

Linear Regulator Series

BUxxSA4 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).

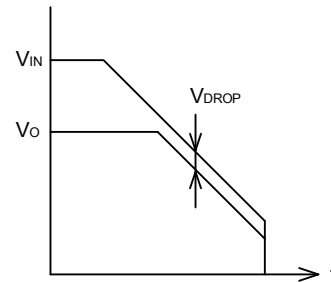


Figure 1. Dropout voltage

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.

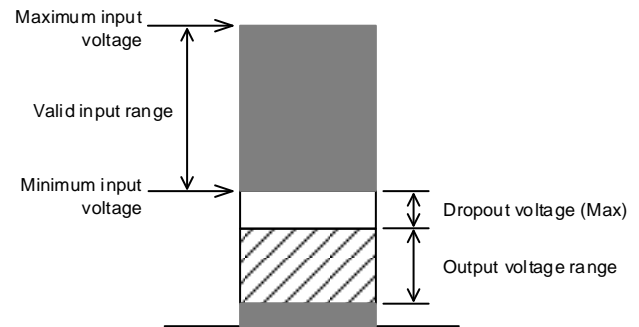


Figure 2. Relation between the input and output voltages

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.

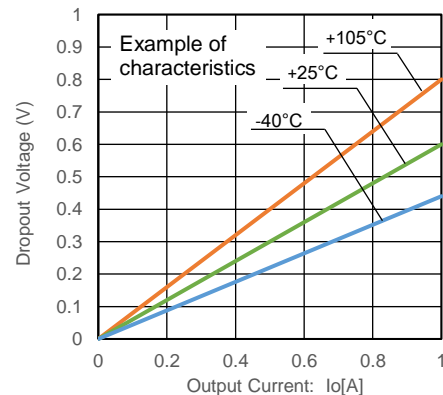
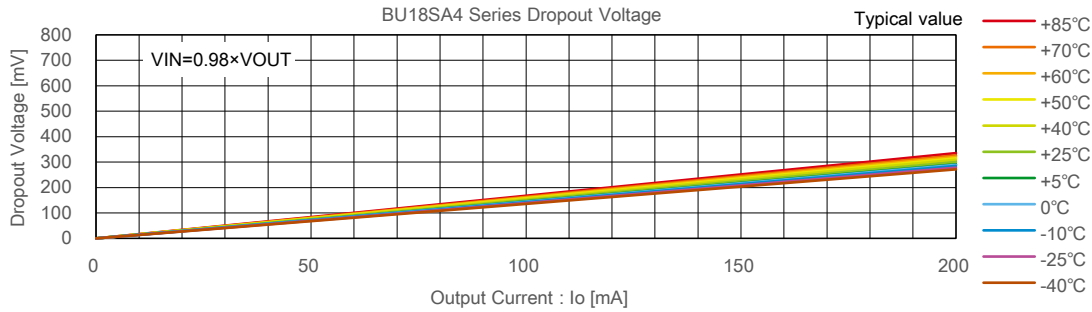


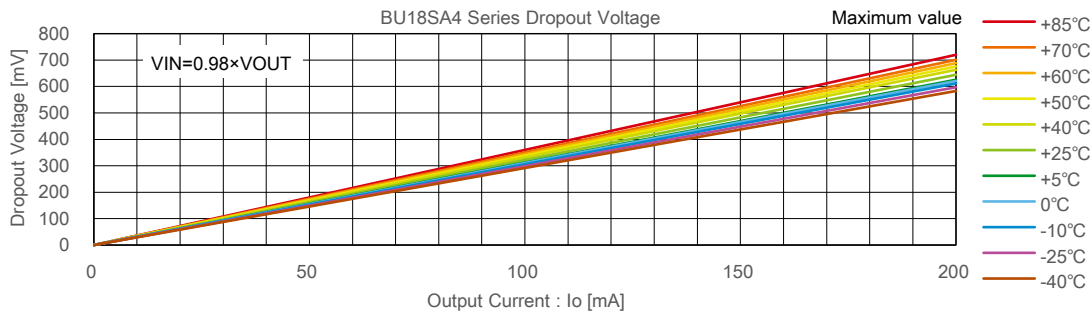
Figure 3. Relation with the output current and temperature

Typical value, BU18SA4



I _o [mA]	Dropout Voltage Typical Value [mV]										
	-40°C	-25°C	-10°C	0°C	+5°C	+25°C	+40°C	+50°C	+60°C	+70°C	+85°C
0	0	0	0	0	0	0	0	0	0	0	0
20	27	28	28	29	29	30	31	31	32	33	34
40	54	56	57	58	58	60	62	63	64	65	67
60	81	83	85	87	87	90	93	94	96	98	101
80	109	111	114	116	116	120	124	126	128	131	134
100	136	139	142	145	146	150	154	157	160	163	168
120	163	167	171	173	175	180	185	189	192	196	201
140	190	195	199	202	204	210	216	220	224	228	235
160	217	222	228	231	233	240	247	252	256	261	268
180	244	250	256	260	262	270	278	283	288	294	302
200	271	278	285	289	291	300	309	315	321	326	335

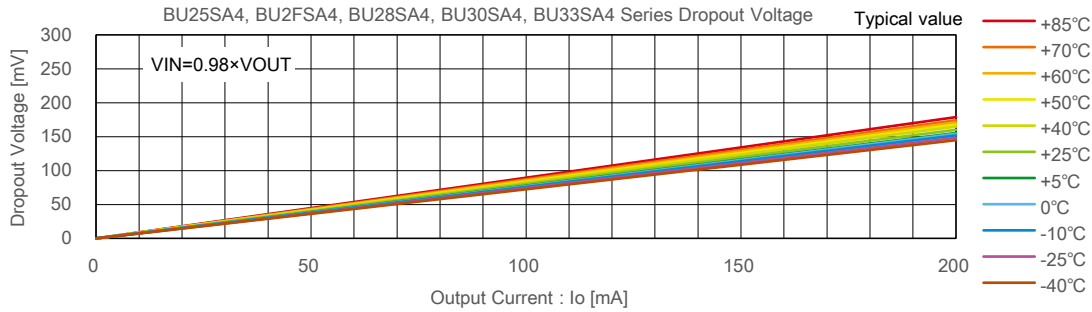
Maximum value, BU18SA4



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
0	0	0	0	0	0	0	0	0	0	0	0
20	58	60	61	62	63	64	66	68	69	70	72
40	117	119	122	124	125	129	133	135	138	140	144
60	175	179	183	186	188	193	199	203	207	210	216
80	233	239	245	248	250	258	265	270	275	280	288
100	292	299	306	310	313	322	332	338	344	351	360
120	350	358	367	372	375	387	398	406	413	421	432
140	408	418	428	435	438	451	464	473	482	491	504
160	466	478	489	497	500	515	531	541	551	561	576
180	525	537	550	559	563	580	597	608	620	631	648
200	583	597	611	621	625	644	663	676	688	701	720

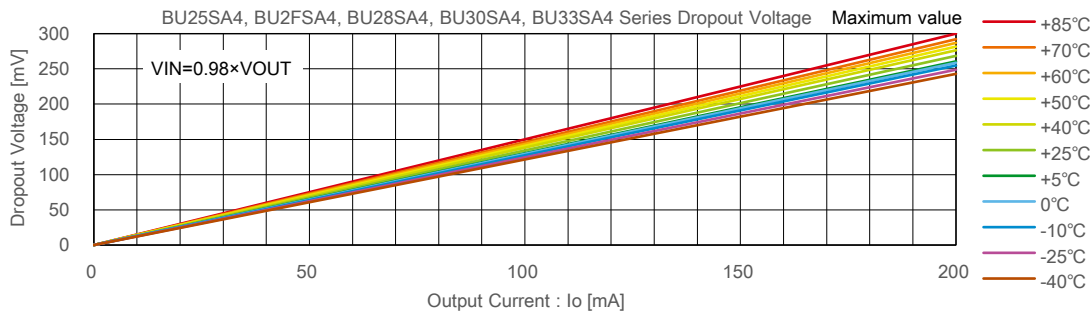
These values are “design reference values” that are necessary for circuit design, and the values are not guaranteed. Check the latest data sheet for the guaranteed values.

Typical value, BU25SA4, BU2FSA4, BU28SA4, BU30SA4, BU33SA4



I _o [mA]	Dropout Voltage Typical Value [mV]										
	-40°C	-25°C	-10°C	0°C	+5°C	+25°C	+40°C	+50°C	+60°C	+70°C	+85°C
0	0	0	0	0	0	0	0	0	0	0	0
20	14	15	15	15	16	16	16	17	17	17	18
40	29	30	30	31	31	32	33	34	34	35	36
60	43	44	46	46	47	48	49	50	51	52	54
80	58	59	61	62	62	64	66	67	68	70	72
100	72	74	76	77	78	80	82	84	85	87	89
120	87	89	91	92	93	96	99	101	103	104	107
140	101	104	106	108	109	112	115	117	120	122	125
160	116	119	121	123	124	128	132	134	137	139	143
180	130	133	137	139	140	144	148	151	154	157	161
200	145	148	152	154	155	160	165	168	171	174	179

Maximum value, BU25SA4, BU2FSA4, BU28SA4, BU30SA4, BU33SA4



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
0	0	0	0	0	0	0	0	0	0	0	0
20	24	25	25	26	26	27	28	28	29	29	30
40	49	50	51	52	52	54	55	56	57	58	60
60	73	75	76	78	78	81	83	84	86	88	90
80	97	100	102	103	104	107	111	113	115	117	120
100	121	124	127	129	130	134	138	141	143	146	150
120	146	149	153	155	156	161	166	169	172	175	180
140	170	174	178	181	182	188	193	197	201	204	210
160	194	199	204	207	208	215	221	225	229	234	240
180	219	224	229	233	235	242	249	253	258	263	270
200	243	249	255	259	261	268	276	282	287	292	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.

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