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Setup and User's Manual
TSHARC "C-Ray" Capacitive
Touch Screen Controller Board
Supports RS-232 and USB

Version 3.3x

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Important Documents and User Information

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Product Description

The TSHARC C-Ray Board is a new standard in capacitive touch screen controller technology. It supports serial and USB communication as well as all manufacturers' capacitive touch screens regardless of whether or not the screen includes a back shield.

The C-Ray is a high-performance touch screen controller which, in holding true to Microchip's design fundamentals, utilizes 'off-the-shelf' microcontroller technology in conjunction with Microchip's proprietary decoding techniques and device driver software. This virtually eliminates the threat of obsolescence while maintaining the high-performance and utility standards expected from Microchip Technology Inc.

Part Number Information

HS12-009C0J-03

The latest firmware revision will be supplied with all TSHARC C-Ray capacitive boards ordered.

Product Core Features

TSHARC C-Ray Core Features

- **RoHS Compliant**
- True 12-bit ratio metric analog to digital converter
- Configurable communication type
  - USB
  - RS-232
- Supports all manufacturers surface capacitive sensors.
  - Any pin-out
  - With backshield
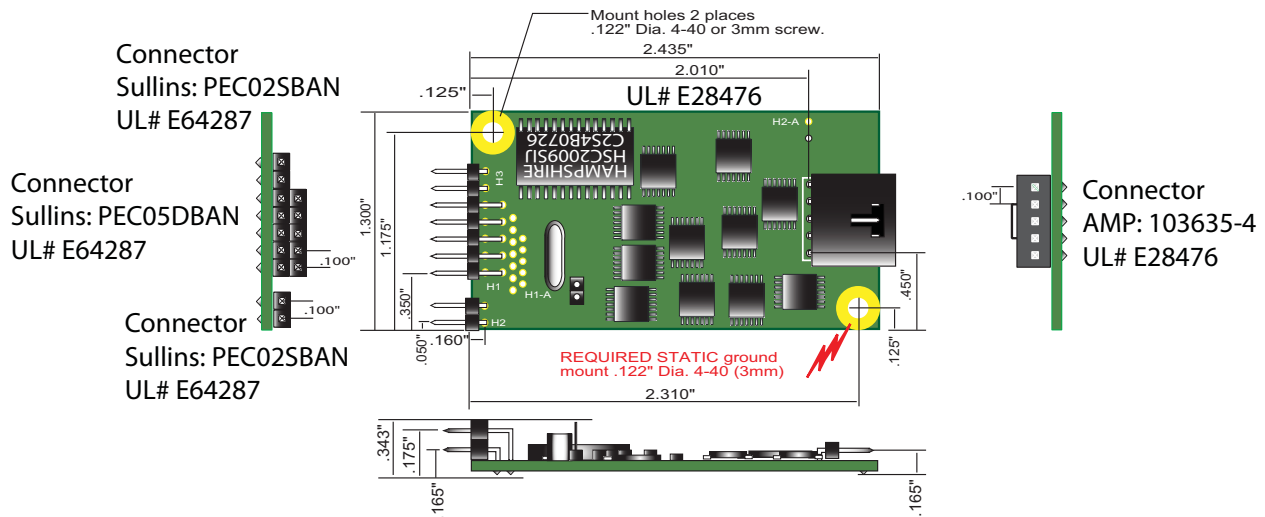 - Without backshield

Mechanical Diagram

Figure 1: Mechanical Diagram of TSHARC C-Ray Touch Screen Controller Board

NOTE!! The board revision number can be found on a label on the back side of your controller board. The firmware revision number may be found on a label or a laser mark located on the TSHARC microcontroller chip.

Integrating the TSHARC Capacitive Controller

Mounting the Controller

The controller has two .122" diameter (4-40 or 3mm screw) plated mounting holes. Notice the mounting hole closest to the touch screen connector H4. **THIS STATIC GROUND MOUNT MUST TERMINATE TO A STATIC GROUND**. Failure to ground the controller will result in poor performance and may eliminate the effectiveness of the on board static protection. For additional details about controller integration, please contact Microchip.

For best performance mount the controller:
1) In such a way to keep the touch screen tail away from high EMI, RFI and power sources.
2) "In line" with the touch screen tail limiting the number and severity of any bends or folds in the touch screen tail.
   Contact your touch screen manufacturer to determine any touch screen manufacturer's mounting specifications.
3) In a way to insure that you are using a communication cable with adequate shielding which is located away from high EMI, RFI radiating system components.
4) To shield the controller and/or the touch screen from EMI / RFI noise in cases where required. Mounting the controller into a metal box which is shielded might be necessary.
5) To insure the back shielded touch screen terminates to pin #3 (center pin) of H4. **It is required if a back shield is available.**
6) Make sure the back shield of the sensor does not come in contact with any grounded part of the system.
   IF PIN #3 IS CONNECTED IN ANY WAY TO AN EXTERNAL GROUND, YOU MAY PERMANENTLY DAMAGE YOUR CONTROLLER BOARD.
7) Such that the board, the LCD, and the computer system all have the same ground. Failure to have the same ground throughout the system may result in reduced controller performance.
8) The static ground mount must be terminated to a static ground before powering on the controller board. Failure to follow this procedure will bypass the static protection and may damage the controller causing the board to not function properly.
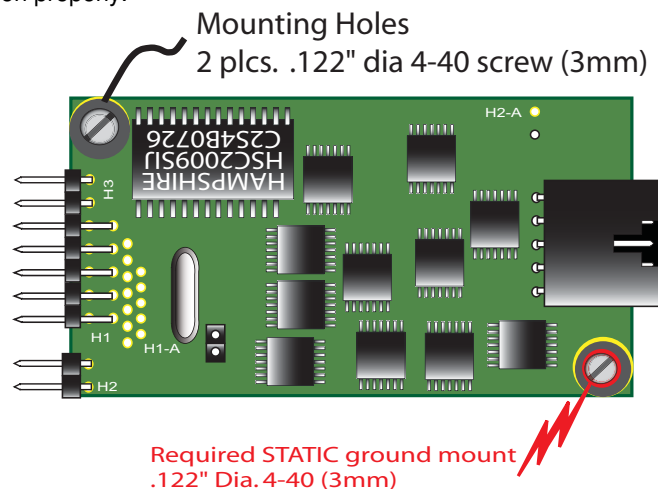
Figure 2: Controller Mounting Diagram

Although Microchip Technology Inc. has taken steps to protect your touch screen controller from transient voltage, it is important to make all grounding, communication and touch screen connections to the controller and touch screen. This must be done before powering on your computer, video monitor or touch screen controller. Failure to follow this procedure may result in damage to your controller and/or communication port**.** If you believe that your application will require additional static protection, it is up to you to determine the appropriate static protection needed to protect your electronics from transient voltage.

Failure to take the necessary precautions may result in damage to your controller. Microchip does not warranty the TSHARC controller board against transient static discharge damage.

Mounting the Capacitive Touch Screen

There are a number of methods that may be used to mount your touch screen depending upon your application and the recommendations of your sensor supplier. In all cases it is important that you do not make any electrical connections between the touch sensor and the integrated system. **Please contact your sensor manufacturer for specific mounting recommendations.**

The sensor tail often experiences more electrical noise than the sensor itself. Special care should be taken when considering the tail mounting of the sensor. Please contact your sensor manufacturer for specific instructions regarding the sensor tail.

In all cases, take special care to mount the touch screen in such a manner as to eliminate any screen shift or movement during operation. The C-Ray controller gathers environmental variables at power-up. Any changes to the touch screen position during use can negatively influence the performance of the system.

Connecting the Touch Screen

The TSHARC C-Ray, capacitive controller supports back shielded, non-back shielded and shielded tail capacitive touch screen overlays. Check the touch screen tail and verify the pin-out of the touch screen before you connect the touch screen to the controller. If the touch screen has a back shield or a shielded tail a connection must be made to the 3rd pin of header H4. Failure to connect a shielded touch screen or tail will cause the controller to malfunction. This connection is shown in Fig. 3.0.

Note: Microchip's touch screen mapping is consistent with all operating system display mapping specifications. Most operating systems draw the screen from upper left to lower right.
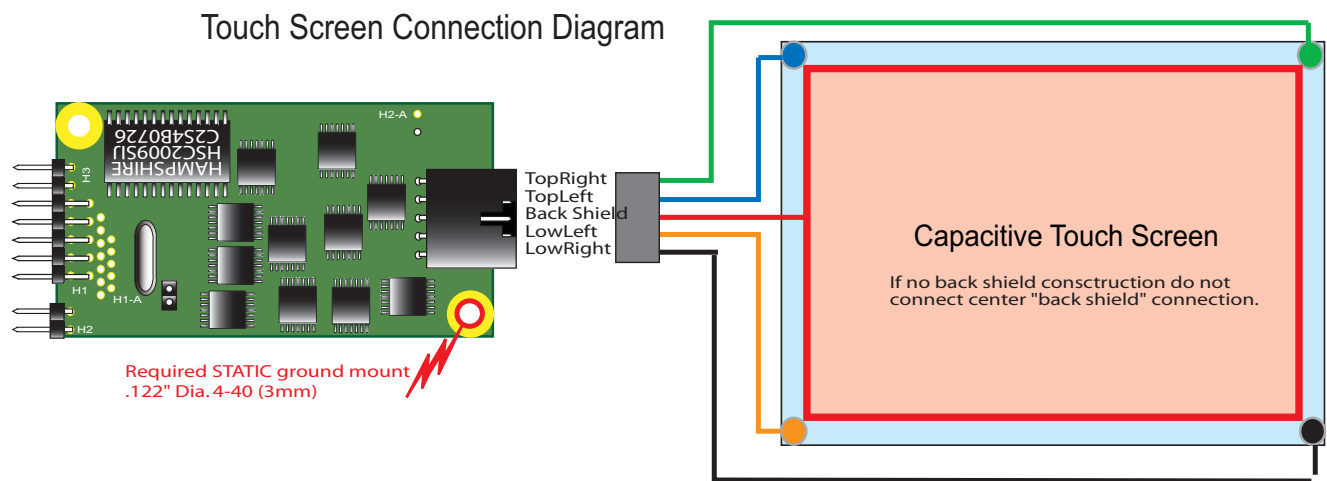

Figure 3: Touch Screen Connection Diagram

Communication Jumper Configurations

The TSHARC Capacitive controller supports RS-232 and USB, HID compliant, low speed, communication. While these are Microchip's standard communication formats, custom communications are available.

Please refer to the figure below for the jumper configurations that may be implemented.
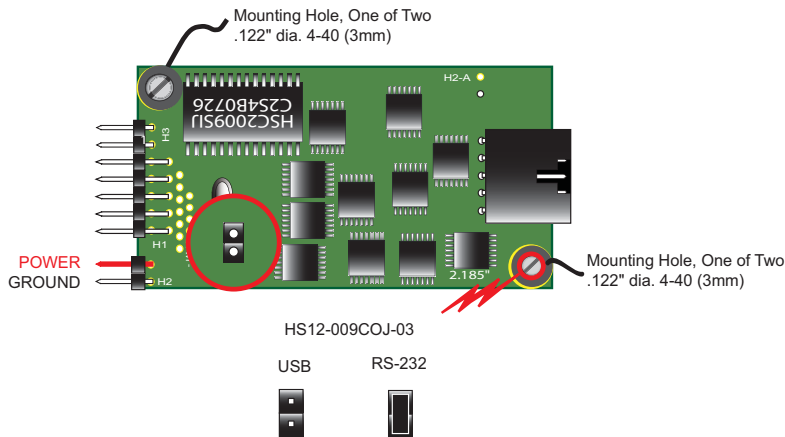
Figure 4: Jumper Selectable Communications

Connecting the C-Ray for RS-232 Communication

Before connecting the RS-232 communication cable, check the jumper setting on the board to insure that it is set properly for RS-232 communication.
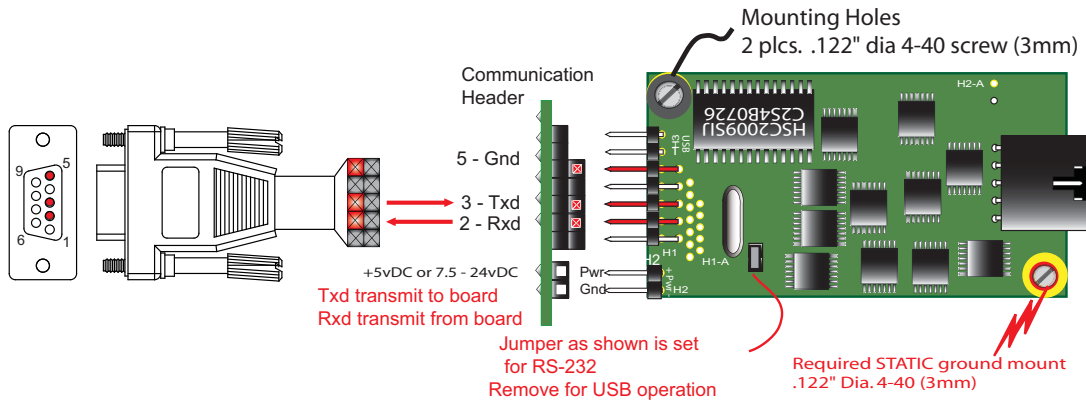
Figure 5: RS-232 Cable Connection Diagram

The RS-232 communication cable can be connected to the controller using a variety of cable types. Part number C72-100S2F-09XDXF cable may be sourced directly from Microchip Technology Inc. This is a standard 6' long DB-9 female connector terminated to a (housing/contact) 10 position dual row socket via a round shielded cable. This cable has a ground shield termination wire running the length of the cable which must be terminated to earth ground. Not terminating the cable shield will have a negative effect on the controller's performance.

Should a self-built cable be required, a 10-position, dual-row socket contact/housing connector type may be used to connect the RS-232 communication header. If an IDC connector type is desired, a 14-position socket can be used, which extends on to the USB pins with only the RS-232 communication connections terminated. A 10-position IDC socket cannot be used for connecting to the communication header because the width of an IDC socket is too wide to fit between the USB connection pins and the pins needed for RS-232 communication.

Microchip also provides the option to use a single row, 2.0 mm, 7-pin connection to the serial communication connection of the TSHARC-C controller board. This option may be used if it is desired to continue to connect the TSHARC-C controller to your system which has already been configured for 3M™ Microtouch™ connections. Please contact Microchip for ordering instructions regarding this option.

Connecting the C-Ray for USB Communication

Take special care when connecting the USB cable. Incorrect pin selection using the USB cable will result in a failed board when attempting to power the board. Also, be sure the jumpers are configured the way required for USB performance.

Connect the USB header contacts as shown in Fig. 7.0 for enabling USB communications with the controller board. The USB contacts are located on the lower side of the communication header. A 6' long 4-position socket to a Type "A" USB plug jacketed and shielded USB cable, part number C72-040S1F-04XAXM from Microchip Technology Inc can be ordered. This particular cable has a ground shield termination wire running the length of the cable which must be terminated to earth ground. <u>Not terminating the cable shield will have a negative effect on the controller's performance.</u> For information about ordering this cable, please contact Microchip Technology Inc.

Special Note: If planning to use a USB-hub, then it is critical to use a hub which has externally supplied power. If multiple devices are attached to the hub, then be sure the hub has sufficient power to power all devices connected. Failure to follow this recommendation will cause the controller to fail during operation.
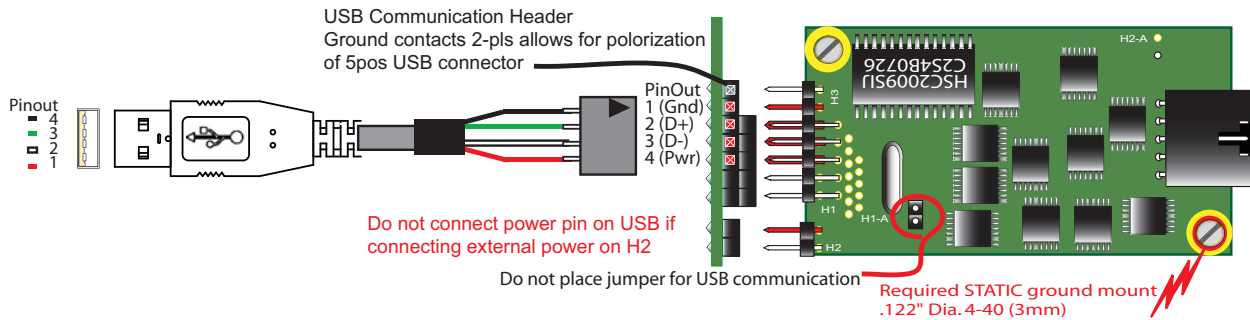

Figure 6: USB Cable Connection Diagram

There is an extra ground pin for USB which may be used to connect a five position USB connector. A five pin connection may be required if polarization of the connector is desired to insure it is terminated correctly.

Additional Connection Information

Communication Connector

UL and part number information can also be found in Fig. 6.
  Touch Screen: Amp 103635-4
  Communication: .100" Sullins: PEC05DBAN & PEC02SBAN

Mounting Hardware

Due to the wide variety of mounting options available for the TSHARC capacitive board, we do not stock mounting hardware. Please visit the RAF web site to review the available mounting hardware.
http://www.rafhdwe.com/RAF_site/OnlineCatalog/EHCoverFrame.html

TSHARC Controller Chip Solutions

Large volume OEM's who have in-house electrical and software engineers on staff may purchase a Microchip "Chip Only" touch screen controller solution which may be integrated on to their main board.   A complete set of technical documentation is available from Microchip Technology Inc. to assist in correctly integrating a chip solution into a product.   Please contact Microchip Technology Inc. for additional information.

Available Cables

Table 1: Available Communication Cables

Part Number:	Description:
C72-100S2F-09XDXF	6' RS-232 cable. Direct connect H1 header to female DB-9
C72-040S1F-04XAXM	6' USB cable. Direct connect H3 header to male type-A plug connector

Table 2: Available Power Cables

C20-020S1F-02XXXX	20" power cable, Direct connect to H2. 2 position, .100" socket to wire lead.
C20-020S1F-020S1F	20" power cable, Direct connect to H2. 2 position, .100" socket to 2 position .100" socket

Powering Your System

Before applying power to your system, please check all cables are tightly connected and verify the mounting of the controller and sensor. If powering the controller using USB, the system power should be brought up at the same time.

If using an external power supply, please be certain that the monitor is activated before the controller is turned on. The environmental baseline is taken at power-up, and performance could be affected if the monitor is not present when the controller is powered on.

Status LED Indicator

The TSHARC C-Ray capacitive touch screen controller board is equipped with a status-indicator Light Emitting Diode (LED). This LED will give you information regarding the functionality of the controller. The LED indication codes are as follows:

> **When powered on:** The LED with blink once (on then off), collect an environment baseline then blink once again for 1 second. DO NOT TOUCH THE TOUCH SCREEN DURING THIS PROCESS.
> **Every time the touch screen is touched:** Once the controller has collected the baseline, the LED will turn off. It will turn on every time the operator touches the touch screen thereafter.

DO NOT TOUCH THE TOUCH SCREEN IMMEDIATELY AFTER THE CONTROLLER IS POWERED ON. THE CONTROLLER MUST COMPLETE THE BASELINE PROCESS IN ORDER TO POWER ON CORRECTLY.

Static Protection Warning

The TSHARC C-Ray controller has internal static protection to +/- 30kV for static discharge from the touch screen to the controller. This static protection is only effective once the board is grounded properly. Adequate static precautions must be taken when connecting the TSHARC controller to the application. In some applications, it may be necessary to further protect your controller board from excess transient voltage. If it is believed that the application will require additional static protection, the appropriate static protection needed to protect the electronics from transient voltage is up to the customer. **Failure to take the necessary precautions may result in damage to your controller. Microchip does not warrantee the board for static voltage damage.**

	Although Microchip Technology Inc. has taken steps to protect your touch screen controller from transient voltage, it is important to make all grounding, communication and touch screen connections to the controller and touch screen. This must be done before powering on your computer, video monitor or touch screen controller. Failure to follow this procedure may result in damage to your controller and/or communication port. If you believe that your application will require additional static protection, it is up to you to determine the appropriate static protection needed to protect your electronics from transient voltage. **Failure to take the necessary precautions may result in damage to your controller. Microchip does not warranty the TSHARC controller board against transient static discharge damage.**

Communication Protocol

All Microchip touch screen controllers communicate with the host computer in a 4-byte communication protocol. Microchip's 4-byte communication protocol produces the industry's most reliable and accurate data transfer information without compromising touch speed.

Table 3: Microchip standard USB Protocol

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0	0	0	0	0	0	0	P
2	X7	X6	X5	X4	X3	X2	X1	X0
3	0	0	0	0	X11	X10	X9	X8
4	Y7	Y6	Y5	Y4	Y3	Y2	Y1	Y0
5	0	0	0	0	Y11	Y10	Y9	Y8

Table 4: Microchip standard RS-232 Protocol

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	1	P	X11	X10	X9	Y11	Y10	Y9
2	0	X8	X7	X6	X5	X4	X3	X2
3	0	Y8	Y7	Y6	Y5	Y4	Y3	Y2
4	0	0	0	0	X1	X0	Y1	Y0

Where: P   - 0 Pen-Up, 1 Pen-Down
           X11-X0   - 12 bit X position data
           Y11-Y0   - 12 bit Y position data

Software Device Drivers

Microchip Technology has device driver software available for all TSHARC touch screen controller chip and board solutions. The software drivers may be downloaded at no additional charge at: www.microchip.com. Reported Microchip resolution is dependent upon the hardware A-D converter specification. TSHARC device driver software is designed to deliver true 10- or 12-bit hardware resolution respective to the touch screen controller hardware.
The TSHARC device driver software enables you to configure the touch screen operation to meet your needs. The following is a list of features available with Microchip's software:

1)   Touch screen calibration
2)   Touch screen linearization
3)   Touch screen alignment
4)   Multi-monitor calibration and configuration
5)   Adjustable calibration inset
6)   Edge acceleration
7)   Touch modes
         a.   Normal mouse emulation
         b.   Touch Up mode
         c.   Touch Down mode
8)   User adjustable Configurations
         a.   Microchip's proprietary touch screen friendly timed right click event
         b.   Touch event area setting
         c.   Touch sound enable / disable
9)   Other special features also included. Please see the complete driver manuals available at the www.microchip.com web site for further details.

Note: TSHARC device drivers vary between operating systems and operating system varieties and versions. Currently Microchip supports the following Windows® Operating systems: DOS, Win3.1x, 9x, ME, XP, XPe, 2k, CE, CENet, Tablet. TSHARC driver for Linux, and MAC are also included with all TSHARC touch screen controller products.

Developed and Supported In-House

All TSHARC touch screen controller products are designed to utilize Microchip TSHARC™ device drivers which are developed, supported and maintained in-house by Microchip engineers. Microchip Technology Inc. does not use third party technical resources to develop, support or maintain any of its software or hardware products.

Private Labeled Drivers

Private labeled software and hardware licenses are available which may be used to enable various non-TSHARC communication protocols, special functions, application specific utilities or OEM contact information.   Contact Microchip for details.

TSHARC™ Controller Chip Solutions

Large volume OEM's who have in-house electrical and software engineers on staff may purchase a Microchip "Chip Only" touch screen controller solution which may be integrated on to their main board.   Technical documentation is available from Microchip Technology Inc. to assist you in correctly integrating a chip solution into your product.

Please contact Microchip Technology Inc at (414) 355-4675 or www.microchip.com.

Support Services

All TSHARC products are 100% developed and supported in house by Microchip technical staff. As a result we have included a broad range of support documentation at www.microchip.com including users and setup manuals, device drivers, driver manuals and other software. In addition we have an e-mail based support. You may contact us via e-mail at: http://support.microchip.com.

In addition, Microchip also understands that there is often a need for "real time" technical support. Please contact Microchip via telephone at any point to discuss issues that you may have regarding our products.

In the event that you need to contact us via telephone or via our support e-mail, please take a minute to identify these items prior to contacting Microchip technical support staff.
1) TSHARC controller part number
2) Information about TSHARC reseller if not purchased directly from Microchip
3) TSHARC chip revision, located on the top of each micro-controller chip
4) Touch Screen type and Manufacturer
5) Communication type
6) TSHARC™ driver and revision
7) Operating system and service pack releases
8) A brief summary of the problem that you are having

Notes

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