Texas Instruments

Technology for Innovators™

Notebook Computer Solutions Guide

Amplifiers, Data Converters, Interface, Logic, Power Management, Temperature Sensors

4Q 2006

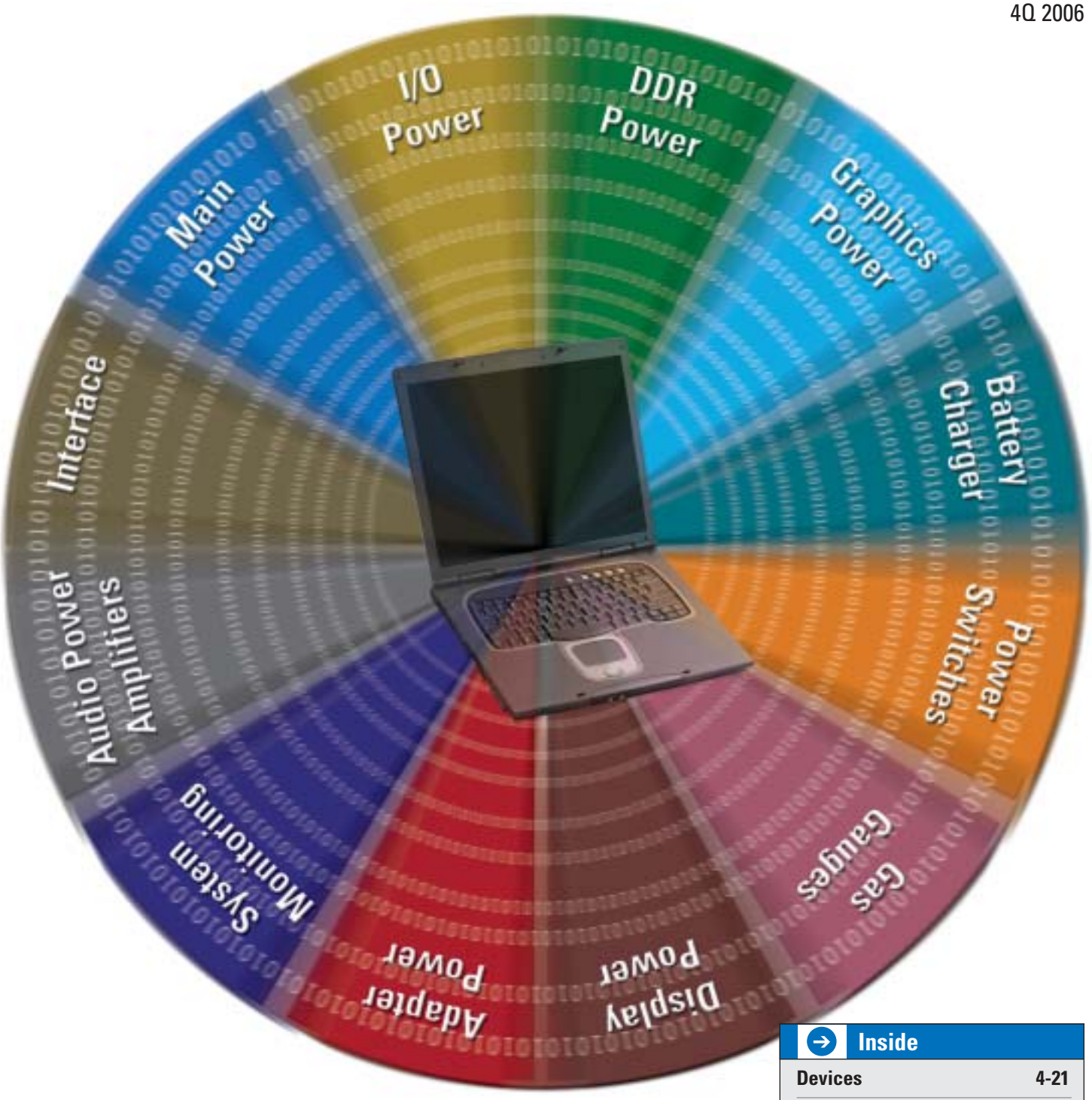
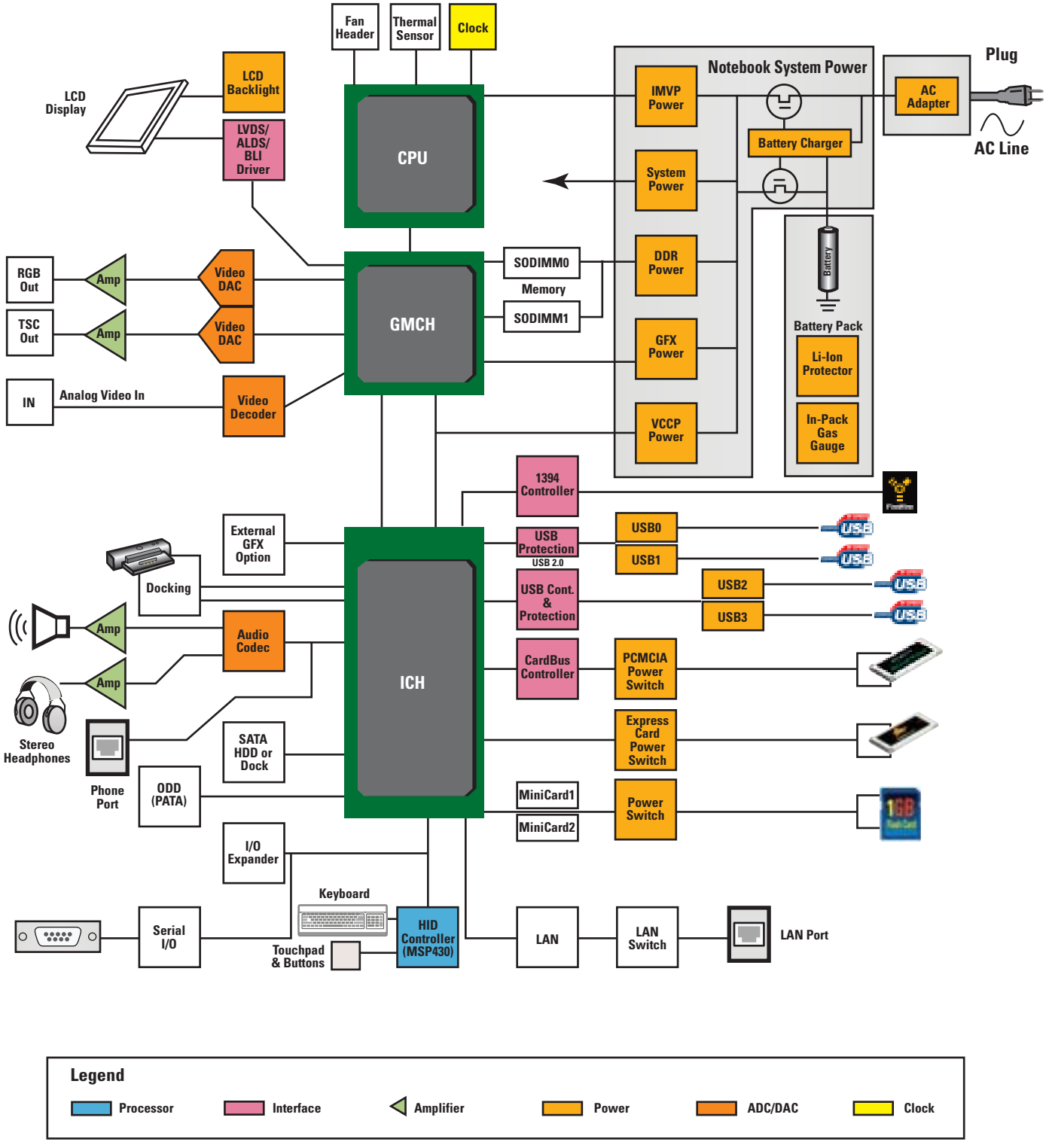


Table of Contents


Fan Header
Thermal Sensor
Clock
LCD Display
LCD Backlight
LVDS/ ALDS/ BLI Driver
CPU
Notebook System Power
IMVP Power
System Power
DDR Power
GFX Power
VCCP Power
Battery Charger
AC Adapter
Plug
AC Line
Battery
Battery Pack
Li-Ion Protector
In-Pack Gas Gauge
RGB Out
TSC Out
Amp
Video DAC
GMCH
SODIMM0
Memory
SODIMM1
IN
Analog Video In
Video Decoder
1394 Controller
External GFX Option
USB Protection
USB 2.0
USB Cont. & Protection
USB0
USB1
USB2
USB3
Docking
Amp
Audio Codec
ICH
CardBus Controller
PCMCIA Power Switch
Express Card Power Switch
Stereo Headphones
Phone Port
SATA HDD or Dock
ODD (PATA)
MiniCard1
MiniCard2
Power Switch
I/O Expander
Keyboard
Touchpad & Buttons
HID Controller (MSP430)
Serial I/O
LAN
LAN Switch
LAN Port
Legend
Processor
Interface
Amplifier
Power
ADC/DAC
Clock

Complete 5-Output Power Solution

TPS51120

www.ti.com/sc/device/TPS51120

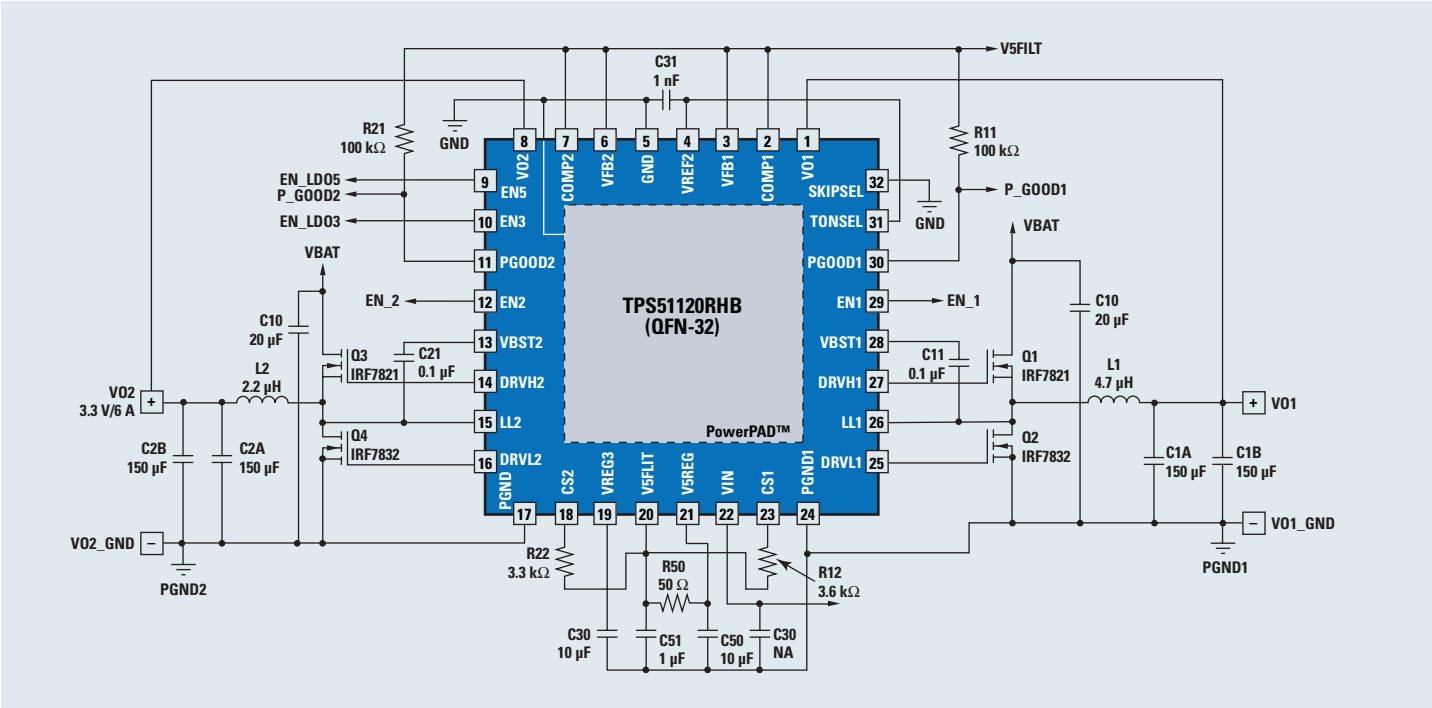
The TPS51120 is a complete five-output main power solution for the notebook computer. Two outputs are high-efficiency DC/DC controllers designed to provide both the 5-V and 3.3-V main switching power rails. These switchers have a pseudo-fixed frequency and adaptive on-time control. The TPS51120 offers two control schemes, D-CAP™ mode and current mode. D-CAP mode is the simplest, allows for the fastest transient and does not require any loop compensation. Current mode requires simple loop compensation and allows for a ceramic-output-capacitor design. In addition, the TPS51120 has two LDO outputs, each set to 5 V and 3.3 V, that are capable of supporting 100-mA loads. These LDOs are used during startup and offer a glitch-free switch-over after the 5-V and 3.3-V switchers have powered up. The fifth output, a 2-V reference capable of supporting 50 µA is commonly used as an accurate reference within the notebook computer. In order to ensure optimal ease of use, the TPS51120 is equipped with an independent Power Good signal for each switcher and separate Enable signals for each switcher and LDOs. This total solution is housed in a small 5 x 5-mm QFN-32 package.

Key Features

- Integrated 5 outputs
- Selectable D-CAP™ mode or current mode
- Selectable temperature compensated $R_{DS(on)}$/resistor OCP
- Fixed PWM or auto-skip modes of operation
- Fixed-value soft-start or externally adjustable
- Fully integrated soft-off
- Independent Enables for switchers and LDOs
- Independent Power Good signals
- Integrated boost diodes
- 4.5-V to 28-V input voltage range
- Packaging: 5 x 5-mm QFN-32

Benefits

- Complete main power solution
- Supports <100-ns transient response and ceramic output capacitors
- Flexible OCP optimized for lossless or accurate sensing
- Optimized for high light-load efficiency
- Optimized for power sequencing and ease of use
- Each switching rail can be independently monitored
- Supports 5-, 12- and 19-V inputs
- Package optimized for small solution size



TPS51120 typical application diagram.

Alternative Main Power Solutions

Device	Key Specifications	URL Link
TPS51020	TSSOP-30 package, 2-switcher outputs, 5-V LDO, 10-V ref, fixed-frequency voltage mode	www.ti.com/sc/device/**TPS51020**
TPS5130	TQFP-48 package, 3-switcher outputs, 5-V/3.3-V LDOs, LDO controller, fixed-frequency voltage mode	www.ti.com/sc/device/**TPS5130**

Optimized Power Solution for System I/O

TPS51124

www.ti.com/sc/device/TPS51124

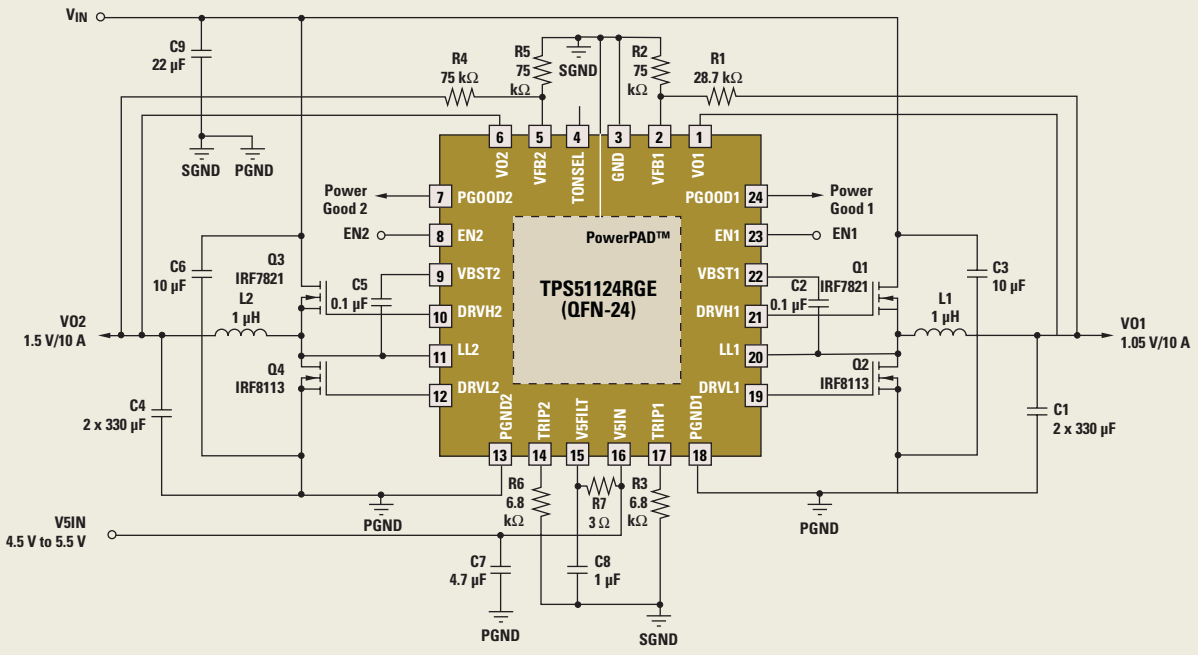
The TPS51124 is a dual DC/DC controller optimized for notebook computers. The two outputs are high-efficiency, adjustable DC/DC controllers designed to provide the I/O power rails. These switchers have a pseudo-fixed frequency and adaptive on-time control. The TPS51124 has been optimized for size and ease of use, offering a solution that is very easy to use without the burden of adding extra external components. This optimization is achieved with D-CAP™ mode, the simplest control scheme which allows for the fastest transient and does not require any loop compensation. In addition, the soft-start times for each switcher are integrated, optimization is achieved by integrating the soft-start times, supporting low-side $R_{DS(on)}$ current sensing only (OCP), integrating both switcher boost diodes and a part which is always with a skip mode option for the highest efficiency. The TPS51124 is also equipped with separate Power Good and Enable pins for each switcher. This optimized solution is housed in a small 4 x 4-mm QFN-24 package.

Key Features

- Optimized dual output
- Fixed D-CAP™ mode
- Pseudo-fixed frequency with adaptive on-time control
- Low-side $R_{DS(on)}$ lossless current sensing
- Fixed internal soft-start time and skip-mode operation
- Fully integrated soft-off
- Integrated boost diodes and independent Power Good signals
- 3-V to 28-V input voltage range
- Packaging: 4 x 4-mm QFN-24

Benefits

- Minimal external components
- Supports <100-ns transient response
- Optimized for best performance and small solution size
- Lossless OCP saves external resistor
- Optimized for high light-load efficiency
- Optimized for power sequencing
- Very wide input voltage range: supports 3.3-, 5-, 12- and 19-V inputs
- Package optimized for small solution size



TPS51124 typical application diagram.

Alternative I/O Power Solutions

Device	Key Specifications	URL Link
TPS51117	QFN-14 package, 1-switcher output, pseudo-fixed frequency D-CAP™ mode	www.ti.com/sc/device/**TPS51117**
TPS5130	TQFP-48 package , 3-switcher outputs, 5-V /3.3-V LDOs, LDO controller, fixed-frequency voltage mode	www.ti.com/sc/device/**TPS5130**
TPS5110	TSSOP-24 package, 1-switcher output, LDO controller, fixed-frequency voltage mode	www.ti.com/sc/device/**TPS5110**

Complete Power Solution for V_{DDQ}, V_{TT} and V_{REF}

TPS51116

www.ti.com/sc/device/TPS51116

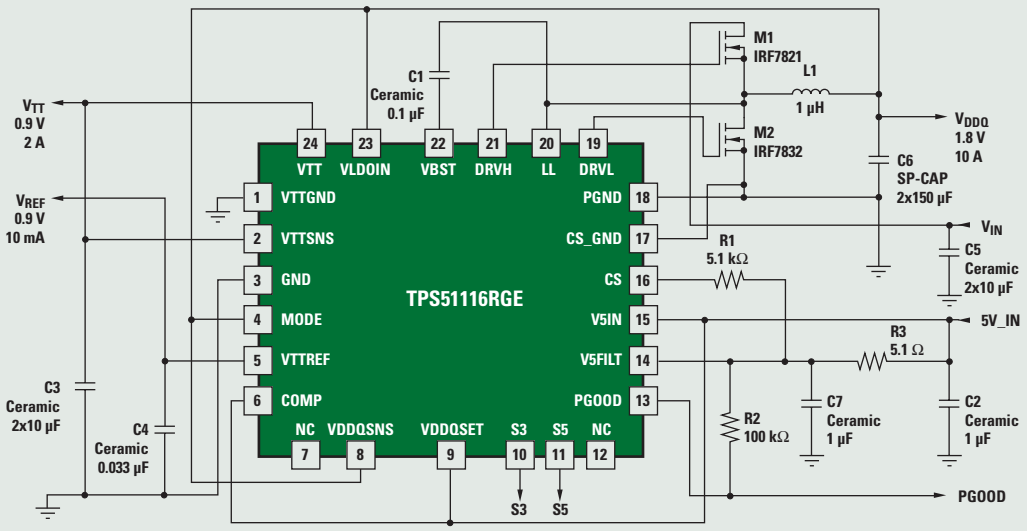
The TPS51116 is a complete DDR power solution. The switcher is designed to provide a high-efficiency output for the V_{DDQ} power rail and has a pseudo-fixed frequency and adaptive on-time control. The TPS51116 offers two control schemes, D-CAP™ mode and current mode. D-CAP mode is the simplest, allows for the fastest transient and does not require any loop compensation. Current mode requires simple loop compensation and allows for a ceramic-output-capacitor design. TPS51116 integrates a high-performance LDO that provides power for the V_{TT} rail. The input to the LDO can be changed to optimize total power dissipation and is capable of sinking/sourcing 3 A. Also integrated is the buffered reference power rail for V_{REF}. This output is capable of supporting a full 10-mA load. The TPS51116 integrates the complete S3 and S4/S5-state control. Simply connecting these pins to the S3 and S4/S5 signals allows for high-Z in S3 and soft-start off in both S4 and S5. This total solution is offered in a small 4 x 4-mm QFN-24 package or an HTSSOP-20 package.

Key Features

- Integrated V_{DDQ}, V_{TT} and V_{REF} rails
- Selectable D-CAP™ mode
- Selectable current mode
- Pseudo-fixed frequency with adaptive on-time
- Selectable temperature compensated $R_{DS(on)}$/resistor OCP
- Fixed PWM or auto-skip modes of operation
- Integrated S3 and S4/S5 states
- Power Good signal
- Integrated boost diode
- Packaging: 4 x 4-mm QFN-24 or HTSSOP-20

Benefits

- Complete DDR power solution
- Supports <100-ns transient response
- Supports ceramic-output-capacitor design
- Optimized for best performance and small solution size
- Flexible OCP optimized for lossless or accurate sensing
- Fixed soft-start value saves output capacitors
- Supports high-Z in S3 and soft-start off in S4/S5
- Power Good monitor for V_{DDQ} output
- Packaged optimized for small solution size



TPS51116 typical application diagram.

Alternative DDR Power Solutions

Device	Key Specifications	URL Link
TPS51020	TSSOP-30 package, 2-switcher (V_{DDQ}/V_{TT}) outputs, fixed-frequency voltage mode	www.ti.com/sc/device/**TPS51020**
TPS51100	MSOP-10 package, 3-A sink/source V_{TT} LDO and V_{REF} output	www.ti.com/sc/device/**TPS51100**

Power Solution for GFX Core

TPS51117

www.ti.com/sc/device/TPS51117

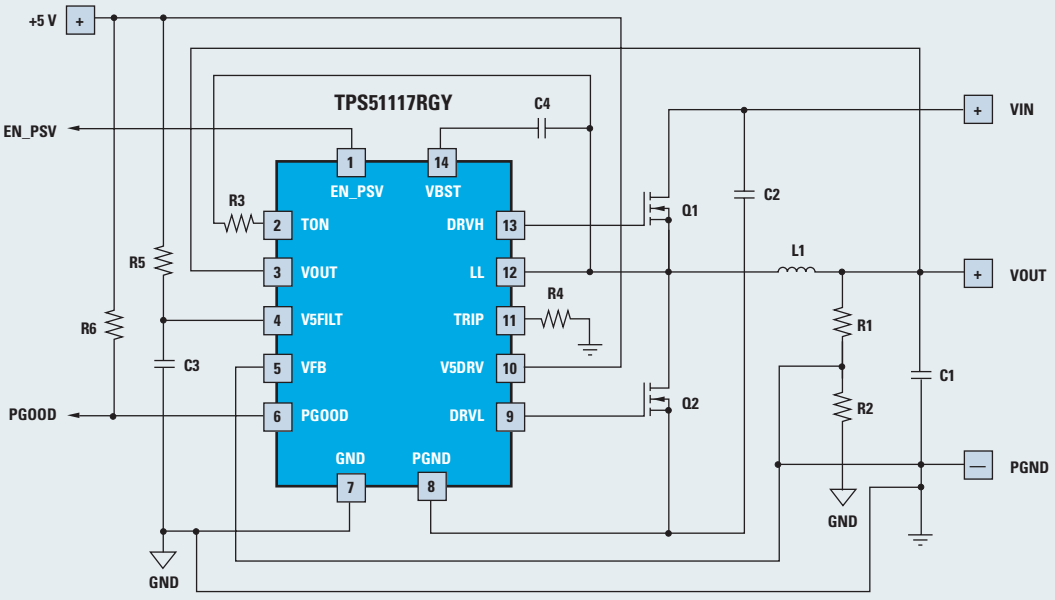
The TPS51117 is a single DC/DC controller that provides power within the notebook computer. The switching output is a high-efficiency, adjustable DC/DC controller optimized to provide power for the graphics core. The switcher has a pseudo-fixed frequency and adaptive on-time control. D-CAP™ mode, the simplest control scheme, allows for the fastest transient demanded by the graphics core and does not require any loop compensation. In addition, the TPS51117 offers both PWM and skip-mode and supports lossless OCP sensing. The TPS51117 is offered in a 3.5 x 4.5-mm QFN-14 or a TSSOP-14 package.

Key Features

- Fixed D-CAP™ mode
- Pseudo-fixed frequency with adaptive on-time
- Selectable temperature-compensated $R_{DS(on)}$ sensing
- Fixed PWM or auto-skip modes of operation
- Fixed internal soft-start time
- Integrated boost diode
- 1.8-V to 28-V input voltage range
- Packaging: 3.5 x 4.5-mm QFN-14 or TSSOP-14

Benefits

- Supports <100-ns transient response
- Optimized for best performance and small solution size
- OCP optimized for lossless current sensing
- Optimized for high light-load efficiency
- Fixed soft-start value saves output capacitors
- Very wide input voltage range: supports 2.5-, 3.3-, 5-, 12- and 19-V inputs
- Package optimized for small solution size



TPS51117 typical application diagram.

Alternative Graphics Power Solutions

Device	Key Specifications	URL Link
TPS5110	TSSOP-24 package, 1-switcher output, LDO controller output, fixed-frequency voltage mode	www.ti.com/sc/device/**TPS5110**

Advanced Synchronous Switch-Mode Charger and System Power Selector

bq24730

www.ti.com/sc/device/bq24730

The bq24730 is a high-efficiency synchronous battery charger with a high level of integration. This device easily interfaces to the system power management microcontroller through a hardware interface.

The Dynamic Power Management (DPM) function modifies the charge current depending on system load conditions, avoiding A/C adapter overload. High-accuracy current sense amplifiers enable accurate measurement of either the charge current or the A/C adapter current.

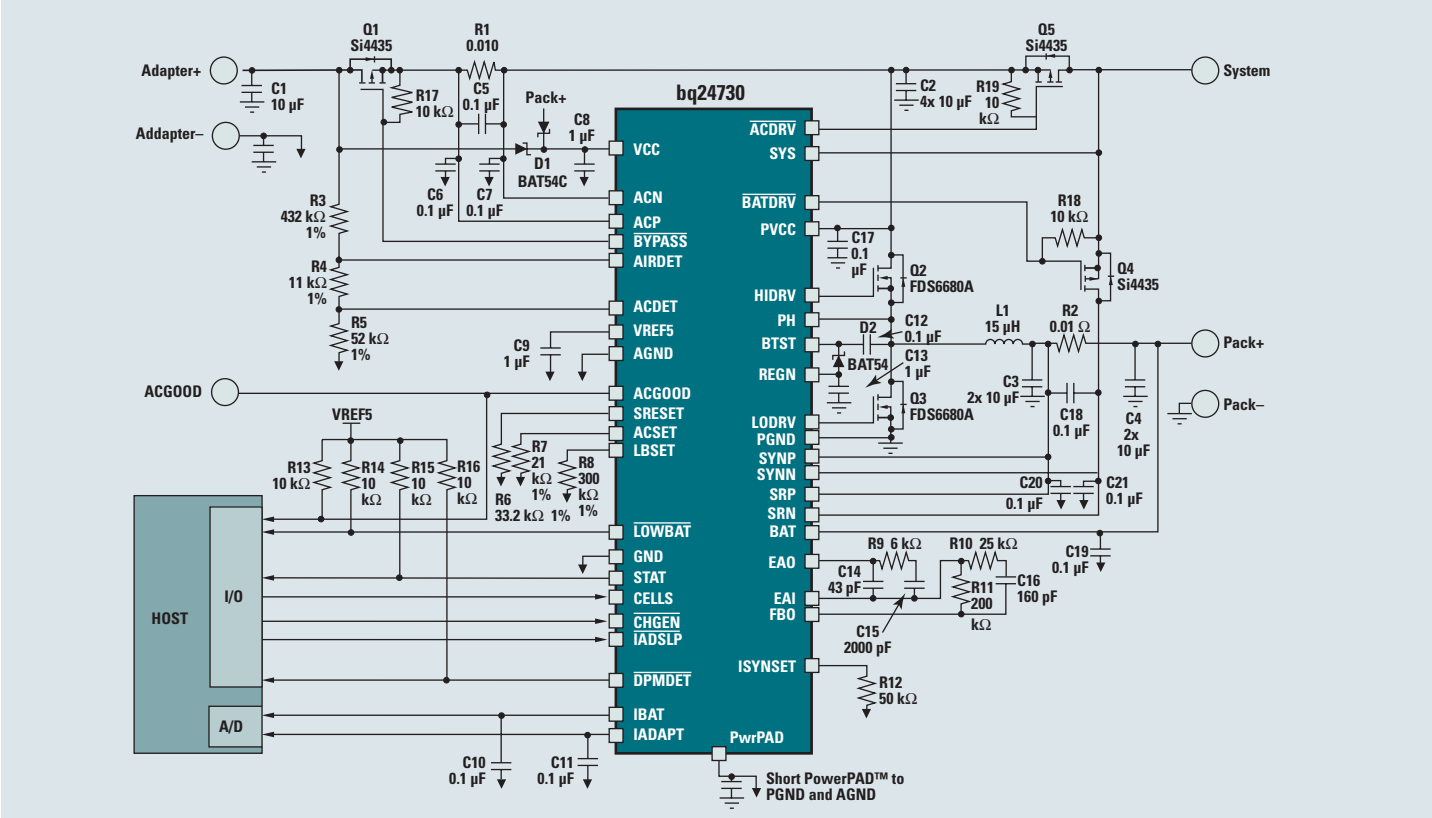
Integrated features such as charger soft-start, charge overcurrent protection and IC temperature monitoring provide a second level of protection in addition to functions that protect the battery pack and system.

Key Features

- NMOS/NMOS synchronous buck converter with fixed 300-kHz frequency and 99.5% max duty cycle
- Programmable battery charge current, and A/C adapter current via resistor
- Regulation accuracy (0°C to 85°C): 0.4% charge voltage/4% charge current/4% adapter current
- Integrated charger with 2% accuracy and A/C adapter with 20x current amplifier output (0°C to 125°C)
- Battery/adapter to system power selector
- Dynamic Power Management
- Overcurrent protection, overvoltage protection, soft-start, reverse-discharge protection, thermal shutdown
- Packaging: 5 x 7mm QFN-40

Benefits

- High efficiency
- High accuracy
- Maximizes use of input power
- High-level protection of battery pack and system



bq24730 typical application.

Alternative Battery Charger Solutions

Device	Key Specifications	URL Link
bq24721	Synchronous charger and system power selector with SMBus	www.ti.com/sc/device/**bq24721**
bq24703	Charger and system power selector; QFN-28 or TSSOP-24	www.ti.com/sc/device/**bq24703**

USB, Power Distribution and ExpressCard™ Bus Solutions

TPS2062

www.ti.com/sc/device/TPS2062

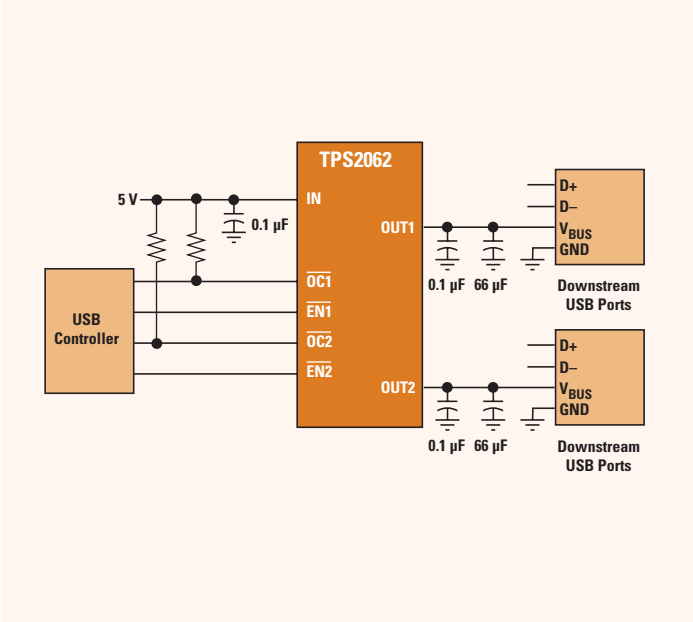
The TPS2062 dual power-distribution switch is designed to set the current limit typically at 1.5 A. When the output load exceeds the current-limit threshold or a short is present, the device limits the output current to a safe level by switching into a constant-current mode.

Key Features

- 70-mΩ high-side MOSFET
- Thermal and short-circuit protection
- Accurate current limit: 1.1 A (min), 1.9 A (max)
- Deglitched fault report (OC)
- No OC glitch during power-up
- UL listed: File No. E169910
- Packaging: SOIC-8, MSOP-8, PowerPAD™

Benefits

- Less voltage drop through switch
- Less heat generated from resistance
- Quick turn-off time for shorts
- Logic levels match most controllers



TPS2062 functional block diagram.

TPS2231

www.ti.com/sc/device/TPS2231

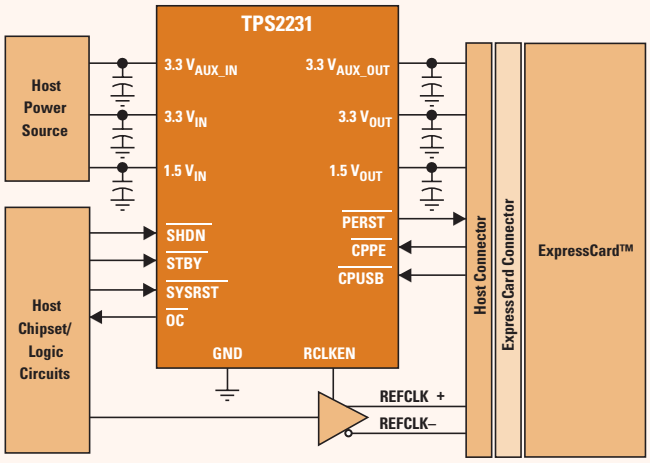
The TPS2231 single ExpressCard power-interface switch provides the total power-management solution required by the ExpressCard specification. The TPS2231 power-interface switch distributes 3.3 V_{AUX} and 1.5 V to the ExpressCard socket. Each voltage rail is protected with integrated current-limiting circuitry.

Key Features

- Fully compliant with the ExpressCard standard
- Fully satisfies the ExpressCard implementation guidelines
- Provides 3.3 V, 3.3 V_{AUX} and 1.5 V to the ExpressCard
- Each voltage output has independent current limit
- Uses "card-present" lines on the connector to enable the delivered voltages
- Integrated card present pull-up resistors
- Packaging: TSSOP-20, HTSSOP-24, QFN-20 PowerPAD™

Benefits

- Fully integrated power monitor and $\overline{\text{PERST}}$
- Low $R_{DS(on)}$ allows min voltage drop



Single slot ExpressCard™.

Alternative Power Switch Solutions

Device	Key Specifications	URL Link
TPS2041B	Single 1.0-A typical current limit USB	www.ti.com/sc/device/**TPS2041B**
TPS2061	Single 1.5-A typical current limit USB	www.ti.com/sc/device/**TPS2061**
TPS2060	Dual 2.1-A typical current limit USB	www.ti.com/sc/device/**TPS2060**
TPS2236	Dual ExpressCard™ power switch	www.ti.com/sc/device/**TPS2236**
TPS2211A	Single switch for parallel PCMCIA controllers	www.ti.com/sc/device/**TPS2211A**
TPS2220B	Single switch for serial PCMCIA controllers	www.ti.com/sc/device/**TPS2220B**

5-Channel Differential 10:20 Multiplexer Switch

TS3DV520

www.ti.com/sc/device/TS3DV520

The TS3DV520 is a 20- to 10-bit multiplexer/demultiplexer digital video switch with a single select (SEL) input that controls the data path of the multiplexer/demultiplexer. The device provides five differential channels for digital video signal switching.

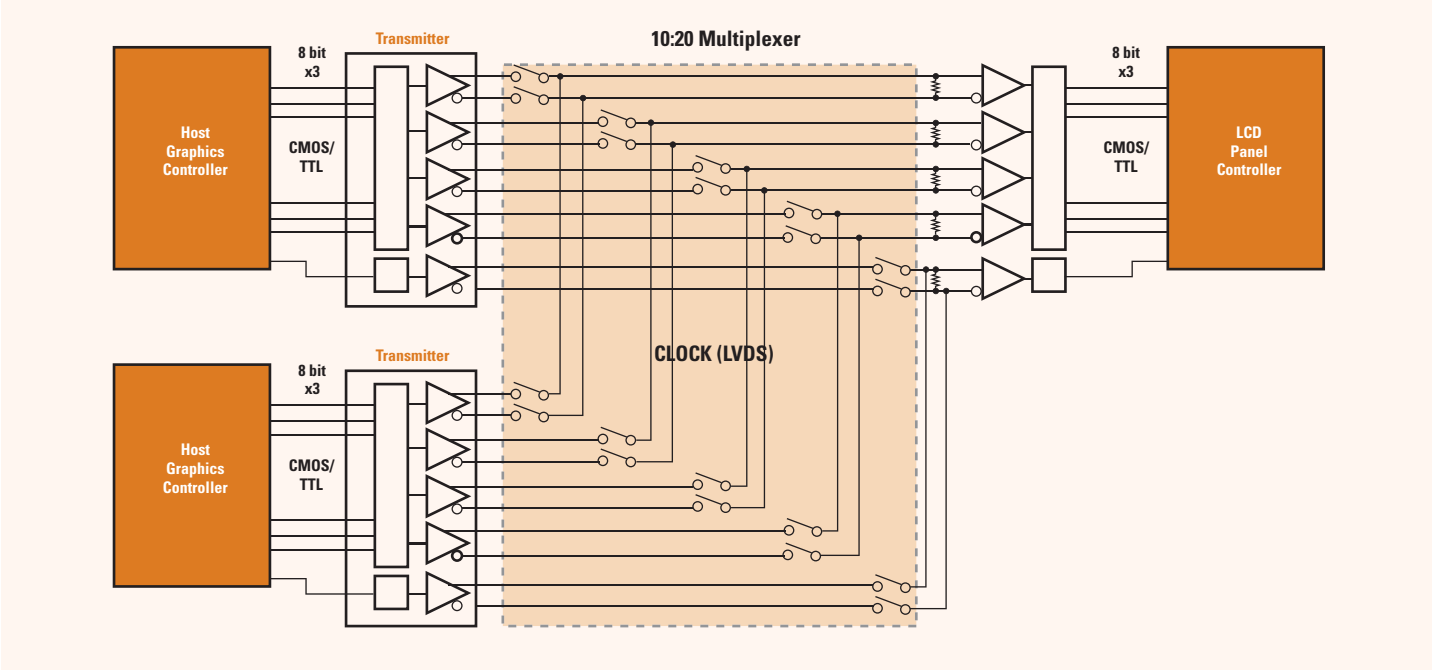
The TS3DV520 provides low and flat ON-state resistance, R_{on}, and an excellent ON-state resistance match. Low input/output capacitance, high bandwidth, low skew and low crosstalk among channels make this device suitable for various digital video applications such as DVI and HDMI.

Key Features

- Compatible with HDMI v1.2a (type A) DVI 1.0 high-speed digital interface
- Wide bandwidth: >1.65 Gbps (bandwidth 2.4 Gbps typ)
- Low crosstalk: –41 dB (typ)
- Low bit-to-bit skew: 0.1 ns (max)
- Low and flat ON-state resistance: R_{on} = 6 Ω (max), $R_{on(flat)}$ = 0.5 Ω (typ)
- Low input/output capacitance: C_{ON} = 7.8 pF (typ)
- Rail-to-rail switching on data I/O ports: 0 to 5 V
- V_{CC} operating range from 3 V to 3.6 V
- I_{OFF} supports operation in partial power-down mode
- Latch-up performance exceeds 100 mA per JESD 78, Class II
- ESD performance tested per JESD 22:
  - 2000-V human-body model (A114-B, Class II)
  - 1000-V charged-device model (C101)
- Packaging: QFN-56

Benefits

- Low R_{on} minimizes signal degradation
- Flat R_{on} allows consistent performance across temperature and input voltage



Dual-port HDMI video multiplexer.

Alternative Power Switch Solutions

Device	Key Specifications	URL Link
TS3DV416	4-channel differential 8:16 mux switch for DVI/HDMI applications	www.ti.com/sc/device/**TS3DV416**
TS3V330	Quad SPDT wide-bandwidth video switch with low on-state resistance	www.ti.com/sc/device/**TS3V330**
TS3V340	Quad SPDT high-bandwidth video switch with low and flat on-state resistance	www.ti.com/sc/device/**TS3V340**
TS5V330	Quad SPDT wide-bandwidth video switch with low on-state resistance	www.ti.com/sc/device/**TS5V330**

16- to 8-Bit SPDT Gigabit LAN Switch

TS3L500

www.ti.com/sc/device/TS3L500

The TS3L500 is a 16- to 8-bit multiplexer/demultiplexer LAN switch with a single select (SEL) input that controls the data path of the multiplexer/demultiplexer. The device provides additional I/Os for switching status-indicating LED signals.

The device provides a low and flat ON-state resistance R_{on}, and an excellent ON-state resistance match. Low input/output capacitance, high bandwidth, low skew and low crosstalk among channels make this device suitable for various LAN applications such as 10/100/1000 Base-T.

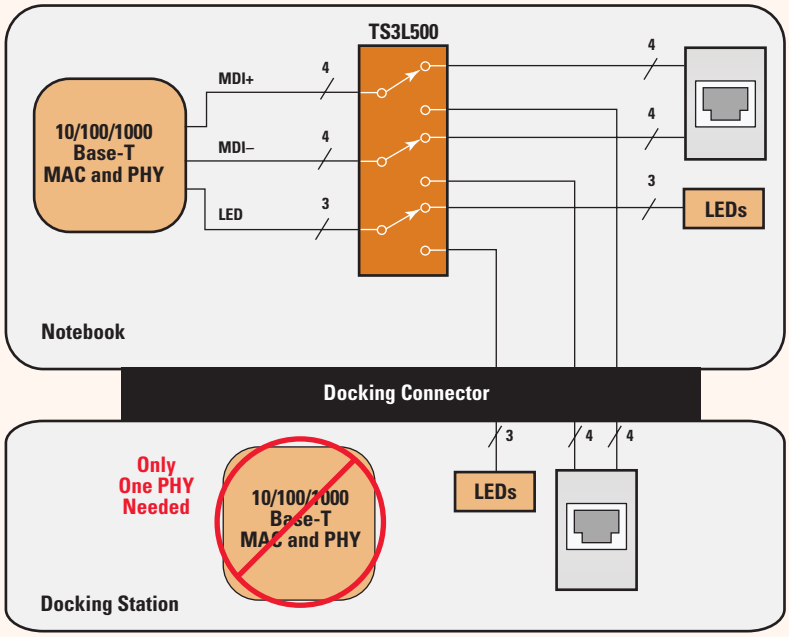
The TS3L500 can be used to replace mechanical relays in LAN applications. It can also be used to route signals from a 10/100 Base-T Ethernet transceiver to the RJ-45 LAN connectors in laptops or in docking stations.

Key Features

- Wide bandwidth: >1100 MHz (typ)
- Low crosstalk: –37 dB (typ)
- Low bit-to-bit skew: 100 ps (max)
- Low and flat ON-state resistance: $R_{on} = 4\ \Omega$ (typ), $R_{on(flat)} = 0.5\ \Omega$ (typ)
- Low input/output capacitance: $C_{ON} = 8$ pF (typ)
- Rail-to-rail switching on data I/O ports: 0 to 5 V
- V_{CC} operating range from 3 V to 3.6 V
- Latch-up performance exceeds 100 mA per JESD 78, Class II
- ESD performance tested per JESD 22:
  - 2000-V human-body model (A114-B, Class II)
  - 1000-V charged-device model (C101)
- Packaging: QFN-56

Benefits

- Supports 10/100/1000 Base-T signaling
- Replaces mechanical relays in LAN applications
- Low I/O capacitance minimizes loading and signal distortion
- Incorporates three extra channels for LED switching



Docking station application.

Alternative Power Switch Solutions

Device	Key Specifications	URL Link
TS3L100	Quad SPDT wide-bandwidth LAN switch with low on-state resistance	www.ti.com/sc/device/**TS3L100**
TS3L110	Quad SPDT wide-bandwidth 10/100 Base-T LAN switch, differential 8:4 multiplexer/demultiplexer	www.ti.com/sc/device/**TS3L110**
TS3L301	16-bit to 8-bit SPDT gigabit LAN switch with low and flat on-state resistance	www.ti.com/sc/device/**TS3L301**
TS5L100	Quad SPDT wide-bandwidth LAN switch with low on-state resistance	www.ti.com/sc/device/**TS5L100**

SBS 1.1 Compliant Battery Gas Gauge

bq20z90

www.ti.com/sc/device/bq20z90

The bq20z70 through bq20z90 family of devices features the industry's first dynamic, self-learning, gas gauging algorithm, Impedance Track™. This new algorithm enables 99% accurate reporting of remaining battery-pack capacity under varying load and temperature conditions.

This high-accuracy reporting allows the full chemical capacity of a battery pack to be used, enabling application in smaller form factors and with longer run times.

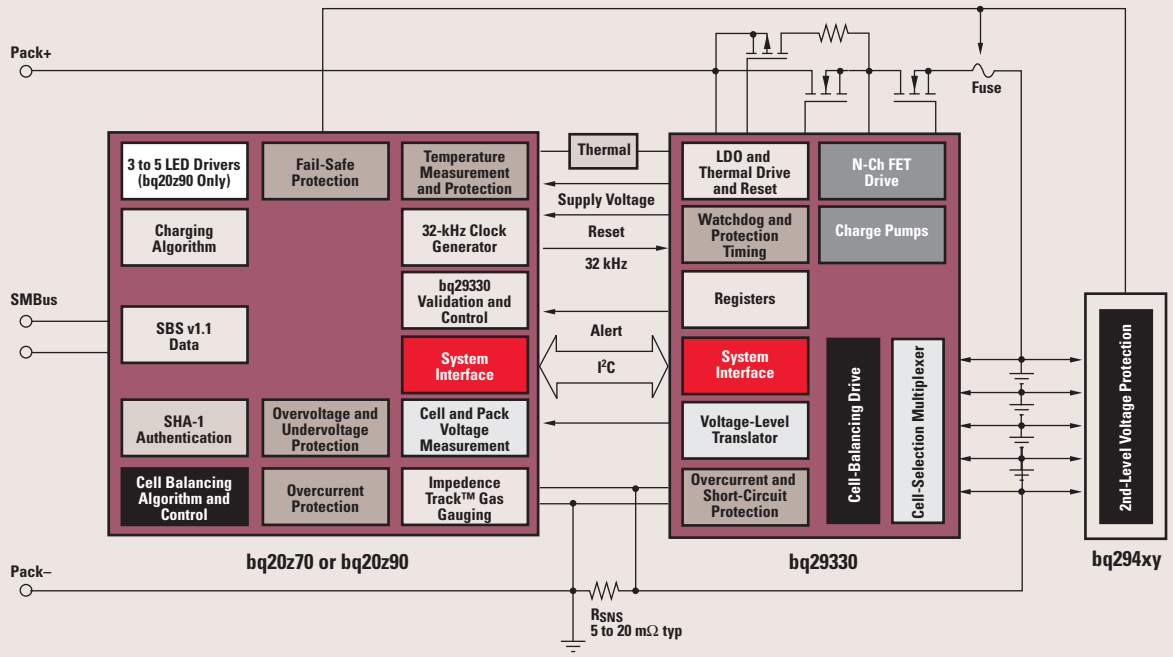
Impedance Track removes in learning-cycle requirements and permits a smaller sense resistor to be used further extending run time and accuracy.

Key Features

- Patented Impedance Track™ gas gauge algorithm
- Two-wire SMBus v1.1 interface
- Full array of programmable voltage-current and temperature-protection features
- Optional pulse-charging feature for improved charge times
- Supports SHA-1 authentication
- Improved, fully integrated cell balancing
- Packaging: SM8-30

Benefits

- Self-learning dynamic algorithm allows for 99% accurate reporting of battery capacity independently from cell age, environment or user profile
- The removed full-charge/discharge learning cycle enables smaller sense resistors
- Self-discharge is now measured instead of estimated



Full protection and reporting battery pack electronics for 2-4 series cell applications.

Alternative Gas Gauge Solutions

Device	Key Specifications	URL Link
bq20z70	TSSOP-20 package, Li-ion protection, cell balancing, charging algorithm; self-calibrating coloumb counter with <0.65 nVh resolution and an offset error of <1 µV enables better than 99% reporting accuracy with bq29330	www.ti.com/sc/device/**bq20z70**
bq20z80-v102	TSSOP-38 package, Li-ion protection, cell balancing, charging algorithm; self-calibrating coloumb counter with <0.65 nVh resolution and an offset error of <1 µV enables better than 99% reporting accuracy with bq29312A	www.ti.com/sc/device/**bq20z80-v102**

High-Efficiency, Phase-Shifted, Full-Bridge CCFL Controller

TPS68000

www.ti.com/sc/device/TPS68000

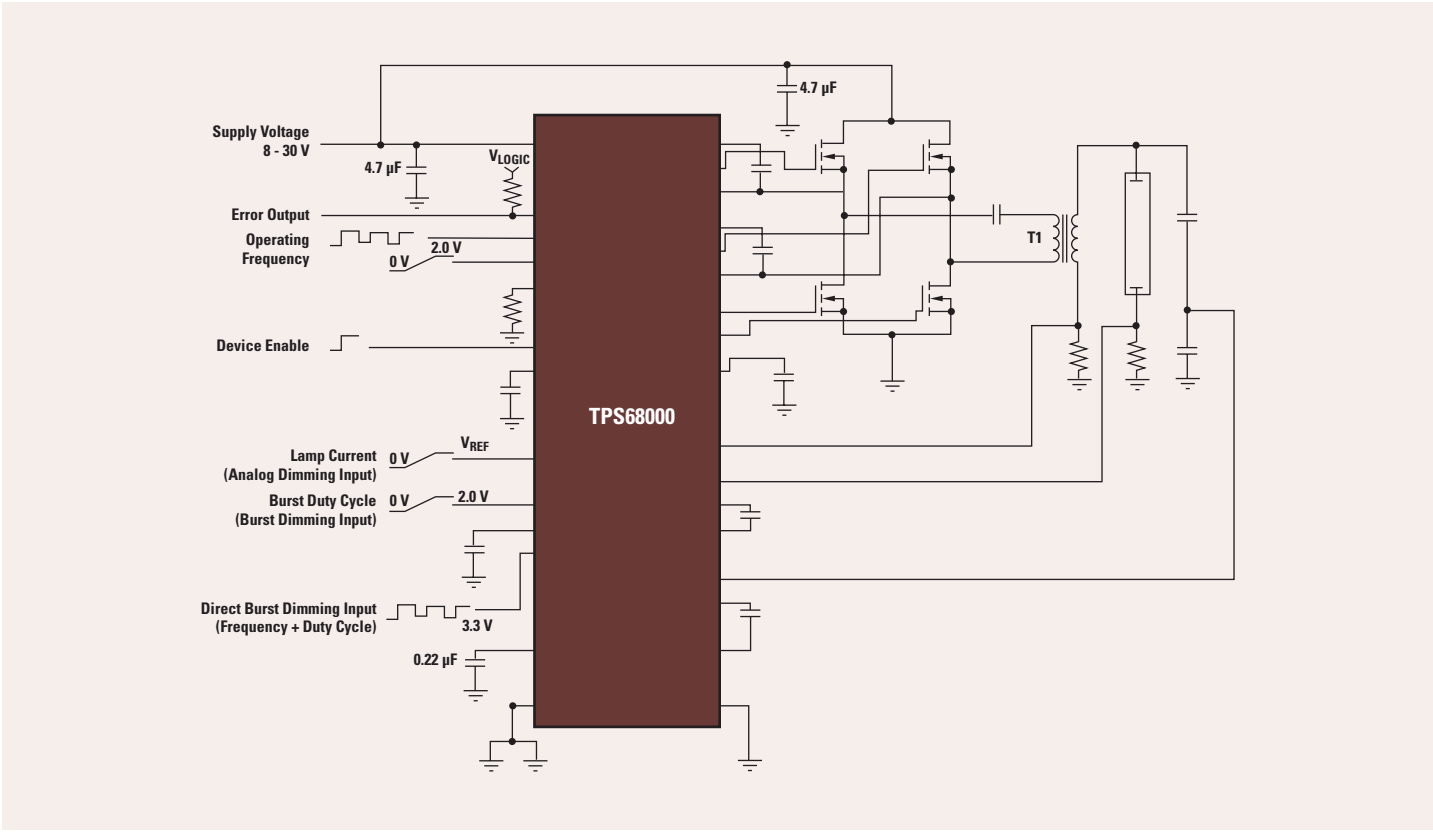
The TPS68000 is a highly integrated, highly efficient power supply controller for CCFL applications. The device offers a wide input voltage range and can drive all four NMOS switches directly without the need for additional circuitry. The TPS68000 supports single-lamp or multi-lamp applications. To protect the lamp during fault conditions, overvoltage and overcurrent protection are implemented. The device features analog dimming and burst dimming. To minimize RMS input current in a multi-controller application, the burst signal can be phase-shifted to the external PWM, which is called distributed dimming.

Key Features

- 8-V to 30-V input voltage range
- Full-bridge topology with integrated gate drivers for four NMOS switches
- Synchronizable constant-frequency operation
- Programmable phase delays
- Lamp-voltage and lamp-current regulation
- Analog and burst dimming
- Programmable voltage regulation time-out
- Open-lamp and short-circuit protection
- Internal over-temperature protection
- Internal and adjustable soft-start
- Undervoltage lockout
- Packaging: SM8-30

Benefits

- Direct PWM dimming (frequency and duty cycle)
- Internal functions to support multi-controller applications
- Two levels of protection



TPS68000 application circuit for single lamp.

Alternative Display Power Solutions

Device	Key Specifications	URL Link
UCC3973	BiCMOS cold cathode fluorescent lamp driver controller	www.ti.com/sc/device/**UCC3973**
UCC3975/76/77	Multi-topology piezoelectric transformer controller	www.ti.com/sc/device/**UCC3975**

Bias Supply for TV and Monitor TFT LCD Panels

TPS65160A

www.ti.com/sc/device/TPS65160A

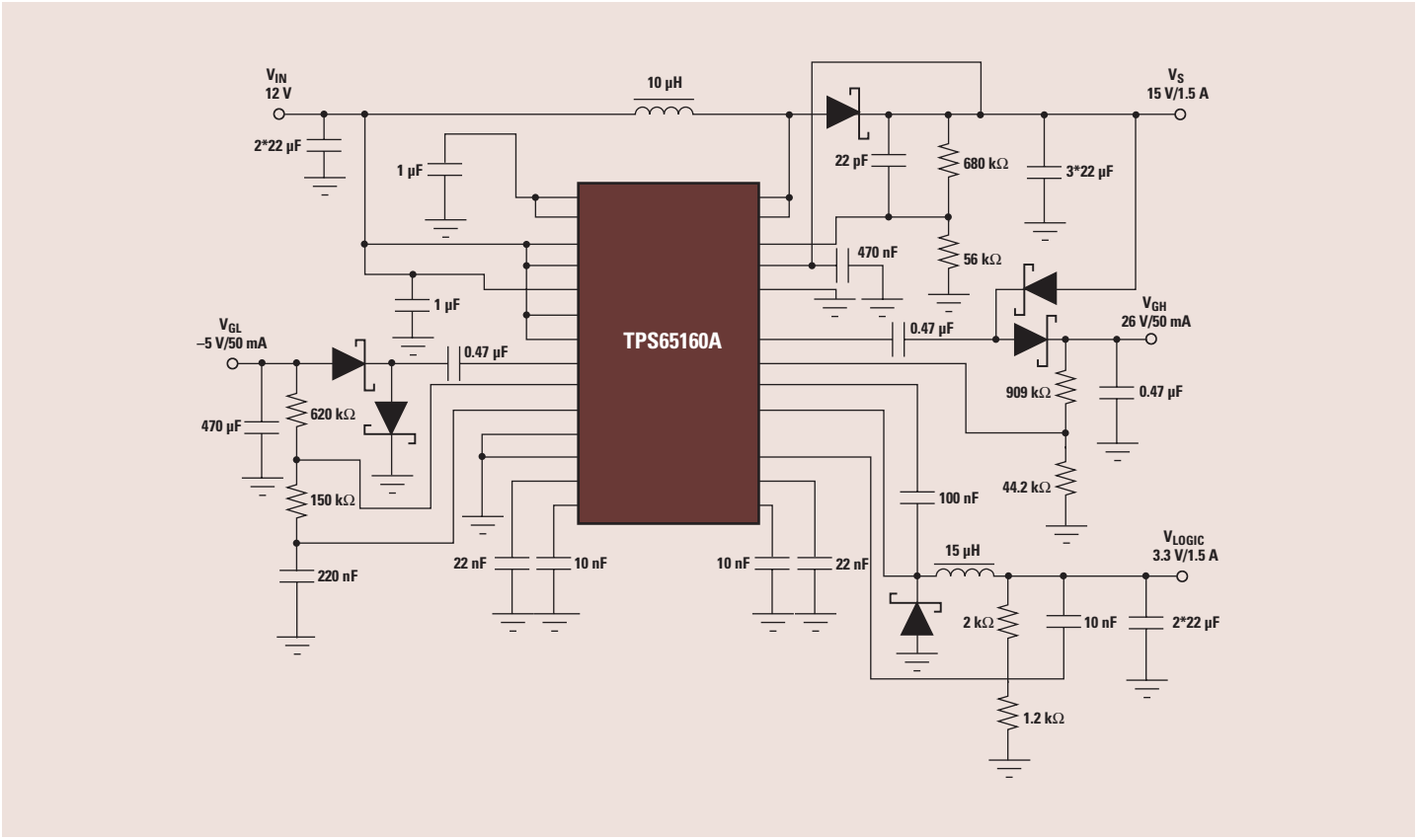
The TPS65160A offers a very compact power-supply solution to provide all four voltages required by thin film transistor (TFT) LCD panels. With its high-current capabilities, the device is ideal for large-screen monitor panels and LCD TV applications. The device can be powered directly from a 12-V input voltage to generate the bias voltages, V_{GH} and V_{GL}; the source voltage, V_S; and the logic voltage for the LCD panels.

Key Features

- 8-V to 14-V input voltage range
- V_S output voltage range up to 20 V
- 2.8-A boost converter switch with 1% tolerance
- 1.8-A step-down converter with 1.5% tolerance
- 500/750-kHz fixed switching frequency
- Negative-charge pump driver for V_{GL} output
- Positive-charge pump driver for V_{GH} output
- Adjustable sequencing for V_{GL}, V_{GH} outputs
- Gate drive signal to drive external MOSFET
- Internal and adjustable soft-start
- Packaging: HTSSOP-28

Benefits

- Fully integrated TFT LCD bias supply
- Integrated and adjustable sequencing
- Maximum protection features
- Short-circuit and overvoltage protection and thermal shutdown



Positive-charge pump doubler running from the output V_S (SUP = V_S) required when higher V_{GH} voltages are required.

Alternative Display Power Solutions

Device	Key Specifications	URL Link
TPS65150	High-accuracy, large form factor TFT LCD bias supply with flicker compensation, sequencing	www.ti.com/sc/device/**TPS65150**
TPS65161	LCD TV/monitor TFT display bias supply with protection, soft-start, sequencing	www.ti.com/sc/device/**TPS65161**

8-Pin Quasi-Resonant Green-Mode Controller
UCC28600

www.ti.com/sc/device/UCC28600

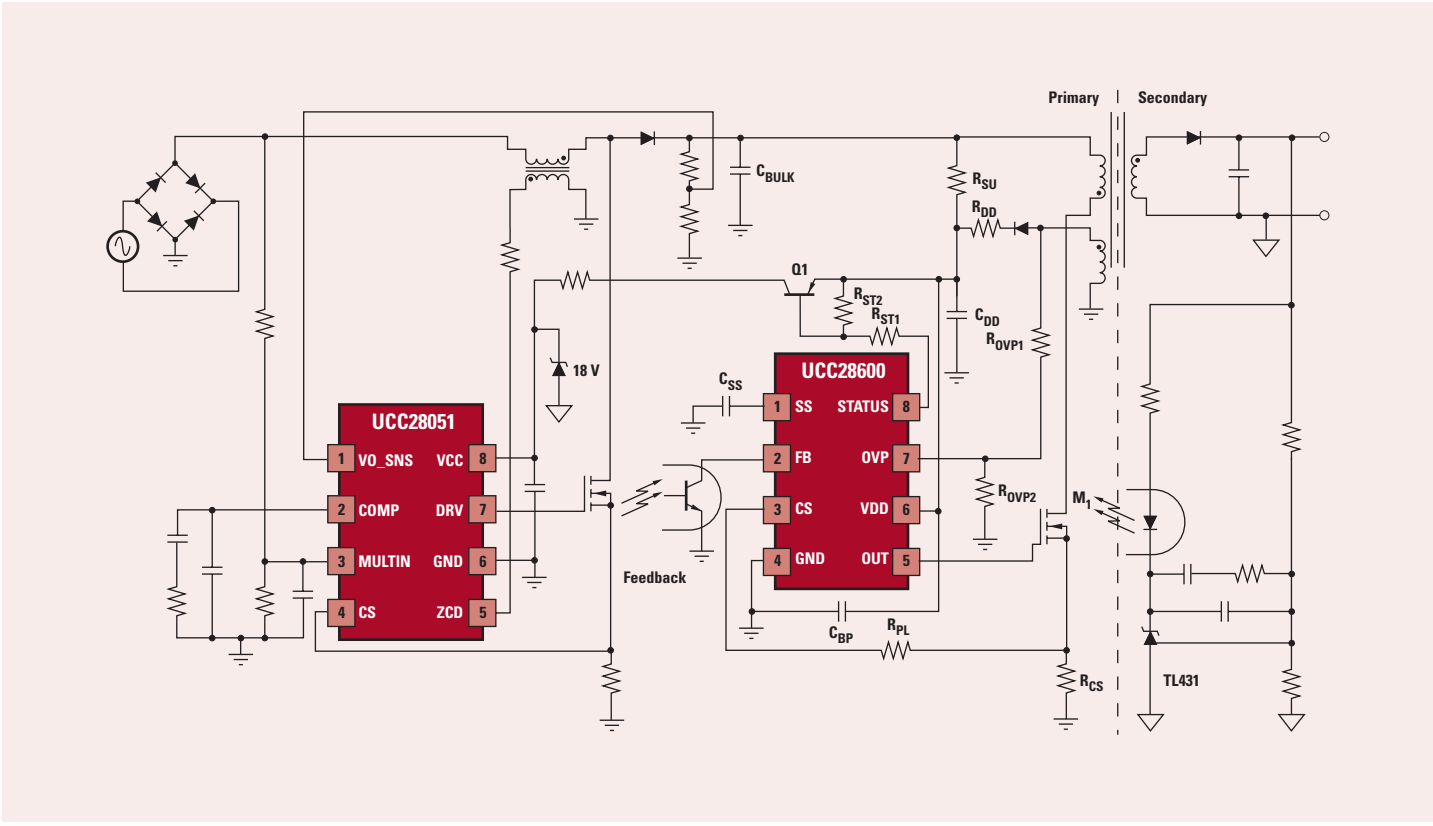
The UCC28600 is a PWM controller that integrates built-in advanced energy-saving features with high-level protection features to provide cost-effective solutions for energy-efficient power supplies. The UCC28600 incorporates frequency fold-back and burst-mode operation to reduce light-load and no-load operation frequencies. The UCC28600 is offered in the SOIC-8 package with an operating temperature range of –40°C to +105°C.

Key Features

- Full green-mode capability in 8 pins
- Multimode operation provides advanced energy-saving capability
- No-load power consumption to 150 mW
- Advanced current limit protection:
  - Cycle-by-cycle power limit
  - Overcurrent hiccup restart mode
- Programmable overvoltage protection
- Low-frequency (40-kHz) burst mode for better efficiencies at light- and no-load operation
- +1-A TrueDrive™ gate-drive output
- Packaging: SOIC-8, PDIP-8

Benefits

- Valley switching provides high efficiency and low EMI
- Green-mode status pin disables power-factor correction (PFC) during light-load for energy savings
- Green-mode tool simplifies design and component selection



Typical green-mode adapter solution with UCC28051 PFC front-end.

Fan Controller and Temperature Monitor

AMC6821 NEW

www.ti.com/sc/device/AMC6821

The AMC6821 is a fan controller with local (on-chip) and remote temperature sensing.

AMC6821 features an internal linear control loop for optimum fan speed. The device has three operation modes. In the auto-temperature fan-speed mode, the fan speed is adjusted automatically to an optimum value when the temperature changes. In the Software-RPM mode, the fan speed is maintained at a software-defined target value. Both of these are closed-looped modes. In the Software-DCY mode, the PWM driver's duty cycle is set to the value the user writes to the device.

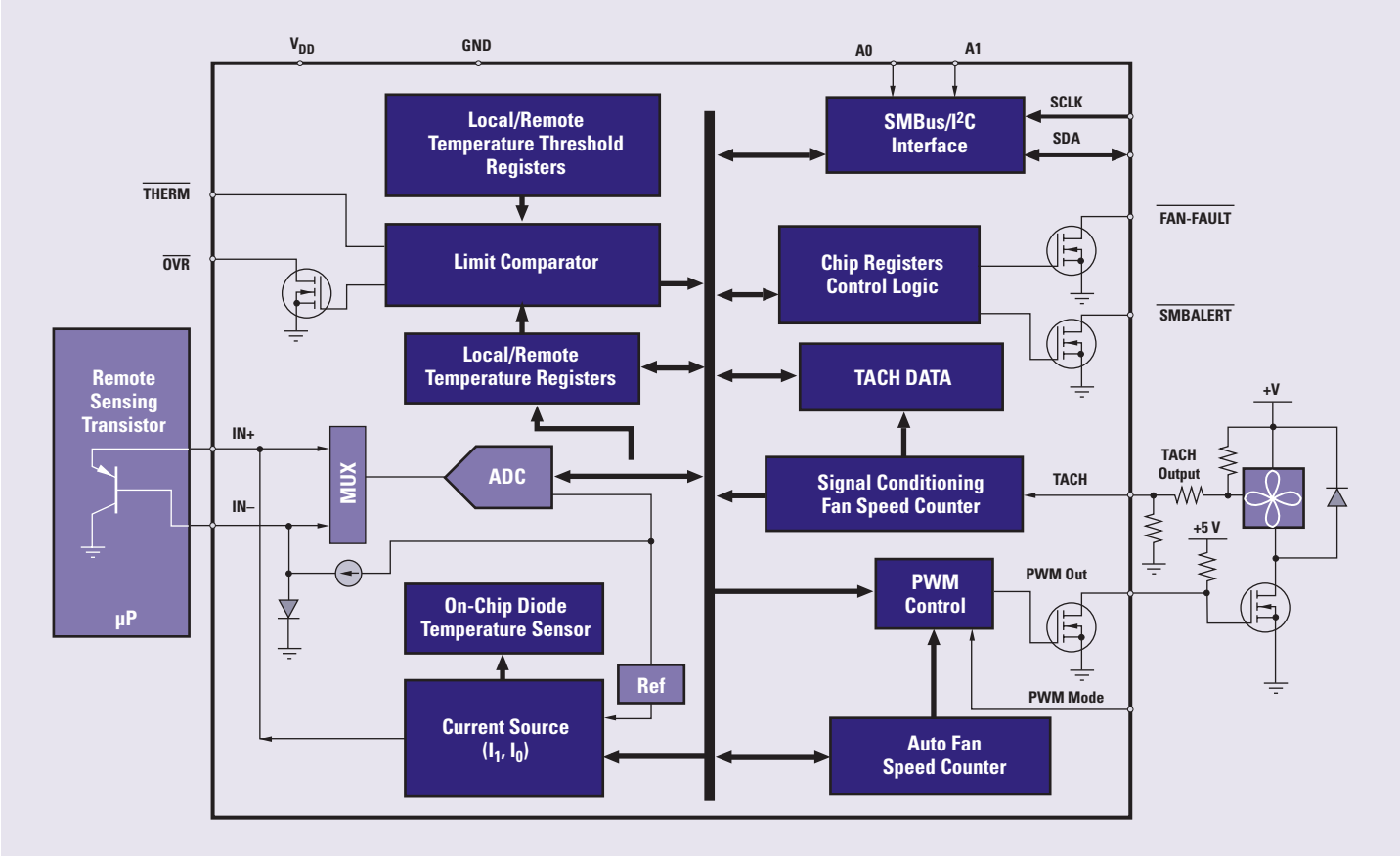
In any closed-looped modes AMC6821 can run stand alone, which reduces the system controller power consumption and reduces bus activity. Operating on as low as 2.7 V, it is ideal for notebook designs.

Key Features

- Remote and local temperature measurement:
  - Remote: ±1°C accuracy
  - Local: ±2°C accuracy
  - 0.125°C resolution on both local and remote
- Fan speed monitor
  - RPM range: 100 to 23,000
  - 6% accuracy
- PWM fan control output:
  - 0 to 100% duty cycle (8 bits)
  - 10-Hz to 40-kHz output frequency
- Control modes:
  - Auto-temperature fan-speed control mode
  - Software-RPM control mode
  - Software-DCY mode
- SMBus/two-wire interface
- 2.7-V to 5.5-V operation
- Packaging: SSOP-16

Benefits

- Reduces audible fan noise
- Reduces power consumption
- Stand-alone mode reduces CPU processing and bus activity



AMC6821 functional block diagram.

World's Smallest Digital Temperature Sensors

TMP105 and TMP106

NEW

www.ti.com/sc/device/TMP105 and **www.ti.com/sc/device/TMP106**

Featuring a 1.0 x 1.5 x 0.6-mm chipscale package and ultra-low-power operation, TMP105 and TMP106 are ideal for temperature monitoring in small-form-factor notebook designs. Utilizing an on-chip delta-sigma ADC and advanced process technology, the sensors are complete temperature-to-digital converters.

By using the "one-shot" mode, 9-bit resolution and 1 sample per second, average power consumption can be reduced to 2 µA.

Key Features

- Digital output: two-wire serial interface
- 2 addresses
- Resolution: 9- to 12-bits, user-selectable
- High accuracy:
  - ±2.0°C (max) from –25°C to +85°C
  - ±3.0°C (max) from –40°C to +125°C
- Low supply current: 50 µA; 0.1 µA in shutdown mode
- No power-up sequence required
- I^2C pull-ups can be enabled prior to V+
- TMP105: 1.8 V to 3.0 V logic
- TMP106: 2.7 V to 5.5 V logic
- Packaging: 1.0 x 1.5-mm chipscale (WCSP)

Benefits

- Chipscale package saves space
- "One-shot" mode extends battery life
- TMP105's 1.8-V-compatible logic simplifies interface to microprocessors

Programmable Remote/Local Temperature Sensor

TMP401

NEW

www.ti.com/sc/device/TMP401

TMP401 is a remote temperature sensor monitor with built-in local temperature sensor. The remote temperature sensor senses diode connected transistors — typically low-cost, easily mounted 2N NPN types or diodes that are an integral part of microcontrollers, microprocessors or FPGAs.

The remote sensor requires no calibration and offers ±1°C accuracy for multiple transistor manufacturers. The 2-wire serial interface accepts SMBus write byte, read byte, send byte and receive byte commands to program the alarm thresholds and to read temperature data.

Other features include series resistance cancellation, wide remote temperature measurement range (up to 150°C), diode fault detection and temperature ALERT function.

Key Features

- Digital output: two-wire serial interface
- Programmable resolution: 9- to 12-bits
- High accuracy:
  - ±1.0°C remote
  - ±3.0°C local
- Low supply current: 250 µA, 3 µA in shutdown mode
- Series resistance cancellation
- ALERT function
- THERM/ALERT2 pin configuration
- Diode fault detection
- 2.7 V to 5.5 V operation
- Packaging: MSOP

Benefits

- Programmable features increase design flexibility, performance
- Low power extends battery life

Alternative System Monitoring and Protection Solutions

Device	Key Specifications	URL Link
TMP100/101	2.7 V to 5.5 V, 2°C (max), 50 µA, I^2C interface, SOT-23	www.ti.com/sc/device/**TMP100** www.ti.com/sc/device/**TMP101**
TMP75	2.7 V to 5.5 V, 2°C (max), 50 µA, I^2C interface, MSOP, SOIC	www.ti.com/sc/device/**TMP75**
TMP175	1.5°C (max), I^2C digital temperature sensor in MSOP, SOIC	www.ti.com/sc/device/**TMP175**
TMP275	0.5°C (max), I^2C digital temperature sensor in MSOP	www.ti.com/sc/device/**TMP275**

*New devices are listed in **bold red.***

Current Shunt Monitor With Comparators and Reference

INA206 NEW

www.ti.com/sc/device/INA206

The INA206 features dual comparators and a 1.2-V reference. The INA206 is ideal for multilevel watchdog systems, window comparators and Power Good detection.

Convenient default trip points of 0.6 V provided at each comparator can be overridden by external inputs if desired. One comparator has latching capability while the other provides for a programmable delay.

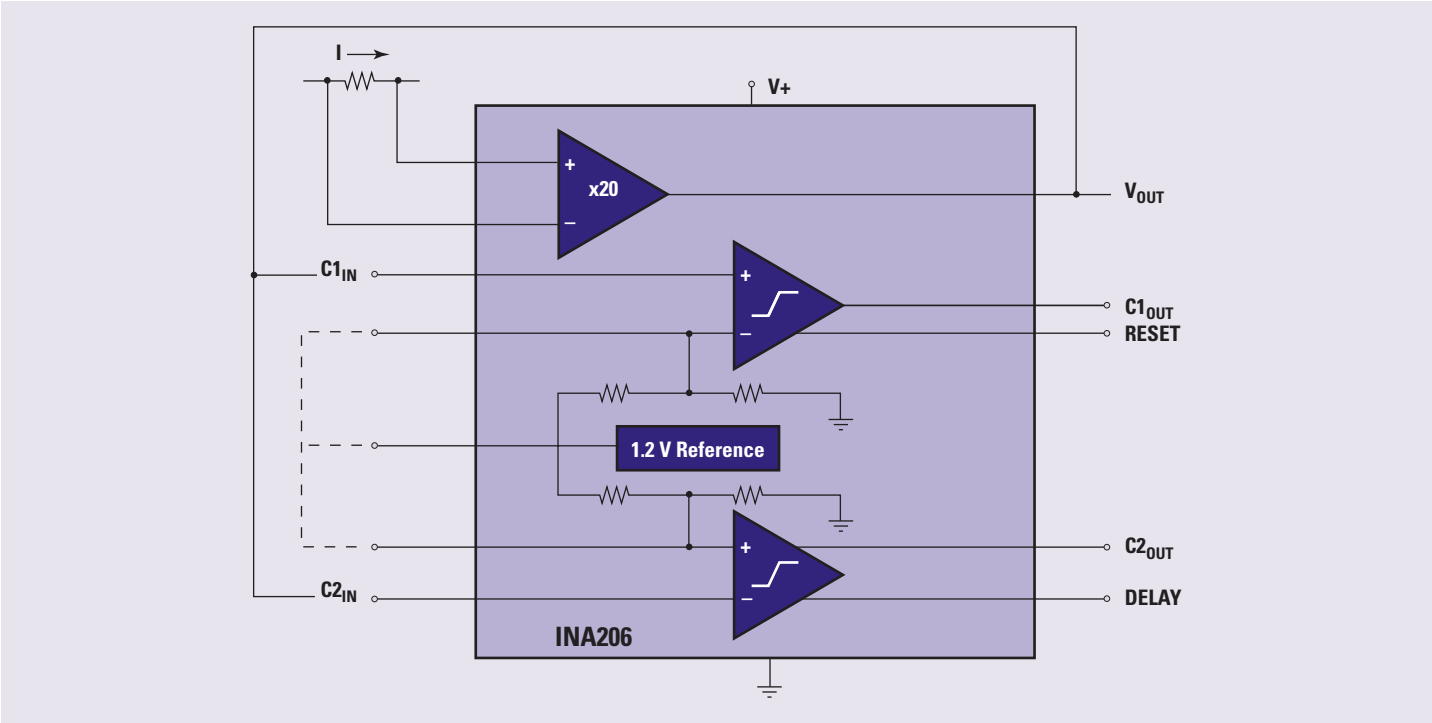
The INA206 features a common-mode range of –16 V to +80 V, independent of supply voltage, and operates on 2.7 V to 18 V. The INA206 provides a fully buffered voltage output and is available in gains of 20, 50 and 100.

Key Features

- Extended common-mode input range: –16 V to +80 V
- Integrated dual open-drain comparators
- 1.2-V reference
- Low offset: 2 mV
- Single supply: 2.7 V to 18 V
- Packaging: MSOP, SO-14, TSSOP

Benefits

- Simplifies threshold current detection
- Integrated features reduce total solution size and lower cost
- Wide common-mode range gives total freedom of design
- Improves total system robustness



INA206 functional block diagram.

Alternative System Monitoring and Protection Solutions

Device	Key Specifications	URL Link
INA193	–16-V to +80-V common mode, 700-µA, 500 kHz, SOT-23	www.ti.com/sc/device/**INA193**
INA138	2.7-V to 36-V common mode, 25-µA supply current, SOT-23	www.ti.com/sc/device/**INA138**
INA327	100-µV (max) offset, true RRIO, very low 1/f noise, MSOP	www.ti.com/sc/device/**INA327**
INA170	Bidirectional current shunt monitor in MSOP	www.ti.com/sc/device/**INA170**

Audio Subsystem for Windows Vista™ Notebooks

PREVIEW*

TPA6040A4

The TPA6040A4 is an audio power amplifier subsystem that meets Windows Vista™ operating system specifications. The audio subsystem contains three functional blocks — a 2-W stereo speaker amplifier that provides enough power to make audio easily heard throughout a large conference room or work area; an integrated 85-mW stereo cap-free headphone amplifier that eliminates external capacitors to reduce cost and size and to greatly improve low-frequency response; and an integrated regulator that supplies power to the audio codec, eliminating the cost and space of an external regulator.

In addition, the internal four-step gain control for the speaker amplifier and the internal fixed gain for the headphone amplifier replace external resistors with matched internal resistors to further lower cost and improve sound quality.

Independent shut-down control and dedicated inputs for the speaker and headphone audio signals allow the TPA6040A4 to drive both internal speakers and headphones simultaneously. Finally, the differential input and output architectures for the speaker amplifier offer superior RF-immunity power-supply noise rejection and common-mode noise rejection.

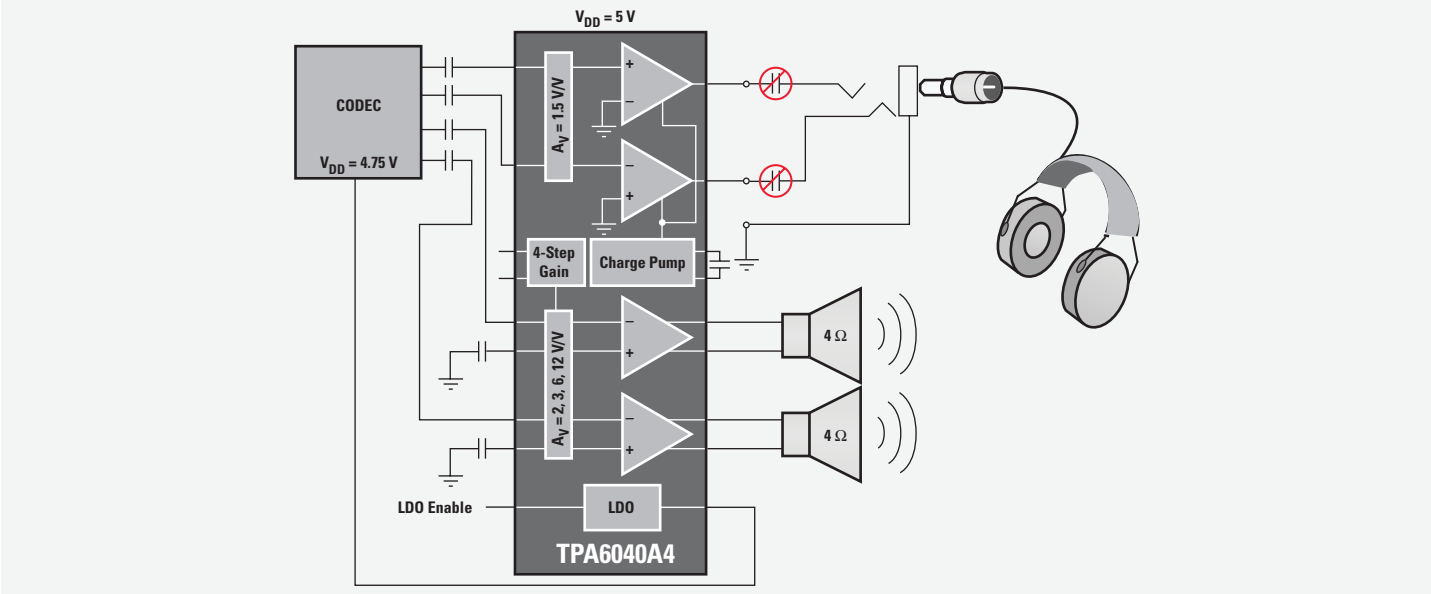
Key Features

- Meets Windows Vista operating system specifications
- 2-W stereo speaker drive, from a 5-V supply
- 85-mW cap-free stereo headphone drive
- Integrated regulator
- Integrated gain:
  - Speakers: 6, 10, 15.6 and 21.6 dB
  - Headphone: –1.5 V/V
- Independent shut-down control
- Separate inputs for speaker and headphone audio signals
- Differential architecture
- Packaging: 32-pin QFN (RHB)

Benefits

- High-quality audio playback
- Creates enough sound for large rooms
- Excellent low-frequency response
- Small solution size
- Improves RF and power-supply noise rejection

** Expected TPA6040A4 release date, 2Q 2007*



TPA6040A4 application block diagram.

Alternative Audio Amplifier Solutions

Device	Key Specifications	URL Link
TPA6017A2	2-W, stereo output with internal gain	www.ti.com/sc/device/**TPA6017A2**
TPA2012D2	2.1-W, Class-D stereo output	www.ti.com/sc/device/**TPA2012D2**
TPA2010D1	2.5-W, Class-D mono output	www.ti.com/sc/device/**TPA2010D1**
TPA3005D2	6-W, Class-D stereo output	www.ti.com/sc/device/**TPA3005D2**
TPA3007D1	6.5-W, Class-D mono output	www.ti.com/sc/device/**TPA3007D1**

IEEE Std 1394b-2002 PHY and OHCI Link Device

TSB83AA22A

www.ti.com/sc/device/TSB83AA22A

The TSB83AA22A is an IEEE Std 1394b-2002 link-layer design and PHY design combined in an industry-leading, small 7 x 7-mm package. The TSB83AA22A device is capable of exceptional 800-Mbps performance, providing the throughput and bandwidth to move data efficiently and quickly between the PCI and 1394 buses.

The TSB83AA22A LLC section implements several enhancements to improve overall performance of the device, such as a highly tuned physical data path for enhanced SBP-2 performance; physical post writing buffers and multiple isochronous contexts; and advanced internal arbitration.

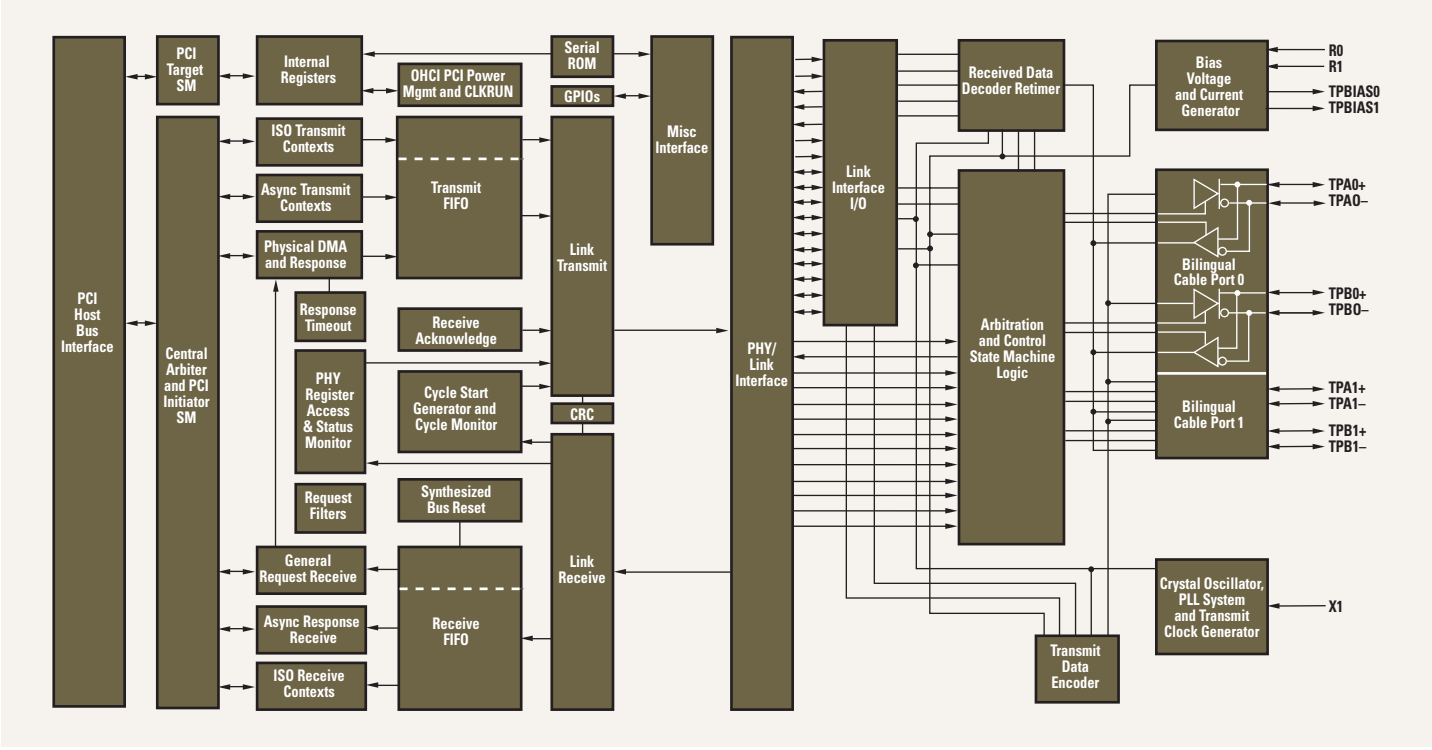
The TSB83AA22A LLC section also implements hardware enhancements to better support digital video (DV) and MPEG data stream reception and transmission. These enhancements include automatic time-stamp insertion for transmitted DV and MPEG-formatted streams and common isochronous packet (CIP) header stripping for received DV streams.

Key Features

- Fully supports provisions of IEEE Std 1394b-2002 revision 1.33+ at 1-Gbit signaling rates
- Fully supports provisions of IEEE Std 1394a-2000 and IEEE Std 1394-1995
- Provides two fully backward-compatible, bilingual IEEE Std 1394b-2002 cable ports at up to 800 Mbps
- Fully compliant with open host controller interface (OHCI) requirements
- Power-down features to conserve energy in battery-powered applications
- Low-power sleep mode
- Packaging: 7 x 7-mm MicroStar BGA™

Benefits

- Production-proven 1394b OHCI solution compatible with leading 1394b S800 storage solutions
- Bilingual PHY ports allow either 1394b or combined 1394a/1394b support
- Ultra-low operational power requirements and intelligent power management capabilities minimize power drain on battery-powered devices



TSB83AA22A functional block diagram.

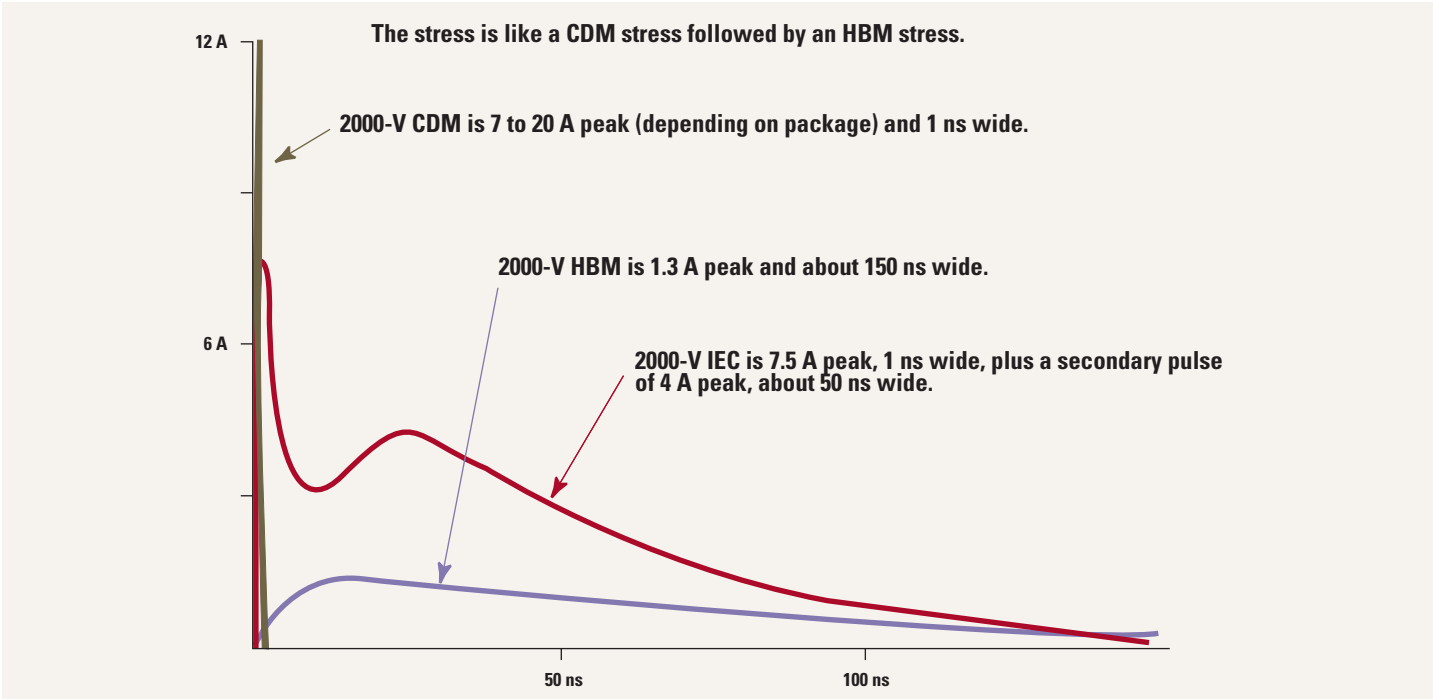
3-V to 5.5-V, Multichannel, RS-232 Line Driver/Receiver with ±15-kV IEC ESD Protection

www.ti.com/ti3243e

This device consists of three line drivers, five line receivers and a dual charge-pump circuit with ±15-kV ESD (HBM and IEC61000-4-2, air-gap discharge) and ±8-kV ESD (IEC61000-4-2, contact discharge) protection on serial-port connection pins. The device meets the requirements of TIA/EIA-232-F and provides the electrical interface between an asynchronous communication controller and the serial-port connector. This combination of drivers and receivers matches that needed for the typical serial port used in portable/consumer equipment, telecom and computing applications. The charge pump and four small external capacitors allow operation from a single 3-V to 5.5-V supply. In addition, the device includes an always-active noninverting output (ROUT2B) that allows applications using the ring indicator to transmit data while the device is powered down. The device operates at data signaling rates of up to 250 kbps and a maximum driver output slew rate of 30 V/µs.

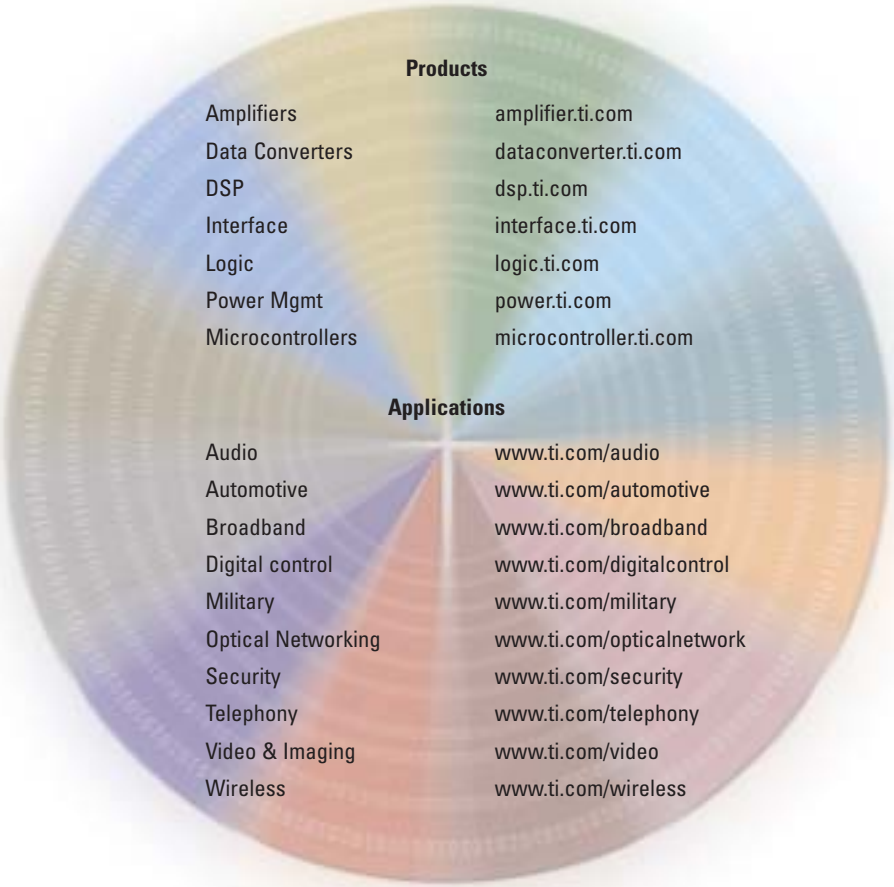
Key Features

- Single-chip and single-supply interface for serial port
- ESD protection for RS-232 bus pins
  - ±15-kV human-body model (HBM)
  - ±8-kV IEC61000-4-2, contact discharge
  - ±15-kV IEC61000-4-2, air-gap discharge
- Meets or exceeds requirements of TIA/EIA-232-F and ITU v.28 standards
- Operates with 3-V to 5.5-V V_{CC} supply
- Always-active noninverting receiver output (ROUT2B)
- Designed to transmit at a data rate of up to 500 kbps
- Low standby current: 1 µA (typ)
- External capacitors: 4 x 0.1 µF
- Accepts 5-V logic input with 3.3-V supply
- Designed to be interchangeable with Maxim MAX3243E
- Serial-mouse driveability
- Auto-power-down feature to disable driver outputs when no valid RS-232 signal is sensed
- Packaging: SOIC-28, SSOP-28, TSSOP-28, QFN-32



Comparing the current stress used in IEC, CDM and HBM tests.

Device Index



TI Worldwide Technical Support

Internet

TI Semiconductor Product Information Center Home Page
support.ti.com

TI Semiconductor KnowledgeBase Home Page
support.ti.com/sc/knowledgebase

Product Information Centers

Americas

Phone	+1(972) 644-5580
Fax	+1(972) 927-6377
Internet/Email	support.ti.com/sc/pic/americas.htm

Europe, Middle East, and Africa

Phone	
Belgium (English)	+32 (0) 27 45 54 32
Finland (English)	+358 (0) 9 25173948
France	+33 (0) 1 30 70 11 64
Germany	+49 (0) 8161 80 33 11
Israel (English)	180 949 0107
Italy	800 79 11 37
Netherlands (English)	+31 (0) 546 87 95 45
Russia	+7 (4) 95 98 10 701
Spain	+34 902 35 40 28
Sweden (English)	+46 (0) 8587 555 22
United Kingdom	+44 (0) 1604 66 33 99
Fax	+(49) (0) 8161 80 2045
Internet	support.ti.com/sc/pic/euro.htm

Japan

Fax	International	+81-3-3344-5317
	Domestic	0120-81-0036
Internet/Email	International	support.ti.com/sc/pic/japan.htm
	Domestic	www.tij.co.jp/pic

Asia

Phone	
International	+886-2-23786800
Domestic	Toll-Free Number
Australia	1-800-999-084
China	800-820-8682
Hong Kong	800-96-5941
India	+91-80-41381665 (Toll)
Indonesia	001-803-8861-1006
Korea	080-551-2804
Malaysia	1-800-80-3973
New Zealand	0800-446-934
Philippines	1-800-765-7404
Singapore	800-886-1028
Taiwan	0800-006800
Thailand	001-800-886-0010
Fax	+886-2-2378-6808
Email	tiasia@ti.com or ti-china@ti.com
Internet	support.ti.com/sc/pic/asia.htm

Safe Harbor Statement: This publication may contain forward-looking statements that involve a number of risks and uncertainties. These "forward-looking statements" are intended to qualify for the safe harbor from liability established by the Private Securities Litigation Reform Act of 1995. These forward-looking statements generally can be identified by phrases such as TI or its management "believes," "expects," "anticipates," "foresees," "forecasts," "estimates" or other words or phrases of similar import. Similarly, such statements herein that describe the company's products, business strategy, outlook, objectives, plans, intentions or goals also are forward-looking statements. All such forward-looking statements are subject to certain risks and uncertainties that could cause actual results to differ materially from those in forward-looking statements. Please refer to TI's most recent Form 10-K for more information on the risks and uncertainties that could materially affect future results of operations. We disclaim any intention or obligation to update any forward-looking statements as a result of developments occurring after the date of this publication.

E062706

Printed in U.S.A. by (Printer, City, State)
Printed on recycled paper

Great Selection of Products!

www.ti.com/selection

Product Selection Guides Available for Ordering and Downloading Now:

- Amplifier and Data Converter
- DSP
- Interface
- Logic
- Interface
- Low-Power RF
- MSP430
- Power Management

Texas Instruments Incorporated
14950 F.A.A. Blvd.
Fort Worth, Texas 76155

Address service requested

PRSRT STD
U.S. POSTAGE
PAID
DALLAS, TEXAS
PERMIT NO. 2758

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
Low Power Wireless	www.ti.com/lpw	Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265