

TinyLogic UHS Dual Unbuffered Inverter

NC7WZU04

Description

The NC7WZU04 is a dual unbuffered inverter from onsemi's Ultra High Speed Series of TinyLogic in the space saving SC-88 6-lead package. The special purpose unbuffered circuit design is intended for crystal oscillator or analog applications. The internal circuit consists of only one-stage, the output, to allow for this part to be used in these oscillator or analog applications. The device is fabricated with advanced CMOS technology to achieve ultra high speed with high output drive while maintaining low static power dissipation over a very broad V_{CC} operating range. The device is specified to operate over the 1.65 V to 5.5 V V_{CC} range. The inputs are high impedance when V_{CC} is 0 V. Inputs tolerate voltages up to 5.5 V independent of V_{CC} operating voltage.

Features

- Space-Saving SC-88 6-Lead Package
- Ultra-Small MicroPak™ Leadless Packages
- Unbuffered for Crystal Oscillator and Analog Applications
- Balanced Output Drive: ± 32 mA at 4.5 V V_{CC}
- Balanced Output Drive: ± 8 mA at 4.5 V V_{CC} (NC7WZU04P6X-L22347)
- Broad V_{CC} Operating Range: 1.65 V to 5.5 V
- Low Quiescent Power: $I_{CC} < 1$ μ A at 5 V V_{CC} , $T_A = 25^\circ\text{C}$
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

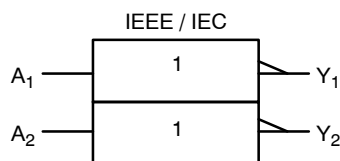
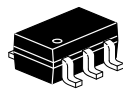
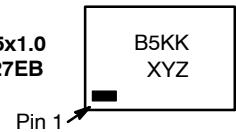


Figure 1. Logic Symbol

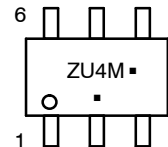
MARKING DIAGRAMS



SIP6 1.45x1.0
CASE 127EB



SC-88
CASE 419B-02



B5, ZU4 = Specific Device Code
 KK = 2-Digit Lot Run Traceability Code
 XY = 2-Digit Date Code Format
 Z = Assembly Plant Code
 M = Data Code*
 ■ = Pb-Free Package

(Note: Microdot may be in either location)

*Date Code orientation and/or position may vary depending upon manufacturing location.

ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 7 of this data sheet.

Pin Configurations

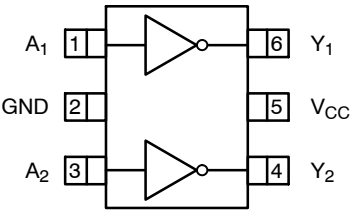


Figure 2. SC-88 (Top View)

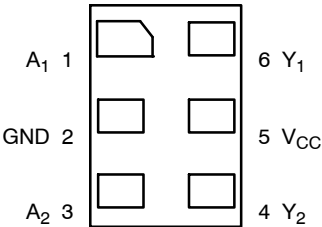
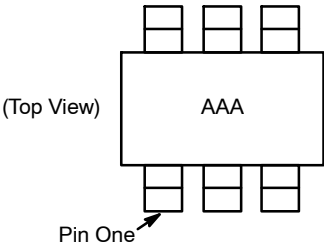


Figure 3. MicroPak (Top Through View)



AAA represents Product Code Top Mark – see ordering code
NOTE: Orientation of Top Mark determines Pin One location.
Reading the top product code mark left to right, Pin One is the lower left pin (see diagram).

Figure 4. SC-88 Pin 1 Orientation

PIN DEFINITIONS

Pin Name	Description
A ₁ , A ₂	Data Inputs
Y ₁ , Y ₂	Outputs

FUNCTION TABLE (Y = \overline{A})

Input	Output
A	Y
L	H
H	L

H = HIGH Logic Level
L = LOW Logic Level

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Min	Max	Unit
V _{CC}	Supply Voltage		-0.5	6.5	V
V _{IN}	DC Input Voltage		-0.5	6.5	V
V _{OUT}	DC Output Voltage		-0.5	V _{CC} + 0.5	V
I _{IK}	DC Input Diode Current	V _{IN} < 0 V	-	-50	mA
I _{OK}	DC Output Diode Current	V _{OUT} < 0 V	-	-50	mA
		V _{OUT} > V _{CC}	-	+50	mA
I _{OUT}	DC Output Current		-	±50	mA
I _{CC} or I _{GND}	DC V _{CC} / GND Current		-	±50	mA
T _{STG}	Storage Temperature		-65	+150	°C
T _J	Junction Temperature Under Bias		-	150	°C
T _L	Junction Lead Temperature (Soldering, 10 Seconds)		-	260	°C
P _D	Power Dissipation in Still Air	SC-88	-	332	mW
		MicroPak-6	-	812	

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	Supply Voltage Operating		1.65	5.5	V
	Supply Voltage Data Retention		1.5	5.5	
V _{IN}	Input Voltage		0	5.5	V
V _{OUT}	Output Voltage		0	V _{CC}	V
T _A	Operating Temperature		-40	+85	°C
θ _{JA}	Thermal Resistance	SC-88	-	377	°C/W
		MicroPak-6	-	154	

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

1. Unused inputs must be held HIGH or LOW. They may not float.

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V _{CC} (V)	T _A = +25°C			T _A = -40 to +85°C		Unit
				Min	Typ	Max	Min	Max	
V _{IH}	HIGH Level Input Voltage		1.8 to 2.7	0.85 V _{CC}	–	–	0.85 V _{CC}	–	V
			3.0 to 5.5	0.8 V _{CC}	–	–	0.8 V _{CC}	–	
V _{IL}	LOW Level Input Voltage		1.8 to 2.7	–	–	0.15 V _{CC}	–	0.15 V _{CC}	V
			3.0 to 5.5	–	–	0.2 V _{CC}	–	0.2 V _{CC}	
V _{OH}	High-Level Output Voltage	V _{IN} = GND	1.65 to 5.5	V _{CC} – 0.1	V _{CC}	–	V _{CC} – 0.1	–	V
		I _{OH} = –100 µA	1.65	1.29	1.4	–	1.29	–	
		I _{OH} = –4 mA	2.3	1.9	2.1	–	1.9	–	
		I _{OH} = –8 mA	2.7	2.2	2.4	–	2.2	–	
		I _{OH} = –12 mA	3.0	2.4	2.7	–	2.4	–	
		I _{OH} = –16 mA	3.0	2.3	2.5	–	2.3	–	
		I _{OH} = –24 mA	4.5	3.8	4.0	–	3.8	–	
		I _{OH} = –32 mA							
V _{OL}	Low-Level Output Voltage	V _{IN} = V _{CC}	1.65 to 5.5	–	–	0.1	–	0.1	V
		I _{OL} = 100 µA	1.65	–	0.08	0.24	–	0.24	
		I _{OL} = 4 mA	2.3	–	0.2	0.3	–	0.3	
		I _{OL} = 8 mA	2.7	–	0.22	0.4	–	0.4	
		I _{OL} = 12 mA	3.0	–	0.28	0.4	–	0.4	
		I _{OL} = 16 mA	3.0	–	0.38	0.55	–	0.55	
		I _{OL} = 24 mA	4.5	–	0.42	0.55	–	0.55	
		I _{OL} = 32 mA							
I _{IN}	Input Leakage Current	V _{IN} = 5.5 V, GND	1.65 to 5.5	–	–	±0.1	–	±1.0	µA
I _{CC}	Quiescent Supply Current	V _{IN} = 5.5 V, GND	1.65 to 5.5	–	–	1.0	–	10	µA
I _{CCPEAK}	Peak Supply Current in Analog Operation	V _{OUT} = Open V _{IN} = Adjust for Peak I _{CC} Current	1.8	–	0.2	–	–	–	mA
			2.5	–	2	–	–	–	
			3.3	–	5	–	–	–	
			5.0	–	15	–	–	–	

NC7WZU04

DC ELECTRICAL CHARACTERISTICS (NC7WZU04P6X–L22347)

Symbol	Parameter	V _{CC} (V)	Conditions		T _A = +25°C			T _A = –40 to +85°C		Unit
					Min	Typ	Max	Min	Max	
V _{IH}	HIGH Level Input Voltage	1.8 to 2.7			0.85 V _{CC}	–	–	0.85 V _{CC}	–	V
		3.0 to 5.5			0.8 V _{CC}	–	–	0.8 V _{CC}	–	
V _{IL}	LOW Level Input Voltage	1.8 to 2.7			–	–	0.15 V _{CC}	–	0.15 V _{CC}	V
		3.0 to 5.5			–	–	0.2 V _{CC}	–	0.2 V _{CC}	
V _{OH}	HIGH Level Output Voltage	1.65	V _{IN} = V _{IL}	I _{OH} = –100 μA	1.55	1.65	–	1.55	–	V
		1.8			1.6	1.79	–	1.6	–	
		2.3			2.1	2.29	–	2.1	–	
		3.0			2.7	2.99	–	2.7	–	
		4.5			4.0	4.48	–	4.0	–	
		1.65	V _{IN} = GND	I _{OH} = –2 mA	1.29	1.52	–	1.29	–	V
		2.3			1.9	2.19	–	1.9	–	
		3.0			2.4	2.82	–	2.4	–	
		3.0			2.3	2.73	–	2.3	–	
		4.5			3.8	4.24	–	3.8	–	
VOL	LOW Level Output Voltage	1.65	V _{IN} = V _{IH}	I _{OL} = 100 μA	–	0.01	0.2	–	0.2	V
		1.8			–	0.01	0.2	–	0.2	
		2.3			–	0.01	0.2	–	0.2	
		3.0			–	0.01	0.3	–	0.3	
		4.5			–	0.01	0.5	–	0.5	
		1.65	V _{IN} = V _{CC}	I _{OL} = 2 mA	–	0.10	0.24	–	0.24	V
		2.3			–	0.12	0.3	–	0.3	
		3.0			–	0.19	0.4	–	0.4	
		3.0			–	0.29	0.55	–	0.55	
		4.5			–	0.29	0.55	–	0.55	
I _{IN}	Input Leakage Current	1.65 to 5.5	V _{IN} = 5.5 V, GND		–	–	±0.1	–	±1.0	μA
I _{CC}	Quiescent Supply Current	1.65 to 5.5	V _{IN} = 5.5 V, GND		–	–	1.0	–	10	μA
I _{CCPEAK}	Peak Supply Current in Analog Operation	1.8	V _{OUT} = Open V _{IN} = Adjust for Peak I _{CC} Current		–	0.2	–	–	–	mA
		2.5			–	2	–	–		
		3.3			–	5	–	–		
		5.0			–	15	–	–		

AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V _{CC} (V)	Conditions	T _A = +25°C			T _A = -40 to +85°C		Unit
				Min	Typ	Max	Min	Max	
t _{PLH} , t _{PHL}	Propagation Delay (Figure 5, 6)	1.65	C _L = 15 pF, R _L = 1 MΩ	–	5.5	9.8	–	11.0	ns
		1.8		–	4.6	8.1	–	8.9	
		2.5 ±0.2		–	3.3	5.7	–	6.3	
		3.3 ±0.3		–	2.7	4.1	–	4.5	
		5.0 ±0.5		–	2.2	3.3	–	3.6	
		3.3 ±0.3	C _L = 50 pF, R _L = 500 Ω	–	4.0	6.4	–	7.0	
		5.0 ±0.5		–	3.4	5.6	–	6.2	
C _{IN}	Input Capacitance	0		–	3	–	–	–	pF
C _{PD}	Power Dissipation Capacitance (Figure 7)	3.3	(Note 2)	–	3.5	–	–	–	pF
		5.0		–	5.5	–	–	–	

2. C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output loading and operating at 50% duty cycle. C_{PD} is related to I_{CCD} dynamic operating current by the expression:
 $I_{CCD} = (C_{PD}) (V_{CC}) (f_{IN}) + (I_{CCstatic})$.

AC Loading and Waveforms

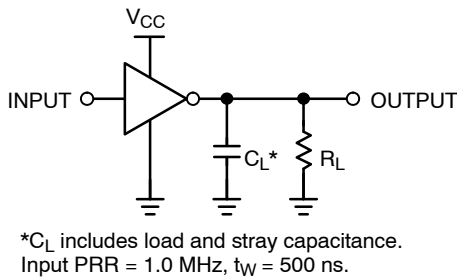


Figure 5. AC Test Circuit

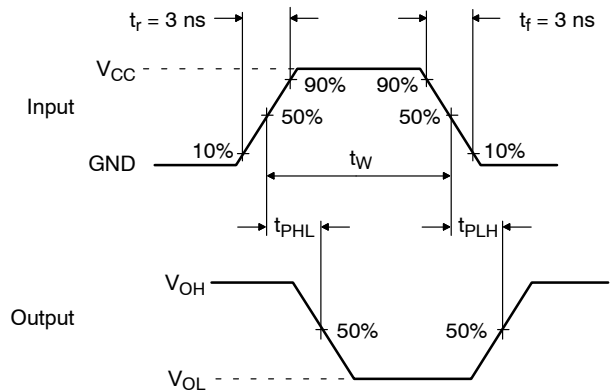
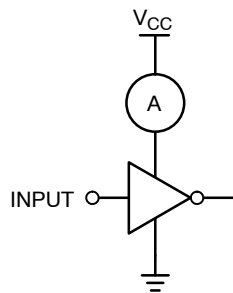


Figure 6. AC Waveforms



Application Note: When operating the NC7WZU04's unbuffered output stage in its linear range, as in oscillator applications, care must be taken to observe maximum power rating for the device and package. The high drive nature of the design of the output stage will result in substantial simultaneous conduction currents when the stage is in the linear region. See the I_{CCPEAK} specification on page 4.

Input = AC Waveform; t_r = t_f = 1.8 ns.
 PRR = 10 MHz; Duty Cycle = 50%.

Figure 7. I_{CCD} Test Circuit

NC7WZU04

DEVICE ORDERING INFORMATION

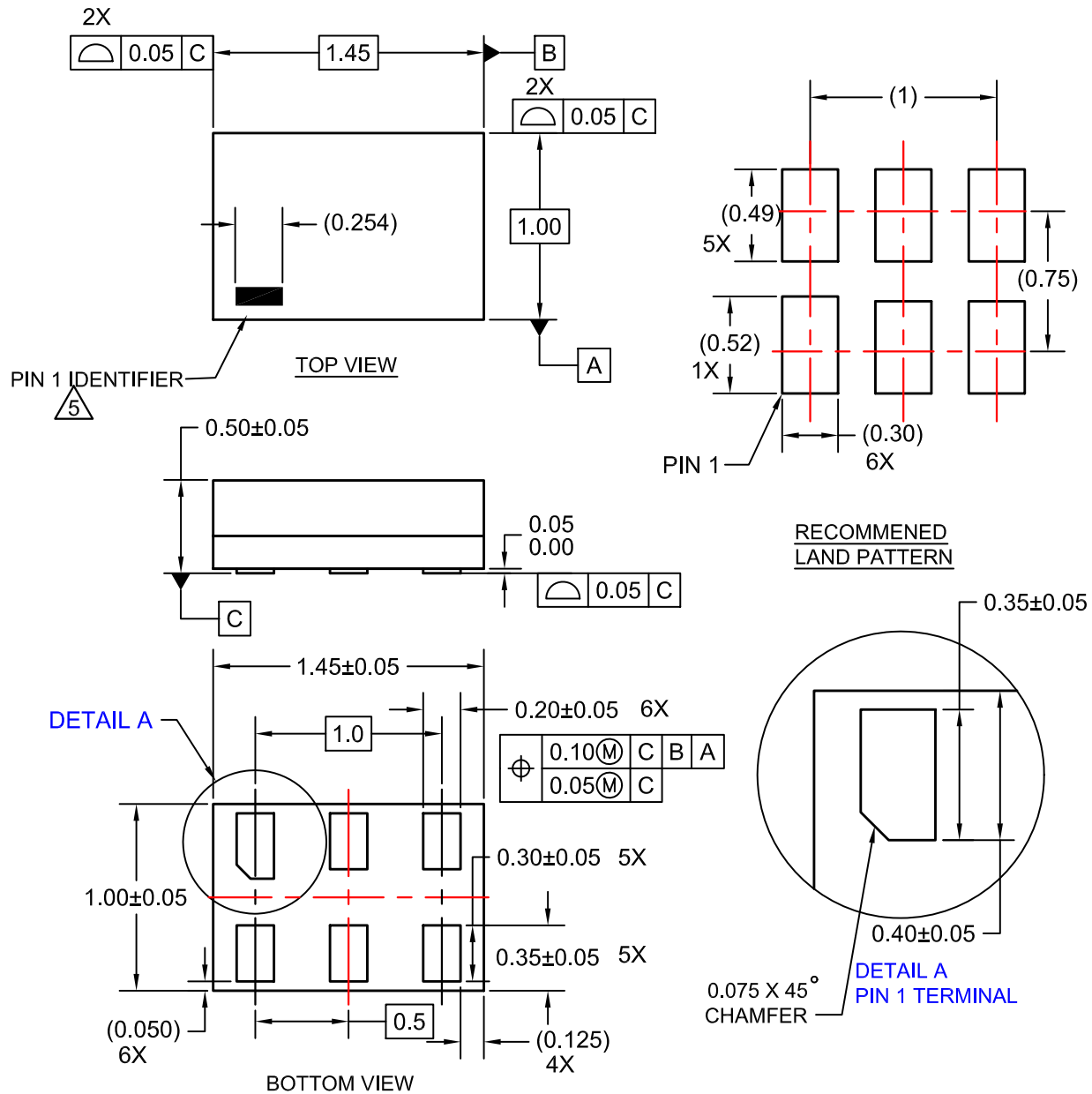
Device	Top Mark	Packages	Shipping [†]
NC7WZU04P6X	ZU4	SC-88	3000 / Tape & Reel
NC7WZU04P6X-L22347	ZU4	SC-88	3000 / Tape & Reel
NC7WZU04L6X	B5	MicroPak	5000 / Tape & Reel

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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SIP6 1.45X1.0
CASE 127EB
ISSUE O


DATE 31 AUG 2016



NOTES:

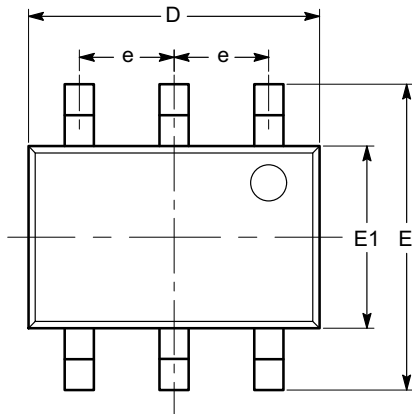
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2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-2009
4. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY OTHER LINE IN THE MARK CODE LAYOUT.

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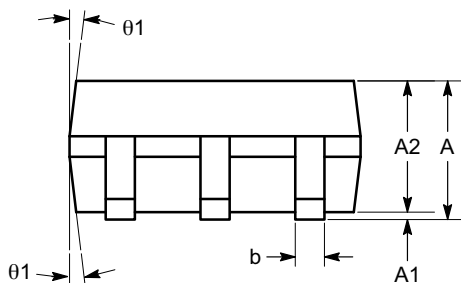
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SC-88 (SC-70 6 Lead), 1.25x2
CASE 419AD-01
ISSUE A

DATE 07 JUL 2010

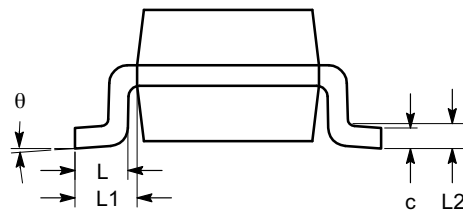


TOP VIEW



SIDE VIEW

SYMBOL	MIN	NOM	MAX
A	0.80		1.10
A1	0.00		0.10
A2	0.80		1.00
b	0.15		0.30
c	0.10		0.18
D	1.80	2.00	2.20
E	1.80	2.10	2.40
E1	1.15	1.25	1.35
e	0.65 BSC		
L	0.26	0.36	0.46
L1	0.42 REF		
L2	0.15 BSC		
θ	0°		8°
θ1	4°		10°




END VIEW

Notes:

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MO-203.

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MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

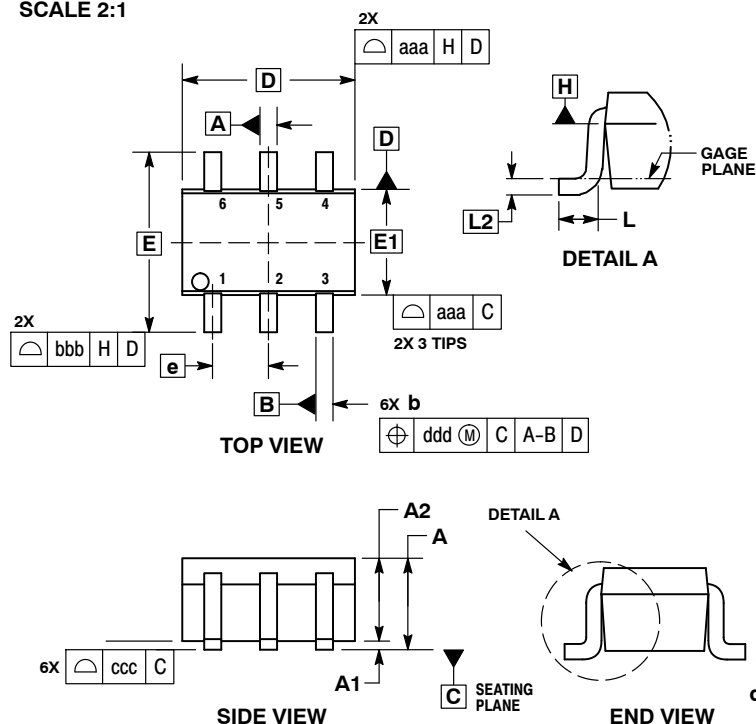
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SCALE 2:1

SC-88/SC70-6/SOT-363
CASE 419B-02
ISSUE Y

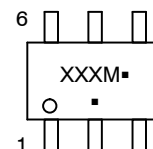
DATE 11 DEC 2012



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
 2. CONTROLLING DIMENSION: MILLIMETERS.
 3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
 4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AND DATUM H.
 5. DATUMS A AND B ARE DETERMINED AT DATUM H.
 6. DIMENSIONS b AND c APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 AND 0.15 FROM THE TIP.
 7. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF DIMENSION b AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	---	---	1.10	---	---	0.043
A1	0.00	---	0.10	0.000	---	0.004
A2	0.70	0.90	1.00	0.027	0.035	0.039
b	0.15	0.20	0.25	0.006	0.008	0.010
C	0.08	0.15	0.22	0.003	0.006	0.009
D	1.80	2.00	2.20	0.070	0.078	0.086
E	2.00	2.10	2.20	0.078	0.082	0.086
E1	1.15	1.25	1.35	0.045	0.049	0.053
e	0.65 BSC			0.026 BSC		
L	0.26	0.36	0.46	0.010	0.014	0.018
L2	0.15 BSC			0.006 BSC		
aaa	0.15			0.006		
bbb	0.30			0.012		
ccc	0.10			0.004		
ddd	0.10			0.004		

GENERIC MARKING DIAGRAM*



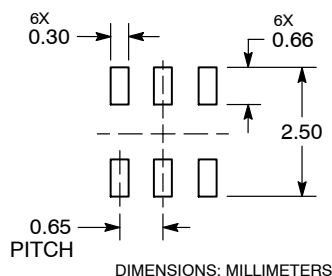
XXX = Specific Device Code
M = Date Code*
▪ = Pb-Free Package

(Note: Microdot may be in either location)

*Date Code orientation and/or position may vary depending upon manufacturing location.

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

RECOMMENDED SOLDERING FOOTPRINT*



*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

STYLES ON PAGE 2

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SC-88/SC70-6/SOT-363
CASE 419B-02
ISSUE Y

DATE 11 DEC 2012

STYLE 1: PIN 1. EMITTER 2 2. BASE 2 3. COLLECTOR 1 4. EMITTER 1 5. BASE 1 6. COLLECTOR 2	STYLE 2: CANCELLED	STYLE 3: CANCELLED	STYLE 4: PIN 1. CATHODE 2. CATHODE 3. COLLECTOR 4. EMITTER 5. BASE 6. ANODE	STYLE 5: PIN 1. ANODE 2. ANODE 3. COLLECTOR 4. EMITTER 5. BASE 6. CATHODE	STYLE 6: PIN 1. ANODE 2 2. N/C 3. CATHODE 1 4. ANODE 1 5. N/C 6. CATHODE 2
STYLE 7: PIN 1. SOURCE 2 2. DRAIN 2 3. GATE 1 4. SOURCE 1 5. DRAIN 1 6. GATE 2	STYLE 8: CANCELLED	STYLE 9: PIN 1. EMITTER 2 2. EMITTER 1 3. COLLECTOR 1 4. BASE 1 5. BASE 2 6. COLLECTOR 2	STYLE 10: PIN 1. SOURCE 2 2. SOURCE 1 3. GATE 1 4. DRAIN 1 5. DRAIN 2 6. GATE 2	STYLE 11: PIN 1. CATHODE 2 2. CATHODE 2 3. ANODE 1 4. CATHODE 1 5. CATHODE 1 6. ANODE 2	STYLE 12: PIN 1. ANODE 2 2. ANODE 2 3. CATHODE 1 4. ANODE 1 5. ANODE 1 6. CATHODE 2
STYLE 13: PIN 1. ANODE 2. N/C 3. COLLECTOR 4. EMITTER 5. BASE 6. CATHODE	STYLE 14: PIN 1. VREF 2. GND 3. GND 4. IOUT 5. VEN 6. VCC	STYLE 15: PIN 1. ANODE 1 2. ANODE 2 3. ANODE 3 4. CATHODE 3 5. CATHODE 2 6. CATHODE 1	STYLE 16: PIN 1. BASE 1 2. EMITTER 2 3. COLLECTOR 2 4. BASE 2 5. EMITTER 1 6. COLLECTOR 1	STYLE 17: PIN 1. BASE 1 2. EMITTER 1 3. COLLECTOR 2 4. BASE 2 5. EMITTER 2 6. COLLECTOR 1	STYLE 18: PIN 1. VIN1 2. VCC 3. VOUT2 4. VIN2 5. GND 6. VOUT1
STYLE 19: PIN 1. IOUT 2. GND 3. GND 4. V CC 5. V EN 6. V REF	STYLE 20: PIN 1. COLLECTOR 2. COLLECTOR 3. BASE 4. EMITTER 5. COLLECTOR 6. COLLECTOR	STYLE 21: PIN 1. ANODE 1 2. N/C 3. ANODE 2 4. CATHODE 2 5. N/C 6. CATHODE 1	STYLE 22: PIN 1. D1 (i) 2. GND 3. D2 (i) 4. D2 (c) 5. VBUS 6. D1 (c)	STYLE 23: PIN 1. Vn 2. CH1 3. Vp 4. N/C 5. CH2 6. N/C	STYLE 24: PIN 1. CATHODE 2. ANODE 3. CATHODE 4. CATHODE 5. CATHODE 6. CATHODE
STYLE 25: PIN 1. BASE 1 2. CATHODE 3. COLLECTOR 2 4. BASE 2 5. EMITTER 6. COLLECTOR 1	STYLE 26: PIN 1. SOURCE 1 2. GATE 1 3. DRAIN 2 4. SOURCE 2 5. GATE 2 6. DRAIN 1	STYLE 27: PIN 1. BASE 2 2. BASE 1 3. COLLECTOR 1 4. EMITTER 1 5. EMITTER 2 6. COLLECTOR 2	STYLE 28: PIN 1. DRAIN 2. DRAIN 3. GATE 4. SOURCE 5. DRAIN 6. DRAIN	STYLE 29: PIN 1. ANODE 2. ANODE 3. COLLECTOR 4. EMITTER 5. BASE/ANODE 6. CATHODE	STYLE 30: PIN 1. SOURCE 1 2. DRAIN 2 3. DRAIN 2 4. SOURCE 2 5. GATE 1 6. DRAIN 1

Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

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DESCRIPTION:	SC-88/SC70-6/SOT-363	PAGE 2 OF 2

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