



Domino[®] Neutron Detector D411S-30-D25-V5.4

Solid-State Neutron Detection Applications

Neutron detector applications include those for homeland security (e.g., border screening), fundamental research (e.g., at neutron scattering beamlines), and industrial monitoring (e.g., personnel monitoring, water content in soil). Solid-state neutron detectors provide an alternative to the ³He-based detectors, maintaining a high thermal-neutron detection efficiency, at a fraction of the volume, mass, voltage, and power required from gas or liquid detectors.

The RDT Domino[®]

A strong demand for thin form-factor neutron detectors with the flexibility to adjust available detection area has driven RDT to offer the end-to-end pluggable Domino[®] with 4-cm² detection area, 20% to 30% thermal-neutron efficiency, less than 0.3-mW power consumption, and digital output per module. The digital outputs of the Domino[®] may also be tied together in the tiled format.

MSND[®] Technology

The detector utilizes microstructured semiconductor neutron detector (MSND[®]) technology[‡] with ⁶Li conversion to yield an adjustable thermal-neutron detection efficiency of up to 30%. Optimum HDPE moderator for ²⁵²Cf neutron source at 1-m is 3-4 cm in front and 3-6 cm behind the MSND[®] sensor.

Electronics & Interfacing

The onboard electronics package includes a preamplifier, shaping-amplifier, discriminator, analog-to-digital converter, temperature sensor, and voltage regulator.

Specifications

Detector Area: 4 cm²

ε_{thermal} : 30(±1)%@ 20°C

ε_{Cf-252} : 0.04%(no mod)

ε_{Cf-252} : ~0.1%(1in.³ mod)

I_{cont} : 120 μA

V_{input} : 2.9-5.5 V

V_{output} : 2.7 V (≥1kΩ)

Pulse width: 5-50 μs

γ-reject: 1:10⁷

Mass: 9.5 grams

Pileup limit: <33 kcps

Rad Hard: <10¹⁰ Rads/s

Deadtime: 150 μs

Tileable: yes, 1-D

Built in Temperature Sensor

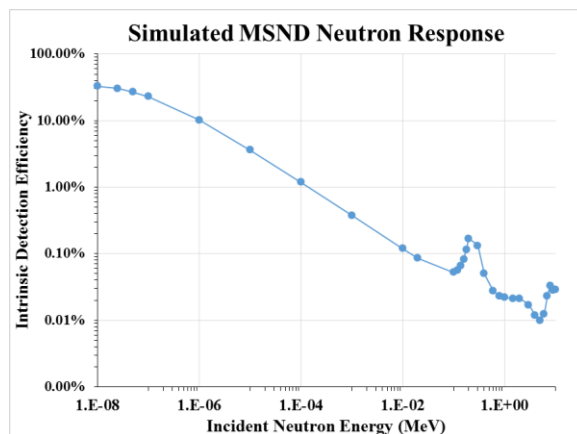
Sensitivity to Ambient Light : No

Temp. Range: -40°C to 55°C

Connector: Samtec (2mm Center)

TMM-110-01-L-S-RA-004 (male)

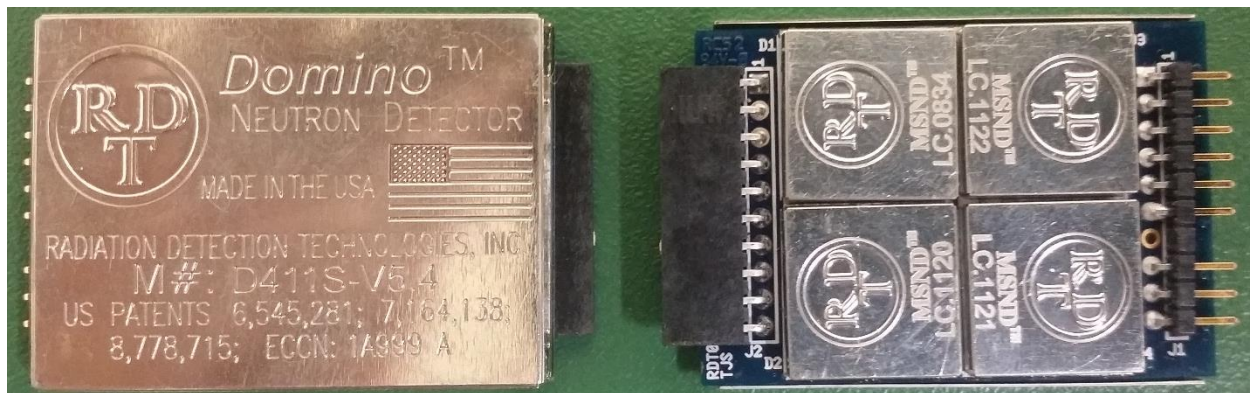
SQT-110-01-L-S-RA-007 (socket)



Website: www.radectech.com

Custom Inquiries: bellinger@radectech.com

Distributor: www.rotundascitech.com



‡US Patents 6,545,281, 7,164,138, & 8,778,715; ECCN: 1A999a



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Electronic Specifications

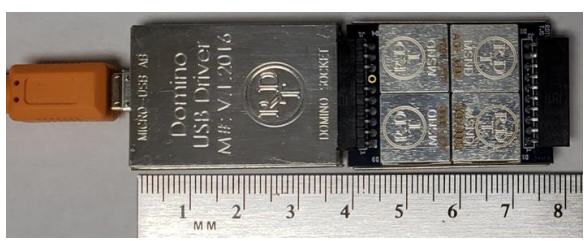
If provided power is particularly noisy, decouple the power to local ground as close as possible to the connectors (ceramic in parallel with a tantalum is always best and a series bead never hurts). Be sure to use all ground pins (tie to a plane if possible). Do not tie anything to the "Do not connect" pins. Some are used for internal diagnostics during the test process and connections may cause device failure.

| Pin # | Domino® V5.4 | |
|-------|---|--|
| | J1 MAIN CONNECTOR (Samtec TMM-110-01-L-S-RA-007) | J2 CASCADE CONNECTOR (Samtec SQT-110-01-L-S-RA-007) |
| 1 | DO NOT CONNECT | DO NOT CONNECT |
| 2 | GROUND | GROUND |
| 3 | GROUND | GROUND |
| 4 | +VDC INPUT (+2.9 VDC MIN. +5.5 VDC MAX) | +VDC CASCADE OUT |
| 5 | +VDC INPUT (+2.9 VDC MIN. +5.5 VDC MAX) | +VDC CASCADE OUT |
| 6 | SDA (+2.7 VDC) | DO NOT CONNECT |
| 7 | POLARITY KEY (CLIPPED PIN) | POLARITY KEY (PLUGGED SOCKET) |
| 8 | SCL (+2.7 VDC) | DO NOT CONNECT |
| 9 | PULSE OUT (DRIVEN - LV CMOS +2.7 VDC) | DO NOT CONNECT |
| 10 | PULSE OUT (CASCADE - OPEN DRAIN W/O INTERNAL PULL-UP) | PULSE IN CASCADE |

Accessories

- ❑ *USB Driver Board:* A great way to quickly test the Domino® detector in your lab. Connection and power is made via a standard USB Micro AB connection and interface software is provided to collect counts for a specified time period.

- ❑ *Panel Array Readout Motherboard:* Another way to panelize the Dominos® into an array. Individual Domino® strings can be readout individually or as a single unit.



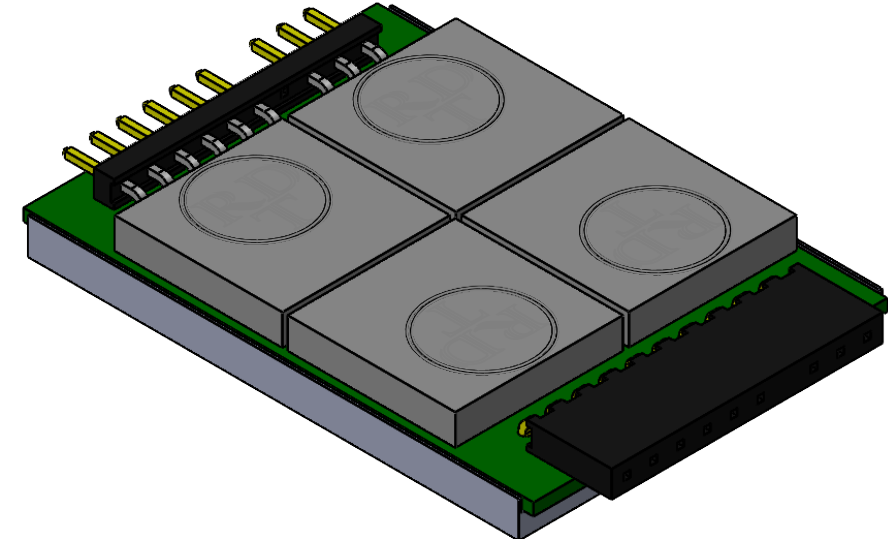
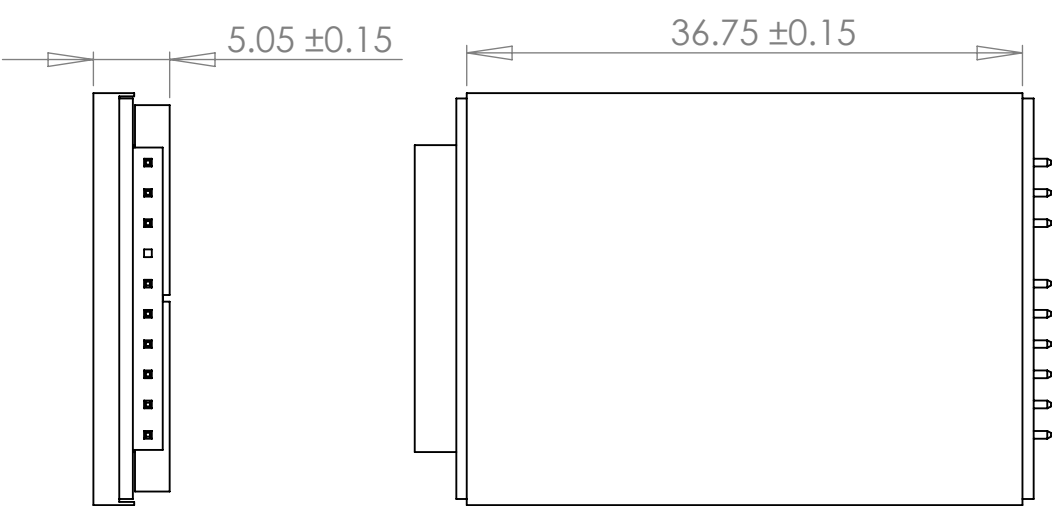
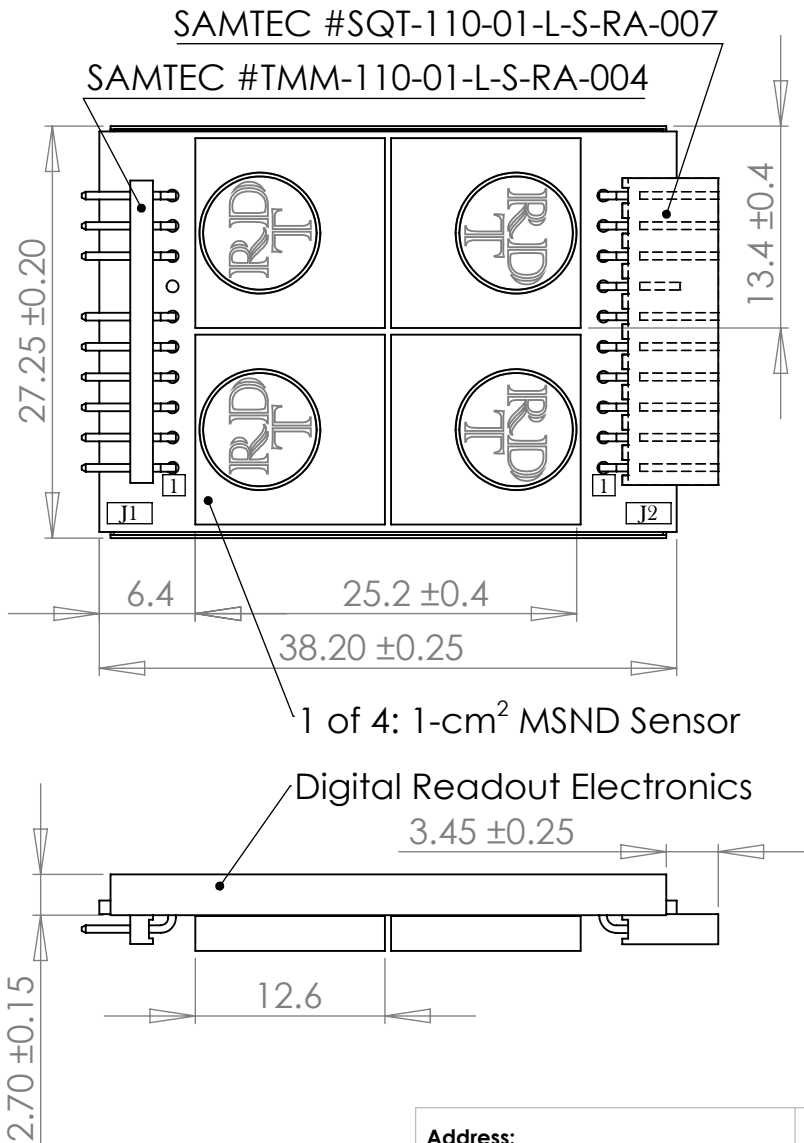
Domino[®] Neutron Detector



Radiological Sensitivity Specifications

All measurements were performed with detectors irradiated with an ANSI-Moderated Cf-252 source at 0.25-m from the source, and compared directly to the vendor-listed calibrated He-3 neutron detector.

| Model | Detector Type | Gamma-ray Reject Rate | Neutron Sensitivity | Measured Cf-252 Response | Power Req. (mW) |
|---|---|--|--|--------------------------|--|
| D411S-20-D25-V5.4 RDT Domino [®] Version 5 | Semiconductor-based detector w/ MSND [®] Technology | < 1-cpm at 75 mR/h with a Cs-137 Source; has increased gamma-ray rejection | 0.8 cps/nv ± 0.04 cps/nv [20% Th. Eff.] | 0.475 cps | 0.3-mW at 3V |
| D411S-30-D25-V5.4 RDT Domino [®] Version 5 | Semiconductor-based detector w/ MSND [®] Technology | < 1-cpm at 50 mR/h with a Cs-137 Source | 1.2 cps/nv ± 0.04 cps/nv [30% Th. Eff.] | 0.729 cps | 0.3-mW at 3V |
| Two (2) Dominos Tiled D411S-30-D25-V5.4 RDT Domino [®] Version 5 | Semiconductor-based detector w/ MSND [®] Technology | < 1-cpm at 50 mR/h with a Cs-137 Source | 2.4 cps/nv ± 0.08 cps/nv [30% Th. Eff.] | 1.417 cps | 0.6-mW at 3V |
| <u>He-3 Neutron Detector Comparison</u> | He-3 Gas-Filled Detector at 10-atm Dimensions: 0.75-in. dia. by 3-in. length | Not Reported. Measured at < 1-cpm at 50 mR/h with a Cs-137 Source. | Reported as: 5.3 cps/nv | 3.175 cps | N/A, depends on the ancillary readout electronics. |



1 of 4: 1-cm² MSND Sensor

Digital Readout Electronics

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| | | | | |
|---------------------------------------|-----------------------------|--|--|-------------------|
| Address: | UNLESS OTHERWISE SPECIFIED: | DATE | Radiation Detection Technologies, Inc. | |
| 4615 S. Dwight Dr. | DIMENSIONS ARE IN: | DRAWN (UPDATED) | TITLE: | |
| Manhattan, KS 66502 | Millimeter (mm) | 7/7/2021 | Domino V5.4 | |
| | Material: | | SIZE | DWG. NO. |
| Contact: Steven Bellinger | | COMMENTS: | A | D411S-30-D25-V5.4 |
| email: bellinger@radectech.com | | Solid-state Neutron Detector | | REV |
| Tel: O:(785) 532-7087 | | Total Detector Area: 4-cm ² | | 01 |
| | | Pulse width: 5-50 μs | SCALE: 1:1 | WEIGHT: |
| | | eth. : 30(±1)%@ 20°C | | SHEET 1 OF 1 |