

## 3-Channel Laser Driver with RF Osc. and APC Amplifier

### Description

The T0810 is a laser diode driver for the operation of a grounded laser diode for CD-RW drives. It includes three channels for three different optical power levels which are controlled by a separate IC. The read channel generates a continuous output level whereas the channels 2 and 3 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. Each channel can contribute up to 150 mA to the total output current of up to 200 mA. A total gain of 400 mA is provided between each reference current input and output. Although the reference inputs are current inputs, voltage control is possible by using external resistors.

An on-chip RF oscillator is provided to reduce laser mode hopping noise during read mode. 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.

The T0810 also includes a fast settling APC (Adaptive Power Control) transimpedance amplifier. It is provided to interface between the front end monitor photo diode and the ALPC (Adaptive Laser Diode Power Controller) circuit.

Electrostatic sensitive device.

Observe precautions for handling.



### Features

- Current-controlled output current source with 3 input channels
- Low-power consumption
- Output current per channel to 150 mA
- Total output current to 200 mA
- Rise time 1.0 ns / fall time 1.1 ns
- On-chip RF oscillator
- Control of frequency and swing by use of 2 external resistors
- Oscillator frequency range from 200MHz to 500 MHz
- Oscillator swing to 100 mA
- Fast settling APC amplifier
- Single 5-V power supply
- Common enable / disable input
- TTL/CMOS control signals
- Small SSO16 package

### Application

- CD-RW drives
- Writable optical drives

### Block Diagram

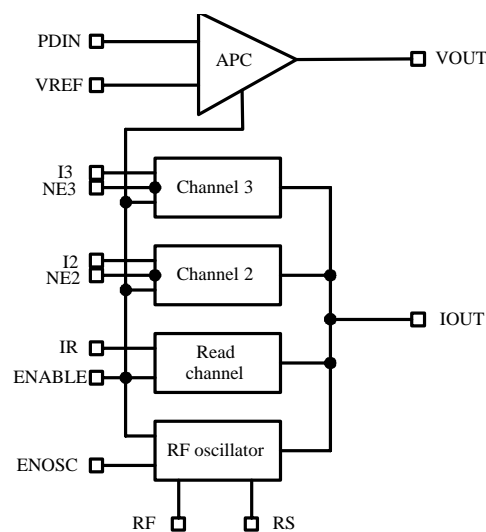


Figure 1. Block diagram

## Ordering Information

Extended Type Number	Package	Remarks
T0810-TCQ	SSO16	Taped and reeled

## Pin Description

Pin	Symbol	Function
1	VOUT	APC amplifier output
2	VREF	Reference voltage input
3	IR	Inp. current, bias voltage approx. GND
4	RF	External resistor to GND sets oscillator frequency
5	I2	Inp. current, bias voltage approx. GND
6	I3	Inp. current, bias voltage approx. GND
7	NE2	Digital control of channel 2 (low active)
8	NE3	Digital control of channel 3 (low active)
9	VCC	+ 5 V power supply
10	ENOSC	Enables RF oscillator (high active)
11	ENABLE	Enables output current (high active)
12	RS	External resistor to GND sets oscillator swing
13	GND	Ground
14	IOUT	Output current source for laser diode
15	VCC	+ 5 V power supply
16	PDIN	Photo diode input

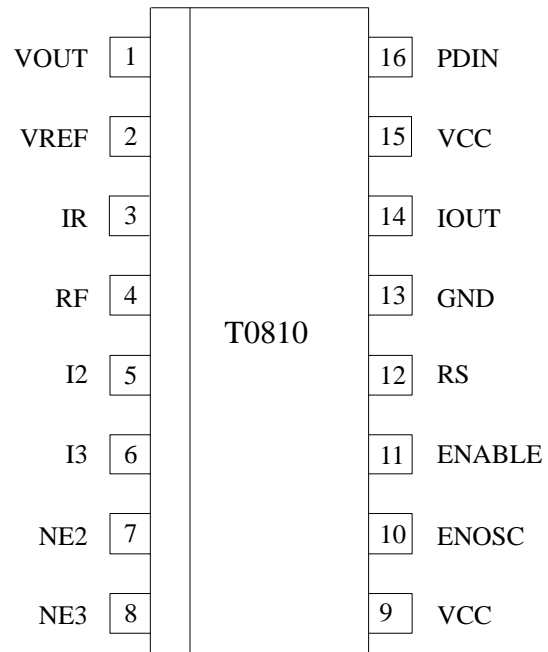


Figure 2. Pinning SSO16

## Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Supply voltage	V <sub>CC</sub>	-0.5 to +6.0	V
Input voltage at IR, I2, I3	V <sub>IN1</sub>	-0.5 to + 0.5	V
Input voltage at NE2, NE3, ENOSC	V <sub>IN2</sub>	-0.5 to V <sub>CC</sub> + 0.5	V
Output voltage	V <sub>OUT</sub>	-0.5 to V <sub>CC</sub> -1	V
Power dissipation	P <sub>MAX</sub>	1 <sup>1)</sup>	W
Junction temperature	T <sub>J</sub>	150	°C
Storage temperature range	T <sub>STG</sub>	-65 to +125	°C

1) R<sub>thJA</sub> ≤ 80 K/W

## Thermal Resistance

Parameter	Symbol	Value	Unit
Junction ambient	$R_{thJA}$	150	K/W

## Recommended Operating Conditions

Parameter	Symbol	Value	Unit
Supply voltage range	VCC	4.5 to 5.5	V
Input current	$I_{IR}/I_{I2}/I_{I3}$	< 0.4	mA
External resistor to GND to set oscillator frequency	RF	> 3	k $\Omega$
External resistor to GND to set oscillator swing	RS	> 100	$\Omega$
Operating temperature range	$T_{amb}$	0 to +70	$^{\circ}$ C

## Electrical Characteristics : General

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

Parameter	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
<b>Power supply</b>						
Supply current, power down	ENABLE = Low, NE2 = NE3 = Low	$ICC_{PD}$		0.2	0.4	mA
Supply current, read mode, Oscillator disabled	$I_{IR} = I_{I2} = I_{I3} = 125$ $\mu$ A	$ICC_{R1}$		90	107	mA
Supply current, read mode, Oscillator enabled	$I_{IR} = I_{I2} = I_{I3} = 125$ $\mu$ A, ENOSC = High, RS = 560 $\Omega$ , RF = 6.8 k $\Omega$	$ICC_{R2}$		100	118	mA
Supply current, write mode	$I_{IR} = I_{I2} = I_{I3} = 125$ $\mu$ A, NE2 = NE3 = Low	$ICC_W$		190	220	mA
Supply current, input off	$I_{IR} = I_{I2} = I_{I3} = 0$ $\mu$ A	$ICC_{off}$		15	20	mA
<b>Digital inputs</b>						
NE2/NE3 low voltage		$VNE_{LO}$			1.3	V
NE2/NE3 high voltage		$VNE_{HI}$	2.0			V
ENABLE low voltage		$VEN_{LO}$			0.5	V
ENABLE high voltage		$VEN_{HI}$	3.0			V
ENOSC low voltage		$VEO_{LO}$			0.5	V
ENOSC high voltage		$VEO_{HI}$	2.0			V
<b>Current at digital inputs</b>						
NE2/NE3 low current	NE = 0 V	$INE_{LO}$	-300			$\mu$ A
NE2/NE3 high current	NE = 5 V	$INE_{HI}$			800	$\mu$ A
ENABLE low current	ENABLE = 0 V	$IEN_{LO}$	-150			$\mu$ A
ENABLE high current	ENABLE = 5 V	$IEN_{HI}$			100	$\mu$ A
ENOSC low current	ENOSC = 0 V	$IEO_{LO}$	-100			$\mu$ A
ENOSC high current	ENOSC = 5 V	$IEO_{HI}$			800	$\mu$ A

## 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
Best fit current gain	Any channel <sup>1)</sup>	GAIN		400		mA/mA
Best fit current offset	Any channel <sup>1)</sup>	IOS	-8		+4	mA
Output current linearity	Any channel <sup>1)</sup>	ILIN	-3		+3	%
Input current range	Input is sinking	IDAC	0		0.4	mA
Output current per channel	Output is sourcing	I <sub>OUTR</sub>	150			mA
Total output current		I <sub>OUT</sub>	200			mA
I <sub>OUT</sub> series resistance	I <sub>OUT</sub> = 180 mA total R <sub>OUT</sub> to V <sub>CC</sub> – Rail	R <sub>OUT</sub>		8		Ω
I <sub>IN</sub> input impedance	R <sub>IN</sub> is to GND	R <sub>IN</sub>	1200	2000	2500	Ω
NE threshold	Temperature stabilized	V <sub>TH</sub>		1.68		V
Output off current 1	ENABLE = Low	I <sub>OFF1</sub>			0.5	mA
Output off current 2	NE2 = NE3 = High, I <sub>IR</sub> = 0, I <sub>I2</sub> = I <sub>I3</sub> = 125 μA	I <sub>OFF2</sub>			0.7	mA
Output off current 3	NE2 = NE3 = Low, I <sub>IR</sub> = I <sub>I2</sub> = I <sub>I3</sub> = 0 μA	I <sub>OFF3</sub>			5	mA
I <sub>OUT</sub> supply sensitivity, read mode	I <sub>OUT</sub> = 40 mA, V <sub>CC</sub> = 5 V ± 10%, read only	V <sub>SE<sub>R</sub></sub>	-4		1	%/V
I <sub>OUT</sub> supply sensitivity, write mode	I <sub>OUT</sub> = 80 mA, 40 mA read + 40 mA write, V <sub>CC</sub> = 5 V ± 10%	V <sub>SE<sub>W</sub></sub>	-6		0	%/V
I <sub>OUT</sub> current output noise	I <sub>OUT</sub> = 40 mA, ENOSC = Low	INO <sub>O</sub>		3		nA/rt-Hz
I <sub>OUT</sub> temperature sensitivity, read mode	I <sub>OUT</sub> = 40 mA, read only	T <sub>SE<sub>R</sub></sub>		100		ppm/°C
I <sub>OUT</sub> temperature sensitivity, write mode	I <sub>OUT</sub> = 80 mA, 40 mA read + 40 mA write	T <sub>SE<sub>W</sub></sub>		100		ppm/°C

<sup>1)</sup> Linearity of the amplifier is calculated using a best fit method at three operating points of I<sub>OUT</sub> at 20 mA, 40 mA, and 60 mA.  $I_{OUT} = (I_{IN} \times GAIN) + I_{OS}$

## Electrical Characteristics : Laser Current Amplifier Outputs AC Performance

VCC = + 5 V, I<sub>OUT</sub> = 40 mA DC with 40 mA pulse, T<sub>A</sub> = 25°C unless otherwise specified

Parameter	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Write rise time	I <sub>OUT</sub> = 40 mA (read) + 40 mA (10% to 90%) <sup>1)</sup>	t <sub>RISE</sub>		1.0	3.0	ns
Write fall time	I <sub>OUT</sub> = 40 mA (read) + 40 mA (10% to 90%) <sup>1)</sup>	t <sub>FALL</sub>		1.4	3.0	ns
Output current overshoot	I <sub>OUT</sub> = 40 mA (read) + 40 mA <sup>1)</sup>	OS		5		%
I <sub>OUT</sub> ON propagation delay	NE 50% High–Low to I <sub>OUT</sub> at 50% of final value	t <sub>ON</sub>		2.0		ns
I <sub>OFF</sub> OFF propagation delay	NE 50% Low–High to I <sub>OUT</sub> at 50% of final value	t <sub>OFF</sub>		2.0		ns
Disable time	ENABLE 50% High–Low to I <sub>OUT</sub> at 50% of final value	t <sub>DIS</sub>		10		ns
Enable time	ENABLE 50% Low–High to I <sub>OUT</sub> at 50% of final value	t <sub>EN</sub>		50		ns
Amplifier bandwidth	I <sub>OUT</sub> = 50 mA, all channels, –3dB value	BW <sub>LCA</sub>		16		MHz
<b>Oscillator</b>						
Oscillator frequency	RF = 4.3 kΩ	F <sub>OSC</sub>	380	470	560	MHz
Osc. temperature coefficient	RF = 4.3 kΩ	TC <sub>OSC</sub>		–150		ppm/°C
Disable time oscillator	ENOSC 50% High–Low to I <sub>OUT</sub> at 50% of final value	T <sub>DISO</sub>		4		ns
Enable time oscillator	ENOSC 50% Low–High to I <sub>OUT</sub> at 50% of final value	T <sub>ENO</sub>		2		ns

<sup>1)</sup> Load resistor at I<sub>OUT</sub>: 10 Ω // 39 Ω + 50 Ω (see test circuit)

## Electrical Characteristics : APC Amplifier

VCC = 5 V, T<sub>A</sub> = 25°C, R<sub>LOAD</sub> = 2 kΩ to V<sub>REF</sub> unless otherwise specified

Parameter	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Bandwidth	G = 1, C <sub>load</sub> = 22 pF	BW <sub>APC</sub>		200		MHz
Slew rate	G = 1, V <sub>OUT</sub> = 1 V to 3 V	SR		80		V/μs
Setting time	To 0.1%, V <sub>OUT</sub> = 1 V to 3 V	t <sub>s</sub>		50		ns
Open loop voltage gain	V <sub>OUT</sub> = 1 V to 3 V	A <sub>vol</sub>		60		dB
Offset voltage	V <sub>REF</sub> = 3 V	V <sub>OS</sub>	–5		+5	mV
Input bias current	V <sub>REF</sub> = 3 V			–1.5		μA
Common mode input range	CMRR > = 54 dB	CMIR	1		V <sub>CC</sub> –1.5	V
Common mode rejection ratio	V <sub>CM</sub> = 0.5 V to 3.0 V	CMRR		60		dB
Input impedance		R <sub>IN</sub>		20		kΩ
Input capacitance	Pin 16 (PDIN)	C <sub>IN</sub>		2		pF
Output voltage swing	R <sub>L</sub> = 2 kΩ to V <sub>REF</sub>	V <sub>OUT</sub>	1		V <sub>CC</sub> –1.5	V

## Application Information Oscillator

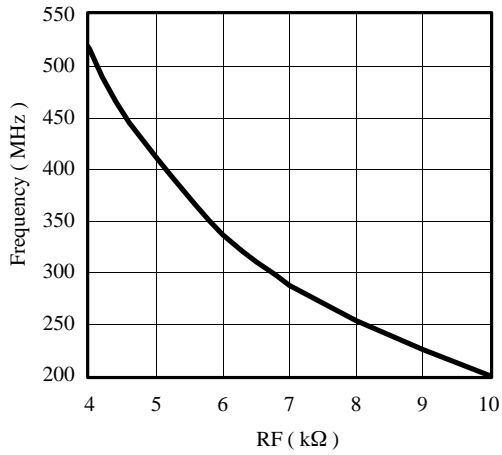


Figure 3. Frequency vs. resistor RF (RS = 680 Ω)

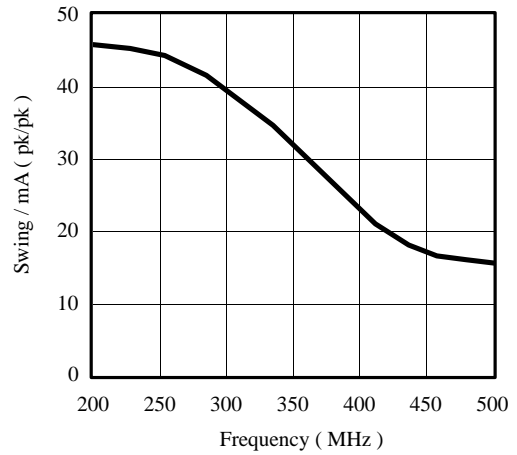


Figure 5. Frequency dependency of swing (RS = 680 Ω)

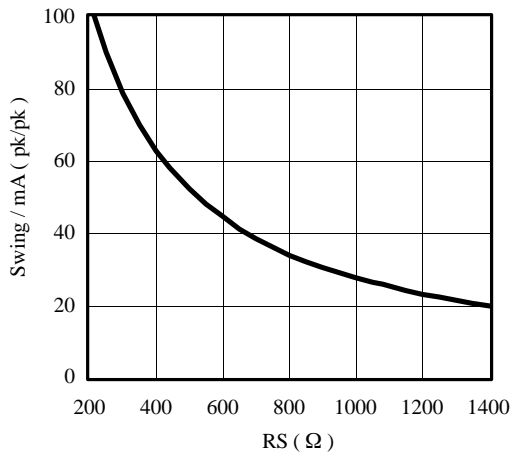


Figure 4. Swing vs. resistor RS (RF = 6.8 kΩ)

## Test Circuit

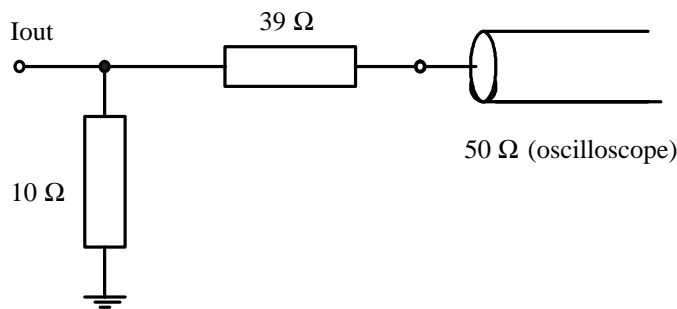


Figure 6. Test circuit for measurement of write rise and fall time

### Timing Diagram

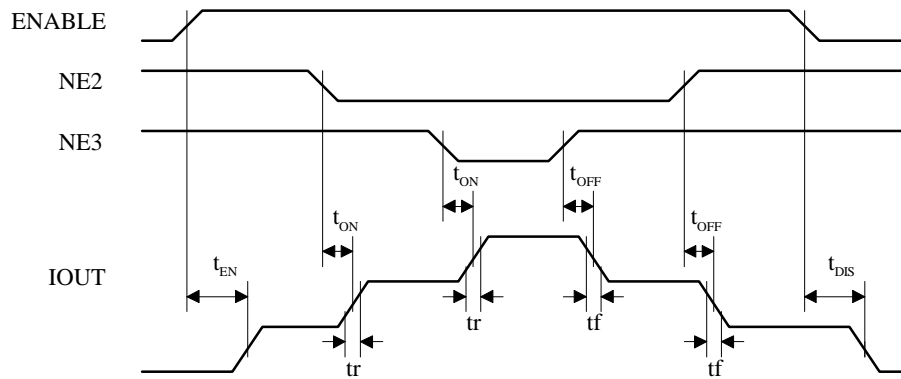


Figure 7. Timing diagram

### Typical Application Circuit

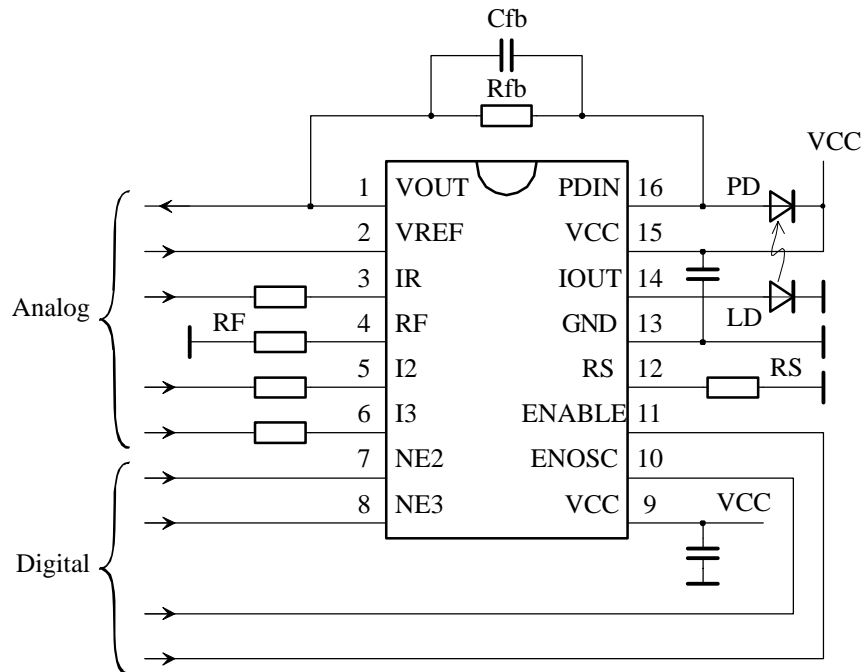
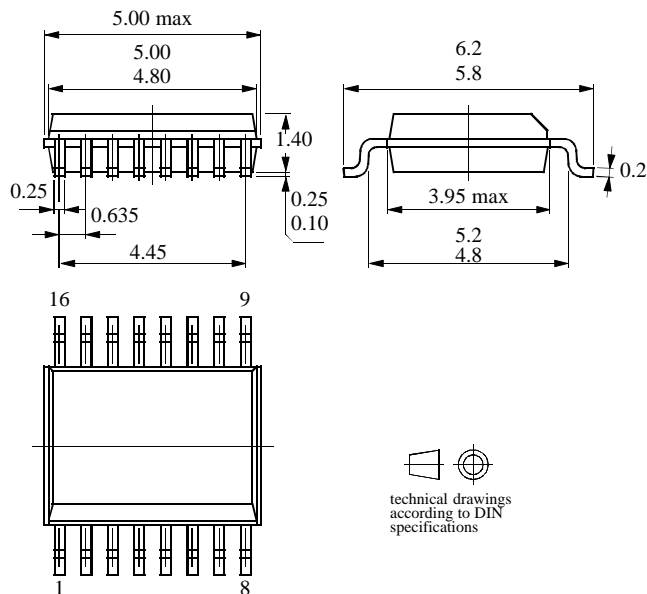


Figure 8. Application circuit

## Package Information

Package SSO16

Dimensions in mm





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1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

**Atmel Germany GmbH** has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

**Atmel Germany GmbH** can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

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