

## CMOS LDO Regulators for Portable Equipments

### 1ch 200mA

# CMOS LDO Regulators



BU□□TD2WNVX series

No.11020ECT07

#### ●Description

BU□□TD2WNVX series is high-performance FULL CMOS regulator with 200-mA output, which is mounted on micro miniature package SSON004X1010 (1.0 mm × 1.0 mm × 0.6 mm). 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. Micro miniature SSON004X1010 with built-in heatsink is adopted for the package, which contributes to the space-saving design of the set.

#### ●Features

- 1) High-accuracy output voltage of ±1% (±25 mV on Vout<2.5V products)
- 2) High ripple rejection: 70 dB (Typ., 1 kHz,)
- 3) Compatible with small ceramic capacitor (CIN=Co=0.47 μF)
- 4) Low current consumption: 35 μA
- 5) ON/OFF control of output voltage
- 6) With built-in overcurrent protection circuit and thermal shutdown circuit
- 7) With built-in output discharge circuit
- 8) Adopting ultra-small package SSON004X1010

#### ●Applications

Battery-powered portable equipment, etc.

#### ●Line up

##### ■200 mA BU□□TD2WNVX Series

| Product Name | 1.0 | 1.2 | 1.5 | 1.8  | 1.85 | 1.9 | 2.0 | 2.05 | 2.1 | 2.3 | 2.5 | Package      |
|--------------|-----|-----|-----|------|------|-----|-----|------|-----|-----|-----|--------------|
| BU□□TD2WNVX  | ○   | ○   | ○   | ○    | ○    | ○   | ○   | ○    | ○   | ○   | ○   | SSON004X1010 |
|              | 2.6 | 2.7 | 2.8 | 2.85 | 2.9  | 3.0 | 3.1 | 3.2  | 3.3 | 3.4 |     |              |
|              | ○   | ○   | ○   | ○    | ○    | ○   | ○   | ○    | ○   | ○   |     |              |

Model name : BU□□TD2WNVX

a

| Symbol | Contents                        |                    |    |                    |    |                    |    |                    |
|--------|---------------------------------|--------------------|----|--------------------|----|--------------------|----|--------------------|
|        | Specification of output voltage |                    |    |                    |    |                    |    |                    |
| a      | □□                              | Output voltage (V) | □□ | Output voltage (V) | □□ | Output voltage (V) | □□ | Output voltage (V) |
|        | 10                              | 1.0 V(Typ.)        | 20 | 2.0 V(Typ.)        | 27 | 2.7 V(Typ.)        | 32 | 3.2 V(Typ.)        |
|        | 12                              | 1.2 V(Typ.)        | 2A | 2.05 V(Typ.)       | 28 | 2.8 V(Typ.)        | 33 | 3.3 V(Typ.)        |
|        | 15                              | 1.5 V(Typ.)        | 21 | 2.1 V(Typ.)        | 2J | 2.85 V(Typ.)       | 34 | 3.4 V(Typ.)        |
|        | 18                              | 1.8 V(Typ.)        | 23 | 2.3V(Typ.)         | 29 | 2.9 V(Typ.)        |    |                    |
|        | 1J                              | 1.85 V(Typ.)       | 25 | 2.5 V(Typ.)        | 30 | 3.0 V(Typ.)        |    |                    |
|        | 19                              | 1.9 V(Typ.)        | 26 | 2.6 V(Typ.)        | 31 | 3.1 V(Typ.)        |    |                    |

### ●Absolute maximum ratings

| Parameter                     | Symbol | Ratings             | Unit |
|-------------------------------|--------|---------------------|------|
| Maximum applied power voltage | VMAX   | -0.3 ~ +6.5         | V    |
| Power dissipation             | Pd     | 560 <sup>(*1)</sup> | mW   |
| Maximum junction temperature  | TjMAX  | +125                | °C   |
| Operational temperature range | Topr   | -40 ~ +85           | °C   |
| Storage temperature range     | Tstg   | -55 ~ +125          | °C   |

(\*1) When PCB (70 mm × 70 mm, thickness 1.6-mm glass epoxy) a standard ROHM board is implemented.  
Reduced to 5.6 mW/°C when used at Ta=25°C or higher.

### ●Recommended operating range (Do not exceed Pd.)

| Parameter                  | Symbol | Ratings   | Unit |
|----------------------------|--------|-----------|------|
| Input power supply voltage | VIN    | 1.7 ~ 5.5 | V    |
| Maximum output current     | IMAX   | 200       | mA   |

### ●Recommended operating conditions

| Parameter        | Symbol | Ratings              |      |      | Unit | Conditions                          |
|------------------|--------|----------------------|------|------|------|-------------------------------------|
|                  |        | Min.                 | Typ. | Max. |      |                                     |
| Input capacitor  | CIN    | 0.22 <sup>(*2)</sup> | 0.47 | —    | μF   | A ceramic capacitor is recommended. |
| Output capacitor | Co     | 0.22 <sup>(*2)</sup> | 0.47 | —    | μF   | A ceramic capacitor is recommended. |

(\*2) Set the capacity value of the capacitor so that it does not fall below the minimum value, taking temperature characteristics, DC device characteristics, and change with time into consideration.

●Electrical characteristics(Ta=25°C, VIN=VOUT+1.0V<sup>(\*)3</sup>, STBY=VIN, CIN=0.47μF, Co=0.47μF, unless otherwise noted.)

| Parameter                     |     | Symbol | Limits        |      |               | Unit | Conditions                                         |
|-------------------------------|-----|--------|---------------|------|---------------|------|----------------------------------------------------|
|                               |     |        | Min.          | Typ. | Max.          |      |                                                    |
| Overall Device                |     |        |               |      |               |      |                                                    |
| Output Voltage                |     | VOUT   | VOUT<br>×0.99 | VOUT | VOUT<br>×1.01 | V    | IOUT=10μA,VOUT≥2.5V                                |
|                               |     |        | VOUT<br>-25mV |      | VOUT<br>+25mV |      | IOUT=10μA,VOUT<2.5V                                |
| Operating Current             |     | IIN    | -             | 35   | 60            | μA   | IOUT=0mA                                           |
| Operating Current (STBY)      |     | ISTBY  | -             | -    | 1.0           | μA   | STBY=0V                                            |
| Ripple Rejection Ratio        |     | RR     | 45            | 70   | -             | dB   | VRR=-20dBv,fRR=1kHz,IOUT=10mA                      |
| Dropout Voltage               |     | VSAT   | -             | 280  | 540           | mV   | 2.5V≤VOUT≤2.6V<br>(VIN=0.98*VOUT,IOUT=200mA)       |
|                               |     |        | -             | 260  | 500           | mV   | 2.7V≤VOUT≤2.85V<br>(VIN=0.98*VOUT,IOUT=200mA)      |
|                               |     |        | -             | 240  | 460           | mV   | 2.9V≤VOUT≤3.1V<br>(VIN=0.98*VOUT,IOUT=200mA)       |
|                               |     |        | -             | 220  | 420           | mV   | 3.2V≤VOUT≤3.4V<br>(VIN=0.98*VOUT,IOUT=200mA)       |
| Line Regulation               |     | VDL    | -             | 2    | 20            | mV   | VIN=VOUT+1.0V to 5.5V <sup>(*4)</sup><br>IOUT=10μA |
| Load Regulation               |     | VDLO   | -             | 10   | 80            | mV   | IOUT=0.01mA to 100mA                               |
| Over-current Protection (OCP) |     |        |               |      |               |      |                                                    |
| Limit Current                 |     | ILMAX  | 220           | 400  | 700           | mA   | Vo=VOUT*0.95                                       |
| Short Current                 |     | ISHORT | 20            | 70   | 150           | mA   | Vo=0V                                              |
| Standby Block                 |     |        |               |      |               |      |                                                    |
| Discharge Resistor            |     | RDSC   | 20            | 50   | 80            | Ω    | VIN=4.0V, STBY=0V, VOUT=4.0V                       |
| STBY Pin Pull-down Current    |     | ISTB   | 0.1           | 0.6  | 2.0           | μA   | STBY=1.5V                                          |
| STBY Control Voltage          | ON  | VSTBH  | 1.2           | -    | 5.5           | V    |                                                    |
|                               | OFF | VSTBL  | -0.3          | -    | 0.3           | V    |                                                    |

\* This product does not have radiation-proof design.

(\*)3 VIN=2.5V for VOUT≤1.5V

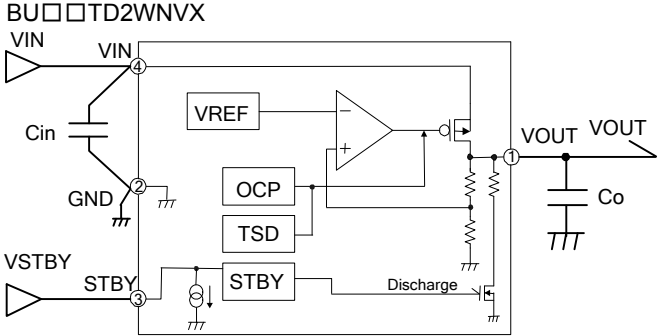
(\*)4 VIN=2.5V to 5.5V for VOUT≤1.5V

●Electrical characteristics of each Output Voltage

(Ta=25°C, STBY=VIN, CIN=0.47μF, Co=0.47μF, unless otherwise noted.)

| Parameter | Symbol                    | Limits |      |      | Unit | Conditions |
|-----------|---------------------------|--------|------|------|------|------------|
|           |                           | Min.   | Typ. | Max. |      |            |
| 1.2V      | Maximum<br>output current | 80     | 160  | -    | mA   | VIN=1.7V   |
|           |                           | 200    | -    | -    |      | VIN=2.1V   |
| 1.5V      |                           | 60     | 120  | -    |      | VIN=1.8V   |
|           |                           | 200    | -    | -    |      | VIN=2.2V   |
| 1.8V      |                           | 200    | -    | -    |      | VIN=2.4V   |
| 1.9V      |                           | 200    | -    | -    |      | VIN=2.5V   |

●Block diagram, recommended circuit diagram, and pin configuration diagram



Recommended ceramic capacitor for Cin & Co  
Murata Manufacturing Co., Ltd.  
GRM188B11A474KA61D

Fig.1 Recommended circuit diagram

| PIN No. | Symbol | Function                                                 |
|---------|--------|----------------------------------------------------------|
| 1       | VOUT   | Voltage output                                           |
| 2       | GND    | Grounding                                                |
| 3       | STBY   | ON/OFF control of output voltage<br>(High: ON, Low: OFF) |
| 4       | VIN    | Power input                                              |

●Input / Output terminal equivalent circuit schematic

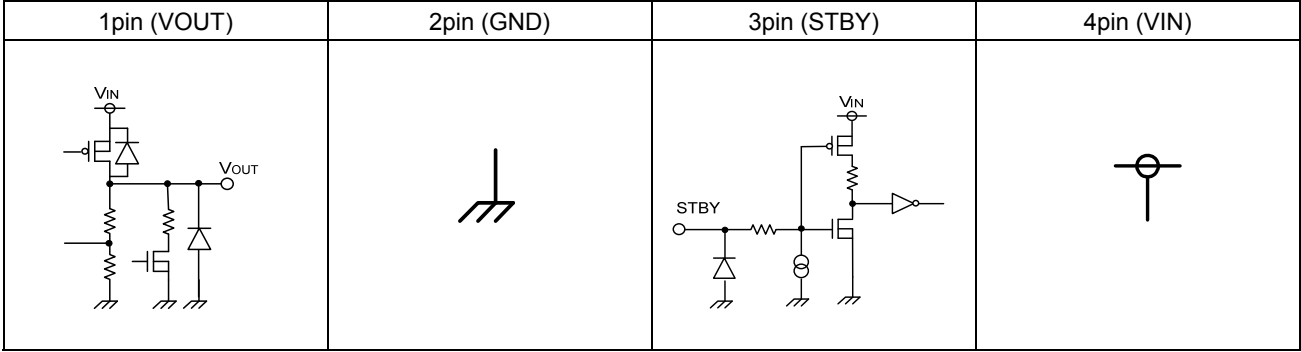


Fig.2 Input/Output equivalent circuit

●About input/output capacitor

It is recommended to place a capacitor as close as possible to the pins between the input terminal and GND or between the output terminal and GND.

The capacitor between the input terminal and GND becomes valid when source impedance increases or when wiring is long. The larger the capacity of the output capacitor between the output terminal and GND is, the better the stability and characteristics in output load fluctuation become.

However, please check the status of actual implementation. Ceramic capacitors generally have variation, temperature characteristics, and direct current bias characteristics and the capacity value also decreases with time depending on the usage conditions. It is recommended to select a ceramic capacitor upon inquiring about detailed data of the related manufacturer.

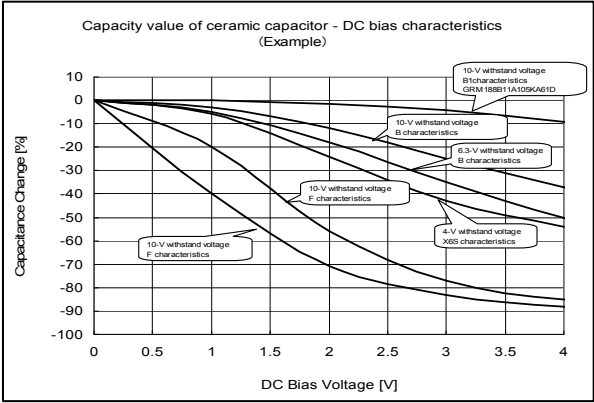


Fig.3 Capacity – bias characteristics

●About the equivalent series resistance (ESR) of a ceramic capacitor

Capacitors generally have ESR (equivalent series resistance) and it operates stably in the ESR-IOUT 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.

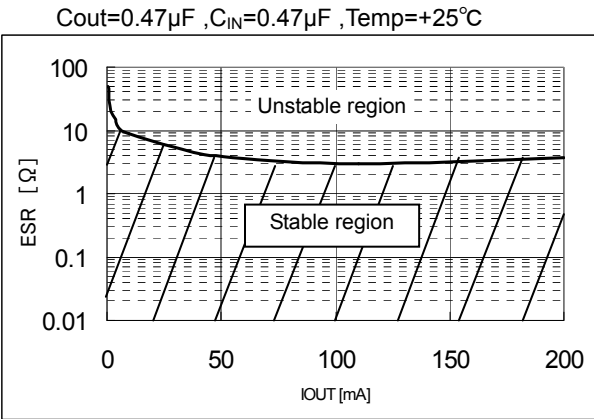


Fig.4 Stability area characteristics (Example)

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

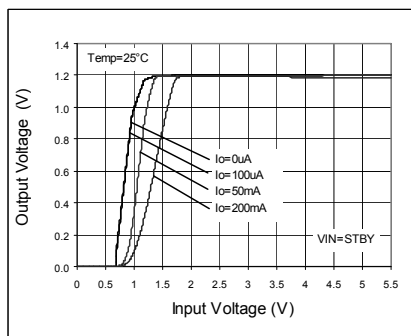


Fig.5. Output Voltage

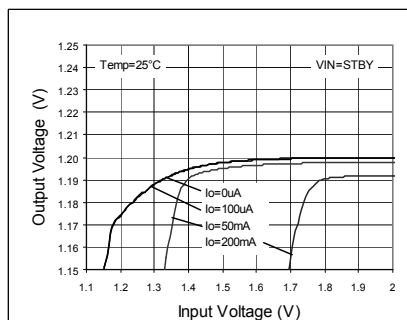


Fig.6. Line Regulation

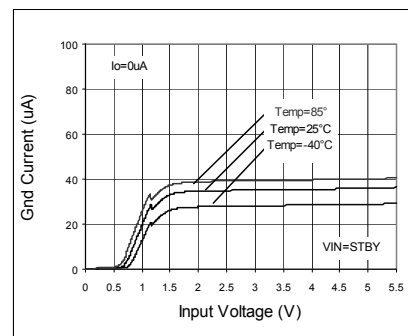


Fig.7. Circuit Current IGND

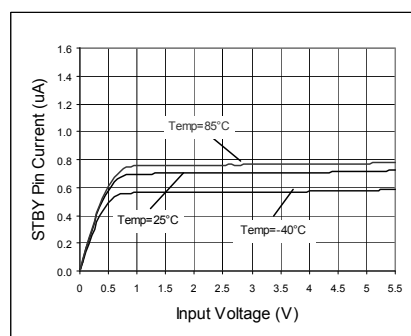


Fig.8. VSTBY - ISTBY

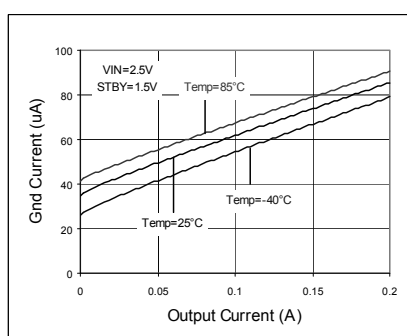


Fig.9. IOUT - IGND

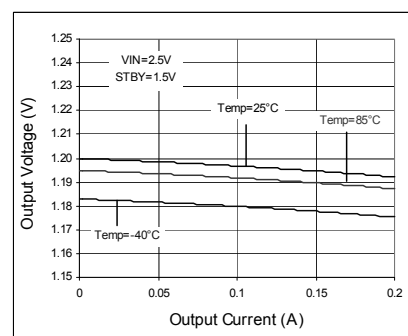


Fig.10. Load Regulation

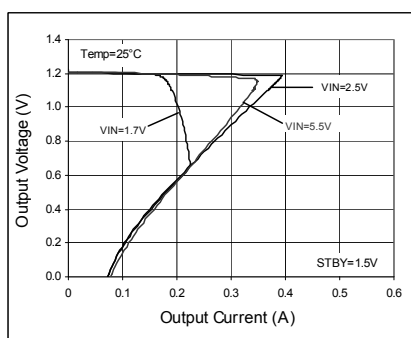


Fig.11. OCP Threshold

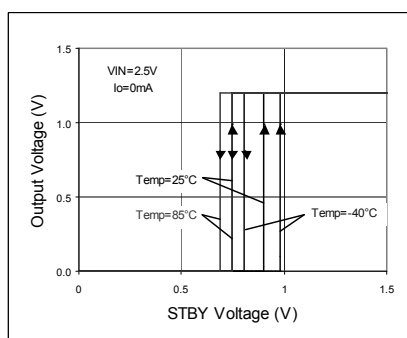


Fig.12. STBY Threshold

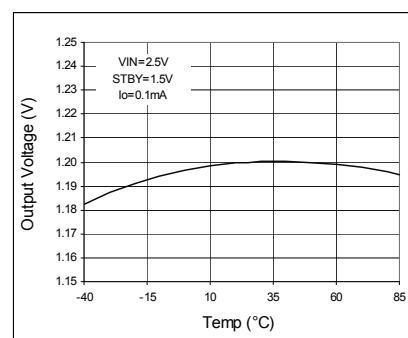


Fig.13. VOUT - Temp

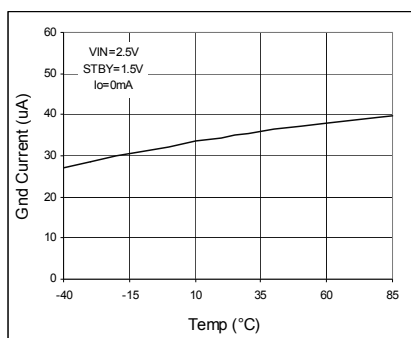


Fig.14. IGND vs Temp

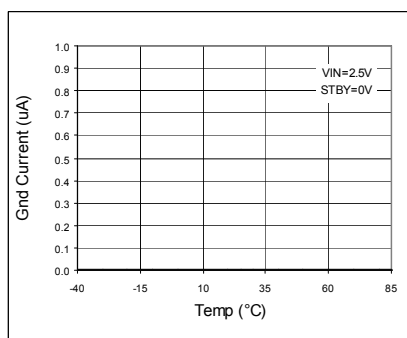


Fig.15. IGND - Temp (STBY)

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

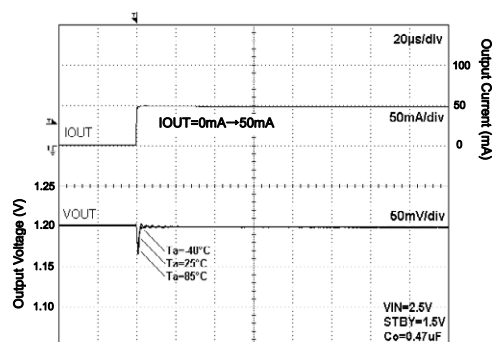


Fig.16. Load Response

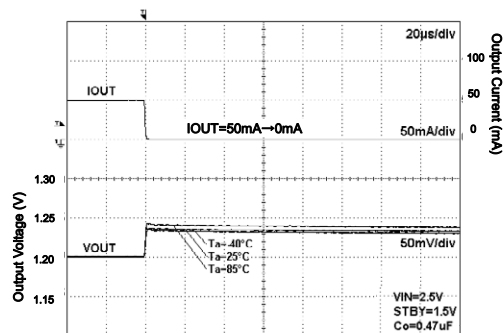


Fig.17. Load Response

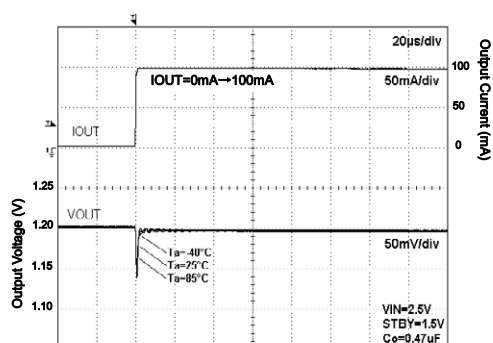


Fig.18. Load Response

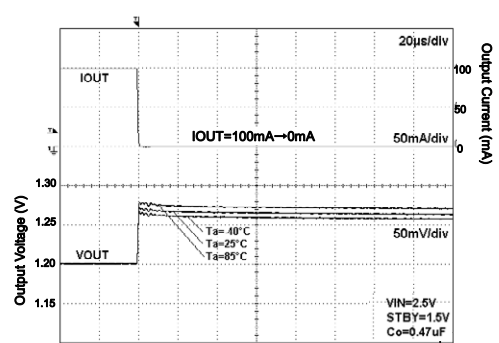


Fig.19. Load Response

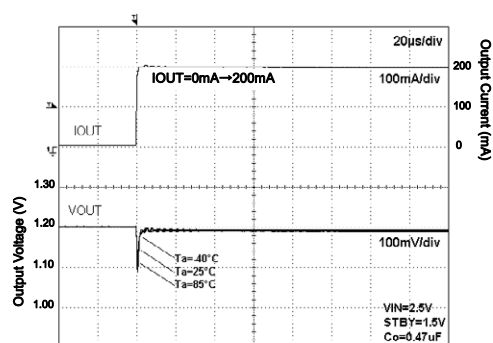


Fig.20. Load Response

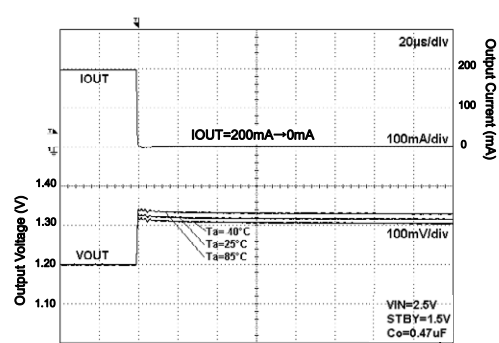


Fig.21. Load Response

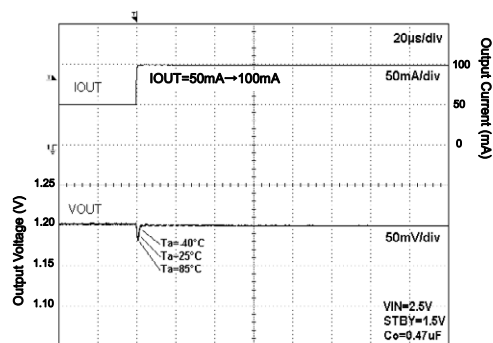


Fig.22. Load Response

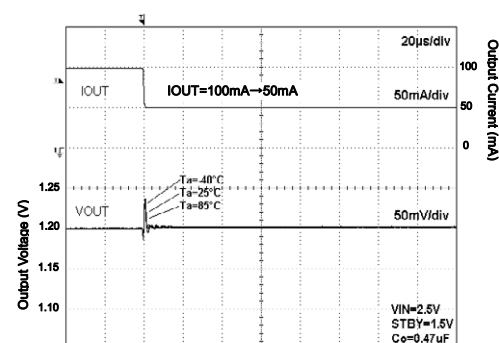


Fig.23. Load Response

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

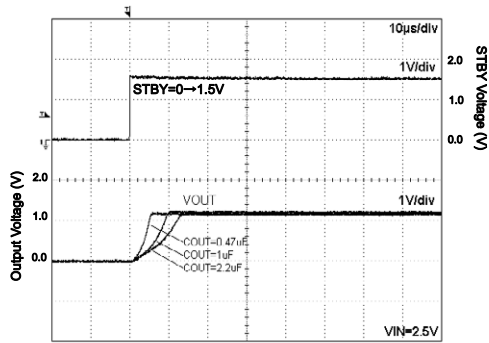


Fig.24. Start Up Time  
Iout=0mA

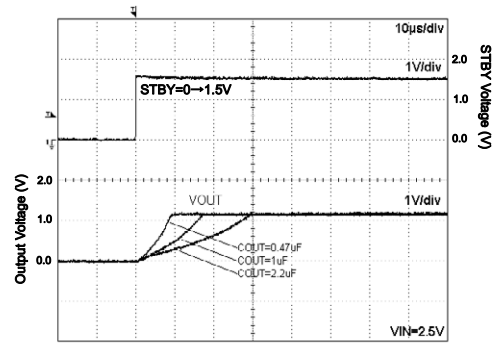


Fig.25. Start Up Time  
Iout=200mA

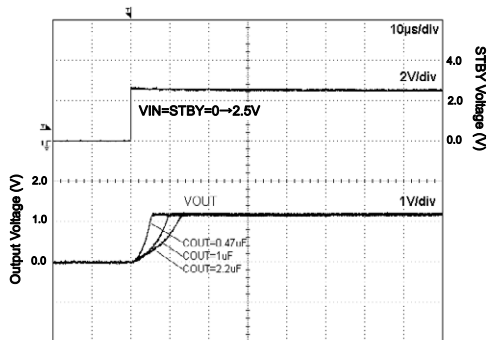


Fig.26. Start Up Time  
(VIN=STBY) Iout=0mA

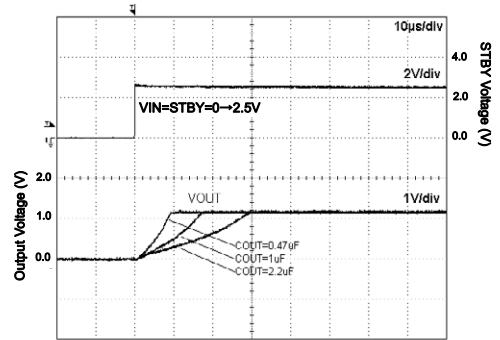


Fig.27. Start Up Time  
(VIN=STBY) Iout=200mA

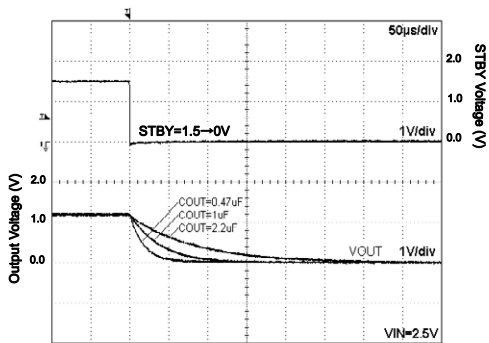


Fig.28. Discharge Time

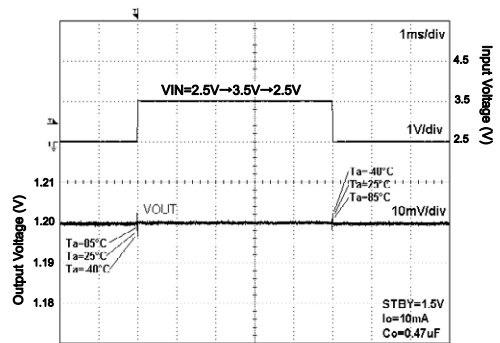


Fig.29. VIN Response

●Reference data BU15TD2WNVX (Ta=25°C unless otherwise specified.)

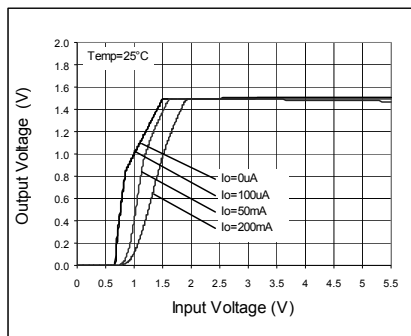


Fig.30. Output Voltage

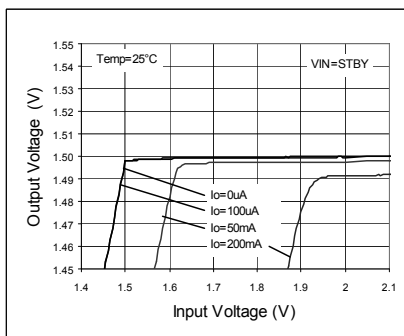


Fig.31. Line Regulation

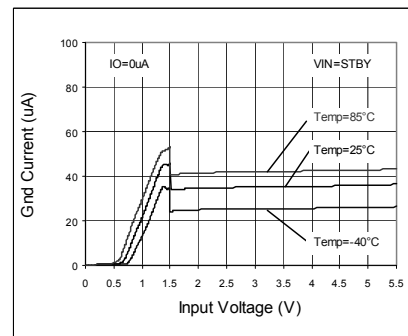


Fig.32. Circuit Current IGND

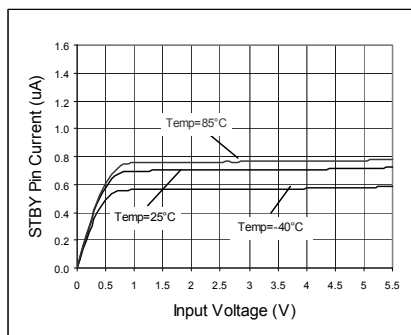


Fig.33. VSTBY - ISTBY

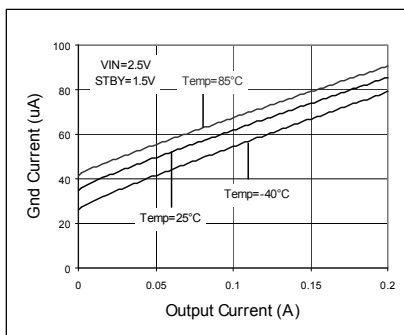


Fig.34. IOU - IGND

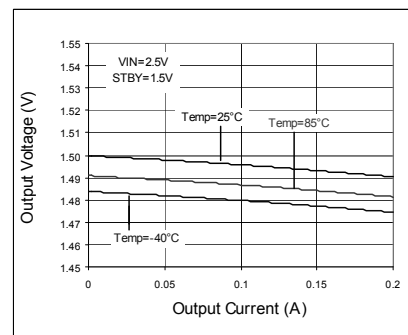


Fig.35. Load Regulation

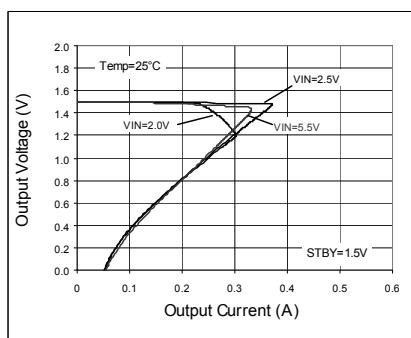


Fig.36. OCP Threshold

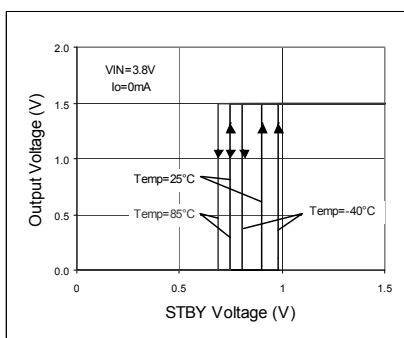


Fig.37. STBY Threshold

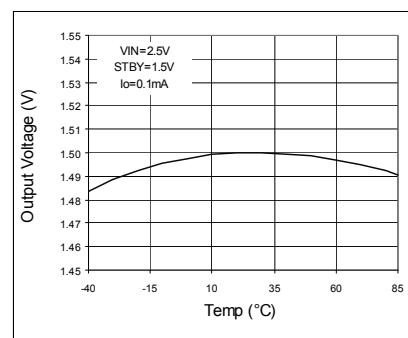


Fig.38. VOUT - Temp

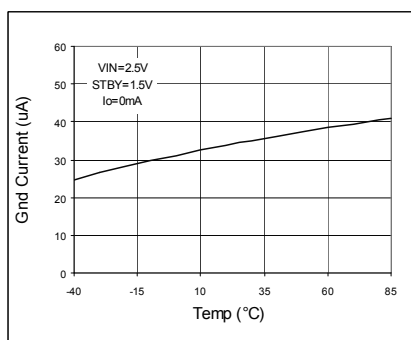


Fig.39. IGND vs Temp

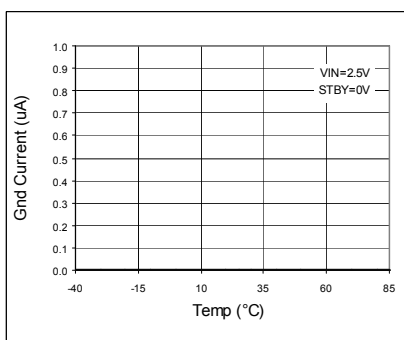


Fig.40. IGND vs Temp (STBY)

●Reference data BU15TD2WNVX ( $T_a=25^\circ\text{C}$  unless otherwise specified.)

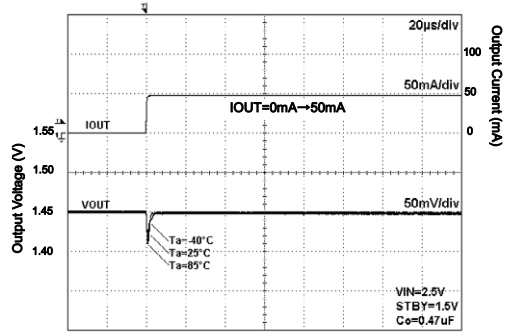


Fig.41. Load Response

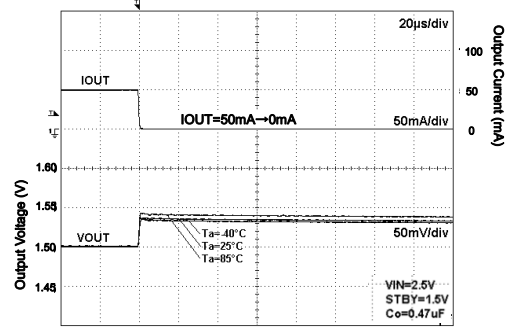


Fig.42. Load Response

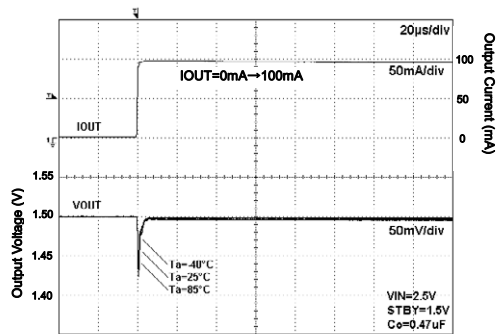


Fig.43. Load Response

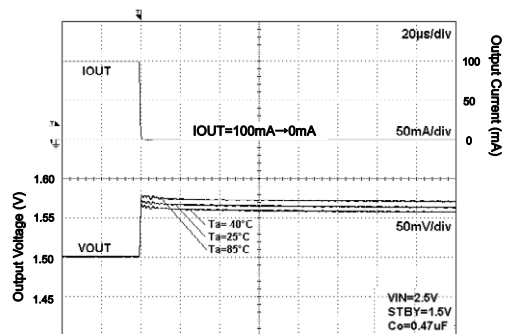


Fig.44. Load Response

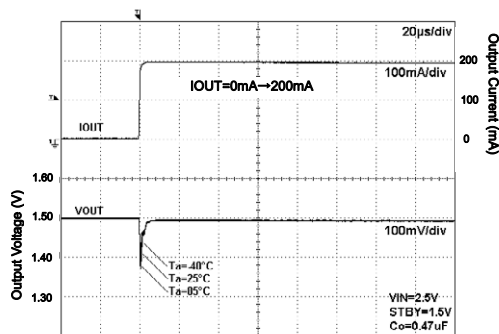


Fig.45. Load Response

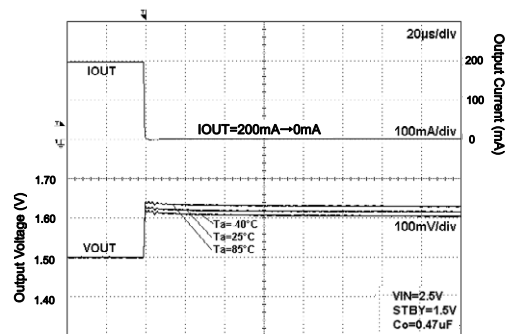


Fig.46. Load Response

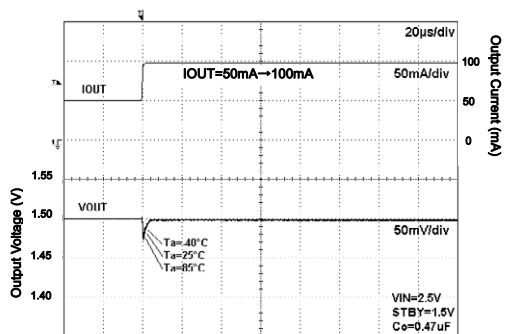


Fig.47. Load Response

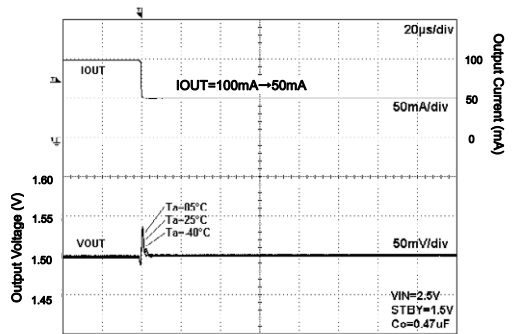


Fig.48. Load Response

●Reference data BU15TD2WNVX (Ta=25°C unless otherwise specified.)

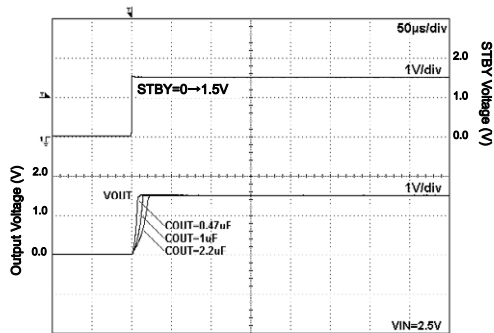


Fig.49. Start Up Time  
Iout=0mA

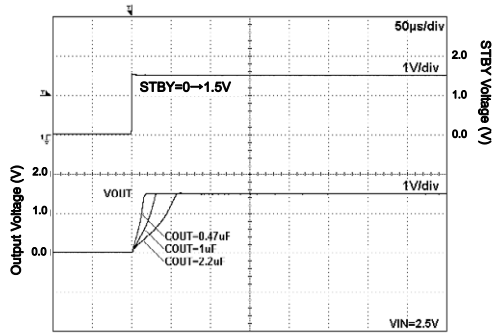


Fig.50. Start Up Time  
Iout=200mA

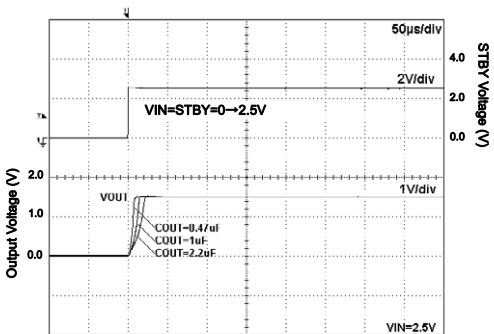


Fig.51. Start Up Time  
(VIN=STBY) Iout=0mA

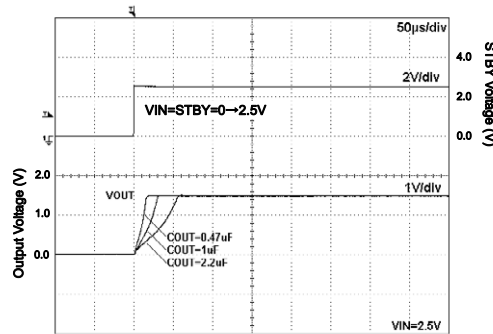


Fig.52. Start Up Time  
(VIN=STBY) Iout=200mA

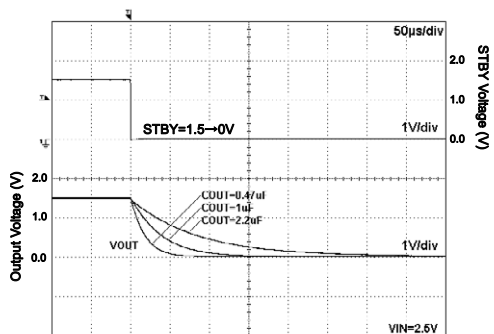


Fig.53. Discharge Time

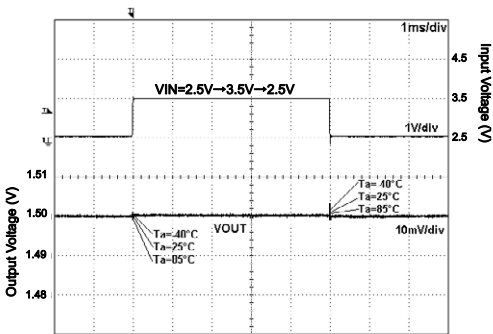


Fig.54. VIN Response

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

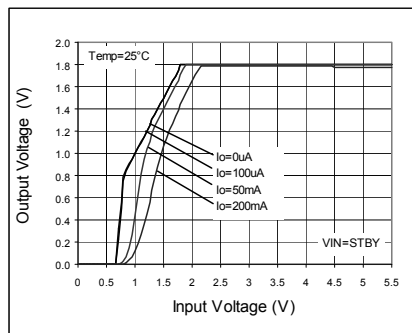


Fig.55. Output Voltage

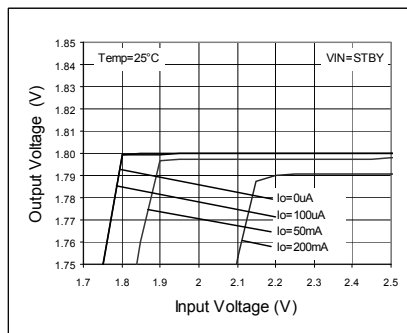


Fig.56. Line Regulation

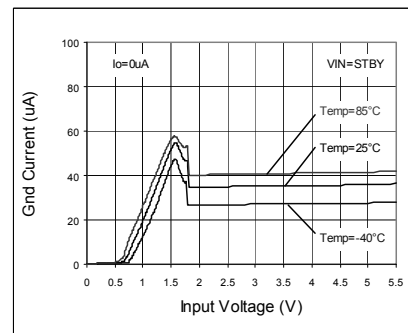


Fig.57. Circuit Current IGND

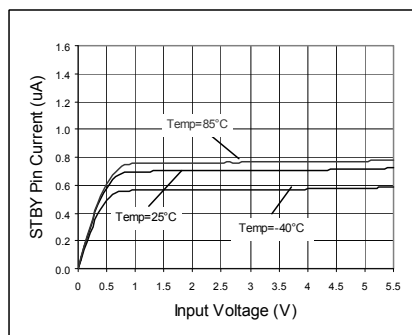


Fig.58. VSTBY - ISTBY

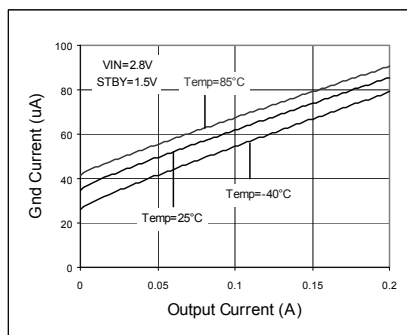


Fig.59. IOU - IGND

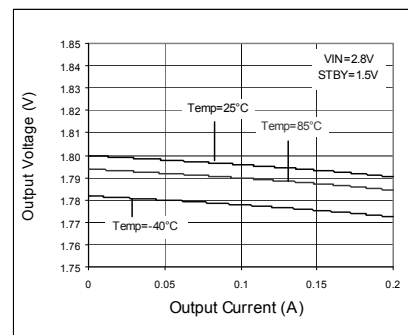


Fig.60. Load Regulation

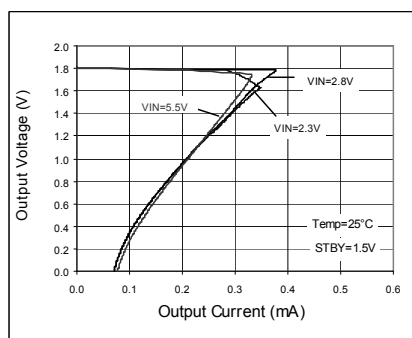


Fig.61. OCP Threshold

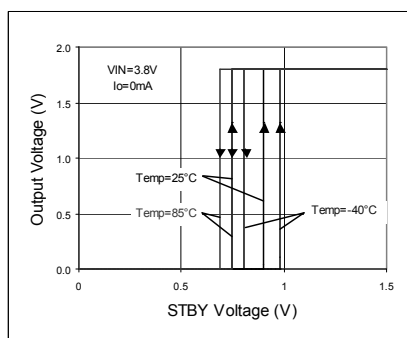


Fig.62. STBY Threshold

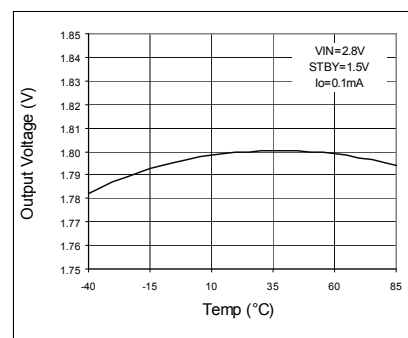


Fig.63. VOUT - Temp

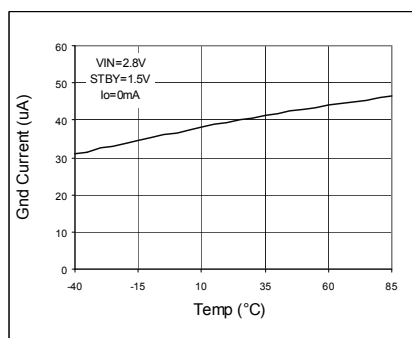


Fig.64. IGND - Temp

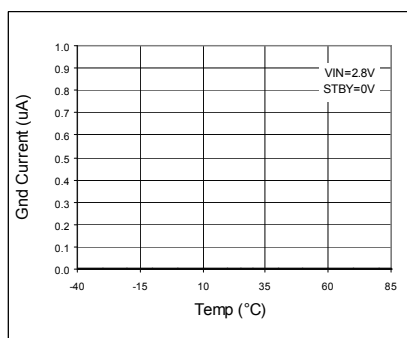


Fig.65. IGND - Temp (STBY)

●Reference data BU18TD2WNVX ( $T_a=25^\circ\text{C}$  unless otherwise specified.)

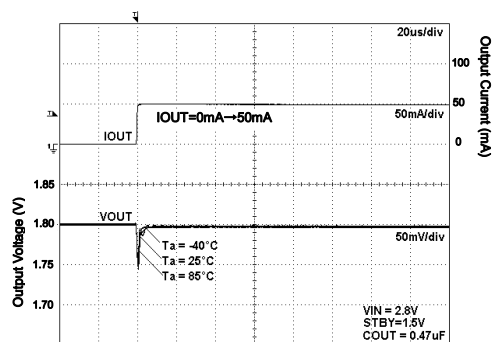


Fig.66. Load Response

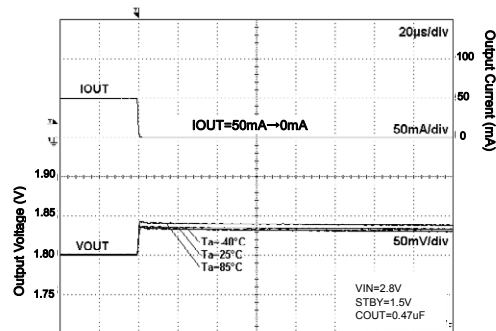


Fig.67. Load Response

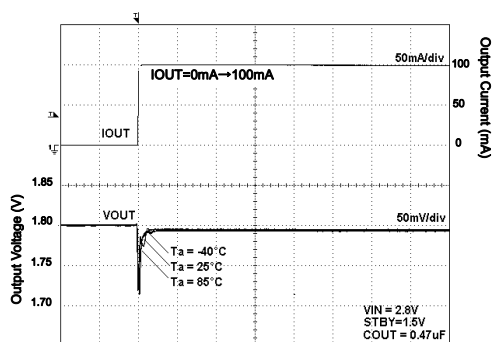


Fig.68. Load Response

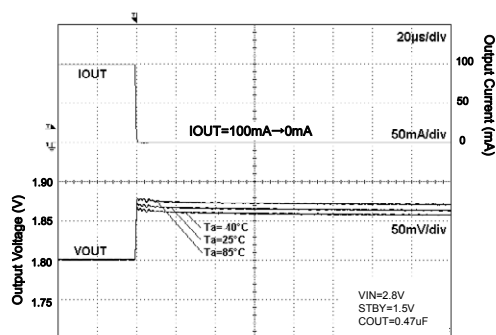


Fig.69. Load Response

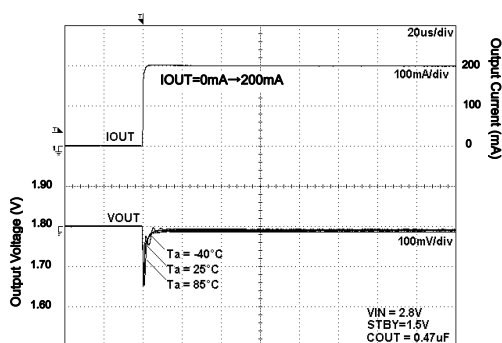


Fig.70. Load Response

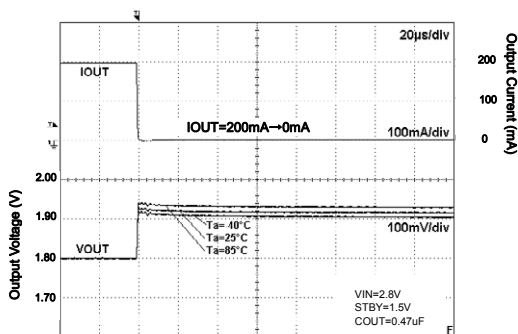


Fig.71. Load Response

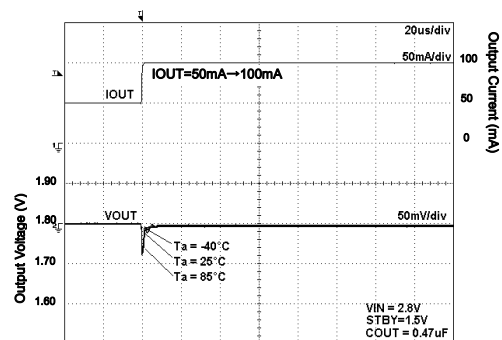


Fig.72. Load Response

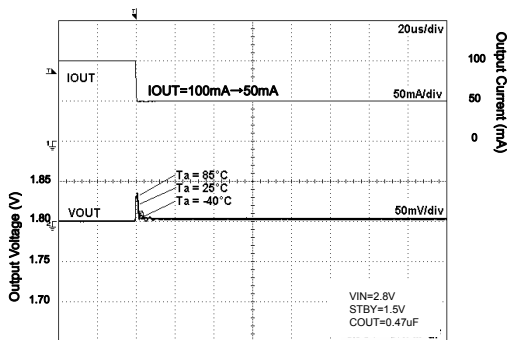


Fig.73. Load Response

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

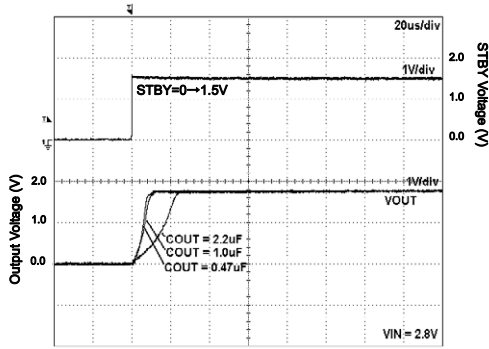


Fig.74. Start Up Time  
Iout=0mA

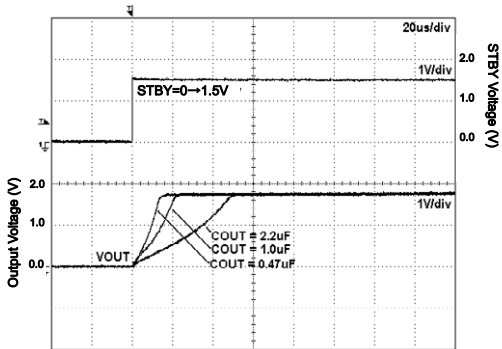


Fig.75. Start Up Time  
Iout=200mA

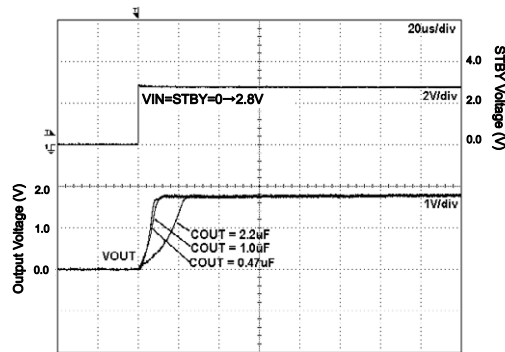


Fig.76. Start Up Time  
(VIN=STBY) Iout=0mA

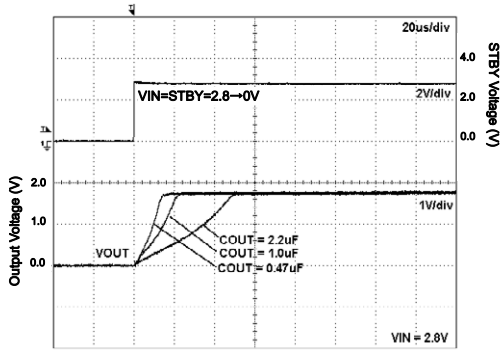


Fig.77. Start Up Time  
(VIN=STBY) Iout=200mA

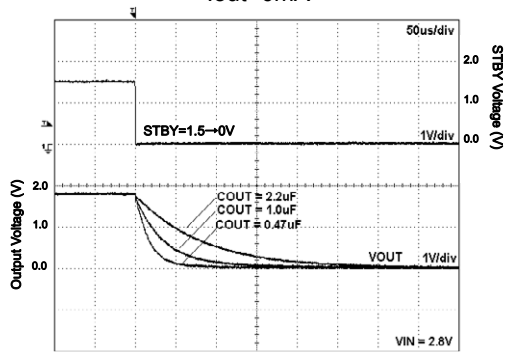


Fig.78. Discharge Time

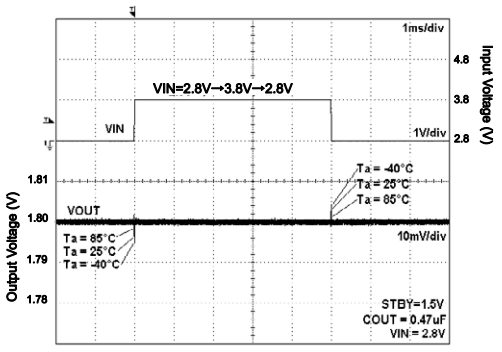


Fig.79. VIN Response

●Reference data BU19TD2WNVX (Ta=25°C unless otherwise specified.)

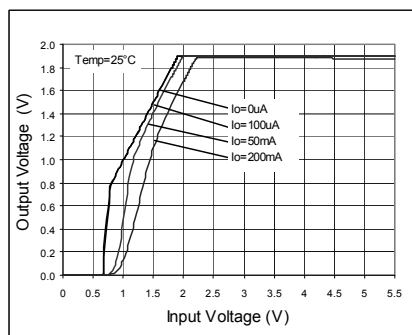


Fig.80. Output Voltage

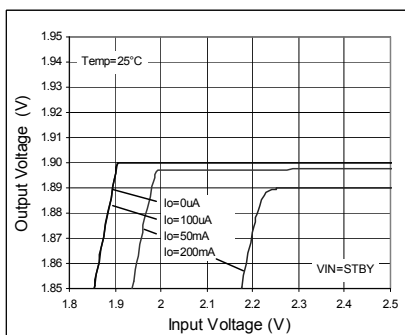


Fig.81. Line Regulation

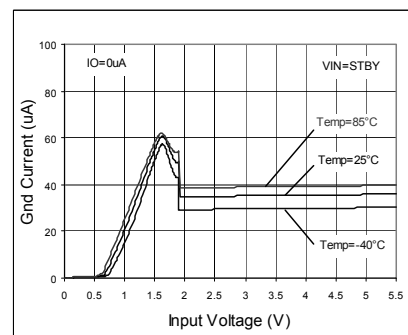


Fig.82. Circuit Current IGND

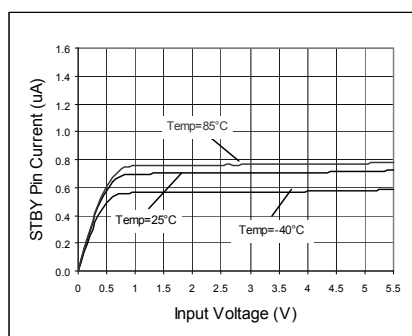


Fig.83. VSTBY - ISTBY

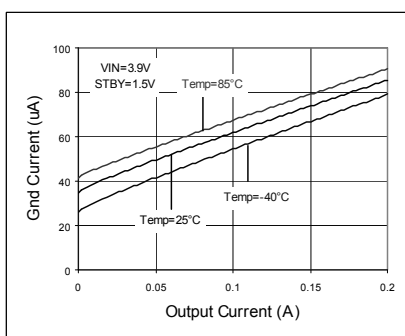


Fig.84. IOUT - IGND

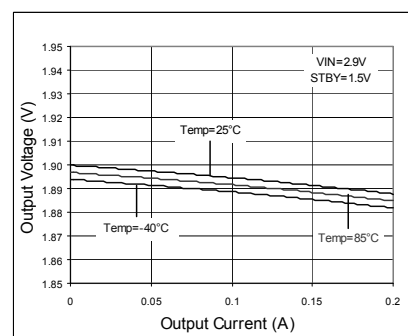


Fig.85. Load Regulation

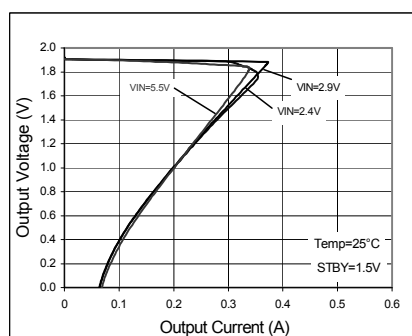


Fig.86. OCP Threshold

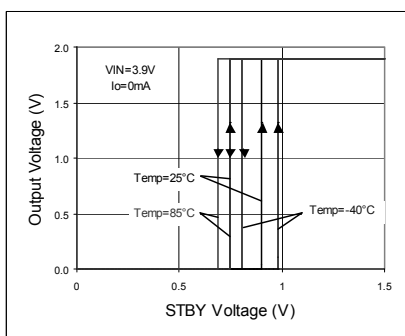


Fig.87. STBY Threshold

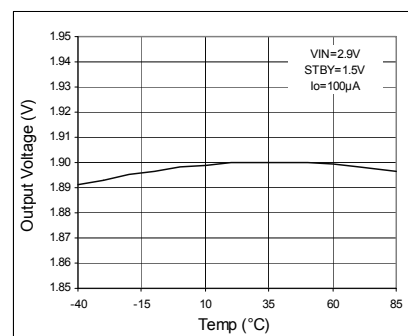


Fig.88. VOUT - Temp

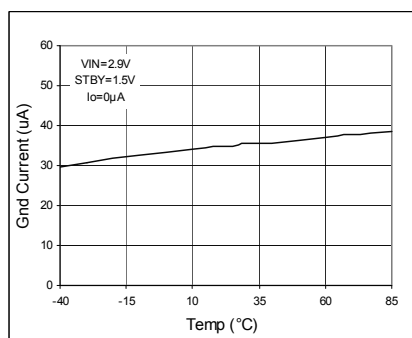


Fig.89. IGND - Temp

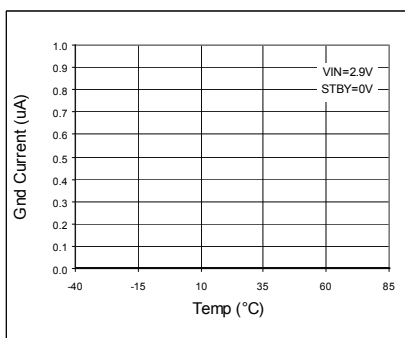


Fig.90. IGND - Temp (STBY)

●Reference data BU19TD2WNVX (Ta=25°C unless otherwise specified.)

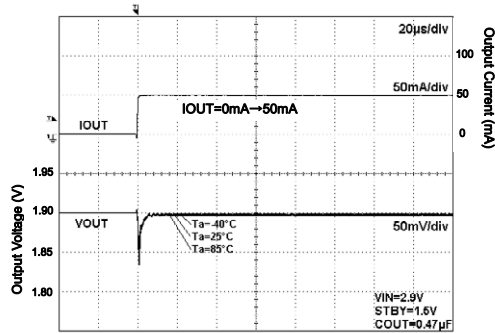


Fig.91. Load Response

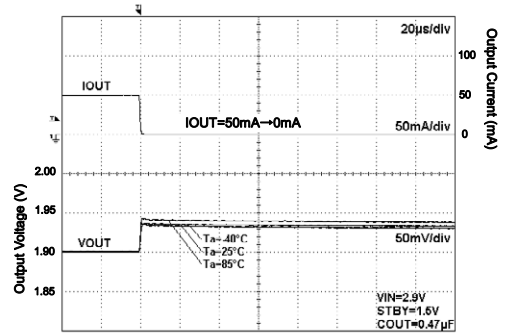


Fig.92. Load Response

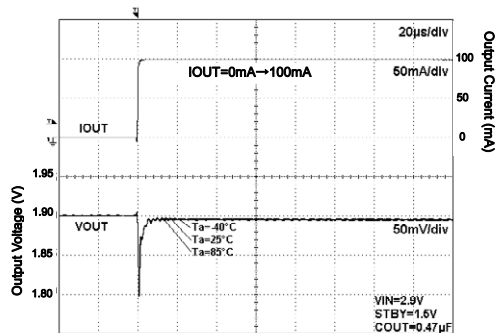


Fig.93. Load Response

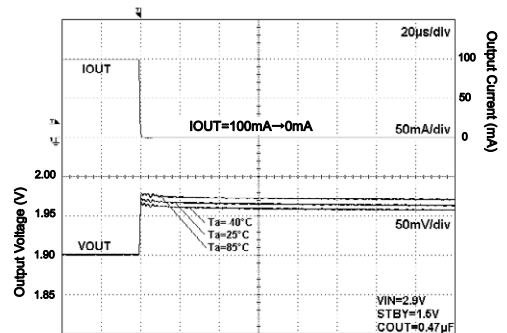


Fig.94. Load Response

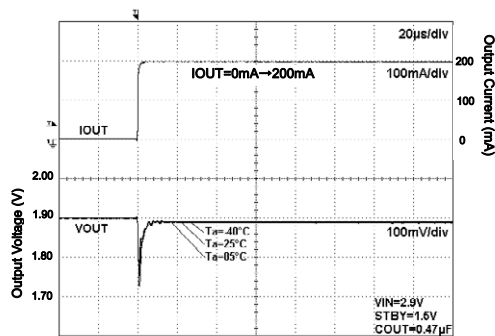


Fig.95. Load Response

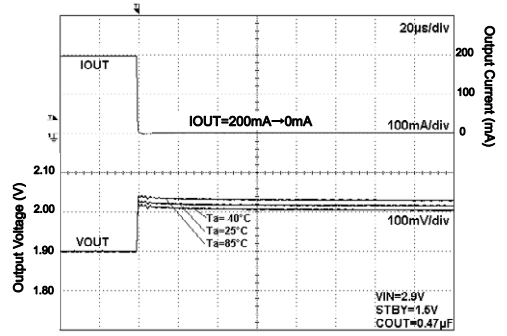


Fig.96. Load Response

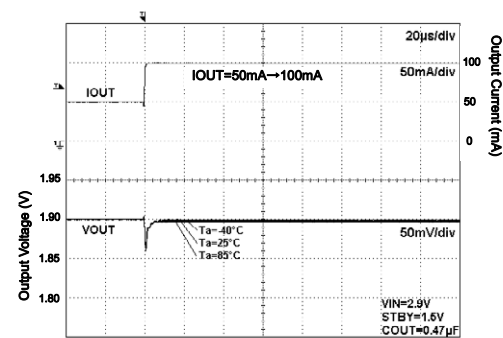


Fig.97. Load Response

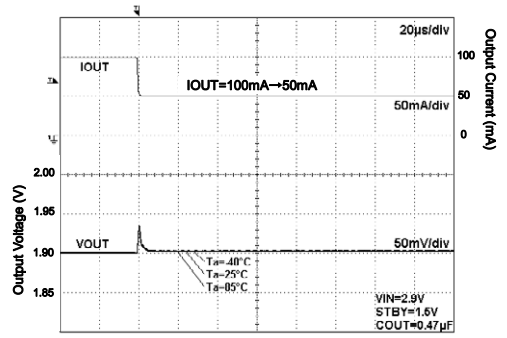


Fig.98. Load Response

●Reference data BU19TD2WNVX (Ta=25°C unless otherwise specified.)

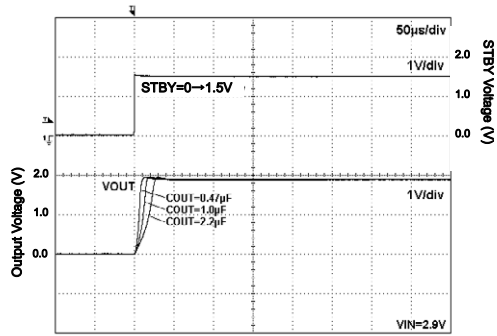


Fig.99. Start Up Time  
Iout=0mA

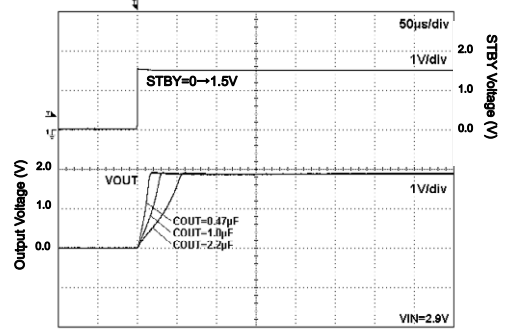


Fig.100. Start Up Time  
Iout=200mA

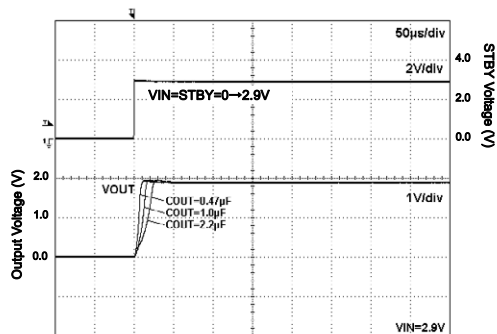


Fig.101. Start Up Time  
(VIN=STBY) Iout=0mA

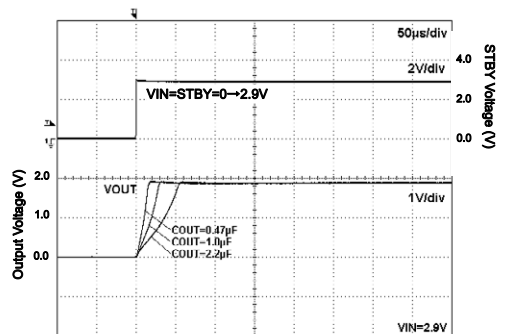


Fig.102. Start Up Time  
(VIN=STBY) Iout=200mA

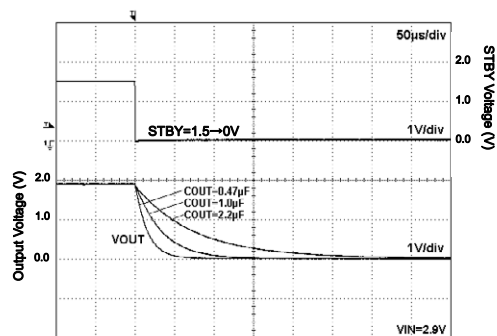


Fig.103. Discharge Time

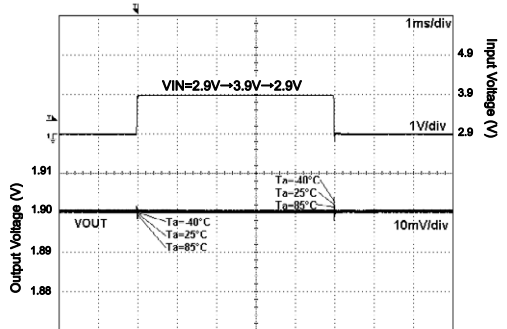


Fig.104. VIN Response

●Reference data BU25TD2WNVX (Ta=25°C unless otherwise specified.)

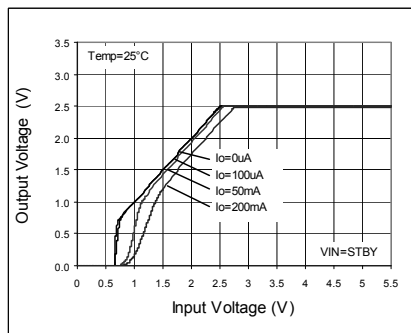


Fig.105. Output Voltage

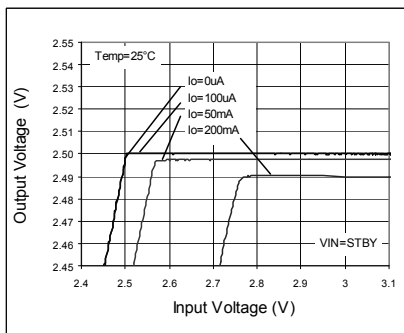


Fig.106. Line Regulation

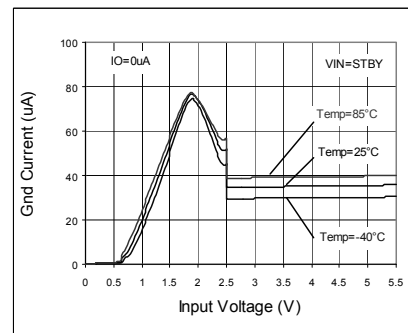


Fig.107. Circuit Current IGND

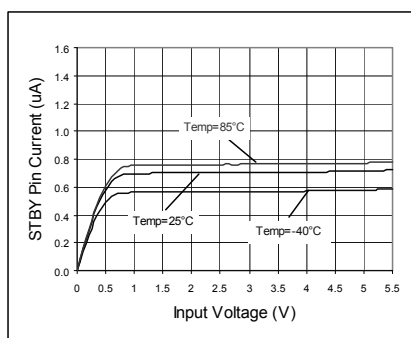


Fig.108. VSTBY - ISTBY

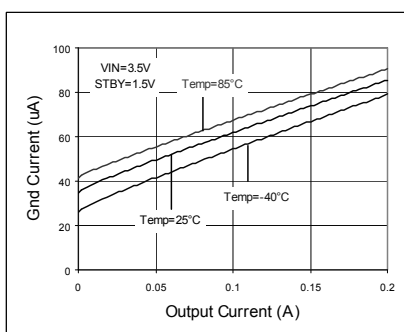


Fig.109. IOUT - IGND

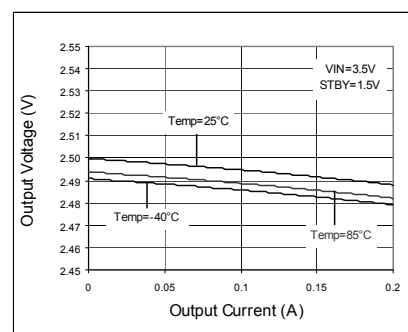


Fig.110. Load Regulation

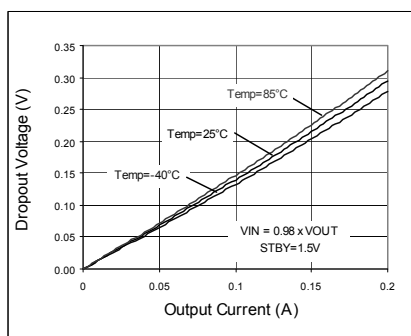


Fig.111. Dropout Voltage

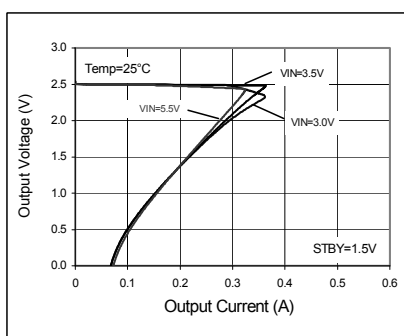


Fig.112. OCP Threshold

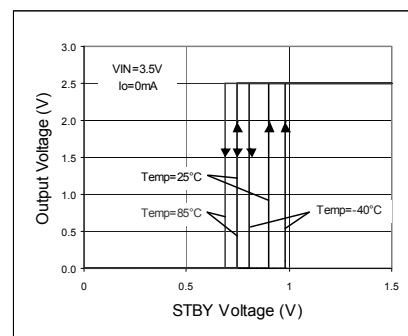


Fig.113. STBY Threshold

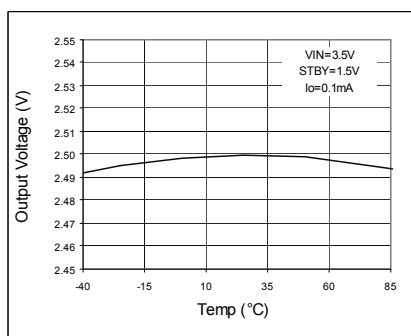


Fig.114. VOUT - Temp

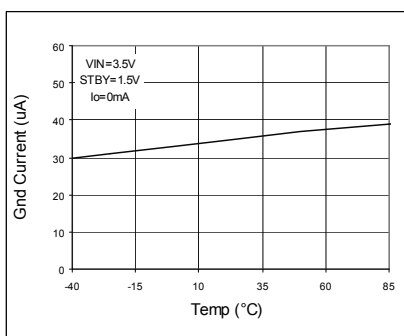


Fig.115. IGND - Temp

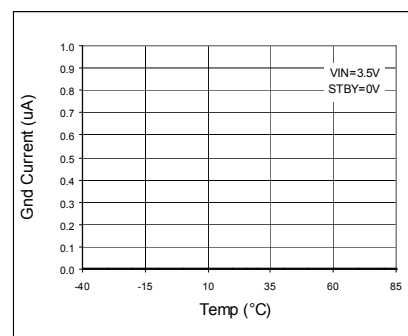


Fig.116. IGND - Temp (STBY)

●Reference data BU25TD2WNVX (Ta=25°C unless otherwise specified.)

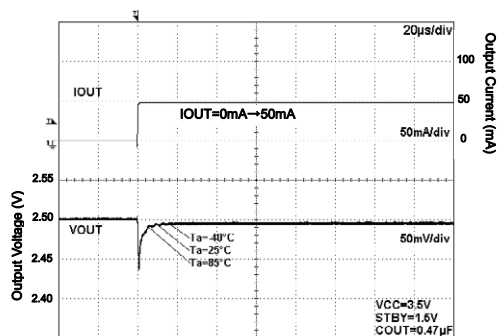


Fig.117. Load Response

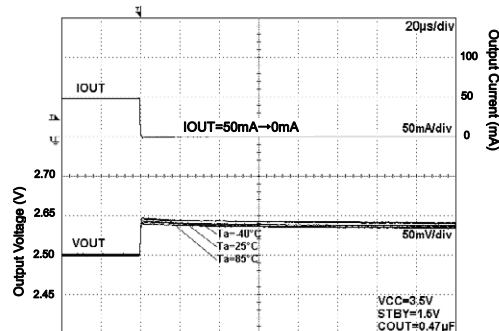


Fig.118. Load Response

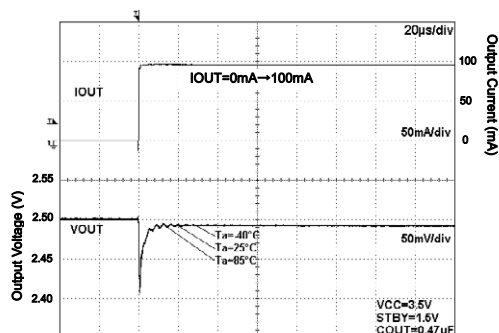


Fig.119. Load Response

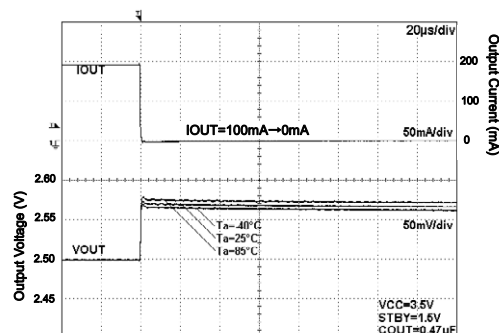


Fig.120. Load Response

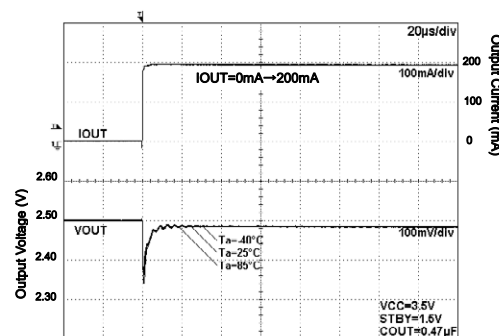


Fig.121. Load Response

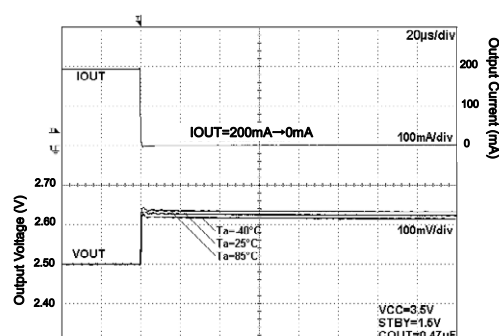


Fig.122. Load Response

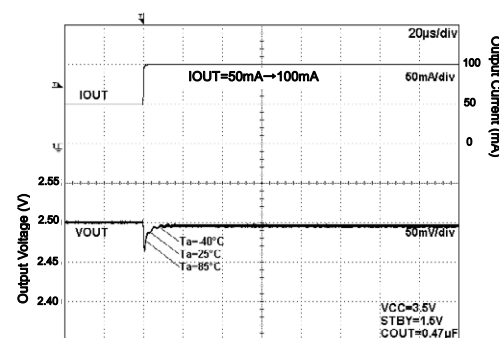


Fig.123. Load Response

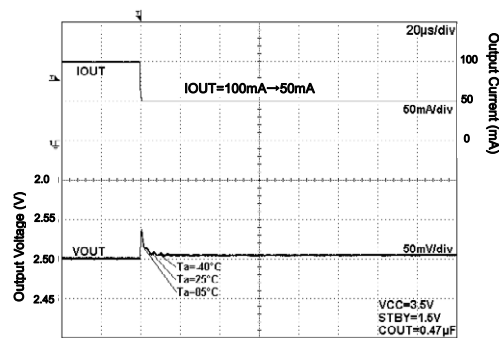


Fig.124. Load Response

●Reference data BU25TD2WNVX (Ta=25°C unless otherwise specified.)

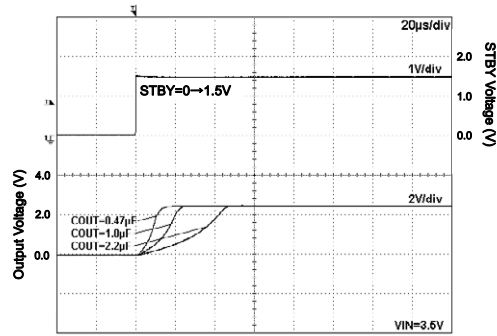


Fig.125. Start Up Time  
Iout=0mA

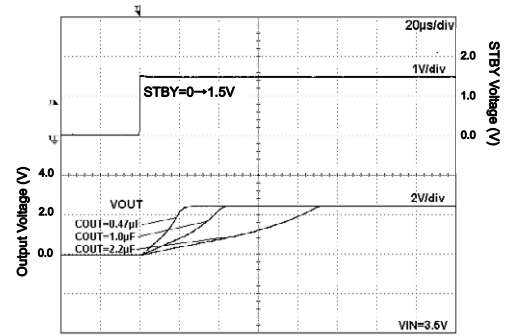


Fig.126. Start Up Time  
Iout=200mA

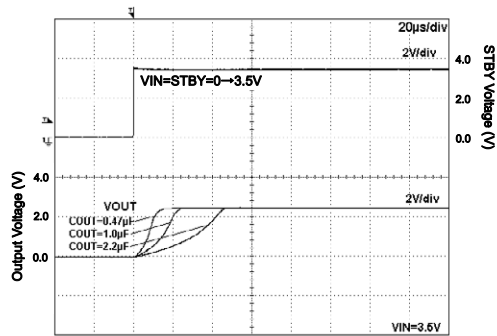


Fig.127. Start Up Time  
(VIN=STBY) Iout=0mA

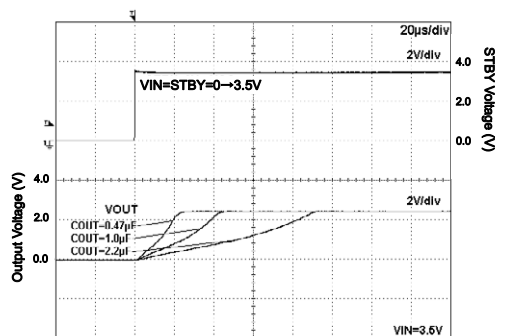


Fig.128. Start Up Time  
(VIN=STBY) Iout=200mA

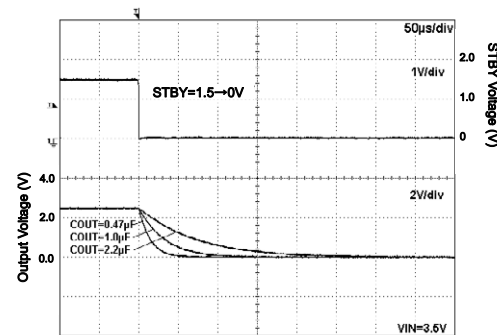


Fig.129. Discharge Time

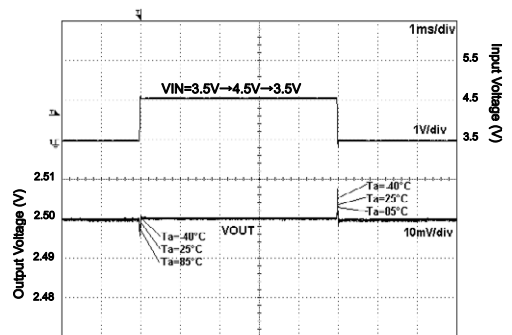


Fig.130. VIN Response

●Reference data BU26TD2WNVX (Ta=25°C unless otherwise specified.)

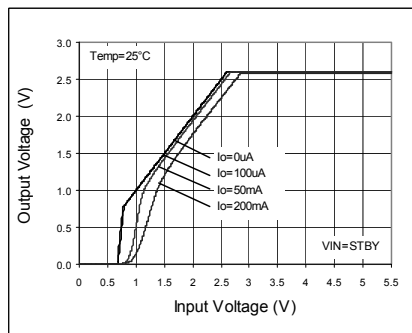


Fig.131. Output Voltage

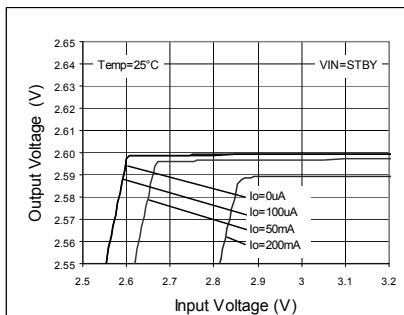


Fig.132. Line Regulation

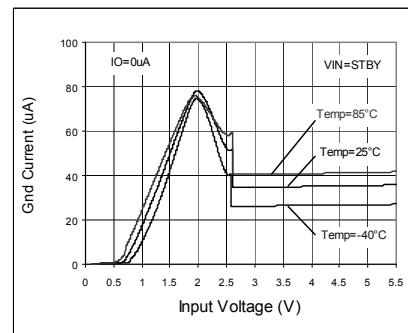


Fig.133. Circuit Current IGND

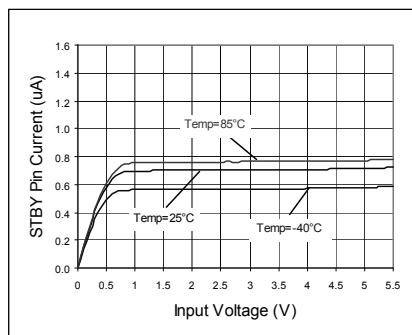


Fig.134. VSTBY - ISTBY

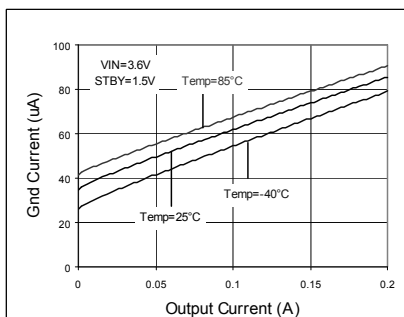


Fig.135. IOU - IGND

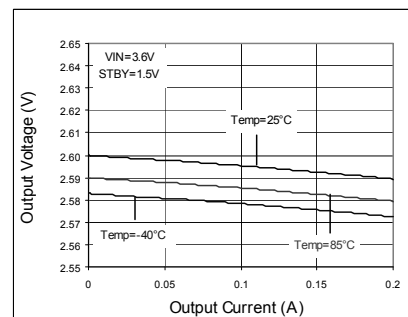


Fig.136. Load Regulation

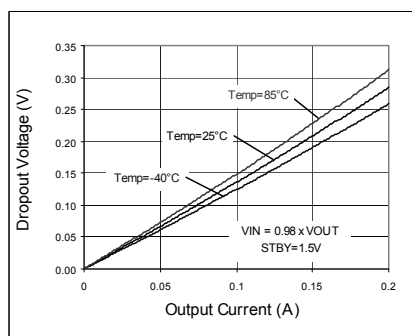


Fig.137. Dropout Voltage

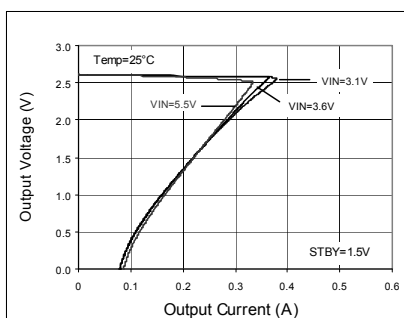


Fig.138. OCP Threshold

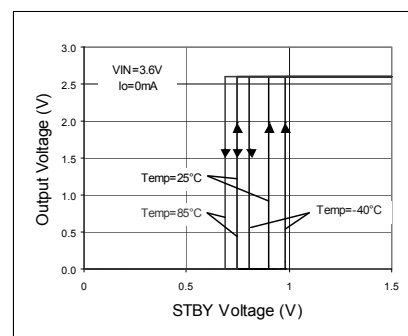


Fig.139. STBY Threshold

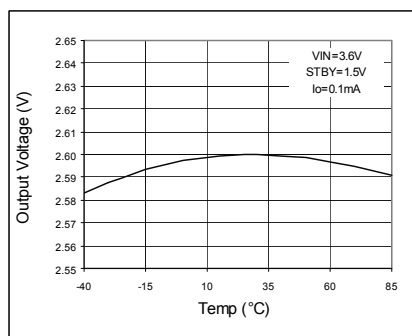


Fig.140. VOUT - Temp

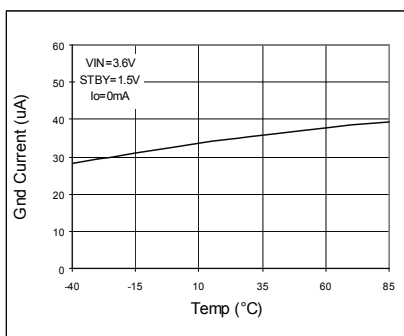


Fig.141. IGND - Temp

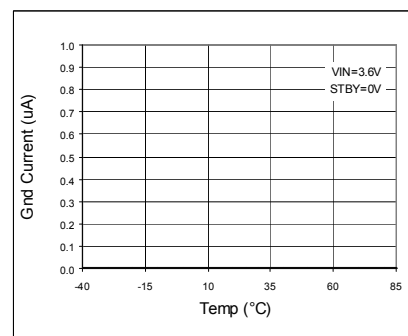


Fig.142. IGND - Temp (STBY)

●Reference data BU26TD2WNVX (Ta=25°C unless otherwise specified.)

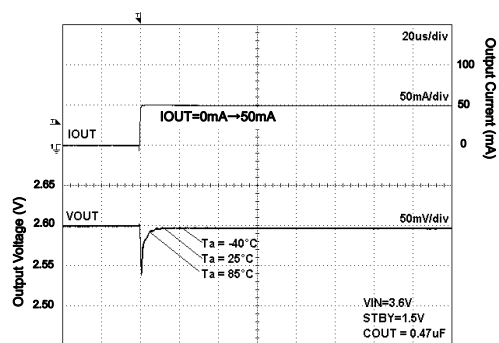


Fig.143. Load Response

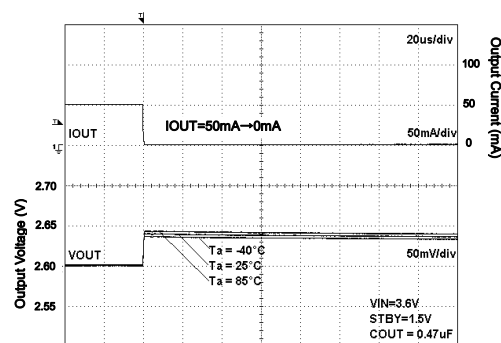


Fig.144. Load Response

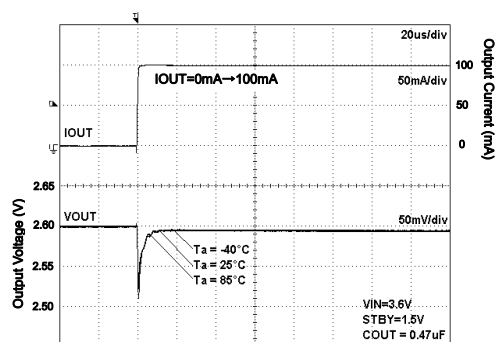


Fig.145. Load Response

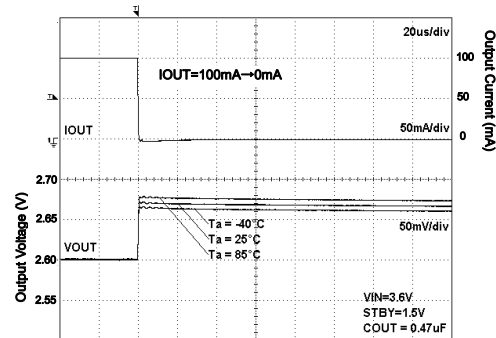


Fig.146. Load Response

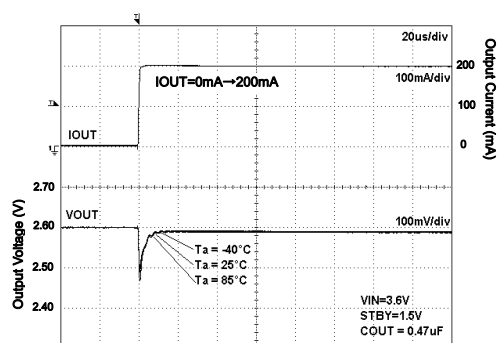


Fig.147. Load Response

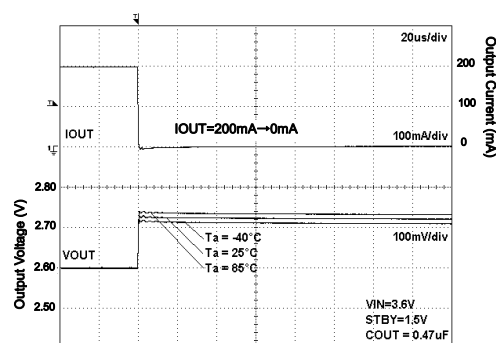


Fig.148. Load Response

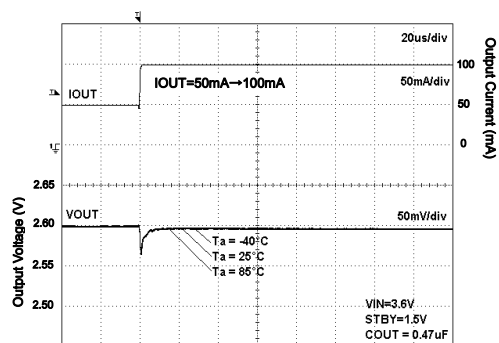


Fig.149. Load Response

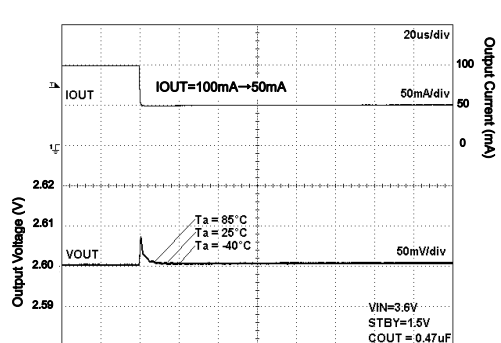


Fig.150. Load Response

●Reference data BU26TD2WNVX (Ta=25°C unless otherwise specified.)

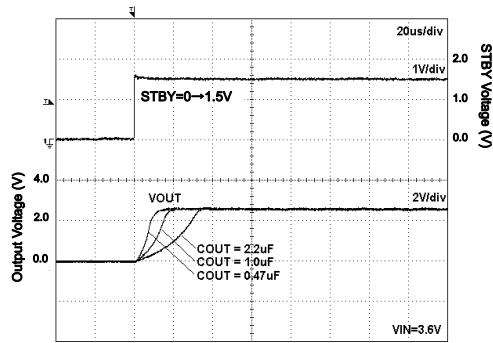


Fig.151. Start Up Time  
 $I_{out}=0\text{mA}$

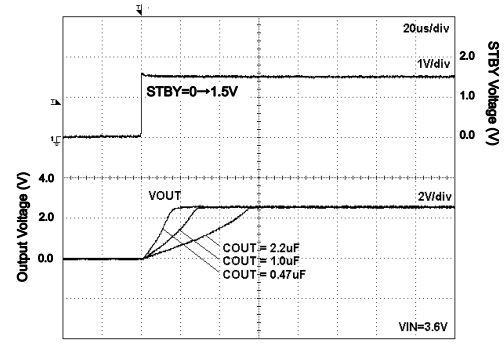


Fig.152. Start Up Time  
 $I_{out}=200\text{mA}$

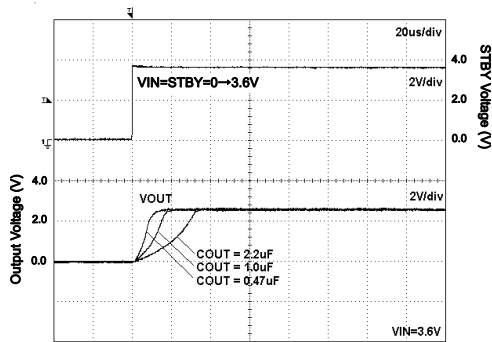


Fig.153. Start Up Time  
( $V_{IN}=STBY$ )  $I_{out}=0\text{mA}$

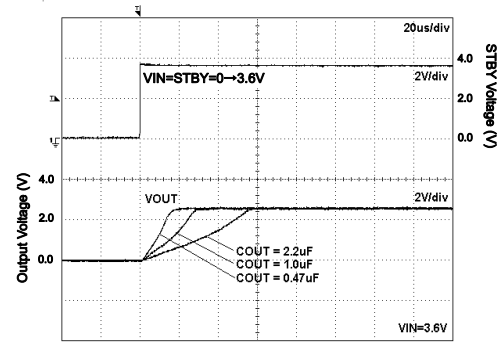


Fig.154. Start Up Time  
( $V_{IN}=STBY$ )  $I_{out}=200\text{mA}$

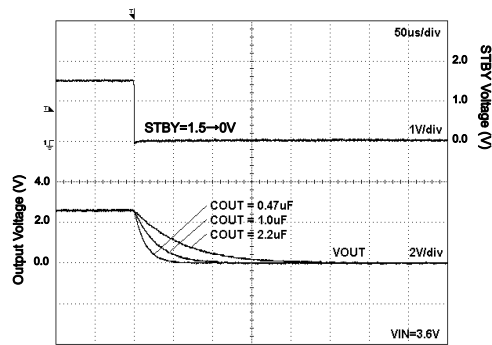


Fig.155. Discharge Time

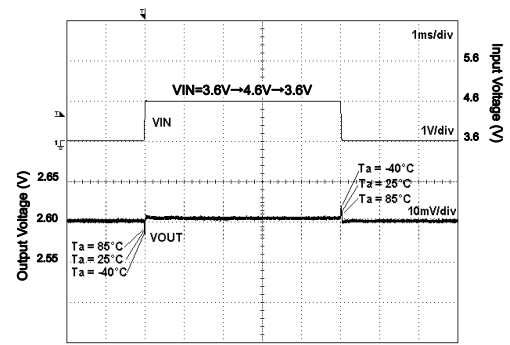


Fig.156. VIN Response

●Reference data BU27TD2WNVX (Ta=25°C unless otherwise specified.)

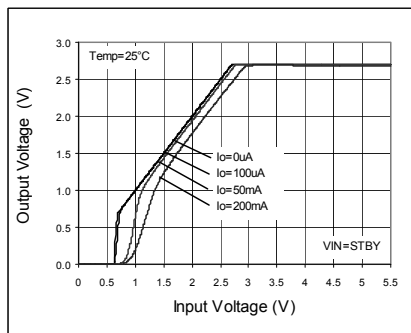


Fig.157. Output Voltage

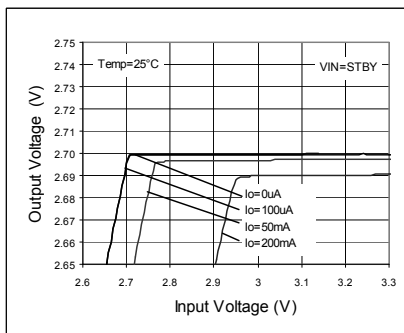


Fig.158. Line Regulation

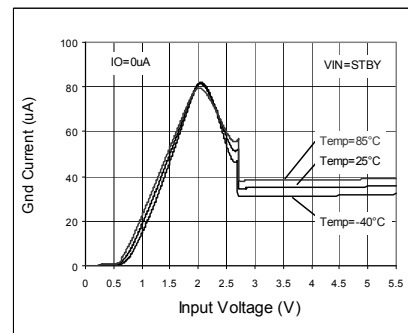


Fig.159. Circuit Current IGND

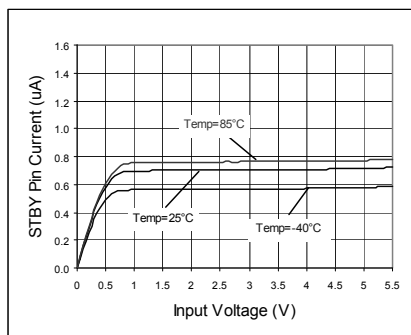


Fig.160. VSTBY - ISTBY

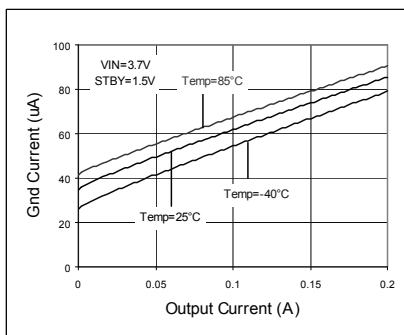


Fig.161. IOUT - IGDND

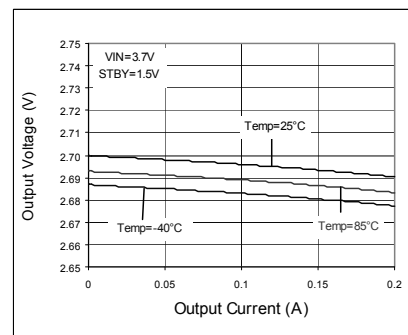


Fig.162. Load Regulation

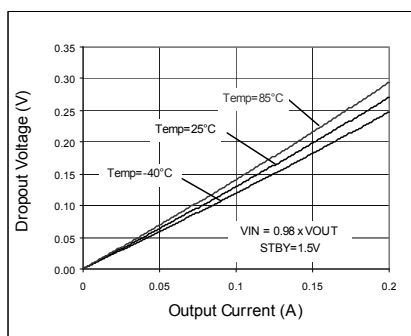


Fig.163. Dropout Voltage

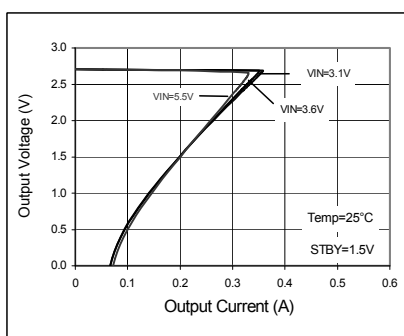


Fig.164. OCP Threshold

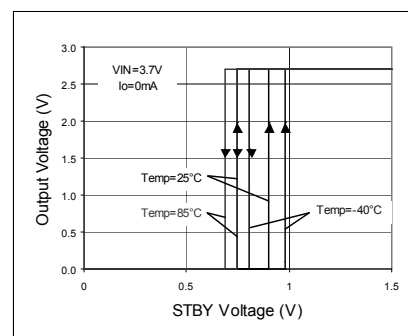


Fig.165. STBY Threshold

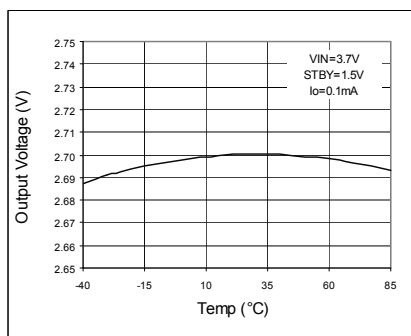


Fig.166. VOUT - Temp

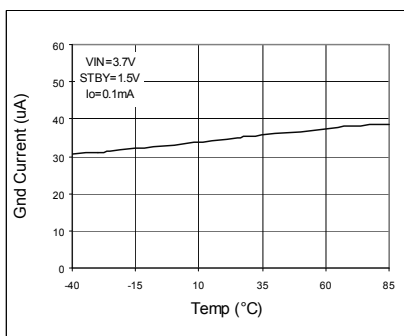


Fig.167. IGDND - Temp

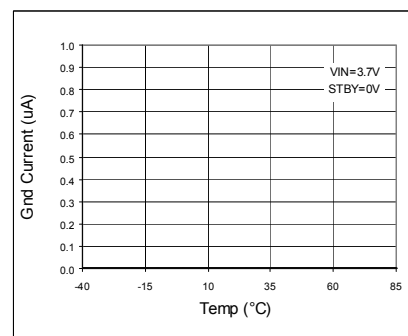


Fig.168. IGDND - Temp (STBY)

●Reference data BU27TD2WNVX (Ta=25°C unless otherwise specified.)

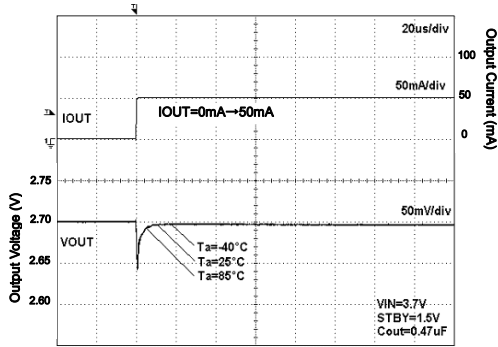


Fig.169. Load Response

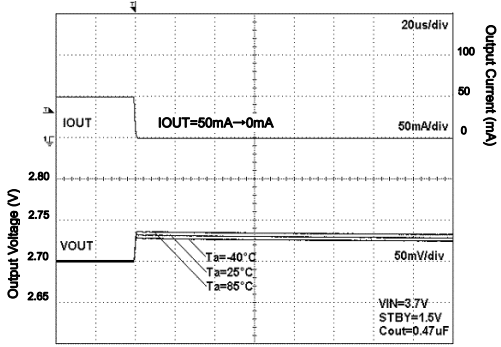


Fig.170. Load Response

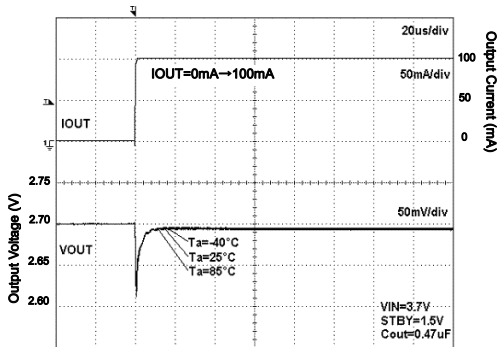


Fig.171. Load Response

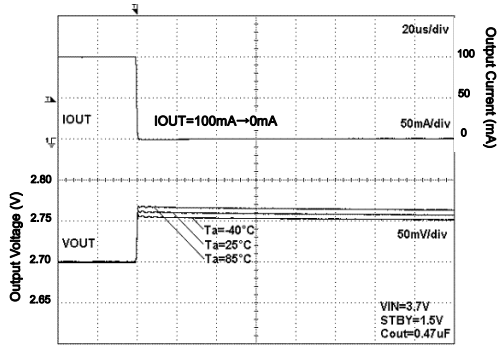


Fig.172. Load Response

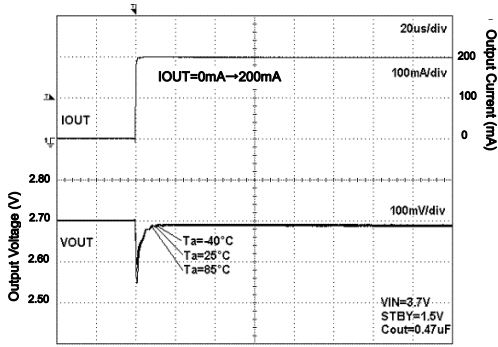


Fig.173. Load Response

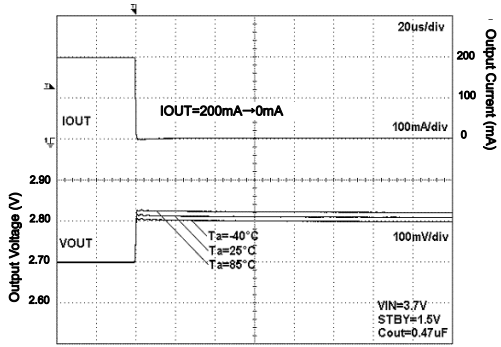


Fig.174. Load Response

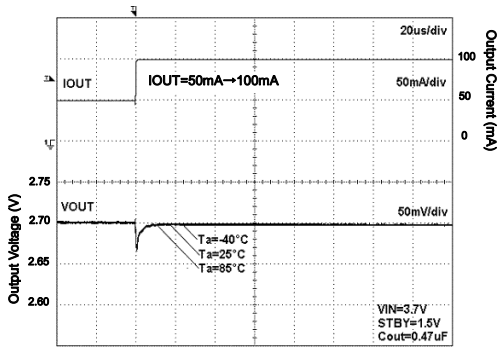


Fig.175. Load Response

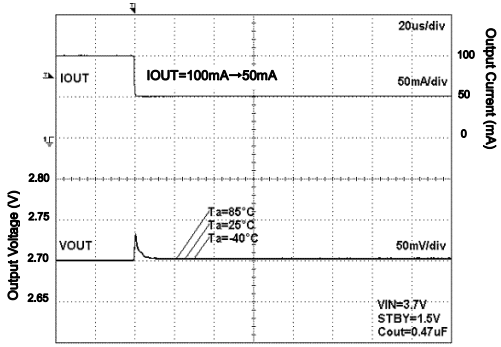


Fig.176. Load Response

●Reference data BU27TD2WNVX (Ta=25°C unless otherwise specified.)

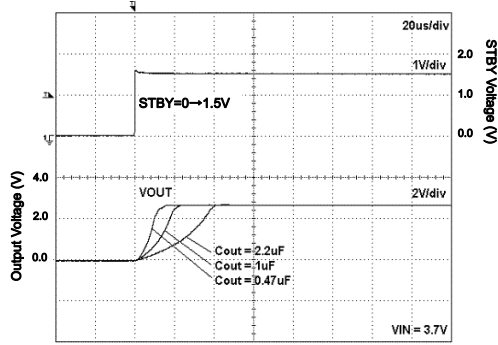


Fig.177. Start Up Time  
 $I_{out}=0\text{mA}$

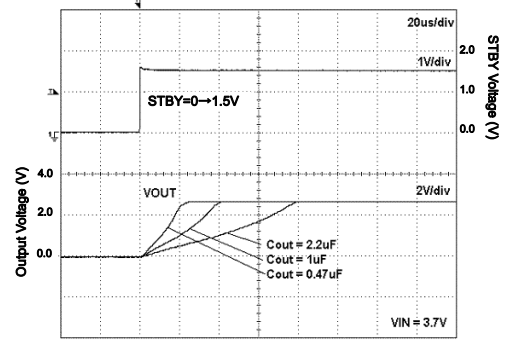


Fig.178. Start Up Time  
 $I_{out}=200\text{mA}$

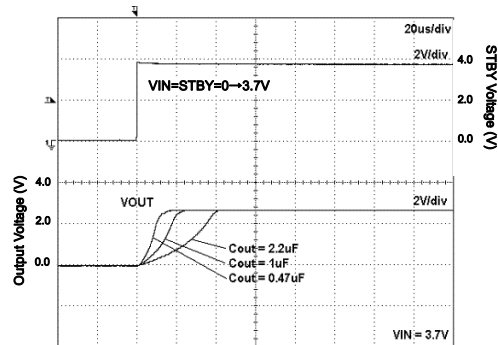


Fig.179. Start Up Time  
( $V_{IN}=STBY$ )  $I_{out}=0\text{mA}$

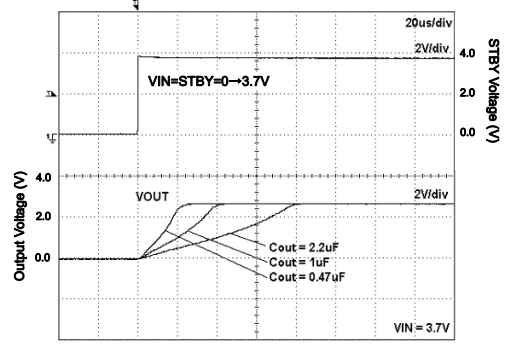


Fig.180. Start Up Time  
( $V_{IN}=STBY$ )  $I_{out}=200\text{mA}$

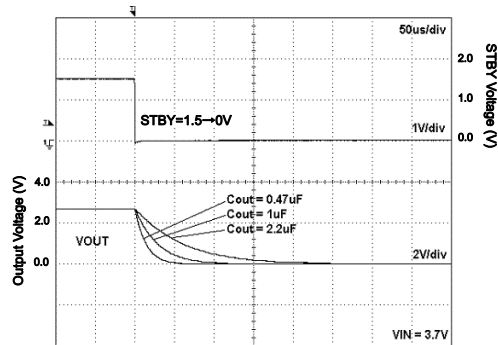


Fig.181. Discharge Time

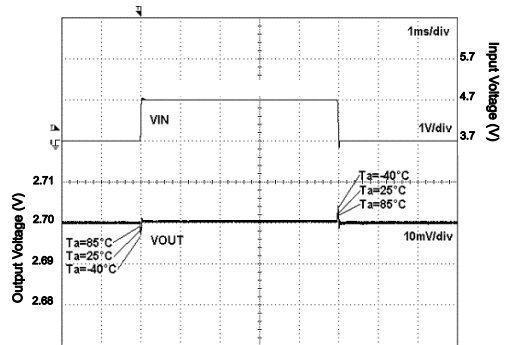


Fig.182. VIN Response

●Reference data BU28TD2WNVX (Ta=25°C unless otherwise specified.)

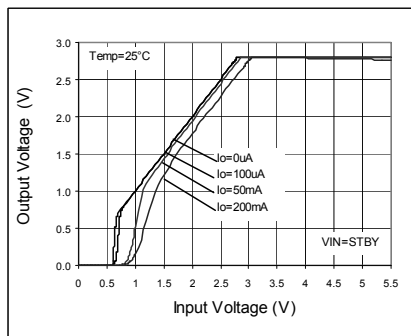


Fig.183. Output Voltage

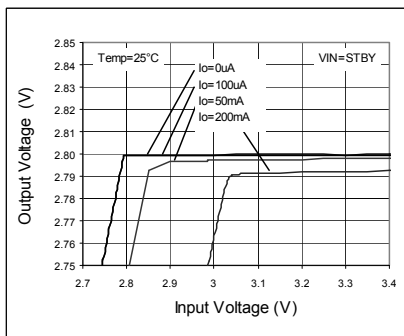


Fig.184. Line Regulation

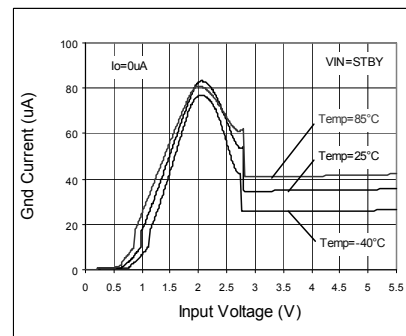


Fig.185. Circuit Current IGND

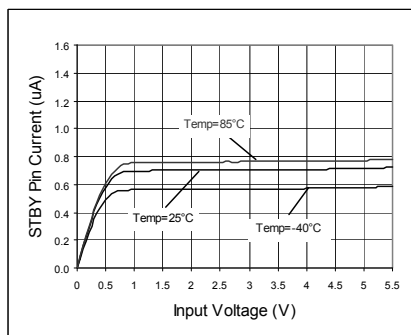


Fig.186. VSTBY - ISTBY

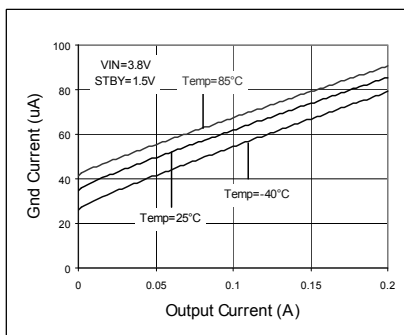


Fig.187. IOU - IGND

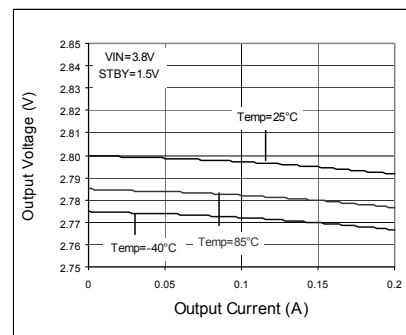


Fig.188. Load Regulation

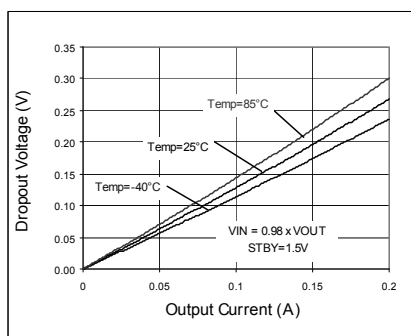


Fig.189. Dropout Voltage

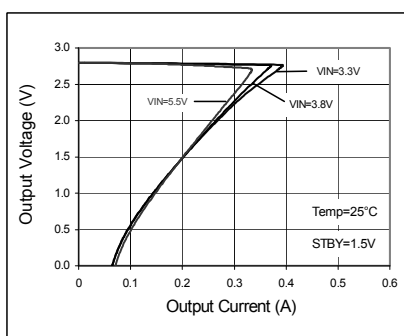


Fig.190. OCP Threshold

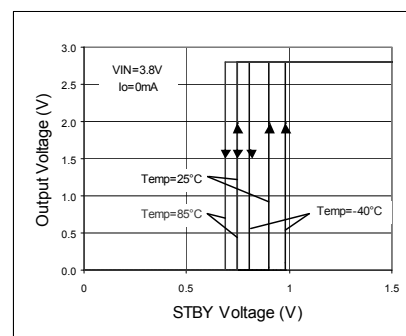


Fig.191. STBY Threshold

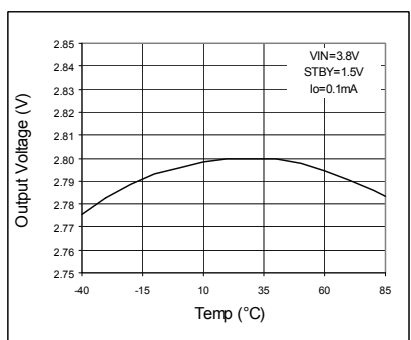


Fig.192. VOUT - Temp

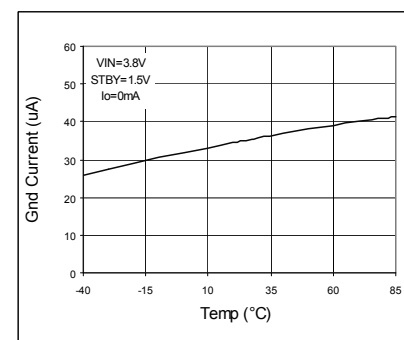


Fig.193. IGND - Temp

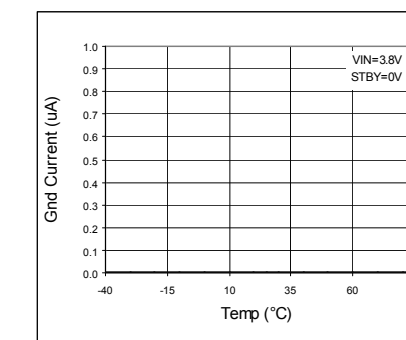


Fig.194. IGND - Temp (STBY)

●Reference data BU28TD2WNVX (Ta=25°C unless otherwise specified.)

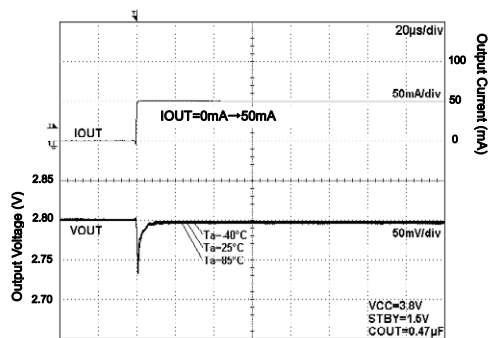


Fig.195. Load Response

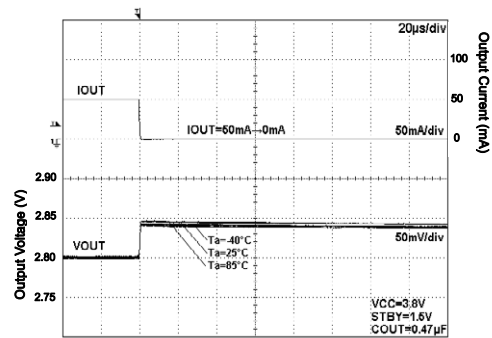


Fig.196. Load Response

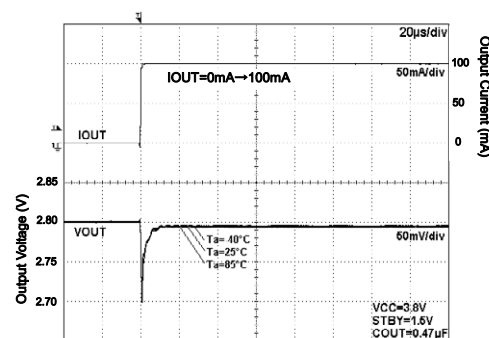


Fig.197. Load Response

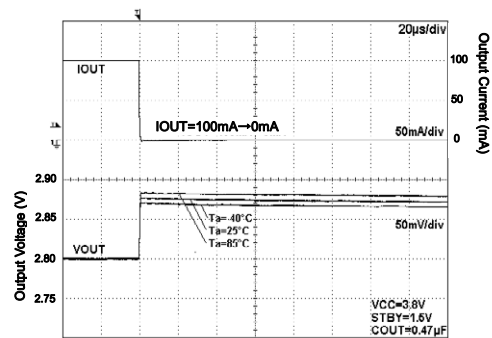


Fig.198. Load Response

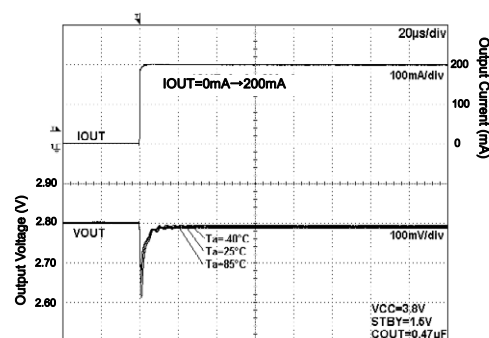


Fig.199. Load Response

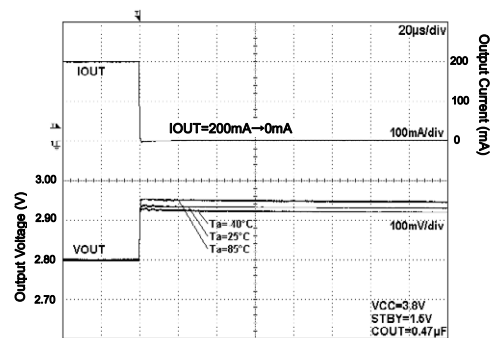


Fig.200. Load Response

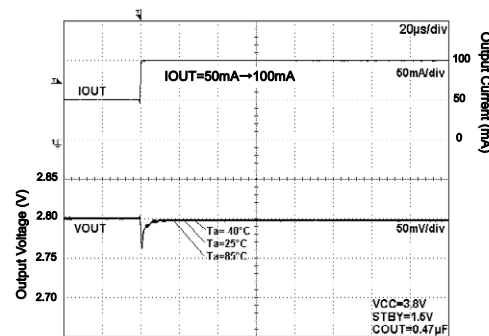


Fig.201. Load Response

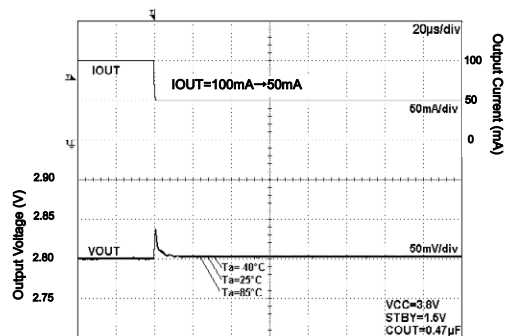


Fig.202. Load Response

●Reference data BU28TD2WNVX (Ta=25°C unless otherwise specified.)

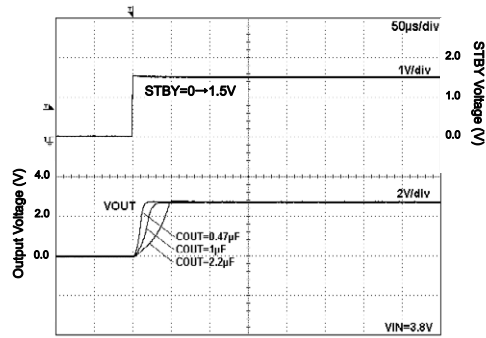


Fig.203. Start Up Time  
Iout=0mA

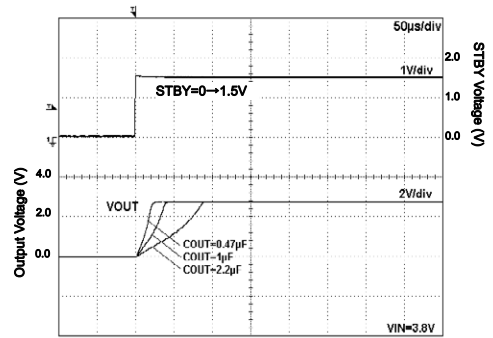


Fig.204. Start Up Time  
Iout=200mA

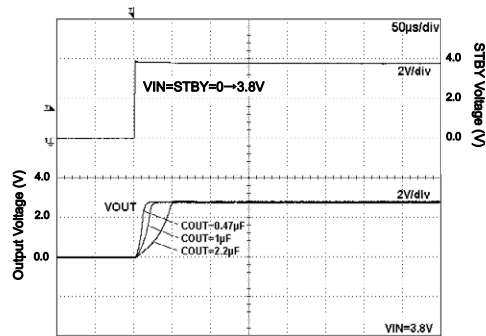


Fig.205. Start Up Time  
(VIN=STBY) Iout=0mA

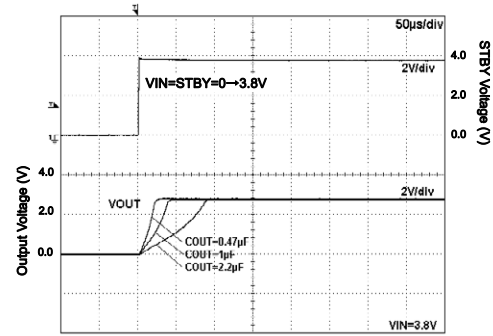


Fig.206. Start Up Time  
(VIN=STBY) Iout=200mA

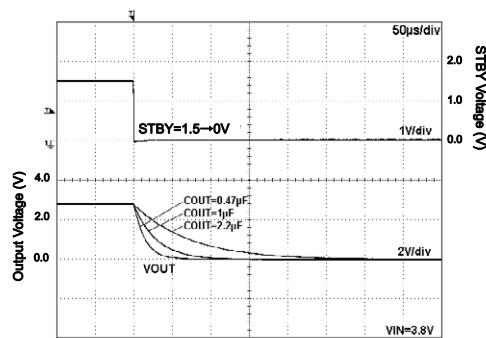


Fig.207. Discharge Time

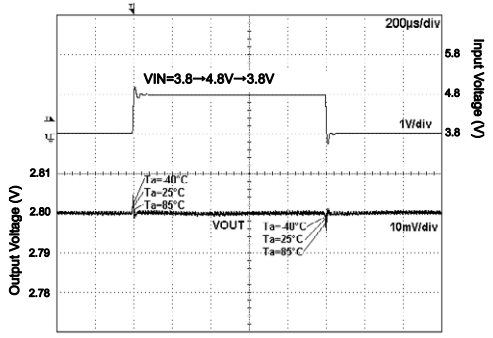


Fig.208. VIN Response

●Reference data BU30TD2WNVX (Ta=25°C unless otherwise specified.)

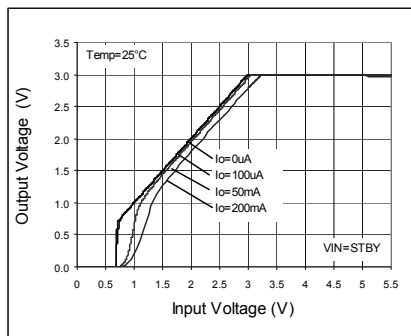


Fig.209. Output Voltage

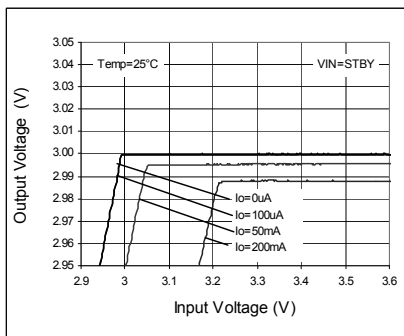


Fig.210. Line Regulation

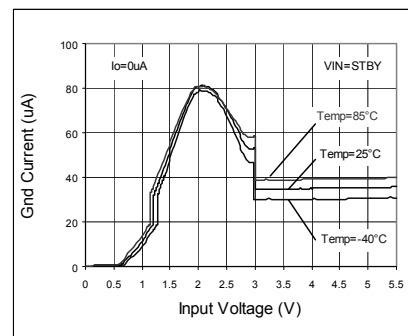


Fig.211. Circuit Current IGND

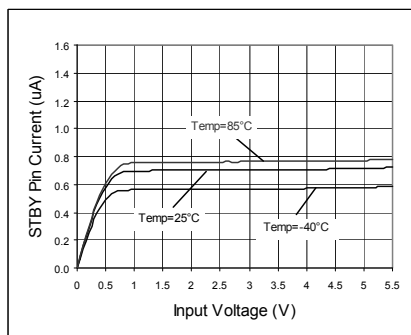


Fig.212. VSTBY - ISTBY

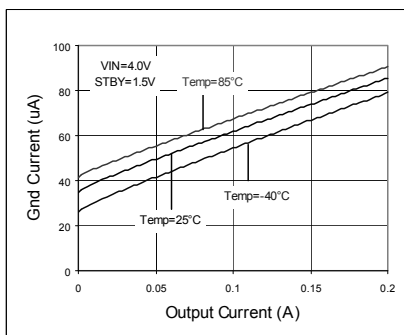


Fig.213. IOUT - IGND

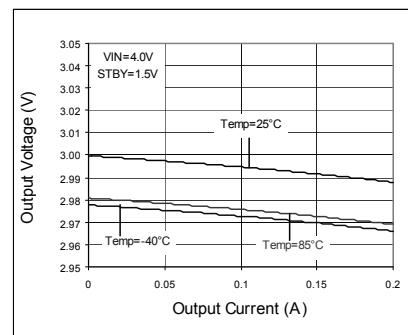


Fig.214. Load Regulation

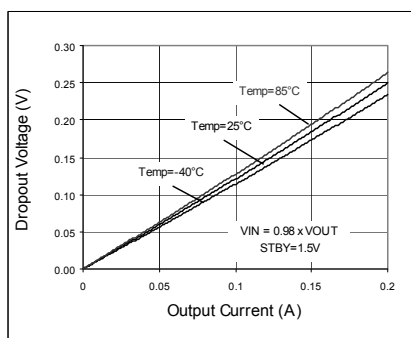


Fig.215. Dropout Voltage

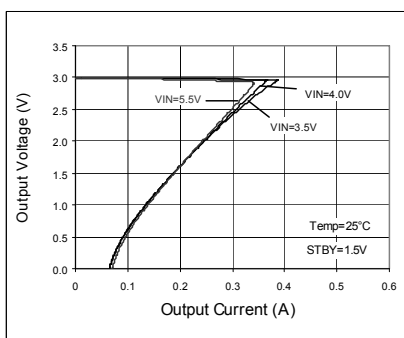


Fig.216. OCP Threshold

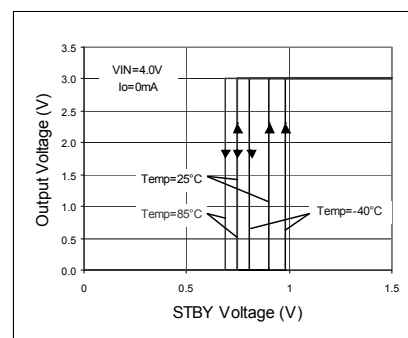


Fig.217. STBY Threshold

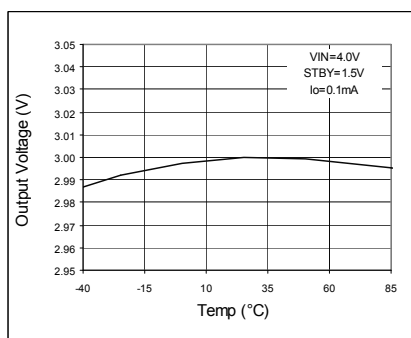


Fig.218. VOUT - Temp

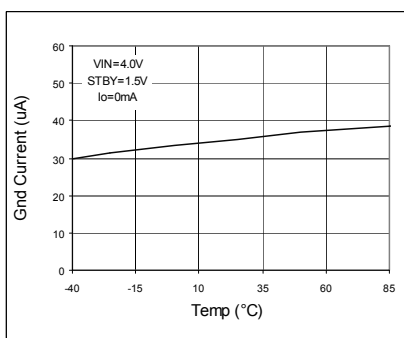


Fig.219. IGND - Temp

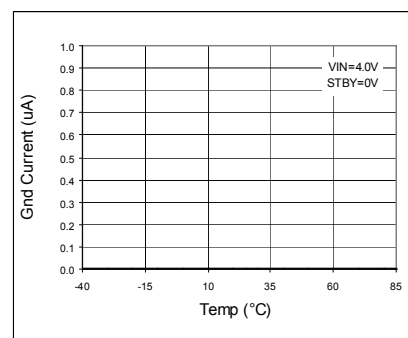
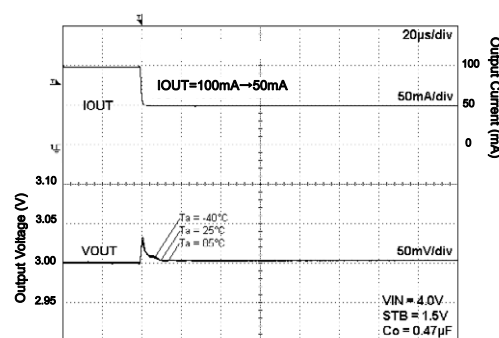
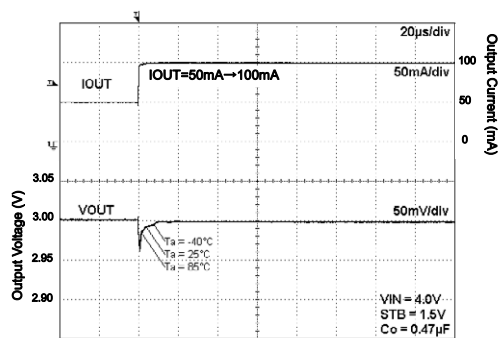
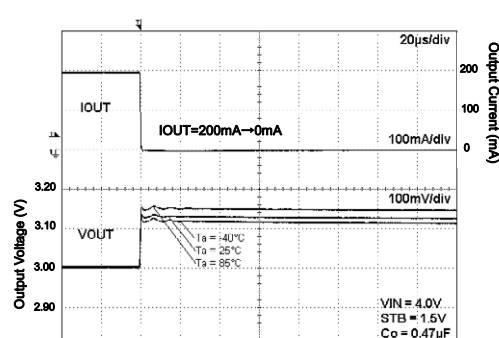
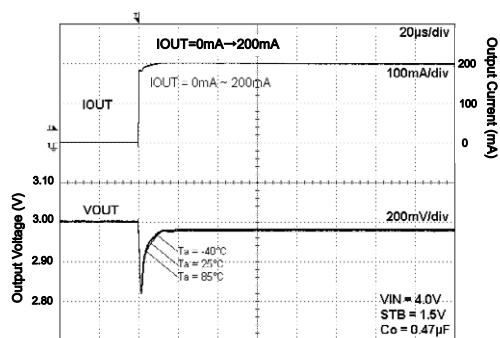
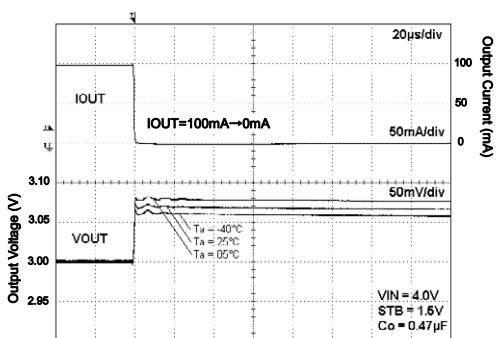
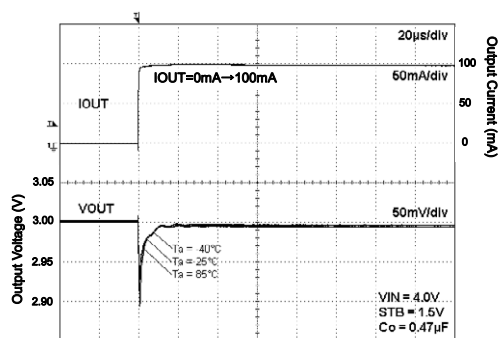
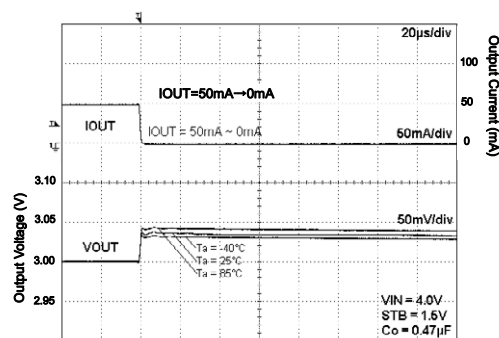
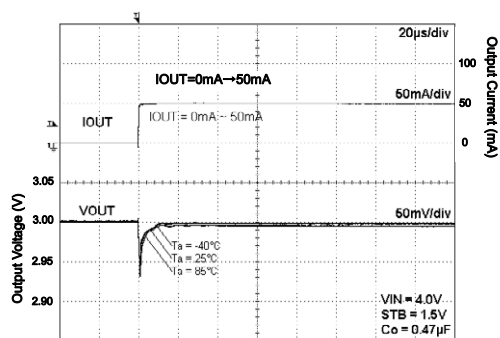


Fig.220. IGND - Temp (STBY)

●Reference data BU30TD2WNVX (Ta=25°C unless otherwise specified.)



●Reference data BU30TD2WNVX (Ta=25°C unless otherwise specified.)

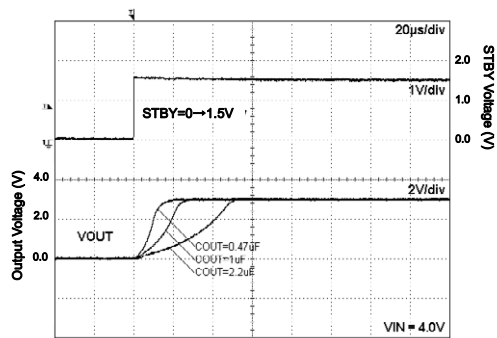


Fig.229. Start Up Time  
Iout=0mA

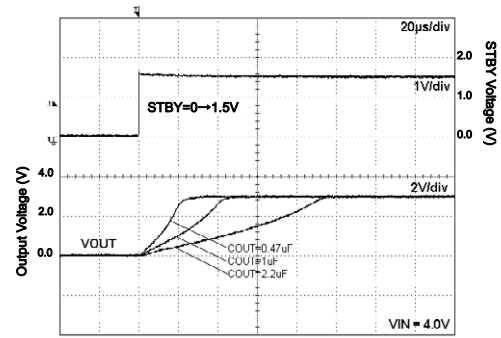


Fig.230. Start Up Time  
Iout=200mA

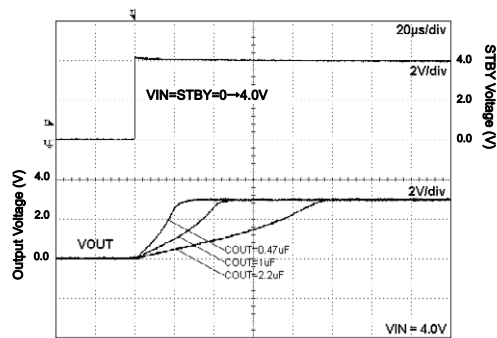


Fig.231. Start Up Time  
(VIN=STBY) Iout=0mA

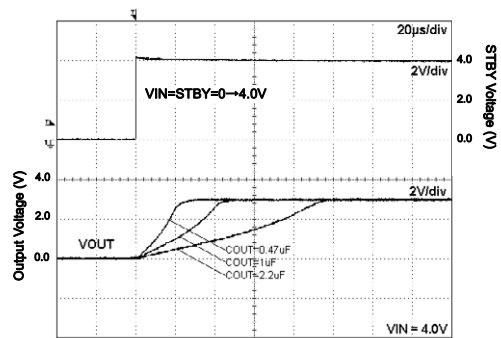


Fig.232. Start Up Time  
(VIN=STBY) Iout=200mA

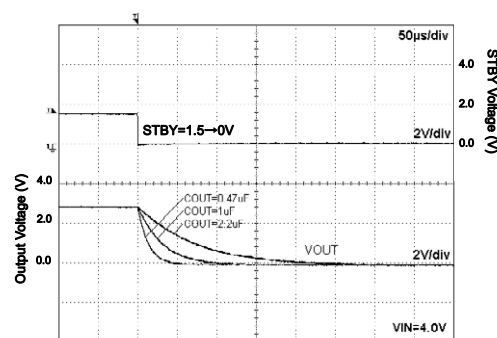


Fig.233. Discharge Time

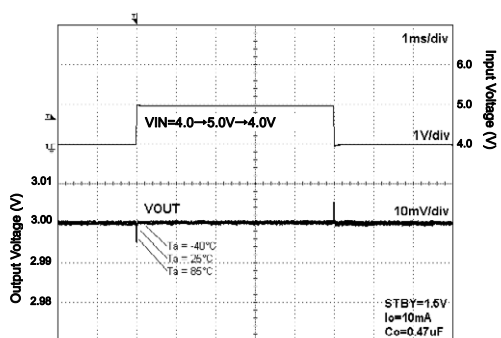


Fig.234. VIN Response

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

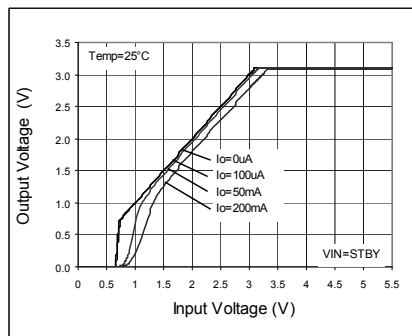


Fig.235. Output Voltage

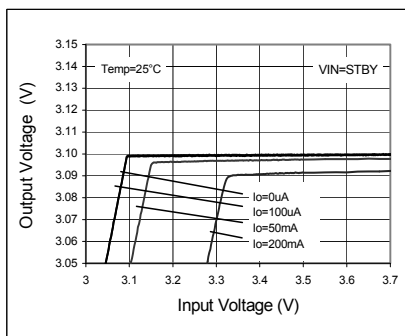


Fig.236. Line Regulation

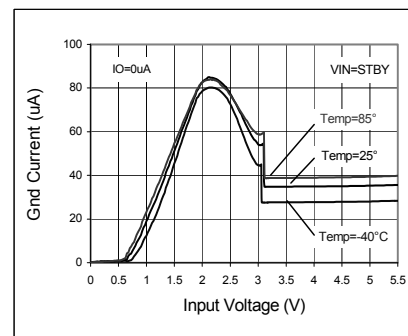


Fig.237. Circuit Current IGND

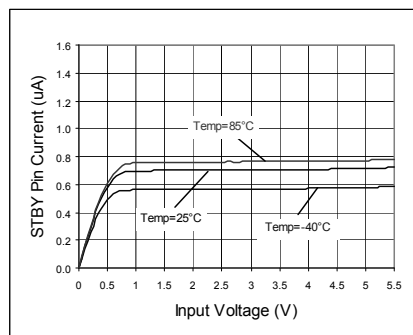


Fig.238. VSTBY - ISTBY

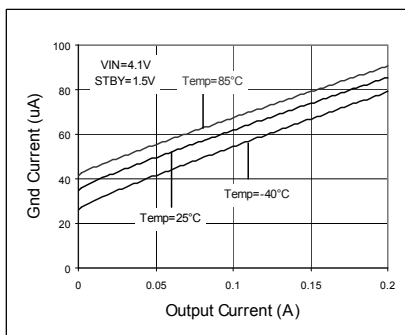


Fig.239. IOU - IGND

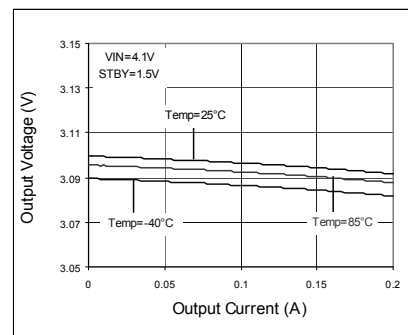


Fig.240. Load Regulation

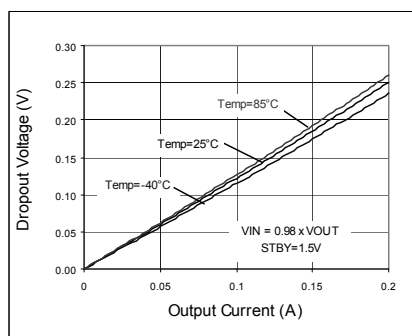


Fig.241. Dropout Voltage

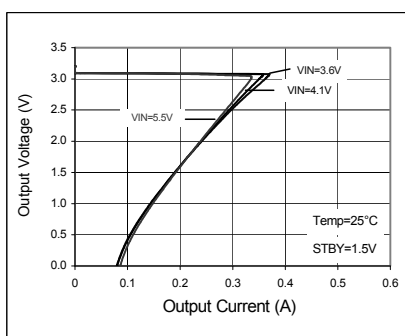


Fig.242. OCP Threshold

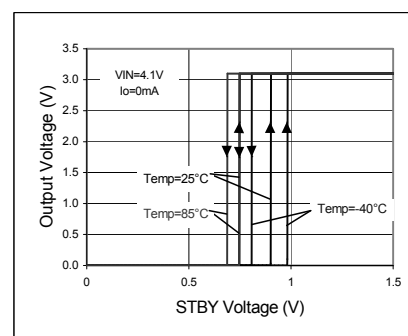


Fig.243. STBY Threshold

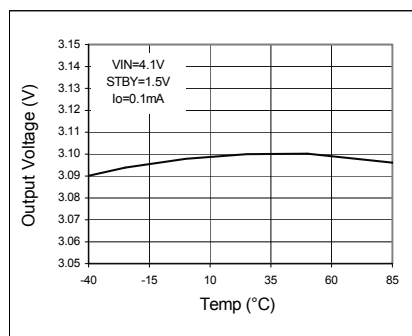


Fig.244. VOUT - Temp

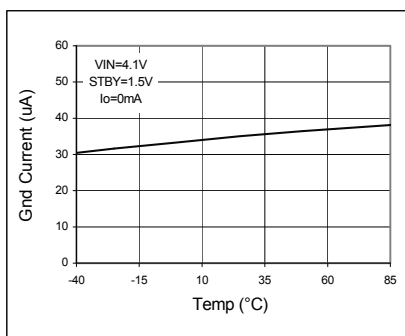


Fig.245. IGND - Temp

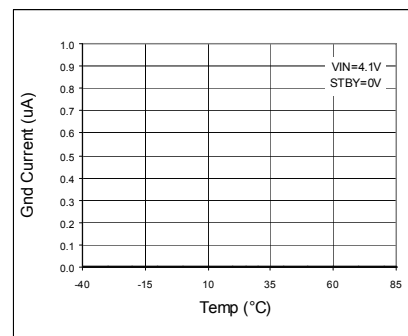


Fig.246. IGND - Temp (STBY)

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

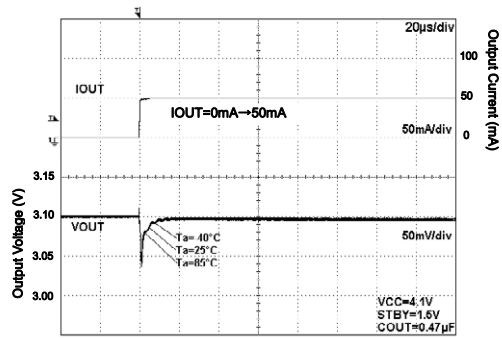


Fig.247. Load Response

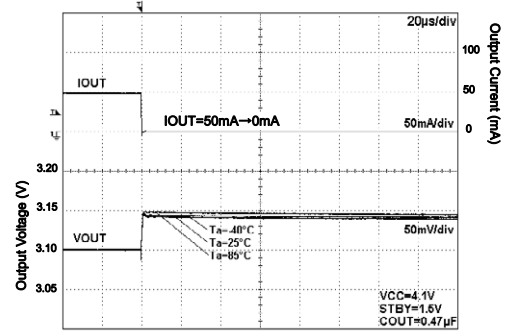


Fig.248. Load Response

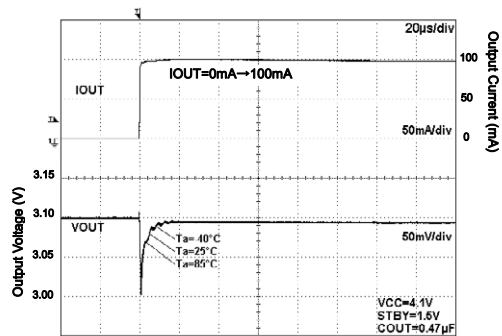


Fig.249. Load Response

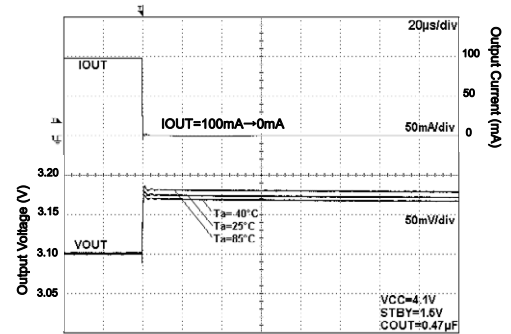


Fig.250. Load Response

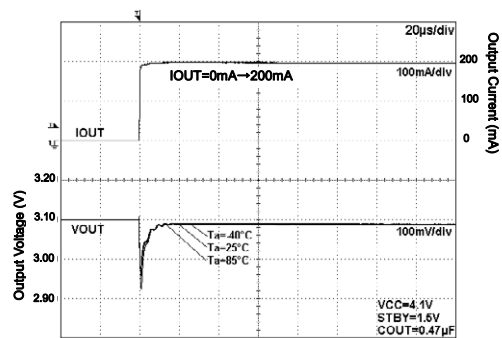


Fig.251. Load Response

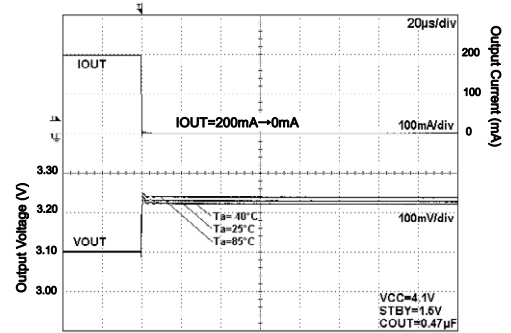


Fig.252. Load Response

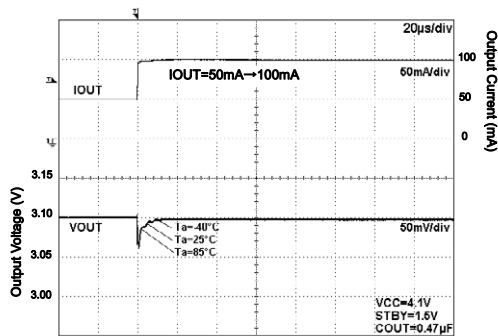


Fig.253. Load Response

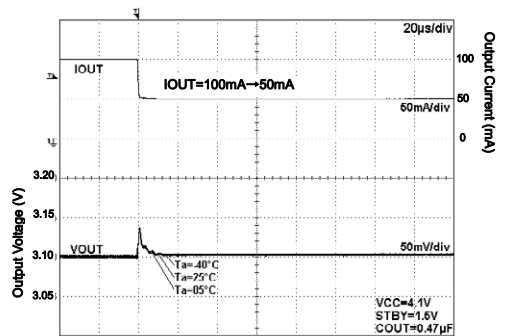


Fig.254. Load Response

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

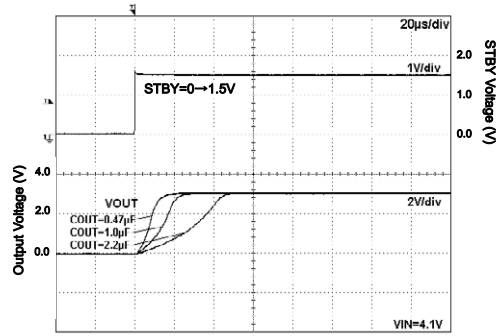


Fig.255. Start Up Time  
Iout=0mA

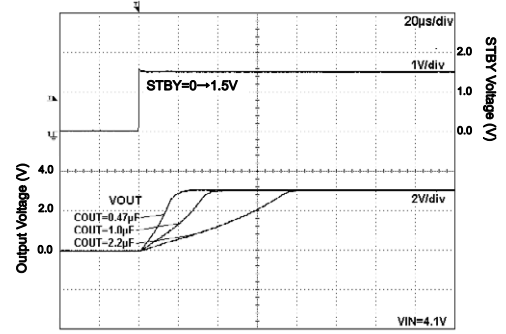


Fig.256. Start Up Time  
Iout=200mA

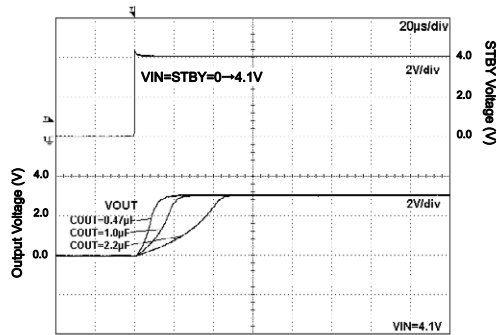


Fig.257. Start Up Time  
(VIN=STBY) Iout=0mA

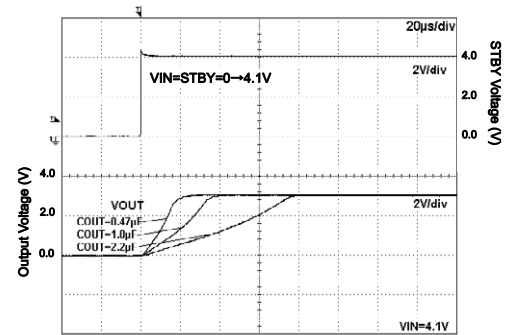


Fig.258. Start Up Time  
(VIN=STBY) Iout=200mA

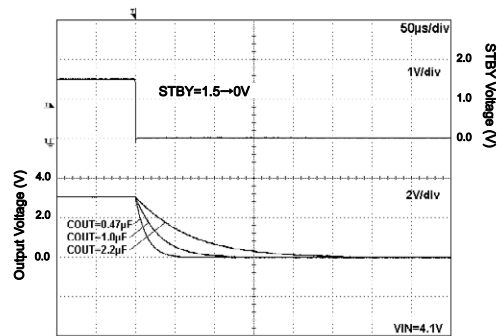


Fig.259. Discharge Time

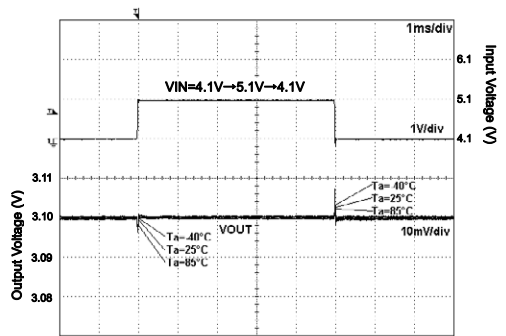


Fig.260. VIN Response

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

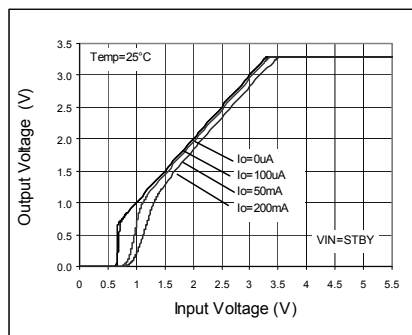


Fig.261. Output Voltage

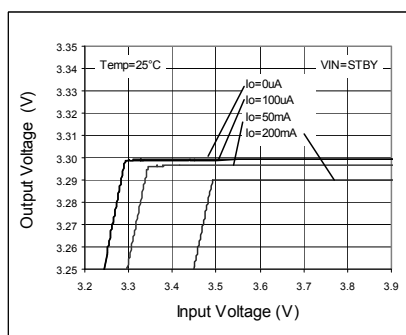


Fig.262. Line Regulation

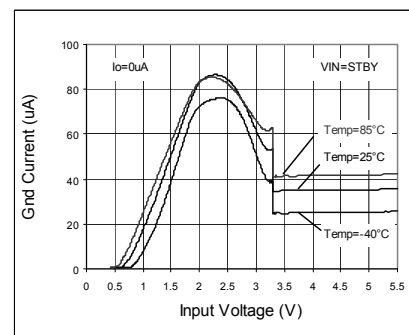


Fig.263. Circuit Current IGND

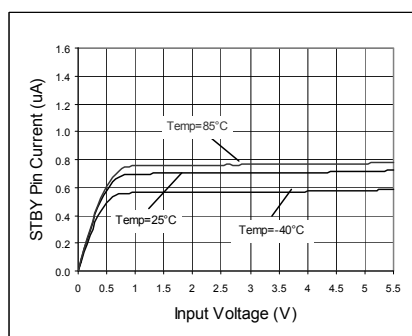


Fig.264. VSTBY - ISTBY

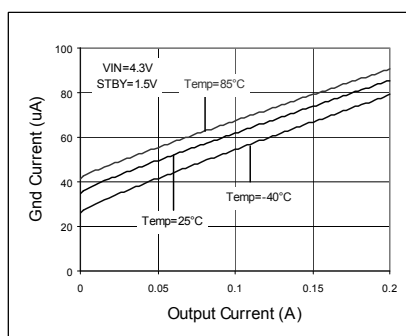


Fig.265. IOUT - IGND

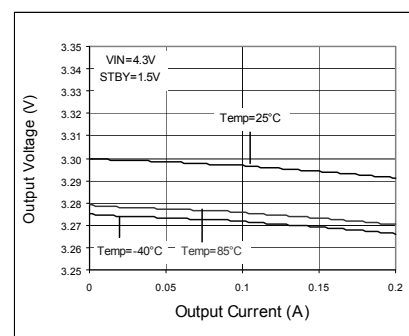


Fig.266. Load Regulation

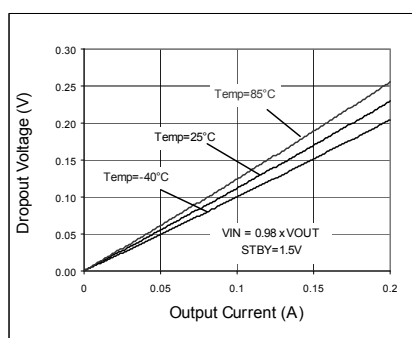


Fig.267. Dropout Voltage

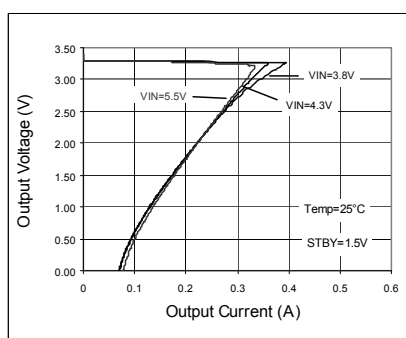


Fig.268. OCP Threshold

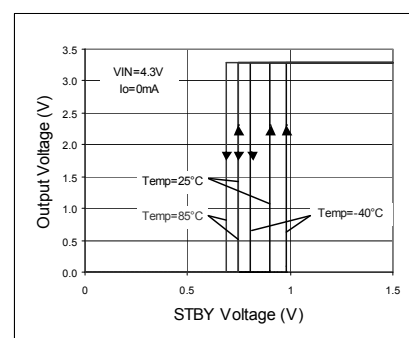


Fig.269. STBY Threshold

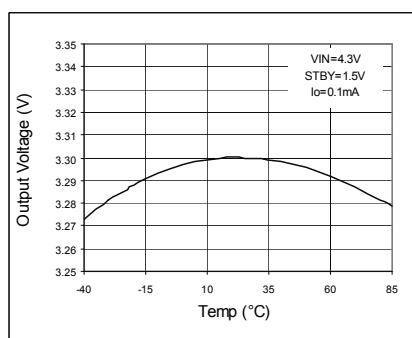


Fig.270. VOUT - Temp

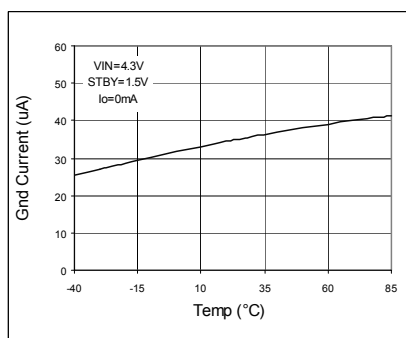


Fig.271. IGND - Temp

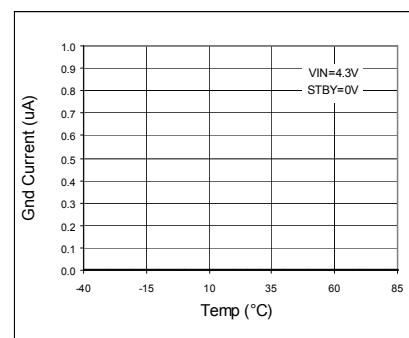


Fig.272. IGND - Temp (STBY)

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

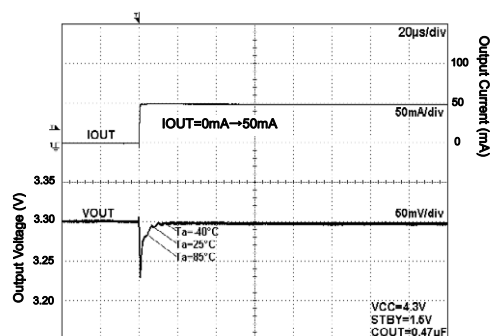


Fig.273. Load Response

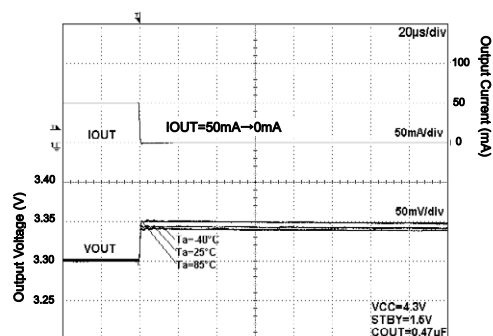


Fig.274. Load Response

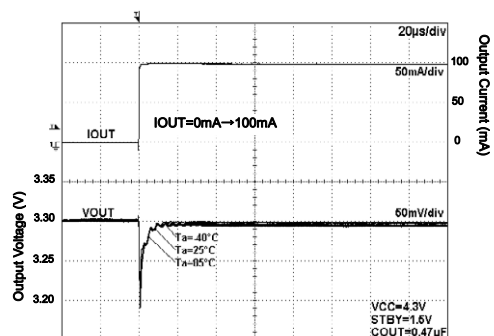


Fig.275. Load Response

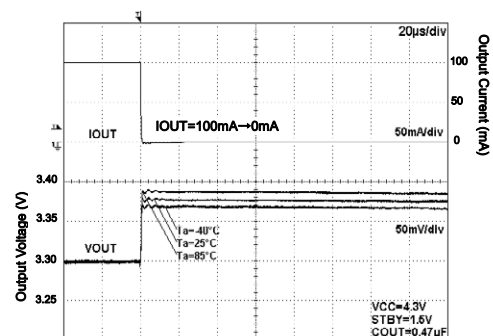


Fig.276. Load Response

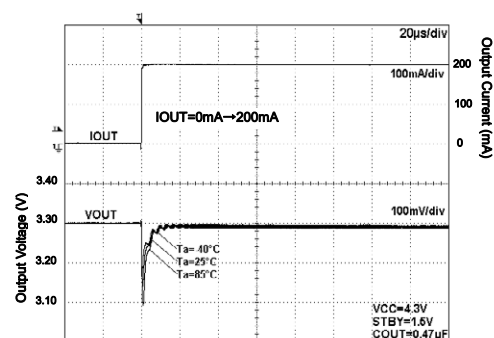


Fig.277. Load Response

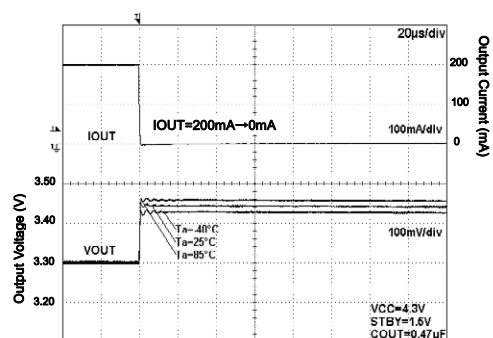


Fig.278. Load Response

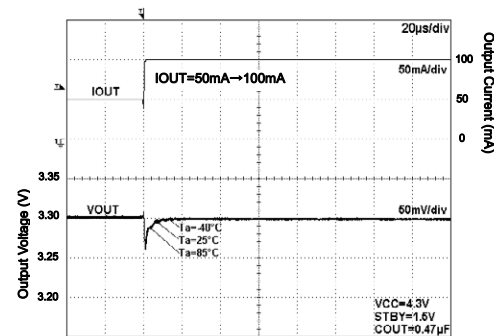


Fig.279. Load Response

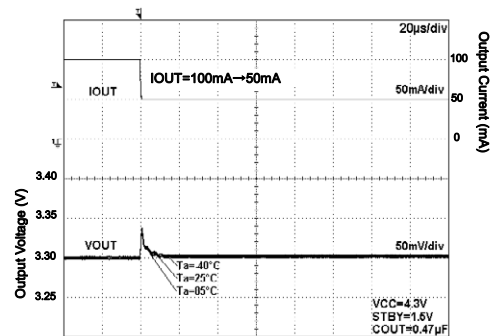


Fig.280. Load Response

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

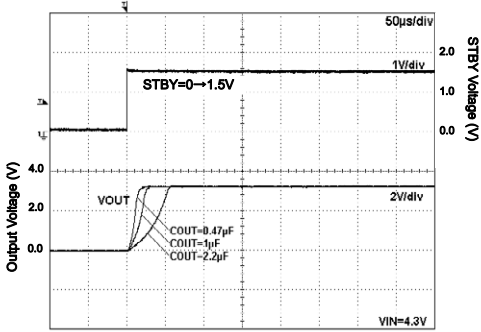


Fig.281. Start Up Time  
 $I_{out}=0\text{mA}$

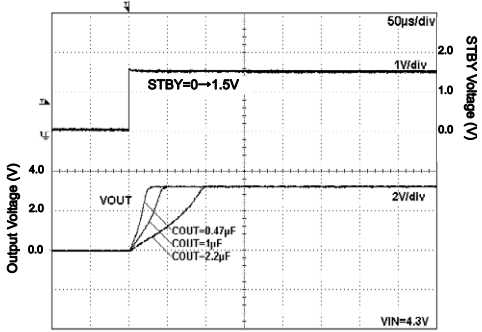


Fig.282. Start Up Time  
 $I_{out}=200\text{mA}$

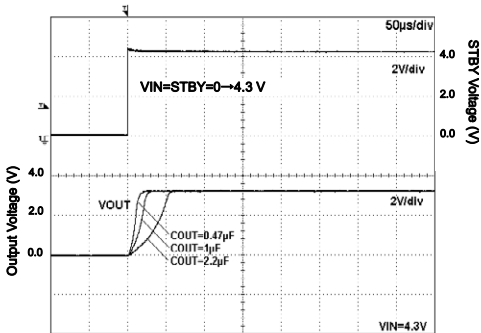


Fig.283. Start Up Time  
( $V_{IN}=STBY$ )  $I_{out}=0\text{mA}$

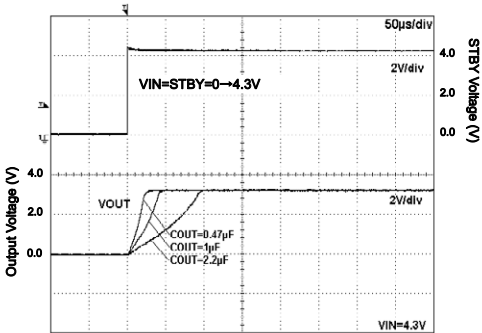


Fig.284. Start Up Time  
( $V_{IN}=STBY$ )  $I_{out}=200\text{mA}$

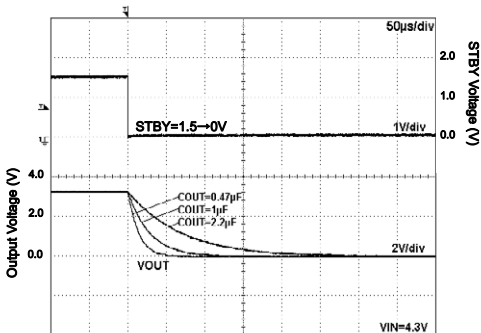


Fig.285. Discharge Time

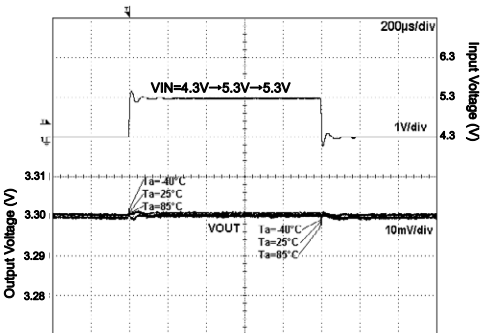


Fig.286. VIN Response

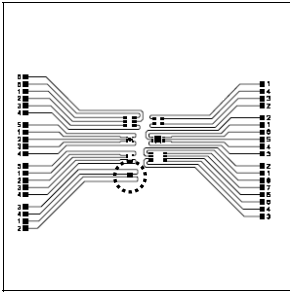
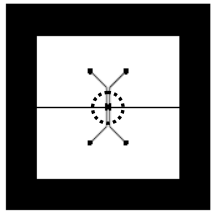
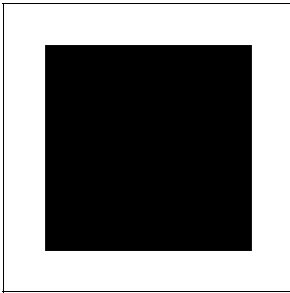
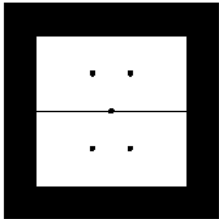
### ● About power dissipation (Pd)

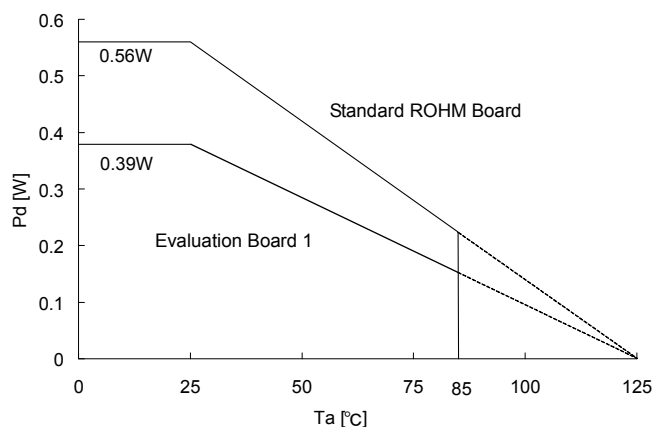
As for power dissipation, an approximate estimate of the heat reduction characteristics and internal power consumption of IC are shown, so please use these for reference. Since power dissipation changes substantially depending on the implementation conditions (board size, board thickness, metal wiring 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 (P<sub>MAX</sub>)

$$P_{MAX} = (V_{IN} - V_{OUT}) \times I_{OUT(MAX)} \quad (V_{IN}: \text{Input voltage } V_{OUT}: \text{Output voltage } I_{OUT(MAX)}: \text{Maximum output current})$$

#### ○ Measurement conditions

|                                 | Standard ROHM Board                                                                | Evaluation Board 1                                                                   |
|---------------------------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Layout of Board for Measurement |   |   |
| IC Implementation Position      |  |  |
| Measurement State               | With board implemented (Wind speed 0 m/s)                                          | With board implemented (Wind speed 0 m/s)                                            |
| Board Material                  | Glass epoxy resin (Double-side board)                                              | Glass epoxy resin (Double-side board)                                                |
| Board Size                      | 70 mm x 70 mm x 1.6 mm                                                             | 40 mm x 40 mm x 1.6 mm                                                               |
| Wiring Rate                     | Top layer                                                                          | Metal (GND) wiring rate: Approx. 0%                                                  |
|                                 | Bottom layer                                                                       | Metal (GND) wiring rate: Approx. 50%                                                 |
| Through Hole                    | Diameter 0.5mm x 6 holes                                                           | Diameter 0.5mm x 25 holes                                                            |
| Power Dissipation               | 0.56W                                                                              | 0.39W                                                                                |
| Thermal Resistance              | $\theta_{ja} = 178.6^{\circ}\text{C/W}$                                            | $\theta_{ja} = 256.4^{\circ}\text{C/W}$                                              |



\* Please design the margin so that P<sub>MAX</sub> becomes is than Pd (P<sub>MAX</sub><Pd) within the usage temperature range.

Figure 287. SSON004X1010 Power dissipation heat reduction characteristics (Reference)

●Device Name and Marking

Device Name : BU□□TD2WNVX

↑  
a

| Symbol | Description |                | Marking |
|--------|-------------|----------------|---------|
|        | □□          | Output Voltage |         |
| a      | 10          | 1.0V typ.      | A       |
|        | 12          | 1.2V typ.      | B       |
|        | 15          | 1.5V typ.      | C       |
|        | 18          | 1.8V typ.      | D       |
|        | 1J          | 1.85V typ.     | E       |
|        | 19          | 1.9V typ.      | F       |
|        | 20          | 2.0V typ.      | G       |
|        | 2A          | 2.05V typ.     | r       |
|        | 21          | 2.1V typ.      | 0       |
|        | 23          | 2.3V typ.      | 1       |
|        | 25          | 2.5V typ.      | H       |
|        | 26          | 2.6V typ.      | J       |
|        | 27          | 2.7V typ.      | K       |
|        | 28          | 2.8V typ.      | L       |
|        | 2J          | 2.85V typ.     | M       |
|        | 29          | 2.9V typ.      | N       |
|        | 30          | 3.0V typ.      | P       |
|        | 31          | 3.1V typ.      | Q       |
|        | 32          | 3.2V typ.      | R       |
|        | 33          | 3.3V typ.      | U       |
|        | 34          | 3.4V typ.      | Y       |

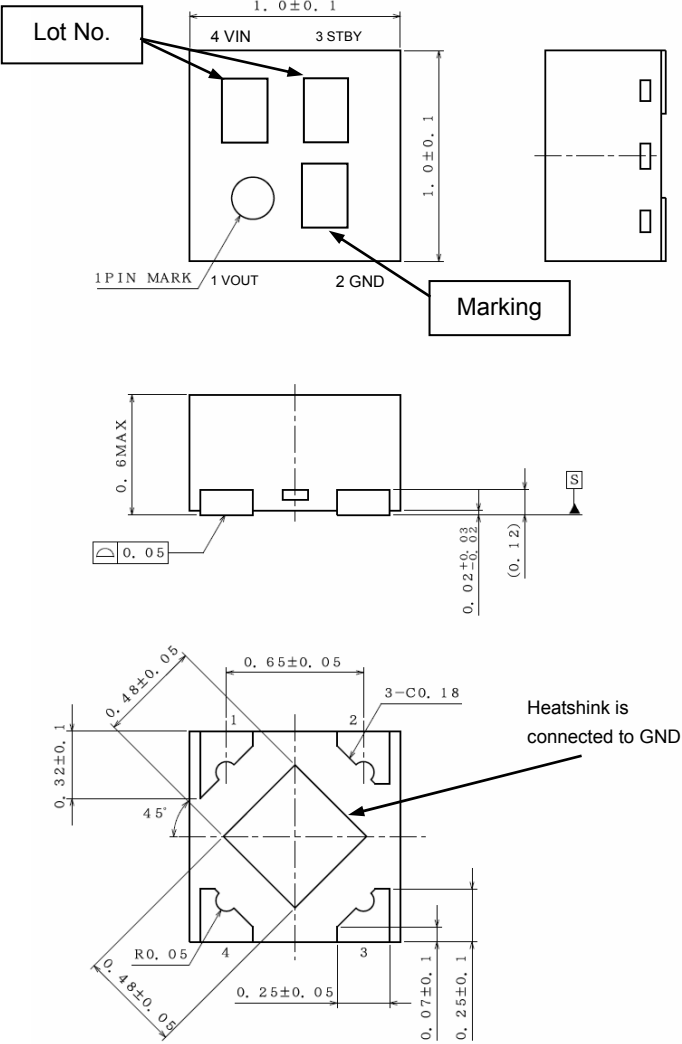


Fig.288. Package dimension and Marking

### ● Notes for use

- 1) About absolute maximum rating  
Breakage may occur when absolute maximum ratings such as applied voltage and operating temperature range are exceeded. Short mode or open mode cannot be specified at occurrence of a break, so please prepare physical safety measures (e.g., fuse) if such special mode in which the absolute maximum rating is exceeded can be assumed.
- 2) About GND potential  
Please be sure that the potential of the GND terminal is the lowest in any operating condition.
- 3) About thermal design  
Please provide thermal design with sufficient margin, taking power dissipation (Pd) in actual usage conditions into consideration.
- 4) About short between pins and misattachment  
Please be careful regarding the IC direction and misalignment at attachment onto a printed circuit board. Misattachment may cause a break of IC. Short caused by foreign matter between outputs, output and power supply, or GNDs may also lead to a break.
- 5) About operation in a strong electromagnetic field  
Please note that usage in a strong electromagnetic field may cause malfunction.
- 6) About common impedance  
Please give due consideration to wiring of the power source and GND by reducing common-mode ripple or making ripple as small as possible (e.g., making the wiring as thick and short as possible, or reducing ripple by L-C), etc.
- 7) About STBY terminal voltage  
Set STBY terminal voltage to 0.3 V or less to put each channel into a standby state and to 1.2 V or more to put each channel into an operating state. Do not fix STBY terminal voltage to 0.3 V or more and 1.2 V or less or do not lengthen the transition time. This may cause malfunction or failure.  
When shorting the VIN terminal and STBY terminal for usage, the status will be "STBY=VIN=LOW" at turning the power OFF, and discharge of the VOUT terminal cannot operate, which means voltage may remain for a certain time in the VOUT terminal. Since turning the power ON again in this state may cause overshoot, turn the power ON for use after the VOUT terminal is completely discharged.
- 8) About overcurrent protection circuit  
Output has a built-in overcurrent protection circuit, which prevents IC break at load short. Note that this protection circuit is effective for prevention of breaks due to unexpected accidents. Please avoid usage by which the protection circuit operates continuously.
- 9) About thermal shutdown  
Output is OFF when the thermal circuit operates since a temperature protection circuit is built in to prevent thermal breakdown. However, it recovers when the temperature returns to a certain temperature. The thermal circuit operates at emergency such as overheating of IC. Since it is prepared to prevent IC breakdown, please do not use it in a state in which protection works.

### ● About reverse current

For applications on which reverse current is assumed to flow into IC, it is recommended to prepare a path to let the current out putting a bypass diode between the VIN-VOUT terminals.

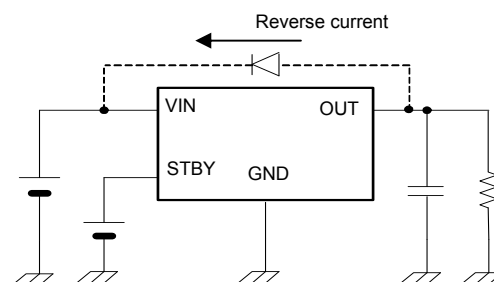


Fig. 289. Example of bypass diode connection

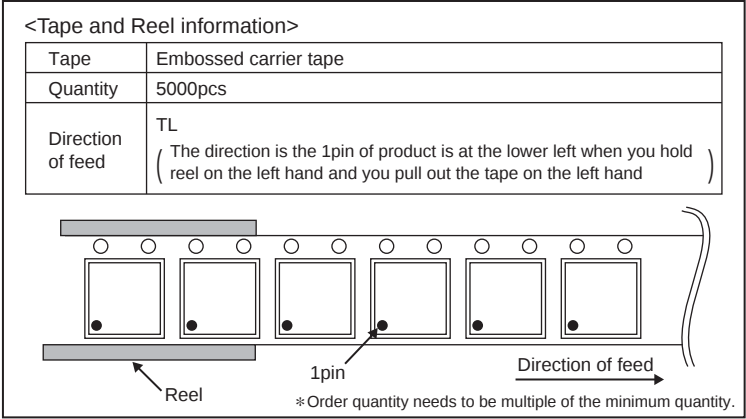
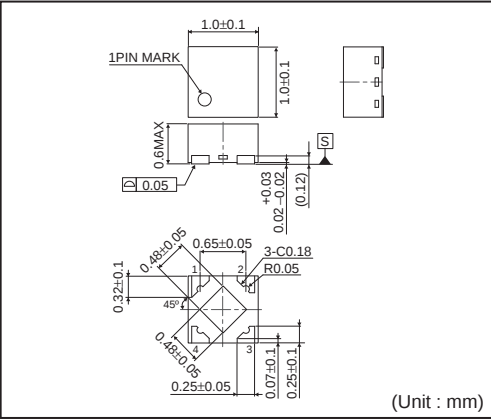
### ● About testing on a set board

When connecting a capacitor to a terminal with low impedance for testing on a set board, please be sure to discharge for each process since IC may be stressed. As a countermeasure against static electricity, prepare grounding in the assembly process and take sufficient care in transportation and storage. In addition, when connecting a capacitor to a jig in a testing process, please do so after turning the power OFF and remove it after turning the power OFF.

●Ordering part number

|          |   |                |   |         |   |   |   |                    |   |   |   |                                     |   |
|----------|---|----------------|---|---------|---|---|---|--------------------|---|---|---|-------------------------------------|---|
| B        | U | 1              | 2 | T       | D | 2 | W | N                  | V | X | - | T                                   | L |
| Part No. |   | Output Voltage |   | Line up |   |   |   | Package            |   |   |   | Packaging and forming specification |   |
|          |   | 10 : 1.0V      |   |         |   |   |   | NVX : SSON004X1010 |   |   |   | TL: Embossed tape and reel          |   |
|          |   | 12 : 1.2V      |   |         |   |   |   |                    |   |   |   |                                     |   |
|          |   | 15 : 1.5V      |   |         |   |   |   |                    |   |   |   |                                     |   |
|          |   | 18 : 1.8V      |   |         |   |   |   |                    |   |   |   |                                     |   |
|          |   | 1J : 1.85V     |   |         |   |   |   |                    |   |   |   |                                     |   |
|          |   | 19 : 1.9V      |   |         |   |   |   |                    |   |   |   |                                     |   |
|          |   | 20 : 2.0V      |   |         |   |   |   |                    |   |   |   |                                     |   |
|          |   | 2A: 2.05V      |   |         |   |   |   |                    |   |   |   |                                     |   |
|          |   | 21 : 2.1V      |   |         |   |   |   |                    |   |   |   |                                     |   |
|          |   | 23 : 2.3V      |   |         |   |   |   |                    |   |   |   |                                     |   |
|          |   | 25 : 2.5V      |   |         |   |   |   |                    |   |   |   |                                     |   |
|          |   | 26 : 2.6V      |   |         |   |   |   |                    |   |   |   |                                     |   |
|          |   | 27 : 2.7V      |   |         |   |   |   |                    |   |   |   |                                     |   |
|          |   | 28 : 2.8V      |   |         |   |   |   |                    |   |   |   |                                     |   |
|          |   | 2J : 2.85V     |   |         |   |   |   |                    |   |   |   |                                     |   |
|          |   | 29 : 2.9V      |   |         |   |   |   |                    |   |   |   |                                     |   |
|          |   | 30 : 3.0V      |   |         |   |   |   |                    |   |   |   |                                     |   |
|          |   | 31 : 3.1V      |   |         |   |   |   |                    |   |   |   |                                     |   |
|          |   | 32 : 3.2V      |   |         |   |   |   |                    |   |   |   |                                     |   |
|          |   | 33 : 3.3V      |   |         |   |   |   |                    |   |   |   |                                     |   |
|          |   | 34 : 3.4V      |   |         |   |   |   |                    |   |   |   |                                     |   |

SSON004X1010



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