

CARSEM ELECTRICAL DATA

TSSOP													
Package Type	Lead		Self Inducta (nH) L ₁	ance]	Bulk Capaci (pF) C ₁	itance		Resistance (mOhm) F	2		Gold Wir	e
1 550P 8L 4.4mmx3.0mmx0.9mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)
	Center	0.7416	0.7520	1.494	0.2031	0.04333	0.2464	8.773	48.04	56.81	0.7	774	1.0
Paddle Size (milxmil)	Corner	1.425	0.6512	2.076	0.2705	0.04118	0.3117	16.21	43.65	59.86	0.6	676	1.0
/9x118		М	utual Induct	ance L ₁₂	Mu	itual Induct	ance L ₁₃	Мι	ıtual Capacita	nce C ₁₂	М	utual Capacita	ance C ₁₃
Die size (milxmil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
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
		Self Inductance											
Package Type	Lead	Self Inductance (nH) L ₁₁ Lead Wire Lead + Wire				Bulk Capaci (pF) C ₁	1 1		Resistance (mOhm) F	e R		Gold Wir	e
4.4mmx5.0mmx0.9mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)
	Center	0.7378	1.122	1.860	0.1844	0.05059	0.2350	9.411	63.10	72.51	1.2	209	1.0
Paddle Size (milxmil)	Corner	1.337	1.328	2.665	0.2999	0.06116	0.3611	15.25	72.18	87.43	1.3	398	1.0
110X122		Мі	utual Induct	ance L ₁₂	Μι	itual Induct	ance L ₁₃	Мι	itual Capacita	nce C ₁₂	Μ	utual Capacita	ance C ₁₃
Die size (milxmil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
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 Inducta (nH) L ₁	ance 1		Bulk Capaci (pF) C ₁	1 1		Resistance (mOhm) F	e R		Gold Wir	e
4.4mmx5.0mmx0.9mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)
	Center	0.7218	1.160	1.882	0.2088	0.05128	0.2601	9.012	56.55	65.56	1.()68	1.0
Paddle Size (milxmil)	Corner	1.369	0.9747	2.344	0.2666	0.04738	0.3140	15.49	64.92	80.41	1.2	242	1.0
110X134		Мі	utual Induct	ance L ₁₂	Мі	itual Induct	ance L ₁₃	Ми	itual Capacita	nce C ₁₂	Μ	utual Capacita	ance C ₁₃
Die size (milxmil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
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



				CARSEM ELI	ECTRICAL	DATA					ι	JPDATED: 201	I0 AUG
Package Type	Lead		Self Inducta (nH) L ₁₁	nce	1	Bulk Capaci (pF) C ₁	tance		Resistance (mOhm) I	e R		Gold Wir	e
14.4mmx6.5mmx0.9mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Leng	th(mm)	Diameter(mils)
Paddle Size (milxmil)	Center	0.6579	0.6729	1.331	0.1592	0.04206	0.2013	8.082	44.63	52.71	0.	6876	1.0
118x165	Corner	1.379	1.196	2.575	0.3512	0.05850	0.4097	15.76	67.60	83.36	1	.226	1.0
Die size (milymil)		Mu	tual Inducta	nce L ₁₂	Mu	itual Induct	ance L ₁₃	Мι	itual Capacita	ince C ₁₂	Ν	Jutual Capacit	ance C ₁₃
106x106		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	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 ₁₁ Lead Wire Lead + vir			I	Bulk Capaci (pF) C1	tance		Resistance (mOhm) l	e R		Gold Wir	e
1580P 24L 7.8mmx6.4mmx0.9mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Leng	th(mm)	Diameter(mils)
Paddle Size (milxmil)	Center	0.6961	0.6328	1.3289	0.1740	0.0438	0.2178	10.770	44.84	55.61	0.	6090	1.0
118x217	Corner	0.6952	0.8748	1.5700	0.1733	0.0596	0.2329	10.6500	55.9100	66.5600	0	.860	1.0
Die size (milymil)		Mu	itual Inducta	nce L ₁₂	Mu	tual Induct	ance L ₁₃	Мι	tual Capacita	ince C ₁₂	N	Autual Capacit	ance C ₁₃
106x139x8		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
*Assumptions: ref (3a)	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 Inducta (nH) L ₁₁	nce	1	Bulk Capaci (pF) C ₁	tance		Resistance (mOhm) l	e R		Gold Wir	e
4.4mmx9.7mmx0.9mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Leng	th(mm)	Diameter(mils)
Paddle Size (milxmil)	Center	0.7479	0.4407	1.189	0.1713	0.04130	0.2126	7.126	24.33	31.46	0.	5466	1.3
118x217	Corner	1.992	0.5348	2.527	0.4388	0.04509	0.4839	16.31	27.34	43.65	0.	6582	1.3
Die size (milymil)		Ми	tual Inducta	nce L ₁₂	Mu	tual Induct	ance L ₁₃	Мι	itual Capacita	nce C ₁₂	Ν	Autual Capacit	ance C ₁₃
108x207		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
*Assumptions: ref(3)	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



CARSEM ELECTRICAL DATA

Package Type	Lead		Self Inducta	ince	1	Bulk Capacit	ance		Resistance			Gold Wir	·e
с •••			(nH) L ₁₁			(pF) C ₁₁			(mOhm) F	2			
TSSOP 38L			() 11			d.) - H			(-)				
4.4mmx9.7mmx0.9mm		Lead	Wire	Lead +Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Leng	gth(mm)	Diameter(mils)
	Center	0.7538	0.4407	1.195	0.1713	0.04130	0.2126	11.58	24.33	35.91	0.	5466	1.3
Paddle Size (milxmil)	Corner	2.006	0.5348	2.541	0.4388	0.04509	0.4839	25.79	27.34	53.13	0.	6582	1.3
118x217		Mu	tuol Inducto	ncol	M	tual Inducto	nco I	M	utual Canacita	neo C		Autual Canacit	anco C
D: · · · · · · · · · · · · · · · · · · ·		IVIU	tual muucta		IVIU	ituai muucta		IVI	ituai Capacita		ľ	utuai Capacita	
108x207		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
*Assumptions: ref (3a)	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
Assumptions. (<i>Sa</i>)	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
				l .					I.	L			
Package Type	Lead		Self Inducta	ince]	Bulk Capacit	ance		Resistance			Gold Wir	·e
			(nH) L ₁₁			(pF) C ₁₁			(mOhm) F	R			
TSSOP 48L				X 1 ·									
12.5mmx6.1mmx0.9mm		Lead	Wire	Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Leng	gth(mm)	Diameter(mils)
Paddle Size (milxmil)	Center	1.186	0.6385	1.825	0.3085	0.03420	0.3427	12.69	43.08	55.77	0.	6007	1.0
118x197	Corner	2.831	0.8678	3.699	0.6909	0.04679	0.7377	26.91	53.37	80.28	0.	8956	1.0
Die size (milymil)		Mu	tual Inducta	nce L ₁₂	Mu	tual Inducta	nce L ₁₃	М	utual Capacita	nce C ₁₂	Ν	Mutual Capacit	ance C ₁₃
108x185							10						10
100x105		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	0.4654	0.1480	0.6134	0.4525	0.1405	0.5930	0.1117	0.005198	0.1169	0.09680	0.004604	0.1014
	Corner	0.1038	0.1164	0.2202	1.067	0.2001	1.267	0.03354	0.002736	0.03628	0.2898	0.005558	0.2954



CARSEM ELECTRICAL DATA

UPDATED: 2010 AUG

Assumptions

Leadframe Material: Copper with resistivity =1.73x10⁻⁸ Ω .m; relative permeability, $\mu_r = 1$ Gold Wire: Resistivity = 2.25x10⁻⁸ Ω .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 = $1.73 \times 10^{-8} \Omega$.m; relative permeability, $\mu_r = 1$ Gold Wire: Resistivity = $2.35 \times 10^{-8} \Omega$.m; relative permeability, $\mu_r = 1$ Mold compound material: 7351LS with $\varepsilon_r = 4.161$; loss tan $\delta = 0.001$ Die thickness = 8 mil; Wire loop height = 6mil

Ref (3a)

Leadframe Material: C7025TR02 with resistivity = $4.35 \times 10^{-8} \Omega$.m; relative permeability, $\mu_r = 1$ Gold Wire: Resistivity = $2.35 \times 10^{-8} \Omega$.m; relative permeability, $\mu_r = 1$ Mold compound material: 7351LS with $\varepsilon_r = 4.161$; loss tan $\delta = 0.001$ Die thickness = 8 mil; Wire loop height = 6 mil

Modeling Tool: Parasitic Parameters 3D Modeler Data Extracted at 100MHz

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

<u>Definition</u> 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.



CARSEM ELECTRICAL DATA

TQFP													
Package Type TQFP 32L	Lead		Self Inductanc (nH) L ₁₁	e	В	Bulk Capaci (pF) C ₁₁	tance		Resistar (mOhm	nce) R		Gold V	Vire
Similar Similar Comm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	n(mm)	Diameter(mils)
Paddle Size (milxmil) 133x133	Center	0.758	0.7829	1.541	0.1967	0.04386	0.2406	9.513	34.41	43.92	0.9	19	1.3
Die size (milxmil)	Corner	0.8174	0.9898	1.807	0.1896	0.04727	0.2369	10.24	40.98	51.22	1.1	32	1.3
110x110		Μ	utual Inductanc	e L ₁₂	Mu	tual Induct	ance L ₁₃	Мι	itual Capac	itance C ₁₂	N	Iutual Capa	citance C ₁₃
		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	Lead		Self Inductanc	e	B	Bulk Capaci (nF) Cu	tance		Resistar (mOhm	nce) R		Gold V	Vire
Package Type TQFP 32L 7mmy7mmy10	Lead		Self Inductanc (nH) L ₁₁	e	В	Bulk Capaci (pF) C ₁₁	tance		Resistar (mOhm	nce) R		Gold V	Vire
Package Type TQFP 32L 7mmx7mmx1.0	Lead	Lead	Self Inductanc (nH) L ₁₁ Wire	e Lead +Wire	E Lead	Bulk Capaci (pF) C ₁₁ Wire	tance Lead + Wire	Lead	Resistar (mOhm Wire	nce) R Lead + Wire	Lengt	Gold V n(mm)	Vire Diameter(mils)
Package Type TQFP 32L 7mmx7mmx1.0 Paddle Size (milxmil) 195milx195mil	Lead Center	Lead 0.754	Self Inductanc (nH) L ₁₁ Wire 0.5860	e Lead +Wire 1.340	E Lead 0.2031	Bulk Capaci (pF) C ₁₁ Wire 0.04052	Lead + Wire	Lead 10.75	Resistar (mOhm Wire 40.37	rce) R Lead + Wire 51.12	Lengt	Gold V n(mm) 551	Vire Diameter(mils) 1.0
Package Type TQFP 32L 7mmx7mmx1.0 Paddle Size (milxmil) 195milx195mil Die size (milxmil)	Lead Center Corner	Lead 0.754 0.8186	Wire 0.5860 0.6900	e Lead +Wire 1.340 1.509	E Lead 0.2031 0.1989	Wire 0.04052 0.04612	Lead + Wire 0.2436 0.2450	Lead 10.75 12.19	Resistar (mOhm) Wire 40.37 45.28	Lead + Wire 51.12 57.47	Lengt 0.6	Gold V n(mm) 551 530	Vire Diameter(mils) 1.0 1.0
Package Type TQFP 32L 7mmx7mmx1.0 Paddle Size (milxmil) 195milx195mil Die size (milxmil) 185milx185mil	Lead Center Corner	Lead 0.754 0.8186 M	Wire 0.5860 0.6900 utual Inductance	e Lead +Wire 1.340 1.509 e L ₁₂	E Lead 0.2031 0.1989 Mu	Wire 0.04052 0.04612 tual Inducts	Lead + Wire 0.2436 0.2450 ance L ₁₃	Lead 10.75 12.19 Mu	Resistar (mOhm Wire 40.37 45.28	1000) R Lead + Wire 51.12 57.47 itance C ₁₂	Lengt 0.6 0.7/	Gold V n(mm) 5551 5330 Iutual Capa	Vire Diameter(mils) 1.0 1.0 citance C ₁₃
Package Type TQFP 32L 7mmx7mmx1.0 Paddle Size (milxmil) 195milx195mil Die size (milxmil) 185milx185mil *new entry	Lead Center Corner	Lead 0.754 0.8186 M Lead	Self Inductanc (nH) L ₁₁ Wire 0.5860 0.6900 utual Inductanc Wire	e Lead +Wire 1.340 1.509 e L ₁₂ Lead +Wire	E Lead 0.2031 0.1989 Mu Lead	Wire 0.04052 0.04612 tual Inducts	tance Lead + Wire 0.2436 0.2450 ance L ₁₃ Lead + Wire	Lead 10.75 12.19 Mu Lead	Resistar (mOhm 40.37 45.28 Itual Capac Wire	Lead + Wire 51.12 57.47 itance C ₁₂ Lead + Wire	Lengt 0.6 0.7 M Lead	Gold V n(mm) 551 630 Iutual Capa Wire	Vire Diameter(mils) 1.0 1.0 citance C ₁₃ Lead + Wire
Package Type TQFP 32L 7mmx7mmx1.0 Paddle Size (milxmil) 195milx195mil Die size (milxmil) 185milx185mil *new entry	Lead Center Corner Center	Lead 0.754 0.8186 M Lead 0.1956	Wire 0.5860 0.6900 utual Inductanc Wire 0.06432	e Lead +Wire 1.340 1.509 e L ₁₂ Lead +Wire 0.2599	E Lead 0.2031 0.1989 Mu Lead 0.1716	Wire 0.04052 0.04612 tual Induct: Wire 0.0585	tance Lead + Wire 0.2436 0.2450 ance L ₁₃ Lead + Wire 0.2301	Lead 10.75 12.19 Mt Lead 0.050	Resistar (mOhm 40.37 45.28 tual Capace Wire 0.0032	Lead + Wire 51.12 57.47 itance C ₁₂ Lead + Wire 0.05269	Lengt 0.6 0.7 N Lead 0.0440	Gold V n(mm) 551 530 Iutual Capa Wire 0.0027	Vire Diameter(mils) 1.0 1.0 citance C ₁₃ Lead + Wire 0.04672
Package Type TQFP 32L 7mmx7mmx1.0 Paddle Size (milxmil) 195milx195mil Die size (milxmil) 185milx185mil *new entry	Lead Center Corner Center Corner	Lead 0.754 0.8186 M Lead 0.1956 0.202	Wire 0.5860 0.6900 utual Inductanc Wire 0.06432 0.0910	e Lead +Wire 1.340 1.509 e L ₁₂ Lead +Wire 0.2599 0.2930	E Lead 0.2031 0.1989 Mu Lead 0.1716 0.05962	Wire 0.04052 0.04612 tual Inducts Wire 0.0585 0.0723	tance Lead + Wire 0.2436 0.2450 ance L ₁₃ Lead + Wire 0.2301 0.1319	Lead 10.75 12.19 Mu Lead 0.050 0.057	Resistar (mOhm Wire 40.37 45.28 ntual Capace Wire 0.0032 0.0044	Lead + Wire 51.12 57.47 itance C ₁₂ Lead + Wire 0.05269 0.06110	Lengti 0.6 0.7 N Lead 0.0440 0.0198	Gold V n(mm) 5551 530 Iutual Capa Wire 0.0027 0.0035	Vire Diameter(mils) 1.0 1.0 citance C ₁₃ Lead + Wire 0.04672 0.02327
Package Type TQFP 32L 7mmx7mmx1.0 Paddle Size (milxmil) 195milx195mil Die size (milxmil) 185milx185mil *new entry	Lead Center Corner Center Corner	Lead 0.754 0.8186 M Lead 0.1956 0.202	Wire 0.5860 0.6900 utual Inductanc Wire 0.06432 0.0910	e Lead +Wire 1.340 1.509 e L ₁₂ Lead +Wire 0.2599 0.2930	E Lead 0.2031 0.1989 Mu Lead 0.1716 0.05962	Wire 0.04052 0.04612 tual Inducts Wire 0.0585 0.0723	tance Lead + Wire 0.2436 0.2450 ance L ₁₃ Lead + Wire 0.2301 0.1319	Lead 10.75 12.19 Mu Lead 0.050 0.057	Resistar (mOhm Wire 40.37 45.28 atual Capace Wire 0.0032 0.0044	Image: cell big	Lengt 0.6 0.7 N Lead 0.0440 0.0198	Gold V n(mm) 551 530 Iutual Capa Wire 0.0027 0.0035	Vire Diameter(mils) 1.0 1.0 citance C ₁₃ Lead + Wire 0.04672 0.02327



CARSEM ELECTRICAL DATA

UPDATED: 2010 AUG

Assumption

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

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

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

*new entry

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

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

Mold compound material : with $\varepsilon_r = 4.281$ 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



CARSEM ELECTRICAL DATA

TBGA													
Package Type	Trace	S	elf Inducta (nH) L ₁₁	ince		Bulk Capac (pF) C	itance		Resistanc (mOhm)	e R		Gold Wir	·e
1BGA 132Balls 2Layer		Trace	Wire	Trace + Wire	Trace	Wire	Trace + Wire	Trace	Wire	Trace + Wire	Length ((mm)	Diameter(mils)
Ball	Longest (D3)	1.084	2.134	3.218	0.1651	0.1185	0.2836	25.09	127.0	152.1	2.59	0	1.0
Pitch=0.8mm	Shortest (A5)	0.2774	2.721	2.998	0.08630	0.1436	0.2299	4.958	141.2	146.2	2.91	0	1.0
Body Size (mmxmm)		Mutu	ial Inducta	ince L ₁₂	М	utual Induc	tance L ₁₃	Mutu	al Capacita	ance C ₁₂	Mut	ual Capacit	ance C ₁₃
12.0x12.0		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
Die Size	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
6.0x4.5	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	S	elf Inducta (nH) L ₁₁	ince		Bulk Capac (pF) C	ritance		Resistanc (mOhm)	e R		Gold Wir	е
Array TBGA 56Balls		Trace	Wire	Trace + Wire	Trace	Wire	Trace + Wire	Trace	Wire	Trace + Wire	Length ((mm)	Diameter(mils)
Ball	Longest (F4)	2.934	1.179	4.113	0.3032	0.06597	0.3692	60.87	69.27	130.1	1.15	1	1.0
Pitch=0.5mm	Shortest (A2)	0.9878	1.170	2.158	0.1928	0.06964	0.2624	19.45	68.91	88.36	1.14	2	1.0
Body Size (mmxmm)		Mutu	ial Inducta	ince L ₁₂	М	utual Induc	tance L ₁₃	Mutu	al Capacita	ance C ₁₂	Mut	ual Capacit	ance C ₁₃
6.0x6.0		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
Die Size	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
3.6x3.6	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	S	elf Inducta (nH) L ₁₁	ince		Bulk Capac (pF) C	itance		Resistanc (mOhm)	e R		Gold Wir	·e
Peripherical		Trace	Wire	Trace + Wire	Trace	Wire	Trace + Wire	Trace	Wire	Trace + Wire	Length	(mm)	Diameter(mils)

TBGA 56Balls	Longest (B8)	1.389	1.182	2.571	0.2015	0.06993	0.2714	29.56	69.39	98.95	1.15	4	1.0
Ball Pitch=0.5mm	Shortest (A4)	0.7337	1.188	1.922	0.1718	0.07006	0.2419	15.47	69.66	85.13	1.15	5	1.0
Body Size		Mutu	ıal Inducta	nce L ₁₂	М	utual Induct	ance L ₁₃	Mutu	al Capacita	ance C ₁₂	Mut	ual Capacita	ance C ₁₃
(mmxmm)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
0.0X0.0	Longest (B8)	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
(mmxmm) 3.6x3.6	Shortest (A4)	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
Package Type	Trace	S	elf Inducta	nce		Bulk Capac	itance		Resistance	e D			
Peripherical			(111) L11			(pr) Cl	1	r	(monin) i				
FLIP CHIP		Trace	Bump	Trace+Bump	Trace	Bump	Trace+Bump	Trace	Bump	Trace+Bump			
I BGA 50 Balls	Longest (J1)	0.9809	0.04214	1.0230	0.1819	0.05859	0.2405	28.39	2.909	31.30			
Pitch=0.5mm	Shortest (H4)	0.2546	0.04214	0.2967	0.09438	0.06821	0.1626	8.640	2.909	11.55			
Body Size		Trace	Bump	Trace+Bump	Trace	Bump	Trace+Bump	Trace	Bump	Trace+Bump	Trace	Bump	Trace+Bump
(mmxmm) 6.0x6.0	Longest (J1)	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
Die Size (mmxmm) 3.6x3.6	Shortest (H4)	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



CARSEM ELECTRICAL DATA

UPDATED: 2010 AUG

Assumption

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

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

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

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

Mold compound material : Plastic Novolac with $\varepsilon_r = 4.8$ 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.

<u>Definition</u> 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.



CARSEM ELECTRICAL DATA

UPDATED: 2010 AUG

SOT223 - 100 MHz

			~		1			i			1	~	
Package Type	Lead		Self Induct	ance		Bulk Capac	itance		Resistance			Gold Wi	ire
SOT222 21			(nH) L ₁	1		(pF) C	11		(mOhm) F	E Contraction of the second seco			
501225 3L 6 5mmy3 5mmy0 75mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Len	gth(mm)	Diameter(mils)
0.5111125.5111120.751111	Center	2.0090	1.88	3.8890	1.6200	6.3000	7.9200	6.0470	80.9800	87.0270	().6770	1.3
Paddle Size (milxmil)	Corner	1.5680	W8) 2.51		1.5680	0.1430		8.2450	80.7700		2	2.4760	1.3
100milx110mil			W9) 1.86		0.6980	0.1290			60.8600			1.9040	1.3
			W10) 2.51	0.4415		0.1580	2.2660		80.7700	14.2878	2	2.4760	1.3
Die size (milxmil)			W11) 1.88			0.1270			60.9100			1.9060	1.3
53.5milx48.6mil			W12) 2.51			0.1410			80.7800		1	2.4800	1.3
100MHz		Ν	Iutual Induct	ance L ₁₂	Μ	utual Induc	tance L ₁₃	Ν	Iutual Capacita	nce C ₁₂		Mutual Capaci	tance C ₁₃
TOOMITZ		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		W7,8)		0.0000	W7,8)			W7,8)			W7,8)	
			0.0773		0.1056	0.0773			0.00171			0.00171	
			W8,9)			W8,9)			W8,9) 0.0342			W8,9)	
			8.880			8.880			100			0.0342	
		0.3793	9 390			9 390 W9,10)		0.1880	W9,10) 0.0328		0.0059	W9,10) 0.0328	
			W10 11)	•		W10 11)			W10 11)			W10 11)	
			8.570			8.570			0.0286			0.0286	
			W11,12)			W11,12)			W11,12)			W11,12)	
			8.730			8.730			0.0326			0.0326	
Package Type	Lead		Self Induct	ance		Bulk Capac	itance		Resistance			Gold Wi	ire
~~~~~			(nH) L ₁	1		(pF) C	11		(mOhm ) F	Ł			
SOT223 3L		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Len	gth(mm)	Diameter(mils)
Paddle Size (milxmil)	Center	2.1230	-0.4160	1.7070	1.3140	1.0870	2.4010	9.48300	10.8170	20.3000		NIL	NIL
100milx110mil	Corner	1.7350	0.0430	1.7780	0.5890	0.6850	1.2740	22.0800	-2.7000	19.3800		NIL	NIL
		Ν	Iutual Induct	ance L ₁₂	Μ	utual Induc	tance L ₁₃	Ν	Iutual Capacita	nce C ₁₂		<b>Mutual Capaci</b>	tance C ₁₃
Die size (mil $x$ mil) (82.9 x 48.2 mil $s$ )		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
(02.7 x 40.2 IIIIS)	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
100Mhz	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



				CARSEM EL	ECTRICAI	L DATA						UPDATED: 20	10 AUG
Package Type	Lead		Self Induct (nH) L ₁	ance	R		Gold Wi	re					
SOT223 3L		Lead	Wire	Lead + Wire	Lead + Wire	Len	gth(mm)	Diameter(mils)					
Paddle Size (milxmil)	Center	1.8520	-0.4720	1.3800	1.3250	0.7440	2.0690	9.7726	10.1274	19.9000	0	.5253	1.3
100milx110mil	Corner	1.6311	0.1989	1.8300	0.5933	0.4417	1.0350	24.3990	-2.7490	21.6500	(1)	1.9633	1.3
	Remarks	s: Simulation	n between (	mold) KMC1758	& CEL9220	HF13, and (	Leadframe CuO	MCL & HC	L-12S).		(2)	2.5592	1.3
Die size (milxmil)											(3)	1.9653	1.3
(57.5 x 48.2 mils)	(Result :	KMC175&0	Cu OMCL)								(4)	2.5609	1.3
100Mbz											(5)	1.9664	1.3
TOOMIZ											(6)	1.9664	1.3
		Mu	itual Induct	ance L ₁₂	Μ	utual Induct	ance L ₁₃	Μ	utual Capacit	ance C ₁₂		<b>Mutual Capaci</b>	tance C ₁₃
		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
												•	



### CARSEM ELECTRICAL DATA

#### UPDATED: 2010 AUG

#### Assumption

Leadframe Material : C194=2.87x10⁸ $\Omega$ .m; relative permeability,  $\mu_r = 1$ 

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

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

* New entries : Mold compound material : with  $\varepsilon_r = 4.1$  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.



### CARSEM ELECTRICAL DATA

UPDATED :2010 AUG

Spak 5L

Data extracted at 1MHz									
Package Type	Lead	Self In (nH	ductance I) L ₁₁	Bulk C	Capacitance DF) C ₁₁	Res (mC	sistance Ohm ) R	Gold Wire	
Spak 5L		Lead only	Lead + Wire	Lead only	Lead + Wire	Lead only	Lead + Wire	Length(mm)	Diameter(mils)
Package Size	Pin 1	0.7850	3.1900	0.2610	0.6140	0.8000	27.8000	4.226,3.953,3.669,3.311	1.3
9.398mm x 10.287mm	Pin 2	0.8310	3.1600	0.3030	0.4050	0.7000	65.8000	2.042	1.3
Pad size	Pin 3	1.6800	0.1770	6.8200	6.9300	0.9000	2.3000	0.749,0.749,0.749	1.3
256mils x 231mils	Pin 4	0.8330	2.5600	0.3000	0.4270	0.7000	34.6000	2.089,2.256	1.3
Die size	Pin 5	0.8760	3.3900	0.2710	0.6030	0.8000	28.1000	3.427,4.167,4.091,4.258	1.3
48.4mils x 44.96mils			Mutual Ind	uctance L ₁₂			Mutual Ca	pacitance C ₁₂	
		Lea	d only	Lea	d + Wire	Le	ad only	Lead + Wire	
	Pin 1 to Pin 2	0.	1220	0	.7890	0	0.0520	0.1430	]
	Pin 2 to Pin 3	0.	1250	0	0.1170	0	0.1390	0.1570	]
	Pin 3 to Pin 4	0.	1260	0	0.1140	0	0.1320	0.1780	
	Pin 4 to Pin 5	0.	1340	0	0.8280	0	0.0540	0.1400	
Data extracted at 1MHz	-	1				+			
Package Type	Lead	Self In (nH	ductance I) L ₁₁	Bulk C (p	Capacitance (F) C ₁₁	Res (mC	sistance Ohm ) R	Gold Wire	
Spak SL		Lead only	Lead + Wire	Lead only	Lead + Wire	Lead only	Lead + Wire	Length(mm)	Diameter(mils)
Package Size	Pin 1	0.7850	3.1500	0.2610	0.6310	0.8000	21.2000	4.226,3.953,3.669,3.311	1.5
9.398mm x 10.287mm	Pin 2	0.8310	3.0900	0.3030	0.4130	0.7000	49.6000	2.042	1.5
Pad size	Pin 3	1.6800	0.1390	6.8200	6.9400	0.9000	1.7800	0.749,0.749,0.749	1.5
256mils x 231mils	Pin 4	0.8330	2.5200	0.3000	0.4340	0.7000	26.2000	2.089,2.256	1.5
Die size	Pin 5	0.8760	3.3500	0.2710	0.6170	0.8000	21.5000	3.427,4.167,4.091,4.258	1.5
48.4mils x 44.96mils			Mutual Ind	uctance L ₁₂			Mutual Ca	pacitance C ₁₂	
		Lea	d only	Lea	d + Wire	Le	ad only	Lead + Wire	- 
	Pin 1 to Pin 2	0.	1220	0	0.7820	0	0.0520	0.1500	
	Pin 2 to Pin 3	0.	1250	0	.1030	0	0.1390	0.1590	
	Pin 3 to Pin 4	0.	1260	0	.1000	0	0.1320	0.1800	
	Pin 4 to Pin 5	0.	1340	0	0.8200	0	0.0540	0.1450	



### CARSEM ELECTRICAL DATA

### UPDATED: 2010 AUG

#### **Assumption**

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

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

Mold compound material : with  $\varepsilon_r = 4.3$ ; 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



				CARSEM ELEC	TRICAL I	DATA					UF	PDATED: 20	010 AUG
SOICW													
Package Type	Lead		Self Induc (nH) I			Bulk Capac (pF) C	itance		Resistan (mOhm)	ce R		Gold W	ire
SOICW 16L		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length	n(mm)	Diameter(mils)
10.11mmx7.4mmx2.24mm	Center	1.364	1.268	2.632	0.4554	0.05952	0.5149	13.15	71.40	84.55	1.2	46	1.0
	Corner	2.625	1.978	4.603	0.7472	0.07682	0.8240	41.01	101.1	142.1	1.8	91	1.0
Paddle Size (milxmil)		Mu	itual Induc	ctance L ₁₂	Μ	utual Induc	tance L ₁₃	Ν	lutual Capaci	tance C ₁₂	Mı	utual Capaci	tance C ₁₃
130X157		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
Die size (milymil)	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
84x84	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 v Gold Wire: Resistivity=2.25x10 Mold compound material : Plas Die thickness = 8 mil; Wire loop Modeling Tool : Parasitic Paran Data Extracted at 100MHz Ground Plane positioned at 15n <u>Definition</u> Self Resistance Resistance of the lead which is o	vith resistivi - ⁸ Ω.m; relati stic Novolac o height = 6r neters 3D M nil below the under study	ty=1.73x10 ive permea with ε _r =4.4 nil lodeler e package s	- ⁸ Ω.m; rela bility, µ _r = 8 loss tan δ eating plar	ntive permeability 1 =0.001 ne.	7, μ _r =1								
Self Inductance Inductance of a lead with a PW	B ground pl	ane at 15m	il below th	e package seating	g place. It is	s a particle s	self inductance.						
Mutual Inductance Inductance between the lead un	der study to	its left or	right adjac	ent lead									
Mutual Capacitance Capacitance between the lead u	nder study t	o its left or	· right adja	cent lead									
Bulk Capacitance Capacitance from the lead unde	er study to a	ll other lea	ds and gro	und plane. All th	e other lead	ls and meta	l are grounded.						
Wire length Wire length stated at the above	table is the	direct dista	nce from <b>j</b>	point on the bond	pad to the	bond point	on the lead.						



				(	CARSEM E	LECTRICA	L DATA					UPDATEI	0: 2010 AUG
QSOP - 100MHz													
Package Type	Lead		Self Induc (nH) L	<b>tance</b>		Bulk Capaci (pF) C ₁	<b>itance</b>		Resistance (mOhm ) l	2 R		Gold	Wire
QSOP 16L 4 89x3 9		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Leng	th(mm)	Diameter(mils)
1107 4017	Center	0.6952	0.4161	1.1110	0.2154	0.03455	0.2500	6.454	30.01	36.46	0.4	4884	1.0
Paddle Size (milxmil)	Corner	1.0560	0.4387	1.4950	0.2785	0.0351	0.3136	9.5020	31.5600	41.0600	0.:	5091	1.0
96x130		Ми	itual Induc	tance L ₁₂	М	utual Induct	ance L ₁₃	Mut	tual Capacita	nce C ₁₂	N	<b>Autual</b> Caj	pacitance C ₁₃
Die size (milxmil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
86x120	Center	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 ₁₁			Bulk Capaci (pF) C ₁	itance		Resistance (mOhm ) l	2 <b>R</b>		Gold	Wire
QSOP 20L 6.0mmx3.9mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Leng	th(mm)	Diameter(mils)
Paddle Size (milxmil)	Center	0.4861	0.5197	1.0060	0.2204	0.03523	0.2556	7.281	31.67	38.95	0.:	5142	1.0
96x140	Corner	0.8754	1.0000	1.8750	0.2328	0.0482	0.2810	10.040	59.090	69.1300	1.0	0370	1.0
Die size (milymil)		Mu	itual Induc	tance L ₁₂	Μ	utual Induct	ance L ₁₃	Mut	tual Capacita	nce C ₁₂	Ν	<b>Autual</b> Ca	pacitance C ₁₃
86x106		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	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 Induc (nH) L	tance		Bulk Capaci (pF) C ₁	<b>itance</b>		Resistance (mOhm ) l	2 <b>2</b>		Gold	Wire
8.65mmx6.00mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengtl	n(mm)	Diameter(mils)
	Center	0.7730	0.5398	1.3128	0.2275	0.0420	0.2695	7.6841	39.6130	47.2971	0.5	576	1.0
Paddle Size (milxmil)	Corner	1.6159	1.0077	2.6236	0.4421	0.0610	0.5031	14.6380	61.3820	76.0200	1.04	488	1.0
96x140		Ми	itual Induc	tance L ₁₂	М	utual Induct	ance L ₁₃	Mut	tual Capacita	nce C ₁₂	ľ	<b>Autual</b> Caj	pacitance C ₁₃
Die size (milxmil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
86x130	Center	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



				С	ARSEM E	LECTRICA	L DATA					UPDATED:	2010 AUG
Package Type	Lead		Self Induc (nH) I	<b>ctance</b> -11		Bulk Capaci (pF) C ₁	itance 1		Resistanc (mOhm )	e R		Gold '	Wire
QSOP 44L 17 83mmx7 5mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	th(mm)	Diameter(mils)
	Center	1.2650	0.7426	2.0080	0.3753	0.04311	0.4184	8.682	47.66	56.43	0.7	7646	1.0
Paddle Size (milxmil)	Corner	4.3040	0.7651	5.0690	1.1930	0.0437	1.2370	27.4400	48.6300	76.0700	0.7	7921	1.0
190x260		M	utual Induo	ctance L ₁₂	М	utual Induct	ance L ₁₃	Мι	itual Capacit	ance C ₁₂	Ν	<b>Iutual Capa</b>	acitance C ₁₃
Die size (milymil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
180x250	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
*Ref [2]	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 Induc (nH) I	-11		Bulk Capac (pF) C ₁	1 1		Resistance (mOhm )	e R		Gold V	Wire
QSOP 20L		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	th(mm)	Diameter(mils)
8.051111123.911111	Center	0.7437	0.4381	1.1820	0.2204	0.03523	0.2556	7.281	31.67	38.95	0.5	5091	1.0
Paddle Size (milxmil)	Corner	1.1450	0.9713	2.1160	0.3170	0.0602	0.3772	10.7900	58.3800	69.1700	1.0	)400	1.0
96x140		M	utual Induo	ctance L ₁₂	М	utual Induct	ance L ₁₃	Мι	itual Capacit	ance C ₁₂	N	<b>Iutual Capa</b>	acitance C ₁₃
Die size (milymil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
86x106	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 Induc (nH) I	-11		Bulk Capaci (pF) C ₁	itance		Resistance (mOhm )	e R		Gold V	Wire
QSOP 16L		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Leng	th(mm)	Diameter(mils)
4.89mmx3.9mm	Center	0.7608	0.5682	1.3290	0.2154	0.00980	0.2252	1.106	27.19	28.30	0.4	1884	1.0
Paddle Size (milxmil)	Corner	1.1510	0.5350	1.6860	0.2785	0.0107	0.2892	1.6150	28.6050	30.2200	0.5	5091	1.0
96x130		M	utual Indu	ctance L ₁₂	М	utual Induct	ance L ₁₃	Мι	itual Capacit	ance C ₁₂	N	<b>Iutual Capa</b>	citance C ₁₃
Die size (milymil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
86x120	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



### CARSEM ELECTRICAL DATA

#### UPDATED: 2010 AUG

#### Assumption

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

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

Mold compound material: with  $\varepsilon_r = 4.281$ ; 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 =  $1.73 \times 10^{-8} \Omega$ .m; relative permeability,  $\mu_r = 1$ 

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

Mold compound material : with  $\varepsilon_r$  =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.



## CARSEM ELECTRICAL DATA

UPDATED: 2010 AUG

Ddpak

Data extracted at DC									
Package Type	Lead	Self In (n	nductance H) L ₁₁	Bulk Ca (pł	pacitance 7) C ₁₁	Re (m	esistance Ohm ) R	Gold	Wire
<b>Дарак 3</b> L		Self Inductance (nH) L ₁₁ Lead only         Lead + Wire           3.144         4.795           4.048         4.168           3.144         4.806           Mutual         Lead only           0.7204         0.7128           0.2839         0.2839           Lead only         Lead + Wire           3.116         4.759           3.991         4.110           3.117         4.770           Mutual         Lead only           0.7204         0.7204		Lead only	Lead + Wire	Lead only	Lead + Wire	Length(mm)	Diameter(mils)
Pad size	Pin 1	3.144	4.795	0.9071	1.037	0.4626	10.63	1.40	3.0
240milx180mil	Pin 2	4.048	4.168	10.54	10.68	0.5555	3.647	1.41,1.47,1.37	3.0
Dia siza	Pin 3	3.144	4.806	0.9034	1.044	0.4653	10.64	1.40	3.0
200milx160mil			Mutual Ind	uctance L ₁₂			Mutual	Capacitance C ₁₂	
		Le	ad only	Lead	+ Wire	Le	ead only	Lead +	Wire
	Pin 1 to Pin 2	0	.7204	0.9	9279	(	).2857	0.32	213
	Pin 2 to Pin 3	0	.7128	0.9	9209	(	0.2838	0.32	.59
	Pin 3 to Pin 1	0	.2839	0.4	4282	0	.01383	0.014	401
Data extracted at 100kHz	2					-			
Package Type	Lead	Self In (n	nductance H) L ₁₁	Bulk Ca (pł	pacitance F) C ₁₁	Re (m	esistance Ohm ) R	Gold	Wire
Ddpak 3L		Lead only	Lead + Wire	Lead only	Lead + Wire	Lead only	Lead + Wire	Length(mm)	Diameter(mils)
Pad size	Pin 1	3.116	4.759	0.9071	1.037	0.5034	10.67	1.40	3.0
240milx180mil	Pin 2	3.991	4.110	10.54	10.68	0.6131	3.701	1.41,1.47,1.37	3.0
Die size	Pin 3	3.117	4.770	0.9034	1.044	0.5059	10.68	1.40	3.0
200milx160mil			Mutual Ind	uctance L ₁₂			Mutual	Capacitance C12	
		Le	ad only	Lead	+ Wire	Le	ead only	Lead +	Wire
	Pin 1 to Pin 2	0	.7204	0.9	9279	(	0.2857	0.32	.13
	Pin 2 to Pin 3	0	.7128	0.9	9209	(	0.2838	0.32	.59
	Pin 3 to Pin 1	0	.2839	0.4	4282	0	.01383	0.01401	



## CARSEM ELECTRICAL DATA

Data extracted at 25MHz	2									
Package Type	Lead	Self In (n	nductance H) L ₁₁	Bulk Ca (pł	pacitance F) C ₁₁	Re (mt	sistance Ohm ) R	Gold	Wire	
Ddpak 3L		Lead only	Lead + Wire	Lead only	Lead + Wire	Lead only	Lead + Wire	Length(mm)	Diameter(mils)	
Pad size	Pin 1	2.824	4.465	0.9071	1.037	5.494	18.78	1.40	3.0	
240milx180mil	Pin 2	3.642	3.761	10.54	10.68	6.388	9.772	1.41,1.47,1.37	3.0	
Die size	Pin 3	2.824	4.474	0.9034	1.044	5.512	18.85	1.40	3.0	
200milx160mil			Mutual Inc	luctance L ₁₂			Mutual	Capacitance C ₁₂		
		Le	ad only	Lead	+ Wire	Le	ad only	Lead +	Wire	
	Pin 1 to Pin 2	0	.7204	0.9	9279	0	0.2857	0.32	213	
	Pin 2 to Pin 3	0	.7128	0.9	9209	0	0.2838	0.32	259	
	Pin 3 to Pin 1	0	.2839	0.4	4282	.01383	0.01	401		
Data extracted at 50MHz	<u> </u>									
Package Type	Lead	Self In (n	nductance H) L ₁₁	Bulk Ca (pł	pacitance 7) C ₁₁	Re (mt	sistance Ohm ) R	Gold	Wire	
<b>Дарак 3</b> L		Lead only	Lead + Wire	Lead only	Lead + Wire	Lead only Lead + Wire		Length(mm)	Diameter(mils)	
Pad size	Pin 1	2.821	4.442	0.9071	1.037	9.849	26.93	1.40	3.0	
240milx180mil	Pin 2	3.636	3.755	10.54	10.68	11.58	15.04	1.41,1.47,1.37	3.0	
Die size	Pin 3	2.820	4.452	0.9034	1.044	9.857	27.11	1.40	3.0	
200milx160mil			Mutual Inc	luctance L ₁₂			Mutual	Capacitance C ₁₂		
		Le	ad only	Lead	+ Wire	Le	ad only	Lead +	Wire	
	Pin 1 to Pin 2	0	.7204	0.9	9279	0	0.2857	0.32	213	
	Pin 2 to Pin 3	0	.7128	0.9	9209	0	0.2838	0.3259		
	Pin 3 to Pin 1	0	.2839	0.4	4282	0	.01383	0.01	401	



## CARSEM ELECTRICAL DATA

Data extracted	at 100MHz									
Package Type	Lead	Self In (n	nductance H) L ₁₁	Bulk Ca (pF	pacitance ) C ₁₁	Re (mt	sistance Ohm ) R	Gold V	Vire	
Ddpak 3L Pad size		Lead only	Lead + Wire	Lead only	Lead + Wire	Lead only	Lead + Wire	Length(mm)	Diameter(mils)	
240milx180mil	Pin 1	2.840	4.446	0.9071	1.037	15.34	39.48	1.40	3.0	
	Pin 2	3.654	Self Inductance (nH) $L_{11}$ Bulk Capacitance (pF) $C_{11}$ Resista (mOhm           nly         Lead + Wire         Lead only         Lead + Wire         Lead only         I           0         4.446         0.9071         1.037         15.34         1           0         4.446         0.9071         1.037         15.34         1           1         3.769         10.54         10.68         17.99         1           0         4.455         0.9034         1.044         15.38         1           Mutual Inductance L ₁₂ Image: Comparison of the second of the secon				25.17	1.41,1.47,1.37	3.0	
Die size	Pin 3	2.840	4.455	0.9034	1.044	15.38	39.83	1.40	3.0	
200111111001111			Mutual Ind	uctance L ₁₂			Mutual (	Capacitance C ₁₂		
		Le	ad only	Lead	+ Wire	Le	ead only	Lead +	Wire	
	Pin 1 to Pin 2	0	.7204	0.9	0279	(	).2857	0.32	13	
	Pin 2 to Pin 3	0	.7128	0.9	9208	(	).2838	0.32	59	
	Pin 3 to Pin 1	0	.2839	0.4	1282	0	.01383	0.014	-01	
				Ddpak	5L					
				Data extracte	ed at 1Hz					
Package Type	Data extracted at 1Hz       Package Type     Lead     Self Inductance (nH) L ₁₁ Bulk Capacitance (pF) C ₁₁ Resistan (mOhm								Vire	
Ddpak 5L		Lead only	Lead + Wire	Lead only	Lead + Wire	Lead only	Lead + Wire	Length(mm)	Diameter(mils)	
Pad size	Pin 1	3.179	5.652	0.8324	0.9161	0.5070	28.64	1.97	2.0	
240milx180mil	Pin 2	3.161	5.352	0.9343	0.9995	0.5029	25.62	1.63	2.0	
Dia siza	Pin 3	4.036	4.569	10.88	11.00	0.5851	11.43	1.57,1.39	2.0	
200milx160mil	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 Ind	uctance L ₁₂			Mutual (	Capacitance C ₁₂		
Lead only     Lead + Wire     Lead only     Lead									Wire	
	Pin 1 to Pin 2	1	1.065	1.	688	(	).2412	0.25	83	
	Pin 2 to Pin 3	0	.9597	1.	399	(	).3034	0.33	75	
	Pin 3 to Pin 4	0	.9895	1.	415	(	0.3101	0.33	98	
	Pin 4 to Pin 5	1	1.059	1.	662	0.2400		0.25	84	
	Pin 5 to Pin1	0	.1709	0.3	3779	0.	007550	0.005869		



## CARSEM ELECTRICAL DATA

Data extracted at 100KH	Iz									
Package Type	Lead	Self I (n	nductance H) L ₁₁	Bulk Ca (pF	pacitance T) C ₁₁	Re (mt	sistance Ohm ) R	Gold V	Wire	
Ddpak 5L		Lead only	Lead + Wire	Lead only	Lead + Wire	Lead only	Lead + Wire	Length(mm)	Diameter(mils)	
Pad size	Pin 1	3.158	5.623	0.8324	0.9161	0.5441	28.68	1.97	2.0	
240milx180mil	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	
Die size 200mily160mil	Pin 4	3.140	5.270	0.9384	1.001	0.5400	25.40	1.50	2.0	
200111111001111	Pin 5	3.157	5.517	0.8296	0.9098	0.5441	27.49	1.80	2.0	
			Mutual Ind	uctance L ₁₂			Mutual	Capacitance C ₁₂		
		Le	ad only	Lead	+ Wire	Le	ad only	Lead +	Wire	
	Pin 1 to Pin 2		1.063	1.	678	(	0.2412	0.25	83	
	Pin 2 to Pin 3	0	.9565	1.	391	(	0.3034	0.33	75	
	Pin 3 to Pin 4	0	.9867	1.	410	(	0.3101	0.33	98	
	Pin 4 to Pin 5		1.049	1.	653	(	0.2400	0.25	84	
	Pin 5 to Pin1	0	.1726	0.3	3796	0.	007550	0.005	869	
Data extracted at 25MHz	Z									
Package Type	Lead	Self I (n	nductance H) L ₁₁	Bulk Ca (pF	pacitance ) C ₁₁	Re (me	sistance Ohm ) R	Gold V	Wire	
Ddpak 5L		Lead only	Lead + Wire	Lead only Lead + Wire		Lead only	Lead + Wire	Length(mm)	Diameter(mils)	
Pad size	Pin 1	2.874	5.346	0.8324	0.9161	5.033	34.99	1.97	2.0	
240milx180mil	Pin 2	2.858	5.050	0.9343	0.9995	4.942	31.45	1.63	2.0	
Disting	Pin 3	3.663	4.209	10.88	11.00	6.683	16.83	1.57,1.39	2.0	
200milx160mil	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 Ind	uctance L ₁₂			Mutual	Capacitance C ₁₂		
		Le	ad only	Lead	+ Wire	Le	ad only	Lead +	Wire	
	Pin 1 to Pin 2	-	1.063	1.	677	(	0.2412	0.25	83	
	Pin 2 to Pin 3	0	.9564	1.	391	(	0.3034	0.33	75	
	Pin 3 to Pin 4	0	.9866	1.	410	(	0.3101	0.33	98	
	Pin 4 to Pin 5		1.049	1.	652	0.2400		0.2584		
	Pin 5 to Pin1	0	.1726	0.3	3858	0.	007550	0.005869		



## CARSEM ELECTRICAL DATA

Data extracted at 50MHz		Lead Self Inductance							
Package Type	Lead	Self In (n	nductance H) L ₁₁	Bulk Ca (pF	pacitance ) C ₁₁	Re (mt	sistance Ohm ) R	Gold V	Vire
<b>Дарак 5</b> L		Lead only	Lead + Wire	Lead only	Lead + Wire	Lead only	Lead + Wire	Length(mm)	Diameter(mils)
Pad size	Pin 1	2.873	5.343	0.8324	0.9161	8.467	44.26	1.97	2.0
240milx180mil	Pin 2	2.858	5.048	0.9343	0.9995	8.231	39.85	1.63	2.0
Die size	Pin 3	3.669	4.207	10.88	11.00	11.81	23.10	1.57,1.39	2.0
200milx160mil	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
		2.873 5.234 Mutual Indu		uctance L ₁₂			Mutual (	Capacitance C ₁₂	
		Le	ad only	Lead	+ Wire	Le	ad only	Lead +	Wire
	Pin 1 to Pin 2	1	.063	1.	677	C	0.2412	0.258	33
	Pin 2 to Pin 3	0.9564		1.	391	C	0.3034	0.33	75
	Pin 3 to Pin 4	0	.9866	1.	410	C	0.3101	0.33	98
	Pin 4 to Pin 5	1	.049	1.	552	C	0.2400	0.25	34
	Pin 5 to Pin1	0	.1726	0.3	860	0.0	007550	0.005	369



### CARSEM ELECTRICAL DATA

#### **Assumption**

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

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

Mold compound material: with  $\varepsilon_r = 4.3$ ; 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.

<u>Definition</u> 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.



					CARSEN	A ELECTI	RICAL DATA					UPDATED:	2010 AUG
MSOP													
Data extracted at 1MHz													
Package Type	Lead		Self Induc	tance		<b>Bulk Capa</b>	citance		Resista	nce		Gold	Wire
			(nH) L	<u>(</u> 11		(pF) (	211		(mOhm	) R			
MSOP 10L		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)
3.0mmx3.0mmx0.91mm	Center	0.7730	0.3185	1.0915	0.1780	0.1068	0.2848	1.4900	19.73	21.2150	0.7	346	1.0
	Corner	0.7730	0.7120	1.4850	0.1560	0.0474	0.2034	1.5000	42.70	44.2000	0.7	471	1.0
Paddle Size (milxmil)		Mu	tual Induc	tance L ₁₂	Μ	utual Indu	ctance L ₁₃	Mu	tual Capac	itance C ₁₂	]	Mutual Cap	acitance C ₁₃
68x98		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
52x81.9	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
			ļ	ł			ł		Į	ł	ļ		
Data extracted at 100MHz													
Package Type	Lead	(nH	) L11 Self	Inductance	(pF)	C11 Bulk	Capacitance	Re	sistance (m	nOhm ) R		Gold	Wire
MSOP 10L		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)
3.0mmx3.0mmx0.91mm	Center	0.7180	0.3175	1.0355	0.1780	0.1068	0.2848	7.2200	21.93	29.1500	0.7	346	1.0
	Corner	0.7190	0.7100	1.4290	0.1560	0.0474	0.2034	7.2500	47.50	54,7500	0.6	733	1.0
Paddle Size (milxmil)		M	utual Indu	ctance L ₁₂	М	utual Indu	ctance L ₁₃	Mu	tual Capac	itance C ₁₂		Mutual Cap	acitance C ₁₃
68x98		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
Die size (milxmil) 52x81.9	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
										1			
Data extracted at 2GHz													_
Package Type	Lead		Self Indu	ctance		<b>Bulk</b> Capa	citance		Resista	nce		Gold	Wire
0 VI			(nH) l	L ₁₁		(pF) (	C11		(mOhm	) R			
MSOP 10L		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	th(mm)	Diameter(mils)
3.0mmx3.0mmx0.91mm	Center	0.7130	0.3035	1.0165	0.1780	0.1068	0.2848	22.600	76.50	99.1000	0.7	/346	1.0
	Corner	0.7130	0.6800	1.3930	0.1560	0.0474	0.2034	22.700	167.00	189.7000	0.6	5733	1.0
Paddle Size (milxmil)		M	utual Indu	ctance L ₁₂	М	utual Indu	ctance L ₁₃	Mu	tual Capac	itance C ₁₂	]	Mutual Cap	acitance C ₁₃
68x98		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
Die size (milymil)	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
52x81.9	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.

<u>Definition</u> 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.



			CAI	RSEM ELECTR	ICAL DAT	Γ <b>Α</b>					τ	IPDATED: 2	2010 AUG
MQFP													
Package Type	Lead		Self Induc (nH) L	<b>tance</b>	1	Bulk Capac (pF) C	itance		Resistar (mOhm	ice ) R		Gold V	Vire
MQFP 208L 28mmx28mmx3.4mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)
	Center	7.073	2.125	9.198	1.606	0.1781	1.784	53.67	84.58	138.3	2.4	16	1.3
Paddle Size (milxmil)	Corner	9.369	2.790	12.16	2.007	0.2101	2.217	70.68	102.8	173.5	2.9	966	1.3
394x394		Mu	itual Induc	tance L ₁₂	Mu	itual Induc	tance L ₁₃	Mu	tual Capaci	itance C ₁₂	Μ	utual Capa	citance C ₁₃
Die size (milxmil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
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
Package Type	Lead		Self Induc (nH) L	tance	1	Bulk Capac (pF) C	itance		Resistar (mOhm	ice ) R		Gold V	Vire
MQFP 208L 28mmx28mmx3 4mm		Lead Wire Lead + Wire		Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)
20111112201111120.441111	Center	7.073	2.266	9.339	1.606	0.1503	1.756	53.67	125.0	178.7	2.416		1.0
Paddle Size (milxmil)	Corner	9.369	2.961	12.33	2.007	0.1785	2.186	70.68	151.9	222.6	2.9	966	1.0
394x394		Mu	itual Induc	tance L ₁₂	Mu	tual Induc	tance L ₁₃	Mu	tual Capaci	itance C ₁₂	Μ	utual Capa	citance C ₁₃
Die size (milxmil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
374x374	Center	4.269	0.8781	5.147	4.045	0.8622	4.907	0.6443	0.03505	0.6794	0.6313	0.03328	0.6646
	Corner	5.672	1.282	6.594	2.547	0.4926	3.040	0.8725	0.05140	0.9239	0.1731	0.01314	0.1862
Data extracted at 1Hz													
Package Type	Lead		Self Induc (nH) L	tance	]	Bulk Capac (pF) C	itance		Resistar (mOhm	nce ) R		Gold V	Vire
MQFP 100L		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)
14.01111.20.01111.22.7111111	Center	2.671	1.227	3.898	0.4559	0.08714	0.5430	5.499	41.54	47.04	1.3	36	1.3
Paddle Size (milxmil)	Corner	5.625	2.514	8.139	0.9531	0.1414	1.095	10.12	72.33	82.45	2.4	92	1.3
358milx358mil		Mu	itual Induc	tance L ₁₂	Mu	tual Induc	tance L ₁₃	Mu	tual Capaci	itance C ₁₂	Μ	utual Capa	citance C ₁₃
Die size		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
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
*Ref(2)	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

Data extracted at 100MHz													
	÷												
Package Type	Lead		Self Indu (nH)	ctance L ₁₁		Bulk Capac (pF) C	citance		Resistan (mOhm)	ice ) R		Gold	Wire
14.0mmx20.0mmx2.71mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Leng	th(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
Paddle Size (milxmil) 358milx358mil	Corner	5.271	2.498	7.769	0.9531	0.1414	1.095	49.76	91.52	141.3	2	.492	1.0
		M	utual Indu	ctance L ₁₂	Μ	lutual Induc	tance L ₁₃	Mu	itual Capaci	tance C ₁₂	I	Mutual Cap	acitance C ₁₃
Die size (milxmil) 218milx332mil		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
21011112021111	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
*Ref [2]	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													
											1		
Package Type	Lead		Self Indu (nH)	ctance L ₁₁		Bulk Capac (pF) C	citance		Resistan (mOhm)	ice ) R		Gold	Wire
14.0mmx20.0mmx2.71mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Leng	th(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
Paddle Size 358milx358mil	Corner	5.247	2.443	7.690	0.9531	0.1414	1.095	117.9	180.4	298.3	2	.492	1.0
		M	utual Indu	ctance L ₁₂	Μ	lutual Induc	tance L ₁₃	Mu	itual Capaci	tance C ₁₂	1	Mutual Cap	acitance C ₁₃
Die size 218milx332mil		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
21011113521111	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
*Ref [2]	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													
		1	~		[			Τ			T	<i></i>	
Package Type	Lead		Self Indu (nH)	ctance L ₁₁		Bulk Capac (pF) C			(mOhm)	) R		Gold	Wire
MQFP 100L 14.0mmx20.0mmx2.71mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Leng	th(mm)	Diameter(mils)
Daddla Siza (milymil)	Center	2.482	1.177	3.659	0.4559	0.08714	0.5430	89.99	146.5	236.5	1.	336	1.0
358milx358mil	Corner	5.244	2.426	7.670	0.9531	0.1414	1.095	179.3	257.4	436.7	2.	492	1.0
Die size (milxmil)		M	utual Indu	ctance L ₁₂	Μ	lutual Induc	tance L ₁₃	Mu	itual Capaci	tance C ₁₂	1	Mutual Cap	acitance C ₁₃
218milx332mil		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
*Ref [2]	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 =1.73x10⁸  $\Omega$ .m; relative permeability,  $\mu_r$  =1

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

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

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

#### *Ref [2]

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

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

Mold compound material : with  $\varepsilon_r = 4.281$  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.

<u>Definition</u> 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



			(	CARSEM ELEC	TRICAL D	ATA					U	PDATED: 2	010 AUG
MLP Micro													
Data Extracted at 10	0MHz												
Package Type	Lead		Self Inducta	ance		Bulk Capac	itance		Resistan	ice		Gold W	Vire
MLP Micro 8L			$(\mathbf{nH}) \mathbf{L}_1$	L		( <b>pF</b> ) C ₁	1		(mOnm	) K			
3.0mmx3.0mmx0.75mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)
<b>D</b> 1 1	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
Pad size 67milx99mil	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
•••••••		Mu	itual Inducta	ance L ₁₂	Μ	utual Induct	ance L ₁₃	M	itual Capaci	tance C ₁₂	Μ	lutual Capac	citance C ₁₃
Die size 59mily81mil		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
5711112011111	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 2	GHz												
Package Type	Lead		Self Induct	ance		Bulk Capac	itance		Resistan	ice		Gold W	Vire
MI D Miana OI			$(\mathbf{nH}) \mathbf{L}_1$	L		( <b>pF</b> ) C ₁	1		(mOhm)	) R			
3.0mmx3.0mmx0.75mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(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
Pad size 67milx99mil	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
		Mu	itual Inducta	ance L ₁₂	Μ	utual Induct	ance L ₁₃	M	itual Capaci	tance C ₁₂	Μ	lutual Capac	citance C ₁₃
Die size		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
37111110111111	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
				•			1			1			1



### CARSEM ELECTRICAL DATA

Assumption	

Leadframe Material: Copper with resistivity =1.73x10⁻⁸ $\Omega$ .m; relative permeability,  $\mu_r$  =1

Gold Wire: Resistivity =  $2.35 \times 10^{-8} \Omega$ .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  $\varepsilon_r = 4.1$ ; 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.



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### CARSEM ELECTRICAL DATA

UPDATED :2005 MARCH

MLPD

## Data Extracted at 1MHz

Package Type	Lead		Self Inductance fnHD L			ulk Capacit	ance		Resistan	te		Gold W	äre
and the second second second			(nH)L			(pF)CII	and and		(m.Ohm.)	R	1.1.1		
MLPD 8L	(	Lead	Wire	Lead +Wire	Lead	Wire	Lead +Wire	Lead	Wire	Lead+Wire	Lengt	h(mm)	Diameter (mils)
3.0mm:c3.0mm:c0.75mm	Center	0.0848	0.5222	0.6070	0.1272	0.0439	0.1711	0.2048	21.4800	21.6848	0.0	037	1.3000
	Comer	0.0848	0.5359	0.6207	0.1173	0.0460	0.1633	0.2048	21.8100	22.0148	0.0	037	1.3000
Pad size		Mut	ual Inducat	nceLiz	Mut	ual Inducts	nce L ₁₃	Mut	ual Capacit	ance Ciz	Mutual	l Capacitane	eCu
104milc75mil		Lead	Wire	Lead +Wire	Lead	Väire	Lead +Wire	Lead	Wire	Lead+Wire	Lead	Wire	Lead+Wire
Die size (milamil)	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
65 x 65	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
1	2	S 1	37 2	20				8		18 C	20 C	12	12 C C C C C C C C C C C C C C C C C C C

## Data Extracted at 2MHz

Package Type	Lead	1	Self Inductance (nH) L			ulk Capacit	ance		Resistan	ce		Gold Wire	
1920			(nH) L	(a) (a)		(pF) CII	1		(m.Ohm.)	R			
MLPD 8L	and a second	Lead	Wire	Lead +Wire	Lead	Viline	Lead +Wire	Lead	Wire	Lead+Wire	Lengt	h(mm)	Diameter (mik)
3.0mmx3.0mmx0.75mm	Center	0.0844	0.5222	0.6066	0.1272	0.0439	0.1711	0.2157	21.4900	21.7057	0.0	037	1.3000
	Corner	0.0844	0.5359	0.6203	0.1173	0.0460	0.1633	0.2157	21,8100	22.0257	0.0	037	1.3000
Pad siz e		Mut	ual Inducat	nce L ₁₂	Mui	ual Inducta	me L ₁₃	Mut	usl Capacit	ance C ₁₂	Mutual	l Capacitan	Ce C 13
104milc75mil		Lead	Wire	Lead +Wire	Lead	Viire	Lead +Wire	Lead	Wire	Lead+Wire	Lead	Mire	Lead+Wire
Die size (milymil)	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
65 x 65	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

and the second													
Package Type	Lead		Self Induct:	ance	B	ulk Capaci	ance		Resistan	(e		Gold V	iire
		10	(nH)L			(pF) CI			(m.Ohm.)	R			
MLPD 8L		Lead	Wire	Lead +Wire	Lead	Viire	Lead +Wire	Lead	Ware	Lead+Wire	Lengi	h(mm)	Diameter (mils)
3.0mm:c3.0mm:c0.75mm	Center	0.0803	0.5178	0.5981	0.1272	0.0439	0.1711	0.6728	26,6900	273628	0.6	6037	1.3000
	Come	0.0803	0.5315	0.6118	0.1173	0.0460	0.1633	0.6728	27.0800	27.7528	0.6	037	1.3000
Pad siz e		Mu	ual Induca	ince L ₁₂	Mu	tual Inducts	ince L ₁₃	Mu	tual Capacit	ance C ₁₂	Mutua	1 Capacitan	ceC ₁₅
104milc75mil	Sources of the	Lead	Wire	Lead +Wire	Lead	Wire	Lead +Wire	Lead	Wire	Lead+Wire	Lead	Wire	Lead+Wire
Die size (milymil)	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
65 x 65	Comer	0.0171	0.0747	0.0918	0.0004	0.0186	0.0190	0.0294	0.0055	0.0349	0.0002	0.0006	0.0008
1000000		100 Marca and 10											
Package Type	Lead	1	Self Induct:	ince	B	ulk Capaci	ance		Resistan	te		Gold Wire	
1992		8	(nH) L	10 A		(pF) CI			(m.Ohm.)	R	8		
MLPD 10L	No. of Concession	Lead	Wire	Lead +Wire	Lead	Wire	Lead +Wire	Lead	Wire	Lead+Wire	Lengt	h(mm)	Diameter (mik)
3.0mm:x3.0mm:x0.75mm	Center	0.0803	0.4780	0.5583	0.1268	0.0590	0.1858	0.6723	37 2842	37.9565	0.6	153	1.0
	Corner	0.0803	0.5237	0.6040	0.1173	0.0599	0.1772	0.6723	39.4352	40.1075	20	5250	10
Pad size		Mu	ual Induca	ince L ₁₀	Mu	ual Inducts	me L.	Mu	tual Capacit	ance Cie	Mutua	1 Capacitan	ceC.



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					1/100-151										
					CARS	EM ELEC	TRICAL DAT	A.							
a steam bases as	UPD A TED -2005 MARCH														
104milc75mil		Lead	Wire	Lead +Wire	Lead	Väire	Lead +Wire	Lead	Wire	Lead+Wire	Lead	Viire	Lead+Wire		
Die size (milamil)	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		
675 x86.4	Comer	0.0170	0.0899	0.1069	0.0004	0.0096	0.0100	0.0288	0.0028	0.0316	0.0003	0.0000	0.0003		
	2	61 E	23	i - 10			593 - C	30	67 C	92 ⁰	199		10 - C		

## Data Extracted at 2 GHz

Package Type	Lead		Self Inducts (nH) L ₁₁	nce	В	ulk Capacit (pF) C ₁₁	ance		Resistanı (m.Ohm.)	e R	a come co	Gold W	äre
MLPD 10L		Lead	Wire	Lead +Wire	Lead	Viire	Lead +Wire	Lead	Wire	Lead+Wire	Lengt	h(mm)	Diameter (mils)
3.0mmed.75mm	Center	0.0799	0.5771	0.6570	0.1269	0.0617	0.1886	3 3 2 7 4	151.7100	155.0374	0.0	037	1.3000
	Caner	0.0799	0.4989	0.5788	0.1173	0.0599	0.1772	3 3 2 7 4	136.8900	140.2174	0.0	037	1.3000
Pad siz e		Mu	tual Inducat	nceLiz	Mui	ual Inducta	me L ₁₃	Mu	usl Capacit	ance C ₁₂	Mutual	l Capacitan	eC ₁₃
104milc75mil		Lead	Wire	Lead +Wire	Lead	Väire	Lead +Wire	Lead	Wire	Lead+Wire	Lead	Wire	Lead+Wire
Die size (milymil)	Center	0.0172	0.0775	0.0947	0.0170	0.0384	0.0554	0.0288	0.0011	0.0299	0.0282	0.0000.0	0.0282
675 x 86.4	Comer	0.0170	0.0899	0.1069	0.0004	0.0096	0.0100	0.0288	0.0028	0.0316	0.0003	0.0000.0	0.0003
			- COMPANY - C					The Charles of Charles			1		

# MLPD FCOL Data Extracted at 1MHz

Package Type	Lead		Self Inducts (nH) L ₁₁	nce	B	ulk Capacit (pF) C ₁₁	ance	ä.	Resistant (m.Ohm.)	e R		Gold Wire	
MLPD 8L		Lead	Bump	Lead +Bump	Lead	Bump	Lead +Bump	Lead	Bump	Lead +Bump	Lengt	h(mm.)	Diameter (mik)
3.0mmed.0mmed0.75mm	Center	0.3286	0.0049	0.3335	0.2887	0.0279	03166	0.5523	20.1100	20.6623	N	L	NIL
	Corner	0 3 2 5 9	0.0049	0.3308	0.2425	0.0276	0.2701	0.5680	20.1100	20.6780	N	L	NIL
Die size (milwail)		Mut	ual Inducat	nce L ₁₂	Mut	ual Inducts	nce L ₁₃	Mub	usl Capacit	ance C ₁₂	Mutual	Capacitano	eCis
675 x86.4		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	.0006 0.1051 0.		0.0002	0.0078	0.0933	0.0027	0.0960	0.0034	0.0004	0.0038
									3				

## Data Extracted at 2MHz

Package Type	Lead		Self Inducts (nH) L	nce	B	ulk Capacii (pF) C ₁₁	ance		Resistant (m.Ohm.)	re R		Gold Wire	
MLPD 8L		Lead	ad Bump Lead+Bump 2 262 0.0049 0.3311 0			Bump	Lead +Bump	Lead	Bump	Lead +Bump	Lengt	h(mm)	Diameter (mik)
3.0mm:c3.0mm:c0.75mm	Center	0.3262	3262 0.0049 0.3311 ( 3335 0.0049 0.3324 (			0.0279	03166	0.6088	20.1100	20.7188	N	Ш.	NIL
[	Comer	0.3335	335 0.0049 0.3384 0			0.0276	0.2701	0.6257	20.1100	20.7357	N	III.	NIL
Die size (milwil)		Mu	ual Inducat	ince L ₁₂	Mut	ual Inducts	nce L ₁₃	Mub	usl Capacit	ance C ₁₂	Mutual	l Capacitane	eCis
67.5 x 86.4		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
		8 <u>.</u>	2 0.0007 0.1049 0.							3.			



			C								U	PDATED :2	010 AUG
Data Extracted at 100	MHz												
	1		G 167 3				•.		P. I.		1	<u>a</u> 11=	7.
Package Type	Lead		Self Induc (nH) I	tance		виік Capac (nF) С.	itance		Resista (mOhn	ince		Gold W	ire
MLPD 8L		Lead	Bump	Lead +Bump	Lead	Bump	Lead +Bump	Lead	Bump	Lead +Bump	Lengt	h(mm)	Diameter(mils)
3.0mmx3.0mmx0.75mm	Center	0.3084	0.0049	0.3133	0.2887	0.0279	0.3166	2.2920	20.1100	22.4020	N	IL	NIL
Die size	Corner	0.3152	0.0049	0.3201	0.2425	0.0276	0.2701	2.3630	20.1100	22.4730	N	IL	NIL
67.5mil x 86.4mil		Mu	itual Induc	tance L ₁₂	M	utual Induct	ance L ₁₃	M	utual Capa	citance C ₁₂	M	utual Capac	itance C ₁₃
	Contor	Lead	Bump 0.0006	Lead +Bump	Lead	Bump 0.0007	Lead +Bump	Lead	Bump 0.0027	Lead +Bump	Lead	Bump 0.0027	Lead +Bump
	Corner	0.1043	0.0007	0.1031	0.0076	0.0007	0.0078	0.0933	0.0027	0.0962	0.0033	0.00027	0.0038
										· · · ·			
Assumption													
Leadframe Material: C194 w	ith resistivity	$=2.87 \times 10^{-8}$	³ Ω.m; relat	ive permeability,	$\mu_r = 1$								
-eadframe Material: C194 with resistivity =2.87x10 ⁻⁸ Ω.m; relative permeability, μ _r =1 Gold Wire: Resistivity = 2.35x10 ⁻⁸ Ω.m; relative permeability, μ _r =1													
Fold Wire: Resistivity = $2.35 \times 10^8 \Omega$ .m; relative permeability, $\mu_r = 1$ Aold compound material: Plastic Novolac with $\varepsilon_r = 4.8$ ; loss tan $\delta = 0.001$													
Fold where: Resistivity = 2.55x10/52.m; relative permeability, $\mu_r = 1$ fold compound material: Plastic Novolac with $\varepsilon_r = 4.8$ ; loss tan $\delta = 0.001$ New entries: Mold compound material: with $\varepsilon_r = 4.1$ ; loss tan $\delta = 0.001$													
Die thickness = 8mil; Wire lo	op height = 6	mil											
Modeling Tool: Parasitic Para	ameters 3D N	Iodeler											
Ground Plane positioned at 1	5mil below th	ie package	seating pla	ine.									
1		1 8	91										
<u>Definition</u> Self Resistance	d 4 d												
Resistance of the lead which i	s under study	Ý											
Self Inductance Inductance of a lead with a P	WB ground p	olane at 15	mil below t	he package seati	ıg place. It	is a particle	self inductance.						
Mutual Inductance Inductance between the lead	under study t	o its left or	right adja	cent lead									
Mutual Capacitance Capacitance between the lead	l under study	to its left o	or right adj	acent lead									
Bulk Capacitance Capacitance from the lead un	der study to	all other le	ads and gr	ound plane. All t	he other lea	ads and met	al are grounded.						
Wire length Wire length stated at the abov	ve table is the	e direct dist	tance from	point on the bon	d pad to th	e bond poin	t on the lead.						



### CARSEM ELECTRICAL DATA

#### UPDATED: 2010 AUG

SOICN-100MHz													
Package Type	Lead		Self Induct (nH) L ₁	ance 1		Bulk Capac (pF) C	<b>itance</b>		Resistar (mOhm	ice ) R		Gold	Wire
Sole (iii) ollered		Lead	d         Wire         Lead + Wire         Lead           00         1.2600         2.3200         0.23			Wire	Lead + Wire	Lead	Wire	Lead + Wire	Leng	th(mm)	Diameter(mils)
Pad Size	Center	1.0600	1.2600	2.3200	0.2820	0.0723	0.3543	8.510	73.10	81.610	1.2	2572	1.0
90 mil x90 mil	Corner	1.3500	1.3500         1.2700         1.9640         0		0 3030	0.0867	0.4733	10.90	73.40	46.756	1.2	2745	1.0
Die size			1.1900		0.3030	0.0836			70.10		1.	1999	
34.8mil x 47.6mil		Mu	tual Induct	ance L ₁₂	M	utual Induc	tance L ₁₃	M	utual Capaci	itance C ₁₂	ľ	Mutual Capa	acitance C ₁₃
	Center	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 =  $2.25 \times 10^{-8} \Omega$ .m; relative permeability,  $\mu_r = 1$ 

Mold compound material: Plastic Novolac with  $\varepsilon_r = 4.8$ ; 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



CARSEM	FLEC	TRICA	I.DA	ТΔ
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SC70-100MHz	:												
Package Type	Lead		Self Induc (nH) L	tance		Bulk Capa (pF)	acitance C ₁₁		Resista (mOhn	ince 1) R		Gold '	Wire
SC70 1.95mm v1.22mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Leng	th(mm)	Diameter(mils)
1./ 5mm x1.22mm	Center	0.4210	0.4970	0.9180	0.1460	0.0305	0.1765	38.800	53.200	92.000	0.4	4706	0.8
Die size (mm)	Corner	0.4200	0.4740	0.8940	0.1480	0.0299	0.1779	38.700	51.800	90.500	0.4	4552	0.8
0.820 x1.010		Mu	itual Induc	tance L ₁₂	N	lutual Indu	ictance L ₁₃	I	Autual Capa	citance C ₁₂	N	<b>Autual Capa</b>	acitance C ₁₃
		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	<u>.</u>												
Package Type	Lead		Self Inductance (nH) L ₁₁ Lead + Wire         Lead           Wire         Lead + Wire         Lead           0         0.4640         0.8850         0.1			Bulk Capa (pF) C	citance		Resistar (mOhm	nce ) R		Gold	Wire
SC70 1 95mm x1 22mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Leng	th(mm)	Diameter(mils)
1./ 5mm x1.22mm	Center	0.4210	0.4640	0.8850	0.1460	0.0345	0.1805	38.800	36.100	74.900	0.4	4706	1.0
Die size (mm)	Corner	0.4200	0.4430	0.8630	0.1480	0.0339	0.1819	38.700	35.100	73.800	0.4	4552	1.0
0.820 x1.010		Mu	itual Induc	tance L ₁₂	M	utual Induc	ctance L ₁₃	Μ	utual Capac	itance C ₁₂	N	<b>Iutual Capa</b>	acitance C ₁₃
		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	<u>:</u>												
Package Type	Lead		Self Induc (nH) L	tance		Bulk Capa (pF) C	citance		Resistar (mOhm	nce ) R		Gold	Wire
SC70 1.95mm v1.22mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Leng	th(mm)	Diameter(mils)
1./ 5mm x1.22mm	Center	0.4210	0.4250	0.8460	0.1460	0.0395	0.1855	38.800	24.300	63.100	0.4	4706	1.3
Die size (mm)	Corner	0.4200	0.4040	0.8240	0.1480	0.0389	0.1869	38.700	23.600	62.300	0.4	4552	1.3
0.820 x1.010		Mu	itual Induc	tance L ₁₂	M	utual Induc	ctance L ₁₃	Μ	utual Capac	itance C ₁₂	N	<b>Iutual Capa</b>	acitance C ₁₃
		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
1													



#### UPDATED: 2010 AUG

SC70-100MHz													
Package Type	Lead		Self Induc (nH) I	<b>tance</b>		Bulk Capa (pF) (	citance		Resistar (mOhm	nce ) R		Gold W	lire
SC70 1 95mm x1 22mm		Lead	d         Wire         Lead + Wire         L           10         0.4610         0.6413         0.1			Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)
	Center	0.4210	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		0.1460	0.0400	0.2246	38.800	35.900	56.288	0.4	706	1.0
Die size			0.4220			0.0386			34.100		0.4	210	
0.820mm x1.010mm	Corner	0.4200	0.4220 0.3990 0.6324		0.1480	0.0381	0.2264	38.700	33.000	55.825	0.4	575	1.0
			0.4540			0.0403			35.600		0.3	660	
		Μ	utual Induc	etance L ₁₂	M	utual Indu	ctance L ₁₃	Mu	itual Capac	itance C ₁₂	Μ	utual Capac	citance C ₁₃
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	Center	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 =  $2.25 \times 10^{-8} \Omega$ .m; relative permeability,  $\mu_r = 1$ 

Mold compound material: Plastic Novolac with  $\varepsilon_r = 4.8$ ; 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



SSOP 125MHz

Package Type

**SSOP 28LEAD** 

5.3mmx7.8mm

Die size (milxmil)

91x172

#### CARSEM ELECTRICAL DATA UPDATED: 2010 AUG Lead Self Inductance **Bulk Capacitance** Resistance Gold Wire (nH) L₁₁ (**pF**) C₁₁ (mOhm) R Wire Lead + Wire Wire Lead + Wire Wire Lead + Wire Lead Lead Lead Length(mm) **Diameter(mils)** 1.0200 1.2600 2.2800 0.2670 0.0688 0.3358 10.6000 76.90 87.5000 1.2438 1.0 Center 2.3600 1.1200 3.4800 0.5430 0.0644 0.6074 70.1000 23.50 93.6000 1.1356 1.0 Corner **Mutual Inductance L12 Mutual Inductance L13** Mutual Capacitance C12 **Mutual Capacitance C13** 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 0.2320 0.0162 Corner 0.7150 0.9470 0.0326 0.1260 0.1586 0.1800 0.0103 0.1903 0.0112 0.0050

#### **Assumption**

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

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

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.



SSBGA-100MHz														
Package Type	Lead		Self Induc (nH) L	tance		Bulk Capac (pF) C			Resista (mOhm	nce ) R		Gold	Wire	
SSBGA 145L		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)	
7.0mmx7.0mmx1.2mm	Center	N/A	0.9810	0.9810	N/A	0.0864	0.0864	N/A	43.10	43.10	1.0	643	1.3	
Die size (milxmil)	Corner	N/A	1.0300	1.0300	N/A	0.0746	0.0746	N/A	44.60	44.60	1.1	115	1.3	
175.5x175		Μ	utual Induc	tance L12	M	utual Induc	tance L13	Mu	utual Capac	itance C12		Mutual Capa	citance C13	
		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	
Wire only	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														
<u>Assumption</u> Gold Wire: Resistivity = 2.25x10 ⁻⁸ Ω.m; relative permeability, μ _r =1														
Gold Wire: Resistivity = 2.25x10 ⁻⁸ Ω.m; relative permeability, μ _r =1 Mold compound material: Plastic Novolac with ε _r = 4.8; loss tan δ =0.001														
Mold compound material: Plastic Novolac with $\varepsilon_r = 4.8$ ; loss tan $\delta = 0.001$														
Mold compound material: Plastic Novolac with $\varepsilon_r$ = 4.8; loss tan o =0.001 Die thickness = 8mil; Wire loop height = 6mil														
Die thickness = 8mil; Wire loop height = 6mil														
Die thickness = 8mil; Wire loop height = 6mil Modeling Tool: Parasitic Parameters 3D Modeler														
Data Extracted at 100MHz														
Cuound Plane positioned at 15	nil halary tha m	a alvaga sa	ating plana											
Ground Flane positioned at 151	in below the p	ackage sea	ating plane.											
<u>Definition</u> Self Resistance Resistance of the lead which is u	under study													
Self Inductance Inductance of a lead with a PW	B ground plan	e at 15mil	below the <b>p</b>	oackage seating p	olace. It is	a particle so	elf inductance.							
Mutual Inductance Inductance between the lead un	der study to it	s left or ri	ght adjacen	t lead										
Mutual Capacitance Capacitance between the lead u	nder study to	its left or 1	right adjace	nt lead										
Bulk Capacitance Capacitance from the lead unde	er study to all o	other leads	s and groun	d plane. All the o	other leads	s and metal	are grounded.							
Wire length Wire length stated at the above	table is the di	rect distan	ce from poi	nt on the bond p	ad to the <b>b</b>	bond point c	on the lead.							



LQFP 100MHz													
Package Type	Lead		Self Induct (nH) L	tance		Bulk Capac (pF) C	<b>citance</b> 11		Resistance (mOhm )	e R		Gold V	Vire
LQFP 80L 14.0mmx14.0mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)
14.01111114.01111	Center	1.8000	1.7100	3.5100	0.4740	0.0994	0.5734	15.500	72.500	88.000	1.7	328	1.2
Paddle Size (milxmil)	Corner	2.6400	1.7000	4.3400	1.2300	0.0930	1.3230	20.000	72.000	92.000	1.7	128	1.2
315x315		Ми	itual Induct	ance L12	M	utual Induct	tance L13	Mut	ual Capacita	ince C12	Μ	utual Capa	citance C13
Die size (milxmil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
264x264	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	Lead		Self Inductance (nH) L ₁₁ d     Wire       Lead + Wire			Bulk Capac (pF) C	e <b>itance</b>		Resistanc (mOhm )	e R		Gold V	Vire
LQFP 80L 14.0mmx14.0mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)
14.011111114.011111	Center	1.7800	1.6600	3.4400	0.4740	0.0994	0.5734	64.700	198.000	262.700	1.7	328	1.2
Paddle Size (milxmil)	Corner	2.6200	1.6500	4.2700	1.2300	0.0930	1.3230	110.000	196.000	306.000	1.7	128	1.2
315x315		Ми	itual Induct	ance L12	M	utual Induct	tance L13	Mut	ual Capacita	ince C12	Μ	utual Capa	citance C13
Die size (milxmil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
264x264	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	Lead		Self Induct (nH) L	tance		Bulk Capac (pF) C	ritance		Resistanc (mOhm )	e R		Gold V	Vire
LQFP 80L 14.0mmx14.0mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)
14.011111114.011111	Center	1.7800	1.6400	3.4200	0.4740	0.0994	0.5734	166.000	750.000	916.000	1.7	328	1.2
Paddle Size (milxmil)	Corner	2.6000	1.6200	4.2200	1.2300	0.0930	1.3230	1960.000	747.000	2707.000	1.7	128	1.2
315x315		Ми	itual Induct	ance L12	M	utual Induct	tance L13	Mut	ual Capacita	ince C12	N	lutual Capa	citance C13
Die size (milxmil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
264x264	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 =  $2.25 \times 10^{-8} \Omega$ .m; relative permeability,  $\mu_r = 1$ 

Mold compound material: Plastic Novolac with  $\varepsilon_r = 4.8$ ; 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.



## CARSEM ELECTRICAL DATA

MLPQ- 500MH	z												
Package Type	Lead		Self Induc (nH) I	211		Bulk Capa (pF) C	citance		Resistan (mOhm )	ce R	Gold Wire		
7 00mm x 7 00mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)
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
Paddle Size (milxmil)	Corner	0.1240	0.0940	0.2180	0.1500	0.0545	0.2045	6.420	104.000	110.420	1.0218		1.0
213x213		Mutual Inductance L ₁₂			Mutual Inductance L ₁₃			Мι	itual Capaci	tance C ₁₂	Mutual Capacitance C ₁₃		
Die size (milxmil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
203x203	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
	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 & 20	GHz												
Package Type	Package Type Lead Self Inductance (nH) L ₁₁					Bulk Capa (pF) C	citance		Resista (mOhm	nce ) R	Gold Wire		
7.00mm x 7.00mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	th(mm)	Diameter(mils)
	Center	0.078	1.010	1.088	0.129	0.062	0.191	7.600	154.000	161.600	1.0764		1.0
Paddle Size (milxmil)	Corner	0.779	1.550	2.329	0.119	0.084	0.203	7.300	217.000	224.300	1.5850		1.0
213x213		Mutual Inductance L ₁₂			Mu	Mutual Inductance L ₁₃			<b>Autual Capac</b>	itance C ₁₂	Mutual Capacitance C ₁₃		
Die size (milxmil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
203x203	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
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 & 2.1	GHz												
Package Type	Lead		Self Induct (nH) L	ance	1	Bulk Capa (pF) (	<b>citance</b>		Resistan (mOhm )	ce R	Gold Wire		
8.00mm x 8.00mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length	n(mm)	Diameter(mils)
	Center	0.0781	1.6700	1.7481	0.1330	0.0924	0.2254	7.090	230.000	237.090	1.7030		1.0
Paddle Size (milxmil)	Corner	0.0779	2.0100	2.0879	0.1240	0.0971	0.2211	7.520	267.000	274.520	2.0000		1.0
251x251		Mutual Inductance L ₁₂			Mutual Inductance L ₁₃			Μ	utual Capaci	tance C ₁₂	Mutual Capacitance C ₁₃		
Die size (milxmil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
212x212	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
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



MLPQ1GHz & 2.1GHz														
Package Type	Lead		Self Induct (nH) L ₁	ance		Bulk Capac (pF) C	itance		Resistant (mOhm )	ce R		Gold Wire		
MLPQ 56LD		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)		Diameter(mils)	
8.00mm x 8.00mm	Center	0.0781	1.5700	1.6481	0.1330	0.1070	0.2400	7.090	178.000	185.090	1.7	030	1.3	
Paddle Size (milxmil)	Corner	0.0779	1.8900	1.9679	0.1240	0.1110	0.2350	7.520	207.000	214.520	2.0	000	1.3	
251x251		Mutual Inductance L12		Ми	Mutual Inductance L13			Mutual Capacitance C12			lutual Capa	citance C13		
Die size (milymil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	
212x212	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	
	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	
Only 4 wires														
MLPQ 2GHz	•													
Package Type	Lead		Self Induct	ance		Bulk Capac	itance		Resistance	e B	Gold Wire			
MI PO 561 D 8 00mm v		(nH) L ₁₁				(pF) C ₁₁			(mOhm)	R				
8.00mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)	
	Center	0.0849	1.4500	1.5349	0.1110	0.1020	0.2130	3.5800	244.000	247.580	1.6	002	1.0	
Paddle Size (milxmil)	Corner	0.0848	2.0500	2.1348	0.1080	0.1280	0.2360	3.6200	323.000	326.620	2.1538		1.0	
251x251		Mu	tual Inducta	ance L12	Mu	itual Induct	ance L13	Mu	tual Capacita	ance C12	Μ	utual Capac	itance C13	
Die size (milxmil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	
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 Induct (nH) L ₁	ance 1		Bulk Capac (pF) C	<b>itance</b>		Resistant (mOhm )	ce R		Gold V	Vire	
MLPQ 56LD 8 00mm x 8 00mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)	
0.00mm x 0.00mm	Center	0.0862	1.4600	1.5462	0.1110	0.1020	0.2130	6.6600	168.000	174.660	1.6	002	1.3	
Paddle Size (milxmil)	Corner	0.0862	2.0600	2.1462	0.1080	0.1280	0.2360	6.720	222.000	228.720	2.1	538	1.3	
251x251		Mu	tual Inducta	ance L12	Mu	itual Induct	ance L13	Mu	tual Capacita	ance C12	Μ	lutual Capa	citance C13	
Die size (milymil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	
212x212	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	
	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 2GHz		-											
Package Type	Lead		Self Induct (nH) L	ance		Bulk Capac (pF) C	itance		Resistan (mOhm )	ce R		Gold V	Vire
MLPQ 56LD 8.00mm x 8.00mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)
0.0011111	Center	0.0849	1.5500	1.6349	0.1110	0.0887	0.1997	3.5800	313.000	316.580	1.6	002	1.0
Paddle Size (milxmil)	Corner	0.0848	2.1800	2.2648	0.1080	0.1090	0.2170	3.6200	413.000	416.620	2.1	538	1.0
251x251		Mu	tual Induct	ance L12	Mu	itual Induct	ance L13	Mu	tual Capacit	ance C12	Μ	lutual Capa	citance C13
Die size (milxmil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
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	Lead Self Inductance (nH) L ₁₁				Bulk Capacitance (pF) C ₁₁			Resistan (mOhm )	ce R	Gold Wire		
MLPQ 56LD 8 00mm x 8 00mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)
0.00mm x 0.00mm	Center	0.0849	1.5500	1.6349	0.1110	0.0887	0.1997	3.5800	313.000	316.580	1.6	002	1.3
Paddle Size (milxmil)	Corner	0.0848	2.1800	2.2648	0.1080	0.1090	0.2170	3.6200	413.000	416.620	2.1538		1.3
251x251		Mu	tual Induct	ance L12	Μι	itual Induct	ance L13	Mu	tual Capacit	ance C12	Mutual Capa	citance C13	
Die size (milxmil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
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
E-II Deslares	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 Induct (nH) L ₁	ance		Bulk Capac (pF) C	itance		Resistan (mOhm )	ce R		Gold V	Vire
MLPQ 56LD		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)
0.0011111 X 0.0011111	Center	0.0775	1.0100	1.0875	0.1290	0.0615	0.1905	7.6000	154.000	161.600	1.0	764	1.0
Paddle Size (milxmil)	Corner	0.0779	1.5500	1.6279	0.1190	0.0835	0.2025	7.3000	217.000	224.300	1.5	850	1.0
251x251		Mu	tual Induct	ance L12	Мι	itual Induct	ance L13	Mu	tual Capacit	ance C12	Μ	lutual Capa	citance C13
Die size (milxmil) 212x212		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
	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
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



MLPQ 1GHz													
Package Type	Lead		Self Induct (nH) L ₁	ance		Bulk Capac (pF) C	citance		Resistan (mOhm )	ce R		Gold V	Vire
MLPQ 56LD 8 00mm x 8 00mm		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Length(mm)		Diameter(mils)
0.00mm x 0.00mm	Center	0.0775	0.9380	1.0155	0.1290	0.0705	0.1995	7.6000	120.000	127.600	1.0	764	1.3
Paddle Size (milxmil)	Corner	0.0779	1.4500	1.5279	0.1190	0.0961	0.2151	7.3000	168.000	175.300	1.5	850	1.3
251x251		Mu	tual Induct	ance L12	Ми	utual Induct	tance L13	Mu	tual Capacit	ance C12	Μ	lutual Capa	citance C13
Die size (milxmil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
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
E-II D-sloves	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
Fun Package													
MLPQ 2.1GHz													
Package Type	Lead	Self Inductance (nH) L ₁₁				Bulk Capacitance (pF) C ₁₁			Resistan (mOhm )	ce R	Gold Wire		
MLPQ 56LD		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)
8.00mm x 8.00mm	Center	0.0774	1.0000	1.0774	0.1290	0.0615	0.1905	2.8800	227.000	229.880	1.0	764	1.0
Paddle Size (milxmil)	Corner	0.0777	1.5400	1.6177	0.1190	0.0835	0.2025	2.8700	320.000	322.870	1.5850		1.0
251x251		Mu	tual Induct	ance L12	Ми	itual Induct	tance L13	Mu	tual Capacit	ance C12	Mutual Capa	citance C13	
Die size (milymil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
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													
MLPQ 1GHz													
Package Type	Lead		Self Induct (nH) L ₁	ance		Bulk Capacitance (pF) C ₁₁			Resistan (mOhm )	ce R		Gold V	Vire
MLPQ 56LD		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lengt	h(mm)	Diameter(mils)
0.0011111 X 0.0011111	Center	0.0774	0.9320	1.0094	0.1290	0.0705	0.1995	2.8800	179.000	181.880	1.0	764	1.3
Paddle Size (milxmil)	Corner	0.0777	1.4400	1.5177	0.1190	0.0961	0.2151	2.8700	250.000	252.870	1.5	850	1.3
251x251		Mu	tual Induct	ance L12	Ми	itual Induct	tance L13	Mu	tual Capacit	ance C12	Μ	lutual Capa	citance C13
Die size (milxmil)		Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire	Lead	Wire	Lead + Wire
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

**Assumption** 

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

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

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Modeling Tool: Parasitic Parameters 3D Modeler

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

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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.