ELECTRONICS, INC.
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NTE159MCP
Silicon Matched Complementary Transistors
(Contains NTE123AP (NPN) and NTE159 (PNP))
Audio Amplifier, Switch
TO–92 Type Package

Absolute Maximum Ratings:

Collector–Emitter Voltage, V_{CEO}
- NTE123AP 40V
- NTE159 . . . . . 80V

Collector–Base Voltage, V_{CBO}
- NTE123AP 60V
- NTE159 . . . . . 80V

Emitter–Base Voltage, V_{EBO}
- NTE123AP 6V
- NTE159 . . . . . 5V

Continuous Collector Current, I_C
- NTE123AP 600mA
- NTE159 . . . . . 800mA

Total Device Dissipation (T_A = +25°C), P_D 625mW
- Derate Above 25°C . . . . . 5.0mW/°C

Total Device Dissipation (T_C = +25°C), P_D 1.5W
- Derate Above 25°C . . . . . 12mW/°C

Operating Junction Temperature Range, T_J . . . . . –55° to +150°C

Storage Temperature Range, T_{stg} . . . . . –55° to +150°C

Thermal Resistance, Junction to Case, R_{thJC} . . . . . 83.3°C/W

Thermal Resistance, Junction to Ambient, R_{thJA} . . . . . 200°C/W

Note 1. Matched complementary pairs have their gain specification (h_{FE}) matched to within 10% of each other.

Electrical Characteristics: (T_A = +25°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
OFF Characteristics						
Collector−Emitter Breakdown Voltage NTE123AP	$V_{(BR)CEO}$	I_C = 1mA, I_B = 0, Note 2	40	–	–	V
NTE159		I_C = 10μA, I_B = 0, Note 2	80	–	–	V
Collector−Base Breakdown Voltage NTE123AP	$V_{(BR)CBO}$	I_C = 0.1mA, I_E = 0	60	–	–	V
NTE159		I_C = 10μA, I_E = 0	80	–	–	V
Emitter−Base Breakdown Voltage NTE123AP	$V_{(BR)EBO}$	I_E = 0.1mA, I_C = 0	6	–	–	V
NTE159		I_E = 10μA, I_C = 0	5	–	–	V
Collector Cutoff Current NTE123AP	I_{CEV}	V_{CE} = 35V, $V_{EB(off)}$ = 0.4V	–	–	0.1	μA
NTE159	I_{CBO}	V_{CB} = 50V, I_E = 0	–	–	50	nA
		V_{CB} = 50V, I_E = 0, T_A = +75°C	–	–	5	μA
Base Cutoff Current **NTE123AP ONLY**	I_{BEV}	V_{CE} = 35V, $V_{EB(off)}$ = 0.4V	–	–	0.1	μA
Emitter Cutoff Current **NTE159 ONLY**	I_{EBO}		–	–	100	nA
ON Characteristics (Note 2)						
DC Current Gain NTE123AP	h_{FE}	V_{CE} = 1V, I_C = 0.1mA	20	–	–	
		V_{CE} = 1V, I_C = 1mA	40	–	–	
		V_{CE} = 1V, I_C = 10mA	80	–	–	
		V_{CE} = 1V, I_C = 150mA	100	–	300	
		V_{CE} = 1V, I_C = 500mA	40	–	–	
NTE159		V_{CE} = 10V, I_C = 100μA	25	–	–	
		V_{CE} = 10V, I_C = 1mA	40	–	–	
		V_{CE} = 10V, I_C = 10mA	50	–	250	
		V_{CE} = 10V, I_C = 100mA	40	–	–	
		V_{CE} = 10V, I_C = 500mA	30	–	–	
Collector−Emitter Saturation Voltage NTE123AP	$V_{CE(sat)}$	I_C = 150mA, I_B = 15mA	–	–	0.4	V
NTE159			–	–	0.15	V
NTE123AP		I_C = 500mA, I_B = 50mA	–	–	0.75	V
NTE159			–	–	0.5	V
Base−Emitter Saturation Voltage NTE123AP	$V_{BE(sat)}$	I_C = 150mA, I_B = 15mA	0.75	–	0.95	V
NTE159			–	–	0.9	V
NTE123AP		I_C = 500mA, I_B = 50mA	–	–	1.2	V
NTE159			–	–	1.1	V

Note 2. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.

Electrical Characteristics (Cont'd): (T_A = +25°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Small−Signal Characteristics (NTE123AP)						
Current Gain−Bandwidth Product	f_T	I_C = 20mA, V_{CE} = 10V, f = 100MHz	250	–	–	MHz
Collector−Base Capacitance	C_{cb}	V_{CB} = 5V, I_E = 0, f = 100kHz	–	–	6.5	pF
Emitter−Base Capacitance	C_{eb}	V_{CB} = 0.5V, I_C = 0, f = 100kHz	–	–	30	pF
Input Impedance	h_{ie}	I_C = 1mA, V_{CE} = 10V, f = 1kHz	1.0	–	15	kΩ
Voltage Feedback Ratio	h_{re}	I_C = 1mA, V_{CE} = 10V, f = 1kHz	0.1	–	8.0	x 10^{-6}
Small−Signal Current Gain	h_{fe}	I_C = 1mA, V_{CE} = 10V, f = 1kHz	40	–	500	
Small−Signal Characteristics (NTE159)						
Output Capacitance	C_{ob}	V_{CB} = 20V, I_E = 0, f = 1MHz	–	–	30	pF
Input Capacitance	C_{ib}	V_{CB} = 500mV, f = 1MHz	–	–	110	pF
Small−Signal Current Gain	h_{fe}	I_C = 500mA, V_{CE} = 10V, f = 100MHz	1	–	5	
Noise Figure	NF	I_C = 100mA, V_{CE} = 10V, R_S = 1kΩ, f = 1kHz, B_W = 1Hz	–	–	3	dB
Switching Characteristics (NTE123AP)						
Delay Time	t_d	V_{CC} = 30V, $V_{EB(off)}$ = 2V, I_C = 150mA, I_{B1} = 15mA	–	–	15	ns
Rise Time	t_r		–	–	20	ns
Storage Time	t_s	V_{CC} = 30V, I_C = 150mA, I_{B1} = I_{B2} = 15mA	–	–	225	ns
Fall Time	t_f		–	–	30	ns
Switching Characteristics (NTE159)						
Turn−On Time	t_{on}	V_{CC} = 30V, I_C = 500mA, I_{B1} = I_{B2} = 15mA	–	–	100	ns
Turn−Off Time	t_{off}		–	–	400	ns