

# The Switching Life of BOSFET® PhotoVoltaic Relays

(BOSFET is a trademark of International Rectifier)

by Bill Collins

## Introduction

All electromechanical relays have a finite switching life resulting from mechanical fatigue and contact deterioration. In contrast there is no inherent deterioration mechanism in a solid state switching device resulting from the change of state from blocking to conducting or vice versa.

The best electromechanical relays can achieve an effective life of  $10^7$  to  $10^9$  switching operations, depending on relay type and load conditions. The longest life of  $10^9$  switching operations is usually achieved by reed capsule relays, but only at light, non-inductive loads and after a burn-in screen. Applications such as Automatic Test Equipment and Scanning Multiplexing systems which require very long switching life can be best served by the inherent lack of a wear-out mechanism of solid state devices.

## The BOSFET Power IC

International Rectifier PhotoVoltaic Relay (PVR) devices use a proprietary power integrated circuit, termed a BOSFET, to overcome many limitations of electromechanical relays. A primary advantage of the PVR is the use

of the BOSFET as a solid state switch to avoid the wear-out mechanism of metallic contacts. The data reported in this application note demonstrate a minimum of 10 billion ( $10^{10}$ ) switching operations with no degradation of the PVR microelectronic devices under test.

## Test Technique

Relay Part No.: PVR3301

Sample Size: n=5 relays,  
10 poles

Switching Rate: 1 kHz

Duty Cycle: 50%

Ambient Temp: 25°C

Input Current:  $I_{LED} = 5 \text{ mA}$

Output Load: 20 mA, 500 VDC  
(1 watt resistive)

Failure Criteria: All parameters to remain within published specifications

The life test setup has five two-pole International Rectifier PVR3301 PhotoVoltaic Relays per fixture and through a timing circuit switches their inputs rapidly. The output in turn switches a load current through a resistor at the same rate. The test is operated continuously.

The selected one kilohertz rate, with

a 50% duty cycle was used so that approximately  $10^8$  operations were completed each day. Each pole was on for 500 microseconds and off for 500 microseconds for one complete period of the input timing circuit. Life test data was taken as follows:  $10^8$ ,  $10^9$  and  $10^{10}$  operations (approximately 115 days continuous operation). All specified parameters were measured at each life increment.

## Test Results

No PVR microelectronic switching device under test exhibited any failures or any parameteric drift out of tolerance.

## Conclusion

The test results demonstrate that the switching life of International Rectifier's PVR is in excess of  $10^{10}$  operations. Note the the 1 watt load is considerably higher than the load normally used with comparable tests of reed relays. The semiconductor component parts of all IR PhotoVoltaic Relays are identical. These include the Series PVR, Series PVA and Series PVD. Therefore, the expected life of each of these devices will be comparable to that of the life of the PVR3301 microelectronic relay reported in this application note. □