

August 2006

Features

- Single 5 V supply ($\pm 10\%$)
- 150 mA low-noise read channel with 100 x current gain
- Three 500 mA write channels with 240 x gain
- Combined channel output 700 mA
- Dual output for DVD/CD laser
- Rise and fall times 1 ns typical
- Oscillator, 500 MHz, 100 mA with external resistor control of frequency and amplitude
- Power Up/Down control
- CMOS control signals
- > 2 kV ESD
- Low R_{th} QFN package
- Contact Zarlink for available Custom Gain and Input Impedance options

Ordering Information

ZL40511LDE	24 Pin QFN	Tubes, Bake & Drypack
ZL40511LDF	24 Pin QFN	Tape & Reel
ZL40511LDG	24 Pin QFN	Trays, Bake & Drypack
ZL40515LDE	24 Pin QFN	Tubes, Bake & Drypack
ZL40515LDF	24 Pin QFN	Tape & Reel
ZL40515LDG	24 Pin QFN	Trays, Bake & Drypack

-40°C to +85°C

Applications

- DVD \pm RW/RAM
- DVD \pm R
- CD-RW
- CD-R
- Write optical drives
- Laser Diode current switch
- Supports double density DVD

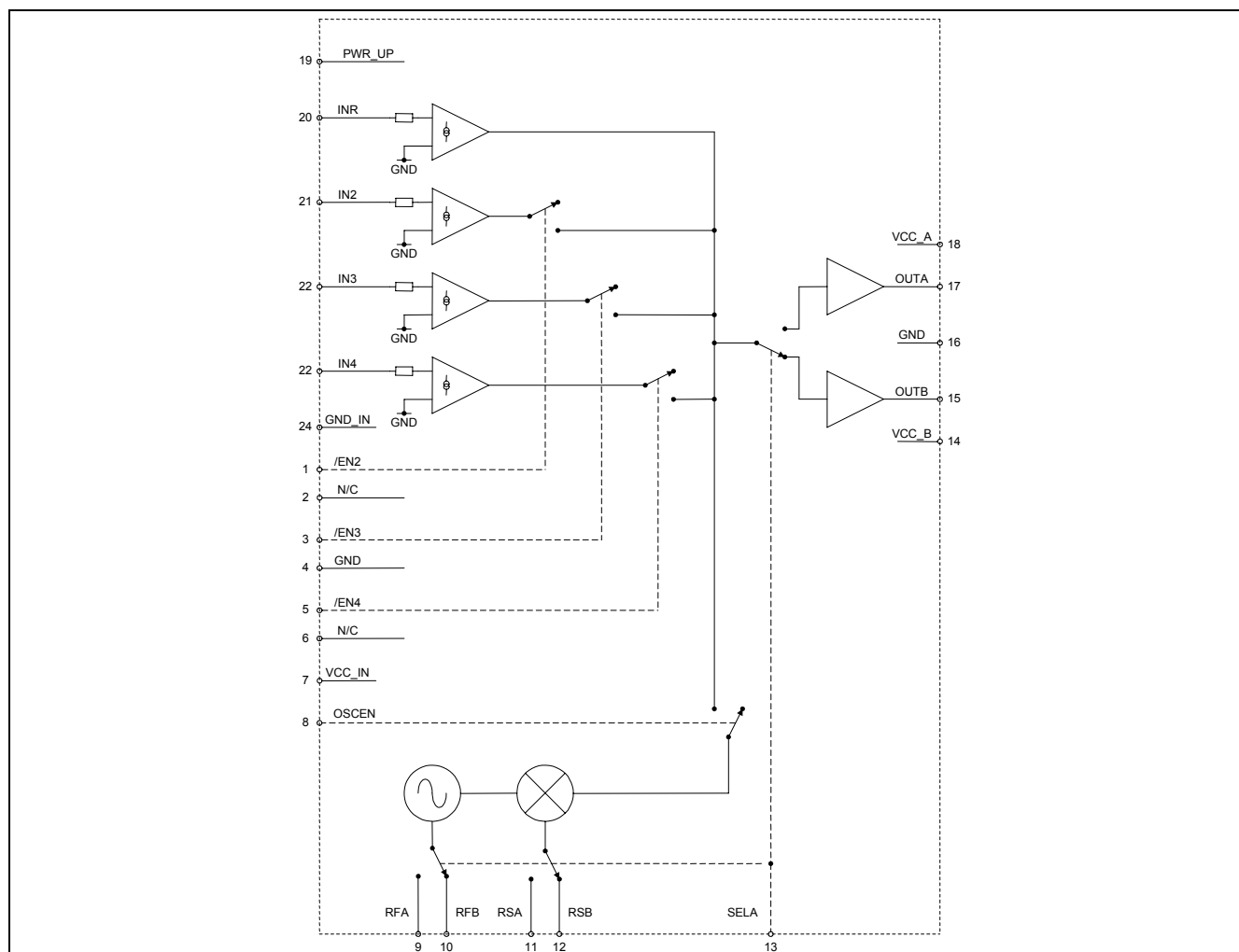


Figure 1 - Functional Block Diagram

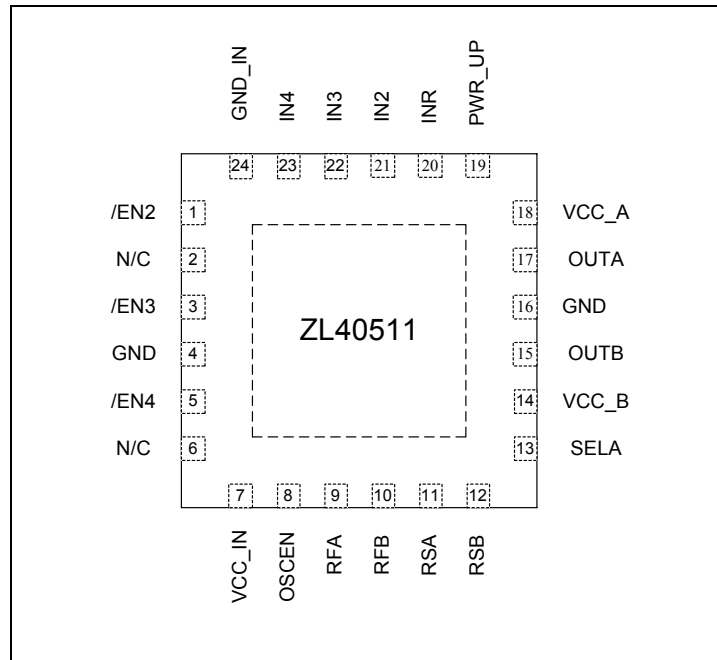


Figure 2 - Pinout of 4x4 mm 24 pin QFN (top view)

Description

The ZL40511/15 are high performance laser drivers capable of driving two separate cathode grounded laser diodes (e.g., 650 nm and 780 nm laser diodes).

The ZL40511/15 contain a 150 mA low-noise read channel (ChR), and three 500 mA write channels (Ch2, Ch3 and Ch4). The read channel amplifies the positive current supplied at its reference input, INR, by a fixed factor of 100. Write channels amplify the positive currents supplied at its reference inputs IN2, IN3, and IN4 by a fixed factor of 240.

An on-chip RF oscillator is provided for the reduction of laser mode hopping noise.

The ZL40511 offers higher tolerance performance.

Table of Contents

1.0 Application Notes	5
1.1 Read and Write Channel Operation	5
1.2 On-chip RF Oscillator	5
1.3 Thermal Considerations	5
1.4 Electrical and Optical Pulse Response	6
1.5 Specified Electrical Performance with 15 mm Interconnect and Zarlink ZLE40511/15 Evaluation Board. .	7
1.6 Application Layout Guide Lines	7
1.7 ZLE40511 Interconnect	8
2.0 Application Diagram	9
3.0 Evaluation Boards From Zarlink Semiconductor	9
4.0 Optical Pulse Response	10
5.0 Pin List	11
6.0 Characteristic Curves	18
7.0 I/O Diagrams	24
8.0 Timing Waveforms	26
9.0 Timing Diagrams	27
10.0 Example Waveforms	28
10.1 Write Waveform	28
10.2 Oscillator Waveform	28

List of Figures

Figure 1 - Functional Block Diagram	1
Figure 2 - Pinout of 4x4 mm 24 pin QFN (top view)	2
Figure 2 - Pulse Response Model	6
Figure 3 - ZLE40511 Application Board Electrical Interconnect	8
Figure 4 - Application Schematic Diagram	9
Figure 5 - Typical Optical Eye Diagram Response*	10
Figure 6 - Write Channel 2, 3 and 4 IP/OP Transfer Characteristic/Temp	18
Figure 7 - Read Channel IP/OP Transfer Characteristic/Temp	18
Figure 8 - Write Channel 2, 3 or 4 IP/OP Transfer Characteristic/Vcc	19
Figure 9 - Write Channel 2, 3 or 4 IP/OP Best Fit Line% Error	19
Figure 10 - Write Channel 2, 3 or 4 Δ Iout% Variation with Temperature	20
Figure 11 - Write Channel 2, 3 or 4 Δ Iout% Variation with Vcc	20
Figure 12 - Oscillator Frequency/RF Vcc = 5 V, Temp = 25°C	21
Figure 13 - Iosc Out/Frequency/ RS = 1 K, 7.5 K, 11 K, Vcc = 5 V, Temp = 25°C	21
Figure 14 - Iosc Amplitude mA pk-pk/RSA or RSB Vcc = 5 V, Temp = 25°C	22
Figure 15 - Iosc/Frequency RS = 7.5 K, Vcc = 5 V, Temp = 25°C	22
Figure 16 - Δ Freq % Variation with Temperature	23
Figure 17 - Oscillator Noise Spectral Density Vcc = 5 V, Temp = 25°C	23
Figure 18 - CMOS/LVTTL Input (PWR_UP, OSCEN)	24
Figure 19 - Oscillator Resistors (RF, RS)	24
Figure 20 - Read Current Input (INR)	24
Figure 21 - Output (OUTA, OUTB)	25
Figure 22 - Write Current Input (IN2, IN3, IN4)	25
Figure 23 - LVDS Input (EN2, /EN2), (EN3, /EN3), (EN4, /EN4)	25
Figure 24 - Timing of Read or Write Channels	27
Figure 25 - Output Waveform Showing Addition of Read and Write Levels	27
Figure 26 - Example of Write Waveform	28
Figure 27 - Example of Oscillator Waveform Superimposed on the Read Waveform	28

1.0 Application Notes

1.1 Read and Write Channel Operation

The read channel is activated by applying a 'High' signal to the PWR_UP pin. In this mode, the fast write channels can be enabled by applying a 'Low' signal to the respective write enable pins (/EN2), (/EN3) or (/EN4). The output currents of the four channels are summed together and output as a composite signal at either OUTA (if SELA select is 'High') or OUTB (if SELA select is 'Low'). This provides the ability to drive two different laser diodes with just one ZL40511/15.

Voltage control of the channel reference inputs (INR, IN2, IN3 and IN4) can be achieved quite easily using an external resistor R_{ref} in series with the reference channel input to convert a given reference potential V_{ref} to an input current, I_{in} :

$$I_{in} = \frac{V_{ref}}{R_{ref} + R_{in}}$$

where R_{in} is the input impedance of the respective reference channel.

1.2 On-chip RF Oscillator

An on-chip RF oscillator is enabled if OSCEN = 'High', and its output signal is added to the appropriate current output (OUTA, if SELA select is 'High', or OUTB, if SELA select is 'Low'). The oscillator amplitude is set by an external resistor from RSA or RSB to GND. Its frequency is set by an external resistor RFA or RFB to GND. RSA and RFA are selected when SELA is 'High'.

The oscillator signal is summed with the programmed Write and Read levels before amplification to the output. The oscillator signal has zero DC level and +1_pt to -1_pt signal swing. Consequently, if the programmed DC level from the Write and Read Channels is less than the PK level programmed for the Oscillator, the combined signal will be clipped on the negative cycle of the signal. This will increase the harmonic content of the output signal and reduce the pk to pk amplitude output.

1.3 Thermal Considerations

Package thermal resistance is 40°C/W under the EIA/JESD51-3 compliant PCB test board condition.

Users should ensure that the junction temperature does not exceed 150°C. Thermal resistance from junction to case and to ambient is very much dependent on how the IC is mounted onto the board, on the PCB layout and on any heat extraction arrangements.

Power consumption and system ambient operating temperature limits should be noted and careful thermal gradient calculations undertaken to ensure that the junction temperature never exceeds 150°C.

1.4 Electrical and Optical Pulse Response

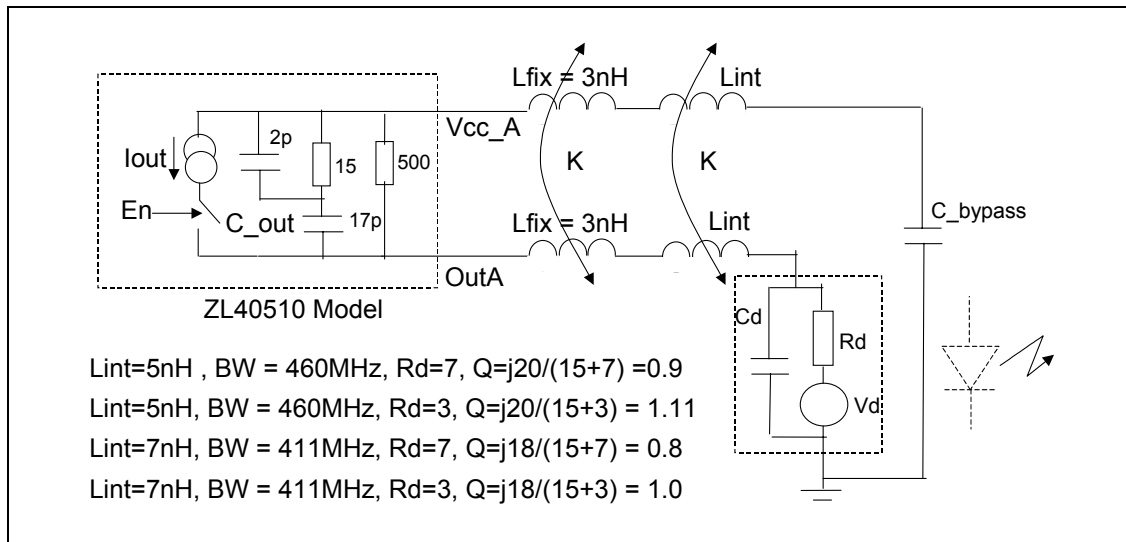


Figure 2 - Pulse Response Model

Figure 3 illustrates a simplified model of the typical ZL40511/15 and the application. The ZL40511/15 consists of an ideal switched current source and an equivalent model of the ZL40510/15 output stage. The Electrical Model for the Laser Diode is a Voltage source V_d (V_{on}) in series with the On Resistance R_d all in parallel with the Junction Capacitance C_d . This simplified model approximately represents the Laser Diode Electrical load when operated beyond the Laser Threshold. To a first approximation, the Optical output is proportional to the current flow in the Resistor R_d .

The Laser Diode and the ZL40511/15 are connected together by interconnect tracks with the return current passing through the supply decoupling bypass capacitor between ground and output V_{cc} .

The ZL40511/15 can be approximated to an ideal switched programmed current source with a propagation delay of l_{out_on} (1.2 nS) and a switch transition time of 400 ps. The final output electrical pulse response parameters, T_{rise} , T_{fall} , Overshoot and Undershoot are determined by the combined electrical network as illustrated in Figure 3.

For example, the Rise Time and Fall time for large current steps can be slew rate limited by the combined interconnect and fixed interconnect inductance. The Fixed Inductance represents that associated with packaging and minimum interconnect distance. The Interconnect Inductance is that associated with the additional tracking between Laser Diode and the ZL40511/15 to accommodate application physical limitations.

For example, if a pulse of 360 mA amplitude (40 mA to 400 mA) is to be switched in a time of 1 nS with the $V_d = 1.6$ V, then the maximum volt drop across the interconnect inductance is approximately 3.5 V (maximum V_{pin} for 500 mA output) – 1.6 V (V_{diode}) = 1.9 V. Consequently, $L \cdot di/dt < 1.9$ V. Hence, $L < 1.9 / (0.36\text{A}/1 \text{ nS}) = 5.3 \text{ nH}$.

Small current step size Rise and Fall Time will be determined by the Bandwidth of the combined network. This is dominated by the Interconnect Inductance and the output Capacitance. Similarly, the overshoot and undershoot will be determined by the Q of the network. This is a function of the Source Impedance from the ZL40511/15, the Interconnect inductance and the Load impedance of the Laser Diode. Figure 3 includes example simplified estimates of the Q and BW of the combined Laser Diode, ZL40511/15 and interconnect network for two different interconnect inductance values (5 nH and 7 nH) and two different Diode On resistance (3 Ohm and 7 Ohm). This simple analysis illustrates the change in BW and Q of the network depending on these parameters. This in turn effects the Rise Time and Fall time and the Overshoot and Undershoot performance achieved in the application.

1.5 Specified Electrical Performance with 15 mm Interconnect and Zarlink ZLE40511/15 Evaluation Board

The specified performance in the table are results based on the electrical measurements and simulations across full process corners using the Zarlink Evaluation Board using a 3.9 Ohm resistive load to ground.

The track interconnect between ZL40511/15 and the 3.9 Ohm Resistor is 15 mm long and uses a 2 mm wide track on single sided FR4 board. The return path is via two 2 mm wide tracks spaced 0.25 mm either side of the track between output and the 3.9 Ohm resistor. The combined forward and return path forms a co planar transmission line with a characteristic impedance of approximately 120 Ohms.

The tight coupled return paths carrying the return current reduce the effective series inductance (L_{eff}) which can be approximated to:

$$L_{eff} = 2 * L_{int} * (1 - K) + 2 * L_{fix} * (1 - K).$$

The ZLE40510 board has two positions for the Laser Diode at two different distances. (15 and 30 mm).

- The measured value of L_{eff} is 7 nH
- The estimated value of $L_{eff} = 2 * 8 (1 - 0.5) = 8$ nH

The actual pulse response achieved in an application is thus dependent on the application.

1.6 Application Layout Guide Lines

Minimize interconnect inductance by:

- a. Using Short Interconnect Distance
- b. Use wide interconnect tracks
- c. Keep the return path tightly coupled to the forward path.

1.7 ZLE40511 Interconnect

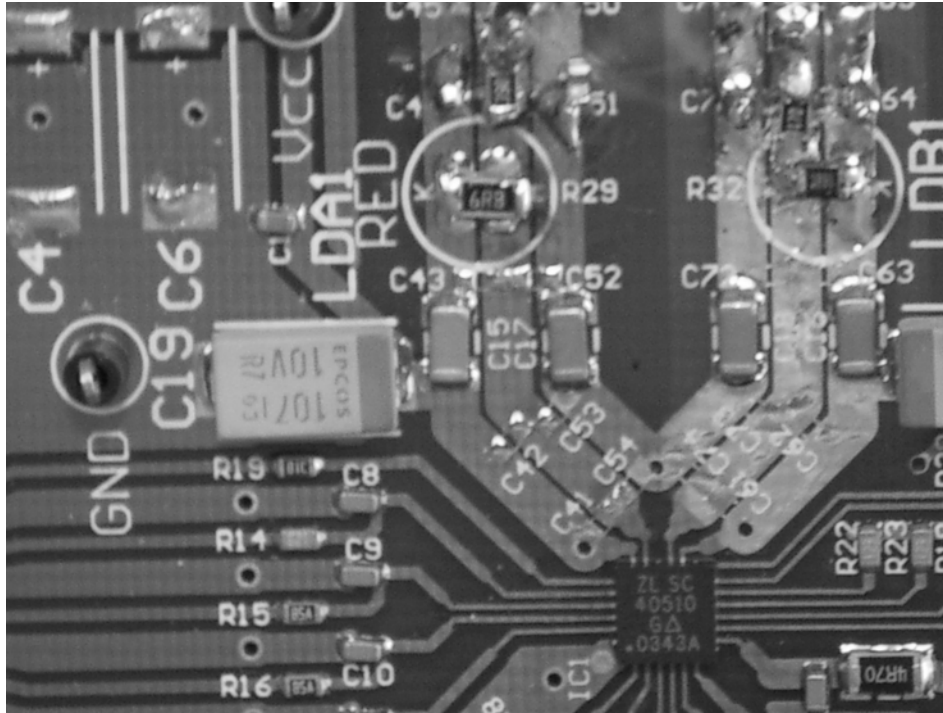


Figure 3 - ZLE40511 Application Board Electrical Interconnect

2.0 Application Diagram

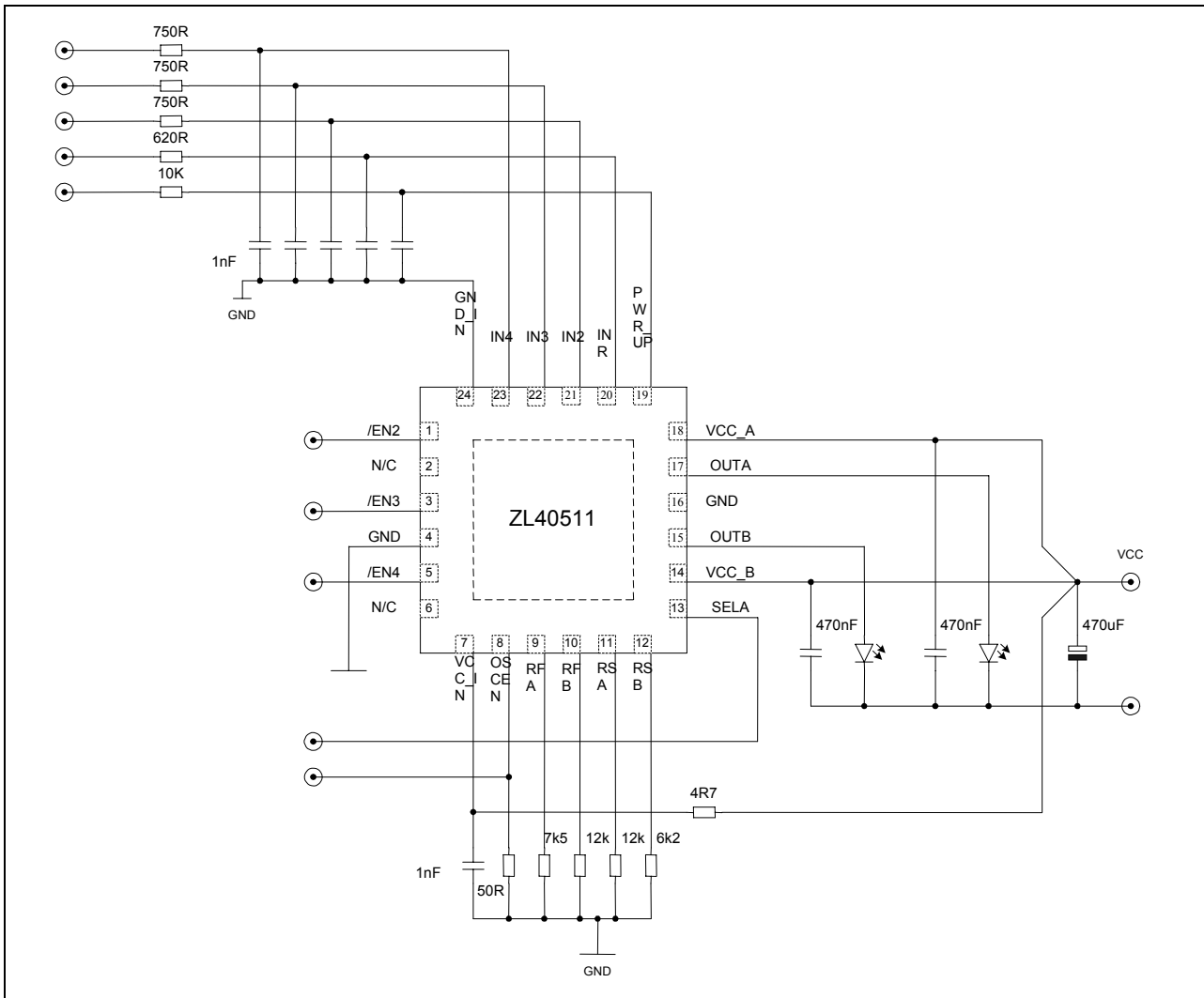


Figure 4 - Application Schematic Diagram

3.0 Evaluation Boards From Zarlink Semiconductor

Zarlink Semiconductor provide an LDD evaluation board. This is primarily for those interested in performing their own assessment of the operation of the LDDs. Figure 5 shows a recommended application configuration. The inputs are connected via side launch SMA connectors.

Please order as ZLE40511.

4.0 Optical Pulse Response

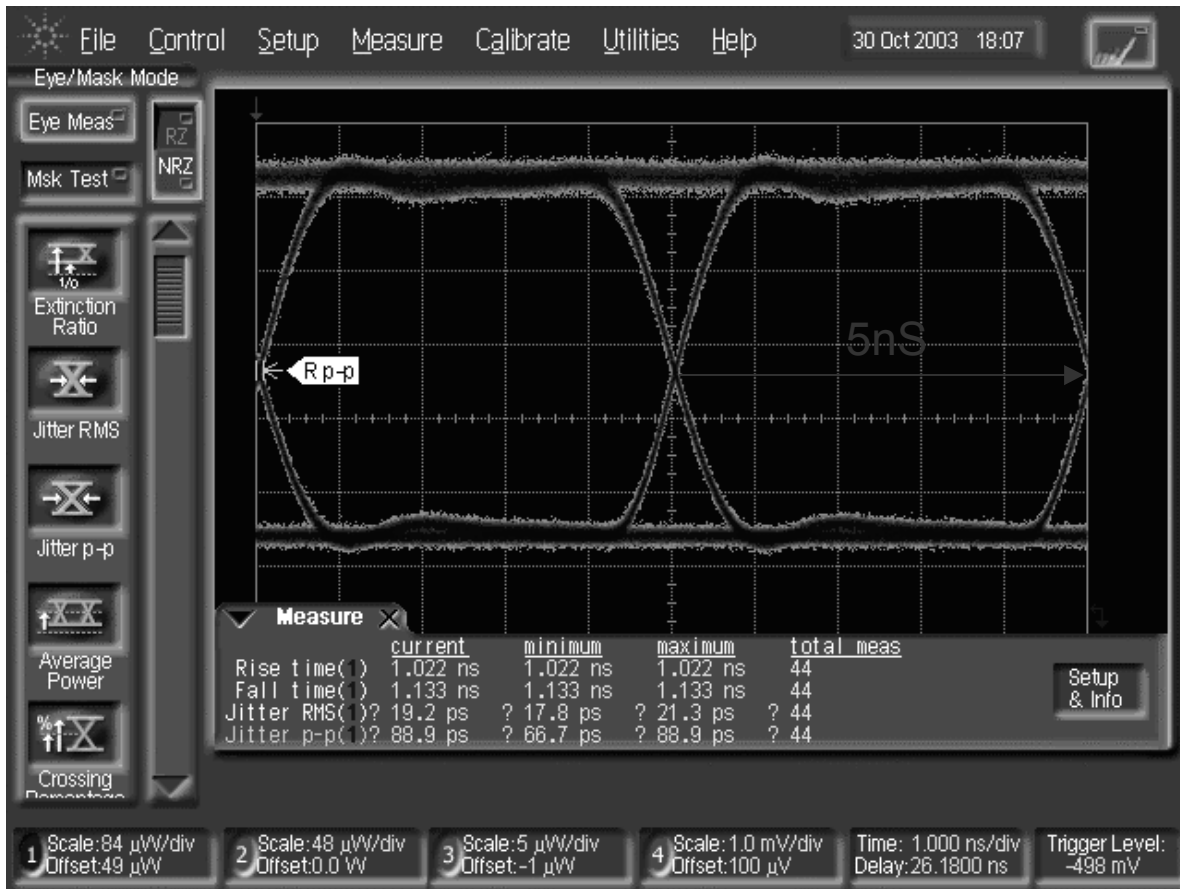


Figure 5 - Typical Optical Eye Diagram Response*

* (Measured using Sanyo DL-7140-201S Infra Red Laser Mounted on ZLE40510 Application Board)
(I read = 50 mA, I write = 125 mA, at 15 mm with 200 MHz PRBS Pattern)

Figure 6 illustrates the typical optical response measured with the ZL40511/15 mounted on the ZLE40510 application board driving a Sanyo DL-7140-201S Infra Red Laser. The test condition is driving a PRBS pattern at 200 MHz clock rate which is representative of a 16X DVD write pattern using Block Write Strategy with minimum write pulse of 2T duration.

The Sanyo DL-7140-201S Infra Red Laser Diode On resistance is typically 3 Ohms which is representative of the On resistance of the Latest generation 250 mW pulsed High Power Red Laser Diodes that are targeted at 16X and 8X DVD.

The pulse is measured stepping from a low level which is above the laser threshold thus avoiding the laser turn on transient which can distort the measured response.

The ZL40511/15 exhibits excellent pulse response characteristics when used with the optimum interconnect.

5.0 Pin List

Pin No.	Pin name	Type	Function
1	/EN2	LVDS	Digital control input for channel 2 (active low)
2	NC	LVDS	No internal connection
3	/EN3	LVDS	Digital control input for channel 3 (active low)
4	NC	LVDS	Ground
5	/EN4	LVDS	Digital control input for channel 4 (active low)
6	NC	LVDS	No internal connection
7	VCC_IN	supply	+5 V Input power supply
8	OSCEN	digital	Oscillator enable control input, high active (TTL)
9	RFA	analog	Resistor to GND sets oscillator frequency when SELA = 'High'
10	RFB	analog	Resistor to GND sets oscillator frequency when SELA = 'Low'
11	RSA	analog	Resistor to GND sets oscillator amplitude when SELA = 'High'
12	RSB	analog	Resistor to GND sets oscillator amplitude when SELA = 'Low'
13	SELA	digital	Output select input; 'High' selects OUTA, 'Low' selects OUTB (TTL)
14	VCC_B	supply	Output B Vcc
15	OUTB	analog	Current output source B
16	GND	supply	Ground
17	OUTA	analog	Current output source A
18	VCC_A	supply	Output A Vcc
19	PWR_UP	digital	Digital chip enable control input, high active (CMOS)
20	INR	analog	Current input, $R_{in} = 400$ Ohms to GND
21	IN2	analog	Current input, $R_{in} = 250$ Ohms to GND (Optional 500 Ohms)
22	IN3	analog	Current input, $R_{in} = 250$ Ohms to GND (Optional 500 Ohms)
23	IN4	analog	Current input, $R_{in} = 250$ Ohms to GND (Optional 500 Ohms)
24	GND_IN	supply	Ground for input circuit

Absolute Maximum Ratings

Characteristic	Min.	Typ.	Max.	Units	Comments
Supply voltage (VCC, VCC_IN)	-0.5		6.0	V	
Input voltage (INR, IN2, IN3, IN4)	-0.5		6.0	V	
Input voltage (PWR_UP, EN2, /EN2, EN3, /EN3, EN4, /EN4, OSCEN, SELA)	-0.5		(VCC_I N + 0.5)	V	
Output voltage (OUTA, OUTB)	-0.5		Vcc	V	
Junction temperature			150	°C	

Operating Range

Characteristic	Min.	Typ.	Max.	Units	Comments
Supply voltage (VCC, VCC_IN)	4.5		5.5	V	
Input voltage (INR)			0.7	V	
Input voltage (IN2, IN3, IN4)			0.7	V	
Output voltage (OUTA, OUTB)	-0.3		(VCCA, B-0.9)	V	
RF	1			kΩ	External resistor to GND
RS	1			kΩ	External resistor to GND
Operating temperature range, junction	0		150	°C	

Package Thermal Resistance

Package Type	Junction to		Units	Comments
	Case R _{thJC}	ambient R _{thJA}		
24 pin QFN		40	K/W	Exposed paddle soldered to multi-layer PCB

Electrical Characteristics $V_{CC} = 5\text{ V}$, $T_{amb} = 25^{\circ}\text{C}$, $INR = 400\ \mu\text{A}$, $IN2 = IN3 = IN4 = 160\ \mu\text{A}$, $PWR_UP = \text{High}$, Ch2, Ch3, Ch4 disabled, $OSCEN = \text{Low}$, unless otherwise specified.

Characteristic	Min.	Typ.	Max.	Units	Comments	Type
Supply Current (into VCC-pin)						
Supply current, power down, I_{CCPD}		80	220	μA	ENABLE = Low	A
Supply current, read mode, oscillator disabled, I_{CCR0}		69	84	mA	INR = 400 μA	A
Supply current, read mode, oscillator enabled, I_{CCR1}		70	85	mA	OSCEN = High, RF = 6.8 kOhm, RS = 8.2 kOhm,	A
Supply current, write mode, I_{CCW}		210	250	mA	Ch2, Ch3, Ch4 enabled	B
Supply current, input off		18		mA	Ch2, Ch3, Ch4 enabled INR = IN2 = IN3 = IN4 = 0	B
/EN2, /EN3, /EN4, SelA & OscEn Digital Inputs						
Logic low voltage			0.8	V		A
Logic high voltage	2.2			V		A
Threshold level		1.68		V	Temperature stabilised	B
Logic low input current	-50			μA	$V_{in} = 0\text{ V}$	B
Logic high input current			50	μA	$V_{in} = 3.3\text{ V}$	B
Power_Up Digital Input						
Logic low voltage			0.5	V	CMOS compatible level	A
Logic high voltage	2.7			V	CMOS compatible level	A
Logic low input current	-50			μA	$V_{in} = 0\text{ V}$	B
Logic high input current			50	μA	$V_{in} = 3.3\text{ V}$	B

Note: A = 100% Tested
 B = Guaranteed by Characterization and Design
 C = Guaranteed by Simulation

Characteristic	Min.	Typ.	Max.	Units	Comments	Type
Current Outputs (OutA & OutB)						
Output current, ChR	150	200		mA	$V_{out} \leq 3.5\text{ V}$	B
Output current, Ch2, Ch3, Ch4	500			mA	Channel enabled, $INR = 0\ \mu\text{A}$, $V_{out} \leq 3.5\text{ V}$, $I_{in} = 2.8\text{ mA}$	A
Total output current	700			mA	Ch2, 3, 4 enabled, $V_{out} \leq 3.5\text{ V}$	A
Write Output current, zero input, I_{out0} (ZL40511)			12	mA	$INR = IN2 = IN3 = IN4 = 0\ \mu\text{A}$, Ch2, or Ch3 or Ch4 enabled	A
Write Output current, zero input, I_{out0} (ZL40515)			15	mA	$INR = IN2 = IN3 = IN4 = 0\ \mu\text{A}$, Ch2, or Ch3 or Ch4 enabled	A
Read Output current, zero input, I_{out0}			2.5	mA	$INR = IN2 = IN3 = IN4 = 0\ \mu\text{A}$, Ch2, 3, & 4 disabled,	A
Input impedance (INR)	330	400	470		R_{in} is to GND	B
Input impedance (IN2, IN3, IN4)	205	250	295	Ω	R_{in} is to GND	B
I_{out} supply sensitivity (any channel)	-5		+5	%/V	$I_{out} = 40\text{ mA to }300\text{ mA}$	B
I_{out} temperature sensitivity (any channel)		300		ppm/ $^{\circ}\text{C}$	$I_{out} = 40\text{ mA to }300\text{ mA}$, I_{in} temp coefficient = $0\text{ ppm}/^{\circ}\text{C}$	B
I_{out} current output noise		3		nA/ $\sqrt{\text{Hz}}$	$I_{out} = 50\text{ mA}$ $INR = 500\ \mu\text{A}$	B
Current Output OutA & OutB						
Current gain, ChR, best fit	85	100	115	mA/mA	$I_{out} = 20\text{ mA to }80\text{ mA}$ † Note 1	A
Current gain, Ch2, best fit	205	240	275	mA/mA	$I_{out} = 20\text{ mA to }120\text{ mA}$ † Note 2	A
Current gain, Ch3, best fit	205	240	275	mA/mA	$I_{out} = 20\text{ mA to }120\text{ mA}$ † Note 2	A
Current gain, Ch4, best fit	205	240	275	mA/mA	$I_{out} = 20\text{ mA to }120\text{ mA}$ † Note 2	A
ZL40511						
Output current offset, ChR, best fit	-1		8	mA	$I_{out} = 20\text{ mA to }80\text{ mA}$ † Note 1	A
Output current offset, Ch2, best fit	-4		12	mA	$I_{out} = 20\text{ mA to }120\text{ mA}$ † Note 2	A
Output current offset, Ch3, best fit	-4		12	mA	$I_{out} = 20\text{ mA to }120\text{ mA}$ † Note 2	A

Characteristic	Min.	Typ.	Max.	Units	Comments	Type
Output current offset, Ch4, best fit	-4		12	mA	$I_{out} = 20 \text{ mA to } 120 \text{ mA} \dagger \text{ Note 2}$	A
ZL40515						
Output current offset, ChR, best fit. Note 3	-1		8	mA	$I_{out} = 20 \text{ mA to } 80 \text{ mA} \dagger \text{ Note 1}$	A
Output current offset, Ch2, best fit. Note 4	-7		15	mA	$I_{out} = 20 \text{ mA to } 120 \text{ mA} \dagger \text{ Note 2}$	A
Output current offset, Ch3, best fit. Note 4	-7		15	mA	$I_{out} = 20 \text{ mA to } 120 \text{ mA} \dagger \text{ Note 2}$	A
Output current offset, Ch4, best fit. Note 4	-7		15	mA	$I_{out} = 20 \text{ mA to } 120 \text{ mA} \dagger \text{ Note 2}$	A
ZL40511/15						
Output current linearity (any channel). Note 3	-3.5		1.5	%	$I_{out} = 20 \text{ mA to } 120 \text{ mA} \dagger \text{ Note 2}$	A
Gain tracking, Ch2 to Ch3 to Ch4	-2.5		+2.5	%	$I_{out} = 20 \text{ mA to } 120 \text{ mA} \dagger \text{ Note 2}$	A

Note: A = 100% Tested

B = Guaranteed by Characterization and Design

C = Guaranteed by Design

Note 1: Gain, offset and linearity of a channel are derived from a best fit line (linear regression graph) to the following three operating points: $I_{out} = 20 \text{ mA}, 50 \text{ mA}$ and 80 mA .

Note 2: Gain, offset and linearity of a channel are derived from a best fit line (linear regression graph) to the following three operating points: $I_{out} = 20 \text{ mA}, 70 \text{ mA}$ and 120 mA .

Note 3: Best Fit output line through $20\text{mA}, 50\text{mA}, 80\text{mA}$

Note 4: = Best Fit output line through $20\text{mA}, 70\text{mA}, 120\text{mA}$

† Electrical measurement into 3.9 Ohm to Gnd

Characteristic	Min.	Typ.	Max.	Units	Comments	Type
Timing						
Current Output OutA & OutB						
Channel rise time, (10% to 90%), t_{r2}		1.0	1.3	ns	40 to 375 mA, Ch2, 3 or 4 pulsed † ‡	B
Channel fall time, (10% to 90%), t_{f2}		1.2	1.6	ns	40 to 375 mA, Ch2, 3 or 4 pulsed † ‡	B
Output current overshoot (any write channel)			10	%	40 to 375 mA Ch2 3, 4 pulsed †	B
Output current undershoot (any write channel)			10	%	40 to 375 mA Ch2 3, 4 pulsed †	B
Channel to Channel Enable Skew T_r		50		ps		B
Channel to Channel Enable Skew T_f		25		ps		B
I_{out} ON propagation delay, t_{onCh}		1.4	1.8	ns	50% En High-Low to 50% I_{out} , any write channel	B
I_{out} OFF propagation delay, t_{offCh}		1.2	1.6	ns	50% En Low-High to 50% I_{out} , any write channel	B
Amplifier -3 dB bandwidth (ChR)	23	43	68	MHz	INR = 400 μ A	C
Amplifier -3 dB bandwidth (Ch2, 3, 4)	6	11	16	MHz	IN2, IN3, IN4 = 400 μ A	C
Power_Up & SelA						
Power_Up time, t_{on}		1.5	3.5	μ s	50% Enable Low-High to 50% I_{out}	C
Power_Up time, t_{off}		20	33	ns	50% Enable High-Low to 50% I_{out}	C
Output A select delay		5	8	ns	50% DVD/CD select Low-High to 50% I_{OUTA}	C
Output A deselect delay		5	8	ns	50% DVD/CD select High-Low to 50% I_{OUTA}	C

Note: A = 100% Tested

B = Guaranteed by Characterization and Design

C = Guaranteed by Design

† (EN2, /EN2), (EN3, /EN3), (EN4, /EN4) input pulse rise and fall time = 0.4 ns.

‡ Parameter is measured Electrical Pulse Response using 3.9 Ohm load to gnd and Zarlink Application Board. Pulse response performance parameters Trise, Tfall, Overshoot and Undershoot can be limited by interconnect inductance. Optical Response is influenced by Laser Diode response. See Application Notes.

Electrical Dynamic Characteristics $V_{CC} = 5\text{ V}$, $T_{amb} = 25^{\circ}\text{C}$, $INR = 400\text{ }\mu\text{A}$, $IN2 = IN3 = IN4 = 160\text{ }\mu\text{A}$, $PWR_UP = \text{High}$, Ch2, Ch3, Ch4 disabled, OSCEN = Low, unless otherwise specified.

Characteristic	Min.	Typ.	Max.	Units	Comments	Type
Oscillator						
Frequency adjust range Low			250	MHz	RF = 16 k Ω , OSCEN = High	B
Frequency adjust range High	575			MHz	RF = 2 k Ω , OSCEN = High	B
Frequency tolerance (ZL40511)	338	375	412	MHz	RF = 7.5 k Ω , OSCEN = High	A
Frequency tolerance (ZL40515)	322	375	428	MHz	RF = 7.5 k Ω , OSCEN = High	A
Frequency temperature coefficient		200		ppm/ $^{\circ}\text{C}$	RF = 7.5 k Ω , OSCEN = High	C
Amplitude adjust range Low (RS=11K Ω)			36	mA pk to pk	RS = 11 k Ω , OSCEN = High RF=9 K (350 MHz) InR = 1 mA	B
Amplitude adjust range High (RS=1K Ω)	100			mA pk to pk	RS = 1 k Ω , OSCEN = High RF = 9 K (330 MHz) InR = 1 mA	B
Third Harmonic		-30		dBc	RS = 10 k Ω to 2 k Ω , OSCEN = High RF = 9 K (330 MHz) InR = 400 μA	C
Second Harmonic		-20		dBc	RS = 10 k Ω to 2 k Ω , OSCEN = High RF = 9 K (330 MHz) InR = 400 μA	C
Amplitude tolerance	-20	0	20	%	Fosc= 250MHz to 450MHz, OSCEN = High, RS 1%	C
Amplitude (RS = 7.5 K)		42		mA pk to pk	f = 375 MHz, RS = 7.5 k Ω , OSCEN = High	C
Amplitude flatness		4		dB	RS = 7.5 k Ω , RF = 9 k Ω to 4 k Ω	B
Amplitude temperature coefficient		800		ppm/ $^{\circ}\text{C}$	RF = 5.6 k Ω , OSCEN = High	C
Oscillator enable time, t_{onOsc}			2	ns	50% OSCEN High-Low to 50% I_{out}	B
Oscillator disable time, t_{offOsc}			3	ns	50% OSCEN Low-High to 50% I_{out}	B

Note: A = 100% Tested

B = Guaranteed by Characterization and Design

C = Guaranteed by Design

† (EN2, /EN2), (EN3, /EN3), (EN4, /EN4) pulse rise and fall time = 0.4 ns.

6.0 Characteristic Curves

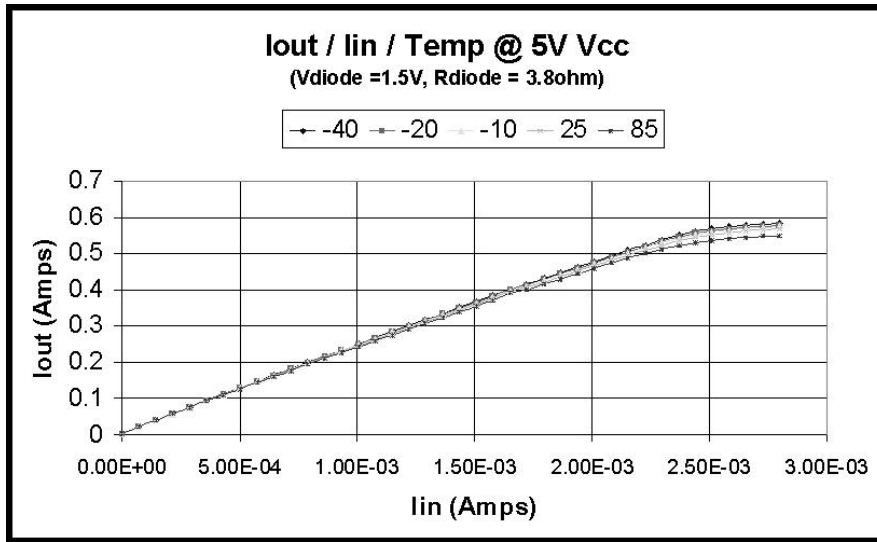


Figure 6 - Write Channel 2, 3 and 4 IP/OP Transfer Characteristic/Temp

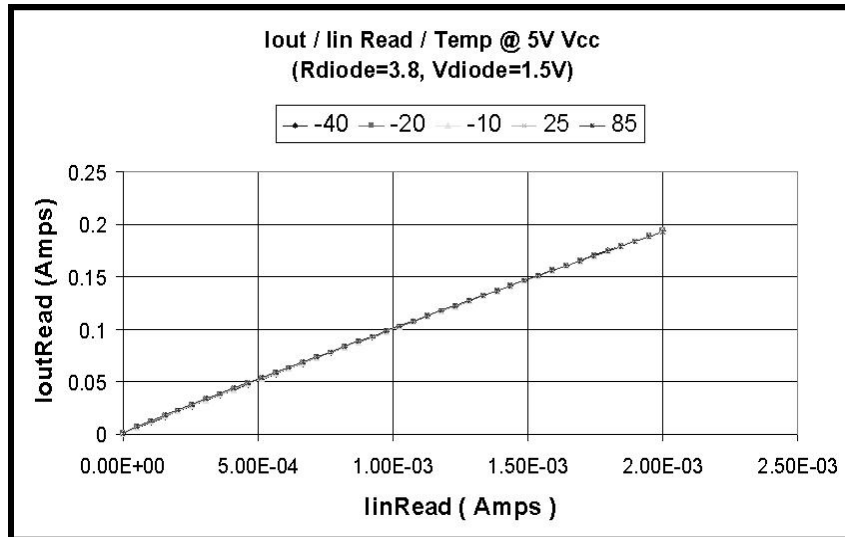


Figure 7 - Read Channel IP/OP Transfer Characteristic/Temp

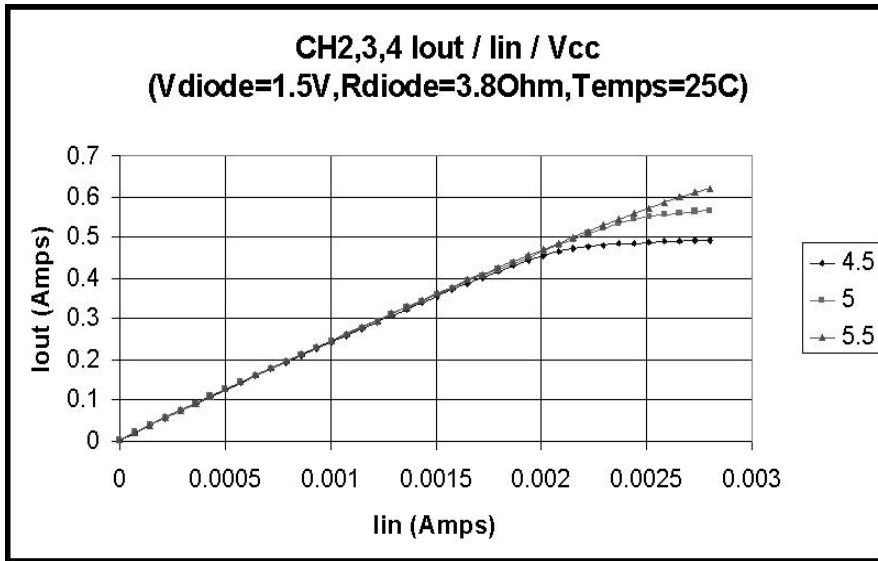


Figure 8 - Write Channel 2, 3 or 4 IP/OP Transfer Characteristic/Vcc

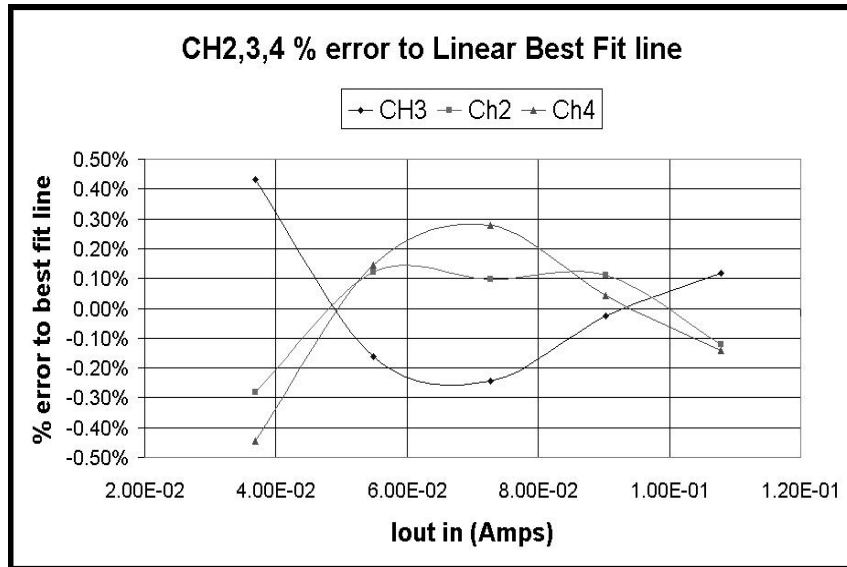


Figure 9 - Write Channel 2, 3 or 4 IP/OP Best Fit Line% Error

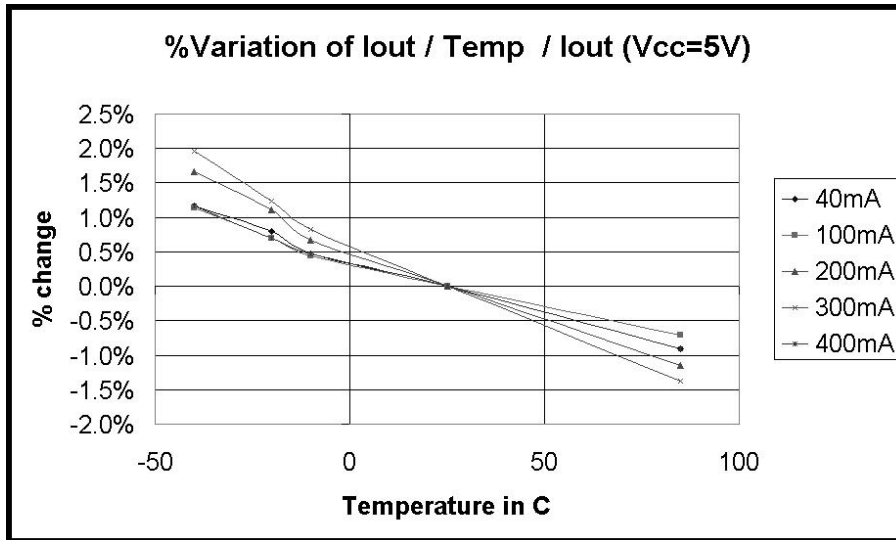


Figure 10 - Write Channel 2, 3 or 4 Δ Iout% Variation with Temperature

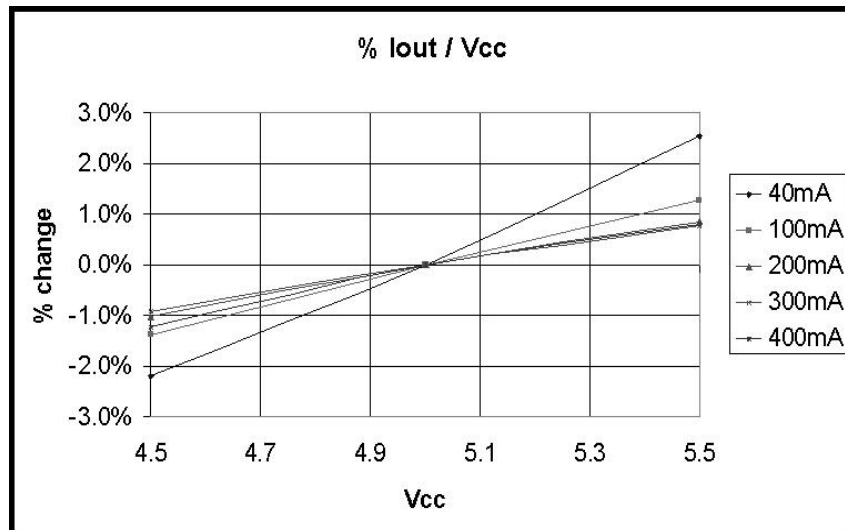


Figure 11 - Write Channel 2, 3 or 4 Δ Iout% Variation with Vcc

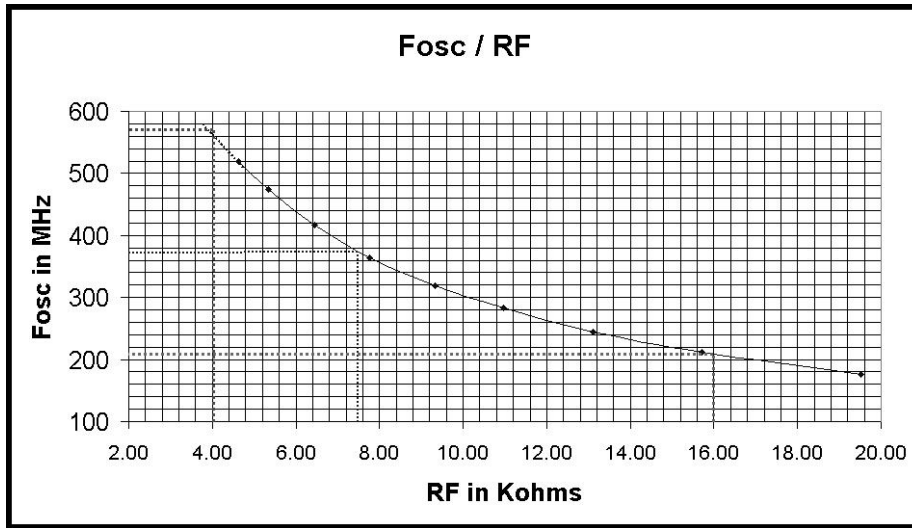


Figure 12 - Oscillator Frequency/RF
Vcc = 5 V, Temp = 25°C

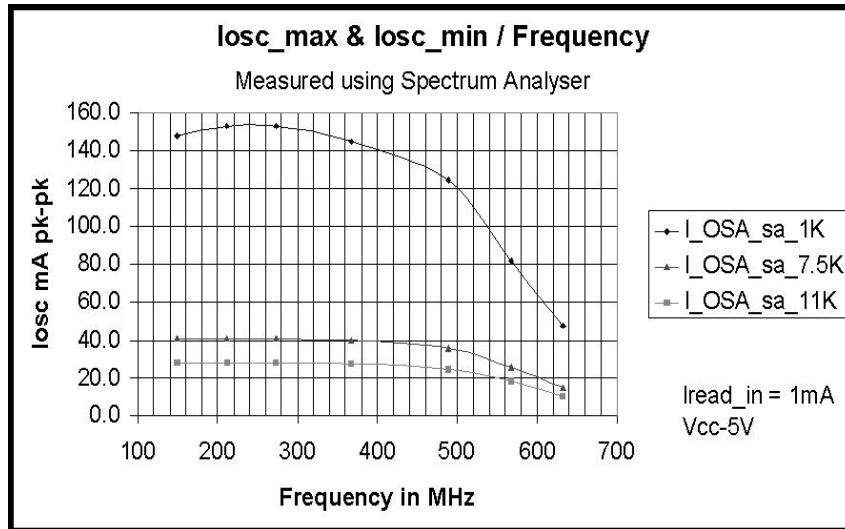


Figure 13 - Iosc Out/Frequency/
RS = 1 K, 7.5 K, 11 K, Vcc = 5 V, Temp = 25°C

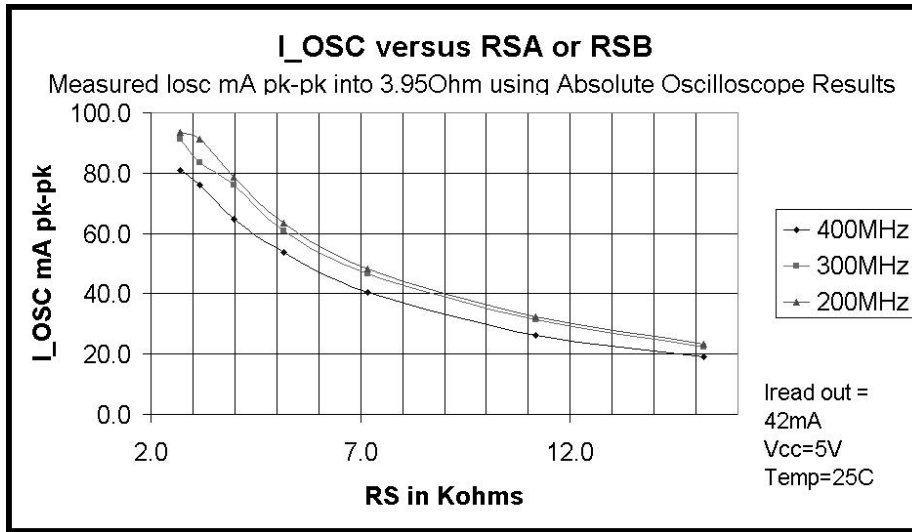


Figure 14 - I_{osc} Amplitude mA pk-pk/RSA or RSB
V_{cc} = 5 V, Temp = 25°C

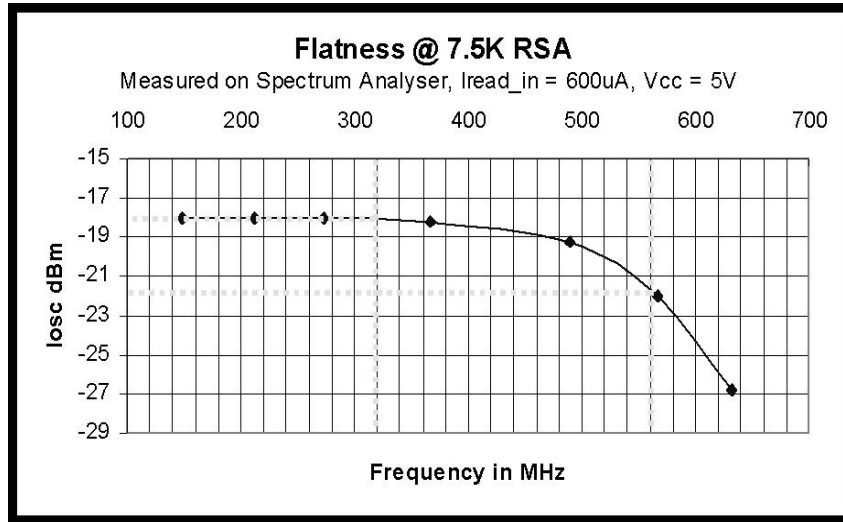


Figure 15 - I_{osc}/Frequency
RS = 7.5 K, V_{cc} = 5 V, Temp = 25°C

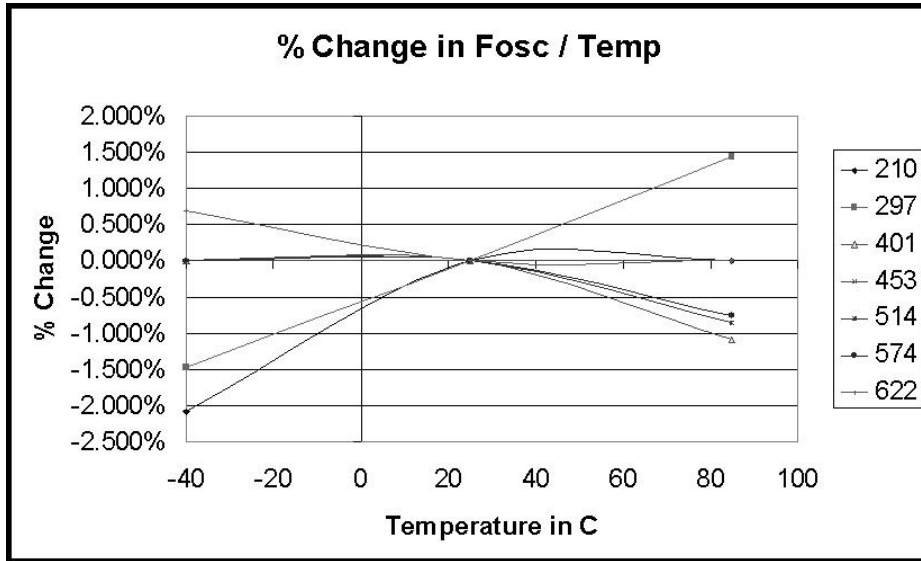


Figure 16 - Δ Freq % Variation with Temperature

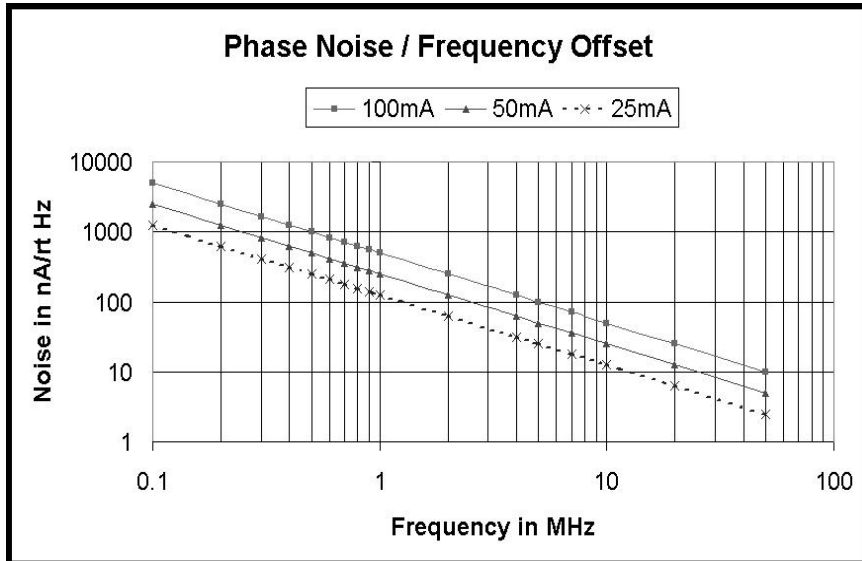


Figure 17 - Oscillator Noise Spectral Density
Vcc = 5 V, Temp = 25°C

7.0 I/O Diagrams

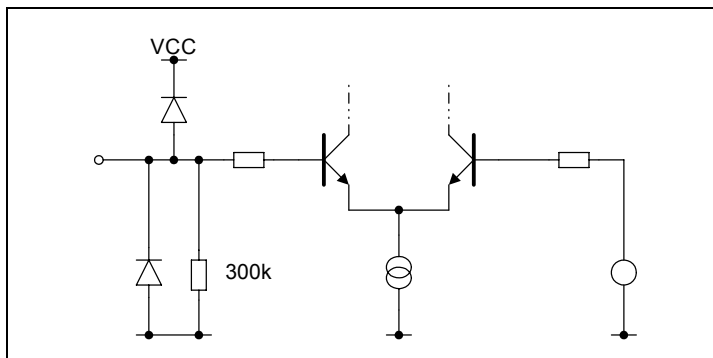


Figure 18 - CMOS/LVTTL Input (PWR_UP, OSCEN)

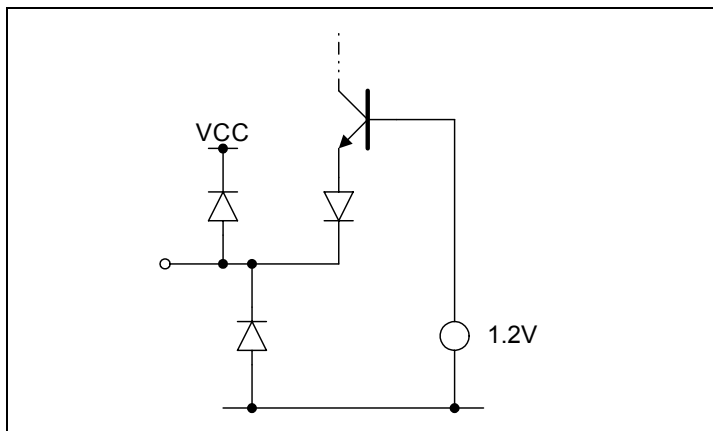


Figure 19 - Oscillator Resistors (RF, RS)

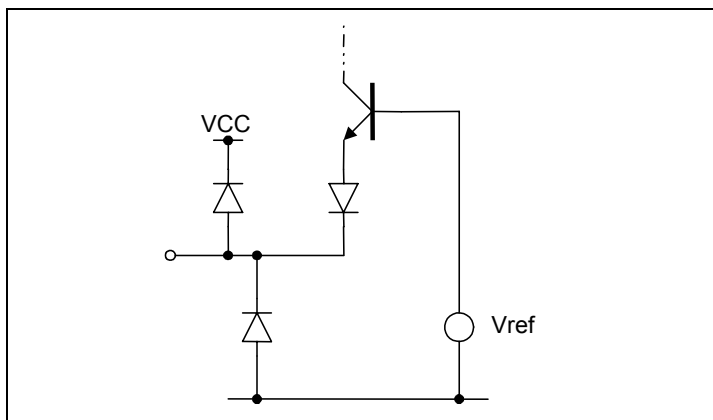


Figure 20 - Read Current Input (INR)

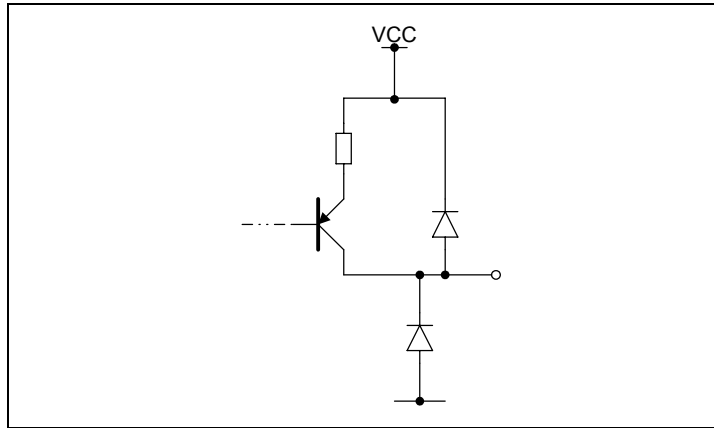


Figure 21 - Output (OUTA, OUTB)

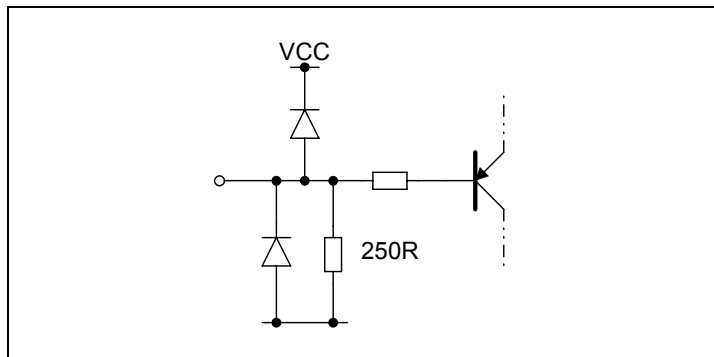


Figure 22 - Write Current Input (IN2, IN3, IN4)

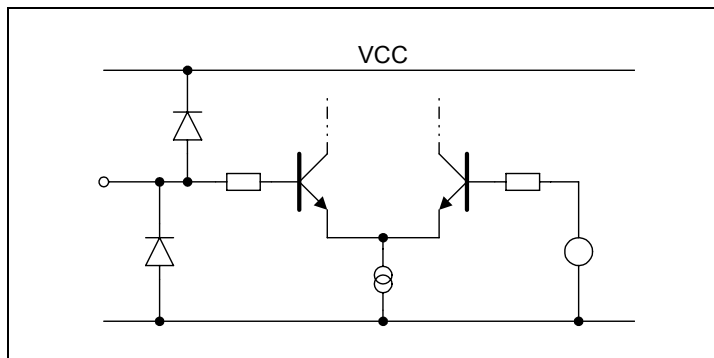


Figure 23 - LVDS Input (EN2, /EN2), (EN3, /EN3), (EN4, /EN4)

8.0 Timing Waveforms

Applying logic levels to the inputs, as shown in Table 1, gives the output waveform shown in Figure 26.

PWR_UP	EN2	EN3	EN4	OUTPUT
0	X	X	X	OFF
1	0	0	0	READ
1	1	0	0	LEVEL 2
1	1	1	0	LEVEL 3
1	1	1	1	LEVEL 4

Note: 1 = logic high, 0 = logic low and X = "don't care"

Table 1 - Output Function for Set Logic Inputs

9.0 Timing Diagrams

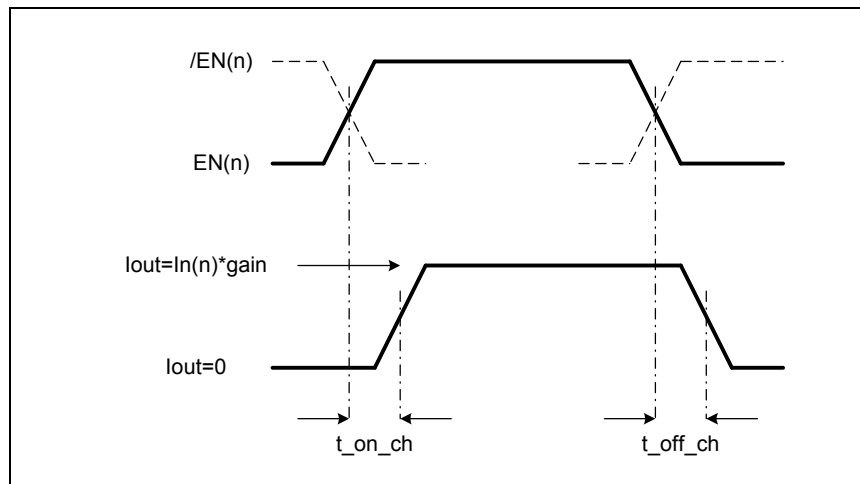


Figure 24 - Timing of Read or Write Channels

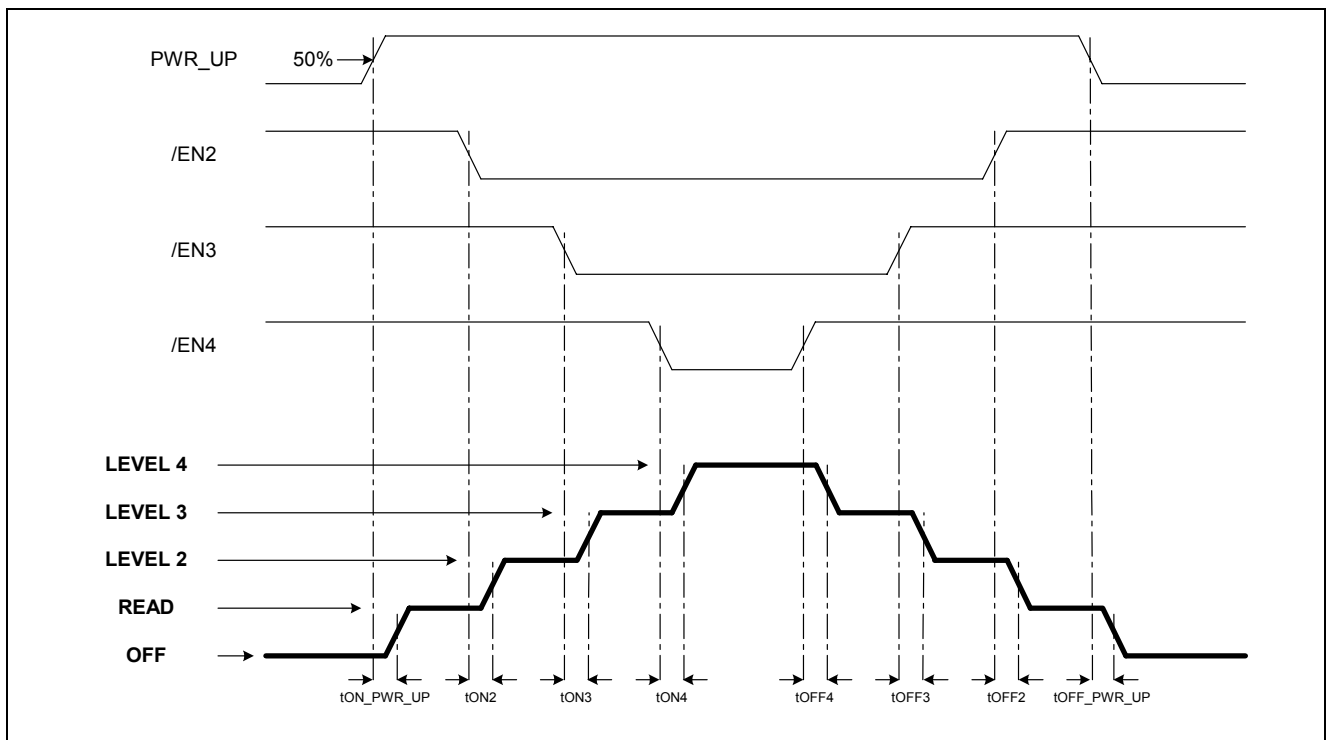


Figure 25 - Output Waveform Showing Addition of Read and Write Levels

10.0 Example Waveforms

10.1 Write Waveform

The Write output waveform may be produced as shown in example 1, Figure 26. The Erase level is set by switching off both the Bias level and the Write level. The Write switching waveform is produced by switching off the Erase level and Switching on the Bias level and then modulating that with the Write level. The peak of the Write waveform is the sum of the Bias and the Write levels.

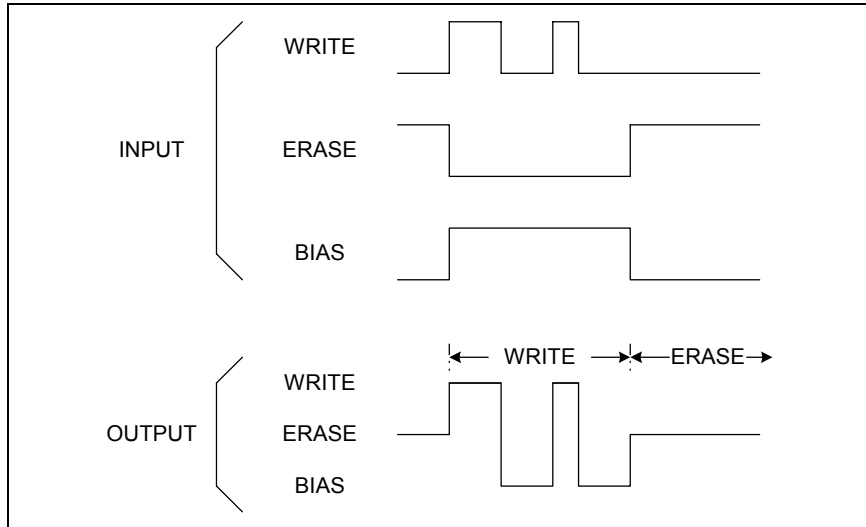


Figure 26 - Example of Write Waveform

NOTES:

1. Only the Write signal changes to modulate the output during the Write pulse.
2. Each of the Write Channels can provide up to 500 mA. It is not necessary to add together the output of more than one Write Channel to achieve 500 mA.

10.2 Oscillator Waveform

The Oscillator may be enabled independently and is summed with the selected level.

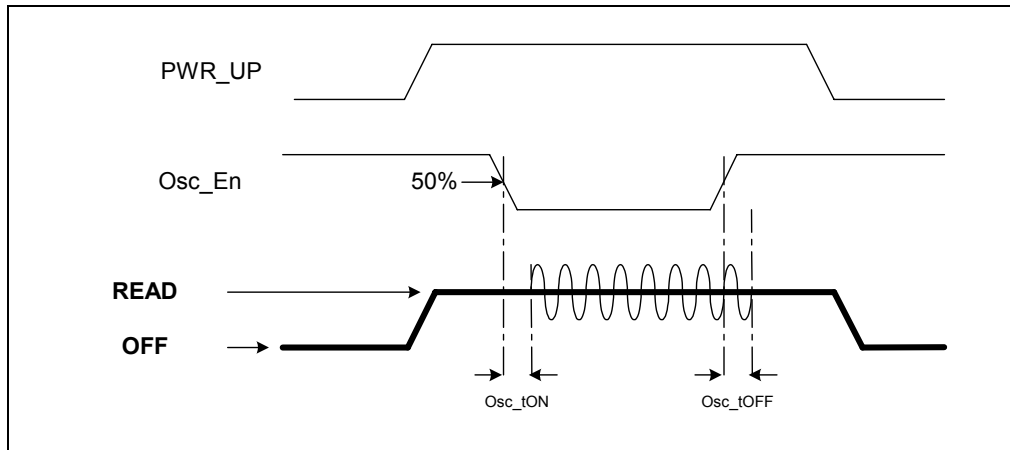
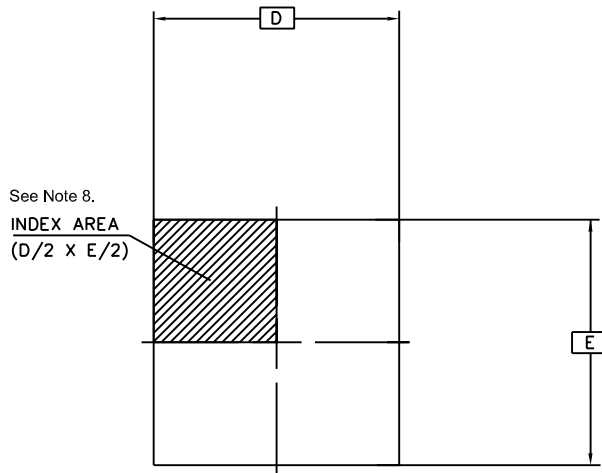
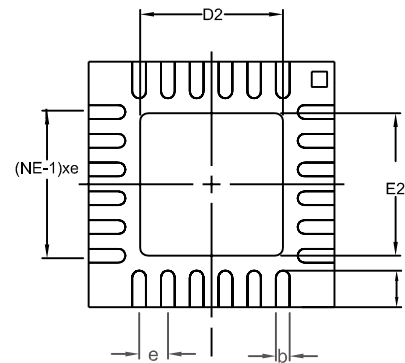
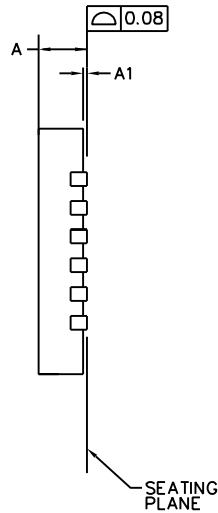


Figure 27 - Example of Oscillator Waveform Superimposed on the Read Waveform

NOTE: The amplitude of the Oscillator must be less than the programmed DC output level to avoid clipping and subsequent increase in harmonic distortion.



TOP VIEW



BOTTOM VIEW

SYMBOL	COMMON DIMENSIONS	
	MIN.	MAX.
A	0.80	1.00
A1	0.00	0.05
b	0.18	0.30
D	4.00 BSC	
D2	2.00	2.25
E	4.00 BSC	
E2	2.00	2.25
N	24	
Nd	6	
Ne	6	
ⓐ	0.50 BSC	
L	0.30	0.50

Conforms to JEDEC MO-220

- NOTES:
1. DIMENSIONING & TOLERANCES CONFORM TO ASME Y14.5M. - 1994.
 2. N IS THE NUMBER OF TERMINALS.
Nd & Ne ARE THE NUMBER OF TERMINALS ON EACH D AND E SIDE RESPECTIVELY
 3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30mm FROM TERMINAL.
 4. ALL DIMENSIONS ARE IN MILLIMETERS.
 5. LEAD COUNT IS 24 .
 6. PACKAGE WARPAGE MAX 0.08mm.
 7. NOT TO SCALE.
 8. TERMINAL #1 IDENTIFIER MUST BE LOCATED WITHIN THE ZONE INDICATED AND MAY BE EITHER A MOULD OR MARKED FEATURE.

© Zarlink Semiconductor 2003 All rights reserved.

ISSUE	1	2		
ACN	CDCA	CDCA		
DATE	11Aug03	5Sep03		
APPRD.				



Previous package codes

Package Code LC

Package Outline for
24Lead4.0x4.0x0.9
QFN

101009



**For more information about all Zarlink products
visit our Web Site at
www.zarlink.com**

Information relating to products and services furnished herein by Zarlink Semiconductor Inc. or its subsidiaries (collectively "Zarlink") is believed to be reliable. However, Zarlink assumes no liability for errors that may appear in this publication, or for liability otherwise arising from the application or use of any such information, product or service or for any infringement of patents or other intellectual property rights owned by third parties which may result from such application or use. Neither the supply of such information or purchase of product or service conveys any license, either express or implied, under patents or other intellectual property rights owned by Zarlink or licensed from third parties by Zarlink, whatsoever. Purchasers of products are also hereby notified that the use of product in certain ways or in combination with Zarlink, or non-Zarlink furnished goods or services may infringe patents or other intellectual property rights owned by Zarlink.

This publication is issued to provide information only and (unless agreed by Zarlink in writing) may not be used, applied or reproduced for any purpose nor form part of any order or contract nor to be regarded as a representation relating to the products or services concerned. The products, their specifications, services and other information appearing in this publication are subject to change by Zarlink without notice. No warranty or guarantee express or implied is made regarding the capability, performance or suitability of any product or service. Information concerning possible methods of use is provided as a guide only and does not constitute any guarantee that such methods of use will be satisfactory in a specific piece of equipment. It is the user's responsibility to fully determine the performance and suitability of any equipment using such information and to ensure that any publication or data used is up to date and has not been superseded. Manufacturing does not necessarily include testing of all functions or parameters. These products are not suitable for use in any medical products whose failure to perform may result in significant injury or death to the user. All products and materials are sold and services provided subject to Zarlink's conditions of sale which are available on request.

Purchase of Zarlink's I²C components conveys a licence under the Philips I²C Patent rights to use these components in and I²C System, provided that the system conforms to the I²C Standard Specification as defined by Philips.

Zarlink, ZL and the Zarlink Semiconductor logo are trademarks of Zarlink Semiconductor Inc.

Copyright Zarlink Semiconductor Inc. All Rights Reserved.

TECHNICAL DOCUMENTATION - NOT FOR RESALE
