MC10EL52, MC100EL52

5V ECL Differential Data and Clock D Flip-Flop

ON Semiconductor®

http://onsemi.com

Description

The MC10EL/100EL52 is a differential data, differential clock D flip-flop with reset. The device is functionally equivalent to the E452 device with higher performance capabilities. With propagation delays and output transition times significantly faster than the E452, the EL52 is ideally suited for those applications which require the ultimate in AC performance.

Data enters the master portion of the flip-flop when the clock is LOW and is transferred to the slave, and thus the outputs, upon a positive transition of the clock. The differential clock inputs of the EL52 allow the device to also be used as a negative edge triggered device.

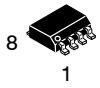
The EL52 employs input clamping circuitry so that under open input conditions (pulled down to V_{EE}) the outputs of the device will remain stable.

The 100 Series contains temperature compensation.

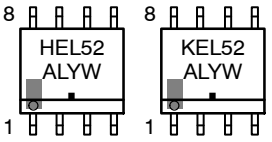
Features

- 365 ps Propagation Delay
- 2.0 GHz Toggle Frequency
- ESD Protection: > 1 kV Human Body Model, > 100 V Machine Model
- PECL Mode Operating Range: V_{CC} = 4.2 V to 5.7 V with V_{EE} = 0 V
- NECL Mode Operating Range: V_{CC} = 0 V with V_{EE} = −4.2 V to −5.7 V
- Internal Input Pulldown Resistors on D and CLK
- Meets or Exceeds JEDEC Spec EIA/JESD78 IC Latchup Test
- Moisture Sensitivity Level 1
  For Additional Information, see Application Note AND8003/D
- Flammability Rating: UL 94 V−0 @ 0.125 in, Oxygen: Index 28 to 34
- Transistor Count = 48 devices
- Pb−Free Packages are Available

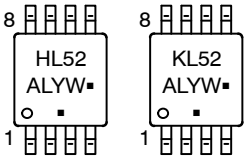
MARKING DIAGRAMS*

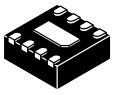


SOIC−8
D SUFFIX
CASE 751

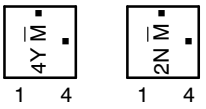


TSSOP−8
DT SUFFIX
CASE 948R





DFN8
MN SUFFIX
CASE 506AA



H = MC10	L = Wafer Lot
K = MC100	Y = Year
4Y = MC10	W = Work Week
2N = MC100	M = Date Code
A = Assembly Location	▪ = Pb−Free Package

(Note: Microdot may be in either location)

*For additional marking information, refer to Application Note AND8002/D.

ORDERING INFORMATION

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

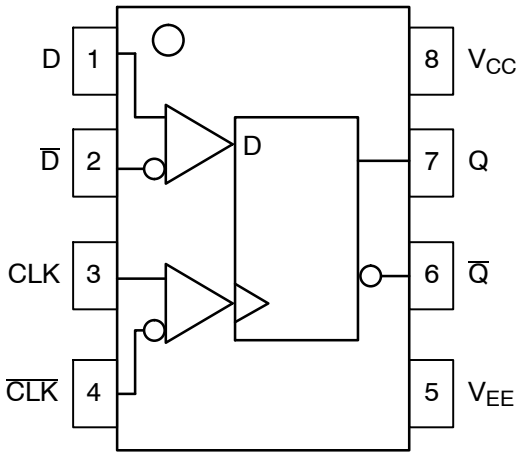


Figure 1. Logic Diagram and Pinout Assignment

Table 1. TRUTH TABLE

D*	CLK*	Q
L H	Z Z	L H

Z = LOW to HIGH Transition

* Pin will default low when left open.

Table 2. PIN DESCRIPTION

PIN	FUNCTION
D, $\overline{D}$	ECL Data Input
CLK, $\overline{CLK}$	ECL Clock Input
Q, $\overline{Q}$	ECL Data Output
V_{CC}	Positive Supply
V_{EE}	Negative Supply
EP	(DFN8 only) Thermal exposed pad must be connected to a sufficient thermal conduit. Electrically connect to the most negative supply (GND) or leave unconnected, floating open.

Table 3. MAXIMUM RATINGS

Symbol	Parameter	Condition 1	Condition 2	Rating	Unit
V_{CC}	PECL Mode Power Supply	V_{EE} = 0 V		8	V
V_{EE}	NECL Mode Power Supply	V_{CC} = 0 V		−8	V
V_I	PECL Mode Input Voltage NECL Mode Input Voltage	V_{EE} = 0 V V_{CC} = 0 V	$V_I \leq V_{CC}$ $V_I \geq V_{EE}$	6 −6	V V
I_{out}	Output Current	Continuous Surge		50 100	mA mA
T_A	Operating Temperature Range			−40 to +85	°C
T_{stg}	Storage Temperature Range			−65 to +150	°C
θ_{JA}	Thermal Resistance (Junction−to−Ambient)	0 lfpm 500 lfpm	8 SOIC 8 SOIC	190 130	°C/W °C/W
θ_{JC}	Thermal Resistance (Junction−to−Case)	Standard Board	8 SOIC	41 to 44	°C/W
θ_{JA}	Thermal Resistance (Junction−to−Ambient)	0 lfpm 500 lfpm	8 TSSOP 8 TSSOP	185 140	°C/W °C/W
θ_{JC}	Thermal Resistance (Junction−to−Case)	Standard Board	8 TSSOP	41 to 44 ± 5%	°C/W
T_{sol}	Wave Solder Pb Pb−Free	<2 to 3 sec @ 248°C <2 to 3 sec @ 260°C		265 265	°C
θ_{JC}	Thermal Resistance (Junction−to−Case)	(Note 1)	DFN8	35 to 40	°C/W

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. JEDEC standard multilayer board − 2S2P (2 signal, 2 power)

Table 4. 10EL SERIES PECL DC CHARACTERISTICS V_{CC} = 5.0 V; V_{EE} = 0 V (Note 2)

Symbol	Characteristic	–40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current		21	25		21	25		21	25	mA
V_{OH}	Output HIGH Voltage (Note 6)	3920	4010	4110	4020	4105	4190	4090	4185	4280	mV
V_{OL}	Output LOW Voltage (Note 3)	3050	3200	3350	3050	3210	3370	3050	3227	3405	mV
V_{IH}	Input HIGH Voltage (Single−Ended)	3770		4110	3870		4190	3940		4280	mV
V_{IL}	Input LOW Voltage (Single−Ended)	3050		3500	3050		3520	3050		3555	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 4) D CLK	3.4 2.5		4.6 4.4	3.4 2.5		4.6 4.4	3.4 2.5		4.6 4.4	V
I_{IH}	Input HIGH Current			150			150			150	μA
I_{IL}	Input LOW Current	0.5			0.5			0.3			μA

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

2. Input and output parameters vary 1:1 with V_{CC}.
   V_{EE} can vary +0.25 V / −0.5 V for +25°C and +85°C. or V_{EE} can vary +0.06 V / −0.5 V for −40°C.
3. Outputs are terminated through a 50 ohm resistor to V_{CC} − 2.0 V.
4. V_{IHCMR} min varies 1:1 with V_{EE}, V_{IHCMR} max varies 1:1 with V_{CC}. The V_{IHCMR} range is referenced to the most positive side of the differential input signal. Normal operation is obtained if the HIGH level falls within the specified range and the peak-to-peak voltage lies between V_{PP}min and 1 V.

Table 5. 10EL SERIES NECL DC CHARACTERISTICS V_{CC} = 0 V; V_{EE} = −5.0 V (Note 5)

Symbol	Characteristic	–40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current		21	25		21	25		21	25	mA
V_{OH}	Output HIGH Voltage (Note 6)	–1080	–990	–890	–980	–895	–810	–910	–815	–720	mV
V_{OL}	Output LOW Voltage (Note 6)	–1950	–1800	–1650	–1950	–1790	–1630	–1950	–1773	–1595	mV
V_{IH}	Input HIGH Voltage (Single−Ended)	–1230		–890	–1130		–810	–1060		–720	mV
V_{IL}	Input LOW Voltage (Single−Ended)	–1950		–1500	–1950		–1480	–1950		–1445	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 4) D CLK	–1.6 –2.5		–0.4 –0.6	–1.6 –2.5		–0.4 –0.6	–1.6 –2.5		–0.4 –0.6	V
I_{IH}	Input HIGH Current			150			150			150	μA
I_{IL}	Input LOW Current	0.5			0.5			0.3			μA

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

5. Input and output parameters vary 1:1 with V_{CC}.
   V_{EE} can vary +0.25 V / −0.5 V for +25°C and +85°C. or V_{EE} can vary +0.06 V / −0.5 V for −40°C.
6. Outputs are terminated through a 50 ohm resistor to V_{CC} − 2.0 V.
7. V_{IHCMR} min varies 1:1 with V_{EE}, V_{IHCMR} max varies 1:1 with V_{CC}. The V_{IHCMR} range is referenced to the most positive side of the differential input signal. Normal operation is obtained if the HIGH level falls within the specified range and the peak-to-peak voltage lies between V_{PP}min and 1 V.

Table 6. 100EL SERIES PECL DC CHARACTERISTICS V_{CC} = 5.0 V; V_{EE} = 0 V (Note 8)

		–40°C			25°C			85°C			
Symbol	**Characteristic**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**
I_{EE}	Power Supply Current		21	25		21	25		24	29	mA
V_{OH}	Output HIGH Voltage (Note 9)	3915	3995	4120	3975	4045	4120	3975	4050	4120	mV
V_{OL}	Output LOW Voltage (Note 9)	3170	3305	3445	3190	3295	3380	3190	3295	3380	mV
V_{IH}	Input HIGH Voltage (Single−Ended)	3835		4120	3835		4120	3835		4120	mV
V_{IL}	Input LOW Voltage (Single−Ended)	3190		3525	3190		3525	3190		3525	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 4) D CLK	2.6 2.5		4.6 4.2	2.6 2.5		4.6 4.2	2.6 2.5		4.6 4.2	V
I_{IH}	Input HIGH Current			150			150			150	μA
I_{IL}	Input LOW Current	0.5			0.5			0.5			μA

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

8. Input and output parameters vary 1:1 with V_{CC}. V_{EE} can vary +0.8 V / −0.5 V.
9. Outputs are terminated through a 50 ohm resistor to V_{CC} − 2.0 V.
10. V_{IHCMR} min varies 1:1 with V_{EE}, V_{IHCMR} max varies 1:1 with V_{CC}. The V_{IHCMR} range is referenced to the most positive side of the differential input signal. Normal operation is obtained if the HIGH level falls within the specified range and the peak-to-peak voltage lies between V_{PP}min and 1 V.

Table 7. 100EL SERIES NECL DC CHARACTERISTICS V_{CC} = 0 V; V_{EE} = −5.0 V (Note 11)

		–40°C			25°C			85°C			
Symbol	**Characteristic**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**
I_{EE}	Power Supply Current		21	25		21	25		24	29	mA
V_{OH}	Output HIGH Voltage (Note 12)	–1085	–1005	–880	–1025	–955	–880	–1025	–955	–880	mV
V_{OL}	Output LOW Voltage (Note 12)	–1830	–1695	–1555	–1810	–1705	–1620	–1810	–1705	–1620	mV
V_{IH}	Input HIGH Voltage (Single−Ended)	–1165		–880	–1165		–880	–1165		–880	mV
V_{IL}	Input LOW Voltage (Single−Ended)	–1810		–1475	–1810		–1475	–1810		–1475	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 4) D CLK	–2.4 –2.5		–0.4 –0.8	–2.4 –2.5		–0.4 –0.8	–2.4 –2.5		–0.4 –0.8	V
I_{IH}	Input HIGH Current			150			150			150	μA
I_{IL}	Input LOW Current	0.5			0.5			0.5			μA

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

11. Input and output parameters vary 1:1 with V_{CC}. V_{EE} can vary +0.8 V / −0.5 V.
12. Outputs are terminated through a 50 ohm resistor to V_{CC} − 2.0 V.
13. V_{IHCMR} min varies 1:1 with V_{EE}, V_{IHCMR} max varies 1:1 with V_{CC}. The V_{IHCMR} range is referenced to the most positive side of the differential input signal. Normal operation is obtained if the HIGH level falls within the specified range and the peak-to-peak voltage lies between V_{PP}min and 1 V.

Table 8. AC CHARACTERISTICS V_{CC} = 5.0 V; V_{EE} = 0 V or V_{CC} = 0 V; V_{EE} = −5.0 V (Note 14)

Symbol	Characteristic	−40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
f_{max}	Maximum Toggle Frequency	1.8	2.5		2.2	2.8		2.2	2.8		GHz
t_{PLH} t_{PHL}	Propagation Delay to Output CLK	225	335	515	275	365	465	320	410	510	ps
t_S	Setup Time	125	0		125	0		125	0		ps
t_H	Hold Time	150	50		150	50		150	50		ps
t_{PW}	Minimum Pulse Width	400			400			400			ps
V_{PP}	Input Swing (Note 15)	150		1000	150		1000	150		1000	mV
t_{JITTER}	Cycle−to−Cycle Jitter		TBD			TBD			TBD		ps
t_r t_f	Output Rise/Fall Times Q (20% − 80%)	100	225	350	100	225	350	100	225	350	ps

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

14. 10 Series: V_{EE} can vary +0.25 V / −0.5 V for +25°C and +85°C. or V_{EE} can vary +0.06 V / −0.5 V for −40°C
    100 Series: V_{EE} can vary +0.8 V / −0.5 V.
15. $V_{PP(}$min) is minimum input swing for which AC parameters guaranteed. The device has a DC gain of ≈40.

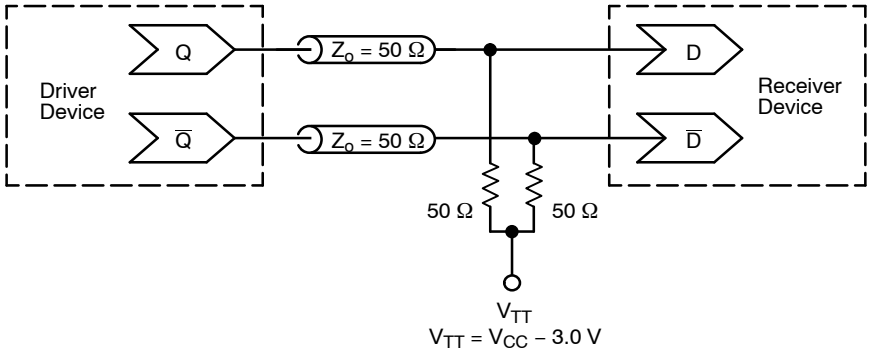


Figure 2. Typical Termination for Output Driver and Device Evaluation (See Application Note AND8020/D − Termination of ECL Logic Devices.)

ORDERING INFORMATION

Device	Package	Shipping†
MC10EL52D	SOIC−8	98 Units / Rail
MC10EL52DG	SOIC−8 (Pb−Free)	98 Units / Rail
MC10EL52DR2	SOIC−8	2500 / Tape & Reel
MC10EL52DR2G	SOIC−8 (Pb−Free)	2500 / Tape & Reel
MC10EL52DT	TSSOP−8	100 Units / Rail
MC10EL52DTG	TSSOP−8 (Pb−Free)	100 Units / Rail
MC10EL52DTR2	TSSOP−8	2500 / Tape & Reel
MC10EL52DTR2G	TSSOP−8 (Pb−Free)	2500 / Tape & Reel
MC10EL52MNR4	DFN8	1000 / Tape & Reel
MC10EL52MNR4G	DFN8 (Pb−Free)	1000 / Tape & Reel
MC100EL52D	SOIC−8	98 Units / Rail
MC100EL52DG	SOIC−8 (Pb−Free)	98 Units / Rail
MC100EL52DR2	SOIC−8	2500 / Tape & Reel
MC100EL52DR2G	SOIC−8 (Pb−Free)	2500 / Tape & Reel
MC100EL52DT	TSSOP−8	100 Units / Rail
MC100EL52DTG	TSSOP−8 (Pb−Free)	100 Units / Rail
MC100EL52DTR2	TSSOP−8	2500 / Tape & Reel
MC100EL52DTR2G	TSSOP−8 (Pb−Free)	2500 / Tape & Reel
MC100EL52MNR4	DFN8	1000 / Tape & Reel
MC100EL52MNR4G	DFN8 (Pb−Free)	1000 / 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.

Resource Reference of Application Notes

AN1405/D – ECL Clock Distribution Techniques

AN1406/D – Designing with PECL (ECL at +5.0 V)

AN1503/D – ECLinPS™ I/O SPiCE Modeling Kit

AN1504/D – Metastability and the ECLinPS Family

AN1568/D – Interfacing Between LVDS and ECL

AN1672/D – The ECL Translator Guide

AND8001/D – Odd Number Counters Design

AND8002/D – Marking and Date Codes

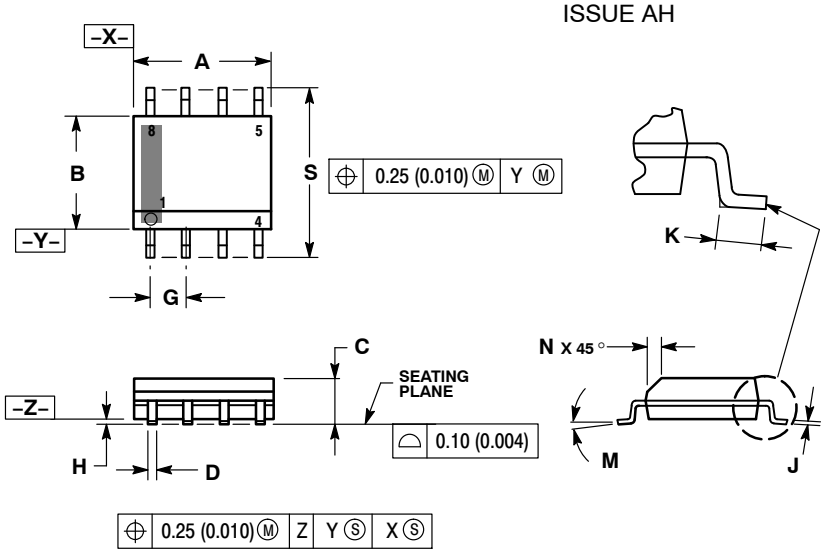
AND8020/D – Termination of ECL Logic Devices

AND8066/D – Interfacing with ECLinPS

AND8090/D – AC Characteristics of ECL Devices

PACKAGE DIMENSIONS

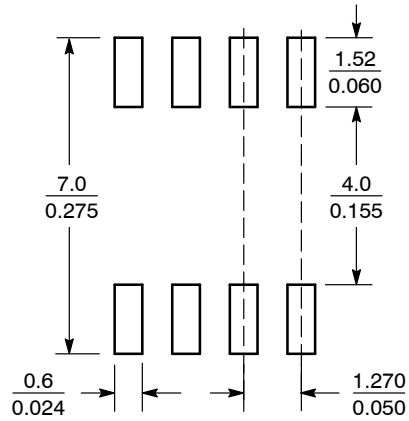
SOIC−8 NB
CASE 751−07
ISSUE AH



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751−01 THRU 751−06 ARE OBSOLETE. NEW STANDARD IS 751−07.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0 °	8 °	0 °	8 °
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

SOLDERING FOOTPRINT*

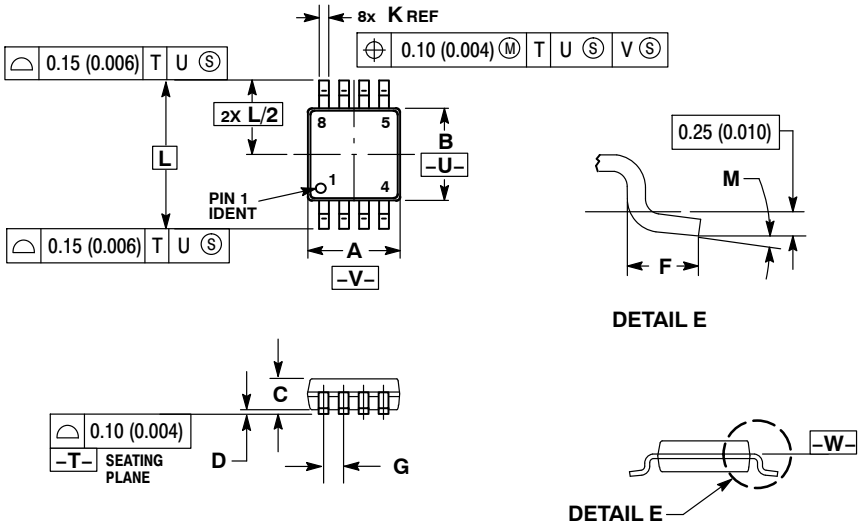


SCALE 6:1 (mm / inches)

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

PACKAGE DIMENSIONS

TSSOP−8
DT SUFFIX
PLASTIC TSSOP PACKAGE
CASE 948R−02
ISSUE A

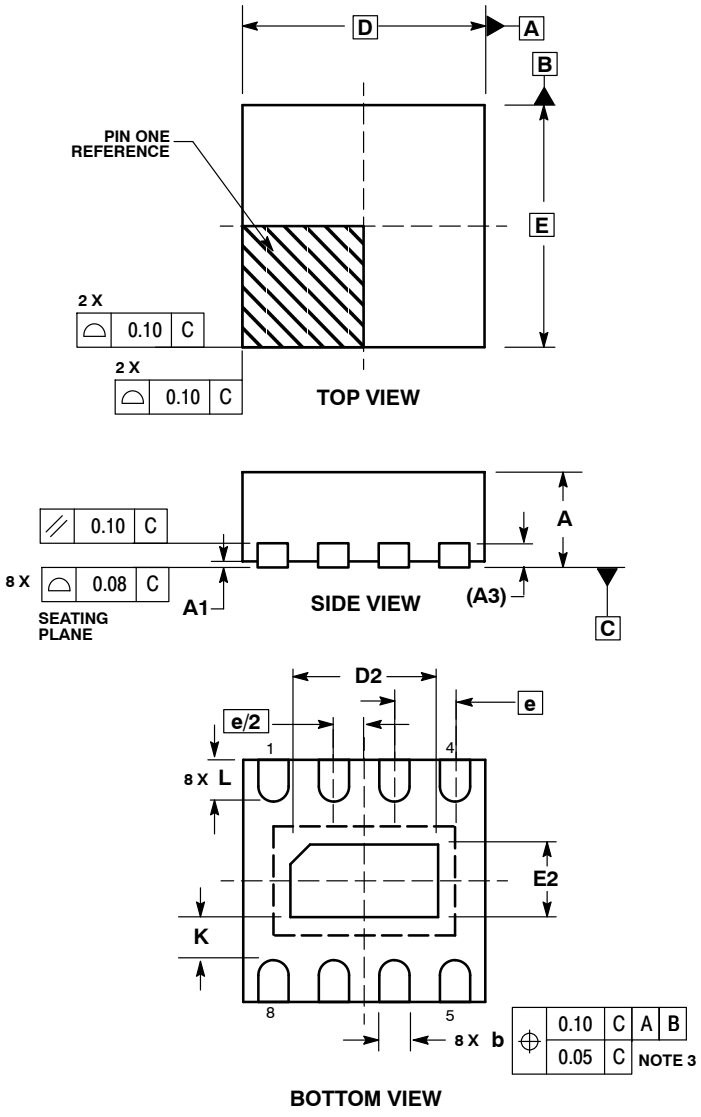


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH. PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD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

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	2.90	3.10	0.114	0.122
B	2.90	3.10	0.114	0.122
C	0.80	1.10	0.031	0.043
D	0.05	0.15	0.002	0.006
F	0.40	0.70	0.016	0.028
G	0.65 BSC		0.026 BSC	
K	0.25	0.40	0.010	0.016
L	4.90 BSC		0.193 BSC	
M	0°	6°	0°	6°

PACKAGE DIMENSIONS

DFN8
CASE 506AA−01
ISSUE D



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994 .
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

	MILLIMETERS	
DIM	MIN	MAX
A	0.80	1.00
A1	0.00	0.05
A3	0.20 REF	
b	0.20	0.30
D	2.00 BSC	
D2	1.10	1.30
E	2.00 BSC	
E2	0.70	0.90
e	0.50 BSC	
K	0.20	−−−
L	0.25	0.35

ECLinPS is a trademark of Semiconductor Components INdustries, LLC (SCILLC).

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
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Phone: 421 33 790 2910
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