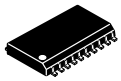
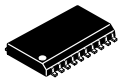
3-STATE Octal D-Type Flip-Flop

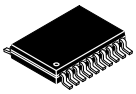
MM74HC374



SOIC−20 WB
CASE 751D−05



SOIC−20, 300 mils
CASE 751BJ−01



TSSOP−20 WB
CASE 948E

General Description

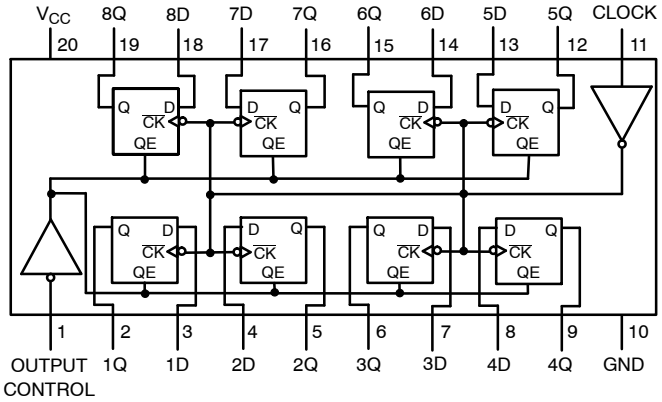
The MM74HC374 high speed Octal D−Type Flip−Flops utilize advanced silicon−gate CMOS technology. They possess the high noise immunity and low power consumption of standard CMOS integrated circuits, as well as the ability to drive 15 LS−TTL loads. Due to the large output drive capability and the 3−STATE feature, these devices are ideally suited for interfacing with bus lines in a bus organized system.

These devices are positive edge triggered flip−flops. Data at the D inputs, meeting the setup and hold time requirements, are transferred to the Q outputs on positive going transitions of the CLOCK (CK) input. When a high logic level is applied to the OUTPUT CONTROL (OC) input, all outputs go to a high impedance state, regardless of what signals are present at the other inputs and the state of the storage elements.

The 74HC logic family is speed, function, and pinout compatible with the standard 74LS logic family. All inputs are protected from damage due to static discharge by internal diode clamps to VCC and ground.

Features

- Typical Propagation Delay: 20 ns
- Wide Operating Voltage Range: 2−6 V
- Low Input Current: 1 μA Maximum
- Low Quiescent Current: 160 μA Maximum
- Compatible with Bus−oriented Systems
- Output Drive Capability: 15 LS−TTL Loads
- This is a Pb−Free Device

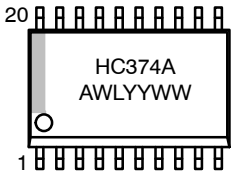


Pin Assignments for SOIC and TSSOP (Top View)

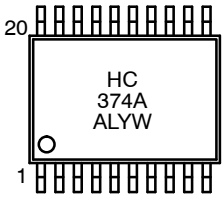
Figure 1. Connection Diagram

MARKING DIAGRAMS

SOIC−20



TSSOP−20



HC374A	= Specific Device Code
A	= Assembly Location
WL, L	= Wafer Lot Number
Y	= Year
WW, YW	= Work Week

ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

TRUTH TABLE

Output Control	Clock	Data	Output
L	↑	H	H
L	↑	L	L
L	L	X	Q_0
H	X	X	Z

NOTES:
H = HIGH Level
L = LOW Level
X = Don't Care
↑ = Transition from LOW−to−HIGH
Z = High Impedance State
Q_0 = The level of the output before steady state input conditions were established.

ABSOLUTE MAXIMUM RATINGS (Note 1)

Symbol	Rating		Value	Unit
V_{CC}	Supply Voltage		−0.5 to +7.0 V	V
V_{IN}	DC Input Voltage		−0.5 to V_{CC} +0.5 V	V
V_{OUT}	DC Output Voltage		−0.5 to V_{CC} +0.5 V	V
I_{IK}, I_{OK}	Clamp Diode Current		±20	mA
I_{OUT}	DC Output Current, per pin		±35	mA
I_{CC}	DC V_{CC} or GND Current, per pin		±70	mA
T_{STG}	Storage Temperature Range		−65 to +150	°C
P_D	Power Dissipation	Note 2	600	mW
		S. O. Package only	500	mW
T_L	Lead Temperature (Soldering 10 seconds)		260	°C

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.
1. Unless otherwise specified all voltages are referenced to ground.
2. Power Dissipation temperature derating − plastic "N" package: 12 mW/°C from 65°C to 85°C.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Max	Unit
V_{CC}	Supply Voltage		2	6	V
V_{IN}, V_{OUT}	DC Input or Output Voltage		0	V_{CC}	V
T_A	Operating Temperature Range		−55	+125	°C
t_r, t_f	Input Rise or Fall Times	V_{CC} = 2.0 V	−	1000	ns
		V_{CC} = 4.5 V	−	500	ns
		V_{CC} = 6.0 V	−	400	ns

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.

DC ELECTRICAL CHARACTERISTICS (Note 3)

Symbol	Parameter	Conditions	V_{CC}	T_A = 25°C	T_A = −40 to 85°C	T_A = −55 to 125°C	Unit
				Typ	Guaranteed Limits		
V_{IH}	Minimum HIGH Level Input Voltage		2.0 V 4.5 V 6.0 V		1.5 3.15 4.2	1.5 3.15 4.2	1.5 3.15 4.2	V V V
V_{IL}	Maximum LOW Level Input Voltage		2.0 V 4.5 V 6.0 V		0.5 1.35 1.8	0.5 1.35 1.8	0.5 1.35 1.8	V V V
V_{OH}	Minimum HIGH Level Output Voltage	$V_{IN} = V_{IH}$ or V_{IL} $\|I_{OUT}\| \le 20$ μA	2.0 V 4.5 V 6.0 V	2.0 4.5 6.0	1.9 4.4 5.9	1.9 4.4 5.9	1.9 4.4 5.9	V V V
		$V_{IN} = V_{IH}$ or V_{IL} $\|I_{OUT}\| \le 6.0$ mA $\|I_{OUT}\| \le 7.8$ mA	 4.5 V 6.0 V	 4.2 5.7	 3.98 5.48	 3.84 5.34	 3.7 5.2	 V V
V_{OL}	Maximum LOW Level Output Voltage	$V_{IN} = V_{IH}$ or V_{IL} $\|I_{OUT}\| \le 20$ μA	2.0 V 4.5 V 6.0 V	0 0 0	0.1 0.1 0.1	0.1 0.1 0.1	0.1 0.1 0.1	V V V
		$V_{IN} = V_{IH}$ or V_{IL} $\|I_{OUT}\| \le 6.0$ mA $\|I_{OUT}\| \le 7.8$ mA	 4.5 V 6.0 V	 0.2 0.2	 0.26 0.26	 0.33 0.33	 0.4 0.4	 V V
I_{IN}	Maximum Input Current	$V_{IN} = V_{CC}$ or GND	6.0 V		±0.1	±1.0	±1.0	μA
I_{OZ}	Maximum 3−STATE Output Leakage Current	$V_{IN} = V_{IH}$, OC = V_{IH} $V_{OUT} = V_{CC}$ or GND	6.0 V		±0.5	±5	±10	μA
I_{CC}	Maximum Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND I_{OUT} = 0 μA	6.0 V		8.0	80	160	μA

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

3. For a power supply of 5 V ±10% the worst case output voltages (V_{OH}, and V_{OL}) occur for HC at 4.5 V. Thus the 4.5 V values should be used when designing with this supply. Worst case V_{IH} and V_{IL} occur at V_{CC} = 5.5 V and 4.5 V respectively. (The V_{IH} value at 5.5 V is 3.85 V.) The worst case leakage current (I_{IN}, I_{CC}, and I_{OZ}) occur for CMOS at the higher voltage and so the 6.0 V values should be used.

AC ELECTRICAL CHARACTERISTICS

(V_{CC} = 5 V, T_A = 25°C, $t_r = t_f$ = 6 ns)

Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Unit
f_{MAX}	Maximum Operating Frequency		50	35	MHz
t_{PHL}, t_{PLH}	Maximum Propagation Delay Clock to Q	C_L = 45 pF	20	32	ns
t_{PZH}, t_{PZL}	Maximum Output Enable Time	R_L = 1 kΩ, C_L = 45 pF	19	28	ns
t_{PHZ}, t_{PLZ}	Maximum Output Disable Time	R_L = 1 kΩ, C_L = 5 pF	17	25	ns
t_s	Minimum Setup Time		–	20	ns
t_H	Minimum Hold Time		–	5	ns
t_W	Minimum Pulse Width		9	16	ns

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

AC ELECTRICAL CHARACTERISTICS

(VCC = 2.0−6.0 V, C_L = 50 pF, $t_r = t_f$ = 6 ns, unless otherwise specified)

Symbol	Parameter	Conditions	V_{CC}	T_A = 25°C	T_A = −40 to 85°C	T_A = −55 to 125°C	Unit
				Typ	Guaranteed Limits		
f_{MAX}	Maximum Operating Frequency	C_L = 50 pF	2.0 V 4.5 V 6.0 V		6 30 35	5 24 28	4 20 23	MHz MHz MHz
t_{PHL}, t_{PLH}	Maximum Propagation Delay, Clock to Q	C_L = 50 pF C_L = 150 pF	2.0 V 2.0 V	68 110	180 230	225 288	270 345	ns ns
		C_L = 50 pF C_L = 150 pF	4.5 V 4.5 V	22 30	36 46	45 57	48 69	ns ns
		C_L = 50 pF C_L = 150 pF	6.0 V 6.0 V	20 28	31 40	39 50	46 60	ns ns
t_{PZH}, t_{PZL}	Maximum Output Enable Time	R_L = 1 kΩ C_L = 50 pF C_L = 150 pF	 2.0 V 2.0 V	 50 80	 150 200	 189 250	 225 300	ns ns
		C_L = 50 pF C_L = 150 pF	4.5 V 4.5 V	21 30	30 40	37 50	45 60	ns ns
		C_L = 50 pF C_L = 150 pF	6.0 V 6.0 V	19 26	26 35	31 44	39 53	ns ns
t_{PHZ}, t_{PLZ}	Maximum Output Disable Time	R_L = 1 kΩ C_L = 50 pF	2.0 V 4.5 V 6.0 V	50 21 19	150 30 26	189 37 31	225 45 39	ns ns ns
t_s	Minimum Setup Time		2.0 V 4.5 V 6.0 V		50 9 9	60 13 11	75 15 13	ns ns ns
t_H	Minimum Hold Time		2.0 V 4.5 V 6.0 V		5 5 5	30 5 5	5 5 5	ns ns ns
t_W	Minimum Pulse Width		2.0 V 4.5 V 6.0 V	30 9 8	80 16 14	100 20 18	120 24 20	ns ns ns
t_{THL}, t_{TLH}	Maximum Output Rise and Fall Time	C_L = 50 pF	2.0 V 4.5 V 6.0 V	25 7 6	60 12 10	75 15 13	90 18 15	ns ns ns
t_r, t_f	Maximum Input Rise and Fall Time, Clock		2.0 V 4.5 V 6.0 V		1000 500 400	1000 500 400	1000 500 400	ns ns ns
C_{PD}	Power Dissipation Capacitance (Note 4)	(per flip−flop) OC = V_{CC} OC = GND		 30 50				 pF pF
C_{IN}	Maximum Input Capacitance			5	10	10	10	pF

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. C_{PD} determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

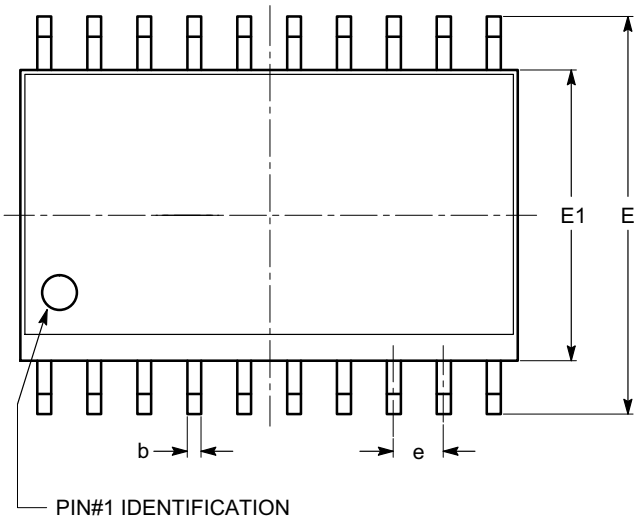
ORDERING INFORMATION

Device	Package	Shipping†
MM74HC374WM	SOIC−20 WB (Pb−Free and Halide Free)	38 Units / Tube
MM74HC374WMX	SOIC−20, 300 mils (Pb−Free and Halide Free)	1000 / Tape & Reel
MM74HC374MTC	TSSOP−20 WB (Pb−Free)	75 Units / Tube
MM74HC374MTCX		2500 / 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.

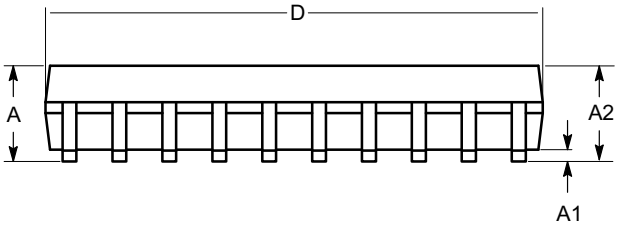
SOIC−20, 300 mils
CASE 751BJ
ISSUE O

DATE 19 DEC 2008

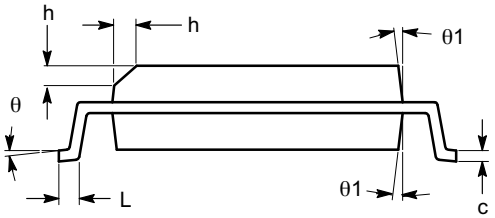


TOP VIEW

SYMBOL	MIN	NOM	MAX
A	2.36	2.49	2.64
A1	0.10		0.30
A2	2.05		2.55
b	0.31	0.41	0.51
c	0.20	0.27	0.33
D	12.60	12.80	13.00
E	10.01	10.30	10.64
E1	7.40	7.50	7.60
e	1.27 BSC		
h	0.25		0.75
L	0.40	0.81	1.27
θ	0°		8°
θ1	5°		15°



SIDE VIEW



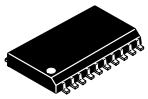
END VIEW

Notes:
(1) All dimensions are in millimeters. Angles in degrees.
(2) Complies with JEDEC MS-013.

DOCUMENT NUMBER:	**98AON34287E**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	**SOIC−20, 300 MILS**	**PAGE 1 OF 1**

SOIC−20 WB
CASE 751D−05
ISSUE H

DATE 22 APR 2015



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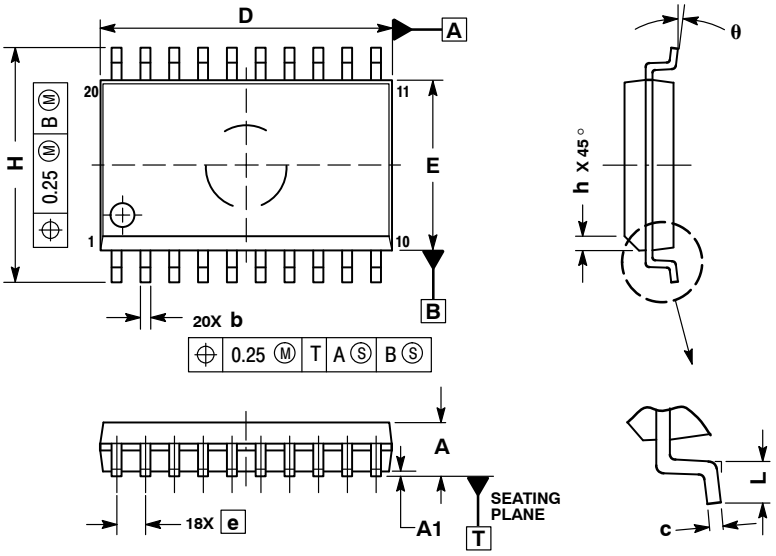
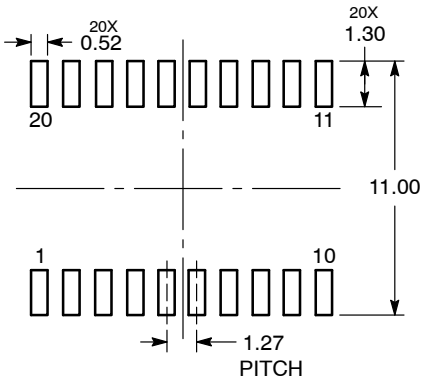


NOTES:
1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF B DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS	
DIM	MIN	MAX
A	2.35	2.65
A1	0.10	0.25
b	0.35	0.49
c	0.23	0.32
D	12.65	12.95
E	7.40	7.60
e	1.27 BSC	
H	10.05	10.55
h	0.25	0.75
L	0.50	0.90
θ	0°	7°

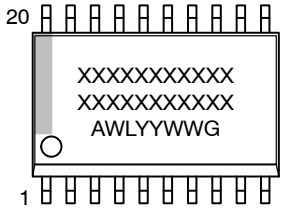
RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

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

GENERIC MARKING DIAGRAM*



XXXXX = Specific Device Code
A = Assembly Location
WL = Wafer Lot
YY = Year
WW = Work Week
G = Pb−Free Package

*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.

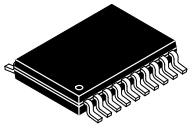
DOCUMENT NUMBER:	**98ASB42343B**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red.	
DESCRIPTION:	**SOIC−20 WB**		**PAGE 1 OF 1**

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Semiconductor®

TSSOP−20 WB
CASE 948E
ISSUE D

DATE 17 FEB 2016



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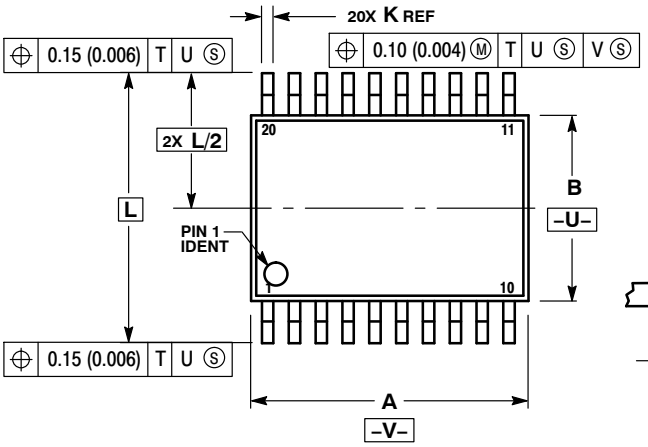
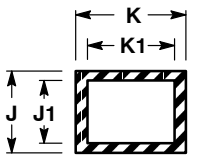
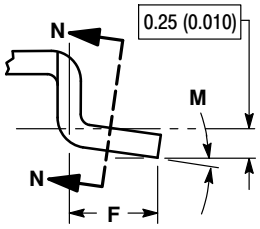
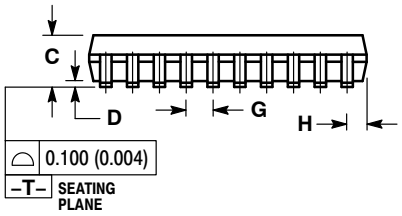


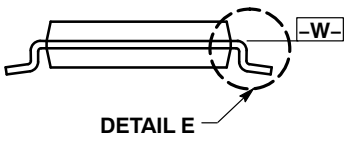


SECTION N−N



DETAIL E

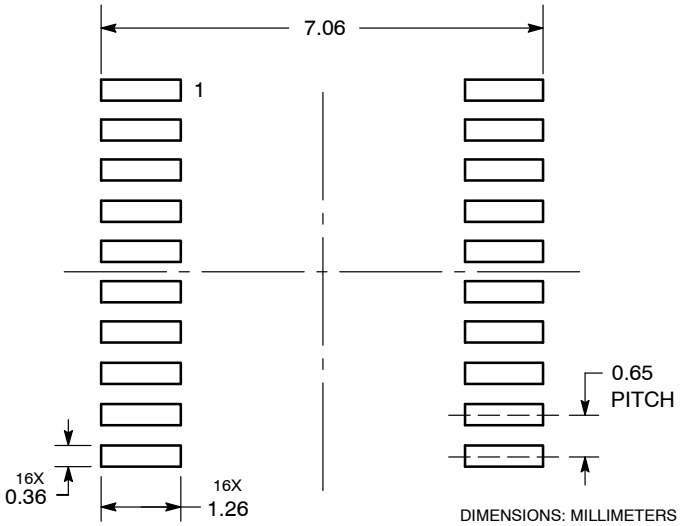




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE −W−.

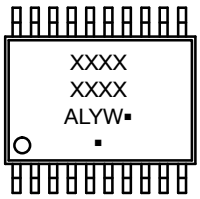
	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	6.40	6.60	0.252	0.260
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.27	0.37	0.011	0.015
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°

SOLDERING FOOTPRINT



DIMENSIONS: MILLIMETERS

GENERIC MARKING DIAGRAM*



A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = 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.

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DESCRIPTION:	TSSOP−20 WB	PAGE 1 OF 1

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