NL17SV16

Ultra-Low Voltage Buffer

The NL17SV16XV5T2 is an ultra-high performance single Buffer fabricated in sub-micron silicon gate 0.35 μm technology with excellent performance down to 0.9 V. This device is ideal for extremely high-speed and high-drive applications. Additionally, limitations of board space are no longer a constraint. The very small SOT–553 makes this device fit most tight designs and spaces.

The internal circuit is composed of three stages; including a buffered output which provides high noise immunity and stable output. The NL17SV16XV5T2 input structure provides protection when voltages up to 3.6 V are applied.

Features
- Extremely High Speed: 1.5 ns (Typ) at VCC = 3.3 V
- Designed for 0.9 V to 3.6 V Operation
- Overvoltage Tolerance (OVT)* Input Permits Logic Translation
- Balanced ±24 mA Output Drive @ 3.3 Volts
- Near Zero Static Supply Current
- Ultra–Tiny SOT–553 5 Pin Package Only 1.6 x 1.6 mm Footprint
- These Devices are Pb–Free and are RoHS Compliant

Typical Applications
- Cellular
- Digital Camera
- PDA
- Digital Video

*Overvoltage Tolerance (OVT) enables input pins to function outside (higher) of their operating voltages, with no damage to the devices or to signal integrity.
**MAXIMUM RATINGS**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Rating</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CC}$</td>
<td>DC Supply Voltage</td>
<td>-0.5 to +4.6</td>
<td>V</td>
</tr>
<tr>
<td>$V_I$</td>
<td>DC Input Voltage</td>
<td>-0.5 to +4.6</td>
<td>V</td>
</tr>
<tr>
<td>$V_O$</td>
<td>DC Output Voltage</td>
<td>-0.5 to $V_{CC} + 0.5$</td>
<td>V</td>
</tr>
<tr>
<td>$I_{IK}$</td>
<td>DC Input Diode Current</td>
<td>$I_{IN} &lt; 0$ V</td>
<td>-50</td>
</tr>
<tr>
<td>$I_{OK}$</td>
<td>DC Output Diode Current</td>
<td>$I_{OUT} &lt; 0$ V</td>
<td>-50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{OUT} &gt; V_{CC}$</td>
<td>+50</td>
</tr>
<tr>
<td>$I_O$</td>
<td>DC Output Sink Current</td>
<td>±50</td>
<td>mA</td>
</tr>
<tr>
<td>$I_{CC}$</td>
<td>DC Supply Current per Supply Pin</td>
<td>±50</td>
<td>mA</td>
</tr>
<tr>
<td>$I_{GND}$</td>
<td>DC Ground Current per Ground Pin</td>
<td>±50</td>
<td>mA</td>
</tr>
<tr>
<td>$T_{STG}$</td>
<td>Storage Temperature Range</td>
<td>-65 to +150</td>
<td>°C</td>
</tr>
<tr>
<td>$T_L$</td>
<td>Lead Temperature, 1.0 mm from Case for 10 seconds</td>
<td>260</td>
<td>°C</td>
</tr>
<tr>
<td>$T_J$</td>
<td>Junction Temperature Under Bias</td>
<td>+150</td>
<td>°C</td>
</tr>
<tr>
<td>$\theta_{JA}$</td>
<td>Thermal Resistance (Note 1)</td>
<td>250</td>
<td>°C/W</td>
</tr>
<tr>
<td>$P_D$</td>
<td>Power Dissipation in Still Air at 85°C</td>
<td>250</td>
<td>mW</td>
</tr>
<tr>
<td>MSL</td>
<td>Moisture Sensitivity</td>
<td>Level 1</td>
<td></td>
</tr>
<tr>
<td>$F_R$</td>
<td>Flammability Rating</td>
<td>UL 94 V-0 @ 0125 in</td>
<td></td>
</tr>
<tr>
<td>$V_{ESD}$</td>
<td>ESD Withstand Voltage</td>
<td>2000</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>Human Body Model (Note 2)</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Machine Model (Note 3)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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. Measured with minimum pad spacing on an FR4 board, using 10 mm–by–1 inch, 2 ounce copper trace no air flow.
2. Tested to EIA/JESD22–A114–A.
3. Tested to EIA/JESD22–A115–A.

**RECOMMENDED OPERATING CONDITIONS**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CC}$</td>
<td>Positive DC Supply Voltage</td>
<td>0.9</td>
<td>3.6</td>
<td>V</td>
</tr>
<tr>
<td>$V_{IN}$</td>
<td>Digital Input Voltage</td>
<td>0</td>
<td>3.6</td>
<td>V</td>
</tr>
<tr>
<td>$V_{OUT}$</td>
<td>Output Voltage</td>
<td>0</td>
<td>$V_{CC}$</td>
<td>V</td>
</tr>
<tr>
<td>$I_{CH/IOL}$</td>
<td>Output Current</td>
<td>±24</td>
<td>±18</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>$V_{CC} = 3.0$ V to 3.6 V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$V_{CC} = 2.3$ V to 2.7 V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$V_{CC} = 1.65$ V to 1.95 V</td>
<td></td>
<td>±6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$V_{CC} = 1.4$ V to 1.6 V</td>
<td></td>
<td>±4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$V_{CC} = 1.1$ V to 1.3 V</td>
<td></td>
<td>±2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$V_{CC} = 0.9$ V</td>
<td>±0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_A$</td>
<td>Operating Temperature Range. All Package Types</td>
<td>-40</td>
<td>+85</td>
<td>°C</td>
</tr>
<tr>
<td>$t_{r}, t_{f}$</td>
<td>Input Rise or Fall Time</td>
<td>0</td>
<td>10</td>
<td>nS/V</td>
</tr>
<tr>
<td></td>
<td>$V_{CC} = 3.3$ V ± 0.3 V</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 CHARACTERISTICS – Digital Section (Voltages Referenced to GND)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Condition</th>
<th>$V_{CC}$</th>
<th>$T_A = 25^\circ C$</th>
<th>$T_A = -40$ to $85^\circ C$</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{IH}$</td>
<td>High Level Input Voltage</td>
<td>$0.90$</td>
<td>$0.65 \times V_{CC}$</td>
<td>$0.65 \times V_{CC}$</td>
<td>$0.65 \times V_{CC}$</td>
<td>$V$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$1.10 \leq V_{CC} \leq 1.30$</td>
<td>$0.65 \times V_{CC}$</td>
<td>$0.65 \times V_{CC}$</td>
<td>$0.65 \times V_{CC}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$1.40 \leq V_{CC} \leq 1.60$</td>
<td>$0.65 \times V_{CC}$</td>
<td>$0.65 \times V_{CC}$</td>
<td>$0.65 \times V_{CC}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$1.65 \leq V_{CC} \leq 1.95$</td>
<td>$1.6$</td>
<td>$1.6$</td>
<td>$1.6$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$2.30 \leq V_{CC} \leq 2.70$</td>
<td>$2.0$</td>
<td>$2.0$</td>
<td>$2.0$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$2.70 \leq V_{CC} \leq 3.60$</td>
<td>$2.0$</td>
<td>$2.0$</td>
<td>$2.0$</td>
<td></td>
</tr>
<tr>
<td>$V_{IL}$</td>
<td>Low Level Input Voltage</td>
<td>$0.90$</td>
<td>$0.35 \times V_{CC}$</td>
<td>$0.35 \times V_{CC}$</td>
<td>$0.35 \times V_{CC}$</td>
<td>$V$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$1.10 \leq V_{CC} \leq 1.30$</td>
<td>$0.35 \times V_{CC}$</td>
<td>$0.35 \times V_{CC}$</td>
<td>$0.35 \times V_{CC}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$1.40 \leq V_{CC} \leq 1.60$</td>
<td>$0.35 \times V_{CC}$</td>
<td>$0.35 \times V_{CC}$</td>
<td>$0.35 \times V_{CC}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$1.65 \leq V_{CC} \leq 1.95$</td>
<td>$0.7$</td>
<td>$0.7$</td>
<td>$0.7$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$2.30 \leq V_{CC} \leq 2.70$</td>
<td>$0.8$</td>
<td>$0.8$</td>
<td>$0.8$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$2.70 \leq V_{CC} \leq 3.60$</td>
<td>$0.8$</td>
<td>$0.8$</td>
<td>$0.8$</td>
<td></td>
</tr>
<tr>
<td>$V_{OH}$</td>
<td>High Level Output Voltage</td>
<td>$I_{OH} = -100$ $\mu$A</td>
<td>$V_{CC} - 0.1$</td>
<td>$V_{CC} - 0.1$</td>
<td>$V_{CC} - 0.1$</td>
<td>$V$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$1.10 \leq V_{CC} \leq 1.30$</td>
<td>$V_{CC} - 0.1$</td>
<td>$V_{CC} - 0.1$</td>
<td>$V_{CC} - 0.1$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$1.40 \leq V_{CC} \leq 1.60$</td>
<td>$V_{CC} - 0.2$</td>
<td>$V_{CC} - 0.2$</td>
<td>$V_{CC} - 0.2$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$1.65 \leq V_{CC} \leq 1.95$</td>
<td>$V_{CC} - 0.2$</td>
<td>$V_{CC} - 0.2$</td>
<td>$V_{CC} - 0.2$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$2.30 \leq V_{CC} \leq 2.70$</td>
<td>$2.0$</td>
<td>$2.0$</td>
<td>$2.0$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$2.70 \leq V_{CC} \leq 3.60$</td>
<td>$2.0$</td>
<td>$2.0$</td>
<td>$2.0$</td>
<td></td>
</tr>
<tr>
<td>$V_{OL}$</td>
<td>Low Level Output Voltage</td>
<td>$I_{OL} = 100$ $\mu$A</td>
<td>$0.1$</td>
<td>$0.1$</td>
<td>$0.1$</td>
<td>$V$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$1.10 \leq V_{CC} \leq 1.30$</td>
<td>$0.1$</td>
<td>$0.1$</td>
<td>$0.1$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$1.40 \leq V_{CC} \leq 1.60$</td>
<td>$0.2$</td>
<td>$0.2$</td>
<td>$0.2$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$1.65 \leq V_{CC} \leq 1.95$</td>
<td>$0.2$</td>
<td>$0.2$</td>
<td>$0.2$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$2.30 \leq V_{CC} \leq 2.70$</td>
<td>$0.2$</td>
<td>$0.2$</td>
<td>$0.2$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$2.70 \leq V_{CC} \leq 3.60$</td>
<td>$0.2$</td>
<td>$0.2$</td>
<td>$0.2$</td>
<td></td>
</tr>
<tr>
<td>$I_{IN}$</td>
<td>Input Leakage Current</td>
<td>$0 = V_I = 3.6$ $V$</td>
<td>$0.90$ to $3.60$</td>
<td>$\pm 0.1$</td>
<td>$\pm 0.9$</td>
<td>$\mu$A</td>
</tr>
<tr>
<td>$I_{OFF}$</td>
<td>Power Off Leakage Current</td>
<td>$0$</td>
<td>$1$</td>
<td>$5$</td>
<td>$\mu$A</td>
<td></td>
</tr>
<tr>
<td>$I_{CC}$</td>
<td>Quiescent Supply Current</td>
<td>$V_I = V_{CC}$ or GND</td>
<td>$0.9$ to $3.60$</td>
<td>$0.9$</td>
<td>$5$</td>
<td>$\mu$A</td>
</tr>
</tbody>
</table>
## AC CHARACTERISTICS

(Input $t_i = t_f = 3.0 \text{ nS}$)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Condition</th>
<th>$-40^\circ \text{C}$</th>
<th>25$^\circ \text{C}$</th>
<th>85$^\circ \text{C}$</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_{PHL}$, $T_{PLH}$</td>
<td>Propagation Delay</td>
<td>$C_L = 15 \text{ pF}, R_L = 1.0 \text{ MΩ}$</td>
<td>0.90</td>
<td>20</td>
<td></td>
<td>nS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$C_L = 15 \text{ pF}, R_L = 2.0 \text{ kΩ}$</td>
<td>$1.10 \leq V_{CC} \leq 1.30$</td>
<td>$1.40 \leq V_{CC} \leq 1.60$</td>
<td>2.0</td>
<td>6.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$C_L = 30 \text{ pF}, R_L = 500 \text{ Ω}$</td>
<td>$1.65 \leq V_{CC} \leq 1.95$</td>
<td>$2.30 \leq V_{CC} \leq 2.70$</td>
<td>$2.70 \leq V_{CC} \leq 3.60$</td>
<td>1.0</td>
</tr>
<tr>
<td>$C_{IN}$</td>
<td>Input Capacitance</td>
<td>0</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$C_{OUT}$</td>
<td>Output Capacitance</td>
<td>0</td>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$C_{PD}$</td>
<td>Power Dissipation Capacitance</td>
<td>$V_I = 0 \text{ V or } V_{DC}$</td>
<td>$0.90 \text{ to 3.60}$</td>
<td>20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### DEVICE JUNCTION TEMPERATURE VERSUS TIME TO 0.1% BOND FAILURES

<table>
<thead>
<tr>
<th>Junction Temperature $^\circ \text{C}$</th>
<th>Time, Hours</th>
<th>Time, Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>1,032,200</td>
<td>117.8</td>
</tr>
<tr>
<td>90</td>
<td>419,300</td>
<td>47.9</td>
</tr>
<tr>
<td>100</td>
<td>178,700</td>
<td>20.4</td>
</tr>
<tr>
<td>110</td>
<td>79,600</td>
<td>9.4</td>
</tr>
<tr>
<td>120</td>
<td>37,000</td>
<td>4.2</td>
</tr>
<tr>
<td>130</td>
<td>17,800</td>
<td>2.0</td>
</tr>
<tr>
<td>140</td>
<td>8,900</td>
<td>1.0</td>
</tr>
</tbody>
</table>
SOT−553, 5 LEAD
CASE 463B
ISSUE C
DATE 20 MAR 2013

NOTES:
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH
THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM
THICKNESS OF BASE MATERIAL.

**SCALE 4:1**

**RECOMMENDED SOLDERING FOOTPRINT**

**GENERIC MARKING DIAGRAM**

XX = Specific Device Code
M = Date Code
= 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.

**SOLDERING FOOTPRINT**

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

**STYLE 1:**
P1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

**STYLE 2:**
P1. CATHODE
2. COMMON ANODE
3. CATHODE 2
4. CATHODE 3
5. CATHODE 4

**STYLE 3:**
P1. ANODE 1
2. N/C
3. ANODE 2
4. CATHODE 2
5. CATHODE 1

**STYLE 4:**
P1. SOURCE 1
2. DRAIN 1/2
3. SOURCE 1
4. GATE 1
5. CATHODE

**STYLE 5:**
P1. ANODE
2. EMITTER
3. BASE
4. COLLECTOR
5. CATHODE

**STYLE 6:**
P1. EMITTER 2
2. BASE 2
3. EMITTER 1
4. COLLECTOR 1
5. COLLECTOR 2/BASE 1

**STYLE 7:**
P1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

**STYLE 8:**
P1. CATHODE
2. COLLECTOR
3. N/C
4. BASE
5. EMITTER

**STYLE 9:**
P1. ANODE
2. CATHODE
3. ANODE
4. ANODE
5. ANODE

**NOTES:**
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH
THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM
THICKNESS OF BASE MATERIAL.

**SCALE 20:1 (mm) (inches)**

**RECOMMENDED SOLDERING FOOTPRINT**

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**STYLE 1:**
P1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

**STYLE 2:**
P1. CATHODE
2. COMMON ANODE
3. CATHODE 2
4. CATHODE 3
5. CATHODE 4

**STYLE 3:**
P1. ANODE 1
2. N/C
3. ANODE 2
4. CATHODE 2
5. CATHODE 1

**STYLE 4:**
P1. SOURCE 1
2. DRAIN 1/2
3. SOURCE 1
4. GATE 1
5. CATHODE

**STYLE 5:**
P1. ANODE
2. EMITTER
3. BASE
4. COLLECTOR
5. CATHODE

**STYLE 6:**
P1. EMITTER 2
2. BASE 2
3. EMITTER 1
4. COLLECTOR 1
5. COLLECTOR 2/BASE 1

**STYLE 7:**
P1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

**STYLE 8:**
P1. CATHODE
2. COLLECTOR
3. N/C
4. BASE
5. EMITTER

**STYLE 9:**
P1. ANODE
2. CATHODE
3. ANODE
4. ANODE
5. ANODE

**NOTES:**
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH
THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM
THICKNESS OF BASE MATERIAL.

**SCALE 20:1 (mm) (inches)**

**RECOMMENDED SOLDERING FOOTPRINT**

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M = Date Code
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**STYLE 1:**
P1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

**STYLE 2:**
P1. CATHODE
2. COMMON ANODE
3. CATHODE 2
4. CATHODE 3
5. CATHODE 4

**STYLE 3:**
P1. ANODE 1
2. N/C
3. ANODE 2
4. CATHODE 2
5. CATHODE 1

**STYLE 4:**
P1. SOURCE 1
2. DRAIN 1/2
3. SOURCE 1
4. GATE 1
5. CATHODE

**STYLE 5:**
P1. ANODE
2. EMITTER
3. BASE
4. COLLECTOR
5. CATHODE

**STYLE 6:**
P1. EMITTER 2
2. BASE 2
3. EMITTER 1
4. COLLECTOR 1
5. COLLECTOR 2/BASE 1

**STYLE 7:**
P1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

**STYLE 8:**
P1. CATHODE
2. COLLECTOR
3. N/C
4. BASE
5. EMITTER

**STYLE 9:**
P1. ANODE
2. CATHODE
3. ANODE
4. ANODE
5. ANODE

**NOTES:**
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH
THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM
THICKNESS OF BASE MATERIAL.

**SCALE 20:1 (mm) (inches)**

**RECOMMENDED SOLDERING FOOTPRINT**

**GENERIC MARKING DIAGRAM**

XX = Specific Device Code
M = Date Code
= 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.

**SOLDERING FOOTPRINT**

*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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<th>ISSUE</th>
<th>REVISION</th>
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<td>A</td>
<td>ADDED STYLES 3-9. REQ. BY D. BARLOW</td>
<td>11 NOV 2003</td>
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<td>B</td>
<td>ADDED NOMINAL VALUES AND UPDATED GENERIC MARKING DIAGRAM. REQ. BY HONG XIAO</td>
<td>27 MAY 2005</td>
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<td>C</td>
<td>UPDATED DIMENSIONS D, E, AND HE. REQ. BY J. LETTERMAN.</td>
<td>20 MAR 2013</td>
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