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## NTE7173 NTE7173SM Integrated Circuit 1.5A Step-Up/Down Inverting Switching Regulator

**Description:**

The NTE7173 and NTE 7173SM are monolithic circuits containing the primary functions required for DC-to-DC converters. These devices consist of an internal temperature compensated reference, comparator, controlled duty cycle oscillator with an active current limit circuit, driver and high current output switch. This series was specifically designed to be incorporated in Step-Down and Step-Up and Voltage-Inverting applications with a minimum number of external components.

**Features:**

- Operation from 3V to 40V Input
- Low Standby Current
- Output Switch Current 1.5A
- Output Voltage Adjustable
- Frequency Operation to 100kHz
- Precision 2% Reference

**Absolute Maximum Ratings:**

|   |                |
|---|----------------|
| Power Supply Voltage, $V_{CC}$ .....                        | 40Vdc          |
| Comparator Input Voltage Range, $V_{IR}$ .....              | -0.3 to +40Vdc |
| Switch Collector Voltage, $V_{C(switch)}$ .....             | 40Vdc          |
| Switch Emitter Voltage ( $V_{Pin1}$ ), $V_E$ .....          | 40Vdc          |
| Switch Collector-to-Emitter Voltage, $V_{CE(switch)}$ ..... | 40Vdc          |
| Driver Collector Voltage, $V_{C(driver)}$ .....             | 40Vdc          |
| Driver Collector Current (Note1), $I_{C(driver)}$ .....     | 100mA          |
| Switch Current, $I_{SW}$ .....                              | 1.5A           |
| Power Dissipation ( $T_A = +25^{\circ}C$ ), $P_D$           |                |
| NTE7173 .....   | 1.25W          |
| NTE7173SM .....   | 625mW          |
| Thermal Resistance, Junction-to-Ambient, $R_{thJA}$         |                |
| NTE7173 .....   | +100°C/W       |
| NTE7173SM .....   | +160°C/W       |
| Operating Ambient Temperature Range, $T_A$ .....            | 0° to +70°C    |
| Storage Temperature Range, $T_{stg}$ .....                  | -65° to +150°C |

Note 1. Maximum package power dissipation limits must be observed.

**Electrical Characteristics:** ( $V_{CC} = 5V$ ,  $T_A = 0^{\circ}C$  to  $+70^{\circ}C$ , unless otherwise specified)

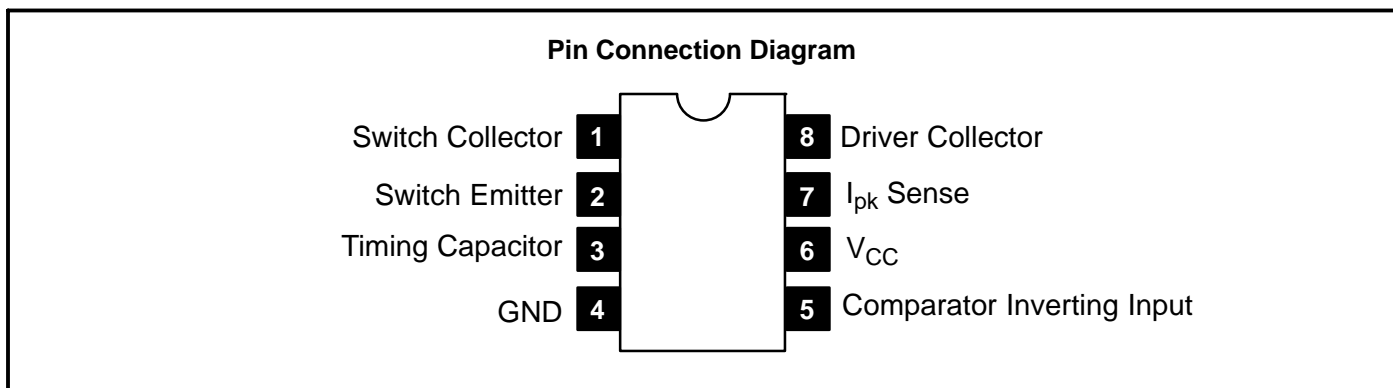
| Parameter                                 | Symbol               | Test Conditions  | Min   | Typ  | Max   | Unit    |
|---|----------------------|--|-------|------|-------|---------|
| <b>Oscillator</b>                         |                      |  |       |      |       |         |
| Frequency                                 | $f_{OSC}$            | $V_{Pin5} = 0V$ , $C_T = 1.0nF$ , $T_A = +25^{\circ}C$   | 24    | 33   | 42    | kHz     |
| Charge Current                            | $I_{chg}$            | $V_{CC} = 5V$ to $40V$ , $T_A = +25^{\circ}C$  | 24    | 35   | 42    | $\mu A$ |
| Discharge Current                         | $I_{dischg}$         | $V_{CC} = 5.0V$ to $40V$ , $T_A = +25^{\circ}C$  | 140   | 220  | 260   | $\mu A$ |
| Discharge to Charge Current Ratio         | $I_{dischg}/I_{chg}$ | Pin7 to $V_{CC}$ , $T_A = +25^{\circ}C$  | 5.2   | 6.5  | 7.5   | –       |
| Current Limit Sense Voltage               | $V_{ipk(sense)}$     | $I_{chg} = I_{dischg}$ , $T_A = +25^{\circ}C$  | 250   | 300  | 350   | mV      |
| <b>Output Switch (Note 2)</b>             |                      |  |       |      |       |         |
| Saturation Voltage, Darlington Connection | $V_{CE(sat)}$        | $I_{SW} = 1.0A$ Pin1 and Pin8 connected  | –     | 1.0  | 1.3   | V       |
| Saturation Voltage                        | $V_{CE(sat)}$        | $I_{SW} = 1.0A$ , $R_{Pin8} = 82\Omega$ to $V_{CC}$ , Forced $\beta \approx 20$ , Note 3                       | –     | 0.45 | 0.7   | V       |
| DC Current Gain                           | $h_{FE}$             | $I_{SW} = 1A$ , $V_{CE} = 5V$ , $T_A = +25^{\circ}C$   | 50    | 75   | –     | –       |
| Collector Off–State Current               | $I_{C(off)}$         | $V_{CE} = 40V$   | –     | 0.01 | 100   | $\mu A$ |
| <b>Comparator</b>                         |                      |  |       |      |       |         |
| Threshold Voltage                         | $V_{Th}$             | $T_A = +25^{\circ}C$   | 1.225 | 1.25 | 1.275 | V       |
|   |                      | $T_A = 0^{\circ}$ to $+70^{\circ}C$  | 1.21  | –    | 1.29  | V       |
| Threshold Voltage Line Regulation         | $Reg_{line}$         | $V_{CC} = 5V$ to $40V$   | –     | 1.4  | 5.0   | mV      |
| Input Bias Current                        | $I_{IB}$             | $V_{in} = 0V$  | –     | –20  | –400  | nA      |
| <b>Total Device</b>                       |                      |  |       |      |       |         |
| Supply Current                            | $I_{CC}$             | $V_{CC} = 5V$ to $40V$ , $C_T = 1nF$ , Pin7 = $V_{CC}$ , $V_{Pin5} > V_{th}$ , Pin2 = GND, remaining pins open | –     | –    | 4     | mA      |

Note 2. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient temperature as possible

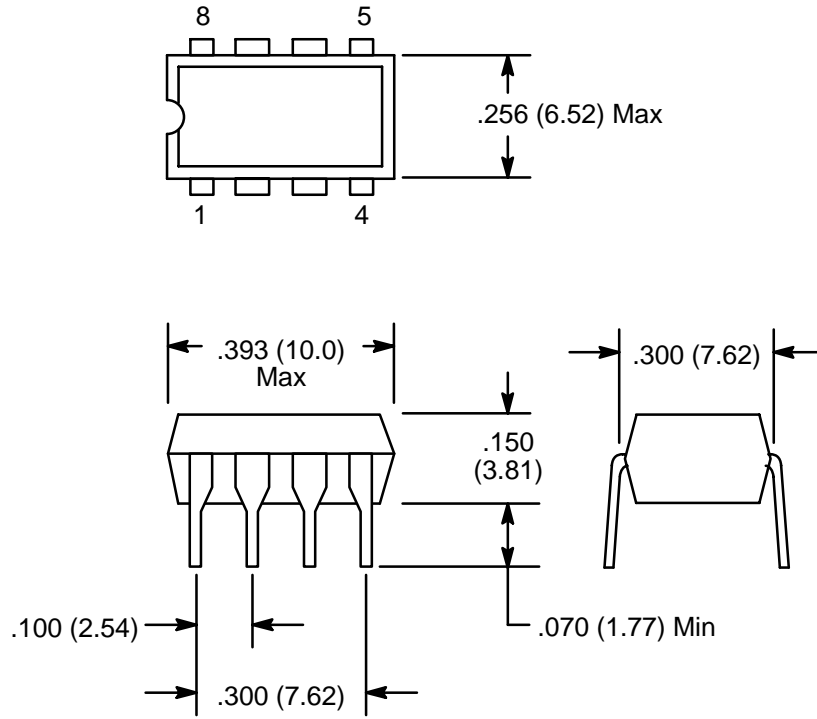
Note 3. If the output switch is driven into hard saturation (non–Darlington configuration) at low switch currents ( $\leq 300mA$ ) and high driver currents ( $\geq 30mA$ ), it may take up to  $2\mu s$  for it to come out of saturation. This condition will shorten the off time at frequencies  $\geq 30kHz$ , and is magnified at high temperatures. This condition does not occur with a Darlington configuration, since the output switch cannot saturate. If a non–Darlington configuration is used, the following output condition is recommended:

$$\text{Forced } \beta \text{ of output switch: } \frac{I_C \text{ output}}{I_C \text{ driver} - 7mA} \geq 10$$

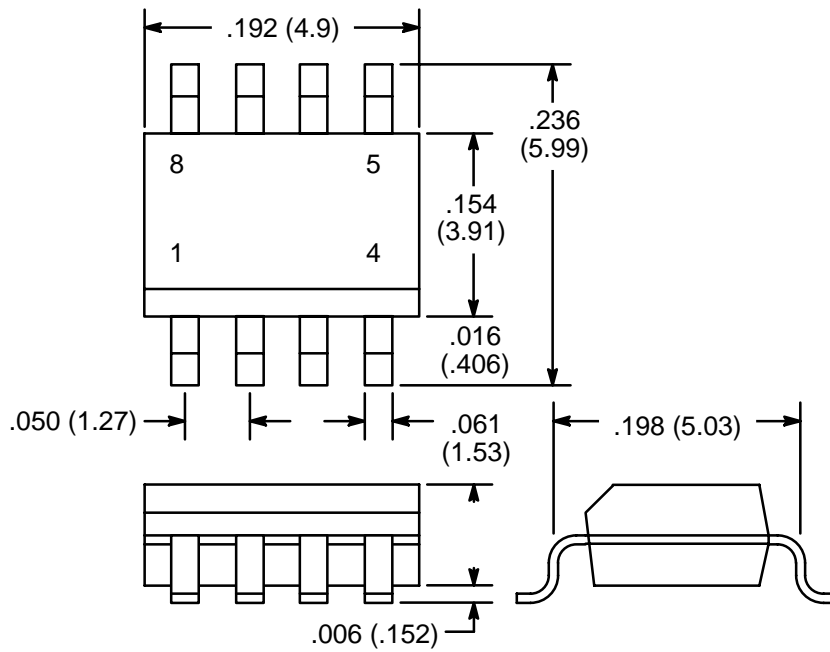
\* The  $100\Omega$  resistor is the emitter of the driver device requires about 7mA before the output switch conducts.



### NTE7173



### NTE7173SM



NOTE: Pin1 on Beveled Edge