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## **NTE1537** **Integrated Circuit** **CMOS, Digital Frequency Indicator** **w/Clock LED Function**

### **Applications:**

- Car Radio Applications: FM/AM Receiving Frequency Display and Clock Display
- Home Radio Applications: FM/AM Receiving Frequency Display and Clock Display
- Car Clock Applications: Hours–Minutes, Month–Date/Stopwatch Display

### **Functions:**

- FM Receiving Frequency Display (4 Digits)
- AM Receiving Frequency Display (4 Digits)
- Month–Date or Stopwatch Display (Either of these Selectable)

### **Features:**

- Single–Chip CMOS LSI for Static Display System
- Capable of Direct Driving Green LED (Drive Capacity 15mA)
- Capable of Selecting Frequency Display/Time Display
- Use FM/AM Local Oscillation Signal of Varactor Diode, Variable Capacitor, or  $\mu$  Tuning System to Digitally Display FM/AM Receiving Frequency
- Covers 4 AM Intermediate Frequencies: +262.5, +452.5, +455, +470kHz
- Covers 2 FM Intermediate Frequencies: +10.7, –10.7MHz
- Capable of Fine–Adjusting AM/FM Display Frequency Error Independently
  - A variable Resistor can be used to Correct AM IF Error within  $\pm 2.8$ kHz
  - A variable Resistor can be used to Correct FM IF Error within  $\pm 140$ kHz
- Two Selections of Display System (12–Hour System with PM Sign which is Displayed During Setting Only, 24–Hour System)
- Programmed on Long Months (31 Days)/Short Months (30 Days). Date in February is Programmed to Count up to the 29<sup>th</sup>
- Easy to Set Time by th Time Signal
- Stopwatch Capable of Counting/Displaying 1 Second to 12 Hours, 59 Minutes, 59 Seconds
- Inhibit Pin for Inhibiting Time Setting with Display Unlighted
- 4MHz Crystal for Reference Frequency

**Absolute Maximum Ratings:** ( $T_A = +25^\circ\text{C}$ ,  $V_{SS} = 0\text{V}$  unless otherwise specified)

Maximum Supply Voltage, $V_{DD\text{max}}$ .....	-0.3 to 11V
(Cumulative applied time: 30min or less) .....	-0.3 to 14V
Reference Voltage ( $V_{\text{ref}} \leq V_{DD}$ ), $V_{\text{ref}}$ .....	-0.3 to 10V
(Cumulative applied time: 30min or less) .....	-0.3 to 13V
Input Voltage, $V_I$ .....	-0.3 to $V_{DD}+0.3\text{V}$
Output Voltage (Output OFF), $V_O$ .....	-0.3 to $V_{DD}+0.3\text{V}$
Allowable Power Dissipation ( $T_A \leq +75^\circ\text{C}$ ), $P_{D\text{max}}$ .....	800mW
Allowable Power Disipation of Segment Output, $P_D(\text{seg})$	
Other than $\overline{\text{PM}}$ : $I_{OL} < 25\text{mA}$ .....	15mW
$\overline{\text{PM}}$ : $I_{OL} < 75\text{mA}$ .....	45mW
Operating Temperature Range, $T_{\text{opr}}$ .....	$-30^\circ$ to $+75^\circ\text{C}$
Storage Temperature Range, $T_{\text{stg}}$ .....	$-40^\circ$ to $+125^\circ\text{C}$

**Allowable Operating Ranges:** ( $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 8$  to  $10.3\text{V}$ ,  $V_{SS} = 0\text{V}$ ,  $V_{\text{ref}} = 7.9$  to  $9\text{V} \leq V_{DD}$ ,  $V_{\text{ref}} = 0\text{V}$  if  $V_{DD} < 8\text{V}$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Voltage	$V_{DD1}$	All function operating mode	8.0	9.3	10.8	V
	$V_{DD2}$	Only clock operating mode	4.3	5.0	8.0	V
Reference Voltage	$V_{\text{ref}}$	$V_{\text{ref}} \leq V_{DD}$	7.9	8.0	9.0	V
Input "H" Level Voltage	$V_{IH1}$	INHI, $V_{DD} = 4.3$ to $10.3\text{V}$	$0.75V_{DD}$	-	$V_{DD}$	V
Input "L" Level Voltage	$V_{IL1}$		$V_{SS}$	-	$0.1V_{DD}$	V
Input "H" Level Voltage	$V_{IH2}$	FM/AM, IF-FM, IF-AM <sub>1</sub> , IF-AM <sub>2</sub> , 12H/24H	$0.85V_{DD}$	-	$V_{DD}$	V
Input "L" Level Voltage	$V_{IL2}$		$V_{SS}$	-	$0.15V_{DD}$	V
Input "H" Level Voltage	$V_{IH3}$	SET, DEMAND, CTR/CLK	$0.88V_{DD}$	-	$V_{DD}$	V
Input "L" Level Voltage	$V_{IL3}$		$V_{SS}$	-	$0.12V_{DD}$	V
Input "M" Level Voltage	$V_{IM}$		$0.36V_{DD}$	-	$0.64V_{DD}$	V
Input Frequency	$f_{IN1}$	Fin-FM, $V_{P-P} = 0.7\text{V}$ , Duty 50%	0.6	-	2.0	MHz
	$f_{IN2}$	Fin-AM, $V_{P-P} = 0.7\text{V}$ , Duty 50%	0.4	-	2.5	MHz
Operating Frequency	$f_{\text{opg}}$	Crystal is externally connected across OSC-IN and OSC-OUT	3.5	-	4.2	MHz
Input Amplitude	$V_{P-P}$	Fin-FM, Fin-AM, Ceramic capacitor of $0.4\mu\text{F}$ is connected across $V_{DD}$ an $V_{SS}$	0.7	-	-	$V_{P-P}$

**Electrical Characteristics:** ( $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 8$  to  $10.3\text{V}$ ,  $V_{SS} = 0\text{V}$ ,  $V_{\text{ref}} = 7.9$  to  $9\text{V}$ ,  $V_{\text{ref}} \leq V_{DD}$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Current	$I_{IN}$	FM-Fine, AM-Fine, $V_{IN} = 0\text{V}$ or $V_{\text{ref}}$	-1	-	+1	$\mu\text{A}$
Input "H" Level Current	$I_{IH1}$	IF-FM, IF-AM <sub>1</sub> , IF-AM <sub>2</sub> , CTR/CLK, 12H/24H, $V_{IN} = 0.9V_{DD}$	-80	-30	-10	$\mu\text{A}$
Input "L" Level Current	$I_{IL1}$	IF-FM, IF-AM <sub>1</sub> , IF-AM <sub>2</sub> , CTR/CLK, 12H/24H, $V_{IN} = 0\text{V}$	-3	-	0	$\mu\text{A}$
Input "H" Level Current	$I_{IH2}$	FM/AM, $V_{IN} = 0.9V_{DD}$	-40	-15	-5	$\mu\text{A}$
Input "L" Level Current	$I_{IL2}$	FM/AM, $V_{IN} = 0\text{V}$	-3	-	0	$\mu\text{A}$
Middle Point Setting Resistance	$r_s$	SET, DEMAND	40	70	100	$\text{k}\Omega$

Note 1. + sign: Flowing into LSI  
 - sign: Flowing out of LSI

**Electrical Characteristics (Cont'd):** ( $T_A = +25^{\circ}\text{C}$ ,  $V_{DD} = 8$  to  $10.3\text{V}$ ,  $V_{SS} = 0\text{V}$ ,  $V_{ref} = 7.9$  to  $9\text{V}$ ,  $V_{ref} \leq V_{DD}$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Floating Voltage	$V_{IF3}$	SET, DEMAND, input floating	$0.45V_{DD}$	–	$0.55V_{DD}$	V
Input “H” Level Current	$I_{IH4}$	$\overline{\text{INH}}\overline{\text{I}}$ , $V_{DD} = 4.3$ to $10.3\text{V}$ , $V_{IN} = V_{DD}$	15	–	400	$\mu\text{A}$
Input Floating Voltage	$V_{IF4}$	$\overline{\text{INH}}\overline{\text{I}}$ , $V_{DD} = 4.3$ to $10.3\text{V}$ , input floating	0	–	0.3	V
Feedback Resistance	$R_{f1}$	Feedback resistance across OSC–IN and OSC–OUT	–	3	–	$\text{M}\Omega$
	$R_{f2}$	Feedback resistance of Fin–FM	–	3	–	$\text{M}\Omega$
	$R_{f3}$	Feedback resistance of Fin–AM	–	3	–	$\text{M}\Omega$
Output “L” Level Voltage	$V_{OL1}$	PM, $V_{DD} = 8\text{V}$ , $I_{OL} = 45\text{mA}$	–	–	0.7	V
	$V_{OL2}$	Segment outputs other than PM $V_{DD} = 8\text{V}$ , $I_{OL} = 15\text{mA}$	–	–	0.7	V
Output Leakage Current	$I_{OFF}$	All segment outputs, $V_{DD} = 10.3\text{V}$ , $V_{OH} = 10.3\text{V}$	–	–	10	$\mu\text{A}$
Current Dissipation	$I_{DD1}$	$V_{DD} = 10.3\text{V}$ , $f_{opg} = 4\text{MHz}$ (with crystal mounted), $f_{IN2} = 2.5\text{MHz}$ ( $0.7V_{P-P}$ )	–	8	17	$\text{mA}$
	$I_{DD2}$	$V_{DD} = 5.5\text{V}$ , $f_{opg} = 4\text{MHz}$ (with crystal mounted), $V_{ref} = 0\text{V}$ , $\overline{\text{INH}}\overline{\text{I}} = 0$	–	1.0	2.5	$\text{mA}$
	$I_{ref}$	$V_{DD} = 10.3\text{V}$ , $V_{ref} = 9\text{V}$ , AM–Fine = FM–Fine = $V_{ref}$	–	0.5	1.5	$\text{mA}$

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– sign: Flowing out of LSI



