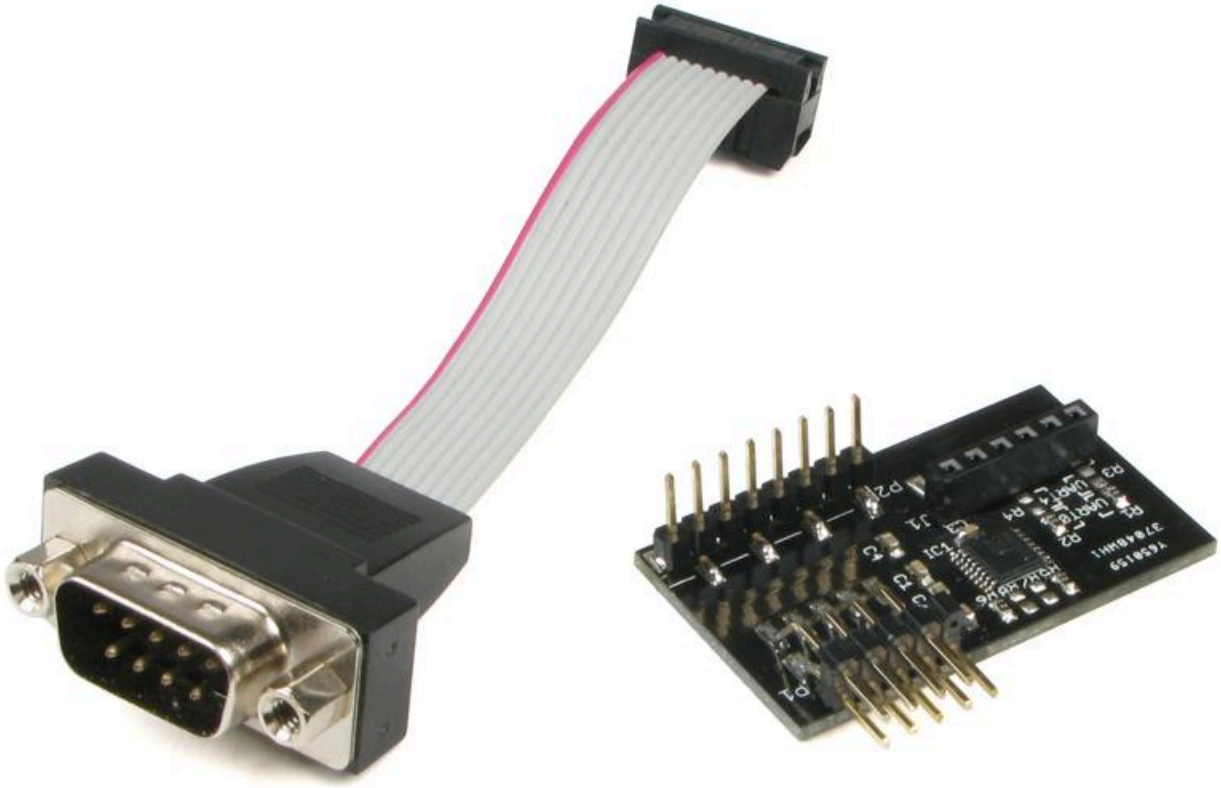
BeagleBone Black TTL to RS232 micro Cape

CBB-TTL-232
Revision 1.5
Dec 18, 2015



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Description

The MICRO TTL-RS232 cape provides a very compact RS-232 serial port level shifter, designed for the BeagleBone Black. The micro-sized cape translates the TTL logic levels of the BeagleBone to RS232 signals.
Either UART 0 or UART 4 can be selected. As well, RxD and TxD can be changed from DTE to DCE configuration; eliminating the need for a signal ('gender changer') adapter. The internal serial ribbon cable to DB9-Male connector is included. This compact design mounts completely inside the Logic Supply case, using the convenient DB9 breakout port. The BeagleBone Black serial debug port (J1) on UART0 is used by default.

Features

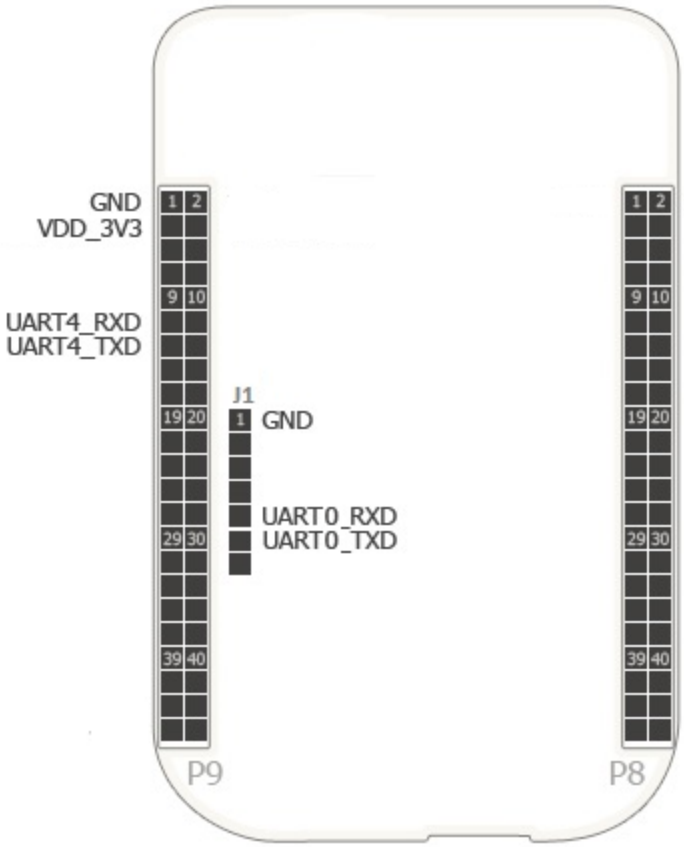
- BeagleBone Black compatible
- TTL-RS232 level shifting
- Selectable UART (0 or 4)
- Debug port as default
- DCE-DTE mode selection (DTE default)
- Serial DB9-Male internal cable included
- Completely fits inside Logic Supply BB100 case.
- Micro-cape design leaves P8 and some P9 signals accessible for other uses.
- Dimensions: approximately 25 x 41 mm
- Rohs compliant

Architecture

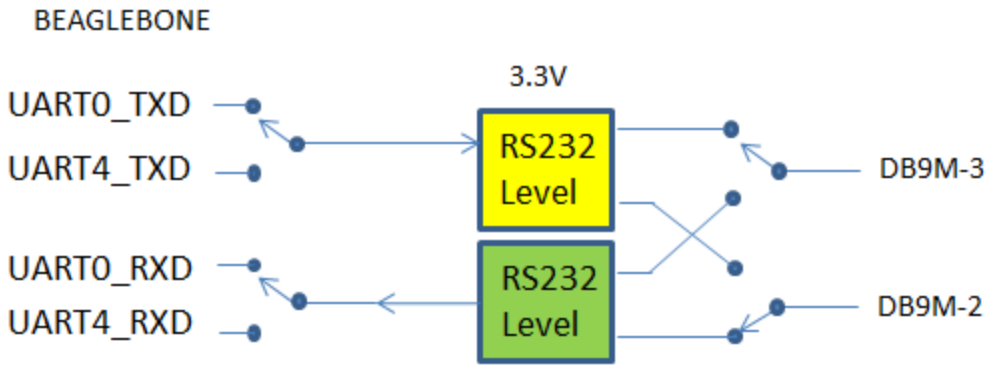
DCE: Device Communication Equipment
DTE: Device Terminal Equipment (normal PC port) - DB9 Female

Beagle Bone Pin Used	Signal	Description
P9-1	GND	-
P9-3	+3.3V	-
P9-11	UART4-RX(6)	If Configured
P9-13	UART4-TX(6)	If Configured
J1-1 (Debug Port Header)	GND	-
J1-4	UART0-RxD	Default
J1-5	UART0_TxD	Default

BeagleBone Black Pin Allocation



Block Diagram



Requirements

The TTL-RS232 micro cape is designed to work with existing software on the BeagleBone Black.

Requirements for use (not included):

- BeagleBone Black with suitable distribution loaded
- Cable to DCE equipment (DB9-female to Equipment)

Getting Started

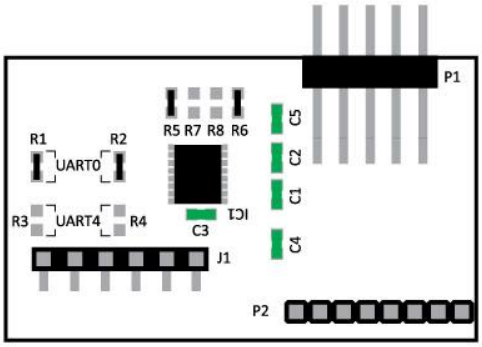
1. Make sure power is disconnected from the BeagleBone Black and connect the Cape to the BeagleBone Black by inserting the header pins in headers P8 and P9.
2. Ensure the BeagleBone Black is loaded with a suitable Linux distribution. Angstrom release 09.04.2013 or later is recommended. Other distributions may also be compatible with this Cape,
3. Configure (default is UART0, DTE).

(Instructions to update the software image on the BeagleBone Black can be found here.)

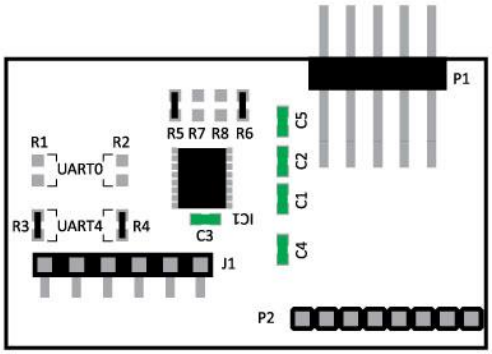
Configuring your MICRO TTL-RS232 cape

Default configuration is UART 0 and DTE (BeagleBone acts as a normal 'PC' computer). This default configuration can be changed by relocating the resistors. This requires soldering, as shown below.

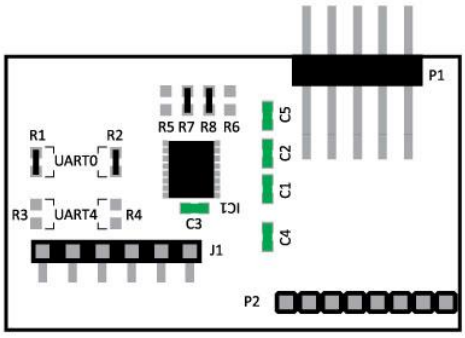
Configuration for UART 0



Configuration for UART 4 (R1, R2 = Open, R3 R4 = 0 Ohms)

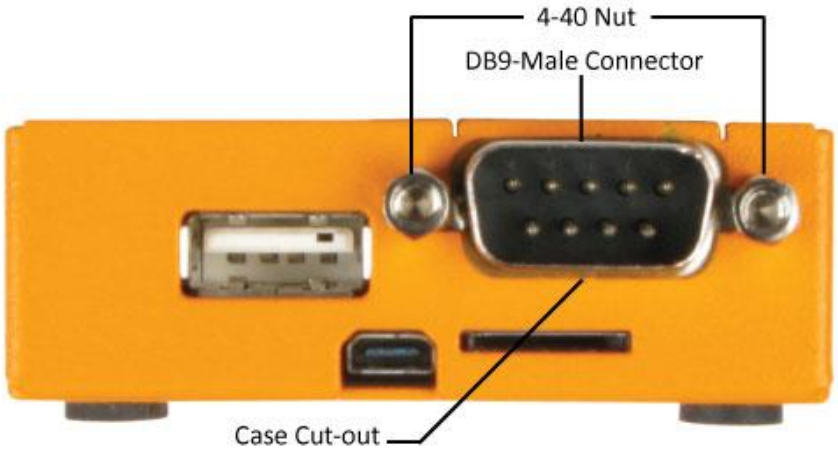


Configuration for DCE - BeagleBone Acts as a Communication Device (R1, R2 = Open, R3, R4 = 0 Ohms)

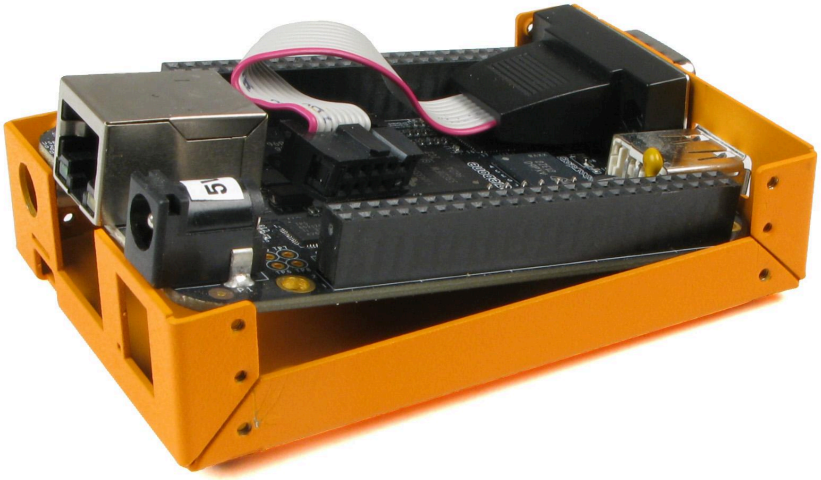


Installation Instructions (mounting inside Logic Supply BB100 case)

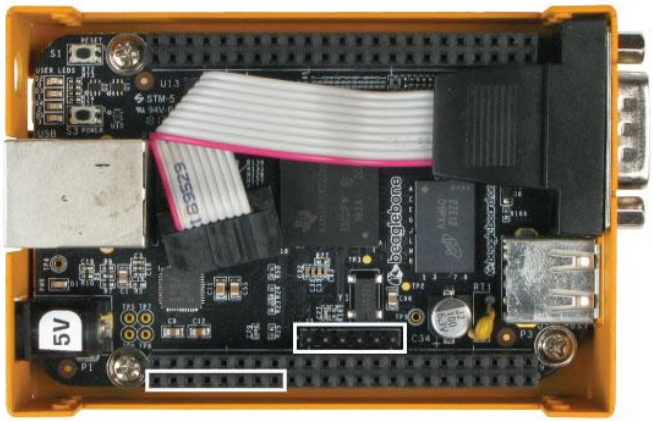
1. Remove the BeagleBone from its case (if previously mounted).
2. Using a small screwdriver remove the DB9 case cut-out.
3. Remove the 4-40 nuts from the serial cable.
4. Insert the DB9 connector to the case (ribbon cable red line away from the edge of the case).
5. Install the 4-40 nuts (leave slightly loose).

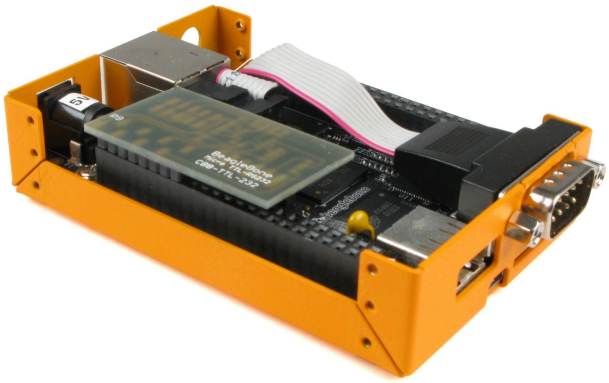


6. Insert the BeagleBone Black (USB connector side first).
7. Slip BeagleBone Black board under the DB9 connector.
8. Slide down the (Ethernet jack) side, while slightly bending the case wall out.



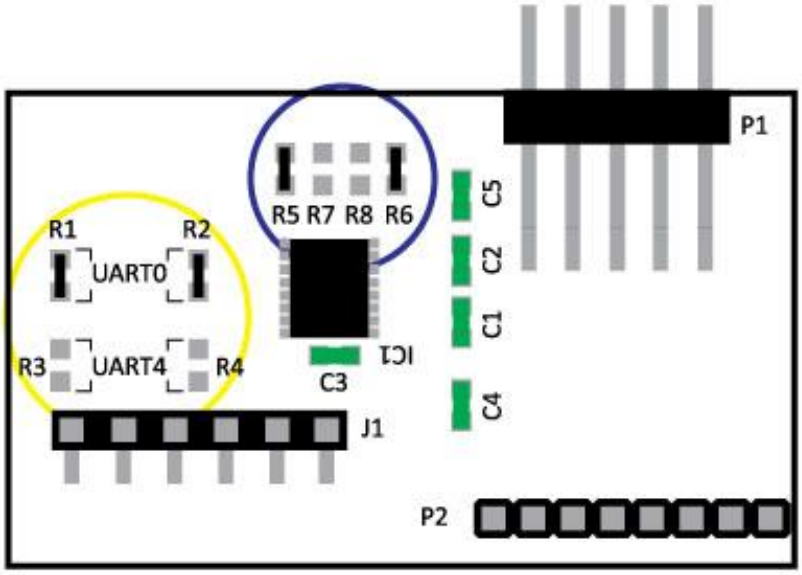
9. Install (3) BeagleBone Black board mounting screws to the bottom of the case.
10. Insert the MICRO-TTL-RS232 board into P9 and J1.





11. Insert the IDC10 ribbon cable into the micro cape P1 connector.
12. Tighten the 4-40 DB9 nuts securely.
13. Install the case cover.

Key Component Locations



Configuration locations
Yellow circle UART 0 or UART 4 selection
Blue circle DTE or DCE selection

P1 (IDC10) provides the RS232 signals to the DB9 (male) connector

IDC10 Pin	Signal	DB9-M pin	Description
1		1	Tied to DB9-4,6
2		6	Tied to DB9-1,4
3	RxD (input to BeagleBone)	2	RxD/TxD(*)
4		7	Tied to DB9-8
5	TxD (output from BeagleBone)	3	TxD/RxD(*)
6		8	Tied to DB9-7
7		4	Tied to DB9-1,6
8		9	Not used
9		5	GND
10	Key (NC)	No connection	Unused

(*) Depends on configuration DTE/DCE

J1 (Female)

This is the connection to the serial debug port of the BeagleBone. UART0 signal are located on this connector. (signals are 3.3V TTL logic levels)

J1 Pins	Signal	Description
1	Ground	Ground
2	Not used	-
3	Not used	-
4	UART0-RXD (3.3V)	Debug port: input to BeagleBone
5	UART0-TXD (3.3V)	Debug port:output of BeagleBone
6	Not used	-

P2 (Male)

P2 provides DC power, and UART4 signals to the micro cape.(signals are 3.3V TTL logic levels)
P2 plugs into P9 of the BeagleBone Black.

P2 Pins	BeagleBone (P9) Signal	Description
1	P9-1	Ground
2	P9-3	+3.3V
3	P9-5	VDD_5V(ext)
4	P9-7	SYS_5V
5	P9-9	Pwr_button
6	P9-11	UART4-RXD (3.3V)
7	P9-13	UART4-TXD (3.3V)
8	P9-15	GPIO-48

Programming

UART 0 is enabled by default (debug port) on Angstrom Linux
UART 0 is the default configuration for RS232 micro cape.

Enabling UART 4 (Angstrom Linux)

Requires hardware configuration (resistors settings).
Next load the device tree overlay for UART 4

echo BB-UART4 > /sys/devices/bone_capemgr.*/slots

To verify the overlay is loaded correctly:

cat /sys/devices/bone_capemgr.*/slots

```
0: 54:PF---
 1: 55:PF---
 2: 56:PF---
 3: 57:PF---
 4: ff:P-O-L Bone-LT-eMMC-2G,00A0,Texas Instrument,BB-BONE-EMMC-2G
 5: ff:P-O-L Bone-Black-HDMI,00A0,Texas Instrument,BB-BONELT-HDMI
 7: ff:P-O-L Override Board Name,00A0,Override Manuf,BB-UART4
```

Here UART4 overlay is loaded as slot 7.
(Note: the file loaded is /lib/firmware/BB-UART4-00A0.dtbo)

To set Baud Rate on UART4 (example 115200 Baud)

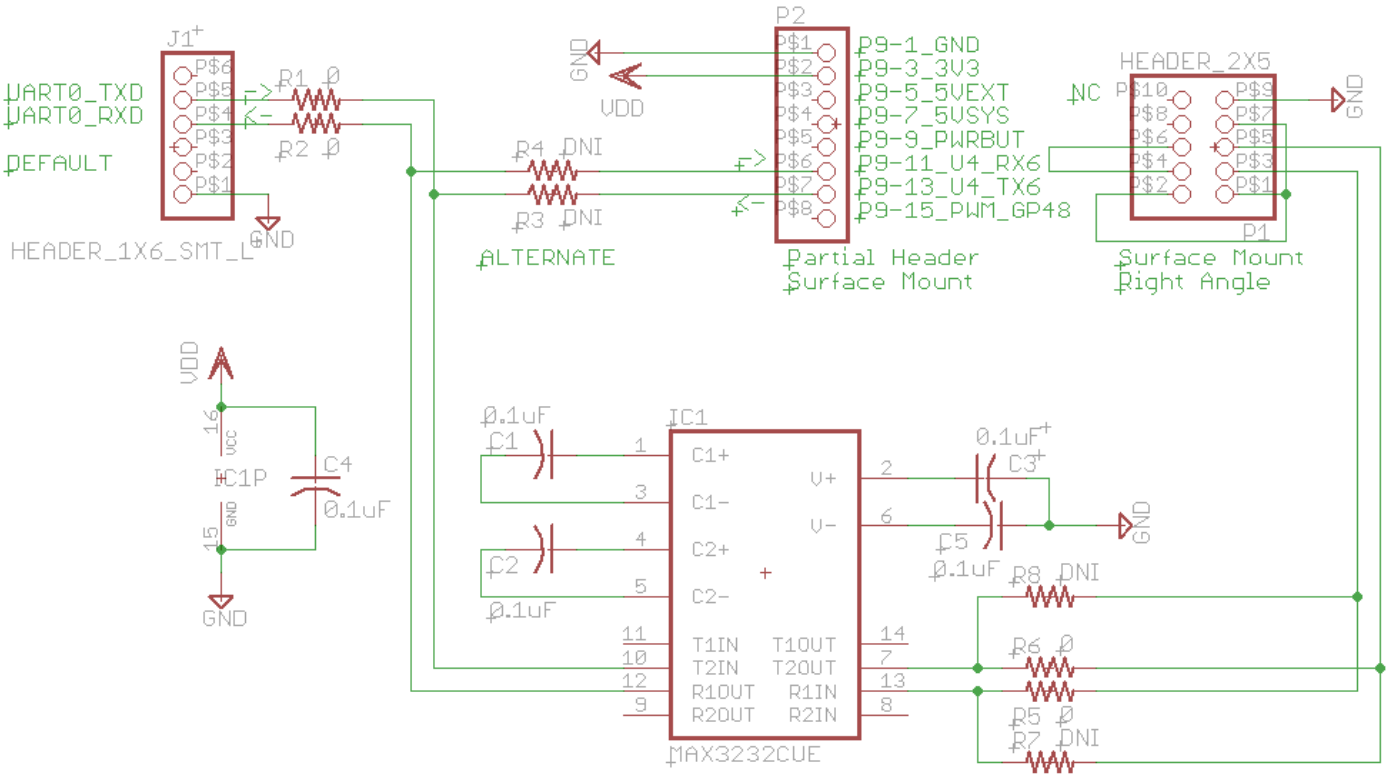
stty -F /dev/ttyO4 115200

To exercise UART4 (send data)

echo test > /dev/ttyO4

To receive (listen) on UART4

cat /dev/ttyO4


J1
UART0_TXD
UART0_RXD
DEFAULT
HEADER_1X6_SMT_L
R1 0
R2 0
R4 DNI
R3 DNI
ALTERNATE
GND
VDD
P2
P9-1_GND
P9-3_3V3
P9-5_5VEXT
P9-7_5USYS
P9-9_PWRBUT
P9-11_U4_RX6
P9-13_U4_TX6
P9-15_PWM_GP48
Partial Header
Surface Mount
HEADER_2X5
NC
P1
Surface Mount
Right Angle
IC1P
C4
0.1uF
C1
C2
C3
C5
IC1
C1+
C1-
C2+
C2-
V+
V-
T1IN
T2IN
R1OUT
R2OUT
T1OUT
T2OUT
R1IN
R2IN
MAX3232CUE
R8 DNI
R6 0
R5 0
R7 DNI

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Change History

[08/11/2013]	Version 1.0	Initial Preliminary Release
[12/03/2013]	Version 1.1	Added UART 4 device tree overlay information
[12/06/2013]	Version 1.2	DCE/DTE definition added, updated
[12/19/2013]	Version 1.3	Wording changes to SKU references
[05/06/2014]	Version 1.4	Schematic RefDes R3,R4 location corrected

More Information

For more information, see www.logicsupply.com

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