TELEDYNE RELAYS
*A Unit of Teledyne Electronic Technologies*

SMART **Series KA/LA**

2.0 to 7.5A, 250 Vrms Optically Isolated
AC Solid-State Relay

| Part Number* | Relay Description |
|---|---|
| KA00HF | 2 A, 250 Vrms, AC Solid-State Relay |
| KA58HF | 2 A, 250 Vrms, AC Solid-State Relay with Thermal Protection and Thermal TRIP Status |
| LA00HL | 7.5 A, 250 Vrms, AC Solid-State Relay |
| LA58HL | 7.5 A, 250 Vrms, AC Solid-State Relay with Thermal Protection and Thermal TRIP Status |

* The Y suffix denotes parameters tested to MIL-PRF-28750 test methods. The W suffix denotes parameters tested to Teledyne specifications.

## ELECTRICAL SPECIFICATIONS

(-55°C TO +110°C UNLESS OTHERWISE SPECIFIED)

**INPUT (CONTROL) CHARACTERISTICS**

| 2 Terminal Configuration (See Fig. 1) | Min | Max | Units |
|---|---|---|---|
| Input Voltage (See note 2) | 3.8 | 32 | Vdc |
| Input Current (See Figure 1) | | | |
| $V_{IN}$ = 5 Vdc | | 15 | mA dc |
| Turn-Off Voltage (Guaranteed Off) | | 1.5 | Vdc |
| Turn-On Voltage (Guaranteed On) | 3.8 | | Vdc |
| Reverse Voltage Protection | | -32 | Vdc |

**INPUT (CONTROL) CHARACTERISTICS**

| 3 Terminal Configuration (See Fig. 1) | Min | Max | Units |
|---|---|---|---|
| Bias Voltage (See note 2) | 3.8 | 32 | Vdc |
| Bias Current ($V_{IN}$=32 Vdc) | | 16 | mA |
| Control Voltage Range | 0 | 18 | Vdc |
| Control Current (at 5 Vdc) | | 250 | μAdc |
| Turn-On Control Voltage | | 0.3 | Vdc |
| Turn-Off Control Voltage | 3.2 | | Vdc |

**OUTPUT (LOAD) SPECIFICATIONS**

| | Min | Max | Units |
|---|---|---|---|
| Load Voltage | 20 | 250 | Vrms |
| Frequency Range | 40 | 440 | Hz |
| Continuous Load Current (See Figure 3) | | | |
| KA and LA without Heat Sink | | 2.0 | Arms |
| LA with Heat Sink | | 7.5 | Arms |
| Output Voltatge Drop | | 1.2 | Vrms |

### FEATURES/BENEFITS

- Available with thermal protection and thermal TRIP status: Provides self-protection from thermal runaway conditions and indicates protection state for system BIT.
- Optical Isolation: Isolates control elements from load transients with reduced EMI.
- Fully Floating Output: Eliminates ground potential loops and allows the output to sink or source current.
- Buffered Control: Relay can be controlled directly from TTL or CMOS logic circuits.
- Integral Snubber Circuit: Enhances dV/dt capability while minimizing EMI.

### DESCRIPTION

The Series KA/LA solid-state relays (SSRs) is designed for use in AC power switching applications where safety and reliability are primary concerns. These SSRs are rated for load voltages up to 250 Vrms from 40 to 440 Hz and are ideal for resistive and reactive loads with power factors as low as 0.2. Inverse parallel SCRs are configured for zero voltage turn on. Optical isolation to 1250 Vrms between the control (input) and load (output) allows the load to be safely controlled by logic circuitry. The KA/LA series is available with thermal protection and thermal TRIP status. In case of a thermal runaway condition, the SSR will shut down the output switch and latch off until the input is reset and the junction temperature returns to a safe level. When the output does latch off, the TRIP status line will yield a logic level output indicating the protection state of the SSR. This feature provides the user with failure mode indication while enhancing the system diagnostic capability. These SSRs are available to the Y screening level of MIL-PRF-28750 and are packaged in low-profile hermetically sealed cases.


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## OUTPUT (LOAD) SPECIFICATIONS

| | Min | Max | Units |
|---|---|---|---|
| Off-State Leakage Current (250 Vac, 400 Hz) | | 10 | mA |
| Turn-On Time | | 1/2 | Cycle |
| Turn-Off Time | | 1 | Cycle |
| Transient Voltage (5 sec, 25°C) | | ±500 | V pk |
| Zero Voltage Turn-On Point | | ±15 | V pk |
| dv/dt | 100 | | V/μs |
| Surge Current | | MIL-PRF-28750 | |
| Load Power Factor | 0.2 | | |
| Insulation Resistance @ 500 Vdc | $10^9$ | | Ohm |
| Input to Output Capacitance | | 15 | pF |
| Dielectric Withstanding Voltage (60Hz) | 1250 | | Vrms |
| Junction Temperature at Rated Current ($T_J$ Max) | | 125 | °C |
| Thermal Resistance Junction to Ambient ($\theta_{JA}$) | | 30 | °C/W |
| Thermal Resistance Junction to Case ($\theta_{JC}$) | | 5 | °C/W |

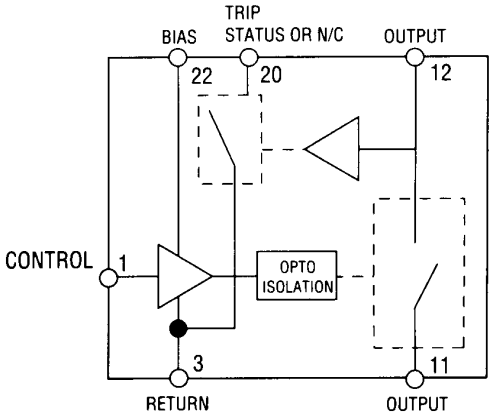
## STATUS OUTPUT TRUTH TABLE

| Status Output State | Control Input | Output (Load) State |
|---|---|---|
| Off (High) | Low | On |
| On (Low) | Low | Tripped (Off) |
| Off (High) | High | Off |
| On (Low) | High | Non-applicable condition |

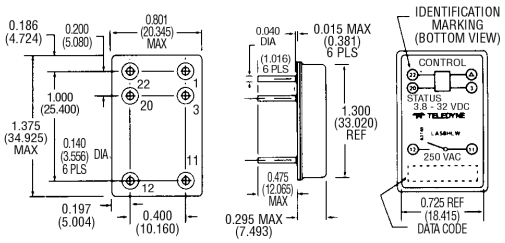
## STATUS OUTPUT SPECIFICATIONS

| | Min | Max | Units |
|---|---|---|---|
| Status Supply Voltage | | 32 | Vdc |
| Status "OFF" Leakage Current @ 32 Vdc | | 10 | μAdc |
| Status Sink Current ($V_{so}$ ≤ 0.4 Vdc) | | 10 | mAdc |
| Status "ON" State Voltage @10mAdc | | 0.4 | Vdc |

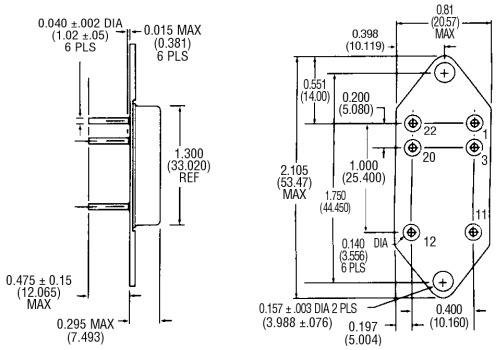
## BLOCK DIAGRAM

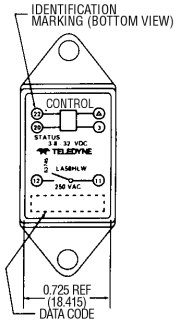



## MECHANICAL SPECIFICATIONS




**KA SERIES**




ENCLOSURE: Hermetically Sealed DIP
LEAK RATE: 1 x $10^{-8}$ CC/Sec Maximum
MATERIAL: Header - Cold Rolled Steel Nickel Plated
Pins - Copper Core
Can - Cold Rolled Steel Nickel Plated
WEIGHT: 20 grams max
TOLERANCE: .XX = ±.010 (±.25)
.XXX = ±.005 (±.13)

**LA SERIES**

DIMENSIONS ARE SHOWN IN INCHES (MILLIMETERS)

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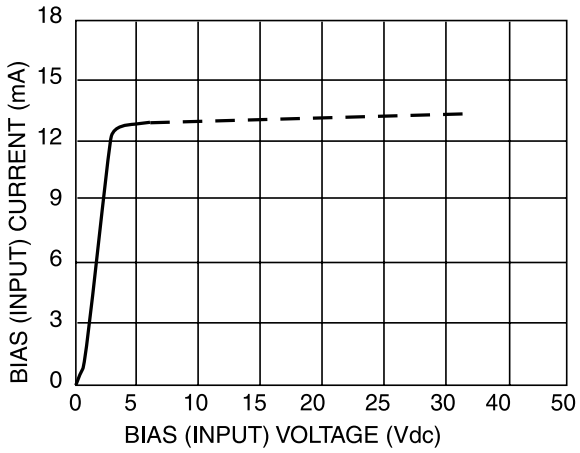
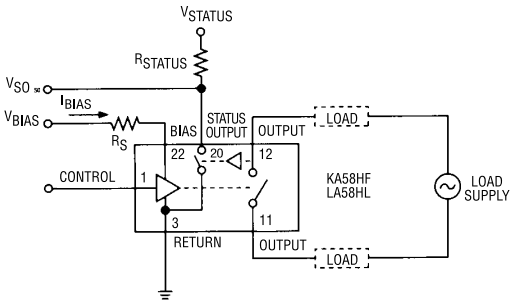
## ENVIRONMENTAL SPECIFICATIONS

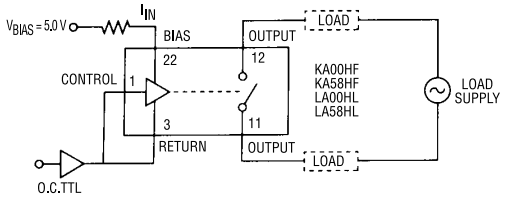
| | Min | Max | Units |
|---|---|---|---|
| Ambient Temperature | | | |
| Operating | -55 | +110 | °C |
| Storage | -55 | +125 | °C |
| Shock (0.5 ms Pulse) | | 1500 | g |
| Vibration (100 g) | 10 | 3000 | Hz |
| Acceleration | | 5000 | g |



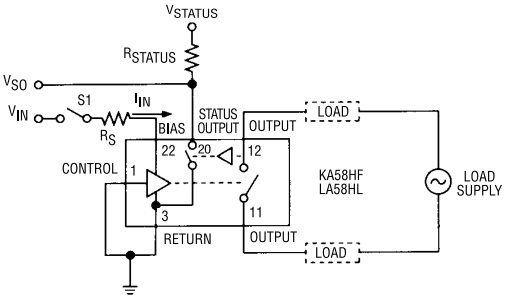

**INPUT CURRENT VS VOLTAGE**
**FIGURE 2 (SEE NOTE 2)**



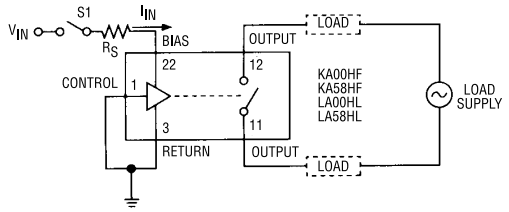

(A) 3 TERMINAL INPUT WITH STATUS (See Note 7)



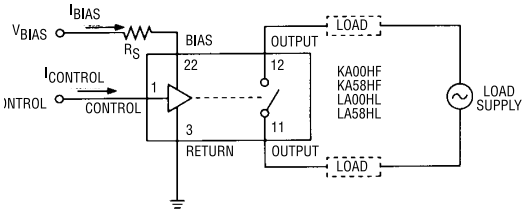

(B) 2 TERMINAL INPUT (OPEN COLLECTOR TTL DRIVE)




(C) 2 TERMINAL INPUT (DIRECT DRIVE) WITH STATUS




(D) 2 TERMINAL INPUT (DIRECT DRIVE)




(E) 3 TERMINAL INPUT WITHOUT STATUS

**WIRING CONFIGURATION**
**FIGURE 1**
**(See Note 1 & 2)**

## NOTES:

1. Control input is compatible with CMOS or open collector TTL (with pull up resistor).
2. For bias voltages above 6 Vdc, a series resistor is recommended. Use a standard resistor value equal to or less than the value found from Figure 6.
3. Unless otherwise noted, the input voltage for functional tests shall be 5 Vdc.
4. Output may temporarily lose blocking capability during and after a surge, until $T_J$ falls below maximum.
5. Transient suppression must be used to limit the voltage to < 500 Vpeak when switching inductive loads.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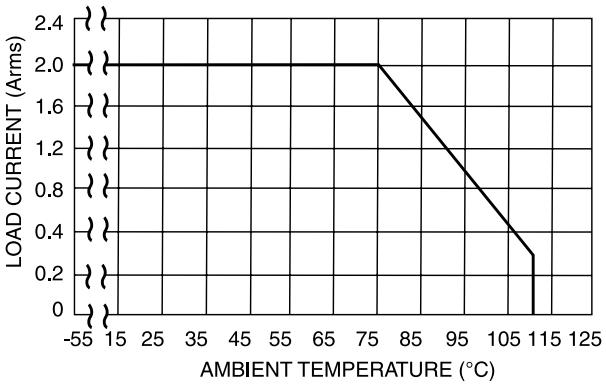
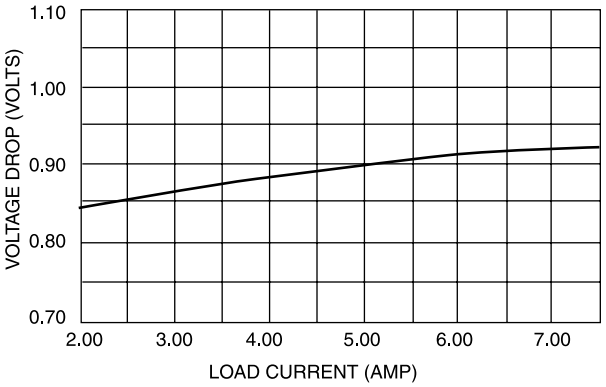
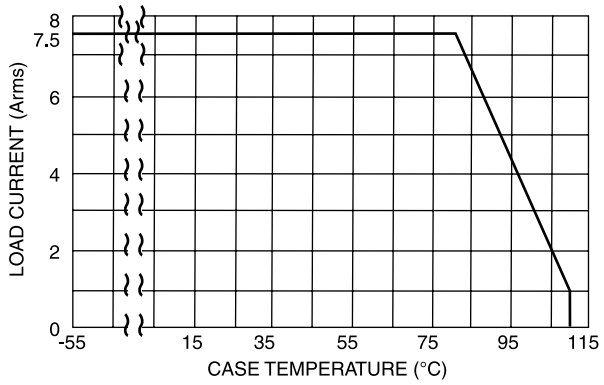


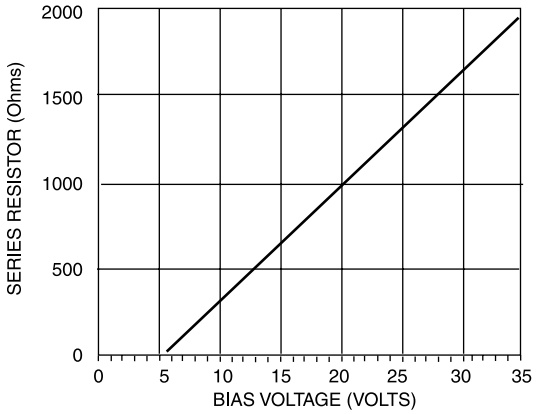

**THERMAL DERATING CURVE**
**LA SERIES / KA SERIES WITOUT HEATSINK**
**FIGURE 3 (A)**



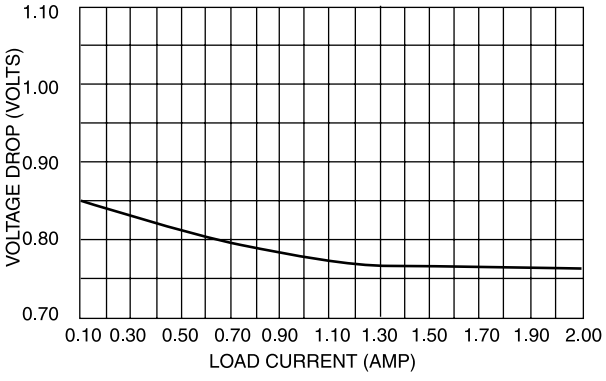

**TYPICAL VOLTAGE DROP VS LOAD CURRENT OF**
**LA SERIES WITH 1 °C/W HEATSINK**
**FIGURE 5**



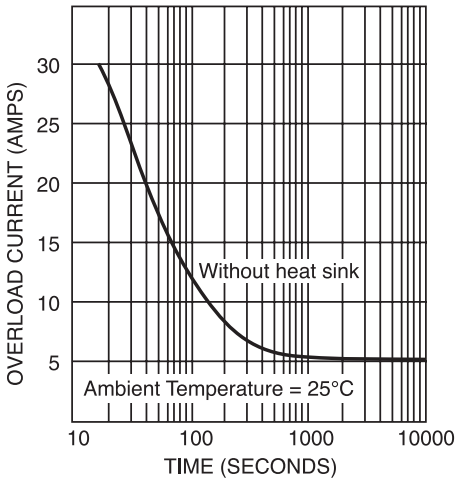

**THERMAL DERATING CURVE**
**LA SERIES WITH HEATSINK**
**FIGURE 3 (B)**




**SERIES LIMIT BIAS RESISTOR VS BIAS VOLTAGE**
**FIGURE 6 (SEE NOTE 2)**




**TYPICAL VOLTAGE DROP VS LOAD CURRENT OF**
**LA SERIES WITHOUT HEATSINK**
**FIGURE 4**




**TYPICAL THERMAL TRIP TIME**
**KA58HF AND LA58HL**
**FIGURE 7**

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