Linear Regulator Series

BUxxJA2DG-C, BUxxJA2VG-C 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).

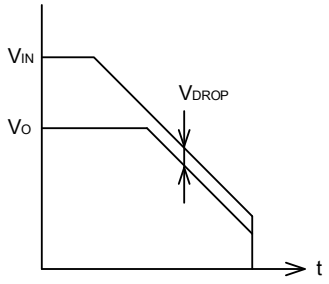

Figure 1. Dropout voltage

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.

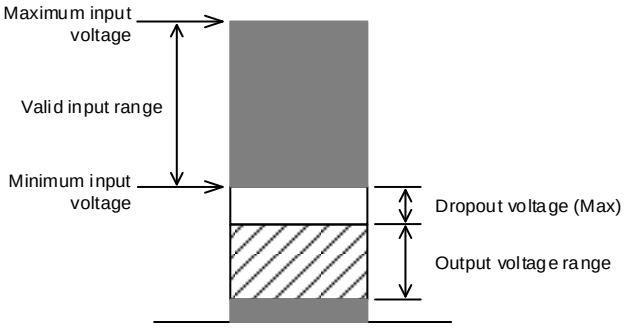

Figure 2. Relation between the input and output voltages

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.

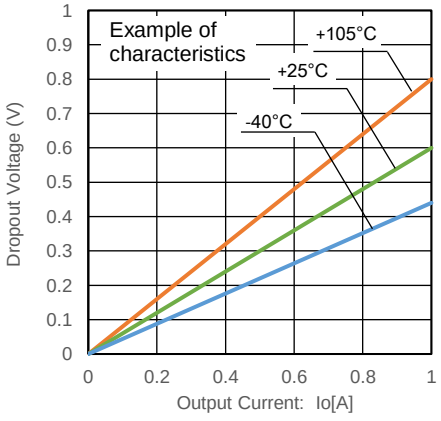

Figure 3. Relation with the output current and temperature

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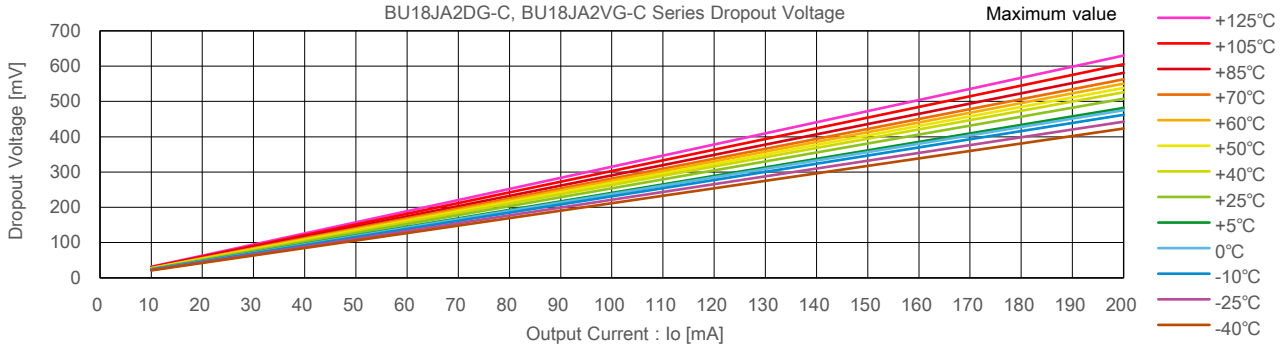
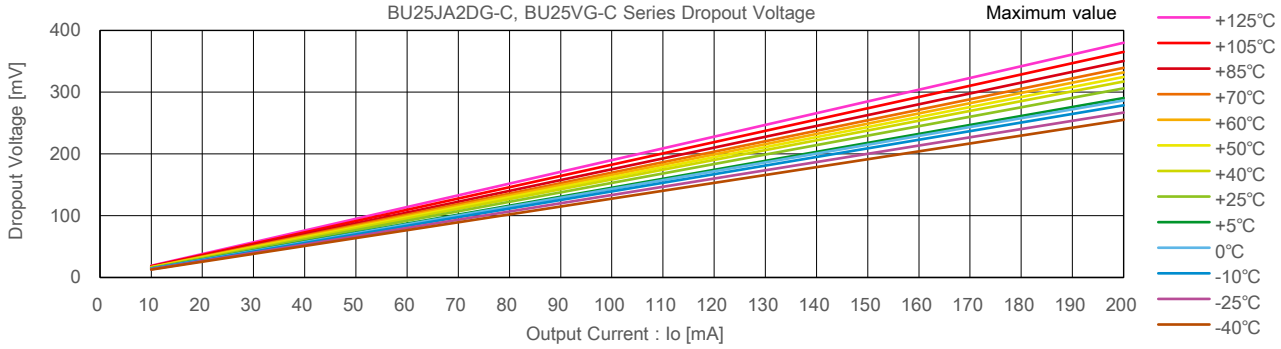
Maximum value, BU18JA2DG-C, BU18JA2VG-C



I_O [mA]	Dropout Voltage Maximum Value [mV]												
	-40℃	-25℃	-10℃	0℃	+5℃	+25℃	+40℃	+50℃	+60℃	+70℃	+85℃	+105℃	+125℃
10	21	22	23	24	24	25	26	27	28	28	29	30	31
20	42	44	46	48	48	51	53	54	55	56	58	61	63
40	85	89	92	95	96	102	105	108	110	113	116	121	126
60	127	133	139	143	144	152	158	161	165	169	174	182	189
80	169	177	185	190	193	203	210	215	220	225	232	242	252
100	212	221	231	238	241	254	263	269	275	281	290	303	315
120	254	266	277	285	289	305	316	323	330	338	349	363	378
140	296	310	323	333	337	355	368	377	385	394	407	424	441
160	338	354	370	380	385	406	421	431	440	450	465	484	504
180	381	398	416	428	433	457	473	484	495	506	523	545	567
200	423	443	462	475	482	508	526	538	550	563	581	605	630

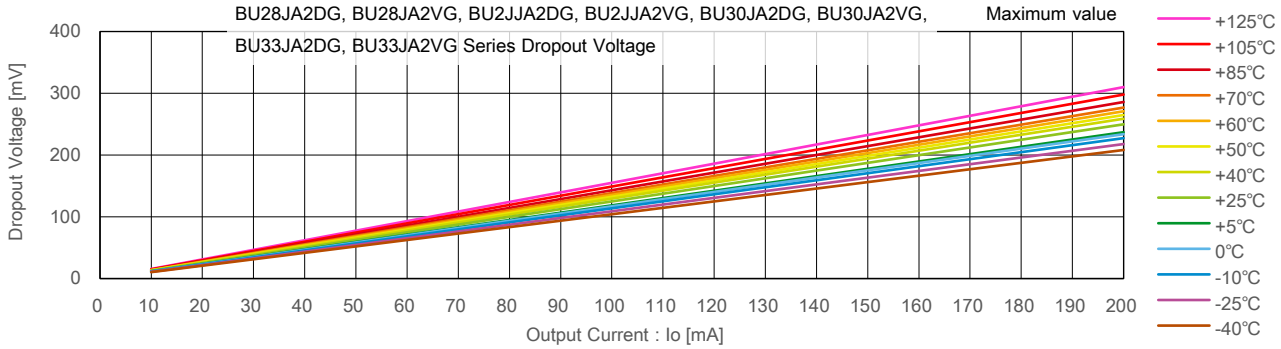
Maximum value, BU25JA2DG-C, BU25JA2VG-C



I_O [mA]	Dropout Voltage Maximum Value [mV]												
	-40℃	-25℃	-10℃	0℃	+5℃	+25℃	+40℃	+50℃	+60℃	+70℃	+85℃	+105℃	+125℃
10	13	13	14	14	15	15	16	16	17	17	18	18	19
20	26	27	28	29	29	31	32	32	33	34	35	37	38
40	51	53	56	57	58	61	63	65	66	68	70	73	76
60	77	80	84	86	87	92	95	97	100	102	105	110	114
80	102	107	112	115	116	122	127	130	133	136	140	146	152
100	128	134	139	143	145	153	159	162	166	170	175	183	190
120	153	160	167	172	174	184	190	195	199	204	210	219	228
140	179	187	195	201	203	214	222	227	232	238	245	256	266
160	204	214	223	229	232	245	254	260	266	272	280	292	304
180	230	240	251	258	261	276	286	292	299	305	315	329	342
200	255	267	279	287	291	306	317	325	332	339	351	365	380

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, BU28JA2DG-C, BU28JA2VG-C, BU2JJA2DG-C, BU2JJA2VG-C, BU30JA2DG-C, BU30JA2VG-C, BU33JA2DG-C, BU33JA2VG-C



I_O [mA]	Dropout Voltage Maximum Value [mV]												
	-40℃	-25℃	-10℃	0℃	+5℃	+25℃	+40℃	+50℃	+60℃	+70℃	+85℃	+105℃	+125℃
10	10	11	11	12	12	12	13	13	14	14	14	15	15
20	21	22	23	23	24	25	26	26	27	28	29	30	31
40	42	44	45	47	47	50	52	53	54	55	57	60	62
60	62	65	68	70	71	75	78	79	81	83	86	89	93
80	83	87	91	94	95	100	104	106	108	111	114	119	124
100	104	109	114	117	118	125	129	132	135	138	143	149	155
120	125	131	136	140	142	150	155	159	163	166	172	179	186
140	146	152	159	164	166	175	181	185	190	194	200	209	217
160	167	174	182	187	190	200	207	212	217	221	229	238	248
180	187	196	205	210	213	225	233	238	244	249	257	268	279
200	208	218	227	234	237	250	259	265	271	277	286	298	310

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.

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