Texas Instruments

Technology for Innovators™

Analog Automotive Products Selection Guide

Amplifiers, Power Management, Interface, Logic

2006/2007

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Automotive Nomenclature

TPSxxxx Q PWR Q1

- Q1 — Automotive Qualified
- PWR — Package
- Q — Temperature
- TPSxxxx — Device Name

Texas Instruments Commitment to Automotive

Texas Instruments (TI) is committed to providing superior quality, cost-effective solutions to the automotive market along with benchmark service in terms of excellent product documentation, on-time delivery and conformance to specifications.

Availability/Commitment

TI supports the requirements defined by the automotive industry, and continues to add to our automotive portfolio. With more than 30 years of experience serving customers with demanding requirements, TI enables customers to achieve the quality, reliability and cost goals needed to succeed in today's marketplace.

TI Automotive Capabilities

- TS16949 certified
- Customer print validation
- Major change approval
- Special electrical test limits / electrical screening
- Automotive qualification
- Special symbolization and custom bar code labeling
- Special packaging
- Automated factory starts through EDI ordering
- JIT delivery and remote warehousing
- EOL Management
- Six month product change notification

Op Amp Rapid Selector

The tables on the following pages have been subdivided into several categories to help quickly narrow the alternatives.

Precision $V_{OS} \leq 500\mu V$

Low Noise $V_N \leq 10nV/\sqrt{Hz}$	pg 4
Low Voltage $V_S \leq 2.7V$	pg 4
Low Power $I_Q \leq 1mA/ch$	pg 4
Low Input Bias Current $I_B \leq 100pA$	pg 4
Wide Bandwidth GBW $\geq$ 5MHz	pg 4

Low Voltage $V_S \leq 2.7V$

Low Noise $V_N \leq 10nV/\sqrt{Hz}$	pg 4
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Low Power $I_Q \leq 1mA/ch$

Low Voltage $V_S \leq 2.7V$	pg 5
Wide Bandwidth GBW $\geq$ 5MHz	pg 5
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Wide Voltage $\pm 5V \leq V_S \leq \pm 20V$

Precision $V_{OS} \leq 500\mu V$	pg 6
Low Power $I_Q \leq 1mA/ch$	pg 6
Low Input Bias Current $I_B \leq 100pA$	pg 6
Wide Bandwidth GBW $\geq$ 5MHz	pg 6
Low Noise $V_N \leq 10nV/\sqrt{Hz}$	pg 6

General Purpose pg 7

TI offers a wide range of amplifiers including high precision, micropower, low voltage, high speed and rail-to-rail I/O in several different process technologies. TI has developed the industry's largest selection of low power and low voltage op amps with features designed to satisfy a very wide range of applications. To help facilitate the selection process, an interactive online op amp parametric search engine is available at amplifier.ti.com/search with links to all op amp specifications.

Common Op Amp Design Questions

What is the amplitude of the input signal?
To ensure that signal errors are small relative to the input signal, small input signals require high precision, (e.g., low offset voltage) amplifiers. Ensure that the amplified output signal stays within the amplifier output voltage.

Will the ambient temperature vary?
Op amps are sensitive to temperature variations, so it is often necessary to consider offset voltage drift over temperature.

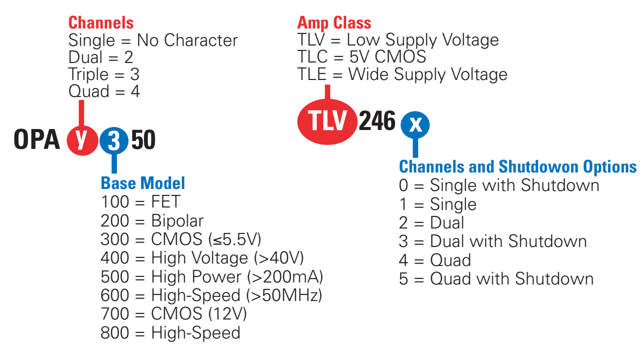
Does the common-mode voltage vary?
Make sure the op amp is operated within its common-mode range and has an adequate common-mode rejection ratio (CMRR). Common-mode voltage will induce additional offset voltage.

Does the power supply voltage vary?
Power supply variations affect the offset voltage.

Precision Application Examples

- High gain circuits (G >100)
- Measuring small input signals (i.e., from a sensor thermocouple)
- Wide operating temperature range circuits (i.e. in automotive)
- Single-supply ≤ 5V data-acquisition systems where input voltage span is limited

Op Amp Naming Conventions



Precision/Low-Voltage Operational Amplifiers

Precision Operational Amplifiers (V_{IO} ≤ 500µV) Selection Guide

Device[1]	Description	Ch.	V_S (V) (min)	V_S (V) (max)	I_Q Per Ch. (mA) (max)	GBW (MHz) (typ)	Slew Rate (V/µs) (typ)	V_{OS} (25°C) (mV) (max)	Offset Drift (µV/°C) (typ)	I_B (pA) (max)	CMRR (dB) (min)	V_N at 1 kHz (nV/√Hz) (typ)	Single Supply	Rail-to-Rail	Q1 Avail
Precision, Low Noise V_N ≤ 10nV/√Hz (typ) at 1kHz															
TLE2027	Precision, Low Noise, Wide Bandwith, Wide V_S	1	8	38	5.3	13	2.8	0.1	0.4	90000	100	2.5	N	N	N
OPAy350	High-Speed, Single Supply	1, 2, 4	2.7	5.5	7.5	38	22	0.5	4	10	76	5	Y	I/O	Preview
TLC220x	Precision, Low Noise	1, 2	4.6	16	1.5	1.8	2.5	0.5	0.5	100	85	8	Y	Out	N
TLC2654	Low-Noise Chopper-Stabilized Op Amp	1	4.6	16	2.4	1.9	3.7	0.02	0.01	150	105	13	Y	—	N
Precision, Low Voltage V_S ≤ 2.7V (min)															
TLC1078	Low Voltage, Precision	2	1.4	16	0.017	0.085	0.032	0.45	1.1	70	600	68	N	—	N
OPAy350	High-Speed, Single Supply	1, 2, 4	2.7	5.5	7.5	38	22	0.5	4	10	76	5	Y	I/O	Preview
TLV2211	Single LinCMOS™ Rail-to-Rail µPower Operational Amplifier	1	2.7	10	0.025	0.065	0.025	0.45	0.5	150	70	22	Y	Out	Preview
OPAy364A	1.8V, High CMR, RRIO Op Amp	1, 2, 4	1.8	5.5	0.75	7	5	0.5	3	10	74	17	Y	I/O	Preview
Precision, Low Power I_Q ≤ 1mA/ch (max)															
TLC1078	Low Voltage, Precision	2	1.4	16	0.017	0.085	0.032	0.45	1.1	70	600	68	N	—	N
TLE202x	Precision, Single Supply	1, 2, 4	4	40	0.3, 0.35	1.2, 1.7	0.5	0.6, 1.1	2	70000	85, 80	17	Y	—	Y
LT1013	Dual Precision	2	4	44	0.55, 0.5	1	0.4	0.3, 0.15, 0.8	2.5, 2, 5	–30000	97, 100	22	Y	N	N
LT1014	Quad Precision	4	5	44	0.55, 0.5	1	0.4	0.3, 0.18, 0.8	2, 2.5, 5	–30000, –20000	97, 100	22	Y	N	N
TLV2211	Single LinCMOS Rail-to-Rail µPower Op Amp	1	2.7	10	0.025	0.065	0.025	0.45	0.5	150	70	22	Y	Out	Preview
OPAy364A	1.8V, High CMR, RRIO Op Amp	1, 2, 4	1.8	5.5	0.75	7	5	0.5	3	10	74	17	Y	I/O	Preview
Precision, Low Input Bias Current I_B ≤ 100 pA (max)															
OPAy350	High-Speed, Single Supply	1, 2, 4	2.7	5.5	7.5	38	22	0.5	4	10	76	5	Y	I/O	Preview
TLC1078	Low Voltage, Precision	2	1.4	16	0.017	0.085	0.032	0.45	1.1	70	600	68	N	—	N
OPAy364A	1.8V, High CMR, RRIO Op Amp	1, 2, 4	1.8	5.5	0.75	7	5	0.5	3	10	74	17	Y	I/O	Preview
Precision, Wide Bandwidth GBW ≥ 5MHz (typ)															
TLE2027	Precision, Low Noise, Wide Bandwith, Wide V_S	1	8	38	5.3	13	2.8	0.1	0.4	90000	100	2.5	N	N	N
TLC450x	Advanced LinEPIC™ Self-Calibrating (Self-Cal)	1, 2	4	6	1.5	4.7	2.5	0.08	1	500	90	12	N	Out	N
OPAy350	High-Speed, Single Supply	1, 2, 4	2.7	5.5	7.5	38	22	0.5	4	10	76	5	Y	I/O	Preview
OPAy364A	1.8V, High CMR, RRIO Op Amp	1, 2, 4	1.8	5.5	0.75	7	5	0.5	3	10	74	17	Y	I/O	Preview

[1] x indicates: 0 = single with shutdown, 1 = single, 2 = dual, 3 = dual with shutdown, 4 = quad, 5 = quad with shutdown. y indicates: no character = single, 2 = dual, 3 = triple, 4 = quad.

Low-Voltage Operational Amplifiers (V_S ≤ 2.7V) Selection Guide

Device[1]	Description	Ch.	SHDN	V_S (V) (min)	V_S (V) (max)	I_Q Per Ch. (mA) (max)	GBW (MHz) (typ)	Slew Rate (V/µs) (typ)	V_{OS} (25°C) (mV) (max)	Offset Drift (µV/°C) (typ)	I_B (pA) (max)	V_N at 1 kHz (nV/√Hz) (typ)	Rail-to-Rail	Q1 Avail
Low-Voltage, Low Noise V_N ≤ 10nV/√Hz (typ) at 1kHz														
TLV246x	Low Power, Rail-to-Rail	1, 2, 4	Y/N	2.7	6	0.575	5.2	1.6	2	2	14000	11	I/O	Y
OPAy350	High-Speed, Single Supply	2, 1, 4	N	2.7	5.5	7.5	38	22	0.5	4	10	5	I/O	Preview
TLV226x	Rail-to-Rail, Low Power	2, 4	N	2.7	16	0.25	0.67	0.55	2.5	2	150	12	Out	N
Low-Voltage, Low Input Bias Current I_Q ≤ 100pA (max)														
TLV277x	RRO, SS, High Slew Rate	1, 2, 4	Y	2.5	5.5	2	4.8	9	2.5	2	100	21	Out	Y
OPAy350	High-Speed, Single Supply	2, 1, 4	N	2.7	5.5	7.5	38	22	0.5	4	10	5	I/O	Preview
TLV247x	Low Power, SS, Low Bias, Current, 35mA Drive	1, 2, 4	Y	2.7	6	0.75	2.8	1.4	2.2	0.4	50	15	I/O	Y
OPAy348	1MHz, 45µA, RRIO, Quad Op Amp	1, 2, 4	N	2.1	5.5	0.065	1	0.5	5	2	10	35	I/O	Preview
OPAy364A	1.8V, High CMR, RRIO Op Amp	1, 2, 4	N	1.8	5.5	0.75	7	5	0.5	3	10	17	Out	Preview
TLV4112	High-Output-Drive Operational Amplifier	1, 2	N	2.5	6	1	2.7	1.6	3.5	3	50	20	Y	Preview
TLV4120	High-Output-Drive, Differential Op Amp w/ Shutdown	1	N	2.7	5.5	1.7	1.4	1.6	3	—	60	10	I/O	Preview

[1] x indicates: 0 = single with shutdown, 1 = single, 2 = dual, 3 = dual with shutdown, 4 = quad, 5 = quad with shutdown. y indicates: no character = single, 2 = dual, 3 = triple, 4 = quad.

Low-Voltage/Low-Power Operational Amplifiers

Low-Voltage Operational Amplifiers ($V_S \leq$ 2.7V) Selection Guide (Continued)

Device[1]	Description	Ch.	SHDN	V_S (V) (min)	V_S (V) (max)	I_Q Per Ch. (mA) (max)	GBW (MHz) (typ)	Slew Rate (V/µs) (typ)	V_{OS} (25°C) (mV) (max)	Offset Drift (µV/°C) (typ)	I_B (pA) (max)	V_N at 1 kHz ($nV/\sqrt{Hz}$) (typ)	Rail-to-Rail	Q1 Avail
Low-Voltage, Low Power $I_Q \leq$ 1mA (max)														
TLC1078	Low Voltage, Precision	2	N	1.4	16	0.017	0.085	0.032	0.45	1.1	600	68	—	N
TLV240x	2.5 V, sub-µPower, SS	1, 2, 4	N	2.5	16	0.00095	0.0055	0.0025	1.2	3	300	800	I/O	N
TLV245x	µPower, SS	1, 2, 4	Y	2.7	6	0.035	0.22	0.12	1.5	0.3	5000	51	I/O	Y
TLV246x	Low Noise, SS, Wide Bandwidth, 25mA Drive	1, 2, 4	Y	2.7	6	0.575	5.2	1.6	2	2	14000	11	I/O	Y
TLV247x	Low Power, SS, Low Bias Current, 35mA Drive	1, 2, 4	Y	2.7	6	0.75	2.8	1.4	2.2	0.4	50	15	I/O	Y
TLV225x	Rail-to Rail, Low Voltage	2, 4	N	2.7	16	0.0625	0.187	0.1	1.5	0.5	150	19	Out	Y
TLV226x	Rail-to Rail, Low Voltage	2, 4	N	2.7	16	0.25	0.67	0.55	2.5	2	70	12	Out	N
OPAy244	µPower, SS	1, 2, 4	N	2.6	36	0.05	0.3, 2.4	0.1	1.5	2.3, 4	25000	22	—	N
LMV324/LMV358	Rail-to-Rail, Low Voltage	2, 4	N	2.7	5.5	0.017	1	1	7	5	25000	39	Out	Y
TLV27x	550µA/Ch 3MHz Rail-to-Rail Output	1, 2, 4	N	2.7	15	0.66	3	2.4	5	2	60	39	Out	Y
OPAy348	1MHz, 45µA, RRIO, Quad Op Amp	1, 2, 4	N	2.1	5.5	0.065	1	0.5	5	2	10	35	I/O	Preview
TLV2211	Single LinCMOS™ Rail-to-Rail µPower Op Amp	1	N	2.7	10	0.025	0.065	0.025	0.45	0.5	150	22	I/O	Preview
OPAy364A	1.8V, High CMR, RRIO Op Amp	1, 2, 4	N	1.8	5.5	0.75	7	5	0.5	3	10	17	Out	Preview
TLV4112	High-Output-Drive Operational Amplifier	1, 2	N	2.5	6	1	2.7	1.6	3.5	3	50	20	Y	Preview
Low-Voltage, Wide Bandwidth GBW ≥ 5MHz (typ)														
TLV277x	SS, High Slew Rate	1, 2, 4	Y	2.5	5.5	2	4.8	9	2.5	2	100	21	Out	Y
TLV246x	Low Noise, SS, Wide Bandwidth, 25mA Drive	1, 2, 4	Y	2.7	6	0.575	5.2	1.6	2	2	14000	11	I/O	Y
OPAy350	High-Speed, Single Supply	2, 1, 4	N	2.7	5.5	7.5	38	22	0.5	4	10	5	I/O	Preview
OPAy364A	1.8V, High CMR, RRIO Op Amp	1, 2, 4	N	1.8	5.5	0.75	7	5	0.5	3	10	17	I/O	Preview

[1] x indicates: 0 = single with shutdown, 1 = single, 2 = dual, 3 = dual with shutdown, 4 = quad, 5 = quad with shutdown. y indicates: no character = single, 2 = dual, 3 = triple, 4 = quad.

Low-Power Operational Amplifiers ($I_Q \leq$ 1mA) Selection Guide

Device[1]	Description	Ch.	SHDN	V_S (V) (min)	V_S (V) (max)	I_Q Per Ch. (mA) (max)	GBW (MHz) (typ)	Slew Rate (V/µs) (typ)	V_{OS} (25°C) (mV) (max)	Offset Drift (µV/°C) (typ)	I_B (pA) (max)	V_N at 1 kHz ($nV/\sqrt{Hz}$) (typ)	Rail-to-Rail	Q1 Avail
Low-Power, Low Voltage $V_S \leq$ 2.7V (min)														
TLV240x	2.5 V, sub-µPower, SS	1, 2, 4	N	2.5	16	0.00095	0.0055	0.0025	1.2	3	300	800	I/O	N
TLC1078	Low Voltage, Precision	2	N	1.4	16	0.017	0.085	0.032	0.45	1.1	600	68	—	N
TLV246x	Low Noise, SS, Wide Bandwidth, 25mA Drive	1, 2, 4	Y	2.7	6	0.575	5.2	1.6	2	2	14000	11	I/O	Y
TLV247x	Low Power, SS, Low Bias Current, 35mA Drive	1, 2, 4	Y	2.7	6	0.75	2.8	1.4	2.2	0.4	50	15	I/O	Y
TLV225x	Rail-to-Rail, Low Voltage	2, 4	N	2.7	16	0.0625	0.187	0.1	1.5	0.5	150	19	Out	Y
TLV226x	Rail-to Rail, Low Voltage	2, 4	N	2.7	16	0.25	0.67	0.55	2.5	2	70	12	Out	N
OPAy244	µPower, SS	2, 1, 4	N	2.6	36	0.05	0.3, 2.4	0.1	1.5	2.3, 4	25000	22	—	N
TLV27x	550µA/Ch 3MHz Rail-to-Rail Output	1, 2, 4	N	2.7	15	0.66	3	2.4	5	2	60	39	Out	Y
OPAy348	1MHz, 45µA, RRIO, Quad Op Amp	1, 2, 4	N	2.1	5.5	0.065	1	0.5	5	2	10	35	I/O	Preview
TLV2211	Single LinCMOS™ Rail-to-Rail µPower Op Amp	1	N	2.7	10	0.025	0.065	0.025	0.45	0.5	150	22	Out	Preview
Low-Power, Wide Bandwidth GBW ≥ 5MHz (typ)														
TLV246x	Low Noise, SS, Wide Bandwidth, 25mA Drive	1, 2, 4	Y	2.7	6	0.575	5.2	1.6	2	2	14000	11	I/O	Y
TLC450x	Advanced LinEPIC™ Self-Calibrating (Self-Cal)	1, 2	N	4	6	1.5	4.7	2.5	0.08	1	500	12	Out	N
Low-Power, Low Noise $V_N \leq 10nV/\sqrt{Hz}$ (typ) at 1kHz														
TLV246x	Low Power, Rail-to-Rail	1, 2, 4	Y/N	2.7	6	0.575	5.2	1.6	2	2	14000	11	I/O	Y
TLV226x	Rail-to-Rail, Low Power	2, 4	N	2.7	16	0.25	0.67	0.55	2.5	2	150	12	Out	N
TLC225x	Rail-To-Rail µPower Operational Amplifier	2, 4	N	4.4	16	0.0625	0.2	0.12	1.5	0.5	100	19	Out	Y
TLC226x	Rail-To-Rail Low Power Operational Amplifier	2, 4	N	4.4	16	0.25	0.82	0.55	2.5	2	100	12	Out	Y
TLC2654	Low-Noise Chopper-Stabilized Operational Amplifier	1	N	4.6	16	2.4	1.9	3.7	0.02	0.01	150	13	—	N

[1] x indicates: 0 = single with shutdown, 1 = single, 2 = dual, 3 = dual with shutdown, 4 = quad, 5 = quad with shutdown. y indicates: no character = single, 2 = dual, 3 = triple, 4 = quad.

Wide-Voltage Range Operational Amplifier

Wide-Voltage Range Operational Amplifiers (±5V ≤ V_S ±20V) Selection Guide

Device[1]	Description	Ch.	V_S (V) (min)	V_S (V) (max)	I_Q Per Ch. (mA) (max)	GBW (MHz) (typ)	Slew Rate (V/µs) (typ)	V_{OS} (25°C) (mV) (max)	Offset Drift (µV/°C) (typ)	I_B (pA) (max)	CMRR (dB) (min)	V_N at 1 kHz (nV/√Hz) (typ)	Single Supply	Rail-to-Rail	Q1 Avail
Wide-Voltage, Precision Offset V_{OS} ≤ 500µV (max)															
TLC220x	Precision, Low Noise	1, 2	4.6	16	1.5	1.8	2.5	0.5	0.5	100	85	8	Y	Out	N
TLE2027	Precision, Low Noise, Wide Bandwidth	1	8	38	5.3	13	2.8	0.1	0.4	90000	100	2.5	N	N	N
TLE202x	Precision, Single Supply	1, 2, 4	4	40	0.3, 0.35	1.2, 1.7	0.5	0.6, 1.1	2	70000	85, 80	17	Y	—	Y
LT1013	Dual Precision	2	4	44	0.55, 0.5	1	0.4	0.3, 0.15, 0.8	2.5, 2, 5	-30000	97, 100	22	Y	N	N
LT1014	Quad Precision	4	5	44	0.55, 0.5	1	0.4	0.3, 0.18	2, 2.5, 5	-30000	97, 100	22	Y	N	N
Wide-Voltage, Low Power I_Q ≤ 1mA/ch (max)															
TLV225x	Rail-to-Rail, Low Voltage	2, 4	2.7	16	0.0625	0.187	0.1	1.5	0.5	150	65	19	Y	Out	Y
TLV226x	Rail-to-Rail, Low Voltage	2, 4	2.7	16	0.25	0.67	0.55	2.5	2	70	70	12	Y	Out	N
OPAy244	µPower, SS	2, 1, 4	2.6	36	0.05	0.3, 2.4	0.1	1.5	2.3, 4	25000	84	22	Y	—	N
TLV237x	550µA, 3MHz, SHDN	1, 2, 4	2.7	15	0.66	3	2.4	4.5	2	60	57	39	Y	I/O	Y
TLV240x	2.5V, sub-µPower	1, 2, 4	2.5	16	0.00095	0.0055	0.0025	1.2	3	300	63	800	Y	I/O	N
TLE206x	Low Power, JFET-Input, High Drive	1, 2, 4	7	36	0.35	2	3.4	3	6	2000	65	40	N	N	N
TLE202x	Low Power, Wide Voltage Supply	1, 2, 4	4	40	0.3	1.2	0.5	0.6	2	70000	85	17	Y	N	Y
TLV2432	Advanced LinCMOS™ Rail-to-Rail Output Wide-Input-Voltage	2, 4	2.7	10	0.125	0.5	0.25	2	2	150	70	18	Y	In, Out	Y
TLV2422	Dual, Wide-Input-Voltage µPower, Rail-to-Rail Single-Supply	2	2.7	10	0.075	0.052	0.02	2	2	150	70	18	Y	Out	Y
TLV244x	Advanced LinCMOS Rail-to-Rail Output Wide-Input-Voltage	2, 4	2.7	10	1.1	1.75	1.3	2	2	150	70	18	Y	Out	Y
Wide-Voltage, Low Input Bias Current I_B ≤ 100pA (max)															
TLV237x	550µA, 3MHz, SHDN	1, 2, 4	2.7	15	0.66	3	2.4	4.5	2	60	57	39	Y	I/O	Y
TLC227x	Low Noise, Rail-to-Rail	2, 4	4.4	16	1.5	2.18	3.6	2.5	2	100	70	9	Y	Out	Y
TLC07x	Low Noise, Wide Bandwidth, CMOS, SHDN, High Drive, Input to V+	1, 2, 4	4.5	16	2.5	10	16	1	1.2	50	100	7	Y	N	N
TLC08x	Low Noise, Wide Bandwidth, CMOS, Input to V–, SHDN, High Drive	1, 2, 4	4.5	16	2.5	10	16	1	1.2	50	100	8.5	Y	N	N
Wide-Voltage, Wide Bandwidth GBW ≥ 5MHz (typ)															
TLC07x	Low Noise, Wide Bandwidth, CMOS, SHDN, High Drive, Input to V+	1, 2, 4	4.5	16	2.5	10	16	1	1.2	50	100	7	Y	N	N
TLC08x	Low Noise, Wide Bandwidth, CMOS, Input to V–, SHDN, High Drive	1, 2, 4	4.5	16	2.5	10	16	1	1.2	50	100	8.5	Y	N	N
TLE207x	Low-Noise High-Speed JFET-Input	1, 2, 4	4.5	38	1.8	10	45	6	2.4	175	80	14	N	N	Y
TLE2027	Precision	1	8	38	5.3	13	2.8	0.1	0.4	90000	100	2.5	N	N	N
TLE2037	Low-Noise High-Speed Precision Decomp.	1	8	38	5.3	50	7.5	0.1	0.4	90000	100	2.5	N	N	Y
Low-Power, Low Noise V_N ≤ 10nV/√Hz (typ) at 1kHz															
TLV226x	Rail-to-Rail, Low Power	2, 4	2.7	16	0.25	0.67	0.55	2.5	2	150	70	12	Y	Out	N
TLC227x	Rail-to-Rail, Low Power	2, 4	4.4	16	1.5	2.18	3.6	2.5	2	100	70	9	Y	Out	Y
TLC07x	Wide-Band, High-Output	1, 2, 4	4.5	16	2.5	10	16	1	1.2	50	100	7	Y	N	N
TLC08x	Wide-Band, High-Output	1, 2, 4	4.5	16	2.5	10	16	1	1.2	50	100	8.5	Y	N	N
TLE214x	High-Speed, Single Supply	1, 2, 4	4	44	4.5	5.9	45	0.9, 1.2, 2.4	1.7	1500000	85	10.5	Y	N	N
TLE2027	Precision	1	8	38	5.3	13	2.8	0.1	0.4	90000	100	2.5	N	N	N
TLE2037	Low-Noise High-Speed Precision Decomp.	1	8	38	5.3	50	7.5	0.1	0.4	90000	100	2.5	N	N	Y

[1] *x indicates: 0 = single with shutdown, 1 = single, 2 = dual, 3 = dual with shutdown, 4 = quad, 5 = quad with shutdown. y indicates: no character = single, 2 = dual, 3 = triple, 4 = quad.*

General Purpose Operational Amplifiers

General Purpose Operational Amplifiers Selection Guide

Device[1]	Description	Ch.	V_S (V) (min)	V_S (V) (max)	I_Q Per Ch. (mA) (max)	GBW (MHz) (typ)	Slew Rate (V/µs) (typ)	V_{OS} (25°C) (mV) (max)	Offset Drift (µV/°C) (typ)	I_B (pA) (max)	CMRR (dB) (min)	V_N at 1 kHz (nV/√Hz) (typ)	Single Supply	Q1 Avail
LM218	High-Speed Operational Amplifier	1	10	40	10	15	70	10	—	500000	70	—	N	Y
LM2902	General Purpose	4	3	26	0.3	1.2	0.5	7	—	250000	50	35	Y	Y
LM2902KV	General-Purpose with 2kV ESD Protection, Voltage Enhanced	4	3	32	0.3	1.2	0.5	7	—	250000	50	35	Y	Y
LM2902KAV	General-Purpose with 2kV ESD Protection, Voltage Enhanced	4	3	32	0.3	1.2	0.5	2	—	250000	50	35	Y	Y
LM2904	General-Purpose	2	3	26	0.6	0.7	0.3	7	7	250000	50	40	Y	Y
LM2904AV	General-Purpose, Enhanced Voltage	2	3	32	0.6	0.7	0.3	7	7	250000	65	40	Y	Y
LM2904V	General-Purpose, Enhanced Voltage	2	3	32	0.6	0.7	0.3	2	7	250000	65	40	Y	Y
LT1013/A/D	Precision, Low Power	2	4	44	0.55, 0.5, 0.55	1	0.4	0.3, 0.18, 0.8	2.5, 2, 5	–30, –20, –30	97, 100, 97	22	Y	N
LT1014/A/D	Precision, Low Power	4	4	44	0.55, 0.5, 0.55	1	0.4	0.3, 0.18, 0.8	2.5, 2, 5	–30, –20, –30	97, 100, 97	22	Y	N
TL06x/A/B	Low Power, JFET-Input	1, 2, 4	7	36	0.25	1	3.5	15, 6, 3	10	0.4, 0.2, 0.2	70, 80, 80	42	N	N
TL07x/A/B	Low Noise, JFET-Input	1, 2, 4	7	36	2.5	3	13	10, 6, 3	18	0.2	70, 75, 75	18	N	N
TL08x	Low Noise, JFET-Input	1, 2, 4	7	36	2.8	3	13	15	18	400	70	18	N	N
TLC27Lx	LinCMOS Low-Power Op Amp	1, 2, 4	3	16	0.017	0.085	0.03	10	1.1	600	65	68	Y	N
TLC27Mx	Precision Single Supply Low-Power Op Amp	2, 4	3	16	0.28	0.525	0.43	10	1.7	600	65	32	Y	N
TLC27x	LinCMOS™ Prog Low-Power Op Amp	1, 2, 4	3	16	1.6	1.7	3.6	10	1.8	600	65	25	Y	N
LMV32x	Low Voltage, RRO	1, 2, 4	2.7	5.5	0.17	1	1	7	5	250	50	39	Y	Y
LMV358	Dual Low Voltage, RRO	2	2.7	5.5	0.34	1	1	7	5, —	250	50	39	Y	Y
LMV82x	Low-Voltage, Low Power, RRO	1, 2, 4	2.7	5.5	0.4	5	2.5	—	—	100000	—	—	Y	Y
LMV93x	1.8V with RRIO	1, 2, 4	1.8	5	0.185	1.4	0.35	4	5.5	50000	60	60	Y	Y
LMV34x	Rail-to-Rail Output CMOS Op Amp w/Shutdown	1, 2, 4	2.5	5.5	0.17	1	1	4	1.7	120	56	40	Y	Y

[1]x indicates: 0 = single with shutdown, 1 = single, 2 = dual, 3 = dual with shutdown, 4 = quad, 5 = quad with shutdown. y indicates: no character = single, 2 = dual, 3 = triple, 4 = quad.

Current Shunt Monitors

Current shunt monitors are used to measure voltage drops across a high- or low-side shunt resistor. These unique difference amplifiers are designed to withstand the presence of high common-mode voltages and provide accurate linear output voltages or currents.

TI offers a variety of voltage and current output current shunt monitors. The INA19x family has a common-mode voltage range that extends from –16V to +80V and provides a battery voltage output.

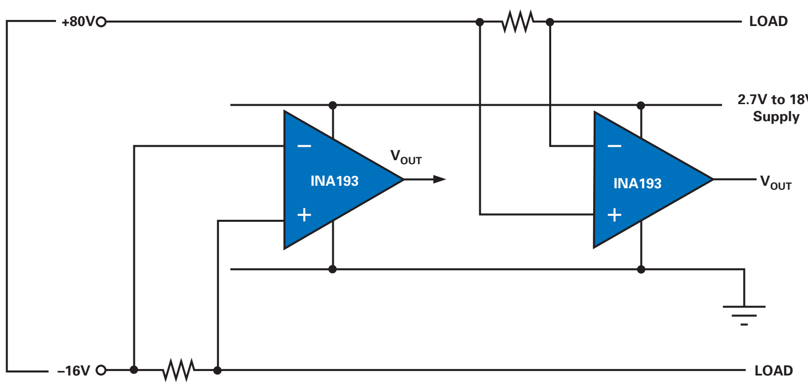
–16V to +80V Current Sense Monitor
INA19x

Get samples, datasheets, and app reports at: **www.ti.com/ina19x**

Key Features
- –16V to +80V common mode range
- 2.7V to 18V specified supply range
- Three transfer functions: 20V/V, 50V/V, 100V/V
- Only 3% max error over –40°C to +125°C
- 500kHz bandwidth
- 700µA quiescent current
- Packaging: SOT23

Applications
- Fault detection
- Power supplies
- Motor control
- Test and measurement
- Automotive transmoission systems
- Battery monitoring

The INA19x voltage output high-side current shunt monitor features –16V to +80V of common-mode voltage range making it capable of withstanding shorts and voltage reversals typical of demanding automotive applications. Available in three gain ranges of 20V/V, 50V/V and 100V/V, the INA19x offers flexible performance in a SOT23 package.



INA19x can measure 80V above ground and 16V below ground.

Current Shunt Monitor Selection Guide

Device[1]	Description	Gain (V/V)	Common Mode Input Range (min) (V)	Input Offset (±) (max) (mV)	Input Offset Drift (±) (max) (µV/°C)	CMRR (min) (dB)	Small Signal Bandwidth (typ) (MHz)	Quiescent Current (±) (typ) (mA)	V_S (max) (V)	V_S (min) (V)	Q1 Avail
INA138	Uni-Directional, Current Output	1 to 100	2.7 to 36	1	1	100	0.08	0.025	36	2.7	N
INA139	Uni-Directional, Current Output	1 to 100	2.7 to 36	1	1	100	0.44	0.06	40	2.7	Y
INA168	Uni-Directional, Current Output	1 to 100	2.7 to 60	1	1	100	0.08	0.025	60	2.7	Y
INA169	Uni-Directional, Current Output	1 to 100	2.7 to 60	1	1	100	0.44	0.06	60	2.7	Y
INA19x	Uni-Directional, Voltage Output	20,50,100	–16 to 80	2	1	100	0.4	0.25	18	2.7	Y

[1]*x = gain / pinout option*

Comparators

Comparator ICs are specialized op amps designed to compare two input voltages and provide a logic state output. They can be considered one-bit analog-to-digital converters.

Comparator vs. Op Amp

	Comparator	Op Amp
Speed (Response time)	Yes	No
Logic Output	Yes	No
Wide Diff. Input Range	Yes	Yes
Low Offset Drift	No	Yes

If a fast response time is required, use a comparator.

Design Considerations

Output topology

- Open collector—connects to the logic supply through a pull-up resistor and allows comparators to interface to a variety of logic families.
- Push-pull—does not require a pull-up resistor. Because the output swings rail-to-rail, the logic level is dependent on the voltage supplies of the comparator.

Response time (propagation delay)—applications requiring "near real-time" signal response should consider comparators with nanosecond (ns) propagation delay. As propagation delay decreases, supply current increases.

Comparators Selection Guide

Device[1]	Description	Ch.	I_Q per Ch. (mA) (max)	Output Current (mA) (min)	t_{RESP} Low-to-High (µs)	V_S (V) (min)	V_S (V) (max)	V_{OS} (25°C) (mV) (max)	Output Type	Q1 Avail
High Speed $t_{RESP} \leq 0.1µs$										
LM211	Single, High Speed, Strobed	1	6	—	0.115	3.5	30	3	Open Drain/Collector	Y
Low Power I_Q < 0.5mA										
TLV370x	Nanopower, Push-Pull, RRIO	1, 2, 4	0.0008	—	36	2.5	16	5	Push Pull	Y
TLC370x	Fast, Low Power	2	0.02	4	1.1	3	16	5	Push Pull	Y
Low Power I_Q < 0.5mA										
TLC393	Linear	2	0.02	6	1.1	3	16	5	Open Drain/Collector	Y
TLC239	Quad, Low Power, Open Drain	4	0.02	6	1	3	16	5	Open Drain/Collector	Y
LMV393	Dual, Low Voltage	2	0.1	10	0.2	2.7	5.5	7	Open Drain/Collector	Preview
LMV339	Quad, Low Voltage	4	0.1	—	0.2	2.7	5.5	7	Open Drain/Collector	Preview
TLC37x	Fast, Low Power	2	0.15	6	0.2	2	18	5	Open Drain/Collector	N
LP2901	Quad, General Purpose Differential Comparator	4	0.5	6	0.3	2	30	7	Open Drain/Collector	Y
TLV3012	Nanopower, 1.8V, SOT23 Push-Pull Comparator with Voltage Reference	1	0.005	—	6	1.8	5.5	12	Push Pull	Preview
Low Voltage $V_S \leq 2.7V$ (min)										
TLC37x	Fast, Low Power	2	0.15	6	0.2	2	18	5	Open Drain/Collector	N
LM2901	Quad, General Purpose	4	0.625	6	0.3	2	30	7	Open Drain/Collector	Y
LM2901V	Quad, General Purpose	4	0.625	6	0.3	2	32	7	Open Drain/Collector	Y
LM2901AV	Quad, General Purpose	4	0.625	6	0.3	2	32	2	Open Drain/Collector	Y
LM239	Quad, General Purpose	4	0.5	6	0.3	2	30	5	Open Drain/Collector	Y
TLV370x	Nanopower, Push-Pull, RRIO	1, 2, 4	0.0008	—	36	2.5	16	5	Push Pull	Y
LMV393	Dual, Low Voltage	2	0.1	10	0.2	2.7	5.5	7	Open Drain/Collector	Preview
LMV339	Quad, Low Voltage	4	0.1	—	0.2	2.7	5.5	7	Open Drain/Collector	Preview
LM2903	Dual, General Purpose	2	0.5	6	0.3	2	30	7	Open Drain/Collector	Y
LM2903V	Dual, General Purpose	2	0.5	6	0.3	2	32	7	Open Drain/Collector	Y
LM2903AV	Dual, General Purpose	2	0.5	6	0.3	2	32	2	Open Drain/Collector	Y
TLV3012	Nanopower, 1.8V, SOT23 Push-Pull Comparator with Voltage Reference	1	0.005	—	6	1.8	5.5	12	Push Pull	Preview

[1]x indicates: 0 = single with shutdown, 1 = single, 2 = dual, 3 = dual with shutdown, 4 = quad, 5 = quad with shutdown. y indicates: no character = single, 2 = dual, 3 = triple, 4 = quad.

Temp Sensors

Digital Temperature Sensors

TI's low-cost, digital temperature sensors are specified for operation from –40°C to +125°C and are designed for thermal measurement in a variety of communication, computer, consumer, industrial and instrumentation applications. These silicon-based temperature sensors are designed on a unique topology that offers excellent accuracy and linearity over temperature.

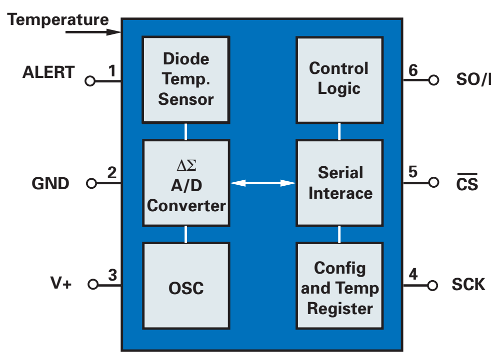
Low power and standard communication protocol pair nicely with low-power micro-controllers. The digital temperature output of the TMP family is created using a high-performance, 12-bit ΔΣ ADC that outputs temperatures as a digital word. Programming and communication with the TMP1xx family of devices is done via a 2-wire or SPI interface for easy integration into existing digital systems.

Temperature Sensor Core

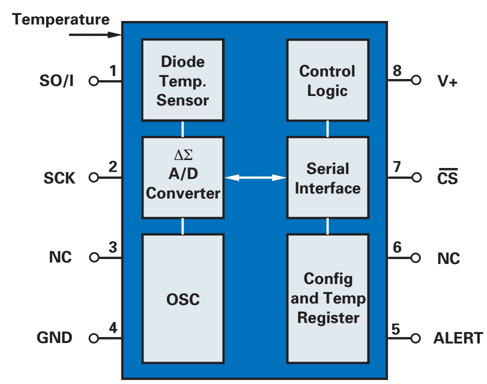
A typical block diagram of the TMP family of digital temperature sensors is shown below. Temperature is sensed through the die flag of the lead frame where the temperature sensing element is the chip itself, ensuring the most accurate temperature information of the monitored area and allowing designers to respond quickly to over and under thermal conditions.

Features of TMP Digital Temperature Sensors

Several of the TMP digital sensors offer programmable features including over and under temperature thresholds, alarm functions and temperature resolution. With extremely low power consumption (50µA) and power down standby features the TMP12x family offers as low as ±1.5°C minimum of accuracy in a SOT23 package and is an excellent candidate for low-power thermal monitoring applications.



TMP122



TMP124

Temp Sensors Selection Guide

Device	Interface	Resolution	Temp. Error (Accuracy) –25 to +125°C Max	Temp. Error (Accuracy) –40 to +125°C Max	Temp. Error (Accuracy) –55 to +125°C Max	Conversion Time (Res - 9 bit) (ms) Max	Conversion Time (Res - 12 bit) (ms) Max	Quiescent Current µA Max	Power Supply Range V	Q1 Avail
TMP122	SPI	9 to 12	± 1.5	± 2.0	± 1.5 (typ)	40	320	75	+2.7 to 5.5	Preview
TMP124	SPI	9 to 12	± 1.5	± 2.0	± 1.5 (typ)	40	320	75	+2.7 to 5.5	Preview

Linear and Low Dropout Regulators (LDOs)

TI offers a broad automotive LDO portfolio. Products are available for simple regulation from other supply rails or directly from the vehicle battery.

Design Factors

Input Voltage — The minimum V_{IN} must be larger than $V_{OUT} + V_{DO}$, independent from the minimum value given in the selection table.

Efficiency — By neglecting the quiescent current (Iq) of the LDO, efficiency can be calculated as V_{OUT}/V_{IN}.

Power Dissipation — $P_D = (V_{IN} – V_{OUT}) x\ I_{OUT}$; P_D is limited by package, T_A and T_{JMAX}. Refer to application note SLVA118, "Digital Designer's Guide to Linear Voltage Regulators and Thermal Management," for support.

Capacitor Requirements — The output capacitor and especially its ESR are critical for stability. Therefore some LDOs require tantalum output capacitors, which have high ESR. If an LDO is stable with no output capacitor or with low-ESR ceramic output capacitors, it is usually stable with all types of capacitors.

RF, Audio and Other Noise-Sensitive Applications — Select an LDO with high power supply ripple rejection (PSRR) for noise immunity from the input supply, and low output noise (< 50 µVrms). Some LDOs have a bypass (BP) pin for adding capacitance to lower the output noise.

PG/SVS — Devices such as microprocessors, DSPs and FPGAs require a minimum voltage for proper operation. The supply voltage supervisor (SVS) function monitors the system voltages and outputs a signal when the voltages drop below a certain value, so the system can reset and prevent malfunction. An SVS asserts the reset signal after a specified delay, while a powergood (PG) function does not have a delay.

Reverse Leakage Protection — In special applications where the voltage on the output of the LDO is higher than at the input, the reverse leakage protection feature prevents current from flowing from the LDO output to the input, which can be damaging to the input supply, especially if it is a battery.

Dual Output LDOs Selection Guide

Device	Description	I_{O1} (mA)	I_{O2} (mA)	V_{DO1} @ I_{O1} (mV)	V_{DO2} @ I_{O2} (mV)	Iq @ I_O (µA)	Voltage (V)	Accuracy (%)	PWP Package	V_O (min)	V_O (max)	Features /EN	SVS	Seq	Low Noise	V_{IN} (min)	V_{IN} (max)	Q1 Available
TPS767D3xx	Dual Output FAST LDO with Integrated SVS	1000	1000	230	—	170	3.3 / 2.5 , 3.3 / 1.8, 3.3V / Adj	2	✔	1.2	5	✔	✔	—	—	2.7	10	Y
TPS70175	Dual-Output LDO with Power-Up Sequencing for Split-Voltage DSP Systems	500	250	275	—	190	2.5 / 5.0	2	✔	—	—	✔	✔	✔	✔	2.7	6	Y

Standard Linear Voltage Regulators Selection Guide

Device	V_{OUT} (nom) (V)	V_{OUT}/V_{REF} Tolerance Over Temp. (%)	I_{OUT} (max) (mA)	Min I_{OUT} for Regulation (mA)	Iq (max) (mA)	V_{DO} (typ) (V)	V_{DO} (max) (V)	V_{IN} (max) (V)	$V_{IN} – V_{OUT}$ (max) (V)	Q1 Available
LM317M	Adj. (1.2 to 37)	4	500	3.5	—	—	3	—	40	N
UA78Mxx	3.3, 5, 10	5	500	—	6	2	2 to 2.5	25 to 30	—	Y

LDOs

Low Dropout (LDO) Regulators Selection Guide

Device	I_O (mA)	V_{DO} at I_O (mV)	Iq at I_O (µA) Full Load	Voltage (V)	Adj.	Min V_{IN}	Max V_{IN}	Accuracy (%)	Packages										Features[1]	Comments	Q1 Available
									SC70	SOT23	MSOP	SO8	SOT223	PWP	TO263	TO220	PW	DDPAK			
TLE4275	450	500	150	5	—	5.5	45	2	—	—	—	—	—	—	—	—	—	✔	V, LD, RST	Automotive LDO, TLE4275 Alternative	Preview
TL760Mxx	500	500	—	1.8, 2.5, 3.3	—	3	45	2	—	—	—	—	—	—	—	—	—	✔	V, LD	Automotive LDO, TLE4274 Alternative	Preview
TL750Mxx	750	600	—	5, 8, 12	—	6, 9, 13	60	3	—	—	—	—	—	—	—	—	—	✔	V, LD	Automotive LDO	Preview
TL751Mxx	750	600	—	5, 8, 12	—	6, 9, 13	60	3	—	—	—	—	—	—	—	—	—	✔	V, LD, /EN	Automotive LDO	Preview
TPS715xx	50	750	12	2.5, 3, 3.3 5	—	2.5	24	4	✔	—	—	—	—	—	—	—	—	—	—	Low Quiscient Current	Y
TPS71Hxx	500	150	285	1.5, 1.8, 2.5, 3.3	✔	4.3	10	2	—	—	—	—	—	✔	—	—	—	—	PG	Fast Transient Response	Y
TPS725xx	1000	170	75	1.5, 1.6, 1.8, 2.5	✔	1.8	6	2	—	—	—	✔	—	—	—	—	—	—	/EN, SVS	Low Noise, SVS	Preview
TPS731xx	150	30	400	1.5, 1.8, 2.5 3.0, 3.3, 5.0	✔	1.7	5.5	1	—	✔	—	—	—	—	—	—	—	—	/EN	Reverse Leakage Protection	Preview
TPS752xx	2000	210	75	1.5, 1.8 2.5, 3.3	✔	2.7	5	2	—	—	—	—	—	✔	—	—	—	—	/EN, SVS	Fast Transient Response	Y
TPS753xx	1500	160	75	1.5, 1.8, 2.5, 3.3	✔	2.7	5	2	—	—	—	—	—	✔	—	—	—	—	/EN, SVS	Fast Transient Response	Y
TPS763xx	150	300	85	1.6, 1.8, 2.5, 2.7, 2.8, 3, 3.3, 3.8, 5	✔	2.7	10	3	—	✔	—	—	—	—	—	—	—	—	EN	Low Cost	Y
TPS767xx	1000	230	85	1.5, 1.8, 2.5, 2.7, 2.8, 3, 3.3, 5	✔	2.7	10	2	—	—	—	✔	—	✔	—	—	—	—	SVS	Fast Transient Response	Y
TPS768xx	1000	230	85	1.5, 1.8, 2.5, 2.7, 2.8, 3, 3.3, 5	✔	2.7	10	2	—	—	—	✔	—	✔	—	—	—	—	PG	Fast Transient Response	Y
TPS769xx	100	70	17	1.2, 1.5, 1.8, 2.5, 2.7, 2.8, 3, 3.3, 5	✔	2.7	10	3	—	✔	—	—	—	—	—	—	—	—	/EN	Low Cost	Y
TPS771xx	150	265	125	1.5, 1.8, 2.7, 2.8, 3.3, 5	—	2.7	10	2	—	—	✔	—	—	—	—	—	—	—	PG, /EN	Fast Transient Response	Y
TPS773xx	250	150	90	1.5, 1.6, 1.8, 2.7, 2.8, 3.3, 5.0	✔	2.7	10	2	—	—	✔	—	—	—	—	—	—	—	/EN, SVS	Low Noise	Preview
TPS775xx	500	169	85	1.5, 1.6, 1.8 2.5, 3.3	✔	2.7	10	2	—	—	—	✔	—	✔	—	—	—	—	SVS	Fast Transient Response	Y
TPS776xx	500	169	85	1.5, 1.8, 2.5, 2.8, 3.3	✔	2.7	10	2	—	—	—	✔	—	✔	—	—	—	—	PG	Fast Transient Response	Y
TPS786xx	1500	580	385	1.8, 2.5, 2.8, 3.0, 3.3	✔	2.7	5.5	2	—	—	—	—	—	—	—	—	—	✔	/EN	Low Noise	Preview
TPS791xx	100	38	170	1.8, 3.3, 4.7	—	2.7	5.5	2	—	✔	—	—	—	—	—	—	—	—	/EN	RF Low Noise; High PSRR	Y
TPS793xx	200	100	170	1.8, 2.5, 2.8, , 2.85 3, 3.3, 4.75	✔	2.7	5.5	2	—	✔	✔	—	✔	—	—	—	—	—	EN	RF Low Noise, High PSRR	Y
TPS797xx	10	400	5	1.8, 3, 3.3	—	1.8	5.5	5, 4, 4	✔	—	—	—	—	—	—	—	—	—	PG	Low Quiscient Current	Y

[1]*V = wide voltage, LD = load dump, PG = power good, /EN = active high enable, SVS = supply voltage supervisor, RST = reset.*

PWM Power Supply Controllers

Things to Consider

Control Method

Voltage Mode — Simple, noise-free control method for wide input and output range requirements.

Peak Current Mode — Fast transient response with built-in current limiting.

Performance

- The voltage mode controllers have input voltage feedforward for instantaneous response to input line changes.
- All controllers have on-board high output current drive capability without external MOSFET drivers.
- Lower start-up current for off-line applications (for BiCMOS products with UCC prefix).
- Low operating current (for BiCMOS products with UCC prefix) for light-load efficiency.
- Additional programmable minimum duty cycle clamp for light load efficiency.

Level of Integration

- Intergrated soft-start (programmable) provides predictable start-up after a fault.
- Internal leading edge blanking to suppress switching spike from MOSFET turn-on.

Technical Information

- 10 W to 350 W off-line and DC/DC power supplies.
- Single-ended topology power supplies.

PWM Power Supply Controllers Selection Guide

Device[1]	Typical Power Level (W)	Max Practical Frequency	Start-Up Current	Operating Current	Supply Voltage (V)	UVLO: On/Off (V)	V_{REF} (V)	V_{REF} Tol. (%)	Max Duty Cycle (%)	Soft Start	E/A	Shutdown	Output Voltage Feed-forward	Leading Edge Blanking	Q1 Available
Peak Current Mode Controllers															
UCC2800	10 to 200	1MHz	100µA	500µA	7.2 to 15	7.2/6.9	5	1.5	100	Yes	Yes	No	No	100 ns	Y
UCC2801	10 to 200	1MHz	100µA	500µA	9.4 to 15	9.4/7.4	5	1.5	50	Yes	Yes	No	No	100 ns	Y
UCC2802	10 to 200	1MHz	100µA	500µA	12.5 to 15	12.5/8.3	5	1.5	100	Yes	Yes	No	No	100 ns	Y
UCC2803	10 to 200	1MHz	100µA	500µA	4.1 to 15	4.1/3.6	4	1.5	100	Yes	Yes	No	No	100 ns	Y
UCC2804	10 to 200	1MHz	100µA	500µA	12.5 to 15	12.5/8.3	5	1.5	50	Yes	Yes	No	No	100 ns	Y
UCC2805	10 to 200	1MHz	100µA	500µA	4.1 to 15	4.1/3.6	4	1.5	50	Yes	Yes	No	No	100 ns	Y
UCC2808A-1/A-2	50 to 500	1MHz	130uA	1mA	4.3 to 15	12.5/8.34/4.1	—	—	Prog	Yes	Yes	No	No	No	Y
UCC2813-0	10 to 200	1MHz	100µA	500µA	7.2 to 15	7.2/6.9	5	2	100	Yes	Yes	No	No	100 ns	Y
UCC2813-1	11 to 200	1MHz	101µA	500µA	9.4 to 15	9.4/7.4	5	2	50	Yes	Yes	No	No	100 ns	Y
UCC2813-2	12 to 200	1MHz	102µA	500µA	12.5 to 15	12.5/8.3	5	2	100	Yes	Yes	No	No	100 ns	Y
UCC2813-3	13 to 200	1MHz	103µA	500µA	4.1 to 15	4.1/3.6	4	2	100	Yes	Yes	No	No	100 ns	Y
UCC2813-4	14 to 200	1MHz	104µA	500µA	12.5 to 15	12.5/8.3	5	2	100	Yes	Yes	No	No	100 ns	Y
UCC2813-5	15 to 200	1MHz	105µA	500µA	4.1 to 15	4.1/3.6	4	2	100	Yes	Yes	No	No	100 ns	Y
UCC28C40	10 to 250	1MHz	50µA	2.3mA	6.6 to 20	7.0/6.6	5	2	100	No	Yes	No	No	No	Preview
UC2524A	50 to 500	250kHz	4mA	5mA	8 to 40	7.5/7	5	2	Prog	Yes	Yes	Y	No	No	Preview
UC2842A	30 to 350	500kHz	0.3mA	11mA	10 to 30	16.0/10.0	5	1.5	100	No	Yes	No	Yes	No	N
UC2843A	30 to 350	500kHz	0.mA	11mA	7.9 to 30	8.5/7.9	5	1.5	100	No	Yes	No	Yes	No	N
UC2844A	30 to 350	500kHz	0.3mA	11mA	10 to 30	16.0/10.0	5	1.5	50	No	Yes	No	Yes	No	N
UC2845A	30 to 350	500kHz	0.3mA	11mA	7.9 to 30	8.5/7.9	5	1.5	50	No	Yes	No	Yes	No	N

[1]*The extra "C" in UCC means BiCMOS technology; therefore, UC2842 is bipolar and UCC2800 is BiCMOS.*

DC/DC Controllers and Converters

Things to Consider

Primary

Output Voltage — Lower voltages are required for today's advanced DSPs, FPGAs and ASICs. Both fixed and adjustable output voltage DC/DC converters are available.

Input Voltage — As the voltage requirements of performance processors drop, so can the bus voltage. The 3.3-V rail is becoming increasingly popular in many applications.

Output Current — When the maximum output current of the device exceeds the application's current consumption, the efficiency will be higher.

Secondary

Board Space — Integrated MOSFETs and externally compensated versions allow passive component flexibility and reduce board space.

Ease of Use — The Switchers With Integrated FET Technology (SWIFT™) designer software tool saves development time and speeds the designer through the external component selection process. The software tool can be downloaded from power.ti.com/swift

Technical Information

- PowerPAD™ packaging, an exposed pad on the bottom side of the IC, allows high currents in a small TSSOP package, eliminating bulky heatsinks.
- Low $RDS_{(ON)}$ MOSFETs in synchronous buck topology increase efficiency for better thermal management.

Switching DC/DC Controllers Selection Guide

Device	V_{IN} (V)	V_O (max) (V)	V_O (min) (V)	V_{REF} Tol (%)	Driver Current (A)	Output Current (A)[1]	Multiple Outputs	Adaptive Voltage Positioning	Protection[2]	Q1 Available	Comments
TPS40050	10 to 40	30	0.7	1	1	20	No	No	OCP, UVLO	Y	Wide input range sync buck, source only
TPS40051	10 to 40	30	0.7	1	1	20	No	No	OCP, UVLO	Y	Wide input range sync buck, source/sink except SS
TPS40053	10 to 40	30	0.7	1	1	20	No	No	OCP, UVLO	Y	Wide input range sync buck, source/sink
TPS5120	4.5 to 30	26	0.9	1.5	1.5	15 (each)	Yes	No	OCP, UVLO, PG, OVP	Y	Dual 180 degree out-of-phase operation
TL1451A	3.6 to 50	50	2.5	4	0.02	Depends on FET driver	Yes	No	UVLO, SCP	Y	Dual PWM buck/boost
TL5001A	3.6 to 40	50	1	3	0.02	Depends on FET driver	No	No	UVLO, SCP	Y	PWM buck/boost
TPS40200	4.5 to 52	46.8	0.7	2	0.2	Depends on FET driver	No	No	UVLO	Preview	Wide input non-synchronous buck DC/DC controller

[1] Current levels of this magnitude and beyond can be supported.

[2] OCP = over-current protection; UVLO = under-voltage lockout; SCP = short-circuit protection; PG = power good; OVP = over-voltage protection.

SWIFT™ Selection Guide

Device	V_{IN} (V)	Output Current (A)	V_{OUT} (V)	Package	Q1 Available
TPS5430	5.5 to 36	3	Adj	8 HSO	Preview
TPS5420	5.5 to 36	2	Adj	8 SO	Preview
TPS54310/1/2/3/4/5/6	3.0 to 6.0	3	Adj., 0.9, 1.2, 1.5, 1.8, 2.5, 3.3	20 HTSSOP	Y
TPS54610/1/2/3/4/5/6	3.0 to 6.0	6	Adj., 0.9, 1.2, 1.5, 1.8, 2.5, 3.3	28 HTSSOP	Y
TPS62000/1/2/3/4/5/6/7/8	2.0 to 5.5	0.6	Adj., 0.9, 1.0, 1.2, 1.5, 1.8, 1.9, 2.5, 3.3	10 MSOP	Y
TPS54680	3.0 to 6	6	4.5 to 0.9	28 HTSSOP	Y

Switching DC/DC Converters Selection Guide

Device	V_{IN} (V)	V_O (max) (V)	V_O (min) (V)	V_{REF} Tol (%)	Driver Current (A)	Q1 Available	Comments
TL2575	4.75 to 40	37	1.23	4	1	Preview	Simple step-down switching voltage regulator, adjustable
MC33063A	3 to 40	40	1.25	2	1.5	Y	1.5-A peak boost/buck/inverting switching regulator

DC/DC Controllers and Converters

Inductorless DC/DC Regulators (Charge Pumps) Selection Guide

Device	I_{OUT} (mA)	V_{IN} (V)	V_{OUT} Adj. (V)	Efficiency (%)	Switching Frequency (max) (kHz)	Quiscient Current (typ) (µA)	Q1 Available
TPS60400	60	1.6 to 5.5	– (1.6 to 5.5)	99	50 to 250	125	Y
TPS60401	60	1.6 to 5.5	– (1.6 to 5.5)	99	28	65	Y
TPS60402	60	1.6 to 5.5	– (1.6 to 5.5)	99	70	120	Y

White LED Drivers Selection Guide

Device	V_{IN} (V)	Type	Number of LEDs[1]	LED Configuration	Switch Current Limit (typ) (µA)	Output Capacitor	Dimming[2]	Peak Efficiency[3]	Quiscient Current (typ) (mA)	Shutdown Current (typ) (µA)	Q1 Available
TPS61040	1.8 to 6.0	Inductive	6	Series	400	1µF	Y	85	0.028	0.1	Y
TPS61041	1.8 to 6.0	Inductive	4	Series	205	1µF	Y	85	0.028	0.1	Y

[1]More LEDs can be driven in parallel string configuration.
[2]May be via ENABLE pin, CONTROL pin, or analog feedback network.
[3]Depends on LED current, input voltage, number of LEDs, ILED pin.

Supervisors

Things to Consider

Primary

System Voltages — The version of supervisor you require is dependent on the voltage rail(s) within the system. For example, supervisors designed to support a processor need to be selected according to the voltage driving the processor.

Number of Channels — Typically the number of supervisor functions required in a system is dependent on the processor and peripheral(s) voltages. For example, split-voltage processors may require supervision of both rails, while the memory in the system may also require supervision and be operating on a third (different) voltage rail.

Manual Reset (MR) — This feature allows the user to manually reset the circuit or control the supervisory circuit by another device of the application.

Secondary

Watchdog Input (WDI) — In situations where the system processor may not be functioning properly, its on-board watchdog feature may fail to reset. Supervisors with integrated watchdog functionality increase system reliability by being able to trigger a reset.

Technical Information

Active High Output — Allows the use of processors with active high reset input without additional components.

Delay Time — Allows the voltage and other components in the circuit to stabilize first before the normal operation starts again.

Supervisors Selection Guide

Device	Number of Supervisors	Supervised Voltages	Packages	I_{DD} (typ) (µA)	Time Delay (ms)	Manual Reset Input/MR	Active-High Reset Output	Watchdog Timer WDI	Q1 Available
TLC77xx	1	Adj./2.5/3.3/3.0/5.0	SO-8, DIP-8, TSSOP-8	9	Prog	—	✔	—	Y
TPS3306	2	1.5/1.8/2.0/2.5/3.3	SO-8	15	100	—	—	✔	Y
TPS3307	3	1.8/2.5/3.3	SO-8	40	200	✔	✔	—	Y
TPS3803	1	Adj./1.5	SC-70	6	0.0055	✔	—	—	Y
TPS3805	1	Adj./3.3	SC-70	6	0.0055	✔	—	—	Y
TPS3809	1	2.5/3.0/3.3/5.0	SOT-23	9	200	—	—	—	Y
TPS3813	1	2.25/2.64/2.93/4.55	SOT-23	20	25	—	✔	✔	Preview
TPS3820/8-xx	1	3.3/5.0	SOT-23	15	25/200	✔	—	✔	Y
TPS3823	1	2.5/3.0/3.3/5.0	SOT-23	15	200	✔	—	✔	Y
TPS3824-xx	1	2.5/3.0/3.3/5.0	SOT-23	15	200	—	✔	✔	Y
TPS3825-xx	1	3.3/5.0	SOT-23	15	200	✔	✔	—	Y
TPS3836/8	1	1.8/2.5/3.0/3.3	SOT-23	0.25	10/200	✔	✔	—	Y
TPS3837	1	1.8/2.5/3.0/3.3	SOT-23	0.25	10/200	✔	—	—	Y
UCC2946	1	Adj.	TSSOP-8	12	Prog	✔	—	✔	Y

All devices feature an Active-Low Reset Output, except TPS3837.

Things to Consider

Due to the high level of integration, Power+™ ICs maintain a significant cost advantage including reduced component count and board space requirements, along with minimized procurement and inventory expenses—over discretes on a per transistor basis.

Power+ devices offer superior alternatives to discrete power MOSFETs and hybrids in many power switching applications including LEDs, lamps, solenoids, valves, relays, and fractional horsepower motors.

Technical Information

- Integrated DMOS drivers offer cost-effective alternatives
- Drive multiple loads to reduce printed circuit board space
- Reduced component count to improve system reliability
- Input transient protection for ESD sensitive applications
- Current-limit capability for applications with high inrush or stall current
- Built-in output clamp diodes for enhanced inductive switching
- Onboard diagnostics for improved fault isolation and shorter down-time
- Fault protection with hysteresis for increased system reliability
- Power performance in standard surface-mount packaging

Power + Logic™ : 8-Bit Devices Selection Guide

Device	Description	V_{DS} max (V)	I_{CC} typ (µs)	I_O (A)	I_{PEAK} (A)	$r_{DS(on)}$ typ (W)	E_{AS} (max) (mJ)	t_{PLH} typ (ns)	ESD (max) (kV)	Pin # / Pkg
TPIC6259	Addressable Latch	45	15	0.25	0.75	1.3	75	625	3	20/DW, N
TPIC6273	D-Type Latch	45	15	0.25	0.75	1.3	75	625	3	20/DW, N
TPIC6595	Shift Register	45	15	0.25	0.75	1.3	75	650	3	20/DW, N
TPIC6596	Shift Register	45	15	0.25	0.75	1.3	75	650	3	20/DW, N
TPIC6A259[1]	Addressable Latch	50	500	0.35	1.1	1	75	125	2.5	20/NE, 24/DW
TPIC6A595[1]	Shift Register	50	500	0.35	1.1	1	75	125	2.5	20/NE, 24/DW
TPIC6A256[1]	Shift Register	50	500	0.35	1.1	1	75	125	2..5	20/NE, 24/DW
TPIC6B259[2]	Addressable Latch	50	20	0.15	0.5	5	30	150	2.5	20/DW, N
TPIC6B273[2]	D-TypeLatch	50	20	0.15	0.5	5	30	150	2.5	20/DW, N
TPIC6B595[2]	Shift Register	50	20	0.15	0.5	5	30	150	2.5	20/DW, N
TPIC6B596[2]	Shift Register	50	20	0.15	0.5	5	30	150	2.5	20/DW, N
TPIC6C595[2]	Sift Register	33	20	0.1	0.25	7	30	80	2.5	16/D, N, PW
TPIC6C596[2]	Shift Register	33	20	0.1	0.25	7	30	80	2.5	16/D, N, PW
TPIC2810[2]	Shift Register	40	620	0.1	0.21	5	—	1150	3	16/D

[1]Fault protection and diagnosis. [2]Fault protection.

Power + Arrays™ Selection Guide

Device	Description	V_{DS} max (V)	V_{GS} typ (V)	I_{CONT} (A)	I_{PEAK} (A)	$r_{DS(on)}$ typ (W)	E_{AS} (max) (mJ)	t_{rr} typ (ns)	Q_a typ (nc)	Pin # / Pkg
TPIC2701	7-Channel Common-Source Driver	60	15	0.5	3	0.5	22	165	2.8	16/N

Power and Control

Power+[TM] Selection Guide

Device	Description	V_{BAT} range (V)	V_{OS} max (V)	I_D/I_{PEAK} (A)	$rDS_{(on)}$ typ (W)	Freq (kHz)	Pin # / Pkg
TPIC0107B[1]	PWM Control Intelligent H-Bridge	6 to 18	40	3/5	0.28	2	20/DWP
TPIC0108B[1]	PWM Control Intelligent H-Bridge	6 to 18	40	3/5	0.28	2	20/DWP
TPIC2603[1]	6-Channel Serial Interface Low-Side Controller	5.5 to 25	68	0.35/2.25	0.7	4000	20/NE, 24/DW

Device	Description	V_{BAT} range (V)	I_{BAT} typ (mA)	I_{GD} max (mA)	f_{OSC} typ (kHz)	t_r/t_f max (µs)	Pin # / Pkg
TPIC2101[2]	DC Brush Motor Controller	8 to 16	4	50	20	1/0.8	14/D, N

Device	Description	V_{CC} range (V)	$V_{IT}\pm$ (HL) range (mA)	$I_{(LGX/UGX)}$ typ (mA)	f_{PWM} typ (kHz)	f_{OSC}/f_{OSC1} max (MHz)	Pin # / Pkg
TPIC43T01[2]	Three-Phase DC Brushless Motor RPM Controller	18 to 28	±4 to ±12	±10	22.7	10/10	38/DA
TPIC43T02[2]	Three-Phase DC Brushless Motor RPM Controller	18 to 28	±4 to ±12	±10	22.7	10/10	38/DA

Device	Description	V_{BAT} range (V)	V_{GATE} range (V)	I_{BAT} typ (mA)	f_{SCLK} max (mHz)	Pin # / Pkg
TPIC44H01[1]	4-Channel Serial/Parallel High-Side FET Pre-Driver	8 to 24	VBAT+4 to VBAT+18	4	5	38/DA
TPIC44L01[1]	4-Channel Serial/Parallel Low-Side FET Pre-Driver	8 to 24	7 to 13.5	0.5	10	24/DB
TPIC44L02[1]	4-Channel Serial/Parallel Low-Side FET Pre-Driver	8 to 24	7 to 13.5	0.5	10	24/DB
TPIC44L03[1]	4-Channel Serial/Parallel Low-Side FET Pre-Driver	8 to 24	7 to 13.5	0.5	10	24/DB
TPIC46L01[1]	6-Channel Serial/Parallel Low-Side FET Pre-Driver	8 to 24	7 to 13.5	0.5	10	24/DB
TPIC46L02[1]	4-Channel Serial/Parallel Low-Side FET Pre-Driver	8 to 24	7 to 13.5	0.5	10	24/DB
TPIC46L03[1]	4-Channel Serial/Parallel Low-Side FET Pre-Driver	8 to 24	7 to 13.5	0.5	10	24/DB

[1]Fault protection and diagnosis. [2]Fault protection.

CAN/LIN

Things to Consider — CAN

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 Interface (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 which is commonly used in automotive and industrial applications.
- ISO-11898-2 covers High Speed CAN Physical Layer and ISO-11898-5 will cover High Speed Physical Layer with Bus Wake.
- This specification describes a twisted-wire pair bus with 120-Ω line impedance and differential signaling at a 40-meter bus with multipoint topology.

Things to Consider — LIN

Primary

Fault Protection and System Integrity—Features such as bus terminal short-circuit protected for short to battery or short to ground, bus fault protection from –40 V to +40 V, thermally protected, ground disconnection fail safe at module level, ground shift operation at system level, and unpowered node does not disturb the network. ESD and current limiting circuitry protect the transceiver and system during fault conditions. In addition dominant state time out (protects LIN bus from software or hardware issues in system connected to transceiver.)

Electromagnetic Compliance (EMC)—Controlled slew rate features can reduce electromagnetic emissions and reflections in systems generated by fast rise and fall times on the bus. Filtered and protected receivers and drivers provide immunity for levels of interference allowing operation in harsh electromagnetic conditions.

Secondary

System Cost—Supply voltage and I/O voltage of the transceivers is important for cost. TI offers a battery supplied transceiver with I/Os that are 3.3 V and 5 V compatible offering system flexibility and reducing cost. External ESD protection may also be a significant system cost that may not be necessary with the TI solution.

Lower System Power—Low Power (Sleep) mode conserves system power and can wake up the rest of the system from LIN bus wake request, external switch on NWakr pin, or via request on EN pin. Low Resistencce INH pin can control system Vreg and devices so they can be shut off to conserve power. Wake-up request from LIN or NWake pin signaled to MCU via RXD pin.

LIN System Integration—Conformance Test Certified to LIN 2.0 for guaranteed interoperability of LIN 2.0 transceivers. Conforms to SAE J2602 recommended practice for LIN.

Technical Information

- LIN specification describes the physical-layer implementation for LIN which is commonly used in automotive. LIN 2.0 physical layer definition is backward compatible to previous LIN specifications. SAEJ2602 gives rcommended practice for LIN systems. This specification describes a bi-directional single wire bus that is referenced to battery voltages. Data rates up to 20 kps are supported on a 40 meter bus with up to 16 nodes.

CAN/LIN Selection Guide

Device	CAN/LIN Physical Layer Standard	Maximum Junction Temp Tj (°C)	Maximum Signaling Rate	Supply Voltage	HBM Bus Pin ESD	Maximum Loop Delay	Bus Pin Standoff Voltage	Bus Wake-Up	Maximum I_{CC} in Low Power Mode	Adjustable Driver Slew Rate Control	Package
SN65HVD230Q	ISO-11898-2	150	1Mbps	3.3V	±15kV	135ns	±16V	N	370µA	Y	8-pin SOIC (D)
SN65HVD231Q	ISO-11898-2	150	1Mbps	3.3V	±15kV	135ns	±16V	N	10µA	Y	8-pin SOIC (D)
SN65HVD232Q	ISO-11898-2	150	1Mbps	3.3V	±15kV	135ns	±16V	N	N/A	N	8-pin SOIC (D)
SN65HVD234Q	ISO-11898-2	150	1Mbps	3.3V	±16kV	135ns	±36V	N	2µA	Y	8-pin SOIC (D)
SN65HVD251Q	ISO-11898-2	150	1Mbps	5V	±14kV	150ns	±36V	N	275µA	Y	8-pin SOIC (D)
SN65HVD1050Q	ISO-11898-2	150	1Mbps	5V	±8kV	190ns	–27V to +40V	N	10mA	N	8-pin SOIC (D)
SN65HVD1040Q	ISO-11898-5	150	1Mbps	5V	±8kV	190ns	–27V to +40V	Y	15µA	N	8-pin SOIC (D)
TPIC1021	LIN 2.0	150	20kbps	Vbat	±12kV	N/A	–40V to +40V	Y	50µA	N	8-pin SOIC (D)

LVDS, MLVDS, RS-485/422

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.

Things to Consider

Primary

Signaling Rate—Transmitters and receivers are capable of switching data at signaling rates of up to 655 Mbps due to low-voltage swings, typically 350 mV. Repeaters/translators and crosspoint switches can go up to 2 Gbps.

Power Consumption—LVDS (low-voltage differential signaling) offers a low-power solution 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-W load.

Secondary

Jitter—Reducing jitter, the deviation of a signal timing event from its ideal position, has become a high priority for ensuring high 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.

Technical Information

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

LVDS Selection Guide

Device	Description	No. of Tx	No of Rx	Input Signal	Output Signal	Signal Rate (Mbps)	Tx tpd Typ (ns)	Rx tpd Typ (ns)	I_{CC} Max (mA)	ESD HBM (kV)	Supply Voltage (V)	Q1 Avail
SN65LVDS1	Single LVDS Transmitter	1	—	LVTTL	LVDS	630	1.7	—	8	15	3.3	N
SN65LVDS2	Single LVDS Receiver	—	1	LVDS	LVTTL	400	—	2.6	7	15	3.3	N
SN65LVDS179	Single Full-Duplex LVDS Transceiver	1	1	LVTTL, LVDS	LVTTL, LVDS	400	1.7	3.7	12	12	3.3	Preview
SN65LVDS180	Single Full-Duplex LVDS Transceiver	1	1	LVTTL, LVDS	LVTTL, LVDS	400	1.7	3.7	12	12	3.3	Y
SN65LVDS051	Dual LVDS Transmitter/Receiver	2	2	LVDS, LVTTL	LVDS, LVTTL	400	1.7	3.7	20	12	3.3	Y

MLVDS Selection Guide

Device	Description	No. of Tx	No of Rx	Input Signal	Output Signal	Signal Rate (Mbps)	Tx tpd Typ (ns)	Rx tpd Typ (ns)	I_{CC} Max (mA)	ESD HBM (kV)	Supply Voltage (V)	Q1 Avail
SN65LVDM050	Dual LVDM Transmitter/Receiver	2	2	LVTTL, LVDM	LVTTL, LVDM	500	1.7	3.7	27	12	3.3	Y
SN65LVDM051	Dual LVDM Transmitter/Receiver	2	2	LVTTL, LVDM	LVTTL, LVDM	500	1.7	3.7	27	12	3.3	Y

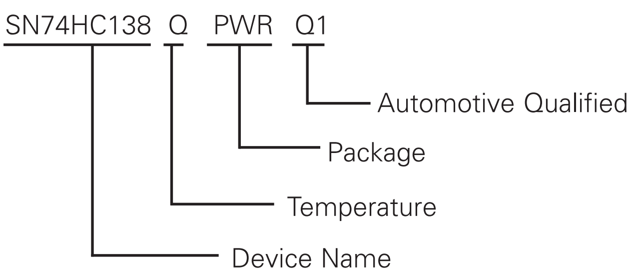
RS-485/422 Selection Guide

Temperature Prefix	Device	No. of Tx	No of Rx	Supply Voltage (V)	Signaling Rate (Mbps)	I_{CC} Max (mA)	ESD (kV)	Footprint	Q1 Avail
SN75	176A	1	1	5	10	50	2	SN75176	N
SN65, SN75	176B	1	1	5	10	70	2	SN75176	N
SN75	178B	1	1	5	10	70	2	SN75176	N
SN75	179B	1	1	5	10	70	2	SN75179	N
SN55, SN65, SN75	LBC176	1	1	5	10	1.5	2	SN75176	Y
SN65, SN75	LBC176A	1	1	5	30	15	12	SN65176	N
SN65, SN75	LBC179	1	1	5	10	5	2	SN75179	N
SN65, SN75	LBC179A	1	1	5	30	15	16	SN75179	N
SN65, SN75	LBC180	1	1	5	10	5	2	SN75LBC180	N
SN65, SN75	LBC180A	1	1	5	30	15	12	SN75180	N

Things to Consider

TI offers a full spectrum of automotive logic functions and technologies (mature to advanced), including bipolar, BiCMOS and CMOS automotive families.

Nomenclature



Automotive Logic Parts Selection Guide

Device	Description
1P1G125QDCKRQ1	Single Bus Buffer Gate with 3-State Output
1P1G126QDBVRQ1	Single Bus Buffer Gate With 3-State Outputs
1P1G3157QDBVRQ1	Single-Pole, Double-Throw Analog Switch
1P1G3157QDCKRQ1	Single-Pole, Double-Throw Analog Switch
1P1G66QDBVRQ1	Single Analog Switch
CAHCT1G04QDCKRQ1	Single Inverter Gate
CAHCT1G125QDCKRQ1	Single Bus Buffer Gate With 3-State Output
CAHCT1G126QDCKRQ1	Single Bus Buffer Gate With 3-State Output
CAHCT1G32QDBVRQ1	Single 2-Input Positive-OR Gate
CAHCT1G32QDCKRQ1	Single 2-Input Positive-OR Gate
CCBT16245IDGGRQ1	16-Bit FET Bus Switch
CCBTLV3861IPWRQ1	Low-Voltage 10-Bit FET Bus Switch
CD4051BQPWRQ1	CMOS Single 8-Channel Analog Multiplexer/Demultiplexer with Logic-Level Conversion
CD4053BQM96Q1	CMOS Triple 2-Channel Analog Multi/Demultiplexer with Logic-Level Conversion
CD4093BQM96Q1	CMOS Quad 2-Input NAND Schmitt Triggers
CD74ACT05QM96Q1	Hex Inverters with Open-Drain Outputs
CD74ACT32QM96Q1	Quad 2-Input OR Gates
CD74ACT74QM96Q1	Dual Positive-Edge-Triggered D-Type Flip-Flops with Set and Reset
CD74HC08QM96Q1	Quadruple 2-Input Positive-AND Gates
CD74HC125QM96Q1	High Speed CMOS Logic Quad Buffers with 3-State Outputs
CD74HC125QPWRQ1	High Speed CMOS Logic Quad Buffers with 3-State Outputs
CD74HC138QM96Q1	High Speed CMOS Logic 3-to-8 Line Decoder Demultiplexer Inverting and Non-Inverting
CD74HC40103QM96Q1	High Speed CMOS Logic 8-Stage Synchronous Down Counters
CD74HC4017QM96Q1	Decade Counter/Divider with 10 Decoded Outputs
CD74HC4017QPWRQ1	Decade Counter/Divider with 10 Decoded Outputs
CD74HC4051QM96Q1	High Speed CMOS Logic Analog Multiplexers/Demultiplexers
CD74HC4051QPWRQ1	High Speed CMOS Logic Analog Multiplexers/Demultiplexers
CD74HC4538QM96Q1	High Speed CMOS Logic Dual Retriggerable Precision Monostable Multivibrators
CD74HC4538QPWRQ1	High Speed CMOS Logic Dual Retriggerable Precision Monostable Multivibrators

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Device	Description
CD74HCT4051QM96Q1	High Speed CMOS 8-Channel Analog Multiplexer/Demultiplexer with TTL Inputs
CD74HCT4066QM96Q1	High Speed CMOS Logic Quad Bilateral Switches
CD74HCT4066QPWRQ1	High Speed CMOS Logic Quad Bilateral Switches
CD74HCT4067IM96Q1	High Speed CMOS 16-Channel Analog Multiplexer/Demultiplexer with TTL Inputs
CD74HCT574QM96Q1	High Speed CMOS Logic Octal Positive-Edge-Triggered D-Type Flip-Flops with 3-State Outputs
CD74HCT574QPWRQ1	High Speed CMOS Logic Octal Positive-Edge-Triggered D-Type Flip-Flops with 3-State Outputs
CLVC16244AIDGGRQ1	16-Bit Buffer/Driver with 3-State Outputs
CLVC1G374QDBVRQ1	Single D-Type Flip-Flop with 3-State Output
CLVC1G374QDCKRQ1	Single D-Type Flip-Flop with 3-State Output
CLVC2G125IDCTRQ1	Dual Bus Buffer Gate with 3-State Outputs
CLVTH16245AQDGGRQ1	3.3-V ABT 16-Bit Bus Transceivers with 3-State Outputs
SN74ABT125QDRQ1	Quadruple Bus Buffer Gates with 3-State Outputs
SN74ABT541BIPWRQ1	Octal Buffers/Drivers with 3-State Outputs
SN74AC04QPWRQ1	Hex Inverters
SN74AC08QDRQ1	Quadruple 2-Input Positive-AND Gates
SN74AC08QPWRQ1	Quadruple 2-Input Positive-AND Gates
SN74AC11IDRQ1	Triple 3-Input Positive-AND Gates
SN74AC11IPWRQ1	Triple 3-Input Positive-AND Gates
SN74AC240QPWRQ1	Octal Buffers/Drivers with 3-State Outputs
SN74ACT00TDRQ1	Quadruple 2-Input Positive-NAND Gates
SN74ACT10QPWRQ1	Triple 3-Input Positive-NAND Gates
SN74ACT244IPWRQ1	Octal Buffers/Drivers with 3-State Outputs
SN74AHC00QDRQ1	Quadruple 2-Input Positive-NAND Gates
SN74AHC00QPWRQ1	Quadruple 2-Input Positive-NAND Gates
SN74AHC02QPWRQ1	Quadruple 2-Input Positive-NOR Gates
SN74AHC04QDRQ1	Hex Inverters
SN74AHC04QPWRQ1	Hex Inverters
SN74AHC08QDRQ1	Quadruple 2-Input Positive-AND Gate
SN74AHC08QPWRQ1	Quadruple 2-Input Positive-AND Gate
SN74AHC125QDRQ1	Quadruple Bus Buffer Gates with 3-State Outputs
SN74AHC125QPWRQ1	Quadruple Bus Buffer Gates with 3-State Outputs
SN74AHC14QDRQ1	Hex Schmitt-Trigger Inverters
SN74AHC14QPWRQ1	Hex Schmitt-Trigger Inverters
SN74AHC1G00QDCKRQ1	Single 2-Input Positive-NAND Gate
SN74AHC1G04QDBVRQ1	Single Inverter Gate
SN74AHC1G04QDCKRQ1	Single Inverter Gate
SN74AHC1G08QDBVRQ1	Single 2-Input Positive-AND Gate
SN74AHC1G08QDCKRQ1	Single 2-Input Positive-AND Gate
SN74AHC1G32TDBVRQ1	Single 2-Input Positive-OR Gate
SN74AHC1G32TDCKRQ1	Single 2-Input Positive-OR Gate
SN74AHC244QDWRQ1	Octal Buffers/Drivers with 3-State Outputs
SN74AHC244QPWRQ1	Octal Buffers/Drivers with 3-State Outputs
SN74AHC245QDWRQ1	Octal Bus Transceivers with 3-State Outputs
SN74AHC245QPWRQ1	Octal Bus Transceivers with 3-State Outputs
SN74AHC32QDRQ1	Quadruple 2-Input Positive-OR Gates
SN74AHC32QPWRQ1	Quadruple 2-Input Positive-OR Gates

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Device	Description
SN74AHC541QPWRQ1	Octal Buffers/Drivers with 3-State Outputs
SN74AHC573QPWRQ1	Octal Transparent D-Type Latches with 3-State Outputs
SN74AHC74QDRQ1	Dual Positive-Edge-Triggered D-Type Flip-Flops with Clear and Preset
SN74AHC74QPWRQ1	Dual Positive-Edge-Triggered D-Type Flip-Flops with Clear and Preset
SN74AHCT00QDRQ1	Quadruple 2-Input Positive Gates
SN74AHCT00QPWRQ1	Quadruple 2-Input Positive Gates
SN74AHCT08QDRQ1	Quadruple 2-Input Positive-AND Gates
SN74AHCT08QPWRQ1	Quadruple 2-Input Positive-AND Gates
SN74AHCT125QDRQ1	Quadruple Bus Buffer Gates with 3-State Outputs
SN74AHCT125QPWRQ1	Quadruple Bus Buffer Gates with 3-State Outputs
SN74AHCT126QDRQ1	Quadruple Bus Buffer Gates with 3-State Outputs
SN74AHCT126QPWRQ1	Quadruple Bus Buffer Gates with 3-State Outputs
SN74AHCT138QDRQ1	3-Line to 8-Line Decoders/Demultiplexers
SN74AHCT138QPWRQ1	3-Line to 8-Line Decoders/Demultiplexers
SN74AHCT14QDRQ1	Hex Schmitt-Trigger Inverters
SN74AHCT14QPWRQ1	Hex Schmitt-Trigger Inverters
SN74AHCT240IPWRQ1	Octal Buffers/Drivers with 3-State Outputs
SN74AHCT244QDWRQ1	Octal Buffers/Drivers with 3-State Outputs
SN74AHCT244QPWRQ1	Octal Buffers/Drivers with 3-State Outputs
SN74AHCT32QDRQ1	Quadruple 2-Input Positive-OR Gates
SN74AHCT32QPWRQ1	Quadruple 2-Input Positive-OR Gates
SN74AHCT573QDWRQ1	Octal Transparent D-Type Latches with 3-State Outputs
SN74AHCT74QDRQ1	Dual Positive-Edge-Triggered D-Type Flip-Flop with Clear and Preset
SN74AHCT74QPWRQ1	Dual Positive-Edge-Triggered D-Type Flip-Flop with Clear and Preset
SN74AHCU04QPWRQ1	Hex Inverters
SN74ALVC00IDRQ1	Quadruple 2-Input Positive-NAND Gate
SN74ALVC00IPWRQ1	Quadruple 2-Input Positive-NAND Gate
SN74ALVC08IDRQ1	Quadruple 2-Input Positive-AND Gate
SN74ALVC08IPWRQ1	Quadruple 2-Input Positive-AND Gate
SN74HC00QDRQ1	Quad 2-Input Positive-NAND Gates
SN74HC00QPWRQ1	Quad 2-Input Positive-NAND Gates
SN74HC02QDRQ1	Quadruple 2-Input Positive-NOR Gates
SN74HC02QPWRQ1	Quadruple 2-Input Positive-NOR Gates
SN74HC04IPWRQ1	Hex Inverters
SN74HC08QDRQ1	Quadruple 2-Input Positive-AND Gates
SN74HC08QPWRQ1	Quadruple 2-Input Positive-AND Gates
SN74HC10QDRQ1	Triple 3-Input Positive-NAND Gates
SN74HC10QPWRQ1	Triple 3-Input Positive-NAND Gates
SN74HC125IPWRQ1	Quadruple Bus Buffer Gates with 3-State Outputs
SN74HC132QDRQ1	Quadruple Positive-NAND Gates with Schmitt-Trigger Inputs
SN74HC132QPWRQ1	Quadruple Positive-NAND Gates with Schmitt-Trigger Inputs
SN74HC138QDRQ1	3-Line to 8-Line Decoders/Demultiplexers
SN74HC138QPWRQ1	3-Line to 8-Line Decoders/Demultiplexers
SN74HC139QDRQ1	Dual 2-Line to 4-Line Decoders/Demultiplexers
SN74HC139QPWRQ1	Dual 2-Line to 4-Line Decoders/Demultiplexers
SN74HC14QDRQ1	Hex Schmitt-Trigger Inverters
SN74HC14QPWRQ1	Hex Schmitt-Trigger Inverters
SN74HC163IPWRQ1	4-Bit Synchronous Binary Counters
SN74HC165QDRQ1	8-Bit Parallel-Load Shift Registers
SN74HC165QPWRQ1	8-Bit Parallel-Load Shift Registers

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Device	Description
SN74HC166AIDRQ1	8-Bit Parallel-Load Shift Registers
SN74HC166AIPWRQ1	8-Bit Parallel-Load Shift Registers
SN74HC193QPWRQ1	4-Bit Synchronous Up/Down Counters (Dual Clock With Clear)
SN74HC21QDRQ1	Dual 4-Input Positive-AND Gates
SN74HC21QPWRQ1	Dual 4-Input Positive-AND Gates
SN74HC244QDWRQ1	Octal Buffers and Line Drivers with 3-State Outputs
SN74HC244QPWRQ1	Octal Buffers and Line Drivers with 3-State Outputs
SN74HC253QDRQ1	Dual 4-Line to 1-Line Data Selectors/Multiplexers with 3-State Outputs
SN74HC273QDWRQ1	Octal D-Type Flip-Flops with Clear
SN74HC273QPWRQ1	Octal D-Type Flip-Flops with Clear
SN74HC4851QDRQ1	8-Channel Analog Multiplexer/Demultiplexer with Injection-Current Effect Control
SN74HC4851QPWRQ1	8-Channel Analog Multiplexer/Demultiplexer with Injection-Current Effect Control
SN74HC573AQDWRQ1	Octal Transparent D-Type Latches with 3-State Outputs
SN74HC573AQPWRQ1	Octal Transparent D-Type Latches with 3-State Outputs
SN74HC74QDRQ1	Dual D-Type Positive-Edge-Triggered Flip-Flops with Clear and Preset
SN74HC74QPWRQ1	Dual D-Type Positive-Edge-Triggered Flip-Flops with Clear and Preset
SN74HC86QPWRQ1	Quadruple 2-Input Exclusive-OR Gates
SN74HCT04IDRQ1	Hex Inverter
SN74HCT14QPWRQ1	Hex Schmitt-Trigger Inverters
SN74HCT244QPWRQ1	Octal Buffers and Line Drivers with 3-State Outputs
SN74LV04ATPWRQ1	Hex Inverters
SN74LV08ATPWRQ1	Quadruple 2-Input Positive-AND Gates
SN74LV11ATPWRQ1	Triple 3-Input Positive-AND Gates
SN74LV123ATPWRQ1	Dual Retriggerable Monostable Multivibrators
SN74LV14ATPWRQ1	Hex Schmitt-Trigger Inverters
SN74LV221AQPWRQ1	Dual Monostable Multivibrators
SN74LV32ATPWRQ1	Quadruple 2-Input Positive-OR Gates
SN74LV373AIPWRQ1	Octal Transparent D-Type Latches with 3-State Outputs
SN74LV374ATPWRQ1	Octal Edge-Triggered D-Type Flip-Flops with 3-State Outputs
SN74LV393ATPWRQ1	Dual 4-Bit Binary Counters
SN74LV4051ATDRQ1	8-Channel Analog Multiplexer/Demultiplexer
SN74LV4051ATDWRQ1	8-Channel Analog Multiplexer/Demultiplexer
SN74LV4051ATPWRQ1	8-Channel Analog Multiplexer/Demultiplexer
SN74LV4052ATDRQ1	Dual 4-Channel Analog Multiplexer/Demultiplexer
SN74LV4052ATPWRQ1	Dual 4-Channel Analog Multiplexer/Demultiplexer
SN74LV4053ATDRQ1	Triple 2-Channel Analog Multiplexer/Demultiplexer
SN74LV4053ATPWRQ1	Triple 2-Channel Analog Multiplexer/Demultiplexer
SN74LV595AIPWRQ1	8-Bit Shift Registers with 3-State Output Registers
SN74LV74AQDRQ1	Dual Positive-Edge-Triggered D-Type Flip-Flop
SN74LV74AQPWRQ1	Dual Positive-Edge-Triggered D-Type Flip-Flop
SN74LV8153QPWRQ1	Serial-To-Parallel Interface
SN74LV86ATPWRQ1	Quadruple 2-Input Exclusive-OR Gates
SN74LVC00AQDRQ1	Quadruple 2-Input Positive-NAND Gate
SN74LVC00AQPWRQ1	Quadruple 2-Input Positive-NAND Gate
SN74LVC02AQDRQ1	Quadruple 2-Input Positive-NOR Gate
SN74LVC02AQPWRQ1	Quadruple 2-Input Positive-NOR Gate
SN74LVC04AQDRQ1	Hex Inverter
SN74LVC04AQPWRQ1	Hex Inverter
SN74LVC06AQDRQ1	Hex Inverter Buffers/Drivers with Open-Drain Outputs

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Device	Description
SN74LVC06AQPWRQ1	Hex Inverter Buffers/Drivers with Open-Drain Outputs
SN74LVC07AQPWRQ1	Hex Buffers/Drivers with Open-Drain Outputs
SN74LVC08AQDRQ1	Quadruple 2-Input Positive-AND Gate
SN74LVC08AQPWRQ1	Quadruple 2-Input Positive-AND Gate
SN74LVC125AQDRQ1	Quadruple Bus Buffer Gate with 3-State Outputs
SN74LVC125AQPWRQ1	Quadruple Bus Buffer Gate with 3-State Outputs
SN74LVC126AQDRQ1	Quadruple Bus Buffer Gate with 3-State Outputs
SN74LVC126AQPWRQ1	Quadruple Bus Buffer Gate with 3-State Outputs
SN74LVC138AQDRQ1	3-Line to 8-Line Decoder/Demultiplexer
SN74LVC138AQPWRQ1	3-Line to 8-Line Decoder/Demultiplexer
SN74LVC139AQPWRQ1	Dual 2-Line To 4-Line Decoder/Demultiplexer
SN74LVC14AQDRQ1	Hex Schmitt-Trigger Inverter
SN74LVC14AQPWRQ1	Hex Schmitt-Trigger Inverter
SN74LVC157AQDRQ1	Quadruple 2-Line to 1-Line Data Selector / Multiplexer
SN74LVC157AQPWRQ1	Quadruple 2-Line to 1-Line Data Selector / Multiplexer
SN74LVC1G04QDCKRQ1	Single Inverter
SN74LVC1G07IDCKRMO	Single Inverter
SN74LVC1G08QDBVRQ1	Single 2-Input Positive-AND Gate
SN74LVC1G08QDCKRQ1	Single 2-Input Positive-AND Gate
SN74LVC1G17QDBVRQ1	Single Schmitt-Trigger Buffer
SN74LVC1G17QDCKRQ1	Single Schmitt-Trigger Buffer
SN74LVC1G32QDBVRQ1	Single 2-Input Positive-OR Gate
SN74LVC1G32QDCKRQ1	Single 2-Input Positive-OR Gate
SN74LVC1G97QDBVRQ1	Configurable Multiple-Function Gate
SN74LVC1G97QDCKRQ1	Configurable Multiple-Function Gate
SN74LVC1G98QDBVRQ1	Configurable Multiple-Function Gate
SN74LVC1G98QDCKRQ1	Configurable Multiple-Function Gate
SN74LVC1T45DCKRQ1	Single-Bit Dual-Supply Bus Transceiver with Configurable Voltage Translation and 3-State Outputs
SN74LVC244AQDWRQ1	Octal Buffer/Driver with 3-State Outputs
SN74LVC244AQPWRQ1	Octal Buffer/Driver with 3-State Outputs
SN74LVC257AQDRQ1	Quadruple 2-Line to 1-Line Data Selector/Multiplexer with 3-State Outputs

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Device	Description
SN74LVC257AQPWRQ1	Quadruple 2-Line to 1-Line Data Selector/Multiplexer with 3-State Outputs
SN74LVC2G06QDCKRQ1	Dual Inverter Buffer/Driver with Open-Drain Output
SN74LVC2G07QDBVRQ1	Dual Buffer/Driver with Open-Drain Output
SN74LVC2G07QDCKRQ1	Dual Buffer/Driver with Open-Drain Output
SN74LVC2G14IDCKRQ1	Dual Schmitt-Trigger Inverter
SN74LVC2G17QDCKRQ1	Dual Schmitt-Trigger Buffer
SN74LVC2G74QDCURQ1	Single Positive-Edge-Triggered D-Type Flip-Flop with Clear and Preset
SN74LVC32AQDRQ1	Quadruple 2-Input Positive-OR Gate
SN74LVC32AQPWRQ1	Quadruple 2-Input Positive-OR Gate
SN74LVC373AQDWRQ1	Octal Transparent D-Type Latches with 3-State Outputs
SN74LVC373AQPWRQ1	Octal Transparent D-Type Latches with 3-State Outputs
SN74LVC374AQDWRQ1	Octal Edge-Triggered D-Type Flip-Flops with 3-State Outputs
SN74LVC374AQPWRQ1	Octal Edge-Triggered D-Type Flip-Flops with 3-State Outputs
SN74LVC3G07QDCURQ1	Triple Buffer/Driver with Open-Drain Output
SN74LVC540AQDWRQ1	Octal Buffer/Driver with 3-State Outputs
SN74LVC540AQPWRQ1	Octal Buffer/Driver with 3-State Outputs
SN74LVC541AQDWRQ1	Octal Buffer/Driver with 3-State Outputs
SN74LVC541AQPWRQ1	Octal Buffer/Driver with 3-State Outputs
SN74LVC573AQDWRQ1	Octal Transparent D-Type Latches with 3-State Outputs
SN74LVC573AQPWRQ1	Octal Transparent D-Type Latches with 3-State Outputs
SN74LVC574AQDWRQ1	Octal Edge-Triggered D-Type Flip-Flop with 3-State Outputs
SN74LVC574AQPWRQ1	Octal Edge-Triggered D-Type Flip-Flop with 3-State Outputs
SN74LVC74AQDRQ1	Dual Positive-Edge-Triggered D-Type Flip-Flops with Clear And Preset
SN74LVC74AQPWRQ1	Dual Positive-Edge-Triggered D-Type Flip-Flops with Clear And Preset
SN74LVC86AQDRQ1	Quadruple 2-Input Exclusive-OR Gate
SN74LVC86AQPWRQ1	Quadruple 2-Input Exclusive-OR Gate
SN74LVT125QDRQ1	3.3-V ABT Quadruple Bus Buffers with 3-State Outputs
SN74LVT125QPWRQ1	3.3-V ABT Quadruple Bus Buffers with 3-State Outputs

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