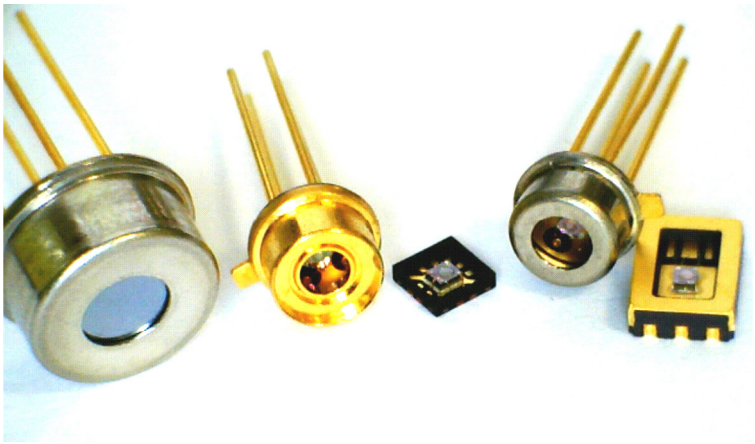
Electro Optical Components, Inc.
5464 Skylane Boulevard, Suite D, Santa Rosa, CA 95403
Toll Free: 855-EOC-6300
www.eoc-inc.com | info@eoc-inc.com

CAMBRIDGE CMOS SENSORS

Applications Note
AN1001

General method of operation of IR Sources

Ilie Poenaru



Cambridge CMOS Sensors manufactures a range of Infrared Sources available with a variety of options in terms of packaging, windows, filters, reflectors and built-in sensors & drivers.

Thermal Infrared Sources are used in applications such as NDIR gas sensing as broadband infrared energy generators. They are usually operated in pulsed modes with frequencies between 1 and 10Hz at the operating temperature recommended on the datasheet. Increasing the operating temperature above the maximum recommended could dramatically decrease the lifetime of the IR Source by breaking the membrane. With membrane breakage, the IR Source becomes an open circuit and fails. Membrane breakage occurs mainly because of mechanical stress built up in the overheated membrane and thus, failure is related to cumulative operating time at temperatures exceeding those recommended. Other factors can affect the IR Source, such as electrical drive mode, package type, ambient temperature and ambient gas flow.

Because of the above, it is important to operate an IR Source correctly. A simple solution to manage the power of an IR Source can be built using a Low Dropout Regulator (LDO) with an enable (EN) input, soft start-up pins and adjustable output voltage capability. Because of the IR Source resistance spread, a potentiometer added on the feedback resistive network (or a simple resistor driven by a DAC) should be used to trim the output voltage of the LDO and the operating temperature of the IR Source. The thermal drift formulas of the IR Source resistance could be implemented from EEPROM look-up tables, which have a more accurate control of the IR Source temperature.

The TPS74801/701 is a good option for the power management of an IR source as it has soft start-up capability, EN pin for digitally driven output power at low frequency, adjustable pin for setting output voltage and eventually driven by a DAC for fine tuning of the output voltage of LDO. Fig1 below shows a typical driving circuit for the CCS IR Sources family where a simple 10kΩ potentiometer is used for trimming the output voltage, and therefore the operation temperature of the IR Source will be set. For sensing the IR signal, a thermopile detector can be used with a TPD91050 sensing op-amp. The signal on the detector is a sine wave (see Fig2 below) and the IR Source can operate long-term because of the slow heat up. The detector signal can be synchronised with the Enable signal in a lock-in amplifier configuration.

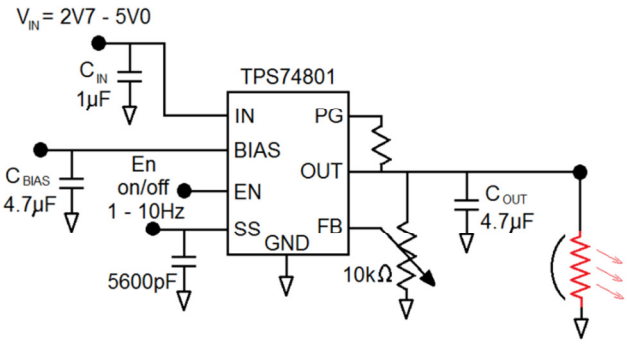


Fig1 Power Management of an IR Source

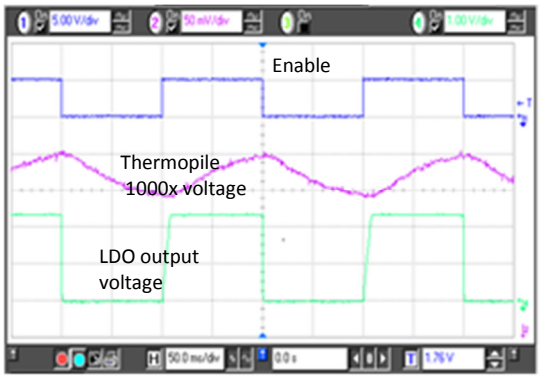


Fig2 Signals on the IR Detector and IR source

For low voltage applications a good solution is also the linear regulator ISL80101Adj from Intersil with the IR Source connected as shown in Fig3 below.

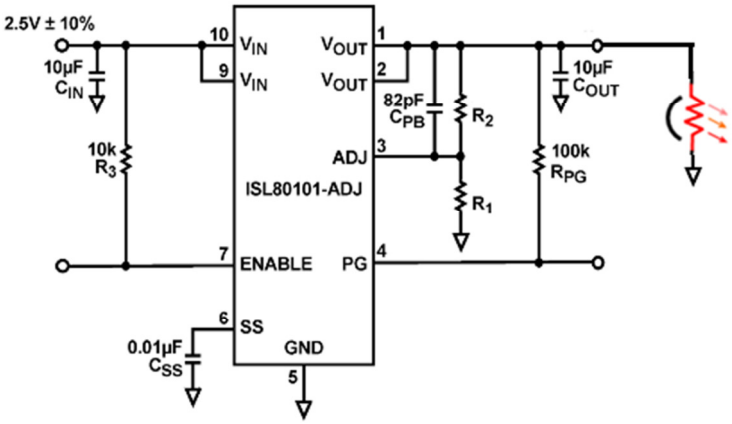


Fig3 Power Management of an IR source, low voltage application

Both drivers and the IR Sources match transient response with Thermopile and Pyro-detector type detectors.

The temperature of the IR Source is dictated by the voltage applied across the device. Fig4 below shows the Voltage/Temperature relationship for specific CCS IR Sources.

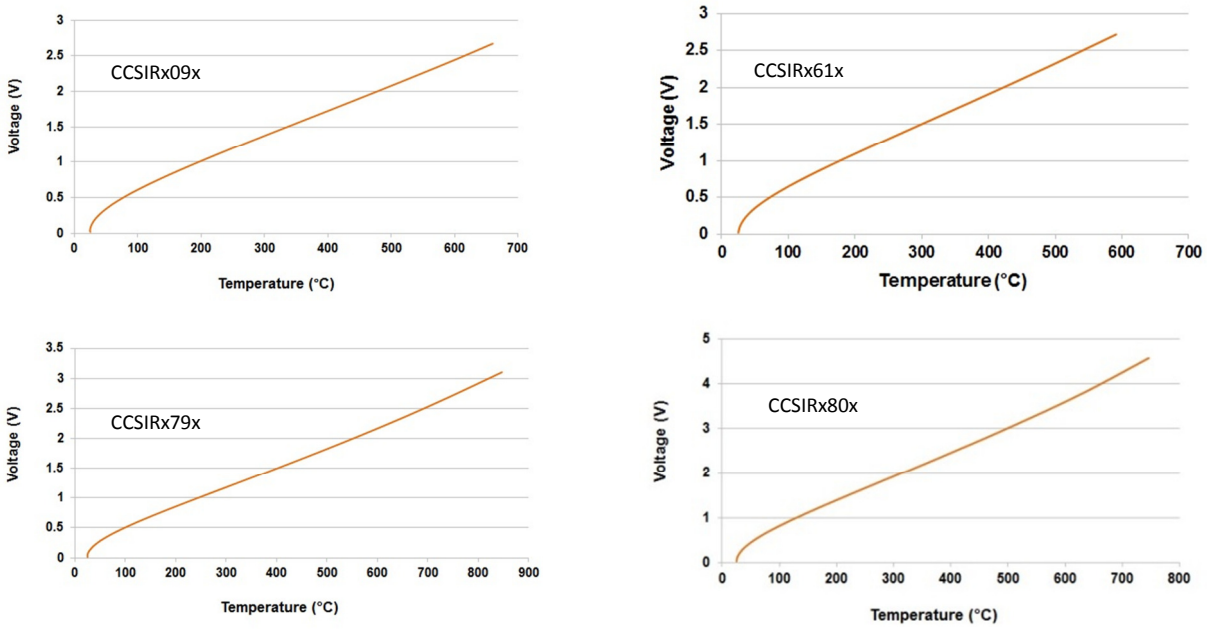


Fig4 Voltage v Temperature graphs, DC operation

Similarly, as the devices are resistive, the temperature is also be related to the current through the device. This relationship is shown in Fig5 below.

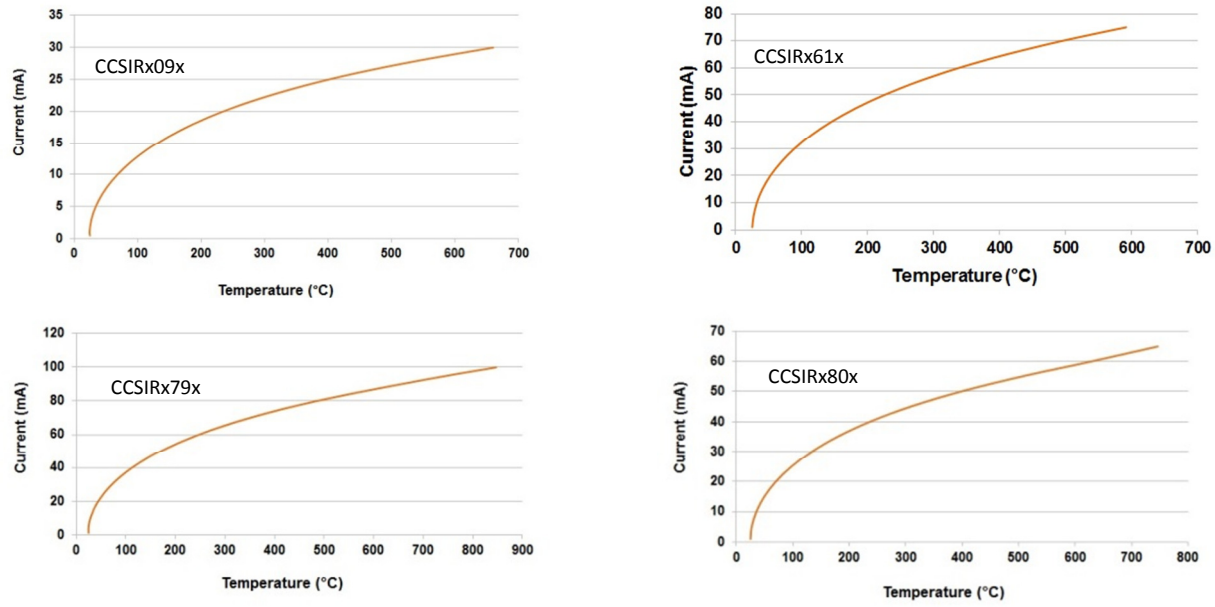


Fig5 Current v Temperature graphs, DC operation

One of the most important factors, however, in choosing an IR Source is the power consumption. CCS IR Sources operate at very low power and the relationship to temperature can be seen in Fig6 below.

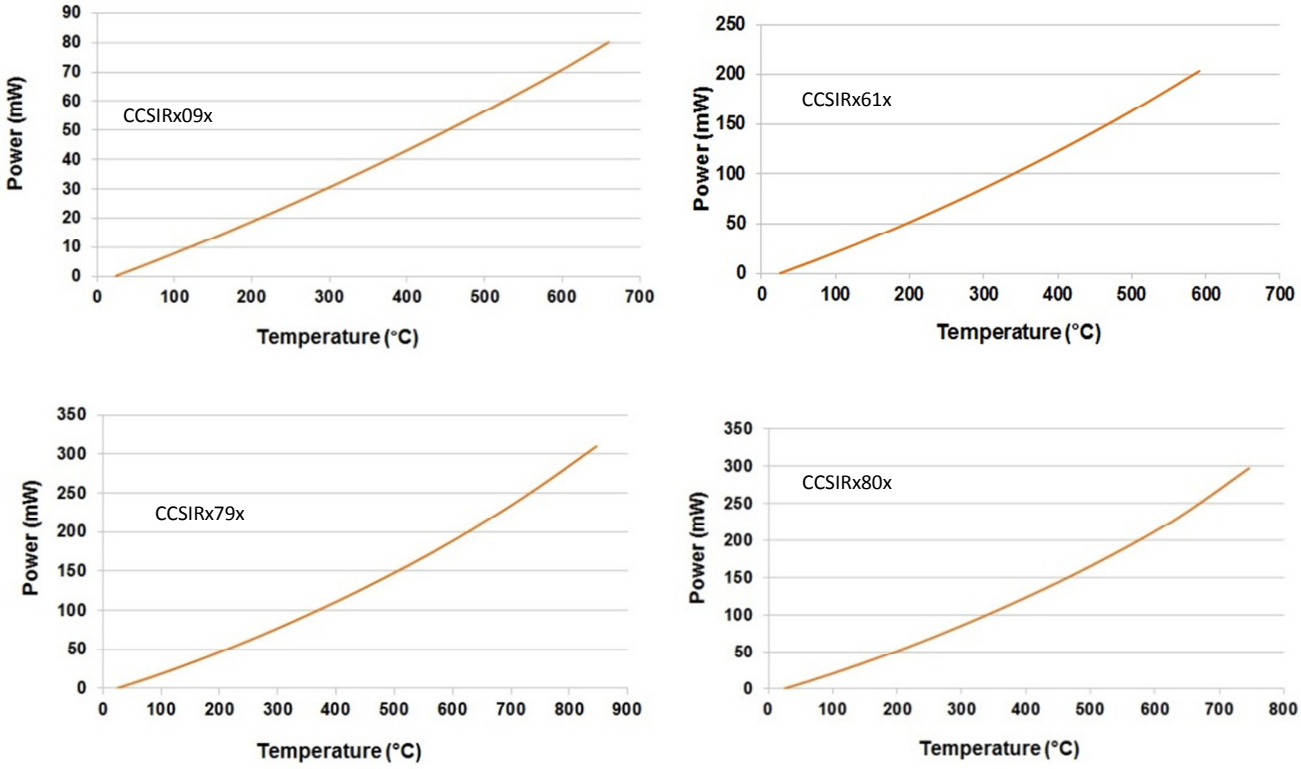


Fig6 Power v Temperature graphs, DC operation

As already mentioned, it is rare that devices will be required to operate in a continuous DC mode, as lifetime can be considerably increased by running IR Sources in pulsed DC configuration. In this method of operation, there will come a point where the device does not fully complete its heating and cooling cycle. The duty cycle at which pulsed DC operation is infinitely variable, but a typical value is 50% (on time = off time). The modulation depth of CCS IR Sources at 50% duty cycle is shown in Fig7 on the next page.

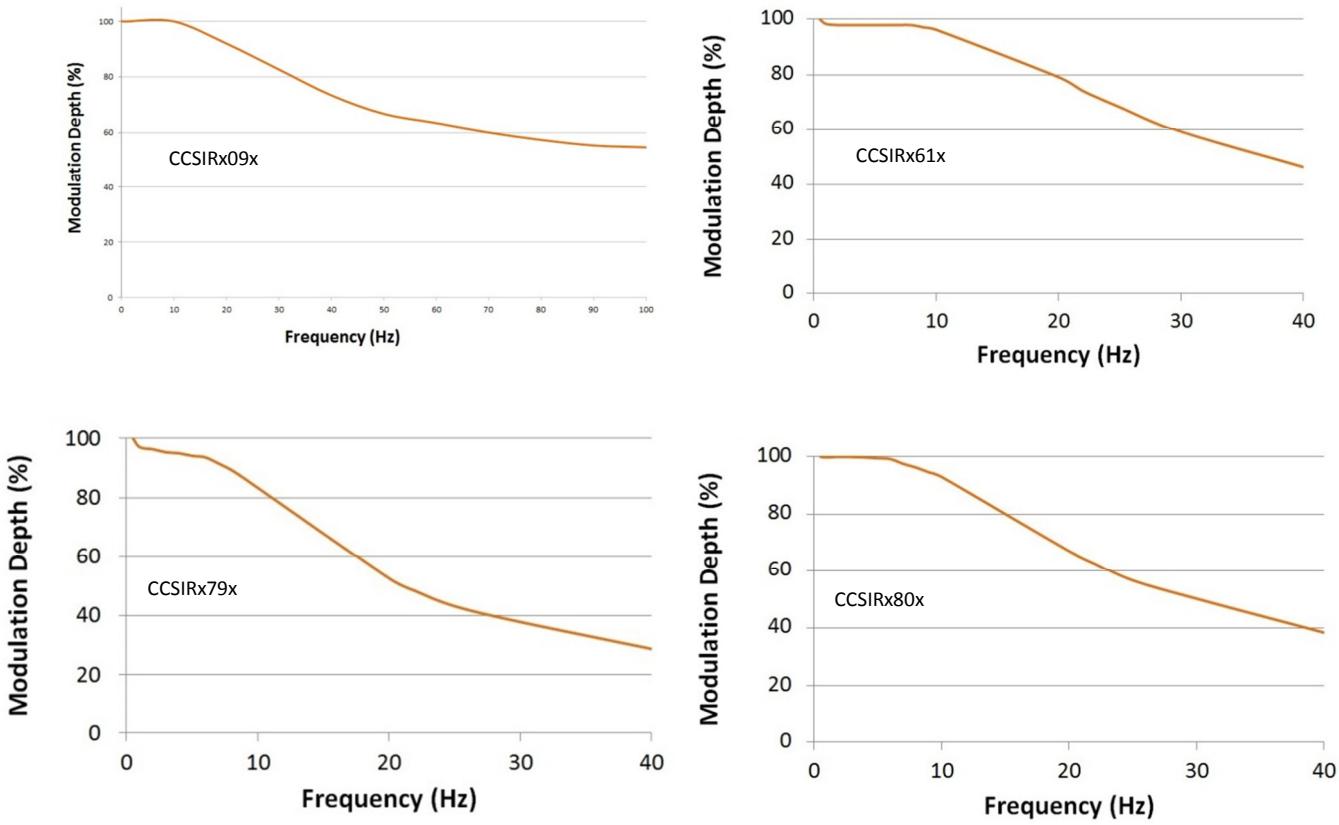


Fig7 Modulation Depth v Frequency

CCS IR Sources are also available with built-in temperature-sensing diode and/or FET driver. Details of operation using these options is given in a separate Applications Note.

For further information on any of the above, please contact Cambridge CMOS Sensors:

Tel: +44 1223 321905

email: sales@ccmoss.com

Many other Applications Notes are available from the CCS website: www.ccmoss.com