19-5715; Rev 0; 12/10

可提供评估板

四通道PCI Express均衡器/转接驱动器

概述

MAX14950是四通道均衡器/转接驱动器，通过其接收器的可编程输入均衡和可编程转接驱动电路提高PCI Express® (PCIe)信号完整性。输出电路能够恢复板上去加重损耗、补偿电路板损耗。该器件有助于优化关键PCIe部件的布局，支持带状线、印制电路微带线以及100Ω平衡电缆传输。

器件适用于PCIe，每个通道提供电路空闲和接收检测功能。器件优化用于PCIe III (8.0GT/s)和II (5.0GT/s)数据速率，同时也支持I代数据速率(2.5GT/s)。

MAX14950采用小尺寸、42引脚(3.5mm x 9.0mm) TQFN无铅封装，优化布局并可满足最小空间要求。器件规定工作在0°C至+70°C温度范围。

应用

服务器/存储设备

工业PC

测试设备

台式计算机

通信交换机

特性

- 优化支持III代(8.0GT/s)和II代(5.0GT/s)数据速率，兼容于I代设备(2.5GT/s)
- 接收检测允许全透明，无需软件操作
- 均衡功能支持长达30英寸的FR4布线
- 输入/输出回波损耗满足PCIe III (8.0GT/s)需求
- 电路空闲状态检测
- 超低延迟：160ps (典型值)传输延迟
- 随机抖动≤ 1.5ps_{RMS} (最大值)
- 确定性抖动≤ 10.5ps_{P-P} (典型值)
- 四电平可编程输入均衡
- 八电平可编程输出去加重
- 片上50Ω输入/输出端接
- +3.3V单电源供电
- 所有引脚提供±5kV人体模式(HBM)保护
- 节省空间的3.5mm x 9.0mm、TQFN封装
- 引脚兼容于MAX4950 PCIe II转接驱动器/均衡器

定购信息

PART	TEMP RANGE	PIN-PACKAGE
MAX14950CTO+	0°C to +70°C	42 TQFN-EP*

+表示无铅(Pb)/符合RoHS标准的封装。
**EP = 裸焊盘。*

PCI Express是PCI-SIG组织的注册商标。

ABSOLUTE MAXIMUM RATINGS

(Voltages referenced to GND.)
V_{CC} .... -0.3V to +4V
All Other Pins (Note 1) .... -0.3V to (V_{CC} + 0.3V)
Continuous Current IN_P/IN_N .... ±30mA
Peak Current IN_P/IN_N (pulsed for 1µs, 1% duty cycle) .... ±100mA
Continuous Power Dissipation (T_A = +70°C)
TQFN (derate 34.5mW/°C above +70°C) 2759mW

Operating Temperature Range .... 0°C to +70°C
Storage Temperature Range .... -55°C to +150°C
Junction Temperature ....+150°C
Lead Temperature (soldering, 10s) ....+300°C
Soldering Temperature (reflow) ....+260°C

Note 1: All I/O pins are clamped by internal diodes.

PACKAGE THERMAL CHARACTERISTICS (Note 2)

TQFN
Junction-to-Ambient Thermal Resistance (θ_{JA}) ....29°C/W
Junction-to-Case Thermal Resistance (θ_{JC}) ....2°C/W

Note 2: Package thermal resistances were obtained using the method described in JEDEC specification JESD51-7, using a four-layer board. For detailed information on package thermal considerations, refer to **china.maxim-ic.com/thermal-tutorial**.

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.

ELECTRICAL CHARACTERISTICS

(V_{CC} = +3.0V to +3.6V, C_{CL} = 200nF coupling capacitor on each output, R_L = 50Ω on each output, T_A = 0°C to +70°C, unless otherwise noted. Typical values are at V_{CC} = +3.3V and T_A = +25°C.) (Note 3)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
DC PERFORMANCE							
Power-Supply Range	V_{CC}			3.0		3.6	V
Supply Current	I_{CC}	EN = V_{CC}	OEQ2 = GND, OEQ1 = GND, OEQ0 = GND		205	260	mA
			OEQ2 = GND, OEQ1 = GND, OEQ0 = V_{CC}		212	270	
			OEQ2 = GND, OEQ1 = V_{CC}, OEQ0 = GND		214	270	
			OEQ2 = GND, OEQ1 = V_{CC}, OEQ0 = V_{CC}		247	305	
			OEQ2 = V_{CC}, OEQ1 = GND, OEQ0 = GND		213	270	
			OEQ2 = V_{CC}, OEQ1 = GND, OEQ0 = V_{CC}		263	330	
			OEQ2 = V_{CC}, OEQ1 = V_{CC}, OEQ0 = GND		276	345	
			OEQ2 = V_{CC}, OEQ1 = V_{CC}, OEQ0 = V_{CC}		328	410	

ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = +3.0V to +3.6V, C_{CL} = 200nF coupling capacitor on each output, R_L = 50Ω on each output, T_A = 0°C to +70°C, unless otherwise noted. Typical values are at V_{CC} = +3.3V and T_A = +25°C.) (Note 3)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Standby Current	I_{STBY}	EN = GND	OEQ2 = GND, OEQ1 = GND, OEQ0 = GND		113	150	mA
			OEQ2 = GND, OEQ1 = GND, OEQ0 = V_{CC}		122	150	
			OEQ2 = GND, OEQ1 = V_{CC}, OEQ0 = GND		125	155	
			OEQ2 = GND, OEQ1 = V_{CC}, OEQ0 = V_{CC}		150	185	
			OEQ2 = V_{CC}, OEQ1 = GND, OEQ0 = GND		122	150	
			OEQ2 = V_{CC}, OEQ1 = GND, OEQ0 = V_{CC}		172	210	
			OEQ2 = V_{CC}, OEQ1 = V_{CC}, OEQ0 = GND		184	225	
			OEQ2 = V_{CC}, OEQ1 = V_{CC}, OEQ0 = V_{CC}		237	290	
Differential Input Impedance	$Z_{RX\text{-}DIFF\text{-}DC}$	DC		80	100	120	Ω
Differential Output Impedance	$Z_{TX\text{-}DIFF\text{-}DC}$	DC		80	100	120	Ω
Common-Mode Resistance to GND When Input Terminations Are Not Powered	$Z_{RX\text{-}HIGH\text{-}IMP\text{-}DC}$	-150mV < V_{IN_CM} < 200mV		50			kΩ
Common-Mode Resistance to GND When Input Terminations Are Powered	$Z_{RX\text{-}DC}$	DC		20	25	30	Ω
Output Short-Circuit Current	$I_{TX\text{-}SHORT}$	Single-ended				90	mA
Common-Mode Delta Between Active and Idle States	$V_{TX\text{-}CM\text{-}DC\text{-}ACTIVE\text{-}IDLE\text{-}DELTA}$					8	mV
DC Output Offset During Active State	$V_{TX\text{-}ACTIVE\text{-}DIFF\text{-}DC}$	$\lvert(V_{OUT\_P} - V_{OUT\_N})\rvert$				65	mV
DC Output Offset During Electrical Idle	$V_{TX\text{-}IDLE\text{-}DIFF\text{-}DC}$	$\lvert(V_{OUT\_P} - V_{OUT\_N})\rvert$				65	mV

ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = +3.0V to +3.6V, C_{CL} = 200nF coupling capacitor on each output, R_L = 50Ω on each output, T_A = 0°C to +70°C, unless otherwise noted. Typical values are at V_{CC} = +3.3V and T_A = +25°C.) (Note 3)

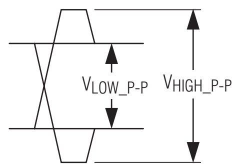
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
AC PERFORMANCE (Note 4)						
Differential Input Return Loss	$RL_{RX-DIFF}$	f = 0.05GHz to 1.25GHz	10			dB
		f = 1.25GHz to 2.5GHz	8			
		f = 2.5GHz to 4GHz	5			
Common-Mode Input Return Loss	RL_{RX-CM}	f = 0.05GHz to 2.5GHz	6			dB
		f = 2.5GHz to 4GHz	4			
Differential Output Return Loss	$RL_{TX-DIFF}$	f = 0.05GHz to 1.25GHz	10			dB
		f = 1.25GHz to 2.5GHz	8			
		f = 2.5GHz to 4GHz	4			
Common-Mode Output Return Loss	RL_{TX-CM}	f = 0.05GHz to 2.5GHz	6			dB
		f = 2.5GHz to 4GHz	4			
Redriver Operation Differential Input-Signal Range	$V_{RX-DIFF-PP}$		100		1200	mV_{P-P}
Full-Swing Differential Output Voltage (No Deemphasis)	$V_{TX-DIFF-PP}$	$\lvert V_{OUT\_P} - V_{OUT\_N} \rvert$, OEQ2 = GND, OEQ1 = GND, OEQ0 = GND	800		1250	mV_{P-P}
Output Deemphasis Ratio, 0dB	$V_{TX-DE-RATIO-0dB}$	OEQ2 = GND, OEQ1 = GND, OEQ0 = GND, Figure 1		0		dB
Output Deemphasis Ratio, 3.5dB	$V_{TX-DE-RATIO-3.5dB}$	OEQ2 = GND, OEQ1 = GND, OEQ0 = V_{CC}, Figure 1		3.5		dB
Output Deemphasis Ratio, 6dB	$V_{TX-DE-RATIO-6dB}$	OEQ2 = GND, OEQ1 = V_{CC}, OEQ0 = GND, Figure 1		6		dB
Output Deemphasis Ratio, 6dB with Higher Amplitude	$V_{TX-DE-HA-RATIO-6dB}$	OEQ2 = GND, OEQ1 = V_{CC}, OEQ0 = V_{CC}, Figure 1		6		dB
Output Deemphasis Ratio, 3.5dB with Preshoot	$V_{TX-DE-PS-RATIO-3.5dB}$	OEQ2 = V_{CC}, OEQ1 = GND, OEQ0 = GND, Figure 1		3.5		dB
Output Deemphasis Ratio, 6dB with Preshoot	$V_{TX-DE-PS-RATIO-6dB}$	OEQ2 = V_{CC}, OEQ1 = GND, OEQ0 = V_{CC}, Figure 1		6		dB
Output Deemphasis Ratio, 9dB with Preshoot	$V_{TX-DE-PS-RATIO-9dB}$	OEQ2 = V_{CC}, OEQ1 = V_{CC}, OEQ0 = GND, Figure 1		9		dB
Output Deemphasis Ratio, 9dB with Preshoot with Higher Amplitude	$V_{TX-DE-PS-HA-RATIO-9dB}$	OEQ2 = V_{CC}, OEQ1 = V_{CC}, OEQ0 = V_{CC}, Figure 1		9		dB
Input Equalization, 3dB	$V_{RX-EQ-3dB}$	INEQ1 = GND, INEQ0 = GND (Note 5)		3		dB
Input Equalization, 5dB	$V_{RX-EQ-5dB}$	INEQ1 = GND, INEQ0 = V_{CC} (Note 5)		5		dB
Input Equalization, 7dB	$V_{RX-EQ-7dB}$	INEQ1 = V_{CC}, INEQ0 = GND (Note 5)		7		dB

ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = +3.0V to +3.6V, C_{CL} = 200nF coupling capacitor on each output, R_L = 50Ω on each output, T_A = 0°C to +70°C, unless otherwise noted. Typical values are at V_{CC} = +3.3V and T_A = +25°C.) (Note 3)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Input Equalization, 9dB	$V_{RX-EQ-9dB}$	INEQ1 = V_{CC}, INEQ0 = V_{CC} (Note 5)		9		dB
AC PERFORMANCE (Note 4)						
Output Common-Mode Voltage Swing Peak-to-Peak	$V_{TX-CM-AC-PP}$	Max(V_{OUT_P} + V_{OUT_N})/2 - Min(V_{OUT_P} + V_{OUT_N})/2			100	mV_{P-P}
Propagation Delay	t_{PD}		120	160	240	ps
Rise/Fall Time	$t_{TX-RISE-FALL}$	(Note 6)	20			ps
Rise/Fall Time Mismatch	$t_{TX-RF-MISMATCH}$	(Note 6)			3	ps
Output Skew Same Pair	t_{SK}	f = 2.5GHz			5	ps
Deterministic Jitter	$t_{TX-DJ-DD}$	K28.5 pattern, AC-coupled, R_L = 50Ω, data rate = 8GT/s		10.5	23.5	ps_{P-P}
Random Jitter	$t_{TX-RJ-DD}$	D10.2 pattern, no deemphasis, no preshoot, data rate = 8GT/s			1.5	ps_{RMS}
Electrical Idle Entry Delay	$t_{TX-IDLE-SET-TO-IDLE}$	From input to output, D10.2 pattern, data rate = 1GT/s		5	8	ns
Electrical Idle Exit Delay	$t_{TX-IDLE-TO-DIFF-DATA}$	From input to output, D10.2 pattern, data rate = 1GT/s		5	8	ns
Electrical Idle Detect Threshold	$V_{TX-IDLE-THRESH}$	D10.2 pattern, data rate = 1GT/s, EITH = GND (Note 3)	65	112	175	mV_{P-P}
		D10.2 pattern, data rate = 1GT/s, EITH = V_{CC} (Note 4) — V_{IH}	65		175	
		D10.2 pattern, data rate = 1GT/s, EITH = V_{CC} (Note 4) — V_{IL}	30		140	
Output Voltage During Electrical Idle (AC)	$V_{TX-IDLE-DIFF-AC-P}$	|(V_{OUT_P} - V_{OUT_N})|			20	mV_{P-P}
Receiver Detection Pulse Amplitude	$V_{TX-RCV-DETECT}$	Voltage change in positive direction			600	mV
Receiver Detection Pulse Width				100		ns
Receiver Detection Retry Period				200		ns
CONTROL LOGIC						
Input Logic-Level Low	V_{IL}				0.6	V
Input Logic-Level High	V_{IH}		1.4			V
Input Logic Hysteresis	V_{HYST}			0.1		V
Input Pulldown Resistance	R_{PD}		200	250		kΩ
ESD PROTECTION						
ESD Voltage		Human Body Model		±5		kV

Note 3: All units are 100% production tested at T_A = +70°C. Specifications for all temperature limits are guaranteed by design.
Note 4: Guaranteed by design, unless otherwise noted.
Note 5: Equivalent to same amount of deemphasis driving the input.
Note 6: Rise and fall times are measured using 20% and 80% levels.



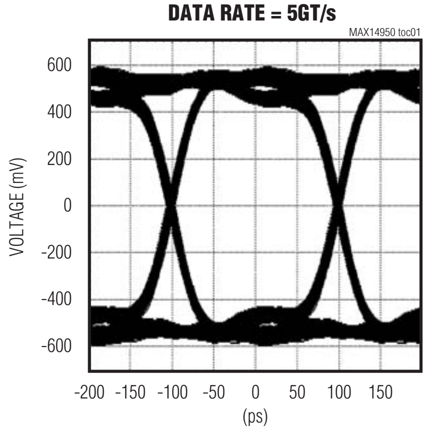
$$DE(dB) = 20\left[\log\left(\frac{V_{HIGH\_P-P}}{V_{LOW\_P-P}}\right)\right]$$

图1. 输出去加重说明

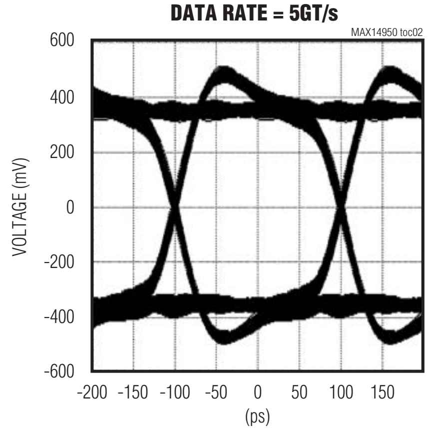
典型工作特性

(T_A = +25°C, unless otherwise noted.)

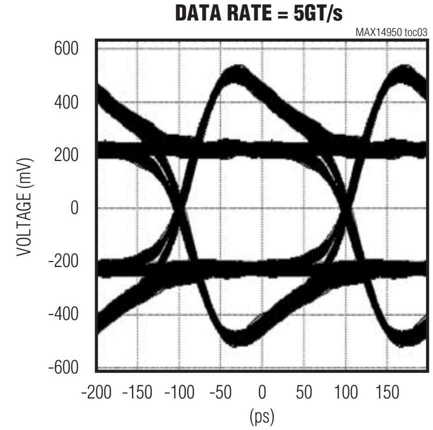
INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$, OEQ0 = 0, OEQ1 = 0, OEQ2 = 0, DATA RATE = 5GT/s



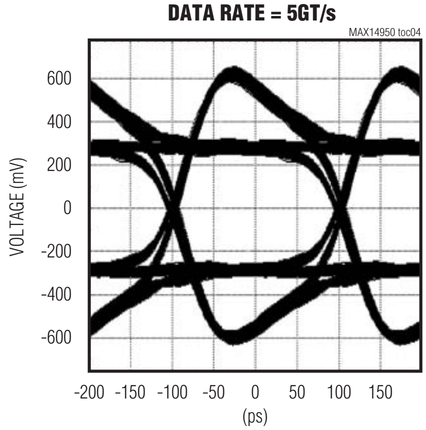
INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$, OEQ0 = 1, OEQ1 = 0, OEQ2 = 0, DATA RATE = 5GT/s



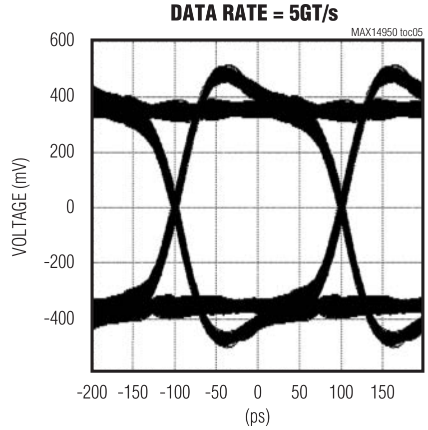
INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$, OEQ0 = 0, OEQ1 = 1, OEQ2 = 0, DATA RATE = 5GT/s



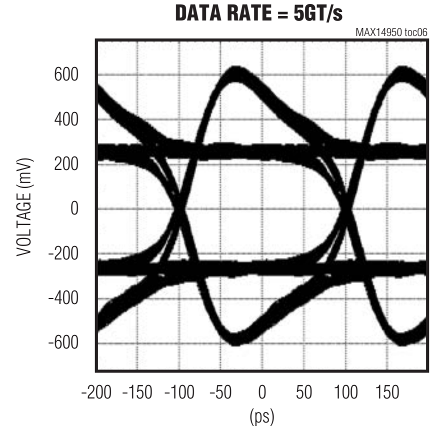
INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$, OEQ0 = 1, OEQ1 = 1, OEQ2 = 0, DATA RATE = 5GT/s



INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$, OEQ0 = 0, OEQ1 = 0, OEQ2 = 1, DATA RATE = 5GT/s



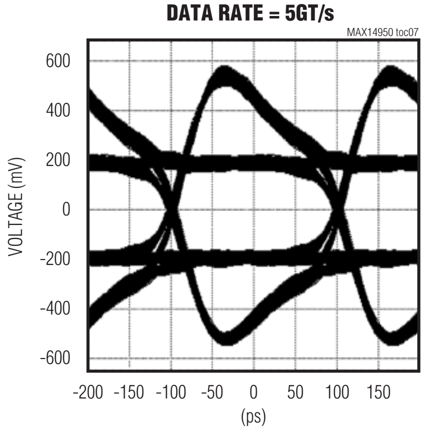
INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$, OEQ0 = 1, OEQ1 = 0, OEQ2 = 1, DATA RATE = 5GT/s



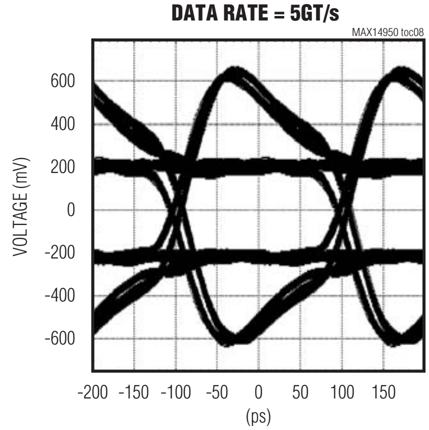
典型工作特性(续)

(T_A = +25°C, unless otherwise noted.)

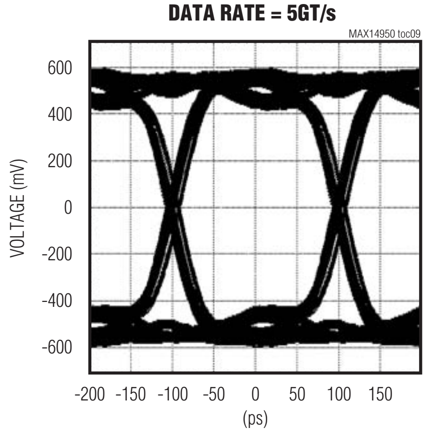
INEQ0 = INEQ1 = 0, V_{IN} = 200mV_{P-P}, OEQ0 = 1, OEQ1 = 0, OEQ2 = 1, DATA RATE = 5GT/s



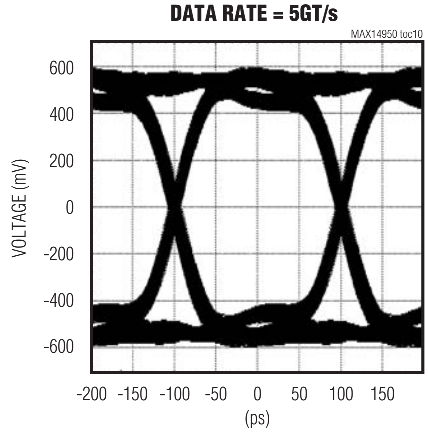
INEQ0 = INEQ1 = 0, V_{IN} = 200mV_{P-P}, OEQ0 = 1, OEQ1 = 1, OEQ2 = 1, DATA RATE = 5GT/s



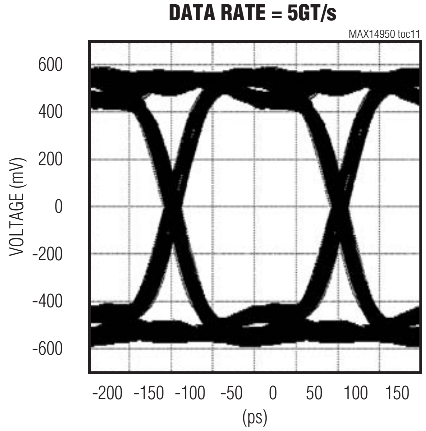
INEQ0 = 1, INEQ1 = 0, V_{IN} = 500mV_{P-P}, WITH 6in STRIPLINE, OEQ0 = OEQ1 = OEQ2 = 0, DATA RATE = 5GT/s



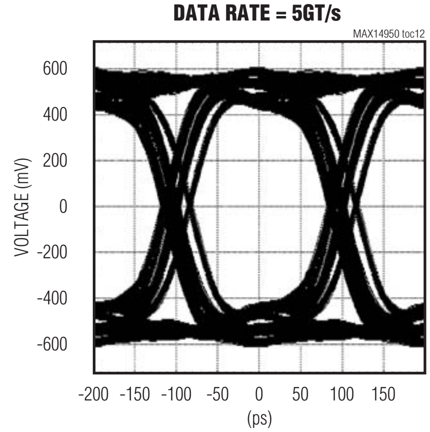
INEQ0 = 0, INEQ1 = 1, V_{IN} = 500mV_{P-P}, WITH 19in STRIPLINE, OEQ0 = OEQ1 = OEQ2 = 0, DATA RATE = 5GT/s



INEQ0 = 1, INEQ1 = 1, V_{IN} = 500mV_{P-P}, WITH 19in STRIPLINE, OEQ0 = OEQ1 = OEQ2 = 0, DATA RATE = 5GT/s



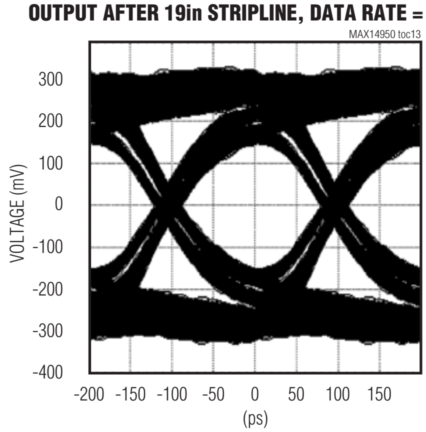
INEQ0 = 0, INEQ1 = 0, V_{IN} = 500mV_{P-P}, WITH 19in STRIPLINE, OEQ0 = OEQ1 = OEQ2 = 0, DATA RATE = 5GT/s



典型工作特性(续)

(T_A = +25°C, unless otherwise noted.)

INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$,
OEQ0 = 1, OEQ1 = 0, OEQ2 = 0,
OUTPUT AFTER 19in STRIPLINE, DATA RATE = 5GT/s



INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$,
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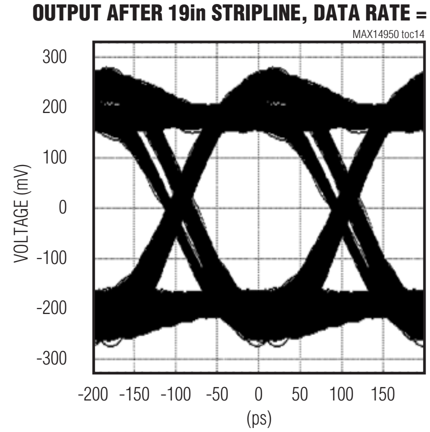
OUTPUT AFTER 19in STRIPLINE, DATA RATE = 5GT/s



INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$,
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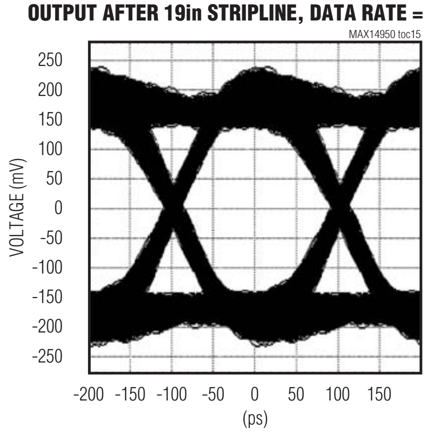
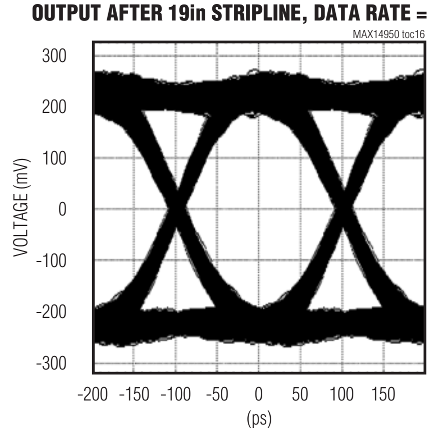
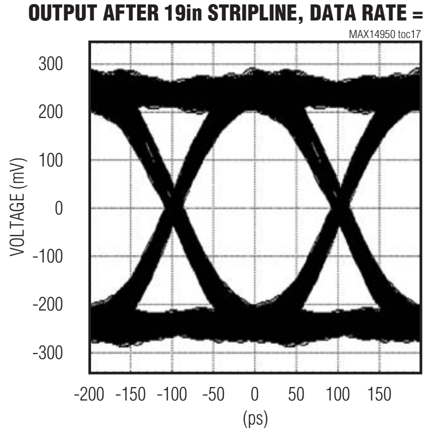
OUTPUT AFTER 19in STRIPLINE, DATA RATE = 5GT/s



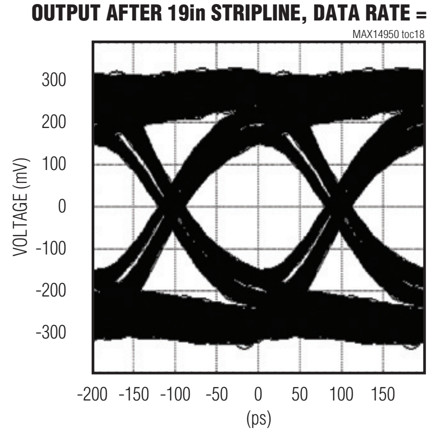
INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$,
OEQ0 = 1, OEQ1 = 0, OEQ2 = 1,
OUTPUT AFTER 19in STRIPLINE, DATA RATE = 5GT/s



INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$,
OEQ0 = 1, OEQ1 = 1, OEQ2 = 0,
OUTPUT AFTER 19in STRIPLINE, DATA RATE = 5GT/s



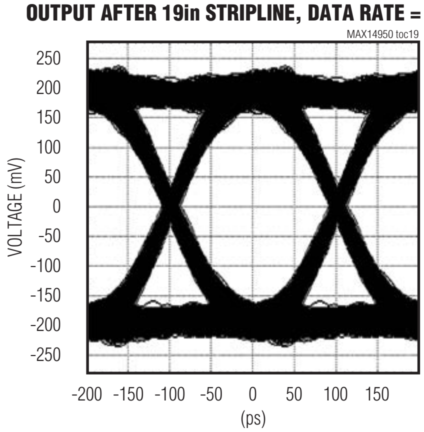
INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$,
OEQ0 = 1, OEQ1 = 0, OEQ2 = 1,
OUTPUT AFTER 19in STRIPLINE, DATA RATE = 5GT/s



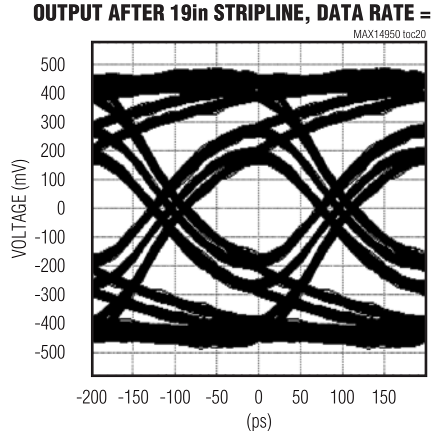
典型工作特性(续)

(T_A = +25°C, unless otherwise noted.)

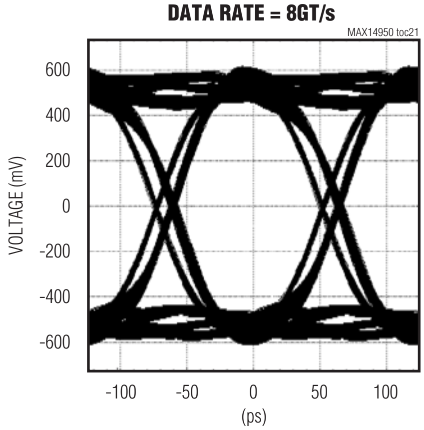
INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$, OEQ0 = 0, OEQ1 = 1, OEQ2 = 0, OUTPUT AFTER 19in STRIPLINE, DATA RATE = 5GT/s



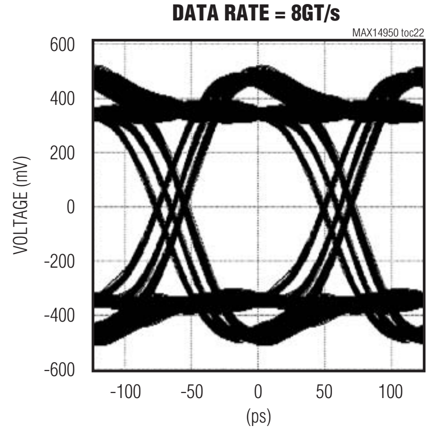
INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$, OEQ0 = 0, OEQ1 = 0, OEQ2 = 0, OUTPUT AFTER 19in STRIPLINE, DATA RATE = 5GT/s



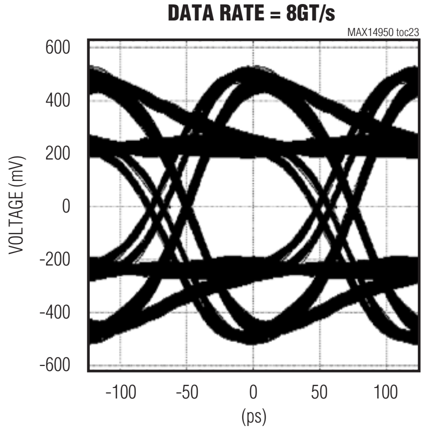
INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$, OEQ0 = 0, OEQ1 = 0, OEQ2 = 0, DATA RATE = 8GT/s



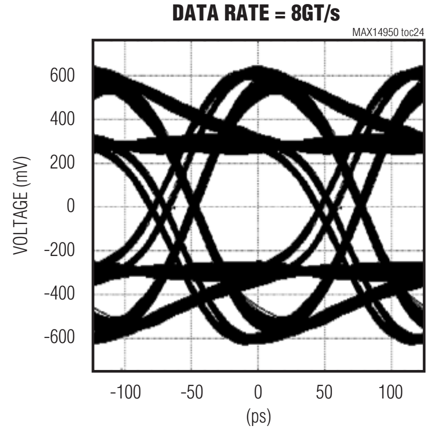
INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$, OEQ0 = 1, OEQ1 = 0, OEQ2 = 0, DATA RATE = 8GT/s



INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$, OEQ0 = 0, OEQ1 = 1, OEQ2 = 0, DATA RATE = 8GT/s



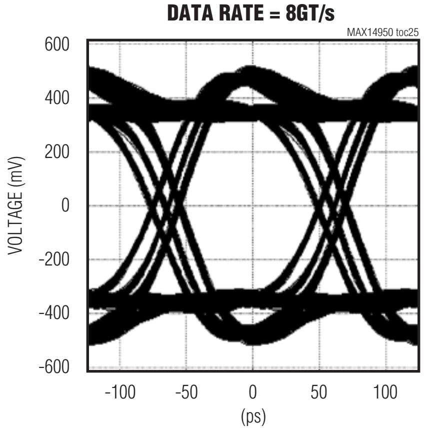
INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$, OEQ0 = 1, OEQ1 = 1, OEQ2 = 0, DATA RATE = 8GT/s



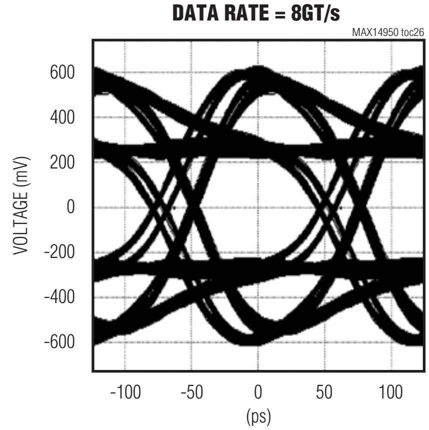
典型工作特性(续)

(T_A = +25°C, unless otherwise noted.)

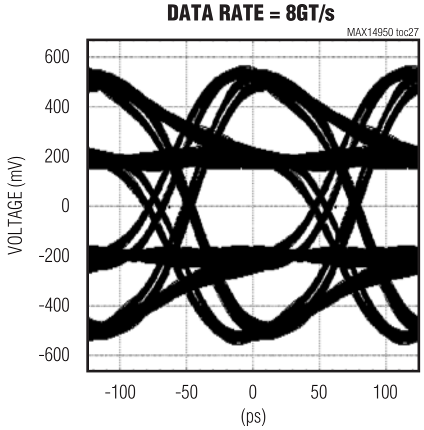
INEQ0 = INEQ1 = 0, V_{IN} = 200mV_{P-P},
OEQ0 = 0, OEQ1 = 0, OEQ2 = 1,
DATA RATE = 8GT/s



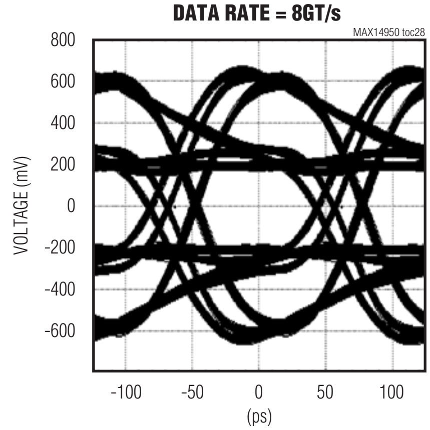
INEQ0 = INEQ1 = 0, V_{IN} = 200mV_{P-P},
OEQ0 = 1, OEQ1 = 0, OEQ2 = 1,
DATA RATE = 8GT/s



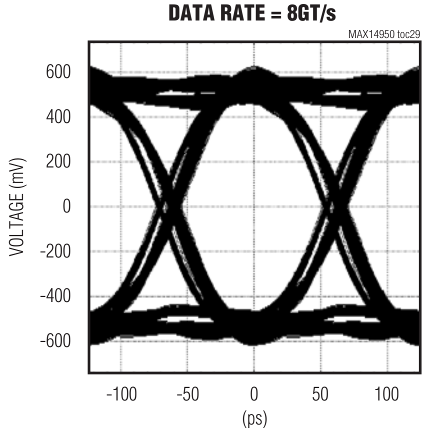
INEQ0 = INEQ1 = 0, V_{IN} = 200mV_{P-P},
OEQ0 = 0, OEQ1 = 1, OEQ2 = 1,
DATA RATE = 8GT/s



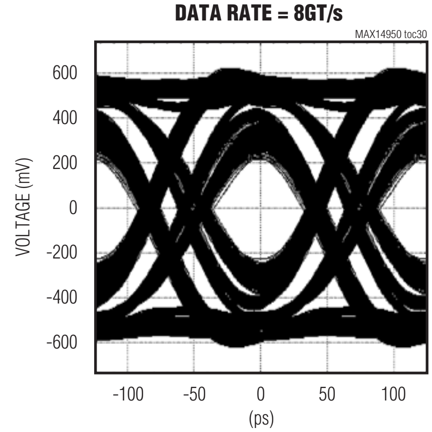
INEQ0 = INEQ1 = 0, V_{IN} = 200mV_{P-P},
OEQ0 = 1, OEQ1 = 1, OEQ2 = 1,
DATA RATE = 8GT/s



INEQ0 = 1, INEQ1 = 0, V_{IN} = 500mV_{P-P},
WITH 6in STRIPLINE, OEQ0 = OEQ1 = OEQ2 = 0,
DATA RATE = 8GT/s

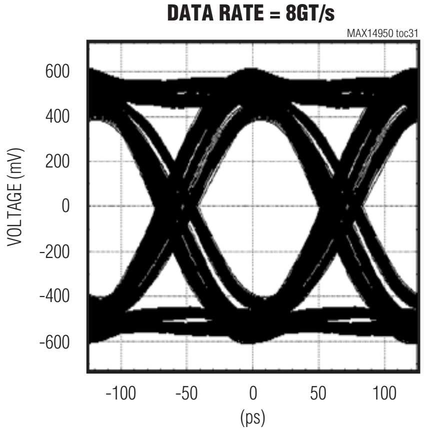


INEQ0 = 0, INEQ1 = 1, V_{IN} = 500mV_{P-P},
WITH 19in STRIPLINE, OEQ0 = OEQ1 = OEQ2 = 0,
DATA RATE = 8GT/s

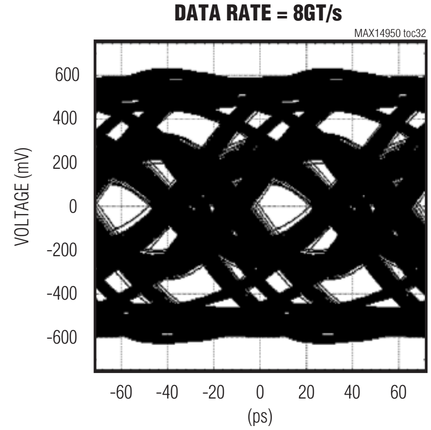


(T$_A$ = +25°C, unless otherwise noted.)

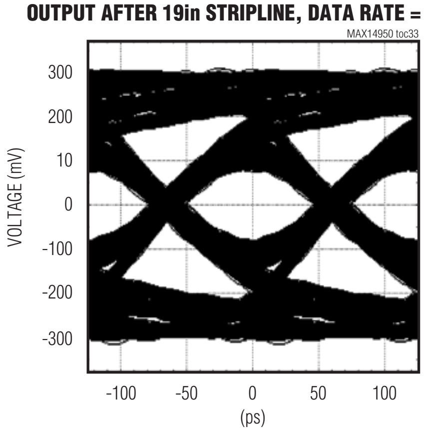
INEQ0 = 1, INEQ1 = 1, V$_{IN}$ = 500mV$_{P-P}$, WITH 19in STRIPLINE, OEQ0 = OEQ1 = OEQ2 = 0, DATA RATE = 8GT/s



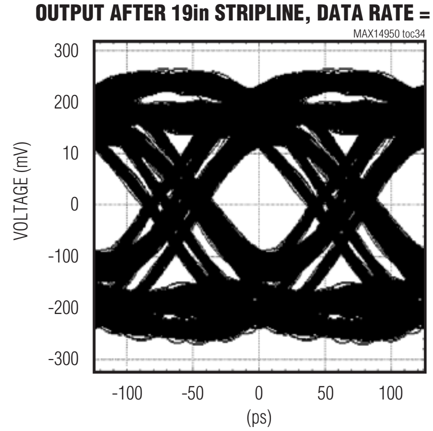
INEQ0 = 0, INEQ1 = 0, V$_{IN}$ = 500mV$_{P-P}$, WITH 19in STRIPLINE, OEQ0 = OEQ1 = OEQ2 = 0, DATA RATE = 8GT/s



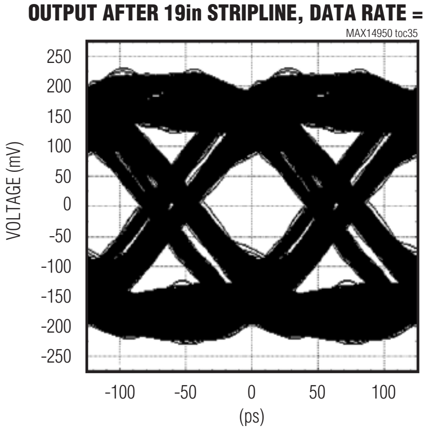
INEQ0 = INEQ1 = 0, V$_{IN}$ = 200mV$_{P-P}$, OEQ0 = 1, OEQ1 = 0, OEQ2 = 0, OUTPUT AFTER 19in STRIPLINE, DATA RATE = 8GT/s



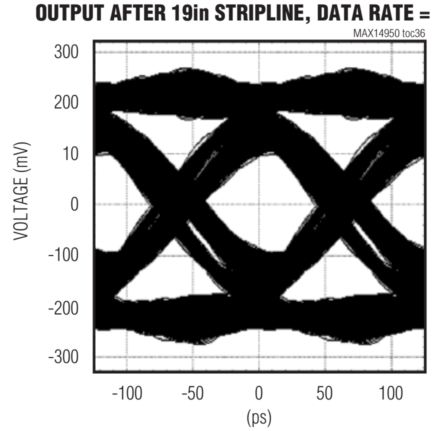
INEQ0 = INEQ1 = 0, V$_{IN}$ = 200mV$_{P-P}$, OEQ0 = 1, OEQ1 = 1, OEQ2 = 1, OUTPUT AFTER 19in STRIPLINE, DATA RATE = 8GT/s



INEQ0 = INEQ1 = 0, V$_{IN}$ = 200mV$_{P-P}$, OEQ0 = 0, OEQ1 = 1, OEQ2 = 1, OUTPUT AFTER 19in STRIPLINE, DATA RATE = 8GT/s



INEQ0 = INEQ1 = 0, V$_{IN}$ = 200mV$_{P-P}$, OEQ0 = 1, OEQ1 = 0, OEQ2 = 1, OUTPUT AFTER 19in STRIPLINE, DATA RATE = 8GT/s

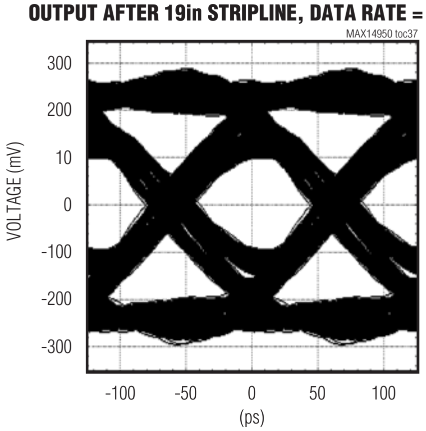


四通道PCI Express均衡器/转接驱动器

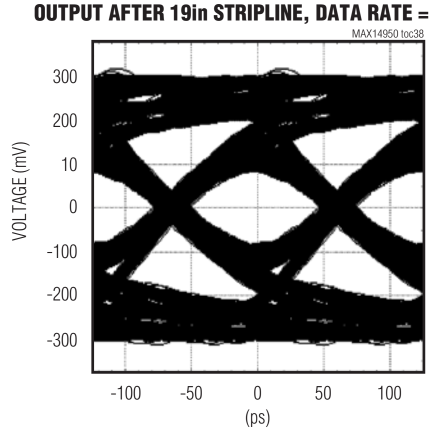
典型工作特性(续)

(T$_A$ = +25°C, unless otherwise noted.)

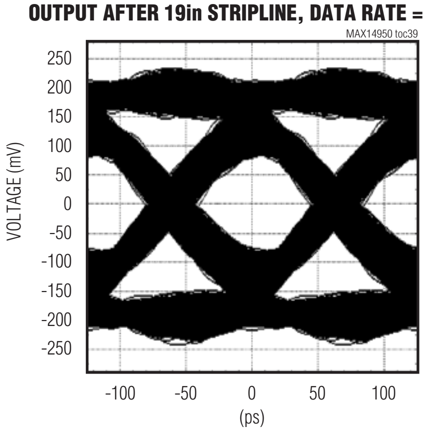
INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$, OEQ0 = 0, OEQ1 = 1, OEQ2 = 1, OUTPUT AFTER 19in STRIPLINE, DATA RATE = 8GT/s



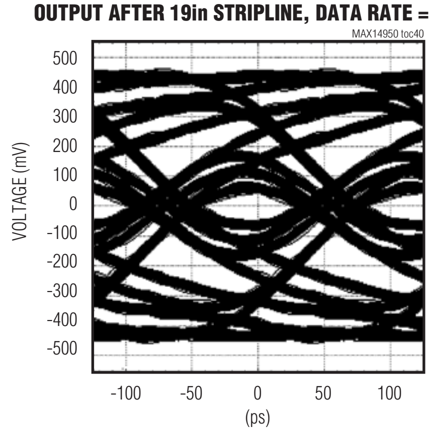
INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$, OEQ0 = 0, OEQ1 = 0, OEQ2 = 1, OUTPUT AFTER 19in STRIPLINE, DATA RATE = 8GT/s



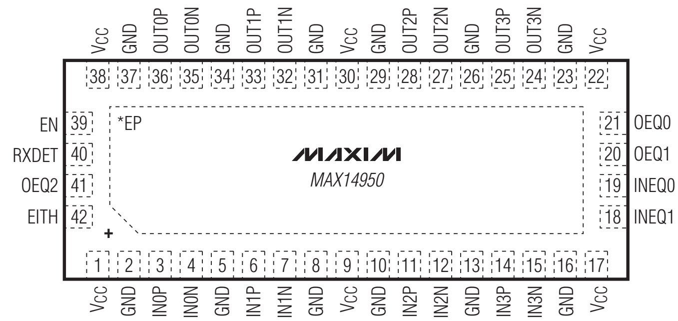
INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$, OEQ0 = 0, OEQ1 = 1, OEQ2 = 0, OUTPUT AFTER 19in STRIPLINE, DATA RATE = 8GT/s



INEQ0 = INEQ1 = 0, V_{IN} = 200mV$_{P-P}$, OEQ0 = 0, OEQ1 = 0, OEQ2 = 0, OUTPUT AFTER 19in STRIPLINE, DATA RATE = 8GT/s



引脚配置



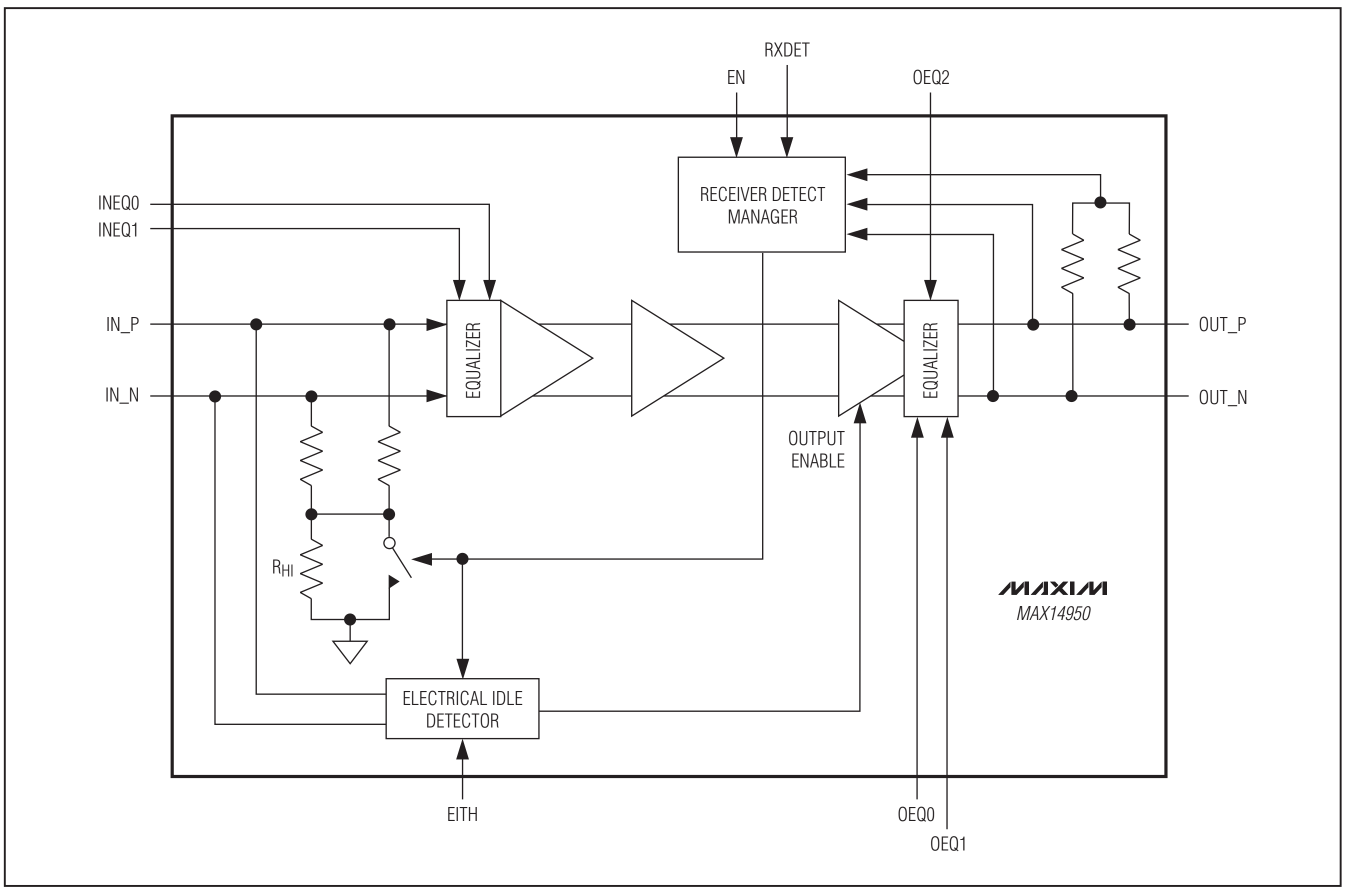
引脚说明

引脚	名称	功能
1, 9, 17, 22, 30, 38	V_{CC}	电源输入端。采用1μF和0.1μF并联电容将V_{CC}旁路至GND，电容尽可能靠近器件放置。
2, 5, 8, 10, 13, 16, 23, 26, 29, 31, 34, 37	GND	地。
3	IN0P	同相输入通道0。
4	IN0N	反相输入通道0。
6	IN1P	同相输入通道1。
7	IN1N	反相输入通道1。
11	IN2P	同相输入通道2。
12	IN2N	反相输入通道2。
14	IN3P	同相输入通道3。
15	IN3N	反相输入通道3。
18	INEQ1	输入均衡控制MSB，INEQ1在内部通过250kΩ (典型值)电阻下拉。
19	INEQ0	输入均衡控制LSB，INEQ0在内部通过250kΩ (典型值)电阻下拉。
20	OEQ1	输出去加重控制第1位，OEQ1在内部通过250kΩ (典型值)电阻下拉。
21	OEQ0	输出去加重控制LSB，OEQ0在内部通过250kΩ (典型值)电阻下拉。
24	OUT3N	反相输出通道3。
25	OUT3P	同相输出通道3。
27	OUT2N	反相输出通道2。
28	OUT2P	同相输出通道2。
32	OUT1N	反相输出通道1。
33	OUT1P	同相输出通道1。

引脚说明(续)

引脚	名称	功能
35	OUT0N	反相输出通道0。
36	OUT0P	同相输出通道0。
39	EN	使能输入，将EN驱动至低电平，进入待机模式；将EN驱动至高电平，进入正常工作模式。EN在内部通过250kΩ (典型值)电阻下拉。
40	RXDET	接收器检测控制位。将RXDET驱动至高电平，启动接收检测；正常工作模式下，将RXDET驱动至低电平。RXDET在内部通过250kΩ (典型值)电阻下拉。
41	OEQ2	输出去加重控制MSB，OEQ2在内部通过250kΩ (典型值)电阻下拉。
42	EITH	电路空闲电压输入低电平门限设置，EITH用于设置电路空闲检测门限(表4)。EITH在内部通过250kΩ (典型值)电阻下拉。
—	EP	裸焊盘。内部连接至GND，将EP连接至大面积地层以改善散热同时保证器件与地之间的良好导热通路。

功能框图



详细说明

MAX14950四通道均衡器/转接驱动器设计支持Gen III (8.0GT/s)、Gen II (5.0GT/s)和Gen I (2.5GT/s) PCIe数据速率。器件包含四路相同的驱动器，每个通道均提供电路空闲/接收检测功能，且具有均衡/去加重/前冲功能，用于补偿电路板损耗。利用可编程输入均衡电路降低确定性抖动，提高信号完整性。该器件输出级具有可编程输出去加重/前冲功能，用于优化PCIe关键电路的布局，支持更远距离的带状线、微带线或电缆传输。

可编程输入均衡

可编程输入均衡由两个设置位控制：INEQI和INEQ0 (表1)。

表1. 输入均衡

INEQ1	INEQ0	INPUT EQUALIZATION (dB)
0	0	3
0	1	5
1	0	7
1	1	9

可编程输出去加重/前冲

可编程输出去加重由三个设置位控制OEQ2、OEQ1和OEQ0，可设置去加重/前冲比例为：0dB、3.5dB、6dB和9dB (表2)。

表2. 输出去加重/前冲

OEQ2	OEQ1	OEQ0	OUTPUT DEEMPHASIS/ PRESHOOT RATIO (dB)
0	0	0	0
0	0	1	3.5
0	1	0	6
0	1	1	6 (Peak-to-Peak Swing is 1.2V)
1	0	0	3.5
1	0	1	6
1	1	0	9 (Peak-to-Peak Swing is 0.9V)
1	1	1	9 (Peak-to-Peak Swing is 1.0V)

接收检测

该器件每个通道均具有接收检测功能。初始上电时，如果EN为高电平，则启动接收检测功能。当EN为高电平时，还可通过RXDET输入的上升沿或下降沿启动接收检测功能。检测过程中，即使EN处于高电平状态，器件仍保持在低功耗待机模式并禁止输出。在某个通道检测到有效接收信号之前会重复接收检测。如果一个通道检测到有效接收信号，则其它通道的重试时间将限制到100ms (典型值)。根据接收检测的结果，使能输入共模端接和电路空闲检测(见表3)。

空闲检测

该器件具有空闲检测功能，以防止将噪声驱动到输出端。当器件检测到差分输入跌落至$V_{TX-IDLE-THRESH}$低电平检测门限以下时，将禁止输出；当差分输入信号高于$V_{TX-IDLE-THRESH}$高电平检测门限时，器件开启输出并对信号进行驱动。按照表4所示$V_{TX-IDLE-THRESH}$门限，将EITH驱动到适当的门限。空闲和转接驱动模式下的输出共模电压略有差异。

表3. 接收检测输入功能

RXDET	EN	DESCRIPTION
X	0	Receiver detection is inactive.
X	1	Following a rising edge of EN signal, indefinite retry until receiver detects at least one channel. Retries stop after 100ms (typ) if any channel receiver is detected.
Rising/Falling Edge	1	Initiates receiver detection.

X = 无关。

表4. 空闲检测门限设置

EITH	THRESHOLD LOW LIMIT (mV_{P-P})	THRESHOLD HIGH LIMIT (mV_{P-P})
0	108 (typ)	115 (typ)
1	81 (typ)	115 (typ)

四通道PCI Express均衡器/转接驱动器

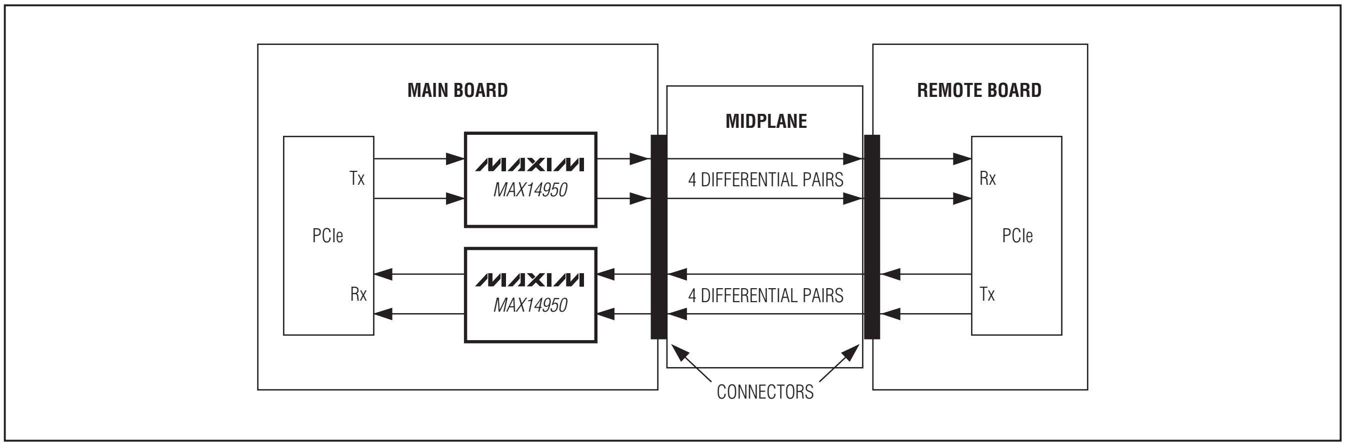


图2. 典型应用电路

应用信息

图2所示为两片MAX14950的典型应用，两个器件均安装在主板上，可独立设置输入和输出均衡，以获得最佳性能。设置接收均衡器，通过两组连接器和中间板带状传输线接收来自远端板卡的衰减信号。Rx输出仅具有小幅均衡或没有均衡。Tx部分提供高质量传输信号，并具有输出电压提升功能(去加重)。

布局

电路板布局和设计会显著影响器件的性能。采用良好的高频设计技术，包括降低地回路的电感、数据信号采用阻抗受控的传输线。电源去耦器件应该尽可能靠近V_{CC}放置，V_{CC}始终连接至电源层。推荐将接收和发送引线放置在不同电路板层，以降低串扰。

裸焊盘封装

带裸焊盘的42引脚、TQFN封装提供低热阻通道，为IC散热。器件裸焊盘必须焊接到电路板的地层，以获得最佳散热，并与地平面建立良好的导热通道。有关裸焊盘封装的更多信息，请参考Maxim应用笔记862：*HFAN-08.1: Thermal Considerations of QFN and Other Exposed-Paddle Packages*。

电源上电顺序

警告：请勿超出最大额定参数，超出规定的额定值可能导致器件永久性损坏。

推荐对所有器件采用正确的上电顺序。加载信号之前，应先接GND，然后接V_{CC}，特别是在信号不具有限流功能的情况下。

芯片信息

PROCESS: BiCMOS

封装信息

如需最近的封装外形信息和焊盘布局，请查询**china.maxim-ic.com/packages**。请注意，封装编码中的“+”、“#”或“-”仅表示RoHS状态。封装图中可能包含不同的尾缀字符，但封装图只与封装有关，与RoHS状态无关。

封装类型	封装编码	外形编号	焊盘布局编号
42 TQFN-EP	T423590+1	21-0181	90-0078

修订历史

修订号	修订日期	说明	修改页
0	12/10	最初版本。	—

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