

## LOW DROPOUT VOLTAGE REGULATOR

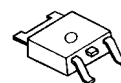
### ■ GENERAL DESCRIPTION

The NJM2391 is low dropout voltage regulators featuring high precision voltage.

It is suitable for Notebook PCs, PC cards and hard disks where 3.3V need to be generated from 5V supply.

A small TO-252 package is adopted for the space saving.

### ■ PACKAGE OUTLINE

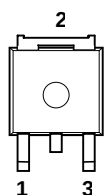


NJM2391DL1

### ■ FEATURES

- Output Current  $I_o(\text{max.})=1\text{A}$
- High Precision Output Voltage  $V_o \pm 1\%$
- Low Dropout Voltage  $\Delta V_{I-O} = 1.1\text{V typ. At } I_o=1\text{A}$
- Internal Excessive Voltage Protection Circuit
- Internal Short Circuit Current Limit
- Internal Thermal Overload Protection
- Bipolar Technology
- Package Outline TO-252

### ■ PIN CONFIGURATION



PIN FUNCTION

- 1.  $V_{IN}$
- 2. GND
- 3.  $V_{OUT}$

NJM2391DL1

### ■ ABSOLUTE MAXIMUM RATINGS

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

| PARAMETER             | SYMBOL    | RATINGS                                                                    | UNIT             |
|-----------------------|-----------|----------------------------------------------------------------------------|------------------|
| Input Voltage         | $V^+$     | +10                                                                        | V                |
| Power Dissipation     | $P_D$     | TO-252 8 ( $T_c=25^\circ\text{C}$ )<br>0.8 ( $T_a \leq 25^\circ\text{C}$ ) | W                |
| Operating Temperature | $T_{opr}$ | $-40 \sim +85$                                                             | $^\circ\text{C}$ |
| Storage Temperature   | $T_{stg}$ | $-50 \sim +125$                                                            | $^\circ\text{C}$ |

### ■ OUTPUT VOLTAGE RANK LIST

| Device Name   | $V_{OUT}$ |
|---------------|-----------|
| NJM2391DL1-25 | 2.5V      |
| NJM2391DL1-26 | 2.6V      |
| NJM2391DL1-28 | 2.85V     |
| NJM2391DL1-03 | 3.0V      |
| NJM2391DL1-33 | 3.3V      |
| NJM2391DL1-35 | 3.5V      |
| NJM2391DL1-05 | 5.0V      |

■ ELECTRICAL CHARACTERISTICS ( $C_{IN}=0.1\mu F$ ,  $C_O=10\mu F$ ,  $T_J=25^\circ C$ )

Measurement is to be conducted is pulse testing

| PARAMETER                          | SYMBOL                     | TEST CONDITION                                               | MIN.  | TYP. | MAX.  | UNIT    |
|------------------------------------|----------------------------|--------------------------------------------------------------|-------|------|-------|---------|
| Vo=2.5V Version<br>Output Voltage  | $V_O$                      | $V_{IN}=5.5V$ , $I_O=0.01A$                                  | 2.475 | 2.5  | 2.525 | V       |
| Line Regulation                    | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=4V\sim 9V$ , $I_O=1A$                                | —     | —    | 50    | mV      |
| Load Regulation                    | $\Delta V_O/\Delta I_O$    | $V_{IN}=5.5V$ , $I_O=0\sim 1A$                               | —     | —    | 50    | mV      |
| Quiescent Current                  | $I_Q$                      | $V_{IN}=5.5V$ , $I_O=0A$                                     | —     | 2.3  | 4.0   | mA      |
| Ripple Rejection                   | RR                         | $V_{IN}=5.5V$ , $e_{in}=2V_{P-P}$<br>$f=120Hz$ , $I_O=0.5A$  | 53    | 63   | —     | dB      |
| Dropout Voltage                    | $\Delta V_{I-O}$           | $I_O=1A$                                                     | —     | 1.1  | 1.2   | V       |
| Output Noise Voltage               | $V_{NO}$                   | $V_{IN}=5.5V$ , $I_O=0.5A$<br>$BW=10Hz\sim 100kHz$           | —     | 85   | 185   | $\mu V$ |
| Vo=2.6V Version<br>Output Voltage  | $V_O$                      | $V_{IN}=5.6V$ , $I_O=0.01A$                                  | 2.574 | 2.60 | 2.626 | V       |
| Line Regulation                    | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=4.1V\sim 9.1V$ , $I_O=1A$                            | —     | —    | 52    | mV      |
| Load Regulation                    | $\Delta V_O/\Delta I_O$    | $V_{IN}=5.6V$ , $I_O=0\sim 1A$                               | —     | —    | 52    | mV      |
| Quiescent Current                  | $I_Q$                      | $V_{IN}=5.6V$ , $I_O=0A$                                     | —     | 2.3  | 4.0   | mA      |
| Ripple Rejection                   | RR                         | $V_{IN}=5.6V$ , $e_{in}=2V_{P-P}$<br>$f=120Hz$ , $I_O=0.5A$  | 53    | 63   | —     | dB      |
| Dropout Voltage                    | $\Delta V_{I-O}$           | $I_O=1A$                                                     | —     | 1.1  | 1.2   | V       |
| Output Noise Voltage               | $V_{NO}$                   | $V_{IN}=5.6V$ , $I_O=0.5A$<br>$BW=10Hz\sim 100kHz$           | —     | 87   | 187   | $\mu V$ |
| Vo=2.85V Version<br>Output Voltage | $V_O$                      | $V_{IN}=5.85V$ , $I_O=0.01A$                                 | 2.82  | 2.85 | 2.88  | V       |
| Line Regulation                    | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=4.35V\sim 9.35V$ , $I_O=1A$                          | —     | —    | 57    | mV      |
| Load Regulation                    | $\Delta V_O/\Delta I_O$    | $V_{IN}=5.85V$ , $I_O=0\sim 1A$                              | —     | —    | 57    | mV      |
| Quiescent Current                  | $I_Q$                      | $V_{IN}=5.85V$ , $I_O=0A$                                    | —     | 2.3  | 4.0   | mA      |
| Ripple Rejection                   | RR                         | $V_{IN}=5.85V$ , $e_{in}=2V_{P-P}$<br>$f=120Hz$ , $I_O=0.5A$ | 53    | 63   | —     | dB      |
| Dropout Voltage                    | $\Delta V_{I-O}$           | $I_O=1A$                                                     | —     | 1.1  | 1.2   | V       |
| Output Noise Voltage               | $V_{NO}$                   | $V_{IN}=5.85V$ , $I_O=0.5A$<br>$BW=10Hz\sim 100kHz$          | —     | 90   | 190   | $\mu V$ |
| Vo=3V Version<br>Output Voltage    | $V_O$                      | $V_{IN}=6V$ , $I_O=0.01A$                                    | 2.97  | 3.00 | 3.03  | V       |
| Line Regulation                    | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=4.5V\sim 9.5V$ , $I_O=1A$                            | —     | —    | 60    | mV      |
| Load Regulation                    | $\Delta V_O/\Delta I_O$    | $V_{IN}=6V$ , $I_O=0\sim 1A$                                 | —     | —    | 60    | mV      |
| Quiescent Current                  | $I_Q$                      | $V_{IN}=6V$ , $I_O=0A$                                       | —     | 2.3  | 4.0   | mA      |
| Ripple Rejection                   | RR                         | $V_{IN}=6V$ , $e_{in}=2V_{P-P}$<br>$f=120Hz$ , $I_O=0.5A$    | 52    | 62   | —     | dB      |
| Dropout Voltage                    | $\Delta V_{I-O}$           | $I_O=1A$                                                     | —     | 1.1  | 1.2   | V       |
| Output Noise Voltage               | $V_{NO}$                   | $V_{IN}=6V$ , $I_O=0.5A$<br>$BW=10Hz\sim 100kHz$             | —     | 95   | 195   | $\mu V$ |

■ ELECTRICAL CHARACTERISTICS ( $C_{IN}=0.1\mu F$ ,  $C_O=10\mu F$ ,  $T_J=25^\circ C$ )

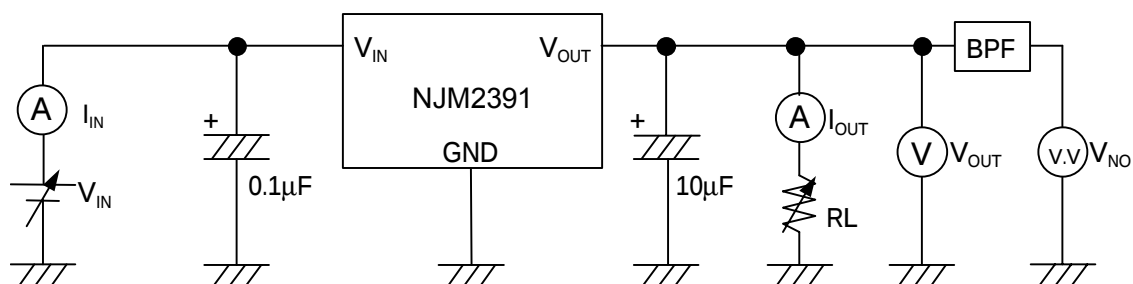
Measurement is to be conducted is pulse testing

| PARAMETER                         | SYMBOL                     | TEST CONDITION                                              | MIN.  | TYP. | MAX.  | UNIT    |
|-----------------------------------|----------------------------|-------------------------------------------------------------|-------|------|-------|---------|
| Vo=3.3V Version<br>Output Voltage | $V_O$                      | $V_{IN}=6.3V$ , $I_O=0.01A$                                 | 3.267 | 3.30 | 3.333 | V       |
| Line Regulation                   | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=4.8V\sim 9.8V$ , $I_O=1A$                           | —     | —    | 66    | mV      |
| Load Regulation                   | $\Delta V_O/\Delta I_O$    | $V_{IN}=6.3V$ , $I_O=0\sim 1A$                              | —     | —    | 66    | mV      |
| Quiescent Current                 | $I_Q$                      | $V_{IN}=6.3V$ , $I_O=0A$                                    | —     | 2.3  | 4.0   | mA      |
| Ripple Rejection                  | RR                         | $V_{IN}=6.3V$ , $e_{in}=2V_{P-P}$<br>$f=120Hz$ , $I_O=0.5A$ | 52    | 62   | —     | dB      |
| Dropout Voltage                   | $\Delta V_{I-O}$           | $I_O=1A$                                                    | —     | 1.1  | 1.2   | V       |
| Output Noise Voltage              | $V_{NO}$                   | $V_{IN}=6.3V$ , $I_O=0.5A$<br>$BW=10Hz\sim 100kHz$          | —     | 100  | 200   | $\mu V$ |
| Vo=3.5V Version<br>Output Voltage | $V_O$                      | $V_{IN}=6.5V$ , $I_O=0.01A$                                 | 3.465 | 3.50 | 3.535 | V       |
| Line Regulation                   | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=5V\sim 10V$ , $I_O=1A$                              | —     | —    | 70    | mV      |
| Load Regulation                   | $\Delta V_O/\Delta I_O$    | $V_{IN}=6.5V$ , $I_O=0\sim 1A$                              | —     | —    | 70    | mV      |
| Quiescent Current                 | $I_Q$                      | $V_{IN}=6.5V$ , $I_O=0A$                                    | —     | 2.3  | 4.0   | mA      |
| Ripple Rejection                  | RR                         | $V_{IN}=6.5V$ , $e_{in}=2V_{P-P}$<br>$f=120Hz$ , $I_O=0.5A$ | 52    | 62   | —     | dB      |
| Dropout Voltage                   | $\Delta V_{I-O}$           | $I_O=1A$                                                    | —     | 1.1  | 1.2   | V       |
| Output Noise Voltage              | $V_{NO}$                   | $V_{IN}=6.5V$ , $I_O=0.5A$<br>$BW=10Hz\sim 100kHz$          | —     | 105  | 205   | $\mu V$ |
| Vo=5V Version<br>Output Voltage   | $V_O$                      | $V_{IN}=8V$ , $I_O=0.01A$                                   | 4.95  | 5.00 | 5.05  | V       |
| Line Regulation                   | $\Delta V_O/\Delta V_{IN}$ | $V_{IN}=6.5V\sim 9.5V$ , $I_O=1A$                           | —     | —    | 60    | mV      |
| Load Regulation                   | $\Delta V_O/\Delta I_O$    | $V_{IN}=8V$ , $I_O=0\sim 1A$                                | —     | —    | 100   | mV      |
| Quiescent Current                 | $I_Q$                      | $V_{IN}=8V$ , $I_O=0A$                                      | —     | 2.3  | 4.0   | mA      |
| Ripple Rejection                  | RR                         | $V_{IN}=8V$ , $e_{in}=2V_{P-P}$<br>$f=120Hz$ , $I_O=0.5A$   | 50    | 60   | —     | dB      |
| Dropout Voltage                   | $\Delta V_{I-O}$           | $I_O=1A$                                                    | —     | 1.1  | 1.2   | V       |
| Output Noise Voltage              | $V_{NO}$                   | $V_{IN}=8V$ , $I_O=0.5A$<br>$BW=10Hz\sim 100kHz$            | —     | 150  | 260   | $\mu V$ |

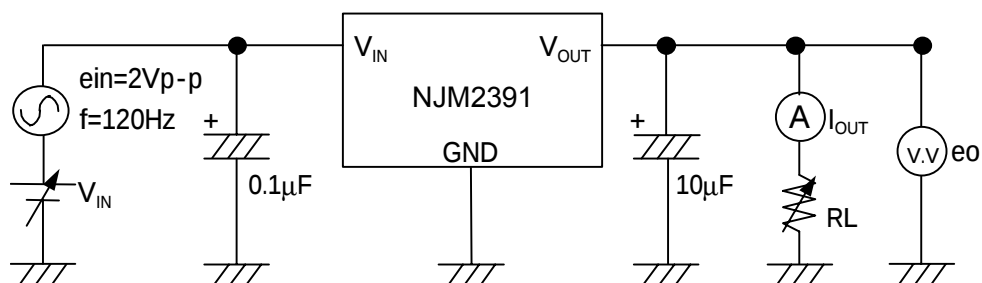
# ■TEST CIRCUIT

## 1.Output Voltage / Line Regulation / Load Regulation

Quiescent Current / Dropout Voltage / Output Noise Voltage

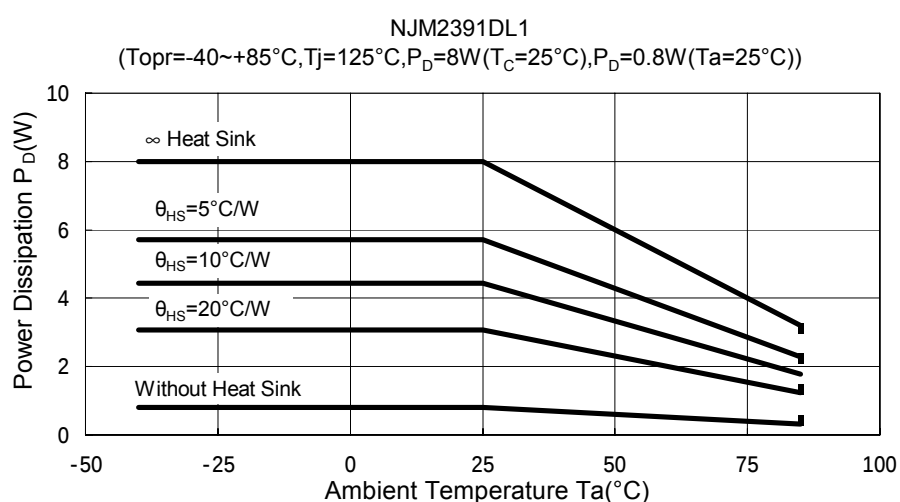


## 2.Ripple Rejection

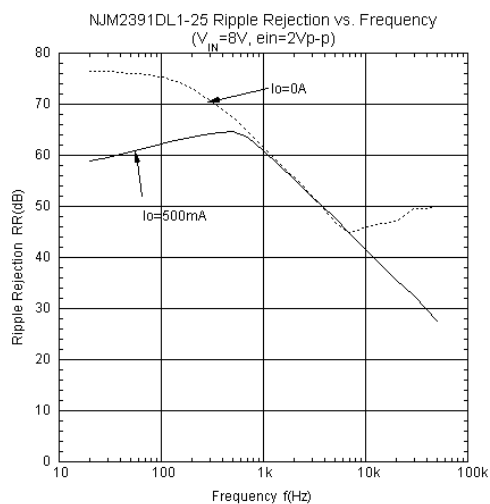
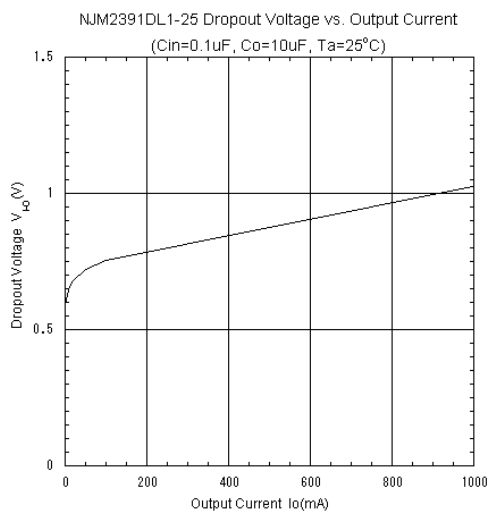
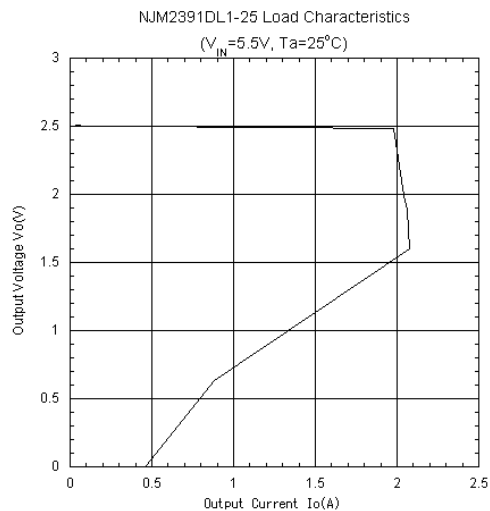
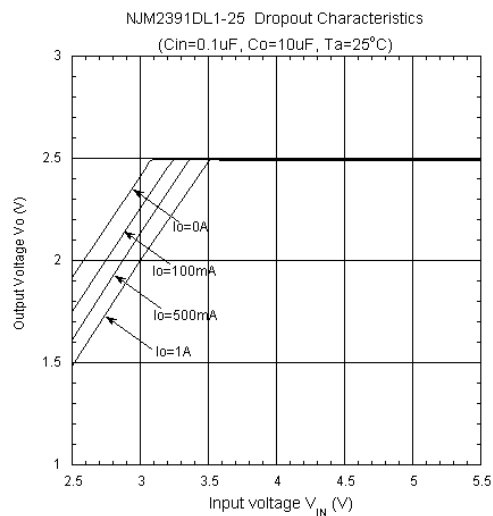


$$RR=20\log_{10}[e_{in}/e_o] \quad (dB)$$

# ■POWER DISSIPATION vs. AMBIENT TEMPERATURE



## ■ ELECTRICAL CHARACTERISTICS



## ■ ELECTRICAL CHARACTERISTICS

