

KrellClone KSA100 MkII BOM

[Mainboard components only]

P Watts 12/2006

Qty	Value	Part Number	Pin Spacing	Comments
2	1N914	D3, D4	12.5mm	
2	1N5309	D5, D6	12.5mm	Alt: J509
2	1N4754A	ZD1, ZD2	12.5mm	0.5W
2	BC546 / 2SC2240	Q1, Q2	TO-92	
2	BC556 / 2SA970	Q3, Q4	TO-92	
2	ZVN2110A / ZVN3310	Q5A, Q6A	TO-92	Choose either of A, B or C sets
2	ZVP2110A / ZVP3310	Q7A, Q8A	TO-92	
2	IRFD110	Q5B, Q6B	HD-1	Can be used in DIP-4 sockets
2	IRFD9110	Q7B, Q8B	HD-1	
2	ZVN2110G	Q5C, Q6C	SOT-223	SMD package
2	ZVP2110G	Q7C, Q8C	SOT-223	SMD package
1	MJE15030	Q13	TO-220	or MJE15032/15034
4	MJE15034	Q10, Q12, Q14, Q16	TO-220	
4	MJE15035	Q9, Q11, Q15, Q17	TO-220	
2	47R5	R30, R35	15mm	0.25W
4	75R	R38, R39, R40, R41	15mm	0.25W
4	150R	R3, R4, R5, R6	15mm	0.25W
1	825R	R16	15mm	0.25W
13	1k	R1, R11, R12, R22, R23, R24, R25, R26, R27, R28, R29, R31, R33	15mm	0.25W [R11, R12: 0.5W]
3	1k5	R32, R34, R36	15mm	0.25W
6	4k75	R7, R8, R9, R10, R20, R21	15mm	0.25W
1	7k5	R37	15mm	0.25W
2	12k1	R13, R14	15mm	0.5W
2	20k	R15, R19	15mm	0.25W
3	47k5	R2, R17, R18	15mm	0.25W [R17, R18: 0.5W]
2	5k	VR1, VR2	Bourns 0.1" inline/offset	
1	680pF	C1	5mm/7.5mm/10mm	Polystyrene/Mica/MKP
2	62pF	C5, C6	5mm/7.5mm/10mm	Polystyrene/Mica
1	20pF	Cx (parallel to R15)	N/A	Polystyrene/Mica, no pad on PCB provided
2	10uF	C8, C9	2mm	16V (Panasonic FC)
2	1000uF	C2, C3	5mm	16V (Elna / Panasonic FC)
2	100nF	C4, C7	5/7.5/10mm	MKP, C7 can be 0.1uF-1uF (Wima/Rifa)
1	2-pin terminal	J1	5mm	Power input conn
1	3-pin terminal	J2	5mm	Signal & ground conn

[OPTIONAL]

2	220uF	CP1, CP2	5mm	63V (Panasonic FC)
8	1000uF	CP3, CP4, CP5, CP6, CP7, CP8, CP9, CP10	7.5mm	63V (Panasonic FC)
4	1uF	CP11, CP12, CP13, CP14	25mm	Axial (Solen) MKP
4	100nF	CP15, CP16, CP17, CP18	5/7.5/10mm	63V MKP (Wima/Rifa)
3	2-pin Jumper	J3, J4, J5	2.5mm	J3 short out C4 J4 & J5 separate the power rails; can be replaced by 10R-47R resistors for improved front-end filtering
2	10k SMT	RLED1, RLED2	1206	
2	LED SMT	PWRLED1, PWRLED2	1206 / 1210	Indicates power on V+/V- rails

Additional comments:

- Most of the guidelines listed on the detailed KSA50 wiki apply to the KSA100 too.
- The original VN021/VP021 MOSFET's aren't available anymore. Provision has been made for four different packages of suitable replacements as listed. TO-92 is the most popular case type, but the HD-1 package has the advantage of being compatible with DIP-4 sockets and thus easy to remove/replace. The SOT-223 package is SMD and not hard to solder, but once its tab has been soldered it will be difficult to remove without damaging either it or the board. It has the best heatsinking ability though due to the large amount of plated vias placed underneath its PCB pads. It's recommended to initially just solder the three pins and leave the tab for when everything's working. Although it's connected to the drain, electrical contact isn't required for proper operation.
- ZD1&ZD2 should ideally be matched, since zeners have large tolerances. Match at the operating current level.
- Q1-Q4 should ideally be matched, and at the correct bias current. The 2SA/2SC types specified are the same as in the original, but the BC ones will do just as well or perhaps even better. When using fast output transistors, slow types such as MPS/MPSA should be avoided.
- Q1-Q4 should be mounted back-to-back and preferably coupled with a layer of thermal grease and kept together with a piece of heatshrink as shroud. This will improve thermal tracking.
- The transistor types used for Q13-Q17 will affect the bias and thus value of VR2, and should be kept in mind if experimenting with different gain types.
- Q13-Q17 should be mounted on the same heatsink, on the area provided. Care must be taken that their collectors aren't shorted out with proper isolation. The collective *idle* power dissipation is around 12W.
- Of the cascade transistors, only Q9&Q10 may benefit from a small heatsink. Its Q11&Q11 partners dissipate significantly less power.
- The original output transistors used were MJ15003/15004. The newer MJ21194/21193's are a drop-in replacement. More modern plastic transistors e.g. MJL32821/1302 are faster, but requires more attention to wiring. Long wires running to the transistors can lead to instability.
- Matching the output transistors at the intended bias level can prove beneficial but is generally not required. Matching D5 and D6 will not do any harm either.
- Power can be applied to either the pads provided at the top such as on the original, or at the 3-pin connector J1 at the bottom.

- J4&J5 connect the front-end power to the drivers' and should be used or hardwired when a single power supply is used to power everything. If the CPx capacitors are installed, J4&J5 can be replaced with 0.5W resistors between 0R and 47R, with power applied to the driver side. This will form an RC filter to improve the front-end's power quality. Increased resistance will improve filtering, but increase the front-end voltage drop.
- If separate power supplies are used, J4&J5 should be open-circuit, with the front-end powered at J1 and the drivers by the open pad at the top.
- J3 can be used to short out C4 and thus remove it and the 1000uF electrolytics from the signal path. This should be done with care as it will turn the amp into a fully DC-coupled design, especially if the preamp is DC-coupled too. A sensitive and fast-acting DC-sensing circuit or DC servo may be necessary and is highly recommended. Experiment with this jumper with caution.
- Refer to the KSA50 wiki for proper grounding principles.
- C8, C9 and all the CPx caps were absent on the original. Since they're fairly cheap they are recommended though. Not all are needed; provision was merely made for flexibility.
- Note that the CPx decoupling capacitors, particularly the large-value electrolytics, are likely to introduce turn-on thump on the speakers. Although this is generally harmless, a delay or DC sensing circuit on the speaker outputs may be beneficial. If no CPx capacitors are used, there should be no/little turn-on thump due to the resistive current sources.
- If a regulated supply is used for the front-end and/or drivers, the power-on sequence is important. The sequence should be output, driver, front-end, or thump is surely to result. Longer time constants may do the trick, but properly delayed sequencing is recommended. This method will reduce/eliminate turn-on thump AND be friendlier to the amp itself compared to the DC sensing circuit, but the latter will provide steady-state protection as well. With ingenuity, these circuits can be combined and minimized.
- The power diodes between output and the respective power rails are not necessary for operation and may be omitted in most cases. They provide limited protection for when the rails drop below the output amplitude.
- On the Mk1, there was no protection circuitry. Soft-start was merely a thermister in series with the incoming AC Live. This provided limited inrush protection, especially if powered up when still warm, and dissipated some power itself. The Mk2 had a DC sensing circuit with a relay in series with the speaker outputs, as well as a resistor in series with the AC Live that is shorted out with a power relay a brief moment after powerup.
- The original bias to provide 100W class-A into 8ohms is 5A; or 620mA per transistor if 4 pairs are used. Many people have reported that dropping the bias to 580mA or even much lower has no effect on the sound, and reduces power dissipation and heatsink size/fan speed. The speaker impedance will influence the optimal bias level, but generally

speaking a speaker of 4ohms nominal or higher with little deviation and phase shift will be happy with <100W reduced bias. Reduced bias can even improve quality as it reduces strain on the transformers and supply capacitors, and subsequently reduce ripple in particular on smaller supplies.

- If forced-cooling are used, AC fans are highly recommended. Even with separate supplies and regulation, DC fans are likely to inject motor noise. PWM DC control over fan speed is even worse.
- Krell used Dale resistors throughout; 0.5W for all the ones depicted here, 5W for the emitter resistors, snubber and earth/ground separation.
- The earth/ground separation was merely a 10R resistor running from each channel's ground connection at the PSU caps' bus bar to the chassis, which was in turn connected to earth (safety) ground.
- The snubber (zobel) RC filter on the output should be placed as close to the output as possible, preferably on the speaker terminals itself. The values used on the original were 100nF and 5R6. A film cap with 100V+ rating should be used along with a non-inductive resistor.
- C1 was an ERO MKP. It should be noted that Krell used ERO MKP's throughout almost all their products including the very recent designs. Rather mid-level cap.
- C4 & C7 were axial Roederstein film types.
- C5, C6 and Cx were silvered mica types.
- Cx has no provision on the board, but is recommended. It wasn't included on the schematic itself, but is present on the actual Mk2 boards. It will improve stability for driving reactive loads.
- The electrolytics' pad sizes provided for were based on those from the Panasonic FC series, but most other brands of the same value will have compatible packages.
- C2 & C3 were Roederstein electrolytics in a plastic case. A single 470uF bipolar cap e.g. Black Gate N or NX can be used instead, but the value can be higher (but not much lower or bass response may suffer). Although boutique caps aren't a necessity, a proper low-ESL electrolytic of at least a reputable brand name is recommended. Panasonic FC and Elna Cerafine are good choices and not very expensive. Low-ESR isn't necessary, but since these are often higher overall quality may offer good performance.
- C4 should be a quality cap with good high-frequency response. MKP box-types are recommended – MKT will also work but is not as good. Avoid ceramics, unless absolutely necessary and of a quality series such as NPO or COG.
- For C7 the quality need not be as high.
- VR1 and VR2 should ideally be a 10-turn type. 25-turn is overkill and just an annoyance when making large adjustments.