
Features

- Current-controlled Output Current Source, 3 Input Channels
- Low-power Consumption
- Output Current per Channel to 250 mA
- Total Output Current to 300 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 200 MHz 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

Applications

- CD-RW Drives
- Writable Optical Drives

Description

The T0816 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 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 250 mA to the total output current of up to 300 mA. A total gain of 100 (read channel), 250 (channel 2) and 150 (channel 3) are provided between each reference current input and the 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.

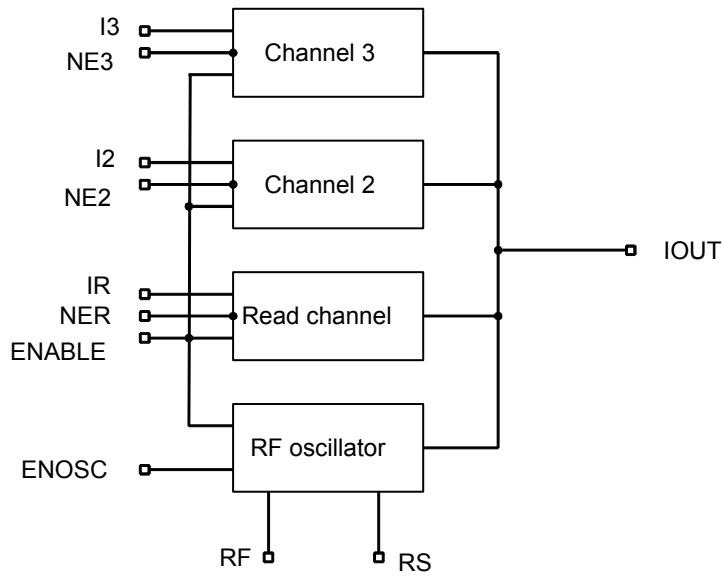


3-Channel Laser Driver with RF Oscillator

T0816

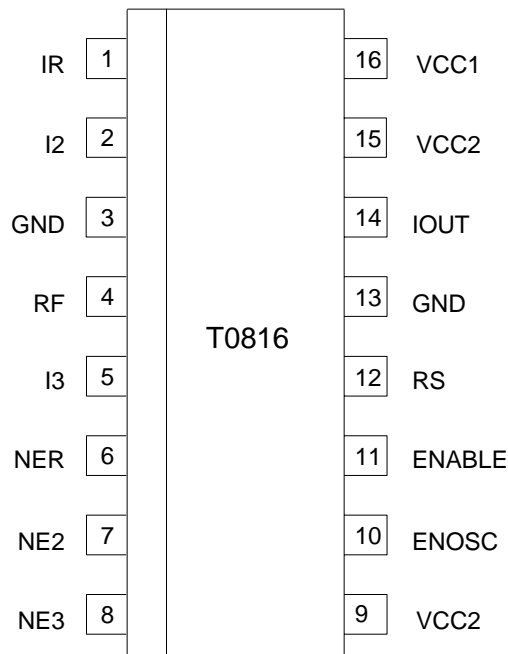


Figure 1. Block Diagram



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	GND	supply	Ground
4	RF	analog	External resistor to GND sets oscillator frequency
5	I3	analog	Input current, bias voltage approximately GND
6	NER	digital	Digital control of read channel (low active)
7	NE2	digital	Digital control of channel 2 (low active)
8	NE3	digital	Digital control of channel 3 (low active)
9	VCC2	supply	+ 5 V power supply for IOOUT
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	IOOUT	analog	Output current source for laser diode
15	VCC2	supply	+ 5 V power supply for IOOUT
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	V_{IN1}	-0.5 to + 2.0	V
Input voltage at NER, NE2, NE3, 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. $R_{thJA} \leq 115$ K/W, $T_{amb} = 70^\circ\text{C}$
 2. $R_{thJA} \leq 115$ K/W, $T_{amb} = 25^\circ\text{C}$

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	V_{CC}	4.5 to 5.5	V
Input current	$I_{IR}/I_{I2}/I_{I3}$	< 2.5	mA

Operating Range (Continued)

Parameters	Symbol	Value	Unit
External resistor to GND to set oscillator frequency	RF	> 3	k Ω
External resistor to GND to set oscillator swing	RS	> 1	k Ω
Operating temperature range	T _{amb}	0 to +70	$^{\circ}$ C

Electrical Characteristics: General

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

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
1	Power Supply								
1.1	Supply current, power down	ENABLE = Low, NE2 = NE3 = Low	9; 15; 16	ICC _{PD2}		0.3		mA	A
1.2	Supply current, read mode, oscillator disabled	I _{IR} = 500 μ A, I _{I2} = 200 μ A, I _{I3} = 333 μ A	9; 15; 16	ICC _{R1}		86		mA	A
1.3	Supply current, read mode, oscillator enabled	I _{IR} = 500 μ A, I _{I2} = 200 μ A, I _{I3} = 333 μ A, ENOSC = High, RS = 8.2 k Ω , RF = 6.8 k Ω	9; 15; 16	ICC _{R2}		90		mA	A
1.4	Supply current, write mode	I _{IR} = 500 μ A, I _{I2} = 200 μ A, I _{I3} = 333 μ A, NE2 = NE3 = Low	9; 15; 16	ICC _W		175		mA	A
1.5	Supply current, input off	I _{IR} = I _{I2} = I _{I3} = 0 μ A	9; 15; 16	ICC _{off}		15		mA	A
2	Digital Inputs								
2.1	NER/NE2/NE3 low voltage		6, 7, 8	VNE _{LO}			1.3	V	A
2.2	NER/NE2/NE3 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}	2.7			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	NER/NE2/NE3 low current	NE = 0 V	6, 7, 8	INE _{LO}	-300			μ A	A
3.2	NER/NE2/NE3 high current	NE = 5 V	6, 7, 8	INE _{HI}			800	μ A	A
3.3	ENABLE low current	ENABLE = 0 V	11	IEN _{LO}	-150			μ A	A
3.4	ENABLE high current	ENABLE = 5 V	11	IEN _{HI}			100	μ A	A
3.5	ENOSC low current	ENOSC = 0 V	10	IEO _{LO}	-100			μ A	A
3.6	ENOSC high current	ENOSC = 5 V	10	IEO _{HI}			800	μ A	A

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

Electrical Characteristics: Laser Amplifier

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

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
4	Output IOUT								
4.1	Total output current	Output is sourcing	14	I_{OUT}	300	350		mA	A
4.2	Output current per channel	Output is sourcing	14	I_{OUTR}	250			mA	A
4.5	I_{OUT} series resistance	Total R_{OUT} to V_{CC} rail	14	R_{OUT}		6		Ω	C
4.6	Best fit current gain IR	Channel R ⁽¹⁾	14	GAINR	90	100	130	mA/mA	A
4.7	Best fit current gain I2	Channel 2 ⁽¹⁾	14	GAIN2	225	250	325	mA/mA	A
4.8	Best fit current gain I3	Channel 3 ⁽¹⁾	14	GAIN3	135	150	195	mA/mA	A
4.9	Best fit current offset	Any channel ⁽¹⁾	14	IOS	-8		+4	mA	A
4.10	Output current linearity	Any channel ⁽¹⁾	14	ILIN	-3		+3	%	A
4.11	I_{IN} input impedance	$R_{IN,IR}$ is to GND	1	$R_{IN,IR}$	400	500	600	Ω	A
4.12	I_{IN} input impedance	$R_{IN,I2}$ is to GND	2	$R_{IN,I2}$	1000	1250	1500	Ω	A
4.13	I_{IN} input impedance	$R_{IN,I3}$ is to GND	5	$R_{IN,I3}$	600	750	900	Ω	A
4.14	NE threshold	Temperature stabilized	6, 7, 8	VTH		1.68		V	B
4.15	Output off current 1	ENABLE = Low	14	IOFF ₁			1	mA	A
4.16	Output off current 2	NE2 = NE3 = High, $I_{IR} = 0$, $I_{I2} = 200\ \mu\text{A}$, $I_{I3} = 333\ \mu\text{A}$	14	IOFF ₂			1	mA	A
4.17	Output off current 3	NE2 = NE3 = Low, $I_{IR} = I_{I2} = I_{I3} = 0\ \mu\text{A}$	14	IOFF ₃			5	mA	A
4.18	I_{OUT} supply sensitivity, read mode	$I_{OUT} = 40\ \text{mA}$, $V_{CC} = 5\ \text{V} \pm 10\%$, read only	14	VSE _R	-4		1	%/V	A
4.19	I_{OUT} supply sensitivity, write mode	$I_{OUT} = 80\ \text{mA}$, 40 mA read + 40 mA write, $V_{CC} = 5\ \text{V} \pm 10\%$	14	VSE _W	-6		0	%/V	A
4.20	I_{OUT} current output noise	$I_{OUT} = 40\ \text{mA}$, ENOSC = Low	14	INO _O		3		nA/ rt-Hz	C
4.21	I_{OUT} temperature sensitivity, read mode	$I_{OUT} = 40\ \text{mA}$, read only	14	TSE _R		-400		ppm/ $^{\circ}\text{C}$	C
4.22	I_{OUT} temperature sensitivity, write mode	$I_{OUT} = 80\ \text{mA}$, 40 mA read + 40 mA write	14	TSE _W		-400		ppm/ $^{\circ}\text{C}$	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. $I_{OUT} = (I_{IN} \times \text{GAIN}) + I_{OS}$

Electrical Characteristics: Laser Current Amplifier Outputs AC Performance

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

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
5	Output AC Performance								
5.1	Write rise time	$I_{OUT} = 40\text{ mA (read) + 40 mA (10 to 90\%) }^{(1)}$	14	t_{RISE}		1.0	2.0	ns	C
5.2	Write fall time	$I_{OUT} = 40\text{ mA (read) + 40 mA (10 to 90\%) }^{(1)}$	14	t_{FALL}		1.1	2.0	ns	C
5.3	Output current overshoot	$I_{OUT} = 40\text{ mA (read) + 40 mA }^{(1)}$	14	OS		5		%	C
5.4	I_{OUT} ON propagation delay	NE 50% High-Low to I_{OUT} at 50% of final value	14	t_{ON}		2		ns	C
5.5	I_{OUT} OFF propagation delay	NE 50% Low-High to I_{OUT} at 50% of final value	14	t_{OFF}		2		ns	C
5.6	Disable time	ENABLE 50% High-Low to I_{OUT} at 50% of final value	14	t_{DIS}		20		ns	C
5.7	Enable time	ENABLE 50% Low-High to I_{OUT} at 50% of final value	14	t_{EN}		20		ns	C
5.8	Amplifier bandwidth	$I_{OUT} = 50\text{ mA}$, all channels, -3 dB value	14	BW_{LCA}		16		MHz	C
6	Oscillator								
6.1	Oscillator frequency	RF = 7.5 k Ω	14	F_{OSC}	255	300	350	MHz	A
6.2	Osc. temperature coefficient	RF = 7.5 k Ω	14	TC_{OSC}		-150		ppm/ $^\circ\text{C}$	C
6.3	Disable time oscillator	ENOSC 50% High-Low to I_{OUT} at 50% of final value	14	T_{DISO}		4		ns	C
6.4	Enable time oscillator	ENOSC 50% Low-High to I_{OUT} at 50% of final value	14	T_{ENO}		2		ns	C

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

Note: 1. Load resistor at I_{OUT} 6.8 Ω , measurement with 50- Ω oscilloscope and 39- Ω series resistor.

Characteristic Curves

Figure 3. Oscillator Frequency vs. Resistor RF (RS = 7.5 kΩ)

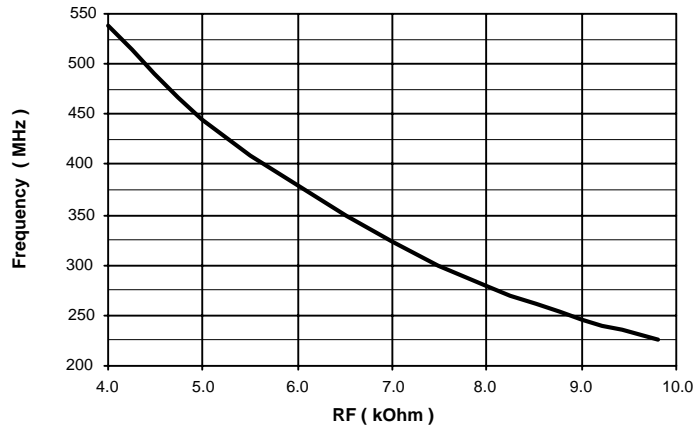


Figure 4. Oscillator Swing vs. Resistor RS (RF = 7.5 kΩ)

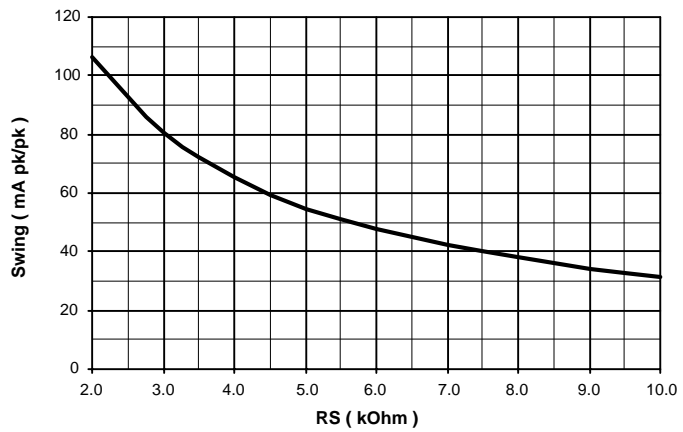


Figure 5. Oscillator Frequency Dependency of Swing

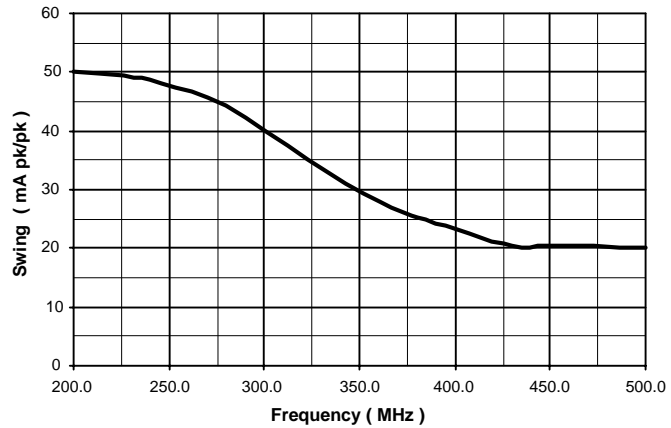


Figure 6. Transfer Characteristic of Channel 2
(gain = 278, load resistor at IOOUT = 6.8 Ω)

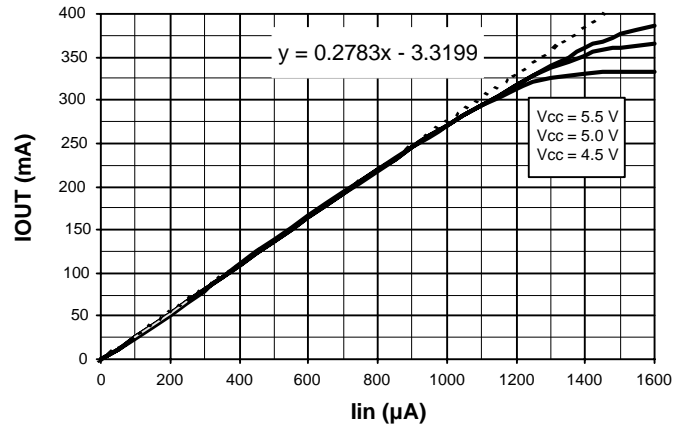


Figure 7. Voltage Compliance R (IOOUT to VCC) = 5.9 Ω

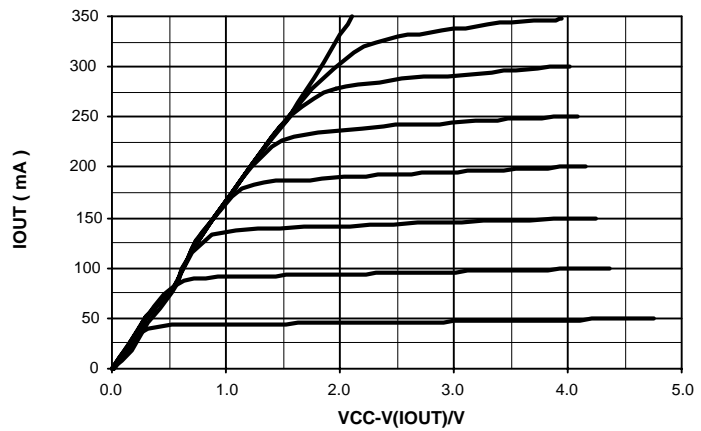


Figure 8. Step Response, Read Channel: 50 mA, Channel 2: 50 mApp

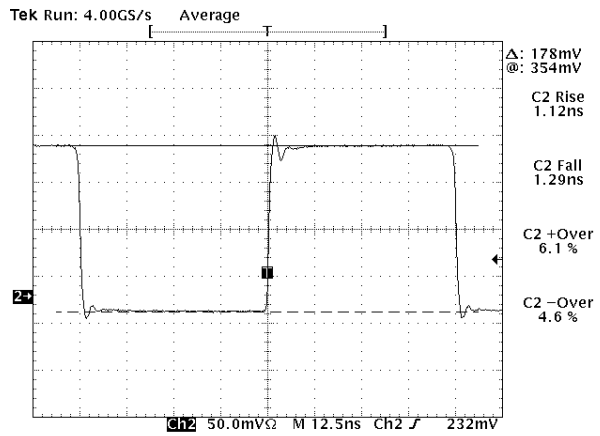


Figure 9. Step Response, Read Channel: 50 mA, Channel 2: 250 mApp

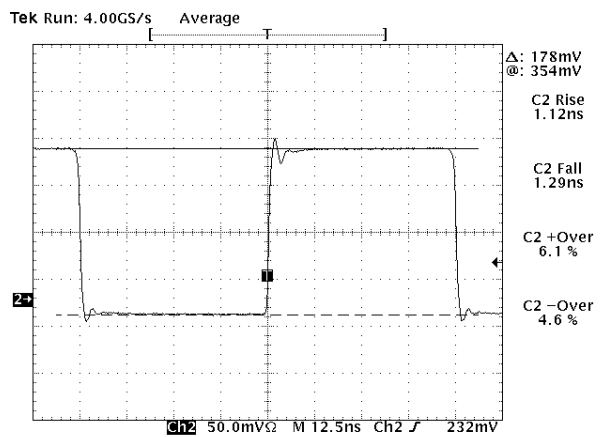


Figure 10. Timing Diagram of IOU**T**

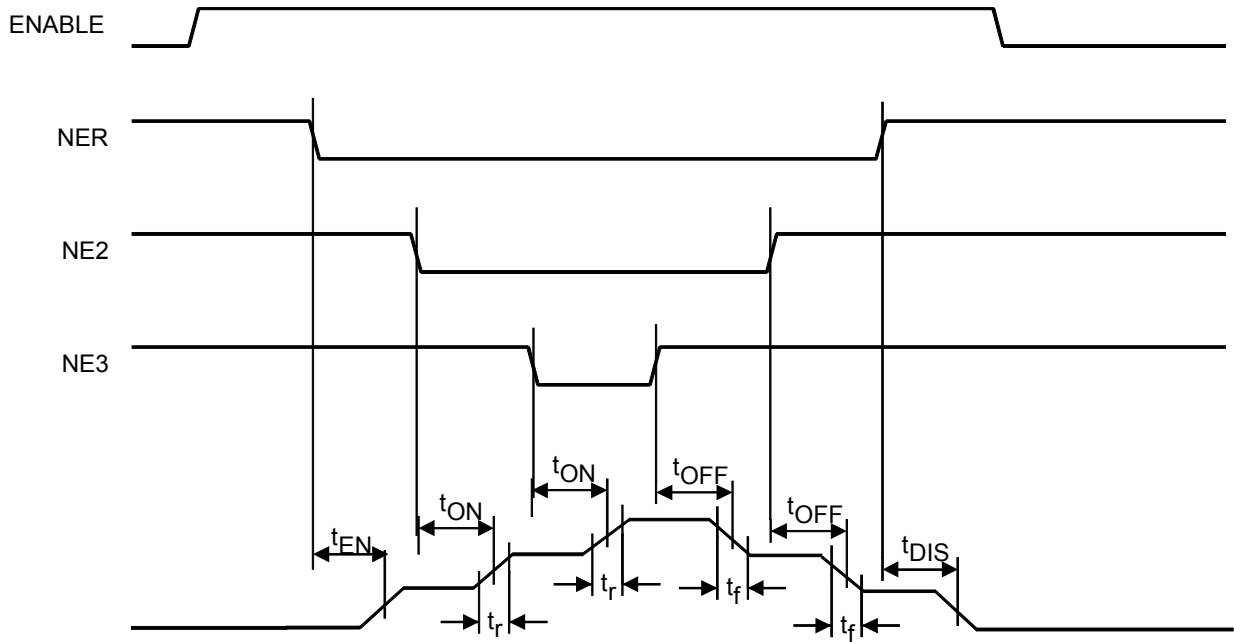
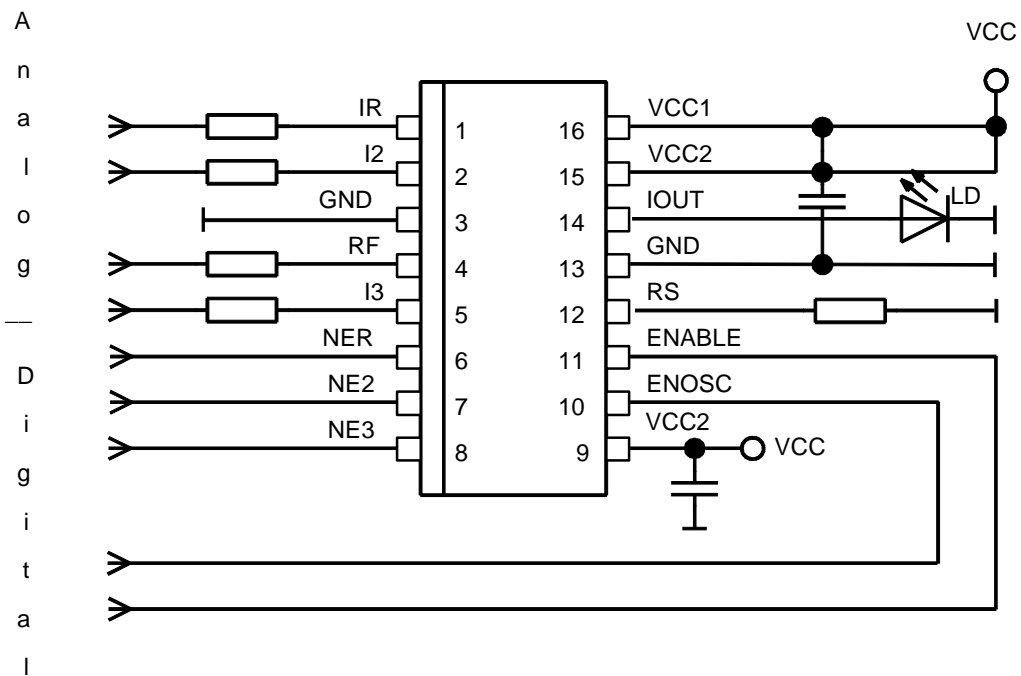


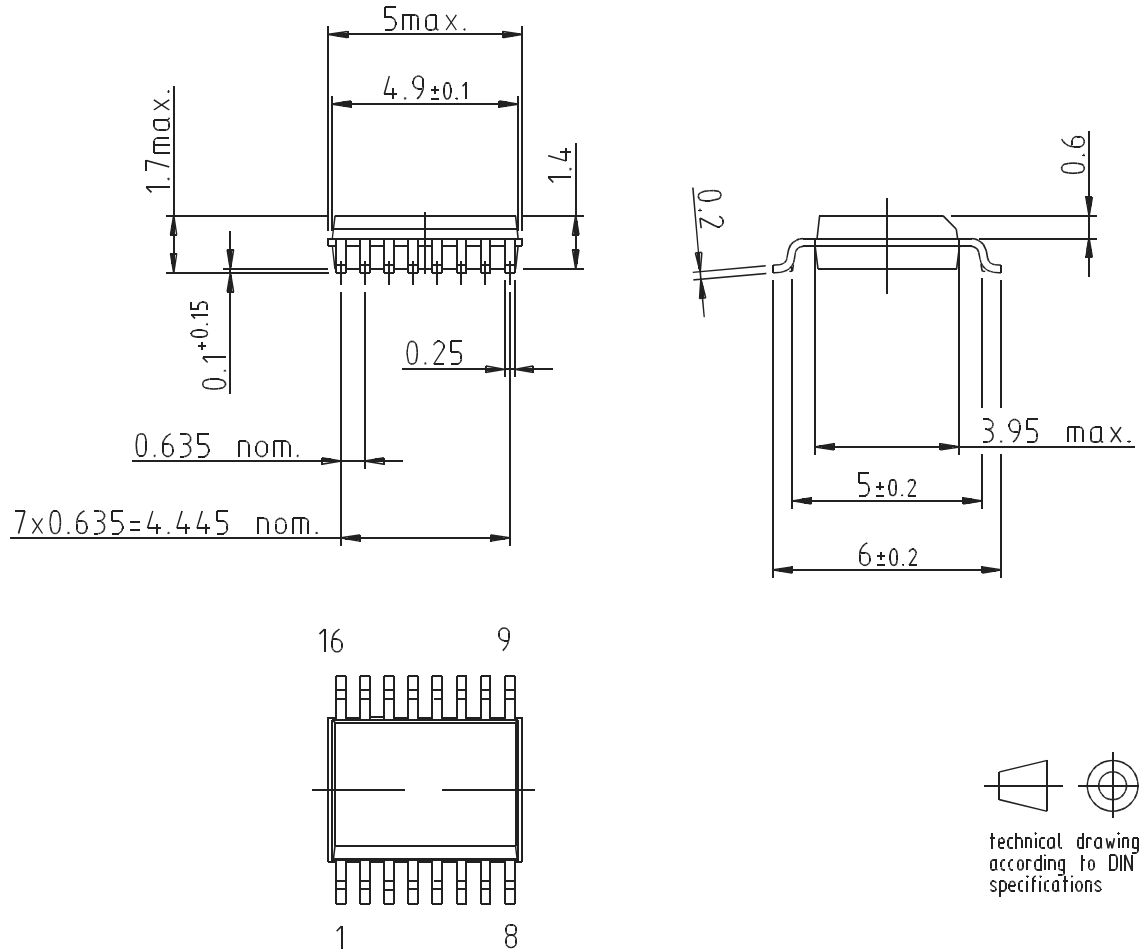
Figure 11. Application Circuit



Ordering Information

Extended Type Number	Package	Remarks
T0816-TCQ	SS016	Taped and reeled

Package Information



technical drawings
according to DIN
specifications

Drawing refers to following types: SS016
Package acc. JEDEC MO 137 AB

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



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