

可提供评估板

MAXIM

## DisplayPort至DVI™/HDMI电平转换器

MAX9406

## 概述

MAX9406是高速、低偏差、四通道差分输入至电流模式逻辑(CML)电平的转换器,支持DisplayPort™(DP)至高清多媒体端口(HDMI™)的高速信号转换。该器件具有350ps的超低传输延迟和小于20ps的通道间偏差。MAX9406支持2Gbps典型数据速率。

MAX9406可为HDMI显示数据通道(DDC)和热插拔检测(HPD)提供电平转换,将5V单端逻辑转换成3.3V单端逻辑。

MAX9406采用3V至3.6V核电源供电,工作在-40°C至+85°C扩展级温度范围。该器件提供48引脚、7mm x 7mm薄型QFN封装和32引脚、5mm x 5mm薄型QFN封装。

## 应用

DP至HDMI电平转换

数据和时钟驱动器与缓冲器

背板数据和时钟分配

基站

ATE

DVI是Digital Display Working Group (DDWG)的商标。

DisplayPort是Video Electronics Standards Association (VESA)的商标。

HDMI是HDMI Licensing, LLC的商标。

## 特性

- ◆ 500mV差分HDMI输出,能够工作在2Gbps数据速率
- ◆ 350ps传输延迟
- ◆ 在2Gbps数据速率下,通道间偏差为20ps
- ◆ 低抖动: DJ = 11ps<sub>P-P</sub>, RJ = 0.5ps<sub>RMS</sub>
- ◆ 为DDC端口提供5V至3.3V的双向电平转换
- ◆ 为I/O端口提供5V至3.3V电平转换
- ◆ 内置50Ω输入匹配和偏置
- ◆ -40°C至+85°C工作温度范围

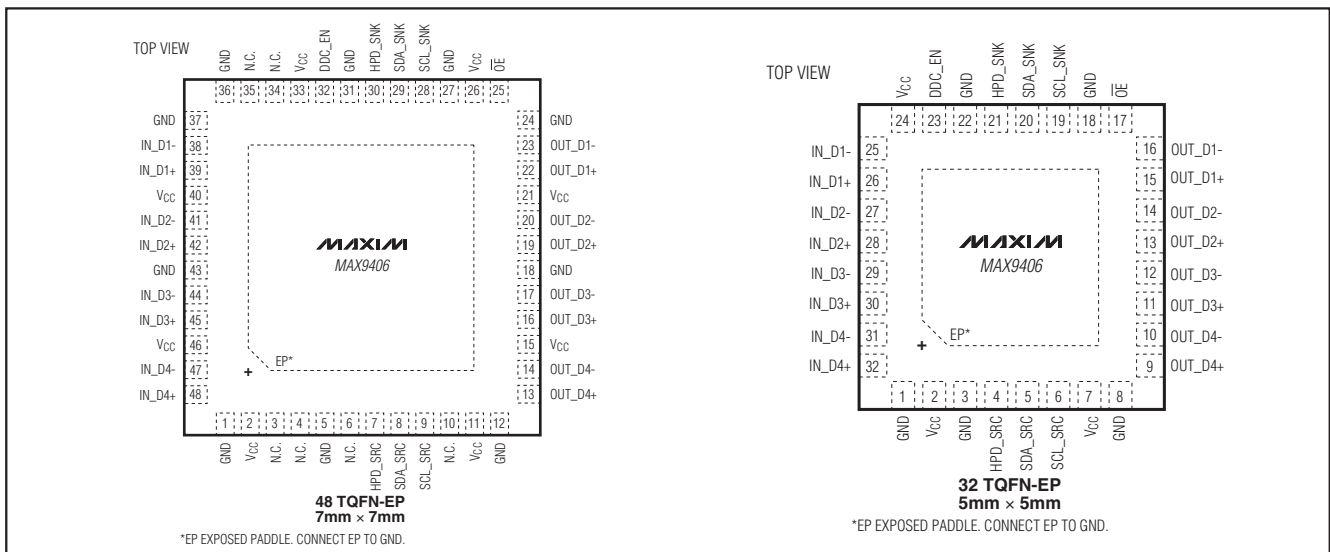
## 订购信息

PART	TEMP RANGE	PIN-PACKAGE	PKG CODE
MAX9406ETJ+	-40°C to +85°C	32 Thin QFN-EP* (5mm x 5mm x 0.8mm)	T3255-4
MAX9406ETM+	-40°C to +85°C	48 Thin QFN-EP* (7mm x 7mm x 0.8mm)	T4877-6

+表示无铅封装。

\*EP = 裸焊盘。

## 引脚配置



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Maxim Integrated Products 1

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# DisplayPort至DVI™/HDMI电平转换器

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## ABSOLUTE MAXIMUM RATINGS

V <sub>CC</sub> to GND .....	-0.3V to +4V
All Pins to GND .....	-0.3V to (V <sub>CC</sub> + 0.3V)
Short-Circuit Duration (all outputs) .....	Continuous
Continuous Power Dissipation (T <sub>A</sub> = +70°C)	
32-Pin Thin QFN (derate 21.3mW/°C above +70°C) ..	1702mW
48-Pin Thin QFN (derate 27.8mW/°C above +70°C) ..	2222mW
Junction-to-Case Thermal Resistance (θ <sub>JC</sub> ) (Note 1)	
32-Pin Thin QFN .....	+1.7°C/W
48-Pin Thin QFN .....	+0.8°C/W
Junction-to-Ambient Thermal Resistance (θ <sub>JA</sub> ) (Note 1)	
32-Pin Thin QFN .....	+29°C/W
48-Pin Thin QFN .....	+25°C/W

Operating Temperature Range .....	-40°C to +85°C
Junction Temperature .....	+150°C
Storage Temperature Range .....	-65°C to +150°C
ESD Protection	
Human Body Model (R <sub>D</sub> = 1.5kΩ, C <sub>S</sub> = 100pF)	
IN_D_ and OUT_D_ to GND .....	±1.5kV
Lead Temperature (soldering, 10s) .....	+300°C

**Note 1:** Package thermal resistances were obtained using the method described in JEDEC specification JESD51-7, using a 4-layer board. For detailed information on package thermal considerations, refer to *Application Note 4083* at [www.maxim-ic.com/thermal-tutorial](http://www.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.

## DC ELECTRICAL CHARACTERISTICS

(V<sub>CC</sub> = 3V to 3.6V, T<sub>A</sub> = -40°C to +85°C, unless otherwise noted. Typical values are at V<sub>CC</sub> = 3.3V, T<sub>A</sub> = +25°C.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
<b>OE INPUT</b>						
Input High Level	V <sub>IH1</sub>		2.4			V
Input Low Level	V <sub>IL1</sub>				0.5	V
Input Current	I <sub>IN-EN</sub>	V <sub>IN</sub> = 0 to V <sub>CC</sub>		24		μA
<b>DDC_EN INPUT</b>						
Input High Level	V <sub>IH1</sub>		2.4			V
Input Low Level	V <sub>IL1</sub>				0.5	V
Input Current	I <sub>IN-DDC</sub>	V <sub>IN</sub> = 0 to V <sub>CC</sub>		100		μA
<b>HPD INPUT AND OUTPUT</b>						
Input High Level	V <sub>IH2</sub>		2.4		5.3	V
Input Low Level	V <sub>IL2</sub>				0.8	V
Input Current	I <sub>IN2</sub>	V <sub>IN</sub> = 0 to V <sub>CC</sub>		80		μA
HPD_SNK Pulldown Resistance	R <sub>HPD</sub>		40	60		kΩ
Output High Level	V <sub>OH-HPDB</sub>		2.5		V <sub>CC</sub>	V
Output Low Level	V <sub>OL-HPDB</sub>		0	0.18	0.4	V
<b>DIFFERENTIAL INPUTS (IN_)</b>						
Differential Input High Threshold	V <sub>IDH</sub>	V <sub>ID</sub> = V <sub>IN+</sub> - V <sub>IN-</sub>			50	mV
Differential Input Low Threshold	V <sub>IDL</sub>	V <sub>ID</sub> = V <sub>IN+</sub> - V <sub>IN-</sub>	-50			mV
Common Input Voltage	V <sub>COM</sub>	V <sub>COD</sub> = DC Avg [(V <sub>IN+</sub> + V <sub>IN-</sub> ) / 2]	0	1.43	2	V
Common-Mode AC Tolerance	V <sub>CM-AC-P-P</sub>	V <sub>CM-AC-P-P</sub> = (V <sub>IN+</sub> + V <sub>IN-</sub> ) / 2 - V <sub>COD</sub>			100	mV
Differential Input Termination	R <sub>IN</sub>		40		60	Ω

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## DC ELECTRICAL CHARACTERISTICS (continued)

(V<sub>CC</sub> = 3V to 3.6V, T<sub>A</sub> = -40°C to +85°C, unless otherwise noted. Typical values are at V<sub>CC</sub> = 3.3V, T<sub>A</sub> = +25°C.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
<b>DIFFERENTIAL OUTPUTS (OUT<sub>-</sub>)</b>						
Single-Ended Output Swing	V <sub>OSW</sub>	With a 50Ω load to V <sub>CC</sub> at both pins	450		600	mV
Single-Ended Output High	V <sub>OH3</sub>	With a 50Ω load to V <sub>CC</sub> at both pins	V <sub>CC</sub> - 10mV		V <sub>CC</sub> + 10mV	mV
Single-Ended Output Low	V <sub>OL3</sub>	With a 50Ω load to V <sub>CC</sub> at both pins	V <sub>CC</sub> - 600mV		V <sub>CC</sub> - 400mV	V
Single-Ended Output Current in High-Z	I <sub>OFF</sub>		-10		+10	μA
Output Short-Circuit Current	I <sub>OS</sub>	Output pins connected to V <sub>CC</sub> or GND	-20		+20	mA
<b>POWER CONSUMPTION</b>						
Supply Current	I <sub>CC</sub>	Includes 4 channels CML termination supply current, OE = 0		77	90	mA
	I <sub>PD</sub>	$\overline{OE} = 1$		5		

## AC ELECTRICAL CHARACTERISTICS

(V<sub>CC</sub> = 3V to 3.6V, T<sub>A</sub> = -40°C to +85°C, unless otherwise noted. Typical values are at V<sub>CC</sub> = 3.3V, T<sub>A</sub> = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
<b>DIFFERENTIAL SIGNAL</b>						
Maximum Data Rate	r <sub>D</sub>		1.85			Gbps
Differential Propagation Delay	t <sub>PD</sub>			350	500	ps
Channel-to-Channel Skew	t <sub>SK</sub>			20	50	ps
Output Rise/Fall Time	t <sub>R/F</sub>		180		515	ps
Added Random Jitter	t <sub>RJ</sub>	1GHz clock input		0.5	1	ps <sub>RMS</sub>
Added Deterministic Jitter	t <sub>DJ</sub>	r <sub>D</sub> = 2Gbps, 2 <sup>23</sup> - 1 PRBS pattern		11	30	ps <sub>P-P</sub>
<b>SINGLE-ENDED SIGNAL</b>						
CLK Frequency	f <sub>SCK</sub>	Supports I <sup>2</sup> C fast mode			400	kHz
HPD_SRC Rise/Fall Time	t <sub>RF-HPDB</sub>		1		20	ns
HPD Propagation Delay	t <sub>HPD</sub>				200	ns

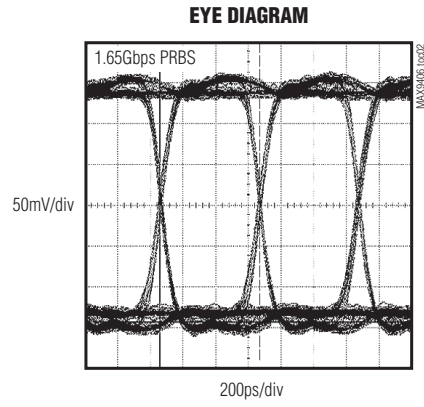
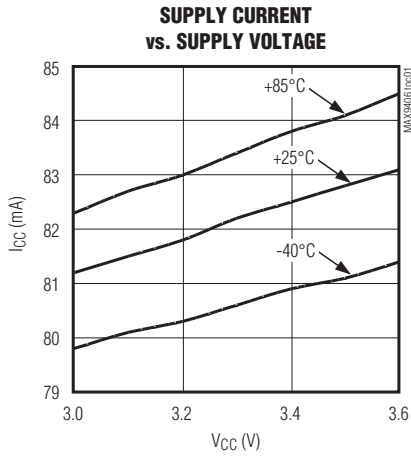
**Note 2:** AC parameters are guaranteed by design and characterization.

# DisplayPort至DVI™/HDMI电平转换器

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典型工作特性

( $V_{CC} = 3.3V$ , outputs terminated with  $50\Omega$ ,  $T_A = +25^\circ C$ , unless otherwise noted.)



# DisplayPort至DVI™/HDMI电平转换器

引脚说明

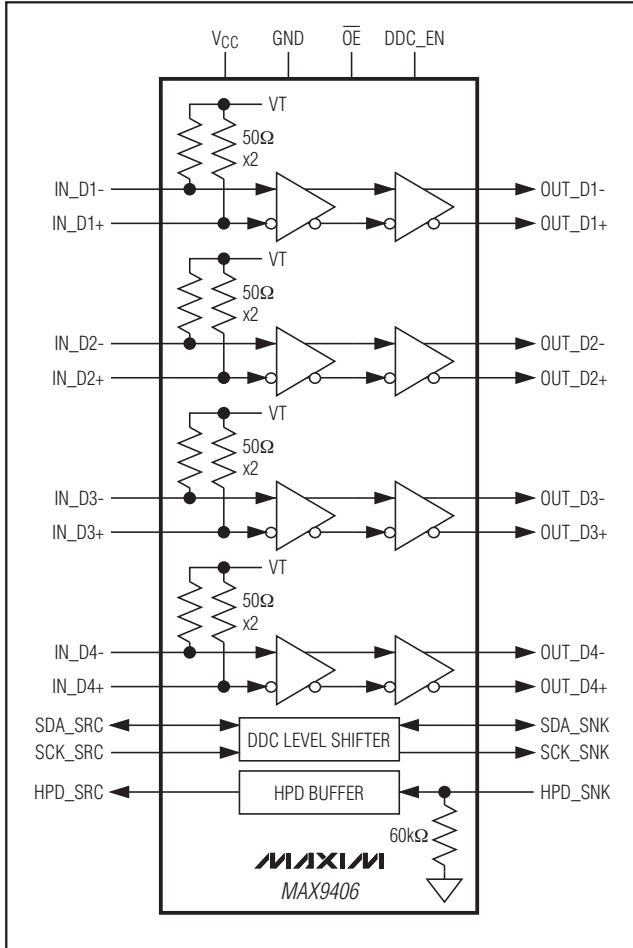
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引脚		名称	功能
32引脚 TQFN	48引脚 TQFN		
1, 3, 8, 18, 22	1, 5, 12, 18, 24, 27, 31, 36, 37, 43	GND	地。
2, 7, 24	2, 11, 15, 21, 26, 33, 40, 46	V <sub>CC</sub>	电源输入，采用0.1μF和0.01μF电容将V <sub>CC</sub> 旁路至GND，电容应尽可能靠近引脚放置。
—	3, 4, 6, 10, 34, 35	N.C.	没有连接，无内部连接；浮空。
4	7	HPD_SRC	3.3V 逻辑侧热插拔检测。
5	8	SDA_SRC	串行数据，3.3V 逻辑侧I <sup>2</sup> C数据线。
6	9	SCL_SRC	串行时钟，3.3V 逻辑侧I <sup>2</sup> C时钟线。
9	13	OUT_D4+	差分输出端口4+。
10	14	OUT_D4-	差分输出端口4-。
11	16	OUT_D3+	差分输出端口3+。
12	17	OUT_D3-	差分输出端口3-。
13	19	OUT_D2+	差分输出端口2+。
14	20	OUT_D2-	差分输出端口2-。
15	22	OUT_D1+	差分输出端口1+。
16	23	OUT_D1-	差分输出端口1-。
17	25	$\overline{\text{OE}}$	输出使能，将 $\overline{\text{OE}}$ 驱动至低电平时使能输出；将 $\overline{\text{OE}}$ 驱动至高电平时禁止输出。
19	28	SCL_SNK	串行时钟，5V 逻辑侧I <sup>2</sup> C时钟线。
20	29	SDA_SNK	串行数据，5V 逻辑侧I <sup>2</sup> C数据线。
21	30	HPD_SNK	+5V 逻辑侧热插拔检测。
23	32	DDC_EN	DDC链路使能。
25	38	IN_D1-	差分输入端口1-。
26	39	IN_D1+	差分输入端口1+。
27	41	IN_D2-	差分输入端口2-。
28	42	IN_D2+	差分输入端口2+。
29	44	IN_D3-	差分输入端口3-。
30	45	IN_D3+	差分输入端口3+。
31	47	IN_D4-	差分输入端口4-。
32	48	IN_D4+	差分输入端口4+。
—	—	EP	裸焊盘，EP应连接至地。

# DisplayPort至DVI™/HDMI电平转换器

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功能框图



## 详细说明

MAX9406是高速、低偏差、四通道差分输入至CML电平转换器，支持DP至HDMI的高速信号转换。该器件具有350ps超低传输延迟和小于20ps的通道间偏差，MAX9406支持2Gbps典型数据速率。

MAX9406可为HDMI的DDC和HPD提供电平转换，将5V单端逻辑电平转换成3.3V单端逻辑电平。

## 高速信号使能

$\overline{OE}$ 控制四个高速信号通路的全部供电环节。将 $\overline{OE}$ 置低可使能所有高速信号通路；将 $\overline{OE}$ 置高可禁止整个高速链路并断开内部偏置电压，使器件进入低功耗模式。低功耗模式下，DDC和HPD端口仍然处于工作状态。

## 显示数据通道(DDC)

MAX9406可实现5V至3V低速DDC链路之间的转换。当任意一侧被拉至GND时，另一侧也随之拉低，反之亦然。DDC\_EN控制DDC链路的导通，DDC\_EN置高时允许数据通过DDC，而DDC\_EN置低时禁止DDC链路。

## 热插拔检测(HPD)

MAX9406将HPD的5V逻辑转换为3V逻辑。

## 应用信息

### DVI/HDMI驱动器

MAX9406可作为主板上的HDMI信号驱动器，MAX9406 CML输出提供大于400mV的差分HDMI输出，并在差分输出端支持3.3V上拉。电平转换器将来自图形芯片的差分信号提升后连接到主板边缘的HDMI连接器。

### 高速信号线的使能/禁止

MAX9406允许使用DDC线，与高速信号线以及 $\overline{OE}$ 引脚的状态无关，可以在不使用任何高速信号的条件通过DDC实现通信。

### 输出端接

使用50Ω电阻将CML输出端接至 $V_{CC}$ 或采用等效的戴维宁端接。两路输出采用相同的端接器进行端接，使输出间偏差最小。

### 电源旁路

适当的电源旁路对于改善性能、提高噪声抑制非常必要。应采用0.01μF的高频表贴陶瓷电容将 $V_{CC}$ 旁路至GND，并尽可能靠近器件放置电容。通过多个旁路过孔进行连接以降低寄生电感。

# DisplayPort至DVI™/HDMI电平转换器

## 印刷电路板(PCB)布线

输入和输出引线会直接影响MAX9406的性能，各个输入、输出应采用特征阻抗为50Ω的引线。应避免差分阻抗的不连续性，并保持固定的差分引线间距，避免出现比较陡的拐角，以提高共模噪声抑制，使过孔数最少有助于降低阻抗的不连续性。保持连接器和电缆的特征阻抗为50Ω可有效降低反射，保证引线的电气长度相互匹配有利于减小偏差。

## 裸焊盘

MAX9406所采用的薄型QFN封装底部带有裸焊盘，应使用足够大的焊盘将裸焊盘连接至地。使用过孔连接裸焊盘的焊接区与PCB另一侧的覆铜层，从而降低MAX9406与周围空气间的热阻。

## 芯片信息

PROCESS: BiPolar

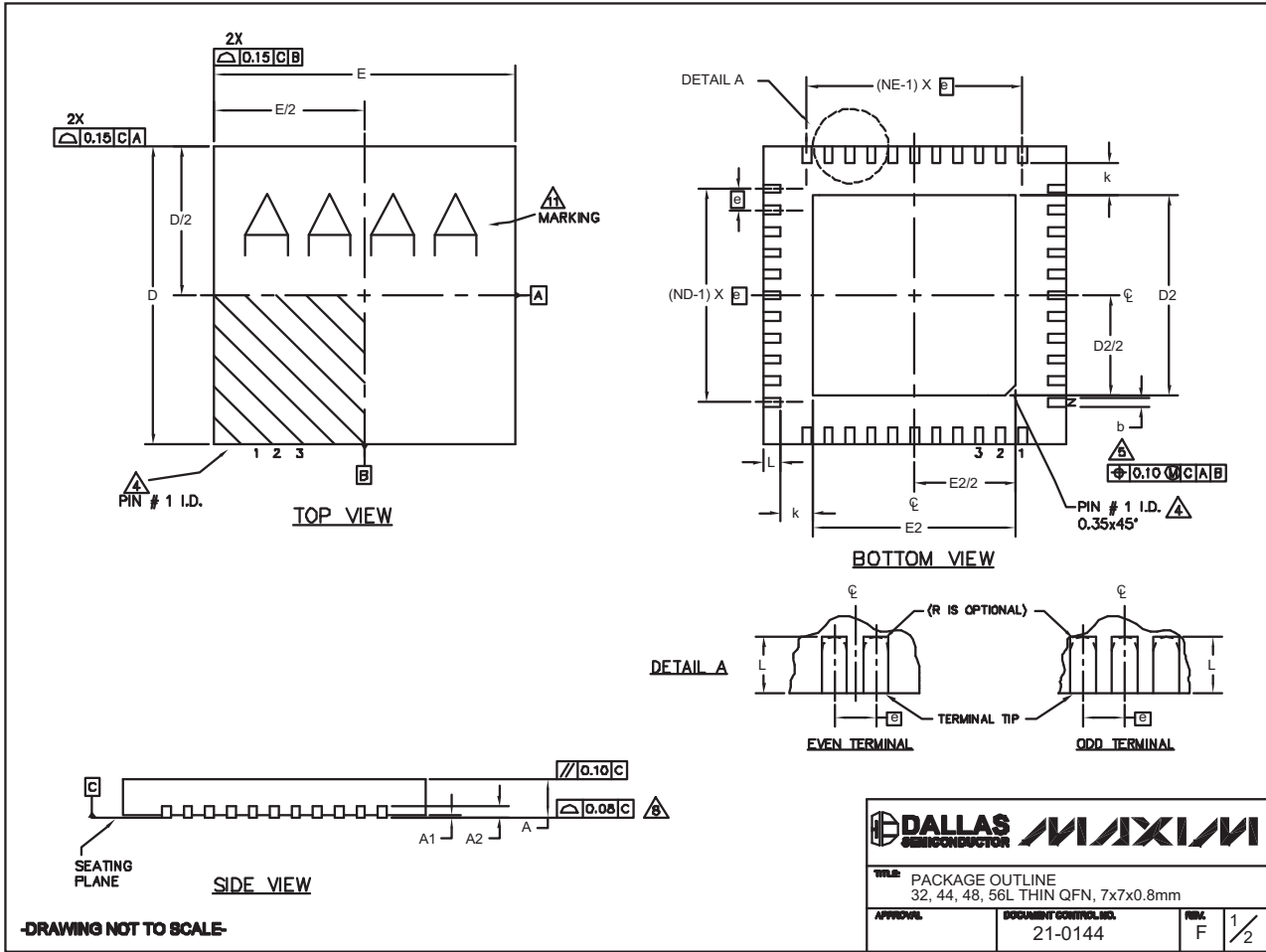
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# DisplayPort至DVI™/HDMI电平转换器

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封装信息

(本数据资料提供的封装图可能不是最近的规格, 如需最近的封装外形信息, 请查询 [www.maxim-ic.com.cn/packages](http://www.maxim-ic.com.cn/packages).)



32, 44, 48L QFN.EPS

-DRAWING NOT TO SCALE-



# DisplayPort至DVI™/HDMI电平转换器

封装信息(续)

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MAX9406

COMMON DIMENSIONS														EXPOSED PAD VARIATIONS													
PKG	32L 7x7			44L 7x7			48L 7x7			CUSTOM PKG. (T4877-1) 48L 7x7			56L 7x7			PKG. CODES	DEPOPULATED LEADS	D2			E2			JEDEC MO220 REV. C			
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	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	0.70	0.75	0.80	T3277-2	-	4.55	4.70	4.85	4.55	4.70	4.85	-			
A1	0	0.02	0.05	0	0.02	0.05	0	0.02	0.05	0	0.02	0.05	0	-	0.05	T3277-3	-	4.55	4.70	4.85	4.55	4.70	4.85	-			
A2	0.20 REF.			0.20 REF.			0.20 REF.			0.20 REF.			0.20 REF.			T4477-2	-	4.55	4.70	4.85	4.55	4.70	4.85	WKD-1			
b	0.25	0.30	0.35	0.20	0.25	0.30	0.20	0.25	0.30	0.20	0.25	0.30	0.20	0.25	0.30	0.15	0.20	0.25	T4477-3	-	4.55	4.70	4.85	4.55	4.70	4.85	WKD-1
D	6.90	7.00	7.10	6.90	7.00	7.10	6.90	7.00	7.10	6.90	7.00	7.10	6.90	7.00	7.10	T4877-1**	13,24,37,48	4.20	4.30	4.40	4.20	4.30	4.40	-			
E	6.90	7.00	7.10	6.90	7.00	7.10	6.90	7.00	7.10	6.90	7.00	7.10	6.90	7.00	7.10	T4877-3	-	4.95	5.10	5.25	4.95	5.10	5.25	-			
e	0.65 BSC.			0.50 BSC.			0.50 BSC.			0.50 BSC.			0.40 BSC.			T4877-4	-	5.40	5.50	5.60	5.40	5.50	5.60	-			
k	0.25	-	-	0.25	-	-	0.25	-	-	0.25	-	-	0.25	-	-	T4877-5	-	2.40	2.50	2.60	2.40	2.50	2.60	-			
L	0.45	0.55	0.65	0.45	0.55	0.65	0.30	0.40	0.50	0.45	0.55	0.65	0.30	0.40	0.50	T4877-6	-	5.40	5.50	5.60	5.40	5.50	5.60	-			
N	32			44			48			44			56			T4877-7	-	4.95	5.10	5.25	4.95	5.10	5.25	-			
ND	8			11			12			10			14			T4877M-1	-	5.40	5.50	5.60	5.40	5.50	5.60	-			
NE	8			11			12			12			14			T4877M-6	-	5.40	5.50	5.60	5.40	5.50	5.60	-			
																T4877MN-8	-	5.40	5.50	5.60	5.40	5.50	5.60	-			
																T5677-1	-	5.40	5.50	5.60	5.40	5.50	5.60	-			
																T5677-2	-	5.40	5.50	5.60	5.40	5.50	5.60	-			

\*\* NOTE: T4877-1 IS A CUSTOM 48L PKG. WITH 4 LEADS DEPOPULATED. TOTAL NUMBER OF LEADS ARE 44.

NOTES:

- DIMENSIONING & TOLERANCING CONFORM TO ASME Y14.5M-1994.
- ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
- N IS THE TOTAL NUMBER OF TERMINALS.
- THE TERMINAL #1 IDENTIFIER AND TERMINAL NUMBERING CONVENTION SHALL CONFORM TO JESD 95-1 SPP-D12. 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.
- DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.25 mm AND 0.30 mm FROM TERMINAL TIP.
- ND AND NE REFER TO THE NUMBER OF TERMINALS ON EACH D AND E SIDE RESPECTIVELY.
- DEPOPULATION IS POSSIBLE IN A SYMMETRICAL FASHION.
- COPLANARITY APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS.
- DRAWING CONFORMS TO JEDEC MO220 EXCEPT THE EXPOSED PAD DIMENSIONS OF T4877-1/-3/-4/-5/-6 & T5677-1.
- WARPAGE SHALL NOT EXCEED 0.10 mm.
- MARKING IS FOR PACKAGE ORIENTATION REFERENCE ONLY
- NUMBER OF LEADS SHOWN ARE FOR REFERENCE ONLY

-DRAWING NOT TO SCALE-

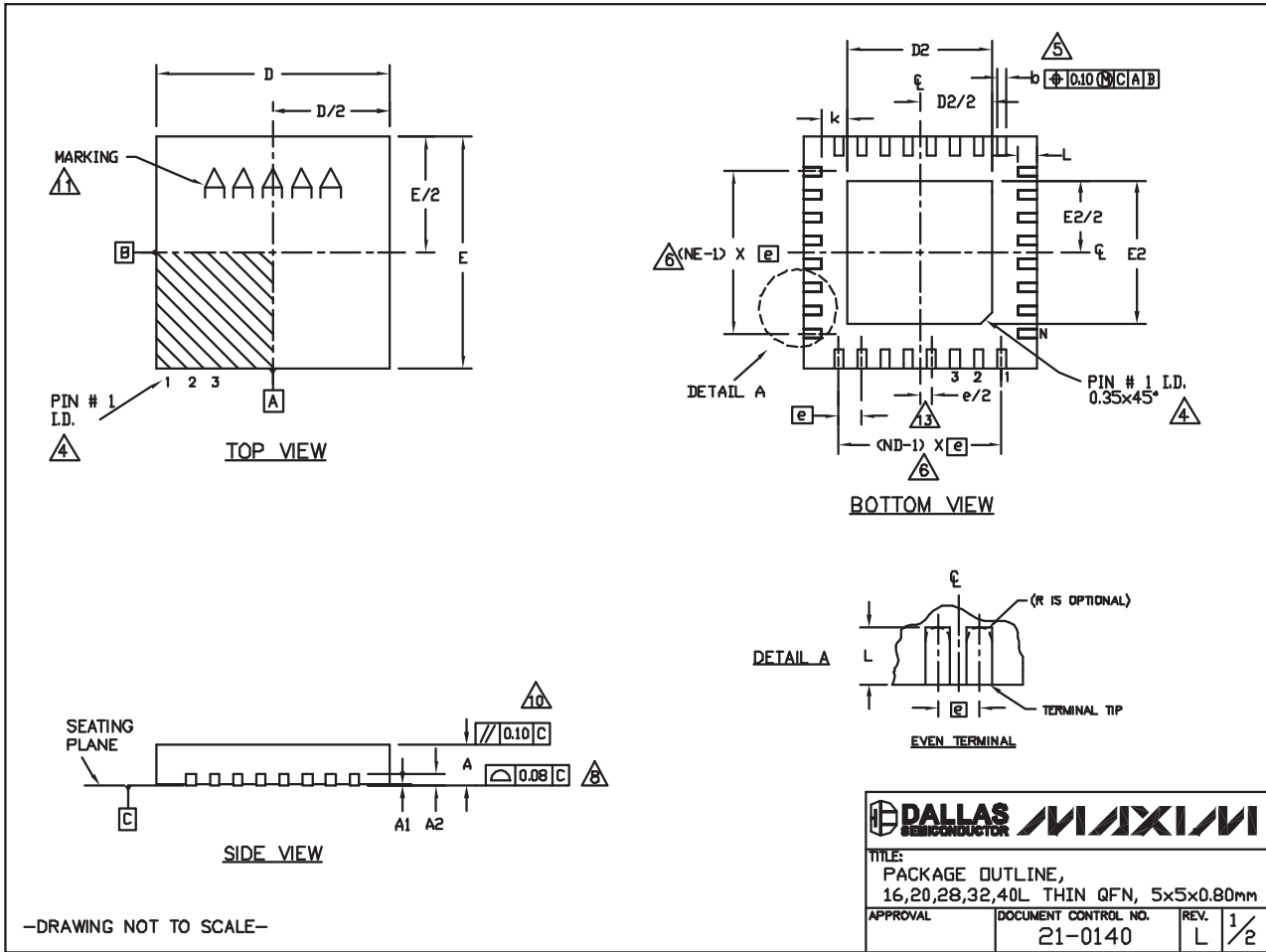
 	
TITLE: PACKAGE OUTLINE 32, 44, 48, 56L THIN QFN, 7x7x0.8mm	
APPROVAL:	DOCUMENT CONTROL NO. 21-0144
REV. F	2/2

# DisplayPort至DVI™/HDMI电平转换器

MAX9406

封装信息(续)

(本数据资料提供的封装图可能不是最近的规格, 如需最近的封装外形信息, 请查询 [www.maxim-ic.com.cn/packages](http://www.maxim-ic.com.cn/packages).)



# DisplayPort至DVI™/HDMI电平转换器

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MAX9406

COMMON DIMENSIONS															
PKG.	16L 5x5			20L 5x5			28L 5x5			32L 5x5			40L 5x5		
SYMBOL	MIN.	NOM.	MAX.	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	0.70	0.75	0.80
A1	0	0.02	0.05	0	0.02	0.05	0	0.02	0.05	0	0.02	0.05	0	0.02	0.05
A2	0.20 REF.			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	0.20	0.25	0.30	0.15	0.20	0.25
D	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10
E	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10
e	0.80 BSC.			0.65 BSC.			0.50 BSC.			0.50 BSC.			0.40 BSC.		
k	0.25	-	-	0.25	-	-	0.25	-	-	0.25	-	-	0.25	-	-
L	0.30	0.40	0.50	0.45	0.55	0.65	0.45	0.55	0.65	0.30	0.40	0.50	0.30	0.40	0.50
N	16			20			28			32			40		
ND	4			5			7			8			10		
NE	4			5			7			8			10		
JEDEC	WHHB			WHHC			WHHD-1			WHHD-2			-----		

EXPOSED PAD VARIATIONS						
PKG. CODES	D2			E2		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
T1655-2	3.00	3.10	3.20	3.00	3.10	3.20
T1655-3	3.00	3.10	3.20	3.00	3.10	3.20
T1655N-1	3.00	3.10	3.20	3.00	3.10	3.20
T2055-3	3.00	3.10	3.20	3.00	3.10	3.20
T2055-4	3.00	3.10	3.20	3.00	3.10	3.20
T2055-5	3.15	3.25	3.35	3.15	3.25	3.35
T2055MN-5	3.15	3.25	3.35	3.15	3.25	3.35
T2855-3	3.15	3.25	3.35	3.15	3.25	3.35
T2855-4	2.60	2.70	2.80	2.60	2.70	2.80
T2855-5	2.60	2.70	2.80	2.60	2.70	2.80
T2855-6	3.15	3.25	3.35	3.15	3.25	3.35
T2855-7	2.60	2.70	2.80	2.60	2.70	2.80
T2855-8	3.15	3.25	3.35	3.15	3.25	3.35
T2855N-1	3.15	3.25	3.35	3.15	3.25	3.35
T3255-3	3.00	3.10	3.20	3.00	3.10	3.20
T3255-4	3.00	3.10	3.20	3.00	3.10	3.20
T3255M-4	3.00	3.10	3.20	3.00	3.10	3.20
T3255-5	3.00	3.10	3.20	3.00	3.10	3.20
T3255N-1	3.00	3.10	3.20	3.00	3.10	3.20
T4055-1	3.40	3.50	3.60	3.40	3.50	3.60
T4055-2	3.40	3.50	3.60	3.40	3.50	3.60
T4055MN-1	3.40	3.50	3.60	3.40	3.50	3.60

**NOTES:**

- DIMENSIONING & TOLERANCING CONFORM TO ASME Y14.5M-1994.
- ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
- N IS THE TOTAL NUMBER OF TERMINALS.
- THE TERMINAL #1 IDENTIFIER AND TERMINAL NUMBERING CONVENTION SHALL CONFORM TO JEDEC 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.
- DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.25 mm AND 0.30 mm FROM TERMINAL TIP.
- ND AND NE REFER TO THE NUMBER OF TERMINALS ON EACH D AND E SIDE RESPECTIVELY.
- DEPOPULATION IS POSSIBLE IN A SYMMETRICAL FASHION.
- COPLANARITY APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS.
- DRAWING CONFORMS TO JEDEC MO220, EXCEPT EXPOSED PAD DIMENSION FOR T2855-3, T2855-6, T4055-1 AND T4055-2.
- WARPAGE SHALL NOT EXCEED 0.10 mm.
- MARKING IS FOR PACKAGE ORIENTATION REFERENCE ONLY.
- NUMBER OF LEADS SHOWN ARE FOR REFERENCE ONLY.
- LEAD CENTERLINES TO BE AT TRUE POSITION AS DEFINED BY BASIC DIMENSION 'e', ±0.05.
- ALL DIMENSIONS APPLY TO BOTH LEADED AND PbFREE PARTS.

-DRAWING NOT TO SCALE-

TITLE: PACKAGE OUTLINE, 16,20,28,32,40L THIN QFN, 5x5x0.80mm	
APPROVAL	DOCUMENT CONTROL NO. 21-0140
REV. L	2/2

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