Texas Instruments

Technology for Innovators™

Interface Selection Guide

3Q 2005

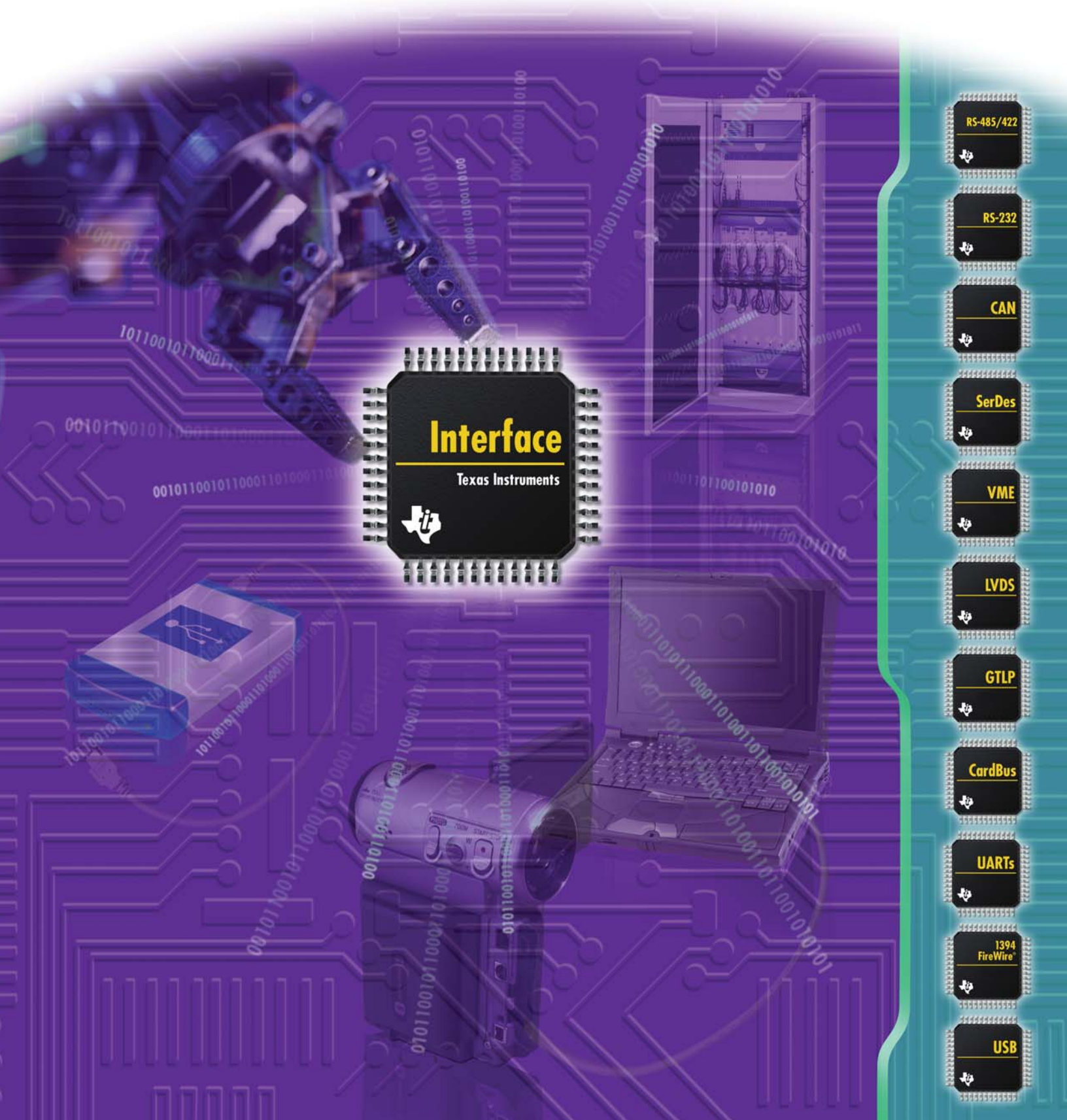


Table of Contents

Introduction 3

LVDS, xECL, CML 4
Multipoint-LVDS (M-LVDS) 8
RS-485/422 10
RS-232 12
UARTs 15
CAN 17
SerDes (Serial Gigabit Transceivers) 18
USB HUB Controllers, Peripheral Devices and Power Managers 20
PCI CardBus Controllers, PCI Bridges, CardBus Power 24
1394 (FireWire®) 29
GTLP 32
VME 34
Clock Distribution Circuits 35
Cross-Reference Guide 36

*Check **interface.ti.com** for the latest IBIS Models and evaluation modules (EVMs).*

Introduction

Texas Instruments (TI) provides complete interface solutions that empower you to differentiate your products and accelerate time-to-market. Our expertise in high-speed, mixed-signal circuits, system-on-a-chip integration and advanced product development processes ensures you will receive the silicon, support tools, software and technical documentation to create and deliver the best products on time and at competitive prices. Included in this selection guide you will find design considerations, technical overviews, graphic representation of portfolios, parametric tables and resource information on the following families of devices:

LVDS: (p. 4) TIA/EIA-644A specification designed for differential transmission delivering signaling rates into the Gbps range and power in the mW range with low EMI to the telecommunication and consumer markets.

xECL: (p. 4) Emitter coupled logic (xECL), high-speed differential interface technology designed for low jitter and skew.

CML: (p. 4) Current-mode logic (CML), high speed differential interface technology.

M-LVDS: (p. 8) TIA/EIA-899 specification with all the benefits of LVDS applicable to multipoint bus architecture in backplanes. Used often for clock distribution, e.g. AdvancedTCA.

RS-485/422: (p. 10) Robust TIA/EIA-485 and TIA/ EIA-422 specifications specially designed for harsh, industrial environments transmitting a differential signal up to 10 Mbps or 1.2 km.

RS-232: (p. 12) TIA/EIA-232 specification defining single-ended interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE).

UARTs: (p. 15) Universal Asynchronous Receiver/Transmitters are the key logic component of serial communication utilizing RS232, RS485/422 or LVDS transceivers to transmit or receive between remote devices performing parallel to serial conversion in the transmit process and serial to parallel conversion in the receive process.

CAN: (p. 17) Controller Area Netowork (ISO11898) specification commonly used in automotive and industrial applications describes differential signaling at a rate up to 1 Mbps on a 40-meter bus with multipoint topology.

SerDes: (p. 18) Serializers and deserializers in the gigabit range designed to bridge large numbers of data bits over a small number of data lines in telecommunication applications.

USB Hub Controllers and Peripheral Devices: (p. 20) The USB standard was established to make connecting PCs, peripherals and consumer electronics flexible and easy. The hub controller manages USB port connect/disconnect activities and a peripheral controller enables USB connectivity of a peripheral device to either a host or hub.

USB Power Managers: (p. 22) TI products, like TPS204xA and TPS205xA, are designed to meet all the USB 1.0 and 2.0 requirements for current-limiting and power switching to reliably control the power on the voltage bus.

PCI CardBus Controllers: (p. 24) PCMCIA standard-compliant, 32-bit, high-performance bus mastering architecture for PC cards.

PCI Bridges: (p. 26) A peripheral component interconnect (PCI) bridge provides a high-performance connection path between either two PCI buses or a PCI component and one or more DSP devices.

CardBus Power Switches: (p. 27) The CardBus controller uses the card detect and voltage sense pins to determine a PC card's voltage requirements and then directs the PCMCIA power switch to enable the proper voltages. Standard PC cards require that V_{CC} be switched between ground, 3.3 V, and 5 V, while V_{PP} is switched between ground, 3.3 V, 5 V, and 12 V. CardBay sockets have the standard requirements for V_{CC}, but require ground, 3.3 V, and 5 V to V_{PP}, and ground, 1.8 V, or 3.3 V to V_{CORE}. Other PC card applications may simply not need 12 V or V_{PP} while still having the standard requirements for V_{CC}. Therefore, consider the voltage requirements of the application when selecting a PCMCIA power switch.

1394: (p. 29) IEEE 1394 (FireWire®) high-speed interconnection enables simple, low-cost, high-bandwidth, real-time data connectivity between computers, peripherals and consumer electronics.

GTLP: (p. 32) Gunning transceiver logic plus (GTLP) derived from the JEDEC JESD8-3 GTL standard is a reduced-voltage-swing technology designed for high-speed interface between cards operating at LVTTL logic levels and backplanes operating at GTLP signal levels.

VME: (p. 34) The VMEbus™ is a standardized, 64-bit, backplane architecture that is coordinated and controlled by VITA. VME is used extensively in military, industrial and aerospace applications.

Clock Distribution Circuits: (p. 35) TI offers both single-ended and differential clock buffers that perform from below 200 MHz up to 3.5 GHz in a variety of fan-out options. In addition to simple option for customers needing differential signals (LVPECL) and single-ended signals (LVTTL/LVCMOS) from the same device.

Design Considerations

Signaling Rate—TI offers repeaters/translators and crosspoint switches with signaling rates up to 4.0 Gbps.

Jitter—Reducing jitter, the deviation of a signal timing event from its ideal position, has become a priority for ensuring reliability in high-speed data buses.

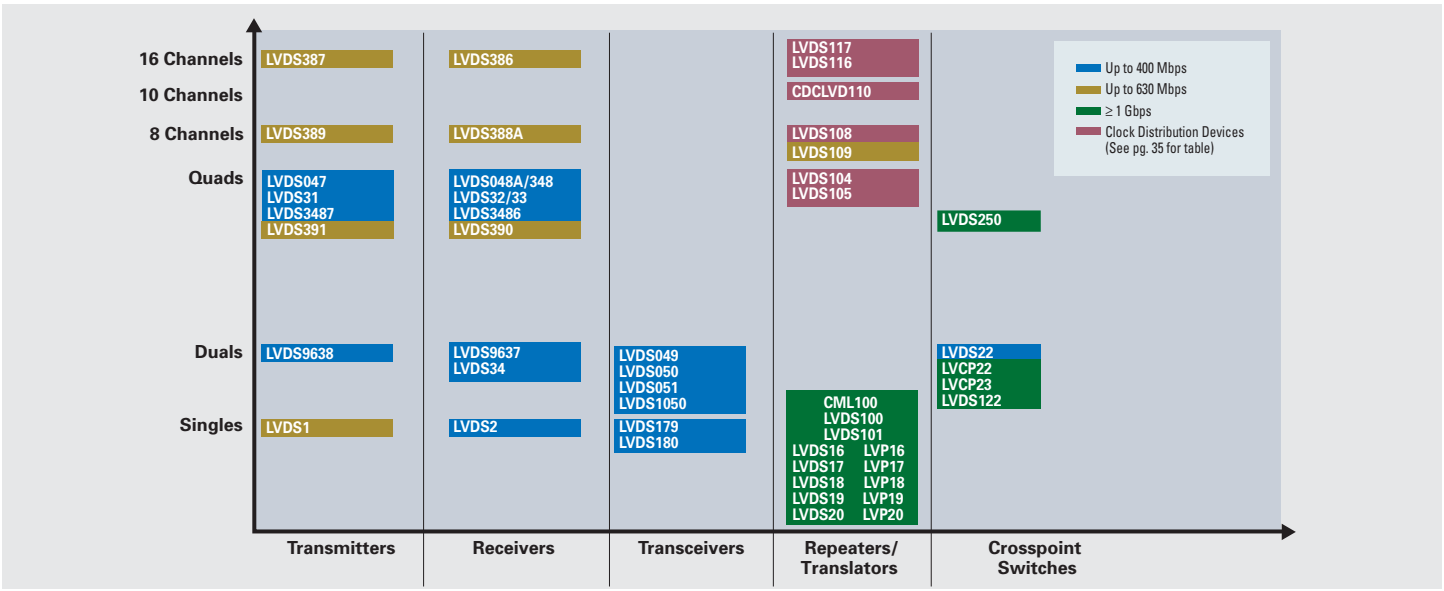
Skew—Excessive skew, the time delta between the actual and expected arrival time of a clock signal, can limit the maximum bandwidth performance and lead to data sampling errors. Low skew specifications make high-speed interconnect devices excellent for signal buffering.

Power Consumption—Low-voltage differential signaling (LVDS) offers a low-power alternative to ECL and PECL devices. Current-mode drivers in LVDS produce a constant current, which allows power consumption to be relatively independent of frequency. The constant current driver delivers about 3.5 mA to a 100-Ω load.

Technical Information

- LVDS is based on the TIA/EIA-644A standard conceived to provide a general-purpose electrical-layer specification for drivers and receivers connected in a point-to-point or multidrop interface.

LVDS Family of Products



Resources

For a complete list of resources (EVMs, data sheets and application notes), visit **interface.ti.com**

Literature Number	Description
Application Notes	
SLLA014A	Low-Voltage Differential Signaling (LVDS) Design Notes (Rev. A)
SLLA030C	Reducing Electromagnetic Interference with LVDS (Rev. C)
SLLA031A	Using an LVDS Receiver with TIA/EIA-422 Data (Rev. A)
SLLA034A	Slew Rate Control of LVDS Circuits (Rev. A)
SLLA038B	Interface Circuits for TIA/EIA-644 (LVDS) (Rev. B)
SLLA053B	Performance of LVDS with Different Cables (Rev. B)
SLLA054A	LVDS Multidrop Connections (Rev. A)
SLLA065	A Comparison of LinBiCMOS and CMOS Process Technologies in LVDS ICs
SLLA082B	Active Fail-Safe in TI's LVDS Receivers (Rev. B)
SLLA100	Increase Current Drive Using LVDS
SLLA101	Interfacing Different Logic with LVDS Receivers
SLLA103	LVPECL and LVDS Power Comparison
SLLA104	Suggestions for LVDS Connections
SLLA105	DSP to DSP Link Using LVDS
SLLA107	Live Insertion with Differential Interface Products
SLLA147	Suitable LVDS Architectures

Literature Number	Description
Application Notes	
SCAA059	AC-Coupling Between Differential LVPECL, LVDS, HSTL, and CML
SCAA062	DC-Coupling Between Differential LVPECL, LVDS, HSTL, and CML

Part Number	Description	Price[1]
Evaluation Modules (EVMs)		
SN65LVDS31-32EVM	Evaluation Module for LVDS31 and LVDS32	49.00
SN65LVDS31-32BEVM	Evaluation Module for LVDS31 and LVDS32B	49.00
SN65LVDS31-33EVM	Evaluation Module for LVDS31 and LVDS33	49.00
SN65LVDS386EVM	SN65LVDS386 Evaluation Module	49.00
SN65LVDS387EVM	SN65LVDS387 Evaluation Module	49.00
SN65LVDS100EVM	SN65LVDS100 Evaluation Module	99.00
SN65LVDS101EVM	SN65LVDS101 Evaluation Module	99.00
SN65CML100EVM	SN65CML100 Evaluation Module	99.00
SN65LVCP22-23EVM	SN65LVCP22 Evaluation Module	25.00
SN65LVDS122EVM	SN65LVDS122 Evaluation Module	49.00
SN65LVDS125EVM	SN65LVDS125 Evaluation Module	49.00

[1] *Suggested resale price in U.S. dollars. Please check **www.ti.com** for the most current pricing information. Note: IBIS models are available at **interface.ti.com***

LVDS/LVPECL/CML Repeaters/Translators and Crosspoints Selection Guide

Device	Description	No. of Tx	No. of Rx	Input Signal	Output Signal	Signaling Rate (Mbps)	Jitter Max (ps)	Part-to-Part Skew Max	Tx tpd Typ (ns)	Rx tpd Typ (ns)	I_{CC} Max (mA)	ESD HBM (kV)	Pin/ Package(s)	Price[1]
Crosspoint Switch Family														
SN65LVCP22	2X2 Crosspoint Switch: LVDS Outputs	2	2	LVPECL, LVDS, CML	LVDS	1000	105	100	0.65	0.65	85	5	16SOIC, 16TSSOP	2.70
SN65LVCP23	2X2 Crosspoint Switch: LVPECL Outputs	2	2	LVPECL, LVDS, CML	LVPECL	1300	100	100	0.65	0.65	65	5	16SOIC, 16TSSOP	5.20
SN65LVCP40	Dual 1:2 Mux with Equalizer and Pre-Emphasis	6	6	LVPECL, LVDS, CML	CML	4000	30	500	1	1	254	4	48QFN	17.40
SN65LVDS122[2]	2X2 Crosspoint Switch: LVDS Output	2	2	LVPECL, LVDS, CML	LVDS	1500	65	150	0.9	0.9	100	4	16SOIC, 16TSSOP	4.75
SN65LVDS250[2]	4X4 Crosspoint Switch: LVDS Output	4	4	LVPECL, LVDS, CML	LVDS	2000	50	150	0.9	0.9	145	3	TSSOP	7.75
Repeaters/Translators														
SN65CML100	LVDS/LVPECL/CML-to-CML Repeater/Translator	1	1	LVPECL, LVDS, CML	CML	1500	70	100	0.8	—	12	5	8SOIC, 8VSSOP	2.55
SN65LVDS100[2]	LVDS/LVPECL/CML to LVDS Repeater/Translator	1	1	LVPECL, LVDS, CML	LVDS	2000	65	100	0.8	—	30	5	8SOIC, 8VSSOP	2.55
SN65LVDS101[2]	LVDS/LVPECL/CML-to-LVPECL Repeater/Translator	1	1	LVPECL, LVDS, CML	LVPECL	2000	65	100	0.9	—	90	5	8SOIC, 8VSSOP	2.55
SN65LVDS16/17	2.5-V/3.3-V Oscillator Gain Stage/Buffer (single ended/diff inputs)	1	1	LVPECL	LVDS	2000	10	130	0.63	—	48	2	8QFN	2.55
SN65LVDS18/19	2.5-V/3.3-V Oscillator Gain Stage/Buffer (single ended/diff inputs)	1	1	LVPECL	LVDS	1000	10	130	0.63	—	36	2	8QFN	1.95
SN65LVDS20	2.5-V/3.3-V LVDS repeater with enable	1	1	LVPECL LVDS, CML	LVDS	4000	45	130	0.63	—	45	3	8QFN	3.30
SN65LVP16/17	2.5-V/3.3-V Oscillator Gain Stage/Buffer (single ended/diff inputs)	1	—	LVPECL	LVPECL	2000	10	130	0.63	—	30	2	8QFN	2.55
SN65LVP18/19	2.5-V/3.3-V Oscillator Gain Stage/Buffer (single ended/diff inputs)	1	—	LVPECL	LVPECL	1000	10	130	0.63	—	20	2	8QFN	1.95
SN65LVP20	2.5-V/3.3-V LVPECL	1	1	LVPECL LVDS, CML	LVPECL	4000	10	130	0.63	—	45	3	8QFN	4.40

Note: Supply voltage for all devices listed above is 3.3 V.

Preview devices appear in **BOLD BLUE**.

[1]Suggested resale price in U.S. dollars in quantities of 1,000. Please check www.ti.com for the most current pricing information.

[2]Integrated Termination Available (100-Ω)-SN65LVDTxxx.

PECL Selection Guide

Device	Description	No. of Tx	No. of Rx	Input Signal	Output Signal	Signaling Rate (Mbps)	Tx tpd Typ (ns)	Rx tpd Typ (ns)	I_{CC} Max (mA)	ESD HBM (kV)	Supply Voltage (V)	Pin/Package(s)	Price[1]
TB5D1M	Replacement for Agere BDG1A & BPNGA, built-in surge protection	4	—	TTL	PECL	400	1.2	—	40	3	3.3, 5	16SOIC gull-wing, 16SOIC	7.20
TB5D2H	Replacement for Agere BDG1A & BDGLA, power down open circuit o/p	4	—	TTL	PECL	400	1.2	—	40	3	3.3, 5	16SOIC gull-wing, 16SOIC	7.20
TB5R1	Replacement for Agere BRF1A & BRF2A, 8KΩ Input Impedance	—	4	PECL	TTL	400	—	2.5	32	3	5	16SOIC gull-wing, 16SOIC	7.20
TB5R2	Replacement for Agere BRS2A & BRS2B	—	4	PECL	TTL	400	—	2.5	32	3	5	16SOIC gull-wing, 16SOIC	7.20
TB3R1	3.3-V supply alternative to Agere BRF1A & BRF2A	—	4	LVPECL	LVTTL	400	—	—	32	3	3.3	16SOIC	8.65
TB3R2	3.3-V supply alternative to Agere BRS2A & BRS2B	—	4	LVPECL	LVTTL	400	—	—	32	3	3.3	16SOIC	8.65
TB5T1	Dual differential transceiver	2	2	LVPECL, LVTTL	LVPECL, LVTTL	400	1.2	2.5	35	3	5	8SOIC gull-wing, 8SOIC	7.20
SN65LVDS33[2]	Receiver with –4 V to 5 V Common-Mode Range, LVDS32 Footprint	—	4	LVDS, LVPECL, PECL, LVECL, ECL	LVTTL	400	—	4	23	15	3.3	16SOIC, 16TSSOP	2.00
SN65LVDS348[2]	Receiver with –4 V to 5 V Common-Mode Range, LVDS48 Footprint	—	4	LVDS, LVPECL, PECL, LVECL, ECL	LVTTL	340	—	6	20	15	3.3	16SOIC, 16TSSOP	1.80
SN65LVDS34[2]	Receiver with –4 V to 5 V Common-Mode Range	—	2	LVDS, LVPECL, PECL, LVECL, ECL	LVTTL	400	—	4	12	15	3.3	8SOIC	1.15
SN65LVDS352[2]	Receiver with –4 V to 5 V Common-Mode Range	—	4	LVDS, LVPECL, PECL, LVECL, ECL	LVTTL	560	—	6	20	15	3.3	24TSSOP	1.80

[1]Suggested resale price in U.S. dollars in quantities of 1,000. Please check www.ti.com for the most current pricing information. *[2]Integrated Termination Available (100-Ω)-SN65LVDTxxx.*

LVDS Selection Guide

Device	Description	No. of Tx	No. of Rx	Input Signal	Output Signal	Signaling Rate (Mbps)	Part-to-Part Skew Max (ps)	Tx tpd Typ (ns)
Single								
SN65LVDS1	Driver	1	—	LVTTL	LVDS	630	—	1.7
SN65LVDS2[1]	Receiver	—	1	LVDS	LVTTL	400	—	1.7
SN65LVDS179	Full-Duplex Transceiver, No Enables	1	1	LVDS, LVTTL	LVTTL, LVDS	400	—	1.7
SN65LVDS180	Full-Duplex Transceiver, with Enables	1	1	LVDS, LVTTL	LVTTL, LVDS	400	—	1.7
Dual								
SN65LVDS9638	Driver	2	—	LVTTL	LVDS	400	800	1.7
SN65LVDS9637	Receiver	—	2	LVDS	LVTTL	400	1000	—
SN65LVDS049	Transceiver, Driver and Receiver Enable	2	2	LVDS, LVTTL	LVTTL, LVDS	400	100	1.3
SN65LVDS050	Transceiver, Driver and Receiver Enable	2	2	LVDS, LVTTL	LVDS, LVTTL	400	—	1.7
SN65LVDS051	Transceiver, Driver Enable Only	2	2	LVDS, LVTTL	LVDS, LVTTL	400	—	1.7
SN65LVDS1050	Transceiver with 2.7-V Supply	2	2	LVDS, LVTTL	LVTTL, LVDS	400	—	1.7
SN65LVDS22	Multiplexed LVDS Repeater	2	2	LVDS	LVDS	250	—	4
Quad								
SN65LVDS047	Driver with Flow-Through Pinout	4	—	LVTTL	LVDS	400	1000	1.8
SN65LVDS31	Driver, AM26LS31 Footprint	4	—	LVTTL	LVDS	400	800	1.7
SN65LVDS3487	Driver, MC34987 Footprint	4	—	LVTTL	LVDS	400	800	1.7
SN65LVDS391	Driver with Flow-Through Pinout	4	—	LVTTL	LVDS	630	1500	1.7
SN65LVDS048A	Receiver with Flow-Through Pinout	—	4	LVDS	LVTTL	400	1000	—
SN65LVDS32	Receiver, AM26LS32 Footprint	—	4	LVDS	LVTTL	400	1000	—
SN65LVDS3486	Receiver, MC3486 Footprint	—	4	LVDS	LVTTL	400	1000	—
SN65LVDS390[1]	Receiver with Flow-Through Pinout	—	4	LVDS	LVTTL	630	1000	—
8-Channel								
SN65LVDS389	Driver	8	—	LVTTL	LVDS	630	1500	1.7
SN65LVDS388A[1]	Receiver	—	8	LVDS	LVTTL	630	1000	
SN65LVDS109	Dual 4-Port LVDS Repeater	8	2	LVDS	LVDS	632	1500	2.8
16-Channel								
SN65LVDS387	Driver	16	—	LVTTL	LVDS	630	1500	1.7
SN65LVDS386[1]	Receiver	—	16	LVDS	LVTTL	630	1000	—

[1]*Integrated termination available (100-Ω) - SN65LVDTx*

LVDS Selection Guide

Device	Rx tpd Typ (ns)	I_{CC} Max (mA)	ESD HBM (kV)	Supply Voltage (V)	Pin/Package(s)	Price[2]
Single Family						
SN65LVDS1	—	8	15	3.3	8SOIC, 5SOP	0.47
SN65LVDS2[1]	2.6	7	15	3.3	8SOIC, 5SOP	0.47
SN65LVDS179	3.7	12	12	3.3	8SOIC, 8VSSOP	1.35
SN65LVDS180	3.7	12	12	3.3	14SOIC, 14TSSOP	1.35
Dual Family						
SN65LVDS9638	—	13	8	3.3	8HTSSOP, 8SOIC, 8VSSOP	1.15
SN65LVDS9637	2.1	10	8	3.3	8HTSSOP, 8SOIC, 8VSSOP	1.15
SN65LVDS049	1.9	35	10	3.3	16TSSOP	1.40
SN65LVDS050	3.7	20	12	3.3	16SOIC, 16TSSOP	2.25
SN65LVDS051	3.7	20	12	3.3	16SOIC, 16TSSOP	2.25
SN65LVDS1050	3.7	20	12	2.7	16TSSOP	2.25
SN65LVDS22	4	20	12	3.3	16SOIC, 16TSSOP	2.80
Quad Family						
SN65LVDS047	—	26	8	3.3	16SOIC, 16TSSOP	1.70
SN65LVDS31	—	35	8	3.3	16SOIC, 16TSSOP, 16SOP	1.70
SN65LVDS3487	—	35	8	3.3	16SOIC	1.50
SN65LVDS391	—	26	15	3.3	16SOIC, 16TSSOP	1.50
SN65LVDS048A	2.4	15	10	3.3	16SOIC, 16TSSOP	1.70
SN65LVDS32	2.1	18	8	3.3	16SOIC, 16TSSOP, 16SOP	1.70
SN65LVDS3486	2.1	18	8	3.3	16SOIC	1.50
SN65LVDS390[1]	2.5	18	15	3.3	16SOIC, 16TSSOP	1.50
8-Channel Family						
SN65LVDS389	—	70	15	3.3	38TSSOP	2.90
SN65LVDS388A[1]	2.5	40	15	3.3	38TSSOP	2.90
SN65LVDS109	—	64	12	3.3	38TSSOP	4.00
16-Channel Family						
SN65LVDS387	—	95	15	3.3	64TSSOP	5.55
SN65LVDS386[1]	2.5	70	15	3.3	64TSSOP	5.55

[1]Integrated termination available (100-Ω) - SN65LVDTx

[2]Suggested resale price in U.S. dollars in quantities of 1,000. Please check www.ti.com for the most current pricing information.

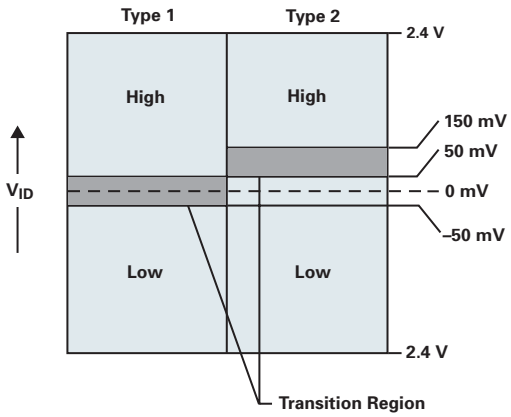
Multipoint LVDS (M-LVDS)

M-LVDS Features

- TIA/EIA-899 standard
- Driver output current
  - 11.3 mA vs. 3.5 mA (LVDS)
- Receiver thresholds
  - 50 mV vs. 100 mV (LVDS)
- Driver edge rate control
  - 1 ns min allows ease-of-stub design
- Contention provisions
  - Driver short circuit limited to 43 mA
  - Drivers, receivers and disabled devices must limit their bus voltage from 0 to 2.4 V
  - Drivers are tested with 32 contending nodes

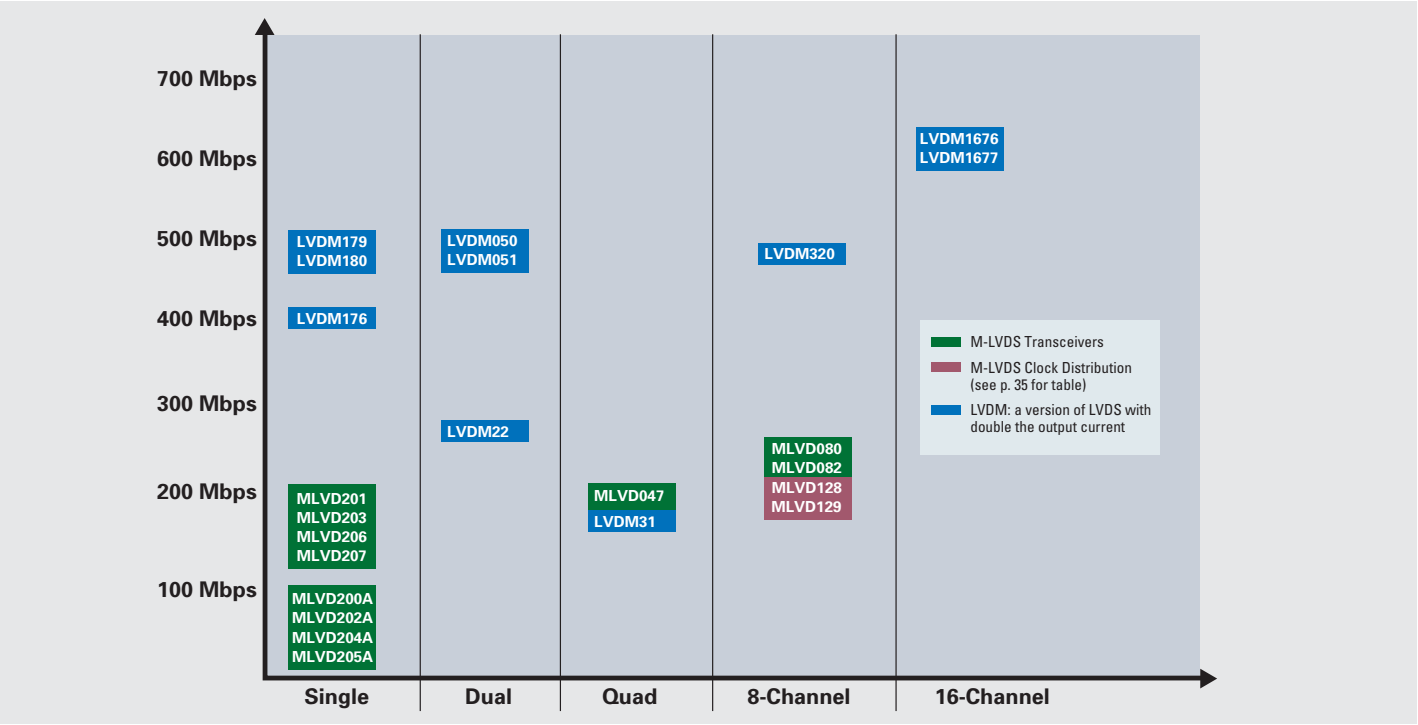
M-LVDS Devices from TI

- TIA/EIA-899 standard compliant guarantees true multipoint
- Type 1 receivers: 25-mV hysteresis to prevent oscillation
- Type 2 receivers: internal failsafe (no external bias network)
- –1-V to 3.4-V common mode
- 3.3-V supply operation



Receiver types.

Multipoint LVDS



M-LVDS Selection Guide

Device	No. of Tx	No. of Rx	Rx Type	Half/ Full Duplex	Input Signal	Output Signal	Signaling Rate (Mbps)	Part-to-Part Skew Max (ps)	Tx tpd Typ (ns)	Rx tpd Typ (ns)	I_{CC} Max (mA)	ESD HBM (kV)	Pin/ Package(s)	TIA/EIA-899 Standard Compliance	Price[2]
SN65MLVD200A	1	1	1	Half	LVTTL, M-LVDS	LVTTL, M-LVDS	100	1000	2.5	3.6	24	8	8SOIC	✔	1.55
SN65MLVD201	1	1	1	Half	LVTTL, M-LVDS	LVTTL, M-LVDS	200	1000	1.5	4	24	8	8SOIC	✔	1.85
SN65MLVD202A	1	1	1	Full	LVTTL, M-LVDS	LVTTL, M-LVDS	100	1000	2.5	3.6	24	8	14SOIC	✔	1.55
SN65MLVD203	1	1	1	Full	LVTTL, M-LVDS	LVTTL, M-LVDS	200	1000	1.5	4	24	8	14SOIC	✔	1.85
SN65MLVD204A	1	1	2	Half	LVTTL, M-LVDS	LVTTL, M-LVDS	100	1000	2.5	3.6	24	8	8SOIC	✔	1.55
SN65MLVD205A	1	1	2	Full	LVTTL, M-LVDS	LVTTL, M-LVDS	100	1000	2.5	3.6	24	8	14SOIC	✔	1.55
SN65MLVD206	1	1	2	Half	LVTTL, M-LVDS	LVTTL, M-LVDS	200	1000	1.5	4	24	8	8SOIC	✔	1.85
SN65MLVD207	1	1	2	Full	LVTTL, M-LVDS	LVTTL, M-LVDS	200	1000	1.5	4	24	8	14SOIC	✔	1.85
SN65MLVD047	4	0	—	Half	LVTTL	M-LVDS	200	1000	1.5	—	60	12	16SOIC, 16TSSOP	✔	1.45
SN65MLVD128	8	1	—	—	LVTTL	M-LVDS	200	800	1.5	1.5	140	8	48TSSOP	✔	3.80
SN65MLVD129	8	2	—	—	LVTTL	M-LVDS	200	800	1.5	1.5	140	8	48TSSOP	✔	3.80
SN65MLVD080	8	8	1	Half	LVTTL, LVDS	LVTTL, M-LVDS	250	1000	2.4	6	180	8	64TSSOP	✔	4.75
SN65MLVD082	8	8	2	Half	LVTTL, LVDS	LVTTL, M-LVDS	250	1000	2.4	6	180	8	64TSSOP	✔	4.75
SN65LVDM179	1	1	—	Full	LVTTL, LVDM	LVTTL, LVDM	500	1000	1.7	3.7	15	12	8SOIC, 8VSSOP	—	1.70
SN65LVDM050[1]	2	2	—	Full	LVTTL, LVDM	LVTTL, LVDM	500	1000	1.7	3.7	27	12	16SOIC, 16TSSOP	—	1.70
SN65LVDM22	2	2	—	—	LVDM	LVDM	250	—	4	4	27	12	16SOIC, 16TSSOP	—	2.50
SN65LVDM31	4	0	—	—	LVCMOS	LVDM	150	1000	2.3	—	40	12	16SOIC	—	1.70
SN65LVDM1676	16	16	—	Half	LVTTL, LVDM	LVTTL, LVDM	630	1000	2.5	3	175	15	64TSSOP	—	7.75

Supply voltage for all devices listed above is 3.3 V and temperature range is –40 to 85°C.
[1]Automotive version available, temperature range of –40 to 125°C
*[2]Suggested resale price in U.S. dollars in quantities of 1,000. Please check **www.ti.com** for the most current pricing information.*

Resources

For a complete list of resources (EVMs, data sheets and application notes), visit **interface.ti.com**

Literature Number	Description
Application Notes	
SLLA106	TIA/EIA-485 and M-LVDS, Power and Speed Comparison
SLLA088A	Transmission at 200 Mbps in VME Card Cage Using LVDM (Rev. A)
SLLA108	Introduction to M-LVDS (TIA/EIA-899)
SLLA121	Interoperability of M-LVDS and BusLVDS
SLLA119	Wired-Logic Signaling with M-LVDS
SLLA127	M-LVDS Signaling Rate Versus Distance

Part Number	Description	Price[1]
Evaluation Modules (EVMs)		
MLVD20xEVM	M-LVDS Evaluation Module	99.00
SN65LVDM31-32BEVM	SN65LVDM31-32BEVM Evaluation Module	49.00

[1]Suggested resale price in U.S. dollars.
*Please check **www.ti.com** for the most current pricing information.*
*Note: IBIS models are available at **interface.ti.com***

Design Considerations

Robustness — RS-485 is a robust interface standard for use in industrial environments. It features a wide common mode range of –7 V to 12 V. Parts from TI are available with ESD protection up to 16 kV.

Reliability — Integrated fail-safe circuitry protects the bus from interpreting noise as valid data when short-circuit, open-circuit or idle line fault conditions occur.

Speed and Distance — Low noise coupling of differential signaling with twisted-pair cabling and wide common-mode voltage range allows data exchange at signaling rates of up to 50 Mbps or to distances of several kilometers at lower rates.

Line Loading — RS-422 is capable of supporting one driver and up to 10 receivers on the bus line. Standard RS-485 is capable of supporting up to 32 unit loads or nodes on the bus line. However, there are reduced unit load devices available that can support up to 256 devices.

Termination — A multipoint bus architecture requires termination at both ends of the bus line. The termination resistors must be within 20 percent of the characteristic impedance of the cable and can vary from 90 Ω to 120 Ω.

Technical Information

- The main difference between RS-422 and RS-485 is the multidrop and multipoint bus architecture—that is, one driver to many receivers and many drivers to many receivers, respectively.
- Typical signaling rates and distances for these standards are up to 10 Mbps or up to 1.2 km. TI offers devices capable of reaching signaling rates of up to 50 Mbps.

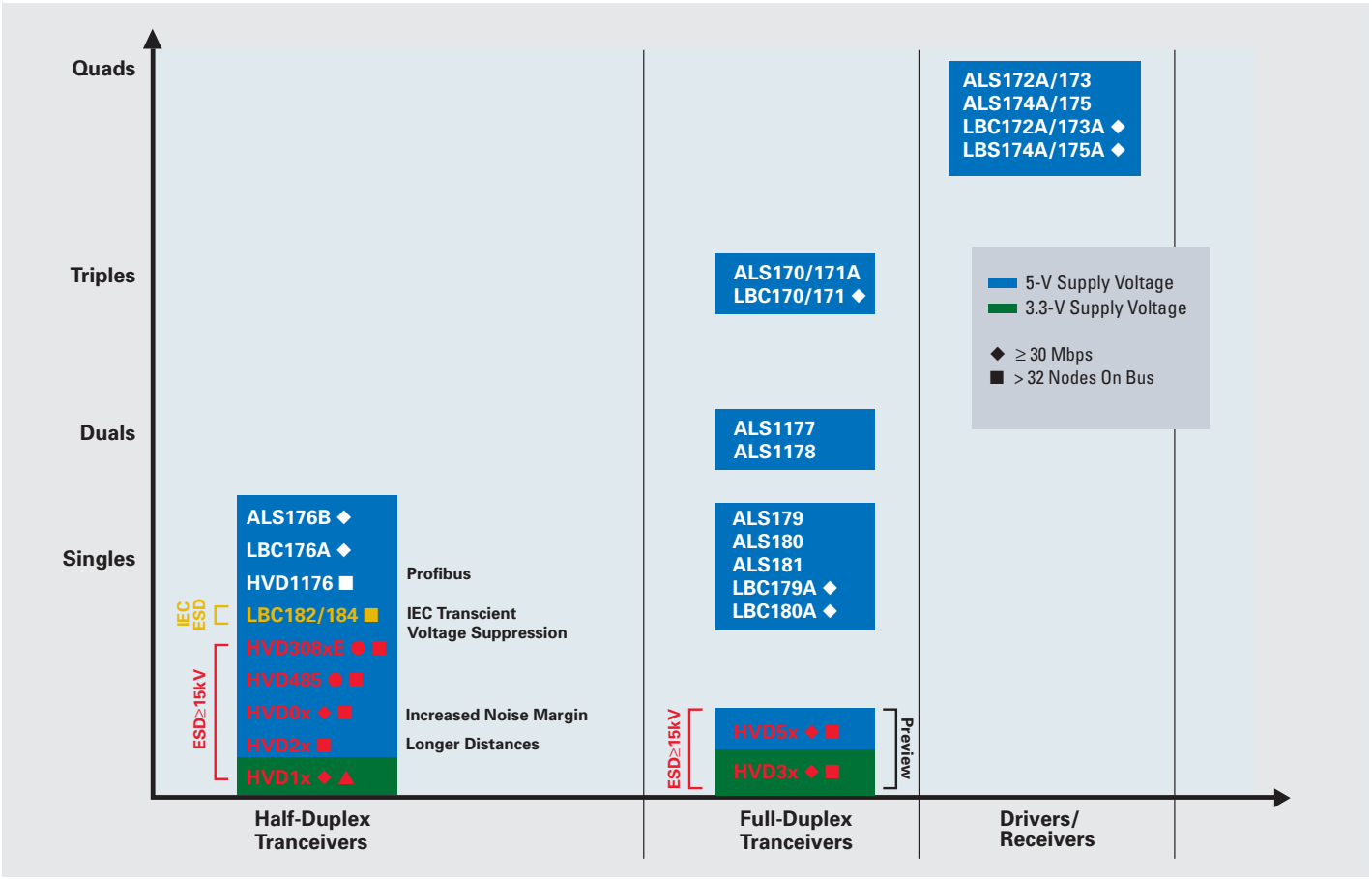
Resources

For a complete list of resources (data sheets and application notes), visit **interface.ti.com**

Literature Number	Description
Application Notes	
SLLA036B	Interface Circuits for TIA/EIA-485 (RS-485)
SLLA070C	422 and 485 Standards Overview and System Configurations
SLLA112	RS-485 for E-Meter Applications
SLLA106	TIA/EIA-485 and M-LVDS, Power and Speed Comparison
SLLA067	Comparing Bus Solutions
SLLA143	RS-485 for Digital Motor Control Applications

*Note: IBIS models are available at **interface.ti.com***

RS-485/422 Family of Products



RS-485/422 Selection Guide

	Temperature Prefix[1]	Device	Description	No. of Tx/Rx	Supply Voltage (V)	I_{CC} Max (mA)	Signaling Rate (Mbps)	ESD (kV)	Fail Safe	Nodes	Footprint	Pin/Package(s)	Price[2]
Half-Duplex	SN65, SN75	HVD12	3.3-V Transceiver — 1 Mbps	1/1	3.3	15.5	1	16	Short, Open	256	SN75176	8PDIP, 8SOIC	1.65
	SN65, SN75	HVD11	3.3-V Transceiver — 10 Mbps	1/1	3.3	15.5	10	16	Short, Open	256	SN75176	8PDIP, 8SOIC	1.70
	SN65, SN75	HVD10	3.3-V Transceiver — 25 Mbps	1/1	3.3	15.5	25	16	Short, Open	64	SN75176	8PDIP, 8SOIC	1.75
	SN65, SN75	HVD08	Wide Supply Range: 3 to 5.5-V	1/1	3.3 to 5	16	10	16	Short, Open	256	SN75176	8PDIP, 8SOIC	1.87
	SN65, SN75	HVD3082E	Low Power, Fail-Safe, High ESD	1/1	5	0.9	0.2	16	Short, Open	256	MAX3082E	8PDIP, 8SOIC, 8MSOP	0.75
	SN65	HVD3085E	Low Power, Fail-Safe, High ESD	1/1	5	TBD	1	16	Short, Open	256	MAX3085E	8PDIP, 8SOIC, 8MSOP	0.90
	SN65	HVD3088E	Low Power, Fail-Safe, High ESD	1/1	5	TBD	10	16	Short, Open	256	MAX3088E	8PDIP, 8SOIC, 8MSOP	1.00
	SN65, SN75	HVD1176	PROFIBUS Transceiver, EN 50170	1/1	5	6	40	10	Short, Open, Idle	160	SN75176	8SOIC	1.40
	SN65	HVD22	–20-V to 25-V Common Mode, 0.5 Mbps	1/1	5	9	0.5	16	Short, Open, Idle	256	SN75176	8PDIP, 8SOIC	1.65
	SN65	HVD21	–20-V to 25-V Common Mode, 5 Mbps	1/1	5	12	5	16	Short, Open, Idle	256	SN75176	8PDIP, 8SOIC	1.65
	SN65	HVD20	–20-V to 25-V Common Mode, 25 Mbps	1/1	5	9	25	16	Short, Open, Idle	64	SN75176	8PDIP, 8SOIC	1.65
	SN65	HVD23	Receiver Equalization, –20-V to 25-V Common Mode, 25 Mbps	1/1	5	11	25	16	Short, Open, Idle	64	SN75176	8PDIP, 8SOIC	1.80
	SN65	HVD24	Receiver Equalization, –20-V to 25-V Common Mode, 3 Mbps	1/1	5	14	3	16	Short, Open, Idle	256	SN75176	8PDIP, 8SOIC	1.80
	SN65, SN75	HVD07	High Output Transceiver — 1 Mbps	1/1	5	15	1	16	Short, Open	256	SN75176	8PDIP, 8SOIC	1.15
	SN65, SN75	HVD06	High Output Transceiver — 10 Mbps	1/1	5	15	10	16	Short, Open	256	SN75176	8PDIP, 8SOIC	1.20
	SN65, SN75	HVD05	High Output Transceiver — 40 Mbps	1/1	5	15	40	16	Short, Open	64	SN75176	8PDIP, 8SOIC	1.25
	SN55, SN65, SN75	LBC176	Low Power, –40° to 125°C	1/1	5	1.5	10	2	Open	32	SN75176	8PDIP, 8SOIC	0.89
	SN65, SN75	LBC176A	Low Power, High ESD	1/1	5	15	30	12	Open	32	SN75176	8PDIP, 8SOIC	1.17
	SN65	HVD485E	Standard Half-Duplex	1/1	5	2	10	15	Open	64	MAX485	8PDIP, 8SOIC, 8MSOP	0.70
	SN65, SN75	LBC184	Integrated Transient Protection, IEC 61000-4-2/5	1/1	5	25	0.25	15	Open	128	SN75176	8PDIP, 8SOIC	0.93
	SN65, SN75	LBC182	Similar to LBC184 without Integrated Transient Protection	1/1	5	30	0.25	15	Open	128	SN75176	8PDIP, 8SOIC	0.85
Full-Duplex	SN65, SN75	ALS176	Skew: 15 ns	1/1	5	30	35	2	Open	32	SN75176	8SOIC	0.90
	SN75	ALS176B	Skew: 5 ns	1/1	5	30	35	2	Open	32	SN75176	8PDIP, 8SOIC	1.06
	SN75	176A	Cost Effective	1/1	5	50	10	2	None	32	SN75176	8PDIP, 8SOIC	0.45
	SN65, SN75	176B	Cost Effective	1/1	5	70	10	2	None	32	SN75176	8PDIP, 8SOIC, 8SOP	0.40
	SN65, SN75	LBC179A	High Signaling Rate, High ESD without Enable	1/1	5	15	30	10	Open	32	SN75179	8PDIP, 8SOIC	1.01
	SN65, SN75	LBC180A	High Signaling Rate, High ESD with Enable	1/1	5	15	30	10	Open	32	SN75180	14PDIP, 14SOIC	1.13
	SN65, SN75	LBC180	Lower Power, with Enable	1/1	5	4	10	2	Open	32	SN75LBC180	14PDIP, 14SOIC	0.84
	SN65, SN75	LBC179	Low Power, without Enable	1/1	5	5	10	2	Open	32	SN75179	8PDIP, 8SOIC	0.75
	SN75	ALS181	–12 V to 12 V Common Mode, with Enable	1/1	5	30	10	2	None	32	SN75ALS180	14PDIP, 14SOP	1.62
	SN65, SN75	ALS180	High Signaling Rate, with Enable	1/1	5	30	25	2	Open	32	SN75ALS180	14SOIC	1.91
	SN75	178B	Without Enables	1/1	5	70	10	2	None	32	SN75176	8PDIP, 8SOP	1.35
	SN75	179B	Without Enables	1/1	5	70	10	2	None	32	SN75179	8PDIP, 8SOIC, 8SOP	0.77
	SN75	ALS1177	Driver and Receiver Pair, Common Enable	2/2	5	50	10	2	Open	32	MC34050	16PDIP, 16SOP	3.24
Dual	SN75	ALS1178	Driver and Receiver Pair, Driver Enable	2/2	5	50	10	2	Open	32	MC34051	16PDIP, 16SOP	3.24
	SN75	1177	Driver and Receiver Pair, Common Enable	2/2	5	110	10	2	N/A	32	MC34050	16PDIP, 16SOP	2.65
	SN75	1178	Driver and Receiver Pair, Driver Enable	2/2	5	110	10	2	Open	32	MC34051	16PDIP, 16SOP	2.65
	SN75, SN65	LBC170	FAST-20 SCSI, Skew: 3 ns	3/3	5	20	30	12	Open	32	SN75ALS170	20SOIC, 16SSOP	3.54
Triple	SN75, SN65	LBC171	FAST-20 SCSI, Skew: 3 ns	3/3	5	20	30	12	Open	32	SN75ALS171	20SOIC, 20SSOP	3.54
	SN75	ALS170A	FAST-20 SCSI, Skew: 5 ns	3/3	5	90	20	2	Open	32	SN75ALS170	20SOIC	4.77
	SN75	ALS171A	FAST-20 SCSI, Skew: 5 ns	3/3	5	90	20	2	Open	32	SN75ALS171	20SOIC	4.54
	SN75	ALS170	FAST-20 SCSI, Skew: 10 ns	3/3	5	90	20	2	Open	32	SN75ALS170	20SOIC	4.77
	SN75	ALS171	FAST-20 SCSI, Skew: 10 ns	3/3	5	90	20	2	Open	32	SN75ALS171	20SOIC	5.40
	SN55, SN65, SN75	LBC172	Low Power	4/0	5	7	10	2	N/A	32	AM26LS31	16PDIP, 20SOIC	1.64
Quad Drivers	SN55, SN65, SN75	LBC174	Low Power	4/0	5	7	10	2	N/A	32	MC3487	16PDIP, 20SOIC	1.72
	SN65, SN75	LBC172A	High Signaling Rate, High ESD	4/0	5	23	30	13	N/A	32	AM26LS31	16PDIP, 16SOIC, 20SOIC	2.21
	SN65, SN75	LBC174A	High Signaling Rate, High ESD	4/0	5	23	30	13	N/A	32	MC3487	16PDIP, 16SOIC, 20SOIC	2.32
	SN75	ALS172A	High Signaling Rate	4/0	5	55	20	2	N/A	32	AM26LS31	16PDIP, 20SOIC	2.61
	SN75	ALS174A	High Signaling Rate	4/0	5	55	20	2	N/A	32	MC3487	16PDIP, 20SOIC	2.29
	SN75	172	Cost Effective	4/0	5	60	4	2	N/A	32	AM26LS31	16PDIP, 20SOIC	1.37
	SN75	174	Cost Effective	4/0	5	60	4	2	N/A	32	MC3487	16PDIP, 20SOIC	0.94
	SN55, SN65, SN75	LBC173	Low Power	0/4	5	20	10	2	Open	32	AM26LS32	16PDIP, 16SOIC	1.01
Quad Receivers	SN55, SN65, SN75	LBC175	Low Power	0/4	5	20	10	2	Open	32	MC3486	16PDIP, 16SOIC, 20SOIC	0.96
	SN65, SN75	LBC173A	High Signaling Rate, High ESD, Low Power	0/4	5	20	50	6	Short, Open	32	AM26LS32	16PDIP, 16SOIC	1.36
	SN65, SN75	LBC175A	High Signaling Rate, High ESD, Low Power	0/4	5	20	50	6	Short, Open	32	MC3486	16PDIP, 16SOIC	1.30
	SN75	ALS173	Low Power	0/4	5	24	10	2	Open	32	AM26LS32	16PDIP, 16SOP	2.61
	SN75	ALS175	Low Power	0/4	5	24	10	2	Open	32	MC3486	16PDIP, 16SOP	2.29
	SN55, SN75	173	Cost Effective	0/4	5	70	10	2	Open	32	AM26LS32	16PDIP, 16SOIC, 16SOP, 20LCCC,16CDIP	1.44
	SN65, SN75	175	Cost Effective	0/4	5	70	10	2	None	32	MC3486	16PDIP, 16SOIC, 16SOP	0.65

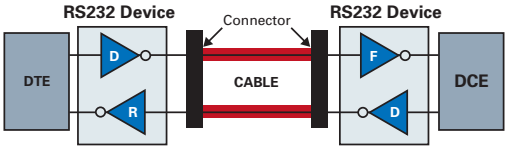
RS-485 and RS-422 standard compliant devices. New products appear in **BOLD RED**.

[1] *All devices above use the following temperature designators: SN55 = military (–55° to 125°C), SN65 = industrial (–40°C to 85°C), SN75 = commercial (0° to 70°C)*

[2] *Suggested resale price in U.S. dollars in quantities of 1,000. Please check www.ti.com for the most current pricing information.*

RS-232 Key Features

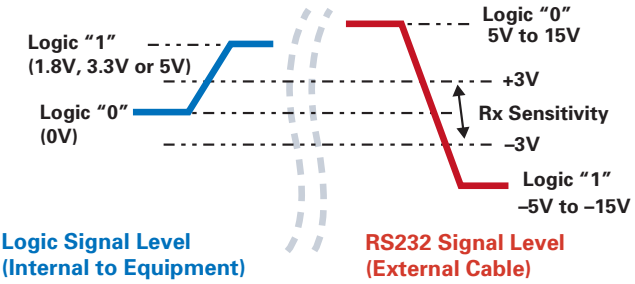
- RS-232 is a popular interface scheme due to ease of design and reliable operation at low frequency
- Single-ended communication scheme
  - Separate driver and receiver line
  - Positive (5 V to15 V) and negative (–5 V to –15 V) signaling levels
  - Receiver ±25 V tolerant
- No external termination resistor used
  - Receivers include 3K-7K resistor
- Drives up to 15m-20m cable



Typical DTE-DCE connection scheme.

TI RS-232 Features and Benefits

- ±15KV ESD eliminates any external ESD device requirements
  - IEC-ESD in development (1H, 2005)
- Internal charge pump allows single-supply operation
  - 3.3 V to 5 V operation available
  - 2.5 V and 1.8 V operation in development (1Q, 05)
- Flexible power down options
  - Standby power reduces current to < 1µA
  - Manual and Auto shutdown features available
- High-speed data rate 250Kbps and 1000Kbps



RS-232 signal level compaired against logic signal level.

Single Supply RS-232 Transceivers		Single Supply RS-232 Receivers	Dual Supply RS-232 Drivers	Dual Supply RS-232 Transceiver	
≤250Kbps Data Rate	1 Mbps Data Rate	≤250Kbps Data Rate	≤250Kbps Data Rate	≤250Kbps Data Rate	
MAX202	SNx5C3221	MC1489	LT1030	GD65232	SN75C1406
MAX207	SNx5C3222	MC1489A	MC1488	GD75232	SN75C185
MAX208	SNx5C3223	SN55189A	SN55188	GD75323	SN75LBC187
MAX211	SNx5C3232	SN75189	SN75150	SN65C1154	SN75LBC241
MAX222	SNx5C3238	SN75189A	SN75C188	SN65C1406	SN75LP1185
MAX232	SNx5C3243	SN75C189	SN75C198	SN75154	SN75LP196
MAX3221	SNx5C23243	SN75C189A	UA9636A	SN75155	SN75LPE185
MAX3222		UC5180C	UC5170C	SN751701	SN75LV4737A
MAX3223		UC5181C	SN75188	SN75185	TL145406
MAX3232				SN75186	
MAX3238				SN75196	
MAX3238-Q1				SN752232	
MAX3243				SN75C1154	

RS-232 Selection Guide

Device	Status	Data Rate (Kbps)	Drivers	Receivers	ESD	Supply Voltage(s) (V)	I_{CC} (max) (mA)	Pin/Package	Description	Price[1]
MAX3243E	Preview	250	3	5	IEC 6100-4-2	3.3, 5	1	28SOIC, 28SSOP, 28TSSOP	3-V to 5.5-V Multichannel RS-232 Line Driver/Receiver With ±15kV ESD (HBM) Protection	Preview
MAX3221E	Preview	250	1	1	IEC 6100-4-2	3.3, 5	1	16SSOP, 16TSSOP	3-V to 5.5-V Single-Channel RS-232 Line Driver/Receiver	Preview
MAX3222E	Preview	—	2	2	IEC 6100-4-2	3.3, 5	1	20SOIC, 20SSOP, 20TSSOP	3-V to 5.5-V Multichannel RS-232 Line Driver/Receiver	Preview
MAX3223E	Preview	250	2	2	IEC 6100-4-2	3.3, 5	1	20SOIC, 20SSOP, 20TSSOP	3-V to 5.5-V Multichannel RS-232 Line Driver/Receiver	Preview
MAX3232E	Preview	250	2	2	IEC 6100-4-2	3.3, 5	1	16SOIC, 16SSOP, 16TSSOP	3-V to 5.5-V Multichannel RS-232 Line Driver/Receiver	Preview

[1]*Suggested resale price in U.S. dollars in quantities of 1,000. Please check www.ti.com for the most current pricing information.*

Preview devices appear in **BOLD BLUE**.

RS-232 Selection Guide (Continued)

Device	Status	Data Rate (Kbps)	Drivers	Receivers	ESD	Supply Voltage(s) (V)	I_{CC} (max) (mA)	Pin/Package	Description	Price[1]
MAX3238E	Preview	250	5	3	IEC 6100-4-2	3.3, 5	2	28SSOP, 28TSSOP	3-V to 5.5-V Multichannel RS-232 Line Driver/Receiver	Preview
MAX202E	Preview	120	2	2	IEC 6100-4-2	5	15	16SOIC, 16TSSOP	5-V Dual RS-232 Line Driver/Receiver with ±15 kV ESD Protection	Preview
MAX213E	Preview	120	4	5	IEC 6100-4-2	5	15	16SOIC, 16TSSOP	5-V Dual RS-232 Line Driver/Receiver	Preview
ADM2209E	Preview	460	6	10	IEC 6100-4-2	3.3, 5	1	38TSSOP	Dual RS-232 Serial Port with Low-Power Standby	Preview
MAX3227E	Preview	250	3	5	IEC 6100-4-2	3.3, 5	1	16SSOP	IEC 6100-4-2 ESD-Protected, 4Dr, 5Rx RS-232 Transceivers	Preview
MAX211E	Preview	120	4	5	IEC 6100-4-2	5	20	28SSOP, 28SOIC	IEC 6100-4-2 ESD-Protected, +5-V RS-232 Transceivers	Preview
MAX207E	Preview	120	5	3	IEC 6100-4-2	5	20	24PDIP, 24SOIC, 24SSOP	IEC 6100-4-2 ESD-Protected, +5-V RS-232 Transceivers	Preview
MAX208E	Preview	120	4	4	IEC 6100-4-2	5	20	24PDIP, 24SOIC, 24SSOP	IEC 6100-4-2 ESD-Protected, +5-V RS-232 Transceivers	Preview
SNx7C3243E	Preview	1000	5	3	IEC 6100-4-2	3.3, 5	1	28SSOP, 28SOIC, 28TSSOP	3-V to 5.5-V Multichannel RS-232 Line Driver/Receiver with IEC 6100-4-2 ESD Protection	Preview
MAX3237E	Preview	1000	5	3	IEC 6100-4-2	3.3, 5	2	28SSOP	IEC6100-4-2 ESD-Protected, 3.0 V to 5.5 V, Up to 1Mbps, RS-232 Transceivers	Preview
MAX3318E	Preview	460	2	2	IEC 6100-4-2	2.5	1	20TSSOP, 20SSOP	IEC 6100-4-2 ESD-Protected, 2.5 V, 1 µA, 460 Kbps, RS-232-Compatible Transceivers	Preview
MAX3386E	Preview	250	3	2	IEC 6100-4-2	3.3, 5	1	20TSSOP	3.0 V, IEC 6100-4-2 ESD Protected RS-232 Transceivers	Preview
MAX3319E	Preview	460	1	1	IEC 6100-4-2	2.5	1	16SSOP	IEC 6100-4-2 ESD-Protected, 2.5 V, 1 µA, 460 Kbps, RS-232-Compatible Transceivers	Preview
GD65232	ACTIVE	—	3	5	—	±9, 5	38	20PDIP, 20SOIC, 20SSOP, 20TSSOP	Multiple RS-232 Drivers and Receivers	0.25
GD75232	ACTIVE	120	3	5	—	±9, 5	30	20PDIP, 20SOIC, 20SSOP, 20TSSOP	Multiple RS-232 Drivers and Receivers	0.22
GD75323	ACTIVE	120	5	3	—	±12, 5	32	20SOIC	Multiple RS-232 Drivers and Receivers	0.22
LT1030	ACTIVE	—	4		—	–5	1	14PDIP, 14SOIC	Quadruple Low-Power Line Driver	0.81
MAX202	ACTIVE	120	2	2	15kV HBM	5	15	16SOIC, 16TSSOP	5-V Dual RS-232 Line Driver/Receiver with ±15-kV ESD Protection	0.58
MAX207	ACTIVE	120	5	3	15kV HBM	5	20	24SOIC, 24SSOP	5-V Multichannel RS-232 Line Driver/Receiver with ±15-kV ESD Protection	1.08
MAX208	ACTIVE	120	4	4	15kV HBM	5	20	24PDIP, 24SOIC, 24SSOP	5-V Multichannel RS-232 Line Driver/Receiver with ±15-kV ESD Protection	1.08
MAX211	ACTIVE	120	4	5	15kV HBM	5	20	28SOIC, 28SSOP	MAX211	1.08
MAX222	ACTIVE	120	2	2	15kV HBM	5	10	18PDIP, 18SOIC	5-V Dual RS-232 Line Driver/Receiver with ±15-kV ESD Protection	1.26
MAX232	ACTIVE	120	2	2	2kV HBM	5	10	16PDIP, 16SOIC, 16SOP	Dual EIA-232 Driver/Receiver	0.45
MAX3221	ACTIVE	250	1	1	15kV HBM	3.3, 5	1	16SSOP, 16TSSOP	3-V to 5.5-V Single-Channel RS-232 Line Driver/Receiver	0.90
MAX3222	ACTIVE	—	2	2	15kV HBM	3.3, 5	1	20SOIC, 20SSOP, 20TSSOP	3-V to 5.5-V Multichannel RS-232 Line Driver/Receiver	1.35
MAX3223	ACTIVE	250	2	2	15kV HBM	3.3, 5	1	20SOIC, 20SSOP, 20TSSOP	3-V to 5.5-V Multichannel RS-232 Line Driver/Receiver	1.26
MAX3232	ACTIVE	250	2	2	15kV HBM	3.3, 5	1	16SOIC, 16SSOP, 16TSSOP	3-V to 5.5-V Multichannel RS-232 Line Driver/Receiver	1.26
MAX3238	ACTIVE	250	5	3	15kV HBM	3.3, 5	2	28SSOP, 28TSSOP	3-V to 5.5-V Multichannel RS-232 Line Driver/Receiver	1.13
MAX3238-Q1	ACTIVE	250	5	3	—	3.3, 5	2	28SSOP, 28TSSOP	Automotive Catalog 3 V to 5.5 V Multichannel RS-232 Line Driver/Receiver	1.42
MAX3243	ACTIVE	250	3	5	15kV HBM	3.3, 5	1	28SOIC, 28SSOP, 28TSSOP	3-V to 5.5-V Multichannel RS-232 Line Driver/Receiver with ±15-kV ESD (HBM) Protection	0.99
MC1488	ACTIVE	—	4		—	-9	25	14PDIP	Quadruple Line Driver	0.20
MC1489	ACTIVE	—	—	4	—	5	26	14PDIP	Quadruple Line Receiver	0.20
MC1489A	ACTIVE	—	—	4	—	5	26	14PDIP	Quadruple Line Receiver	0.20
SN55188	ACTIVE	—	4		—	-9	—	14CDIP, 14CFP, 20LCCC	Quadruple Line Driver	1.97
SN55189A	ACTIVE	—	—	4	—	5	—	14CDIP, 14CFP, 20LCCC	Quadruple Line Receiver	1.97
SN65C1154	ACTIVE	—	4	4	—	—	—	20PDIP	Quadruple Low-Power Drivers/Receivers	3.42
SN65C1406	ACTIVE	—	3	3	—	±12, 5	—	16SOIC	Triple Low-Power Drivers and Receivers	1.80
SN65C23243	ACTIVE	250	6	10	15kV HBM	3.3, 5	0.02	48SSOP, 48TSSOP	3-V to 5.5-V Dual RS-232 Port	4.32

[1] *Suggested resale price in U.S. dollars in quantities of 1,000. Please check www.ti.com for the most current pricing information.*

Preview devices appear in **BOLD BLUE**.

RS-232 Selection Guide (Continued)

Device	Status	Data Rate (Kbps)	Drivers	Receivers	ESD	Supply Voltage(s) (V)	I_{CC} (max) (mA)	Pin/Package	Description	Price[1]
SN65C3221	ACTIVE	1000	1	1	15kV HBM	3.3 or 5	1	16SOIC, 16SSOP, 16TSSOP	3-V To 5.5-V Multichannel RS-232 Line Driver/Receiver	2.38
SN65C3222	ACTIVE	—	2	2	15kV HBM	3.3 or 5	1	20SOIC, 20SSOP, 20TSSOP	3-V To 5.5-V Multichannel RS-232 Compatible Line Driver/Receiver	3.24
SN65C3223	ACTIVE	1000	2	2	15kV HBM	3.3 or 5	1	20SOIC, 20SSOP, 20TSSOP	3-V to 5-V Multichannel RS-232 Compatible Line Driver/Receiver	2.81
SN65C3232	ACTIVE	1000	2	2	15kV HBM	3.3 or 5	1	16SOIC, 16SSOP, 16TSSOP	3-V To 5.5-V Multichannel RS-232 Compatible Line Driver/Receiver	3.02
SN65C3238	ACTIVE	1000	5	3	15kV HBM	3.3 or 5	2	28SOIC, 28SSOP, 28TSSOP	3-V To 5.5-V Multichannel RS-232 Line Driver/Receiver	3.24
SN65C3243	ACTIVE	1000	3	5	15kV HBM	3.3 or 5	1	28SOIC, 28SSOP, 28TSSOP	3-V To 5.5-V Multichannel RS-232 Line Driver/Receiver	3.46
SN75150	ACTIVE	120	2	—	2kV HBM	–12	22	8PDIP, 8SOIC	Dual Line Driver	0.41
SN75154	ACTIVE		4	4		5 or 12	35	16PDIP, 16SOIC, 16SOP	Quadruple Differential Line Receiver	0.41
SN75155	ACTIVE	120	1	1	2kV HBM	–12	14	8PDIP, 8SOIC	Line Driver and Receiver	0.63
SN751701	ACTIVE		1	1		±5, 9, 12	11.9	8SOP	RS-232C Regulator	1.17
SN75185	ACTIVE	120	3	5	10kV HBM	±12, 5	30	20PDIP, 20SOIC, 20SSOP	Multiple RS-232 Drivers and Receivers	0.43
SN75186	ACTIVE		1	1		±12, 5		24SOIC	Quadruple Driver/Receiver with Loopback	2.88
SN75188	ACTIVE	120	4	—	2kV HBM	–9	25	14PDIP, 14SOIC, 14SOP	Quadruple Line Driver	0.18
SN75189	ACTIVE	—	—	4	—	5	26	14PDIP, 14SOIC, 14SOP	Quadruple Line Receiver	0.18
SN75189A	ACTIVE	—	—	4	—	5	26	14PDIP, 14SOIC, 14SOP	Quadruple Line Receiver	0.18
SN75196	ACTIVE	120	5	3	10kV HBM	±12, 5	20	20PDIP, 20SOIC	Multiple RS-232 Driver and Receiver	0.41
SN752232	ACTIVE	—	6	10	—	5	+/-50	48SSOP, 48TSSOP	Dual RS-232 Port	0.81
SN75C1154	ACTIVE	—	4	4	—	±12, 5	—	20PDIP, 20SOIC, 20SOP	Quadruple Low-Power Drivers/Receivers	0.76
SN75C1406	ACTIVE	120	3	3	2kV HBM	±12, 5	0.45	16PDIP, 16SOIC, 16SOP	Triple Low-Power Drivers and Receivers	0.67
SN75C185	ACTIVE	120	3	5	2kV HBM	±12, 5	0.75	20PDIP, 20SOIC	Low-Power Multiple Drivers and Receivers	0.90
SN75C188	ACTIVE	120	4	—	2kV HBM	–12	0.16	14PDIP, 14SOIC, 14SOP, 14SSOP	Quadruple Low-Power Line Driver	0.31
SN75C189	ACTIVE	—	—	4	—	5	0.7	14PDIP, 14SOIC, 14SOP	Quadruple Low-Power Line Receiver	0.31
SN75C189A	ACTIVE	—	—	4	—	5	0.7	14PDIP, 14SOIC, 14SOP, 14SSOP	Quadruple Low-Power Line Receiver	0.31
SN75C198	ACTIVE	—	4		—	–12	0.32	14PDIP, 14SOIC	Quadruple Low-Power Line Drivers	2.25
SN75C23243	ACTIVE	250	6	10	15kV HBM	3.3, 5	0.02	48SSOP, 48TSSOP	3-V to 5.5-V Dual RS-232 Port	3.42
SN75C3221	ACTIVE	1000	1	1	15kV HBM	3.3 or 5	1	16SOIC, 16SSOP, 16TSSOP	3-V To 5.5-V Multichannel RS-232 Line Driver/Receiver	1.94
SN75C3222	ACTIVE		2	2	15kV HBM	3.3 or 5	1	20SOIC, 20SSOP, 20TSSOP	3-V To 5.5-V Multichannel RS-232 Compatible Line Driver/Receiver	2.81
SN75C3223	ACTIVE	1000	2	2	15kV HBM	3.5 or 5	1	20SOIC, 20SSOP, 20TSSOP	3-V to 5-V Multichannel RS-232 Compatible Line Driver/Receiver	2.38
SN75C3232	ACTIVE	1000	2	2	15kV HBM	3.3 or 5	1	16SOIC, 16SSOP, 16TSSOP	3-V To 5.5-V Multichannel RS-232 Compatible Line Driver/Receiver	2.79
SN75C3238	ACTIVE	1000	5	3	15kV HBM	3.3 or 5	2	28SOIC, 28SSOP, 28TSSOP	3-V To 5.5-V Multichannel RS-232 Line Driver/Receiver	2.81
SN75C3243	ACTIVE	1000	3	5	15kV HBM	3.3 or 5	1	28SOIC, 28SSOP, 28TSSOP	3-V To 5.5-V Multichannel RS-232 Line Driver/Receiver	2.59
SN75LBC187	ACTIVE	—	3	5	—	5	30	28SSOP	Multichannel EIA-232 Driver/Receiver with Charge Pump	3.60
SN75LBC241	ACTIVE	—	4	5	—	5	8	28SOIC	Low-Power LinBiCMOS™ Multiple Drivers and Receivers	1.73
SN75LP1185	ACTIVE	256	3	5	15kV HBM	5, ±12	1	20PDIP, 20SOIC, 20SSOP	Low-Power Multiple RS-232 Drivers and Receivers	1.53
SN75LP196	ACTIVE	256	5	3	15kV HBM	5, ±12	1	20PDIP, 20SOIC, 20SSOP, 20TSSOP	Low-Power Multiple RS-232 Drivers and Receivers	1.53
SN75LPE185	ACTIVE	256	3	5	15kV HBM	5, ±12	1	24PDIP, 24SOIC, 24SSOP, 24TSSOP	Low-Power Multiple Drivers and Receivers with Enable	1.62
SN75LV4737A	ACTIVE	128	3	5	4kV HBM	3 or 5	20.7	28SSOP	3.3-V/5-V Multichannel RS-232 Line Driver/Receiver	2.61
TL145406	ACTIVE	120	3	3	2kV HBM	±12, 5	20	16PDIP, 16SOIC	Triple RS-232 Drivers/Receivers	0.94
UA9636A	ACTIVE	—	2	—	—	–12	36	8PDIP, 8SOIC	Dual Line Driver with Adjustable Slew Rate	0.36
UC5170C	ACTIVE	—	—	—	—	—	—	28PLCC	Octal Line Driver with Strapped Mode Selection	3.15
UC5180C	ACTIVE	—	—	8	—	4.75 - 5.25	35	28PDIP, 28PLCC	Low-Speed Asynchronous Octal Line Receiver	3.00
UC5181C	ACTIVE	—	—	8	—	4.75 - 5.25	35	28PDIP, 28PLCC	High-Speed Synchronous Octal Line Receiver	3.15

[1]Suggested resale price in U.S. dollars in quantities of 1,000. Please check www.ti.com for the most current pricing information.

Preview devices appear in **BOLD BLUE**.

Design Considerations

The UART is a key component of an asynchronous serial communications system. For example, every computer contains a UART to manage the serial ports, and all internal modems have their own UARTs. In these applications, parallel data within the computer is converted by the UART to serial data before being transferred to the modem, which is a serial device. In addition to PC/peripheral communication, UARTs can be used to interface various components on a PCB.

As data transfer speeds have increased to support applications such as telecommunication base stations, cell phones, PCs, fax servers and rack modems, the transmission rate of the UART has become critical to preventing system bottlenecks. When a fast external modem is used, designers should be sure the computer's UART can handle the modem's maximum transmission rate. For example, the TL16C550D UART contains a 16-byte buffer, enabling it to support higher sustained transmission rates than the older 8250 UART. To reduce software buffering and data overruns, TI has added its patented hardware autoflow control to all new designs and most existing UARTs. Most UARTs allow the divisor to be programmed from 1 to 65,535 and sometimes with an added predivisor factor of 1, 4, 16 or 64.

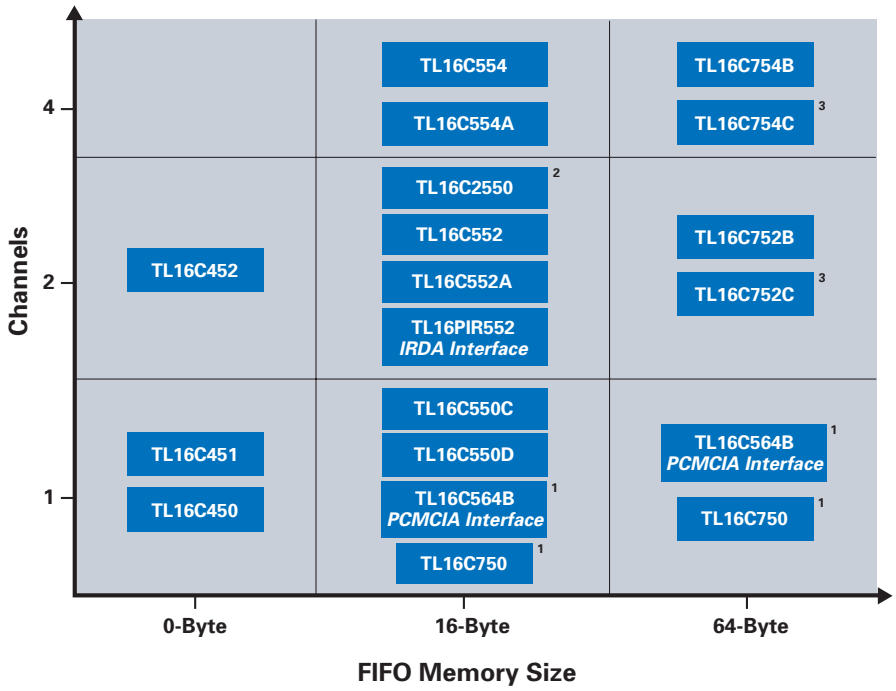
To accommodate the requirements of diverse applications, TI offers a wide portfolio of parallel-to-serial and serial-to-parallel UARTs in highly integrated, space-saving configurations that allow designers to increase system performance while decreasing space requirements.

As one of the world's leading high-volume semiconductor manufacturers, TI offers designers and OEMs the satisfaction of knowing they are backed by a supplier with the resources to meet their needs. These include a dedicated marketing and technical support team to assist with any issues.

Key Features

- Single-, dual- and quad-channel devices
- 16- and 64-byte FIFOs available
- 5-, 3.3- and 2.5-V supply
- Clock rates up to 24/20/16-MHz for 1.5/1.25/1.0-Mbps data transfer rates
- Hardware and software autoflow control
- Programmable sleep mode and low-power mode
- Industrial temperature characterization

UART Family of Products



[1] *Programmable 16- or 64-Byte FIFO*
[2] *Available 2Q 05*
[3] *Available 3Q 05*

UARTs (Universal Asynchronous Receiver/Transmitters)

Selection Guide

Device	Channel(s)	FIFOs	Voltage (V)	Characterized Temp. (°C)	Package(s)	Description	Price[1]
Universal Asynchronous Receiver/Transmitters (UARTs)							
TL16C2550	2	16-Byte	2,5/3.3/5	0 to 70, –40 to 85	32 QFN, 44 PLCC, 48 TQFP	Dual UART with Programmable Auto-RTS and Auto-CTS Available 2Q05	Call
TL16C2552	2	16-Byte	2.5/3.3/5	0 to 70, –40 to 85	32 QFN, 44 PLCC	Dual UART with programmable Auto-RTS and Auto-CTS Available 2Q05	Call
TL16C450	1	None	5	0 to 70	40 DIP, 44 PLCC	Single UART	1.50
TL16C451	1	None	5	0 to 70	68 PLCC	Single UART with Parallel Port	2.50
TL16C452	2	None	5	0 to 70	68 PLCC	Dual UART with Parallel Port	2.55
TL16C550C	1	16-Byte	3.3/5	0 to 70, –40 to 85	40 DIP, 44 PLCC, 48 LQFP, 48 TQFP	Single UART with Hardware Autoflow Control	1.75
TL16C550D	1	16-Byte	2.5/3.3/5	0 to 70, –40 to 85	32 QFN 48 LQFP, 48 TQFP	Single UART with Hardware Autoflow Control	1.75
TL16C552	2	16-Byte	5	0 to 70, –40 to 85	68 PLCC	Dual UART with Parallel Port; Recommend using TL16C552A	3.90
TL16C552A	2	16-Byte	5	0 to 70, –40 to 85	68 PLCC, 80 TQFP	Dual UART with Parallel Port	3.85
TL16C554	4	16-Byte	5	0 to 70, –40 to 85	68 PLCC, 80 LQFP	Quad UART; Recommend using TL16554A	6.05
TL16C554A	4	16-Byte	5	0 to 70, –40 to 85	68 PLCC, 80 LQFP	Quad UART with Hardware Autoflow Control	6.00
TL16C750	1	16/64-Byte	5	0 to 70, –40 to 85	44 PLCC, 64 LQFP	Single UART with Hardware Autoflow Control, Low-Power Modes	3.70
TL16C752B	2	64-Byte	3.3	0 to 70, –40 to 85	48 LQFP, 48 TQFP	Dual UART with Hardware Autoflow Control, Low-Power Modes	3.10
TL16C752C	2	64-Byte	2.5/3.3/5	0 to 70, –40 to 85	32 QFN, 48 TLQFP	Dual UART with Hardware Autoflow Control Lower Power Modes, RS485 and IrDA Interface, Available 3Q05	Call
TL16C754B	4	64-Byte	3.3/5	0 to 70, –40 to 85	68 PLCC, 80 LQFP	Dual UART with Hardware Autoflow Control, Low-Power Modes	8.35
TL16C754C	4	64-Byte	2.5/3.3/5	0 to 70, –40 to 85	80 LQFP	Dual UART with Hardware Autoflow Control Lower Power Modes, Available 3Q05	Call
TL16PC564B/BLV	1	16/64-Byte	3.3/5	0 to 70	100 BGA, 100 LQFP	Single UART with PCMCIA Interface	5.90/6.10
TL16PIR552	2	16-Byte	5	0 to 70	80 QFP	Dual UART with Selectable IR & 1284 Modes	6.10

[1] *Suggested resale price in U.S. dollars in quantities of 1,000.*

TL16C550D

Get samples and datasheets at: **www.ti.com/sc/device/TL16C550D**

Asynchronous Communications Element with Autoflow Control

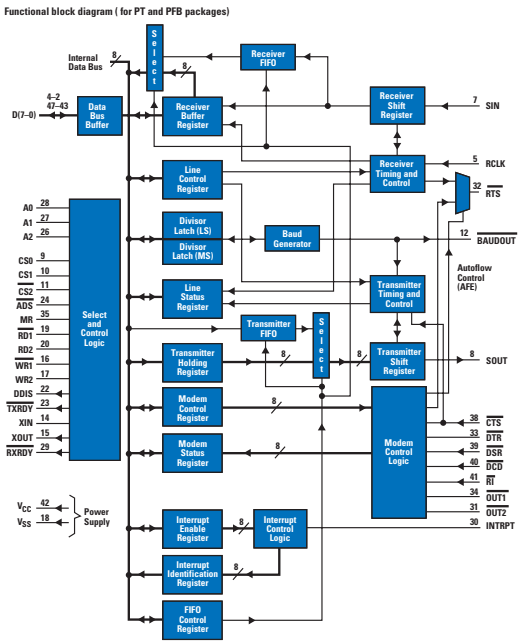
The TL16C550D is a performance-enhanced version of TI's industry-standard TL16C550C single-channel UART with 16-byte FIFO. The TL16C550D can support voltages of down to 2.5 V and data transfer rates of up to 1.5 Mbps. Combining these features with an ultra-small 32-pin QFN package, the TL16C550D is ideal for a variety of portable applications.

Key Features

- Expanded voltage and package options ideal for small form factors
- Lower voltage and higher frequency than TL16C550C
- Pin-for-pin replacement for TL16C550C
- Programmable auto-RTS and auto-CTS (autoflow)
- Up to 24/20/16-MHz clock rates for up to 1.5/1.25/1-Mbps operation
- Programmable baud-rate generator allows division to generate internal 16x clock
- Independent clock input receiver
- Fully programmable serial interface characteristics
- Available packages: DIP, PLCC, TQFP and QFN

Applications

- PDAs
- MP3 players
- Gaming systems
- Modems
- Serial ports
- Telecom



Design Considerations

Primary

Fault Protection—Features such as short-circuit protection, thermal shutdown protection, glitch-free power-up and power-down protection, ESD and current-limiting circuitry protect the transceivers and system from damage during a fault condition.

Electromagnetic Interference (EMI)—Limited slew-rate features can reduce EMI and reflection in systems generated by fast rise times and resulting harmonics in transceivers.

Secondary

Supply Voltage—In addition to 5-V supply transceivers, TI offers low-voltage supply parts. 3.3-V transceivers can save on cost in 3.3-V powered applications.

Technical Information

- ISO11898 describes the physical-layer implementation of CAN.
- This specification describes a twisted-wire pair bus with 120-Ω line impedance and differential signaling at a rate of up to 1 Mbps (typ) on a 40-meter bus with multipoint topology.

CAN Selection Guide

Supply Voltage (V)	Device	Description	Transient Pulse Protection (V)	I_{CC} Max (mA)	ESD (kV)	Bus Fault Protection (V)	Footprint	Temp Range (°C)	Pin/ Package(s)	Price[1]
5	SN65HVD251	Standby Mode, Improved Drop-In Replacement for PCA82C250 and PCA82C251	–200 to 200	65	14	±36	PCA82C250	–40 to 125	8PDIP, 8SOIC	0.90
	SN65HVD1040	Improved Drop-In Replacement for TJA1040	–200 to 200	70	6	–27 to 40	TJA1040	–40 to 125	8SOIC	Preview
	SN65HVD1039	Same as HVD1040 w/o Dominant Time Out Mode	–200 to 200	70	6	–27 to 40	TJA1040	–40 to125	8SOIC	Preview
	SN65HVD1050	Improved Drop-In Replacement for TJA1050	–200 to 200	70	6	–27 to 40	TJA1050	–40 to 125	8SOIC	Preview
	SN65HVD1049	Same as HVD1050 w/o Dominant Time Out Mode	–200 to 200	70	6	–27 to 40	TJA1050	–40 to 125	8SOIC	Preview
	SN65HVD1040v33	TJA1040 w/ 3-V MCU I/Os	±200	70	6	–27 to 40	TJA1040	–40 to 125	8SOIC	Preview
	SN65HVD1050v33	TJA1050 w/ 3-V MCU I/Os	±200	70	6	–27 to 40	TJA1050	–40 to 125	8SOIC	Preview
	SN65HVD6250v33	Standby Mode w/o Bus Monitor	±200	70	6	–27 to 40	TLE6250V33	–40 to 125	8SOIC	Preview
3.3	SN65HVD230	Standby Mode	–25 to 25	17	16	–4 to 16	PCA82C250	–40 to 85	8SOIC	1.35
	SN65HVD231	Sleep Mode	–25 to 25	17	16	–4 to 16	PCA82C250	–40 to 85	8SOIC	1.35
	SN65HVD232	Cost Effective	–25 to 25	17	16	–4 to 16	SN65HVD232	–40 to 85	8SOIC	1.30
	SN65HVD230Q	Automotive Temp, Standby Mode	–25 to 25	17	15	–7 to 16	PCA82C250	–40 to 125	8SOIC	1.55
	SN65HVD231Q	Automotive Temp, Sleep Mode	–25 to 25	17	15	–7 to 16	PCA82C250	–40 to 125	8SOIC	1.55
	SN65HVD232Q	Automotive Temp, Cost Effective	–25 to 25	17	15	–7 to 16	SN65HVD232	–40 to 125	8SOIC	1.50
	SN65HVD233	Standby Mode, Diagnostic Loop-Back	–100 to 100	6	16	±36	SN65HVD233	–40 to 125	8SOIC	1.50
	SN65HVD234	Standby Mode, Sleep Mode	–100 to 100	6	16	±36	SN65HVD234	–40 to 125	8SOIC	1.45
	SN65HVD235	Standby Mode, Autobaud Loop-Back	–100 to 100	6	16	±36	SN65HVD235	–40 to 125	8SOIC	1.50

All devices have a signaling rate of 1 Mbps except LBC031.

Preview devices appear in **BOLD BLUE**.

*[1]Suggested resale price in U.S. dollars in quantities of 1,000. Please check **www.ti.com** for the most current pricing information.*

DSP with CAN Controller

Supply Voltage (V)	Device	
5	TMS320F241	
	TMS320F243	
3.3	TMS320LC2406A	TMS320F2801
	TMS320LF2406A	TMS320F2806
	TMS320LF2407A	TMS320F2808
	TMS320LF2403A	TMS320F2810
	TMS320C2810	TMS320F2811
	TMS320C2811	TMS320F2812
	TMS320C2812	

Resources

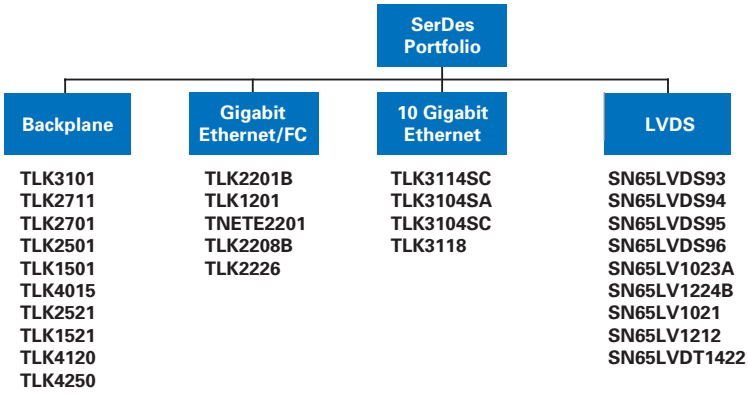
For a complete list of resources (EVMs, data sheets and application notes), visit **interface.ti.com**

Literature Number	Description
Application Notes	
SLLA019	A System Evaluation of CAN Transceivers
SLOA101	Introduction to the Controller Area Network
SLLA123	Using CAN Arbitration for Electrical Layer Testing

*IBIS models are available at **interface.ti.com***

SerDes (Serial Gigabit Transceivers)

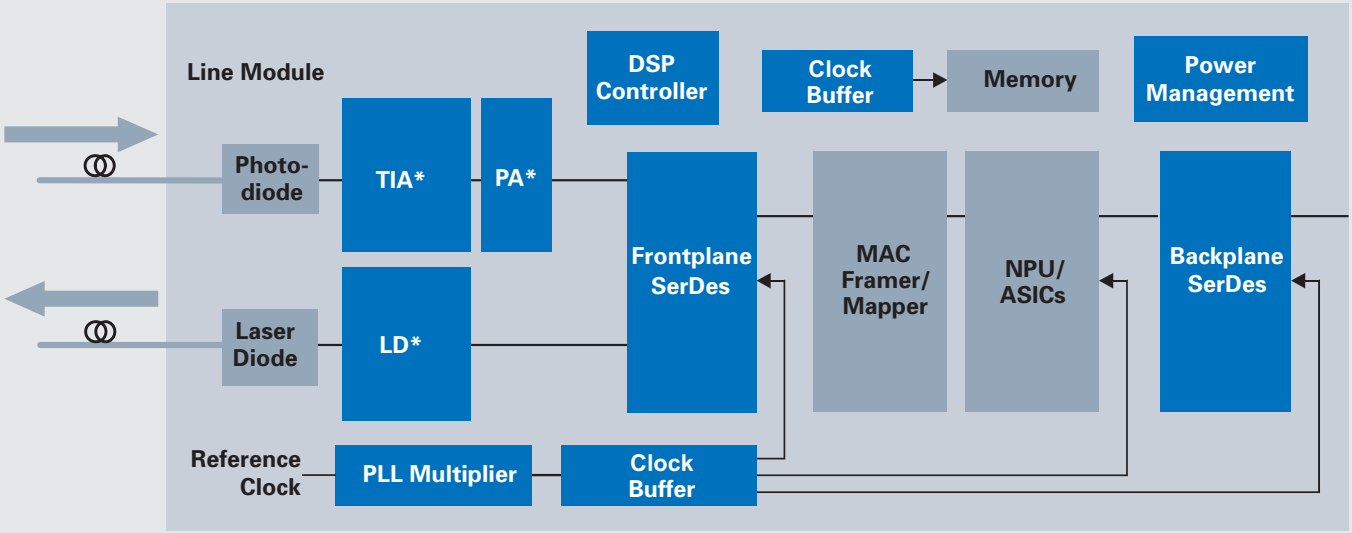
The serial gigabit transceiver family of devices from TI provides low power dissipation while enabling multigigabit transmission over copper backplanes, cable and optical links. The transceivers can be used in a variety of applications, including Gigabit Ethernet, 10-Gigabit Ethernet modules, synchronous optical network (SONET) OC-48 and OC-192 based equipment, wireless infrastructure backplanes and general-purpose backplane applications.



SerDes Solutions—Frontplane/Backplane

TLK2201B/1201A/TLK2226/TLK2208
Low-power 1 GbE Transceiver
1-1.6 Gbps

(Backplane/Frontplane)



*TIA, PA and LD are in development and not currrently available.

TLK3114SC—10-Gigabit Ethernet Backplane Device XAUI (4 x 3.125 Gbps)

TLK2208B—8-Channel Gigabit Ethernet Xcvr (8 x 1-1.3-Gbps)

TLK2226—6-Channel Gigabit Ethernet Xcvr (6 x 1-1.3 Gbps)

TLK2201B/TLK1201—1- to 1.6-Gbps Gigabit Ethernet-Compliant SerDes

TLK3101/TLK2501/TLK1501—600-Mbps to 3.2-Gbps General-Purpose Backplane SerDes

SN65LV1023A/1224B—100 to 660 Mbps—10:1 LVDS SerDes

SN65LV1021/1212—100 to 400 Mbps—10:1 LVDS SerDes

SerDes (Serial Gigabit Transceivers) Selection Guide

Device	Function	Data Rate	Serial I/F	Parallel I/F	Power	Special Features	Price[5]
TLK1501	Single-Ch. 16:1 SerDes	0.6-1.5 Gbps	1 CML[2]	16 LVTTL	200 mW	Built-In Testability	8.00
TLK2501	Single-Ch. 16:1 SerDes	1.6-2.5 Gbps	1 CML	16 LVTTL	300 mW	Built-In Testability	12.00
TLK2701	Single-Ch. 16:1 SerDes	1.6-2.5 Gbps	1 CML	16 LVTTL	300 mW	Built-In Testability and K Character Control	12.00
TLK2711	Single-Ch. 16:1 SerDes	1.6-2.5 Gbps	1 VML[3]	16 LVTTL	350 mW	MicroStar Junior™ BGA Packaging	12.00
TLK3101	Single-Ch. 16:1 SerDes	2.5-3.125 Gbps	1 VML	16 LVTTL	350 mW	Built-In Testability	16.00
TLK1201A	Single-Ch. 10:1 Gigabit Ethernet Xcvr	0.6-1.3 Gbps	1 LVPECL	10 LVTTL	200 mW	Industrial Temperature	3.95
TLK2201B	Single-Ch.	1.0-1.6 Gbps	1 LVPECL	10 LVTTL	200 mW	JTAG; 5-Bit DDR Mode	3.95
TLK2201BI	Single-Ch. 10:1 Gigabit Ethernet Xcvr	1.2-1.6 Gbps	1 LVPECL	10 LVTTL	200 mW	JTAG; 5-Bit DDR Mode, Industrial Temperature Qualified	4.74
TLK2201JR	Single-Ch. 10:1 Gigabit Ethernet Xcvr	1.0-1.6 Gbps	1 LVPECL	10 LVTTL	200 mW	MicroStar Junior 5 mm x 5 mm LGA	3.95
TLK2521	Single-Ch. 18:1 SerDes	1.0-2.5 Gbps	1 VML	18 LVTTL	<550 mW	Low Power and Built-In Equalization	18.00
TLK1521	Single-Ch. 18:1 SerDes	0.6-1.3 Gbps	1 VML	18 LVTTL	<350 mW	Low Power and Built-In Equalization	10.00
TLK4120	Four-Ch. 18:1 Serdes	0.5-1.3 Gbps	4 VML	18 LVTTL	<350 mW	Four-Channel Version of TLK1521	24.00
TLK4250	Four-Ch. 18:1 Serdes	1.0-2.5 Gbps	4 VML	18 LVTTL	<550 mW	Four-Channel Version of TLK2521	28.00
TLK2208B	Eight-Ch. of 10:1 Gigabit Ethernet Xcvr	1.0-1.3 Gbps	8 VML	4/5-Bit/Ch. (Nibble DDR Mode), 8/10-Bit/Ch. (Multiplex Ch. Mode)	1 W	JTAG, MDIO Supported	30.00
TLK2226[4]	Six-Ch. 16:1 Gigabit Ethernet Xcvr	1.0-1.3 Gbps	6 VML	4/5-Bit RTBI or RGMII	<1.5 W	MDIO Supported 100-FX mode support	Web
TLK3104SA	Four-Ch. of 10/8:1 Xcvr	2.5-3.125 Gbps	4X 3.125 Gbps LVPECL (XAUI)	4X 10/8-Bit SSTL/HSTL	700 mW/Ch.	JTAG; Programmable Pre-Emphasis and XAUI I/F	55.00
TLK3104SC	Four-Ch. of 4.1: Xcvr	3.0-3.125 Gbps	4X LVPECL	20X622 LVDS Lines	700 mW/Ch.	JTAG, 8b/10b On/Off	120.00
TLK3114SC	Four-Ch. of 10/8:1: Xcvr	2.5-3.125 Gbps	4X 3.125 Gbps LVPECL (XAUI)	4X 10/8-Bit SSTL/HSTL (XGMII)	600 mW/Ch.	IEEE 802.3ae Backplane Transceiver Compliant	55.00
TLK3118	Four-Ch. 10/8:1 Xcvr w/ (XAUI) Full Redundancy	2.5-3.125 Gbps/Ch.	4X 3.125 LVPECL (XAUI)	8/10 HSTLx4 (XGMII)	<2 W	Full Redundancy for Four Channels (XAUI)	Web
TLK4015	Four-Ch. of 16:1 Xcvr	0.6-1.5 Gbps/Ch.	4X CML	16 LVTTL/Ch.	1 W	Four-Channel Version of TLK1501	28.00
SN65LVDS93/94	Four-Ch. 28:4 TX/RX Chipset	140-455 Mbps/Ch.	5 LVDS	28 LVTTL	250 mW/Chip	Supports Up to 1.82 Gbps Throughout	3.73
SN65LVDS95/96	Three-Ch. 21:3 TX/RX Chipset	140-455 Mbps/Ch.	4 LVDS	28 LVTTL	250 mW/Chip	Supports Up to 1.82 Gbps Throughout	3.73
SN65LV1021/1212	Single-Ch. 10:1 TX/RX Chipset	100-400 Mbps	1 LVDS	10 LVTTL	<400 mW total	Low Power Solution	5.00
SN65LV1023A/1024B[1]	Single-Ch. 10:1 TX/RX Chipset	100-660 Mbps	1 LVDS	10 LVTTL	<400 mW	Low Power Solution	5.20
SN65LVDT1422[4]	14:1 Xcvr SerDes	140 Mbps-1.4 Gbps	1 LVDS	14-Bit LVTTL	<300 mW	Supports Spread Spectrum Clocking	Web

[1]'A'/'B' revision will support 100 to 660 Mbps. [2]CML (Current Mode Logic).
[3]VML (Voltage Mode Logic). [4]Product Preview—2H 2005 planned availability. [5]Suggested resale price in U.S. dollars in quantities of 1,000.

Resources

For a complete list of resources (data sheets and application notes), visit **interface.ti.com**

Literature Number	Description
Application Notes	
SLLA120	Interfacing Between LVPECL, VML, CML and LVDS Levels
SCAA052	Using TI's CDCV304 with Backplane Transceiver (TLK1201/1501/2201/2501/2701/3101)
SLLU010	TLK2501 Serdes EVM Kit Setup and Usage
SCAA049	Using TI's CDC111/CDCVF111 W/ TLK3104SA Serial Transceiver for Gigabit Ethernet
SLLA071	Understanding Jitter and Bit Error for the TLK2500
SLLA091	High-Speed Gigabit Data Transmission Across Various Cable Media

*EVMs available for all production devices at **interface.ti.com**.*
*IBIS models and H-SPICE models available at **interface.ti.com**.*

Universal Serial Bus (USB)

The USB standard defines a bus product that requires a host controller and enables plug-and-play connectivity. The most recently released final specification, USB 2.0, defines high speed and allows complete backward compatibility with USB 1.1.

USB products fall into three categories: hubs, host controllers and peripherals. USB 1.1 supports speeds of up to 12 Mbps and cables up to 5 meters long for these devices. USB 2.0 extends the connection speed to 480 Mbps to support next-generation peripherals of higher-performance PCs and applications. USB 2.0 officially defines three speeds: low (1.5 Mbps), full (12 Mbps) and high (480 Mbps). The lowest speed is ideal for human interface devices such as a mouse, game pad or keyboard; while full speed is well suited for "data dumps" to the PC via digital still cameras, PDA cradles and flash-card readers. Modems, printers, scanners and storage drives are just a few of the items that can take advantage of USB's highest speed specification.

The USB On-The-Go (OTG) supplement to USB 2.0 specifies a new class of devices aimed at the portable market. USB OTG defines devices that can operate as standard USB peripherals when connected to a standard USB host controller.

However, these same devices can operate as reduced-function host controllers to support selected USB OTG peripheral devices. End-equipment manufacturers can specify what type of peripherals their devices will support when in OTG host mode. This new specification allows easy sharing of contact information between USB OTG PDAs and cell phones or printing of photographs directly from an OTG-enabled digital still camera without a PC.

Technical Information

Speed

- The USB 2.0 standard defines three speeds: low speed (LS) 1.5 Mbps, full speed (FS) 12 Mbps and high speed (HS) 480 Mbps. It requires full backward and forward compatibility for devices and cables. All three modes offer both asynchronous and isochronous (real-time) data transmission over a simple and inexpensive 4-wire cable to meet requirements of peripherals including keyboards, mice, printers, speakers, scanners, external storage devices and digital still cameras.

Transfer Type

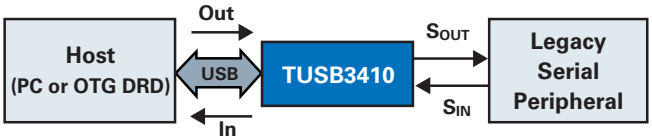
- USB 2.0 defines four types of transfers: bulk, control, interrupt and isochronous. Bulk transfer is intended for applications such as printers, scanners and mass storage, where latency isn't critical but accuracy is. All devices must include control transfers for configuration. Interrupt transfer is for devices such as mice, keyboards and game pads that must receive the host's or device's attention periodically. Isochronous transfer offers guaranteed delivery time but no error-checking or automatic retransmission of data received with errors, making it the better choice for audio or video applications.

TUSB3410

Get samples, datasheets, EVMs and app reports at: **www.ti.com/sc/device/TUSB3410**

USB-to-Serial Bridge

The TUSB3410 provides an easy way to move a serial-based legacy device to a fast, flexible USB interface by bridging between a USB port and an enhanced UART serial port. The TUSB3410 contains all the necessary logic to communicate with the host computer using the USB bus.



TUSB3410 data flow

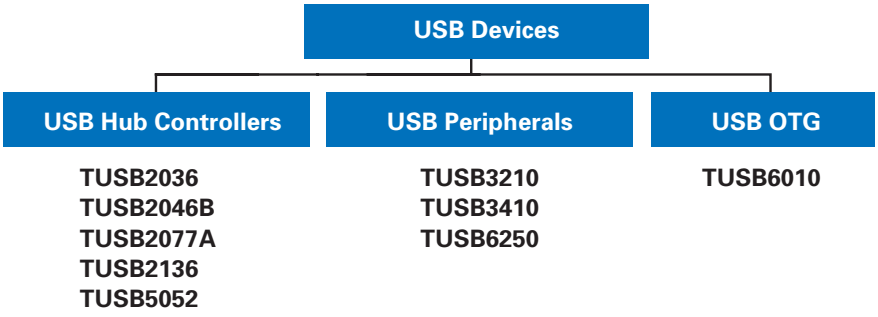
Key Features

- USB full-speed-compliant: data rate of 12 Mbps
- 8052 microcontroller with 16 Kbytes of RAM that can be loaded from the host or from external onboard memory via an I^2C bus
- Integrated, enhanced UART features including:
  - Programmable software/hardware flow control
  - Automatic RS-485 bus transceiver control, with and without echo
  - Software-selectable baud rate from 50 to 921.6 kbaud
  - Built-in, two-channel DMA controller for USB/UART bulk I/O
- Evaluation module to jump-start USB development or for use as a complete USB-to-RS-232 converter

Applications

- Handheld meters
- Health metrics/monitors
- Any legacy serial device that needs to be upgraded to USB

USB Family of Products



Selection Guide

Device	Speed	Ports	I²C	Voltage (V)	Package	Description	Price[1]
USB Hub Controllers							
TUSB2036	Full (1.1)	2/3	No	3.3	32 LQFP	2/3-port hub for USB with optional serial EEPROM interface	1.15
TUSB2046B	Full (1.1)	4	No	3.3	32 LQFP	4-port hub for USB with optional serial EEPROM interface	1.20
TUSB2077A	Full (1.1)	7	No	3.3	48 LQFP	7-port USB hub with optional serial EEPROM interface	1.95
TUSB2136	Full (1.1)	1/2	Yes	3.3	64 LQFP	2-port hub with integrated general-purpose function controller	3.25
TUSB5052	Full (1.1)	1-5	Yes	3.3	100 LQFP	5-port hub with integrated bridge to two serial ports	5.10

Device	Speed	Voltage (V)	Remote Wakeup	Package	Description	Price[1]
USB Peripherals						
TUSB3210	Full	3.3	Yes	64 LQFP	USB full-speed general-purpose device controller	2.50
TUSB3410	Full	3.3	Yes	32 LQFP	USB-to-serial converter (RS-232, RS-485)	2.25
TUSB6250	Full, High	3.3	Yes	80 TQFP	USB 2.0 high-speed, low-power ATA/ATAPI bridge solution	2.80

Device	Speed	Voltage (V)	Package	Local Bus Interface	Description	Price
USB On-The-Go (OTG) Devices						
TUSB6010	High	1.5, 1.8 & 3.3	80 MicroStar BGA™	16-Bit Muxed NOR	USB 2.0 High-Speed On-The-Go to Local Bus Interface Controller	Call

[1]*Suggested resale price in U.S. dollars in quantities of 1,000.*

Preview devices appear in **BOLD BLUE**.

Resources

For a complete list of resources (EVMs, data sheets and application notes), visit **interface.ti.com**

Literature Number	Description
Application Notes	
SLLA122	Selection and Specification of Crystals for Texas Instruments USB 2.0 Devices
SLLA154	VIDs, PIDs and Firmware: Design Decisions When Using TI USB Device Controllers
SLLU043	TUSB3410 UART Evaluation Board
SLLU031	TUSB3210 Generic Eval. Board
SLLU020	TUSB2136/3210/5052/5152 USB Firmware Programming Flow

Design Considerations

USB High-Power Peripheral Switch With Dual Current Limit + LDO

TPS2140/41/50/51—The TPS2140/41/50/51 target high-power USB peripherals such as ADSL modems. The devices contain a power switch and an LDO. The dual-current-limiting switch allows the use of high-value capacitance to stabilize the voltage from the USB bus.

Dual Power Switch + LDO for USB Bus-Powered Peripherals and Hubs

TPS2148/49—TPS2148 is a complete power management solution for USB bus-powered peripherals such as zip drives, while TPS2149 is for USB bus-powered hubs, such as keyboards with integrated hubs. TPS2148/9 each combine a 3.3-V LDO and dual power switch in a single MSOP package. The TPS2148 switch configuration allows power and board capacitance segmentation to meet USB system current requirements. The TPS2149 switches manage two independent or four ganged USB ports.

4-Port USB Hub Power Controllers

TPS207x—The TPS207x family provides the complete power solution for 4-port self-powered, bus-powered or hybrid USB hubs by incorporating current-limited switches for four ports, a 3.3-V 100-mA LDO, a 5-V LDO controller for self power (TPS2070, TPS2071) and a DP0 line control to signal an attach to the host.

Ease of Use—USB allows simplified installation and improved performance for peripheral devices by eliminating the need to repeatedly load new drivers and establish individual settings. USB combines a multitude of existing interfaces into a single easy-to-use connector, greatly reducing system complexity and offering manufacturers the ability to develop highly integrated products.

Power Distribution Switches

TPS204xA/5xA—The TPS204xA/5xA families of 80-mΩ current-limiting power switches meet all the USB power management requirements for controlling downstream ports, and include additional features to improve the design reliability. For example, when an over-current condition exists, the device intelligently shuts down only the port that sees the fault.

TPS202x/3x/6x—The TPS202x/3x/6x families of low on-resistance current-limiting power switches allow ganging of multiple ports to a single switch, as described in Application Note SLVA049. Though ganging can be cost-effective, all ports are affected by a fault.

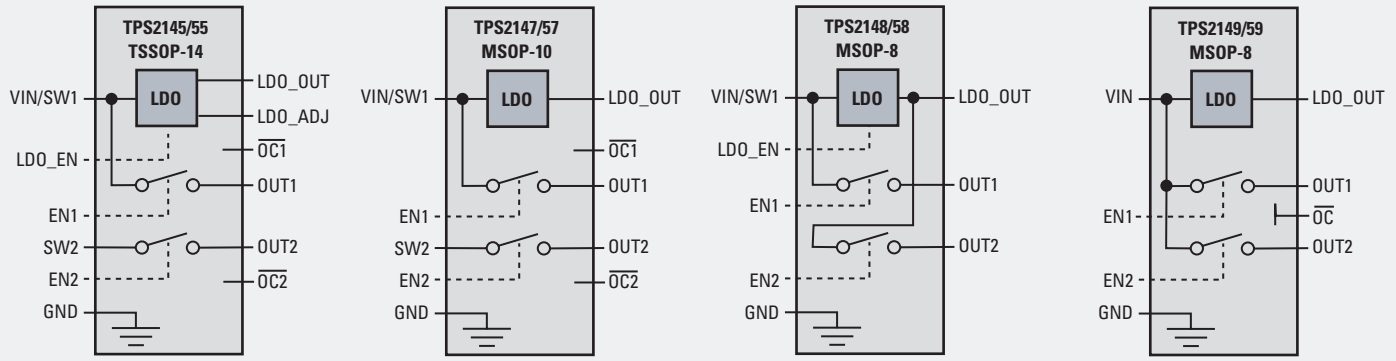
For detailed information regarding USB solutions, please visit:
www.ti.com/sc/usbsolutions

USB Power Managers Family of Products

	Current Limit (min) (A)							
	0.22	0.3	0.66	0.7	1.1	1.5	1.65	2.2
USB Power Distribution Switches								
Quad	—	TPS2048A/58A	—	TPS2044B/54B	—	—	—	—
Triple	—	TPS2047B/57A	—	TPS2043B/53B	TPS2063/67	—	—	—
Dual	—	TPS2046B/56A	—	TPS2042B/52B	TPS2062/66	TPS2060/64	—	—
Single	TPS2020/30	TPS2045A/55A	TPS2021/31	TPS2041B/51B	TPS2022/32/61/65	—	TPS2023/33	TPS2024/34

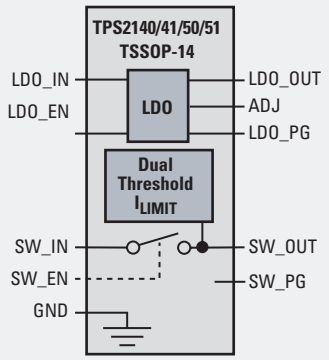
Device	5-V LDO Controller	Bus Power Mode Indicator	Pins	Package
4-Port USB Hub Power Controllers				
TPS2070	Yes	Active Low	32	HTSSOP
TPS2071	Yes	Active High	32	HTSSOP
TPS2074	No	Active Low	24	SSOP
TPS2075	No	Active High	24	SSOP

Dual Power Switch + LDO for USB Bus-Powered Peripherals and Hubs



USB Power Managers Family of Products (Continued)

USB High-Power Peripheral Bus Switch + LDO		
Device	**Switch Voltage**	**Description**
TPS2140	3.3 V	3.3-V, 500-mA switch with active-low enable, 250-mA LDO
TPS2141	5.0 V	5.0-V, 500-mA switch with active-low enable, 250-mA LDO
TPS2150	3.3 V	3.3-V, 500-mA switch with active-high enable, 250-mA LDO
TPS2151	5.0 V	5.0-V, 500-mA switch with active-high enable, 250-mA LDO



USB Power Managers Selection Guide

Device	Number of FETs	I_{OS} (min) (A)	$r_{DS(on)}$ (mΩ)	V_{IN} Range (V)	Supply Current (µA)	OC Logic Output	OT Logic Output	Enable	Predecessor	Price[1]
USB Power Distribution Switches										
TPS2020/30	1	0.22	33	2.7 to 5.5	73	Yes	Yes	L/H	—	1.05
TPS2021/31	1	0.66	33	2.7 to 5.5	73	Yes	Yes	L/H	TPS2014	1.05
TPS2022/32	1	1.1	33	2.7 to 5.5	73	Yes	Yes	L/H	TPS2015	1.05
TPS2023/33	1	1.65	33	2.7 to 5.5	73	Yes	Yes	L/H	—	1.05
TPS2024/34	1	2.2	33	2.7 to 5.5	73	Yes	Yes	L/H	—	1.05
TPS2041B/51B	1	0.7	70	2.7 to 5.5	40	Yes	Yes	L/H	TPS2041/51/41A/51A	0.50
TPS2042B/52B	2	0.7	70	2.7 to 5.5	53	Each	Yes	L/H	TPS2042/52/42A/52A	0.70
TPS2043B/53B	3	0.7	70	2.7 to 5.5	65	Each	Yes	L/H	TPS2043/53/43A/53A	0.90
TPS2044B/54B	4	0.7	70	2.7 to 5.5	75	Each	Yes	L/H	TPS2044/54/44A/54A	1.00
TPS2045A/55A	1	0.3	80	2.7 to 5.5	80	Yes	Yes	L/H	TPS2045/55	0.60
TPS2046B/56A	2	0.3	80	2.7 to 5.5	80	Each	Yes	L/H	TPS2046/46A/56	0.65
TPS2047B/57A	3	0.3	80	2.7 to 5.5	160	Each	Yes	L/H	TPS2047/47A/57	0.90
TPS2048A/58A	4	0.3	80	2.7 to 5.5	160	Each	Yes	L/H	TPS2048/58	1.20
TPS2060/4	2	1.5	70	2.7 to 5.5	50	Each	Yes	L/H	—	1.20
TPS2061/5	1	1.1	70	2.7 to 5.5	43	Yes	Yes	L/H	—	0.60
TPS2062/6	2	1.1	70	2.7 to 5.5	50	Each	Yes	L/H	—	0.75
TPS2063/7	3	1.1	70	2.7 to 5.5	65	Each	Yes	L/H	—	0.90

Device	Application	Number of FETs	Switch Enable	Bus Power Indicator (BPMODE)	V_{IN} (min) (V)	V_{IN} (max) (V)	Bus Powered $r_{DS(on)}$ per FET (typ) (mΩ)	Bus Powered Current Limit (min) (A)	Self Powered $r_{DS(on)}$ per FET (typ) (mΩ)	Self Powered Current Limit (min) (A)	LDO Controller (A)	LDO	Price[1]
USB Power Controllers													
TPS2070	USB 4-port hub	8	L	1L	4.5	5.5	560	0.12	107	0.6	5 V, 3 A	3.3 V, 100 mA	2.55
TPS2071	USB 4-port hub	8	L	1H	4.5	5.5	560	0.12	107	0.6	5 V, 3 A	3.3 V, 100 mA	2.55
TPS2074	USB 4-port hub	8	L	1L	4.5	5.5	500	0.12	100	0.6	—	3.3 V, 100 mA	2.55
TPS2075	USB 4-port hub	8	L	1H	4.5	5.5	500	0.12	100	0.6	—	3.3 V, 100 mA	2.55
TPS2140	USB peripheral	1	L	—	2.7	5.5	70	0.1 & 1.2	—	—	—	Adj. 0.9 to 3.3 V, 250 mA	1.10
TPS2141	USB peripheral	1	L	—	4	5.5	70	0.1 & 1.2	—	—	—	Adj. 0.9 to 3.3 V, 250 mA	1.10
TPS2150	USB peripheral	1	H	—	2.7	5.5	70	0.1 & 1.2	—	—	—	Adj. 0.9 to 3.3 V, 250 mA	1.10
TPS2151	USB peripheral	1	H	—	4	5.5	70	0.1 & 1.2	—	—	—	Adj. 0.9 to 3.3 V, 250 mA	1.10
TPS2145	DSP, PDA	2	L	—	2.9	5.5	340	0.2	—	—	—	3.3 V, 200 mA	1.15
TPS2147	DSP, PDA	2	L	—	2.9	5.5	340	0.2	—	—	—	3.3 V, 200 mA	1.10
TPS2148	USB peripheral	2	L	—	2.9	5.5	340	0.2	—	—	—	3.3 V, 200 mA	0.99
TPS2149	USB 2-port hub	2	L	—	2.9	5.5	340	0.2	—	—	—	3.3 V, 200 mA	0.95
TPS2155	DSP, PDA	2	H	—	2.9	5.5	340	0.2	—	—	—	3.3 V, 200 mA	1.15
TPS2157	DSP, PDA	2	H	—	2.9	5.5	340	0.2	—	—	—	3.3 V, 200 mA	1.10
TPS2158	USB peripheral	2	H	—	2.9	5.5	340	0.2	—	—	—	3.3 V, 200 mA	0.99
TPS2159	USB 2-port hub	2	H	—	2.9	5.5	340	0.2	—	—	—	3.3 V, 200 mA	0.95

[1] *Suggested resale price in U.S. dollars in quantities of 1,000. Please check www.ti.com for the most current pricing information.*

PCI CardBus Controllers

Design Considerations

PCI CardBus is a PCMCIA-standard-compliant, 32-bit, high-performance bus-mastering architecture for PC cards. TI's CardBus controllers are especially suited for mobile systems because a compact card can be inserted completely within the host device, eliminating the need for external cabling.

Key Features

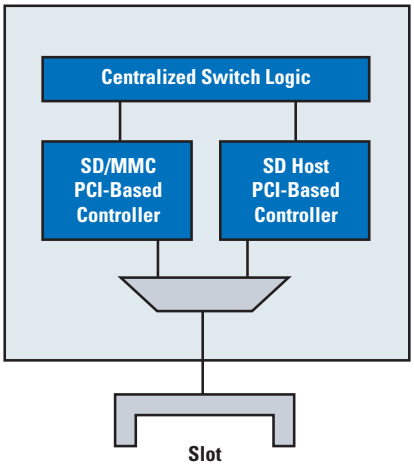
- Standard, broadly supported PC card form factor and connector
- PCI performance level and bus-master capability
- Low-voltage (3.3-V) operation with standardized power management
- Ease of use through plug-and-play and hot-plug capabilities
- CardBus slots offer full backward compatibility for PC Card-16 cards

Technical Information

TI Integrated CardBus/Flash Media/1394/Smart Card Advantages

- TI offers the fastest Flash media controllers available in the market with the PCI7621 device family via the use of a high-speed DMA interface
- TI offers patent pending SD switching technology that allows the use of MMC and SD/SDIO cards on a single notebook platform
- TI controllers support the latest Flash media interfaces including SD/SDIO, xD, MMC, SM, Memory Stick, Memory Stick PRO and SmartMedia
- TI controllers support a dedicated EMV-compliant and B1-certified SmartCard interface
- TI offers Linux driver support for flash media types including SD/MMC, MS/MS Pro, Smartmedia, and xD

PCI Flash Media Interface



Patent pending dual host implementation in the PCI7621 and PCI7612 device families permits the use of both MMC and SD memory cards in the same Flash media slot. Without this implementation, the media slot will either support only SD cards or only MMC cards, which could frustrate the end users, as both cards are the identical form factor.

PCI CardBus Controller Family of Products

PCI CardBus

CardBus Controllers

PCI1510	**PCI7x10**
PCI1520	**PCI7x20**
PCI4510	**PCI6x20**
PCI4520	**PCI6x11**
	PCI6x21
	PCI7x11
	PCI7x21

Selection Guide

Device	Voltage (V)	D3 Cold Wake	Integrated 1394	Flash Support	Package(s)	Description	Price[1]
PCI CardBus Controllers							
PCI1620	3.3	Yes	No	Yes[2]	209 BGA, 208 LQFP	PC card, Flash media and SmartCard Controller	Web
PCI1520	3.3	Yes	No	No	209 BGA, 208 LQFP	2-slot PC CardBus Controller	Web
PCI4520	3.3	Yes	Yes	No	257 BGA	2-slot PC and integrated 1394a-2000 OHCI two-port PHY/link-layer controller	Web
PCI7610	3.3	Yes	Yes	Yes[2]	209 BGA, 208 LQFP	Integrated PC card, SmartCard, Flash media, 1394a-2000 OHCI 2-port PHY/link-layer controller	Web
PCI7510	3.3	Yes	Yes	No	209 BGA, 208 LQFP	Integrated PC card, SmartCard and 1394 controller	Web
PCI7410	3.3	Yes	Yes	Yes[2]	209 BGA, 208 LQFP	PC card, SmartCard, Flash media, integrated 1394a-2000 OHCI 2-port PHY/link-layer controller	Web
PCI4510	3.3	Yes	Yes	No	209 BGA, 208 LQFP	PC card and Integrated 1394a-2000 OHCI two-port PHY/link-layer controller	Web
PCI1510	3.3	Yes	No	No	144 BGA, 144 LQFP	Single-slot PC CardBus controller	Web
PCI7620	3.3	Yes	Yes	Yes[3]	288 BGA	Integrated 2-slot PC card w/SmartCard, Flash media, 1394a-2000 OHCI 2-port PHY/link-layer controller	Web
PCI7420	3.3	Yes	Yes	Yes[3]	288 BGA	Integrated 2-slot PC card, dedicated Flash media socket and 1394a-2000 OHCI 2-port PHY/link-layer controller	Web
PCI6620	3.3	Yes	No	Yes[3]	288 BGA	Integrated 2-slot PC card with SmartCard and dedicated Flash media controller	Web
PCI6420	3.3	Yes	Yes	Yes[3]	288 BGA	Integrated 2-slot PC card and dedicated Flash media controller	Web
PCI7621	3.3	Yes	Yes	Yes[4]	288 BGA	Integrated 2-slot PC card, dedicated Flash media socket and 1394a-2000 OHCI 2-port PHY/link-layer controller	Web
PCI7421	3.3	Yes	Yes	Yes[4]	288 BGA	Integrated 2-slot PC card, dedicated Flash media socket and 1394a-2000 OHCI 2-port PHY/link-layer controller	Web
PCI6621	3.3	Yes	No	Yes[4]	288 BGA	Integrated 2-slot PC card with SmartCard and dedicated Flash media controller	Web
PCI6421	3.3	Yes	No	Yes[4]	288 BGA	Integrated 2-slot PC card and dedicated Flash media controller	Web
PCI7611	3.3	Yes	Yes	Yes[4]	288 BGA	Integrated PC card, SmartCard, Flash media, 1394a-2000 OHCI 2-port PHY/link-layer controller	Web
PCI7411	3.3	Yes	Yes	Yes[4]	288 BGA	PC card, Flash media, integrated 1394a-2000 OHCI 2-port PHY/link-layer controller	Web
PCI6611	3.3	Yes	No	Yes[4]	288 BGA	Integrated 1-slot PC card with SmartCard and dedicated Flash media controller	Web
PCI6411	3.3	Yes	No	Yes[4]	288 BGA	Integrated 1-slot PC card and dedicated Flash media controller	Web
PCI4510R	3.3	Yes	Yes	No	288 BGA	PC card and integrated 1394a-2000 OHCI 2-port PHY/link-layer controller	Web
PCI1510R	3.3	Yes	No	No	288 BGA	Single-slot PC CardBus controller	Web
PCI7515	3.3	Yes	Yes	No	257 BGA	Integrated 1-slot PC card controller with1 1394a-2000 OHCI port and 1 dedicated SmartCard interface	Web
PCI6515	3.3	Yes	No	No	257 BGA	Integrated 1-slot PC card and 1 dedicated SmartCard interface	Web
PCI4515	3.3	Yes	Yes	No	257 BGA	Integrated 1-slot PC card controller with 1 1394a-2000 OHCI port	Web
PCI1515	3.3	Yes	No	No	257 BGA	Integrated 1-slot PC card controller, pin compatible with PCI4515, PCI6515 and PCI7515	Web

Note: *Parts highlighted in the same color are pin compatible.*

[1] *Please check* ***www.ti.com*** *for the most current pricing information.*

[2] *SD/MMC MemoryStick™/MemoryStick Pro SmartMedia™ xD.*

[3] *SD/MMC MemoryStick/MemoryStick Pro.*

[4] *SD/MMC SDIO MemoryStick/MemoryStick Pro SmartMedia xD.*

PCI Bridges

Design Considerations

Peripheral Component Interconnect (PCI) is an interconnection system between a microprocessor and attached devices in which expansion slots are spaced closely for high-speed operation. A PCI-to-PCI bridge is a high-performance connection path between two PCI buses that allows bridge transactions to occur concurrently on both buses. Burst-mode transfers maximize data throughput while the two bus traffic paths through the bridge act independently. In future systems, many PCI bus structures will be replaced by the new serial PCI Express architecture. TI is actively developing a portfolio of PCI Express products to address this new market.

Key Features

- Two 32-bit, 33- or 66-MHz buses
- Configurable for PCI power-management interface specification
- CompactPCI hot-swap functionality
- 3.3-V core logic with 3.3- to 5-V PCI signaling compatibility
- Intel® bridge compatibility
- Transparent bridging

Technical Information

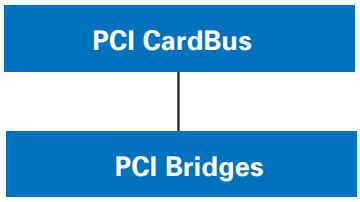
Capabilities

- TI's PCI2050B is a 32-bit, 66-MHz bridge with internal two-tier arbitration for up to 9 secondary bus masters and support for an external secondary bus. There are independent read/write buffers for each direction and 10 secondary PCI clock outputs.

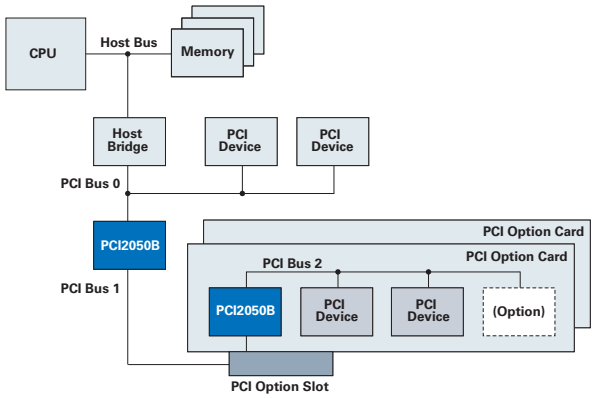
Functionality

- The PCI2250 is a 33-MHz bridge similar to the PCI2050B but supports 4 secondary bus masters and 5 secondary PCI clock outputs.

PCI Bridge Family of Products



Typical PCI-to-PCI Bridge System Application



Selection Guide

Device	Intel-Compatible Part No.	Speed (MHz)	Expansion Interface (bits)	Hot-Swap	MicroStar BGA™ Packaging	Voltage (V)	Package(s)	Description	Price[1]
PCI Bridges									
HPC3130	—	33	32	—	No	3.3	128 LQFP, 120 QFP	Hot-plug controller	10.95
HPC3130A	—	66	64	—	No	3.3	144 LQFP, 128 LQFP, 120 QFP	Hot-plug controller	10.95
PCI2040	—	33	—	—	Yes	3.3, 5	144 BGA, 144 LQFP	PCI-to-DSP bridge controller, compliant with Compact PCI Hot-Swap Specification	10.55 1.00
PCI2050B	21150bc	66	32	Yes	Yes	3.3, 5	208 LQFP, 208 QFP, 257 BGA	32-bit, 66-MHz, 9-master PCI-to-PCI bridge	9.50
PCI2250	21152ab	33	32	Friendly	No	3.3, 5	176 LQFP, 160 QFP	32-bit, 33-MHz PCI-to-PCI bridge, Compact PCI hot-swap friendly, 4-master	6.10
PCI2060	—	66	32	Yes	Yes	3.3, 5	257 BGA	32-bit, 66-MHz, 9-master, asynchronous PCI-to-PCI bridge	9.50

[1] *Suggested resale price in U.S. dollars in quantities of 1,000.*

Resources

For a complete list of resources (data sheets and application notes), visit **interface.ti.com**

Literature Number	Description
Application Notes	
SCPA029A	Adding Debounce Logic to /HSSwitch Terminal
SLLA067	Comparing Bus Solutions
SCPA027	Connecting ENUM Terminal to an External Open-Drain Buffer
SCPA030	Interfacing the PCI2040 to the TMS320VC5420 DSP
SPRA679	Texas Instruments TMS320VC5409/5421 DSP to PCI Bus

Design Considerations

ExpressCard Power Switches

The TPS2231 and TPS2236 ExpressCard power interface switches provide the total power management solution required by the ExpressCard specification. The TPS2231 and TPS2236 ExpressCard power interface switches distribute 3.3 V, AUX and 1.5 V to the ExpressCard socket. Each voltage rail is protected with integrated current-limiting circuitry. The TPS2231 supports systems with single-slot ExpressCardj34 or ExpressCardj54 sockets. The TPS2236 supports systems with dual-slot ExpressCard sockets.

PCMCIA/CardBus Power Switches

Standard PC cards require that V_{CC} be switched between ground, 3.3 V and 5 V, while V_{PP} is switched between ground, 3.3 V, 5 V and 12 V. CardBay sockets have the standard requirements for V_{CC}, but require ground, 3.3 V and 5 V to V_{PP}, and ground, 1.8 V or 3.3 V to V_{CORE}. Other PC card applications may simply not need 12 V or V_{PP} while still having the standard requirements for V_{CC}. Therefore, consider the voltage requirements of the application when selecting a PCMCIA power switch.

Current-Limiting Power Switches

Power switches are used to intelligently turn power on and off, while providing fault protection. They are useful anywhere controlled allocation of power is needed to circuit blocks, modules, add-in cards or cabled connections. They are ideal for power sequencing or segmentation.

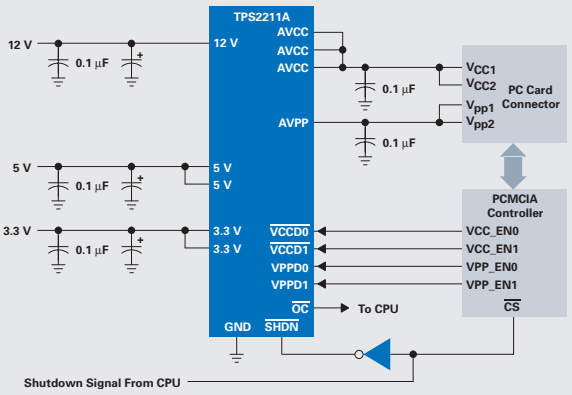
To minimize voltage drop, select devices with the lowest $r_{DS(on)}$ or Drain to Source on-resistance.

Power MUX ICs

Power MUX ICs are designed to transition from a main power supply to an auxiliary source when the main supply shuts down (e.g. switching from battery operation to a wall adapter).

TPS2211A

- *Fully integrated V_{CC} and V_{PP} switching for single-slot PC card interface*
- *Low $r_{DS(on)}$*
- *3.3-V low-voltage mode*
- *Short-circuit and thermal protection*
- *Compatible with 3.3-V, 5-V and 12-V PC cards*



Typical PC card power-distribution application.

Power Distribution Devices Family of Products

Current-Limiting Power Switch ICs

	Current Limit (min) (A)							
	0.22	0.3	0.345	0.66	0.7	1.1	1.65	2.2
Fault Reporting								
Quad	—	TPS2048A/58A TPS2095/6/7	TPS2048/58[1]	—	TPS2044/54[2] TPS2044A/54A TPS2044B/54B TPS2085/6/7	—	—	—
Triple	—	TPS2047B/57A	TPS2047/57[1]	—	TPS2043/53[2] TPS2043A/53A TPS2043B/53B	—	—	—
Dual	—	TPS2046B/56A TPS2090/1/2	TPS2046/56[1]	—	TPS2042/52[2] TPS2042A/52A TPS2042B/52B TPS2080/1/2	—	—	—
Single	TPS2020/30[1]	TPS2045A/55A	TPS2045/55[1]	TPS2021/31[1]	TPS2041/51[2] TPS2041A/51A TPS2041B/51B	TPS2022/32	TPS2023/33	TPS2024/34
No Fault Reporting								
Single	TPS2010A	—	—	TPS2011A	—	TPS2012A	TPS2013A	—

[1] *Nemko recognized.* [2] *UL and Nemko recognized.*

PCMCIA/CardBus Power Switch Matrix ICs

	Current Limit (min) (A)			
	0.3	0.7	1.0	2.5
3.3 V, 5 V, 12 V, V_{PP}				
Dual	—	—	TPS2224(A), TPS2226(A), TPS2204A, TPS2206A, TPS2205	—
Single	TPS2212	—	TPS2204A, TPS2210A, TPS2211(A), TPS2220A, TPS2220B	TPS2231
No 12 V				
Dual	—	—	TPS2223A	TPS2236
Single	—	TPS2044B/54B	—	—
No V_{PP}				
Dual	—	TPS2044B/54B	—	—

Power MUX ICs

Configuration	Device	I_{OUT} (mA)	Transition	Comments
	TPS2100/1	IN1: 500, IN2: 10	Manual	SOT-23, 0 to 70°C
	TPS2102/3	IN1: 500, IN2: 100	Manual	SOT-23, 0 to 70°C
	TPS2104/5	IN1: 500, IN2: 100	Manual	SOT-23, –40 to 85°C
IN1 IN2	TPS2110A	Adj. 310 to 750	Auto/Manual	TSSOP
	TPS2111A	Adj. 630 to 1250	Auto/Manual	TSSOP
	TPS2112A	Adj. 310 to 750	Auto	TSSOP, Status pin
	TPS2113A	Adj. 630 to 1250	Auto	TSSOP, Status pin
	TPS2114A	Adj. 310 to 750	Auto/Manual	TSSOP, Status pin
	TPS2115A	Adj. 630 to 1250	Auto/Manual	TSSOP, Status pin

ExpressCard Power Switch ICs

Device	Ports	3V r_{DS}(on) (mΩ)	Interface	Current Limit (Min) (A)
TPS2231	1	45	Parallel	2.5
TPS2236	2	45	Parallel	2.5

Selection Guide

Device	Number of FETs	I_{OS} (min) (A)	$r_{DS(on)}$ (mΩ)	V_{IN} Range (V)	Supply Current (µA)	OC Logic Output	OT Logic Output	Enable	Predecessor	Price[1]
Current-Limiting Power Switch ICs										
TPS2010A	1	0.22	30	2.7 to 5.5	73	No	No	L	TPS2010	0.75
TPS2011A	1	0.66	30	2.7 to 5.5	73	No	No	L	TPS2011	0.75
TPS2012A	1	1.1	30	2.7 to 5.5	73	No	No	L	TPS2012	0.75
TPS2013A	1	1.65	30	2.7 to 5.5	73	No	No	L	TPS2013	0.75
TPS2020/30	1	0.22	33	2.7 to 5.5	73	Yes	Yes	L/H	—	1.05
TPS2021/31	1	0.66	33	2.7 to 5.5	73	Yes	Yes	L/H	TPS2014	1.05
TPS2022/32	1	1.1	33	2.7 to 5.5	73	Yes	Yes	L/H	TPS2015	1.05
TPS2023/33	1	1.65	33	2.7 to 5.5	73	Yes	Yes	L/H	—	1.05
TPS2024/34	1	2.2	33	2.7 to 5.5	73	Yes	Yes	L/H	—	1.05
TPS2041B/51B	1	0.7	70	2.7 to 5.5	43	Yes	Yes	L/H	TPS2041/51/41A/51A	0.50
TPS2042B/52B	2	0.7 ea	70	2.7 to 5.5	50	Each	Yes	L/H	TPS2042/52/42A/52A	0.70
TPS2043B/53B	3	0.7 ea	70	2.7 to 5.5	65	Each	Yes	L/H	TPS2043/53/43A/53A	0.90
TPS2044B/54B	4	0.7 ea	70	2.7 to 5.5	75	Each	Yes	L/H	TPS2044/54/44A/54A	1.00
TPS2045A/55A	1	0.3	80	2.7 to 5.5	80	Yes	Yes	L/H	TPS2045/55	0.60
TPS2046B/56A	2	0.3 ea	80	2.7 to 5.5	80	Each	Yes	L/H	TPS2046/46A/56	0.65
TPS2047B/57A	3	0.3 ea	80	2.7 to 5.5	160	Each	Yes	L/H	TPS2047/47A/57	0.90
TPS2060/4	2	1.5 ea	70	2.7 to 5.5	50	Each	Yes	L/H	—	1.20
TPS2061/5	1	1.1	70	2.7 to 5.5	43	Yes	Yes	L/H	—	0.60
TPS2062/6	2	1.1 ea	70	2.7 to 5.5	50	Each	Yes	L/H	—	0.75
TPS2063/7	3	1.1 ea	70	2.7 to 5.5	65	Each	Yes	L/H	—	0.90
TPS2048A/58A	4	0.3 ea	80	2.7 to 5.5	160	Each	Yes	L/H	TPS2048/58	1.20
TPS2080/1/2[2]	2	0.7 ea	80	2.7 to 5.5	85	Yes	Yes	2H, 1L/1H, 2L	—	0.65
TPS2085/6/7[2]	4	0.7 ea	80	2.7 to 5.5	85	Yes	Yes	4H, 2L/2H, 4L	—	1.05
TPS2090/1/2[2]	2	0.3 ea	80	2.7 to 5.5	85	Yes	Yes	2H, 1L/1H, 2L	—	0.65
TPS2095/6/7[2]	4	0.3 ea	80	2.7 to 5.5	85	Yes	Yes	4H, 2L/2H, 4L	—	1.05

Device	Interface	Number of Ports	3.3-V $r_{DS(on)}$ (typ) (mΩ)	5.0-V $r_{DS(on)}$ (typ) (mΩ)	I_{OS} (min) (A)	Predecessor	Price[1]
PCMCIA/CardBus Switch Matrix ICs							
TPS2210A	3-line Serial	1	85	95	1	—	0.85
TPS2204A	3-line Serial	2	85	95	1	TPS2214/14A	1.95
TPS2220B	3-line Serial	1	85	95	1	TPS2220A	0.85
TPS2223A	3-line Serial	2	85	95	1	—	1.80
TPS2224A	3-line Serial	2	85	95	1	TPS2214/14A	1.95
TPS2226A	3-line Serial	2	85	95	1	TPS2206, TPS2216/16A	2.10
TPS2206A	3-line Serial	2	85	95	1	TPS2206, TPS2216/16A	2.10
TPS2205	8-line Parallel	2	70	100	1	TPS2201	2.90
TPS2211A	4-line Parallel	1	70	57	1	TPS2211	0.75
TPS2212	4-line Parallel	1	160	160	0.3	—	1.45
TPS2231	4-line Parallel	1	68	—	2.5	—	1.00
TPS2044B or 54B	Parallel	1 or 2	80	80	0.7	TPS2044/44A, TPS2054/54A	1.00
TPS2221	Interface Parallel	1	72	97	1	—	1.85
TPS2228	Interface Serial	2	72	97	1	—	3.10

Device	Number of Inputs	IN1 $r_{DS(on)}$ (mΩ)	IN2 $r_{DS(on)}$ (mΩ)	IN1 Output Current (mA)	IN2 Output Current (mA)	IN1 Supply Current (µA)	IN2 Supply Current (µA)	Input Voltage Range (V)	Transition Time IN1 to IN2 (µs)	Transition Time IN2 to IN1 (µs)	Transition	Price[1]
Power MUX ICs												
TPPM0301/2	3	—	—	400	400	2500	250	3 to 5.5	—	—	Autoswitch	1.60
TPPM0303	3	—	—	250	250	2500	250	3 to 5.5	—	—	Autoswitch	1.07
TPS2100/1	2	250	1300	500	10	10	0.75	2.7 to 4.0	4	900	L/H enable	0.59
TPS2102/3	2	250	1300	500	100	14	0.75	2.7 to 4.0	3	700	L/H enable	0.69
TPS2104/5	2	250	1300	500	100	18	0.75	2.7 to 5.5	3	700	L/H enable	0.85
TPS2110A/2A/4A	2	120	120	312 to 750	312 to 750	85	85	2.8 to 5.5	40	40	Autoswitch	0.70
TPS2111A/3A/5A	2	84	84	625 to 1250	625 to 1250	85	85	2.8 to 5.5	40	40	Autoswitch	0.70

[1] *Suggested resale price in U.S. dollars in quantities of 1,000.*

New Products appear in **BOLD RED**.

[2] *Can be configured as power MUX ICs.*

Overview

IEEE 1394 high-speed interconnection enables simple, low-cost, high-bandwidth real-time data connectivity between many types of electronic equipment. As a multimedia network standard, 1394 is ideally suited for consumer electronics, computers and peripherals. It is also ideal for situations that benefit from true peer-to-peer operation and maximum flexibility. 1394 is self-configuring, has strong power management/distribution capabilities and robust error-detection that make it a leading choice in control applications, especially those that also need to accommodate streaming multimedia.

The new 1394b technology enables higher performance (up to 3.2 Gbps), longer distance (up to 100 meters) and a variety of cable media to fit any application (STP, UTP, POF and GOF), making it ideal for home networking and high-speed data transfer applications. For example, in long-haul applications such as home networking, 1394b is capable of 100 Mbps over 100 meters of unshielded twisted pair Category 5 cable (called CAT5 or UTP5). For high-speed applications, TI offers a 1394b chip set that enable speeds up to 800 Mbps for applications such as video-on-demand or backing up a RAID array. TI 1394b is backward compatible to 1394a.

Design Considerations

Physical-Layer Selection Issues

- The 1394 PHY layer should support the minimum number of nodes or ports required by the end product. Having two ports permits spanning to other devices on the bus through daisy-chaining. Three or more nodes enable branching or hub capabilities.

- Will the end product need DC isolation at the 1394 interface? The cable doesn't provide a DC-isolated path from node to node. In cases where there's a possibility for the various equipment connected across 1394 to be at different ground potentials or different power domains, the grounds may need to be isolated from each other to prevent excessive currents and noise. However, the ground signal on the 1394 cable must not be DC-isolated from the PHY power-distribution ground plane. Thus when DC isolation between units is required at the 1394 interface, it is frequently performed at the PHY- and link-layer interfaces—often through the use of special I/O cells that allow for capacitive coupling of the PHY-link signals.

- While the EIA-775 specification requires a minimum speed of 200 Mbps at the 1394 interface, using 400-Mbps PHYs is recommended. Slower nodes present on the bus can be a source of speed traps. Almost all 1394 silicon available today is already 400-Mbps capable.

- The suspend/resume feature of the PHY layer lets two currently inactive ports achieve low-power states while maintaining their connection status. It also permits them to quickly resume operation as soon as they detect an applied port bias voltage.

Link-Layer Selection Issues

- What kind of data needs to be transferred? Some link controllers are designed to implement specific data protocols over 1394, such as the serial bus protocol 2 (SBP-2) for mass storage or IEC 61883-4 for MPEG-2 transport, and some are designed as general purpose.

- What is being interfaced to 1394? If the system has PCI, consider one of the PCI/OHCI links. Applications involving streaming compressed audio/video most likely need a link from the iceLynx family. Other TI links have interfaces for external processors/memory or are dedicated for a peripheral function (camera/storage).

- For audio/visual (A/V) applications, different types of A/V data require different formatting and transmission methods on 1394. Specifically identifying which types of A/V to be supported is fundamental to choosing the right 1394 chip set for the digital set-top box (DSTB) or digital TV (DTV) design. Standards define how to carry MPEG-2 transport streams in both digital video broadcasting (DVB) format and in DirecTV format, which have different packetization schemes.

- Another aspect of the link layer that should be considered is the amount of data-buffer memory supported. Typically, the more bandwidth an application requires, or the more simultaneous isochronous/asynchronous traffic that needs to be supported, the larger the buffer memories must be.

- As the number of simultaneous isochronous channels present goes up, or the bit rate of an individual stream increases, the receive buffer needs to be larger.

Technical Information

- 1394-1995 is an IEEE designation for a high-performance serial bus. A revision to this standard has been published as IEEE 1394a-2000, and clarifies and adds to portions of the IEEE 1394-1995 standard. The 1394b standard increases the speed of 1394 to 800, 1600 and 3200 Mbps, as well as providing new connection options such as plastic optical fiber (POF), glass optical fiber (GOF) and UTP-5. This serial bus defines both a backplane (for example, VME, FB+) physical layer and a point-to-point, cable-connected virtual bus. The backplane version operates at 12.5, 25 or 50 Mbps, whereas the cable version supports data rates of 100, 200, 400, 800 and 1,600 Mbps across the cable medium supported in the current standard. Both versions are totally compatible at the link layer and above. The interface standard defines transmission method, media and protocol.

Technical Information *(Continued)*

- Applications of the cable version are the integration of I/O connectivity of personal computers, peripherals, and consumer electronics using a low-cost, scalable, high-speed serial interface. The 1394 standard provides services such as real-time I/O and live connect/disconnect capability for devices including storage (HDD, CD-ROM, CDRW, MO, ZIP, RAID, SAN, etc.), printers, scanners, cameras, set-top boxes, HDTVs and camcorders.

Key Features

- Real-time streaming of audio and video
- High-speed: up to 400 Mbps with IEEE 1394-1995 and 1394a-2000, up to 1, 2 and 4 Gbps with 1394b
- Plug-and-play hot pluggable
- Peer-to-peer communication
- Small, durable and flexible cable and connectors
- Memory-mapped architecture
- Seamless I/O interconnect

1394b Advantages

- Faster: speeds from 800 Mbps to 3200 Mbps
- Longer distances: 100 meters with GOF and CAT5; 50 meters with POF
- TI1394b is bi-lingual: communicates in 1394a and 1394b modes
- More cabling options: STP, CAT5, POF, GOF
- More efficient: BOSS arbitration
- More user-friendly: loop-free build allows any topology and redundancy

1394 Family of Products

1394 (FireWire®)

Integrated Devices	Link Layer Controllers	Physical Layer Controllers
TSB43AA82	TSB12LV01B	TSB14AA1A
TSB43AA82A	TSB12LV21B	TSB41AB1
TSB43AB21A	TSB12LV26	TSB41AB2
TSB43AB22A	TSB12LV32	TSB41AB3
TSB43AB23	TSB15LV01	TSB41LV04A
TSB43CA43A	TSB42AA9A	TSB41LV06A
TSB43CB43A	TSB82AA2	TSB41BA3A
TSB43CA42	TSB42AC3	TSB81BA3
TSB43DA42A		TSB17BA1
TSB43DB42		
TSB43DA43		

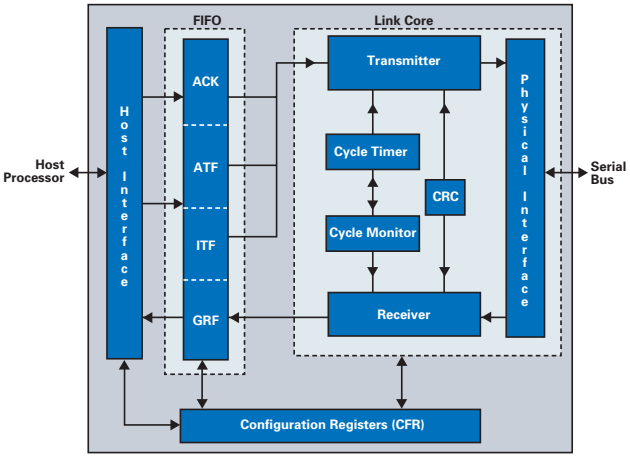
TSB42AC3

Key Features

- Generic 32-bit, 50-MHz host bus interface
- Programmable 10 Kbyte total for asynchronous, isochronous and general FIFO
- Separate ACK FIFO register decreases SCK-tracking burden on the host
- Additional programmable status output to pins
- Completely software-compatible with the TSB12LV01B
- IEEE 1149.1 JTAG interface to support board-level scan testing

Applications

- Motor/motion/process control
- Industrial imaging



The TSB42AC3 is a 1394-1995 general-purpose link layer that provides a high-performance interface that can transfer data between the 32-bit host controller and the 1394 PHY-link interface. The LLC provides the control for transmitting and receiving 1394 packet data between the FIFO and PHY-link interface at rates of 50 (backplane only), 100, 200 and 400 Mbps.

Selection Guide

Device	Family Name	Voltage (V)	Data Rate (Mbps)	FIFOs	Package(s)	Description	Price[1]
1394 Integrated Devices							
TSB43AA82(A)	iShynx2	3.3	up to 400	4.7	144 LQFP 176 MicroStar BGA	2-port high-performance integrated PHY and link-layer device for PC peripherals	8.30
TSB43AB21A	iOHCI-Lynx	3.3	up to 400	9	128 TQFP	OHCI 1.1, 1394a link layer controller integrated with 1394a, 400-Mbps, 1-port PHY	4.35
TSB43AB22A	iOHCI-Lynx	3.3	up to 400	9	128 TQFP	OHCI 1.1, 1394a link layer controller integrated with 1394a, 400-Mbps, 2-port PHY	4.55
TSB43AB23	iOHCI-Lynx	3.3	up to 400	9	128 TQFP 144 LQFP	OHCI 1.1-compliant 1394 link layer controller and 1394a-2000 compliant 1-, 2- and 3-port PHY, 9-K FIFO	4.90
TSB43CA42	iceLynx-Micro	3.3	up to 400	16.5	176 BGA	iceLynx-Micro integrated 1394a link/2-port PHY with ARM microprocessor and program memory, 5C support for consumer applications, MPEG2, DV and audio formats	10.60
TSB43CA43A	iceLynx-Micro	3.3	up to 400	16.5	176 BGA 176 LQFP	iceLynx-Micro integrated 1394a link/3-port PHY with streaming audio and 5C content protection	12.60
TSB43CB43A	iceLynx-Micro	3.3	up to 400	16.5	176 LQFP	iceLynx-Micro integrated 1394a link/3-port PHY with streaming audio	11.40
TSB43DA42A	—	3.3/1.5	up to 400	21	196 MicroStar BGA™	Integrated 1394a link/2-port PHY for consumer applications, supports 5C copy protection, PCI I/F, 3 high-speed data I/F	8.25
TSB43DA43	—	3.3/1.5	up to 400	21	256 MicroStar BGA	Integrated 1394a link/3-port PHY for consumer applications, supports 5C copy protection, PCI I/F, 3 high-speed data I/F	8.95
1394 Link-Layer Controllers							
TSB12LV01B	—	3.3	up to 400	2	100 TQFP	High-performance link layer with 32-bit I/F. May be cycle master; has 2-KB FIFO. PHY-link timing compliant with 1394a-2000 for data and control bus applications in backplane and cable	8.90
TSB12LV21B	PCILynxII	3.3	up to 400	4	176 LQFP	High-performance link for host or peripheral applications. 32-bit PCI I/F, 4-K FIFO, handles asynch streaming and DV applications (not supported by Microsoft® Windows®)	9.60
TSB12LV26	OHCI-Lynx™	3.3	up to 400	9	100 TQFP	OHCI 1.0-compliant 1394a-2000 link layer controller. 32-bit PCI I/F, 9-K FIFO, pin-compatible w/TSB12LV23	3.95
TSB12LV32	GP2Lynx	3.3	up to 400	4	100 LQFP	1394a-2000 compliant link layer for camera, printer or scanner applications. 8/16-bit host I/F, 2-K FIFO, high-speed data I/F	5.15
TSB15LV01	CameraLynx	3.3	up to 400	0	80 TQFP	Integrated 1394 link layer and camera ASIC. High-performance, cost-effective link layer for PC cameras	4.80
TSB42AA9A	StorageLynx	3.3	up to 400	4	100 TQFP	StorageLynx, Rev. A. high-performance 1394a 3.3-V link-layer controller for 1394 mass storage apps	5.35
TSB42AC3	—	3.3	up to 400	10	100 TQFP	High-performance link layer featuring a 32-bit, 50-MHz host interface and integrated 10-Kbyte FIFO. PHY-link timing compliant with 1394a-2000	8.90
TSB82AA2	OHCI-Lynx	3.3	up to 800	11	144 LQFP	High-performance 1394b 3.3-V OHCI 1.1+ compliant	7.80

Device	Ports	Voltage (V)	Data Rate (Mbps)	Package(s)	Description	Price[1]
1394 Physical Layer Controllers						
TSB14AA1A	1	3.3	up to 100	48 TQFP	IEEE 1394-1995, 3.3-V, 1-port, 50/100-Mbps, backplane PHY controller	5.90
TSB17BA1	1	3.3	up to 100	24 TSSOP	1394b-2002 1-port CAT5 (UTP5) cable transceiver for up to 100 meters, to be used with TSB41BA3	2.50
TSB41AB1	1	3.3	up to 400	48 HTQFP, 64 HTQFP	IEEE 1394a 1-port cable transceiver/arbiter	1.50
TSB41AB2	2	3.3	up to 400	64 HTQFP	IEEE 1394a 2-port cable transceiver/arbiter	1.85
TSB41AB3	3	3.3	up to 400	80 HTQFP	IEEE 1394a 3-port cable transceiver/arbiter	3.00
TSB41BA3A	3	3.3	up to 400	80 TQFP	1394b-2002 3-port physical layer device	6.50
TSB41LV04A	4	3.3	up to 400	80 HTQFP	IEEE 1394a 4-port cable transceiver/arbiter	6.50
TSB41LV06A	6	3.3	up to 400	100 HTQFP	IEEE 1394a 6-port cable transceiver/arbiter	6.40
TSB81BA3	3	1.8, 3.3	up to 800	80 HTQFP	High-performance 1394b s800 3-port cable transceiver/arbiter	7.80

[1]*Suggested resale price in U.S. dollars in quantities of 1,000.*

Design Considerations

Primary

Speed—The speed of the GTLP family in parallel backplanes is 4X that of traditional logic. Optimized output edge-rate control (OEC™) circuitry allows clock frequencies in excess of 100 MHz in high-performance system backplane applications.

Voltage Range—The GTLP family operates at 3.3 V and with 5-V tolerant LVTTL inputs/outputs and can operate in a mixed-voltage environment. GTLP acts as LVTTL-to-GTLP bi-directional translators with 5 V tolerance on the LVTTL port.

Drive—The GTLP family provides ±24-mA drive on the A-Port (LVTTL side) and the choice of medium (50 mA) or high (100 mA) drive on the B-Port (GTLP side). This offers flexibility in matching the device to backplane length, slot spacing and termination resistance.

Signal Integrity–TI-OPC™—Overshoot protection circuitry was designed specifically for the GTLP family and incorporated into the GTLP outputs. TI-OPC actively clamps any overshoots that are caused by improperly terminated backplanes, unevenly distributed cards or empty slots. OEC on the rising and falling edge of the GTLP outputs reduces line reflections and extra EMI, improving overall signal integrity.

True Live Insertion—GTLP backplane drivers allow for Level 3 isolation and true live-insertion capability. Level 1 isolation, partial power-down: I_{OFF} circuitry within the device prevents damage by limiting the current flowing from an energized bus when the device V_{CC} goes to zero. Level 2 isolation, hot insertion: both I_{OFF} and power-up 3-state (PU3S) circuitry allow insertion or removal of a board into a backplane without powering down the host system and without suspending signaling. Level 3 isolation, live insertion: for live insertion both I_{OFF} and PU3S circuitry are needed and the board I/Os must be precharged to mid-swing levels prior to connector insertion/removal.

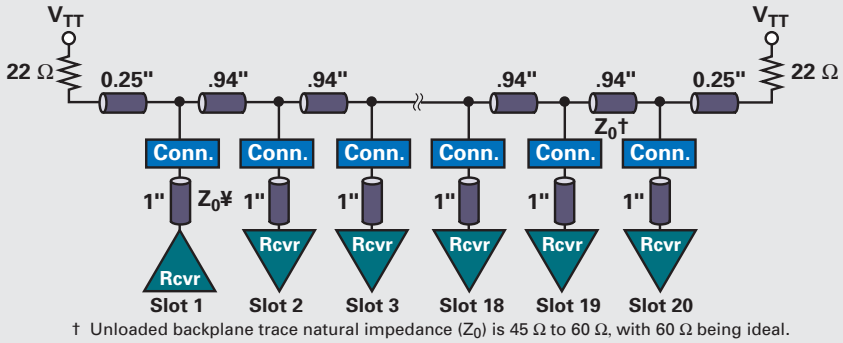
Secondary

Compatibility—GTLP provides an easy migration path from traditional backplane logic like ABT, FCT, LVT, ALVT, LVC and FB+.

Portfolio—TI offers the broadest GTLP portfolio in the industry, with both high-drive (100 mA) and medium-drive (50 mA) devices.

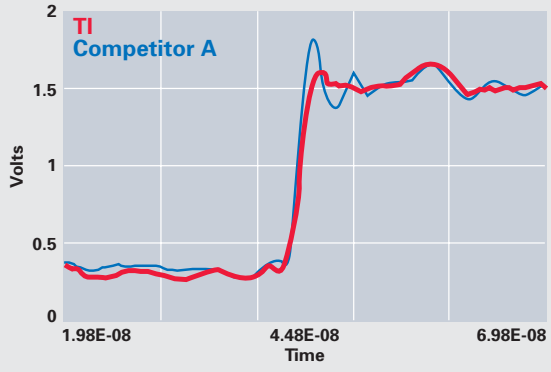
Packaging—TI offers GTLP in a low-profile, fine-pitch BGA package (LFBGA) and in a quad flat no-lead package (QFN) for higher performance and the ultimate reduction in board-space requirements.

Single Bit Representation of a Multipoint Parallel Backplane



† Unloaded backplane trace natural impedance (Z_0) is 45 Ω to 60 Ω, with 60 Ω being ideal.
¥ Card stub natural impedance (Z_0) is 60 Ω.

Signal Integrity: TI vs Competition



GTLP Selection Guide

Device	Description	Price[1]
SN74GTLP1394	2-Bit LVTTL-to-GTLP Adjustable-Edge-Rate Bus Xcvr w/ Split LVTTL Port, Feedback Path and Selectable Polarity	2.09
SN74GTLP1395	Two 1-Bit LVTTL/GTLP Adjustable-Edge-Rate Bus Xcvrs w/ Split LVTTL Port, Feedback Path and Selectable Polarity	2.09
SN74GTLP2033	8-Bit LVTTL-GTLP Adjustable-Edge-Rate Registered Transceiver w/ Split LVTTL Port and Feedback Path	5.17
SN74GTLP2034	8-Bit LVTTL-GTLP Adjustable-Edge-Rate Registered Transceiver w/ Split LVTTL Port and Feedback Path	5.17
SN74GTLP21395	Two 1-Bit LVTTL/GTLP Adjustable-Edge-Rate Bus Xcvrs w/ Split LVTTL Port, Feedback Path and Selectable Polarity	2.09
SN74GTLP22033	8-Bit LVTTL-GTLP Adjustable-Edge-Rate Registered Transceiver w/ Split LVTTL Port and Feedback Path	5.17
SN74GTLP22034	8-Bit LVTTL-GTLP Adjustable-Edge-Rate Registered Transceiver with Split LVTTL Port and Feedback Path	5.17
SN74GTLP817	GTLP-to-LVTTL 1-to-6 Fanout Driver	1.95
SN74GTLPH1612	18-Bit LVTTL-to-GTLP Adjustable-Edge-Rate Universal Bus Transceiver	5.25
SN74GTLPH1616	17-Bit LVTTL-to-GTLP Adjustable-Edge-Rate Universal Bus Transceiver w/ Buffered Clock Outputs	5.25
SN74GTLPH1627	18-Bit LVTTL-to-GTLP Bus Xcvr w/Source Synchronous Clock Outputs	5.63
SN74GTLPH1645	16-Bit LVTTL-to-GTLP Adjustable-Edge-Rate Bus Transceiver	3.30
SN74GTLPH1655	16-Bit LVTTL-to-GTLP Adjustable-Edge-Rate Universal Bus Transceiver	5.25
SN74GTLPH16612	18-Bit LVTTL-to-GTLP Universal Bus Transceiver	4.58
SN74GTLPH16912	18-Bit LVTTL-to-GTLP Universal Bus Transceiver	4.88
SN74GTLPH16916	17-Bit LVTTL-to-GTLP Universal Bus Transceiver w/ Buffered Clock Outputs	4.88
SN74GTLPH16927	18-Bit LVTTL-to-GTLP Bus Transceiver w/Source Synchronous Clock Outputs	7.70
SN74GTLPH16945	16-Bit LVTTL-to-GTLP Bus Transceiver	2.75
SN74GTLPH306	8-Bit LVTTL-to-GTLP Bus Transceiver	2.42
SN74GTLPH3245	32-Bit LVTTL-to-GTLP Adjustable-Edge-Rate Bus Transceiver	5.83
SN74GTLPH32912	36-Bit LVTTL-to-GTLP Universal Bus Transceiver	7.50
SN74GTLPH32916	34-Bit LVTTL-to-GTLP Universal Bus Transceiver w/ Buffered Clock Outputs	7.50
SN74GTLPH32945	32-Bit LVTTL-to-GTLP Bus Transceiver	4.29

[1]*Suggested resale price in U.S. dollars in quantities of 1,000. Please check **www.ti.com** for the most current pricing information.*

Resources

For a complete list of resources (data sheets and application notes), visit **interface.ti.com**

Literature Number	Description
Application Notes	
SCEA017	GTLP in BTL Applications
SCEA019	Texas Instruments GTLP Frequently Asked Questions
SCEA026	Logic in Live-Insertion Applications With a Focus on GTLP
SCEA022	Achieving Maximum Speed on Parallel Buses With Gunning Transceiver Logic
SCBA015A	Fast GTLP Backplanes With the GTLPH1655
Other Literature	
SCYT126	Advanced Bus Interface Logic Selection Guide

Design Considerations

Backward compatibility—The VMEH22501 improves the performance up to 8X of the VMEbus™ without making changes to existing hardware.

Standard Specification—The VMEH22501 is referenced by the 2eSST VITA 1.5 spec as a device that provides excellent signaling at 40-Mbps data rate.

Increased Noise Immunity—The ±50-mV input threshold allows the VMEH22501 to provide clean signaling under harsh environments.

Full Live Insertion—This device is fully specified for live-insertion applications using I_{OFF}, power-up 3-state and BIAS V_{CC}.

Speed/Signal Integrity—High-speed backplane operation is a direct result of the improved OEC circuitry that has been tested on the standard VME backplane. Furthermore, signal integrity is not compromised with higher speed operation.

VME Parametric Table

Parameter Name	SN74VMEH22501
Voltage Nodes (V)	3.3
V_{CC} Range (V)	3.15 to 3.45
Input Level	LVTTL
Output Level	LVTTL
Output Drive (mA)	–48/64
No. of Outputs	10
Logic	True
Static Current (mA)	30
t_{pd} max (ns)	8.9

Resources

For a complete list of resources (data sheets and application notes), visit **interface.ti.com**

Literature Number	Description
Application Notes	
SCEA028	VMEH22501 in 2eSST and Conventional VME Backplane Applications
Other Literature	
SCYB009	VME Application Clip

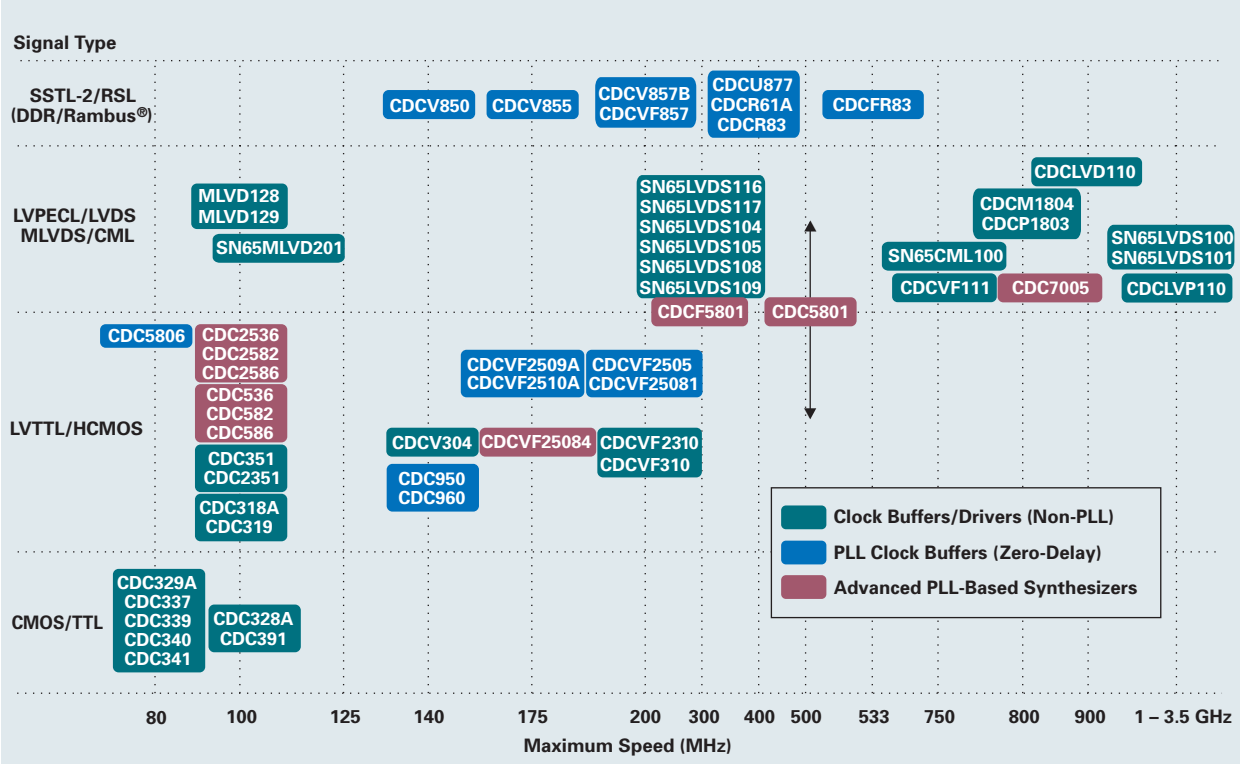
Technical Information

- TI's SN74VMEH22501 is specifically designed for the VMEbus technology. The device is an 8-bit universal bus transceiver (UBT) with two bus transceivers. It provides incident switching on the 21-slot VMEbus backplane, thus providing data signaling rates of up to 40 Mbps—an 8X improvement over the VME64 standard.

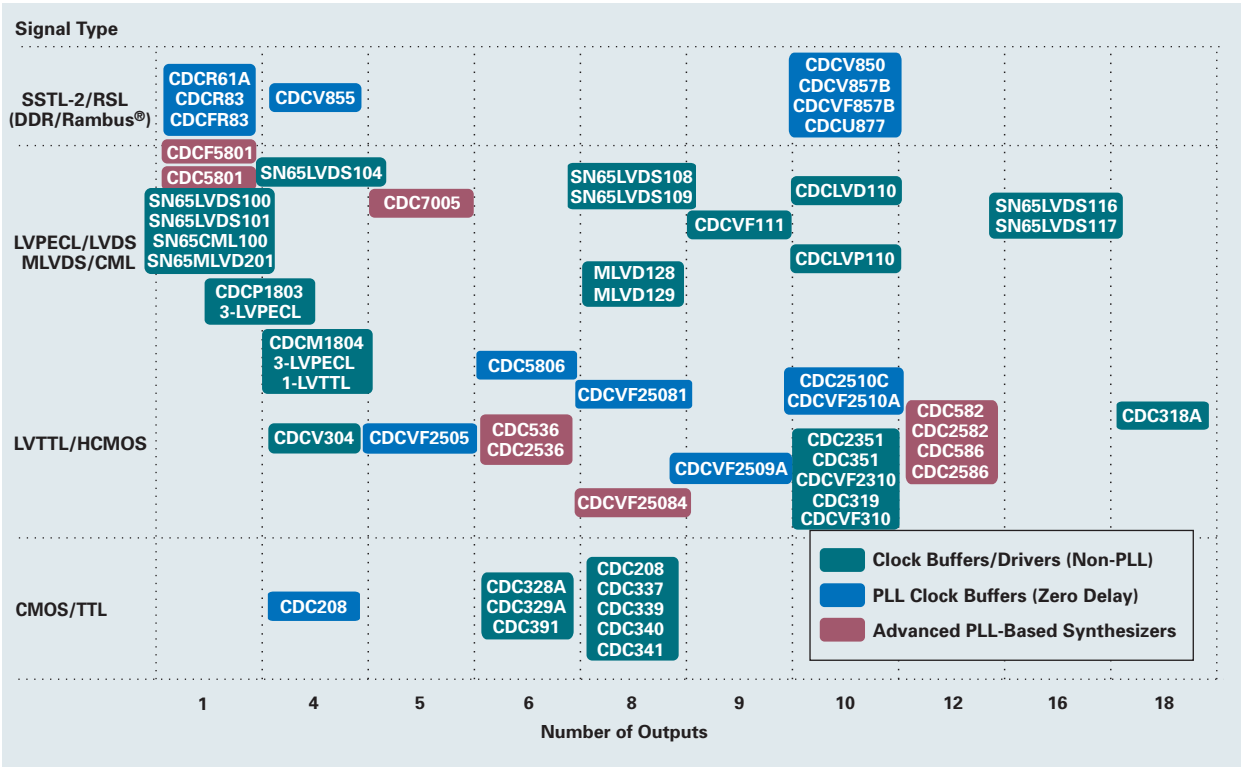
Highlights

- Ability to transmit data on the VMEbus up to 2eSST protocol speed is an improvement over VME64.
- Incident wave switching allows for higher performance on the VMEbus compared to conventional logic that depends on reflective wave switching.

Clock Selection by Speed and Signaling Type



Clock Selection by Number of Outputs and Signaling Type



The following products have similar functionality:

Part Number	TI Replacement
AGERE	
BDG1A	TB5D1M
BDG1A	TB5D2H
BDGLA	TB5D2H
BPNGA	TB5D1M
BRF1A	TB5R1
BRF2A	TB5R1
BRS2A	TB5R2
BRS2B	TB5R2
BTF1A	TB5T1
AGILENT	
HDMP1636/1646	TNETE2201B
ALLEGRO	
A2525	TPS2051A
A2526	TPS2052A
A2535	TPS2041A
A2536	TPS2042A
ANALOG DEVICES (ADI)	
ADM1485	SN75LBC176A*
ADM1486	SN65HVD1176*
ADM3485E	SN75HVD10*
ADM483E	SN65HVD3082E
ADM483E	SN75LBC176A*
ADM485	SN65HVD3085E*
ADM485	SN65HVD485E*
ADM485	SN75LBC176A*
ADM485	SN75176B*
ADM488	SN75LBC179A*
ADM489	SN75LBC180A*
CMP	
CMPWR025	TPS210x
CYPRESS	
AN-213x	TUSB3410
EUREKA	
EP600	TL16C550C
EXAR	
ST16C2450	TL16C452
ST16C2550	TL16C552A
ST16C2550	TL16C752B*
ST16C2552	TL16C552A*
ST16C450	TL16C450*
ST16C452	TL16C452*
ST16C550	TL16C550B
ST16C550	TL16C550C
ST16C552	TL16C552
ST16C552	TL16C552A
ST16C552A	TL16C552
ST16C552A	TL16C552A
ST16C554	TL16C554A
ST16C554D	TL16C554
ST16C554D	TL16C554A
ST16C580	TL16C550C

Part Number	TI Replacement
EXAR (cont.)	
ST16C654	TL16C754B
ST16C654D	TL16C754B
ST68C554	TL16C554A
XR16L2750	TL16C752B
XR16L2751	TL16C752B
XR16L2752	TL16C752B
XR16L651	TL16C750
XR16L784	TL16C754B
FAIRCHILD SEMICONDUCTOR	
FIN1001	SN65LVDS1*
FIN1002	SN65LVDS2*
FIN1017	SN65LVDS1*
FIN1018	SN65LVDS2*
FIN1019	SN65LVDS180
FIN1022	SN65LVCP22*
FIN1025	SN65LVDS9638
FIN1026	SN65LVDS9637
FIN1027	SN65LVDS9638*
FIN1028	SN65LVDS9637*
FIN1031	SN65LVDS31*
FIN1032	SN65LVDS32*
FIN1047	SN65LVDS047*
FIN1048	SN65LVDS048A*
FIN1049	SN65LVDS049
FIN1101	SN65LVDS100
FIN1102	SN65LVCP22
FIN1104	SN65LVDS125
GTLP1616	SN74GTLPH1616
GTLP16612	SN74GTLPH1612
GTLP16612	SN74GTLPH16612
GTLP16T1655	SN74GTLPH1655
GTLP17T616	SN74GTLPH16916
GTLP18T612	SN74GTLPH16912
GTLP36T612	SN74GTLPH32916
GTLP6C817	SN74GTLP817
GTLP8T306	SN74GTLPH306
FTDI	
FT232BM	TUSB3410
GOLDSTAR	
GM16C550	TL16C550B*
GM16C550	TL16C550C*
HYNIX (LG)	
GD75232	GD75232*
IDT	
IDT74GTLP16612	SN74GTLPH16612
IMP	
Ei16C450	TL16C450
Ei16C550	TL16C550C
Ei16C552	TL16C552
Ei16C552	TL16C552A
Ei16C554	TL16C554
Ei16C554	TL16C554A

Part Number	TI Replacement
IMPX	
IMP2525	TPS2051A
IMP2525A	TPS2051A
IMP2526	TPS2052A
INFINEON	
TLE6250	SN65HVD251
TLE6250	SN65HVD1050
INTEL	
21150AB/AC	PCI2050*
21150BC	PCI2050B*
21152	PCI2250*
INTERSIL	
HIN211	SN75LBC241
HIN211E	SN75LBC241
HIN232	MAX232*
HIN232E	MAX232
HIN241	SN75LBC241
HIN241E	SN75LBC241
ICL232	MAX232*
ICL3221	MAX3221*
ICL3221E	MAX3221
ICL3222	MAX3222*
ICL3222E	MAX3222
ICL3223	MAX3223*
ICL3223E	MAX3223
ICL3232	MAX3232*
ICL3232E	MAX3232
ICL3238	MAX3238*
ICL3238E	MAX3238
ICL3243	MAX3243*
ICL3243E	MAX3243
ISL1483	SN65HVD3082E*
ISL1483	SN65LBC184*
ISL1487	SN65HVD06*
ISL1487	SN65HVD21*
ISL1487E	SN65HVD06*
ISL1487E	SN65HVD21*
ISL1487L	SN65HVD3082E*
ISL1487L	SN65LBC184*
ISL8483	SN65HVD3082E*
ISL8485	SN65HVD06*
ISL8485	SN65HVD21*
ISL8488	SN65LBC179A*
ISL8489	SN65LBC180A*
ISL8490	SN65LBC179A*
ISL8491	SN65LBC180A*
LINEAR TECHNOLOGY CORP. (LTC)	
LT1030	LT1030
LT1081	MAX232
LT1181A	MAX232
LT1381	MAX232

* Drop-in, pin-compatible devices

The following products have similar functionality:

Part Number	TI Replacement
LINEAR TECHNOLOGY CORP. (LTC) (cont.)	
LT1785	SN75LBC184*
LTC1472	TPS2211A
LTC1480	SN75HVD11*
LTC1481	SN75LBC176A*
LTC1482	SN75LBC176A*
LTC1483	SN75LBC176A*
LTC1484	SN75LBC176A*
LTC1485	SN65LBC176A*
LTC1487	SN65HVD3082E*
LTC1487	SN75HVD07*
LTC1518	SN75LBC173A*
LTC1519	SN75LBC175A*
LTC1685	SN65HVD1176*
LTC1686	SN75LBC179A*
LTC1687	SN75LBC180A*
LTC1688	SN75LBC172A*
LTC1689	SN75LBC174A*
LTC1690	SN75LBC179A*
LTC1796	SN65HVD251*
LTC485	SN65HVD3085E*
LTC485	SN65HVD485E*
LTC485	SN75LBC176A*
LTC485	SN75176B*
LTC486	SN75172*
LTC486	SN75ALS172A*
LTC486	SN75LBC172A*
LTC487	SN75174*
LTC487	SN75ALS174A*
LTC487	SN75LBC174A*
LTC488	SN75173*
LTC488	SN75ALS173*
LTC488	SN75LBC173A*
LTC489	SN75175*
LTC489	SN75ALS175*
LTC489	SN75LBC175A*
LTC490	SN75LBC179A*
LTC491	SN75LBC180A*
MAXIM	
MAX1487	SN65HVD3082E*
MAX1487	SN75HVD06*
MAX1487E	SN65HVD3082E*
MAX1487E	SN75HVD06*
MAX1600/MAX1603	TPS2205
MAX1601/MAX1604	TPS2205
MAX1602	TPS2211A
MAX1607	TPS2041A
MAX202	MAX202*
MAX211	MAX211*
MAX232	MAX232*
MAX241	SN75LBC241
MAX3040	SN75LBC174A*
MAX3041	SN75LBC174A*
MAX3042B	SN75LBC174A*
MAX3043	SN75LBC172A*

Part Number	TI Replacement
MAXIM (cont.)	
MAX3044	SN75LBC172A*
MAX3045B	SN75LBC172A*
MAX3050	SN65HVD251*
MAX3053	SN65HVD251
MAX3053	SN65HVD251*
MAX3057	SN65HVD251*
MAX3082	SN65HVD3082E*
MAX3082E	SN65HVD3082E*
MAX3085	SN65HVD3085E*
MAX3085E	SN65HVD3085E*
MAX3088	SN65HVD3088E*
MAX3088E	SN65HVD3088E*
MAX3093E	SN75LBC173A*
MAX3095E	SN75LBC175A*
MAX3221	MAX3221*
MAX3221E	MAX3221
MAX3222	MAX3222*
MAX3222E	MAX3222
MAX3223	MAX3223*
MAX3223E	MAX3223
MAX3232	MAX3232*
MAX3232E	MAX3232
MAX3238	MAX3238*
MAX3238E	MAX3238
MAX3243	MAX3243*
MAX3243E	MAX3243
MAX3362	SN75HVD10*
MAX3443E	SN75LBC184*
MAX3463	SN65HVD1176*
MAX3464	SN65HVD3082E*
MAX3464	SN75HVD05*
MAX3483	SN75HVD12*
MAX3483E	SN75HVD12*
MAX3485	SN75HVD11*
MAX3485E	SN75HVD11*
MAX3486	SN75HVD12*
MAX3486E	SN75HVD12*
MAX481/E	SN65HVD3088E*
MAX481	SN75LBC176*
MAX481E	SN75LBC176A*
MAX483/E	SN65HVD3082E*
MAX483	SN75LBC176*
MAX483E	SN75LBC176A*
MAX485/E	SN65HVD3085E*
MAX485	SN75LBC176*
MAX485E	SN75LBC176A*
MAX487	SN75HVD07*
MAX487	SN75LBC182*
MAX487E	SN65HVD3082E*
MAX488	SN75LBC179*
MAX488E	SN75LBC179A*
MAX489	SN75LBC180*
MAX489E	SN75LBC180A*
MAX490	SN75LBC179*
MAX490E	SN75LBC179A*

Part Number	TI Replacement
MAXIM (cont.)	
MAX491	SN75LBC180*
MAX491E	SN75LBC180A*
MAX625	TPS2044A/54A
MAX780	TPS2205
MAX869L	TPS2024/34
MAX890L	TPS2022/32
MAX9110	SN65LVDS1*
MAX9111	SN65LVDS2*
MAX9112	SN65LVDS9638*
MAX9113	SN65LVDS9637*
MAX9115	SN65LVDS2
MAX9121	SN65LVDS048A*
MAX9122	SN65LVDT048A*
MAX9123	SN65LVDS047*
MAX9124	SN65LVDS31*
MAX9125	SN65LVDS32*
MAX9126	SN65LVDT32*
MAX9130	SN65LVDS2
MAX9152	SN65LVCP22
MAX9155	SN65LVDS100
MAX9156	SN65LVDS100
MAX9159	SN65LVDS9637*
MAX9163	SN65MLVD201
MAX9164	SN65LVDS180
MAX9169	SN65LVDS104*
MAX9170	SN65LVDS105*
MAX9171	SN65LVDS2*
MAX9172	SN65LVDS9637
MAX9173	SN65LVDS048A
MAX9174	SN65LVDS122
MAX9175	SN65LVDS122
MAX9177	SN65LVCP22
MAX9178	SN65LVDS047*
MAX9179	SN65LVDS348*
MAX9180	SN65LVDS100
MAX9181	SN65LVDS100
MAX9205	SN65LV1023*
MAX9206	SN65LV1021*
MAX9207	SN65LV1224*
MAX9208	SN65LV1212*
MAX9320	SN65LVCP23
MAX9320A	SN65LVCP23
MAX9321B	SN65LVDS101
MAX9374	SN65LVDS100
MAX9374A	SN65LVDS100
MAX9375	SN65LVDS101
MICROCHIP	
MCP2551	SN65HVD251*
MCP2120	TIR1000

* Drop-in, pin-compatible devices

The following products have similar functionality:

Part Number	TI Replacement
MICREL	
MIC2505	TPS2024/34
MIC2506	TPS2042A/52A
MIC2507	TPS2044A/54A
MIC2514	TPS210x
MIC2524	TPS2044A/54A
MIC2525	TPS2041A/51A
MIC2526	TPS2042A/52A
MIC2527	TPS2044A/54A
MIC2563A	TPS2205
MIC2564A	TPS2216A
NATIONAL SEMICONDUCTOR	
DS14185	SN75185*
DS14196	SN75196
DS1487	SN75HVD06*
DS1488	SN75188
DS1489	SN75189
DS14C232	MAX232
DS14C88	SN75C188
DS14C89A	SN75C189A
DS36276	SN75HVD05*
DS3695	SN65HVD3088E*
DS3695	SN75LBC176A*
DS3695	SN75ALS176*
DS3695	SN75176B*
DS3697	SN75179*
DS3697	SN75ALS179*
DS3697	SN75LBC179*
DS36C278	SN75HVD06*
DS36C279	SN75HVD06*
DS36C280	SN75HVD06*
DS36F95	SN75LBC176*
DS485	SN65HVD3088E*
DS485	SN75LBC176A*
DS485	SN75ALS176*
DS485	SN75176B*
DS75176B	SN75LBC176A*
DS75176B	SN75ALS176*
DS75176B	SN75176B*
DS90CP04	SN65LVDS250
DS90CP22	SN65LVCP22*
DS90CR215	SN65LVDS95*
DS90CR216	SN65LVDS96*
DS90CR283	SN65LVDS93*
DS90CR284	SN65LVDS94*
DS90LT012A	SN65LVDT2*
DS90LV001	SN65LVDS100*
DS90LV0101A	SN65MLVD201
DS90LV011A	SN65LVDS1*
DS90LV012A	SN65LVDS2*
DS90LV017	SN65LVDS1*
DS90LV017A	SN65LVDS1*
DS90LV018A	SN65LVDS2*
DS90LV018A	SN65LVDT2*
DS90LV019	SN65LVDS179
DS90LV027A	SN65LVDS9638*

Part Number	TI Replacement
NATIONAL SEMICONDUCTOR (cont.)	
DS90LV028A	SN65LVDS9637*
DS90LV031	SN65LVDM31*
DS90LV031	SN65LVDS31*
DS90LV031A	SN65LVDM31*
DS90LV031A	SN65LVDS31*
DS90LV031B	SN65LVDM31*
DS90LV031B	SN65LVDS31*
DS90LV032	SN65LVDS32*
DS90LV032A	SN65LVDS32*
DS90LV047	SN65LVDS047*
DS90LV047A	SN65LVDS047*
DS90LV048	SN65LVDS048A*
DS90LV048A	SN65LVDS048A*
DS90LV049	SN65LVDS049*
DS90LV1021	SN65LV1021*
DS90LV1023	SN65LV1023*
DS90LV1023	SN65LV1023A*
DS90LV1212A	SN65LV1212*
DS90LV1224	SN65LV1224A*
DS92LV010A	SN65MLVD200*
DS92LV010A	SN65MLVD201*
DS92LV010A	SN65MLVD204*
DS92LV010A	SN65MLVD206*
DS92LV090	SN65LVDM976
DS92LV090	SN65LVDM977
DS92LV090A	SN65LVDM976
DS92LV090A	SN65LVDM977
DS92LV1010	SN65MLVD201
DS92LV1021	SN65LV1021*
DS92LV1021	SN65LV1023A*
DS92LV1021	SN65LVDS151
DS92LV1023	SN65LV1023A*
DS92LV1212A	SN65LV1212*
DS92LV1224	SN65LV1224B*
DS92LV16	TLK2521
DS92LV18	TLK2521
DS92LV222	SN65LVCP22
DS92LV222	SN65LVDM22
DS92LV222A	SN65LVCP22
DS92LV222A	SN65LVDM22
DS96173	SN75173*
DS96173	SN75ALS173*
DS96173	SN75LBC173A*
DS96174	SN75174*
DS96174	SN75ALS174A*
DS96174	SN75LBC174A*
DS96175	SN75LBC175A*
DS96175	SN75ALS175*
DS96175	SN75175*
DS96176	SN65HVD3088E*
DS96176	SN75LBC176A*
DS96176	SN75ALS176*
DS96176	SN75176B*
DS9636	DS9636

Part Number	TI Replacement
NATIONAL SEMICONDUCTOR (cont.)	
DS96F174C	SN75174*
DS96F174C	SN75ALS174A*
DS96F174C	SN75LBC174A*
DS96F175C	SN75175*
DS96F175C	SN75ALS175*
DS96F175C	SN75LBC175A*
PC16550D	TL16C550B
PC16550D	TL16C550C*
PC16552D	TL16C552A
SC28L194	TL16C554A*
SC28L92	TL16C552A*
SC68C562C1A	TL16C552A*
ON SEMI	
MC100EP16	SN65LVDS100
MC100EP16	SN65LVDS101
MC1488	SN75188*
MC1489	SN75189*
MC1489A	SN75189A*
MC14C89AB	SN75C189A
MC3488A	UA9636A
OXFORD	
OXCF950	TL16PC564B
PERICOM	
PI7C8150A	PCI2050*
PI7C8150A	PCI2050B*
PI7C8152A	PCI2250*
PI90LV001	SN65LVDS1*
PI90LV019	SN65LVDS180
PI90LV02	SN65LVDS2*
PI190LV03	SN65LVDS100
PI90LV051	SN65LVDS051*
PI90LV179	SN65LVDS179*
PI90LV180	SN65LVDS180*
PI90LV3486	SN65LVDS3486*
PI90LV3487	SN65LVDS3487
PI90LV3487	SN65LVDS3487*
PI90LV9637	SN65LVDS9637*
PI90LV9638	SN65LVDS9638*
PI90LVB001	SN65LVDS1
PI90LVB010	SN65MLVD201
PI90LVB03	SN65LVDS100
PI90LVB047A	SN65LVDS047
PI90LVB180	SN65LVDM180*
PI90LVB387	SN65LVDS387
PI90LVB9638	SN65LVDS9638
PI90LVT02	SN65LVDS2*
PI90LVT02	SN65LVDT2*
PI90LVT048A	SN65LVDT348
PI90LVT3486	SN65LVDT3486*
PI90LVT3486	SN65LVDT3486B*
PI90LVT386	SN65LVDT386*
PI90LVT9637	SN65LVDT9637*

* Drop-in, pin-compatible devices

The following products have similar functionality:

Part Number	TI Replacement
PERICOM (cont.)	
PI90LVT9637	SN65LVDT9637B*
PI90LV017A	SN65LVDS1*
PI90LV018A	SN65LVDS2*
PI90LV019	SN65MLVD200*
PI90LV019	SN65MLVD201*
PI90LV019	SN65MLVD204*
PI90LV019	SN65MLVD206*
PI90LV022	SN65LVCP22
PI90LV022	SN65LVDS122
PI90LV027A	SN65LVDS9638*
PI90LV028A	SN65LVDS9637*
PI90LV031A	SN65LVDS31*
PI90LV032A	SN65LVDS32*
PI90LV047A	SN65LVDS047*
PI90LV048A	SN65LVDS048*
PI90LV050	SN65LVDS050*
PI90LV386	SN65LVDS386*
PI90LV387	SN65LVDS387*
PI90LVB022	SN65LVDM22
PI90LVB047A	SN65LVDM31
PI90LVB050	SN65LVDM050*
PI90LVB051	SN65LVDM051*
PI90LVB179	SN65LVDM179*
PI90LVB180	SN65MLVD202*
PI90LVB180	SN65MLVD203*
PI90LVB180	SN65MLVD205*
PI90LVB180	SN65MLVD207*
PHILIPS	
74GTLPH16612	SN74GTLPH16612
74GTLPH16612	SN74GTLPH16912
PCA82C250	SN65HVD251*
PCA82C251	SN65HVD251*
SC16C550	TL16C55C*
SC16C554	TL16C554*
SC16C554	TL16C554A*
SC16C650A	TL16C550
SC16C652	TL16C752
SC16C654	TL16C754
SC16C752	TL16C752B*
SC16C2550	TL16C752B
SC16C2552	TL16C752B
SC28L194	TL16C554A
SC28L91	TL16C550C
SC28L92	TL16C552A
SC68C562C1A	TL16C552A
SCC2691	TL16C450
SCC2692	TL16C452*
SCC68692	TL16C452*

Part Number	TI Replacement
PHILIPS (cont.)	
SCN2681	TL16C452*
TJA1040	SN65HVD1040*
TJA1050	SN65HVD1050*
PLX	
PCI6150	PCI2050*
PCI6150	PCI2050B*
PCI6140	PCI2250*
PROLIFIC	
PL-2303	TUSB3410
SEMTECH	
SC5825	TPS2041A/51A
SC5826	TPS2042A/52A
SILICON LABORATORIES	
CP2101	TUSB3410
CP2102	TUSB3410
SILICONIX/VISHAY	
Si9711	TPS2211A
Si9712	TPS2211A
SILICON SYSTEM	
73M550	TL16C550C*
SIPEX	
SP211	SN75LBC241
SP232A	MAX232
SP3222E	MAX3222
SP3222EB	MAX3222
SP3222EU	SNx5C3222
SP3223E	MAX3223
SP3223EB	MAX3223
SP3223EU	SNx5C3223
SP3232E	MAX3232
SP3232EB	MAX3232
SP3232EU	SNx5C3232
SP3238E	MAX3238
SP3243E	MAX3243
SP3243EB	MAX3243
SP3243EU	SNx5C3243
SP3481	SN75HVD11*
SP3483	SN75HVD12*
SP3485	SN75HVD11*
SP3494	SN75HVD10*
SP481	SN65HVD3088E*
SP481	SN75LBC176*
SP481	SN75ALS176*
SP481	SN75176B*
SP481E	SN65HVD3088E*

Part Number	TI Replacement
SIPEX (cont.)	
SP481E	SN75LBC176A*
SP481R	SN65HVD3088E*
SP483	SN65HVD3082E*
SP483	SN75LBC176*
SP483	SN75ALS176*
SP483	SN75176B*
SP483E	SN65HVD3085E*
SP483E	SN65HVD485E*
SP485	SN65HVD3088E*
SP485	SN75LBC176*
SP485	SN75ALS176*
SP485	SN75176B*
SP485E	SN65HVD3088E*
SP485E	SN75LBC176A*
SP486	SN75LBC172*
SP486E	SN75LBC172A*
SP487	SN75LBC174*
SP487E	SN75LBC174A*
SP488	SN75LBC173*
SP488A	SN75LBC173A*
SP488E	SN75LBC173A*
SP489	SN75LBC175*
SP489A	SN75LBC175A*
SP489E	SN75LBC175A*
SP490	SN75LBC179*
SP490E	SN75LBC179A*
SP491	SN75LBC180*
SP491E	SN75LBC180A*
STM	
74GTL1655	SN74GTLPH1655
ST232	MAX232*
ST3222	MAX3222*
ST3222E	MAX3222
ST3232	MAX3232*
ST3232E	MAX3232
ST3243	MAX3243*
ST3243E	MAX3243
ST75185	SN75185
ST75C185	SN75C185*

* Drop-in, pin-compatible devices

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