




## Choice, flexibility, and support for LCD TVs

A broad offering of standard components to complement your design



**Your reliable partner for LCD TV**



## Sharpen your competitive edge with guaranteed deliveries from a single supply chain

In today's LCD TVs, true performance goes beyond the image processor and scaler. Every component in the system, from the video processor to even the smallest discrete device, needs to be optimized to enhance the LCD TV architecture. That means reducing power consumption, shrinking footprint, and, wherever possible, limiting cost.

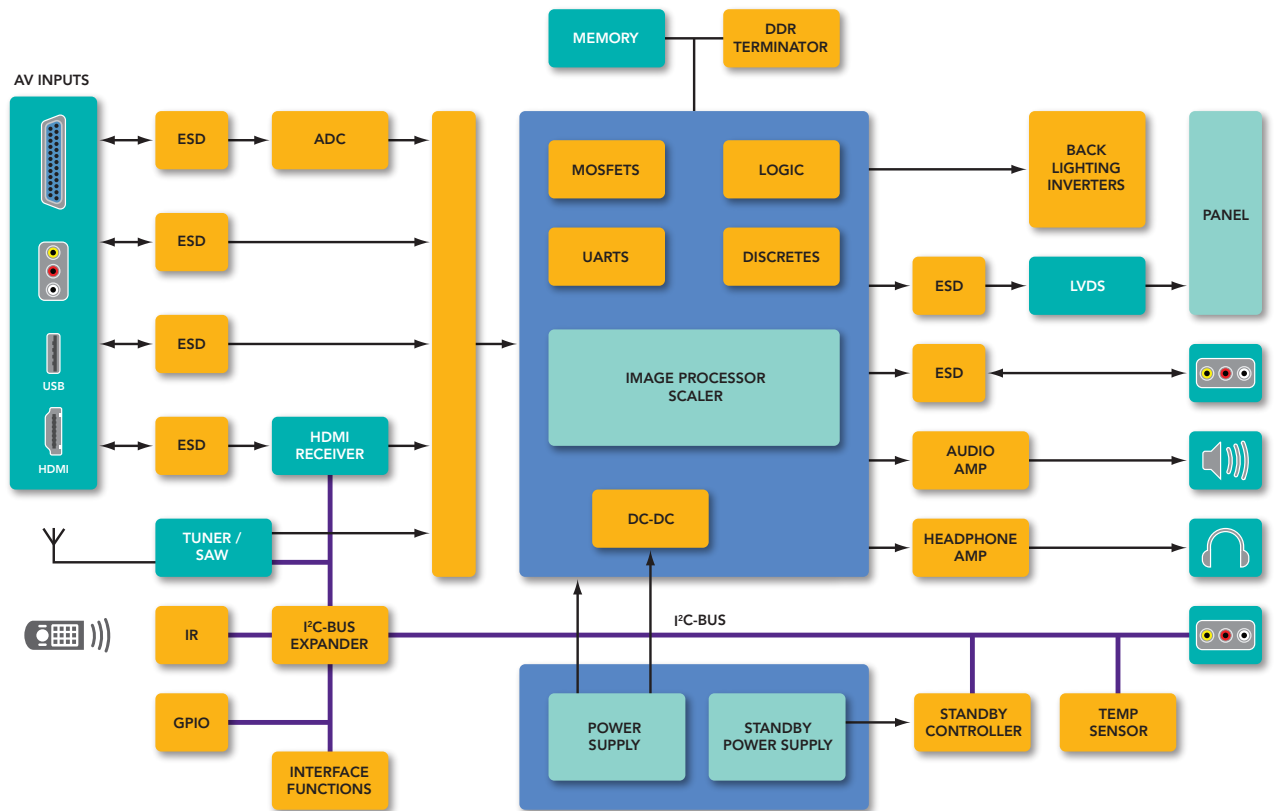
That's where we come in. At NXP Semiconductors, we offer one of the broadest portfolios of semiconductor components in the industry. LCD TVs are one of the places where we really shine, bringing together our decades of experience in high-end multimedia, our industry-leading technologies for power management and system control, and our in-depth knowledge of consumer electronics.

Our product portfolio reflects that expertise, with more than 11,000 catalog items just for LCD TV. And, since we take a system-level approach to development, each one of those catalog items is carefully designed to work seamlessly with other components in the portfolio.

We cover the whole spectrum, and have developed lasting relationships with our customers worldwide. We have engineers located close to our customers, so we can address design issues quickly. We also have large-scale, dedicated production capacity, supported by an advanced logistics network, for quick responses and guaranteed deliveries wherever you need them. What's more, we can adapt our capacity to your fluctuating volume demands, so you can respond quickly to changes in the market. You get a reliable yet flexible supply, and have the freedom to sharpen your competitive edge.

In short, with NXP as your partner for LCD TVs, you have a partner fully committed to your success, today and tomorrow.

LCD TV architecture



# NXP's optimized solutions for

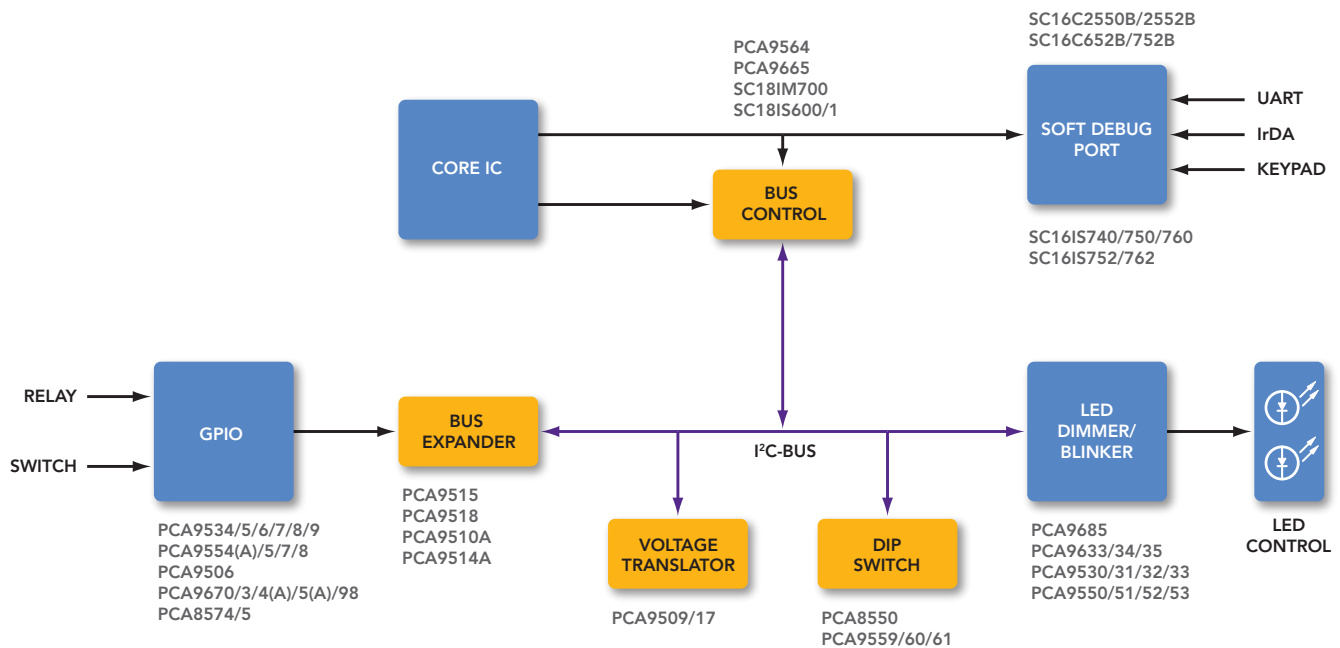


### The NXP portfolio for LCD TVs: more choice and greater design flexibility

LCD TV function	Product offering	No. of products in portfolio
Interfaces	I <sup>2</sup> C-bus components (GPIO, bus expanders, voltage translators, DIP switches, LED dimmer/blinkers, RTCs, bus repeaters/extenders/hubs, and more)	900
Audio unit	Class-D stereo audio amplifiers	40
	Class-AB stereo headphone amplifiers	85
Video unit	RF discretes for tuners	120
Power and power management	GreenChip and STARplug SMPS controller ICs with low standby power	12
	PFC diodes	22
	Power MOSFETs	20
	Backlighting controller ICs	5
ESD protection	Integrated discretes for ESD	120
	ESD protection diodes	120
General-purpose logic	Switches	180
	Digital multiplexers	160
	Translators	40
	Buffers and transceivers	620
	Control and glue logic: Building-block functions, including AND/XOR, Schmitt triggers etc. (LVC, AHC/T, and AUP families)	1700
Small-signal discretes	BISS transistors	160
	Load switches	40
	Matched-pair transistors	30
	Resistor-equipped transistors	320
	MEGA Schottky diodes	80
	Voltage regulators	10

Note: This is only a partial listing. To view our complete portfolio, please visit [www.standardics.nxp.com](http://www.standardics.nxp.com)

# LCD TV address the entire system

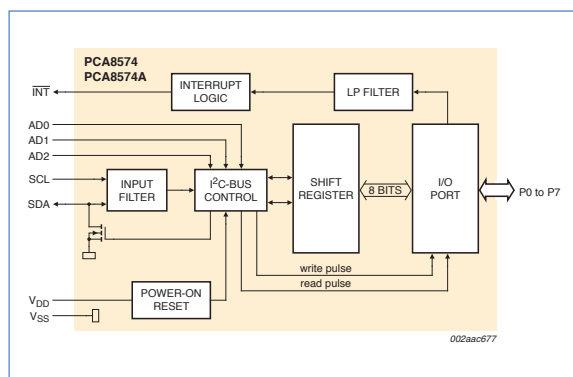


## Interface ICs: I<sup>2</sup>C-bus components for



In the more than 20 years since we first introduced the I<sup>2</sup>C-bus (as Philips Semiconductors), this simple, two-wire protocol has been a key enabling technology for a broad range of successful LCD TV innovations. Our off-the-shelf I<sup>2</sup>C-bus peripherals reduce time-to-market by providing designers with plug-and-play functionality, in both hardware and software, and by increasing design flexibility. As a result, you'll find optimized implementations, such as remote push-buttons, status LEDs, and buffers, for virtually all LCD TV platforms.

## I<sup>2</sup>C-bus GPIO PCA8574

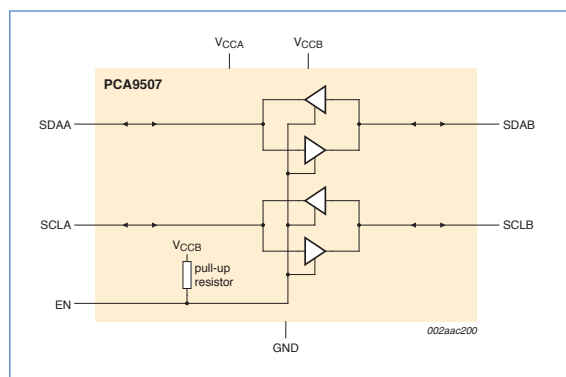


## Key features

- ▶ 400-kHz I<sup>2</sup>C-bus interface
- ▶ 8-bit remote I/O pins that default to inputs at power-up
- ▶ Total package sink capability of 200 mA
- ▶ Active LOW open-drain interrupt output

More information: [www.nxp.com/i2c](http://www.nxp.com/i2c)

## I<sup>2</sup>C-bus device for HDMI PCA9507

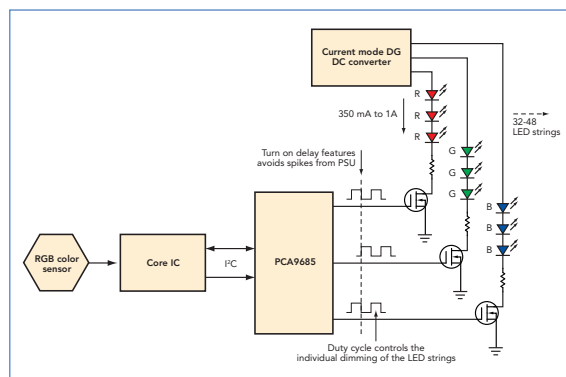


## Key features

- ▶ 400-kHz I<sup>2</sup>C-bus interface
- ▶ Two-channel, bidirectional operation
- ▶ Isolates capacitance: up to 400 pF allowed on TV side and up to 1400 pF on DDC-cable side (18 m) due to rise-time accelerator
- ▶ Voltage-level translation (2.7 to 5.5 V)
- ▶ Optimized for HDMI
- ▶ Active HIGH input for repeater enable

More information: [www.nxp.com/i2c](http://www.nxp.com/i2c)

## I<sup>2</sup>C-bus LED voltage source with 12-bit PWM



## Key features

- ▶ I<sup>2</sup>C-bus interface = Fast-mode Plus
- ▶ SDA = 1 MHz and 30 mA
- ▶ Supply = 2.3 to 5.5 V
- ▶ 4,096-step duty cycle adjustment PWM for each bit
- ▶ PWM frequency = 100 to 1000 Hz
- ▶ External clock option for synchronization and frequency control
- ▶ Staggered ON times reduce current surge
- ▶ Operation of all outputs = 5 V, 25 mA
- ▶ Push-pull outputs enable glueless connection to FET switched-mode regulators

More information: [www.nxp.com/i2c](http://www.nxp.com/i2c)

# system control

Our portfolio includes GPIO expanders, bus expanders, voltage translators, LED blinkers and dimmers, tiny serial ADCs and DACs, buffers, clocks and RTCs, simple LCD display drivers, DIP switches, EEPROMs, RAM, and CBT switches, multiplexers, digital temperature sensors (LM75B), bridge ICs, and more.

# Audio unit: audio amplifiers

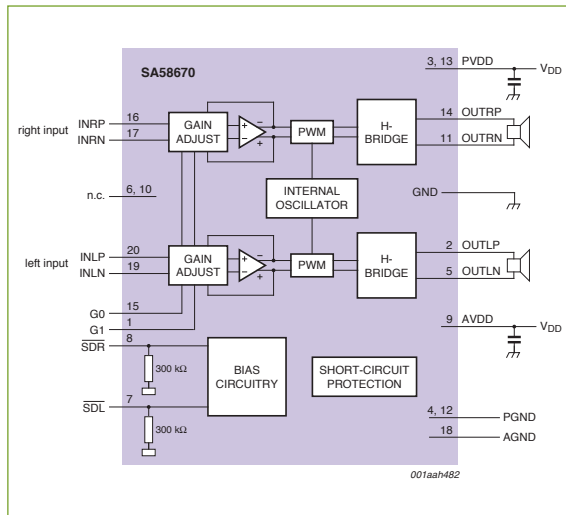


We are a leading provider of affordable, easy-to-use audio “workhorses” that provide better sound quality and reduced component count. For LCD TV, we have flexible options for audio and headphone amplifiers that support wide operating voltages, reduce external components, save space, and lower cost.





### 2.1-W/channel, Class-D, dual-power amplifier SA58670A



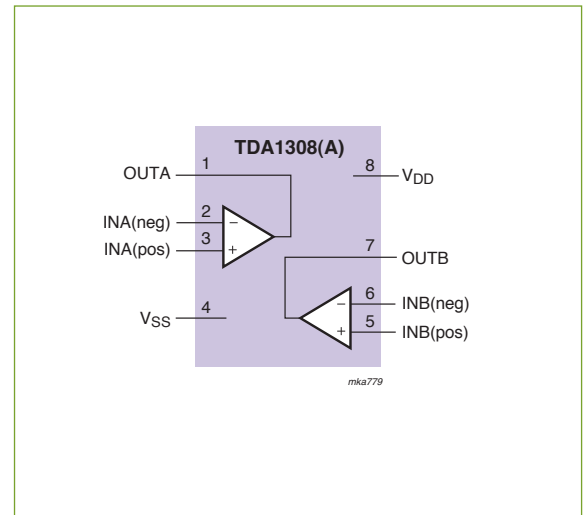
#### Key features

- ▶ 2.1 W per channel in  $4\ \Omega$  at 5 V
- ▶ 1.4 W per channel in  $8\ \Omega$  at 5 V
- ▶ 720 mW per channel into  $8\ \Omega$  at 3.6 V
- ▶ Space and cost savings
- ▶ No output filter required
- ▶ Power supply: 2.5 to 5.5 V
- ▶ Independent shutdown control for each channel
- ▶ High PSSR: 80 dB at 217 Hz
- ▶ Short-circuit and thermal protection
- ▶ Selectable gain: 6, 12, 18, or 24 dB
- ▶ Small (4 x 4 mm) HVQFN20 package

Also recommended: SA58631TK, SA58632BS,  
SA58671UK, SA58637BS

More information: [www.nxp.com/products/audio/  
audio\\_amplifiers/class\\_d/](http://www.nxp.com/products/audio/audio_amplifiers/class_d/)

### Low-voltage headphone amplifier TDA1308AUK



#### Key features

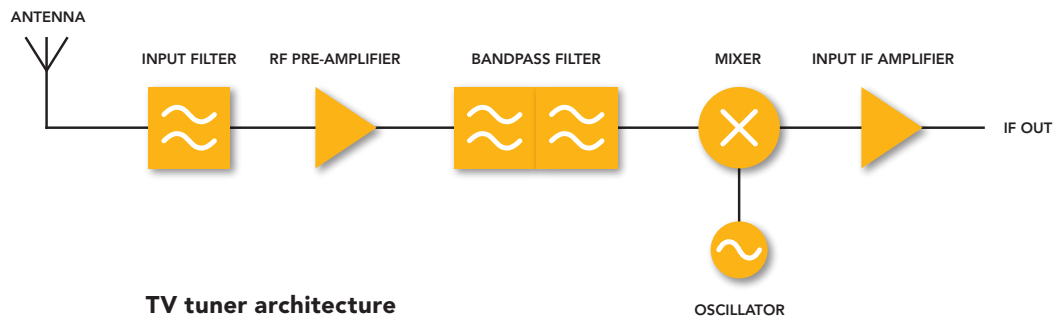
- ▶ Wide temperature range
- ▶ Excellent power-supply ripple rejection
- ▶ High performance: high signal-to-noise ratio, high slew rate, low distortion
- ▶ Ultra-small (655 x 847  $\mu\text{m}$ ) CSP8 package
- ▶ Operates from a single supply (2.4 to 7.0 V) or a dual supply (1.5 to 3.5 V) over a wide temperature range with no switch on/off clicks

Also recommended: TDA1308ATT

More information: [www.nxp.com/products/audio/  
audio\\_amplifiers/class\\_ab/](http://www.nxp.com/products/audio/audio_amplifiers/class_ab/)

Every product in our extensive selection for RF discretes for TV tuners builds on our decades of experience in RF design. We cover every step between the antenna to the IF out, with support for VHF and UHF. You can be confident that you're designing with the very best components, from highly integrated products that combine several functions in a single package, such as dual-gate, dual-RF MOSFETs in SOT368 or SOT666 packages, to optimized components that improve performance, such as RF diodes in packages as small as 1.0 x 0.6 x 0.4 mm.

## Video unit: RF discretes for tuners



**TV tuner architecture**

### Dual-gate MOSFET double amplifier BF1210 for 5-V applications

Manufactured in our advanced poly-silicon IC process, this amplifier ensures excellent performance on cross modulation, especially during gain control, noise, and gain.

### Dual-gate MOSFET double amplifier BF1206F for low-power applications

Housed in a small SOT666 flat-lead package, this is a true low-power device specified for low voltages and low currents. It is ideal for use in applications with a supply voltage of 3 V and a drain current of 4 mA.

### Band-switching diodes for TV tuners

Type	Package	$V_R$ max	$r_D$ at $I_f = 3$ mA	$C_d$ at $V_R = 3$ V
BA792	SOD110	35 V	0.7 $\Omega$ (max)	1.1 pF (max)
BA591	SOD323	35 V	0.7 $\Omega$ (max)	0.9 pF (max)
BA891	SOD523	35 V	0.7 $\Omega$ (max)	0.9 pF (max)
BA277	SOD523	35 V	0.7 $\Omega$ (max)	1.2 pF (max)

More information: [www.nxp.com/products/rf/smallsignal/diodes/](http://www.nxp.com/products/rf/smallsignal/diodes/)

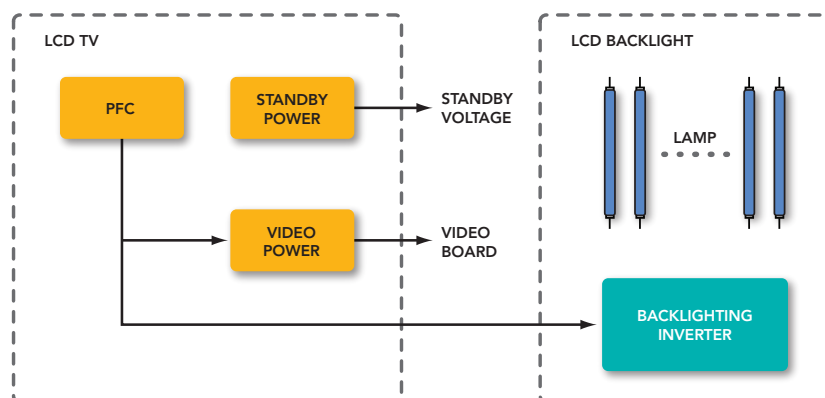


### Recommended products

Function	Product		Package	Type
Input filter	Varicap diode	VHF low	SOD323 SOD523	BB152 BB182
		VHF high	SOD323 SOD523 SOD523	BB153 BB178 BB187
		UHF	SOD323 SOD523	BB149A BB179
RF pre-amplifier	Mosfet	5 V	SOT143 SOT143 SOT143 SOT143 SOT143 SOT143 SOT143	BF904 BF909 BF1201 BF1202 BF1105 BF1211 BF1212
		9 V	SOT143 SOT143	BF1100 BF1109
		2-in-1 5 V	SOT363 SOT363 SOT363 SOT363 SOT363 SOT363 SOT363 SOT666 SOT363	BF1102R BF1203 BF1204 BF1205 BF1205C BF1206 BF1207 BF1208 BF1210
Bandpass filter	Varicap diode	VHF low	SOD323 SOD523	BB152 BB182
		VHF high	SOD323 SOD523 SOD523	BB153 BB178 BB187
		UHF	SOD323 SOD523	BB149A BB179
Oscillator	Varicap diode	VHF low	SOD323 SOD523	BB152 BB182
		VHF high	SOD323 SOD523 SOD523	BB153 BB178 BB187
		UHF	SOD323 SOD523	BB149A BB179
IF amplifier	MMIC	Wideband amplifier	SOT363	BGA2717

# Power and power management

As part of our commitment to sustainability and eco-friendly design, we offer a full range of power-saving technologies that increase efficiency and lower overall cost. For LCD TV, we support the latest trend of using LCD integrated power solutions (LIPS) architectures that provide fully optimized power while reducing costs by as much as 30%.



## LCD TV backlighting controllers

To support backlighting applications in LCD TVs, NXP has a complete portfolio of controllers to drive CCFL and EEFL lamps. The product line-up includes half- and full-bridge controllers, and covers a range of voltages: low (LV = 9 to 24 V), medium (MV = ~60 V), and high (HV = 400 V, from PFC bus).

UBA2072	9 V > V <sub>bridge</sub> > 24 V	LV, full-bridge
UBA2074	400 V > V <sub>bridge</sub> > 24 V	HV (MV), full-bridge, with hard-switching protection
UBA2074A	400 V > V <sub>bridge</sub> > 24 V	MV (HV), full-bridge, without hard-switching protection
UBA2071	V <sub>bridge</sub> = 400 V	HV, half-bridge, with self-supplying configuration
UBA2071A	V <sub>bridge</sub> = 400 V	HV, half-bridge, for use with auxiliary supply
UBA2073	V <sub>bridge</sub> = 400 V	HV, half-bridge, slave driver device for use with UBA2071 in master/slave applications

## SMPS ICs for efficient control of the power supply

Our proven STARplug and GreenChip families provide a range of options for power-supply control. Both families include a full range of protection features that reduce external components and lower overall cost.

### STARplug family

Each highly integrated STARplug controller includes a 650-V MOSFET, so there are fewer external components required, and uses valley switching for increased efficiency and lower EMI. Operating over a wide V<sub>CC</sub> range, STARplug devices deliver output power up to 30 W. They support low-power standby operation with frequency reduction. The STARplug family also integrates an internal error amplifier that enables primary sensing, and has adjustable over-current protection.



### GreenChip family

Now in its third generation, the GreenChip family offers flexibility in choosing a suitable external MOSFET and can deliver output power up to 250 W. Most GreenChip ICs feature valley switching for higher efficiency. High integration reduces the cost of external parts, shrinks the design footprint, lowers placement costs, and shortens design-in time.

### GreenChip IC TEA1750 key features

- ▶ Integrated flyback controller and power-factor controller in one small SO16 package
- ▶ Valley switching for increased efficiency and lower EMI
- ▶ Significantly reduced number of external components
- ▶ Wide  $V_{CC}$  range (no external voltage regulator needed)
- ▶ Integrated detection of mains enable and brown-out protection
- ▶ Integrated high-voltage start-up current source
- ▶ Built-in protection for robust design

### PFC diodes for main power-supply unit

In Continuous Conduction Mode, our diodes offer the lowest  $T_{rr}$  while maintaining an average to best-in-class rating for  $V_F$ . In Discontinuous Mode, they are the best in terms of giving a reasonably low  $T_{rr}$  and low  $V_F$  ratings, to minimize on-state losses.

### Power MOSFETs

We offer a series of MOSFETs for use in bidirectional I<sup>2</sup>C-bus level shifters, support a large portfolio of n-channel devices, and are increasing our support for p-channel devices. Our  $\mu$ TrenchMOS technology delivers a low  $R_{DS(ON)}$  and low capacitance, for reduced power dissipation in a small footprint.

More information: [www.nxp.com/products/power\\_management/](http://www.nxp.com/products/power_management/)

### PFC diodes:

#### Hyperfast for Continuous Current Mode (CCM)

$V_{RRM}$ (V)	$I_{F(AV)}$ (A)	$V_{F(typ)}$ @150 °C (V)	@ $I_F$ (A)	$t_{rr (typ)}$ @25 °C (ns)	SOD59 (TO220AC)	SOD113 (2-pin SOT186A)	SOT404 (D2 PAK)
600	5	1.4	5	19	BYC5-600	BYC5X-600	BYC5B-600
	8	1.4	8		BYC8-600	BYC8X-600	BYC8B-600
	10	1.4	10		BYC10-600	BYC10X-600	BYC10B-600
	15	1.32	15		BYC15-600	BYC15X-600	
	20	1.54	20		BYC20-600	BYC20X-600	



#### Ultrafast for Discontinuous Current Mode (DCM)

$V_{RRM}$ (V)	$I_{F(AV)}$ (A)	$V_{F(typ)}$ @150 °C (V)	@ $I_F$ (A)	$t_{rr (typ)}$ @25 °C (ns)	SOD59 (TO220AC)	SOD113 (2-pin SOT186A)	SOT404 (D2 PAK)
500	9	0.9	8	50	BYV29-500	BYV29X-500	BYV29B-500
	14		15		BYT79-500		
600	9		8		BYV29-600	BYV29X-600	BYV29B-600
	14		15		BYT79-600	BYT79X-600	



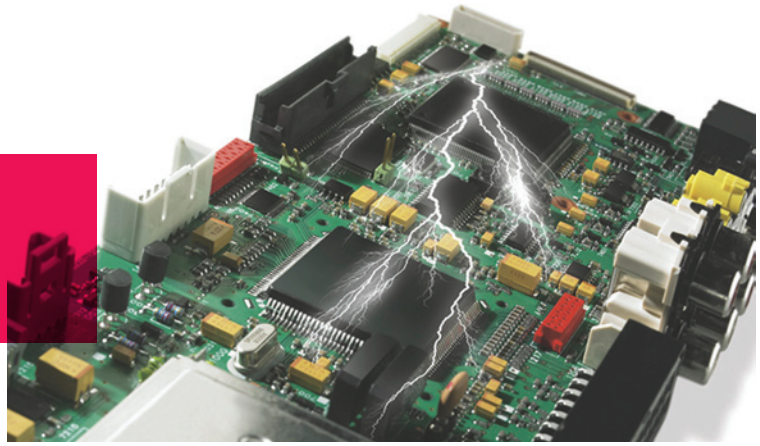


# ESD protection: discrete and integrated

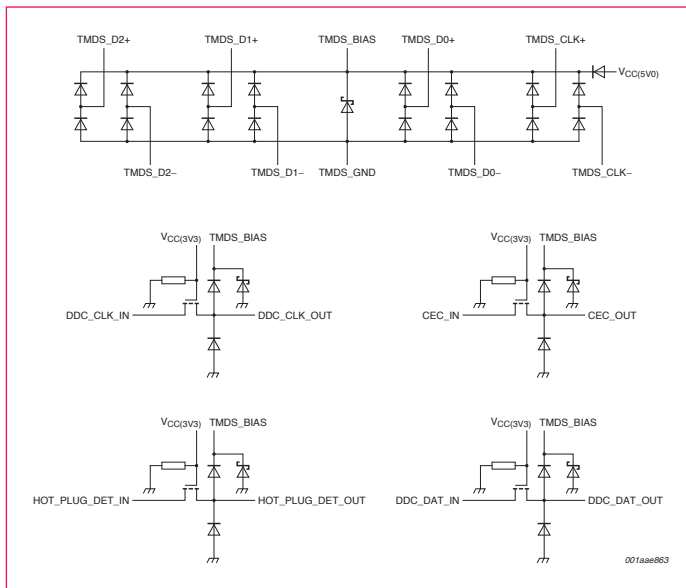
To protect complex, highly integrated circuits from ESD surges at the external interfaces, we provide a broad range of diodes and integrated discretes specially designed to protect, terminate, and filter all the relevant I/O ports. All are compatible with the highest ESD standard required for all CE equipment (IEC 61000-4-2, level 4, 8 kV for contact charge, and 15 kV for air discharge), and all let you improve reliability while reducing component count and lowering "cost of non-quality". Options that support ultra-high protection, up to 30 kV, are also available. Plus, since we're key members of the USB Implementers Forum, we offer various protection solutions that filter and terminate the USB interfaces of an LCD TV.



NXP type number	SCART	Digital video	USB	Audio/video	Universal card reader	Analog video	LVDS	HDMI
PRTR5V0U2X			•					
PRTR5V0U2AX			•					
PRTR5V0U4D		•	•	•			•	•
IP4221CZ6			•					
PRTR5V0U8S	•	•					•	•
PESD5V0L4UW				•		•		
PESD5V0L5UV	•			•		•		
PESD5V0L7BAS	•							
IP4051CX11/LF					•			
IP4052CX20/LF					•			
IP4352CX24/LF								
IP4067CX9/LF					•			
IP4776CZ38								•
IP4854CX16/LF					•			
IP4853CX24/LF					•			
IP4778CZ38								•
IP4280CZ10								•
IP4772CZ16						•		
IP4223CZ6						•		
IP9019CZ6			•					



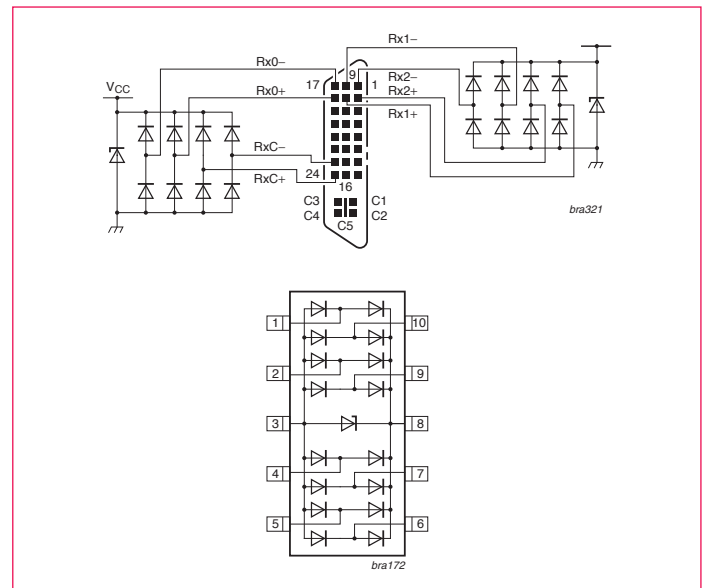
## ESD protection for TMDS interfaces IP4776CZ38



### Key features

- ▶ All TMDS lines with ESD protection of  $\pm 8$  kV, IEC61000-4-2, level 4
- ▶ Bidirectional level-shifting N-channel FETs provided for DDC channels
- ▶ TMDS lines with capacitance matching of  $\leq 0.05$  pF between TMDS pairs
- ▶ Industry's smallest line capacitance in Si with 8-kV ESD protection
- ▶ Line capacitance for tMDS channels of 0.7 pF in full compliance with HDMI 1.3, and with back-drive protection
- ▶ Full compliance with HDMI 1.2, HDMI 1.3A, and HDMI 1.3b
- ▶ Full NXP support with board layout (including Gerber file), plus HDMI pre-compliant tests
- ▶ Dark Green and RoHS-compliant

## ESD protection for DVI/HDMI interfaces PRTR5V0U8S and PRTR5V0U4D



### Key features

- ▶ 8-kV contact ESD protection
- ▶ 4-, 6-, and 8-channel rail-to-rail
- ▶ Ultra-low capacitance (1.0 pF)
- ▶ PRTR5V0U8S available in TSSOP10 package
- ▶ PRTR5V0U4D available in SOT457 package

More information: [www.nxp.com/products/discretes/esd\\_emi\\_filtering/](http://www.nxp.com/products/discretes/esd_emi_filtering/)



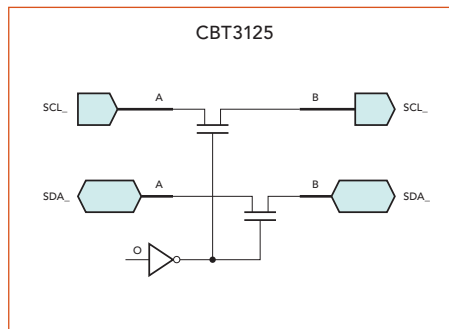
## General-purpose logic and small-signal discretes

As the second-largest supplier of general-purpose logic and small signal-discretes, we offer one of the largest production capacities in the world. Our portfolio gives you the broadest range of options, so you get choice as well as the ability to support peak delivery. We are a recognized innovator in new technologies, including BISS transistors and AUP logic, and continually expand our packaging portfolio with new formats, such as leadless packages (SOT883/SOT891).

# General-purpose logic

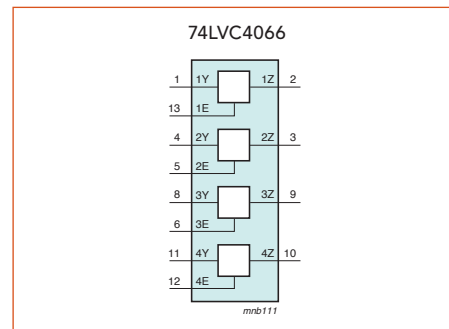
We are one of the world's largest suppliers of general-purpose logic. We have our own production facilities, so we can support high demands and quick ramp-ups, and back our manufacturing with a global distribution network that supports customers on every continent. We regularly expand our portfolio, with more than 350 innovative new products introduced each year, and have a full line of cost-effective, leadless packages that make designs increasingly robust, smaller, and more energy efficient.

## Switches



### Key features

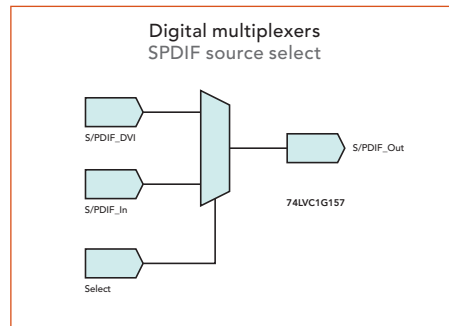
- ▶ Low ON resistance ( $R_{ON} = 5 \Omega$  typ)
- ▶ Low switch capacitance ( $C_{ON} = 7 \text{ pF}$  typ)
- ▶ Fast switching times ( $t_{en} = 5 \text{ ns}$  max)
- ▶ Low propagation delay ( $t_{pd} = 0.25 \text{ ns}$  max)



### Key features

- ▶ Low ON resistance:
  - 7.5  $\Omega$  typ at  $V_{CC} = 2.7 \text{ V}$
  - 6.5  $\Omega$  typ at  $V_{CC} = 3.3 \text{ V}$
  - 6.0  $\Omega$  typ at  $V_{CC} = 5 \text{ V}$
- ▶ Bandwidth = 215 MHz (typ)
- ▶ Wide supply voltage range (1.65 to 5.5 V)
- ▶ Crosstalk: -60 dB typ

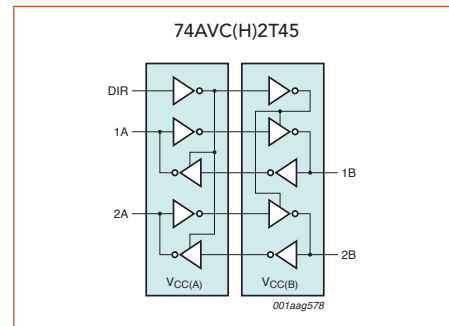
## Digital multiplexers



### Key features

- ▶ Digital audio source select
- ▶ Low propagation delay ( $t_{pd} = 4.0 \text{ ns}$  max)
- ▶ Low power CMOS
- ▶ Wide supply voltage (1.65 V to 3.6 V)
- ▶ Small footprint PicoGate and MicroPak packages

## Translators

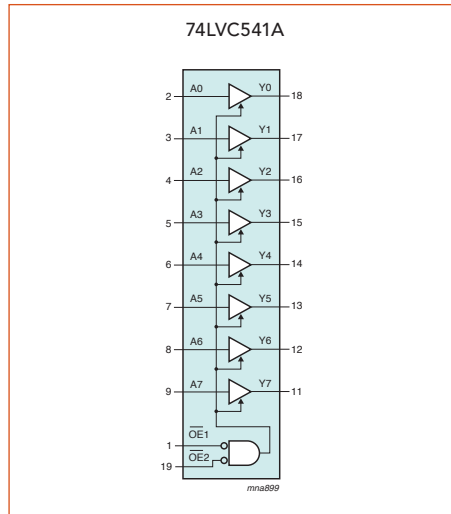


### Key features

- ▶ Bidirectional level translation between 1.1 and 3.6 V
- ▶ Low-power CMOS
- ▶ Suspend mode
- ▶ 8-kV HBM ESD protection (JESD22-A114E class 3B)
- ▶ PicoGate and MicroPak packages

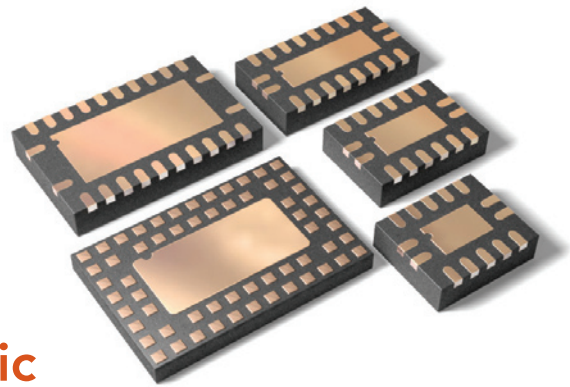
# Buffers and transceivers

Our portfolio includes devices used in CI-slot subscriber-card (POD) interfaces (PCMCIA), transceivers, and memory and data buffers.



## Key features

- ▶ Octal buffer/line driver (2.7 to 3.6 V) with I/O tolerant to 5 V (3-state)
- ▶ Low-power CMOS
- ▶ Dual enable pins
- ▶ Flow-through architecture
- ▶ TSSOP and DQFN packages



# Control and glue logic

We offer state-of-the-art solutions, with options in miniature packaging (including PicoGate and MicroPak), that significantly reduce board space and simplify PCB routing.

LVC	AHC/T	AUP (future glue)
<ul style="list-style-type: none"> <li>▶ 4 ns performance</li> <li>▶ <math>\pm 24</math> mA drive</li> <li>▶ 20 <math>\mu</math>A standby current</li> <li>▶ <math>V_{CC} = 1.2</math> to 3.6 V</li> <li>▶ <math>T_{AMB} = -40</math> to 125 <math>^{\circ}</math>C</li> <li>▶ 5 V-tolerant I/Os</li> <li>▶ Live insertion</li> <li>▶ Bus-hold option</li> <li>▶ Termination-resistor option</li> <li>▶ PicoGate, MicroPak, and DQFN packages</li> </ul>	<ul style="list-style-type: none"> <li>▶ 5 ns performance</li> <li>▶ <math>\pm 8</math> mA drive</li> <li>▶ 40 <math>\mu</math>A standby current</li> <li>▶ <math>V_{CC} = 2.0</math> to 6.0 V</li> <li>▶ <math>T_{AMB} = -40</math> to 125 <math>^{\circ}</math>C</li> <li>▶ PicoGate and MicroPak packages</li> </ul>	<ul style="list-style-type: none"> <li>▶ 3.4 ns performance</li> <li>▶ <math>\pm 4</math> mA drive</li> <li>▶ 0.9 <math>\mu</math>A standby current</li> <li>▶ <math>C_{PD} &lt; 4.5</math> pF</li> <li>▶ <math>&lt; 0.5</math> <math>\mu</math>A leakage current</li> <li>▶ <math>V_{CC} = 0.8</math> to 3.6 V</li> <li>▶ <math>T_{AMB} = -40</math> to 125 <math>^{\circ}</math>C</li> <li>▶ Over-voltage tolerant</li> <li>▶ Live insertion</li> <li>▶ <math>I_{OFF}</math> feature</li> <li>▶ PicoGate and MicroPak packages</li> </ul>

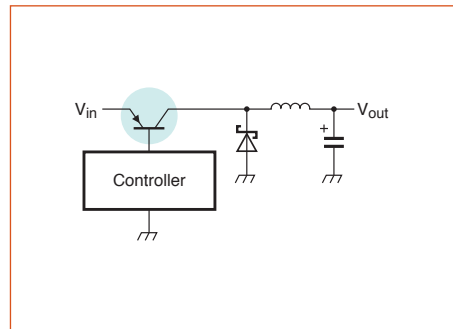
More information: [www.standardics.nxp.com/logic/](http://www.standardics.nxp.com/logic/)



# Small-signal discretes

Our extensive portfolio of small-signal bipolar transistors covers a wide range of functionality, from Darlington and switching devices right up to the latest developments in Resistor Equipped Transistors (RETs) and low  $V_{CEsat}$  (BISS) transistors. We are always expanding our portfolio, with new levels of integration, smaller packaging, and improved performance.

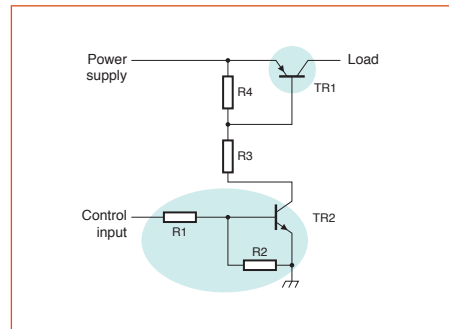
## BISS transistors



### Key features

- ▶ Low saturation voltage ( $V_{CEsat} = 334 \text{ mV}$  at 5 A)
- ▶ High collector current (SOT223:  $I_{c(max)} = 5 \text{ A}$ ; SOT666:  $I_{c(max)} = 2 \text{ A}$ ; SOT883:  $I_{c(max)} = 0.5 \text{ A}$ )
- ▶ Reduced board space via smaller packages

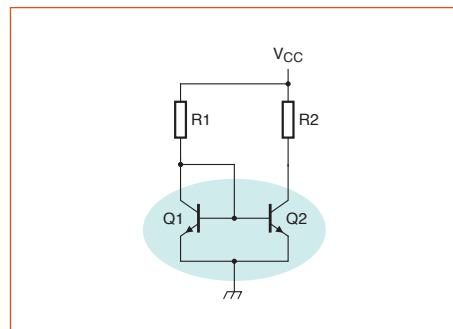
## Load switches



### Key features

- ▶ High performance at a low price
- ▶ Large load currents driven by only a fraction of a milliampere
- ▶ Lowest losses in the pass transistor via PNP-BISS technology
- ▶ Ready-to-use, integrated solution saves time
- ▶ Replaces expensive P-MOSFETs

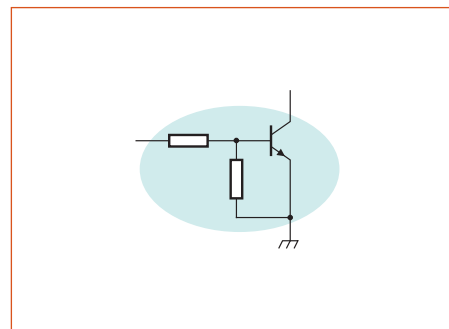
## Matched-pair transistors



### Key features

- ▶ High performance at a low price

## Resistor-equipped transistors



### Key features

- ▶ 500- and 800-mA RETs (PDTx and PBRx series)
- ▶ Best-in-class solutions for higher currents (up to 800 mA)
- ▶ Many resistor combinations available

## MEGA Schottky diodes

An extensive family of high-performance diodes in small packages.

## Voltage regulators

High integration, combining the transistor and the Zener diode, provides low-cost operation.

More information: [www.nxp.com/products/discretes/bipolar\\_transistors/](http://www.nxp.com/products/discretes/bipolar_transistors/)



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