Principle of Operation

Each model incorporates a silicon detector (3 mm x 7 mm x 250 µm) and a pulse-processing architecture that creates a shaped pulse in response to ionizing radiation. This pulse is integrated into an accumulator circuit. The integration continues for each event until a preset limit is reached. When this happens, a Quanta of charge is removed from the integrator equal to a value of 15 µrads, and a counter value is incremented. This counter is divided into sub-groups of 8 bits which are each presented to a D/A converter. The DAC Low range gives dose as 15 µrads per 19.5 mV step, the DAC Medium range is 256 times the Low range, and the High is 256 times the Medium range. The dosimeter will retain the value of the dose for as long as it is powered. A Pseudo-Log output can be sampled at a very low rate to monitor the total dose over extended periods of time. The other DAC ranges can be sampled at higher rates to obtain useful dose rate measurements. The High LET UDOS007 Dosimeter incorporates a raised energy level input threshold. The increased minimum energy level allows for accumulating and counting higher levels of detected ionizing radiation.

Note: The dosimeter does not measure incident energy directly. The dosimeter measures the amount of energy absorbed in the silicon detector due to the energy loss of the particle as it passes through the detector volume.

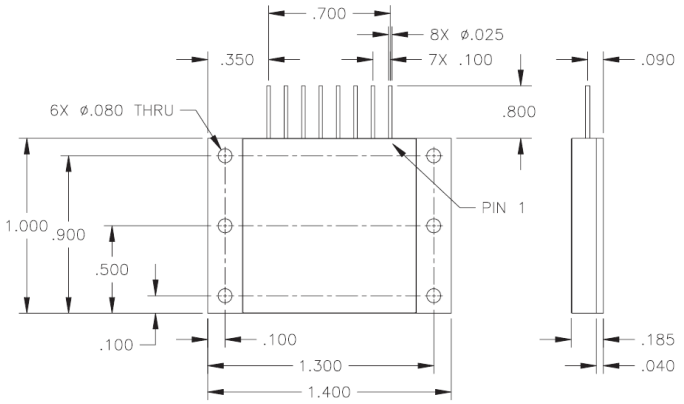
Ratings

Parameters		Symbol	Min	Max	Units
Supply Voltage		V_{CC}	13	40	Vdc
Supply Current		I_{CC}	8	12	mA
Dose Rate			1	10,000	µrad(Si)/sec
Integrated Error			-20	+20	%
Low Energy Threshold	UDOS001	E_t	60	120	keV
	UDOS007	E_r	800	1200	keV
Energy Range		E_r	E_r	15	Ev
Dose Sensitivity	UDOS001	S	14	16	µrad(Si)/step
	UDOS007	S	19	21	µrad(Si)/step
DAC Voltage Step			15	25	mV
DAC Output Voltage Swing			5		V
DAC Output Impedance			8	12	kΩ
Relative Humidity		RH	0	90	%
Operating Temperature	UDOS001	T_O	-30	+40	°C
	UDOS007	T_O	-30	+70	°C
Storage Temperature		T_S	-40	+110	°C

Pin Specifications

Pin	Description	Notes
1	Power	
2	Ground	
3	Reserved – connect to ground during normal operation	
4	N/C – should be formed and mounted	
5	DAC Output – Low Range	Low
6	DAC Output – Medium Range	Medium
7	DAC Output – High Range	High
8	DAC Output – Pseudo-Log	Log

Mechanical Configuration



Drawing shows the hermetic package, mounting flange and 8 external connections. All dimensions given are inches, tolerances ±0.005. The package walls are 0.040 inch thick, cover is 0.010 inch thick. Pin 1 is top-right in the diagram.

Radiation Survivability

Xe-beam testing done at Lawrence Berkeley Labs demonstrated latch-up immunity up to 67.8 LET (MeV-cm2/mg). Harsh proton susceptibility testing was performed using a high energy beam and UDOS001 showed no degradation up to 40 krad(Si).

DAC Output Conversions

DACx	Dose Conversion	Range
Low (Pin 5)	15 µrad(Si)/19.5 mV	0 – 3.8 mrad(Si)
Medium (Pin 6)	3.8 mrad (Si)/19.5 mV	0 – 0.98 rad(Si)
High (Pin 7)	0.98 rad(Si)/19.5 mV	0 – 252 rad (Si)
Log (Pin 8)	Detailed table will be provided upon request	0 – 40 krad(Si)

Application Notes

Grounding

The dosimeter case is electrically connected to pin 2 inside the hybrid in order to minimize electromagnetic interference on the sensitive detector electronics. Isolate the dosimeter case from structural chassis to avoid ground loops.

Supply Voltage

Ensure voltage input is stable and maintains the required voltage level. No ripple from dc converters, on board voltage supply should be clean.

Energy Threshold

The dosimeter typically will integrate the dose absorbed by the silicon detector for energy deposits in the nominal range of 100 keV to 15 MeV.

Calibration

Each dosimeter can be exposed to a known "fixed" source level of ionizing dose by the end user to calibrate the dosage input to DAC output. Positioning of the dosimeter and area shielding can be used for directional mapping of radiation events.

DAC/Log Output Resets

When any of the DAC or Log outputs reaches its maximum value of 5-volts, the output is reset to 0-volts and the next higher DAC is incremented by 1 step. If the device reaches its maximum dose (i.e., the internal dose counter reaches its maximum), the Micro Dosimeter will reset all outputs and continue stepping in response to radiation. The outputs should be buffered or connected to a high impedance ADC. During operation, the outputs should be sampled at the same time to avoid TID ambiguity.

Export Classification

The dosimeters are classified 1A999.a for export purposes.

Quality Flow

The Micro Dosimeter hybrids are built using commercial grade and military grade components. All assembled hybrids receive full electrical testing at HIGH, LOW and ROOM operating temperature ranges.

Class H-equivalent screening options are available as per the screening table below:

Class H	Screening
Hybrid Microcircuit 100% Testing	
✓	Internal visual inspection
✓	Temperature cycling 10 times from -65°C to +150°C
✓	Constant acceleration 3,000 G
✓	Burn-in 160 hours at 125°C, PDA 10%
✓	Seal (fine and gross)
✓	Electrical test at min, max and room temp
✓	External Visual

Class H Screening Table

Notes

Trademarks are the property of their respective owners.

Product Specification

The data sheet contains final data. In the event Teledyne e2v HiRel Electronics decides to change the specifications, Teledyne e2v HiRel will notify customers of the intended changes by issuing a CNF (Customer Notification Form). The information in this data sheet is believed to be reliable. However, Teledyne e2v HiRel assumes no liability for the use of this information. Use shall be entirely at the user's own risk. No patent rights or licenses to any circuits described in this data sheet are implied or granted to any third party. Teledyne e2v HiRel's products are not designed or intended for use in devices or systems intended for surgical implant, or in other applications intended to support or sustain life, or in any application in which the failure of the Teledyne e2v HiRel product could create a situation in which personal injury or death might occur. Teledyne e2v HiRel assumes no liability for damages, including consequential or incidental damages, arising out of the use of its products in such applications.

Data

Teledyne e2v HiRel requests that the Micro Dosimeter data be made available to The Aerospace Corporation for the purpose of improving space environment models used to predict radiation dose with the multitude of Micro Dosimeter data obtained from orbits.

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