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# NTE1803
# Integrated Circuit
# Stereo Audio Control

**Description:**

The NTE1803 is an linear integrated circuit in a 18–Lead DIP type package designed as an active stereo tone/volume control for car radios, TV receivers, and audio equipment. It includes functions for bass and treble control, volume control with built–in contour (can be switched off), and balance. All these functions can be controlled by DC voltages or by single linear potentiometers. The bass and treble responses are defined by a single capacitor per control per channel.

**Features:**

- Few External Components Necessary
- Low Noise due to Internal Gain
- Bass Emphasis can be Increased by a Double–Pole Low–Pass Filter
- Wide Power Supply Range

**Applications:**

- Hi–Fi Radio
- Auto Radio
- TV
- Audio Systems

**Absolute Maximum Ratings:**

Supply Voltage ($V_{3–18}$), $V_{CC}$ . . . . . 20V
Total Power Dissipation, $P_{TOT}$ . . . . . 1200mW
Operating Ambient Temperature Range, $T_A$ . . . . . –30° to +80°C
Storage Temperature Range, $T_{stg}$ . . . . . –65° to +150°C

**DC Electrical Charactertistics:** ($V_{CC}$ = 12V, $T_A$ = +25°C, $R_G \leq 600\Omega$, $R_L \leq 4.7k\Omega$, $C_L \leq 200pF$ unless otherwise specified)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Supply** (Pin3) | | | | | | |
| Supply Voltage ($V_{CC}$) | $V_{3-18}$ | | 7.5 | – | 16.5 | V |
| Supply Current ($I_C$) | $I_3$ | $V_{CC}$ = 8.5V | 19 | 27 | 36 | mA |
| | | $V_{CC}$ = 12V | 25 | 35 | 45 | mA |
| | | $V_{CC}$ = 15V | 30 | 43 | 56 | mA |
| DC Input Levels (Pin4 and Pin15) | $V_{4, 15-18}$ | $V_{CC}$ = 8.5V | 3.8 | 4.25 | 4.7 | V |
| | | $V_{CC}$ = 12V | 5.3 | 5.9 | 6.6 | V |
| | | $V_{CC}$ = 15V | 6.5 | 7.3 | 8.2 | V |
| DC Output Levels (Pin8 and Pin11) under all control voltage conditions with DC feedback | $V_{8, 11-18}$ | $V_{CC}$ = 8.5V | 3.3 | 4.25 | 5.2 | V |
| | | $V_{CC}$ = 12V | 4.6 | 6.0 | 7.4 | V |
| | | $V_{CC}$ = 15V | 5.7 | 7.5 | 9.3 | V |
| **Pin17** | | | | | | |
| Application with Internal Potentiometer | $V_{17-18}$ | $V_{CC}$ = 8.5V | 3.5 | 3.75 | 4.0 | V |
| Contour ON/OFF Switch (Control by $I_{17}$) | $-I_{17}$ | Contour (Switch Open) | – | – | 0.5 | mA |
| | | Linear (Switch Open) | 1.5 | – | 10 | mA |
| Application without Internal Potentiometer | $V_{17-18}$ | $V_{CC} \geq$ 10.8V, voltage range forced to Pin17(Contour cannot be switched OFF) | 4.5 | – | $V_{CC}/2-V_{BE}$ | V |
| DC Control Voltage Range for volume, bass, treble, and balance (Pin1, Pin9, Pin10, and Pin16 respectively) | $V_{1, 9, 10, 16}$ | $V_{17-18}$ = 5V | 1.0 | – | 4.25 | V |
| | | Using internal supply | 0.25 | – | 3.8 | V |
| Input Current of Control Inputs (Pin1, Pin9, Pin10, and Pin16) | $-I_{1, 9, 10, 16}$ | | – | – | 5 | µA |

**AC Electrical Charactertistics:** ($V_{CC} = V_{3-18}$ = 12V, $T_A$ = +25°C, contour switch closed (linear position), volume, balance, bass, and treble controls in mid–position, $R_G \leq 600\Omega$, $R_L \leq 4.7k\Omega$, $C_L \leq 200pF$, f = 1kHz unless otherwise specified)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Control Range** | | | | | | |
| Maximum Gain of Volume | $A_V$max | | 20.5 | 21.5 | 23 | dB |
| Volume Control Range | $\Delta A_V$ | $A_V$max/$A_V$min | 90 | 100 | – | dB |
| Balance Control Range | $\Delta A_V$ | $A_V$ = 0dB | – | –40 | – | dB |
| Bass Control Range at 40Hz | $\Delta A_V$ | | ±12 | ±15 | – | dB |
| Treble Control Range at 16kHz | $\Delta A_V$ | | ±12 | ±15 | – | dB |
| **Signal Inputs, Outputs** | | | | | | |
| Input Resistance (Pin4 and Pin15) | $R_{14,15}$ | $A_V$ = 20dB, Note 1 | 10 | – | – | kΩ |
| | | $A_V$ = –40dB, Note 1 | – | 160 | – | kΩ |
| Output Resistance (Pin8 and Pin11) | $R_{O8,11}$ | | – | – | 300 | Ω |

Note 1. Equation for input resistance:

$$R_I = \frac{160k\Omega}{1 + A_V};\ A_V\text{max} = 12.$$

**AC Electrical Charactertistics (Cont'd):** ($V_{CC}$ = $V_{3–18}$ = 12V, $T_A$ = +25°C, contour switch closed (linear position), volume, balance, bass, and treble controls in mid–position, $R_G \leq 600\Omega$, $R_L \leq 4.7k\Omega$, $C_L \leq 200pF$, f = 1kHz unless otherwise specified)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Signal Processing** | | | | | | |
| Power Supply Ripple Rejection | PSRR | $V_{CC(RMS)} \leq 200mV$, f = 100Hz, $A_V$ = 0dB | 35 | 50 | – | dB |
| Channel Separation (250Hz to 10kHz) | $\alpha_{CS}$ | $A_V$ = –20dB to +21.5dB | 46 | 60 | – | dB |
| Spread of Volume Contol with Constant Control Voltage | $\Delta A_V$ | $V_{1–18} = 0.5V_{17–18}$ | – | – | ±3 | dB |
| Gain Tolerance Between Left and Right Channel | $\Delta A_{V, L–R}$ | $V_{16–18} = V_{1–18} = 0.5V_{17–18}$ | – | – | 1.5 | dB |
| Tracking Between Channels | $\Delta A_V$ | $A_V$ = 21.5dB to –26dB, f = 250Hz to 6.3kHz, balance adjusted at $A_V$ = 10dB | – | – | 2.5 | dB |
| **Signal Handling with DC Feedback** | | | | | | |
| Input Signal Handling | $V_{I(RMS)}$ | $V_{CC}$ = 8.5V, THD = 0.5%, f = 1kHz (RMS Value) | 1.4 | – | – | V |
| | | $V_{CC}$ = 8.5V, THD = 0.7%, f = 1kHz (RMS Value) | 1.8 | 2.4 | – | V |
| | | $V_{CC}$ = 12V, THD = 0.5%, f = 40Hz to 16kHz (RMS Value) | 1.4 | – | – | V |
| | | $V_{CC}$ = 12V, THD = 0.7%, f = 40Hz to 16kHz (RMS Value) | 2.0 | 3.2 | – | V |
| | | $V_{CC}$ = 15V, THD = 0.5%, f = 40Hz to 16kHz (RMS Value) | 1.4 | – | – | V |
| | | $V_{CC}$ = 15V, THD = 0.7%, f = 40Hz to 16kHz (RMS Value) | 2.0 | 3.2 | – | V |
| Output Signal Handling (Note 2, Note 3) | $V_{O(RMS)}$ | $V_{CC}$ = 8.5V, THD = 0.5%, f = 1kHz (RMS Value) | 1.8 | 2.0 | – | V |
| | | $V_{CC}$ = 8.5V, THD = 10%, f = 1kHz (RMS Value) | – | 2.2 | – | V |
| | | $V_{CC}$ = 12V, THD = 0.5%, f = 40Hz to 16kHz (RMS Value) | 2.5 | 3.0 | – | V |
| | | $V_{CC}$ = 15V, THD = 0.5%, f = 40Hz to 16kHz (RMS Value) | – | 3.5 | – | V |
| **Noise Performance** ($V_{CC}$ = 8.5V) | | | | | | |
| Output Noise Voltage (Unweighted) at f = 20Hz to 20kHz (RMS value) | $V_{NO(RMS)}$ | for maximum voltage gain, Note 4 | – | 260 | – | µV |
| | | $A_V$ = –3dB, Not e 4 | – | 70 | 140 | µV |
| Output Noise Voltage (Weighted) CCIR recommendation 468–2 (peak value) | $V_{NO(M)}$ | for maximum voltage gain, Note 4 | – | 890 | – | µV |
| | | for maximum emphasis of bass and treble (contour OFF, $A_V$ = –40dB), Note 4 | – | 360 | – | µV |

Note 2. Frequencies below 200Hz and above 5kHz have reduced voltage swing. The reduction at 40Hz and at 16kHz is 30%.

Note 3. In the event of bass boosting the output signal handling is reduced. The reduction is 1dB for maximum bass boost.

Note 4. Linear frequency response.

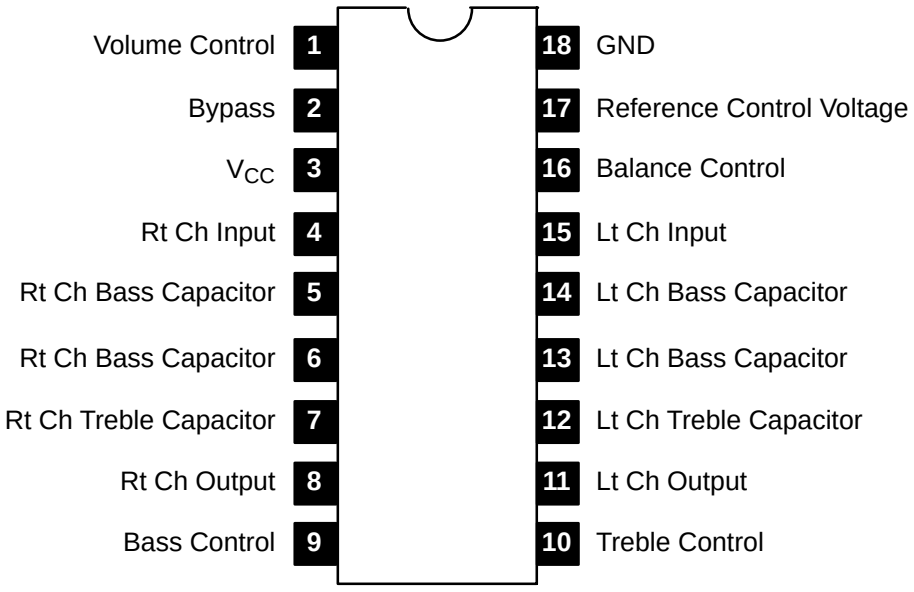
**AC Electrical Charactertistics (Cont'd):** ($V_{CC}$ = $V_{3–18}$ = 12V, $T_A$ = +25°C, contour switch closed (linear position), volume, balance, bass, and treble controls in mid–position, $R_G \leq 600\Omega$, $R_L \leq 4.7k\Omega$, $C_L \leq 200pF$, f = 1kHz unless otherwise specified)

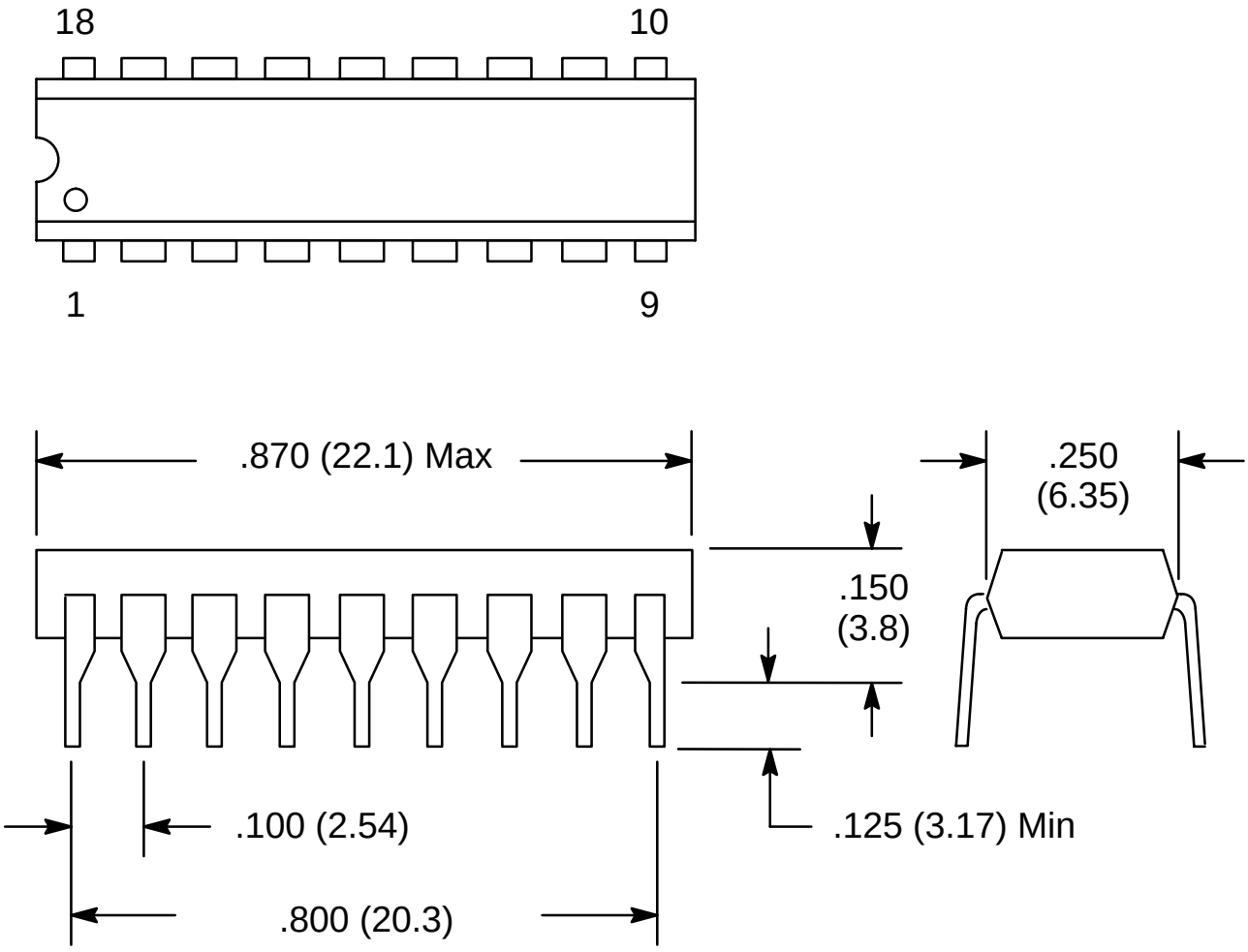
| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Noise Performance** ($V_{CC}$ = 12V) | | | | | | |
| Output Noise Voltage (Unweighted) at f = 20Hz to 20kHz (RMS value), Note 5 | $V_{NO(RMS)}$ | for maximum voltage gain, Note 4 | – | 310 | – | µV |
| | | $A_V$ = –16dB, Note 4 | – | 100 | 200 | µV |
| Output Noise Voltage (Weighted) CCIR recommendation 468–2 (peak value) | $V_{NO(M)}$ | for maximum voltage gain, Note 4 | – | 940 | – | µV |
| | | for maximum emphasis of bass and treble (contour OFF, $A_V$ = –40dB) | – | 400 | – | µV |
| **Noise Performance** ($V_{CC}$ = 15V) | | | | | | |
| Output Noise Voltage (Unweighted) at f = 20Hz to 20kHz (RMS value), Note 5 | $V_{NO(RMS)}$ | for maximum voltage gain, Note 4 | – | 350 | – | µV |
| | | $A_V$ = –16dB, Note 4 | – | 110 | 220 | µV |
| Output Noise Voltage (Weighted) CCIR recommendation 468–2 (peak value) | $V_{NO(M)}$ | for maximum voltage gain, Note 4 | – | 980 | – | µV |
| | | for maximum emphasis of bass and treble (contour OFF, $A_V$ = –40dB) | – | 420 | – | µV |

Note 4. Linear frequency response.

Note 5. For peak values add 4.5dB to RMS values.

**Pin Connection Diagram**




18
10
1
9
.870 (22.1) Max
.250
(6.35)
.150
(3.8)
.100 (2.54)
.125 (3.17) Min
.800 (20.3)