Features

- **Current-controlled Output Current Source with 4 Input Channels**
- **Low-power Consumption**
- **Output Current up to 150 mA, Read Channel and Channel 2**
- **Output Current up to 200 mA, Channel 3 and Channel 4**
- **Total Output Current to 300 mA**
- **Rise Time 1.0 ns, Fall Time 1.1 ns**
- **On-chip RF Oscillator**
- **Control Frequency and Swings by Use of 2 External Resistors**
- **Oscillator Frequency Range from 200 MHz to 600 MHz**
- **Oscillator Swing to 100 mA**
- **Single 5 V Power Supply**
- **Common Enable/Disable Input**
- **TTL/CMOS Control Signals**
- **Small SSO16 Package**

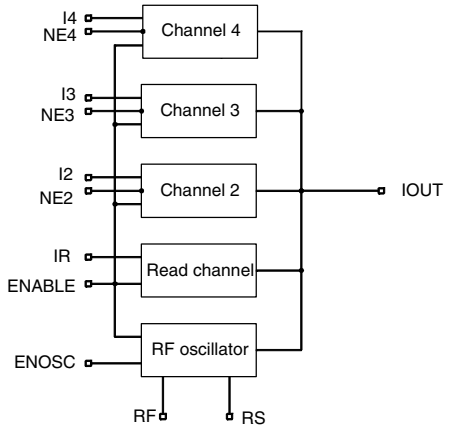
Application

- **DVD-RAM**
- **DVD-RW**
- **DVD+RW**
- **CD-RW**
- **Writable Optical Drives**

Description

The T0820 is a laser diode driver for the operation of a grounded laser diode for writable optical drives. It includes four channels for four different optical power levels which are controlled by a separate IC. The read channel generates a continuous output level whereas channels 2 to 4 are provided as write channels with very fast switching speeds. Write current pulses are enabled when a "low" signal is applied to the NE pins. All channels are summed together at the IOUT pin. Read channel and channel 2 can contribute up to 150 mA and channels 3 and 4 up to 200 mA to the total output current of up to 300 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. Frequency and swing can be set by two external resistors. Oscillation is enabled by a "high" at the ENOSC pin. Complete output current and oscillator switch-off is achieved by a `low' at the ENABLE input.

Figure 1. Block Diagram



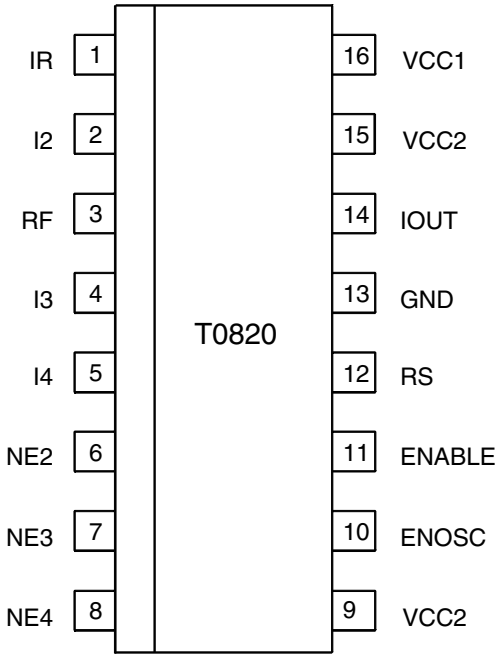
4-channel Laser Driver with RF Oscillator

T0820

Rev. 4506F–DVD–09/04

Pin Configuration

Figure 2. Pinning SSO16



Pin Description

Pin	Symbol	Type	Function
1	IR	Analog	Input current, bias voltage approximately GND
2	I2	Analog	Input current, bias voltage approximately GND
3	RF	Analog	External resistor to GND sets oscillator frequency
4	I3	Analog	Input current, bias voltage approximately GND
5	I4	Analog	Input current, bias voltage approximately GND
6	NE2	Digital	Digital control of channel 2 (low active)
7	NE3	Digital	Digital control of channel 3 (low active)
8	NE4	Digital	Digital control of channel 4 (low active)
9	VCC2	Supply	+5 V power supply for IOUT
10	ENOSC	Digital	Enables RF oscillator (high active)
11	ENABLE	Digital	Enables output current (high active)
12	RS	Analog	External resistor to GND sets oscillator swing
13	GND	Supply	Ground
14	IOUT	Analog	Output current source for laser diode
15	VCC2	Supply	+5 V power supply for IOUT
16	VCC1	Supply	+5 V power supply for circuit

Absolute Maximum Ratings

Parameters	Symbol	Value	Unit
Supply voltage	V_{CC}	-0.5 to +6.0	V
Input voltage at IR, I2, I3, I4	V_{IN1}	-0.5 to +0.8	V
Input voltage at NE2, NE3, NE4, 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_{MAX}	0.7(1) to 1(2)	W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	-65 to +125	°C

Notes: 1. R_{thJA} ≤115 k/W, T_{amb} = 70°C
2. R_{thJA} ≤115 k/W, T_{amb} = 25°C

Thermal Resistance

Parameters	Symbol	Value	Unit
Junction ambient	R_{thJA}	115(1)	K/W

Note: 1. Measured with multi-layer test board (JEDEC standard)

Operating Range

Parameters	Symbol	Value	Unit
Supply voltage range	VCC	4.5 to 5.5	V
Input current	I_{IR}, I_{I2}, I_{I3}, I_{I4}	<2	mA
External resistor to GND to set oscillator frequency	RF	>3	kΩ
External resistor to GND to set oscillator swing	RS	>100	Ω
Operating temperature range	T_{amb}	0 to +70	°C

Electrical Characteristics: General

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

No.	Parameters	Test Condition	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
1	**Power supply**								
1.1	Supply current, power down	ENABLE = Low, NE2 = NE3 = NE4 = Low	9, 15, 16	ICC_{PD2}		0.3		mA	A
1.2	Supply current, read mode, oscillator disabled	$I_{IR} = I_{I2} = I_{I3} = I_{I4}$ = 500 µA	9, 15, 16	ICC_{R1}		95		mA	A
1.3	Supply current, read mode, oscillator enabled	$I_{IR} = I_{I2} = I_{I3} = I_{I4}$ = 500 µA, ENOSC = High, RS = 560 Ω, RF = 7.5 kΩ	9, 15, 16	ICC_{R2}		100		mA	A
1.4	Supply current, write mode	$I_{IR} = I_{I2} = I_{I3} = I_{I4}$= 500 µA, NE2 = NE3 = NE4 = Low	9, 15, 16	ICC_{W}		230		mA	A
1.5	Supply current, input off	$I_{IR} = I_{I2} = I_{I3} = I_{I4}$ = 0 µA	9, 15, 16	ICC_{off}		16		mA	A
2	**Digital inputs**								
2.1	NE2/NE3/NE4 low voltage		6, 7, 8	VNE_{LO}			1.3	V	A
2.2	NE2/NE3/NE4 high voltage		6, 7, 8	VNE_{HI}	2.0			V	A
2.3	ENABLE low voltage		11	VEN_{LO}			0.5	V	A
2.4	ENABLE high voltage		11	VEN_{HI}	3.0			V	A
2.5	ENOSC low voltage		10	VEO_{LO}			0.5	V	A
2.6	ENOSC high voltage		10	VEO_{HI}	3.0			V	A
3	**Current at digital inputs**								
3.1	NE2/NE3/NE4 low current	NE = 0 V	6, 7, 8	INE_{LO}	-300			µA	A
3.2	NE2/NE3/NE4 high current	NE = 5 V	6, 7, 8	INE_{HI}			800	µA	A
3.3	ENABLE low current	ENABLE = 0 V	11	IEN_{LO}	-150			µA	A
3.4	ENABLE high current	ENABLE = 5 V	11	IEN_{HI}			100	µA	A
3.5	ENOSC low current	ENOSC = 0 V	10	IEO_{LO}	-100			µA	A
3.6	ENOSC high current	ENOSC = 5 V	10	IEO_{HI}			800	µA	A

* Type means: A: 100% tested B: 100% correlation tested C: Characterized on samples D: Design parameter

Electrical Characteristics: Laser Amplifier

V_{CC} = 5 V, T_{amb} = 25°C, ENABLE = High, unless otherwise specified

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
4	**Laser Amplifier**								
4.1	Best fit current gain	Any channel(1)	14	GAIN	90	105	130	mA/mA	A
4.2	Best fit current offset	Any channel(1)	14	IOS	-8		+4	mA	A
4.3	Output current linearity	Any channel(1)	14	ILIN	-3		+3	%	A
4.4	Input current range	Input is sinking	1, 2, 4, 5	IDAC	0		3	mA	C
4.5	Output current read channel	Output is sourcing	14	I_{OUTR}	150			mA	A
4.6	Output current channel 2	Output is sourcing	14	I_{OUT2}	150			mA	A
4.7	Output current channel 3	Output is sourcing	14	I_{OUT3}	200			mA	A
4.8	Output current channel 4	Output is sourcing	14	I_{OUT4}	200			mA	A
4.9	Output current read channel + channel 2	Output is sourcing	14	$I_{OUTR,2}$	150			mA	A
4.10	Output current channel 3 + channel 4	Output is sourcing	14	$I_{OUT3,4}$	200			mA	A
4.11	Total output current	Output is sourcing	14	I_{OUT}	300			mA	A
4.12	IOUT series resistor	I_{OUT} = 250 mA total R_{OUT} to V_{CC}-Rail	14	R_{OUT}		8		Ω	C
4.13	I_{IN} input impedance	R_{IN} is to GND	1, 2, 4, 5	R_{IN}	150	200	250	Ω	A
4.14	NE threshold	Temperature stabilized	6, 7, 8	VTH		1.68		V	B
4.15	Output off current 1	ENABLE = Low		$IOFF_1$			1	mA	A
4.16	Output off current 2	NE2=NE3=NE4=High I_{IR}=0 µA, I_{I2}=I_{I3}=I_{I4}= 500 µA	14	$IOFF_2$			1	mA	A
4.17	Output off current 3	NE2=NE3=NE4=Low, I_{IR}=I_{I2}=I_{I3}=I_{I4}= 0 µA	14	$IOFF_3$			5	mA	A
4.18	I_{OUT} supply sensitivity, read mode	I_{OUT} = 40 mA, V_{CC} = 5 V ± 10%, read only	14	VSE_R	-4		-1	%/V	A
4.19	I_{OUT} supply sensitivity, write mode	I_{OUT} = 80 mA, 40 mA read + 40 mA write, V_{CC}=5V±10%	14	VSE_W	-4		0.2	%/V	A
4.20	I_{OUT} current output noise	I_{OUT} = 40 mA, ENOSC = Low	14	INO_O		3		nA/ rt-Hz	C
4.21	I_{OUT} temperature sensitivity, read mode	I_{OUT} = 40 mA, read only	14	TSE_R		-500		ppm/ °C	C
4.22	I_{OUT} temperature sensitivity, write mode	I_{OUT} = 80 mA, 40 mA read + 40 mA Write	14	TSE_W		-600		ppm/ °C	C

*) Type means: A =100% tested, B = 100% correlation tested, C = Characterized on samples, D = Design parameter

Note: 1. Linearity of the amplifier is calculated using a best fit method at three operating points of I_{OUT} at 20 mA, 40 mA, and 60 mA. I_{OUT} = (I_{IN} × GAIN) + I_{OS}

Electrical Characteristics: Laser Current Amplifier Output AC Performance

V_{CC} = +5 V, IOUT = 40 mA DC with 40 mA pulse, T_{amb} = 25°C, unless otherwise specified

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
5	**Laser Current Amplifier Output AC Performance**								
5.1	Write rise time	I_{OUT} = 40 mA (read) + 40 mA (10% - 90%)(1)	14	t_{RISE}		1.0	3.0	ns	C
5.2	Write fall time	I_{OUT} = 40 mA (read) + 40 mA (10% - 90%)(1)	14	t_{FALL}		1.1	3.0	ns	C
5.3	Output current overshoot	I_{OUT} = 40 mA (read) + 40 mA (1)	14	OS		5		%	C
5.4	I_{OUT} ON prop delay	NE 50% High-Low to I_{OUT} at 50% of final value	14	t_{ON}		2.0		ns	C
5.5	I_{OUT} OFF prop delay	NE 50% Low-High to I_{OUT} at 50% of final value	14	t_{OFF}		2.0		ns	C
5.6	Disable time	ENABLE 50% High-Low to I_{OUT} at 50% of final value	14	t_{DIS}		10		ns	C
5.7	Enable time	ENABLE 50% Low-High to I_{OUT} at 50% of final value	14	t_{EN}		50		ns	C
5.10	Amplifier bandwidth	I_{OUT} = 50 mA, all channels, -3 dB value	14	BW_{LCA}		20		MHz	C
6	**Oscillator**								
6.1	Oscillator frequency	RF = 7.5 kΩ RS = 560 Ω	14	F_{OSC}	255	300	350	MHz	A
6.2	Oscillator temperature coefficient	RF = 7.5 kΩ RS = 560 Ω	14	TC_{OSC}		-150		ppm/°C	C
6.3	Disable time oscillator	ENOSC 50% Low-High to I_{OUT} at 50% of final value	14	T_{DISO}		4		ns	C
6.4	Enable time oscillator	ENOSC 50% High-Low to I_{OUT} at 50% of final value	14	T_{ENO}		2		ns	C
6.5	Oscillator swing	RF = 7.5 kΩ RS = 560 Ω	14	S_{OSC}	35		55	mApp	A

*) Type means: A =100% tested, B = 100% correlation tested, C = Characterized on samples, D = Design parameter

Note: 1. Load resistor at IOUT 10 Ω, measurement with a 50-Ω oscilloscope and a 39-Ω series resistor

Application Information

Figure 3. Oscillator Frequency vs. Resistor RF (RS = 560 Ω)

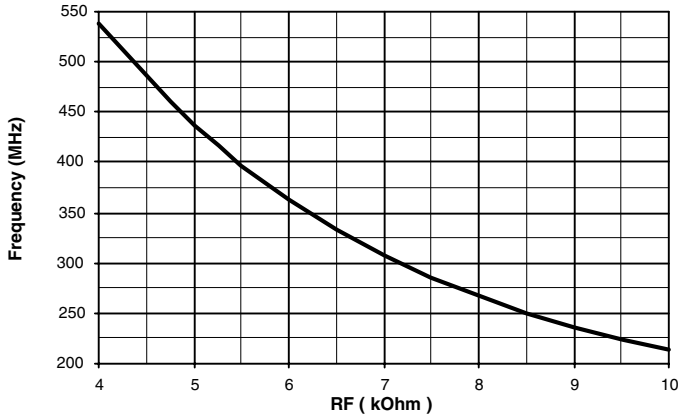


Figure 4. Oscillator Swing vs. Resistor RS (RF = 7.5 kΩ)

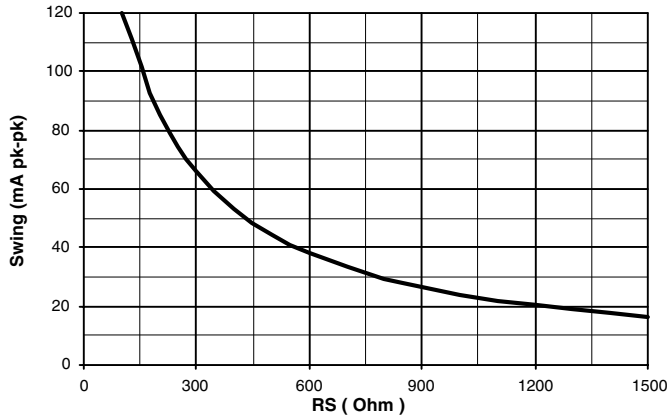


Figure 5. Oscillator Frequency Depending of Swing (RS = 560 Ω)

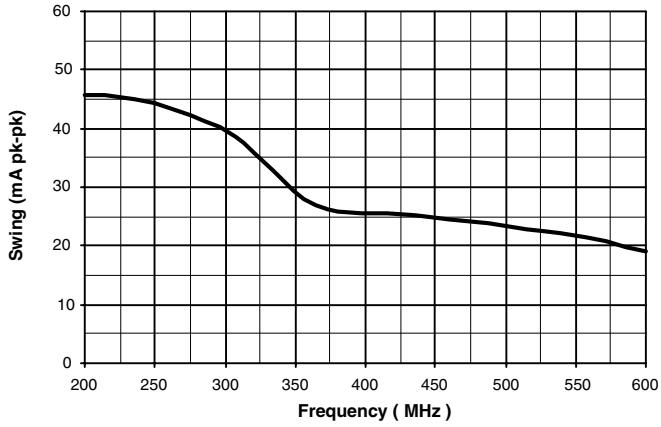


Figure 6. Transfer Characteristic of Channel 2 (gain = 112)

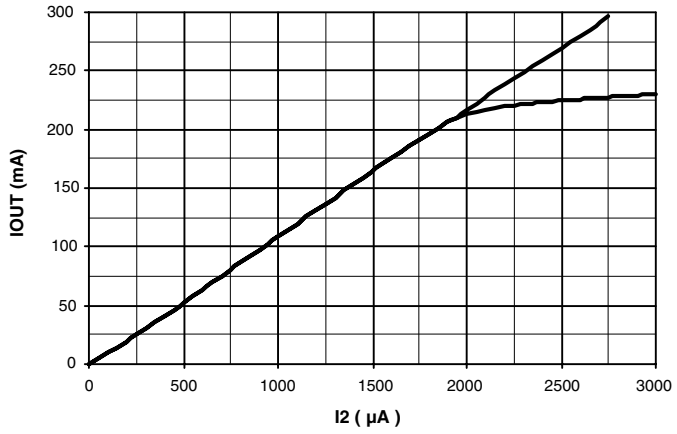


Figure 7. Transfer Characteristic of Channel 3 and 4 (gain = 112)

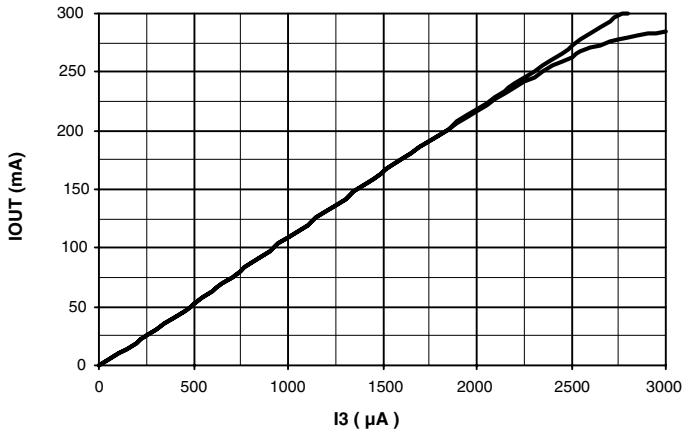


Figure 8. Step Response, Read Channel: 50 mA, Channel 3 = 200 mApp

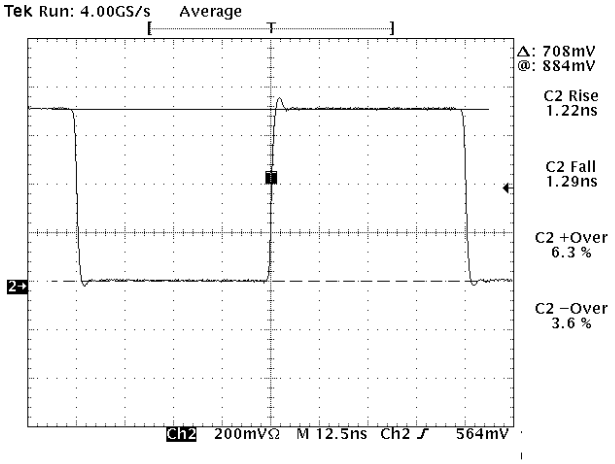


Figure 9. Timing Diagram

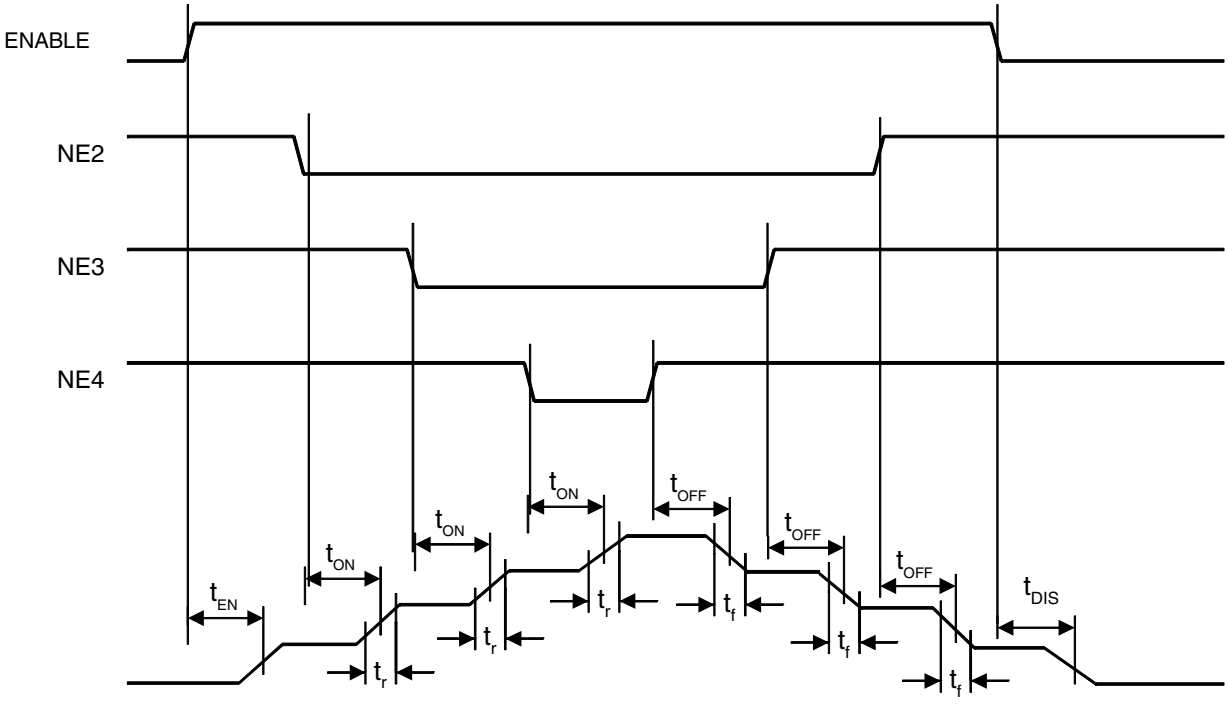
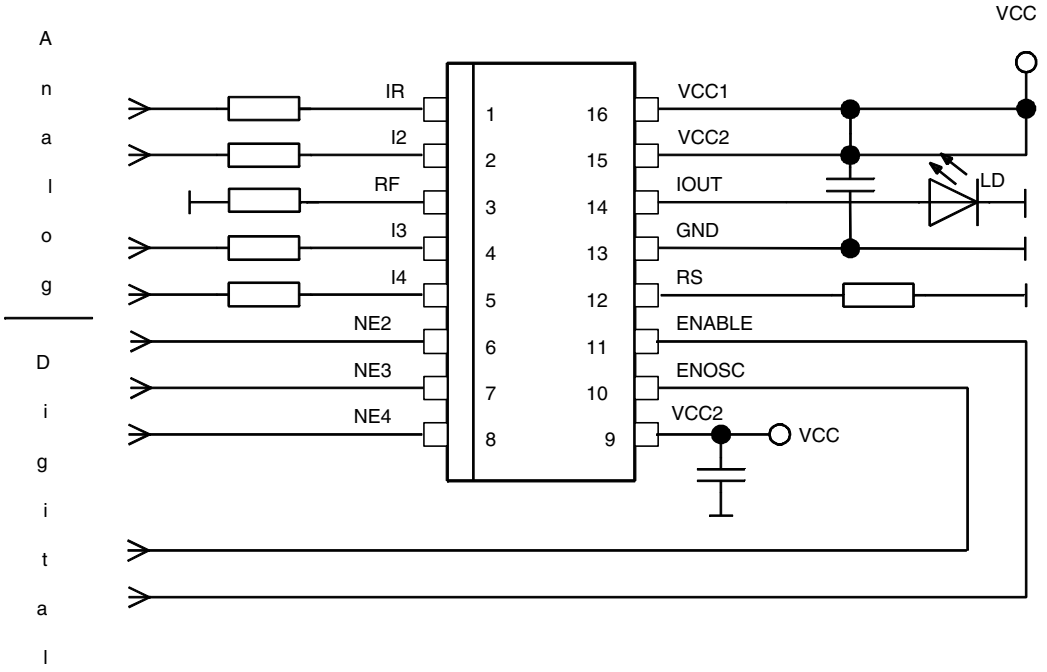


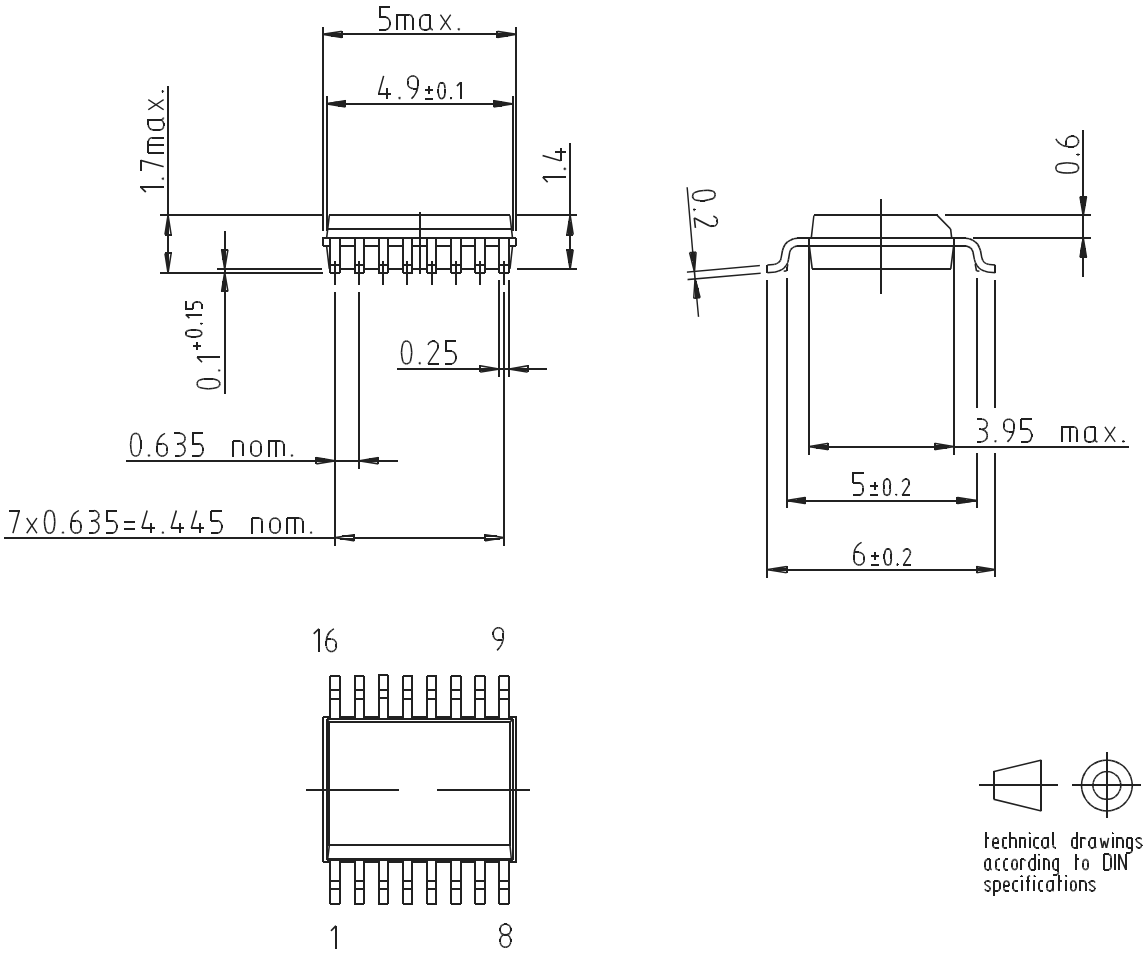
Figure 10. Typical Application Circuit



Ordering Information

Extended Type Number	Package	Remarks
T0820-TCQ	SSO16	Taped and reeled

Package Information



Drawing refers to following types: SSO16
Package acc. JEDEC MO 137 AB

Drawing-No.: 6.543-5060.01-4
Issue: 2; 05.02.99

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