agdr Desktop Headphone Amplifier
6/1/2013 - Bill Of Materials (BOM)
Goes with ODA 13 80x160 #39

part	function	part number	qty	mfgr	mfgr #	Each	TTL - basic amo	TTL - case, PCB, adaster	ootional	Mouser	Digikey	Allied	Farnell UK / Element14 / Newark	RS	Notes
JACKS, SWITCHES, HEADERS, AND WIRE JUMPERS															
3.5mm stereo jack, vertical, PC mount, with switch	Input signal jack	J2	1	Switchcraft	35RAPC4BVB	$2.24	$2.24			502-35RAPC4BVB	SC1661-ND	70214417	2154523 / 99P9809	398AP2BV4	
3.5mm stereo jack, vertical, PC mount, without switch	Output 3.5mm headphone jack	J4	1	Switchcraft	35RAPC2BVB	$3.55	$3.55			502-35RAPC2BV4	SC1460-ND		2660562 / 2780344		
1/4" slim stereo jack, no switch	Output 1/4" headphone jack	J6	1	Neutrik	NRJ6HF-1	$0.55	$0.55			568-NRJ6HF-1					
Dual RCA jack, vertical mount	Rear signal input jacks, pre-amp output jacks	J1, J5	2	Robiconn	161-4210-E	$0.69	$1.38			161-4219-E					
DC power jack, 2.1mm center pin 5.5mm outer. PCB mount	Power input jack	J3	1	Switchcraft	RAPC722X	$1.26	$1.26			502-RAPC722X	SC1313-ND	70214249	1638727 / 495C7786	RAPC722X	Alt Kokiosnm 163-7630E-E Alt Switchcraft PJRAS1X2S01AUX. Panel mount or on upper accessory PCB.
Optional upper PCB dual RCA jack, horizontal mount	Input or pre-amp output	optional	1	Kezon	KLP42X-60S-W/R	$1.93			$1.93	806-KLP42X-60S-W/R	SC1856-ND				
Rotary switch. DP4T	Gain selector	S5	1	Alpha	SR1003DF-0204-20FBB-C7-N	$5.86	$5.86			105-SR1003DF-24NS					
DPDT toggle switch, vertcle toggle	Power on/off	S1	1	Mountain Switch	108-3MD1T2BM4QTQE-EVX	$3.65	$3.65			108-3MD1T2BM4QTQE-EVX					
DPDT pushbutton switch	Voltage selector, Input jack selector	S2, S4	2	C&K	PN22LFNA03QE	$1.61	$3.22			611-PN22LFNA03QE					
Optional panel mount DPDT rotary for damping factor switch. 0.5inch	Output damping selector	optional	1	C&K	MR00LLN2QD	$13.21			$13.21	611-MR00LLN2QD					
1 pin test point	pre-regulator voltage test & gain stage output test loponts	JP8, JP9 JP10, JP11	4												
2 pin header - optional	Rear input signal, signal select switch. bass boost switch	JP1, JP2, JP3, JP5, JP6, JP7	6												Header is optional. wires can just go in holes
3 pin header - optional	Pre-amp feed. Output	JP14, JP15, JP16	3												Header is optional, wires can just go in holes
4 pin square header - optional	Power rails and around test pt	JP4, JP12, JP13	3												
6mm jumper wire - use 22 awuie insulated wire		JP52, JP64	2												
5mm jumper wire - use 22 awuie insulated wire		JP61	2												
7mm jumper wire - use 22 awuie insulated wire		JP63	2												
10mm jumper wire - use 22 awuie insulated wire		JP55	1												
12mm jumper wire - use 22 awuie insulated wire		JP66	1												
If damping resistors not being used, use 22 awuie uninsulated wire		R70, R71	2												See build instructions. Can use 1R. 50R. 20R. 120R. etc. for damp.
Subtotal for this section							**$21.71**		**$15.14**						
IC, TRANSISTOR															
Op amp, single, ultra low-noise ultra low-distortion, SOIC-8	Gain stage	IC1, IC2	2	Texas Instruments	LME49990MA/NOPB	$2.58	$5.16			926-LME49990MA/NOPB	LME49990MA-5/NOPB-ND		1800191	793-6233	Also fits: OPA627AU and OPA827AID (FET input)
Op amp. dual low noise low distortion audio. SOIC-8	Pre-amp out buffer/amp	IC6	1	Texas Instruments	LME49720MA/NOPB	$2.67	$2.67			926-LME49720MA/NOPB					
Op amp. dual high current. SIP-8	Output current buffer	IC9, IC12 IC14 IC15	4	New Japan Radio	NJM4556AS	$0.67	$4.02			513-NJM4556AS					Also at onlinecomponents.com
Op amp, quad FET input, SOIC-14	Clipping comparator	IC5	1	Texas Instruments	TL064BCDR	$0.70			$0.35	595-TL064BCDR	TL064BCDR		/ 79C9088		
Positive low-noise LDO voltage regulator	Positive volt reg LDO	IC6	1	Linear Technology	LT1963AES8#PBF	$4.52	$4.52				LT1963AES8#PBF-ND		1273827 / 57M7479	6808053	
Positive voltage regulator. TO-220. 1.5A	Positive volt pre-reg	IC3	1	ON Semiconductor	LM317TG	$0.54	$0.54			863-LM317TG	LM317T5OS-ND				
Negative low-noise LDO voltage regulator	Negative volt reg LDO	IC7	1	Linear Technology	LT3015ITH#PBF	$7.36	$7.36				LT3015ITH#PBF-ND		5975805 / 2066751		
Negative voltage regulator. TO-220. 1.5A	Negative volt pre-reg	IC4	1	ON Semiconductor	LM337TG	$0.54	$0.54			863-LM337TG	LM337T5OS-ND				
Positive fixed 24V 100mA voltage regulator	Relay power volt regulator	IC13	1	ON Semiconductor	MC78L24ACPG	$0.37	$0.37			863-MC78L24ACPGOS-ND	MC78L24ACPGOS-ND		1652347 / 451422	5164795	
NPN transistor, Vceo=40V, Ic=200mA, hfe~100	Clipping indicator	Q1	1	Fairchild	2N3904BU	$0.10			$0.10	512-2N3904BU	2N3904FS-ND				Any 2N3904
n-ch enhancement mosfet. 60V. 300mA. 5 ohm. +/-20Vgs or greater	Relay control	Q2 . Q3	2	Fairchild	2N7000	$0.11	$0.22			512-2N7000	2N7000FS-ND	70214748	9845178 / 588S650	6714733	Alt: 512-2N7000. Any 2N7000 with Vds = 20Vdc or greater
Subtotal for this section							**$25.40**		**$0.80**						
DIODE, LED															
1A rectifier diode, std recovery, 200V, DO-41 case, Vf~1.1V, Ir=5uA	vreg protect, relay coil suppression	D5, D4, D5, D6 D13	5	Vishay	1N4003GP-E3/54	$0.11	$0.55			625-1N4003GP-E3/54	1N4003GP-E3/54GITR-ND	70217645	1576108 / 35C0674	7596676	1N4001 from anyone.
2A rectifier diode, std recovery, 600V, DO-15 case, Vf~1V, Ir~5uA	Power rectifiers	D1. D2	2	Taiwan Semiconductor	2A05	$0.14	$0.28			821-2A05					2A04
Zener diode. 24Vdc. 5%. 1W. DO-41. Izt = 10.5mA	Relay coil suppression	D14	1	Fairchild	1N4749A	$0.14	$0.14			512-1N4749A	1N4749AFS-ND		1467579 / 18C8965		18Vdc - 24Vdc 1W zener
Schottky rectifier diode, 1A, 40V	Rail clamps	D11. D12	2	ST Micro	1N5819	$0.12	$0.24			511-1N5819					
Schottky diode, 0.1A, 100V	Clipping indicator diode logic	ST-D10	4	ST Micro	BAT41	$0.13			$0.52	511-BAT41					
LED, ultrabright, indicator, green, PCB right angle mount	Power good indicators	LED4, LED5	2	Everlight	MV5464MP4B	$0.30	$0.78			638-MV5464-MP4B	1080-1114-ND				Arrow and Future Electronics also have stock
LED, ultrabright, indicator, red, PCB right angle mount	Clipping indicator	LED3	1	Everlight	MV5764MP4B	$0.31			$0.31	638-MV5764-MP4B					
LED, blue, 1206 SMD, 40mcd@20mA, 130 degrees	Clipping window reference	LED1, LED2	2	Everlight	EL-15-21/BHC-AN1P2/2T	$0.27			$0.54	638-1528HC-AN1P22T					
Subtotal for this section							**$1.99**		**$1.37**						
RELAYS AND INDUCTORS															
Relay, small signal DPDT. 2 form C. 24V 8.3mA coil. 1A contact	Headphone protection	K1	1	Omron	G6A-234P-ST-US-DC24	$4.18	$4.18			653-G6A-234P-DC24	Z107-ND	70176188 / 36K1944		6278451	
Power inductors, 50uH, 2.8A, vertical	CLC filter	L1, L2	2	Bourns	6100-470K-RC	$0.63	$1.26			652-6100-470K-RC					
Subtotal for this section							**$5.44**								
CHASS, PCB, AC ADAPTER															
Aluminum chassis in black 1.77Hx6.27Wx3.15L inch. w/o ship	Case		1	Box Enclosures	B4-DBOBL	$18.50		$18.50				70920265	9307400 / 2069063		Other colors available. Use longer B4-160 with 2 PCB to hold DDAC
PCB. 80mm x 160mm. 2 layer. 1.6mm thick. 100% e-test. HASL. w/o ship	PC board		1	FreeEStudio		$14.00		$14.00							Use 2 PCB with B4-160 case to hold DDAC. Seeed studio ion.
AC Adapter, 115Vac. 24Vac out at 1000m. w/o ship (150mA per channel max)	AC Adapter - normal load		1	Triad	WAU24-1000	$11.95		$11.95		553-WAU24-1000		70218015	2137528 / 63M5191		20Vac output at 1amp or higher. 115Vac.
AC Adapter. 115Vac. 24Vac at 3.8A. w/o ship (for full ODA output current)	AC Adapter - full load		1	Triad	WAU28-1800	$29.00				553-WAU24-1800					For full 350mA per channel output current. Also WAU20-2000
Subtotal for this section								**$44.45**							
RESISTORS AND POTS															
Bourns pro audio 1K dual 9mm audio taper, 15mm shaft	volume pot	VR1	1	Bourns	PTD902-1015K-A102	$1.99	$1.99			652-PTD902-1015K-A103					Alt: PTD902-1015K-B102 (1K dual linear taper)
402K 0.1% 1/4W 1206 SMD - optional	Input bias ground return, clipping dct ref LED limit	R40, R41, R26	3	Vishay	RN732BTTD4022B25	$0.50			$1.50	660-RN732BTTD4022B25					Use with 10K ont
1.99K Ohm 0.1% 1/8W 1206 SMD 0.6mm H	Input bias ground return	R42, R41	2	KOA Speer	RN732BTTD1991B25	$0.50	$1.00			660-RN732BTTD1991B25					Use with 1K pot
16.9K Ohm 1/2W 1% Metal Film 1.9mm x 3.5mm	power-on LED current-limit	R47, R48	2	Vishay/BC	SFR16S0001692FR500	$0.20	$0.40			594-SFR16S0001692FR500	SFR16S0001692FR500	7012456			
0.5 Ohm 1/4W 1% Metal Film 2.29mm dia x 6.1mm L 150PPM/C, low current noise. mount vertically (horizontal	Output parallel balance	R51-R58, R60, R61, R64, R65	12	Vishay	CPF1R5000FUB14	$0.99	$11.88			71-CPF1-F-0.5					
274 ohm 1/4 Watt 1% metal film 1.85mm x 3.9mm	input RF filter	R3, R4	2	Vishay	SFR16S0002740FR50	$0.20	$0.40			594-SFR16S0002740FR50	SFR16S0002740FR50				
274 ohm 0.1% 1/8W thin film 1206 SMD 0.55mm H	input RF filter	R5. R6	2	Vishay	TNPW12062740BEEA	$0.55	$1.10			71-TNPW12062740BEEA					
0 ohm jumpers. 5%. 250mW thick film 1206 SMD 0.6 H	jumpers for input jack gnd. pre-amp jack around	J01. J02. R72	4	Yageo	RC1206JR-070RL	$0.20	$0.40			603-RC1206JR-070RL	RC1206JR-070RL	9240276 / 68R0297		6182249	
10K 1/8W 1% metal film 3.85 x 3.9mm 50PPM/C	Gain stage input gnd return	R16, R17	2	Xicon	270-10K-RC	$0.15	$0.30			270-10K-RC					
3.01K 0.1% 1/8W thin film SMD 1206 25 PPM/K 0.6H - optional	feedback w/ bass boost	R20-R23	4	Vishay	TNPW120630I0BEEN	$0.85			$3.40	71-TNPW120630I0BEEN					
1.5k 0.1% 130mW thin film SMD 1206 25 PPM/C 0.6mm H / high power	feedback w/o bass boost	R22. R23	2	IRC	PFC-W1206LF-03-1501-B	$1.03	$2.06			66-PFC12LF1.5K-B					Alt: TNPW120615K00BEEN Don't use less than 1/4W
1.5k 0.1% 130mW thin film SMD 1206 25 PPM/C 0.6mm H / high power	optional pre-amp feedback	R44, R46	2	IRC	PFC-W1206LF-03-1501-B	$1.03			$2.06	66-PFC12LF1.5K-B					Alt: TNPW120615K00BEEN Don't use less than 1/4W
15K ohm 0.1% 1/8W thin film SMD 1206 25PPM 0.6H	(1.5x gain). Clipping LED limit	R10. R15. R62	3	KOA Speer	RN732BTTD1502B25	$0.50	$1.50			660-RN732BTTD1502B25					
1.0K ohm 0.1% 130mW thin film SMD 1206 25PPM/C 0.6H / high power	(2.5x gain)	R9, R14	2	IRC	PFC-W1206LF-03-1001-B	$1.03	$2.06			66-PFC12LF1.0K-B					Alt: TNPW120610K00BEEN. don't use less than 1/4W
1.0K ohm 0.1% 130mW thin film SMD 1206 25PPM/C 0.6H / high power	Optional pre-amp 2.5x gain	R43, R45	2	IRC	PFC-W1206LF-03-1001-B	$1.03			$2.06	66-PFC12LF1.0K-B					Alt: TNPW120610K00BEEN. don't use less than 1/4W
499 ohm 0.1% 1/8W thin film 1206 SMD 250PM 0.6mm H	(4x gain)	R8. R12	4	KOA Speer	RN732BTTD4990B25	$0.50	$2.00			660-RN732BTTD4990B25					
301 ohm 0.1% 1/8W thin film 1206 SMD 250PM 0.6mm H	(6x gain)	R7. R11	4	KOA Speer	RN732BTTD3010B25	$0.50	$2.00			660-RN732BTTD3010B25					
110 Ohm 0.1% 1/8 watt thin film 1206 SMD	snubber	R13	1	KOA Speer	RN732BTTD1100B25	$0.50			$0.50	660-RN732BTTD1100B25	RN732BTTD1100B25				
249K 0.1% 250mW thin film 1206 SMD 0.55mm H. 25PPM/K	Volt pre-regulator set	R27. R28	2	Vishay	TNPW1206249KBEEA	$0.55	$1.10			71-TNPW1206249KBEEA	TNPW1206249KBEEA		1698668 / 84R1923		Alt: RNT32BTTD2490B25
5.40k 0.1% 250mW thin film 1206 SMD 0.55mm H. 25PPM/K	Volt pre-regulator set, LDO -7v	R24, R25	2	Vishay	TNPW120654K0BEEN	$0.85	$1.70			71-TNPW120654K0BEEN					Alt: W1206R0334K01B-R1
15.8k 0.1% 1/8W thin film SMD 1206 25 PPM/C 0.6H	Voltage LDO regulator set	R13, R14	2	KOA Speer	RN732BTTD1582B25	$0.50	$1.00			660-RN732BTTD1582B25					
2.36k 0.1% 250mW thin film SMD 1206 25 PPM/K 0.55 H	Voltage LDO regulator set 16v	R17	1	KOA Speer	RN732BTTD2361B25	$0.50	$0.50			660-RN732BTTD2361B25					
2.15k 0.1% 250mW thin film SMD 1206 25 PPM/K 0.55 H	Voltage LDO regulator set 16v	R37	1	KOA Speer	RN732BTTD2151B25	$0.50	$0.50			660-RN732BTTD2151B25					
3.32k 0.1% 250mW thin film SMD 1206 25 PPM/K 0.55 H	Voltage LDO regulator set 7v	R11	1	Vishay	TNPW120633K0BEEN	$0.85	$0.85			71-TNPW120633K0BEEN					Alt: ERA-8AEB332V
3.32k 0.1% 1/8W thin film SMD 1206 25 PPM/K 0.6H	Voltage LDO regulator set 7v	R32	1	KOA Speer	RN732BTTD3321B25	$0.50	$0.50			660-RN732BTTD3321B25					Alt: TNPW120633K32BEEN
1K 0.1% 1/4W metal film 2.29mm dia x 6.1mm L low current noise	Attentuation	R29, R30	2	Vishay	CMF551K0000BHEB	$1.17			$2.34	71-CMF551K0000BHEB					Use 10K w/ 10K pot, adjust for desired attenuation
274k 1% 1/8W metal film 1.85mm x 3.5mm 50 ppm	Relay delay circuit	R61, R67	2	Xicon	270-274K-RC	$0.15	$0.30			270-274K-RC					Alt: CCF502749FKR36
0.51 Ohm (510mohm) 1% 2W thick film 2512 SMD	OLC O reduction	R18, R19	2	Bourns	CRM2512JR51DELF	$0.19	$0.38			652-CRM2512JR51DELF					Alt: RCWE2512R510FKEA
100k 1% 1/8W metal film 1.85mm x 3.5mm 50 ppm	Clipping detect dct. relay ckt	R38, R62	2	Xicon	270-100K-RC	$0.15			$0.15	270-100K-RC	CMF100KQA-ND	70205723	03M2669 / 1536328		Alt: MFS1/4DC7129100JF, CMF50100K00FHEK
100k 1% 1/4W thick film 1206 SMD 0.55mm H		R66	1	Vishay / Dale	CRCW1206100KFKEA	$0.10	$0.10			71-CRCW1206-100K-E3		70031267	1469975 / 24W3980	8791567	Alt: RK73H2BTTD0100F
24.9k 1% 1/8W metal film 1.85 x 3.5mm	Relay ckt vreg load	R59	1	Xicon	270-24.9K-RC	$0.15	$0.15			270-24.9K-RC					
22k 1% 1/4W metal film 1.85mm x 3.5mm	Clipping detect circuit	R39	1	Xicon	270-22K-RC	$0.15			$0.15	270-22K-RC					Alt: MFR-12FTF52-22K
2.2k 1% 1/4W metal film 1.85mm x 3.5mm	Clipping detect circuit	R35	1	Xicon	270-2.2K-RC	$0.15			$0.15	270-2.2K-RC					Alt: MFS1/4DC7282201F
20R 0.1% 1/8W thin film SMD 1206 25 PPM/K 0.6H	Output loop cap decouple	R49, R50	2	KOA Speer	RN732BTTD20R0B25	$0.50	$1.00			660-RN732BTTD20R0B25					
See build instructions, jumper with wires if not being used	Damping factor resistors	R70, R71	2												OR (turnover). 1R. 5R. 10R. 20R. 80R. 100R. 120R. etc. See build instr.
200R 1% 2W metal film 3.68mm dia x 8.74mm L	Rebel network	R68. R69	2	Vishay / Dale	CMF220R000FHE14	$0.49			$0.98	71-CMF220R000FHE14	F20W-2BK-ND	70205173	1277013 / 41K8853		
Subtotal for this section							**$34.17**		**$12.31**						
CAPACITORS															
220pF 5% 100V MLCC COG / NPO L5 2.54mm.	Compensation. RF filters	C3, C4, C6, C7, C16, C17	6	Kemet	C315C221J1G5TA	$0.37	$2.22			80-C315C221J1G			1457636		
220pF 5% 100V MLCC COG / NPO L5 2.54mm.	Optional pre-amp compensation	C45. C46	2	Kemet	C315C221J1G5TA	$0.37			$0.74	80-C315C221J1G			1457636		
4.7uF 63Vdc/40Vac 10% 5mm L5 7.2mm wide x 8.5mm thick x 14mm film	Middle cousoline	C9-C13, C35-C39, C41	12	Wima	MKS2C044701M00JSSD	$4.33	$51.96		$41.90	505-MKS24.7/63/5					2 with 40.2K resistor. 12 with 4.9k resistor.
0.1uF 5% 50V MLCC COG (NPO) 2.5mm L5 3.5mm t x 5.5mm w	LDO vreg feedforward, relay vreg bypass	C25, C26, C52	3	TDK	FK16C0G1H104J	$0.63	$1.89			810-FK16C0G1H104J					
0.1uF 5% 50V MLCC COG (NPO) 2.5mm L5 3.5mm t x 5.5mm w	Bass Boost	C18, C19	2	TDK	FK16C0G1H104J	$0.63			$1.26	810-FK16C0G1H104J					
100uF 25v Low ESR organic polymer 10mm dia x 25 mm high 5.0 mm L5	Power Rail Bypass	C43, C44, C50, C51	4	United Chemi-Con	APSO250ELL101MB5S	$3.12	$12.48			661-APSO250ELL101MB5S			1818631	715-2669	
22uF 20v Low ESR organic polymer 6.3mm dia x 6 mm high 2.5 mm L5	Power Rail Bypass	C55, C51	2	Nichicon	PLF1D220MCL2	$1.42	$2.84			647-PLF1D220MCL2					
1000uF 20%, 50V, low impedance aluminum electrolytic, 16mm dia, 25mm tall, 1600mA ripple@90Hz. L5 7.5mm	Main filter caps	C10, C11	2	Nichicon	UHD1H102MHD1TN	$1.20	$2.40			647-UHD1H102MHD1TN					
820uF 20% 50V low impedance aluminum electrolytic, 12.5mm dia, 30mm tall, 1500mA rms ripple@90Hz. L5 5mm. 105C. 10.000 hour	Main filter cases	C14, C15	2	United Chemi-Con	ESPA500EL821MK30S	$1.42	$2.84			661-ESPA500EL821MK3					
4.7uF 50V 20%. MLCC X7R. 43mm wide 7.5mm long. 8.0 mm tall. 5mm L5	Relay time delay	C53	1	TDK	FK23X7R1H475K	$1.83	$1.83			810-FK23X7R1H475K	445-8482-ND				Alt: C4ZJC475K5HK5TA. aov 4.7uF 50V X7R MLCC that fits
0.22uF 50V 10% stacked film	Gain & Output Decoupling	C12, C13, C22, C47-C49, C54,C59, C62	11	Epcos	B32529C224K	$0.14	$1.82			871-B32529C224K					
100pF 100V MLCC 20% COG/NPO X2Y EMI filter 0805 SMD	EMI filters, cell phone	C1, C2, C65	3	Johanson Dielectrics	101X15N101MV4E	$0.72			$2.16		709-1338-1-ND				Also in stock at Arrow and Vertical
0.01 100V MLCC 20% COG/NPO X2Y EMI filter 0805 SMD use if no C7	EMI filters + snubber	C5	1	Syfer	1206Y0001031MXTE03	$2.01			$2.01	843-1206Y0001031MX3					
0.01uF 630V 5% MLCC COG/NPO 1206 SMD - use if no C4	Snubber	C8	1	TDK	C0A5L4O5O3I03U	$0.27			$0.27	810-C0A5L4O5O3I03U					Use only if C4 is not installed
0.068uF 100V 10% MLCC X7R 1206 SMD	Snubber	C9	1	Murata	GRM31MR72A683KA01L	$0.14			$0.14	81-GRM31MR72A683KA1L	GRM31MR72A683KA01L				
0.22uF 50% 50Vdc MLCC X7R 5mm L5	Clipping detect circuit	C27	1	Murata	RDER71H224K1M1C03A	$0.35			$0.35	81-RDER71H224K1M1C03					
10uF 25V 20%. aluminum electrolytic. 2mm L5. 5mm dia. 7mm lame	Clipping detect circuit	C42	1	Nichicon	UST1E100MDD1TE	$0.27			$0.27	647-UST1E100MDD1TE					
10uF 10% 35V solid tantalum 2.5mm L5 6mm dia, ESR 2 ohms	Vreg caps	C20. C21. C23. C24	4	AVX	TAP106K035SCS	$1.42	$5.68			581-TAP106K035SCS	478-1842-ND	70195938	1650974 / 19C6247		
0.001uF 5% 50V COG / NPO axial MLCC. 2.54mm dia x 4.32mm L - optional	Film & electro can RF bypass	C45, C46	10	AVX	SA105A102JAR	$0.38			$3.80	581-SA105A102JAR					optional bypassing. wire across cap leads on back of PCB
0.001uF 5% 100V COG / NPO MLCC 1206 0.85mm H - optional	Film & electro can RF bypass	C14, C40	2	Murata	GRM1195C2A102JA01D	$0.20			$0.40	81-GRM1195C2A102JA1D					optional bypassing
0.056uF 5% 63Vdc 40Vac MKT stacked film 5mm L5	Rebel network	C63, C64	2	Epcos	B32529C563J	$0.11			$0.22	871-B32529C563J					
Subtotal for this section							**$85.96**		**$50.50**						
GRAND TOTAL							**$174.87**	**$44.45**	**$80.12**						