tyco Electronics

Crimp and Separable Interface Qualification Testing: Tin vs. Tin/Lead

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Introduction

The conversion to lead free products and processes is now imminent. Publication of the ELV directive and the RoHS directive ensures that lead use in electronics will rapidly decline over the next few years. This testing was performed to document the performance of tin electroplated coatings as a drop-in replacement for tin/lead platings in crimp interconnects and separable interfaces.

This testing analyzes the performance of a two-piece connector system. The test method is severe, exposing the connectors to heat age, vibration, thermal shock and temperature humidity cycling. The primary evaluation method is electrical resistance. The results show the equivalent performance of tin to a tin/lead finish.

Test Method

The testing follows SAE/USCAR-20, Field Correlated Life Test Supplement to SAE/USCAR-2 (issued November 2001). SAE is the Society of Automotive Engineers, www.sae.org. USCAR is the United States Council for Automotive Research. It is a consortium of representatives from Ford, General Motors and DaimlerChrysler to promote joint research in non-competitive areas that can strengthen the US automotive industry (www.uscar.org).

The USCAR-20 testing conditions for each of the environmental conditions were as shown in Table 1. The test sequence occurs in the order shown in the table. The entire test sequence is repeated such that each test condition is experienced twice. All electrical testing occurs at room temperature and humidity after each leg of the test sequence. The conduction path for these samples includes a wire, crimp, separable interface, another crimp and another wire. Thus, this test method is evaluating the performance of two crimps and a separable interface for every measurement.

Table 1. USCAR-20 Environmental testing conditions. All test environments are experienced twice during the testing.

Test	Conditions
Heat Age	125 C for 72 hours
Random Vibration	4 hours per plane, 3.2 g's RMS, 10 to 2000 Hz @ 0.070 to 0.0001 g^2/Hz respectively
Thermal shock	-40 C to 125 C for 72 cycles, 30 minutes soak at each extreme, transition in less than 30 seconds
Temperature & humidity cycling	16 hours at 65 C, 95-98% RH; 2 hours at –40 C, uncontrolled humidity 2 hours at 85 C, uncontrolled humidity 4 hours at 25 C, uncontrolled humidity

Materials and Samples

Two products were selected for this testing. Both products use the Tyco 2.8mm automotive connector terminal, one as a blade and the other as the receptacle. These are inserted into a Tyco Electronics plastic housing and the housing of one of our customers. Quantities and descriptions for the samples are provided in Table 2. Drawings of the two contacts are provided in Appendix 1. Wire information is provided in Table 3.

Table 2. Parts tested in this evaluation.

Part Number/Identifier	Part Description	Quantity Tested
1326030-8	2.8mm Receptacle, Unsealed, 12 AWG wire, tin/lead plating	10
1326029-8	2.8mm blades, Unsealed, 12 AWG wire, tin/lead plating	10
7283	2.8mm receptacle with customer housing	10
7282	2.8mm blades with customer housing	10
1326030-8/lead free	2.8mm Receptacle, Unsealed, 12 AWG wire, tin/lead plating	10
1326029-8/lead free	2.8mm Receptacle, Unsealed, 12 AWG wire, tin/lead plating	10
7283/lead free	2.8mm receptacle with customer housing	10
7282/lead free	2.8mm receptacle with customer housing	10

Table 3. Wire information for USCAR-20 testing.

Wire Information
Wire Gage 12(2.8mm)
Green/White
Overall Diameter 0.1245”
Strand Diameter 0.0175”
Number of Strands 19
Wire Length 12”

Results:

GrpNumber :GrpDescription	Samp	Pos	Initial Data	H/A #1 Data	Vib #1 Data	T/S #1 Data	T/H #1 Data	H/A #2 Data	Vib #2 Data	T/S #2 Data	Final Data
1 :Sample 1, Standard	1	1	0.21	0.12	0.17	0.38	0.36	0.38	0.25	0.33	0.33
1 :Sample 1, Standard	1	2	0.31	0.26	0.27	0.32	0.32	0.37	0.31	0.37	0.38
1 :Sample 1, Standard	1	3	0.21	0.16	0.18	0.33	0.39	0.43	0.28	0.33	0.35
1 :Sample 1, Standard	1	4	0.28	0.19	0.20	0.34	0.36	0.39	*	*	0.35
1 :Sample 1, Standard	1	5	0.23	0.23	0.22	0.33	0.32	0.37	0.28	0.39	0.38
1 :Sample 1, Standard	1	6	0.23	0.13	0.14	0.31	0.29	0.31	0.25	0.33	0.37
1 :Sample 1, Standard	1	7	0.16	0.16	0.14	0.25	0.26	0.29	0.19	0.23	0.25
1 :Sample 1, Standard	1	8	0.13	0.06	0.07	0.19	0.38	0.34	0.16	0.31	0.35
1 :Sample 1, Standard	1	9	0.21	0.20	0.22	0.35	0.38	0.41	0.30	0.35	0.38
1 :Sample 1, Standard	1	10	0.27	0.19	0.25	0.44	0.62	0.59	0.31	0.45	0.59

	Initial	H/A #1	Vib #1	T/S #1	T/H #1	H/A #2	Vib #2	T/S #2	Final
Minimum	**0.13**	**0.06**	**0.07**	**0.19**	**0.26**	**0.29**	**0.16**	**0.23**	**0.25**
Maximum	**0.31**	**0.26**	**0.27**	**0.44**	**0.62**	**0.59**	**0.31**	**0.45**	**0.59**
Mean	**0.22**	**0.17**	**0.19**	**0.32**	**0.37**	**0.39**	**0.26**	**0.34**	**0.37**

Figure 1. Electrical resistance values in mΩ after each leg of the environmental exposure. These results are for tin/lead plated 1326030-8. Readings marked with an * indicate a failed test lead during the vibration sequence. This sample was hand probed at the end of the test.

GrpNumber :GrpDescription	Samp	Pos	Initial Data	H/A #1 Data	Vib #1 Data	T/S #1 Data	T/H #1 Data	H/A #2 Data	Vib #2 Data	T/S #2 Data	Final Data
2 :Sample 2, Standard	1	1	0.19	0.11	0.15	0.42	0.47	0.45	0.26	0.52	0.55
2 :Sample 2, Standard	1	2	0.36	0.27	0.30	0.41	0.44	0.47	0.37	0.53	0.55
2 :Sample 2, Standard	1	3	0.27	0.26	0.29	0.32	0.33	0.40	0.35	0.37	0.40
2 :Sample 2, Standard	1	4	0.18	0.20	0.20	0.29	0.33	0.37	0.26	0.43	0.44
2 :Sample 2, Standard	1	5	0.23	0.23	0.25	0.31	0.33	0.41	0.29	0.31	0.35
2 :Sample 2, Standard	1	6	0.26	0.30	0.28	0.35	0.36	0.39	0.31	0.37	0.40
2 :Sample 2, Standard	1	7	0.34	0.27	0.28	0.37	0.38	0.43	0.40	0.47	0.50
2 :Sample 2, Standard	1	8	0.34	0.30	0.33	0.43	0.43	0.48	0.41	0.52	0.56
2 :Sample 2, Standard	1	9	0.34	0.22	0.24	0.28	0.28	0.35	0.29	0.34	0.38
2 :Sample 2, Standard	1	10	0.27	0.25	0.26	0.34	0.35	0.39	0.32	0.38	0.43

	Initial	H/A #1	Vib #1	T/S #1	T/H #1	H/A #2	Vib #2	T/S #2	Final
Minimum	**0.18**	**0.11**	**0.15**	**0.28**	**0.28**	**0.35**	**0.26**	**0.31**	**0.35**
Maximum	**0.36**	**0.30**	**0.33**	**0.43**	**0.47**	**0.48**	**0.41**	**0.53**	**0.56**
Mean	**0.28**	**0.24**	**0.26**	**0.35**	**0.37**	**0.41**	**0.33**	**0.42**	**0.46**

Figure 2. Electrical resistance values in mΩ after each leg of the environmental exposure. These results are for tin/lead plated 1326029-8.

GrpNumber :GrpDescription	Samp	Pos	Initial Data	H/A #1 Data	Vib #1 Data	T/S #1 Data	T/H #1 Data	H/A #2 Data	Vib #2 Data	T/S #2 Data	Final Data
3 :Sample 3, Standard	1	1	0.21	0.20	0.21	0.32	0.34	0.39	0.33	0.38	0.40
3 :Sample 3, Standard	1	2	0.27	0.14	0.16	0.26	0.26	0.30	0.29	0.30	0.33
3 :Sample 3, Standard	1	3	0.27	0.14	0.18	0.29	0.31	0.35	0.24	0.37	0.40
3 :Sample 3, Standard	1	4	0.24	0.30	0.29	0.33	0.36	0.41	0.36	0.34	0.37
3 :Sample 3, Standard	1	5	0.35	0.31	0.29	0.38	0.41	0.43	0.44	0.40	0.44
3 :Sample 3, Standard	1	6	0.18	0.07	0.08	0.24	0.28	0.30	0.22	0.33	0.38
3 :Sample 3, Standard	1	7	0.23	0.21	0.22	0.31	0.30	0.34	0.28	0.30	0.33
3 :Sample 3, Standard	1	8	0.26	0.27	0.26	0.34	0.33	0.39	0.30	0.37	0.41
3 :Sample 3, Standard	1	9	0.15	0.13	0.16	0.24	0.25	0.28	0.25	0.29	0.30
3 :Sample 3, Standard	1	10	0.22	0.14	0.15	0.26	0.27	0.31	0.23	0.32	0.36

	Initial	H/A #1	Vib #1	T/S #1	T/H #1	H/A #2	Vib #2	T/S #2	Final
Minimum	**0.15**	**0.07**	**0.08**	**0.24**	**0.25**	**0.28**	**0.22**	**0.29**	**0.30**
Maximum	**0.35**	**0.31**	**0.29**	**0.38**	**0.41**	**0.43**	**0.44**	**0.40**	**0.44**
Mean	**0.24**	**0.19**	**0.20**	**0.30**	**0.31**	**0.35**	**0.29**	**0.34**	**0.37**

Figure 3. Electrical resistance values in mΩ after each leg of the environmental exposure. These results are for tin/lead plated 7283.

GrpNumber :GrpDescription	Samp	Pos	Initial Data	H/A #1 Data	Vib #1 Data	T/S #1 Data	T/H #1 Data	H/A #2 Data	Vib #2 Data	T/S #2 Data	Final Data
4 :Sample 4, Standard	1	1	0.27	0.24	0.28	0.34	0.36	0.37	0.34	0.37	0.41
4 :Sample 4, Standard	1	2	0.32	0.20	0.26	0.25	0.28	0.30	0.30	0.33	0.37
4 :Sample 4, Standard	1	3	0.27	0.22	0.29	0.37	0.37	0.41	0.36	0.36	0.42
4 :Sample 4, Standard	1	4	0.29	0.26	0.27	0.31	0.31	0.36	0.31	0.33	0.36
4 :Sample 4, Standard	1	5	0.24	0.26	0.25	0.29	0.29	0.33	0.28	0.30	0.34
4 :Sample 4, Standard	1	6	0.18	0.15	0.16	0.23	0.24	0.28	0.23	0.26	0.28
4 :Sample 4, Standard	1	7	0.16	0.14	0.14	0.19	0.21	0.25	0.19	0.28	0.31
4 :Sample 4, Standard	1	8	0.21	0.19	0.19	0.28	0.30	0.34	0.33	0.33	0.36
4 :Sample 4, Standard	1	9	0.19	0.13	0.13	0.18	0.20	0.23	0.22	0.21	0.25
4 :Sample 4, Standard	1	10	0.20	0.26	0.25	0.27	0.28	0.32	0.33	0.32	0.35

	Initial	H/A #1	Vib #1	T/S #1	T/H #1	H/A #2	Vib #2	T/S #2	Final
Minimum	**0.16**	**0.13**	**0.13**	**0.18**	**0.20**	**0.23**	**0.19**	**0.21**	**0.25**
Maximum	**0.32**	**0.26**	**0.29**	**0.37**	**0.37**	**0.41**	**0.36**	**0.37**	**0.42**
Mean	**0.23**	**0.21**	**0.22**	**0.27**	**0.28**	**0.32**	**0.29**	**0.31**	**0.35**

Figure 4. Electrical resistance values in mΩ after each leg of the environmental exposure. These results are for tin/lead plated 7282.

GrpNumber :GrpDescription	Samp	Pos	Initial Data	H/A #1 Data	Vib #1 Data	T/S #1 Data	T/H #1 Data	H/A #2 Data	Vib #2 Data	T/S #2 Data	Final Data
5 :Sample 1, Lead-Free	1	1	0.25	0.16	0.19	0.23	0.24	0.32	0.22	0.41	0.38
5 :Sample 1, Lead-Free	1	2	0.21	0.15	0.17	0.25	0.25	0.36	0.21	0.40	0.42
5 :Sample 1, Lead-Free	1	3	0.20	0.19	0.21	0.27	0.29	0.36	0.22	0.34	0.35
5 :Sample 1, Lead-Free	1	4	0.19	0.20	0.24	0.30	0.26	0.31	0.23	0.37	0.40
5 :Sample 1, Lead-Free	1	5	0.21	0.19	0.18	0.26	0.28	0.34	0.21	0.39	0.46
5 :Sample 1, Lead-Free	1	6	0.19	0.21	0.21	0.31	0.31	0.37	0.26	0.42	0.48
5 :Sample 1, Lead-Free	1	7	0.17	0.16	0.19	0.31	0.31	0.38	0.25	0.40	0.37
5 :Sample 1, Lead-Free	1	8	0.26	0.15	0.22	0.15	0.18	0.23	0.23	0.34	0.34
5 :Sample 1, Lead-Free	1	9	0.24	0.09	0.13	0.16	0.18	0.23	0.12	0.20	0.22
5 :Sample 1, Lead-Free	1	10	0.31	0.24	0.26	0.28	0.28	0.35	0.25	0.31	0.36

	Initial	H/A #1	Vib #1	T/S #1	T/H #1	H/A #2	Vib #2	T/S #2	Final
Minimum	**0.17**	**0.09**	**0.13**	**0.15**	**0.18**	**0.23**	**0.12**	**0.20**	**0.22**
Maximum	**0.31**	**0.24**	**0.26**	**0.31**	**0.31**	**0.38**	**0.26**	**0.42**	**0.48**
Mean	**0.22**	**0.17**	**0.20**	**0.25**	**0.26**	**0.33**	**0.22**	**0.36**	**0.38**

Figure 5. Electrical resistance values in mΩ after each leg of the environmental exposure. These results are for tin/lead plated 1326030-8/leadfree.

GrpNumber :GrpDescription	Samp	Pos	Initial Data	H/A #1 Data	Vib #1 Data	T/S #1 Data	T/H #1 Data	H/A #2 Data	Vib #2 Data	T/S #2 Data	Final Data
6 :Sample 2, Lead-Free	1	1	0.26	0.18	0.24	0.30	0.32	0.41	0.22	0.47	0.53
6 :Sample 2, Lead-Free	1	2	0.25	0.12	0.19	0.29	0.27	0.33	0.18	0.48	0.45
6 :Sample 2, Lead-Free	1	3	0.22	0.19	0.21	0.32	0.32	0.38	0.28	0.39	0.40
6 :Sample 2, Lead-Free	1	4	0.22	0.16	0.20	0.36	0.31	0.39	0.24	0.65	0.53
6 :Sample 2, Lead-Free	1	5	0.25	0.21	0.25	0.40	0.38	0.50	0.27	0.58	0.55
6 :Sample 2, Lead-Free	1	6	0.34	0.17	0.17	0.19	0.21	0.27	0.22	0.36	0.42
6 :Sample 2, Lead-Free	1	7	0.19	0.14	0.13	0.21	0.25	0.24	0.21	0.29	0.33
6 :Sample 2, Lead-Free	1	8	0.16	0.19	0.23	0.25	0.26	0.31	0.23	0.34	0.37
6 :Sample 2, Lead-Free	1	9	0.26	0.20	0.17	0.38	0.34	0.41	0.22	0.41	0.43
6 :Sample 2, Lead-Free	1	10	0.26	0.19	0.18	0.28	0.27	0.33	0.25	0.24	0.27

	Initial	H/A #1	Vib #1	T/S #1	T/H #1	H/A #2	Vib #2	T/S #2	Final
Minimum	**0.16**	**0.12**	**0.13**	**0.19**	**0.21**	**0.24**	**0.18**	**0.24**	**0.27**
Maximum	**0.34**	**0.21**	**0.25**	**0.40**	**0.38**	**0.50**	**0.28**	**0.65**	**0.55**
Mean	**0.24**	**0.18**	**0.20**	**0.30**	**0.29**	**0.36**	**0.23**	**0.42**	**0.43**

Figure 6. Electrical resistance values in mΩ after each leg of the environmental exposure. These results are for tin/lead plated 1326029-8/leadfree.

GrpNumber :GrpDescription	Samp	Pos	Initial Data	H/A #1 Data	Vib #1 Data	T/S #1 Data	T/H #1 Data	H/A #2 Data	Vib #2 Data	T/S #2 Data	Final Data
7 :Sample 3, Lead-Free	1	1	0.11	0.19	0.22	0.34	0.27	0.35	0.19	0.47	0.38
7 :Sample 3, Lead-Free	1	2	0.23	0.17	0.19	0.25	0.24	0.30	0.25	0.32	0.32
7 :Sample 3, Lead-Free	1	3	0.14	0.21	0.19	0.33	0.32	0.45	0.21	0.30	0.30
7 :Sample 3, Lead-Free	1	4	0.18	0.18	0.19	0.32	0.25	0.33	0.18	0.13	0.16
7 :Sample 3, Lead-Free	1	5	0.21	0.15	0.17	0.49	0.32	0.43	0.21	0.34	0.36
7 :Sample 3, Lead-Free	1	6	0.16	0.09	0.11	0.15	0.19	0.24	0.12	0.31	0.35
7 :Sample 3, Lead-Free	1	7	0.20	0.18	0.17	0.23	0.18	0.28	0.22	0.29	0.32
7 :Sample 3, Lead-Free	1	8	0.13	0.11	0.10	0.29	0.23	0.34	0.11	0.28	0.37
7 :Sample 3, Lead-Free	1	9	0.21	0.05	0.15	0.26	0.22	0.26	*	*	0.34
7 :Sample 3, Lead-Free	1	10	0.28	0.10	0.16	0.23	0.19	0.26	0.13	0.15	0.18

	Initial	H/A #1	Vib #1	T/S #1	T/H #1	H/A #2	Vib #2	T/S #2	Final
Minimum	0.11	0.05	0.10	0.15	0.18	0.24	0.11	0.13	0.16
Maximum	0.28	0.21	0.22	0.49	0.32	0.45	0.25	0.47	0.38
Mean	0.19	0.14	0.17	0.29	0.24	0.32	0.18	0.29	0.31

Figure 7. Electrical resistance values in mΩ after each leg of the environmental exposure. These results are for tin/lead plated 7283/leadfree. Readings marked with an * indicate a failed test lead during the vibration sequence. This sample was hand probed at the end of the test.

GrpNumber :GrpDescription	Samp	Pos	Initial Data	H/A #1 Data	Vib #1 Data	T/S #1 Data	T/H #1 Data	H/A #2 Data	Vib #2 Data	T/S #2 Data	Final Data
8 :Sample 4, Lead-Free	1	1	0.18	0.14	0.14	0.14	0.17	0.21	0.16	0.31	0.31
8 :Sample 4, Lead-Free	1	2	0.23	0.16	0.17	0.20	0.23	0.26	0.21	0.32	0.34
8 :Sample 4, Lead-Free	1	3	0.21	0.12	0.12	0.15	0.17	0.20	0.20	0.29	0.33
8 :Sample 4, Lead-Free	1	4	0.21	0.21	0.20	0.25	0.25	0.29	0.23	0.34	0.35
8 :Sample 4, Lead-Free	1	5	0.22	0.18	0.19	0.30	0.32	0.43	0.24	0.33	0.38
8 :Sample 4, Lead-Free	1	6	0.32	0.16	0.16	0.16	0.18	0.23	0.19	0.43	0.48
8 :Sample 4, Lead-Free	1	7	0.24	0.13	0.13	0.12	0.13	0.17	0.15	0.30	0.34
8 :Sample 4, Lead-Free	1	8	0.25	0.20	0.17	0.30	0.33	0.35	0.20	0.39	0.42
8 :Sample 4, Lead-Free	1	9	0.35	0.31	0.31	0.42	0.40	0.42	0.27	0.42	0.46
8 :Sample 4, Lead-Free	1	10	0.22	0.17	0.18	0.25	0.24	0.28	0.19	0.27	0.31

	Initial	H/A #1	Vib #1	T/S #1	T/H #1	H/A #2	Vib #2	T/S #2	Final
Minimum	0.18	0.12	0.12	0.12	0.13	0.17	0.15	0.27	0.31
Maximum	0.35	0.31	0.31	0.42	0.40	0.43	0.27	0.43	0.48
Mean	0.24	0.18	0.18	0.23	0.24	0.28	0.20	0.34	0.37

Figure 8. Electrical resistance values in mΩ after each leg of the environmental exposure. These results are for tin/lead plated 7282/leadfree.

Each of the results indicated in Figures 1 through 8 show that both the tin and tin/lead plated samples pass the USCAR-20 test. The pass/fail criterion is a maximum resistance of 20 milliohms.

In order to more easily compare tin/lead and tin plated parts, the results from all four samples that were plated with tin or tin/lead, were tabulated in Figures 9 and 10 below. We also include the standard deviation and a value for the mean plus three times the standard deviation. The results show that tin and tin/lead are statistically equivalent.

	Initial	H/A #1	Vib #1	T/S #1	T/H #1	H/A #2	Vib #2	T/S #2	Final
Minimum	0.13	0.06	0.07	0.18	0.20	0.23	0.16	0.21	0.25
Maximum	0.36	0.31	0.33	0.44	0.62	0.59	0.44	0.53	0.59
Mean	0.24	0.20	0.22	0.31	0.33	0.37	0.29	0.35	0.39
std dev	0.059	0.066	0.064	0.064	0.076	0.069	0.061	0.072	0.077
mean + 3 std dev	0.419	0.398	0.408	0.502	0.561	0.573	0.476	0.569	0.618

Figure 9. Compiled statistical data for all four tin/lead plated samples, 40 readings total.

	Initial	H/A #1	Vib #1	T/S #1	T/H #1	H/A #2	Vib #2	T/S #2	Final
Minimum	0.11	0.05	0.10	0.12	0.13	0.17	0.11	0.13	0.16
Maximum	0.35	0.31	0.31	0.49	0.40	0.50	0.28	0.65	0.55
Mean	0.22	0.17	0.18	0.27	0.26	0.32	0.21	0.35	0.37
std dev	0.052	0.046	0.043	0.081	0.062	0.076	0.042	0.100	0.085
mean + 3 std dev	0.380	0.305	0.313	0.511	0.444	0.550	0.336	0.653	0.626

Figure 10. Compiled statistical data for all four tin plated samples, 40 readings total.

Conclusions:

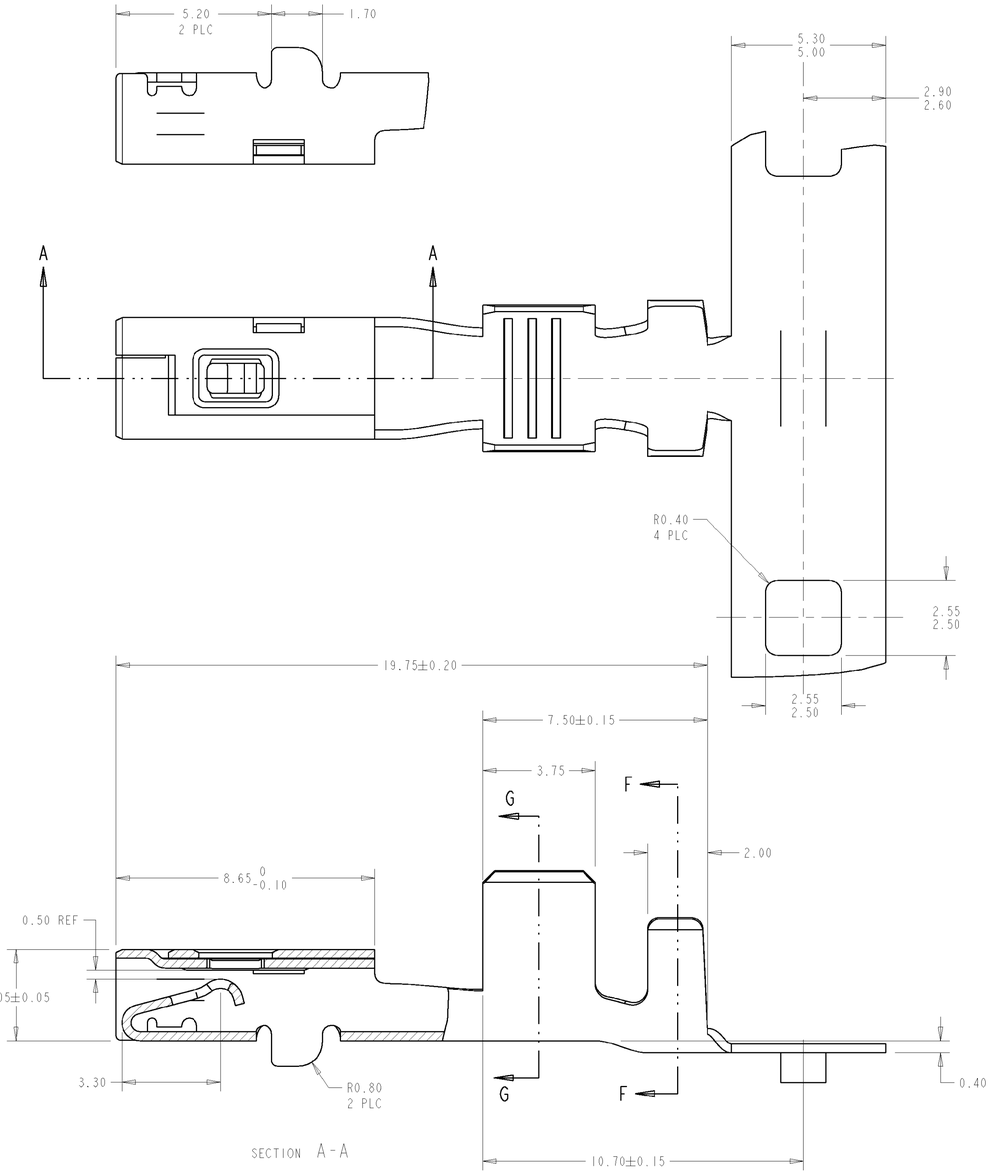
1) USCAR-20, Field Correlated Life Test, has been performed on two versions of the 2.8mm automotive terminal.
2) Analysis of the electrical resistance shows that these products pass the USCAR-20 requirements with either tin/lead plating or pure tin plating.
3) Tin performs statistically equivalent to tin lead.
4) This data further reinforces the historical performance of Sn plated contact systems and provides additional data to prove that the conversion of SnPb to Sn plating in the crimp barrels and separable interface has no impact on product performance.

LOC	DIST
GE	00

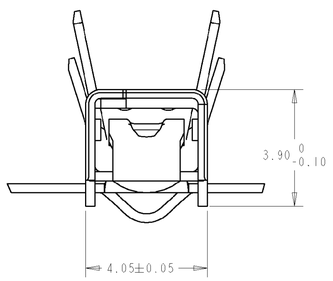
REVISIONS

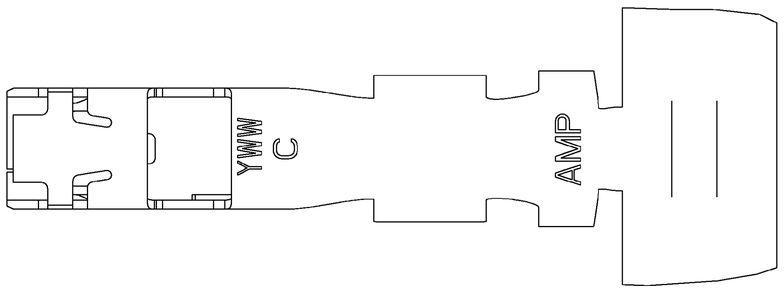
P	LTR	DESCRIPTION	DATE	DWN	APVD
	D	REV PER OK40-0354-01	30OCT2001	AG	SM
	E	REV PER OK40-0405-02	17APR2002	AH	TW

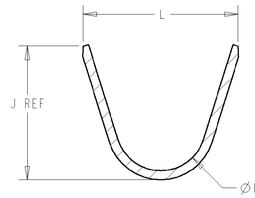
DUAL CRIMP TABLE	
PART NO	WIRE SIZE
1326030-9 AND 1-1326030-1	0.35+0.35
	0.35+0.5
	0.35+0.75
	0.35+1.0
	0.5+0.5
	0.5+0.75
1-1326030-0 AND 1-1326030-2	0.35+1.5
	0.5+1.0
	0.5+1.5
	0.75+0.75
	0.75+1.0
	0.75+1.5
	1.0+1.0
	1.0+1.5



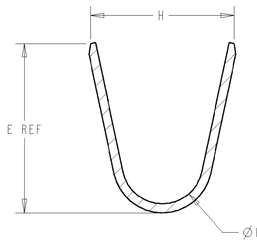
SECTION A-A







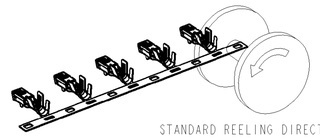
SECTION F-F



SECTION G-G

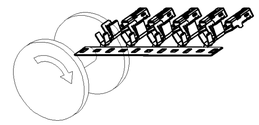
1. MATERIAL: 0.30 THICK COPPER ALLOY, PREPLATED WITH 0.0008 MINIMUM THICK BRIGHT TIN-LEAD

2.



STANDARD REELING DIRECTION

3.



REVERSE REELING DIRECTION

4. CURRENT CAVITY DESIGNS DO NOT ACCEPT CRIMPED 10 AWG TERMINALS. SEE PRODUCT ENGINEERING FOR DETAILS.

REELING	L	ØK	J	H	ØF	E	WIRE SIZE	PART NO.
3	1-1326030-0 REELED FOR AMP APPLICATOR						REFERENCE DUAL CRIMP TABLE	1-1326030-2
	1326030-9 REELED FOR AMP APPLICATOR						REFERENCE DUAL CRIMP TABLE	1-1326030-1
2	4.6	1.80	5.35	3.9	1.70	3.88	REFERENCE DUAL CRIMP TABLE	1-1326030-0
	3.6	1.40	4.32	3.3	1.30	2.76	REFERENCE DUAL CRIMP TABLE	1326030-9
3	1326030-4 REELED FOR AMP APPLICATORS						10-12 AWG 4	1326030-8
	1326030-3 REELED FOR AMP APPLICATORS						14-16 AWG	1326030-7
	1326030-2 REELED FOR AMP APPLICATORS						18-20 AWG	1326030-6
	1326030-1 REELED FOR AMP APPLICATORS						22 AWG	1326030-5
2	5.2	3.20	4.22	4.7	2.70	5.25	10-12 AWG 4	1326030-4
	3.8	1.80	3.16	3.9	1.70	3.88	14-16 AWG	1326030-3
	3.1	1.40	2.55	3.3	1.30	2.76	18-20 AWG	1326030-2
	2.6	1.00	2.04	2.5	0.90	2.11	22 AWG	1326030-1

DIMENSIONS: mm

TOLERANCES UNLESS OTHERWISE SPECIFIED:
0 PLC ±-
1 PLC ±0.3
2 PLC ±0.10
3 PLC ±-
4 PLC ±-
ANGLES ±4°

MATERIAL 1

FINISH 1

DWN D. STRAUSSER 28APR99
CHK D. BROWN 28APR99
APVD D. BROWN 28APR99
PRODUCT SPEC SAE/USCAR-2 8/97
APPLICATION SPEC 114-13013
WEIGHT -

Tyco Electronics
Harrisburg, PA 17105-3608

NAME 2.8mm RECEPTACLE UNSEALED
-

SIZE	CAGE CODE	DRAWING NO	RESTRICTED TO
A1	00779	C-1326030	-

CUSTOMER DRAWING

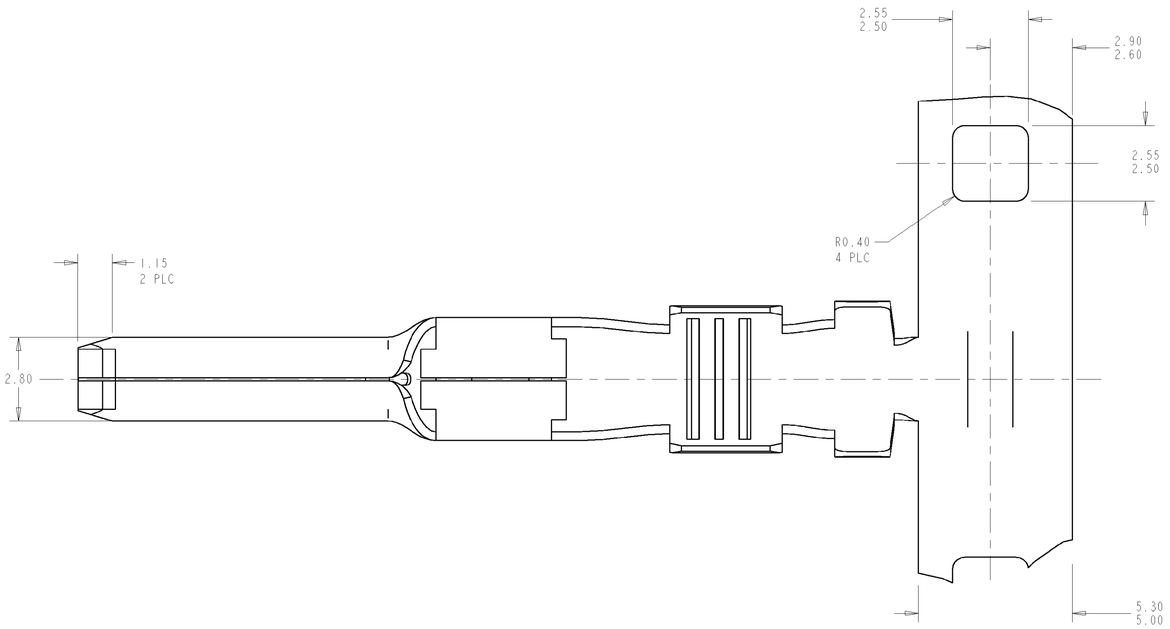
SCALE 10:1 SHEET 1 OF 1 REV E

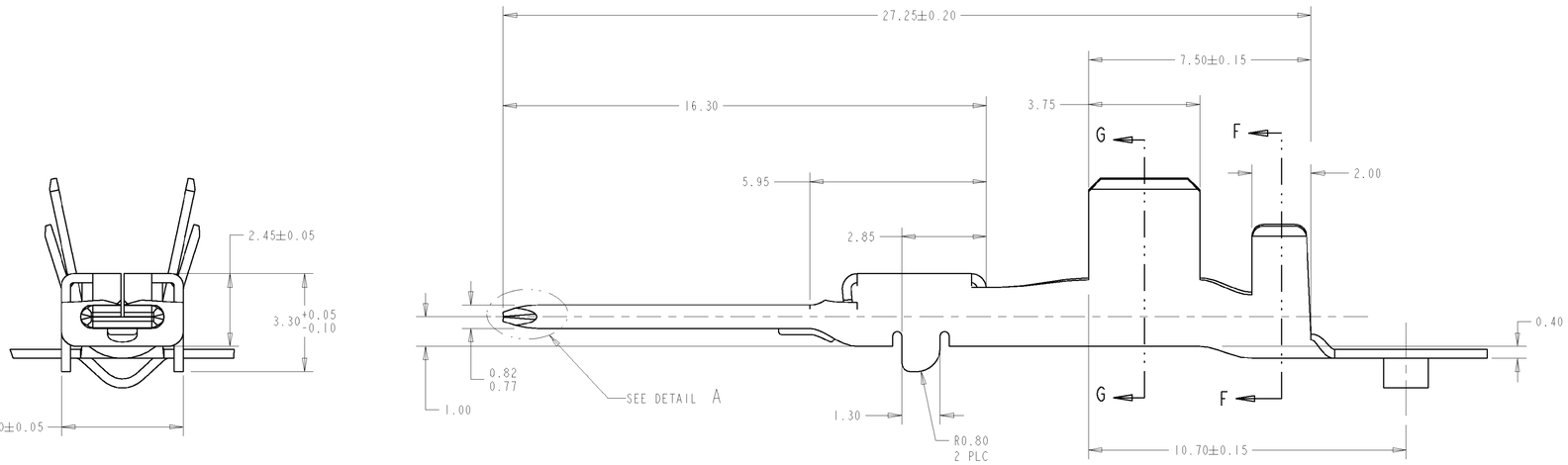
LOC	DIST
GE	00

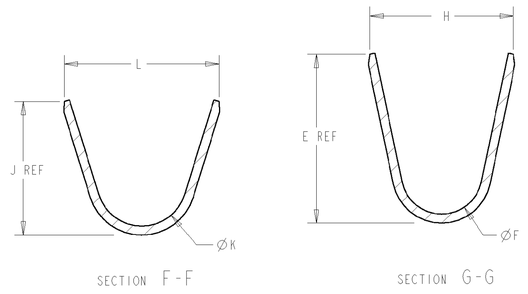
REVISIONS

P	LTR	DESCRIPTION	DATE	DWN	APVD
	D	REV PER OK40-0354-01	30OCT2001	AG	SM
	E	REV PER OK40-0480-01	12NOV2001	AG	SM

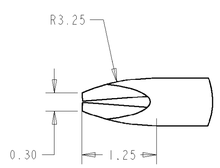
DUAL CRIMP TABLE	
PART NO	WIRE SIZE
1326029-9 AND 1-1326029-1	0.35+0.35
	0.35+0.5
	0.35+0.75
	0.35+1.0
	0.5+0.5
	0.5+0.75
1-1326029-0 AND 1-1326029-2	0.35+1.5
	0.5+1.0
	0.5+1.5
	0.75+0.75
	0.75+1.0
	0.75+1.5
	1.0+1.0
	1.0+1.5



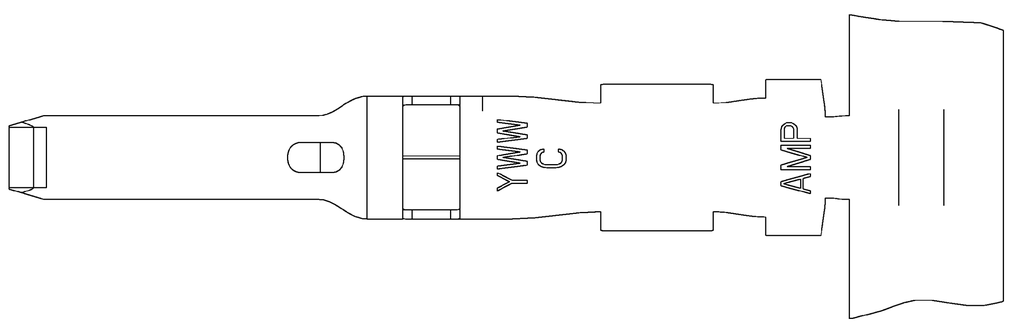




SECTION F-F SECTION G-G

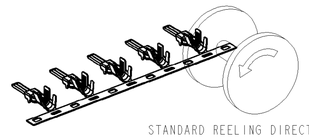


DETAIL A
SCALE 20:1



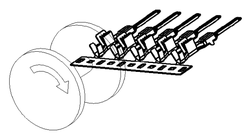
△1 MATERIAL: 0.30 THICK COPPER ALLOY, PREPLATED WITH 0.0008 MINIMUM THICK MATTE TIN-LEAD.

△2



STANDARD REELING DIRECTION

△3



REVERSE REELING DIRECTION

△4 CURRENT CAVITY DESIGNS DO NOT ACCEPT CRIMPED 10 AWG TERMINALS. SEE PRODUCT ENGINEERING FOR DETAILS.

△3	1-1326029-0 REELED FOR AMP APPLICATOR						REFERENCE DUAL CRIMP TABLE	1-1326029-2
	1326029-9 REELED FOR AMP APPLICATOR						REFERENCE DUAL CRIMP TABLE	1-1326029-1
△2	4.6	1.80	5.35	3.9	1.70	3.88	REFERENCE DUAL CRIMP TABLE	1-1326029-0
	3.6	1.40	4.32	3.3	1.30	2.76	REFERENCE DUAL CRIMP TABLE	1326029-9
△3	1326029-4 REELED FOR AMP APPLICATORS						10-12 AWG △4	1326029-8
	1326029-3 REELED FOR AMP APPLICATORS						14-16 AWG	1326029-7
	1326029-2 REELED FOR AMP APPLICATORS						18-20 AWG	1326029-6
	1326029-1 REELED FOR AMP APPLICATORS						22 AWG	1326029-5
△2	5.2	3.20	4.22	4.7	2.70	5.25	10-12 AWG △4	1326029-4
	3.8	1.80	3.16	3.9	1.70	3.88	14-16 AWG	1326029-3
	3.1	1.40	2.55	3.3	1.30	2.76	18-20 AWG	1326029-2
	2.6	1.00	2.04	2.5	0.90	2.11	22 AWG	1326029-1
REELING	L		ØK	J	H	ØF	E	WIRE SIZE / PART NO.

DIMENSIONS: mm

TOLERANCES UNLESS OTHERWISE SPECIFIED:
0 PLC ±-
1 PLC ±0.3
2 PLC ±0.10
3 PLC ±-
4 PLC ±-
ANGLES ±5°

MATERIAL △1

FINISH △1

DWN D STRAUSSER 27APR99
CHK D BROWN 27APR99
APVD D BROWN 27APR99

AMP Incorporated
Harrisburg, PA 17105-3608

NAME 2.8mm BLADE, UNSEALED
-
-

PRODUCT SPEC SAE/USCAR-2 8/97
APPLICATION SPEC 114-13013
WEIGHT -

SIZE	CAGE CODE	DRAWING NO	RESTRICTED TO
A1	00779	C-1326029	-

CUSTOMER DRAWING

SCALE 10:1 SHEET 1 OF 1 REV E