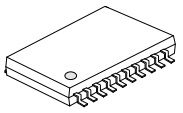
# 2 × 0.7W BTL AUDIO AMPLIFIER WITH OUTPUT CHANNEL SWITCHING



SSOP-20N
(209mil)

## ■ DESCRIPTION

The UTC **TDA8547** is a two channel audio power amplifier for an output power of 2 × 0.7W with a 16Ω load at a 5V supply. At a low supply voltage of 3.3V an output power of 0.6W with an 8Ω load can be obtained. The circuit contains two BTL amplifiers with a complementary PNP-NPN output stage and standby/mute logic.

The operating condition of all channels of the device (standby, mute or on) is externally controlled by the MODE pin. With the SELECT pin one of the output channels can be switched in the standby condition. This feature can be used for loudspeaker selection and also reduces the quiescent current consumption. When only one channel is used the maximum output power is 1.2W.

## ■ FEATURES

* Selection between output channels
* Flexibility in use
* Few external components
* Low saturation voltage of output stage
* Gain can be fixed with external resistors
* Standby mode controlled by CMOS compatible levels
* Low standby current
* No switch-on/switch-off plops
* High supply voltage ripple rejection
* Protected against electrostatic discharge
* Outputs short-circuit safe to ground, $V_{CC}$ and across the load
* Thermally protected

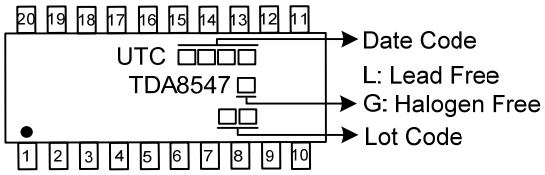
## ■ ORDERING INFORMATION

| Ordering Number | | Package | Packing |
|---|---|---|---|
| Lead Free | Halogen Free | | |
| TDA8547L-R20N-R | TDA8547G-R20N-R | SSOP-20N | Tape Reel |

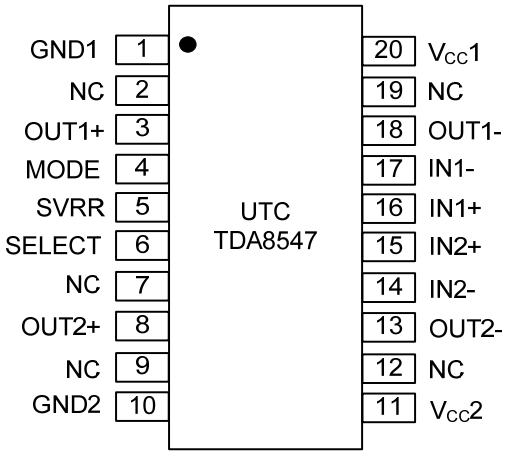
TDA8547G-R20N-R
(1)Packing Type
(2)Package Type
(3)Green Package

(1) R: Tape Reel
(2) R20N: SSOP-20N
(3) G: Halogen Free and Lead Free, L: Lead Free

## ■ MARKING



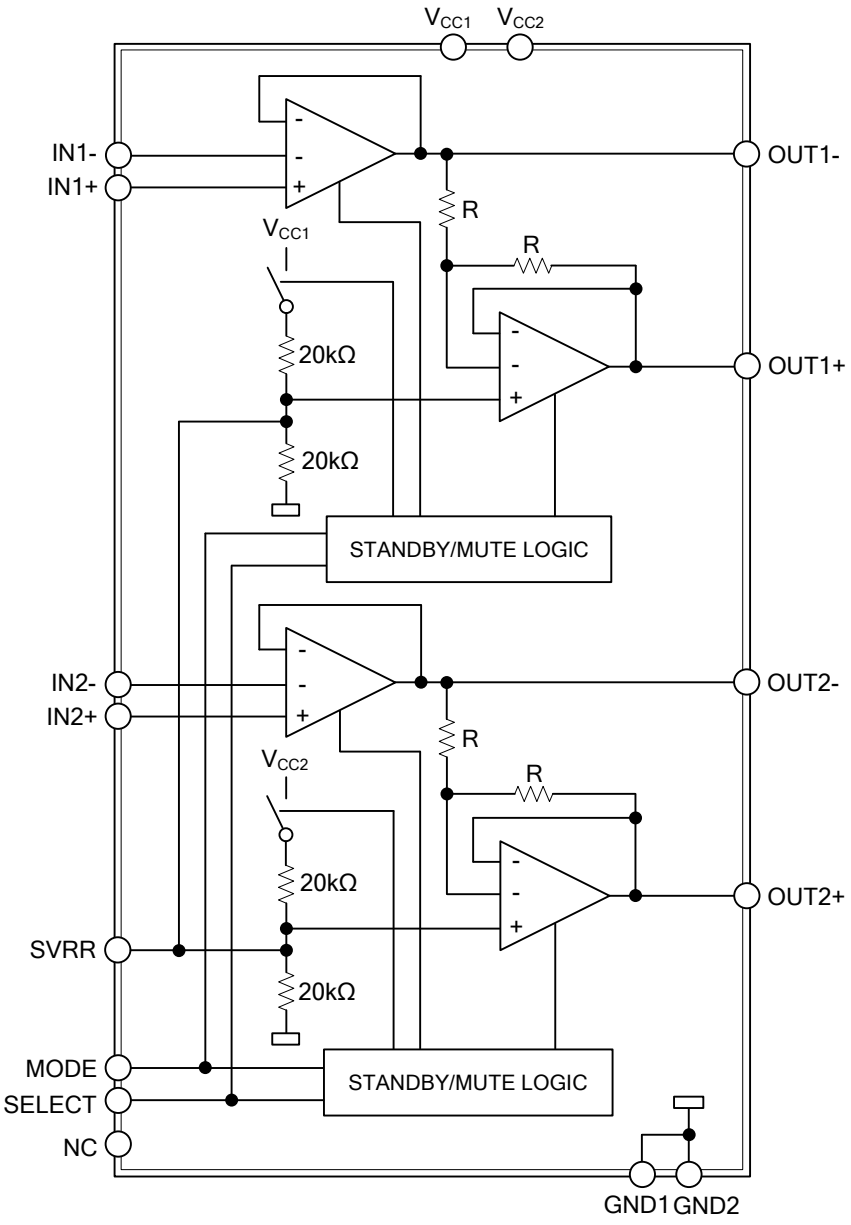

## ■ PIN CONFIGURATION




## ■ PIN DESCRIPTION

| PIN NO. | PIN NAME | DESCRIPTION |
|---|---|---|
| 1 | GND1 | Ground, channel 1 |
| 2, 7, 9, 12, 19 | NC | Not connected |
| 3 | OUT1+ | Positive loudspeaker terminal, channel 1 |
| 4 | MODE | Operating mode select (standby, mute, operating) |
| 5 | SVRR | Half supply voltage, decoupling ripple rejection |
| 6 | SELECT | Input for selection of operating channel |
| 8 | OUT2+ | Positive loudspeaker terminal, channel 2 |
| 10 | GND2 | Ground, channel 2 |
| 11 | $V_{CC}2$ | Supply voltage, channel 2 |
| 13 | OUT2- | Negative loudspeaker terminal, channel 2 |
| 14 | IN2- | Negative input, channel 2 |
| 15 | IN2+ | Positive input, channel 2 |
| 16 | IN1+ | Positive input, channel 1 |
| 17 | IN1- | Negative input, channel 1 |
| 18 | OUT1- | Negative loudspeaker terminal, channel 1 |
| 20 | $V_{CC}1$ | Supply voltage, channel 1 |

## ■ BLOCK DIAGRAM



## ■ ABSOLUTE MAXIMUM RATING

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---|---|---|---|
| Supply Voltage | $V_{CC}$ | -0.3 ~ +18 | V |
| Input Voltage | $V_I$ | -0.3 ~ $V_{CC}$ +0.3 | V |
| Repetitive Peak Output Current | $I_{ORM}$ | 1 | A |
| AC and DC Short-Circuit Safe Voltage | $V_{PSC}$ | 10 | V |
| Power Dissipation | $P_D$ | 1.1 | W |
| Operating Ambient Temperature | $T_A$ | -40 ~ +85 | °C |
| Storage Temperature | $T_{STG}$ | -55 ~ +150 | °C |

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

## ■ THERMAL DATA

| PARAMETER | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Junction to Ambient | $\theta_{JA}$ | 110 | °C/W |

## ■ DC ELECTRICAL CHARACTERISTICS ($T_A$=25°C, unless otherwise specified)

($V_{CC}$=5V, $R_L$=8Ω, $V_{MODE}$=0V, gain=20dB, measured in BTL application circuit Fig.1)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Supply Voltage | $V_{CC}$ | Operating | 2.2 | 5 | 18 | V |
| Quiescent Current | $I_Q$ | BTL 2 Channels (Note 1) | | 15 | 22 | mA |
| | | BTL 1 Channel (Note 1) | | 8 | 12 | mA |
| Standby Current | $I_{STB}$ | $V_{MODE}$=$V_{CC}$ | | | 10 | μA |
| DC Output Voltage | $V_O$ | Note 2 | | 2.2 | | V |
| Differential Output Voltage Offset | $\lvert V_{OUT+} - V_{OUT-} \rvert$ | | | | 50 | mV |
| Input Bias Current | $I_{IN+}$, $I_{IN-}$ | | | | 500 | nA |
| Input Voltage MODE Pin | $V_{MODE}$ | Operating | 0 | | 0.5 | V |
| | | Mute | 1.5 | | $V_{CC}$-1.5 | V |
| | | Standby | $V_{CC}$-0.5 | | $V_{CC}$ | V |
| Input Current MODE Pin | $I_{MODE}$ | 0V < $V_{MODE}$ < $V_{CC}$ | | | 20 | μA |
| Input Voltage SELECT Pin | $V_{SELECT}$ | Channel 1 = Standby<br>Channel 2 = On | 0 | | 1 | V |
| | | Channel 1 = On<br>Channel 2 = Standby | $V_{CC}$ - 1 | | $V_{CC}$ | V |
| Input Current SELECT Pin | $I_{SELECT}$ | $V_{SELECT}$ =0V | | | 100 | μA |

Notes: 1. Measured with $R_L$=∞. With a load connected at the outputs the quiescent current will increase, the maximum of this increase being equal to the DC output offset voltage divided by $R_L$.
2. The DC output voltage with respect to ground is approximately 0.5$V_{CC}$

## ■ AC ELECTRICAL CHARACTERISTICS ($T_A$=25°C, unless otherwise specified)

($V_{CC}$=5V, $R_L$=8Ω, f =1kHz, $V_{MODE}$=0V, gain=20dB, measured in BTL application circuit Fig.1)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Output Power, One Channel | $P_O$ | THD=10% | 1 | 1.2 | | W |
| | | THD=0.5% | 0.6 | 0.9 | | W |
| Total Harmonic Distortion | THD | $P_O$=0.4W | | 0.15 | 0.3 | % |
| Closed Loop Voltage Gain | $G_V$ | Note 1 | 6 | | 30 | dB |
| Differential Input Impedance | $Z_I$ | | | 100 | | kΩ |
| Noise Output Voltage | $V_{NO}$ | Note 2 | | | 100 | μV |
| Supply Voltage Ripple Rejection | SVRR | Note 3 | 50 | | | dB |
| | | Note 4 | 40 | | | dB |
| Output Voltage | $V_O$ | Note 5 | | | 200 | μV |
| Channel Separation | $\alpha_{CS}$ | $V_{SELECT}$ =0.5$V_{CC}$ (Note 6) | 40 | | | dB |

Notes: 1. Gain of the amplifier is $2 \times \frac{R_2}{R_1}$ in BTL application circuit Fig.1.

2. The noise output voltage is measured at the output in a frequency range from 20Hz to 20kHz (unweighted), with a source impedance of $R_S$ =0Ω at the input.
3. Supply voltage ripple rejection is measured at the output, with a source impedance of $R_S$ =0Ω at the input. The ripple voltage is a sine wave with a frequency of 1kHz and an amplitude of 100mV (RMS), which is applied to the positive supply rail.
4. Supply voltage ripple rejection is measured at the output, with a source impedance of $R_S$ =0Ω at the input. The ripple voltage is a sine wave with a frequency between 100Hz and 20kHz and an amplitude of 100mV (RMS), which is applied to the positive supply rail.
5. Output voltage in mute position is measured with a 1V (RMS) input voltage in a bandwidth of 20Hz to 20kHz, so including noise.
6. Channel separation is measured at the output with a source impedance of $R_S$=0Ω at the input and a frequency of 1 kHz. The output power in the operating channel is set to 0.5W.

## ■ CONTROL PINS MODE AND SELECT VERSUS STATUS OF OUTPUT CHANNELS

| Control Pin | | Status of Output Channel | | TYP |
|---|---|---|---|---|
| MODE | SELECT | CHANNEL 1 | CHANNEL 2 | $I_Q$ (mA) |
| HIGH(Note 1) / NC(Note 2) | X(Note 3) | Standby | Standby | 0 |
| HVP | HVP(Note 4) / NC(Note 2) | Mute | Mute | 15 |
| LOW | HVP(Note 4) / NC(Note 2) | on | on | 15 |
| HVP(Note 4) / LOW(Note 5) | HIHG(Note 1) | Mute / on | Mute / on | 8 |
| HVP(Note 4) / LOW(Note 5) | HVP(Note 4) / NC(Note 2) | Mute / on | Mute / on | 15 |
| HVP(Note 4) / LOW(Note 5) | LOW(Note 5) | Standby | Mute / on | 8 |

Notes: 1. HIGH=$V_{PIN}$ > $V_{CC}$ – 0.5V
2. NC=not connected or floating.
3. X=don't care.
4. HVP=1.5V < $V_{PIN}$ < $V_{CC}$ – 1.5V
5. LOW= $V_{PIN}$ < 0.5V.

## ■ FUNCTIONAL DESCRIPTION

The **TDA8547** is a 2 × 0.7 W BTL audio power amplifier capable of delivering 2 × 0.7 W output power to a 16 Ω load at THD = 10% using a 5 V power supply. Using the MODE pin the device can be switched to standby and mute condition. The device is protected by an internal thermal shutdown protection mechanism. The gain can be set within a range from 6 to 30 dB by external feedback resistors.

**Power amplifier**

The power amplifier is a Bridge-Tied Load (BTL) amplifier with a complementary PNP-NPN output stage. The voltage loss on the positive supply line is the saturation voltage of a PNP power transistor, on the negative side the saturation voltage of a NPN power transistor. The total voltage loss is <1 V and with a 5 V supply voltage and a 16 Ω loudspeaker an output power of 0.7 W can be delivered, when two channels are operating. If only one channel is operating then an output power of 1.2 W can be delivered (5 V, 8 Ω).

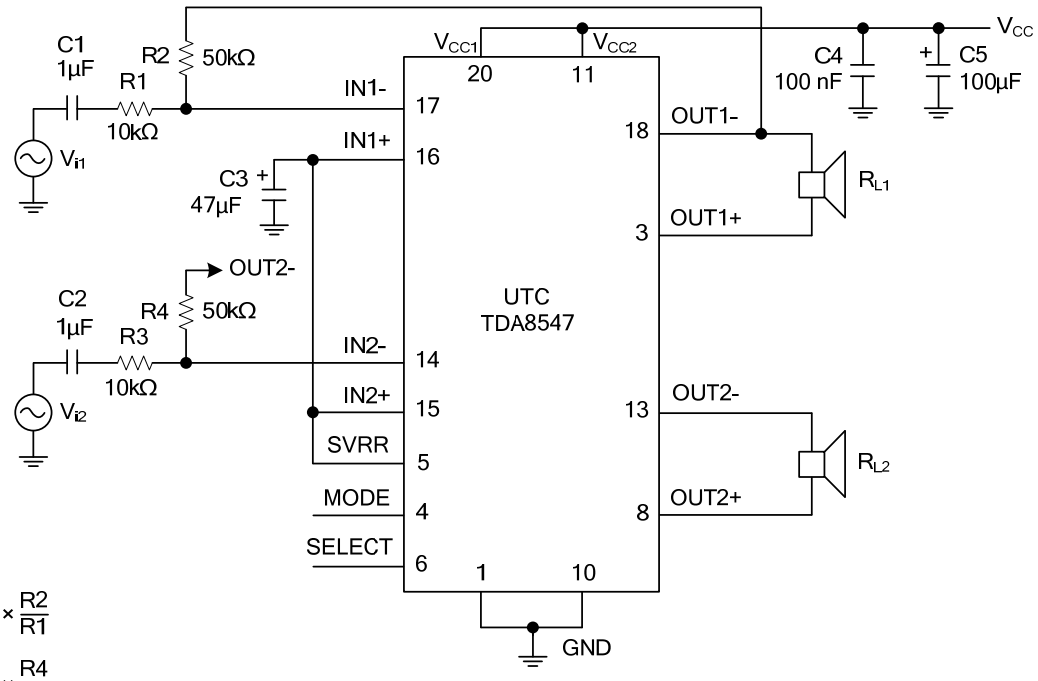
**MODE pin**

The whole device (both channels) is in the standby mode (with a very low current consumption) if the voltage at the MODE pin is >($V_{CC}$ − 0.5 V), or if this pin is floating. At a MODE voltage level of less than 0.5 V the amplifier is fully operational. In the range between 1.5 V and $V_{CC}$ - 1.5 V the amplifier is in mute condition. The mute condition is useful to suppress plop noise at the output caused by charging of the input capacitor

**SELECT pin**

If the voltage at the SELECT pin is in the range between 1.5 V and $V_{CC}$ − 1.5 V, or if it is kept floating, then both channels can be operational. If the SELECT pin is set to a LOW voltage or grounded, then only channel 2 can operate and the power amplifier of channel 1 will be in the standby mode. In this case only the loudspeaker at channel 2 can operate and the loudspeaker at channel 1 will be switched off. If the SELECT pin is set to a HIGH level or connected to $V_{CC}$, then only channel 1 can operate and the power amplifier of channel 2 will be in the standby mode. In this case only the loudspeaker at channel 1 can operate and the loudspeaker at channel 2 will be switched off. Setting the SELECT pin to a LOW or a HIGH voltage results in a reduction of quiescent current consumption by a factor of approximately 2.Switching with the SELECT pin during operating is not plop-free, because the input capacitor of the channel which is coming out of standby needs to be charged first. For plop-free channel selecting the device has first to be set in mute condition with the MODE pin (between 1.5 V and $V_{CC}$ − 1.5 V), then set the SELECT pin to the new level, after a delay set the MODE pin to a LOW level. The delay needed depends on the values of the input capacitor and the feedback resistors. Time needed is approx. 10 × C1 × (R1 + R2), so approximately 0.6 s. for the values in Fig.1.

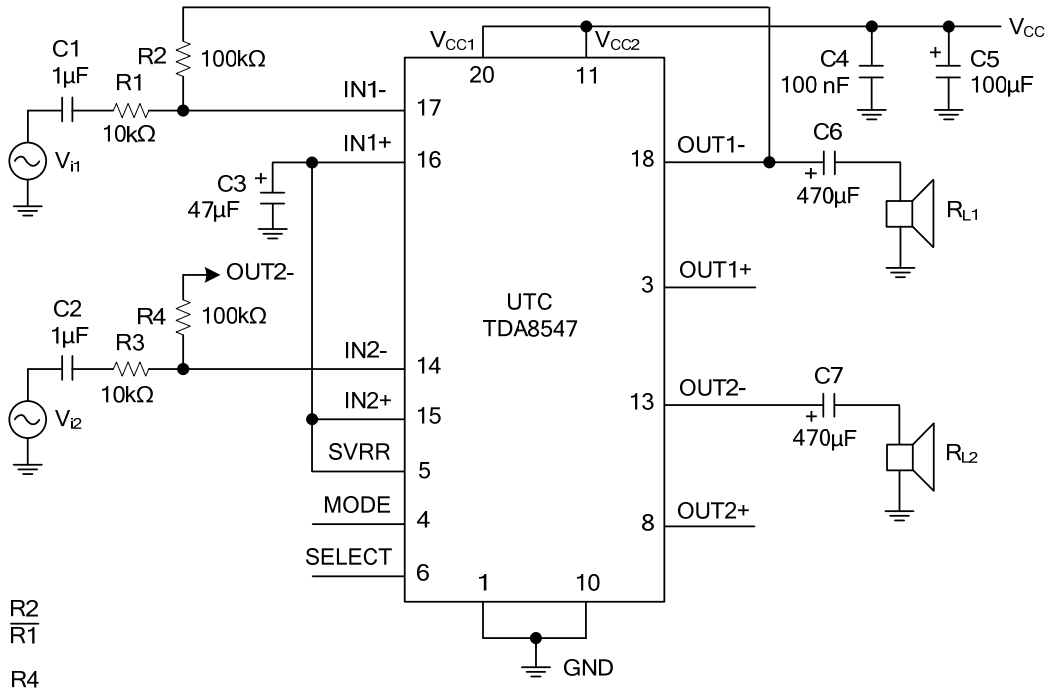
## ■ TYPICAL APPLICATION CIRCUIT




Gain channel 1 = $2 \times \frac{R2}{R1}$

Gain channel 2 = $2 \times \frac{R4}{R3}$

**Fig.1 BTL Application**




Gain channel 1 = $\frac{R2}{R1}$

Gain channel 2 = $\frac{R4}{R3}$

**Fig.2 SE Application**

## ■ TYPICAL CHARACTERISTICS