NL17SZ74

Single D Flip Flop

The NL17SZ74 is a high performance, full function Edge triggered D Flip Flop, with all the features of a standard logic device such as the 74LCX74.

- Extremely High Speed: t_{PD} 2.6 ns (typical) at V_{CC} = 5 V
- Designed for 1.65 V to 5.5 V V_{CC} Operation
- 5 V Tolerant Inputs – Interface Capability with 5 V TTL Logic
- LVTTL Compatible
- LVCMOS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current (10 μA) Substantially Reduces System Power Requirements
- Replacement for NC7SZ74
- Tiny Ultra Small Package Only 2.1 X 3.0 mm
- High ESD Ratings: 2000 V Human Body Model
  200 V Machine Model
- Chip Complexity: FET = 64

TRUTH TABLE

Inputs				Outputs		
$\overline{PR}$	$\overline{CLR}$	CP	D	Q	$\overline{Q}$	Operating Mode
L	H	X	X	H	L	Asynchronous Set
H	L	X	X	L	H	Asynchronous Clear
L	L	X	X	H	H	Undetermined
H	H	↑	h	H	L	
H	H	↑	l	L	H	Load and Read Register
H	H	↥	X	NC	NC	Hold

H = High Voltage Level
h = High Voltage Level One Setup Time Prior to the Low–to–High Clock Transition
L = Low Voltage Level
l = Low Voltage Level One Setup Time Prior to the Low–to–High Clock Transition
NC = No Change
X = High or Low Voltage Level and Transitions are Acceptable
↑ = Low–to–High Transition
↥ = Not a Low–to–High Transition

For I_{CC} reasons, DO NOT FLOAT Inputs

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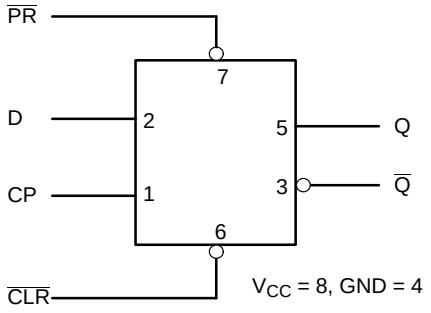
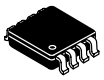


Figure 1. Logic Diagram

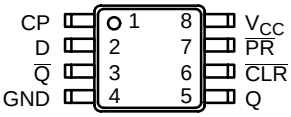


US8
CASE 493
US SUFFIX

MARKING DIAGRAM

MH = Specific Device Code
D = Date Code

PINOUT



ORDERING INFORMATION

Device	Package	Shipping
NL17SZ74US	US8	3000/Tape & Reel

MAXIMUM RATINGS

Symbol	Parameter		Value	Unit
V_{CC}	DC Supply Voltage		–0.5 to +7.0	V
V_I	DC Input Voltage		–0.5 to +7.0	V
V_O	DC Output Voltage – Output in High or Low State (Note 1)		–0.5 to V_{CC} +0.5	V
I_{IK}	DC Input Diode Current	V_I < GND	–50	mA
I_{OK}	DC Output Diode Current	V_O < GND	–50	mA
I_O	DC Output Sink Current		±50	mA
I_{CC}	DC Supply Current Per Supply Pin		±100	mA
I_{GND}	DC Ground Current Per Ground Pin		±100	mA
T_{STG}	Storage Temperature Range		–65 to +150	°C
T_L	Lead Temperature, 1 mm from Case for 10 Seconds		260	°C
T_J	Junction Temperature Under Bias		+150	°C
θ_{JA}	Thermal Resistance (Note 2)		250	°C/W
P_D	Power Dissipation in Still Air at 85°C		250	mW
MSL	Moisture Sensitivity		Level 1	
F_R	Flammability Rating	Oxygen Index: 28 to 34	UL 94 V–0 @ 0.125 in	
V_{ESD}	ESD Withstand Voltage	Human Body Model (Note 3) Machine Model (Note 4) Charged Device Model (Note 5)	>2000 >200 N/A	V

Maximum Ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute maximum–rated conditions is not implied. Functional operation should be restricted to the Recommended Operating Conditions.

1. I_O absolute maximum rating must be observed.
2. Measured with minimum pad spacing on an FR4 board, using 10 mm X 1 inch, 2 ounce copper trace with no air flow.
3. Tested to EIA/JESD22–A114–A.
4. Tested to EIA/JESD22–A115–A.
5. Tested to JESD22–C101–A.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Max	Unit
V_{CC}	Supply Voltage	Operating Data Retention Only	1.65 1.5	5.5 5.5	V
V_I	Input Voltage	(Note 6)	0	5.5	V
V_O	Output Voltage	(HIGH or LOW State)	0	V_{CC}	V
T_A	Operating Free–Air Temperature		–40	+85	°C
$\Delta t/\Delta V$	Input Transition Rise or Fall Rate	V_{CC} = 2.5 V ±0.2 V V_{CC} = 3.0 V ±0.3 V V_{CC} = 5.0 V ±0.5 V	0 0 0	20 10 5.0	ns/V

6. Unused inputs may not be left open. All inputs must be tied to a high–logic voltage level or a low–logic input voltage level.

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	V_{CC} (V)	T_A = 25°C			−40°C ≤ T_A ≤ 85°C		Unit
				Min	Typ	Max	Min	Max	
V_{IH}	High–Level Input Voltage		1.65	0.75 V_{CC}			0.75 V_{CC}		V
			2.3 to 5.5	0.7 V_{CC}			0.7 V_{CC}		
V_{IL}	Low–Level Input Voltage		1.65			0.25 V_{CC}		0.25 V_{CC}	V
			2.3 to 5.5			0.3 V_{CC}		0.3 V_{CC}	
V_{OH}	High–Level Output Voltage V_{IN} = V_{IL} or V_{IL}	I_{OH} = 100 μA I_{OH} = –3 mA I_{OH} = –8 mA I_{OH} = –12 mA I_{OH} = –16 mA I_{OH} = –24 mA I_{OH} = –32 mA	1.65 to 5.5 1.65 2.3 2.7 3.0 3.0 4.5	V_{CC} – 0.1 1.29 1.9 2.2 2.4 2.3 3.8	V_{CC} 1.52 2.1 2.4 2.7 2.5 4.0		V_{CC} – 0.1 1.29 1.9 2.2 2.4 2.3 3.8		V
V_{OL}	Low–Level Output Voltage V_{IN} = V_{IH}	I_{OL} = 100 μA I_{OL} = 3 mA I_{OL} = 8 mA I_{OL} = 12 mA I_{OL} = 16 mA I_{OL} = 24 mA I_{OL} = 32 mA	1.65 to 5.5 1.65 2.3 2.7 3.0 3.0 4.5		0.008 0.10 0.12 0.15 0.19 0.30 0.30	0.1 0.24 0.3 0.4 0.4 0.55 0.55		0.1 0.24 0.3 0.4 0.4 0.55 0.55	V
I_{IN}	Input Leakage Current	V_{IN} = V_{CC} or GND	5.5			±0.1		±1.0	μA
I_{OFF}	Power off Input Leakage Current	5.5V or V_{IN} = GND	0			1.0		10	μA
I_{CC}	Quiescent Supply Current	V_{IN} = V_{CC} or GND	5.5			1.0		10	μA

AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0$ ns)

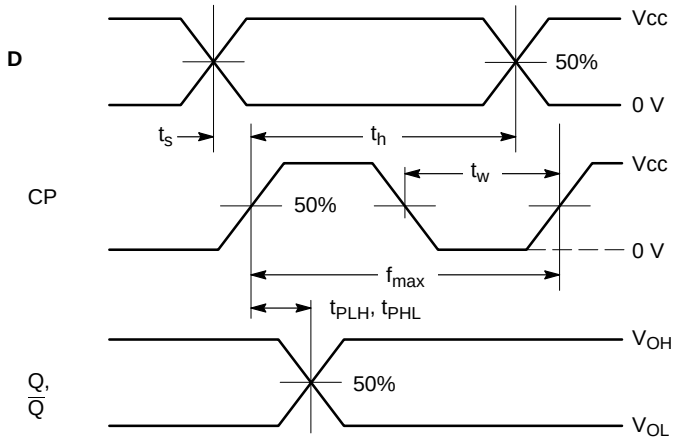
Symbol	Parameter	V_{CC} (V)	Test Conditions	T_A = 25°C			T_A = –40 to 85°C		Unit
				Min	Typ	Max	Min	Max	
f_{MAX}	Maximum Clock Frequency (50% Duty Cycle) (Waveform 1)	1.8 ± 0.15	C_L = 15 pF, R_D = 1 MΩ, S_1 = Open	75			75		MHz
		2.5 ± 0.2		150			150		
		3.3 ± 0.3		200			200		
		5.0 ± 0.5		250			250		
		3.3 ± 0.3	C_L = 50 pF, R_D = 500 Ω, S_1 = Open	175			175		
		5.0 ± 0.5		200			200		
t_{PLH}, t_{PHL}	Propagation Delay, CP to Q or $\overline{Q}$ (Waveform 1)	1.8 ± 0.15	C_L = 15 pF, R_D = 1 MΩ, S_1 = Open	2.5	6.5	12.5	2.5	13	ns
		2.5 ± 0.2		1.5	3.8	7.5	1.5	8.0	
		3.3 ± 0.3		1.0	2.8	6.5	1.0	7.0	
		5.0 ± 0.5		0.8	2.2	4.5	0.8	5.0	
		3.3 ± 0.3	C_L = 50 pF, R_D = 500 Ω, S_1 = Open	1.0	3.4	7.0	1.0	7.5	
		5.0 ± 0.5		1.0	2.6	5.0	1.0	5.5	
t_{PLH}, t_{PHL}	Propagation Delay, $\overline{PR}$ or $\overline{CLR}$ to Q or $\overline{Q}$ (Waveform 2)	1.8 ± 0.15	C_L = 15 pF, R_D = 1 MΩ, S_1 = Open	2.5	6.5	14	2.5	14.5	ns
		2.5 ± 0.2		1.5	3.8	9.0	1.5	9.5	
		3.3 ± 0.3		1.0	2.8	6.5	1.0	7.0	
		5.0 ± 0.5		0.8	2.2	5.0	0.8	5.5	
		3.3 ± 0.3	C_L = 50 pF, R_D = 500 Ω, S_1 = Open	1.0	3.4	7.0	1.0	7.5	
		5.0 ± 0.5		1.0	2.6	5.0	1.0	5.5	
t_S	Setup Time, D to CP (Waveform 1)	1.8 ± 0.15	C_L = 15 pF, R_D = 1 MΩ, S_1 = Open	6.5			6.5		ns
		2.5 ± 0.2		3.5			3.5		
		3.3 ± 0.3		2.0			2.0		
		5.0 ± 0.5		1.5			1.5		
		3.3 ± 0.3	C_L = 50 pF, R_D = 500 Ω, S_1 = Open	2.0			2.0		
		5.0 ± 0.5		1.5			1.5		
t_H	Hold Time, D to CP (Waveform 1)	1.8 ± 0.15	C_L = 15 pF, R_D = 1 MΩ, S_1 = Open	0.5			0.5		ns
		2.5 ± 0.2		0.5			0.5		
		3.3 ± 0.3		0.5			0.5		
		5.0 ± 0.5		0.5			0.5		
		3.3 ± 0.3	C_L = 50 pF, R_D = 500 Ω, S_1 = Open	0.5			0.5		
		5.0 ± 0.5		0.5			0.5		
t_W	Pulse Width, CP, $\overline{CLR}$, $\overline{PR}$ (Waveform 3)	1.8 ± 0.15	C_L = 15 pF, R_D = 1 MΩ, S_1 = Open	6.0			6.0		ns
		2.5 ± 0.2		4.0			4.0		
		3.3 ± 0.3		3.0			3.0		
		5.0 ± 0.5		2.0			2.0		
		3.3 ± 0.3	C_L = 50 pF, R_D = 500 Ω, S_1 = Open	3.0			3.0		
		5.0 ± 0.5		2.0			2.0		
t_{REC}	Recover Time $\overline{PR}$, $\overline{CLR}$ to CP (Waveform 3)	1.8 ± 0.15	C_L = 15 pF, R_D = 1 MΩ, S_1 = Open	8.0			8.0		MHz
		2.5 ± 0.2		4.5			4.5		
		3.3 ± 0.3		3.0			3.0		
		5.0 ± 0.5		3.0			3.0		
		3.3 ± 0.3	C_L = 50 pF, R_D = 500 Ω, S_1 = Open	3.0			3.0		
		5.0 ± 0.5		3.0			3.0		

7. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}/2$ (per flip–flop). C_{PD} is used to determine the no–load dynamic power consumption; $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.

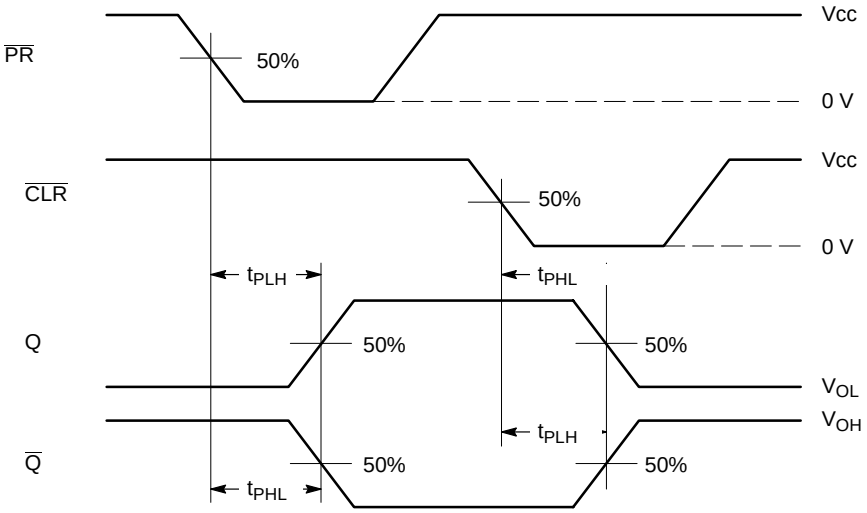
CAPACITANCE (Note 8)

Symbol	Parameter	Condition	Typical	Unit
C_{IN}	Input Capacitance	V_{CC} = 5.5 V	7.0	pF
C_{OUT}	Output Capacitance	V_{CC} = 5.5 V	7.0	pF
C_{PD}	Power Dissipation Capacitance (Note 9) Frequency = 10 MHz	V_{CC} = 3.3 V V_{CC} = 5.0 V	16 21	pF

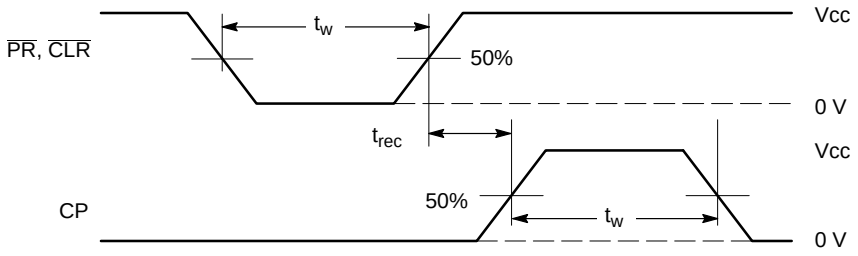
8. T_A = +25°C, f = 1 MHz
9. C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output loading and operating at 50% duty cycle. (See Figure 2) C_{PD} is related to I_{CCD} dynamic operating current by the expression: $I_{CCD} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC(static)}$.



WAVEFORM 1 – PROPAGATION DELAYS, SETUP AND HOLD TIMES
$t_R = t_F$ = 3.0 ns, 10% to 90%; f = 1 MHz; t_W = 500 ns



WAVEFORM 2 – PROPAGATION DELAYS
$t_R = t_F$ = 3.0 ns, 10% to 90%; f = 1 MHz; t_W = 500 ns



WAVEFORM 3 – RECOVERY TIME
$t_R = t_F$ = 3.0 ns from 10% to 90%; f = 1 MHz; t_w = 500 ns
Output Reg: $V_{OL} \leq 0.8$ V, $V_{OH} \geq 2.0$ V

Figure 2. AC Waveforms

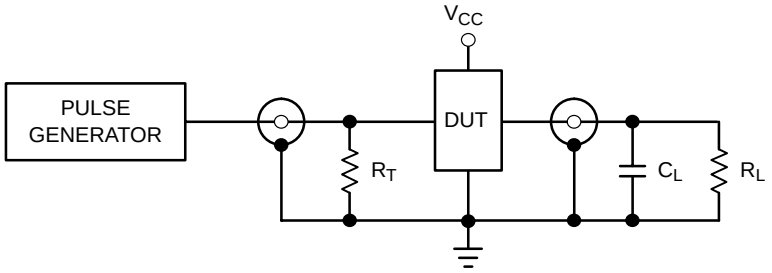


Figure 3. Test Circuit

DEVICE ORDERING INFORMATION

Device Order Number	Device Nomenclature						Package Type	Tape and Reel Size
	Logic Circuit Indicator	No. of Gates per Package	Temp Range Identifier	Technology	Device Function	Package Suffix		
NL17SZ74US	NL	1	7	SZ	74	US	US8	178 mm, 3000 Unit

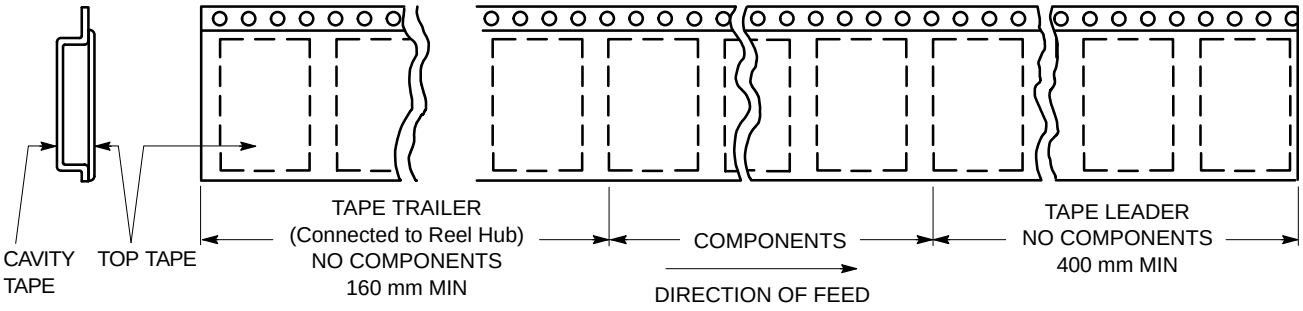


Figure 4. Tape Ends for Finished Goods

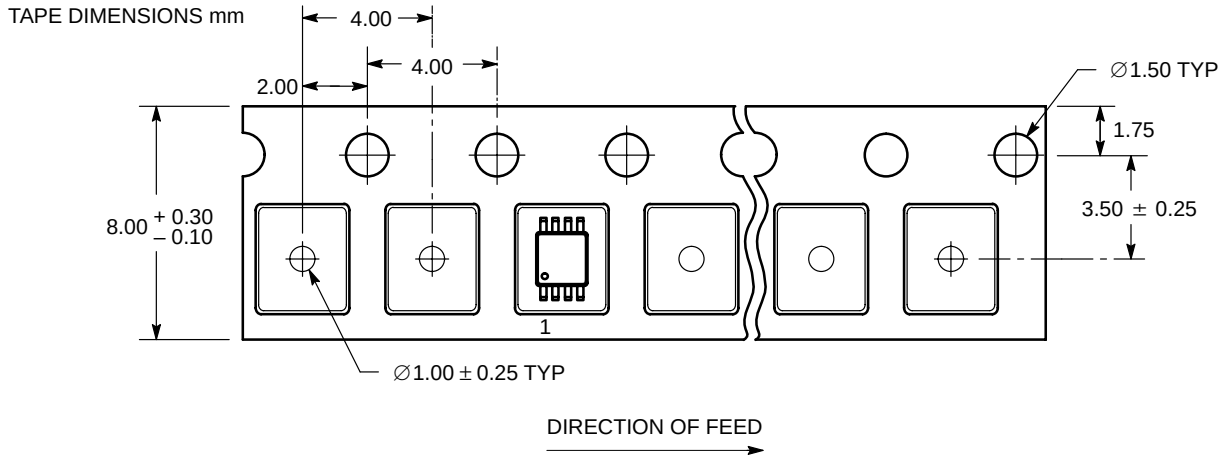


Figure 5. US8 Reel Configuration/Orientation

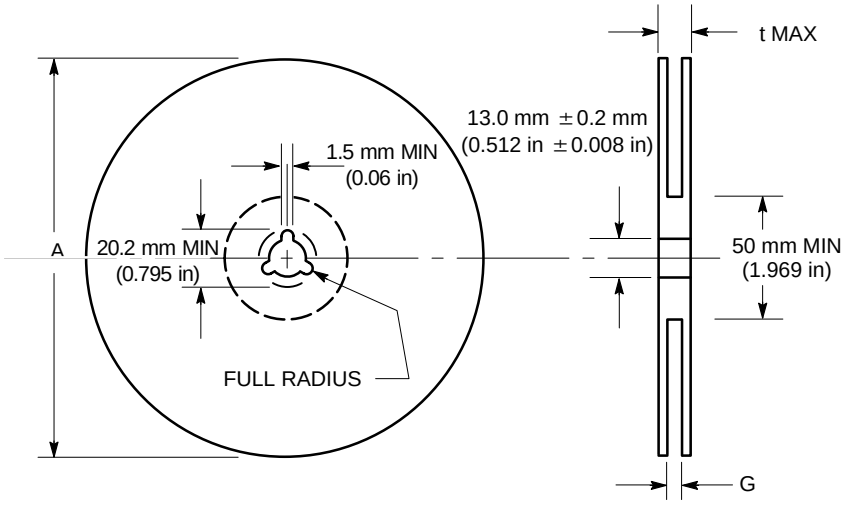


Figure 6. Reel Dimensions

REEL DIMENSIONS

Tape Size	T and R Suffix	A Max	G	t Max
8 mm	US	178 mm (7 in)	8.4 mm, + 1.5 mm, –0.0 (0.33 in + 0.059 in, –0.00)	14.4 mm (0.56 in)

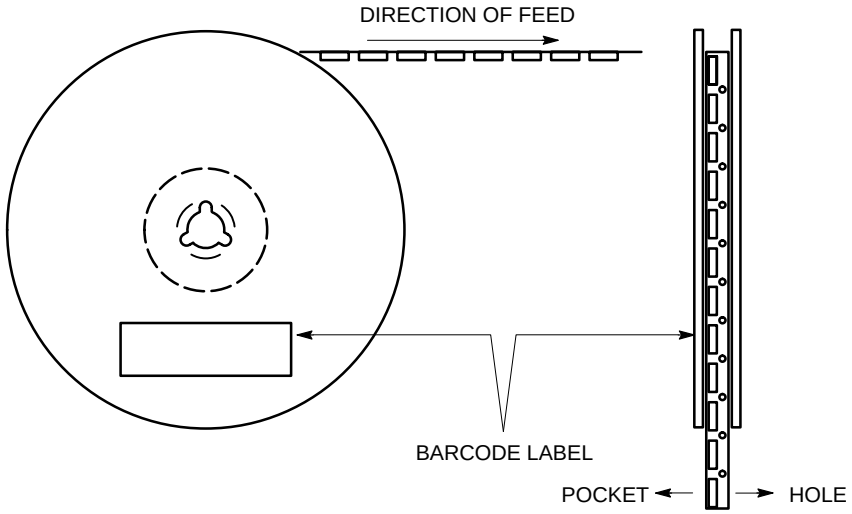
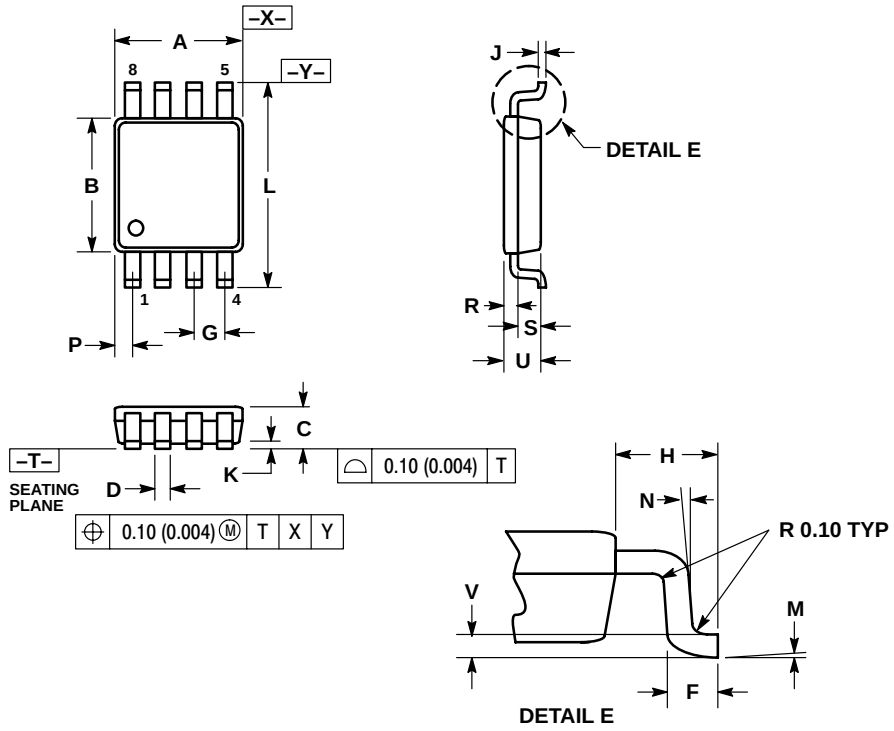
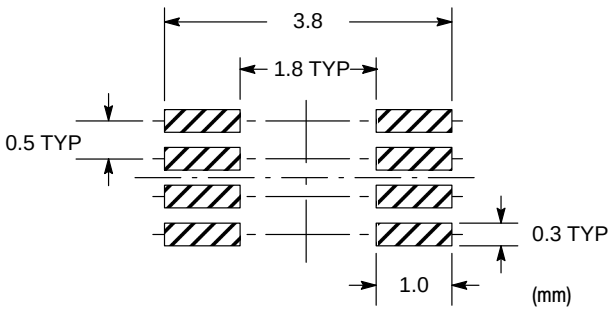


Figure 7. Reel Winding Direction

PACKAGE DIMENSIONS

US8
US SUFFIX
CASE 493–01
ISSUE O





NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION "A" DOES NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURR. MOLD FLASH. PROTRUSION AND GATE BURR SHALL NOT EXCEED 0.140 MM (0.0055") PER SIDE.
4. DIMENSION "B" DOES NOT INCLUDE INTER–LEAD FLASH OR PROTRUSION. INTER–LEAD FLASH AND PROTRUSION SHALL NOT E3XCEED 0.140 (0.0055") PER SIDE.
5. LEAD FINISH IS SOLDER PLATING WITH THICKNESS OF 0.0076–0. 0203 MM. (300–800 mINCH).
6. ALL TOLERANCE UNLESS OTHERWISE SPECIFIED ±0.0508 (0.0002").

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	1.90	2.10	0.075	0.083
B	2.20	2.40	0.087	0.094
C	0.60	0.90	0.024	0.035
D	0.17	0.25	0.007	0.010
F	0.20	0.35	0.008	0.014
G	0.50 BSC		0.020 BSC	
H	0.40 REF		0.016 REF	
J	0.10	0.18	0.004	0.007
K	0.00	0.10	0.000	0.004
L	3.00	3.20	0.118	0.126
M	0 °	6 °	0 °	6 °
N	5 °	10 °	5 °	10 °
P	0.28	0.44	0.011	0.017
R	0.23	0.33	0.009	0.013
S	0.37	0.47	0.015	0.019
U	0.60	0.80	0.024	0.031
V	0.12 BSC		0.005 BSC	

Notes

PUBLICATION ORDERING INFORMATION

Literature Fulfillment:
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