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## NTE912 Integrated Circuit General Purpose Transistor Array (Three Isolated Transistors and One Differentially-Connected Transistor Pair)

**Description:**

The NTE912 consists of five general-purpose silicon NPN transistors on a common monolithic substrate in a 14-Lead DIP type package. Two of the transistors are internally connected to form a differentially-connected pair.

The transistors of the NTE912 are well suited to a wide variety of applications in low power systems in the DC through VHF range. They may be used as discrete transistors in conventional circuits. However, in addition, they provide the very significant inherent integrated circuit advantages of close electrical and thermal matching.

**Features:**

- Two Matched Pairs of Transistors:  
 $V_{BE}$  matched  $\pm 5mV$   
 Input Offset Current  $2\mu A$  Max. @  $I_C = 1mA$
- 5 General Purpose Monolithic Transistors
- Operation from DC to 120MHz
- Wide Operating Current Range
- Low Noise Figure: 3.2dB Typ @ 1kHz

**Applications:**

- General Use In All Types of Signal Processing Systems Operating Anywhere in the Frequency Range from DC to VHF
- Custom Designed Differential Amplifiers
- Temperature Compensated Amplifiers

**Absolute Maximum Ratings:** ( $T_A = +25^\circ C$  unless otherwise specified)

Power Dissipation ( $T_A \leq +55^\circ C$ ), $P_D$	
Each Transistor .....	300mW
Total Package .....	750mW
Derate Above $55^\circ C$ .....	6.67mW/ $^\circ C$
Collector Emitter Voltage, $V_{CEO}$ .....	15V
Collector Base Voltage, $V_{CBO}$ .....	20V
Collector Substrate Voltage (Note 1), $V_{CIO}$ .....	20V
Emitter Base Voltage, $V_{EBO}$ .....	5V
Collector Current, $I_C$ .....	50mA
Operating Temperature Range, $T_{opr}$ .....	$-55^\circ$ to $+125^\circ C$
Storage Temperature Range, $T_{stg}$ .....	$-65^\circ$ to $+150^\circ C$
Lead Temperature (During Soldering, 1/16" $\pm$ 1/32" from case, 10sec max), $T_L$ .....	$+265^\circ C$

Note 1. The collector of each transistor is isolated from the substrate by an integral diode. The substrate (Pin13) must be connected to the most negative point in the external circuit to maintain isolation between transistors and to provide for normal transistor action.

**Electrical Characteristics:** ( $T_A = +25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
<b>Static Characteristics</b>							
Collector Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 10\mu\text{A}, I_E = 0$	20	60	–	V	
Collector Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 1\text{mA}, I_B = 0$	15	24	–	V	
Collector Substrate Breakdown Voltage	$V_{(BR)CIO}$	$I_C = 10\mu\text{A}, I_{CI} = 0$	20	60	–	V	
Emitter Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\mu\text{A}, I_C = 0$	5	7	–	V	
Collector Cutoff Current	$I_{CBO}$	$V_{CB} = 10\text{V}, I_E = 0$	–	0.002	40	nA	
	$I_{CEO}$	$V_{CE} = 10\text{V}, I_B = 0$	–	–	0.5	$\mu\text{A}$	
Static Forward Current Transfer Ratio	$h_{FE}$	$V_{CE} = 3\text{V}$	$I_C = 10\text{mA}$	–	100	–	
			$I_C = 1\text{mA}$	40	100	–	
			$I_C = 10\mu\text{A}$	–	54	–	
Input Offset Current for Matched Pair $Q_1$ and $Q_2$ . $ I_{O1} - I_{O2} $		$V_{CE} = 3\text{V}, I_C = 1\text{mA}$	–	0.3	2.0	$\mu\text{A}$	
Base Emitter Voltage	$V_{BE}$	$V_{CE} = 3\text{V}$	$I_E = 1\text{mA}$	–	0.715	–	V
			$I_E = 10\text{mA}$	–	0.800	–	V
Magnitude of Input Offset Voltage for Differential Pair $ V_{BE1} - V_{BE2} $		$V_{CE} = 3\text{V}, I_C = 1\text{mA}$	–	0.45	5.0	mV	
Magnitude of Input Offset Voltage for Isolated Transistors $ V_{BE3} - V_{BE4} $ $ V_{BE4} - V_{BE5} $ $ V_{BE5} - V_{BE3} $		$V_{CE} = 3\text{V}, I_C = 1\text{mA}$	–	0.45	5.0	mV	
Temperature Coefficient of Base Emitter Voltage	$\frac{\Delta V_{BE}}{\Delta T}$	$V_{CE} = 3\text{V}, I_C = 1\text{mA}$	–	–1.9	–	$\text{mV}/^\circ\text{C}$	
Collector Emitter Saturation Voltage	$V_{CES}$	$I_B = 1\text{mA}, I_C = 10\text{mA}$	–	0.23	–	V	
Temperature Coefficient: Magnitude of Input–Offset Voltage	$\frac{ \Delta V_{IO} }{\Delta T}$	$V_{CE} = 3\text{V}, I_C = 1\text{mA}$	–	1.1	–	$\mu\text{V}/^\circ\text{C}$	

**Electrical Characteristics:** ( $T_A = +25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Dynamic Characteristics</b>						
Low–Frequency Noise Figure	NF	$f = 1\text{kHz}, V_{CE} = 3\text{V}, I_C = 100\mu\text{A},$ Source Resistance = $1\text{k}\Omega$	–	3.25	–	dB
Low–Frequency, Small–Signal Equivalent Circuit Characteristics: Forward Current Transfer Ratio	$h_{fe}$	$f = 1\text{kHz}, V_{CE} = 3\text{V}, I_C = 1\text{mA}$	–	110	–	
Short–Circuit Input Impedance	$h_{ie}$		–	3.5	–	$\text{k}\Omega$
Open–Circuit Output Impedance	$h_{oe}$		–	15.6	–	$\mu\text{mhos}$
Open–Circuit Reverse Voltage Transfer Ratio	$h_{re}$		–	$1.8 \times 10^{-4}$	–	
Admittance Characteristics: Forward Transfer Admittance	$Y_{fe}$	$f = 1\text{kHz}, V_{CE} = 3\text{V}, I_C = 1\text{mA}$	–	$31 - j1.5$	–	
Input Admittance	$Y_{ie}$		–	$0.3 + j0.04$	–	
Output Admittance	$Y_{oe}$		–	$0.001 + j0.03$	–	

**Electrical Characteristics (Cont'd):** ( $T_A = +25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Dynamic Characteristics (Cont'd)</b>						
Gain-Bandwidth Product	$f_T$	$V_{CE} = 3V, I_C = 3mA$	300	550	–	
Emitter Base Capacitance	$C_{EB}$	$V_{EB} = 3V, I_E = 0$	–	0.6	–	pF
Collector Base Capacitance	$C_{CB}$	$V_{CB} = 3V, I_C = 0$	–	0.58	–	pF
Collector Substrate Capacitance	$C_{CI}$	$V_{CS} = 3V, I_C = 0$	–	2.8	–	pF

**Pin Connection Diagram**

