

**Poor Serbian Man Lightspeed Volume**

**Cook Book**

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**scribed by Zen Mod ;**

**Gadget made by sp300b & ZM**

Well , you're Macho ;  
You certainly have all these gadgets which real Macho must have .....  
CD player , or even transport with separate DAC , recently you made dedicated media PC, which is dead silent and capable as HAL9000 .  
You have nice and potent speakers , too . And recently you finished best amp(s) money can buy , just because you're lucky , you're also potent ( same as your speakers ) and you're hanging with right Macho bunch , on right place – sharing ideas and newest tips how to reach Audio Nirvana .

Maybe you also have ancient Black Disc's Spinner , but that's another issue ....or isn't ? That gives you even more possibilities to make another one two-box gadget , equipped strictly to amplify these tiny signals randomly collected from black grooves .....

As written above – you're Macho , and you like to listen your music loud , you also like to watch fave Football or MotoGP LISTENING them , not just staring in moving picture .... there is nothing better than HEAR bones cracking (Football) or metal to asphalt scream (MotoGP) !

Wait a minute – you're not so BIIIIIG Macho ?  
You have a Wife ( or even Mom ?) , and they aren't always in mood for your torture – loud music every day .

So – you really are not Macho – you need Volume Control ( “gotcha ya !” – JB ) .

#### What is important with Volume Control ?

First – it's name is written with capital letters ;

Second – it must be lossless ( contrary to MP3 , which you hate even more than Volume Control ) ;

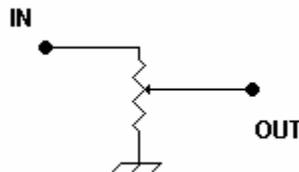
Third – it must be in peaceful coexistence/cooperation with preceding and following stage , in same time .

OK , except first fact (capital letters ) , following two aren't easy tasks to achieve.

Now we are going little more technical .....

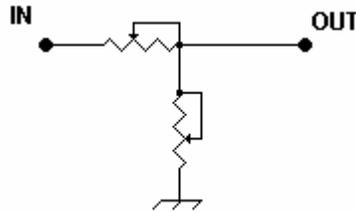
Everyone here knows what is resistive divider , so I have no intention to teach you that , just for your amusement . In fact , I'm lazy and I'm typing all that , just buying time when I really must paste some schematics and pictures here , and start to explain few things .....

OK – there's first pic – voltage divider ( Pic.1) :



As you can see – that's pic of plain ole potentiometer .

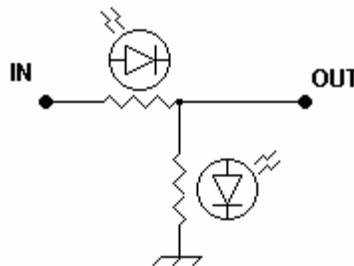
Lightspeed is , in fact , made of not physically one resistor , with contact track exposed to wiper , but from two variable resistors , pictured as (Pic.2) :



These two variable pots are ganged , in that way that – while series one is decreasing , shunt one is increasing in value .....

To complicate/or simplify things further – imagine that pots are shaftless (funny term , isn't it ? ) ..... and that these two resistors are light-dependable , or – better defined – their resistance is inversely proportional to amount of light to which they are exposed .

So , pic can look something like (Pic.3):

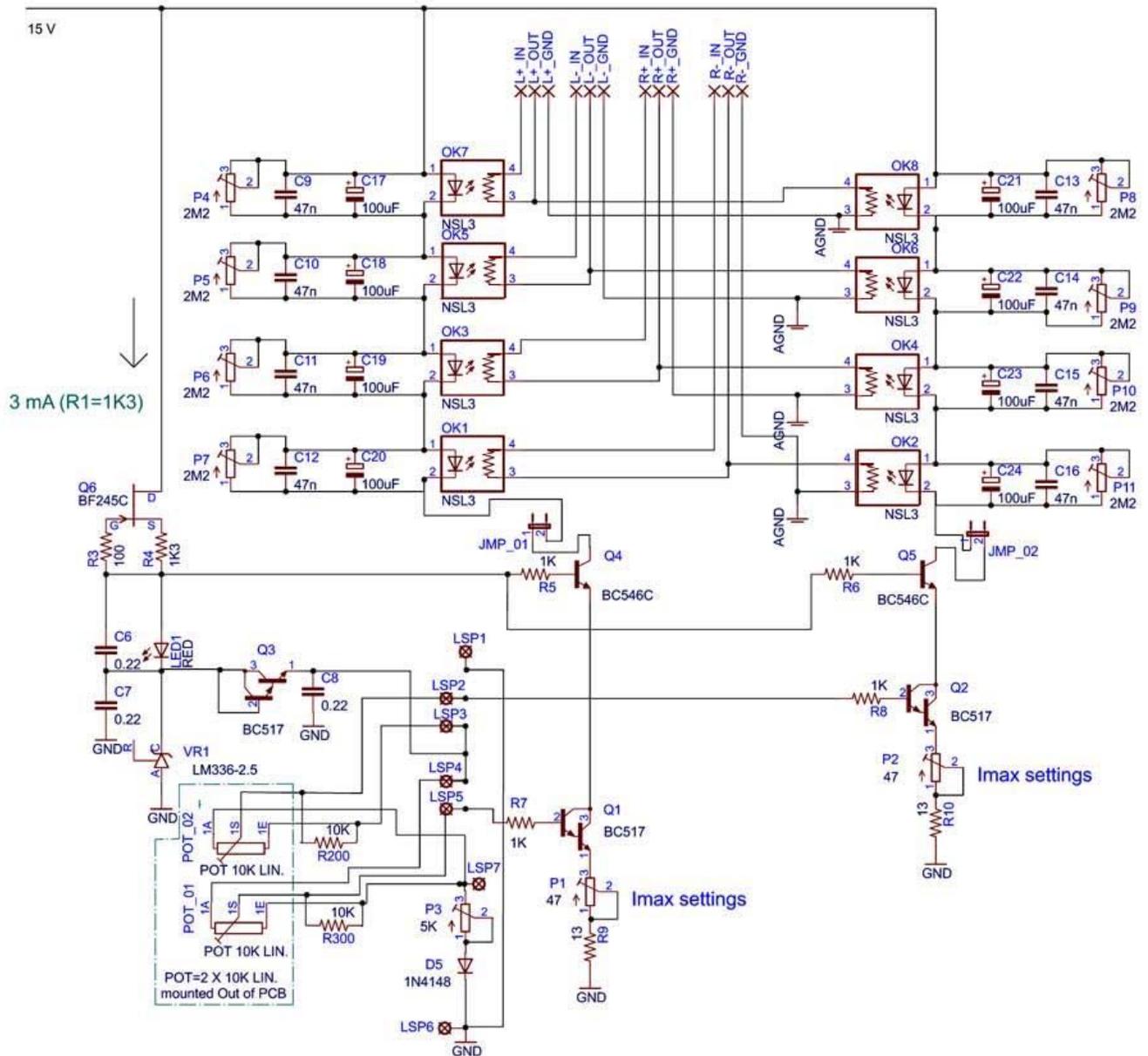


Assuming that we still have same law of decrease/increase of series/shunt resistance , it looks that we gained something – at least twofold : now we have sort of contactless variable resistance (which means that we succeeded in first factor needed for losslessness , hehe ) ..... and we really need some proper circuit to make these LEDs to behave in way we want them ..... and – there is also hidden benefit – we must make some unnecessary complicated circuit blocks , just to preserve impression that we are still Macho , doing things what our Chicks really aren't capable to understand .....

Luckily – tnx to kind people from Pro oriented Industry ( part of Industry pretty unaware of even existence of bunch of sick people , using real parts in something which is intended to make some funny noises called Music) , we have those nice and precious parts – LDRs , or Light Dependent Resistors .

For further info – just search on [Diyaudio.com](http://Diyaudio.com) , typing either [GeorgeHiFi](#) , or [Lightspeed passive attenuator](#) in search field . That boy started entire Frenzy on Big DiyA . Tnx again !

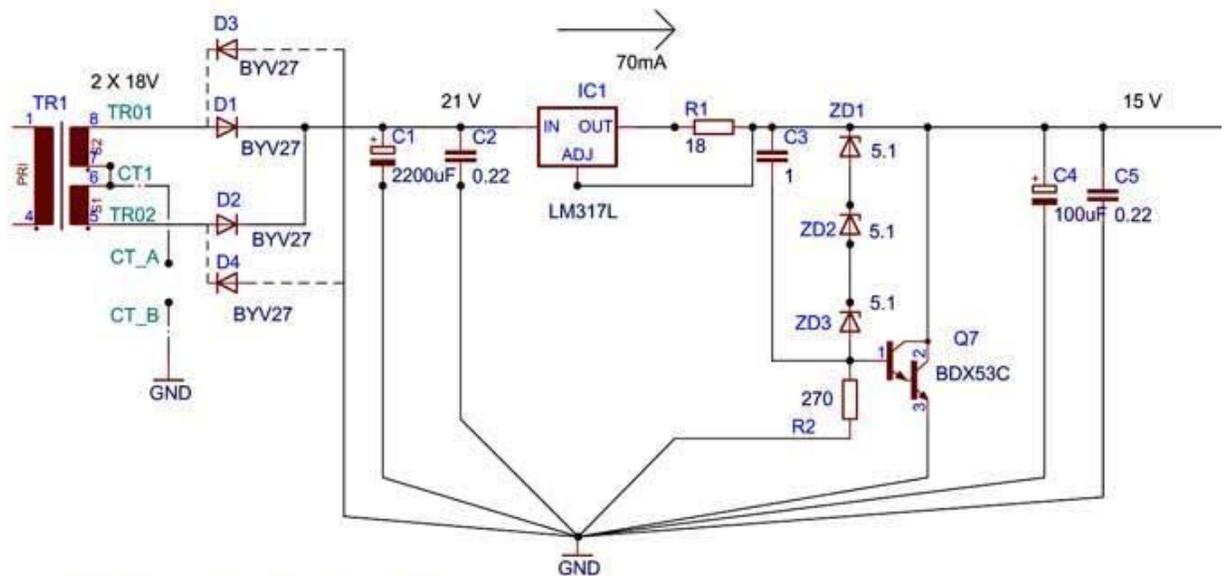
We , boyz from Serbian DiyA , have idea to arrange well behaving of our tiny LDRs with current sources ; they must be , off course , adjustable , and variable . So , schematic is this one (Pic.4) :



As you can see – we decide to use old fashioned approach – without use of fancy add-ons as microprocessors etc.

Pot is still main adjusting part , but this time we use cheapest 2x10Klin one , and audio signal is nowhere near it ..... it's role is to handle variable voltages , which are steering adjustable Current Sources .

For your convenience , dedicated Power supply schematic is next ; both circuits are on same pcb , accidentally named as PCB01 ( Pic.5) :



1) Tr. with Central Tap:

D1 & D2 used. D3 & D4 not used

Central tap connect to CT1

Short connect CT\_A to CT\_B

P : 220V S: 2 X18V

2) Tr. with NO central Tap:

D1, D2, D3, D4 used.

Tr. is to be connected to TR1 & TR2 on PCB

P : 220V S: 18V

Supply schematic is pretty self explanatory ; CT or non CT xformer , few diodes, LM317 as 70mA CCS , few Zener diodes working as reference for shunt Darlington on output . Exact output voltage is sum of Zener voltages plus 2xVbe of Darlington (that's 1V35) . 15V is drawn on schematic , but who cares if we have 1V35 more .....

So , go back to exact LDR circuit schematic ....

- Q6 , along with LED1 , and VR1 , forms reference voltage string , with 3mA of current flowing through ; we have available there two fine voltage points – 2V5 on top of VR1 , and ~ 2V more on top of LED1 .
- We are using reference voltage of 2V5 to inject it in our main Governor (Hasta La Vista ring a bell ?) – main Pot itself , so we have nice and clean and steady DC

voltage to play with ; Q3 – any small N type darlington (or even two small signal diodes connected in series if you're cheapskate ) is nothing else than convenient voltage shifter , and using it there is to try null TempCo of same type Darlings used as control elements in two main Current Sources (look down) .

- So , we have clean and steady voltage ( $2V_5$  less two  $V_{be}$ ) on top of Pot1 ; now look on vertical string starting from 15V , made of LEDS in 4 LDRs (OK7,5,3,1) , closed jumper JMP\_01 , and dedicated Current Source ; CS is made of Q1 (steered with voltage from POT\_01) , cleverly cascoded (by Mighty ZM) with Q4 . That one – Q4 – is biased from before mentioned voltage tap on top of LED1 . That vertical string is dedicated to **series** LDRs .
- I'm clever , so I'll paste above paragraph for right vertical string .... just changing appropriate part marks , so ..... now look on vertical string starting from 15V , made of LEDS in 4 LDRs (OK8,6,4,2) , closed jumper JMP\_02 , and dedicated Current Source ; CS is made of Q2 (steered with voltage from POT\_02) , cleverly cascoded (by Mighty ZM) with Q5 . That one – Q5 – is biased from before mentioned voltage tap on top of LED1 . That vertical string is dedicated to **shunt** LDRs .

Idea is , while having main pot in zero ( 7h) position that minimum current is flowing through left – series – LDR LED string (on top of Q1) so mating LD Resistors have max resistance ; in same time , max current is flowing through right – shunt – LDR LED string (on top of Q2 ) so mating LD Resistors have minimum resistance . Result is that our poor tone signal is attenuated maximally .

That – crossed – behavior is achieved with crossed connection of reference voltage to two section of main pot ; while reference voltage is connected to “start” end of POT\_02 , it's connected to “end” end of POT\_01 . Incidentally , on 12h position of main pot , these two voltages coming on both wipers must be same . But – we are clever , so we introduced in each section one “fake log law” inducing resistors – R200 and R300 . That's old trick – use Lin pot because section matching of them is better than with cheapskate class logs , put few resistors from wiper to gnd and – Voilla! – we have Audiophool pot for pocket money ..... or we hope , at least .... where's da :devil: smiley when Man need it ?

OK – look again at Pic.3 :

You see where signal is coming in , where gnd is , where signal is coming out ; Now – look at Pic.4 ; we have 4 ( or just two, for stereo unbalanced , if you wish so) sections . first one is made of OK1 & OK2 (R-) ; second one is made of OK3 & OK4 (R+) ; third one is made of OK5 & OK6 (L-) ; fourth one is made of OK7 & OK8 (L+) . If you obtained your LDRs from me – use SeriesX and Shunt X as pair , where X is 1 to 4 ; so – Series1+ Shunt1 , Series2 +Shunt2 , Series3 + Shunt3 ,Series4 + Shunt4 ; they're matched with that in mind .

I think that everything is clear , regarding points where signal is coming in , where GND is , and where signal is coming out . Just one note – cleverly – on both schematic and pcb

itself , audio gnd **isn't** connected to any point of steering circuit ..... my Fullrange Bro sp300b , responsible for these funny patchwork pcbs , even use top pcb layer as gnd for steering circuit , without any ill effects .

Electrolytic caps and block caps , connected in paralel with LDR LEDs are there for cleaning any possible residual noise in PSU ; use them or not , your choice – they aren't criticall at all .

P4-P11 , 2M2 trimpots are there just in case that LDRs aren't tightly matched . If you have tight matched LDRs , you don't need them at all . Later in this text I'll explain what's better cure , in case that you feel or measure that some section is slightly weaker than other one .