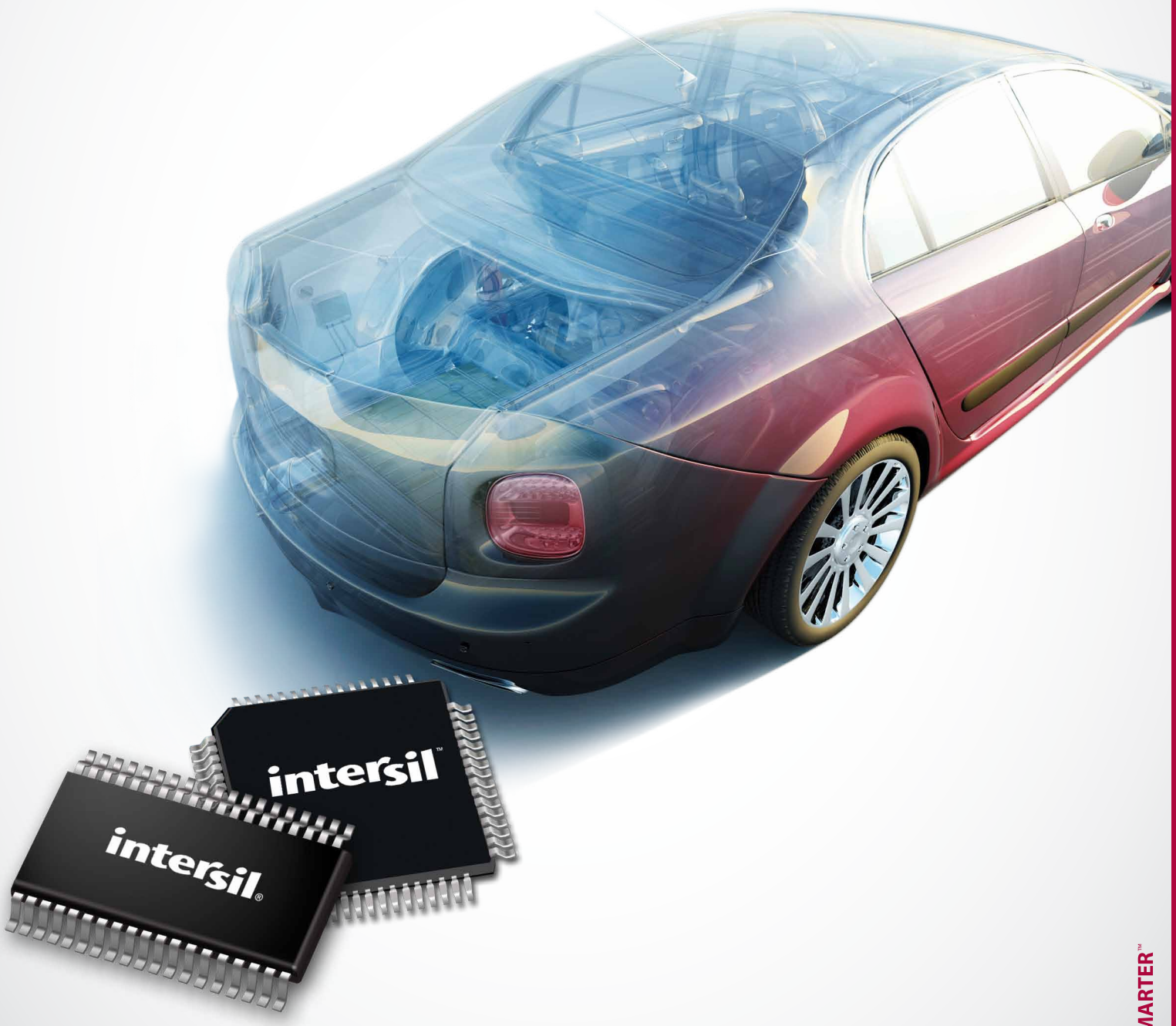
SELECTION GUIDE

# AUTOMOTIVE IC PRODUCTS

2013

CERTIFIED MANAGEMENT SYSTEM ISO/TS 16949:2009 DNV

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# Intersil's Automotive Solutions

Intersil, with a proven history of providing innovative and highly reliable ICs for the space, consumer, computing, and industrial markets, is uniquely qualified to meet the challenging requirements of the automotive industry.

Over the past few years Intersil has invested in key technologies to address the current mega trends within the automotive market such as safety, efficiency, connectivity and affordability.

This effort has resulted in leadership positions in high performance power conversion, state-of-the-art precision analog, cell balancing and battery charging ICs, power management, and highly-flexible TFT display controllers.

Intersil has also invested in TS16949 certification of internal fabs and the development of proprietary process technologies (including smart power) for automotive. Intersil, with a strong balance sheet and a dedicated organization of automotive professionals, is committed to delivering world class automotive solutions for you and your customers.

**1. SAFETY:** See behind your car within 500 milliseconds with TW88xx Display Processors.

**2. EFFICIENCY:** Improve power efficiency by 5% with highly efficient Synchronous Regulators.

**3. CONNECTIVITY:** Get end-to-end, bi-directional communication with enhanced SerDes video links.

**4. AFFORDABILITY:** Eliminate costly CAN transceivers with proprietary cell-balancing diagnostic communications system.

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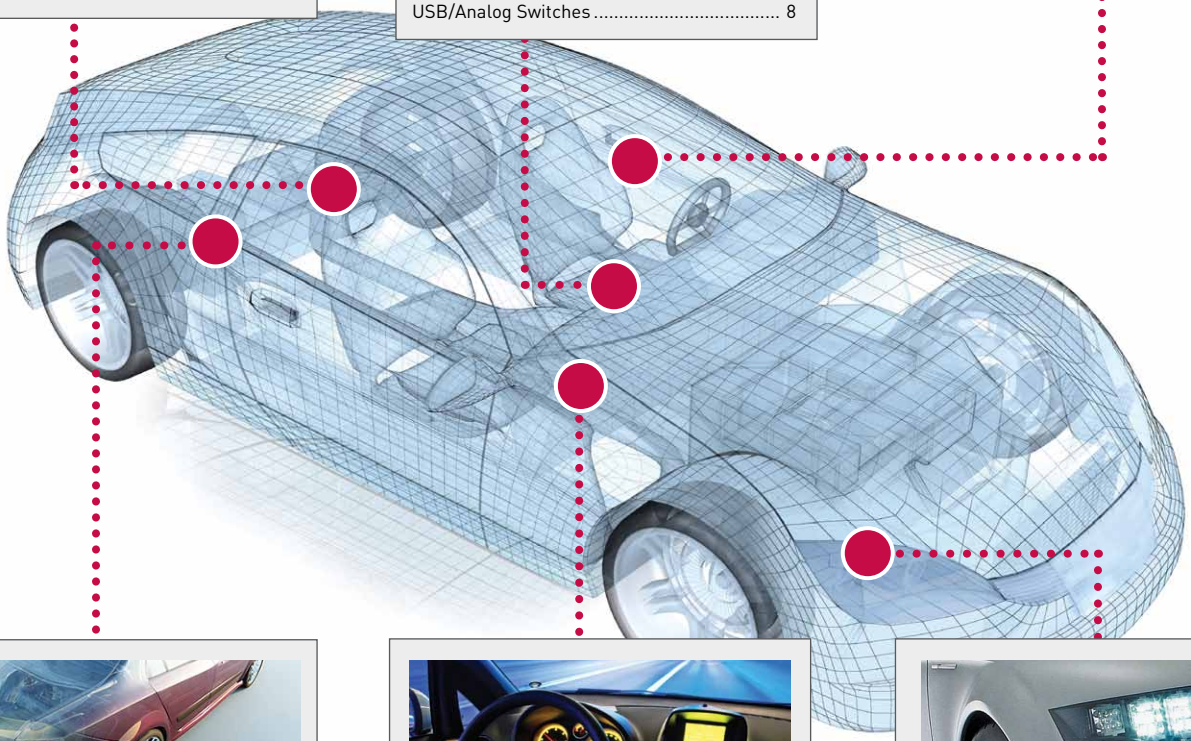
## Rear Camera Display (RCD)

**Sensing**


**Video/Display**


**Interface**

## EV/HEV Solutions

**Powertrain**


## Interior Cabin Lighting

**LED**


## Exterior Lighting

**LED**


### Product Status

Intersil offers both standard and AEC-Q100 products for automotive applications. Full AEC-Q100 qualified components are indicated by the following part number designations: ISL76xxx (analog products) and ISL78xxx (power products) as well as by the AEC-Q100 balloon in this brochure. The Sampling balloon indicates both pre-production and near production ready parts, that may have not completed their complete qualification cycle at the time of printing.

Intersil products are neither designed nor intended for use in automotive applications or environments unless the specific Intersil products are designated by Intersil as compliant with ISO/TS 16949 and AECQ100 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, Intersil will not be responsible for any failure to meet such requirements.

# AUTOMOTIVE INFOTAINMENT PRODUCTS

## Core & GPU Power

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**Single, Compact 3, 4 & 5A 2MHz Synchronous Buck Regulator**
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**3A/4A Low Iq 1MHz High Efficiency Synchronous Buck Regulator**
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**Single, Compact 3, 4 & 5A 2MHz Synchronous Buck Regulator**
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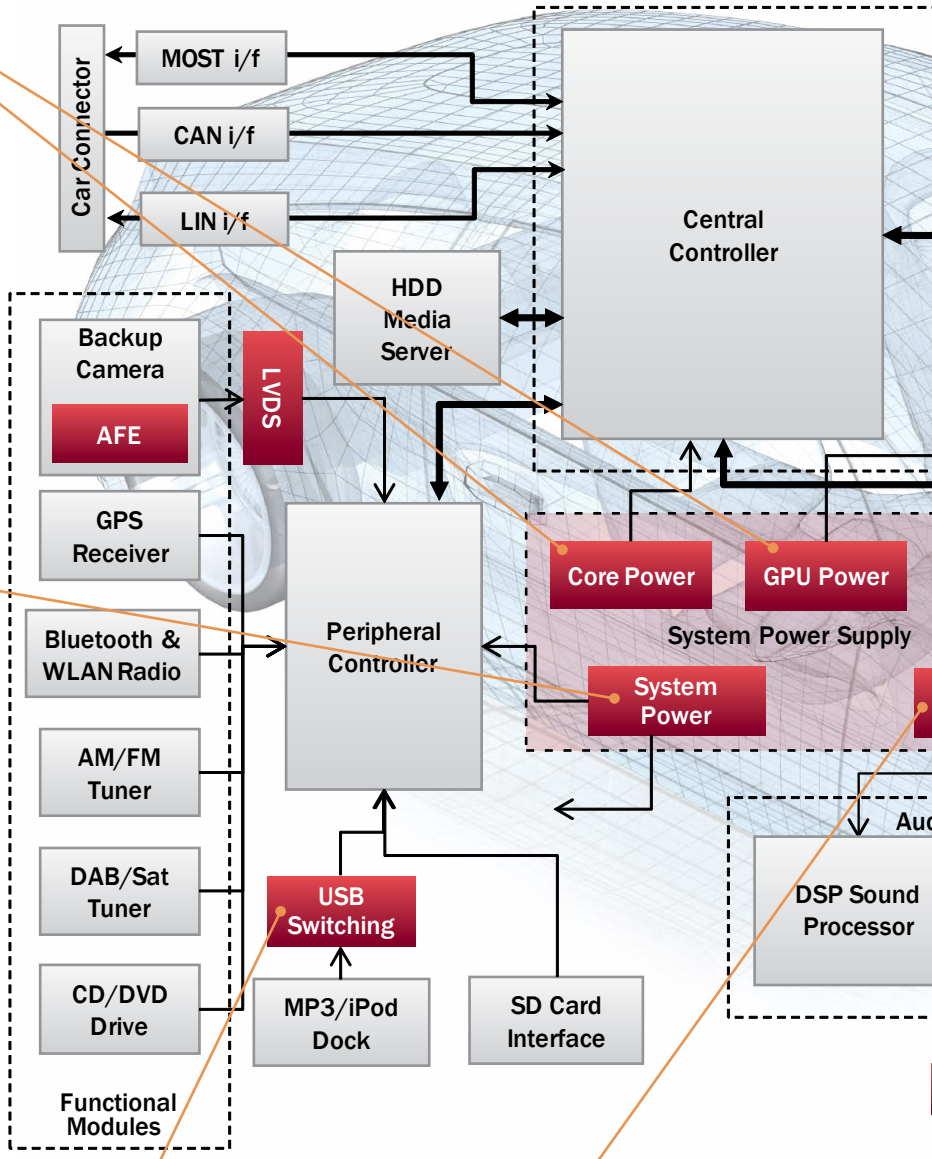


## USB Switching

**USB 2.0 High/Full Speed Multiplexer**
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## Audio Power Booster

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**Multi-Phase Boost PWM Controller with Phase Dropping Enhancement**
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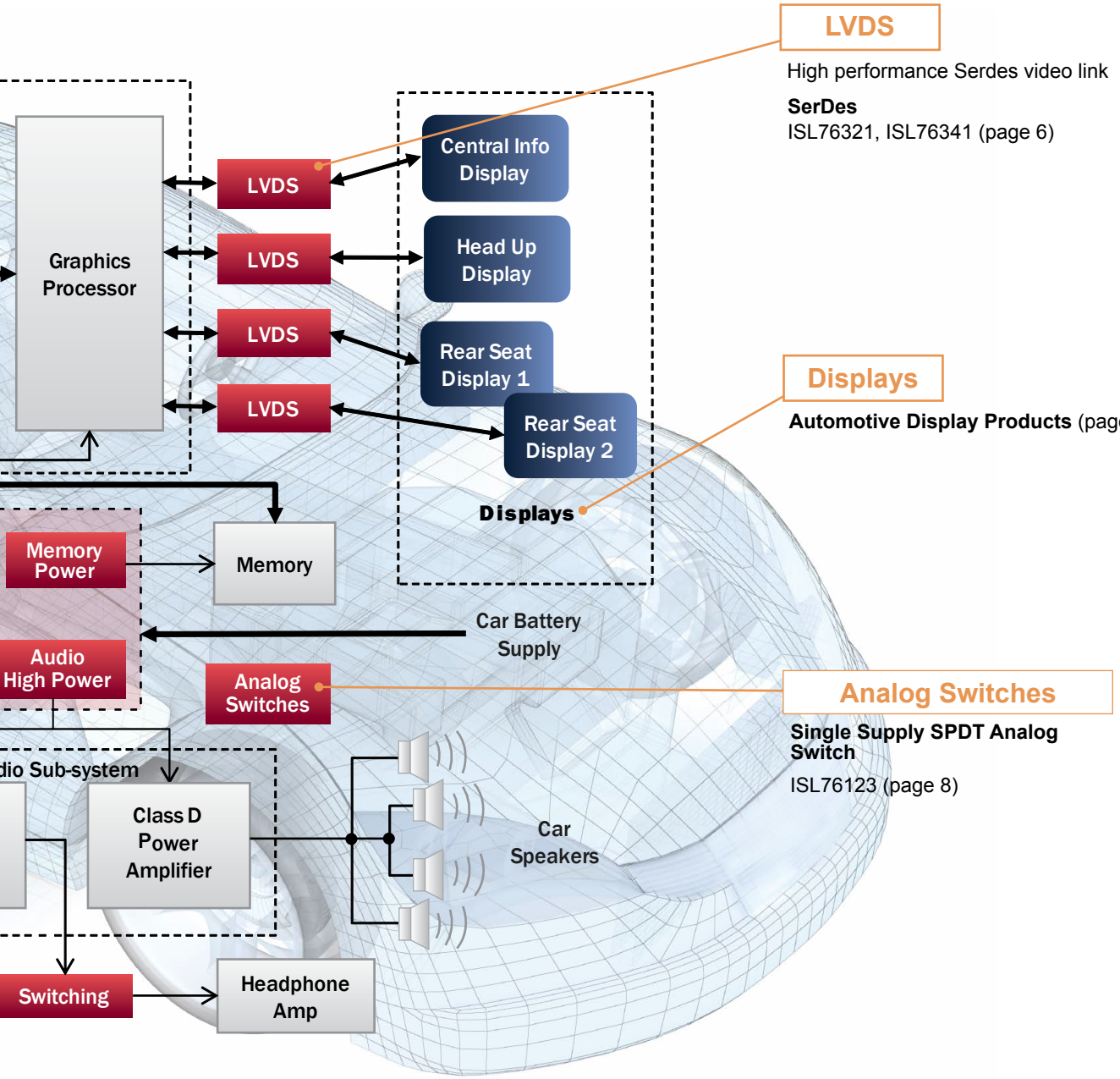


**LVDS**

High performance Serdes video link

**SerDes**
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SerDes

## ISL76321, ISL76341

AEC-Q100

## Automotive SerDes Video Link

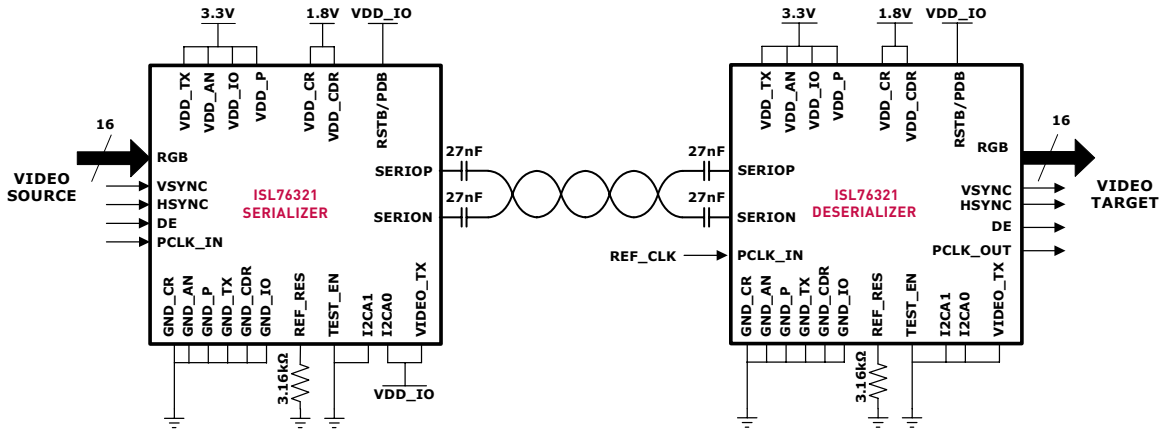
**ISL76321 - 16(+3)-bits, 6 to 45MHz Pixel Clock Serdes**
**ISL76341 - 24(+3)-bits, 6 to 45MHz Pixel Clock Serdes**

A simple, low overhead solution to video data transmission in the car. Intersil's SerDes enables transmission of video data together with bi-directional control down a single shielded twisted pair (STP) cable. The ISL76321/41 are the only products in their class to use a transceiver at both cable ends allowing on-demand, primary data direction change.

These SerDes links offer user flexibility through their I²C programmability, including 16 levels of cable equalization and pre-emphasis. A unique fast locking circuit at the receiver ensures excellent link performance even when exposed to considerable noise.

### Key Features

- Tx pre-emphasis and Rx-equalization
  - Allows for longer cable runs and/or cable cost optimization
  - EQ provides maximum cable drive capability whilst minimizing EMI
- Unique back-channel solution
  - Allows low cost end-to-end control data communication
  - I²C control interface with four I²C addresses
- Unique transceiver design
  - Reduces inventory management
- Superior line rate locking performance
  - Ensures continuous video transmission in the face of noise
- Hot-plugging with automatic re-lock with every Hsync
- DC balanced line coding via 8B/10B allows AC coupling
- 48 Ld QFN package




**LONG REACH VIDEO SERDES**

| Device | Product Topology | $V_{IN}$ (V) | $f_{CLK}$ (MHz) | Data Throughput (Mbps) | Data Format | Control Interface | Temperature Range (°C) | Features | Package |
|---|---|---|---|---|---|---|---|---|---|
| ISL76321 | Transceiver | 3.3 & 1.8 | 7 to 45 | 900 | 16-bit data and 3-bit video control (H, V & Sync) | I²C | -40 to 105 | Pre-emphasis, EQ, 8kV ESD on Serial lines, Low EMI, int. 100Ω termination, control back-channel, fast locking. | 48 Ld QFN |
| ISL76322 | Transceiver | 3.3 & 1.8 | 7 to 45 | 900 | 16-bit data and 3-bit video control (H, V & Sync) | I²C | -40 to 105 | Pre-emphasis, EQ, 8kV ESD on Serial lines, Low EMI, int. 100Ω termination, fast locking. | 48 Ld QFN |
| ISL76341 | Transceiver | 3.3 & 1.8 | 7 to 45 | 1200 | 24-bit data and 3-bit video control (H, V & Sync) | I²C | -40 to 105 | Pre-emphasis, EQ, 8kV ESD on Serial lines, Low EMI, int. 100Ω termination, control back-channel, fast locking. | 64 Ld TQFP |

# Ambient Light Sensors

Digital Ambient Light Sensor

## ISL76683

Evalboard Available! Contact Sales

AEC-Q100

### Digital Ambient Light Sensor

The ISL76683 is an integrated light sensor with an internal integrating ADC intended for automotive applications. The ADC provides 16-bit resolution and is capable of rejecting 50Hz and 60Hz flicker from artificial light sources. The ISL76683 is packaged in a tiny 6 pin package with the benefit of its digital interface offers both programmable features and a robust, low cost link to a microcontroller.

### Key Features

- Four sensitivities range selection via $I^2C$:
  - Range 1 = 0 lux to 1000 lux
  - Range 2 = 0 lux to 4000 lux
  - Range 3 = 0 lux to 16,000 lux
  - Range 4 = 0 lux to 64,000 lux
- Human eye response (540nm peak sensitivity)
- -40 to 105°C operation
- 16-bit resolution
  - Adjustable up to 65 counts per lux
- User-programmable upper and lower threshold interrupt
- Simple output code, directly proportional to lux
- Built-in rejection for:
  - IR & UV as well as 50Hz/60Hz flicker
- Tiny 2.1 x 2.1mm ODFN package

Ambient Light Sensor

## ISL76671

Evalboard Available! Contact Sales

AEC-Q100

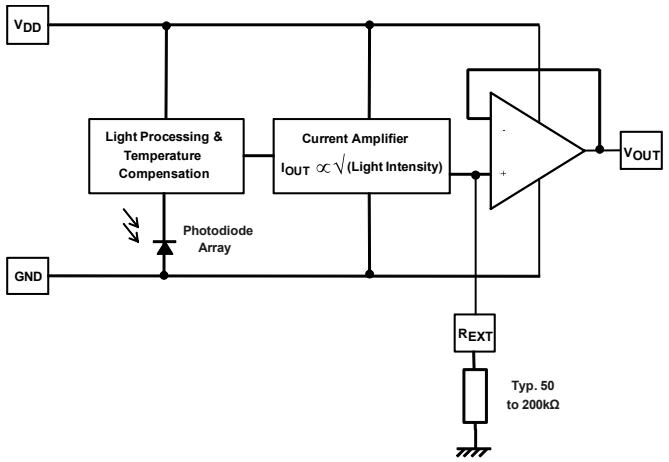
### Low Light Optimized Ambient Light Sensor

Offered in a tiny 4.2mm$^2$ package the ISL76671 will measure incident light levels to lower than 0.01 lux. As such, it's an ideal solution for light detection when hidden behind darkened glass and plastic bezels in a wide range of light based control applications. With temperature compensation and excellent IR rejection, the ISL76671 is an economic and easy to use alternative to other forms of optical sensors such as photo diodes & transistors as it can be directly connected to an ADC sampling system.

### Key Features

- Operates down to < 0.01 lux
- Ultra-low operating current < 5µA
- 1.8V to 3.0V supply range
- Full scale determined by low cost bias resistor
- Square root law voltage output
- Close to human eye spectral response
- Fast response time 30ms
- -40 to 105°C operation
- Tiny 2.1 x 2.1mm ODFN package

### Simplified Block Diagram



# USB/Analog Switches

USB Switch

## ISL76120

AEC-Q100

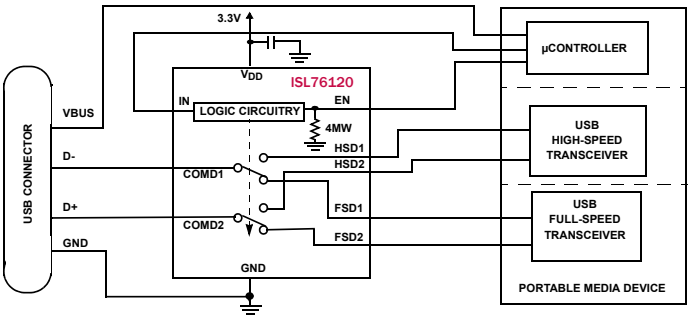
### USB 2.0 High/Full Speed Multiplexer

Intersil's ISL76120 dual 2:1 multiplexer IC is a single supply part that contains two SPDT (Single Pole/ Double Throw) switches configured as a DPDT. The part was designed for switching between USB High-Speed and USB Full-Speed sources in a variety of applications. A high ESD rating combined with ultra-low supply current make this an ideal automotive USB interface solution.

#### Key Features

- High speed (480Mbps) and full speed (12Mbps) signaling capability per USB 2.0
- 1.8V logic compatible (2.7V to +3.6V supply)
- Enable pin to open all switches, simplifies multiple USB client management
- -3dB frequency
  - HSx switches 880MHz
  - FSx switches 550MHz
- Crosstalk @ 1MHz -70dB
- Off-Isolation @ 100kHz -98dB
- Single supply operation ($V_{DD}$) 2.7V to 5.5V
- Robust ESD rating > 8.5kV HBM
- Ultra-low operating current: 60nA
- -40°C to 105°C operation
- 10 Ld TDFN package

#### Typical Application Circuit




Analog Switch

## ISL76123

AEC-Q100

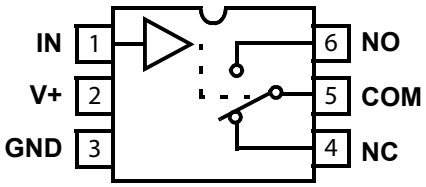
### Single Supply SPDT Analog Switch

The Intersil ISL76123 is a precision, bidirectional, SPDT analog switch designed to operate from a single 2.7 to 12V supply.

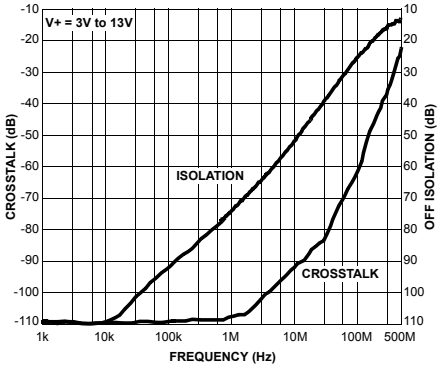
#### Key Features

- Fully specified for 3.3V, 5V, and 12V supplies
- ON resistance ($R_{ON}$): 15Ω (at 12V)
- $R_{ON}$ matching between channels : ≤ 1Ω
- Low charge injection: 5pC (Max)
- Low power consumption ($P_D$): < 15µW (at 12V)
- Low leakage current: 10nA (typ)
- Fast switching action
  - $t_{ON}$: 28ns & $t_{OFF}$: 20ns
- Guaranteed break-before-make operation
- Minimum 2kV ESD protection
- 6 Ld SOT23 package

#### Space-saving Tiny SOT-23 Package (3mm x 3mm)




#### Crosstalk and Off Isolation



# AUTOMOTIVE DISPLAY PRODUCTS

Intersil has one of the largest portfolios of video semiconductor solutions for automotive infotainment display applications. As a pioneer in this market, we have leveraged our extensive mixed signal video and display processing expertise to create unique and robust IC products specifically tailored to the requirements of the automotive display market.

*Intersil's proprietary SPI OSD engine allows for a low cost bit-map based OSD capability.*

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Video Decoder (page 16)

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Techwell Advanced Display Controllers (page 10)

Embedded PSU Components

Embedded Power

Analog Video In

ADC

Video Decoder

2D Scaler

PIP

Advanced LCD Controller

OSD

Link to Camera

STP

LVDS SerDes

Digital RGB Video i/ps & 2-way I²C

TFT Intelligent Controller

TCON

Touch Screen Controller

IR Proximity Sensor

STP

LVDS SerDes

Link to Infotainment System

$V_{SUPPLY}$

Gamma Buffer

$V_{SUPPLY}$

Level Shifter (Viewing angle)

Column Drivers

Power In

LCD Power (DC/DC)

$V_{ON}$

Row Drivers

LCD Panel

Check surroundings for safety

LED Backlight

Ambient Light Sensor

Level Shifter (Gate Drive)

$V_{OFF}$

$V_{COM}$ Calibrator

$V_{COM}$ Buffer

$V_{COM}$

Ambient Light Sensors (page 7)

TFT LCD Power Supply (page 18)

LED Backlight Controllers (page 19)

# Techwell Advanced Display Controllers

Intersil's TW88xx automotive infotainment display IC product line is defined by feature rich, highly integrated semiconductor solutions that incorporate many key function blocks for front console, rear seat entertainment, and rear camera display applications. The family includes an analog video decoder, high quality H/V scaler, 2D de-interlacer, and embedded timing controllers. In addition, certain TW88xx products include advanced technologies such as a 3D adaptive comb filter, 3D noise reduction, an embedded MCU, a touchscreen controller, 16-bit multi-window OSD, graphic overlay with alpha blending, PIP/POP, dual view display support, and a single channel LVDS interface to directly drive LVDS based LCD panels.

The TW88xx product line is designed for OEM Automotive applications and therefore support -40˚C to +85˚C or +105˚C and all of the listed products are AEC-Q100 qualified.

Samples and evalboards are available for all parts listed in this section. Contact your local sales office for your samples and evalboards.

## TW88xx Comparison Table

| | | TW8809 | TW8819 | TW8823 | TW8832S | TW8835 | TW8836 |
|---|---|---|---|---|---|---|---|
| Input | CVBS | Yes | Yes (differential) | Yes | Yes | Yes | Yes (differential) |
| | S-Video | No | No | Yes | Yes | Yes | Yes |
| | Analog RGB/YPbPr | No | No | Yes (720p) | Yes (720p) | Yes (1080p) | Yes (1080p) |
| | Digital RGB/YCbCr | 24-bit | No | 24-bit | 8-bit | 24-bit | 24-bit |
| | ADC | 27MHz | 27MHz | 80MHz | 60MHz | 148MHz | 148MHz |
| Display Processing | Max Resolution | 720p | SVGA | WXGA | SVGA | XGA | WXGA+ |
| | De-interlacer | 2D | 2D | 2D | 2D | 2D | 2D |
| | Black/White Stretch | Static | Static | Dynamic | Static | Static | Static |
| | Color Enhancement | No | No | Yes | No | No | No |
| OSD | SPI OSD | No | No | No | Yes | Yes (9 Window) | Yes (9 Window) |
| | Font OSD | 4 Window | 4 Window | No | 4 Window | 4 Window | 8 Window |
| | - Font RAM (# of chars) | 256 | 256 | - | 256 | 256 | 256 |
| | - Display RAM | 512 | 512 | - | 384 | 512 | 512 |
| | - Colors | 16 Color/16-bit Pallette | 16 Color/16-bit Pallette | - | 16 Color/16-bit Pallette | 16 Color/16-bit Pallette | 16 Color/16-bit Pallette |
| | Bitmap OSD | No | No | 16-bit (1 Window)<br>8-bit (2 Window) | No | No | No |
| Output | TCON | No | Digital | Digital & Analog | Digital | Digital | Digital |
| | LVDS (Open-LDI 1CH) | No | No | Yes | No | No | Yes |
| | TTL | Yes | No | Yes | Yes | Yes | Yes |
| | Delta RGB | No | Yes | Yes | Yes | Yes | Yes |
| | BT.656 Output | Yes | No | No | No | Yes - interlaced<br>(from decoder) | Yes<br>(progressive - all inputs) |
| Other | MCU (8051) | No | No | 1T + Cache | No | 1T + Cache | 1T + Cache |
| | Backlight Controller | No | No | LED & CCFL | LED | LED | No |
| | Touch-screen Controller | No | No | Yes | No | Yes | Yes |
| | Package | 56 QFN | 48 QFN | 216 LQFP | 80 LQFP | 128 LQFP/144 BGA | 128 LQFP/172 BGA |
| | Short Diagnostics | Yes | Yes | No | No | No | Yes |
| | AEC-Q100 Qualified | Yes | Yes | Yes | Yes | Yes | Yes |
| | Temp Spec | -40°C to +105°C | -40°C to +105°C | -40°C to +105°C | -40°C to +85°C | -40°C to +85°C | -40°C to +105°C |

# Low Cost LCD Display Controllers

LCD Controller

## TW8823

AEC-Q100

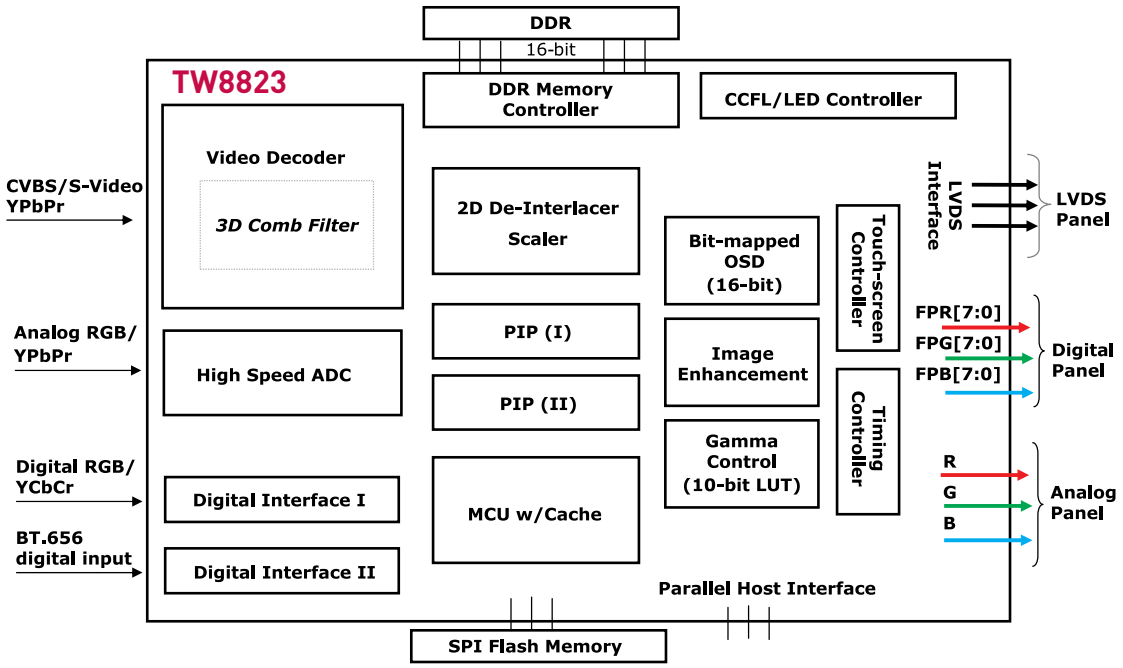
### Advanced LCD Controller with On-chip MCU and 65K Color 16-bit OSD Support

The TW8823 is a highly integrated advanced LCD controller designed for the automotive infotainment market, targeting center console and rear seat entertainment applications. Features such as an embedded MCU, LED/CCFL backlight controllers, a 4-wire touch screen controller, analog and digital TCON, and a multi-window 16-bit (65K color) bit-map OSD are designed to reduce the system's overall BOM cost. The TW8823 has multiple analog and digital inputs to support a wide array of video and graphic sources, including navigation modules, back-up cameras, DVD/multimedia modules, PCs, etc. The TW8823 can support a wide variety of both digital & analog LCD panels with resolutions up to WXGA, and also has an integrated single channel LVDS interface to directly drive LVDS based LCD panels.

### Key Features

- Input support: CVBS, S-Video, analog RGB/YPbPr, & two digital RGB ports
- Panel support: TTL or LVDS panels up to WXGA/analog panels up to WQVGA
- 3D comb filter NTSC/PAL/SECAM video decoder + 2D de-interlacer
- Two PIP engines
- 16-bit/65K color bit-map OSG support
- Integrated 8052 MCU with cache
- 4-wire resistive touch screen controller built-in
- 16-bit DDR memory controller
- Quad SPI Flash memory support
- 216 Ld LQFP
- -40°C to +105°C

### TW8823 Functional Block Diagram



# Low Cost LCD Display Controllers

LCD Controller

## TW8836

AEC-Q100

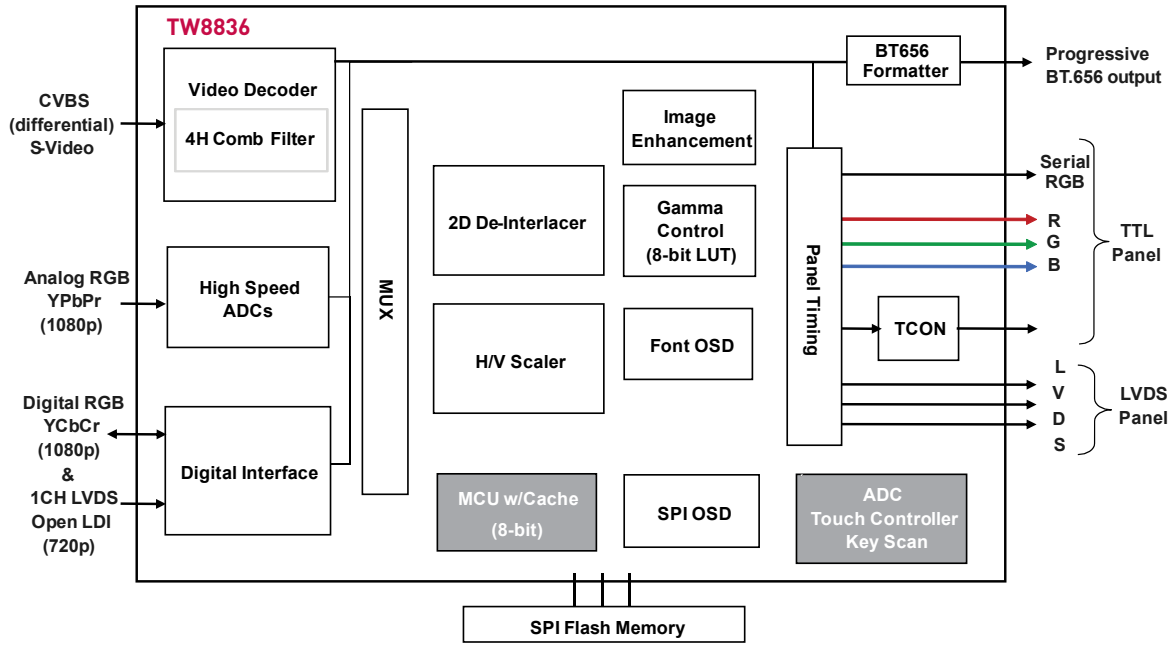
### Next Generation Integrated LCD Controller with LVDS input & Output, MCU, OSD, & Differential CVBS Signal Support

The TW8836 is a highly integrated LCD video processor that supports differential or single-ended composite video inputs, analog RGB and digital RGB sources, as well as a LVDS (single CH OpenLDI) input interface. This versatile solution has a high quality 2D comb NTSC/PAL/SECAM video decoder, triple high speed ADCs, a powerful H/V scaler and 2D de-interlacer, an on-chip MCU, plus a font and SPI OSD engine. TW8836 can support input resolutions up to 1080p and can drive LCD panels at resolutions up to 1366x768. The output panel interface can be either TTL, TCON, or LVDS (single CH OpenLDI). Bonus features include Short Diagnostics for the differential inputs and a BT.656 output port.

### Key Features

- Supports analog inputs including CVBS, S-Video, and analog RGB/YPbPr
- Bi-directional 24-bit digital RGB port and LVDS (single CH open LDI) interface
- Input resolution up to 1080p, output resolution up to 1366x768
- Panel output supports TTL, LVDS (single CH open LDI), Serial RGB, or TCON
- Font OSD and proprietary 8-bit bitmap SPI OSD engine
- Independent progressive or interlaced BT.656 format output from any input source
- Short diagnostics, MCU, image enhancement, and 1.8V I/O support
- 128 Ld LQFP and 172 ball BGA packages
- -40°C to +105°C

### TW8836 Functional Block Diagram



# Low Cost LCD Display Controllers

LCD Video Processor

## TW8835

AEC-Q100

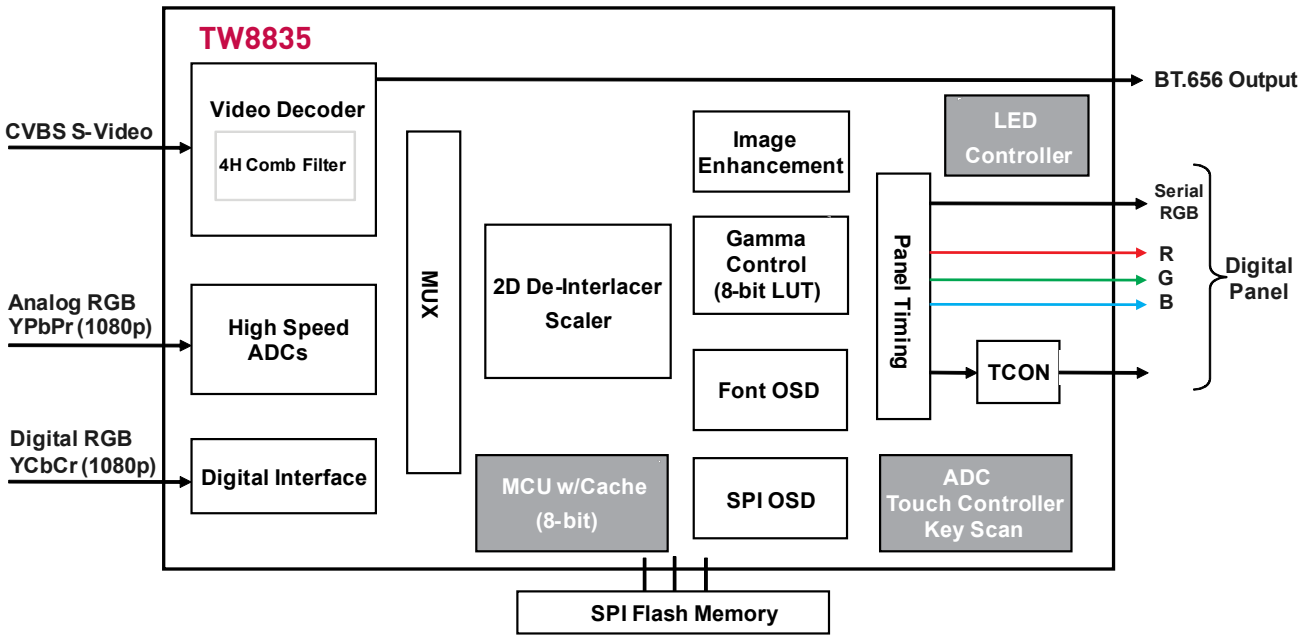
### Highly Integrated LCD Controller with 1080p Input

The TW8835 incorporates many of the features required to create multi-purpose in-car LCD display systems in a single package. It integrates a high quality 2D comb NTSC/PAL/SECAM video decoder, triple high speed RGB ADCs, high quality scaler, versatile OSD, and high performance MCU. Its image video processing capability includes arbitrary scaling, panoramic scaling, image mirroring, image adjustment and enhancement, Black and White Stretch. On the input side, it supports a rich combination of CVBS, S-video, component video, analog RGB as well as digital YCbCr/RGB. On the output side, it supports a variety of digital panel types with its built-in timing controller. The integration of a touch controller, LED driver controller, PWM and MCU makes this a versatile solution for many automotive display and portable display applications.

### Key Features

- Input support: CVBS, S-Video, 1080p analog RGB/YPbPr & Digital RGB
- Panel support: TTL panels up to XGA
- NTSC/PAL/SECAM video decoder + 2D de-interlacer
- Proprietary SPI OSD capability to support multi-window 8-bit bitmap overlay
- Quad SPI Flash memory support
- Enhanced font OSD engine
  - Variable font width and height for easy support of Asian characters
- Built-in 8052 MCU with cache
- BT.656 decoder bypass output
- 4-wire resistive touch screen controller
- Integrated LED back-light controller
- 128 Ld LQFP and 144 Ld BGA
- -40°C to +85°C

### TW8835 Functional Block Diagram



# Low Cost LCD Display Controllers

TFT Display Controller

## TW8832 (S)

AEC-Q100

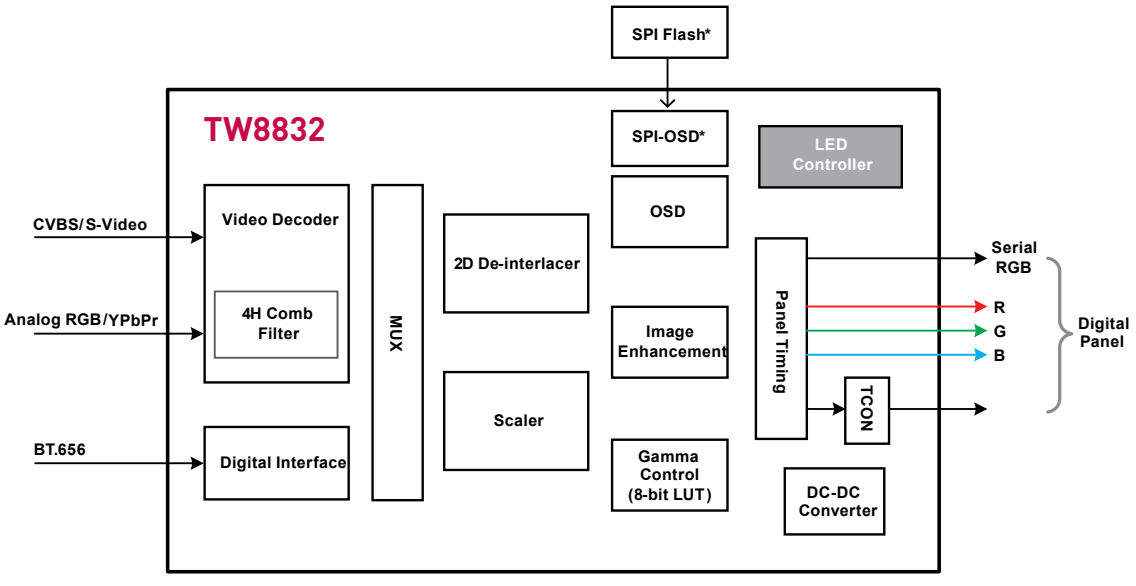
### Cost-effective, Highly Integrated LCD Controller for Digital LCD Panels

The TW8832 is a highly integrated cost-effective LCD controller supporting digital LCD panels. TW8832 integrates a high quality NTSC/PAL/SECAM 2D comb video decoder, 2D de-interlacer, and an improved H/V scaling engine. Additional features include a robust font-based OSD engine, independent mirroring functionality for the scaler and OSD, serial RGB output, and an LED backlight controller. The TW8832S version also supports a proprietary SPI Bitmap OSD.

### Key Features

- Supports analog inputs including CVBS, S-Video, and analog RGB/YPbPr (480p)
- Digital input interface supporting BT.656
- Drives digital panel up to SVGA resolution
  - Digital RGB with TCON or serial digital RGB
- Built-in font-based OSD with 256 programmable fonts and a 384 character display RAM
- Integrated LED backlight controller (single string)
- Supports VCOM-DC, VCOM-AC and spread spectrum clock
- Independent mirror function for the scaler and the OSD
- Embedded image enhancement
  - Programmable CTI, hue, brightness, saturation, contrast & sharpness control
  - Black/White Stretch
  - Programmable gamma correction table
- 80 Ld LQFP
- -40°C to +85°C

### TW8832 Functional Block Diagram




*TW8832S version only

# Low Cost LCD Display Controllers

Video Converter

## TW8809

AEC-Q100

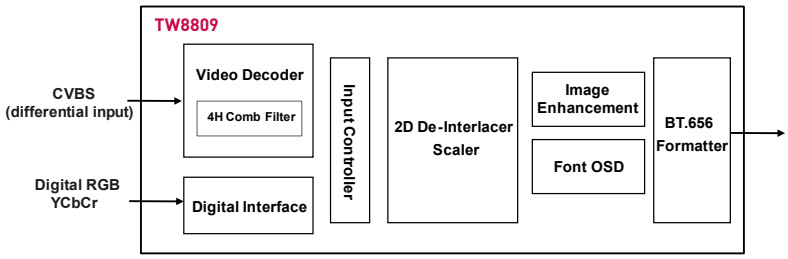
### Digital RGB to BT.656 Format Converter with Scaling & Progressive Output

The TW8809 is a low cost video format converter that can convert either analog CVBS or 24-bit digital RGB format video and output these signals in ITU-R BT.656 format. The video sources can be scaled and de-interlaced so that the ITU-R BT.656 output is already formatted to the desired resolution and can be either progressive or interlaced format. In addition, TW8809 has a built-in font OSD engine as well as image enhancement capabilities.

**Key Features**

- Supports digital input: YCbCr / 24-bit RGB up to 720p resolution
- Supports analog CVBS input (2 single ended or 1 differential)
- Output support: ITU-R BT.656 (interlaced or progressive) up to SVGA resolution
- Font OSD with 256 Font RAM / 512 display RAM (4 windows)
- Short diagnostics
- 56 Ld QFN package (wettable flanks QFN available)
- -40°C to +105°C

**TW8809 Functional Block Diagram**




LCD Controller

## TW8819

AEC-Q100

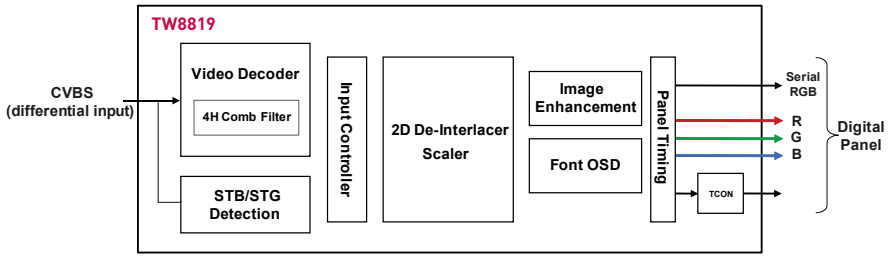
### Low-Cost LCD Controller Solution (for RCD applications)

The TW8819 is an ultra low-cost highly integrated LCD controller targeting basic Rear Camera Display (RCD) applications. It combines a high quality 2D comb NTSC/PAL/SECAM video decoder, a powerful H/V scaler, font based OSD engine, and image enhancement functions. TW8819 supports differential and single-ended analog composite video inputs and the output supports a wide variety of digital LCD panel types.

**Key Features**

- Supports analog CVBS input (4 single ended or 2 differential)
- Panel output support 24-bit & 18-bit TTL up to WSVGA resolution
  - Also supports TCON and Serial (8-bit) RGB panel outputs
- Font OSD with 256 font RAM / 512 display RAM (4 windows)
- Short diagnostics & image enhancement built-in
- 48 Ld QFN package (wettable flanks QFN available)
- -40°C to +105°C

**TW8819 Functional Block Diagram**



# Video Decoder

NTSC/PAL/SECAM Video Decoder

## TW9990

AEC-Q100

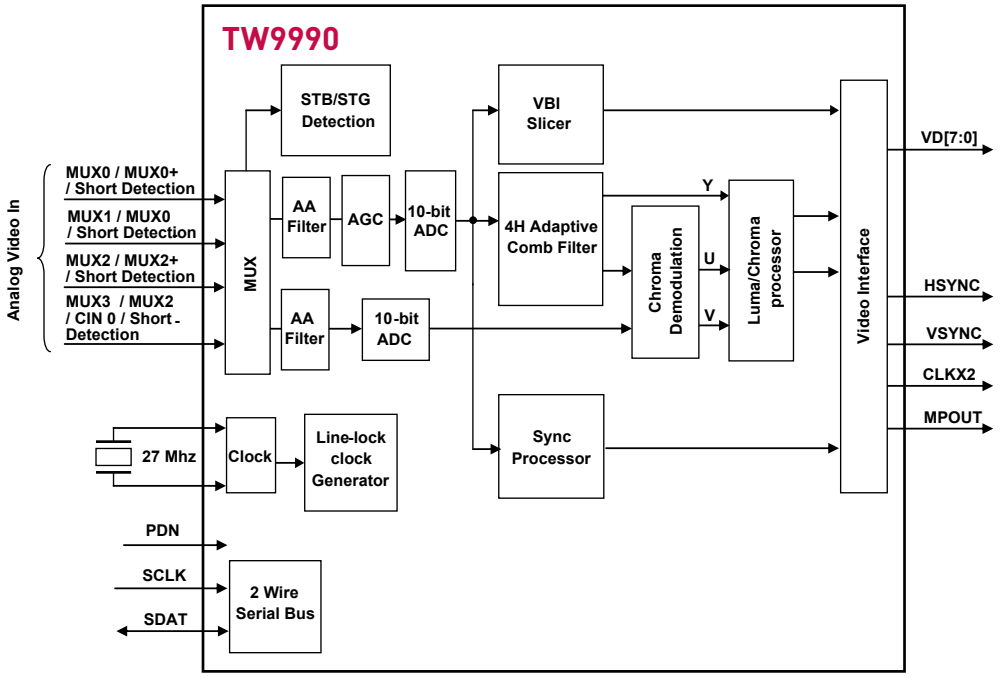
### Low Power NTSC/PAL/SECAM Video Decoder with Differential Inputs

TW9990 is Intersil's next generation low-cost multi-standard video decoder with differential CVBS input support. It consumes less than 100mW in typical composite video applications, and has a power-down mode as well. The TW9990 supports both single ended and differential input types, and has short detection capabilities making it an ideal analog video decoder for Automotive applications.

### Key Features

- NTSC (M, 4.43) and PAL (B, D, G, H, I, M, N, N combination), PAL (60), SECAM support with automatic format detection
- Software selectable analog input control allows for combinations of single ended CVBS, differential CVBS, and S-Video
- Built-in analog anti-alias filter
- 4-H adaptive comb filter Y/C separation
- Fully programmable static gain or automatic gain control for the Y channel
- Advanced synchronization processing and sync detection for handling non-standard and weak signal
- Programmable hue, brightness, saturation, contrast, and sharpness
- ITU-R 601 or ITU-R 656 compatible YCbCr (4:2:2) output format
- Short to battery and short to ground detection test
- 32 Ld QFN with wettable flanks
- -40°C to +105°C

### TW9990 Functional Block Diagram



## INTERSIL TECHWELL DISPLAY AND VIDEO PROCESSORS

| | Device | Description | CVBS Input | S-Video Input | YPbPr Input | SCART Input | Analog RGB Input | Digital RGB/ YCbCr Input | ADC Input Frequency (MHz) | Comb Filter | Max Output Resolution |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | TW8804 | LCD Flat Panel Controller with Integrated NTSC/ PAL/SECAM Decoder and Analog/Digital RGB/ FB Input | Yes | Yes | Yes | Yes | No | 24-bit | 75 | 2D | SXGA |
| | TW8806 | LCD Display Processors with Built-in Video Decoder and T-CON | Yes | Yes | Yes | No | Yes | 24-bit | 27 | 2D | WXGA |
| | TW8807 | LCD Controller with Built-In Video Decoder and TCON for Analog LCD Panels | Yes | Yes | No | No | No | No | 27 | 2D | WVGA |
| AEC-Q100 | TW8809 | Digital RGB to BT.656 Format Converter with Scaling & Progressive Output | Yes | No | No | No | No | 24-bit | 27 | | WSVGA |
| | TW8810D | 3D Decoder Based LCD Controller for Sharp Dual-view Digital Panel | Yes | Yes | Yes | No | Yes | 24-bit | 108 | 3D/2D | WXGA |
| | TW8811D | In-Car LCD Display Processor | Yes | Yes | Yes | Yes | Yes | 24-bit | 108 | 3D/2D | WXGA |
| | TW8813B | 3D Video Decoder Based LCD Controller with Built-in LVDS Panel Interface | Yes | Yes | Yes | No | Yes | 16-bit | 108 | 3D/2D | WXGA |
| AEC-Q100 | TW8816B3 | Highly Integrated LCD Controller with On-Chip MCU & CCFL Controller | Yes | Yes | Yes | No | Yes | 24-bit | 75 | 2D | XGA |
| AEC-Q100 | TW8817 | Low Cost, Highly Integrated LCD Controller for Digital LCD Panels | Yes | Yes | No | No | No | No | 75 | 2D | SVGA |
| AEC-Q100 | TW8819 | Ultra Low-Cost LCD Controller Solution (for RCD application) | Yes | Yes | No | No | No | BT.656 only | 27 | 2D | WSVGA |
| | TW8820 | LCD Controller | Yes | Yes | No | No | No | No | 75 | 2D | SVGA |
| AEC-Q100 | TW8823 | Advanced LCD Controller with On-chip MCU and 65K Color 16-bit OSD Support | Yes | Yes | Yes | Yes | Yes | 2 Ports | 108 | 3D/2D | WXGA |
| | TW8826 | Ultra Low Cost, Highly Integrated LCD Controller for Analog Panels | Yes | Yes | Yes | No | Yes | 24-bit | 27 | 2D | WQVGA |
| | TW8827 | Ultra Low Cost, Highly Integrated LCD Controller for Analog LCD Panels | Yes | Yes | No | No | No | 16-bit | 75 | 2D | WQVGA |
| | TW8830 | LCD Controller | Yes | Yes | Yes | No | Yes | BT.656 only | 80 | 2D | SVGA |
| | TW8831 | TFT Display Controller | Yes | Yes | No | No | No | No | 75 | 2D | SVGA |
| AEC-Q100 | TW8832 | TFT Display Controller | Yes | Yes | Yes | No | Yes | BT.656 only | 60 | 2D | SVGA |
| AEC-Q100 | TW8832S | TFT Display Controller | Yes | Yes | Yes | No | Yes | BT.656 only | 60 | 2D | SVGA |
| AEC-Q100 | TW8833 | TFT Display Controller | Yes | Yes | No | No | No | No | 75 | 2D | WQVGA |
| AEC-Q100 | TW8833S | TFT Display Controller | Yes | Yes | No | No | No | No | 75 | 2D | WQVGA |
| AEC-Q100 | TW8835 | LCD Video Processor with Built-in Decoder, MCU, OSD, TCON and Analog RGB Input Support | Yes | Yes | Yes | No | Yes | 24 bit | 148 | 2D | XGA |
| AEC-Q100 | TW8836 | Next Generation Integrated LCD Controller with LVDS input & Output, MCU, OSD, & Differential CVBS Signal Support | Yes | Yes | Yes | Yes | Yes | 24-bit/LVDS | 148 | 2D | WXGA+ |
| AEC-Q100 | TW9900 | Low Power NTSC/PAL/SECAM Video Decoder with VBI Slicer | Yes | Yes | No | No | No | No | 27 | 2D | D1 (480i/576i) |
| AEC-Q100 | TW9990 | Low Power NTSC/PAL/SECAM Video Decoder with Differential Inputs | Yes | Yes | No | No | No | No | 27 | 2D | D1 (480i/576i) |

# TFT LCD Power Supply

## Integrated TFT-LCD DC-DC Regulators
## ISL78010

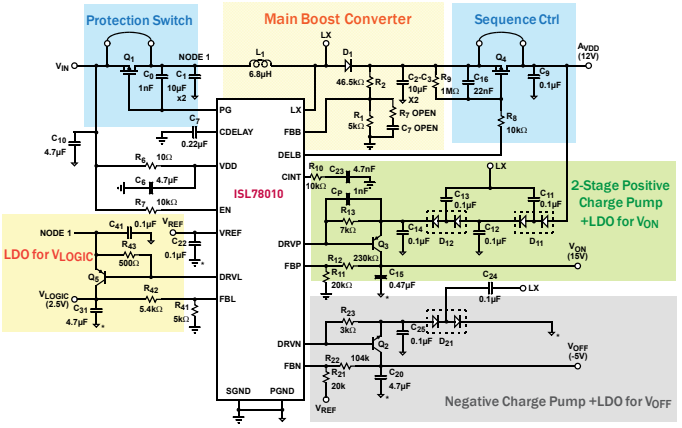
AEC-Q100

### Boost with Integrated FET, 2 Positive Linear Regulator Controller and Negative Linear Regulator Controller

#### Key Features

- High performance boost regulator with integrated FET
  - 2A switch current
  - Up to 20V output
  - Current mode control
- $V_{ON}$ and $V_{LOGIC}$ linear regulator controllers 2% accuracy
- $V_{OFF}$ linear regulator controllers with 3% accuracy
- $V_{LOGIC}$-$V_{OFF}$-$V_{BOOST}$-$V_{ON}$ or $V_{BOOST}$/$V_{LOGIC}$-$V_{OFF}$-$V_{ON}$ sequence control
- Programmable sequence delay
- Configurable fault protection
- 32 Ld TQFP package

#### Typical Application Block Diagram




## Integrated TFT-LCD DC-DC Regulators
## ISL78419

New!

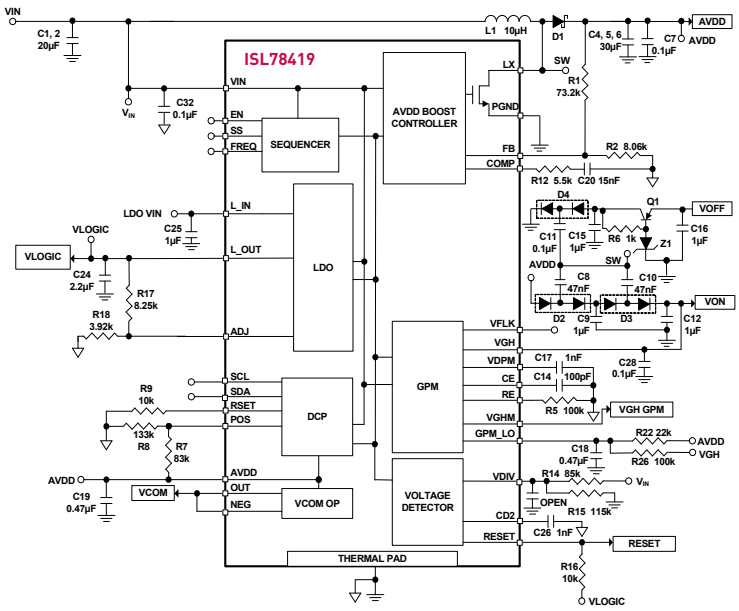
AEC-Q100

### Integrated Automotive TFT-LCD Power Supply Regulator with $V_{COM}$ DCP

#### Key Features

- 2.5V to 5.5V input
- 1.5A, 0.18Ω integrated boost FET
- $V_{ON}$/$V_{OFF}$ supplies generated by charge pumps driven by the boost switch node
- 350mA LDO for $V_{LOGIC}$ channel
- 600kHz/1200kHz selectable switching frequency
- Integrated gate pulse modulator
- Reset signal generated by supply monitor
- Integrated $V_{COM}$ amplifier
- Integrated digitally controlled potentiometer (DCP)
- UVLO, UVP, OVP, OCP, and OTP protection
- -40°C to 105 °C operation
- Supplied in 5x4 mm 28 Ld TQFN package

#### Application Diagram




**MULTIPLE OUTPUT TFT POWER SUPPLIES**

| Device | Device Description | Input Voltage (V) | $V_{BOOST}$ (V) | FET Size (A) | $V_{ON}$ (V) | $V_{OFF}$ (V) | $V_{LOGIC}$ (V) | # of $V_{COM}$ | # of Gamma | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| ISL78010 | Automotive Grade TFT-LCD Power Supply | 3 to 5.5 | 5.5 to 20 | 2 | 15 to 36 | -5 to -20 | 1.3 to $V_{DD}$ - 0.2 | N/A | N/A | 32 Ld TQFP |
| ISL78020 | Automotive Grade TFT-LCD DC/DC with $V_{COM}$ Amplifier | 2.6 to 5.5 | 2.99 to 18 | 3 | 15 to 36 | -25 to -5 | N/A | 1 | 0 | 32 Ld TQFP |
| ISL78022 | Automotive Grade TFT-LCD DC/DC with Integrated Amplifier | 2.6 to 5.5 | 2.99 to 18 | 3 | 15 to 36 | -25 to -5 | N/A | 1 | 4 | 32 Ld TQFP |
| ISL78419 | TFT LCD Power Supply with Integrated $V_{COM}$ DCP | 2.5 to 5.5 | 18 max | 1.5 | N/A | N/A | 0.8 to $V_{DD}$ - 0.3 | 1 with DCP | 0 | 28 Ld 4x5 mm QFN |

LED Backlight Control

## ISL78171 (Sampling as standard product ISL97671A)

2013 Auto Qualification — Coming Soon!

# 6-Channel SMBus/I²C or PWM Dimming LED Driver with Phase Shift Control

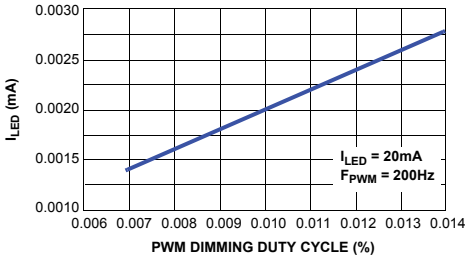
The ISL78171 is a 6-Channel 45V dual mode dimming capable LED driver that can be used with either SMBus/I²C or PWM signal for dimming control. The ISL78171 can drive six channels of LEDs from input 4.5V~26.5V to output of up to 45V. It can also operate from inputs as low as 3V to output of up to 26.5V in bootstrap configuration.

### Key Features

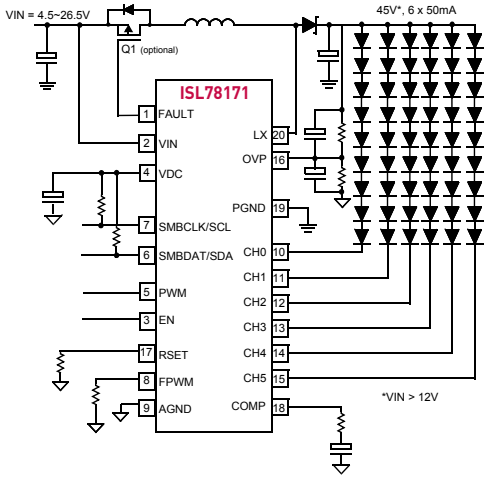
- 6 x 50mA channels
- 4.5V to 26.5V input with max 45V output
- 3V to 21V input with max 26.5V output
- PWM dimming with optional phase shift control
- SMBus/I²C controlled PWM and/or DC dimming
- PWM dimming linearity
  - PWM dimming with adjustable dimming frequency and duty cycle linear from 0.4% to 100% <30kHz
  - Direct PWM dimming duty cycle linear from 0.007% to 100% at 200Hz
- Current matching ±0.7% (typ)
- 600kHz (default)/1.2MHz I²C selectable switching frequency
- Dynamic headroom control
- Fault protection

### Dimming Linearity

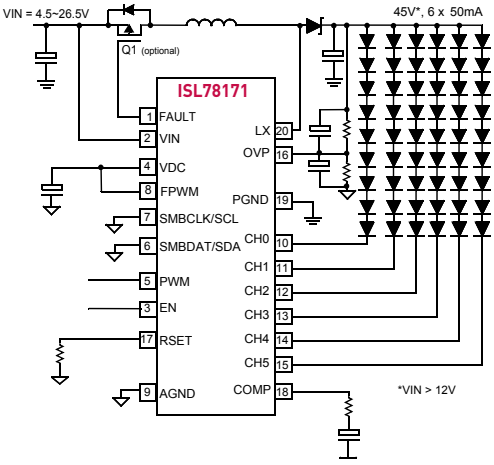
Direct PWM dimming duty cycle linear from 0.007% to 100% at 200Hz




### Typical Application Circuit




SMBus/I²C Controlled Dimming




Direct PWM Dimming

**LED LIGHTING CONTROLLERS**

| Device | Device Description | Topology | Max. No. of LEDs | Digital i/f | For LCD Size | $I_{OUT}$ max (mA) | Peak Efficiency (%) | $V_{IN}$ (V) | $V_{OUT}$ max (V) | Dimming Controls | Package |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *ISL78171 (ISL97671A) | 6-Channel SMBus/I²C or PWM Dimming LED Driver with Phase Shift Control | Inductive boost | 78 | Yes - SMBus/I²C | Up to 17 in | 300 | 92.9 | 4.5 to 26.5 | 45 | SMBus, PWM or DC | 20 Ld 3x4 mm QFN |
| *ISL78172 (ISL97672A) | 6-Channel SMBus/I²C or PWM Dimming LED Driver with Phase Shift Control | Inductive boost | 78 | No | Up to 17 in | 300 | 92.9 | 4.5 to 26.5 | 45 | SMBus, PWM or DC | 20 Ld 3x4 mm QFN |
| ISL97674 | 6-Channel LED driver | Inductive boost | 78 | Yes - SMBus/I²C | Up to 17 in | 240 | 93 | 4.5 to 26.5 | 45 | SMBus, PWM or DC | 20 Ld 3x4 mm QFN |
| ISL97678 | 8-Channel LED driver | Inductive boost | 96 | No | Up to 17 in | 400 | 93 | 4.75 to 26 | 45 | PWM up to 25kHz | 32 Ld 5x5 mm QFN |
| *ISL78186 (ISL97686) | 4-Channel LED Driver with Phase Shift Control and 10-Bit Resolution Dimming | Inductive boost | 84 | Yes - SPI | Up to 17 in | 640 | 93 | 9 to 32 | 75 | PWM or DC | 28 Ld 5x5 mm TQFN |
| *ISL78187 (ISL97687) | 4-Channel LED Driver with Phase Shift Control and 10-Bit Resolution Dimming | Inductive boost | 84 | No | Up to 17 in | 640 | 93 | 9 to 32 | 75 | PWM or DC | 28 Ld 5x5 mm TQFN |

* AEC-Q100 qualification planned for 2013 - contact sales and/or marketing for more information

# AUTOMOTIVE POWER PRODUCTS

**Processor Power • Linear Regulators • Off-Battery Power • Synchronous & Standard Buck Regulators • PWM Controllers • MOSFET Drivers**

## Embedded Processor Power

From single to multiple core embedded processors to GPUs and FPGAs, Intersil has a wealth of power experience to deliver versatile and efficient power solutions for your next Infotainment, Navigation or Telematics platform. Today Intersil offers a rapidly expanding range of point-of-need DC/DC controllers and regulators offering the best in features, performance, efficiency and size.

**EMBEDDED POWER SUMMARY**

| Part | Description | $V_{IN}$ (V) | $I_{OUT}$ (A) | $V_{OUT}$ (V) | Iq (µA) | fsw (MHz) | Comments |
|---|---|---|---|---|---|---|---|
| ISL78210 | 30A High Performance PWM Controller | 3.3 to 25 | 30 | 0.5 to 3.3 | 1 in shutdown | 0.3 | Power good, programmable soft-start, ±0.75% Vout tolerance, diode emulation mode, R3 technology for rapid transient response. |
| ISL78211 | Single Phase Core Regulator with IMVP-6TM | 5 | 2 | 0.300 to 1.500 | 1 in shutdown | 0.33 | 7-bit VID code programs output in 12.5mV increments. User programmable switching frequency, current sense trough DCR & Rsense. |
| ISL78213 | 3A, 1MHz Sync DC/DC Regulator | 2.8 to 5.5 | 3 | 0.8 to 5 | 45 | 1 | Power good, sync to 4MHz, soft-start, pre-biased o/p, current mode control |
| ISL78214 | 4A, 1MHz Sync DC/DC Regulator | 2.8 to 5.5 | 4 | 0.8 to 5 | 45 | 1 | Power good, sync to 4MHz, soft-start, pre-biased o/p, current mode control |
| ISL78228 | Dual 800mA Sync DC/DC Regulator | 2.8 to 5.5 | 2 x 0.8 | 2x 0.6 to 5 | 50 | 2.25 | Power good, sync to 4MHz, soft-start, pre-biased o/p, current mode control |
| ISL78233 | 3A, 2MHz Sync DC/DC Regulator | 2.7 to 5.5 | 3 | 0.8 to 5 | 60 | 2 | Contact factory |
| ISL78234 | 4A, 2MHz Sync DC/DC Regulator | 2.7 to 5.5 | 4 | 0.8 to 5 | 60 | 2 | Contact factory |
| ISL78235 | 5.3A, 2MHz Sync DC/DC Regulator | 2.7 to 5.5 | 5.3 | 0.8 to 5 | 60 | 2 | Contact factory |
| ISL78302 | Dual 300mA LDO | 2.3 to 6.5 | 2 x 0.3 | 3.3, 2.5, 1.8, 1.5, 1.2 | 55 | N/A | 8 output combinations. Independent Enable and POR pins, soft-start & staged turn-on. |
| ISL78302A | Dual 300mA Low Noise LDO | 2.3 to 6.5 | 2 x 0.3 | 3, 2.9, 2.8, 2.7, 2.6, 1.85, 1.8, 1.5 | 55 | N/A | 8 output combinations. Independent Enable and POR pins, soft-start & staged turn-on. Low noise and 90dB PSRR. |
| ISL78310 | 1A High Performance LDO | 2.2 to 6 | 1 | 0.8 to 5 | 12 in shutdown | N/A | Power good, adjustable in-rush current limit, 130mV dropout at full load, programmable soft-start, ±1.8% Vout tolerance. |
| ISL78322 | 2/1.7A Sync DC/DC Regulator | 2.8 to 5.5 | 2 & 1.7 | 2x 0.6 to 5 | 55 | 2.25 | Power good, sync to 4 MHz, soft-start, pre-biased o/p, current mode control, 180° out of phase switching reduces EMI. |

Dual LDO

## ISL78302

New! AEC-Q100

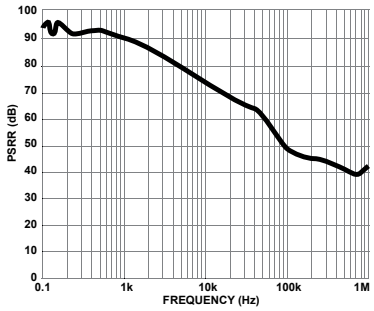
### Dual LDO with Low Noise, Very High PSRR and Low $I_q$

#### Key Features

- Integrates two 300mA high performance LDOs
- Excellent transient response to large current steps
- ±1.8% accuracy over all operating conditions
- Excellent load regulation: < 0.1%
- Low output noise: typically 30µ$V_{RMS}$ @ 100µA (1.5V)
- Very high PSRR: 90dB @ 1kHz
- Extremely low quiescent current: 42µA (both LDOs active)
- Wide input voltage capability: 2.3V to 6.5V
- Low dropout voltage: typically 200mV @ 300mA
- Stable with 1µF to 10µF ceramic capacitors
- Separate enable and POR pins for each LDO
- Soft-start and staged turn-on to limit input current surge
- Current limit and overheat protection
- -40°C to +85°C operating temperature range
- Tiny 10 Ld 3mm x 3mm DFN package

#### Very High PSRR

90dB @ 1kHz




PSRR vs Frequency

#### Standard Voltage Options

| Part Number | Vo1 (V) | Vo2 (V) | Part Number | Vo1 (V) | Vo2 (V) |
|---|---|---|---|---|---|
| ISL78302ARFBZ | 2.5 | 1.5 | ISL78302AARMMZ | 3.0 | 3.0 |
| ISL78302ARBFZ | 1.5 | 2.5 | ISL78302AARLLZ | 2.9 | 2.9 |
| ISL78302ARNBZ | 3.3 | 1.5 | ISL78302AARJMZ | 2.8 | 3 |
| ISL78302ARBNZ | 1.5 | 3.3 | ISL78302AARJRZ | 2.8 | 2.6 |
| ISL78302ARNWZ | 3.3 | 1.2 | ISL78302AARJCZ | 2.8 | 1.8 |
| ISL78302ARWCZ | 1.2 | 1.8 | ISL78302AARGCZ | 2.7 | 1.8 |
| ISL78302ARFWZ | 2.5 | 1.2 | ISL78302AARPLZ | 1.85 | 2.9 |
| ISL78302ARCWZ | 1.8 | 1.2 | ISL78302AARBJZ | 1.5 | 2.8 |

For other options contact factory.

Single LDO

## ISL78310

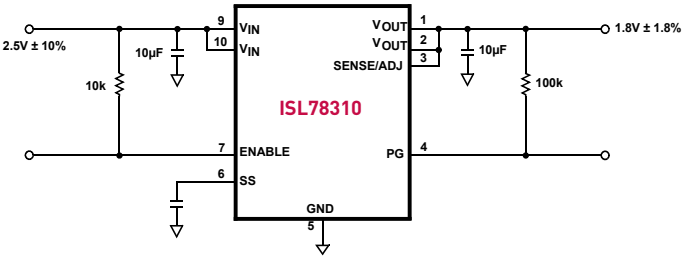
AEC-Q100

### High Performance 1A LDO

#### Key Features

- 2.2V to 6V input supply
- 130mV dropout voltage typical (@ 1A)
- Fast load transient response
- ±0.2% initial $V_{OUT}$ accuracy
- Adjustable in-rush current limiting
- 58dB typical PSRR
- 63µVRMS output noise at $V_{OUT}$ = 1.8V
- Power-good feature
- Supply-independent 1V enable input threshold
- Short-circuit current protection
- 1A peak reverse current
- Any cap stable with minimum 10µF ceramic
- ±1.8% guaranteed $V_{OUT}$ accuracy for junction temperature range from -40°C to +125°C
- 10 Ld DFN package

#### Fixed Typical Application Diagram



# Off-Battery Power

Off-Battery Power

## ISL78301, ISL78307

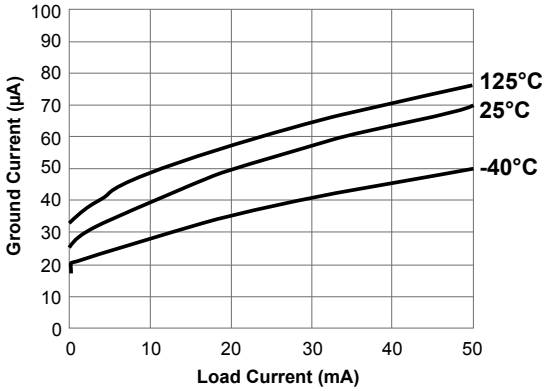
AEC-Q100

### 40V, Low $I_q$, 50mA and 150mA Linear Regulators

**Key Features**

- Optimized for “always-on” applications
- 21µA quiescent current (typical)
- Withstands 45V load dump
- Operates down to 3V during cold cranking
- Low 300mV dropout voltage
- 50mA (ISL78307) or 150mA (ISL78301) output
- +3.3V, +5.0V or 2.5-12V adjustable output
- Stable operation with 10µF output capacitor
- Shutdown input (EN)
- Thermal protection
- Current limit protection
- -40°C to +125°C operating temperature range
- Thermally enhanced 8 Ld SOIC & 14 Ld HTSSOP packages

**Low Ground Current Over Full Operating Range**




# Synchronous Buck Regulators

Dual DC/DC Sync Buck with Dual LDO

## ISL78155, ISL78157 (Sampling as standard product ISL9305H, ISL9307)

2013 Auto Qualification

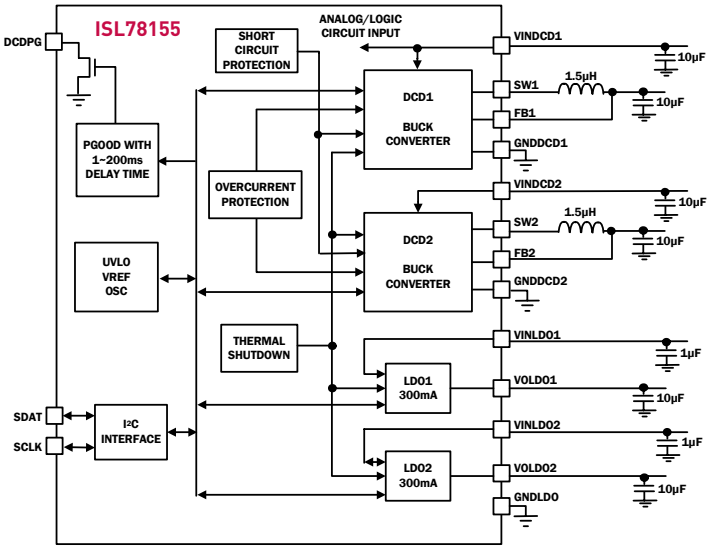
Coming Soon!

### 3MHz Dual 1.5A Step-Down Converters and Dual 300mA Low-Input LDOs

**Key Features**

- I²C programmable (ISL78155) automotive PMIC and fixed outputs option (ISL78157)
- Input voltage range
  - DCD1/DCD2: 2.5V to 5.5V
  - VINLDO: 1.5V to 5.5V
- Adjustable output voltage
  - VODCD1/VODCD2: 0.8V to $V_{IN}$
- 50µA Iq (Typ) with DCD1/DCD2 in skip mode; 20µA Iq (Typ) for each enabled LDO
- Independent enable (EN) pins for DCD1/DCD2 and LDO1/LDO2

**Block Diagram**



Integrated FET Regulators

## ISL78200, ISL78205

Evalboard Available! Contact Sales

AEC-Q100

# 2.5A Boost/Buck (ISL78200) and 2.5A Synchronous Buck (ISL78205) Regulators

### Key Features

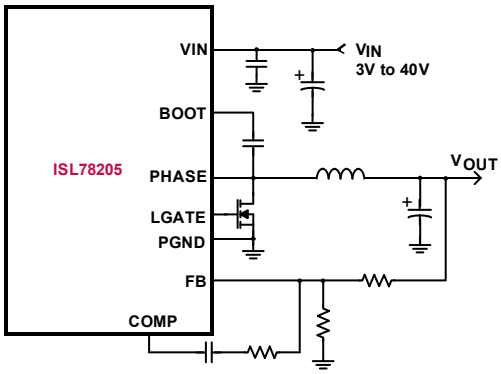
- Buck with boost pre-regulator for start-stop and cold crank operation (ISL78200); Buck only (ISL78205)
- Single inductor non-inverting buck boost ($I_{OUT}$≤1.2A)
- Flexible device operational topologies
  - Buck with pre-boost
  - Single inductor non-inverting buck boost
  - Synchronous buck
  - Standard buck
- Optional mode operation
  - Constant frequency PWM
  - Programmable load boundary between PFM and PWM modes
  - Optional PFM under light load
- 3V to 40V input range
  - ISL78200 starts-up with $V_{IN}$ = 3V
- 4A integrated HS FET
- Programmable frequency from 200kHz - 2.2MHz
- 200µA quiescent current, 3µA shutdown current
- Programmable cycle by cycle current limit
- Frequency fold back feature
- -40°C to +125°C operating temperature range
- 20 Ld HTSSOP package

### Evaluation Board

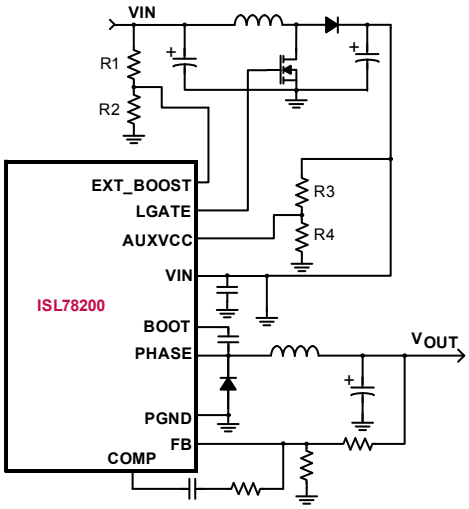

ISL78205EVAL2Z

►For more information, see app note: **AN1773** (ISL78205EVAL2Z Evaluation Board Setup Procedure)

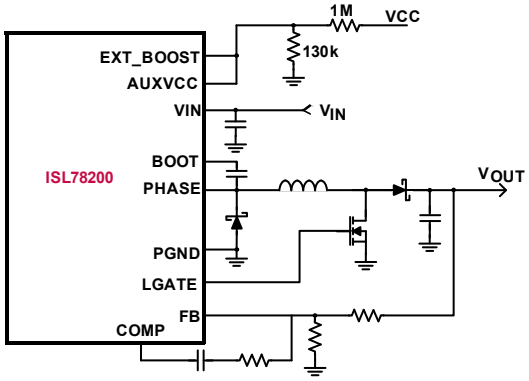
### Typical Application Schematic




**SYNC Buck**




**Buck with Pre-Boost**




**Single Inductor Non-inverting Buck Boost**

# Synchronous Buck Regulators

Integrated FET Regulator

## ISL78228

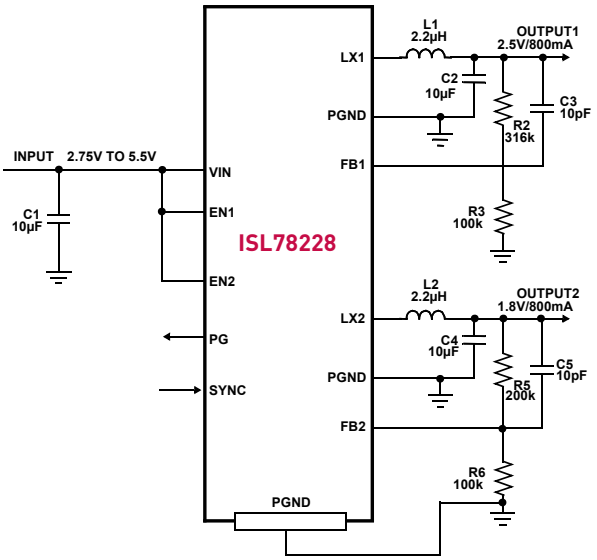
AEC-Q100

### Dual Low Quiescent Current, 2.25MHz High Efficiency Synchronous Buck Regulator

#### Key Features

- Dual 800mA output current
- 30µA standby and 6.5µA shutdown current
- Internal current mode compensation
- 100% maximum duty cycle for lowest dropout
- Selectable forced PWM mode and PFM mode
- External synchronization up to 4MHz
- Start-up with pre-biased output
- Soft-stop output discharge during disable
- Internal digital soft-start: 2ms
- Power-Good (PG) output with 1ms delay
- 10 Ld 3x3mm DFN package
- For higher output current capability consider the ISL78322 (see below)

#### Typical Application Diagram




Multiple Output Integrated FET Buck Regulator

## ISL78322

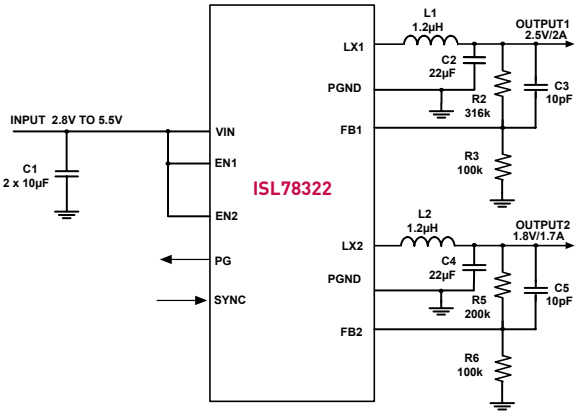
AEC-Q100

### Dual 2A/1.7A Low Quiescent Current 2.25MHz High Efficiency Synchronous Buck Regulator

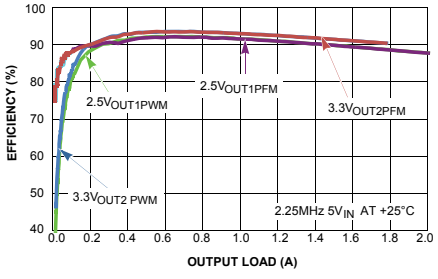
#### Key Features

- Dual 2A/1.7A high efficiency synchronous buck regulator with up to 97% efficiency, low Iq (40µA)
- Outputs 180° out-of-phase
- Start-up with pre-biased output
- Selectable forced PWM mode and PFM mode
- External synchronization up to 8MHz
- Negative current detection and protection
- 100% maximum duty cycle for lowest dropout
- Internal current mode compensation
- Peak current limiting, hiccup mode short circuit protection and over-temperature protection
- Pb-free (RoHs compliant)
- 12 Ld 4mm x 3mm DFN package

#### Typical Application




#### Up to 97% Efficiency



# Synchronous Buck Regulators

## Multiple Output Integrated FET Buck Regulator

**ISL78236** (Sampling as standard product ISL8036A)

2013 Auto Qualification — Coming Soon!

### Dual 3A 1MHz/2.5MHz High Efficiency Synchronous Buck Regulator

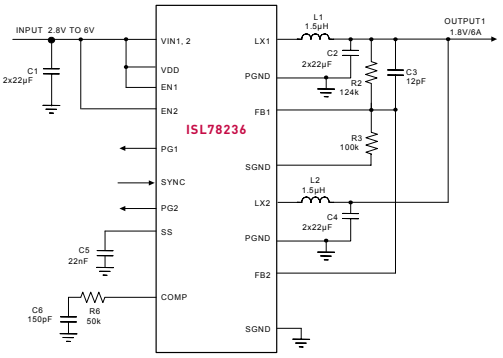
#### Key Features

- 3A high efficiency synchronous buck regulator with up to 95% efficiency
- 2% output accuracy over-temperature/load/line
- Internal digital soft-start: 1.5ms
- 6A current sharing mode operation
- External synchronization up to 6MHz
- Internal current mode compensation
- Peak current limiting and hiccup mode short circuit protection
- Reverse overcurrent protection
- 24 Ld 4x4 mm QFN package

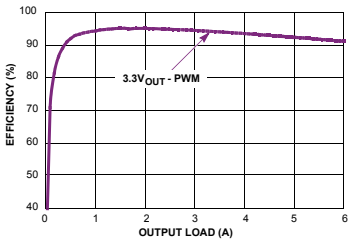
#### Applications

- Embedded processor power: µC/µP, FPGA and DSP power

#### Typical Applications (Single 6A)




#### Up to 95% Efficiency




## Single Output Buck Regulator

**ISL78213, ISL78214**

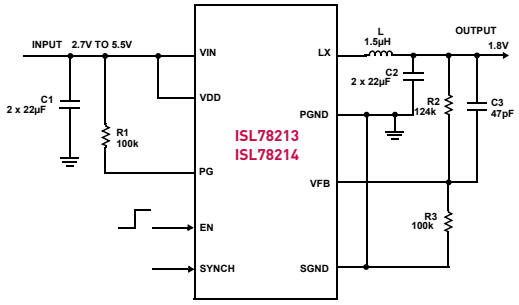
AEC-Q100

### 3A/4A Low $I_q$ 1MHz High Efficiency Synchronous Buck Regulator

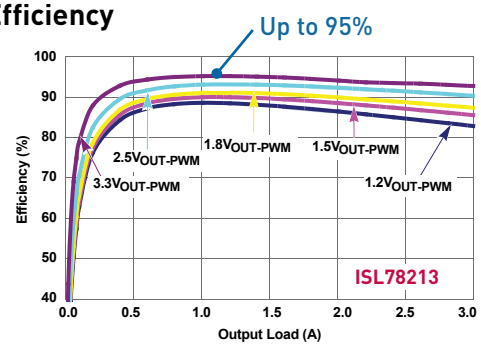
#### Key Features

- Pin-to-pin compatible 3A/4A integrated FET regulators
- $V_{IN}$ range: 2.7V to 5.5V
- $V_{OUT}$ range: 0.8V to $V_{IN}$
- ISL78213: 3A continuous load current
- ISL78214: 4A continuous load current
- Current mode control
- Flexible operation mode: selectable PFM/PWM mode
- Highest light load efficiency: 35µA quiescent current
- High switching frequency: 1MHz
- External synchronization capability
- Up to 95% efficiency
- $P_{GOOD}$ (Power OK) output, internal digital soft-start & regulator enable pin
- Peak current limiting, short circuit protection over-temp
- 16 Ld 4x4mm QFN package

#### Typical Application Diagram




#### High Efficiency




Efficiency vs Load (1MHz $5V_{IN}$ PWM)

# Synchronous Buck Regulators

## Single Output Buck Regulator

**ISL78233, ISL78234, ISL78235** (Sampling as standard product ISL8023A/24A/25A)

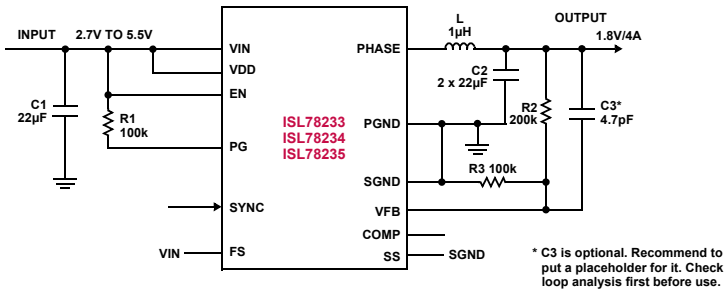
2013 Auto Qualification — Coming Soon!

### Single, Compact 3, 4 & 5A 2MHz Synchronous Buck Regulator

#### Key Features

- 2.7V to 5.5V input voltage range
- Very low on-resistance FET's
  - P-channel 45mΩ and N-channel 19mΩ typical values
- High efficiency up to 95% synchronous regulator design
- 0.8% reference accuracy over-temperature/load/line
- Complete BOM with as few as 3 external parts
- Start-up with pre-biased output
- Internal soft-start: 1ms or adjustable
- Soft-stop output discharge during disable
- Adjustable frequency from 500kHz to 4MHz: default at 2MHz
- External synchronization up to 4MHz
- Over-temperature, over-current, over-voltage and negative over-current protection
- -40 to 105 °C operation

#### Typical Application Diagram




# Standard Buck Regulator

## Dual Output Buck Regulator

**ISL78208** (Sampling as standard product ISL85033)

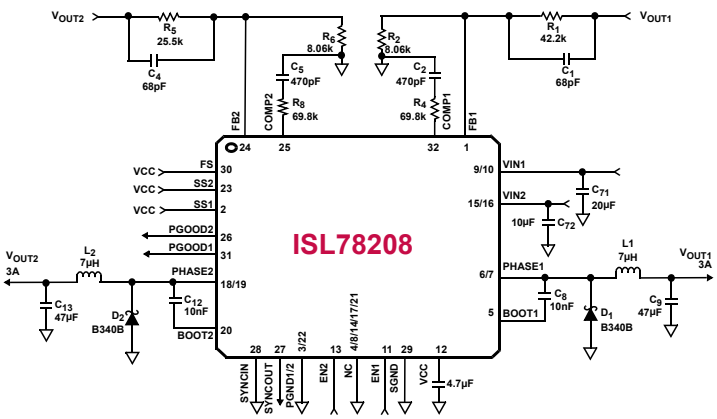
2013 Auto Qualification — Coming Soon!

### Dual 3A Standard Buck Regulator

#### Key Features

- Wide input voltage range from 4.5V to 28V
- Adjustable output voltage with continuous output current up to 3A
- Current mode control
- Adjustable switching frequency from 300kHz to 2MHz
- Current sharing parallel outputs support single 6A output
- Independent power-good detection
- Selectable in-phase or out-of-phase PWM operation
- Independent, sequential, ratiometric or absolute tracking between outputs
- Internal 2ms soft-start time
- Overcurrent/short circuit protection, thermal overload
- -40 to 105 °C operation
- Supplied in 32 Ld 5x5mm wettable flank QFN package

#### Typical Application Diagram




Dual 3A Output ($V_{IN}$ Range From 4.5V to 28V)

# Embedded Processor PWM Controllers

Single-phase PWM Controller

## ISL78210

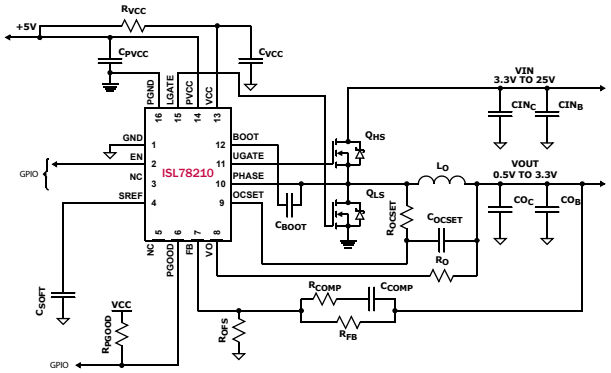
AEC-Q100

### Automotive PWM DC/DC Voltage Controller

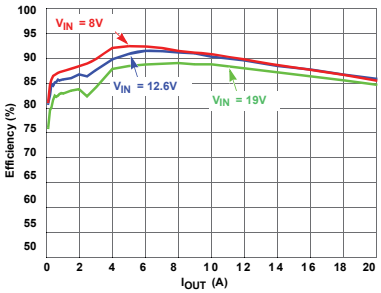
#### Key Features

- Input voltage range: 3.3V to 25V
- Output voltage range: 0.5V to 3.3V
- Output load to 30A
- Simple resistor programming for output voltage
- ±0.75% system accuracy: -40°C to +105°C
- Capacitor programming for soft-start delay
- Fixed 300kHz PWM frequency in continuous conduction
- External compensation affords optimum control loop tuning
- Automatic diode emulation mode for highest efficiency
- Integrated high-current MOSFET drivers and schottky boot-strap diode for optimal efficiency
- Choice of over-current detection schemes
  - Lossless inductor DCR current sensing
  - Precision resistive current sensing
- Power-Good monitor for soft-start and fault detection
- 16 Ld 2.6 x 1.8mm µTQFN package

#### Application Schematic with DCR Current Sense




#### High Efficiency




Efficiency at $V_{OUT}$ = 1.1V

Single-phase Buck Regulator

## ISL78211

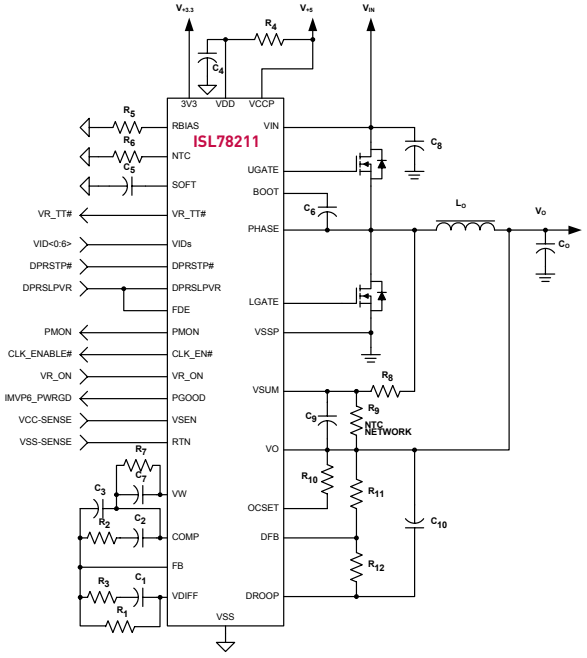
AEC-Q100

### Automotive Single-Phase Core Regulator for IMVP-6™ CPUs

#### Key Features

- Precision single-phase CORE voltage regulator
  - 0.5% system accuracy over -10°C to 100°C temperature range
  - 0.8% system accuracy over entire temperature range
  - Enhanced load line accuracy
- Internal gate driver with 2A driving capability
- Microprocessor voltage identification input
  - 7-Bit VID input
  - 0.300V to 1.500V in 12.5mV steps
  - Support VID change on-the-fly
- Multiple current sensing schemes supported
  - Lossless inductor DCR current sensing
  - Precision resistive current sensing
- Power monitor indicating CPU instantaneous power
- User programmable switching frequency
- Differential remote voltage sensing at CPU die
- 14 Ld 6x6mm QFN package

#### Typical ISL78211 Circuit Configuration



# High Power Controllers and FET Drivers

## High Power Boost
## ISL78220, ISL78225

Evalboard Available! Contact Sales

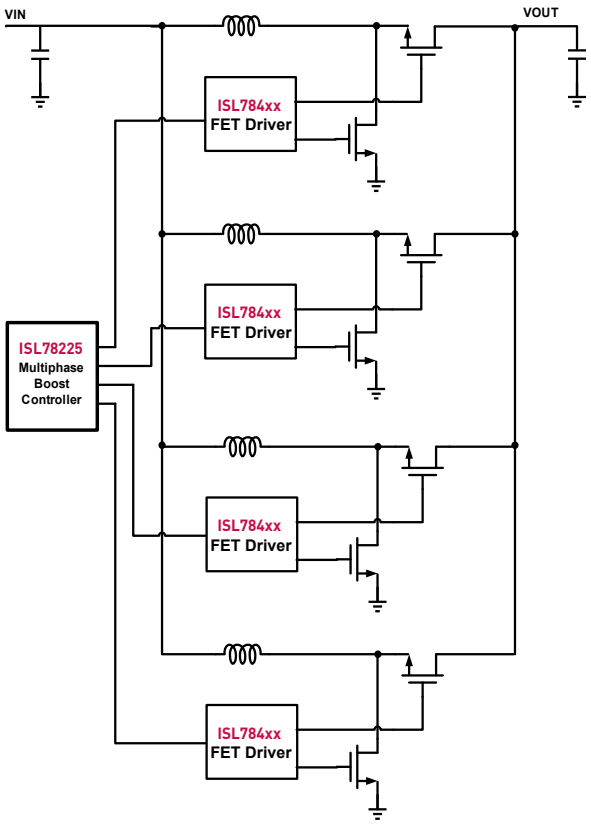
AEC-Q100

### Multi-Phase Boost PWM Controller with Phase Dropping Enhancement

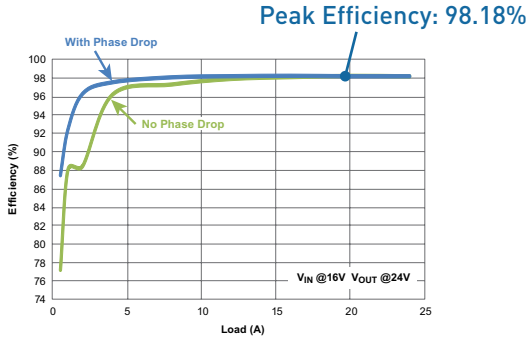
#### Key Features

- Peak current mode PWM control with adjustable slope compensation
- Precision resistor/DCR current sensing
  - Accurate channel-current balancing
  - Accurate total current monitoring pin ($I_{OUT}$)
- ISL78220 - 2, 3, 4 or 6-phase operation
- ISL78225 - 2, 3 or 4-phase operation
- Adjustable phase dropping/diode emulation/pulse skipping for high efficiency at light load
- Phase dropping facilitated with ISL78420 tri-level input FET driver
- Adjustable (75kHz to 1MHz) switching frequency
- Adjustable maximum duty cycle
- Frequency synchronization
- Dedicated PWM invert signal allows use of inverting or non-inverting FET drivers
- Input & output over-voltage detection
- Fast response facilitates for audio envelope tracking
- 44 Ld TQFP package

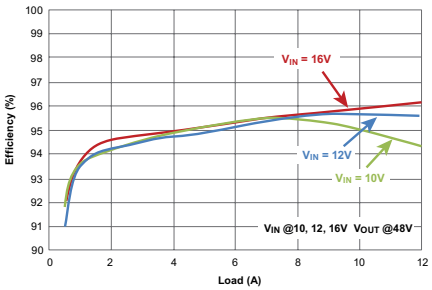
#### Typical Application 4-Phase SYNC Boost Converter




#### High Efficiency




24V Sync Boost Efficiency vs Load Current




48V Non-Sync Boost Efficiency vs Load Current

#### Evaluation Boards

ISL78220EVAL1Z

Low Battery Boost Evaluation Board

6-11$V_{IN}$ to 12$V_{OUT}$ @ 30A

ISL78225EVAL1Z

600W Continuous Power Audio Booster

10-16$V_{IN}$ to 35$V_{OUT}$

## 100V, 2A MOSFET Driver

## ISL78420

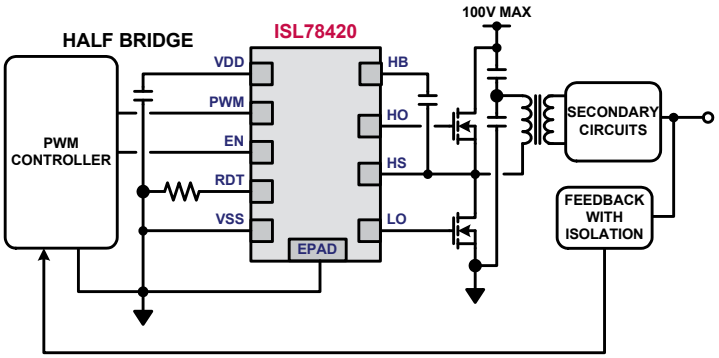
New! AEC-Q100

### 100V, 2A Peak, High Frequency Half-Bridge Driver with Adjustable Dead Time

#### Key Features

- Tri-Level PWM input for single input switch control
  - Ideal in phase shedding multi-phase power supplies
  - Ideal companion product to ISL78220/225
- Bootstrap supply max voltage to 114 VDC
- Break-before-make dead-time prevents shoot-through
  - Adjustable up to 250ns
- Wide supply voltage range (8V to 14V)
- Supply under-voltage protection
- 1.6Ω/1Ω typical output pull-up/pull-down resistance
- 9 and 10 Ld 4x4 mm TDFN packages
  - The 9 Ld "B" package compliant with 100V conductor spacing guidelines per IPC-2221

#### Typical Application




## 6A MOSFET Driver

## ISL78463, ISL78464 (Sampling as standard product ISL89163, ISL89164)

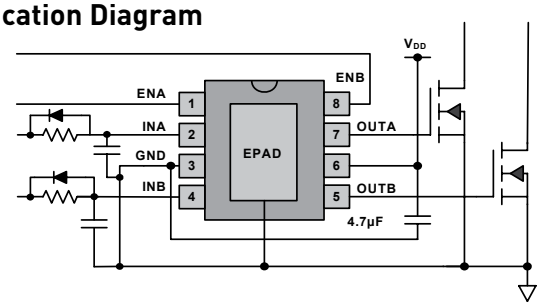
2013 Auto Qualification — Coming Soon!

### High Speed, Dual Channel, 6A, Power MOSFET Driver with Enable Inputs

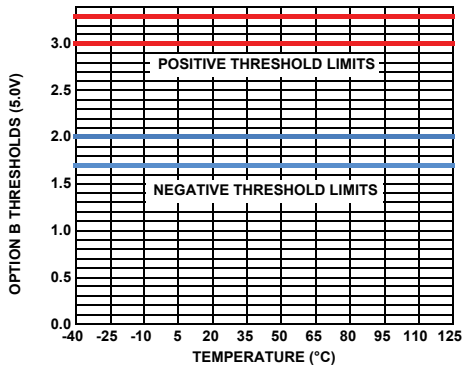
#### Key Features

- Dual output, 6A peak currents, can be paralleled
- Inverting (ISL78464) & non-inverting inputs (ISL78463)
- Dual AND-ed input logic, (INput and ENable)
- Typical ON-resistance <1Ω
- Specified Miller plateau drive currents
- Very low thermal impedance ($\Theta_{JC}$ = 3°C/W)
- Hysteretic input logic levels for 3.3V CMOS, 5V CMOS, TTL and logic levels proportional to $V_{DD}$
- Precision threshold inputs for time delays with external RC components
- 20ns rise and fall time driving a 10nF load
- -40 to 125 °C operation
- 8 Ld thermally enhanced SOIC package

#### Application Diagram




#### Guaranteed Temperature Stable Thresholds



# POWER CONVERSION APPLICATIONS

**Audio Amplifier Boosters • High Power Controllers and FET Drivers**

## Audio Amplifier Boosters

### Audio Amplifier Power Boosting with ISL7822x

Automotive OEM brands are increasingly turning to audio as one tool to win customers over with. However, packing multi-channel sound into a limited space has forced renewed focus on techniques to improve amplifier efficiency and power densities. This has fed an increasing interest in new amplifier topologies including wider adoption of Class D switching amplifiers. Intersil is helping this activity by developing multi-phase power boosters to increase efficiency of these audio solutions.

When designing high performance audio amplifiers using the supposedly efficient class D architecture, achieving high efficiency is not automatic especially at nominal listening levels. With a traditional fixed supply voltage, power dissipated in the output stages can be pretty significant as illustrated by the red shading in figure 1. However, dynamically modulating the voltage supplied to the power stage in such a way that it tracks the instantaneous audio signal can result in significant system operating improvements, especially in efficiency, resulting in a reduced need for heat sinking (figure 2).

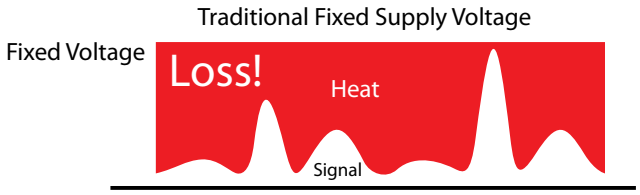



Figure 1

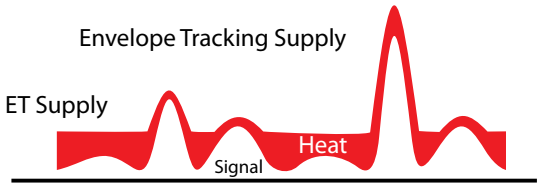



Figure 2

### Advantages of Envelop Tracking

- Reduced average amplifier power dissipation (irrespective of using digital or linear amplifier topologies)
- Significantly reduces power stage heat sinking and thus weight and space
- Lower average operating temperatures
- Maintain amplifier dynamic range for excellent acoustic performance

The ISL78225 4-phase PWM controller offers a practical and economic route to a smart power booster for high power automotive audio trunk amplifiers. Each phase can supply 200 to 300W allowing significant power to be delivered to the amplifier loads. The ISL78225 offers a unique reference input pin which can be driven by an audio tracking signal derived from the audio pre-/post processor providing a practical implementation of envelope tracking.

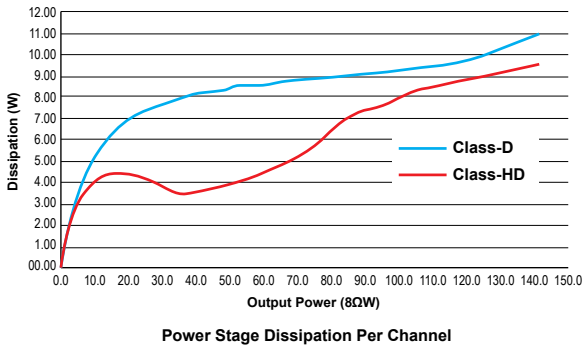



*Figure: Graph illustrating potential power savings from a realized class D based amplifier with envelop tracking implementation.*

## High Power Boost

### ISL78227, ISL78229 (Contact Intersil for status of this product)

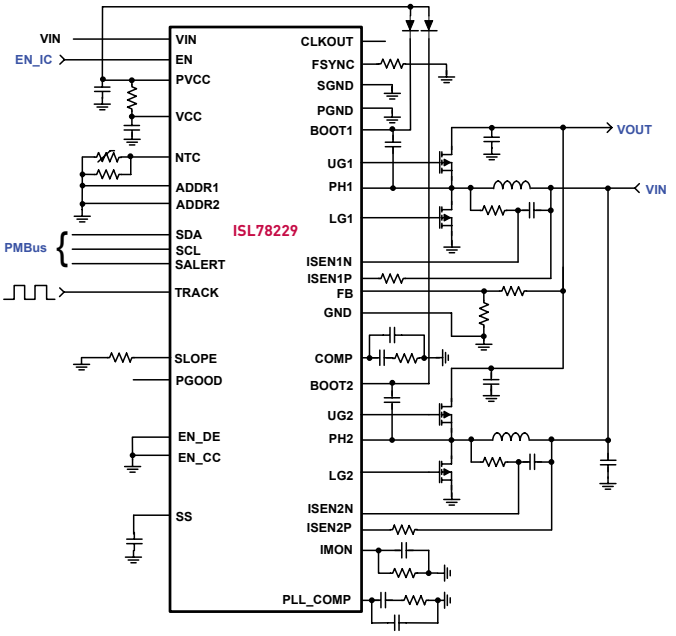
2013 Auto Qualification — Coming Soon!

## Dual-phase Boost Controller with Integrated MOSFET Driver

### Key Features

- Wide input range 5V to 55V, withstand 60V transients
- Easy to use 2-phase interleaved switching reduces ripple currents and capacitors as well as induced noise
- I²C/PMBus compatible digital interface (ISL78229 only)
- Integrated 4A MOSFET drivers
- Adjustable switching frequency or external synchronization from 75kHz up to 1MHz per phase
- Low shutdown current, $I_Q$ < 3µA
- Selectable continuous current (CCM)/ diode emulation modes
- Peak current mode PWM control with adjustable slope compensation
- Over-temperature/over-voltage protection
- 1.6V ±1.0% internal reference

### Typical Application, 2-Ph Synchronous Boost




## Isolated PWM Controllers

### ISL78245 (Sampling as standard product ISL6745A)

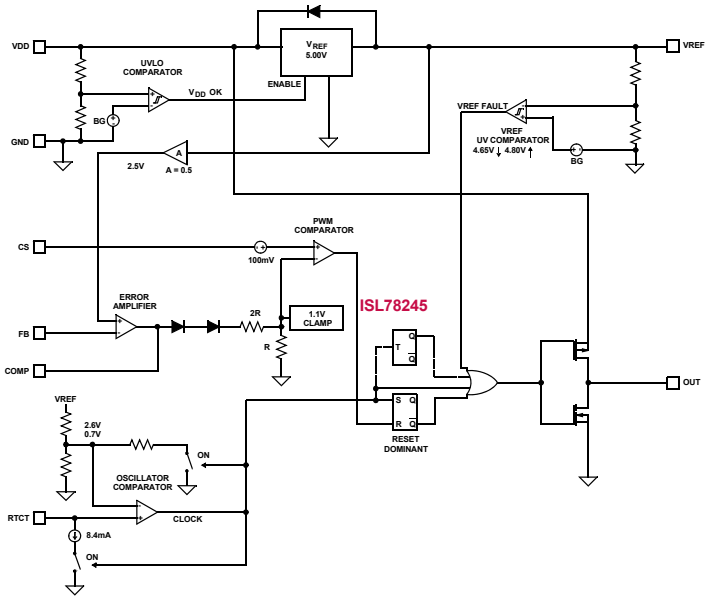
2013 Auto Qualification — Coming Soon!

## Improved Industry Standard Single-Ended Current Mode PWM Controller

### Key Features

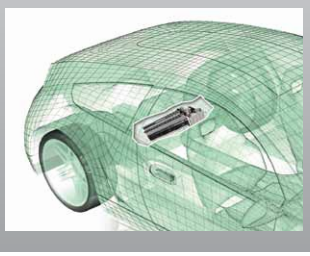
- Improved 384x industry standard PWM controller
- 1A MOSFET gate driver
- 60µA start-up current, 100µA maximum
- 25ns propagation delay current sense to output
- Fast transient response with peak current mode control
- Adjustable switching frequency to 2MHz
- 20ns rise and fall times with 1nF output Load
- Trimmed timing capacitor discharge current for accurate deadtime/maximum duty cycle control
- High bandwidth error amplifier
- Tight tolerance voltage reference over line, load, and temperature
- Tight tolerance current limit threshold
- Supplied in 8 Ld MSOP package
- -40 to 105 °C operation

### Functional Block Diagram



# BATTERY CELL BALANCING

## Hybrid Electric, Plug-in Hybrid Electric and Electric Vehicle (HEV/PHEV/EV) Battery Management Solutions

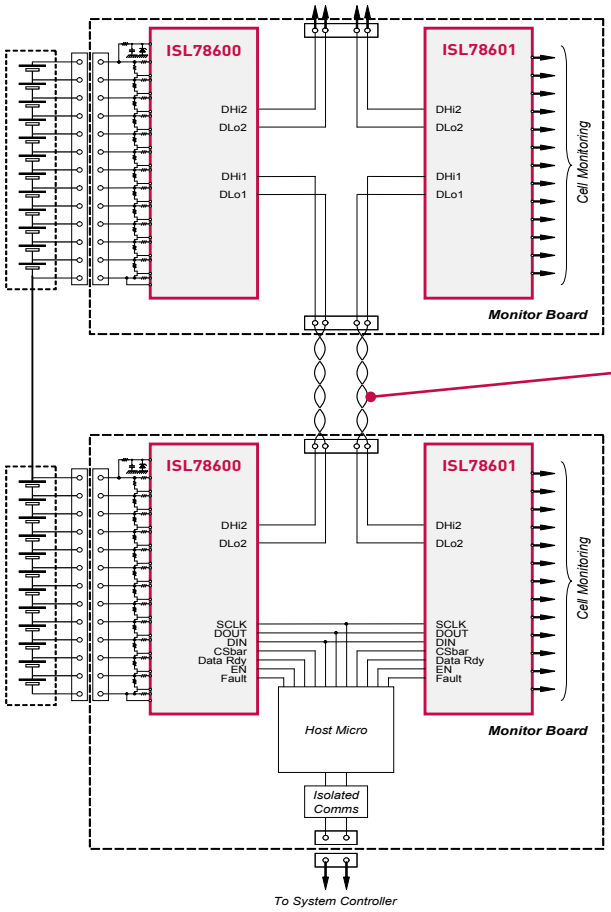


Intersil's ISL78600 and ISL78601 automotive grade Li-Ion battery management and safety monitoring chipset solution is specifically designed to meet the stringent safety, reliability and performance requirements of next generation Hybrid Electric Vehicle (HEV), Plug-in Hybrid Electric Vehicle (PHEV) and Electric Vehicle (EV) applications.

The automotive grade (AEC-Q100), ISL78600 12-cell battery pack manager can be used as a standalone part in ASIL compliant systems or deployed in conjunction with the complimentary ISL78601 for higher ASIL ratings or in systems requiring an independent backup solution. The solution provides built-in fault detection for all of its major internal functions and detects external faults such as open wire, over- and under-voltage as well as temperature and cell balancing faults to mitigate battery pack failures.

Overall, the highly integrated functionality of the ISL78600 and ISL78601 offers a number of benefits and can significantly reduce the overall battery management costs of HEV/PHEV/EV battery packs and their associated systems.

### Intersil Cell Balancing System




### Daisy Chain Serial Communication Lines - up to 14 Packs

- Differential communication system provides high noise immunity
- Uses low cost twisted pair wiring for pack stacking (up to 1m)
- High immunity to system transient and EMI events

# Multi-Cell Balancing (MCB)

## ISL78600

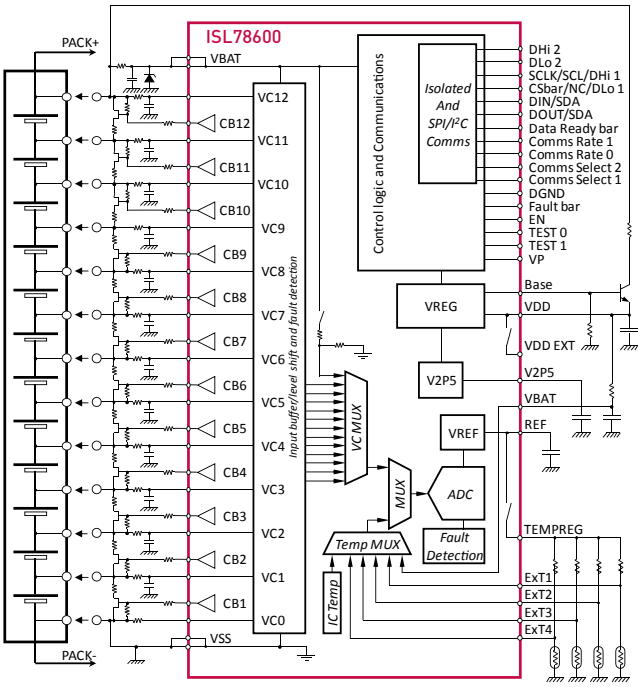
Evalboard Available! Contact Sales

AEC-Q100

### 12 Cell Li-ion Battery Pack Manager

#### Key Features

- Up to 12 cell voltage management
- Supports full range of Li-Ion cell chemistries
- Cell voltage measurement accuracy ±2.5mV
- Also available in ±10mV version - ISL78610
- $V_{BAT}$ measurement accuracy ±100mV
- Cell voltage scan rate of 20µs per cell
- Proprietary daisy chain communications system
  - Robust EMI performance
  - Excellent system transient resistance
- Passive balancing
- Integrated system diagnostic functions:
  - Cell over and under-voltage
  - Over temperature
  - Open cell monitoring wires
  - Open temperature monitoring wires
  - $V_{BAT}$ and $V_{SS}$ connection integrity
  - Voltage reference function
  - Oscillator function
- 64 Ld TQFP package




## ISL78601

Evalboard Available! Contact Sales

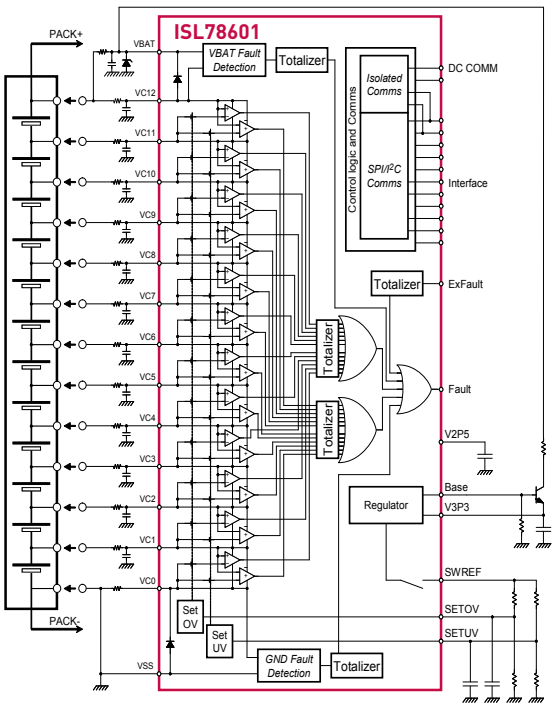
AEC-Q100

### 12 Cell Li-ion Battery Pack Monitor

#### Key Features

- Stand-alone operation or backup to ISL78600 in redundant monitoring systems
- Up to 12 cell voltage monitoring
- Supports full range of Li-Ion cell chemistries
- Programmable over and under voltage thresholds
- Cell over-voltage threshold accuracy ±20mV
- Cell under-voltage threshold accuracy ±50mV
- Logic fault input provides system expansion possibilities
- Proprietary Daisy chain communications system
  - Robust EMI performance
  - Excellent system transient resistance
- Faults reported to microcontroller via SPI and a logic level "fault" output
- <5µA shutdown current
- 38 Ld TSSOP package

For more information about Intersil's Automotive Products, contact your local sales office.



# 400V to 12V DC/DC

Isolated Power

## ISL78223

Evalboard Available! Contact Sales

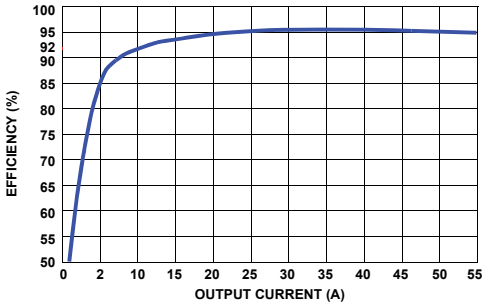
AEC-Q100

## Zero Voltage Switching (ZVS) Full-bridge PWM Controller

### Key Features

- Adjustable resonant delay for ZVS operation
- Synchronous rectifier control outputs with adjustable delay/advance
- Voltage- or current-mode control
- 3% current limit threshold
- Adjustable average current limit & deadtime control
- 175µA start-up current
- Supply UVLO
- Adjustable oscillator frequency up to 2MHz
- Internal over-temperature protection
- Buffered oscillator sawtooth output
- Fast current sense to output delay
- Adjustable cycle-by-cycle peak current limit
- 70ns leading edge blanking
- Multi-pulse suppression
- 20 Ld QSSOP package

### High Efficiency



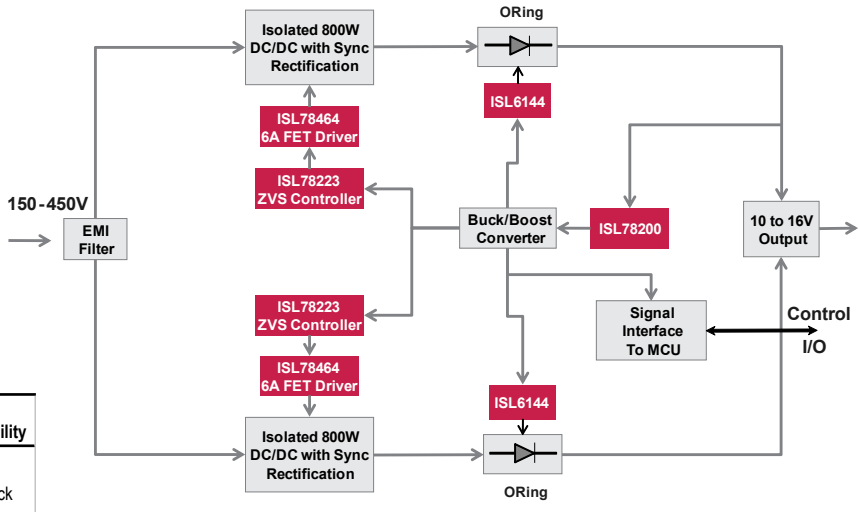

### Evaluation Board Specifications

| | |
|---|---|
| Absolute Maximum Input Voltage | 450VDC |
| Operating Input Voltage | 150V to 450VDC |
| Maximum Input Current | 2.5ADC |
| Rated Output Current | 50ADC |
| Current Limit | 60A ± 5% |
| Output Voltage | 12V ± 5% |
| Efficiency at 100% (50A) load | 95% |
| Efficiency at 20% (10A) load | 92% |

### Evaluation Board

ISL78223EVAL1Z

### ISL78223 kW Power Supply




### Evaluation Board Ordering Info

| Order Code | Main Parts Featured | Description | Electrical Summary | Availability |
|---|---|---|---|---|
| ISL78223EVAL1Z | ISL78223, ISL78245, ISL7846x, ISL78200 | Isolated, high efficiency ZVS 400V to 12V DC/DC | 150-450$V_{IN}$ to 12$V_{OUT}$ @ 30A | In stock |

To order an evalboard, please contact your local sales office.

# 48/12V Bi-Directional DC/DC

Bi-Directional DC/DC System

## ISL78225EVB

Evalboard Available! Contact Sales

## 48/12V Bi-directional DC/DC Converter Demonstrator

Designed to support future dual battery power systems now being considered in Europe, this 48/12V bi-directional DC/DC system combines significant power conversion capabilities yet maintains impressive conversion efficiencies above 95%. The system exploits Intersil's ISL78220/5 multi-phase PWM controllers to provide a high performance converter in a dense form factor. The demonstrator (ISL78225EVAL2Z) is capable of supplying 1.5kW using a 4-phase configuration (ISL78225). In fact, the modular PWM controllers can easily be exploited to develop conversion designs up to 4kW.

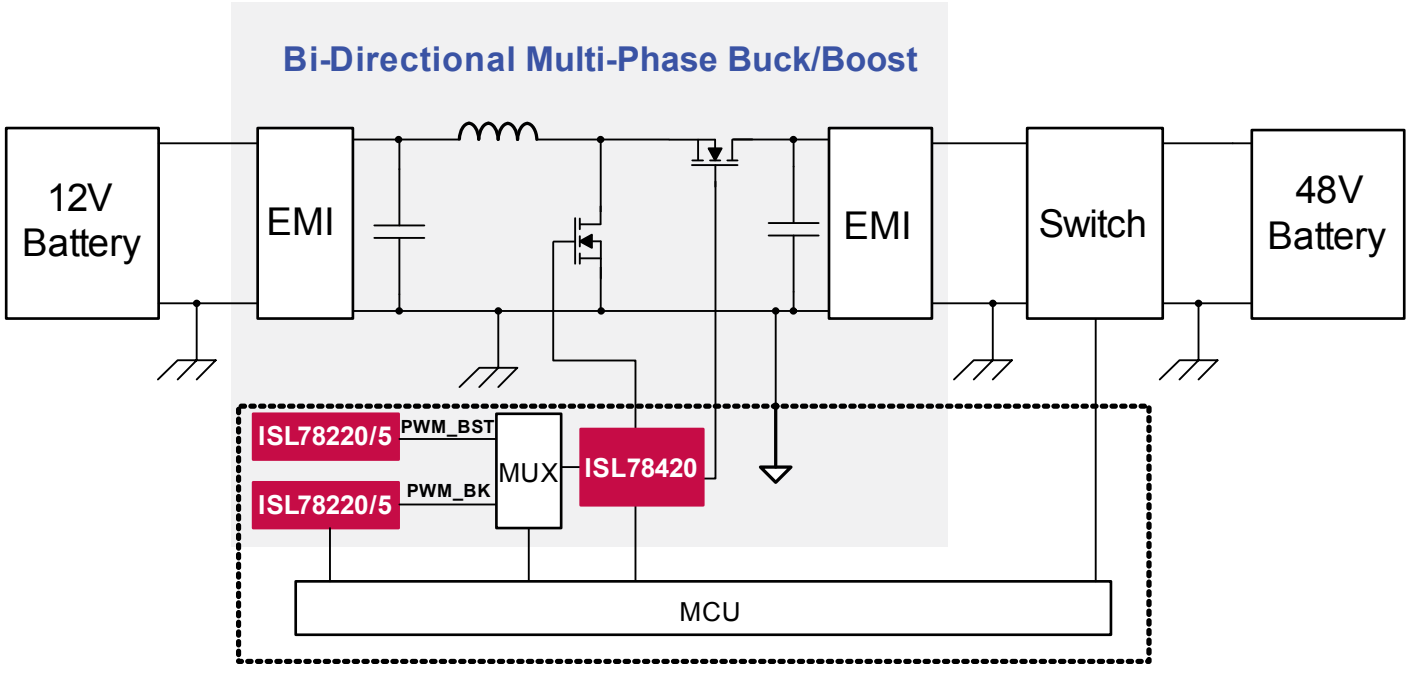
### Key Features

- Targets > 95% efficiency
- Paired 4-phase buck/boost architecture
- Features smart phase shedding to boost efficiency
- $V_{IN}$ = 9 to 18V (boost mode), 24 to 60V (buck mode)
- $V_{OUT}$ = 24 to 60V (boost mode), 6 to 16V (buck mode)
- $I_{OUT}$ & $V_{OUT}$ adjustable in either direction
  - Up to 180A output current buck direction
  - Up to 30A in boost direction
- fsw = 100kHz: PWM switching up to 1MHz possible with ISL78220/5
- Start-up time = 10ms
- Output ripple 100mV (boost), 200mV (buck mode)

### Evaluation Board Ordering Info

| Order Code | Main Parts Featured | Description | Electrical Summary | Availability |
|---|---|---|---|---|
| ISL78220EVAL1Z | ISL78220, ISL6609A | Low Battery Boost Evaluation Board | 6-11$V_{IN}$ to 12$V_{OUT}$ @ 30A | In stock |
| ISL78225EVAL1Z | ISL78225, ISL78420 | 600W Continuous Power Audio Booster | 10-16$V_{IN}$ to 35$V_{OUT}$ @ 17 A | In stock |
| ISL78225EVAL2Z | ISL78225, ISL78420 | 1.5kW Bi-directional 48 to 12V DC/DC | 1.5kW 48 to 12/12 to 48V, 180A buck & 30A boost direction | Coming soon |

To order an evalboard, please contact your local sales office.

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