

Summary of Electrical Performance of USA Site Qualification Modules

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1. Detailed Results

The full electrical test data of the completed modules can be found at

<http://www-atlas.lbl.gov/strips/modules/production.html>

All measurements satisfy the module electrical specifications.

An overview summary of the results is given in the Table below.

Module Number	Uncorrected Noise ENC (from NO)	Noise-Occupancy at 1fC	Poor Quality Channels (Inclusive Masked Channels)	Leakage Current (warm) at 500V bias
20220040200004 (Q1)	1247 - 1386	2.6e-007 – 5.5e-006	7(2)	2.255 μ A
20220040200003 (Q2)	1193 - 1333	1.9e-007 – 1.0e-006	15(5)	6.426 μ A
20220040200006 (Q3)	1190 - 1302	1.8e-007 – 1.2e-006	4(0)	1.056 μ A
20220040200007 (Q4)	1138 - 1214	1.6e-008 – 2.2e-007	13(4)	2.819 μ A
20220040200005 (Q5)	1200 - 1406	2.6e-007 – 2.4e-006	13(10)	0.492 μ A

Table 1. Overview summary of the electrical results

2. General comments

2.1 Noise and Noise-Occupancy

The results presented here have not been corrected for differing values of ASIC calibration capacitor. One effect of this is to flag a number of otherwise good channels as “partbonded” due to measured (uncorrected) noise falling slightly below the software cut during the low temperature (0 C) long term test of Q3, Q4, and Q5.

Given the normal uncertainties, the noise and noise occupancy results seem satisfactory.

2.2 S-Curves

These can be found with the electrical results. They show a standard level and shape.

2.3 Bad Channels

The numbers of bad channels is given in Table 1. The number of channels masked by the TrimRange test, which is a subset of the total number, is given in parentheses. The

remaining “bad” channels fall in one of the following categories: noisy (often due to wirebond shorts), unbonded, and low gain. Of the bad channels in Q5, seven were present at the wafer level (chips with 1 bad channel were used on the hybrid for this module). In addition, two channels were masked manually since they had high offset and the TrimRange test was not masking them automatically.

2.4 Leakage Currents

Module Q2 shows a high leakage current due to a scratch on the surface of one of the detectors. Operating the module at 350V bias for several hours or days in a dry atmosphere results in the current dropping to the level shown in the above table (see assembled module summary).

The remaining qualification modules all have leakage current within specifications.

2.5 Long-Term Cold Electrical Tests

The long-term (24 hour) cold tests at $\sim 0^{\circ}\text{C}$ (thermistors reading) and a bias voltage of 200V have been completed for all modules. The results show good long-term stability. In the case of Q1, Q4 and Q5, the characterization test at the end of the long-term run had to be re-run due to software crashes. In the case of Q2, the characterization test had to be re-run due to a SCTHV current trip at the end.

3 Comparison of Results at Different Institutes

Module Q1 and Q3 have been sent to KEK and RAL, respectively, for mechanical and electrical measurement by clusters outside the USA.