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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 ($T_A = +25^{\circ}\text{C}$), P_D	625mW
Derate Above 25°C	5.0mW/ $^{\circ}\text{C}$
Total Device Dissipation ($T_C = +25^{\circ}\text{C}$), P_D	1.5W
Derate Above 25°C	12mW/ $^{\circ}\text{C}$
Operating Junction Temperature Range, T_J	-55° to $+150^{\circ}\text{C}$
Storage Temperature Range, T_{stg}	-55° to $+150^{\circ}\text{C}$
Thermal Resistance, Junction to Case, R_{thJC}	83.3 $^{\circ}\text{C/W}$
Thermal Resistance, Junction to Ambient, R_{thJA}	200 $^{\circ}\text{C/W}$

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

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

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

Note 2. Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$.

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

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

