



# DIGITAL POWER AMPLIFIER

DLogixs Inc.



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# I. Overview

## 1. Concept(1) :

: MMA(From Dec, 2001, starting to produce MMA IC)

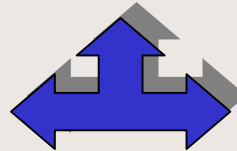
**New Technology :**

**High Efficiency of Digital Amp +High Fidelity of Analog Amp**



ASIC

Independent Current Source  
Digital Amplifier



Dependent Voltage Source  
Analog Amplifier



# I. Overview

## 1. Concept(2) : DMA

- CLASS-D ?

- Amplified by switching mode, operating more than 85% efficiency

## 1. Concept(3)

Amplifier	Class	Fidelity	Efficiency
Analog	A	Excellent	Poor
	AB	Good	Fair
	B	Fair	Good
Digital	D	Bad	Excellent

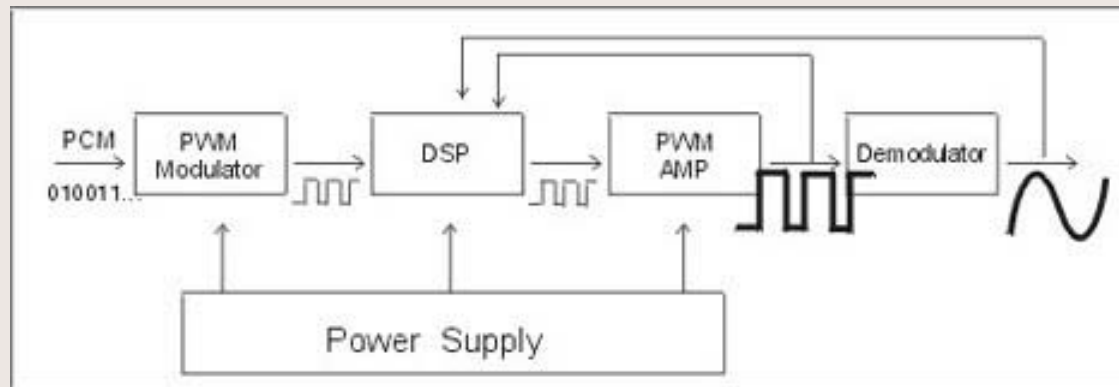
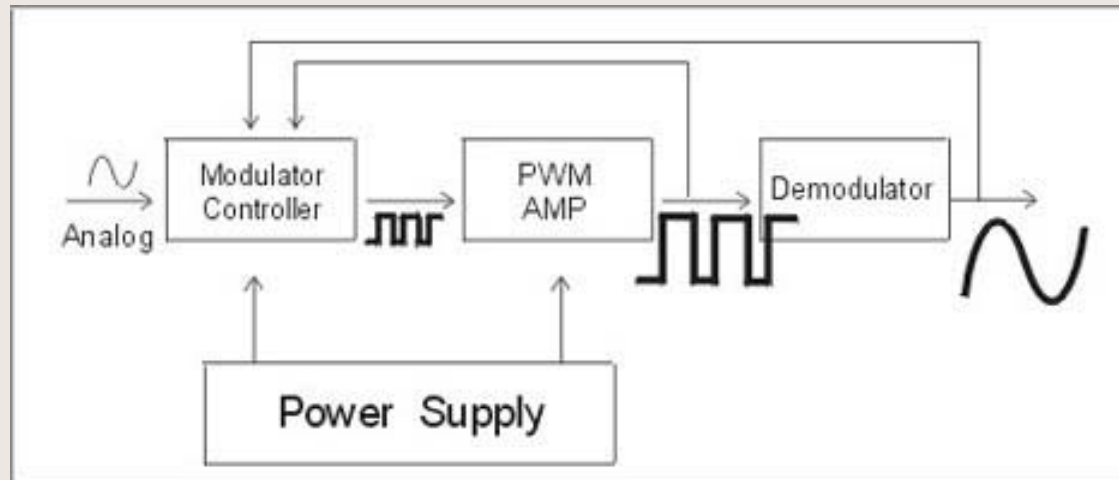
## Patent For World Wide

1. Digital Power Amplifier: International patent no.---PCT/KR01/00085.(JAN.18,2001)  
KOREAN patent no.---10-2001-0002995(JAN.18,2001)



## II. Digital VS Analog AMPLIFIER

### A. DIGITAL AMP Type





## B.DIGITAL AMP /ANALOG AMP

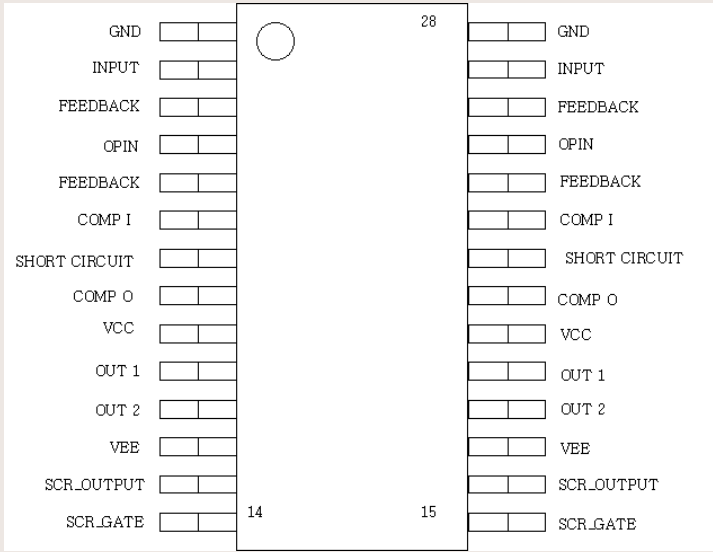
	Advantage	Disadvantage
Digital (MMA,DMA)	<ul style="list-style-type: none"><li>- Less Power Consumption</li><li>- Compact Size</li><li>- Wide Applications</li><li>- Low Cost</li><li>- New Technology</li></ul>	<ul style="list-style-type: none"><li>- Very small noise</li></ul>
Analog	<ul style="list-style-type: none"><li>- Conventional Technology</li><li>- Better Sound Quality</li></ul>	<ul style="list-style-type: none"><li>- More Power Consumption</li><li>- Large Size</li></ul>



# DLI4050(2)

## PACKAGE PIN OUT

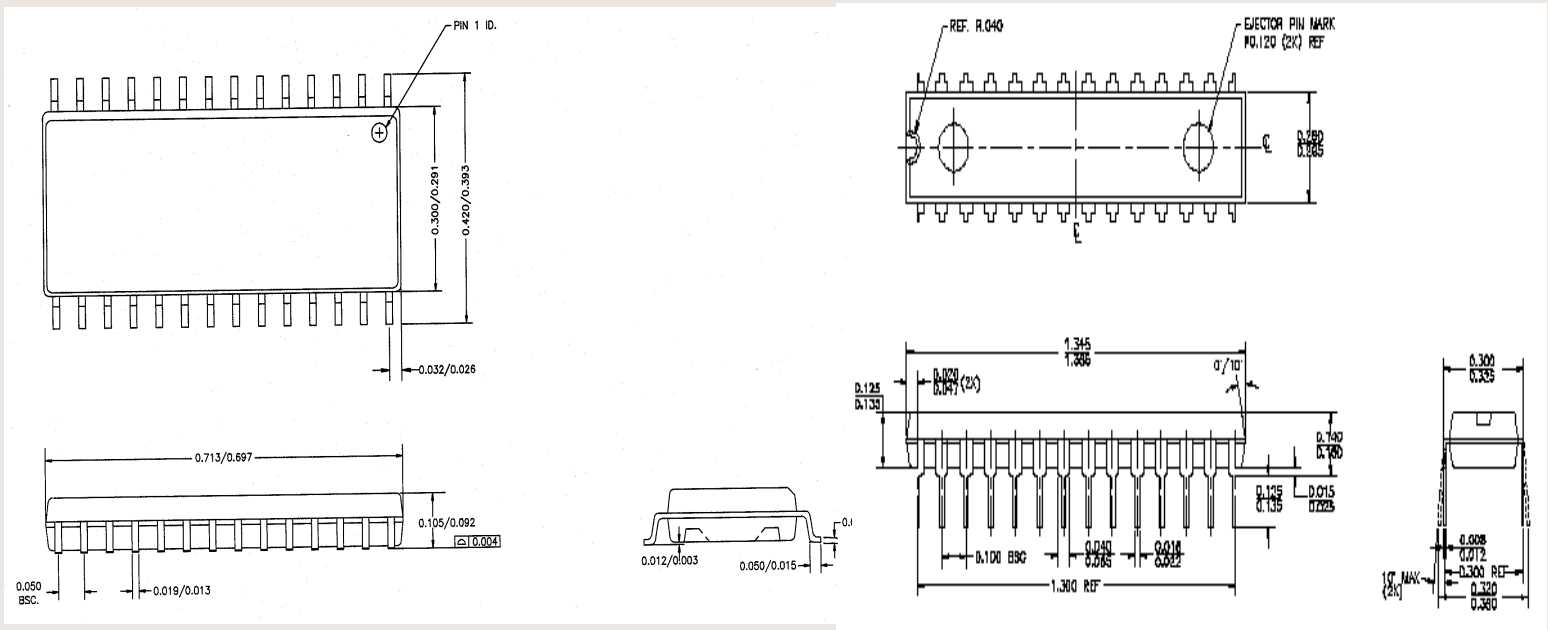
## ABSOLUTE MAXIMUM RATINGS



- Input IC Voltage .....  $\pm 3V \sim \pm 12V$
- Input Power Voltage .....  $\pm 12V \sim \pm 35V$
- Operating Junction Temperature...  $-20 \sim 85^{\circ}C$
- Storage Temperature Range.....  $-55 \sim 125^{\circ}C$



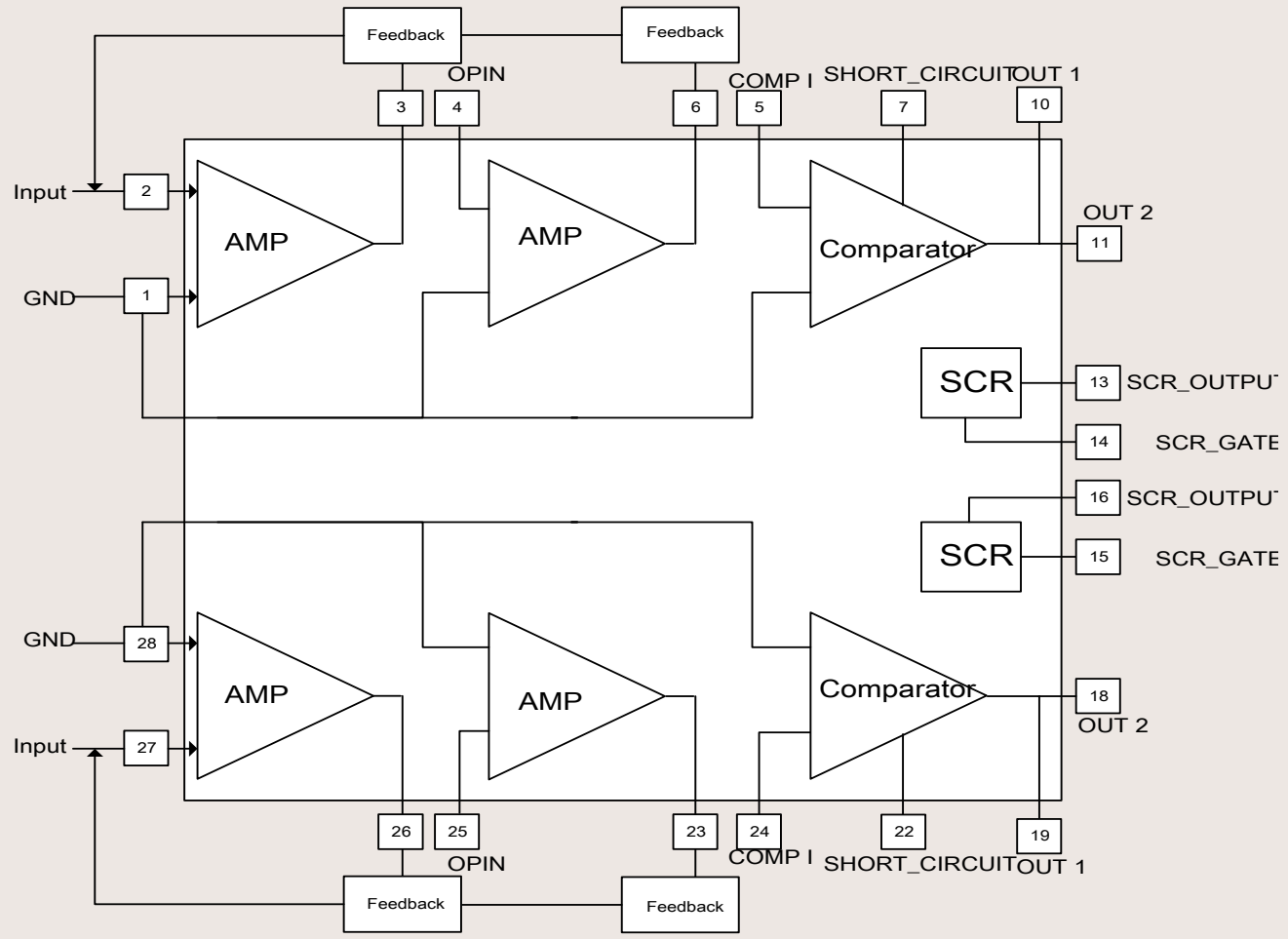
# DLI4050(3)







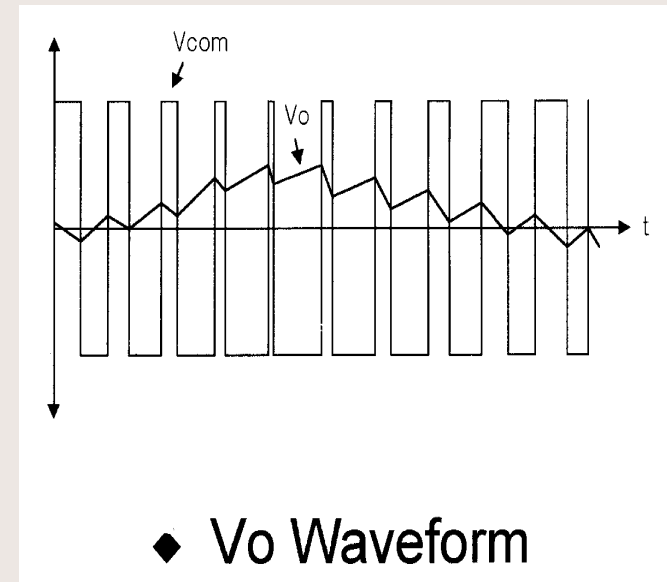
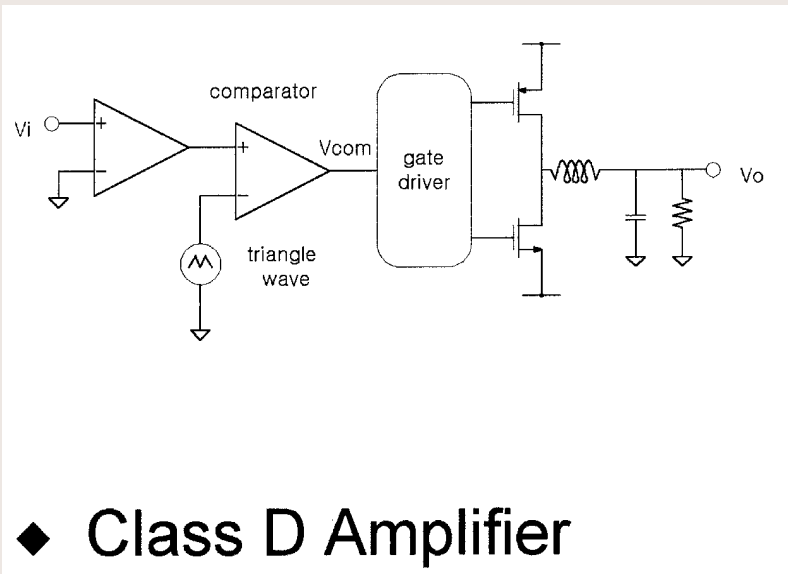
# DLI4050(4)





# DLI4050 (5)

## PWM MOVEMENT



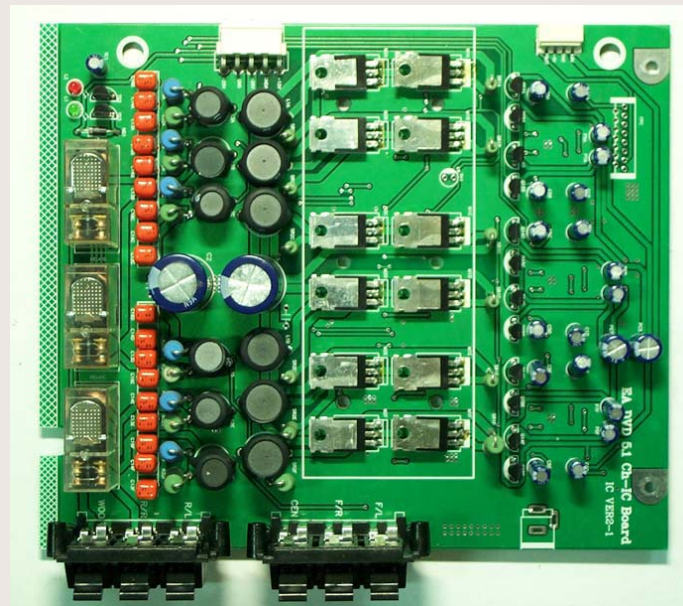


# DLI4050 (6)

## Application

A. DVD Player Digital Amplifier.

(60w x 5ch/4 $\Omega$ , 120w x 1ch/2 $\Omega$ )





# DLI4050 (7)

## Dlogixs digital amplifier(DLI4050 DVD 5.1ch)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS
$\pm V_S$	Power Supply Voltage	$\pm 25$	$\pm 27$	$\pm 29$	V
$\pm V_C$	Control Voltage		$\pm 6$		V
$F_{SW}$	Switching Frequency	400	450	500	kHz
$T_A$	Operating Temp	-20	25	90	$^{\circ}\text{C}$

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP.	MAX.	UNITS
$P_{out}$	Outp	THD+N=0.31%, $R_L=4\Omega$ (at 1kHz)		60		W
		THD+N= 1%, $R_L=4\Omega$ (at 1kHz)		72		W
		THD+N= 10%, $R_L=4\Omega$ (at 1kHz)		94		W
THD+D	Tot	$P_{out}= 30W$		0.16		%
	Distortion Plus Noise	$R_L= 4\Omega$ (at 1kHz), A-weighting				
SNR	Signal-to- Noise Ratio	A- Weighted, $P_{out}= 50 W$ , $R_L=4\Omega$		88		dB
CS	Channel Separation	0dB <sub>r</sub> = 50 W, $R_L=4\Omega$		83		dB
Fr	Frequency Response	$P_{out}= 50 W$ , $R_L=4\Omega$	10	-	27K	Hz
$V_{offset}$	Output DC	No Load		2	5	mV
	g Offset					
$\eta$	Power Efficiency	$P_{out}= 80 W$ , $R_L=4\Omega$		90		%

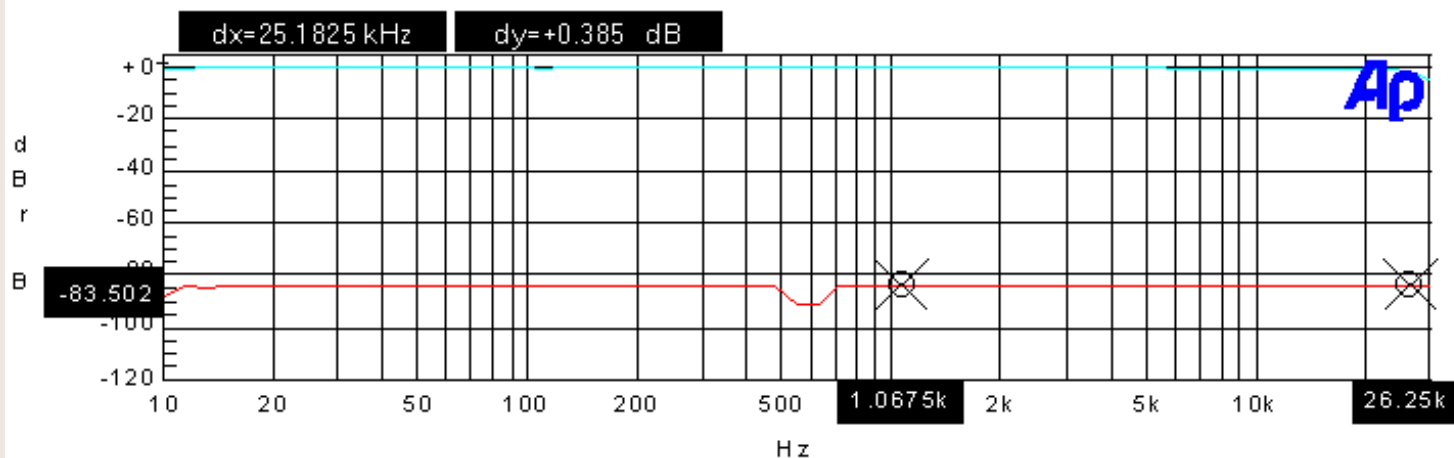


# DLI4050 (8)

## CHANNEL SEPARATION

Audio Precision

12/22/01 01:13:30



Color	Line Style	Thick	Data	Axis	Cursor1	Cursor2
Cyan	Solid	1	Anlr.Ampl	Left	-0.215 dB/B	-1.282 dB/B
Red	Solid	1	Anlr.Ampl	Left	*-83.886 dB/B	*-83.502 dB/B

Eastern(DVD-6ch): CHANNEL SEPERATION  
(R L= 4ohm, Fc= 1kHz, OdB= 60W, Input shorted, A-weighting)

cs.at2c

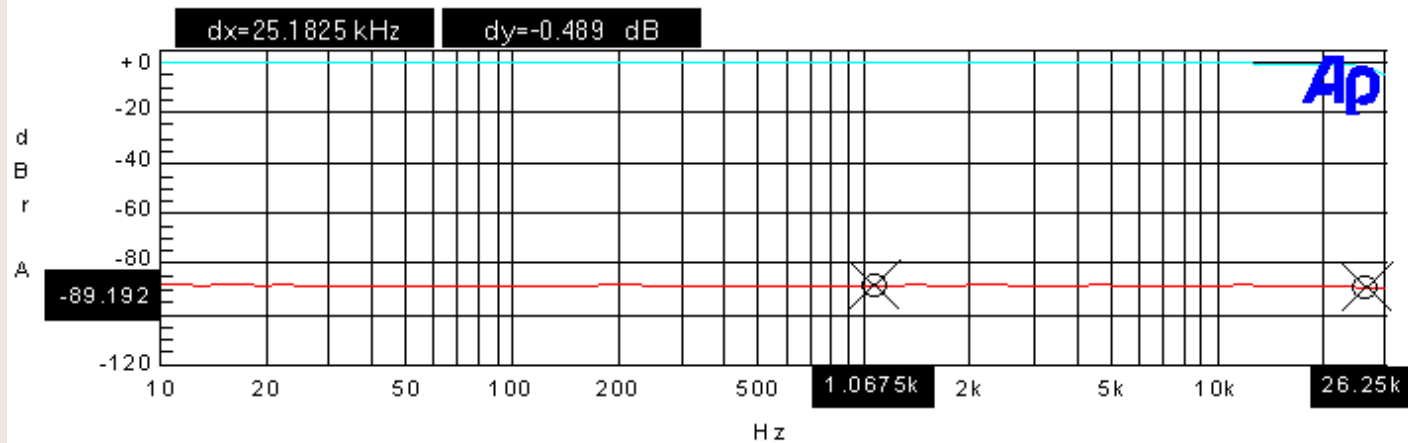


# DLI4050 (9)

## SIGNAL TO NOISE RATIO

Audio Precision

12/24/01 12:41:56



Color	Line Style	Thick	Data	Axis	Cursor1	Cursor2
Cyan	Solid	1	Anlr.Ampl	Left	-0.000 dBrA	-1.177 dBrA
Red	Solid	1	Anlr.Ampl	Left	*-88.703 dBrAD	*-89.192 dBrAD

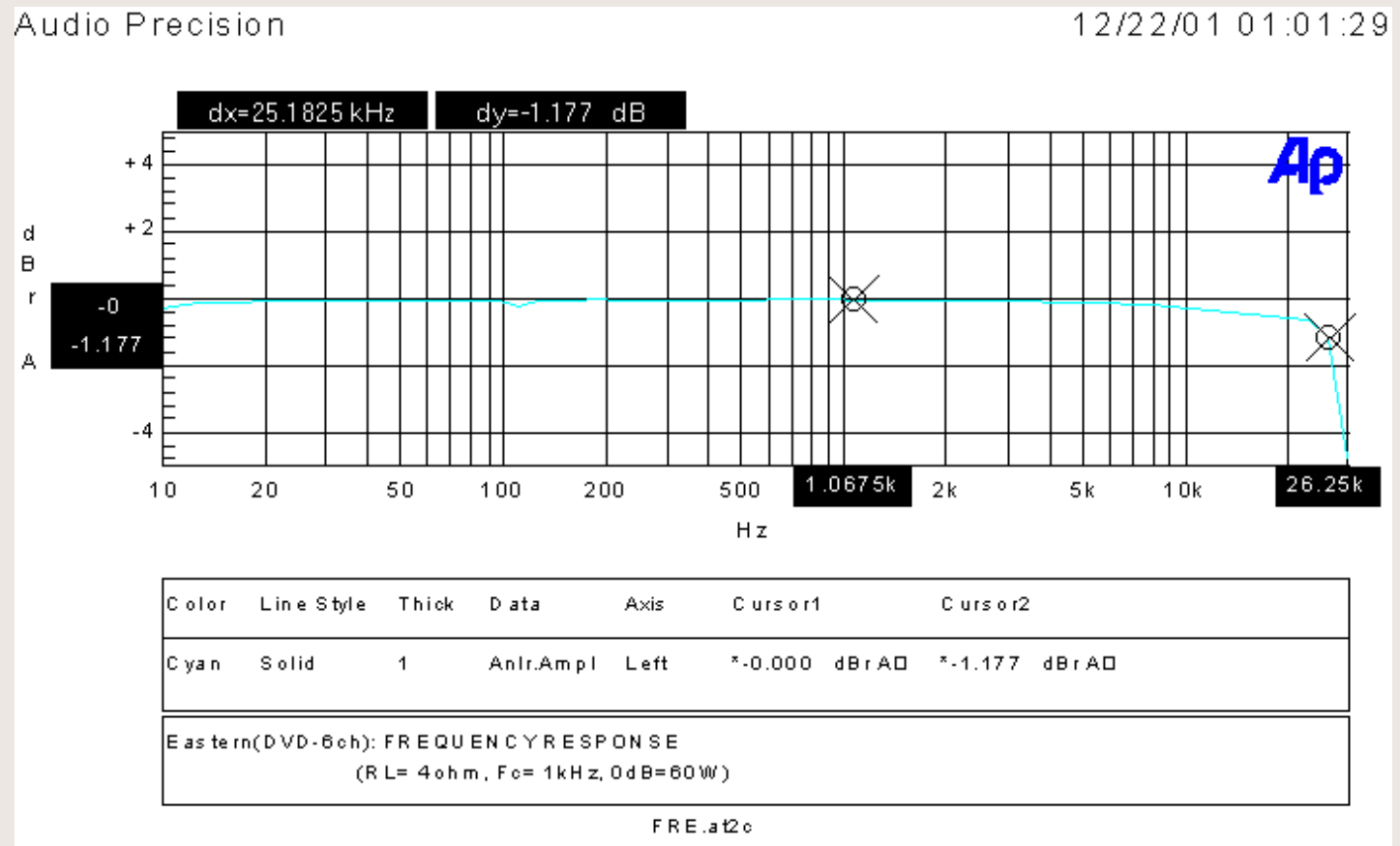
Eas tern(DVD-6ch): SIGNAL TO NOISE RATIO  
(RL= 4ohm, Fc= 1kHz, OdB=60W, Inputs hortcd, A-weighting)

snr.at2c



# DLI4050 (10)

## THD + N VS. FREQUENCY RESPONSE



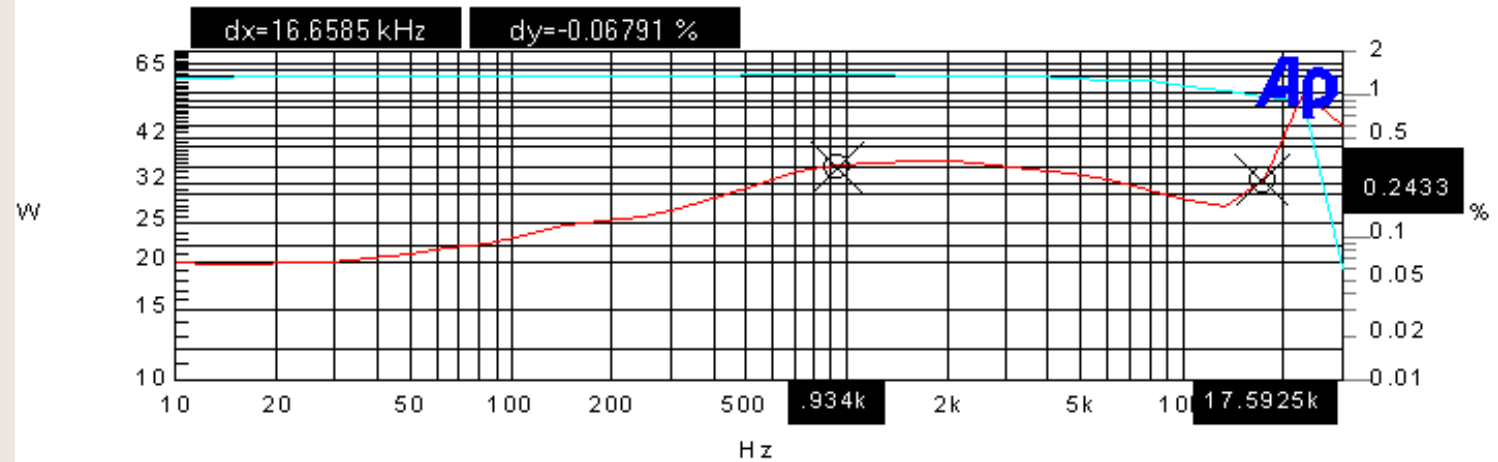


# DLI4050 (11)

## THD+N VS FREQUENCY VS OUTPUT

Audio Precision

12/22/01 00:51:13



Color	Line Style	Thick	Data	Axis	Cursor1	Cursor2
Cyan	Solid	1	Anlr.Level A	Left	60.49 W	53.60 W
Red	Solid	1	Anlr.TH D+N Ratio	Right	*0.31120 %	*0.24330 %

Eastern(DVD-6ch): THD+N Vs FREQUENCY Vs OUTPUT POWER  
(RL= 4ohm, A-weighting)

thd\_fre\_out.at2c



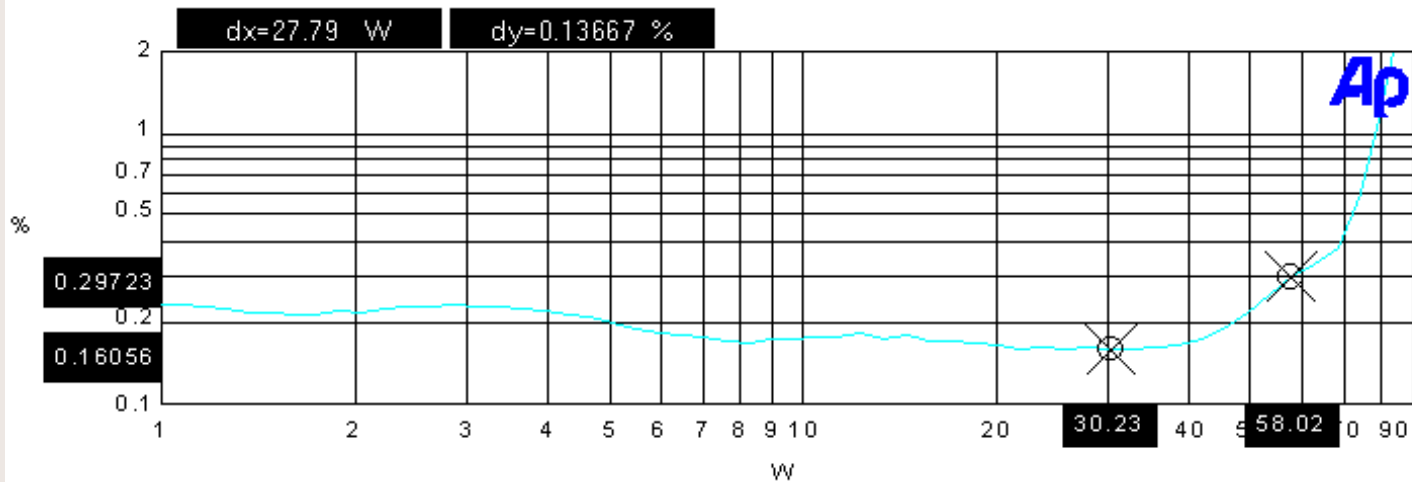


# DLI4050 (12)

## THD + N VS. OUTPUT POWER

Audio Precision

12/22/01 00:56:48



Color	Line Style	Thick	Data	Axis	Cursor1	Cursor2
Cyan	Solid	1	Anlr.TH D+N Ratio	Left	*0.16056 %	*0.29723 %

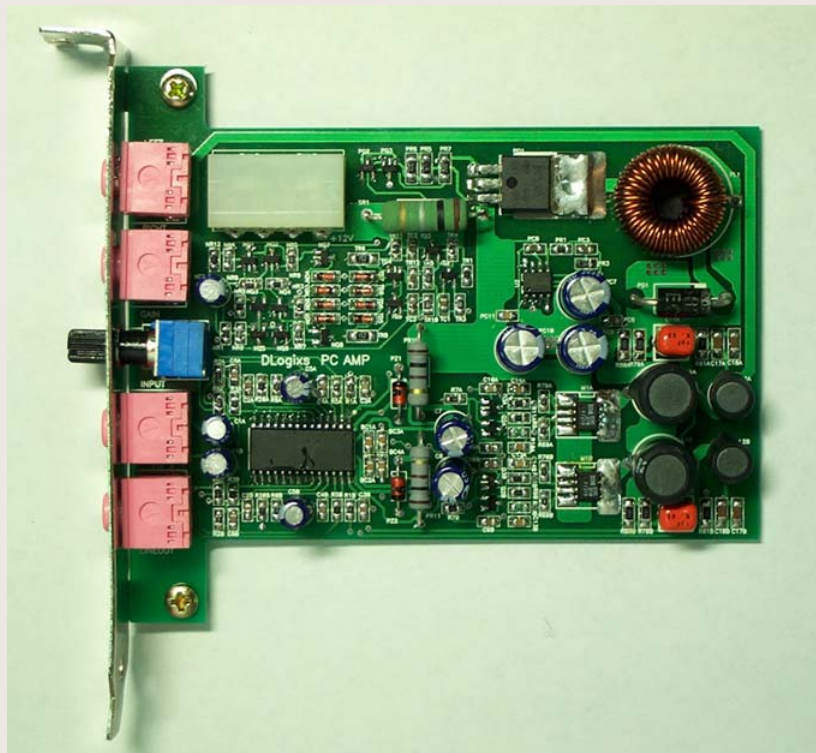
Eastern(DVD-6ch): THD+N Vs OUTPUT POWER  
(RL= 4ohm, Fc= 1kHz, A-weighting)

thd\_out.at2c



# DLI4050(13)

B. PC Multi Media Digital Amp(2ch x 18w).





# DLI4050 (14)

## PC AMP Analysis Data

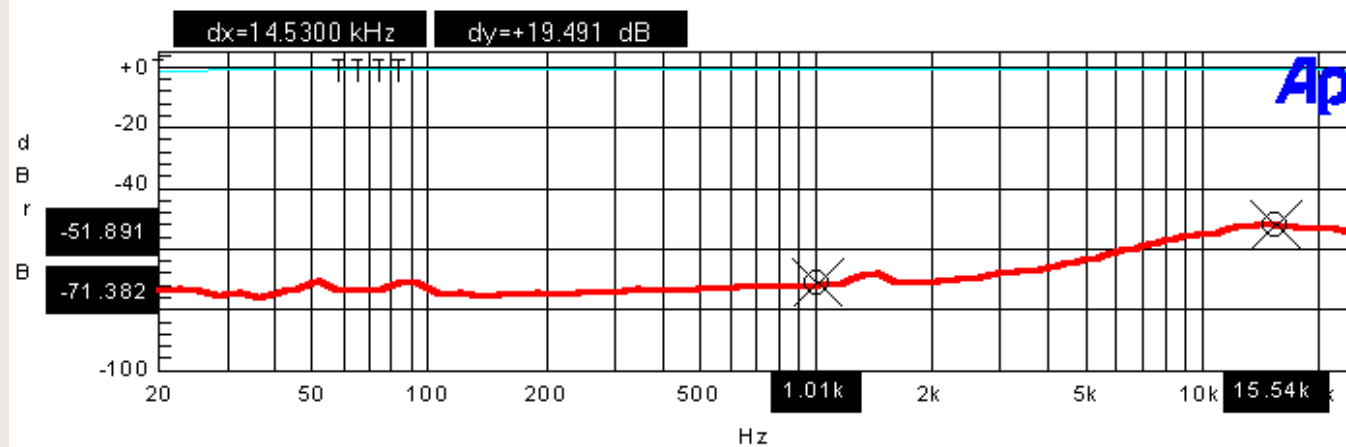
PARAMETER	DESCRIPTION	CONDITION	MIN	TYP.	MAX.	UNITS
P <sub>out</sub>	Output Power	THD+N=0.15% R=4 Ω(at 1kHz)		12		W
		THD+N= 1% R=4 Ω(at 1kHz)		14		W
		THD+N= 10% R=4 Ω(at 1kHz)		18		W
THD+N	Tot	P <sub>out</sub> = 4 W		0.18		%
	Distortion Plus Noise	R <sub>L</sub> = 4Ω(at 1kHz)				
SNR	Signal- to- Noise Ratio	A- Weighted, P <sub>out</sub> = 12 W, R <sub>L</sub> =4Ω		85		dB
CS	Channel Separation	0dB <sub>r</sub> = 12 W, R <sub>L</sub> =4Ω		71		dB
Fr	Frequency Response	P <sub>out</sub> = 12 W, R <sub>L</sub> =4Ω	20	-	25k	Hz
V <sub>offset</sub> <sub>g</sub>	Output DC	No Load		5	10	mV
	Offset					
A	IDLE CURRENT	No Load		300		mA
η	Power Efficiency(Amp)	P <sub>out</sub> = 12 W, R <sub>L</sub> =4Ω(at 1KHz)		82		%
		THD+N 10% R <sub>L</sub> =4Ω(at 1KHz)		85		%
PROTECTION	At Speaker short- circuit	OK				
POP SOUND		OK				



# DLI4050 (15)

## CHANNEL SEPARATION

Audio Precision DLogixs (PC-AMP) 01/05/02 14:46:16



Color	Line Style	Thick	Data	Axis	Cursor1	Cursor2
Cyan	Solid	1	Anlr.Ampl	Left	-0.735 dBrB	-1.143 dBrB
Red	Solid	1	Anlr.Ampl	Left	*-71.382 dBrB	*-51.891 dBrB

PC Amp: CHANNEL SEPARATION  
(0dB=12W, RL=4ohm, Fc=1KHz, Aweighted, inputsorted)

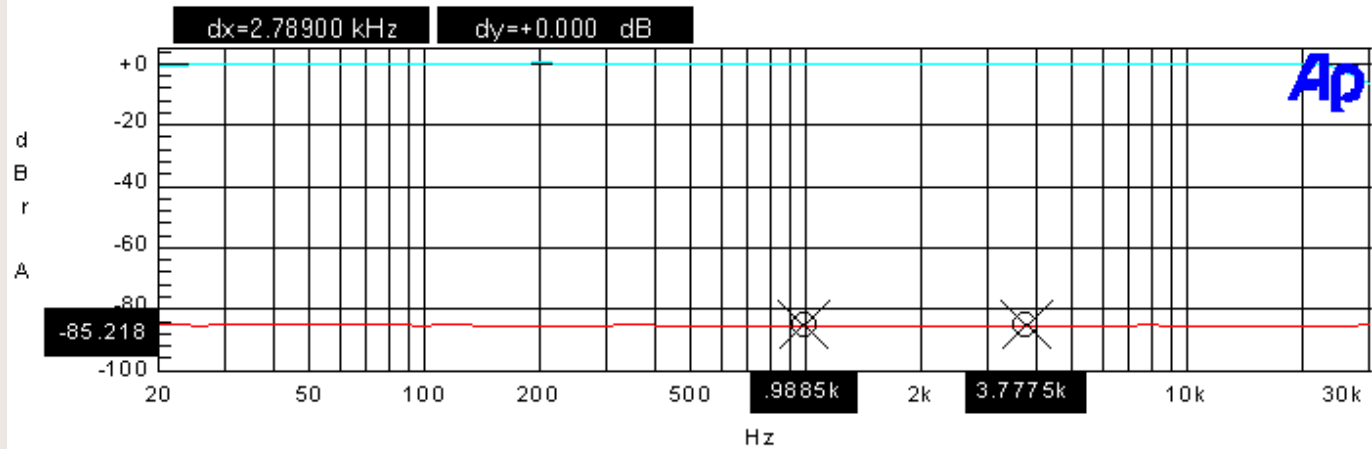
ch.at2c



# DLI4050 (16)

## SIGNAL TO NOISE RATIO

Audio Precision      DLogixs (PC-AMP)      01/05/02 14:23:22



Color	Line Style	Thick	Data	Axis	Cursor1	Cursor2
Cyan	Solid	1	Anlr.Ampl	Left	-0.001 dB(A)	-0.020 dB(A)
Red	Solid	1	Anlr.Ampl	Left	*-85.218 dB(A)	*-85.218 dB(A)

PC Amp: SIGNAL TO RATIO  
(0dB=12W,RL=4ohm,Fc=1KHz A-weighted,inputs hortd)

snr.at2c



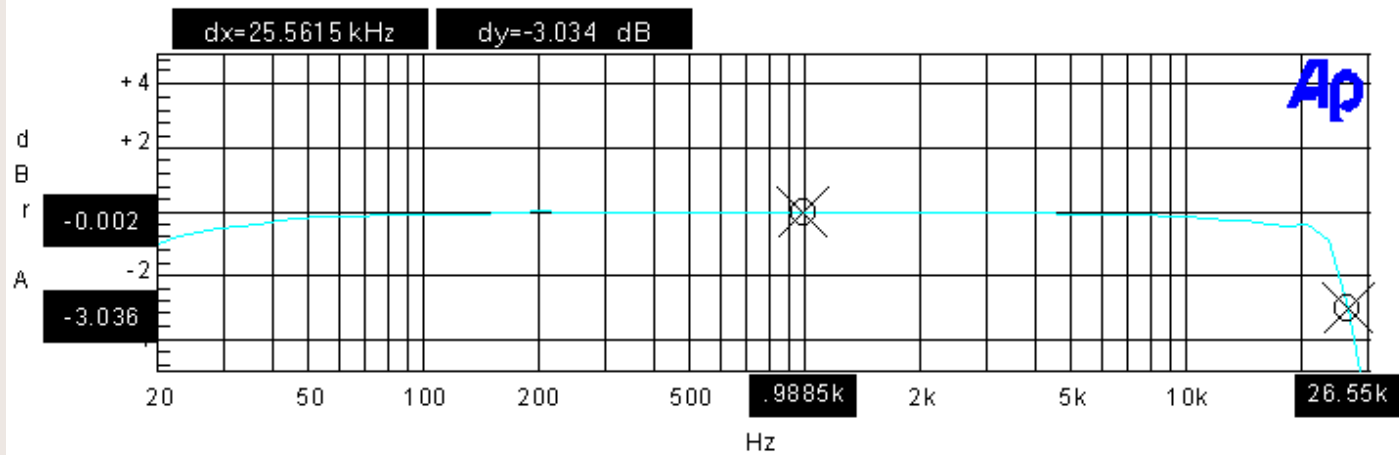
# DLI4050 (17)

## THD + N VS. FREQUENCY RESPONSE

Audio Precision

DLLogixs (PC-AMP)

01/05/02 14:28:42



Color	Line Style	Thick	Data	Axis	Cursor1	Cursor2
Cyan	Solid	1	Anlr.Ampl	Left	*-0.002 dB r AD	*-3.036 dB r AD

PC Amp: FREQUENCY REPNSE  
(0dB=12W, RL=4ohm, Fc=1KHz)

FRE-REPONSE.at2c



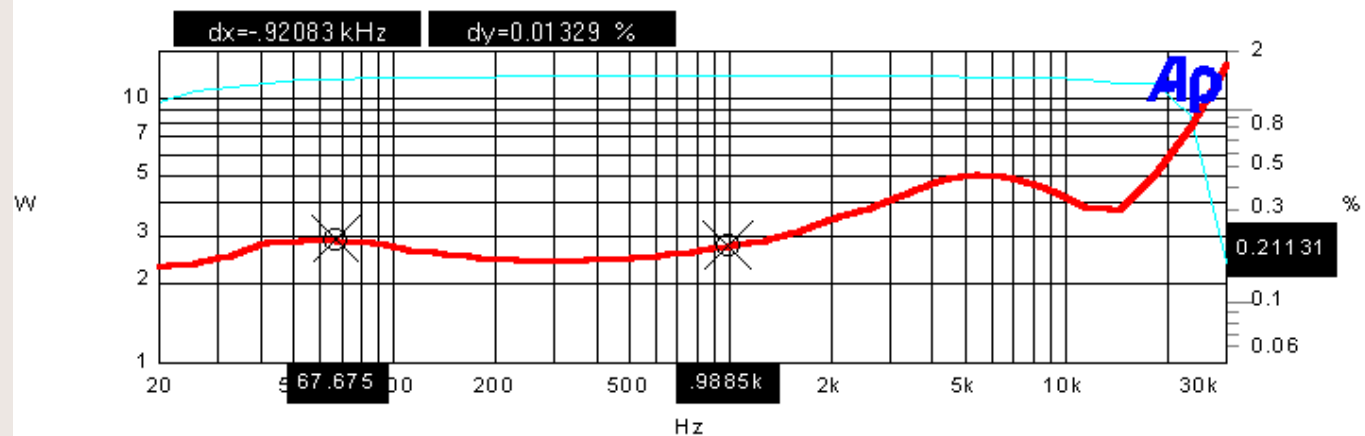
# DLI4050 (18)

## THD+N VS FREQUENCY VS OUTPUT

Audio Precision

DLogixs (PC-AMP)

01/05/02 13:51:48



Color	Line Style	Thick	Data	Axis	Curs or1	Curs or2
Cyan	Solid	1	Anlr.Level A	Left	11.97 W	11.67 W
Red	Solid	1	Anlr.TH D+N Ratio	Right	*0.19801 %	*0.21131 %

PC Amp: THD+N Vs FREQUENCY VS OUTPOWER  
(RL=4ohm, A-weighted)

thd\_fr-out.at2.c



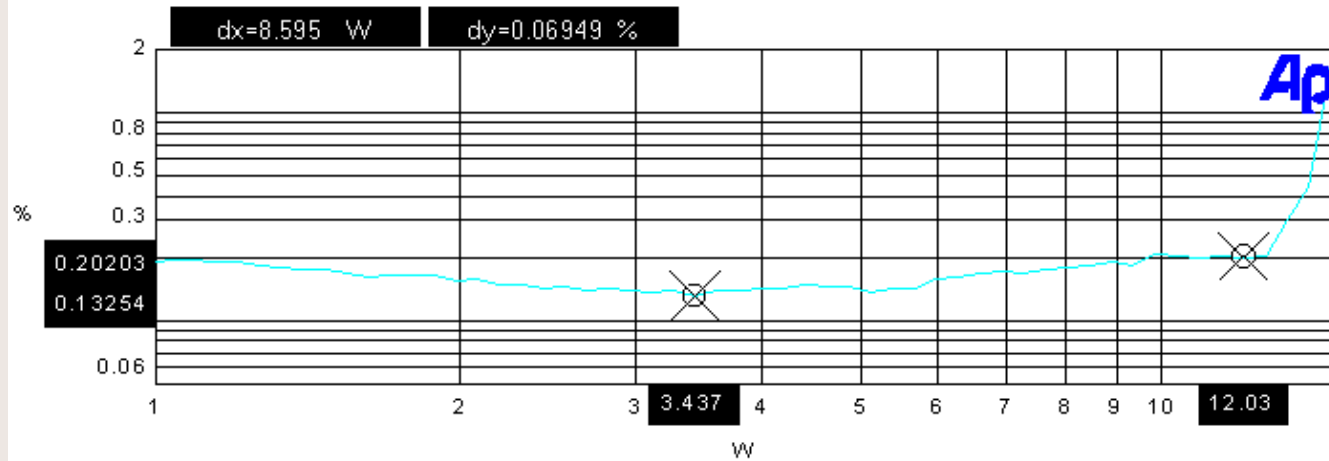
# DLI4050 (19)

## THD + N VS. OUTPUT POWER

Audio Precision

DLogixs (PC-AMP)

01/05/02 13:55:34



Color	Line Style	Thick	Data	Axis	Cursor1	Cursor2
Cyan	Solid	1	Anlr.TH D+N Ratio	Left	*0.13254 %	*0.20203 %

PC Amp: THD+N Vs OUTPUT POWER  
(RL=4ohm ,Fc=1KHz A-weighted)

thd\_out2.at2c





# DLI4050(20)

C. Digital Amplifier.(2ch x 50w)





# DLI4050 (21)

Dlogixs digital amplifier(DLI4050 50W \* 2ch)

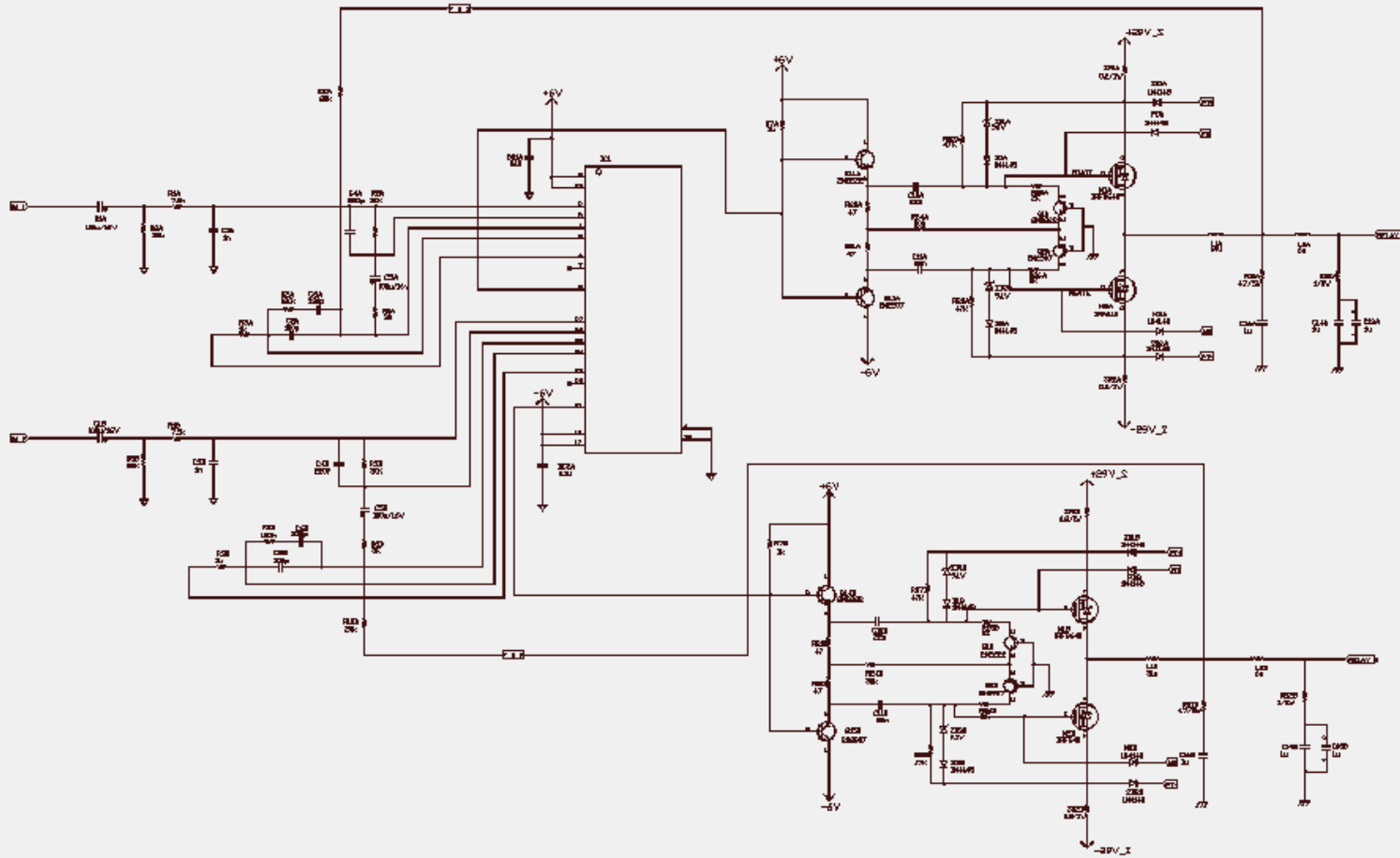
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS
$\pm V_s$	Power Supply Voltage	$\pm 23$	$\pm 25$	$\pm 27$	V
$\pm V_c$	IC Control Voltage		$\pm 6$		V
$F_{sw}$	Switching Frequency	250	300	350	KHz
$T_A$	Operating Temp	-20	25	90	$^{\circ}C$

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP.	MAX.	UNITS
$P_{out}$	Outp	THD+N=0.31%, $R_L=4\ \Omega$ (at 1kHz)		50		W
		THD+N= 1%, $R_L=4\ \Omega$ (at 1kHz)		62		W
		THD+N= 10%, $R_L=4\ \Omega$ (at 1kHz)		80		W
THD+D	Tot Distortion Plus Noise	$P_{out}= 30\ W$ $R_L= 4\ \Omega$ (at 1kHz), A- weighting		0.29		%
SNR	Signal- to- Noise Ratio	A- weight $P_{out}= 50\ W$ , $R_L=4\ \Omega$		98		dB
CS	Channel Separation	0dB $r= 50\ W$ , $R_L=4\ \Omega$		67	75	dB
Fr	Frequency Response	$P_{out}= 50\ W$ , $R_L=4\ \Omega$	10	-	25k	Hz
$V_{offset}$	Output DC Offset	No Load		2	5	mV
$\eta$	Power Efficiency	$P_{out}= 80\ W$ , $R_L=4\ \Omega$		90		%



# DLI4050 (22)

## APPLICATION CIRCUIT





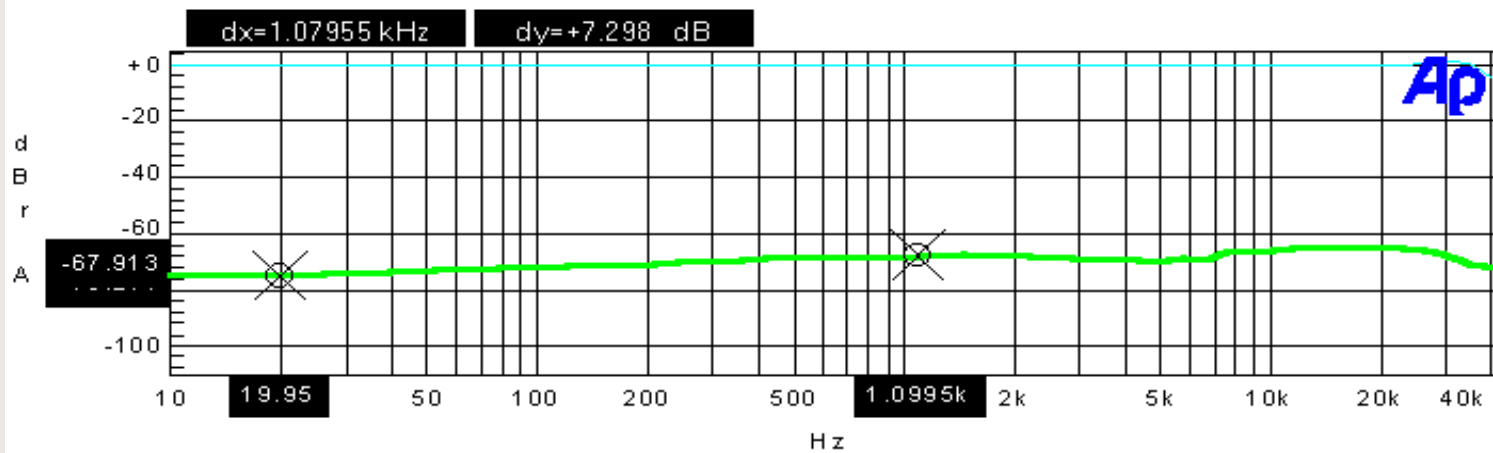
# DLI4050 (23)

## CHANNEL SEPARATION

Audio Precision

DLogixs (DLI4050 50W - 2ch)

11/28/01 23:46:55



Color	Line Style	Thick	Data	Axis	Cursor1	Cursor2
Cyan	Solid	1	Anlr.Ampl	Left	-0.053 dBr A	-0.004 dBr A
Green	Solid	3	Anlr.Ampl	Left	*-75.211 dBr AD	*-67.913 dBr AD

DLogixs DLI4050: CHANNEL SEPERATION  
(RL= 4ohm, OdB= 50W, inputs horted, A-weighting)

C S.at2c



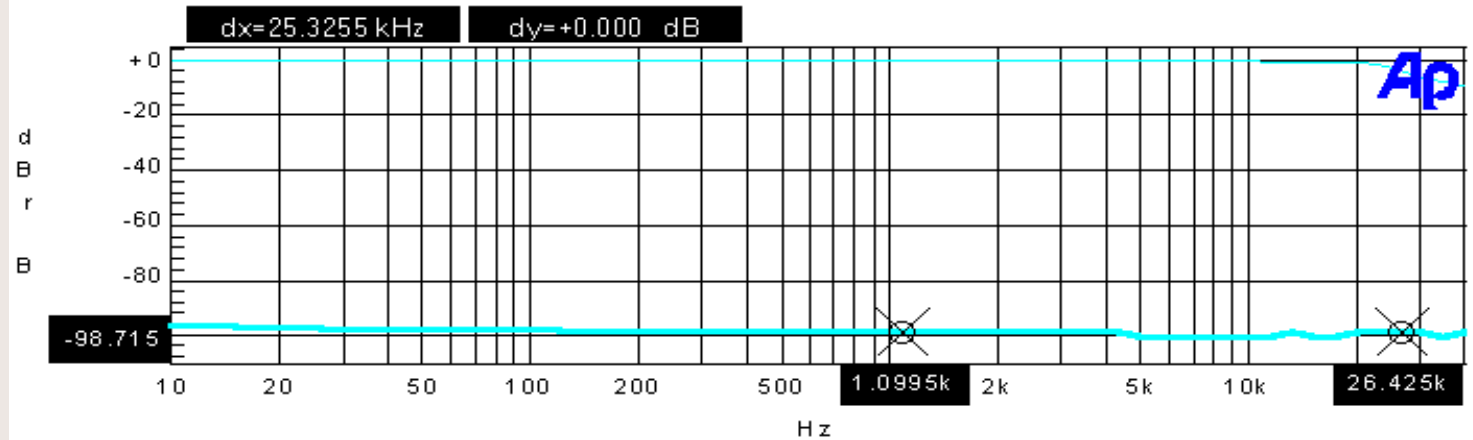
# DLI4050 (24)

## SIGNAL TO NOISE RATIO

Audio Precision

DLLogixs (DLI4050 50W - 2ch)

11/28/01 23:28:46



Color	Line Style	Thick	Data	Axis	Cursor1	Cursor2
Cyan	Solid	1	Anlr.Ampl	Left	+0.005 dBr B	-3.448 dBr B
Cyan	Solid	3	Anlr.Ampl	Left	^-98.715 dBr B	^-98.715 dBr B

DLLogixs DLI4050: SIGNAL TO RATIO  
(R L= 4ohm , 0dB= 50W , inputs horted , A-weighting)

s nr.at2o



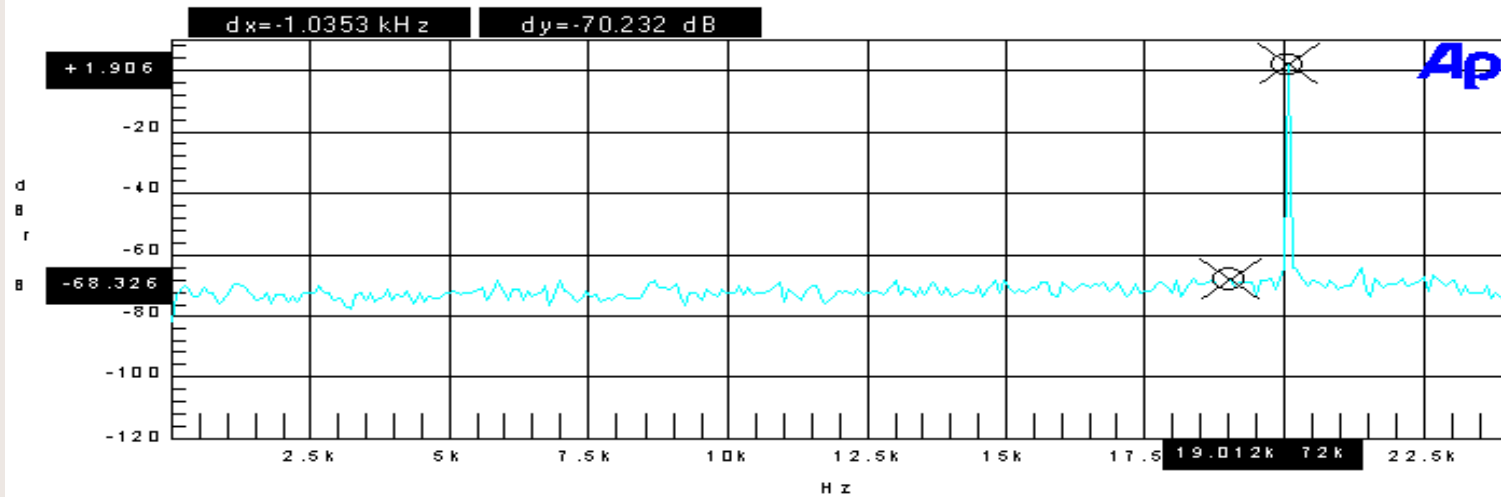
# DLI4050 (25)

## OUTPUT SPECTRUM

Audio Precision

DLLogixs (DLI4050 50-2ch)

11/28/01 23:54:16



Color	Line Style	Thick	Data	Axis	Cursor 1	Cursor 2
Cyan	Solid	1	Fft.Cl.Ampl	Left	+1.906 dB	-68.326 dB

DLLogixs (DLI4050): A-A FFT SPECTRUM ANALYSIS  
(Fc = 20kHz, 0dB = 1W)

A-A FFT.a2c



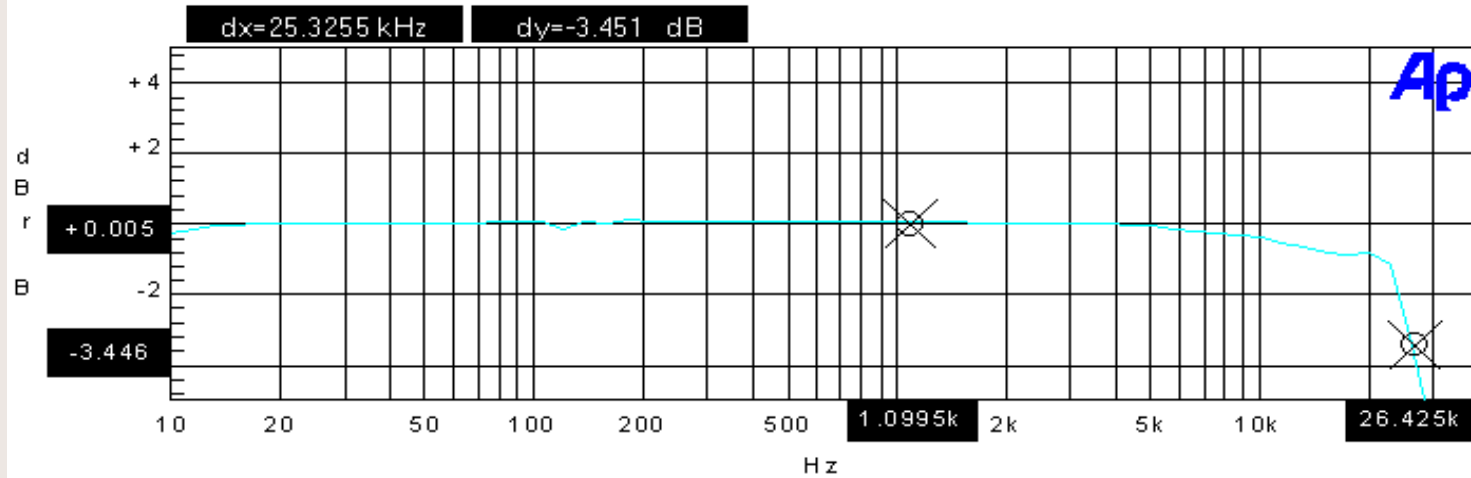
# DLI4050 (26)

## THD + N VS. FREQUENCY RESPONSE

Audio Precision

DLogixs (DLI4050 50W - 2ch)

11/28/01 23:19:02



Color	Line Style	Thick	Data	Axis	Cursor1	Cursor2
Cyan	Solid	1	Anlr.Ampl	Left	*+0.005 dB B0	*-3.446 dB B0

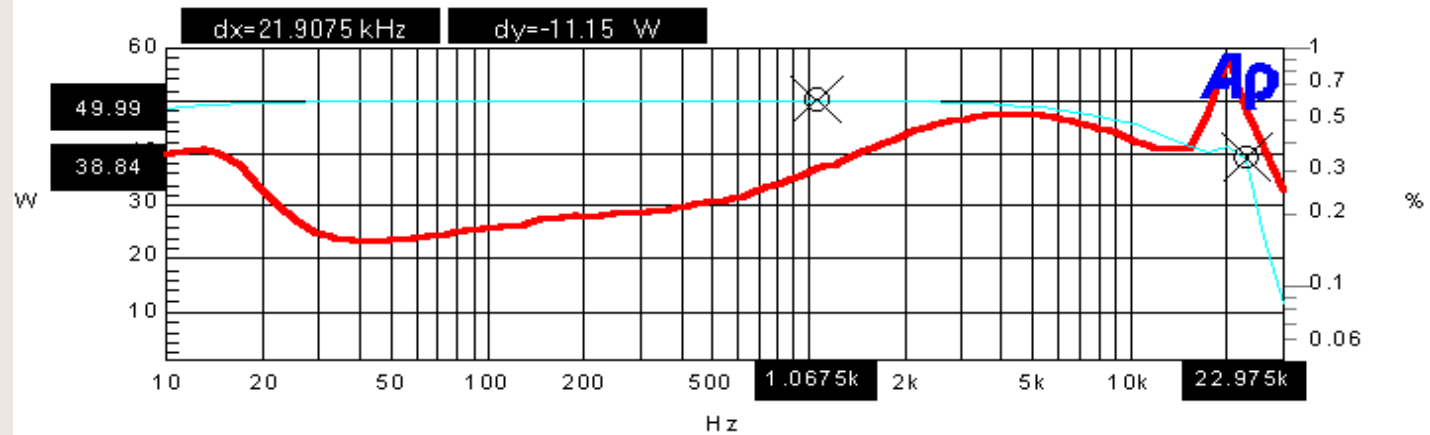
DLogixs DLI4050: FREQUENCY RESPONSE  
(RL= 4ohm, 0dB= 50W)



# DLI4050 (27)

## THD+N VS FREQUENCY VS OUTPUT

Audio Precision      DLogixs (DLI4050 50W - 2ch)      11/28/01 23:38:11



Color	Line Style	Thick	Data	Axis	Cursor1	Cursor2
Cyan	Solid	1	Anlr.Level B	Left	*49.99 W	*38.84 W
Red	Solid	1	Anlr.TH D+N Ratio	Right	0.31205 %	0.55056 %

DLogixs DLI4050: THD+N Vs FREQUENCY@OUTPUT  
(RL= 4ohm, A-weighting)

THD\_FRE\_OUT.at2c





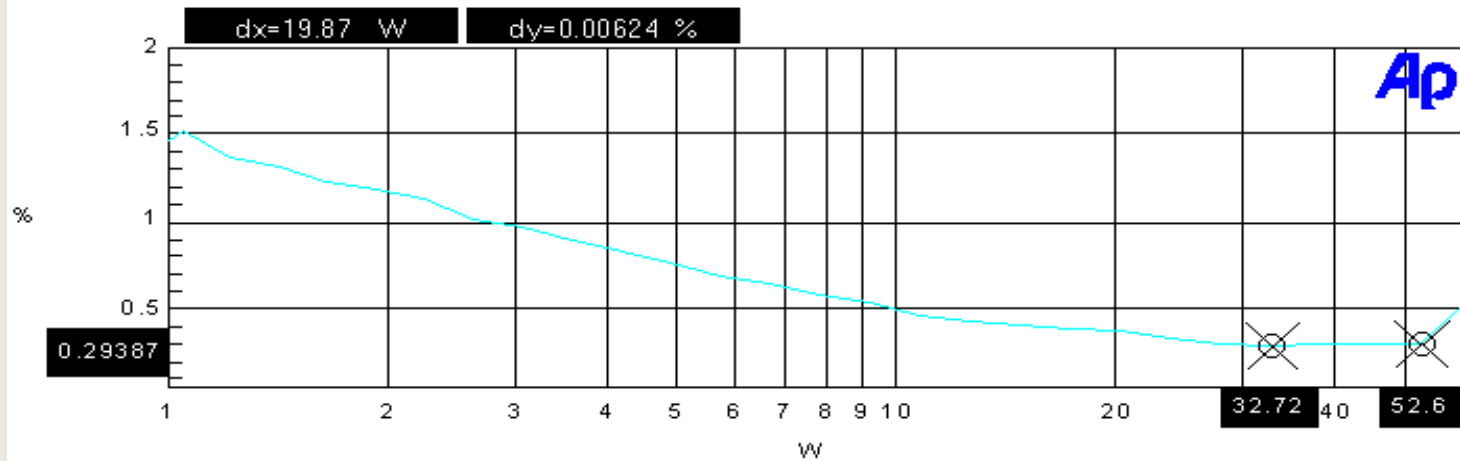
# DLI4050 (28)

## THD + N VS. OUTPUT POWER

Audio Precision

DLLogixs (DLI4050 50W - 2ch)

11/28/01 23:40:10



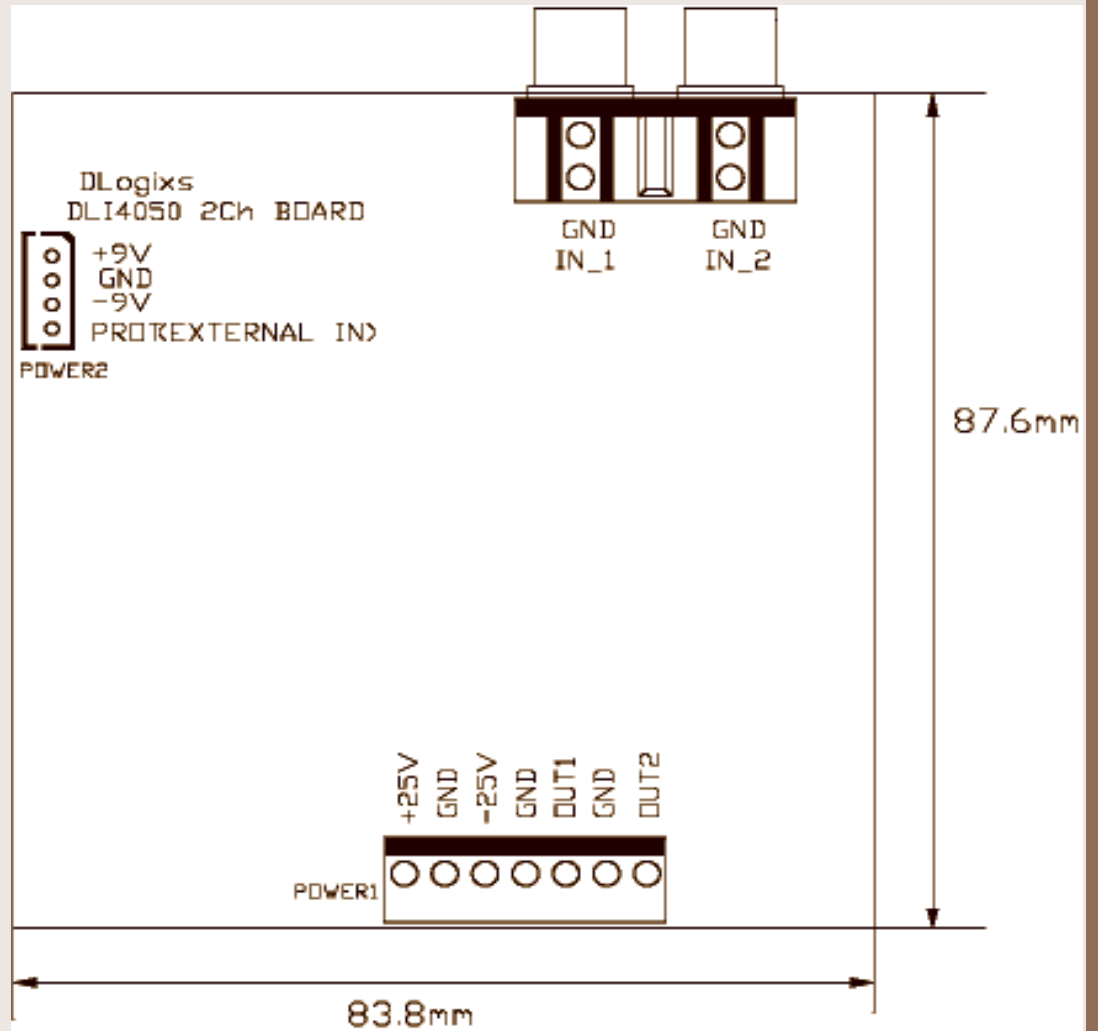
Color	Line Style	Thick	Data	Axis	Cursor1	Cursor2
Cyan	Solid	1	Anlr.TH D+N Ratio	Left	*0.28763 %	*0.29387 %

DLLogixs DLI4050: THD+N Vs OUTPUT  
(R L= 4ohm , Fc= 1kHz, A-weighting)

THD\_OUT.at2c



# DLI4050 (29)



- \*\* RED : +25V, +9V
- \*\* WHITE : -25V, -9V
- \*\* BLACK : GND
- \*\* YELLOW : OUT1
- \*\* BLUE : OUT2