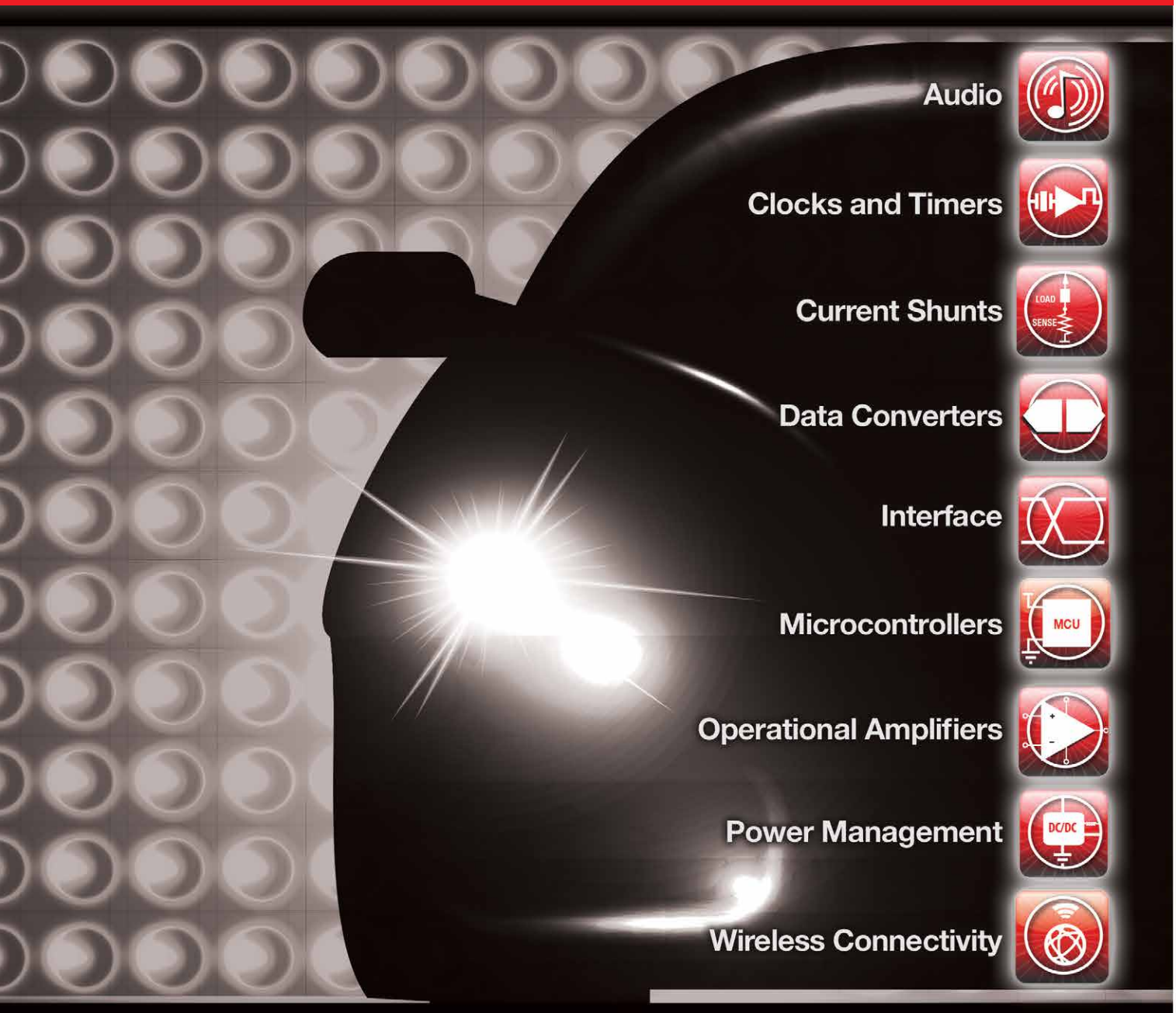
Automotive and Transportation Solutions Guide

Texas Instruments



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2014

Automotive and Transportation Guide
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Texas Instruments Commitment to Transportation

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

Support/History

TI supports the requirements defined by the industry, and continues to add to our transportation 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 Transportation Capabilities

- TS16949 certified
- Automotive temperature range
- AEC-Q100 automotive qualification
- Six month product change notification

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High-Voltage (36-V), Low-Power, Rail-Rail Operational Amplifier

OPA171-Q1

The OPA171-Q1 is an automotive-qualified single-channel 36-V, single-supply, low-noise operational amplifier (op amp) that can operate on supplies ranging from +2.7 V to +36 V. The OPA171-Q1 offers high-precision performance in a cost-effective, low-power device. In addition to industry-standard packaging, the device is available for automotive qualification in the SOT-553 micro package, which is 50 percent smaller than comparable devices available today, and can reduce board space for automotive applications including HEV/EV and body. Dual- and quad-channel options are also available for automotive qualification.

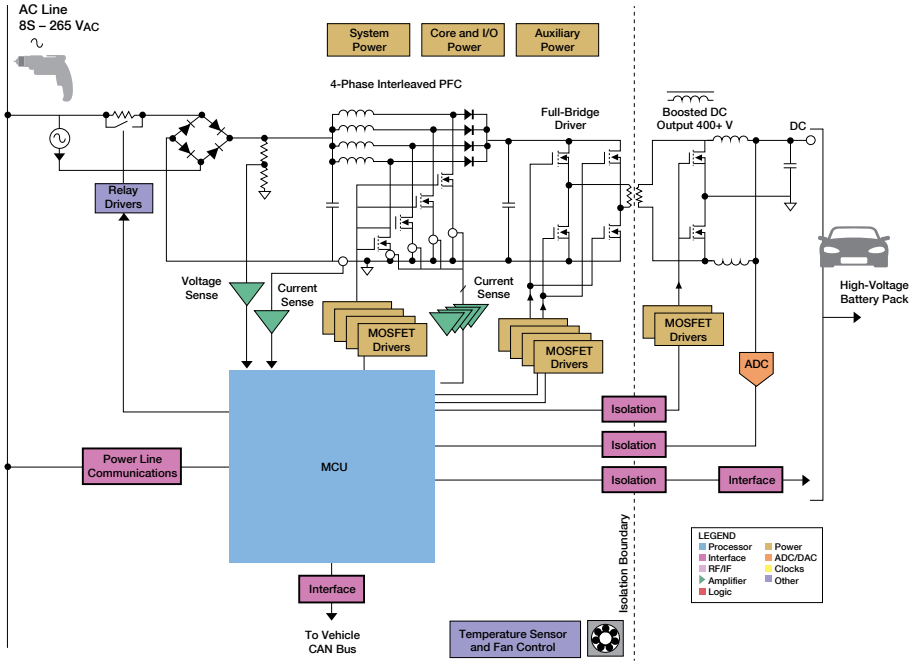
The OPA171-Q1 offers features designed to enhance overall system design stability, such as the ability to handle input signals beyond the supply rails without causing output phase reversal. The OPA171-Q1 remains stable when exposed to capacitive loads up to 300 pF or when the input operates 100 mV below the negative rail and within 2 V of the top rail during normal operation.

Key Features

- Dynamic input voltage range of +2.7 V to +36 V or ±1.35 V to ±18 V allows for greater design versatility across varying supply rails, while still enabling precise, low-voltage sensor outputs.
- The OPA171-Q1 provides precision performance, including low offset of up to 1.8 mV, typical drift of 0.3 µV/C and wide gain bandwidth of 3 MHz.
- Low quiescent current of 475 µA enables efficient battery-powered operation.

Applications

- Automotive HEV/EV
- Automotive body applications
- Tracking amplifier in power modules
- Transducer amplifiers



Functional block diagram.

Get more information: **www.ti.com/product/OPA171-Q1**

Operational Amplifiers and Comparators

Precision Operational Amplifiers Selection Table

Precision Operational Amplifiers

Device	Number of Channels	V_S (min) (V)	V_S (max) (V)	Iq per Channel (max) (mA)	GBW (typ) (MHz)	Slew Rate (typ) (V/µs)	VOS (Offset Voltage @ 25°C) (max) (mV)	Offset Drift (typ) (µV/C)	Input Bias (max) (pA)	V_n at 1 kHz (typ) (nV/√Hz)	Rail-to-Rail
LM7321-Q1	1	—	—	1.7	20	18	—	2	2500000	—	In/Out
LM7322-Q1	—	—	—	—	20	—	—	—	2500000	—	—
LMC6035-Q1	2	2	15.5	0.8	1.4	1.5	—	2.3	—	27	—
LMC7101Q-Q1	—	—	—	—	1.1	—	—	—	64	—	—
LMP7716-Q1	—	—	—	—	17	—	—	—	—	—	—
LMV324-N-Q1	4	2.7	5.5	0.2075	1	—	—	5	—	—	Out
LMV358-N-Q1	2	—	—	0.22	1	1	7	5	—	39	Out
LMV712-N-Q1	2	2.7	5.5	1.7	5	5	3.2	5	—	20	—
LMV772-Q1	—	—	—	—	3.5	—	—	—	—	—	—
LMV796-Q1	1	1.8	5	1.75	17	9.5	1.35	1	100	5.8	Out
LMV822-N-Q1	2	2.5	5.5	0.35	5.6	2	—	1	—	24	—
LMV822-Q1	2	—	—	0.4	5	—	—	—	100000	—	Out
LMV841-Q1	—	—	—	—	4.5	—	—	—	10	—	—
LMV842-Q1	—	—	—	—	4.5	—	—	—	10	—	—
LMV844-Q1	—	—	—	—	4.5	—	—	—	10	—	—
LMV931-N-Q1	1	1.8	5.5	0.23	1.5	0.42	—	5.5	—	50	—
LMV932-N-Q1	2	1.8	5.5	0.23	1.5	0.42	—	5.5	—	50	—
LMV932-Q1	2	1.8	5	0.185	1.4	0.35	5.5	5.5	—	60	In/Out
OPA1662-Q1	2	—	—	1.8	22	17	—	2	1200000	—	Out
OPA171-Q1	1	2.7	36	0.595	3	1.5	1.8	0.3	—	14	Out
OPA2322A-Q1	2	1.5	5.5	1.75	20	10	—	1.8	—	8.5	—
OPA2333-Q1	2	—	—	0.025	0.35	0.16	—	0.02	200	—	In/Out
OPA2348-Q1	2	—	—	0.065	1	0.5	—	4	10	—	In/Out
OPA2354-Q1	—	—	—	—	—	—	—	—	—	—	—
OPA333-Q1	—	—	—	0.025	0.35	0.16	0.01	0.02	200	55	In/Out
OPA376-Q1	1	—	—	0.95	5.5	2	—	0.26	10	—	In/Out
OPA4348-Q1	4	—	—	0.065	1	0.5	—	4	10	—	In/Out
OPA4364-Q1	4	—	—	0.75	7	5	—	3	10	—	In/Out
OPA564-Q1	1	—	—	50	17	20	—	10	—	—	—
TLC072-Q1	2	—	—	2.5	10	16	0.39	1.2	50	7	—
TLC082-Q1	2	4.5	16	2.5	10	16	1.9	1.2	50	8.5	—
TLC084-Q1	4	—	—	2.5	10	19	—	1.2	50	—	—
TLC2252-Q1	2	4.4	16	0.0625	0.2	0.12	1.5	0.5	—	19	Out
TLC2252A-Q1	2	4.4	16	0.0625	0.2	0.12	0.85	0.5	—	19	Out
TLC2254-Q1	4	4.4	16	0.0625	0.2	0.12	1.5	0.5	—	19	Out
TLC2254A-Q1	4	4.4	16	0.0625	0.2	0.12	0.85	0.5	—	19	Out
TLC2272-Q1	2	—	—	1.5	2.18	3.6	—	2	100	—	Out
TLC2272A-Q1	2	—	—	1.5	2.18	3.6	—	2	100	—	Out
TLC2274-Q1	4	4.4	16	1.5	2.18	3.6	2.5	2	800	9	Out
TLC2274A-Q1	4	—	—	1.5	2.18	3.6	—	2	800	—	Out
TLE2021-Q1	1	4	40	0.3	1.2	0.5	0.5	2	70000	17	—
TLE2021A-Q1	1	—	—	0.3	1.2	0.5	—	2	70000	—	—
TLE2022-Q1	2	—	—	0.3	1.7	0.5	—	2	70000	—	—
TLE2022A-Q1	2	—	—	0.3	1.7	0.5	—	2	70000	—	—
TLE2024-Q1	—	—	—	—	1.7	—	—	—	—	—	—
TLE2024A-Q1	4	4	40	0.3	1.7	0.5	0.75	2	70000	17	—
TLE2071-Q1	1	—	—	2.2	9.4	35	—	3.2	175	—	—

Operational Amplifiers and Comparators

Precision Operational Amplifiers Selection Table

Precision Operational Amplifiers

Device	Number of Channels	V_S (min) (V)	V_S (max) (V)	Iq per Channel (max) (mA)	GBW (typ) (MHz)	Slew Rate (typ) (V/µs)	VOS (Offset Voltage @ 25°C) (max) (mV)	Offset Drift (typ) (µV/C)	Input Bias (max) (pA)	V_n at 1 kHz (typ) ($nV/\sqrt{Hz}$)	Rail-to-Rail
TLE2071A-Q1	1	—	—	2.2	9.4	35	—	3.2	175	—	—
TLE2072-Q1	2	—	—	1.8	9.4	35	—	2.4	175	—	—
TLE2072A-Q1	2	—	—	1.8	9.4	35	—	2.4	175	—	—
TLE2141-Q1	1	4	44	4.6	5.8	42	1.4	1.7	—	10.5	Out
TLE2142-Q1	2	—	—	4.4	5.8	45	—	1.7	2000000	—	—
TLV2252-Q1	2	2.7	16	—	0.187	0.1	1.5	0.5	—	19	Out
TLV2252A-Q1	2	2.7	16	—	0.187	0.1	0.85	0.5	—	19	Out
TLV2254-Q1	4	2.7	16	—	0.187	0.1	1.5	0.5	—	19	Out
TLV2254A-Q1	4	2.7	16	—	0.187	0.1	0.85	0.5	—	19	Out
TLV2371-Q1	1	2.7	16	0.56	2.4	2	4.5	2	—	39	In/Out
TLV2372-Q1	2	2.7	16	0.9	2.4	2	4.5	2	—	39	In/Out
TLV2374-Q1	4	2.7	16	0.56	2.4	2	4.5	2	—	39	In/Out
TLV2402-Q1	2	2.5	16	0.00095	0.0055	0.0025	1.2	3	—	800	In/Out
TLV2422-Q1	2	2.7	10	0.075	0.052	0.02	2	2	—	18	Out
TLV2422A-Q1	2	2.7	10	0.075	0.052	0.02	0.95	2	—	18	Out
TLV2432-Q1	2	2.7	10	0.125	0.5	0.25	2	2	—	18	Out
TLV2432A-Q1	2	2.7	10	0.125	0.5	0.25	0.95	2	—	18	Out
TLV2434A-Q1	—	—	—	0.125	0.5	0.25	—	2	—	—	Out
TLV2442-Q1	2	2.7	10	—	1.75	1.3	2	2	—	18	Out
TLV2442A-Q1	2	2.7	10	1.1	1.75	1.3	0.65	2	—	18	Out
TLV2444A-Q1	4	2.7	10	1.1	1.75	1.3	0.95	2	—	18	Out
TLV2460-Q1	1	—	—	—	6.4	1.6	—	2	14000	—	In/Out
TLV2460A-Q1	1	—	—	—	6.4	1.6	—	2	14000	—	In/Out
TLV2461-Q1	1	—	—	—	6.4	1.6	—	2	14000	—	In/Out
TLV2461A-Q1	1	—	—	—	6.4	1.6	—	2	14000	—	In/Out
TLV2462-Q1	2	—	—	0.575	6.4	1.6	—	2	14000	—	In/Out
TLV2462A-Q1	2	—	—	—	6.4	1.6	—	2	14000	—	In/Out
TLV2463-Q1	2	—	—	—	6.4	1.6	—	2	14000	—	In/Out
TLV2463A-Q1	2	—	—	—	6.4	1.6	—	2	14000	—	In/Out
TLV2464A-Q1	4	2.7	6	—	6.4	1.6	1.5	2	—	11	In/Out
TLV2471-Q1	1	2.7	6	0.75	2.8	1.4	2.2	0.4	—	15	In/Out
TLV2471A-Q1	1	2.7	6	0.75	2.8	1.4	1.6	0.4	—	15	In/Out
TLV2472-Q1	2	2.7	6	0.75	2.8	1.1	2.2	0.4	—	15	In/Out
TLV2472A-Q1	2	2.7	6	0.75	2.8	1.1	1.6	0.4	—	15	In/Out
TLV2474-Q1	4	2.7	6	0.75	2.8	1.4	2.2	0.4	—	15	In/Out
TLV2474A-Q1	4	2.7	6	0.75	2.8	1.4	1.6	0.4	—	15	In/Out
TLV271-Q1	1	2.7	16	0.66	3	1.4	5	2	—	39	Out
TLV272-Q1	2	2.7	16	0.66	3	2.4	5	2	—	39	Out
TLV274-Q1	4	2.7	16	0.66	3	2.4	5	2	—	39	Out
TLV2771-Q1	1, 2	—	—	—	5.1	10.5	—	—	—	—	Out
TLV2772-Q1	2	—	—	2	5.1	10.5	—	2	—	—	Out
TLV2772A-Q1	2	—	—	2	5.1	10.5	—	2	—	—	Out
OPA2356-Q1	2	2.5	5.5	14	200	360	—	0.05	—	—	Out
OPA330-Q1	1	1.8	5.5	0.035	0.35	0.16	0.05	—	—	55	In/Out
OPA4171-Q1	4	2.7	36	0.595	3	1.5	1.8	—	—	14	Out
TLC080-Q1	—	—	—	—	—	—	—	—	—	—	—
TLE2027-Q1	—	—	—	—	—	—	—	—	—	—	—

Operational Amplifiers and Comparators

Precision Operational Amplifiers Selection Table

Precision Operational Amplifiers

Device	Number of Channels	V_S (min) (V)	V_S (max) (V)	Iq per Channel (max) (mA)	GBW (typ) (MHz)	Slew Rate (typ) (V/µs)	VOS (Offset Voltage @ 25°C) (max) (mV)	Offset Drift (typ) (µV/C)	Input Bias (max) (pA)	V_n at 1 kHz (typ) ($nV/\sqrt{Hz}$)	Rail-to-Rail
TLV2401-Q1	1	2.5	16	0.0013	0.0055	0.0025	1.9	—	500	—	In/Out
TLV2434-Q1	—	—	—	—	—	—	—	—	—	—	—
TLV2444-Q1	—	—	—	—	—	—	—	—	—	—	—
TLV2464-Q1	4	—	—	—	6.4	1.6	—	—	—	—	In/Out
TLV2470A-Q1	—	—	—	—	—	—	—	—	—	—	—
TLV2470-Q1	—	—	—	—	—	—	—	—	—	—	—
TLV2473A-Q1	—	—	—	—	—	—	—	—	—	—	—
TLV2473-Q1	—	—	—	—	—	—	—	—	—	—	—
TLV2475A-Q1	—	—	—	—	—	—	—	—	—	—	—
TLV2475-Q1	—	—	—	—	—	—	—	—	—	—	—
TLV2770A-Q1	—	—	—	—	5.1	10.5	—	—	—	—	Out
TLV2770-Q1	—	—	—	—	5.1	10.5	—	—	—	—	Out
TLV2771A-Q1	—	—	—	—	5.1	10.5	—	—	—	—	Out
TLV2773A-Q1	—	—	—	—	5.1	10.5	—	—	—	—	Out
TLV2773-Q1	—	—	—	—	5.1	10.5	—	—	—	—	Out
TLV2774A-Q1	—	—	—	—	5.1	10.5	—	—	—	—	Out
TLV2774-Q1	—	—	—	—	5.1	10.5	—	—	—	—	Out
TLV2775A-Q1	—	—	—	—	5.1	10.5	—	—	—	—	Out
TLV2775-Q1	—	—	—	—	5.1	10.5	—	—	—	—	Out
High-Speed Operational Amplifiers											
LMH6601-Q1	1	2.4	5.5	11.5	125	275	1	0.05	—	—	—
LMH6619-Q1	2	—	—	1.65	—	57	—	2400	—	—	—
LMH6642Q-Q1	1	—	—	4.5	57	135	—	2600	—	—	Out
LMH6643Q-Q1	2	—	—	4.5	57	135	—	2600	—	—	Out
LMH6722-Q1	4	10	12	7.5	400	1800	6	10000	—	—	—
OPA2354A-Q1	2	2.7	5.5	7.5	180	150	—	0.05	—	—	In/Out
OPA2365-Q1	2	—	—	5	50	25	0.2	—	13	—	In/Out
OPA354A-Q1	1	2.5	5.5	7.5	100	150	—	0.05	—	—	In/Out
OPA356-Q1	1	2.5	5.5	14	200	360	—	—	—	—	Out
OPA365-Q1	1	—	—	5	50	25	—	—	—	—	In/Out
THS4041-Q1	1	—	—	—	—	400	—	—	—	—	—
THS4509-Q1	1	3	5.25	37.7	3000	6600	—	—	—	—	—
TLE2037-Q1	1	8	38	—	50	7.5	0.1	—	2.5	—	—
TLE2037A-Q1	1	8	38	—	50	7.5	0.025	—	2.5	—	—

Operational Amplifiers and Comparators

Precision Operational Amplifiers Selection Table

Precision Operational Amplifiers

Device	Number of Channels	V_S (min) (V)	V_S (max) (V)	Iq per Channel (max) (mA)	GBW (typ) (MHz)	Slew Rate (typ) (V/µs)	VOS (Offset Voltage @ 25°C) (max) (mV)	Offset Drift (typ) (µV/C)	Input Bias (max) (pA)	V_n at 1 kHz (typ) ($nV/\sqrt{Hz}$)	Rail-to-Rail
TLE2072-Q1	2	—	—	1.8	9.4	35	—	2.4	175	—	—
TLE2072A-Q1	2	—	—	1.8	9.4	35	—	2.4	175	—	—
TLE2141-Q1	1	4	44	4.6	5.8	42	1.4	1.7	—	10.5	Out
TLE2142-Q1	2	—	—	4.4	5.8	45	—	1.7	2000000	—	—
TLV2252-Q1	2	2.7	16	—	0.187	0.1	1.5	0.5	—	19	Out
TLV2252A-Q1	2	2.7	16	—	0.187	0.1	0.85	0.5	—	19	Out
TLV2254-Q1	4	2.7	16	—	0.187	0.1	1.5	0.5	—	19	Out
TLV2254A-Q1	4	2.7	16	—	0.187	0.1	0.85	0.5	—	19	Out
TLV2371-Q1	1	2.7	16	0.56	2.4	2	4.5	2	—	39	In/Out
TLV2372-Q1	2	2.7	16	0.9	2.4	2	4.5	2	—	39	In/Out
TLV2374-Q1	4	2.7	16	0.56	2.4	2	4.5	2	—	39	In/Out
TLV2402-Q1	2	2.5	16	0.00095	0.0055	0.0025	1.2	3	—	800	In/Out
TLV2422-Q1	2	2.7	10	0.075	0.052	0.02	2	2	—	18	Out
TLV2422A-Q1	2	2.7	10	0.075	0.052	0.02	0.95	2	—	18	Out
TLV2432-Q1	2	2.7	10	0.125	0.5	0.25	2	2	—	18	Out
TLV2432A-Q1	2	2.7	10	0.125	0.5	0.25	0.95	2	—	18	Out
TLV2434A-Q1	—	—	—	0.125	0.5	0.25	—	2	—	—	Out
TLV2442-Q1	2	2.7	10	—	1.75	1.3	2	2	—	18	Out
TLV2442A-Q1	2	2.7	10	1.1	1.75	1.3	0.65	2	—	18	Out
TLV2444A-Q1	4	2.7	10	1.1	1.75	1.3	0.95	2	—	18	Out
TLV2460-Q1	1	—	—	—	6.4	1.6	—	2	14000	—	In/Out
TLV2460A-Q1	1	—	—	—	6.4	1.6	—	2	14000	—	In/Out
TLV2461-Q1	1	—	—	—	6.4	1.6	—	2	14000	—	In/Out
TLV2461A-Q1	1	—	—	—	6.4	1.6	—	2	14000	—	In/Out
TLV2462-Q1	2	—	—	0.575	6.4	1.6	—	2	14000	—	In/Out
TLV2462A-Q1	2	—	—	—	6.4	1.6	—	2	14000	—	In/Out
TLV2463-Q1	2	—	—	—	6.4	1.6	—	2	14000	—	In/Out
TLV2463A-Q1	2	—	—	—	6.4	1.6	—	2	14000	—	In/Out
TLV2464A-Q1	4	2.7	6	—	6.4	1.6	1.5	2	—	11	In/Out
TLV2471-Q1	1	2.7	6	0.75	2.8	1.4	2.2	0.4	—	15	In/Out
TLV2471A-Q1	1	2.7	6	0.75	2.8	1.4	1.6	0.4	—	15	In/Out
TLV2472-Q1	2	2.7	6	0.75	2.8	1.1	2.2	0.4	—	15	In/Out
TLV2472A-Q1	2	2.7	6	0.75	2.8	1.1	1.6	0.4	—	15	In/Out
TLV2474-Q1	4	2.7	6	0.75	2.8	1.4	2.2	0.4	—	15	In/Out
TLV2474A-Q1	4	2.7	6	0.75	2.8	1.4	1.6	0.4	—	15	In/Out
TLV271-Q1	1	2.7	16	0.66	3	1.4	5	2	—	39	Out
TLV272-Q1	2	2.7	16	0.66	3	2.4	5	2	—	39	Out
TLV274-Q1	4	2.7	16	0.66	3	2.4	5	2	—	39	Out
TLV2771-Q1	1, 2	—	—	—	5.1	10.5	—	—	—	—	Out
TLV2772-Q1	2	—	—	2	5.1	10.5	—	2	—	—	Out
TLV2772A-Q1	2	—	—	2	5.1	10.5	—	2	—	—	Out

Operational Amplifiers and Comparators

Comparators and Sensing Selection Table

Comparators

Device	Number of Comparators	Number of Channels	Vs (min) (V)	Vs (max) (V)	Iq per Channel (max) (mA)	Vos (Offset Voltage @ 25°C) (max) (mV)	t_{RESP} Low-to-High (µs)	Output Current (min) (mA)	Output Type
LM211-Q1	1	1	3.5	30	6	3	0.115	50	Open collector; open drain
LM239A-Q1	4	4	2	36	0.5	2.5	1.3	16	Open collector; open drain
LM2901-Q1	4	4	2	30	0.5	7	1.3	16	Open collector; open drain
LM2901AV-Q1	4	4	2	32	0.5	2	1.3	16	Open collector; open drain
LM2901V-Q1	4	4	2	32	0.5	7	1.3	16	Open collector; open drain
LM2903-Q1	2	2	2	32	0.5	7	1.3	16	Open collector; open drain
LMC6772-Q1	2	2	2.7	15	0.01	10	4	45	Open collector; open drain
LMC7215-Q1	1	1	2	8	0.001	6	24	30	Push-pull
LMV331-Q1	1	1	2.7	5.5	0.12	7	0.3	84	Open collector; open drain
LMV339-Q1	—	—	—	—	—	—	—	—	—
LMV393-Q1	2	2	2.7	5.5	0.1	7	0.2	84	Open collector
LMV7239-Q1	1	1	2.7	5.5	0.095	6	0.075	55	Push-pull
LMV762Q-Q1	2	2	2.7	5	0.7	1	0.12	40	Push-pull
LP2901-Q1	4	4	3	30	0.25	5	8	30	Open collector; open drain
TL331-Q1	1	1	2	36	0.7	5	0.3	6	Open collector
TLC3702-Q1	2	2	4	16	0.02	5	1.1	20	Push-pull
TLC3704-Q1	4	4	3	16	0.02	5	1.1	20	Push-pull
TLC393-Q1	2	2	4	16	0.02	5	1	8	Open collector; open drain
TLV3012-Q1	1	1	1.8	5.5	0.005	12	6	5	Push-pull
TLV3401-Q1	1	1	2.7	16	0.00000064	3.6	80	—	Open collector
TLV3402-Q1	2	2	2.7	16	0.00000064	3.6	80	—	Open collector
TLV3404-Q1	4	4	2.7	16	0.00000064	3.6	80	—	Open collector
TLV3501A-Q1	1	1	2.7	5.5	5	6.5	0.0045	70	Push-pull
TLV3502-Q1	1	1	2.7	5.5	5	6.5	0.0045	70	Push-pull
TLV3701-Q1	1	1	2.7	16	0.0008	5	36	1	Push-pull
TLV3702-Q1	2	2	2.7	16	0.0008	5	36	1	Push-pull
TPS3700-Q1	—	—	—	—	—	—	—	—	—

Haptics Drivers

Device	Haptic Actuator Type	Input Signal	Iq (typ) (mA)	V_{OUT} (max) (V)	Vs (min) (V)	Vs (max) (V)
DRV2605-Q1	ERM, LRA	PWM Analog	—	5.5	2.5	5.5
DRV8662-Q1	Piezo	PWM Analog	5	100	3	5.5

*Preview products are listed in **bold teal**.*

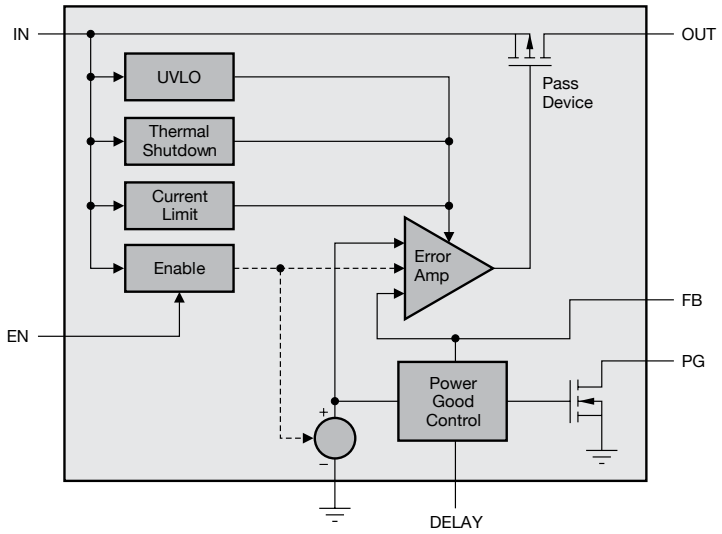
60-V, 5-µA IQ Low-Dropout 100-mA Linear Regulator

TPS7A16xx-Q1

The TPS7A16xx-Q1, TPS7A1601-Q1 and TPS7A1650-Q1 ultra-low-power, low-dropout (LDO) voltage regulators offer the benefits of ultra-low quiescent current; high input voltage; and miniaturized, high-thermal-performance packaging.

The TPS7A16xx-Q1, TPS7A1601-Q1 and TPS7A1650-Q1 are designed for continuous or sporadic (power backup) battery-powered applications where ultra-low quiescent current is critical to extending system battery life.

The TPS7A16xx-Q1, TPS7A1601-Q1 and TPS7A1650-Q1 offer an enable pin (EN) compatible with standard CMOS logc and an integrated open-drain active-high power-good output (PG) with a user-programmable delay. These pins are intended for use in microcontroller-based, battery-powered applications where power-rail sequencing is required.



Functional block diagram.

Key Features

- AEC-Q100 test guidance with the following results:
  - Device temperature grade 1: –40°C to 125°C ambient operating temperature range
  - Device HBM ESD classification level H2
  - Device CDM ESD classification level C3B
- Wide input voltage range: 3 V to 60 V
- Ultra-low quiescent current: 5 µA
- Quiescent current at shutdown: 1 µA
- Output current: 100 mA
- Low dropout voltage: 60 mV at 20 mA
- Accuracy: 2%
- Available in:
  - Fixed output voltage: 3.3 V, 5.0 V
  - Adjustable version from approximately 1.2 V to 18.5 V
- Power-good with programmable delay
- Current-limit and thermal shutdown protections
- Stable with ceramic output capacitors: ≥ 2.2 µF
- Package: high-thermal-performance MSOP-8 PowerPad™ package

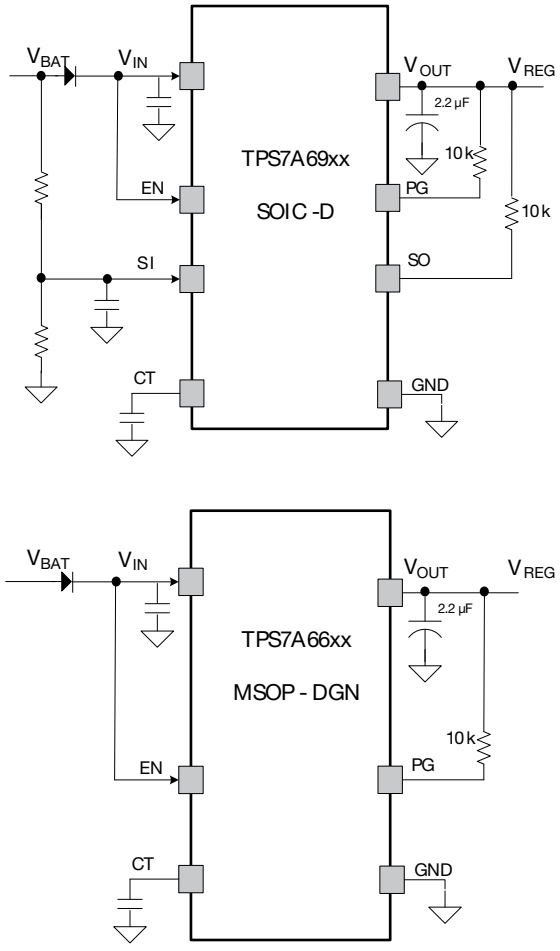
Get more information: **www.ti.com/product/TPS7A16xx-Q1**

Power Management
Low-Dropout Regulators (LDOs)

40-V, 20-µA IQ Low-Dropout 100-/150-mA Linear Regulator
TPS7A66/69xx–Q1

The TPS7A66xx and TPS7A69xx are low-dropout linear regulators designed for up to 40-V V_{IN} operations. With a quiescent current of only 20 µA at no load, they are quite suitable for standby microcontroller unit systems, especially in automotive applications.

The devices feature an integrated short-circuit and overcurrent protection. Reset delay is implemented on power up to indicate that the output voltage is stable and in regulation. The delay can be programmed with an external capacitor. Low-voltage tracking allows for a smaller input capacitor and can possibly eliminate the need to use a boost converter during cold-crank conditions.



Functional block diagrams.

Key Features

- AEC-Q100 test guidance with the following results:
  - Device temperature grade 1: –40°C to 125°C ambient operating temperature range
  - Device HBM ESD classification level H2
  - Device CDM ESD classification level C3B
- 4-V to 40-V wide-input voltage range
- LDO low Iq typical 20 µA
- Stable with 2.2-µF low-ESR ceramic output capacitor
- 150-mA maximum output current
- 2-µA (typ) low shutdown/sleep current
- 2.5-V and 7-V adjustable output voltage
- 2% output voltage tolerance
- Integrated fault protection
  - Short-circuit/overcurrent protection
  - Thermal shutdown
  - Low-input voltage tracking
- MSOP-8 and SOIC-8

Get more information: **www.ti.com/product/TPS7A66/69xx-Q1**

Power Management

Low-Dropout Regulators (LDOs) Selection Tables

Dual-Output LDOs

Device	I_{OUT} (max) (A)	$I_{OUT}2$ (A)	V_{OUT} (min) (V)	V_{OUT} (max) (V)	$V_{OUT}2$ (min) (V)	$V_{OUT}2$ (max) (V)	Iq (typ) (mA)	V_{IN} (min) (V)	V_{IN} (max) (V)	Accuracy (%)
TLV7101828-Q1	0.2	0.2	1.8	1.8	2.8	2.8	0.03	2	5.5	2
TLV7103318-Q1	0.2	0.2	3.3	3.3	1.8	1.8	0.03	2	5.5	2
TPS70175-Q1	0.5	0.25	5	5	2.5	2.5	0.19	2.7	6	2
TPS767D301-Q1	1	1	1.5	5.5	3.3	3.3	0.08	2.7	10	2
TPS767D318-Q1	1	1	1.8	1.8	3.3	3.3	0.08	2.7	10	2
TPS767D325-Q1	1	1	2.5	2.5	3.3	3.3	0.08	2.7	10	2

Single-Channel LDOs

Device	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{DO} (typ) (mV)	Iq (typ) (mA)	V_{OUT} (min) (V)	V_{OUT} (max) (V)	Pin/Package
LM2936Q-Q1	5.5	60	200	0.015	3	5	3TO-252, 4SOT-223, 8SOIC, 8VSSOP
LM9036-Q1	–45	40	400	2.5	3.3	5	—
LM9036Q-Q1	–45	40	400	2.5	3.3	5	8SOIC, 8VSSOP
LM9076Q-Q1	3.65	40	250	4.5	3.3	5	8SOIC
LP2950–50-Q1	1	30	—	0.075	1.2	30	—
LP2951–33-Q1	2	30	—	0.075	3.234	3.366	8SON
LP2951–50-Q1	1	30	—	0.075	1.2	30	8SON
LP38691–ADJ-Q1	2.7	10	250	0.055	—	—	6WSON
LP38691-Q1	2.7	10	250, 330, 430	0.055	1.8	5	6WSON
LP38693–ADJ-Q1	2.7	10	250	0.055	1.25	9	6WSON
LP38693-Q1	2.7	10	250, 330, 430	0.055	1.8	5	6WSON
LP3988-Q1	2.7	6	80	0.085	2.5	3	—
TL1963A-Q1	2.1	20	340	1	1.2	20	5DDPAK/TO-263
TL720M05-Q1	5.5	42	250	12	5	5	20HTSSOP, 3DDPAK/TO-263, 3TO-252
TL750M05-Q1	6	26	600	60	5	5	3DDPAK/TO-263, 3TO-252
TL750M08-Q1	9	26	600	60	8	8	3TO-252
TL750M10-Q1	—	—	—	—	—	—	—
TL750M12-Q1	13	26	600	60	12	12	3DDPAK/TO-263, 3TO-252
TL751M05-Q1	6	26	650	60	12	12	5DDPAK/TO-263, 5TO-252
TL751M08-Q1	9	26	650	60	12	12	5DDPAK/TO-263, 5TO-252
TL751M10-Q1	—	—	—	—	—	—	—
TL751M12-Q1	13	26	650	60	12	12	5DDPAK/TO-263, 5TO-252
TL755M05-Q1	—	26	385	30	4.85	5.15	—
TL760M18-Q1	3.8	26	500	20	—	—	—
TL760M25-Q1	3.8	26	500	20	2.5	2.5	—
TL760M33-Q1	3.8	26	500	20	3.3	3.3	3DDPAK/TO-263, 3TO-252
TLE4275-Q1	5.5	42	250	5	5	5	20HTSSOP, 5DDPAK/TO-263, 5TO-252
TLV1117-Q1	2.7	15	1.2	—	1.25	13.7	—
TLV70012-Q1	2	5.5	220	0.03	1.2	1.2	5SOT
TLV70012A-Q1	2	5.5	175	0.03	1.2	1.2	5SC70
TLV70018-Q1	2	5.5	175	0.03	1.8	1.8	5SOT
TLV70025-Q1	2	5.5	175	0.03	2.5	2.5	5SOT
TLV70030-Q1	2	5.5	175	0.03	3	3	5SC70
TLV70033-Q1	2	5.5	175	0.03	3.3	3.3	5SOT
TPPM0110-Q1	—	—	—	—	—	—	—

Power Management

Low-Dropout Regulators (LDOs) Selection Table

Single-Channel LDOs

Device	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{DO} (typ) (mV)	Iq (typ) (mA)	V_{OUT} (min) (V)	V_{OUT} (max) (V)	Pin/Package
TPS51200-Q1	2.3	3.5		0.5	—	—	10SON
TPS71501-Q1	2.5	24	415	0.003	1.2	15	5SC70
TPS71525-Q1	2.5	24	415	0.003	2.5	2.5	5SC70
TPS71530-Q1	2.5	24	415	0.003	3	3	5SC70
TPS71533-Q1	2.5	24	415	0.003	3.3	3.3	5SC70
TPS71550-Q1	2.5	24	415	0.003	5	5	5SC70
TPS71709-Q1	2.5	6.5	170	0.045	0.9	0.9	6WSON
TPS71750-Q1	2.5	6.5	170	0.045	5	5	6WSON
TPS71H01-Q1	2.5	10	235	0.28	1.2	9.75	—
TPS71H33-Q1	3.7	10	235	0.28	3.3	3.3	—
TPS71H48-Q1	5.2	10	150	0.28	4.8	4.8	—
TPS71H50-Q1	5.33	10	146	0.28	5	5	—
TPS72301-Q1	–10	–2.7	280	0.13	–9.75	–1.18	—
TPS72325-Q1	–10	–2.7	280	0.13	–2.5	–2.5	—
TPS73125-Q1	1.7	5.5	30	0.4	2.5	2.5	—
TPS73201-Q1	1.7	5.5	40	0.4	1.2	5.4	—
TPS73215-Q1	1.7	5.5	40	0.4	1.5	1.5	—
TPS73216-Q1	1.7	5.5	40	0.4	1.6	1.6	—
TPS73218-Q1	1.7	5.5	40	0.4	1.8	1.8	—
TPS73225-Q1	1.7	5.5	40	0.4	2.5	2.5	—
TPS73230-Q1	1.7	5.5	40	0.4	3	3	—
TPS73233-Q1	1.7	5.5	40	0.4	3.3	3.3	—
TPS73250-Q1	1.7	5.5	40	0.4	5	5	—
TPS73433-Q1	2.7	6.5	125	0.04	3.3	3.3	—
TPS73601-Q1	1.7	5.5	75	0.4	1.2	5.4	—
TPS73719-Q1	2.2	5.5	130	0.4	1.9	1.9	—
TPS73733-Q1	2.2	5.5	130	0.4	3.3	3.3	—
TPS74701-Q1	0.8	5.5	50	1	0.8	3.6	—
TPS74801-Q1	0.8	5.5	60	1	0.8	3.6	—
TPS75125-Q1	2.7	5.5	160	0.07	2.5	2.5	—
TPS75201-Q1	2.7	5.5	210	0.07	1.5	5.5	—
TPS75215-Q1	2.7	5.5	210	0.07	1.5	1.5	—
TPS75218-Q1	2.7	5.5	210	0.07	1.8	1.8	—
TPS75225-Q1	2.7	5.5	210	0.07	2.5	2.5	—
TPS75233-Q1	2.7	5.5	210	0.07	3.3	3.3	—
TPS75301-Q1	2.7	5.5	160	0.07	1.5	5.5	—
TPS75315-Q1	2.7	5.5	160	0.07	1.5	1.5	—
TPS75318-Q1	2.7	5.5	160	0.07	1.8	1.8	—
TPS75325-Q1	2.7	5.5	160	0.07	2.5	2.5	—
TPS75333-Q1	2.7	5.5	160	0.07	3.3	3.3	—
TPS76201-Q1	2.7	10	100	0.02	0.7	5.5	—
TPS76301-Q1	2.7	10	375	0.08	1.5	5	—
TPS76316-Q1	2.7	10	375	0.08	1.6	1.6	—
TPS76318-Q1	2.7	10	375	0.08	1.8	1.8	—
TPS76325-Q1	2.7	10	375	0.08	2.5	2.5	—
TPS76330-Q1	2.7	10	375	0.08	3	3	—
TPS76333-Q1	2.7	10	375	0.08	3.3	3.3	—
TPS76350-Q1	2.7	10	375	0.08	5	5	—
TPS76501-Q1	2.7	10	85	0.03	1.2	5.5	—
TPS76701-Q1	2.7	10	230	0.08	1.2	5.5	—
TPS76715-Q1	2.7	10	230	0.08	1.5	1.5	—

Power Management

Low-Dropout Regulators (LDOs) Selection Table

Single-Channel LDOs

Device	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{DO} (typ) (mV)	Iq (typ) (mA)	V_{OUT} (min) (V)	V_{OUT} (max) (V)	Pin/Package
TPS76718-Q1	2.7	10	230	0.08	1.8	1.8	—
TPS76725-Q1	2.7	10	230	0.08	2.5	2.5	—
TPS76727-Q1	2.7	10	230	0.08	2.7	2.7	—
TPS76728-Q1	2.7	10	500	0.08	2.8	2.8	—
TPS76730-Q1	2.7	10	450	0.08	3	3	—
TPS76733-Q1	2.7	10	350	0.08	3.3	3.3	—
TPS76750-Q1	2.7	10	230	0.08	5	5	—
TPS76801-Q1	2.7	10	230	0.08	1.2	5.5	—
TPS76815-Q1	2.7	10	230	0.08	1.5	1.5	—
TPS76818-Q1	2.7	10	230	0.08	1.8	1.8	—
TPS76825-Q1	2.7	10	230	0.08	2.5	2.5	—
TPS76827-Q1	2.7	10	230	0.08	2.7	2.7	—
TPS76828-Q1	2.7	10	500	0.08	2.8	2.8	—
TPS76830-Q1	2.7	10	450	0.08	3	3	—
TPS76833-Q1	2.7	10	350	0.08	3.3	3.3	20HTSSOP
TPS76850-Q1	2.7	10	230	0.08	5	5	20HTSSOP
TPS76901-Q1	2.7	10	71	0.017	1.2	5.5	5SOT-23
TPS76912-Q1	2.7	10	71	0.017	1.2	1.2	5SOT-23
TPS76915-Q1	2.7	10	71	0.017	1.5	1.5	5SOT-23
TPS76918-Q1	2.7	10	71	0.017	1.8	1.8	5SOT-23
TPS76925-Q1	2.7	10	71	0.017	2.5	2.5	5SOT-23
TPS76927-Q1	2.7	10	71	0.017	2.7	2.7	5SOT-23
TPS76928-Q1	2.7	10	122	0.017	2.8	2.8	5SOT-23
TPS76930-Q1	2.7	10	115	0.017	3	3	5SOT-23
TPS76933-Q1	2.7	10	98	0.017	3.3	3.3	5SOT-23
TPS76950-Q1	2.7	10	71	0.017	5	5	5SOT-23
TPS77001-Q1	2.7	10	35	0.017	1.2	5.5	—
TPS77012-Q1	2.7	10	35	0.017	1.2	1.2	—
TPS77015-Q1	2.7	10	35	0.017	1.5	1.5	—
TPS77033-Q1	2.7	10	48	0.017	3.3	3.3	—
TPS77101-Q1	2.7	10	75	0.09	1.5	5.5	8VSSOP
TPS77501-Q1	2.7	10	169	0.08	1.5	5.5	20HTSSOP
TPS77515-Q1	2.7	10	169	0.08	1.5	1.5	—
TPS77516-Q1	2.7	10	169	0.08	1.6	1.6	—
TPS77518-Q1	2.7	10	169	0.08	1.8	1.8	—
TPS77525-Q1	2.7	10	169	0.08	2.5	2.5	—
TPS77533-Q1	2.7	10	169	0.08	3.3	3.3	20HTSSOP
TPS77550-Q1	2.7	10	169	0.08	5	5	—
TPS77601-Q1	2.7	10	169	0.08	1.2	5.5	20HTSSOP
TPS77615-Q1	2.7	10	169	0.08	1.5	1.5	—
TPS77618-Q1	2.7	10	169	0.08	1.8	1.8	20HTSSOP
TPS77625-Q1	2.7	10	169	0.08	2.5	2.5	—
TPS77628-Q1	2.7	10	285	0.08	2.8	2.8	—
TPS77633-Q1	2.7	10	169	0.08	3.3	3.3	20HTSSOP
TPS77650-Q1	2.7	10	169	0.08	5	5	—
TPS78225-Q1	2.2	5.5	130	0.001	2.5	2.5	6SON
TPS78227-Q1	2.2	5.5	130	0.001	2.7	2.7	6SON
TPS78228-Q1	2.2	5.5	130	0.001	2.8	2.8	6SON
TPS78230-Q1	2.2	5.5	130	0.001	3	3	6SON
TPS79101-Q1	2.7	5.5	38	0.17	1.2	5.2	6SOT-23
TPS79118-Q1	2.7	5.5	38	0.17	1.8	1.8	5SOT-23

Power Management

Low-Dropout Regulators (LDOs) Selection Table

Single-Channel LDOs

Device	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{DO} (typ) (mV)	Iq (typ) (mA)	V_{OUT} (min) (V)	V_{OUT} (max) (V)	Pin/Package
TPS79133-Q1	2.7	5.5	50	0.17	3.3	3.3	5SOT-23
TPS79147-Q1	2.7	5.5	38	0.17	4.7	4.7	5SOT-23
TPS79301-Q1	2.7	5.5	112	0.17	1.22	5.5	6SOT-23
TPS79318-Q1	2.7	5.5	112	0.17	1.8	1.8	5SOT-23
TPS79325-Q1	2.7	5.5	112	0.17	2.5	2.5	5SOT-23
TPS79328-Q1	2.7	5.5	120	0.17	2.8	2.8	5SOT-23
TPS793285-Q1	2.7	5.5	120	0.17	2.85	2.85	5SOT-23
TPS79330-Q1	2.7	5.5	112	0.17	3	3	5SOT-23
TPS79333-Q1	2.7	5.5	102	0.17	3.3	3.3	5SOT-23
TPS793475-Q1	2.7	5.5	77	0.17	4.75	4.75	5SOT-23
TPS79433-Q1	2.7	5.5	155	0.17	3.3	3.3	—
TPS79501-Q1	2.7	5.5	110	0.26	1.2	5.4	8SON
TPS79633-Q1	2.7	5.5	220	0.26	3.3	3.3	6SOT-223
TPS79718-Q1	1.8	5.5	110	0.001	1.8	1.8	5SC70
TPS79730-Q1	1.8	5.5	110	0.001	3	3	5SC70
TPS79733-Q1	1.8	5.5	105	0.001	3.3	3.3	5SC70
TPS79801-Q1	3	50	300	0.04	1.275	28	8MSOP-PowerPad™
TPS79805-Q1	5.5	50	200	—	5	5	—
TPS79850-Q1	3	50	300	0.04	5	5	8MSOP-PowerPad
TPS79901-Q1	2.7	6.5	90	0.04	1.2	6.4	6SON
TPS79912-Q1	2.7	6.5	100	0.04	1.2	1.2	6SON
TPS79915-Q1	2.7	6.5	100	0.04	1.5	1.5	5SOT, 6SON
TPS79918-Q1	2.7	6.5	100	0.04	1.8	1.8	5SOT
TPS79925-Q1	2.7	6.5	100	0.04	2.5	2.5	5SOT
TPS79927-Q1	2.7	6.5	100	0.04	2.7	2.7	5SOT, 6SON
TPS79933-Q1	2.7	6.5	90	0.04	3.3	3.3	5SOT
TPS7A1601-Q1	3	60	60	0.005	1.2	18.5	8MSOP-PowerPad
TPS7A1633-Q1	3	60	60	0.005	3.3	3.3	8MSOP-PowerPad
TPS7A1650-Q1	3	60	60	0.005	5	5	8MSOP-PowerPad
TPS7A6033-Q1	4	40	300	0.02	3.3	3.3	5DDPAK/TO-263, 5TO-252
TPS7A6050-Q1	4	40	300	0.02	5	5	5DDPAK/TO-263, 5TO-252
TPS7A6133-Q1	4	40	300	0.02	3.3	3.3	5TO-252
TPS7A6150-Q1	4	40	300	0.02	5	5	5TO-252
TPS7A6201-Q1	4	40	300	0.02	2.5	7	5DDPAK/TO-263
TPS7A6301-Q1	2.8	40	300	0.3	2.5	7	14HTSSOP
TPS7A6333-Q1	3.6	40	300	0.3	3.3	3.3	10VSON, 14HTSSOP
TPS7A6350-Q1	5.3	40	300	0.3	5	5	14HTSSOP
TPS7A6401-Q1	2.8	40	300	0.3	2.5	7	14HTSSOP
TPS7A6433-Q1	3.6	40	300	0.3	3.3	3.3	—
TPS7A6450-Q1	5.3	40	300	0.3	5	5	—
TPS7A6533-Q1	3.6	40	300	0.02	3.3	3.3	3TO-252
TPS7A6550-Q1	5.3	40	300	0.02	5	5	3TO-252
TPS7A6601-Q1	5.5	40	180	0.01	1.5	5	8MSOP-PowerPad
TPS7A6633-Q1	5.5	40	180	0.01	3.3	3.3	8MSOP-PowerPad
TPS7A6650-Q1	5.5	40	180	0.01	5	5	8MSOP-PowerPad
TPS7A6933-Q1	5.5	40	180	0.025	3.3	3.3	8SOIC
TPS7A6950-Q1	5.5	40	180	0.025	5	5	8SOIC
UA78M05-Q1	7	25	—	6	5	5	4SOT-223
UA78M10-Q1	12.5	28	—	6	—	—	—
UA78M33-Q1	5.3	25	—	6	3.3	3.3	4SOT-223

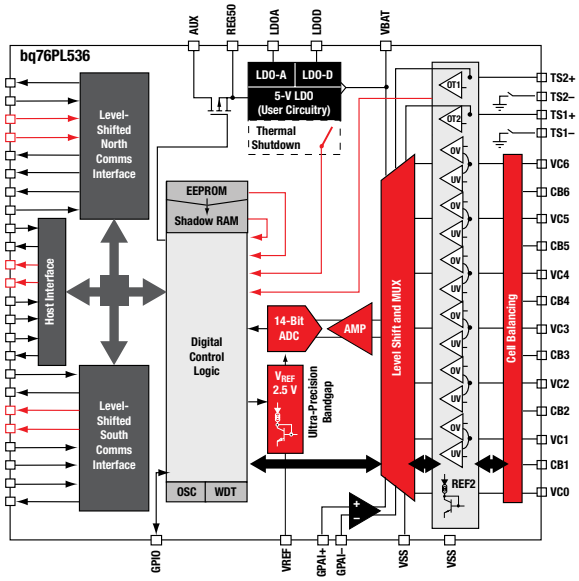
Power Management
Battery Management

Three- to Six-Series Cell Lithium-Ion Battery Monitor and Secondary Protection IC
bq76PL536A-Q1

The bq76PL536A-Q1 is a stackable three- to six-series cell lithium-ion battery pack protector and analog front end (AFE) that incorporates a precision analog-to-digital converter (ADC), independent cell voltage and temperature protection, cell balancing, and a precision 5-V low-dropout regulator (LDO) to power user circuitry.

The bq76PL536A-Q1 provides full protection (secondary protection) for overvoltage, undervoltage and overtemperature conditions. When safety thresholds are exceeded, the bq76PL536A-Q1 sets the fault output. No external components are needed to configure or enable the protection features.

Cell voltage and temperature-protection functions are independent of the ADC. The IC is intended to be used with a host controller to maximize the functionality of the battery management system. However, the protection functions do not require a host controller. The bq76PL536A-Q1 can be stacked vertically to monitor as many as 192 cells without additional isolation components between ICs.



Functional block diagram.

Key Features

- Three- to six-series cell support, all chemistries hot-pluggable
- Stackable vertical SPI interface
- No isolation components required
- High-speed SPI for data communications
- Dedicated fault signals
- High-accuracy ADC:
  - ±1 mV typical, ±3 mV max
  - 14-bit resolution
  - 6-µs conversion time
- Nine ADC inputs: six cell voltages, one six-cell "brick," voltage, two temperatures, one general-purpose input
- Built-in comparators (secondary protector) for overvoltage, undervoltage and overtemperature protection
- Programmable thresholds and delay times
- Supply voltage range from 5.5 V to 30 V
- Low power:
  - 12-µA sleep current typical
  - 48-µA idle current typical
- Integrated precision 5.0-V 3-mA LDO

Get more information: **www.ti.com/product/bq76PL536A-Q1**

Battery Management Chargers

Device	Number of Series Cells	Charge Current (max) (A)	Charge Status Outputs	Battery Charge Voltage (V)	Control Topology	Battery Charge Voltage (min) (V)	Battery Charge Voltage (max) (V)	V_{IN} (min) (V)	V_{IN} (max) (V)
BQ24030-Q1	1	1.5	2	4.2	Linear	—	—	4.3	16
BQ24031-Q1	1	1.5	2	4.1	Linear	—	—	4.3	16
BQ24075-Q1	1	1.5	2	4.2	Linear	—	—	4.3	6.4
BQ24105-Q1	1, 2	2	2	Adjustable	Switch-Mode	2.1	15.5	4.3	16

Multicell Lithium-Ion Battery Management

Device	Number of Series Cells	Cell Chemistry	Protection FETs	Delay Timer (typ) (Sec)	Shutdown Current (µA)
BQ76PL536-Q1	3, 4, 5, 7	Li–Ion, Li-Polymer	External	Variable	12
BQ76PL536A-Q1	3, 4, 5, 9	Li–Ion, Li-Polymer	External	Variable	12

Power Management
DC/DC Controllers and Converters

4.7-V to 60-V, 200-mA Synchronous Step-Down DC/DC Converter
TPS54061-Q1

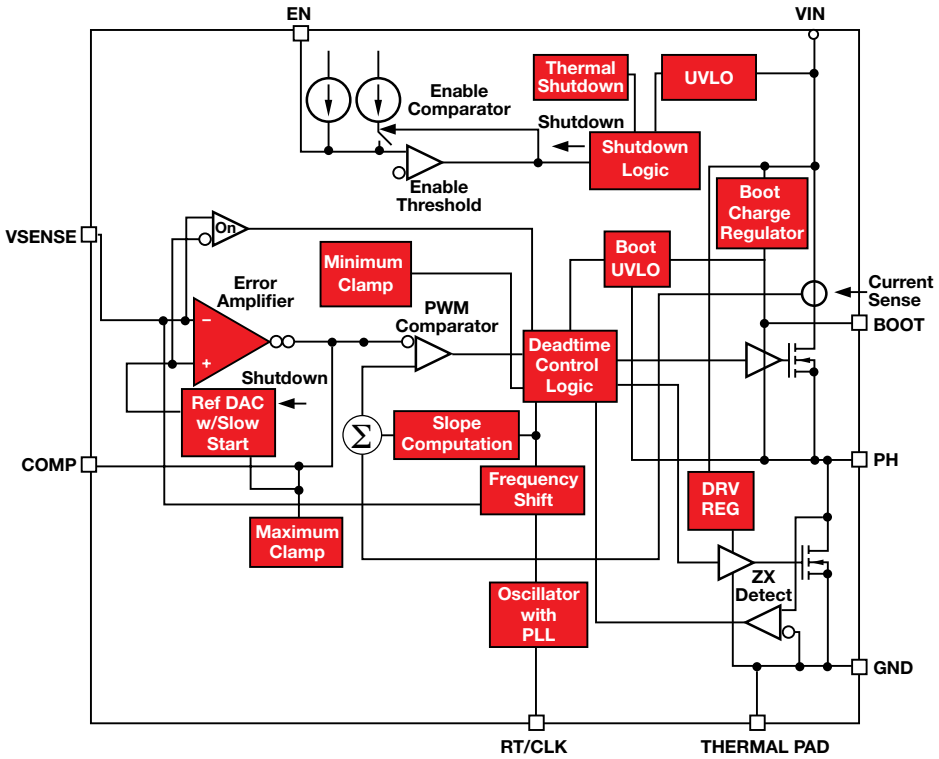
The TPS54061-Q1 device is a 60-V, 200-mA, synchronous step-down DC/DC converter with integrated high-side and low-side MOSFETs. Current-mode control provides simple external compensation and flexible component selection. The nonswitching supply current is 90 µA. Using the enable pin reduces the shutdown supply current to 1.4 µA.

To increase light-load efficiency, the low-side MOSFET emulates a diode when the inductor current reaches zero.

The internal undervoltage lockout setting is 4.5 V, but using two resistors on the enable pin can increase the setting. The internal slow-start time controls the output-voltage startup ramp.

The adjustable switching-frequency range allows optimization of efficiency and external component size. Frequency foldback and thermal shutdown protect the part during an overload condition.

The TPS54061-Q1 enables small designs by integrating the MOSFETs and boot recharge diode, and by minimizing the IC footprint with a small 3-mm × 3-mm thermally enhanced VSON package.



Functional block diagram.

Key Features

- Integrated high-side and low-side MOSFETs
- Diode emulation for lightload efficiency
- Peak-current mode control
- 90-µA operating quiescent current
- 1.4-µA shutdown supply current
- 50-kHz to 1.1-MHz adjustable switching frequency
- Synchronizes to external clock
- 0.8-V ±1% voltage reference
- Stable with ceramic output capacitors or low-cost aluminum electrolytic
- Cycle-by-cycle current limit, thermal, OVP and frequency foldback protection
- 3-mm × 3-mm with thermal pad
- –40°C to 150°C operating junction temperature

Get more information: **www.ti.com/product/TPS54061-Q1**

Power Management

DC/DC Controllers and Converters Selection Table

DC/DC Controllers and Converters

Device	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{OUT} (min) (V)	V_{OUT} (max) (V)	I_{OUT} (max) (A)	Iq (typ) (mA)	Pin/Package
Step-Up Boost Converter							
LM2700Q-Q1	2.2	12	1.26	17.5	2.5	—	14TSSOP
LM27313-Q1	2.7	14	4	28	—	2.1	5SOT-23
LM2735-Q1	2.7	5.5	3	24	—	7	5SOT-23
TPS55332-Q1	3.6	60	2.5	50	0.5	4.2	20HTSSOP
TPS61029-Q1	0.9	5.5	1.8	5.5	1.5	0.025	10SON
TPS61071-Q1	0.9	5.5	1.8	5.5	0.5	0.019	6SOT
TPS61085-Q1	2.3	6	2.8	18.5	2	0.07	8VSSOP
TPS61085T-Q1	2.3	6	2.8	18.5	2	0.07	—
TPS61087-Q1	2.5	6	3	18.5	3.2	0.075	10SON
TPS61170-Q1	3	18	3	38	0.96	2.3	6SON
TPS61240-Q1	2.3	5.5	5	5	0.5	0.03	6SON
Step-Up Boost Controller							
LM3478Q/88Q-Q1	2.95	40	1.26	—	1	—	8VSSOP
LM3481-Q1	2.97	48	1.275	—	1	—	10VSSOP
LM5122-Q1	3	65	3	100	15	4	20HTSSOP
TPS40210-Q1	4.5	52	7	—	6	—	10MSOP-PowerPad™
TPS43340-Q1	4	40	0.9	—	—	0.03	48HTQFP
Step-Down Buck Converter							
LM20143-Q1	2.95	5.5	0.8	5	3	—	16HTSSOP
LM20144-Q1	2.95	5.5	0.8	5	4	—	16HTSSOP
LM20145-Q1	2.95	5.5	0.8	5	5	—	16HTSSOP
LM22670-Q1	4.5	42	1.285	37	3	3.4	7TO-263, 8SO PowerPad
LM22671-Q1	4.5	42	1.285	37	0.5	3.4	8SO PowerPad
LM22672-Q1	4.5	42	1.285	37	1	3.4	8SO PowerPad
LM22674-Q1	4.5	42	1.285	37	0.5	3.4	8SO PowerPad
LM22675-Q1	4.5	42	1.285	37	1	3.4	8SO PowerPad
LM22676-Q1	4.5	42	1.285	37	3	3.4	7TO-263, 8SO PowerPad
LM22677-Q1	4.5	42	1.285	37	5	3.4	7TO-263
LM22678-Q1	4.5	42	1.285	37	5	3.4	7TO–263
LM22680-Q1	4.5	42	1.285	37	2	3.4	8SO PowerPad
LM25010-Q1	6	42	2.5	37	1	0.645	14HTSSOP
LM25011-Q1	6	42	2.51	40	2	1.2	10MSOP-PowerPad
LM25574-Q1	6	42	1.23	40	0.5	1	16TSSOP
LM25575-Q1	6	42	1.23	40	1.5	1	16HTSSOP
LM25576-Q1	6	42	1.23	40	3	1	20HTSSOP
LM2590HV-AQ-Q1	4.5	60	—	—	1	—	7DDPAK/TO-263
LM26001-Q1	3	38	1.25	35	1.5	—	16HTSSOP
LM26003-Q1	3	38	1.25	35	3	0.04	20HTSSOP
LM26420-Q1	3	5.5	0.8	4.5	2	—	16WQFN
LM26480-Q1	2.8	5.5	1	3.3	1.5	0.033	24WQFN
LM2734-Q1	3	20	0.8	18	1		6SOT
LM27341-Q1	3	20	1	18	1.5	2.4	10MSOP-PowerPad
LM27342-Q1	3	20	1	18	2	2.4	10MSOP-PowerPad
LM2734Z-Q1	3	20	0.8	18	1	—	6SOT, 6WSON
LM2830-Q1	3	5.5	0.6	4.5	1	—	5SOT-23
LM2840-Q1	4.5	42	0.765	34	0.1	—	6SOT
LM2841-Q1	4.5	42	0.765	34	0.3	—	6SOT
LM2842-Q1	4.5	42	0.765	34	0.6	—	6SOT
LM3102-Q1	4.5	42	0.8	7	2.5	1	20HTSSOP
LM34919C-Q1	4.5	50	2.5	45	0.6	2.2	12DSBGA
LM3671-Q1	2.7	5.5	2.5	3.3	0.6	1.7	5SOT-23
LM5010A-Q1	6	75	2.5	70	1	0.65	14HTSSOP

Power Management

DC/DC Controllers and Converters Selection Table

DC/DC Controllers and Converters

Device	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{OUT} (min) (V)	V_{OUT} (max) (V)	I_{OUT} (max) (A)	Iq (typ) (mA)	Pin/Package
LM5574-Q1	6	75	1.23	70	0.5	1	16TSSOP
LM5575-Q1	6	75	1.23	70	1.5	1	16HTSSOP
LM5576-Q1	6	75	1.23	70	3	1	20HTSSOP
TL2575HV-05-Q1	4.75	60	5	5	1	5	5DDPAK/TO-263
TL2575HV-33-Q1	4.75	60	3.3	3.3	1	5	5DDPAK/TO-263
TLV620612-Q1	2.9	6	1.2	1.2	2	0.018	8WSON
TLV62065-Q1	2.9	5.5	0.8	5.5	2	18	8WSON
TPS54040-Q1	3.5	42	0.8	39	0.5	0.116	10MSOP-PowerPad™, 10SON
TPS54060-Q1	3.5	60	0.8	58	0.5	0.116	10MSOP-PowerPad, 10SON
TPS54061-Q1	4.7	60	0.8	58	0.2	0.09	8SON
TPS5410-Q1	5.5	36	1.23	31	1	3	8SOIC
TPS54110-Q1	3	6	0.9	4.5	1.5	4.2	20HTSSOP
TPS54140-Q1	3.5	42	0.8	39	1.5	0.116	10MSOP-PowerPad, 10SON
TPS54160-Q1	3.5	60	0.8	58	1.5	0.116	10MSOP-PowerPad, 10SON
TPS54162-Q1	3.6	60	0.9	18	1	0.05	20HTSSOP
TPS5420-Q1	5.5	36	1.23	31	2	3	8SOIC
TPS54225-Q1	4.5	18	0.75	5.5	2	0.8	14HTSSOP
TPS54233-Q1	3.5	28	0.8	25	2	0.11	8SOIC
TPS54240-Q1	3.5	42	0.8	39	2.5	0.138	10MSOP-PowerPad
TPS54260-Q1	3.5	60	0.8	58	2.5	0.138	10MSOP-PowerPad
TPS54262-Q1	3.6	60	0.9	18	2	0.05	20HTSSOP
TPS5430-Q1	5.5	36	1.23	31	3	3	8SO PowerPad
TPS54310-Q1	3	6	0.9	3.3	3	6.2	20HTSSOP
TPS54311-Q1	3	6	0.9	0.9	3	6.2	—
TPS54312-Q1	3	6	1.2	1.2	3	6.2	20HTSSOP
TPS54313-Q1	3	6	1.5	1.5	3	6.2	—
TPS54314-Q1	3	6	1.8	1.8	3	6.2	—
TPS54315-Q1	3	6	2.5	2.5	3	6.2	—
TPS54316-Q1	3	6	3.3	3.3	3	6.2	20HTSSOP
TPS54325-Q1	4.5	18	0.76	5.5	3	0.85	14HTSSOP
TPS54331-Q1	3.5	28	0.8	25	3	0.11	8SOIC
TPS54340-Q1	4.5	42	—	—	3.5	0.146	8SO PowerPad
TPS54360-Q1	4.5	60	—	—	3.5	0.146	8SO PowerPad
TPS54362-Q1	3.6	60	0.9	18	3	0.065	20HTSSOP
TPS54380-Q1	3	6	0.9	4.5	3	6.2	20HTSSOP
TPS54386-Q1	4.5	28	0.8	25.2	3	1.8	14HTSSOP
TPS54388-Q1	2.95	6	0.8	4.5	3	0.35	16WQFN
TPS5450-Q1	5.5	36	1.22	31	5	3	8SO PowerPad
TPS54540-Q1	4.5	42	—	—	5	0.146	8SO PowerPad
TPS54560-Q1	4.5	60	—	—	5	0.146	8SO PowerPad
TPS54610-Q1	3	6	0.9	4.5	6	11	28HTSSOP
TPS54612-Q1	3	6	1.2	1.2	6	15	28HTSSOP
TPS54613-Q1	3	6	1.5	1.5	6	15	—
TPS54614-Q1	3	6	1.8	1.8	6	15	28HTSSOP
TPS54615-Q1	3	6	2.5	2.5	6	15	28HTSSOP
TPS54616-Q1	3	6	3.3	3.3	6	15	28HTSSOP
TPS54618-Q1	2.95	6	0.8	4.5	6	0.25	—
TPS54680-Q1	3	6	0.9	3.3	6	11	—
TPS57040-Q1	3.5	42	0.8	39	0.5	0.116	10MSOP-PowerPad, 10SON
TPS57060-Q1	3.5	60	0.8	58	0.5	0.116	10MSOP-PowerPad, 10SON
TPS57112-Q1	2.95	6	0.8	4.5	2	0.515	16WQFN
TPS57114-Q1	2.95	6	0.8	4.5	4	0.35	16WQFN
TPS57140-Q1	3.5	42	0.8	39	1.5	0.116	10MSOP-PowerPad, 10SON

Power Management

DC/DC Controllers and Converters Selection Table

DC/DC Controllers and Converters

Device	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{OUT} (min) (V)	V_{OUT} (max) (V)	I_{OUT} (max) (A)	Iq (typ) (mA)	Pin/Package
TPS57160-Q1	3.5	60	0.8	58	1.5	0.116	10MSOP-PowerPad™, 10SON
TPS62000-Q1	2	5.5	0.9	5	0.6	0.05	10VSSOP
TPS62004-Q1	2	5.5	1.5	1.5	0.6	0.05	10VSSOP
TPS62005-Q1	2	5.5	1.8	1.8	0.6	0.05	10VSSOP
TPS62006-Q1	2	5.5	2.5	2.5	0.6	0.05	—
TPS62007-Q1	2	5.5	3.3	3.3	0.6	0.05	10VSSOP
TPS62090-Q1	2.5	6	0.8	6	3	0.02	16QFN
TPS62110-Q1	3.1	17	1.2	16	1.5	0.02	16QFN
TPS62152-Q1	3	1.7	3.3	3.3	1	0.017	16QFN
TPS62231-Q1	2.05	6	1.8	1.8	0.5	0.022	6SON
TPS622314-Q1	2.05	6	1.5	1.5	0.5	0.022	6SON
TPS62242-Q1	2	6	0.6	6	0.3	0.015	5SOT
TPS62260-Q1	2	6	0.6	6	0.6	0.015	6SON
TPS62261-Q1	2	6	1.8	1.8	0.6	0.015	6SON
TPS62262-Q1	2	6	1.2	1.2	0.6	0.015	6SON
TPS62263-Q1	2	6	2.5	2.5	0.6	0.015	6SON
TPS62290-Q1	2.3	6	0.6	6	1	0.015	6SON
TPS62293-Q1	2.3	6	1.8	1.8	1	0.015	6SON
TPS62400-Q1	2.5	6	0.6	6	0.4	0.032	10SON
TPS62402-Q1	2.5	6	1.2	1.8	0.4	0.032	10SON
TPS62404-Q1	2.5	6	1.575	1.9	0.4	0.032	10SON
TPS62405-Q1	2.5	6	1.575	1.925	0.4	0.032	10SON
TPS62410-Q1	2.5	6	0.6	6	0.8	0.032	10SON
TPS62420-Q1	2.5	6	0.6	6	0.6	0.032	10SON
TPS62590-Q1	2.5	5.5	0.75	5.5	1	0.015	6SON
TPS62650-Q1	2.3	5.5	0.75	1.4375	0.8	0.038	9DSBGA
Step-Down Buck Controller							
LM25085-Q1	4.5	42	1.25	—	—	—	16HTSSOP
LM25088-Q1	4.5	42	1.205	40	10	—	20HTSSOP, 24WQFN
LM25117-Q1	—	—	—	—	—	—	—
LM2743-Q1	1	16	0.6	13.5	20	—	8VSSOP
LM3485-Q1	4.5	35	1.242	—	4	—	—
LM3487-Q1	—	—	—	—	—	—	8VSSOP
LM3489-Q1	4.5	35	1.239	—	4	—	—
LM34937-Q1	—	—	—	—	—	—	8MSOP-PowerPad™
LM5085-Q1	4.5	75	1.25	—	—	—	16HTSSOP
LM5088-Q1	4.5	75	1.205	70	10	—	20HTSSOP, 24WQFN
LM5117-Q1	5.5	65	0.8	—	20	—	—
LMH34937-Q1	—	—	—	—	—	—	16HTSSOP
TPS40050-Q1	8	40	—	—	—	1.5	16HTSSOP
TPS40051-Q1	8	40	—	—	—	1.5	—
TPS40053-Q1	8	40	—	—	—	1.5	—
TPS40057-Q1	8	40	–0.3	6	0.0002	—	24TSSOP
TPS40090-Q1	4.5	15	0.7	3.3	120	4	20VQFN
TPS40170-Q1	4.5	60	0.6	57	20	—	8SOIC
TPS40200-Q1	4.5	52	0.7	46	0.3	1.5	38HTSSOP
TPS43350-Q1	4	40	0.9	11	0.7	0.03	38HTSSOP
TPS43351-Q1	4	40	0.9	11	0.7	0.03	30TSSOP
TPS5120-Q1	4.5	28	—	—	1.5	1.1	32WQFN
TPS51220A-Q1	4.5	32	1	12	20	1.3	48LQFP
TPS5130-Q1	4.5	28	0.9	5.5	—	2	—
TPS64202-Q1	1.8	6.5	1.2	6.5	3	0.02	—

Power Management

DC/DC Controllers and Converters Selection Table

DC/DC Controllers and Converters

Device	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{OUT} (min) (V)	V_{OUT} (max) (V)	I_{OUT} (max) (A)	Iq (typ) (mA)	Pin/Package
Buck Boost Charge Pump							
REG71055-Q1	3	5.5	5.5	5.5	0.06	0.065	6SOT
Inverting Charge Pump							
TPS60400-Q1	1.8	5.25	–1.8	–5.25	0.06	0.27	5SOT-23
TPS60401-Q1	1.8	5.25	–1.8	–5.25	0.06	0.19	5SOT-23
TPS60402-Q1	1.8	5.25	–1.8	–5.25	0.06	0.27	5SOT-23
TPS60403-Q1	1.8	5.25	–1.8	–5.25	0.06	0.7	5SOT-23
Buck Boost Converter							
TPIC74100-Q1	1.5	40	5	5	1	0.1	20HTSSOP
TPIC74101-Q1	1.5	40	5	5	1	0.1	20HTSSOP
TPS55065-Q1	1.5	40	5	5	0.5	0.1	20HTSSOP
TPS63000-Q1	1.8	5.5	1.2	5.5	1.2	0.04	10SON
Inverting Converter							
MC33063A-Q1	3	40	1.25	40	0.75	—	8SOIC

Isolated DC/DC Converter

Device	V_{IN} (Min) (V)	V_{IN} (Max) (V)	V_{OUT} (Min) (V)	V_{OUT} (Max) (V)	I_{OUT} (A)	Switching Frequency (kHz)	Special Features	Pin/Package
SN6501-Q1	3	5.5	0	11	0.25	620	Enable and Isolated	5SOT-23

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

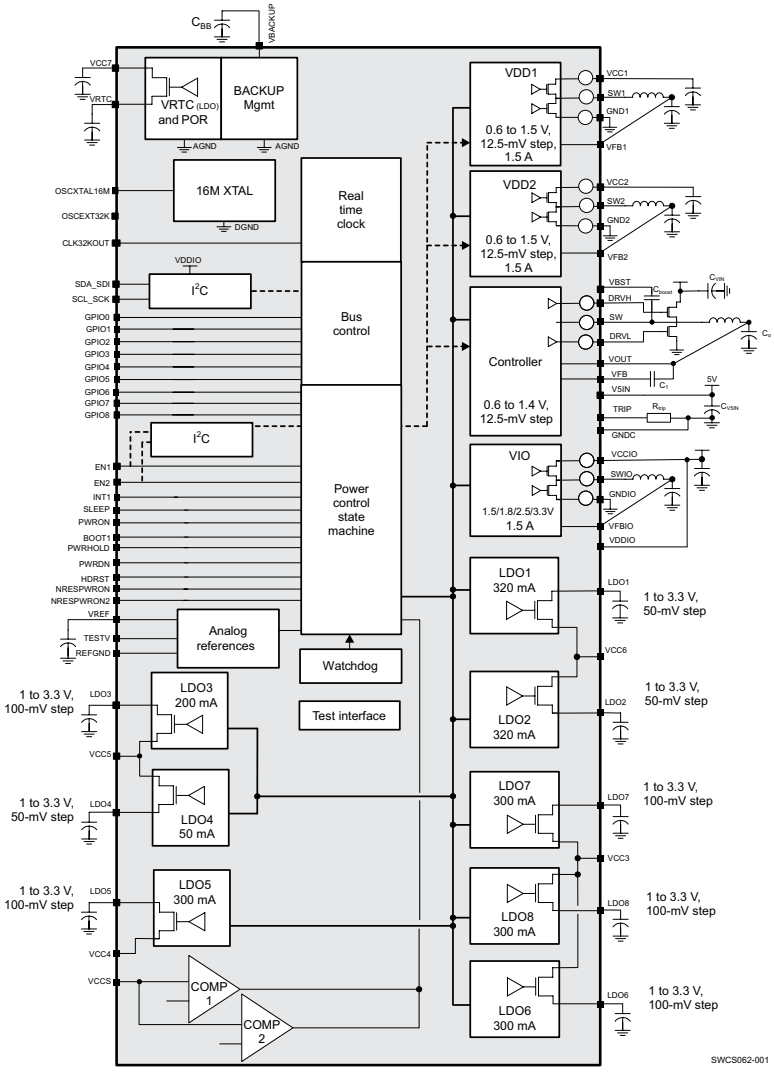
Power Management

Power Management Multichannel IC (PMIC)

Integrated Power Management IC
TPS659119-Q1

The TPS659119-Q1 is an integrated power management IC dedicated to applications powered by a 5-V input that require multiple output power rails. The device provides three step-down converters and an interface to control an external DC/DC buck converter, eight LDOs, and is designed to be a flexible PMIC for supporting different multicore processors and applications.

Two of the step-down converters support dynamic voltage scaling through a dedicated I^2C interface for optimum power savings. The third converter provides power for the I/Os and memory in the system. The device includes eight general-purpose LDOs, providing a wide range of voltage and current capabilities. Five of the LDOs support 1.0 to 3.3 V with 100-mV step and three (LDO1, LDO2, LDO4) support 1.0 to 3.3 V with 50-mV step. All LDOs are fully controllable by the I^2C interface. In addition to the power resources, the device contains an embedded power controller (EPC) to manage the power sequencing requirements of systems and an RTC. Power sequencing is programmable by EEPRO.



Functional block diagram.

Key Features

- Three efficient step-down DC/DC converters
  - Two with dynamic voltage scaling
  - One for I/O power
- One controller for an external DC/DC converter
- Eight LDO voltage regulators and one RTC LDO (supply for internal RTC)
- One high-speed I^2C interface for general-purpose control commands
- Two independent enable signals for controlling power resources
- Two reset inputs
- Real-time clock resource for fast startup
- Nine configurable GPIOs with multiplexed feature support
- Watchdog
- One PWM generator and two LED pulse generators
- Thermal shutdown protection and hot die detection
- Efficient hardware sleep mode management
- Optimized design for processors from the OMAP4 and Nvidia T30 family

Get more information: **www.ti.com/product/TPS659119-Q1**

Power Management

Power Management Multichannel IC (PMIC) Selection Table

Power Management Multichannel IC (PMIC) Solutions

Device	V_{IN} (min) (V)	V_{IN} (max) (V)	LDOs	I_{OUT} (max) (A)	Iq (typ) (mA)	V_{OUT} (min) (V)	V_{OUT} (max) (V)
LP8728-Q1	4.5	5.5	—	1	20	1.25	3.3
TPS43330-Q1	4	40	0	10	0.03	0.9	11
TPS43331-Q1	5	40	2	4	0.065	1.2	10
TPS43332-Q1	4	40	0	10	0.03	0.9	11
TPS43333-Q1	4	40	0	10	0.03	0.9	11
TPS43335-Q1	4	40	0	6	0.03	0.9	11
TPS43336-Q1	4	40	0	6	0.03	0.9	11
TPS65000-Q1	2	6	2	0.6	—	—	—
TPS65023-Q1	2.5	6	3	1.7	0.1	0.6	6
TPS650241-Q1	2.5	6	3	1.6	0.085	0.6	6
TPS650243-Q1	2.5	6	3	1.6	0.085	0.6	6
TPS650244-Q1	2.5	6	3	1.6	0.085	0.6	6
TPS650250-Q1	2.5	6	3	1.6	0.17	0.6	6
TPS65051-Q1	2.5	6	4	1	2.4	0.6	2.5
TPS65053-Q1	2.5	6	3	1	0.032	–0.3	4
TPS650732-Q1	2.8	6.3	2	1.5	0.08	0.8	3.3
TPS65251-Q1	4.5	18	—	—	—	—	—
TPS65300-Q1	5.6	40	3	1.2	5.4	5.15	5.45
TPS65310-Q1	4	40	1	2	0.06	—	—
TPS65310A-Q1	4.8	40	1	2	0.06	—	—
TPS65320-Q1	3.6	40	1	3.2	0.14	1.1	20
TPS65381-Q1	5.8	40	4	1.3	0.075	0.8	5
TPS658629-Q1	2.9	5.5	11	2	—	3	18
TPS659038-Q1	3.135	5.5	11	9	—	0.5	3.3
TPS659039-Q1	3.135	5.5	6	9	—	0.5	3.3
TPS659119-Q1	2.7	5.5	8	1.5	—	0.6	3.3

Power Management
LED Drivers

8-/12-Bit Shift Register LED Driver
TLC6C598/12-Q1

Key Features

- Output maximum rating: 40 V
- Optimized turn on/off switching slew rate
- Devices are cascadable
- Eight/12 power DMOS transistor outputs of 30-mA continuous current (50-mA current for V_{CC}=5 V)
- Logic supply V_{CC} ranges from 3 V to 6 V
- ESD protection: 2000 V
- Thermal shutdown protection
- Package: 16-/20-pin TSSOP-PW
- Industrial process control

TI Solutions for Low/Middle/High Cluster	Texas Instruments ULQ2003-Q	Texas Instruments TLC6C598-Q	Texas Instruments TLC5916-Q
LED control method	Parallel in, parallel out	Serial in, both serial and parallel out Benefits: suitable for limited MCU I/O	Serial in, both serial and parallel out Benefits: suitable for limited MCU I/O
Output current adjusted through external resistor	N	N	Y
Constant current	N	N	Y
Programmable global current gain by serial interface	N	N	Y
Output current accuracy	No rating	No rating	<±3% between channels <±6% between ICs
Diagnostic	N	N	Y Suitable for higher safety level apps
Thermal shutdown	N	Y	Y
Package/pins	SOIC, TSSOP, 16 pins	SOIC, TSSOP, 16 pins	SOIC-D 16 pins

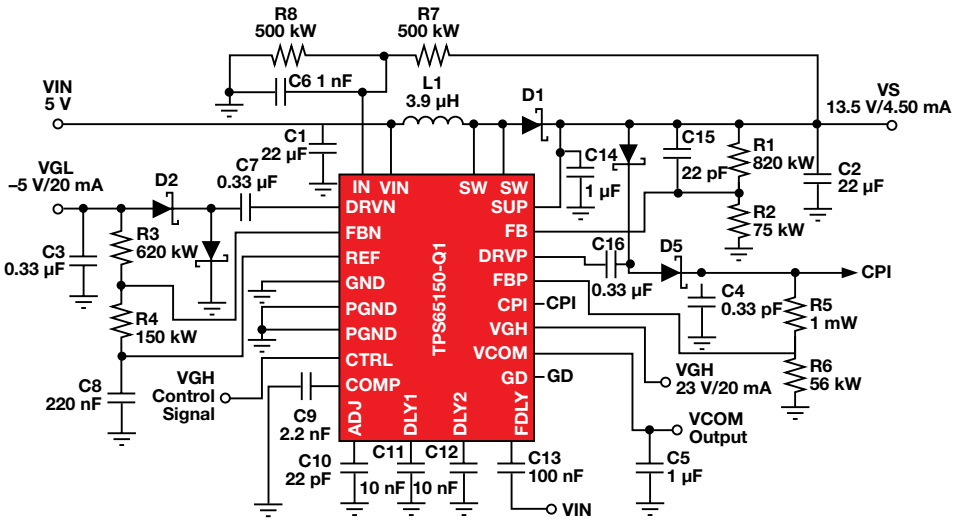
Get more information: **www.ti.com/product/TLC6C598/12-Q1**

Power Management
LCD Display Bias Solutions

Low-Input Voltage, Compact LCD Bias IC with VCOM Buffer
TPS65150-Q1

The TPS65150-Q1 offers a very compact and small power-supply solution that provides all three voltages required by thin film transistor (TFT) LCD displays. With an input voltage range of 1.8 V to 6 V, the device is ideal for automotive displays powered by a 2.5-V or 3.3-V input rail or by a 5-V input-voltage rail. Additionally the TPS65150-Q1 provides an integrated high-current buffer to provide the VCOM voltage for the TFT backplane.

Two regulated adjustable charge-pump drivers provide the positive VGH and negative VGL bias voltages for the TFT. The device incorporates adjustable power-on sequencing for VGL as well as for VGH. This avoids the need for any additional external components to implement application-specific sequencing.



Functional block diagram.

Key Features

- 1.8-V to 6-V input voltage range
- Integrated VCOM buffer
- High-voltage switch to isolate VGH
- Gate voltage shaping of VGH
- 2-A internal MOSFET switch
- Main output VS up to 15 V with <1% output voltage accuracy
- Virtual synchronous converter technology
- Negative regulated charge pump driver VGL
- Positive regulated charge pump driver VGH
- Adjustable power-on sequencing
- Adjustable fault detection timing
- Gate drive signal for external isolation
- MOSFET
- Thermal shutdown

Get more information: **www.ti.com/product/TPS65150-Q1**

Power Management

LCD Display Bias Solutions Selection Table

LCD Bias Power Solutions

Device	V_{IN} (V)	AV_{DD} (max) (V)	V_{GH} (max) (V)	V_{GL} (max) (V)	V_{COM}	Other	Pin/Package
TPS65100-Q1	2.7 to 5.8	15	30	–12	Yes	3.3-V LDO	24/HTSSOP
TPS65131-Q1	2.7 to 5.5	—	15	–15	No	—	24/VQFN
TPS65140-Q1	2.7 to 5.8	15	30	–12	No	3.3-V LDO	24/HTSSOP
TPS65145-Q1	2.7 to 5.8	15	30	–12	No	3.3-V LDO	24/HTSSOP
TPS65150-Q1	1.8 to 6.0	15	30	–12	Yes	Gate-Pulse Modulation	24/HTSSOP

LED Backlighting

Device	Type	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{OUT} (min) (V)	V_{OUT} (max) (V)	LED Configuration	Number of LEDs	Iq (typ) (mA)
LM3492-Q1	Inductive	4.5	65	—	65	Parallel	28	3.6
LM3492HC-Q1	Inductive	4.5	65	—	65	Parallel	28	3.6
TPS61040-Q1	Inductive	1.8	6	1.8	28	Series	6	0.05
TPS61041-Q1	Inductive	1.8	6	1.8	28	Series	4	0.028
TPS61161-Q1	Inductive	2.7	18	2.7	—	Series	10	1.5
TPS61165-Q1	Inductive	3	18	3	—	Series	10	1.5

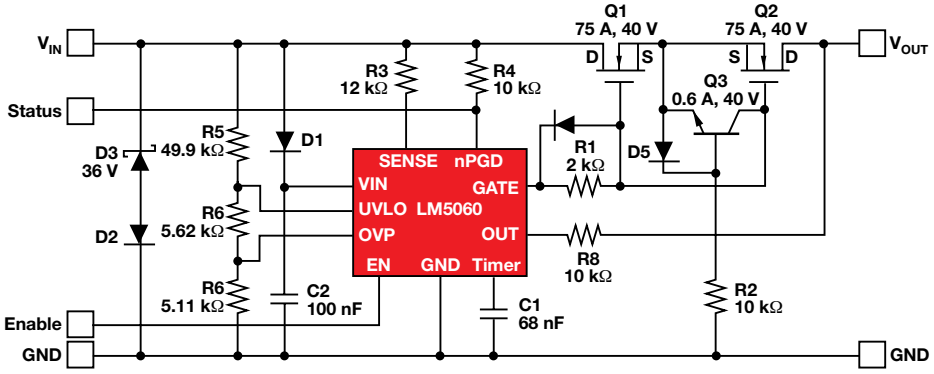
LED Signage Linear

Device	Data Transfer Rate (typ) (MHz)	Data V_{IN} (min) (V)	Data V_{IN} (max) (V)	LED Voltage (max) (V)	Numeric Price for Sort	Operating Temperature Range (°C)	Output Channels	Per Channel Drive (mA)	Pin/Package
TL4242-Q1	0.01	4.5	42	42	0.4	–40 to 105, –40 to 125	1	500	7DDPAK/TO-263, 8SON
TLC5916-Q1	30	3	5.5	17	0.55	–40 to 125	8	120	16SOIC
TLC5917-Q1	30	3	5.5	17	0.7	–40 to 125	8	120	16SOIC
TLC5926-Q1	30	3	5.5	17	0.7	–40 to 125	16	120	24HTSSOP
TLC5927-Q1	30	3	5.5	17	0.75	–40 to 125	16	120	24HTSSOP
TLC5941-Q1	30	3	5.5	17	1.11	–40 to 125	16	80	28HTSSOP

High-Side Protection Controller with Low Quiescent Current

LM5060-Q1

The LM5060-Q1 high-side protection controller provides intelligent control of a high-side N-channel MOSFET during normal on/off transitions and fault conditions. In-rush current is controlled by the nearly constant rise time of the output voltage. A power-good output indicates when the output voltage reaches the input voltage and the MOSFET is fully on. Input undervoltage lockout, with hysteresis, is provided as well as programmable input overvoltage protection. An enable input provides remote on/off control. The programmable undervoltage lockout input can be used as second enable input for safety redundancy. A single capacitor programs the initial startup VGS fault detection delay time, the transition VDS fault detection delay time and the continuous overcurrent VDS fault detection delay time. When a detected fault condition persists longer than the allowed fault delay time, the MOSFET is latched off until either the enable input or the undervoltage lockout input is toggled low and then high.



Overvoltage, overcurrent and reverse polarity solution with LM5060-Q1.

Key Features

- Wide operating input voltage range: +5.5 V to +65 V
- Less than 15 µA quiescent current in disabled mode
- Controlled output rise time for safe connection of capacitive loads
- Charge pump gate driver for external N-channel MOSFET
- Adjustable undervoltage lockout (UVLO) with hysteresis
- UVLO serves as second enable input for systems requiring safety redundancy
- Programmable fault detection delay time
- MOSFET latched off after load fault is detected
- Active low open-drain power good (nPGD) output
- Adjustable input overvoltage protection (OVP)

Get more information: **www.ti.com/product/LM5060-Q1**

Power Management

Inductorless DC/DC Regulators (Charge Pumps) Selection Table

Inverting Charge Pumps

Device	I_{OUT} (max) (A)	I_q (typ) (mA)	Switching Frequency (max) (kHz)	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{OUT} (min) (V)	V_{OUT} (max) (V)
TPS60400-Q1	0.06	0.27	375	1.8	5.25	–1.8	–5.25
TPS60401-Q1	0.06	0.19	30	1.8	5.25	–1.8	–5.25
TPS60402-Q1	0.06	0.27	75	1.8	5.25	–1.8	–5.25
TPS60403-Q1	0.06	0.7	325	1.8	5.25	–1.8	–5.25
TPS61161-Q1	Inductive	2.7	18	2.7	—	Series	10
TPS61165-Q1	Inductive	3	18	3	—	Series	10

Inductorless DC/DC Regulators (Charge Pumps)

Device	I_{OUT} (mA)	V_{IN} (V)	V_{OUT} (V)	Efficiency (%)	Switching Frequency (max) (kHz)	Quiescent Current (typ) (µA)
TPS60400	60	1.6 to 5.5	Adj. - (1.6 to 5.5)	99	375	125
TPS60401	60	1.6 to 5.5	Adj. - (1.6 to 5.5)	99	30	65
TPS60402	60	1.6 to 5.5	Adj. - (1.6 to 5.5)	99	75	120
TPS60403	60	1.8 to 5.25	Adj. - (1.8 to 5.25)	90	325	425
REG71055	100	3 to 5.5	5.5	90	1000	65

Protection Switch Controller

Device	Function	Voltage Range	$V_{THRESHOLD}$	Features	Standby Current (µA)
LM5060-Q1	Overvoltage/overcurrent switch controller	5.5 to 6.5	R_{DSON} +10%	OV, UV, PG, EN	9
LM5050-1-Q1	Ideal diode (Oring controller)	5 to 7.5	–28 mV	AUX input (–1) FET fault detection (–2)	100

Power Management

PWM Power Supply Controllers Selection Table

PWM Power Supply Controllers

Device	UVLO Thresholds On/Off (V)	V_{IN} (min) (V)	V_{IN} (max) (V)	Frequency (max) (kHz)	Duty Cycle (max) (%)	Pin/Package
LM25037-Q1	—	5.5	75	2000	—	16TSSOP
TL2843B-Q1	8.4/7.6	7.6	30	500	100	14SOIC
UC2825A-Q1	9.2/8.4	8.4	22	1000	50	16SOIC
UC2843A-Q1	8.5/7.9	8.5	30	500	100	8SOIC
UC2856-Q1	7.7/7	8	40	1000	50	16SOIC
UCC2570-Q1	13/9	9	15	500	80	—
UCC25706-Q1	12/8	8	15	4000	93	8SOIC
UCC2800-Q1	7.2/6.9	6.9	—	1000	100	8SOIC
UCC2801-Q1	9.4/7.4	7.4	—	1000	50	8SOIC
UCC2802-Q1	12.5/8.3	8.3	—	1000	100	8SOIC
UCC2803-Q1	4.1/3.6	3.6	12	1000	100	8SOIC
UCC2804-Q1	12.5/8.3	8.3	—	1000	50	8SOIC
UCC2805-Q1	4.1/3.6	3.6	—	1000	50	8SOIC
UCC2808A-2Q1	4.3/4.1	—	—	1000	50	8SOIC
UCC2813-0-Q1	7.2/6.9	—	—	1000	100	8SOIC
UCC2813-1-Q1	9.4/7.4	—	—	1000	50	8SOIC
UCC2813-2-Q1	12.5/8.3	—	—	1000	100	8SOIC
UCC2813-3-Q1	4.1/3.6	—	—	1000	100	8SOIC, 8TSSOP
UCC2813-4-Q1	12.5/8.3	—	—	1000	50	8SOIC
UCC2813-5-Q1	4.1/3.6	—	—	1000	50	8SOIC
UCC28220-Q1	10.5/8.4	8.5	14	2000	90	16SOIC, 16TSSOP
UCC28221-Q1	13.0/8.0	—	—	2000	90	—
UCC28600-Q1	10.3/9.3	—	—	130	99	8SOIC
UCC2895-Q1	11.8/9.8	9	16.5	1000	100	20SOIC
UCC28950-Q1	6.75/6.15	8	20	1000	97	24TSSOP
UCC28C41-Q1	7/6.6	6.6	20	1000	50	8SOIC

Power Management
USB Power Switches Selection Tables

USB Power Switches

Device	$r_{DS(on)}$ per FET (typ) (mΩ)	V_{IN} (min) (V)	V_{IN} (max) (V)	Continuous Current (max) (A)	Current Limit (A)	Number of Switches	Enable
Fixed-Current Limited Switches							
TPS2020-Q1	—	2.7	5.5	0.2	—	1	Active Low
TPS2021-Q1	33	2.7	5.5	0.6	0.9	1	Active Low
TPS2022-Q1	33	2.7	5.5	1	1.5	1	Active Low
TPS2023-Q1	—	—	—	—	—	—	—
TPS2024-Q1	33	2.7	5.5	2	3	1	Active Low
TPS2030-Q1	33	2.7	5.5	0.2	0.3	1	Active High
TPS2031-Q1	—	—	—	—	—	—	—
TPS2032-Q1	33	2.7	5.5	1	1.5	1	Active High
TPS2033-Q1	—	—	—	—	—	—	—
TPS2034-Q1	—	—	—	—	—	—	—
TPS2041B-Q1	70	2.7	5.5	0.5	—	1	Active Low
TPS2042B-Q1	70	2.7	5.5	0.5	1	2	Active Low
TPS2051B-Q1	70	2.7	5.5	0.5	1	1	Active High
TPS2062-Q1	70	2.7	5.5	1	1.5	2	Active Low
TPS2065-Q1	70	2.7	5.5	1	1.5	1	Active High
TPS2066-Q1	—	2.7	5.5	1	1.5	2	Active High
TPS2068-Q1	70	2.7	5.5	1.5	2.1	1	Active Low
TPS2069C-2	76	4.5	5.5	1.5	2.23	1	Active High
Precision-Adjusted Limited-Load Switches							
TPS2551-Q1	100/DRV/85/DBV	2.5	6.5	1.1	0.1 to 1.1	1	Active High
TPS2553-Q1	100/DRV/85/DBV	2.5	6.5	1.5	0.075 to 1.7	1	Active High
TPS2561-Q1	45	2.5	6.5	2.5	0.25 to 2.5	2	Active High
TPS2511-Q1	70	4.5	5.5	2.7	0.25 to 2.7	1	—
TPS2543-Q1	75	4.5	5.5	2.5	0.25 to 2.7	1	Active High
TPS2546-Q1	73	4.5	5.5	2.5	0.25 to 2.7	1	Active High

Power Management

Supervisors and References Selection Tables

Supervisors

Device	Iq (typ) (µA)	V_{CC} (min) (V)	V_{CC} (max) (V)	Time Delay (ms)	Special Features
TLC7701/05/33-Q1	9	2	6	Programmable	Programmable
TPS3306-15/18/20/25/33-Q1	15	2.7	6	100	Watchdog timer
TPS3307-18-Q1	15	2	6	200	Manual reset
TPS3803-01-Q1	3	1.3	6	0	—
TPS3803G15-Q1	3	1.3	6	0	—
TPS3805H33-Q1	3	1.3	6	0	—
TPS3806I33-Q1	3	1.3	6	0	SOT-23
TPS3808G01/12/125/15/18/30/33/50-Q1	2.4	1.7	6.5	Programmable	EEPROM voltage spin/manual reset/programmable delay
TPS3809I50-Q1	9	2	6	200	Fixed delay
TPS3809J25-Q1	9	2	6	200	Fixed delay
TPS3809K33-Q1	9	2	6	200	Fixed delay
TPS3809L30-Q1	9	2	6	200	Fixed delay
TPS3813I50-Q1	9	2	6	25	Watchdog timer
TPS3813K33-Q1	9	2	6	25	Watchdog timer
TPS53820-33/50-Q1	15	1.1	5.5	25	Manual reset/watchdog timer
TPS3823-25/30/33/50-Q1	15	1.1	5.5	200	Manual reset/watchdog timer
TPS3824-25/30/33/50-Q	15	1.1	5.5	200	Watchdog timer
TPS3825-33/50-Q1	15	1.1	5.5	200	Fixed delay
TPS3828-33/50-Q1	15	1.1	5.5	200	Watchdog timer
TPS3836E18-Q1	0.22	1.6	6	10/200	Fixed delay/low power consumption
TPS3836H30-Q1	0.22	1.6	6	10/200	Fixed delay/low power consumption
TPS3836J25-Q1	0.22	1.6	6	10/200	Fixed delay/low power consumption
TPS3836K33-Q1	0.22	1.6	6	10/200	Fixed delay/low power consumption
TPS3836L30-Q1	0.22	1.6	6	10/200	Fixed delay/low power consumption
TPS3837E18-Q1	0.22	1.6	6	10/200	Fixed delay/low power consumption
TPS3837J25-Q1	0.22	1.6	6	10/200	Fixed delay/low power consumption
TPS3837K33-Q1	0.22	1.6	6	10/200	Fixed delay/low power consumption
TPS3837L30-Q1	0.22	1.6	6	10/200	Fixed delay/low power consumption
TPS3838E18-Q1	0.22	1.6	6	10/200	Fixed delay/low power consumption
TPS3838J25-Q1	0.22	1.6	6	10/200	Fixed delay/low power consumption
TPS3838K33-Q1	0.22	1.6	6	10/200	Fixed delay/low power consumption
TPS3838L30-Q1	0.22	1.6	6	10/200	Fixed delay/low power consumption
TPS386000-Q1	11	1.8	6.5	20/30/Programmable	—
UCC2946-Q1	12	2.1	5.5	Programmable	Manual reset/watchdog timer

References

Device	V_O (V)	Initial Accuracy @ 25°C (%)	Temp. Coeff. (max) (ppm/°C)	I_{OUT}/I_Z (max) (mA)	V_{IN} (min) (V)	V_{IN} (max) (V)	Pin/Package
LM4128-Q1	1.8, 2.048, 2.5, 3, 3.3, 4.096	0.1	100, 75	20	2.2	5.5	5SOT-23
REF3033-Q1	3.3	0.2	50, 60, 65, 80	25	3.301	5.5	3SOT-23
REF5020-Q1	2.048	0.05	3	10	2.7	18	—
REF5020A-Q1	2.048	0.05	3	10	2.7	18	8SOIC
REF5025-Q1	2.5	0.05	3	10	2.7	18	—
REF5025A-Q1	2.5	0.05	3	10	2.7	18	8SOIC
REF5030-Q1	3	0.05	3	—	3.2	18	—
REF5030A-Q1	3	0.05	3	10	3.2	18	8SOIC
REF5040A-Q1	4.096	0.05	3	10	4.296	18	8SOIC
REF5045-Q1	4.5	0.05	3	10	4.7	18	—
REF5045A-Q1	4.5	0.05	3	10	4.7	18	8SOIC
REF5050A-Q1	5	0.05	3	10	5.2	18	8SOIC

Power Management
Power and Control Selection Tables

Power Logic

Device	V_{DS} (max) (V)	I_{CC} (µA)	I_O(CONT) (A)	$r_{DS(on)}$ (Ohms)	t_{PLH} (ns)	Pin/Package
TLC6C5912-Q1	40	130	0.05	7.4	210	20SOIC, 20TSSOP
TLC6C598-Q1	40	88	0.05	7.4	218	16SOIC, 16TSSOP

Peripheral Drivers and Actuators

Device	Output Voltage (max) (V)	Switching Voltage (max) (V)	Peak Output Current (mA)	Drivers Per Package	Input Compatibility	Delay Time (typ) (ns)
ULQ2003A-Q1	50	50	500	7	CMOS/TTL	1000
ULQ2004A-Q1	50	50	500	7	CMOS	1000

Temperature Monitoring and Fan Control

Device	Duty Cycle (max) (%)	Numeric Price for Sort	Operating Supply (max) (V)	Startup Current (mA)	UVLO Thresholds On/Off (V)	Vref (V)
UCC28061-Q1	99	1.3	21	0.1	12.6/10.4	6
UCC28070-Q1	98	2.3	21	20	10.2/9.2	6
UCC2818A-Q1	100	1.35	18	0.15	10.5/10	7.5

MOSFET Drivers

Device	No. of Outputs	Driver Config.	V_{CC} (min) (V)	V_{CC} (max) (V)	Peak Output Current (A)	Prop Delay (ns)	Description
UCC2720x	2	Noninverting	8	20	3	20	120-V boot, 3-A peak, high-frequency, high-side/low-side driver
UCC27321	1	Inverting	4	15	9	25	Single 9-A high-speed low-side MOSFET driver with enable
UCC27322	1	Noninverting	4	15	9	25	Single 9-A high-speed low-side MOSFET driver with enable
UCC27324	2	Noninverting	4	15	4	35	Dual 4-A high-speed low-side power MOSFET driver
UCC27423	2	Inverting	4	15	4	35	Dual 4-A high-speed low-side MOSFET drivers with enable
UCC27424	2	Noninverting	4	15	4	35	Dual 4-A high-speed low-side MOSFET drivers with enable
UCC27425	2	Inverting/noninverting	4	15	4	35	Dual 4-A high-speed low-side MOSFET drivers with enable
TPS2811	2	Inverting/noninverting	4	15	4	35	Dual 4-A high-speed low-side MOSFET drivers with enable
TPS2829	2	Inverting/noninverting	4	15	4	35	Dual 4-A high-speed low-side MOSFET drivers with enable
TPS2819	1	Noninverting	4	14	2	40	Automotive catalog noninverting high-speed MOSFET driver with internal regulator
LM5112	1	Inverting/noninverting	3.5	14	7	25	Tiny 7-A MOSFET gate driver

Power Factors

Device	Operating Frequency (max) (MHz)	Duty Cycle (max) (%)	Startup Current (mA)	V_{REF} Voltage (V)	V_{REF} Tolerance (%)	Operating Supply Current (mA)	Supply Voltage (max) (V)	UVLO: On/Off (V)	Description
UCC28070	0.3	98	8	6	3	20	21	10.2/9.2	Two-phase interleaved CCM PFC controller
UCC2818A	0.25	100	0.15	7.5	1.5	4	18	10.5/10	BiCMOS power factor preregulator

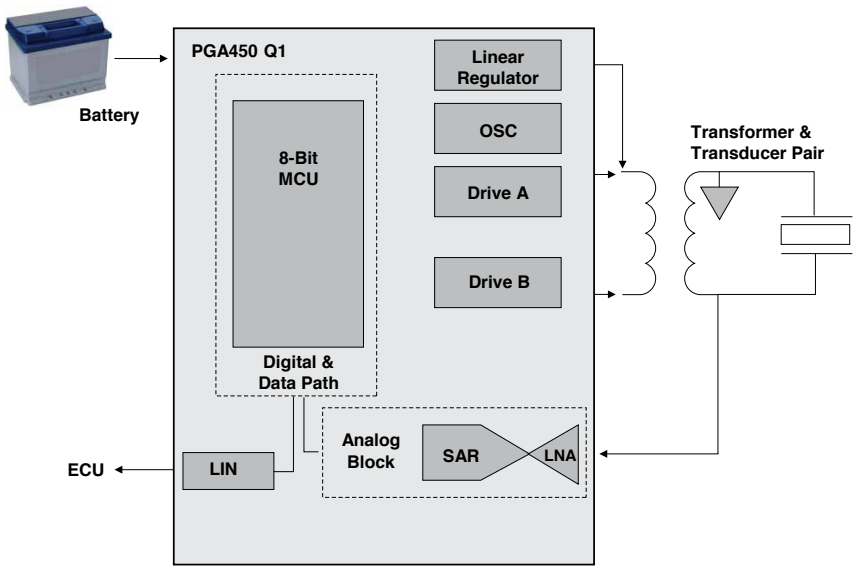
Automotive Ultrasonic Sensor Signal Conditioner
PGA450-Q1

The PGA450-Q1 is a fully integrated interface device for ultrasonic transducers used in automotive park distance or object-detection applications. It incorporates these system blocks: voltage regulators, a 12-bit SAR ADC, an 8-bit microcontroller, a digital band-pass filter, a DAC, dual NMOS low-side drivers, a low-noise amplifier, an oscillator, and a LIN 2.1 physical interface and protocol for interfacing.

The PGA450-Q1 possesses an 8-bit microcontroller and OTP memory for program storage for processing the echo signal and calculating the distance between the transducer and the object. This data is transmitted through the LIN 2.1 communication protocol. The LIN 2.1 physical layer is slave-only and does not implement the LIN wakeup feature.

Key Features

- Dual NMOS low-side drivers
- Configurable burst generator
- Low-noise amplifier
- 12-bit SAR ADC
- Configurable digital band-pass filter
- Digital signal envelope detect
- On-chip 8-bit microprocessor
- LIN 2.1 physical interface and protocol
- Watchdog timer
- Four-wire SPI for testability/ programming
- 8 KB OTP
- 768 B of FIFO RAM
- 256 B scratch pad RAM
- 8 KB of development RAM
- 32 B of EEPROM for application



Functional block diagram.

Sensor Interface, Power Control and Safety

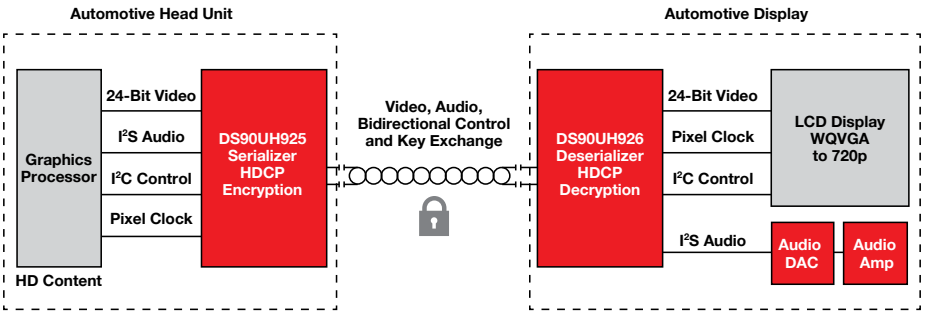
Device	Supply (V)	V_{DD} (max) (V)	ADC Resolution (min) (bits)	I_{DD} (max) (mA)	$I_{DD(q)}$ (max) (mA)
TPIC83000-Q1	5	5	14	13	13

Get more information: **www.ti.com/product/PGA450-Q1**

Interface
LVDS

SERDES FPD-Link III
DS90UH925/6Q

The DS90UH925Q serializer, in conjunction with the DS90UH926Q deserializer, provides a solution for secure distribution of content-protected digital video in automotive entertainment systems. This chipset translates a parallel RGB video interface into a single-pair high-speed serialized interface. The digital video data is protected using the industry-standard high-bandwidth digital content protection (HDCP) copy protection scheme, enabling playback of content-protected media. The serial bus scheme, FPD-Link III, supports video and audio data transmission and full duplex control, including I²C communication over a single differential link. Consolidation of video data and control over a single differential pair reduces interconnect size and weight, while also eliminating skew issues and simplifying system design.



System block diagram.

Key Features

- Integrated HDCP cipher engine with on-chip key storage
- Bidirectional control interface channel with I²C-compatible serial control bus
- Supports high-definition 720-pixel digital video format
- RGB888 + VS, HS, DE and synchronized I²S audio supported
- 5- to 85-MHz PCLK supports high-definition resolutions, dual-view displays and 24-bit color depth
- Single 3.3-V operation with 1.8-V or 3.3-V compatible LVCMOS I/O interface
- AC-coupled STP interconnect up to 10 meters
- Parallel LVCMOS video inputs
- I²C compatible serial control bus for configuration (DS90UH926Q)
- DC-balanced and scrambled data with embedded clock simplifies interconnects and reduces the number of cables and connectors
- Adaptive cable equalization (DS90UH926Q)
- HDCP content protected
- Supports HDCP repeater application at SPEED link BIST mode and LOCK status pin (DS90UH926Q)
- EMI minimization (SSCG and EPTO) (DS90UH926Q)
- Image enhancement (white balance and dithering) and internal pattern generation
- Low-power modes minimize power dissipation
- Automotive grade product: AEC-Q100 grade two qualified
- >8-kV HBM and ISO 10605 ESD rating
- Backward-compatible modes

Get more information: **www.ti.com/product/DS90UH925/6Q**

Interface

LVDS, FPD-Link II SERDES and Clocks Selection Tables

LVDS

Device	No. of Rx	No. of Tx	Input Signal	Output Signal	Signaling Rate (Mbps)	Tx t_{pd} (typ) (ns)	Rx t_{pd} (typ) (ns)	I_{CC} (max) (mA)	ESD HBM (kV)	Supply Voltage(s) (V)
DS90LT012AQ-Q1	1	1	LVDS	LVTTL	400	—	—	9	2	3.3
DS90LV011AQ-Q1	1	1	LVTTL	LVDS	400	—	—	10	8	3.3
DS90LV027AQ-Q1	2	2	LVTTL	LVDS	600	—	—	20	8	3.3
DS90LV028AQ-Q1	2	2	LVDS	LVTTL	400	—	—	9	8	3.3
DS90LV049Q-Q1	2	2	LVTTL, LVDS	LVTTL, LVDS	400	—	—	35	8	3.3
SN65LVDS050-Q1	2	2	LVDS, LVTTL	LVDS, LVTTL	400Tx/100Rx	1.7	3.7	20	12	3.3
SN65LVDS051-Q1	2	2	LVDS, LVTTL	LVDS, LVTTL	400	1.7	3.7	20	2	3.3
SN65LVDS180-Q1	1	1	LVDS, LVTTL	LVDS, LVTTL	400	1.7	3.7	12	2	3.3
Crosspoints										
DS10CP152Q-Q1	2	2	LVDS, LVPECL, CML	LVDS	1500	0.44	0.44	70	8	3.3
DS25CP102Q-Q1	2	2	LVDS, LVPECL, CML	LVDS	3125	0.365	0.365	90	8	3.3
DS25CP152Q-Q1	2	2	LVDS, LVPECL, CML	LVDS	3125	0.345	0.345	77	8	3.3
Multipoints										
SN65LVDM050-Q1	2	2	LVDM, LVTTL	LVDM, LVTTL	500	1.7	3.7	27	12	3.3
SN65LVDM051-Q1	2	2	LVDM, LVTTL	LVDM, LVTTL	500	1.7	3.7	27	12	3.3

FPD-Link II SERDES

Device	Pixel Clock (min) (MHz)	Pixel Clock (max) (MHz)	Supply Voltage	Color Depth (bpp)	Function	Input Compatibility	Output Compatibility	Total Throughput (Mbps)
DS90C124-Q1	5	35	3.3	18	Deserializer	FPD-Link II LVDS	LVCMOS	840
DS90C241-Q1	5	35	3.3	18	Serializer	LVCMOS	FPD-Link LVDS	840
DS90UR124-Q1	5	43	3.3	18	Deserializer	FPD-Link II LVDS	LVCMOS	1032
DS90UR241-Q1	5	43	3.3	18	Serializer	LVCMOS	FPD-Link LVDS	1032
DS90UR903Q-Q1	10	43	1.8	18	Serializer	LVCMOS	FPD-Link II LVDS	—
DS90UR904Q-Q1	10	43	1.8	18	Deserializer	FPD-Link II LVDS	LVCMOS	—
DS90UR905Q-Q1	5	65	1.8	24	Serializer	LVCMOS	FPD-Link II LVDS	1560
DS90UR906Q-Q1	5	65	1.8	24	Deserializer	FPD-Link II LVDS	LVCMOS	1560
DS90UR907Q-Q1	5	65	1.8	24	Serializer	FPD-Link LVDS	FPD-Link II LVDS	1560
DS90UR908Q-Q1	5	65	1.8	24	Deserializer	FPD-Link II LVDS	FPD-Link LVDS	1560
DS90UR910-Q1	10	75	1.8	24	Deserializer	FPD-Link II LVDS	CSI-2	1800
DS90UR916Q-Q1	5	65	—	24	Deserializer	FPD-Link II LVDS	LVCMOS	1560
DS99R124AQ-Q1	5	43	1.8	18	Deserializer	FPD-Link II LVDS	FPD-Link LVDS	—
DS99R124Q-Q1	5	43	1.8	18	Deserializer	FPD-Link II LVDS	FPD-Link LVDS	1200

Clocks

Device	V_{CC} (V)	V_{CC} Out (V)	Output Frequency (max) (MHz)	No. of PLLs	No. of Outputs	Cycle to Cycle Jitter (P-P)	Features
CDCE913-Q1	1.8	3.3	230	1	3	50 ps	I^2C, EEPROM, VCXO, spread-spectrum clocking
CDCE937-Q1	1.8	3.3	230	3	7	50 ps	I^2C, EEPROM, VCXO, spread-spectrum clocking
CDCS503-Q1	3.3	3.3	108	1	1	110 ps	Spread-spectrum clocking
CDCVF2505-Q1	3.3	3.3	200	1	4	150 ps	On-chip series damping resistor, automatic input clock detector

Interface

CAN/LIN, Digital Isolators, USB Switches and ESD Protection Selection Tables

Automotive CAN Transceivers

Device	Supply Voltage(s) (V)	Bus Fault Voltage (V)	Key Features	Pin/Package	ESD HBM (kV)
SN65HVDA540-5-Q1	4.68 to 5.33	–27 to 40	Low-power standby mode	8SOIC	±12
SN65HVDA540-Q1	4.68 to 5.33	–27 to 40	Low-power standby mode, I/O level shifting	8SOIC	±12
SN65HVDA541-5-Q1	4.68 to 5.33	–27 to 40	Low-power standby mode with bus wake	8SOIC	±12
SN65HVDA541-Q1	4.68 to 5.33	–27 to 40	Low-power standby mode with bus wake, I/O level shifting	8SOIC	±12
SN65HVDA542-5-Q1	4.68 to 5.33	–27 to 40	Silent mode	8SOIC	±12
SN65HVDA542-Q1	4.68 to 5.33	–27 to 40	Silent mode, I/O level shifting	8SOIC	±12
HVDA551-Q1	4.68 to 5.33	–27 to 40	Enhanced ESD and transient protection, low-power standby mode with bus wake, I/O level shifting	8SOIC	±12
HVDA553-Q1	4.68 to 5.33	–27 to 40	Enhanced ESD and transient protection, low-power standby mode with bus wake, common-mode bus stabilization output	8SOIC	±12
SN65HVDA1040A-Q1	4.75 to 5.25	–27 to 40	Low-power standby mode with bus wake, common-mode bus stabilization output	8SOIC	±12
SN65HVDA1050A-Q1	4.75 to 5.25	–27 to 40	Silent mode, common-mode bus stabilization output	8SOIC	±12

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

Automotive LIN

Device	Dominant State Timeout Protection	ESD LIN (HBM) (kV)	LIN Bus Wakeup Capable	LIN Voltage (min) (V)	LIN Voltage (max) (V)	Operating Voltage (min) (V)	Operating Voltage (max) (V)	Pin/Package	Spec Referenced
SN65HVDA100-Q1	Yes	12	Yes	–27	45	5	27	8SOIC	LIN 2.1, MOST ECL, K-Line ISO9141
SN65HVDA195-Q1	No	12	Yes	–40	40	7	27	8SOIC	LIN 2.1, MOST ECL, K-Line ISO9141
TPIC1021A-Q1	Yes	12	Yes	–40	40	7	27	8SOIC	LIN 2.0

Digital Isolators

Device	Number of Channels	Insulation Rating (V_{RMS})	Supply Voltage(s) (V)	Data Rate (Mbps)	Input Noise Filter
ISO721/2-Q1	1	2500	3.3, 5	100	Yes
ISO7220A/1A-Q1	2	2500	3.3, 5	1	Yes
ISO7231C-Q1	3	2500	3.3, 5	25	Yes
ISO7240CF/41C/42C-Q1	4	2500	3.3, 5	25	Yes
ISO7421/A-Q1	2	2500	3.3, 5	1	No
ISO7421E-Q1	2	2500	3.3,5	50	No

USB Switch

Device	Number of Channels	V_{CC} (min) (V)	V_{CC} (max) (V)	Bandwidth (MHz)	I_{CC} (max) (µA)	Pin/Package
TS3USB221A-Q1	2	2.3	3.6	900	30	10UQFN

ESD Solutions

Device	IEC 61000-4-2 Air Gap (kV)	IEC 61000-4-2 Contact (kV)	IO Capacitance (typ) (pF)	IO Leakage Current (nA)	IPP Amps (max)	Number of Channels	Supply Voltage(s) (V)	Pin/Package
SN65220-Q1	—	—	35	1000	—	2	3.3	6SOT-23
TPD2E001-Q1	15	8	1.5	1	5.5	2	—	5SOT
TPD4E001-Q1	15	8	1.5	1.5	5.5	4	—	6SOT-23

Interface

Analog Switches and Ethernet Selection Tables

Analog Switches

Device	Number of Channels	I_{CC} (µA)	r_{on}(max) (Ohms)	ON Time (max) (ns)	V_{CC} (min) (V)	V_{CC} (max) (V)	Voltage Nodes (V)
TS3A27518E-Q1	6	0.04	6.2	59	—	—	1.8, 2.5, 3.0, 3.3
TS5A2066-Q1	2	—	15	6.4	1.65	5.5	—
TS5A23157-Q1	2	10	10	5.7	1.65	5.5	1.8, 2.5, 3.3, 5.0
TS5A3159-Q1	1	0.01	1.1	35	1.65	5.5	1.8, 2.5, 3.0, 3.3, 5.0
TS5A3357-Q1	1	1	7	6.5	1.65	5.5	1.8, 2.5, 3.3, 5.0

10/100 Ethernet PHY

Device	Port Count	Supply Voltage	Interface	Pin/Package
DP83848Q-Q1	Single	3.3	MII, RMII	40WQFN

RS-232

Device	ESD HBM (kV)	I_{CC} (max) (mA)	Main Supply Voltage (nom) (V)	Numeric Price for Sort	Operating Temperature Range (°C)	Pin/Package
MAX3232E-Q1	15	1	3.3, 5	1.1	–40 to 85	16TSSOP
MAX3238-Q1	15	2	3.3, 5	1.35	–40 to 85	28SSOP, 28TSSOP
SN65C3221-Q1	15	1	3.3, 5	1.4	–40 to 85	16TSSOP
TRS3223-Q1	15	1	3.3, 5	1.3	–40 to 125	20TSSOP
TRS3232E-Q1	15	1	3.3, 5	1.1	–40 to 125	16TSSOP

RS-485

Device	Duplex	Supply Voltage(s) (nom) (V)	Signaling Rate (Mbps)	Common-Mode Range	Fail-Safe	I_{CC} (max) (mA)	Number of Rx	Number of Tx	Number of Nodes	ESD (kV)	Pin/Package
SN65HVD1781-Q1	Half	3.3 to 5	1	–7 to 12	Idle, Open, Short	6	1	1	320	16	8SOIC
SN65LBC176-Q1	Half	5	10	–7 to 12	Open	1.75	1	1	32	12	8SOIC
SN65LBC180-Q1	Full	5	30	–7 to 12	Open	5	1	1	32	15	14SOIC

Voltage Translation

Device	Number of Bits	V_{CC} Range (V)	V_{CCA}_Min (V)	V_{CCA}_Max (V)	V_{CCB}_Min (V)	V_{CCB}_Max (V)	t_{pd} (max) (ns)	Pin/Package
Auto Direction Sensing Translators								
TXB0104-Q1	4	1.2 to 5.5	1.2	3.6	1.65	5.5	1, 5.5, 5.8	14TSSOP, 14VQFN
TXB0106-Q1	6	1.2 to 3.6 (A-port), 1.65 to 5.5 (B-port)	1.2	3.6	1.65	5.5	—	16TSSOP
Directional Control Translators								
SN74AVC16T245-Q1	16	1.2 to 3.6	1.2	3.6	1.2	3.6	5	48TVSOP
SN74AVC2T45-Q1	2	1.2 to 3.6	1.2	3.6	1.2	3.6	2.4	8US8
SN74AVC4T245-Q1	4	1.2 to 3.6	1.2	3.6	1.2	3.6	2.9	16VQFN
SN74AVC8T245-Q1	8	1.2 to 3.6	1.2	3.6	1.2	3.6	2.5	24QFN, 24TSSOP
SN74AVCB164245-Q1	16	1.4 to 3.6	1.4	3.6	1.4	3.6	7.6	48TSSOP
SN74LVC1T45-Q1	1	1.65 to 5.5	1.65	5.5	1.65	5.5	3.9	6SC70
SN74LVC2T45-Q1	2	1.65 to 5.5	1.65	5.5	1.65	5.5	3.9	8US8
SN74LVC4245A-Q1	8	Split Rail	—	—	—	—	11	—
SN74LVC8T245-Q1	8	1.65 to 5.5	1.65	5.5	1.65	5.5	8.2	24TSSOP

Interface
Sensors Selection Tables

Temperature Sensors

Part Number	Description	Part Type	Local Sensor Accuracy (max) (±°C)	Interface	Supply Current (typ) (µA)	Shutdown	Pin/Package	Price*
LM60-Q1	Automotive 2.7-V, SOT-23 or TO-92 temperature sensor	Analog	2	Analog	125	No	3SOT-23	0.36
TMP101-Q1	Automotive catalog digital temperature sensor with I^2C serial interface, prog. thermostat/alarm function	Digital	2	I^2C	45	Yes	6SOT-23	0.95
TMP102-Q1	Low-power digital temperature sensor with SMBus/ two-wire serial interface in SOT563	Digital	2	I^2C	10	Yes	6SOT	0.6
TMP411-Q1	Automotive catalog ±1°C remote and local temperature sensor with n-factor and series resistance	Remote	2.5	SMBus	400	Yes	8VSSOP	0.53
TMP451-Q1	Remote and local temperature sensor with n-factor correction	Remote	1	I^2C, SMBus	35	Yes	8WSON	0.52
LM26LV-Q1	Automotive 1.6-V, LLP-6 factory preset temperature switch and temperature sensor	Switch	2.3	Analog	8	—	6WSON	0.47
TMP300-Q1	Automotive catalog 1.8-V, resistor-programmable temperature switch and analog-out temperature sensor	Switch	—	Analog	110	—	6SC70	0.9

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

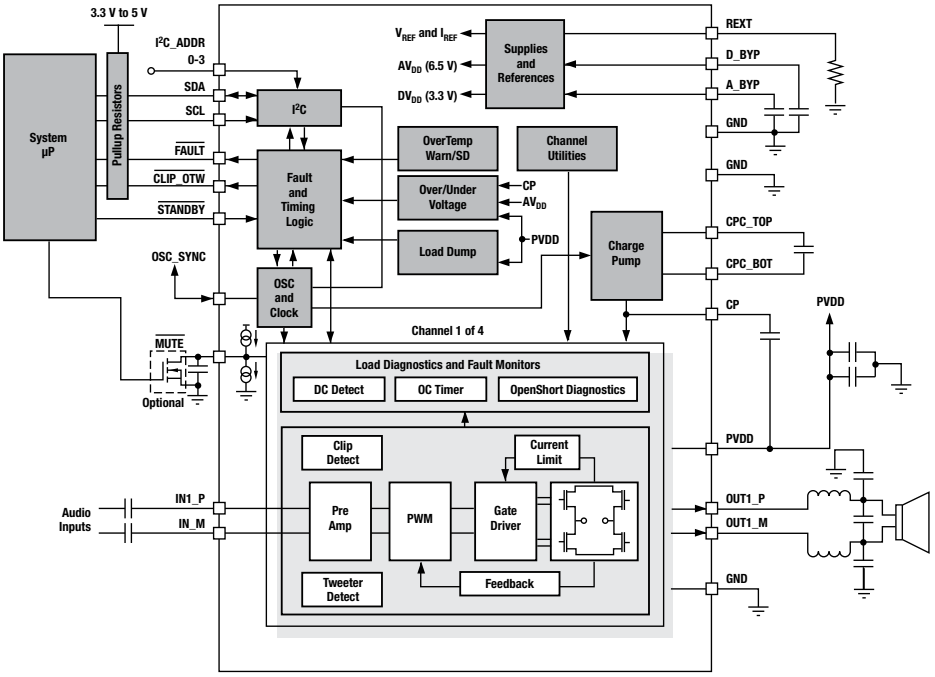
Current Sense Amplifiers

Part Number	Description	Part Type	Common-Mode Voltage Range	Iq (max) (mA)	Small-Signal Bandwidth (typ) (MHz)	Input Offset (±) (max) (µV)	Input Offset Drift (±) (typ) (µV/°C)	Gain (V/V)	Gain Error (%)	Pin/Package	Price*
INA19xA-Q1	Automotive catalog -16-V to 80-V common-mode range current shunt monitors	Analog voltage output	–16 to 80	1.05	0.2 to 0.5	2000	2.5	20 to 100	2	5SOT-23	0.95
INA21x-Q1	Voltage output, high- or low-side measurement, bidirectional, zero-drift current shunt monitor	Analog voltage output	–0.3 to 26	0.115	0.004 to .014	35 to 100	0.1	50 to 1000	0.02	6SC70	0.76
INA220B-Q1	Automotive catalog bidirectional current/power monitor with I^2C interface	Digital output	0 to 26	1	0.011	50	0.16	1, 0.5, 0.25, 0.125	0.2	10VSSOP	1.15
INA28x-Q1	Automotive catalog wide common-mode range, bidirectional, high-accuracy current shunt monitor	Analog voltage output	–14 to 80	0.9	0.002 to 0.01	70	0.3	50 to 1000	0.4	8SOIC	1.5
LMP8278Q-Q1	LMP8278Q high common-mode, 14x gain, precision current sensing amplifier	Analog voltage output	–2 to 40	0.55	0.09	2000	2.5	14	0.5	8VSSOP	0.75
LMP8601-Q1	60-V common-mode, bidirectional precision current sensing amplifier	Analog voltage output	–22 to 60	1.5	0.06	1000	2	20, 50, 100	0.5	8SOIC	1.76

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

Four-Channel Automotive Digital Amplifier
TAS5414C-Q1

The TAS5414C-Q1 is a four-channel digital audio amplifier designed for use in automotive head units and external amplifier modules. The device provides four channels at 23 W continuously into 4 Ω at less than 1 percent THD+N from a 14.4-V supply. Each channel can also deliver 38 W into 2 Ω at 1percent THD+N. The digital PWM topology of the device provides dramatic improvements in efficiency over traditional linear amplifier solutions. This reduces the power dissipated by the amplifier by a factor of 10 under typical music playback conditions. The device incorporates all the functionality needed to perform in the demanding OEM applications area. The device has built-in load diagnostic functions for detecting and diagnosing misconnected outputs to help reduce test time during the manufacturing process.



Functional block diagram.

Key Features

- Four-channel digital power amplifier
- Four analog inputs, four BTL power outputs
- Typical output power at 10% THD+N
- Channels can be paralleled (PBTL) for high-current applications
- THD+N <0.02%, 1 kHz, 1 W into 4 Ω
- Patented pop- and click-reduction technology
  - Soft muting with gain ramp control
  - Common-mode ramping
- Patented AM interference avoidance
- Patented cycle-by-cycle current limit
- 75-dB PSRR
- Four-address I²C serial interface for device configuration and control
- Channel gains: 12 dB, 20 dB, 26 dB, 32 dB
- Designed for automotive EMC requirements

Get more information: **www.ti.com/product/TAS5414C-Q1**

Data Converters/Audio

Digital Amplifiers Selection Tables

ADCs

Device	Resolution (Bits)	Architecture	Sample Rate (max) (SPS)	Number of Input Channels	Interface	Power Consumption (typ) (mW)	DNL (max) (LSB)	INL (max) (LSB)	Analog Voltage AV/DD (min) (V)	Analog Voltage AV/DD (max) (V)	Digital Supply (min) (V)	Digital Supply (max) (V)
High-Speed ADCs												
ADC08B200-Q1	8	—	200 MSPS	1	Parallel CMOS	543	0.4	0.55	3	3.6	2.7	3.6
ADC10040-Q1	10	Pipeline	40 MSPS	1	—	55.5	0.3	0.3	2.7	3.6	2.5	3.6
ADS5204-Q1	10	Pipeline	40 MSPS	2	—	275	1	1.5	0	3.6	0	3.6
TLV5535-Q1	8	Pipeline	35 MSPS	1	—	106	2.4	2.4	3	—	3	3.6
AMC1204-Q1	16	Delta-Sigma, Modulator	78 kSPS	1	Serial	88	1	9	4.5	5.5	3	5.5
Precision ADCs												
ADC101S051-Q1	10	SAR	500 kSPS	1	Serial SPI, QSPI, Microwire (Serial I/O)	2.7	—	0.7	2.7	5.25	—	—
ADC104S021Q-Q1	10	SAR	200 kSPS	4	Serial SPI, QSPI, Microwire (Serial I/O)	1.94	—	–0.4,+0.3	2.7	5.25	2.7	5.25
ADC121C021-Q1	12	SAR	189 kSPS	1	Serial I^2C	0.26	—	1	2.7	5.5	2.7	5.25
ADC121S101-Q1	12	SAR	1 MSPS	1	Serial SPI, QSPI, Microwire (Serial I/O)	2	—	1	2.7	5.25	2.7	5.25
ADC122S051Q-Q1	12	SAR	500 kSPS	2	Serial SPI, QSP, Microwire (Serial I/O)	3	—	1.1	2.7	5.25	2.7	5.25
ADC128S052-Q1	12	SAR	500 kSPS	8	Serial SPI, QSPI, Microwire (Serial I/O)	1.6	—	1	2.7	5.25	2.7	5.25
ADS1000-Q1	12	Delta-Sigma	128 SPS	1	Serial I^2C	0.21	—	0.1	2.7	5.5	2.7	5.5
ADS1015-Q1	12	Delta-Sigma	3.3 kSPS	4	Serial I^2C	—	—	—	2	5.5	—	—
ADS1115-Q1	16	Delta-Sigma	860 SPS	4	Serial I^2C	0.36	—	1	2	5.5	2	5.5
ADS7822-Q1	12	SAR	200 kSPS	1	Serial SPI	0.6	0.75	—	2.7	5.25	2.7	5.25
ADS7828-Q1	—	SAR	50 kSPS	8	Serial I^2C	0.675	1	—	2.7	5.25	2.7	5.25
ADS7841-Q1	12	SAR	200 kSPS	4	Serial SPI	0.84	2	1	2.7	5.25	2.7	5.25
ADS7955-Q1	10	SAR	1 MSPS	8	Serial SPI	11.5	0.5	0.5	2.7	5.25	1.7	5.25
ADS8344-Q1	—	—	—	—	—	—	—	—	—	—	—	—
TLC2543-Q1	12	SAR	66 kSPS	11	Serial SPI	5	1	1	4.5	5.5	4.5	5.5
TLV1548-Q1	10	SAR	85 kSPS	8	Serial SPI	—	1	1	2.7	5.5	2.7	5.5
TLV2553-Q1	12	SAR	200 kSPS	11	Serial SPI	2.43	1	1	2.7	5.5	2.7	5.5

DACs

Device	Resolution (Bits)	Architecture	Sample Update Rate (MSPS)	Interface	Power Consumption (typ) (mW)	DNL (max) (±LSB)	INL (max) (±LSB)
High-Speed DACs							
DAC900-Q1	10	Current Source	200	Parallel CMOS	170	0.5	1
Precision DACs							
DAC101S101-Q1	10	String	—	Serial SPI	0.63	0.35	2.8
DAC104S085-Q1	10	String	—	Serial SPI	1.1	0.35	2
DAC121S101-Q1	12	String	—	Serial SPI	0.64	1	8
DAC5311-Q1	8	String	—	Serial SPI	—	0.25	0.25
DAC7551-Q1	12	String	0.5	Serial SPI	0.27	0.5	1
DAC8562-Q1	16	—	—	Serial SPI	0.5	1	12

Class-D Audio Amplifiers

Device	Output Power (W)	Supply (min)	Supply (max)	Half Power THD + N @ 1 kHz (%) (kHz)	Iq per Channel (mA)	ISD (µA)	PSRR (dB)
TPA2000D1-Q1	2	2.7	5.5	0.2	4	0.05	77
TPA2005D1-Q1	1.18	2.5	5.5	0.2	2.8	0.5	75

Class-AB Audio Amplifiers

Device	Output Power (W)	Supply (min)	Supply (max)	Half Power THD + N @ 1 kHz (%) (kHz)	Iq per Channel (mA)	ISD (µA)	PSRR (dB)
LM48100Q-Q1	2.4	3	5	0.04	4.4	0.01	74
TPA6211A1-Q1	3.1	2.5	5.5	0.02	4	0.01	85

Data Converters/Audio

Digital Amplifiers and Codecs Selection Tables

Mid- to High-Power Amplifiers

Device	Max. Number of Speaker Outputs	Min. Supported Bridge-Tied Load	Min. Supported Parallel Bridge-Tied Load	Max. Power to Bridge-Tied Load	Max. Power to Parallel Bridge-Tied Load	Power Stage Supply (Min) (V)	Power Stage Supply (Max) (V)	Pin/Package
TAS5412-Q1	2	2	1	70	116	6	26.5	64HTQFP
TAS5414B-Q1	4	2	1	70	116	6	26.5	36HSSOP, 64HTQFP
TAS5414C-Q1	4	2	1	70	116	6	26.5	64HTQFP
TAS5424B-Q1	4	2	1	70	116	6	26.5	44HSSOP
TAS5514B-Q1	4	2	1	70	116	6	26.5	36HSSOP
TPA3110D2-Q1	2	4	4	26	40	8	26	28HTSSOP
TPA3111D1-Q1	1	4	—	10	—	8	26	28HTSSOP
TPA3112D1-Q1	1	4	—	25	—	8	26	28HTSSOP

Sample Rate Converters

Device	Number of SRC Channels	Control Interface	Control Mode	Digital Audio Interface	Digital Supply (up to 5 V) (V)	Dynamic Range (dB)	Power Supply (V)	Sampling Rate (max) (kHz)	THD+N (dB)
SRC4190-Q1	2	H/W	H/W	I^2S, R, L, TDM	3 to 3.6	128	3.3	212	–125

Analog-to-Digital

Device	Number of ADCs	Resolution (Bits)	Sampling Rate (max) (kHz)	ADC SNR (typ) (dB)	Digital Audio Interface	Control Interface	Power Consumption (typ) (mW)	Analog Voltage AV/DD (min) (V)	Analog Voltage AV/DD (max) (V)
PCM1804-Q1	2	24	192	112	L, R, I^2S, DSP	H/W	225	—	5.25
PCM1808-Q1	2	24	96	99	L, I^2S	H/W	62	4.5	5.5
TLV320ADC3101-Q1	2	24	96	92	L, R, I^2S, DSP, TDM, PCM	I^2C	17	2.7	3.6

Digital-to-Analog

Device	Number of DACs	Number of Inputs/ Outputs	Resolution (Bits)	Sampling Rate (max) (kHz)	DAC SNR (typ) (dB)	Digital Audio Interface	Control Interface	Power Consumption (typ) (mW)	Analog Voltage AV/DD (min) (V)	Analog Voltage AV/DD (max) (V)
PCM1602-Q1	6	0/6	—	—	—	—	SPI	171	4.5	5.5
PCM1608-Q1	—	0/8	—	—	—	—	SPI	—	4.5	5.5
PCM1681-Q1	8	0/8	24	200	105	L, R, I^2S, TDM, DSP	SPI, I^2C, H/W	386	4.5	5.5
PCM1690-Q1	8	0/8	24	192	113	L, R, I^2S, TDM, DSP	SPI, I^2C, H/W	558	4.5	5.5
PCM1753-Q1	2	0/2	24	192	106	L, R, I^2S	SPI	80	4.5	5.5
PCM1754-Q1	2	0/2	24	192	106	R, I^2S	H/W	80	4.5	5.5
PCM1789-Q1	2	0/2	24	192	113	L, R, I^2S, DSP	SPI, I^2C, H/W	154	4.5	5.5
PCM5100-Q1	2	0/2	32	384	100	L, I^2S	HW	59.4	3	3.6
PCM5102-Q1	2	0/2	32	384	112	L, I^2S	HW	59.4	3	3.6

*Preview products are listed in **bold teal**.*

Codecs

Device	Number of ADCs (typ)	Number of DACs	Number of Digital Audio Interfaces	Resolution (Bits)	Sampling Rate (max) (kHz)	ADC SNR (typ) (dB)	DAC SNR (typ) (dB)	Digital Audio Interface	Control Interface	Power Consumption (typ) (mW)	Analog Voltage AV/DD (min) (V)	Analog Voltage AV/DD (max) (V)	Digital Supply DV/DD (min) (V)	Digital Supply DV/DD (max) (V)
PCM3168A-Q1	6	8	4	24	192	107	112	R, L, I^2S, TDM, DSP	I^2C, SPI, H/W	1160	4.5	5.5	3	3.6
TLV320AIC23B-Q1	1	1	1	24	96	90	100	L, R, I^2S, DSP	SPI, I^2C	23	2.7	3.6	1.42	1.95
TLV320AIC3104-Q1	2	2	1	—	96	92	102	L, R, I^2S, DSP, TDM	I^2C	14	2.7	3.6	—	—
TLV320AIC3106-Q1	2	2	1	24	96	92	102	L, R, I^2S, DSP, TDM	SPI, I^2C	14	2.7	3.6	1.65	1.95
TLV320AIC3254-Q1	2	2	1	32	192	93	100	L, R, I^2S, TDM, DSP	SPI, I^2C	4.1	1.5	3.6	1.26	3.6

Data Converters/Audio

Secure IC Transponders Selection Tables

Secure IC Transponders

Device	Supply Voltage (V_{dc})	Encryption	Number of Channels	EPROM (KB)	Communication Interface	Data Rate (Max) (kbps)	Frequency	Standby Current (µA)
CC1101-Q1	—	—	1	—	SPI	250	310-928 MHz (3)	0.7
CC1131-Q1	—	—	1	—	SPI	250	310-928 MHz (3)	0.7
CC1151-Q1	—	—	1	—	SPI	250	310-928 MHz (3)	0.7
TMS3705	4.5 to 5.5	—	1	—	I/O Logic	8	134.2 kHz	—
TMS37126	2.0 to 3.6 V	DST80	3	0.2	SPI	8	134.2 kHz	3.9
TMS37145	—	DST80	1	0.1	—	8	134.2 kHz	0
TMS37F128	2.0 to 3.6 V	DST80	3	0.2	I/O	8	134.2 kHz	4
TMS37F158	2.0 to 3.6 V	DST80	1	0.2	I/O	8	134.2 kHz	0.3

Sensor AFEs

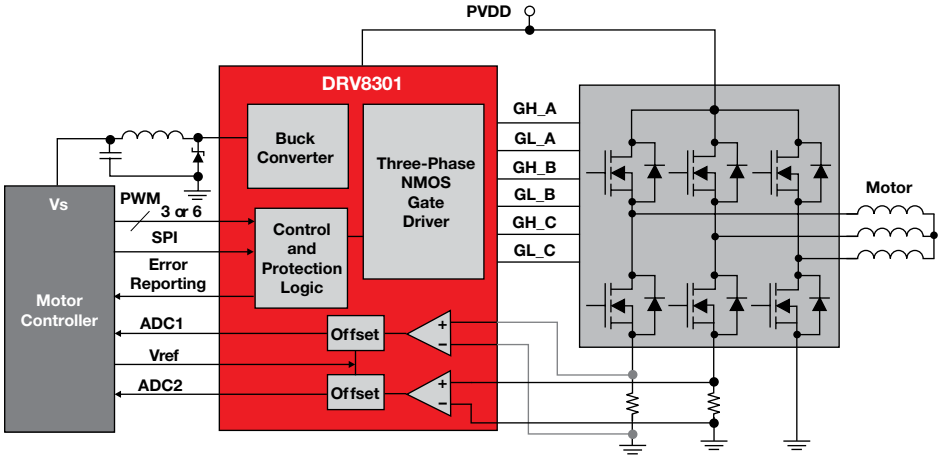
Device	Resolution (Bits)	Number of Input Channels	Integrated Features	Interface	Operating Temperature Range (°C)	Sample Rate (max) (SPS)	Pin/Package
AFE5401-Q1	12	4	LNA, EQ, PGA, AAF, ADC	Serial SPI	–40 to 105	25000	64VQFN
LMP90080-Q1	16	7	Continuous background calibration, current sources (iDACs), PGA	Serial SPI	–40 to 105	214	28HTSSOP

*Preview products are listed in **bold teal**.*

Three-Phase Brushless Motor Pre-Driver

DRV8301-Q1

The DRV8301-Q1 is an automotive gate driver IC for three-phase motor drive applications. It provides three half-bridge drivers, each capable of driving two N-type MOSFETs, one for the high side and one for the low side. It supports up to 2.3-A sink and 1.7-A source peak current capability and only needs a single power supply with a wide range from 6 V to 60 V. The DRV8301-Q1 uses bootstrap gate drivers with trickle-charge circuitry to support 100 percent duty cycles. The gate driver uses automatic handshaking when high-side FET or low-side FET is switching to prevent current shoot-through. Vds of FETs is sensed to protect the external power stage during overcurrent conditions.



Functional block diagram.

Get more information: **www.ti.com/product/DRV8301**

Key Features

- Integrated three-phase gate driver with dual current-shunt amplifiers and buck converter for MCU or system power needs
- Wide input-voltage range (6 V to 60 V)
- Supports up to 1.7-A gate current
- Intelligent gate drive and cross-conduction prevention
- Overcurrent (OC) protection of external FETs with programmable cycle-by-cycle current limit
- SPI interface for programmability
- Automotive qualified: –40°C to +125°C ambient temperature operating range

Benefits

- Reduced board space and improved performance
- Automatic handshake of high-side and low-side FET transition to prevent shoot-through, simplify gate control, and improve system reliability
- External FETs improve thermal performance and efficiency and can easily scale to support both low- and high-current platforms

Motor Drivers

Device	Motor Type	Description	Supply Voltage (V)	I_{OUT} Cont (A)	Control Interface	Price*
DRV8801-Q1	Brushed DC	2.8-A peak-brushed DC motor driver with current-sense pin	8 to 38	1.5	Phase enable	1.50
DRV8823-Q1	Brushed DC stepper	1.5-A quad-brushed DC/dual stepper motor driver	8 to 32	1.5	Serial	2.34
DRV8832-Q1	Brushed DC	1-A peak-brushed DC motor driver with inrush current protection	2.75 to 6.8	1	IN/IN	1.00
DRV8301-Q1	Brushed or brushless DC	Pre-driver with 1.5-A step-down voltage regulator and dual current-sense amps (SPI MGMT I/F)	6 to 60	Ext. FETs	PWM	3.00

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

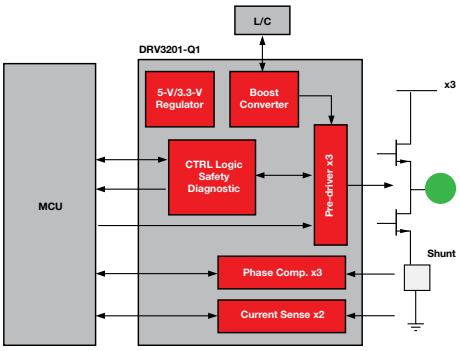
Motor Drivers

Motor Drivers for Functional Safety Applications

The Industry's First Automotive Motor Driver Family Meeting the Functional Safety Requirements of ISO 26262

DRV32xx

- Devices help customers design applications to meet the functional safety requirements of ISO 26262: the DRV3201-Q1 can help TI customers design critical-safety applications, such as electric power steering and electric braking systems, to meet ASIL-D requirements, and the DRV3203-Q1 and DRV3204-Q1 can help customers design safety applications, such as oil pump and water pump, to meet ASIL-B requirements.
- Design simplicity for start-stop and cold-crank applications: with an integrated boost regulator, the DRV3201-Q1 eliminates the need for a large capacitor to hold battery voltage. With an integrated low dropout (LDO) linear regulator and an external FET, the DRV3203-Q1 and DRV3204-Q1 also eliminate the need for a large capacitor or external boost regulator. This integration simplifies design and speeds up development time.
- Optimized component count and board space for cost- and space-sensitive applications: the DRV3202-Q1 integrates a voltage regulator and CAN interface to reduce component count and minimize system cost and board space.



Functional block diagram.

Key Features

- Three-phase pre-FET drivers
- Programmable 140-mA to 1-A gate-current drive
- Gate driver with low-supply voltage operation, with integrated boost converter
- Two modes of gate drivers:
  - Direct mode (6x inputs)
  - PWM mode to 20 kHz, 100% duty operation (3x inputs)
- High-accuracy current-sense amplifiers (two channel)
- Real-time phase comparator (three channel)
- Shoot-through protection
- Pre-FET driver short-circuit protection
- Over/undervoltage protection
- Overtemperature warning and shutdown
- AEC-Q100 grade 1 (–40°C to 125°C)
- Operating supply voltage: 4.75 V to 30 V
- 3.3-V to 5-V MCU interface
- –7-V to 40-V tolerance for all FET driver pins
- Logic functional down to 3 V
- Package: 64-pin HTQFP PowerPad™

DRV32xx Product Overview

Function	DRV3201-Q1	DRV3204-Q1	DRV3203-Q1	DRV3210-Q1	DRV3202-Q1	DRV3211-Q1
Gate Driver Stage	140 mA to 1 A programmable current sources	1-A gate driver switches	1-A gate driver switches	1-A gate driver switches	1-A gate driver switches	1-A gate driver switches
Current Sense Amplifiers	2 ch, low side	1 ch, high side	1 ch, high side	1 ch, high side	1 ch, high side	1 ch, high side
Short Protecting	VDC	High-side overcurrent, phase comparator	High-side overcurrent, phase comparator	High-side overcurrent, phase comparator	High-side overcurrent, phase comparator	High-side overcurrent, phase comparator
Watchdog	No watchdog for MCU	Pulse, WD input	Pulse, WD input	Pulse, WD input	Pulse, WD input	Pulse, WD input
Phase Comparators	3	3	3	3	3	3
Voltage Monitoring	VDDIO and ADCREF not monitored for UV/OV	VB, VCC5	VB, VCC3	VB, VCC5	VB, VCC5	VB, VCC5
Others	ASIL-D system target	5-V MCU LDO	3.3-V MCU LDO	5-V low-power MCU LDO	CAN, 5-V MCU LDO	5-V MCU LDO
Maximum Supply Voltage	40	40	40	40	40	40
Maximum Operations Temperature	Ta = 125°C	Ta = 125°C Ta = 150°C option	Ta = 125°C Ta = 150°C option	Ta = 125°C	Ta = 125°C	Ta = 125°C
Package	64-pin HTQFP PowerPad	48-pin HTQFP PowerPad	48-pin HTQFP PowerPad	48-pin HTQFP PowerPad	80-pin HTQFP PowerPad	80-pin HTQFP PowerPad

Get more information: **www.ti.com/automotordriver**

Motor Drivers

Motor Drivers for Functional Safety Applications

The Industry's First Automotive Motor Driver Family Meeting the Functional Safety Requirements of ISO 26262

DRV32xx

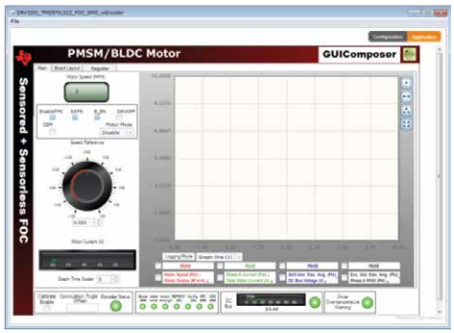
DRV3201 Development Tools

DRV3201EVM ($499)

- The Texas Instruments DRV3201 evaluation module (DRV3201EVM) helps designers evaluate the operation and performance of the DRV3201-Q1 bridge driver for electronic power-steering applications. The DRV3201EVM can accept many TI microcontroller unit (MCU) control cards. The device with the MCU offers configurability and can turn a motor via a graphical user interface (GUI).

Features

- Maximum 1-A (programmable) pre-drive with 2x internal programmable gain amplifiers for shunt current sensing
- Operating supply voltage: 4.75 V to 30 V
- 5-V step-down converter (2.5 A) and 3.3-V LDO (400 mA)
- Six N-channel MOSFETs
- Isolated 5-V controller area network (CAN) transceiver
- Sockets for sensor input



DRV32xx Motor Drivers

Device	Motor Type	Description	I_{OUT}	Supply Voltage	Control Interface	Price*
DRV3201-Q1	3-phase brushless	VDS monitoring, sleep mode, over and undervoltage protection, 3-phase comparator, shoot-through protection, failure detection	—	4.75 to 38	6x direct predriver control inputs, SPI	2.63
DRV3202-Q1	3-phase brushless	CAN, 3-phase comparator, shoot-through protection, failure detection, watchdog timer, over and undervoltage protection	—	5.3 to 18	SPI	3.8
DRV3203-Q1	3-phase brushless	3-phase comparator, shoot-through protection, failure detection, watchdog timer, over and undervoltage protection, sleep mode	—	5.3 to 28.5	SPI	2.1
DRV3203E-Q1	3-phase brushless	3-phase comparator, shoot-through protection, failure detection, watchdog timer, over and undervoltage protection, sleep mode	—	5.3 to 26.5	SPI	—
DRV3204-Q1	3-phase brushless	3-phase comparator, shoot-through protection, failure detection, watchdog timer, over and undervoltage protection, sleep mode	—	5.3 to 26.5	SPI	—
DRV3204E-Q1	3-phase brushless	3-phase comparator, shoot-through protection, failure detection, watchdog timer, over and undervoltage protection, sleep mode	—	5.3 to 26.5	SPI	—
DRV3210-Q1	3-phase brushless	3-phase comparator, shoot-through protection, failure detection, watchdog timer, over and undervoltage protection, sleep mode	—	5.3 to 28.5	SPI	2.1
DRV3211-Q1	3-phase brushless	3-phase comparator, shoot-through protection, failure detection, watchdog timer, over and undervoltage protection, sleep mode	—	5.3 to 18	SPI	3.8

Suggested resale price in U.S. dollars in quantities of 1,000. Preview products are listed in **bold teal.*

Get more information: **www.ti.com/automotordriver**

32-Bit Real-Time Control C2000™ Microcontrollers

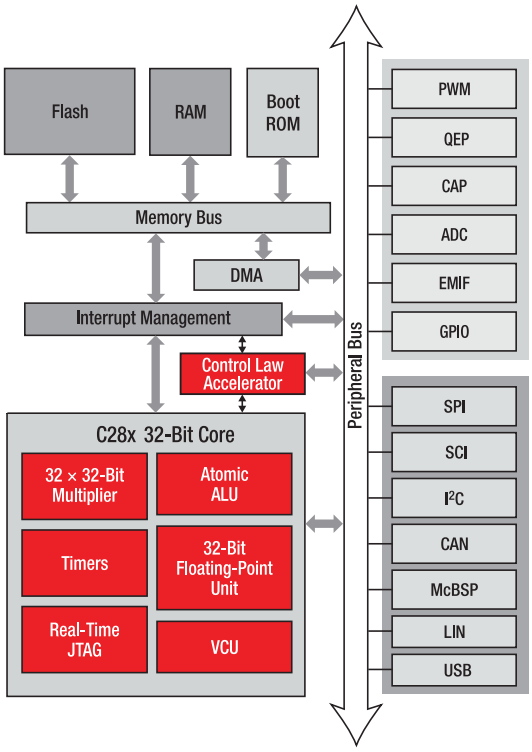
C2000 MCUs

C2000 MCUs are designed specifically for control applications. Using application experience combined with processing know-how, the C2000 MCU platform series is made for power electronics system designers. C2000 MCUs are different in three key areas: performance, peripherals and application expertise.

The C2000 architecture is based on DSP fundamentals with single cycle instructions and fast interrupt servicing. Yet we've added specific differentiation hooks such as dual-core architectures and signal processing acceleration. These hooks enable both added performance for real-time control applications as well as differentiated control architectures for power electronics applications.

The C2000 MCU is known for its robust peripherals. C2000 PWMs are industry-leading with very flexible waveform generation, high-resolution duty-cycle control, high-resolution deadband generation, 12-bit ADCs and analog integration with application-specific hooks. C2000 peripherals are very powerful for running fast, flexible and efficient control loops.

The C2000 MCU has a wealth of experience and knowledge in power electronics applications such as motor control, digital power supplies, solar inverters, power line communications, and more. We extend this expertise back to our devices and to customers' systems with application-specific developer's kits and application-tuned software libraries. These libraries and hardware reference designs enable designers to rapidly develop differentiated products in a competitive landscape.



Functional block diagram.

Get more information: **www.ti.com/product/C2000**

Microcontrollers/Embedded Processors

Real-Time Control C2000™ Microcontrollers Selection Table

C2000™ Microcontrollers

Device	Frequency (MHz)	OTP RPM (KB)	RAM (KB)	Flash (KB)	Flash (Words)	Total On-Chip Memory (KB)	PWM (Ch)	Timers	SPI	LIN	CAN	I²C	UART (SCI)	GPIO	Core Supply (V)	I/O Supply (V)	Peak MMACS	Pin/ Package
Piccolo™ Microcontrollers																		
TMS320F28022	50	2	12	32	16 K	46	9	13	1	—	—	1	1	22	3.3	3.3	50	38TSSOP, 48LQFP
TMS320F28023	50	2	12	64	32 K	78	9	13	1	—	—	1	1	22	3.3	3.3	50	38TSSOP, 48LQFP
TMS320F28026	60	2	12	32	16 K	46	9	13	1	—	—	1	1	22	3.3	3.3	60	38TSSOP, 48LQFP
TMS320F28027	60	2	12	64	32 K	78	9	13	1	—	—	1	1	22	3.3	3.3	60	38TSSOP, 48LQFP
TMS320F28030	60	2	12	32	16 K	46	15	16	2	1	1	1	1	45	3.3	3.3	60	64TQFP, 80LQFP
TMS320F28031	60	2	16	64	32 K	82	15	16	2	1	1	1	1	45	3.3	3.3	60	64TQFP, 80LQFP
TMS320F28032	60	2	20	64	32 K	86	17	16	2	1	1	1	1	45	3.3	3.3	60	64TQFP, 80LQFP
TMS320F28033	60	2	20	64	32 K	86	17	16	2	1	1	1	1	45	3.3	3.3	60	64TQFP, 80LQFP
TMS320F28034	60	2	20	128	64 K	150	17	16	2	1	1	1	1	45	3.3	3.3	60	64TQFP, 80LQFP
TMS320F28035	60	2	20	128	64 K	150	17	16	2	1	1	1	1	45	3.3	3.3	60	64TQFP, 80LQFP
TMS320F28050	60	2	12	32	16 K	46	15	16	1	—	1	1	3	42	3.3	3.3	60	80LQFP
TMS320F28051	60	2	16	64	32 K	82	15	16	1	—	1	1	3	42	3.3	3.3	60	80LQFP
TMS320F28052	60	2	20	64	32 K	86	15	16	1	—	1	1	3	42	3.3	3.3	60	80LQFP
TMS320F28053	60	2	20	64	32 K	86	15	16	1	—	1	1	3	42	3.3	3.3	60	80LQFP
TMS320F28054	60	2	20	128	64 K	150	15	16	1	—	1	1	3	42	3.3	3.3	60	80LQFP
TMS320F28055	60	2	20	128	64 K	150	15	16	1	—	1	1	3	42	3.3	3.3	60	80LQFP
TMS320F28062	90	2	52	128	64 K	182	19	16	2	—	1	1	2	54	3.3	3.3	90	80HTQFP, 100HTQFP
TMS320F28063	90	2	68	128	64 K	198	19	16	2	—	1	1	2	54	3.3	3.3	90	80HTQFP, 100HTQFP
TMS320F28064	90	2	100	128	64 K	230	19	16	2	—	1	1	2	54	3.3	3.3	90	80HTQFP, 100HTQFP
TMS320F28065	90	2	100	128	64 K	230	19	16	2	—	1	1	2	54	3.3	3.3	90	80HTQFP, 100HTQFP
TMS320F28066	90	2	68	256	128 K	326	19	16	2	—	1	1	2	54	3.3	3.3	90	80HTQFP, 100HTQFP
TMS320F28067	90	2	100	256	128 K	358	19	16	2	—	1	1	2	54	3.3	3.3	90	80HTQFP, 100HTQFP
TMS320F28068	90	2	100	256	128 K	358	19	16	2	—	1	1	2	54	3.3	3.3	90	80HTQFP, 100HTQFP
TMS320F28069	90	2	100	256	128 K	358	19	16	2	—	1	1	2	54	3.3	3.3	90	80HTQFP, 100HTQFP
InstaSPIN-FOC and -MOTION																		
TMS320F28026F	60	2	6	32	16 K	40	9	9	1	—	—	1	1	22	3.3	3.3	60	48LQFP
TMS320F28027F	60	2	6	32	16 K	40	9	9	1	—	—	1	1	22	3.3	3.3	60	48LQFP
TMS320F28062F	90	2	48	128	64 K	178	15	12	2	—	1	1	2	40	3.3	3.3	90	80HTQFP
TMS320F28068F	90	2	96	256	128 K	354	15	12	2	—	1	1	2	40	3.3	3.3	90	80HTQFP
TMS320F28068M	90	2	96	256	128 K	354	15	12	2	—	1	1	2	40	3.3	3.3	90	80HTQFP
TMS320F28069F	90	2	96	256	128 K	354	15	12	2	—	1	1	2	40	3.3	3.3	90	80HTQFP
TMS320F28069M	90	2	96	256	128 K	354	15	12	2	—	1	1	2	40	3.3	3.3	90	80HTQFP

Microcontrollers/Embedded Processors

Real-Time Control C2000™ Microcontrollers Selection Table

C2000™ Microcontrollers

Device	Frequency (MHz)	OTP RPM (KB)	RAM (KB)	Flash (KB)	Flash (Words)	Total On-Chip Memory (KB)	PWM (Ch)	Timers	SPI	LIN	CAN	I²C	UART (SCI)	GPIO	Core Supply (V)	I/O Supply (V)	Peak MMACS	Pin/ Package
Delfino™ Microcontrollers																		
TMS320F28332	150	2	52	128	64 K	182	16	14	1	—	2	1	2	88	1.9	3.3	150	176HLQFP, 176PBGA
TMS320F28334	150	2	68	256	128 K	326	16	14	1	—	2	1	3	88	1.9	3.3	150	176HLQFP, 176PBGA
TMS320F28335	150	2	68	512	256 K	582	18	16	1	—	2	1	3	88	1.9	3.3	150	176HLQFP, 176PBGA
TMS320F28377D	200	4	204	1024	512 K	1232	24	24	3	—	2	2	4	169	3.3	3.3	200	176HLQFP, 337NFBGA
F28MCx	**C28x/M3 Frequency (MHz)**	**C28x/M3 Flash (KB)**																
F28M35E20B1	60/60	—	72	256/256	—	—	24	25	5	—	2	3	6	64	3.3	3.3	60/60	144HTQFP
F28M35H22C1	150/75 or 100/100	—	136	256/256	—	—	24	25	5	—	2	3	6	64	3.3	3.3	150/75 or 100/100	144HTQFP
F28M35H52C1	150/75 or 100/100	—	136	512/512	—	—	24	25	5	—	2	3	6	64	3.3	3.3	150/75 or 100/100	144HTQFP

Microcontrollers/Embedded Processors

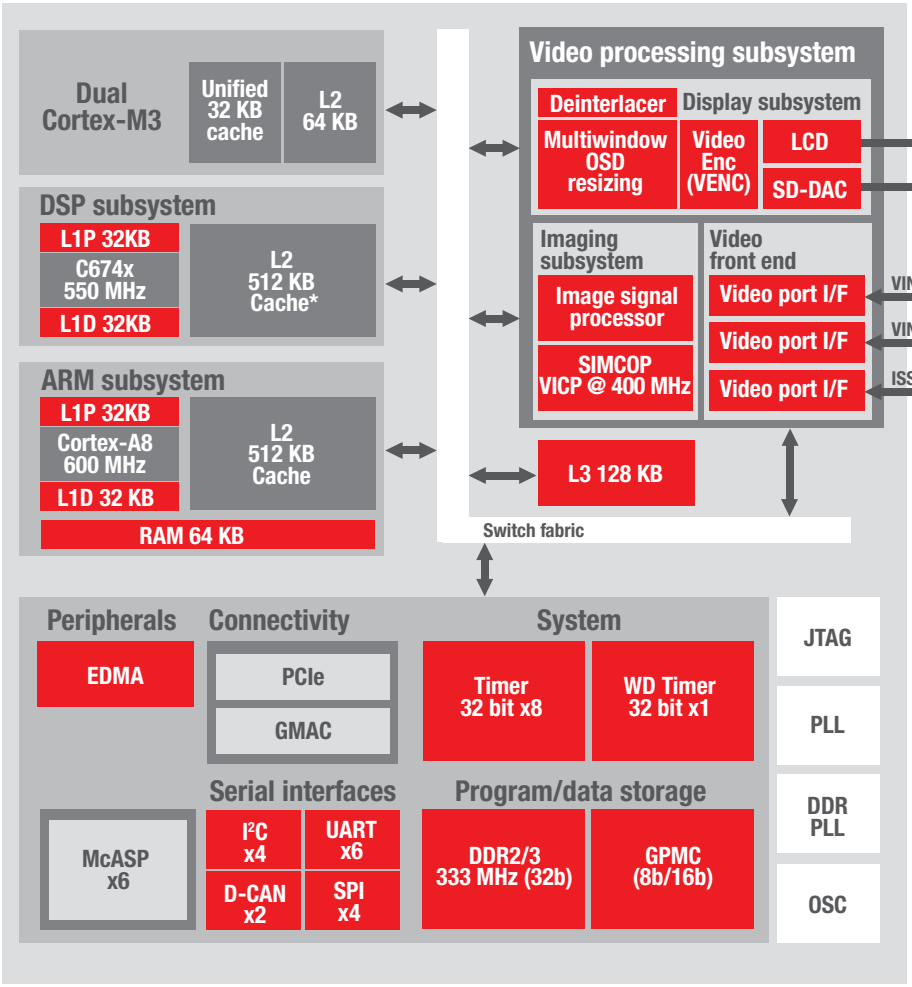
Automotive Vision Processors

Automotive Vision Processors

Texas Instruments automotive vision processors are scalable and flexible and enable a broad range of automotive driver assistance and safety (ADAS) applications.

Our ADAS application and preferred sensor technology provides parking assistance, front camera capabilities, blind-spot detection, adaptive cruise control and night vision.

TI's R&D team has a long history of vision analytics leadership, enabling automotive safety analytics systems to process digital information from sources like digital camera sensors, lasers, radar and other sensors to perform tasks such as forward-facing warning systems, drowsiness sensors or intelligent parking assistance. The processed information can be displayed on screens or announced via acoustical warning signals.



** Cache/RAM reconfigurable*
*** Third video port optional*

Functional block diagram.

Key Features

- 45–m CMOS process for maximum system performance and low power
- DSP core: C674x
  - 450 MHz-550 MHz
  - Floating-point extension
- ARM Cortex-A8 core 600-MHz VFP v3 floating point
- Two ARM Cortex-M3 cores
  - 200 MHz
- Imaging subsystem for vision acceleration
  - Image signal processor (ISP)
  - Statistic data collection, imaging front end raw data processing, two resizers
  - Still image coprocessor (SIMCOP):
    - Video and imaging accelerator (VICP)
- Memory
  - DSP: 32-KB L1D, 32-KB L1P, 256-KB L2 cache
  - ARM: 32-KB L1D, 32-KB L1P, 512-KB L2 cache, 64-KB RAM
  - On-chip L3 RAM: 128 KB
- Peripherals highlights (1.8/3.3-V I/Os)
  - Three video input ports – 16-bit wide
  - Digital video output, one SD video DAC
  - EMIF: 32-bit wide DDR2/3 at 333 MHz
  - Package: 23 x 23 mm, BGA, 0.8-mm ball pitch, 684 pins
- Power (1.1-V/1.2-V core, 1.8-V/3.3-V I/Os): support for dynamic voltage scaling and SmartReflex™ technology for low-power operation

Get more information: **www.ti.com/product/AUTOMOTIVE_VISION_CONTROL**

Microcontrollers/Embedded Processors

Automotive Vision Processors Selection Table

TI Driver Assistance Processors

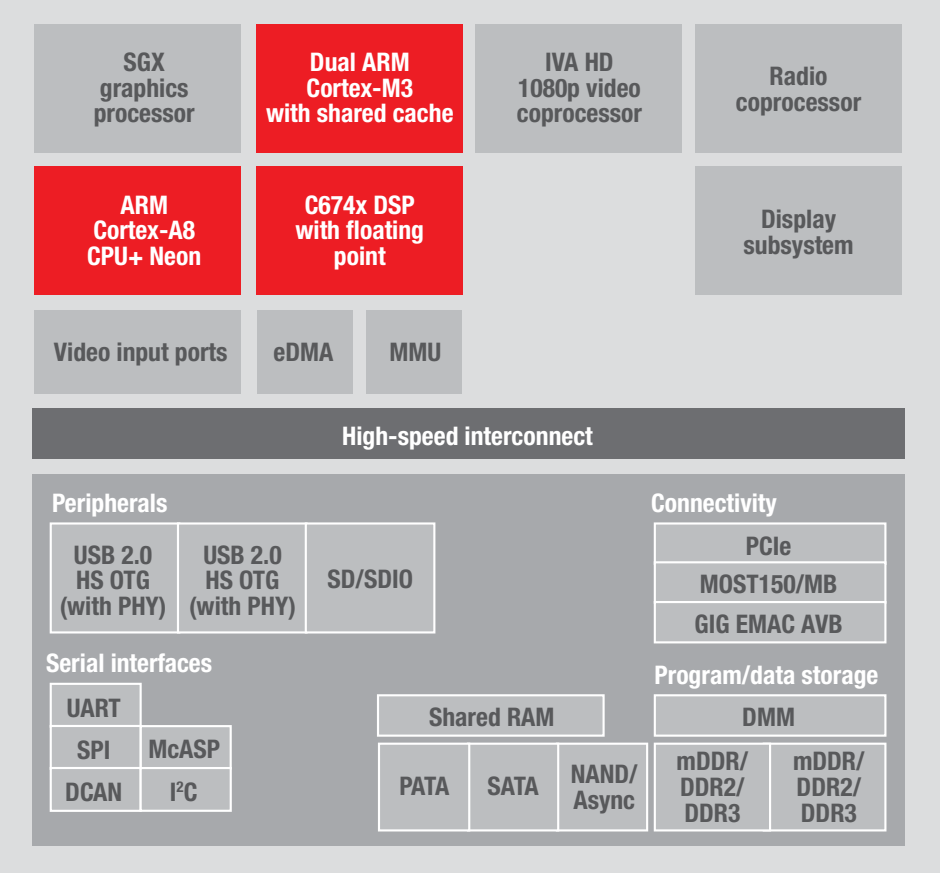
Device	DSP	MPU	Accelerator	Frequency (MHz)	L1 P/L1 D (3) SRAM (Bytes)	L2/ SRAM (Bytes)	L3/ SRAM	Video Ports (Hardware Support)	Program/Data Storage	Voltage Core (V)	I/O	Package
Fixed-Point Processor												
TMS320DM642	C64x+	—	—	A5: 500 A6: 600	16 K/ 16 K	256 K	—	3x configurable	Async SRAM, SDRAM	1.4	3.3	BGA/27 x 27 mm (ZNZ) BGA/23 x 23 mm (ZDK)
TMS320DM6431-Q3	C64x+	—	—	Q3: 300	32 K/ 80 K	64 K	—	1x input 10 bit	Async SRAM, DDR2 SDRAM, NAND flash	1.2	1.8/ 3.3	BGA/16 x 16 mm (ZWT) BGA/13 x 13 mm (ZDU)
TMS320DM6435-Q6/Q5/Q4	C64x+	—	—	Q6: 660 Q5: 500 Q4: 400	32 K/ 80 K	128 K	—	1x input 16 bit	Async SRAM, DDR2 SDRAM, NAND flash	1.05/ 1.2	1.8/ 3.3	BGA/16 x 16 mm (ZWT) BGA/13 x 13 mm (ZDU)
TMS320DM6437-Q6/Q5/Q4	C64x+	—	—	Q6: 660 Q5: 500 Q4: 400	32 K/ 80 K	128 K	—	1x input 16 bit 1x output (digital/analog)	Async SRAM, DDR2 SDRAM, NAND flash	1.05/ 1.2	1.8/ 3.3	BGA/16 x 16 mm (ZWT) BGA/13 x 13 mm (ZDU)
TMS320DM648-Q7	C64x+	—	VICP @ 365 MHz	Q7: 730	32 K/ 32 K	1408 K	—	5x video ports	Async SRAM	1.2	1.8/ 3.3	BGA/19 x 19 mm (ZUT)
Floating-/Fixed-Point Processor												
TMS320C6747BZKBT3	C674x	—	—	375	32 K/ 32 K	L2: 256 K	128 K	—	Async SRAM, SDRAM, NAND flash, NOR	1.2	1.8/ 3.3	BGA/17 x 17 mm (ZKB)
TMS320C6748B-Q4/Q3/Q2	C674x	—	—	Q4: 400 Q3: 300	32 K/ 32 K	L2: 256 K	128 K	Video IN: 2x 8 bit SD (BT.656), OR 1x 16 bit, OR 1x raw (8/10/12 bit) Video OUT: 2x 8 bit SD (BT.656), OR 1x 16 bit	Async SRAM, SDRAM, DDR2, mDDR, NAND flash, NOR	1.3	1.8/ 3.3	BGA/16 x 16 mm (ZWT) BGA/13 x 13 mm (ZCE)
OMAPL138B-Q4/Q3	C674x	ARM9EJ-S	—	Q4: DSP @ 400 ARM @ 400 Q3: DSP @ 300 ARM @ 300	ARM9: 16 K/ 16 K DSP: 32 K/ 32 K	L2: 256 K	128 K	Video IN: 2x 8 bit SD (BT.656), OR 1x 16 bit, OR 1x raw (8/10/12 bit) Video OUT: 2x 8 bit SD (BT.656) OR 1x 16 bit	Async SRAM, SDRAM, DDR2, mDDR, NAND flash, NOR	1.3	1.8/ 3.3	BGA/16 x 16 mm (ZWT) BGA/13 x 13 mm (ZCE)
TDA1MSA-Q4/Q5	C674x	Cortex-A8	VICP @ 400 MHz	Q4: DSP @ 450 ARM @ 600 Q5: DSP @ 550 ARM @ 600	Cortex-A8: 32 K/ 32 K DSP: 32 K/ 32 K	Cortex-A8: 512 K DSP: 256 K	128 K	Video IN: 1x 16/24 bit	NAND, NOR, SRAM, DDR2/3 SDRAM	0.83-1.2	1.5/ 1.8/ 3.3	BGA/23 x 23 mm (CYE)
TDA1MSV-Q4/Q5	C674x	Cortex-A8	VICP @ 400 MHz	Q4: DSP @ 450 ARM @ 600 Q5: DSP @ 550 ARM@600	Cortex-A8: 32 K/ 32 K DSP: 32 K/ 32 K	Cortex-A8: 512 K DSP: 256 K	128 K	Video IN: 2x 16/24 bit 1x 8/16 bit Video OUT: 2x SD-DAC 2x digital	NAND, NOR, SRAM, DDR2/3 SDRAM	0.83-1.2	1.5/ 1.8/ 3.3	BGA/23 x 23 mm (CYE)
TDA1MED-Q4/Q5	C674x	Cortex-A8	VICP @ 400 MHz	Q4: DSP @ 450 ARM @ 600 Q5: DSP @ 550 ARM @ 600	Cortex-A8: 32 K/ 32 K DSP: 32 K/ 32 K	Cortex-A8: 512 K DSP: 256 K	128 K	Video IN: 1x 16/24 bit Video OUT: 2x SD-DAC 2x digital 16 bit	NAND, NOR, SRAM, DDR2/3 SDRAM	0.83-1.2	1.5/ 1.8/ 3.3	BGA/23 x 23 mm (CYE)

Microcontrollers/Embedded Processors

Automotive Infotainment Processors

Automotive Infotainment Processors

Infotainment systems combine entertainment, multimedia and driver information functions in one module. Texas Instruments automotive infotainment processors are scalable and flexible and enable a broad range of features including navigation, multimedia, advanced speech and connectivity applications, and include the peripherals that automotive markets need.



Functional block diagram.

Key Features

- 45–m CMOS process for maximum system performance and low power
- ARM Cortex-A8 core
  - Up to 800 MHz
  - VFPv3 floating point
- DSP core: C674x
  - Up to 570 MHz
  - Floating-point extension
- 3-D graphics accelerator
  - Up to 250 MHz
  - ~23-M polygons/sec
- IVA-HD video coprocessor – 1080p video encode/decode support
- Two ARM Cortex-M3 cores
  - 200 MHz
- Highly flexible display subsystem
  - Multiple video/graphics pipelines
  - Flexible video processing
  - Multiple simultaneous display outputs
- Other peripheral highlights (1.8/3.3-V I/Os)
  - Multiple configurable video input ports
  - Multiple USB 2.0 ports with PHY, MMC/SD and NAND/async interface support
  - Vehicle peripherals: MOST MLB 150, PCIe, 10/100/1000 Ethernet AVB with optional two-port switch, PATA, SATA, multiple CAN, audio serial ports, SPI, UART and I^2C ports
  - EMIF: two 32-bit wide DDR2/3 @ 333 MHz
  - Optional security features
- Power (1.1-V/1.2-V core, 1.8-V/3.3-V I/Os): support for dynamic voltage scaling and SmartReflex™ technology for power/performance management

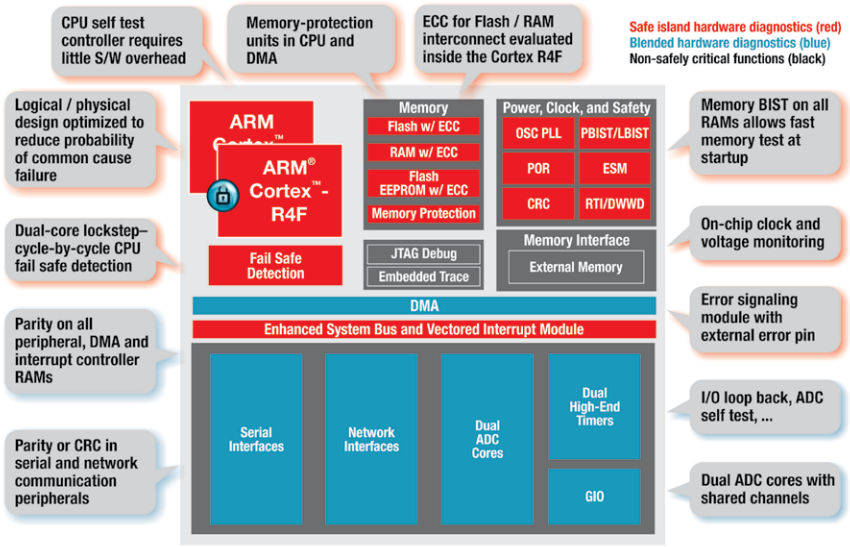
Get more information: **www.ti.com/solution/AUTOMOTIVE_INFOTAINMENT**

Microcontrollers/Embedded Processors

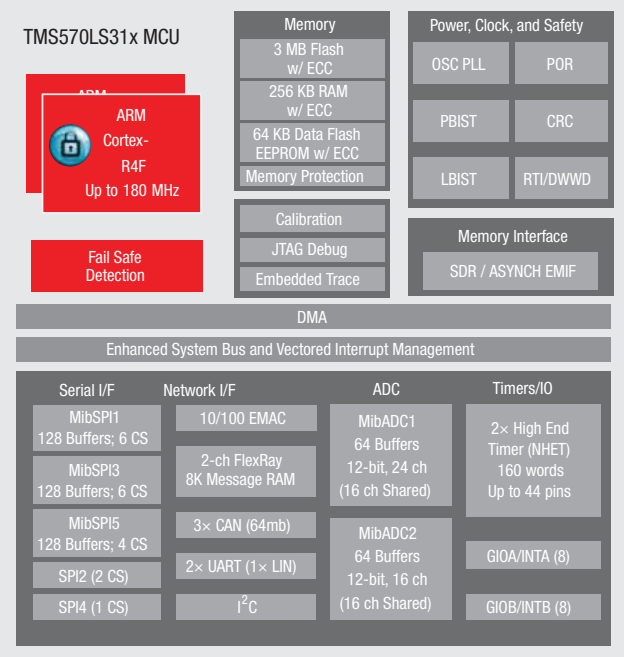
Transportation Safety Microcontrollers

Hercules™ Safety MCUs

The Hercules microcontroller family consists of more than 28 automotive-grade products suitable for use in ISO26262 ASIL-D safety applications. Based on the high-performance ARM Cortex-R4F floating-point CPU, Hercules MCUs offer an efficient 1.6 DMIPS/MHz and include configurations that can run up to 180 MHz, providing up to 288 DMIPS.



General block diagram.



TMS570LS31x block diagram.

Get more information: **www.ti.com/product/HERCULES**

Key Features

- High-performance automotive-grade microcontroller for safety-critical applications
  - Dual CPUs running in lockstep
  - ECC on flash and RAM interfaces
  - Built-in self test for CPU and on-chip RAMs
  - Error-signaling module with error pin
  - Voltage and clock monitoring
- ARM Cortex-R4F 32-bit RISC CPU
  - Efficient 1.6 DMIPS/MHz with eight-stage pipeline
  - Floating-point unit with single/double precision
  - 12-region memory protection unit
  - Open architecture with third-party support
- Operating conditions
  - Up to 180-MHz system clock
  - Core supply voltage (VCC): 1.2-V nominal
  - I/O supply voltage (VCCIO): 3.3-V nominal
- Integrated memory
  - Up to 3-MB program flash with ECC
  - Up to 256-KB RAM with ECC
  - 64-KB flash for emulated EEPROM
- 16-bit external memory interface

Microcontrollers/Embedded Processors

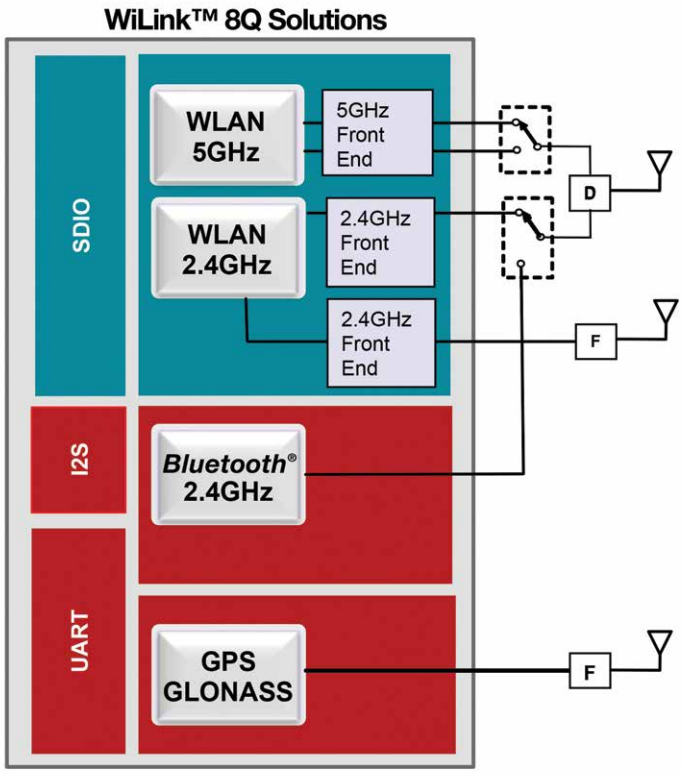
Transportation Safety Microcontrollers Selection Table

Hercules™ MCUs

Part Number	Description	Frequency (MHz)	Flash (KB)	RAM (KB)	CAN	MibSPI	SPI	SCI/LIN	HET Channels	GPIO	I/O Supply (V)
TMS570LS0332	16-/32-bit RISC flash microcontroller	80	256	32	2	1	2	1/1	19	45	3.3
TMS570LS0432	16-/32-bit RISC flash microcontroller	80	384	32	2	1	2	1/1	19	45	3.3
TMS570LS10106-PGE	ARM Cortex-R4F flash microcontroller	140	1024	128	2	3	—	2/2	25	68	3.3
TMS570LS10106-ZWT	ARM Cortex-R4F flash microcontroller	160	1024	128	3	3	—	2/2	32	115	3.3
TMS570LS10116-ZWT	ARM Cortex-R4F flash microcontroller	160	1024	128	3	3	—	2/2	32	115	3.3
TMS570LS10116-PGE	ARM Cortex-R4F flash microcontroller	140	1024	128	2	3	—	2/2	25	68	3.3
TMS570LS10206-ZWT	ARM Cortex-R4F flash microcontroller	160	1024	160	3	3	—	2/2	32	115	3.3
TMS570LS10206-PGE	ARM Cortex-R4F flash microcontroller	140	1024	160	2	3	—	2/2	25	68	3.3
TMS570LS10216-ZWT	ARM Cortex-R4F flash microcontroller	160	1024	160	3	3	—	2/2	32	115	3.3
TMS570LS10216-PGE	ARM Cortex-R4F flash microcontroller	140	1024	160	2	3	—	2/2	25	68	3.3
TMS570LS1114-PGE	16-/32-bit RISC flash microcontroller	160	1024	128	3	3	1	1/2	40	64	3.3
TMS570LS1114-ZWT	16-/32-bit RISC flash microcontroller	180	1024	128	3	3	2	1/2	44	101	3.3
TMS570LS1115-PGE	16-/32-bit RISC flash microcontroller	160	1024	128	3	3	1	1/2	40	58	3.3
TMS570LS1115-ZWT	16-/32-bit RISC flash microcontroller	180	1024	128	3	3	2	1/2	44	101	3.3
TMS570LS1224-PGE	16-/32-bit RISC flash microcontroller	160	1280	192	3	3	1	1/2	40	64	3.3
TMS570LS1224-ZWT	16-/32-bit RISC flash microcontroller	180	1280	192	3	3	2	1/2	44	101	3.3
TMS570LS1225-PGE	16-/32-bit RISC flash microcontroller	160	1280	192	3	3	1	1/2	40	58	3.3
TMS570LS1225-ZWT	16-/32-bit RISC flash microcontroller	180	1280	192	3	3	2	1/2	44	101	3.3
TMS570LS1227-PGE	16-/32-bit RISC flash microcontroller	160	1280	192	3	3	1	1/2	40	58	3.3
TMS570LS1227-ZWT	16-/32-bit RISC flash microcontroller	180	1280	192	3	3	2	1/2	44	101	3.3
TMS570LS20206-PGE	ARM Cortex-R4F flash microcontroller	140	2048	160	2	3	—	2/2	25	68	3.3
TMS570LS20206-ZWT	ARM Cortex-R4F flash microcontroller	160	2048	160	3	3	—	2/2	32	115	3.3
TMS570LS20206EP-GWT	Enhanced product 16-/32-bit RISC flash microcontroller	160	2048	160	3	3	—	2/2	32	115	3.3
TMS570LS20206EP-PGE	Enhanced product 16-/32-bit RISC flash microcontroller	140	2048	160	2	3	—	2/2	25	68	3.3
TMS570LS20216-PGE	ARM Cortex-R4F flash microcontroller	140	2048	160	2	3	—	2/2	25	68	3.3
TMS570LS20216-ZWT	ARM Cortex-R4F flash microcontroller	160	2048	160	3	3	—	2/2	32	115	3.3
TMS570LS20216EP-GWT	Enhanced product 16-/32-bit RISC flash microcontroller	160	2048	160	3	3	—	2/2	32	115	3.3
TMS570LS20216EP-PGE	Enhanced product 16-/32-bit RISC flash microcontroller	140	2048	160	2	3	—	2/2	25	68	3.3
TMS570LS2124-PGE	16-/32-bit RISC flash microcontroller	160	2048	192	3	3	1	1/2	40	64	3.3
TMS570LS2124-ZWT	16-/32-bit RISC flash microcontroller	180	2048	192	3	3	2	1/2	44	120	3.3
TMS570LS2125-PGE	16-/32-bit RISC flash microcontroller	160	2048	192	3	3	1	1/2	40	58	3.3
TMS570LS2125-ZWT	16-/32-bit RISC flash microcontroller	180	2048	192	3	3	2	1/2	44	120	3.3
TMS570LS2134-PGE	16-/32-bit RISC flash microcontroller	160	2048	256	3	3	1	1/2	40	64	3.3
TMS570LS2134-ZWT	16-/32-bit RISC flash microcontroller	180	2048	256	3	3	2	1/2	44	120	3.3
TMS570LS2135-PGE	16-/32-bit RISC flash microcontroller	160	2048	256	3	3	1	1/2	40	58	3.3
TMS570LS2135-ZWT	16-/32-bit RISC flash microcontroller	180	2048	256	3	3	2	1/2	44	120	3.3
TMS570LS3134-PGE	16-/32-bit RISC flash microcontroller	160	3072	256	3	3	1	1/2	40	64	3.3
TMS570LS3134-ZWT	16-/32-bit RISC flash microcontroller	180	3072	256	3	3	2	1/2	44	120	3.3
TMS570LS3135-PGE	16-/32-bit RISC flash microcontroller	160	3072	256	3	3	1	1/2	40	58	3.3
TMS570LS3135-ZWT	16-/32-bit RISC flash microcontroller	180	3072	256	3	3	2	1/2	44	120	3.3
TMS570LS3137-PGE	16-/32-bit RISC flash microcontroller	160	3072	256	3	3	1	1/2	40	58	3.3
TMS570LS3137-ZWT	16-/32-bit RISC flash microcontroller	180	3072	256	3	3	2	1/2	44	120	3.3
TMS470MF03107	16-/32-bit RISC flash microcontroller	80	320	16	2	2	—	—	16	49	3.3
TMS470MF04207	16-/32-bit RISC flash microcontroller	80	448	24	2	2	—	—	16	49	3.3
TMS470MF06607	16-/32-bit RISC flash microcontroller	80	640	64	2	2	—	—	16	49	3.3

WiLink™ 8Q – Scalable Wi-Fi, *Bluetooth*® and GNSS

The Texas Instruments WiLink 8Q product family brings high-performing Wi-Fi, *Bluetooth*® and GNSS positioning solutions to infotainment systems, enabling close integration with mobile handsets and high-speed data traffic to multiple devices in parallel. The WiLink 8Q family has a scalable and flexible combo-chip architecture where pin-to-pin compatible devices enable hardware and software reuse across platforms. It offers the lowest power and best-in-class RF performance and coexistence.



Functional block diagram.

Learn more at: **www.ti.com/wilink8q**

Key Features

- Integrated solution for Wi-Fi, *Bluetooth*® and GNSS
- Qualified following AEC-Q100 guidelines for automotive
- *Bluetooth*®
  - *Bluetooth*® 4.0, including *Bluetooth*® low energy
  - Best-in-class sensitivity
  - On-chip mSBC codec
  - Shared UART for *Bluetooth*®, GNSS control
  - PCM for audio
- Wi-Fi
  - IEEE 802.11a/b/g/n
  - Station/access point/Wi-Fi direct
  - Wi-Fi protected access 2 (WPA2) and setup (WPS)
  - 100-Mbps throughput
  - Wi-Fi Miracast ready
  - SDIO interface
- Location
  - Autonomous and assisted GNSS
  - Supporting four satellite systems in parallel: GPS, Glonass, QZSS and SBAS
  - Short TTFF, fast cold start
  - High tracking sensitivity
  - Sensors blending
  - Integrated LNA, support for external LNA/active antenna
  - On-chip position engine
- Leading co-ex performance through advanced techniques
- Operating temp. –40 to +85°C

WiLink 8Q Solutions

Available Technology Options	WL187xQ	WL183xQ
Dual-band 2 x 2 MIMO mobile	WL1877	WL1837
Wi-Fi 802.11 a/b/g/n	WL1873	WL1833
Wi-Fi 802.11 b/g/n	WL1871	WL1831
Wi-Fi SS 40 MHz (HT40)	•	•
GNSS	•	—
Bluetooth® 4.0 (including BLE)	•	•

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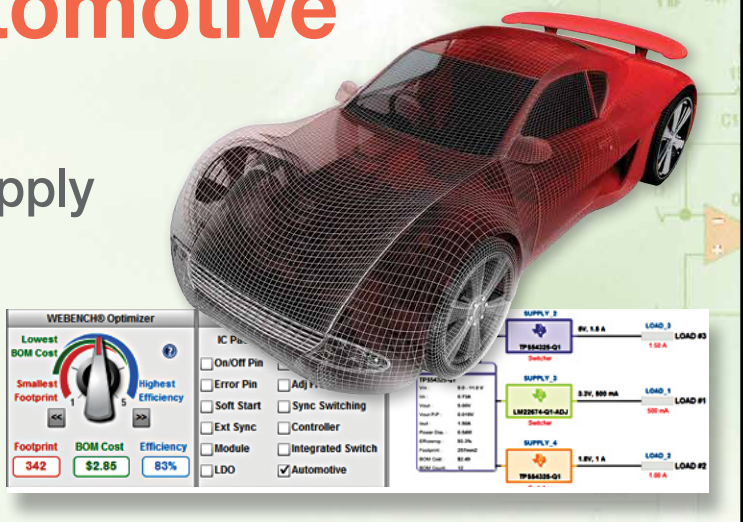

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