

Linear Regulator Series

BDxxHA5 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).

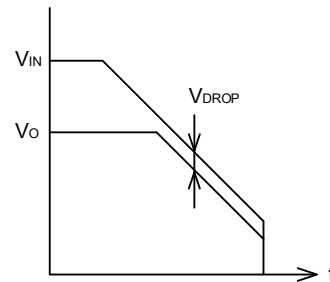


Figure 1. Dropout voltage

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 5 V is generated from 12 V.

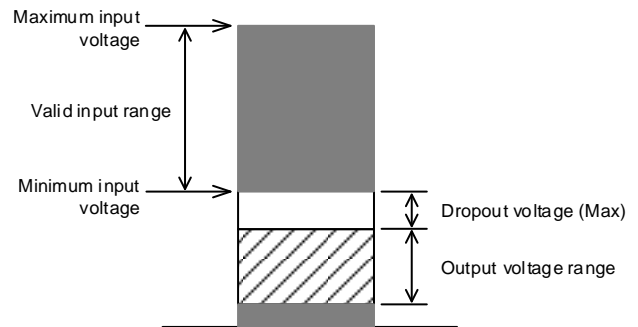


Figure 2. Relation between the input and output voltages

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.

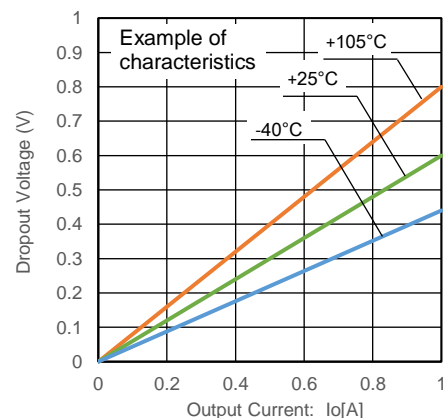
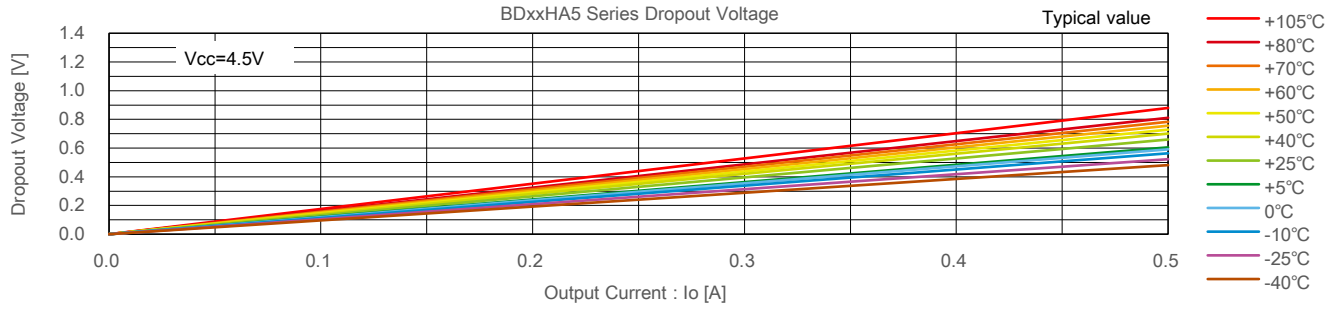


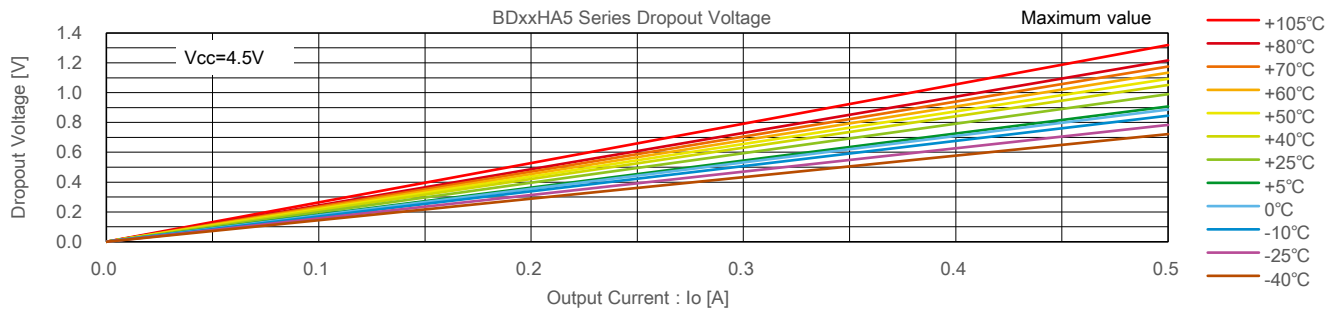
Figure 3. Relation with the output current and temperature

Typical value, Vcc = 4.5 V



| Io [A] | Dropout Voltage Typical Value [V] | | | | | | | | | | | |
|--------|-----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| | -40°C | -25°C | -10°C | 0°C | +5°C | +25°C | +40°C | +50°C | +60°C | +70°C | +80°C | +105°C |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0.05 | 0.048 | 0.052 | 0.056 | 0.059 | 0.060 | 0.066 | 0.070 | 0.073 | 0.076 | 0.078 | 0.081 | 0.088 |
| 0.10 | 0.096 | 0.105 | 0.113 | 0.118 | 0.121 | 0.132 | 0.140 | 0.146 | 0.151 | 0.157 | 0.162 | 0.176 |
| 0.15 | 0.144 | 0.157 | 0.169 | 0.177 | 0.181 | 0.198 | 0.210 | 0.219 | 0.227 | 0.235 | 0.243 | 0.264 |
| 0.20 | 0.193 | 0.209 | 0.225 | 0.236 | 0.242 | 0.264 | 0.280 | 0.291 | 0.302 | 0.313 | 0.324 | 0.352 |
| 0.25 | 0.241 | 0.261 | 0.282 | 0.296 | 0.302 | 0.330 | 0.351 | 0.364 | 0.378 | 0.392 | 0.405 | 0.440 |
| 0.30 | 0.289 | 0.314 | 0.338 | 0.355 | 0.363 | 0.396 | 0.421 | 0.437 | 0.454 | 0.470 | 0.487 | 0.528 |
| 0.35 | 0.337 | 0.366 | 0.395 | 0.414 | 0.423 | 0.462 | 0.491 | 0.510 | 0.529 | 0.548 | 0.568 | 0.616 |
| 0.40 | 0.385 | 0.418 | 0.451 | 0.473 | 0.484 | 0.528 | 0.561 | 0.583 | 0.605 | 0.627 | 0.649 | 0.704 |
| 0.45 | 0.433 | 0.470 | 0.507 | 0.532 | 0.544 | 0.594 | 0.631 | 0.656 | 0.680 | 0.705 | 0.730 | 0.792 |
| 0.50 | 0.481 | 0.523 | 0.564 | 0.591 | 0.605 | 0.660 | 0.701 | 0.729 | 0.756 | 0.783 | 0.811 | 0.880 |

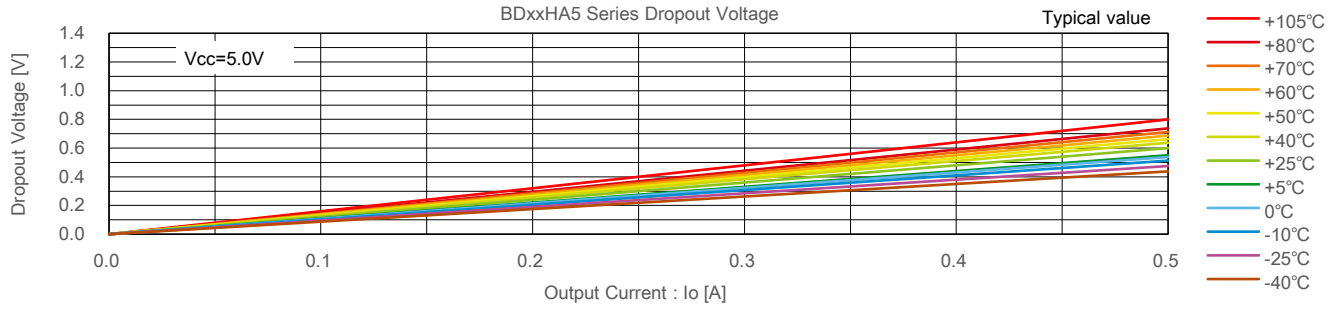
Maximum value, Vcc = 4.5 V



| Io [A] | Dropout Voltage Maximum Value [V] | | | | | | | | | | | |
|--------|-----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| | -40°C | -25°C | -10°C | 0°C | +5°C | +25°C | +40°C | +50°C | +60°C | +70°C | +80°C | +105°C |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0.05 | 0.072 | 0.078 | 0.085 | 0.089 | 0.091 | 0.099 | 0.105 | 0.109 | 0.113 | 0.118 | 0.122 | 0.132 |
| 0.10 | 0.144 | 0.157 | 0.169 | 0.177 | 0.181 | 0.198 | 0.210 | 0.219 | 0.227 | 0.235 | 0.243 | 0.264 |
| 0.15 | 0.217 | 0.235 | 0.254 | 0.266 | 0.272 | 0.297 | 0.315 | 0.328 | 0.340 | 0.353 | 0.365 | 0.396 |
| 0.20 | 0.289 | 0.314 | 0.338 | 0.355 | 0.363 | 0.396 | 0.421 | 0.437 | 0.454 | 0.470 | 0.487 | 0.528 |
| 0.25 | 0.361 | 0.392 | 0.423 | 0.443 | 0.454 | 0.495 | 0.526 | 0.546 | 0.567 | 0.588 | 0.608 | 0.660 |
| 0.30 | 0.433 | 0.470 | 0.507 | 0.532 | 0.544 | 0.594 | 0.631 | 0.656 | 0.680 | 0.705 | 0.730 | 0.792 |
| 0.35 | 0.505 | 0.549 | 0.592 | 0.621 | 0.635 | 0.693 | 0.736 | 0.765 | 0.794 | 0.823 | 0.851 | 0.924 |
| 0.40 | 0.578 | 0.627 | 0.676 | 0.709 | 0.726 | 0.792 | 0.841 | 0.874 | 0.907 | 0.940 | 0.973 | 1.055 |
| 0.45 | 0.650 | 0.705 | 0.761 | 0.798 | 0.817 | 0.891 | 0.946 | 0.983 | 1.021 | 1.058 | 1.095 | 1.187 |
| 0.50 | 0.722 | 0.784 | 0.846 | 0.887 | 0.907 | 0.990 | 1.052 | 1.093 | 1.134 | 1.175 | 1.216 | 1.319 |

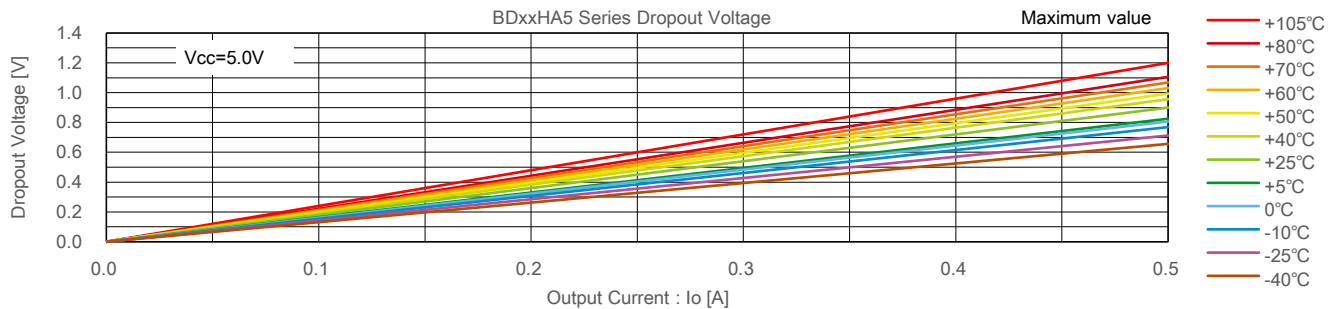
These values are “design reference values” that are necessary for circuit design, and the values are not guaranteed. Check the latest data sheet for the guaranteed values.

Typical value, Vcc = 5.0 V



| Io [A] | Dropout Voltage Typical Value [V] | | | | | | | | | | | |
|--------|-----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| | -40°C | -25°C | -10°C | 0°C | +5°C | +25°C | +40°C | +50°C | +60°C | +70°C | +80°C | +105°C |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0.05 | 0.044 | 0.048 | 0.051 | 0.054 | 0.055 | 0.060 | 0.064 | 0.066 | 0.069 | 0.071 | 0.074 | 0.080 |
| 0.10 | 0.088 | 0.095 | 0.103 | 0.108 | 0.110 | 0.120 | 0.127 | 0.132 | 0.137 | 0.142 | 0.147 | 0.160 |
| 0.15 | 0.131 | 0.143 | 0.154 | 0.161 | 0.165 | 0.180 | 0.191 | 0.199 | 0.206 | 0.214 | 0.221 | 0.240 |
| 0.20 | 0.175 | 0.190 | 0.205 | 0.215 | 0.220 | 0.240 | 0.255 | 0.265 | 0.275 | 0.285 | 0.295 | 0.320 |
| 0.25 | 0.219 | 0.238 | 0.256 | 0.269 | 0.275 | 0.300 | 0.319 | 0.331 | 0.344 | 0.356 | 0.369 | 0.400 |
| 0.30 | 0.263 | 0.285 | 0.308 | 0.323 | 0.330 | 0.360 | 0.382 | 0.397 | 0.412 | 0.427 | 0.442 | 0.480 |
| 0.35 | 0.306 | 0.333 | 0.359 | 0.376 | 0.385 | 0.420 | 0.446 | 0.464 | 0.481 | 0.499 | 0.516 | 0.560 |
| 0.40 | 0.350 | 0.380 | 0.410 | 0.430 | 0.440 | 0.480 | 0.510 | 0.530 | 0.550 | 0.570 | 0.590 | 0.640 |
| 0.45 | 0.394 | 0.428 | 0.461 | 0.484 | 0.495 | 0.540 | 0.574 | 0.596 | 0.619 | 0.641 | 0.664 | 0.720 |
| 0.50 | 0.438 | 0.475 | 0.513 | 0.538 | 0.550 | 0.600 | 0.637 | 0.662 | 0.687 | 0.712 | 0.737 | 0.800 |

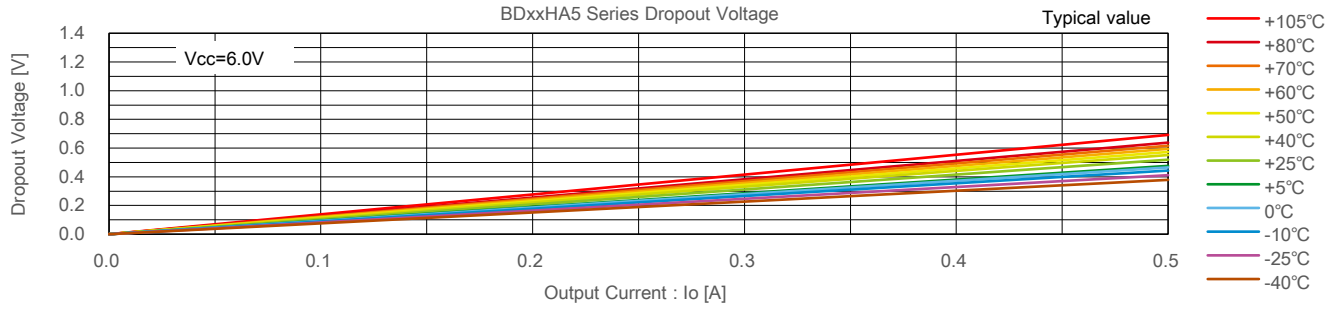
Maximum value, Vcc = 5.0 V



| Io [A] | Dropout Voltage Maximum Value [V] | | | | | | | | | | | |
|--------|-----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| | -40°C | -25°C | -10°C | 0°C | +5°C | +25°C | +40°C | +50°C | +60°C | +70°C | +80°C | +105°C |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0.05 | 0.066 | 0.071 | 0.077 | 0.081 | 0.083 | 0.090 | 0.096 | 0.099 | 0.103 | 0.107 | 0.111 | 0.120 |
| 0.10 | 0.131 | 0.143 | 0.154 | 0.161 | 0.165 | 0.180 | 0.191 | 0.199 | 0.206 | 0.214 | 0.221 | 0.240 |
| 0.15 | 0.197 | 0.214 | 0.231 | 0.242 | 0.248 | 0.270 | 0.287 | 0.298 | 0.309 | 0.321 | 0.332 | 0.360 |
| 0.20 | 0.263 | 0.285 | 0.308 | 0.323 | 0.330 | 0.360 | 0.382 | 0.397 | 0.412 | 0.427 | 0.442 | 0.480 |
| 0.25 | 0.328 | 0.356 | 0.384 | 0.403 | 0.413 | 0.450 | 0.478 | 0.497 | 0.516 | 0.534 | 0.553 | 0.600 |
| 0.30 | 0.394 | 0.428 | 0.461 | 0.484 | 0.495 | 0.540 | 0.574 | 0.596 | 0.619 | 0.641 | 0.664 | 0.720 |
| 0.35 | 0.460 | 0.499 | 0.538 | 0.564 | 0.578 | 0.630 | 0.669 | 0.696 | 0.722 | 0.748 | 0.774 | 0.840 |
| 0.40 | 0.525 | 0.570 | 0.615 | 0.645 | 0.660 | 0.720 | 0.765 | 0.795 | 0.825 | 0.855 | 0.885 | 0.960 |
| 0.45 | 0.591 | 0.641 | 0.692 | 0.726 | 0.743 | 0.810 | 0.861 | 0.894 | 0.928 | 0.962 | 0.995 | 1.080 |
| 0.50 | 0.656 | 0.713 | 0.769 | 0.806 | 0.825 | 0.900 | 0.956 | 0.994 | 1.031 | 1.069 | 1.106 | 1.200 |

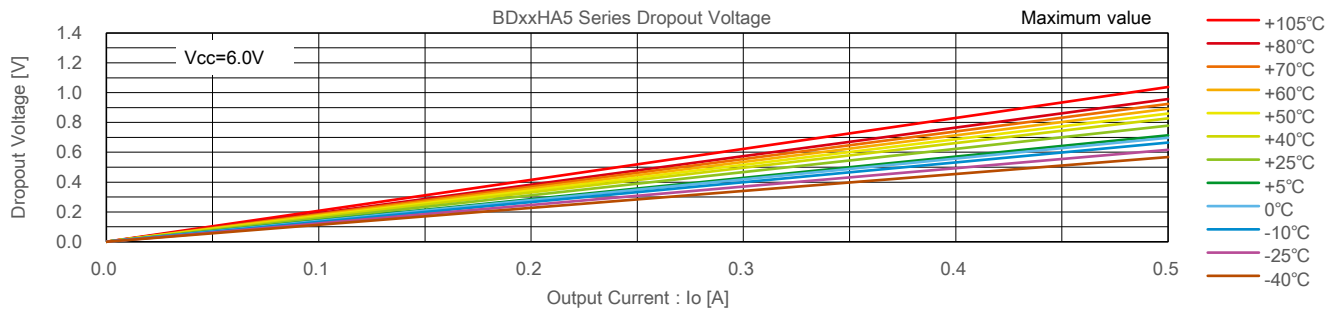
These values are “design reference values” that are necessary for circuit design, and the values are not guaranteed. Check the latest data sheet for the guaranteed values.

Typical value, Vcc = 6.0 V



| Io [A] | Dropout Voltage Typical Value [V] | | | | | | | | | | | |
|--------|-----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| | -40°C | -25°C | -10°C | 0°C | +5°C | +25°C | +40°C | +50°C | +60°C | +70°C | +80°C | +105°C |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0.05 | 0.038 | 0.041 | 0.044 | 0.047 | 0.048 | 0.052 | 0.055 | 0.057 | 0.059 | 0.062 | 0.064 | 0.069 |
| 0.10 | 0.076 | 0.082 | 0.089 | 0.093 | 0.095 | 0.104 | 0.110 | 0.115 | 0.119 | 0.123 | 0.128 | 0.138 |
| 0.15 | 0.114 | 0.123 | 0.133 | 0.140 | 0.143 | 0.156 | 0.165 | 0.172 | 0.178 | 0.185 | 0.191 | 0.208 |
| 0.20 | 0.151 | 0.164 | 0.177 | 0.186 | 0.190 | 0.208 | 0.221 | 0.229 | 0.238 | 0.247 | 0.255 | 0.277 |
| 0.25 | 0.189 | 0.206 | 0.222 | 0.233 | 0.238 | 0.260 | 0.276 | 0.287 | 0.297 | 0.308 | 0.319 | 0.346 |
| 0.30 | 0.227 | 0.247 | 0.266 | 0.279 | 0.286 | 0.311 | 0.331 | 0.344 | 0.357 | 0.370 | 0.383 | 0.415 |
| 0.35 | 0.265 | 0.288 | 0.310 | 0.326 | 0.333 | 0.363 | 0.386 | 0.401 | 0.416 | 0.431 | 0.447 | 0.484 |
| 0.40 | 0.303 | 0.329 | 0.355 | 0.372 | 0.381 | 0.415 | 0.441 | 0.459 | 0.476 | 0.493 | 0.510 | 0.554 |
| 0.45 | 0.341 | 0.370 | 0.399 | 0.419 | 0.428 | 0.467 | 0.496 | 0.516 | 0.535 | 0.555 | 0.574 | 0.623 |
| 0.50 | 0.379 | 0.411 | 0.444 | 0.465 | 0.476 | 0.519 | 0.552 | 0.573 | 0.595 | 0.616 | 0.638 | 0.692 |

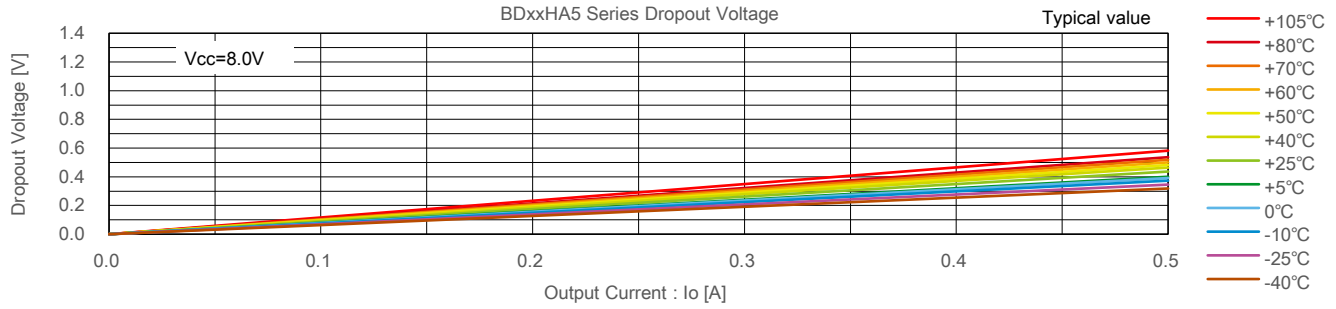
Maximum value, Vcc = 6.0 V



| Io [A] | Dropout Voltage Maximum Value [V] | | | | | | | | | | | |
|--------|-----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| | -40°C | -25°C | -10°C | 0°C | +5°C | +25°C | +40°C | +50°C | +60°C | +70°C | +80°C | +105°C |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0.05 | 0.057 | 0.062 | 0.067 | 0.070 | 0.071 | 0.078 | 0.083 | 0.086 | 0.089 | 0.092 | 0.096 | 0.104 |
| 0.10 | 0.114 | 0.123 | 0.133 | 0.140 | 0.143 | 0.156 | 0.165 | 0.172 | 0.178 | 0.185 | 0.191 | 0.208 |
| 0.15 | 0.170 | 0.185 | 0.200 | 0.209 | 0.214 | 0.234 | 0.248 | 0.258 | 0.268 | 0.277 | 0.287 | 0.311 |
| 0.20 | 0.227 | 0.247 | 0.266 | 0.279 | 0.286 | 0.311 | 0.331 | 0.344 | 0.357 | 0.370 | 0.383 | 0.415 |
| 0.25 | 0.284 | 0.308 | 0.333 | 0.349 | 0.357 | 0.389 | 0.414 | 0.430 | 0.446 | 0.462 | 0.478 | 0.519 |
| 0.30 | 0.341 | 0.370 | 0.399 | 0.419 | 0.428 | 0.467 | 0.496 | 0.516 | 0.535 | 0.555 | 0.574 | 0.623 |
| 0.35 | 0.398 | 0.432 | 0.466 | 0.488 | 0.500 | 0.545 | 0.579 | 0.602 | 0.625 | 0.647 | 0.670 | 0.727 |
| 0.40 | 0.454 | 0.493 | 0.532 | 0.558 | 0.571 | 0.623 | 0.662 | 0.688 | 0.714 | 0.740 | 0.766 | 0.830 |
| 0.45 | 0.511 | 0.555 | 0.599 | 0.628 | 0.642 | 0.701 | 0.745 | 0.774 | 0.803 | 0.832 | 0.861 | 0.934 |
| 0.50 | 0.568 | 0.617 | 0.665 | 0.698 | 0.714 | 0.779 | 0.827 | 0.860 | 0.892 | 0.925 | 0.957 | 1.038 |

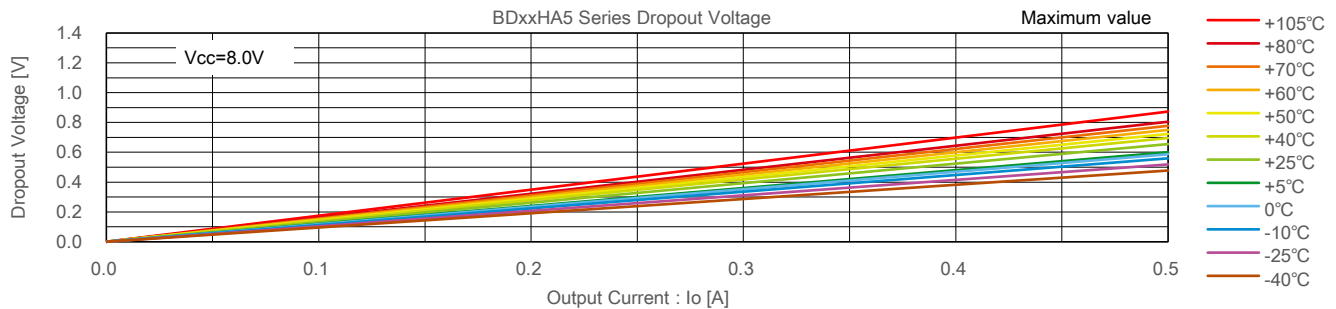
These values are “design reference values” that are necessary for circuit design, and the values are not guaranteed. Check the latest data sheet for the guaranteed values.

Typical value, Vcc = 8.0 V



| I _o [A] | Dropout Voltage Typical Value [V] | | | | | | | | | | | |
|--------------------|-----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| | -40°C | -25°C | -10°C | 0°C | +5°C | +25°C | +40°C | +50°C | +60°C | +70°C | +80°C | +105°C |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0.05 | 0.032 | 0.035 | 0.037 | 0.039 | 0.040 | 0.044 | 0.046 | 0.048 | 0.050 | 0.052 | 0.054 | 0.058 |
| 0.10 | 0.064 | 0.069 | 0.075 | 0.078 | 0.080 | 0.087 | 0.093 | 0.096 | 0.100 | 0.104 | 0.107 | 0.116 |
| 0.15 | 0.096 | 0.104 | 0.112 | 0.117 | 0.120 | 0.131 | 0.139 | 0.145 | 0.150 | 0.156 | 0.161 | 0.175 |
| 0.20 | 0.127 | 0.138 | 0.149 | 0.156 | 0.160 | 0.175 | 0.186 | 0.193 | 0.200 | 0.207 | 0.215 | 0.233 |
| 0.25 | 0.159 | 0.173 | 0.187 | 0.196 | 0.200 | 0.218 | 0.232 | 0.241 | 0.250 | 0.259 | 0.268 | 0.291 |
| 0.30 | 0.191 | 0.207 | 0.224 | 0.235 | 0.240 | 0.262 | 0.278 | 0.289 | 0.300 | 0.311 | 0.322 | 0.349 |
| 0.35 | 0.223 | 0.242 | 0.261 | 0.274 | 0.280 | 0.306 | 0.325 | 0.337 | 0.350 | 0.363 | 0.376 | 0.407 |
| 0.40 | 0.255 | 0.277 | 0.298 | 0.313 | 0.320 | 0.349 | 0.371 | 0.386 | 0.400 | 0.415 | 0.429 | 0.466 |
| 0.45 | 0.287 | 0.311 | 0.336 | 0.352 | 0.360 | 0.393 | 0.418 | 0.434 | 0.450 | 0.467 | 0.483 | 0.524 |
| 0.50 | 0.319 | 0.346 | 0.373 | 0.391 | 0.400 | 0.437 | 0.464 | 0.482 | 0.500 | 0.518 | 0.537 | 0.582 |

Maximum value, Vcc = 8.0 V



| I _o [A] | Dropout Voltage Maximum Value [V] | | | | | | | | | | | |
|--------------------|-----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| | -40°C | -25°C | -10°C | 0°C | +5°C | +25°C | +40°C | +50°C | +60°C | +70°C | +80°C | +105°C |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0.05 | 0.048 | 0.052 | 0.056 | 0.059 | 0.060 | 0.065 | 0.070 | 0.072 | 0.075 | 0.078 | 0.080 | 0.087 |
| 0.10 | 0.096 | 0.104 | 0.112 | 0.117 | 0.120 | 0.131 | 0.139 | 0.145 | 0.150 | 0.156 | 0.161 | 0.175 |
| 0.15 | 0.143 | 0.156 | 0.168 | 0.176 | 0.180 | 0.196 | 0.209 | 0.217 | 0.225 | 0.233 | 0.241 | 0.262 |
| 0.20 | 0.191 | 0.207 | 0.224 | 0.235 | 0.240 | 0.262 | 0.278 | 0.289 | 0.300 | 0.311 | 0.322 | 0.349 |
| 0.25 | 0.239 | 0.259 | 0.280 | 0.293 | 0.300 | 0.327 | 0.348 | 0.362 | 0.375 | 0.389 | 0.402 | 0.437 |
| 0.30 | 0.287 | 0.311 | 0.336 | 0.352 | 0.360 | 0.393 | 0.418 | 0.434 | 0.450 | 0.467 | 0.483 | 0.524 |
| 0.35 | 0.334 | 0.363 | 0.392 | 0.411 | 0.420 | 0.458 | 0.487 | 0.506 | 0.525 | 0.544 | 0.563 | 0.611 |
| 0.40 | 0.382 | 0.415 | 0.448 | 0.469 | 0.480 | 0.524 | 0.557 | 0.579 | 0.600 | 0.622 | 0.644 | 0.698 |
| 0.45 | 0.430 | 0.467 | 0.504 | 0.528 | 0.540 | 0.589 | 0.626 | 0.651 | 0.675 | 0.700 | 0.724 | 0.786 |
| 0.50 | 0.478 | 0.519 | 0.560 | 0.587 | 0.600 | 0.655 | 0.696 | 0.723 | 0.750 | 0.778 | 0.805 | 0.873 |

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/>