

L70A

Multiscanning Color Monitor

TECHNICAL SERVICE MANUAL



Safety Precaution

WARNING

Service should not be attempted by anyone unfamiliar with the necessary precautions on this monitor. The followings are the necessary precautions to be observed before servicing.

1. When managing this monitor, cover with shield plate to avoid to scratch on LCD surface.
2. When replacing a chassis in the cabinet, always be certain that all the protective devices are put back in place, such as nonmetallic control knobs, insulating covers, shields, isolation resistor capacitor network etc.
3. Before returning the monitor to the customer, always perform an AC leakage current check on the exposed metallic parts of the cabinet, such as signal connectors, terminals, screw heads, metal overlays, control shafts etc, to be sure the monitor is safe to operate without danger of electrical shock.

General Information

1. Description

This 17" LCD color display monitor is operated in R, G, B drive mode input.

2. Operating instructions

2-1. Front

Power Switch, Menu, Select, Down, Up, DPMS (Power) LED

2-2. Rear

Input connector (AC & Signal Cable & DVI Cable & Video Cable & USB Cable)

2-3. OSD Controls

H/V Position, Clock (H-Size), Clock Phase, Brightness, Contrast, Recall, Color Control, Preset mode, Language, OSD Adjust, Auto Adjust, Hue, Fleshtone. Input Select

3. Electrical Characteristic

3-1. Power Supply

AC/DC - Input Voltage : 90V~264V

Input Current : 1A (Max)

Input Frequency : 50 ~ 60Hz

- Output Voltage 12V

Output Current 3.75A

3-2. Video Input Signal

Level : 0.7 Vp-p analog signal(at 75 ohm termination to ground)

Polarity : Positive or Negative

3-3. Horizontal Synchronization Signal

Level : TTL High : 2.4V min

Low : 0.4V max

Polarity : - or +

Frequency : 31kHz ~ 80kHz

3-4. Vertical Synchronization Signal

Level : TTL High : 2.4V min

Low : 0.4V max

Polarity : - or +

Frequency : 56Hz ~ 75Hz

Control Description

Front View



LED Indicator

Soft Power Switch

Support Modes

*Aualog R,G,B Input

No.	Resolution	H Frequency (kHz)	V Frequency (kHz)	H Polarity	V Polarity	Dot Clock (MHz)
1	720 x 400	31.5	70.1	0	1	28.322
2	640 x 480	31.5	59.9	0	0	25.175
3	640 x 480	37.5	75	0	0	31.5
4	800 x 600	35.2	56.3	1	1	36.000
5	800 x 600	37.9	60.3	1	1	40.000
6	800 x 600	48.1	72.2	1	1	50.000
7	800 x 600	46.9	75.0	1	1	49.500
8	832 x 624	49.725	74.55	0	0	57.283
9	1024 x 768	48.4	60.0	0	0	65.000
10	1024 x 768	56.5	70.1	0	0	75.000
11	1024 x 768	60.0	75.0	1	1	78.750
12	1152 x 870	68.681	75.000	1	1	100.00
13	1280 x 1024	63.900	60.000	1	1	108.00
14	1280 x 1024	79.976	75.025	1	1	135.00

*Digital R,G,B Input

No.	Resolution	H Frequency (kHz)	V Frequency (kHz)	H Polarity	V Polarity	Dot Clock (MHz)
1	640 x 480	31.5	59.9	0	0	25.175
2	800 x 600	37.9	60.3	1	1	40.000
3	1024 x 768	48.4	60.0	0	0	65.000
4	1280 x 1024	63.9	60.0	1	1	108.00

Video Input Signal

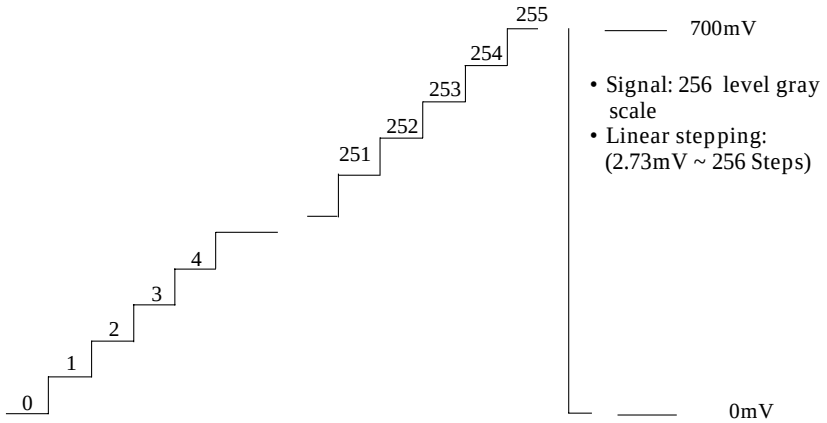
Recommended signal are shown below

- **Video Signal**

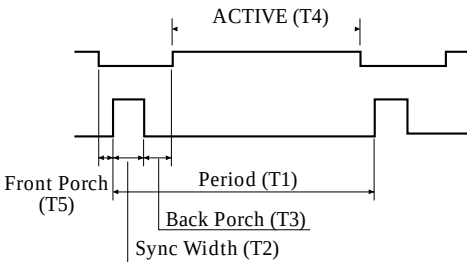
Video level : 0 to 700mV
Polarity : positive or Negative
Video Input : RGB separated
Analog level
Sync input : H-Sync(TTL level)
V-Sync (TTL level)

- **Waveform**

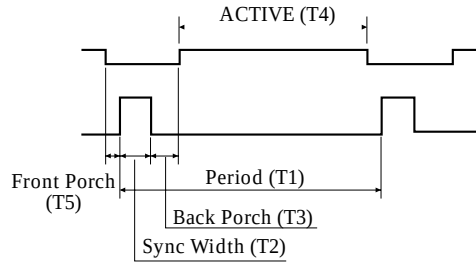
Video input(R.G.B)



- **H-Sync**



- **V-Sync**



Video Input Terminal

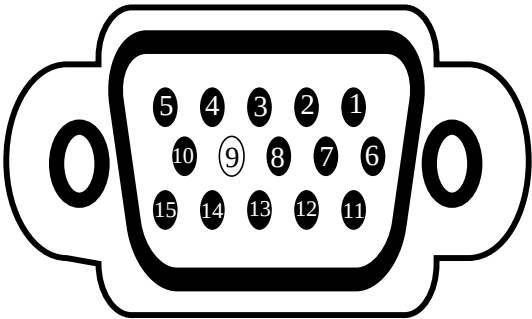
1. Analog

A 15 Pin D-sub connector is used as the input signal connector
Pin and input signals are shown in the table below.

Pin Description

PIN NO. \ SIGNAL	SEPARATE SYNC / DDC 1/2B
1	RED
2	GREEN
3	BLUE
4	GND
5	RETURN
6	RED GROUND
7	GREEN GROUND
8	BLUE GROUND
9	N.C
10	LOGIC GROUND
11	GROUND
12	SDA
13	H-SYNC(TTL)
14	V-SYNC(VCLK)
15	SCL

D-Sub miniature connector



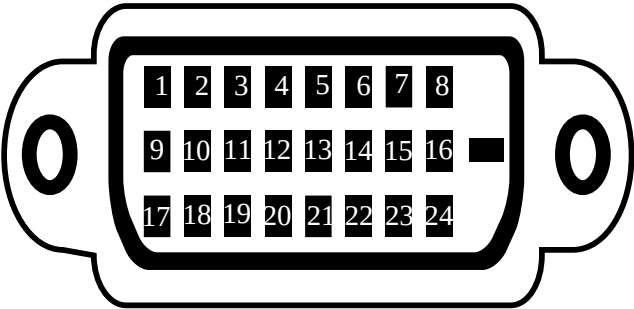
2. Digital

24 Pin DVI-D Interface connector is used as the input signal connector Pin and input signal are shown in the table below.

Pin Description

PIN NO.	SEPARATE SYNC / DDC 1/2B	PIN NO.	SEPARATE SYNC / DDC 1/2B
1	T.MD.S Data 2-	13	T.MD.S Data 3+
2	T.MD.S Data 2+	14	+5V Power
3	T.MD.S Data2/4 Shield	15	Ground(for +5V)
4	T.MD.S Data 4-	16	Hot Plug Detect
5	T.MD.S Data 4+	17	T.M.D.S Data 0-
6	DDC Clock	18	T.M.D.S Data 0+
7	DDC Data	19	T.M.D.S Data 0/5 Shield
8	No Connect	20	T.M.D.S Data 5-
9	T.MD.S Data1-	21	T.M.D.S Data 5+
10	T.MD.S Data1+	22	T.M.S.D Clock Shield
11	T.MD.S Data 1/3 Shield	23	T.M.D.S Clock +
12	T.MD.S Data 3-	24	T.M.D.S Clock -

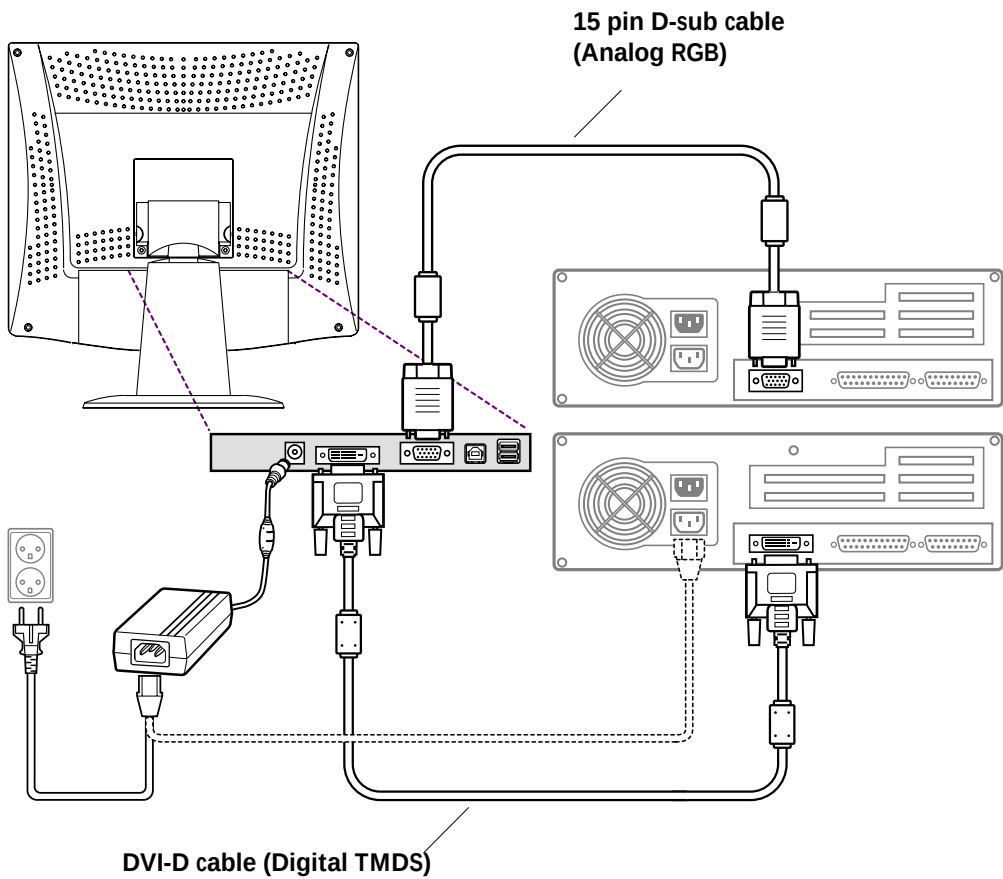
Digital-Only Receptacle Connector



Connecting with External Equipment

Cautions

Be sure to turn off the power of your computer before connecting the monitor.



Theory of Operation

1. DC/AC INVERTER

Input voltage : DC 12V
Input current : 2.0A(Max)
Output current : 6mAmps(TYP)
Frequency(switching) : 60KHz(Max)
Output power : 17W(TYP)
On/off control voltage : 5.0V

2. DPMS MODE

Reference to DPMS files

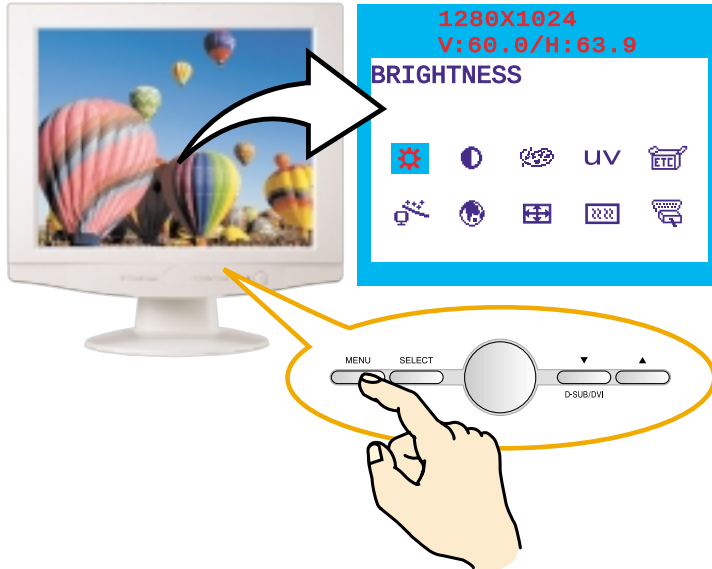
Status	Signal			Power Consumption	Recovery Time	LED Indicator
	H-Sync	V-Sync	Video			
on	Pulse	Pulse	Active	45W	-	Green
off	No Pulse	No Pulse	Blank	Less Than 5W	Within 3 Sec	Orange

On Screen Controls & LED Indicator

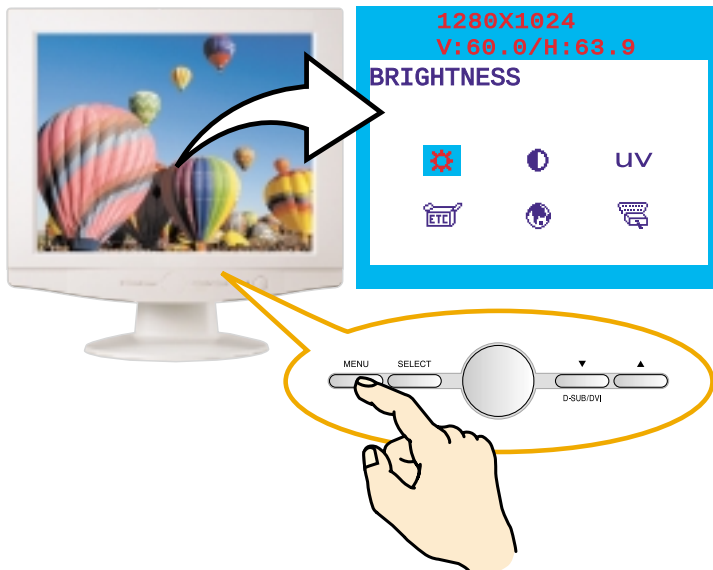
The menu for screen setting adjustment is located in the OSD and can be viewed in one of five languages

OSD feature and main functions are as follows:

* Analog OSD Control



* Digital OSD Control



OSD Adjustments

The OSD adjustments available to you are listed below.



BRIGHTNESS

Adjust the brightness of the screen.



CONTRAST

Adjust the contrast of the screen.



COLOR CONTROL

Color temperature affects the tint of the image. With lower color temperatures the image turns reddish and with higher temperatures bluish.

There are three color settings available: Mode 1(a cool white), Mode 2(a warm white) or USER. With the USER setting you can set individual values for red, green and blue.



YUV COLOR

In particular, color technology allows users to make the following color adjustment.

HUE

Adjust the hue of the video image.

FLESH TONE

Adjust the flesh Tone of the video image.



MISCELLANEOUS

RECALL

Recall the saved color data.

OSD TIMER

You can set the displayed time of OSD Menu window on the screen by using this adjustment.

OSD POSITION

Adjust the OSD menu's horizontal or vertical position on the screen.



AUTO ADJUST

You can adjust the shape of screen automatically at the full screen pattern.



LANGUAGE

You can select the language in which adjustment menus are displayed. The following languages are available: English, French, German, Italian, Spanish and Japanese.



H/V POSITION

H-POSITION

Adjusts the horizontal position of the entire screen image.

V-POSITION

Adjusts the vertical position of the entire screen image.



CLOCK PHASE

PHASE

Adjust the noise of the screen image.

CLOCK

Adjust the horizontal size of the entire screen image.



INPUT SELECT

This menu used to choose the desired input signal source. There are two available signal source.

- Analog R.G.B : 15 pin D-sub, Analog Signal
- Digital TMDS : 24 pin DVI-D, Digital Signal

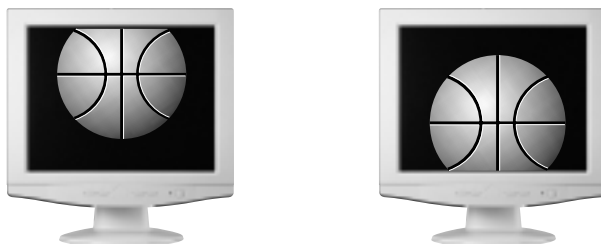


In case of applying Digital TMDS Input, the functions of Color Control, Auto Adjust, H/V Position, Clock Phase are not supported.

Getting Fine Picture

Step 1. At first Display, a full screen, such as, Window's background or "H" character should be achieved by using Editor (ex: Notepad. exe)

Step 2. Adjust the screen to the center of the Display(LCD), by using the top and bottom display controls. (i.e.Using V-Position Adjust menu)



Step 3. Adjust the screen to the center of the Display(LCD), by using the right and left display controls. (i.e.Using Clock and H-Position adjust menu)



Step 4. Adjust the Clock-phase until the "H" Character displays clear.



Step 5. Using the Contrast, Brightness, and Color Control menu, set the color to your preference.

Step 6. When you finish the adjustment, you can save your settings by pressing on the menu until the OSD screen has disappeared.

Factory Setting & EEPROM Initialization Method

Factory Setting Method

- Connect the signal cable and power cable to the LCD monitor.
- Press Power switch with pressed MENU key.(Menu key + Power key).
- Then, a User can change the factory setting value in OSD menu.
- Save changed value and Turn off the power s/w.
- Turn on the power, adjust the screen.

Specification

LCD Module	SIZE	17" Viewable diagonal
	Dot Pitch	0.264mm
	Contrast Ratio	450 : 1(TYP)
	Brightness	250 cd / m ² (TYP)
	Response Time	20ms (TYP.)
Input	Signal	Analog R.G.B Signal / TMDS Signal
	Connector	15 pin D-SUB Connector / Digital 24Pin DVI
SYNC	H-Freq	31.0 kHz~80 kHz
	V-Freq	56Hz ~75 Hz
Display	Area	337.92(H)X270.336(V)mm
	Color	16.7M
Recommmand Resolution		1280X1024 @ 60Hz
Video Bandwidth		54MHz (Max)
User Control & OSD Control		Contrast,Brightness,H-V Position, Clock, Clock Phase, Color Control, Language, OSD Adjust(Position, Display,Time), Auto Adjust, Hue, Flesh tone, Recall, Source, Input Select, Scaling Mode
Power Management		VESA DPMS Standard
Plug & Play		VESA DDC 1 /2B
Safety & Regulation	EMC	FCC CLASS B , CE , VCCI
	Safety	cULus, CE, TUV-GS, SEMKO, FIMKO
	Ergonomi	TCO'99
Temperature	Operating	5 to 35 °C
	Storage	- 5 to 45 °C
Humidity	Operating	30 to 80%(Non-condensing)
	Storage	5 to 90%(Non-condensing)
Weight	unpacked	7.1Kg
	packed	10.0Kg
Dimension(LXWXH mm)		220X420X437mm

* Specification is subject to change without notice for performance improvement.

Critical Parts Specification

1. LCD Module

HT18E22-200 is a A-Si TFT active matrix color liquid crystal comprising amorphous silicon TFT attached to each signal electrode, a driving circuit and a backlight.
a built-in backlight display area contains 1280X1024 pixels and can display full color (16.7M colors)

Display area	337.92(H)X270.336(V)mm
Drive system	A-Si TFT
Display color	16.7M Colors
Number of Pixel	1280X1024
Pixel arrangement	RGB vertical strip
Pixel pitch	0.264(H)X0.264(V)mm
Weight	2.2Kg
Contrast ratio	450:1
Viewing angle	
Horizontal:	70 degree , 70 degree
Vertical:	45 degree , 65 degree
Response time	20ms(max)
Luminance	250 cd / m ² (TYP)
Signal system	Digital RGB signals, Sync signals(H, V-Sync), Dot clock(DCLK) , DE(Data Enable)
Supply voltage	5.0V / 12V (Typ)
Backlight	Edge light type: Four colt cathode fluorescent lamps With in- verter
Power consumption	2.8W(TYP) without B/L

GM5020

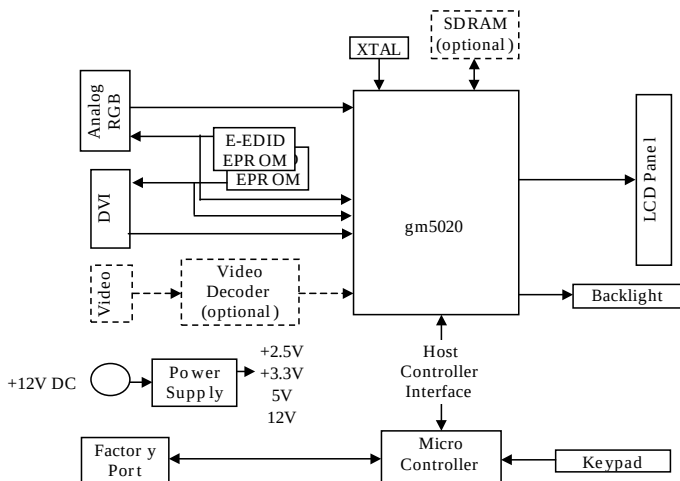
The gm5020 is a graphics processing IC providing high-quality images for LCD monitors and other pixelated displays. It combines a triple ADC, a DVI compliant TMDs receiver, a high quality zoom and shrink scaling engine, frame rate conversion, an on-screen display (OSD) controller, a microprocessor and many other functions in a single device. This high level of integration enables simple, flexible, cost-effective solutions featuring fewer required components.

The gm5020 operates at frequencies up to 160 MHz; ideal for dual-interface (analog and digital) LCD monitors up to SXGA resolutions.

gm5020 System Design Example

Figure 1 below shows a typical dual interface LCD monitor system based on the gm5020. Designs based on the gm5020 have reduced system cost and simplified hardware and firmware design because only a minimal number of components are required in the system. The chip can be used in a variety of systems, ranging from 'single-chassis' solutions for XGA and SXGA monitors with no frame store memory, up to high-end XGA and SXGA monitors featuring a frame store memory and video input.

Figure 1. gm5020 System Design Example



FEATURES

- Zoom and shrinks scaling (all resolutions from VGA to SXGA)
- Frame rate conversion
- Integrated 8-bit triple-channel ADC / PLL
- Integrated DVI 1.0-c compliant TMDS receiver
- Integrated High-bandwidth Digital Content Protection (HDCP)
- Embedded microcontrollersimplifies OSD creation
- On-chip versatile OSD engine
- All system clocks synthesized from a single external crystal
- Programmable gamma correction (CLUT)
- RealColor fleshstone adjustment and digital color control with innovative color management
- Hue, Saturation, Brightness, Contrast and Gamma controls for RGB and YUV signals
- PWM backlight intensity control
- 5 Volt tolerant inputs
- High-Quality Advanced Scaling
 - Fully programmable zoom / shrink ratios
 - Independent horizontal / vertical zoom and shrink
 - Variable sharpness control
 - Moiré cancellation
 - Adjustable scaling algorithms
- Analog RGB Input Port
 - Supports up to SXGA at 85Hz
 - Support for Sync-on-Green (SOG) and Composite Sync modes
- DVI Compliant Digital Input Port
 - Single link on-chip TMDS receiver
 - Operating up to 160 MHz
 - Direct connect to all DVI compliant TMDS transmitters
 - High-bandwidth Digital Content Protection (HDCP)
 - Enhanced protection of HDCP secret keys
- Digital Video Port
 - 8-bit ITU-R BT656 input video
 - Seamless connection to all commercially available video capture devices

APPLICATIONS

- Multi-synchronous XGA or SXGA LCD monitors with dual analog / digital interface
- Any fixed-resolution pixelated display device

• Auto-Configuration / Auto-Detection

- Phase and image positioning
- Input format detection
- Compatibility with all graphic cards and standard VESA modes

• Frame Store Interface

- Fully-programmable 48 / 32-bit wide data path
- Optional use of data compression for more flexibility and lower system solution cost
- Support for up to 143MHz SDRAM or SGRAM

• On-chip OSD Controller

- Bit-mapped OSD capability - 256 24-bit colors
- Horizontal and vertical stretch of OSD images
- Blinking, transparency and blending
- Enhanced Character OSD
 - On-chip RAM for downloadable fonts

• Output Format

- Single wide up to SXGA 60Hz output
- Double wide up to SXGA 75Hz output
- Support for 8 or 6-bit panels (with high-quality dithering)

• Operating Modes

- Frame rate conversion and scaling of images
- Bypass mode with no filtering and/or frame buffering 1:1 centering
- De-interlaced zoom
- Frame Sync and Free Run display synchronization modes

• Highly Integrated Solution Provides Lowest System Cost

• Simplicity of Design Speeds Time to Market

• Complete reference design kit available (software and hardware)

PACKAGE

- 292-pin PBGA

MECHANICAL SPECIFICATIONS

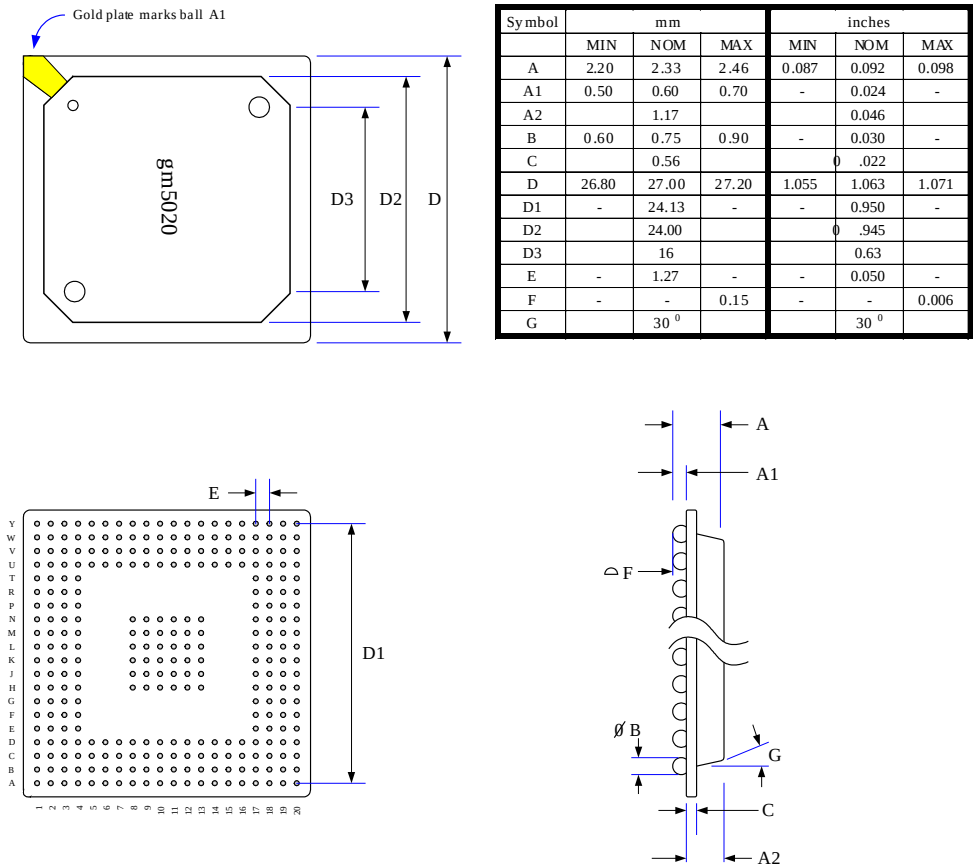


Figure 31. gm5020 292-pin PBGA

LP3961/3964

800mA Fast Ultra Low Dropout Linear Regulators

General Description

The LP3961/LP3964 series of fast ultra low-dropout linear regulators operate from a +2.5V to +7.0V input supply. Wide range of preset output voltage options are available. These ultra low dropout linear regulators respond very fast to step changes in load which makes them suitable for low voltage microprocessor applications. The LP3961/LP3964 are developed on a CMOS process which allows low quiescent current operation independent of output load current. This CMOS process also allows the LP3961/LP3964 to operate under extremely low dropout conditions.

Dropout Voltage: Ultra low dropout voltage; typically 24mV at 80mA load current and 240mV at 800mA load current.

Ground Pin Current: Typically 4mA at 800mA load current.

Shutdown Mode: Typically 15 A quiescent current when the shutdown pin is pulled low.

Error Flag: Error flag goes low when the output voltage drops 10% below nominal value (for LP3961).

SENSE: Sense pin improves regulation at remote loads. (For LP3964)

Precision Output Voltage: Multiple output voltage options are available ranging from 1.2V to 5.0V and adjustable, with a guaranteed accuracy of +/- 1.5% at room temperature, and +/- 3.0% over all conditions (varying line, load, and temperature).

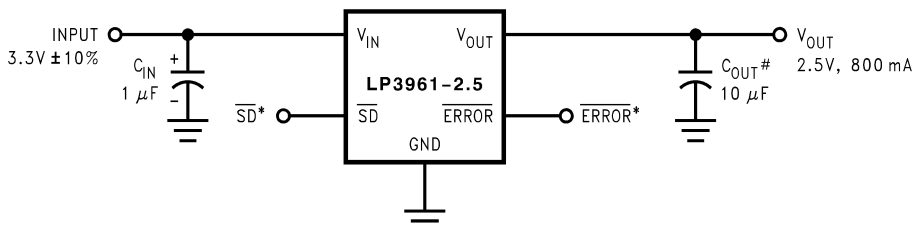
Features

- Ultra low dropout voltage
- Low ground pin current
- Load regulation of 0.02%
- 15 A quiescent current in shutdown mode
- Guaranteed output current of 0.8A DC
- Available in SOT-223, TO-263 and TO-220 packages
- Output voltage accuracy +/- 1.5%
- Error flag indicates output status (LP3961)
- Sense option improves better load regulation (LP3964)
- Extremely low output capacitor requirements
- Overtemperature / overcurrent protection
- - 40 C to +125 C junction temperature range

Applications

- Microprocessor power supplies
- GTL, GTL+, BTL, and SSTL bus terminators
- Power supplies for DSPs
- SCSI terminator
- Post regulators
- High efficiency linear regulators
- Battery chargers
- Other battery powered applications

Typical Application Circuits

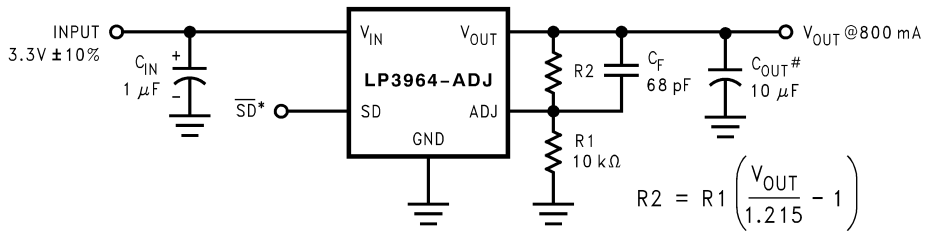
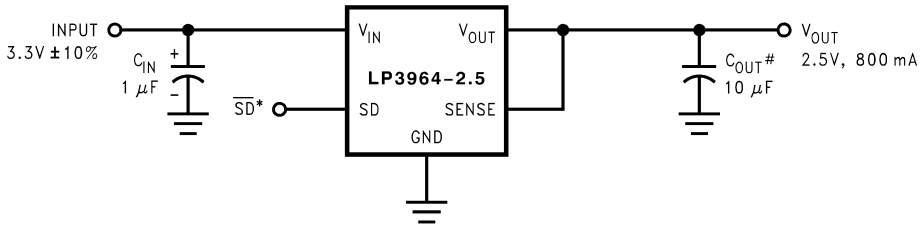


DS101 129-1

Minimum output capacitance is 10 F to ensure stability over full load current range. More capacitance provides superior dynamic performance and additional stability margin.

*SD and ERROR pins must be pulled high through a 10kΩ pull-up resistor. Connect the ERROR pin to ground if this function is not used. See applications section for more information.

Typical Application Circuits (Continued)

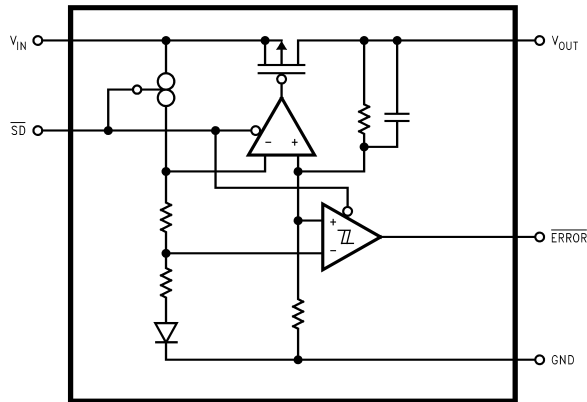


DS101 129-2

Minimum output capacitance is 10 F to ensure stability over full load current range. More capacitance provides superior dynamic performance and additional stability margin.

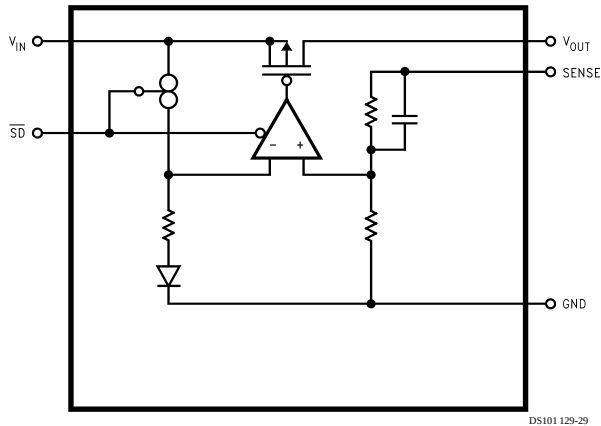
*SD and ERROR pins must be pulled high through a 10k W pull-up resistor. Connect the ERROR pin to ground if this function is not used. See applications section for more information.

Block Diagram LP3961

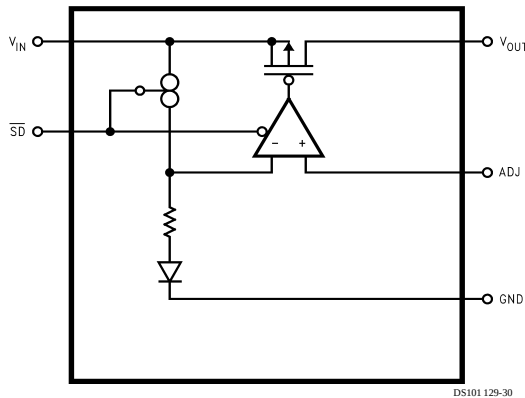


DS101 129-3

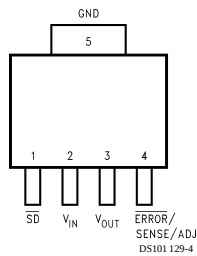
Block Diagram LP3964



Block Diagram LP3964-ADJ

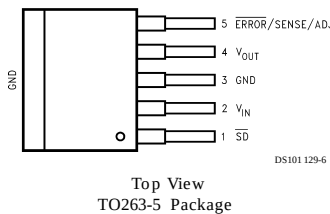
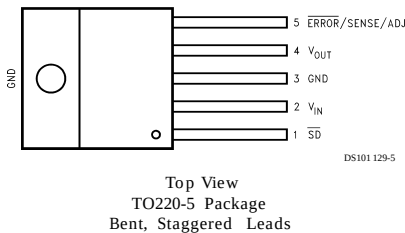


Connection Diagrams



Top View
SOT 223-5 Package

Connection Diagrams (Continued)



Pin Description for SOT223-5 Package

Pin #	LP3961		LP3964	
	Name	Function	Name	Function
1	$\overline{SD}$	Shutdown	$\overline{SD}$	Shutdown
2	V_{IN}	Input Supply	V_{IN}	Input Supply
3	V_{OUT}	Output Voltage	V_{OUT}	Output Voltage
4	$\overline{ERROR}$	ERROR Flag	SENSE / ADJ	Remote Sense Pin or output Adjust Pin
5	GND	Ground	GND	Ground

Pin Description for TO220-5 and TO263-5 Packages

Pin #	LP3961		LP3964	
	Name	Function	Name	Function
1	$\overline{SD}$	Shutdown	$\overline{SD}$	Shutdown
2	V_{IN}	Input Supply	V_{IN}	Input Supply
3	GND	Ground	GND	Ground
4	V_{OUT}	Output Voltage	V_{OUT}	Output Voltage
5	$\overline{ERROR}$	ERROR Flag	SENSE / ADJ	Remote Sense Pin or output Adjust Pin

DS90C387/DS90CF388

Dual Pixel LVDS Display Interface (LDI)-SVGA / QXGA

General Description

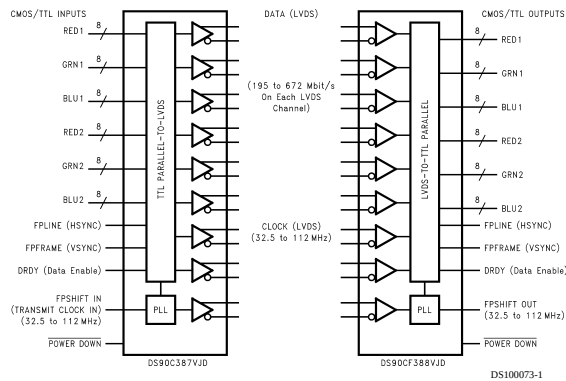
The DS90C387/DS90CF388 transmitter/receiver pair is designed to support dual pixel data transmission between Host and Flat Panel Display up to QXGA resolutions. The transmitter converts 48 bits (Dual Pixel 24-bit color) of CMOS/TTL data into 8 LVDS (Low Voltage Differential Signalling) data streams. Control signals (VSYNC, HSYNC, DE and two user-defined signals) are sent during blanking intervals. At a maximum dual pixel rate of 112MHz, LVDS data line speed is 672Mbps, providing a total throughput of 5.38Gbps (672 Megabytes per second). Two other modes are also supported. 24-bit color data (single pixel) can be clocked into the transmitter at a maximum rate of 170MHz. In this mode, the transmitter provides single-to-dual pixel conversion, and the output LVDS clock rate is 85MHz maximum. The third mode provides inter-operability with FPD-Link devices.

The LDI chipset is improved over prior generations of FPD-Link devices and offers higher bandwidth support and longer cable drive with three areas of enhancement. To increase bandwidth, the maximum pixel clock rate is increased to 112 (170) MHz and 8 serialized LVDS outputs are provided. Cable drive is enhanced with a user selectable pre-emphasis feature that provides additional output current during transitions to counteract cable loading effects. DC balancing on a cycle-to-cycle basis, is also provided to reduce ISI (Inter-Symbol Interference). With pre-emphasis and DC balancing, a low distortion eye-pattern is provided at the receiver end of the cable. A cable deskew capability has been added to deskew long cables of pair-to-pairskew of up to +/-1 LVDS data bit time (up to 80 MHz Clock Rate). These three enhancements allow cables 5 to 10+ meters in length to be driven. (Continued)

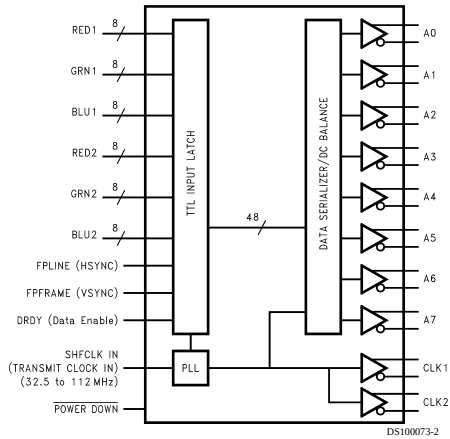
Features

- Complies with OpenLDI specification for digital display interfaces
- 32.5 to 112/170MHz clock support
- Supports SVGA through QXGA panel resolutions
- Drives long, low cost cables
- Up to 5.38Gbps bandwidth
- Pre-emphasis reduces cable loading effects
- DC balance data transmission provided by transmitter
- reduces ISI distortion
- Cable Deskew of +/-1 LVDS data bit time (up to 80 MHz Clock Rate) of pair-to-pairskew at receiver inputs; intra-pairskew tolerance of 300ps
- Dual pixel architecture supports interface to GUI and timing controller; optional single pixel transmitter inputs support single pixel GUI interface
- Transmitter rejects cycle-to-cycle jitter
- 5V tolerant on data and control input pins
- Programmable transmitter data and control strobe select (rising or falling edge strobe)
- Backward compatible configuration select with FPD-Link
- Optional second LVDS clock for backward compatibility w/FPD-Link
- Support for two additional user-defined control signals in DC Balanced mode
- Compatible with TIA/EIA LVDS Standard

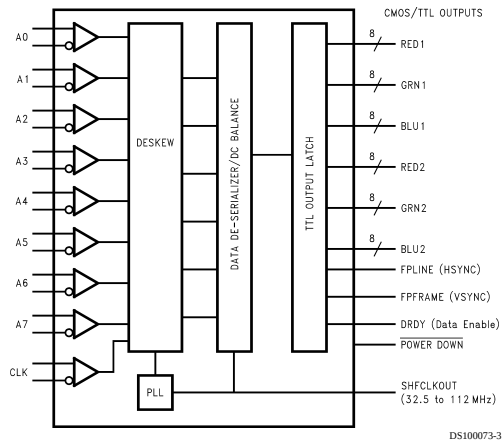
Generalized Block Diagram



Transmitter Block Diagram



Receiver Block Diagram



General Description (Continued)

This chipset is an ideal means to solve EMI and cable size problems for high-resolution flat panel applications. It provides a reliable interface based on LVDS technology that delivers the bandwidth needed for high-resolution panels while maximizing bit times, and keeping clock rates low to reduce EMI and shielding requirements. For more details, please refer to the TMApplication Information section of this datasheet.

Absolute Maximum Ratings (Note 1)

If Military /Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

Supply Voltage (V_{CC})	-0.3V to +4V
CMOS/TTLInput Voltage	-0.3V to +5.5V
CMOS/TTLOutput Voltage	-0.3V to (V_{CC} + 0.3V)
LVDS Receiver Input Voltage	-0.3V to +3.6V
LVDS DriverOutput Voltage	-0.3V to +3.6V
LVDS OutputShort Circuit Duration	Continuous
Junction Temperature	+150 C
Storage Temperature	-65 C to +150 C
Lead Temperature (Soldering, 4 sec.)	+260 C
MaximumPackage Power Dissipation Capacity @ 25 C	
100 TQFP Package:	
DS90C387	2.8W
DS90CF388	2.8W

Package Derating:

DS90C387	18.2mW / C above +25 C
DS90CF388	18.2mW / C above +25 C

ESD Rating:

DS90C387	
(HBM, 1.5kW, 100pF)	> 6 kV
(EIAJ, 0W, 200pF)	> 300 V
DS90CF388	
(HBM, 1.5kW, 100pF)	> 2 kV
(EIAJ, 0W, 200pF)	> 200 V

Recommended Operating Conditions

	Min	Nom	Max	Units
Supply Voltage (V_{CC})	3.0	3.3	3.6	V
Operating Free Air Temperature (T_A)	-10	+25	+70	C
Receiver InputRange	0		2.4	V
Supply Noise Voltage (V_{CC})			100	mV _{p-p}

Electrical Characteristics

Over recommended operating supply and temperature ranges unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
CMOS/TTLDC SPECIFICATIONS (Tx inputs, Rx outputs, control inputs and outputs)						
V_{IH}	High Level Input Voltage		2.0		5.0	V
V_{IL}	Low Level Input Voltage		GND		0.8	V
V_{OH}	High Level Output Voltage	$I_{OH} = -0.4$ mA	2.7	2.9		V
		$I_{OH} = -2$ mA	2.7	2.85		V
V_{OL}	Low Level Output Voltage	$I_{OL} = 2$ mA		0.1	0.3	V
V_{CL}	Input Clamp Voltage	$I_{CL} = -18$ mA		- 0.79	-1.5	V
I_{IN}	Input Current	$V_{IN} = 0.4V, 2.5V$ or V_{CC}		+1.8	+15	A
		$V_{IN} = GND$	-15	0		A
I_{OS}	Output Short Circuit Current	$V_{OUT} = 0V$			-120	mA
LVDS DRIVER DC SPECIFICATIONS						
V_{OD}	Differential Output Voltage	$R_L = 100$ W	250	345	450	mV
DV_{OD}	Change in V_{OD} between Complimentary Output States				35	mV
V_{OS}	Offset Voltage		1.125	1.25	1.375	V
DV_{OS}	Change in V_{OS} between Complimentary Output States				35	mV
I_{OS}	Output Short Circuit Current	$V_{OUT} = 0V, R_L = 100$ W		-3.5	-10	mA
I_{OZ}	Output TRI-STATE [®] Current	$\overline{PD} = 0V, V_{OUT} = 0V$ or V_{CC}		+/- 1	+/- 10	A
LVDS RECEIVER DC SPECIFICATIONS						
V_{TH}	Differential Input High Threshold	$V_{CM} = +1.2V$			+100	mV
V_{TL}	Differential Input Low Threshold		.100			mV
I_{IN}	Input Current	$V_{IN} = +2.4V, V_{CC} = 3.6V$			+/- 10	A
		$V_{IN} = 0V, V_{CC} = 3.6V$			+/- 10	A

Electrical Characteristics (Continued)

Over recommended operating supply and temperature ranges unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
TRANSMITTER SUPPLY CURRENT						
ICCTW	Transmitter Supply Current Worst Case	$R_L = 100\ \Omega$, $C_L = 5\ \text{pF}$, Worst Case Pattern (Figures 1, 3), DUAL=High (48-bit RGB), BAL=High (enabled)	f = 32.5 MHz	91.4	140	mA
			f = 65 MHz	106	160	mA
			f = 85 MHz	135	183	mA
			f = 112 MHz	155	210	mA
ICCTG	Transmitter Supply Current 16 Grayscale	$R_L = 100\ \Omega$, $C_L = 5\ \text{pF}$, 16 Grayscale Pattern (Figures 2, 3), DUAL=High (48-bit RGB), BAL=High (enabled)	f = 32.5 MHz	62.6	120	mA
			f = 65 MHz	84.4	130	mA
			f = 85 MHz	89.0	145	mA
			f = 112 MHz	94.5	155	mA
ICCTZ	Transmitter Supply Current Power Down	PD = Low Driver Outputs in TRI-STATE under Powerdown Mode		4.8	50	A
RECEIVER SUPPLY CURRENT						
ICCRW	Receiver Supply Current Worst Case	$C_L = 8\ \text{pF}$, Worst Case Pattern (Figures 1, 4), DUAL(48-bit RGB), BAL=High (enabled)	f = 32.5 MHz	115	150	mA
			f = 65 MHz	200	250	mA
			f = 85 MHz	240	275	mA
			f = 112 MHz	250	300	mA
ICCRG	Receiver Support Current 16 Grayscale	$C_L = 8\ \text{pF}$, 16 Grayscale Pattern (Figures 2, 4), DUAL(48-bit RGB), BAL=High (enabled)	f = 32.5 MHz	60	95	mA
			f = 65 MHz	95	125	mA
			f = 85 MHz	115	150	mA
			f = 112 MHz	150	270	mA
ICCRZ	Receiver Supply Current Power Down	PD = Low Receiver Outputs stay low during Powerdown mode.		255	300	A

Note 1: TMAbsolute Maximum Ratings are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the device should be operated at these limits. The tables of TMElectrical Characteristics specify conditions for device operation.

Note 2: Typical values are given for $V_{CC} = 3.3\text{V}$ and $T_A = +25\ ^\circ\text{C}$.

Note 3: Current into device pins is defined as positive. Current out of device pins is defined as negative. Voltages are referenced to ground unless otherwise specified (except V_{OD} and DV_{OD}).

LM-2596

SIMPLE SWITCHER Power Converter 150kHz 3A Step-Down Voltage Regulator

General Description

The LM2596 series of regulators are monolithic integrated circuits that provide all the active functions for a step-down (buck) switching regulator, capable of driving a 3A load with excellent line and load regulation. These devices are available in fixed output voltages of 3.3V, 5V, 12V, and an adjustable output version.

Requiring a minimum number of external components, these regulators are simple to use and include internal frequency compensation, and a fixed-frequency oscillator.

The LM2596 series operates at a switching frequency of 150 kHz thus allowing smaller sized filter components than what would be needed with lower frequency switching regulators. Available in a standard 5-lead TO-220 package with several different lead bend options, and a 5-lead TO-263 surface mount package.

A standard series of inductors are available from several different manufacturers optimized for use with the LM2596 series. This feature greatly simplifies the design of switch-mode power supplies.

Other features include a guaranteed $\pm 4\%$ tolerance on output voltage under specified input voltage and output load conditions, and $\pm 15\%$ on the oscillator frequency. External shutdown is included, featuring typically 80 μ A standby current. Self protection features include a two stage frequency reducing current limit for the output switch and an over temperature shutdown for complete protection under fault conditions.

Features

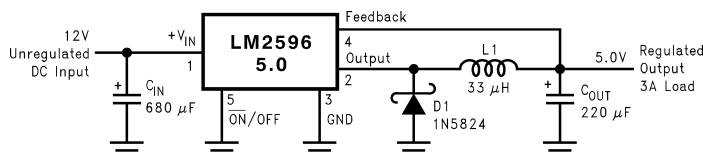
- 3.3V, 5V, 12V, and adjustable output versions
- Adjustable version output voltage range, 1.2V to 37V 4% max over line and load conditions
- Available in TO-220 and TO-263 packages
- Guaranteed 3A output load current
- Input voltage range up to 40V
- Requires only 4 external components
- Excellent line and load regulation specifications
- 150 kHz fixed frequency internal oscillator
- TTL shutdown capability
- Low power standby mode, I_Q typically 80 μ A
- High efficiency
- Uses readily available standard inductors
- Thermal shutdown and current limit protection

Applications

- Simple high-efficiency step-down (buck) regulator
- On-card switching regulators
- Positive to negative converter

Note: $\leq$ Patent Number 5,382,918.

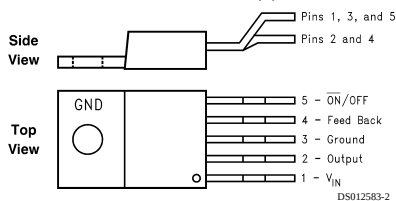
Typical Application (Fixed Output Voltage Versions)



Connection Diagrams and Ordering Information

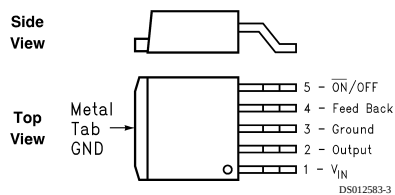
Bent and Staggered Leads, Through Hole

Package 5-Lead TO-220 (T)



Order Number LM2596T-3.3, LM2596T-5.0,
LM2596T-12 or LM2596T-ADJ
See NS Package Number T05D

Surface Mount Package 5-Lead TO-263 (S)



Order Number LM2596S-3.3, LM2596S-5.0,
LM2596S-12 or LM2596S-ADJ
See NS Package Number TS5B

Absolute Maximum Ratings (Note 1)

If Military / Aerospace specified devices are required, please contact the National Semiconductor Sales Office / Distributors for availability and specifications.

Maximum Supply Voltage	45V
ON / OFF Pin Input Voltage	-0.3 i ' V i ' +25V
Feedback Pin Voltage	-0.3 i ' V i ' +25V
Output Voltage to Ground (Steady State)	-1V
Power Dissipation	Internally limited
Storage Temperature Range	-65 C to +150 C
ESD Susceptibility	

Human Body Model (Note 2)

2 kV

Lead Temperature	
S Package	
Vapor Phase (60 sec.)	+215 C
Infrared (10 sec.)	+245 C
T Package (Soldering, 10 sec.)	+260 C
Maximum Junction Temperature	+150 C

Operating Conditions

Temperature Range	-40 C i T _j i +125 C
Supply Voltage	4.5V to 40V

LM2596-3.3
Electrical Characteristics

Specifications with standard type face are for T_j = 25 C and those with boldface type apply over full Operating Temperature Range

Symbol	Parameter	Conditions	LM2596-3.3		Units (Limits)
			Typ (Note 3)	Limit (Note 4)	
SYSTEM PARAMETERS (Note 5) Test Circuit <i>Figure 1</i>					
V _{OUT}	Output Voltage	4.75V i ⁻ V _{IN} i ⁻ 40V, 0.2A i ⁻ I _{LOAD} i ⁻ 3A	3.3	3.168/3.135 3.432/3.465	V V(min) V(max)
h	Efficiency	V _{IN} = 12V, I _{LOAD} = 3A	73		%

LM2596-5.0
Electrical Characteristics

Specifications with standard type face are for T_j = 25 C and those with boldface type apply over full Operating Temperature Range

Symbol	Parameter	Conditions	LM2596-5.0		Units (Limits)
			Typ (Note 3)	Limit (Note 4)	
SYSTEM PARAMETERS (Note 5) Test Circuit <i>Figure 1</i>					
V _{OUT}	Output Voltage	7V ≤ V _{IN} ≤ 40V, 0.2A ≤ I _{LOAD} ≤ 3A	5.0	4.800/4.750 5.200/5.250	V V(min) V(max)
h	Efficiency	V _{IN} = 12V, I _{LOAD} = 3A	80		%

LM2596-12
Electrical Characteristics

Specifications with standard type face are for T_j = 25 C, and those with boldface type apply over full Operating Temperature Range

Symbol	Parameter	Conditions	LM2596-12		Units (Limits)
			Typ (Note 3)	Limit (Note 4)	
SYSTEM PARAMETERS (Note 5) Test Circuit <i>Figure 1</i>					
V _{OUT}	Output Voltage	15V ≤ V _{IN} ≤ 40V, 0.2A ≤ I _{LOAD} ≤ 3A	12.0	11.52/11.40 12.48/12.60	V V(min) V(max)
h	Efficiency	V _{IN} = 12V, I _{LOAD} = 3A	90		%

LM2596-ADJ

Electrical Characteristics

Specifications with standard type face are for $T_j = 25^\circ\text{C}$, and those with boldface type apply over full Operating Temperature Range.

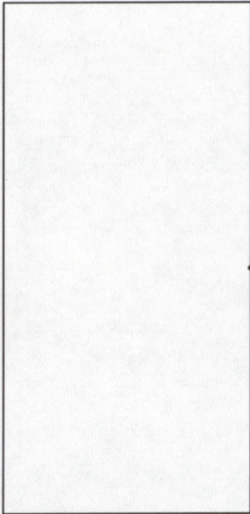
Symbol	Parameter	Conditions	LM2596-ADJ		Units (Limits)
			Typ (Note 3)	Limit (Note 4)	
SYSTEM PARAMETERS (Note 5) Test Circuit <i>Figure 1</i>					
V _{FB}	Feedback Voltage	4.5V i ´ V _{IN} i ´ 40V, 0.2A i ´ I _{LOAD} i 3A V _{OUT} programmed for 3V. Circuit of <i>Figure 1</i>	1.230	1.193/1.180 1.267/1.280	V V(min) V(max)
h	Efficiency	V _{IN} = 12V, V _{OUT} = 3V, I _{LOAD} = 3A	73		%

All Output Voltage Versions Electrical Characteristics

Specifications with standard type face are for $T_j = 25^\circ\text{C}$, and those with boldface type apply over full Operating Temperature Range. Unless otherwise specified, $V_{IN} = 12V$ for the 3.3V, 5V, and Adjustable version and $V_{IN} = 24V$ for the 12V version. $I_{LOAD} = 500\text{ mA}$

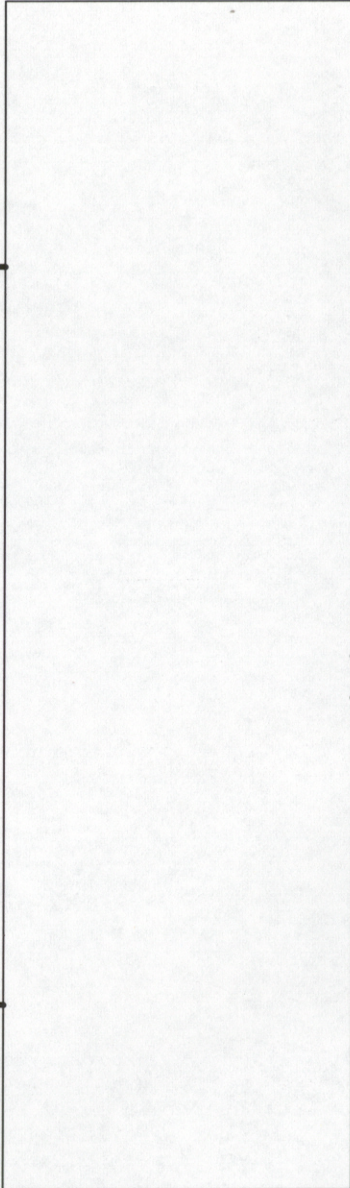
Symbol	Parameter	Conditions	LM2596-XX		Units (Limits)
			Typ (Note 3)	Limit (Note 4)	
DEVICE PARAMETERS					
I _b	Feedback Bias Current	Adjustable Version Only, V _{FB} = 1.3V	10	50/100	nA nA (max)
f _O	Oscillator Frequency	(Note 6)	150	127/110 173/173	kHz kHz(min) kHz(max)
V _{SAT}	Saturation Voltage	I _{OUT} = 3A (Notes 7, 8)	1.16	1.4/1.5	V V(max)
DC	Max Duty Cycle (ON) Min Duty Cycle (OFF)	(Note 8) (Note 9)	100 0		%
I _{CL}	Current Limit	Peak Current (Notes 7, 8)	4.5	3.6/3.4 6.9/7.5	A A(min) A(max)
I _L	Output Leakage Current	Output = 0V (Notes 7, 9)		50	A(max)
		Output = .1V (Note 10)	2	30	mA mA(max)
I _Q	Quiescent Current	(Note 9)	5	10	mA mA(max)
I _{STBY}	Standby Quiescent Current	ON / OFF pin = 5V (OFF) (Note 10)	80	200/250	A A(max)
q _{JC}	Thermal Resistance	TO-220 or TO-263 Package, Junction to Case	2		C / W
q _{JA}		TO-220 Package, Junction to Ambient (Note 11)	50		C / W
q _{JA}		TO-263 Package, Junction to Ambient (Note 12)	50		C / W
q _{JA}		TO-263 Package, Junction to Ambient (Note 13)	30		C / W
q _{JA}		TO-263 Package, Junction to Ambient (Note 14)	20		C / W
ON / OFF CONTROL Test Circuit <i>Figure 1</i>					
V _{IH} V _{IL}	ON / OFF Pin Logic Input Threshold Voltage	Low (Regulator ON) High (Regulator OFF)	1.3	0.6 2.0	V V(max) V(min)

Sheet 3_2



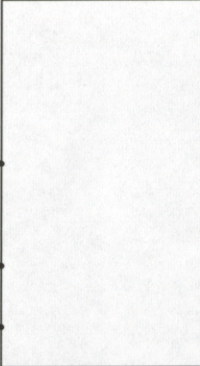
1. Input Connectors

Sheet 6_4



4. gm5020

Sheet 7_4



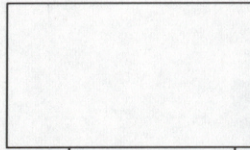
LCD PANEL

LCD Lamp

LCD Lamp

DC / AC INVERTER

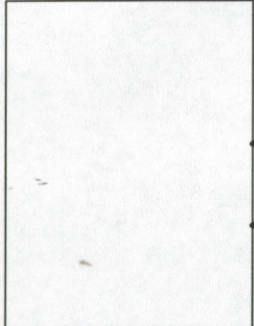
Sheet 8_2



6. USB

12MHz

Sheet 5_2



3. MCU

16MHz

Sheet 4_20



2. Power Adaptor

5V REG

3.3V REG

2.5V REG

MCU

Image Quest Co., Ltd.

L70A / BLOCK

Title

Size
A

Document Number
<Doc>

Rev
A

Date: Wednesday, September 05, 2001

Sheet 2 of 8

MAIN BOARD

NUM.	LOCATION	PART NUMBER	DESCRIPTION	REMARK
1	BD801	3540800044	COR-CHP,HH-1M2012-600JT	
2	BD802	3540800044	COR-CHP,HH-1M2012-600JT	
3	BD804	3540800044	COR-CHP,HH-1M2012-600JT	
4	BD805	3540800013	COR-CHP,HH-1M3216-601	
5	BD806	3540800013	COR-CHP,HH-1M3216-601	
6	BD807	3540800012	COR-CHP,HB-1M2012-102JT	
7	BD809	3540800013	COR-CHP,HH-1M3216-601	
8	BD810	3540800013	COR-CHP,HH-1M3216-601	
9	BD811	3540800013	COR-CHP,HH-1M3216-601	
10	BD812	3540800013	COR-CHP,HH-1M3216-601	
11	BD817	3540800013	COR-CHP,HH-1M3216-601	
12	BD818	3540800013	COR-CHP,HH-1M3216-601	
13	C300	2121030029	CAP-C-C,0.01UF 50V K X7R	
14	C301	2121030029	CAP-C-C,0.01UF 50V K X7R	
15	C302	2121030029	CAP-C-C,0.01UF 50V K X7R	
16	C303	2121030029	CAP-C-C,0.01UF 50V K X7R	
17	C304	2121030029	CAP-C-C,0.01UF 50V K X7R	
18	C305	2121030029	CAP-C-C,0.01UF 50V K X7R	
19	C306	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
20	C307	E4001020808J	CAP,CHIP 50V 47PF J 1608	
21	C309	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
22	C400	2012210007	CAP-AL-C,220UF 25V M 1010	
23	C402	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
24	C404	2012210007	CAP-AL-C,220UF 25V M 1010	
25	C405	2012210007	CAP-AL-C,220UF 25V M 1010	
26	C406	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
27	C407	2014700009	CAP-AL-C,47UF 16V M 6352	
28	C408	2014700009	CAP-AL-C,47UF 16V M 6352	
29	C412	2121020033	CAP-C-C,1000PF 50V J C0G	
30	C413	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
31	C414	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
32	C421	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
33	C424	2012200005	CAP-AL-C,22UF 16V M 5052	
34	C425	2012200005	CAP-AL-C,22UF 16V M 5052	
35	C426	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
36	C427	2012200005	CAP-AL-C,22UF 16V M 5052	
37	C428	2012200005	CAP-AL-C,22UF 16V M 5052	
38	C429	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
39	C432	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
40	C435	2012200005	CAP-AL-C,22UF 16V M 5052	
41	C436	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
42	C437	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
43	C438	2012200005	CAP-AL-C,22UF 16V M 5052	
44	C500	2012200005	CAP-AL-C,22UF 16V M 5052	
45	C501	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
46	C502	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	

NUM.	LOCATION	PART NUMBER	DESCRIPTION	REMARK
47	C503	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
48	C504	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
49	C505	CC7FCA1H180J	CAP-CC,18PF 50V J C0G 160	
50	C506	CC7FCA1H180J	CAP-CC,18PF 50V J C0G 160	
51	C507	201109000401	CAP-AL-C,1UF 50V M 4052	
52	C508	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
53	C509	2011000006	CAP-AL-C,10UF 16V M 4052	
54	C511	2121020033	CAP-C-C,1000PF 50V J C0G	
55	C512	2121020033	CAP-C-C,1000PF 50V J C0G	
56	C513	2121020033	CAP-C-C,1000PF 50V J C0G	
57	C514	2121020033	CAP-C-C,1000PF 50V J C0G	
58	C515	2121020033	CAP-C-C,1000PF 50V J C0G	
59	C516	2121020033	CAP-C-C,1000PF 50V J C0G	
60	C517	2121020033	CAP-C-C,1000PF 50V J C0G	
61	C519	2121020033	CAP-C-C,1000PF 50V J C0G	
62	C522	2121020033	CAP-C-C,1000PF 50V J C0G	
63	C523	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
64	C524	2012210007	CAP-AL-C,220UF 25V M 1010	
65	C600	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
66	C601	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
67	C602	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
68	C603	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
69	C604	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
70	C605	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
71	C606	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
72	C607	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
73	C608	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
74	C609	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
75	C610	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
76	C611	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
77	C612	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
78	C613	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
79	C614	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
80	C615	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
81	C616	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
82	C617	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
83	C618	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
84	C619	2012200005	CAP-AL-C,22UF 16V M 5052	
85	C620	2012200005	CAP-AL-C,22UF 16V M 5052	
86	C621	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
87	C622	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
88	C623	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
89	C624	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
90	C625	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
91	C626	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
92	C627	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
93	C628	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
94	C629	CC7FCA1H221J	CAP CER CP 220P 50V J 060	

NUM.	LOCATION	PART NUMBER	DESCRIPTION	REMARK
95	C630	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
96	C631	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
97	C632	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
98	C633	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
99	C634	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
100	C635	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
101	C636	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
102	C638	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
103	C639	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
104	C640	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
105	C641	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
106	C642	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
107	C643	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
108	C644	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
109	C645	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
110	C647	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
111	C648	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
112	C649	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
113	C650	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
114	C651	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
115	C652	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
116	C653	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
117	C654	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
118	C655	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
119	C656	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
120	C658	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
121	C659	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
122	C660	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
123	C661	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
124	C662	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
125	C663	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
126	C664	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
127	C665	CC7FCA1H221J	CAP CER CP 220P 50V J 060	
128	C666	2012200005	CAP-AL-C,22UF 16V M 5052	
129	C667	2012200005	CAP-AL-C,22UF 16V M 5052	
130	C668	2012200005	CAP-AL-C,22UF 16V M 5052	
131	C674	2125090017	CAP-C-C,5PF 50V J C0G 160	
132	C675	2125090017	CAP-C-C,5PF 50V J C0G 160	
133	C701	2012200005	CAP-AL-C,22UF 16V M 5052	
134	C702	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
135	C703	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
136	C704	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
137	C705	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
138	C706	2012200005	CAP-AL-C,22UF 16V M 5052	
139	C707	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
140	C708	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
141	C709	2012200005	CAP-AL-C,22UF 16V M 5052	
142	C710	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	

NUM.	LOCATION	PART NUMBER	DESCRIPTION	REMARK
143	C711	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
144	C712	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
145	C718	2011010014	CAP-AL-C,100UF 16V M 6357	
146	C780	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
147	C781	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
148	C782	2011010014	CAP-AL-C,100UF 16V M 6357	
149	C801	E4001020808J	CAP,CHIP 50V 47PF J 1608	
150	C802	E4001020808J	CAP,CHIP 50V 47PF J 1608	
151	C803	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
152	C804	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
153	C807	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
154	C809	CC7FCA1H180J	CAP-CC,18PF 50V J C0G 160	
155	C810	CC7FCA1H180J	CAP-CC,18PF 50V J C0G 160	
156	C811	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
157	C812	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
158	C813	2121040045	CAP-C-C,0.1UF 50V Z Y5V 1	
159	C814	2011010014	CAP-AL-C,100UF 16V M 6357	
160	C815	2012210005	CAP-AL-C,220UF 6.3V M 635	
161	C816	2012210005	CAP-AL-C,220UF 6.3V M 635	
162	C819	E4001020808J	CAP,CHIP 50V 47PF J 1608	
163	C820	E4001020808J	CAP,CHIP 50V 47PF J 1608	
164	C821	E4001020808J	CAP,CHIP 50V 47PF J 1608	
165	C822	E4001020808J	CAP,CHIP 50V 47PF J 1608	
166	CN300	E4204307601A	CONN,D-SUB 15P FEMALE STI	
167	CN301	3721101228	CONN-F,DVI FEMALE RIGHT A	
168	CN400	3721101229	CONN-F,DC PWR JACK DJ-023	
169	CN501	372010139001	CONN-M,SMAW200-08P	
170	CN502	372010138801	CONN-M,SMAW200-06P	
171	CN701	3720101983	CONN-M,12507WR-30A00 30	
172	CN801	372110108601	CONN-F,USB A -TYPE 4	
173	CN805	3721101087	CONN-F,USB B-TYPE 2	
174	D301	3101000376	DI-ZN,Z02W6.2V SMD	
175	D302	3101000376	DI-ZN,Z02W6.2V SMD	
176	D303	3101000376	DI-ZN,Z02W6.2V SMD	
177	D304	3101000376	DI-ZN,Z02W6.2V SMD	
178	D305	3101000376	DI-ZN,Z02W6.2V SMD	
179	D306	3101000376	DI-ZN,Z02W6.2V SMD	
180	D307	DTRLS4148	DIODE,CHIP S/W RLS4148	
181	D308	DTRLS4148	DIODE,CHIP S/W RLS4148	
182	D310	DTRLS4148	DIODE,CHIP S/W RLS4148	
183	D311	3100100038	DI-AR,KDS226 SMD	
184	D312	3100100038	DI-AR,KDS226 SMD	
185	D313	3100100038	DI-AR,KDS226 SMD	
186	D400	3104100121	DI-SCHOT,MBRS340 SMD	
187	D502	DTRLS4148	DIODE,CHIP S/W RLS4148	
188	F400	3701200150	SW-SENSTI,RGE400 16V 100A	
189	FB501	3540800038	COR-CHP,HB-1M1608-601-JT	
190	FB502	3540800038	COR-CHP,HB-1M1608-601-JT	

NUM.	LOCATION	PART NUMBER	DESCRIPTION	REMARK
191	FB503	3540800038	COR-CHP,HB-1M1608-601-JT	
192	FB504	3540800038	COR-CHP,HB-1M1608-601-JT	
193	FB701	3540800044	COR-CHP,HH-1M2012-600JT	
194	FB703	3540800044	COR-CHP,HH-1M2012-600JT	
195	FB704	3540800044	COR-CHP,HH-1M2012-600JT	
196	L400	3500101731	INDUCT-FIX,DHA1206-33U3 K	
197	L701	2600008008	RES-C,0 0.125W J 3216	
198	Q501	TT2N3904D	TR,SMD 2N3904D TAPPING	
199	R300	RK1JC0T0101J	RES-C,100 0.063W J 1608	
200	R301	RK1JC0T0101J	RES-C,100 0.063W J 1608	
201	R302	RK1JC0T0101J	RES-C,100 0.063W J 1608	
202	R303	RK1JC0T0101J	RES-C,100 0.063W J 1608	
203	R304	RK1JC0T0101J	RES-C,100 0.063W J 1608	
204	R305	RK1JC0T0101J	RES-C,100 0.063W J 1608	
205	R306	2607509010	RES-C,75 0.063W F 1608	
206	R307	2607509010	RES-C,75 0.063W F 1608	
207	R308	2607509010	RES-C,75 0.063W F 1608	
208	R310	RK1JC0T0473J	RES-C,47K 0.063W J 1608	
209	R311	RK1JC0T0473J	RES-C,47K 0.063W J 1608	
210	R312	RK1JC0T0101J	RES-C,100 0.063W J 1608	
211	R313	RK1JC0T0101J	RES-C,100 0.063W J 1608	
212	R314	RK1JC0T0220J	RES-C,22 0.063W J 1608	
213	R315	RK1JC0T0220J	RES-C,22 0.063W J 1608	
214	R318	RK1JC0T0473J	RES-C,47K 0.063W J 1608	
215	R319	RK1JC0T0473J	RES-C,47K 0.063W J 1608	
216	R320	RK1JC0T0101J	RES-C,100 0.063W J 1608	
217	R321	RK1JC0T0101J	RES-C,100 0.063W J 1608	
218	R322	RK1JC0T0103J	RES-C,10K 0.063W J 1608	
219	R323	RK1JC0T0473J	RES-C,47K 0.063W J 1608	
220	R330	RK1JC0T0000J	RES-C,0 0.063W J 1608	
221	R331	RK1JC0T0000J	RES-C,0 0.063W J 1608	
222	R401	RK1JC0T0103J	RES-C,10K 0.063W J 1608	
223	R500	RK1JC0T0103J	RES-C,10K 0.063W J 1608	
224	R501	RK1JC0T0103J	RES-C,10K 0.063W J 1608	
225	R502	RK1JC0T0102J	RES-C,1K 0.063W J 1608	
226	R504	RK1JC0T0331J	RES CHIP 330 5% 1/16W	
227	R505	RK1JC0T0331J	RES CHIP 330 5% 1/16W	
228	R510	RK1JC0T0471J	RES-C,470 0.063W J 1608	
229	R511	RK1JC0T0103J	RES-C,10K 0.063W J 1608	
230	R512	RK1JC0T0103J	RES-C,10K 0.063W J 1608	
231	R513	RK1JC0T0103J	RES-C,10K 0.063W J 1608	
232	R520	RK1JC0T0471J	RES-C,470 0.063W J 1608	
233	R521	RK1JC0T0102J	RES-C,1K 0.063W J 1608	
234	R522	RK1JC0T0102J	RES-C,1K 0.063W J 1608	
235	R523	RK1JC0T0102J	RES-C,1K 0.063W J 1608	
236	R524	RK1JC0T0102J	RES-C,1K 0.063W J 1608	
237	R525	RK1JC0T0102J	RES-C,1K 0.063W J 1608	
238	R526	RK1JC0T0102J	RES-C,1K 0.063W J 1608	

NUM.	LOCATION	PART NUMBER	DESCRIPTION	REMARK
239	R527	RK1JC0T0102J	RES-C,1K 0.063W J 1608	
240	R528	RK1JC0T0102J	RES-C,1K 0.063W J 1608	
241	R530	RK1JC0T0102J	RES-C,1K 0.063W J 1608	
242	R531	RK1JC0T0472J	RES CHIP 4.7K 5% 1/16W	
243	R533	RK1JC0T0103J	RES-C,10K 0.063W J 1608	
244	R534	RK1JC0T0103J	RES-C,10K 0.063W J 1608	
245	R535	RK1JC0T0103J	RES-C,10K 0.063W J 1608	
246	R536	RK1JC0T0103J	RES-C,10K 0.063W J 1608	
247	R540	RK1JC0T0000J	RES-C,0 0.063W J 1608	
248	R541	RK1JC0T0000J	RES-C,0 0.063W J 1608	
249	R542	RK1JC0T0000J	RES-C,0 0.063W J 1608	
250	R543	RK1JC0T0000J	RES-C,0 0.063W J 1608	
251	R544	RK1JC0T0000J	RES-C,0 0.063W J 1608	
252	R545	RK1JC0T0000J	RES-C,0 0.063W J 1608	
253	R546	RK1JC0T0000J	RES-C,0 0.063W J 1608	
254	R547	RK1JC0T0000J	RES-C,0 0.063W J 1608	
255	R600	2601001019	RES-C,1K 0.063W F 1608	
256	R601	RK1JC0T0000J	RES-C,0 0.063W J 1608	
257	R602	RK1JC0T0000J	RES-C,0 0.063W J 1608	
258	R619	RK1JC0T0101J	RES-C,100 0.063W J 1608	
259	R620	RK1JC0T0101J	RES-C,100 0.063W J 1608	
260	R621	RK1JC0T0101J	RES-C,100 0.063W J 1608	
261	R622	RK1JC0T0101J	RES-C,100 0.063W J 1608	
262	R681	RK1JC0T0222J	RES CHIP 2.2K 5% 0.063W	
263	R683	RK1JC0T0103J	RES-C,10K 0.063W J 1608	
264	R685	RK1JC0T0100J	RES-C,10 0.063W J 1608	
265	R701	RK1JC0T0220J	RES-C,22 0.063W J 1608	
266	R702	RK1JC0T0220J	RES-C,22 0.063W J 1608	
267	R703	RK1JC0T0220J	RES-C,22 0.063W J 1608	
268	R704	RK1JC0T0220J	RES-C,22 0.063W J 1608	
269	R709	RK1JC0T0472J	RES CHIP 4.7K 5% 1/16W	
270	R710	RK1JC0T0103J	RES-C,10K 0.063W J 1608	
271	R711	RK1JC0T0103J	RES-C,10K 0.063W J 1608	
272	R801	RK1JC0T0152J	RES-C,1.5K 0.063W J 1608	
273	R802	2603909011	RES-C,39 0.063W J 1608	
274	R803	2603909011	RES-C,39 0.063W J 1608	
275	R804	RK1JC0T0103J	RES-C,10K 0.063W J 1608	
276	R805	RK1JC0T0102J	RES-C,1K 0.063W J 1608	
277	R806	RK1JC0T0102J	RES-C,1K 0.063W J 1608	
278	R807	RK1JC0T0472J	RES CHIP 4.7K 5% 1/16W	
279	R808	RK1JC0T0472J	RES CHIP 4.7K 5% 1/16W	
280	R819	RK1JC0T0153J	RES-C,15K 0.063W J 1608	
281	R820	RK1JC0T0153J	RES-C,15K 0.063W J 1608	
282	R821	RK1JC0T0153J	RES-C,15K 0.063W J 1608	
283	R822	RK1JC0T0153J	RES-C,15K 0.063W J 1608	
284	R823	RK1JC0T0153J	RES-C,15K 0.063W J 1608	
285	R824	RK1JC0T0153J	RES-C,15K 0.063W J 1608	
286	R825	RK1JC0T0153J	RES-C,15K 0.063W J 1608	

NUM.	LOCATION	PART NUMBER	DESCRIPTION	REMARK
287	R826	RK1JC0T0153J	RES-C,15K 0.063W J 1608	
288	R828	RK1JC0T0105J	RES-C,1M 0.063W J 1608	
289	R829	RK1JC0T0472J	RES CHIP 4.7K 5% 1/16W	
290	R835	RK1JC0T0103J	RES-C,10K 0.063W J 1608	
291	R836	RK1JC0T0103J	RES-C,10K 0.063W J 1608	
292	RN701	2591002009	RES-C-NET,10K 0.063W J 32	
293	RN702	2591002009	RES-C-NET,10K 0.063W J 32	
294	RN703	2591002009	RES-C-NET,10K 0.063W J 32	
295	U300	3203000745	IC-MEMO,24LC211/SN S0I	
296	U301	3203000745	IC-MEMO,24LC211/SN S0I	
297	U302	3202001505	IC-TTL,74LCX14M14A S0I	
298	U400	3200001278	IC-LIN,LM2596S-5.0 T02	
299	U401	3200001538	IC-LIN,LP3961/EMP-2.5 S0T	
300	U402	3200001392	IC-LIN,RC1117-3.3 S0T	
301	U403	3200001462	IC-LIN,RC1117ST-2.5 S0T	
302	U404	3200001392	IC-LIN,RC1117-3.3 S0T	
303	U500	3203000907	IC-MEMO,AT24C04N-10SC-2.7	
304	U501	3205001365	IC-U,M6759 LCC MTP	
305	U501	3721100621	CONN-F,PLL-44-PPS-T-M 44	
306	U502	3200001478	IC-LIN,KIA7042AF S0T	
307	U600	3205001383	IC-U,GM5020 BGA SCALER CH	
308	U701	3202001509	IC-TTL,DS90C387AVJD	
309	U704	3114000127	FET,SI4435DY SMD	
310	U801	3200001521	IC-LIN,AU9254 S0P	
311	U802	320000127901	IC-LIN,MIC2026-2BM	
312	X500	3530200591	VIB-QUARTZ,SMD-16MHZ 18PF	
313	X600	3530200573	VIB-QUARTZ,SMD 20MHZ 18PF	
314	Y801	3530200537	VIB-QUARTZ,SX-1 12MHZ SMD	

Miscellaneous

NUM.	LOCATION	PART NUMBER	DESCRIPTION	REMARK
1		3010700778	OSD B/D ASSY,L701	
2		3041001038	PCB-DOUBLE,L701/HMO MAIN	
3		3330500229	LCD,17",HT17E11-200	
4		3610200099	PWR-LIN-SPPLY,AD4512(0)	
5		3610400245	INVERTER,SIC1802	
6		3725005203	CONN-A,INVERTER CABLE L70	
7		3725005211	CONN-A,LVDS CBL HYDIS PAN	
8		3758000200	CBL-PWR,MW WALL 1.8MT EUR	
9		3758500425	CBL-SGN,7PAI 1.5M 2C MW S	
10		5004000187	SCR-TT2,BIN(+) MC 4*14	
11		5004000191	SCR-TT,BIN + MC 3*12	
12		5004000192	SCR-TT,BIN + MC 3*6	
13		5004000198	SCR-TT,WAP + MC 3X10	
14		6101218300	MAIN FRAME ASSY,L70A	
15		6101218400	MAIN FRAME,L70A	
16		6101218500	STAND FRAME,L70A	
17		6105205900	BASE METAL,L70A	
18		6110275600	BKT SHIELD,L70A	
19		6110275700	HINGE SUPPORTER,L70A	
20		6115023500	HINGE TILT,L70A	
21		6115023600	HINGE SWIVEL,L70A	
22		6120037205	SHLD-PLTAPE,L70A(100X100)	
23		6120051200	FRAME SHIELD,L70A	
24		6120051300	HINGE PLATE,L70A	
25		6128010126	GASKET EMI,L70A(15X6X380)	
26		6128010127	GASKET EMI,L70A(10X20X120)	
27		6128010128	GASKET EMI,L70A(8X10X40)	
28		6128010129	WIREET EMI,L70A(20X20X45)	
29		6130020306	PEM(H=7.0),L70A	
30		6130020307	PEM(H=13.0),L70A	
31		6130020305	PEM(H=22.2),L70A	
32		6201298200	COVER FRONT ASSY,L70A	
33		6201298300	COVER FRONT,L701	
34		6201298400	COVER REAR,L70A	
35		6201298800	STAND ASSY,L70A	
36		6201298900	STAND COVER,L70A	
37		6201299000	HINGE COVER,L70A	
38		6201299100	HINGE MOLD,L70A	
39		6201299200	HINGE RING,L70A	
40		6215237500	KNOB POWER,L701	
41		6215237600	KNOB CONTROL,L701	
42		6220085000	LENS LED,L701	
43		6223066800	HOLDER,HANDLE TOP	
44		6223066900	HOLDER,HANDLE BOTTOM	
45		6242027803	SHEET PROTECT TAPE,L70A	
46		6243028300	BAG,PE(ST) CLEAR 14"/15"A	

NUM.	LOCATION	PART NUMBER	DESCRIPTION	REMARK
47		6253114900	CUSHION "L",L70A	
48		6253115000	CUSHION "R",L70A	
49		6261043900	RUBBER FOOT,L70A	
50		6301168200	BOX INNER,HLM-1400	
51		6301190600	BOX CTN,SW-3 L70A	
52		375850041101	CBL-SGN,USB A+B CABLE 153	
53		B4209501301C	BAG PE,MANUAL TO.03	
54		B4210328801	PACKING ASSY,L70A	
55		B4210328901	LCD MEC,ASSY,L70A	
56		B4210329001	KIT COVER,L70A	
57		B4210329101	MAIN MODULE ASSY,L70A	
58		B4214000701A	SPRING COM	
59		E4205017802	MAIN ASSY/E,L70A	
60		E4208420012	PCBA MA(A1*)/E,L70A	
61		E4208520002	PCBA MA(I1*)/E,L70A	
62		E4208620002	PCBA MA(T1*)/E,L70A	
63		M11144012014	SCREW,BIN(+)M4*P0.7*12 MI	
64		M11183010012	SCREW,M/WAS(+) 3*10,MSZPC	

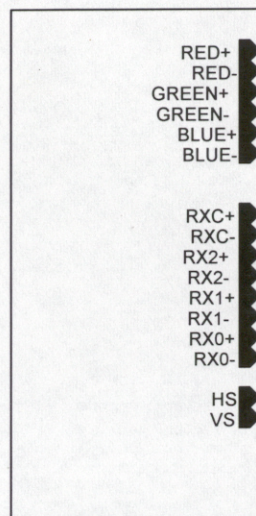
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L70A Dual Schematic.																											
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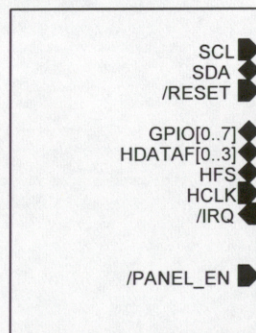
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Sheet 3



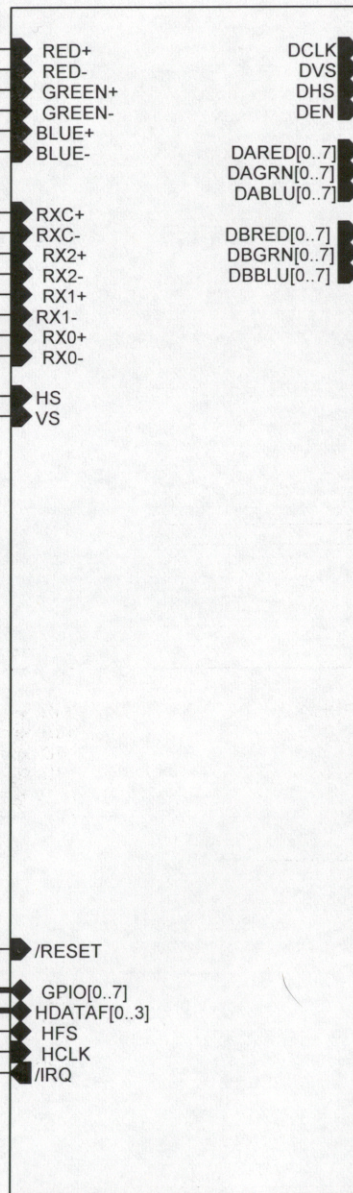
1. Input Connectors

Sheet 5



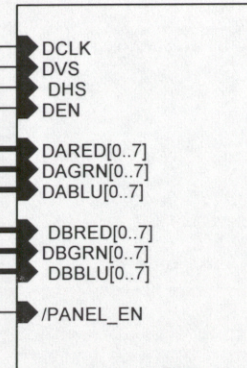
3. MCU

Sheet 6



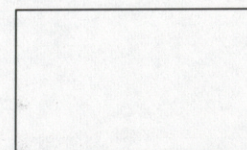
4. gm5020

Sheet 7



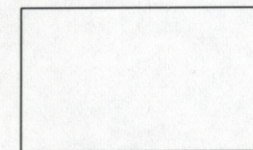
5. Display

Sheet 4



2. Power

Sheet 8



6. USB

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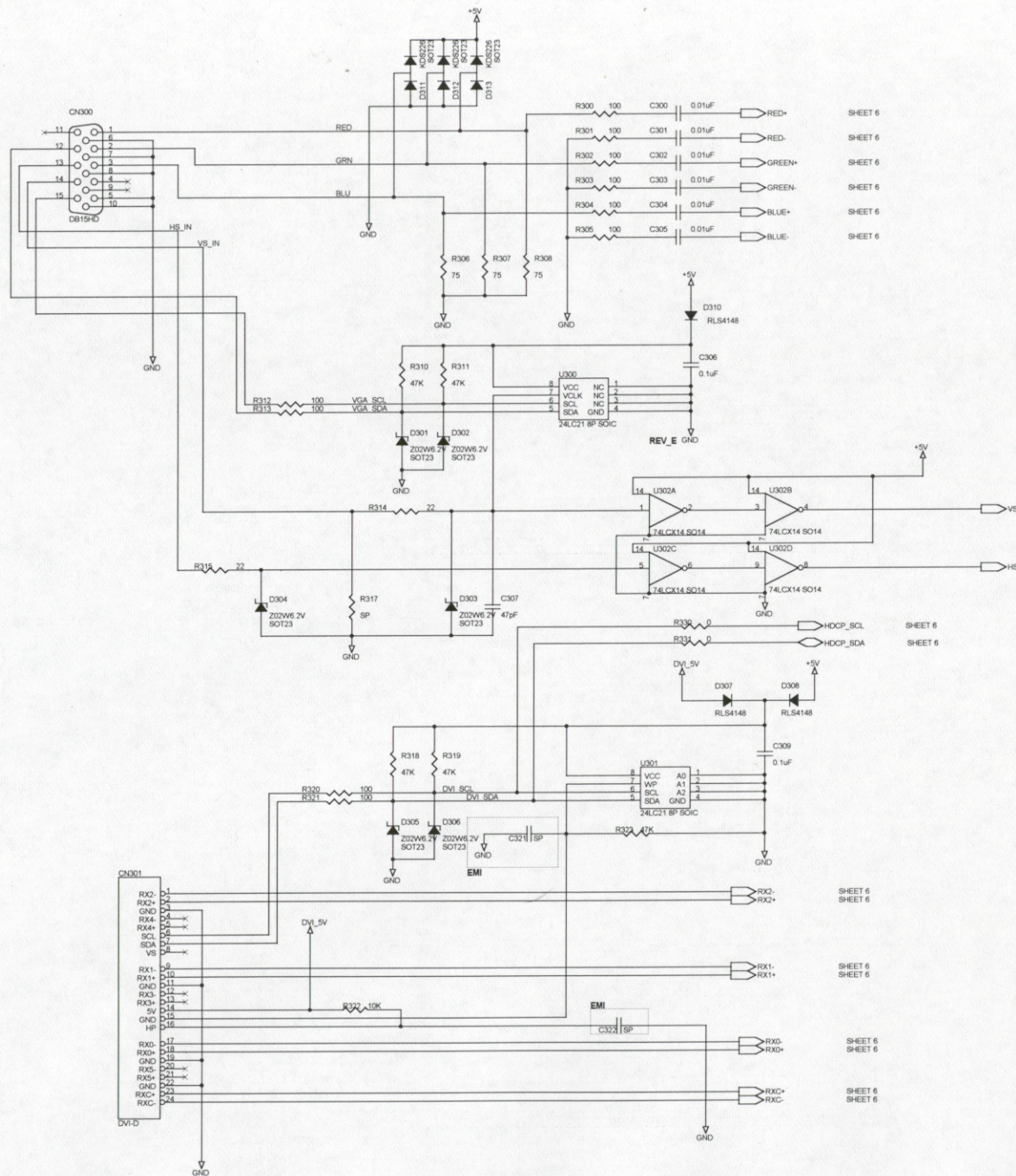
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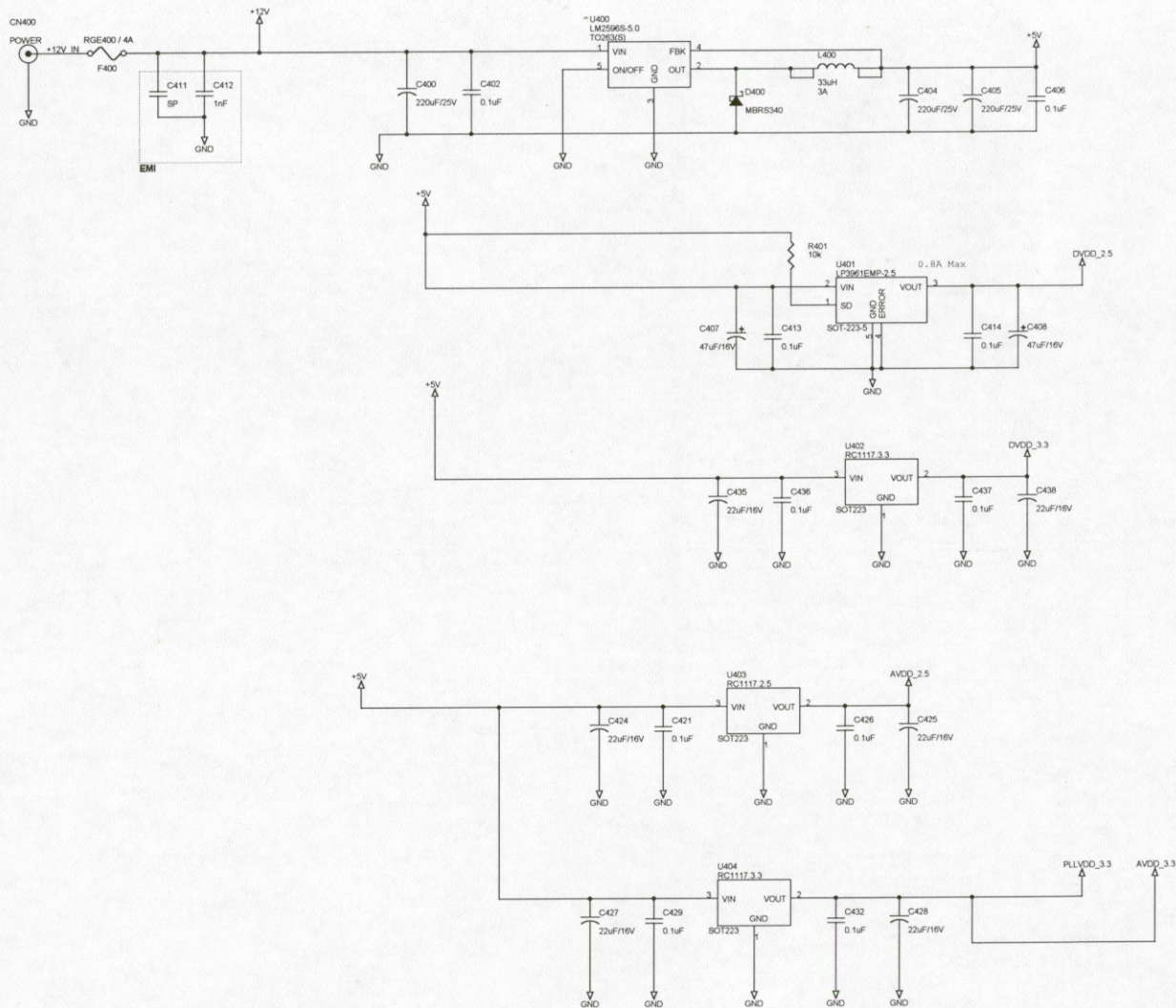
L70A / Top Level

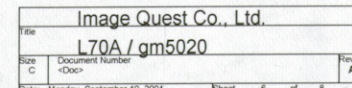
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<Doc>Rev
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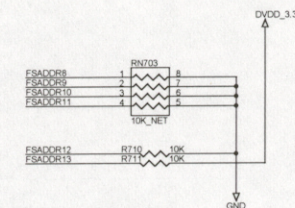
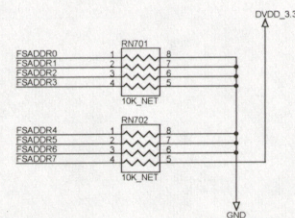
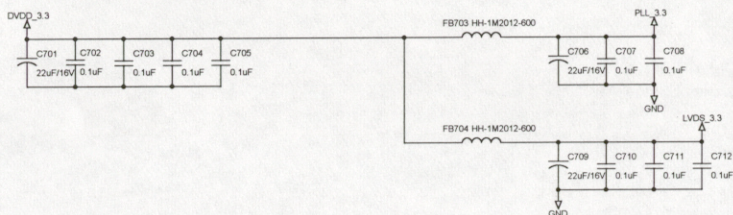
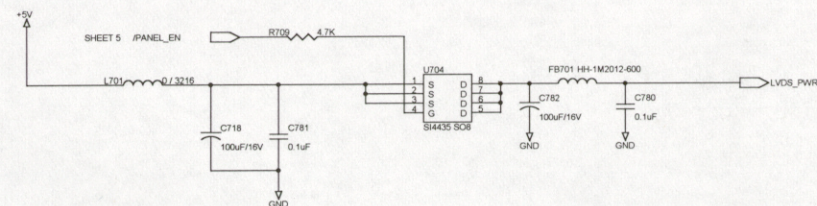
Date: Monday, September 10, 2001

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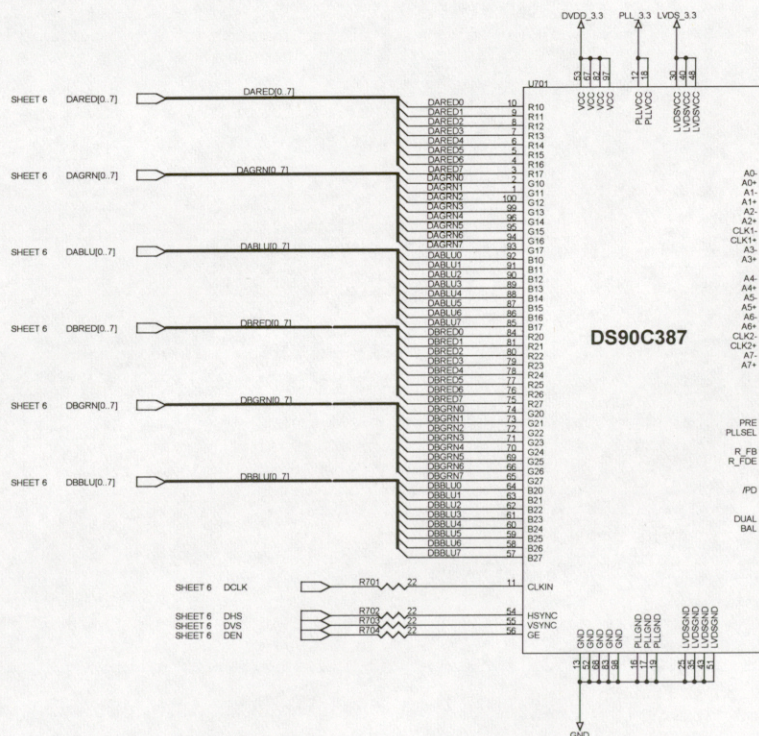


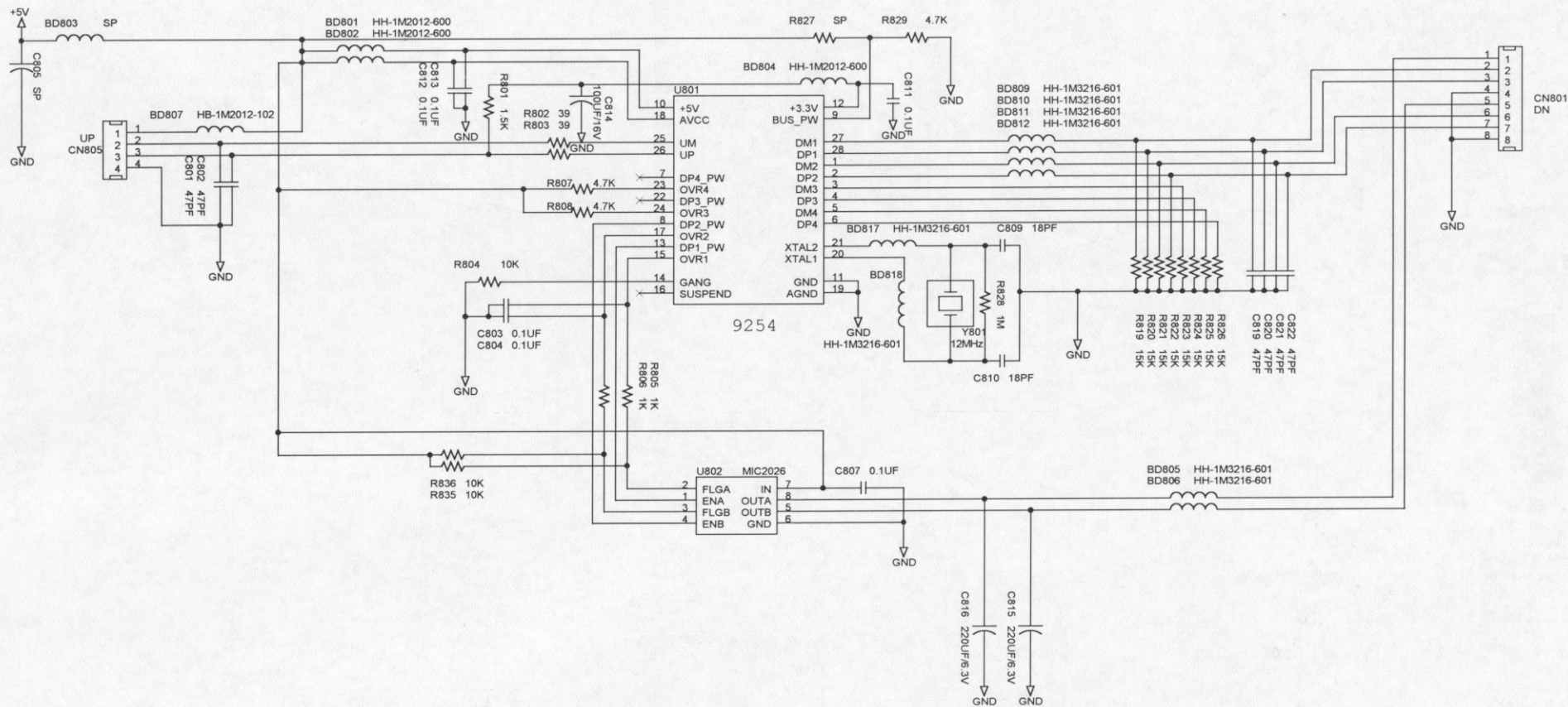






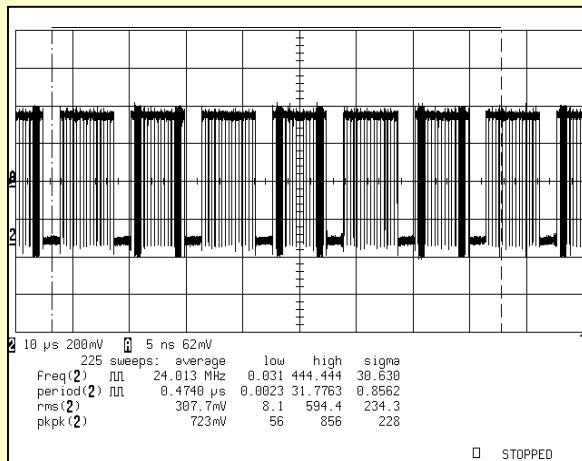
PLACE RN CLOSE TO MEMORY ICs



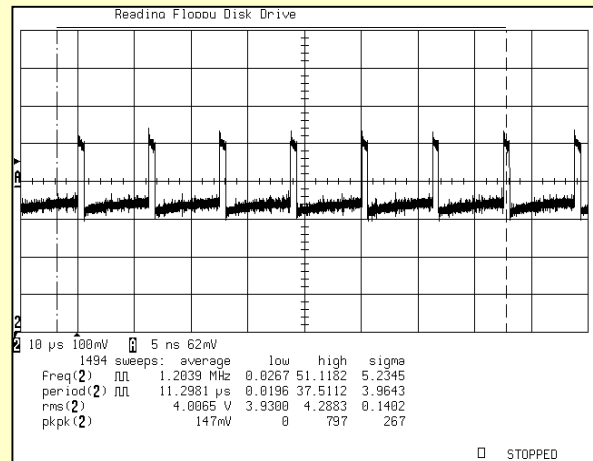


Wave From

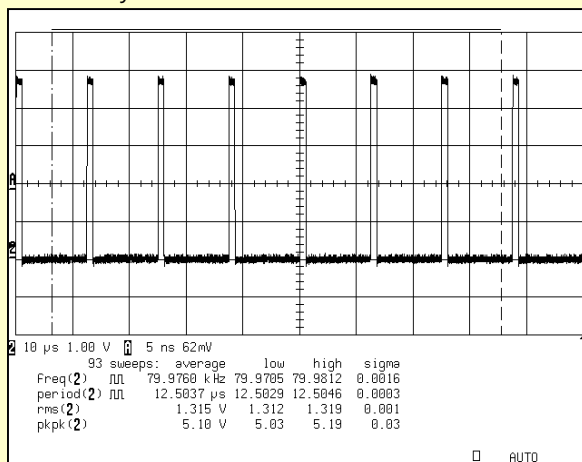
N01 : SIGNAL _ RED INPUT



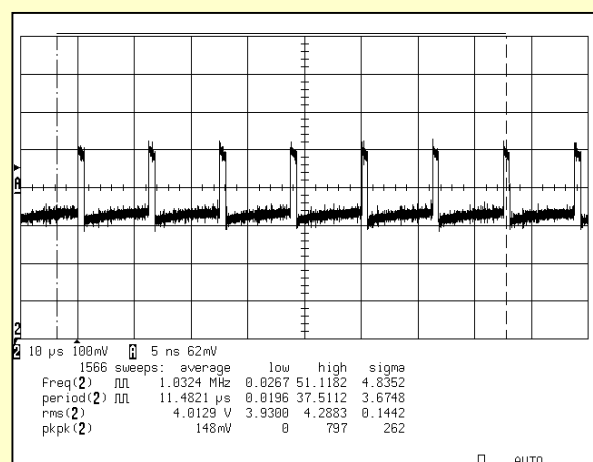
N04: SCL



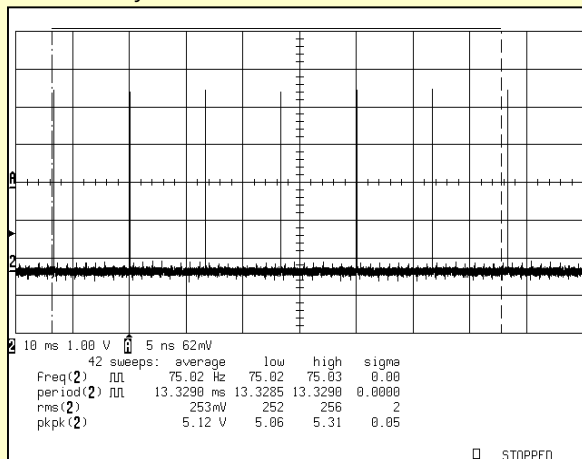
N02:H-sync



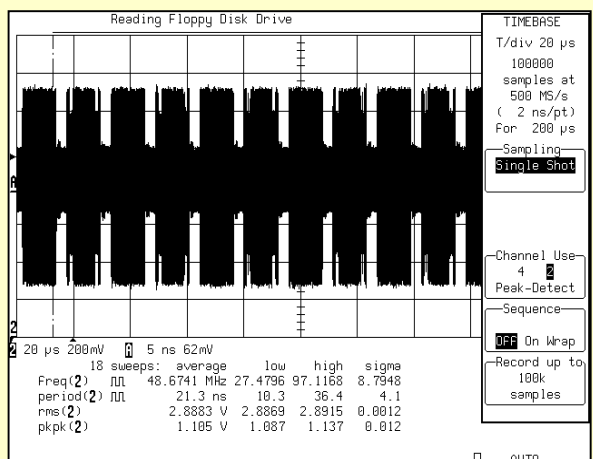
N05: SDA



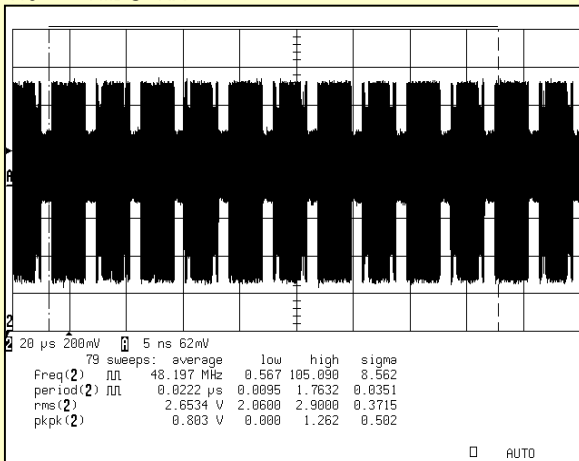
N03: V-Sync



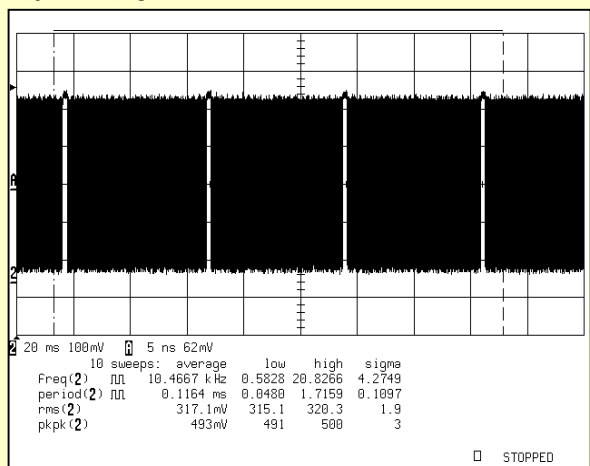
N06: TMDS RX2-



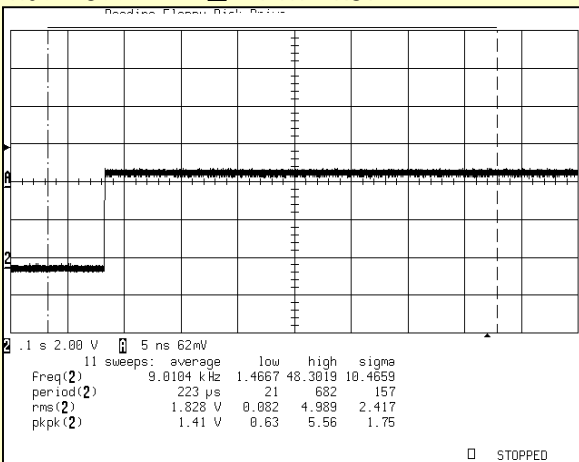
N07: TMD5 RX2+



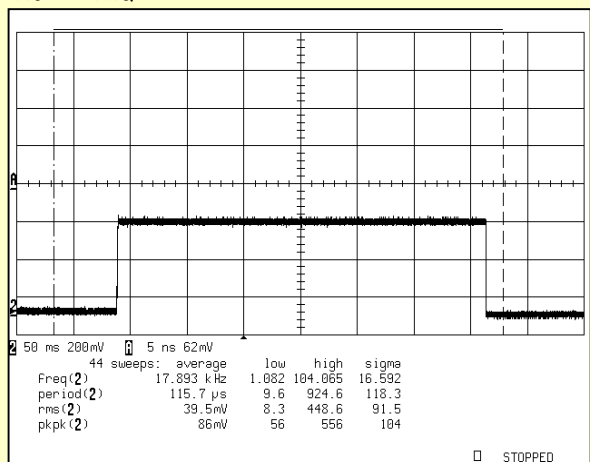
N010: HFS



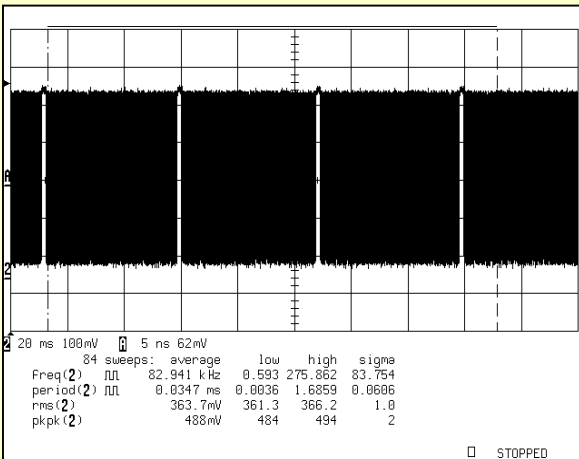
N08: U501- 10번 PIN_RST



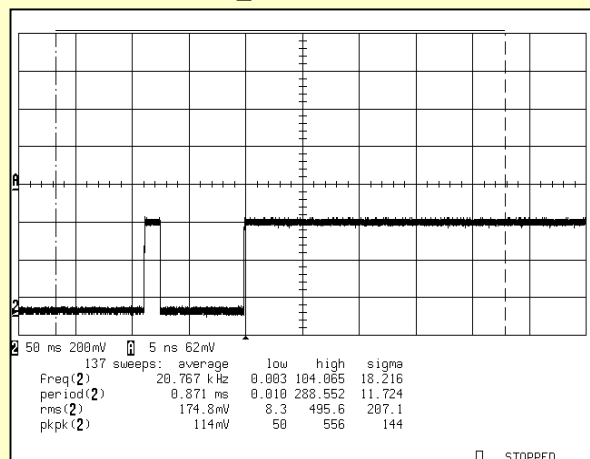
N011: IRQ



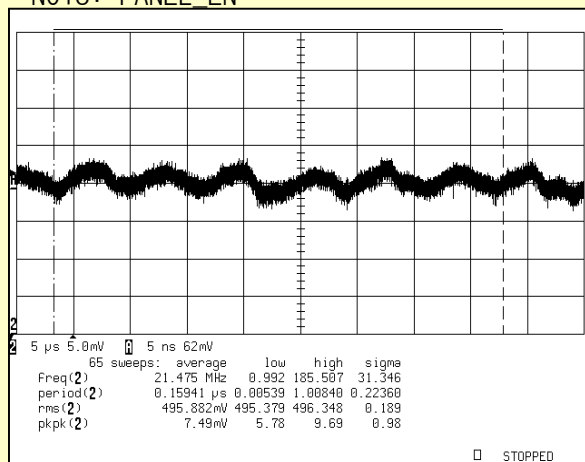
N09: H-CLK



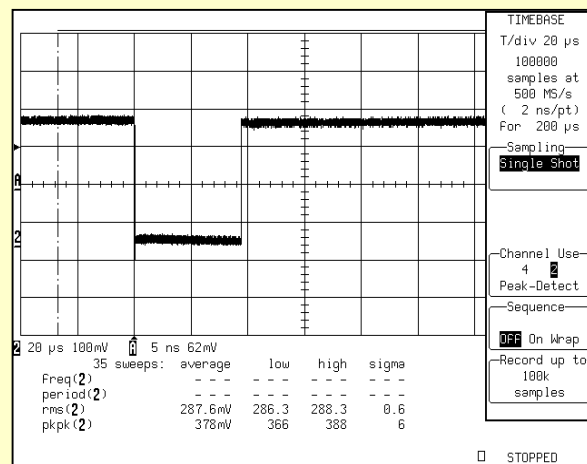
N012: U600+A669_RST



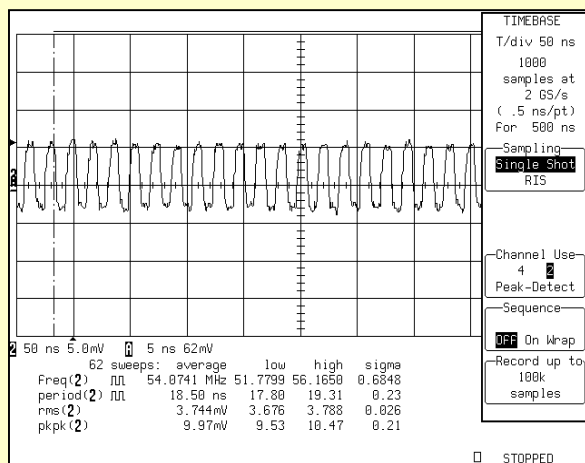
N013: PANEL_EN



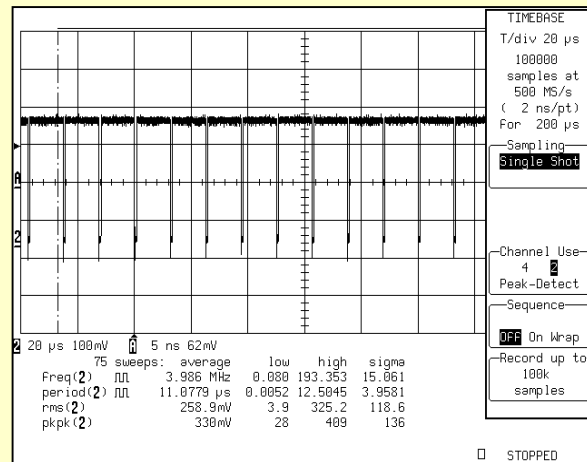
N016:DVS_R621



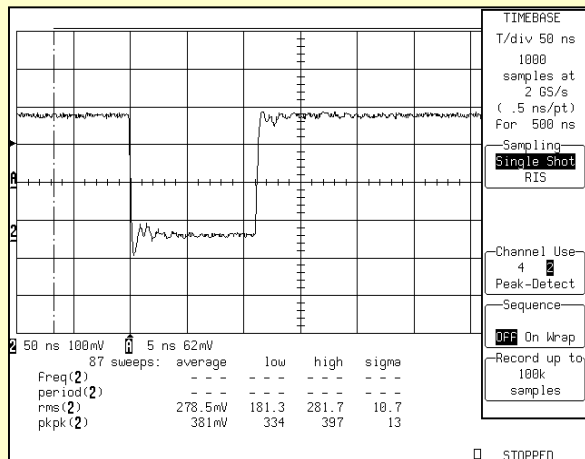
N014: DCLK gm5020_R619



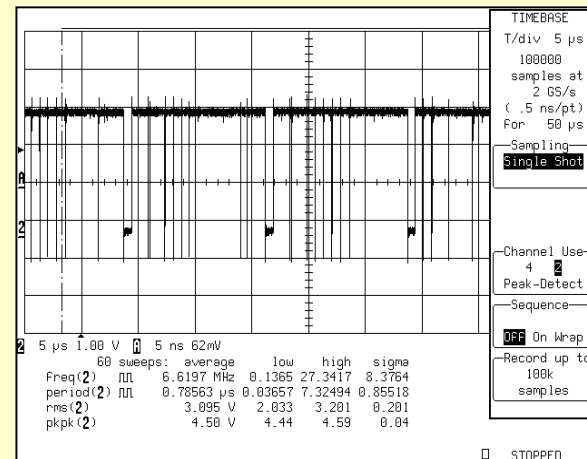
N017: DEN_R622



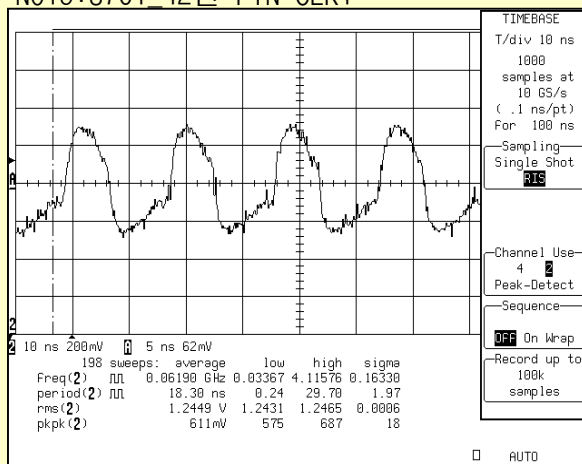
N015:DHS_R620



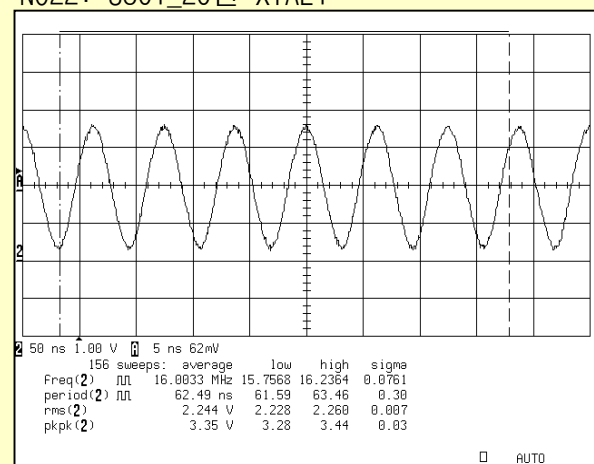
N018:U701_1번 PIN



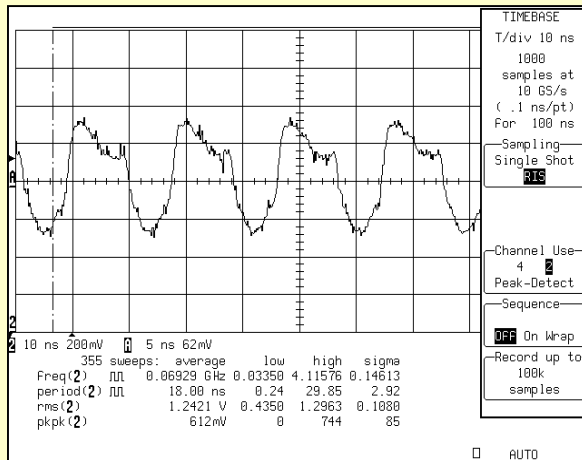
N019:U701_42번 PIN CLK1-



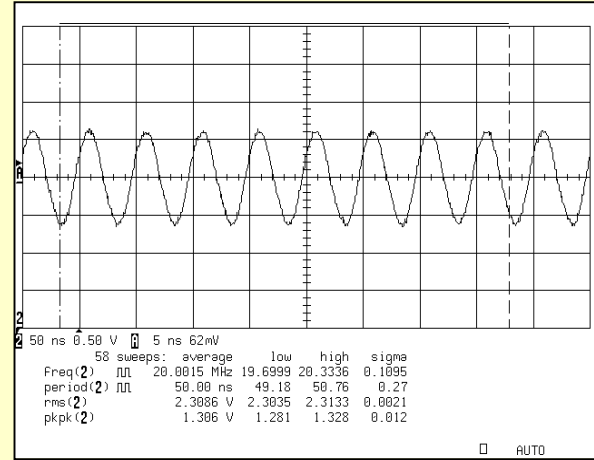
N022: U501_20번 XTAL1



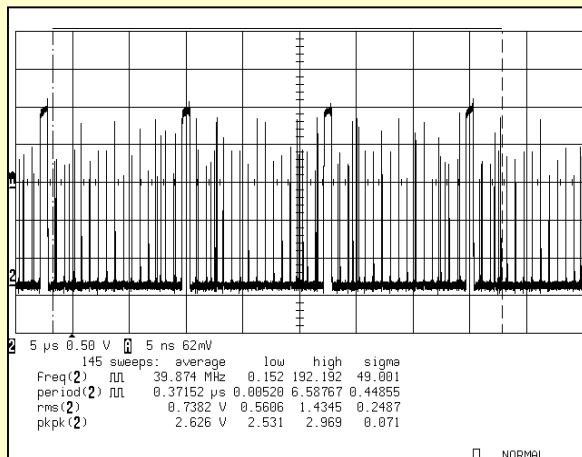
N020:U701_41번 PIN CLK1+



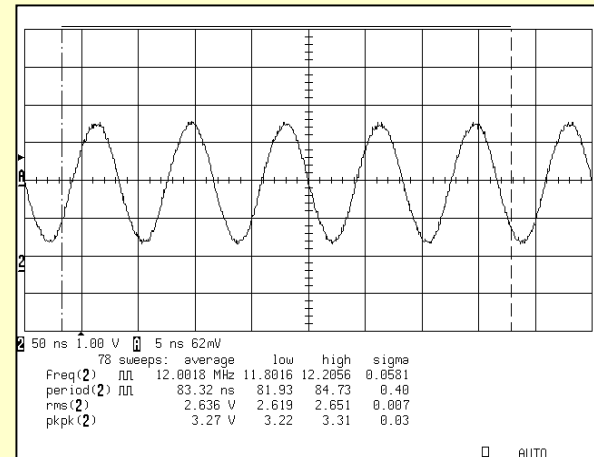
N023:U600_XTAL 20MHZ



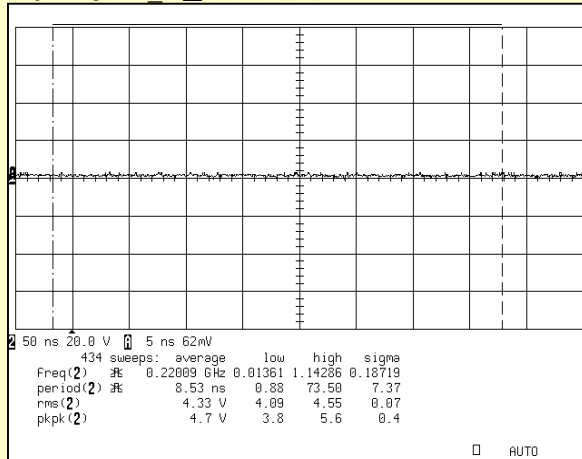
N021: U701_50번 PIN A0-



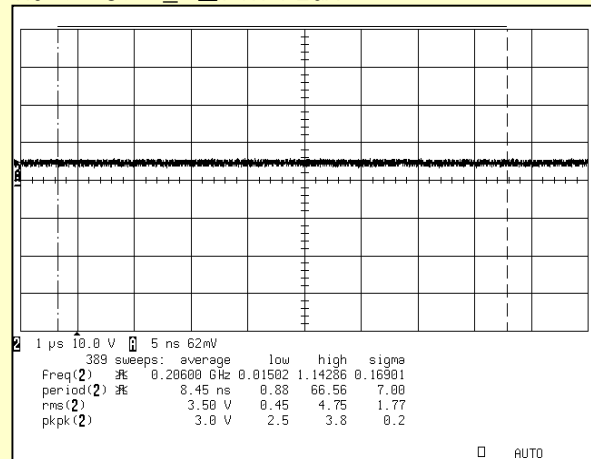
N024: U801_21번 XTAL2



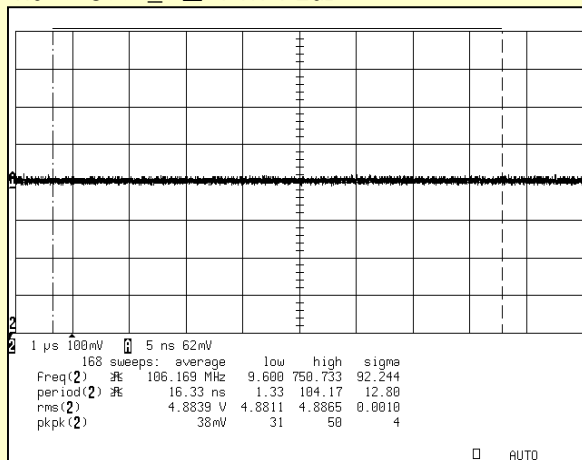
N025:U802_4번 PIN ENB



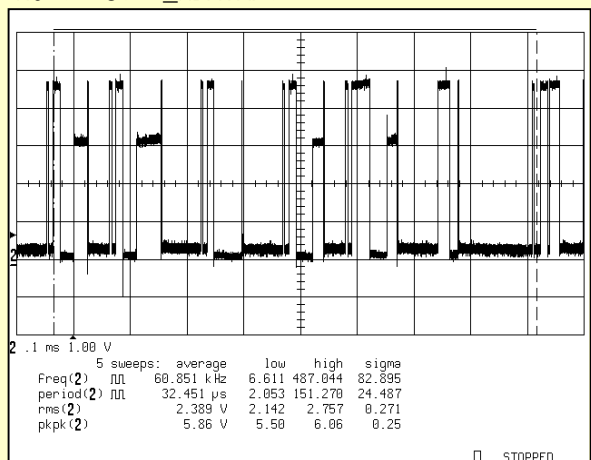
N028: U802_2번PIN FLGA



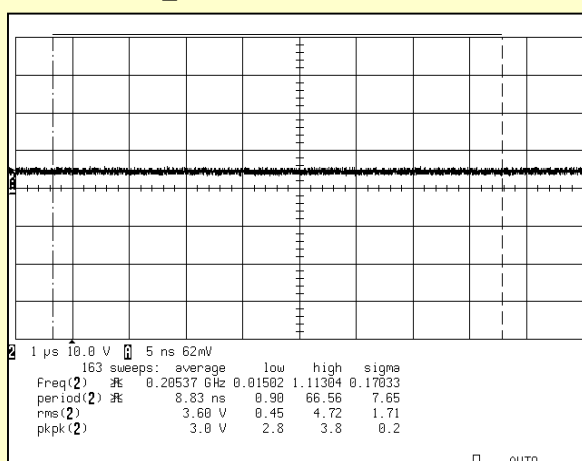
N026:U802_3번 PIN FLGB



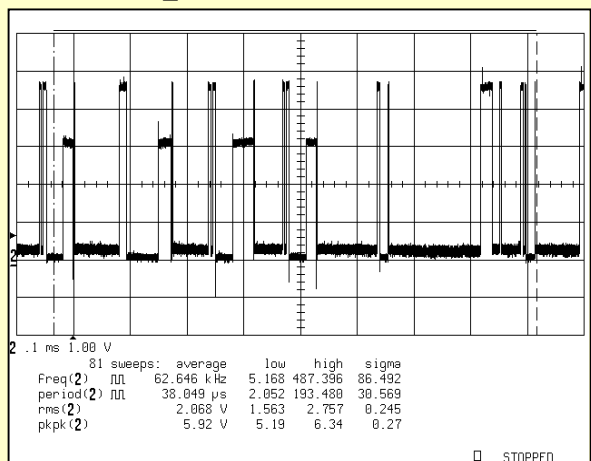
N029: U501_HDATAF0



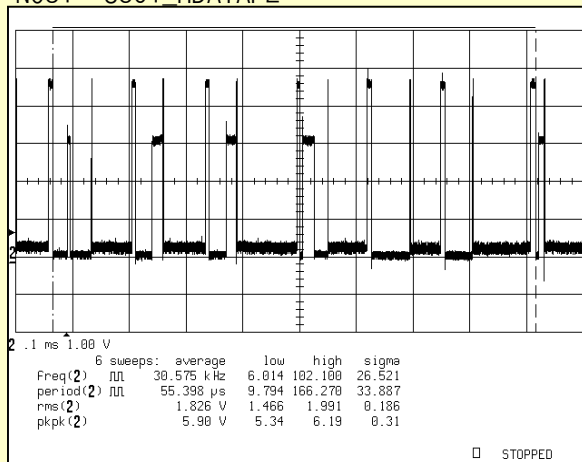
N027: U802_1번 PIN ENA



N030: U501_HDATAF1



N031: U501_HDATAF2



N032: U501_HDATAF3

