

Alternate Shock Pulse Width Study Anomaly Preliminary NSWC Crane Data Review

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Agenda

1. Task Group Composition
2. PIND Anomaly Sample Package Test Status
3. Additional PIND Testing performed
4. Future plans

PIND Task Group Members

- PIND Task Group Work participant members represent the manufacturers, industry, and government agencies, and international partners:
 - Manufacturers: Microchip, Texas Instruments, IR Hi Rel/Infineon, VPT Components, Semicoa, Teledyne Microwave Solutions, Micropac Industries Inc.
 - Industry Test Laboratories – Hi Rel Labs, ORS Labs, Golden Altos
 - Government Agencies and their contractors – NASA, NSWC Crane Division, US Air Force, US Army, Aerospace Corporation, DLA Land and Maritime,
 - International Partners – ESA, NASAM, TESAT/DLR

First Group of Sample Package PIND Test Anomalies Re-PIND Test Results By NSWC Crane

PIND Test Modes

Differences in operational mode of PIND testing discovered after the January 2023 JEDEC meeting.

- Initial PIND testing of first group of 39 sample packages performed using “Static” PIND test mode.
- Initial PIND testing of the second group of 86 devices performed using the “Dynamic” PIND test mode.

Sample Package PIND Anomalies PIND Tested By NSWC Crane

Initial PIND testing of second group of 86 sample packages by NSWC Crane completed and results reported at the January 2023 JEDEC task group meeting.

PIND test anomalies detected in both groups of sample packages.

- PIND test anomalies detected in 11 of first group of 39 sample packages tested.
- PIND test anomalies detected in 30 of second group of 86 sample packages tested.

Sample Package PIND Anomalies PIND Tested By NSWCR Crane

Plan for retesting of the PIND package anomalies involved the following steps:

- 1. X-ray sample packages identified as anomalies prior to PIND retest and record information about particle location.
- 2. Perform PIND retest of PIND anomalies and record results.
- 3. X-ray sample packages and record information about particle location changes.

NSWC Crane Standard Shock Pulse Width PIND “Non-Simultaneous” Test Mode Original Test Results

Table 2. Test Facility PIND detection results for standard shock pulse width (~40 uS)

Test Facility NSWC CRANE Standard PIND Test Results

PIND Equipment Manufacturer		B&W		PIND Equipment Model number		BW					
Lot number (Traveler number)	Device Part Number - optional	Package Type	Serial number	Pulse Width in uS	Shock pulse in g's		Vibration detection (X=detect)				
						Run #	Vib 1	Vib 2	Vib 3	Vib 4	
JDC101SPT	JANSR2N7390	TO-39	87	40	1000	1					
JDC101SPT	JANSR2N7390	TO-39	87	40	1000	2					
JDC101SPT	JANSR2N7390	TO-39	88	40	1000	1					
JDC101SPT	JANSR2N7390	TO-39	88	40	1000	2					
JDC101SPT	JANSR2N7390	TO-39	89	40	1000	1					
JDC101SPT	JANSR2N7390	TO-39	89	40	1000	2					
JDC102SPT	PKG TYPE - TO-5	TO-5	77	40	1000	1					
JDC102SPT	PKG TYPE - TO-5	TO-5	77	40	1000	2					
JDC102SPT	PKG TYPE - TO-5	TO-5	78	40	1000	1					
JDC102SPT	PKG TYPE - TO-5	TO-5	78	40	1000	2	X	X	X	X	
JDC151SPT	PKG TYPE - UB	UB	37	40	1000	1	X	X		X	
JDC151SPT	PKG TYPE - UB	UB	37	40	1000	2	X				
JDC152SPT	PKG TYPE - UA	UA	60	40	1000	1	X	X	X	X	
JDC152SPT	PKG TYPE - UA	UA	60	40	1000	2	X	X	X	X	
JDC152SPT	PKG TYPE - UA	UA	71	40	1000	1	X				
JDC152SPT	PKG TYPE - UA	UA	71	40	1000	2	X				
JDC153SPT	PKG TYPE - UMC	UMC	1	40	1000	1	X	X	X	X	
JDC153SPT	PKG TYPE - UMC	UMC	1	40	1000	2					
JDC153SPT	PKG TYPE - UMC	UMC	2	40	1000	1					
JDC153SPT	PKG TYPE - UMC	UMC	2	40	1000	2					
JDC153SPT	PKG TYPE - UMC	UMC	3	40	1000	1	X	X	X	X	
JDC153SPT	PKG TYPE - UMC	UMC	3	40	1000	2					

First Group Sample Package PIND Anomalies PIND Tested By NSWC Crane

	PIND Anomalies													
	Lot number (Traveler number)	Device Part Number - optional	Package Type	Serial number	Pulse Width in uS	Shock pulse in g's	Pre- Xray	Vibration detection (X=detect)					Post- Xray	CT Scan
								Run #	Vib 1	Vib 2	Vib 3	Vib 4		
GROUP 1 NON-SIMULTANEOUS MODE	JDC101SPT	JANSR2N7390	TO-39	87	40	1000	X	1					X	
	JDC101SPT	JANSR2N7390	TO-39	88	40	1000	X	1					X	
	JDC101SPT	JANSR2N7390	TO-39	89	40	1000	X	1					X	
	JDC102SPT	PKG TYPE - TO-5	TO-5	77	40	1000	X	1					X	
	JDC102SPT	PKG TYPE - TO-5	TO-5	78	40	1000	X	1					X	
	JDC151SPT	PKG TYPE - UB	UB	37	40	1000	X	1					X	
	JDC152SPT	PKG TYPE - UA	UA	60	40	1000	X	1					X	
	JDC152SPT	PKG TYPE - UA	UA	71	40	1000	X	1	X				X	
	JDC153SPT	PKG TYPE - UMC	UMC	1	40	1000	X	1					X	
	JDC153SPT	PKG TYPE - UMC	UMC	2	40	1000	X	1					X	
	JDC153SPT	PKG TYPE - UMC	UMC	3	40	1000	X	1					X	

Results of First Group of Sample Package PIND Test Anomalies X-rayed By NSWC Crane

Pre and post PIND test X-rays showed the following for the first group of 11 PIND test package anomalies:

- Particle lodged in the TO-5 package serial numbers 77 and 78.
- UA serial number 71 nothing appeared in X-ray. Believe particle to be organic.

Results For First Group of Sample Package PIND Test Anomalies Re-PIND Tested By NSWC Crane

- No change in PIND detection test results for TO-39 serial numbers 87, 88, and 89 from original testing, “No” particles detected.
- UA serial number 60 particle detection changed from detection in both runs in original test results to “No” detection on this run.
- UA serial number 71 particle detection changed from partial in first run and full detection in second run original data to only 1 detection during one vibration sequence on this run.
- UMC serial number 3 changed from particle detection on first run in original test results to “No” detection on this run.

Second Group of Sample Package PIND Test Anomalies Re-PIND Test Results By NSWCrane

NSWC Crane Standard Shock Pulse Width PIND “Dynamic” Mode Original Test Results

Table 2. Test Facility PIND detection results for standard shock pulse width (~40 uS)

Test Facility NSWC CRANE Standard PIND Test Results

PIND Equipment Manufacturer B&W

Equipment Model number BW-LPD-DAQ4000 SN 6083

Lot number (Traveler number)	Device Part Number - optional	Package Type	Serial number	Pulse Width in uS	Shock pulse in g's	Vibration detection (X=detect)				
						Run #	Vib 1	Vib 2	Vib 3	Vib 4
JDC042SPT	PKG TYPE - 7-pin FP	7-pin FP	AL 1	40	1000	1				
JDC042SPT	PKG TYPE - 7-pin FP	7-pin FP	AL 1	40	1000	2				
JDC042SPT	PKG TYPE - 7-pin FP	7-pin FP	AL 2	40	1000	1				
JDC042SPT	PKG TYPE - 7-pin FP	7-pin FP	AL 2	40	1000	2	X	X	X	X
JDC042SPT	PKG TYPE - 7-pin FP	7-pin FP	AL 3	40	1000	1	X	X	X	X
JDC042SPT	PKG TYPE - 7-pin FP	7-pin FP	AL 3	40	1000	2	X	X	X	X
JDC043SPT-02	PKG TYPE - 16-pin FP	16-pin FP	SI 2	40	1000	1	X	X	X	X
JDC043SPT-02	PKG TYPE - 16-pin FP	16-pin FP	SI 2	40	1000	2	X	X	X	X
JDC043SPT-03	PKG TYPE - 16-pin FP	16-pin FP	SI 1	40	1000	1		X	X	X
JDC043SPT-03	PKG TYPE - 16-pin FP	16-pin FP	SI 1	40	1000	2	X	X	X	X
JDC043SPT-03	PKG TYPE - 16-pin FP	16-pin FP	SI 2	40	1000	1	X	X	X	X
JDC043SPT-03	PKG TYPE - 16-pin FP	16-pin FP	SI 2	40	1000	2	X	X	X	X
JDC102SPT-02	PKG TYPE - TO-5	TO-5	S 04	40	1000	1	X	X	X	X
JDC102SPT-02	PKG TYPE - TO-5	TO-5	S 04	40	1000	2	X	X	X	X
JDC102SPT-02	PKG TYPE - TO-5	TO-5	S 05	40	1000	1	X	X	X	X
JDC102SPT-02	PKG TYPE - TO-5	TO-5	S 05	40	1000	2	X	X	X	X
JDC102SPT-02	PKG TYPE - TO-5	TO-5	S 08	40	1000	1				
JDC102SPT-02	PKG TYPE - TO-5	TO-5	S 08	40	1000	2				
JDC102SPT-02	PKG TYPE - TO-5	TO-5	S 11	40	1000	1				
JDC102SPT-02	PKG TYPE - TO-5	TO-5	S 11	40	1000	2				

NSWC Crane Standard Shock Pulse Width PIND Test Results “Non-Simultaneous Test Runs

Test Facility NSWC CRANE Standard PIND Test Results

PIND Equipment Manufacturer B&W

Equipment Model number BW-LPD-DAQ4000_SN 6083

Lot number (Traveler number)	Device Part Number - optional	Package Type	Serial number	Pulse Width in uS	Shock pulse in g's	Run #	Vibration detection (X=detect)			
							Vib 1	Vib 2	Vib 3	Vib 4
JDC042SPT	PKG TYPE - 7-pin FP	7-pin FP	AL 1	40	1000	1	X	X	X	X
JDC042SPT	PKG TYPE - 7-pin FP	7-pin FP	AL 1	40	1000	2	X	X	X	X
JDC042SPT	PKG TYPE - 7-pin FP	7-pin FP	AL 2	40	1000	1	X	X	X	X
JDC042SPT	PKG TYPE - 7-pin FP	7-pin FP	AL 2	40	1000	2	X	X	X	X
JDC042SPT	PKG TYPE - 7-pin FP	7-pin FP	AL 3	40	1000	1				
JDC042SPT	PKG TYPE - 7-pin FP	7-pin FP	AL 3	40	1000	2				
JDC043SPT-02	PKG TYPE - 16-pin FP	16-pin FP	SI 2	40	1000	1	X	X		
JDC043SPT-02	PKG TYPE - 16-pin FP	16-pin FP	SI 2	40	1000	2	X			X
JDC043SPT-03	PKG TYPE - 16-pin FP	16-pin FP	SI 1	40	1000	1	X	X	X	X
JDC043SPT-03	PKG TYPE - 16-pin FP	16-pin FP	SI 1	40	1000	2	X	X	X	X
JDC043SPT-03	PKG TYPE - 16-pin FP	16-pin FP	SI 2	40	1000	1	X	X	X	X
JDC043SPT-03	PKG TYPE - 16-pin FP	16-pin FP	SI 2	40	1000	2	X	X	X	X
JDC102SPT-02	PKG TYPE - TO-5	TO-5	S 04	40	1000	1				
JDC102SPT-02	PKG TYPE - TO-5	TO-5	S 04	40	1000	2				
JDC102SPT-02	PKG TYPE - TO-5	TO-5	S 05	40	1000	1	X	X	X	X
JDC102SPT-02	PKG TYPE - TO-5	TO-5	S 05	40	1000	2	X	X		
JDC102SPT-02	PKG TYPE - TO-5	TO-5	S 08	40	1000	1				
JDC102SPT-02	PKG TYPE - TO-5	TO-5	S 08	40	1000	2				
JDC102SPT-02	PKG TYPE - TO-5	TO-5	S 11	40	1000	1				
JDC102SPT-02	PKG TYPE - TO-5	TO-5	S 11	40	1000	2				
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	111	40	1000	1	X	X	X	
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	111	40	1000	2	X		X	

Results For Second Group of Sample Package PIND Test Anomalies Re-PIND Tested By NSWC Crane

- 7 pin FP serial number AL1 showed no particle detection in the original dynamic mode test runs, and had 100 percent detection during Non-simultaneous test runs.
- 7 pin FP serial number AL2 showed no particle detection in the original dynamic mode first test run and detected on all 4 vibrations during the second test run. Retest using non-simultaneous mode resulted in 100 percent detection during both test runs.
- 7 pin FP serial number AL3 showed 100 percent particle detection in original dynamic mode during both test runs. Retest using non-simultaneous mode failed to detect any particles during either test run.
- TO-5 serial numbers 4 and 5 showed 100 percent particle detection in original dynamic mode during both test runs. Retest using non-simultaneous mode failed to detect any particles during either test run serial number 4. Serial number 5 had 100 percent detection on first run and 50 percent detection on second run.

Results For Second Group of Sample Package PIND Test Anomalies Re-PIND Tested By NSWC Crane

- TO-5 serial numbers S4 and S5 showed 100 percent particle detection in original dynamic mode during both test runs. Retest using non-simultaneous mode failed to detect any particles during either test run serial number S4. Serial number S5 had 100 percent detection on first run and 50 percent detection on second run.
- TO-5 serial number S11 showed no particle detection in dynamic mode operation during both test runs. Retest using non-simultaneous mode for serial number S11 showed 75 percent particle detection on first run and 50 percent particle detection on second test run.

NSWC Crane Standard Shock Pulse Width PIND “Dynamic” Mode Original Test Results

Table 2. Test Facility PIND detection results for standard shock pulse width (~40 uS)

Test Facility NSWC CRANE Standard PIND Test Results

PIND Equipment Manufacturer <u>B&W</u>				Equipment Model number <u>BW-LPD-DAQ4000 SN 6083</u>						
Lot number (Traveler number)	Device Part Number - optional	Package Type	Serial number	Pulse Width in uS	Shock pulse in g's	Vibration detection (X=detect)				
						Run #	Vib 1	Vib 2	Vib 3	Vib 4
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	111	40	1000	1	X	X	X	X
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	111	40	1000	2	X	X	X	X
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	113	40	1000	1	X	X	X	X
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	113	40	1000	2			X	
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	115	40	1000	1	X	X	X	X
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	115	40	1000	2	X	X	X	X
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	117	40	1000	1				
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	117	40	1000	2	X	X	X	X
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	118	40	1000	1	X	X	X	X
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	118	40	1000	2	X	X	X	X
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	119	40	1000	1	X	X	X	X
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	119	40	1000	2	X	X	X	X
JDC104SPT	PKG TYPE - TO-254	TO-254	101	40	1000	1	X	X	X	X
JDC104SPT	PKG TYPE - TO-254	TO-254	101	40	1000	2	X	X	X	X
JDC104SPT	PKG TYPE - TO-254	TO-254	102	40	1000	1	X	X	X	X
JDC104SPT	PKG TYPE - TO-254	TO-254	102	40	1000	2	X	X	X	X
JDC104SPT	PKG TYPE - TO-254	TO-254	103	40	1000	1	X	X	X	X
JDC104SPT	PKG TYPE - TO-254	TO-254	103	40	1000	2	X	X	X	X
JDC104SPT	PKG TYPE - TO-254	TO-254	105	40	1000	1	X	X	X	X
JDC104SPT	PKG TYPE - TO-254	TO-254	105	40	1000	2	X	X	X	X
JDC104SPT	PKG TYPE - TO-254	TO-254	106	40	1000	1	X	X	X	X
JDC104SPT	PKG TYPE - TO-254	TO-254	106	40	1000	2	X	X	X	X

NSWC Crane Standard Shock Pulse Width PIND “Non-Simultaneous” Test Mode Test Results

Table 2. Test Facility PIND detection results for standard shock pulse width (~40 uS)

Test Facility NSWC CRANE Standard PIND Test Results

PIND Equipment Manufacturer B&W

Equipment Model number BW-LPD-DAQ4000_SN 6083

Lot number (Traveler number)	Device Part Number - optional	Package Type	Serial number	Pulse Width in uS	Shock pulse in g's	Vibration detection (X=detect)				
						Run #	Vib 1	Vib 2	Vib 3	Vib 4
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	111	40	1000	1	X	X	X	
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	111	40	1000	2	X		X	
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	113	40	1000	1				
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	113	40	1000	2				
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	115	40	1000	1		X		X
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	115	40	1000	2		X		X
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	117	40	1000	1		X	X	
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	117	40	1000	2				
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	118	40	1000	1		X	X	X
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	118	40	1000	2	X	X	X	X
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	119	40	1000	1	X		X	X
JDC103SPT	PKG TYPE - SMD 0.5	SMD 0.5	119	40	1000	2	X	X	X	X
JDC104SPT	PKG TYPE - TO-254	TO-254	101	40	1000	1				
JDC104SPT	PKG TYPE - TO-254	TO-254	101	40	1000	2				
JDC104SPT	PKG TYPE - TO-254	TO-254	102	40	1000	1	X	X	X	
JDC104SPT	PKG TYPE - TO-254	TO-254	102	40	1000	2	X	X	X	X
JDC104SPT	PKG TYPE - TO-254	TO-254	103	40	1000	1	X	X	X	
JDC104SPT	PKG TYPE - TO-254	TO-254	103	40	1000	2	X	X	X	X
JDC104SPT	PKG TYPE - TO-254	TO-254	105	40	1000	1	X	X	X	X
JDC104SPT	PKG TYPE - TO-254	TO-254	105	40	1000	2	X	X	X	
JDC104SPT	PKG TYPE - TO-254	TO-254	106	40	1000	1	X		X	
JDC104SPT	PKG TYPE - TO-254	TO-254	106	40	1000	2	X	X	X	X

Second Group of Sample Package PIND Test Anomalies Re-PIND Tested By NSWC Crane

- SMD 0.5 serial number 111 showed 100 percent particle detection in original dynamic mode during both test runs. Retest using non-simultaneous mode had 75 percent particle detection during first run and 50 percent during second test run.
- SMD 0.5 serial number 113 showed 100 percent particle detection in original dynamic mode during first test run and 25 percent during the second test run. Retest using non-simultaneous mode had “No” detection during first run and 50 percent during second test run.
- SMD 0.5 serial number 115 showed 100 percent particle detection in original dynamic mode during during both test runs. Retest using non-simultaneous mode had 50 percent particle detection during both test runs.
- SMD 0.5 serial number 117 showed “No” particle detection in original dynamic mode during first test run and 100 percent during the second test run. Retest using non-simultaneous mode had 50 percent detection during first test run and “No” particle detection during second test run.
- SMD 0.5 serial number 118 showed 100 percent particle detection in original dynamic mode during both test runs. Retest using non-simultaneous mode had 75 percent detection during first test run and 100 percent particle detection during second test run.

Second Group of Sample Package PIND Test Anomalies Re-PIND Tested By NSWC Crane

- TO-254 serial number 101 showed 100 percent particle detection in original dynamic mode during both test runs. Retest using non-simultaneous mode had “No” particle detection during both test runs.
- TO-254 serial number 102 showed 100 percent particle detection in original dynamic mode during both test runs. Retest using non-simultaneous mode had “No” detection during first run and 50 percent during second test run.
- TO-254 serial number 103 showed 100 percent particle detection in original dynamic mode during both test runs. Retest using non-simultaneous mode had 50 percent particle detection during both test runs.
- TO-254 serial number 105 showed 100 percent particle detection in original dynamic mode during both test runs. Retest using non-simultaneous mode had 75 percent particle detection during first test run and 100 percent particle detection during second test run.
- TO-254 serial number 106 showed 100 percent particle detection in original dynamic mode during both test runs. Retest using non-simultaneous mode had 75 percent detection during first test run and 100 percent particle detection during second test run.

NSWC Crane Standard Shock Pulse Width PIND “Dynamic” Mode Original Test Results

Table 2. Test Facility PIND detection results for standard shock pulse width (~40 uS)

Test Facility NSWC CRANE Standard PIND Test Results

PIND Equipment Manufacturer B&W

Equipment Model number BW-LPD-DAQ4000 SN 6083

Lot number (Traveler number)	Device Part Number - optional	Package Type	Serial number	Pulse Width in uS	Shock pulse in g's	Run #	Vibration detection (X=detect)			
							Vib 1	Vib 2	Vib 3	Vib 4
JDC104SPT	PKG TYPE - TO-254	TO-254	110	40	1000	1	X	X	X	X
JDC104SPT	PKG TYPE - TO-254	TO-254	110	40	1000	2	X	X	X	X
JDC104SPT	PKG TYPE - TO-254	TO-254	204	40	1000	1	X	X	X	X
JDC104SPT	PKG TYPE - TO-254	TO-254	204	40	1000	2	X	X	X	X
JDC104SPT	PKG TYPE - TO-254	TO-254	205	40	1000	1	X	X	X	X
JDC104SPT	PKG TYPE - TO-254	TO-254	205	40	1000	2				
JDC154SPT	JANSR2N7626UB	UB	132	40	1000	1	X	X	X	X
JDC154SPT	JANSR2N7626UB	UB	132	40	1000	2			X	X
JDC154SPT	JANSR2N7626UB	UB	447	40	1000	1	X	X	X	X
JDC154SPT	JANSR2N7626UB	UB	447	40	1000	2	X	X	X	X
JDC154SPT	JANSR2N7626UB	UB	467	40	1000	1	X	X	X	X
JDC154SPT	JANSR2N7626UB	UB	467	40	1000	2	X	X	X	X
JDC155SPT	JANSR2N7616UB	UB	253	40	1000	1	X	X	X	X
JDC155SPT	JANSR2N7616UB	UB	253	40	1000	2				
JDC155SPT	JANSR2N7616UB	UB	334	40	1000	1	X	X	X	X
JDC155SPT	JANSR2N7616UB	UB	334	40	1000	2				

NSWC Crane Standard Shock Pulse Width PIND “Non-Simultaneous” Test Mode Test Results

Test Facility NSWC CRANE Standard PIND Test Results

PIND Equipment Manufacturer B&W

Equipment Model number BW-LPD-DAQ4000_SN 6083

Lot number (Traveler number)	Device Part Number - optional	Package Type	Serial number	Pulse Width in uS	Shock pulse in g's	Run #	Vibration detection (X=detect)			
							Vib 1	Vib 2	Vib 3	Vib 4
JDC104SPT	PKG TYPE - TO-254	TO-254	110	40	1000	1				
JDC104SPT	PKG TYPE - TO-254	TO-254	110	40	1000	2				
JDC104SPT	PKG TYPE - TO-254	TO-254	204	40	1000	1				
JDC104SPT	PKG TYPE - TO-254	TO-254	204	40	1000	2				
JDC104SPT	PKG TYPE - TO-254	TO-254	205	40	1000	1				
JDC104SPT	PKG TYPE - TO-254	TO-254	205	40	1000	2				
JDC154SPT	JANSR2N7626UB	UB	132	40	1000	1	X	X	X	X
JDC154SPT	JANSR2N7626UB	UB	132	40	1000	2	X	X		
JDC154SPT	JANSR2N7626UB	UB	447	40	1000	1	X	X	X	X
JDC154SPT	JANSR2N7626UB	UB	447	40	1000	2				
JDC154SPT	JANSR2N7626UB	UB	467	40	1000	1				
JDC154SPT	JANSR2N7626UB	UB	467	40	1000	2				
JDC155SPT	JANSR2N7616UB	UB	253	40	1000	1				
JDC155SPT	JANSR2N7616UB	UB	253	40	1000	2				
JDC155SPT	JANSR2N7616UB	UB	334	40	1000	1	X	X	X	X
JDC155SPT	JANSR2N7616UB	UB	334	40	1000	2	X	X	X	X

Results For Second Group of Sample Package PIND Test Anomalies Re-PIND Tested By NSWC Crane

- TO-254 serial numbers 110 and 204 showed 100 percent particle detection in original dynamic mode during both test runs. Retest using non-simultaneous mode failed to detect any particles during either test run for either serial numbers.
- TO-254 serial number 205 showed no particle detection in dynamic mode operation during both test runs. Retest using non-simultaneous mode for serial number S11 showed 75 percent particle detection on first run and 50 percent particle detection on second test run.
- UB serial number 132 showed 100 percent particle detection in dynamic mode operation during first test run and 50 percent detection in second test run. Retest using non-simultaneous mode for serial number 132 showed 100 percent particle detection on first run and 50 percent particle detection on second test run.
- UB serial numbers 447 and 467 showed 100 percent particle detection in original dynamic mode during both test runs. Retest using non-simultaneous mode failed to detect any particles during either test run for either serial number.

Second Group of Sample Package PIND Test Anomalies Re-PIND Tested By NSWC Crane

- TO-254 serial numbers 110 and 204 showed 100 percent particle detection in original dynamic mode during both test runs. Retest using non-simultaneous mode failed to detect any particles during either test run for either serial numbers.
- TO-254 serial number 205 showed 100 percent particle detection in dynamic mode operation during first test run and “No” particle detection for second run. Retest using non-simultaneous mode failed to detect any particles during either test run.
- UB serial number 132 showed 100 percent particle detection in dynamic mode operation during first test run and 50 percent detection in second test run. Retest using non-simultaneous mode showed 100 percent particle detection on first run and 50 percent particle detection on second test run.
- UB serial numbers 447 and 467 showed 100 percent particle detection in original dynamic mode during both test runs. Retest using non-simultaneous mode failed to detect any particles during either test run for either serial number.

NSWC Crane Standard Shock Pulse Width PIND Anomalies Results Summary

Plan for retesting of the PIND package anomalies involved the following steps:

- 1. X-ray sample packages identified as anomalies prior to PIND retest and record information about particle location.
- 2. Perform PIND retest of PIND anomalies and record results.
- 3. X-ray sample packages and record information about particle location changes.

Summary of Additional PIND Tests Completed By NSWC Crane

Differences in operational mode of PIND testing discovered after the January 2023 JEDEC meeting.

- Initial PIND testing of first group of 39 sample packages performed using “Static” PIND test mode.
- X-rayed and performed “Static” PIND test mode testing on 11 sample package anomalies from first group of 39 samples.
- Initial PIND testing of the second group of 86 devices performed using the “Dynamic” PIND test mode.
- X-rayed and performed “Static” PIND test mode testing on 30 sample package anomalies from the second group of 86 samples.

Summary of Additional PIND Tests Completed By NSWCC Crane

Observations:

1. PIND test operation mode used for second group of sample packages was different than the first group (Static versus Dynamic).
2. Particle detection test results varied for the same anomaly sample package depending on PIND test operating mode.
3. Particle detection results could be “No” detection in Dynamic mode and 100 percent in Static mode.
4. X-rays confirmed particle lodging in some sample packages.

Longer Shock Pulse Width Task Proposal Future Plans

- Compile X-ray files for package sample anomalies.
- Then send samples to MSFC for testing.

Thank you!

- We would like to express our appreciation to the task group members, NASA NEPAG and SLS programs, Government Working Group, and NSWC Crane for their continued support of this effort.

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Acronyms

- DLA – Defense Logistics Agency
- DLR – German Aerospace Center
- DPA – Destructive Physical Analysis
- ESA – European Space Agency
- ESD – Electrostatic Discharge
- FOD – Foreign Object Debris
- JEDEC – JEDEC Solid State Technology Association
- NASA – National Aeronautics and Space Administration
- MSFC- Marshall Space Flight Center
- NSWC Crane – Naval Surface Warfare Center, Crane Division
- PIND – Particle Impact Noise Detection
- STU – Sensitivity Test Unit