



open **TRV**



applying IoT to buses

Damon Hart-Davis

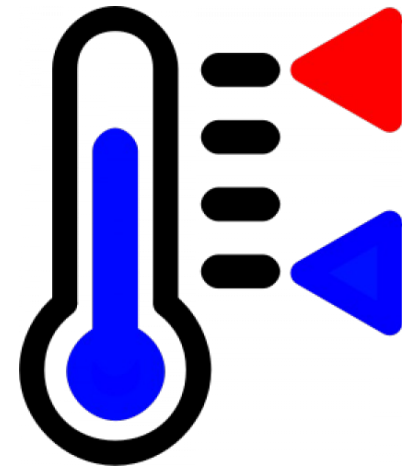
w opentrv.org.uk

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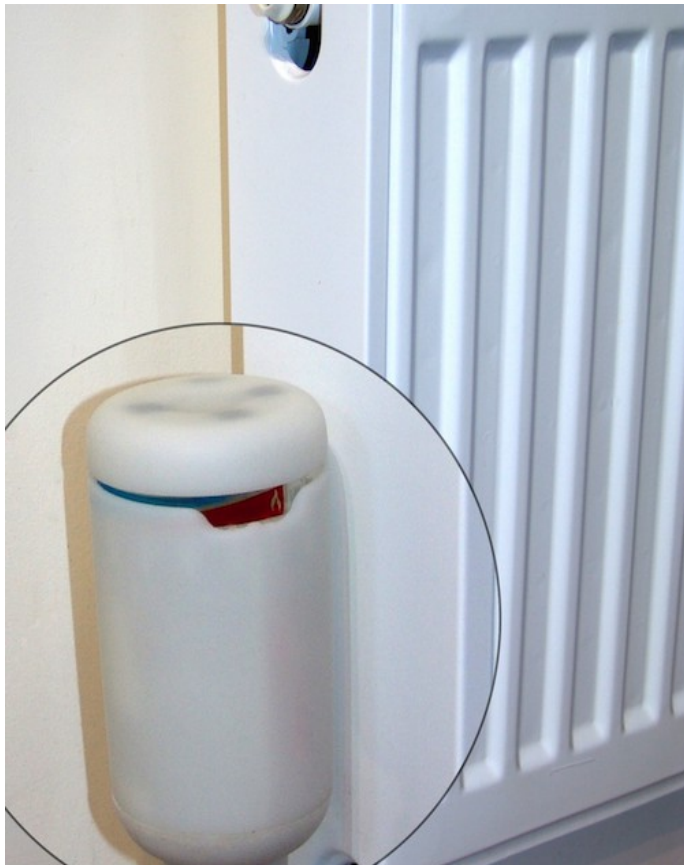


environmental

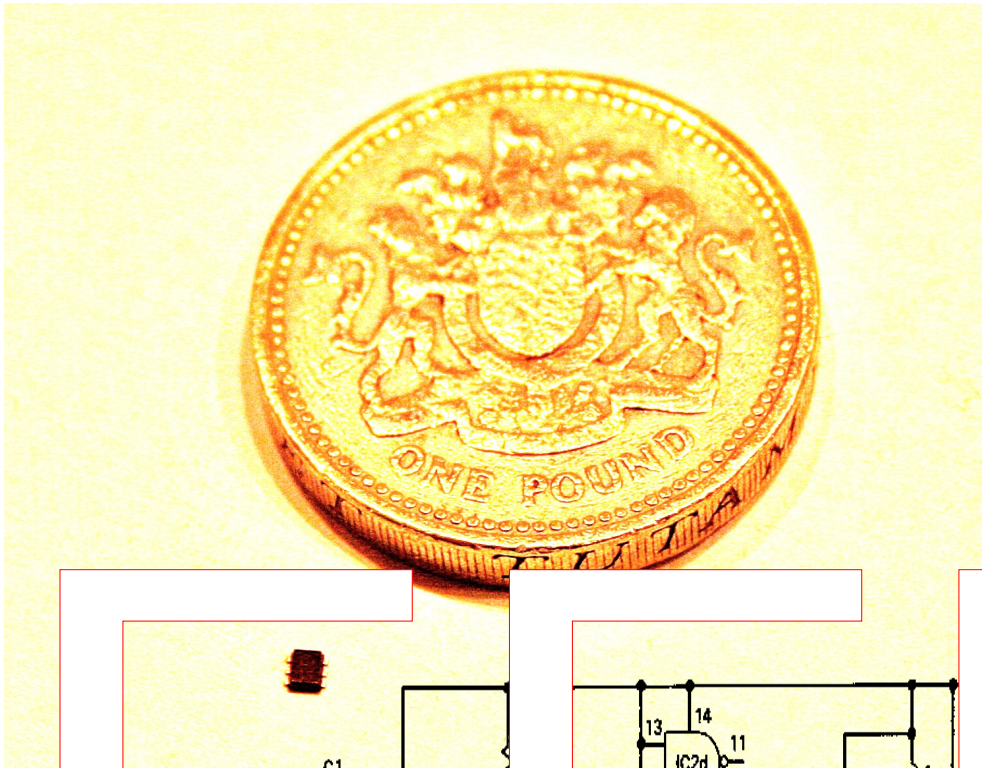


people

footfall



Cities: buses (transport), building health, efficiency, air + other env (20k temps across London?)



Electrical Characteristics

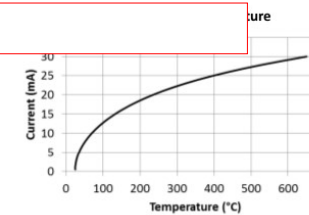
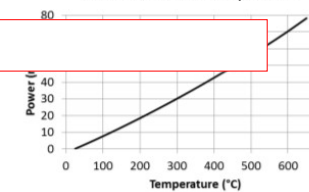
| Parameters | Conditions | Typical Value | Units |
|--|---------------------------|---------------|-----------------|
| Operating Temperature | | 600 | °C |
| Thermal Rise Time (t_{R0}) | | 15 ± 5 | ms |
| Thermal Fall Time (t_{F0}) | | 30 ± 5 | ms |
| Power Consumption (P_{VI}) | DC @ 600 °C | 72 ± 7 | mW |
| Heater Voltage (V_H) | | 2.4 ± 0.3 | V |
| Heater Current (I_H) | | 30 ± 4 | mA |
| Ambient Resistance (R_0) | | 40 ± 10 | Ω |
| Heater Resistance (R_H) ¹ | | 80 ± 20 | Ω |
| Heated Area | | 0.05 | mm ² |
| Emissivity | 2 - 14 μ m wavelength | 0.7 | |
| Frequency at 50% Modulation | | 38 | Hz |
| Lifetime | 600 °C @ 50% duty cycle | >5 | years |

Note:

- $R = (R_0 - RT)[1 + \alpha(T - T_0) + \beta(T - T_0)^2] + RT$; $T_0 = 25^\circ\text{C}$;
 RT (Track Resistance) = $12\Omega \pm 0.5\Omega @ 25^\circ\text{C}$; $\alpha = 2.05 \times 10^{-3} \text{ K}^{-1}$; $\beta = 0.3 \times 10^{-6} \text{ K}^{-2}$

Infrared Source Performance

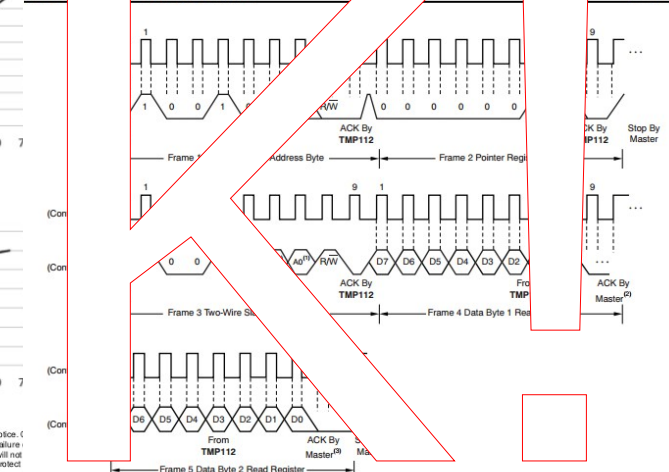
Electrical Power vs. Temperature



If notice: 1 are failure CS will not inherently a certain rate of failure, it is therefore necessary to protect
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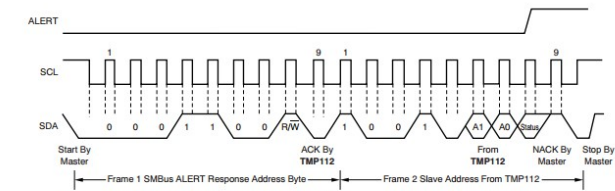
TMP112

SBS0473C—MARCH 2009—REVISED OCTOBER 2014



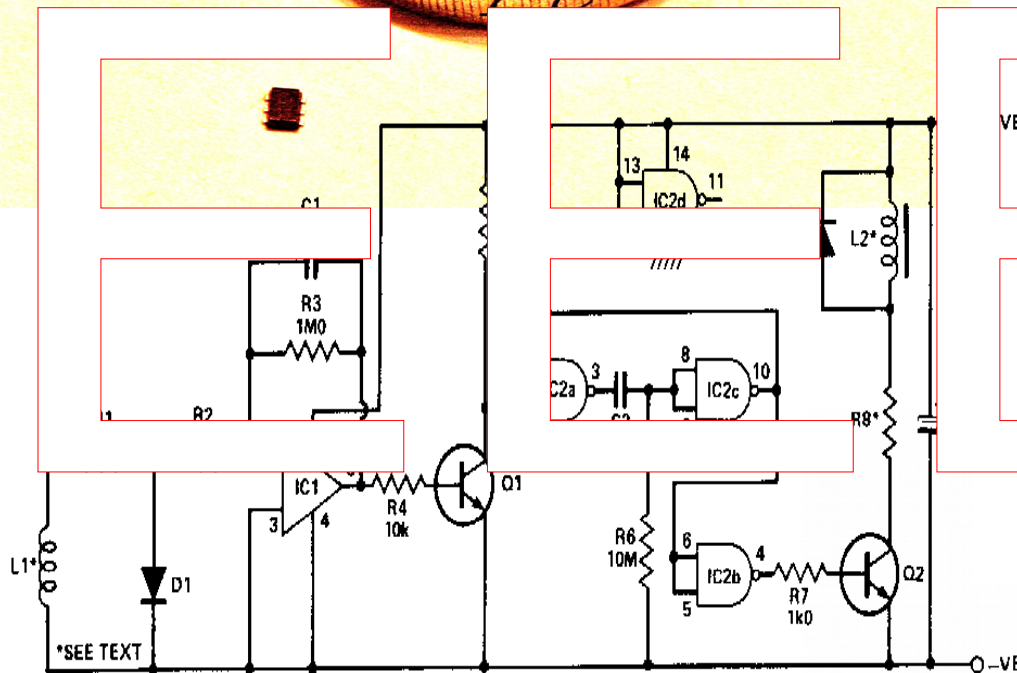
NOTE: (1) The values of A0 and A1 are determined by the ADD0 pin.
 (2) Master should leave SDA high to terminate a single-byte read operation.
 (3) Master should leave SDA high to terminate a two-byte read operation.

Figure 12. Two-Wire Timing Diagram for Read Word Format



NOTE: (1) The values of A0 and A1 are determined by the ADD0 pin.

Figure 13. Timing Diagram for SMBus ALERT



Hardware is hard!



Security / privacy still poorly handled in the IoT world



Horizontal: IoT technology; Innovate UK funding, new verticals in transport and building health

measure and manage,
deliver better, cheaper!

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simple open tech
big shared benefits