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NTE904
Integrated Circuit
General Purpose Transistor Array
(Two Isolated Transistors and a Darlington Connected Transistor Pair)

Description:

The NTE904 consists of four general purpose silicon NPN transistors on a common monolithic substrate in a 12–Lead TO5 type metal can. Two of the four transistors are connected in the Darlington configuration. The substrate is connected to a separate terminal for maximum flexibility.

The transistors of the NTE904 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 but in addition they provide the advantages of close electrical and thermal matching inherent in integrated circuit construction.

Features:

- Matched Monolithic General Purpose Transistors
- Current Gain Matched to ±10%
- Base–Emitter Voltage Matched to ±2mV
- Operation from DC to 120MHz
- Wide Operating Current Range
- Low Noise Figure

Applications:

- General use in Signal Processing Systems in DC through VHF Range
- Custom Designed Differential Amplifiers
- Temperature Compenstaed Amplifiers

Absolute Maximum Ratings: (T_A = +25°C unless otherwise specified)

Collector–Emitter Voltage (Each Transistor), V_{CEO} 15V
Collector–Base Voltage (Each Transistor), V_{CBO} 30V
Collector–Substrate Voltage (Each Transistor, Note 1), V_{CIO} 40V
Emitter–Base Voltage (Each Transistor), V_{EBO} 5V
Collector Current (Each Transistor), I_C 50mA
Power Dissipation, P_D
Any One Transistor 300mW
Total package 450mW
Derate Above 85°C . . . . 5mW/°C
Operating Temperature Range, T_{opr} . . . . –55° to +125°C
Storage Temperature Range, T_{stg} . . . . –65° to +150°C

Note 1. The collector of each transistor is isolated from the substrate by an integral diode. The substrate (Pin10) 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°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Static Characteristics						
Collector Cutoff Current	I_{CBO}	V_{CB} = 10V, I_E = 0	–	0.002	–	nA
	I_{CEO}	V_{CE} = 10V, I_B = 0	–	–	0.5	μA
Collector Cutoff Current (Darlington Pair)	I_{CEOD}	V_{CE} = 10V, I_B = 0	–	–	5	μA
Collector–Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C = 1mA, I_B = 0	15	24	–	V
Collector–Base Breakdown Voltage	$V_{(BR)CBO}$	I_C = 10μA, I_E = 0	30	60	–	V
Emitter–Base Breakdown Voltage	$V_{(BR)EBO}$	I_E = 10μA, I_C = 0	5	7	–	V
Collector–Substrate Breakdown Voltage	$V_{(BR)CIO}$	I_C = 10μA, I_{C1} = 0	40	60	–	V
Collector–Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 10mA, I_B = 1mA	–	0.23	0.5	V
Static Forward Current Transfer Ratio	h_{FE}	V_{CE} = 3V, I_C = 10mA	50	100	–	
		V_{CE} = 3V, I_C = 1mA	60	100	200	
		V_{CE} = 3V, I_C = 10μA	54	–	–	
Magnitude of Static–Beta Ratio (Isolated Transistors Q_1 and Q_2)		V_{CE} = 3V, I_{C1} = I_{C2} = 1mA	0.9	0.97	–	
Static Forward Current Transfer Ratio (Darlington Pair Q_3 and Q_4)	h_{FED}	V_{CE} = 3V, I_C = 1mA	2000	5400	–	
		V_{CE} = 3V, I_C = 10μA	1000	2800	–	
Base–Emitter Voltage	V_{BE}	V_{CE} = 3V, I_E = 1mA	0.600	0.715	0.800	V
		V_{CE} = 3V, I_E = 10mA	–	0.800	0.900	V
Input Offset Voltage		V_{CE} = 3V, I_E = 1mA	–	0.48	2.0	mV
Temperature Coefficient of Base–Emitter Voltage (Q_1 – Q_2)		V_{CE} = 3V, I_E = 1mA	–	1.9	–	mV/°C
Base (Q_3)–Emitter (Q_4) Voltage Darlington Pair	V_{BED}	V_{CE} = 3V, I_E = 10mA	–	1.46	1.60	V
		V_{CE} = 3V, I_E = 1mA	1.10	1.32	1.50	V
Temperature Coefficient of Base–Emitter Voltage (Darlington Pair Q_3–Q_4)		V_{CE} = 3V, I_E = 1mA	–	4.4	–	mV/°C
Temperature Coefficient of Magnitude of Input Offset Voltage		V_{CC} = 6V, V_{EE} = –6V, I_{C1} = I_{C2} = 1mA	–	10	–	μV/°C
Low Frequency Noise Figure	NF	V_{CE} = 3V, I_C = 100μA, f = 1kHz, R_S = 1kΩ	–	3.25	–	dB
Low Frequency, Small–Signal Equivalent Circuit Characteristics						
Forward Current Transfer Ratio	h_{fe}	V_{CE} = 3V, I_C = 1mA, f = 1kHz	–	110	–	
Short–Circuit Input Impedance	h_{ie}		–	3.5	–	kΩ
Open–Circuit Output Impedance	h_{oe}		–	15.6	–	μmhos
Open–Circuit Reverse Voltage Transfer Ratio	h_{re}		1.8 x 10^4 (Typ)			
Admittance Characteristics						
Forward Transfer Admittance	Y_{fe}	V_{CE} = 3V, I_C = 1mA, f = 1kHz	31–j1.5 (Typ)			mmho
Input Admittance	Y_{ie}		0.3+j0.04 (Typ)			mmho
Output Admittance	Y_{oe}		0.001+j0.03 (Typ)			mmho
Gain–Bandwidth Product	f_T	V_{CE} = 3V, I_C = 3mA	300	500	–	MHz
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_{CI} = 3V, I_C = 0	–	2.8	–	pF

Pin Connection Diagram
(Top View)