

TELEDYNE SOLID STATE

MILITARY POWER FET AC/DC SOLID STATE RELAY

OPTICALLY ISOLATED
UP TO 1.3 AMP AT 25°C

SERIES
685
686
690
691

RADIATION
TESTED
SP57/110

FEATURES

- DC or AC/DC units available
- Surge blocking voltage of 80 volts peak (per MIL-704)
- Power FET output
- Fast switching speed
- Low on-resistance (0.3 ohms typ.)
- Virtually no offset voltage
- Opto isolation up to 1200 volts
- Input CMOS or TTL compatible
- 3.8 to 32.0 volt input range (Table 1)
- Constant current input in TTL mode
- Schmitt trigger input in buffered mode at 50 microamps
- Built and tested to MIL-R-28750 utilizing the test methods of MIL-STD-883C
- Radiation hardening levels: contact factory

APPLICATIONS

- Low level switching applications
- Isolated line drivers
- Current loop switches
- Servo and synchro resolver control
- Load control from microcomputer I/O ports
- Data coupler
- General purpose analog and transducer signal switching in military/aerospace applications
- Telecommunications

DESCRIPTION

These all solid state relays utilize the latest power FET output technology to minimize on-state resistance and bipolar offset voltages normally associated with solid state relay outputs. The input and output are optically isolated to protect delicate input logic circuits from output voltage transients. The input is buffered to enable the relay to be driven directly by CMOS logic gates or standard interface circuitry. A Schmitt trigger at the input significantly increases noise margin when using the relay in the CMOS input mode. This prevents false triggering in noisy environments. State-of-the-art construction techniques maximizes MTBF and minimizes package size.

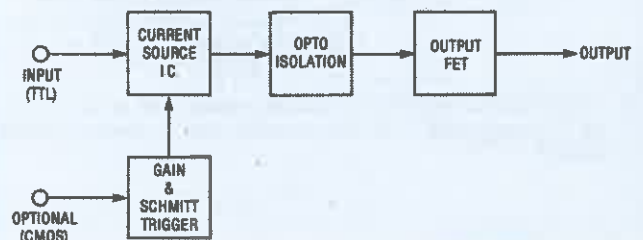
The 685 and 686 are housed in metal DIP packages which maximize heat dissipation.

The 690 and 691 are housed in low profile Centrigrid® packages which conserve space in high density packaging applications.

PART NUMBERING AND GENERAL SPECIFICATIONS

| Teledyne Part No. | Maximum Continuous Operating Output Voltage | Maximum Load Current (25°C) |
|-------------------|---|-----------------------------|
| 690-1 | 60 Volts DC | 0.56 DC Amps |
| 690-2 | 60 Volts DC | 1.00 DC Amps |
| 691-1 | ±60 Volts Peak | 0.40 Amp (RMS) |
| 691-2 | ±60 Volts Peak | 0.70 Amp (RMS) |
| 685-1 | 60 Volts DC | 0.75 DC Amps |
| 685-2 | 60 Volts DC | 1.35 DC Amps |
| 686-1 | ±60 Volts Peak | 0.54 Amp (RMS) |
| 686-2 | ±60 Volts Peak | 0.95 Amp (RMS) |

BLOCK DIAGRAM



INPUT (CONTROL) CHARACTERISTICS When used in 5 terminal configuration (CMOS) See Fig. 3

| | MIN. | TYP. | MAX. | UNITS |
|---------------------------------------|------|------|------|-------------|
| Input Current @ 5 VDC | | | 250 | μA |
| Control Voltage Range | 2.5 | | 18 | VDC |
| Bias Supply Range V _c | 3.8 | | 32 | VDC Table 1 |
| Bias Current | | 13 | 16 | mA |
| Turn-Off Minimum (For guaranteed off) | | 2.5 | 2.8 | VDC |
| Turn-On Maximum (For guaranteed on) | 0.5 | | | VDC |
| Total Schmitt Hysteresis | | 1.8 | | VDC |

INPUT (CONTROL) CHARACTERISTICS When used in 4 terminal configuration (TTL) See Fig. 2

| | MIN. | TYP. | MAX. | UNITS |
|---------------------------------------|------|------|------|-------------|
| Input Current | | 13 | 16 | mA |
| Control Voltage Range | 3.8 | | 32 | VDC Table 1 |
| Turn-Off Maximum (For guaranteed off) | | | 1.5 | VDC |
| Turn-On Minimum (For guaranteed on) | 3.8 | | | VDC |

SERIES 685/690

ELECTRICAL CHARACTERISTICS AT 25°C

| | | 690-1 | 685-1 | 690-2 | 685-2 | 691-1 | 686-1 | 691-2 | 686-2 | Units | |
|--|------|--|-------|-------|-------|----------------|-------|-------|-------|---------------------------|--------------------|
| Maximum Continuous Operating Output Voltage | | 60 Volts DC | | | | ±60 Volts Peak | | | | Volts (DC or Peak) | |
| Maximum Load Current At 25°C | | 0.56 | 0.75 | 1.0 | 1.35 | 0.40 | 0.54 | 0.70 | 0.95 | Amps (DC or RMS) | |
| ON Resistance | Typ. | 0.60 | | 0.30 | | 1.2 | | 0.60 | | Ohms | |
| | Max. | 0.90 | | 0.35 | | 1.6 | | 0.70 | | | |
| Maximum Output Capacitance | | 160 | | 400 | | 80 | | 200 | | pf at 25V 1 MHz | |
| Maximum Input-Output Capacitance | | 5 | | | | | | | | | pf at 25V 1 KHz |
| Typical Thermal Resistance | θJA | 150 | 90 | 120 | 70 | 150 | 90 | 120 | 70 | °C/Watt | |
| | θJC | 40 | 30 | 30 | 25 | 40 | 30 | 30 | 25 | | |
| t _r * (Typical Rise Time) | | 0.8 | | 1.5 | | 1.2 | | 2.0 | | msec | |
| t _{ON} * (Typical On Delay) | | 0.7 | | 0.8 | | 0.8 | | 2.2 | | msec | |
| t _f * (Typical Fall Time) | | 0.4 | | 0.6 | | 0.6 | | 0.6 | | msec | |
| t _{OFF} * (Typical Off Delay) | | 1.8 | | 2.0 | | 2.4 | | 2.5 | | msec | |
| Maximum Surge Voltage Note 5 (Transient Blocking) 2 sec max. | | 80 | | | | | | | | | Volt (DC or Peak) |
| Leakage Current at 60 Volts, 25°C | | 10 | | | | | | | | | μA |
| Dielectric Strength (Input-Output) | | 1000 | 1200 | 1000 | 1200 | 1000 | 1200 | 1000 | 1200 | VAC RMS 60Hz Sine Wave | |
| Isolation (Input to Case at 500 Volts) | | 10' | | | | | | | | | Ohms |
| Current Surge | | 200% of maximum load current at 25°C for 1 sec duration 10% duty cycle | | | | | | | | | |

NOTES:

- Used in the 5 terminal CMOS compatible configuration, the relays provide inversion such that when the control voltage is 0.5 VDC or less, the relay's output will be guaranteed "on." When the control voltage is 2.8 VDC or more the relay's output will be guaranteed "off."
- In the 4 terminal TTL configuration the relays are non-inverting. When the TTL driving gate is sinking the drive current the relay output will be on.
- All power FET relays may drive loads connected to either positive or negative referenced power supply lines. (Source or sink modes)
- For on state resistance at temperatures other than 25°C, use the following equation —

$$R = R_{25} \times e^{0.006 \times \Delta T}$$

where R₂₅ = resistance at 25°C from table
 R = resistance at new temperature
 ΔT = new temperature - 25°C
 e = 2.7182818

- If 600V transient capability is required, a zener diode across the output is recommended. If an internal zener diode is required, consult factory.

ENVIRONMENTAL SPECIFICATIONS*

| | |
|---------------------------------|---|
| Temperature (Ambient Operating) | -55°C to Maximum Per Thermal Derating Curve |
| Temperature (Ambient Storage) | -55°C to 125°C |
| Vibration | 100g, 10 to 3000 Hz |
| Shock | 1500g, 0.5 msec |
| Acceleration | 5000g |

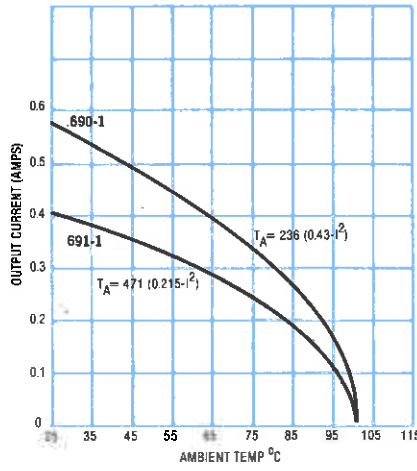
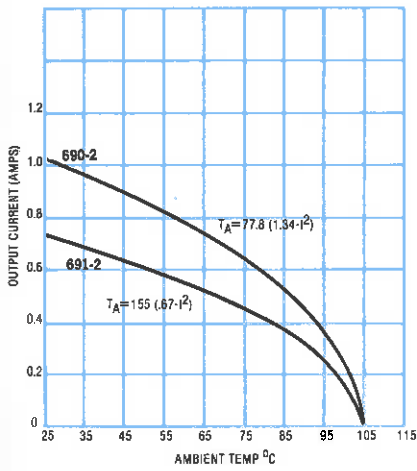
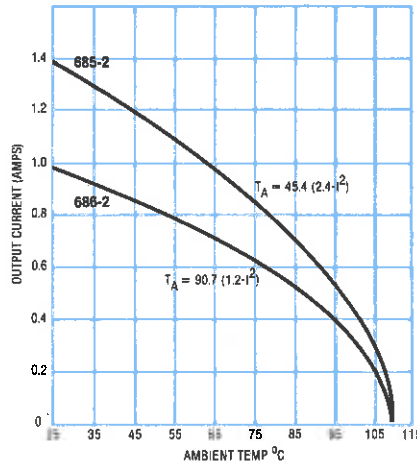
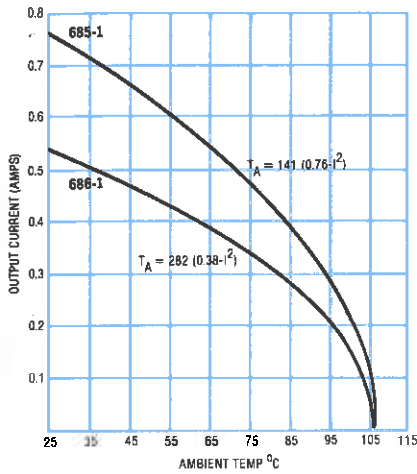
*For higher environmental requirements, contact factory.

CONTROL INPUT RESISTANCE REQUIREMENTS

| Vc Range | 3.8-6V | 6.0-10V | 10-14V | 14-18V | 18-22V | 22-26V | 26-32V |
|--------------------|--------------|---------|--------|--------|--------|--------|--------|
| Rs Ohms | | 300 | 620 | 910 | 1200 | 1500 | 2000 |
| Power Rating Watts | Not Required | ¼ | ¼ | ½ | ½ | ½ | 1 |

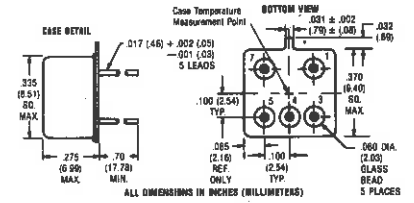
TABLE 1

THERMAL DERATING CURVES (FREE AIR)



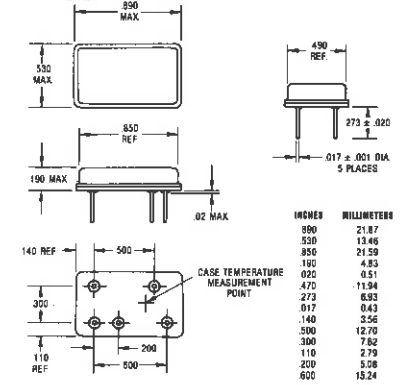
MECHANICAL SPECIFICATIONS

690 & 691



Weight: 1.5 Grams (Typical)

685 & 686



Weight: 5.0 Grams (Typical)

TURN-ON AND TURN-OFF TIMING

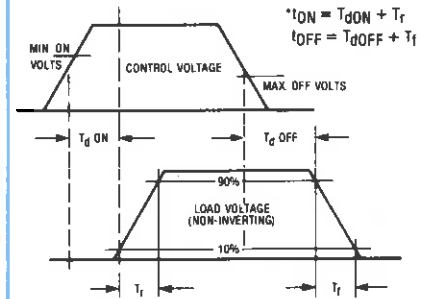


FIGURE 1

WIRING CONFIGURATIONS

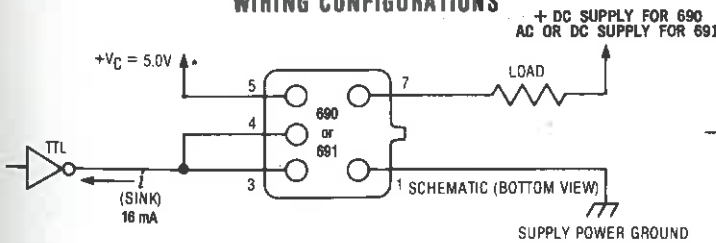


FIGURE 2: FOUR TERMINAL (TTL) USE-SEE NOTE 2

LIMITING RESISTOR REQUIRED OVER 6.0 VOLTS (TABLE 1) WHEN NOT USED WITH A HEAT SINK. WITH A HEAT SINK, THE VALUES ARE TO BE DETERMINED.

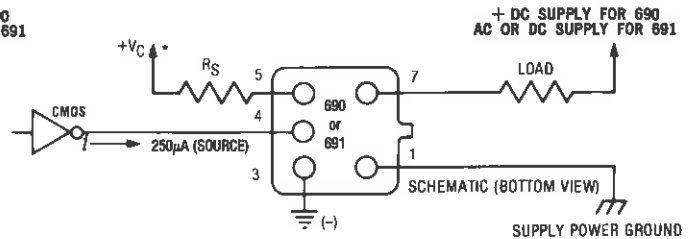
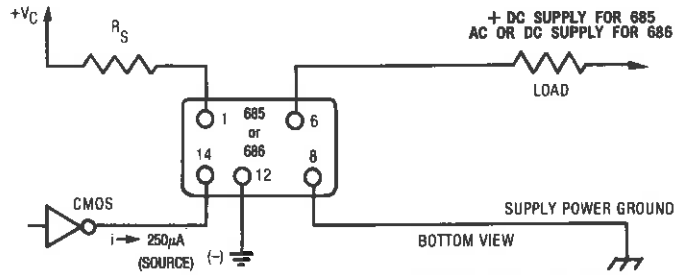
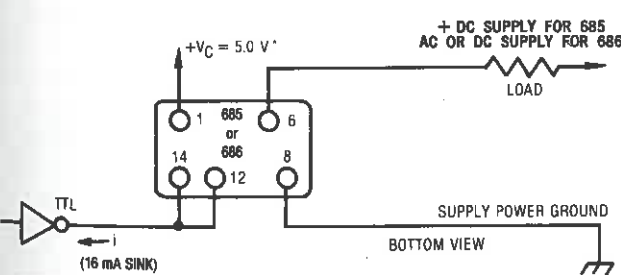


FIGURE 3: FIVE TERMINAL (CMOS) USE-SEE NOTE 1



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