

5-Channel Laser Driver with RF Oscillator and 2 Outputs

Description

The T0800 is a laser diode driver for the operation of two different, grounded laser diodes for DVD-RAM (650 nm) and CD-RW (780 nm). It includes five channels for five different optical power levels which are controlled by a separate IC. The read channel generates a continuous output level. The channels 2 to 5 are provided as write channels with very fast switching speeds. When a 'low' signal is applied to the NE pins, write current pulses are enabled. All channels are summed together and switched to one of the two outputs IOUTA or IOUTB by the select input SELA. Each channel can contribute up to 150 mA

to the total output current of up to 200 mA. A total gain of 100 is provided between each reference current input and the selected output. Although the reference inputs are current inputs, voltage control is possible by using external resistors. An on-chip RF oscillator reduces laser mode hopping noise during read mode. Frequency and swing can be set independently for the two selectable outputs with two pairs of resistors. Oscillation is enabled by a 'high' signal at the ENOSC pin. Complete output current and oscillator switch-off is achieved by a 'low' signal at the ENABLE input.

Features

- Current-controlled output current source with 5 input channels
- 2 selectable outputs for grounded laser diodes
- Output current per channel up to 150 mA
- Total output current up to 200 mA
- Rise time 1.0 ns / fall time 1.1 ns
- On-chip RF oscillator
- Control of 2 different frequencies and swings by use of 4 external resistors
- Oscillator frequency range from 100 MHz to 600 MHz
- Oscillator swing to 100 mA
- Single 5-V power supply
- Common enable/disable input
- TTL/CMOS control signals
- Small SSO24 package

Application

- DVD-RAM with CD-RW capability

Block Diagram

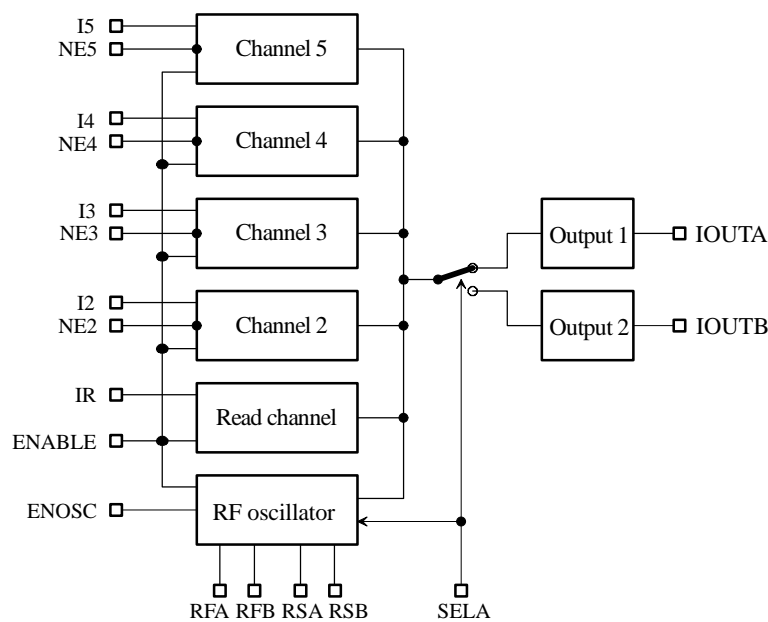


Figure 1. Block diagram

Pin Description

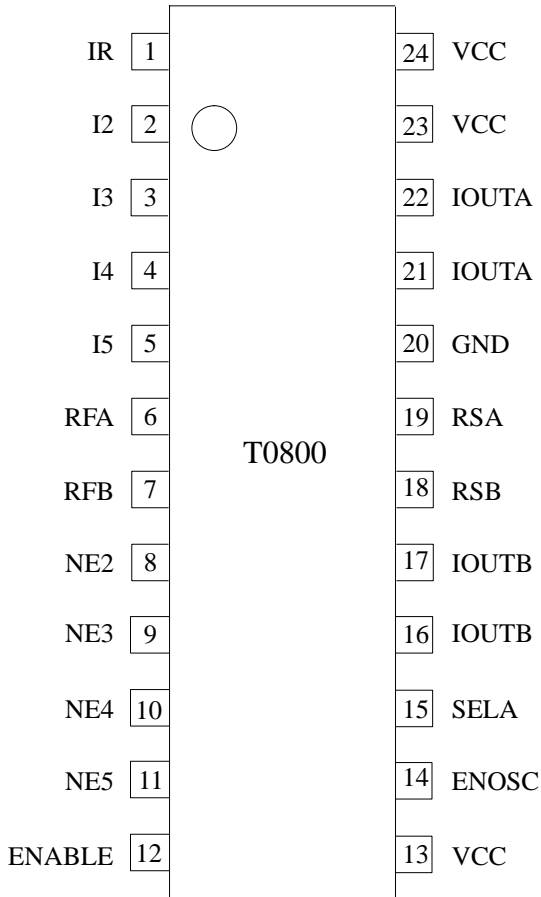


Figure 2. Pinning

| Pin | Symbol | Type | Function |
|-----------|---------|---------|---|
| 1 | IR | Analog | Input current, bias voltage approx. GND |
| 2 | I2 | Analog | Input current, bias voltage approx. GND |
| 3 | I3 | Analog | Input current, bias voltage approx. GND |
| 4 | I4 | Analog | Input current, bias voltage approx. GND |
| 5 | I5 | Analog | Input current, bias voltage approx. GND |
| 6 | RFA | Analog | External resistor to GND sets frequency of oscillator A |
| 7 | RFB | Analog | External resistor to GND sets frequency of oscillator B |
| 8 | NE2 | Digital | Digital control of channel 2 (low active) |
| 9 | NE3 | Digital | Digital control of channel 3 (low active) |
| 10 | NE4 | Digital | Digital control of channel 4 (low active) |
| 11 | NE5 | Digital | Digital control of channel 5 (low active) |
| 12 | EN-ABLE | Digital | Enables output current (high active) |
| 13 | VCC | Supply | +5V power supply |
| 14 | ENOSC | Digital | Enables RF oscillator (high active) |
| 15 | SELA | Digital | High: selects IOUTA, RFA, RSA Low: selects IOUTB, RFB, RSB |
| 16/ 17 | IOUTB | Analog | Output current source B for laser diode |
| 18 | RSB | Analog | External resistor to GND sets swing of oscillator B |
| 19 | RSA | Analog | External resistor to GND sets swing of oscillator A |
| 20 | GND | Supply | Ground |
| 21/ 22 | IOUTA | Analog | Output current source A for laser diode |
| 23/ 24 | VCC | Supply | +5V power supply |

Absolute Maximum Ratings

| Parameter | Symbol | Value | Unit |
|--|------------------|-------------------------------|------|
| Supply voltage | V _{CC} | -0.5 to +6.0 | V |
| Input voltage at IR, I2, I3, I4, I5 | V _{IN1} | -0.5 to +0.5 | V |
| Input voltage at NE2, NE3, NE4, NE5, ENOSC | V _{IN2} | -0.5 to V _{CC} + 0.5 | V |
| Output voltage | V _{OUT} | -0.5 to V _{CC} -1 | V |
| Power dissipation | P _{tot} | 1 ¹ | W |
| Junction temperature | T _J | 150 | °C |
| Storage temperature range | T _{stg} | -65 to +125 | °C |

¹ R_{thJA} ≤ 80 K/W

Thermal Resistance

| Parameter | Symbol | Value | Unit |
|------------------|-------------------|-------|------|
| Junction ambient | R _{thJA} | 135 | K/W |

Operating Range

| Parameter | Symbol | Value | Unit |
|--|--|------------|------|
| Supply voltage range | V _{CC} | 4.5 to 5.5 | V |
| Input current | I _{IR} , I _{I2} , I _{I3} , I _{I4} , I _{I5} | < 2 | mA |
| External resistor to GND to set oscillator frequency | R _{FA} , R _{FB} | > 3 | kΩ |
| External resistor to GND to set oscillator swing | R _{SA} , R _{SB} | > 100 | Ω |
| Operating temperature range | T _{amb} | 0 to +70 | °C |

Electrical Characteristics

V_{CC} = 5 V, T_{amb} = 25°C, ENABLE=High, NE2=NE3=NE4=NE5=High, ENOSC=Low, unless otherwise specified

| Parameter | Test Conditions / Pins | Symbol | Min. | Typ. | Max. | Unit |
|--|--|--------------------|------|------|------|------|
| Power Supply | | | | | | |
| Supply current, power down | ENABLE = Low, NE2=NE3=NE4=NE5=Low | ICC _{PD2} | | 0.5 | | mA |
| Supply current, read mode, oscillator disabled | I _{IR} =I _{I2} = I _{I3} = I _{I4} = I _{I5} = 125 μA | ICC _{R1} | | 90 | | mA |
| Supply current, read mode, oscillator enabled, output A selected | I _{IR} =I _{I2} = I _{I3} = I _{I4} = I _{I5} = 125 μA, ENOSC=High, RS = 430 Ω, RF = 7.5 KΩ, SELA = High | ICC _{R2} | | 100 | | mA |
| Supply current, write mode | I _{IR} =I _{I2} = I _{I3} = I _{I4} = I _{I5} = 125 μA, NE2=NE3=NE4=NE5=Low | ICC _W | | 195 | | mA |
| Supply current, input off | I _{IR} =I _{I2} =I _{I3} =I _{I4} = I _{I5} = 0 μA | ICC _{off} | | 18 | | mA |
| V _{CC} shutdown voltage | | V _{SHUT} | | 2.4 | | V |

Electrical Characteristics (continued)

$V_{CC} = 5\text{ V}$, $T_{amb} = 25^\circ\text{C}$, ENABLE=High, NE2=NE3=NE4=NE5=High, ENOSC=Low, unless otherwise specified

| Parameter | Test Conditions / Pins | Symbol | Min. | Typ. | Max. | Unit |
|----------------------------------|------------------------|-----------------|------|------|------|---------------|
| Digital Inputs | | | | | | |
| NE2/NE3/NE4/NE5 low voltage | | $V_{NE_{LO}}$ | | | 1.3 | V |
| NE2/NE3/NE4/NE5 high voltage | | $V_{NE_{HI}}$ | 2.0 | | | V |
| SELA low voltage | | $V_{SELA_{LO}}$ | | | 0.5 | V |
| SELBA high voltage | | $V_{SELA_{HI}}$ | 2.7 | | | V |
| ENABLE low voltage | | $V_{EN_{LO}}$ | | | 0.5 | V |
| ENABLE high voltage | | $V_{EN_{HI}}$ | 2.7 | | | V |
| ENOSC low voltage | | $V_{EO_{LO}}$ | | | 0.5 | V |
| ENOSC high voltage | | $V_{EO_{HI}}$ | 2.0 | | | V |
| Current at Digital Inputs | | | | | | |
| NE2/NE3/NE4/NE5 low current | NE = 0 V | $I_{NE_{LO}}$ | -300 | | | μA |
| NE2/NE3/NE4/NE5 high current | NE = 5 V | $I_{NE_{HI}}$ | | | 800 | μA |
| SELA low current | SELA = 0 V | $I_{SELA_{LO}}$ | -50 | | | μA |
| SELA high current | SELA = 5 V | $I_{SELA_{HI}}$ | | | 150 | μA |
| ENABLE low current | ENABLE = 0 V | $I_{EN_{LO}}$ | -150 | | | μA |
| ENABLE high current | ENABLE = 5 V | $I_{EN_{HI}}$ | | | 100 | μA |
| ENOSC low current | ENOSC = 0 V | $I_{EO_{LO}}$ | -100 | | | μA |
| ENOSC high current | ENOSC = 5 V | $I_{EO_{HI}}$ | | | 800 | μA |

Electrical Characteristics Laser Amplifier

$V_{CC} = 5\text{ V}$, $T_{amb} = 25^\circ\text{C}$, ENABLE=High, unless otherwise specified

| Parameter | Test Conditions / Pins | Symbol | Min. | Typ. | Max. | Unit |
|---|--|-------------------|------|------|------|----------|
| Outputs IOUTA and IOUTB | | | | | | |
| Best fit current gain | Any channel ¹ | GAIN | | 100 | | mA/mA |
| Best fit current offset | Any channel ¹ | IOS | -8 | | +4 | mA |
| Output current linearity | Any channel ¹ | ILIN | -3 | | +3 | % |
| Input current range | Input is sinking | IDAC | 0 | | 2 | mA |
| Output current per channel | Output is sourcing | I_{OUTR} | 150 | | | mA |
| I_{IN} input impedance | R_{IN} is to GND | R_{IN} | 150 | 200 | 250 | Ω |
| NE threshold | Temperature stabilized | V_{TH} | | 1.68 | | V |
| Output off current 1 | ENABLE = Low | IOFF ₁ | | | 1 | mA |
| Output off current 2 | NE2=NE3=NE4=NE5=High | IOFF ₂ | | | 1 | mA |
| Output off current 3 | NE2=NE3=NE4=NE5=Low, $I_{IR}=I_{I2}=I_{I3}=I_{I4}=I_{I5}=0\ \mu\text{A}$ | IOFF ₃ | | | 5 | mA |
| I_{OUT} supply sensitivity, read mode | $I_{OUT} = 40\text{mA}$, $V_{CC} = 5\text{ V}$ $\pm 10\%$, read-only | V_{SER} | -4 | | 1 | %V |

Electrical Characteristics (continued) Laser Amplifier

$V_{CC} = 5\text{ V}$, $T_{amb} = 25^{\circ}\text{C}$, ENABLE=High, unless otherwise specified

| Parameter | Test Conditions / Pins | Symbol | Min. | Typ. | Max. | Unit |
|---|---|------------------|------|------|------|----------|
| I_{OUT} supply sensitivity, write mode | $I_{OUT} = 80\text{ mA}$, 40 mA read + 40 mA write, $V_{CC} = 5\text{ V} \pm 10\%$ | VSE _W | -6 | | 0 | %V |
| I_{OUT} current output noise | $I_{OUT} = 40\text{ mA}$, ENOSC = Low | INO _O | | tbd | | nA/rt-Hz |
| I_{OUT} temperature sensitivity, read mode | $I_{OUT} = 40\text{ mA}$, read only | TSE _R | | 100 | | ppm/°C |
| I_{OUT} temperature sensitivity, write mode | $I_{OUT} = 80\text{ mA}$, 40 mA read + 40 mA write | TSE _W | | 100 | | ppm/°C |

Laser Current Amplifier Outputs AC Performance

$V_{CC} = +5\text{ V}$, $I_{OUT} = 40\text{ mA}$ DC with 40-mA pulse, $T_A = 25^{\circ}\text{C}$ unless otherwise specified

| Parameter | Test Conditions / Pins | Symbol | Min. | Typ. | Max. | Unit |
|------------------------------------|---|-------------------|------|------|------|--------|
| Outputs IOUTA and IOUTB | | | | | | |
| Write rise time | $I_{OUT} = 40\text{ mA}$ (read) + 40 mA (10%–90%) ¹⁾ | t _{RISE} | | 1.0 | 3.0 | ns |
| Write fall time | $I_{OUT} = 40\text{ mA}$ (read) + 40 mA (10%–90%) ¹⁾ | t _{FALL} | | 1.1 | 3.0 | ns |
| Output current overshoot | $I_{OUT} = 40\text{ mA}$ (read) + 40 mA ¹⁾ | OS | | 5 | | % |
| I_{OUT} ON prop delay | NE 50% High-Low to I_{OUT} at 50% of final value | t _{ON} | | 2.0 | | ns |
| I_{OFF} OFF prop delay | NE 50% Low-High to I_{OUT} at 50% of final value | t _{OFF} | | 2.0 | | ns |
| Disable time | ENABLE 50% High-Low to I_{OUT} at 50% of final value | t _{DIS} | | 20 | | ns |
| Enable time | ENABLE 50% Low-High to I_{OUT} at 50% of final value | t _{EN} | | 20 | | ns |
| Disable time oscillator | ENOSC 50% Low-High to I_{OUT} at 50% of final value | T _{DISO} | | 3 | | ns |
| Enable time oscillator | ENOSC 50% High-Low to I_{OUT} at 50% of final value | T _{ENO} | | 20 | | ns |
| SELA delay | SELA Low-High 50% to I_{OUT} at 50% of final value | T _{SAH} | | tbd | | ns |
| SELA delay | SELA High-Low 50% to I_{OUT} at 50% of final value | T _{SAL} | | tbd | | ns |
| Amplifier bandwidth | $I_{OUT} = 50\text{ mA}$, all channels, -3 dB value | BW _{LCA} | | 20 | | MHz |
| Oscillator frequency | RF = 4.7 kΩ | F _{OSC} | 380 | 470 | 560 | MHz |
| Oscillator temperature coefficient | RF = 4.7 kΩ | TC _{OSC} | | -150 | | ppm/°C |

1) Load resistor at I_{OUT} 10 Ω, measurement with a 50-Ω oscilloscope and a 39-Ω series resistor.

Application Information Oscillator

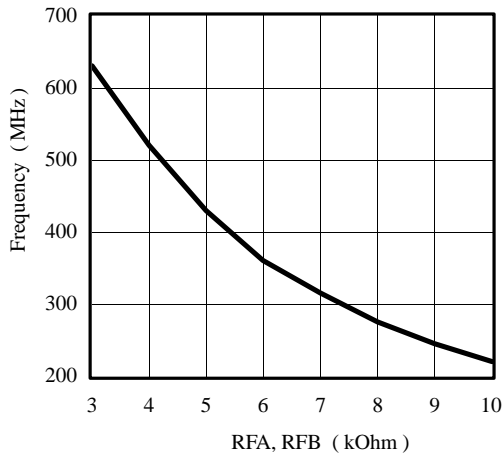


Figure 3. Frequency vs. resistor RFA and RFB

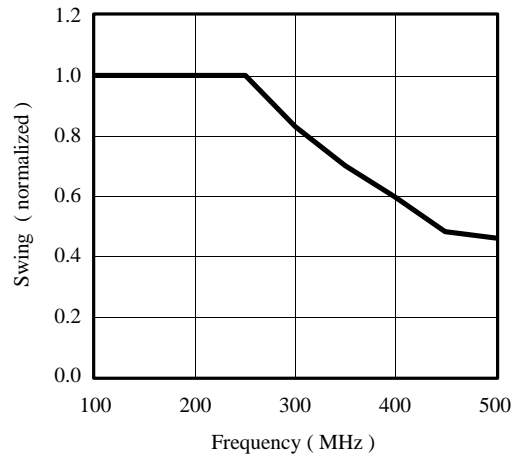


Figure 5. Frequency dependency of swing

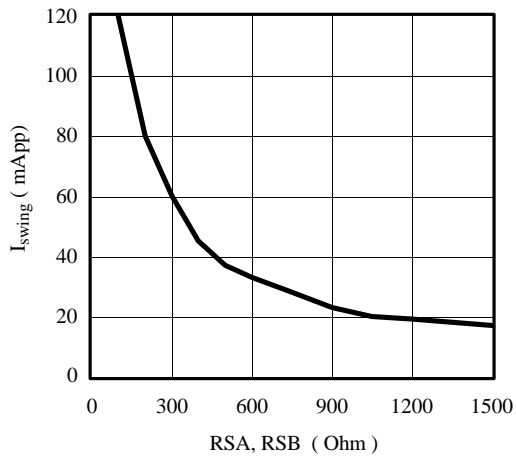


Figure 4. Swing vs. resistor RSA and RSB

Timing Diagram

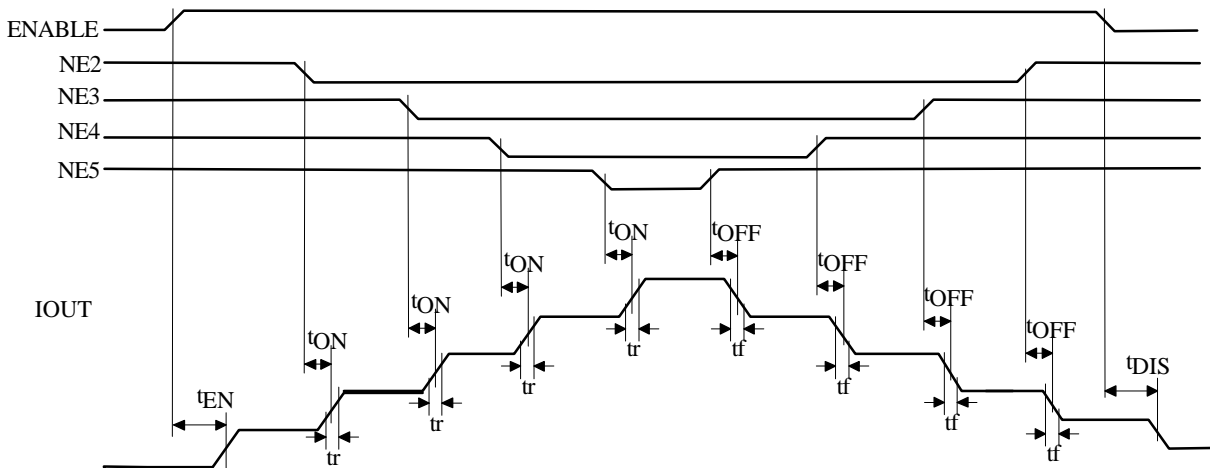


Figure 6. Timing diagram

Typical Application Circuit

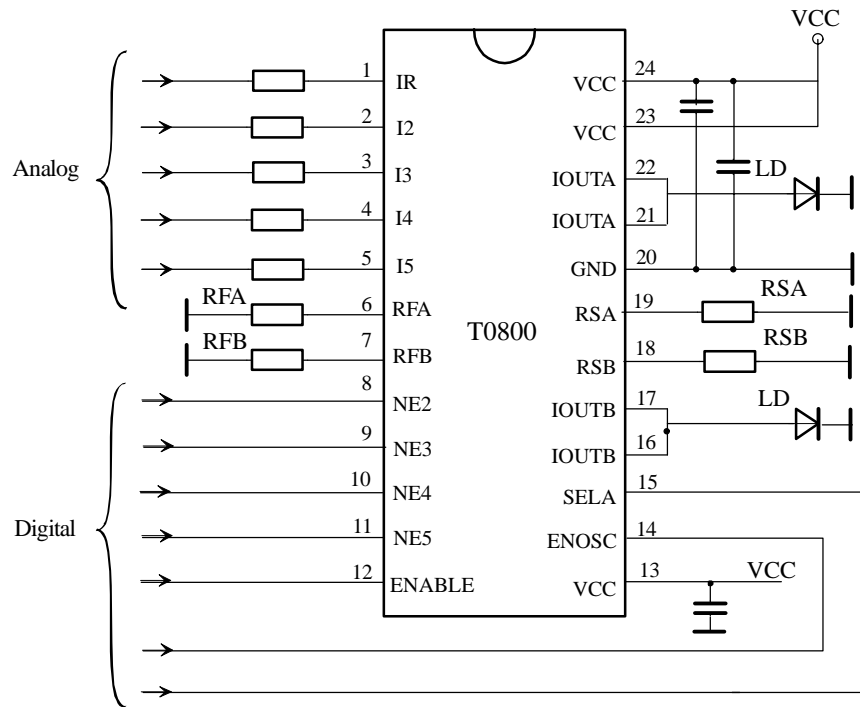
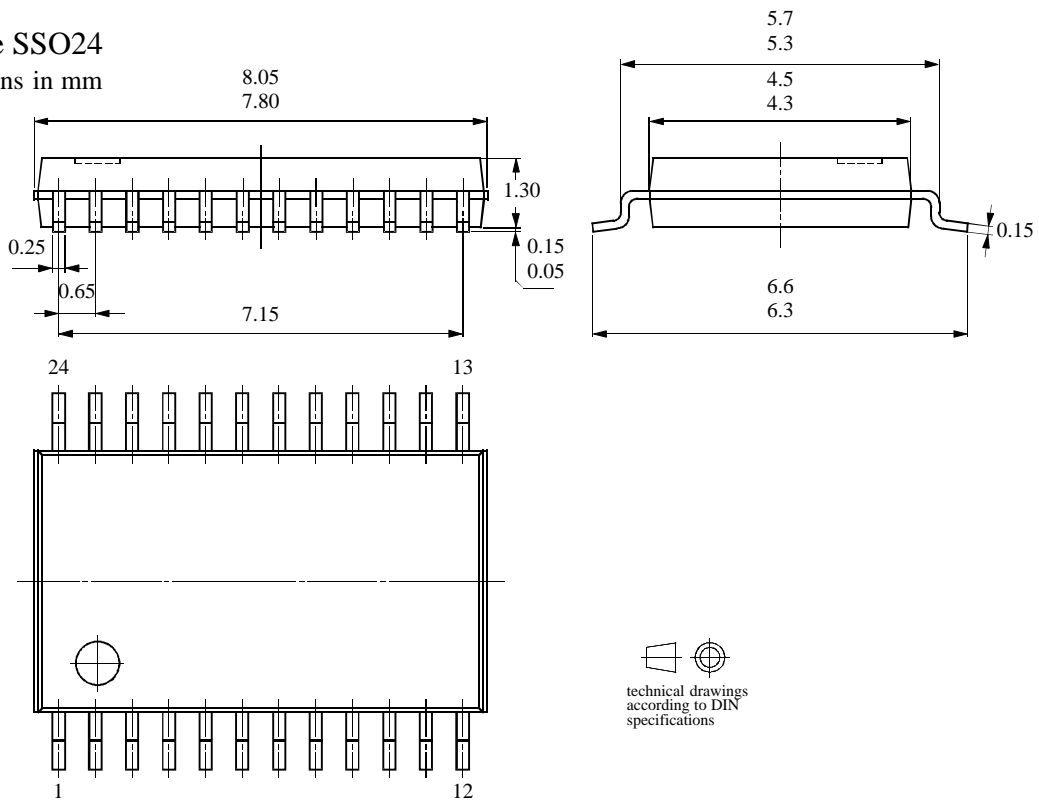


Figure 7. Application circuit

Package Information

Package SSO24

Dimensions in mm



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