

Linear Regulator Series

BUxxSD2 Series Dropout Voltage

This application note provides design values of the “Dropout voltage” that are necessary for designing circuits. From the operating temperature and output current of the target specification, check the maximum value of the input/output voltage difference in the next page and use it as the circuit design value. The values listed in this material are “design reference values” that are necessary for designing devices, and the values are not guaranteed. Check the latest data sheet for the guaranteed values.

What is dropout voltage

The dropout voltage is the difference between the input and output voltages that is necessary for the stabilizing operation of a linear regulator. When the input voltage approaches the output voltage, stabilizing operation cannot be maintained and the output starts dropping in proportion to the input. The voltage at which this situation starts, i.e., the difference between the input and output voltages that is necessary for the stabilizing operation, is referred to as the dropout voltage (Figure 1).

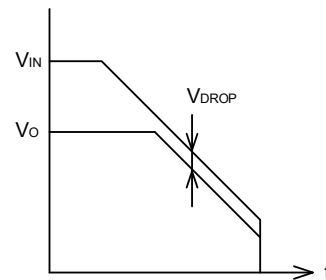


Figure 1. Dropout voltage

Figure 2 shows the relation between the input and output voltages and the dropout voltage. The dropout voltage varies with the circuit configuration of ICs. Compared with a standard linear regulator, an LDO has a smaller dropout voltage. Simply stated, the operation can be performed with the input voltage closer to the output voltage as the dropout voltage is smaller. On the other hand, the dropout voltage is not important in an application where 2.5 V is generated from 5 V.

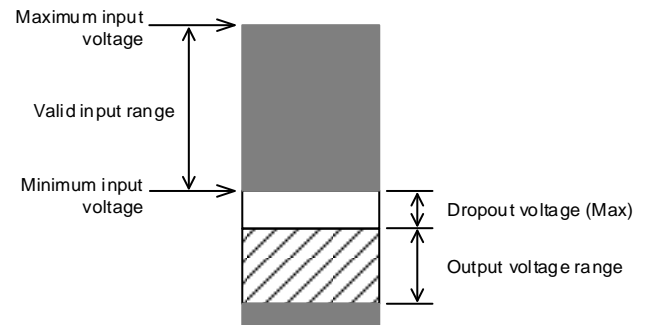


Figure 2. Relation between the input and output voltages

For example, Figure 3 shows the relation between the output current and temperature. It can be said that the dropout voltage is a parameter that varies with the output current and temperature. Therefore, if only the specifications at ordinary temperature are considered in the design, the circuit may not work at high temperature.

Study of dropout voltage and characteristics

The minimum value of the input voltage is determined by adding the output voltage to the dropout voltage at the load current to be used. At this time, the operation can work as DC, but the control performance is degraded. When there are fluctuations in the load, a large current cannot be supplied in a short period of time from input to output, as the dropout voltage is small. In other words, the load responsiveness will slow down. The slowness in responsiveness will also show up as a degradation in the PSRR characteristics. If only the minimum voltage amount of the dropout voltage is secured in order to focus on efficiency, the expected characteristics of the LDO will not be achieved. Increase the input voltage until the high-speed load responsiveness and PSRR performance is achieved, and find a trade-off between efficiency and each characteristic.

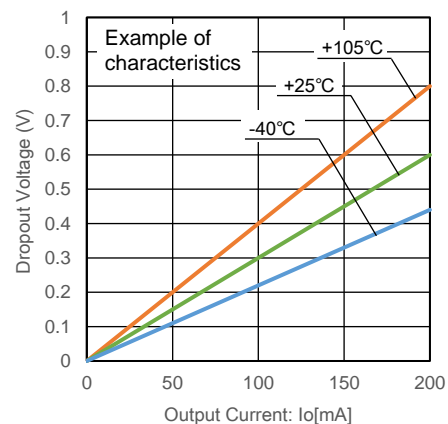
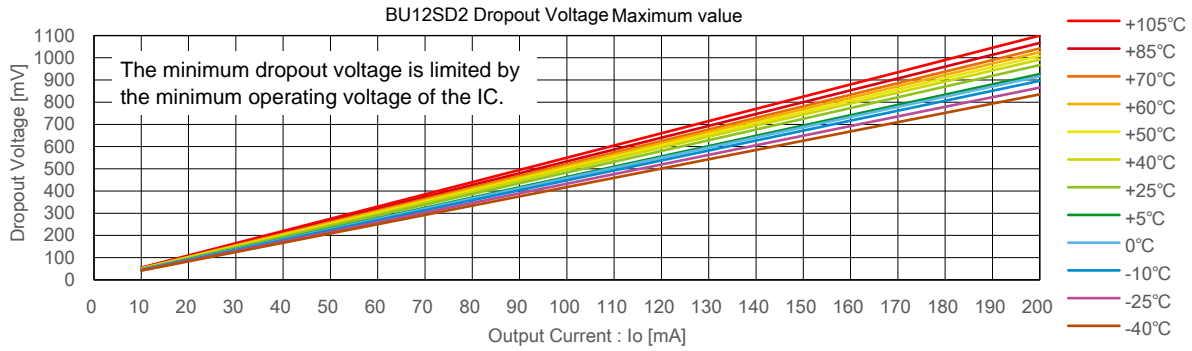


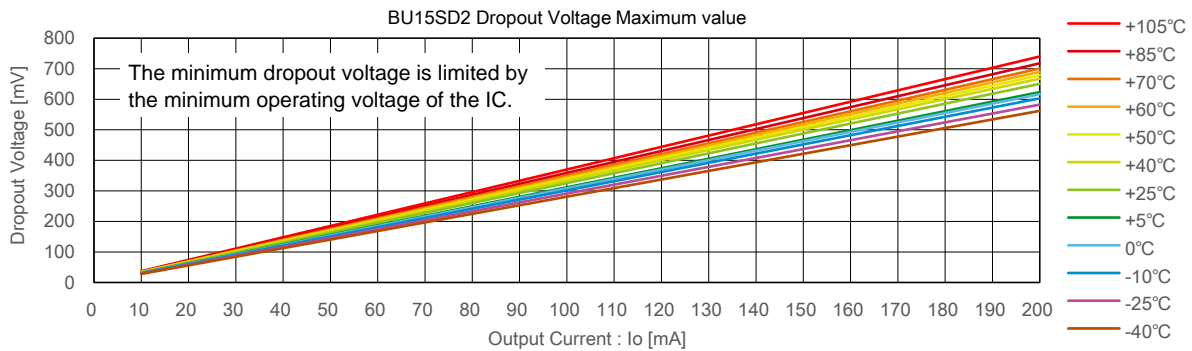
Figure 3. Relation with the output current and temperature

Maximum value, BU12SD2



Io [mA]	Dropout Voltage Maximum Value [mV]											
	-40°C	-25°C	-10°C	0°C	+5°C	+25°C	+40°C	+50°C	+60°C	+70°C	+85°C	+105°C
10	42	43	45	46	46	48	50	50	51	52	53	55
20	84	87	90	92	93	97	99	101	103	104	107	110
40	167	173	179	183	185	193	198	202	205	208	213	220
60	251	260	269	275	278	290	298	303	308	313	320	330
80	334	346	358	367	371	387	397	403	410	417	427	440
100	418	433	448	458	463	484	496	504	513	521	533	550
120	501	519	538	550	556	580	595	605	615	625	640	660
140	585	606	627	642	649	677	694	706	718	729	747	770
160	668	693	717	733	741	774	794	807	820	833	853	880
180	752	779	807	825	834	870	893	908	923	938	960	990
200	835	866	896	916	927	967	992	1009	1025	1042	1067	1100

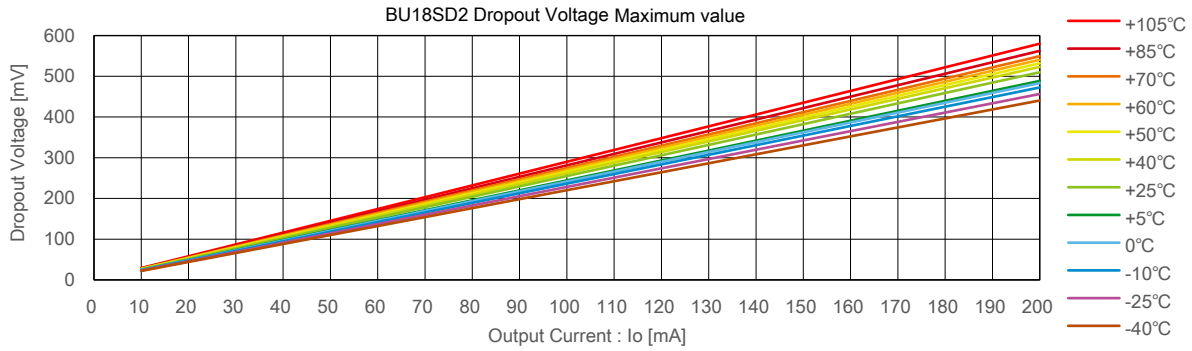
Maximum value, BU15SD2



Io [mA]	Dropout Voltage Maximum Value [mV]											
	-40°C	-25°C	-10°C	0°C	+5°C	+25°C	+40°C	+50°C	+60°C	+70°C	+85°C	+105°C
10	28	29	30	31	31	33	33	34	34	35	36	37
20	56	58	60	62	62	65	67	68	69	70	72	74
40	112	116	121	123	125	130	133	136	138	140	144	148
60	169	175	181	185	187	195	200	204	207	210	215	222
80	225	233	241	247	249	260	267	271	276	280	287	296
100	281	291	301	308	312	325	334	339	345	350	359	370
120	337	349	362	370	374	390	400	407	414	421	431	444
140	393	408	422	432	436	455	467	475	483	491	502	518
160	450	466	482	493	499	520	534	543	552	561	574	592
180	506	524	543	555	561	586	601	611	621	631	646	666
200	562	582	603	617	623	651	667	679	690	701	718	740

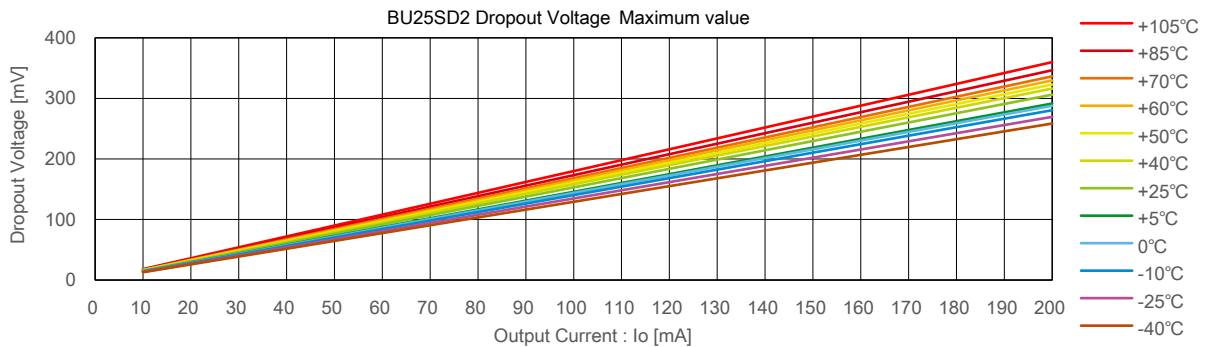
These values are "design reference values" that are necessary for circuit design, and the values are not guaranteed. Check the latest data sheet for the guaranteed values.

Maximum value, BU18SD2



I_o [mA]	Dropout Voltage Maximum Value [mV]											
	-40°C	-25°C	-10°C	0°C	+5°C	+25°C	+40°C	+50°C	+60°C	+70°C	+85°C	+105°C
10	22	23	24	24	24	25	26	27	27	27	28	29
20	44	46	47	48	49	51	52	53	54	55	56	58
40	88	91	95	97	98	102	105	106	108	110	113	116
60	132	137	142	145	147	153	157	160	162	165	169	174
80	176	183	189	193	195	204	209	213	216	220	225	232
100	220	228	236	242	244	255	262	266	270	275	281	290
120	264	274	284	290	293	306	314	319	324	330	338	348
140	308	320	331	338	342	357	366	372	378	385	394	406
160	352	365	378	387	391	408	418	425	432	440	450	464
180	396	411	425	435	440	459	471	479	487	494	506	522
200	441	457	473	483	489	510	523	532	541	549	563	580

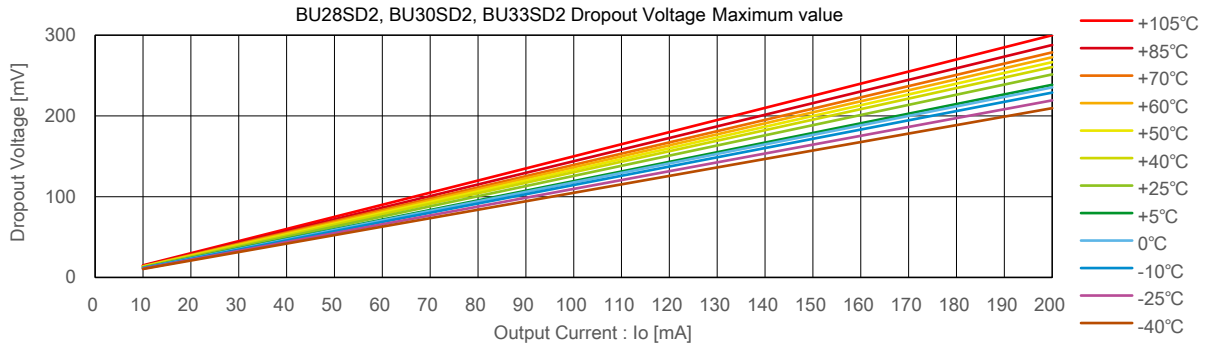
Maximum value, BU25SD2



I_o [mA]	Dropout Voltage Maximum Value [mV]											
	-40°C	-25°C	-10°C	0°C	+5°C	+25°C	+40°C	+50°C	+60°C	+70°C	+85°C	+105°C
10	13	13	14	14	15	15	16	16	16	17	17	18
20	26	27	28	29	29	31	32	32	33	34	35	36
40	52	54	56	58	58	61	63	65	66	67	69	72
60	78	81	84	86	87	92	95	97	99	101	104	108
80	103	108	112	115	117	122	126	129	132	135	139	144
100	129	135	140	144	146	153	158	161	165	168	173	180
120	155	162	168	173	175	184	190	194	198	202	208	216
140	181	189	196	201	204	214	221	226	231	235	243	252
160	207	216	224	230	233	245	253	258	264	269	277	288
180	233	243	252	259	262	276	285	291	297	303	312	324
200	258	269	280	288	291	306	316	323	330	336	346	360

These values are “design reference values” that are necessary for circuit design, and the values are not guaranteed. Check the latest data sheet for the guaranteed values.

Maximum value, BU28SD2, BU30SD2, BU33SD2



I_o [mA]	Dropout Voltage Maximum Value [mV]											
	-40°C	-25°C	-10°C	0°C	+5°C	+25°C	+40°C	+50°C	+60°C	+70°C	+85°C	+105°C
10	10	11	11	12	12	13	13	13	14	14	14	15
20	21	22	23	24	24	25	26	27	27	28	29	30
40	42	44	46	47	48	50	52	53	55	56	58	60
60	63	66	69	71	72	75	78	80	82	84	86	90
80	84	88	92	94	95	101	104	107	109	112	115	120
100	105	110	114	118	119	126	130	133	136	139	144	150
120	126	132	137	141	143	151	156	160	164	167	173	180
140	147	154	160	165	167	176	182	187	191	195	202	210
160	168	175	183	188	191	201	208	213	218	223	230	240
180	189	197	206	212	215	226	235	240	245	251	259	270
200	210	219	229	235	239	251	261	267	273	279	288	300

These values are “design reference values” that are necessary for circuit design, and the values are not guaranteed. Check the latest data sheet for the guaranteed values.

Notes

- 1) The information contained herein is subject to change without notice.
- 2) Before you use our Products, please contact our sales representative and verify the latest specifications :
- 3) Although ROHM is continuously working to improve product reliability and quality, semiconductors can break down and malfunction due to various factors.
Therefore, in order to prevent personal injury or fire arising from failure, please take safety measures such as complying with the derating characteristics, implementing redundant and fire prevention designs, and utilizing backups and fail-safe procedures. ROHM shall have no responsibility for any damages arising out of the use of our Products beyond the rating specified by ROHM.
- 4) Examples of application circuits, circuit constants and any other information contained herein are provided only to illustrate the standard usage and operations of the Products. The peripheral conditions must be taken into account when designing circuits for mass production.
- 5) The technical information specified herein is intended only to show the typical functions of and examples of application circuits for the Products. ROHM does not grant you, explicitly or implicitly, any license to use or exercise intellectual property or other rights held by ROHM or any other parties. ROHM shall have no responsibility whatsoever for any dispute arising out of the use of such technical information.
- 6) The Products specified in this document are not designed to be radiation tolerant.
- 7) For use of our Products in applications requiring a high degree of reliability (as exemplified below), please contact and consult with a ROHM representative : transportation equipment (i.e. cars, ships, trains), primary communication equipment, traffic lights, fire/crime prevention, safety equipment, medical systems, servers, solar cells, and power transmission systems.
- 8) Do not use our Products in applications requiring extremely high reliability, such as aerospace equipment, nuclear power control systems, and submarine repeaters.
- 9) ROHM shall have no responsibility for any damages or injury arising from non-compliance with the recommended usage conditions and specifications contained herein.
- 10) ROHM has used reasonable care to ensure the accuracy of the information contained in this document. However, ROHM does not warrants that such information is error-free, and ROHM shall have no responsibility for any damages arising from any inaccuracy or misprint of such information.
- 11) Please use the Products in accordance with any applicable environmental laws and regulations, such as the RoHS Directive. For more details, including RoHS compatibility, please contact a ROHM sales office. ROHM shall have no responsibility for any damages or losses resulting non-compliance with any applicable laws or regulations.
- 12) When providing our Products and technologies contained in this document to other countries, you must abide by the procedures and provisions stipulated in all applicable export laws and regulations, including without limitation the US Export Administration Regulations and the Foreign Exchange and Foreign Trade Act.
- 13) This document, in part or in whole, may not be reprinted or reproduced without prior consent of ROHM.



Thank you for your accessing to ROHM product informations.
More detail product informations and catalogs are available, please contact us.

ROHM Customer Support System

<http://www.rohm.com/contact/>