HARRIS SEMICONDUCTOR

HI1166Y

April 1995

8-Bit 250 MSPS Flash A/D Converter

Features

- **Differential Linearity Error . . . . . ±0.5 LSB or Less**
- **Integral Linearity Error. . . . . ±0.5 LSB or Less**
- **Built-In Integral Linearity Compensation Circuit**
- **Ultra High Speed Operation with Maximum Conversion Rate of 250 MSPS (Min)**
- **Low Input Capacitance . . . . . 18pF (Typ)**
- **Wide Analog Input Bandwidth . . . . . 200MHz (Min. for Full-Scale Input)**
- **Single Power Supply . . . . . -5.2V**
- **Low Power Consumption . . . . . 1400mW (Typ)**
- **Low Error Rate**
- **Capable of Driving 50Ω Loads**

Applications

- **Spectrum Analyzers**
- **Radar Systems**
- **Direct RF Down-Conversion**
- **Video Digitizing**
- **Communication Systems**
- **Digital Oscilloscopes**

Description

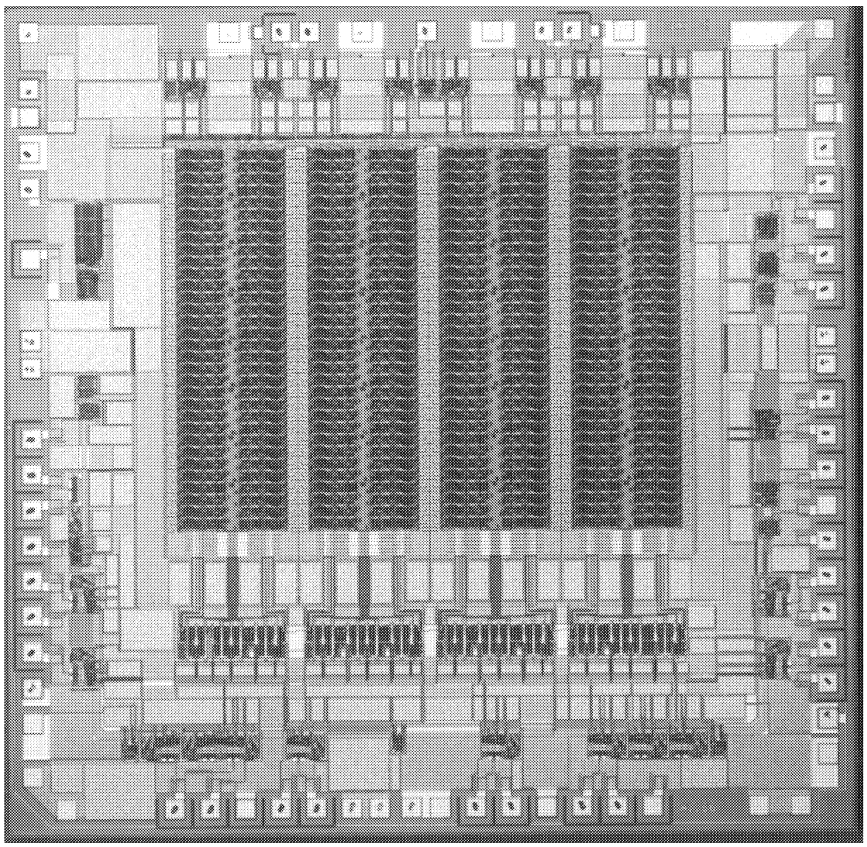
This is a specification that outlines the mechanical and electrical characteristics for the HI1166Y, 8-bit Flash A/D converter IC, in chip (die) form.

Ordering Information

PART NUMBER	TEMPERATURE	PACKAGE
HI1166Y	+25^{o}C	Die

- **All performance parameters are for packaged devices when supplied by Harris.**

Die Metallization Layer

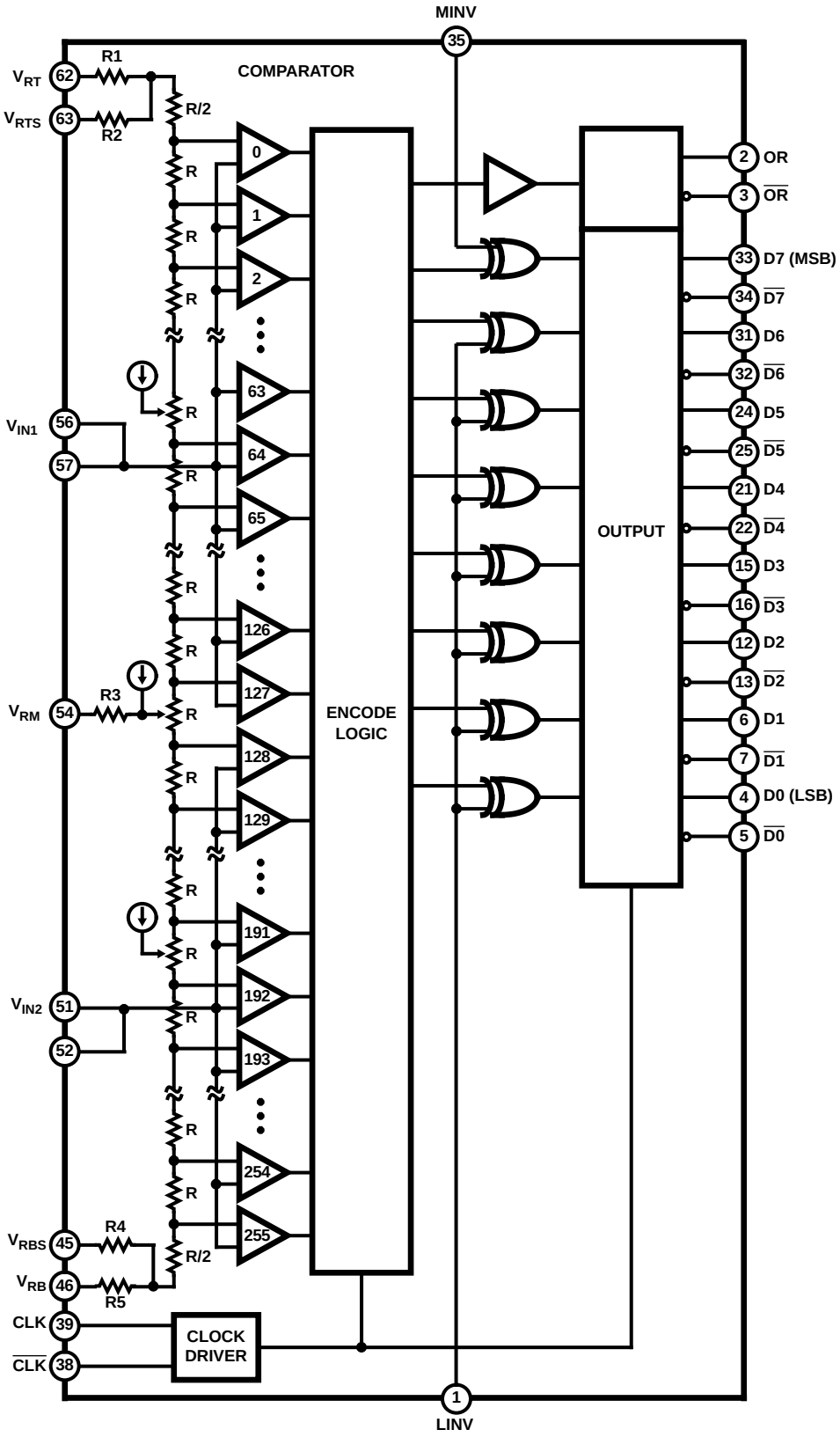


CAUTION: These devices are sensitive to electrostatic discharge. Users should follow proper I.C. Handling Procedures.

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File Number **3960**

Functional Block Diagram



Absolute Maximum Ratings $T_A = +25^oC$

Supply Voltage (AV_{EE}, DV_{EE}) . . . . . -7V to +0.5V
Analog Input Voltage (V_{IN}) . . . . . -2.7V to +0.5V
Reference Input Voltage
V_{RT}, V_{RB}, V_{RM} . . . . . -2.7V to +0.5V
$|V_{RT} - V_{RB}|$ 2.5V
Digital Input Voltage
MINV, LINV, CLK, $\overline{CLK}$ . . . . . -4V to +0.5V
$|CLK-\overline{CLK}|$ 2.7V
V_{RM} Pin Input Current (I_{VRM}) . . . . . -3mA to +3mA
Digital Output Current
(ID0 to ID7, IOR, $\overline{ID0}$ to $\overline{ID7}$, $\overline{IOR}$) . . . . . -30mA to 0mA
Storage Temperature Range (T_{STG}) . . . . . -65^oC to $+150^oC$

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

Operating Conditions

Supply Voltage
AV_{EE}, DV_{EE} . . . . . -5.5V to -4.95V
AV_{EE} - DV_{EE} . . . . . -0.05V to 0.05V
AGND - DGND . . . . . -0.05V to 0.05V
Reference Input Voltage
V_{RT} . . . . . -0.1V to 0.1V
V_{RB} . . . . . -2.2V to -1.8V
Analog Input Voltage, V_{IN} . . . . . V_{RB} to V_{RT}

Electrical Specifications $T_A = +25^oC$, DV_{EE}, AV_{EE} = -5.2V, V_{RT} = 0V, V_{RB} = -2V

PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT
Differential Linearity Error (DNL) (00000000 to 11111111)		-0.7	0.7	LSB
Integral Linearity Error (INL) (00000000 to 11111111)		-0.7	0.7	LSB
Resolution		8	-	Bits
Input Bias Current, L_{IN}	V_{IN} = -1.0V	35	400	µA
Analog Input Resistance, R_{IN}	V_{IN} = -1.0V	55	350	kΩ
Resister-String Current, I_{REF}		-24	-13	mA
Reference Voltage, V_{RM}		-1.1	-0.9	V
Residual Resistance, R1		0.1	1.2	Ω
Residual Resistance, R2		380	620	Ω
Residual Resistance, R5		0.1	1.2	Ω
Residual Resistance, R4		380	620	Ω
Digital Input Current HI, I_{IH}	Hi = -0.8V	0	40	µA
Digital Input Current LO, I_{IL}	Lo = -1.6V	-30	30	µA
$\overline{CLK}$ Open Voltage, V_{OPN}	$\overline{CLK}$ = Open	-1.4	-1.2	V
Leakage (1) D0 to D7, V_{LEAK}	I = -10µA	-1.0	-0.3	V
Leakage (2) D0 to D7, VIN, LINV, MINV, CLK, $\overline{CLK}$, I_{LEAK}	V = 0.3V	-1.0	1.0	µA
Digital Output Voltage HI, V_{OH}	620Ω to -5.2V	-1	-0.6	V
Digital Output Voltage LO, V_{OL}	620Ω to -5.2V	-2	-1.55	V
Supply Current, I_{EE}		-330	-190	mA

Timing Diagram

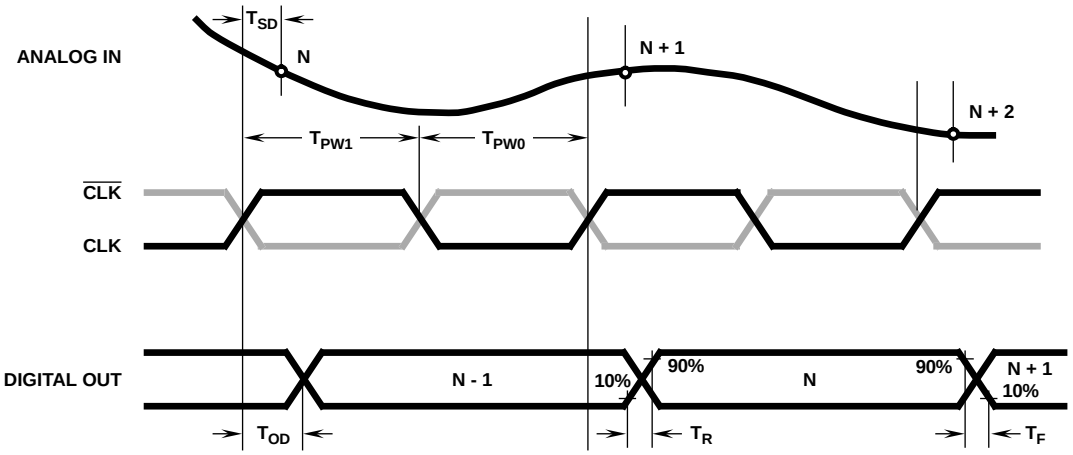
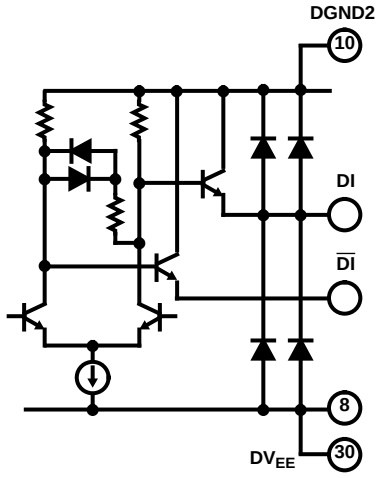
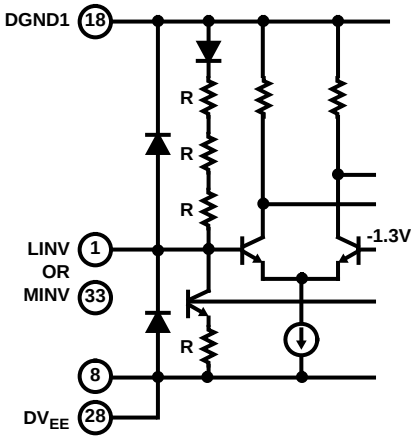
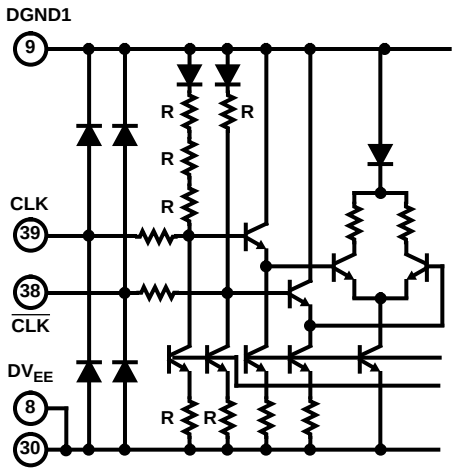
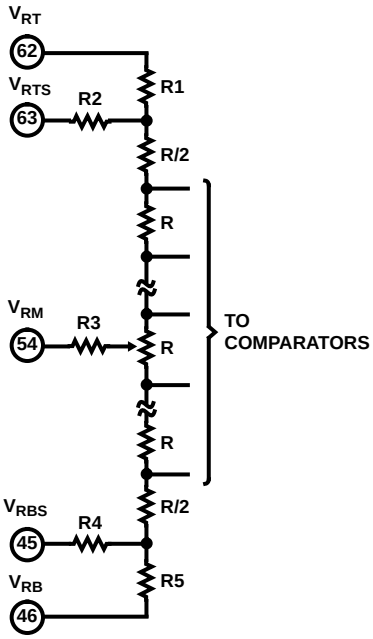
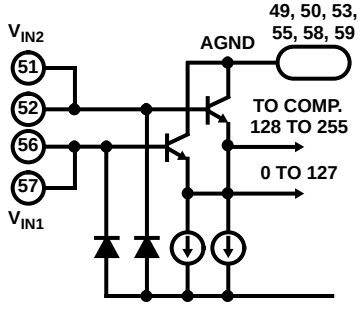


FIGURE 1.

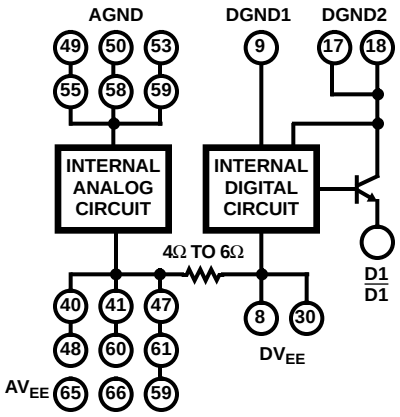
Pad Descriptions

PAD NUMBER	SYMBOL	I/O	STANDARD VOLTAGE LEVEL	EQUIVALENT CIRCUIT	DESCRIPTION
4, 5	D0, $\overline{D0}$	O	ECL		LSB and complementary LSB output.
6, 7	D1, $\overline{D1}$				$\underline{D1}$ to $\underline{D6}$: Data output $\overline{D1}$ to $\overline{D6}$: Complementary Data output
12, 13	D2, $\overline{D2}$				
14, 15	D3, $\overline{D3}$				
21, 22	D4, $\overline{D4}$				
24, 25	D5, $\overline{D5}$				
31, 32	D6, $\overline{D6}$				
33, 34	D7, $\overline{D7}$				MSB complementary MSB data output.
2, 3	OR, $\overline{OR}$				Overrange and complementary overrange output.
1	LINV	I	ECL		Polarity selection for LSBs (refer to the A/D Output Code Table.) Pulled low when left open.
35	MINV	I	ECL		Polarity selection for MSB (refer to the A/D Output Code Table). Pulled low when left open.

Pad Descriptions (Continued)

PAD NUMBER	SYMBOL	I/O	STANDARD VOLTAGE LEVEL	EQUIVALENT CIRCUIT	DESCRIPTION
39	CLK	I	ECL		CLK Input
38	$\overline{CLK}$				Complementary CLK input. Pulled down to -1.3V when left open.
62	V_{RT}	I	0V		Analog reference voltage (top) (0V Typ.).
63	V_{RTS}	O	0V		Reference voltage sense (top).
54	V_{RM}	I	$V_{RB/2}$		Reference voltage mid point. Can be used for linearity compensation.
45	V_{RBS}	O	-2V		Reference voltage sense (bottom).
46	V_{RB}	I	-2V		Analog reference voltage (bottom).
51, 52	V_{IN2}	I	V_{RTS} to V_{RBS}		Analog input. All of the pins must be wired externally.
56, 57	V_{IN1}				

Pad Descriptions (Continued)

PAD NUMBER	SYMBOL	I/O	STANDARD VOLTAGE LEVEL	EQUIVALENT CIRCUIT	DESCRIPTION
49, 50, 53, 55, 58, 59	AGND	-	0V		Analog ground.
40, 41, 47, 48, 60, 61, 65, 66	AV_{EE}		-5.2V		Analog supply. Internally connected to DV_{EE} (resistance: 4Ω to 6Ω).
9, 19, 20, 29	DGND1		0V		Digital ground.
10, 17, 18, 27, 28	DGND2		0V		Digital ground for output drive.
8, 14, 23, 30	DV_{EE}		-5.2V		Digital supply. Internally connected to AV_{EE} (resistance: 4Ω to 6Ω).

A/D OUTPUT CODE TABLE

V_{IN} (Note 1)	STEP	MINV 1 LINV 1			0 1			1 0			0 0		
		OR	D7	D0	OR	D7	D0	OR	D7	D0	OR	D0	D7
0V		0	000 • • • • • 00		0	100 • • • • • 00		0	011 • • • • • 11		0	111 • • • • • 11	
	0	1	000 • • • • • 00		1	100 • • • • • 00		1	011 • • • • • 11		1	111 • • • • • 11	
	1	1	000 • • • • • 01		1	100 • • • • • 01		1	011 • • • • • 10		1	111 • • • • • 10	
			• • •			• • •			• • •			• • •	
-1V	127	1	011 • • • • • 11		1	111 • • • • • 11		1	000 • • • • • 00		1	100 • • • • • 00	
	128	1	100 • • • • • 00		1	000 • • • • • 00		1	111 • • • • • 11		1	011 • • • • • 11	
			• • •			• • •			• • •			• • •	
	254	1	111 • • • • • 10		1	011 • • • • • 10		1	100 • • • • • 01		1	000 • • • • • 01	
	255	1	111 • • • • • 11		1	011 • • • • • 11		1	100 • • • • • 00		1	000 • • • • • 00	
-2V		1	111 • • • • • 11		1	011 • • • • • 11		1	100 • • • • • 00		1	000 • • • • • 00	

NOTE:

1. $V_{RT} = V_{RTS} = 0V$, $V_{RM} = -1V$ or open, $V_{RB} = V_{RBS} = -2V$

Pad Coordinates

PAD COORDINATE 1

PAD NO.	PAD NAME	X [μm]	Y [μm]
1	LINV	2198.40	4490.40
2	OR	2008.00	4490.40
3	$\overline{OR}$	1817.60	4490.40
4	D0	1627.20	4490.40
5	$\overline{D0}$	1436.80	4490.40
6	D1	1246.40	4490.40
7	$\overline{D1}$	1056.00	4490.40
8	DV_{EE}	865.60	4490.40
9	DGND1	675.20	4490.40
10	DGND2	388.80	4490.40
11	DGND2	209.60	4311.20
12	D2	209.60	3730.40
13	$\overline{D2}$	209.60	3540.00
14	DV_{EE}	209.60	3349.60
15	D3	209.60	3159.20
16	$\overline{D3}$	209.60	2968.80
17	DGND2	209.60	2778.40
18	DGND2	209.60	2629.60
19	DGND1	209.60	2458.40
20	DGND1	209.60	2301.60
21	D4	209.60	2111.20
22	$\overline{D4}$	209.60	1920.80
23	DV_{EE}	209.60	1730.40
24	D5	209.60	1540.00
25	$\overline{D5}$	209.60	1349.60
26		209.60	1159.20
27	DGND2	209.60	588.00
28	DGND2	209.60	362.40
29	DGND1	484.80	215.20
30	DV_{EE}	675.20	215.20
31	D6	865.60	215.20
32	$\overline{D6}$	1056.00	215.20
33	D7	1246.40	215.20
34	$\overline{D7}$	1436.80	215.20
35	MINV	1627.20	215.20
36		1817.60	215.20
37		2008.00	215.20
38	$\overline{CLK}$	2198.40	215.20
39	CLK	2388.80	215.20
40	AV_{EE}	2579.20	215.20
41	AV_{EE}	2728.00	215.20
42		2974.40	215.20
43		3164.80	215.20
44		3355.20	215.20
45	V_{RBS}	3545.60	215.20
46	V_{RB}	3736.00	215.20
47	AV_{EE}	3926.40	215.20
48	AV_{EE}	4075.20	215.20
49	AGND	4377.60	215.20
50	AGND	4377.60	1292.00
51	V_{IN2}	4377.60	1570.40
52	V_{IN2}	4377.60	1720.80
53	AGND	4377.60	1999.20
54	V_{RM}	4377.60	2352.80
55	AGND	4377.60	2698.40
56	V_{IN1}	4377.60	2984.80
57	V_{IN1}	4377.60	3135.20
58	AGND	4377.60	3413.60
59	AGND	4377.60	4490.40
60	AV_{EE}	4075.20	4490.40
61	AV_{EE}	3926.40	4490.40
62	V_{RT}	3736.00	4490.40
63	V_{RTS}	3545.60	4490.40
64		3164.80	4490.40
65	AV_{EE}	2728.00	4490.40
66	AV_{EE}	2579.20	4490.40

Pad Coordinates (Continued)

PAD COORDINATE 2

PAD NO.	PAD NAME	X [μm]	Y [μm]
1	LINV	2158.40	4450.40
2	OR	1968.00	4450.40
3	$\overline{OR}$	1777.60	4450.40
4	D0	1587.20	4450.40
5	$\overline{D0}$	1396.80	4450.40
6	D1	1206.40	4450.40
7	$\overline{D1}$	1016.00	4450.40
8	DV_{EE}	825.60	4450.40
9	DGND1	635.20	4450.40
10	DGND2	348.80	4450.40
11	DGND2	169.60	5271.20
12	D2	169.60	3690.40
13	$\overline{D2}$	169.60	3500.00
14	DV_{EE}	169.60	3309.60
15	D3	169.60	3119.20
16	$\overline{D3}$	169.60	2928.80
17	DGND2	169.60	2738.40
18	DGND2	169.60	2589.60
19	DGND1	169.60	2418.40
20	DGND1	169.60	2261.60
21	D4	169.60	2071.20
22	$\overline{D4}$	169.60	1880.80
23	DV_{EE}	169.60	1690.40
24	D5	169.60	1500.00
25	$\overline{D5}$	169.60	1309.60
26		169.60	1119.20
27	DGND2	169.60	548.00
28	DGND2	169.60	322.40
29	DGND1	444.80	175.20
30	DV_{EE}	635.20	175.20
31	D6	825.60	175.20
32	$\overline{D6}$	1016.00	175.20
33	D7	1206.40	175.20
34	$\overline{D7}$	1396.80	175.20
35	MINV	1587.20	175.20
36		1777.60	175.20
37		1968.00	175.20
38	$\overline{CLK}$	2158.40	175.20
39	CLK	2348.80	175.20
40	AV_{EE}	2539.20	175.20
41	AV_{EE}	2688.00	175.20
42		2934.40	175.20
43		3124.80	175.20
44		3315.20	175.20
45	V_{RBS}	3505.60	175.20
46	V_{RB}	3696.00	175.20
47	AV_{EE}	3886.40	175.20
48	AV_{EE}	4035.20	175.20
49	AGND	4337.60	175.20
50	AGND	4337.60	1252.00
51	V_{IN2}	4337.60	1530.40
52	V_{IN2}	4337.60	1680.80
53	AGND	4337.60	1959.20
54	V_{RM}	4337.60	2312.80
55	AGND	4337.60	2658.40
56	V_{IN1}	4337.60	2944.80
57	V_{IN1}	4337.60	3095.20
58	AGND	4337.60	3373.60
59	AGND	4337.60	4450.40
60	AV_{EE}	4035.20	4450.40
61	AV_{EE}	3886.40	4450.40
62	V_{RT}	3696.00	4450.40
63	V_{RTS}	3505.60	4450.40
64		3124.80	4450.40
65	AV_{EE}	2688.00	4450.40
66	AV_{EE}	2539.20	4450.40

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