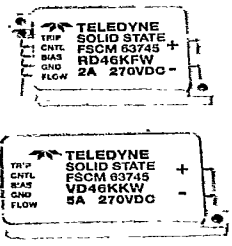
T-25-31



TELEDYNE SOLID STATE

MILITARY AND AEROSPACE SOLID STATE RELAY

270 Vdc REMOTE POWER CONTROLLER

SERIES

RD
VD

SPST/NO

FEATURES

- **Temperature-independent current rating and overload protection**
- **Trip-free short circuit protection**
- **Optical isolation**
- **Output capable of sourcing and sinking current**
- **Extremely low ON-resistance**
- **Flow and Trip status**
- **TTL and CMOS compatible control**
- **Meets 270 Vdc surge and spike requirements of MIL-STD-704D**
- **Available to the 'W' and 'Y' level screens of MIL-R-28750**

PART NUMBER*	RELAY DESCRIPTION
RD46KD	Solid State Relay 270 Vdc, 1A Power Controller
RD46KF	Solid State Relay 270 Vdc, 2A Power Controller
VD46KK	Solid State Relay 270 Vdc, 5A Power Controller

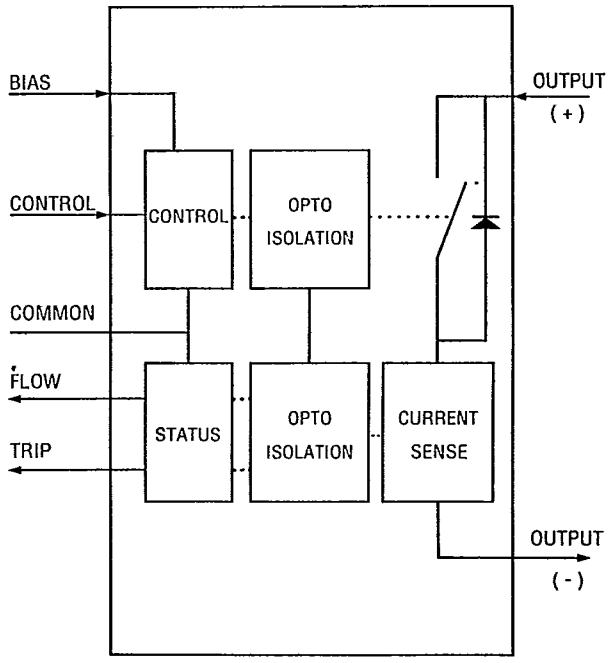
* A suffix, W or Y, denoting the screening level of MIL-R-28750, must be added to the part number.

DESCRIPTION

These state-of-the-art Solid State Relays are designed for use in Remote Power Controller applications. These relays utilize the latest technology to provide a low ON-resistance output with complete short circuit and current overload protection. In addition, status output lines for trip and flow are provided to monitor the load and provide a built-in-test (BIT) feature. The control circuit is TTL and CMOS compatible and is optically isolated from the output (load) circuit. This optical isolation allows the output to source or sink current to the load (high or low side switching).

The integrated short circuit and overload protection provides complete protection for both the relay and the system wiring. This feature not only provides protection should a short or overload occur while the relay output is on, but also if the relay is switched into a short. The output can be reset by recycling the control. The relay's trip levels and output (load) current ratings are maintained over the full operating temperature range. The trip current is inversely proportional to time, thus preventing false tripping due to current surges.

The optically isolated status lines provide direct feedback of the output state. The trip status line changes state if the relay output has automatically turned off due to a current overload or short circuit condition. The flow status line turns on if the output (load) current is greater than 10% of the rated output current. A system test (or BIT) can be accomplished by monitoring the status lines and the state of the control line as shown in the truth table.



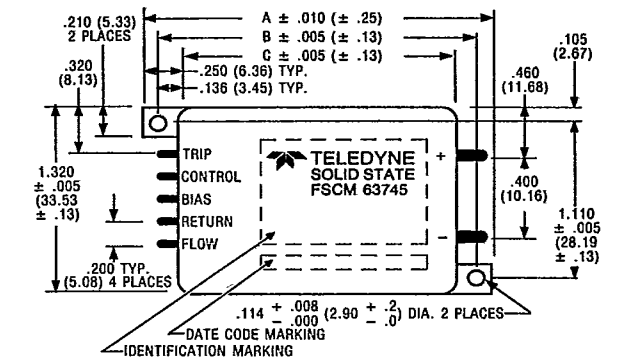
BLOCK DIAGRAM

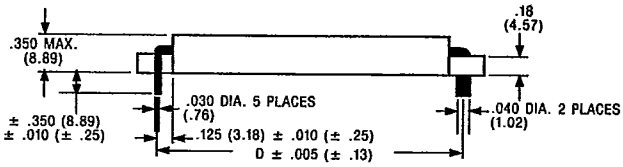
10/91

ELECTRICAL SPECIFICATIONS
(-55°C TO +105°C CASE TEMPERATURE)

INPUT CHARACTERISTICS		MIN.	MAX.	UNITS
Bias Voltage Range		4.5	5.5	Vdc
Bias Current at V_{BIAS} = 5 Vdc			45	mA
Turn-On Voltage		2.0	5.5	Vdc
Turn-Off Control Voltage		−0.5	0.8	Vdc
Control Current at $V_{CONTROL}$ = 5 Vdc			100	μA
OUTPUT CHARACTERISTICS (V_{BIAS} = 5 Vdc, V_{LOAD} (Rated) = 270 Vdc)		**MIN.**	**MAX.**	**UNITS**
Continuous Load Current	RD46KD		1	A
	RD46KF		2	A
	VD46KK		5	A
Leakage Current V_{LOAD} = 270 Vdc	RD46KD		100	μA
	RD46KF		200	μA
	VD46KK		500	μA
Load Voltage		60	300	Vdc
Surge Voltage — MIL-STD-704D			470	Vdc
Transient Voltage — MIL-STD-704A			±600	Vpk
ON-Resistance	RD46KD		0.780	Ohms
	RD46KF		0.390	Ohms
	VD46KK		0.160	Ohms
Turn-On Delay Time			0.7	mS
Rise Time			0.3	mS
Turn-Off Delay Time			0.7	mS
Fall Time			0.3	mS
Exponential Rate of Voltage Rise		100		V/μs
Rupture Current		unlimited		
Overload Current (see Figure 3)			1900	%
Trip Reset Time		50		mS
Output Capacitance	RD46KD		450	pF
	RD46KF		900	pF
	VD46KK		2250	pF
Input to Output Capacitance			30	pF
Dielectric Strength		1500		Vrms
Insulation Resistance (@ 500 Vdc)		1000		M Ohm
Junction Temperature at I max			115	°C
Maximum Junction Temperature			150	°C
Thermal Trip Temperature			145	°C
Thermal Resistance (Junction to Case)			0.5	°C/W
Thermal Resistance (Junction to Ambient)	R_{SERIES}		21	°C/W
	V_{SERIES}		19	

MECHANICAL SPECIFICATIONS





	'R' SERIES	'V' SERIES
DIM. 'A'	2.245 (57.02)	2.690 (68.33)
DIM. 'B'	2.017 (51.23)	2.462 (62.54)
DIM 'C'	1.745 (44.32)	2.190 (55.63)
DIM 'D'	1.995 (50.67)	2.440 (61.98)
WEIGHT	60 gm. max.	70 gm. max.

XXX = INCHES
(xxx) = MILLIMETERS

.xx = ±.01 (±.25)
.xxx = ±.003 (±.08)

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	Operating	−55°C to +105°C
	Storage	−55°C to +125°C
Vibration		30 g, 10 to 2000 Hz
Constant Acceleration		5000 g
Shock		100 g, 6 ms pulse

STATUS CHARACTERISTICS	MIN.	MAX.	UNITS
V_{STATUS} (L) at I_{STATUS} = 4.0 mA		0.4	Vdc
V_{STATUS} (H) at I_{STATUS} = −4.0 mA	3.7		Vdc
Flow Status Response Time		3	mS
Trip Status Response Time		1	mS

STATUS TRUTH TABLE

CONTROL VOLTAGE	FLOW STATUS	TRIP STATUS	SYSTEM STATUS
Low	Low	Low	Relay Malfunction or No Bias
Low	Low	High	Control Malfunction or Shorted Output
Low	High	Low	Relay Malfunction
Low	High	High	Normal Condition Relay Off
High	Low	Low	Trip Status Malfunction
High	Low	High	Normal Condition Relay On
High	High	Low	Output Tripped Off Overload or Short
High	High	High	Load Circuit Open or Current Less Than 10%

WIRING DIAGRAM

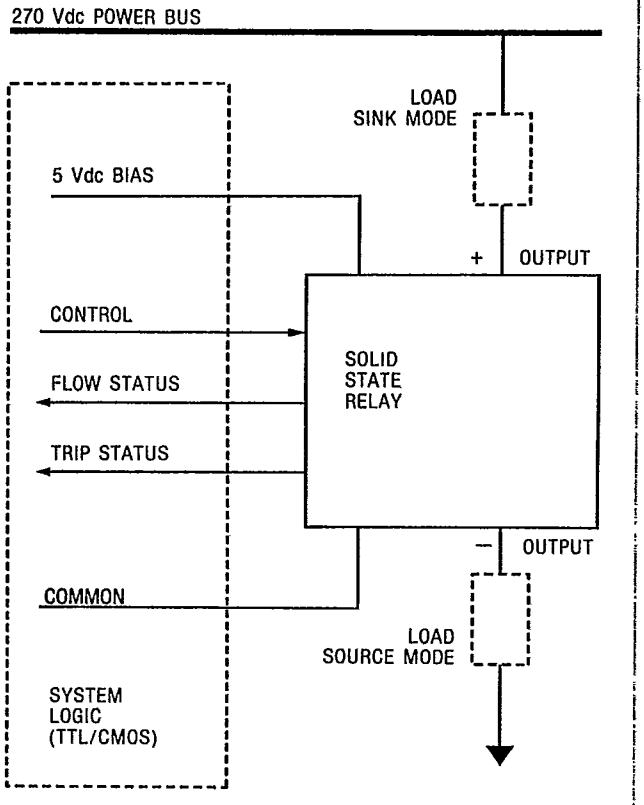
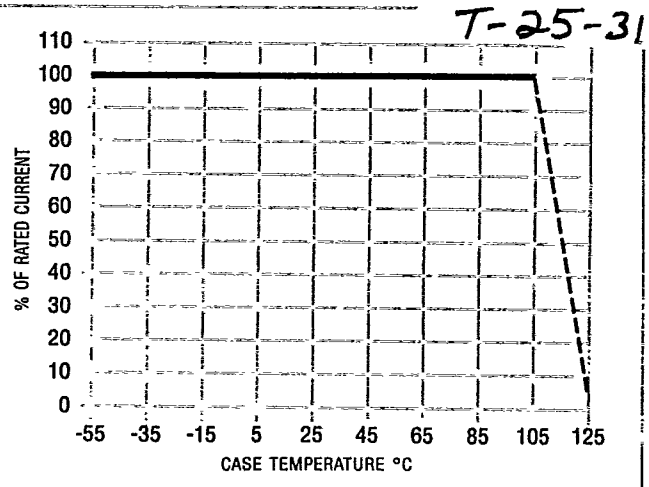
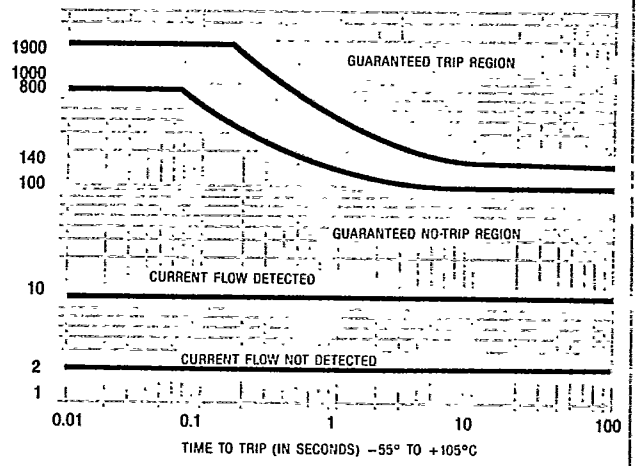


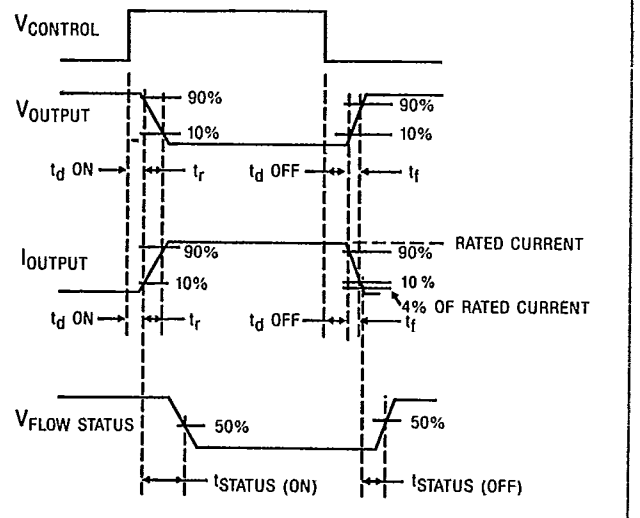
FIGURE 1



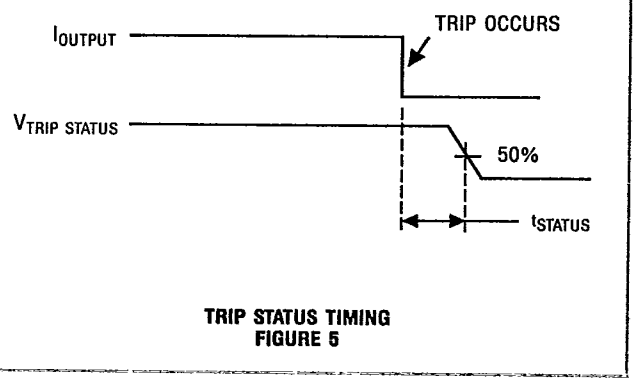
THERMAL DERATING CURVE
FIGURE 2



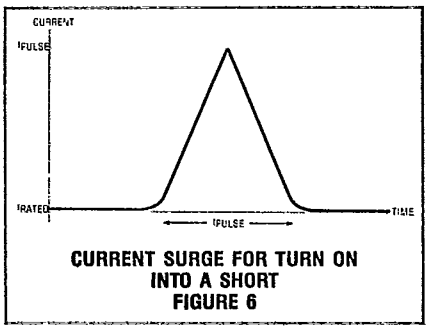
TRIP CURRENT VS. TIME
FIGURE 3



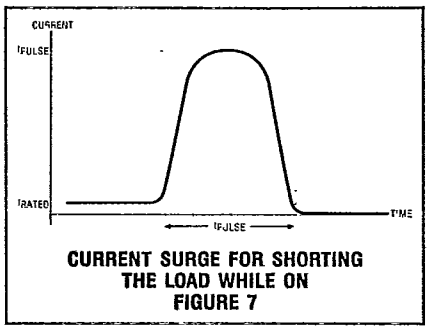
OUTPUT AND FLOW STATUS TIMING
FIGURE 4



TRIP STATUS TIMING
FIGURE 5



CURRENT SURGE FOR TURN ON INTO A SHORT
FIGURE 6



CURRENT SURGE FOR SHORTING THE LOAD WHILE ON
FIGURE 7

SHORT CIRCUIT CHARACTERISTICS	SHORTING THE LOAD WHILE ON		TURN ON INTO A SHORT	
	MAX. SURGE CURRENT A	MAX. PULSE DURATION μS	MAX. SURGE CURRENT A	MAX. PULSE DURATION μS
RD46KD	500	75	50	80
RD46KF	675	75	95	80
VD46KK	800	125	250	80

T-25-31

APPLICATION INFORMATION

The RD and VD series Solid State Relays are designed for power control applications. They are capable of switching power as well as providing complete circuit and self-protection. These Solid State Relays are ideally suited as a replacement for a mechanical contactor and circuit breaker combination.

Typical applications include:

- Load management systems
- Circuit protection device
- Power Switching
- Load monitoring systems
- Replacement for mechanical/thermal circuit breakers
- Replacement for Remote Power Controllers
- Replacement for mechanical power relays/contactors
- Replacement for Remote Controlled Circuit Breakers

The wiring diagram in Figure 1 shows a typical connection of the relay in a remote power controller application. Power can be switched to the load from either the 270 Vdc bus or ground, depending upon where the load is connected. Since the 270 Vdc power is normally applied to the output through a load, the circuit wiring, as well as the relay itself, is fully protected by the integrated short circuit/overload protection built into the relay. This feature is only present with a two terminal output, such as on these Solid State Relays.

To control the relay, a bias voltage is applied between the bias and common pins. This is typically a standard 5 Vdc TTL supply. The control and status lines are referenced to the common pin and are fully TTL and CMOS compatible. Typically, the relay would interface with system logic, such as a load management center or a remote terminal of a 1553 data bus system. A logic high on the control pin will turn the relay output on and a logic low will turn the relay output off. Toggling the control from high to low and back to high will reset the relay output in event that the short circuit or current overload trip has been activated. The flow status line will indicate a logic low when the output (load) current exceeds 10% of the rated current and a logic high when the output current is less than 2% or the rated current. The trip status line will indicate a logic low should the relay output automatically turn off due to a short circuit or current overload condition. It will remain low until the output is reset by pulling the control line low for 50 mS. The trip status line is normally high when the trip circuit has not been activated. The timing relationships for the status lines are shown in Figures 4 and 5.

The trip curve in Figure 3 shows the relationship between current and time for an overload condition. For a short circuit or very high current overload conditions, the time to trip is extremely short. For a lower current overload, such as those encountered with inrush currents, this reponse time is longer. This allows the relay to handle inrush currents without tripping. Unlike current limiter type trip circuits, these relays use a current sense circuit which does not require the relay to dissipate excessive power and heat prior to tripping. Also, the trip circuit used in these relays does not exhibit oscillations that current limit type circuit often have prior to trip. The predetermined trip levels have been set to provide circuit wiring protection in event of overloads and shorts. This level is significantly less that the I^2t ratings for standard wire gauges.

The state-of-the-art technology incorporated into these relays allows a tight tolerance on the trip current. This feature allows for consistent trip levels over the entire operating temperature range. This 'flat trip' characteristic means that the output rating is not temperature dependent, as shown in Figure 2. In addition to the 'flat trip' characteristic, these relays incorporate true short circuit protection and are not damaged by a direct short, thus allowing for unlimited rupture current. Unlike other circuit protection/power control devices, these relays are not damaged by the true short circuits that can occur in real systems.

TELEDYNE SOLID STATE
A Division of Teledyne Relays
12525 Daphne Avenue
Hawthorne, California 90250
(213) 777-0077