



## NS7000

### Water Loss and Water Damage Detection/Prevention IC for Tank-based Toilets

#### Description

The NS7000 is a single IC water loss and damage detection/prevention solution for all types of tank-based toilets. Using an inexpensive water height sensor measurement technology and incorporating algorithms developed over 20+ years of research, the NS7000 detects leaks, faulty fill valves, running toilets, and toilet overflows. Serial communication with a host processor allows for register R/W operations and can be configured to determine accurate flush volumes and water loss volumes. Valve control ports allow for solenoid valve control of water supply lines to prevent water loss due to wide-open flush valves and prevent water damage due to toilet bowl overflows. The NS7000 has been specifically designed for use in IoT and telemetry-based products.

#### Features and Problems Detected

- Patented, patent pending, and trade secret-based algorithms providing the most reliable and lowest cost detection solution for tank-based toilets in a single IC
- Easily integrates with any IoT platform or module<sup>1</sup>
- Reliably detects leaks, running toilets, overflowing toilets, and faulty fill valves
- Simple water height sensor provides accurate and repeatable 0.010" resolution
- High immunity to conditions and environments known for creating false positives
- R/W registers allow for custom configurations and product operation
- Precise calculations of intentional and unintentional water flow volumes
- Precise flush volume control when used with an inline water supply valve<sup>2</sup>
- Extremely low power consumption; wide input operating voltage range
- Optional valve control for SmartStop™ operation

#### Operational & Configuration Modes

- 2 Operating Modes for all types of IoT and standalone deployment options
  - Simple: Identification of basic toilet problems; no data or access to registers
  - Serial: Identification of all toilet problems; full data and access to registers
- Configurable registers to set alert notifications and track actual water usage
- Configurable sequential Alert Counter for problem detection
- Continuous serial data output of water height (in Serial Mode)

#### Device Availability

- Available in 14-Pin PDIP, SOIC, and TSSOP
- Samples Available Feb 2019
- Development Boards Available Feb 2019
- Production Quantities Available Apr 2019

<sup>1</sup> Call to inquire about nth Solutions' manufacturing of customer-coded Wi-Fi, BLE, and LoRa in-tank products

<sup>2</sup> Custom designed specifically for use with tank-based toilets; installs without tools; available from nth Solutions

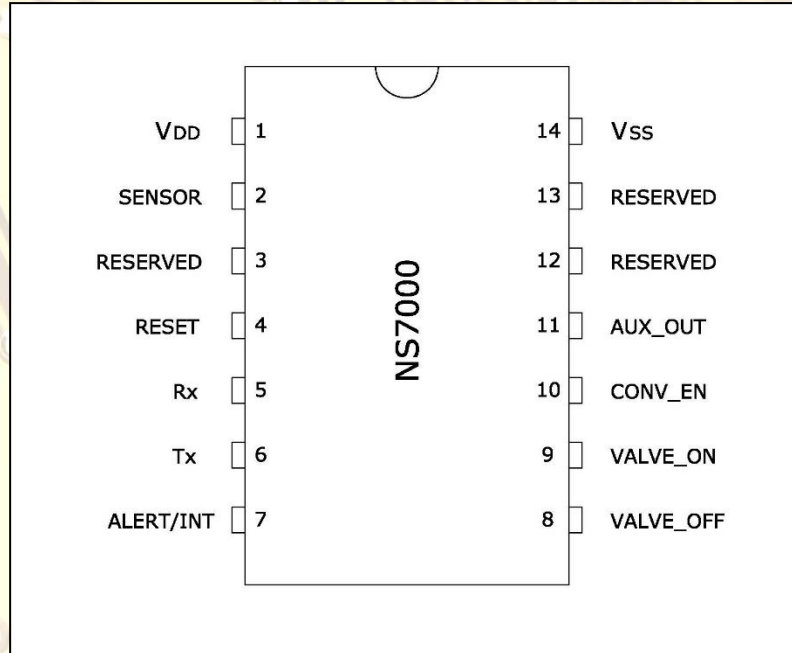




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FIGURE 1: 14-PIN PDIP, SOIC, TSSOP



#### Electrical Characteristics

- Operating Voltage Range: 2.5v to 5.5v
- Temperature Range: -40°C to 85°C

#### Low-Power Features

- $I_{avg} < 12\mu A$
- $I_{avg} < 35\mu A$  (serial data output enabled)

#### Water Height Measurement Accuracy and Water Loss Detection

- Water Height Measurement Accuracy<sup>3</sup>: 0.020"/bit
- Water Loss Detection Minimum: 0.5 GPH

#### Non-Volatile Toilet-Specific Data Storage

- Total Flushes
- Precise Water Volume-Per-Flush
- Average Water Loss Per Hour
- Cumulative Water Loss

<sup>3</sup> Based upon the cross-section dimensions of most tank-based toilet; approximately 1.0" water height = 50 bits