



HARWIN

Test Report Summary

HT05004

Environmental & Mechanical Testing
of Sycamore Contacts

1. Introduction

1.1. Description and Purpose

The Harwin Sycamore Contacts are a range of vertical SMT sockets. The following tests were carried out to validate the performance against specification, through Insertion and Withdrawal forces, current vs temperature rise and contact resistance before and after temperature life testing.

1.2. Conclusion

The following data has been collated from Harwin test critical reports 1453, 1551, 1556, 1557, 1772, QA000257, QA000258 & QA000269. The results were used to compile the Component Specification for the Sycamore Contact range. The contacts met the specification parameters set out in section 2.2 of this test report summary – all electrical and mechanical requirements were fulfilled. Further information available on request – please contact technical@harwin.com.

2. Test Samples and Parameters

2.1. Specification Parameters

Tests were performed in accordance with EIA-364 standards, as follows:

Testing Standard	Description of Test	Section	Page No.
EIA-364-06C: 2006	Contact Resistance – Initial Range	3.1	3
	Contact Resistance – Extended Range	3.2	3-4
EIA-364-70A: 1998, Method 2	Temperature Rise versus Current – Initial Range	3.3	4-6
	Temperature Rise versus Current – Extended Range	3.4	7-9
EIA-364-13C: 2006, Method B	Mating and Un-mating Forces	3.5	9-10
EIA-364-09C: 1999	Durability (Mechanical Operations) – Initial Range	3.6	10-11
	Durability (Mechanical Operations) – Extended Range	3.7	11-12

2.2. List of Test Samples

Initial Range:

- S9111-45R – Vertical SMT Sycamore Contact, Top Entry for Ø1.50-1.90mm mating pin
- S9121-45R – Vertical SMT Sycamore Contact, Bottom Entry for Ø1.50-1.90mm mating pin
- S9131-45R – Vertical SMT Sycamore Contact, Top Entry for Ø0.80-1.30mm mating pin
- S9141-45R – Vertical SMT Sycamore Contact, Bottom Entry for Ø0.80-1.30mm mating pin

Extended Range:

- S9321-45R – Vertical SMT Extended Sycamore Contact, Bottom Entry for Ø1.50-1.90mm mating pin
- S9341-45R – Vertical SMT Extended Sycamore Contact, Bottom Entry for Ø0.80-1.30mm mating pin
- H2183-05 – Ø1.75mm Terminal Pin (mating pin for applicable tests)
- H2175-05 – Ø1.00mm Terminal Pin (mating pin for applicable tests)

3. Test Method and Results

3.1. Contact Resistance – Initial Range: EIA-364-06C: 2006

Methodology: Contact resistance was measured across the initial Sycamore Contact range (S9111-45R, S9121-45R, S9131-45R, S9141-45R). Resistances were measured across the contact with a mating pin before and after durability, to determine the effect of plating wear on contact resistance.

Results: Pre-Conditioning Contact Resistance

Mating Pin	Sample Part No.	Contact Resistance (mΩ)	
		Sample 1	Sample 2
Ø1.90mm	S9111-45R	2.34	2.17
	S9121-45R	2.24	2.28
Ø1.50mm	S9111-45R	3.04	3.22
	S9121-45R	3.82	3.69
Ø1.30mm	S9131-45R	3.47	3.45
	S9141-45R	4.00	4.26
Ø0.80mm	S9131-45R	4.03	4.11
	S9141-45R	3.93	4.76

Results: Post Temperature Life

Mating Pin	Sample Part No.	Contact Resistance (mΩ)			
		96hrs at 125°C		1,000hrs at 125°C	
		Sample 1	Sample 2	Sample 3	Sample 4
Ø1.90mm	S9111-45R	1.98	2.00	1.90	2.03
	S9121-45R	1.99	2.05	2.08	2.02
Ø1.50mm	S9111-45R	1.95	2.09	2.00	1.97
	S9121-45R	2.17	2.02	2.16	2.00
Ø1.30mm	S9131-45R	1.99	1.97	1.96	1.94
	S9141-45R	1.91	2.11	2.08	2.01
Ø0.80mm	S9131-45R	2.00	2.10	2.14	2.01
	S9141-45R	2.05	2.02	1.99	2.02

Results: Post Durability

Mating Pin	Sample Part No.	Contact Resistance (mΩ)			
		96hrs at 125°C		1,000hrs at 125°C	
		Sample 1	Sample 2	Sample 3	Sample 4
Ø1.90mm	S9111-45R	2.03	2.02	1.94	2.17
	S9121-45R	2.03	2.13	2.15	2.18
Ø1.50mm	S9111-45R	2.04	2.12	2.02	2.01
	S9121-45R	2.20	2.16	2.21	2.08
Ø1.30mm	S9131-45R	2.10	2.04	1.96	1.99
	S9141-45R	2.04	2.14	2.18	2.04
Ø0.80mm	S9131-45R	2.01	2.15	2.12	1.98
	S9141-45R	2.00	2.03	2.06	2.02

3.2. Contact Resistance – Extended Range: EIA-364-06C: 2006

Methodology: Contact Resistance was measured across the extended range of Sycamore Contacts (S9321-45R & S9341-45R, mated with H2183-05 & H2176-05 pins respectively). These contacts were subject to various environmental conditions and resistance readings were taken across the mated pairs as well as individual contacts in isolation to determine the effect of these conditions on contact resistance.

Results: Contact Only

Sample Part No.	Test Condition	Contact Resistance (mΩ)			
		Sample 1	Sample 2	Sample 3	Average
S9321-45R	Pre-Conditioned	3.66	3.80	3.56	3.67
	Durability	3.85	3.76	3.74	3.78
	Temperature Life	3.96	3.89	3.88	3.91
	Salt Spray	3.95	3.99	3.87	3.94
	Humidity	3.69	3.77	3.68	3.71
	Thermal Shock	3.71	3.65	3.77	3.71
S9341-45R	Pre-Conditioned	3.96	3.76	3.89	3.87
	Durability	3.80	3.97	4.04	3.94
	Temperature Life	4.02	4.08	4.06	4.05
	Salt Spray	4.14	4.02	4.08	4.08
	Humidity	4.04	3.93	3.98	3.98
	Thermal Shock	3.94	3.91	3.99	3.95

Results: Mated Pair

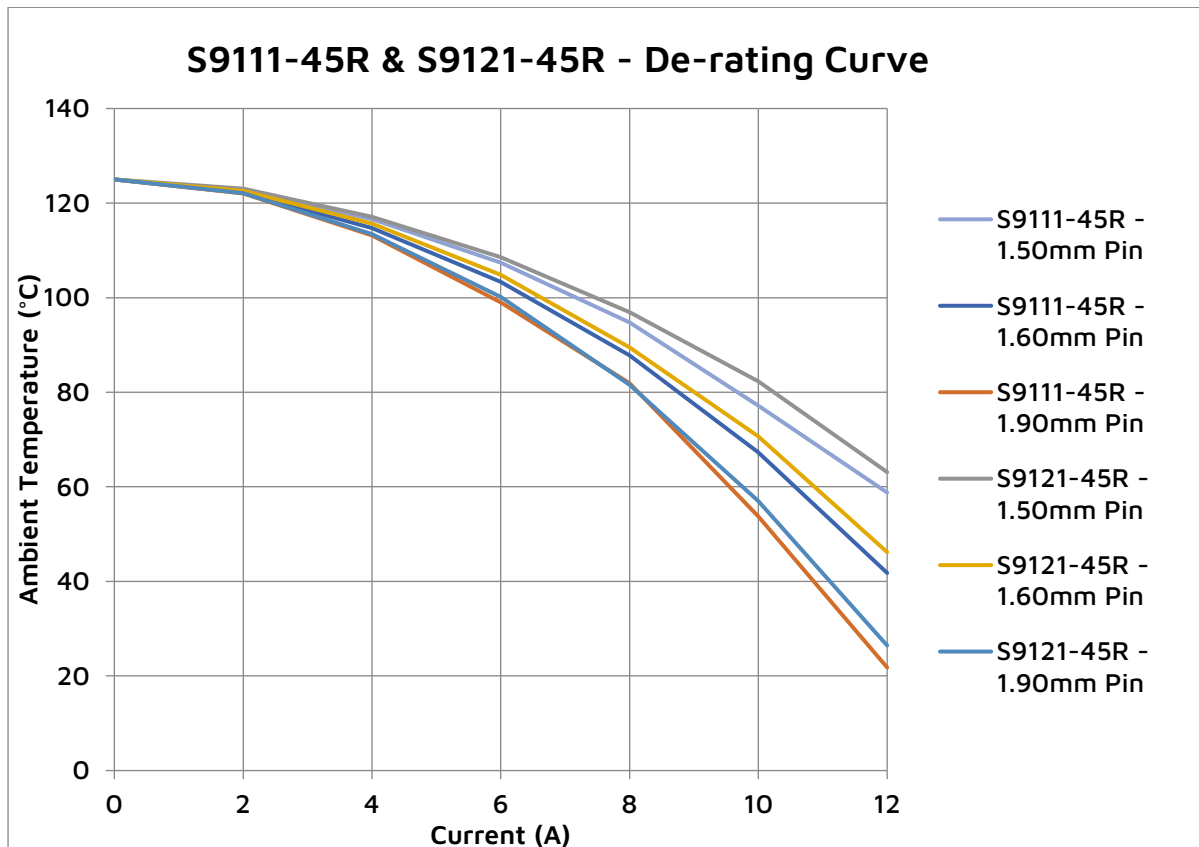
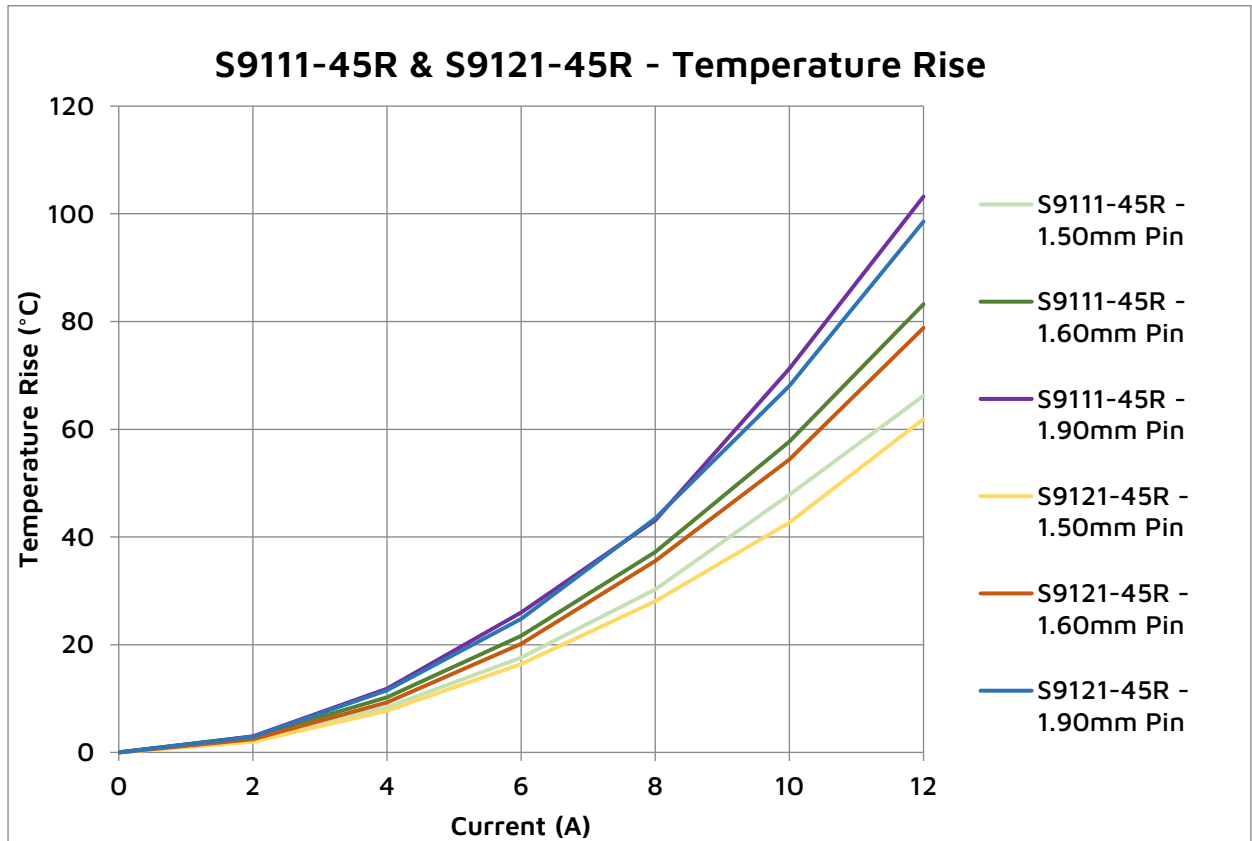
Sample Part No.	Test Condition	Contact Resistance (mΩ)			
		Sample 1	Sample 2	Sample 3	Average
S9321-45R and H2183-05	Pre-Conditioned	3.93	4.07	3.83	3.94
	Durability	4.12	4.03	4.01	4.05
	Temperature Life	4.23	4.16	4.15	4.18
	Salt Spray	4.22	4.26	4.14	4.21
	Humidity	3.96	4.04	3.95	3.98
	Thermal Shock	3.98	3.92	4.04	3.98
S9341-45R and H2176-05	Pre-Conditioned	4.71	4.51	4.64	4.62
	Durability	4.55	4.72	4.79	4.69
	Temperature Life	4.77	4.83	4.81	4.80
	Salt Spray	4.89	4.77	4.83	4.83
	Humidity	4.79	4.68	4.73	4.73
	Thermal Shock	4.69	4.66	4.74	4.70

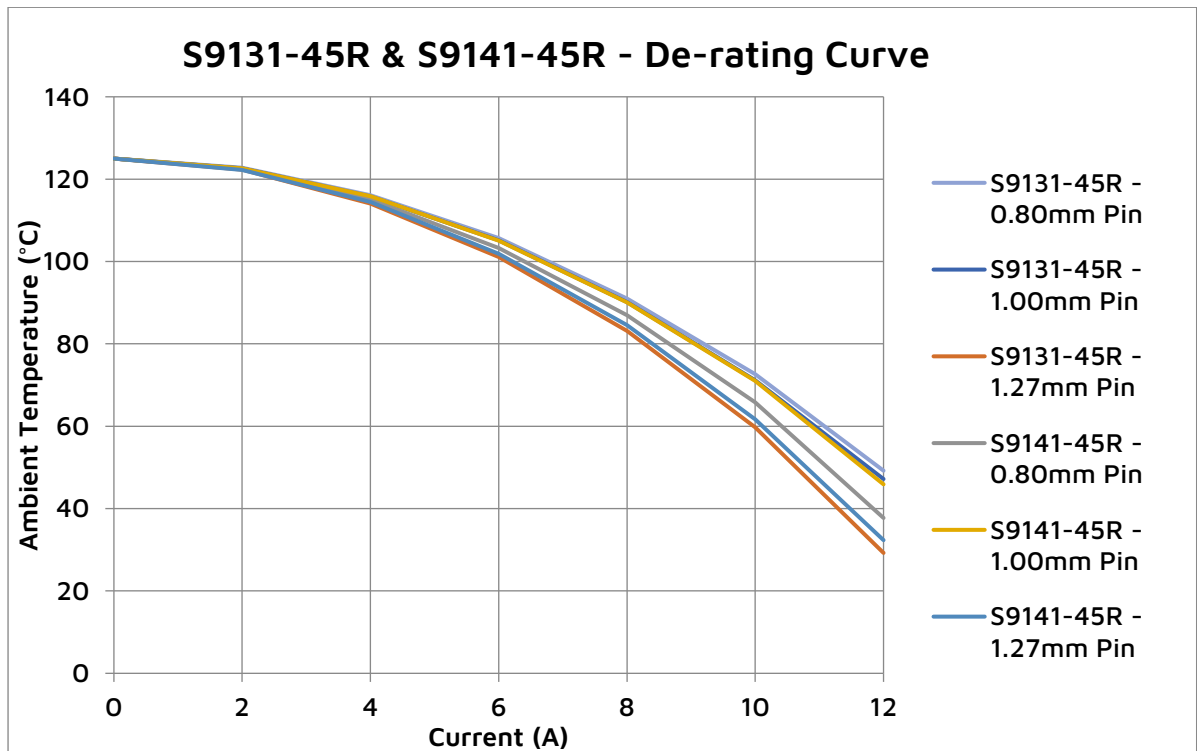
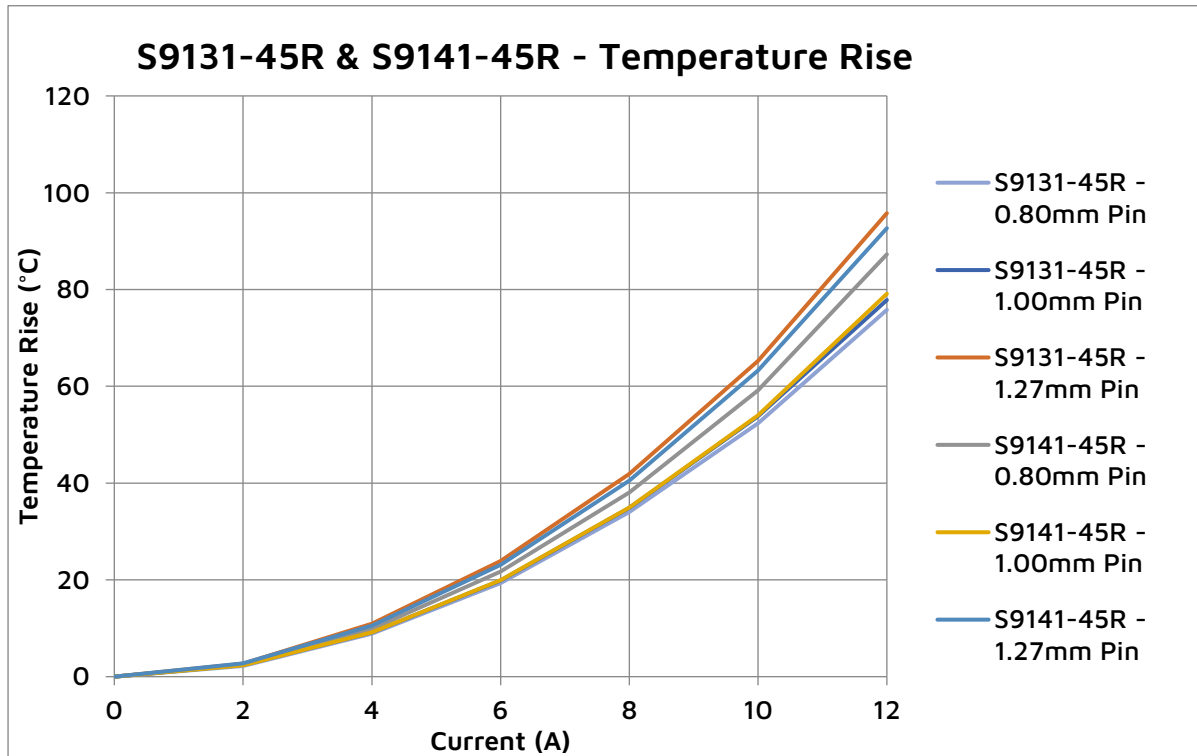
3.3. Current Rating – Initial Range: EIA-364-70A: 1998, Method 2

Methodology: Four pre-conditioned samples of S9111-45R, S9121-45R, S9131-45R & S9141-45R Sycamore Contacts were tested with three mating pin diameters for temperature rise under load. Tests were conducted at 25±5°C with a variable current of 0 to 12A in 2A increments. Visual checks for defects were performed before and after testing.

Results:

Sample Part No.	Pin Diameter (Ømm)	Average Current causing 30°C Rise (A)
S9111-45R	1.50	8.0
	1.60	8.0
	1.90	8.0
S9121-45R	1.50	10.0
	1.60	8.0
	1.90	8.0
S9131-45R	1.50	8.0
	1.60	8.0
	1.90	8.0
S9141-45R	1.50	8.0
	1.60	8.0
	1.90	8.0



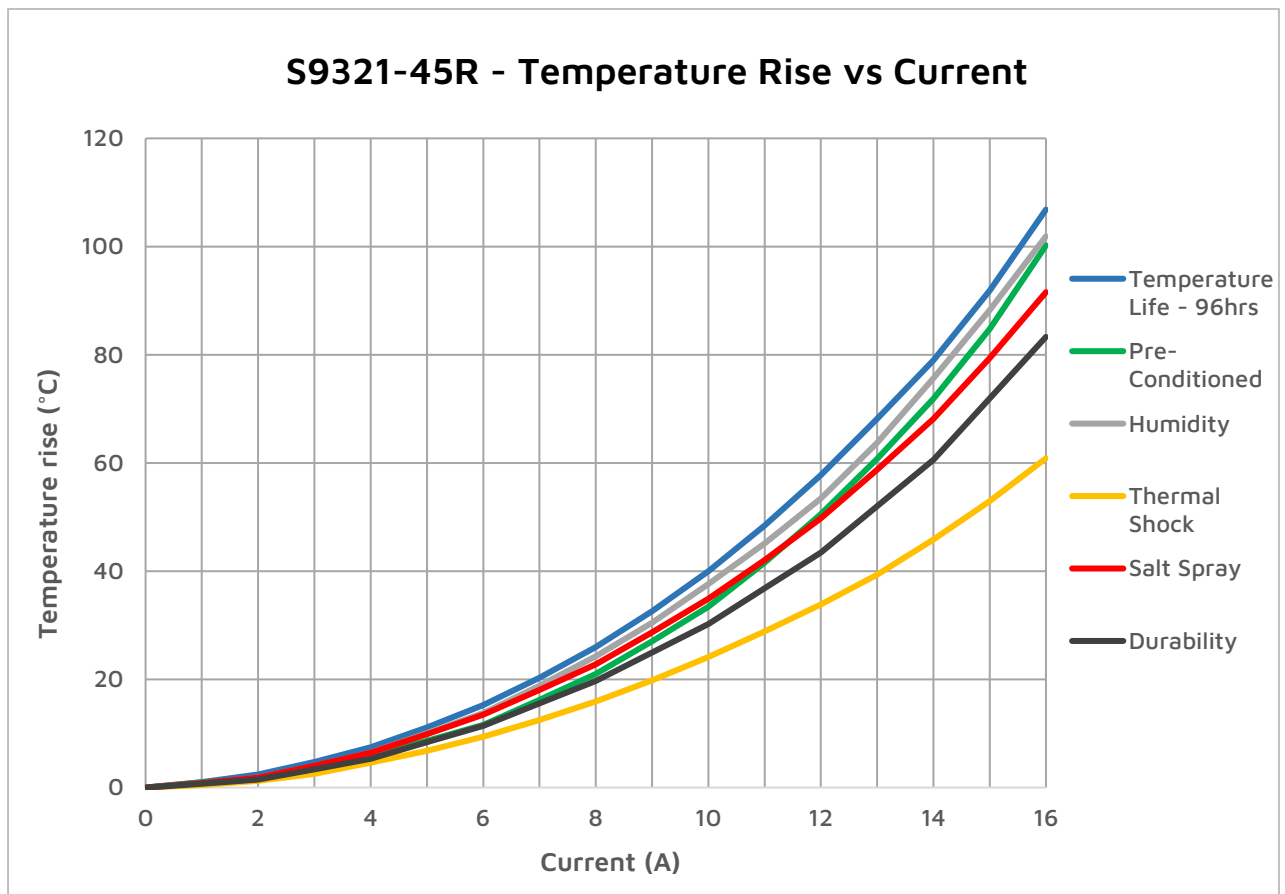


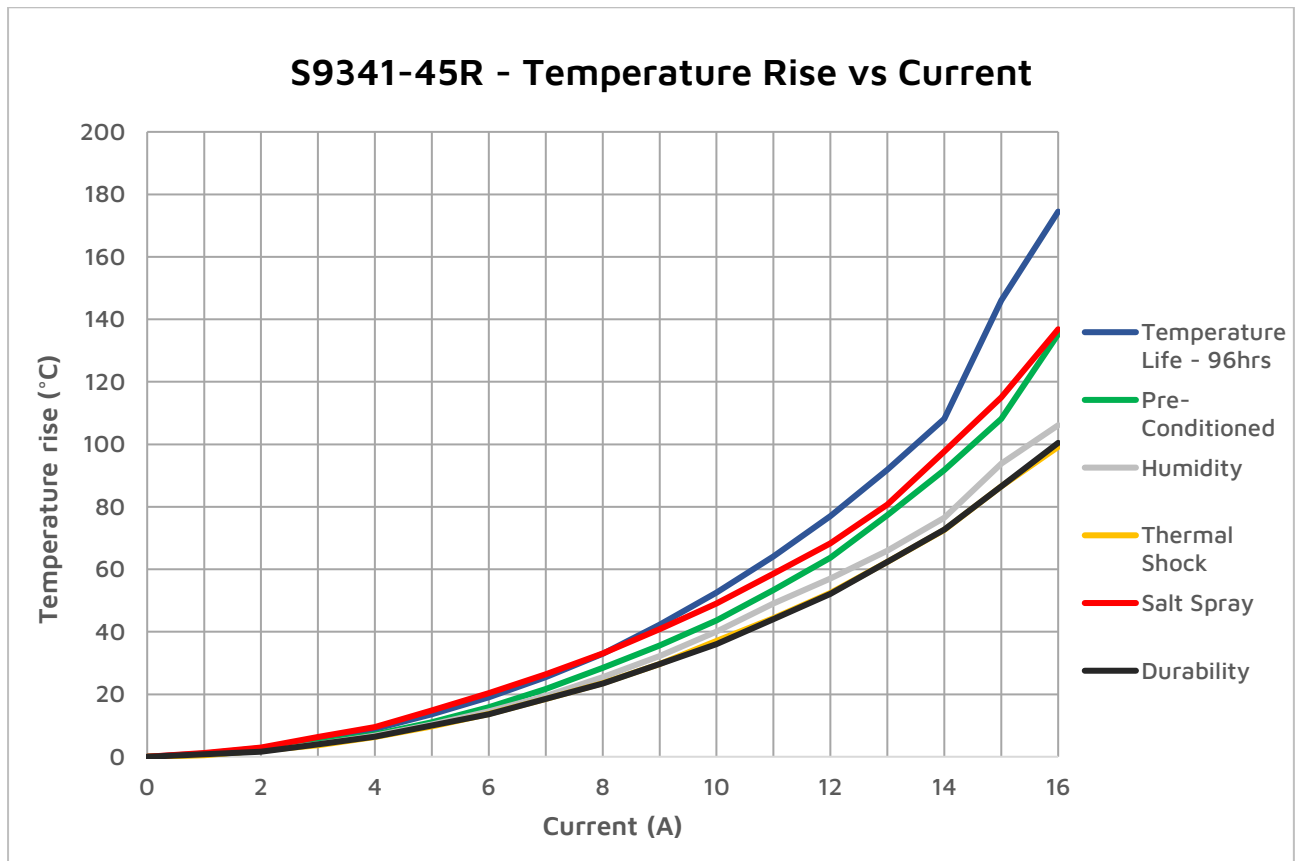
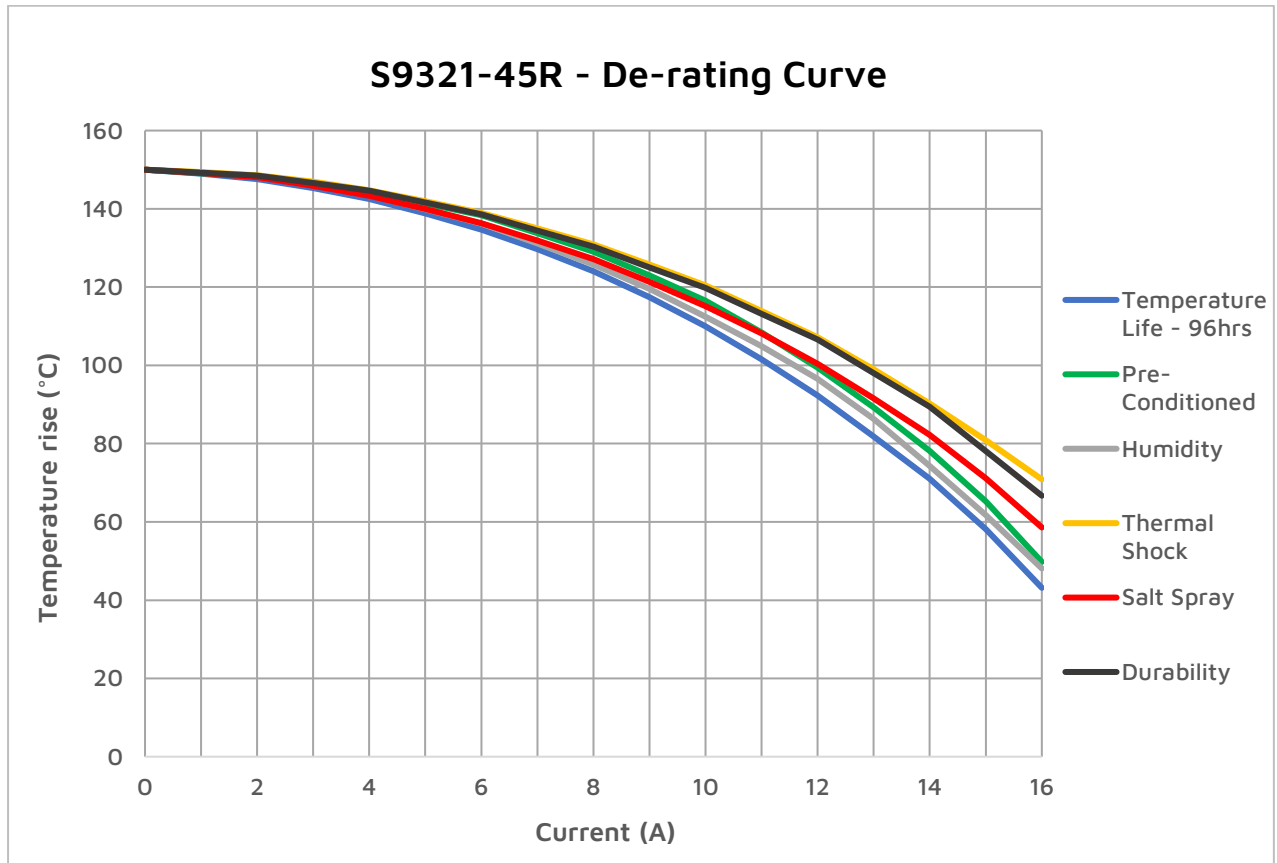
3.4. Current Rating – Extended Range: EIA-364-70A: 1998, Method 2

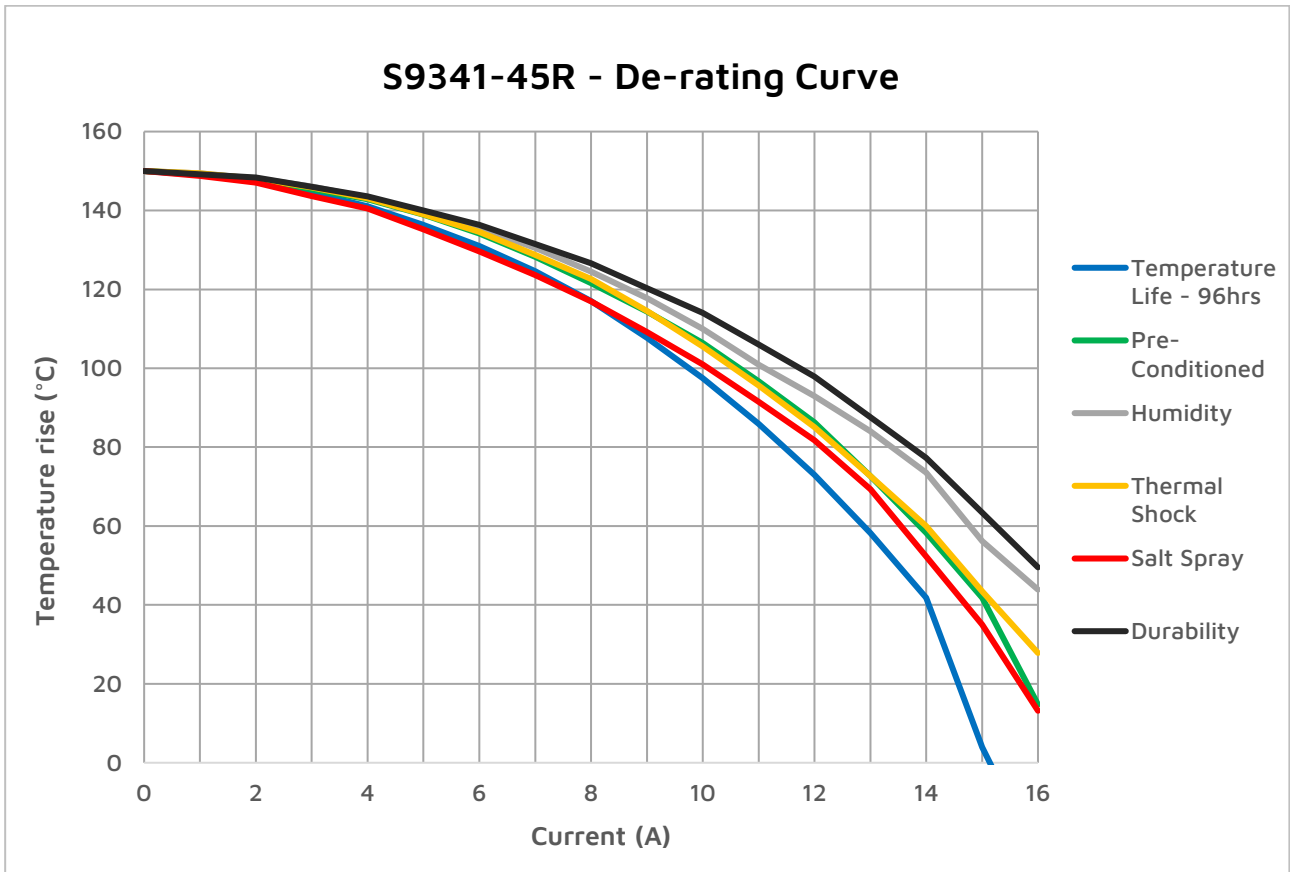
Methodology: S9321-45R & S9341-45R Sycamore Contacts were also tested for temperature rise under load, measuring three pre-conditioned contacts as well as the performance under various environmental test conditions (EIA-364 standards outlined in the table) whilst mated with corresponding pin. Tests conducted at 25±5°C with a variable current of 0-16A. Visual checks for defects were performed before and after testing.

Results:

Mated Part Numbers	Average Current causing 30°C Rise (A)					
	Pre-Conditioned	Durability (EIA-364-09C)	Temperature Life 96hrs (EIA-364-17B)	Humidity 96hrs (EIA-364-31B)	Thermal Shock (EIA-364-32C)	Salt Spray (EIA-364-26B)
S9321-45R, H2183-05	9.0	10.0	8.0	9.0	11.0	8.0
S9341-45R, H2175-05	8.0	9.0	7.5	8.0	9.0	9.0







3.5. Insertion & Withdrawal, Durability Testing: EIA-364-13C: 2006, Method B

Methodology: Eight samples of each Sycamore Contact were cycled 500 times using an auto-load cycling machine at 25.4mm/minute. Insertion and withdrawal forces were recorded. Tests were conducted at 25±5°C at a relative humidity of 60±20%.

Results: S9111-45R

Mating pin	Insertion Force (N)			Withdrawal Force (N)		
	Max	Min	Average	Max	Min	Average
Ø1.27mm	1.05	0.88	0.97	0.98	0.75	0.86
Ø1.50mm	2.43	2.04	2.20	1.45	0.70	0.97
Ø1.60mm	4.39	3.07	3.78	2.72	1.04	1.85
Ø1.90mm	15.58	11.20	13.99	7.60	5.10	5.92

Results: S9121-45R

Mating pin	Insertion Force (N)			Withdrawal Force (N)		
	Max	Min	Average	Max	Min	Average
Ø1.27mm	1.11	0.94	1.04	1.40	1.24	1.32
Ø1.50mm	2.45	2.18	2.32	1.14	0.90	1.02
Ø1.60mm	4.91	4.01	4.50	2.30	1.34	1.75
Ø1.90mm	10.60	9.08	9.89	5.00	3.10	3.99



Results: S9131-45R

Mating pin	Insertion Force (N)			Withdrawal Force (N)		
	Max	Min	Average	Max	Min	Average
Ø0.80mm	2.21	1.90	2.08	3.40	2.44	2.85
Ø1.00mm	2.68	2.34	2.44	3.74	2.88	0.86
Ø1.27mm	4.22	3.93	4.10	3.08	2.71	2.88
Ø1.50mm	7.05	6.57	6.80	2.02	1.64	1.77

Results: S9141-45R

Mating pin	Insertion Force (N)			Withdrawal Force (N)		
	Max	Min	Average	Max	Min	Average
Ø0.80mm	1.90	1.51	1.67	3.23	1.62	2.76
Ø1.00mm	2.67	2.13	2.50	3.46	2.97	3.17
Ø1.27mm	4.41	4.00	4.14	3.32	2.65	2.92

Results: S9321-45R

Mating pin	Insertion Force (N)			Withdrawal Force (N)		
	Max	Min	Average	Max	Min	Average
Ø0.80mm	2.29	1.52	1.96	1.16	0.81	1.09
Ø1.00mm	3.07	1.92	2.77	1.98	1.13	1.76
Ø1.27mm	5.05	2.73	3.82	3.88	1.46	2.38

Results: S9341-45R

Mating pin	Insertion Force (N)			Withdrawal Force (N)		
	Max	Min	Average	Max	Min	Average
Ø1.50mm	3.75	1.61	3.38	3.28	0.91	3.01
Ø1.75mm	5.30	2.61	4.87	4.33	1.43	3.90
Ø1.90mm	10.58	3.82	8.73	7.92	2.97	7.45

3.6. Durability- Initial Range: EIA-364-09C: 1999

Methodology: Samples of each Sycamore Contact from the initial range were tested for durability post-temperature life conditioning, using an auto-load cycling machine operating at 25.4mm/minute for 500 cycles. Contact resistance was measured across the contact and pin system before and after cycling. Tests were conducted at 25±5°C at a relative humidity of 60±20%.

Results: S9111-45R

Mating pin	Temperature Life Duration (at 125°C)	Insertion Force (N)			Withdrawal Force (N)		
		Initial	Max	Min	Initial	Max	Min
Ø1.50mm	96hrs	1.02	1.89	1.02	0.54	0.54	1.64
		0.86	2.27	0.76	0.52	0.52	2.00
	1,000hrs	0.79	1.90	0.61	0.53	2.39	0.53
		3.43	7.21	3.43	1.17	4.50	1.17
Ø1.90mm	96hrs	5.04	13.88	5.02	3.11	11.67	3.11
		3.90	8.62	3.61	1.63	7.28	1.63
	1,000hrs	5.14	10.99	4.84	1.85	9.92	1.69
		4.04	7.41	3.64	1.43	6.19	1.36

Results: S9121-45R

Mating pin	Temperature Life Duration (at 125°C)	Insertion Force (N)			Withdrawal Force (N)		
		Initial	Max	Min	Initial	Max	Min
Ø1.50mm	96hrs	1.01	2.10	0.83	0.60	2.30	0.60
		1.40	2.55	1.40	0.80	2.75	0.78
	1,000hrs	0.84	1.63	0.62	0.91	2.29	0.91
		2.43	4.88	2.38	1.49	4.54	1.49
Ø1.90mm	96hrs	5.27	10.00	5.05	3.44	6.58	3.47
		5.62	11.42	5.62	2.32	7.31	2.12
	1,000hrs	6.27	16.46	6.08	2.75	9.35	2.75
		5.71	11.93	5.52	3.00	7.08	3.00

Results: S9131-45R

Mating pin	Temperature Life Duration (at 125°C)	Insertion Force (N)			Withdrawal Force (N)		
		Initial	Max	Min	Initial	Max	Min
Ø0.80mm	96hrs	1.17	1.76	1.15	0.54	1.54	1.05
		1.07	1.54	1.05	0.50	1.40	0.50
	1,000hrs	1.06	2.06	0.95	0.53	1.58	0.50
		0.88	1.53	0.76	0.83	1.89	0.80
Ø1.30mm	96hrs	1.84	3.29	1.41	1.10	3.04	1.10
		1.77	3.69	1.77	0.94	3.16	0.89
	1,000hrs	1.29	3.16	1.29	1.00	3.32	0.96
		1.20	3.22	1.08	1.60	3.45	1.60

Results: S9141-45R

Mating pin	Temperature Life Duration (at 125°C)	Insertion Force (N)			Withdrawal Force (N)		
		Initial	Max	Min	Initial	Max	Min
Ø0.80mm	96hrs	0.80	0.96	0.72	0.61	1.06	0.53
		1.03	1.30	0.92	0.53	1.28	0.48
	1,000hrs	0.87	1.80	0.84	0.47	1.35	0.47
		1.08	1.45	1.08	0.58	1.36	0.58
Ø1.30mm	96hrs	1.04	2.71	0.95	1.07	2.49	1.03
		1.45	2.81	1.31	2.06	3.30	1.53
	1,000hrs	1.25	3.11	1.14	1.21	4.02	1.21
		1.28	2.62	1.28	0.65	3.23	0.65

3.7. Durability – Extended Range: EIA-364-09C: 1999

Methodology: Samples of S9321-45R & S9341-45R contacts were tested for durability post-environmental conditioning, using an auto-load cycling machine operating at 25.4mm/minute for 500 cycles. Contact resistance was measured across the contact only before and after cycling.

- Temperature life testing (EIA-364-13C) was conducted at 125±5°C at a relative humidity of 60±20%
- Humidity tests (EIA-364-31B) were carried out at an ambient temperature of 40±5°C at a relative humidity of 90-95% for a duration of 96 hours
- Thermal shock tests (EIA-364-32C) were carried out with a range of -55°C to +125°C, with dwell times of 1 hour at each temperature extreme for 5 cycles
- Salt spray tests (EIA-364-26B) were carried out with a 96 hours continuous spray of 5% NaCl solution and a chamber temperature of +35°C

Results: S9321-45R

Test Condition	Mating pin	Insertion Force (N)			Withdrawal Force (N)		
		Initial	Max	Min	Initial	Max	Min
Pre-Conditioning	Ø0.80mm	1.96	2.29	1.52	0.94	1.98	0.91
	Ø1.00mm	1.95	3.07	1.92	0.42	1.16	0.24
	Ø1.30mm	4.91	5.05	2.73	1.37	3.88	1.46
Temperature Life - 96hrs (+125°C)	Ø0.80mm	1.29	2.03	1.19	0.65	1.80	0.62
	Ø1.00mm	1.48	2.18	1.24	0.66	1.87	0.66
	Ø1.30mm	2.37	3.34	1.45	0.94	3.02	0.96
Humidity - 96hrs	Ø0.80mm	1.28	2.27	1.28	0.62	2.12	0.61
	Ø1.00mm	1.46	2.53	1.33	0.70	2.50	0.71
	Ø1.30mm	1.85	3.91	1.49	0.86	3.40	0.89
Thermal Shock	Ø0.80mm	1.36	2.01	1.17	0.54	1.50	0.51
	Ø1.00mm	1.20	1.96	1.18	0.61	1.64	0.58
	Ø1.30mm	1.68	3.20	1.33	0.88	3.13	0.93
Salt Spray	Ø0.80mm	1.14	1.53	1.03	0.61	1.54	0.56
	Ø1.00mm	1.19	2.27	1.19	0.54	2.10	0.52
	Ø1.30mm	1.52	3.11	1.27	0.86	2.72	0.79

Results: S9341-45R

Test Condition	Mating pin	Insertion Force (N)			Withdrawal Force (N)		
		Initial	Max	Min	Initial	Max	Min
Pre-Conditioning	Ø1.50mm	2.76	3.75	1.61	0.98	3.28	0.91
	Ø1.75mm	5.14	5.30	2.61	1.81	4.33	1.43
	Ø1.90mm	10.34	10.58	3.82	3.20	7.92	2.97
Temperature Life - 96hrs (+125°C)	Ø1.50mm	1.47	2.25	1.12	0.68	2.09	0.68
	Ø1.75mm	1.68	2.99	1.29	0.74	2.71	0.75
	Ø1.90mm	3.14	6.19	2.28	1.78	5.67	1.74
Humidity - 96hrs	Ø1.50mm	1.48	3.34	1.35	0.82	3.21	0.82
	Ø1.75mm	1.56	3.40	1.34	0.69	3.07	0.70
	Ø1.90mm	2.96	7.45	2.55	2.11	6.66	2.16
Thermal Shock	Ø1.50mm	1.21	2.18	0.98	0.72	2.22	0.78
	Ø1.75mm	4.90	5.30	2.25	1.19	4.51	1.13
	Ø1.90mm	4.23	8.30	3.38	2.68	6.72	2.90
Salt Spray	Ø1.50mm	1.44	2.36	1.15	1.55	2.35	0.78
	Ø1.75mm	1.75	3.53	1.49	0.84	3.14	0.82
	Ø1.90mm	10.33	10.58	2.27	3.18	7.92	1.78