



+1.2V to +3.6V, 0.1µA, 100Mbps, 8-Channel Level Translators

MAX3013-MAX3022

General Description

The MAX3013–MAX3022 8-channel level translators provide the level shifting necessary to allow 100Mbps data transfer in a multivoltage system. Externally applied voltages, V_{CC} and V_L , set the logic levels on either side of the device. Logic signals present on the V_L side of the device appear as a higher voltage logic signal on the V_{CC} side of the device, and vice-versa.

The MAX3013–MAX3022 feature an EN input that, when at logic low, places all inputs/outputs on both sides in tristate and reduces the V_{CC} and V_L supply currents to 0.1µA. These devices operate at a guaranteed data rate of 100Mbps for $V_L > 1.8V$.

The MAX3013–MAX3022 accept a V_{CC} voltage from +1.65V to +3.6V and a V_L voltage from +1.2V to ($V_{CC} - 0.4V$), making them ideal for data transfer between low-voltage ASICs/PLDs and higher voltage systems. The MAX3013–MAX3022 are available in 5 x 4 UCSP™, 20-pin 5mm x 5mm QFN, and 20-pin TSSOP packages.

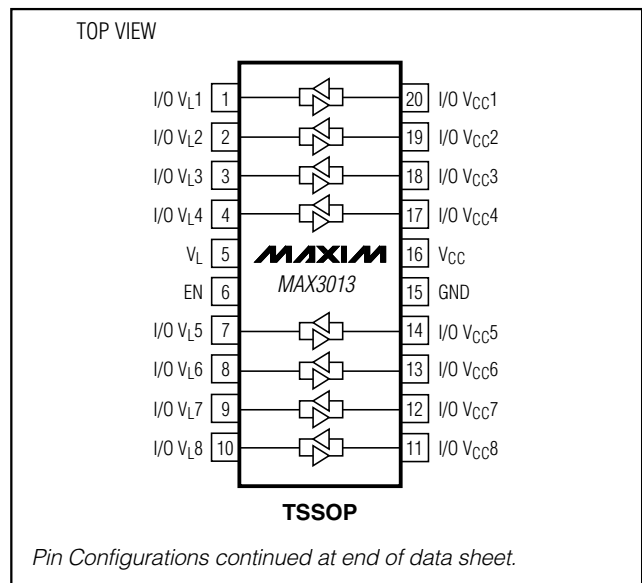
Applications

- Low-Voltage ASIC Level Translation
- Cell Phones
- SPI™, MICROWIRE™ Level Translation
- Portable POS Systems
- Portable Communication Devices
- GPS
- Telecommunications Equipment

Features

- ◆ 100Mbps Guaranteed Data Rate
- ◆ Bidirectional Level Translation (MAX3013)
- ◆ Unidirectional Level Translation (MAX3014–MAX3022)
- ◆ V_L Operation Down to +1.2V
- ◆ Ultra-Low 0.1µA Supply Current in Shutdown
- ◆ Low-Quiescent Current (0.1µA)
- ◆ UCSP, QFN, and TSSOP Packages

Pin Configurations



UCSP is a trademark of Maxim Integrated Products, Inc.
 SPI is a trademark of Motorola, Inc.
 MICROWIRE is a trademark of National Semiconductor Corp.

Typical Operating Circuit appears at end of data sheet.

Ordering Information

PART	TEMP RANGE	PIN-PACKAGE	NUMBER OF $V_L \rightarrow V_{CC}$ TRANSLATORS	NUMBER OF $V_L \leftarrow V_{CC}$ TRANSLATORS	DATA RATE (Mbps)
MAX3013EUP	-40°C to +85°C	20 TSSOP	8	8	100
MAX3013EBP-T	-40°C to +85°C	5 x 4 UCSP	8	8	100
MAX3013EGP	-40°C to +85°C	20 QFN-EP*	8	8	100

*EP = Exposed paddle.

Ordering Information continued at end of data sheet.



For pricing, delivery, and ordering information, please contact Maxim/Dallas Direct! at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.

+1.2V to +3.6V, 0.1µA, 100Mbps, 8-Channel Level Translators

ABSOLUTE MAXIMUM RATINGS

(All voltages referenced to GND.)

V _{CC}	-0.3V to +4V	Continuous Power Dissipation (T _A = +70°C)
V _L	-0.3V to +4V	20-Pin TSSOP (derate 11mW/°C above +70°C)
I/O V _{CC}	-0.3V to (V _{CC} + 0.3V)	5 x 4 UCSP (derate 10mW/°C above +70°C)
I/O V _L	-0.3V to (V _L + 0.3V)	20-Pin QFN (derate 20.0mW/°C above +70°C)
EN	-0.3V to (V _L + 0.3V)	Operating Temperature Range
Short-Circuit Duration I/O V _L , I/O V _{CC} to GND.....	Continuous	Junction Temperature
		Storage Temperature Range
		Lead Temperature (soldering, 10s)

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} = +1.65V to +3.6V, V_L = +1.2V to (V_{CC} - 0.4V) (Note 1), EN = V_L, C_{IOV_L} ≤ 15pF, C_{IOV_{CC}} ≤ 40pF, T_A = T_{MIN} to T_{MAX}. Typical values are at V_{CC} = +3.3V, V_L = +1.8V, T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
POWER SUPPLIES						
V _L Supply Range	V _L		1.2		V _{CC} - 0.4	V
V _{CC} Supply Range	V _{CC}		1.65		3.6	V
Supply Current from V _{CC}	I _{QVCC}	I/O V _{CC} ₋ = 0, I/O V _L ₋ = 0 or I/O V _{CC} ₋ = V _{CC} , I/O V _L ₋ = V _L		0.1	1	µA
Supply Current from V _L	I _{QVL}	I/O V _{CC} ₋ = 0, I/O V _L ₋ = 0 or I/O V _{CC} ₋ = V _{CC} , I/O V _L ₋ = V _L		0.1	4	µA
		I/O V _{CC} ₋ = 0, I/O V _L ₋ = 0 or I/O V _{CC} ₋ = V _{CC} , I/O V _L ₋ = V _L , V _L < V _{CC} - 0.2V		0.1	100	
V _{CC} Tristate Output Mode Supply Current	I _{TS-VCC}	T _A = +25°C, EN = 0		0.03	1	µA
V _L Tristate Output Mode Supply Current	I _{TS-VL}	T _A = +25°C, EN = 0		0.1	0.2	µA
		T _A = +25°C, EN = 0, V _L = V _{CC} - 0.2V		1	2	
I/O Tristate Output Mode Leakage Current		T _A = +25°C, EN = 0,			0.15	µA
		T _A = +25°C, EN = 0, V _L = V _{CC} - 0.2V			30	
LOGIC-LEVEL THRESHOLDS						
I/O V _L ₋ Input-Voltage High	V _{IHL}		2/3 x V _L			V
I/O V _L ₋ Input-Voltage Low	V _{ILL}				1/3 x V _L	V
I/O V _{CC} ₋ Input-Voltage High	V _{IHC}		2/3 x V _{CC}			V
I/O V _{CC} ₋ Input-Voltage Low	V _{ILC}				1/3 x V _{CC}	V
EN Input-Voltage High	V _{IH}	T _A = +25°C	2/3 x V _L			V

+1.2V to +3.6V, 0.1μA, 100Mbps, 8-Channel Level Translators

MAX3013-MAX3022

ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = +1.65V to +3.6V, V_L = +1.2V to (V_{CC} - 0.4V) (Note 1), EN = V_L, C_{IOVL} ≤ 15pF, C_{IOVCC} ≤ 40pF, T_A = T_{MIN} to T_{MAX}. Typical values are at V_{CC} = +3.3V, V_L = +1.8V, T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
EN Input-Voltage Low	V _{IL}	T _A = +25°C			1/3 x V _L	V
EN Input Current		T _A = +25°C			±5	μA
I/O V _L _ Output-Voltage High	V _{OHL}	I/O V _L _ source current = 20μA	2/3 x V _L			V
I/O V _L _ Output-Voltage Low	V _{OLL}	I/O V _L _ sink current = 20μA			1/3 x V _L	V
I/O V _{CC} _ Output-Voltage High	V _{OHC}	I/O V _{CC} _ source current = 20μA	2/3 x V _{CC}			V
I/O V _{CC} _ Output-Voltage Low	V _{OLC}	I/O V _{CC} _ sink current = 20μA			1/3 x V _{CC}	V

TIMING CHARACTERISTICS

(V_{CC} = +1.65V to +3.6V, V_L = +1.2V to (V_{CC} - 0.4V) (Note 1), EN = V_L, C_{IOVL} ≤ 15pF, C_{IOVCC} ≤ 40pF, T_A = T_{MIN} to T_{MAX}. Typical values are at V_{CC} = +3.3V, V_L = +1.8V, T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
I/O V _{CC} _ Rise Time	t _{RVCC}	C _{IOVCC} = 15pF, Figure 1			2.5	ns
		C _{IOVCC} = 20pF, Figure 1			3	
		C _{IOVCC} = 40pF, Figure 1			4	
I/O V _{CC} _ Fall Time	t _{FVCC}	C _{IOVCC} = 15pF, Figure 1			2.5	ns
		C _{IOVCC} = 20pF, Figure 1			3	
		C _{IOVCC} = 40pF, Figure 1			4	
I/O V _{CC} _ One-Shot Output					18.5	Ω
I/O V _L _ Rise Time	t _{RVL}	C _{IOVL} = 15pF, Figure 2			2.5	ns
I/O V _L _ Fall Time	t _{FVL}	C _{IOVL} = 15pF, Figure 2			2.5	ns
I/O V _L _ One-Shot Output Impedance					12.5	Ω
Propagation Delay (Driving I/O V _L)	I/O _{VL-VCC}	C _{IOVCC} = 15pF, Figure 1			6.5	ns

+1.2V to +3.6V, 0.1µA, 100Mbps, 8-Channel Level Translators

TIMING CHARACTERISTICS (continued)

(V_{CC} = +1.65V to +3.6V, V_L = +1.2V to (V_{CC} - 0.4V) (Note 1), EN = V_L, C_{IOV_L} ≤ 15pF, C_{IOV_{CC}} ≤ 40pF, T_A = T_{MIN} to T_{MAX}. Typical values are at V_{CC} = +3.3V, V_L = +1.8V, T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Propagation Delay (Driving I/O V _{CC} _)	I/O _{VCC-VL}	C _{IOV_L} = 15pF, Figure 2			6	ns
Part-to-Part Skew	t _{PPSKEW}	C _{IOV_{CC}} = 15pF, C _{IOV_L} = 15pF, V _{CC} = 2.5V, V _L = 1.8V (Note 3)			4	ns
Propagation Delay from I/O V _L _ to I/O V _{CC} _ after EN	t _{EN-VCC}	C _{IOV_{CC}} = 15pF, Figure 3			1000	ns
Propagation Delay from I/O V _{CC} _ to I/O V _L _ after EN	t _{EN-VL}	C _{IOV_L} = 15pF, Figure 4			1000	ns
Maximum Data Rate		C _{IOV_{CC}} = 15pF, C _{IOV_L} = 15pF, V _L > 1.8V	100			Mbps
		C _{IOV_{CC}} = 15pF, C _{IOV_L} = 15pF, V _L > 1.2V	80			

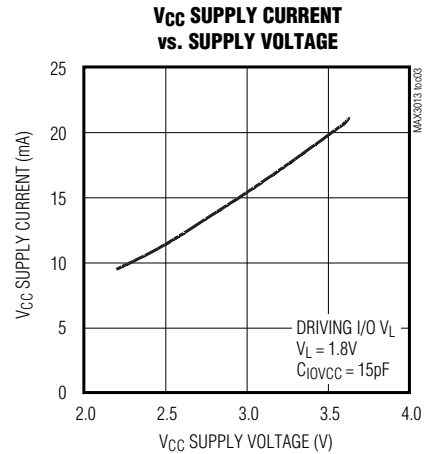
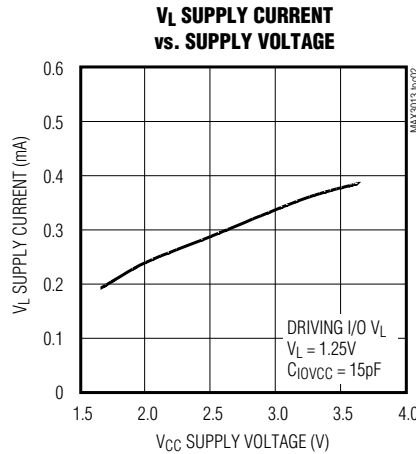
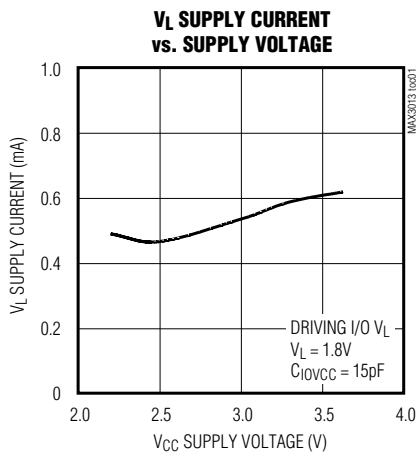
Note 1: V_L must be less than or equal to V_{CC} - 0.4V during normal operation. However, V_L can be greater than V_{CC} - 0.4V during starting up and shutting down conditions.

Note 2: All units are 100% production tested at T_A = +25°C. Limits over the operating temperature range are guaranteed by design and not production tested.

Note 3: Not production tested. Guaranteed by design.

Typical Operating Characteristics

(Data rate = 100Mbps, V_{CC} = 3.3V, V_L = 1.8V, T_A = +25°C, unless otherwise noted.)

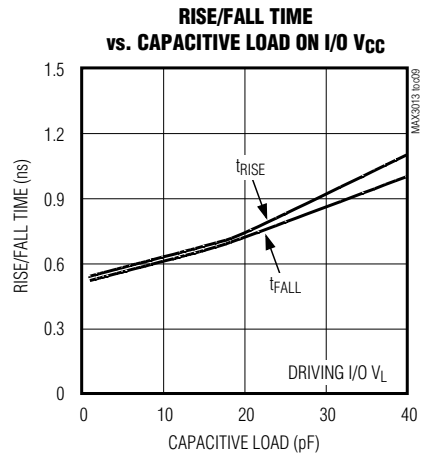
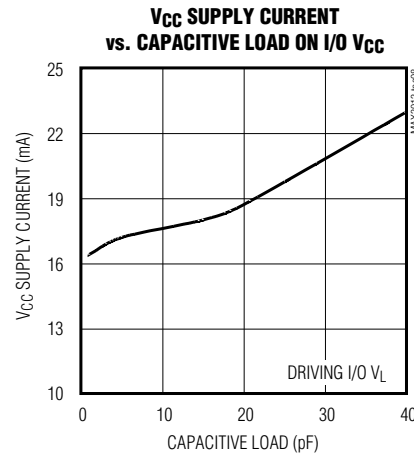
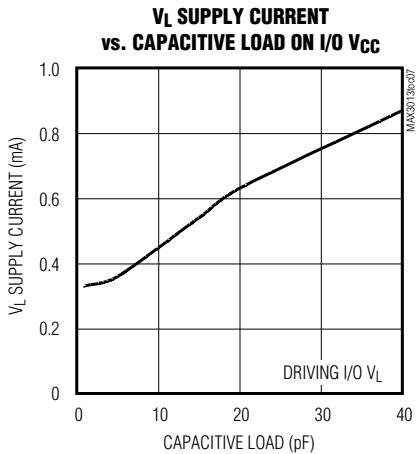
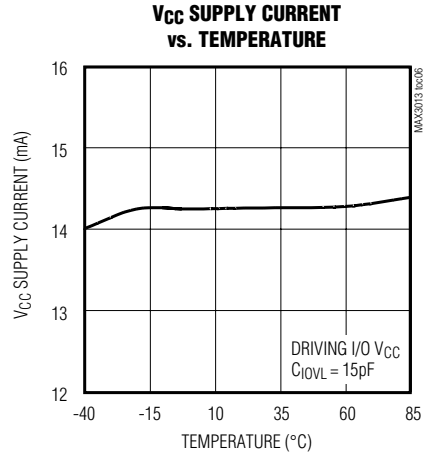
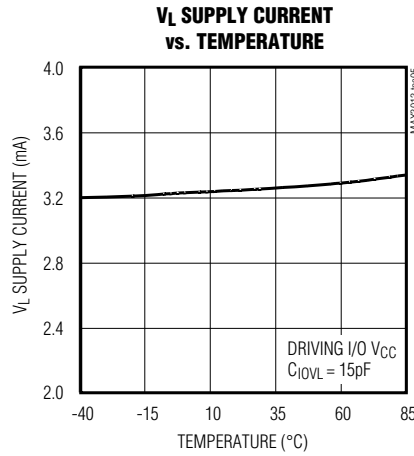
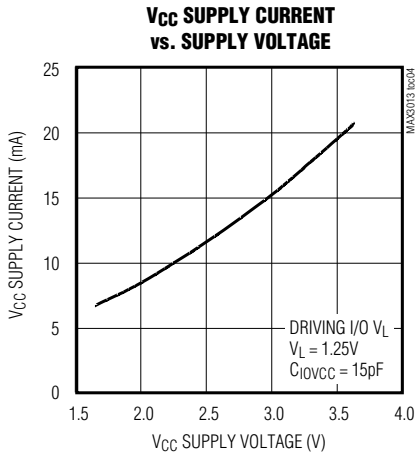


+1.2V to +3.6V, 0.1μA, 100Mbps, 8-Channel Level Translators

Typical Operating Characteristics (continued)

(Data rate = 100Mbps, $V_{CC} = 3.3V$, $V_L = 1.8V$, $T_A = +25^\circ C$, unless otherwise noted.)

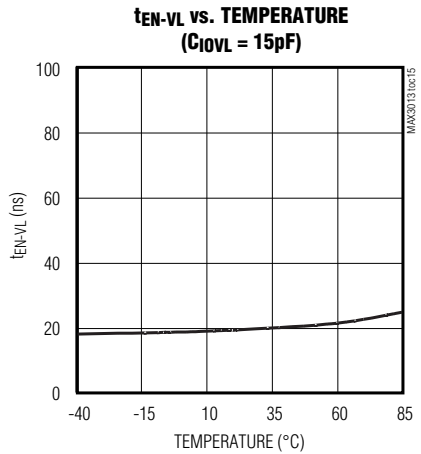
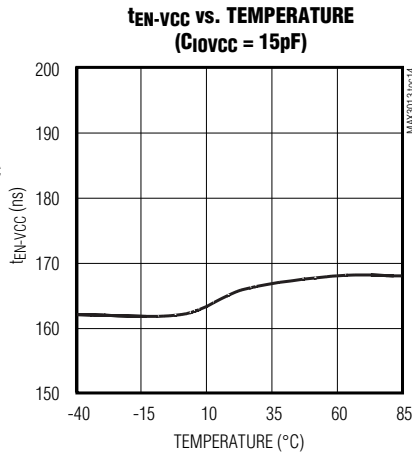
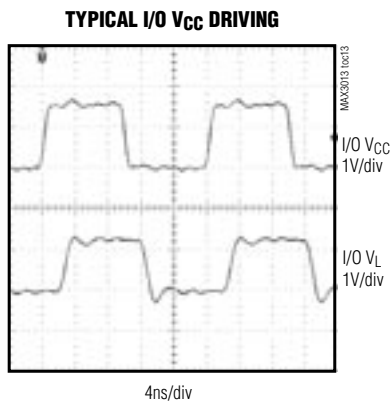
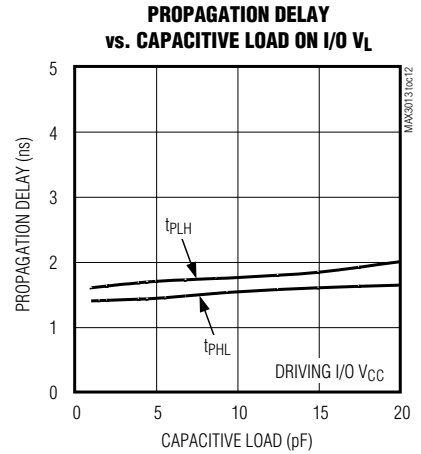
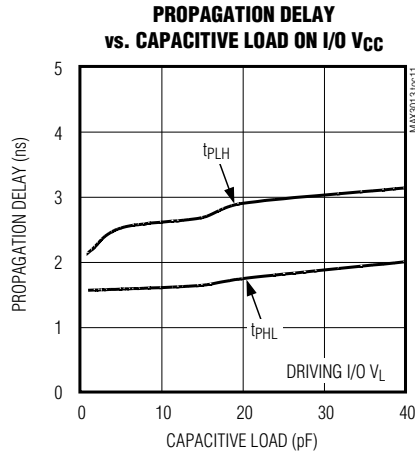
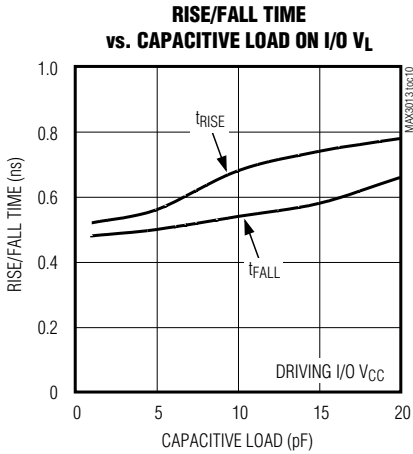
MAX3013-MAX3022



+1.2V to +3.6V, 0.1μA, 100Mbps, 8-Channel Level Translators

Typical Operating Characteristics (continued)

(Data rate = 100Mbps, $V_{CC} = 3.3V$, $V_L = 1.8V$, $T_A = +25^\circ C$, unless otherwise noted.)



+1.2V to +3.6V, 0.1μA, 100Mbps, 8-Channel Level Translators

MAX3013-MAX3022

Pin Description (MAX3013)

PIN			NAME	FUNCTION
TSSOP	QFN	UCSP		
1	18	B1	I/O VL1	Input/Output 1, Referenced to VL
2	19	A1	I/O VL2	Input/Output 2, Referenced to VL
3	20	B2	I/O VL3	Input/Output 3, Referenced to VL
4	1	A2	I/O VL4	Input/Output 4, Referenced to VL
5	2	A3	VL	VL Input Voltage, $+1.2V \leq V_L \leq (V_{CC} - 0.4V)$. Bypass VL to GND with a 0.1μF capacitor.
6	3	A4	EN	Enable Input. If EN is pulled low, all inputs/outputs are in tristate. Drive EN high (VL) for normal operation.
7	4	B3	I/O VL5	Input/Output 5, Referenced to VL
8	5	A5	I/O VL6	Input/Output 6, Referenced to VL
9	6	B4	I/O VL7	Input/Output 7, Referenced to VL
10	7	B5	I/O VL8	Input/Output 7, Referenced to VL
11	8	C5	I/O VCC8	Input/Output 8, Referenced to VCC
12	9	C4	I/O VCC7	Input/Output 7, Referenced to VCC
13	10	D5	I/O VCC6	Input/Output 6, Referenced to VCC
14	11	C3	I/O VCC5	Input/Output 5, Referenced to VCC
15	12	D4	GND	Ground
16	13	D3	VCC	VCC Input Voltage, $+1.65V \leq V_{CC} \leq +3.6V$. Bypass VCC to GND with a 0.1μF capacitor.
17	14	D2	I/O VCC4	Input/Output 4, Referenced to VCC
18	15	C2	I/O VCC3	Input/Output 3, Referenced to VCC
19	16	D1	I/O VCC2	Input/Output 2, Referenced to VCC
20	17	C1	I/O VCC1	Input/Output 1, Referenced to VCC

Pin Description (MAX3014-MAX3022)

NAME	FUNCTION (Note 4)
VCC	VCC Input Voltage, $+1.65V \leq V_{CC} \leq +3.6V$. Bypass VCC to GND with a 0.1μF capacitor.
VL	VL Input Voltage, $+1.2V \leq V_L \leq V_{CC} - 0.4V$. Bypass VL to GND with a 0.1μF capacitor.
GND	Ground
EN	Enable Input. If EN is pulled low, all inputs/outputs are in tristate. Drive EN high (VL) for normal operation.
IVL1-IVL8	Inputs Referenced to VL, Numbers 1 to 8
OVL1-OVL8	Outputs Referenced to VL, Numbers 1 to 8
IVCC1-IVCC8	Inputs Referenced to VCC, Numbers 1 to 8
OVCC1-OVCC8	Outputs Referenced to VCC, Numbers 1 to 8

Note 4: For specific pin numbers, see the *Pin Configurations* for more information.

**+1.2V to +3.6V, 0.1μA, 100Mbps,
8-Channel Level Translators**

Test Circuits/Timing Diagrams

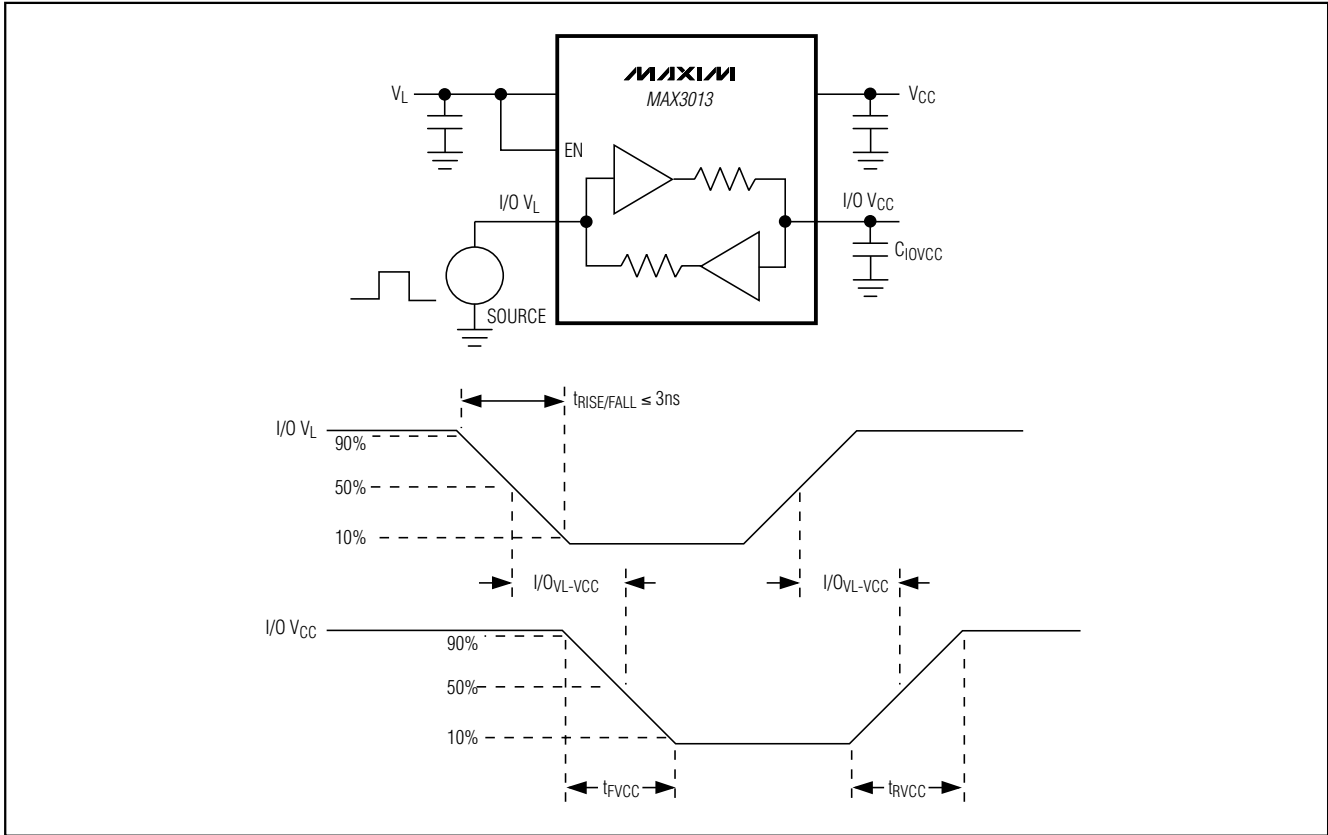


Figure 1. Driving I/O VL Test Circuit and Timing

+1.2V to +3.6V, 0.1 μ A, 100Mbps, 8-Channel Level Translators

Test Circuits/Timing Diagrams (continued)

MAX3013-MAX3022

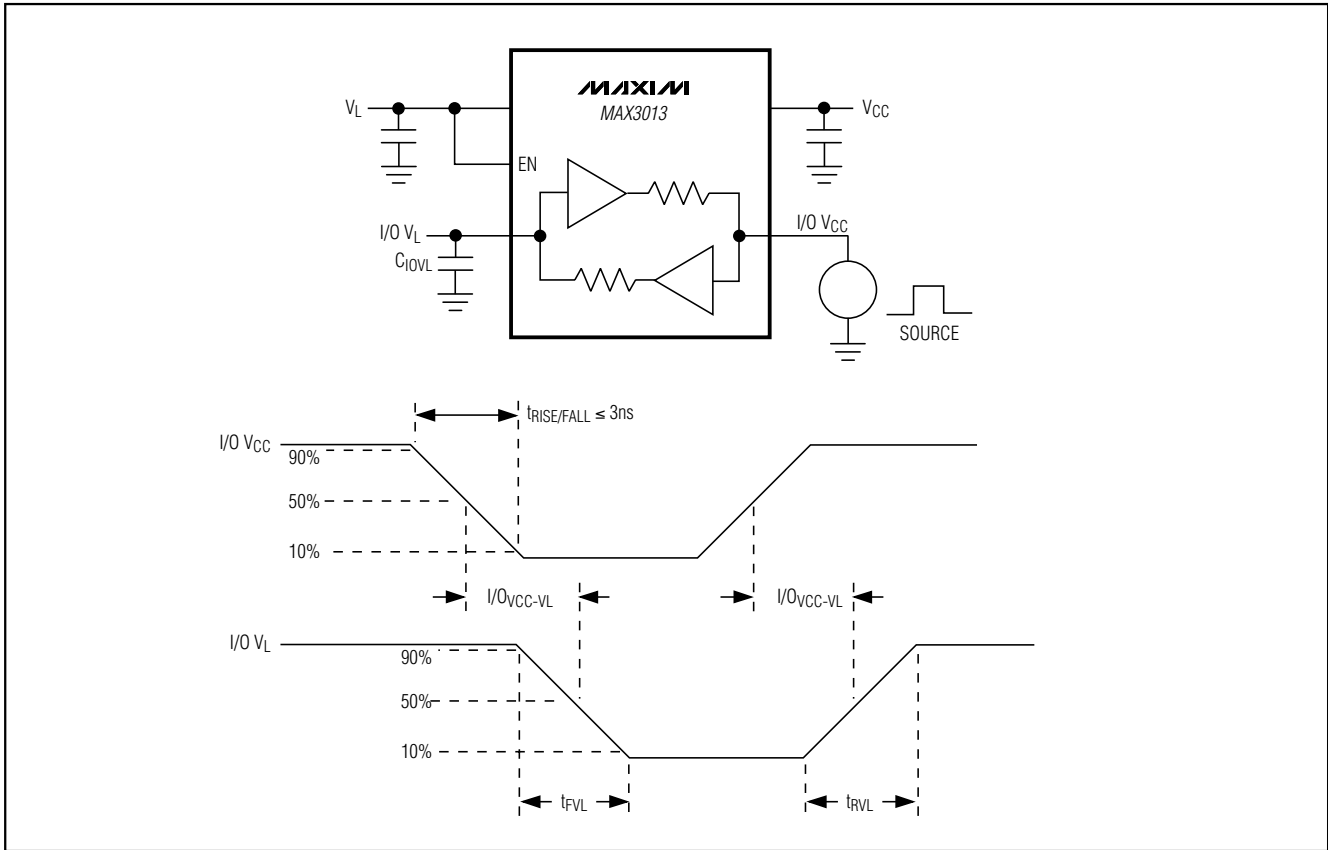


Figure 2. Driving I/O VCC Test Circuit and Timing

**+1.2V to +3.6V, 0.1µA, 100Mbps,
8-Channel Level Translators**

Test Circuits/Timing Diagrams (continued)

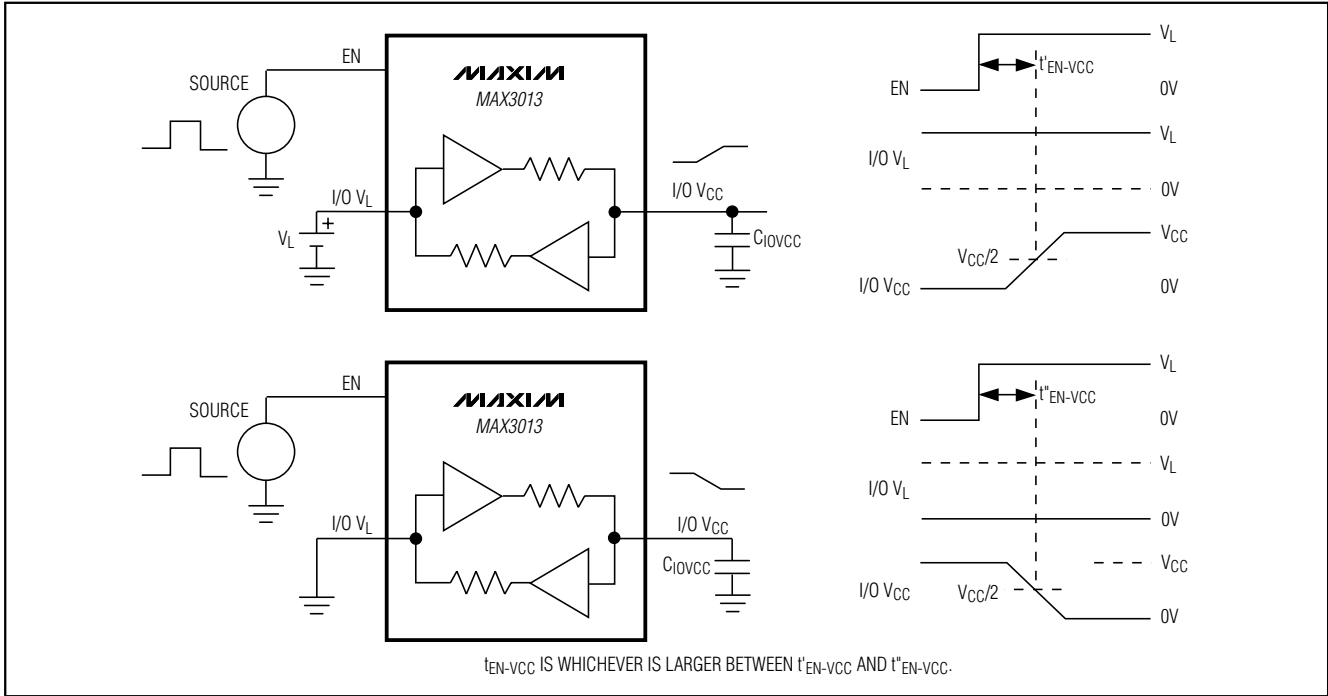


Figure 3. Propagation Delay from I/O V_L to I/O V_{CC} after EN

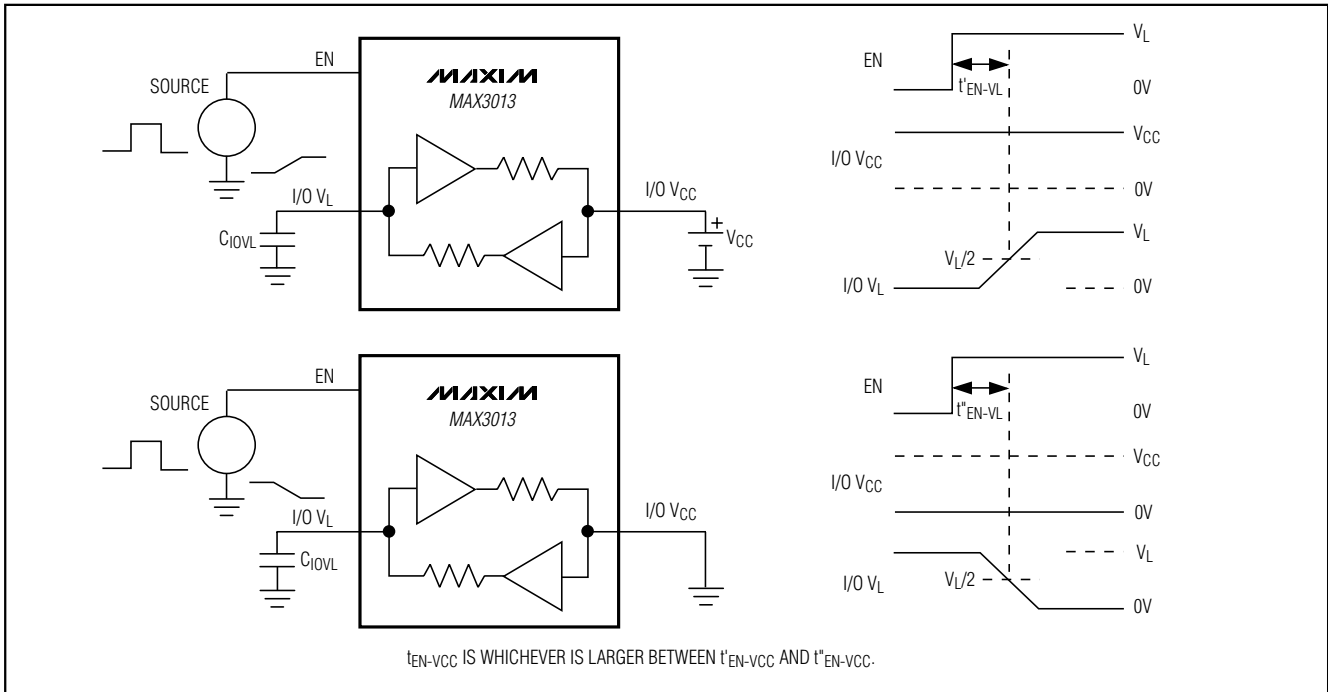


Figure 4. Propagation Delay from I/O V_{CC} to I/O V_L after EN

+1.2V to +3.6V, 0.1µA, 100Mbps, 8-Channel Level Translators

MAX3013-MAX3022

Detailed Description

The MAX3013–MAX3022 logic-level translators provide the level shifting necessary to allow 100Mbps data transfer in a multivoltage system. Externally applied voltages, V_{CC} and V_L , set the logic levels on either side of the device. Logic signals present on the V_L side of the device appear as a higher voltage logic signal on the V_{CC} side of the device, and vice-versa. The MAX3013 bidirectional level translator allows data translation in either direction ($V_L \leftrightarrow V_{CC}$) on any single data line. The MAX3014–MAX3022 unidirectional translators level-shift data in one direction ($V_L \rightarrow V_{CC}$ or $V_{CC} \rightarrow V_L$) on any single data line. The MAX3013–MAX3022 accept V_L from +1.2V to ($V_{CC} - 0.4V$) and operate with V_{CC} from +1.65V to +3.6V, making them ideal for data transfer between low-voltage ASICs/PLDs and higher voltage systems.

The MAX3013–MAX3022 feature an input enable mode (EN) that reduces V_{CC} and V_L supply currents to 0.1µA, when in tristate mode. These devices operate at a guaranteed data rate of 100Mbps for $V_L > +1.8V$.

Level Translation

For proper operation, ensure that $+1.65V \leq V_{CC} \leq +3.6V$, $+1.2V \leq V_L \leq (V_{CC} - 0.4V)$. During power-up sequencing, $V_L \geq V_{CC}$ does not damage the device. During power-supply sequencing, when V_{CC} is floating and V_L is powering up, up to 40mA current can be sourced to each load on the V_L side, yet the device does not latch up. The maximum data rate depends heavily on the load capacitance (see the *Typical Operating Characteristics*, Rise/Fall Times), output impedance of the driver, and the operating voltage range (see the *Timing Characteristics*).

Input Driver Requirements

The MAX3013–MAX3022 architecture is based on a one-shot accelerator output stage (see Figure 5). Accelerator output stages are always in tristate mode except when there is a transition on any of the translators on the input side, either I/O V_L or I/O V_{CC} . Then, a short pulse is generated during which the accelerator output stages become active and charge/discharge the capacitances at the I/Os. Due to its bidirectional nature, both input stages become active during the one-shot pulse. This can lead to some current feeding into the external source that is driving the translator. However, this behavior helps to speed up the transition on the driven side.

For proper operation, the external driver must meet the following conditions: $<25\Omega$ output impedance and $>20mA$ output current. Figure 6 shows a graph of Typical Input Current vs. Input Voltage.

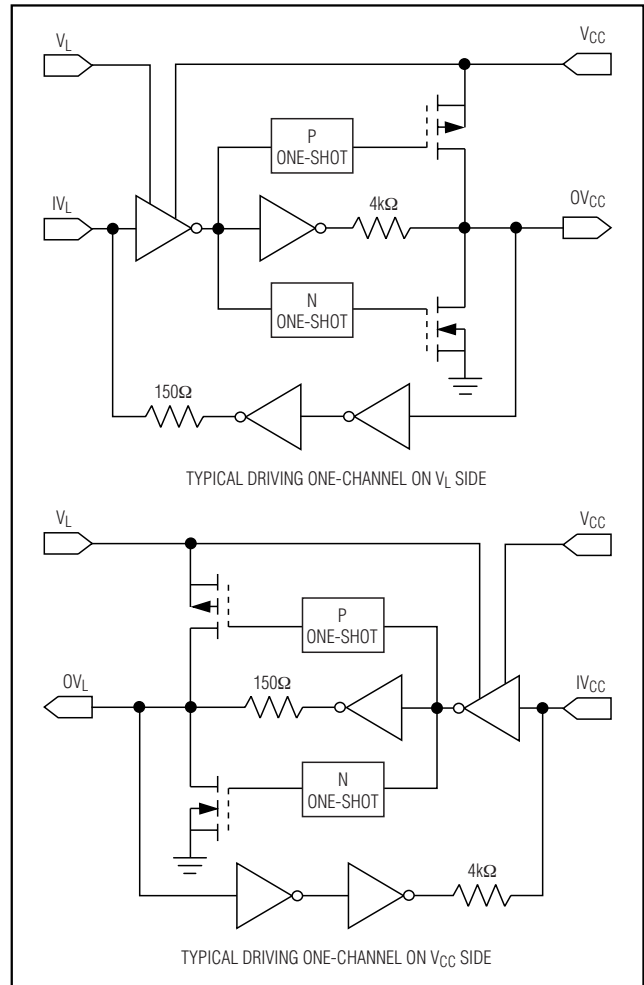


Figure 5. MAX3013–MAX3022 Simplified Diagram (1 I/O line)

Output Load Requirements

The MAX3013–MAX3022 I/O were designed to drive CMOS inputs. Do not load the I/O lines with a resistive load less than 25kΩ. Also, do not place an RC circuit at the input of the MAX3013–MAX3022 to slow down the edges. If a slower data rate is required, please see the MAX3000E/MAX3001E logic-level translator.

For I²C™ level translation, please refer to the MAX3372E–MAX3379E/MAX3390E–MAX3393E data sheet.

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+1.2V to +3.6V, 0.1µA, 100Mbps, 8-Channel Level Translators

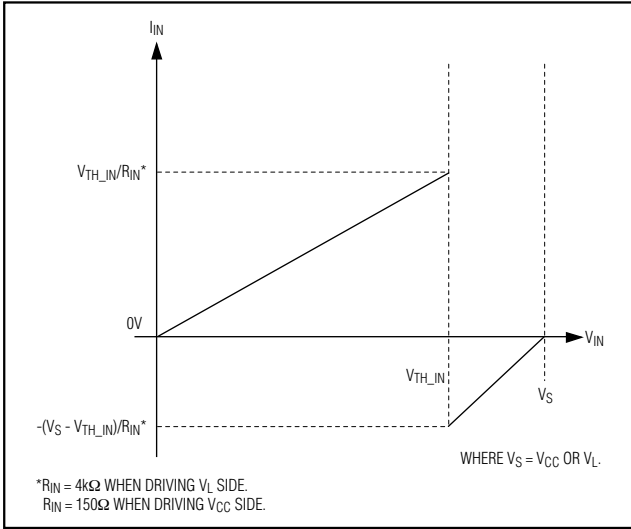


Figure 6. Typical I_{IN} vs. V_{IN}

Enable Input (EN)

The MAX3013–MAX3022 feature an EN input. Pull EN low to set the MAX3013–MAX3022’s I/O on both sides in tristate output mode. Drive EN to logic high (V_L) for normal operation.

Applications Information

Power-Supply Decoupling

To reduce ripple and the chance of introducing data errors, bypass V_L and V_{CC} to ground with a 0.1µF ceramic capacitor. Place the bypass capacitors as close to the power-supply input pins as possible.

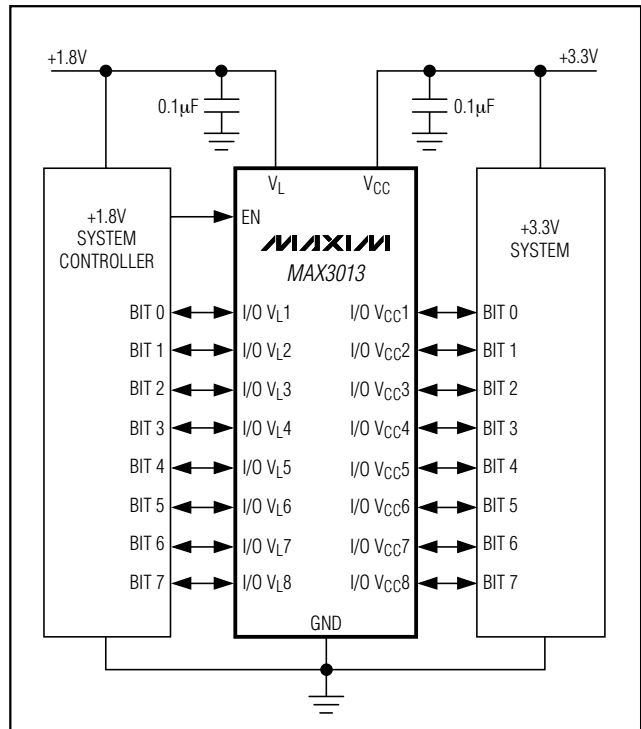
8-Bit Bus Translation

The MAX3013–MAX3022 level-shift the data present on the I/O line between +1.2V to +3.6V, making them ideal for level translation between a low-voltage ASIC and a higher voltage system. The *Typical Operating Circuit* shows the MAX3013 bidirectional translator in an 8-bit bus level translation from a 1.8V system to a 3.3V system and vice versa.

Unidirectional vs. Bidirectional Level Translator

The MAX3013 bidirectional translator can operate as a unidirectional device to translate signals without inversion. The MAX3014–MAX3022 unidirectional translators level-shift data in one direction ($V_L \rightarrow V_{CC}$ or $V_{CC} \rightarrow V_L$) on any single data line (see the *Ordering Information*). These devices provide the smallest solution (UCSP package) for unidirectional level translation without inversion.

Typical Operating Circuit



Chip Information

TRANSISTOR COUNT: 1447
PROCESS: BiCMOS

+1.2V to +3.6V, 0.1μA, 100Mbps, 8-Channel Level Translators

Ordering Information (continued)

MAX3013-MAX3022

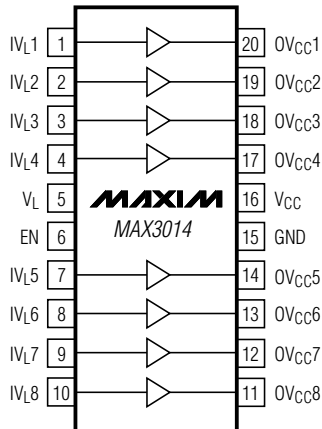
PART	TEMP RANGE	PIN-PACKAGE	NUMBER OF V _L → V _{CC} TRANSLATORS	NUMBER OF V _L ← V _{CC} TRANSLATORS	DATA RATE (Mbps)
MAX3014 EUP*	-40°C to +85°C	20 TSSOP	8	0	100
MAX3014EBP-T*	-40°C to +85°C	5 x 4 UCSP	8	0	100
MAX3014EGP*	-40°C to +85°C	20 QFN-EP**	8	0	100
MAX3015 EUP*	-40°C to +85°C	20 TSSOP	7	1	100
MAX3015EBP-T*	-40°C to +85°C	5 x 4 UCSP	7	1	100
MAX3015EGP*	-40°C to +85°C	20 QFN-EP**	7	1	100
MAX3016 EUP*	-40°C to +85°C	20 TSSOP	6	2	100
MAX3016EBP-T*	-40°C to +85°C	5 x 4 UCSP	6	2	100
MAX3016EGP*	-40°C to +85°C	20 QFN-EP**	6	2	100
MAX3017 EUP*	-40°C to +85°C	20 TSSOP	5	3	100
MAX3017EBP-T*	-40°C to +85°C	5 x 4 UCSP	5	3	100
MAX3017EGP*	-40°C to +85°C	20 QFN-EP**	5	3	100
MAX3018 EUP*	-40°C to +85°C	20 TSSOP	4	4	100
MAX3018EBP-T*	-40°C to +85°C	5 x 4 UCSP	4	4	100
MAX3018EGP*	-40°C to +85°C	20 QFN-EP**	4	4	100
MAX3019 EUP*	-40°C to +85°C	20 TSSOP	3	5	100
MAX3019EBP-T*	-40°C to +85°C	5 x 4 UCSP	3	5	100
MAX3019EGP*	-40°C to +85°C	20 QFN-EP**	3	5	100
MAX3020 EUP*	-40°C to +85°C	20 TSSOP	2	6	100
MAX3020EBP-T*	-40°C to +85°C	5 x 4 UCSP	2	6	100
MAX3020EGP*	-40°C to +85°C	20 QFN-EP**	2	6	100
MAX3021 EUP*	-40°C to +85°C	20 TSSOP	1	7	100
MAX3021EBP-T*	-40°C to +85°C	5 x 4 UCSP	1	7	100
MAX3021EGP*	-40°C to +85°C	20 QFN-EP**	1	7	100
MAX3022 EUP*	-40°C to +85°C	20 TSSOP	0	8	100
MAX3022EBP-T*	-40°C to +85°C	5 x 4 UCSP	0	8	100
MAX3022EGP*	-40°C to +85°C	20 QFN-EP**	0	8	100

*Future Product—Contact factory for availability.

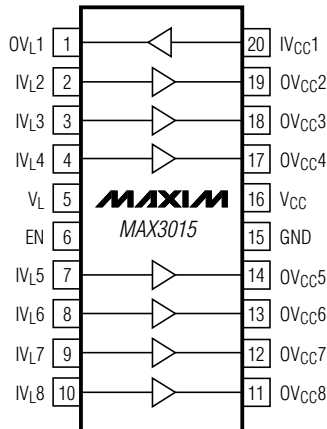
**EP = Exposed paddle.

+1.2V to +3.6V, 0.1µA, 100Mbps, 8-Channel Level Translators

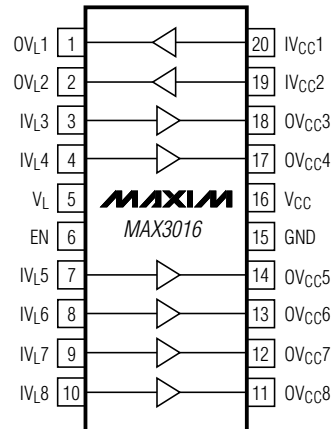
Pin Configurations (continued)



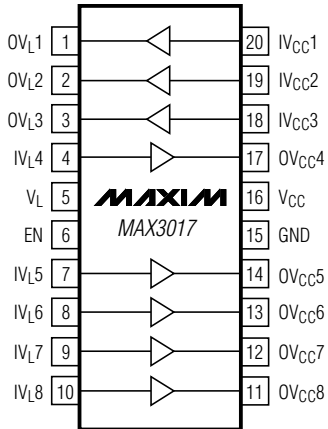
TSSOP



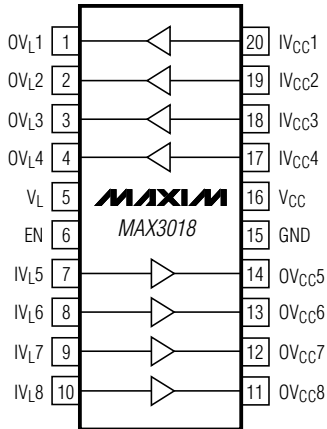
TSSOP



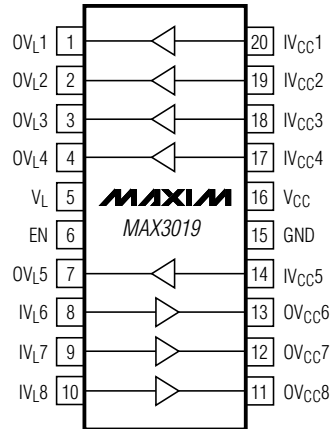
TSSOP



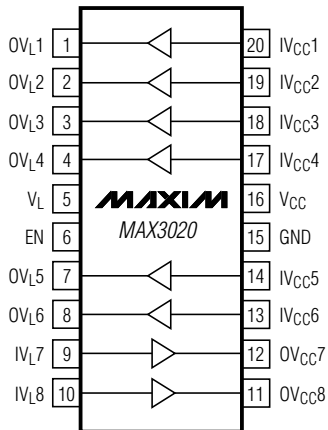
TSSOP



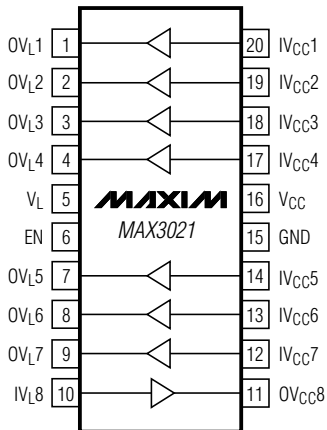
TSSOP



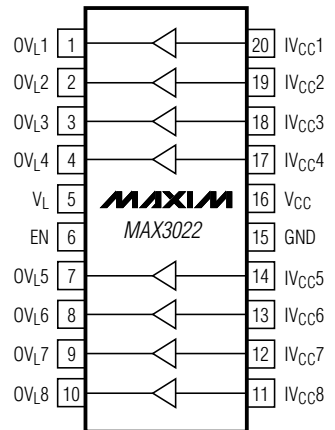
TSSOP



TSSOP



TSSOP

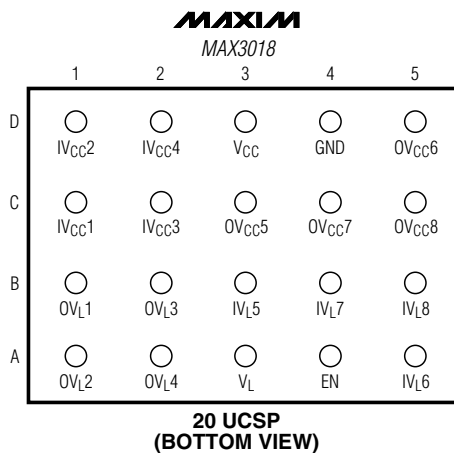
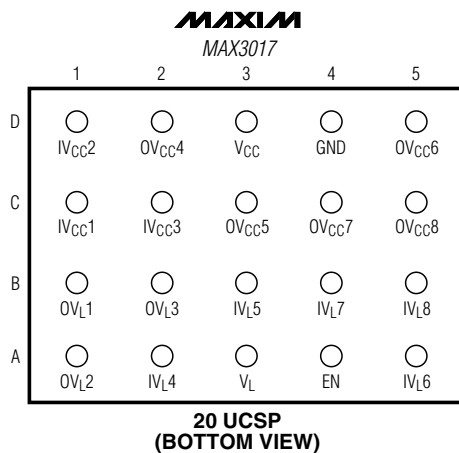
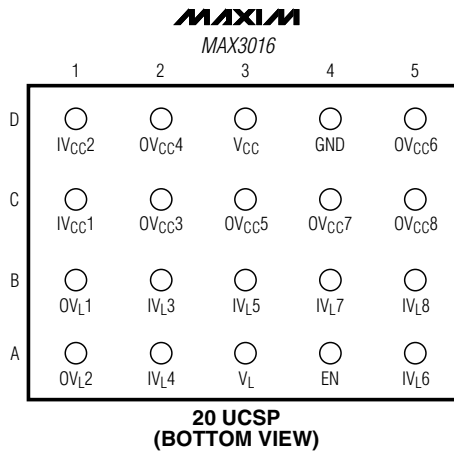
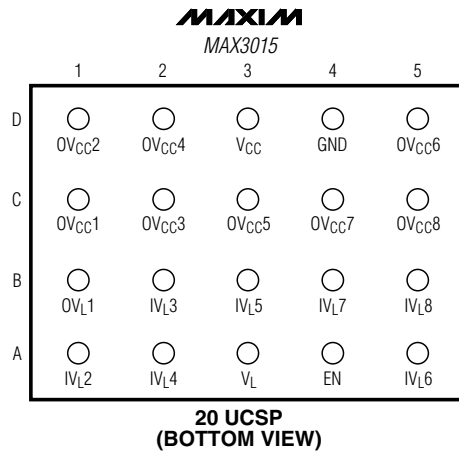
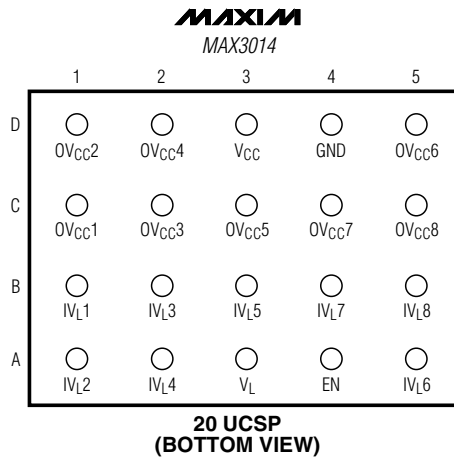
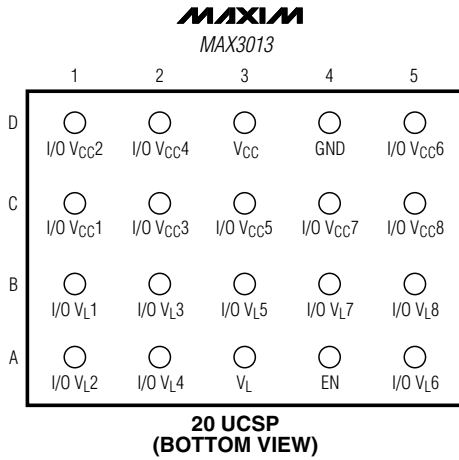


TSSOP

+1.2V to +3.6V, 0.1µA, 100Mbps, 8-Channel Level Translators

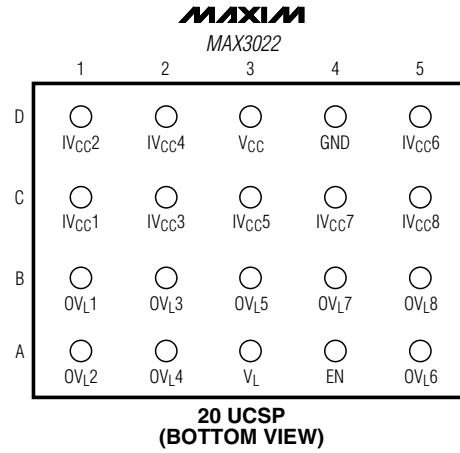
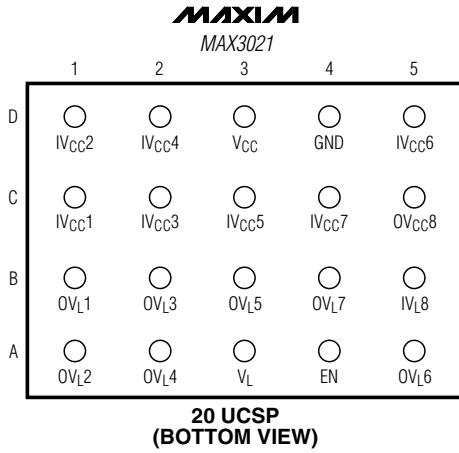
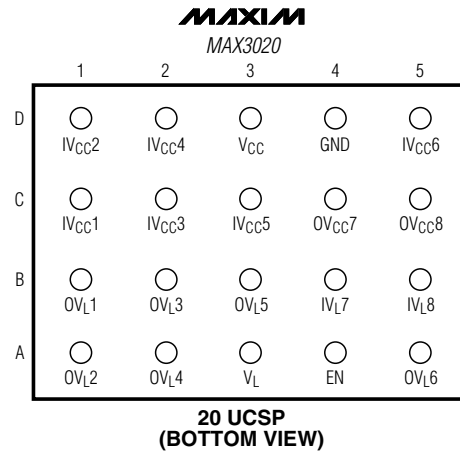
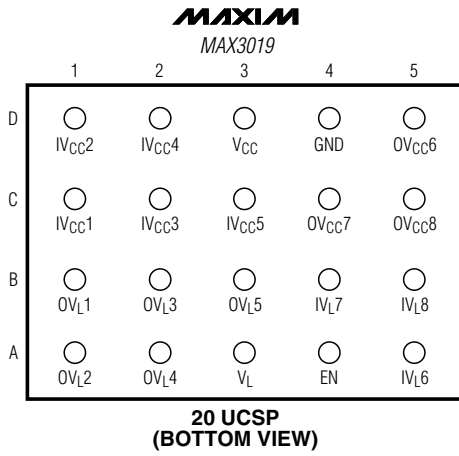
Pin Configurations (continued)

MAX3013-MAX3022



**+1.2V to +3.6V, 0.1µA, 100Mbps,
8-Channel Level Translators**

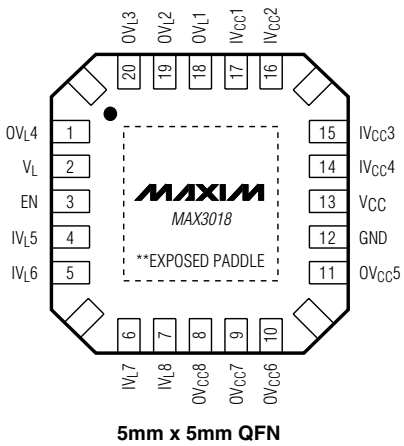
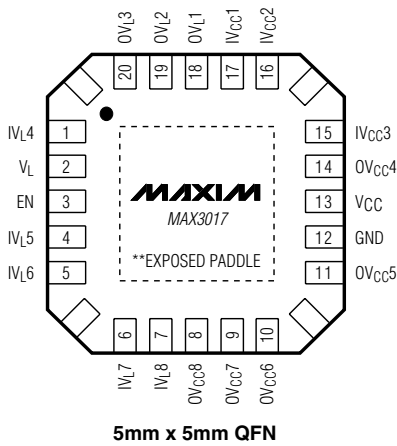
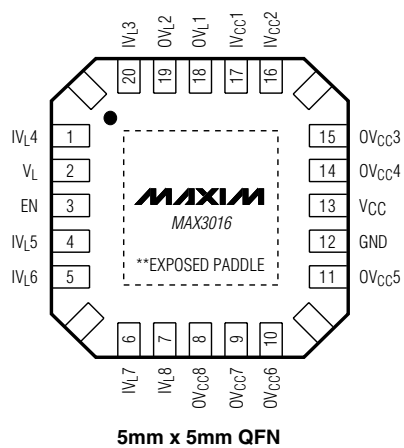
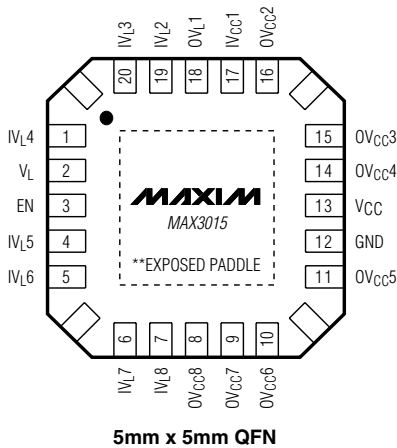
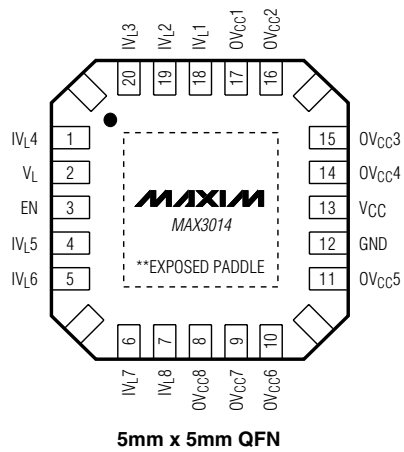
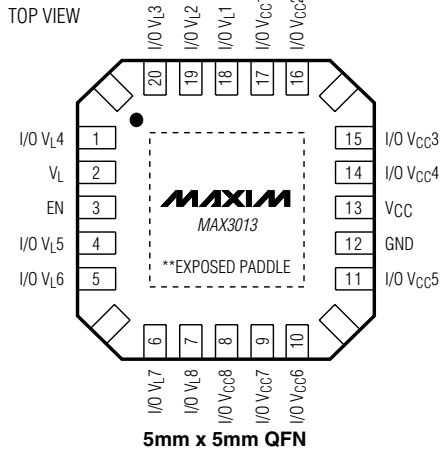
Pin Configurations (continued)



+1.2V to +3.6V, 0.1µA, 100Mbps, 8-Channel Level Translators

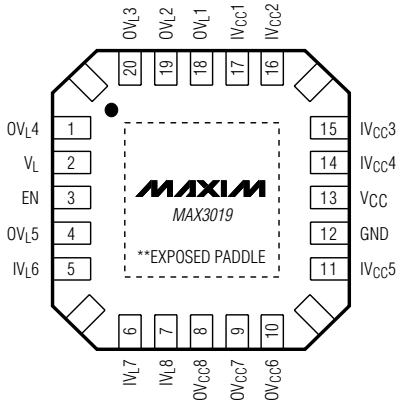
Pin Configurations (continued)

MAX3013-MAX3022

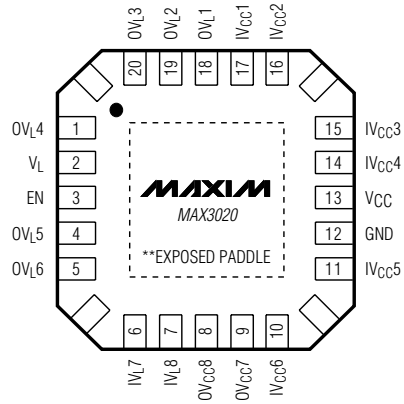


**+1.2V to +3.6V, 0.1µA, 100Mbps,
8-Channel Level Translators**

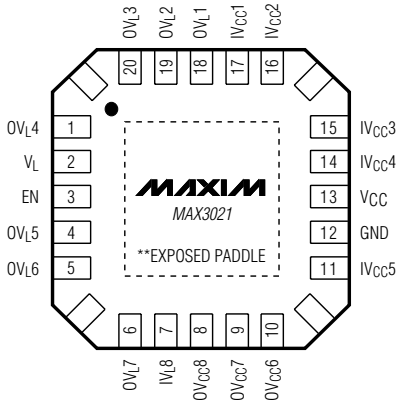
Pin Configurations (continued)



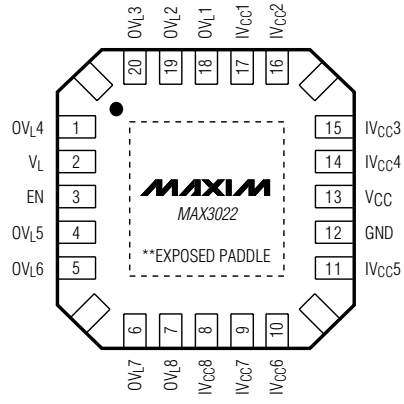
5mm x 5mm QFN



5mm x 5mm QFN



5mm x 5mm QFN



5mm x 5mm QFN

QFN-EP** (5mm x 5mm)
**CONNECT EXPOSED PADDLE TO GND.

+1.2V to +3.6V, 0.1μA, 100Mbps, 8-Channel Level Translators

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.)

MAX3013-MAX3022

SYMBOL	COMMON DIMENSIONS			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	—	1.10	—	.043
A ₁	0.05	0.15	.002	.006
A ₂	0.85	0.95	.033	.037
b	0.19	0.30	.007	.012
b ₁	0.19	0.25	.007	.010
c	0.09	0.20	.004	.008
c ₁	0.09	0.14	.004	.006
D	SEE VARIATIONS		SEE VARIATIONS	
E	4.30	4.50	.169	.177
e	0.65 BSC		.026 BSC	
H	6.25	6.55	.246	.258
L	0.50	0.70	.020	.028
N	SEE VARIATIONS		SEE VARIATIONS	
α	0°	8°	0°	8°

JEDEC			VARIATIONS			
			MILLIMETERS		INCHES	
			MIN.	MAX.	MIN.	MAX.
MO-153	N					
AB-1	14	D	4.90	5.10	.193	.201
AB	16	D	4.90	5.10	.193	.201
AC	20	D	6.40	6.60	.252	.260
AD	24	D	7.70	7.90	.303	.311
AE	28	D	9.60	9.80	.378	.386

NOTES:

- DIMENSIONS D AND E DO NOT INCLUDE FLASH
- MOLD FLASH OR PROTRUSIONS NOT TO EXCEED 0.15mm PER SIDE
- CONTROLLING DIMENSION: MILLIMETER
- MEETS JEDEC OUTLINE MO-153. SEE JEDEC VARIATIONS TABLE
- 'N' REFERS TO NUMBER OF LEADS
- THE LEAD TIPS MUST LIE WITHIN A SPECIFIED ZONE. THIS TOLERANCE ZONE IS DEFINED BY TWO PARALLEL PLANES. ONE PLANE IS THE SEATING PLANE, DATUM [-C-]; THE OTHER PLANE IS AT THE SPECIFIED DISTANCE FROM [-C-] IN THE DIRECTION INDICATED

LEAD TIP DETAIL

WITH PLATING
BASE METAL

0.25 BSC
PARTING LINE
L
C

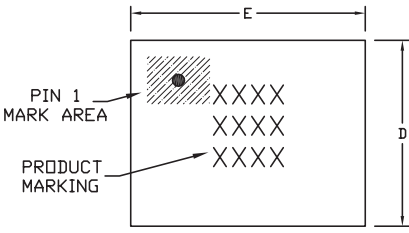
DALLAS SEMICONDUCTOR **MAXIM**
PROPRIETARY INFORMATION
TITLE: PACKAGE OUTLINE, TSSOP 4.40mm BODY
APPROVAL: DOCUMENT CONTROL NO. 21-0066 REV. F 1/1

TSSOP 4.40mm EPS

+1.2V to +3.6V, 0.1µA, 100Mbps, 8-Channel Level Translators

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.)



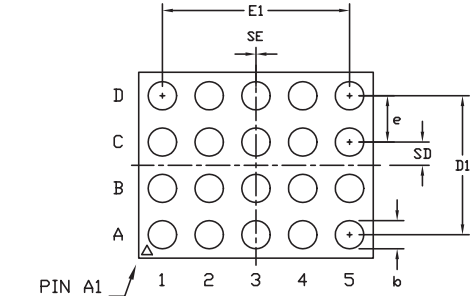
PIN 1 MARK AREA
PRODUCT MARKING

TOP VIEW

COMMON DIMENSIONS	
A	0.62±0.05-0.08
A1	0.29±0.02
A2	0.33 REF.
b	∅0.35±0.03
D1	1.50 BASIC
E1	2.00 BASIC
e	0.50 BASIC
SD	0.25 BASIC
SE	0.00 BASIC

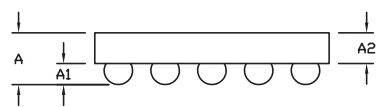
PKG. CODE	VARIABLE DIMENSIONS		DEPOPULATED SOLDER BALLS
	D	E	
B20-1	2.03±0.08	2.54±0.08	NONE
B20-2	2.03±0.08	2.54±0.08	B2, B3, B4
B20-4	2.03±0.08	2.54±0.08	B2, B3, B4, C2, C4
B20-5	2.03±0.08	2.54±0.08	B2, B3, B4, C2, C3, C4
B20-6	2.16±0.08	2.54±0.08	B2, B3, B4

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. PRODUCT MARKING: NUMBER OF CHARACTERS AND LINES VARY PER PRODUCT.



PIN A1 INDICATOR

BOTTOM VIEW



SIDE VIEW

DALLAS SEMICONDUCTOR **MAXIM**

PROPRIETARY INFORMATION

TITLE: PACKAGE OUTLINE, 5x4 UCSP

APPROVAL	DOCUMENT CONTROL NO. 21-0095	REV. I	1/1
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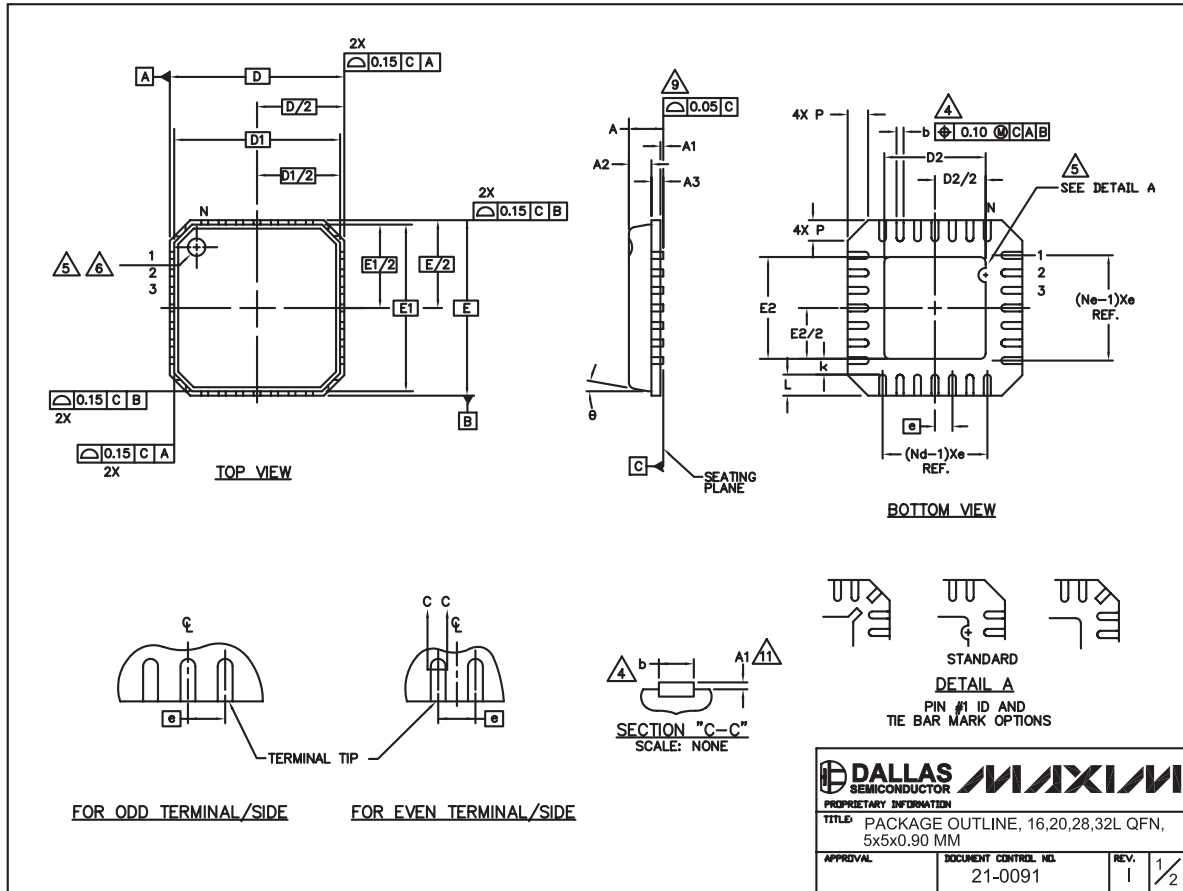
5x4 UCSP.EPS

+1.2V to +3.6V, 0.1μA, 100Mbps, 8-Channel Level Translators

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.)

MAX3013-MAX3022



+1.2V to +3.6V, 0.1µA, 100Mbps, 8-Channel Level Translators

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	16L 5x5			20L 5x5			28L 5x5			32L 5x5		
SYMBOL	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.80	0.90	1.00	0.80	0.90	1.00	0.80	0.90	1.00	0.80	0.90	1.00
A1	0.00	0.01	0.05	0.00	0.01	0.05	0.00	0.01	0.05	0.00	0.01	0.05
A2	0.00	0.65	1.00	0.00	0.65	1.00	0.00	0.65	1.00	0.00	0.65	1.00
A3	0.20 REF			0.20 REF			0.20 REF			0.20 REF		
b	0.28	0.33	0.40	0.23	0.28	0.35	0.18	0.23	0.30	0.18	0.23	0.30
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
D1	4.75 BSC			4.75 BSC			4.75 BSC			4.75 BSC		
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
E1	4.75 BSC			4.75 BSC			4.75 BSC			4.75 BSC		
e	0.80 BSC			0.65 BSC			0.50 BSC			0.50 BSC		
k	0.25	-	-	0.25	-	-	0.25	-	-	0.25	-	-
L	0.35	0.55	0.75	0.35	0.55	0.75	0.35	0.55	0.75	0.30	0.40	0.50
N	16			20			28			32		
ND	4			5			7			8		
NE	4			5			7			8		
P	0.00	0.42	0.60	0.00	0.42	0.60	0.00	0.42	0.60	0.00	0.42	0.60
ϕ	0"		12"	0"		12"	0"		12"	0"		12"

EXPOSED PAD VARIATIONS						
PKG. CODES	D2			E2		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
G1655-3	2.95	3.10	3.25	2.95	3.10	3.25
G2055-1	2.55	2.70	2.85	2.55	2.70	2.85
G2055-2	2.95	3.10	3.25	2.95	3.10	3.25
G2855-1	2.55	2.70	2.85	2.55	2.70	2.85
G2855-2	2.95	3.10	3.25	2.95	3.10	3.25
G3255-1	2.95	3.10	3.25	2.95	3.10	3.25

NOTES:

- DIE THICKNESS ALLOWABLE IS 0.305mm MAXIMUM (.012 INCHES MAXIMUM)
- DIMENSIONING & TOLERANCES CONFORM TO ASME Y14.5M. - 1994.
- N IS THE NUMBER OF TERMINALS.
Nd IS THE NUMBER OF TERMINALS IN X-DIRECTION & Ne IS THE NUMBER OF TERMINALS IN Y-DIRECTION.
- DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.20 AND 0.25mm FROM TERMINAL TIP.
- THE PIN #1 IDENTIFIER MUST BE EXISTED ON THE TOP SURFACE OF THE PACKAGE BY USING INDENTATION MARK OR INK/LASER MARKED. DETAILS OF PIN #1 IDENTIFIER IS OPTIONAL, BUT MUST BE LOCATED WITHIN ZONE INDICATED.
- EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- PACKAGE WARPAGE MAX 0.05mm.
- APPLIED FOR EXPOSED PAD AND TERMINALS. EXCLUDE EMBEDDED PART OF EXPOSED PAD FROM MEASURING.
- MEETS JEDEC MO220; EXCEPT DIMENSION "b".
- APPLIED FOR EXPOSED PAD AND TERMINALS. EXCLUDE EMBEDDING PART OF EXPOSED PAD FROM MEASURING.
- THIS PACKAGE OUTLINE APPLIES TO ANVIL SINGULATION (STEPPED SIDES).

DALLAS SEMICONDUCTOR		MAXIM	
PROPRIETARY INFORMATION			
TITLE: PACKAGE OUTLINE, 16,20,28,32L QFN, 5x5x0.90 MM			
APPROVAL	DOCUMENT CONTROL NO.	REV.	2/2
	21-0091	1	

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22 **Maxim Integrated Products, 120 San Gabriel Drive, Sunnyvale, CA 94086 408-737-7600**