- **Military Operating Temperature Range –55°C to 125°C, QML Processing**
- **Fast Instruction Cycle Time of 50 ns**
- **Two 1K × 32-Bit Single-Cycle Dual-Access On-Chip RAM Blocks**
- **32-Bit Instruction and Data Words, 24-Bit Addresses**
- **Integer, Floating-Point, and Logical Operations**
- **40- or 32-Bit Floating-Point/Integer Multiplier and Arithmetic Logic Unit (ALU)**
- **24 × 24-Bit Integer Multiplier, 32-Bit Product**
- **32 × 32-Bit Floating-Point Multiplier, 40-Bit Product**
- **Parallel ALU and Multiplier Execution in a Single Cycle**
- **32-Bit Barrel Shifter**
- **Eight Extended-Precision Registers (Accumulators)**
- **Circular and Bit-Reversed Addressing Capabilities**
- **Two (One for the ’320C31KGD) Independent Bidirectional Serial Ports With Support for 8-, 16-, 24-, or 32-Bit Transfers**
- **Two 32-Bit Timers With Control and Counter Registers**
- **Validated Ada Compiler**
- **64-Word × 32-Bit Instruction Cache**
- **On-Chip Direct Memory Access (DMA) Controller for Concurrent I/O and CPU Operation**
- **One 4K × 32-Bit Single-Cycle Dual-Access On-Chip ROM Block (’320C30KGD Only)**
- **Flexible Boot Program Loader for the ’320C31KGD Instead of the ROM**
- **Two 32-Bit External Ports for the ’320C30KGD (24- and 13-Bit Addresses)**
- **One 32-Bit External Port for the ’320C31KGD (24-Bit Address)**
- **Two Address Generators With Eight Auxiliary Registers and Two Auxiliary Register Arithmetic Units (ARAUs)**
- **Zero-Overhead Loops With Single-Cycle Branches**
- **Interlocked Instructions for Multiprocessing Support**
- **Two- and Three-Operand Instructions**
- **Conditional Calls and Returns**
- **Block Repeat Capability**
- **Fabricated Using 0.8-μm Enhanced Performance Implanted CMOS (EPIC ™) Technology by Texas Instruments**

description

The SMJ320C3xKGD digital signal processor (DSP) is a high-performance, 32-bit floating-point processor manufactured in 0.8-μm, double-level metal CMOS technology.

The SMJ320C3xKGD’s internal busing and special digital signal processing instruction set have the speed and flexibility to execute up to 40 million floating-point operations per second (MFLOPS). The SMJ320C3xKGD optimizes speed by implementing functions in hardware that other processors implement through software or microcode. This hardware-intensive approach provides performance previously unavailable on a single chip.

The SMJ320C3xKGD can perform parallel multiply and ALU operations on integer or floating-point data in a single cycle. Each processor also possesses a general-purpose register file, a program cache, dedicated ARAUs, internal dual-access memories, one DMA channel supporting concurrent I/O, and a short machine-cycle time. High performance and ease of use are results of these features.

The large address space, multiprocessor interface, internally and externally generated wait states, two external interface ports (one for the ’320C31KGD), two timers, two serial ports (one for the ’320C31KGD), and multiple interrupt structure enhanced general-purpose applications. The SMJ320C3xKGD supports a wide variety of system applications from host processor to dedicated coprocessor.

description (continued)

High-level language support is easily implemented through a register-based architecture, large address space, powerful addressing modes, flexible instruction set, and well-supported floating-point arithmetic.

known good die (KGD) technology

KGD options are available for use in multichip modules and chip-on-board (COB) applications. The current verification technology that supports KGD requirements for the SMJ320C30KGD and the SMJ320C31KGD is the removable tab (R-Tab).

The availability of selected DSP products in a tape automated bond (TAB) configuration has made possible the use of a R-Tab technique. The TAB leadframe is attached to gold-bumped die using nonoptimal bonding parameters. This technique allows easy removal of the tape after all the needed 100% screens and parametric tests. The tape is removed from the tested part and the die is shipped in a conventional die container. The gold bumps remain on the bond pads which provide for subsequent attachment of gold ball bonds.

electrical specifications

For electrical and timing specifications, please refer to the *SMJ320C3x Digital Signal Processor* data sheet, literature number SGUS014A.

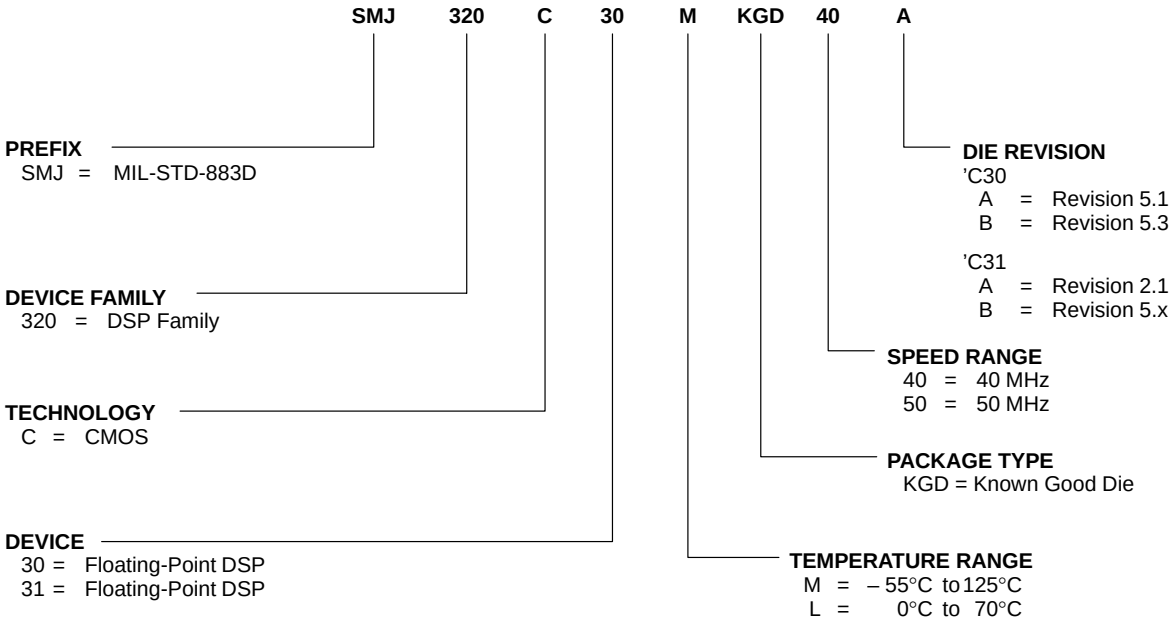

Figure 1. SMJ320C3xKGD Device Nomenclature

JEDEC STANDARD

- Die thickness is approximately 15 mils.
- Backside surface finish is silicon.
- Maximum allowable die junction operating temperature is 175°C.
- Glassivation material is compressive nitride.
- Bond pad metal is composed of copper-doped aluminum.
- Percent defective allowed for burned in die is 5.
- Life test data is available.
- Configuration control notification.
- Group A attribute summary is available (SMJ only).
- Suggested die-attach material is QMI 2569F.
- Suggested bond wire size is 1.0 to 1.25 mil.
- Suggested bonding method is gold ball bonding.
- ESD rating is Class II.
- Maximum allowable peak process temperature for die attach is 440°C.
- Saw curve is dependent on blade size used.
- Moisture-resistance data on die in plastic and TAB packages is available.

SMJ320C30KGD (rev 5.3) known good die pad information

Figure 2 shows the SMJ320C30KGD die numbering format. See Table 1 for SMJ320C30KGD die pad information.

Figure 2. ’320C30KGD Die Numbering Format (See Table 1)

Table 1 provides a reference for the following:

- The ’C30 signal identities in relation to the pad numbers.
- The ’C30 X,Y coordinates, where bond pad 51 serves as the origin (0,0).

In addition, significant specifications include:

- X,Y coordinate data is in microns.
- Coordinate origin is at (0,0) (center of bond pad 51).
- The active silicon dimensions are 10224.00 μm × 11032.00 μm (402.52 mils × 434.33 mils).
- The die size is approximately 10541 μm × 11353.8 μm (415.00 mils × 447.00 mils).
- Bond pad dimensions are 115.00 μm × 115.00 μm (4.53 mils × 4.53 mils).
- Gold bump dimensions are approximately 97.2 μm × 77.2 μm (3.83 mils × 3.04 mils) with the longer edge of the bump lying adjacent to the outer edge of the die.
- Center of bond pad to edge of die ranges from 180 μm–220 μm (7.1 mils–8.6 mils). The range of 40 μm exists since the dicing process results in some tolerance. Due to the consistency and precision of the bond pad locations in reference to each other, the center of bond pad 51 is chosen as the origin.

Table 1. ’320C30KGD Die Pad Information : rev 5.3 (0,8 μm)

DIE SIDE #1			
C30 DIE BOND PAD LOCATIONS	**DIE/TAB BOND PAD IDENTITY**	**X-COORDINATE OF THE DIE BOND PAD**	**Y-COORDINATE OF THE DIE BOND PAD**
1	PDV_{DD}		9563.00
2	PDV_{DD}		9367.80
3	DR0		9199.20
4	FSR0		9007.20
5	CLKR0		8823.20
6	CLKX0		8631.20
7	FSX0		8447.20
8	DX0		8255.20
9	TCLK0		8071.20
10	TCLK1		7879.20
11	EMU6		7695.20
12	XD0		7503.20
13	XD1		7319.20
14	XD2		7127.20
15	$IODV_{DD}$		6947.00
16	$IODV_{DD}$		6751.80
17	XD3		6853.20
18	XD4		6399.20
19	XD5		6207.20
20	XD6		6023.20
21	XD7		5831.20
22	XD8		5647.20
23	XD9		5455.20
24	XD10		5271.20
25	V_{DD}	– 423.80	5083.20
26	V_{DD}		4887.80
27	V_{SS}		4731.00
28	V_{SS}		4535.80
29	XD11		4367.20
30	XD12		4183.20
31	XD13		3991.20
32	XD14		3807.20
33	XD15		3615.20
34	XD16		3431.20
35	XD17		3239.20
36	XD18		3055.20
37	XD19		2863.20
38	XD20		2679.20
39	XD21		2487.20
40	XD22		2303.20
41	XD23		2111.20
42	XD24		1927.20
43	XD25		1735.20
44	XD26		1551.20
45	XD27		1359.20
46	XD28		1175.20
47	XD29		983.20
48	XD30		799.20
49	$IODV_{DD}$		619.00
50	$IODV_{DD}$		423.80

Table 1. ’320C30KGD Die Pad Information : rev 5.3 (0,8 μm) (Continued)

DIE SIDE #2			
C30 DIE BOND PAD LOCATIONS	**DIE/TAB BOND PAD IDENTITY**	**X-COORDINATE OF THE DIE BOND PAD**	**Y-COORDINATE OF THE DIE BOND PAD**
51	DV_{SS}	0.00	
52	DV_{SS}	195.20	
53	CV_{SS}	374.80	
54	CV_{SS}	570.00	
55	XD31	746.60	
56	A23	983.60	
57	A22	1138.60	
58	A21	1338.60	
59	A20	1530.60	
60	A19	1730.60	
61	A18	1922.60	
62	A17	2122.60	
63	A16	2322.60	
64	A15	2514.36	
65	A14	2902.80	
66	ADV_{DD}	2714.60	
67	ADV_{DD}	2902.80	
68	A13	3098.00	
69	A12	3274.60	
70	A11	3474.60	
71	A10	3666.60	
72	A9	3866.60	
73	A8	4258.60	
74	A7	4458.60	
75	A6	4650.60	
76	V_{DD}	4846.80	0.00
77	V_{DD}	5042.00	
78	V_{SS}	5214.80	
79	V_{SS}	2410.00	
80	A5	5578.60	
81	A4	5778.60	
82	A3	5970.60	
83	A2	6170.60	
84	A1	6370.60	
85	A0	6562.60	
86	EMU0	6774.80	
87	EMU1	6990.80	
88	EMU2	7198.80	
89	EMU3	7402.60	
90	EMU4	7606.80	
91	MC/$\overline{MP}$	7822.80	
92	XA12	8026.60	
93	XA11	8218.60	
94	XA10	8418.60	
95	XA9	8610.60	
96	XA8	8810.60	
97	XA7	9010.60	
98	XA6	9202.60	
99	IV_{SS}	9398.80	
100	IV_{SS}	9594.00	
101	DV_{SS}	9758.80	
102	DV_{SS}	9954.00	

Table 1. ’320C30KGD Die Pad Information : rev 5.3 (0,8 μm) (Continued)

DIE SIDE #3			
C30 DIE BOND PAD LOCATIONS	**DIE/TAB BOND PAD IDENTITY**	**X-COORDINATE OF THE DIE BOND PAD**	**Y-COORDINATE OF THE DIE BOND PAD**
103	ADV_{DD}		430.60
104	ADV_{DD}		625.80
105	XA5		764.40
106	XA4		986.40
107	XA3		1170.40
108	XA2		1362.40
109	XA1		1546.40
110	XA0		1738.40
111	D31		1922.40
112	D30		2114.40
113	D29		2298.40
114	D28		2490.40
115	D27		2674.40
116	D26		2866.40
117	DDV_{DD}		3046.60
118	DDV_{DD}		3241.80
119	D25		3410.40
120	D24		3594.40
121	D23		3786.40
122	D22		3970.40
123	D21		4162.40
124	D20		4346.40
125	D19		4538.40
126	D18		4722.40
127	V_{DD}	13077.80	4910.60
128	V_{DD}		5105.80
129	V_{SS}		5262.60
130	V_{SS}		5457.80
131	D17		5626.40
132	D16		5810.40
133	D15		6002.40
134	D14		6186.40
135	D13		6378.40
136	D12		6562.40
137	D11		6754.40
138	D10		6938.40
139	D9		7130.40
140	D8		7314.40
141	D7		7506.40
142	D6		7690.40
143	D5		7882.40
144	D4		8066.40
145	D3		8258.40
146	D2		8442.40
147	D1		8634.40
148	D0		8818.40
149	H1		9010.40
150	H3		9194.40
151	DDV_{DD}		9374.60
152	DDV_{DD}		9569.80

Table 1. ’320C30KGD Die Pad Information : rev 5.3 (0,8 μm) (Continued)

DIE SIDE #4			
C30 DIE BOND PAD LOCATIONS	**DIE/TAB BOND PAD IDENTITY**	**X-COORDINATE OF THE DIE BOND PAD**	**Y-COORDINATE OF THE DIE BOND PAD**
153	DV_{SS}	9947.20	
154	DV_{SS}	9752.00	
155	CV_{SS}	9587.20	
156	CV_{SS}	9392.00	
157	X2/CLKIN	9217.00	
158	X1	9043.80	
159	V_{SUBS}	8696.00	
160	V_{BBP}	8535.40	
161	$\overline{EMU5}$	7935.40	
162	$\overline{XRDY}$	7739.40	
163	MSTRB	7551.40	
164	IOSTRB	7359.40	9986.80
165	$\overline{XRW}$	7175.40	
166	$\overline{HOLDA}$	6991.40	
167	$\overline{HOLD}$	6795.20	
168	MDV_{DD}	6611.20	
169	MDV_{DD}	6416.00	
170	$\overline{RDY}$	6243.20	
171	$\overline{STRB}$	6055.40	
172	$\overline{R/W}$	5863.40	
173	$\overline{RESET}$	5667.20	
174	XF1	5479.40	
175	XF0	5295.40	
176	$\overline{IACK}$	5111.40	
177	$\overline{INT0}$	4915.20	
178	V_{DD}	4731.20	
179	V_{DD}	4536.00	
180	V_{SS}	4371.20	
181	V_{SS}	4176.00	
182	$\overline{INT1}$	4003.20	
183	$\overline{INT2}$	3803.20	
184	$\overline{INT3}$	3603.20	
185	RSV0	3403.20	
186	RSV1	3203.20	
187	RSV2	3003.20	
188	RSV3	2795.20	
189	RSV4	2595.20	
190	RSV5	2407.40	9993.60
191	RSV6	2223.40	
192	RSV7	2039.40	
193	RSV8	1855.40	
194	RSV9	1671.40	
195	RSV10	1479.40	
196	DR1	1295.40	
197	FSR1	1111.40	
198	CLKR1	927.40	
199	CLKX1	743.40	
200	FSX1	559.40	
201	DX1	375.40	
202	DV_{SS}	195.20	
203	DV_{SS}	0.00	

SMJ320C31KGD (rev 2.1) known good die pad information

Figure 3 shows the SMJ320C31KGD die numbering format. See Table 2 for SMJ320C31KGD die pad information.

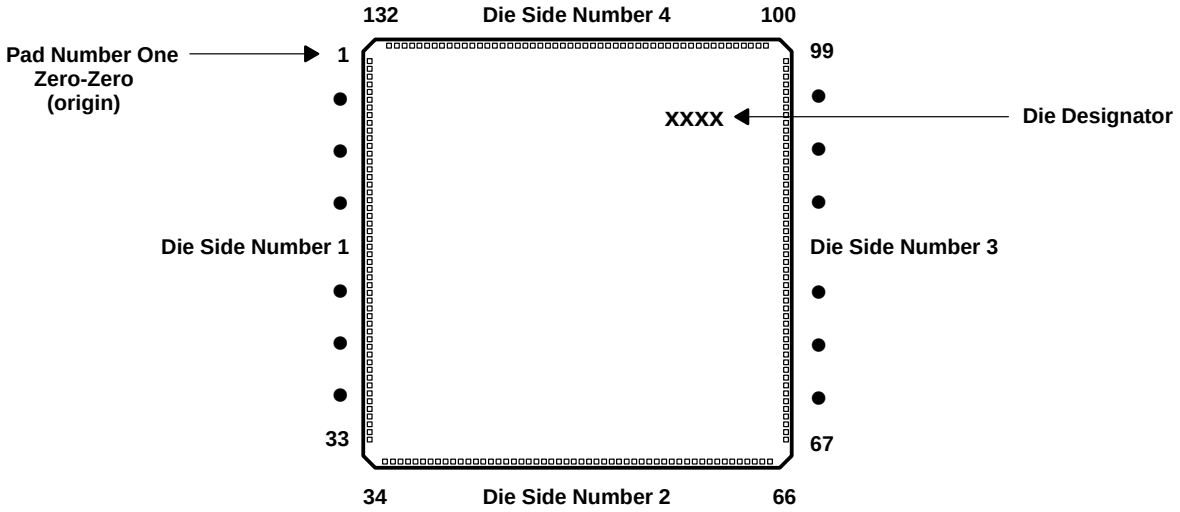

Figure 3. ’320C31KGD Die Numbering Format (See Table 2)

Table 2 provides a reference for the following:

- The ’C31 signal identities in relation to the pad numbers.
- The ’C31 X,Y coordinates, where bond pad 1 serves as the origin (0,0).

In addition, significant specifications include:

- X,Y coordinate data is in microns.
- Coordinate origin is at (0,0) (center of bond pad 1).
- The active silicon dimensions are 10215.20 μm × 10324.00 μm (402.17 mils × 406.46 mils).
- The die size is approximately 10541.00 μm × 10642.6 μm (415.00 mils × 419.00 mils).
- Bond pad dimensions are 130.00 μm × 130.00 μm (5.12 mils × 5.12 mils).
- Gold bump dimensions are approximately 107 μm × 92 μm (4.21 mils × 3.62 mils) with the longer edge of the bump lying adjacent to the outer edge of the die.
- Center of bond pad to edge of die ranges from 180 μm–220 μm (7.1 mils–8.6 mils). The range of 40 μm exists since the dicing process results in some tolerance. Due to the consistency and precision of the bond pad locations in reference to each other, the center of bond pad 1 was chosen as the (0,0) origin.

Table 2. ’320C31KGD Die Pad Information : rev 2.1 (0,8 μm)

DIE SIDE #1				DIE SIDE #2			
C31 DIE BOND PAD LOCATIONS	DIE/TAB BOND PAD IDENTITY	X-COORDINATE OF THE DIE BOND PAD	Y-COORDINATE OF THE DIE BOND PAD	C31 DIE BOND PAD LOCATIONS	DIE/TAB BOND PAD IDENTITY	X-COORDINATE OF THE DIE BOND PAD	Y-COORDINATE OF THE DIE BOND PAD
1	A9		0.00	34	DV_{SS}	508.60	
2	DV_{SS}		–300.00	35	D19	861.20	
3	A8		–569.20	36	D18	1142.00	
4	A7		–843.80	37	D17	1414.00	
5	A6		–1137.00	38	D16	1682.80	
6	A5		–1415.60	39	D15	1926.00	
7	AV_{DD}		–1710.80	40	CV_{SS}	2301.60	
8	A4		–1974.00	41	D14	2514.00	
9	A3		–2251.40	42	DV_{DD}	2828.00	
10	A2		–2536.40	43	D13	3035.60	
11	A1		–2809.80	44	IV_{SS}	3436.20	
12	A0		–3108.20	45	D12	3650.80	
13	CV_{SS}		–3406.00	46	D11	3919.60	
14	D31		–3662.80	47	D10	4213.20	
15	V_{DDL}		–3983.60	48	V_{DDL}	4556.60	
16	V_{DDL}		–4164.00	49	V_{DDL}	4736.20	
17	D30	0.00	–4457.80	50	D9	5051.60	– 9480.40
18	V_{SSL}		–4821.40	51	D8	5333.20	
19	V_{SSL}		–5001.40	52	DV_{SS}	5618.40	
20	DV_{SS}		–5316.80	53	V_{SSL}	5958.40	
21	D29		–5594.80	54	V_{SSL}	6138.80	
22	D28		–5873.20	55	D7	6428.40	
23	DV_{DD}		–6193.40	56	D6	6714.80	
24	D27		–6543.20	57	DV_{DD}	7012.60	
25	IV_{SS}		–6796.40	58	D5	7279.60	
26	D26		–7102.20	59	D4	7560.40	
27	D25		–7374.40	60	D3	7842.80	
28	D24		–7659.60	61	D2	8127.60	
29	D23		–7947.40	62	D1	8403.60	
30	D22		–8237.80	63	D0	8689.20	
31	D21		–8496.60	64	H1	8979.60	
32	DV_{DD}		–8788.20	65	H3	9254.00	
33	D20		–9012.40	66	DV_{DD}	9631.20	

Table 2. ’320C31KGD Die Pad Information : rev 2.1 (0,8 μm) (Continued)

DIE SIDE #3				DIE SIDE #4			
C31 DIE BOND PAD LOCATIONS	DIE/TAB BOND PAD IDENTITY	X-COORDINATE OF THE DIE BOND PAD	Y-COORDINATE OF THE DIE BOND PAD	C31 DIE BOND PAD LOCATIONS	DIE/TAB BOND PAD IDENTITY	X-COORDINATE OF THE DIE BOND PAD	Y-COORDINATE OF THE DIE BOND PAD
67	DV_{SS}		−9032.60	100	V_{SUBS}	9649.40	
68	CV_{SS}		−8822.20	101	SHZ	9335.20	
69	IV_{SS}		−8542.20	102	DV_{SS}	9055.60	
70	X2/CLKIN		−8240.40	103	TCLK0	8776.80	
71	X1		−8054.20	104	PV_{DD}	8506.80	
72	$\overline{\text{HOLDA}}$		−7742.80	105	TCLK1	8223.20	
73	$\overline{\text{HOLD}}$		−7460.00	106	EMU3	7851.00	
74	CV_{SS}		−7167.00	107	EMU0	7580.60	
75	$\overline{\text{RDY}}$		−6736.00	108	EMU1	7277.40	
76	$\overline{\text{STRB}}$		−6459.20	109	EMU2	6976.60	
77	R/$\overline{\text{W}}$		−6191.20	110	MCBL/$\overline{\text{MP}}$	6736.60	
78	$\overline{\text{RESET}}$		−5896.00	111	CV_{SS}	6394.00	
79	XF0		−5617.60	112	A23	6191.00	
80	CV_{DD}		−5351.00	113	A22	5895.40	
81	XF1		−5060.00	114	V_{DDL}	5564.60	
82	$\overline{\text{IACK}}$		−4784.80	115	V_{DDL}	5384.20	
83	$\overline{\text{INT0}}$	10074.00	−4504.00	116	A21	4986.80	484.80
84	DV_{SS}		−4279.20	117	A20	4704.80	
85	V_{SSL}		−3998.80	118	V_{SSL}	4366.80	
86	$\overline{\text{INT1}}$		−3672.00	119	DV_{SS}	4186.40	
87	V_{DDL}		−3330.60	120	A19	3863.80	
88	V_{DDL}		−3150.20	121	AV_{DD}	3586.40	
89	$\overline{\text{INT2}}$		−2826.40	122	A18	3290.80	
90	$\overline{\text{INT3}}$		−2546.60	123	A17	3014.60	
91	DR0		−2280.20	124	A16	2724.40	
92	CV_{SS}		−1970.20	125	A15	2457.40	
93	FSR0		−1699.40	126	A14	2172.60	
94	CLKR0		−1423.80	127	A13	1826.00	
95	CLKX0		−1143.20	128	A12	1550.00	
96	IV_{SS}		−862.80	129	A11	1271.80	
97	FSX0		−601.40	130	AV_{DD}	989.00	
98	PV_{DD}		−288.60	131	A10	715.20	
99	DX0		5.60	132	CV_{SS}	441.00	

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