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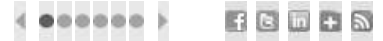
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designlines PROTOTYPING

Max's Cool Beans

MSGEQ7-Based DIY Audio Spectrum Analyzer: Construction

Max's Cool Beans

7/8/2014 07:30 PM EDT

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Here's a step-by-step guide to constructing a simple 14-band (2 x 7) audio spectrum analyzer using two MSGEQ7s and a chipKIT or Arduino microcontroller development platform.

Modifying the hardware to add the LEDs

We're really racing along now. All we have to do is add 14 LEDs -- seven for each channel. Just to make things visually interesting, I decided to use two red LEDs for the lower-frequency bands, three orange LEDs for the middle-frequency bands, and two yellow for the higher frequencies.

Each LED requires a current-limiting resistor, which is sometimes called a ballast resistor. Otherwise, we could easily blow it up. The data sheet for a LED will detail a number of parameters, including its forward voltage (V_f) and its forward current (I_f). The data sheet may also specify minimum, typical, and maximum values, in which case we'll use the typical values. All my LEDs had a typical forward voltage drop of 2 V and a typical forward current of 20 mA.

The formula we use to calculate the value of the current-limiting resistor is $R = (V_{supply} - V_f) / I_f$. Since I'm using a chipKIT MAX32, my V_{supply} is 3.3 V, so this gives $R = (3.3 \text{ V} - 2.0 \text{ V}) / 0.02 \text{ A}$ (where 0.02 A = 20 mA), resulting in a resistor value of 65 Ω . The thing is that resistors come in a range of values. The closest value to what I need is 68 Ω , so that's what I used.

The color code for a 68 Ω resistor (the three colored bands on the resistor) is blue-gray-black. You can find all sorts of information about resistor color codes on the Internet, including this rather nice [resistor color code converter](#). Another useful tool is this [LED resistor calculator](#), which rounds the result to the closest resistance value that is actually available.

As an aside, if I'd been using an Arduino Mega with its 5V supply, I would have required 150 Ω current-limiting resistors with color codes of brown-green-brown.

Some electronic components, like the resistors and capacitors we used earlier, are nonpolarized, which means it doesn't matter which way we connect them. (Some capacitors are polarized, but we didn't use any of them.) However, LEDs are polarized components; they can be connected only one way round. If you

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Don Swaab Joe experiences ground bounce caused by an improperly terminated cable.

 5/5/2017
 11:11:29 PM

Crack the resistor color code

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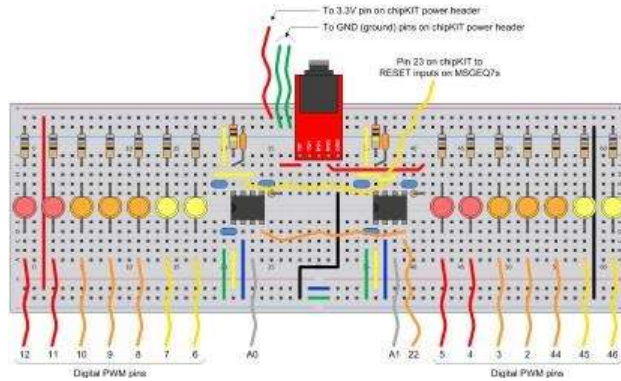
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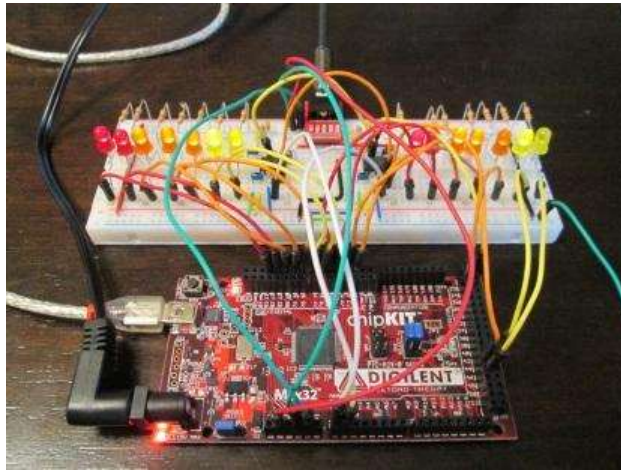
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look closely at a LED, you will see that one lead is longer than the other. The longer lead is the anode or positive terminal; the shorter one is the cathode or negative terminal. The cathode also has a flat side on the body of the LED. Keeping this in mind, the following image reflects the addition of the LEDs.



(Click [here](#) for a larger image.)

In each case, we start with one side of a 68Ω resistor connected to the '-' (ground) rail at the top of the breadboard. The other side of the resistor is connected to the cathode (negative) side of the LED (the one with the flat side). The anode side of the LED is connected -- via a flying lead -- to a PWM output from the microcontroller. Once again, let's do a quick reality check in the form of a photo of the real boards.



(Click [here](#) for a larger image.)

If you are unfamiliar with the PWM concept, you can discover a lot of information on the Internet, so we will cover this very briefly. A LED can be either on or off; it cannot be dimmed in the same way as an incandescent light bulb. If we wish to vary a LED's brightness, the solution is to turn the LED on and off very quickly. If it's on only 50% of the time, it will appear to be only half its full brightness. If it's on only 25% of the time, it will appear to be only a quarter of its full brightness, and so forth. If we turn the LED on and off again thousands of times a second, we won't be able to detect any flickering. It will simply appear as though we are brightening or dimming the LED.

In the case of a PWM output on our microcontroller, we can assign it a value between 0 and 255, where 0 means the pin will be LOW (off) all the time and 255 means the pin will be HIGH (on) all the time. A value of 64 means the pin will be HIGH 25% of the time, 128 means it will be HIGH 50% of the time, 192 means it will be HIGH 75% of the time, and so forth.

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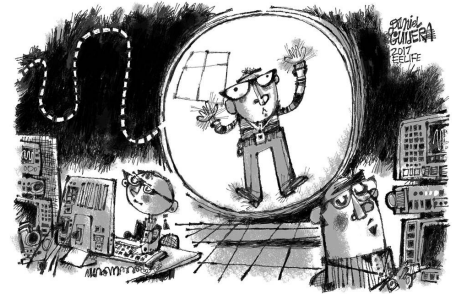
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USER RANK
AUTHOR**Re: lacking vocals?**Clive "Max" Maxfield 9/9/2015
11:41:59 AMNO RATINGS
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@antedeluvian: ROTFL- autocomplete, typo, modegreen or Freudian slip?

My bad LOL

Even worse, when I first saw the Deja Vu album cover when I was a lad -- with all the arty-farty calligraphy, I read it as "Crosby Stills Nash & Donny" (instead of "Crosby Stills Nash & Young") ... so that's how I always think of them LOL

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AUTHOR**Re: lacking vocals?**

antedeluvian 9/9/2015 11:28:03 AM

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Max

I've played "out house" by Crosby Stills & Nash

ROTFL- autocomplete, typo, modegreen or Freudian slip?

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ROOKIE**Re: lacking vocals?**

sunneh 9/9/2015 10:00:25 AM

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Thanks for the quick response!

I havent scoped it yet, have bought a cheap version it should be on its way now.

do you think the timing could be the problem? i got everything set on 1000us (i figured hey it works) haha!!!

im using avr... so i think coding is a little different. my email is shangss@gmail.com thank you in advance :D

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AUTHOR**Re: lacking vocals?**Max The Magnificent 9/9/2015
9:43:33 AMNO RATINGS
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@sunneh: I was wondering if you know of any problems with the msgeq7.

Hi there -- I haven't had any problems with my MSGEQ7s -- check out this blog (with embedded video) showing my BADASS Display <http://ubm.io/1FxDP2>.

I'm puzzled by your vocals problem -- I've played "out house" by Crosby Stills & Nash -- which is lagely vocals -- and it works great -- have you put a 'scope' on the input signal to see what's going in?

If you email me at max@clivemaxfield.com -- I'll send you the Arduino code I'm using to drive my BADASS display -- this includes the part that reads the data from the MSGEQ7s with the correct delays in it).

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**Mike Demler** @MikeDemler

.@Mobileye may currently hold a large lead in #ADAS processor market, but they're not the only game in town. @RenesasAmerica

11 Apr

**EE Times** @eetimes

@MikeDemler thanks, Mike. The story is corrected!

09 Apr

**EE Times** @eetimes

@MikeDemler Mentor's new platform could do away with each sensor module whose MCU is designed to do pre-processing to some degree.

**lacking vocals?**

sunneh 9/9/2015 7:52:23 AM

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ROOKIE

Hi there, saw your post, great vu meter :D

i was wondering if you know of any problems with the msgeq7.

So far mine is working great, but the led display does not move when there are vocals.

it only goes up and down when there is instrumentals. maybe it filtered out a frequency range? i am using lm386 to amplify the signal, otherwise the voltage would be too small

[Reply](#) [Post Message](#) [Messages List](#) [Start a Board](#)**Re: Input level for the MSGEQ7**

Clive"Max"Maxfield 6/11/2015 1:31:29 PM

NO RATINGS
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AUTHOR@jreza: *I just watched your BADASS display and I have to say it discouraged me from building my own analyzer*

It was that bad?

LOL

In the Coding Competition blog there's a link to the code I'm using for the BADASS Display. You could certainly create a much smaller version of the physical beast.

I agree that I feel really lucky being able to get components so easily.

I would love to see photos and video of your creation(s) – maybe we could create a column around them...

[Reply](#) [Post Message](#) [Messages List](#) [Start a Board](#)**Re: Input level for the MSGEQ7**

jreza 6/11/2015 1:18:52 PM

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Max

Thanks for your quick response and all the info.

I just watched your BADASS display and I have to say it discouraged me from building my own analyzer :(, I know I'll never get close to that (just kidding! Baby steps).

About the function generator and the shield, I live in Mexico, so it's kind of hard for me to try to get any of those (I barely got the MSGEQ7, I envy you and the way you get everything practically from around the corner : ()

I'll take a deeper look at the posts when I get home.

When it is done I'll share some photos or video on what you've helped to build :)

Thanks a lot.

jreza

[Reply](#) [Post Message](#) [Messages List](#) [Start a Board](#)**Re: Input level for the MSGEQ7**

Clive"Max"Maxfield 6/11/2015 11:38:21 AM

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AUTHOR@Jezra: *...I have a question though...*

You might also be interested in these related columns (I've included the link to this one because they form a set)

[Building a Low-Cost Frequency/Function Generator](#)[Determining the Signal Characteristics of the iPad/iPod/iPhone Headphone Output](#)[MSGEQ7-Based DIY Audio Spectrum Analyzer for BADASS Display](#)[MSGEQ7-Based DIY Audio Spectrum Analyzer: Construction](#)[MSGEQ7-Based DIY Audio Spectrum Analyzer: Testing](#)[MSGEQ7-Based DIY Audio Spectrum Analyzer: Software & Timing](#)[BADASS Display Coding Competition](#)[Reply](#) [Post Message](#) [Messages List](#) [Start a Board](#)



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AUTHOR

Re: Input level for the MSGEQ7

Clive"Max"Maxfield 6/11/2015
11:33:24 AM

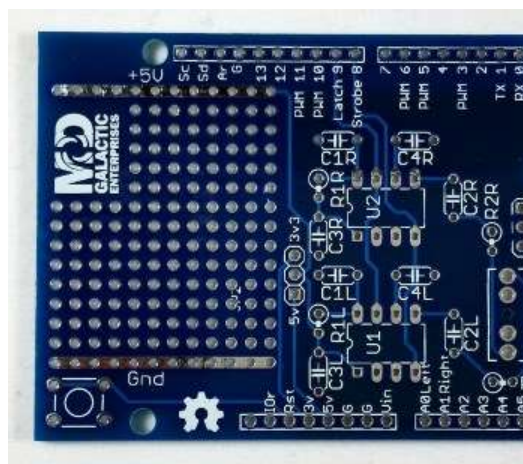
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@Jreza: *What is the input level required by the MSGEQ7? Is it enough with just the output signal from a regular portable player? (from your tutorial it seems it does). Is it enough with the output level of a regular mic?*

Hi there -- I think you're going to really enjoy playing with this chip. Take a look at [This YouTube Video](#) showing two of these chips driving my BADASS Display.

I'm using the output from the headphone jack from my iPod (sometimes my iPad) with no problems at all -- typically I set the iPad to about 3/4 full volume to drive this chip -- then I control the actual sound volume using the amplifier driving the speakers.

I started off by creating a prototype using a breadboard (see [This YouTube Video](#)), but later my chum Duane Benson took my circuit and generated a special printed circuit board (PCB) for an Arduino Shield (this uses two MSGEQ7 chips -- one for each channel).



You can buy one of these boards from Duane from his [SteelPuppet.com](#) website if you wish.

Are you using an Arduino? If so, one of the things I do when I've just built a new sound analyzer card (I've now constructed three using Duane's shield for different projects) is to use the Serial I/O to display the numerical values on the screen so I can see what's happening -- you could use this technique to see how your microphone was working.

If you want to see some example Arduino code for this, email me at max@clivemaxfield.com and I'll send it to you.

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ROOKIE

Input level for the MSGEQ7

jreza 6/11/2015 10:14:43 AM

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Hi there.

I'm getting all the components to start this project. Thanks for the tutorial.

I have a question though, What is the input level required by the MSGEQ7? Is it enough with just the output signal from a regular portable player? (from your tutorial it seems it does). Is it enough with the output level of a regular mic?

Thanks

jreza

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