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## NTE102 (PNP) & NTE103 (NPN) Germanium Complementary Transistors Power Output, Driver TO-5 / TO-39 Type Package

### **Description:**

The NTE102 (PNP) and NTE103 (NPN) are Germanium complementary transistors designed for medium-speed saturated switching applications.

### **Features:**

- Low Collector-Emmitter Saturation Voltage:  
 $V_{CE(sat)} = 200\text{mV Max @ } I_C = 24\text{mA}$
- High Emmitter-Base Breakdown Voltage:  
 $V_{(BR)EBO} = 12\text{V Min @ } I_E = 20\mu\text{A}$

### **Absolute Maximum Ratings:**

Collector-Base Voltage, $V_{CBO}$ .....	25V
Collector-Emmitter Voltage, $V_{CES}$ .....	24V
Emmitter-Base Voltage, $V_{EBO}$ .....	12V
Continuous Collector Current, $I_C$ .....	150mA
Emmitter Current, $I_E$ .....	100mA
Total Device Dissipation ( $T_A = +25^\circ\text{C}$ ), $P_D$ .....	150mW
Derate Above $+25^\circ$ .....	2mW/ $^\circ\text{C}$
Total Device Dissipation ( $T_C = +25^\circ\text{C}$ ), $P_D$ .....	300mW
Derate Above $+25^\circ$ .....	4mW/ $^\circ\text{C}$
Operating Junction Temperature Range, $T_J$ .....	$-65^\circ$ to $+100^\circ\text{C}$
Storage Junction Temperature Range, $T_{stg}$ .....	$-65^\circ$ to $+100^\circ\text{C}$

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>OFF Characteristics</b>						
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 20\mu\text{A}, I_E = 0$	25	-	-	V
Emmitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 20\mu\text{A}, I_C = 0$	12	-	-	V
Punch-Through Voltage	$V_{PT}$	$V_{EBfl} = 1\text{V}$ , Note 1	24	-	-	V
Collector Cutoff Current	$I_{CBO}$	$V_{CB} = 12\text{V}, I_E = 0$	-	0.8	5.0	$\mu\text{A}$
		$V_{CB} = 12\text{V}, I_E = 0, T_A = +80^\circ\text{C}$	-	20	90	$\mu\text{A}$
Emmitter Cutoff Current	$I_{EBO}$	$V_{EB} = 2.5\text{V}, I_C = 0$	-	0.5	2.5	$\mu\text{A}$

Note 1.  $V_{PT}$  is determined by measuring the Emmitter-Base floating potential  $V_{EBfl}$ , using a voltmeter with  $11\text{M}\Omega$  minimum input impedance. The Collector-Base Voltage,  $V_{CB}$ , is increased until  $V_{EBfl} = 1\text{V}$ ; this value of  $V_{CB} = (V_{PT} + 1)$ .

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>ON Characteristics</b>						
DC Current Gain	$h_{FE}$	$V_{CE} = 150\text{mV}, I_C = 12\text{mA}$	30	80	-	
		$V_{CE} = 200\text{mV}, I_C = 24\text{mA}$	24	90	-	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 12\text{mA}, I_B = 0.4\text{mA}$	-	0.09	0.15	V
		$I_C = 24\text{mA}, I_B = 1\text{mA}$	-	0.09	0.20	V
Base-Emitter Voltage	$V_{BE}$	$I_C = 12\text{mA}, I_B = 0.4\text{mA}$	-	0.27	0.35	V
		$I_C = 24\text{mA}, I_B = 1\text{mA}$	-	0.30	0.40	V
<b>Small-Signal Characteristics</b>						
Alpha Cutoff Frequency	$f_{hfb}$	$V_{CB} = 6\text{V}, I_E = 1\text{mA}$	4	25	-	MHz
Output Capacitance	$C_{ob}$	$V_{CB} = 6\text{V}, I_E = 1\text{mA}, f = 1\text{MHz}$	-	8	20	pF
Input Impedance	$h_{ie}$	$V_{CE} = 6\text{V}, I_E = 1\text{mA}, f = 1\text{MHz}$	-	3.6	-	k $\Omega$
Voltage Feedback Ratio	$h_{re}$		-	8	-	$\times 10^{-4}$
Small-Signal Current Gain	$h_{fe}$		-	135	-	
Output Admittance	$h_{oe}$		-	50	-	$\mu\text{mhos}$
<b>Switching Characteristics</b>						
Delay Time	$t_d$		-	0.07	-	$\mu\text{s}$
Rise Time	$t_r$		-	0.12	-	$\mu\text{s}$
Storage Time	$t_s$		-	0.20	-	$\mu\text{s}$
Fall Time	$t_f$		-	0.10	-	$\mu\text{s}$
Stored Base Charge	$Q_{sb}$		-	300	1400	pC

