

54F/74F240•54F/74F241•54F/74F244 Octal Buffers/Line Drivers with TRI-STATE® Outputs

General Description

The 'F240, 'F241 and 'F244 are octal buffers and line drivers designed to be employed as memory and address drivers, clock drivers and bus-oriented transmitters/receivers which provide improved PC and board density.

Features

- TRI-STATE outputs drive bus lines or buffer memory address registers
- Outputs sink 64 mA (48 mA mil)
- 12 mA source current
- Input clamp diodes limit high-speed termination effects
- Guaranteed 4000V minimum ESD protection

| Commercial | Military | Package Number | Package Description |
|--------------------|-------------------|----------------|---|
| 74F240PC | | N20A | 20-Lead (0.300" Wide) Molded Dual-In-Line |
| | 54F240DM (Note 2) | J20A | 20-Lead Ceramic Dual-In-Line |
| 74F240SC (Note 1) | | M20B | 20-Lead (0.300" Wide) Molded Small Outline, JEDEC |
| 74F240SJ (Note 1) | | M20D | 20-Lead (0.300" Wide) Molded Small Outline, EIAJ |
| | 54F240FM (Note 2) | W20A | 20-Lead Cerpack |
| | 54F240LM (Note 2) | E20A | 20-Lead Ceramic Leadless Chip Carrier, Type C |
| 74F241PC | | N20A | 20-Lead (0.300" Wide) Molded Dual-In-Line |
| | 54F241DM (Note 2) | J20A | 20-Lead Ceramic Dual-In-Line |
| 74F241SC (Note 1) | | M20B | 20-Lead (0.300" Wide) Molded Small Outline, JEDEC |
| 74F241SJ (Note 1) | | M20D | 20-Lead (0.300" Wide) Molded Small Outline, EIAJ |
| | 54F241FM (Note 2) | W20A | 20-Lead Cerpack |
| | 54F241LM (Note 2) | E20A | 20-Lead Ceramic Leadless Chip Carrier, Type C |
| 74F244PC | | N20A | 20-Lead (0.300" Wide) Molded Dual-In-Line |
| | 54F244DM (Note 2) | J20A | 20-Lead Ceramic Dual-In-Line |
| 74F244SC (Note 1) | | M20B | 20-Lead (0.300" Wide) Molded Small Outline, JEDEC |
| 74F244SJ (Note 1) | | M20D | 20-Lead (0.300" Wide) Molded Small Outline, EIAJ |
| 74F244MSA (Note 1) | | MSA20 | 20-Lead Molded Shrink Small Outline, EIAJ Type II |
| | 54F244FM (Note 2) | W20A | 20-Lead Cerpack |
| | 54F244LM (Note 2) | E20A | 20-Lead Ceramic Leadless Chip Carrier, Type C |

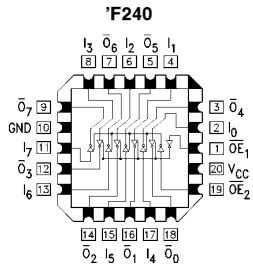
Note 1: Devices also available in 13" reel. Use Suffix = SCX, SJX and MSAX.

Note 2: Military grade device with environmental and burn-in processing. Use suffix = DMQB, FMQB and LMQB.

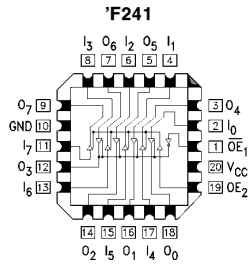
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Connection Diagrams

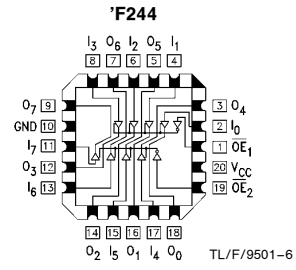
Pin Assignment for LCC



TL/F/9501-2

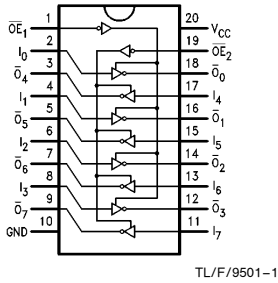


TL/F/9501-4

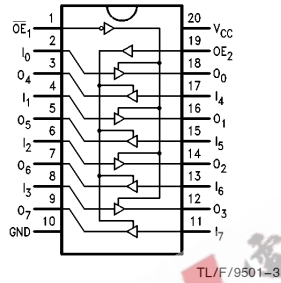


TL/F/9501-6

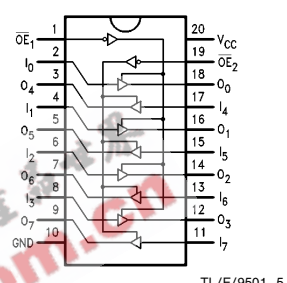
Pin Assignment for DIP, SOIC, SSOP and Flatpak



TL/F/9501-1



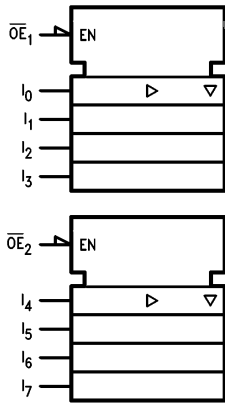
TL/F/9501-3



TL/F/9501-5

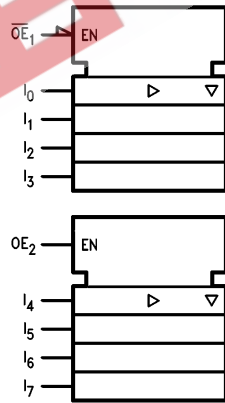
Logic Symbols

IEEE/IEC
'F240



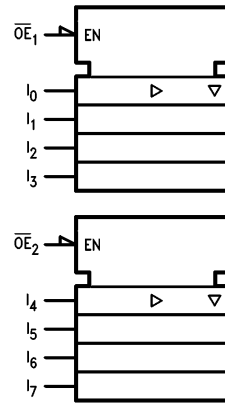
TL/F/9501-7

IEEE/IEC
'F241



TL/F/9501-8

IEEE/IEC
'F244



TL/F/9501-9

Unit Loading/Fan Out

| Pin Names | Description | 54F/74F | |
|--|---|------------------|---|
| | | U.L. HIGH/LOW | Input I_{IH}/I_{IL} Output I_{OH}/I_{OL} |
| $\overline{OE}_1, \overline{OE}_2$ | TRI-STATE Output Enable Input (Active LOW) | 1.0/1.667 | 20 μA / -1 mA |
| OE_2 | TRI-STATE Output Enable Input (Active HIGH) | 1.0/1.667 | 20 μA / -1 mA |
| I_0-I_7 | Inputs ('F240) | 1.0/1.667* | 20 μA / -1 mA |
| I_0-I_7 | Inputs ('F241, 'F244) | 1.0/2.667* | 20 μA / -1.6 mA |
| $\overline{O}_0-\overline{O}_7, O_0-O_7$ | Outputs | 600/106.6 (80) | -12 mA/64 mA (48 mA) |

*Worst-case 'F240 enabled; 'F241, 'F244 disabled

Truth Tables

'F240

| \overline{OE}_1 | D_{1n} | O_{1n} | \overline{OE}_2 | D_{2n} | O_{2n} |
|-------------------|----------|----------|-------------------|----------|----------|
| H | X | Z | H | X | Z |
| L | H | L | L | H | L |
| L | L | H | L | L | H |

'F244

| \overline{OE}_1 | D_{1n} | O_{1n} | \overline{OE}_2 | D_{2n} | O_{2n} |
|-------------------|----------|----------|-------------------|----------|----------|
| H | X | Z | H | X | Z |
| L | H | H | L | H | H |
| L | L | L | L | L | L |

'F241

| \overline{OE}_1 | D_{1n} | O_{1n} | OE_2 | D_{2n} | O_{2n} |
|-------------------|----------|----------|--------|----------|----------|
| H | X | Z | L | X | Z |
| L | H | H | H | H | H |
| L | L | L | H | L | L |

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial
Z = High Impedance

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Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

| | |
|---|--------------------------------------|
| Storage Temperature | -65°C to +150°C |
| Ambient Temperature under Bias | -55°C to +125°C |
| Junction Temperature under Bias | -55°C to +175°C |
| Plastic | -55°C to +150°C |
| V _{CC} Pin Potential to Ground Pin | -0.5V to +7.0V |
| Input Voltage (Note 2) | -0.5V to +7.0V |
| Input Current (Note 2) | -30 mA to +5.0 mA |
| Voltage Applied to Output in HIGH State (with V _{CC} = 0V) | |
| Standard Output | -0.5V to V _{CC} |
| TRI-STATE Output | -0.5V to +5.5V |
| Current Applied to Output in LOW State (Max) | twice the rated I _{OL} (mA) |
| ESD Last Passing Voltage (Min) | 4000V |

Note 1: Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

Note 2: Either voltage limit or current limit is sufficient to protect inputs.

Recommended Operating Conditions

| | |
|------------------------------|-----------------|
| Free Air Ambient Temperature | |
| Military | -55°C to +125°C |
| Commercial | 0°C to +70°C |
| Supply Voltage | |
| Military | +4.5V to +5.5V |
| Commercial | +4.5V to +5.5V |

DC Electrical Characteristics

| Symbol | Parameter | 54F/74F | | | Units | V _{CC} | Conditions |
|------------------|-----------------------------------|-------------------------|------|--------------|-------|-----------------|---|
| | | Min | Typ | Max | | | |
| V _{IH} | Input HIGH Voltage | 2.0 | | | V | | Recognized as a HIGH Signal |
| V _{IL} | Input LOW Voltage | | | | 0.8 | V | Recognized as a LOW Signal |
| V _{CD} | Input Clamp Diode Voltage | | | | -1.2 | V | Min I _{IN} = -18 mA |
| V _{OH} | Output HIGH Voltage | 54F 10% V _{CC} | 2.4 | | V | Min | I _{OH} = -3 mA |
| | | 54F 10% V _{CC} | 2.0 | | | | I _{OH} = -12 mA |
| | | 74F 10% V _{CC} | 2.4 | | | | I _{OH} = -3 mA |
| | | 74F 10% V _{CC} | 2.0 | | | | I _{OH} = -15 mA |
| | | 74F 5% V _{CC} | 2.7 | | | | I _{OH} = -3 mA |
| V _{OL} | Output LOW Voltage | 54F 10% V _{CC} | | 0.55 | V | Min | I _{OL} = 48 mA |
| | | 74F 10% V _{CC} | | 0.55 | | | I _{OL} = 64 mA |
| I _{IH} | Input HIGH Current | 54F | | 20.0 | μA | Max | V _{IN} = 2.7V |
| | | 74F | | 5.0 | | | |
| I _{BVI} | Input HIGH Current Breakdown Test | 54F | | 100 | μA | Max | V _{IN} = 7.0V |
| | | 74F | | 7.0 | | | |
| I _{CEx} | Output HIGH Leakage Current | 54F | | 250 | μA | Max | V _{OUT} = V _{CC} |
| 74F | | 50 | | | | | |
| V _{ID} | Input Leakage Test | 74F | 4.75 | | V | 0.0 | I _{ID} = 1.9 μA All Other Pins Grounded |
| I _{OD} | Output Leakage Circuit Current | 74F | | 3.75 | μA | 0.0 | V _{IOD} = 150 mV All Other Pins Grounded |
| I _{IL} | Input LOW Current | | | -1.0 -1.6 | mA | Max | V _{IN} = 0.5V ($\overline{OE}_1, \overline{OE}_2, OE_2, D_n$ ('F240)) V _{IN} = 0.5V (D _n ('F241, 'F244)) |
| I _{OZH} | Output Leakage Current | | | 50 | μA | Max | V _{OUT} = 2.7V |
| I _{OZL} | Output Leakage Current | | | -50 | μA | Max | V _{OUT} = 0.5V |
| I _{OS} | Output Short-Circuit Current | | | -100 -225 | mA | Max | V _{OUT} = 0V |
| I _{ZZ} | Bus Drainage Test | | | 500 | μA | 0.0V | V _{OUT} = 5.25V |

| DC Electrical Characteristics (Continued) | | | | | | | |
|--|-------------------------------------|---------|-----|-----|-------|-----------------|-------------------------|
| Symbol | Parameter | 54F/74F | | | Units | V _{CC} | Conditions |
| | | Min | Typ | Max | | | |
| I _{CCH} | Power Supply Current ('F240) | | 19 | 29 | mA | Max | V _O = HIGH |
| I _{CCL} | Power Supply Current ('F240) | | 50 | 75 | mA | Max | V _O = LOW |
| I _{CCZ} | Power Supply Current ('F240) | | 42 | 63 | mA | Max | V _O = HIGH Z |
| I _{CCH} | Power Supply Current ('F241, 'F244) | | 40 | 60 | mA | Max | V _O = HIGH |
| I _{CCL} | Power Supply Current ('F241, 'F244) | | 60 | 90 | mA | Max | V _O = LOW |
| I _{CCZ} | Power Supply Current ('F241, 'F244) | | 60 | 90 | mA | Max | V _O = HIGH Z |

| AC Electrical Characteristics | | | | | | | | | |
|--------------------------------------|------------------------------------|---|-----|-----|--|------|--|------|-------|
| Symbol | Parameter | 74F | | | 54F | | 74F | | Units |
| | | T _A = +25°C V _{CC} = +5.0V C _L = 50 pF | | | T _A , V _{CC} = Mil C _L = 50 pF | | T _A , V _{CC} = Com C _L = 50 pF | | |
| | | Min | Typ | Max | Min | Max | Min | Max | |
| t _{PLH} | Propagation Delay | 3.0 | 5.1 | 7.0 | 3.0 | 9.0 | 3.0 | 8.0 | ns |
| t _{PHL} | Data to Output ('F240) | 2.0 | 3.5 | 4.7 | 2.0 | 6.0 | 2.0 | 5.7 | |
| t _{PZH} | Output Enable Time ('F240) | 2.0 | 3.5 | 4.7 | 2.0 | 6.5 | 2.0 | 5.7 | ns |
| t _{PZL} | Output Disable Time ('F240) | 4.0 | 6.9 | 9.0 | 4.0 | 10.5 | 4.0 | 10.0 | |
| t _{PHZ} | Output Disable Time ('F240) | 2.0 | 4.0 | 5.3 | 2.0 | 6.5 | 2.0 | 6.3 | ns |
| t _{PLZ} | Output Disable Time ('F240) | 2.0 | 6.0 | 8.0 | 2.0 | 12.5 | 2.0 | 9.5 | |
| t _{PLH} | Propagation Delay | 2.5 | 4.0 | 5.2 | 2.0 | 6.5 | 2.5 | 6.2 | ns |
| t _{PHL} | Data to Output ('F241, 'F244) | 2.5 | 4.0 | 5.2 | 2.0 | 7.0 | 2.5 | 6.5 | |
| t _{PZH} | Output Enable Time ('F241, 'F244) | 2.0 | 4.3 | 5.7 | 2.0 | 7.0 | 2.0 | 6.7 | ns |
| t _{PZL} | Output Disable Time ('F241, 'F244) | 2.0 | 5.4 | 7.0 | 2.0 | 8.5 | 2.0 | 8.0 | |
| t _{PHZ} | Output Disable Time ('F241, 'F244) | 2.0 | 4.5 | 6.0 | 2.0 | 7.0 | 2.0 | 7.0 | ns |
| t _{PLZ} | Output Disable Time ('F241, 'F244) | 2.0 | 4.5 | 6.0 | 2.0 | 7.5 | 2.0 | 7.0 | |

Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:

74F 240/241/244* S C X

Temperature Range Family
74F = Commercial
54F = Military

Device Type

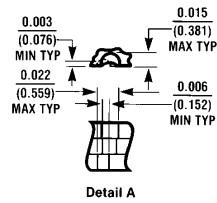
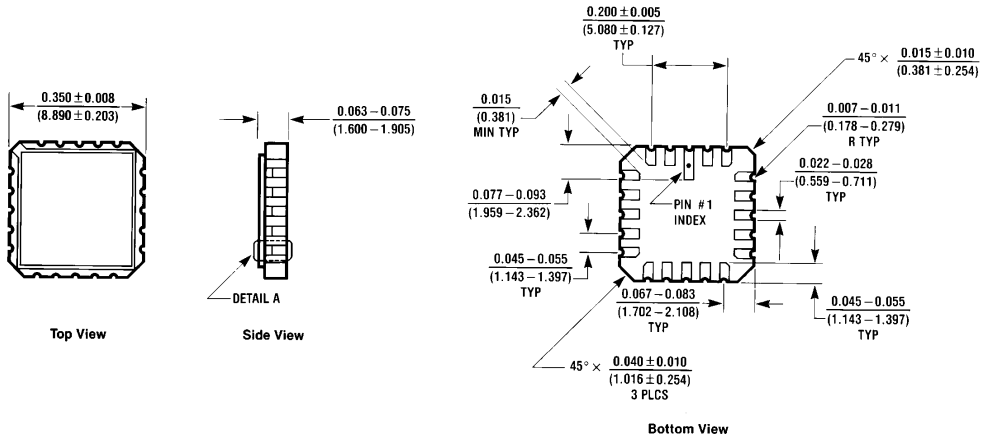
Package Code
P = Plastic DIP
D = Ceramic DIP
F = Flatpak
L = Leadless Chip Carrier (LCC)
S = Small Outline SOIC JEDEC
*MSA = Shrink Small Outline Package (EIAJ SSOP) ('244 only)
SJ = Small Outline SOIC EIAJ

Special Variations
QB = Military grade device with environmental and burn-in processing
X = devices shipped in 13" reel

Temperature Range
C = Commercial (0°C to +70°C)
M = Military (-55°C to +125°C)
NOTE:
Not required for MSA package code

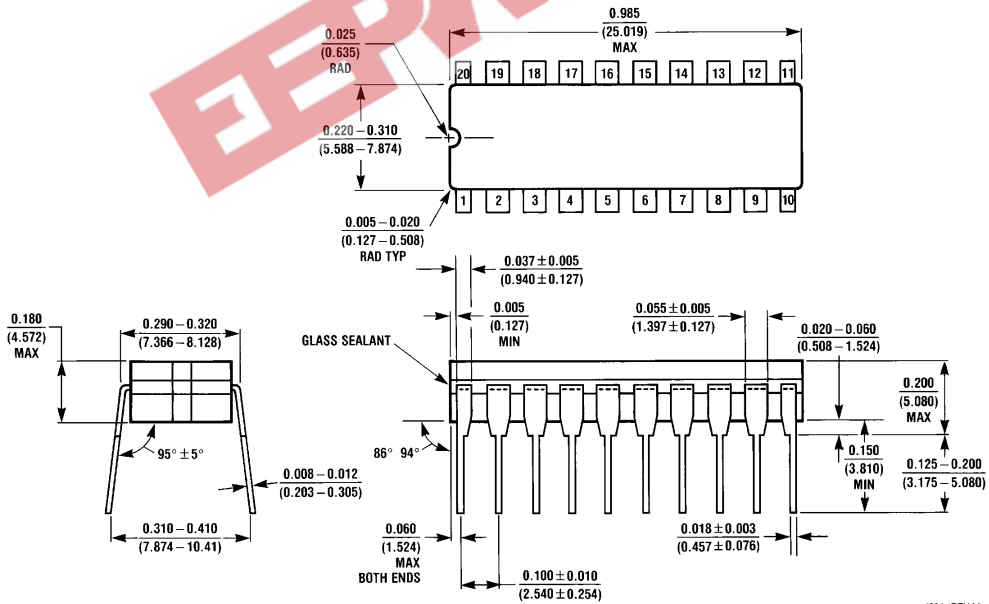
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Physical Dimensions inches (millimeters)



20-Lead Ceramic Leadless Chip Carrier (L)
 NS Package Number E20A

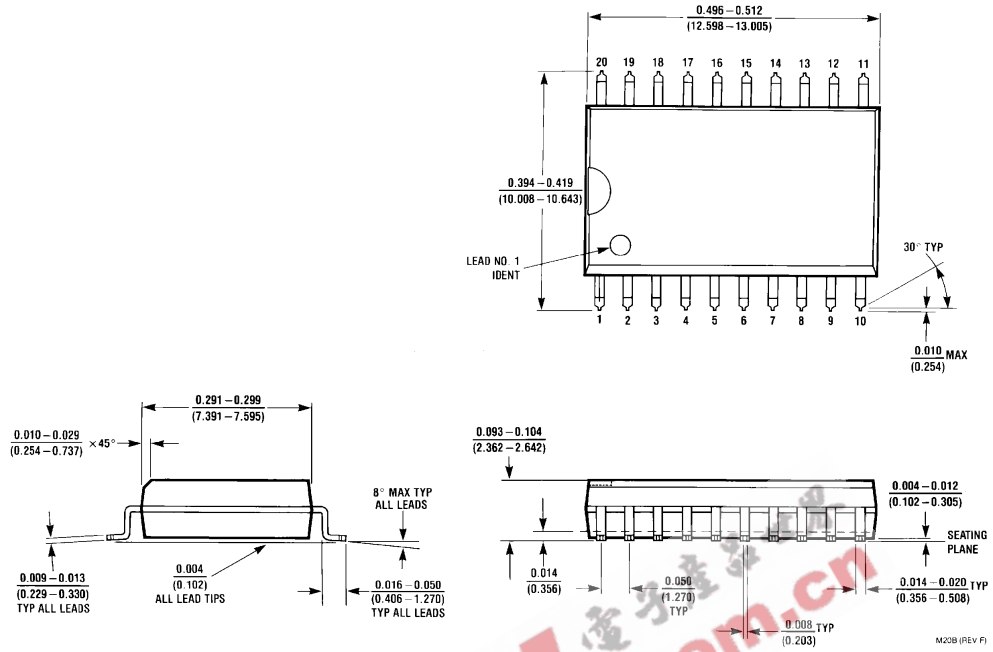
E20A (REV D)



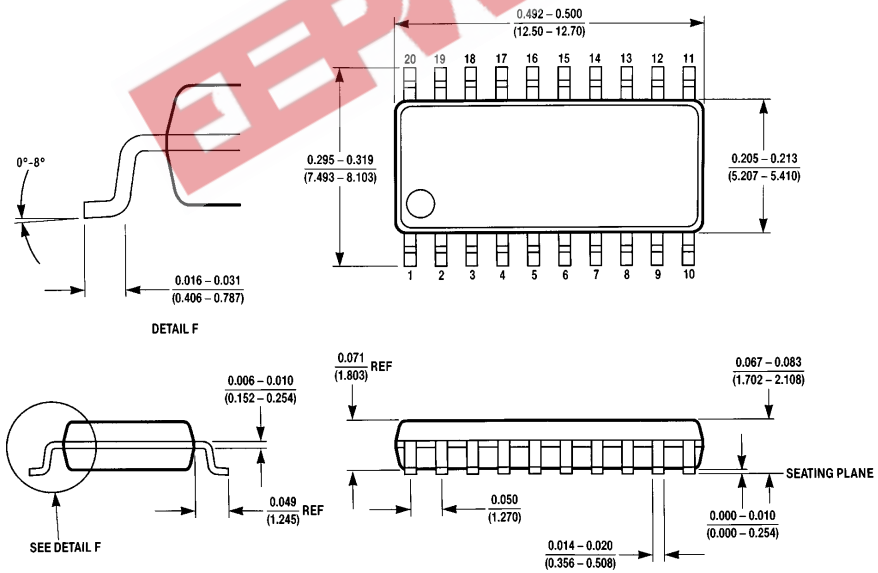
20-Lead Ceramic Dual-In-Line Package (D)
 NS Package Number J20A

J20A (REV M)

Physical Dimensions inches (millimeters) (Continued)

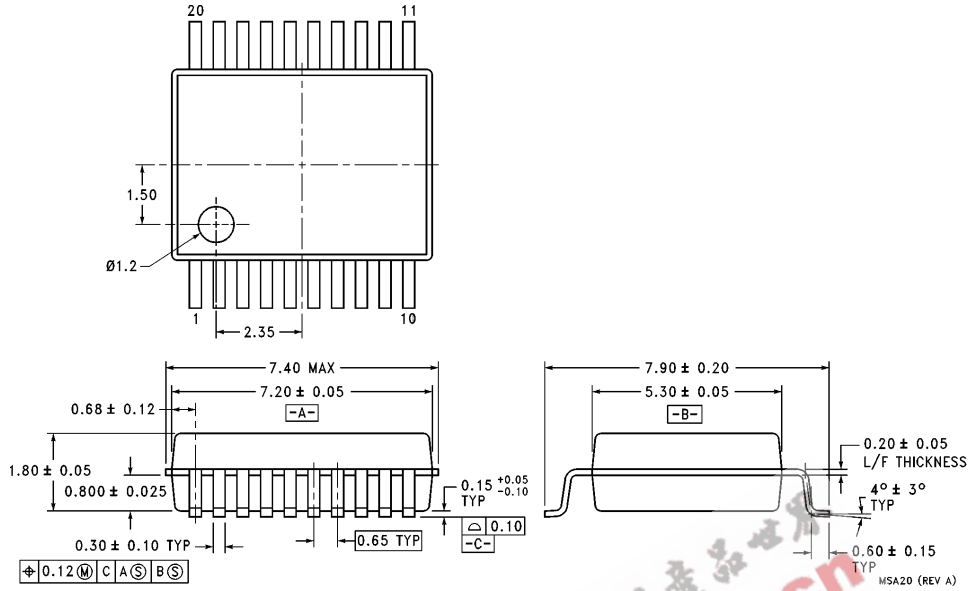


**20-Lead (0.300" Wide) Molded Small Outline Package, JEDEC (S)
 NS Package Number M20B**

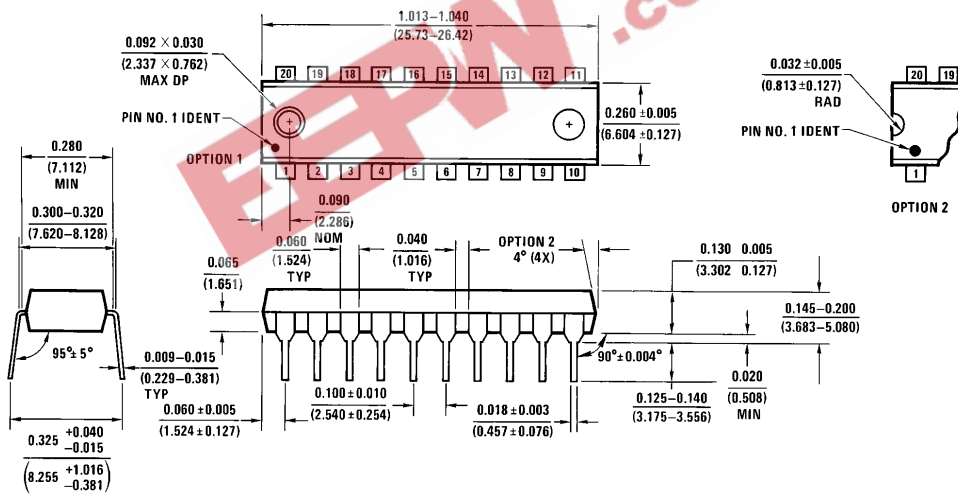


**20-Lead (0.300" Wide) Molded Small Outline Package, EIAJ (SJ)
 NS Package Number M20D**

Physical Dimensions inches (millimeters) (Continued)

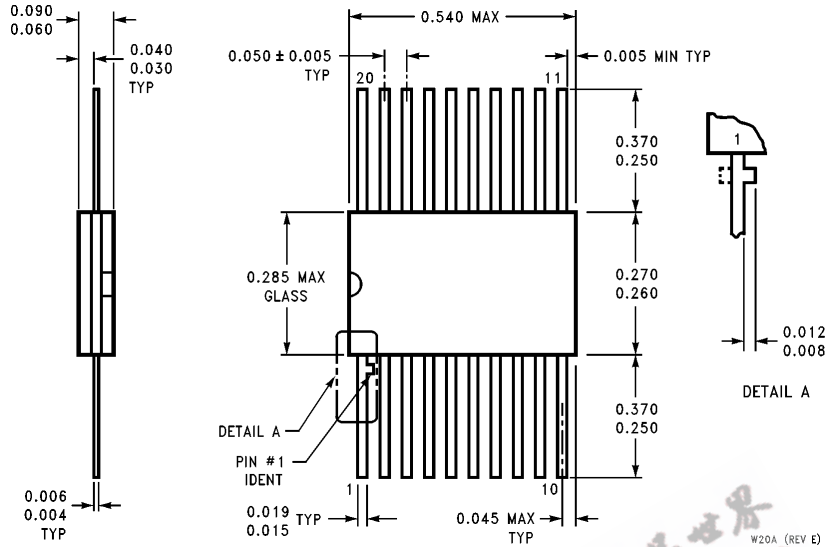


20-Lead Molded Shrink Small Outline, EIAJ Type II (MSA)
NS Package Number MSA20

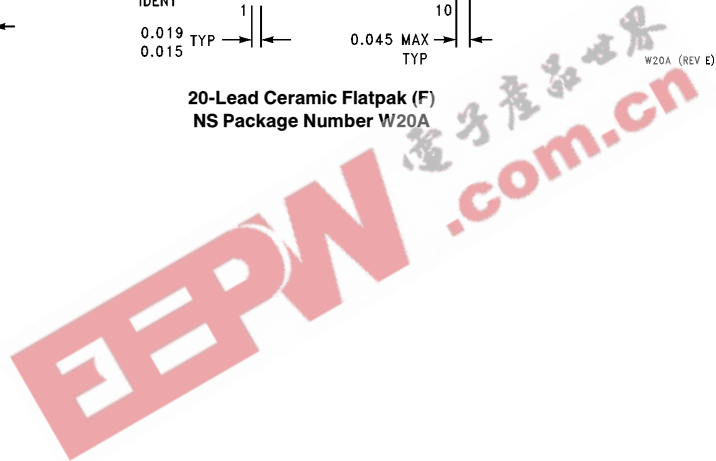


20-Lead (0.300" Wide) Molded Dual-In-Line Package (P)
NS Package Number N20A

Physical Dimensions inches (millimeters) (Continued)



20-Lead Ceramic Flatpak (F)
NS Package Number W20A



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