GENERAL-PURPOSE STANDARD POWER

Product Selector Guide

www.maximintegrated.com/power

Table of Contents

GENERAL-PURPOSE STANDARD POWER

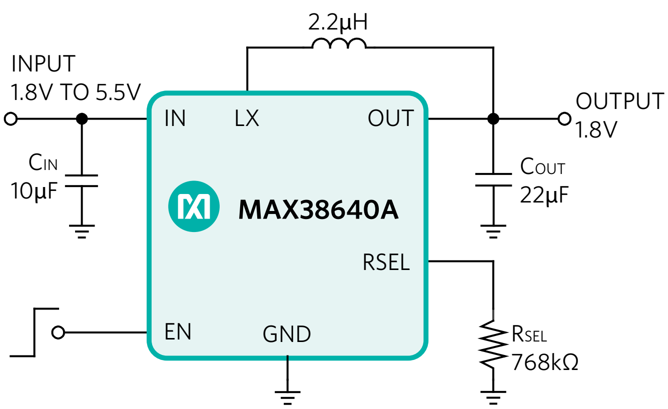
Buck or Boost Regulators and LDOs

Whether you are designing a medical device, a sensor, a programmable logic controller, or a portable battery-powered product, you will certainly need power in your system. Fortunately, our power components can turn the “must-have” power-supply portion into a tangible advantage by reducing heat dissipation, decreasing circuit size, and extending battery life. Explore our power product lines, featured technology, and customer stories to understand why so many engineers are using Maxim. Then, find the part that works right for you.

HIGH-EFFICIENCY BUCK REGULATORS

Our robust portfolio of step-down switching regulators with high efficiency, high integration, and wide temperature range offer solutions for a variety of applications ranging from industrial to portable, low-power applications.

Typical Operating Circuit



Features and Benefits

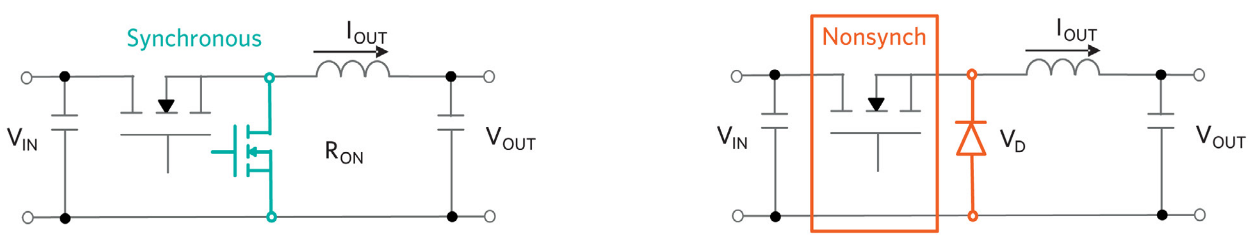
- Extend battery life with nanoamp quiescent current
- Get superior conversion efficiency with "No-Schottky" synchronous operation
- Shrink component size and get fast transient response with high switching frequency
- Obtain high efficiency even for light loads with multi-mode operation
- Ensure reliable operation through EN55022 compliance

Design Tip

Synchronous step-down regulators are a great choice for sensitive power designs that require a small battery for the power source. These devices provide much higher efficiency and very low I_Q, reducing heat dissipation and improving battery life.

Here is a quick power loss calculation to compare synchronous versus nonsynchronous solutions.

$V_{IN} = 3.6V, V_{OUT} = 1.8V, I_{OUT} = 190mA$ at 4MHz



FET $R_{ON} = 0.08\Omega$
Power dissipation across the FET:
$P_{FET} = R_{ON} \times I^2_{OUT} \times (1 - V_{OUT}/V_{IN}) = 1.44mW$

Voltage drop across diode $V_D = 0.5V$
Power dissipation across the diode:
$P_D = V_D \times I_{OUT} \times (1 - V_{OUT}/V_{IN}) = 47.5mW$

As you can see, the synchronous solution reduces the power loss in the rectification diode by a factor of 33!

Customer Insight

The **MAX38640** buck converter has been designed into many top-selling consumer products. "Due to its extremely low I_Q and high efficiency, the MAX38640 was the best choice for our battery-powered devices," said one company. Customers like the fact that such a tiny part can make their batteries last much longer than a typical converter.

Focus Products - Buck Regulators

Product	Switch Type	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{OUT} (min) (V)	V_{OUT} (max) (V)	I_{OUT} (A)	f_{SW} (kHz)	I_Q	No. of Outputs	Peak Efficiency (%)	Package/Pins
MAX38640	Internal	1.8	5.5	0.5	5	0.175	Variable	330nA	1	96	TDFN/8 WLP/6
MAX38641/2	Internal	1.8	5.5	0.5	5	0.35	Variable	330nA	1	96	TDFN/8 WLP/6
MAX38643	Internal	1.8	5.5	0.5	5	0.70	Variable	330nA	1	96	TDFN/8 WLP/6
MAX17620	Internal	2.7	5.5	1.5	V_{IN}	0.60	4000	40µA	1	91	TDFN/8
MAX17509	Internal	4.5	16	0.9	5	3	500, 1000, 1500, 2000	1mA	2	94	TQFN/32
MAX1836/7	Internal	4.5	24	3.3	V_{IN}	0.125/ 0.25	200	12µA	1	94	TDFN/6 SOT/6
MAX15023	External	4.5	28	0.6	0.85 x V_{IN}	12	200 to 1000	4.5mA	2	93	TQFN/24
MAX15026	External	4.5	28	0.6	0.85 x V_{IN}	25	200 to 2000	1.75mA	1	90	TDFN/14

Featured Technology

Our modern switching regulators provide tremendous benefit in terms of efficiency, integration, and size. Synchronous switchers eliminate a diode, yet may not provide high efficiency at light load, due to the on-resistance of the integrated FET. Fortunately, our advanced process technology builds FETs with $R_{DS(ON)}$ in the milliohm range to reduce losses. Combining these FETs with multi-mode operation, such as skip mode on the **MAX17620** and many other products, results in high efficiency across a broad load range. Furthermore, the high switching frequency of the MAX17620 reduces overall solution size.

To learn more, read the latest application note:

Synchronous or Nonsynchronous Topology? Boost System Performance with the Right DC-DC Converter

Buck Regulators Product Selector Table

Part No.	Input Voltage		Output Voltage		I_{OUT} (max) (A)	Switch Type	I_Q (max) (mA)	Operating Frequency (kHz)	Package/Pins
	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{OUT} (min) (V)	V_{OUT} (max) (V)					
MAX638	2.2	16.5	1.25	16	0.075	Internal	0.6	65	CDIP/8 PDIP/8 SOIC (N)/8
MAX1637	6	26	1.1	5.5	0.1	External	0.5	350	QSOP/16
MAX1836	4.5	24	1.25	24	0.125	Internal	0.025	200	SOT23/6 TDFN/6
MAX38640A	1.8	5.5	0.7	5.5	0.175	Internal	0.00066	Various	WLP/6 µDFN/6
MAX639	4	11.5	1.3	11.5	0.225	Internal	0.02	Various	PDIP/8 SOIC (N)/8
MAX640	4	11.5	1.3	11.5	0.225	Internal	0.02	Various	PDIP/8 SOIC (N)/8
MAX653	4	11.5	1.3	11.5	0.225	Internal	0.02	Various	CDIP/8 PDIP/8 SOIC (N)/8
MAX1837	4.5	24	1.25	24	0.25	Internal	0.025	200	SOT23/6 TDFN/64
MAX1672	1.8	11	1.25	5.5	0.26	Internal	0.125	Various	QSOP/16
MAX38641A	1.8	5.5	0.7	5.5	0.35	Internal	0.00066	Various	WLP/6 µDFN/6
MAX38642A	1.8	5.5	0.7	5.5	0.35	Internal	0.00066	Various	WLP/6 µDFN/6
MAX1920	2	5.5	1.25	4	0.4	Internal	0.07	1200	SOT23/6 TDFN/6
MAX1921	2	5.5	1.5	3.3	0.4	Internal	0.07	1200	SOT23/6
MAX730A	5.2	11	5	5	0.45	Internal	3	210	PDIP/8 SOIC (N)/8
MAX750A	4	11	1.25	11	0.45	Internal	3	190	PDIP/8 SOIC (N)/8
MAX8640Y	2.7	5.5	0.8	2.5	0.5	Internal	0.048	2000	SC70/6 µDFN/6
MAX8640Z	2.7	5.5	1.1	1.8	0.5	Internal	0.048	4000	SC70/6 µDFN/6
MAX748A	3.3	16	3.3	3.3	0.5	Internal	3	212.5	PDIP/8 SOIC (W)/16
MAX763A	3.3	11	3.3	3.3	0.5	Internal	2.5	212.5	PDIP/8 SOIC (N)/8

Buck Regulators Product Selector Table (Continued)

Part No.	Input Voltage		Output Voltage		I_{OUT} (max) (A)	Switch Type	I_Q (max) (mA)	Operating Frequency (kHz)	Package/Pins
	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{OUT} (min) (V)	V_{OUT} (max) (V)					
MAX17620	2.7	5.5	1.5	5.5	0.6	Internal	0.04	4000	TDFN/8
MAX1692	2.7	5.5	1.25	5.5	0.6	Internal	0.14	750	µMAX®/10
MAX887	3.5	11	1.25	10	0.6	Internal	0.5	440	SOIC (N)/8
MAX38643A	1.8	5.5	0.7	5.5	0.7	Internal	0.00066	Various	Thin WLP/6 µDFN/6
MAX738A	6	16	5	5	0.75	Internal	3	190	CDIP/8 PDIP/8 SOIC (W)/16
MAX744A	6	16	5	5	0.75	Internal	3	212.5	CDIP/8 PDIP/8 SOIC (W)/16
MAX758A	4	16	1.25	16	0.75	Internal	3	190	PDIP/8 SOIC (W)/16
MAX1927	2.6	5.5	0.75	5	0.8	Internal	0.24	1000	µMAX/10
MAX1928	2.6	5.5	1.5	2.5	0.8	Internal	0.24	1000	µMAX/10
MAX1684	2.7	14	1.25	14	1	Internal	0.61	300	QSOP/16
MAX1685	2.7	14	1.25	14	1	Internal	0.61	600	QSOP/16
MAX5072	4.5	23	0.8	28	2	Internal	4	2200	TQFN/32
MAX5073	5.5	23	0.8	28	2	Internal	4	2200	TQFN/28
MAX1644	3	5.5	1.1	5.5	2	Internal	0.36	350	SSOP/16
MAX651	4	16.5	1.5	16.5	2.5	External	0.1	300	SOIC (N)/8
MAX1649	3	16	1.5	3.3	2.5	External	0.1	300	PDIP/8 SOIC (N)/8
MAX1651	3	16	1.5	3.3	2.5	External	0.1	300	PDIP/8 SOIC (N)/8
MAX17509	4.5	16	0.9	5	3	Internal	1.9	500, 1000, 1500, 2000,	TQFN/32
MAX15036	4.5	23	0.6	23	3	Internal	2.5	2200	TQFN/16
MAX1626	3	16.5	3.3	5	3	External	0.09	300	SOIC (N)/8

Buck Regulators Product Selector Table (Continued)

Part No.	Input Voltage		Output Voltage		I_{OUT} (max) (A)	Switch Type	I_Q (max) (mA)	Operating Frequency (kHz)	Package/Pins
	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{OUT} (min) (V)	V_{OUT} (max) (V)					
MAX1627	3	16.5	1.3	16	3	External	0.09	300	SOIC (N)/8
MAX38800	6.5	14	0.6	5.5	9	Internal	35	400, 500, 600, 700, 800, 900	WLP/19
MAX797	4.5	30	2.5	6	10	External	0.44	340	CDIP/16 PDIP/16 SOIC (N)/16
MAX1652	4.5	30	2.5	5.5	10	External	0.364	340	QSOP/16
MAX1653	4.5	30	2.5	5.5	10	External	0.364	340	QSOP/16 SOIC (N)/16
MAX1654	4.5	30	2.5	5.5	10	External	0.364	340	QSOP/16
MAX1655	4.5	30	1	5.5	10	External	0.364	340	QSOP/16 SOIC (N)/16
MAX797H	4.5	40	2.5	6	10	External	0.44	340	SOIC (N)/16
MAX798	4.5	30	1.6	6	10	External	0.567	340	SOIC (N)/16
MAX38801	6.5	14	0.6	5.5	15	Internal	35	400, 500, 600, 700, 800, 900	WLP/19
MAX15048	4.7	23	0.6	20	15	External	9	1200	TQFN/32
MAX15049	4.7	23	0.6	20	15	External	9	1200	TQFN/32
MAX15023	4.5	28	0.6	28	15	External	6	1000	TQFN/24
MAX15002	4.5	23	0.6	18	20	External	6	2200	TQFN/40
MAX15026	4.5	28	0.6	28	25	External	2.75	2000	TDFN/14
MAX8655	4.5	25	0.7	5.5	25	Internal	3	1000	TQFN/56
MAX1639	4.5	5.5	1.1	4.5	35	External	2.5	300, 600, 1000	SOIC (N)/16
MAX1638	4.5	5.5	1.3	3.5	35	External	2.5	300, 600, 1000	SSOP/24

Buck Regulators Related Resources

- Application Notes
  - **DC-DC Converter Tutorial**
  - **Power-Supply Solutions for Xilinx FPGAs**
  - **Power-Supply Solutions for Intel (Altera) FPGAs**
  - **Choosing the Right Power-Supply IC for your Application**
  - **Power Supplies Begin the Circuit Foundation, Taming Switching Power-Supply Layout**
  - **Prolonging the Battery Life of Wireless Security Cameras with Proper Power Management**

- Design Solution
  - **Make Your Small Asset Tracker Last Longer**

- Reference Design
  - **Reference Design Using the MAX15026 for an Auxiliary Power Supply for LCD TVs or Set-Top Boxes**
  - **Palo Verde (MAXREFDES33#): Step-Down Converter**

- Video
  - **In The Lab: High-Efficiency Power Supply Reference Design**

Customer Insight

The **MAX8640** was designed into a top-selling consumer product because it is the best solution for minimizing conducted switching power-supply noise when powering sensitive RF circuits like GPS. One customer shared that the MAX8640 is considered the gold standard for noise when it comes to buck converters. In the application, to reduce the system power consumption, the MAX8640 was used to power an RF circuit directly bypassing an internal LDO, to improve battery life in wearables.

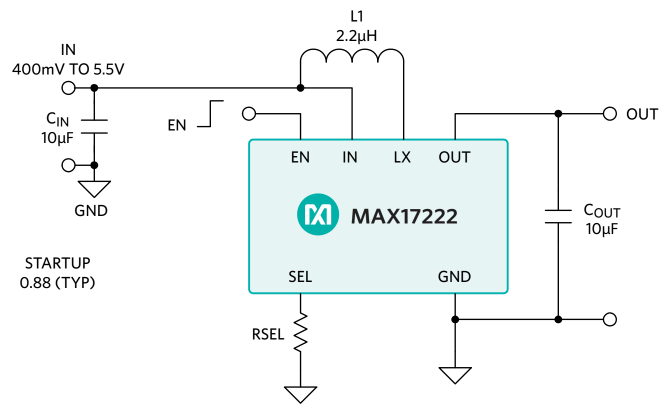
SMALL, LOW-POWER BOOST REGULATORS

Our high-efficiency, low-noise, and tiny packages make these step-up switching regulator solutions ideal for today's mobile and wearable markets.

Features and Benefits

- Increase battery life with low quiescent current and True Shutdown™ mode
- Easily adapt to design requirements with single- or dual-cell battery input
- High switching frequencies provide fast transient response and shrink component size
- Minimize EMI in noise-sensitive applications using our proprietary LX-damping circuitry

Typical Operating Circuit



Design Tip

Addressing New Designs for the Wearable Market

Many companies are looking at wearables as the next big market opportunity following mobile phones. Smart watches appear to be the most popular wearable devices today, and the healthcare sector, including medical, fitness, and wellness, promises even broader opportunities. These devices require very small form factors and prolonged operating times, creating very difficult design challenges.

The **MAX17222** is a boost converter optimized for these wearable applications, delivering up to 200mA of current in a small 2mm x 2mm 6-pin µDFN package or a 0.8mm x 1.4mm 6-bump WLP. Aggressive power-saving techniques are utilized to reduce current consumption when the system is in sleep mode. This leads to an ultra-low quiescent current of only 300nA. The True Shutdown™ feature disconnects the output from the input with no forward or reverse current, resulting in a minimal 0.5nA shutdown current.

Customer Insight

We offer a superior selection of DC-DC step-up converters for all types of applications. Utilized in a variety of applications, the **MAX17222** step-up converter was the best choice for a portable audio device in a major consumer product. This boost converter features an 'Ultra-Low-Power Mode' that reduces operating current under light loads and maximizes efficiency. This solution is ideal for battery-powered, portable devices that require high efficiency for prolonged battery life.

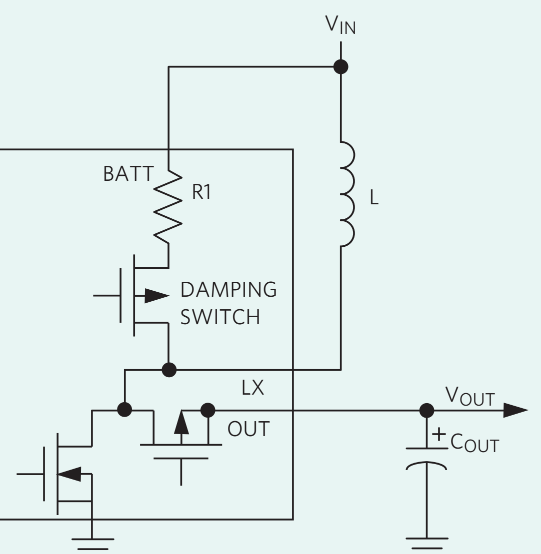
Focus Products - Boost Regulators

Product	Switch Type	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{OUT} (min) (V)	V_{OUT} (max) (V)	I_{IN} Limit* (A)	f_{SW} (kHz)	I_Q (µA)	Peak Efficiency (%)	Package/Pins
MAX17220/1	Internal	0.4	5.5	1.8	5	0.225	2000	0.3	95	µDFN/6, WLP/6
MAX17222/3	Internal	0.4	5.5	1.8	5	0.5	2000	0.3	95	µDFN/6, WLP/6
MAX17224/5	Internal	0.4	5.5	1.8	5	1	2000	0.3	95	µDFN/6, WLP/6
MAX17227A	Internal	0.4	5.5	2.3	5.5	2	2000	0.35	96	µDFN/10, WLP/6
MAX17250	Internal	2.7	18	3	18	3.5	1000	60	93	TDFN/14, WLP/12
MAX668/9	External	1.8	28	2.7	100	6	500	220	92	µMAX/10
MAX5026	Internal	3	11	V_{IN}	36	0.26	500	350	82	SOT23/6
MAX1674/5/6	Internal	0.7	5.5	2	5.5	0.5/1	500	16	94	µMAX/8
MAX1795/6/7	Internal	0.7	5.5	2	5.5	0.55	500	25	95	µMAX/8
MAX8815A	Internal	1.2	5.5	3.3	5	2.5	2000	30	97	TDFN/10

*$I_{OUT} = I_{IN}$ Limit × (V_{IN}/V_O) × Efficiency

Featured Technology

Our step-up converters contain an internal damping switch to minimize ringing at LX. The damping switch connects a resistor across the inductor when the inductor's energy is depleted. Normally, when the energy in the inductor is insufficient to supply current to the output, the capacitance and inductance at LX form a resonant circuit that causes ringing. The ringing continues until the energy is dissipated through the series resistance of the inductor. The damping switch supplies a path to quickly dissipate this energy, minimizing the ringing at LX. Damping LX ringing does not reduce V_{OUT} ripple but does reduce EMI.



Boost Regulators Product Selector Table

Part No.	Input Voltage V_{IN} (min) (V)	Input Voltage V_{IN} (max) (V)	Output Voltage V_{OUT} (min) (V)	Output Voltage V_{OUT} (max) (V)	I_{OUT} (max) (A)	Switch Type	I_Q (max) (mA)	Operating Frequency (kHz)	Package/Pins
MAX77231	2.7	4.8	11.2	16.2	0.01	Internal	0.12	2000	WLP/9
MAX1606	0.8	5.5	1.25	28	0.02	Internal	0.16	500	µMAX/8
MAX1605	2.5	5.5	2.5	28	0.02	Internal	0.018	500	SOT23/6 TDFN/6
MAX5026	3	11	5	36	0.04	Internal	0.35	500	SOT23/6
MAX631	2	16.5	2	16.5	0.05	Internal	0.135	60	CDIP/8 PDIP/8 SOIC (N)/8
MAX632	2	16.5	2	16.5	0.05	Internal	0.5	65	CDIP/8 PDIP/8 SOIC (N)/8
MAX633	1.5	15.6	2	16.5	0.05	Internal	0.75	65	CDIP/8 PDIP/8 SOIC (N)/8
MAX858	0.8	6	3.3	5	0.06	Internal	0.025	500	PDIP/8 SOIC (N)/8
MAX859	0.8	6	2.7	6	0.06	Internal	0.025	500	PDIP/8 SOIC (N)/8 µMAX/8
MAX17220	0.4	5.5	1.8	5	0.085	Internal	0.0003	2000	WLP/6 µDFN/6
MAX17221	0.4	5.5	1.8	5	0.085	Internal	0.0003	2000	WLP/6 µDFN/6
MAX1678	0.7	5.5	2	5.5	0.09	Internal	0.037	Various	µMAX/8
MAX1722	0.8	5.5	2	5.5	0.15	Internal	0.0015	2000	TSOT/5 µDFN/6
MAX1723	0.8	5.5	2	5.5	0.15	Internal	0.0015	2000	TSOT/5 µDFN/6
MAX1724	0.8	5.5	2.7	5	0.15	Internal	0.0015	2000	TSOT/5 µDFN/6
MAX1832	1.5	5.5	2	5.5	0.15	Internal	0.004	500	SOT23/6
MAX1833	1.5	5.5	3.3	3.3	0.15	Internal	0.004	500	SOT23/6 TDFN/6
MAX1834	1.5	5.5	2	5.5	0.15	Internal	0.004	500	SOT23/6
MAX856	0.8	6	3.3	5	0.15	Internal	0.025	500	PDIP/8 SOIC (N)/8 µMAX/8

Boost Regulators Product Selector Table (Continued)

Part No.	Input Voltage		Output Voltage		I_{OUT} (max) (A)	Switch Type	I_Q (max) (mA)	Operating Frequency (kHz)	Package/Pins
	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{OUT} (min) (V)	V_{OUT} (max) (V)					
MAX857	0.8	6	2.7	6	0.15	Internal	0.025	500	PDIP/8 SOIC (N)/8
MAX1795	0.7	5.5	2	5.5	0.18	Internal	0.025	Various	µMAX/8
MAX606	3	5.5	3	12.5	0.18	Internal	0.25	1000	SOIC (N)/8 µMAX/8
MAX607	3	5.5	3	12.5	0.18	Internal	0.15	500	SOIC (N)/8 µMAX/8
MAX17222	0.4	5.5	1.8	5	0.2	Internal	0.0003	2000	WLP/6 µDFN/6
MAX17223	0.4	5.5	1.8	5	0.2	Internal	0.0003	2000	Thin WLP/6 µDFN/6
MAX732	4	9.3	12	12	0.2	Internal	1.7	210	CDIP/8 LCC/20 PDIP/8 SOIC (W)/16
MAX1796	1	5.5	2	5.5	0.3	Internal	0.025	Various	µMAX/8
MAX757	0.7	5.5	2.7	5.5	0.3	Internal	0.06	500	PDIP/8 SOIC (N)/
MAX1674	0.7	5.5	2	5.5	0.3	Internal	0.016	Various	µMAX/8
MAX1675	0.7	5.5	2	5.5	0.3	Internal	0.016	Various	µMAX/8
MAX1676	0.7	5.5	2	5.5	0.3	Internal	0.016	Various	µMAX/10
MAX848	0.7	5.5	2.7	5.5	0.3	Internal	0.035	400	SOIC (N)/16
MAX618	3	28	3	28	0.5	Internal	0.5	250	QSOP/16
MAX1797	1	5.5	2	5.5	0.55	Internal	0.025	Various	µMAX/8
MAX17224	0.4	5.5	1.8	5	0.8	Internal	0.0003	2000	WLP/6 µDFN/6
MAX17225	0.4	5.5	1.8	5	0.8	Internal	0.0003	2000	WLP/6 µDFN/6
MAX1700	0.7	5.5	2.2	5.5	0.8	Internal	0.035	400	QSOP/16
MAX17227A	0.4	5.5	2.3	5.5	1	Internal	0.00035	2000	µDFN/10, WLP/6
MAX8815A	1.2	5.5	1.265	5.5	1	Internal	0.03	2000	TDFN/10

Boost Regulators Product Selector Table (Continued)

Part No.	Input Voltage		Output Voltage		I_{OUT} (max) (A)	Switch Type	I_Q (max) (mA)	Operating Frequency (kHz)	Package/Pins
	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{OUT} (min) (V)	V_{OUT} (max) (V)					
MAX8627	0.9	5.5	1	5	1	Internal	0.02	1000	TDFN/14
MAX1522	2.5	5.5	2.5	100	1	External	0.025	1000	SOT23/6
MAX1523	2.5	5.5	2.5	100	1	External	0.025	1000	SOT23/6
MAX849	0.7	5.5	2.7	5.5	1	Internal	0.035	400	SOIC (N)/16
MAX608	1.8	16.5	3	16.5	1	External	0.085	300	PDIP/8 SOIC (N)/8
MAX1703	0.7	5.5	2.5	5.5	1.5	Internal	0.065	400	SOIC (N)/16
MAX1771	2	16.5	2	100	2	External	0.085	300	CDIP/8 LCC/20 PDIP/8 SOIC (W)/16
MAX863	1.5	11	1.25	100	2	External	0.05	Various	QSOP/16
MAX38888	0.8	4.5	2.5	5	2.5	Internal	0.035	2000	TDFN/14
MAX1687	2.7	6	1.25	6	2.5	Internal	2	500	PDIP/8 SOIC (N)/16
MAX1688	2.7	6	1.25	6	2.5	Internal	2	500	SOIC (N)/8 TSSOP/16
MAX15036	4.5	23	4.5	28	3	Internal	1.8	2200	TQFN/16
MAX17250	2.7	18	3	18	3.5	Internal	0.06	1000	TDFN/14 WLP/12
MAX668	3	28	3	100	6	External	0.22	500	µMAX/10
MAX669	1.8	28	3	28	6	External	0.22	500	µMAX/10
MAX1701	0.7	5.5	2.2	5.5	0.8	Internal	0.055	300	QSOP/16
MAX686	0.8	27	-27	27	0.5	Internal	0.065	300	QSOP/16
MAX1705	0.7	5.5	2.5	5.5	0.8	Internal	0.1	400	QSOP/16
MAX1706	0.7	5.5	2.5	5.5	0.4	Internal	0.1	400	QSOP/16
MAX629	0.8	28	-28	28	0.5	Internal	0.08	300	SOIC (N)/8

Boost Regulators Related Resources

- Application Notes
  - **Small, High-Voltage Boost Converters**
  - **±15V or ±12V Output Switch- Mode Power Supply Has Wide Input-Voltage Range**
  - **Step-Up Converter with LDO Beats SEPIC Efficiency**
  - **Boost Converter Switches Between Battery and USB Power**
  - **Protection from Blackouts: Dirt Cheap to Fully Integrated**
  - **Introduction to Hearing Aids and Important Design Considerations**
  - **Important Design Considerations for Digital Thermometers**

- Reference Design
  - **USB Battery Charging Guide**

- Design Solutions
  - **How to Efficiently Power Your Smart Gas/Water Meter**
  - **Triple Punch Extends the Life of Your Smart Factory Indoor BLE Beacon**
  - **Very Low Input-Voltage Boost Converter Enables Direct Methanol Fuel Cell Hearing Aids**
  - **Make Your IoT Device Last Longer with a nanoPower Boost Converter**
  - **Choose the Right Voltage Regulator to Extend Battery Life in Wearables**
  - **More-Efficient Boost Converter Extends Battery Life For Wearable Medical Patches**

- White Papers
  - **Why Low Quiescent Current Matters for Longer Battery Life**

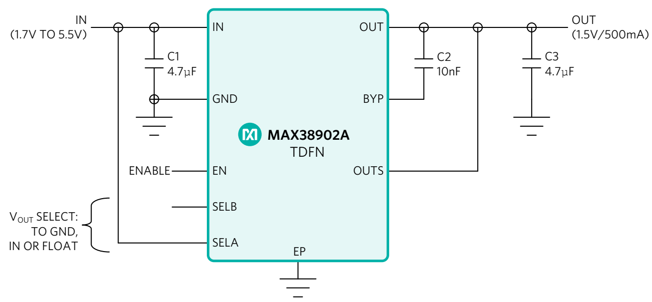
HIGH-PERFORMANCE, LOW-NOISE LDOs

High-performance, low-noise operation makes our low-dropout linear regulators ideal for a variety of portable applications.

Features and Benefits

- Very low dropout voltages reduce heat dissipation
- Ultra-low noise ensures precise system measurements
- High output accuracy provides closely regulated voltages
- High PSRR provides a clean power supply by filtering out noise

Typical Operating Circuit



Design Tip

Choosing the Correct LDO Linear Regulator for Mobile Devices

Low-dropout linear regulators (LDOs) are used to power many sections of a typical mobile device. The baseband, RF, and audio sections have different requirements that influence which LDO linear regulator is most appropriate.

Ideally, one IC would have all these characteristics so only one LDO would be needed. But in practice, the various blocks are best powered by LDOs with different performance characteristics. For example, most cell phone baseband chipsets require power supplies for three circuit blocks: internal digital circuitry, analog circuitry, and peripheral interface circuitry.

Internal digital circuits typically operate from 1.8V to 2.6V with plenty of battery headroom so dropout is not critical. Output noise and the PSRR are not critical specs for the digital circuits. This supply requires low quiescent current such as the **MAX1725**, at light loads because this LDO stays on at all times.

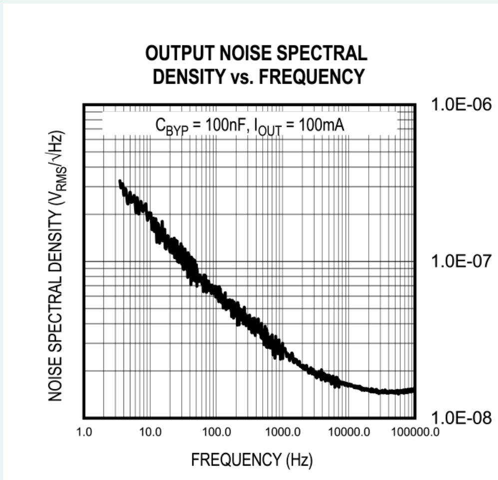
The RF circuits require low-noise and high-PSRR LDOs. In particular, the VCO and PLL blocks' overall performance affects the radio's critical specifications. Noise can alter the oscillator's phase and amplitude characteristic and the oscillator's loop circuitry amplifies the noise. An LDO such as the **MAX8840** is more suited for this application.

High-current LDOs like the **MAX38903** are required for audio circuit demands such as hands-free, gaming, and multimedia applications in cell phones. This power supply requires low noise and high PSRR at the audio frequency range (20Hz to 20kHz) in order to provide good audio quality.

Focus Products - LDOs

Product	V_{IN} (V)	V_{OUT} (V)	I_{OUT} (A)	I_Q (µA)	$V_{DROPOUT}$ (mV)	Accuracy (%)	Output Voltage Noise (μV_{RMS})	PSRR-10kHz (dB)	No. of Outputs	Package/Pins
MAX38902	1.7 to 5.5	0.6 to 5.3	0.5	365	50	1	10.7	70	1	TDFN/8 WLP/6
MAX38903	1.7 to 5.5	0.6 to 5.3	1.0	1200	50	1	5.5	70	1	TDFN/10 WLP/9
MAX38904	1.7 to 5.5	0.6 to 5.3	2.0	1300	50	1	4	70	1	TDFN/14 WLP/15
MAX38908	0.9 to 5.5	0.6 to 5.0	4.0	70	82	1	25	78	1	TDFN/14 WLP/15
MAX1510/1/2	1.1 to 3.6	0.5 to 1.5	3.0	700	500			80	1	TDFN/10
MAX8902	1.7 to 5.5	0.6 to 5.3	0.5	80	50	1.5	16	92	1	TDFN/8
MAX8510	2 to 6	1.5 to 4.5	0.12	40	120	3	11	78	1	TDFN/8 SC70/5
MAX8840/1/2	2 to 6	1.5 to 4.5	0.15	40	120	3	11	78	1	µDFN/6
MAX1818	2.5 to 5.5	1.25 to 5	0.5	125	120	3	115	63	1	SOT23/6
MAX1725/6	2.5 to 12	1.5 to 5	0.02	2	300	3	350	40	1	SOT23/5
MAX8880/1	2.5 to 12	1.25 to 5	0.2	3.5	100	1.5	300	40	1	TDFN/6 SOT23/6
MAX1615/6	4 to 28	1.24 to 28	0.03	6.2	350*	2		65	1	SOT23/5

Featured Technology



To know which LDO you need, you must first define the application of your LDO and then examine which parameters are most important. There are tradeoffs made in IC design to accommodate the various LDO requirements for specific applications.

For example, ultra-low noise LDOs, designed for sensitive applications, must tradeoff high PSRR with low I_Q. For applications such as in system measurement or RF circuits, the low I_Q is not a primary system requirement and the low-noise LDO is a suitable choice.

There are many applications where the functionality of a circuit or device is highly dependent on the quality and accuracy of the power supply. For example, power supplies that are used in applications to supply power-sensitive CPUs, precision regulator applications, or data-converter references need to have a very high degree of accuracy. Due to IC design limitations, high-accuracy output LDOs do not have a wide input supply range and increasing the input range decreases accuracy.

We have addressed these needs and created many LDOs to meet the important criteria for specific applications, providing the very best solution for any given system. For example, the **MAX38904** was designed to meet ultra-low noise requirements by achieving 5.1µV_{RMS} output noise in the 10Hz to 100kHz range, while maintaining an output accuracy of ±1% over the input voltage range, and requiring only 100mV of input-to-output headroom at full load (see graph).

Linear Regulators Product Selector Table

Part No.	Input Voltage		Output Voltage		Rated I_{LOAD} (mA)	I_Q (typ) (µA)	Output Voltage Noise (typ) (μV_{RMS})	$V_{dropout}$ At Rated I_{LOAD} (typ) (V)	Package/Pins
	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{OUT}(min) (V)	V_{OUT} (max) (V)					
MAX1725	2.5	12	1.5	5	20	2	350	0.3	SOT23/5
MAX1726	2.5	12	1.8	5	20	2	350	0.3	SOT23/5
MAX1615	4	28	3.3	5	30	6.2		0.35	SOT23/5
MAX1616	4	28	1.24	28	30	6.2		0.35	SOT23/5
MAX663	2	16.5	1.3	16	40	6		0.9	CDIP/8 PDIP/8 SOIC (N)/8
MAX664	-2	-16.5	-1.3	-15	40	6		0.35	CDIP/8 PDIP/8 SOIC (N)/8
MAX666	2	16.5	1.3	15	40	6		0.9	CDIP/8 PDIP/8 SOIC (N)/8
ICL7663	1.5	16	1.3	16	40	3.5		0.9	MET.CAN/8 PDIP/8 SOIC (N)/8
MAX8865	2.5	5.5	1.3	5.5	100	105	220	0.11	µMAX/8
MAX8866	2.5	5.5	1.5	5.5	100	105	220	0.11	µMAX/8
MAX8940	2.8	6	2.8	3	120	40	13	0.12	SC70/5
MAX8510	2	6	1.5	4.5	120	40	11	0.12	SC70/5 TDFN/8
MAX8511	2	6	1.5	4.5	120	40	230	0.12	SC70/5 TDFN/8
MAX8512	2	6	1.5	4.5	120	40	230	0.12	SC70/5 TDFN/8
MAX8863	2.5	5.5	1.25	5.5	120	70	220	0.13	SOT23/5
MAX8864	2.5	5.5	1.25	5.5	120	70	220	0.13	SOT23/5
MAX1749	2.5	6.5	1.25	6.5	120	80		0.13	SOT23/5
MAX8873	2.5	6.5	1.25	6.5	120	73	220	0.13	SOT23/5
MAX8874	2.5	6.5	1.25	6.5	120	73	220	0.13	SOT23/5

Linear Regulators Product Selector Table (Continued)

Part No.	Input Voltage		Output Voltage		Rated I_{LOAD} (mA)	I_Q (typ) (µA)	Output Voltage Noise (typ) ($µV_{RMS}$)	$V_{dropout}$ At Rated I_{LOAD} (typ) (V)	Package/Pins
	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{OUT}(min) (V)	V_{OUT} (max) (V)					
MAX8891	2	6	1.5	4.5	150	40	230	0.15	SC70/5
MAX8892	2	6	1.225	4.5	150	40	230	0.15	SC70/5
MAX8840	2	6	1.5	4.5	150	40	11	0.17	µDFN/6 Ultra Thin LGA/6
MAX8841	2	6	1.5	4.5	150	40	230	0.17	µDFN/6
MAX8842	2	6	1.5	4.5	150	40	230	0.17	µDFN/6
MAX8875	2.5	6.5	1.5	5	150	85	170	0.16	SOT23/5
MAX8885	2.5	6.5	1.5	5	150	85	170	0.16	SOT23/5
MAX8867	2.5	5.5	2.5	5	150	85	20	0.16	SOT23/5 TSOT/5
MAX8868	2.5	5.5	2.5	5	150	85	20	0.16	SOT23/5 TSOT/5
MAX8877	2.5	6.5	2.5	5	150	85	20	0.16	SOT23/5 TSOT/
MAX8878	2.5	6.5	1.5	5	150	85	20	0.16	SOT23/5 TSOT/5
MAX8882	2.5	6.5	1.8	3.3	160	165	40	0.15	SOT23/6
MAX8883	2.5	6.5	1.8	3.3	160	165	320	0.15	SOT23/6
MAX8532	2.5	6.5	1.5	3.3	200	80	40	0.22	UCSP (B)/6
MAX8530	2.5	6.5	1.5	3.3	200	130	320	0.22	TDFN/6 UCSP (B)/6 WLP/6
MAX8531	2.5	6.5	1.5	3.3	200	130	40	0.22	TDFN/6 UCSP (B)/6
MAX1735	-2.5	-6.5	-1.25	-5.5	200	85	160	0.08	SOT23/5
MAX882	2.7	11.5	1.25	11	200	11	250	0.32	PDIP/8 SOIC (N)/8
MAX883	2.7	11.5	1.25	11	200	11	250	0.22	PDIP/8 SOIC (N)/8
MAX884	2.7	11.5	1.25	11	200	11	250	0.32	PDIP/8 SOIC (N)/8

Linear Regulators Product Selector Table (Continued)

Part No.	Input Voltage		Output Voltage		Rated I_{LOAD} (mA)	I_Q (typ) (µA)	Output Voltage Noise (typ) ($µV_{RMS}$)	$V_{dropout}$ At Rated I_{LOAD} (typ) (V)	Package/Pins
	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{OUT}(min) (V)	V_{OUT} (max) (V)					
MAX8880	2.5	12	1.25	5	200	3.5	300	0.36	SOT23/6 TDFN/6
MAX8881	2.5	12	1.25	5	200	3.5	300	0.36	SOT23/6
MAX667	3.5	16.5	1.3	15	250	20		0.19	CDIP/8 PDIP/8 SOIC (N)/8
MAX8633	2.7	5.5	1.5	3	300	54	450	0.25	TDFN/8 µDFN/8
MAX8636	2.7	5.5	1.5	3	300	54	45	0.25	TDFN/8 µDFN/8
MAX1963A	1.62	3.6	0.75	3	300	70	86	0.1	TDFN/6 TSOT/6
MAX1976A	1.62	3.6	0.75	3	300	70	86	0.1	TDFN/6 TDFN/8 TSOT/6
MAX8559	2.5	6.5	1.5	3.3	300	180	32	0.2	TDFN/8 UCSP (B)/8
MAX8887	2.5	5.5	1.5	3.3	300	55	42	0.15	TSOT/5
MAX8888	2.5	5.5	1.5	3.3	300	55	360	0.15	TSOT/5
MAX1799	2.5	5.5	1.8	3.3	300	367	45	0.12	QFN/20 TQFN/20
MAX8860	2.5	6.5	1.25	6.5	300	120	55	0.15	µMAX/8
MAX1658	2.7	16.5	1.25	16	350	30	2500	0.65	SOIC (N)/8
MAX1659	2.7	16.5	1.25	16	350	30	2500	0.65	SOIC (N)/8
MAX38902E	1.7	5.5	0.8	5	500	600	14	0.05	TDFN/8
MAX38902A	1.7	5.5	0.6	5.3	500	365		0.05	TDFN/8
MAX38902B	1.7	5.5	0.6	5.3	500	365	10.7	0.05	TDFN/8
MAX38902C	1.7	5.5	0.6	5.3	500	365	10.7	0.05	Thin WLP/6
MAX38902D	1.7	5.5	0.6	5.3	500	365	10.7	0.05	Thin WLP/6
MAX8902	1.7	5.5	0.6	5.3	500	80	16	0.05	SOIC(N)/8

Linear Regulators Product Selector Table (Continued)

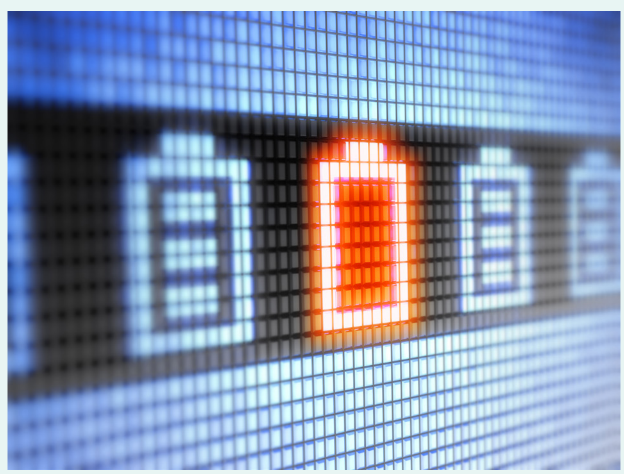
Part No.	Input Voltage		Output Voltage		Rated I_{LOAD} (mA)	I_Q (typ) (µA)	Output Voltage Noise (typ) ($µV_{RMS}$)	$V_{dropout}$ At Rated I_{LOAD} (typ) (V)	Package/Pins
	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{OUT} (min) (V)	V_{OUT} (max) (V)					
MAX1589A	1.62	3.6	0.75	3	500	70	86	0.175	TDFN/6 TSOT/6
MAX1935	2.25	5.5	0.8	4.5	500	200	300	0.175	TDFN/8
MAX1806	2.25	5.5	0.8	4.5	500	210	300	0.17	µMAX/8
MAX1857	2.5	5.5	1.25	5	500	135	115	0.12	µMAX/8
MAX1792	2.5	5.5	1.25	5	500	80	115	0.13	µMAX/8
MAX1818	2.5	5.5	1.25	5	500	125	115	0.12	SOT23/6
MAX38903A	1.7	5.5	0.6	5.3	1000	1200	5.5	0.05	TDFN/10 Thin WLP/9
MAX38903B	1.7	5.5	0.6	5.3	1000	1200	5.5	0.05	TDFN/10 Thin WLP/9
MAX38903C	1.7	5.5	0.6	5.3	1000	1200	5.5	0.05	Thin WLP/9
MAX38903D	1.7	5.5	0.6	5.3	1000	1200	5.5	0.05	Thin WLP/9
MAX15101	1.7	5.5	0.6	5.2	1000	1800	15	0.025	WLP/15
MAX8516	1.4	3.6	0.5	3.4	1000	320		0.2	µMAX/10
MAX8517	1.4	3.6	0.5	3.4	1000	320		0.2	µMAX/10
MAX8518	1.4	3.6	0.5	3.4	1000	320		0.2	µMAX/10
MAX8869	2.7	5.5	0.8	5	1000	500	150	0.2	TSSOP/16
MAX1793	2.5	5.5	1.25	5	1000	125	115	0.21	TSSOP/16
MAX38904A	1.7	5.5	0.6	5	2000	1300	4	0.05	TDFN/14
MAX38904B	1.7	5.5	0.6	5	2000	1300	4	0.05	TDFN/14
MAX38904C	1.7	5.5	0.6	5	2000	1300	4	0.05	Thin WLP/15
MAX38904D	1.7	5.5	0.6	5	2000	1300	4	0.05	Thin WLP/15

Linear Regulators Product Selector Table (Continued)

Part No.	Input Voltage		Output Voltage		Rated I_{LOAD} (mA)	I_Q (typ) (µA)	Output Voltage Noise (typ) (μV_{RMS})	$V_{dropout}$ At Rated I_{LOAD} (typ) (V)	Package/Pins
	V_{IN} (min) (V)	V_{IN} (max) (V)	V_{OUT} (min) (V)	V_{OUT} (max) (V)					
MAX15104	2.2	5.5	0.6	5.2	2000	1800		0.05	Thin WLP/15
MAX15102	1.7	5.5	0.6	5.2	2000	1800	15	0.05	WLP/15
MAX8526	1.4	3.6	0.5	3.4	2000	500		0.1	WLP/15
MAX8527	1.4	3.6	0.5	3.4	2000	500		0.1	TSSOP/14
MAX8528	1.4	3.6	0.5	3.4	2000	500		0.1	TSSOP/14
MAX1510	1.1	3.6	0.5	1.5	2000	700		0.35	TSSOP/14
MAX15103	1.7	5.5	0.6	5.3	3000	1800	16	0.056	TDFN/10
MAX8564	4.5	13.2	0.5	5	3000	660		0.056	WLP/15
MAX38908	0.9	5.5	0.6	5	4000	70.5	25	0.082	TDFN/14 Thin WLP/15
MAX8556	1.4	3.6	0.5	3.4	4000	800		0.1	TQFN/16
MAX8557	1.4	3.6	0.5	3.4	4000	800		0.1	TQFN/16

Customer Insight

The **MAX1725** is an ultra-low supply current, LDO linear regulator intended for low-power applications that demand the longest possible battery life. It was selected to support a power-sensitive smoke detector system, which was required to run in idle mode until a detection occurred. Low I_Q was essential so the system could run for an extended period of time while powered by a 9V battery. Reverse-polarity protection was also required in case the battery was installed incorrectly. The MAX1725 was the perfect choice for this application by offering a mere 2µA quiescent current with reverse-battery protection.



Linear Regulators Related Resources

- Application Notes
  - Reduce the Chances of Human Error: Part 1, Power and Ground
  - Spare Op Amp Generates Its Own Regulated Negative Supply
  - Selecting LDO Linear Regulators for Cellphone Designs
  - Design Considerations for a Low-Cost Sensor and A/D Interface
  - Using a Linear Regulator to Produce a Constant Current Source
  - Analog ICs for Low Voltage Systems
  - Complete Stand-Alone GPS Receiver Solution with MAX2742
  - Improved Power-Supply Rejection for Linear Regulators

- Tutorial
  - Low-Dropout Linear Regulator (LDO) Application Tutorial

- Design Solution
  - Modern Portable Devices Require a New Breed of LDOs

- Reference Design
  - Reference Circuit 2765: Flexible Fault Protection
  - System Board 6147: MAXREFDES73#: Wearable, Galvanic Skin Response System

Notes

Trademarks

UCSP and True Shutdown are trademarks and µMAX is a registered trademark of Maxim Integrated Products, Inc.

Learn more

For more information, visit:
www.maximintegrated.com/power

Rev 0; September 2020