TPA3000D1 in a Hands-Free Car Kit

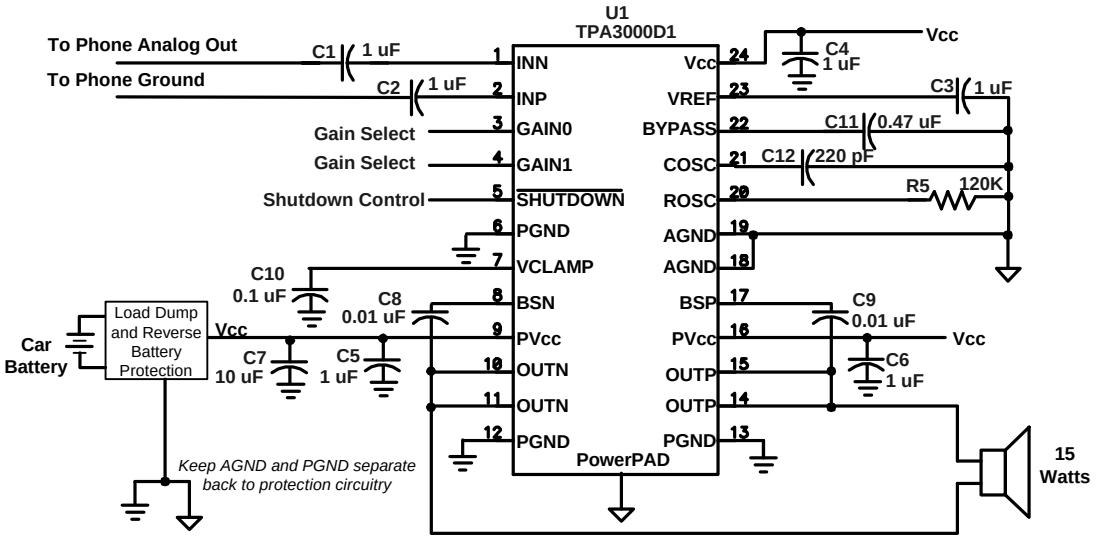

Figure 1: TPA3000D1 car kit schematic

Benefits of using the TPA3000D1 in a car kit:

The TPA3000D1 is the perfect amplifier for a hands-free car kits for the following reasons…

- No voltage regulator required
  - 8 V to 18 V supply voltage range
  - PSRR > 70 dB
- Minimal space
  - No heat sink required because of class-D efficiency and powerPAD Θ_{JA} = 46 ^{o}C/W
  - No output filter required if output traces are very short
  - 4 internal gain settings saves 4 resistors
  - 24-pin PWP package

Design Tips:

Keep Vcc less than 18V:
Although the TPA3000D1 does not need a voltage regulator, you still need to make sure that the supply voltage from the load-dump circuitry does not allow Vcc to exceed 18 V. The designer may need to add a zener diode to the load-dump circuitry to ensure that Vcc does not exceed 18 V. See General Semiconductors at http://www.gensemi.com for information on load-dump protection.

Connect TPA3000D1 inputs through capacitors to the phone's analog output and ground:
Most phones have a single-ended analog output. The noise to the speaker can be minimized by connecting INN through a capacitor to the phone's ground, and INP through a capacitor to the phone's analog output (see capacitors C1 and C2 in figure 1). The INN and INP traces should be as close as possible to each other when running from the phone connector to the TPA3000D1. This forms a pseudo-differential signal and will cancel noise pick-up and reduce turn-on and turn-off pop.

Keep AGND and PGND separate to protection circuitry:
The analog ground and power ground must be separate back to the protection circuitry. Separating the grounds back to the protection circuitry keeps the ripple currents from the switching power stage out of the sensitive analog stage.

Shutdown the TPA3000D1 during start-up or add an R and C to the SHUTDOWN pin:
The TPA3000D1 can either be shutdown when not in use, or left active. If the TPA3000D1 can be shutdown, leave the TPA3000D1 in shutdown while it and other devices power up. If the device is left active, connect a 120-kΩ resistor from SHUTDOWN to Vcc and a 0.1-μF capacitor from SHUTDOWN to ground, as shown in figure 2.

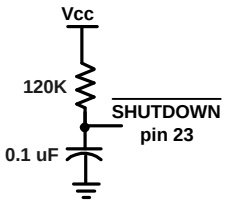

Figure 1: TPA3000D1 shutdown circuitry

Connect GAIN0 and GAIN1 directly to VREF or ground when setting the gain:
Setting the gain of the TPA3000D1 can be set by connecting GAIN0 and GAIN1 to VREF or GND as shown in table below. Connect the gain pins to VREF, **not Vcc**, because the gain pins cannot handle more than 5.5 V.

Table 1: GAIN0 and GAIN1 connections for various gains.

GAIN1	GAIN0	gain (dB)
GND	GND	12
GND	VREF	18
VREF	GND	23.6
VREF	VREF	36

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