



Product Change Notification



Product Group: DR/Thu Sep 8, 2022/PCN-DR-00012-2022-REV-0

WSL0805 & WSL0805-18 - Addition of Manufacturing Site

DESCRIPTION OF CHANGE: Columbus, NE, USA is being added as a manufacturing location for the welded construction WSL0805 & WSL0805-18 part numbers. Production will continue in the existing location in Beer-Sheva Israel. This will increase total production capacity to improve availability and support greater production flexibility.

REASON FOR CHANGE: Due to high market demand, qualified manufacturing is being expanded to Columbus, NE, USA. The location is ISO9001 and IATF16949 certified and is currently producing Automotive grade products, such as WSLx2512 and WSLx1206.

EXPECTED INFLUENCE ON QUALITY/RELIABILITY/PERFORMANCE: No Change, same design.

PART NUMBERS/SERIES/FAMILIES AFFECTED: WSL0805*

VISHAY BRAND(s): Vishay Dale

TIME SCHEDULE:

Start Shipment Date: Mon Oct 24, 2022

SAMPLE AVAILABILITY: Now

PRODUCT IDENTIFICATION: Product labeling with Country of Origin.

QUALIFICATION DATA: Available upon request

This PCN is considered approved, without further notification, unless we receive specific customer concerns before Sat Oct 8, 2022 or as specified by contract.

ISSUED BY: Bryan Yarborough, bryan.yarborough@vishay.com

For further information, please contact your regional Vishay office.

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ONE OF THE WORLD'S LARGEST MANUFACTURERS OF DISCRETE SEMICONDUCTORS AND PASSIVE COMPONENT



Vishay WSL0805

Qualification Documentation

Use the Control Bars below to navigate to the various documents.

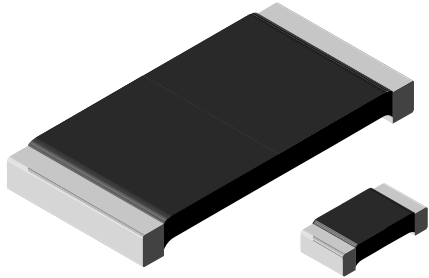
Vishay Dale Electronics

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ONE OF THE WORLD'S LARGEST MANUFACTURERS OF PASSIVE COMPONENTS



Power Metal Strip® Resistors, Low Value (Down to 0.0005 Ω), Surface-Mount



FEATURES

- All welded construction of the Power Metal Strip® resistors are ideal for all types of current sensing, voltage division and pulse applications
- Proprietary processing technique produces extremely low resistance values (down to 0.0005 Ω)
- Sulfur resistance by construction that is unaffected by high sulfur environments
- Very low inductance 0.5 nH to 5 nH
- Low thermal EMF (< 3 μV/°C)
- AEC-Q200 qualified ⁽¹⁾
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



Available



RoHS* Available

HALOGEN

FREE Available

GREEN

(5-2008) Available

LINKS TO ADDITIONAL RESOURCES



Notes

- * This datasheet provides information about parts that are RoHS-compliant and / or parts that are non-RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details
- Follow link to Overview of Automotive Grade Products for more details: www.vishay.com/doc?49924
- “SMD Current Sense: AEC-Q200 vs. Vishay Qualification” technical note: www.vishay.com/doc?30416
- ⁽¹⁾ Flame retardance test may not be applicable to some resistor technologies

STANDARD ELECTRICAL SPECIFICATIONS

GLOBAL MODEL	SIZE	POWER RATING $P_{70\text{ °C}}$ W	RESISTANCE VALUE RANGE Ω ⁽²⁾		WEIGHT (typical) g/1000 pieces
			TOL. ± 0.5 %	TOL. ± 1.0 %	
WSL0603	0603	0.1	0.01 to 0.1	0.01 to 0.1	1.9
WSL0805	0805	0.125	0.005 to 0.2	0.005 to 0.2	4.8
WSL1206	1206	0.25	0.005 to 0.2	0.0005 to 0.2	16.2
WSL2010	2010	0.5	0.004 to 0.5	0.001 to 0.5	38.9
WSL2512	2512	1.0 ⁽¹⁾	0.003 to 0.5	0.0005 to 0.5	63.6
WSL2816	2816	2.0	0.003 to 0.1	0.002 to 0.1	118

Notes

- Part marking: value; tolerance: due to resistor size limitations some resistors will be marked with only the resistance value
- “Thermal Management for Surface-Mount Devices” white paper: www.vishay.com/doc?30380
- ⁽¹⁾ For values above 0.1 Ω derate linearly to 80 % rated power at 0.5 Ω
- ⁽²⁾ WSL1206 0.0005 Ω to 0.00099 Ω is only available with 2 % tolerance (G tolerance code)

GLOBAL PART NUMBER INFORMATION

Global Part Numbering Example: WSL25124L000FEA (visit www.vishay.net Vishay Dale parts numbering manual for all options)

W S L 2 5 1 2 4 L 0 0 0 F E A

GLOBAL MODEL (7 digits)	RESISTANCE VALUE ⁽¹⁾ (5 digits)	TOLERANCE CODE (1 digit)	PACKAGING CODE ⁽²⁾ (2 digits)	SPECIAL ⁽³⁾ (up to 2 digits)
WSL0603 WSL0805 WSL1206 WSL2010 WSL2512 WSL2816	L = mΩ* R = decimal 5L000 = 0.005 Ω R0100 = 0.01 Ω * Use “L” for resistance values < 0.01 Ω	D = ± 0.5 % F = ± 1.0 % J = ± 5.0 %	EA = lead (Pb)-free, tape / reel EH = lead (Pb)-free, tape / reel (WSL2816) TA = tin / lead, tape / reel (R86) TG = tin / lead, tape / reel (RT1, for WSL0603 and WSL0805) TH = tin / lead, tape / reel (RJ9, WSL2816) SB = tin / lead, tape / reel for DLA drawings	(dash number) from 1 to 99 as applicable

Notes

- Per PCN-DR-00009-2022-REV-0, WSL marking will be removed effective March 1st, 2023
- ⁽¹⁾ WSL marking (www.vishay.com/doc?30327); WSL decade values (www.vishay.com/doc?30117)
- ⁽²⁾ Packaging code: EB (lead (Pb)-free) and TB (tin / lead) are non-standard packaging codes designating 1000 piece reels. These non-standard packaging codes are identical to our standard EA (lead (Pb)-free) and TA (tin / lead), except that they have a package quantity of 1000 pieces
- ⁽³⁾ Follow link for customization capabilities: www.vishay.com/doc?48163

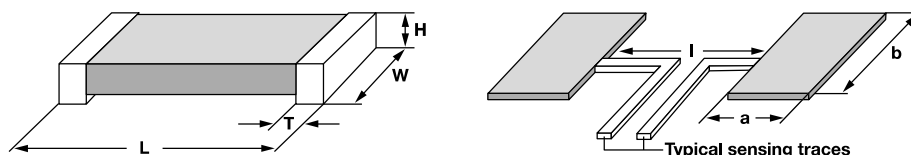


TECHNICAL SPECIFICATIONS						
PARAMETER	UNIT	WSL RESISTOR CHARACTERISTICS				
		WSL0603 ⁽¹⁾	WSL0805	WSL1206	WSL2010	WSL2512
Component temperature coefficient (including terminal) ⁽²⁾ TCR measured from -55 °C to +155 °C	ppm/°C	± 75 for 50 mΩ to 100 mΩ	± 75 for 7 mΩ to 500 mΩ			
		± 110 for 10 mΩ to 49 mΩ	± 110 for 5 mΩ to 6.9 mΩ			
		-	± 150 for 3 mΩ to 4.9 mΩ			
		-	± 275 for 1 mΩ to 2.9 mΩ			
Element TCR ⁽³⁾	ppm/°C	< 20				
Operating temperature range	°C	-65 to +170				
Maximum working voltage ⁽⁴⁾	V	$(P \times R)^{1/2}$				

Notes

- “Temperature Coefficient of Resistance for Current Sensing” white paper: www.vishay.com/doc?30405
- ⁽¹⁾ Consult factory for detailed TCR performance across temperature range associated with PCN-DR-00003-2020 for WSL0603. TCR performance is improved for +25 °C to +155 °C
- ⁽²⁾ Component TCR - total TCR that includes the TCR effects of the resistor element and the copper terminal
- ⁽³⁾ Element TCR - only applies to the alloy used for the resistor element; refer to item 1 in the construction illustration on the following page
- ⁽⁴⁾ Maximum working voltage - the WSL is not voltage sensitive, but is limited by power / energy dissipation and is also not ESD sensitive

DIMENSIONS in inches (millimeters)



Notes

- 3D models available: www.vishay.com/doc?30306
- Surface mount solder profile recommendations: www.vishay.com/doc?31052

MODEL	RESISTANCE RANGE (Ω)	DIMENSIONS				SOLDER PAD DIMENSIONS		
		L	W	H	T	a	b	l
WSL0603 ⁽¹⁾	0.01 to 0.1	0.060 ± 0.010 (1.52 ± 0.254)	0.030 ± 0.010 (0.76 ± 0.254)	0.016 ± 0.005 (0.406 ± 0.127)	0.015 ± 0.010 (0.381 ± 0.254)	0.040 (1.01)	0.040 (1.01)	0.020 (0.50)
WSL0805 ⁽²⁾	0.005 to 0.2	0.080 ± 0.010 (2.03 ± 0.254)	0.050 ± 0.010 (1.27 ± 0.254)	0.016 ± 0.005 (0.406 ± 0.127)	0.015 ± 0.010 (0.381 ± 0.254)	0.040 (1.02)	0.050 (1.27)	0.020 (0.50)
WSL1206	0.0005 to 0.00099	0.126 ± 0.010 (3.20 ± 0.254)	0.063 ± 0.010 (1.60 ± 0.254)	0.025 ± 0.010 (0.635 ± 0.254)	0.041 ± 0.010 (1.04 ± 0.254)	0.089 (2.26)	0.076 (1.93)	0.023 (0.58)
	0.001 to 0.0019				0.086 (2.18)	0.076 (1.93)	0.029 (0.74)	
	0.002 to 0.0059				0.025 ± 0.010 (0.635 ± 0.254)	0.070 (1.78)	0.076 (1.93)	0.061 (1.55)
	0.006 to 0.20				0.020 ± 0.010 (0.508 ± 0.254)	0.065 (1.65)	0.076 (1.93)	0.071 (1.80)
WSL2010	0.001 to 0.0069	0.200 ± 0.010 (5.08 ± 0.254)	0.100 ± 0.010 (2.54 ± 0.254)	0.025 ± 0.010 (0.635 ± 0.254)	0.058 ± 0.010 (1.47 ± 0.254)	0.093 (2.36)	0.120 (3.05)	0.055 (1.40)
	0.007 to 0.5				0.020 ± 0.010 (0.508 ± 0.254)	0.055 (1.40)	0.120 (3.05)	0.130 (3.30)
WSL2512	0.0005 to 0.00099	0.250 ± 0.010 (6.35 ± 0.254)	0.125 ± 0.010 (3.18 ± 0.254)	0.025 ± 0.010 (0.635 ± 0.254)	0.107 ± 0.010 (2.72 ± 0.254)	0.120 (3.05)	0.145 (3.68)	0.050 (1.27)
	0.001 to 0.0049				0.087 ± 0.010 (2.21 ± 0.254)			
	0.005 to 0.0069				0.047 ± 0.010 (1.19 ± 0.254)	0.083 (2.11)		0.125 (3.18)
	0.007 to 0.5				0.030 ± 0.010 (0.762 ± 0.254)	0.065 (1.65)		
WSL2816	0.002 to 0.00399	0.280 ± 0.010 (7.1 ± 0.254)	0.165 ± 0.010 (4.2 ± 0.254)	0.025 ± 0.010 (0.635 ± 0.254)	0.098 ± 0.010 (2.49 ± 0.254)	0.135 (3.43)	0.185 (4.7)	0.060 (1.52)
	0.004 to 0.1				0.062 ± 0.010 (1.57 ± 0.254)	0.096 (2.45)		0.125 (3.20)

Notes

- ⁽¹⁾ PCN-DR-00003-2020 changed terminal height for WSL0603 from 0.013" ± 0.005" for clad construction to 0.016" ± 0.005" for welded construction
- ⁽²⁾ PCN-DR-00021-2021-REV-1 changed terminal height for WSLP0805 from 0.013" ± 0.005" for clad construction to 0.016" ± 0.005" for welded construction

Upgrade for Higher Current to WSLP and for Zero Ohm Jumper to WSL-9

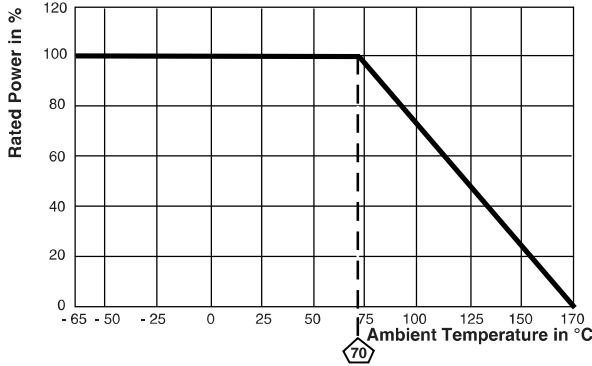


www.vishay.com

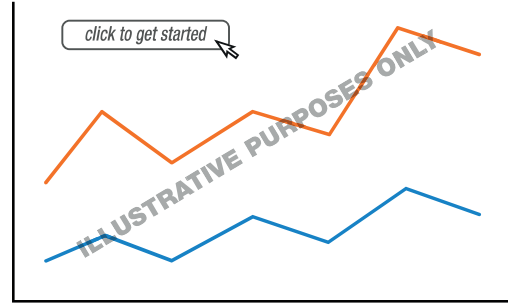
WSL

Vishay Dale

DERATING

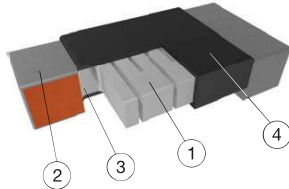


PULSE CAPABILITY



www.vishay.com/resistors/power-metal-strip-calculator

WELDED CONSTRUCTION



- ① Resistive element: solid metal nickel-chrome or manganese-copper alloy resistive element with low TCR (< 20 ppm/°C)
- ② Plated terminal: solid copper, 100 % Sn (100 μ" min.) with 100 % Ni (20 μ" min.) under layer finish
- ③ Terminal / element weld
- ④ Silicone coating with ink print

PERFORMANCE		
TEST	CONDITIONS OF TEST	TEST LIMITS
Thermal shock	-55 °C to +150 °C, 1000 cycles, 15 min at each extreme	± (0.5 % + 0.0005 Ω)
Short time overload	Refer to link for short time overload performance and pulse capability; www.vishay.com/resistors/power-metal-strip-calculator/	± (0.5 % + 0.0005 Ω)
Low temperature operation	-65 °C for 24 h	± (0.5 % + 0.0005 Ω)
High temperature exposure	1000 h at + 170 °C	± (1.0 % + 0.0005 Ω)
Bias humidity	+85 °C, 85 % RH, 10 % bias, 1000 h	± (0.5 % + 0.0005 Ω)
Mechanical shock	100 g's for 6 ms, 5 pulses	± (0.5 % + 0.0005 Ω)
Vibration	Frequency varied 10 Hz to 2000 Hz in 1 min, 3 directions, 12 h	± (0.5 % + 0.0005 Ω)
Load life	1000 h at rated power, + 70 °C, 1.5 h "ON", 0.5 h "OFF"	± (1.0 % + 0.0005 Ω)
Resistance to solder heat	+260 °C solder, 10 s to 12 s dwell, 25 mm/s emergence	± (0.5 % + 0.0005 Ω)
Moisture resistance	MIL-STD-202, method 106, 0 % power, 7a and 7b not required	± (0.5 % + 0.0005 Ω)

PACKAGING (1)				
MODEL	REEL			
	TAPE WIDTH	DIAMETER	PIECES/REEL	CODE
WSL0603	8 mm / punched paper	178 mm / 7"	5000	EA
WSL0805	8 mm / punched paper	178 mm / 7"	5000	EA
WSL1206	8 mm / embossed plastic	178 mm / 7"	4000	EA
WSL2010	12 mm / embossed plastic	178 mm / 7"	4000	EA
WSL2512	12 mm / embossed plastic	178 mm / 7"	2000	EA
WSL2816	12 mm / embossed plastic	178 mm / 7"	2000	EH

Notes

- Embossed carrier tape per EIA-481
- (1) Additional packaging details at www.vishay.com/doc?20051



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FIT rate as calculated by Observed Failure Rate

The observed failure rate is estimated from field failures reported by our customers. FIT_{observed} figures can be derived from this database by applying the following assumptions:

- all resistors failed in an application are reported
- the confidence level of the estimation can be stated at 90 % (resulting in a Poisson parameter $\lambda =$
- As a conservative estimate, the average number of operating hours for assessed components is 200 h

$$FIT_{observed} = (1+\lambda) / [(1/failure\ rate\ [ppb]) * average\ Component\ hours] * ((10^{-9})/h)$$

Observed Fit Rate	
Product	WSL0805
Date	8-10-2022
Confidence level of 90% = λ	2.85
Field returns (minimum of 1)	6
Parts shipped	7,409,260,530
failure rate [ppb] = (Field Returns) / (Parts Shipped)	0.810
Average Component Hours	200
FIT _{observed} [ppb hr ⁻¹] =	0.016
MTBF [failures / 10 ⁻⁶ hrs]	
	0.0000156

Years	10
hours	87600
P(t) [probability of failure in 10 operation years]	0%

SUPPLIER - Vishay- Columbus		PART NAME - WSL-0805 .005Ω Surface Mount Resistor									
NAME OF LABORATORY - Vishay Dale Electronics Test Lab											
DESCRIPTION	AEC TEST #	TEST CONDITIONS	LIMIT	OHMIC ADDER	QTY. TESTED	HOURS/ CYCLES	RANGE				
High Temperature Exposure (Storage)	3	MIL-STD-202, Method 108, 2000 Hrs @ T=170°C @ 0% power, Measurements at 24± 2 hrs	±(1.0%)	0.0005	77	2000	-0.353	TO	0.733		
Temperature Cycling	4	MIL-STD-202 Method 107 Condition F, -55°C to 150°C, Dwell time = 15min, 2000 Cycles.	±(0.5%)	0.0005	77	2000	-0.008	TO	0.17		
Moisture Resistance	6	MIL-STD-202, Method 106, t=24 hours/cycle. Note: Steps 7a & 7b not required, 0% power, No Polo, 65°C, Measurement at 24± 2 Hrs after test.	±(0.5%)	0.0005	24		0.026	TO	0.089		
Biased Humidity	7	MIL-STD-202, Method 103, 2000 hrs 85°C/85%RH, Note: Specified conditions: 10% of operating power. Measurement at 24± 2 hrs after test.	±(0.5%)	0.0005	77	1000	-0.004	TO	0.061		
Operational Life	8.1	MIL-STD 202, Method 108, Condition D Steady State, Ta=70°C @rated power from derating curve. Measurements at 24± 2 hrs after test. Test to 2000hrs.	±(1.0%)	0.0005	24	2000	-0.02	TO	0.018		
Operational Life	8	MIL-STD 202, Method 108, 2,000 hr test; Condition F; 1.5 hrs "ON", 0.5 hrs "OFF"; +125°C @ rated power. Measurement 24±4 hrs. after test conclusion.	±(1.0%)	0.0005	77	2000	-0.071	TO	0.101		
External Visual	9	Inspect per ICP document and sections listed in general specifications section. Inspect device construction, marking and workmanship.	Per MIL-STD-883		All Qual. Parts						
Physical Dimension	10	JESD22 Method JB-100, Verify physical dimensions to the standard WSL data sheet.	Per Datasheet		30						
Resistance to Solvents	12	MIL-STD-202, Method 215 Aqueous wash chemical- OKEM Clean or equivalent.	Marking remains legible		5						
Mechanical Shock	13	MIL-STD-202, Method 213	±(0.5%)	0.0005	30		-0.444	TO	0.01		
Vibration	14	MIL-STD-202, Method 204, Condition D	±(0.5%)	0.0005	30		-0.006	TO	0.006		
Resistance to Solder Heat	15	MIL-STD-202, Method 210, Condition K	±(0.5%)	0.0005	30		0.032	TO	0.115		
Thermal Shock	16	Temperatute Cycling has been substituted as it is a more severe test; refer to test 4.	NA		NA						
ESD	17	AEC-Q200-002	±(1.0%)		15	25 kV	-0.01	TO	0.01		
Solderability	18.5	J-STD-002, Test B1, Preconditioning E 4 hours @ 155°C dry heat, Pb-free Solder @ 245°C, Magnification 50X.	>95% coverage		15						
Solderability	18.6	J-STD-002, Test B (backward compatibility), Preconditioning Category E, 4 hours @ 155°C dry heat, Pb Solder @ 215°C, Magnification 50X.	>95% coverage		15						
Solderability	18.8	J-STD-002, Test D (backward compatibility), Preconditioning Category C, 4 hours @ 155°C dry heat, Pb Solder @ 260°C, Magnification 50X.	>95% coverage		15						
Electrical Characterization	19	RTC at -55°C & 150°C	±110 ppm/°C		30		-55°C	76	TO	93.7	
							150°C	10.5	TO	21.6	
Board Flex	21	AEC-Q200-005 2mm min	±(0.5%)	0.0005	30		Reading 2	0.0510	TO	0.1050	
							Reading 3	0.0490	TO	0.0970	
Terminal Strength (SMD)	22	AEC-Q200-006 Force of 1.8 Kg for 60 seconds.	±(0.5%)	0.0005	30		0.022	TO	0.157		
Flame Retardance	24	AEC-Q200-001	0		30						
Flammability	20	UL-94	NA		NA						
Short Time Overload		MIL-PRF-55342 paragraph 4.86: 5 X rated power for 5 Seconds.	±(0.5%)	0.0005	24		-0.016	TO	0.012		
Low Temp Storage		MIL-PRF-26 Paragraph 4,7,12	±(0.5%)	0.0005	24	2000	-0.01	TO	0.02		
Bump Test		Per IEC 68 2-29, 4000 each mechanical axis, 40g peak acceleration, 6ms pulse length	±(0.5%)	0.0005	30		0.002	TO	0.014		

Note 1) Moisture Resistance testing was performed on 24 pieces instead of 77. Data package will be updated upon completion of testing with corrected sample size. Estimated date of completion is 9/23/22.
Note 2) Flame retardance requires the application of 9V for 1 hour on a low resistance value current sense resistor, which causes the device to be substantially overpowered. The Power Metal Strip @ technod would under these conditions, resulting in temperatures that exceeds 350 °C for > 10 seconds.

SUPPLIER - Vishay- Columbus		PART NAME - WSL-0805 .05Ω Surface Mount Resistor							
NAME OF LABORATORY - Vishay Dale Electronics Test Lab									
DESCRIPTION	AEC TEST #	TEST CONDITIONS	LIMIT	OHMIC ADDER	QTY. TESTED	HOURS/ CYCLES	RANGE		
High Temperature Exposure (Storage)	3	MIL-STD-202, Method 108, 2000 Hrs @ T=170°C @ 0% power, Measurements at 24± 2 hrs	±(1.0%)	0.0005	77	2000	0.149	TO	0.31
Temperature Cycling	4	MIL-STD-202 Method 107 Condition F, -55°C to 150°C, Dwell time = 15min, 2000 Cycles.	±(0.5%)	0.0005	77	2000	0.028	TO	0.078
Moisture Resistance	6	MIL-STD-202, Method 106, t=24 hours/cycle. Note: Steps 7a & 7b not required, 0% power, No Polo, 65°C, Measurement at 24± 2 Hrs after test.	±(0.5%)	0.0005	24		0.002	TO	0.014
Biased Humidity	7	MIL-STD-202, Method 103, 2000 hrs 85°C/85%RH, Note: Specified conditions: 10% of operating power. Measurement at 24± 2 hrs after test.	±(0.5%)	0.0005	77	1000	-0.002	TO	0.04
Operational Life	8.1	MIL-STD 202, Method 108, Condition D Steady State, Ta=70°C @rated power from derating curve. Measurements at 24± 2 hrs after test. Test to 2000hrs.	±(1.0%)	0.0005	24	2000	-0.012	TO	0.002
Operational Life	8	MIL-STD 202, Method 108, 2,000 hr test; Condition F; 1.5 hrs "ON", 0.5 hrs "OFF"; +125°C @ rated power. Measurement 24±4 hrs. after test conclusion.	±(1.0%)	0.0005	77	2000	-0.004	TO	0.499
External Visual	9	Inspect per ICP document and sections listed in general specifications section. Inspect device construction, marking and workmanship.	Per MIL-STD-883		All Qual. Parts				
Physical Dimension	10	JESD22 Method JB-100, Verify physical dimensions to the standard WSL data sheet.	Per Datasheet		30				
Resistance to Solvents	12	MIL-STD-202, Method 215 Aqueous wash chemical- OKEM Clean or equivalent.	Marking remains legible		5				
Mechanical Shock	13	MIL-STD-202, Method 213	±(0.5%)	0.0005	30		-0.004	TO	0.002
Vibration	14	MIL-STD-202, Method 204, Condition D	±(0.5%)	0.0005	30		-0.008	TO	0
Resistance to Solder Heat	15	MIL-STD-202, Method 210, Condition K	±(0.5%)	0.0005	30		0	TO	0.026
Thermal Shock	16	Temperatute Cycling has been substituted as it is a more severe test; refer to test 4.	NA		NA				
ESD	17	AEC-Q200-002	±(1.0%)		15	25 kv	-0.01	TO	0.01
Solderability	18.5	J-STD-002, Test B1 , Preconditioning E 4 hours @ 155°C dry heat, Pb-free Solder @ 245°C, Magnification 50X.	>95% coverage		15				
Solderability	18.6	J-STD-002, Test B (backward compatibility), Preconditioning Category E, 4 hours @ 155°C dry heat, Pb Solder @ 215°C, Magnification 50X.	>95% coverage		15				
Solderability	18.8	J-STD-002, Test D (backward compatibility), Preconditioning Category C, 4 hours @ 155°C dry heat, Pb Solder @ 260°C, Magnification 50X.	>95% coverage		15				
Electrical Characterization	19	RTC at -55°C & 150°C	±75 ppm/°C		30	-55°C	49.6	TO	57.2
Board Flex	21	AEC-Q200-005 2mm min	±(0.5%)	0.0005	30	150°C	44.2	TO	50.4
						Reading 2	0.0340	TO	0.0650
						Reading 3	-0.0100	TO	0.0100
Terminal Strength (SMD)	22	AEC-Q200-006 Force of 1.8 Kg for 60 seconds.	±(0.5%)	0.0005	30		-0.261	TO	0.044
Flame Retardance	24	AEC-Q200-001	0		30				
Flammability	20	UL-94	NA		NA				
Short Time Overload		MIL-PRF-55342 paragraph 4.86: 5 X rated power for 5 Seconds.	±(0.5%)	0.0005	24		-0.02	TO	-0.006
Low Temp Storage		MIL-PRF-26 Paragraph 4,7,12	±(0.5%)	0.0005	24	2000	-0.044	TO	-0.004
Bump Test		Per IEC 68 2-29, 4000 each mechanical axis, 40g peak acceleration, 6ms pulse length	±(0.5%)	0.0005	30		-0.002	TO	0.006

Note 1) Moisture Resistance testing was performed on 24 pieces instead of 77. Data package will be updated upon completion of testing with corrected sample size. Estimated date of completion is 9/23/22.
Note 2) Flame retardance requires the application of 9V for 1 hour on a low resistance value current sense resistor, which causes the device to be substantially overpowered. The Power Metal Strip @ technod would under these conditions, resulting in temperatures that exceeds 350 °C for > 10 seconds.

SUPPLIER - Vishay- Columbus		PART NAME - WSL-0805 .2Ω Surface Mount Resistor							
NAME OF LABORATORY - Vishay Dale Electronics Test Lab									
DESCRIPTION	AEC TEST #	TEST CONDITIONS	LIMIT	OHMIC ADDER	QTY. TESTED	HOURS/ CYCLES	RANGE		
High Temperature Exposure (Storage)	3	MIL-STD-202, Method 108, 2000 Hrs @ T=170°C @ 0% power, Measurements at 24± 2 hrs	±(1.0%)	0.0005	77	2000	0.085	TO	0.659
Temperature Cycling	4	MIL-STD-202 Method 107 Condition F, -55°C to 150°C, Dwell time = 15min, 2000 Cycles.	±(0.5%)	0.0005	77	2000	0.02	TO	0.165
Moisture Resistance	6	MIL-STD-202, Method 106, t=24 hours/cycle. Note: Steps 7a & 7b not required, 0% power, No Polo, 65°C, Measurement at 24± 2 Hrs after test.	±(0.5%)	0.0005	24		-0.005	TO	0.11
Biased Humidity	7	MIL-STD-202, Method 103, 2000 hrs 85°C/85%RH, Note: Specified conditions: 10% of operating power. Measurement at 24± 2 hrs after test.	±(0.5%)	0.0005	77	1000	-0.015	TO	0.03
Operational Life	8.1	MIL-STD 202, Method 108, Condition D Steady State, Ta=70°C @rated power from derating curve. Measurements at 24± 2 hrs after test. Test to 2000hrs.	±(1.0%)	0.0005	24	2000	-0.025	TO	-0.005
Operational Life	8	MIL-STD 202, Method 108, 2,000 hr test; Condition F; 1.5 hrs "ON", 0.5 hrs "OFF"; +125°C @ rated power. Measurement 24±4 hrs. after test conclusion.	±(1.0%)	0.0005	77	2000	-0.01	TO	0.065
External Visual	9	Inspect per ICP document and sections listed in general specifications section. Inspect device construction, marking and workmanship.	Per MIL-STD-883		All Qual. Parts				
Physical Dimension	10	JESD22 Method JB-100, Verify physical dimensions to the standard WSL data sheet.	Per Datasheet		30				
Resistance to Solvents	12	MIL-STD-202, Method 215 Aqueous wash chemical- OKEM Clean or equivalent.	Marking remains legible		5				
Mechanical Shock	13	MIL-STD-202, Method 213	±(0.5%)	0.0005	30		-0.01	TO	0.005
Vibration	14	MIL-STD-202, Method 204, Condition D	±(0.5%)	0.0005	30		-0.01	TO	0.005
Resistance to Solder Heat	15	MIL-STD-202, Method 210, Condition K	±(0.5%)	0.0005	30		-0.005	TO	0.145
Thermal Shock	16	Temperatute Cycling has been substituted as it is a more severe test; refer to test 4.	NA		NA				
ESD	17	AEC-Q200-002	±(1.0%)		15	25 kv	-0.015	TO	0.01
Solderability	18.5	J-STD-002, Test B1 , Preconditioning E 4 hours @ 155°C dry heat, Pb-free Solder @ 245°C, Magnification 50X.	>95% coverage		15				
Solderability	18.6	J-STD-002, Test B (backward compatibility), Preconditioning Category E, 4 hours @ 155°C dry heat, Pb Solder @ 215°C, Magnification 50X.	>95% coverage		15				
Solderability	18.8	J-STD-002, Test D (backward compatibility), Preconditioning Category C, 4 hours @ 155°C dry heat, Pb Solder @ 260°C, Magnification 50X.	>95% coverage		15				
Electrical Characterization	19	RTC at -55°C & 150°C	±75 ppm/°C		30	-55°C	49.3	TO	63.9
Board Flex	21	AEC-Q200-005 2mm min	±(0.5%)	0.0005	30	150°C	42.3	TO	51.7
						Reading 2	0.0000	TO	0.0200
						Reading 3	0.0000	TO	0.0100
Terminal Strength (SMD)	22	AEC-Q200-006 Force of 1.8 Kg for 60 seconds.	±(0.5%)	0.0005	30		-0.03	TO	0.02
Flame Retardance	24	AEC-Q200-001	0		30				
Flammability	20	UL-94	NA		NA				
Short Time Overload		MIL-PRF-55342 paragraph 4.86: 5 X rated power for 5 Seconds.	±(0.5%)	0.0005	24		-0.005	TO	0.015
Low Temp Storage		MIL-PRF-26 Paragraph 4,7,12	±(0.5%)	0.0005	24	2000	0.005	TO	0.035
Bump Test		Per IEC 68 2-29, 4000 each mechanical axis, 40g peak acceleration, 6ms pulse length	±(0.5%)	0.0005	30		0	TO	0.01

Note 1) Moisture Resistance testing was performed on 24 pieces instead of 77. Data package will be updated upon completion of testing with corrected sample size. Estimated date of completion is 9/23/22.
Note 2) Flame retardance requires the application of 9V for 1 hour on a low resistance value current sense resistor, which causes the device to be substantially overpowered. The Power Metal Strip @ technod would under these conditions, resulting in temperatures that exceeds 350 °C for > 10 seconds.

Production Part Approval

AEC-CDF- Passive Component Qualification

Vishay Test Report #145152, 145298, 146678, 144694

SUPPLIER - Vishay-Israel		PART NAME -WSL-0805 0.005 Ohm Surface Mount Wirewound Resistor									
NAME OF LABORATORY - Vishay Dale Electronics Test Lab											
DESCRIPTION	AEC TEST #	TEST CONDITIONS	LIMIT	QTY. TESTED	HOURS/ CYCLES	RANGE		MEAN	STD. DEV.	CPK	PASS
High Temperature Exposure	3	ML-STD-202, Method 108, 2000 Hrs@ T=125°C @ 0% power, Measurements at 24± 2 hrs after test	± (1.0% + 0.0005Ω)	77	2000	-0.269	TO 1.06191	0.27365	0.2802	12.760523	PASS
Temperature Cycling	4	ML-STD-202 Method 107 Condition F, -55°C to 150°C, Dwell time = 15min, 2000 Cycles.	± (0.5% + 0.0005Ω)	77	2000	-0.058	TO 0.341	0.03419	0.08261	42.230002	PASS
Moisture Resistance	6	ML-STD-202, Method 106, t=24 hours/cycle. Note: Steps 7a & 7b not required, 0% power, No Polo, 65°C, Measurement at 24± 2 Hrs after test.	± (0.5% + 0.0005Ω)	77	NA	0.002	TO 0.158	0.0173	0.0308	10.635	PASS
Biased Humidity	7	ML-STD-202, Method 103, 1000 hrs 85°C/85%RH, Note: Specified conditions: 10% of operating power. Measurement at 24± 2 hrs after test.	± (0.5% + 0.0005Ω)	77	1000	0.012	TO 0.039	0.0259	0.0053	29.818	PASS
Operational Life 70°C	8	ML-STD 202, Method 108, Condition D Steady State, Ta=70°C @rated power from derating curve. Measurements at 24± 2 hrs after test. Test to 2000hrs	± (1.0% + 0.0005Ω)	24	2000	0	TO 0.008	0.0038	0.0026	100	PASS
Operational Life 125°C	8.1	ML-STD 202, Method 108, Condition D Steady State, Ta=125°C @rated power from derating curve. Measurements at 24± 2 hrs after test. Test to 2000hrs	± (1.0% + 0.0005Ω)	77	2000	-0.02	TO 0.02	0.0011	0.0077	43.242	PASS
External Visual	9	Inspect per ICP document and sections listed in general specifications section. Inspect device construction, marking and workmanship.	Per MIL-STD-883	All Qual. Parts	NA	All parts satisfactory (547)					PASS
Physical Dimensions	10	JESD22 Method JB-100. Verify physical dimensions to the standard WSL data sheet	Drawing 211195	30		All parts satisfactory (30)					PASS
Mechanical Shock	13	ML-STD-202, Method 213, Figure 1, SMD, Condition C	± (0.5% + 0.0005Ω)	30		0	TO 0.012	0.0036	0.0028	59.095	PASS
Vibration	14	ML-STD-202, Method 204, condition D, 20 G's for 20 minutes. 12 cycles each of 3 orientations..	± (0.5% + 0.0005Ω)	30		0	TO 0.008	0.0015	0.0021	79.127	PASS
Resistance to Soldering Heat	15	ML-STD-202, Method 210, Condition B in reflow oven	± (0.5% + 0.0005Ω)	30		0.024	TO 0.137	0.076	0.0281	5.03	PASS
Thermal Shock	16	ML-STD-202, Method 107, Number of cycles = 300 air to air. Maximum transfer time = 20 seconds, Dwell time =15 seconds	NA	NA							NA
Electrostatic Discharge	17	AEC-Q200-002	± (1.0% + 0.0005Ω)	15	25 kV	-0.008	TO -0.002	-0.005	0.0022	100	PASS
Solderability	18.5	J-STD-002, Test B1, Preconditioning E 4 hours @ 155°C dry heat, Pb-free Solder @ 245°C, Magnification 50X	95% COVERAGE	15	All parts satisfactory						PASS
Solderability	18.6	J-STD-002, Test B (backward compatibility), Preconditioning Category E, 4 hours @ 155°C dry heat, Pb Solder @ 215°C, Magnification 50X	95% COVERAGE	15	All parts satisfactory						PASS
Solderability	18.7	J-STD-002, Test D1, Preconditioning C 8 hours Steam, Pb-free Solder @ 260°C, Magnification 50X	95% COVERAGE	15	All parts satisfactory						PASS
Solderability	18.8	J-STD-002, Test D (backward compatibility), Preconditioning Category C, 8 hours Steam, Pb Solder @ 260°C, Magnification 50X	95% COVERAGE	15	All parts satisfactory						PASS
Electrical Characterization	19	User Spec. Parametrically test lot and sample size requirements, summary to show Min, Max, Mean and Standard Deviation at room as well as Min and Max operating temperatures	± 110 PPM/°C	30	-55°C	76.6	TO 88	81.69	2.71	3.476	PASS
					150°C	14.8	TO 23.2	18.95	2.48	12.247	
Board Flex	21	AEC-Q200-005 2mm min	± (1.0% + 0.0005Ω)	30		0.0400	TO 0.1380	0.0879	0.0224	13.573	PASS
Terminal Strength	22	AEC-Q200-006 Force of 1.8 Kg for 60 seconds	± (1.0% + 0.0005Ω)	30		-0.012	TO 0.014	-0.0003	0.005	66.647	PASS
Flame Retardance	24	AEC-Q200-001	Per AEC-Q200-001	30							Note 1
Flamability		UL-94	NA	NA							PASS
Bump Test		Per IEC 68 2-29, 4000 each mechanical axis, 40g peak acceleration, 6ms pulse length	± (0.5%)	24		-0.02	TO 0	-0.0074	0.0057	28.807	PASS
Low Temperature Storage		MIL-PRF-26 Paragraph 4.7.12	± (0.5% + 0.0005Ω)	24	2000	-0.002	TO 0.006	0.0006	0.0022	75.667	PASS

Note 1) Flame retardance requires the application of 9V for 1 hour on a low resistance value current sense resistor, which causes the device to be substantially overpowered. The Power Metal Strip® technology does not fuse as a thick film resistor would under these conditions, resulting in temperatures that exceeds 350 °C for > 10 seconds.

Production Part Approval

AEC-CDF- Passive Component Qualification

Vishay Test Report #145148, 145299

SUPPLIER - Vishay-Israel		PART NAME -WSL-0805 0.05 Ohm Surface Mount Wirewound Resistor										
NAME OF LABORATORY - Vishay Dale Electronics Test Lab												
DESCRIPTION	AEC TEST #	TEST CONDITIONS	LIMIT	QTY. TESTED	HOURS/ CYCLES	RANGE			MEAN	STD. DEV.	CPK	PASS
High Temperature Exposure	3	MIL-STD-202, Method 108, 2000 Hrs@ T=125°C @ 0% power. Measurements at 24± 2 hrs after test	± (1.0% + 0.0005Ω)	77	2000	0.621	TO	0.803	0.6929	0.032	3.199	PASS
Temperature Cycling	4	MIL-STD-202 Method 107 Condition F, -55°C to 150°C, Dwell time = 15min, 2000 Cycles.	± (0.5% + 0.0005Ω)	77	2000	0.056	TO	0.264	0.104	0.0303	4.356	PASS
Moisture Resistance	6	MIL-STD-202, Method 106, t=24 hours/cycle. Note: Steps 7a & 7b not required, 0% power, No Polo, 65°C, Measurement at 24± 2 Hrs after test.	± (0.5% + 0.0005Ω)	77	NA	0.008	TO	0.014	0.0108	0.0014	100	PASS
Biased Humidity	7	MIL-STD-202, Method 103, 1000 hrs 85°C/85%RH. Note: Specified conditions: 10% of operating power. Measurement at 24± 2 hrs after test..	± (0.5% + 0.0005Ω)	77	1000	0.008	TO	0.068	0.0182	0.0078	20.59	PASS
Operational Life 70°C	8	MIL-STD 202, Method 108, Condition D Steady State, Ta=70°C @rated power from derating curve. Measurements at 24± 2 hrs after test. Test to 2000hrs	± (1.0% + 0.0005Ω)	24	2000	-0.002	TO	0.01	0.0037	0.0033	100	PASS
Operational Life 125°C	8.1	MIL-STD 202, Method 108, Condition D Steady State, Ta=125°C @rated power from derating curve. Measurements at 24± 2 hrs after test. Test to 2000hrs	± (1.0% + 0.0005Ω)	77	2000	0.064	TO	0.106	0.0814	0.0085	36.024	PASS
External Visual	9	Inspect per ICP document and sections listed in general specifications section. Inspect device construction, marking and workmanship.	Per MIL-STD-883	All Qual. Parts	NA	All parts satisfactory (512)						PASS
Physical Dimensions	10	JESD22 Method JB-100, Verify physical dimensions to the standard WSL data sheet	Drawing 211195	30	NA	All parts satisfactory (30)						PASS
Mechanical Shock	13	MIL-STD-202, Method 213, Figure 1, SMD, Condition C	± (0.5% + 0.0005Ω)	30	NA	-0.01	TO	0.008	-0.0006	0.0038	43.807	PASS
Vibration	14	MIL-STD-202, Method 204, condition D, 20 G's for 20 minutes, 12 cycles each of 3 orientations..	± (0.5% + 0.0005Ω)	30	NA	0.006	TO	0.02	0.0086	0.0032	51.188	PASS
Resistance to Soldering Heat	15	MIL-STD-202, Method 210, Condition B in reflow oven	± (0.5% + 0.0005Ω)	30	NA	0.04	TO	0.078	0.0568	0.0074	19.964	PASS
Thermal Shock	16	MIL-STD-202, Method 107, Number of cycles = 300 air to air, Maximum transfer time = 20 seconds, Dwell time =15 seconds	NA	NA								NA
Electrostatic Discharge	17	AEC-Q200-002	± (1.0% + 0.0005Ω)	15	25 kV	-0.008	TO	-0.004	-0.005	0.0012	100	PASS
Solderability	18.5	J-STD-002, Test B1, Preconditioning E 4 hours @ 155°C dry heat, Pb-free Solder @ 245°C, Magnification 50X	95% COVERAGE	15	All parts satisfactory (15)							PASS
Solderability	18.6	J-STD-002, Test B (backward compatibility), Preconditioning Category E, 4 hours @ 155°C dry heat, Pb Solder @ 215°C, Magnification 50X	95% COVERAGE	15	All parts satisfactory (15)							PASS
Solderability	18.7	J-STD-002, Test D1, Preconditioning C 8 hours Steam, Pb-free Solder @ 260°C, Magnification 50X	95% COVERAGE	15	All parts satisfactory (15)							PASS
Solderability	18.8	J-STD-002, Test D (backward compatibility), Preconditioning Category C, 8 hours Steam, Pb Solder @ 260°C, Magnification 50X	95% COVERAGE	15	All parts satisfactory (15)							PASS
Electrical Characterization	19	User Spec. Parametrically test lot and sample size requirements, summary to show Min, Max, Mean and Standard Deviation at room as well as Min and Max operating temperatures	± 110 PPM/°C	30	-55°C	50.2	TO	61.9	57.36	2.7	2.181	PASS
					150°C	44.9	TO	54.4	50.66	2.33	3.476	
Board Flex	21	AEC-Q200-005 2mm min	± (1.0% + 0.0005Ω)	30		0.0000	TO	0.04	0.0153	0.0101	32.498	PASS
Terminal Strength	22	AEC-Q200-006 Force of 1.8 Kg for 60 seconds	± (1.0% + 0.0005Ω)	30		-0.01	TO	0.006	-0.00287	0.002667	124.60273	PASS
Flamability		UL-94	NA	NA								PASS
Bump Test		Per IEC 68 2-29, 4000 each mechanical axis, 40g peak acceleration, 6ms pulse length	± (0.5%)	24		-0.004	TO	0.004	-0.0005	0.0023	72.391	PASS
Low Temperature Storage		MIL-PRF-26 Paragraph 4.7.12	± (0.5% + 0.0005Ω)	24	2000	-0.012	TO	-0.006	-0.0095	0.0015	100	PASS

Note 1) Flame retardance requires the application of 9V for 1 hour on a low resistance value current sense resistor, which causes the device to be substantially overpowered. The Power Metal Strip™ technology does not fuse as a thick film resistor would under these conditions, resulting in temperatures that exceeds 350 °C for > 10 seconds.

Production Part Approval

AEC-CDF- Passive Component Qualification

Vishay Test Report #145149, 145300

SUPPLIER - Vishay-Israel		PART NAME -WSL-0805 0.2 Ohm Surface Mount Wirewound Resistor										
NAME OF LABORATORY - Vishay Dale Electronics Test Lab												
DESCRIPTION	AEC TEST #	TEST CONDITIONS	LIMIT	QTY. TESTED	HOURS/ CYCLES	RANGE		MEAN	STD. DEV.	CPK	PASS	
High Temperature Exposure	3	ML-STD-202, Method 108, 2000 Hrs@ T=125°C @ 0% power, Measurements at 24± 2 hrs after test	± (1.0% + 0.0005Ω)	77	2000	0.488	TO	0.598	0.5237	0.0207	7.67	PASS
Temperature Cycling	4	ML-STD-202 Method 107 Condition F, -55°C to 150°C, Dwell time = 15min, 2000 Cycles.	± (0.5% + 0.0005Ω)	77	2000	0.075	TO	0.13	0.0938	0.0115	11.774	PASS
Moisture Resistance	6	ML-STD-202, Method 106, t=24 hours/cycle. Note: Steps 7a & 7b not required, 0% power, No Polo, 65°C, Measurement at 24± 2 Hrs after test.	± (0.5% + 0.0005Ω)	77		-0.005	TO	0.005	0.0019	0.0036	92.417	PASS
Biased Humidity	7	ML-STD-202, Method 103, 1000 hrs 85°C/85%RH, Note: Specified conditions: 10% of operating power. Measurements at 24± 2 hrs after test.	± (0.5% + 0.0005Ω)	77	1000	-0.025	TO	-0.005	-0.0156	0.0041	39.382	PASS
Operational Life 70°C	8	ML-STD 202, Method 108, Condition D Steady State, Ta=70°C @rated power from derating curve. Measurements at 24± 2 hrs after test. Test to 2000hrs	± (1.0% + 0.0005Ω)	24	2000	-0.005	TO	0.01	0.0031	0.0038	87.447	PASS
Operational Life 125°C	8.1	ML-STD 202, Method 108, Condition D Steady State, Ta=125°C @rated power from derating curve. Measurements at 24± 2 hrs after test. Test to 2000hrs	± (1.0% + 0.0005Ω)	77	2000	0.025	TO	0.065	0.0427	0.0089	35.854	PASS
External Visual	9	Inspect per ICP document and sections listed in general specifications section. Inspect device construction, marking and workmanship.	Per MIL-STD-883	All Qual. Parts		All parts satisfactory (512)						PASS
Physical Dimensions	10	JESD22 Method JB-100. Verify physical dimensions to the standard WSL data sheet	Drawing 211195	30		All parts satisfactory (30)						PASS
Mechanical Shock	13	ML-STD-202, Method 213, Figure 1, SMD, Condition C	± (0.5% + 0.0005Ω)	30		-0.005	TO	0.005	0.0023	0.0034	48.794	PASS
Vibration	14	ML-STD-202, Method 204 , condition D, 20 G's for 20 minutes. 12 cycles each of 3 orientations..	± (0.5% + 0.0005Ω)	30		0	TO	0.01	0.0067	0.0036	45.676	PASS
Resistance to Soldering Heat	15	ML-STD-202, Method 210, Condition B in reflow oven	± (0.5% + 0.0005Ω)	30		0.03	TO	0.05	0.0392	0.0046	33.391	PASS
Thermal Shock	16	ML-STD-202, Method 107, Number of cycles = 300 air to air, Maximum transfer time = 20 seconds, Dwell time =15 seconds	NA	NA								NA
Electrostatic Discharge	17	AEC-Q200-002	± (1.0% + 0.0005Ω)	15	25 kV	-0.01	TO	0	-0.006	0.003	100	PASS
Solderability	18.5	J-STD-002, Test B1 , Preconditioning E 4 hours @ 155°C dry heat, Pb-free Solder @ 245°C , Magnification 50X	95% COVERAGE	15	All parts satisfactory (15)							PASS
Solderability	18.6	J-STD-002, Test B (backward compatibility), Preconditioning Category E, 4 hours @ 155°C dry heat, Pb Solder @ 215°C, Magnification 50X	95% COVERAGE	15	All parts satisfactory (15)							PASS
Solderability	18.7	J-STD-002, Test D1 , Preconditioning C 8 hours Steam, Pb-free Solder @ 260°C , Magnification 50X	95% COVERAGE	15	All parts satisfactory (15)							PASS
Solderability	18.8	J-STD-002, Test D (backward compatibility), Preconditioning Category C, 8 hours Steam, Pb Solder @ 260°C, Magnification 50X	95% COVERAGE	15	All parts satisfactory (15)							PASS
Electrical Characterization	19	User Spec. Parametrically test lot and sample size requirements, summary to show Min, Max, Mean and Standard Deviation at room as well as Min and Max operating temperatures	± 110 PPM/°C	30	-55°C	49.2	TO	54.8	52.03	1.29	5.935	PASS
					150°C	43.4	TO	47.8	45.91	1.04	9.344	
Board Flex	21	AEC-Q200-005 2mm min	± (1.0% + 0.0005Ω)	30		0.0400	TO	0.1380	0.0879	0.0224	13.573	PASS
Terminal Strength	22	AEC-Q200-006 Force of 1.8 Kg for 60 seconds	± (1.0% + 0.0005Ω)	30		-0.015	TO	0.01	-0.007	0.0069	47.971	PASS
Flame Retardance	24	AEC-Q200-001	Per AEC-Q200-001	30								Note 1
Flamability		UL-94	NA	NA								PASS
Bump Test		Per IEC 68 2-29, 4000 each mechanical axis, 40g peak acceleration, 6ms pulse length	± (0.5%)	24		-0.005	TO	0.01	0.0005	0.0036	46.25	PASS
Low Temperature Storage		MIL-PRF-26 Paragraph 4.7.12	± (0.5% + 0.0005Ω)	24	2000	-0.015	TO	0	-0.007	0.0034	48.333	PASS

Note 1) Flame retardance requires the application of 9W for 1 hour on a low resistance value current sense resistor, which causes the device to be substantially overpowered. The Power Metal Strip ® technology does not fuse as a thick film resistor would under these conditions, resulting in temperatures that exceeds 350 °C for > 10 seconds.