

Dead Battery Music (dBm) Circuits

making sounds & music with digital logic gates.

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The Art of Power Starving

or how to make dead battery music

It has been known since the early days of music electronics that electronic instruments sometimes produce strange sound artifacts during power on and off.

Also, that battery-powered devices change their sound or even behave completely differently at the end of their battery life.

In recent decades, this has led to the development of instruments in the experimental music electronics scene that deliberately exploit this effect of “power starving”.

The insertion of a variable resistor between the (stable) power supply and a sound generator, which can be a simple oscillator, is widely used. This variable resistor, also known as a “dead battery potentiometer”, simulates the increasing internal resistance of a battery during progressive discharge.

This means that power starving can be set reproducibly, even with mains-powered instruments or instruments fitted with new batteries.

Alternatively, solar cells were also used to power the CMOS oscillators, which we are currently studying.

Thus power starving could be controlled via adjustable LED lighting.

Experiments have shown that it can be musically useful to be able to additionally reduce the operating voltage with a second potentiometer.

In recent years, the friends of the Kulturgüterschuppen have dug up this topic again and made new experiments.

It turned out that a real adjustable current limiter, aka constant current source (CCS), could further expand the sound space when “power starving”.

Finally, we wanted to make the 3 parameters voltage, internal resistance and current limiting voltage controllable in addition to potentiometers.

As only operating voltages $<5V$ and currents of a few mA are required for the CMOS oscillators, simple opamp circuits are sufficient.

dBm 2025 workshop & festival

14. - 18. May 2025 , Bahnhofstr.16 D-72144 Dusslingen

dbm

1) dBm (deciBel-milliwatts) is a unit of power level expressed using a logarithmic decibel (dB) scale respective to 1 mW.

this is not what we are talking about in this book :-)

2) acronym for "dead Battery music". dBm occurs when electronic circuits that generate audio signals, not necessarily musical instruments in the narrower sense, have their power supply reduced to such an extent that they generate artifacts or even completely different signals than in normal operation. This process is also known as "power starving". Oscillator circuits with CMOS logic gates have proven to be particularly suitable.

dBm 2025 is a DIY workshop festival for advanced ^{*)} music electronic tinkerers where we will investigate the sonic limits of CMOS logic gate circuits. We want to delve deep into theory and practice and systematically develop, measure and optimize dBm circuits, so that at the end of the workshop the participants can take home a new dBm synth, or at least many ideas.

The workshop will take place near Tübingen, more precisely, 7km away in Dusslingen, right next to the train station in the Kulturgüter-Schuppen. There is an electronics workshop with lots of, mostly free, material, as well as a laser cutter and other tools.

Accommodation will be in the local YMCA house, which is 15min walking distance. We can also use the kitchen there in the evening for self-catering.

Drinks, fruit and something to nibble on will of course also be available during the day in the KulturgüterSchuppen. We plan a small, public matinee on Sunday at the end of the event, where we will present our "research results".

The costs for 4 overnight stays will be around 100€ per person. Cost of care depends on how often we want to cook ourselves.

I will be able to give more details when the list of participants is complete.

If you would like to take part, please send a short description of what you do and what you would like to contribute technically and musically.

Register as early as possible by email to kulturgueterschuppen@tgooglemail.com, as places are

limited.

Note: Everything we develop together (schematics, hardware) is subject to the CC NC BY SA license. We develop for the DIY community!

*) : advanced means: you can read a circuit diagram and put it on a breadboard, solder it on a breadboard or assemble a PCB without outside help.

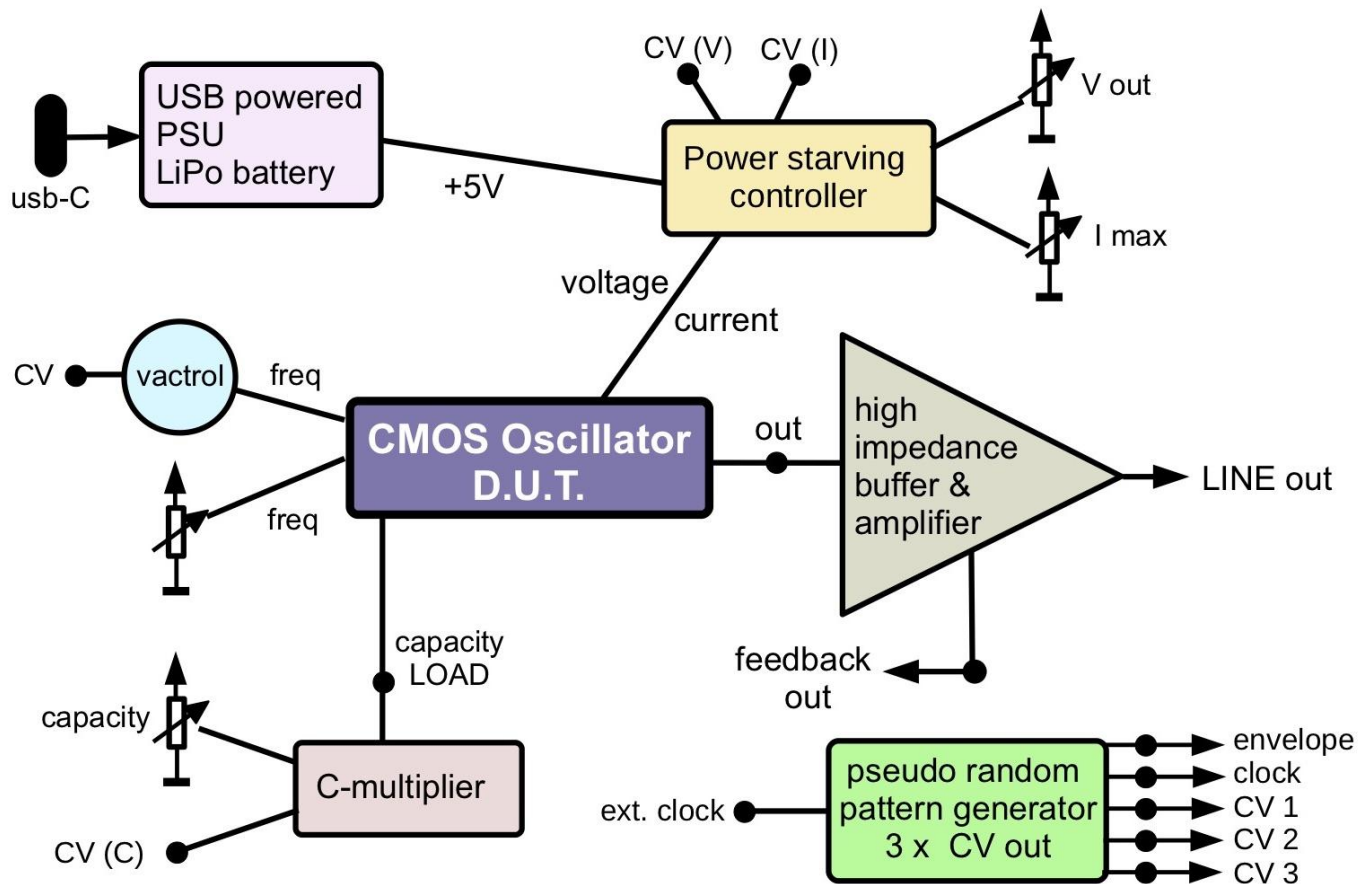
dBm 2025 program

building test hardware

our dBm research system consists of these modules :

- Power supply : USB powered, LiPo battery, 5V out
- Power starving controller : voltage and current control with potentiometers & CV inputs
- CMOS oscillator (D.U.T.) : various topologies of Schmitt-Trigger based squarewave oscillators
- High impedance buffer & amplifiers: line and feedback outputs Potentiometers for gain and feedback
- C-multiplier: electronically variable capacitance with potentiometer and CV control. Acts as capacitive load for D.U.T.
- triple CV out pseudo random pattern generator : for controlling CVs of power starving controller and C-multipliers
- vactrol module : DIY dual vactrol with exponential CV control for potentiometer replacement in D.U.T.

overview experimental dBm setup



module details

WARNING : following schematics , layouts and documentation is WORK IN PROGRESS. Expect many changes during dBm 2025 week !

chaosz

chaosz is the Kulturgüter-Schuppen classic of dBm instruments. It was created in 2010 at the first Circuit Control Festival Dresden in the legendary Ostpol location. CHAOSZ (CHAOTic OSZillator), is a simple astable CMOS oscillator that can be made chaotic by power starving and variable filtering of the power supply. The sound ranges from a boring square wave to stomping locomotives to clucking chickens...

chaosz schematics Version 2011: touch body contacts (BC) and output clipping to preserve the hearing of the remaining ear ;-)

[download chaosz .mp3 example](#)

CHAOSZ FAQ

why this exotic CD4085 chip ?

because I got some hundred of them for free. You can use almost any CMOS gate connected as inverter in this circuit

what's this Bruce Willis "die hard" capacitor ?

it creates a "power starving" envelope after switching off chaosz

McMOS handbook 1973 - the bible for Lunetta style music electronics

After more than 50 years, the original Motorola manual from 1973 is still the most important source for CMOS4000 designs.

It is so important for the music electronics engineer because, in addition to the digital possibilities of the 4000 CMOS logic, it describes the analog applications in great detail. Fortunately, I have owned the original edition to this day. Until today, because I decided to destructively scan the book, which cannot be found as a PDF on the Internet, to allow it to survive digitally, because my original is slowly decaying after decades of use. So you can download it here for private use :-)

