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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

FAIRCHILD SEMICONDUCTOR®

December 2013

74VCX00
Low Voltage Quad 2-Input NAND Gate with 3.6V Tolerant Inputs and Outputs

Features

- 1.2V to 3.6V V_{CC} supply operation
- 3.6V tolerant inputs and outputs
- t_{PD}
  - 2.8ns max. for 3.0V to 3.6V V_{CC}
- Power-off high impedance inputs and outputs
- Static Drive (I_{OH}/I_{OL})
  - ±24mA @ 3.0V V_{CC}
- Uses proprietary noise/EMI reduction circuitry
- Latchup performance exceeds JEDEC 78 conditions
- ESD performance:
  - Human body model > 2000V
  - Machine model > 250V
- Leadless DQFN package

General Description

The VCX00 contains four 2-input NAND gates. This product is designed for low voltage (1.2V to 3.6V) V_{CC} applications with I/O compatibility up to 3.6V.

The VCX00 is fabricated with an advanced CMOS technology to achieve high speed operation while maintaining low CMOS power dissipation.

Ordering Information

Order Number	Package Number	Package Description
74VCX00M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74VCX00BQX(1)	MLP14A	14-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 3.0mm
74VCX00MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

Note:

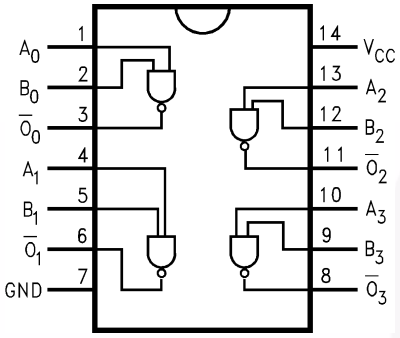
1. DQFN package available in Tape and Reel only.

Device also available in Tape and Reel. Specify by appending suffix letter “X” to the ordering number.

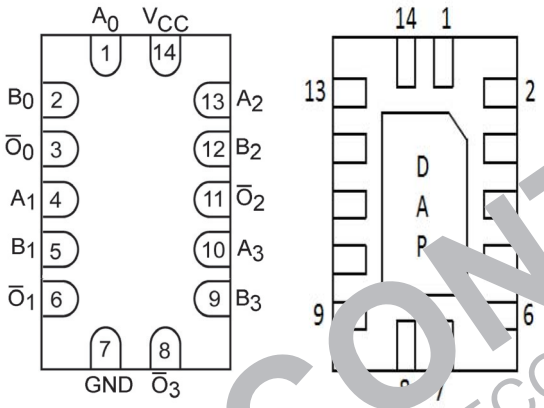
All packages are lead free per JEDEC: J-STD-020B standard.

Connection Diagrams

Pin Assignments for SOIC and TSSOP



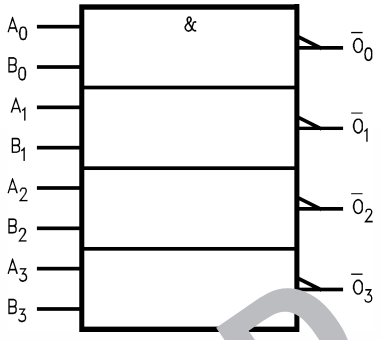
Pad Assignments for DQFN



(Top View) (Bottom View)

Logic Symbol

IEEE/IEC



Pin Description

Pin Names	Description
A_n, B_n	Inputs
$\overline{O}_n$	Outputs
DAP	No Connect

Note: DAP (Die Attach Pad)

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Rating
V_{CC}	Supply Voltage	–0.5V to +4.6V
V_I	DC Input Voltage	–0.5V to 4.6V
V_O	DC Output Voltage HIGH or LOW State(2)	–0.5V to V_{CC} + 0.5V
	V_{CC} = 0V	–0.5V to 4.6V
I_{IK}	DC Input Diode Current, V_I < 0V	–50mA
I_{OK}	DC Output Diode Current V_O < 0V	-50mA
	V_O > V_{CC}	+50mA
I_{OH} / I_{OL}	DC Output Source/Sink Current	±50mA
I_{CC} or GND	DC V_{CC} or Gound Current per Supply Pin	±100mA
T_{STG}	Storage Temperature Range	–65°C to +150°C

Note:

2. I_O Absolute Maximum Rating must be observe

Recommended Operating Conditions(3)

The Recommended Operating Conditions Table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Rating
V_{CC}	Supply Operating	1.2V to 3.6V
V_I	Input Voltage	–0.3V to 3.6V
V_O	Output Voltage, HIGH or LOW State	0V to V_{CC}
I_H / I_O	Output Current V_{CC} = 3.0V to 3.6V	±24mA
	V_{CC} = 2.3V to 2.7V	±18mA
	V_{CC} = 1.65V to 2.3V	±6mA
	V_{CC} = 1.4V to 1.6V	±2mA
	V_{CC} = 1.2V	± 100µA
T_A	Free Air Operating Temperature	–40°C to +85°C
$\Delta t / \Delta V$	Minimum Input Edge Rate, V_{IN} = 0.8V to 2.0V, V_{CC} = 3.0V	10ns/V

Note:

3. Floating or unused inputs must be held HIGH or LOW

DC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	Conditions	Min	Max	Units
V_{IH}	HIGH Level Input Voltage	2.7–3.6		2.0		V
		2.3–2.7		1.6		
		1.65–2.3		$0.65 \times V_{CC}$		
		1.4–1.6		$0.65 \times V_{CC}$		
		1.2		$0.65 \times V_{CC}$		
V_{IL}	LOW Level Input Voltage	2.7–3.6			0.8	V
		2.3–2.7			0.7	
		1.65–2.3			$0.35 \times V_{CC}$	
		1.4–1.6			$0.3 \times V_{CC}$	
		1.2			$0.05 \times V_{CC}$	
V_{OH}	HIGH Level Output Voltage	2.7–3.6	I_{OH} = –100µA	V_{CC} – 0.2		V
		2.7	I_{OH} = –12mA	2.2		
		3.0	I_{OH} = –18mA	2.4		
		3.0	I_{OH} = –24mA	2.2		
		2.3–2.7	I_{OH} = –10	V_{CC} – 0.2		
		2.3	I_{OH} = –mA	2.0		
		2.3	I_{OH} = –1 mA	1.8		
		2.3	I_{OH} = –18mA	1.7		
		1.65–2.3	I_{OH} = –100µA	V_{CC} – 0.2		
		1.65	I_{OH} = –6mA	1.25		
		1.4–1.6	I_{OH} = –100µA	V_{CC} – 0.2		
		1.4	I_{OH} = –2mA	1.05		
		1.2	I_{OH} = –100µA	V_{CC} – 0.2		
V_{OL}	LOW Level Output Voltage	2.7–3.6	I_{OL} = 100µA		0.2	V
		2.7	I_{OL} = 12mA		0.4	
		3.0	I_{OL} = 18mA		0.4	
		3.0	I_{OL} = 24mA		0.55	
		2.3–2.7	I_{OL} = 100µA		0.2	
		2.3	I_{OL} = 12mA		0.4	
		2.3	I_{OL} = 18mA		0.6	
		1.65–2.3	I_{OL} = 100µA		0.2	
		1.65	I_{OL} = 6mA		0.3	
		1.4–1.6	I_{OL} = 100µA		0.2	
		1.4	I_{OL} = 2mA		0.35	
		1.2	I_{OL} = 100µA		0.05	
I_I	Input Leakage Current	1.4–3.6	$0 \le V_I \le 3.6V$		±5.0	µA
I_{OZ}	3-STATE Output Leakage	1.4–3.6	$0 \le V_O \le 3.6V$, $V_I = V_{IH}$ or V_{IL}		±10	µA
I_{OFF}	Power-OFF Leakage Current	0	$0 \le (V_I, V_O) \le 3.6V$		10	µA
I_{CC}	Quiescent Supply Current	1.4–3.6	$V_I = V_{CC}$ or GND		20	µA
			$V_{CC} \le (V_I, V_O) \le 3.6V$(4)		±20	
ΔI_{CC}	Increase in I_{CC} per Input	2.7–3.6	$V_{IH} = V_{CC}$ –0.6V		750	µA

Note:

4. Outputs disabled or 3-STATE only.

AC Electrical Characteristics[5]

Symbol	Parameter	V_{CC} (V)	Conditions	T_A = –40°C to +85°C		Units	Figure Number
				Min.	Max.		
t_{PHL}, t_{PLH}	Propagation Delay	3.3 ± 0.3	C_L = 30pF, R_L = 500Ω	0.6	2.8	ns	Fig. 1
		2.5 ± 0.2		0.8	3.7		Fig. 2
		1.8 ± 0.15		1.0	7.4		
		1.5 ± 0.1	C_L = 15pF, R_L = 2kΩ	1.0	14.8		Fig. 3
		1.2		1.5	37.0		Fig. 4
t_{OSHL}, t_{OSLH}	Output to Output Skew[6]	3.3 ± 0.3	C_L = 30pF, R_L = 500Ω		0.5		
		2.5 ± 0.2			0.5		
		1.8 ± 0.15			.75		
		1.5 ± 0.1	C_L = 15pF, R_L = 2kΩ		1		
		1.2			5		

Note:

5. For C_L = 50pF, add approximately 300ps to the AC Maximum specification.
6. Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW (t_{OSHL}) or LOW-to-HIGH (t_{OSLH}).

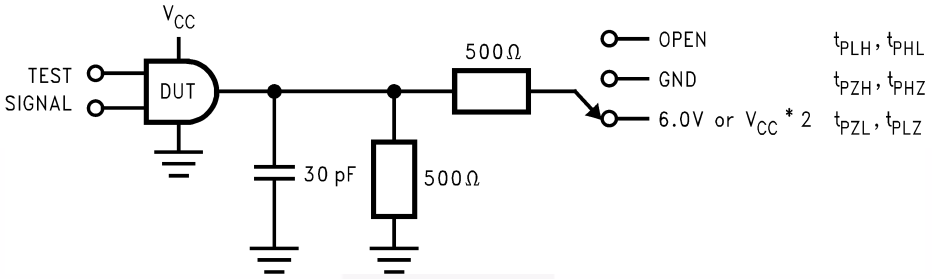
Dynamic Switching Characteristics

Symbol	Parameter	V_{CC} (V)	Conditions	T_A = 25°C Typical	Unit
V_{OLP}	Quiet Output Dynamic Peak V_{OL}	1.8	C_L = 30pF, V_{IH} = V_{CC}, V_{IL} = 0V	0.25	V
		2.5		0.6	
		3.3		0.8	
	Quiet Output Dynamic Valley V_{OL}	1.8	C_L = 30pF, V_{IH} = V_{CC}, V_{IL} = 0V	–0.25	V
		2.5		–0.6	
		3.3		–0.8	
V_{OHV}	Quiet Output Dynamic Valley V_{OH}	1.8	C_L = 30pF, V_{IH} = V_{CC}, V_{IL} = 0V	1.5	V
		2.5		1.9	
		3.3		2.2	

Capacitance

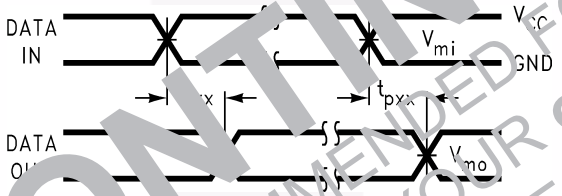
Symbol	Parameter	Conditions	T_A = +25°C Typical	Units
C_{IN}	Input Capacitance	V_I = 0V or V_{CC}, V_{CC} = 1.8V, 2.5V or 3.3V	6	pF
C_{OUT}	Output Capacitance	V_I = 0V or V_{CC}, V_{CC} = 1.8V, 2.5V or 3.3V	7	pF
C_{PD}	Power Dissipation Capacitance	V_I = 0V or V_{CC}, f = 10 MHz, V_{CC} = 1.8V, 2.5V or 3.3V	20	pF

AC Loading and Waveforms (V_{CC} 3.3V ± 0.3V to 1.8V ± 0.15V)



Test	Switch
t_{PLH}, t_{PHL}	Open

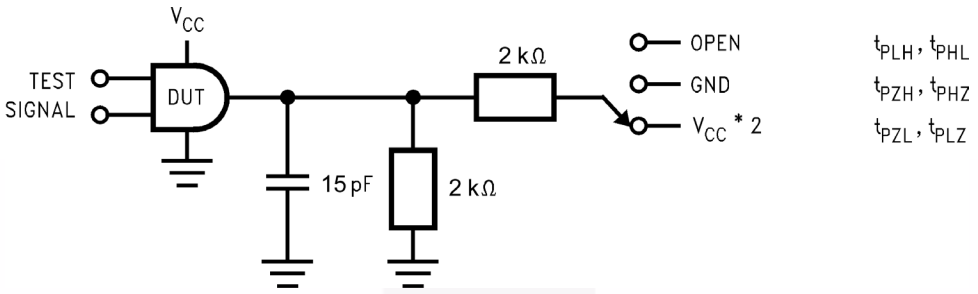
Figure 1. AC Test Circuit



Symbol	V_{CC}		
	3.3V ± 0.3V	2.5V ± 0.2V	1.8V ± 0.15V
V_{mi}	1.5V	V_{CC} / 2	V_{CC} / 2
V_{mo}	1.5V	V_{CC} / 2	V_{CC} / 2

Figure 2. Waveform for Inverting and Non-inverting Functions

AC Loading and Waveforms (V_{CC} 1.5 ± 0.1V to 1.2V)



Test	SWITCH
t_{PLH}, t_{PHL}	Open
t_{PZL}, t_{PLZ}	V_{CC} x 2 at V_{CC} = 1.5V ± 0.1V
t_{PZH}, t_{PHZ}	GND

Figure 3. AC Test Circu

Symbol	V_{CC} 1.5V ± 0.1V
V_{mi}	V_{CC} / 2
V_{mo}	V_{CC} / 2

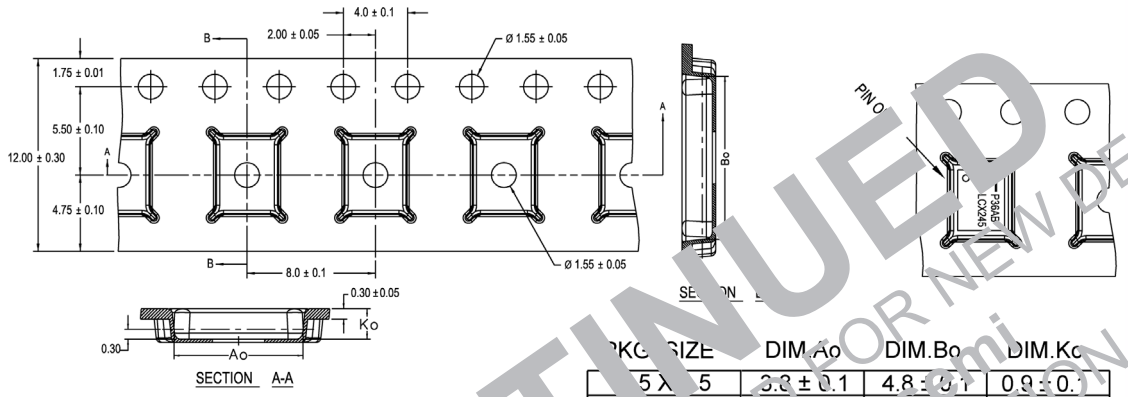
Figure 4. Waveform for Inverting and Non-Inverting Functions

Tape and Reel Specification

Tape Format for DQFN

Package Designator	Tape Section	Number of Cavities	Cavity Status	Cover Tape Status
BQX	Leader (Start End)	125 (Typ.)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (Typ.)	Empty	Sealed

Tape Dimensions inches (millimeters)



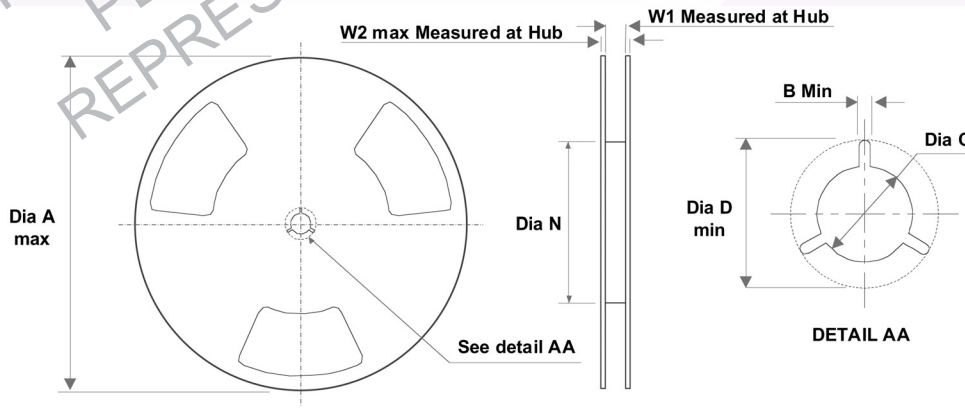
PKG SIZE	DIM.Ao	DIM.Bo	DIM.Ko
2.5 X 2.5	2.8 ± 0.1	4.8 ± 0.1	0.9 ± 0.1
3.0 X 3.0	3.3 ± 0.1	3.8 ± 0.1	0.9 ± 0.1
2.5 X 4.5	2.8 ± 0.1	4.8 ± 0.1	0.9 ± 0.1
2.5 X 3.5	2.8 ± 0.1	3.8 ± 0.1	0.9 ± 0.1
2.5 X 3.0	2.8 ± 0.1	3.3 ± 0.1	0.9 ± 0.1
2.5 X 2.5	2.3 ± 0.1	2.8 ± 0.1	0.9 ± 0.1

DIMENSIONS ARE IN MILLIMETERS

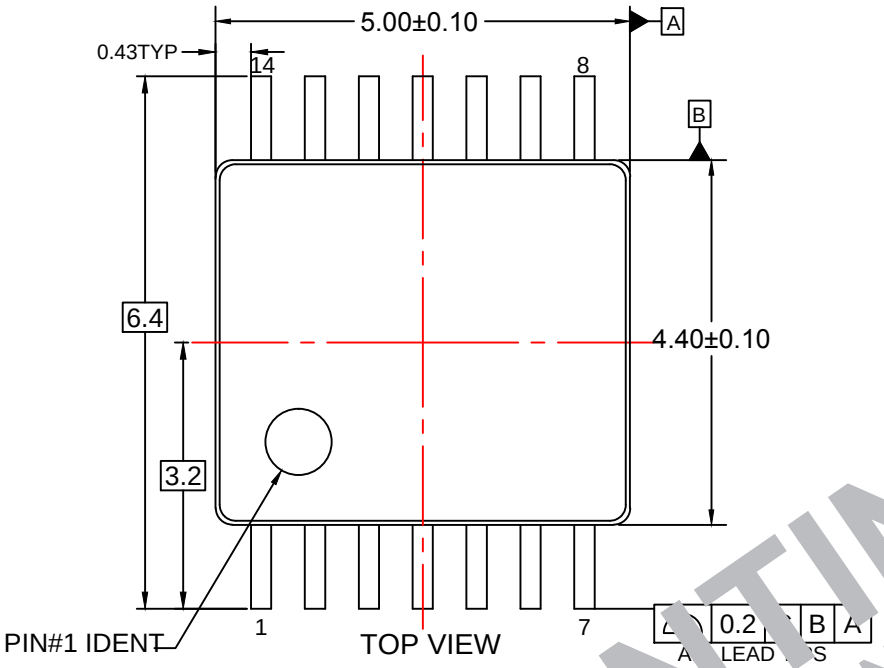
NOTES: unless otherwise specified

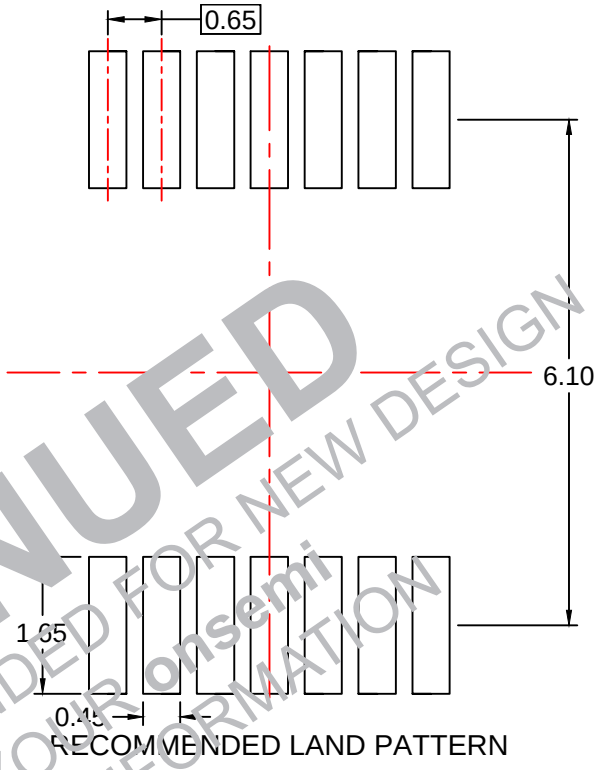
1. Cummulative pitch error for feeding holes and cavities (chip pockets) not to exceed 0.008[0.20] over 10 pitch span.
2. Smallest allowable bending radius.
3. Thru hole inside cavity is centered within cavity.
4. Tolerance is ±0.002[0.05] for these dimensions on all 12mm tapes.
5. Ao and Bo measured on a plane 0.120[0.30] above the bottom of the pocket.
6. Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
   Pocket position relative to sprocket hole measured as true position of pocket. Not pocket hole.
   Unless otherwise noted, controlling dimension is millimeter. Dimension in inches rounded.

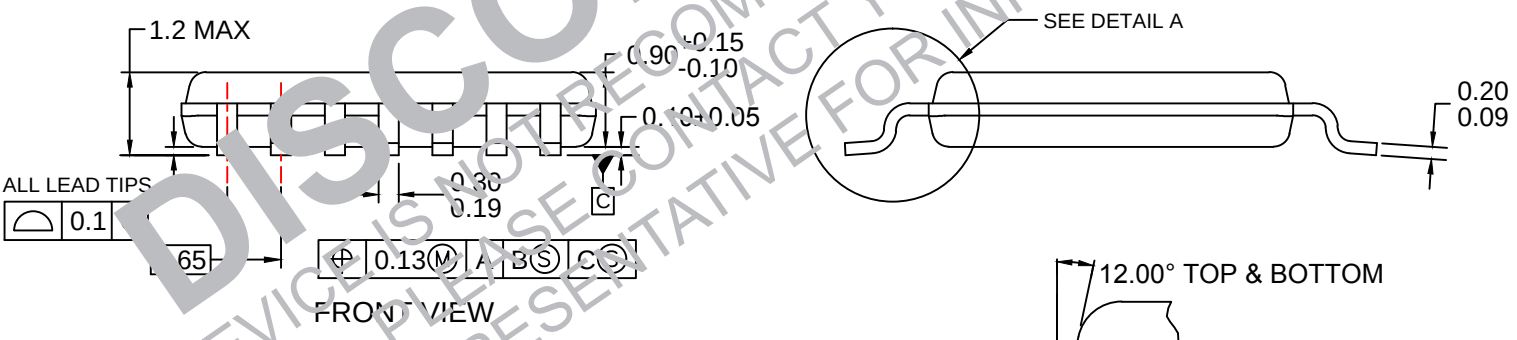
Reel Dimensions inches (millimeters)

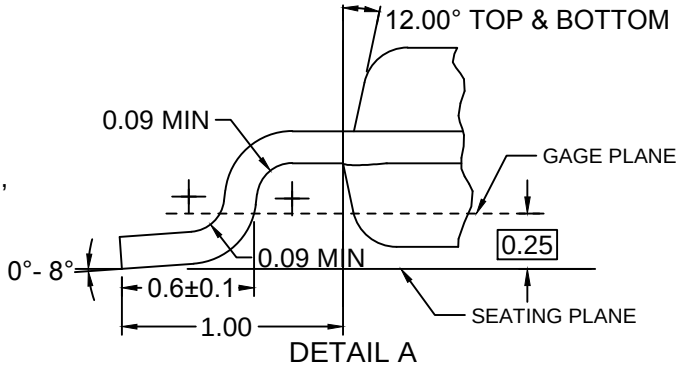


Tape Size	A	B	C	D	N	W1	W2
12mm	13.0 (330.0)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	2.165 (55.00)	0.488 (12.4)	0.724 (18.4)









NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6

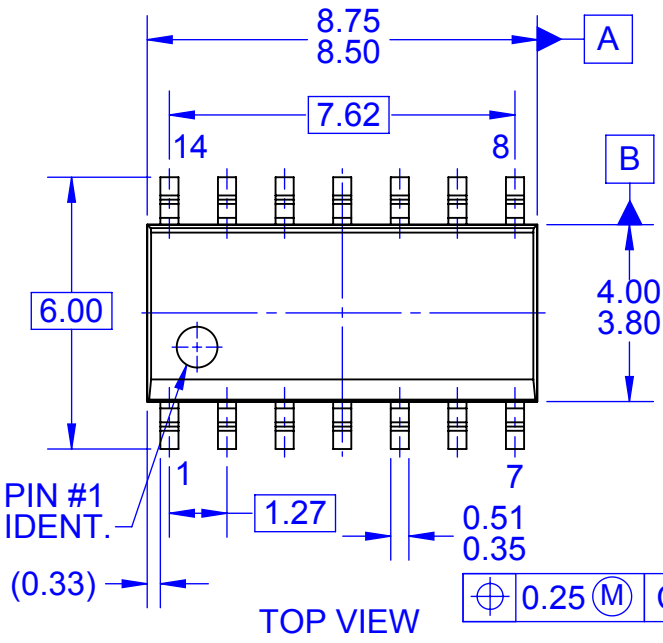
B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS

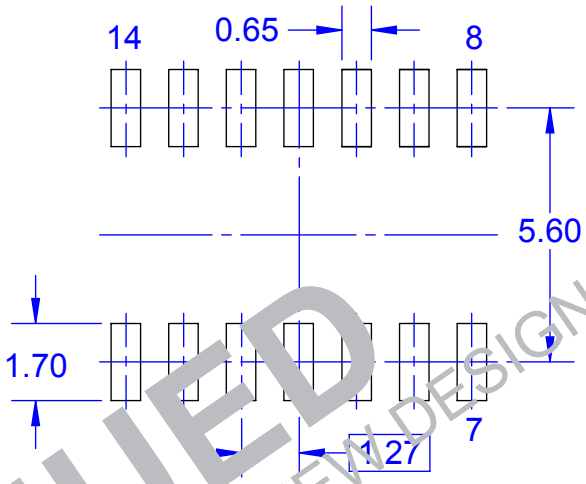
D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 2009.

E. LANDPATTERN STANDARD: SOP65P640X110-14M.

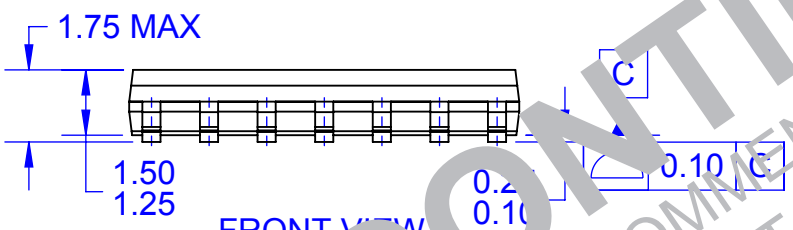
F. DRAWING FILE NAME: MKT-MTC14rev7.



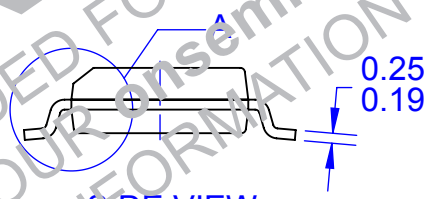
TOP VIEW



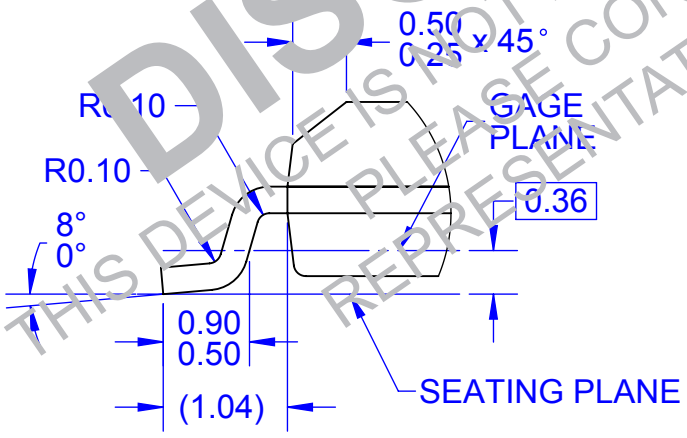
LAND PATTERN RECOMMENDATION



FRONT VIEW



SIDE VIEW



DETAIL A
SCALE 16 : 1

NOTES:

A. CONFORMS TO JEDEC MS-012, VARIATION AB, ISSUE C
B. ALL DIMENSIONS ARE IN MILLIMETERS
C. DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS
D. LAND PATTERN STANDARD: SOIC127P600X145-14M
E. CONFORMS TO ASME Y14.5M, 2009
D. DRAWING FILENAME: MKT-M14Arev14

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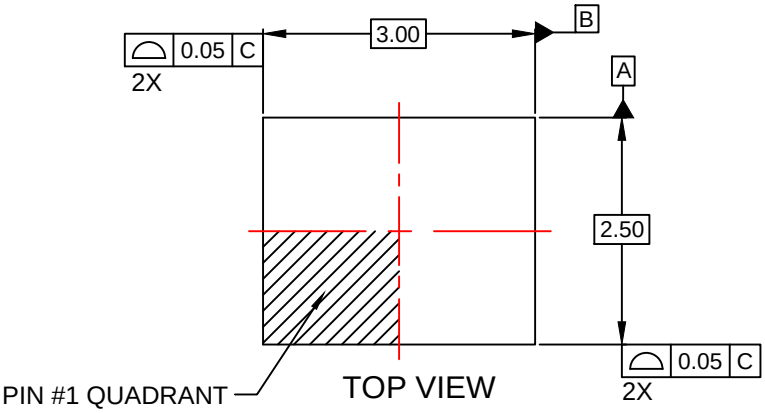
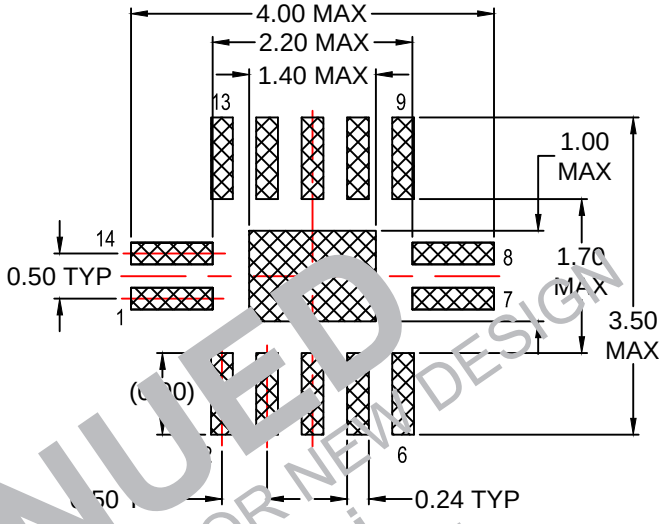
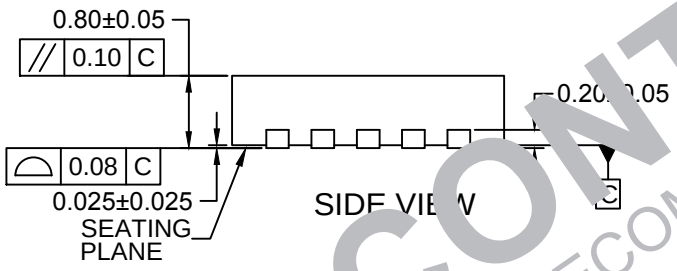
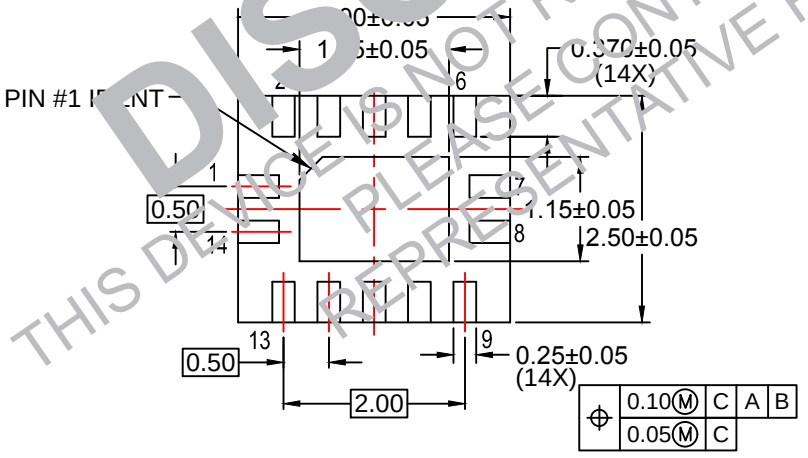




RECOMMENDED LAND PATTERN





NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-241, VARIATION AA

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.

D. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.

E. DRAWING FILENAME: MKT-MLP14Arev2.

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