Lyontek Inc.

LY8366F

Rev. 1.3

30Wx2(BTLx2) Stereo / 11Wx2(SE)+37Wx1(BTL) 2.1CH / 16Wx4(SEx4) / 70Wx1(PBTL) Mono Class D Audio Amplifier

FEATURES

- 12.0V ~ 26.0V power supply.
- Single-Ended analog inputs.
- High output power capability:

(Test @1KHz,THD+N=10%.25℃)

Load	Without heat-sink	
	4Ω	**8Ω**
SEx4	7Wx4/14.4V	4Wx4/14.4V
	11Wx4/18V	10Wx4/24V
BTLx2	24Wx2/14.4V	14Wx2/14.4V
	--	22Wx2/18V
2.1CH	7Wx2+24W/4Ω/14.4V	

Load	Without heat-sink	
	2Ω	**4Ω**
PBTLx1	40Wx1/14.4V	26Wx1/14.4V

Load	With heat-sink	
	4Ω	**8Ω**
SEx4	16Wx4/22V	10Wx4/24V
BTLx2	30Wx2/16V	32Wx2/22V
2.1CH	11Wx2+37W/4Ω/18V	

Load	With heat-sink	
	2Ω	**4Ω**
PBTLx1	60Wx1/18V	70Wx1/24V

- 4 kinds of output type options:
  4xSE、2.1CH、2xBTL、1xPBTL.
- Include High/Low pass filter OP.
- DC volume control with 32 steps.
- Over-Heat protection with automatic recovery.
- Under-voltage and Over-voltage detection.
- Short protection with automatic recovery.
- Mute function selectable.
- Lead free and green package available.
  (RoHS Compliant)
- Space saving package :
  48-pin LQFP 7*7 package.

GENERAL DESCRIPTION

The LY8366F is a high efficiency class D audio power amplifier with DC volume control. It can to work either in dual bridge or quad single-ended output、2.1 channel and PBTL mono application configuration.

The device features a low noise and a low power consumption in shutdown mode and support thermal shutdown protection. It also utilizes circuitry to reduce low noise during device turn-on.

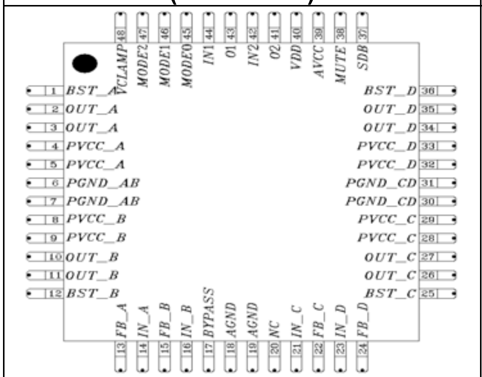
The outputs are also fully protected against faults with short-circuit protection (output-to-output pin、output pin to VDD and output pin to GND) and thermal protection as well as over-voltage, under-voltage. The short-circuit protection and thermal protection include an auto-recovery feature.

APPLICATION

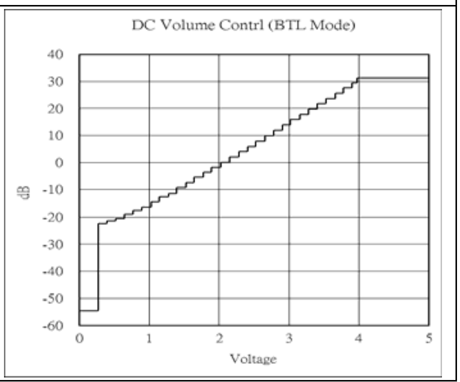
- After-market automotive audio.
- Sound-bar home theater.
- Powered speakers.
- Music instrument devices.
- Multimedia TFT LCD TVs.
- System configurations require reduction in heat from the audio power amplifier.

PIN CONFIGURATION

LY8366F LQFP48 pin configuration (TOP VIEW)



DC Volume Control



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TEL: 886-3-6668838
FAX: 886-3-6668836

PIN DESCRIPTION

SYMBOL	Pin No.	DESCRIPTION
BST_A	1	Bootstrap I/O for A channel.
OUT_A	2/3	Speaker output for A channel.(SE Mode=VOUT+) (BTL Mode=Left channel VOUT+)
PVCC	4/5/8/9/28/29/32/33	Power supply of A、B、C、D channel.
PGND	6/7/30/31	Ground of A、B、C、D channel.
OUT_B	10/11	Speaker output for B channel. (SE Mode=VOUT+) (BTL Mode=Left channel VOUT-)
BST_B	12	Bootstrap I/O for B channel.
FB_A	13	A-Channel Feedback. Connect feedback resistor between FB_A and IN_A to set amplifier gain.
IN_A	14	Input of A channel.
FB_B	15	B-Channel Feedback. Connect feedback resistor between FB_B and IN_B to set amplifier gain.
IN_B	16	Input of B channel.
BYPASS	17	Bypass pin.
AGND	18/19	Analog GND.
DCV	20	DC volume control.
IN_C	21	Input of C channel.
FB_C	22	C-Channel Feedback. Connect feedback resistor between FB_C and IN_C to set amplifier gain.
IN_D	23	Input of D channel.
FB_D	24	D-Channel Feedback. Connect feedback resistor between FB_D and IN_D to set amplifier gain.
BST_C	25	Bootstrap I/O for C channel.
OUT_C	26/27	Speaker output for C channel. (SE Mode=VOUT+) (BTL Mode=Right channel VOUT+)
OUT_D	34/35	Speaker output for D channel. (SE Mode=VOUT+) (BTL Mode=Left channel VOUT-)
BST_D	36	Bootstrap I/O for D channel.
SDB	37	Shutdown control pin.(when **LOW** level in shutdown mode).
MUTE	38	Mute signal for quick enable/disable of output. (when **High** level in mute mode).
AVCC	39	Analog Power supply.
VDD	40	Regulator output terminal.(with external capacitor)
O2	41	Pure OP Output 2.
IN2	42	Pure OP Negative input 2.
O1	43	Pure OP Output 1.
IN1	44	Pure OP Negative input 1
Mode 0/1/2	45/46/47	Output mode selectable.
VCLAMP	48	Internally generated voltage power supply for all channel bootstrap capacitors.

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ORDERING INFORMATION

Ordering Code	Packing Type	Speaker Channels	Pin/ Package	Output Power (THD+N=10%) *3	Input Type	Output Type
LY8366F	Tray	Multi channel	LQFP48	**Without heat-sink** 7Wx4/**4Ω/SE** @14.4V, 4Wx4/**8Ω/SE** @14.4V, 11Wx4/**4Ω/SE** @18V, 10Wx4/**8Ω/SE** @24V, 24Wx2/**4Ω/BTL** @14.4V, 14Wx2/**8Ω/BTL** @14.4V, 22Wx2/**8Ω/BTL** @18V, 7Wx2+24W/**4Ω/2.1CH** @14.4V, **With heat-sink** 16Wx4/**4Ω/SE** @22V, 10Wx4/**8Ω/SE** @24V, 30Wx2/**4Ω/BTL** @16V, 32Wx2/**8Ω/BTL** @22V, 11Wx2+37W/**4Ω/2.1CH** @18V,	SE	4xSE, 2xBTL, 2.1CH (SEx2+ BTLx1)

(*3) The device must be mounted to the PCB board and increase a large area of copper or recommended to use external heat sink.
But when total output power ≧40W, the device must be use external heat sink.

DEMO BOARD ORDERING INFORMATION

Demo Board Ordering Code		Pin/ Package	Input Type	Speaker Output Channels	Notes
LY8366F-DB1(FB)	Feedback	LQFP48	SE	PBTL mode (Mono)	
LY8366F-DB1(DC)	DC volume control				
LY8366F-DB2(FB)	Feedback			BTLx2 mode (Stereo)	
LY8366F-DB2(DC)	DC volume control				
LY8366F-DB3(FB)	Feedback			2.1CH mode (SEx2+BTLx1)	
LY8366F-DB3(DC)	DC volume control				
LY8366F-DB4(FB)	Feedback			SEx4 mode	
LY8366F-DB4(DC)	DC volume control				

TYPICAL APPLICATION CIRCUIT (With FB Mode)

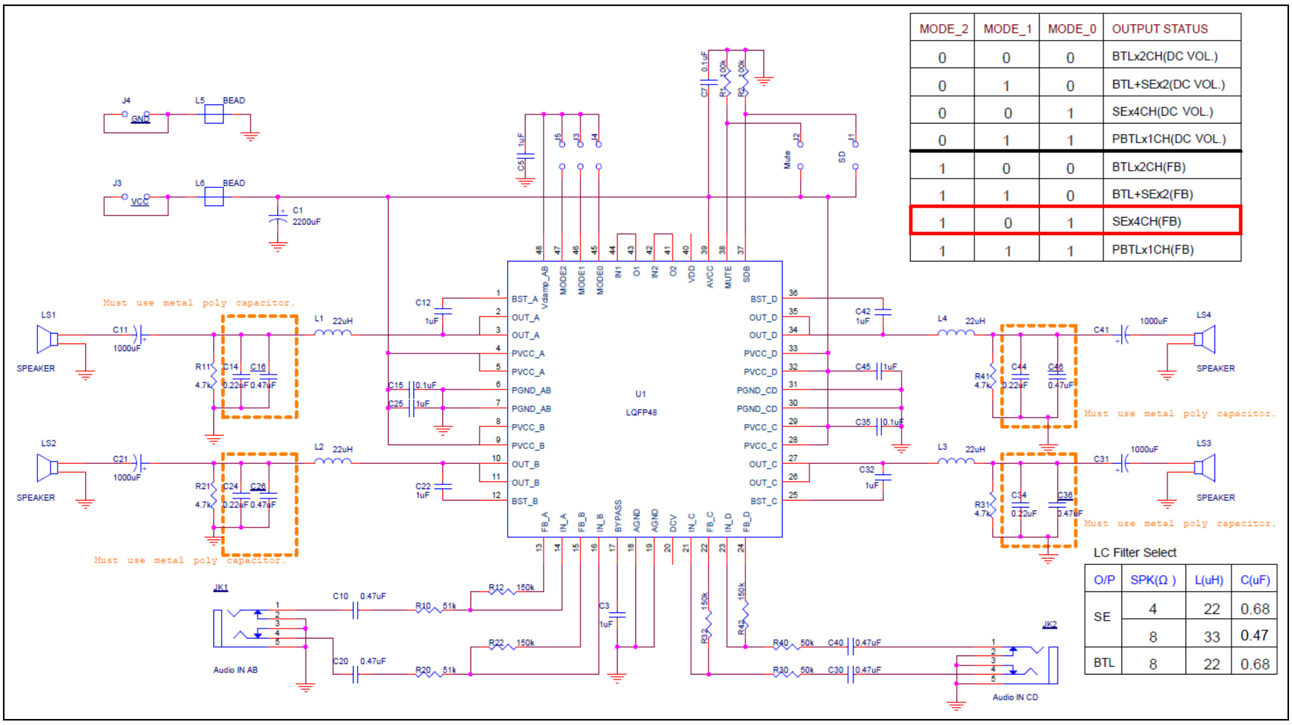


Figure 1. LY8366F Application Circuit **(SEx4 with FB Mode)**

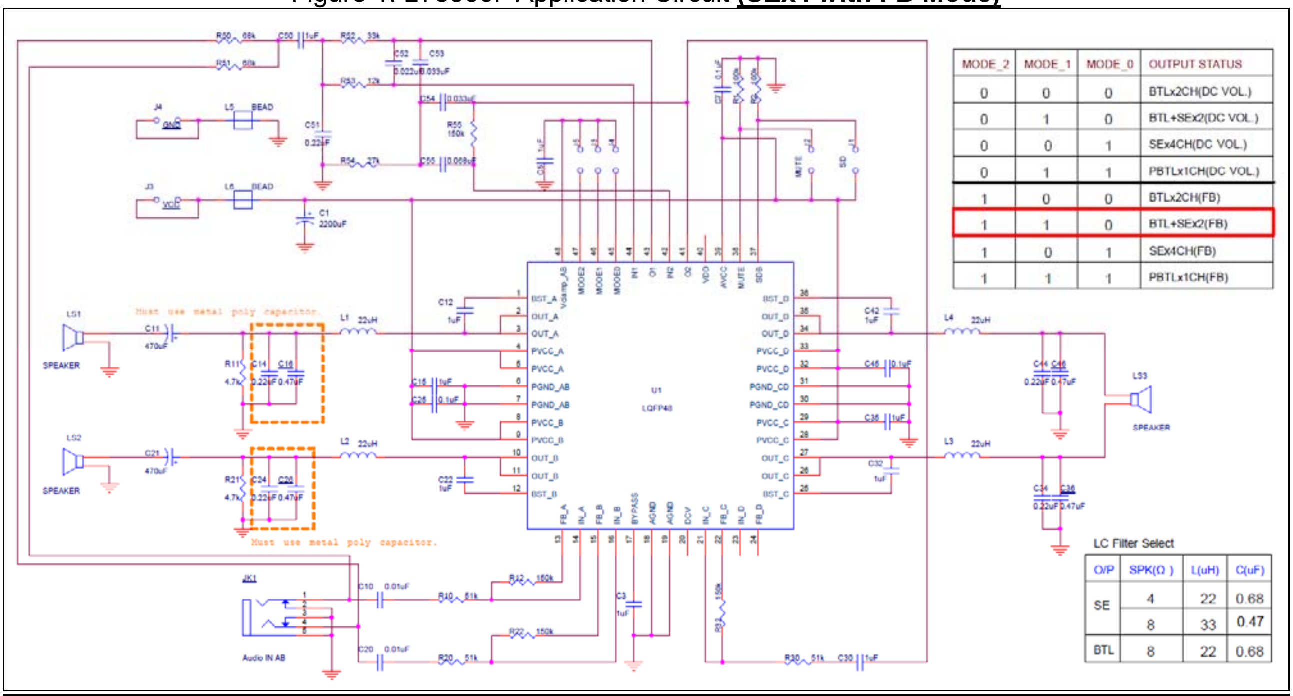
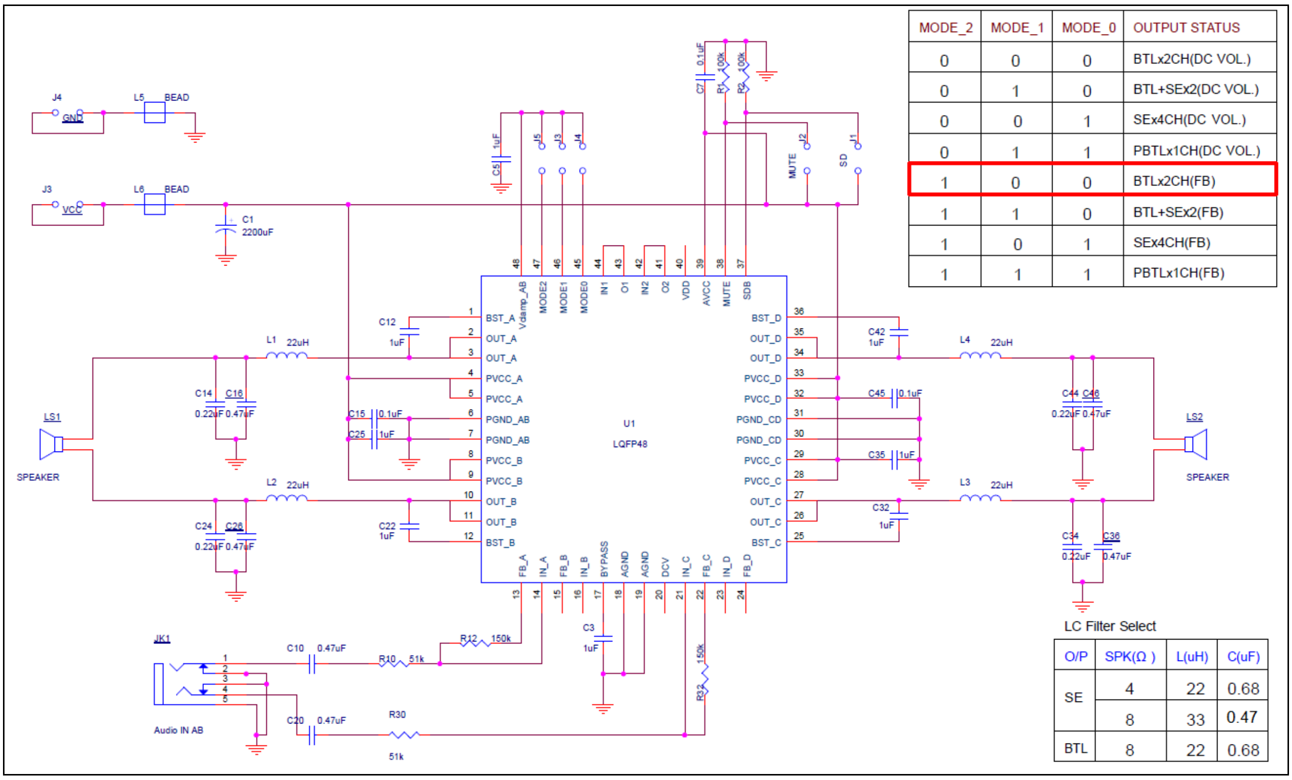


Figure 2. LY8366F Application Circuit **(SEx2 +BTLx1(2.1CH) with FB Mode)**

(*3) The device must be mounted to the PCB board and increase a large area of copper or recommended to use external heat sink. But when total output power ≧40W, the device must be use external heat sink.

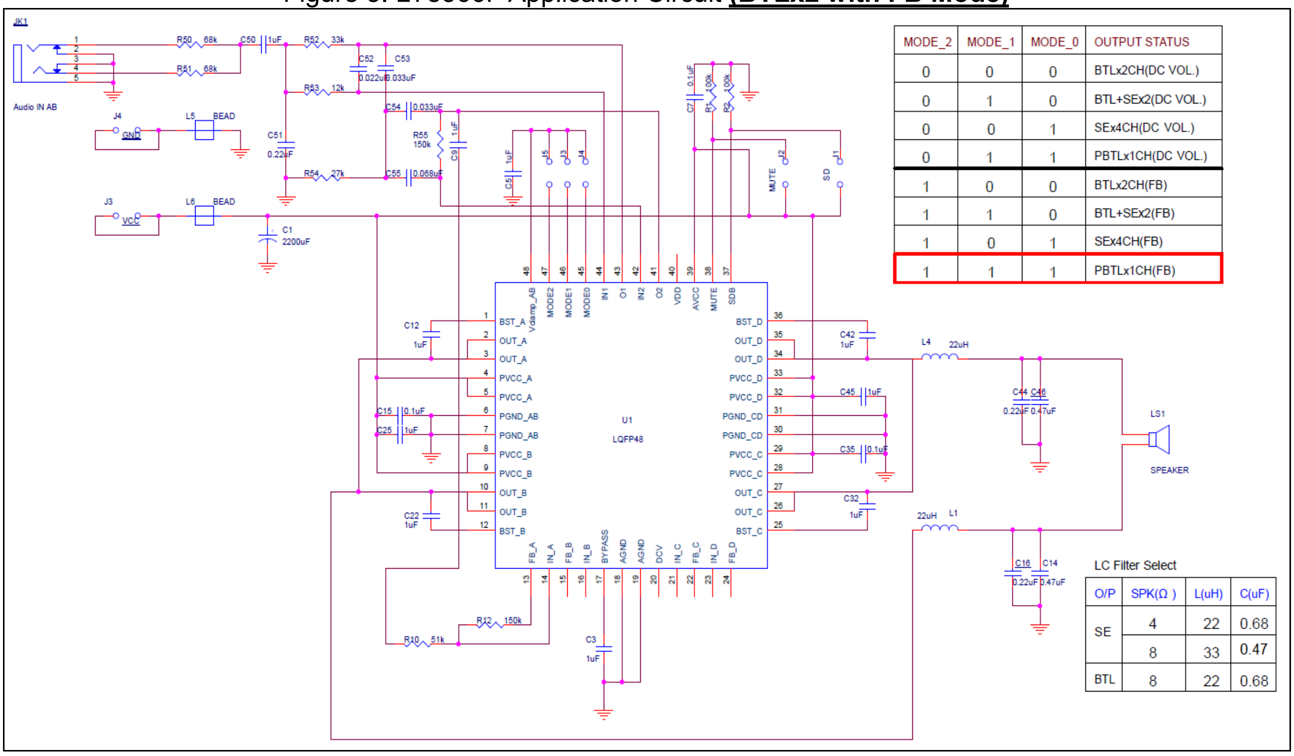


MODE_2	MODE_1	MODE_0	OUTPUT STATUS
0	0	0	BTLx2CH(DC VOL.)
0	1	0	BTL+SEx2(DC VOL.)
0	0	1	SEx4CH(DC VOL.)
0	1	1	PBTLx1CH(DC VOL.)
1	0	0	BTLx2CH(FB)
1	1	0	BTL+SEx2(FB)
1	0	1	SEx4CH(FB)
1	1	1	PBTLx1CH(FB)

LC Filter Select

O/P	SPK(Ω)	L(uH)	C(uF)
SE	4	22	0.68
	8	33	0.47
BTL	8	22	0.68

Figure 3. LY8366F Application Circuit **(BTLx2 with FB Mode)**



MODE_2	MODE_1	MODE_0	OUTPUT STATUS
0	0	0	BTLx2CH(DC VOL.)
0	1	0	BTL+SEx2(DC VOL.)
0	0	1	SEx4CH(DC VOL.)
0	1	1	PBTLx1CH(DC VOL.)
1	0	0	BTLx2CH(FB)
1	1	0	BTL+SEx2(FB)
1	0	1	SEx4CH(FB)
1	1	1	PBTLx1CH(FB)

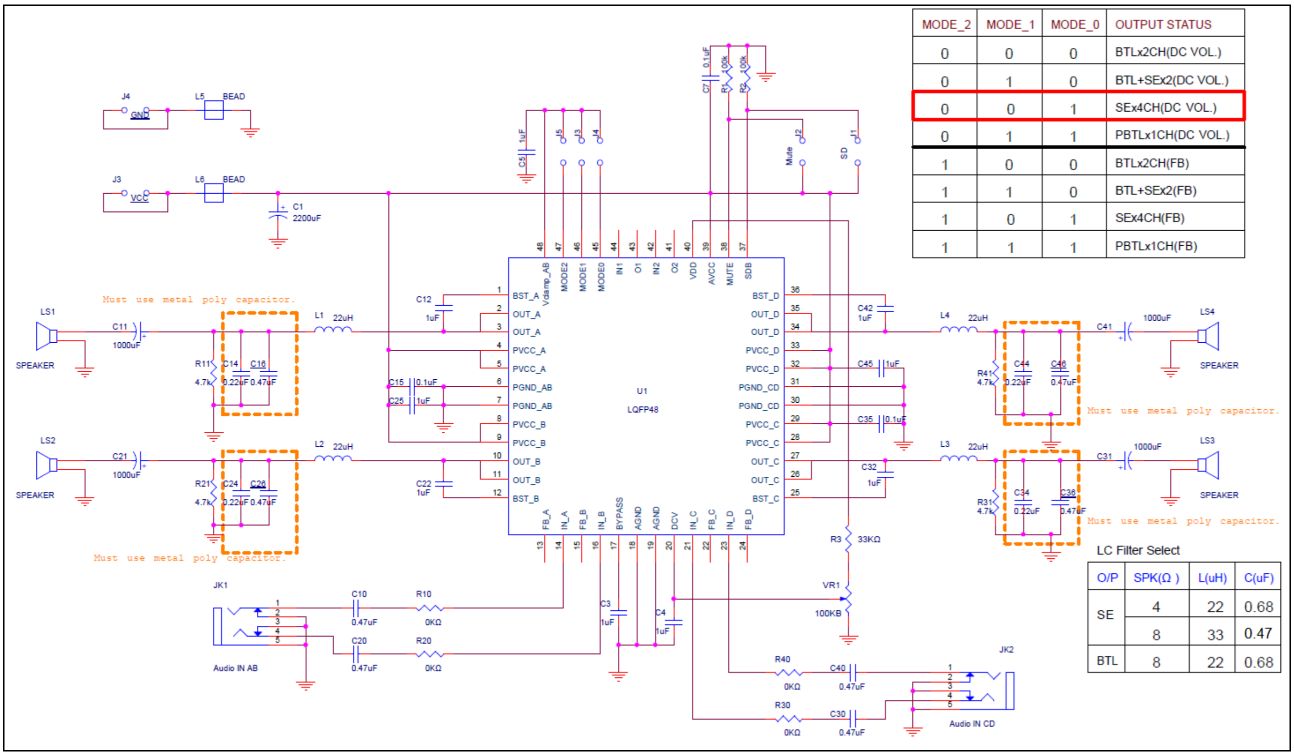
LC Filter Select

O/P	SPK(Ω)	L(uH)	C(uF)
SE	4	22	0.68
	8	33	0.47
BTL	8	22	0.68

Figure 4. LY8366F Application Circuit **(PBTLx1 with FB Mode)**

(*3) The device must be mounted to the PCB board and increase a large area of copper or recommended to use external heat sink. But when total output power ≧40W, the device must be use external heat sink.

TYPICAL APPLICATION CIRCUIT-2 (DC Volume Mode)

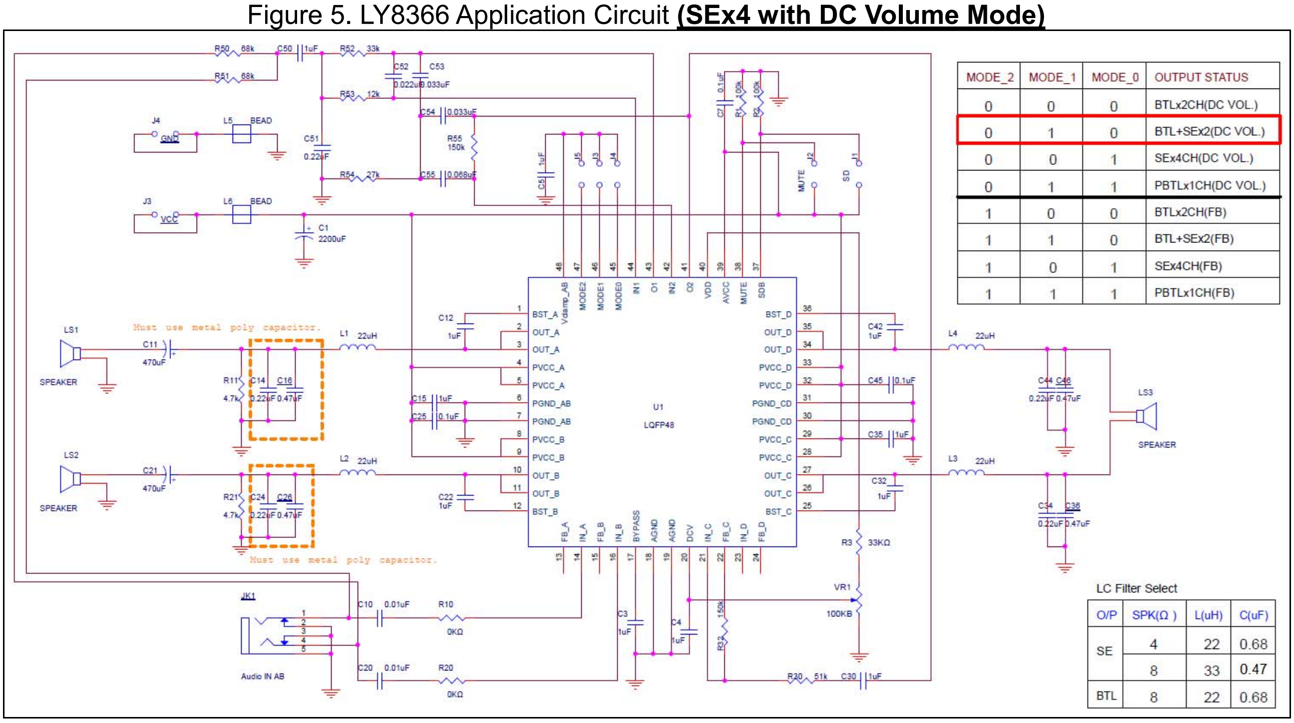


MODE_2	MODE_1	MODE_0	OUTPUT STATUS
0	0	0	BTLx2CH(DC VOL.)
0	1	0	BTL+SEx2(DC VOL.)
0	0	1	SEx4CH(DC VOL.)
0	1	1	PBTLx1CH(DC VOL.)
1	0	0	BTLx2CH(FB)
1	1	0	BTL+SEx2(FB)
1	0	1	SEx4CH(FB)
1	1	1	PBTLx1CH(FB)

LC Filter Select

O/P	SPK(Ω)	L(uH)	C(uF)
SE	4	22	0.68
	8	33	0.47
BTL	8	22	0.68

Figure 5. LY8366 Application Circuit **(SEx4 with DC Volume Mode)**



MODE_2	MODE_1	MODE_0	OUTPUT STATUS
0	0	0	BTLx2CH(DC VOL.)
0	1	0	BTL+SEx2(DC VOL.)
0	0	1	SEx4CH(DC VOL.)
0	1	1	PBTLx1CH(DC VOL.)
1	0	0	BTLx2CH(FB)
1	1	0	BTL+SEx2(FB)
1	0	1	SEx4CH(FB)
1	1	1	PBTLx1CH(FB)

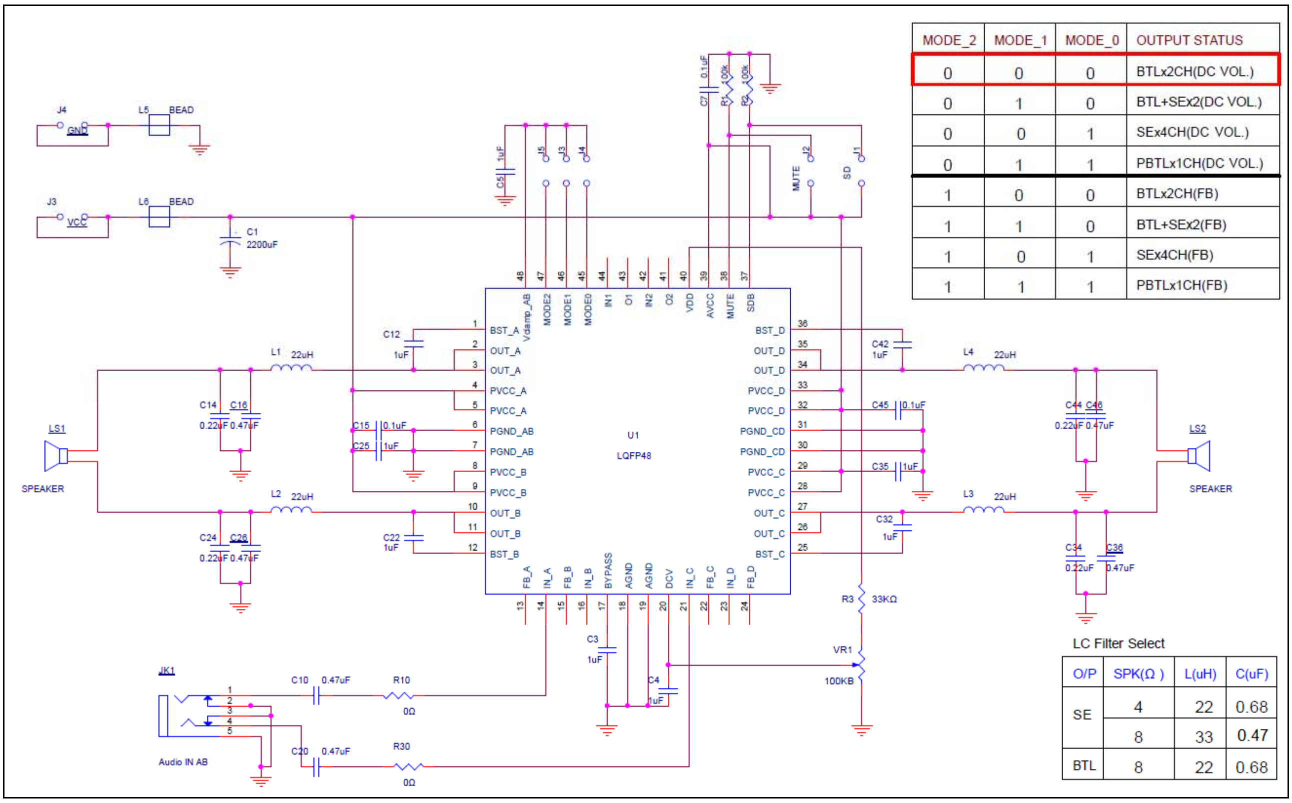
LC Filter Select

O/P	SPK(Ω)	L(uH)	C(uF)
SE	4	22	0.68
	8	33	0.47
BTL	8	22	0.68

Figure 6. LY8366 Application Circuit **(SEx2 +BTLx1(2.1CH) with DC Volume Mode)**

(*3) The device must be mounted to the PCB board and increase a large area of copper or recommended to use external heat sink. But when total output power ≧40W, the device must be use external heat sink.

30Wx2(BTLx2) Stereo / 11Wx2(SE)+37Wx1(BTL) 2.1CH / 16Wx4(SEx4) / 70Wx1(PBTL) Mono Class D Audio Amplifier

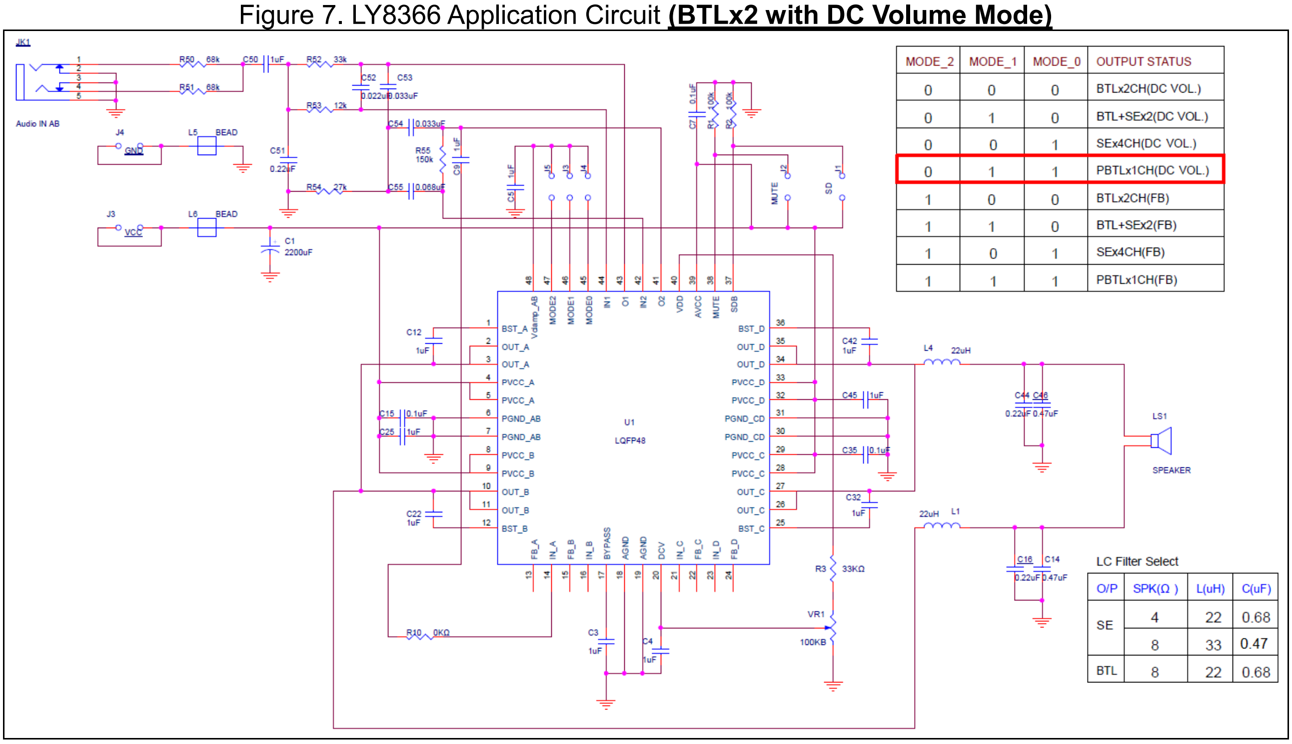


MODE_2	MODE_1	MODE_0	OUTPUT STATUS
0	0	0	BTLx2CH(DC VOL.)
0	1	0	BTL+SEx2(DC VOL.)
0	0	1	SEx4CH(DC VOL.)
0	1	1	PBTLx1CH(DC VOL.)
1	0	0	BTLx2CH(FB)
1	1	0	BTL+SEx2(FB)
1	0	1	SEx4CH(FB)
1	1	1	PBTLx1CH(FB)

LC Filter Select

O/P	SPK(Ω)	L(uH)	C(uF)
SE	4	22	0.68
	8	33	0.47
BTL	8	22	0.68

Figure 7. LY8366 Application Circuit **(BTLx2 with DC Volume Mode)**



MODE_2	MODE_1	MODE_0	OUTPUT STATUS
0	0	0	BTLx2CH(DC VOL.)
0	1	0	BTL+SEx2(DC VOL.)
0	0	1	SEx4CH(DC VOL.)
0	1	1	PBTLx1CH(DC VOL.)
1	0	0	BTLx2CH(FB)
1	1	0	BTL+SEx2(FB)
1	0	1	SEx4CH(FB)
1	1	1	PBTLx1CH(FB)

LC Filter Select

O/P	SPK(Ω)	L(uH)	C(uF)
SE	4	22	0.68
	8	33	0.47
BTL	8	22	0.68

Figure 8. LY8366 Application Circuit **(PBTL with DC Volume Mode)**

(*3) The device must be mounted to the PCB board and increase a large area of copper or recommended to use external heat sink. But when total output power ≧40W, the device must be use external heat sink.

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TEL: 886-3-6668838
FAX: 886-3-6668836

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	AVCC, PVCC	27.0	V
Interface pin voltage	SD, Mute	-0.3V to PVCC +0.3V	V
Audio input pin voltage	IN_A/B/C/D	-0.3V to 6.0V	V
Operating Temperature	T_A	-40 to 85 (I grade)	℃
Storage Temperature	T_{STG}	-65 to 150	℃
ESD Susceptibility	V_{ESD}	2000	V
Junction Temperature	T_{JMAX}	150	℃
Soldering Temperature (under 10 sec)	T_{SOLDER}	260	℃

ELECTRICAL CHARACTERISTICS (1) (T_A = 25℃)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP. *2	MAX.	UNIT
Power supply voltage	PVCC		12.0	-	26.0	V
High-level input voltage	V_{SDIH}	PVCC=12~26V	2.0	-	PVCC	
	V_{MULTIH}		2.0		PVCC	
Low-level input voltage	V_{SDIL}		0	-	0.3	
	V_{MULTIL}		0	-	0.3	
Quiescent Current	I_Q	PVCC=14V, SD≧2.0V, MUTE=0V, No Load	-	35	-	mA
		PVCC=24V, SD≧2.0V, MUTE=0V, No Load	-	55	-	
Quiescent Current (at mute mode)		PVCC=14V, MUTE≧2.0V, SD=high, No Load	-	35	-	
		PVCC=24V, MUTE≧2.0V, SD=high, No Load		55		
Shutdown Current	I_{SD}	PVCC=14V,$V_{SHUTDOWN}$≦0.3V, No Load	-	0.25	-	
		PVCC=24V,$V_{SHUTDOWN}$ ≦ 0.3V, No Load		0.4		
Drain-source on-state resistance	Rdson	PVCC=12V, Io=1A	-	360	-	mΩ
Bypass output voltage	V_{BYPASS}	No Load	-	PVCC/8	-	V
Output offset voltage	$\|V_{OS}\|$	PVCC=24V, V_I=0V, Av=10, BTL mode	-	60	-	mV
Under-voltage protection	V_{UV}		-	8	-	V
Over-voltage protection	V_{OV}		-	27	-	V

(*2) Typical values are included for reference only and are not guaranteed or tested.
Typical values are measured at PVCC = PVCC(TYP.) and T_A = 25℃

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▪ OPERATING CHARACTERISTICS (1) (T_A = 25℃)

PARAMETER	SYMBOL	TEST CONDITION		MIN.	TYP. *2	MAX.	UNIT
Power Supply ripple rejection	Ksvr	PVCC=24V, Av=10, Vripple = 200mVpp at 1kHz, R_L=4Ω, BTL mode	217Hz Input=GND	-	-76	-	dB
			217Hz Input=Floating	-	-75	-	dB
Output voltage noise	Vn	**SE Mode**, PVCC=24V, Av=10, f = 20 Hz to 20 kHz,R_L=4Ω, Input=GND,	A weighting	-	245	-	uV
				-	-72	-	dBV
			Without A weighting	-	365	-	uV
				-	-68.5	-	dBV
		BTL Mode, PVCC=24V, Av=10, f = 20 Hz to 20 kHz, R_L=4Ω, Input=GND	A weighting	-	350	-	uV
				-	-69	-	dBV
			Without A weighting	-	450	-	uV
				-	-67	-	dBV
Signal-to-noise ratio	SNR	**SE mode**, PVCC=24V, Av=10, R_L=4Ω, Max output THD+N<1%, f=1KHz, Input=GND,	A weighting	-	91	-	dB
			Without A weighting	-	87	-	dB
		BTL mode, PVCC=24V, Av=10, R_L=4Ω, Max output THD+N<1%, f=1KHz, Input=GND,	A weighting	-	92	-	dB
			Without A weighting	-	90	-	dB
Crosstalk	Cs	**SE mode**, PVCC=24V, Av=10, R_L=4Ω, Po = 0.25W,	A ch. to B ch.	-	-67	-	dB
			B ch. to A ch.	-	-48	-	dB
			C ch. to D ch.	-	-67	-	dB
			D ch. to C ch.	-	-62	-	dB
		BTL mode, PVCC=24V, Av=10, R_L=4Ω, Po = 0.25W,	A ch. to C ch.	-	-80	-	dB
			C ch. to A ch.	-	-71	-	dB

▪ OPERATING CHARACTERISTICS (2) (T_A = 25℃)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP. *2	MAX.	UNIT
Oscillator frequency	fosc		-	316	-	kHz
Thermal shutdown temperature	T_{SD}	Shutdown temp.	-	180	-	℃
		Restore temp.	-	160	-	℃
Mute attenuation		VDD=24V, R_L=4Ω, Po=5W, SD=High	-	-90	-	dB
Mute delay	Δt mute	VDD=24V, Time from mute input switches high until outputs muted.	-	350	-	us
Unmute delay	Δt mute	Time from mute input switches low until outputs muted.	-	480	-	us
Start-up time from shutdown	Z_I	PVCC=24V, C_{bypass}=1μF.	-	560	-	ms
		PVCC=18V, C_{bypass}=1μF.	-	460	-	ms
		PVCC=12V, C_{bypass}=1μF.	-	430	-	ms

(*2) Typical values are included for reference only and are not guaranteed or tested.
Typical values are measured at PVCC = PVCC(TYP.) and T_A = 25℃

▪ OPERATING CHARACTERISTICS (3)(TA = 25℃)

Output Power per Channel **(Output Type=SE mode)** Unit=W

PARAMETER	SYMBOL	TEST CONDITION	RL=8Ω		RL=4Ω	
			10% *2	1% *2	**10%** *2	1% *2
Output-power	Po	12V	**3**	2	**5**	4
		14V	**3.5**	2.9	**6.5**	5
		14.4V	**4**	3	**7**	5.5
		16V	**5**	3.8	**8.5**	7
		18V	**6**	4.8	**11**	9
		20V	**7**	5.8	**13**	11
		22V	**9**	7	**16** *3	13 *3
		24V	**10**	8.5	**19** *3	15 *3

Output Power per channel **(Output Type=BTL mode)** Unit=W

PARAMETER	SYMBOL	TEST CONDITION	RL=8Ω		RL=4Ω	
			10% *2	1% *2	**10%** *2	1% *2
Output-power	Po	12V	**10**	8	**17**	13.5
		14V	**13**	10.5	**23** *3	18
		14.4V	**14**	11	**24** *3	19.5
		16V	**17**	13	**30** *3	24 *3
		18V	**22**	18	**37** *3	29 *3
		20V	**28** *3	21 *3	**45** *3	35 *3
		22V	**32** *3	25.5 *3	**53** *3	42.5 *3
		24V	**39** *3	31 *3	**-**	-

Output Power per channel **(Output Type=PBTL mode)** Unit=W

PARAMETER	SYMBOL	TEST CONDITION	RL=4Ω		RL=3Ω		RL=2Ω	
			10% *2	1% *2	**10%** *2	1% *2	**10%** *2	1% *2
Output-power	Po	10V	**13**	10	**16**	13	**20**	15
		12V	**18**	14	**23**	18	**28**	22
		14V	**25**	20	**32**	25	**38**	29
		14.4V	**26.5**	21	**33**	26	**40** *3	30 *3
		16V	**41**	26	**41**	33	**49** *3	36 *3
		18V	**51** *3	32 *3	**52** *3	42 *3	**61** *3	37 *3
		20V	**61** *3	39 *3	**64** *3	50 *3	**-**	-
		22V	**72** *3	47 *3	**77** *3	60 *3	**-**	-
		24V	**77** *3	55 *3	**92** *3	70 *3	**-**	-

(*2) Typical values are included for reference only and are not guaranteed or tested.
Typical values are measured at PVCC = PVCC(TYP.) and TA = 25℃

(*3) The device must be mounted to the PCB board and increase a large area of copper or recommended to use external heat sink.
But when total output power ≧40W, the device must be use external heat sink.

TYPICAL PERFORMANCE CHARACTERISTICS

Figure 9

THD+N vs. Output Power (@ Output type=BTL Mode, **RL=4Ω**, f=1kHz, Av=10)

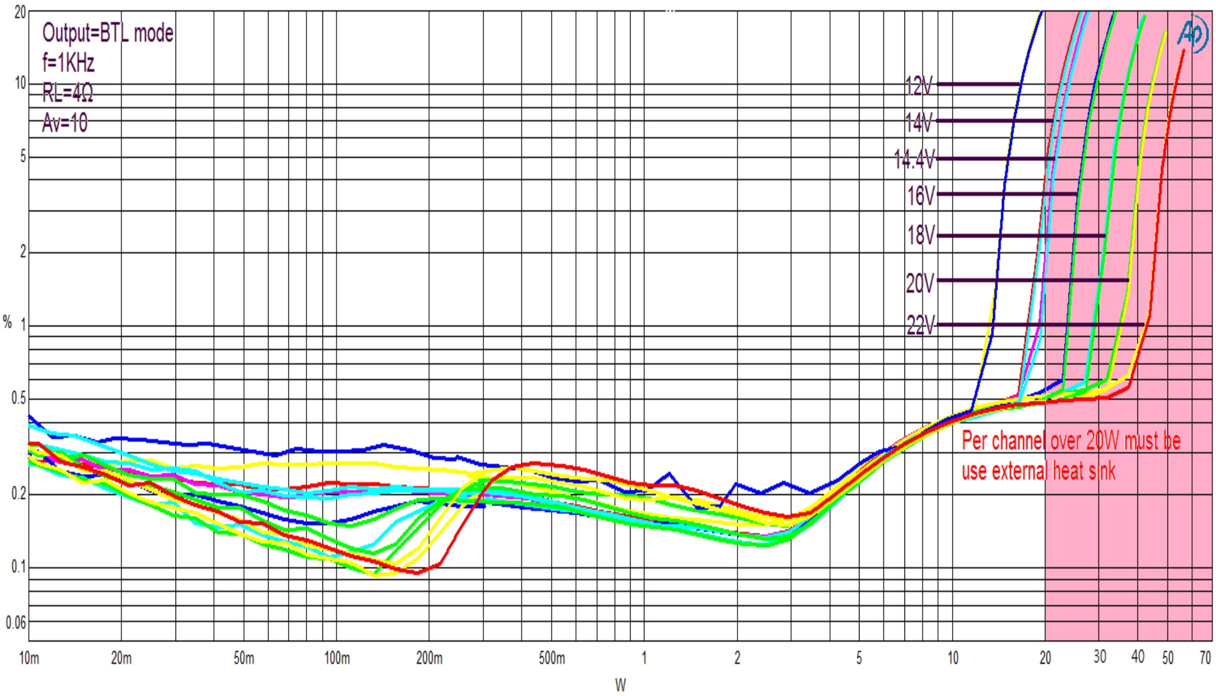

Figure 10

THD+N vs. Output Power (@ Output type=BTL Mode, **RL=8Ω**, f=1kHz, Av=10)

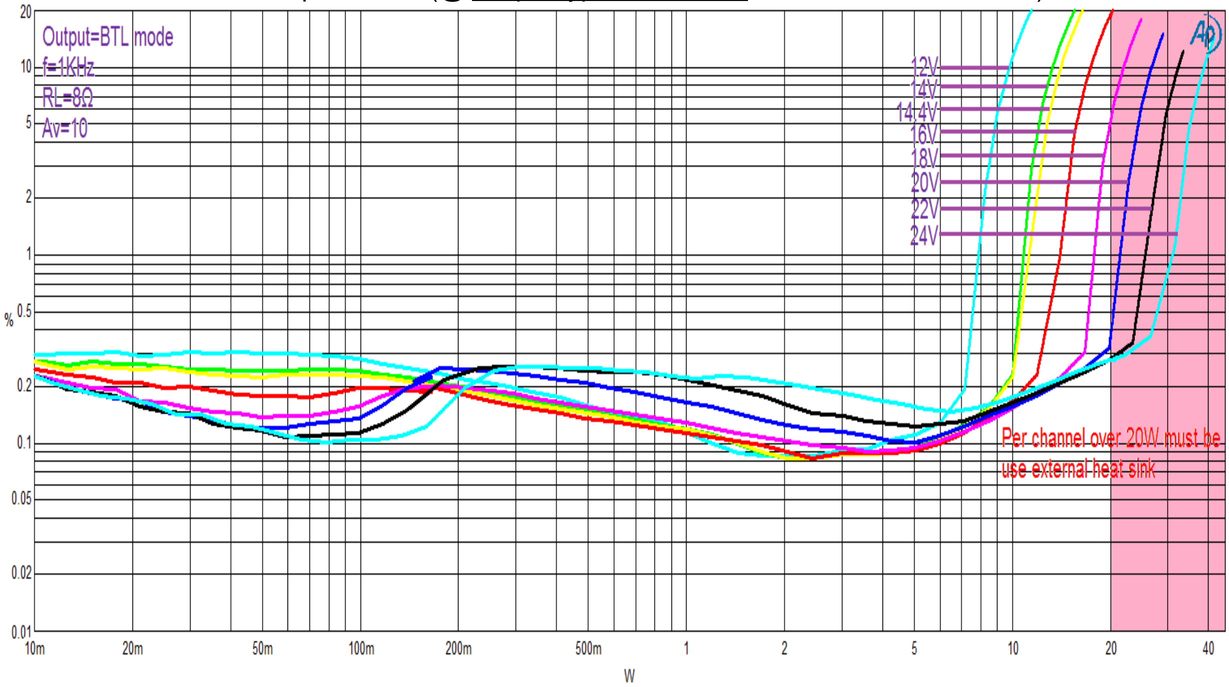

Figure 11
THD+N vs. Output Power (@ Output type=SE Mode, **RL=4Ω**, f=1kHz, AV=10)

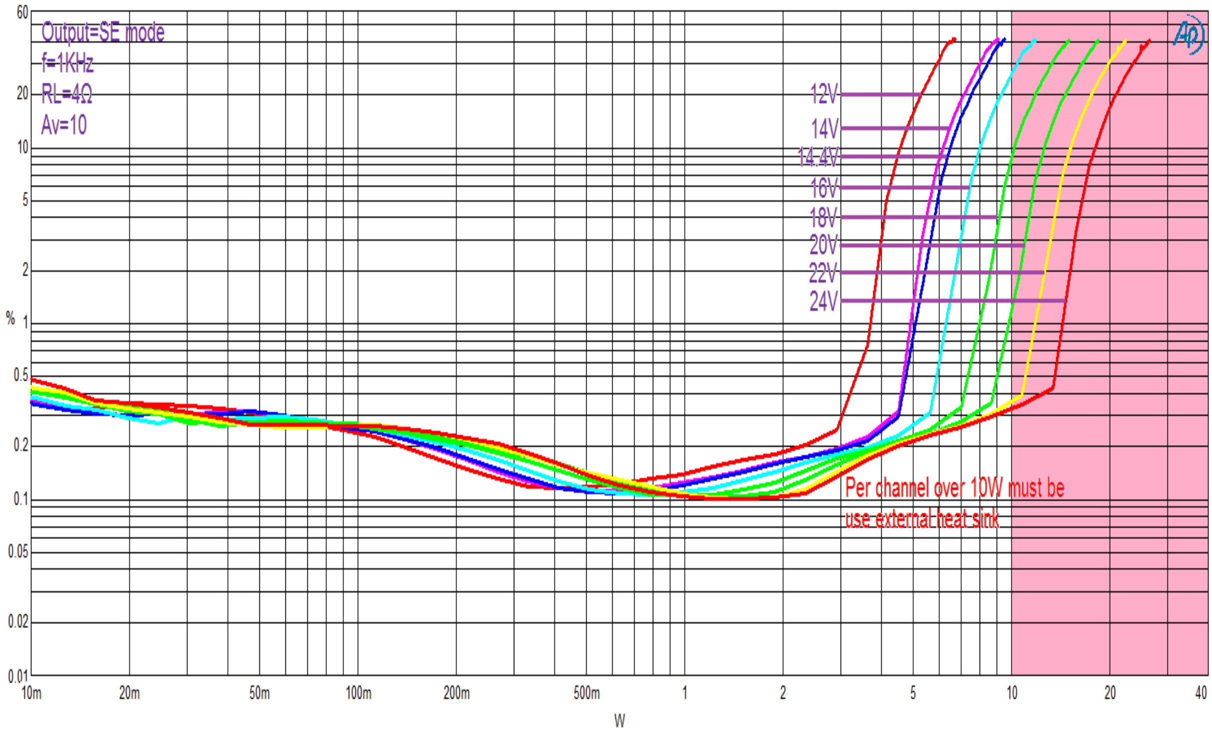

Figure 12
THD+N vs. Output Power (@ Output type=SE Mode, **RL=8Ω**, f=1kHz, AV=10)

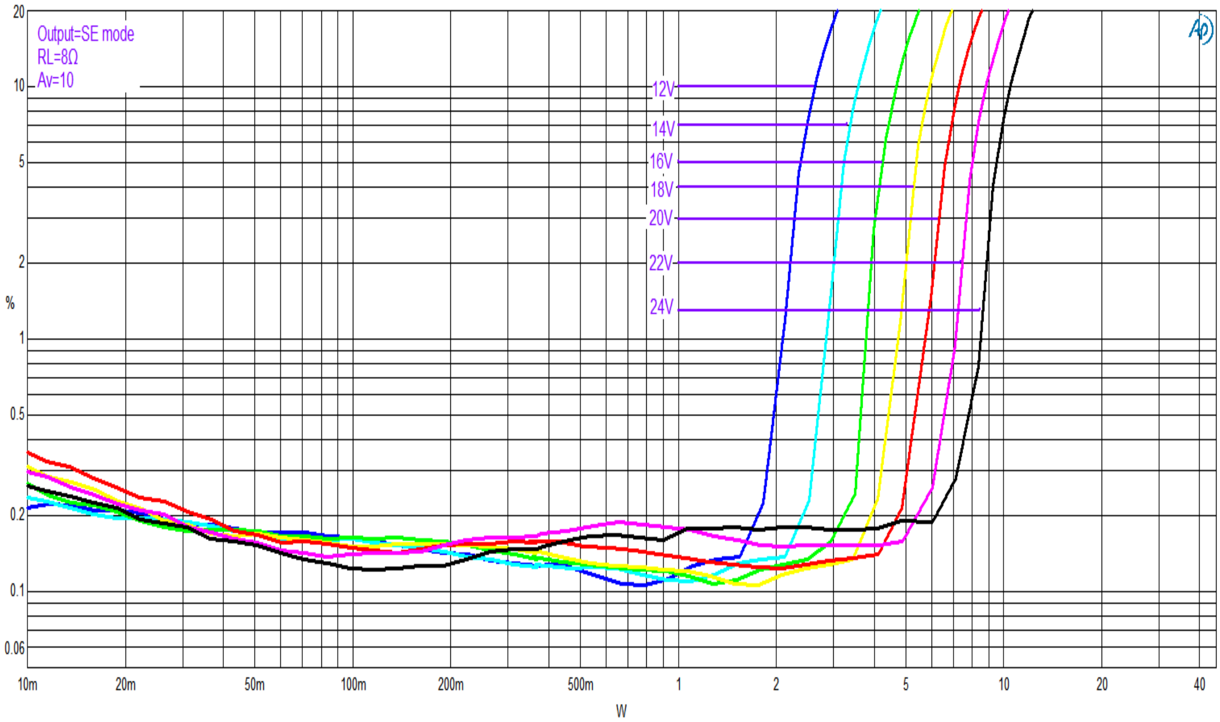

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Figure 13
THD+N vs. Output Power (@ Output type=PBTL Mode, **RL=2Ω**, f=1kHz, Av=10)

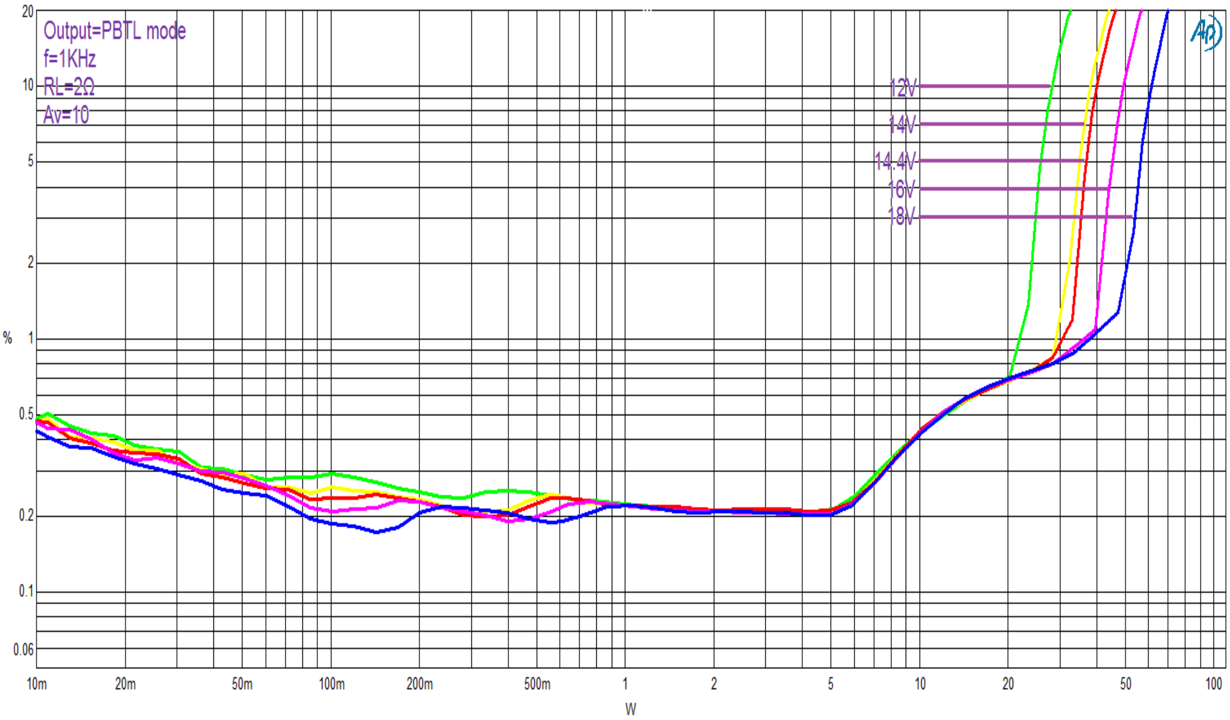

Figure 14
THD+N vs. Output Power (@ Output type=PBTL Mode, **RL=3Ω**, f=1kHz, Av=10)

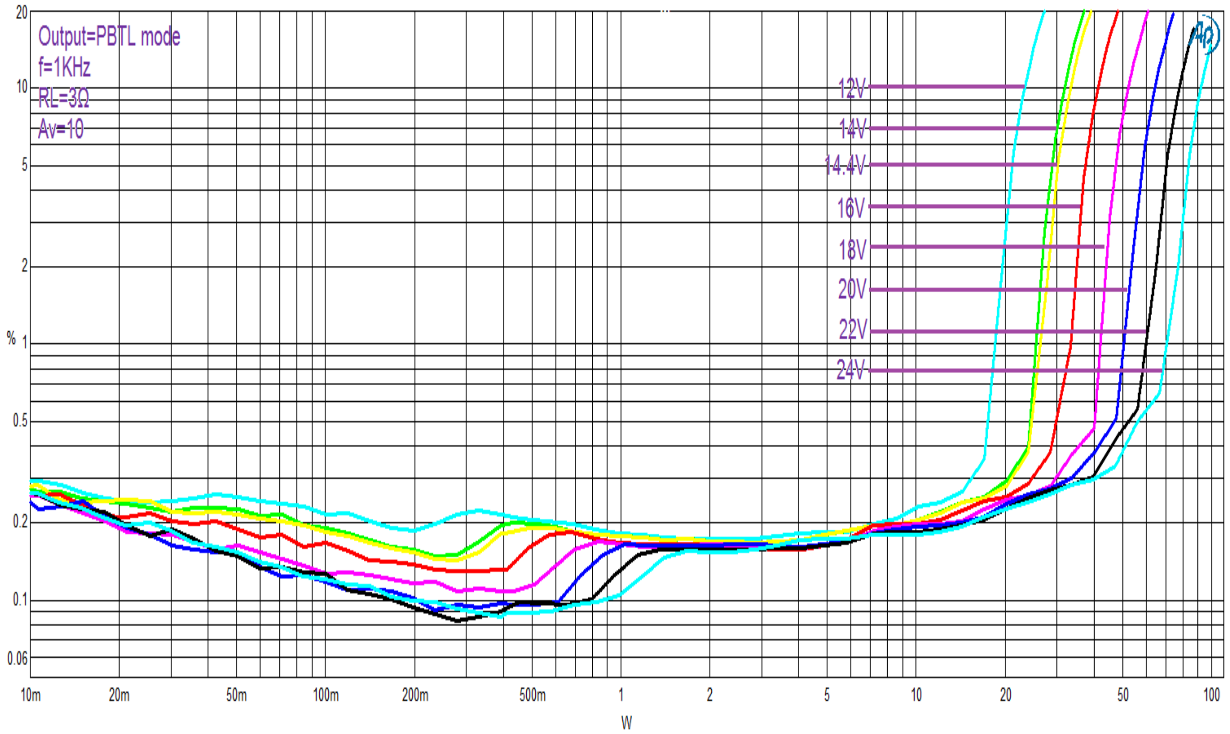

Figure 15

THD+N vs. Output Power (@ Output type=PBTL Mode, **RL=4Ω**, f=1kHz, Av=10)

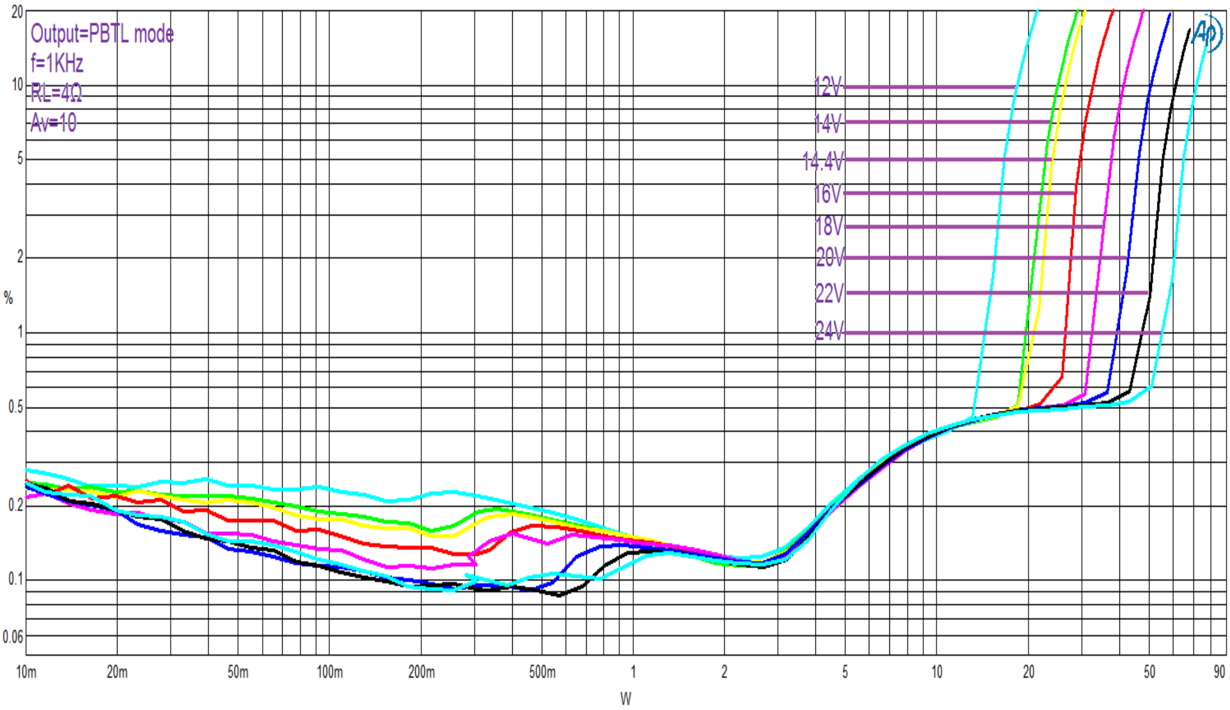

Figure 16

Supply ripple rejection (Ksvr, **RL=4Ω**, BTL mode)

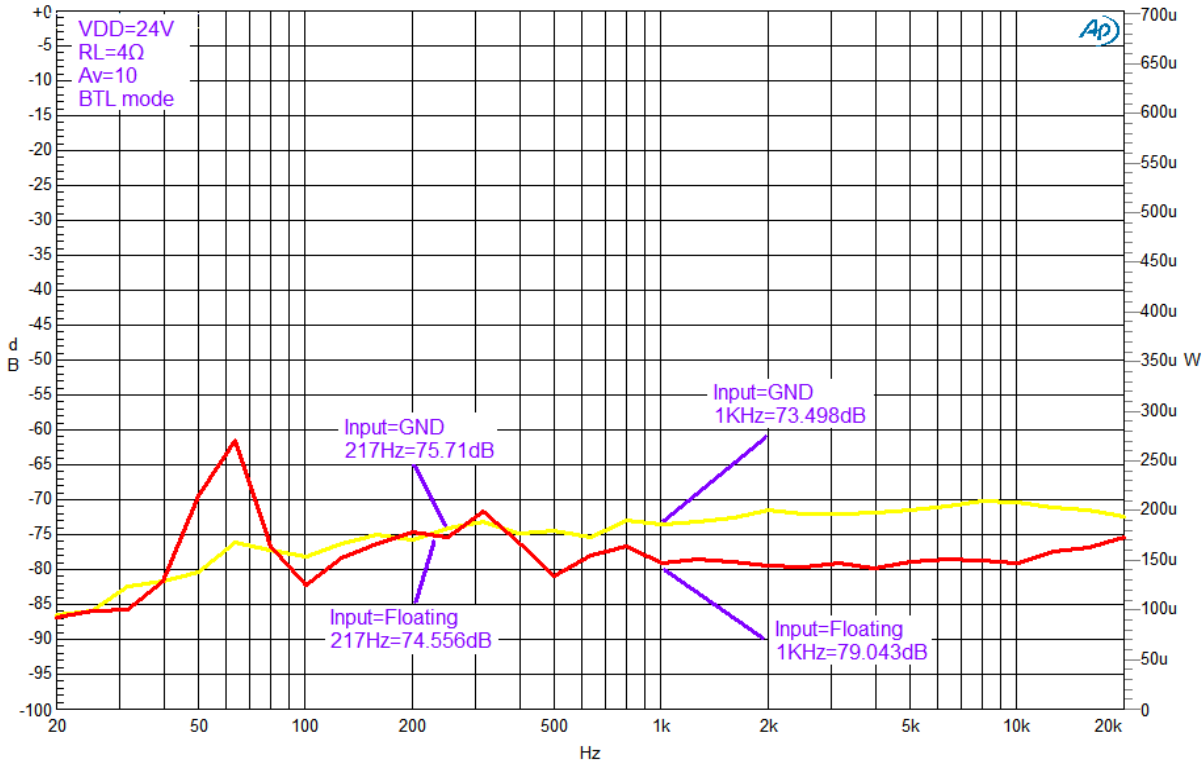

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Figure 17

Supply ripple rejection (Ksvr, **RL=8Ω**, BTL mode)

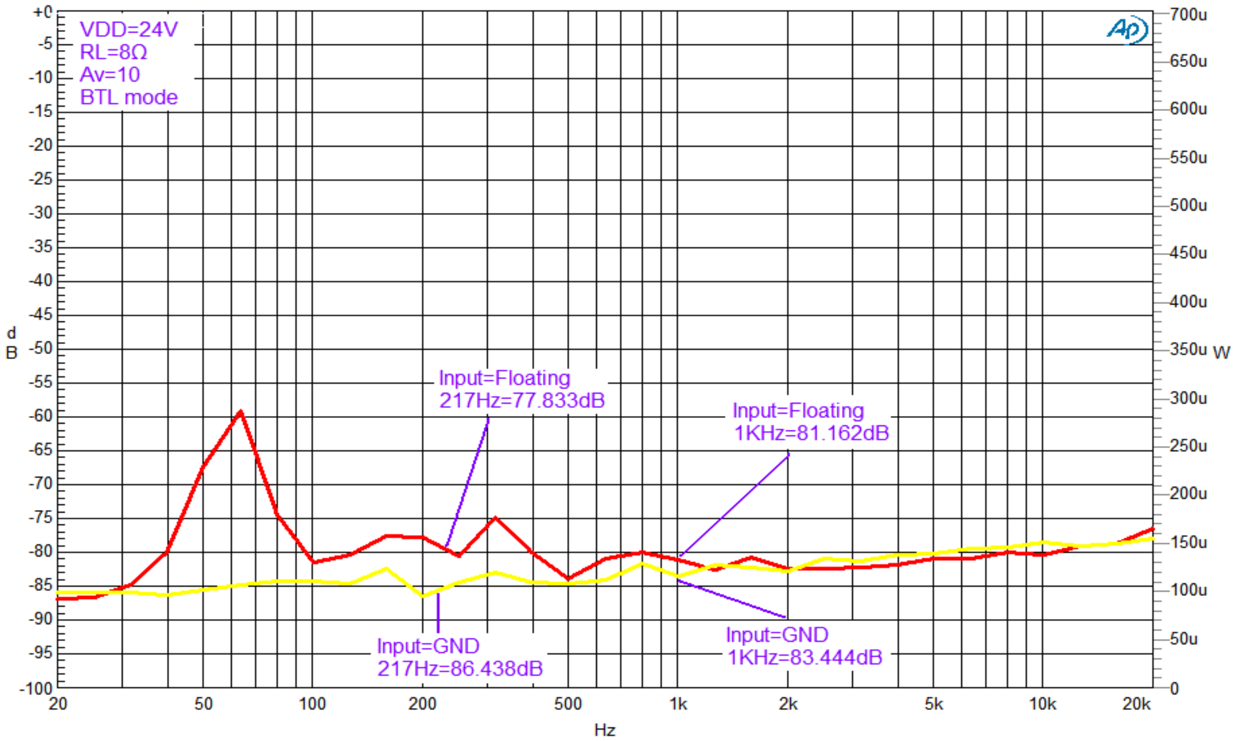


Figure 18

Supply ripple rejection (Ksvr, **RL=4Ω**, SE mode)

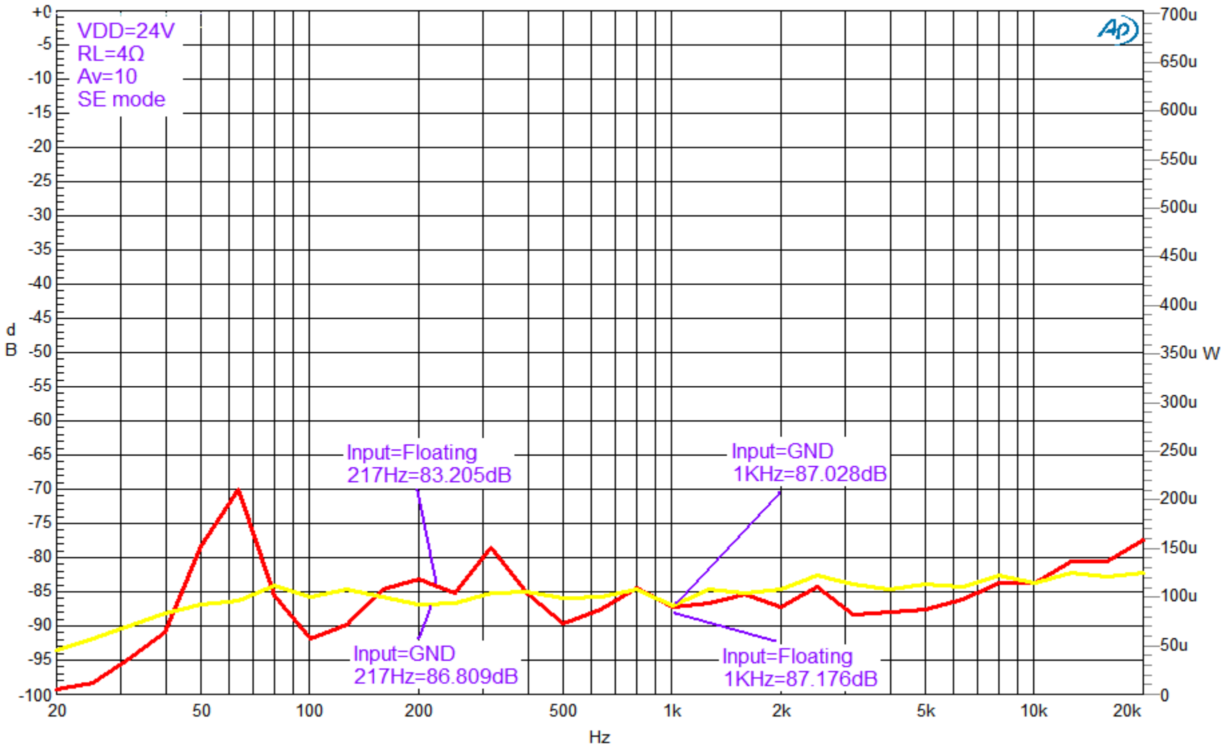


Figure 19
Supply ripple rejection (Ksvr, **RL=8Ω**, SE mode)

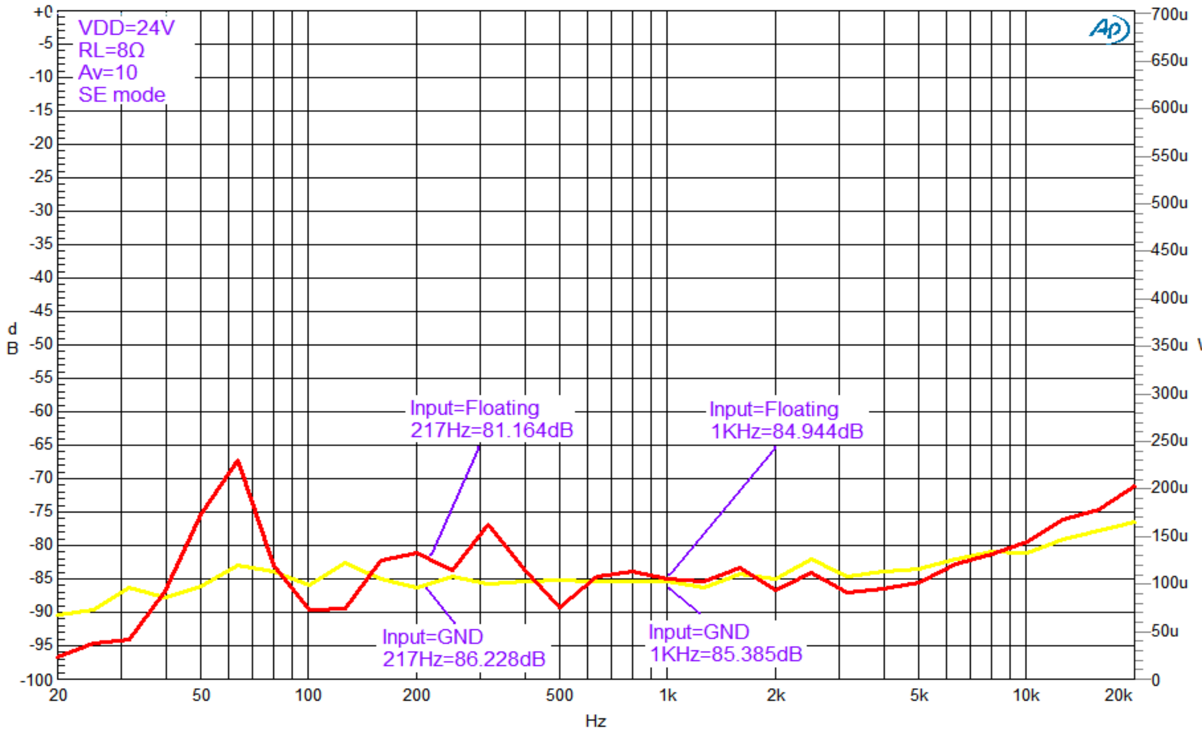


Figure 20
SNR vs. Noise Level (BTL mode)

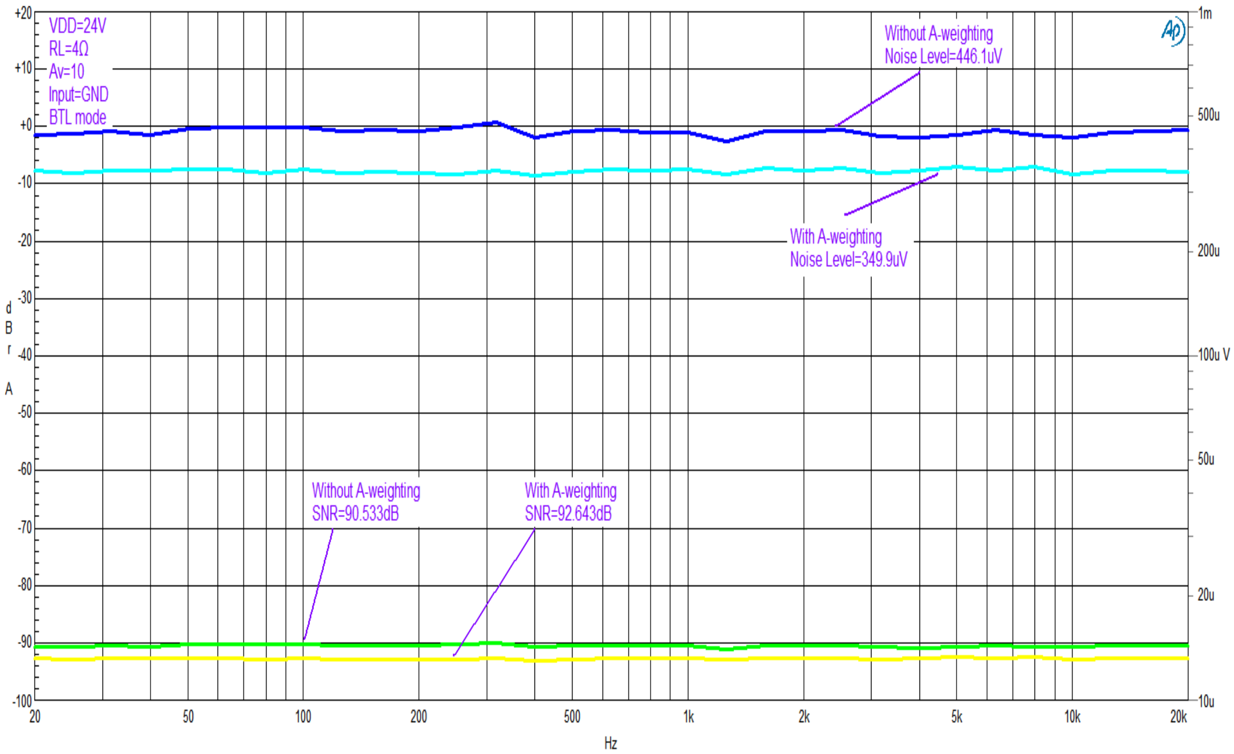


Figure 21
SNR vs. Noise Level (SE mode)

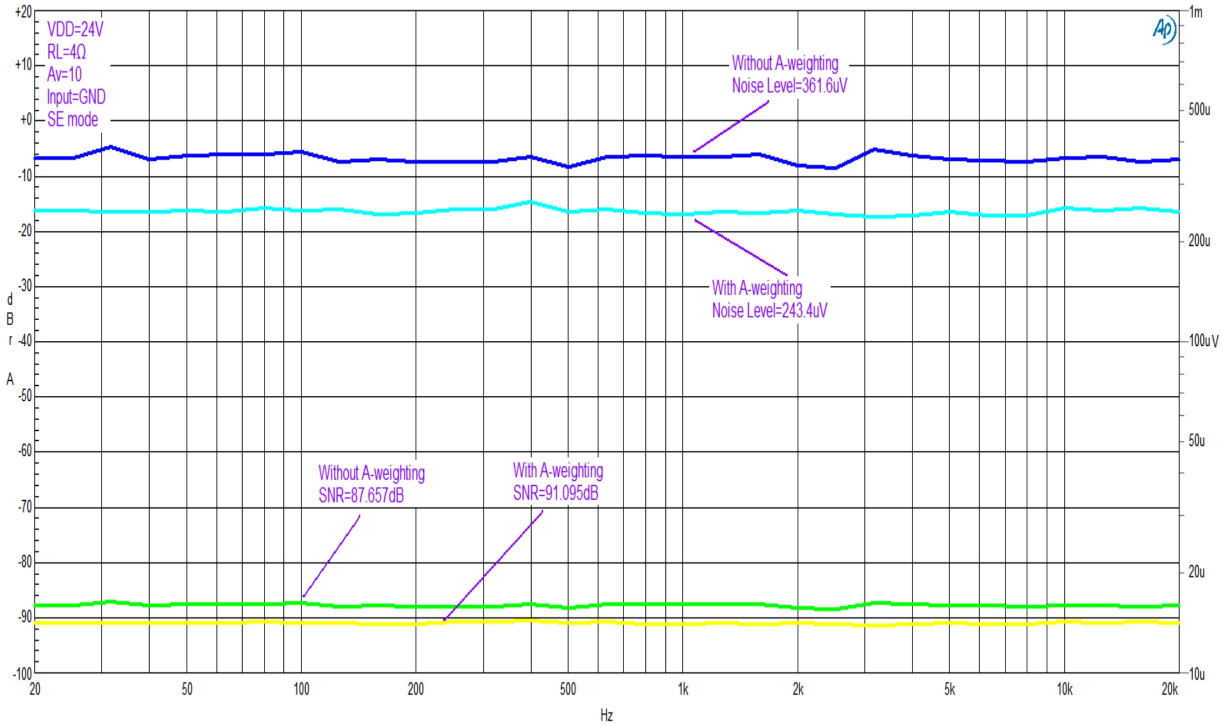


Figure 22
Crosstalk vs. Frequency (BTL mode)

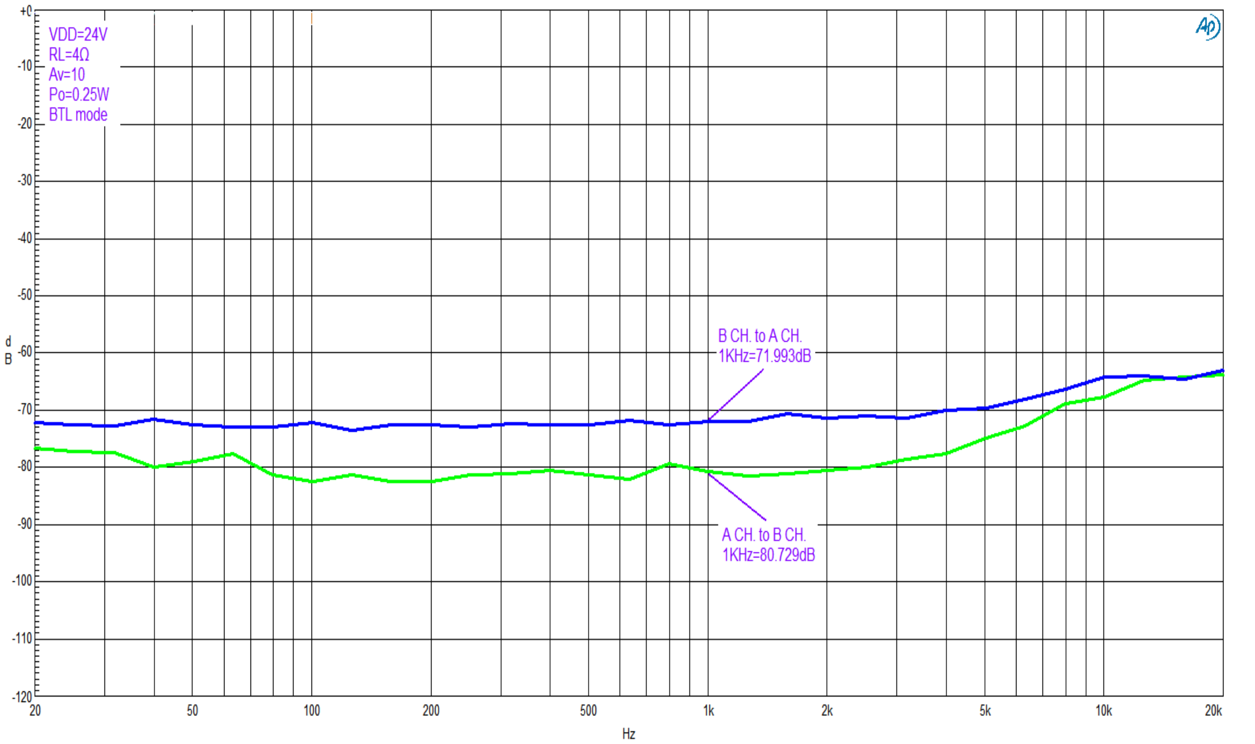
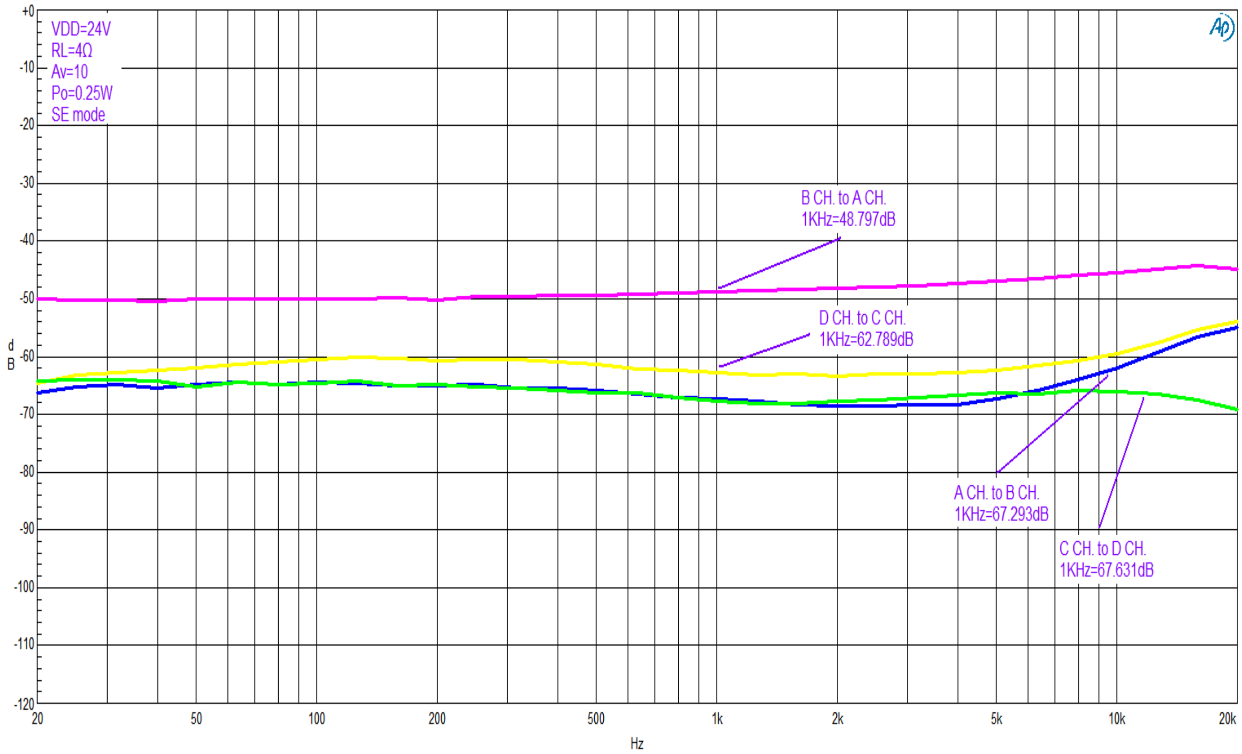
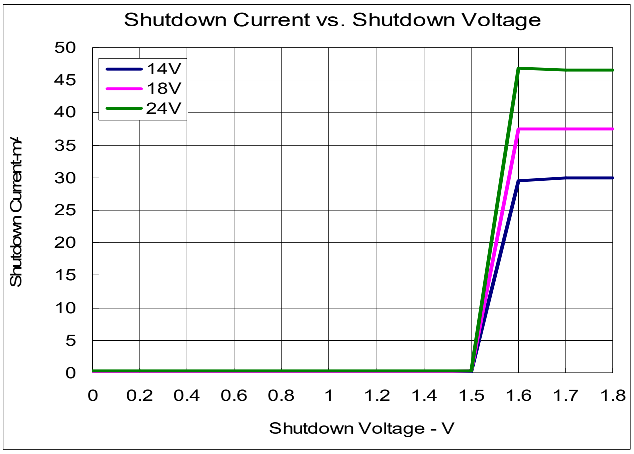
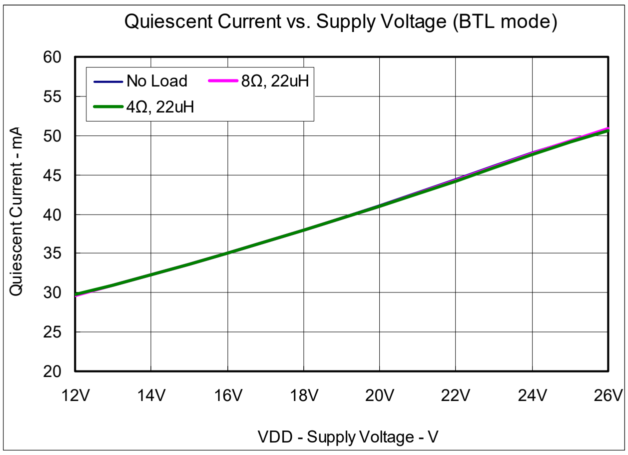


Figure 23
Crosstalk vs. Frequency (SE mode)



SD Current vs. SD Voltage	Quiescent Current vs. Supply voltage (BTL mode)
	

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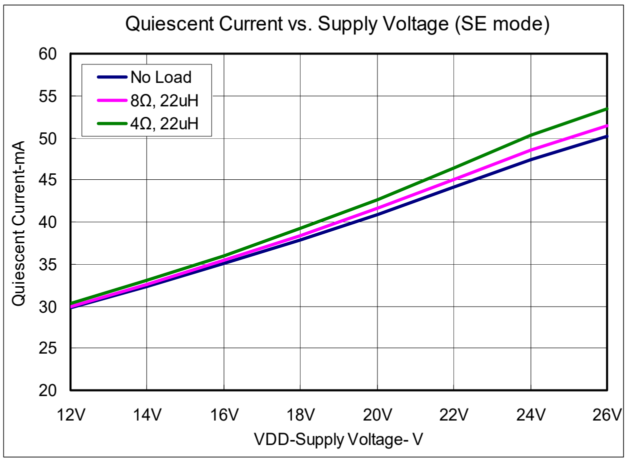
Quiescent Current vs. Supply voltage
(SE mode)



Output Power vs. Supply Voltage
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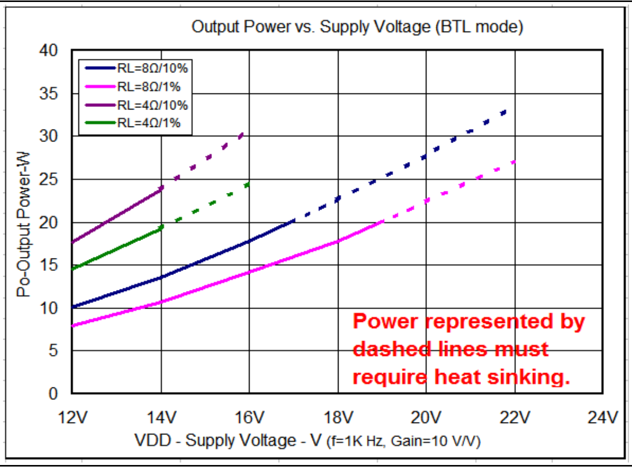
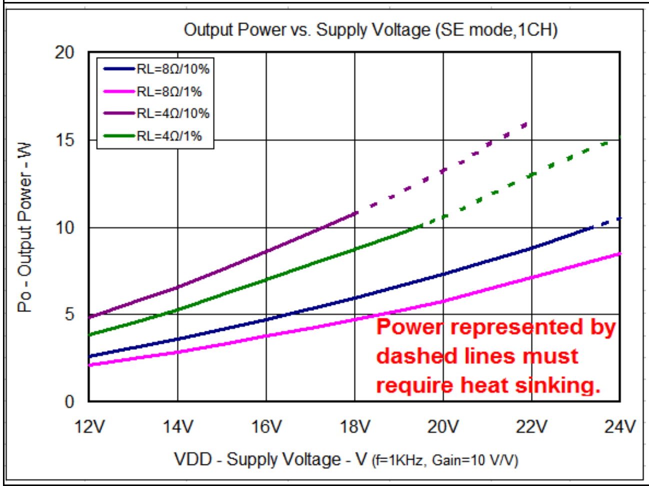


Output Power vs. Supply Voltage
(SE mode)



Supply Current vs. Output Power
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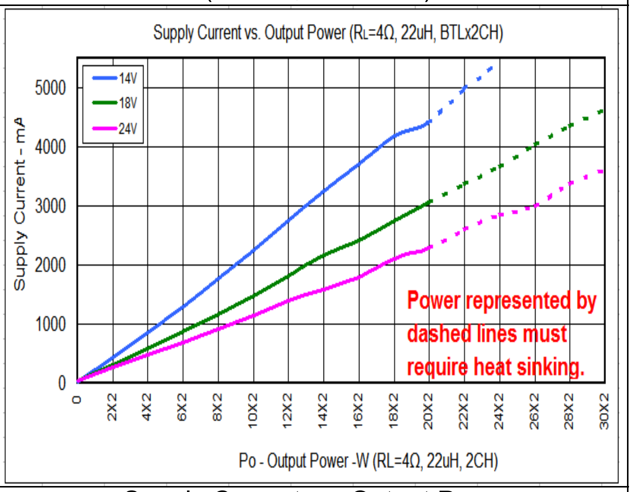
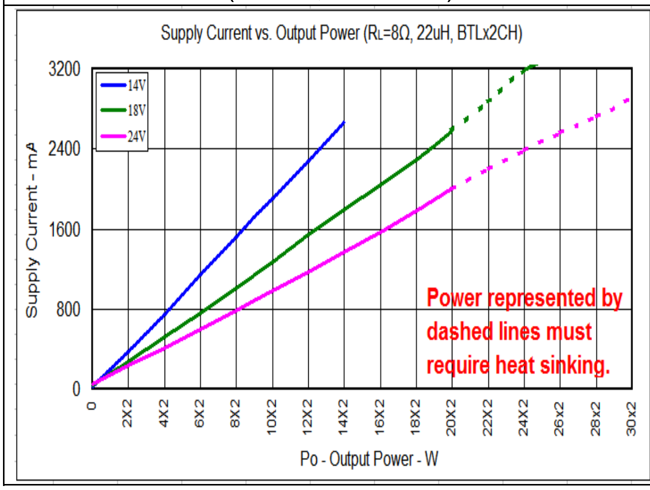
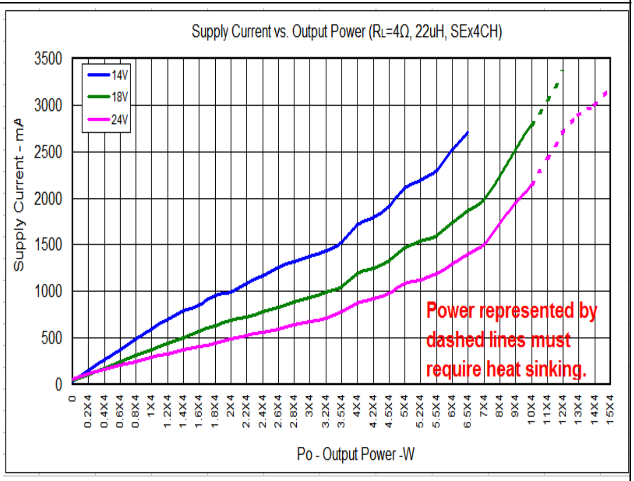


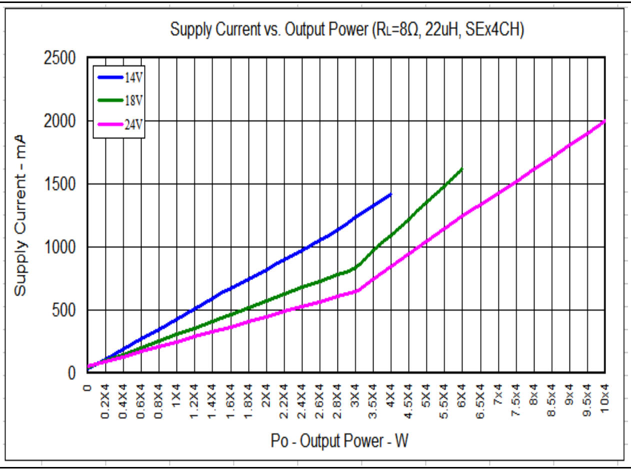
Supply Current vs. Output Power
(RL=8Ω,BTL mode)



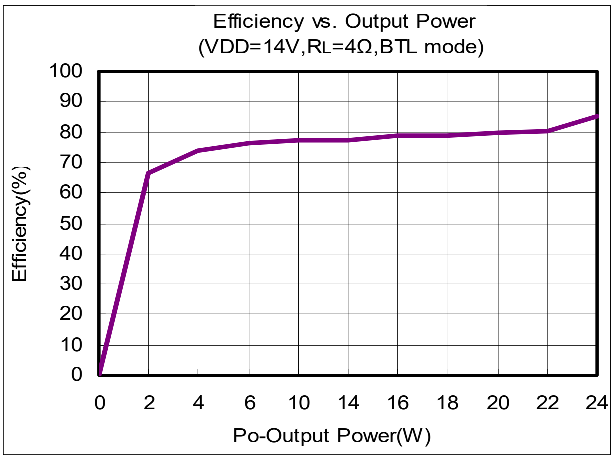
Supply Current vs. Output Power
(RL=4Ω,SE mode)



Supply Current vs. Output Power
(RL=8Ω,SE mode)



Efficiency
(VDD=14V,RL=4Ω,BTL mode)



Efficiency
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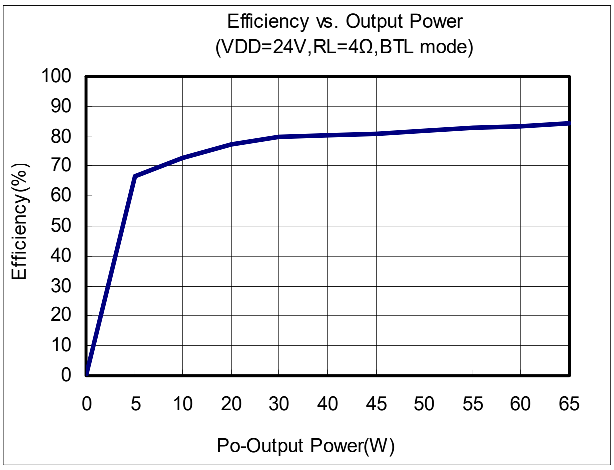

Efficiency
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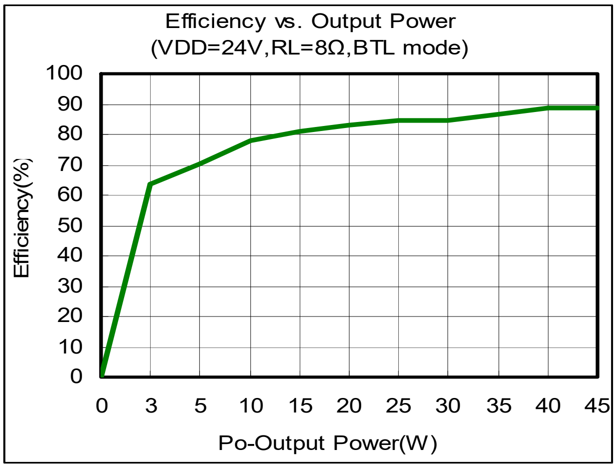

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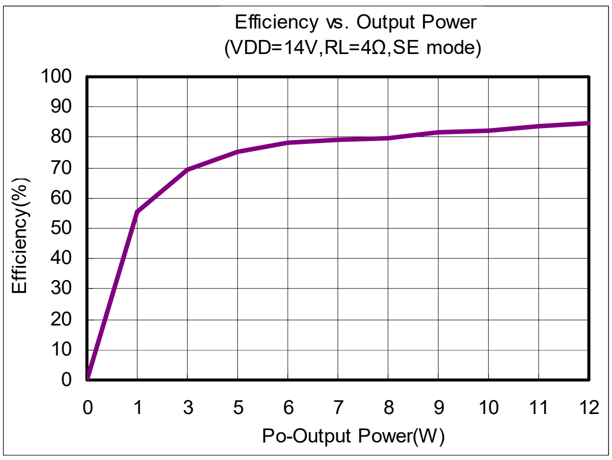

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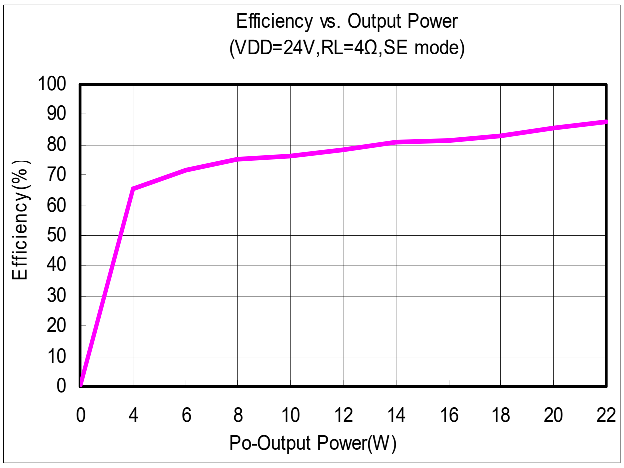
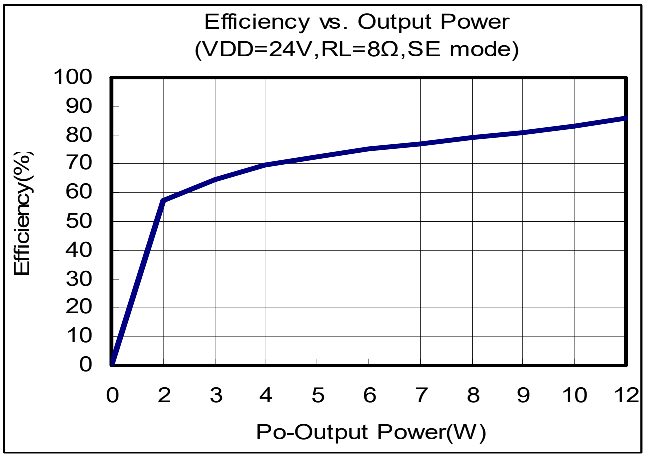
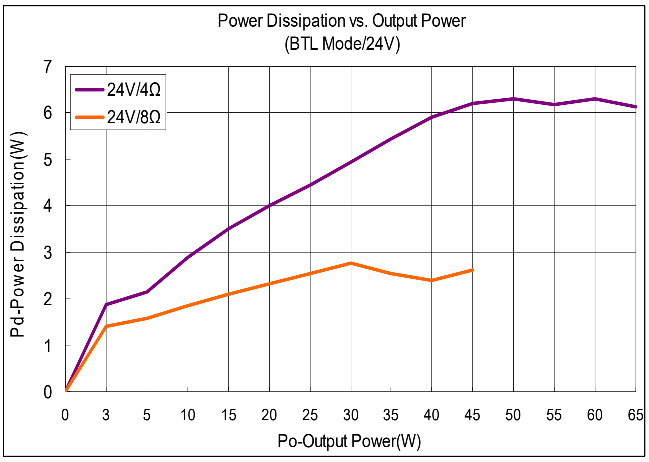
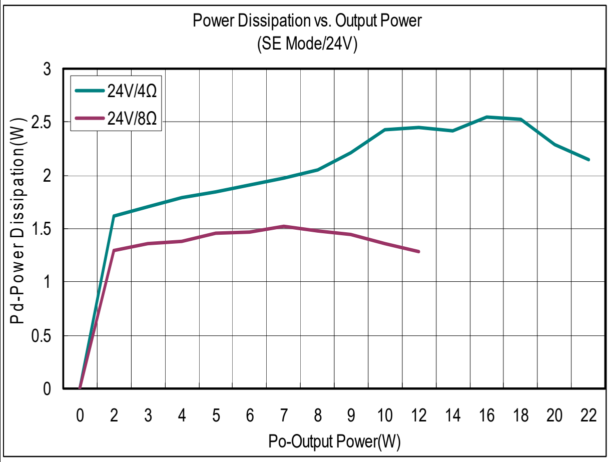


Efficiency (VDD=24V,RL=8Ω,SE mode)	
	
Power Dissipation vs. Output Power (VDD=24V,BTL mode)	Power Dissipation vs. Output Power (VDD=24V,SE mode)
	

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EMI test result

(Refer to demo-board V3.0)

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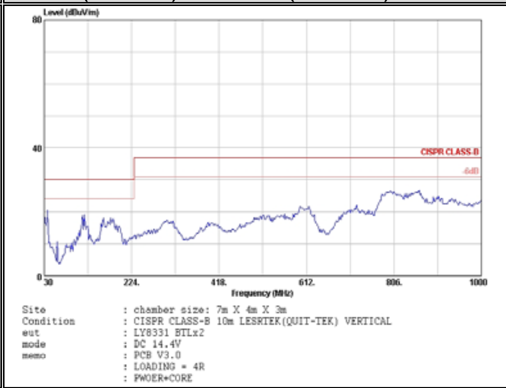
/4Ω</td><td>
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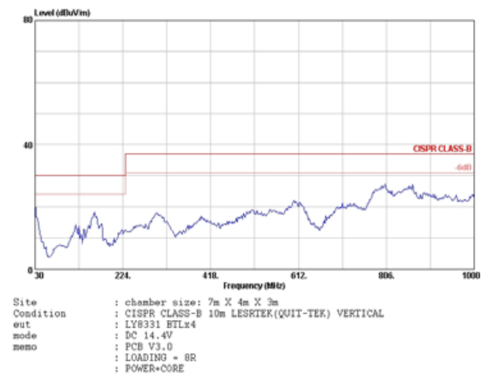
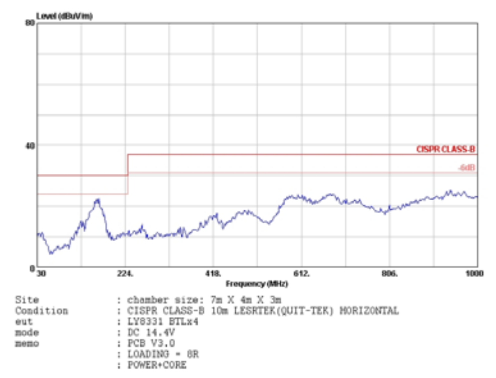
/8Ω</td><td>
</td><td>
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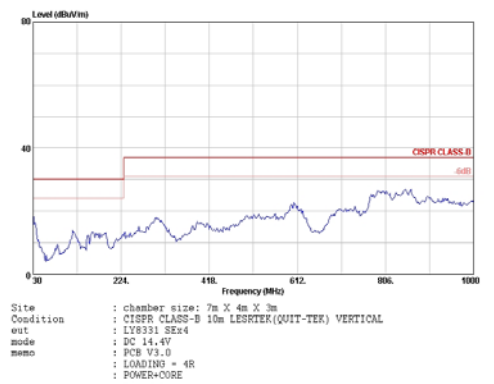
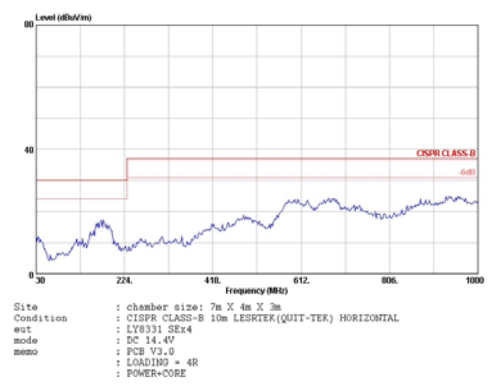
/4Ω</td><td>
</td><td>
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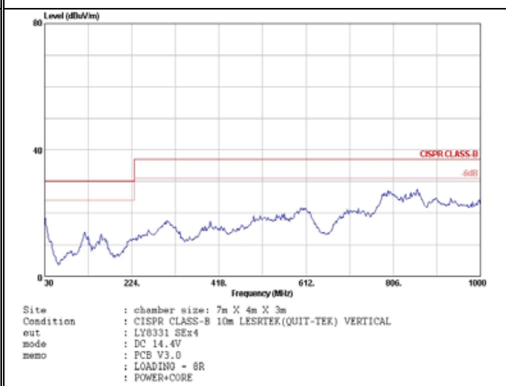
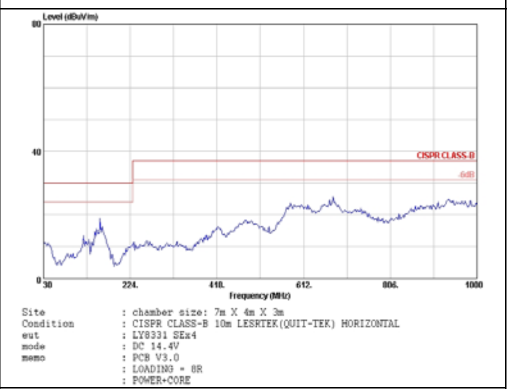
/8Ω</td><td>
</td><td>
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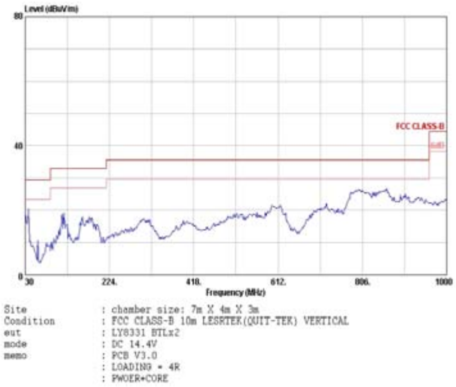
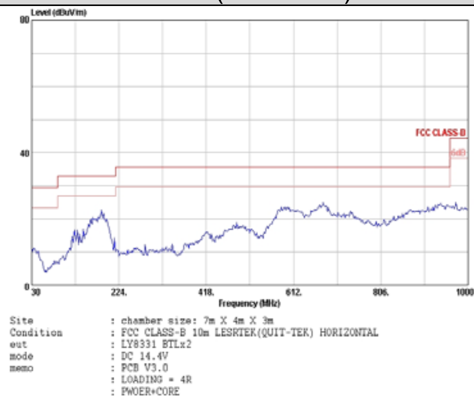
/4Ω</td><td>
</td><td>
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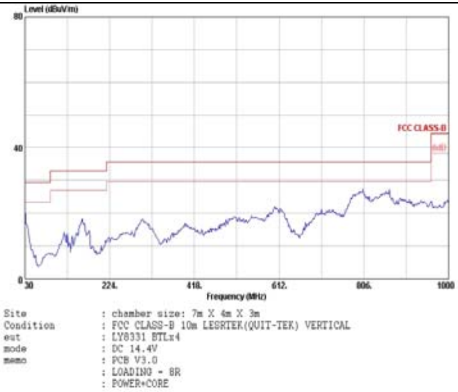
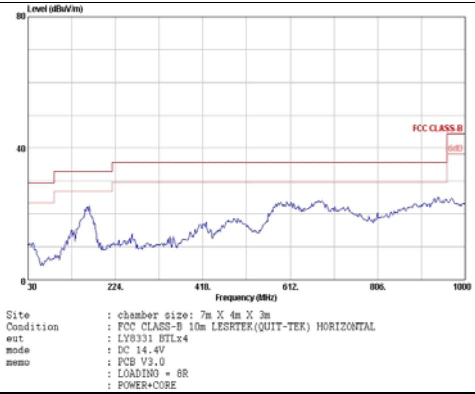
/8Ω</td><td>
</td><td>
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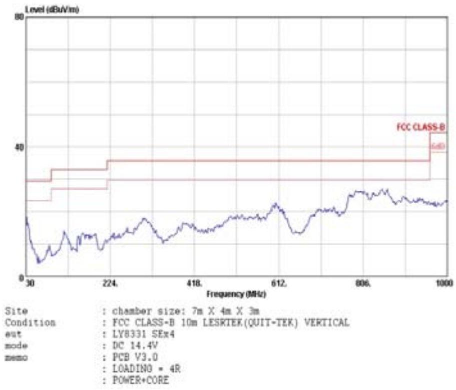
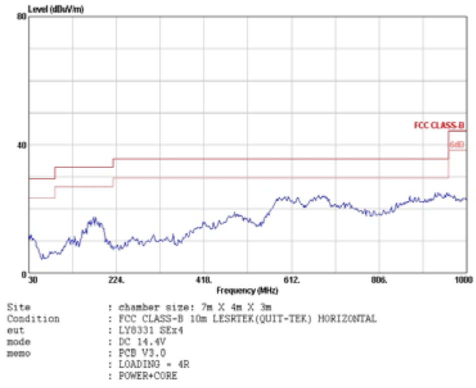
/4Ω</td><td>
</td><td>
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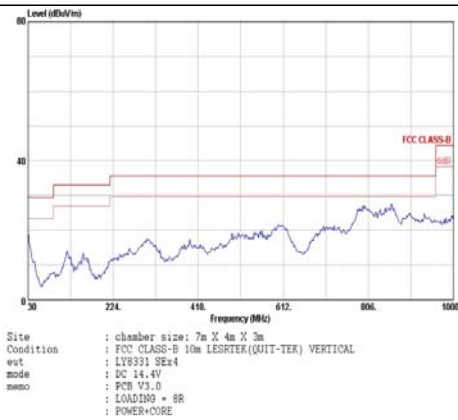
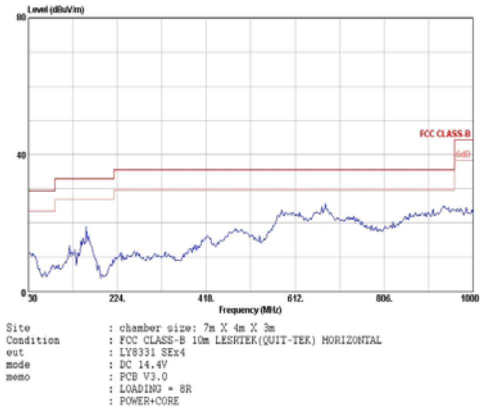
/8Ω</td><td>
</td><td>
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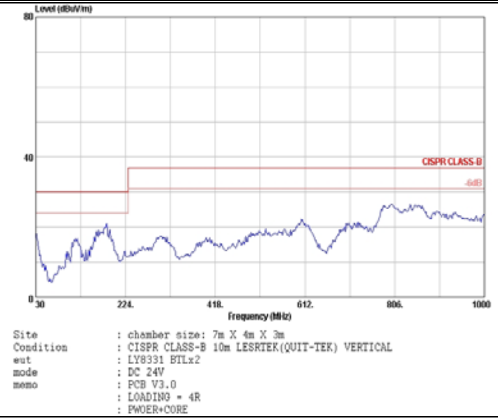

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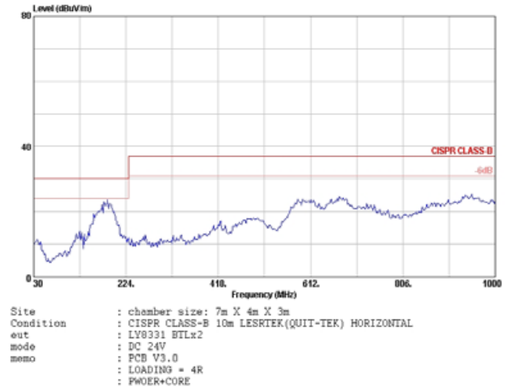

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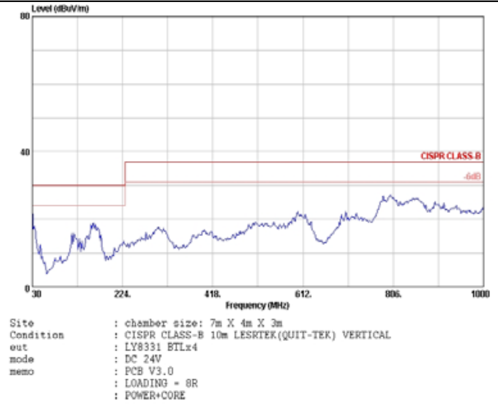

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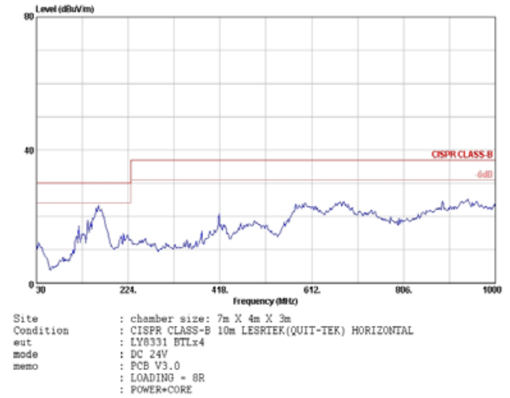

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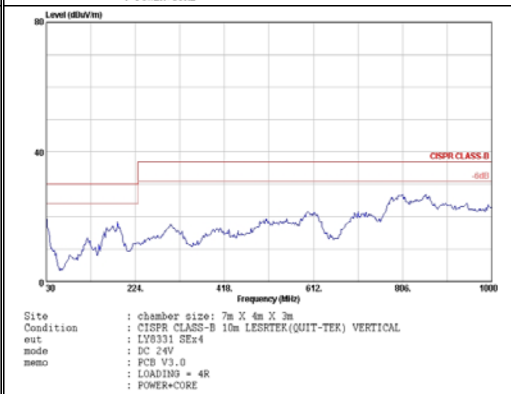

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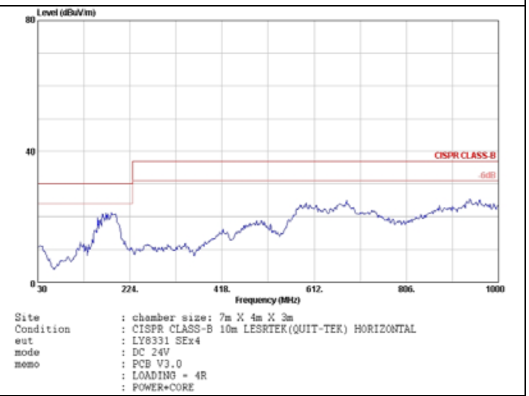

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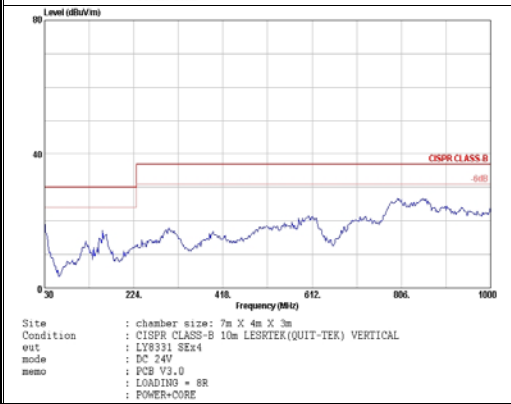

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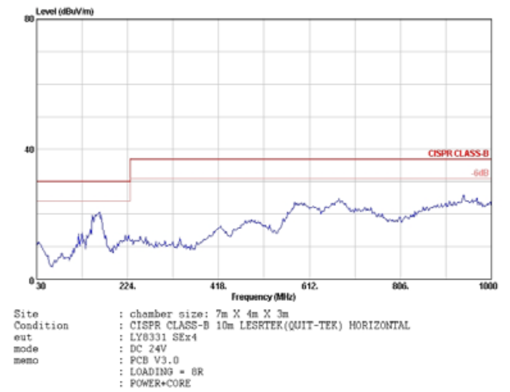

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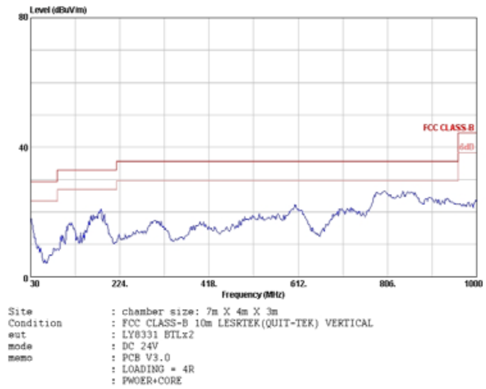
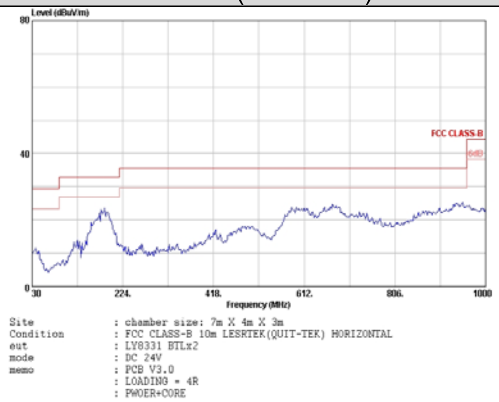
/4Ω</td><td>
</td><td>
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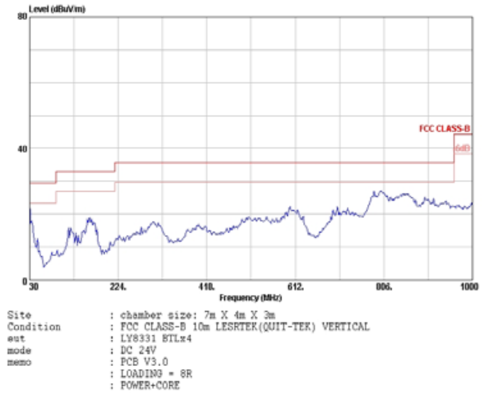
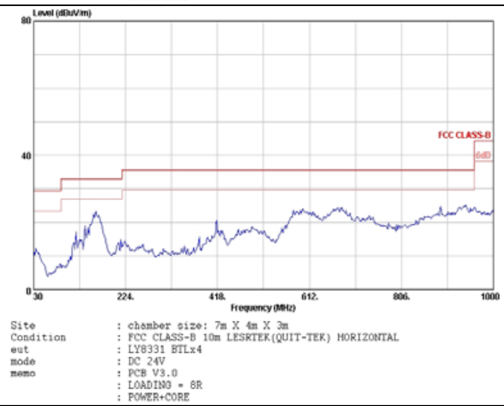
/8Ω</td><td>
</td><td>
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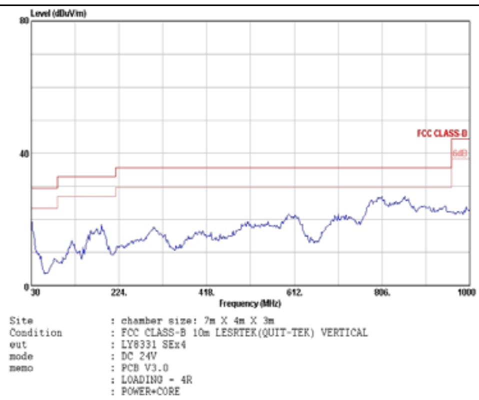
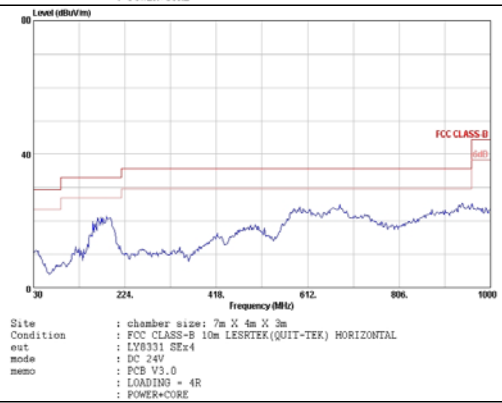
/4Ω</td><td>
</td><td>
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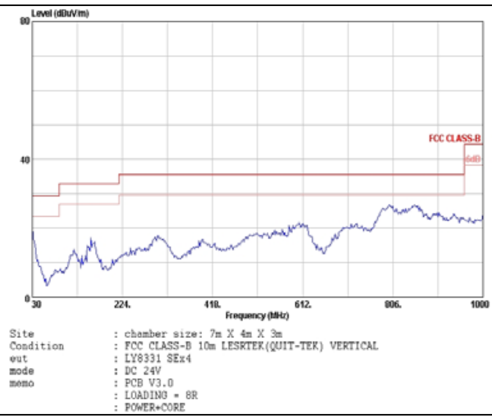
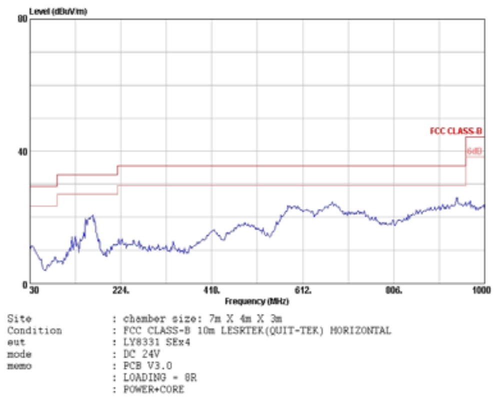
/8Ω</td><td>
</td><td>
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APPLICATION INFORMATION

Input Resistors (Ri) and Gain

The LY8366 has two internal amplifier stages. The pre-amplifier gain is externally configurable, while the total gain is internally fixed. The closed-loop gain of the pre-amplifier gain is set by selecting the Rf to Ri while the total gain is fixed at 6x. So the input resistors (R_i) set the gain of the amplifier according to the equation.

Pre-Amplifier Gain = Rf / Ri

Output=SE Mode:

Total Gain = (Rf / Ri) x 6

A_{VD} = 20 x log [6 x (Rf /Ri)]

For example

Table 1. Typical Total Gain and A_{VD} Values (SE Mode)

Rf (KΩ)	50	100	150	200	250	300
Ri (KΩ)	50	50	50	50	50	50
Total Gain	6	12	18	24	30	36
A_{VD} (db)	15.56	21.58	25.1	27.6	29.54	31.13

Output=BTL Mode:

Total Gain = (Rf / Ri) x 12

A_{VD} = 20 x log [12 x (Rf /Ri)]

For example

Table 2. Typical Total Gain and A_{VD} Values (BTL Mode)

Rf (KΩ)	50	100	150	200
Ri (KΩ)	50	50	50	50
Total Gain	12	24	36	48
A_{VD} (db)	21.58	27.6	31.13	33.62

Input Capacitors (Ci)

In typical application, C_i and the input resistance of the amplifier (R_i) form a high-pass filter with the corner frequency(f_c) determined in equation.

$f_c = 1 / (2\pi R_i C_i)$

The value of the input capacitor is important to consider as it directly affects the bass (low frequency) performance of the circuit.

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TEL: 886-3-6668838
FAX: 886-3-6668836

For example

C_i is 0.1 μF, so one would likely choose a value in the range of 0.1 μF to 1.0 μF. R_i is 50 kΩ and the specification calls for a flat bass response down to 30 Hz.

Ci = 1 / (2πRi fc)

Ci = 1 / (2π x 50KΩ x 30Hz)=0.106uF，One would likely choose a value of 0.1uF as this value is commonly used.

Note that it is important to C_i must be 10 times smaller than the bypass capacitor to reduce clicking and popping noise from power on/off and entering and leaving shutdown. After sizing C_i for a given cutoff frequency, size the bypass capacitor to 10 times that of the input capacitor.

Ci ≦ Cbypass

Bypass Capacitor (Cbypass)

The Bypass Capacitor (C3) is the most critical capacitor and serves important functions.
During start-up or recovery from shutdown mode, Cbypass determines the rate at which the amplifier starts up. The Cbypass will to reduce noise caused by the power supply coupling into the output drive signal. This noise is from the internal analog reference to the amplifier, which appears as degraded the PSRR and THD+N values.
The bypass capacitor (C3) with values of 1.0μF to 10.0μF is recommended for the best THD and noise performance. Therefore, increasing the bypass capacitor reduces clicking and popping noise from power on/off and entering and leaving shutdown. To have minimal pop, Cbypass should be 10 times larger than C_i.

Cbypass ≧ Ci

Power Supply Decoupling Capacitor (Cs)

The LY8366 is a high-performance class-D audio amplifier that requires adequate power supply decoupling to ensure the efficiency is high and total harmonic distortion (THD) is low. For higher frequency transients, spikes, or digital hash on the line, a good low equivalent-series-resistance (ESR) ceramic capacitor, typically 0.1uF~1.0uF, placed as close as possible to the device PVCC lead works best. Placing this decoupling capacitor close to the LY8366 is very important for the efficiency of the class-D amplifier, because any resistance or inductance in the trace between the device and the capacitor can cause a loss in efficiency. For filtering lower-frequency noise signals, a 1000uF or greater capacitor placed near the audio power amplifier would also help, so 1000uF or larger capacitor should be placed on each PVCC terminal.

Single-Ended Output Capacitor, (C_O)

In single-ended (SE) applications, the dc blocking capacitor forms a high-pass filter with the speaker impedance. The frequency response rolls off with decreasing frequency at a rate of 20 dB/decade. The cutoff frequency is determined by

$$f_c = 1 / (2\pi R_L C_O)$$

Table 3. Filter Responses Reference Values

Speaker Load (Ω)	SE mode - Co Capacitor select(uF)						
	fc=180Hz	fc=120Hz	fc=100Hz	fc=80Hz	fc=60Hz	fc=40Hz	fc=20Hz
4	220	330	390	470	680	1000	2200
6	-	220	-	330	470	680	1500
8	-	-	200	-	330	470	1000

Output Filter and Frequency Response

The output filter components consist of the series inductor and capacitor to ground at the LOUT and ROUT pins. There are several possible configurations, depending on the speaker impedance and whether the output configuration is single-ended (SE) or bridge-tied load (BTL). Table 4 lists the recommended values for the filter components. It is important to use a high-quality capacitor in this application and use metal poly capacitor in single-ended (SE) output.

Table 4. Recommended Filter Output Components Reference Values

Output Type	Speaker Load (Ω)	Filter Inductor (uH)	Filter Capacitor (uF)
Bridge Tied Load (BTL)	8	22	0.68
Single Ended (SE)	8	33	0.47
	4	22	0.68

BST Capacitors

The half H-bridge output stages use only NMOS transistors. Therefore, they require bootstrap capacitors for the high side of each output to turn on correctly. A 1.0uF ceramic capacitor, rated for at least 25V up, must be connected from each output to its corresponding bootstrap input. Specifically, all 1.0uF capacitor must be connected from OUT to BST pin.

The bootstrap capacitors connected between the BST pins and their corresponding outputs function as a floating power supply for the high-side N-channel power MOSFET gate-drive circuitry. During each high-side switching cycle, the bootstrap capacitors hold the gate-to-source voltage high enough to keep the high-side MOSFETs turned on.

VCLAMP Capacitor

To ensure that the maximum gate-to-source voltage for the NMOS output transistors is not exceeded, one internal regulator clamps the gate voltage. A 1.0uF capacitor must be connected from VCLAMP pin to ground and must be rated for 25V up. The voltages at the VCLAMP terminal may vary with PVCC and may not be used for powering any other circuitry.

Shutdown Function

When the LY8366 not in use. The device will be to turn off the amplifier to reduce power consumption. When logic low is applied to the shutdown pin, this shutdown feature will turns the amplifier off. By switching the shutdown pin connected to GND, the device supply current draw will be minimized in idle mode. The pin cannot be left floating due to the internal did not pull-up.

Mute Function

The Mute pin is an input pin to control the LY8366 output state. A logic high is disable the LY8366 outputs. A logic low on this pin enables the outputs. This terminal may be used as a quick disable/enable of outputs when changing channels on a TV or transitioning between different audio sources.

The Mute pin should never be left floating. For power conservation, the SD pin should be used to reduce the quiescent current to the absolute minimum level.

2F, No. 17, Industry E . Rd. II, Science-Based Industrial Park, Hsinchu 300, Taiwan
TEL: 886-3-6668838
FAX: 886-3-6668836

Over-Heat Protection and Automatic Recovery

The LY8366 has a built-in over-heat protection circuit, it will turn off all power output when the chip temperature over 180℃, the chip will return to normal operation automatically after the temperature cool down to 160℃.

Short Circuit Protection and Automatic Recovery

The LY8366 has short circuit protection circuitry on the outputs that prevents damage to the device during output-to-output shorts , output-to-GND shorts, and output-to-PVCC shorts.
When the short circuit is detected on the outputs, the part immediately disables the output drive. If the short was not removed, the protection circuitry activates again until the short is removed.

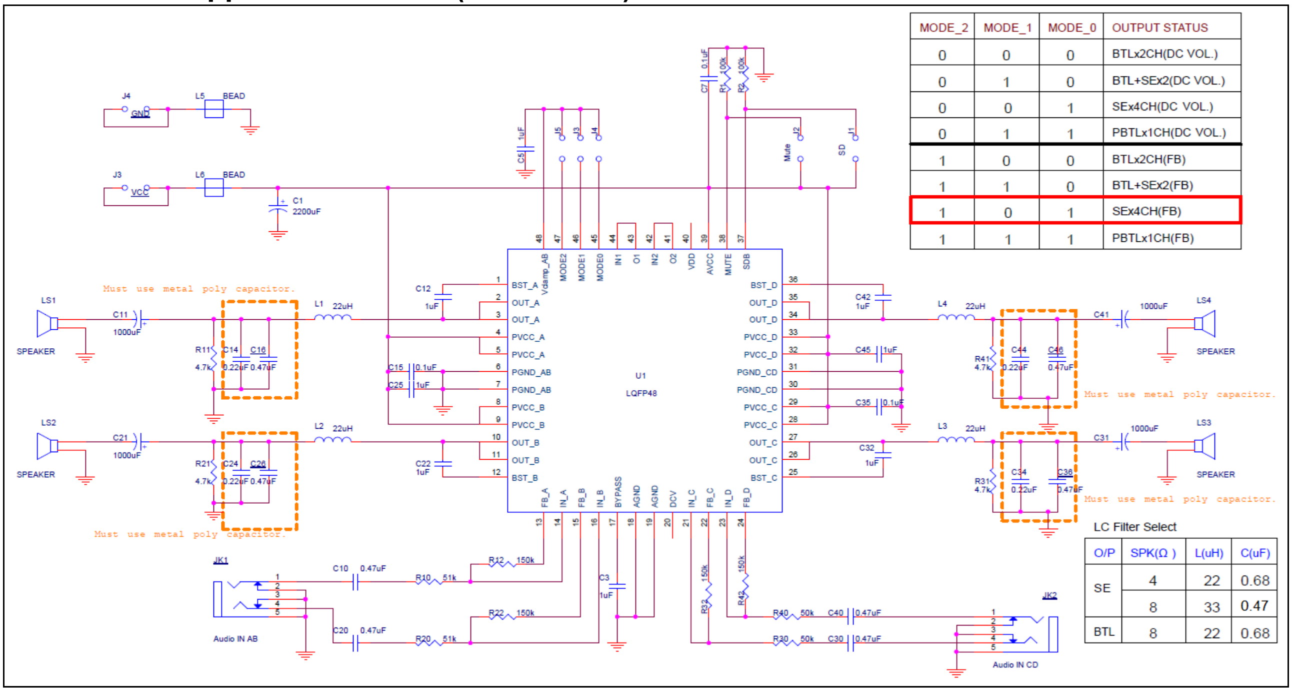
PCB Layout

Because the LY8366 is a class-D amplifier that switches at a high frequency, the layout of the PCB should be optimized according to the following guidelines for the best possible performance.

1. Thermal pad—The thermal pad must be soldered to the PCB for proper thermal performance and optimal reliability.
   Then the LY8366 must be mounted to the PCB board and increase a large area of copper or recommended to use external heat sink.
   But when total output power ≧40W, the device must be use external heat sink.
2. Decoupling capacitors—The high-frequency 0.1uF decoupling capacitors should be placed as close to the PVCC pins and AVCC pin terminals as possible.
   And the Bypass pin capacitor and VCLAMP pin capacitor should also be placed as close to the device as possible.
   Large (1000uF or greater) bulk power-supply decoupling capacitors should be placed near the device on the PVCC terminals.
3. Grounding—The AVCC pin decoupling capacitor and Bypass pin capacitor should each be grounded to analog ground (AGND).
   The PVCC decoupling capacitors and VCLAMP capacitors should each be grounded to power ground (PGND). Analog ground and power ground should be connected at the thermal pad, which should be used as a central ground connection or star ground for the LY8366.
4. Output filter—The reconstruction filter should be placed as close to the output terminals as possible for the best EMI performance. The capacitors should be grounded to power ground.
5. The input resistors need to be very close to the device input pins so noise does not couple on the high impedance nodes between the input resistors and the input amplifier of the device.
6. Making the high current traces going to PVCC, GND, V_{O+} and V_{O-} pins of the device should be as wide as possible to minimize trace resistance. If these traces are too thin, the device's performance and output power will decrease. The input traces do not need to be wide, but do need to run side-by-side to enable common-mode noise cancellation.

■DEMO BOARD INFORMATION-1 (Satellite Type – SEx4 or BTLx2 Mode)

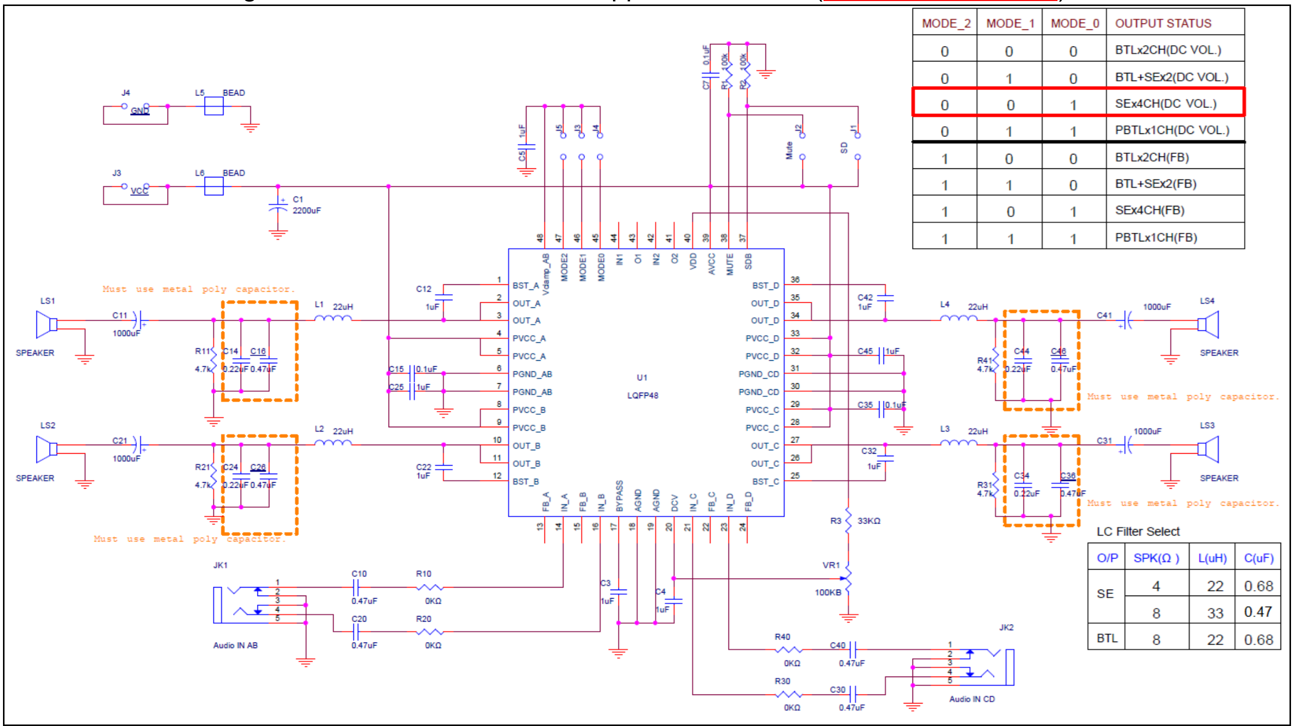
Demo Board Application Circuit (SEx4 mode)



MODE_2	MODE_1	MODE_0	OUTPUT STATUS
0	0	0	BTLx2CH(DC VOL.)
0	1	0	BTL+SEx2(DC VOL.)
0	0	1	SEx4CH(DC VOL.)
0	1	1	PBTLx1CH(DC VOL.)
1	0	0	BTLx2CH(FB)
1	1	0	BTL+SEx2(FB)
1	0	1	SEx4CH(FB)
1	1	1	PBTLx1CH(FB)

O/P	SPK(Ω)	L(uH)	C(uF)
SE	4	22	0.68
	8	33	0.47
BTL	8	22	0.68

Figure 24 LY8366 Demo Board Application Circuit (SEx4 with FB mode)



MODE_2	MODE_1	MODE_0	OUTPUT STATUS
0	0	0	BTLx2CH(DC VOL.)
0	1	0	BTL+SEx2(DC VOL.)
0	0	1	SEx4CH(DC VOL.)
0	1	1	PBTLx1CH(DC VOL.)
1	0	0	BTLx2CH(FB)
1	1	0	BTL+SEx2(FB)
1	0	1	SEx4CH(FB)
1	1	1	PBTLx1CH(FB)

O/P	SPK(Ω)	L(uH)	C(uF)
SE	4	22	0.68
	8	33	0.47
BTL	8	22	0.68

Figure 25 LY8366 Demo Board Application Circuit (SEx4 with DC Volume mode)

(*3) The device must be mounted to the PCB board and increase a large area of copper or recommended to use external heat sink. But when total output power ≧40W, the device must be use external heat sink.

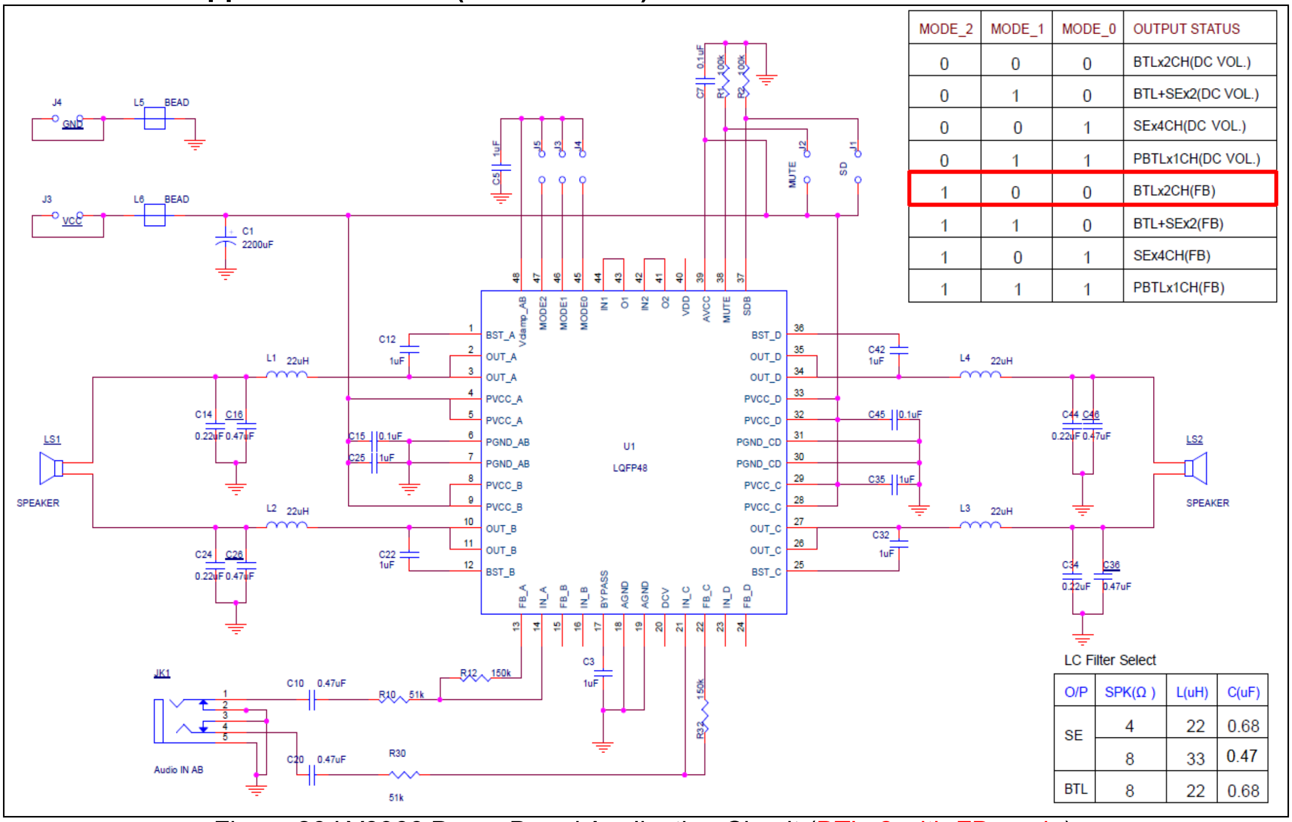
2F, No. 17, Industry E . Rd. II, Science-Based Industrial Park, Hsinchu 300, Taiwan
TEL: 886-3-6668838
FAX: 886-3-6668836

Demo Board BOM List (SEx4 mode)

LY8366 V3.0/4.0 BOM List **(SEx4 mode)**

No.	Description	Reference	Amount	Note	Remark
1	Capacitor,2200uF	C1,	1	DIP, 35V,105℃,10*20, EC Cap.	
2	Capacitor,470uF	C11,C21,C31,C41	4	DIP, 35V,105℃,10*20, EC Cap.	
3	Capacitor, 1.0uF	C3,C5,C12,C22,C32, C42,C25,C45	8	SMD0805 ,80%/-20%,NP	
4	Capacitor, 0.47uF	C16,C26,C36,C46	4	DIP, MSC,100Vdc, ±10%	Metal poly cap.
5	Capacitor, 0.22uF	C14,C24,C34,C44	4	DIP, MSC,100Vdc, ±10%	
6	Capacitor, 0.1uF	C7,C10,C20,C30,C40, C15,C35	7	SMD0805,80%/-20%,NP	
7	Resistor, 150KΩ	R12,R22,R32,R42	4	SMD0805,1/8W, 1%	FB mode only
8	Resistor, 100KΩ	R1,R2	2	SMD0805,1/8W, 1%	
9	Resistor, 51KΩ	R10,R20,R30,R40	4	SMD0805,1/8W, 1%	DCV mode use 0Ω
10	Resistor, 4.7KΩ	R11,R21,R31,R41	4	SMD0805,1/8W, 1%	
11	Fixed Inductors 22uH	L1,L2,L3,L4	4	DIP TOKO (A7502BY-330M)	
12	Capacitor, 0.1uF	C4	1	MD0805,80%/-20%,NP	DCV mode only
13	Resistor, 33KΩ	R3	1	SMD0805,1/8W, 1%	
14	Metal shaft rotary potentiometer	VR1	1	DIP100K,taper,+20%/-20%	

Demo Board Application Circuit (BTLx2 mode)



MODE_2	MODE_1	MODE_0	OUTPUT STATUS
0	0	0	BTLx2CH(DC VOL.)
0	1	0	BTL+SEx2(DC VOL.)
0	0	1	SEx4CH(DC VOL.)
0	1	1	PBTLx1CH(DC VOL.)
1	0	0	BTLx2CH(FB)
1	1	0	BTL+SEx2(FB)
1	0	1	SEx4CH(FB)
1	1	1	PBTLx1CH(FB)

LC Filter Select

O/P	SPK(Ω)	L(uH)	C(uF)
SE	4	22	0.68
	8	33	0.47
BTL	8	22	0.68

Figure 26 LY8366 Demo Board Application Circuit (BTLx2 with FB mode)

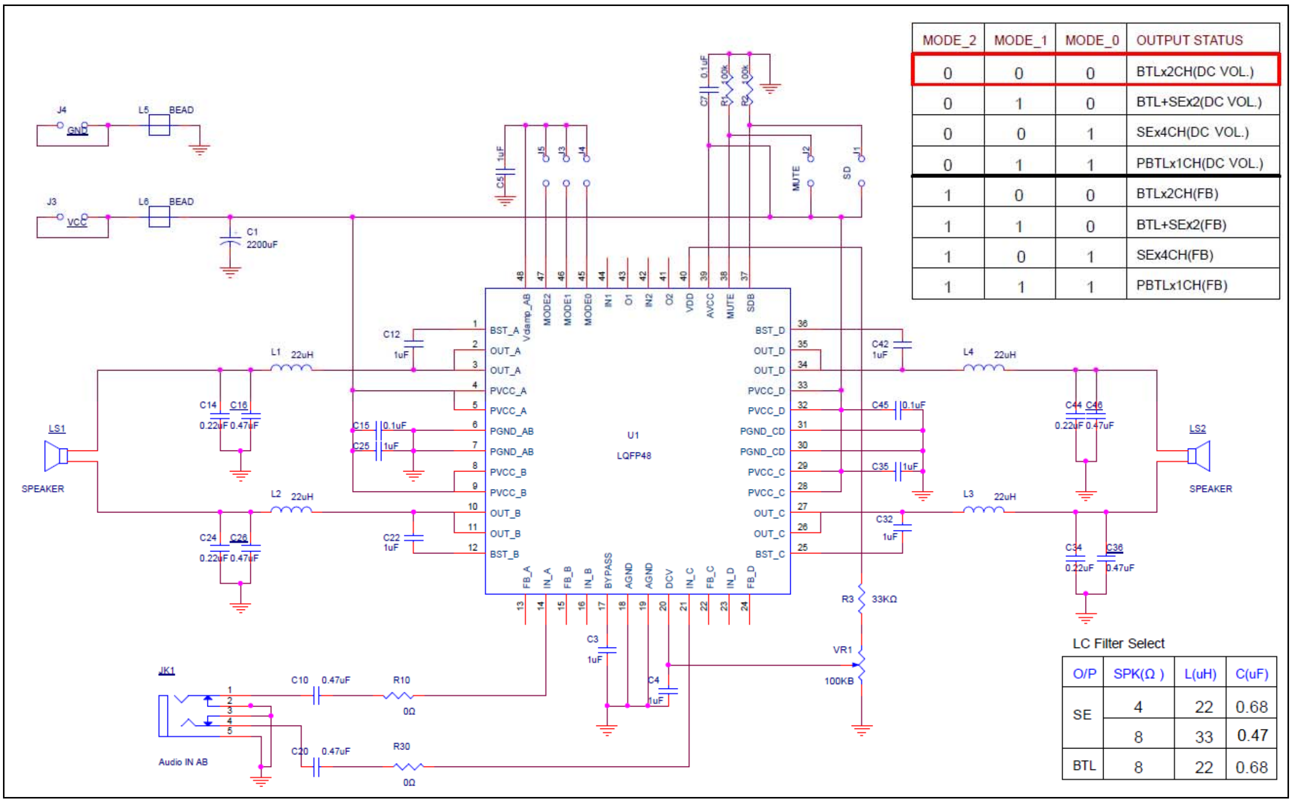


Figure 27 LY8366 Demo Board Application Circuit (BTLx2 with DC Volume mode)

(*3) The device must be mounted to the PCB board and increase a large area of copper or recommended to use external heat sink. But when total output power ≧40W, the device must be use external heat sink.

Demo Board BOM List (BTLx2 mode)

LY8366 V3.0/4.0 BOM List **(BTLx2 mode)**

No.	Description	Reference	Amount	Note	Remark
1	Capacitor,2200uF	C1,	1	DIP, 35V,105℃,10*20, EC Cap.	
2	Capacitor, 1.0uF	C3,C5,C12,C22,C32, C42,C25,C45	8	SMD0805 ,80%/-20%,NP	
3	Capacitor,0.47uF	C16,C26,C36, C46	4	SMD0805 ,80%/-20%,NP	
4	Capacitor, 0.22uF	C14,C24,C34,C44	4	DIP, MSC,100Vdc, ±10%	Metal poly cap.
5	Capacitor, 0.1uF	C7,C10,C20,C15,C35	5	SMD0805,80%/-20%,NP	
6	Resistor, 150KΩ	R12,R32	2	SMD0805,1/8W, 1%	FB mode only
7	Resistor, 100KΩ	R1,R2	2	SMD0805,1/8W, 1%	
8	Resistor, 51KΩ	R10,R30	2	SMD0805,1/8W, 1%	DCV mode use 0Ω
9	Fixed Inductors 22uH	L1,L2,L3,L4	4	DIP, TOKO (A7502BY-330M)	
10	Capacitor, 0.1uF	C4	1	MD0805,80%/-20%,NP	DCV mode only
11	Resistor, 33KΩ	R3	1	SMD0805,1/8W, 1%	
12	Metal shaft rotary potentiometer	VR1	1	DIP100K,taper,+20%/-20%	

Demo Board Application Circuit (2.1CH mode) SEx2 + BTLx1 mode

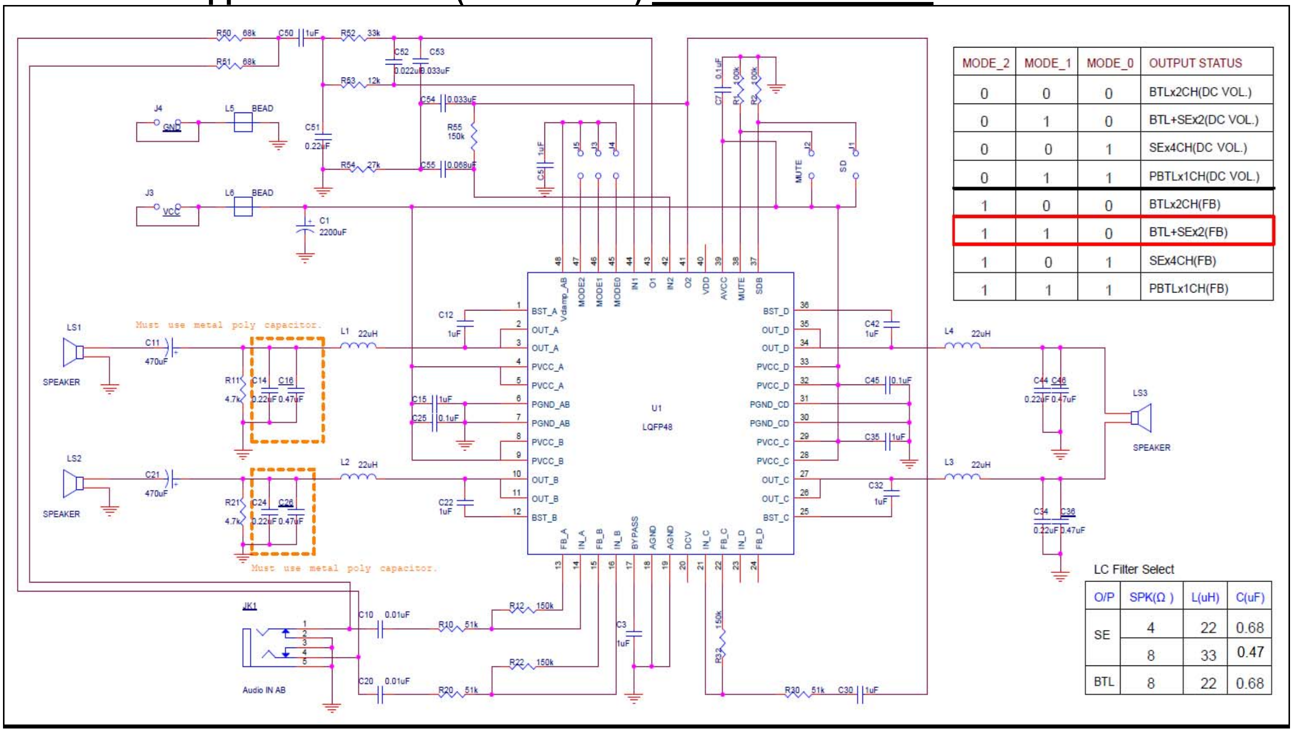


Figure 28 LY8366 Demo Board Application Circuit (2.1CH with FB mode)

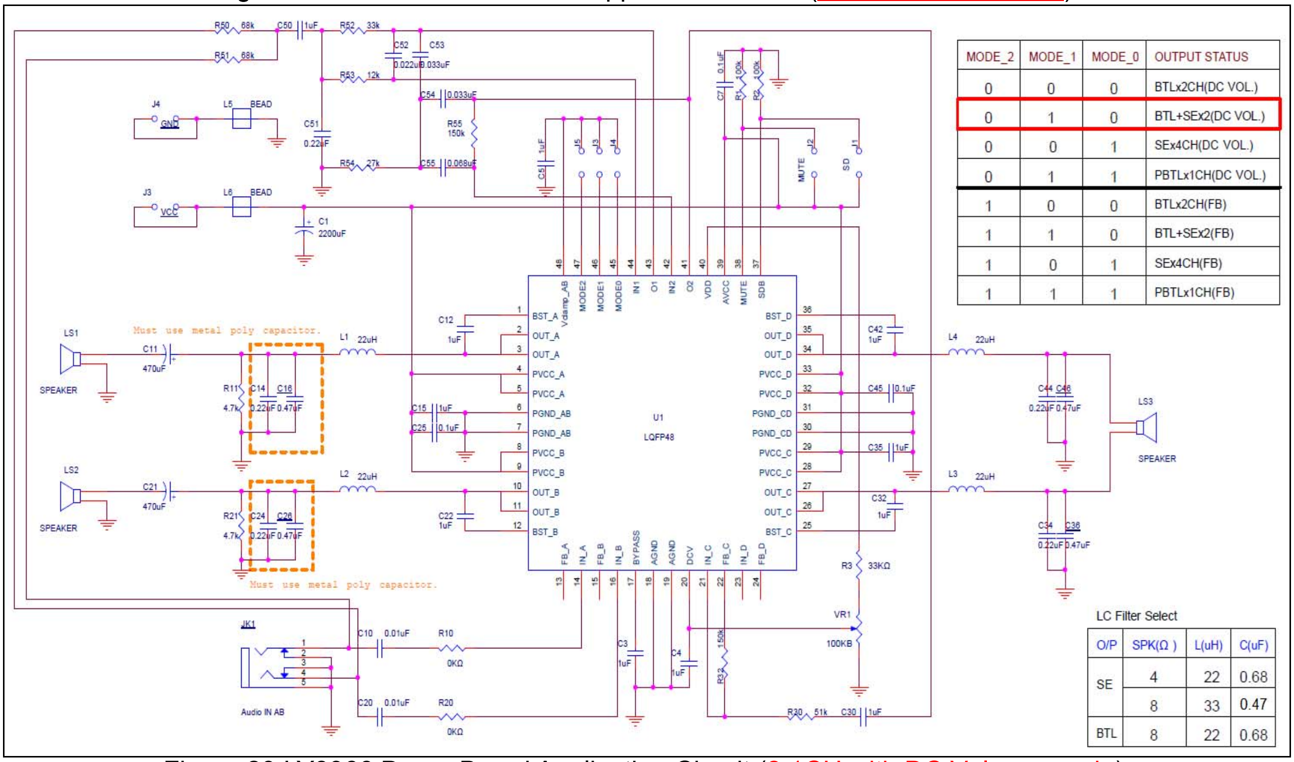


Figure 29 LY8366 Demo Board Application Circuit (2.1CH with DC Volume mode)

(*3) The device must be mounted to the PCB board and increase a large area of copper or recommended to use external heat sink. But when total output power ≧40W, the device must be use external heat sink.

Demo Board BOM List (2.1CH mode)

LY8366 V3.0/4.0 BOM List **(2.1CH mode)**

No.	Description	Reference	Amount	Note	Remark
1	Capacitor,2200uF	C1	1	DIP 35V,105℃,10*20, EC Cap.	
2	Capacitor,220uF	C11,C21	2	DIP 35V,105℃,10*20, EC Cap.	
3	Capacitor, 1.0uF	C3,C5,C30,C12,C22,C32,C42,C50,C15,C35	10	SMD0805,80%/-20%,NP	
4	Capacitor,0.47uF	C16,C26,C36,C46	4	DIP, MSC,100Vdc, ±10%	SE Output use Metal poly cap.
5	Capacitor,0.22uF	C14,C24,C34,C44	4	DIP, MSC,100Vdc, ±10%	
6	Capacitor,0.22uF	C51	1	SMD0805,80%/-20%,NP	
7	Capacitor, 0.1uF	C7,C25,C45	3	SMD0805 ,80%/-20%,NP	
8	Capacitor, 0.068uF	C55	2	SMD0805,80%/-20%,NP	
9	Capacitor, 0.033uF	C53,C54	2	SMD0805,80%/-20%,NP	
10	Capacitor, 0.022uF	C52	1	SMD0805,80%/-20%,NP	
11	Capacitor, 0.01uF	C10,C20	2	SMD0805,80%/-20%,NP	
12	Resistor, 150KΩ	R12,R22,R32,R55	4	SMD0805,1/8W, 1%	R12,R22, R32 FB mode only
13	Resistor, 100KΩ	R1,R2	2	SMD0805,1/8W, 1%	
14	Resistor, 82KΩ	R30	1	SMD0805,1/8W, 1%	DCV mode use 0Ω
15	Resistor, 68KΩ	R50,R51	2	SMD0805,1/8W, 1%	
16	Resistor, 51KΩ	R10,R20	2	SMD0805,1/8W, 1%	DCV mode use 0Ω
17	Resistor, 33KΩ	R52	1	SMD0805,1/8W, 1%	
18	Resistor, 27KΩ	R54	1	SMD0805,1/8W, 1%	
19	Resistor, 12KΩ	R53	1	SMD0805,1/8W, 1%	
20	Resistor, 4.7KΩ	R11,R21	2	SMD0805,1/8W, 1%	
21	Fixed Inductors 22uH	L1,L2,L3,L4	4	DIP, TOKO (A7502BY-220M)	
22	Capacitor, 0.1uF	C4	1	MD0805,80%/-20%,NP	
23	Resistor, 33KΩ	R3	1	SMD0805,1/8W, 1%	DCV mode only
24	Metal shaft rotary potentiometer	VR1	1	DIP100K,taper,+20%/-20%	

2.1 Channel (2xSE+1xBTL Mode) Hi-Low Pass filter cutoff frequency chart:

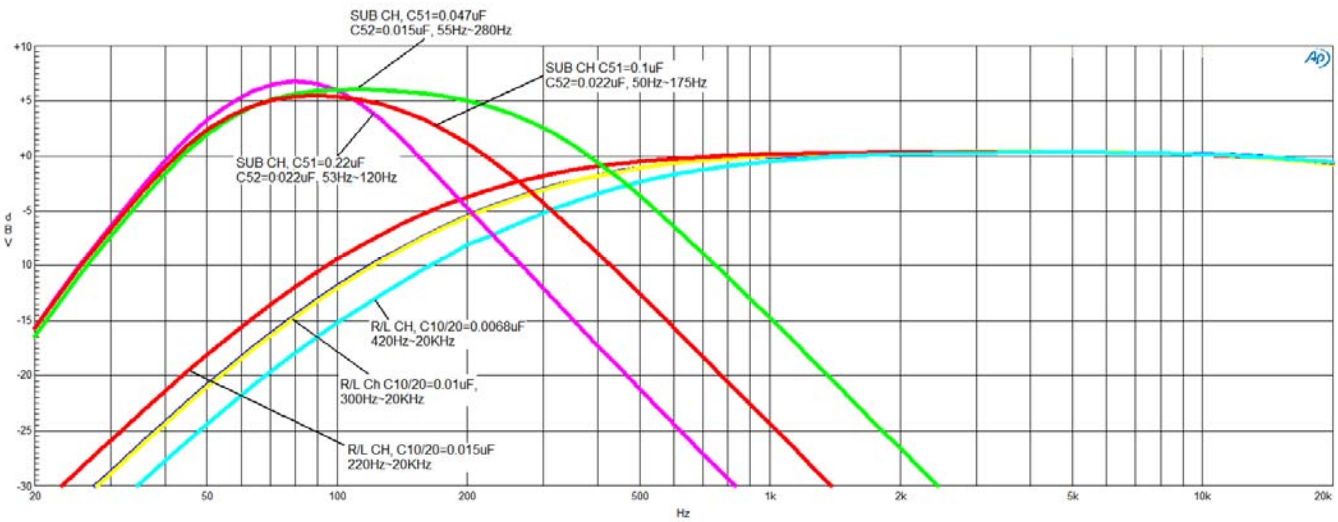
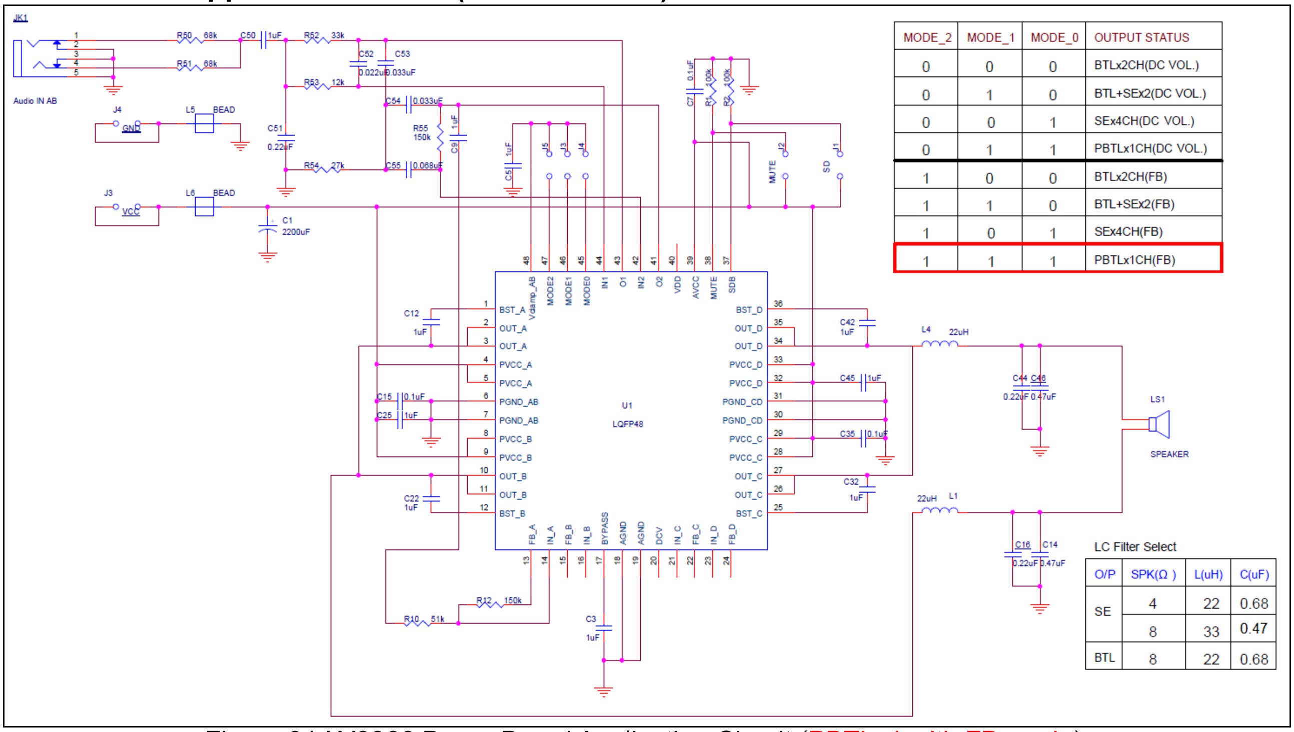


Figure 30 LY8366 2.1CH mode Hi-Low Pass filter cutoff frequency chart

Demo Board Application Circuit (PBTLx1 mode)

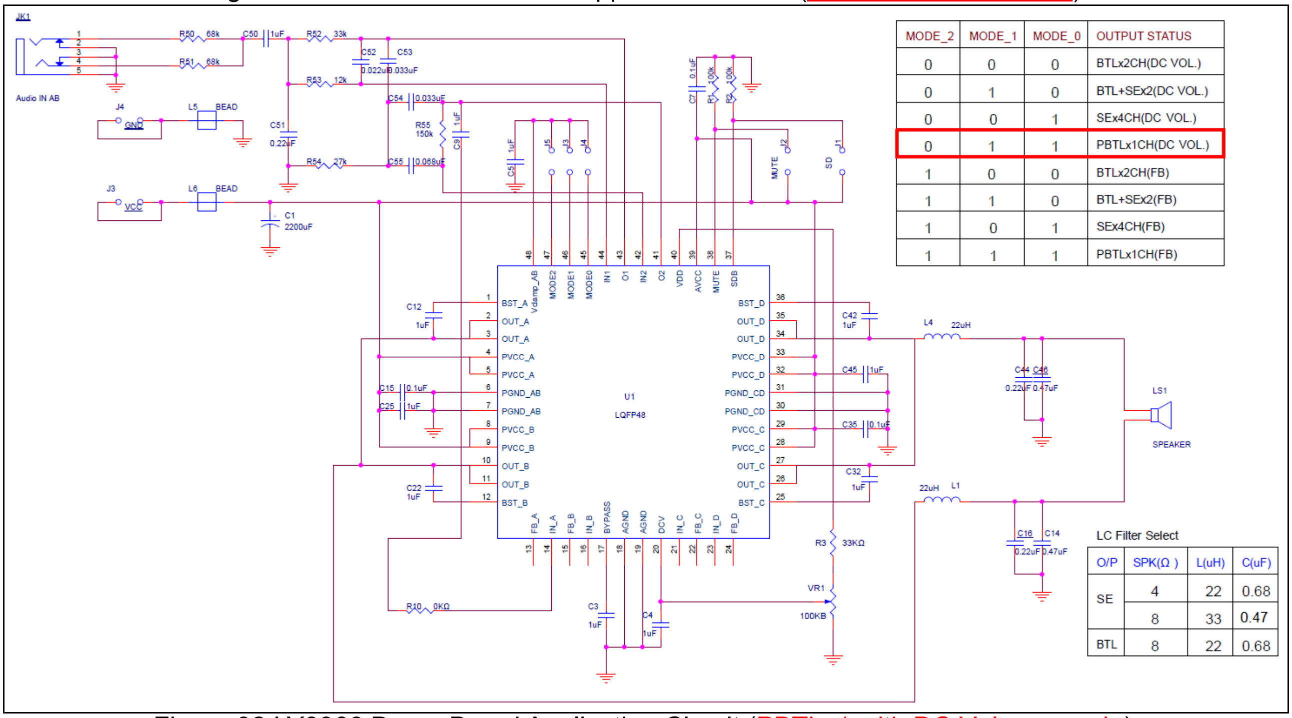


MODE_2	MODE_1	MODE_0	OUTPUT STATUS
0	0	0	BTLx2CH(DC VOL.)
0	1	0	BTL+SEx2(DC VOL.)
0	0	1	SEx4CH(DC VOL.)
0	1	1	PBTLx1CH(DC VOL.)
1	0	0	BTLx2CH(FB)
1	1	0	BTL+SEx2(FB)
1	0	1	SEx4CH(FB)
1	1	1	PBTLx1CH(FB)

LC Filter Select

O/P	SPK(Ω)	L(uH)	C(uF)
SE	4	22	0.68
	8	33	0.47
BTL	8	22	0.68

Figure 31 LY8366 Demo Board Application Circuit (PBTLx1 with FB mode)



MODE_2	MODE_1	MODE_0	OUTPUT STATUS
0	0	0	BTLx2CH(DC VOL.)
0	1	0	BTL+SEx2(DC VOL.)
0	0	1	SEx4CH(DC VOL.)
0	1	1	PBTLx1CH(DC VOL.)
1	0	0	BTLx2CH(FB)
1	1	0	BTL+SEx2(FB)
1	0	1	SEx4CH(FB)
1	1	1	PBTLx1CH(FB)

LC Filter Select

O/P	SPK(Ω)	L(uH)	C(uF)
SE	4	22	0.68
	8	33	0.47
BTL	8	22	0.68

Figure 32 LY8366 Demo Board Application Circuit (PBTLx1 with DC Volume mode)

(*3) The device must be mounted to the PCB board and increase a large area of copper or recommended to use external heat sink. But when total output power ≧40W, the device must be use external heat sink.

2F, No. 17, Industry E . Rd. II, Science-Based Industrial Park, Hsinchu 300, Taiwan
TEL: 886-3-6668838
FAX: 886-3-6668836

Demo Board BOM List (PBTL mode)

LY8366 V3.0/4.0 BOM List **(PBTL mode)**

No.	Description	Reference	Amount	Note	Remark
1	Capacitor,2200uF	C1,	1	DIP 35V,105℃,10*20, EC Cap.	
2	Capacitor, 1.0uF	C3,C5,C9,C12,C22, C32,C42,C50,C25,C45	10	SMD0805,80%/-20%,NP	
3	Capacitor,0.47uF	C14,C44	2	SMD0805,80%/-20%,NP	
4	Capacitor,0.22uF	C51	1	SMD0805,80%/-20%,NP	
5	Capacitor,0.22uF	C16,C46	2	DIP, MSC,100Vdc, ±10%	
6	Capacitor, 0.1uF	C7,C15,C35	3	SMD0805 ,80%/-20%,NP	
7	Capacitor, 0.068uF	C55	1	SMD0805,80%/-20%,NP	
8	Capacitor, 0.033uF	C53,C54	2	SMD0805,80%/-20%,NP	
9	Capacitor, 0.022uF	C52	1	SMD0805,80%/-20%,NP	
10	Resistor, 150KΩ	R12,R55	2	SMD0805,1/8W, 1%	R12 FB mode only
11	Resistor, 120KΩ	R10	1	SMD0805,1/8W, 1%	DCV mode use 0Ω
12	Resistor, 100KΩ	R1,R2	2	SMD0805,1/8W, 1%	
13	Resistor, 68KΩ	R50,R51	2	SMD0805,1/8W, 1%	
14	Resistor, 33KΩ	R52	1	SMD0805,1/8W, 1%	
15	Resistor, 27KΩ	R54	1	SMD0805,1/8W, 1%	
16	Resistor, 12KΩ	R53	1	SMD0805,1/8W, 1%	
17	Fixed Inductors 22uH	L1,L2,L3,L4	4	DIP, TOKO (A7502BY-220M)	
18	Capacitor, 0.1uF	C4	1	MD0805,80%/-20%,NP	DCV mode only
19	Resistor, 33KΩ	R3	1	SMD0805,1/8W, 1%	
20	Metal shaft rotary potentiometer	VR1	1	DIP100K,taper,+20%/-20%	

PBTL Mode (Hi-Low Pass filter cutoff frequency chart):

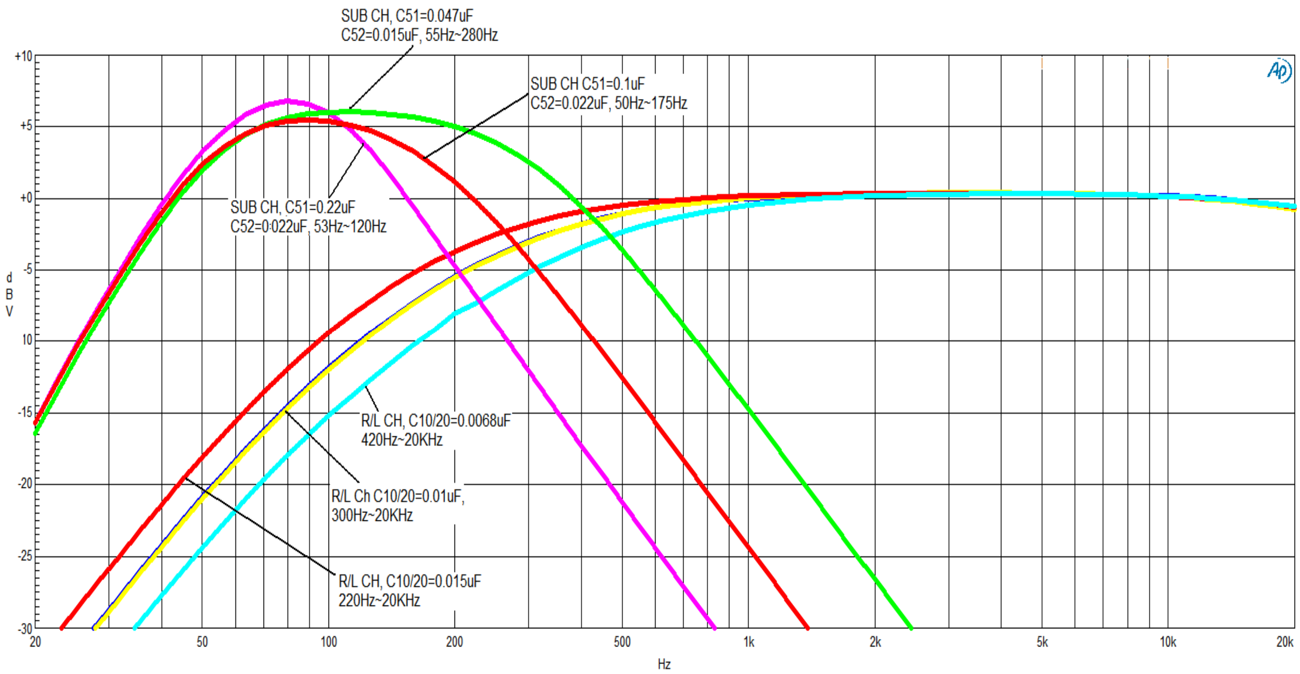
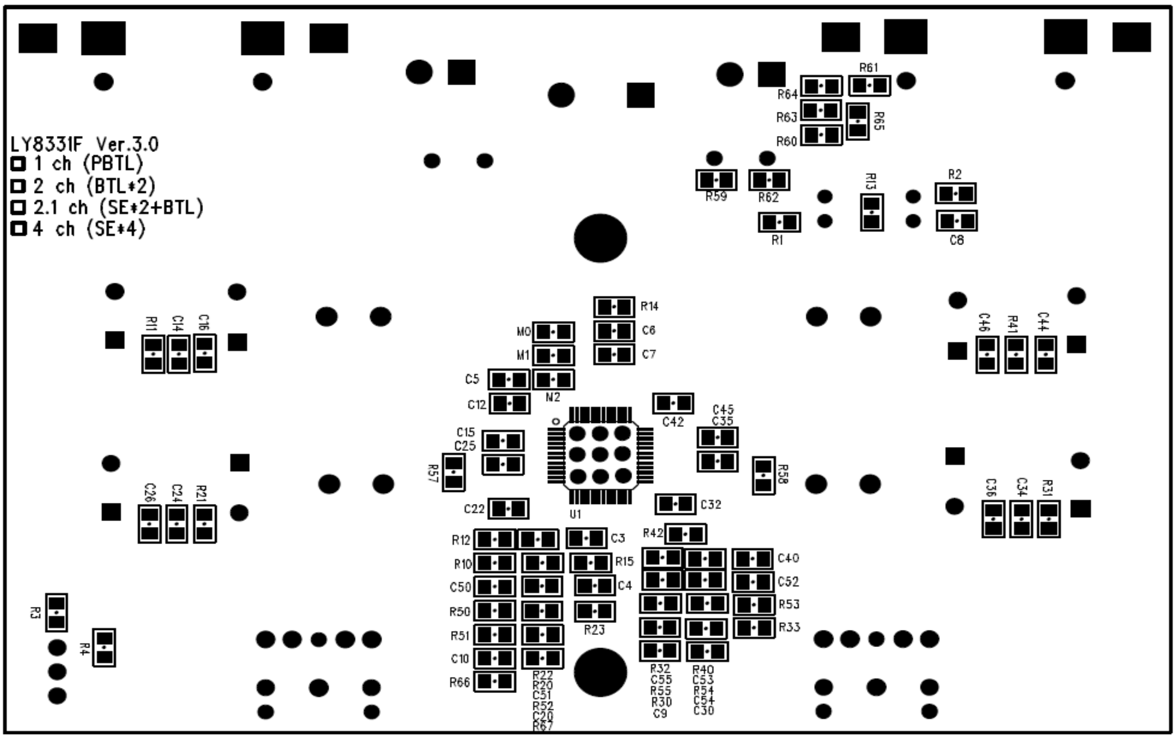


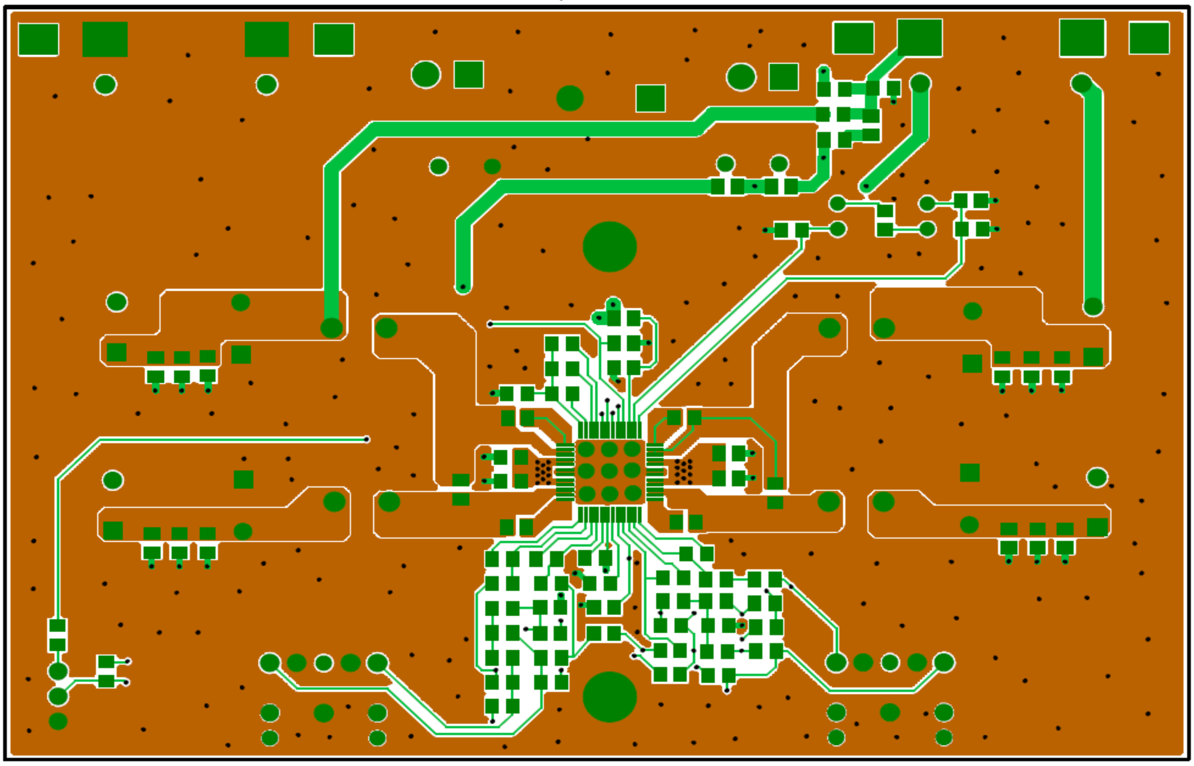
Figure 33 LY8366 2.1CH mode Hi-Low Pass filter cutoff frequency chart

Demo Board Artwork (SEx4、BTLx2、2.1CH and PBTL Mode)

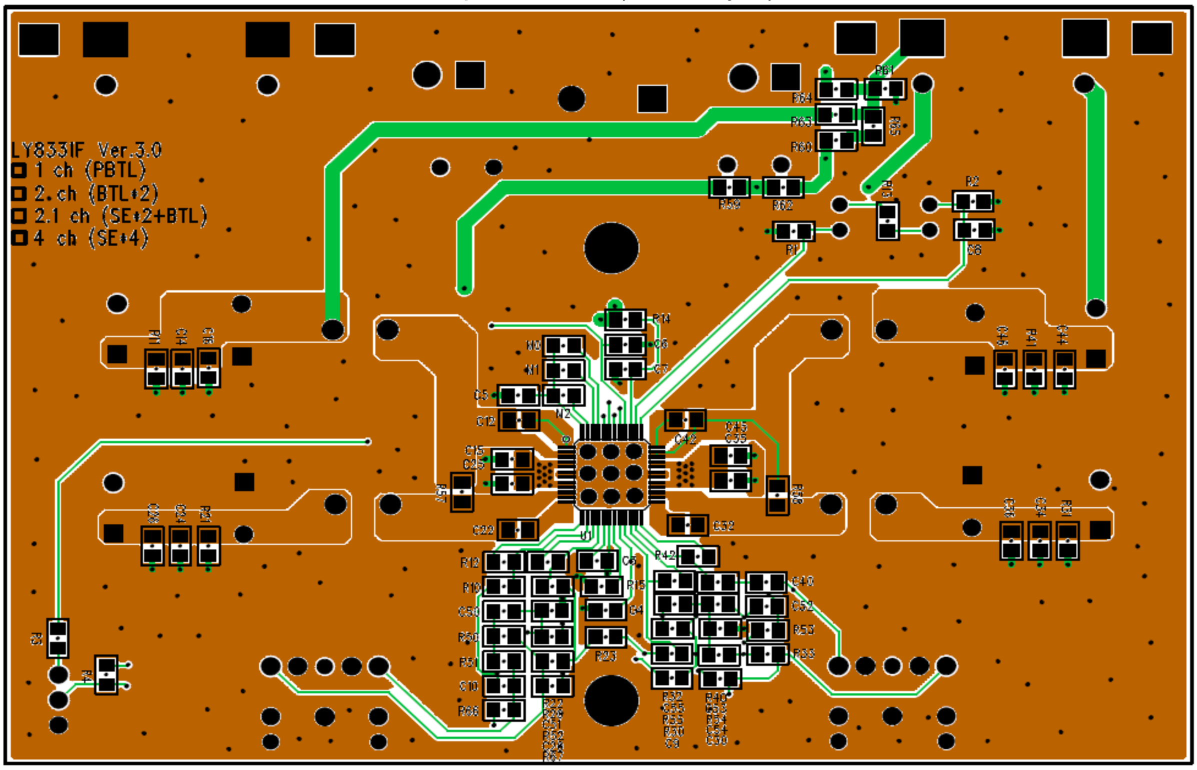
Top Silkscreen



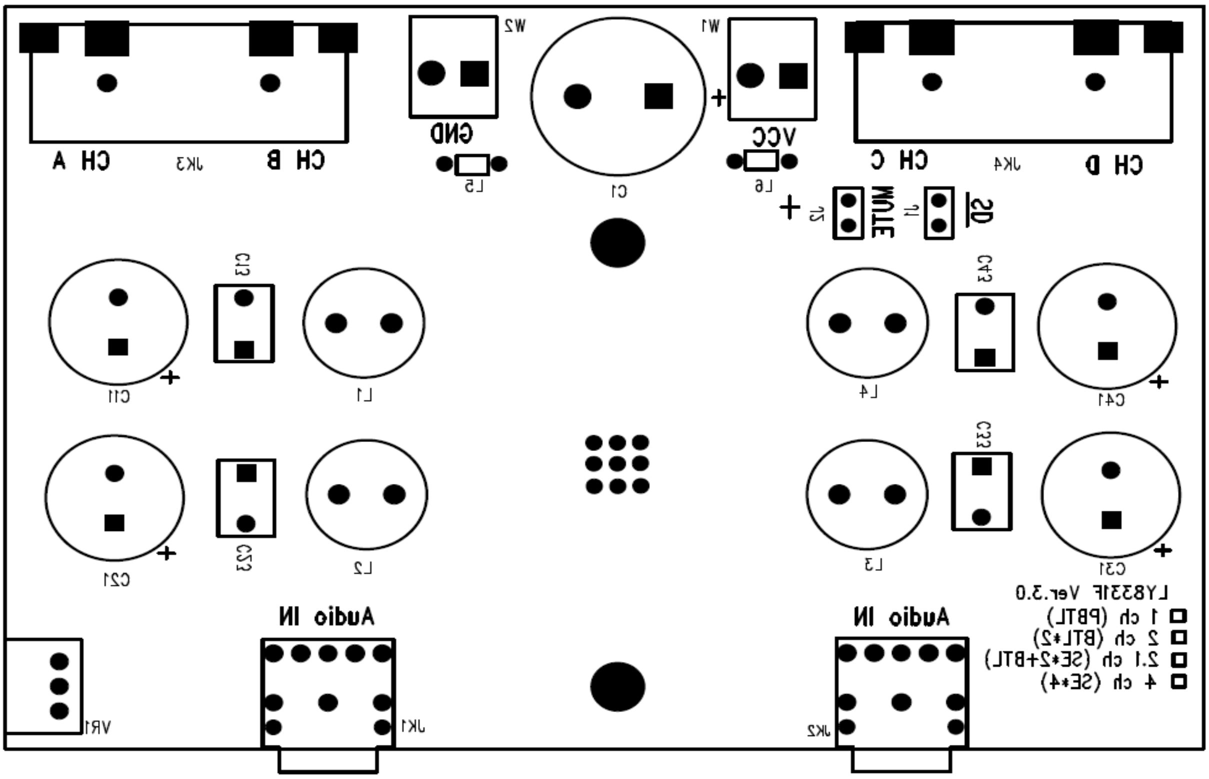
Top Layer



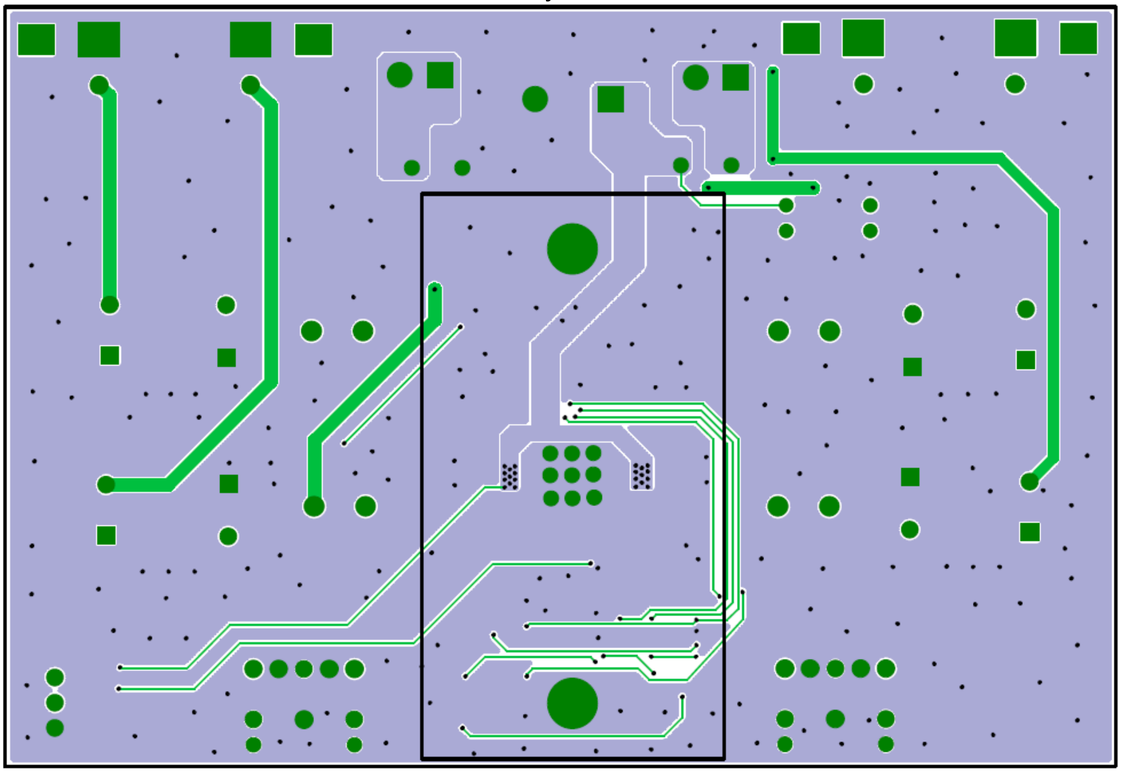
Composite view (TOP Layer)



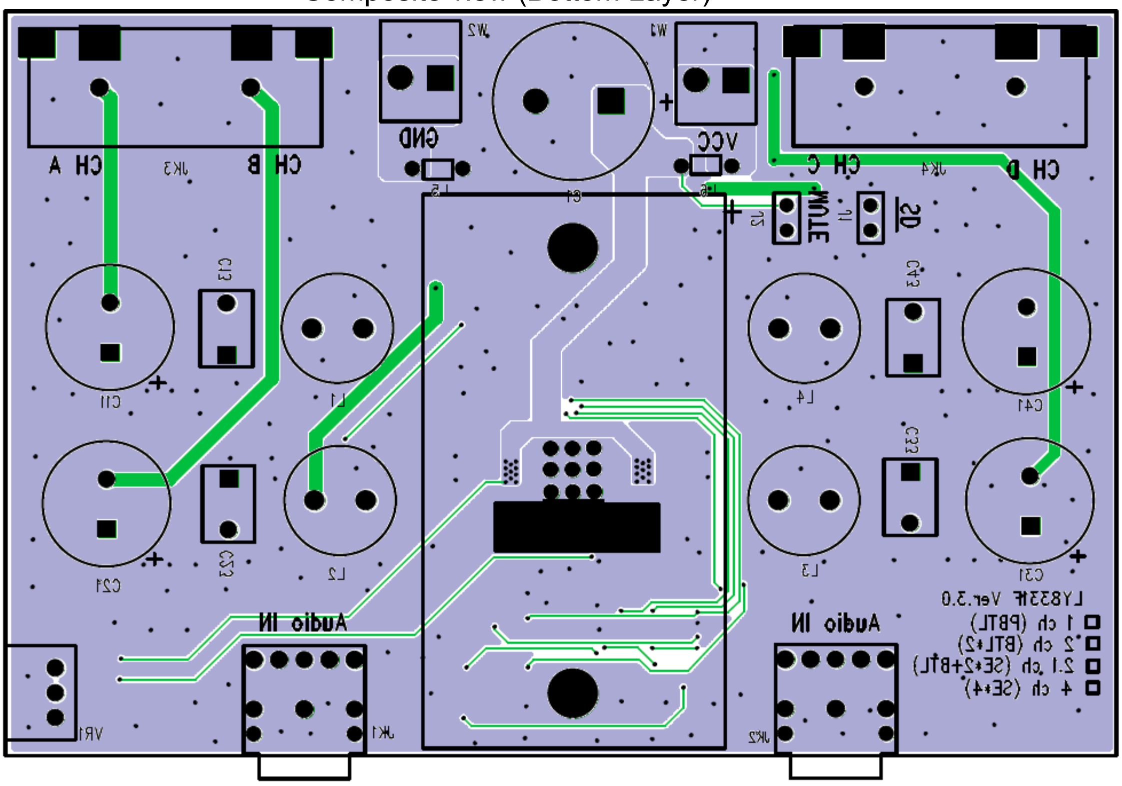
Bottom Silkscreen



Bottom Layer

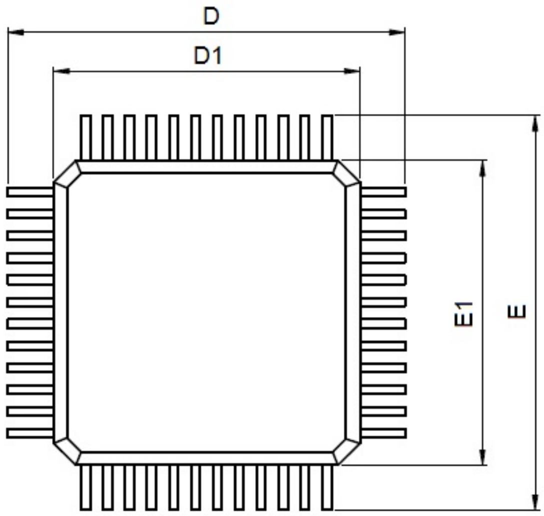


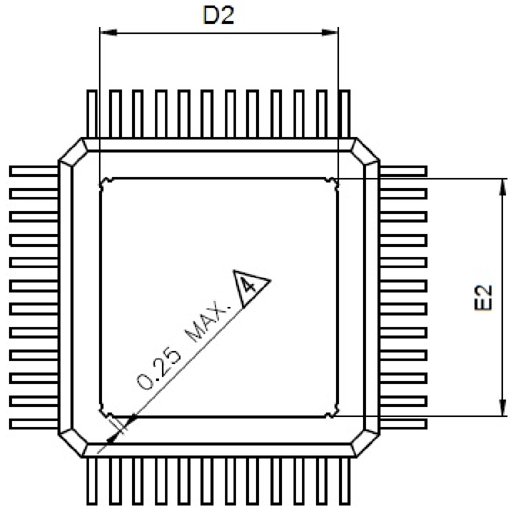
Composite view (Bottom Layer)



PACKAGE OUTLINE DIMENSION

LQFP 48 Pin Package Outline Dimension

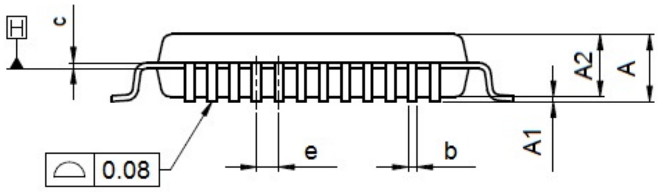




THERMALLY ENHANCED VARIATIONS ONLY

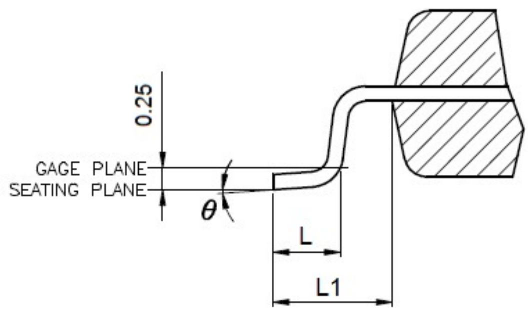
VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

SYMBOLS	MIN.	NOM.	MAX.
A	--	--	1.60
A1	0.05	--	0.15
A2	1.35	1.40	1.45
b	0.17	0.22	0.27
c	0.09	--	0.20
D	9.00 BSC		
D1	7.00 BSC		
E	9.00 BSC		
E1	7.00 BSC		
e	0.50 BSC		
L	0.45	0.60	0.75
L1	1.00 REF		
θ	0°	3.5°	7°



THERMALLY ENHANCED DIMENSIONS(SHOWN IN MM)

PAD SIZE	E2		D2	
	MIN.	MAX.	MIN.	MAX.
205X20E	4.31	5.21	4.31	5.21



NOTES:
1. JEDEC OUTLINE :
   MS-026 BBC
   MS-026 BBC-HD(THERMALLY ENHANCED VARIATIONS ONLY)
2. DATUM PLANE H IS LOCATED AT THE BOTTOM OF THE MOLD PARTING LINE COINCIDENT WITH WHERE THE LEAD EXITS THE BODY.
3. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.25 mm PER SIDE. DIMENSIONS D1 AND E1 DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE H .
4. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION.

2F, No. 17, Industry E . Rd. II, Science-Based Industrial Park, Hsinchu 300, Taiwan
TEL: 886-3-6668838
FAX: 886-3-6668836