DC Solid State Relay Series KD/LD

TELEDYNE RELAYS

SHORT CIRCUIT PROTECTED OPTICALLY ISOLATED, 10A, 60 VDC

Part Number	Relay Description
KD00CK	5 A Solid State Relay (SSR)
KD02CK	5 A SSR with Switch Status
KD20CK	5 A SSR with Short Circuit Protection
KD22CK	5 A SSR with Short Circuit Protection and Switch Status
LD00CM	10 A Solid State Relay
LD02CM	10 A SSR with Switch Status
LD20CM	10 A SSR with Short Circuit Protection
LD22CM	10 A SSR with Short Circuit Protection and Switch Status

* The Y suffix denotes parameters tested to MIL-R-28750 specifications.
The W suffix denotes parameters tested to Teledyne specifications.

ELECTRICAL SPECIFICATIONS
(-55°C TO +105°C UNLESS OTHERWISE NOTED)

INPUT (CONTROL) SPECIFICATION

When used in 2 terminal configuration
(TTL or direct control) (See Fig. 1)

	Min	Typ	Max	Units
Input Current @ V_{BIAS} = 5 Vdc (See Fig. 2)		14	15	mAdc
Turn-Off Voltage (Guaranteed Off)			1.5	Vdc
Turn-On Voltage (Guaranteed On)	3.8			Vdc
Reverse Voltage Protection			-32	Vdc
Input Supply Range (See Note 1)	3.8		32	Vdc

INPUT (CONTROL) SPECIFICATION

When used in 3 terminal configuration
(CMOS or open collector TTL) (See Fig. 1)

		Min	Typ	Max	Units
Control Current	$V_{CONTROL}$ = 5 Vdc			250	µAdc
	$V_{CONTROL}$ = 18 Vdc			1	mAdc
Control Voltage Range		0		18	Vdc
Bias Supply Voltage (See Note 1)		3.8		32	Vdc
Bias Supply Current			14	16	mAdc
Turn-Off Voltage (Guaranteed Off)		3.2			Vdc
Turn-On Voltage (Guaranteed On)				0.3	Vdc

FEATURES
- Available with short circuit/current overload protection
- Available with switch status output
- TTL and CMOS compatible control
- Low ON resistance power FET output
- Fast switching speed
- Meets 28 Vdc system requirements of MIL-STD-704
- Optical isolation
- Low profile hermetic package
- Built and tested to the requirements of MIL-R-28750

DESCRIPTION
The KD and LD series solid state relays are screened utilizing MIL-R-28750 test methods and are packaged in low profile hermetically sealed cases. These relays are constructed with state-of-the-art solid state techniques and feature fully floating power FET output technology. This allows the load to be connected to either output terminal and provides a low ON resistance. The input (control) and output are optically isolated to protect input logic circuits from output transients. Available options include short circuit and current overload protection, which provides complete protection for both the relay and system wiring. This feature not only provides protection should a short or overload occur while the relay is on, but will also provide protection should the relay be switched into a short. The second option is a status output line. Switch status returns the true status of the output switch and is optically isolated from the load. It provides status indication independent of the control circuit of the relay. The status line provides a logic 0 (low) when the relay output is off with load voltage and continuity present, and a logic 1 (high) when the output is on. These options are available either together or separately as standard features.

TELEDYNE RELAYS

DC

OUTPUT (LOAD) SPECIFICATIONS

(See Note 2)

|		Min	Typ	Max	Units
Continuous Load Current (See Fig. 3)	KD and LD series without heat sink			5	Adc
	LD series with heat sink			10	
Leakage Current V_{LOAD}=60Vdc	KD00CK, KD20CK LD00CM, LD20CM			100	µA
	KD02CK, KD22CK LD02CM, LD22CM			2	mA
Output Voltage Drop	KD00CK, KD02CK KD20CK, KD22CK			.60 .70	Vdc
	LD00CM, LD02CM LD20CM, LD22CM			1.2 1.4	
Continuous Operating Load Voltage				60	Vdc
Transient Blocking Voltage				80	Vdc
ON Resistance I_{LOAD} = 100 mA	KD00CK, KD20CK LD00CM, LD20CM			.075	Ohms
T_J = 25°C (See Fig. 4)	KD20CK, KD22CK LD20CM, LD22CM			.100	
Turn-On Time (See Fig. 5)				5	ms
Turn-Off Time (See Fig. 5)				2	ms
Electrical System Spike				±600	Vpk
Output Capacitance at 25 Vdc, 100 KHz				1600	pF
Isolation (Input to Output)	KD00CK, KD20CK LD00CM, LD20CM			10	pF
	KD02CK, KD22CK LD02CM, LD22CM			15	
Dielectric Strength			1000		Vac
Insulation Resistance @ 500 Vdc			10^9		Ohms
Output Junction Temperature @ I_{LOAD} = $I_{MAX\ RATED}$				130	°C
Maximum Junction Temperature				150	°C
Thermal Resistance Junction to Ambient (θ_{JA})				30	°C/W
Thermal Resistance Junction to Case (θ_{JC})				7	°C/W

BLOCK DIAGRAM
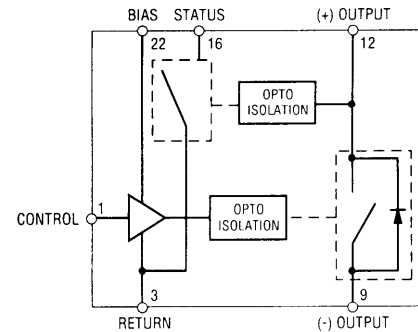
WITH STATUS
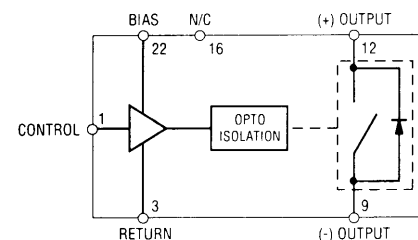
NO STATUS

MECHANICAL SPECIFICATIONS

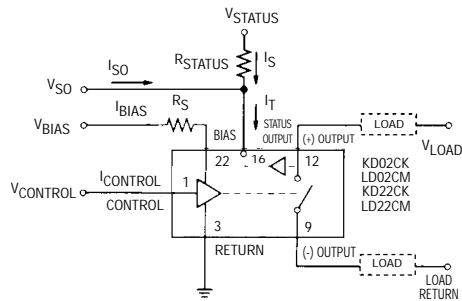DIMENSIONS ARE SHOWN IN INCHES (MILLIMETERS)
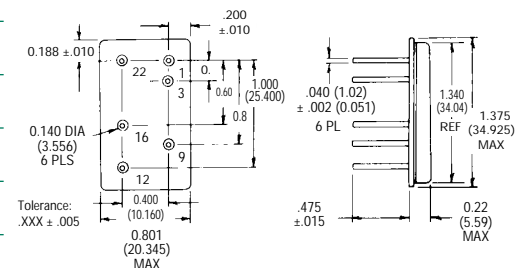
K PACKAGE
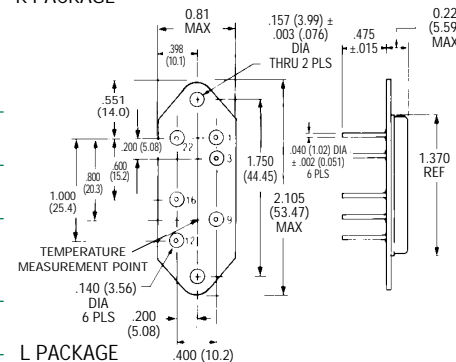
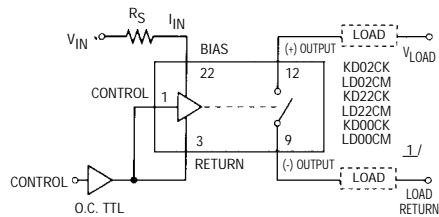
L PACKAGE

- Enclosure: Hermetically Sealed DIP
- Leak Rate: 1 x 10^{-8} CC/Sec Maximum
- Material: Header: Cold Rolled Steel Nickel Plated
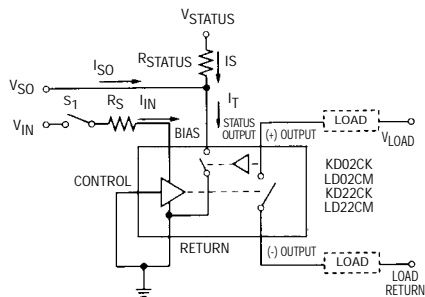 Pins Copper Core
- Weight: 20 grams
- Tolerance: .XXX ± .005

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE
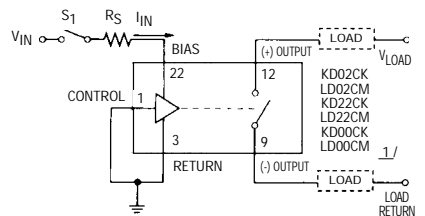
◥ TELEDYNE RELAYS

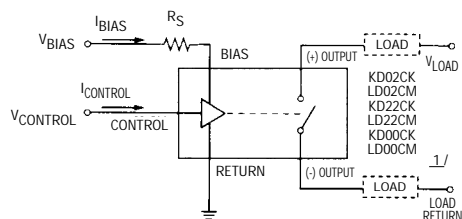(A) 3 TERMINAL INPUT WITH STATUS (See Note 5)

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

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

(D) 2 TERMINAL INPUT (DIRECT DRIVE)

1/ KD02CK, KD22CK, LD02CM and LD22CM may be wired without the status line as shown in (B), (D) and (E) above.

(E) 3 TERMINAL INPUT WITHOUT STATUS

WIRING CONFIGURATIONS

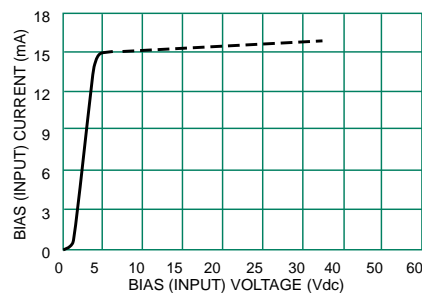**FIGURE 1 (See Note 1)**

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	Operating	-55°C to +105°C
	Storage	-55°C to +125°C
Vibration		100 g, 10 to 3000 Hz
Constant Acceleration		5000 g
Shock		1500 g, 0.5 ms pulse

STATUS OUTPUT TRUTH TABLE
(KD02CK, LD02CM, KD22CK, LD22CM)

Control Voltage	Relay Output State	Status Output Level
High	Off	Low ($V_{SO} \leq 0.4$ Vdc)
Low	On	High ($V_{SO} = V_{STATUS}$)

STATUS OUTPUT SPECIFICATIONS
(KD02CK, LD02CM, KD22CK, LD22CM)

	Min	Typ	Max	Units
Status Supply Voltage			30	Vdc
Status Leakage Current @ 15 Vdc			10	µAdc
Status (sink) Current ($V_{SO} < 0.4$ Vdc)			600	µAdc
Status Turn-On Time (See Fig. 6)			3.5	ms
Status Turn-Off Time (See Fig. 6)			8.0	ms

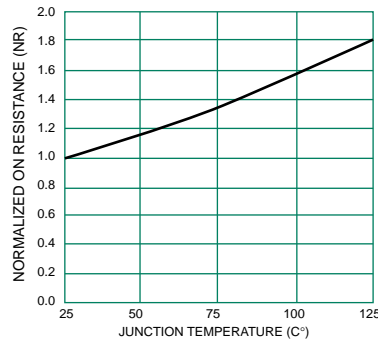**BIAS (INPUT) CURRENT VS BIAS (INPUT) VOLTAGE**
FIGURE 2 (See Note 1)
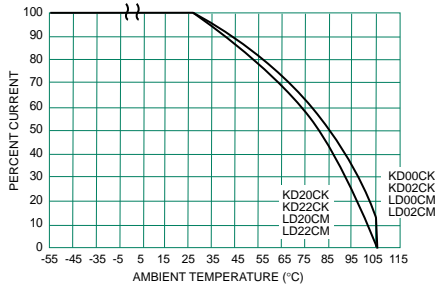
LOAD CURRENT DERATING CURVE FOR
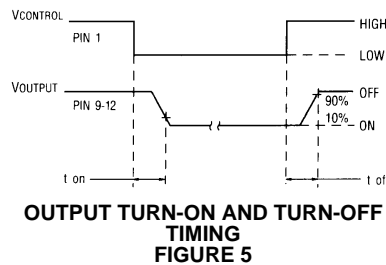KD/LD SERIES WITHOUT A HEAT SINK
(A)
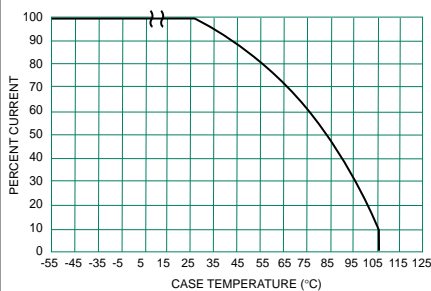
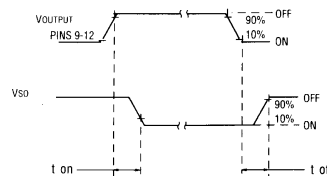LOAD CURRENT DERATING CURVE FOR
LD SERIES
(B)

**THERMAL DERATING CURVES
FIGURE 3**

**NORMALIZED ON RESISTANCE
VS JUNCTION TEMPERATURE
FIGURE 4 (See Note 3)**

**OUTPUT TURN-ON AND TURN-OFF
TIMING
FIGURE 5**

**STATUS TURN-ON AND TURN-OFF
TIMING
FIGURE 6**

**OVERLOAD CURRENT VS TIME TO TRIP
(TYPICAL)
KD20CK, KD22CK, LD20CM, LD22CM
FIGURE 7**

**SERIES LIMIT BIAS RESISTOR VS BIAS
VOLTAGE
FIGURE 8 (See Note 1)**

TURN RELAY ON INTO A SHORTED LOAD

21Apk

250uSEC

SHORT-CIRCUIT LOAD WITH RELAY ON

130ApK

250uSEC

**TYPICAL TRIP CURRENT CHARACTERISTICS
FOR SHORT CIRCUIT CONDITIONS
FIGURE 9**

NOTES:

1. Control input is compatible with CMOS or open collector TTL (with pull up resistor). For bias voltages above 6V, a series resistor is required. Use the standard resistor value equal to or less than the value found in Figure 8.
2. The rated input voltage is 5V for all tests unless otherwise specified.
3. To calculate the maximum ON resistance for a given junction temperature, find the normalized ON resistance factor (NR) from Figure 4. Calculate the new ON resistance as follows:

$$R_{(ON)} = NR \cdot R_{ON} @ 25°C$$

(KD00CK, LD00CM, KD02CK, LD02CM)

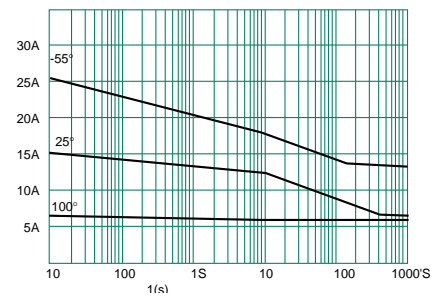$$R_{(ON)} = NR(R_{ON} @ +25°C) + .025 \text{ ohm}$$

(KD20CK, LD20CM, KD22CK, LD22CM)

4. Overload testing to the requirements of MIL-R-28750 is constrained to the limits imposed by the short circuit protection characteristics as defined in this specification. System series inductance for "shorted-load" mode of operation should be 50 µH. Maximum repetition rate into a shorted load should not exceed 10 Hz.
5. A status pull up resistor is required for proper operation of the status output. Determine the current (Iso) required by the status interface. Calculate the current (Is) through the status resistor such that the sink current through the status output is 0.6 mA. Select the status resistor such that it does not allow more than 0.6 mA to flow through the status output.
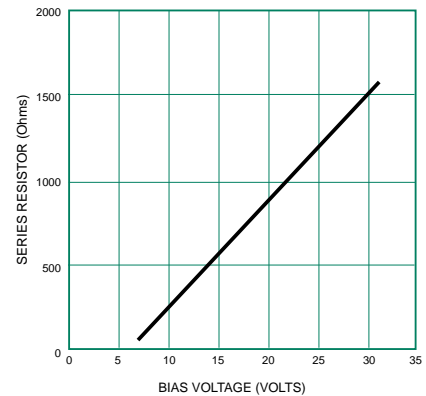
$$R_{STATUS} = \frac{V_{STATUS} - 0.4V}{Iso}$$

6. Inductive loads should be diode suppressed. Input transitions should be ≤ 1 ms duration and the input drive should be a bounceless contact type.
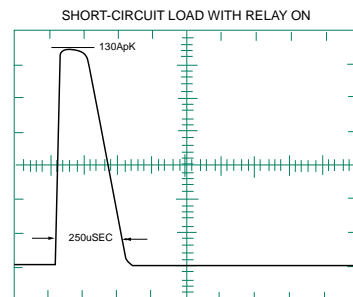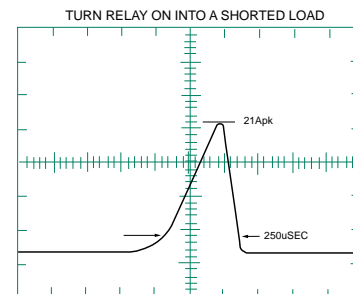
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