



**MOTOROLA**

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# Dual EIA-423/EIA-232D Line Driver

The MC3488A dual is single-ended line driver has been designed to satisfy the requirements of EIA standards EIA-423 and EIA-232D, as well as CCITT X.26, X.28 and Federal Standard FIDS1030. It is suitable for use where signal wave shaping is desired and the output load resistance is greater than 450 ohms. Output slew rates are adjustable from 1.0  $\mu$ s to 100  $\mu$ s by a single external resistor. Output level and slew rate are insensitive to power supply variations. Input undershoot diodes limit transients below ground and output current limiting is provided in both output states.

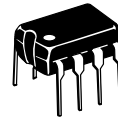
The MC3488A has a standard 1.5 V input logic threshold for TTL or NMOS compatibility.

- PNP Buffered Inputs to Minimize Input Loading
- Short Circuit Protection
- Adjustable Slew Rate Limiting
- MC3488A Equivalent to 9636A
- Output Levels and Slew Rates are Insensitive to Power Supply Voltages
- No External Blocking Diode Required for  $V_{EE}$  Supply
- Second Source  $\mu$ A9636A

## MC3488A

### DUAL EIA-423/EIA-232D DRIVER

#### SEMICONDUCTOR TECHNICAL DATA

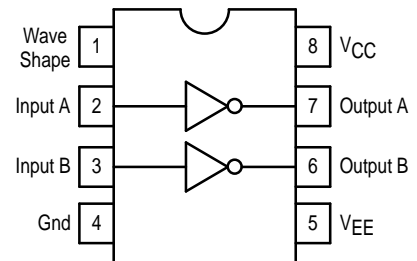


**P1 SUFFIX**  
PLASTIC PACKAGE  
CASE 626

**D SUFFIX**  
PLASTIC PACKAGE  
CASE 751  
(SO-8)



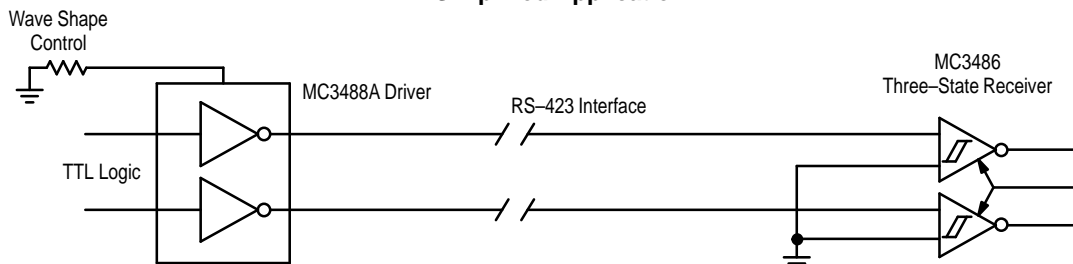
#### PIN CONNECTIONS



#### ORDERING INFORMATION

| Device    | Operating Temperature Range      | Package     |
|-----------|----------------------------------|-------------|
| MC3488AP1 | $T_A = 0$ to $+70^\circ\text{C}$ | Plastic DIP |
| MC3488AD  |                                  | SO-8        |

#### Simplified Application



# MC3488A

## MAXIMUM RATINGS (Note 1)

| Rating                           | Symbol               | Value          | Unit |
|----------------------------------|----------------------|----------------|------|
| Power Supply Voltages            | $V_{CC}$<br>$V_{EE}$ | + 15<br>– 15   | V    |
| Output Current<br>Source<br>Sink | $I_{O+}$<br>$I_{O-}$ | + 150<br>– 150 | mA   |
| Operating Ambient Temperature    | $T_A$                | 0 to + 70      | °C   |
| Junction Temperature Range       | $T_J$                | 150            | °C   |
| Storage Temperature Range        | $T_{Stg}$            | – 65 to + 150  | °C   |

## RECOMMENDED OPERATING CONDITIONS

| Characteristic              | Symbol               | Min            | Typ        | Max            | Unit       |
|-----------------------------|----------------------|----------------|------------|----------------|------------|
| Power Supply Voltages       | $V_{CC}$<br>$V_{EE}$ | 10.8<br>– 13.2 | 12<br>– 12 | 13.2<br>– 10.8 | V          |
| Operating Temperature Range | $T_A$                | 0              | 25         | 70             | °C         |
| Wave Shaping Resistor       | $R_{WS}$             | 10             | –          | 1000           | k $\Omega$ |

## TARGET ELECTRICAL CHARACTERISTICS (Unless otherwise noted, specifications apply over recommended operating conditions)

| Characteristic   | Symbol                 | Min                     | Typ         | Max                     | Unit     |
|--|------------------------|-------------------------|-------------|-------------------------|----------|
| Input Voltage – Low Logic State  | $V_{IL}$               | –                       | –           | 0.8                     | V        |
| Input Voltage – High Logic State   | $V_{IH}$               | 2.0                     | –           | –                       | V        |
| Input Current – Low Logic State<br>( $V_{IL} = 0.4$ V)   | $I_{IL}$               | – 80                    | –           | –                       | $\mu$ A  |
| Input Current – High Logic State<br>( $V_{IH} = 2.4$ V)<br>( $V_{IH} = 5.5$ V)   | $I_{IH1}$<br>$I_{IH2}$ | –<br>–                  | –<br>–      | 10<br>100               | $\mu$ A  |
| Input Clamp Diode Voltage<br>( $I_{IK} = -15$ mA)  | $V_{IK}$               | – 1.5                   | –           | –                       | V        |
| Output Voltage – Low Logic State<br>( $R_L = \infty$ ) EIA-423<br>( $R_L = 3.0$ k $\Omega$ ) EIA-232D<br>( $R_L = 450$ $\Omega$ ) EIA-423  | $V_{OL}$               | – 6.0<br>– 6.0<br>– 6.0 | –<br>–<br>– | – 5.0<br>– 5.0<br>– 4.0 | V        |
| Output Voltage – High Logic State<br>( $R_L = \infty$ ) EIA-423<br>( $R_L = 3.0$ k $\Omega$ ) EIA-232D<br>( $R_L = 450$ $\Omega$ ) EIA-423 | $V_{OH}$               | 5.0<br>5.0<br>4.0       | –<br>–<br>– | 6.0<br>6.0<br>6.0       | V        |
| Output Resistance<br>( $R_L \geq 450$ $\Omega$ )   | $R_O$                  | –                       | 25          | 50                      | $\Omega$ |
| Output Short-Circuit Current (Note 2)<br>( $V_{in} = V_{out} = 0$ V)<br>( $V_{in} = V_{IH}(\text{Min})$ , $V_{out} = 0$ V)                 | $I_{OSH}$<br>$I_{OSL}$ | – 150<br>+ 15           | –<br>–      | – 15<br>+ 150           | mA       |
| Output Leakage Current (Note 3)<br>( $V_{CC} = V_{EE} = 0$ V, $-6.0$ V $\leq V_O \leq 6.0$ V)  | $I_{ox}$               | – 100                   | –           | 100                     | $\mu$ A  |
| Power Supply Currents<br>( $R_W = 100$ k $\Omega$ , $R_L = \infty$ , $V_{IL} \leq V_{in} \leq V_{IH}$ )                                    | $I_{CC}$<br>$I_{EE}$   | –<br>– 18               | –<br>–      | + 18<br>–               | mA       |

- NOTES:** 1. Devices should not be operated at these values. The "Electrical Characteristics" provide conditions for actual device operation.  
 2. One output shorted at a time.  
 3. No  $V_{EE}$  diode required.

# MC3488A

**TRANSITION TIMES** (Unless otherwise noted,  $C_L = 30 \text{ pF}$ ,  $f = 1.0 \text{ kHz}$ ,  $V_{CC} = -V_{EE} = 12.0 \text{ V} \pm 10\%$ ,  $T_A = 25^\circ\text{C}$ ,  $R_L = 450 \Omega$ .  
Transition times measured 10% to 90% and 90% to 10%)

| Characteristic  | Symbol    | Min | Typ | Max | Unit          |
|---|-----------|-----|-----|-----|---------------|
| Transition Time, Low-to-High State Output<br>( $R_W = 10 \text{ k}\Omega$ )<br>( $R_W = 100 \text{ k}\Omega$ )<br>( $R_W = 500 \text{ k}\Omega$ )<br>( $R_W = 1000 \text{ k}\Omega$ ) | $t_{TLH}$ | 0.8 | —   | 1.4 | $\mu\text{s}$ |
|   |           | 8.0 | —   | 14  |               |
|   |           | 40  | —   | 70  |               |
|   |           | 80  | —   | 140 |               |
| Transition Time, High-to-Low State Output<br>( $R_W = 10 \text{ k}\Omega$ )<br>( $R_W = 100 \text{ k}\Omega$ )<br>( $R_W = 500 \text{ k}\Omega$ )<br>( $R_W = 1000 \text{ k}\Omega$ ) | $t_{THL}$ | 0.8 | —   | 1.4 | $\mu\text{s}$ |
|   |           | 8.0 | —   | 14  |               |
|   |           | 40  | —   | 70  |               |
|   |           | 80  | —   | 140 |               |

**Figure 1. Test Circuit and Waveforms for Transition Times**

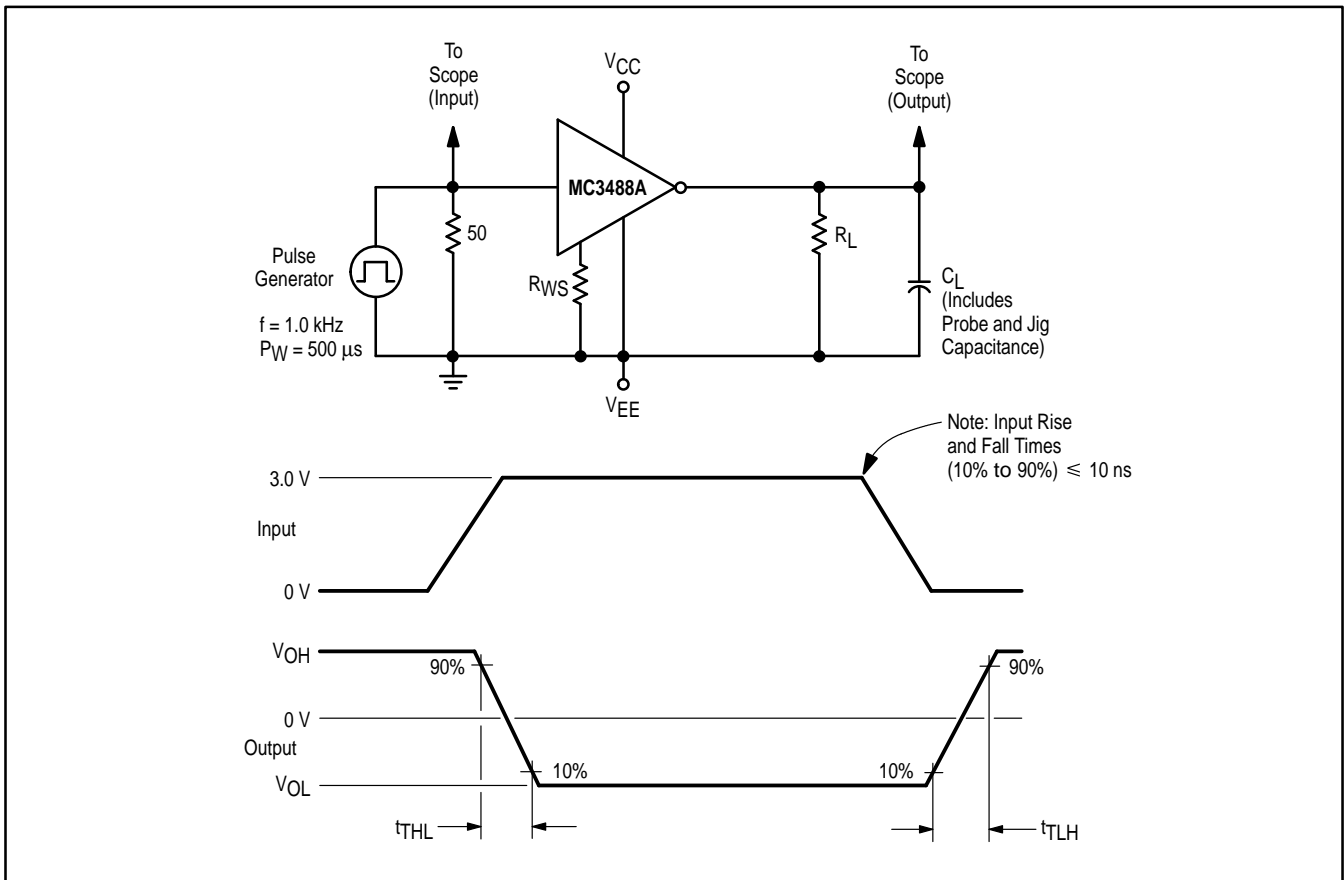


Figure 2. Output Transition Times versus Wave Shape Resistor Value

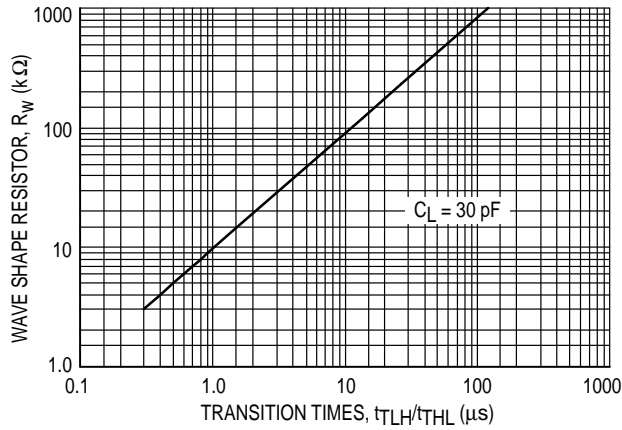


Figure 3. Input/Output Characteristics versus Temperature

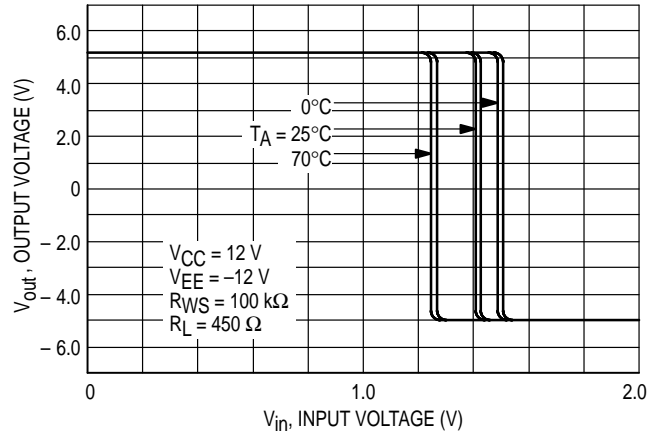


Figure 4. Output Current versus Output Voltage

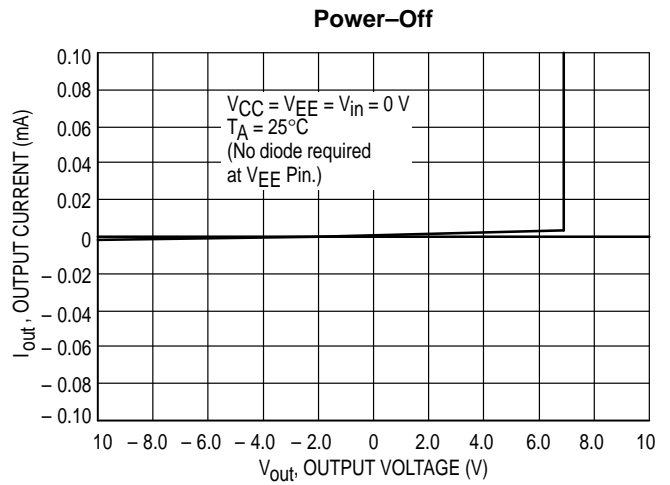
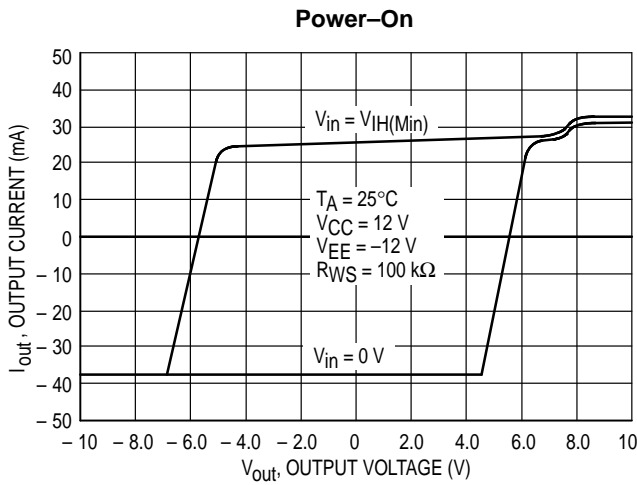


Figure 5. Supply Current versus Temperature

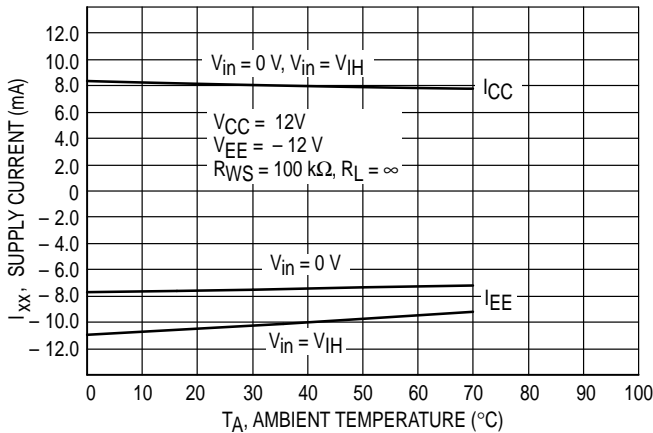
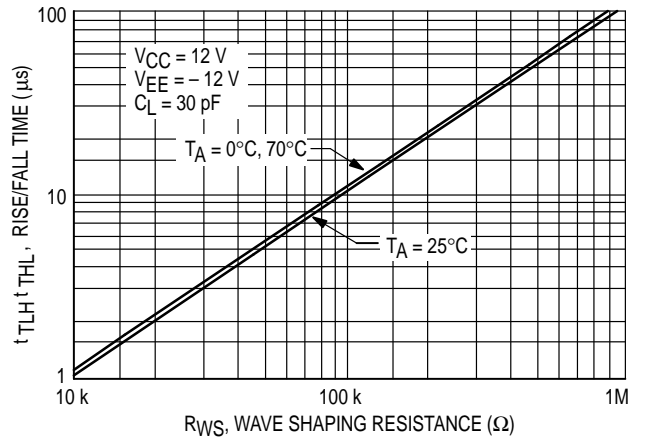


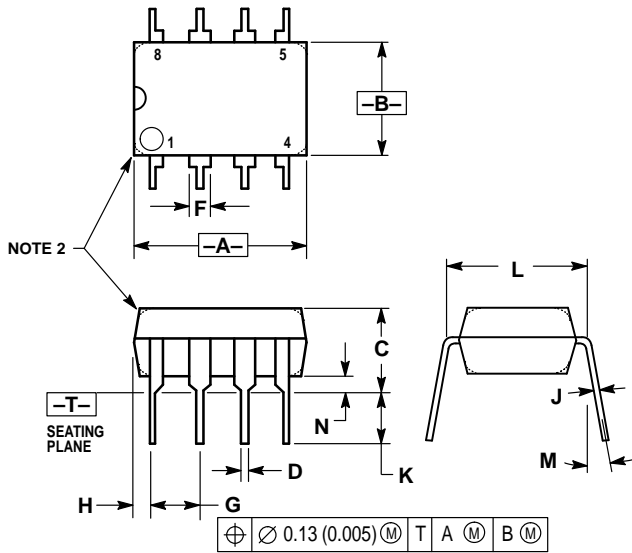
Figure 6. Rise/Fall Time versus  $R_{WS}$



# MC3488A

## OUTLINE DIMENSIONS

### P1 SUFFIX PLASTIC PACKAGE CASE 626-05 ISSUE K

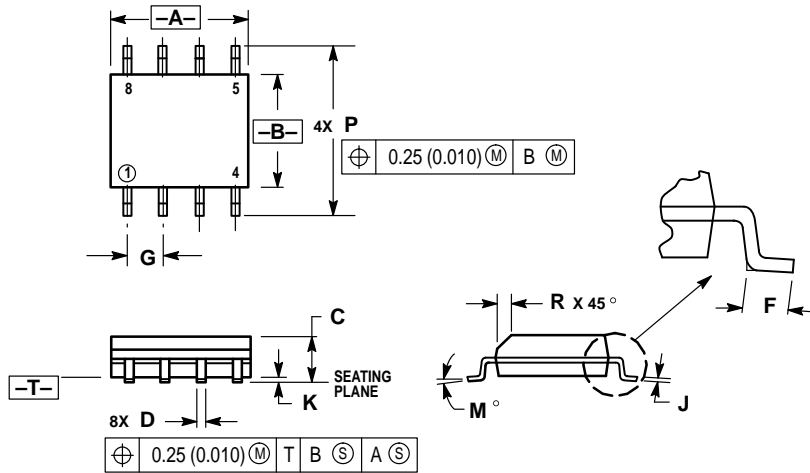


NOTES:

1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | 9.40        | 10.16 | 0.370     | 0.400 |
| B   | 6.10        | 6.60  | 0.240     | 0.260 |
| C   | 3.94        | 4.45  | 0.155     | 0.175 |
| D   | 0.38        | 0.51  | 0.015     | 0.020 |
| F   | 1.02        | 1.78  | 0.040     | 0.070 |
| G   | 2.54 BSC    |       | 0.100 BSC |       |
| H   | 0.76        | 1.27  | 0.030     | 0.050 |
| J   | 0.20        | 0.30  | 0.008     | 0.012 |
| K   | 2.92        | 3.43  | 0.115     | 0.135 |
| L   | 7.62 BSC    |       | 0.300 BSC |       |
| M   | — 10°       |       | — 10°     |       |
| N   | 0.76        | 1.01  | 0.030     | 0.040 |

### D SUFFIX PLASTIC PACKAGE CASE 751-05 (SO-8) ISSUE N



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS 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.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 4.80        | 5.00 | 0.189     | 0.196 |
| B   | 3.80        | 4.00 | 0.150     | 0.157 |
| C   | 1.35        | 1.75 | 0.054     | 0.068 |
| D   | 0.35        | 0.49 | 0.014     | 0.019 |
| F   | 0.40        | 1.25 | 0.016     | 0.049 |
| G   | 1.27 BSC    |      | 0.050 BSC |       |
| J   | 0.18        | 0.25 | 0.007     | 0.009 |
| K   | 0.10        | 0.25 | 0.004     | 0.009 |
| M   | 0° 7°       |      | 0° 7°     |       |
| P   | 5.80        | 6.20 | 0.229     | 0.244 |
| R   | 0.25        | 0.50 | 0.010     | 0.019 |

# MC3488A

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3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 03-81-3521-8315

**ASIA/PACIFIC:** Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,  
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298



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