



ELECTRONICS, INC.  
44 FARRAND STREET  
BLOOMFIELD, NJ 07003  
(973) 748-5089  
<http://www.nteinc.com>



## **NTE7223**

### **Integrated Circuit**

### **Step-Down Switching Voltage Regulator**

### **Adjustable Output**

#### **Description:**

The NTE7223 regulator is a monolithic integrated circuit in a 5-Lead TO220 type package that provides all the active functions for a step-down (buck) switching regulator, capable of driving a 3A load with excellent line and load regulation. This device offers a high-efficiency replacement for popular three-terminal linear regulators and substantially reduces the size of the heat sink and in some cases, no heat sink is required.

#### **Features:**

- Adjustable Output:  $V_{OUT} = 1.23V$  to  $37V$
- Guaranteed 3A Output Current
- 52kHz Fixed Frequency Internal Oscillator
- TTL Shutdown Capability, Low Power Standby Mode
- High Efficiency
- Thermal Shutdown and Current Limit Protection

#### **Applications:**

- Simple High-Efficiency Step-Down (Buck) Regulator
- Efficient Pre-Regulator for Linear Regulators
- On-Card Switching Regulator
- Positive to Negative Converter (Buck-Boost)

#### **Absolute Maximum Ratings:** (Note 1)

|                                                                                             |                             |
|---------------------------------------------------------------------------------------------|-----------------------------|
| Maximum Supply Voltage                                                                      | 45V                         |
| ON/OFF Pin Input Voltage                                                                    | $-0.3V \leq V \leq +V_{IN}$ |
| Output Voltage to GND (Steady State)                                                        | -1V                         |
| Power Dissipation                                                                           | Internally Limited          |
| Maximum Junction Temperature                                                                | +150°C                      |
| Storage Temperature Range                                                                   | -65° to +150°C              |
| Minimum ESD Rating (C = 100pF, R = 1.5kΩ)                                                   | 2kV                         |
| Lead Temperature (During Soldering, 10 sec Max)                                             | +260°C                      |
| Typical Thermal Resistance, Junction-to-Ambient (Mounted Vertically, No External Heat Sink) |                             |
| 1/2" leads in a socket or PC mounted with minimum copper area                               | 65°C/W                      |
| 1/4" leads soldered to a PC board containing approx 4 square inches of copper               | 45°C/W                      |
| Typical Thermal Resistance, Junction-to-Case                                                | 2°C/W                       |

Note 1. Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics.

**Operating Ratings:**

Supply Voltage ..... 40V

Temperature Range .....  $-40^{\circ} \leq T_J \leq +125^{\circ}\text{C}$ **Electrical Characteristics:** ( $V_{IN} = 12\text{V}$ ,  $I_{LOAD} = 500\text{mA}$ ,  $T_J = +25^{\circ}\text{C}$  unless otherwise specified)

| Parameter                                                   | Symbol     | Test Conditions                                                                                                    | Min   | Typ  | Max   | Unit          |
|-------------------------------------------------------------|------------|--------------------------------------------------------------------------------------------------------------------|-------|------|-------|---------------|
| Output Voltage                                              | $V_{OUT}$  | $V_{OUT} = 5\text{V}$                                                                                              | 1.217 | 1.23 | 1.243 | V             |
|                                                             |            | $0.5\text{A} \leq I_{LOAD} \leq 3\text{A}$ ,<br>$8\text{V} \leq V_{IN} \leq 40\text{V}$ ,<br>$V_{OUT} = 5\text{V}$ | 1.193 | 1.23 | 1.267 | V             |
|                                                             |            | $T_J = -40^{\circ} \text{ to } +125^{\circ}\text{C}$                                                               | 1.18  | 1.23 | 1.28  | V             |
| Efficiency                                                  | $\eta$     | $V_{IN} = 12\text{V}$ , $I_{LOAD} = 3\text{A}$ , $V_{OUT} = 5\text{V}$                                             | –     | 77   | –     | %             |
| Feedback Bias Current                                       | $I_b$      | $V_{OUT} = 5\text{V}$                                                                                              | –     | 50   | 100   | nA            |
|                                                             |            | $T_J = -40^{\circ} \text{ to } +125^{\circ}\text{C}$                                                               | –     | 50   | 500   | nA            |
| Oscillator Frequency                                        | $f_O$      | Note 2                                                                                                             | 47    | 52   | 58    | kHz           |
|                                                             |            | $T_J = -40^{\circ} \text{ to } +125^{\circ}\text{C}$                                                               | 42    | 52   | 63    | kHz           |
| Saturation Voltage                                          | $V_{SAT}$  | $I_{OUT} = 3\text{A}$ , Note 3                                                                                     | –     | 1.4  | 1.8   | V             |
|                                                             |            | $T_J = -40^{\circ} \text{ to } +125^{\circ}\text{C}$                                                               | –     | 1.4  | 2.0   | V             |
| Maximum Duty Cycle                                          | DC         | Note 4                                                                                                             | 93    | 98   | –     | %             |
| Current Limit                                               | $I_{CL}$   | Note 2, Note 3                                                                                                     | 4.2   | 5.8  | 6.9   | A             |
|                                                             |            | $T_J = -40^{\circ} \text{ to } +125^{\circ}\text{C}$                                                               | 3.5   | 5.8  | 7.5   | A             |
| Output Leakage Current                                      | $I_L$      | Note 5                                                                                                             | –     | –    | 2     | mA            |
|                                                             |            | Output = –1V                                                                                                       | –     | 7.5  | 30    | mA            |
| Quiescent Current                                           | $I_Q$      | Note 5                                                                                                             | –     | 5    | 10    | mA            |
| Standby Quiescent Current                                   | $I_{STBY}$ | $\overline{\text{ON}}/\text{OFF}$ Pin = 5V (OFF)                                                                   | –     | 50   | 200   | $\mu\text{A}$ |
| <b><math>\overline{\text{ON}}/\text{OFF}</math> Control</b> |            |                                                                                                                    |       |      |       |               |
| $\overline{\text{ON}}/\text{OFF}$ Pin Logic Input Level     | $V_{IH}$   | $V_{OUT} = 0\text{V}$                                                                                              | 2.2   | 1.4  | –     | V             |
|                                                             |            | $T_J = -40^{\circ} \text{ to } +125^{\circ}\text{C}$                                                               | 2.4   | 1.4  | –     | V             |
|                                                             | $V_{IL}$   | $V_{OUT} = \text{Nom Output}$                                                                                      | –     | 1.0  | 1.2   | V             |
|                                                             |            | $T_J = -40^{\circ} \text{ to } +125^{\circ}\text{C}$                                                               | –     | 0.8  | 1.2   | V             |
| $\overline{\text{ON}}/\text{OFF}$ Pin Input Current         | $I_{IH}$   | $\overline{\text{ON}}/\text{OFF}$ Pin = 5V (OFF)                                                                   | –     | 12   | 30    | $\mu\text{A}$ |
|                                                             | $I_{IL}$   | $\overline{\text{ON}}/\text{OFF}$ Pin = 0V (ON)                                                                    | –     | 0    | 10    | $\mu\text{A}$ |

Note 2. The oscillator frequency reduces to approximately 11kHz in the event of an output short or an overload which causes the regulated output voltage to drop approximately 40% from the nominal output voltage. This self protection feature lowers the average power dissipation of the IC by lowering the minimum duty cycle from 5% down to approximately 2%.

Note 3. Output pin sourcing current. No diode, inductor or capacitor connected to output.

Note 4. Feedback pin removed from output and connected to 0V.

Note 5. Feedback pin removed from output and connected to +12V to force the output transistor OFF.

**Pin Connection Diagram**  
(Front View)

