PRELIMINARY DATA SHEET

53246

RADIATION TOLERANT 40VDC – 2A SOLID STATE RELAY

Mii

HYBRID MICROELECTRONICS PRODUCTS DIVISION

Features:	**Applications:**
• This Design Tested to 100 krad (Si) Total Dose • Hermetically Sealed in Surface Mount Package • Low On-resistance • 2A Continuous Output Current • Operation over Full Military Temperature Range -55°C to +125°C • Optically Coupled • Input/Output Isolation Tested to 1000 VDC • Shock and Vibration Resistance	• Satellite/Space Systems • Military/High Reliability Systems • Power Distribution/Switching • Solenoid Driver • Stepper Motor Driver • Switching Heaters

DESCRIPTION

The 53246 is a SPST, radiation tolerant, DC solid-state relay (SSR) designed for military and space applications. This light-weight device is resistant to damage from severe shock and vibration, and is immune to contact related problems inherent in electro-mechanical relays. The SSR is enclosed in a hermetic metal package to ensure reliability in harsh environments. Effective isolation of 1000 VDC between control and load circuits is achieved through the use of optical coupling.

Functionally, the device operates as a single-pole single-throw, normally open (1 Form A) DC solid-state relay. The SSR is actuated by an input current of 5 to 15 mA, which can be supplied from standard logic types such as a standard TTL device. Output is provided by a power MOSFET exhibiting very low $R_{DS(ON)}$ and capable of carrying a continuous current of 2 amperes. This design has demonstrated it will function with minimal degradation after exposure to 100 krad (Si) total dose. The 53246 is available in a variety of quality levels from COTS to class K including any custom screening requirements. The basic data sheet part is environmentally screened to H level in accordance with Table C-IX of MIL-PRF-38534.

ABSOLUTE MAXIMUM RATINGS

Output Voltage .... 50 VDC
Continuous Output current .... 2 A
Peak Output Current (1) .... 19 A
Storage Temperature Range .... -65°C to +150°C
Operating Junction Temperature .... -55°C to +150°C
Lead Solder Temperature, for 10 seconds .... 300°C
Continuous Input Current .... 20 mA
Peak Input Current (2) .... 100 mA
Reverse Input Voltage .... 6 VDC
Power Dissipation (3) .... 20 W
Linear Derating Factor .... 0.15 W/°C

WEIGHT: 3.7 grams (typical

RECOMMENDED OPERATING CONDITIONS:

Parameter	Symbol	Min.	Max.	Units
Output Voltage	$V_{O\ (OFF)}$		40	VDC
Continuous Output Current	$I_{O\ (ON)}$		2	A
Input Current (on)	$I_{F\ (ON)}$	5	15	mA
Input Voltage (off)	$V_{F\ (OFF)}$	0	1	VDC
Operating Case Temperature	T_C	-55	125	°C

ELECTRICAL SPECIFICATIONS (Pre-Irradiation)

T_C= -55°C to +125°C unless otherwise specified

Parameter	Symbol	Min.	Typ.*	Max.	Units	Test Conditions	Notes
Output On-Resistance	$R_{(ON)}$	—	.032	.060	Ω	I_F = 15 mA I_O = 1 A	
Output Leakage Current	$I_{O\ (OFF)}$	—	<1	250	µA	V_F = 1 VDC V_O = 50 VDC	
Input Forward Voltage	V_F	3.10	3.75	4.20	VDC	I_F = 15 mA	
Input Reverse Breakdown Voltage	V_R	6	40	—	VDC	I_R = 10 µA	
Input-Output Leakage	I_{I-O}	—	—	1	µA	RH ≤ 45%, t = 5 s V_{I-O} = 1000 VDC T_C = 25°C	4, 5
Turn-On Time	t_{ON}	—	2.8	8.0	ms	I_F = 15 mA I_O = 10 A V load = 40 VDC Pulse width = 10 ms Duty cycle ≤ 1%	Figures 3, 4
Turn-Off time	t_{OFF}	—	61	80	ms		Figures 3, 5
Rise Time	t_R	—	2.1	6.0	ms		6, Figure 3
Fall Time	t_F	—	31	50	ms		
Thermal Resistance (junction-case)	θ_{JC}	—	5.5	—	°C/W		
Output Off-Capacitance	$C_{O\ (OFF)}$	—	1.8	—	nF	V_O = 28 VDC f = 1 MHz	
Input Capacitance	C_{IN}	—	27	—	pF	V_F = 0 V f = 1 MHz	
Input-Output Capacitance	C_{I-O}	—	3.8	—	pF	V_{I-O} = 0 V f = 1 MHz	4

* All typical values are at T_C = 25°C

Notes:

1. Non-repetitive, pulse width ≤ 10 ms, T_C = 25°C (see Figure 6).
2. Non-repetitive, pulse width ≤ 100 µs, T_C = 25°C.
3. Case Temperature T_C = 25°C (see Figure 7).
4. Input pins shorted together and output pins shorted together.
5. Input-output potential applied momentarily, not an operating condition.
6. Rise time is measured from 10% to 90% of load current (90% to 10% of V_O). Fall time is measured from 90% to 10% of load current (10% to 90% of V_O).

CAUTION:

Care should be taken so as not to exceed the maximum power dissipation and maximum junction temperature when repetitively switching loads.

INPUT	OUTPUT
ON	ON
OFF	OFF

Figure 1. Truth Table

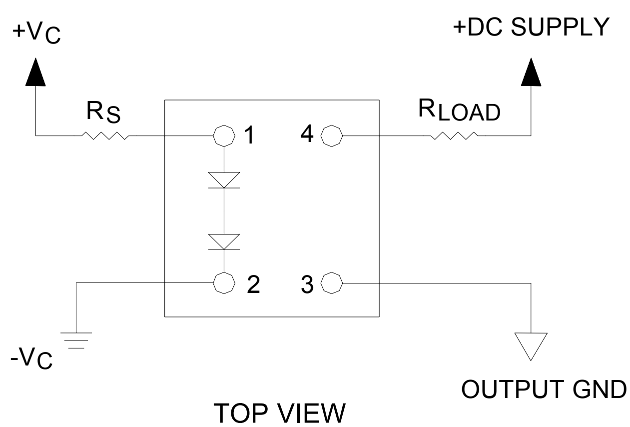

Figure 2. Terminal Connections

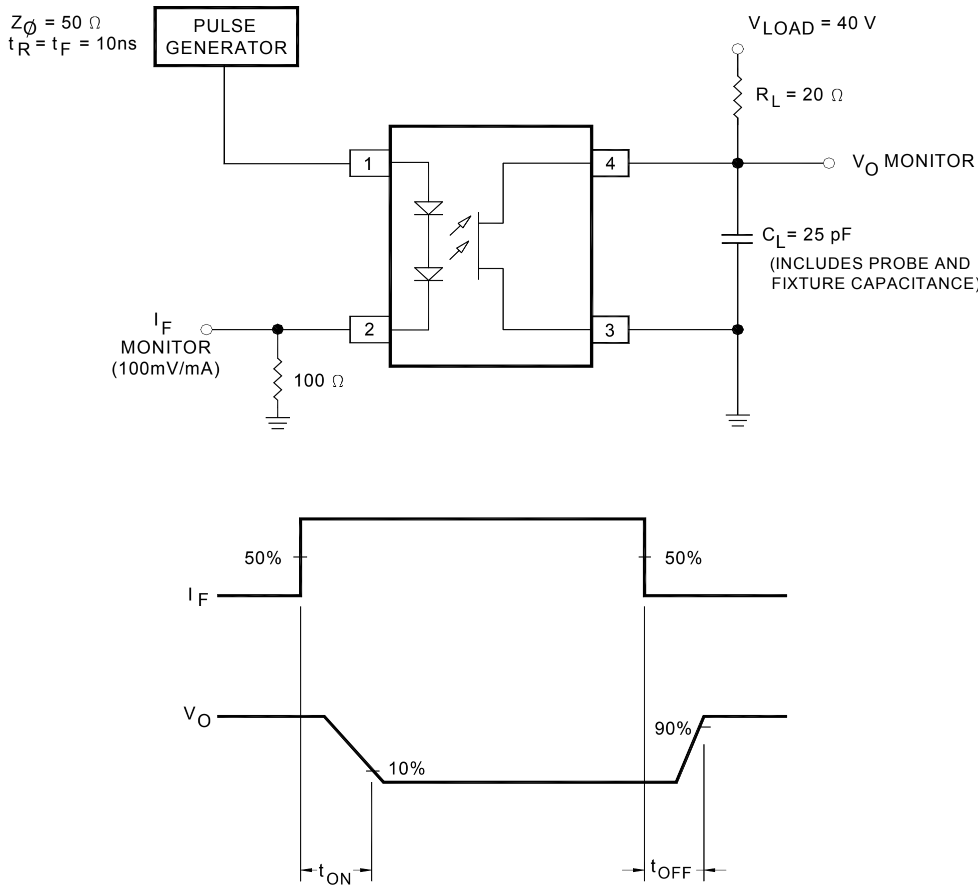

Figure 3. Switching Waveforms and Test Circuits

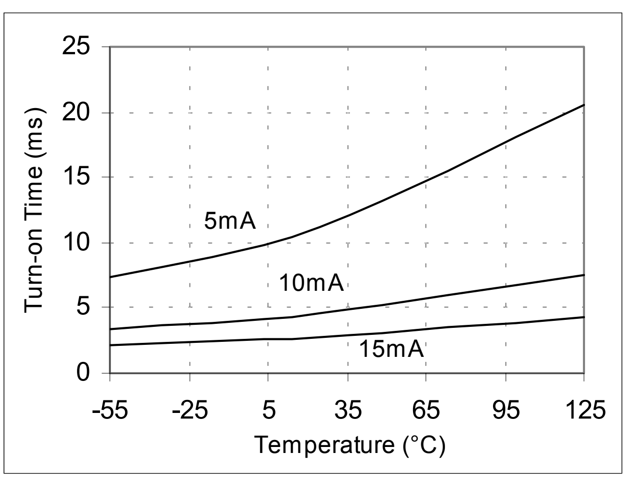

Figure 4. Turn-on Time vs. Case Temperature for Different Values of I_F (typical data).

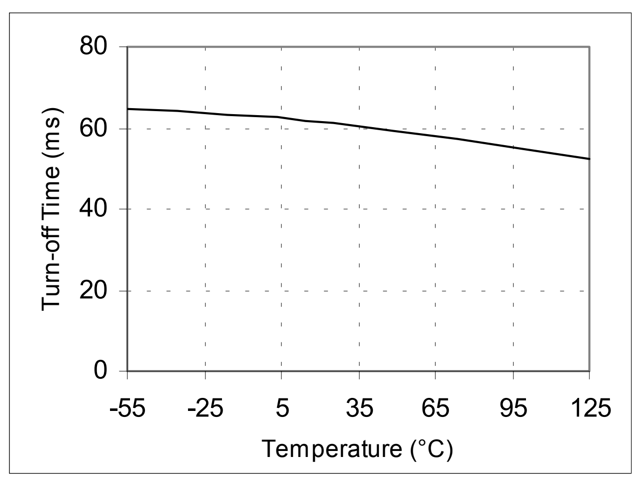

Figure 5. Turn-off Time vs. Case Temperature with I_F = 5 to 15mA (typical data).

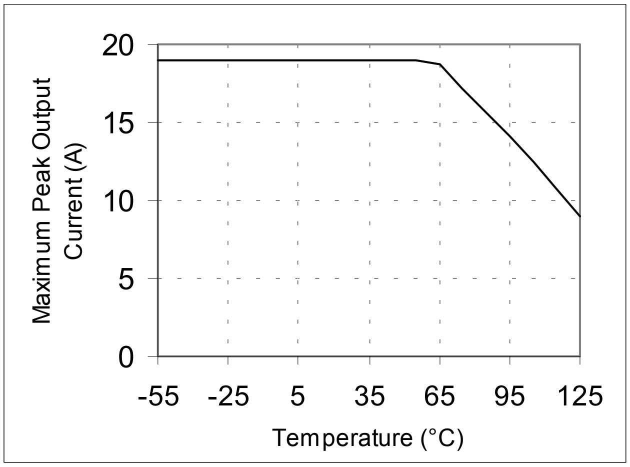

Figure 6. Maximum Non-repetitive Output Current vs. Case Temperature (pulse width ≤ 10 ms).

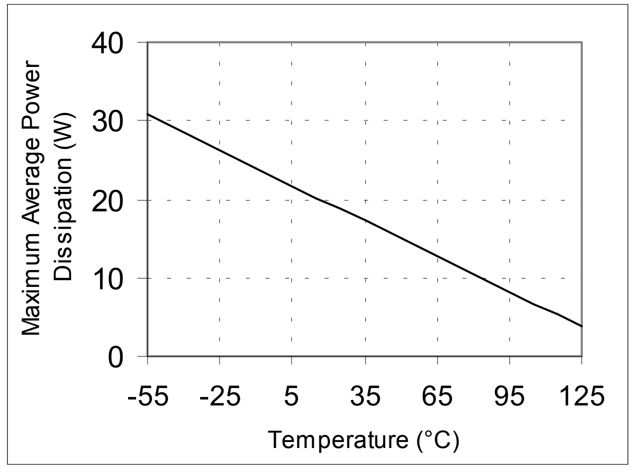

Figure 7. Maximum Average Output Power Dissipation vs. Case Temperature.

TOTAL DOSE TEST RESULTS

<u>Disclaimer:</u> The data of 3 representative units irradiated in Cobalt-60 chamber is only typical of one lot of solid state relays. Micropac does not guarantee performance of its SSR to these radiation levels. Individual lots have to be screened to guarantee the performance.

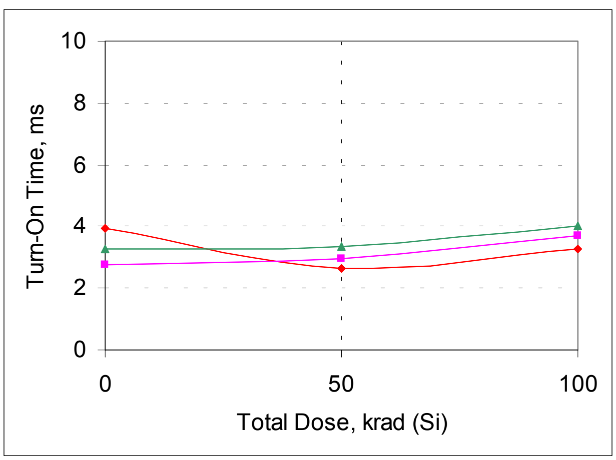

Figure 8. Turn-On Time vs Total Dose at V_{out} = 28 V, R_{load} = 35 Ω, I_{in} = 15 mA, 10% duty cycle.

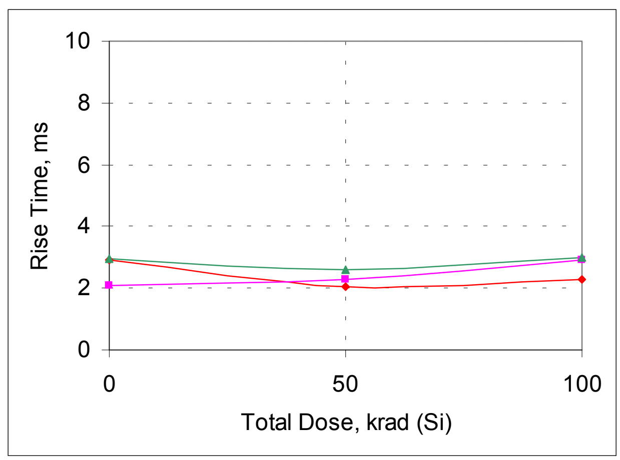

Figure 9. Rise Time vs Total Dose at V_{out} = 28 V, R_{load} = 35 Ω, I_{in} = 15 mA, 10% duty cycle.

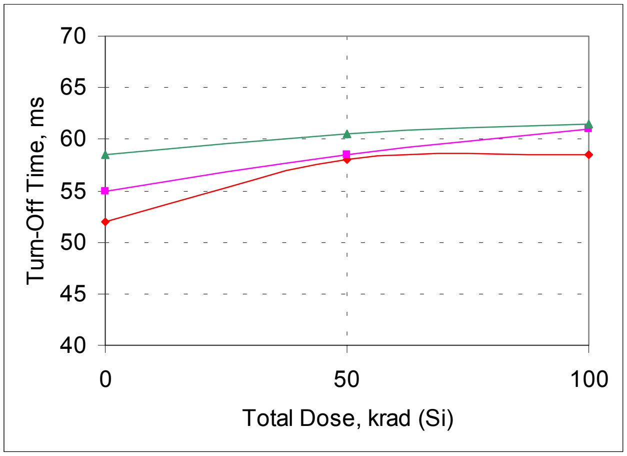

Figure 10. Turn-Off Time vs Total Dose at V_{out} = 28 V, R_{load} = 35 Ω, I_{in} = 15 mA, 10% duty cycle.

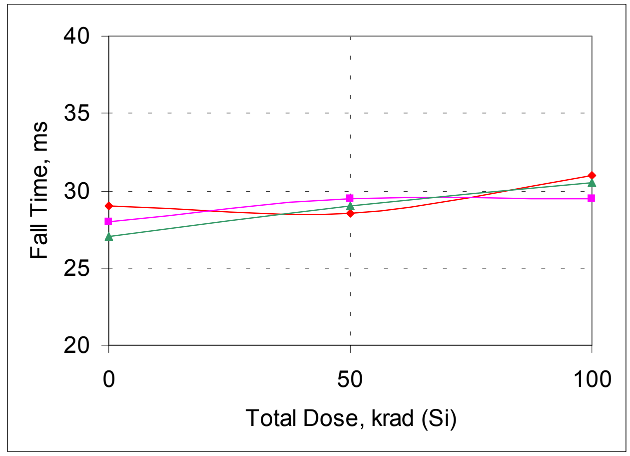

Figure 11. Fall Time vs Total Dose at V_{out} = 28 V, R_{load} = 35 Ω, I_{in} = 15 mA, 10% duty cycle.

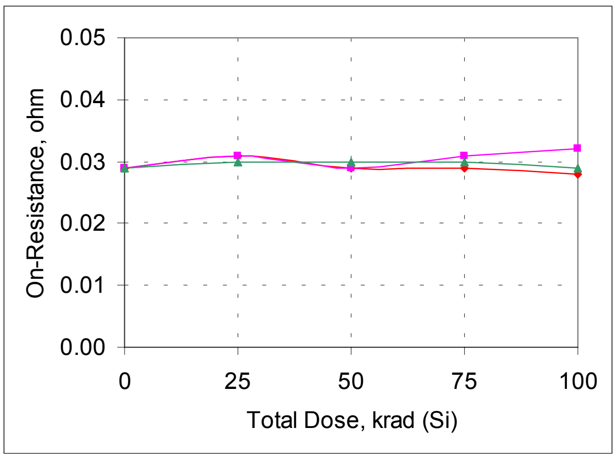

Figure 12. On-Resistance vs Total Dose at I_F =10 mA, I_{out} =100 mA for 1second.

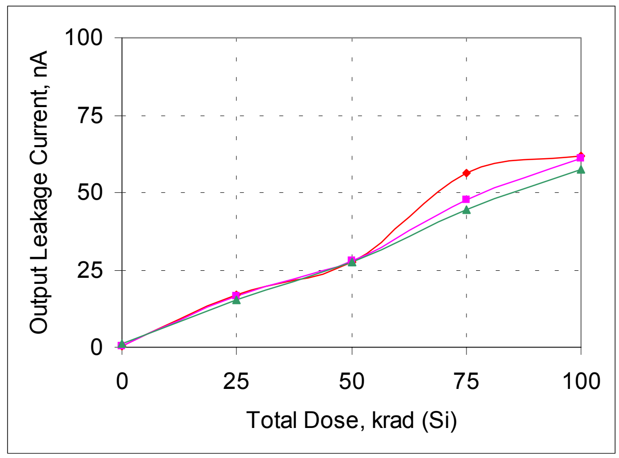

Figure 13. Output Leakage Current vs Total Dose at V_F = 1.0 V, V_{out} = 50 V.

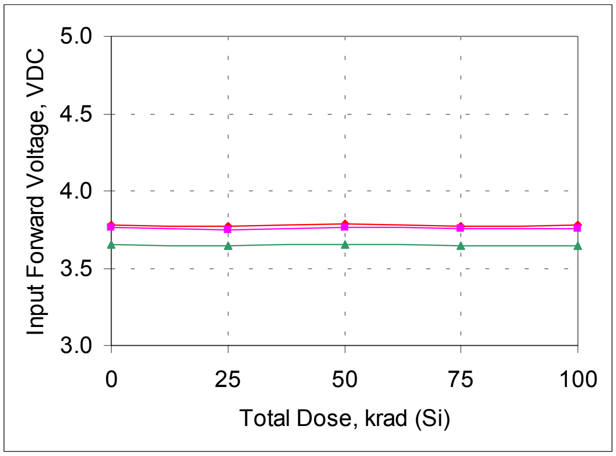

Figure 12. Input Forward Voltage vs Total Dose at I_F =15 mA.

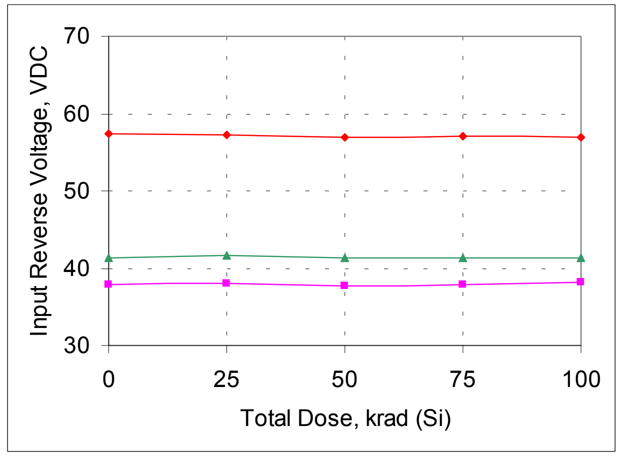

Figure 15. Input Reverse Voltage vs Total Dose at I_R = 10 µA.

CASE OUTLINE