

Monolithic CMOS Analog Multiplexers

General Description

Maxim's DG506A/DG507A are monolithic CMOS analog multiplexers. The DG506A is a single 16-channel (1 of 16) multiplexer and the DG507A is a differential 8-channel (2 of 16) multiplexer.

Both devices feature break-before-make switching. Maxim guarantees that these multiplexers will not latch-up if the power supplies are turned off with the input signals still present as long as absolute maximum ratings are not violated. The multiplexers operate over a wide range of power supplies from $\pm 4.5\text{V}$ to $\pm 18\text{V}$.

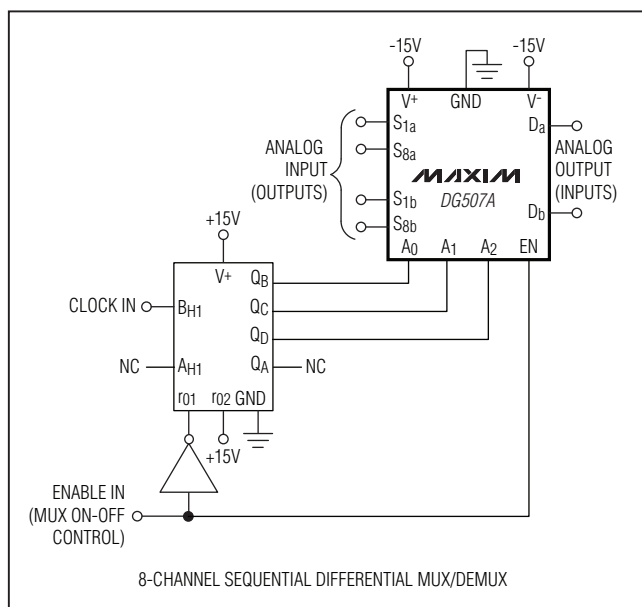
Compared to the original manufacturer's devices, Maxim's DG506A/DG507A consume significantly less power, making them ideal for portable equipment.

Maxim's DG506A/DG507A meet or exceed the specifications of, and are drop-in replacements for Intersil's IH6116 and IH6216, Siliconix's DG506A and DG507A, and Harris' HI506 and HI507.

Applications

Control Systems
Data Logging Systems
Aircraft Heads Up Displays
Data Acquisition Systems
Signal Routing

Typical Operating Circuit



Features

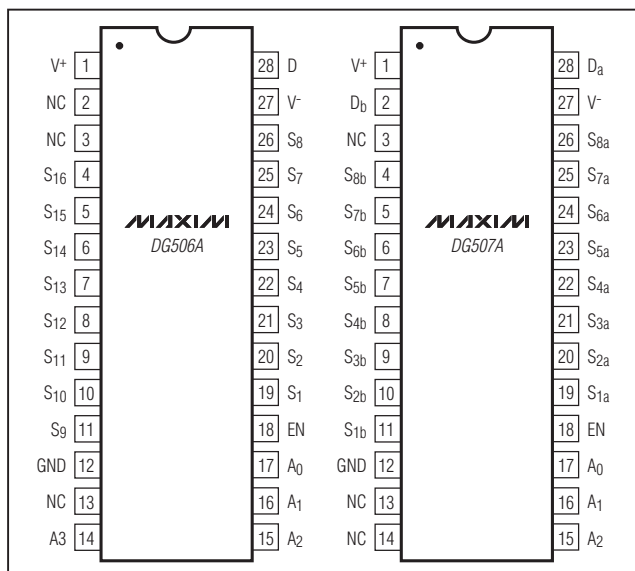
- ◆ Improved 2nd Source
- ◆ Pin Compatible with Harris, Siliconix, Intersil
- ◆ Operable with $\pm 4.5\text{V}$ to $\pm 18\text{V}$ Supplies
- ◆ Symmetrical, Bidirectional Operation
- ◆ Logic and Enable Inputs, TTL and CMOS Compatible
- ◆ Latch-Up Proof Construction
- ◆ Monolithic, Low-Power CMOS Design

Ordering Information

| PART† | TEMP RANGE | PIN-PACKAGE |
|--------------|-----------------|----------------|
| DG506AAK | -55°C to +125°C | 28 CERDIP |
| DG506ABK | -25°C to +85°C | 28 CERDIP |
| DG506AC/D | 0°C to +70°C | Dice |
| DG506ACJ | 0°C to +70°C | 28 Plastic Dip |
| DG506ACK | 0°C to +70°C | 28 CERDIP |
| DG506ACWI | 0°C to +70°C | 28 Wide SO |
| DG506AMWI/PR | -55°C to +125°C | 28 Wide SO |
| DG507AAK | -55°C to +125°C | 28 CERDIP |
| DG507ABK | -25°C to +85°C | 28 CERDIP |
| DG507AC/D | 0°C to +70°C | Dice |
| DG507ACJ | 0°C to +70°C | 28 Plastic DIP |
| DG507ACK | 0°C to +70°C | 28 CERDIP |
| DG507ACWI | 0°C to +70°C | 28 Wide SO |

† Devices are available in a lead(Pb)-free/RoHS-compliant package, specify lead-free by adding "+" to the part number when ordering.

Pin Configurations



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ABSOLUTE MAXIMUM RATINGS

(Voltages referenced to V⁻.)

| | |
|---|---|
| V ⁺ | 44V |
| GND..... | 25V |
| Digital Inputs V _S , V _D (Note 1) | -2V to (V ⁺ + 2V) or 20mA, whichever occurs first |
| Current, Any Terminal Except S or D..... | 30mA |
| Continuous Current, S or D..... | 20mA |
| Peak Current, S or D (pulsed at 1ms, 10% duty cycle max)... | 40mA |

| | |
|--|-----------------|
| Storage Temperature (A and B Suffix)..... | -65°C to +150°C |
| (C Suffix) | -65°C to +125°C |
| Operating Temperature Range (A Suffix) | -55°C to +125°C |
| (B Suffix) | -25°C to +85°C |
| (C Suffix)..... | 0°C to +70°C |
| Continuous Power Dissipation (Package)* | |
| 28-Pin Ceramic DIP (derate 16.7mW/°C above +75°C).. | 1333mW |
| 28-Pin Plastic DIP (derate 14.3mW/°C above +75°C)... | 1143mW |
| 28-Pin Wide SO (derate 12.5mW/°C above +75°C).. | 1000mW |

*All leads soldered or welded to PCB.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

(V⁺ = 15V, V⁻ = -15V, V_{GND} = 0V, T_A = +25°C, unless otherwise indicated.)

| PARAMETER | SYMBOL | CONDITIONS | DG506AA DG507AA | | | DG506AB/C DG507AB/C | | | UNITS | |
|--|---------------------|--|---|-----------------|--------|------------------------|-----------------|--------|-------|----|
| | | | MIN (Note 2) | TYP (Note 3) | MAX | MIN (Note 2) | TYP (Note 3) | MAX | | |
| SWITCH | | | | | | | | | | |
| Analog Signal Range | V _{ANALOG} | | -15 | | +15 | -15 | | +15 | V | |
| Drain-to-Source On-Resistance | R _{DS(ON)} | Sequence each switch on, V _{AL} = 0.8V, V _{AH} = 2.4V, V _{EN} = 2.4V | V _D = 10V, I _S = -200μA | | 270 | 400 | 270 | 450 | Ω | |
| | | | V _D = -10V, I _S = -200μA | | 230 | 400 | 230 | 450 | | |
| Greatest Change in Drain-Source On-Resistance Between Channels | R _{DS(ON)} | $\Delta R_{DS(ON)} = \left(\frac{R_{DS(ON)MAX} - R_{DS(ON)MIN}}{R_{DS(ON)AVE}} \right)$ -10V ≤ V _S ≤ +10V | | 6 | | 6 | | % | | |
| Source Off-Leakage Current | I _{S(OFF)} | V _{EN} = 0.8V, V _{AL} = 0.8V | V _S = 10V, V _D = -10V | -1 | 0.002 | +1 | -5 | 0.002 | +5 | nA |
| | | | V _S = -10V, V _D = 10V | -1 | -0.005 | +1 | -5 | -0.005 | +5 | |
| Drain Off-Leakage Current | I _{D(OFF)} | DG506A, V _{EN} = 0.8V, V _{AL} = 0.8V | V _D = 10V, V _S = -10V | -10 | 0.02 | +10 | -20 | 0.02 | +20 | nA |
| | | | V _D = -10V, V _S = 10V | -10 | -0.03 | +10 | -20 | -0.03 | +20 | |
| | | DG507A, V _{EN} = 0.8V, V _{AL} = 0.8V | V _D = 10V, V _S = -10V | -5 | 0.007 | +5 | -10 | 0.007 | +10 | |
| | | | V _D = -10V, V _S = 10V | -5 | -0.015 | +5 | -10 | -0.015 | +10 | |

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ELECTRICAL CHARACTERISTICS (continued)

(V+ = 15V, V- = -15V, VGND = 0V, TA = +25°C, unless otherwise indicated.)

DG506A/DG507A

| PARAMETER | SYMBOL | CONDITIONS | | DG506AA DG507AA | | | DG506AB/C DG507AB/C | | | UNITS |
|--|--------------------|--|------------------------|--------------------|-----------------|------|------------------------|-----------------|-----|-------|
| | | | | MIN (Note 2) | TYP (Note 3) | MAX | MIN (Note 2) | TYP (Note 3) | MAX | |
| Channel On-Leakage Current | ID(ON) (Note 4) | DG506A, sequence each switch on, VAL = 0.8V, VAH = 2.4V, VEN = 2.4V | VS(all) = VD = 10V | -10 | 0.03 | +10 | -20 | 0.03 | +20 | nA |
| | | | VS(all) = VD = -10V | -10 | -0.06 | +10 | -20 | -0.06 | +20 | |
| | | DG507A, sequence each switch on, VAL = 0.8V, VAH = 2.4V, VEN = 2.4V | VS(all) = VD = 10V | -5 | 0.015 | +5 | -10 | 0.015 | +10 | |
| | | | VS(all) = VD = -10V | -5 | -0.03 | +5 | -10 | -0.03 | +10 | |
| INPUT | | | | | | | | | | |
| Address Input Current, Input- Voltage High | IAH | VA = 2.4V | | -10 | -0.002 | | -10 | -0.002 | | μA |
| | | VA = 15V | | | 0.006 | 10 | | 0.006 | 10 | |
| Address Input Current, Input- Voltage Low | IAL | All VA = 0V | VEN = 2.4V | -10 | -0.002 | | -10 | -0.002 | | μA |
| | | | VEN = 0V | -10 | -0.002 | | -10 | -0.002 | | |
| DYNAMIC | | | | | | | | | | |
| Switching Time of Multiplexer | ttransition | Figure 1 | | | 0.6 | 1 | | 0.06 | | μs |
| Break-Before- Make Interval | tOPEN | Figure 3 | | | 0.2 | | | 0.2 | | μs |
| Enable Turn- On Time | ton(EN) | Figure 2 | | | 1 | | | 1 | | μs |
| Enable Turn- Off Time | tOFF(EN) | Figure 2 | | | 0.4 | | | 0.4 | | μs |
| Off-Isolation (Note 5) | OIRR | VEN = 0V, RL = 1kΩ, CL = 15pF, VS = 7VRMS, f = 500kHz | | | 68 | | | 68 | | dB |
| Source Off- Capacitance | CS(OFF) | VEN = 0V, f = 140kHz, VS = 0V | | | 6 | | | 6 | | pF |
| Drain Off- Capacitance | CD(OFF) | VEN = 0V, f = 140kHz | DG506A, VD = 0V | | 45 | | | 45 | | pF |
| | | | DG507A, VD = 0V | | 23 | | | 23 | | |
| SUPPLY | | | | | | | | | | |
| Positive Supply Current | I+ | VEN = 0 or 5V, all VA = 0V | | | 0.13 | 0.25 | | 0.13 | 0.3 | mA |
| Negative Supply Current | I- | VEN = 0 or 5V, all VA = 0V | | -0.15 | -0.07 | | -0.25 | -0.07 | | |

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DG506A/DG507A

ELECTRICAL CHARACTERISTICS (Overtemperature)

(V₊ = 15V, V₋ = -15V, V_{GND} = 0V, T_A = overtemperature range, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | | DG506AA DG507AA | | | DG506AB/C DG507AB/C | | | UNITS |
|---|--------------------------------|---|--|--------------------|-----------------|------|------------------------|-----------------|------|-------|
| | | | | MIN (Note 2) | TYP (Note 3) | MAX | MIN (Note 2) | TYP (Note 3) | MAX | |
| SWITCH | | | | | | | | | | |
| Analog Signal Range | V _{ANALOG} | | | -15 | | +15 | -15 | | +15 | V |
| Drain-to-Source On-Resistance | R _{D(S)ON} | Sequence each switch on, V _{AL} = 0.8V, V _{AH} = 2.4V, V _{EN} = 2.4V | V _D = 10V, I _S = -200μA | | 500 | | | | 550 | Ω |
| | | | V _D = -10V, I _S = -200μA | | 500 | | | 550 | | |
| Source Off-Leakage Current | I _{S(OFF)} | V _{EN} = 0.8V, V _{AL} = 0.8V | V _S = 10V, V _D = -10V | -50 | | +50 | -50 | | +50 | nA |
| | | | V _S = -10V, V _D = 10V | -50 | | +50 | -50 | | +50 | |
| Drain Off-Leakage Current | I _{D(OFF)} | DG506A, V _{EN} = 0.8V, V _{AL} = 0.8V | V _D = 10V, V _S = -10V | -300 | | +300 | -300 | | +300 | nA |
| | | | V _D = -10V, V _S = 10V | -300 | | +300 | -300 | | +300 | |
| | | DG507A, V _{EN} = 0.8V, V _{AL} = 0.8V | V _D = 10V, V _S = -10V | -200 | | +200 | -200 | | +200 | |
| | | | V _D = -10V, V _S = 10V | -200 | | +200 | -200 | | +200 | |
| Channel On-Leakage Current | I _{D(ON)} (Note 4) | DG506A, sequence each switch on, V _{AL} = 0.8V, V _{AN} = 2.4V, V _{EN} = 2.4V | V _{S(all)} = V _D = 10V | -300 | | +300 | -300 | | +300 | nA |
| | | | V _{S(all)} = V _D = -10V | -300 | | +300 | -300 | | +300 | |
| | | DG507A, sequence each switch on, V _{AL} = 0.8V, V _{AN} = 2.4V, V _{EN} = 2.4V | V _{S(all)} = V _D = 10V | -200 | | +200 | -200 | | +200 | |
| | | | V _{S(all)} = V _D = -10V | -200 | | +200 | -200 | | +200 | |
| INPUT | | | | | | | | | | |
| Address Input Current, Input-Voltage High | I _{AH} | V _A = 2.4V | | -30 | | | -30 | | | μA |
| | | V _A = 15V | | | | 30 | | 30 | | |
| Address Input Current, Input-Voltage Low | I _{AL} | All V _A = 0V | V _{EN} = 2.4V | -30 | | | -30 | | | μA |
| | | | V _{EN} = 0V | | | | 30 | | 30 | |

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ELECTRICAL CHARACTERISTICS (Overtemperature) (continued)

(V+ = 15V, V- = -15V, VGND = 0V, TA = over temperature range, unless otherwise noted.)

- Note 1:** Signals on SX, DX, or INX exceeding V+ or V- will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
- Note 2:** The algebraic convention whereby the most negative value is a minimum, and the most positive value is a maximum, is used in this data sheet.
- Note 3:** Typical values are for design aid only, not guaranteed nor subject to production testing.
- Note 4:** ID(ON) is leakage from driver into on switch.
- Note 5:** Off-isolation = 20log x VO/VS, VS = input to off switch, VD = output due to VS.

Truth Tables

| A3 | A2 | A1 | A0 | EN | ON SWITCH |
|----|----|----|----|----|-----------|
| X | X | X | X | 0 | None |
| 0 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 0 | 1 | 1 | 2 |
| 0 | 0 | 1 | 0 | 1 | 3 |
| 0 | 0 | 1 | 1 | 1 | 4 |
| 0 | 1 | 0 | 0 | 1 | 5 |
| 0 | 1 | 0 | 1 | 1 | 6 |
| 0 | 1 | 1 | 0 | 1 | 7 |
| 0 | 1 | 1 | 1 | 1 | 8 |
| 1 | 0 | 0 | 0 | 1 | 9 |
| 1 | 0 | 0 | 1 | 1 | 10 |
| 1 | 0 | 1 | 0 | 1 | 11 |
| 1 | 0 | 1 | 1 | 1 | 12 |
| 1 | 1 | 0 | 0 | 1 | 13 |
| 1 | 1 | 0 | 1 | 1 | 14 |
| 1 | 1 | 1 | 0 | 1 | 15 |
| 1 | 1 | 1 | 1 | 1 | 16 |

| A2 | A1 | A0 | EN | ON SWITCH |
|----|----|----|----|-----------|
| X | X | X | 0 | None |
| 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 1 | 1 | 2 |
| 0 | 1 | 0 | 1 | 3 |
| 0 | 1 | 1 | 1 | 4 |
| 1 | 0 | 0 | 1 | 5 |
| 1 | 0 | 1 | 1 | 6 |
| 1 | 1 | 0 | 1 | 7 |
| 1 | 1 | 1 | 1 | 8 |

Note: Logic "0" = VAL ≤ 0.8V, Logic "1" = VAH ≥ 2.4V, "0" = Don't Care.

Switching Time Test Circuits

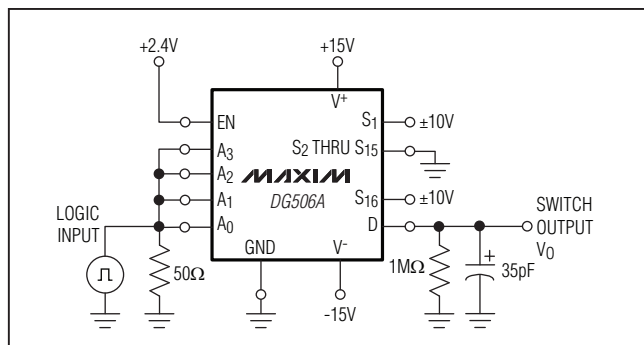


Figure 1a. Transition Switching Time

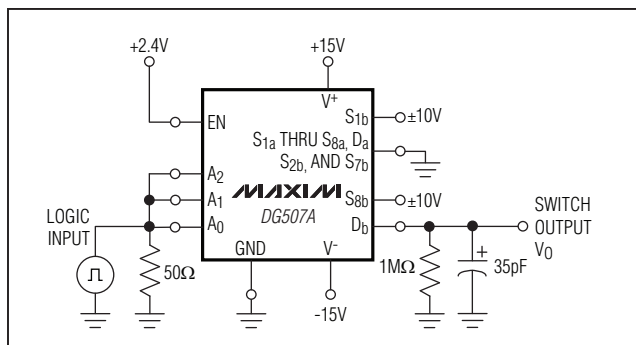


Figure 1b. Transition Switching Time

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Switching Time Test Circuits (continued)

DG506A/DG507A

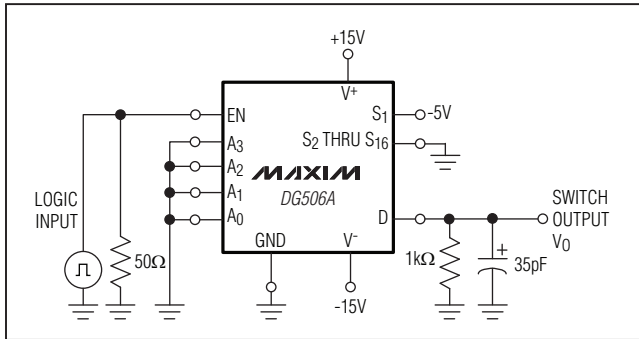


Figure 2a. Enable Switching Time

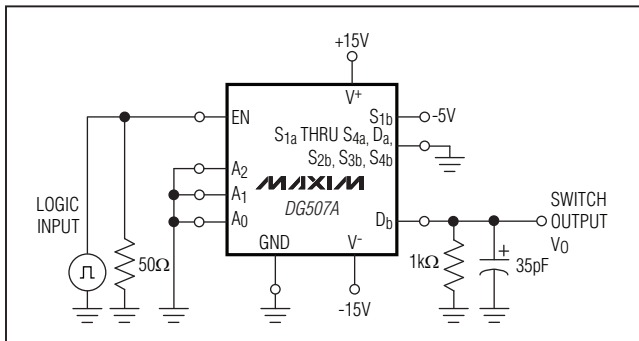


Figure 2b. Enable Switching Time

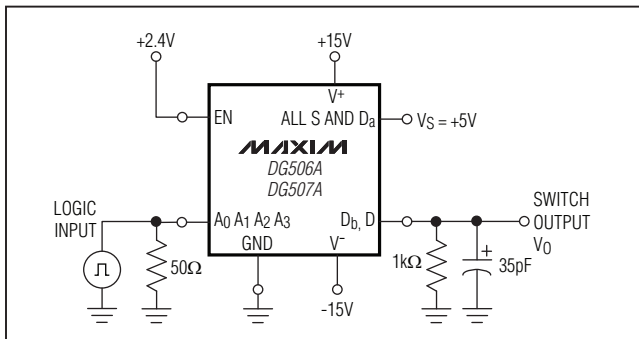


Figure 3. Break-Before-Make

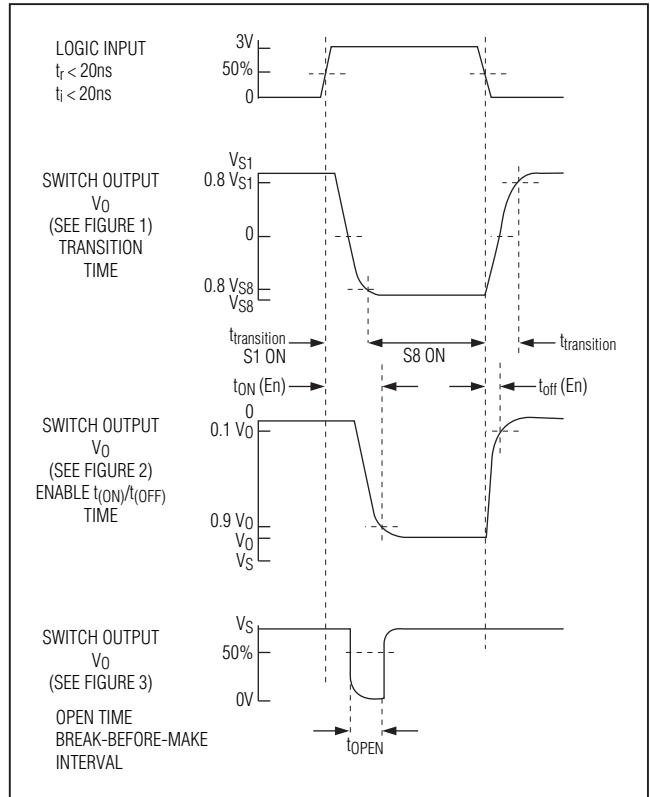


Figure 4. Timing Diagrams for Figures 1, 2, and 3

Package Information

For the latest package outline information and land patterns, go to www.maxim-ic.com/packages.

| PACKAGE TYPE | PACKAGE CODE | DOCUMENT NO. |
|----------------|--------------|-------------------------|
| 28 CERDIP | J28-2 | 21-0046 |
| 28 Plastic DIP | P28-2 | 21-0044 |
| 28 Wide SO | W28-5 | 21-0042 |

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Revision History

| REVISION NUMBER | REVISION DATE | DESCRIPTION | PAGES CHANGED |
|-----------------|---------------|--------------------------------|---------------|
| 0 | 8/92 | Initial release | — |
| 1 | 1/99 | Updated to Word format. | 1-7 |
| 2 | 5/09 | Added ruggedized plastic part. | 1-4, 7 |

DG506A/DG507A

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