

# LDO Regulators Glossary

## **Outline**

This document provides the definitions of the terms used in LDO regulator datasheets.

## Table of Contents

Outline .....	1
Table of Contents .....	2
1. Absolute maximum ratings.....	3
2. Operating range.....	4
3. Electrical characteristics.....	5
4. Built-in Functions.....	6
RESTRICTIONS ON PRODUCT USE .....	7

### 1. Absolute maximum ratings

Term	Symbol	Description
Input voltage	$V_{IN}$	The maximum rated voltage that can be applied to the $V_{IN}$ terminal without causing permanent damage to an IC or degrading its characteristics or reliability
Bias voltage	$V_{BAT}$ $V_{BIAS}$	The maximum rated voltage that can be applied to the $V_{BAT}$ or $V_{BIAS}$ terminal without causing permanent damage to an IC or degrading its characteristics or reliability
Control voltage	$V_{CT}$	The maximum rated voltage that can be applied to the CONTROL terminal without causing permanent damage to an IC or degrading its characteristics or reliability
Adjustable voltage	$V_{ADJ}$	The maximum rated voltage that can be applied to the $V_{BAT}$ or $V_{ADJ}$ terminal without causing permanent damage to an IC or degrading its characteristics or reliability
Output voltage	$V_{OUT}$	The maximum rated voltage that can be applied to the $V_{OUT}$ terminal without causing permanent damage to an IC or degrading its characteristics or reliability
Output current	$I_{OUT}$	The maximum rated current that can be applied to the output terminal without causing permanent damage to an IC or degrading its characteristics or reliability
Power dissipation	$P_D$	The maximum power consumption that does not cause permanent damage to an IC over the entire operating range
Operating temperature range	$T_{opr}$	The ambient temperature range in which an IC functions properly
Storage temperature range	$T_{stg}$	The ambient temperature range in which an IC can be stored and transported without voltage application

## 2. Operating range

Term	Symbol	Description
Input voltage	$V_{IN}$	The input voltage range in which the normal operation and electrical characteristics of an IC are guaranteed
Bias voltage	$V_{BIAS}$	The bias voltage range in which the normal operation and electrical characteristics of an IC are guaranteed
Control voltage	$V_{CT}$	The control voltage range in which the normal operation and electrical characteristics of an IC are guaranteed
Output voltage	$V_{OUT}$	The output voltage range in which the normal operation and electrical characteristics of an IC are guaranteed
Output current	$I_{OUT}$	The maximum output current at which the normal operation and electrical characteristics of an IC are guaranteed
Input capacitor	$C_{IN}$	The minimum input capacitor value at which the normal operation and electrical characteristics of an IC are guaranteed
Bias capacitor	$C_{BIAS}$	The minimum bias capacitor value at which the normal operation and electrical characteristics of an IC are guaranteed
Output capacitor	$C_{OUT}$	The minimum output capacitor value at which the normal operation and electrical characteristics of an IC are guaranteed
Operating temperature	$T_{opr}$	The operating temperature range in which the normal operation and electrical characteristics of an IC are guaranteed

### 3. Electrical characteristics

Term	Symbol	Description
Output voltage accuracy	$V_{OUT}$	The accuracy of output voltage when the output current specified as a test condition is applied
Bias voltage	$V_{BAT}$ $V_{BIAS}$	The bias voltage range in which the proper operation and electrical characteristics of an IC are guaranteed
Input voltage	$V_{IN}$	The input voltage range in which the proper operation and electrical characteristics of an IC are guaranteed
Adjustable voltage	$V_{ADJ}$	The reference voltage of the internal error amplifier
Line regulation	Reg·line	The variation of the output voltage as a function of input voltage changes over the specified test condition
Load regulation	Reg·load	The variation of the output voltage as a function of output current changes over the specified test condition
Quiescent current	$I_B$	The current that flows to the GND terminal under the specified test conditions
Standby current	$I_B(OFF)$ $I_{BIAS(OFF)}$ $I_{IN(OFF)}$	The current that flows to the GND terminal when an IC is in the standby state by maintaining the control voltage at zero
Minimum dropout voltage	$V_{IN} - V_{OUT}$ $V_{DO}$	The drain-source on-voltage of the output MOSFET when the output current specified as a test condition is applied
Temperature coefficient	$T_{CVO}$	The rate of change of the output voltage over the temperature range specified as a test condition
Output noise voltage	$V_{NO}$	The noise voltage generated at the output of the specified test circuit
Ripple rejection ratio	R.R.	The ratio of output voltage ripple to input voltage ripple applied to the specified test circuit
Control voltage (ON)	$V_{CT(ON)}$	The CONTROL terminal voltage at which an IC turns on
Control voltage (OFF)	$V_{CT(OFF)}$	The CONTROL terminal voltage at which an IC is in the standby state
Control pulldown current	$I_{CT}$	The current that flows through the CONTROL terminal when the control voltage specified as a test condition is applied
Load transient response	$\Delta V_{OUT}$	The variation of the output voltage as a function of output current changes over the specified test condition
Undervoltage lockout	$V_{UVLO}$	The input voltage at which the undervoltage lockout circuit is tripped to prevent a malfunction in the event of the voltage dropping below the operational value
Output discharge on-resistance	$R_{SD}$	The value of the resistor that discharges an output capacitor when the output turns off

Term	Symbol	Description
Turn-on delay Turn-off delay	$t_{ON}$ $t_{OFF}$	<p>The time required for the output voltage to rise to its 90% point after the control voltage rises to its 10% point, and the time required for the output voltage to fall to its 10% point after the control voltage falls to its 90% point</p>

### 4. Built-in Functions

Term	Description
Overcurrent protection	A protection function that limits the output current in the event that it exceeds the programmed value
Foldback	A protection function that decreases the output voltage and thereby the output current in the event of an overcurrent condition. This output voltage-vs-output current curve is called the foldback curve.
Thermal shutdown	A function that protects an IC by turning off its output in the event that the IC temperature exceeds the programmed value
Inrush current reduction	A function that prevents a false malfunction of the overcurrent protection circuitry and an overshoot of the output voltage by limiting the current that flows to an output capacitor when the output turns on
Auto output discharge function	A function that discharges the charge stored in an output capacitor when the CONTROL terminal voltage drops to the Low level, turning off the output
Undervoltage lockout circuit	A function that maintains an IC in the standby state to prevent a malfunction in the event that the input voltage drops below the specified operating value
Output-voltage soft-start	A function that prevents a malfunction of the overcurrent protection circuitry and an overshoot of the output voltage by slowly raising the output voltage to slowly charge an output capacitor
Control pulldown connection	A function that pulls the CONTROL terminal to the Low level to prevent the internal circuitry from entering an undefined state in the event that the CONTROL terminal becomes open

## RESTRICTIONS ON PRODUCT USE

Toshiba Corporation and its subsidiaries and affiliates are collectively referred to as "TOSHIBA". Hardware, software and systems described in this document are collectively referred to as "Product".

- TOSHIBA reserves the right to make changes to the information in this document and related Product without notice.
- This document and any information herein may not be reproduced without prior written permission from TOSHIBA. Even with TOSHIBA's written permission, reproduction is permissible only if reproduction is without alteration/omission.
- Though TOSHIBA works continually to improve Product's quality and reliability, Product can malfunction or fail. Customers are responsible for complying with safety standards and for providing adequate designs and safeguards for their hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption. Before customers use the Product, create designs including the Product, or incorporate the Product into their own applications, customers must also refer to and comply with (a) the latest versions of all relevant TOSHIBA information, including without limitation, this document, the specifications, the data sheets and application notes for Product and the precautions and conditions set forth in the "TOSHIBA Semiconductor Reliability Handbook" and (b) the instructions for the application with which the Product will be used with or for. Customers are solely responsible for all aspects of their own product design or applications, including but not limited to (a) determining the appropriateness of the use of this Product in such design or applications; (b) evaluating and determining the applicability of any information contained in this document, or in charts, diagrams, programs, algorithms, sample application circuits, or any other referenced documents; and (c) validating all operating parameters for such designs and applications. **TOSHIBA ASSUMES NO LIABILITY FOR CUSTOMERS' PRODUCT DESIGN OR APPLICATIONS.**
- **PRODUCT IS NEITHER INTENDED NOR WARRANTED FOR USE IN EQUIPMENTS OR SYSTEMS THAT REQUIRE EXTRAORDINARILY HIGH LEVELS OF QUALITY AND/OR RELIABILITY, AND/OR A MALFUNCTION OR FAILURE OF WHICH MAY CAUSE LOSS OF HUMAN LIFE, BODILY INJURY, SERIOUS PROPERTY DAMAGE AND/OR SERIOUS PUBLIC IMPACT ("UNINTENDED USE").** Except for specific applications as expressly stated in this document, Unintended Use includes, without limitation, equipment used in nuclear facilities, equipment used in the aerospace industry, lifesaving and/or life supporting medical equipment, equipment used for automobiles, trains, ships and other transportation, traffic signaling equipment, equipment used to control combustions or explosions, safety devices, elevators and escalators, and devices related to power plant. **IF YOU USE PRODUCT FOR UNINTENDED USE, TOSHIBA ASSUMES NO LIABILITY FOR PRODUCT.** For details, please contact your TOSHIBA sales representative or contact us via our website.
- Do not disassemble, analyze, reverse-engineer, alter, modify, translate or copy Product, whether in whole or in part.
- Product shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable laws or regulations.
- The information contained herein is presented only as guidance for Product use. No responsibility is assumed by TOSHIBA for any infringement of patents or any other intellectual property rights of third parties that may result from the use of Product. No license to any intellectual property right is granted by this document, whether express or implied, by estoppel or otherwise.
- **ABSENT A WRITTEN SIGNED AGREEMENT, EXCEPT AS PROVIDED IN THE RELEVANT TERMS AND CONDITIONS OF SALE FOR PRODUCT, AND TO THE MAXIMUM EXTENT ALLOWABLE BY LAW, TOSHIBA (1) ASSUMES NO LIABILITY WHATSOEVER, INCLUDING WITHOUT LIMITATION, INDIRECT, CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OR LOSS, INCLUDING WITHOUT LIMITATION, LOSS OF PROFITS, LOSS OF OPPORTUNITIES, BUSINESS INTERRUPTION AND LOSS OF DATA, AND (2) DISCLAIMS ANY AND ALL EXPRESS OR IMPLIED WARRANTIES AND CONDITIONS RELATED TO SALE, USE OF PRODUCT, OR INFORMATION, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, ACCURACY OF INFORMATION, OR NONINFRINGEMENT.**
- Do not use or otherwise make available Product or related software or technology for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). Product and related software and technology may be controlled under the applicable export laws and regulations including, without limitation, the Japanese Foreign Exchange and Foreign Trade Law and the U.S. Export Administration Regulations. Export and re-export of Product or related software or technology are strictly prohibited except in compliance with all applicable export laws and regulations.
- Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. Please use Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. **TOSHIBA ASSUMES NO LIABILITY FOR DAMAGES OR LOSSES OCCURRING AS A RESULT OF NONCOMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS.**