TinyLogic UHS D-Type Latch with 3-STATE Output NC7SZ373

Description

The NC7SZ373 is a single positive edge−triggered D−type CMOS Lach with 3−STATE output from **onsemi**'s Ultra High Speed Series of TinyLogic in the space saving SC70 6−lead package. 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 and output are high impedance when V_{CC} is 0 V. Inputs tolerate voltages up to 5.5 V independent of V_{CC} operating voltage. The latch appears transparent to the data when Latch Enable (LE) is HIGH. When LE is LOW, the data that meets the setup time is latched. The output tolerates voltages above V_{CC} in the 3−STATE condition.

Features

- Space Saving SC−88 6−Lead Package
- Ultra Small MicroPak™ Leadless Package
- Ultra High Speed: t_{PD} = 2.6 ns Typ 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 the Performance of LCX when Operated at 3.3 V V_{CC}
- Power Down High Impedance Inputs / Output
- Overvoltage Tolerant Inputs Facilitate 5 V to 3 V Translation
- Patented Noise / EMI Reduction Circuitry Implemented
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

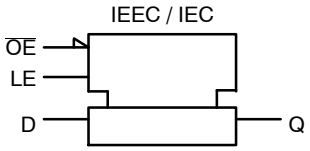
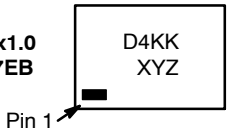
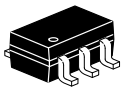


Figure 1. Logic Symbol

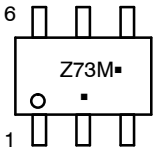
MARKING DIAGRAMS

SIP6 1.45x1.0
CASE 127EB





SC−88
CASE 419B−02



D4, Z73	= 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

(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.

Connection Diagrams

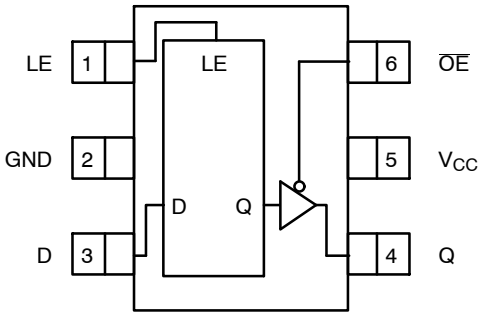


Figure 2. SC−88 (Top View)

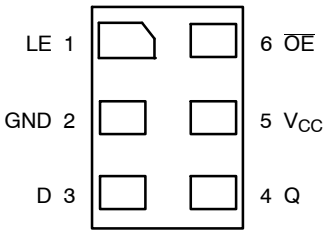
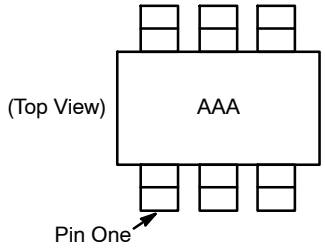


Figure 4. MicroPak (Top Through View)



AAA = Product Code Top Mark − see ordering code

NOTE: Orientation of Top Mark determines Pin One location. Read the top product code mark left to right, Pin One is the lower left pin (see diagram).

Figure 3. Pin 1 Orientation

PIN DESCRIPTIONS

Pin Name	Description
D	Data Input
CP	Latch Enable Input
$\overline{OE}$	Output Enable Input
Q	Latch Output

FUNCTION TABLE

Inputs			Output
LE	**D**	**$\overline{OE}$**	**Q**
H	L	L	L
H	H	L	H
L	X	L	Q_{n-1}
X	X	H	Z

H = HIGH Logic Level X = Immaterial
L = LOW Logic Level Z = HIGH Impedance
Q_{n-1} = Previous state prior to HIGH−to−LOW transition of latch enable

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 Source / Sink Current		−	±50	mA
I_{CC} / I_{GND}	DC V_{CC} / GND 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−88	−	332	mW
		MicroPak	−	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	Active State	0	V_{CC}	V
		3−STATE	0	5.5	V
t_r, t_f	Input Rise and Fall Time	V_{CC} = 1.8 V, 2.5 V ±0.2 V	0	20	ns/V
		V_{CC} = 3.3 V ±0.3 V	0	10	
		V_{CC} = 5.5 V ±0.5 V	0	5	
T_A	Operating Temperature		−40	+85	°C
θ_{JA}	Thermal Resistance	SC−88	−	377	°C/W
		MicroPak	−	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 ELECTICAL 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 Control Input Voltage	1.65 to 1.95			0.65 V_{CC}	–	–	0.65 V_{CC}	–	V
		2.3 to 5.5			0.7 V_{CC}	–	–	0.7 V_{CC}	–	
V_{IL}	LOW Level Control Input Voltage	1.65 to 1.95			–	–	0.35 V_{CC}	–	0.35 V_{CC}	V
		2.3 to 5.5			–	–	0.3 V_{CC}	–	0.3 V_{CC}	
V_{OH}	HIGH Level Control Output Voltage	1.65	V_{IN} = V_{IH} or V_{IL}	I_{OH} = −100 μA	1.55	1.65	–	1.55	–	V
		1.8			1.7	1.8	–	1.7	–	
		2.3			2.2	2.3	–	2.2	–	
		3.0			2.9	3.0	–	2.9	–	
		4.5			4.4	4.5	–	4.4	–	
		1.65		I_{OH} = −4 mA	1.24	1.52	–	1.29	–	
		2.3		I_{OH} = −8 mA	1.9	2.15	–	1.9	–	
		3.0		I_{OH} = −16 mA	2.4	2.8	–	2.4	–	
		3.0		I_{OH} = −24 mA	2.3	2.68	–	2.3	–	
		4.5		I_{OH} = −32 mA	3.8	4.2	–	3.8	–	
V_{OL}	LOW Level Control Output Voltage	1.65	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 100 μA	–	0.0	0.08	–	0.0	V
		1.8			–	0.0	0.1	–	0.1	
		2.3			–	0.0	0.1	–	0.1	
		3.0			–	0.0	0.1	–	0.1	
		4.5			–	0.0	0.1	–	0.1	
		1.65		I_{OL} = 4 mA	–	0.08	0.24	–	0.24	
		2.3		I_{OL} = 8 mA	–	0.10	0.3	–	0.3	
		3.0		I_{OL} = 16 mA	–	0.15	0.4	–	0.4	
		3.0		I_{OL} = 24 mA	–	0.22	0.55	–	0.55	
		4.5		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		–	–	±0.1	–	±1.0	μA
I_{OZ}	3−STATE Output Leakage	1.65 to 5.5	V_{IN} = V_{IL} or V_{IH} 0 ≤ V_{OUT} ≤ 5.5 V		–	–	±0.5	–	±5.0	μA
I_{OFF}	Power Off Leakage Current	0.0	V_{IN} or V_{OUT} = 5.5 V		–	–	1.0	–	10	μA
I_{CC}	Quiescent Supply Current	1.65 to 5.5	V_{IN} = 5.5 V, GND		–	–	1.0	–	10	μA

AC ELECTRICAL CHARACTERISTICS

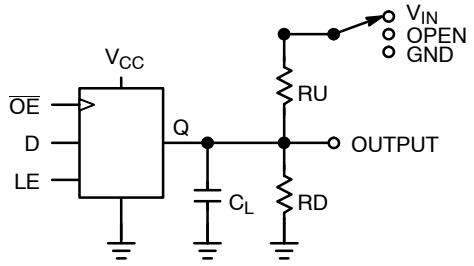
Symbol	Parameter	V_{CC} (V)	Conditions	T_A = +25°C			T_A = −40 to +85°C		Unit
				Min	Typ	Max	Min	Max	
t_{PLH} t_{PHL}	Propagation Delay D to Q	1.65	C_L = 15 pF, R_D = 1 MΩ, S_1 = Open (Figures 5, 7)	–	9.0	15.0	–	16.0	ns
		1.8		–	6.1	10.0	–	10.5	
		2.5 ±0.2		–	3.6	6.5	–	6.8	
		3.3 ±0.3		–	2.7	4.6	–	5.0	
		5.0 ±0.5		–	2.0	3.4	–	3.7	
		3.3 ±0.3	C_L = 50 pF, R_D = 500 Ω S_1 = Open (Figures 5, 7)	–	3.3	5.5	–	6.2	
		5.0 ±0.5		–	2.6	4.3	–	4.8	
t_{PLH} t_{PHL}	Propagation Delay LE to Q	1.65	C_L = 15 pF, R_D = 1 MΩ, S_1 = Open (Figures 5, 7)	–	9.0	1.45	–	15.0	ns
		1.8		–	6.0	9.6	–	10.0	
		2.5 ±0.2		–	3.5	6.1	–	6.6	
		3.3 ±0.3		–	2.6	4.4	–	4.8	
		5.0 ±0.5		–	2.0	3.2	–	3.5	
		3.3 ±0.3	C_L = 50 pF, R_D = 500 Ω, S_1 = Open (Figures 5, 8)	–	3.3	5.3	–	6.2	
		5.0 ±0.5		–	2.6	4.2	–	4.6	
t_{PZL} t_{PZH}	Output Enable Time	1.65	C_L = 50 pF, V_I = 2 x V_{CC}, R_U, R_D = 500 Ω, S_1 = GND for t_{PZH} S_1 = V_I for t_{PZL} (Figures 5, 8)	–	9.0	13.5	–	14.6	ns
		1.8		–	6.0	9.0	–	9.5	
		2.5 ±0.2		–	3.7	6.0	–	6.6	
		3.3 ±0.3		–	2.8	5.0	–	5.3	
		5.0 ±0.5		–	2.2	3.7	–	3.9	
t_{PLZ} t_{PHZ}	Output Disable Time	1.65	C_L = 50 pF, V_I = 2 x V_{CC}, R_U, R_D = 500 Ω, S_1 = GND for t_{PHZ} S_1 = V_I for t_{PLZ} (Figures 5, 8)	–	7.7	12.0	–	13.0	ns
		1.8		–	5.1	8.0	–	8.5	
		2.5 ±0.2		–	3.5	6.0	–	6.3	
		3.3 ±0.3		–	2.8	4.5	–	4.7	
		5.0 ±0.5		–	2.3	3.7	–	3.9	
t_S	Setup Time, D to LE	2.5 ±0.2	C_L = 50 pF, R_D = 500 Ω, S_1 = Open (Figures 5, 9)	–	–	–	2.0	–	ns
		3.3 ±0.3		–	–	–	1.5	–	
		5.0 ±0.5			–	–	1.5	–	
t_H	Hold Time, D to LE	2.5 ±0.2	C_L = 50 pF, R_D = 500 Ω, S_1 = Open (Figures 5, 9)	–	–	–	1.5	–	ns
		3.3 ±0.3		–	–	–	1.5	–	
		5.0 ±0.5		–	–	–	1.5	–	
t_W	Pulse Width, LE	2.5 ±0.2	C_L = 50 pF, R_D = 500 Ω, S_1 = Open (Figures 5, 9)	–	–	–	3.0	–	ns
		3.3 ±0.3		–	–	–	3.0	–	
		5.0 ±0.5		–	–	–	3.0	–	

CAPACITANCE (T_A = +25°C, f = 1 MHz)

Symbol	Parameter	Condition	Typ	Max	Units
C_{IN}	Input Capacitance	V_{CC} = Open, V_{IN} = 0 V or V_{CC}	3	–	pF
C_{OUT}	Output Capacitance	V_{CC} = 3.3 V, V_{IN} = 0 V or V_{CC}	4	–	pF
C_{PD}	Power Dissipation Capacitance (Note 2)	V_{CC} = 3.3 V V_{CC} = 5.0 V	14 17	– –	pF

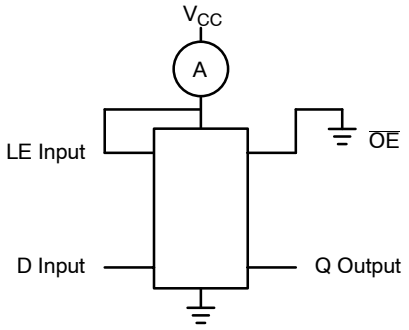
2. C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output loading and operating at 50% duty cycle. (See Figure 6)
C_{PD} is related to I_{CCD} dynamic operating current by the expression: $I_{CCD} = (C_{PD})\ (V_{CC})\ (f_{IN}) + (I_{CC}static)$.

AC Loading and Waveforms



C_L includes load and stray capacitance
Input PRR = 1.0 MHz, t_W = 500 ns.

Figure 5. AC Test Circuit



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

Figure 6. I_{CCD} Test Circuit

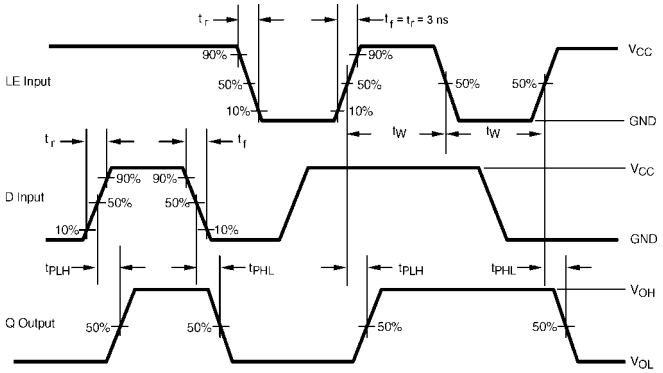


Figure 7. AC Waveforms

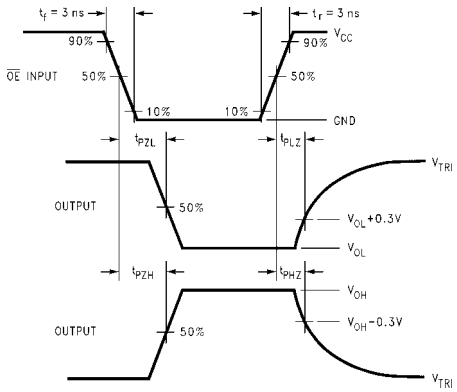


Figure 8. AC Waveforms

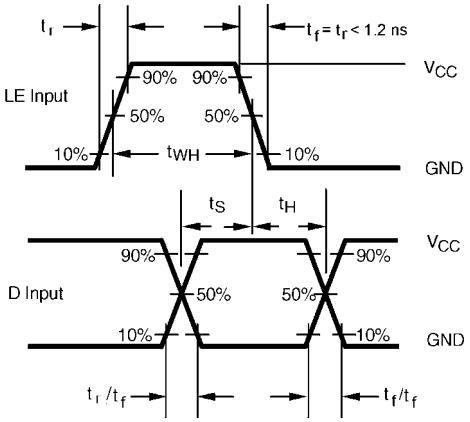


Figure 9. AC Waveforms

ORDERING INFORMATION

Device	Top Mark	Packages	Shipping†
NC7SZ373P6X	Z73	6−Lead SC70, EIAJ SC88, 1.25 mm Wide	3000 / Tape & Reel
NC7SZ373P6X−L22347	Z73	6−Lead SC70, EIAJ SC88, 1.25 mm Wide	3000 / Tape & Reel
NC7SZ373L6X	D4	6−Lead MicroPak, 1.00 mm Wide	5000 / Tape & Reel

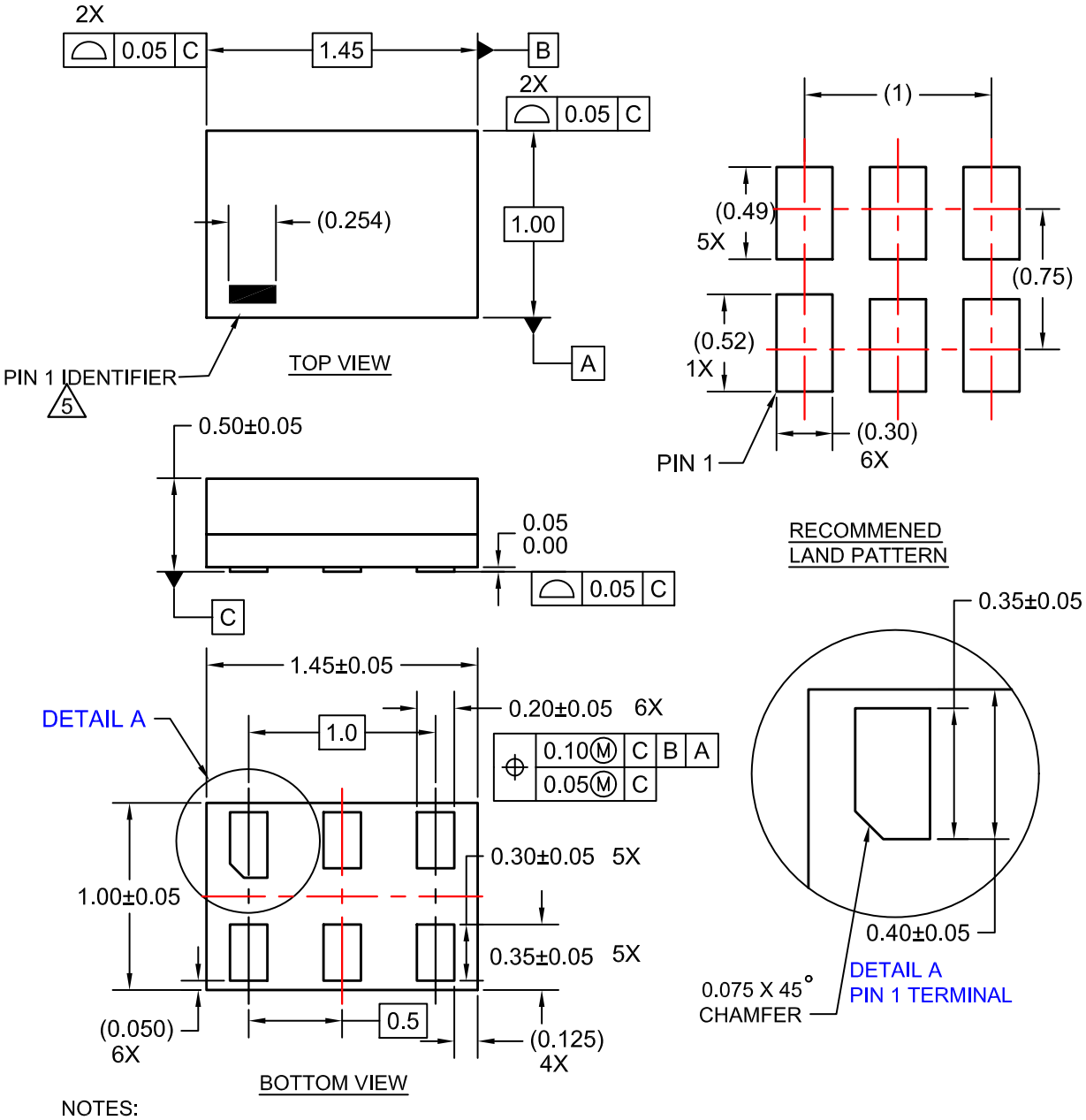
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Semiconductor®

SIP6 1.45X1.0
CASE 127EB
ISSUE O

DATE 31 AUG 2016



NOTES:

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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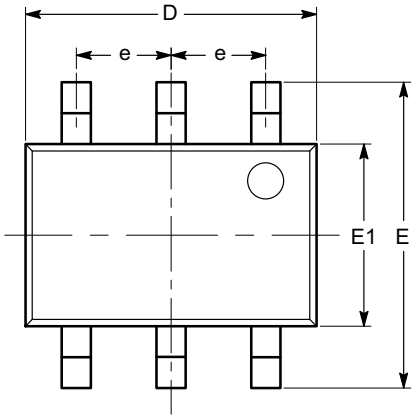
DESCRIPTION:	**SIP6 1.45X1.0**	**PAGE 1 OF 1**

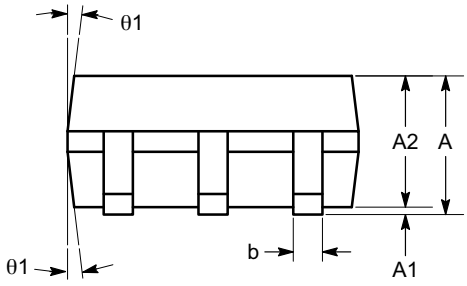
SC−88 (SC−70 6 Lead), 1.25x2
CASE 419AD−01
ISSUE A

DATE 07 JUL 2010

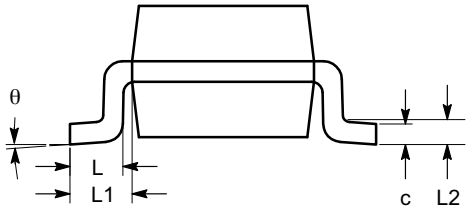


TOP VIEW

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°



SIDE VIEW



END VIEW

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

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DESCRIPTION:	**SC−88 (SC−70 6 LEAD), 1.25X2**	**PAGE 1 OF 1**

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

DATE 11 DEC 2012

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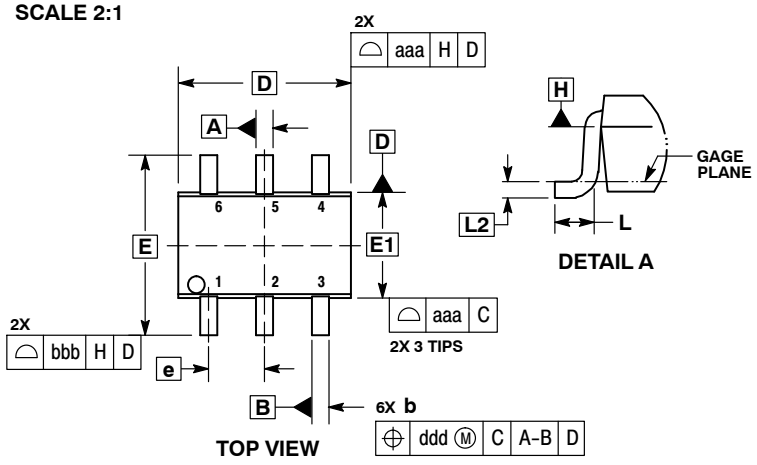
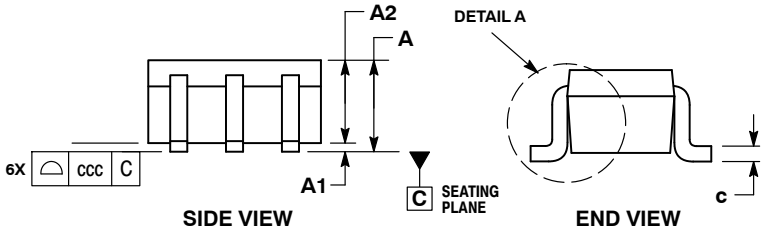
SCALE 2:1

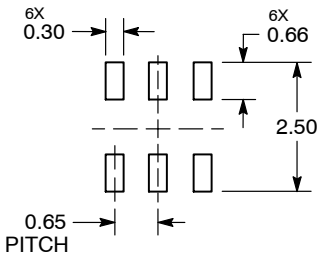




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF 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.

	MILLIMETERS			INCHES		
DIM	**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		

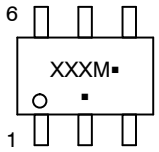
RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

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

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.

STYLES ON PAGE 2

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. I OUT
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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