

## Issue #294 — January 2015

### PROJECT FILES

All of the project files for this issue are available: [ftp://ftp.circuitcellar.com/pub/Circuit\\_Cellar/2015/294/](ftp://ftp.circuitcellar.com/pub/Circuit_Cellar/2015/294/)

### ARTICLE MATERIALS

#### **Current Tracking**

How to Monitor Current Flow Under Various Operating Conditions

By Jeff Bachiochi

#### **SOURCES**

MAX4069 Bidirectional amplifiers  
Maxim Integrated | [www.maximintegrated.com](http://www.maximintegrated.com)

PIC16F1829LIN Microcontroller  
Microchip Technology | [www.microchip.com](http://www.microchip.com)

Series 10  
Ohmite Mfg. Co. | [www.ohmite.com](http://www.ohmite.com)

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#### **Brute-Force Universal Motor Control**

By Ed Nisley

#### **RESOURCES**

E. Nisley, "Current Sensing: Powered Iron Toroid," <http://softsolder.com/2014/09/18/current-sensing-powered-iron-toroid/>.

— — —, "Gapped Ferrite Toroid: 5 A Calculations," <http://softsolder.com/2014/08/14/gapped-ferrite-toroid-5-a-calculations/>.

— — —, "Universal Motor Control vs. Transistor SOA," Circuit Cellar 292, 2014.

Universal AC-DC Motors, [https://en.wikipedia.org/wiki/Universal\\_motor](https://en.wikipedia.org/wiki/Universal_motor).

#### **SOURCES**

MCP4725 DAC Breakout board  
Adafruit Industries | [www.adafruit.com/products/935](http://www.adafruit.com/products/935)

SS49E Hall effect sensors  
Honeywell | [http://sensing.honeywell.com/product-page?pr\\_id=36526](http://sensing.honeywell.com/product-page?pr_id=36526)

## Essential Electromagnetic Compliance (Part 2)

A Look at EMI Causes & Signal Types

By George Novacek

### RESOURCES

K. Armstrong, Interference Technology Webinars, [www.interferencetechnology.com/webinar-series/](http://www.interferencetechnology.com/webinar-series/)

O. Hartal, Electromagnetic Compatibility by Design, R&BV Enterprises, 1993.

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## Adaptive Applications for Energy Efficiency

By Ayse K. Coskun

### REFERENCES

[1] H. Hoffmann, S. Sidiroglou, M. Carbin, S. Misailovic, A. Agarwal, and M. Rinard, "Dynamic Knobs for Responsive Power-aware Computing," Proceedings of the Sixteenth International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS), 2010.

[2] H. Hoffmann, J. Eastep, M. D. Santambrogio, J. Miller and A. Agarwal, "Application Heartbeats: A Generic Interface for Specifying Program Performance and Goals in Autonomous Computing Environments," Proceedings of the 7th International Conference on Autonomic Computing (ICAC), 2010.

[3] C. Hankendi, S. Reda, A. K. Coskun, "vCap: Adaptive Power Capping for Virtualized Servers," Proceedings of IEEE International Symposium on Low Power Electronics and Design (ISLPED), 2013.

[4] C. Hankendi, H. Hoffmann, and A. K. Coskun, "Adapt&Cap: Coordinating System and Application-level Adaptation for Power Constrained Systems." To appear in IEEE Design & Test, 2015.

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## Build a Duodecimal Clock

By Devlin Gualtieri

### REFERENCE

Microchip Technology, "PIC16F630/676 Data Sheet: 14-Pin, Flash-Based 8-Bit CMOS Microcontrollers," DS40039F, 2010,

[www.microchip.com/downloads/en/DeviceDoc/40039F.pdf](http://www.microchip.com/downloads/en/DeviceDoc/40039F.pdf).

### SOURCES

LDS-AA12RI Display

Lumex | [www.lumex.com](http://www.lumex.com)

PIC16F630 Microcontroller

Microchip Technology | [www.microchip.com](http://www.microchip.com)

PIC Basic Pro

microEngineering Labs | [www.melabs.com](http://www.melabs.com)

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## The Twin-T Oscillator Configuration

An Audio Oscillator and Stereo VU Meter

By Larry Cicchinelli

### RESOURCES

L. Cicchinelli, "DIY Function Generator," Circuit Cellar 270, 2013.

———, "Calibrated Decibel Meter Design," Circuit Cellar 236, 2010.

———, K3PTO Published Articles, [www.qsl.net/k3pto](http://www.qsl.net/k3pto).

DiscoverCircuits.com, <http://discovercircuits.com/Andy/Twin-Toscillator.pdf>.

eSSB Hi-Fi Audio, [www.nu9n.com](http://www.nu9n.com).

A. Morris, "Twin-T Oscillator," <http://discovercircuits.com/Andy/Twin-Toscillator.pdf>.

OSH Park, [www.oshpark.com](http://www.oshpark.com).

Wikipedia, "Line Level," [http://en.wikipedia.org/wiki/Line\\_level](http://en.wikipedia.org/wiki/Line_level).

### REFERENCE

[1] Wikipedia, "Line level," [http://en.wikipedia.org/wiki/Line\\_level](http://en.wikipedia.org/wiki/Line_level).

### SOURCES

PCB design software

DipTrace | [www.diptrace.com](http://www.diptrace.com)

LM3916, LM3915, and LM3914 Circuits

Texas Instruments, Inc. | [www.ti.com](http://www.ti.com)

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## Webcam Mouse

By Alex Leung & Miles Pedrone (US)

### RESOURCES

D. Henriksson and A. Cervin, Tiny Real Time, [www.control.lth.se/Staff/AntonCervin/tinyrealtime.html](http://www.control.lth.se/Staff/AntonCervin/tinyrealtime.html).

J. Lecoq, "Real-Time Processing in MATLAB," [www.MATLABtips.com/realtime-processing/](http://www.MATLABtips.com/realtime-processing/).

### REFERENCE

[1] A. Bhargav Anand, "Tracking Red Color Objects Using MATLAB," [www.mathworks.com/MATLABcentral/fileexchange/28757-tracking-red-color-objects-using-MATLAB](http://www.mathworks.com/MATLABcentral/fileexchange/28757-tracking-red-color-objects-using-MATLAB).

### SOURCES

ATmega1284 Microcontroller

Atmel | [www.atmel.com](http://www.atmel.com)

MATLAB

MathWorks | [www.mathworks.com](http://www.mathworks.com)

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## Virtual Instrumentation

A Tool for Characterizing NMOS Transistors

By Ahron Emanuel, Shlomo Engelberg, and Dvir Ophir (Israel)

### REFERENCES

[1] Wikipedia, "Virtual Instrumentation," [http://en.wikipedia.org/wiki/Virtual\\_instrumentation](http://en.wikipedia.org/wiki/Virtual_instrumentation).

[2] Wikipedia, "MOSFET," <http://en.wikipedia.org/wiki/MOSFET>.

### RESOURCE

Analog Devices, "ADuC841: Precision Analog Microcontroller: 20 MIPS 8052 Flash MCU + 8-Ch 12-Bit ADC + Dual 12-Bit DAC," 2003, [www.analog.com/en/processors-dsp/analog-microcontrollers/aduc841/products/product.html](http://www.analog.com/en/processors-dsp/analog-microcontrollers/aduc841/products/product.html).

### SOURCES

ADuC841 Microcontroller

Analog Devices | [www.analog.com](http://www.analog.com)

MATLAB

MathWorks | [www.mathworks.com](http://www.mathworks.com)

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## Measuring Small Circuits

By David Ludington