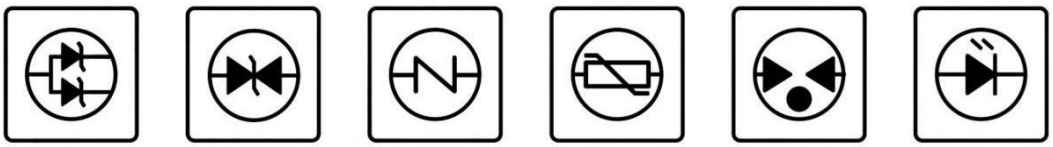
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# ULN2803Q-MS

**Product specification**

# ULN2803Q-MS

**Darlington Transistor Array**

## Description

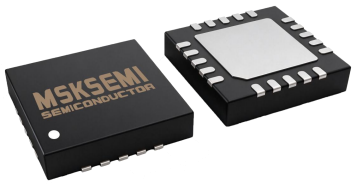
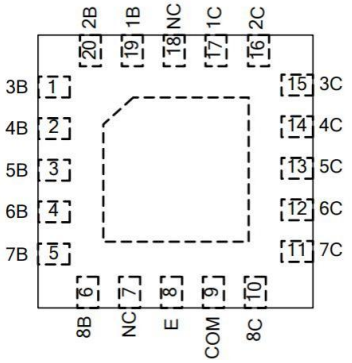
The ULN2803Q-MS device is a 50V, 500mA Darlington transistor array. The device consists of eight NPN Darlington pairs that feature high-voltage outputs with common-cathode clamp diodes for switching inductive loads. The collector-current rating of each Darlington pair is 500 mA. The Darlington pairs can be connected in parallel for higher current capability.

Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED and gas discharge), line drivers, and logic buffers. The ULN2803Q-MS device has a 2.7kΩ series base resistor for each Darlington pair for operation directly with TTL or 5V CMOS devices.

## Features

- 500mA-rated collector current (single output)
- High-voltage outputs: 50 V
- Output clamp diodes
- Inputs compatible with various types of logic

## Reference News

| QFN-20L(4x4) | PIN CONFIGURATION | MARKING |
|---|---|---|
|  |  |  |



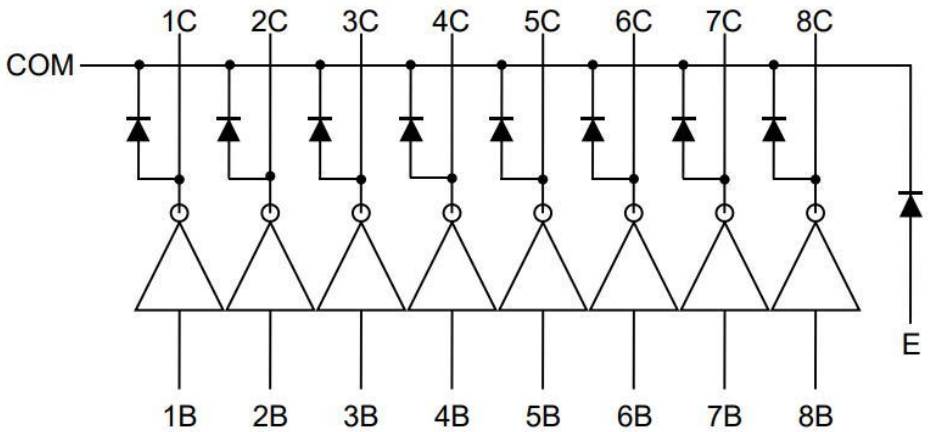



Figure1.FunctionalDiagram

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## Ordering Information (Example)

| Type | Package | Minimum Package(pcs) |
|---|---|---|
| ULN2803Q-MS | QFN-20L(4x4) | 3000PCS |

## Pin Description

| PIN No. | NAME | I/O | FUNCTION |
|---|---|---|---|
| 7 | NC | | No Connect Pin |
| 19 | 1B | I | Channel 1 Darlington Base Input |
| 20 | 2B | I | Channel 2 Darlington Base Input |
| 1 | 3B | I | Channel 3 Darlington Base Input |
| 2 | 4B | I | Channel 4 Darlington Base Input |
| 3 | 5B | I | Channel 5 Darlington Base Input |
| 4 | 6B | I | Channel 6 Darlington Base Input |
| 5 | 7B | I | Channel 7 Darlington Base Input |
| 6 | 8B | I | Channel 8 Darlington Base Input |
| 8 | GND/E | | Common Emitter Shared by All Channels (typically tied to ground) |
| 9 | COM | I/O | Common Cathode Node for Flyback Diodes (required for inductive loads) |
| 10 | 8C | O | Channel 8 Darlington Collector Output |
| 11 | 7C | O | Channel 7 Darlington Collector Output |
| 12 | 6C | O | Channel 6 Darlington Collector Output |
| 13 | 5C | O | Channel 5 Darlington Collector Output |
| 14 | 4C | O | Channel 4 Darlington Collector Output |
| 15 | 3C | O | Channel 3 Darlington Collector Output |
| 16 | 2C | O | Channel 2 Darlington Collector Output |
| 17 | 1C | O | Channel 1 Darlington Collector Output |
| 18 | NC | | No Connect Pin |

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## Logic Diagram

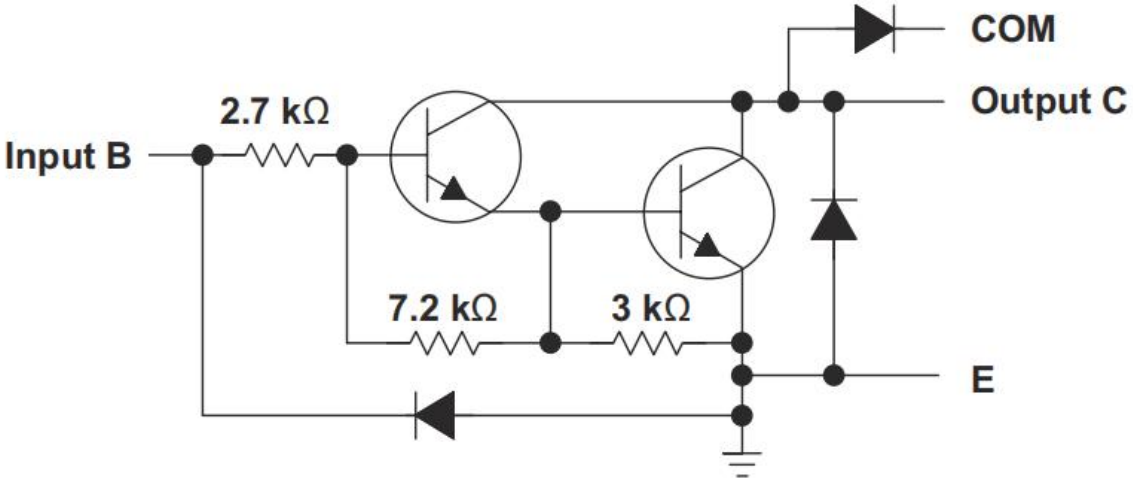



Figure 2 ： ULN2803Q-MS Logic Diagram

## Absolute Maximum Ratings

| Symbol | Parameter | MIN | MAX | Unit |
|---|---|---|---|---|
| $V_{CE}$ | Collector-Emitter Voltage | | 50 | V |
| $V_I$ | Input Voltage Range, All Inputs | | 30 | V |
| Peak Collector Current | | | 500 | mA |
| $P_D$ | Power Dissipation | | 500 | mW |
| $T_J$ | Junction Temperature | | 125 | ℃ |
| $T_{OP}$ | Operating Temperature | -40 | 85 | ℃ |

Absolute maximum ratings are those values beyond which the device could be permanently damaged,These are stress ratings only,which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions.

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## Electrical Characteristics

### DC Specifications

($T_a$=25℃, voltages are referenced to VSS (ground=0V), unless otherwise specified)

| Symbol | Parameter | Test Condition | MIN | TYP | MAX | Unit |
|---|---|---|---|---|---|---|
| $I_{CEX}$ | Collector Cutoff Current | $V_{CE}$=50V,$I_I$= 0 | -- | -- | 50 | uA |
| $I_{I(off)}$ | Off-state input current | $I_C$ = 500 uA | 50 | 80 | -- | uA |
| $I_{I(on)}$ | Input Current | VI=3.85V | -- | 0.9 | -- | mA |
| $V_{I(on)}$ | On-state Input Voltage | $V_{CE}$=2V,$I_C$ = 200 mA | -- | 1.8 | 2.4 | V |
| | | $V_{CE}$=2V,$I_C$ = 250 mA | -- | 1.85 | 2.7 | V |
| | | $V_{CE}$=2V,$I_C$ = 300 mA | -- | 1.9 | 3 | V |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $I_I$=250uA,$I_C$ = 100 mA | -- | 0.9 | 1.2 | V |
| | | $I_I$=350uA,$I_C$ = 200 mA | -- | 1 | 1.3 | V |
| | | $I_I$=500uA,$I_C$ = 350 mA | -- | 1.25 | 1.7 | V |
| $I_R$ | Clamp Diode Reverse Current | $V_R$=50V | -- | -- | 50 | uA |
| $V_F$ | Clamp Diode Forward Voltage | $I_F$= 350 mA | -- | 1.3 | 2 | V |

## Parameter Measurement Information

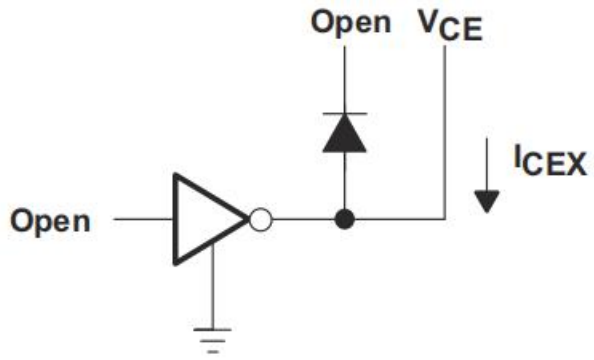



Figure 3: $I_{CEX}$ Test Circuit

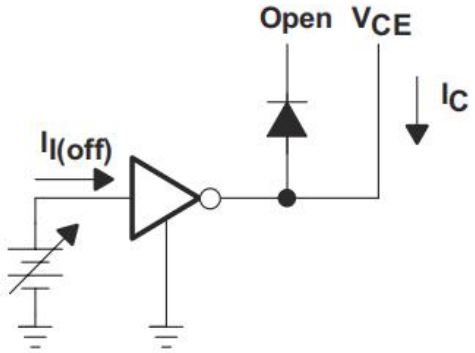



Figure 4: $I_{I(off)}$ Test Circuit

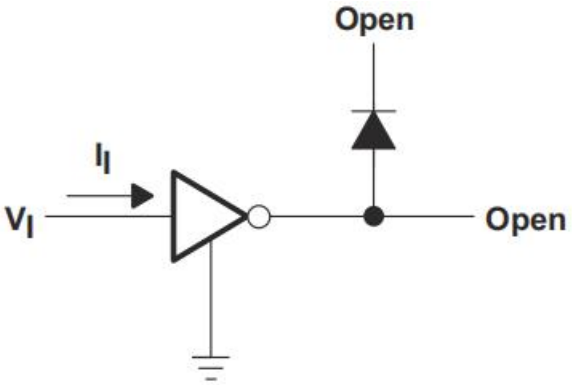



Figure 5 : $I_{I(on)}$ Test Circuit

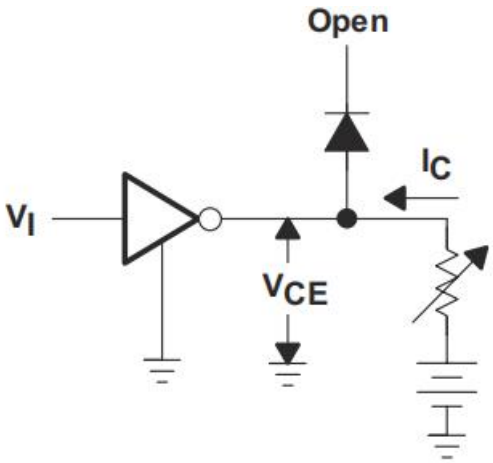



Figure 6: $V_{I(on)}$ Test Circuit

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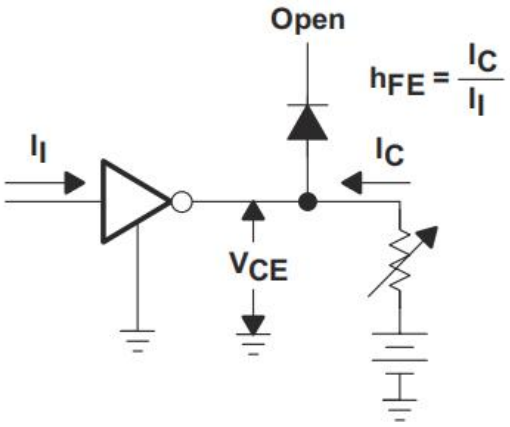



Figure 7: $V_{CE(sat)}$ Test Circuit

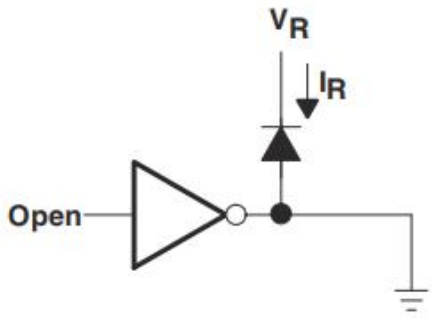



Figure 8: $I_R$ Test Circuit

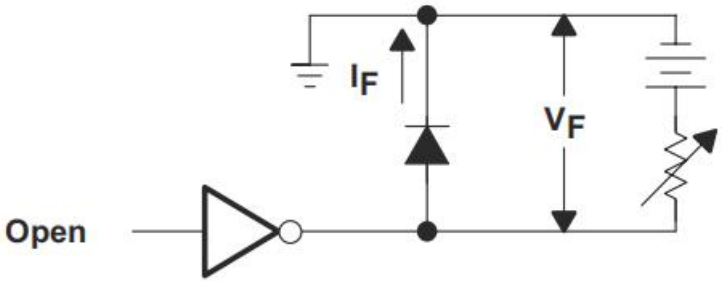



Figure 9: $V_F$ Test Circuit

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## Applications information

ULN2803Q-MS is typically used to drive a high-voltage or current peripherals from an MCU or logic device that cannot tolerate these conditions. The following design is a common application of ULN2803Q-MS, driving inductive loads. This includes motors, solenoids, and relays. Each load type can be modeled by what is seen in Figure 10.

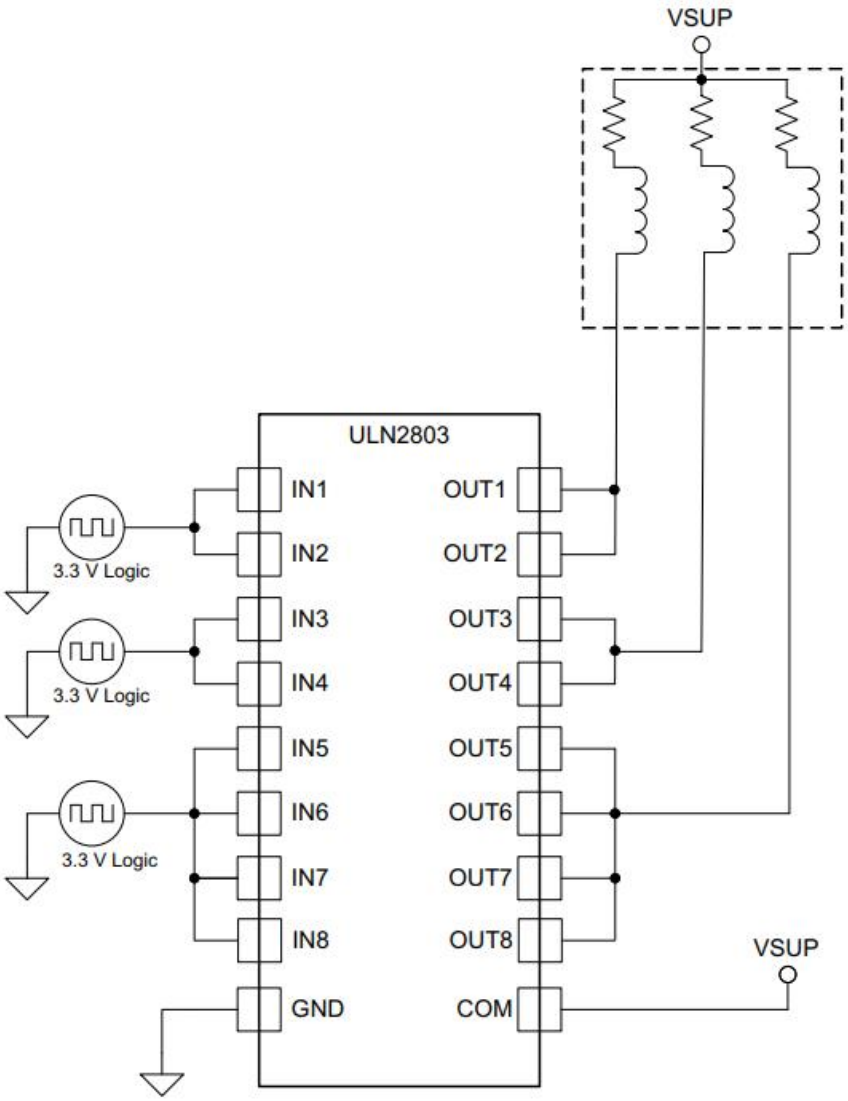
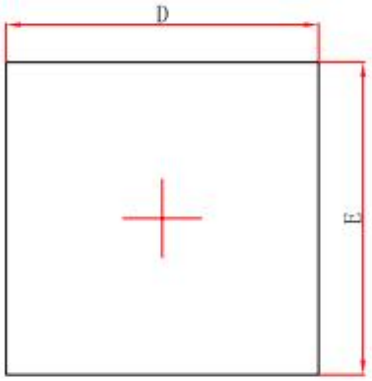


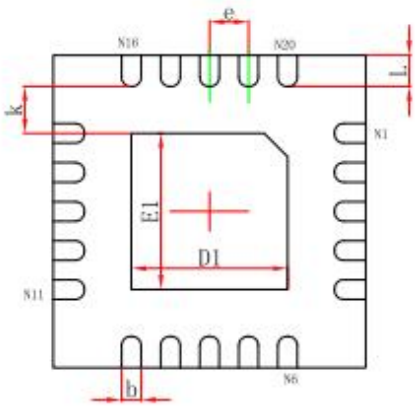

Figure 10: ULN2803Q-MS as inductive load driver

## PackageInformation

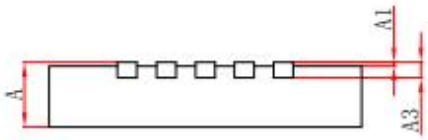
**QFN-20L(4x4)**




Top View




Bottom View




Side View

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 0.700/0.800 | 0.800/0.900 | 0.028/0.031 | 0.031/0.035 |
| A1 | 0.000 | 0.050 | 0.000 | 0.002 |
| A3 | 0.203REF. | | 0.008REF. | |
| D | 3.900 | 4.100 | 0.154 | 0.161 |
| E | 3.900 | 4.100 | 0.154 | 0.161 |
| D1 | 1.900 | 2.100 | 0.075 | 0.083 |
| E1 | 1.900 | 2.100 | 0.075 | 0.083 |
| k | 0.600REF. | | 0.024REF. | |
| b | 0.200 | 0.300 | 0.008 | 0.012 |
| e | 0.500BSC. | | 0.020BSC. | |
| L | 0.300 | 0.500 | 0.012 | 0.020 |

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