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NTE2050 & NTE2051
Integrated Circuit
$3^1/_2$–Digit Single Chip A/D Converter

Description:

The NTE2050 and NTE2051 are high performance, low power 3–1/2 digit A/D converters containing all the necessary active devices on a single CMOS IC. Included are seven segment decoders, display drivers, reference and a clock. The NTE2051 is designed to interface with a liquid crystal display (LCD) and includes a backplane drive; the NTE2050 will directly drive an instrument–size light emitting diode (LED) display.

The NTE2050 and NTE2051 bring together an unprecedented combination of high accuracy, versatility, and true economy. High accuracy like auto–zero to less than 10μV, zero drift of less than 1μV/°C, input bias current of 10pA max., and roll–over error of less than one count. The versatility of true differential input and reference is useful in all systems, but gives the designer an uncommon advantage when measuring load cells, strain gauges and other bridge–type transducers. And, finally, the true economy of single power supply operation (NTE2051), enabling a high performance panel meter to be built with the addition of only 7 passive components and a display.

Features:

- Guaranteed Zero Reading for 0 Volts Input on all Scales
- True Polarity at Zero for Precise Null Detection
- Input Current: 1pA Typ
- True Differential Input and Reference
- Direct Display Drive – No External Components Required:
  NTE2050 (LED)
  NTE2051 (LCD)
- Low Noise – Less than $15\mu V_{P-P}$
- On–Chip Clock and Reference
- Low Power Dissipation – Typically Less than 10mW
- No Additional Active Circuits Required

Absolute Maximum Ratings:

Supply Voltage,
- NTE2051, V+ to V– 15V
- NTE2050, V+ to GND . . . . . +6V
- NTE2050, V– to GND . . . . . –9V

Analog Input Voltage (Either Input, Note 2) . . . . . V+ to V–

Reference Input Voltage (Either Input) . . . . . V+ to V–

Clock Input,
- NTE2051 . . . . . TEST to V+
- NTE2050 . . . . . GND to V+

Power Dissipation (Note 3) 800mW

Operating Temperature Range . . . . . 0° to +70°C

Storage Temperature Range . . . . . –65° to +160°C

Lead Temperature (During Soldering, 60sec) . . . . . +300°C

Note 1. Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or another conditions above those indicated in the operational section of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Note 2. Input voltages may exceed the supply voltages provided the input current is limited to ±100μA.

Note 3. Dissipation rating assumes device is mounted with all leads soldered to printed circuit board.

Electrical Characteristics: (T_A = +25°C, f_{clock} = 48kHz unless otherwise specified)

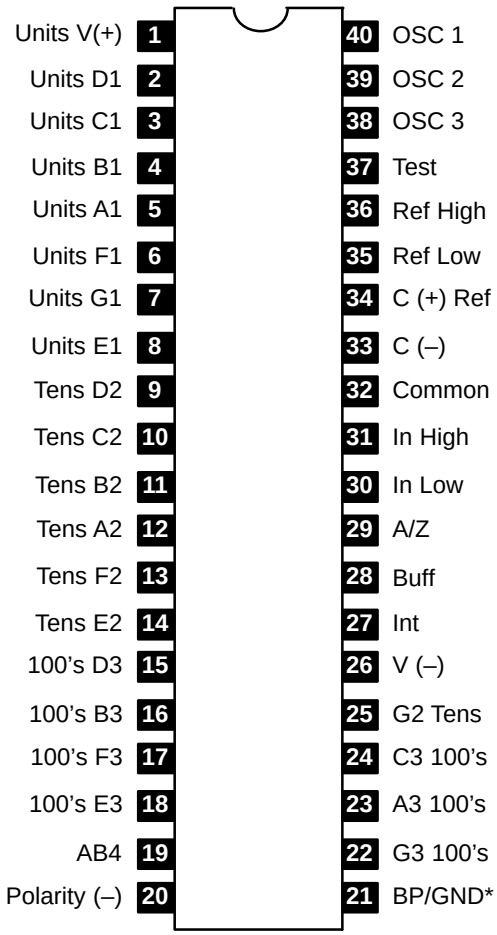
Parameter	Test Conditions	Min	Typ	Max	Unit
Zero Input Reading	V_{IN} = 0V Full Scale = 200mV	–000.0	±000.0	+000.0	Digital Reading
Ratiometric Reading	$V_{IN} = V_{REF}$ V_{REF} = 100mV	999	999/1000	1000	Digital Reading
Rollover Error (Difference in Reading for Equal Positive and Negative Reading near Full Scale)	$-V_{IN} = +V_{IN}$ □ 200mV	–1	±.2	+1	Counts
Linearity (Maximum Deviation from Best Straight Line Fit)	Full Scale = 200mV or Full Scale = 2V	–1	±.2	+1	Counts
Common Mode Rejection Ratio	V_{CM} = ±1V, V_{IN} = 0V Full Scale = 200mV	–	50	–	μV/V
Noise (Peak–Peak Value not Exceeded 95% of Time)	V_{IN} = 0V Full Scale = 200mV	–	15	–	μV
Leakage Current | Input	V_{IN} = 0	–	1	10	pA
Zero Reading Drift	V_{IN} = 0, 0° < T_A < +70°C	–	0.2	1.0	μV/°C
Scale Factor Temperature Coefficient	V_{IN} = 199.0mV 0° < T_A < +70°C (Ext. Ref. 0ppm/°C)	–	1	5	ppm/°C
V+ Supply Current (Does Not Include LED Current for NTE2050)	V_{IN} = 0	–	0.8	1.8	mA
V– Supply Current (NTE2050 Only)		–	0.6	1.8	mA

Electrical Characteristics (Cont'd): (T_A = +25°C, f_{clock} = 48kHz unless otherwise specified)

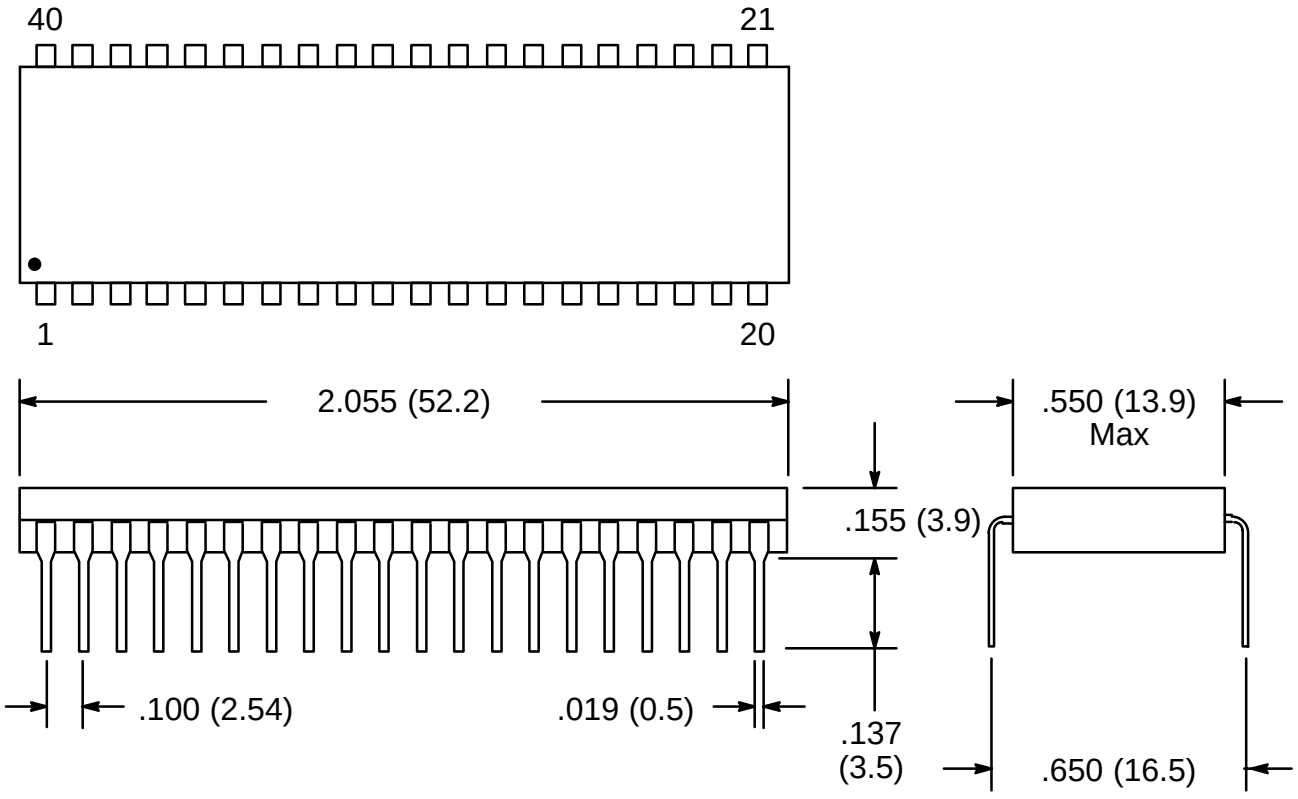
Parameter	Test Conditions	Min	Typ	Max	Unit
Analog Common Voltage Common (With Respect to Positive Supply)	25kΩ Between Common & Positive Supply	2.4	2.8	3.2	V
Temperature Coefficient of Analog Common (With Respect to Positive Supply)	25kΩ Between Common & Positive Supply	–	80	–	ppm/°C
Peak–Peak Segment Drive Voltage, Peak–Peak Backplane Drive Voltage (NTE2051 Only)	V+ to V– = 9V, Note 4	4	5	6	V
Segment Sinking Current (NTE2050 Only) (Except Pin19) (Pin19 Only)	V+ = 5V Segment Voltage = 3V	 5 10	 8 16	 – –	mA

Note 4. Back plane drive is in phase with segment drive for "off" segment, 180° outp of phase for "on" segment. Frequency is 20 times conversion rate. Average DC component is less than 50mV.

Pin Connection Diagram



Note: Pin21 is GND on the NTE2050


40
21
1
20
2.055 (52.2)
.550 (13.9)
Max
.155 (3.9)
.100 (2.54)
.019 (0.5)
.137
(3.5)
.650 (16.5)