19-3265; Rev 0; 5/04

MAXIM

Dual-Output, Multimode CD-RW/DVD Laser-Diode Drivers

General Description

The MAX9483/MAX9484 high-performance, multimode, laser-diode drivers (LDDs) are designed for CD and DVD combination pickup heads. The drivers consist of three input channels, an RF oscillator, and two precision current-amplifier outputs to drive the CD and DVD laser diodes. The MAX9483/MAX9484 support multiple CD and DVD read/write standards, such as CD-R/RW, DVD-R, DVD+R, DVD-RW, DVD+RW, and DVD-RAM by choosing the writing control signals and input currents on these input channels. The peak total output current is 400mA with a current gain of 100 at each channel. External resistors set the oscillation frequency and output swing. The MAX9484 features an extra resistor input allowing the oscillation frequencies of the two outputs to be set separately. Additionally, the MAX9484 allows the writing control signals to be received in low-voltage differential signal (LVDS) mode or single-ended mode to provide reliable high-speed writing.

The MAX9483 is offered in 16-pin QSOP and 4mm x 4mm 16-pin thin QFN packages. The MAX9484 is offered in a 4mm x 4mm 20-pin thin QFN package. Both devices are specified for 4.5V to 5.5V supply and 0°C to +70°C temperature range.

Applications

Laser Diode Driver for CD-RW and DVD Combos: CD-R/RW, DVD-R, DVD+R, DVD-RW, DVD+RW, DVD-RAM

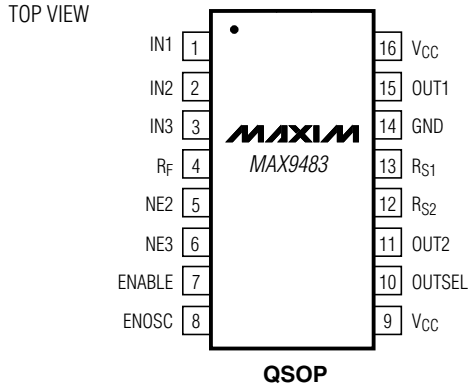
DVD Video Recorders

High-Power and High-Speed Laser-Writable Device Drivers

Features

- **Dual Output Ports with Three Controlled-Current Channels**
- **Support Various Laser-Diode Driver Standards CD-R/RW, DVD-R, DVD+R, DVD-RW, DVD+RW, DVD-RAM, and DVD Video**
- **MAX9483 is Pin and Function Compatible with ATMEL T0806**
- **Independent Frequency Setting for the Two Output Ports (MAX9484)**
- **Accepts Differential (LVDS) or Single-Ended Inputs for Writing Data (MAX9484)**
- **Enable Control**
- **High-Current Swing Up to 270mA for the Reading Current**
- **High 400mA Total Peak Writing Current**
- **Adjustable Modulation Frequency from 100MHz to 600MHz**
- **Fast Output-Current Pulse Rise and Fall Time 1.0ns (typ)**
- **4.5V to 5.5V Single-Supply Voltage**
- **No External Reference Clock Required**
- **0°C to +70°C Commercial Temperature Range**

Pin Configurations



QSOP

Pin Configurations continued at end of data sheet.

Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
MAX9483CEE	0°C to +70°C	16 QSOP
MAX9483CTE*	0°C to +70°C	16 Thin QFN
MAX9484CTP	0°C to +70°C	20 Thin QFN

**Future product—contact factory for availability.*

Dual-Output, Multimode CD-RW/DVD Laser-Diode Drivers

ABSOLUTE MAXIMUM RATINGS

V_{CC}, $V_{CCO\_}$ to GND .....-0.3V to +6.0V
IN_, $R_{F\_}$, $R_{S\_}$ to GND.....-0.3V to (V_{CC} + 0.3V)
ENABLE, ENOSC, NE2_, NE3_,
OUTSEL to GND.....-0.3V to (V_{CC} + 0.3V)
Output Voltage at OUT1, OUT2.....-0.3V to (V_{CC} - 1V)
Continuous Power Dissipation (T_A = +70°C)
QSOP (derate 8.3mW/°C above +70°C).....667mW
TQFN (derate 16.9mW/°C above +70°C).....1349mW
Junction Temperature.....+150°C
Storage Temperature Range.....-65°C to +150°C
ESD Rating (Human Body Model).....≥ ±2.0kV
Lead Temperature (soldering, 10s).....+300°C

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

DC ELECTRICAL CHARACTERISTICS

(V_{CC} = $V_{CCO\_}$ = +4.5V to +5.5V, R_L = 6.8Ω, ENABLE = high, NE2 = NE3 = high (MAX9483), NE2_ = NE3_ = differential high (MAX9484), ENOSC = low, T_A = 0°C to +70°C, unless otherwise noted. Typical values are at V_{CC} = $V_{CCO\_}$ = +5V, T_A = +25°C.) (Notes 1, 2, 4)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
POWER SUPPLY							
Write-Mode Supply Current	I_{CC1}	I_{IN1} = I_{IN2} = I_{IN3} = 500µA, NE2 = NE3 = low	MAX9483		181	200	mA
			MAX9484		182	210	
Read-Mode Supply Current	I_{CC2}	Oscillator enabled, I_{IN1} = I_{IN2} = I_{IN3} = 500µA, ENOSC = high, R_S = 8.2kΩ, R_F = 6.8kΩ	MAX9483		91	100	mA
			MAX9484		92	105	
		Oscillator disabled, I_{IN1} = I_{IN2} = I_{IN3} = 500µA	MAX9483		82	95	
			MAX9484		83	95	
Supply Current	I_{CC3}	Input disabled, I_{IN1} = I_{IN2} = I_{IN3} = 0	MAX9483		14	20	mA
			MAX9484		14	20	
Power-Down Supply Current	I_{CC4}	ENABLE = NE2 = NE3 = low, I_{IN1} = I_{IN2} = I_{IN3} = 0	MAX9483		0.96	2.0	mA
			MAX9484		1.2	2.0	
DIGITAL INPUTS FOR WRITE CHANNEL CONTROL (NE2, NE3) (MAX9483)							
High-Level Input Voltage	V_{IH1}			2.0			V
Low-Level Input Voltage	V_{IL1}					0.8	V
Input Current	I_{IN1}	V_{IN} = high or low		-20		+20	µA
LVDS DIGITAL INPUTS FOR WRITE CHANNEL CONTROL (NE2_, NE3_) (MAX9484)							
Differential Input High Threshold	V_{TH}					50	mV
Differential Input Low Threshold	V_{TL}			-50			mV
SINGLE-ENDED DIGITAL INPUTS FOR WRITE CHANNEL CONTROL (NE2+, NE3+) (MAX9484)							
Reference Voltage	V_{REF}			1.10	1.25	1.40	V
High-Level Input Voltage	V_{IH2}			V_{REF} + 300			mV
Low-Level Input Voltage	V_{IL2}					V_{REF} - 300	mV
Input Current	I_{IN2}	V_{IN} = high or low		-20		+20	µA

DC ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = $V_{CCO\_}$ = +4.5V to +5.5V, R_L = 6.8Ω, ENABLE = high, NE2 = NE3 = high (MAX9483), NE2_ = NE3_ = differential high (MAX9484), ENOSC = low, T_A = 0°C to +70°C, unless otherwise noted. Typical values are at V_{CC} = $V_{CCO\_}$ = +5V, T_A = +25°C.) (Notes 1, 2, 4)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DIGITAL INPUTS FOR CONTROL SIGNALS (ENABLE, OUTSEL, ENOSC)						
High-Level Input Voltage	V_{IH3}		2.0			V
Low-Level Input Voltage	V_{IL3}				0.8	V
Input Current	I_{IN3}	V_{IN} = high or low	-10		+10	µA
ANALOG INPUTS (IN1, IN2, IN3)						
Current Channel Input Current Range	I_{CIN}	Current flowing into IN1, IN2, or IN3	0		4.0	mA
Current Channel Input Impedance	R_{IN}	IN_ to GND	165	200	235	Ω
OUTPUTS (OUT1 and OUT2)						
Maximum Total Output Current	I_{OUT}		320	400		mA
Maximum Output Current per Channel	I_{OUT}	Read current IN1	210	273		mA
		Write current IN2, IN3	250	347		
Best-Fit Current Gain	A_I	Any channel (Note 3)		100		I/I
Best-Fit Current Offset	I_{OFFSET}	Any channel (Note 3)	-4		+4	mA
Output Current Linearity		Any channel (Note 3)	-3		+3	%
Output Off Current	I_{OFF1}	ENABLE = low		0.2	1	mA
	I_{OFF2}	NE2 = NE3 = high, I_{IN1} = 0µA, I_{IN2} = I_{IN3} = 500µA		0.22	1.5	
	I_{OFF3}	NE2 = NE3 = low, I_{IN1} = I_{IN2} = I_{IN3} = 0µA		0.14	5	
Read-Mode Output Supply Sensitivity		I_{OUT} = 40mA	-2		+2	%/V
Write-Mode Output Supply Sensitivity		I_{OUT} = 80mA	-2		+2	%/V
Read-Mode Output Temperature Sensitivity		I_{OUT} = 40mA		15		ppm°C
Write-Mode Output Temperature Sensitivity		I_{OUT} = 80mA		16		ppm°C
Output Noise		I_{OUT} = 40mA, ENOSC = low		3		nA/√Hz

Dual-Output, Multimode CD-RW/DVD Laser-Diode Drivers

AC ELECTRICAL CHARACTERISTICS

(V_{CC} = $V_{CCO\_}$ = +4.5V to +5.5V, I_{OUT} = 40mA (read) + 40mA, R_L = 6.8Ω, ENABLE = high, NE2 = NE3 = high (MAX9483), NE2_ = NE3_ = differential high (MAX9484), ENOSC = low, T_A = 0°C to +70°C, unless otherwise noted. Typical values are at V_{CC} = $V_{CCO\_}$ = +5V, T_A = +25°C.) (Notes 1, 4)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
OSCILLATOR						
Oscillator Frequency	f_{OSC}	$R_{F\_}$ = 7.5kΩ (Note 2), I_{OUT} = 40mA (read)	255	300	350	MHz
Oscillator Temperature Coefficient		$R_{F\_}$ = 7.5kΩ		10		ppm/°C
OUTPUT TIMING						
Write Rise Time	t_r	I_{OUT} = 40mA (read) + 40mA (10% to 90%)		0.9	1.6	ns
Write Fall Time	t_f	I_{OUT} = 40mA (read) + 40mA (90% to 10%)		1.0	1.6	ns
Output-Current Overshoot	OCO			5		%
Output ON Propagation Delay	t_{ON}	NE 50% high-low to IOUT at 50% of final value		1.0	2.0	ns
Output OFF Propagation Delay	t_{OFF}	NE 50% low-high to IOUT at 50% of final value		1.0	2.0	ns
Output Disable Time	t_{DIS}	ENABLE 50% high-low to I_{OUT} at 50% of final value at I_{OUT} = 40mA (read)		60	100	ns
Output Enable Time	t_{EN}	ENABLE 50% low-high to I_{OUT} at 50% of final value at I_{OUT} = 40mA (read)		60	100	ns
Oscillator Disable Time	t_{DISO}	ENOSC 50% high-low to I_{OUT} at 50% of final value at I_{OUT} = 40mA (read)		4	10	ns
Oscillator Enable Time	t_{EHO}	ENOSC 50% high-low to I_{OUT} at 50% of final value at I_{OUT} = 40mA (read)		25	50	ns
Channel-Select Delay	t_{ODH}	OUTSEL 50% low-high to I_{OUT} at 50% of final value measured at OUT1		2.9	10	ns
	t_{ODL}	OUTSEL 50% high-low to I_{OUT} at 50% of final value measured at OUT2		2.9	10	

Note 1: Current into a pin is defined as positive. Current out of a pin is defined as negative. All voltages are referenced to ground except V_{TH}.

Note 2: Maximum and minimum limits over temperature are guaranteed by design and characterization. Devices are production tested at T_A = +25°C.

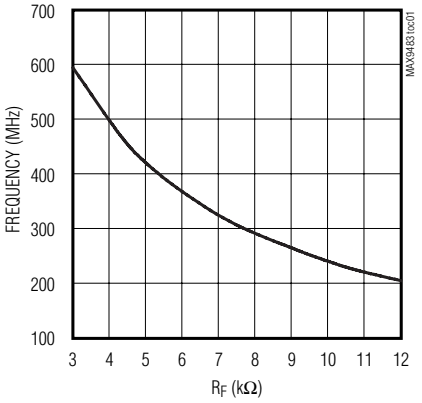
Note 3: Linearity of the amplifier is calculated using a best-fit method at three operating points of I_{OUT} at 20mA, 40mA, and 60mA. I_{OUT} = (I_{IN} x GAIN) + I_{OFFSET}.

Note 4: Guaranteed by design and characterization. Limit set at ±6 sigma.

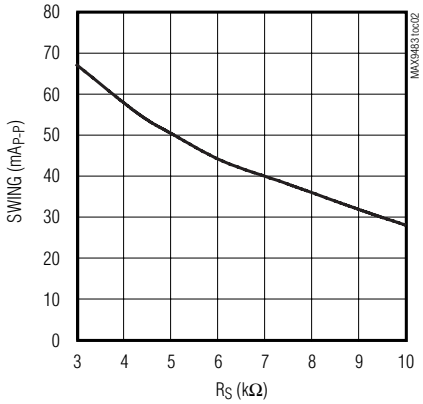
Typical Operating Characteristics

(V_{CC} = $V_{CCO\_}$ = +5V, T_A = +25°C, unless otherwise noted.)

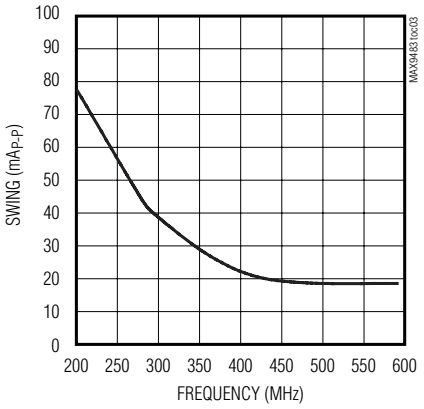
OSCILLATOR FREQUENCY vs. RESISTOR R_F



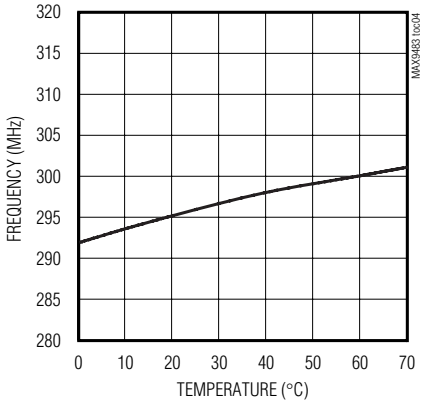
OSCILLATOR PEAK-TO-PEAK SWING vs. RESISTOR R_S



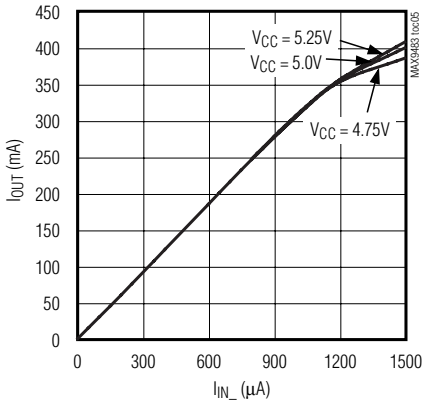
OSCILLATOR PEAK-TO-PEAK SWING vs. FREQUENCY



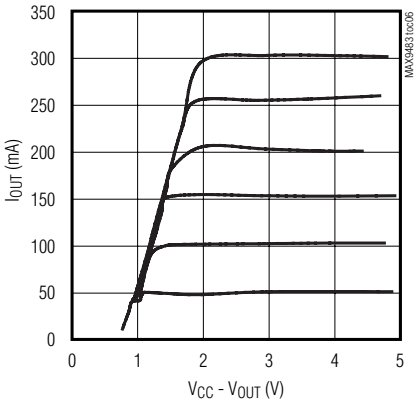
OSCILLATOR FREQUENCY vs. TEMPERATURE



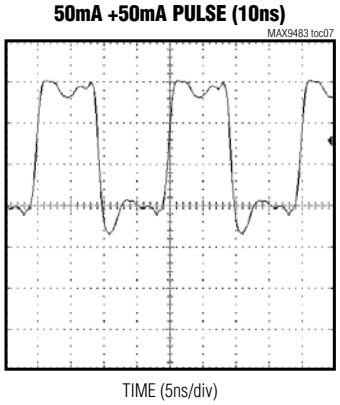
OUTPUT CHANNEL CURRENT vs. INPUT CURRENT (I_{IN1} = I_{IN2} = I_{IN3})



OUTPUT VOLTAGE COMPLIANCE



50mA +50mA PULSE (10ns)



Dual-Output, Multimode CD-RW/DVD Laser-Diode Drivers

Pin Description

PIN			NAME	FUNCTION
MAX9483		MAX9484		
QSOP	TQFN	TQFN		
1	15	18	IN1	Channel 1 Input Current (Read Channel)
2	16	19	IN2	Channel 2 Input Current (Write Channel)
3	1	20	IN3	Channel 3 Input Current (Write Channel)
4	2	—	R_F	Oscillator Frequency-Setting Resistor. Connect an external resistor to GND to set the frequency of the oscillator for both outputs OUT1 and OUT2.
5	3	—	NE2	Channel 2 Active-Low Digital Control Input
6	4	—	NE3	Channel 3 Active-Low Digital Control Input
7	5	8	ENABLE	LVTTL Output-Current Enable
8	6	9	ENOSC	LVTTL Oscillator Enable
9, 16	14	17	V_{CC}	+5V Power Supply. Bypass to GND with 0.1µF and 0.01µF capacitors with the 0.01µF capacitor as close to the pin as possible.
10	8	11	OUTSEL	LVTTL Output Select. Drive high to select output 1; pull low to select output 2.
11	9	12	OUT2	Output Current 2
12	10	13	R_{S2}	Output 2 Oscillator Current Swing-Setting Resistor. Connect an external resistor to GND to set the swing current of output port 2.
13	11	14	R_{S1}	Output 1 Oscillator Current Swing-Setting Resistor. Connect an external resistor to GND to set the swing current of output port 1.
14	—	—	GND	Ground
15	12	15	OUT1	Output Current 1
—	—	1	R_{F1}	Output 1 Oscillator Frequency-Setting Resistor. Connect an external resistor to GND to set the frequency of the oscillator for OUT1.
—	—	2	R_{F2}	Output 2 Oscillator Frequency-Setting Resistor. Connect an external resistor to GND to set the frequency of the oscillator for OUT2.
—	—	3	NE2+	Noninverting Channel 2 LVDS or Single-Ended Digital Control Input
—	—	4	NE2-	Inverting Channel 2 LVDS or Reference for Single-Ended Digital Control Input
—	—	6	NE3+	Noninverting Channel 3 LVDS or Single-Ended Control Digital Input
—	—	7	NE3-	Inverting Channel 3 LVDS or Reference for Single-Ended Control Digital Input
—	7	10	V_{CCO2}	+5V Power Supply for Output 2. Bypass to GND with 0.1µF and 0.01µF capacitors with the 0.01µF capacitor as close to pin as possible.
—	13	16	V_{CCO1}	+5V Power Supply for Output 2. Bypass to GND with 0.1µF and 0.01µF capacitors with the 0.01µF capacitor as close to the pin as possible.
—	—	5	REF	Reference Voltage for Single-Ended Input. Connect a 0.1µF decoupling capacitor to ground.
—	EP	EP	EP	Exposed Pad. Connect to ground.

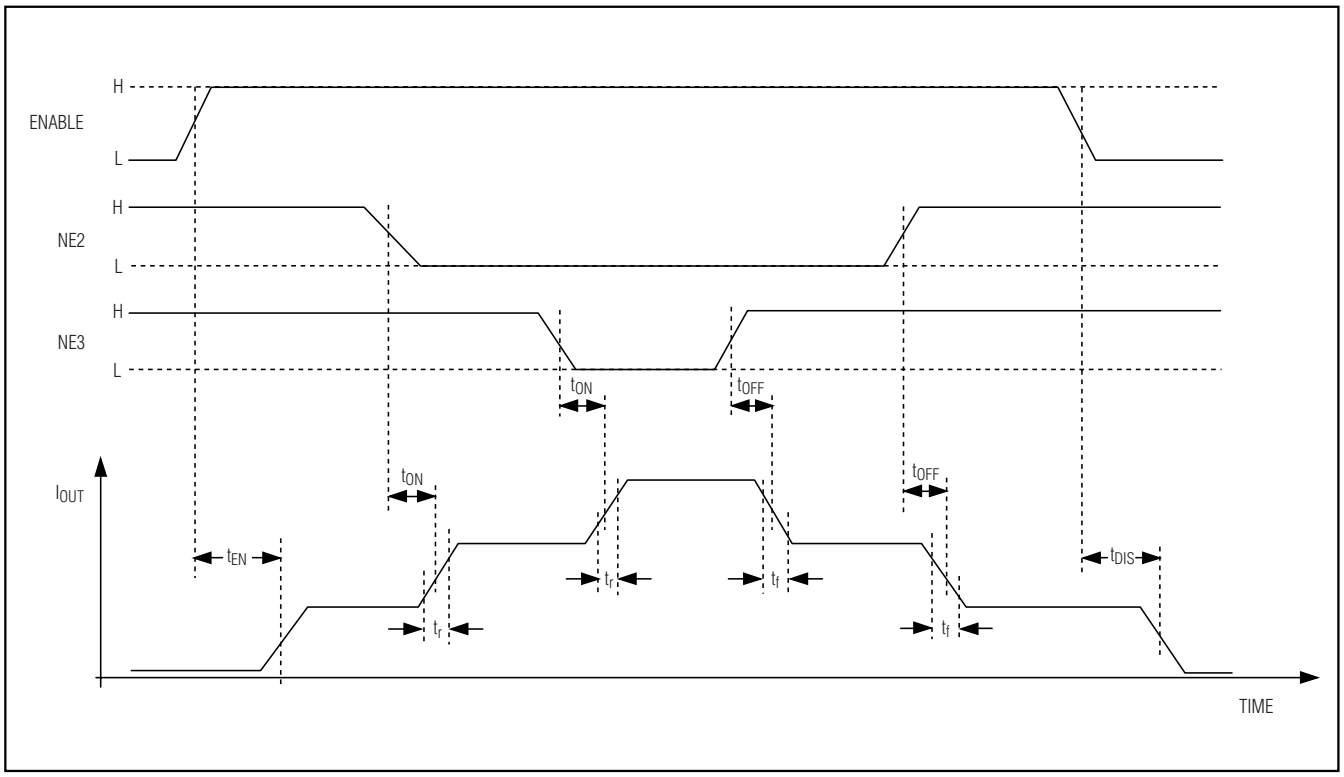


Figure 1. Timing Diagram of Output vs. Control Signals

Detailed Description

Read Channel and Write Channels

The MAX9483/MAX9484 high-performance multimode LDDs are designed for CD and DVD combination pick-up heads. The drivers have three current channels. Each channel has a current input IN_ (_ = 1, 2, or 3) and a channel control signal (ENABLE, NE2, or NE3). IN1 supplies the reference for the read channel, which provides the read current or the offset current to the lasers. The other two channels are the write channels. The currents of these two channels are superimposed on the read current that serves as the offset current for the laser in write mode. The offset current significantly reduces the laser output ramp-up time. When ENABLE is low, all three channels are disabled. Driving ENABLE high enables the read channel and leaves the other two write channels to be controlled by NE2 and NE3 (see Figure 1). By selecting the input currents at IN2 and IN3, as well as the signal timing of NE2 and NE3, the drivers can generate various current waveforms for different CD/DVD writing standards. All three channels have a current gain of 100. The maximum total current each output can provide is 400mA.

RF Oscillator

To reduce the laser-mode hopping noise in read mode, modulate the read current with an oscillator with a 100MHz to 600MHz frequency. An external resistor, RF, determines the oscillator frequency selection. For the MAX9484, two external resistors, R_{F1} and R_{F2}, are used to select the oscillator frequency for CD and DVD lasers separately. The swing amplitude of the oscillator current is set by two external resistors, R_{S1} and R_{S2}, one for CD and one for DVD. The oscillator is enabled when both ENABLE and ENOSC are driven high.

Dual-Output, Multimode CD-RW/DVD Laser-Diode Drivers

Applications Information

LVDS Inputs for MAX9484

The MAX9484 input control signals, NE2_ and NE3_, are compatible with LVDS or single-ended inputs. The LVDS inputs allow the driver to handle higher data writing rates. When using single-ended input signals, such as LVTTL or SSTL_2, connect NE2- and NE3- to REF.

Laser Safety and IEC 825

Using the MAX9483/MAX9484 laser drivers alone does not ensure that a transmitter design is compliant with IEC 825. The entire transmitter circuit and component selections must be considered. Customers must determine the level of fault tolerance required by their application. Note that Maxim products are not designed or authorized for use as components in systems intended for surgical implantation into the body, for applications intended to support or sustain life, or for any other application where the failure of a Maxim product could create a situation where personal injury or death may occur.

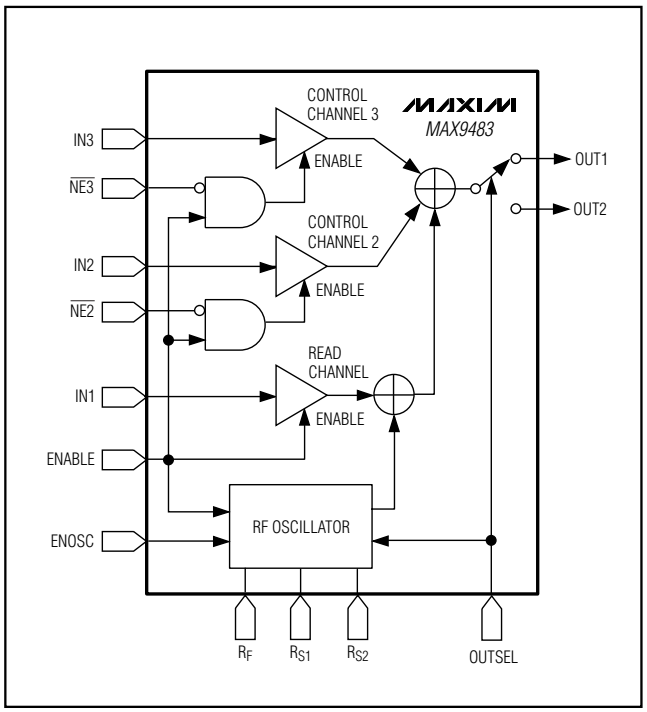


Figure 2. MAX9483 Functional Diagram

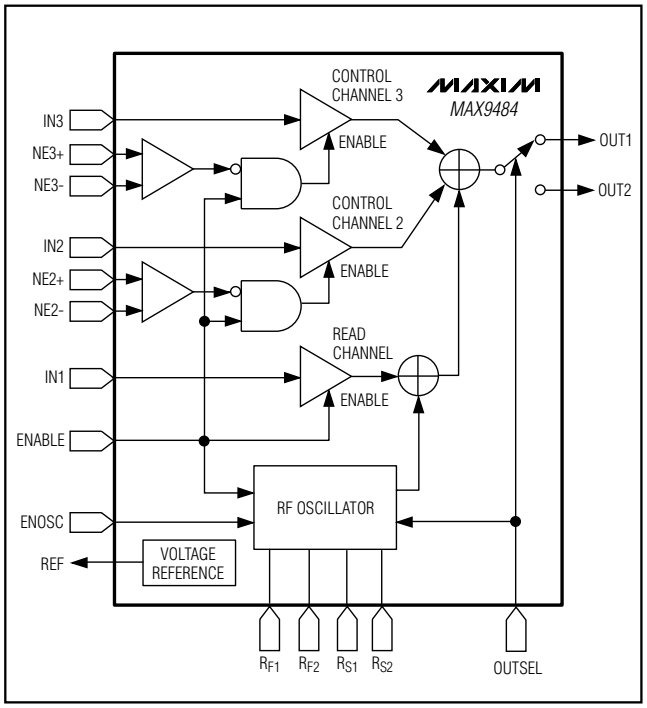


Figure 3. MAX9484 Functional Diagram

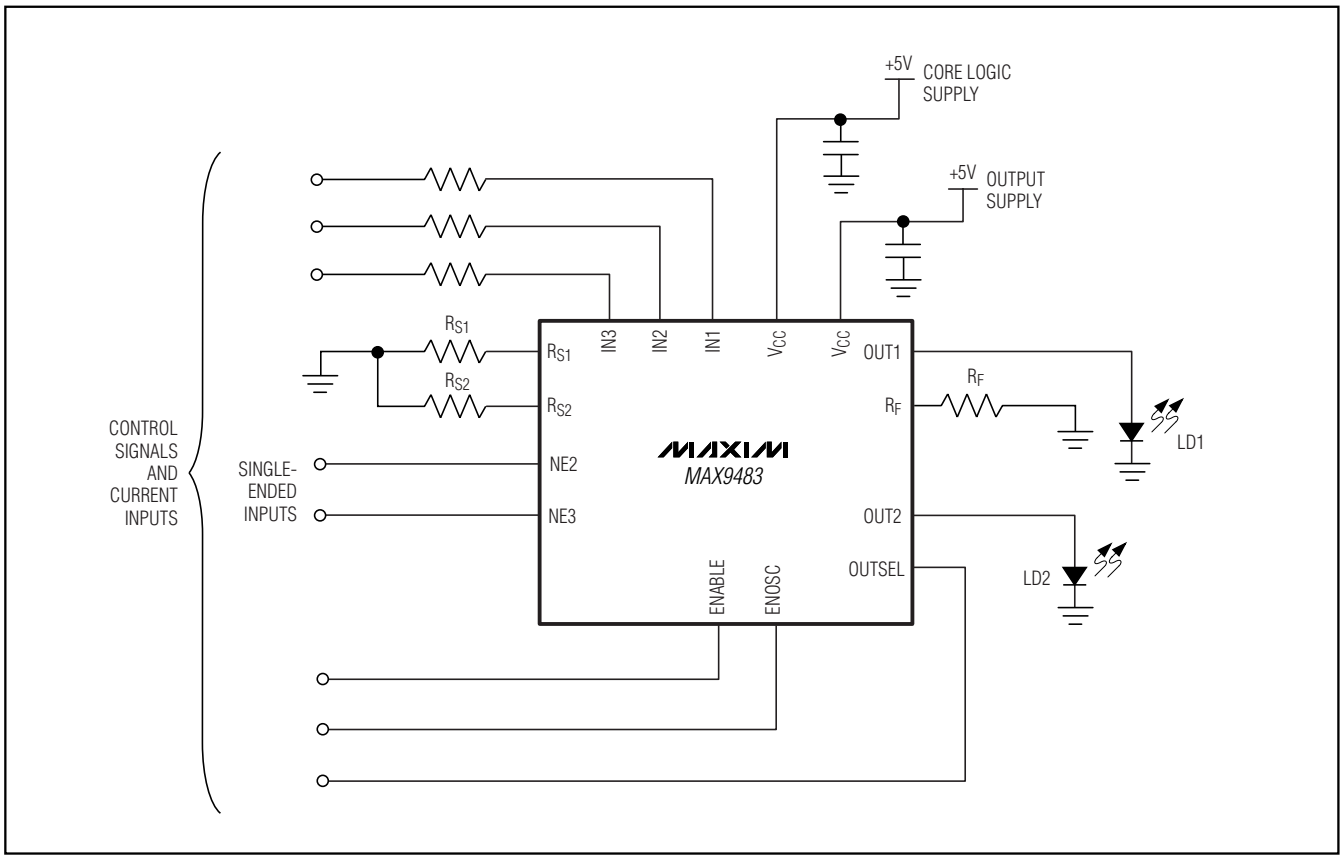


Figure 4. MAX9483 Typical Operating Circuit

Dual-Output, Multimode CD-RW/DVD Laser-Diode Drivers

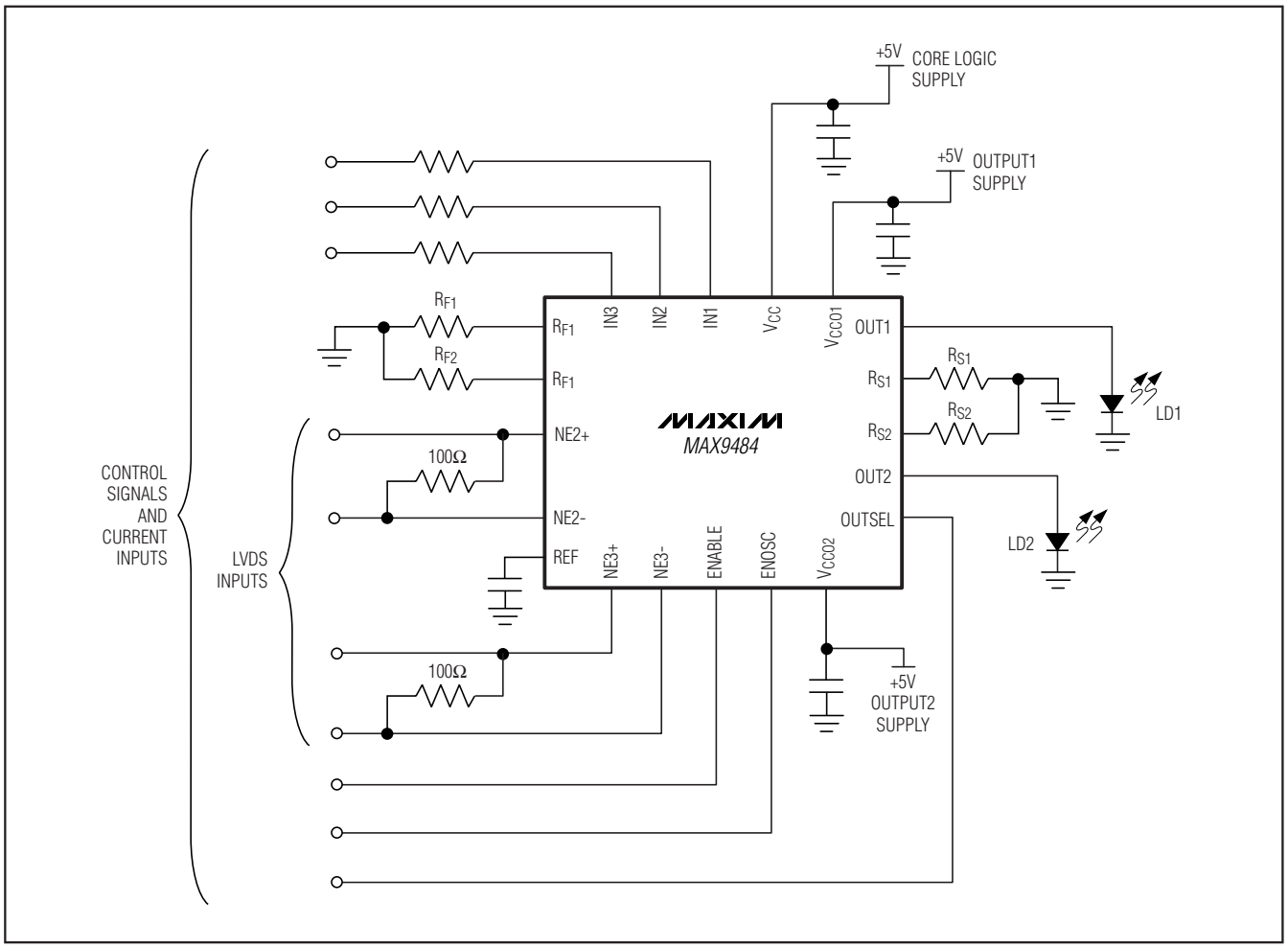


Figure 5. MAX9484 Typical Operating Circuit with LVDS Inputs

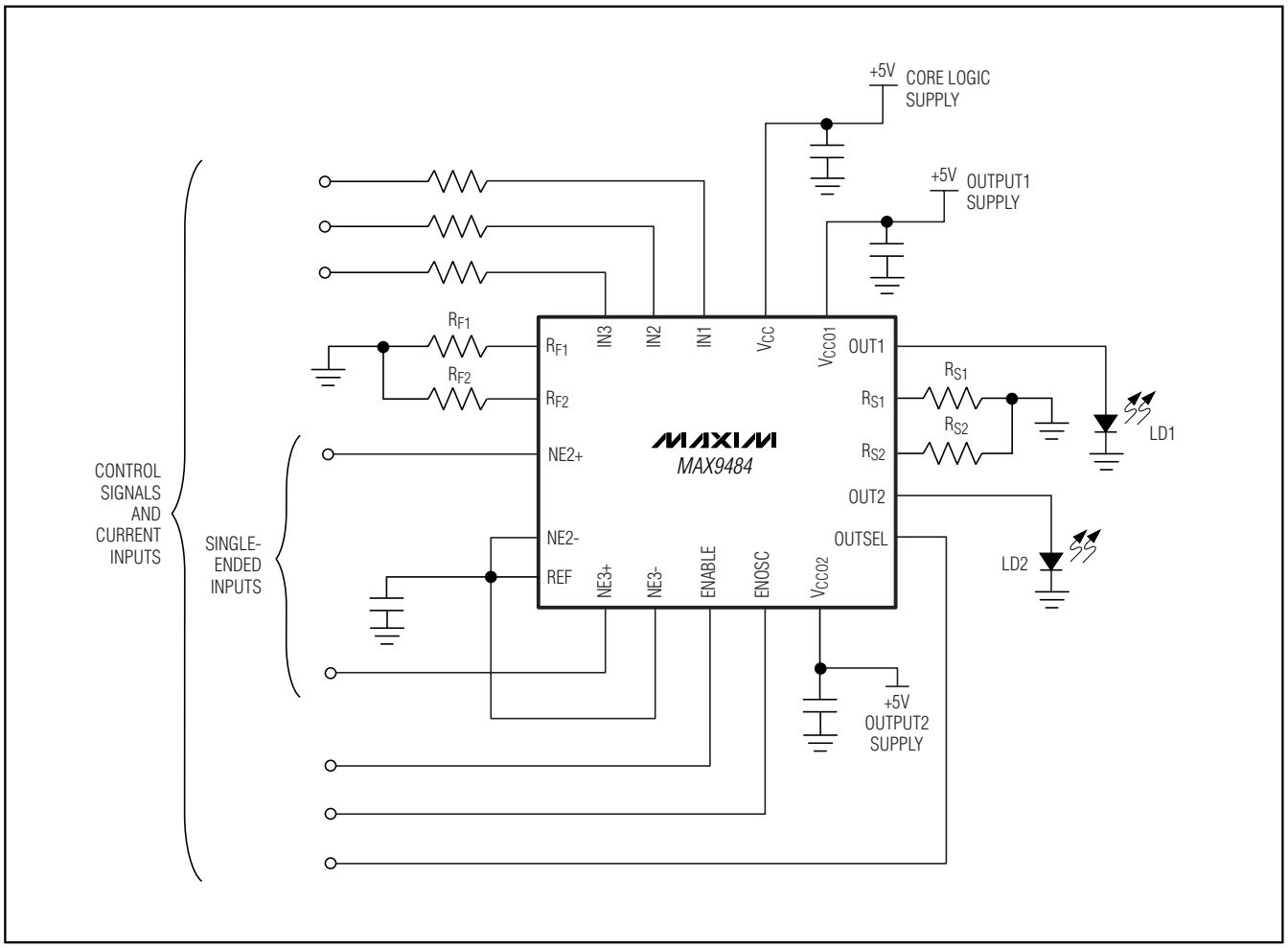
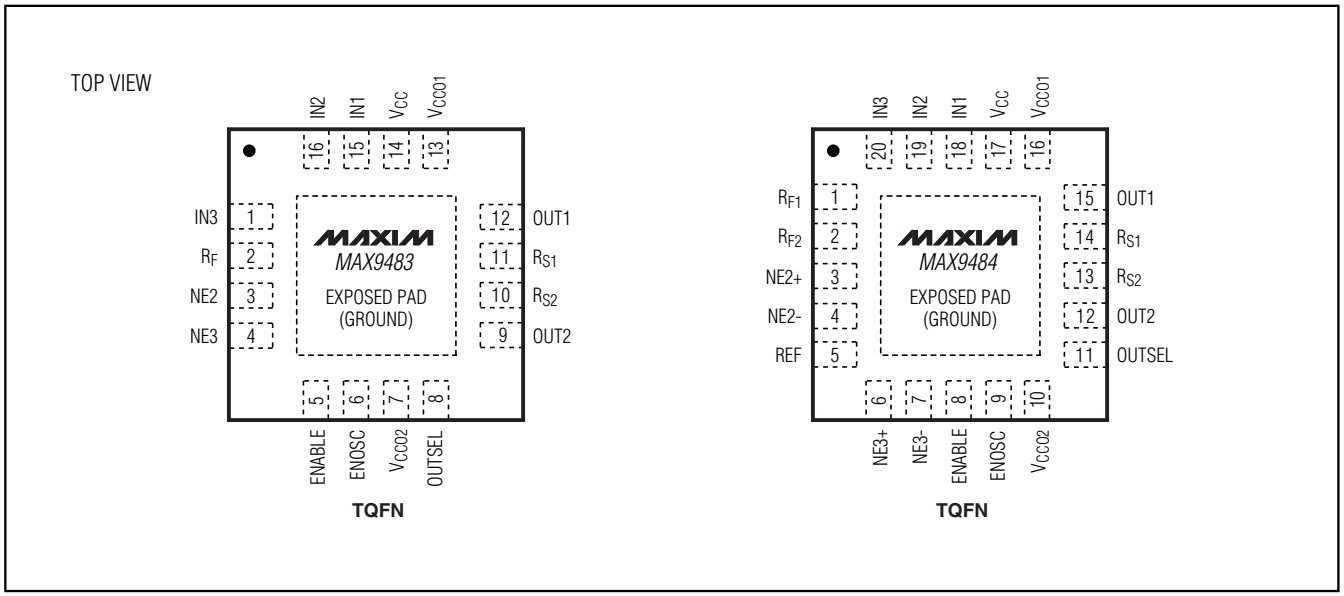


Figure 6. MAX9484 Typical Operation Circuit with Single-Ended Inputs

Dual-Output, Multimode CD-RW/DVD Laser-Diode Drivers

Pin Configurations (continued)



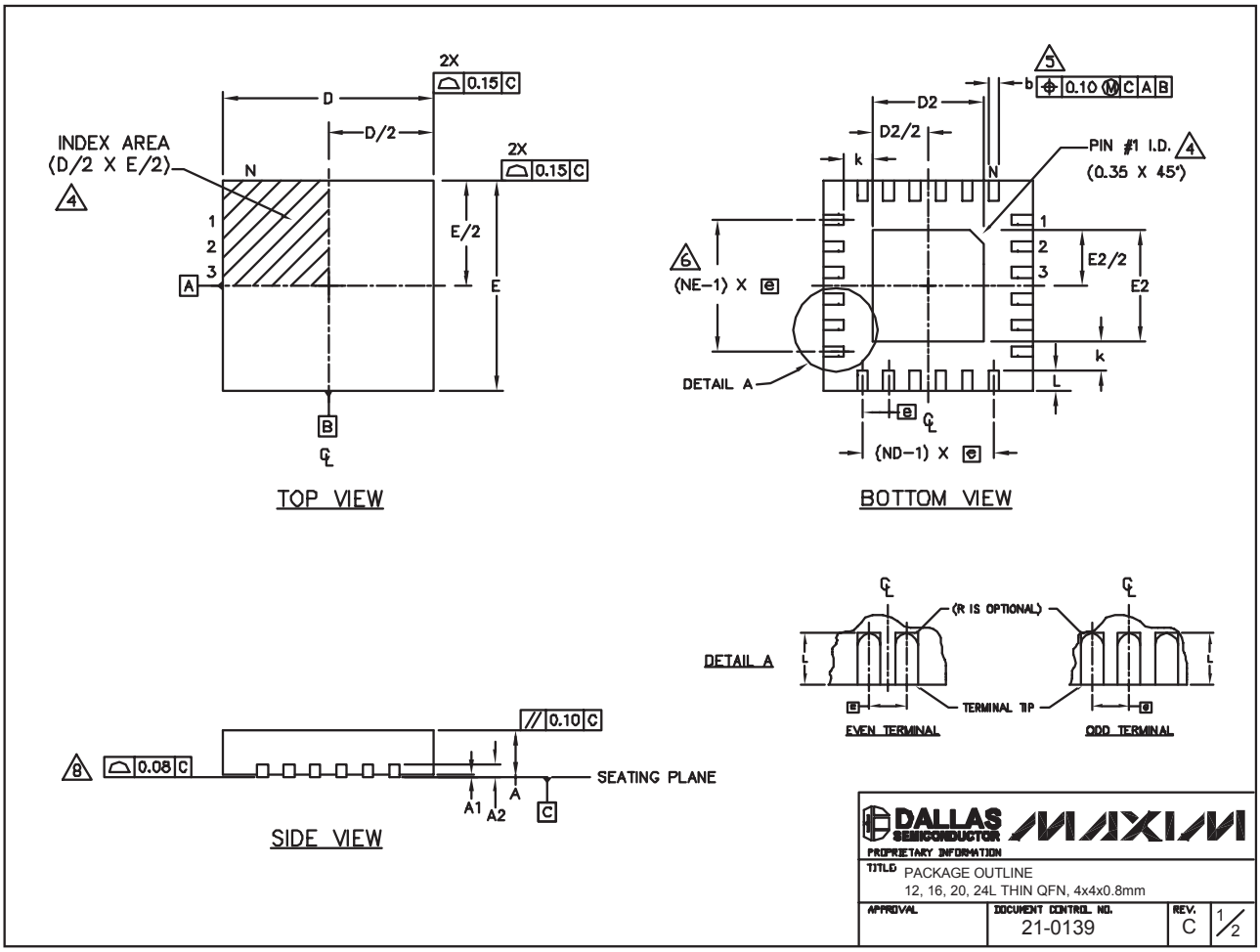
Chip Information

TRANSISTOR COUNT: 1399

Package Information

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)

24L QFN THIN.EPS



Dual-Output, Multimode CD-RW/DVD Laser-Diode Drivers

Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)

COMMON DIMENSIONS												
PKG	12L 4x4			16L 4x4			20L 4x4			24L 4x4		
REF.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.70	0.75	0.80	0.70	0.75	0.80	0.70	0.75	0.80
A1	0.0	0.02	0.05	0.0	0.02	0.05	0.0	0.02	0.05	0.0	0.02	0.05
A2	0.20 REF			0.20 REF			0.20 REF			0.20 REF		
b	0.25	0.30	0.35	0.25	0.30	0.35	0.20	0.25	0.30	0.18	0.23	0.30
D	3.90	4.00	4.10	3.90	4.00	4.10	3.90	4.00	4.10	3.90	4.00	4.10
E	3.90	4.00	4.10	3.90	4.00	4.10	3.90	4.00	4.10	3.90	4.00	4.10
e	0.80 BSC.			0.65 BSC.			0.50 BSC.			0.50 BSC.		
k	0.25	-	-	0.25	-	-	0.25	-	-	0.25	-	-
L	0.45	0.55	0.65	0.45	0.55	0.65	0.45	0.55	0.65	0.30	0.40	0.50
N	12			16			20			24		
ND	3			4			5			6		
NE	3			4			5			6		
Jedec Var.	WGGB			WGGC			WGGD-1			WGGD-2		

EXPOSED PAD VARIATIONS							
PKG. CODES	D2			E2			DOWN BONDS ALLOWED
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	
T1244-2	1.95	2.10	2.25	1.95	2.10	2.25	NO
T1244-3	1.95	2.10	2.25	1.95	2.10	2.25	YES
T1244-4	1.95	2.10	2.25	1.95	2.10	2.25	NO
T1644-2	1.95	2.10	2.25	1.95	2.10	2.25	NO
T1644-3	1.95	2.10	2.25	1.95	2.10	2.25	YES
T1644-4	1.95	2.10	2.25	1.95	2.10	2.25	NO
T2044-1	1.95	2.10	2.25	1.95	2.10	2.25	NO
T2044-2	1.95	2.10	2.25	1.95	2.10	2.25	YES
T2044-3	1.95	2.10	2.25	1.95	2.10	2.25	NO
T2444-1	2.45	2.60	2.63	2.45	2.60	2.63	NO
T2444-2	1.95	2.10	2.25	1.95	2.10	2.25	YES
T2444-3	2.45	2.60	2.63	2.45	2.60	2.63	YES
T2444-4	2.45	2.60	2.63	2.45	2.60	2.63	NO

NOTES:

1. DIMENSIONING & TOLERANCING CONFORM TO ASME Y14.5M-1994.
2. ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
3. N IS THE TOTAL NUMBER OF TERMINALS.
4. THE TERMINAL #1 IDENTIFIER AND TERMINAL NUMBERING CONVENTION SHALL CONFORM TO JESD 95-1 SPP-012. DETAILS OF TERMINAL #1 IDENTIFIER ARE OPTIONAL, BUT MUST BE LOCATED WITHIN THE ZONE INDICATED. THE TERMINAL #1 IDENTIFIER MAY BE EITHER A MOLD OR MARKED FEATURE.
5. DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.25 mm AND 0.30 mm FROM TERMINAL TIP.
6. ND AND NE REFER TO THE NUMBER OF TERMINALS ON EACH D AND E SIDE RESPECTIVELY.
7. DEPOPULATION IS POSSIBLE IN A SYMMETRICAL FASHION.
8. COPLANARITY APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS.
9. DRAWING CONFORMS TO JEDEC MO220, EXCEPT FOR T2444-1, T2444-3 AND T2444-4.

DALLAS SEMICONDUCTOR MAXIM

PROPRIETARY INFORMATION

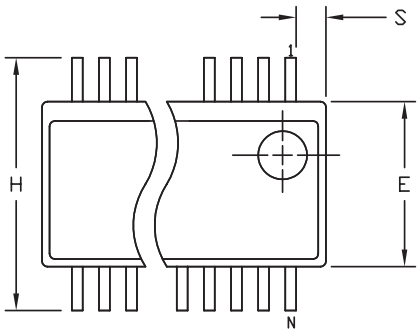
TITLE: PACKAGE OUTLINE
12, 16, 20, 24L THIN QFN, 4x4x0.8mm

APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0139	C	2/2

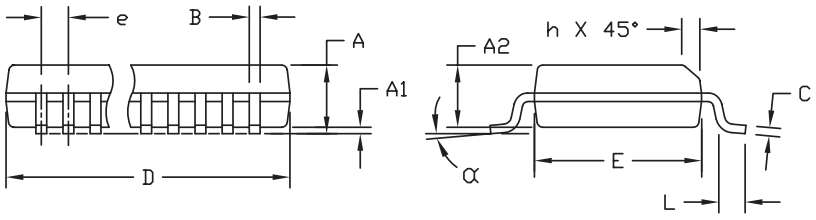
Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)

QSOP.EPS



	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	.061	.068	1.55	1.73
A1	.004	.0098	0.102	0.249
A2	.055	.061	1.40	1.55
B	.008	.012	0.20	0.30
C	.0075	.0098	0.191	0.249
D	SEE VARIATIONS			
E	.150	.157	3.81	3.99
e	.025 BSC		0.635 BSC	
H	.230	.244	5.84	6.20
h	.010	.016	0.25	0.41
L	.016	.035	0.41	0.89
N	SEE VARIATIONS			
α	0°	8°	0°	8°



VARIATIONS:

	INCHES		MILLIMETERS			
	MIN.	MAX.	MIN.	MAX.	N	
D	.189	.196	4.80	4.98	16	AB
S	.0020	.0070	0.05	0.18		
D	.337	.344	8.56	8.74	20	AD
S	.0500	.0550	1.270	1.397		
D	.337	.344	8.56	8.74	24	AE
S	.0250	.0300	0.635	0.762		
D	.386	.393	9.80	9.98	28	AF
S	.0250	.0300	0.635	0.762		

NOTES:
1). D & E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
2). MOLD FLASH OR PROTRUSIONS NOT TO EXCEED .006" PER SIDE.
3). CONTROLLING DIMENSIONS: INCHES.
4). MEETS JEDEC MO137.

DALLAS SEMICONDUCTOR MAXIM
PROPRIETARY INFORMATION

TITLE:
PACKAGE OUTLINE, QSOP .150", .025" LEAD PITCH

APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0055	E	1/1