



CARSEM (A MEMBER OF THE HONG LEONG GROUP)

CARSEM ELECTRICAL DATA

UPDATED: 2010 AUG

**TSSOP**

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
TSSOP 8L 4.4mmx3.0mmx0.9mm	Center	0.7416	0.7520	1.494	0.2031	0.04333	0.2464	8.773	48.04	56.81	0.7774	1.0	
	Corner	1.425	0.6512	2.076	0.2705	0.04118	0.3117	16.21	43.65	59.86	0.6676	1.0	
Paddle Size (milxmil) 79x118	Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>			
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
Die size (milxmil) 53x75	Center	0.2024	0.02355	0.2260	0.1748	0.09186	0.2667	0.05019	0.002623	0.05281	0.05357	0.002941	0.05651
	Corner	0.01939	0.02801	0.04740	0.2024	0.02355	0.2260	0.005745	0.0009239	0.006669	0.05019	0.002623	0.05281
Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
TSSOP 14L 4.4mmx5.0mmx0.9mm	Center	0.7378	1.122	1.860	0.1844	0.05059	0.2350	9.411	63.10	72.51	1.209	1.0	
	Corner	1.337	1.328	2.665	0.2999	0.06116	0.3611	15.25	72.18	87.43	1.398	1.0	
Paddle Size (milxmil) 118x122	Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>			
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
Die size (milxmil) 50x60	Center	0.1716	0.2311	0.4027	0.1671	0.2925	0.4596	0.05104	0.004395	0.05544	0.04973	0.006229	0.05596
	Corner	0.2209	0.3074	0.5283	0.02317	0.04338	0.06655	0.06041	0.005838	0.06625	0.008935	0.0005085	0.009444
Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
TSSOP 16L 4.4mmx5.0mmx0.9mm	Center	0.7218	1.160	1.882	0.2088	0.05128	0.2601	9.012	56.55	65.56	1.068	1.0	
	Corner	1.369	0.9747	2.344	0.2666	0.04738	0.3140	15.49	64.92	80.41	1.242	1.0	
Paddle Size (milxmil) 118x154	Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>			
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
Die size (milxmil) 50x100	Center	0.1703	0.2532	0.4235	0.1697	0.2349	0.4046	0.05177	0.004338	0.05611	0.04966	0.004343	0.05400
	Corner	0.02246	0.06403	0.08649	0.2235	0.1508	0.3743	0.006585	0.004019	0.01060	0.05197	0.0009715	0.05294



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Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
TSSOP 20L 14.4mmx6.5mmx0.9mm	Center	0.6579	0.6729	1.331	0.1592	0.04206	0.2013	8.082	44.63	52.71	0.6876	1.0	
	Corner	1.379	1.196	2.575	0.3512	0.05850	0.4097	15.76	67.60	83.36	1.226	1.0	
Paddle Size (milxmil) 118x165	Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>			
	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	
Die size (milxmil) 106x106	Center	0.1391	0.08243	0.2215	0.1462	0.07128	0.2175	0.03514	0.002887	0.03803	0.03711	0.002559	0.03967
	Corner	0.3282	0.2522	0.5804	0.009624	0.1288	0.1384	0.1056	0.006210	0.1118	0.01302	0.002454	0.01547

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
TSSOP 24L 7.8mmx6.4mmx0.9mm	Center	0.6961	0.6328	1.3289	0.1740	0.0438	0.2178	10.770	44.84	55.61	0.6090	1.0	
	Corner	0.6952	0.8748	1.5700	0.1733	0.0596	0.2329	10.6500	55.9100	66.5600	0.860	1.0	
Paddle Size (milxmil) 118x217	Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>			
	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	
Die size (milxmil) 106x139x8	Center	0.1659	0.0645	0.2304	0.1674	0.0709	0.2383	0.0473	0.0044	0.0517	0.0467	0.0052	0.0519
	Corner	0.1977	0.1658	0.3635	0.1668	0.1165	0.2833	0.0522	0.0081	0.0603	0.0467	0.0078	0.0545

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
TSSOP 38L 4.4mmx9.7mmx0.9mm	Center	0.7479	0.4407	1.189	0.1713	0.04130	0.2126	7.126	24.33	31.46	0.5466	1.3	
	Corner	1.992	0.5348	2.527	0.4388	0.04509	0.4839	16.31	27.34	43.65	0.6582	1.3	
Paddle Size (milxmil) 118x217	Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>			
	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	
Die size (milxmil) 108x207	Center	0.2411	0.05425	0.2954	0.2401	0.06292	0.3030	0.04949	0.003690	0.05320	0.04934	0.004735	0.05410
	Corner	0.6846	0.09943	0.7840	0.05674	0.04707	0.1038	0.1838	0.006795	0.1906	0.03130	0.003362	0.03470

\*Assumptions: ref (3a)

\*Assumptions: ref(3)





**Assumptions**

Leadframe Material: Copper with resistivity =  $1.73 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Gold Wire: Resistivity =  $2.25 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Mold compound material: Plastic Novolac with  $\epsilon_r = 4.8$ ; loss  $\tan \delta = 0.001$

Die thickness = 8 mil; Wire loop height = 6mil

**Ref (3)**

Leadframe Material: Copper with resistivity =  $1.73 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Gold Wire: Resistivity =  $2.35 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Mold compound material: 7351LS with  $\epsilon_r = 4.161$ ; loss  $\tan \delta = 0.001$

Die thickness = 8 mil; Wire loop height = 6mil

**Ref (3a)**

Leadframe Material: C7025TR02 with resistivity =  $4.35 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Gold Wire: Resistivity =  $2.35 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Mold compound material: 7351LS with  $\epsilon_r = 4.161$ ; loss  $\tan \delta = 0.001$

Die thickness = 8 mil; Wire loop height = 6mil

Modeling Tool: Parasitic Parameters 3D Modeler

Data Extracted at 100MHz

Ground Plane positioned at 15mil below the package seating plane.

**Definition**

**Self Resistance**

Resistance of the lead which is under study

**Self Inductance**

Inductance of a lead with a PWB ground plane at 15mil below the package seating place. It is a particle self inductance.

**Mutual Inductance**

Inductance between the lead under study to its left or right adjacent lead

**Mutual Capacitance**

Capacitance between the lead under study to its left or right adjacent lead

**Bulk Capacitance**

Capacitance from the lead under study to all other leads and ground plane. All the other leads and metal are grounded.

**Wire length**

Wire length stated at the above table is the direct distance from point on the bond pad to the bond point on the lead.



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**TQFP**

Package Type TQFP 32L 5mmx5mmx1.0mm  Paddle Size (milxmil) 133x133  Die size (milxmil) 110x110	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
	Center	0.758	0.7829	1.541	0.1967	0.04386	0.2406	9.513	34.41	43.92	0.919	1.3	
	Corner	0.8174	0.9898	1.807	0.1896	0.04727	0.2369	10.24	40.98	51.22	1.132	1.3	
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	0.269	0.2614	0.5304	0.2597	0.2394	0.4991	0.065	0.0061	0.07096	0.0615	0.0060	0.06745
	Corner	0.248	0.2171	0.4653	0.06765	0.1509	0.2186	0.054	0.0062	0.06008	0.0183	0.0032	0.02148

Package Type TQFP 32L 7mmx7mmx1.0  Paddle Size (milxmil) 195milx195mil  Die size (milxmil) 185milx185mil  *new entry	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
	Center	0.754	0.5860	1.340	0.2031	0.04052	0.2436	10.75	40.37	51.12	0.6551	1.0	
	Corner	0.8186	0.6900	1.509	0.1989	0.04612	0.2450	12.19	45.28	57.47	0.7630	1.0	
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	0.1956	0.06432	0.2599	0.1716	0.0585	0.2301	0.050	0.0032	0.05269	0.0440	0.0027	0.04672
	Corner	0.202	0.0910	0.2930	0.05962	0.0723	0.1319	0.057	0.0044	0.06110	0.0198	0.0035	0.02327



**Assumption**

Leadframe Material : Copper with resistivity =  $1.73 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Gold Wire: Resistivity =  $2.25 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Mold compound material : Plastic Novolac with  $\epsilon_r = 4.8$  loss  $\tan \delta = 0.001$

\*new entry

Leadframe Material : C7025TR02 with resistivity =  $4.35 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Gold Wire: Resistivity =  $2.25 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Mold compound material : with  $\epsilon_r = 4.281$  loss  $\tan \delta = 0.004$

Die thickness = 8mil; Wire loop height = 6mil

Modeling Tool: Parasitic Parameters 3D Modeler

Data Extracted at 100MHz

Ground Plane positioned at 15mil below the package seating plane.

**Definition**

**Self Resistance**

Resistance of the lead which is under study

**Self Inductance**

Inductance of a lead with a PWB ground plane at 15mil below the package seating place. It is a particle self inductance.

**Mutual Inductance**

Inductance between the lead under study to its left or right adjacent lead

**Mutual Capacitance**

Capacitance between the lead under study to its left or right adjacent lead

**Bulk Capacitance**

Capacitance from the lead under study to all other leads and ground plane. All the other leads and metal are grounded.

**Wire length**

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TBGA													
Package Type	Trace	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
TBGA 132Balls 2Layer  Ball Pitch=0.8mm  Body Size (mmxmm) 12.0x12.0  Die Size (mmxmm) 6.0x4.5		Trace	Wire	Trace + Wire	Trace	Wire	Trace + Wire	Trace	Wire	Trace + Wire	Length (mm)		Diameter(mils)
	Longest (D3)	1.084	2.134	3.218	0.1651	0.1185	0.2836	25.09	127.0	152.1	2.590		1.0
	Shortest (A5)	0.2774	2.721	2.998	0.08630	0.1436	0.2299	4.958	141.2	146.2	2.910		1.0
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Longest (D3)	0.1110(E2)	1.175	1.286	0.02650(D1)	1.097	1.124	0.04030(E2)	0.05420	0.09450	0.03180(D1)	0.04720	0.07900
	Shortest (A5)	0.02430(B5)	1.385	1.409	0.01640(C6)	1.056	1.073	0.03470(B5)	0.06512	0.09982	0.01610(C6)	0.04230	0.05840
Package Type	Trace	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
Array TBGA 56Balls  Ball Pitch=0.5mm  Body Size (mmxmm) 6.0x6.0  Die Size (mmxmm) 3.6x3.6		Trace	Wire	Trace + Wire	Trace	Wire	Trace + Wire	Trace	Wire	Trace + Wire	Length (mm)		Diameter(mils)
	Longest (F4)	2.934	1.179	4.113	0.3032	0.06597	0.3692	60.87	69.27	130.1	1.151		1.0
	Shortest (A2)	0.9878	1.170	2.158	0.1928	0.06964	0.2624	19.45	68.91	88.36	1.142		1.0
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Longest (F4)	0.5249(G1)	0.4011	0.9260	0.1982(G2)	0.01160	0.2098	0.09976(G1)	0.01860	0.1184	0.08852(G2)	0.003979	0.09250
	Shortest (A2)	0.4829(B2)	0.3942	0.8771	0.5009(B3)	0.3969	0.8978	0.09068(B2)	0.01657	0.1073	0.07127(B3)	0.01663	0.08790
Package Type	Trace	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
Peripheral		Trace	Wire	Trace + Wire	Trace	Wire	Trace + Wire	Trace	Wire	Trace + Wire	Length (mm)		Diameter(mils)

<b>TBGA 56Balls</b>  <b>Ball Pitch=0.5mm</b>  <b>Body Size (mmxmm) 6.0x6.0</b>  <b>Die Size (mmxmm) 3.6x3.6</b>	<b>Longest (B8)</b>	1.389	1.182	2.571	0.2015	0.06993	0.2714	29.56	69.39	98.95	1.154	1.0	
	<b>Shortest (A4)</b>	0.7337	1.188	1.922	0.1718	0.07006	0.2419	15.47	69.66	85.13	1.155	1.0	
		<b>Mutual Inductance L<sub>12</sub></b>			<b>Mutual Inductance L<sub>13</sub></b>			<b>Mutual Capacitance C<sub>12</sub></b>			<b>Mutual Capacitance C<sub>13</sub></b>		
		<b>Lead</b>	<b>Wire</b>	<b>Lead + Wire</b>	<b>Lead</b>	<b>Wire</b>	<b>Lead + Wire</b>	<b>Lead</b>	<b>Wire</b>	<b>Lead + Wire</b>	<b>Lead</b>	<b>Wire</b>	<b>Lead + Wire</b>
	<b>Longest (B8)</b>	0.4203(B9)	0.4009	0.8212	0.3663(C9)	0.4013	0.7676	0.07329(B9)	0.01666	0.08995	0.06724(C9)	0.01667	0.08391
	<b>Shortest (A4)</b>	0.3612(B3)	0.4041	0.7653	0.3752(B4)	0.4041	0.7793	0.06433(B3)	0.01668	0.08101	0.08071(B4)	0.01672	0.09743
<b>Package Type</b>  <b>Peripheral FLIP CHIP TBGA 56 Balls</b>  <b>Ball Pitch=0.5mm</b>  <b>Body Size (mmxmm) 6.0x6.0</b>  <b>Die Size (mmxmm) 3.6x3.6</b>	<b>Trace</b>	<b>Self Inductance (nH) L<sub>11</sub></b>			<b>Bulk Capacitance (pF) C<sub>11</sub></b>			<b>Resistance (mOhm) R</b>					
		<b>Trace</b>	<b>Bump</b>	<b>Trace+Bump</b>	<b>Trace</b>	<b>Bump</b>	<b>Trace+Bump</b>	<b>Trace</b>	<b>Bump</b>	<b>Trace+Bump</b>			
	<b>Longest (J1)</b>	0.9809	0.04214	1.0230	0.1819	0.05859	0.2405	28.39	2.909	31.30			
	<b>Shortest (H4)</b>	0.2546	0.04214	0.2967	0.09438	0.06821	0.1626	8.640	2.909	11.55			
		<b>Trace</b>	<b>Bump</b>	<b>Trace+Bump</b>	<b>Trace</b>	<b>Bump</b>	<b>Trace+Bump</b>	<b>Trace</b>	<b>Bump</b>	<b>Trace+Bump</b>	<b>Trace</b>	<b>Bump</b>	<b>Trace+Bump</b>
	<b>Longest (J1)</b>	0.3031(I1)	0.01700	0.3201	0.1959(J2)	0.008365	0.2043	0.06881(I1)	0.02206	0.09087	0.04571(J2)	0.007823	0.05353
	<b>Shortest (H4)</b>	0.02601(J4)	0.01709	0.04310	0.02662(J5)	0.01710	0.04372	0.02808(J4)	0.02317	0.05125	0.02563(J5)	0.02320	0.04883





**Assumption**

For SSBGA: BT-RESIN with  $\epsilon_r = 4.3$  loss  $\tan \delta = 0.007$

For TBGA : POLYIMIDE with  $\epsilon_r = 4.5$  loss  $\tan \delta = 0.01$

Gold Wire: Resistivity =  $2.25 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Copper with resistivity =  $1.73 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Mold compound material : Plastic Novolac with  $\epsilon_r = 4.8$  loss  $\tan \delta = 0.001$

Wire loop height = 6mil

Data Extracted at 100MHz

Modeling Tool: Parasitic Parameters 3D Modeler

Ground Plane positioned at 15mil below the package seating plane.

**Definition**

**Self Resistance**

Resistance of the lead which is under study

**Self Inductance**

Inductance of a lead with a PWB ground plane at 15mil below the package seating place. It is a particle self inductance.

**Mutual Inductance**

Inductance between the lead under study to its left or right adjacent lead

**Mutual Capacitance**

Capacitance between the lead under study to its left or right adjacent lead

**Bulk Capacitance**

Capacitance from the lead under study to all other leads and ground plane. All the other leads and metal are grounded.

**Wire length**

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SOT223 - 100 MHz

Package Type SOT223 3L 6.5mmx3.5mmx0.75mm Paddle Size (milxmil) 100milx110mil Die size (milxmil) 53.5milx48.6mil 100MHz	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire					
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)				
Center	2.0090	1.88	3.8890	1.6200	6.3000	7.9200	6.0470	80.9800	87.0270	0.6770	1.3					
Corner	1.5680	W8) 2.51 W9) 1.86 W10) 2.51 W11) 1.88 W12) 2.51	0.4415	1.5680 0.6980	0.1430	2.2660	8.2450	80.7700	14.2878	80.7700 60.8600 60.9100 80.7800	2.4760	1.3				
								0.1290					60.8600		1.9040	1.3
								0.1580					80.7700		2.4760	1.3
								0.1270					60.9100		1.9060	1.3
								0.1410					80.7800		2.4800	1.3
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>					
	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire				
Center	0.3792	2.140	2.5192	0.3793	0.0773	0.4566	0.1860	9.780	9.9660	0.1880	9.230	9.4180				
Corner	0.3793	W7,8) 0.0773		0.0000 0.1056	W7,8) 0.0773		0.1880	W7,8) 0.00171		0.0059	W7,8) 0.00171					
		W8,9) 8.880			W8,9) 8.880			W8,9) 0.0342			W8,9) 0.0342					
		W9,10) 9.390			W9,10) 9.390			W9,10) 0.0328			W9,10) 0.0328					
		W10,11) 8.570			W10,11) 8.570			W10,11) 0.0286			W10,11) 0.0286					
		W11,12) 8.730			W11,12) 8.730			W11,12) 0.0326			W11,12) 0.0326					

Package Type SOT223 3L Paddle Size (milxmil) 100milx110mil Die size (milxmil) (82.9 x 48.2 mils) 100Mhz	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire	
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)
Center	2.1230	-0.4160	1.7070	1.3140	1.0870	2.4010	9.48300	10.8170	20.3000	NIL	NIL	
Corner	1.7350	0.0430	1.7780	0.5890	0.6850	1.2740	22.0800	-2.7000	19.3800	NIL	NIL	
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>	
	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
Center	0.3873	-0.1409	0.2464	0.3865	-0.1643	0.2222	0.1950	0.4649	0.6599	0.1933	0.5030	0.6963
Corner	0.3865	-0.1643	0.2222	0.1021	-0.0254	0.0767	0.1933	0.5030	0.6963	0.0055	0.0615	0.0670



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CARSEM ELECTRICAL DATA

UPDATED: 2010 AUG

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
SOT223 3L													
Paddle Size (milxmil) 100milx110mil	Center	1.8520	-0.4720	1.3800	1.3250	0.7440	2.0690	9.7726	10.1274	19.9000	0.5253	1.3	
	Corner	1.6311	0.1989	1.8300	0.5933	0.4417	1.0350	24.3990	-2.7490	21.6500	(1) 1.9633	1.3	
Die size (milxmil) (57.5 x 48.2 mils)	Remarks: Simulation between (mold) KMC175& CEL9220HF13, and (Leadframe CuOMCL & HCL-12S).										(2) 2.5592	1.3	
	(Result : KMC175&Cu OMCL)										(3) 1.9653	1.3	
											(4) 2.5609	1.3	
											(5) 1.9664	1.3	
											(6) 1.9664	1.3	
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	0.2747	-0.1226	0.1521	0.2734	-0.1830	0.0904	0.2230	0.3639	0.5869	0.2187	0.3671	0.5858
	Corner	0.2734	-0.1830	0.0904	0.0553	0.0749	0.1302	0.2187	0.3671	0.5858	0.0062	0.0391	0.0453



**Assumption**

Leadframe Material : C194= $2.87 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Gold Wire: Resistivity= $2.35 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Mold compound material : Plastic Novolac with  $\epsilon_r = 4.8$  loss  $\tan \delta = 0.001$

\* New entries : Mold compound material : with  $\epsilon_r = 4.1$  loss  $\tan \delta = 0.001$

Die thickness = 8 mil; Wire loop height = 6mil

Modeling Tool : Parasitic Parameters 3D Modeler

Ground Plane positioned at 15mil below the package seating plane.

**Definition**

**Self Resistance**

Resistance of the lead which is under study

**Self Inductance**

Inductance of a lead with a PWB ground plane at 15mil below the package seating place. It is a particle self inductance.

**Mutual Inductance**

Inductance between the lead under study to its left or right adjacent lead

**Mutual Capacitance**

Capacitance between the lead under study to its left or right adjacent lead

**Bulk Capacitance**

Capacitance from the lead under study to all other leads and ground plane. All the other leads and metal are grounded.

**Wire length**

Wire length stated at the above table is the direct distance from point on the bond pad to the bond point on the lead.



CARSEM (A MEMBER OF THE HONG LEONG GROUP)

CARSEM ELECTRICAL DATA

UPDATED :2010 AUG

Spak 5L

Data extracted at 1MHz

Package Type Spak 5L Package Size 9.398mm x 10.287mm Pad size 256mils x 231mils Die size 48.4mils x 44.96mils	Lead	Self Inductance (nH) L <sub>11</sub>		Bulk Capacitance (pF) C <sub>11</sub>		Resistance (mOhm ) R		Gold Wire		
		Lead only	Lead + Wire	Lead only	Lead + Wire	Lead only	Lead + Wire	Length(mm)	Diameter(mils)	
	Pin 1	0.7850	3.1900	0.2610	0.6140	0.8000	27.8000	4.226,3.953,3.669,3.311	1.3	
	Pin 2	0.8310	3.1600	0.3030	0.4050	0.7000	65.8000	2.042	1.3	
	Pin 3	1.6800	0.1770	6.8200	6.9300	0.9000	2.3000	0.749,0.749,0.749	1.3	
	Pin 4	0.8330	2.5600	0.3000	0.4270	0.7000	34.6000	2.089,2.256	1.3	
	Pin 5	0.8760	3.3900	0.2710	0.6030	0.8000	28.1000	3.427,4.167,4.091,4.258	1.3	
		Mutual Inductance L <sub>12</sub>				Mutual Capacitance C <sub>12</sub>				
		Lead only		Lead + Wire		Lead only		Lead + Wire		
	Pin 1 to Pin 2	0.1220		0.7890		0.0520		0.1430		
	Pin 2 to Pin 3	0.1250		0.1170		0.1390		0.1570		
	Pin 3 to Pin 4	0.1260		0.1140		0.1320		0.1780		
	Pin 4 to Pin 5	0.1340		0.8280		0.0540		0.1400		

Data extracted at 1MHz

Package Type Spak 5L Package Size 9.398mm x 10.287mm Pad size 256mils x 231mils Die size 48.4mils x 44.96mils	Lead	Self Inductance (nH) L <sub>11</sub>		Bulk Capacitance (pF) C <sub>11</sub>		Resistance (mOhm ) R		Gold Wire		
		Lead only	Lead + Wire	Lead only	Lead + Wire	Lead only	Lead + Wire	Length(mm)	Diameter(mils)	
	Pin 1	0.7850	3.1500	0.2610	0.6310	0.8000	21.2000	4.226,3.953,3.669,3.311	1.5	
	Pin 2	0.8310	3.0900	0.3030	0.4130	0.7000	49.6000	2.042	1.5	
	Pin 3	1.6800	0.1390	6.8200	6.9400	0.9000	1.7800	0.749,0.749,0.749	1.5	
	Pin 4	0.8330	2.5200	0.3000	0.4340	0.7000	26.2000	2.089,2.256	1.5	
	Pin 5	0.8760	3.3500	0.2710	0.6170	0.8000	21.5000	3.427,4.167,4.091,4.258	1.5	
		Mutual Inductance L <sub>12</sub>				Mutual Capacitance C <sub>12</sub>				
		Lead only		Lead + Wire		Lead only		Lead + Wire		
	Pin 1 to Pin 2	0.1220		0.7820		0.0520		0.1500		
	Pin 2 to Pin 3	0.1250		0.1030		0.1390		0.1590		
	Pin 3 to Pin 4	0.1260		0.1000		0.1320		0.1800		
	Pin 4 to Pin 5	0.1340		0.8200		0.0540		0.1450		



**Assumption**

Leadframe Material : C194 =  $2.87 \times 10^{-8} \Omega \cdot \text{m}$ ; relative permeability,  $\mu_r = 1$

Gold Wire: Resistivity =  $2.35 \times 10^{-8} \Omega \cdot \text{m}$ ; relative permeability,  $\mu_r = 1$

Mold compound material : with  $\epsilon_r = 4.3$ ; loss  $\tan \delta = 0.001$

Die thickness = 19mil; Wire loop height = 8mil

Modeling Tool: Parasitic Parameters 3D Modeler

Ground Plane positioned at 15mil below the package seating plane.

\* Mold compound material: KMC289 with  $\epsilon_r = 4.0$  loss  $\tan \delta = 0.004$

**Definition**

**Self Resistance**

Resistance of the lead which is under study

**Self Inductance**

Inductance of a lead with a PWB ground plane at 15mil below the package seating place. It is a particle self inductance.

**Mutual Inductance**

Inductance between the lead under study to its left or right adjacent lead

**Mutual Capacitance**

Capacitance between the lead under study to its left or right adjacent lead

**Bulk Capacitance**

Capacitance from the lead under study to all other leads and ground plane. All the other leads and metal are grounded.

**Wire length**

Wire length stated at the above table is the direct distance from point on the bond pad to the bond point on the lead.



CARSEM ELECTRICAL DATA

UPDATED: 2010 AUG

SOICW													
Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
SOICW 16L 10.11mmx7.4mmx2.24mm	Center	1.364	1.268	2.632	0.4554	0.05952	0.5149	13.15	71.40	84.55	1.246	1.0	
	Corner	2.625	1.978	4.603	0.7472	0.07682	0.8240	41.01	101.1	142.1	1.891	1.0	
Paddle Size (milxmil) 130x157		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
Die size (milxmil) 84x84	Center	0.3471	0.1900	0.5371	0.3404	0.1421	0.4825	0.1137	0.004742	0.1184	0.1130	0.002886	0.1159
	Corner	0.5766	0.4118	0.9884	0.03352	0.2324	0.2659	0.2250	0.007533	0.2325	0.04367	0.004110	0.04778

**Assumption**

Leadframe Material : Copper with resistivity=1.73x10<sup>-8</sup>Ω.m; relative permeability, μ<sub>r</sub> =1

Gold Wire: Resistivity=2.25x10<sup>-8</sup>Ω.m; relative permeability, μ<sub>r</sub> =1

Mold compound material : Plastic Novolac with ε<sub>r</sub> =4.8 loss tan δ =0.001

Die thickness = 8 mil; Wire loop height = 6mil

Modeling Tool : Parasitic Parameters 3D Modeler

Data Extracted at 100MHz

Ground Plane positioned at 15mil below the package seating plane.

**Definition**

**Self Resistance**

Resistance of the lead which is under study

**Self Inductance**

Inductance of a lead with a PWB ground plane at 15mil below the package seating place. It is a particle self inductance.

**Mutual Inductance**

Inductance between the lead under study to its left or right adjacent lead

**Mutual Capacitance**

Capacitance between the lead under study to its left or right adjacent lead

**Bulk Capacitance**

Capacitance from the lead under study to all other leads and ground plane. All the other leads and metal are grounded.

**Wire length**

Wire length stated at the above table is the direct distance from point on the bond pad to the bond point on the lead.



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CARSEM ELECTRICAL DATA

UPDATED: 2010 AUG

**QSOP - 100MHz**

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
QSOP 16L 4.89x3.9	Center	0.6952	0.4161	1.1110	0.2154	0.03455	0.2500	6.454	30.01	36.46	0.4884	1.0	
Paddle Size (milxmil) 96x130	Corner	1.0560	0.4387	1.4950	0.2785	0.0351	0.3136	9.5020	31.5600	41.0600	0.5091	1.0	
Die size (milxmil) 86x120		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Corner	0.2104	0.0424	0.2528	0.2051	0.0381	0.2432	0.0529	0.0027	0.0557	0.050	0.0022	0.0518
	Corner	0.2593	0.0326	0.2919	0.0106	0.0175	0.0281	0.0660	0.0028	0.0688	0.008	0.0008	0.0085

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
QSOP 20L 6.0mmx3.9mm	Center	0.4861	0.5197	1.0060	0.2204	0.03523	0.2556	7.281	31.67	38.95	0.5142	1.0	
Paddle Size (milxmil) 96x140	Corner	0.8754	1.0000	1.8750	0.2328	0.0482	0.2810	10.040	59.090	69.1300	1.0370	1.0	
Die size (milxmil) 86x106		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Corner	0.1390	0.0514	0.1940	0.1185	0.0491	0.1676	0.0387	0.0019	0.0407	0.032	0.0018	0.0338
*Ref [2]	Corner	0.1972	0.2160	0.4132	0.0107	0.0506	0.0613	0.0708	0.0057	0.0764	0.007	0.0012	0.0084

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
QSOP 24L 8.65mmx6.00mm	Center	0.7730	0.5398	1.3128	0.2275	0.0420	0.2695	7.6841	39.6130	47.2971	0.5676	1.0	
Paddle Size (milxmil) 96x140	Corner	1.6159	1.0077	2.6236	0.4421	0.0610	0.5031	14.6380	61.3820	76.0200	1.0488	1.0	
Die size (milxmil) 86x130		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Corner	0.2343	0.0539	0.2882	0.2327	0.0623	0.2950	0.0588	0.0048	0.0636	0.056	0.0049	0.0613
	Corner	0.4955	0.1852	0.6807	0.0385	0.1287	0.1672	0.1428	0.0087	0.1515	0.004	0.0066	0.0110





CARSEM (A MEMBER OF THE HONG LEONG GROUP)

CARSEM ELECTRICAL DATA

UPDATED: 2010 AUG

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm ) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
<b>QSOP 44L</b> 17.83mmx7.5mm  <b>Paddle Size (milxmil)</b> 190x260  <b>Die size (milxmil)</b> 180x250 *Ref [2]	Center	1.2650	0.7426	2.0080	0.3753	0.04311	0.4184	8.682	47.66	56.43	0.7646	1.0	
	Corner	4.3040	0.7651	5.0690	1.1930	0.0437	1.2370	27.4400	48.6300	76.0700	0.7921	1.0	
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	0.4515	0.1051	0.5566	0.4300	0.1052	0.5352	0.1097	0.0037	0.1134	0.106	0.0036	0.1096
	Corner	0.3771	0.0730	0.4501	1.9380	0.1468	2.0850	0.0905	0.0023	0.0928	0.554	0.0049	0.5593

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm ) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
<b>QSOP 20L</b> 8.65mmx3.9mm  <b>Paddle Size (milxmil)</b> 96x140  <b>Die size (milxmil)</b> 86x106	Center	0.7437	0.4381	1.1820	0.2204	0.03523	0.2556	7.281	31.67	38.95	0.5091	1.0	
	Corner	1.1450	0.9713	2.1160	0.3170	0.0602	0.3772	10.7900	58.3800	69.1700	1.0400	1.0	
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	0.2340	0.0435	0.2775	0.1993	0.0392	0.2385	0.0568	0.0022	0.0590	0.047	0.0020	0.0490
	Corner	0.2913	0.2099	0.5012	0.0019	0.0502	0.0521	0.0931	0.0104	0.1035	0.007	0.0018	0.0089

QSOP - 300kHz

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm ) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
<b>QSOP 16L</b> 4.89mmx3.9mm  <b>Paddle Size (milxmil)</b> 96x130  <b>Die size (milxmil)</b> 86x120	Center	0.7608	0.5682	1.3290	0.2154	0.00980	0.2252	1.106	27.19	28.30	0.4884	1.0	
	Corner	1.1510	0.5350	1.6860	0.2785	0.0107	0.2892	1.6150	28.6050	30.2200	0.5091	1.0	
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	0.2104	0.1503	0.3607	0.2051	0.1439	0.3490	0.0529	0.0047	0.0576	0.050	0.0035	0.0531
	Corner	0.2593	0.1399	0.3992	0.0106	0.0428	0.0534	0.0660	0.0054	0.0713	0.008	0.0090	0.0087



**Assumption**

Leadframe Material: C194 =  $2.87 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Gold Wire: Resistivity =  $2.25 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Mold compound material: with  $\epsilon_r = 4.281$ ; loss  $\tan \delta = 0.004$

Die thickness = 10mil; Wire loop height = 6mil

Modeling Tool: Parasitic Parameters 3D Modeler

Data Extracted at 100MHz

Ground Plane positioned at 15mil below the package seating plane.

\*Ref [2]

Leadframe Material: Copper with resistivity =  $1.73 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Gold Wire: Resistivity =  $2.25 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Mold compound material : with  $\epsilon_r = 4.8$ ; loss  $\tan \delta = 0.001$

Die thickness = 8mil; Wire loop height = 6mil

**Definition**

**Self Resistance**

Resistance of the lead which is under study

**Self Inductance**

Inductance of a lead with a PWB ground plane at 15mil below the package seating place. It is a particle self inductance.

**Mutual Inductance**

Inductance between the lead under study to its left or right adjacent lead

**Mutual Capacitance**

Capacitance between the lead under study to its left or right adjacent lead

**Bulk Capacitance**

Capacitance from the lead under study to all other leads and ground plane. All the other leads and metal are grounded.

**Wire length**

Wire length stated at the above table is the direct distance from point on the bond pad to the bond point on the lead.



CARSEM (A MEMBER OF THE HONG LEONG GROUP)

CARSEM ELECTRICAL DATA

UPDATED: 2010 AUG

**Ddpak**

**Data extracted at DC**

Package Type Ddpak 3L Pad size 240milx180mil Die size 200milx160mil	Lead	Self Inductance (nH) L <sub>11</sub>		Bulk Capacitance (pF) C <sub>11</sub>		Resistance (mOhm ) R		Gold Wire	
		Lead only	Lead + Wire	Lead only	Lead + Wire	Lead only	Lead + Wire	Length(mm)	Diameter(mils)
	Pin 1	3.144	4.795	0.9071	1.037	0.4626	10.63	1.40	3.0
	Pin 2	4.048	4.168	10.54	10.68	0.5555	3.647	1.41,1.47,1.37	3.0
	Pin 3	3.144	4.806	0.9034	1.044	0.4653	10.64	1.40	3.0
		Mutual Inductance L <sub>12</sub>				Mutual Capacitance C <sub>12</sub>			
		Lead only		Lead + Wire		Lead only		Lead + Wire	
	Pin 1 to Pin 2	0.7204		0.9279		0.2857		0.3213	
	Pin 2 to Pin 3	0.7128		0.9209		0.2838		0.3259	
	Pin 3 to Pin 1	0.2839		0.4282		0.01383		0.01401	

**Data extracted at 100kHz**

Package Type Ddpak 3L Pad size 240milx180mil Die size 200milx160mil	Lead	Self Inductance (nH) L <sub>11</sub>		Bulk Capacitance (pF) C <sub>11</sub>		Resistance (mOhm ) R		Gold Wire	
		Lead only	Lead + Wire	Lead only	Lead + Wire	Lead only	Lead + Wire	Length(mm)	Diameter(mils)
	Pin 1	3.116	4.759	0.9071	1.037	0.5034	10.67	1.40	3.0
	Pin 2	3.991	4.110	10.54	10.68	0.6131	3.701	1.41,1.47,1.37	3.0
	Pin 3	3.117	4.770	0.9034	1.044	0.5059	10.68	1.40	3.0
		Mutual Inductance L <sub>12</sub>				Mutual Capacitance C <sub>12</sub>			
		Lead only		Lead + Wire		Lead only		Lead + Wire	
	Pin 1 to Pin 2	0.7204		0.9279		0.2857		0.3213	
	Pin 2 to Pin 3	0.7128		0.9209		0.2838		0.3259	
	Pin 3 to Pin 1	0.2839		0.4282		0.01383		0.01401	



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Data extracted at 25MHz

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>		Bulk Capacitance (pF) C <sub>11</sub>		Resistance (mOhm) R		Gold Wire		
		Lead only	Lead + Wire	Lead only	Lead + Wire	Lead only	Lead + Wire	Length(mm)	Diameter(mils)	
Ddpak 3L Pad size 240milx180mil Die size 200milx160mil	Pin 1	2.824	4.465	0.9071	1.037	5.494	18.78	1.40	3.0	
	Pin 2	3.642	3.761	10.54	10.68	6.388	9.772	1.41,1.47,1.37	3.0	
	Pin 3	2.824	4.474	0.9034	1.044	5.512	18.85	1.40	3.0	
		Mutual Inductance L <sub>12</sub>				Mutual Capacitance C <sub>12</sub>				
		Lead only		Lead + Wire		Lead only		Lead + Wire		
		Pin 1 to Pin 2	0.7204		0.9279		0.2857		0.3213	
		Pin 2 to Pin 3	0.7128		0.9209		0.2838		0.3259	
		Pin 3 to Pin 1	0.2839		0.4282		0.01383		0.01401	

Data extracted at 50MHz

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>		Bulk Capacitance (pF) C <sub>11</sub>		Resistance (mOhm) R		Gold Wire		
		Lead only	Lead + Wire	Lead only	Lead + Wire	Lead only	Lead + Wire	Length(mm)	Diameter(mils)	
Ddpak 3L Pad size 240milx180mil Die size 200milx160mil	Pin 1	2.821	4.442	0.9071	1.037	9.849	26.93	1.40	3.0	
	Pin 2	3.636	3.755	10.54	10.68	11.58	15.04	1.41,1.47,1.37	3.0	
	Pin 3	2.820	4.452	0.9034	1.044	9.857	27.11	1.40	3.0	
		Mutual Inductance L <sub>12</sub>				Mutual Capacitance C <sub>12</sub>				
		Lead only		Lead + Wire		Lead only		Lead + Wire		
		Pin 1 to Pin 2	0.7204		0.9279		0.2857		0.3213	
		Pin 2 to Pin 3	0.7128		0.9209		0.2838		0.3259	
		Pin 3 to Pin 1	0.2839		0.4282		0.01383		0.01401	



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CARSEM ELECTRICAL DATA

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Data extracted at 100MHz

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>		Bulk Capacitance (pF) C <sub>11</sub>		Resistance (mOhm ) R		Gold Wire	
		Lead only	Lead + Wire	Lead only	Lead + Wire	Lead only	Lead + Wire	Length(mm)	Diameter(mils)
Ddpak 3L Pad size 240milx180mil  Die size 200milx160mil	Pin 1	2.840	4.446	0.9071	1.037	15.34	39.48	1.40	3.0
	Pin 2	3.654	3.769	10.54	10.68	17.99	25.17	1.41,1.47,1.37	3.0
	Pin 3	2.840	4.455	0.9034	1.044	15.38	39.83	1.40	3.0
		Mutual Inductance L <sub>12</sub>				Mutual Capacitance C <sub>12</sub>			
		Lead only		Lead + Wire		Lead only		Lead + Wire	
	Pin 1 to Pin 2	0.7204		0.9279		0.2857		0.3213	
	Pin 2 to Pin 3	0.7128		0.9208		0.2838		0.3259	
	Pin 3 to Pin 1	0.2839		0.4282		0.01383		0.01401	

Ddpak 5L

Data extracted at 1Hz

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>		Bulk Capacitance (pF) C <sub>11</sub>		Resistance (mOhm ) R		Gold Wire	
		Lead only	Lead + Wire	Lead only	Lead + Wire	Lead only	Lead + Wire	Length(mm)	Diameter(mils)
Ddpak 5L  Pad size 240milx180mil  Die size 200milx160mil	Pin 1	3.179	5.652	0.8324	0.9161	0.5070	28.64	1.97	2.0
	Pin 2	3.161	5.352	0.9343	0.9995	0.5029	25.62	1.63	2.0
	Pin 3	4.036	4.569	10.88	11.00	0.5851	11.43	1.57,1.39	2.0
	Pin 4	3.161	5.303	0.9384	1.001	0.5029	25.36	1.50	2.0
	Pin 5	3.178	5.545	0.8296	0.9098	0.5070	27.45	1.80	2.0
		Mutual Inductance L <sub>12</sub>				Mutual Capacitance C <sub>12</sub>			
		Lead only		Lead + Wire		Lead only		Lead + Wire	
	Pin 1 to Pin 2	1.065		1.688		0.2412		0.2583	
	Pin 2 to Pin 3	0.9597		1.399		0.3034		0.3375	
	Pin 3 to Pin 4	0.9895		1.415		0.3101		0.3398	
Pin 4 to Pin 5	1.059		1.662		0.2400		0.2584		
Pin 5 to Pin1	0.1709		0.3779		0.007550		0.005869		



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Data extracted at 100KHz

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>		Bulk Capacitance (pF) C <sub>11</sub>		Resistance (mOhm ) R		Gold Wire		
		Lead only	Lead + Wire	Lead only	Lead + Wire	Lead only	Lead + Wire	Length(mm)	Diameter(mils)	
Ddpak 5L Pad size 240milx180mil Die size 200milx160mil	Pin 1	3.158	5.623	0.8324	0.9161	0.5441	28.68	1.97	2.0	
	Pin 2	3.140	5.319	0.9343	0.9995	0.5400	25.66	1.63	2.0	
	Pin 3	3.975	4.516	10.88	11.00	0.6327	11.48	1.57,1.39	2.0	
	Pin 4	3.140	5.270	0.9384	1.001	0.5400	25.40	1.50	2.0	
	Pin 5	3.157	5.517	0.8296	0.9098	0.5441	27.49	1.80	2.0	
	Mutual Inductance L <sub>12</sub>				Mutual Capacitance C <sub>12</sub>					
			Lead only		Lead + Wire		Lead only		Lead + Wire	
	Pin 1 to Pin 2		1.063		1.678		0.2412		0.2583	
	Pin 2 to Pin 3		0.9565		1.391		0.3034		0.3375	
	Pin 3 to Pin 4		0.9867		1.410		0.3101		0.3398	
	Pin 4 to Pin 5		1.049		1.653		0.2400		0.2584	
	Pin 5 to Pin1		0.1726		0.3796		0.007550		0.005869	

Data extracted at 25MHz

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>		Bulk Capacitance (pF) C <sub>11</sub>		Resistance (mOhm ) R		Gold Wire		
		Lead only	Lead + Wire	Lead only	Lead + Wire	Lead only	Lead + Wire	Length(mm)	Diameter(mils)	
Ddpak 5L Pad size 240milx180mil Die size 200milx160mil	Pin 1	2.874	5.346	0.8324	0.9161	5.033	34.99	1.97	2.0	
	Pin 2	2.858	5.050	0.9343	0.9995	4.942	31.45	1.63	2.0	
	Pin 3	3.663	4.209	10.88	11.00	6.683	16.83	1.57,1.39	2.0	
	Pin 4	2.858	5.000	0.9384	1.001	4.942	31.15	1.50	2.0	
	Pin 5	2.874	5.237	0.8296	0.9098	5.022	33.75	1.80	2.0	
	Mutual Inductance L <sub>12</sub>				Mutual Capacitance C <sub>12</sub>					
			Lead only		Lead + Wire		Lead only		Lead + Wire	
	Pin 1 to Pin 2		1.063		1.677		0.2412		0.2583	
	Pin 2 to Pin 3		0.9564		1.391		0.3034		0.3375	
	Pin 3 to Pin 4		0.9866		1.410		0.3101		0.3398	
	Pin 4 to Pin 5		1.049		1.652		0.2400		0.2584	
	Pin 5 to Pin1		0.1726		0.3858		0.007550		0.005869	



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CARSEM ELECTRICAL DATA

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Data extracted at 50MHz

Package Type	Lead	Self Inductance (nH) $L_{11}$		Bulk Capacitance (pF) $C_{11}$		Resistance (mOhm) $R$		Gold Wire		
		Lead only	Lead + Wire	Lead only	Lead + Wire	Lead only	Lead + Wire	Length(mm)	Diameter(mils)	
Ddpak 5L Pad size 240milx180mil Die size 200milx160mil	Pin 1	2.873	5.343	0.8324	0.9161	8.467	44.26	1.97	2.0	
	Pin 2	2.858	5.048	0.9343	0.9995	8.231	39.85	1.63	2.0	
	Pin 3	3.669	4.207	10.88	11.00	11.81	23.10	1.57,1.39	2.0	
	Pin 4	2.858	4.998	0.9384	1.001	8.231	39.49	1.50	2.0	
	Pin 5	2.873	5.234	0.8296	0.9098	8.432	42.76	1.80	2.0	
		Mutual Inductance $L_{12}$				Mutual Capacitance $C_{12}$				
			Lead only	Lead + Wire			Lead only	Lead + Wire		
		Pin 1 to Pin 2	1.063	1.677			0.2412	0.2583		
		Pin 2 to Pin 3	0.9564	1.391			0.3034	0.3375		
		Pin 3 to Pin 4	0.9866	1.410			0.3101	0.3398		
		Pin 4 to Pin 5	1.049	1.652			0.2400	0.2584		
		Pin 5 to Pin1	0.1726	0.3860			0.007550	0.005869		



CARSEM ELECTRICAL DATA

**Assumption**

Leadframe Material: C194 =  $2.87 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Gold Wire: Resistivity =  $2.35 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Mold compound material: with  $\epsilon_r = 4.3$ ; loss  $\tan \delta = 0.001$

Die thickness = 17mil; Wire loop height = 8mil

Modeling Tool: Parasitic Parameters 3D Modeler

Ground Plane positioned at 15mil below the package seating plane.

**Definition**

**Self Resistance**

Resistance of the lead which is under study

**Self Inductance**

Inductance of a lead with a PWB ground plane at 15mil below the package seating place. It is a particle self inductance.

**Mutual Inductance**

Inductance between the lead under study to its left or right adjacent lead

**Mutual Capacitance**

Capacitance between the lead under study to its left or right adjacent lead

**Bulk Capacitance**

Capacitance from the lead under study to all other leads and ground plane. All the other leads and metal are grounded.

**Wire length**

Wire length stated at the above table is the direct distance from point on the bond pad to the bond point on the lead.





CARSEM ELECTRICAL DATA

UPDATED: 2010 AUG

MSOP

Data extracted at 1MHz

Package Type MSOP 10L 3.0mmx3.0mmx0.91mm Paddle Size (milxmil) 68x98 Die size (milxmil) 52x81.9	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
	Center	0.7730	0.3185	1.0915	0.1780	0.1068	0.2848	1.4900	19.73	21.2150	0.7346	1.0	
	Corner	0.7730	0.7120	1.4850	0.1560	0.0474	0.2034	1.5000	42.70	44.2000	0.7471	1.0	
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	0.2610	0.1120	0.3730	0.2610	0.1150	0.3760	0.0483	0.0060	0.0543	0.0490	0.0075	0.0565
	Corner	0.2600	0.1150	0.3750	0.2600	0.1020	0.3620	0.0512	0.0073	0.0585	0.0487	0.0065	0.0552

Data extracted at 100MHz

Package Type MSOP 10L 3.0mmx3.0mmx0.91mm Paddle Size (milxmil) 68x98 Die size (milxmil) 52x81.9	Lead	(nH) L <sub>11</sub> Self Inductance			(pF) C <sub>11</sub> Bulk Capacitance			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
	Center	0.7180	0.3175	1.0355	0.1780	0.1068	0.2848	7.2200	21.93	29.1500	0.7346	1.0	
	Corner	0.7190	0.7100	1.4290	0.1560	0.0474	0.2034	7.2500	47.50	54.7500	0.6733	1.0	
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	0.2610	0.1120	0.3730	0.2610	0.1440	0.4050	0.0483	0.0060	0.0543	0.0490	0.0075	0.0565
	Corner	0.2600	0.1150	0.3750	0.2600	0.1020	0.3620	0.0512	0.0073	0.0585	0.0487	0.0065	0.0552

Data extracted at 2GHz

Package Type MSOP 10L 3.0mmx3.0mmx0.91mm Paddle Size (milxmil) 68x98 Die size (milxmil) 52x81.9	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
	Center	0.7130	0.3035	1.0165	0.1780	0.1068	0.2848	22.600	76.50	99.1000	0.7346	1.0	
	Corner	0.7130	0.6800	1.3930	0.1560	0.0474	0.2034	22.700	167.00	189.7000	0.6733	1.0	
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	0.2610	0.1120	0.3730	0.2610	0.1440	0.4050	0.0483	0.0060	0.0543	0.0490	0.0075	0.0565
	Corner	0.2600	0.1150	0.3750	0.2600	0.1020	0.3620	0.0512	0.0073	0.0585	0.0487	0.0065	0.0552



CARSEM ELECTRICAL DATA

**Assumption**

**Modeling Tool: Parasitic Parameters 3D Modeler**

**Data extracted at 1MHz, 100MHz & 2GHz**

**Ground Plane positioned at 15mil below the package seating plane.**

**Definition**

**Self Resistance**

**Resistance of the lead which is under study**

**Self Inductance**

**Inductance of a lead with a PWB ground plane at 15mil below the package seating place. It is a particle self inductance.**

**Mutual Inductance**

**Inductance between the lead under study to its left or right adjacent lead**

**Mutual Capacitance**

**Capacitance between the lead under study to its left or right adjacent lead**

**Bulk Capacitance**

**Capacitance from the lead under study to all other leads and ground plane. All the other leads and metal are grounded.**

**Wire length**

**Wire length stated at the above table is the direct distance from point on the bond pad to the bond point on the lead.**



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CARSEM ELECTRICAL DATA

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**MQFP**

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
MQFP 208L 28mmx28mmx3.4mm	Center	7.073	2.125	9.198	1.606	0.1781	1.784	53.67	84.58	138.3	2.416	1.3	
	Corner	9.369	2.790	12.16	2.007	0.2101	2.217	70.68	102.8	173.5	2.966	1.3	
Paddle Size (milxmil) 394x394	Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>			
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
Die size (milxmil) 374x374	Center	4.269	0.8775	5.147	4.045	0.8616	4.907	0.6443	0.04789	0.6922	0.6313	0.04408	0.6754
	Corner	5.672	1.281	6.953	2.547	0.4918	3.039	0.8725	0.06630	0.9388	0.1731	0.01618	0.1893
<b>Data extracted at 1Hz</b>													
MQFP 100L 14.0mmx20.0mmx2.71mm	Center	2.671	1.227	3.898	0.4559	0.08714	0.5430	5.499	41.54	47.04	1.336	1.3	
	Corner	5.625	2.514	8.139	0.9531	0.1414	1.095	10.12	72.33	82.45	2.492	1.3	
Paddle Size (milxmil) 358milx358mil	Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>			
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
Die size 218milx332mil	Center	1.140	0.3700	1.510	1.146	0.3668	1.513	0.1594	0.01500	0.1744	0.1613	0.01428	0.1756
	Corner	1.471	0.7057	2.177	2.759	0.9106	3.670	0.1713	0.01997	0.1913	0.4641	0.03048	0.4946
*Ref(2)													



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CARSEM ELECTRICAL DATA

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Data extracted at 100MHz

Package Type MQFP 100L 14.0mmx20.0mmx2.71mm Paddle Size (milxmil) 358milx358mil Die size (milxmil) 218milx332mil *Ref [2]	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm ) R			Gold Wire		
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
	Center	2.495	1.218	3.713	0.4559	0.08714	0.5430	25.53	52.29	77.82	1.336	1.0	
	Corner	5.271	2.498	7.769	0.9531	0.1414	1.095	49.76	91.52	141.3	2.492	1.0	
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	1.140	0.3700	1.510	1.146	0.3668	1.513	0.1594	0.01500	0.1744	0.1613	0.01428	0.1756
	Corner	1.471	0.7057	2.177	2.759	0.9106	3.670	0.1713	0.01997	0.1913	0.4641	0.03048	0.4946

Data extracted at 500MHz

Package Type MQFP 100L 14.0mmx20.0mmx2.71mm Paddle Size 358milx358mil Die size 218milx332mil *Ref [2]	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm ) R			Gold Wire		
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
	Center	2.483	1.187	3.670	0.4559	0.08714	0.5430	59.58	102.6	162.2	1.336	1.0	
	Corner	5.247	2.443	7.690	0.9531	0.1414	1.095	117.9	180.4	298.3	2.492	1.0	
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	1.140	0.3700	1.510	1.146	0.3668	1.513	0.1594	0.01500	0.1744	0.1613	0.01428	0.1756
	Corner	1.471	0.7057	2.177	2.759	0.9106	3.670	0.1713	0.01997	0.1913	0.4641	0.03048	0.4946

Data extracted at 1GHz

Package Type MQFP 100L 14.0mmx20.0mmx2.71mm Paddle Size (milxmil) 358milx358mil Die size (milxmil) 218milx332mil *Ref [2]	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm ) R			Gold Wire		
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
	Center	2.482	1.177	3.659	0.4559	0.08714	0.5430	89.99	146.5	236.5	1.336	1.0	
	Corner	5.244	2.426	7.670	0.9531	0.1414	1.095	179.3	257.4	436.7	2.492	1.0	
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	1.140	0.3700	1.510	1.146	0.3668	1.513	0.1594	0.01500	0.1744	0.1613	0.01428	0.1756
	Corner	1.471	0.7057	2.177	2.759	0.9106	3.670	0.1713	0.01997	0.1913	0.4641	0.03048	0.4946



## CARSEM ELECTRICAL DATA

### Assumption

Leadframe Material: Copper with resistivity =  $1.73 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Gold Wire: Resistivity =  $2.25 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Mold compound material: Plastic Novolac with  $\epsilon_r = 4.8$ ; loss  $\tan \delta = 0.001$

Die thickness = 8mil; Wire loop height = 6mil

\*Ref [2]

Leadframe Material : C7025TR02 with resistivity =  $4.35 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Gold Wire: Resistivity =  $2.35 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Mold compound material : with  $\epsilon_r = 4.281$  loss  $\tan \delta = 0.004$

Die thickness = 10mil; Wire loop height = 6mil

Modeling Tool: Parasitic Parameters 3D Modeler

Ground Plane positioned at 15mil below the package seating plane.

### Definition

**Self Resistance**

Resistance of the lead which is under study

**Self Inductance**

Inductance of a lead with a PWB ground plane at 15mil below the package seating place. It is a particle self inductance.

**Mutual Inductance**

Inductance between the lead under study to its left or right adjacent lead

**Mutual Capacitance**

Capacitance between the lead under study to its left or right adjacent lead

**Bulk Capacitance**

Capacitance from the lead under study to all other leads and ground plane. All the other leads and metal are grounded.

**Wire length**

Wire length stated at the above table is the direct distance from point on the bond pad to the bond point on the lead.



CARSEM (A MEMBER OF THE HONG LEONG GROUP)

CARSEM ELECTRICAL DATA

UPDATED: 2010 AUG

MLP Micro

Data Extracted at 100MHz

Package Type MLP Micro 8L 3.0mmx3.0mmx0.75mm  Pad size 67milx99mil  Die size 59milx81mil	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
Center		0.1226	0.4974	0.6200	0.1418	0.0135	0.1553	1.1834	25.4026	26.5860	0.6164 / 0.6479		1.0
Corner		0.1228	0.6568	0.7796	0.1363	0.0396	0.1759	1.1820	31.6298	32.8118	0.9800 / 0.8857		1.0
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
Center		0.0208	0.0865	0.1073	0.0210	0.1044	0.1254	0.0229	-0.0079	0.0150	0.0233	-0.0022	0.0211
Corner		0.0210	0.1226	0.1436	0.0006	0.0288	0.0294	0.0233	0.0001	0.0234	0.0002	0.0006	0.0008

Data Extracted at 2GHz

Package Type MLP Micro 8L 3.0mmx3.0mmx0.75mm  Pad size 67milx99mil  Die size 59milx81mil	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
Center		0.1216	0.4817	0.6033	0.1418	0.0135	0.1553	6.4389	89.7687	96.2076	0.6164 / 0.6479		1.0
Corner		0.1218	0.6369	0.7587	0.1363	0.0396	0.1759	6.4376	112.3024	118.7400	0.9800 / 0.8857		1.0
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
Center		0.0208	0.0864	0.1072	0.0210	0.1043	0.1253	0.0229	-0.0079	0.0150	0.0233	-0.0022	0.0211
Corner		0.0210	0.1225	0.1435	0.0006	0.0288	0.0294	0.0233	0.0001	0.0234	0.0002	0.0006	0.0008



## CARSEM ELECTRICAL DATA

### Assumption

Leadframe Material: Copper with resistivity =  $1.73 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Gold Wire: Resistivity =  $2.35 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Mold compound material: Plastic Novolac with  $\epsilon_r = 4.8$ ; loss  $\tan \delta = 0.001$

\* New entries: Mold compound material: with  $\epsilon_r = 4.1$ ; loss  $\tan \delta = 0.001$

Die thickness = 8mil; Wire loop height = 6mil

Modeling Tool: Parasitic Parameters 3D Modeler

Ground Plane positioned at 15mil below the package seating plane.

### Definition

#### Self Resistance

Resistance of the lead which is under study

#### Self Inductance

Inductance of a lead with a PWB ground plane at 15mil below the package seating place. It is a particle self inductance.

#### Mutual Inductance

Inductance between the lead under study to its left or right adjacent lead

#### Mutual Capacitance

Capacitance between the lead under study to its left or right adjacent lead

#### Bulk Capacitance

Capacitance from the lead under study to all other leads and ground plane. All the other leads and metal are grounded.

#### Wire length

Wire length stated at the above table is the direct distance from point on the bond pad to the bond point on the lead.



**CARSEM**  
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**CARSEM ELECTRICAL DATA**

UPDATED :2005 MARCH

**MLPD**

**Data Extracted at 1MHz**

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm )R			Gold Wire		
		Lead	Wire	Lead +Wire	Lead	Wire	Lead +Wire	Lead	Wire	Lead+Wire	Length(mm)	Diameter (mil)	
MLPD 8L 3.0mmx3.0mmx0.75mm	Center	0.0848	0.5222	0.6070	0.1272	0.0439	0.1711	0.2048	21.4800	21.6848	0.6037	1.3000	
	Corner	0.0848	0.5359	0.6207	0.1173	0.0460	0.1633	0.2048	21.8100	22.0148	0.6037	1.3000	
	Pad size 104milx75mil Die size (milxmil) 65 x 65		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>	
	Center	Lead	Wire	Lead +Wire	Lead	Wire	Lead +Wire	Lead	Wire	Lead+Wire	Lead	Wire	Lead+Wire
	Center	0.0171	0.0734	0.0905	0.0171	0.0738	0.0909	0.0279	0.0049	0.0328	0.0294	0.0049	0.0343
	Corner	0.0171	0.0747	0.0918	0.0004	0.0186	0.0190	0.0294	0.0055	0.0349	0.0002	0.0006	0.0008

**Data Extracted at 2MHz**

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm )R			Gold Wire		
		Lead	Wire	Lead +Wire	Lead	Wire	Lead +Wire	Lead	Wire	Lead+Wire	Length(mm)	Diameter (mil)	
MLPD 8L 3.0mmx3.0mmx0.75mm	Center	0.0844	0.5222	0.6066	0.1272	0.0439	0.1711	0.2157	21.4900	21.7057	0.6037	1.3000	
	Corner	0.0844	0.5359	0.6203	0.1173	0.0460	0.1633	0.2157	21.8100	22.0257	0.6037	1.3000	
	Pad size 104milx75mil Die size (milxmil) 65 x 65		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>	
	Center	Lead	Wire	Lead +Wire	Lead	Wire	Lead +Wire	Lead	Wire	Lead+Wire	Lead	Wire	Lead+Wire
	Center	0.0171	0.0734	0.0905	0.0171	0.0738	0.0909	0.0279	0.0049	0.0328	0.0294	0.0049	0.0343
	Corner	0.0171	0.0747	0.0918	0.0004	0.0186	0.0190	0.0294	0.0055	0.0349	0.0002	0.0006	0.0008

**Data Extracted at 100MHz**

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm )R			Gold Wire		
		Lead	Wire	Lead +Wire	Lead	Wire	Lead +Wire	Lead	Wire	Lead+Wire	Length(mm)	Diameter (mil)	
MLPD 8L 3.0mmx3.0mmx0.75mm	Center	0.0803	0.5178	0.5981	0.1272	0.0439	0.1711	0.6728	26.6900	27.3628	0.6037	1.3000	
	Corner	0.0803	0.5315	0.6118	0.1173	0.0460	0.1633	0.6728	27.0800	27.7528	0.6037	1.3000	
	Pad size 104milx75mil Die size (milxmil) 65 x 65		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>	
	Center	Lead	Wire	Lead +Wire	Lead	Wire	Lead +Wire	Lead	Wire	Lead+Wire	Lead	Wire	Lead+Wire
	Center	0.0171	0.0734	0.0905	0.0171	0.0738	0.0909	0.0279	0.0049	0.0328	0.0294	0.0049	0.0343
	Corner	0.0171	0.0747	0.0918	0.0004	0.0186	0.0190	0.0294	0.0055	0.0349	0.0002	0.0006	0.0008

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm )R			Gold Wire	
		Lead	Wire	Lead +Wire	Lead	Wire	Lead +Wire	Lead	Wire	Lead+Wire	Length(mm)	Diameter (mil)
MLPD 10L 3.0mmx3.0mmx0.75mm	Center	0.0803	0.4780	0.5583	0.1268	0.0590	0.1858	0.6723	37.2842	37.9565	0.6153	1.0
	Corner	0.0803	0.5237	0.6040	0.1173	0.0599	0.1772	0.6723	39.4352	40.1075	0.5250	1.0
	Pad size		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>





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**CARSEM ELECTRICAL DATA**

UPDATED :2005 MARCH

104milx75mil Die size (milxmil) 67.5 x 86.4		Lead	Wire	Lead+Wire	Lead	Wire	Lead+Wire	Lead	Wire	Lead+Wire	Lead	Wire	Lead+Wire
	Center	0.0172	0.0775	0.0947	0.0170	0.0384	0.0554	0.0288	0.0011	0.0299	0.0282	0.0000	0.0282
	Corner	0.0170	0.0899	0.1069	0.0004	0.0096	0.0100	0.0288	0.0028	0.0316	0.0003	0.0000	0.0003

**Data Extracted at 2GHz**

Package Type MLPD 10L 3.0mmx3.0mmx0.75mm Die size (milxmil) 67.5 x 86.4	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (nOhm) R			Gold Wire		
		Lead	Wire	Lead+Wire	Lead	Wire	Lead+Wire	Lead	Wire	Lead+Wire	Length(mm)	Diameter(mil)	
		Center	0.0799	0.5771	0.6570	0.1269	0.0617	0.1886	3.3274	151.7100	155.0374	0.6037	1.3000
Corner	0.0799	0.4989	0.5788	0.1173	0.0599	0.1772	3.3274	136.8900	140.2174	0.6037	1.3000		
Pad size 104milx75mil Die size (milxmil) 67.5 x 86.4	Lead	Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
		Lead	Wire	Lead+Wire	Lead	Wire	Lead+Wire	Lead	Wire	Lead+Wire	Lead	Wire	Lead+Wire
		Center	0.0172	0.0775	0.0947	0.0170	0.0384	0.0554	0.0288	0.0011	0.0299	0.0282	0.0000
Corner	0.0170	0.0899	0.1069	0.0004	0.0096	0.0100	0.0288	0.0028	0.0316	0.0003	0.0000	0.0003	

**MLPD FCOL Data Extracted at 1MHz**

Package Type MLPD 8L 3.0mmx3.0mmx0.75mm Die size (milxmil) 67.5 x 86.4	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (nOhm) R			Gold Wire		
		Lead	Bump	Lead+Bump	Lead	Bump	Lead+Bump	Lead	Bump	Lead+Bump	Length(mm)	Diameter(mil)	
		Center	0.3286	0.0049	0.3335	0.2887	0.0279	0.3166	0.5523	20.1100	20.6623	NIL	NIL
Corner	0.3259	0.0049	0.3308	0.2425	0.0276	0.2701	0.5680	20.1100	20.6780	NIL	NIL		
Die size (milxmil) 67.5 x 86.4	Lead	Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
		Lead	Bump	Lead+Bump	Lead	Bump	Lead+Bump	Lead	Bump	Lead+Bump	Lead	Bump	Lead+Bump
		Center	0.1045	0.0006	0.1051	0.1042	0.0007	0.1049	0.0935	0.0027	0.0962	0.0933	0.0027
Corner	0.1042	0.0007	0.1049	0.0076	0.0002	0.0078	0.0933	0.0027	0.0960	0.0034	0.0004	0.0038	

**Data Extracted at 2MHz**

Package Type MLPD 8L 3.0mmx3.0mmx0.75mm Die size (milxmil) 67.5 x 86.4	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (nOhm) R			Gold Wire		
		Lead	Bump	Lead+Bump	Lead	Bump	Lead+Bump	Lead	Bump	Lead+Bump	Length(mm)	Diameter(mil)	
		Center	0.3262	0.0049	0.3311	0.2887	0.0279	0.3166	0.6088	20.1100	20.7188	NIL	NIL
Corner	0.3335	0.0049	0.3384	0.2425	0.0276	0.2701	0.6257	20.1100	20.7357	NIL	NIL		
Die size (milxmil) 67.5 x 86.4	Lead	Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
		Lead	Bump	Lead+Bump	Lead	Bump	Lead+Bump	Lead	Bump	Lead+Bump	Lead	Bump	Lead+Bump
		Center	0.1045	0.0006	0.1051	0.1042	0.0007	0.1049	0.0935	0.0027	0.0962	0.0933	0.0027
Corner	0.1042	0.0007	0.1049	0.0076	0.0002	0.0078	0.0933	0.0027	0.0960	0.0034	0.0004	0.0038	



CARSEM ELECTRICAL DATA

UPDATED :2010 AUG

Data Extracted at 100MHz

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm ) R			Gold Wire		
		Lead	Bump	Lead +Bump	Lead	Bump	Lead +Bump	Lead	Bump	Lead +Bump	Length(mm)	Diameter(mils)	
MLPD 8L 3.0mmx3.0mmx0.75mm	Center	0.3084	0.0049	0.3133	0.2887	0.0279	0.3166	2.2920	20.1100	22.4020	NIL	NIL	
	Corner	0.3152	0.0049	0.3201	0.2425	0.0276	0.2701	2.3630	20.1100	22.4730	NIL	NIL	
Die size 67.5mil x 86.4mil		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
		Lead	Bump	Lead +Bump	Lead	Bump	Lead +Bump	Lead	Bump	Lead +Bump	Lead	Bump	Lead +Bump
	Center	0.1045	0.0006	0.1051	0.1042	0.0007	0.1049	0.0935	0.0027	0.0962	0.0933	0.0027	0.0960
	Corner	0.1042	0.0007	0.1049	0.0076	0.0002	0.0078	0.0933	0.0027	0.0960	0.0034	0.0004	0.0038

**Assumption**

Leadframe Material: C194 with resistivity = $2.87 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Gold Wire: Resistivity =  $2.35 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Mold compound material: Plastic Novolac with  $\epsilon_r = 4.8$ ; loss  $\tan \delta = 0.001$

\* New entries: Mold compound material: with  $\epsilon_r = 4.1$ ; loss  $\tan \delta = 0.001$

Die thickness = 8mil; Wire loop height = 6mil

Modeling Tool: Parasitic Parameters 3D Modeler

Ground Plane positioned at 15mil below the package seating plane.

**Definition**

**Self Resistance**

Resistance of the lead which is under study

**Self Inductance**

Inductance of a lead with a PWB ground plane at 15mil below the package seating place. It is a particle self inductance.

**Mutual Inductance**

Inductance between the lead under study to its left or right adjacent lead

**Mutual Capacitance**

Capacitance between the lead under study to its left or right adjacent lead

**Bulk Capacitance**

Capacitance from the lead under study to all other leads and ground plane. All the other leads and metal are grounded.

**Wire length**

Wire length stated at the above table is the direct distance from point on the bond pad to the bond point on the lead.



CARSEM ELECTRICAL DATA

UPDATED: 2010 AUG

SOICN-100MHz

Package Type SOIC (N) 8LEAD  Pad Size 90 mil x90 mil  Die size 34.8mil x 47.6mil	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm ) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
Center		1.0600	1.2600	2.3200	0.2820	0.0723	0.3543	8.510	73.10	81.610	1.2572	1.0	
	Corner	1.3500	1.2700	1.9640	0.3030	0.0867	0.4733	10.90	73.40	46.756	1.2745	1.0	
		1.1900	0.0836					70.10	1.1999				
Center		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
		Lead		Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
		0.2550	0.1900	0.4450	0.2330	0.1550	0.3880	0.0621	0.0076	0.0697	0.0448	0.0123	0.0571
Corner	0.2550	0.1900	0.4450	0.0395	0.0895	0.1290	0.0621	0.0069	0.0690	0.0189	0.0026	0.0215	

**Assumption**

Gold Wire: Resistivity =  $2.25 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Mold compound material: Plastic Novolac with  $\epsilon_r = 4.8$ ; loss  $\tan \delta = 0.001$

Die thickness = 8mil; Wire loop height = 6mil

Modeling Tool: Parasitic Parameters 3D Modeler

Data Extracted at 100MHz

Ground Plane positioned at 15mil below the package seating plane.

**Definition**

**Self Resistance**

Resistance of the lead which is under study

**Self Inductance**

Inductance of a lead with a PWB ground plane at 15mil below the package seating plane. It is a particle self inductance.

**Mutual Inductance**

Inductance between the lead under study to its left or right adjacent lead

**Mutual Capacitance**

Capacitance between the lead under study to its left or right adjacent lead

**Bulk Capacitance**

Capacitance from the lead under study to all other leads and ground plane. All the other leads and metal are grounded.

**Wire length**

Wire length stated at the above table is the direct distance from point on the bond pad to the bond point on the lead.



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CARSEM ELECTRICAL DATA

UPDATED: 2010 AUG

**SC70-100MHz**

Package Type SC70 1.95mm x1.22mm  Die size (mm) 0.820 x1.010	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm ) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
	Center	0.4210	0.4970	0.9180	0.1460	0.0305	0.1765	38.800	53.200	92.000	0.4706	0.8	
	Corner	0.4200	0.4740	0.8940	0.1480	0.0299	0.1779	38.700	51.800	90.500	0.4552	0.8	
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	0.1070	0.0170	0.1240	0.0214	0.0286	0.0500	0.0285	0.0007	0.0292	0.0050	0.0016	0.0066
	Corner	0.1100	0.0677	0.1777	0.0214	0.0238	0.0452	0.0750	0.0050	0.0800	0.0504	0.0016	0.0520

**SC70-100MHz**

Package Type SC70 1.95mm x1.22mm  Die size (mm) 0.820 x1.010	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm ) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
	Center	0.4210	0.4640	0.8850	0.1460	0.0345	0.1805	38.800	36.100	74.900	0.4706	1.0	
	Corner	0.4200	0.4430	0.8630	0.1480	0.0339	0.1819	38.700	35.100	73.800	0.4552	1.0	
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	0.1070	0.0170	0.1240	0.0214	0.0286	0.0500	0.0285	0.0007	0.0292	0.0050	0.0016	0.0066
	Corner	0.1100	0.0677	0.1777	0.0214	0.0238	0.0452	0.0750	0.0050	0.0800	0.0504	0.0016	0.0520

**SC70-100MHz**

Package Type SC70 1.95mm x1.22mm  Die size (mm) 0.820 x1.010	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm ) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
	Center	0.4210	0.4250	0.8460	0.1460	0.0395	0.1855	38.800	24.300	63.100	0.4706	1.3	
	Corner	0.4200	0.4040	0.8240	0.1480	0.0389	0.1869	38.700	23.600	62.300	0.4552	1.3	
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	0.1070	0.0170	0.1240	0.0214	0.0286	0.0500	0.0285	0.0007	0.0292	0.0050	0.0016	0.0066
	Corner	0.1100	0.0677	0.1777	0.0214	0.0238	0.0452	0.0750	0.0050	0.0800	0.0504	0.0016	0.0520

SC70



CARSEM ELECTRICAL DATA

UPDATED: 2010 AUG

SC70-100MHz

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
SC70 1.95mm x1.22mm  Die size 0.820mm x1.010mm	Center	0.4210	0.4610	0.6413	0.1460	0.0400	0.2246	38.800	35.900	56.288	0.4706	1.0	
			0.4220			0.0386			34.100		0.4210		
	Corner	0.4200	0.3990	0.6324	0.1480	0.0381	0.2264	38.700	33.000	55.825	0.4575	1.0	
			0.4540			0.0403			35.600		0.3660		
		Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>		
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
		0.1070	0.0155	0.1225	0.0214	0.0338	0.0552	0.0285	0.0008	0.0293	0.0050	0.0012	0.0062
	Corner	0.1100	0.0441	0.1541	0.0214	0.0243	0.0457	0.0750	0.0029	0.0779	0.0504	0.0013	0.0517

**Assumption**

Gold Wire: Resistivity =  $2.25 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Mold compound material: Plastic Novolac with  $\epsilon_r = 4.8$ ; loss  $\tan \delta = 0.001$

Die thickness = 8mil; Wire loop height = 6mil

Modeling Tool: Parasitic Parameters 3D Modeler

Data Extracted at 100MHz

Ground Plane positioned at 15mil below the package seating plane.

**Definition**

**Self Resistance**

Resistance of the lead which is under study

**Self Inductance**

Inductance of a lead with a PWB ground plane at 15mil below the package seating place. It is a particle self inductance.

**Mutual Inductance**

Inductance between the lead under study to its left or right adjacent lead

**Mutual Capacitance**

Capacitance between the lead under study to its left or right adjacent lead

**Bulk Capacitance**

Capacitance from the lead under study to all other leads and ground plane. All the other leads and metal are grounded.

**Wire length**

Wire length stated at the above table is the direct distance from point on the bond pad to the bond point on the lead.



CARSEM ELECTRICAL DATA

UPDATED: 2010 AUG

**SSOP 125MHz**

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm ) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
SSOP 28LEAD 5.3mmx7.8mm  Die size (milxmil) 91x172	Center	1.0200	1.2600	2.2800	0.2670	0.0688	0.3358	10.6000	76.90	87.5000	1.2438	1.0	
	Corner	2.3600	1.1200	3.4800	0.5430	0.0644	0.6074	70.1000	23.50	93.6000	1.1356	1.0	
		Mutual Inductance L12			Mutual Inductance L13			Mutual Capacitance C12			Mutual Capacitance C13		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	0.3300	0.2540	0.5840	0.3270	0.2490	0.5760	0.0676	0.0094	0.0770	0.0672	0.0093	0.0765
	Corner	0.7150	0.2320	0.9470	0.0326	0.1260	0.1586	0.1800	0.0103	0.1903	0.0112	0.0050	0.0162

**Assumption**

Gold Wire: Resistivity = 2.25x10<sup>-8</sup>Ω.m; relative permeability, μ<sub>r</sub> =1

Mold compound material: Plastic Novolac with ε<sub>r</sub> = 4.8; loss tan δ =0.001

Die thickness = 8mil; Wire loop height = 6mil

Modeling Tool: Parasitic Parameters 3D Modeler

Data Extracted at 125MHz

Ground Plane positioned at 15mil below the package seating plane.

**Definition**

**Self Resistance**

Resistance of the lead which is under study

**Self Inductance**

Inductance of a lead with a PWB ground plane at 15mil below the package seating place. It is a particle self inductance.

**Mutual Inductance**

Inductance between the lead under study to its left or right adjacent lead

**Mutual Capacitance**

Capacitance between the lead under study to its left or right adjacent lead

**Bulk Capacitance**

Capacitance from the lead under study to all other leads and ground plane. All the other leads and metal are grounded.

**Wire length**

Wire length stated at the above table is the direct distance from point on the bond pad to the bond point on the lead.



CARSEM ELECTRICAL DATA

UPDATED: 2010 AUG

**SSBGA-100MHz**

Package Type  SSBGA 145L 7.0mmx7.0mmx1.2mm  Die size (milxmil) 175.5x175  Wire only	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
	Center	N/A	0.9810	0.9810	N/A	0.0864	0.0864	N/A	43.10	43.10	1.0643	1.3	
	Corner	N/A	1.0300	1.0300	N/A	0.0746	0.0746	N/A	44.60	44.60	1.1115	1.3	
		Mutual Inductance L12			Mutual Inductance L13			Mutual Capacitance C12			Mutual Capacitance C13		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	N/A	0.4350	0.4350	N/A	0.4130	0.4130	N/A	0.0214	0.0214	N/A	0.0197	0.0197
	Corner	N/A	0.3770	0.3770	N/A	0.0613	0.0613	N/A	0.0151	0.0151	N/A	0.0058	0.0058

**Assumption**

Gold Wire: Resistivity =  $2.25 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Mold compound material: Plastic Novolac with  $\epsilon_r = 4.8$ ; loss  $\tan \delta = 0.001$

Die thickness = 8mil; Wire loop height = 6mil

Modeling Tool: Parasitic Parameters 3D Modeler

Data Extracted at 100MHz

Ground Plane positioned at 15mil below the package seating plane.

**Definition**

**Self Resistance**

Resistance of the lead which is under study

**Self Inductance**

Inductance of a lead with a PWB ground plane at 15mil below the package seating place. It is a particle self inductance.

**Mutual Inductance**

Inductance between the lead under study to its left or right adjacent lead

**Mutual Capacitance**

Capacitance between the lead under study to its left or right adjacent lead

**Bulk Capacitance**

Capacitance from the lead under study to all other leads and ground plane. All the other leads and metal are grounded.

**Wire length**

Wire length stated at the above table is the direct distance from point on the bond pad to the bond point on the lead.



CARSEM ELECTRICAL DATA

UPDATED: 2010 AUG

**LQFP 100MHz**

Package Type LQFP 80L 14.0mmx14.0mm Paddle Size (milxmil) 315x315 Die size (milxmil) 264x264	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
Center		1.8000	1.7100	3.5100	0.4740	0.0994	0.5734	15.500	72.500	88.000	1.7328	1.2	
Corner		2.6400	1.7000	4.3400	1.2300	0.0930	1.3230	20.000	72.000	92.000	1.7128	1.2	
		Mutual Inductance L12			Mutual Inductance L13			Mutual Capacitance C12			Mutual Capacitance C13		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
Center		0.8050	0.5340	1.3390	0.8030	0.5400	1.3430	0.1760	0.0172	0.1932	0.1840	0.0174	0.2014
Corner		1.2000	0.4960	1.6960	0.4920	0.2840	0.7760	0.1640	0.0148	0.1788	0.0127	0.0064	0.0191

**LQFP 1GHz**

Package Type LQFP 80L 14.0mmx14.0mm Paddle Size (milxmil) 315x315 Die size (milxmil) 264x264	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
Center		1.7800	1.6600	3.4400	0.4740	0.0994	0.5734	64.700	198.000	262.700	1.7328	1.2	
Corner		2.6200	1.6500	4.2700	1.2300	0.0930	1.3230	110.000	196.000	306.000	1.7128	1.2	
		Mutual Inductance L12			Mutual Inductance L13			Mutual Capacitance C12			Mutual Capacitance C13		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
Center		0.8050	0.5340	1.3390	0.8030	0.5400	1.3430	0.1760	0.0172	0.1932	0.1840	0.0174	0.2014
Corner		1.2000	0.4960	1.6960	0.4920	0.2840	0.7760	0.1640	0.0148	0.1788	0.0127	0.0064	0.0191

**LQFP 10GHz**

Package Type LQFP 80L 14.0mmx14.0mm Paddle Size (milxmil) 315x315 Die size (milxmil) 264x264	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
Center		1.7800	1.6400	3.4200	0.4740	0.0994	0.5734	166.000	750.000	916.000	1.7328	1.2	
Corner		2.6000	1.6200	4.2200	1.2300	0.0930	1.3230	1960.000	747.000	2707.000	1.7128	1.2	
		Mutual Inductance L12			Mutual Inductance L13			Mutual Capacitance C12			Mutual Capacitance C13		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
Center		0.8050	0.5340	1.3390	0.8030	0.5400	1.3430	0.1760	0.0172	0.1932	0.1840	0.0174	0.2014
Corner		1.2000	0.4960	1.6960	0.4920	0.2840	0.7760	0.1640	0.0148	0.1788	0.0127	0.0064	0.0191





CARSEM ELECTRICAL DATA

**Assumption**

Gold Wire: Resistivity =  $2.25 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Mold compound material: Plastic Novolac with  $\epsilon_r = 4.8$ ; loss  $\tan \delta = 0.001$

Die thickness = 8mil; Wire loop height = 6mil

Modeling Tool: Parasitic Parameters 3D Modeler

Ground Plane positioned at 15mil below the package seating plane.

**Definition**

**Self Resistance**

Resistance of the lead which is under study

**Self Inductance**

Inductance of a lead with a PWB ground plane at 15mil below the package seating place. It is a particle self inductance.

**Mutual Inductance**

Inductance between the lead under study to its left or right adjacent lead

**Mutual Capacitance**

Capacitance between the lead under study to its left or right adjacent lead

**Bulk Capacitance**

Capacitance from the lead under study to all other leads and ground plane. All the other leads and metal are grounded.

**Wire length**

Wire length stated at the above table is the direct distance from point on the bond pad to the bond point on the lead.



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**MLPQ- 500MHz**

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
MLPQ 44LD 7.00mm x 7.00mm	Center	0.1230	0.8400	0.9630	0.1600	0.0518	0.2118	6.610	95.700	102.310	0.9022	1.0	
	Corner	0.1240	0.0940	0.2180	0.1500	0.0545	0.2045	6.420	104.000	110.420	1.0218	1.0	
Paddle Size (milxmil) 213x213	Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>			
	Center	0.0307	0.1520	0.1827	0.0307	0.1510	0.1817	0.0409	0.0055	0.0464	0.0409	0.0056	0.0465
Die size (milxmil) 203x203	Corner	0.0306	0.1870	0.2176	0.00018	0.1410	0.1412	0.0388	0.0060	0.0448	0.0082	0.0055	0.0136

**MLPQ- 1GHz & 2GHz**

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
MLPQ 44LD 7.00mm x 7.00mm	Center	0.078	1.010	1.088	0.129	0.062	0.191	7.600	154.000	161.600	1.0764	1.0	
	Corner	0.779	1.550	2.329	0.119	0.084	0.203	7.300	217.000	224.300	1.5850	1.0	
Paddle Size (milxmil) 213x213	Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>			
	Center	0.0170	N/A	0.0170	0.0171	N/A	0.0171	0.0297	N/A	0.0297	0.0299	N/A	0.0299
Die size (milxmil) 203x203 Full Package	Corner	0.0171	0.4980	0.5151	0.00007	N/A	0.00007	0.0303	0.0167	0.0470	0.0112	N/A	0.0112

**MLPQ1GHz & 2.1GHz**

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
MLPQ 56LD 8.00mm x 8.00mm	Center	0.0781	1.6700	1.7481	0.1330	0.0924	0.2254	7.090	230.000	237.090	1.7030	1.0	
	Corner	0.0779	2.0100	2.0879	0.1240	0.0971	0.2211	7.520	267.000	274.520	2.0000	1.0	
Paddle Size (milxmil) 251x251	Mutual Inductance L <sub>12</sub>			Mutual Inductance L <sub>13</sub>			Mutual Capacitance C <sub>12</sub>			Mutual Capacitance C <sub>13</sub>			
	Center	0.0171	0.5360	0.5531	0.0172	0.6100	0.6272	0.0291	0.0190	0.0481	0.0298	0.0193	0.0491
Die size (milxmil) 212x212 Only 4 wires	Corner	0.0172	0.6100	0.6272	0.01720	0.6470	0.6642	0.0298	0.0193	0.0491	0.0307	0.0193	0.0500



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**MLPQ1GHz & 2.1GHz**

Package Type MLPQ 56LD 8.00mm x 8.00mm	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
Paddle Size (milxmil) 251x251	Center	0.0781	1.5700	1.6481	0.1330	0.1070	0.2400	7.090	178.000	185.090	1.7030	1.3	
	Corner	0.0779	1.8900	1.9679	0.1240	0.1110	0.2350	7.520	207.000	214.520	2.0000	1.3	
Die size (milxmil) 212x212		Mutual Inductance L12			Mutual Inductance L13			Mutual Capacitance C12			Mutual Capacitance C13		
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	0.0171	0.5360	0.5531	0.0172	0.6100	0.6272	0.0291	0.0244	0.0535	0.0298	0.0253	0.0551
Only 4 wires	Corner	0.0172	0.6100	0.6272	0.01720	0.6470	0.6642	0.0298	0.0253	0.0551	0.0307	0.0251	0.0558

**MLPQ 2GHz**

Package Type MLPQ 56LD 8.00mm x 8.00mm	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
Paddle Size (milxmil) 251x251	Center	0.0849	1.4500	1.5349	0.1110	0.1020	0.2130	3.5800	244.000	247.580	1.6002	1.0	
	Corner	0.0848	2.0500	2.1348	0.1080	0.1280	0.2360	3.6200	323.000	326.620	2.1538	1.0	
Die size (milxmil) 212x212		Mutual Inductance L12			Mutual Inductance L13			Mutual Capacitance C12			Mutual Capacitance C13		
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	0.0165	0.5060	0.5225	0.0164	N/A	0.0164	0.0228	0.0152	0.0380	0.0223	N/A	0.0223
Full Package	Corner	0.0164	N/A	0.0164	0.00004	N/A	0.00004	0.0238	N/A	0.0238	0.0095	N/A	0.0095

**MLPQ 1GHz**

Package Type MLPQ 56LD 8.00mm x 8.00mm	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
Paddle Size (milxmil) 251x251	Center	0.0862	1.4600	1.5462	0.1110	0.1020	0.2130	6.6600	168.000	174.660	1.6002	1.3	
	Corner	0.0862	2.0600	2.1462	0.1080	0.1280	0.2360	6.720	222.000	228.720	2.1538	1.3	
Die size (milxmil) 212x212		Mutual Inductance L12			Mutual Inductance L13			Mutual Capacitance C12			Mutual Capacitance C13		
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	0.0165	0.5060	0.5225	0.0164	N/A	0.0164	0.0228	0.0189	0.0417	0.0223	N/A	0.0223
Full Package	Corner	0.0164	N/A	0.0164	0.00004	N/A	0.00004	0.0238	N/A	0.0238	0.0095	N/A	0.0095



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**MLPQ 2GHz**

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
MLPQ 56LD 8.00mm x 8.00mm	Center	0.0849	1.5500	1.6349	0.1110	0.0887	0.1997	3.5800	313.000	316.580	1.6002	1.0	
	Corner	0.0848	2.1800	2.2648	0.1080	0.1090	0.2170	3.6200	413.000	416.620	2.1538	1.0	
Paddle Size (milxmil) 251x251	Mutual Inductance L12			Mutual Inductance L13			Mutual Capacitance C12			Mutual Capacitance C13			
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
Die size (milxmil) 212x212	Center	0.0165	0.5060	0.5225	0.0164	N/A	0.0164	0.0228	0.0152	0.0380	0.0223	N/A	0.0223
	Corner	0.0164	N/A	0.0164	0.00004	N/A	0.00004	0.0238	N/A	0.0238	0.0095	N/A	0.0095
Full Package													

**MLPQ 1GHz**

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
MLPQ 56LD 8.00mm x 8.00mm	Center	0.0849	1.5500	1.6349	0.1110	0.0887	0.1997	3.5800	313.000	316.580	1.6002	1.3	
	Corner	0.0848	2.1800	2.2648	0.1080	0.1090	0.2170	3.6200	413.000	416.620	2.1538	1.3	
Paddle Size (milxmil) 251x251	Mutual Inductance L12			Mutual Inductance L13			Mutual Capacitance C12			Mutual Capacitance C13			
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
Die size (milxmil) 212x212	Center	0.0165	0.5060	0.5225	0.0164	N/A	0.0164	0.0228	0.0152	0.0380	0.0223	N/A	0.0223
	Corner	0.0164	N/A	0.0164	0.00004	N/A	0.00004	0.0238	N/A	0.0238	0.0095	N/A	0.0095
Full Package													

**MLPQ 1GHz**

Package Type	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm) R			Gold Wire		
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)	
MLPQ 56LD 8.00mm x 8.00mm	Center	0.0775	1.0100	1.0875	0.1290	0.0615	0.1905	7.6000	154.000	161.600	1.0764	1.0	
	Corner	0.0779	1.5500	1.6279	0.1190	0.0835	0.2025	7.3000	217.000	224.300	1.5850	1.0	
Paddle Size (milxmil) 251x251	Mutual Inductance L12			Mutual Inductance L13			Mutual Capacitance C12			Mutual Capacitance C13			
	Center	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
Die size (milxmil) 212x212	Center	0.0170	N/A	0.0170	0.0171	N/A	0.0171	0.0297	N/A	0.0297	0.0299	N/A	0.0299
	Corner	0.0171	0.4980	0.5151	0.00007	N/A	0.00007	0.0303	0.0167	0.0470	0.0112	N/A	0.0112
Full Package													



CARSEM ELECTRICAL DATA

UPDATED: 2010 AUG

**MLPQ 1GHz**

Package Type MLPQ 56LD 8.00mm x 8.00mm Paddle Size (milxmil) 251x251 Die size (milxmil) 212x212 Full Package	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm ) R			Gold Wire	
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)
Center	0.0775	0.9380	1.0155	0.1290	0.0705	0.1995	7.6000	120.000	127.600	1.0764	1.3	
Corner	0.0779	1.4500	1.5279	0.1190	0.0961	0.2151	7.3000	168.000	175.300	1.5850	1.3	
		Mutual Inductance L12			Mutual Inductance L13			Mutual Capacitance C12			Mutual Capacitance C13	
Center	0.0170	N/A	0.0170	0.0171	N/A	0.0171	0.0297	N/A	0.0297	0.0299	N/A	0.0299
Corner	0.0171	0.4980	0.5151	0.00007	N/A	0.00007	0.0303	0.0167	0.0470	0.0112	N/A	0.0112

**MLPQ 2.1GHz**

Package Type MLPQ 56LD 8.00mm x 8.00mm Paddle Size (milxmil) 251x251 Die size (milxmil) 212x212 Full Package	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm ) R			Gold Wire	
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)
Center	0.0774	1.0000	1.0774	0.1290	0.0615	0.1905	2.8800	227.000	229.880	1.0764	1.0	
Corner	0.0777	1.5400	1.6177	0.1190	0.0835	0.2025	2.8700	320.000	322.870	1.5850	1.0	
		Mutual Inductance L12			Mutual Inductance L13			Mutual Capacitance C12			Mutual Capacitance C13	
Center	0.0170	N/A	0.0170	0.0171	N/A	0.0171	0.0297	N/A	0.0297	0.0299	N/A	0.0299
Corner	0.0171	0.4980	0.5151	0.00007	N/A	0.00007	0.0303	0.0167	0.0470	0.0112	N/A	0.0112

**MLPQ 1GHz**

Package Type MLPQ 56LD 8.00mm x 8.00mm Paddle Size (milxmil) 251x251 Die size (milxmil) 212x212 Full Package	Lead	Self Inductance (nH) L <sub>11</sub>			Bulk Capacitance (pF) C <sub>11</sub>			Resistance (mOhm ) R			Gold Wire	
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)	Diameter(mils)
Center	0.0774	0.9320	1.0094	0.1290	0.0705	0.1995	2.8800	179.000	181.880	1.0764	1.3	
Corner	0.0777	1.4400	1.5177	0.1190	0.0961	0.2151	2.8700	250.000	252.870	1.5850	1.3	
		Mutual Inductance L12			Mutual Inductance L13			Mutual Capacitance C12			Mutual Capacitance C13	
Center	0.0170	N/A	0.0170	0.0171	N/A	0.0171	0.0297	N/A	0.0297	0.0299	N/A	0.0299
Corner	0.0171	0.4980	0.5151	0.00007	N/A	0.00007	0.0303	0.0167	0.0470	0.0112	N/A	0.0112



CARSEM ELECTRICAL DATA

**Assumption**

Gold Wire: Resistivity =  $2.25 \times 10^{-8} \Omega \cdot m$ ; relative permeability,  $\mu_r = 1$

Mold compound material: Plastic Novolac with  $\epsilon_r = 4.8$ ; loss  $\tan \delta = 0.001$

Die thickness = 8mil; Wire loop height = 6mil

Modeling Tool: Parasitic Parameters 3D Modeler

Ground Plane positioned at 15mil below the package seating plane.

**Definition**

**Self Resistance**

Resistance of the lead which is under study

**Self Inductance**

Inductance of a lead with a PWB ground plane at 15mil below the package seating place. It is a particle self inductance.

**Mutual Inductance**

Inductance between the lead under study to its left or right adjacent lead

**Mutual Capacitance**

Capacitance between the lead under study to its left or right adjacent lead

**Bulk Capacitance**

Capacitance from the lead under study to all other leads and ground plane. All the other leads and metal are grounded.

**Wire length**

Wire length stated at the above table is the direct distance from point on the bond pad to the bond point on the lead.