

TI Logic and Linear Products



Completing your designs

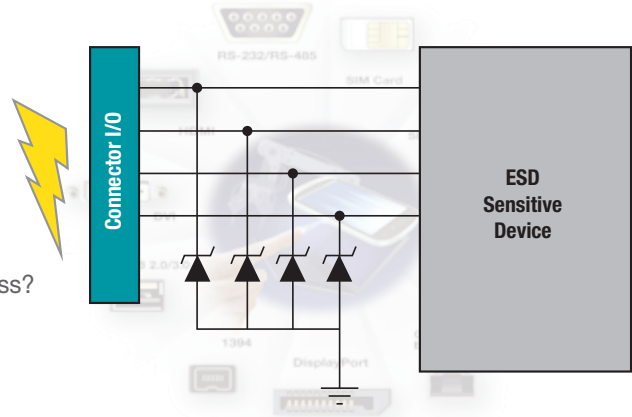


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ESD and Load Switches

ESD

- How do you **protect** your interfaces from ESD?
- What interface and connectors do you have in your system?
 - USB, HDMI, Ethernet, LVDS, VGA, RS232, RS485, CAN
- How is each interface protected?
 - Transient voltage suppressors (TVS), varistors, ESD diode arrays, or an interface specific protector
- What level of IEC ESD/Surge/EFT tests does your system need to pass?

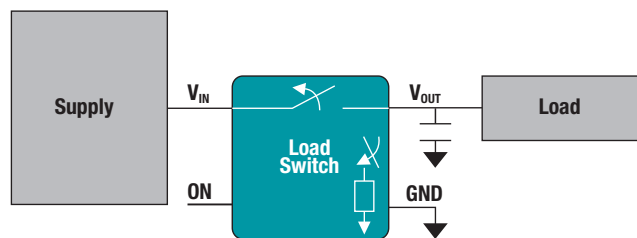


Integrated Protection Devices

Hero Parts	No of Chs	I/O Capacitance (C _{I/O})	Contact ESD Level	Breakdown Voltage (V _{BR}) or OVP	Features	Interface
TPD1S414	1	n/a	±15 kV	30 V	ESD, OVP, and 100 V Surge for Power Rail	USB
TPDxE05U06	1, 4, 6	0.4-0.5 pF	±12 kV	6.5 V	1, 4, 6 Channel High Speed ESD	USB3.0, HDMI2.0, MHL, eSATA
TPD4E110	4	0.45 pF	±12 kV	6.5 V	Tiny 0.8 x 0.8 mm Four Channel ESD	USB, HDMI, MHL, LVDS
TPD13S523	13	1 pF	±12 kV	6 V	Integrated HDMI1.4 Protection w/Current Limit Switch in Small 2.6x1.8 mm Package	HDMI
TPD12S016	12	1 pF	±8 kV	6.5 V	Integrated HDMI1.4 Protection w/Current Limit Switch and Level Shifter Buffers	HDMI
TPD4E001-Q1	4	1.5 pF	±8 kV	11 V	Ultra Low Leakage ESD clamp for Automotive	Automotive Infotainment, USB2.0, Ethernet, LVDS
TPD4S014	4	1.6 pF	±15 kV	30 V	Integrated 2A USB Charger Protection w/V _{BUS} OVP and D+, D-, ID ESD Protection	USB
TPD4S214	4	1.9 pF	±15 kV	30 V	ESD, OVP and Adjustable Current Limit up to 1.2 A	USB OTG
TPD2E007	2	15 pF	±8 kV	14 V	High Breakdown Voltage, Small 0.8x0.8 mm or SC-70 Package	Audio, RS-232, RS-485, RS-422

Load Switches

- Do you need **load switches** to manage power distribution and sequencing?
- Do you use any discrete FETs in your system?
- Do you need to reduce leakage or inrush current? At what voltage and load current?
- Would you be interested in reducing BOM count and PCB space through integration?
- What parameters are required?
 - On resistance, current, voltage range, packages?



Integrated Load Switches

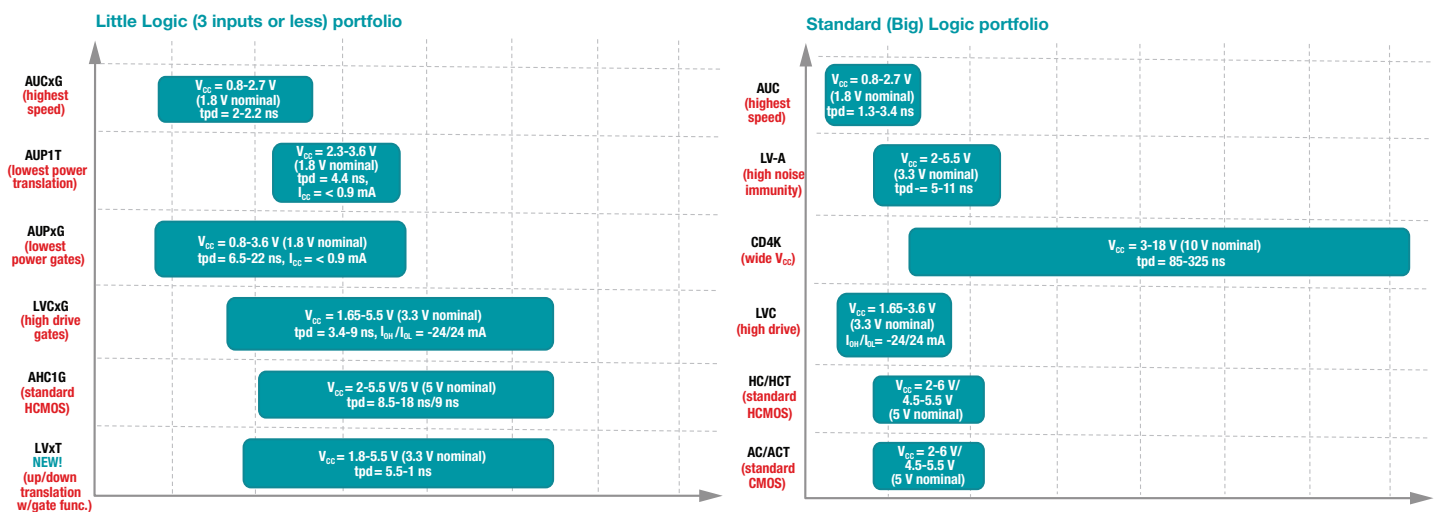
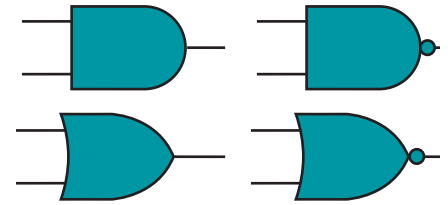
Hero Parts	R _{ON} (Typ) (mΩ)	Max. Input Voltage (V)	Max. Current (A)	Max. I _q (μA)	Package	Features	Applications
TPS22920	5.3	3.6	4	350	WCSP-8	Ultra-Low R _{on} with Quick Output Discharge (QOD)	Smartphones/Tablets Consumer Portable Computing
TPS22922	14	3.6	2	0.88	WCSP-6	Low Leakage, Low On Resistance, with QOD	
TPS22964C	13	5.5	3	96	WCSP-6	Ultra-Low ON Resistance with Reverse Current Protection and QOD	
TPS22908	28	3.6	1	1	WCSP-4	Best-in-Class On Resistance with QOD	
TPS22913B	61	5.5	2	10	WCSP-4	Full Time Reverse Current Protection, and Under Voltage Lock Out	
TPS22902	78	3.6	0.5	0.88	WCSP-4	Ultra-Low Leakage and Low-Quiescent Current with QOD; Small Package	Ultrabooks Industrial Set Top Box
TPS22965	16	5.5	6	75	SON-14	Single Channel, Configurable Rise Time Automotive Grade Available	
TPS22966	18	5.5	6	120	SON-8	Dual Channel, Configurable Rise Time, Automotive Grade Available	
TPS27081A	32	8	3	20	TSOT 23-6	P+N Architecture Configurable Slew Rate	

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Logic Gates and Voltage Level Translations

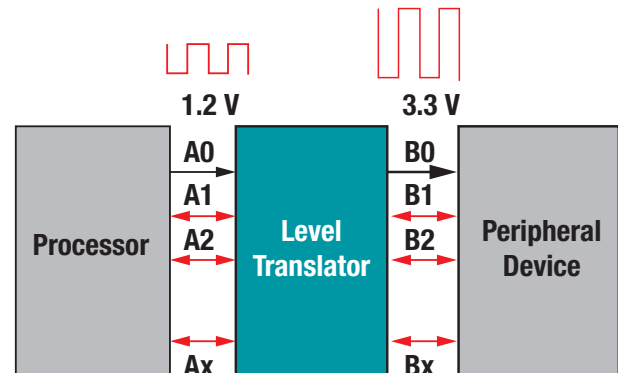
Logic Gates

- Is discrete **logic** required to make up for missing processor functions?
- What function is required?
 - AND, OR, NAND, NOR, XOR, XNOR, Buffer, Inverter, Flip-Flop, Latches, Shift Register, Multivibrators
- What is the operating voltage node, system constraint and technology you need?
 - 19 different logic families with large portfolio covering 0.8-18 V V_{CC} .
- What parameters are required?
 - Voltage node, prop delay, number of channels
- What package is needed?
 - PDIP, SOIC, SOT, TSSOP, QFN, WCSP etc.



Voltage Level Translation

- Do you need **voltage translation** to resolve I/O voltage mismatch between two blocks?
- For these blocks what digital signals run between them?
 - What voltage, bit width and data speed is required?
- Are the signals open-drain or push-pull?
- Application specific? (SIM/SD//IC-USB)



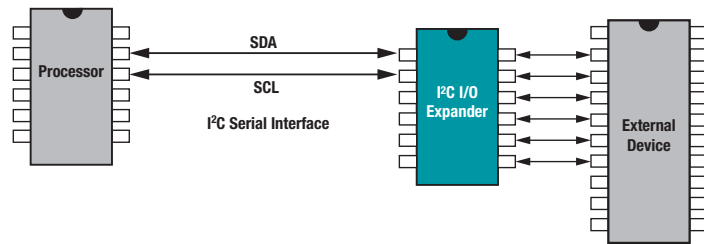
Hero Parts	V_{CCA} (V)	V_{CCB} (V)	Features	Applications
LSF0101	1.0 to 4.5	1.8 to 5.5	1-Bit Bidirectional Multi-Voltage Translator for Open-Drain & Push-Pull	Portable Consumer Communication
SN74AUP1T08	2.3 to 3.6	0.8 V to 3.6 V	2-Input Positive-AND Gate Single Direction, Up Translator	
SN74LV1T34	1.8 to 5.5	None	Single Power Supply Buffer GATE CMOS Logic Level Shifter	Consumer Communications
SN74AVCA164245	1.4 to 3.6	1.4 to 3.6	16-Bit Dual-Supply Transceiver with DOC™ Circuitry	
SN74LVC4245A	4.5 to 5.5	2.7 to 3.6	8-Bit Dual-Supply Bus Transceiver	
SN74AVC32T245	1.2 to 3.6	1.2 to 3.6	32-Bit Dual-Supply Transceiver	Enterprise Computing, Telecom, Industrial
SN74GTL2014	3 to 3.6	3 to 3.6	4-Bits LVTTTL to GTL Transceiver	
TXS0102	1.65 to 3.6	2.3 to 5.5	Open Drain Auto Direction	Portable Consumer Communication
TXB0304	0.9 to 3.6	0.9 to 3.6	Push-Pull Auto Direction	
TXS0104	1.65 to 3.6	2.3 to 5.5	Open Drain Auto Direction	

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I²C I/O Expanders and Switches

I²C I/O Expanders

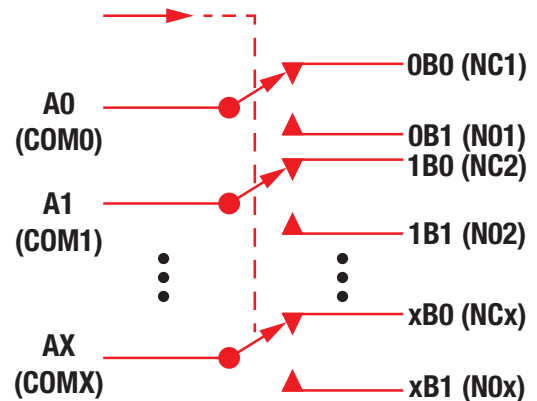
- Do you use I²C bus to enable communication between host and peripherals?
- What is the I/O voltage requirement for each device on the bus?
- What do you do when you run out of GPIOs?



Family	Hero Parts	Voltage Range (V)	Features	Applications
I/O Expander	TCA6408A	1.65 to 5.5	8-Bit GPIO	Add More I/Os Without Upgrading to a More Expensive Host Processor
	TCA9539	1.65 to 5.5	16-Bit GPIO	
	TCA9555	1.65 to 5.5	16-Bit GPIO	
Translator	PCA9306	1.2 to 5	Translation	Level Shifting Point to Point I ² C Interfaces
	TCA9617A	0.8 V to 5.5 V on A Side 2.2 V to 5.5 V on B Side	1 MHz FastMode+ I ² C Bus	Servers, Telecom, Industrial
Multiplexer	TCA9548A	1.65 to 5.5	8 V Input Voltage, Configurable Rise Time	Resolve I ² C Address Conflicts

Switches

- Are there two or more blocks accessing the same interface that need a **switch/mux**?
- Do you have any USB, LAN, video, Ethernet or audio interface in your system?
- What configuration (SPST, SPDT, dual, quad) is needed?
- What is RON and bandwidth requirement?



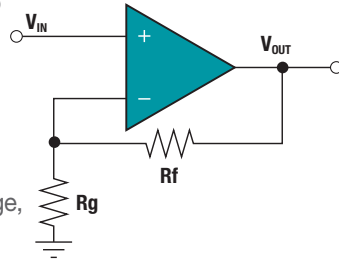
Hero Products	R _{ON} (TYP) (Ω)	Bandwidth (TYP) (MHz)	Features	Applications
TS3A5223	0.45	80	Dual SPDT with Break-Before-Make Capability	Portable Consumer, Computing, Audio, Medical Imaging
TS5A22364	0.65	17	Dual SPDT with Negative Signaling Capability	
TS5A3166	0.7	200	Single SPST with 5 V Tolerant Control Input	
TS5A3159A	1.1	100	Single SPDT with Break-Before-Make Capability	
SN74CB3Q3257	4	500	High Bandwidth, 5 V Tolerant Bus Switch	
SN74CBTLV3245A	5	200	Low-Voltage Octal FET Bus Switch	
SN74LVC2G66	6	300	Dual SPST with 5 V Tolerant Control Input	Industrial, Automotive, Consumer, Telecom
TS5A2066	7.5	300	Dual SPST with 5 V Tolerant Control Inputs	
TS5A23157	10 (max)	220	Dual SPDT with Break-Before-Make Capability	USB
TS3USB3031	5.5	6500	Double-pole, Triple Throw (DP3T) Multiplexer	For MHL/MyDP/USB Signal Switching
TS3DV642	8	6900	12 Channel 1:2 Bi-directional Mux for HDMI Applications	Computing & Consumers
TS3V712EL	3	1300	5 x SPDT + HSYNC/VSYNC Level Shifter	Computing & Telecom
TS3L501E	4	600	8 x SPDT + 3 LED	LAN
TS3V330	5	300	Quad SPDT	

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Standard Op Amps and Comparators and Shunt Voltage References

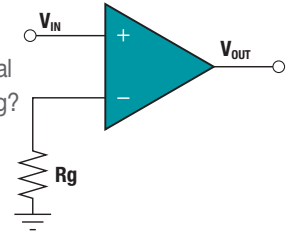
Op Amps

- Do you need **standard op amps** for signal conditioning?
- Do you perform any filtering, driving ADCs, buffering DACs, level shifting, or adding gain to your analog signal chain?
 - You need an op amp!
- What operating voltage range and number of channels is required?
- Which parameters are required?
 - Bandwidth, slew-rate, I_O , offset voltage, drift, bias current, noise, distortion



Comparators

- Do you **compare** current or voltage signals in your analog signal chain?
- How do you measure or digitize analog signals?
- Are you currently using an operational amplifier for comparisons/referencing?
- Which parameters are required?
 - Supply voltage, number of channels, response time

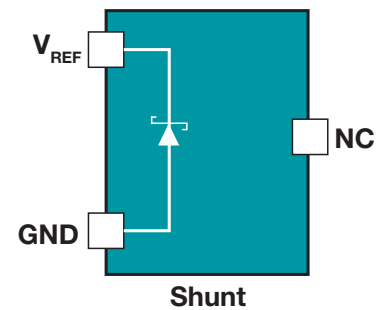


Op-Amps Family	Hero Parts	V_{CC} (Max) (V)	I_O/Ch (Max) (mA)	BW (MHz)	No of Ch.	Features	Applications
High Voltage	MC33078	36	2.5	16	2	Single/Dual Supply, Audio, Low Total Harmonic Distortion	Industrial (Appliance, Power, Test & Measurement) STB, Computing
	OP07C	36	5	0.6	1	Precision $V_{IO}=150\ \mu V$ (max), Low Noise	
	TL3472	36	4.5	4	2	Single Supply, High Slew Rate and Fast Settling Time	
	LT1013	44	0.55	1	2	Precision $V_{IO}=150\ \mu V$ (max), Low Noise	
Low Voltage	TLV2362	5	2.25	6	2	Low Noise, High Slew Rate	Portable Equipment, Instrumentation and Sensors
	LMV321	5.5	0.17	1	1	R2R Output Swing, No Crossover Distortion	
JFET Input	TL082	36	2.8	3	2	High Slew Rate, $I_B=400\ pA$	Test & Measurement
	TL052	30	2.8	3	2	High Slew Rate, $I_B=200\ pA$	
Audio	NE5532	30	4	10	2	Common-Mode Rejection Ratio (100 dB), Slew Rate=9 V/ μs	Headphone Amplifier, Industrial Measurement Equipment
	RC4580	32	4.5	12	2	Low Noise Voltage (0.8 μV_{rms}) Low THD (0.0005%), Slew Rate=5 V/ μs	

Comparator Family	Hero Parts	V_{CC} (Max) (V)	I_O/Ch (Typ) (mA)	τ_{RESP} (μs)	No of Ch.	Features	Applications
High Voltage	TL331	36	0.7	0.3	1	Low I_B and Input Offset Voltage	Computing, Industrial power, STB, Communication equipment
Low Voltage	LMV331	5.5	0.12	0.2	1	Input Common-Mode Voltage Range Includes Ground	

Shunt Voltage References

- Do you need a stable (constant) **voltage reference** irrespective of the loading of the device - power supply variations, temperature changes, and the passage of time?
- How do you ensure you have stable voltage for power supplies, data converters and control systems?
 - Are there voltage peaks on the input voltage? Is a floating or negative voltage required?
 - Shunt voltage reference is needed
 - What accuracy do you need?
 - Max temp Coeff, max initial accuracy



Type	Hero Parts	Output Voltage (V)	Temp Coeff (Max) (ppm/ $^{\circ}C$)	Initial Accuracy (Max) (%)					
Fixed	TL4050	2.5, 4.1, 5, 10	50	A: 0.1%		B: 0.2%		C: 0.5%	
	LM4040	2, 2.5, 3, 4.1, 5, 8.2, 10	100	A: 0.1%		B: 0.2%		C: 0.5%	
Adjustable	TL431/TL432	2.5 to 36	92	B: 0.5%		A: 1%		(): 2%	
			138	B: 0.5%		A: 1%			
	TLV431	1.2 to 6	129	(): 1.5%					
			138	B: 0.5%		A: 1%			
	TLVH431	1.2 to 18	129	(): 1.5%					

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