NC7SZ374

TinyLogic UHS D-Type Flip-Flop with 3-STATE Output

ON Semiconductor®

www.onsemi.com

Description

The NC7SZ374 is a single positive edge−triggered D−type CMOS Flip−Flop with 3−STATE output from ON Semiconductor'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. This single flip−flop will store the state of the D input that meets the setup and hold time requirements on the LOW−to−HIGH Clock (CP) transition. The output tolerates voltages above V_{CC} in the 3−STATE condition.

Features

- Space Saving SC70 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 − 3 V Translation
- Patented Noise / EMI Reduction Circuitry Implemented
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

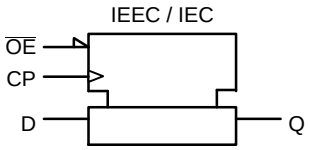
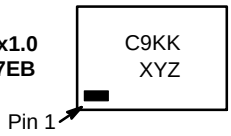
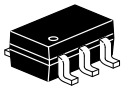


Figure 1. Logic Symbol

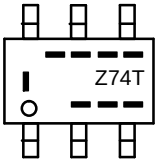
MARKING DIAGRAMS

SIP6 1.45x1.0
CASE 127EB





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



C9, Z74	= Specific Device Code
KK	= 2−Digit Lot Run Traceability Code
XY	= 2−Digit Date Code Format
Z	= Assembly Plant Code
▬▬▬	= Year Coding Scheme
▮▪▬	= Plant Code Identifier
T	= Die Run Code
▬▬▬	= Eight−Week Datacoding Scheme

ORDERING INFORMATION

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

Connection Diagrams

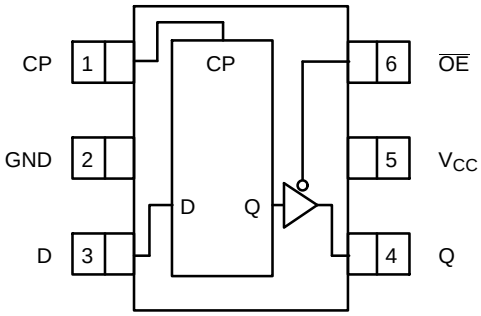


Figure 2. SC70 (Top View)

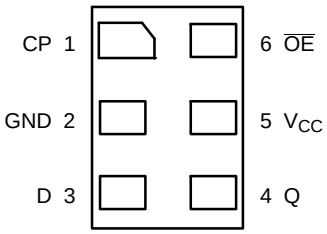
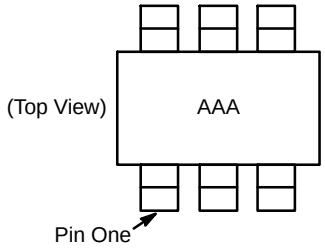


Figure 4. MicroPak (Top Through View)



AAA represents 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	Clock Pulse Input
$\overline{OE}$	Output Enable Input
Q	Flip−Flop Output

FUNCTION TABLE

Inputs			Output
CP	**D**	**$\overline{OE}$**	**Q**
↑	L	L	L
↑	H	L	H
↓	X	L	Q_n
X	X	H	Z

H = HIGH Logic Level
L = LOW Logic Level
X = Immaterial
Z = High Impedance
Q_n = No Change in Data

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−70−6	−	190	mW
		MicroPak	−	327	

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−70−6	−	659	°C/W
		MicroPak	−	382	

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}	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}	I_{OL} = 100 μA	−	0.0	0.1	−	0.1	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	−	10.0	μA

AC ELECTRICAL CHARACTERISTICS

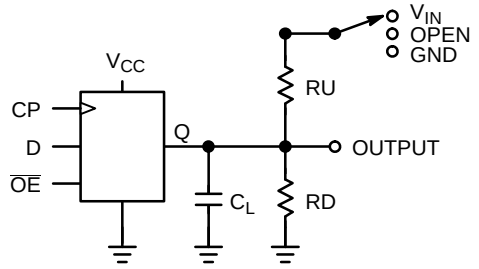
Symbol	Parameter	V_{CC} (V)	Conditions	T_A = +25°C			T_A = −40 to +85°C		Unit
				Min	Typ	Max	Min	Max	
f_{MAX}	Maximum Clock Frequency (Figures 5, 7)	1.65	C_L = 50 pF, R_D = 500 Ω, S_1 = Open	−	−	−	100	−	MHz
		1.8		−	−	−	100	−	
		2.5 ±0.2		−	−	−	125	−	
		3.3 ±0.3		−	−	−	150	−	
		5.0 ±0.5		−	−	−	175	−	
t_{PLH}, t_{PHL}	Propagation Delay CP to Q (Figures 5, 7)	1.65	C_L = 15 pF, R_D = 1 MΩ, S_1 = Open	−	9.7	1.50	−	16.5	ns
		1.8		−	6.5	10.0	−	11.0	
		2.5 ±0.2		−	3.8	6.5	−	7.0	
		3.3 ±0.3		−	2.8	4.5	−	5.0	
		5.0 ±0.5		−	2.2	3.5	−	3.8	
		3.3 ±0.3	C_L = 50 pF, R_D = 500 Ω, S_1 = Open	−	3.4	5.5	−	6.2	
		5.0 ±0.5		−	2.6	4.0	−	4.7	
t_{PZL}, t_{PZH}	Output Enable Time (Figures 5, 8)	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}	−	9.0	13.5	−	14.3	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 (Figures 5, 8)	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}	−	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		−	2.23	3.7	−	3.9	
t_S	Setup Time, CP to D (Figures 5, 9)	2.5 ±0.2	C_L = 50 pF, R_D = 500 Ω, S_1 = Open	−	−	−	2.5	−	ns
		3.3 ±0.3		−	−	−	2.0	−	
		5.0 ±0.5			−	−	1.5	−	
t_H	Hold Time, CP to D (Figures 5, 9)	2.5 ±0.2	C_L = 50 pF, R_D = 500 Ω, S_1 = Open	−	−	−	1.5	−	ns
		3.3 ±0.3		−	−	−	1.5	−	
		5.0 ±0.5		−	−	−	1.5	−	
t_W	Pulse Width, CP (Figures 5, 9)	2.5 ±0.2	C_L = 50 pF, R_D = 500 Ω, S_1 = Open	−	−	−	3.0	−	ns
		3.3 ±0.3		−	−	−	2.8	−	
		5.0 ±0.5		−	−	−	2.5	−	

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	10 12	− −	pF

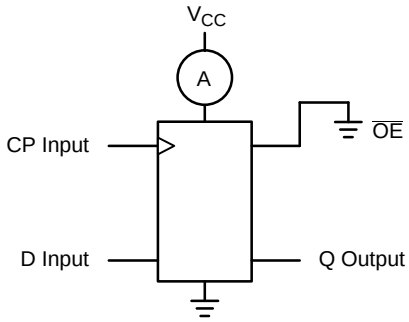
2. C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output loading and operating at 50% duty cycle. (See Figure 6)
C_{PD} is related to I_{CCD} dynamic operating current by the expression: I_{CCD} = (C_{PD})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



CP Input = AC Waveform; $t_r = t_f$ = 1.8 ns;
CP Input PRR = 10 MHz; Duty Cycle = 50%
D Input PRR = 5 MHz; Duty Cycle = 50%.

Figure 6. I_{CCD} Test Circuit

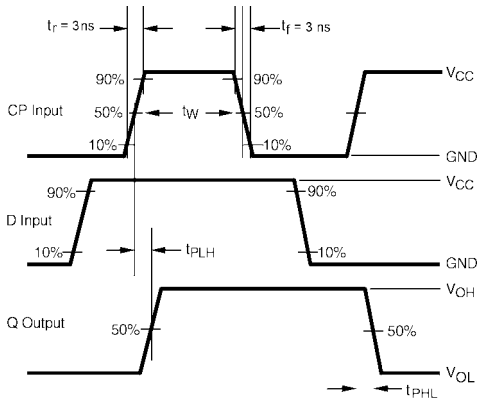


Figure 7. AC Waveforms

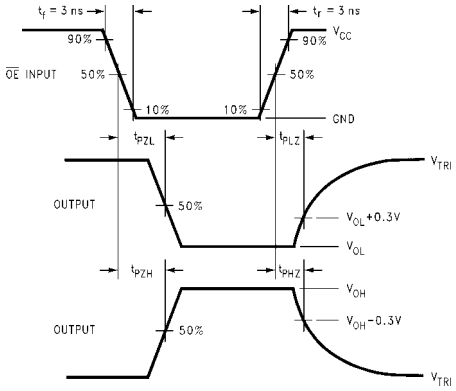


Figure 8. AC Waveforms

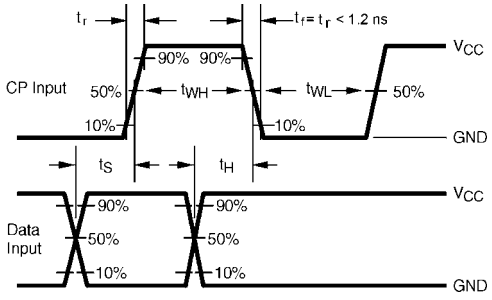


Figure 9. AC Waveforms

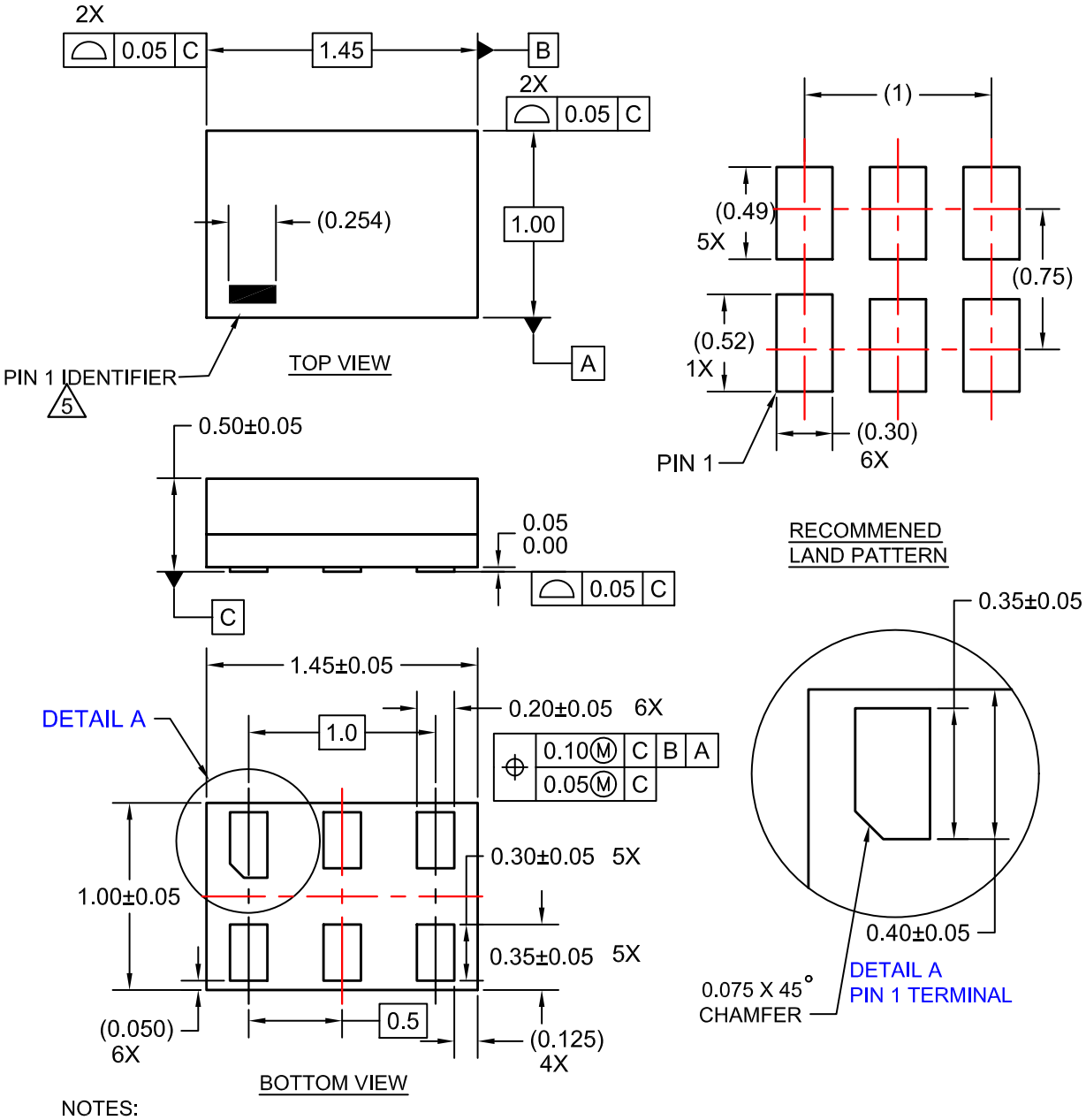
ORDERING INFORMATION

Device	Top Mark	Packages	Shipping†
NC7SZ374P6X	Z74	6−Lead SC70, EIAJ SC88, 1.25 mm Wide	3000 / Tape & Reel
NC7SZ374L6X	C9	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.

SIP6 1.45X1.0
CASE 127EB
ISSUE O

DATE 31 AUG 2016



NOTES:

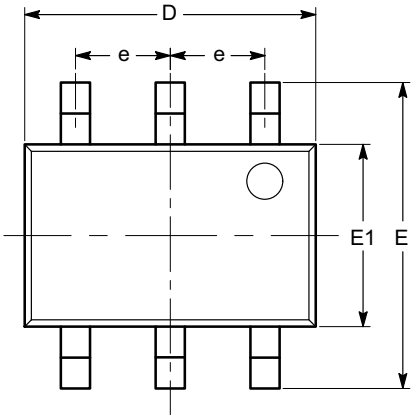
1. CONFORMS TO JEDEC STANDARD MO-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-2009
4. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY OTHER LINE IN THE MARK CODE LAYOUT.

DOCUMENT NUMBER:	**98AON13590G**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.	
STATUS:	**ON SEMICONDUCTOR STANDARD**		
NEW STANDARD:			
DESCRIPTION:	**SIP6 1.45X1.0**		**PAGE 1 OF 2**

ISSUE	REVISION	DATE
O	RELEASED FOR PRODUCTION FROM FAIRCHILD MAC06A TO ON SEMICONDUCTOR. REQ. BY B. MARQUIS.	31 AUG 2016

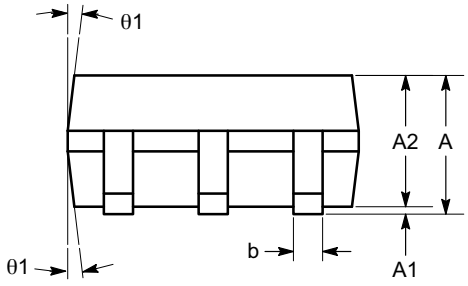
SC−88 (SC−70 6 Lead), 1.25x2
CASE 419AD−01
ISSUE A

DATE 07 JUL 2010

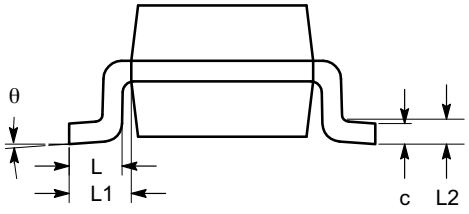


TOP VIEW

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.

ISSUE	REVISION	DATE
O	RELEASED FOR PRODUCTION FROM POD #SC706−023−02 TO ON SEMICONDUCTOR. REQ. BY B. BERGMAN.	19 DEC 2008
A	ADDED SC−88 TO DESCRIPTION AND TITLE. REQ. BY D. TRUHITTE.	07 JUL 2010

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
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19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
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