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TinyLogic UHS Buffer with Three-State Output

NC7SZ125

Description

The NC7SZ125 is a single buffer with three-state output from onsemi's Ultra-High Speed (UHS) of TinyLogic. 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 range. The inputs and output are high impedance above ground when V_{CC} is 0 V. Inputs tolerate voltages up to 5.5 V independent of V_{CC} operating voltage. The output tolerates voltages above V_{CC} when in the 3-STATE condition.

Features

- Ultra-High Speed: $t_{PD} = 2.6$ ns (Typical) into 50 pF at 5 V V_{CC}
- High Output Drive: ± 24 mA at 3 V V_{CC}
- Broad V_{CC} Operating Range: 1.65 V to 5.5 V
- Matches Performance of LCX when Operated at 3.3 V V_{CC}
- Power Down High-Impedance Inputs / Outputs
- Over-Voltage Tolerance Inputs Facilitate 5 V to 3 V Translation
- Proprietary Noise / EMI Reduction Circuitry
- Ultra-Small MicroPak™ Packages
- Space-Saving SOT23-5, SC-74A and SC-88A Packages
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

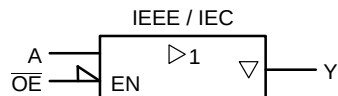
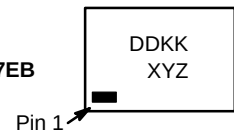


Figure 1. Logic Symbol

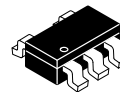
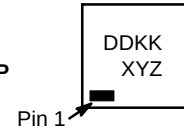
MARKING DIAGRAMS



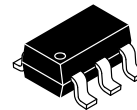
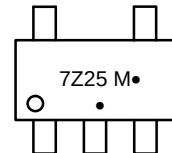
SIP6
CASE 127EB



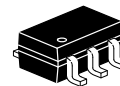
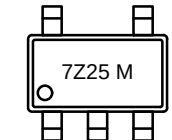
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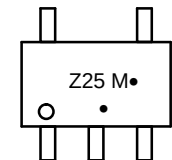
SC-74A
CASE 318BQ



SOT23-5
CASE 527AH



SC-88A
CASE 419A-02



DD, 7Z25, Z25 = Specific Device Code
 KK = 2-Digit Lot Run Traceability Code
 XY = 2-Digit Date Code Format
 Z = Assembly Plant Code
 M = Date Code
 • = Pb-Free Package
 (Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 6 of this data sheet.

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 6.

Pin Configurations

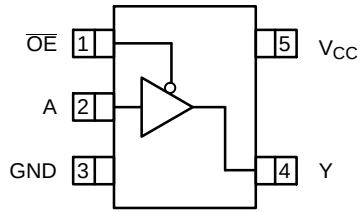


Figure 2. SOT23-5, SC-88A and SC-74A
(Top View)

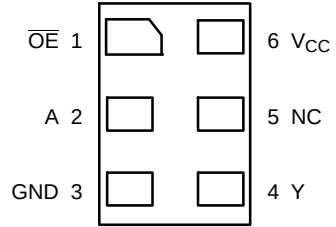


Figure 3. MicroPak (Top Through View)

PIN DEFINITIONS

Pin # SOT23-5 / SC-88A / SC74A	Pin # MicroPak	Name	Description
1	1	$\overline{OE}$	Input
2	2	A	Input
3	3	GND	Ground
4	4	Y	Output
5	6	V _{CC}	Supply Voltage
	5	NC	No Connect

FUNCTION TABLE

Inputs		Output
$\overline{OE}$	A	Y
L	L	L
L	H	H
H	X	Z

H = HIGH Logic Level
 L = LOW Logic Level
 X = HIGH or LOW Logic Level
 Z = HIGH Impedance State

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	6.5	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
I _{OUT}	DC Output Current		-	±50	mA
I _{CC} or I _{GND}	DC V _{CC} or Ground Current		-	±50	mA
T _{STG}	Storage Temperature Range		-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-74A / SOT23-5	-	390	mW
		SC-88A	-	332	
		MicroPak-6	-	812	
		MicroPak2™-6	-	812	
ESD	Human Body Model, JEDEC: JESD22-A114		-	4000	V
	Charge Device Model, JEDEC: JESD22-C101		-	2000	

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	5.50	V
	Supply Voltage Data Retention		1.50	5.50	
V _{IN}	Input Voltage		0	5.5	V
V _{OUT}	Output Voltage	Active State	0	V _{CC}	V
		Three-State	0	5.5	
T _A	Operating Temperature		-40	+85	°C
t _r , t _f	Input Rise and Fall Times	V _{CC} at 1.8 V, 2.5 V ±0.2 V	0	20	ns/V
		V _{CC} at 3.3 V ±0.3 V	0	10	
		V _{CC} at 5.0 V ±0.5 V	0	5	
θ _{JA}	Thermal Resistance	SC-74A / SOT23-5	-	320	°C/W
		SC-88A	-	377	
		MicroPak-6	-	154	
		MicroPak2-6	-	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.

NC7SZ125

DC ELECTRICAL CHARACTERISTICS

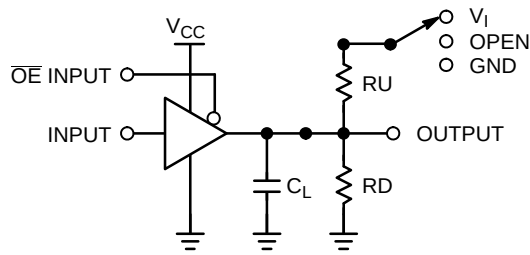
Symbol	Parameter	V _{CC} (V)	Conditions	T _A = +25°C			T _A = -40 to +85°C		Unit
				Min	Typ	Max	Min	Max	
V _{IH}	HIGH Level Input Voltage	1.65 to 1.95		0.65 V _{CC}	–	–	0.65 V _{CC}	–	V
		2.30 to 5.50		0.70 V _{CC}	–	–	0.70 V _{CC}	–	
V _{IL}	LOW Level Input Voltage	1.65 to 1.95		–	–	0.35 V _{CC}	–	0.35 V _{CC}	V
		2.30 to 5.50		–	–	0.30 V _{CC}	–	0.30 V _{CC}	
V _{OH}	HIGH Level Output Voltage	1.65	V _{IN} = V _{IH} or V _{IL} , I _{OH} = –100 µA	1.55	1.65	–	1.55	–	V
		1.80		1.70	1.80	–	1.70	–	
		2.30		2.20	2.30	–	2.20	–	
		3.00		2.90	3.00	–	2.90	–	
		4.50		4.40	4.50	–	4.40	–	
		1.65	I _{OH} = –4 mA	1.29	1.52	–	1.29	–	
		2.30	I _{OH} = –8 mA	1.90	2.15	–	1.90	–	
		3.00	I _{OH} = –16 mA	2.40	2.80	–	2.40	–	
		3.00	I _{OH} = –24 mA	2.30	2.68	–	2.30	–	
		4.50	I _{OH} = –32 mA	3.80	4.20	–	3.80	–	
V _{OL}	LOW Level Output Voltage	1.65	V _{IN} = V _{IH} or V _{IL} , I _{OL} = 100 µA	–	0.00	0.10	–	0.00	V
		1.80		–	0.00	0.10	–	0.10	
		2.30		–	0.00	0.10	–	0.10	
		3.00		–	0.00	0.10	–	0.10	
		4.50		–	0.00	0.10	–	0.10	
		1.65	I _{OL} = 4 mA	–	0.80	0.24	–	0.24	
		2.30	I _{OL} = 8 mA	–	0.10	0.30	–	0.30	
		3.00	I _{OL} = 16 mA	–	0.15	0.40	–	0.40	
		3.00	I _{OL} = 24 mA	–	0.22	0.55	–	0.55	
		4.50	I _{OL} = 32 mA	–	0.22	0.55	–	0.55	
I _{IN}	Input Leakage Current	1.65 to 5.5	0 ≥ V _{IN} ≥ 5.5 V	–	–	±1	–	±10	µA
I _{OZ}	3-STATE Output Leakage	0 to 5.5	V _{IN} = V _{IH} or V _{IL} 0 ≥ V _O ≥ 5.5 V	–	–	±1	–	±10	µA
I _{OFF}	Power Off Leakage Current	0	V _{IN} or V _{OUT} = 5.5 V	–	–	1	–	10	µA
I _{CC}	Quiescent Supply Current	1.65 to 5.50	V _{IN} = 5.5 V, GND	–	–	2	–	20	µA

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 4, 6)	1.65	C _L = 15 pF, R _D = 1 MΩ S ₁ = OPEN	–	6.4	13.2	–	13.8	ns
		1.80		–	5.3	11.0	–	11.5	
		2.50 ±0.20		–	3.4	7.5	–	8.0	
		3.30 ±0.30		–	2.5	5.2	–	5.5	
		5.00 ±0.50		–	2.1	4.5	–	4.8	
		3.30 ±0.30	C _L = 50 pF, R _D = 500 Ω S ₁ = OPEN	–	3.2	5.7	–	6.0	
		5.00 ±0.50		–	2.6	5.0	–	5.3	
t _{PZL} , t _{PZH}	Output Enable Time (Figure 4, 6)	1.65	C _L = 50 pF, R _D = 500 Ω R _U = 500 Ω S ₁ = GND for t _{PZH} S ₁ = V _{IN} for t _{PZL} V _{IN} = 2 · V _{CC}	–	8.4	15.0	–	15.6	ns
		1.80		–	7.0	12.5	–	13.0	
		2.50 ±0.20		–	4.6	8.5	–	9.0	
		3.30 ±0.30		–	3.5	6.2	–	6.5	
		5.00 ±0.50		–	2.8	5.5	–	5.8	
t _{PLZ} , t _{PHZ}	Output Disable Time (Figure 4, 6)	1.65	C _L = 50 pF, R _D = 500 Ω R _U = 500 Ω S ₁ = GND for t _{PHZ} S ₁ = V _{IN} for t _{PLZ} V _{IN} = 2 · V _{CC}	–	6.5	13.2	–	14.5	ns
		1.80		–	5.4	11.0	–	12.0	
		2.50 ±0.20		–	3.5	8.0	–	8.5	
		3.30 ±0.30		–	2.8	5.7	–	6.0	
		5.00 ±0.50		–	2.1	4.7	–	5.0	
C _{IN}	Input Capacitance	0.00		–	4	–	–	–	pF
C _{OUT}	Output Capacitance	0.00		–	8	–	–	–	
C _{PD}	Power Dissipation Capacitance (Note 2) (Figure 5)	3.30		–	17	–	–	–	pF

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:
 $I_{CCD} = (C_{PD}) (V_{CC}) (f_{IN}) + (I_{CCStatic})$.

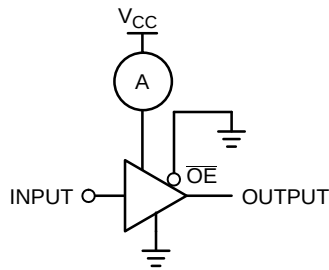
NC7SZ125



NOTE:

3. C_L includes load and stray capacitance; Input PRR = 1.0 MHz; $t_W = 500$ ns

Figure 4. AC Test Circuit



NOTE:

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

Figure 5. I_{CCD} Test Circuit

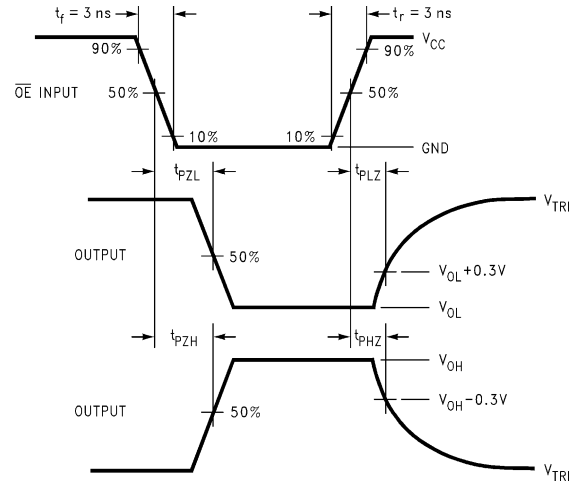
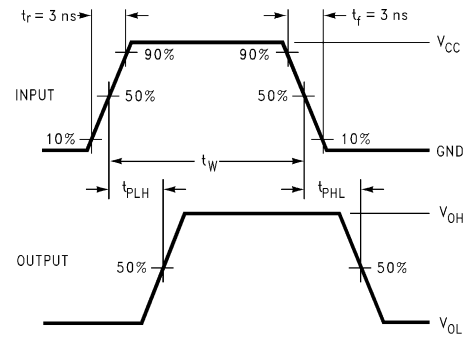


Figure 6. AC Waveforms

ORDERING INFORMATION

Part Number	Top Mark	Operating Temperature	Packages	Shipping†
NC7SZ125M5X	7Z25	-40 to +85°C	SC-74A	3000 / Tape & Reel
NC7SZ125P5X	Z25	-40 to +85°C	SC-88A	3000 / Tape & Reel
NC7SZ125L6X	DD	-40 to +85°C	MicroPak	5000 / Tape & Reel
NC7SZ125FHX	DD	-40 to +85°C	MicroPak2	5000 / Tape & Reel

DISCONTINUED (Note 5)

NC7SZ125M5X-L22090	7Z25	-40 to +85°C	SOT23-5	3000 / Tape & Reel
NC7SZ125P5X-F22057	Z25	-40 to +85°C	SC-88A	3000 / Tape & Reel
NC7SZ125L6X-L22175	DD	-40 to +85°C	MicroPak	5000 / Tape & Reel
NC7SZ125FHX-L22175	DD	-40 to +85°C	MicroPak2	5000 / Tape & Reel

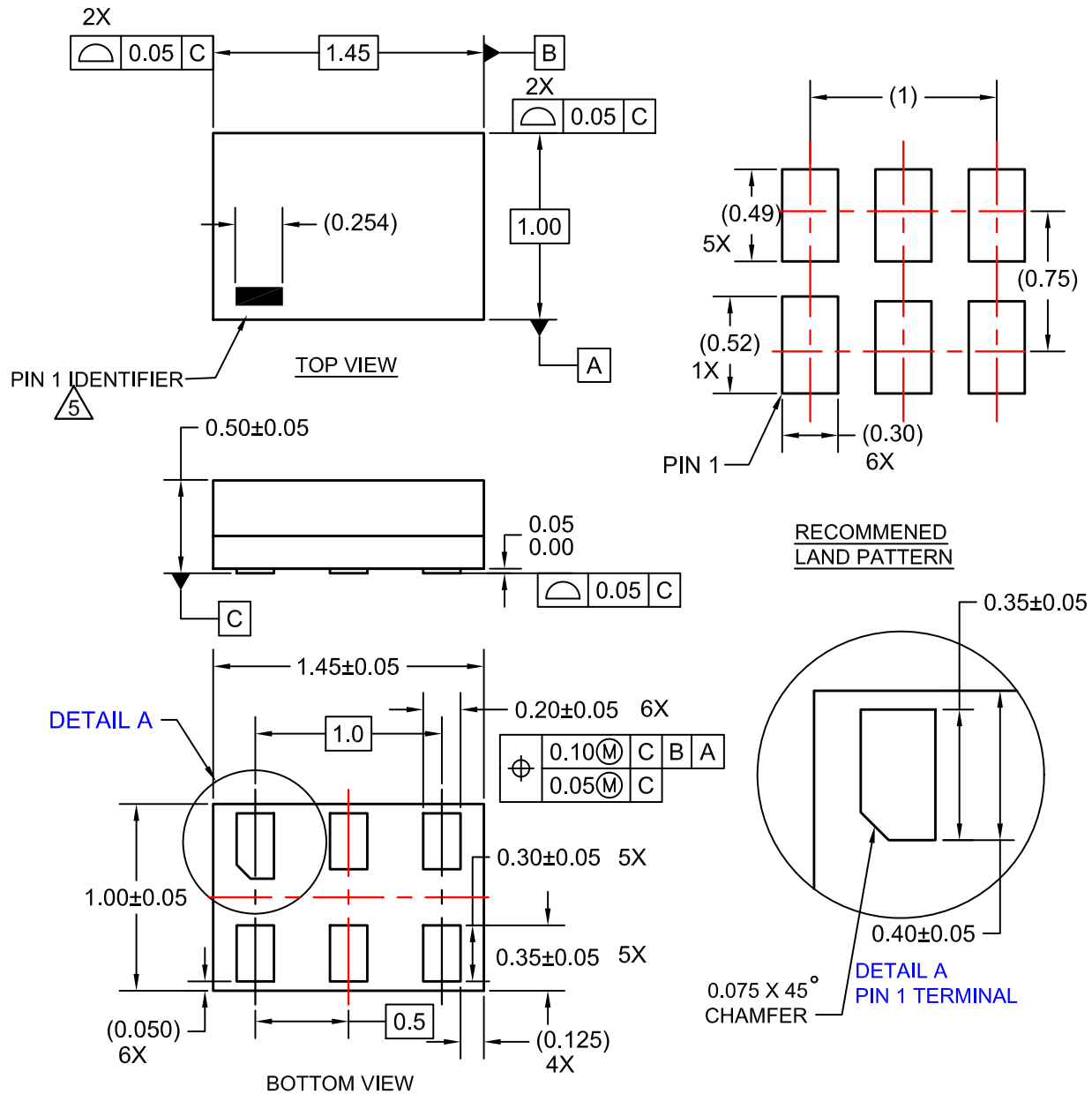
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

5. **DISCONTINUED:** These devices are not recommended for new design. Please contact your onsemi representative for information. The most current information on these devices may be available on www.onsemi.com.

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SIP6 1.45X1.0
CASE 127EB
ISSUE O

DATE 31 AUG 2016

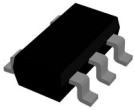


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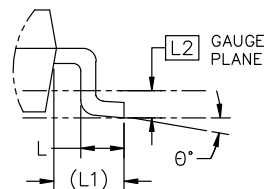
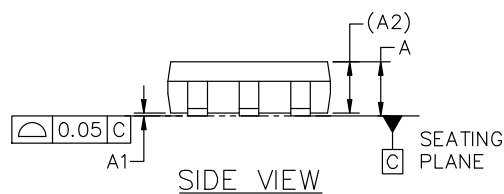
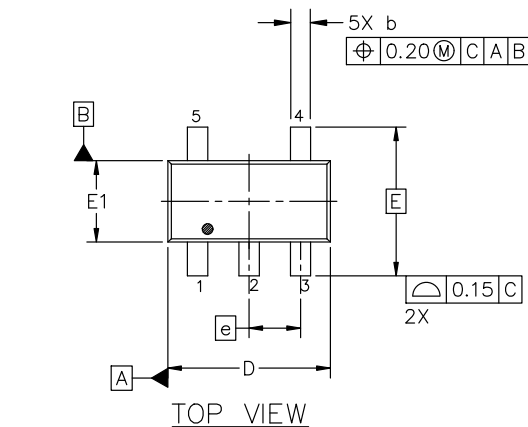
1. CONFORMS TO JEDEC STANDARD MO-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-2009
4. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY OTHER LINE IN THE MARK CODE LAYOUT.

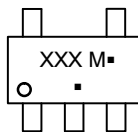
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SC-74A-5 3.00x1.50x0.95, 0.95P
CASE 318BQ
ISSUE C

DATE 26 FEB 2024


DETAIL "A"
SCALE 2:1

GENERIC
MARKING DIAGRAM*


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

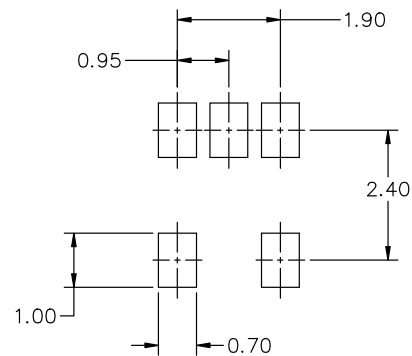
(Note: Microdot may be in either location)

*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.

NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
2. ALL DIMENSION ARE IN MILLIMETERS (ANGLES IN DEGREES).
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OF GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0.01	0.18	0.10
A2	0.95 REF.		
b	0.25	0.37	0.50
c	0.10	0.18	0.26
D	2.85	3.00	3.15
E	2.75 BSC		
E1	1.35	1.50	1.65
e	0.95 BSC		
L	0.20	0.40	0.60
L1	0.62 REF.		
L2	0.25 BSC		
θ	0°	5°	10°



RECOMMENDED MOUNTING 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.

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DESCRIPTION:	SC-74A-5 3.00x1.50x0.95, 0.95P	PAGE 1 OF 1

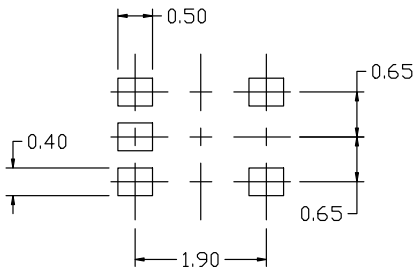
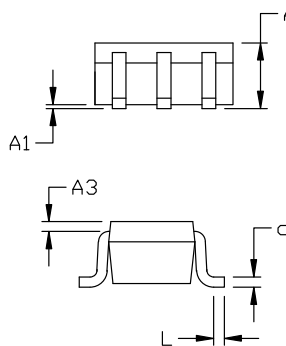
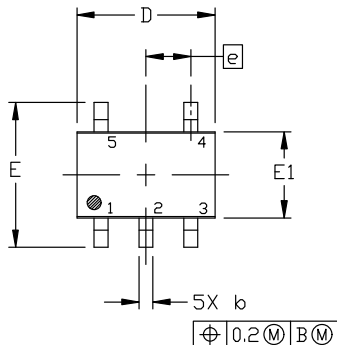
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SCALE 2:1

SC-88A (SC-70-5/SOT-353)
CASE 419A-02
ISSUE M

DATE 11 APR 2023

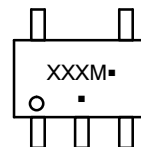

**RECOMMENDED
MOUNTING FOOTPRINT**

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

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.1016MM PER SIDE.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.80	0.95	1.10
A1	---	---	0.10
A3	0.20 REF		
b	0.10	0.20	0.30
c	0.10	---	0.25
D	1.80	2.00	2.20
E	2.00	2.10	2.20
E1	1.15	1.25	1.35
e	0.65 BSC		
L	0.10	0.15	0.30

**GENERIC MARKING
DIAGRAM***


*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.

XXX = Specific Device Code

M = Date Code

▪ = Pb-Free Package

(Note: Microdot may be in either location)

STYLE 1:

- PIN 1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

STYLE 2:

- PIN 1. ANODE
2. EMITTER
3. BASE
4. COLLECTOR
5. CATHODE

STYLE 3:

- PIN 1. ANODE 1
2. N/C
3. ANODE 2
4. CATHODE 2
5. CATHODE 1

STYLE 4:

- PIN 1. SOURCE 1
2. DRAIN 1/2
3. SOURCE 1
4. GATE 1
5. GATE 2

STYLE 5:

- PIN 1. CATHODE
2. COMMON ANODE
3. CATHODE 2
4. CATHODE 3
5. CATHODE 4

STYLE 6:

- PIN 1. EMITTER 2
2. BASE 2
3. EMITTER 1
4. COLLECTOR
5. COLLECTOR 2/BASE 1

STYLE 7:

- PIN 1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

STYLE 8:

- PIN 1. CATHODE
2. COLLECTOR
3. N/C
4. BASE
5. EMITTER

STYLE 9:

- PIN 1. ANODE
2. CATHODE
3. ANODE
4. ANODE
5. ANODE

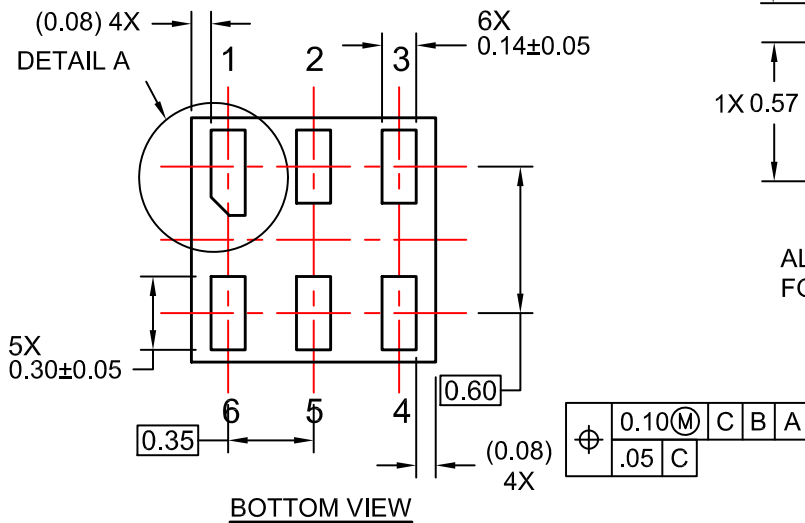
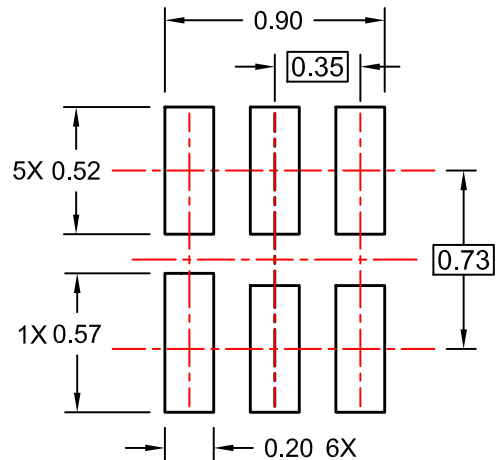
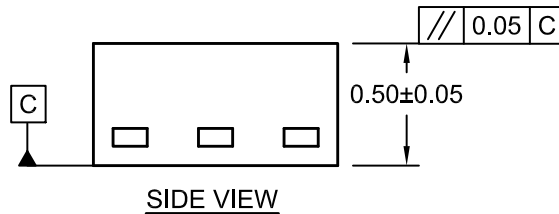
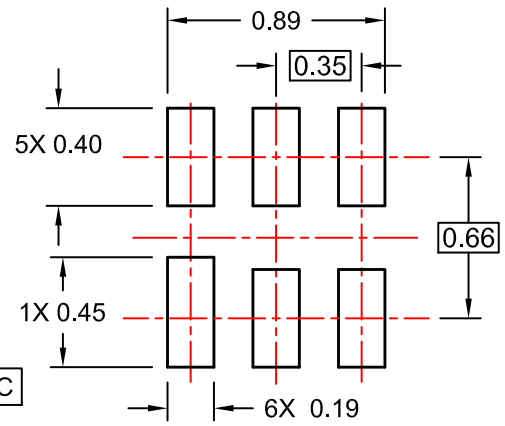
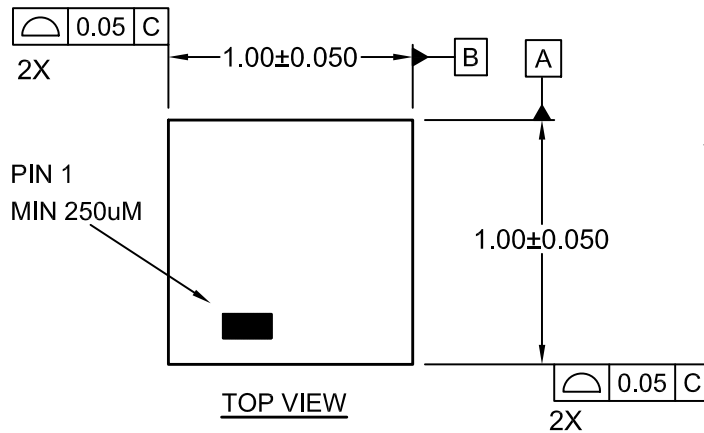
Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

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DESCRIPTION:	SC-88A (SC-70-5/SOT-353)	PAGE 1 OF 1

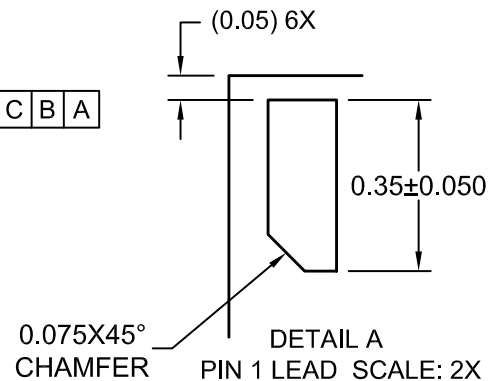
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UDFN6 1.0X1.0, 0.35P
CASE 517DP
ISSUE O

DATE 31 AUG 2016

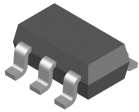


- NOTES:
- A. COMPLIES TO JEDEC MO-252 STANDARD
 - B. DIMENSIONS ARE IN MILLIMETERS.
 - C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009

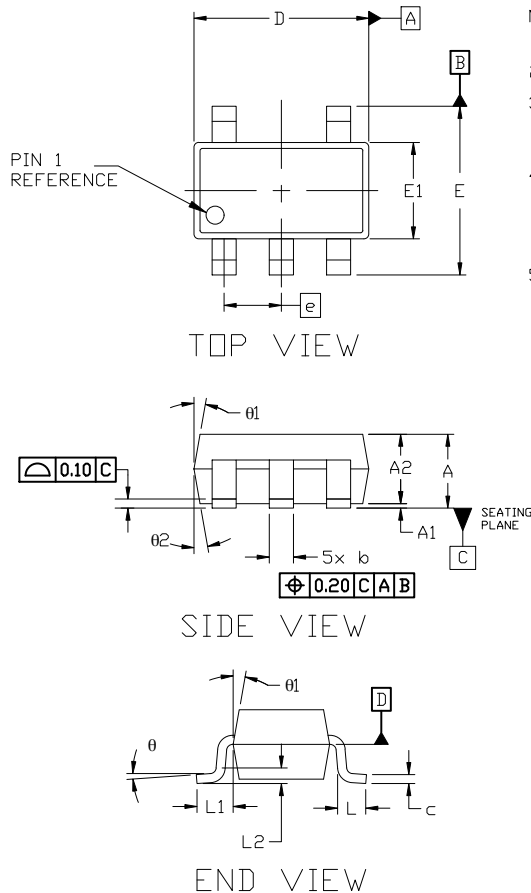


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SOT-23, 5 Lead
CASE 527AH
ISSUE A

DATE 09 JUN 2021

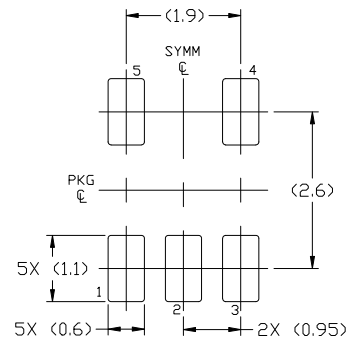

XXX = Specific Device Code
M = Date Code

*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.

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1989A
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.25 PER SIDE. D AND E1 DIMENSIONS ARE DETERMINED AT DATUM D.
5. DIMENSION 'b' DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08mm TOTAL IN EXCESS OF THE 'b' DIMENSION AT MAXIMUM MATERIAL CONDITION. MINIMUM SPACE BETWEEN PROTRUSION AND AN ADJACENT LEAD SHALL NOT BE LESS THAN 0.07mm.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	—	1.45
A1	0.00	—	0.15
A2	0.90	1.15	1.30
b	0.30	—	0.50
c	0.08	—	0.22
D	2.90 BSC		
E	2.80 BSC		
E1	1.60 BSC		
e	0.95 BSC		
L	0.30	0.45	0.60
L1	0.60 REF		
L2	0.25 REF		
θ	0°	4°	8°
θ1	0°	10°	15°
θ2	0°	10°	15°



RECOMMENDED MOUNTING 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.

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DESCRIPTION:	SOT-23, 5 LEAD	PAGE 1 OF 1

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