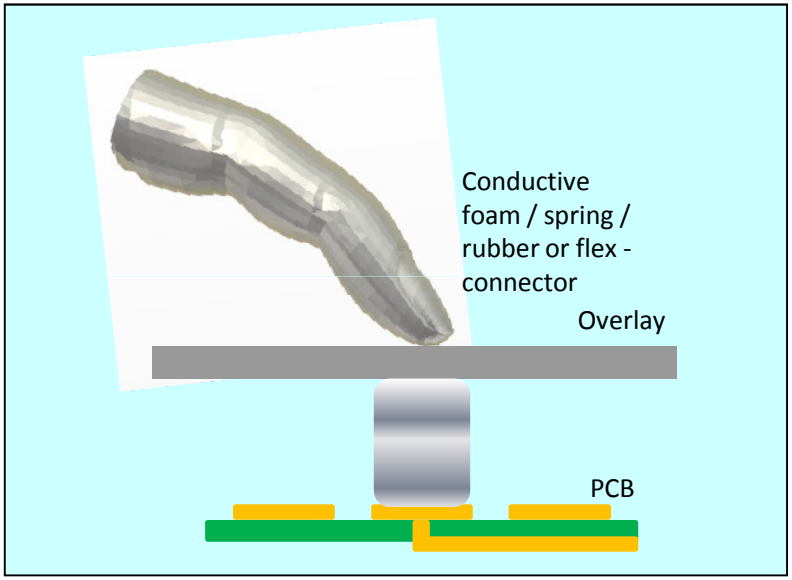
- Capacitive proximity/touch switch

(i) Mechanical

Comparison mechanical vs. capacitive Switch

(ii) Capacitive





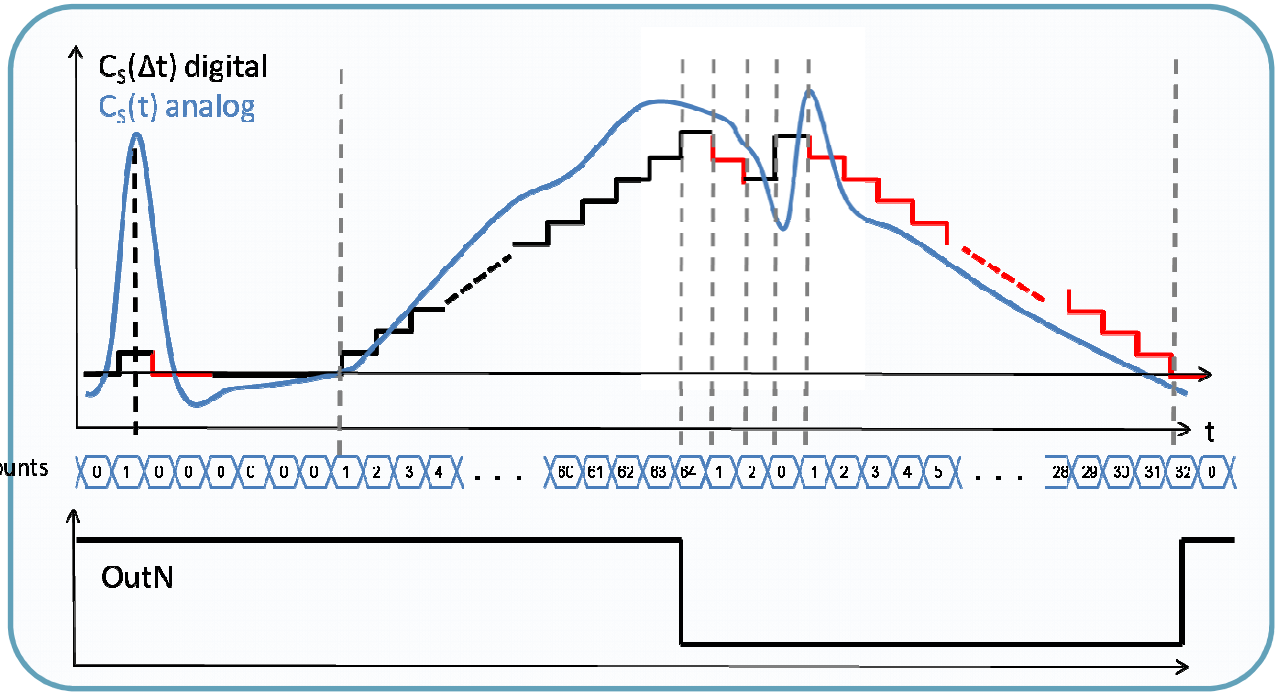
- No mechanical wear ➔ no friction
- No contamination issues ➔ Dirt, dust, ...
- Touch and proximity sensing possible ➔ up to several cm

- One technology fits all ➔ Button, slider, wheel, key matrix, ...
- Prospect for lower cost ➔ one device for multiple channels

NXP Capacitive Sensors for Automotive

Value Proposition (2/3)

- Digital Signal Processing with auto calibration



- Patented (EDISEN) digital method to detect a change in capacitance on a remote sensing plate
- Changes in the static capacitance (as opposed to dynamic capacitance changes) are automatically compensated using continuous auto-calibration (no need for post-processing)

NXP Capacitive Sensors for Automotive

Value Proposition (3/3)

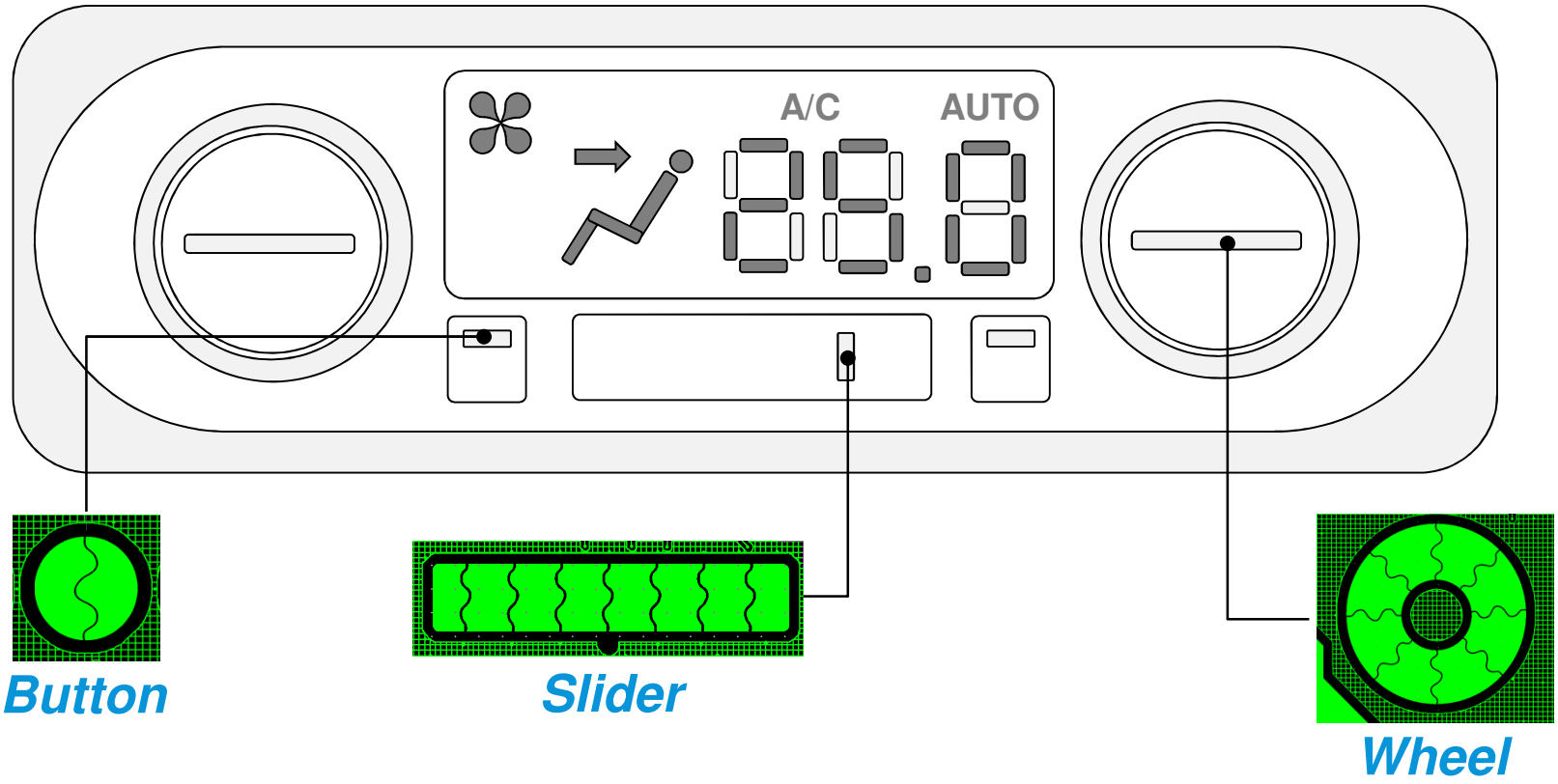
1. **Low power Consumption**
   - Specific low-power design with dedicated functional blocks provide industry leading power consumption.
2. **Versatile in Use (how to use it)**
   - Easily configurable input and output modes allow implementation of buttons, wheels and sliders with single IC.
3. **Simplicity in Use (focus on feature)**
   - Minimal usage of microcontroller resources to configure and monitor events
4. **False Trigger Prevention**
   - Digital signal processing and key –press modes prevent false triggering
5. **High immunity to Environmental Changes (Temp, Moisture, ..)**
   - Built-in, continuous auto-calibration and wide input capacitance range provides high immunity to environmental changes
6. **High RF-Noise Immunity**
   - Low impedance input and digital signal processing provides high RF-noise immunity
7. **High robustness / low failure rate**
   - Automotive AEC-Q100 compliant qualification ensures highest robustness and low failure rate

NXP Capacitive Sensors for Automotive

Application Example

➢ *Climate Control Unit (1/4)*

– From push button, rotary knob, slider...

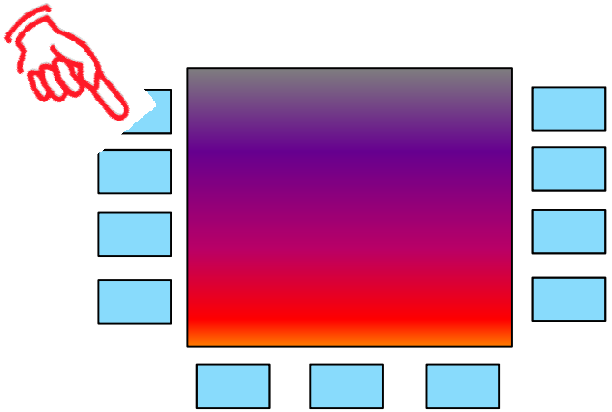


NXP Capacitive Sensors for Automotive

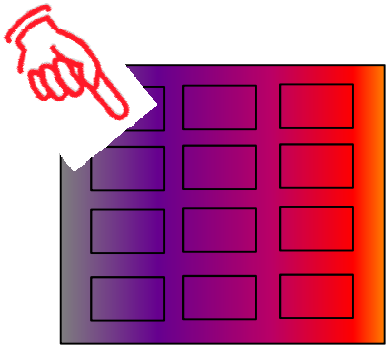
Application Example

➢ *Climate Control Unit (2/4)*

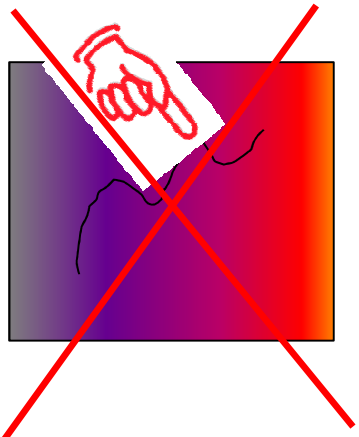
– ... to display with touch...



Outside from display



Fields on display



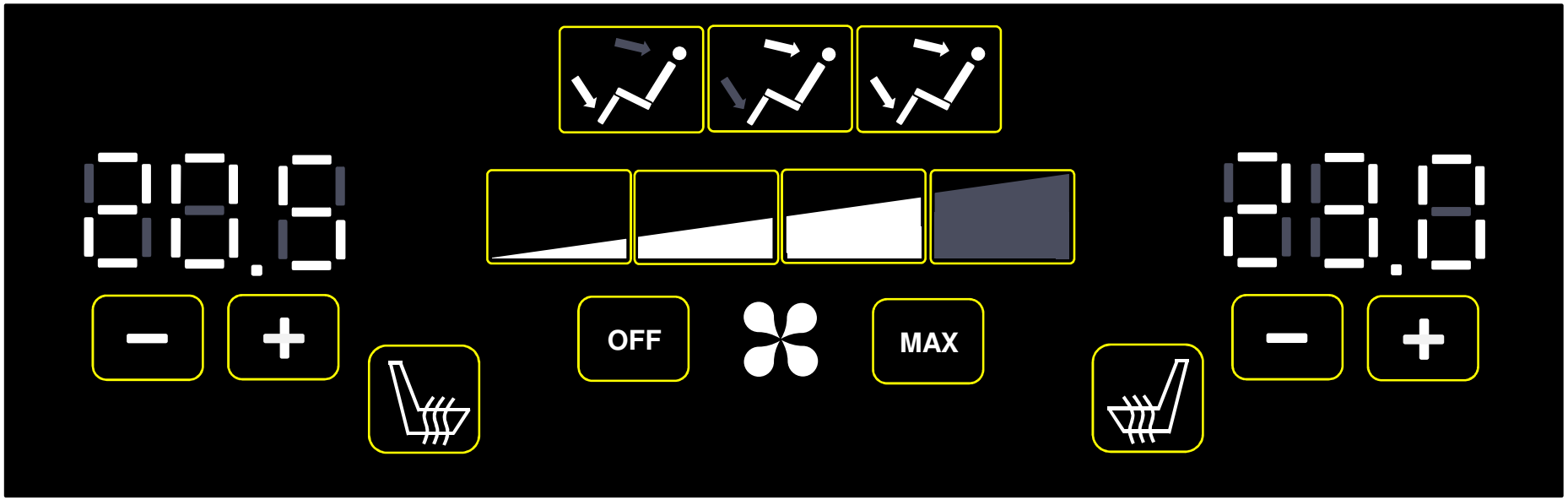
Free Control on display

NXP Capacitive Sensors for Automotive

Application Example

➢ *Climate Control Unit (3/4)*

– ...on segmented Display...



NXP Capacitive Sensors for Automotive

Application Example

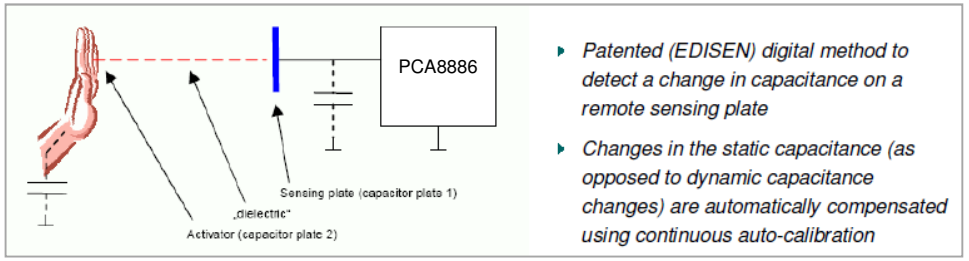
➢ *Climate Control Unit (4/4)*

– ...or on TFT Display

NXP Capacitive Sensors for Automotive

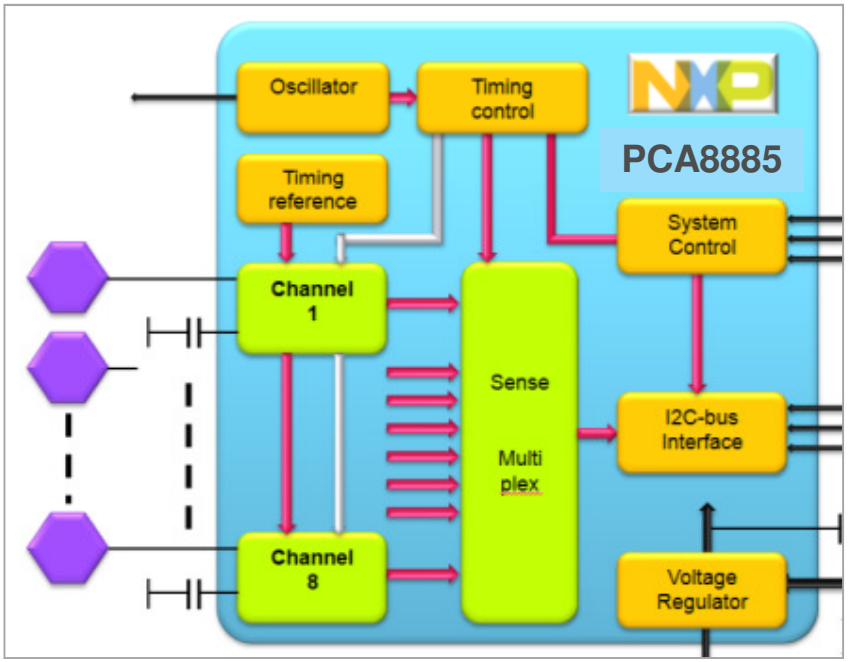
Product Overview

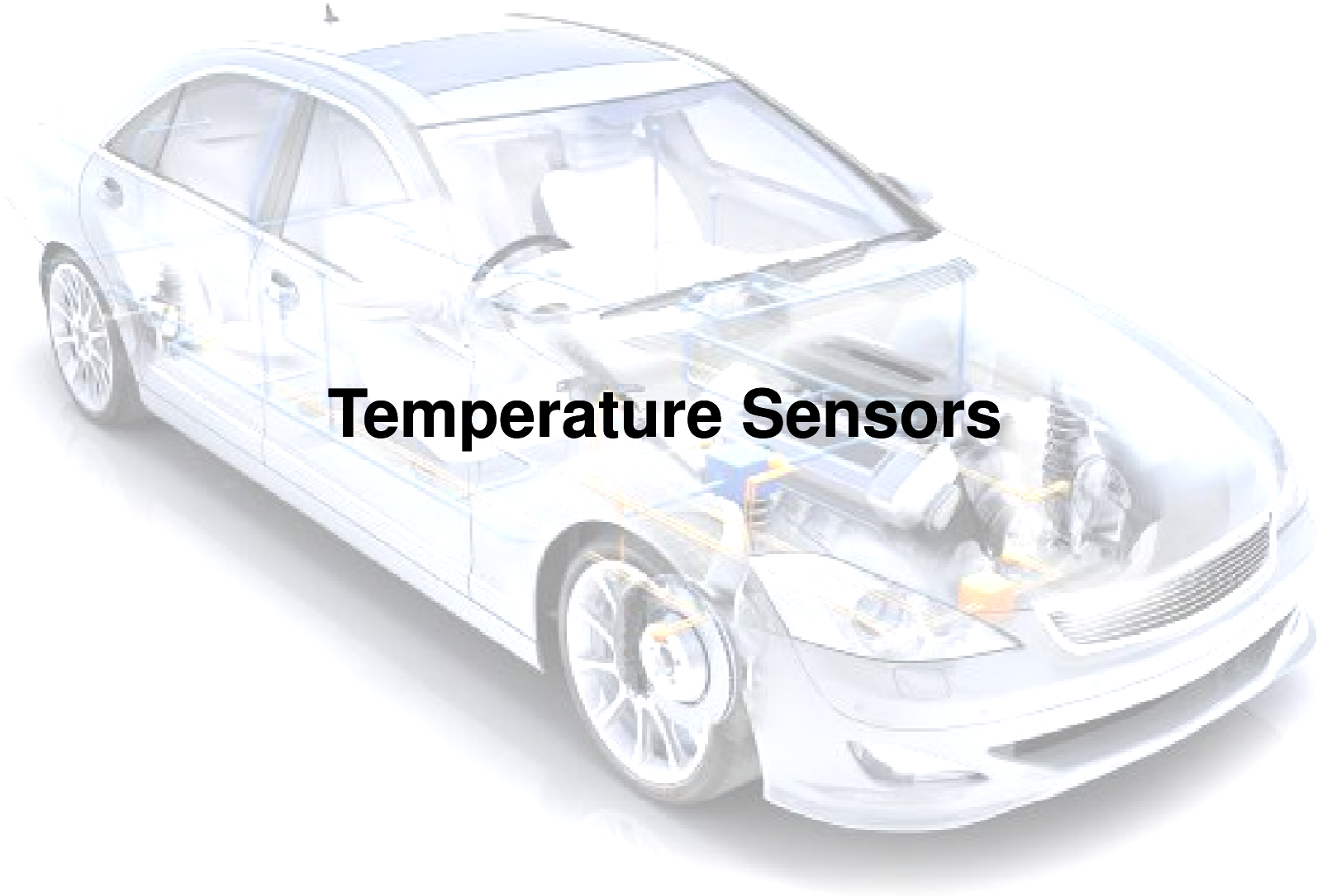
- **PCA8886TS/Q900/1** released
  - two channels
  - Patented EDISEN auto-calibration mechanism
  - large supply voltage range (3V to 9V)
  - low power consumption (< 6uA)
  - -40°C, .. , +85°C; TSSOP16 package
  - *AEC-Q100 automotive compliant qualification*



- *Patented (EDISEN) digital method to detect a change in capacitance on a remote sensing plate*
- *Changes in the static capacitance (as opposed to dynamic capacitance changes) are automatically compensated using continuous auto-calibration*

- **PCA8885TS/Q900/1** released
  - eight channel device
  - patented EDISEN auto-calibration mechanism
  - Sleep mode, activated via I2C-bus or external input
  - three sensing modes: one key, two keys and N-keys
  - two event handling modes: direct and latching mode
  - adjustable scan frequency
  - channel masking feature
  - low power consumption (< 10uA)
  - I2C-bus interface
  - possibility to cascade (up to two devices)
  - -40°C, .. , +85°C; TSSOP28 package
  - *AEC-Q100 automotive compliant qualification*





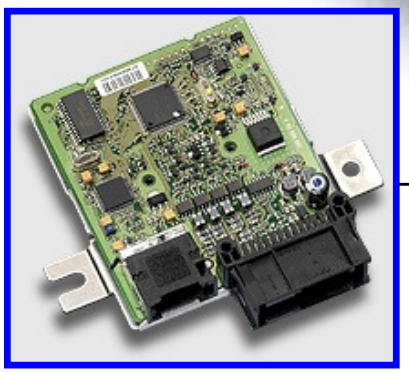
Temperature Sensors

NXP Temperature Sensors for Automotive

Focus Application Areas

Instrument Cluster

Infotainment



Body Control Unit

Climate Control Unit

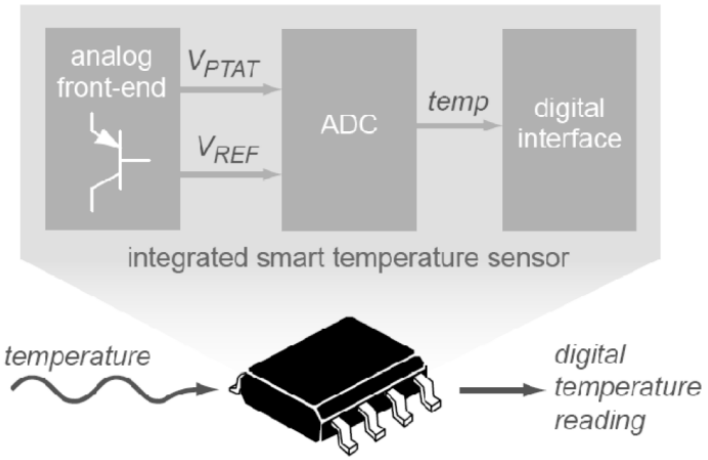
NXP Temperature Sensors for Automotive

Overview

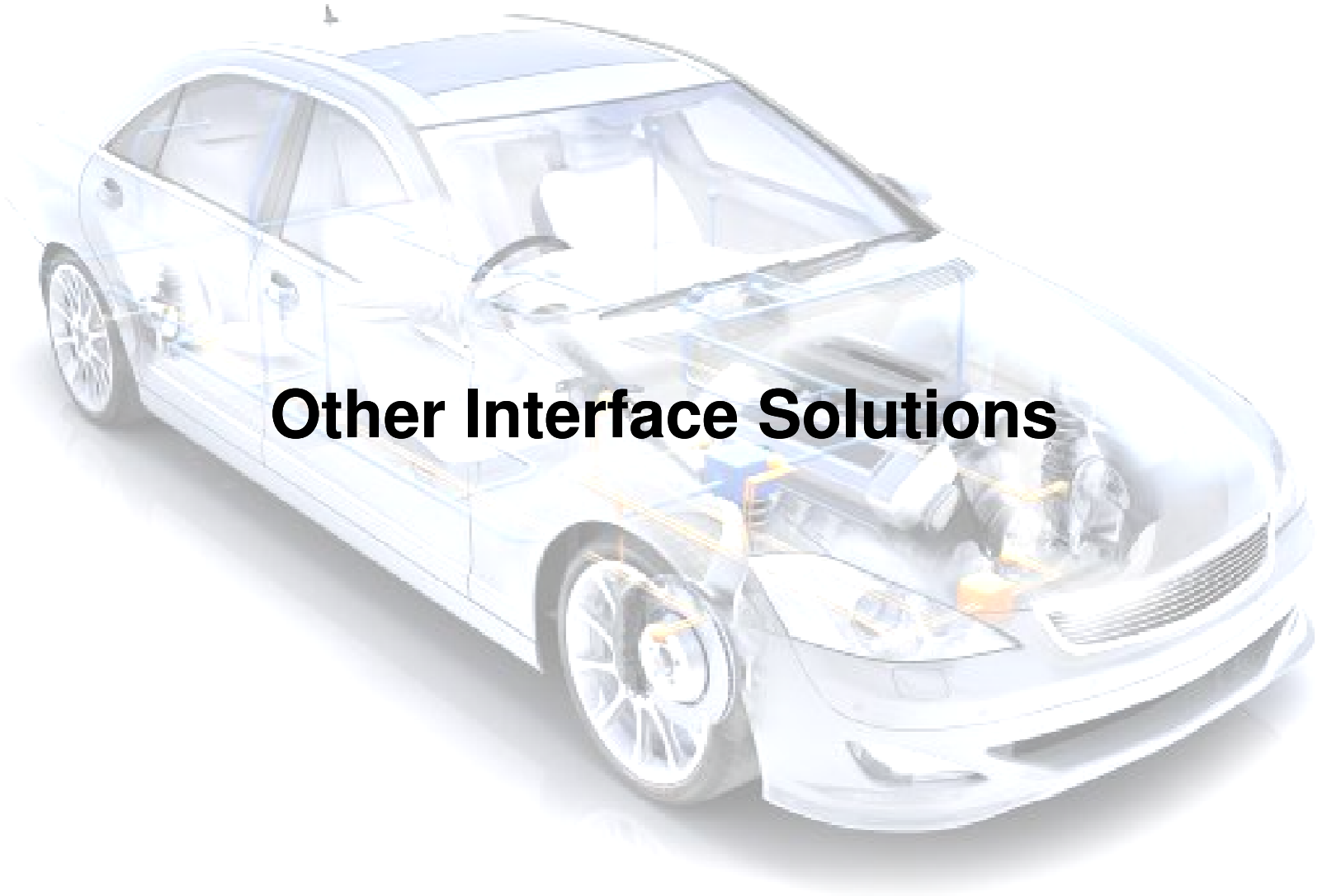
- ***Why used?***
  - To trigger interrupts, shut-downs, or over-temperature alarms
  - To enable very precise temperature sensing
  - To offload the microcontroller
- ***Where used?***
  - Multimedia systems
  - High-end audio systems
  - Infotainment /cluster displays
  - Body Control Unit
  - Climate Control Unit
- ***Why NXP?***
  - High accuracy
  - Wide operating temperature range
  - AEC-Q100 compliant automotive qualification

PCT2075DP/Q900

- Pin-for-pin replacement for LM75 series
- Vdd = 2.7 V to 5.5 V
- –55 °C to +125 °C
- 11-bit ADC, 0.125 °C resolution
- accuracy:
  +/-1 °C : [–25 °C to +100 °C]
  +/-2 °C : [–55 °C to +125 °C]
- I2C-bus Interface
- TSSOP8



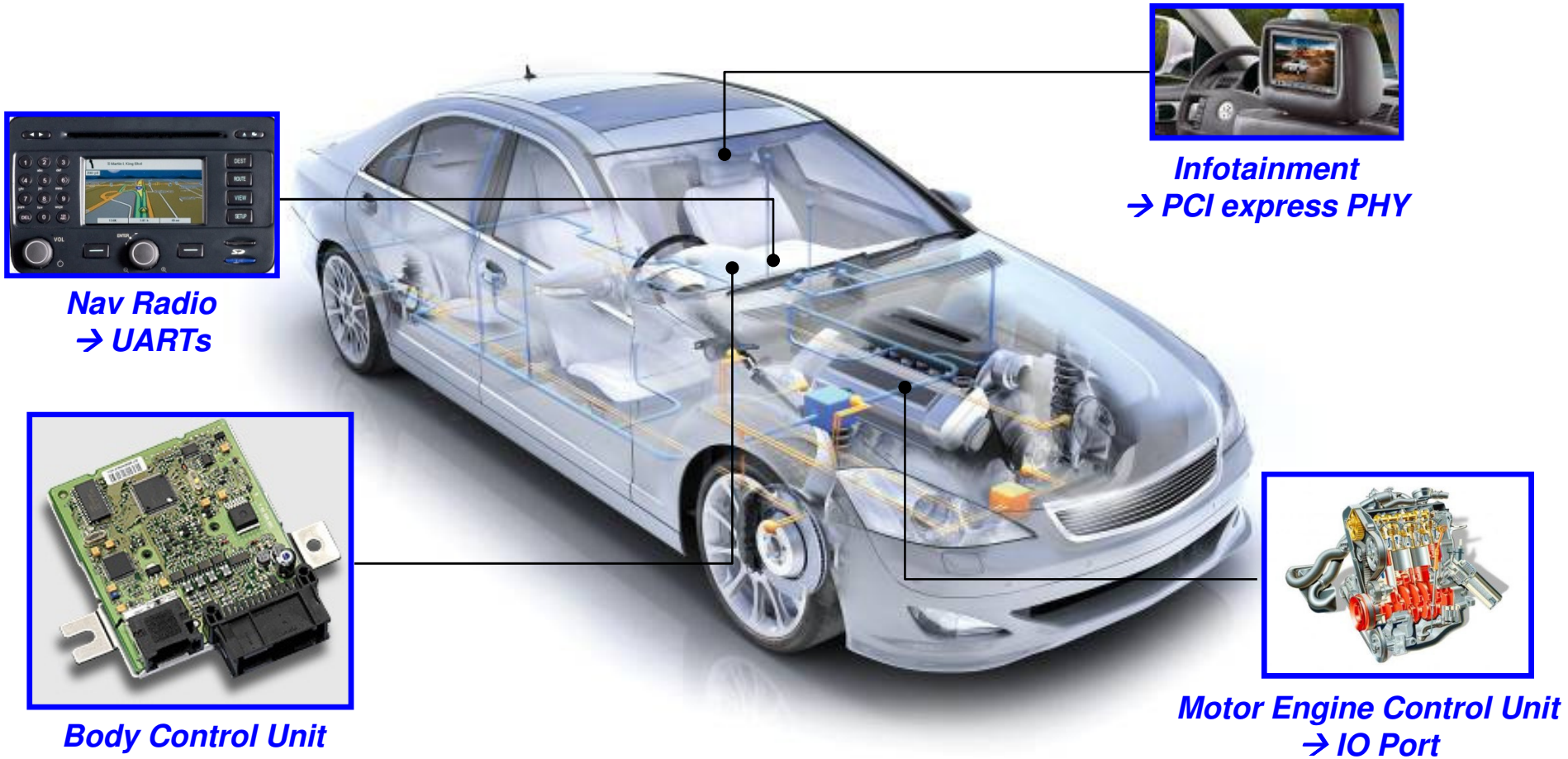
In Development



Other Interface Solutions

NXP Other Interface Products for Automotive

Focus Application Areas



Infotainment
→ PCI express PHY

Nav Radio
→ UARTs

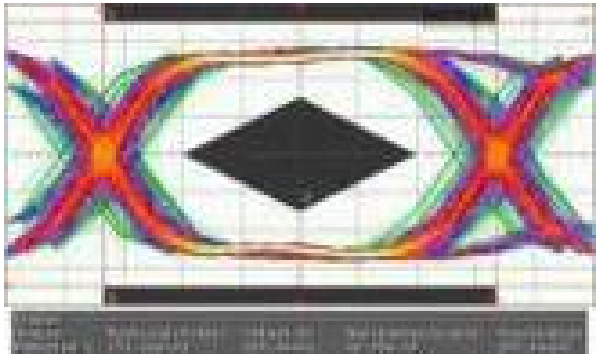
Body Control Unit
→ IO Expanders (GPIO)

Motor Engine Control Unit
→ IO Port

NXP PCI Express PHY for Automotive

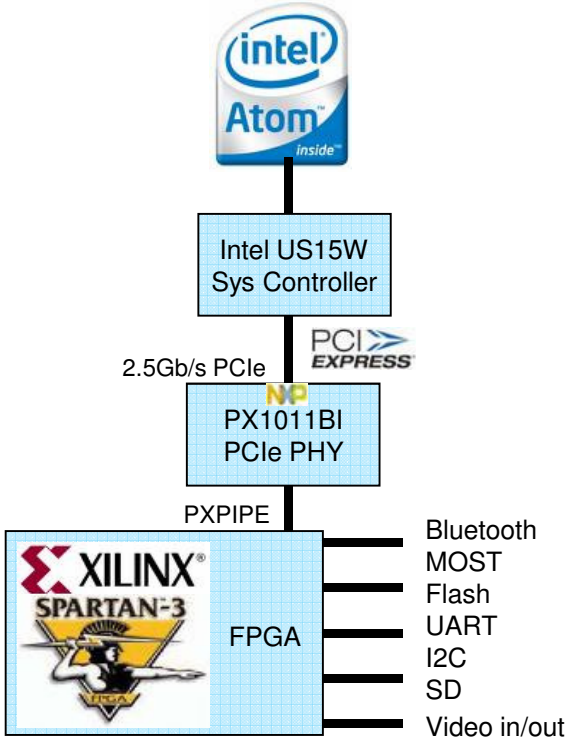
Overview

- ***Why used?***
  - Enable to leverage on existing PC software to give the end-user the computing and infotainment freedom that they are already used to outside the car
- ***Where used?***
  - Infotainment
- ***Why NXP?***
  - low power consumption
  - Wide operating temperature range
  - Small package (LFBGA81



PX1011B-EL1/Q900 released

- x1 PCI Express physical layer device 2.5Gb/s TX / RX; PCI Express Spec v1.0a & v1.1; receiver bit error rate <10^{-12}; PXPIPE interface (FPGA-compatible SSTL2 signaling); <300mW power in L0 mode; -40°C to +85°C; LFBGA81; AEC-Q100 compliant automotive qualification



NXP I/O Expanders (GPIOs) for Automotive

Overview

- ***Why used?***
  - Easily adds I/Os via I2C-bus for input/output, key scan or to control LEDs
  - Combats “Feature Creep” by expanding I/O ports instead of requirement for new µC
  - Allows seamless migration to newer µC and still keeps the same peripherals
  - Eliminates costly congested PCB since a trace or wire is not needed for each signal
- ***Where used?***
  - Body Control Unit
  - Instrument Cluster
  - Car radio
- ***Why NXP?***
  - Large portfolio
  - NXP (Philips) has invented the I2C bus
  - AEC-Q100 compliant automotive qualification

PCA9554PW/Q900 released

- IO Expander 8x; Interrupt; -40 °C to +85 °C; TSSOP16 ; AEC-Q100 compliant automotive qualification

PCA9701PW/Q900 in qualification

- General Purpose Input (GPI); 16x; SPI; up to 18V tolerant; -40 °C to +85 °C; TSSOP24; AEC-Q100 compliant automotive qualification

PCA9703PW/Q900 released

- General Purpose Input (GPI); 16x; SPI; up to 18V tolerant; maskable inputs; -40 °C to +85 °C; TSSOP24; AEC-Q100 compliant automotive qualification

PCA9538PW/Q900 in qualification

- 8-bit I2C-bus and SMBus I/O port with interrupt and reset; -40 °C to +85 °C; TSSOP16; AEC-Q100 compliant automotive qualification

PCA9539PW/Q900 in qualification

- 16-bit I2C-bus and SMBus I/O port with interrupt and reset; -40 °C to +85 °C; TSSOP24; AEC-Q100 compliant automotive qualification

NXP UARTs and Bridges for Automotive

Overview

- ***Why used?***
  - UARTs and Bridges are Interface solutions to facilitate and handle communication among various bus interfaces
  - The purpose is to overcome the limitations of the host bus interface to the peripherals
- ***Where used?***
  - Telematics
  - Nav Radio
  - Instrument Clusters
- ***Why NXP?***
  - number #1 in Industrial UARTs
  - committed long-term supplier
  - Broad portfolio
  - AEC-Q100 compliant automotive qualification

SC16IS740IPW/Q900 released

- Fully featured standalone UART (IrDA) with I2C/SPI interface and 64byte FIFOs; -40 °C to +85 °C; TSSOP24; AEC-Q100 compliant automotive qualification

SC16C850IBS/Q900 released

- Fully featured standalone UART (IrDA) with 16 mode or 68 mode parallel bus interface and 128byte FIFO; -40 °C to +85 °C; HVQFN32 ; AEC-Q100 compliant automotive qualification

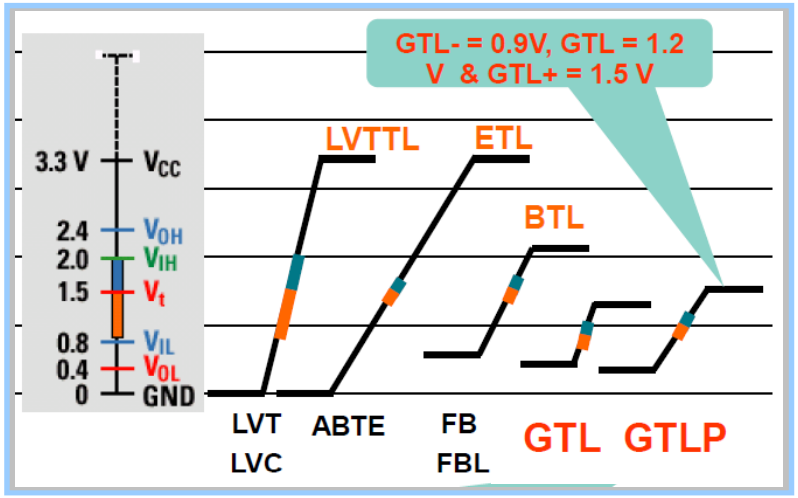
SC18IS600A/Q900 considered

- SPI to I2C Bridge; I2C-bus master-transmitter or master-receiver; 1.2 Mbit/s SPI-bus; 400 kbit/s I2C-bus; 96-byte transmit and receive buffer; 2.4V to 3.6V operation; 5V tolerant I/O; 4 GPIO; active low interrupt pin; TSSOP16

NXP Level Shifters for Automotive

Overview

- ***Why used?***
  - Provides bi-directional translation between GTL *(Gunning Transceiver Logic)* signal levels and LVTTL/TTL *(Low Voltage Transistor Transistor Logic)* signal levels
  - GTL enables low-voltage swing, single ended, high-speed point-to-point backplane bus signaling
- ***Where used?***
  - Processor interface in Infotainment Systems
- ***Why NXP?***
  - NXP is the market leader in GTL devices used for processor to chipset interface
  - Wide portfolio of 2-bit, 4-bit, 8-bit and 16-bit devices



GTL2018PW/Q900 released

- 8-bit GTL to LVTTL/TTL bi-directional Translator; operates as an octal GTL-/GTL/GTL+ sampling receiver or as an LVTTL to GTL-/GTL/GTL+ driver; 3.0 V to 3.6 V operation with 5 V tolerant LVTTL input; GTL input and output 3.6 V tolerant; Vref adjustable from 0.5 V to 0.5VCC; TSSOP24 package

Thank you for your Attention !