### General Description

BUxxTD2WNVX series is high-performance FULL CMOS regulator with 200-mA output, which is mounted on versatile package SSON004X1010 (1.00mm × 1.00 mm × 0.60mm). It has excellent noise characteristics and load responsiveness characteristics despite its low circuit current consumption of 35μA. It is most appropriate for various applications such as power supplies for logic IC, RF, and camera modules.

### Features

- High accuracy detection
- Low current consumption
- Compatible with small ceramic capacitor (Cin=Co=0.47uF)
- With built-in output discharge circuit
- High ripple rejection
- ON/OFF control of output voltage
- With built-in over current protection circuit and thermal shutdown circuit
- Low dropout voltage

### Key Specifications

- **Output voltage:** 1.0V to 3.4V
- **Accuracy output voltage:** ±1.0% (±25mV)
- **Low current consumption:** 35μA
- **Operating temperature range:** -40°C to +85°C

### Applications

Battery-powered portable equipment, etc.

### Package

- SSON004X1010 : 1.00mm x 1.00mm x 0.60mm

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**Fig.1 Application Circuit**

![Application Circuit Diagram]

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*This product is not designed protection against radioactive rays.*
BUxxTD2WNVX series

Datasheet

● Connection Diagram

SSON004X1010 (TOP VIEW)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Symbol</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VOUT</td>
<td>Output Voltage</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Grounding</td>
</tr>
<tr>
<td>3</td>
<td>STBY</td>
<td>ON/OFF control of output voltage (High: ON, Low: OFF)</td>
</tr>
<tr>
<td>4</td>
<td>VIN</td>
<td>Power Supply Voltage</td>
</tr>
</tbody>
</table>

BOTTOM VIEW

● Pin Descriptions

<table>
<thead>
<tr>
<th>PIN No.</th>
<th>Symbol</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VOUT</td>
<td>Output Voltage</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Grounding</td>
</tr>
<tr>
<td>3</td>
<td>STBY</td>
<td>ON/OFF control of output voltage (High: ON, Low: OFF)</td>
</tr>
<tr>
<td>4</td>
<td>VIN</td>
<td>Power Supply Voltage</td>
</tr>
</tbody>
</table>

reverse FIN Substrate (Connect to GND)

● Ordering Information

BUxxTD2WNVX - T L

Part Number Output Voltage Low Dropout Voltage Maximum Output Current with output discharge Package Package and forming specification
10 : 1.0V 200mA SSON004X1010 TL: The pin number 1 is the lower left
34 : 3.4V

SSON004X1010

<Tape and Reel information>

Tape Embossed carrier tape

Quantity 5000pcs

Direction of feed TL: The direction is the 1pin of product is at the lower left when you hold reel on the left hand and you pull out the tape on the left hand

Order quantity needs to be multiple of the minimum quantity.

(Unit : mm)
BUxxTD2WNVX series

● Lineup

<table>
<thead>
<tr>
<th>Marking</th>
<th>A</th>
<th>6</th>
<th>5</th>
<th>2</th>
<th>B</th>
<th>3</th>
<th>5i</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Voltage</td>
<td>1.0V</td>
<td>1.05V</td>
<td>1.1V</td>
<td>1.15V</td>
<td>1.2V</td>
<td>1.25V</td>
<td>1.3V</td>
<td>1.5V</td>
<td>1.8V</td>
</tr>
<tr>
<td>Part Number</td>
<td>BU10</td>
<td>BU1A</td>
<td>BU11</td>
<td>BU1B</td>
<td>BU12</td>
<td>BU1C</td>
<td>BU13</td>
<td>BU15</td>
<td>BU18</td>
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<table>
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<tr>
<th>E</th>
<th>F</th>
<th>G</th>
<th>r</th>
<th>0</th>
<th>1</th>
<th>H</th>
<th>J</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.85V</td>
<td>1.9V</td>
<td>2.0V</td>
<td>2.05V</td>
<td>2.1V</td>
<td>2.3V</td>
<td>2.5V</td>
<td>2.6V</td>
<td>2.7V</td>
</tr>
<tr>
<td>BU1J</td>
<td>BU19</td>
<td>BU20</td>
<td>BU2A</td>
<td>BU21</td>
<td>BU23</td>
<td>BU25</td>
<td>BU26</td>
<td>BU27</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>a</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>P</th>
<th>Q</th>
<th>R</th>
<th>U</th>
<th>Y</th>
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</thead>
<tbody>
<tr>
<td>2.75V</td>
<td>2.8V</td>
<td>2.85V</td>
<td>2.9V</td>
<td>3.0V</td>
<td>3.1V</td>
<td>3.2V</td>
<td>3.3V</td>
<td>3.4V</td>
</tr>
<tr>
<td>BU2H</td>
<td>BU28</td>
<td>BU2J</td>
<td>BU29</td>
<td>BU30</td>
<td>BU31</td>
<td>BU32</td>
<td>BU33</td>
<td>BU34</td>
</tr>
</tbody>
</table>

● Absolute Maximum Ratings (Ta=25°C)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>Symbol</th>
<th>Limit</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply Voltage</td>
<td>VMAX</td>
<td>-0.3</td>
<td>~ +6.5</td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>Pd</td>
<td>560(*1)</td>
<td>mW</td>
</tr>
<tr>
<td>Maximum junction temperature</td>
<td>TjMAX</td>
<td>+125</td>
<td>℃</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>Topr</td>
<td>-40</td>
<td>~ +85</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>Tstg</td>
<td>-55</td>
<td>~ +125</td>
</tr>
</tbody>
</table>

(*1)Pd deleted at 5.6mW/℃ at temperatures above Ta=25℃, mounted on 70×70×1.6 mm glass-epoxy PCB.

● RECOMMENDED OPERATING RANGE (not to exceed Pd)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>Symbol</th>
<th>Limit</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply Voltage</td>
<td>VIN</td>
<td>1.7~6.0</td>
<td>V</td>
</tr>
<tr>
<td>Maximum Output Current</td>
<td>IMAX</td>
<td>200</td>
<td>mA</td>
</tr>
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</table>

● OPERATING CONDITIONS

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>Symbol</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>Unit</th>
<th>CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Capacitor</td>
<td>Cin</td>
<td>0.22(*2)</td>
<td>0.47</td>
<td>–</td>
<td>µF</td>
<td>Ceramic capacitor recommended</td>
</tr>
<tr>
<td>Output Capacitor</td>
<td>Co</td>
<td>0.22(*2)</td>
<td>0.47</td>
<td>–</td>
<td>µF</td>
<td></td>
</tr>
</tbody>
</table>

(*2)Make sure that the output capacitor value is not kept lower than this specified level across a variety of temperature, DC bias, changing as time progresses characteristic.
**Electrical Characteristics**

(\(T_a=25^\circ\text{C},\ \text{VIN}=\text{VOUT}+1.0\text{V}\) (*3), \(\text{STBY} = \text{VIN},\ \text{Cin}=0.47\mu\text{F},\ \text{Co}=0.47\mu\text{F}\), unless otherwise noted.)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>Symbol</th>
<th>Limit</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>MIN.</td>
<td>TYP.</td>
<td>MAX.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VOUT×0.99</td>
<td>VOUT</td>
<td>VOUT×1.01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VOUT&lt;25mV</td>
<td>VOUT</td>
<td>VOUT&lt;25mV</td>
</tr>
<tr>
<td>Output Voltage</td>
<td>VOUT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Current</td>
<td>IIN</td>
<td>35</td>
<td>60</td>
<td>(\mu\text{A})</td>
</tr>
<tr>
<td>Operating Current (STBY)</td>
<td>ISTBY</td>
<td>–</td>
<td>–</td>
<td>1.0 (\mu\text{A})</td>
</tr>
<tr>
<td>Ripple Rejection Ratio</td>
<td>RR</td>
<td>45</td>
<td>70</td>
<td>–</td>
</tr>
<tr>
<td>Dropout Voltage (VSAT)</td>
<td>VSAT</td>
<td>–</td>
<td>800</td>
<td>1100 (\text{mV})</td>
</tr>
<tr>
<td></td>
<td></td>
<td>–</td>
<td>600</td>
<td>900 (\text{mV})</td>
</tr>
<tr>
<td></td>
<td></td>
<td>–</td>
<td>440</td>
<td>700 (\text{mV})</td>
</tr>
<tr>
<td></td>
<td></td>
<td>–</td>
<td>380</td>
<td>600 (\text{mV})</td>
</tr>
<tr>
<td></td>
<td></td>
<td>–</td>
<td>280</td>
<td>540 (\text{mV})</td>
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<tr>
<td></td>
<td></td>
<td>–</td>
<td>260</td>
<td>500 (\text{mV})</td>
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<tr>
<td></td>
<td></td>
<td>–</td>
<td>240</td>
<td>460 (\text{mV})</td>
</tr>
<tr>
<td></td>
<td></td>
<td>–</td>
<td>220</td>
<td>420 (\text{mV})</td>
</tr>
<tr>
<td>Line Regulation (VDL)</td>
<td>VDL</td>
<td>–</td>
<td>2</td>
<td>20 (\text{mV})</td>
</tr>
<tr>
<td>Load Regulation (VDLO)</td>
<td>VDLO</td>
<td>–</td>
<td>10</td>
<td>80 (\text{mV})</td>
</tr>
</tbody>
</table>

**Over Current Protection (OCP)**

| Limit Current (ILMAX)      | 220    | 400   | 700  | \text{mA} | Vo=VOUT×0.95 |
| Short Current (ISHORT)     | 20     | 70    | 150  | \text{mA} | Vo=0\text{V} |

**Standby Block**

| Discharge Resistor (RDSC)  | 20     | 50    | 80   | Ω      | VIN=4.0\text{V}, STBY=0\text{V}, VOUT=4.0\text{V} |
| STBY Pin Pull-down Current (ISTB) | 0.1   | 0.6   | 8.0  | \(\mu\text{A}\) | STBY=1.5\text{V} |
| STBY Control Voltage ON (VSTBH) | 1.2  | –     | 6.0  | \text{V} |
| STBY Control Voltage OFF (VSTBL) | –0.3 | –     | 0.3  | \text{V} |

*This product is not designed for protection against radioactive rays.*

*(*3) VIN=2.5\text{V} for VOUT\(\leq 1.5\text{V}\)*

*(*4) VIN=2.5\text{V} to 3.6\text{V} for VOUT\(\leq 1.5\text{V}\)*

**Block Diagrams**

![Block Diagrams](image-url)
BUxxTD2WNVX series

- Reference data BU12TD2WNVX (Ta=25°C unless otherwise specified.)

![Fig 3. Output Voltage](image1)
![Fig 4. Line Regulation](image2)
![Fig 5. Circuit Current IGND](image3)

![Fig 6. VSTBY - ISTBY](image4)
![Fig 7. IOUT - IGND](image5)
![Fig 8. Load Regulation](image6)

![Fig 9. OCP Threshold](image7)
![Fig 10. STBY Threshold](image8)
![Fig 11. VOUT - Temp](image9)

![Fig 12. IGND vs Temp](image10)
![Fig 13. IGND - Temp (STBY)](image11)
Reference data BU12TD2WNVX (Ta=25°C unless otherwise specified.)

Fig 14. Load Response

Fig 15. Load Response

Fig 16. Load Response

Fig 17. Load Response

Fig 18. Load Response

Fig 19. Load Response

Fig 20. Load Response

Fig 21. Load Response
Reference data   **BU12TD2WNVX**  (Ta=25°C unless otherwise specified.)

**BUxxTD2WNVX series**

**Fig 22. Start Up Time**  
\(I_{\text{out}}=0\) mA

**Fig 23. Start Up Time**  
\(I_{\text{out}}=200\) mA

**Fig 24. Start Up Time**  
\((V_{\text{IN}}=\text{STBY}) \quad I_{\text{out}}=0\) mA

**Fig 25. Start Up Time**  
\((V_{\text{IN}}=\text{STBY}) \quad I_{\text{out}}=200\) mA

**Fig 26. Discharge Time**

**Fig 27. VIN Response**
Reference data BU15TD2WNVX (Ta=25°C unless otherwise specified.)

Fig 28. Output Voltage

Fig 29. Line Regulation

Fig 30. Circuit Current IGDN

Fig 31. VSTBY - ISTBY

Fig 32. IOUT - IGDN

Fig 33. Load Regulation

Fig 34. OCP Threshold

Fig 35. STBY Threshold

Fig 36. VOUT - Temp

Fig 37. IGND vs Temp

Fig 38. IGND vs Temp (STBY)
Reference data BU15TD2WNVX (Ta=25°C unless otherwise specified.)

Fig 39. Load Response

Fig 40. Load Response

Fig 41. Load Response

Fig 42. Load Response

Fig 43. Load Response

Fig 44. Load Response

Fig 45. Load Response

Fig 46. Load Response
Reference data BU15TD2WNVX (Ta=25°C unless otherwise specified.)

Fig 47. Start Up Time
I_{out}=0\,mA

Fig 48. Start Up Time
I_{out}=200\,mA

Fig 49. Start Up Time
(VIN=STBY) I_{out}=0\,mA
I_{out}=0\,mA

Fig 50. Start Up Time
(VIN=STBY) I_{out}=200\,mA

Fig 51. Discharge Time

Fig 52. VIN Response
**BUxxTD2WNVX series**

- **Reference data** BU18TD2WNVX (Ta=25°C unless otherwise specified.)

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**Fig 53. Output Voltage**

**Fig 54. Line Regulation**

**Fig 55. Circuit Current IGND**

**Fig 56. VSTBY - ISTBY**

**Fig 57. IOUT - IGND**

**Fig 58. Load Regulation**

**Fig 59. OCP Threshold**

**Fig 60. STBY Threshold**

**Fig 61. VOUT - Temp**

**Fig 62. IGND - Temp**

**Fig 63. IGND - Temp (STBY)**
Reference data **BU18TD2WNVX** (Ta=25°C unless otherwise specified.)

![Fig 64. Load Response](image1)

![Fig 65. Load Response](image2)

![Fig 66. Load Response](image3)

![Fig 67. Load Response](image4)

![Fig 68. Load Response](image5)

![Fig 69. Load Response](image6)

![Fig 70. Load Response](image7)

![Fig 71. Load Response](image8)
Reference data BU18TD2WNVX (Ta=25°C unless otherwise specified.)

Fig 72. Start Up Time
Iout=0mA

Fig 73. Start Up Time
Iout=200mA

Fig 74. Start Up Time
(VIN=STBY) Iout=0mA
Iout=0mA

Fig 75. Start Up Time
(VIN=STBY) Iout=200mA

Fig 76. Discharge Time

Fig 77. VIN Response
Reference data BU19TD2WNVX (Ta=25°C unless otherwise specified.)

Fig 78. Output Voltage

Fig 79. Line Regulation

Fig 80. Circuit Current IGND

Fig 81. VSTBY - ISTBY

Fig 82. IOUT - IGND

Fig 83. Load Regulation

Fig 84. OCP Threshold

Fig 85. STBY Threshold

Fig 86. VOUT - Temp

Fig 87. IGND - Temp

Fig 88. IGND - Temp (STBY)
● Reference data  BU19TD2WNVX  (Ta=25°C unless otherwise specified.)
Reference data  BU19TD2WNVX  (Ta=25°C unless otherwise specified.)

Fig 97. Start Up Time
\( I_{out}=0\text{mA} \)

Fig 98. Start Up Time
\( I_{out}=200\text{mA} \)

Fig 99. Start Up Time
\( (VIN=STBY) I_{out}=0\text{mA} \)
\( I_{out}=0\text{mA} \)

Fig 100. Start Up Time
\( (VIN=STBY) I_{out}=200\text{mA} \)

Fig 101. Discharge Time

Fig 102. VIN Response
Reference data  BU25TD2WNVX  (Ta=25°C unless otherwise specified.)

Fig 103. Output Voltage

Fig 104. Line Regulation

Fig 105. Circuit Current IGND

Fig 106. VSTBY - ISTBY

Fig 107. IOUT - IGND

Fig 108. Load Regulation

Fig 109. Dropout Voltage

Fig 110. OCP Threshold

Fig 111. STBY Threshold

Fig 112. VOUT - Temp

Fig 113. IGND - Temp
Reference data  
**BU25TD2WNVX**  (Ta=25°C unless otherwise specified.)

Fig 115. Load Response

![Load Response](image1)

Fig 116. Load Response

![Load Response](image2)

Fig 117. Load Response

![Load Response](image3)

Fig 118. Load Response

![Load Response](image4)

Fig 119. Load Response

![Load Response](image5)

Fig 120. Load Response

![Load Response](image6)

Fig 121. Load Response

![Load Response](image7)

Fig 122. Load Response

![Load Response](image8)
Reference data: BU25TD2WNVX (Ta=25°C unless otherwise specified.)

Fig 123. Start Up Time
I_{out}=0\,mA

Fig 125. Start Up Time
(VIN=STBY) I_{out}=0\,mA
I_{out}=0\,mA

Fig 127. Discharge Time

Fig 128. VIN Response
Reference data BU26TD2WNVX (Ta=25°C unless otherwise specified.)

Fig 129. Output Voltage

Fig 130. Line Regulation

Fig 131. Circuit Current IGND

Fig 132. VSTBY - ISTBY

Fig 133. IOUT - IGND

Fig 134. Load Regulation

Fig 135. Dropout Voltage

Fig 136. OCP Threshold

Fig 137. STBY Threshold

Fig 138. VOUT - Temp

Fig 139. IGND - Temp

Fig 140. IGND - Temp (STBY)
Reference data: BU26TD2WNVX (Ta=25°C unless otherwise specified.)

Fig 141. Load Response

Fig 142. Load Response

Fig 143. Load Response

Fig 144. Load Response

Fig 145. Load Response

Fig 146. Load Response

Fig 147. Load Response

Fig 148. Load Response
Reference data: BU26TD2WNVX (Ta=25°C unless otherwise specified.)

- Fig 149. Start Up Time
  \( I_{\text{out}} = 0 \text{mA} \)

- Fig 150. Start Up Time
  \( I_{\text{out}} = 200 \text{mA} \)

- Fig 151. Start Up Time
  (VIN=STBY) \( I_{\text{out}} = 0 \text{mA} \)

- Fig 152. Start Up Time
  (VIN=STBY) \( I_{\text{out}} = 200 \text{mA} \)

- Fig 153. Discharge Time

- Fig 154. VIN Response
Reference data BU27TD2WNVX (Ta=25°C unless otherwise specified.)

Fig 155. Output Voltage

Fig 156. Line Regulation

Fig 157. Circuit Current IGND

Fig 158. VSTBY - ISTBY

Fig 159. IOUT - IGND

Fig 160. Load Regulation

Fig 161. Dropout Voltage

Fig 162. OCP Threshold

Fig 163. STBY Threshold

Fig 164. VOUT - Temp

Fig 165. IGND - Temp

Fig 166. IGND - Temp (STBY)
Reference data **BU27TD2WNVX** (Ta=25°C unless otherwise specified.)

![Fig 167. Load Response](image1)

![Fig 168. Load Response](image2)

![Fig 169. Load Response](image3)

![Fig 170. Load Response](image4)

![Fig 171. Load Response](image5)

![Fig 172. Load Response](image6)

![Fig 173. Load Response](image7)

![Fig 174. Load Response](image8)
Reference data: BU27TD2WNVX (Ta=25°C unless otherwise specified.)

Fig 175. Start Up Time
iout=0mA

Fig 176. Start Up Time
iout=200mA

Fig 177. Start Up Time
(VIN=STBY) iout=0mA
iout=0mA

Fig 178. Start Up Time
(VIN=STBY) iout=200mA

Fig 179. Discharge Time

Fig 180. VIN Response
Reference data  BU28TD2WNVX  (Ta=25°C unless otherwise specified.)

Fig 181. Output Voltage

Fig 182. Line Regulation

Fig 183. Circuit Current IGND

Fig 184. VSTBY - ISTBY

Fig 185. IOUT - IGND

Fig 186. Load Regulation

Fig 187. Dropout Voltage

Fig 188. OCP Threshold

Fig 189. STBY Threshold

Fig 190. VOUT - Temp

Fig 191. IGND - Temp

Fig 192. IGND - Temp (STBY)
●Reference data **BU28TD2WNVX** (Ta=25°C unless otherwise specified.)

**Fig 193. Load Response**

**Fig 194. Load Response**

**Fig 195. Load Response**

**Fig 196. Load Response**

**Fig 197. Load Response**

**Fig 198. Load Response**

**Fig 199. Load Response**

**Fig 200. Load Response**
Reference data  BU28TD2WNVX  (Ta=25°C unless otherwise specified.)

Fig 201. Start Up Time  
I_{out}=0\text{mA}

Fig 202. Start Up Time  
I_{out}=200\text{mA}

Fig 203. Start Up Time  
(VIN=STBY)  I_{out}=0\text{mA}

Fig 204. Start Up Time  
(VIN=STBY)  I_{out}=200\text{mA}

Fig 205. Discharge Time

Fig 206. VIN Response
Reference data  BU30TD2WNVX  (Ta=25°C unless otherwise specified.)

Fig 207. Output Voltage
Fig 208. Line Regulation
Fig 209. Circuit Current IGND

Fig 210. VSTBY - ISTBY
Fig 211. IOUT - IGND
Fig 212. Load Regulation

Fig 213. Dropout Voltage
Fig 214. OCP Threshold
Fig 215. STBY Threshold

Fig 216. VOUT - Temp
Fig 217. IGND - Temp
Fig 218. IGND - Temp (STBY)
Reference data **BU30TD2WNVX**  \( (T_a=25^\circ \text{C} \text{ unless otherwise specified.}) \)

Fig 219. Load Response

Fig 220. Load Response

Fig 221. Load Response

Fig 222. Load Response

Fig 223. Load Response

Fig 224. Load Response

Fig 225. Load Response

Fig 226. Load Response
Reference data BU30TD2WNVX (Ta=25°C unless otherwise specified.)

Fig 227. Start Up Time
I_out=0mA

Fig 228. Start Up Time
I_out=200mA

Fig 229. Start Up Time
(VIN=STBY) I_out=0mA
I_out=0mA

Fig 230. Start Up Time
(VIN=STBY) I_out=200mA

Fig 231. Discharge Time

Fig 232. VIN Response
BUxxTD2WNVX series

Reference data BU31TD2WNVX (Ta=25°C unless otherwise specified.)

- Fig 233. Output Voltage
- Fig 234. Line Regulation
- Fig 235. Circuit Current IGND
- Fig 236. VSTBY - ISTBY
- Fig 237. IOUT - IGND
- Fig 238. Load Regulation
- Fig 239. Dropout Voltage
- Fig 240. OCP Threshold
- Fig 241. STBY Threshold
- Fig 242. VOUT - Temp
- Fig 243. IGND - Temp
- Fig 244. IGND - Temp (STBY)
● Reference data  
BU31TD2WNVX  
(Ta=25°C unless otherwise specified.)

Fig 245. Load Response

Fig 246. Load Response

Fig 247. Load Response

Fig 248. Load Response

Fig 249. Load Response

Fig 250. Load Response

Fig 251. Load Response

Fig 252. Load Response
Reference data  BU31TD2WNVX  (Ta=25°C unless otherwise specified.)

Fig 253. Start Up Time  
I_{out}=0\,\text{mA}

Fig 254. Start Up Time  
I_{out}=200\,\text{mA}

Fig 255. Start Up Time  
(VIN=STBY)  
I_{out}=0\,\text{mA}  
I_{out}=0\,\text{mA}

Fig 256. Start Up Time  
(VIN=STBY)  
I_{out}=200\,\text{mA}

Fig 257. Discharge Time

Fig 258. VIN Response
Reference data **BU33TD2WNVX** (Ta=25°C unless otherwise specified.)

![Fig 259. Output Voltage](image1)

![Fig 260. Line Regulation](image2)

![Fig 261. Circuit Current](image3)

![Fig 262. VSTBY - ISTBY](image4)

![Fig 263. IOUT - IGND](image5)

![Fig 264. Load Regulation](image6)

![Fig 265. Dropout Voltage](image7)

![Fig 266. OCP Threshold](image8)

![Fig 267. STBY Threshold](image9)

![Fig 268. VOUT - Temp](image10)

![Fig 269. IGND - Temp](image11)

![Fig 270. IGND - Temp (STBY)](image12)
Reference data  BU33TD2WNVX  (Ta=25°C unless otherwise specified.)

Fig 271. Load Response

Fig 272. Load Response

Fig 273. Load Response

Fig 274. Load Response

Fig 275. Load Response

Fig 276. Load Response

Fig 277. Load Response

Fig 278. Load Response
BUxxTD2WNVX series

Reference data BU33TD2WNVX (Ta=25°C unless otherwise specified.)

Fig 279. Start Up Time
Iout=0mA

Fig 280. Start Up Time
Iout=200mA

Fig 281. Start Up Time
(VIN=STBY) Iout=0mA
Iout=0mA

Fig 282. Start Up Time
(VIN=STBY) Iout=200mA

Fig 283. Discharge Time

Fig 284. VIN Response
About power dissipation (Pd)

As for power dissipation, an approximate estimate of the heat reduction characteristics and internal power consumption of IC are shown, so please use these for reference. Since power dissipation changes substantially depending on the implementation conditions (board size, board thickness, metal wiring rate, number of layers and through holes, etc.), it is recommended to measure Pd on a set board. Exceeding the power dissipation of IC may lead to deterioration of the original IC performance, such as causing operation of the thermal shutdown circuit or reduction in current capability. Therefore, be sure to prepare sufficient margin within power dissipation for usage.

Calculation of the maximum internal power consumption of IC (PMAX)

\[ PMAX = (V_{IN} - V_{OUT}) \times I_{OUT(MAX)} \]

(VIN: Input voltage  VOUT: Output voltage  IOUT(MAX): Maximum output current)

Measurement conditions

<table>
<thead>
<tr>
<th>Measurement State</th>
<th>Standard ROHM Board</th>
<th>Evaluation Board 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>With board implemented (Wind speed 0 m/s)</td>
<td>With board implemented (Wind speed 0 m/s)</td>
<td></td>
</tr>
<tr>
<td>Board Material</td>
<td>Glass epoxy resin (Double-side board)</td>
<td>Glass epoxy resin (Double-side board)</td>
</tr>
<tr>
<td>Board Size</td>
<td>70 mm x 70 mm x 1.6 mm</td>
<td>40 mm x 40 mm x 1.6 mm</td>
</tr>
<tr>
<td>Wiring Rate</td>
<td>Top layer: Metal (GND) wiring rate: Approx. 0%  Bottom layer: Metal (GND) wiring rate: Approx. 50%</td>
<td>Top layer: Metal (GND) wiring rate: Approx. 50%  Bottom layer: Metal (GND) wiring rate: Approx. 50%</td>
</tr>
<tr>
<td>Through Hole</td>
<td>Diameter 0.5mm x 6 holes</td>
<td>Diameter 0.5mm x 25 holes</td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>0.56W</td>
<td>0.39W</td>
</tr>
<tr>
<td>Thermal Resistance</td>
<td>( \theta_{ja} = 178.6°C/W )</td>
<td>( \theta_{ja} = 256.4°C/W )</td>
</tr>
</tbody>
</table>

* Please design the margin so that PMAX becomes less than Pd (PMAX<Pd) within the usage temperature range
Operation Notes

1.) Absolute maximum ratings
Use of the IC in excess of absolute maximum ratings (such as the input voltage or operating temperature range) may result in damage to the IC. Assumptions should not be made regarding the state of the IC (e.g., short mode or open mode) when such damage is suffered. If operational values are expected to exceed the maximum ratings for the device, consider adding protective circuitry (such as fuses) to eliminate the risk of damaging the IC.

2.) GND potential
The potential of the GND pin must be the minimum potential in the system in all operating conditions. Never connect a potential lower than GND to any pin, even if only transiently.

3.) Thermal design
Use a thermal design that allows for a sufficient margin for that package power dissipation rating (Pd) under actual operating conditions.

4.) Inter-pin shorts and mounting errors
Use caution when orienting and positioning the IC for mounting on printed circuit boards. Improper mounting or shorts between pins may result in damage to the IC.

5.) Operation in strong electromagnetic fields
Strong electromagnetic fields may cause the IC to malfunction. Caution should be exercised in applications where strong electromagnetic fields may be present.

6.) Common impedance
Wiring traces should be as short and wide as possible to minimize common impedance. Bypass capacitors should be used to keep ripple to a minimum.

7.) Voltage of STBY pin
To enable standby mode for all channels, set the STBY pin to 0.3 V or less, and for normal operation, to 1.2 V or more. Setting STBY to a voltage between 0.3 and 1.2 V may cause malfunction and should be avoided. Keep transition time between high and low (or vice versa) to a minimum.
Additionally, if STBY is shorted to VIN, the IC will switch to standby mode and disable the output discharge circuit, causing a temporary voltage to remain on the output pin. If the IC is switched on again while this voltage is present, overshoot may occur on the output. Therefore, in applications where these pins are shorted, the output should always be completely discharged before turning the IC on.

8.) Over-current protection circuit (OCP)
This IC features an integrated over-current and short-protection circuitry on the output to prevent destruction of the IC when the output is shorted. The OCP circuitry is designed only to protect the IC from irregular conditions (such as motor output shorts) and is not designed to be used as an active security device for the application. Therefore, applications should not be designed under the assumption that this circuitry will engage.

9.) Thermal shutdown circuit (TSD)
This IC also features a thermal shutdown circuit that is designed to turn the output off when the junction temperature of the IC exceeds about 150°C. This feature is intended to protect the IC only in the event of thermal overload and is not designed to guarantee operation or act as an active security device for the application. Therefore, applications should not be designed under the assumption that this circuitry will engage.

10.) Input/output capacitor
Capacitors must be connected between the input/output pins and GND for stable operation, and should be physically mounted as close to the IC pins as possible. The input capacitor helps to counteract increases in power supply impedance, and increases stability in applications with long or winding power supply traces. The output capacitance value is directly related to the overall stability and transient response of the regulator, and should be set to the largest possible value for the application. During design, keep in mind that in general, ceramic capacitors have a wide range of tolerances, temperature coefficients and DC bias characteristics, and that their capacitance values tend to decrease over time. Confirm these details before choosing appropriate capacitors for your application. (Please refer the technical note, regarding ceramic capacitor of recommendation)

11.) About the equivalent series resistance (ESR) of a ceramic capacitor
Capacitors generally have ESR (equivalent series resistance) and it operates stably in the ESR-10Ω area shown on the right. Since ceramic capacitors, tantalum capacitors, electrolytic capacitors, etc. generally have different ESR, please check the ESR of the capacitor to be used and use it within the stability area range shown in the right graph for evaluation of the actual application.
## Revision History

<table>
<thead>
<tr>
<th>Date</th>
<th>Revision</th>
<th>Changes</th>
</tr>
</thead>
</table>
Notice

Precaution on using ROHM Products

1. Our Products are designed and manufactured for application in ordinary electronic equipments (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), transport equipment, traffic equipment, aircraft/spacraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property (“Specific Applications”), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM’s Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

<table>
<thead>
<tr>
<th>JAPAN</th>
<th>USA</th>
<th>EU</th>
<th>CHINA</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLASS III</td>
<td>CLASS III</td>
<td>CLASS II b</td>
<td>CLASS III</td>
</tr>
<tr>
<td>CLASS IV</td>
<td></td>
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</tbody>
</table>

2. ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:

[a] Installation of protection circuits or other protective devices to improve system safety
[b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

3. Our Products are designed and manufactured for use under standard conditions and not under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM’s Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:

[a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
[b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
[c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl₂, H₂S, NH₃, SO₂, and NO₂
[d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
[e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
[f] Sealing or coating our Products with resin or other coating materials
[g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
[h] Use of the Products in places subject to dew condensation

4. The Products are not subject to radiation-proof design.

5. Please verify and confirm characteristics of the final or mounted products in using the Products.

6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse, is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7. De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.

8. Confirm that operation temperature is within the specified range described in the product specification.

9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

Precaution for Mounting / Circuit board design

1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2. In principle, the reflow soldering method must be used; if flow soldering method is preferred, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification
Precautions Regarding Application Examples and External Circuits
1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

Precaution for Electrostatic
This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

Precaution for Storage / Transportation
1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
   [a] the Products are exposed to sea winds or corrosive gases, including Cl2, H2S, NH3, SO2, and NO2
   [b] the temperature or humidity exceeds those recommended by ROHM
   [c] the Products are exposed to direct sunshine or condensation
   [d] the Products are exposed to high Electrostatic

2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

Precaution for Product Label
QR code printed on ROHM Products label is for ROHM's internal use only.

Precaution for Disposition
When disposing Products please dispose them properly using an authorized industry waste company.

Precaution for Foreign Exchange and Foreign Trade act
Since our Products might fall under controlled goods prescribed by the applicable foreign exchange and foreign trade act, please consult with ROHM representative in case of export.

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