

EVM User's Guide: ULN2003ADYYEVM

ULN2003ADYY Evaluation Module



Description

The ULN2003ADYYEVM is a hardware evaluation module (EVM) used to enable hardware engineers to evaluate the full performance and functionality of the ULN2003ADYY Darlington Transistor Arrays. The ULN2003ADYYEVM is designed to be used as a standalone board with an attached voltage supply and output load to test and assess the ULN2003ADYY before designing into part of a greater application's power system. This EVM is populated with the SOT (DYY version) of ULN2003ADYY.

Features

- Pull-down resistors at each control input to make sure INx signals are not floating. Jumpers to parallel channels for higher current capability. An additional diode is connected from OUT7 to COM to suppress the kick-back voltage from an inductive load that is excited when the NPN drivers are turned off on OUT7.



1 Evaluation Module Overview

1.1 Introduction

The Texas Instruments ULN20003ADYYEVM is an evaluation module that is used to demonstrate and showcase all of the features of the underlying ULN2003ADYY Darlington Transistor Arrays. This evaluation board provides a seamless way to connect power supplies to the collector inputs of the device and turn on and off the device using the base control pins of the chip. Pull-down resistors on the base control channels make sure the control signal is never floating. Jumpers are included to short input channels together for increased current capability. Refer to the *Maximum Collector Current vs Duty Cycle* plots in the [ULN200x, ULQ200x High-Voltage, High-Current Darlington Transistor Arrays](#) data sheet to determine the maximum collector current given the number of outputs conducting simultaneously.

1.2 Kit Contents

[Table 1-1](#) lists the contents of the EVM kit. Contact the Texas Instruments Product Information Center nearest if any component is missing.

Table 1-1. Kit Contents

Item	Quantity
ULN2003ADYYEVM	1

1.3 Specification

The ULN2003ADYYEVM is compatible with the SOT (DYY version) of the ULN2003ADYY device. The distinction between packages is in the thermal properties. Please refer to the *Thermal Information* section of the [ULN200x, ULQ200x High-Voltage, High-Current Darlington Transistor Arrays](#) data sheet for more detailed specifications.

1.4 Device Information

The ULx200xA devices are high-voltage, high-current Darlington transistor arrays. Each consists of seven NPN Darlington pairs that feature high-voltage outputs with common-cathode clamp diodes for switching inductive loads. The collector-current rating of a single Darlington pair is 500mA. The Darlington pairs can be paralleled for higher current capability. Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED and gas discharge), line drivers, and logic buffers. This EVM is populated with the SOT (DYY version) of ULN2003A.

Table 1-2. Device Information

Part Number	Package	Body Size (nom)
ULN2003A	SOT (16)	4.20mm × 2.20mm

2 Hardware

2.1 Jumper Information

The ULN2003ADYYEVM jumpers are used to parallel channels for additional current capability. [Table 2-1](#) shows the relevant configuration jumpers of the ULN2003ADYYEVM as well as the associated values. Please refer to the ULN2003A data sheet for detailed information on each pin's functionality.

Note

A white mark on the jumper silkscreen is reflecting the position 1 of the jumper.

Table 2-1. Jumper Configurations

Jumper	Function, Settings
JP1	Connect 1 and 2 to connect 1B and 2B Darlington base inputs.
JP2	Connect 1 and 2 to connect 2B and 3B Darlington base inputs.
JP3	Connect 1 and 2 to connect 3B and 4B Darlington base inputs.
JP4	Connect 1 and 2 to connect 4B and 5B Darlington base inputs.
JP5	Connect 1 and 2 to connect 5B and 6B Darlington base inputs.
JP6	Connect 1 and 2 to connect 6B and 7B Darlington base inputs.
JP8	Connect 1 and 2 to connect 1C and 2C Darlington collector outputs.
JP9	Connect 1 and 2 to connect 2C and 3C Darlington collector outputs.
JP10	Connect 1 and 2 to connect 3C and 4C Darlington collector outputs.
JP11	Connect 1 and 2 to connect 4C and 5C Darlington collector outputs.
JP12	Connect 1 and 2 to connect 5C and 6C Darlington collector outputs.
JP13	Connect 1 and 2 to connect 6C and 7C Darlington collector outputs.

2.2 Test Points

[Table 2-2](#) shows the test points populated on the board as well as the signal connectors.

Table 2-2. Connections and Test Points

Connector and Test Point	Description
J1, TP1	1B Darlington base input
J2, TP2	2B Darlington base input
J3, TP3	3B Darlington base input
J4, TP4	4B Darlington base input
J5, TP5	5B Darlington base input
J6, TP6	6B Darlington base input
J7, TP7	7B Darlington base input
J8, TP8	1C Darlington collector output
J9, TP9	2C Darlington collector output
J10, TP10	3C Darlington collector output
J11, TP11	4C Darlington collector output
J12, TP12	5C Darlington collector output
J13, TP13	6C Darlington collector output
J14, TP14	7C Darlington collector output
J15, TP15	COM Common cathode node for flyback diodes
J29, TP16, TP17, TP18	Ground test point

3 Hardware Design Files

3.1 Schematics

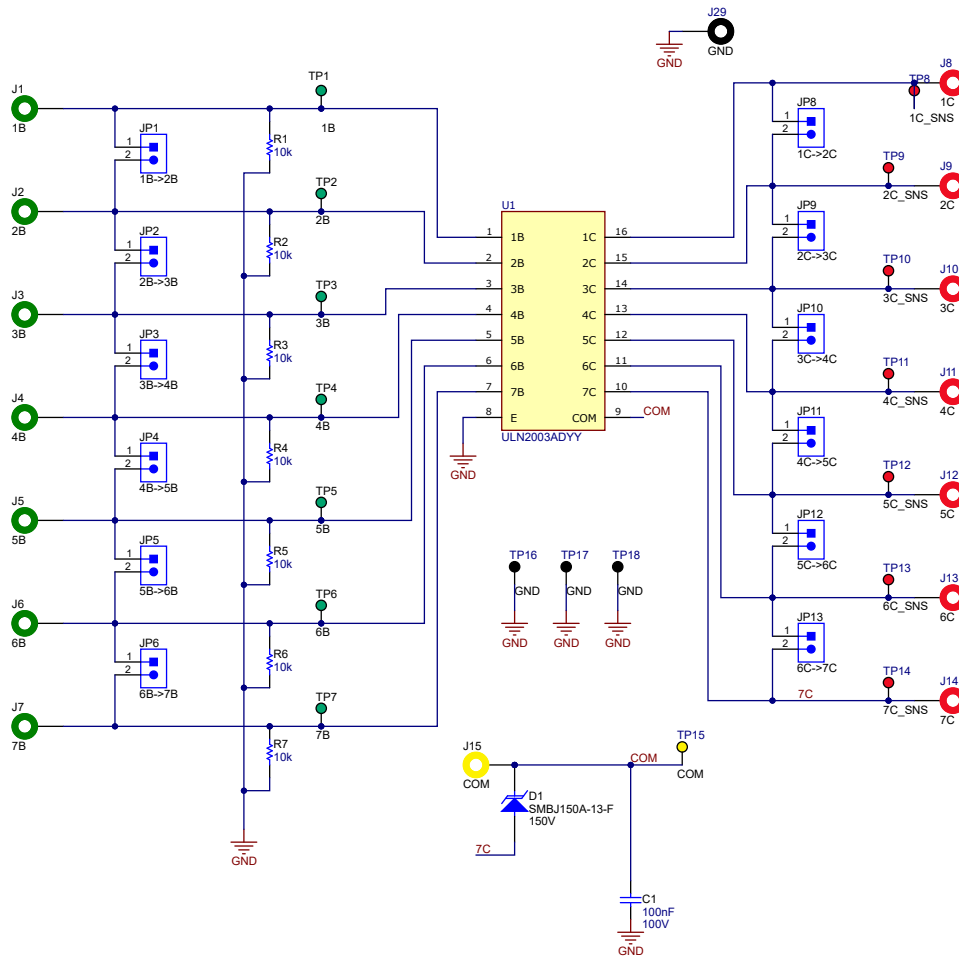


Figure 3-1. ULN2003ADYYEVM Schematic

3.2 PCB Layouts

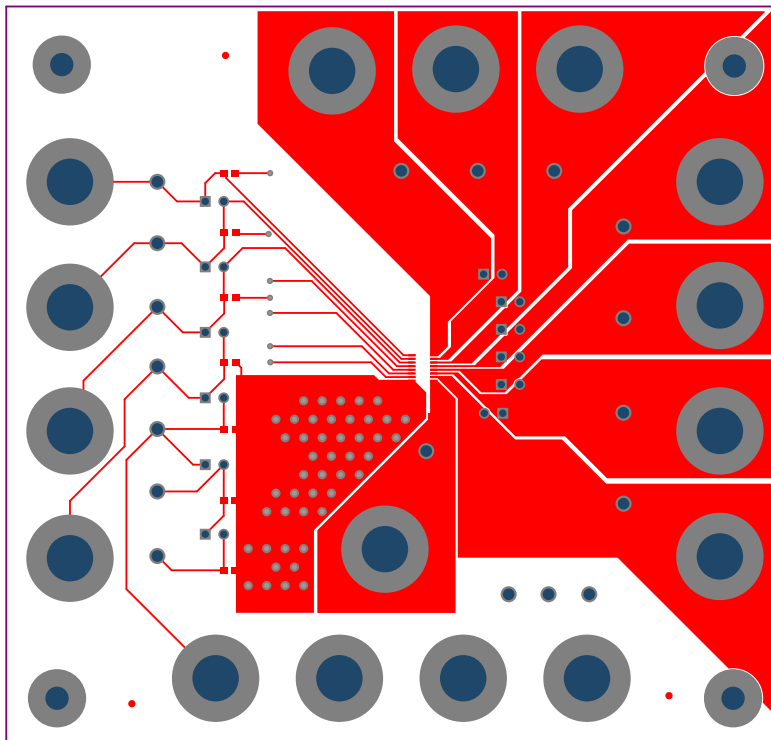


Figure 3-2. Top Layer

3.3 Bill of Materials (BOM)

Table 3-1. Bill of Materials

Designator	Description	Part Number	Manufacturer
C1	CAP, CERM, 0.1uF, 100V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	GCJ188R72A104KA01D	MuRata
D1	Diode, TVS, Uni, 150V, 243 Vc, SMB	SMBJ150A-13-F	Diodes Inc.
H1, H2, H3, H4	Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	NY PMS 440 0025 PH	B&F Fastener Supply
H5, H6, H7, H8	Standoff, Hex, 0.5"L #4-40 Nylon	1902C	Keystone
J1, J2, J3, J4, J5, J6, J7	BANANA JACK, SOLDER LUG, GREEN, TH	SPC15382	Tenma
J8, J9, J10, J11, J12, J13, J14	BANANA JACK, SOLDER LUG, RED, TH	SPC15363	Tenma
J15	BANANA JACK, SOLDER LUG, YELLOW, TH	SPC15390	Tenma
J29	BANANA JACK, SOLDER LUG, BLACK, TH	SPC15354	Tenma
JP1, JP2, JP3, JP4, JP5, JP6, JP8, JP9, JP10, JP11, JP12, JP13	Header, 100mil, 2x1, Tin, TH	PEC02SAAN	Sullins Connector Solutions
R1, R2, R3, R4, R5, R6, R7	RES, 10 k, 5%, 0.1 W, 0603	CRCW060310K0JNEA	Vishay-Dale
SH-J1, SH-J2, SH-J3, SH-J4, SH-J5, SH-J6, SH-J7, SH-J8, SH-J9, SH-J10, SH-J11	Shunt, 100mil, Gold plated, Black	SNT-100-BK-G	Samtec
TP1, TP2, TP3, TP4, TP5, TP6, TP7	Test Point, Multipurpose, Green, TH	5126	Keystone
TP8, TP9, TP10, TP11, TP12, TP13, TP14	Test Point, Multipurpose, Red, TH	5010	Keystone
TP15	Test Point, Compact, Yellow, TH	5009	Keystone
TP16, TP17, TP18	Test Point, Multipurpose, Black, TH	5011	Keystone
U1	High-Voltage, High-Current Darlington Transistor Arrays	ULN2003ADYY	Texas Instruments

4 Additional Information

4.1 Trademarks

All trademarks are the property of their respective owners.

5 Related Documentation

Texas Instruments, [ULN200x, ULQ200x High-Voltage, High-Current Darlington Transistor Arrays](#), data sheet

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NOTE:

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3 Regulatory Notices:

3.1 United States

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3.1.2 For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

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<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

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2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
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