

## High-Precision LDO 60mA C-MOS Voltage Regulator with Standby

### ■ GENERAL DESCRIPTION

The NJU7241 series are high precision  $\pm 2\%$ , 60mA output, C-MOS voltage regulators with standby function, which contains internal accurate voltage reference, error amplifier, control transistor, output voltage setting resistor, short current protection circuit and standby circuit.

The fixed regulation voltages of internal circuits are as following line-up.

The NJU7241 series packed MTP5 and suitable for battery-operated items, battery back-up systems, and especially control block of cellular phone system because of low operating current and low dropout voltage.

### ■ PACKAGE OUTLINE



NJU7241F

### ■ FEATURES

- High Precision Output Voltage       $\pm 2\%$
- Low Operating Current                 $20\mu\text{A typ.}$
- Low Standby Current                  $0.1\mu\text{A typ.}$
- Low Dropout Voltage                  $0.2\text{V typ. } V_{\text{OUT}}=3\text{V}$
- Ripple Rejection                       $55\text{dB typ. @}1\text{kHz}$
- Standby Function
- Small Temperature Coefficient of Output Voltage
- Wide Operating Voltage Range
- Package Outline                        MTP-5
- C-MOS Technology

### ■ OUTPUT VOLTAGE LINE-UP

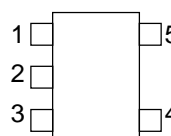
| Output Voltage | Type        | Output Voltage | Type       |
|----------------|-------------|----------------|------------|
| 1.8V           | NJU7241F18  | 3.4V           | NJU7250F34 |
| 2.4V           | NJU7241F24  | 3.5V           | NJU7241F35 |
| 2.5V           | NJU7241F25  | 3.6V           | NJU7241F36 |
| 2.55V          | NJU7241F255 | 4.0V           | NJU7241F40 |
| 2.8V           | NJU7241F28  | 4.5V           | NJU7241F45 |
| 2.85V          | NJU7241F285 | 5.0V           | NJU7241F50 |
| 2.9V           | NJU7241F29  | 5.9V           | NJU7241F59 |
| 3.0V           | NJU7241F30  | 6.0V           | NJU7241F60 |
| 3.3V           | NJU7250F33  | -              | -          |

Planning Voltage: 2.4V, 3.5V, 3.6V, 4.0V and 6.0V

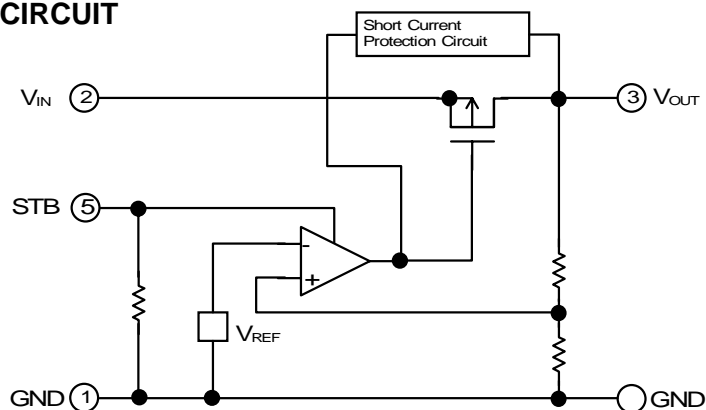
### ■ TERMINAL DESCRIPTION

| No. | Symbol           | Function   |
|-----|------------------|--|
| 1   | GND              | GND  |
| 2   | $V_{\text{IN}}$  | Input  |
| 3   | $V_{\text{OUT}}$ | Output   |
| 4   | NC               | None Connection  |
| 5   | STB              | Standby: Internal Pull-down<br>H: Regulation<br>L: Standby, Output off |

### ■ PIN CONFIGURATION



## ■ EQUIVALENT CIRCUIT



## ■ ABSOLUTE MAXIMUM RATINGS

( $T_a=25^\circ\text{C}$ )

| Parameter             | Symbol    | Ratings                          | Unit             |
|-----------------------|-----------|----------------------------------|------------------|
| Input Voltage         | $V_{IN}$  | 15                               | V                |
| Input Voltage         | $V_{STB}$ | $\text{GND}-0.3 \sim V_{IN}+0.3$ | V                |
| Output Voltage        | $V_{OUT}$ | $\text{GND}-0.3 \sim V_{IN}+0.3$ | V                |
| Output Current        | $I_{OUT}$ | 120                              | mA               |
| Power Dissipation     | $P_D$     | 200                              | mW               |
| Operating Temperature | $T_{opr}$ | $-40 \sim +85$                   | $^\circ\text{C}$ |
| Storage Temperature   | $T_{stg}$ | $-40 \sim +125$                  | $^\circ\text{C}$ |

## ■ ELECTRICAL CHARACTERISTICS

• $V_O=1.8\text{V}$

( $C_{IN}=0.1\mu\text{F}$ ,  $C_O=10\mu\text{F}$ ,  $T_a=25^\circ\text{C}$ )

| Parameter             | Symbol                     | Condition   | MIN.  | TYP.  | MAX.     | Unit          |
|-----------------------|----------------------------|---|-------|-------|----------|---------------|
| Output Voltage        | $V_O$                      | $V_{IN}=2.8\text{V}$ , $I_O=30\text{mA}$                      | 1.764 | 1.800 | 1.836    | V             |
| Dropout Voltage       | $\Delta V_{IO}$            | $I_O=15\text{mA}$   |       | 0.2   | 0.3      | V             |
| Input Voltage         | $V_{IN}$                   |   |       |       | 14       | V             |
| Operating Current     | $I_{DD1}$                  | $V_{IN}=2.8\text{V}$ , $V_{STB}=V_{IN}$ , No Load             |       | 20    | 40       | $\mu\text{A}$ |
| Standby Current       | $I_{DD2}$                  | $V_{IN}=2.8\text{V}$ , $V_{STB}=\text{GND}$                   |       | 0.1   | 1.0      | $\mu\text{A}$ |
| Input Current         | $I_{STB}$                  | $V_{IN}=2.8\text{V}$ , $V_{STB}=V_{IN}$                       |       | 0.56  | 1.12     | $\mu\text{A}$ |
| Load Regulation       | $\Delta V_O/\Delta I_O$    | $V_{IN}=2.8\text{V}$ , $1\text{mA} \leq I_O \leq 60\text{mA}$ |       | 200   | 300      | mV            |
| Line Regulation       | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=2.8\text{V} \sim 12\text{V}$                          |       | 0.10  |          | $\%/V$        |
| Ripple Rejection      | RR                         | $V_{IN}=2.8\text{V}$ , $e_{in}=0.5\text{Vp-p}$ , 1kHz         |       | 55    |          | dB            |
| H Level Input Voltage | $V_{STBH}$                 |   | 1.5   |       | $V_{IN}$ | V             |
| L Level Input Voltage | $V_{STBL}$                 |   | 0     |       | 0.25     | V             |

• $V_O=2.4\text{V}$

( $C_{IN}=0.1\mu\text{F}$ ,  $C_O=10\mu\text{F}$ ,  $T_a=25^\circ\text{C}$ )

| Parameter             | Symbol                     | Condition   | MIN.  | TYP.  | MAX.     | Unit          |
|-----------------------|----------------------------|---|-------|-------|----------|---------------|
| Output Voltage        | $V_O$                      | $V_{IN}=3.4\text{V}$ , $I_O=30\text{mA}$                      | 2.352 | 2.400 | 2.448    | V             |
| Dropout Voltage       | $\Delta V_{IO}$            | $I_O=30\text{mA}$   |       | 0.2   | 0.3      | V             |
| Input Voltage         | $V_{IN}$                   |   |       |       | 14       | V             |
| Operating Current     | $I_{DD1}$                  | $V_{IN}=3.4\text{V}$ , $V_{STB}=V_{IN}$ , No Load             |       | 20    | 40       | $\mu\text{A}$ |
| Standby Current       | $I_{DD2}$                  | $V_{IN}=3.4\text{V}$ , $V_{STB}=\text{GND}$                   |       | 0.1   | 1.0      | $\mu\text{A}$ |
| Input Current         | $I_{STB}$                  | $V_{IN}=3.4\text{V}$ , $V_{STB}=V_{IN}$                       |       | 0.9   | 1.8      | $\mu\text{A}$ |
| Load Regulation       | $\Delta V_O/\Delta I_O$    | $V_{IN}=3.4\text{V}$ , $1\text{mA} \leq I_O \leq 60\text{mA}$ |       | 200   | 300      | mV            |
| Line Regulation       | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=3.4\text{V} \sim 12\text{V}$                          |       | 0.10  |          | $\%/V$        |
| Ripple Rejection      | RR                         | $V_{IN}=3.4\text{V}$ , $e_{in}=0.5\text{Vp-p}$ , 1kHz         |       | 55    |          | dB            |
| H Level Input Voltage | $V_{STBH}$                 |   | 1.5   |       | $V_{IN}$ | V             |
| L Level Input Voltage | $V_{STBL}$                 |   | 0     |       | 0.25     | V             |

• $V_O=2.5V$

( $C_{IN}=0.1\mu F$ ,  $C_O=10\mu F$ ,  $T_a=25^\circ C$ )

| Parameter             | Symbol                     | Condition                                  | MIN.  | TYP.  | MAX.     | Unit    |
|-----------------------|----------------------------|--|-------|-------|----------|---------|
| Output Voltage        | $V_O$                      | $V_{IN}=3.5V$ , $I_O=30mA$                 | 2.450 | 2.500 | 2.550    | V       |
| Dropout Voltage       | $\Delta V_{IO}$            | $I_O=50mA$                                 |       | 0.2   | 0.3      | V       |
| Input Voltage         | $V_{IN}$                   |  |       |       | 14       | V       |
| Operating Current     | $I_{DD1}$                  | $V_{IN}=3.5V$ , $V_{STB}=V_{IN}$ , No Load |       | 20    | 40       | $\mu A$ |
| Standby Current       | $I_{DD2}$                  | $V_{IN}=3.5V$ , $V_{STB}=GND$              |       | 0.1   | 1.0      | $\mu A$ |
| Input Current         | $I_{STB}$                  | $V_{IN}=3.5V$ , $V_{STB}=V_{IN}$           |       | 1.0   | 2.0      | $\mu A$ |
| Load Regulation       | $\Delta V_O/\Delta I_O$    | $V_{IN}=3.5V$ , $1mA \leq I_O \leq 60mA$   |       | 35    | 120      | mV      |
| Line Regulation       | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=3.5V \sim 12V$                     |       | 0.10  |          | %/V     |
| Ripple Rejection      | RR                         | $V_{IN}=3.5V$ , $e_{in}=0.5Vp-p$ , 1kHz    |       | 55    |          | dB      |
| H Level Input Voltage | $V_{STBH}$                 |  | 1.5   |       | $V_{IN}$ | V       |
| L Level Input Voltage | $V_{STBL}$                 |  | 0     |       | 0.25     | V       |

• $V_O=2.55V$

( $C_{IN}=0.1\mu F$ ,  $C_O=10\mu F$ ,  $T_a=25^\circ C$ )

| Parameter             | Symbol                     | Condition                                   | MIN.  | TYP.  | MAX.     | Unit    |
|-----------------------|----------------------------|---|-------|-------|----------|---------|
| Output Voltage        | $V_O$                      | $V_{IN}=3.55V$ , $I_O=30mA$                 | 2.499 | 2.550 | 2.601    | V       |
| Dropout Voltage       | $\Delta V_{IO}$            | $I_O=50mA$                                  |       | 0.2   | 0.3      | V       |
| Input Voltage         | $V_{IN}$                   |   |       |       | 14       | V       |
| Operating Current     | $I_{DD1}$                  | $V_{IN}=3.55V$ , $V_{STB}=V_{IN}$ , No Load |       | 20    | 40       | $\mu A$ |
| Standby Current       | $I_{DD2}$                  | $V_{IN}=3.55V$ , $V_{STB}=GND$              |       | 0.1   | 1.0      | $\mu A$ |
| Input Current         | $I_{STB}$                  | $V_{IN}=3.55V$ , $V_{STB}=V_{IN}$           |       | 1.05  | 2.1      | $\mu A$ |
| Load Regulation       | $\Delta V_O/\Delta I_O$    | $V_{IN}=3.55V$ , $1mA \leq I_O \leq 60mA$   |       | 35    | 120      | mV      |
| Line Regulation       | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=3.55V \sim 12V$                     |       | 0.10  |          | %/V     |
| Ripple Rejection      | RR                         | $V_{IN}=3.55V$ , $e_{in}=0.5Vp-p$ , 1kHz    |       | 55    |          | dB      |
| H Level Input Voltage | $V_{STBH}$                 |   | 1.5   |       | $V_{IN}$ | V       |
| L Level Input Voltage | $V_{STBL}$                 |   | 0     |       | 0.25     | V       |

• $V_O=2.8V$

( $C_{IN}=0.1\mu F$ ,  $C_O=10\mu F$ ,  $T_a=25^\circ C$ )

| Parameter             | Symbol                     | Condition                                  | MIN.  | TYP.  | MAX.     | Unit    |
|-----------------------|----------------------------|--|-------|-------|----------|---------|
| Output Voltage        | $V_O$                      | $V_{IN}=3.8V$ , $I_O=30mA$                 | 2.744 | 2.800 | 2.856    | V       |
| Dropout Voltage       | $\Delta V_{IO}$            | $I_O=50mA$                                 |       | 0.2   | 0.3      | V       |
| Input Voltage         | $V_{IN}$                   |  |       |       | 14       | V       |
| Operating Current     | $I_{DD1}$                  | $V_{IN}=3.8V$ , $V_{STB}=V_{IN}$ , No Load |       | 20    | 40       | $\mu A$ |
| Standby Current       | $I_{DD2}$                  | $V_{IN}=3.8V$ , $V_{STB}=GND$              |       | 0.1   | 1.0      | $\mu A$ |
| Input Current         | $I_{STB}$                  | $V_{IN}=3.8V$ , $V_{STB}=V_{IN}$           |       | 1.3   | 2.6      | $\mu A$ |
| Load Regulation       | $\Delta V_O/\Delta I_O$    | $V_{IN}=3.8V$ , $1mA \leq I_O \leq 60mA$   |       | 35    | 120      | mV      |
| Line Regulation       | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=3.8V \sim 12V$                     |       | 0.10  |          | %/V     |
| Ripple Rejection      | RR                         | $V_{IN}=3.8V$ , $e_{in}=0.5Vp-p$ , 1kHz    |       | 55    |          | dB      |
| H Level Input Voltage | $V_{STBH}$                 |  | 1.5   |       | $V_{IN}$ | V       |
| L Level Input Voltage | $V_{STBL}$                 |  | 0     |       | 0.25     | V       |

• $V_O=2.85V$

( $C_{IN}=0.1\mu F$ ,  $C_O=10\mu F$ ,  $T_a=25^\circ C$ )

| Parameter             | Symbol                     | Condition                                   | MIN.  | TYP.  | MAX.     | Unit    |
|-----------------------|----------------------------|---|-------|-------|----------|---------|
| Output Voltage        | $V_O$                      | $V_{IN}=3.85V$ , $I_O=30mA$                 | 2.793 | 2.850 | 2.907    | V       |
| Dropout Voltage       | $\Delta V_{IO}$            | $I_O=50mA$                                  |       | 0.2   | 0.3      | V       |
| Input Voltage         | $V_{IN}$                   |   |       |       | 14       | V       |
| Operating Current     | $I_{DD1}$                  | $V_{IN}=3.85V$ , $V_{STB}=V_{IN}$ , No Load |       | 20    | 40       | $\mu A$ |
| Standby Current       | $I_{DD2}$                  | $V_{IN}=3.85V$ , $V_{STB}=GND$              |       | 0.1   | 1.0      | $\mu A$ |
| Input Current         | $I_{STB}$                  | $V_{IN}=3.85V$ , $V_{STB}=V_{IN}$           |       | 1.35  | 2.70     | $\mu A$ |
| Load Regulation       | $\Delta V_O/\Delta I_O$    | $V_{IN}=3.85V$ , $1mA \leq I_O \leq 60mA$   |       | 35    | 120      | mV      |
| Line Regulation       | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=3.85V \sim 12V$                     |       | 0.10  |          | %/V     |
| Ripple Rejection      | RR                         | $V_{IN}=3.85V$ , $e_{in}=0.5Vp-p$ , 1kHz    |       | 55    |          | dB      |
| H Level Input Voltage | $V_{STBH}$                 |   | 1.5   |       | $V_{IN}$ | V       |
| L Level Input Voltage | $V_{STBL}$                 |   | 0     |       | 0.25     | V       |

• $V_O=2.9V$

( $C_{IN}=0.1\mu F$ ,  $C_O=10\mu F$ ,  $T_a=25^\circ C$ )

| Parameter             | Symbol                     | Condition                                  | MIN.  | TYP.  | MAX.     | Unit    |
|-----------------------|----------------------------|--|-------|-------|----------|---------|
| Output Voltage        | $V_O$                      | $V_{IN}=3.9V$ , $I_O=30mA$                 | 2.842 | 2.900 | 2.958    | V       |
| Dropout Voltage       | $\Delta V_{IO}$            | $I_O=50mA$                                 |       | 0.2   | 0.3      | V       |
| Input Voltage         | $V_{IN}$                   |  |       |       | 14       | V       |
| Operating Current     | $I_{DD1}$                  | $V_{IN}=3.9V$ , $V_{STB}=V_{IN}$ , No Load |       | 20    | 40       | $\mu A$ |
| Standby Current       | $I_{DD2}$                  | $V_{IN}=3.9V$ , $V_{STB}=GND$              |       | 0.1   | 1.0      | $\mu A$ |
| Input Current         | $I_{STB}$                  | $V_{IN}=3.9V$ , $V_{STB}=V_{IN}$           |       | 1.4   | 2.8      | $\mu A$ |
| Load Regulation       | $\Delta V_O/\Delta I_O$    | $V_{IN}=3.9V$ , $1mA \leq I_O \leq 60mA$   |       | 35    | 120      | mV      |
| Line Regulation       | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=3.9V \sim 12V$                     |       | 0.10  |          | %/V     |
| Ripple Rejection      | RR                         | $V_{IN}=3.9V$ , $e_{in}=0.5Vp-p$ , 1kHz    |       | 55    |          | dB      |
| H Level Input Voltage | $V_{STBH}$                 |  | 1.5   |       | $V_{IN}$ | V       |
| L Level Input Voltage | $V_{STBL}$                 |  | 0     |       | 0.25     | V       |

• $V_O=3.0V$

( $C_{IN}=0.1\mu F$ ,  $C_O=10\mu F$ ,  $T_a=25^\circ C$ )

| Parameter             | Symbol                     | Condition                                  | MIN.  | TYP.  | MAX.     | Unit    |
|-----------------------|----------------------------|--|-------|-------|----------|---------|
| Output Voltage        | $V_O$                      | $V_{IN}=4.0V$ , $I_O=30mA$                 | 2.940 | 3.000 | 3.060    | V       |
| Dropout Voltage       | $\Delta V_{IO}$            | $I_O=60mA$                                 |       | 0.2   | 0.3      | V       |
| Input Voltage         | $V_{IN}$                   |  |       |       | 14       | V       |
| Operating Current     | $I_{DD1}$                  | $V_{IN}=4.0V$ , $V_{STB}=V_{IN}$ , No Load |       | 20    | 40       | $\mu A$ |
| Standby Current       | $I_{DD2}$                  | $V_{IN}=4.0V$ , $V_{STB}=GND$              |       | 0.1   | 1.0      | $\mu A$ |
| Input Current         | $I_{STB}$                  | $V_{IN}=4.0V$ , $V_{STB}=V_{IN}$           |       | 1.5   | 3.0      | $\mu A$ |
| Load Regulation       | $\Delta V_O/\Delta I_O$    | $V_{IN}=4.0V$ , $1mA \leq I_O \leq 60mA$   |       | 35    | 120      | mV      |
| Line Regulation       | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=4.0V \sim 12V$                     |       | 0.10  |          | %/V     |
| Ripple Rejection      | RR                         | $V_{IN}=4.0V$ , $e_{in}=0.5Vp-p$ , 1kHz    |       | 55    |          | dB      |
| H Level Input Voltage | $V_{STBH}$                 |  | 1.5   |       | $V_{IN}$ | V       |
| L Level Input Voltage | $V_{STBL}$                 |  | 0     |       | 0.25     | V       |

• $V_O=3.3V$

( $C_{IN}=0.1\mu F$ ,  $C_O=10\mu F$ ,  $T_a=25^\circ C$ )

| Parameter             | Symbol                     | Condition                                  | MIN.  | TYP.  | MAX.     | Unit    |
|-----------------------|----------------------------|--|-------|-------|----------|---------|
| Output Voltage        | $V_O$                      | $V_{IN}=4.3V$ , $I_O=30mA$                 | 3.234 | 3.300 | 3.366    | V       |
| Dropout Voltage       | $\Delta V_{IO}$            | $I_O=60mA$                                 |       | 0.2   | 0.3      | V       |
| Input Voltage         | $V_{IN}$                   |  |       |       | 14       | V       |
| Operating Current     | $I_{DD1}$                  | $V_{IN}=4.3V$ , $V_{STB}=V_{IN}$ , No Load |       | 20    | 40       | $\mu A$ |
| Standby Current       | $I_{DD2}$                  | $V_{IN}=4.3V$ , $V_{STB}=GND$              |       | 0.1   | 1.0      | $\mu A$ |
| Input Current         | $I_{STB}$                  | $V_{IN}=4.3V$ , $V_{STB}=V_{IN}$           |       | 1.8   | 3.6      | $\mu A$ |
| Load Regulation       | $\Delta V_O/\Delta I_O$    | $V_{IN}=4.3V$ , $1mA \leq I_O \leq 60mA$   |       | 35    | 120      | mV      |
| Line Regulation       | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=4.3V \sim 12V$                     |       | 0.10  |          | %/V     |
| Ripple Rejection      | RR                         | $V_{IN}=4.3V$ , $e_{in}=0.5Vp-p$ , 1kHz    |       | 55    |          | dB      |
| H Level Input Voltage | $V_{STBH}$                 |  | 1.5   |       | $V_{IN}$ | V       |
| L Level Input Voltage | $V_{STBL}$                 |  | 0     |       | 0.25     | V       |

• $V_O=3.4V$

( $C_{IN}=0.1\mu F$ ,  $C_O=10\mu F$ ,  $T_a=25^\circ C$ )

| Parameter             | Symbol                     | Condition                                  | MIN.  | TYP.  | MAX.     | Unit    |
|-----------------------|----------------------------|--|-------|-------|----------|---------|
| Output Voltage        | $V_O$                      | $V_{IN}=4.4V$ , $I_O=30mA$                 | 3.332 | 3.400 | 3.468    | V       |
| Dropout Voltage       | $\Delta V_{IO}$            | $I_O=60mA$                                 |       | 0.2   | 0.3      | V       |
| Input Voltage         | $V_{IN}$                   |  |       |       | 14       | V       |
| Operating Current     | $I_{DD1}$                  | $V_{IN}=4.4V$ , $V_{STB}=V_{IN}$ , No Load |       | 20    | 40       | $\mu A$ |
| Standby Current       | $I_{DD2}$                  | $V_{IN}=4.4V$ , $V_{STB}=GND$              |       | 0.1   | 1.0      | $\mu A$ |
| Input Current         | $I_{STB}$                  | $V_{IN}=4.4V$ , $V_{STB}=V_{IN}$           |       | 1.9   | 3.8      | $\mu A$ |
| Load Regulation       | $\Delta V_O/\Delta I_O$    | $V_{IN}=4.4V$ , $1mA \leq I_O \leq 60mA$   |       | 35    | 120      | mV      |
| Line Regulation       | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=4.4V \sim 12V$                     |       | 0.10  |          | %/V     |
| Ripple Rejection      | RR                         | $V_{IN}=4.4V$ , $e_{in}=0.5Vp-p$ , 1kHz    |       | 55    |          | dB      |
| H Level Input Voltage | $V_{STBH}$                 |  | 1.5   |       | $V_{IN}$ | V       |
| L Level Input Voltage | $V_{STBL}$                 |  | 0     |       | 0.25     | V       |

• $V_O=3.5V$

( $C_{IN}=0.1\mu F$ ,  $C_O=10\mu F$ ,  $T_a=25^\circ C$ )

| Parameter             | Symbol                     | Condition                                  | MIN.  | TYP.  | MAX.     | Unit    |
|-----------------------|----------------------------|--|-------|-------|----------|---------|
| Output Voltage        | $V_O$                      | $V_{IN}=4.5V$ , $I_O=30mA$                 | 3.430 | 3.500 | 3.570    | V       |
| Dropout Voltage       | $\Delta V_{IO}$            | $I_O=60mA$                                 |       | 0.2   | 0.3      | V       |
| Input Voltage         | $V_{IN}$                   |  |       |       | 14       | V       |
| Operating Current     | $I_{DD1}$                  | $V_{IN}=4.5V$ , $V_{STB}=V_{IN}$ , No Load |       | 20    | 40       | $\mu A$ |
| Standby Current       | $I_{DD2}$                  | $V_{IN}=4.5V$ , $V_{STB}=GND$              |       | 0.1   | 1.0      | $\mu A$ |
| Input Current         | $I_{STB}$                  | $V_{IN}=4.5V$ , $V_{STB}=V_{IN}$           |       | 2.0   | 4.0      | $\mu A$ |
| Load Regulation       | $\Delta V_O/\Delta I_O$    | $V_{IN}=4.5V$ , $1mA \leq I_O \leq 60mA$   |       | 35    | 120      | mV      |
| Line Regulation       | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=4.5V \sim 12V$                     |       | 0.10  |          | %/V     |
| Ripple Rejection      | RR                         | $V_{IN}=4.5V$ , $e_{in}=0.5Vp-p$ , 1kHz    |       | 55    |          | dB      |
| H Level Input Voltage | $V_{STBH}$                 |  | 1.5   |       | $V_{IN}$ | V       |
| L Level Input Voltage | $V_{STBL}$                 |  | 0     |       | 0.25     | V       |

• $V_O=3.6V$

( $C_{IN}=0.1\mu F$ ,  $C_O=10\mu F$ ,  $T_a=25^\circ C$ )

| Parameter             | Symbol                     | Condition                                  | MIN.  | TYP.  | MAX.     | Unit    |
|-----------------------|----------------------------|--|-------|-------|----------|---------|
| Output Voltage        | $V_O$                      | $V_{IN}=4.6V$ , $I_O=30mA$                 | 3.528 | 3.600 | 3.672    | V       |
| Dropout Voltage       | $\Delta V_{IO}$            | $I_O=60mA$                                 |       | 0.2   | 0.3      | V       |
| Input Voltage         | $V_{IN}$                   |  |       |       | 14       | V       |
| Operating Current     | $I_{DD1}$                  | $V_{IN}=4.6V$ , $V_{STB}=V_{IN}$ , No Load |       | 20    | 40       | $\mu A$ |
| Standby Current       | $I_{DD2}$                  | $V_{IN}=4.6V$ , $V_{STB}=GND$              |       | 0.1   | 1.0      | $\mu A$ |
| Input Current         | $I_{STB}$                  | $V_{IN}=4.6V$ , $V_{STB}=V_{IN}$           |       | 2.1   | 4.2      | $\mu A$ |
| Load Regulation       | $\Delta V_O/\Delta I_O$    | $V_{IN}=4.6V$ , $1mA \leq I_O \leq 60mA$   |       | 35    | 120      | mV      |
| Line Regulation       | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=4.6V \sim 12V$                     |       | 0.10  |          | %/V     |
| Ripple Rejection      | RR                         | $V_{IN}=4.6V$ , $e_{in}=0.5Vp-p$ , 1kHz    |       | 55    |          | dB      |
| H Level Input Voltage | $V_{STBH}$                 |  | 1.5   |       | $V_{IN}$ | V       |
| L Level Input Voltage | $V_{STBL}$                 |  | 0     |       | 0.25     | V       |

• $V_O=4.0V$

( $C_{IN}=0.1\mu F$ ,  $C_O=10\mu F$ ,  $T_a=25^\circ C$ )

| Parameter             | Symbol                     | Condition                                  | MIN.  | TYP.  | MAX.     | Unit    |
|-----------------------|----------------------------|--|-------|-------|----------|---------|
| Output Voltage        | $V_O$                      | $V_{IN}=5.0V$ , $I_O=30mA$                 | 3.920 | 4.000 | 4.080    | V       |
| Dropout Voltage       | $\Delta V_{IO}$            | $I_O=60mA$                                 |       | 0.2   | 0.3      | V       |
| Input Voltage         | $V_{IN}$                   |  |       |       | 14       | V       |
| Operating Current     | $I_{DD1}$                  | $V_{IN}=5.0V$ , $V_{STB}=V_{IN}$ , No Load |       | 20    | 40       | $\mu A$ |
| Standby Current       | $I_{DD2}$                  | $V_{IN}=5.0V$ , $V_{STB}=GND$              |       | 0.1   | 1.0      | $\mu A$ |
| Input Current         | $I_{STB}$                  | $V_{IN}=5.0V$ , $V_{STB}=V_{IN}$           |       | 2.5   | 5.0      | $\mu A$ |
| Load Regulation       | $\Delta V_O/\Delta I_O$    | $V_{IN}=5.0V$ , $1mA \leq I_O \leq 60mA$   |       | 35    | 120      | mV      |
| Line Regulation       | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=5.0V \sim 12V$                     |       | 0.10  |          | %/V     |
| Ripple Rejection      | RR                         | $V_{IN}=5.0V$ , $e_{in}=0.5Vp-p$ , 1kHz    |       | 55    |          | dB      |
| H Level Input Voltage | $V_{STBH}$                 |  | 1.5   |       | $V_{IN}$ | V       |
| L Level Input Voltage | $V_{STBL}$                 |  | 0     |       | 0.25     | V       |

• $V_O=4.5V$

( $C_{IN}=0.1\mu F$ ,  $C_O=10\mu F$ ,  $T_a=25^\circ C$ )

| Parameter             | Symbol                     | Condition                                  | MIN.  | TYP.  | MAX.     | Unit    |
|-----------------------|----------------------------|--|-------|-------|----------|---------|
| Output Voltage        | $V_O$                      | $V_{IN}=5.5V$ , $I_O=30mA$                 | 4.410 | 4.500 | 4.590    | V       |
| Dropout Voltage       | $\Delta V_{IO}$            | $I_O=60mA$                                 |       | 0.2   | 0.3      | V       |
| Input Voltage         | $V_{IN}$                   |  |       |       | 14       | V       |
| Operating Current     | $I_{DD1}$                  | $V_{IN}=5.5V$ , $V_{STB}=V_{IN}$ , No Load |       | 20    | 40       | $\mu A$ |
| Standby Current       | $I_{DD2}$                  | $V_{IN}=5.5V$ , $V_{STB}=GND$              |       | 0.1   | 1.0      | $\mu A$ |
| Input Current         | $I_{STB}$                  | $V_{IN}=5.5V$ , $V_{STB}=V_{IN}$           |       | 3.0   | 6.0      | $\mu A$ |
| Load Regulation       | $\Delta V_O/\Delta I_O$    | $V_{IN}=5.5V$ , $1mA \leq I_O \leq 60mA$   |       | 35    | 120      | mV      |
| Line Regulation       | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=5.5V \sim 12V$                     |       | 0.10  |          | %/V     |
| Ripple Rejection      | RR                         | $V_{IN}=5.5V$ , $e_{in}=0.5Vp-p$ , 1kHz    |       | 55    |          | dB      |
| H Level Input Voltage | $V_{STBH}$                 |  | 1.5   |       | $V_{IN}$ | V       |
| L Level Input Voltage | $V_{STBL}$                 |  | 0     |       | 0.25     | V       |

• $V_O=5.0V$

( $C_{IN}=0.1\mu F$ ,  $C_O=10\mu F$ ,  $T_a=25^\circ C$ )

| Parameter             | Symbol                     | Condition                                  | MIN.  | TYP.  | MAX.     | Unit    |
|-----------------------|----------------------------|--|-------|-------|----------|---------|
| Output Voltage        | $V_O$                      | $V_{IN}=6.0V$ , $I_O=30mA$                 | 4.900 | 5.000 | 5.100    | V       |
| Dropout Voltage       | $\Delta V_{IO}$            | $I_O=60mA$                                 |       | 0.2   | 0.3      | V       |
| Input Voltage         | $V_{IN}$                   |  |       |       | 14       | V       |
| Operating Current     | $I_{DD1}$                  | $V_{IN}=6.0V$ , $V_{STB}=V_{IN}$ , No Load |       | 20    | 40       | $\mu A$ |
| Standby Current       | $I_{DD2}$                  | $V_{IN}=6.0V$ , $V_{STB}=GND$              |       | 0.1   | 1.0      | $\mu A$ |
| Input Current         | $I_{STB}$                  | $V_{IN}=6.0V$ , $V_{STB}=V_{IN}$           |       | 3.5   | 7.0      | $\mu A$ |
| Load Regulation       | $\Delta V_O/\Delta I_O$    | $V_{IN}=6.0V$ , $1mA \leq I_O \leq 60mA$   |       | 35    | 120      | mV      |
| Line Regulation       | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=6.0V \sim 12V$                     |       | 0.10  |          | %/V     |
| Ripple Rejection      | RR                         | $V_{IN}=6.0V$ , $e_{in}=0.5Vp-p$ , 1kHz    |       | 55    |          | dB      |
| H Level Input Voltage | $V_{STBH}$                 |  | 1.5   |       | $V_{IN}$ | V       |
| L Level Input Voltage | $V_{STBL}$                 |  | 0     |       | 0.25     | V       |

• $V_O=5.9V$

( $C_{IN}=0.1\mu F$ ,  $C_O=10\mu F$ ,  $T_a=25^\circ C$ )

| Parameter             | Symbol                     | Condition                                  | MIN.  | TYP.  | MAX.     | Unit    |
|-----------------------|----------------------------|--|-------|-------|----------|---------|
| Output Voltage        | $V_O$                      | $V_{IN}=6.9V$ , $I_O=30mA$                 | 5.782 | 5.900 | 6.018    | V       |
| Dropout Voltage       | $\Delta V_{IO}$            | $I_O=60mA$                                 |       | 0.2   | 0.3      | V       |
| Input Voltage         | $V_{IN}$                   |  |       |       | 14       | V       |
| Operating Current     | $I_{DD1}$                  | $V_{IN}=6.9V$ , $V_{STB}=V_{IN}$ , No Load |       | 20    | 40       | $\mu A$ |
| Standby Current       | $I_{DD2}$                  | $V_{IN}=6.9V$ , $V_{STB}=GND$              |       | 0.1   | 1.0      | $\mu A$ |
| Input Current         | $I_{STB}$                  | $V_{IN}=6.9V$ , $V_{STB}=V_{IN}$           |       | 4.4   | 8.8      | $\mu A$ |
| Load Regulation       | $\Delta V_O/\Delta I_O$    | $V_{IN}=6.9V$ , $1mA \leq I_O \leq 60mA$   |       | 35    | 120      | mV      |
| Line Regulation       | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=6.9V \sim 12V$                     |       | 0.10  |          | %/V     |
| Ripple Rejection      | RR                         | $V_{IN}=6.9V$ , $e_{in}=0.5Vp-p$ , 1kHz    |       | 55    |          | dB      |
| H Level Input Voltage | $V_{STBH}$                 |  | 1.5   |       | $V_{IN}$ | V       |
| L Level Input Voltage | $V_{STBL}$                 |  | 0     |       | 0.25     | V       |

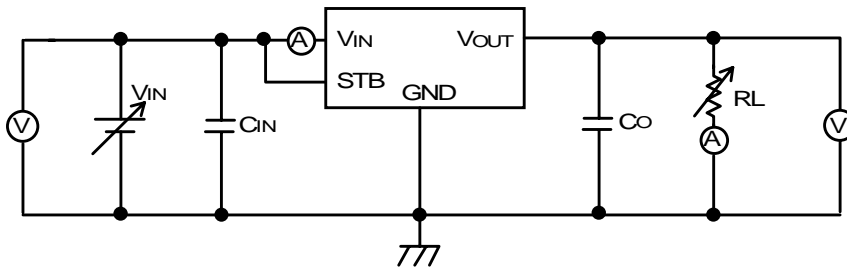
• $V_O=6.0V$

( $C_{IN}=0.1\mu F$ ,  $C_O=10\mu F$ ,  $T_a=25^\circ C$ )

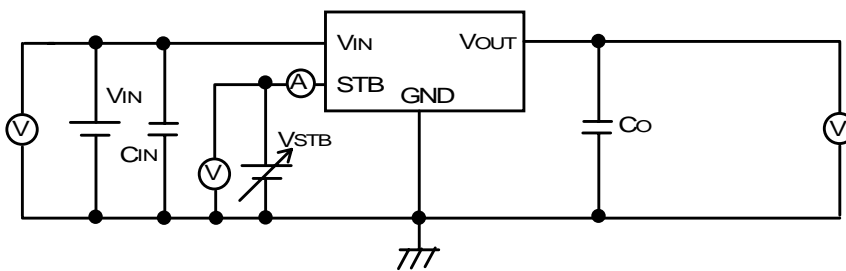
| Parameter             | Symbol                     | Condition                                  | MIN.  | TYP.  | MAX.     | Unit    |
|-----------------------|----------------------------|--|-------|-------|----------|---------|
| Output Voltage        | $V_O$                      | $V_{IN}=7.0V$ , $I_O=30mA$                 | 5.880 | 6.000 | 6.120    | V       |
| Dropout Voltage       | $\Delta V_{IO}$            | $I_O=60mA$                                 |       | 0.2   | 0.3      | V       |
| Input Voltage         | $V_{IN}$                   |  |       |       | 14       | V       |
| Operating Current     | $I_{DD1}$                  | $V_{IN}=7.0V$ , $V_{STB}=V_{IN}$ , No Load |       | 20    | 40       | $\mu A$ |
| Standby Current       | $I_{DD2}$                  | $V_{IN}=7.0V$ , $V_{STB}=GND$              |       | 0.1   | 1.0      | $\mu A$ |
| Input Current         | $I_{STB}$                  | $V_{IN}=7.0V$ , $V_{STB}=V_{IN}$           |       | 4.5   | 9.0      | $\mu A$ |
| Load Regulation       | $\Delta V_O/\Delta I_O$    | $V_{IN}=7.0V$ , $1mA \leq I_O \leq 60mA$   |       | 35    | 120      | mV      |
| Line Regulation       | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=7.0V \sim 12V$                     |       | 0.10  |          | %/V     |
| Ripple Rejection      | RR                         | $V_{IN}=7.0V$ , $e_{in}=0.5Vp-p$ , 1kHz    |       | 55    |          | dB      |
| H Level Input Voltage | $V_{STBH}$                 |  | 1.5   |       | $V_{IN}$ | V       |
| L Level Input Voltage | $V_{STBL}$                 |  | 0     |       | 0.25     | V       |

■ MEASUREMENT CIRCUIT

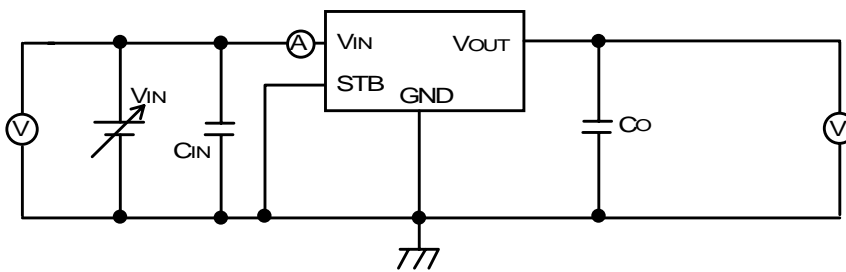
- Standard Test Circuit



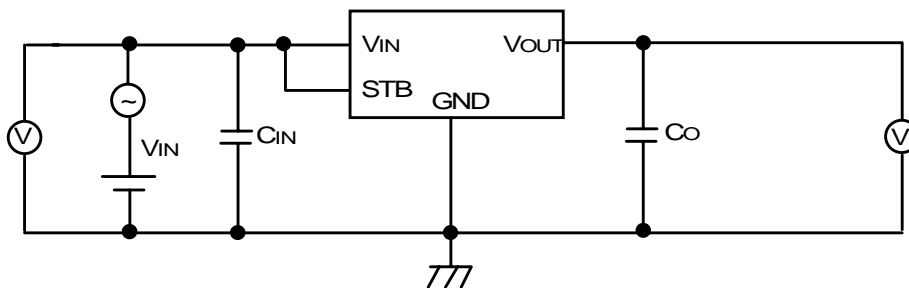
- Standby Input Voltage Test Circuit



- Standby Input Current Test Circuit



- Ripple Rejection Test Circuit



[CAUTION]  
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