Low-dropout (LDO) linear voltage regulators Quick reference guide

Low-dropout (LDO) voltage regulators are engineered to work efficiently with small voltage differences between input and output, which minimizes power loss and boosts efficiency.

They provide a budget-friendly option for achieving regulated and consistent output voltages with only a few additional parts, simplifying the design process. Ideal for scenarios where the output current is low and the output voltage is near the input level, LDO regulators strike an excellent balance between cost and performance. This guide provides developers a comprehensive look at our frequently utilized LDO regulators, helping to pinpoint the perfect option for various applications.

LDO PRODUCT TYPES

Ultra-low dropout

- Minimum required difference between the input voltage and the desired output voltage, for the specified output current
- Ultra-low dropout voltage extends the lifetime of battery-operated devices by sustaining high current output as the battery voltage decreases
- Reduces power dissipation

Product reference
LD57100
LDL112
LD39200
LDCL015

Low quiescent current

- Optimized for drastically reduce the current consumption
- Ideal for power-budgeted applications, extending battery life and reducing power consumption
- Suitable for portable consumer devices, industrial sensors, smart building and smart-home applications, automotive (AEC-Q100 grade 1 qualified) power supply for microcontrollers, smart meters, healthcare devices, and coin-cell powered devices
- Available in small footprint package options, including SOT23-5L, SOT323-5L, flip-chip4 (0.65x0.65 mm), DFN6 (1x1, 2x2, and 3x3 mm), and DFN8 (3x2)

Product reference
LDH40
LDL40
LDQ40
L99VR03
LDLN025
LD39100/LD49100
ST730/ST732
ST715
LDK715

High PSRR/Low noise

- PSRR measures the LDO's ability to mitigate changes in the input voltage without affecting the output
- Low-noise LDOs minimize intrinsic noise
- Vital for maintaining a precise output voltage and low noise when powering sensitive devices or when the supply voltage is derived from a noisy source.
- Designed for noise-sensitive and RF applications
- Features a remarkable power supply rejection ratio (up to 92 dB at 1 kHz) and ultra-low noise operation (as low as 6.3 µVRMS)
- Ensures cleaner and stable output voltages suitable for ultrasensitive loads
- Advanced design allows fast and stable dynamic performance with low power consumption

Product reference
LDLN015/025/030
LD39015/020/030
LDL112/212
LD59100
LD56020
LD59015
LDLN050
LDBL20
L99VR01
L99VR02J/XP

LDO EFFICIENCY IN COMPACT DESIGNS

Harness the simplicity and compactness of LDOs for your projects:

- Ease of use: LDO integration is straightforward, typically requiring just two capacitors.
- Many of ST's LDOs come in fixed-output versions, potentially eliminating the need for resistors.
- Small footprint: many space-saving options with ultra-tiny form factors including the 0.65x0.65 mm flip-chip and the 1x1 mm
- Dual LDOs: where LDO1 and LDO2 can work indipendently or in tracking mode in the same package.

Some of LDO applications...


Personal care and hygiene


3-D glasses


Robotic toys

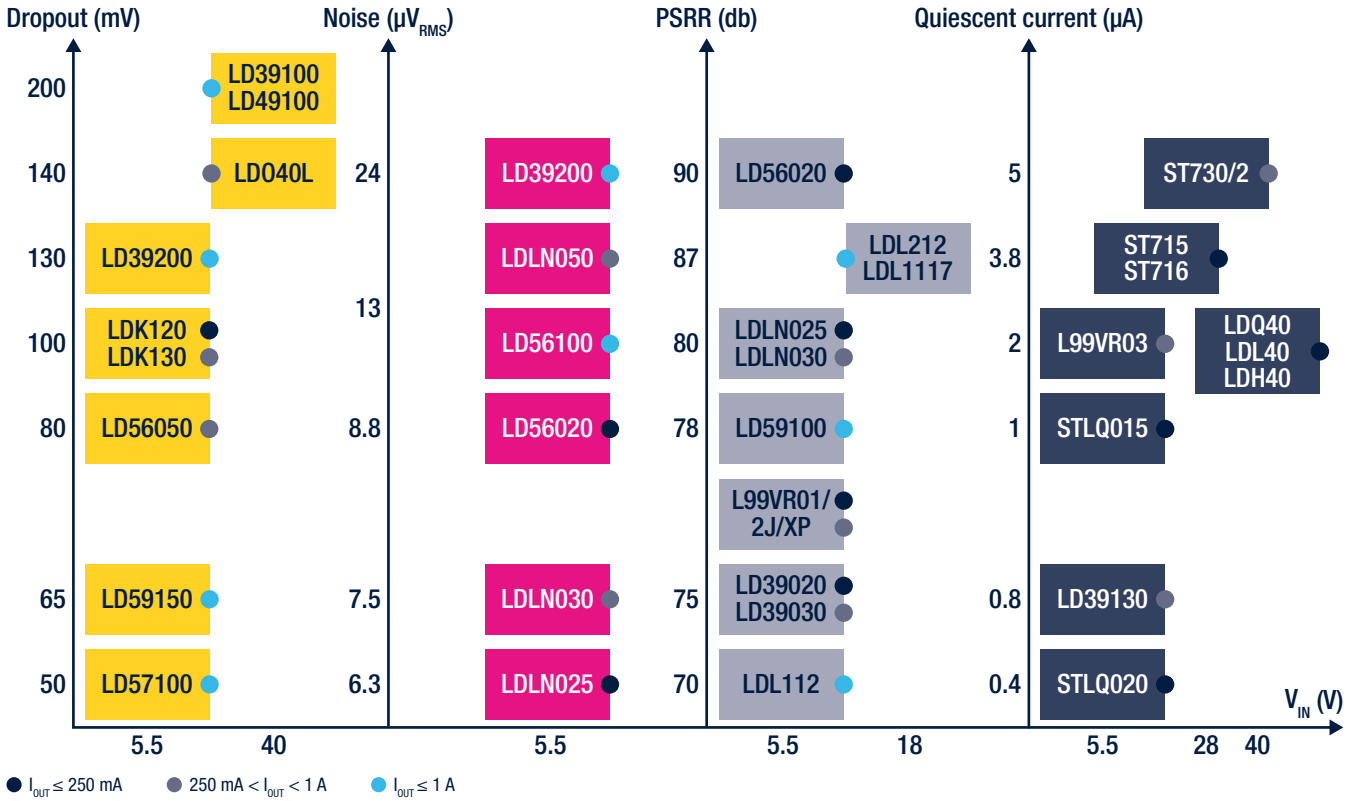

Drone

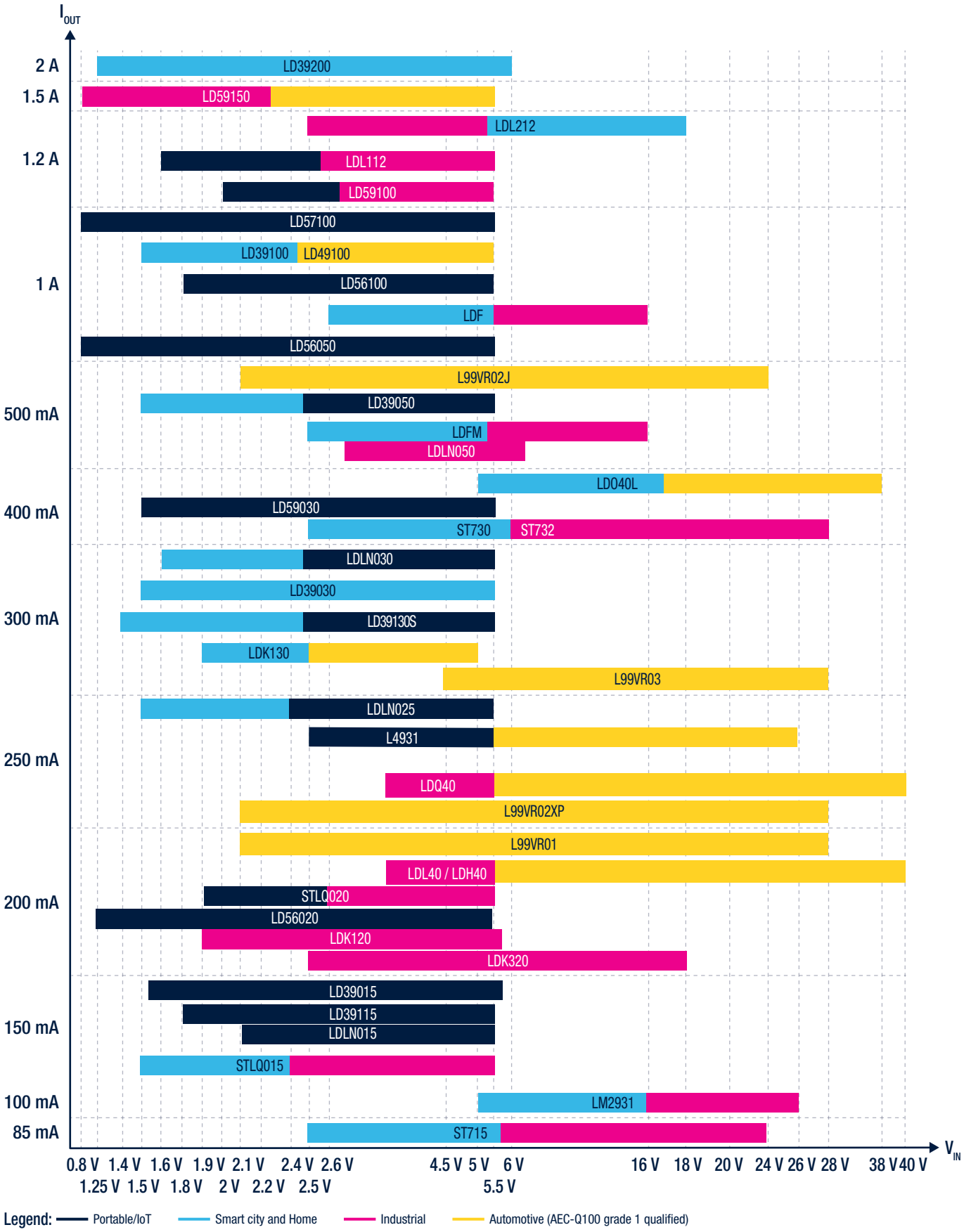

Wearables


Gaming


ADAS & telematics

LDO key performance overview at a glance




I_{OUT}
2 A
1.5 A
1.2 A
1 A
500 mA
400 mA
300 mA
250 mA
200 mA
150 mA
100 mA
85 mA
LD39200
LD59150
LDL212
LDL112
LD59100
LD57100
LD39100
LD49100
LD56100
LDF
LD56050
L99VR02J
LD39050
LDFM
LDLN050
LDO40L
LD59030
ST730
ST732
LDLN030
LD39030
LD39130S
LDK130
L99VR03
LDLN025
L4931
LDQ40
L99VR02XP
L99VR01
LDL40 / LDH40
STLQ020
LD56020
LDK120
LDK320
LD39015
LD39115
LDLN015
STLQ015
LM2931
ST715
0.8 V 1.4 V 1.6 V 1.9 V 2.1 V 2.4 V 2.6 V
1.25 V 1.5 V 1.8 V 2 V 2.2 V 2.5 V
4.5 V 5 V 6 V
5.5 V
16 V 18 V 20 V 24 V 26 V 28 V 38 V 40 V
V_{IN}
Legend:
Portable/IoT
Smart city and Home
Industrial
Automotive (AEC-Q100 grade 1 qualified)

GLOSSARY

Accuracy – The maximum deviation from the specified output. Nominal accuracy can be affected by factors such as low tolerance components, temperature, and load variations. Commonly cited across temperature ranges, it is sometimes specified as tolerance.

AEC-Q100 – Any integrated circuit needs to be tested for compliance with the failure modes/stress tests as described in AEC-Q100 before it can be marketed as an automotive-grade device.

Bias voltage (Vbias) – An external power rail required by some LDOs. Associated with low dropout voltages and excellent noise characteristics.

Dropout voltage – The dropout voltage is a measure of the smallest difference between input and output voltages. A lower dropout allows for more effective regulation and can be used to prolong the lifetime of battery-powered devices.

Enable/Inhibit (EN/INH) – Externally enabling (or disabling) the internal circuitry when the regulator is not required reduces the consumed current and can prolong battery lifetime.

Feedback network – Resistors are used to set the desired output voltage in a linear regulator. In fixed output regulators, these are already embedded inside the chip itself.

Line regulation – Line regulation describes how well the regulator can maintain its intended output voltage given a change in the input voltage.

Load regulation – Load regulation describes the regulator's ability to maintain the specified output given a change in the load (output) conditions.

Noise – Specifically the noise generated by the LDO's internal bandgap reference, which is amplified in the feedback network. Good noise figures are critical in circuits for wireless communication or that rely on high-speed clock signals.

Package – The packaging size is a compromise between size and thermal properties. The smaller a package, the more susceptible it is to self-heating. Some larger packages have exposed metal pads to facilitate thermal dissipation into the PCB, allowing for improved passive cooling.

Pass element – The voltage regulation is performed by applying a variable voltage to a MOSFET gate, making it act in a similar way to a variable resistor. This transistor is commonly referred to as the pass element.

Power dissipation – When a voltage is regulated, excess power is dissipated as heat. As heat can affect the LDO and other parts negatively, and eventually cause a malfunction or thermal shutdown, thermal management is important.

Power Good (PG) – This signal indicates that the output is in regulation. It is useful for power-sequencing, reset triggering, and more.

PSRR – Power supply rejection ratio, measure of the LDO's ability to filter out noisy ripples in the input voltage. It is always specified in dB, and always over a range of frequencies.

Quiescent current – The current consumed by the regulator to operate the internal circuitry. Lowering the quiescent current is especially important for battery-powered solutions.

Soft-start (SS) – Soft-start is a controlled gradual increase of the power throughput, which prevents large inrush currents that can overload the power supply.

Thermal shutdown – A protective function that shuts down the device to prevent damage from overheating.

Transient response – A description of the regulator's ability to resist fast changes, known as transients, in the load and supply conditions. See line transient and load transient.

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