

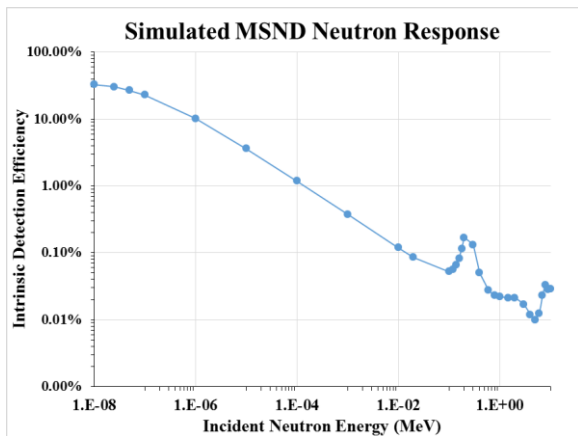


Microstructured Semiconductor Neutron Detector (MSND®)

[Updated: December 31, 2020]

Description:

The MSND® Tile technology implements ⁶Li conversion to yield a thermal neutron detection efficiency of 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.

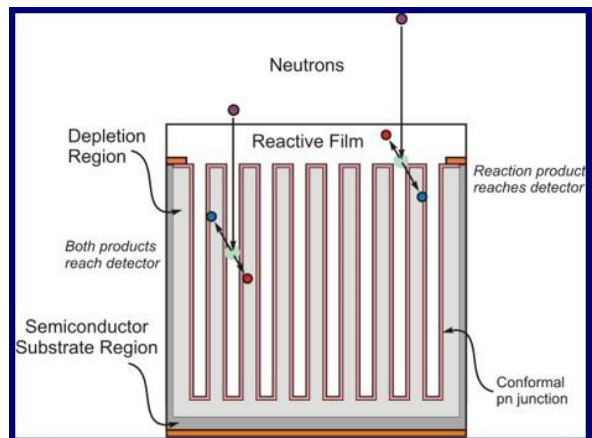


Features:

- Surface mount ceramic package
- Silver RF integrated shielding
- Thin form factor
- Dimensions: 12.6 x 12.6 x 2.4 mm
- 20-30% thermal neutron efficiency
- Low power
- Low voltage
- Solid State
- 1-cm² active area

Solid-State Neutron Detection Applications:

Neutron detector applications include those for homeland security (e.g., border screening), fundamental research (e.g., 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. Recommend AC coupling to electronic readout circuit.





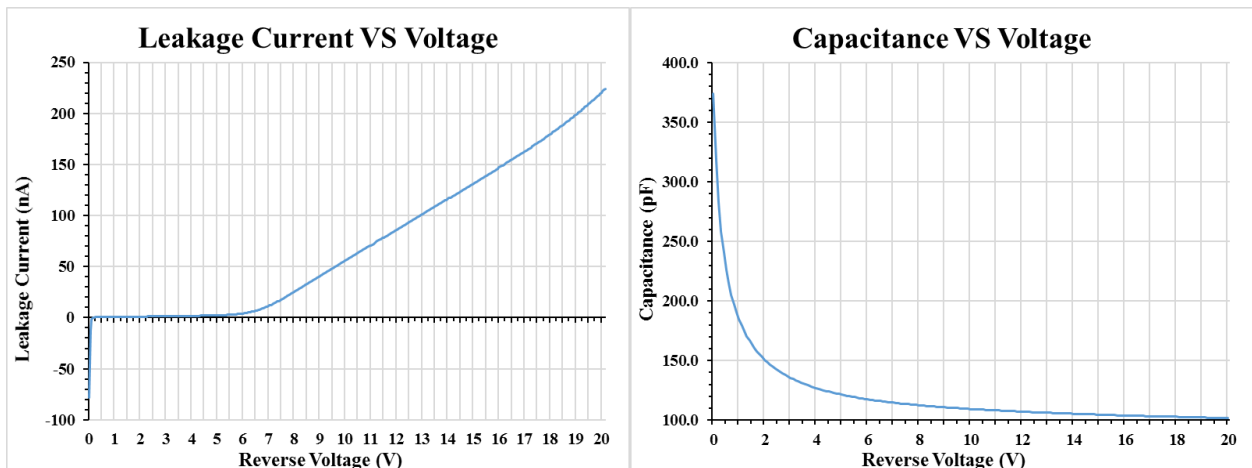
ABSOLUTE MAXIMUM RATINGS (T _a = 25°C)			
PARAMETER	SYMBOL	VALUE	UNIT
Reverse voltage	V _R	50	V
Operating temperature range	T _{amb}	-40 to 60	°C
Storage Temperature	T _{stg}	-40 to 100	°C

BASIC CHARACTERISTICS (T _a = 25°C)						
PARAMETER	TEST CONDITION	SYMBOL	MIN	TYP	MAX	UNIT
Forward Voltage	I _F = 50mA	V _F		1.05		V
Breakdown Voltage	I _R = 50μA	V _(BR)	28	60	>110	V
Diode Capacitance	V _R = 0V, f = 1MHz, E = 0	C _D		374		pF
	V _R = 5V, f = 1MHz, E = 0	C _D		121		pF
Leakage Current	V _R = 3V	I _L	3	8	20	nA
Leakage Current	V _R = 5V	I _L	17	31	240	nA
Operating Voltage	Recommended	V _R	1	2.5	5	V
Est. Average Charge Per Neutron Capture		Q _{av}		80		fC

BASIC CHARACTERISTICS (T _a = 55°C)						
PARAMETER	TEST CONDITION	SYMBOL	MIN	TYP	MAX	UNIT
Leakage Current	V _R = 2V	I _L	500	550	600	nA
Leakage Current	V _R = 3V	I _L	600	750	850	nA

BASIC CHARACTERISTICS (T _a = 60°C)						
PARAMETER	TEST CONDITION	SYMBOL	MIN	TYP	MAX	UNIT
Leakage Current	V _R = 3V	I _L	1000	1150	1500	nA

BASIC CHARACTERISTICS (T_a = 25°C)





MSND Tile Assembly Notes:

- The MSND Tile is **Moisture Sensitive MSL 5a** according to IPC/JEDEC J-STD-020. Follow IPC/JEDEC J-STD-033B handling and storage protocols.
- Solder-paste stencil mask recommendation in MSND Package Drawing below.
 - Stencil thickness recommendation is 5-mil.
 - Solder paste recommendation is Alpha OM-5100.
 - No-clean solder paste is required.
 - Do not clean the sensors in ultrasonic baths.
 - Do not use water clean solder paste, the MSND Tile is not hermetically sealed.

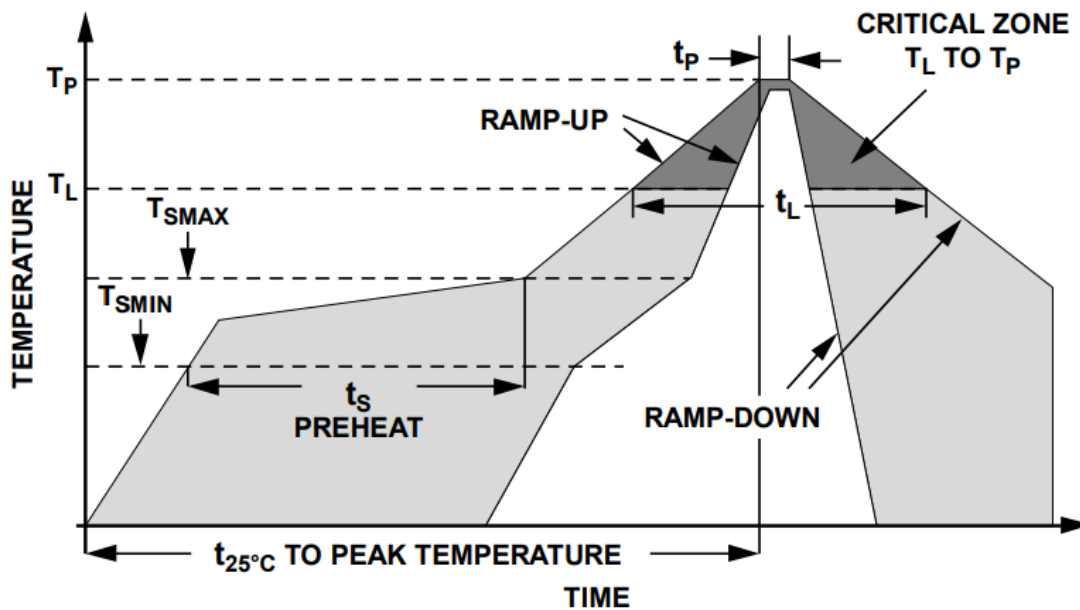


Figure 1: Recommended solder paste reflow profile for solder paste Alpha OM-5100.

Average Ramp Rate (T_L to T_P)	1°C/second
Preheat	
Minimum Temperature (T_{SMIN})	150°C
Maximum Temperature (T_{SMAX})	180°C
Time (T_{SMIN} to T_{SMAX}), t_s	150 seconds
Ramp-Up Rate (T_{SMAX} to T_L)	1°C/second
Time Maintained Above Liquidus (t_L)	70 seconds
Liquidus Temperature (T_L)	221°C
Peak Temperature (T_P)	240°C
Time Within 5°C of Actual Peak Temperature (t_p)	10 seconds
Ramp-Down Rate (T_P to T_L)	2.5°C/second
Time 25°C (t_{25°) to Peak Temperature	390 seconds



ESD CONSIDERATIONS

Establish and use ESD-safe handling precautions when unpacking and handling ESD-sensitive devices.

- Store ESD sensitive devices in ESD safe containers until ready for use. The moisture-sealed bag is an ESD approved barrier. The best practice is to keep the units in the original moisture sealed bags until ready for assembly.
- Ensure that all workstations and personnel are properly grounded to prevent ESD. Restrict all device handling to ESD protected work areas.

STORAGE SPECIFICATIONS

The MSND Tile is Moisture Sensitive MSL 5a according to IPC/JEDEC J-STD-020. Follow IPC/JEDEC J-STD-033B handling and storage protocols. This standard classifies proper packaging, storage and handling in order to avoid subsequent thermal and mechanical damage during the solder-reflow attachment phase of PCB assembly. Parts not stored in a moisture sealed container must be dehydrated before assembly to PCB. Recommended dehydration is 12 hrs under 25-in. Hg vacuum at 100C. Also see IPC/JEDEC J-STD-020 notes on dehydration of parts.

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ProtoFlow S, 0Z3001N626 // ProtoFlow test

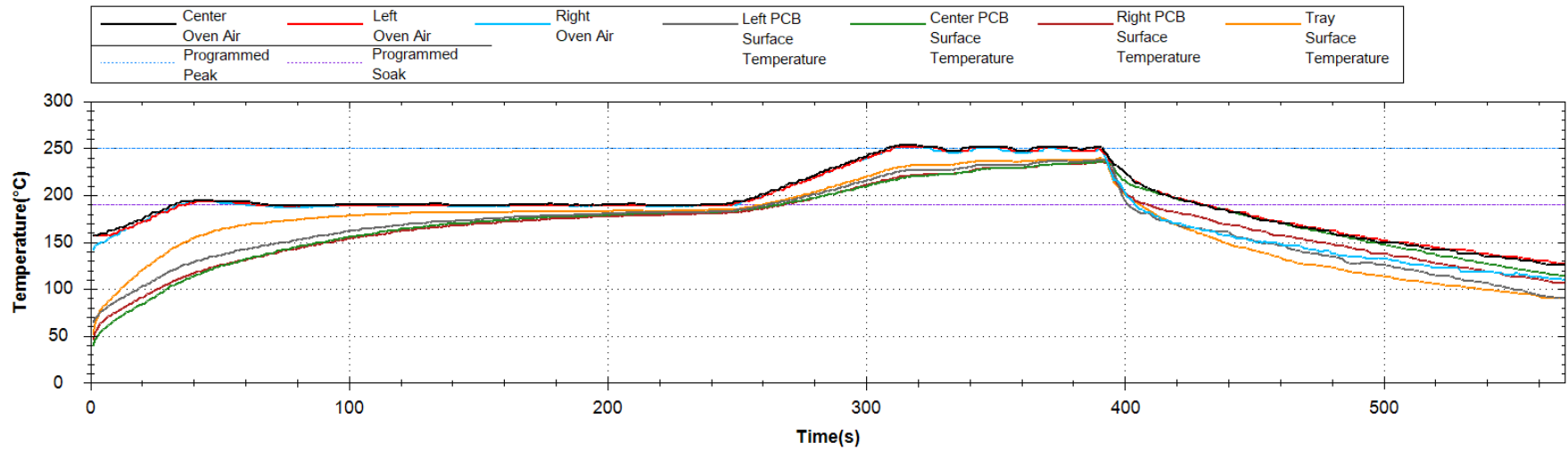
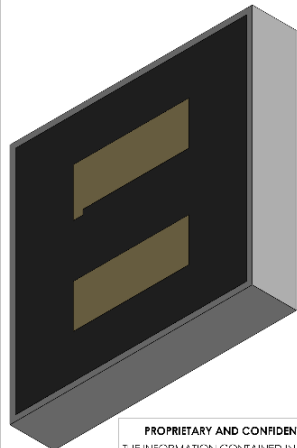
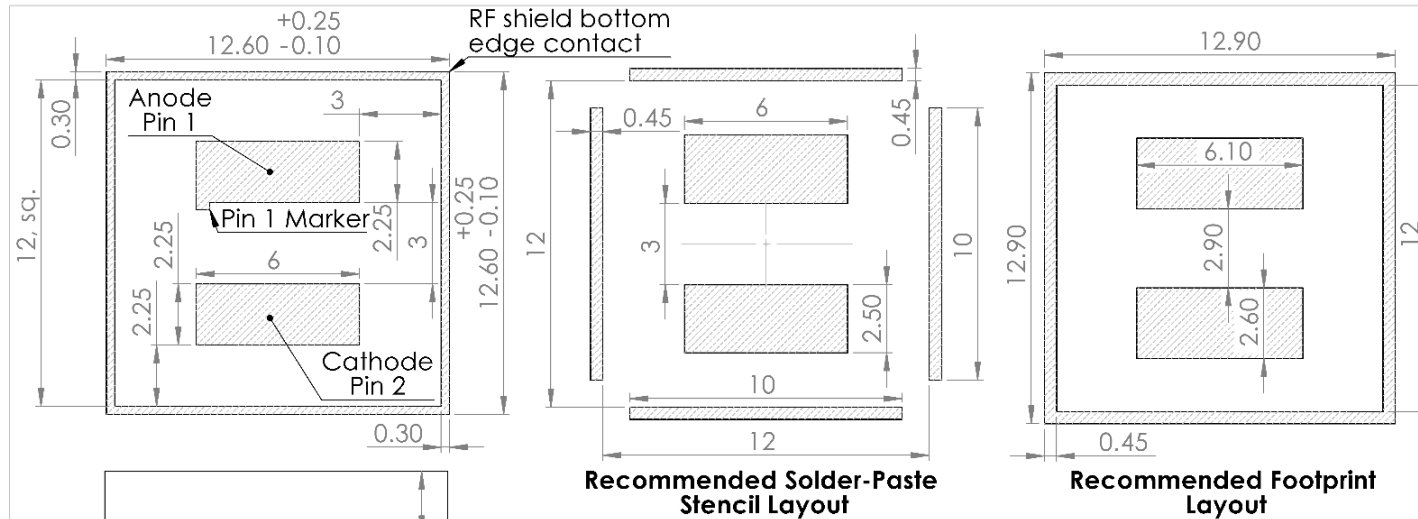


Figure 2: Example reflow profile in ProtoFlow S oven.



AGF-series MSND Package Drawing



2.30 ±0.05

Notes:

- Solder-Paste Stencil mask should have a reduced area for each solder pad and be a 5-mil stencil thickness.
- PCB should have ENIG Finish.
- PCB should have 1-mil Soldermask, with Plugged & Tented Vias under package.

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Address:	UNLESS OTHERWISE SPECIFIED:	DATE	Radiation Detection Technologies, Inc.	
4615 S. Dwight Dr.	DIMENSIONS ARE IN:	DRAWN (UPDATED)	3/19/2020	TITLE: MSND CDB With RF Shield
Manhattan, KS 66502	Millimeter (mm) and do not include thickness of plating.	PART #:	MSND.S17.CRFS	
	Material: Alumina	COMMENTS:		
Contact: Steven Bellinger		RF shield is Silver Plated Brass	SIZE DWG. NO.	REV
email: bellinger@radectech.com			A	01
Tel: O:(785) 532-7087 & C:(785) 477-1338			SCALE: 5:1	WEIGHT: SHEET 1 OF 1