



# CONNECTED-CHIP-C2N-DEMO

## Cresnet<sup>®</sup> Connected Demo Chip

Reference Guide  
Crestron Electronics, Inc.

**Original Instructions**

The U.S. English version of this document is the original instructions.  
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## Introduction

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The Cresnet Connected interface module enables native Cresnet communications integration with third party devices, providing seamless integration with Crestron® control systems. The Cresnet Connected Chip has two modes of operation: Generic Keypad mode and Serial Bridge mode. This manual describes the interface details for the Serial Bridge mode (UART Mode).

## Serial Bridge Mode (UART Mode)

A Cresnet Connected Chip in serial bridge mode has a bidirectional UART for communications to the third-party device manufacturer's internal microcontroller. In this mode, it is possible to convey data messages between a Cresnet wired network as needed by the end application.

It is necessary to follow the ASCII serial data protocol established for the Cresnet Connected Chip in [Talking Crestron: Cresnet \(on page 6\)](#).

Third-party devices using this bridge will have a custom Crestron model name and symbol within the Crestron programming software.

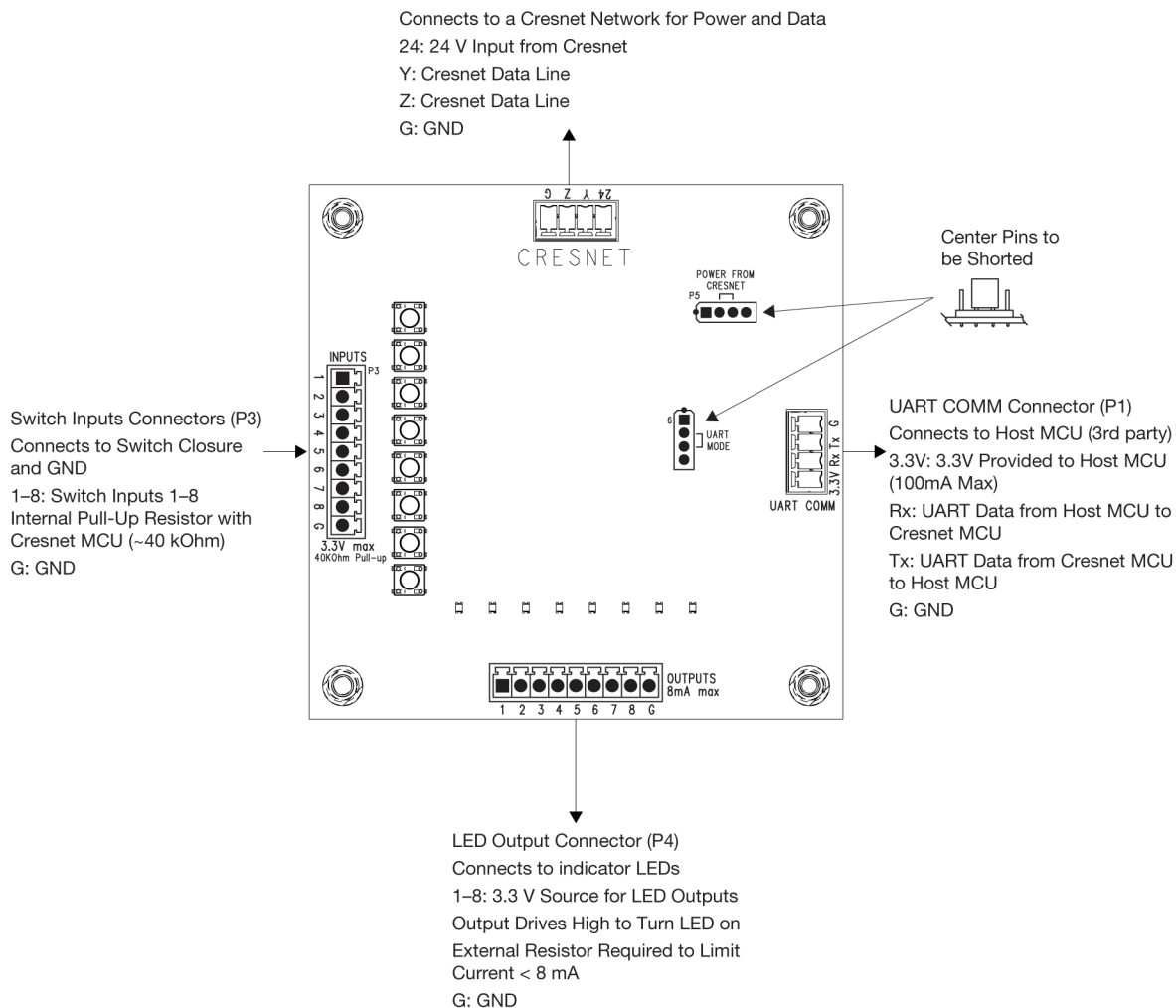
# Terminology

## Terminology and Definitions

Term	Definition
UART	A Universal Asynchronous Receiver and Transmitter (UART).
Cresnet	Crestron control wired network.
Crestron Symbol	Defines the data control variables the device can support.
Crestron Model Name	The designated model name of the Crestron enabled device. The model name must start with the manufacturer name and cannot start with a number.
Joins	Data control variables, which can be inputs or outputs. The variables can be digital, analog, or serial.

# Board Layout

The following illustration shows the board layout and port description for the CONNECTED-CHIP-C2N-DEMO.





## Electrical Interface

The Crestron Cresnet Connected Chip provides a 3.3 V TTL UART port with an RX pin (pin 13), TX pin (pin 12), and a ground. Ground pin 2 when operating in Serial Bridge mode (UART mode).

# Talking Crestron: Cresnet

A Crestron Cresnet network is a wired network between a control system and one or more Cresnet addressable devices.

Crestron devices send and receive program data to the control system through the Cresnet protocol.

At the upper protocol layer (Crestron Application), all devices should be able to handle the most basic commands and Cresnet protocol primitives, such as:

## Cresnet ID

The Cresnet ID is the device identification address in the Cresnet network. The ID can be any number between 3 and 254. Values below 3 are reserved.

## Light and Poll

Light and Poll (LP) is a mechanism that allows a device to identify itself through physical input from a user. This helps identify devices in their physical location, as well as reduce the chance of communicating with the wrong device. LP works in the following manner:

1. A Start Light and Poll (SLP) command is sent from the control system to a device.
2. The device indicates through its UI that it is executing a Light and Poll routine. The device may flash its LEDs or screen, generate a tone, or, if motorized, slowly move back and forth.
3. When the device receives a trigger from the user (such as a button press), it will send a Light and Poll Press (LPP) command back to the control system, indicating acknowledgement of the SLP.
4. When the control system receives the LPP acknowledgement, it will end the Light and Poll procedure by sending an End Light and Poll (ELP) command.

## Joins (Program Control Variables)

In the Crestron Application Layer, joins are used to communicate the state of a control variable between the device and the control system. Each relevant control variable has its own address (from 1 to 256).

Input joins define control variables to the device; the values on these variables tell the device what to do.

Output joins feedback variable values from the device; the values are reported by the device.

There are three different types of joins:

- Digital Joins
- Analog Joins
- String.Joins

#### NOTES:

- Digital, analog, and string joins are exclusive among themselves. This means that digital join 1 is not related to analog join 1 or string join 1.
- Join inputs are typically associated with the same join output. For example, digital join 1 input is generally linked to digital join 1 output. But, digital join 1 input can be linked to a different digital join output.

### Digital Joins

Digital join data has two values: high (i.e., on) and low (i.e., off). For example, a light switch with a digital input join turns the load on when the value is on (high), and it turns the load off when the value is off (low).

### Analog Joins

Analog join data has a value between 0 and 65535. An example of an output analog join would be a device reporting a temperature range between 0°C and 100°C. 0 on the join would indicate a temperature of 0°C, and a value of 65535 would indicate 100°C. An intermediate value of 32768 would indicate a temperature of 50°C assuming a linear scale on the sensor device.

Analog joins feature the ability to ramp their values. Ramping allows an analog join value to change over time without the need to send multiple analog signals. The ramp, R|1|200|56, changes the value from 1 to 56 over a period of 2 seconds while sending only one command.

### String Joins

String type joins can accept up to 32 alphanumeric characters. These are intended for relaying human-readable messages, indicators, or codes.

# Serial Interface Protocol

## UART Configuration

The UART is configured to run at:

- 115200 baud
- No parity
- 8 data bits
- 1 stop bit
- Software flow control (XON - XOFF) - handshaking

## Serial Data Start Up Sequence

When the Cresnet Connected module is powered up, it emits the serial data sequence:

0x00 0x2A 0x0D

This initial sequence indicates that the Cresnet Connected module is running and ready for serial interface communication. About 1 second after startup, the third-party device should query for the Cresnet ID and model name before performing any function.

## Serial Interface ASCII Protocol

The Cresnet Connected microcontroller communicates via an ASCII protocol to simplify debugging but, for efficiency, will be terse. The microcontroller will translate the ASCII data to and from joins that will be passed between it and the control system.

## Packet Details

All packets have a packet header, values, delimiters, and an ending byte.

### Packet Header

The header is an alphabetic character (one byte) that identifies the packet type.

### Parameter Delimiters

Between parameters, use the delimiter "|" (ASCII value (0x7C)).

### Packet Ending Byte

The packets ends in a carriage return (ASCII value (0x0D)).

## Packet Examples

Digital packet example: A third-party device will report that a Digital Join addressed at 5 is high.

D|5|ON (ASCII)

0x44 0x7C 0x35 0x7C 0x4F 0x4E 0x0D (Hex values)

An analog packet example, where the join index is 27 and the value is 3512, would look like this:

A|27|3512 (ASCII)

0x41 0x7C 0x32 0x37 0x7C 0x33 0x35 0x31 0x32 0x0D (Hex values)

### Join Passing between Third-Party and Crestron Devices (Bidirectional)

Message Type	Format	Index Range	Value(s)
Digital Value	D <index> <value>	1-256	ON, OFF
Analog Value	A <index> <value>	1-256	0-65535
Ramp	R <index> <time> <end value>	1-256	<time> = Time to ramp in hundredths of a second (max 65535) <end value> = The ending value (between 0 and 65535)
String	S <index> <length> <1-32 characters>	1-256	<length> = 1-32 Characters are limited to alphanumeric

### Crestron to Third-Party Device Commands

Message Type	Format	Index Range	Value(s)
Serial Data Startup Sequence			0x00 0x2A 0x0D
Start Light and Poll	SLP		
Exit Light and Poll	ELP		
Cresnet ID	CID <id>		0-254 (except 2)
Error	ERR <value>		0 = Generic error 1 = Invalid product name 2 = Invalid ID 3 = Invalid command received 4 = Queue overflow 5 = Packet syntax error 6 = Cresnet is not connected
Network Status Response	NET <value>		0 = Cresnet not detected 1 = Cresnet activity 2 = Connected to Program (Device being polled)

### Third-Party Device to Crestron Commands

Message Type	Format	Index Range	Value(s)
Light and Poll Selected	LPP		
Model	M <length> <1-18 characters>	<length> = 1-18 Character entry must be alphanumeric Use only uppercase letters and hyphen as valid characters. Model name should not end with a hyphen. The model name must start with the manufacturer name and cannot start with a number.	
Set Cresnet ID	CID <id>	<id> = 3-254	
Get Cresnet ID	ID	Requests Cresnet ID value	
Reset Cresnet Processor	RESET	N/A	N/A
Network Status Request	NET	N/A	N/A

## Error Reporting Crestron to Third-Party Device

The device will send out any encountered errors as it receives and parses the packets.

### Error Description

ID	Error	Description
0	Generic Error	This type of error is reported when the serial port RX module detects a frame error, overrun error, or noise error.
1	Invalid Product Name	If a given model name does not conform to Crestron device name standards, this error is triggered.
2	Invalid ID	This error is displayed when the assigned Cresnet ID does not conform to the range of 3-254.
3	Invalid Command Received	This error is issued when the command is not recognized.
4	Queue Overflow	This error occurs when the incoming RX queue is over the acceptable limit. Before this error is triggered, an XOFF byte is sent to the third-party device. The next byte sent by the third-party device will most likely trigger this error.

## Error Description

ID	Error	Description
5	Packet Syntax Error	This error occurs when a packet is incorrectly formed or has invalid parameters.
6	Cresnet is not Connected	If there is no Cresnet connectivity after an incoming packet is successfully parsed, this error will be triggered and the packet lost. The third-party device should query the network status with the NET command and retransmit the last request.

# General Information

## Cresnet ID

The default Cresnet ID is 0x25.

## Light and Poll

Third-party devices must support regular light and poll messages and should flash all LEDs when in identify mode.

When in Generic Keypad mode, the third-party device will respond to a light and poll request with any button press.

In Serial Bridge mode (UART mode), the third-party device should flash all LEDs and respond to a button press. This ensures compliance with Crestron standards.

The sequence is:

1. The third-party device will receive an "SLP" command from the Cresnet device.
2. The LEDs on the third-party device flash at a rate of 1 per second and continue until "ELP" is received from the control system.
3. When the third-party device receives a trigger from the user (such as a button press), the device responds with an "LPP" command.
4. The control system will send an "ELP" indicating the identification was successful.

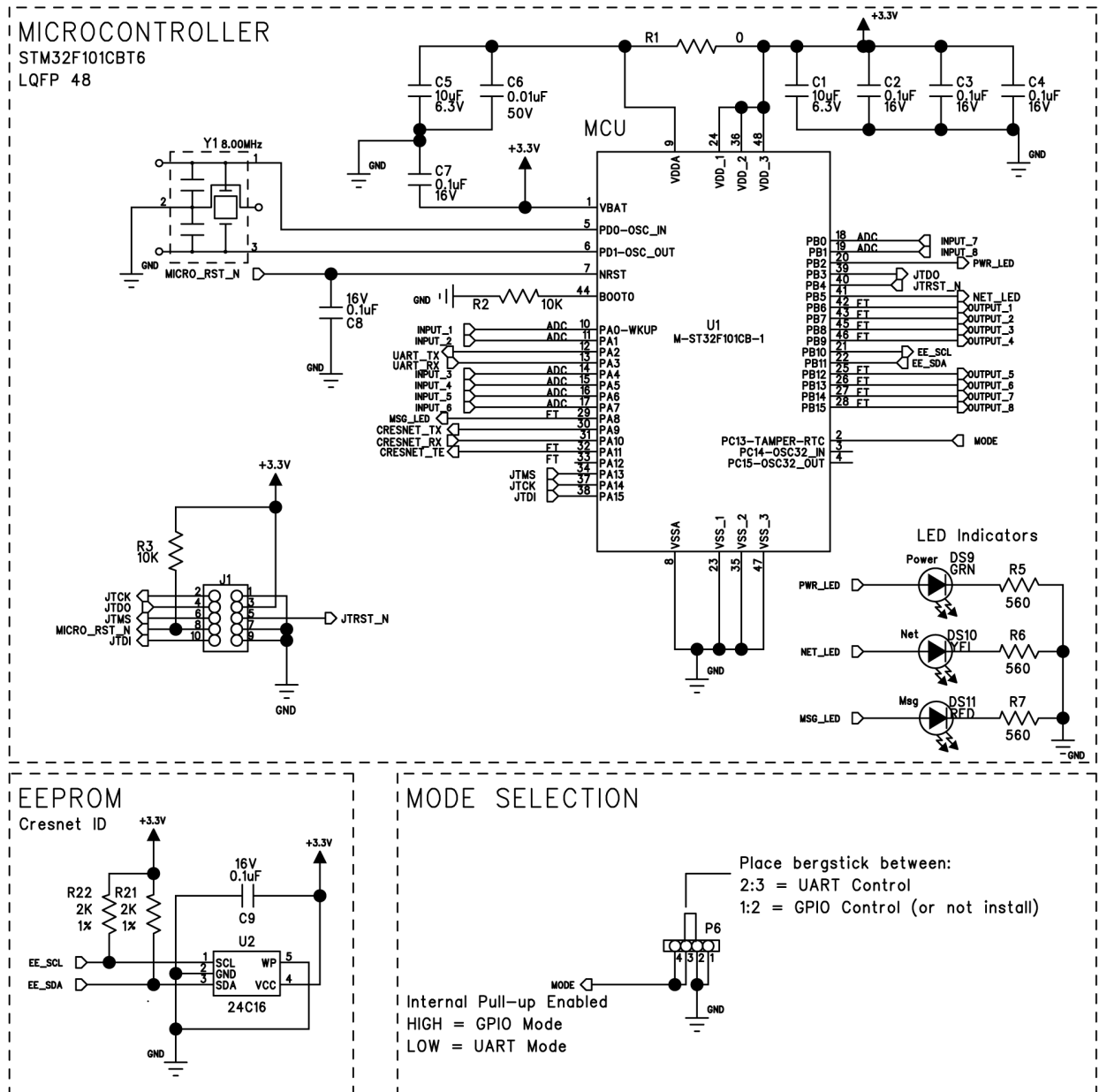
## NET LED Operation

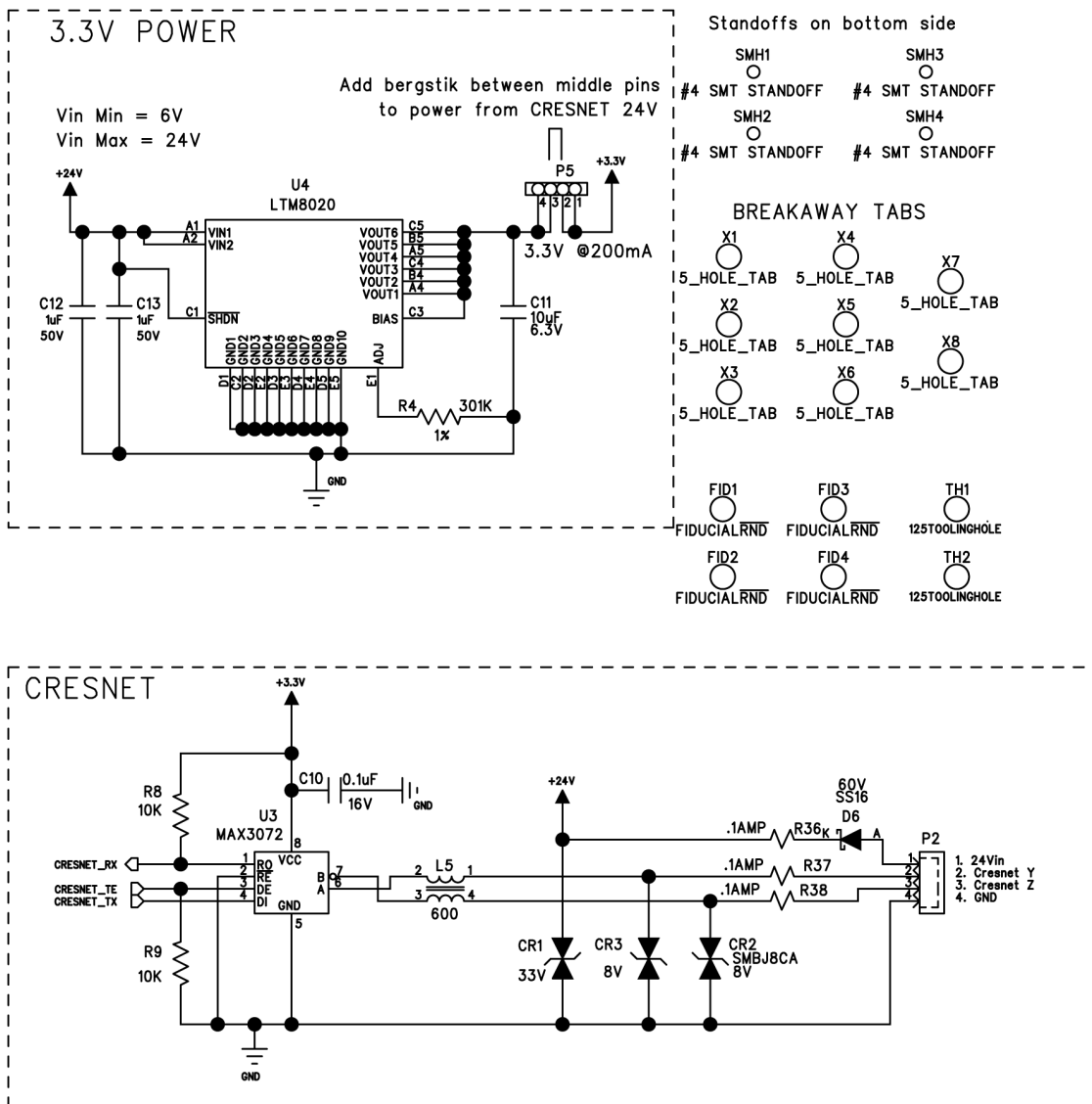
NET LED is located at pin 41. It should be on when the device is being polled by the control system while the program is running and the device is in the program. This LED should also turn on during Crestron Toolbox® software activity to the device.



# CONNECTED-CHIP-C2N-DEMO Schematic and Bill of Material

The illustrations that follow are schematics of the board parts. The table that follows is the bill of material for the board.





Reference Designators	Description	Manufacturer(s)	Manufacturer Part Number
C6	CAP, CER, 0.01UF, 50V, 0603, X7R, 10%, SM	AVX CORPORATION	06035C103KAT2A
		MURATA	GRM188R71H103KA01D
		NIC COMPONENTS	NMC0603X7R103K50F
		NIC COMPONENTS	NMC0603X7R103K50TRPF
C2-4 C7-10 C14-18	CAP, CER, 0.1UF, 16V, 0603, X7R, 10%, SM	AVX CORPORATION	0603YC104KAT2A
		KEMET	C0603C104K4RAC
		MURATA	GRM188R71C104K
		NIC COMPONENTS	NMC0603X7R104K16
		VISHAY/ROEDERSTEIN	VJ0603Y104KXJ
		NIC COMPONENTS	NMC0603X7R104K16TRPF
		NIC COMPONENTS	NMC0603X7R104K16TRP10F
		KEMET	C0603C104K4RAC TU.
C12-13	CAP, CER, 1.0UF, 50V, 0805, X7R, ±10%, SM	NIC COMPONENTS	NMC0603X7R104K16TRP15F
		MURATA	GRM21BR71H105KA12L
		KEMET	C0805C105K5RACTU
		AVX CORPORATION	08055C105KAT2A
		NIC COMPONENTS	NMC0805X7R105K50TRPF
		TAIYO YUDEN	UMK212B7105KG-T
C1 C5 C11	CAP, CER, 10UF, 6.3V, 0603, X5R, 20%, SM	MURATA	GRM188R60J106ME47D
		AVX CORPORATION	06036D106MAT2A
		PANASONIC ELECTRIC WORKS	ECJ-1VB0J106M
		MURATA	GRM188R60J106ME47J
D6	DIODE, SM, SS16, SCHOTTKY, 1A, DO-214AC (SMA)	GENERAL INSTRUMENT	SS16-E3
		VISHAY INTERTECHNOLOGY	SS16-E3/61T
CR1	DIODE, SM, TRANS SUP, 33.0 VWM, 600W, 5%, BI-DIRECT, DO-214AA (SMB)	GENERAL SEMICONDUCTOR	SMBJ33CA
		ST MICROELECTRONICS	SMBJ33CA
		FAIRCHILD SEMICONDUCTOR	SMBJ33CA
		VISHAY	SMBJ33CA-E3/52

Reference Designators	Description	Manufacturer(s)	Manufacturer Part Number
CR2-3	DIODE, SM, TRANS SUP, 8.0VWM, 600W, 5%, BI-DIRECT, DO-214AA (SMB)	INTERTECHNOLOGY	
		CRYDOM	SMBJ8.0CA
		DIODES INC	SMBJ8.0CA-13
		FAIRCHILD SEMICONDUCTOR	SMBJ8.0CA
		GENERAL INSTRUMENT	SMBJ8.0CA
		LITE-ON TECHNOLOGY CORP.	SMBJ8.0CA
		TAITRON	SMBJ8.0CA
		GENERAL INSTRUMENT	SMBJ8.0CA-E3/2
		DIODES INC	SMBJ8.0CA-13-F
		VISHAY INTERTECHNOLOGY	SMBJ8.0CA-E3/2C
Z4	DIODE, SM, 4685, ZENER, 3.6V, , SOD123	VISHAY INTERTECHNOLOGY	SMBJ8.0CA-E3/52
		ON SEMICONDUCTOR	MMSZ4685T1G
U4	IC, DC MODULE 0.2A, STEP-DOWN CONVERTER, V <sub>in</sub> 3V to 36V; V <sub>out</sub> 0.8V to 5V; 21PIN LGA, SM	VISHAY INTERTECHNOLOGY	MMSZ4685-V
		LINEAR TECHNOLOGY	LTM8020EV#PBF
R36-38	FUSE, RESET, 0.1AMP HOLD, 0.3AMP TRIP, 10 AMP MAX, 30V, 1210, SM	BOURNS	MF-USMF010-2
		LITTELFUSE	1210L010WR
		SCHURTER, INC.	PFUF.010.2
U3	IC, RS-485 XCVR, HALF-DPLX, 0.25Mbps, 3.3V, 1/8LOAD, 1.5mA, 15kVESD, GND DIFF COMPLIANT, SO-8	INTERSIL	ISL3172EIBZ
		INTERSIL	ISL3172EIBZ-T
		MAXIM/DALLAS SEMICONDUCTOR	MAX3072EESA+
		MAXIM/DALLAS SEMICONDUCTOR	MAX3072EESA+T

Reference Designators	Description	Manufacturer(s)	Manufacturer Part Number
U2	IC, EEPROM, I2C, 16K BIT, 16-BYTE PAGE, 1.7~3.6V, 400 KHz, SOT23-5, SM	ATMEL	AT24C16BTSU-T
		CATALYST SEMICONDUCTOR	CAT24C16TDI-GT3
		ATMEL	AT24C16C-STUM-T
		ATMEL	AT24C16D-STUM-T
U1	IC,PROG,ROHS,		
U6 U8-11	IC, ESD & OVER VOLTAGE PROTECT, 70V, 4 CHANNEL, 1.5PF, SM	ON SEMICONDUCTOR	NUP4301MR6T1
		ON SEMICONDUCTOR	NUP4301MR6T1G
		ON SEMICONDUCTOR	NUP4301MR6T1G
P5-6	CONN, HEADER, 4PIN, SGL ROW, 0.1"LS, 0.23"PIN L, STRGHT, TH	BERG	68000-104HLF
P1-2	CONN, HEADER, 4PIN, SGL ROW, 0.138"LS, STRGHT, PCB MNT	AMPHENOL, PCD	ELXH045G0
		PHOENIX CONTACT GmbH	MCV1,5/4-G-3,5
P3-4	CONN, HEADER, 9PIN, SGL ROW, 0.138"LS, STRGHT, PCB MNT	AMPHENOL, PCD	ELXH095G0
		PHOENIX CONTACT GmbH	MCV 1,5/9-G-3,5
		PHOENIX CONTACT	18 43 67 7
J1	CONN, SOCKET, 5PIN, DBL ROW, 0.050" X 0.050"LS, SM, POLARIZED, STRGHT	MAJOR LEAGUE ELECTRONICS	PSSHSM-505-D-06-GT-TR-P-LF
		SAMTEC	SFM-105-02-L-D-K-TR
DS9	LED, GRN DIFFUSED, 0805, SQUARE, SM	AVAGO TECHNOLOGIES( AGILENT SPG)	HSMG-C670
		LITE-ON TECHNOLOGY CORP.	LTST-C170GKT
		AVAGO TECHNOLOGIES	HSMG-C170
DS1-8 DS11	LED, RED DIFFUSED, 0805, SQUARE, SM	AVAGO TECHNOLOGIES( AGILENT SPG)	HSMH-C670
		ELNA AMERICA	CL-170R-CD-T
		LITE-ON TECHNOLOGY CORP.	LTST-C170CKT
		AVAGO	HSMH-C170

Reference Designators	Description	Manufacturer(s)	Manufacturer Part Number
		TECHNOLOGIES (AGILENT SPG)	
DS10	LED, YEL DIFFUSED, 0805, SQUARE, SM	AVAGO TECHNOLOGIES (AGILENT SPG)	HSMY-C670
		LITE-ON TECHNOLOGY CORP.	LTST-C170YKT
		AVAGO TECHNOLOGIES	HSMY-C170
R1	RES, SM, OR, 1/16W, 0402, THKF	KOA SPEER ELECTRONICS	RK73Z1ETTP
		VISHAY INTERTECHNOLOGY	CRCW04020000Z0ED
		NIC COMPONENTS	NRC04Z0
		NIC COMPONENTS	NRC04Z0TRF
		NIC COMPONENTS	NRC04Z0TR50F
R11-18 R25-32	RES, SM, 100 OHM, 1/10W, 5%, 0603, TF	KOA SPEER ELECTRONICS	RK73B1JTDD101J
		NIC COMPONENTS	NRC06J101TRF
R2-3 R8-9	RES, SM, 10K, 1/10W, 5%, 0603, TF	KOA SPEER ELECTRONICS	RK73B1JTDD103J
		NIC COMPONENTS	NRC06J103F
		NIC COMPONENTS	NRC06J103TRF
R33-34	RES, SM, 47R, 1/10W, 5%, 0603, TF	KOA SPEER ELECTRONICS	RK73B1JTDD470-J
		INTERNATIONAL RESISTIVE CO.(IRC)	WCR-WCR0603LF-470-J-P- LT
		VISHAY/DALE	CRCW060347R0JNEA
R5-7 R46- 53	RES, SM, 560R, 1/10W, 5%, 0603, TF	KOA SPEER ELECTRONICS	RK73B1JTDD561J
		NIC COMPONENTS	NRC06J561TRF
		VISHAY INTERTECHNOLOGY	CRCW0603560RJNEA

Reference Designators	Description	Manufacturer(s)	Manufacturer Part Number
R21-22	RES, SM, PREC, 2K, 1/16W, 1%, 0402, THKF	VISHAY/DALE	CRCW04022K00FKED
		KOA SPEER ELECTRONICS	RK73H1ETTP2001F
		NIC COMPONENTS	NRC04F2001TRF
		PANASONIC ELECTRIC WORKS	ERJ2RKF2001V
R4	RES, SM, PREC, 301K, 1/16W, 1%, 0402, THKF	KOA SPEER ELECTRONICS	RK73H1ETTP3013F
		NIC COMPONENTS	NRC04F3013TRF
		PANASONIC ELECTRIC WORKS	ERJ-2RKF3013X
		VISHAY INTERNATIONAL	CRCW0402301KFKED
SMH1-4	STANDOFF, 0.250"L, 04-40, SMT, THD, 0.219"OD, CARBON STEEL, ELECTROPLATED BRIGHT TIN	PEM	SMTSO-440-8ET
S1-8	SWITCH, TACTILE, SM, 6mm SQ, 4.3mm HIGH, 160g FORCE, 0.25mm TRAV, 50mA@12V, BLACK, J-LEAD	E-SWITCH	TL-3301-N-F160-Q-J (BLACK ACTUATOR)
		CIT SWITCH	CS1102-4.3-F160J (BLACK ACTUATOR)
P5-6 PINS 2 & 3	WIRE, SHUNT/JUMPER, BERG STIX 2POS, 0.100" SPACING, 0.36"H	BERG	65474-001
		BERG	65474-001LF
L5	XFMR, COMMON-MODE, SM, 0.260A, 3.2X1.6MM (1206), 600 OHMS @ 100MHZ, 2 WINDINGS	WURTH ELEKTRONIK	744232601
		WURTH ELEKTRONIK	744232601A
Y1	CRYSTAL, RESONATOR, CERAMIC, 8.00 MHZ, W/CAPS, TOL<0.5%, STB<0.5% -20~80C, 7.4X3.4MM,SM	AVX CORPORATION	PBRC-8.00HR
		PANASONIC ELECTRIC WORKS	EFOS8004E5
		KYOCERA INDUSTRIAL CERAMICS CO	PBRC8.00HR50X000
		KYOCERA INDUSTRIAL CERAMICS CO	PBRC8.00HR50Y000
		TGS CRYSTALS	TGS CRTC 8.0M G TLF

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