

# MC100EP16VC

## 3.3V / 5V ECL Differential Receiver/Driver with High Gain and Enable Output

### Description

The EP16VC is a differential receiver/driver. The device is functionally equivalent to the EP16 and LVEP16 devices but with high gain and enable output.

The EP16VC provides an  $\overline{EN}$  input which is synchronized with the data input (D) signal in a way that provides glitchless gating of the  $Q_{HG}$  and  $\overline{Q}_{HG}$  outputs.

When the  $\overline{EN}$  signal is LOW, the input is passed to the outputs and the data output equals the data input. When the data input is HIGH and  $\overline{EN}$  goes HIGH, it will force the  $Q_{HG}$  LOW and the  $\overline{Q}_{HG}$  HIGH on the next negative transition of the data input. If the data input is LOW when the  $\overline{EN}$  goes HIGH, the next data transition to a HIGH is ignored and  $Q_{HG}$  remains LOW and  $\overline{Q}_{HG}$  remains HIGH. The next positive transition of the data input is not passed on to the data outputs under these conditions. The  $Q_{HG}$  and  $\overline{Q}_{HG}$  outputs remain in their disabled state as long as the  $\overline{EN}$  input is held HIGH. The  $\overline{EN}$  input has no influence on the  $\overline{Q}$  output and the data input is passed on (inverted) to this output whether  $\overline{EN}$  is HIGH or LOW. This configuration is ideal for crystal oscillator applications where the oscillator can be free running and gated on and off synchronously without adding extra counts to the output.

The  $V_{BB}/\overline{D}$  pin is internally dedicated and available for differential interconnect.  $V_{BB}/\overline{D}$  may rebias AC coupled inputs. When used, decouple  $V_{BB}/\overline{D}$  and  $V_{CC}$  via a 0.01  $\mu$ F capacitor and limit current sourcing or sinking to 1.5 mA. When not used,  $V_{BB}/\overline{D}$  should be left open.

The 100 Series contains temperature compensation.

### Features

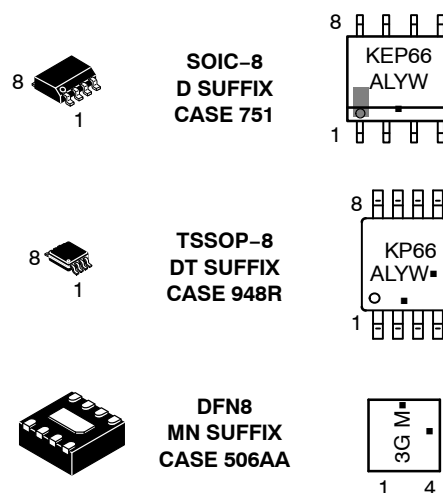
- 310 ps Typical Prop Delay  $\overline{Q}$ ,  
380 ps Typical Prop Delay  $Q_{HG}$ ,  $\overline{Q}_{HG}$
- Gain > 200
- Maximum Frequency > 3 GHz Typical
- PECL Mode Operating Range:  $V_{CC} = 3.0$  V to 5.5 V  
with  $V_{EE} = 0$  V
- NECL Mode Operating Range:  $V_{CC} = 0$  V  
with  $V_{EE} = -3.0$  V to -5.5 V
- Open Input Default State
- $Q_{HG}$  Output Will Default LOW with D Inputs Open or at  $V_{EE}$
- $V_{BB}$  Output
- Pb-Free Packages are Available



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### MARKING DIAGRAMS\*



- A = Assembly Location
- L = Wafer Lot
- Y = Year
- W = Work Week
- M = Date Code
- = Pb-Free Package

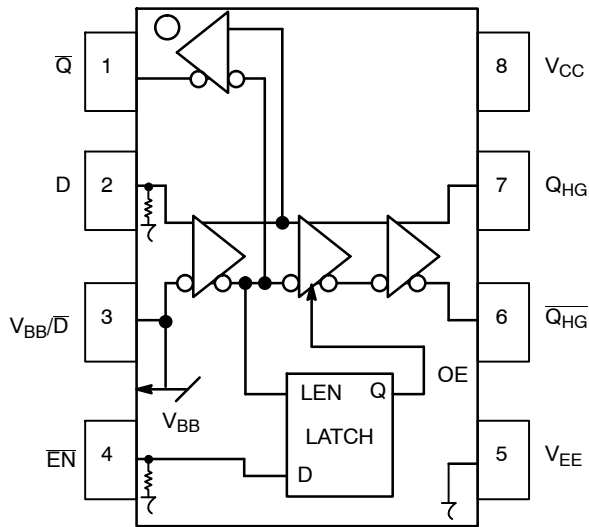
(Note: Microdot may be in either location)

\*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 8 of this data sheet.

# MC100EP16VC



**Figure 1. 8-Lead Pinout (Top View) and Logic Diagram**

**Table 1. PIN DESCRIPTION**

Pin	Function
D*	ECL Data Input
$\bar{Q}$	ECL Data Output
$Q_{HG}, \bar{Q}_{HG}$	ECL High Gain Data Outputs
$\bar{EN}^*$	ECL Enable Input
$V_{BB}/\bar{D}$	Reference Voltage Output / ECL Data Input
$V_{CC}$	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.

\*Pins will default LOW when left open.

**Table 2. ATTRIBUTES**

Characteristics	Value	
Internal Input Pulldown Resistor	75 k $\Omega$	
Internal Input Pullup Resistor	N/A	
ESD Protection	Human Body Model	> 4 kV
	Machine Model	> 200 V
	Charged Device Model	> 2 kV
Moisture Sensitivity, Indefinite Time Out of Drypack (Note 1)	Pb Pkg	Pb-Free Pkg
	SOIC-8	Level 1
	TSSOP-8	Level 1
	DFN8	Level 1
Flammability Rating	Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in
Transistor Count	167 Devices	
Meets or exceeds JEDEC Spec EIA/JESD78 IC Latchup Test		

1. For additional information, see Application Note AND8003/D.

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**Table 3. MAXIMUM RATINGS**

Symbol	Parameter	Condition 1	Condition 2	Rating	Unit
V <sub>CC</sub>	PECL Mode Power Supply	V <sub>EE</sub> = 0 V		6	V
V <sub>EE</sub>	NECL Mode Power Supply	V <sub>CC</sub> = 0 V		-6	V
V <sub>I</sub>	PECL Mode Input Voltage NECL Mode Input Voltage	V <sub>EE</sub> = 0 V V <sub>CC</sub> = 0 V	V <sub>I</sub> ≤ V <sub>CC</sub> V <sub>I</sub> ≥ V <sub>EE</sub>	6 -6	V V
I <sub>out</sub>	Output Current	Continuous Surge		50 100	mA mA
I <sub>BB</sub>	V <sub>BB</sub> Sink/Source			± 1.5	mA
T <sub>A</sub>	Operating Temperature Range			-40 to +85	°C
T <sub>stg</sub>	Storage Temperature Range			-65 to +150	°C
θ <sub>JA</sub>	Thermal Resistance (Junction-to-Ambient)	0 lfpm 500 lfpm	8 SOIC 8 SOIC	190 130	°C/W °C/W
θ <sub>JC</sub>	Thermal Resistance (Junction-to-Case)	Standard Board	8 SOIC	41 to 44	°C/W
θ <sub>JA</sub>	Thermal Resistance (Junction-to-Ambient)	0 lfpm 500 lfpm	8 TSSOP 8 TSSOP	185 140	°C/W °C/W
θ <sub>JC</sub>	Thermal Resistance (Junction-to-Case)	Standard Board	8 TSSOP	41 to 44	°C/W
θ <sub>JA</sub>	Thermal Resistance (Junction-to-Ambient)	0 lfpm 500 lfpm	DFN8 DFN8	129 84	°C/W °C/W
T <sub>sol</sub>	Wave Solder Pb Pb-Free			265 265	°C
θ <sub>JC</sub>	Thermal Resistance (Junction-to-Case)	(Note 2)	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.

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

**Table 4. 100EP DC CHARACTERISTICS, PECL V<sub>CC</sub> = 3.3 V, V<sub>EE</sub> = 0 V (Note 3)**

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I <sub>EE</sub>	Power Supply Current	27	37	47	32	42	52	34	44	54	mA
V <sub>OH</sub>	Output HIGH Voltage (Note 4)	2155	2280	2405	2155	2280	2405	2155	2280	2405	mV
V <sub>OL</sub>	Output LOW Voltage (Note 4)	1305	1400	1555	1305	1400	1555	1305	1400	1555	mV
V <sub>IH</sub>	Input HIGH Voltage (Single-Ended)	2075		2420	2075		2420	2075		2420	mV
V <sub>IL</sub>	Input LOW Voltage (Single-Ended)	1355		1675	1355		1675	1355		1675	mV
V <sub>BB</sub>	Output Voltage Reference	1775	1890	2045	1775	1890	2045	1775	1890	2045	mV
V <sub>IHCMR</sub>	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 5)	2.0		3.3	2.0		3.3	2.0		3.3	V
I <sub>IH</sub>	Input HIGH Current			150			150			150	μA
I <sub>IL</sub>	Input LOW Current	D 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.

3. Input and output parameters vary 1:1 with V<sub>CC</sub>. V<sub>EE</sub> can vary +0.3 V to -2.2 V.

4. All loading with 50 Ω to V<sub>CC</sub> - 2.0 V.

5. V<sub>IHCMR</sub> min varies 1:1 with V<sub>EE</sub>, V<sub>IHCMR</sub> max varies 1:1 with V<sub>CC</sub>. The V<sub>IHCMR</sub> range is referenced to the most positive side of the differential input signal.

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**Table 5. 100EP DC CHARACTERISTICS, PECL**  $V_{CC} = 5.0\text{ V}$ ,  $V_{EE} = 0\text{ V}$  (Note 6)

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$I_{EE}$	Power Supply Current	27	37	47	32	42	52	34	44	54	mA
$V_{OH}$	Output HIGH Voltage (Note 7)	3855	3980	4105	3855	3980	4105	3855	3980	4105	mV
$V_{OL}$	Output LOW Voltage (Note 7)	3005	3100	3255	3005	3100	3255	3005	3100	3255	mV
$V_{IH}$	Input HIGH Voltage (Single-Ended)	3775		4120	3775		4120	3775		4120	mV
$V_{IL}$	Input LOW Voltage (Single-Ended)	3055		3375	3055		3375	3055		3375	mV
$V_{BB}$	Output Voltage Reference	3475	3490	3705	3475	3490	3705	3475	3490	3705	mV
$V_{IHCMR}$	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 8)	2.0		5.0	2.0		5.0	2.0		5.0	V
$I_{IH}$	Input HIGH Current			150			150			150	$\mu\text{A}$
$I_{IL}$	Input LOW Current	D	0.5		0.5			0.5			$\mu\text{A}$

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 lfm. 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.

6. Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +2.0 V to -0.5 V.

7. All loading with 50  $\Omega$  to  $V_{CC} - 2.0\text{ V}$ .

8.  $V_{IHCMR}$  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.

**Table 6. 100EP DC CHARACTERISTICS, NECL**  $V_{CC} = 0\text{ V}$ ;  $V_{EE} = -5.5\text{ V}$  to  $-3.0\text{ V}$  (Note 9)

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$I_{EE}$	Power Supply Current	27	37	47	32	42	52	34	44	54	mA
$V_{OH}$	Output HIGH Voltage (Note 10)	-1145	-1020	-895	-1145	-1020	-895	-1145	-1020	-895	mV
$V_{OL}$	Output LOW Voltage (Note 10)	-1995	-1900	-1745	-1995	-1900	-1745	-1995	-1900	-1745	mV
$V_{IH}$	Input HIGH Voltage (Single-Ended)	-1225		-880	-1225		-880	-1225		-880	mV
$V_{IL}$	Input LOW Voltage (Single-Ended)	-1945		-1625	-1945		-1625	-1945		-1625	mV
$V_{BB}$	Output Voltage Reference	-1525	-1425	-1325	-1525	-1425	-1325	-1525	-1425	-1325	mV
$V_{IHCMR}$	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 11)	$V_{EE} + 2.0$		0.0	$V_{EE} + 2.0$		0.0	$V_{EE} + 2.0$		0.0	V
$I_{IH}$	Input HIGH Current			150			150			150	$\mu\text{A}$
$I_{IL}$	Input LOW Current	0.5			0.5			0.5			$\mu\text{A}$

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 lfm. 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.

9. Input and output parameters vary 1:1 with  $V_{CC}$ .

10. All loading with 50  $\Omega$  to  $V_{CC} - 2.0\text{ V}$ .

11.  $V_{IHCMR}$  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.

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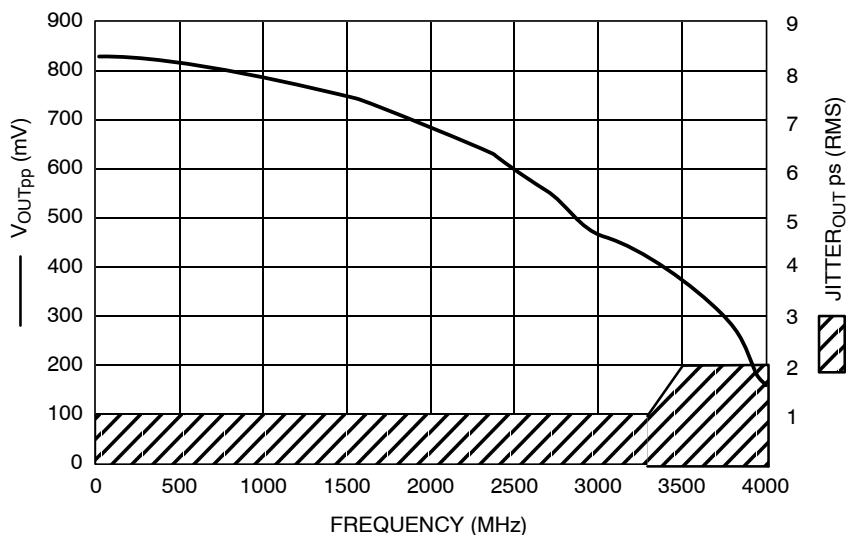
**Table 7. AC CHARACTERISTICS**  $V_{CC} = 0\text{ V}$ ;  $V_{EE} = -3.0\text{ V}$  to  $-5.5\text{ V}$  or  $V_{CC} = 3.0\text{ V}$  to  $5.5\text{ V}$ ;  $V_{EE} = 0\text{ V}$  (Note 12)

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$f_{max}$	Maximum Frequency (Figure 2)		> 3			> 3			> 3		GHz
$t_{PLH}$ , $t_{PHL}$	Propagation Delay (Differential) $\overline{Q}$ (Differential) QHG, $\overline{QHG}$ (Single-Ended) $\overline{Q}$ (Single-Ended) QHG, $\overline{QHG}$	200 250 250 300	280 360 330 410	350 450 400 500	250 300 300 350	310 380 360 430	400 500 450 550	275 325 325 375	340 430 390 480	425 525 475 575	ps
$t_S$	Setup Time $\overline{EN} = L$ to D $\overline{EN} = H$ to D	50 100	15 60		50 100	5 40		50 100	18 10		ps
$t_H$	Hold Time $\overline{EN} = L$ to D $\overline{EN} = H$ to D	100 50	50 15		100 50	40 20		100 50	5 20		ps
$t_{SKEW}$	Duty Cycle Skew (Note 13)		5.0	20		5.0	20		5.0	20	ps
$t_{JITTER}$	RMS Random Clock Jitter (Figure 2)		0.2	< 1		0.2	< 1		0.2	< 1	ps
$V_{PP}$	Input Voltage Swing (Differential Configuration)	HG $\overline{Q}$ 25 150	800 800	1200 1200	25 150	800 800	1200 1200	25 150	800 800	1200 1200	mV
$t_r$ , $t_f$	Output Rise/Fall Times (20% – 80%) $\overline{Q}$ QHG, $\overline{QHG}$	200 70	300 130	400 220	250 80	350 150	450 240	250 100	350 170	500 270	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 lpm. 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.

12. Measured using a 750 mV source, 50% duty cycle clock source. All loading with  $50\ \Omega$  to  $V_{CC} - 2.0\text{ V}$ .

13. Skew is measured between outputs under identical transitions. Duty cycle skew is defined only for differential operation when the delays are measured from the cross point of the inputs to the cross point of the outputs.



**Figure 2.  $F_{max}$ /Jitter for QHG,  $\overline{QHG}$  Output**

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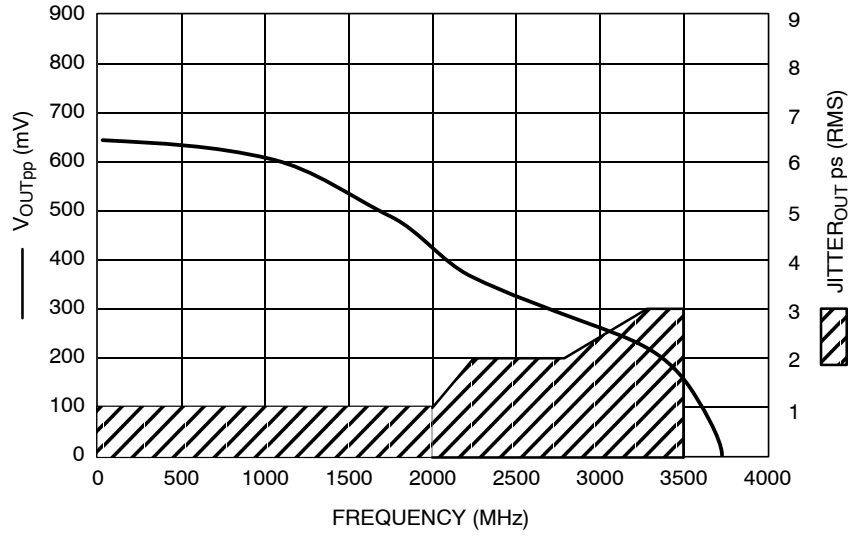


Figure 3.  $F_{max}$ /Jitter for  $\bar{Q}$  Output

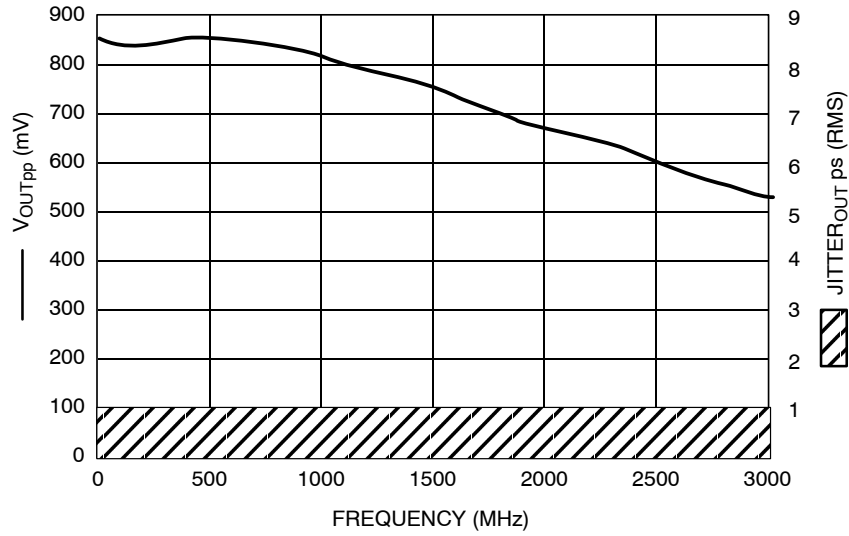


Figure 4.  $F_{max}$ /Jitter for QHG,  $\bar{QHG}$  Output

# MC100EP16VC

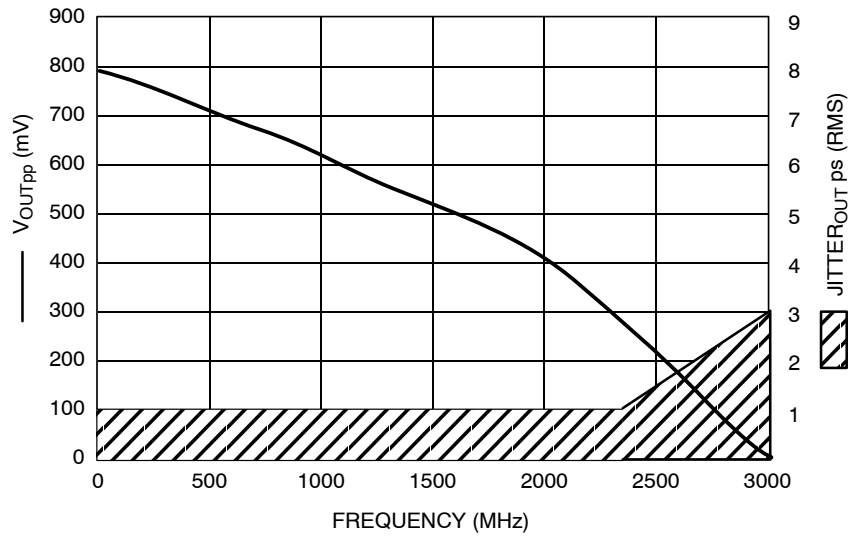


Figure 5. F<sub>max</sub>/Jitter for  $\bar{Q}$  Output

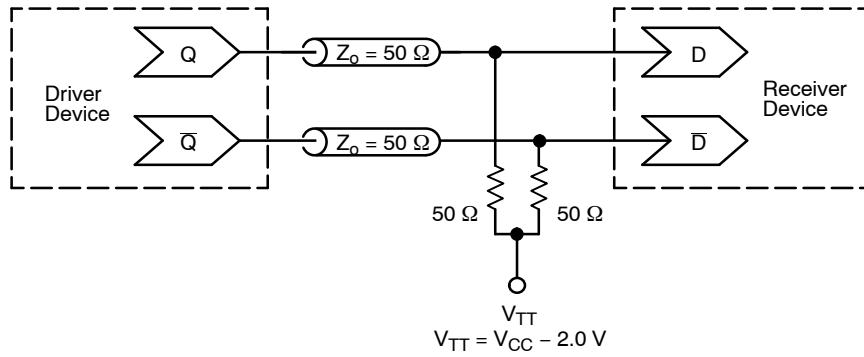


Figure 6. Typical Termination for Output Driver and Device Evaluation  
(See Application Note AND8020/D – Termination of ECL Logic Devices.)

# MC100EP16VC

## ORDERING INFORMATION

Device	Package	Shipping†
MC100EP16VCD	SOIC-8	98 Units / Rail
MC100EP16VCDG	SOIC-8 (Pb-Free)	98 Units / Rail
MC100EP16VCDR2	SOIC-8	2500 / Tape & Reel
MC100EP16VCDR2G	SOIC-8 (Pb-Free)	2500 / Tape & Reel
MC100EP16VCDT	TSSOP-8	100 Units / Rail
MC100EP16VCDTG	TSSOP-8 (Pb-Free)	100 Units / Rail
MC100EP16VCDTR2	TSSOP-8	2500 / Rail
MC100EP16VCDTR2G	TSSOP-8 (Pb-Free)	2500 / Rail
MC100EP16VCMNR4	DFN8	1000 / Tape & Reel
MC100EP16VCMNR4G	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

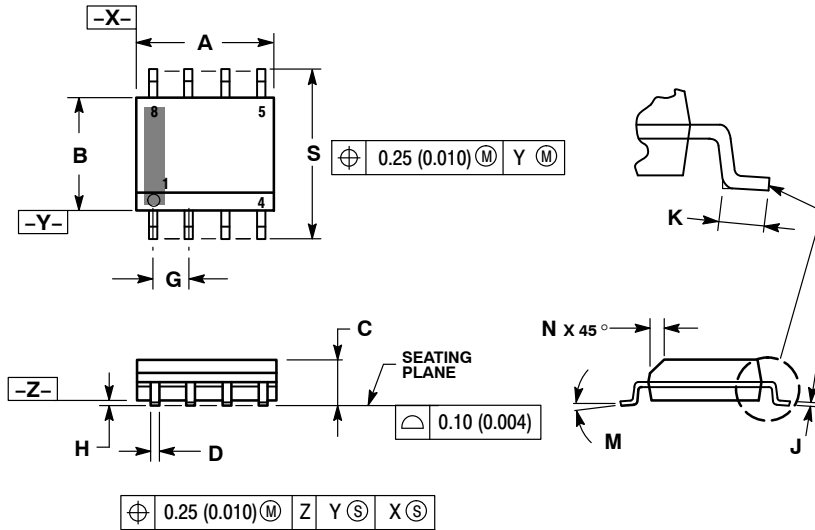
- AN1405/D** - ECL Clock Distribution Techniques
- AN1406/D** - Designing with PECL (ECL at +5.0 V)
- AN1503/D** - ECLinPS™ I/O SPICE Modeling Kit
- AN1504/D** - Metastability and the ECLinPS Family
- AN1568/D** - Interfacing Between LVDS and ECL
- AN1672/D** - The ECL Translator Guide
- AND8001/D** - 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



# MC100EP16VC

## PACKAGE DIMENSIONS

SOIC-8 NB  
CASE 751-07  
ISSUE AJ

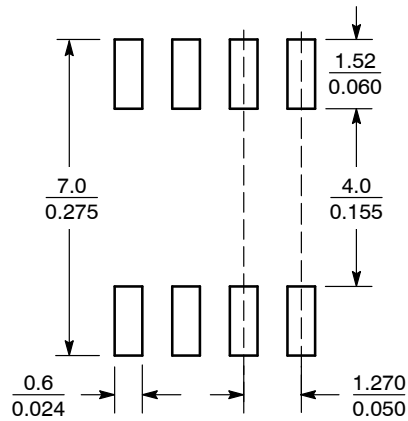


**NOTES:**

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.

DIM	MILLIMETERS		INCHES	
	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\*



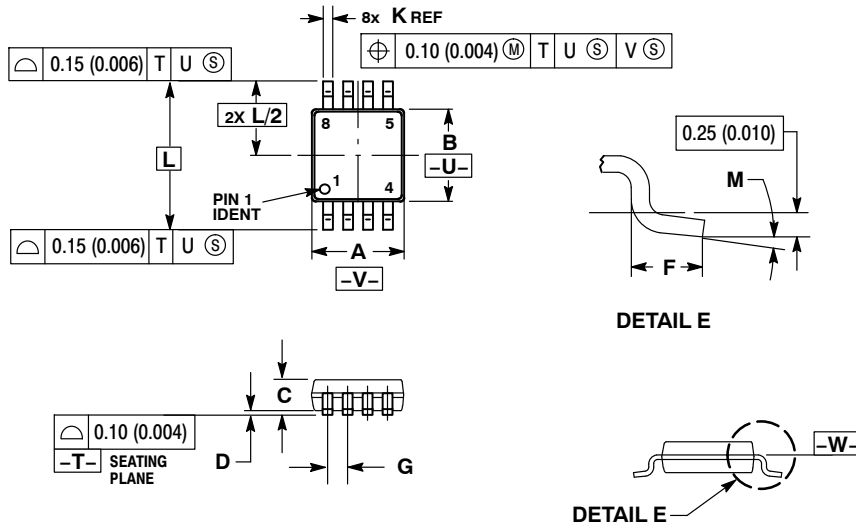
SCALE 6:1 ( $\frac{\text{mm}}{\text{inches}}$ )

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

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## PACKAGE DIMENSIONS

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



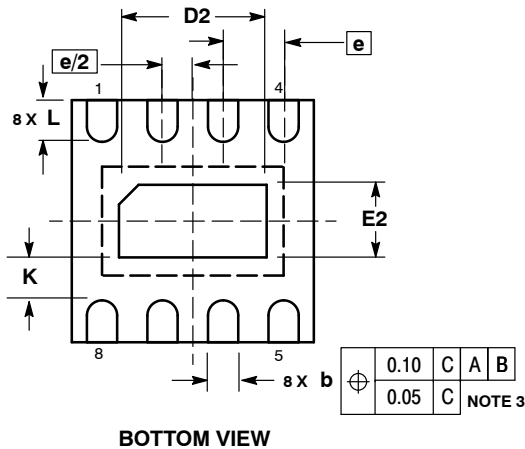
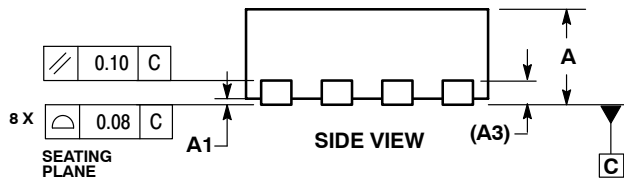
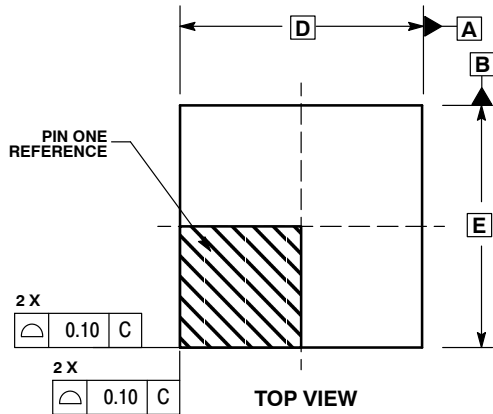
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSION A DOES NOT INCLUDE MOLD FLASH. PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION 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-.

DIM	MILLIMETERS		INCHES	
	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°

# MC100EP16VC

## 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

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