|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Part ID | Qty | Description | Mouser # | Digi-Key # | Farnell # | RS # | Notes |
| Circuit board | | | | | | | |
| PCB | 1 | δ2 PCB | AMB audio shop | | | | - |
| Resistors | | | | | | | |
| R1+, R1- | 2 | resistor array 1KΩx10, bussed (SIP-11) | AMB audio shop | | | | see Note 5 |
| R2+, R2- | 2 | resistor array 47Ωx8, bussed (SIP-9) | - |
| R5+, R5- | 2 | resistor array 47KΩx8, bussed (SIP-9) | - |
| R3, R4 | 2 | miniature 1/8W resistor 3.3KΩ | 270-3.3K-RC | S3.3KCACT-ND | 9343040 | 165-0296 | see Note 1 |
| RT*n*L, RT*n*R | up to 16 | termination resistors | (your choice) | | | | see Note 2 |
| ROUTL, ROUTR | 2 | output load resistors | (your choice) | | | | see Note 3 |
| Capacitors | | | | | | | |
| C1, C3 | 2 | aluminum electrolytic capacitor 470µF 10V | 647-UHE1A471MPD | P10221-ND | 9691944 | 315-0338 | - |
| C2+, C2-, C4 | 3 | multilayer ceramic capacitor 0.1µF 50V X7R | 80-C320C104K5R | 399-4264-ND | 1457655 or 1141775 | 538-1310 | - |
| Ferrite bead | | | | | | | |
| L1 | 1 per δ1/δ2 stack | Ferrite bead, axial-lead | AMB audio shop | | | | See Note 1 |
| Integrated circuits | | | | | | | |
| U1+, U1- | 2 | PCF8574A or PCF8574 I²C port expander (DIP-16) | AMB audio shop (PCF8574A only) | | | | See Note 4 |
| U2+, U2- | 2 | ULN2803A darlington transistor array (DIP-18) | 511-ULN2803A | 497-2356-5-ND | 1094428 | 714-1167 | - |
| LEDs | | | | | | | |
| LED+, LED- | 2 | 10-LED bargraph array (DIP-20) | 604-DC-10EWA | 754-1176-5-ND | 1208882 | 247-3056 | see Notes 5, 6 |
| Relays | | | | | | | |
| K0-K7 | up to 8 | miniature latching DPDT relay Panasonic AGN2104H | AMB audio shop | | | | - |
| IC sockets | | | | | | | |
| - | 2 | DIP-16 low-profile socket, gold contacts | 575-393316 | ED5316-ND | 1077315 | 813-137 | for U1+, U1- |
| - | 2 | DIP-18 low-profile socket, gold contacts | 575-393318 | ED5318-ND | 1077318 | 813-143 | for U2+, U2- |
| Connectors | | | | | | | |
| J1 | 1 | 6P Molex KK 254 headers, right angle, tin or gold | 538-22-05-3061 or 538-22-12-2064 | WM4304-ND or WM2715-ND | 1756799 or 1756808 | 679-5473 or 679-5565 | see Note 7 |
| 1 | 6P Molex KK 254 crimp housing | 538-22-01-3067 | WM2004-ND | 1654529 | 679-5391 |
| J2, J3 | 1 | 6P vertical pin headers tin or gold | 538-22-03-2061 or 538-22-10-2061 | WM4004-ND or WM2726-ND | 9731113 | 479-181 |
| 1 | SIP-6 pin receptacle | AMB audio shop | | | |
| J4 | 1 | 16P dual-row header, right-angle, unshrouded | 538-10-88-3161 | SAM1049-08-ND | 1248191 | 681-2581 | see Note 8 |
| J5 | 1 | 16P dual-row receptacle, right-angle | - | SAM1006-08-ND | 1766333 | - |
| J4, J5 | 2 | 16P dual-row header, right-angle, shrouded | 517-D2516-5002-AR | MHE16E-ND | 1099247 | 542-8920 | see Note 9 |
| 2 | 16P dual-row IDC socket with strain-relief | 517-D89116-0131HK and 517-D3448-89116 | MKC16E-ND and  MESR16-ND | 1099238 | 192-7372 |
| 1 | 16-conductor 0.050" ribbon cable | 517-3365/16FT | MC16G-5-ND | 297318 | 289-9874 |
| IO*n*L, IO*n*R, IBUSL, IBUSR, OBUSL, OBUSR | up to 20 | 2P Molex KK 254 headers, right angle, tin or gold | 538-22-05-3021 or 538-22-12-2024 | WM4300-ND or WM2711-ND | 1756797 or 1756806 | 679-5448 or 679-5555 | see Notes 7, 10 |
| 4 | 2P Molex KK 254 crimp housing | 538-22-01-3027 | WM2000-ND | 1462825 | 679-5363 |
| - | up to 46 | Molex KK 254 crimp terminals, tin or gold | 538-08-50-0114 or 538-08-55-0102 | WM1114-ND or WM2312-ND | 1462641 or 1462642 | 172-9178 or 678-3149 | for all Molex KK 254 crimp housings |
| Miscellaneous | | | | | | | |
| JP1A+, JP1B+, JP1C+, JP1A-, JP1B-, JP1C-, JP2, JP3 | 1 | 36P pin headers, break-apart | 517-647-01-36 | S1011E-36-ND | 1097955 | - | for all jumpers, see Note 11 |
| - | 8 | jumper shunts, 2P, 0.100" | 649-68786-202LF | S9001-ND (10-pack) | 1097979 (10-pack) | - |
| - | - | PCB standoffs, 0.5" or 13mm long, imperial #4-40 or metric M3 threaded | (your choice) | | | | [McMaster-Carr](http://www.mcmaster.com/), etc. |
| - | - | Machine screws, imperial #4-40 or metric M3 | (your choice) | | | | [McMaster-Carr](http://www.mcmaster.com/), etc. |

#### Notes

1. If you will be stacking multiple δ1/δ2 boards, then only one of them needs to have R3, R4 and L1 installed. L1 connects the driver section's digital ground to the chassis through the mounting hole.
2. For ports configured as input, the RT*n* resistors serve as a load for the connected sources while they are not selected. Use a value of between 10KΩ to 100KΩ. For ports configured as output, RT*n* act as "shorting resistors" while the port is not selected, so that the target amplifier's inputs do not "float" and pick up noise. Use anywhere from 0Ω (resistor lead cutoff) to 1KΩ for these. See Parts selection guide below.
3. The ROUT resistors provide an output load for the active line stage/buffer or headphone amp, if any, that you will connect between IBUS and OBUS. The appropriate resistor value depends on the design of the active amp, Typical values are somewhere between 100Ω (for a headphone amp that's capable of driving low-to-mid impedance headphones) and tens of KΩ (pre-amplifier line stage). If you are using a low resistance here, then you may need to use 1/4W or 1/2W resistors. If you will be connecting IBUS directly to OBUS (e.g., totally passive pre-amp), you may omit ROUT.
4. PCF8574A and PCF8574 occupy different I²C addresses spaces. AMB recommends that you use the same chip type for U1+ and U1- on a per-board basis. See the [Initial setup](https://www.amb.org/audio/delta2/instructions.shtml" \l "initial_setup) section and the [LCDuino-1](https://www.amb.org/audio/lcduino1/) website for more information.
5. Optional: Install these if you want relay coil activity indicators, useful for debugging purposes.
6. No IC socket is specified for LED+ and LED- because it would make them too tall to fit between stacked boards. Solder them directly to the board.
7. If you are building the [α10 stereo pre-amplifier](https://www.amb.org/audio/alpha10/) using the special backplane board, use the α10 parts list for these parts.
8. If your δ2 board's driver and selector sections will remain in one piece, use these for J4 and J5.
9. If your δ2 board's driver and selector sections will be snapped apart, use these for J4 and J5.
10. The number of these connectors required depends on how many relays you will be installing. You need two per relay (for the two channels), plus four more for IBUSL, IBUSR, OBUSL and OBUSR.
11. The quantities here assume that you will not be using pin headers and jumper shunts for the JP*n*S and JP*n*G positions. See [δ2 board assembly instructions](https://www.amb.org/audio/delta2/instructions.shtml" \l "pcb_assembly).

### Parts selection guide

The following is a list of recommendations and options. Please read through this carefully before you order any parts.

#### Resistors

R1+, R1-, R2+, R2-, R5+, R5-: These are all "bussed" resistor networks. R1+ and R1- are SIP-11, each with ten internal 1KΩ resistors. R2+, R2- are SIP-9, each with eight internal 47Ω resistors. R5+ and R5- are SIP-9, each with eight internal 47KΩ resistors. One pin of each of them are connected to a common bus. The lead pitch is 0.1" (2.5mm) for all of these.

* Bourns [4600X series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=bourns-4600x_resistor_network) (AMB audio shop)
* Bourns [4300R series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=bourns-4300r_resistor_network)
* other similar

R3, R4: These resistors are 3.3KΩ miniature axial lead types with a body length no longer than about 4mm and no wider than 1.9mm. Carbon film, thin film or metal film types are acceptable, with 5% tolerances or less.

* Xicon [MF-RC 270 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=xicon-mf-rc)
* Xicon [CF-RC 299 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=xicon-cf-rc)
* Vishay-Beyschlag [MBA 0204 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay-beyschlag_thin_film_leaded)
* Stackpole [RN 1/8 or RNM 1/4 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=stackpole-RNF_RNMF)
* Stackpole [CF18 or CFM14 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=stackpole-CF_CFM)
* Multicomp [MF12 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=multicomp-mf)
* Koa-Speer [MFS1/4C series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=koa-speer_MF_MFS_RK)
* other similar

RT*n*L, RT*n*R: For these resistors, the δ2 PCB accommodates miniature through-hole types with a body length no longer than about 4mm and no wider than 1.9mm. These resistors are not in the audio path (they are "seen" only by unselected inputs sources or output targets), therefore it is not necessary to use very fancy resistor types here. See Note 2 above about the approrpriate resistance to use for ports configured as input or output.

* Xicon [MF-RC 270 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=xicon-mf-rc)
* Vishay-Beyschlag [MBA 0204 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay-beyschlag_thin_film_leaded)
* Stackpole [RNF 1/8 or RNMF 1/4 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=stackpole-RNF_RNMF)
* Vishay-Dale [RN50 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay_dale_cmf_military)
* Vishay-Dale [CMF50 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay_dale_cmf_industrial)
* Multicomp [MF12 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=multicomp-mf)
* Koa-Speer [MFS1/4C series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=koa-speer_MF_MFS_RK)
* others

ROUT*n*L, ROUT*n*R: The δ2 PCB accommodates through-hole resistors with lead-pitch of 5mm to 12.5mm and several intermediate sizes. See Note 3 above about the approrpriate resistance to use.

* Vishay-Dale [RN60 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay_dale_cmf_military)
* Vishay-Dale [CMF60 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay_dale_cmf_industrial)
* Vishay-Dale [RN55 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay_dale_cmf_military)
* Vishay-Dale [CMF55 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay_dale_cmf_industrial)
* Vishay-Dale [RN50 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay_dale_cmf_military)
* Vishay-Dale [CMF50 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay_dale_cmf_industrial)
* Vishay-Dale [PTF series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay_dale_ptf)
* Xicon [MF-RC 270 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=xicon-mf-rc)
* Vishay-Beyschlag [MBA 0204 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=vishay-beyschlag_thin_film_leaded)
* Stackpole [RNF 1/8 or RNMF 1/4 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=stackpole-RNF_RNMF)
* Multicomp [MF12 series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=multicomp-mf)
* Koa-Speer [MFS1/4C series](https://www.amb.org/cgi-bin/ds.cgi?c=resistors&f=koa-speer_MF_MFS_RK)
* others

#### Capacitors

C1, C3: Aluminum electrolytic capacitor 470µF 10V, radial lead, lead spacing: 3.5mm;, diameter: 8mm, height: 11.5mm maximum

* Nichicon [HE series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=nichicon_he)
* Panasonic [FC series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=panasonic_FC)
* other similar

C2+, C2-, C4: X7R multilayer ceramic capacitor 0.1µF, radial lead, lead spacing 2.5mm

* Kemet [C320 series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=kemet-multilayer_ceramic)
* Vishay [Mono-Kap series](https://www.amb.org/cgi-bin/ds.cgi?c=capacitors&f=vishay-mono-kap)
* other similar

#### Ferrite bead

L1: Ferrite bead, axial-lead (AMB audio shop)

#### Integrated circuits

U1+, U1-: I²C port expander (DIP-16)

* NXP [PCF8574AP](https://www.amb.org/cgi-bin/ds.cgi?c=logic&f=PCF8574_nxp) (AMB audio shop)
* NXP [PCF8574P](https://www.amb.org/cgi-bin/ds.cgi?c=logic&f=PCF8574_nxp)
* Texas Instruments [PCF8574AN](https://www.amb.org/cgi-bin/ds.cgi?c=logic&f=PCF8574A_ti)
* Texas Instruments [PCF8574N](https://www.amb.org/cgi-bin/ds.cgi?c=logic&f=PCF8574_ti)

U2+, U2-: Darlington transistor array (DIP-18)

* STmicro [ULN2803A](https://www.amb.org/cgi-bin/ds.cgi?c=logic&f=ULN2803A_STmicro)

#### LEDs

LED+, LED-: 10-LED bargraph array (DIP-20)

* Kingbright [DC10EWA](https://www.amb.org/cgi-bin/ds.cgi?c=optical_infrared_ultraviolet&f=kingbright_DC10EWA_10_segment_LED)
* Opto Images [LL10000HR](https://www.amb.org/cgi-bin/ds.cgi?c=optical_infrared_ultraviolet&f=opto_images_G10000_10_segment_LED)
* other similar

#### Relays

K0-K7: Miniature DPDT relay 4.5V DC latching

* Panasonic [AGN2104H](https://www.amb.org/cgi-bin/ds.cgi?c=switches_relays_pots&f=panasonic_AGN) (AMB audio shop)
* Omron [G6JU-2P-Y-DC4.5](https://www.amb.org/cgi-bin/ds.cgi?c=switches_relays_pots&f=omron_G6J-Y)
* **Note**: You may use another single-coil latching relay in the Omron G6JU-2P-Y or Panasonic AGN series with a different coil voltage, but you need to have a separate power supply. See [Power options](https://www.amb.org/audio/delta2/instructions.shtml" \l "power_options) for details.

#### IC sockets

DIP-16 and DIP-18 low profile sockets with machined contacts

* Mill-Max [115 series](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=mill-max_115_dip_sockets)
* Aries [518 series](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=aries-518_dip_sockets)
* TE-Connectivity [800 series](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=TE_Connectivity_800_dip_sockets)
* Winslow Adaptics [DIP sockets](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=winslow_adaptics_dip_sockets)
* other similar

#### Connectors

J1, IO*n*L, IO*n*R, IBUSL, IBUSR, OBUSL, OBUSR: (not for α10)

* Molex KK 254 series

[headers with friction lock](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=molex_kk254_headers)

[crimp housings](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=molex_kk254_crimp_housings)

[crimp terminals](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=molex_kk254_crimp_terminal)

J2, J3: (for board stacking)

* Vertical 6P single-row pin header with solder tails, .100" pitch, .318" mating length
* Vertical 6P single-row pin receptacle with solder tails, .100" pitch (AMB audio shop)

J4, J5: (one-piece δ2 board option)

* J4: Samtec [TSW-108-08-T-D-RA](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=samtec_TSW_pin_receptacles) 16P dual-row pin header, right-angle, unshrouded
* J5: Samtec [BCS-108-L-D-HE](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=samtec_BCS_series_socket) 16P dual-row pin receptacle, right-angle
* other similar

J4, J5: (separated δ2 board option)

* 3M [D2516-5002-AR](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=3M_d2500_series_shrouded_header) 16P dual-row pin header, right angle, shrouded
* 3M [D89116-0131HK](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=3M_d89_series_IDC_socket) 16P dual-row IDC socket
* 3M [D3448-89116](https://www.amb.org/cgi-bin/ds.cgi?c=connectors_sockets&f=3M_d89_series_IDC_socket) strain relief
* 3M [3365/16](https://www.amb.org/cgi-bin/ds.cgi?c=wires_cables&f=3M_3365_series_ribbon_cable) 16P 0.05" ribbon cable
* other similar