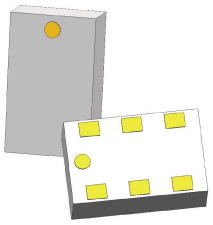
DC09T10

Directional Coupler

Rev A2.0

Description

The DC09T10 is a low cost, low profile sub-miniature high performance 10 dB directional coupler in an easy to use RoHS compliant, Halogen Free surface mount package. It is designed for 700 – 1000MHz applications including: WCDMA, CDMA, LTE700 and GSM850 / 900 applications. The DC09T10 is ideal for power detection, signal injection and other applications where low insertion loss signal monitoring is required. The DC09T10 is available on tape and reel for pick and place high volume manufacturing. All of the components are constructed from ceramic filled PTFE composites which possess excellent electrical and mechanical stability. All parts have been subjected to rigorous qualification testing and units are 100% RF tested.



Features:

- **700 – 1000 MHz**
- **Mean Coupling 10dB**
- **Ultra Low Insertion Loss**
- **Surface Mountable**
- **Tape & Reel**
- **RoHS Compliant**
- **Halogen Free**
- **-55°C to 85°C**

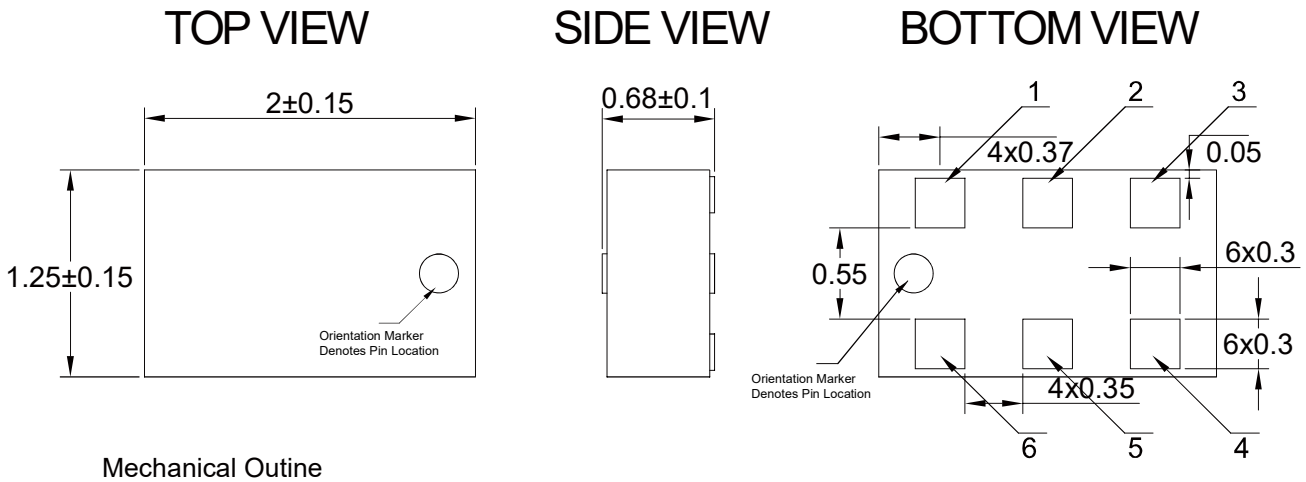
Electrical Specifications

Frequency	Coupling		Directivity	Return Loss
MHz	*dB Min*	*dB Max*	*dB Min*	*dB Min*
700 - 1000	-12.0	-9.2	14.5	16.7

Insertion Loss	Power	Operating Temp.
dB Max	*Avg. CW Watts*	*°C*
0.35	2	-55 to +95

Notes:
1. All the above data are based on specified demo board.
2. Insertion loss:Thru board loss has been removed.

Mechanical Outline



Mechanical Outine
-Dimensions are in Millimeters
-Tolerances are Non-Cumulative

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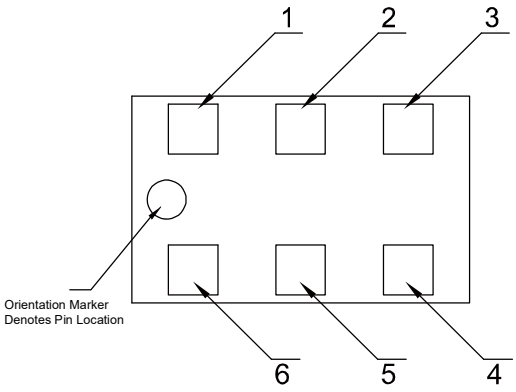
Directional Coupler Pin Configuration

The DC09T10 has an orientation marker to denote Pin1. Once port one has been identified the other ports are known automatically. Please see the chart below for clarification:



Pin	Configuration-1	Configuration-2
1	Direct	Input
2	Isolated	Coupled
3	Gnd	Gnd
4	Gnd	Gnd
5	Coupled	Isolated
6	Input	Direct

Typical Performance Data (@25

Frequency (MHz)	Coupling (dB)	Transmission (dB)	Insertion Loss (dB)	Directivity (dB)	Return Loss(dB)			
					S11	S22	S33	S44
700	-11.88	-0.55	-0.24	-17.67	-19.23	-20.22	-20.39	-19.23
715	-11.79	-0.56	-0.25	-17.70	-19.18	-20.24	-20.32	-19.22
730	-11.69	-0.57	-0.25	-17.72	-19.15	-20.24	-20.21	-19.20
745	-11.61	-0.58	-0.25	-17.65	-19.15	-20.22	-20.20	-19.15
760	-11.53	-0.59	-0.26	-17.51	-19.14	-20.17	-20.06	-19.16
775	-11.45	-0.60	-0.26	-17.41	-19.13	-20.07	-19.98	-19.16
790	-11.38	-0.61	-0.26	-17.32	-19.13	-19.97	-19.91	-19.13
805	-11.32	-0.62	-0.26	-17.20	-19.07	-19.85	-19.78	-19.07
820	-11.26	-0.63	-0.27	-17.16	-19.01	-19.76	-19.60	-19.08
835	-11.21	-0.64	-0.27	-17.16	-18.99	-19.68	-19.39	-19.12
850	-11.16	-0.65	-0.28	-17.10	-19.02	-19.51	-19.27	-19.10
865	-11.13	-0.65	-0.28	-17.06	-19.05	-19.33	-19.20	-19.10
880	-11.09	-0.66	-0.28	-17.01	-19.10	-19.14	-19.09	-19.14
895	-11.06	-0.67	-0.29	-16.95	-19.22	-18.93	-19.02	-19.21
910	-11.04	-0.67	-0.29	-16.89	-19.26	-18.77	-18.88	-19.25
925	-11.01	-0.68	-0.30	-16.84	-19.24	-18.67	-18.74	-19.25
940	-11.00	-0.69	-0.30	-16.83	-19.29	-18.59	-18.68	-19.25
955	-11.00	-0.69	-0.30	-16.83	-19.32	-18.49	-18.59	-19.30
970	-10.99	-0.70	-0.31	-16.78	-19.32	-18.37	-18.51	-19.34
985	-10.99	-0.70	-0.31	-16.71	-19.41	-18.24	-18.46	-19.45
1000	-11.00	-0.70	-0.32	-16.61	-19.51	-18.09	-18.38	-19.60

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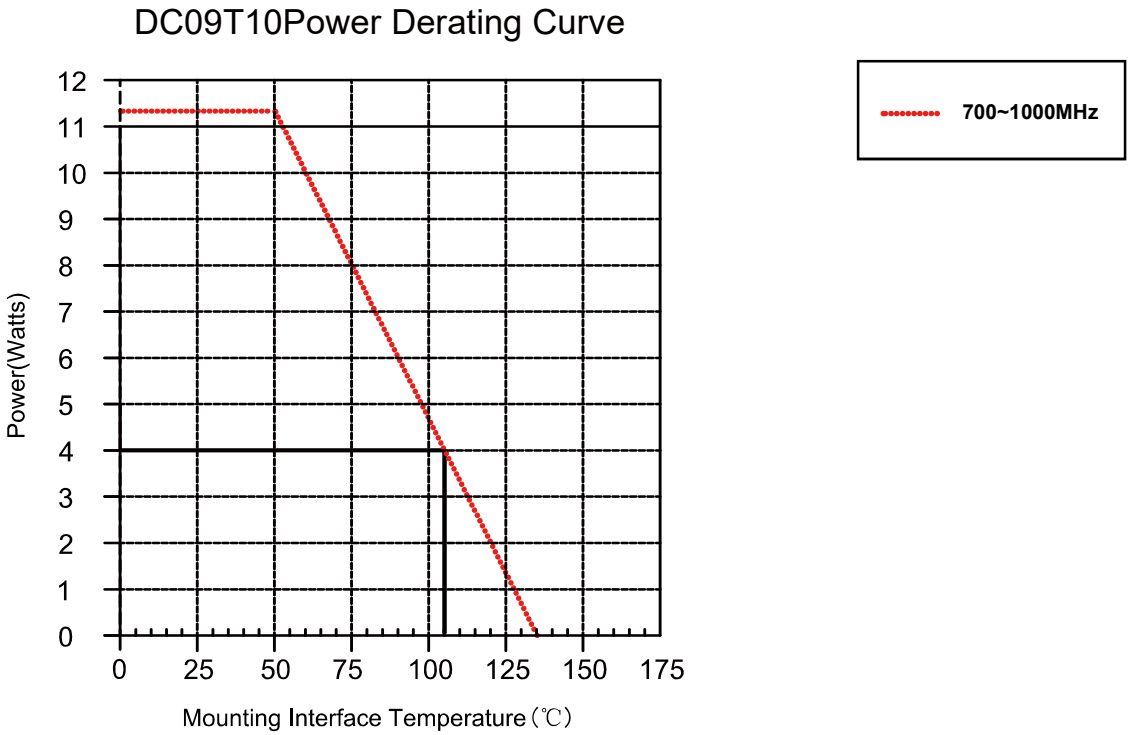
Power Derating Curves



Power Derating:

As the mounting interface temperature approaches the maximum continuous operating temperature, the power handling decreases to zero.

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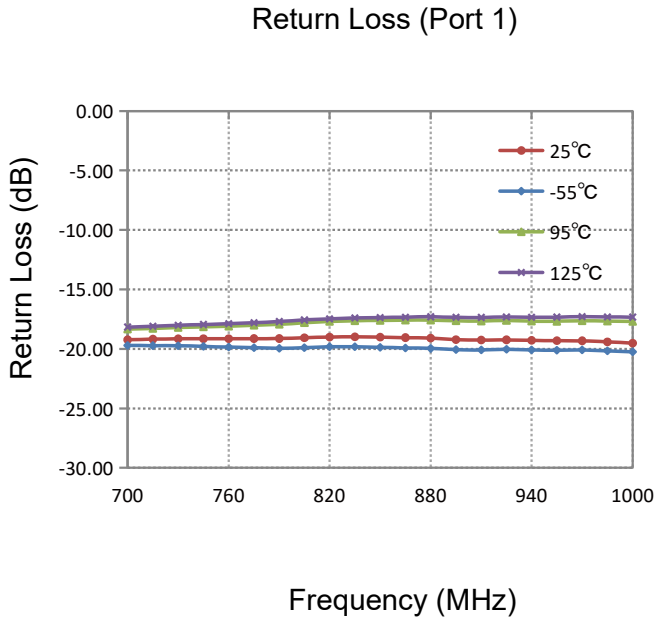
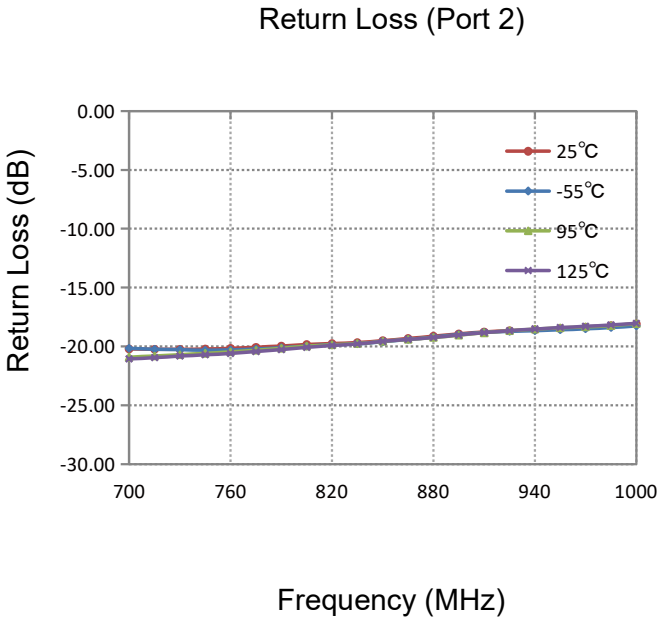
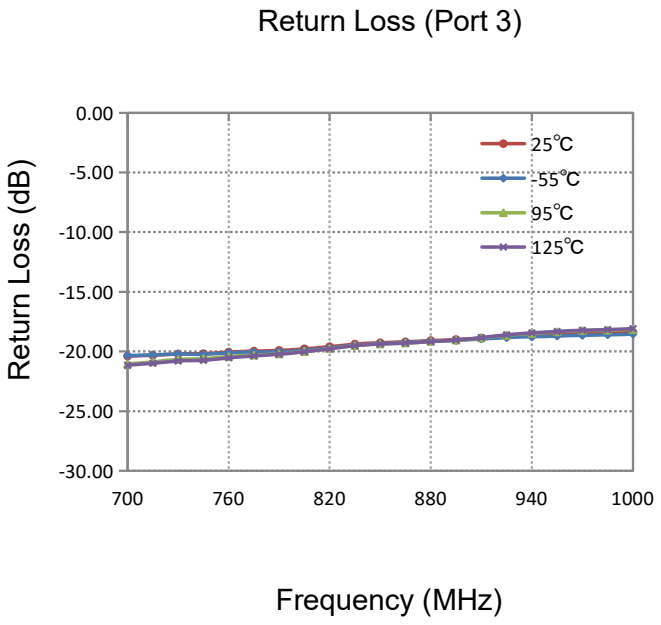
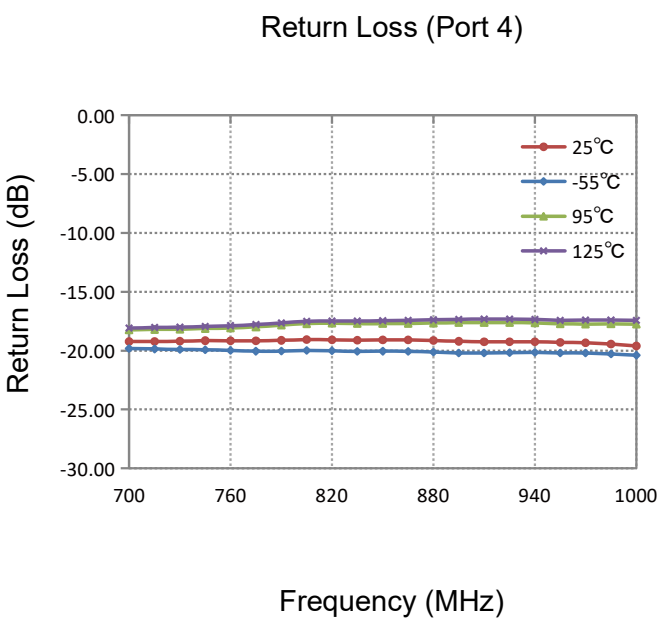
Typical Performance (-55°C,25°C,95°C,125°C: 700-1000 MHz)









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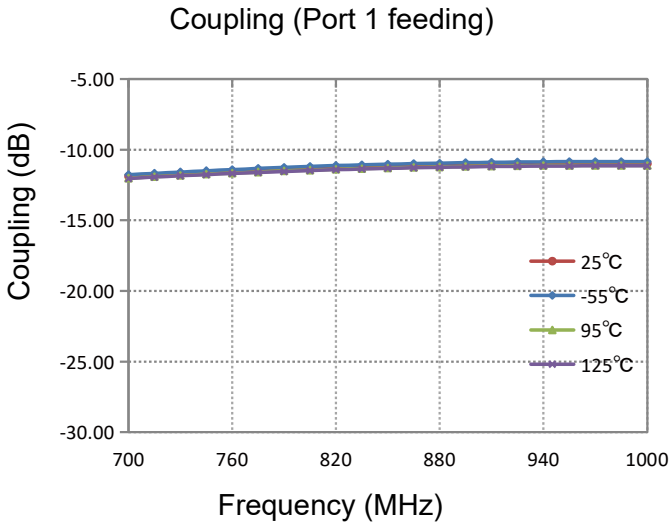

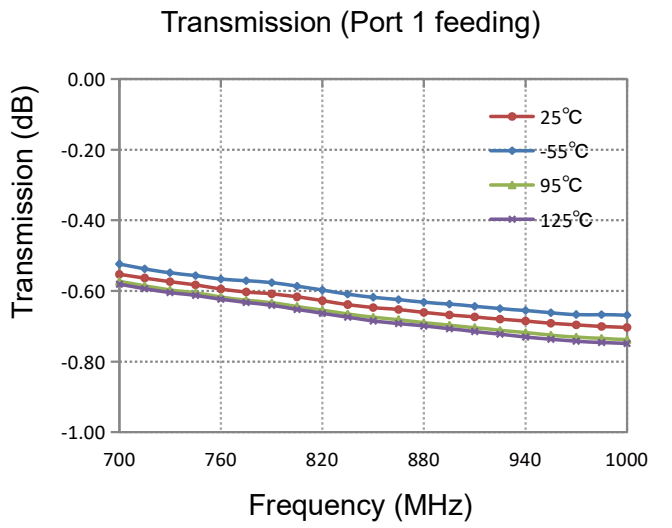

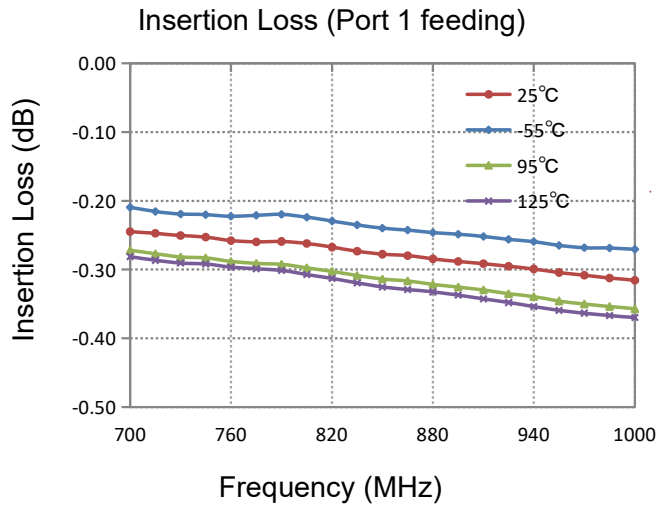

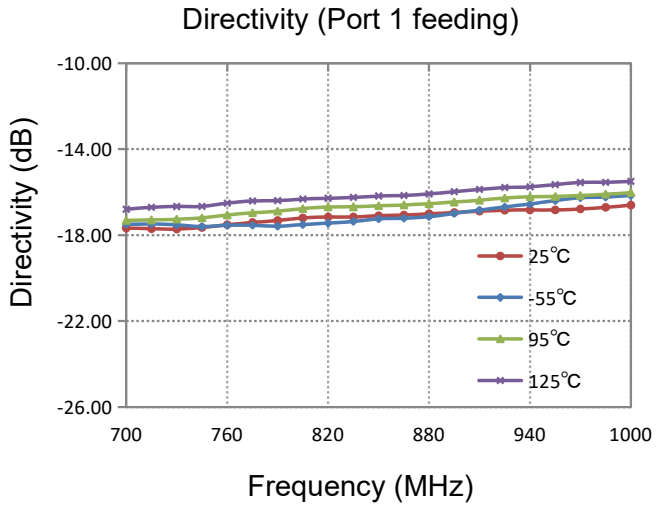

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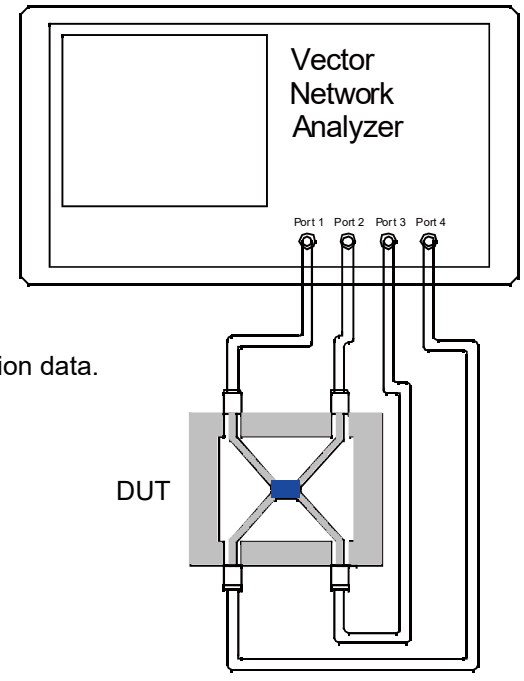
Definition of Measured Specifications

Parameter	Definition	Mathematical Representation
VSWR (Voltage Standing Wave Ratio)	The impedance match of the coupler to a 50Ω system. A VSWR of 1:1 is optimal.	$VSWR = \frac{V_{max}}{V_{min}}$ Vmax = voltage maxima of a standing wave Vmin = voltage minima of a standing wave
Return Loss	The impedance match of the coupler to a 50Ω system. Return Loss is an alternate means to express VSWR.	Return Loss (dB)= $20\log \frac{VSWR+1}{VSWR-1}$
Insertion Loss	The input power divided by the sum of the power at the two output ports.	Insertion Loss(dB)= $10\log \frac{P_{in}}{P_{cpl}+P_{transmission}}$
Isolation	The input power divided by the power at the isolated port.	Isolation(dB)= $10\log \frac{P_{in}}{P_{iso}}$
Phase Balance	The difference in phase angle between the two output ports.	Phase at coupled port – Phase at transmisson port
Amplitude Balance	The power at each output divided by the average power of the two outputs.	$10\log \frac{P_{cpl}}{(\frac{P_{cpl}+P_{transmission}}{2})}$ or $10\log \frac{P_{transmission}}{(\frac{P_{cpl}+P_{transmission}}{2})}$

Test Method

1. Calibrating your vector network analyzer.
2. Connect the VNA 4 Port to DUT respectively.
3. Measure the data of coupling through port 1 to port 4(S41).
4. Measure the data of transmission through port 1 to port 3(S31).
5. Measure the data of isolation through port 1 to port 2(S21).
6. Measure the data of phase port 4 & port 3(port 1 feeding).
7. Measure the data of return loss port 1, port 2, port 3 & port 4.
8. According to the above data to calculate insertion loss, amplitude balance & phase.



Note:

1. When calculating insertion loss at room temperature, demo board loss should be removed from both coupling & transmission data.

Please refer to the below table for demo board loss :

Frequency Range(MHz)	Demo Board Loss (dB) @25℃
470-860	0.07
800-1000	0.10
1200-1700	0.15
1700-2000	0.15
2000-2300	0.20
2300-3700	0.25

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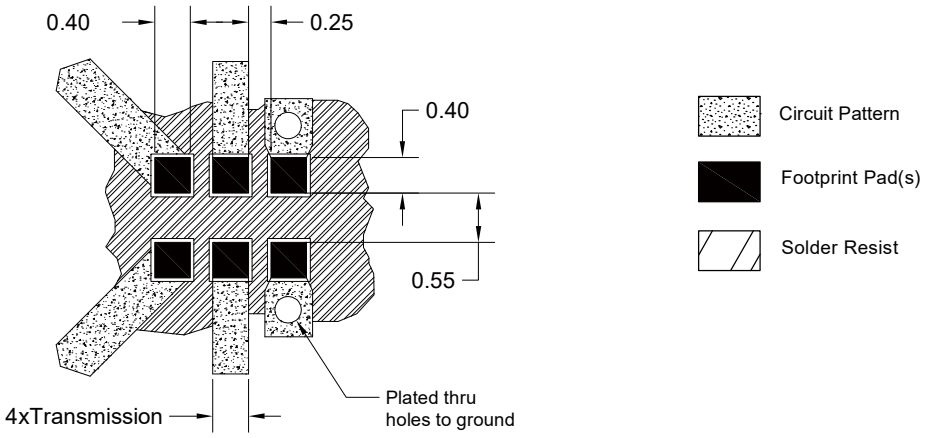
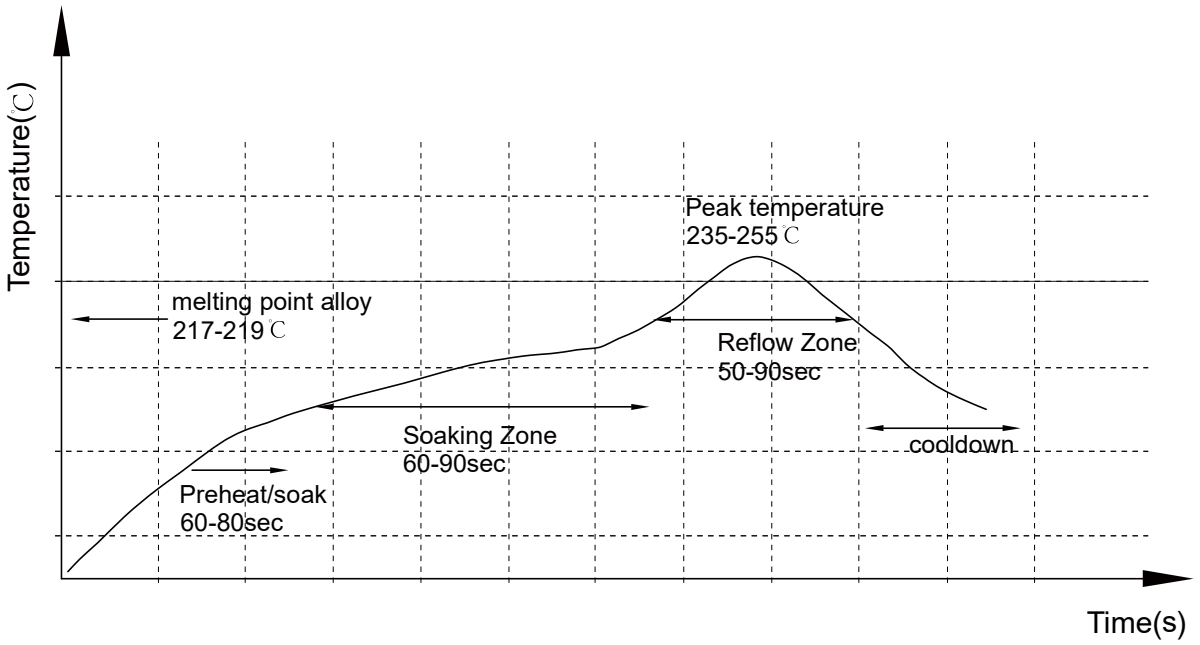
Recommended PCB Layout



NOTE:

1. 50Ω line width is shown above designing.
2. Bottom side of the PCB is continuous ground plane.
3. All dimensions shown in mm [inch].

Reflow Profile



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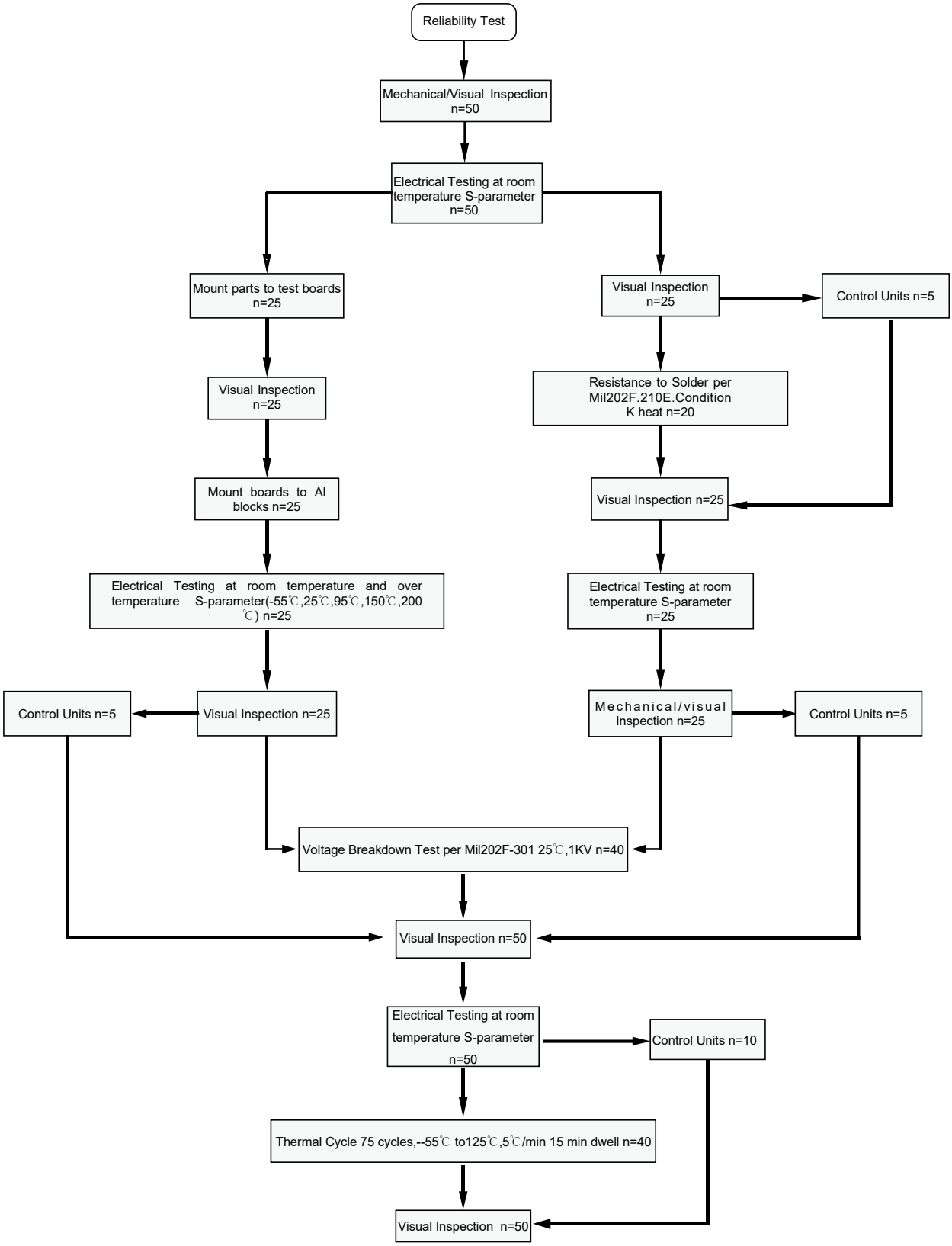
Reliability Test Flow



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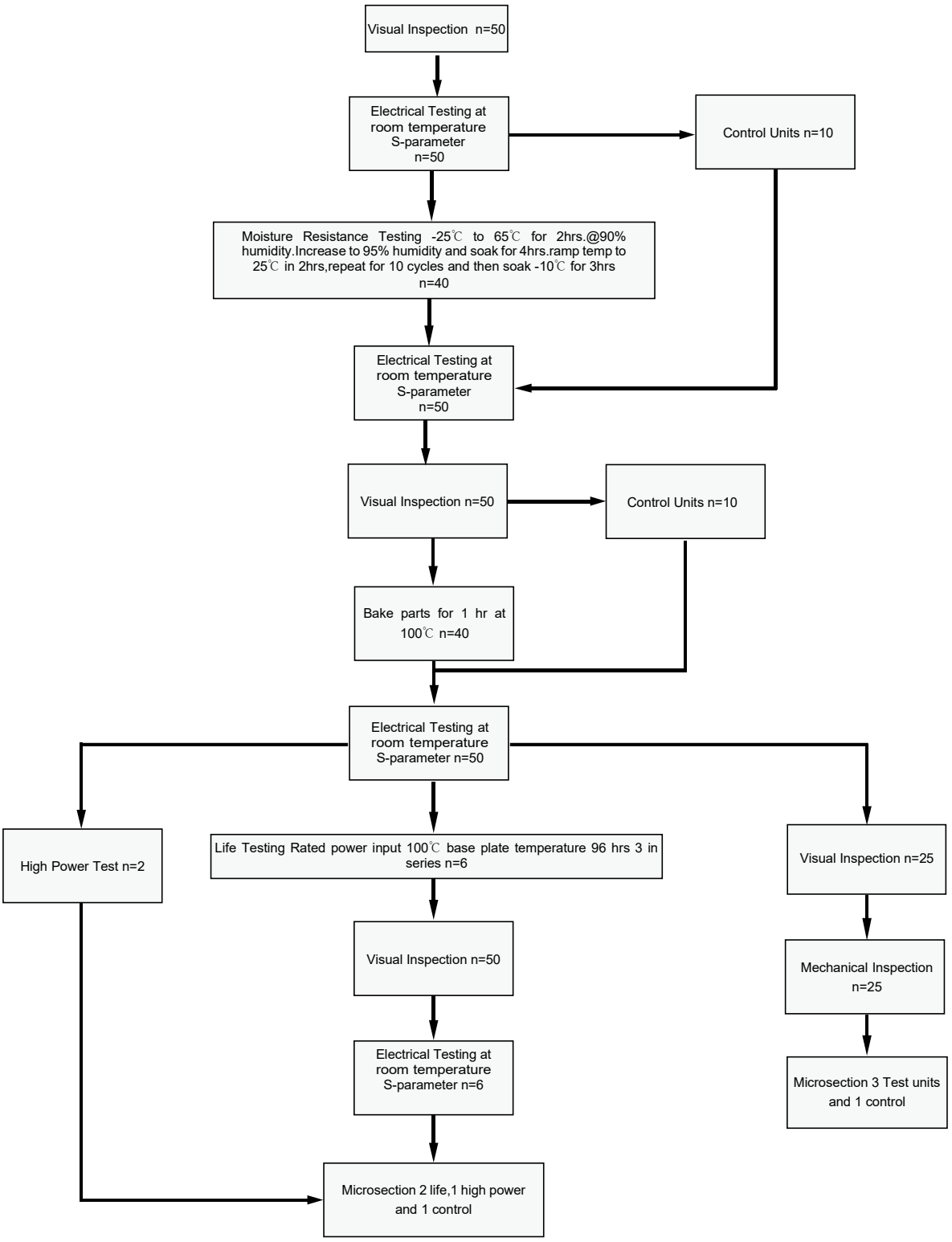
Reliability Test Flow



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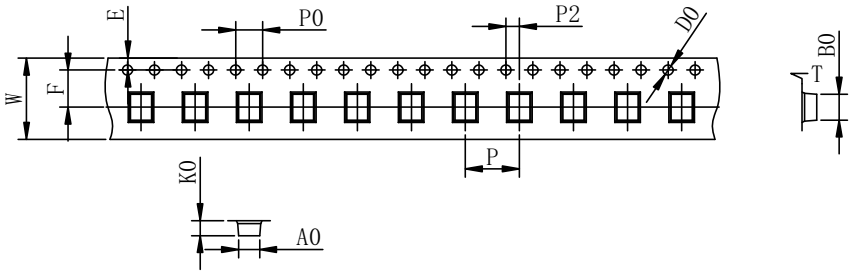
Tape and Reel Drawing

Feeding Direction



ITEM	W	A0	B0	K0	K1	P	F	E	D0	P0	P2	t	7"
DIM(mm)	8.0	1.4	2.3	1.0		4.0	3.5	1.7	1.5	4.0	2.0	0.2	P/R
TOLE	+0.10 -0.10	+0.10 -0.10	+0.10 -0.10	+0.10 -0.10	+0.10 -0.10	+0.10 -0.10	+0.10 -0.10	+0.10 -0.10	+0.10 -0.00	+0.10 -0.10	+0.10 -0.10	+0.05 -0.05	4000pcs

Notice:

A.10 Sprocket hole pitch cumulative tolerance is 0.2mm.

B. Carrier camber shall be not more than 1mm per 100mm through a length of 250mm.

C. All dimensions meet EIA-418-B requirements.

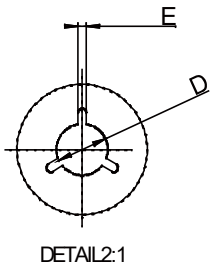
D. A0 & B0 measured as indicated.

E. K0 measured from a place on the inside bottom of the pocket to top surface of carrier.

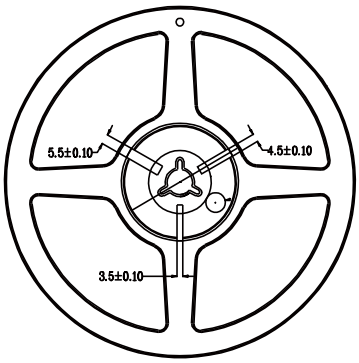
F. Material: PE 100

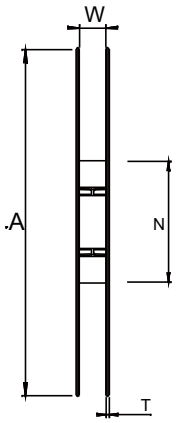
G. Thickness: 0.20±0.05mm

H. 4000 units (maximum) / T&R

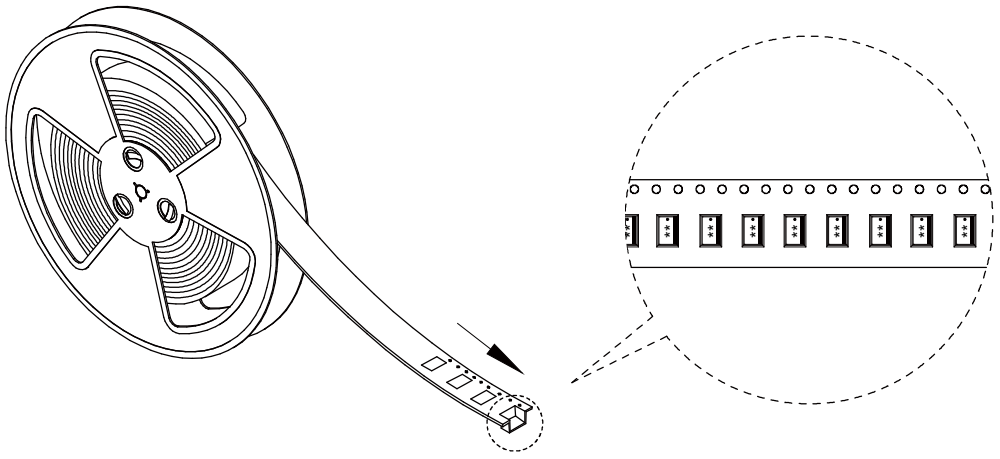


DETAIL2:1





Symbol	Dimensions(mm)
W	9.0±0.4
A	180±0.3
N	60±0.3
T	1.4±0.2
E	3±0.5
D	25±0.8



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