

*Advance Information*

# Contact Monitoring and Dual Low Side Protected Driver

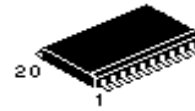
The MC33287 has been designed to interface between switching contacts (to battery or ground) and a microcontroller. This circuit includes 2 low side drivers, resistive and inductive loads or lamps.

- 8 High Voltage Input Triggers :
  - 1 Direct Output and 7 Multiplexed,
  - Direct Interface with Microcontroller
- 2 Low Side Drivers
  - Current Limitation :  $I_{lim}$  Typ = 0.5A (Each Output)
  - Internal Clamp :  $V_{clamp}$  Typ = 50V
  - Low Power Consumption in Standby Mode :  $I_{max} = 110\mu A$
  - Overtemperature Protection (Typical 160°C)
  - Outputs Fault Detection

## MC33287

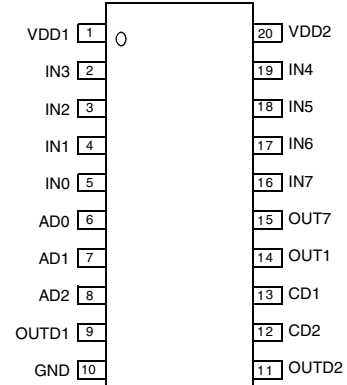
### Contact Monitoring and Dual Low Side Protected Driver

SEMICONDUCTOR  
TECHNICAL DATA



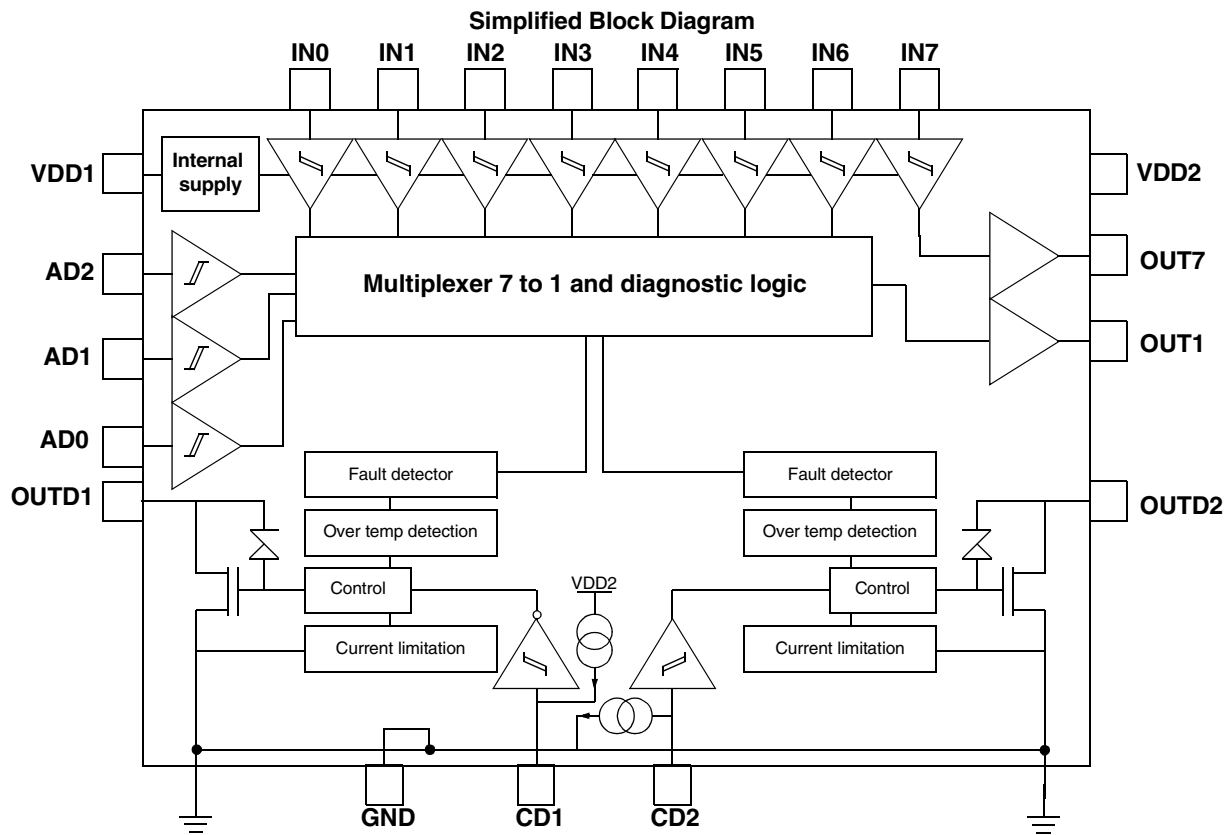
**DW SUFFIX**  
PLASTIC PACKAGE  
SO20L

#### PIN ASSIGNMENT



#### ORDERING INFORMATION

| Device    | Temperature Range | Package |
|-----------|-------------------|---------|
| MC33287DW | -40°C to +125°C   | SO20L   |



This document contains information on a new product. Specifications and information herein are subject to change without notice.

**For More Information On This Product,  
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**MAXIMUM RATINGS**

| Ratings   | Symbol   | Min    | Typ | Max    | Unit |
|---|----------|--------|-----|--------|------|
| Operating Ambient Temperature                                   | Tamb     | - 40   |     | 85     | °C   |
| Storage Ambient Temperature                                     | Tstorage | - 65   |     | 105    | °C   |
| Supply Voltage (Load Dump Conditions)                           | VDD1     |        |     | 40     | V    |
| Supply Voltage (Continuous)                                     | VDD1     |        |     | 24     | V    |
| Supply Voltage (Continuous)                                     | VDD2     |        |     | 7      | V    |
| Input Voltage On Pin IN1 (With Serial Resistor ≥ 25kΩ)          | VIN      |        |     | 40     | V    |
| Total Power Dissipation (Tamb = 85°C)                           | Pd       |        |     | 0,7    | W    |
| V ESD (Note MIL STD 883C)                                       | VESD     | - 2000 |     | + 2000 | V    |
| Thermal Resistance Jonction To Air<br>(Circuit Soldered On Pcb) | Rth(j-a) |        | 80  | 100    | °C/W |

**ELECTRICAL CHARACTERISTICS.** Full specification is  $7V \leq V_{DD1} \leq 18V$ ;  $4,75V \leq V_{DD2} \leq 5,25V$ ;  $-40^{\circ}C \leq t_{amb} \leq 85^{\circ}C$ , unless otherwise noted. Extended limit is :  $5V \leq V_{DD1} \leq 7V$  and other parameters are full spec. in this mode, inputs IN1 and lowside drivers are still fonctionnal with downgraded characteristics.

| Parameters | Symbol | Min | Typ | Max | Unit |
|------------|--------|-----|-----|-----|------|
|------------|--------|-----|-----|-----|------|

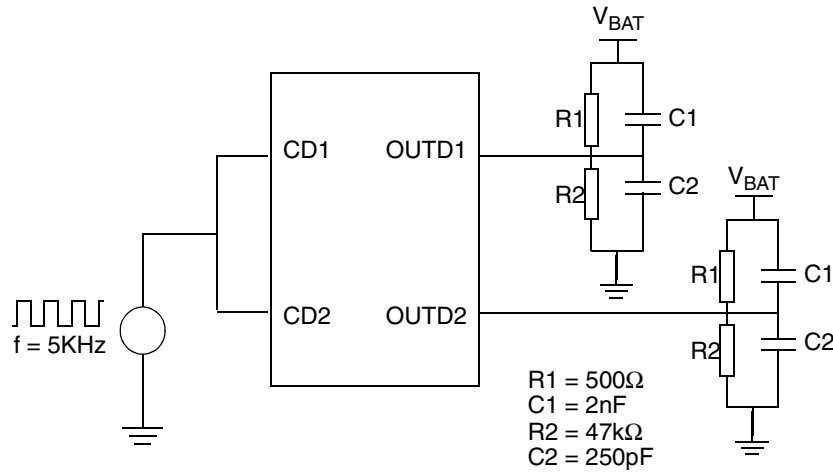
**SUPPLY VOLTAGE : VDD1 and VDD2 Pins**

|  |                    |      |            |              |    |
|--|--------------------|------|------------|--------------|----|
| Operational Supply Voltage (Full Spec)   | VDD1               | 7    | 12         | 18           | V  |
| Operational Supply Voltage (Extend limit)  | VDD1               | 5    |            | 7            | V  |
| Operational Supply Voltage (Full Spec)   | VDD2               | 4.75 | 5          | 5.25         | V  |
| Supply Current Standby Mode ( $V_{DD1} \leq 14V$ ; $V_{CD1} = V_{DD2}$ , $V_{CD2} = 0V$ )<br>All IN1 and AD1 inputs connected to ground      | IVDD1-0<br>IVDD2-0 |      | 55         | 110          | μA |
| Supply Current in Drivers on Configuration (Full Spec ; $V_{CD1} = 0V$ ; $V_{CD2} = V_{DD2}$ )<br>All INi and ADi inputs connected to ground | IVDD1-1<br>IVDD2-1 |      | 250<br>650 | 1500<br>1500 | μA |

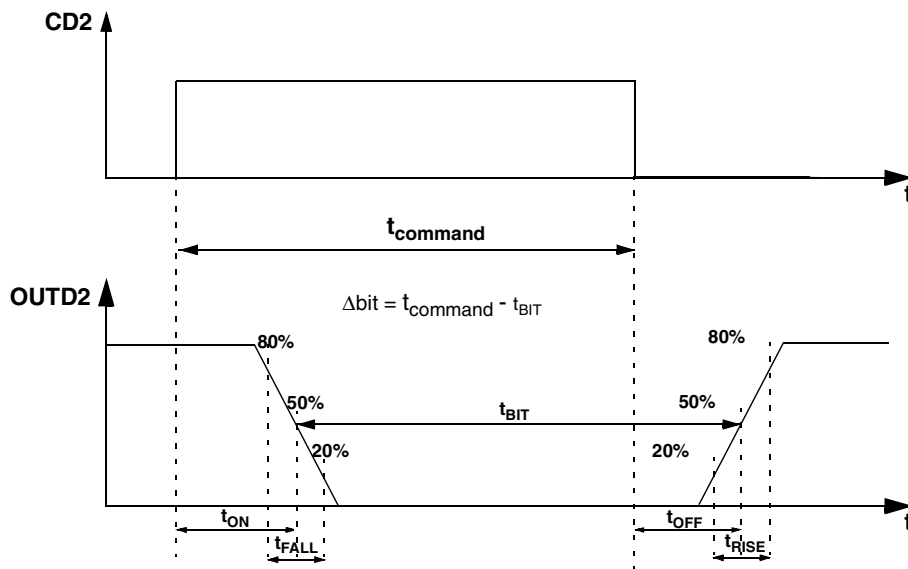
**DRIVERS CHARACTERISTICS : Output Driver Characteristics : OUTD1 and OUTD2 Pins**

|   |                   |     |      |      |    |
|---|-------------------|-----|------|------|----|
| Output Resistance (Full Spec and $T_j \leq 130^{\circ}C$ )    | Rdson             |     | 1.40 | 3.20 | Ω  |
| Output Resistance (Extend limit and $T_j \leq 130^{\circ}C$ ) | Rdson             |     |      | 5.00 | Ω  |
| Leakage Current (Internal current source)                     | ILeakage          | 1   |      | 13   | μA |
| Turn On Delay Time  | t <sub>ON</sub>   |     | 1.3  | 10   | μs |
| Turn Off Delay Time   | t <sub>OFF</sub>  |     | 2.1  | 10   | μs |
| Output Rising Edge  | t <sub>RISE</sub> |     | 2.8  | 10   | μs |
| Output Falling Edge   | t <sub>FALL</sub> |     | 1.0  | 10   | μs |
| Difference between command duration and bit duration          | Δbit              | - 5 |      | 5    | μs |

**Figure 1. Timing Test Configuration**



**Figure 2. Timing Characteristics**



**PROTECTION AND LEVEL DETECTION : OUTD1 AND OUTD2 PINS**

| Parameters   | Symbol | Min  | Typ  | Max | Unit |
|--|--------|------|------|-----|------|
| Positive Output Clamp                                      | Vclamp | 40   | 50   | 60  | V    |
| Output Current Limitation (130°C ≥ Tj)                     | Ilim   | 300  | 535  | 750 | mA   |
| Output Fault Detector Level                                | Vfault | 2,00 | 2,75 | 3,5 | V    |
| Overtemperature Detection (At 25°C by function simulation) | Tdetec | 145  | 160  | 175 | °C   |

**INPUTS : CD1 AND CD2 PINS**

|   |          |            |     |            |    |
|---|----------|------------|-----|------------|----|
| Input Voltage Low   | Vil      |            |     | 0,4 x VDD2 | V  |
| Input Voltage High  | Vih      | 0,8 x VDD2 |     |            | V  |
| Hysteresis  | Vhys     | 500        | 800 |            | mV |
| Input Current on Pin CD1 (Internal pull up and CD1 connected to ground) | ICD1     | -100       | -30 | -10        | μA |
| Leakage Current on Pin CD1 (Internal pull-up CD1 connected to VDD2)     | Ileakage | -5         |     | 5          | μA |
| Input Current on Pin CD2 (Internal pull down CD2 connected to VDD2)     | ICD2     | 10         | 30  | 100        | μA |

**PROTECTION AND LEVEL DETECTION : OUTD1 AND OUTD2 PINS**

| Parameters   | Symbol   | Min | Typ | Max | Unit |
|--|----------|-----|-----|-----|------|
| Leakage Current on Pin CD2<br>(Internal pull-up CD1 connected to ground) | Ileakage | -5  |     | 5   | μA   |

**DRIVERS FUNCTION TABLE : Outputs and fault detector status (Diag)**

| CD1 | OUTD1 | DIAGD1 | Status                               |
|-----|-------|--------|--------------------------------------|
| h   | H     | h      | Driver 1 normally OFF                |
| l   | L     | h      | Driver 1 normally ON                 |
| h   | L     | l      | Driver 1 shorted to GND or open load |
| l   | H     | l      | Driver 1 over loaded                 |

| CD2 | OUTD2 | DIAGD2 | Status                               |
|-----|-------|--------|--------------------------------------|
| l   | H     | h      | Driver 2 normally OFF                |
| h   | L     | h      | Driver 2 normally ON                 |
| l   | L     | l      | Driver 2 shorted to GND or open load |
| h   | H     | l      | Driver 2 over loaded                 |

H = High Level for Drivers Outputs, L = Low Level for Drivers Outputs  
h = High Level for Logic Signals, l = Low Level for Logic Signals.

**NOTES** : CD1 is active on low level (driver 1 is on when CD1 is low), CD2 is active on high level (driver 2 is on when CD2 is high). The DIAGD1 output is neither latched for filtered.

**LOGIC CHARACTERISTICS**

| Characteristic | Symbols | Min | Typ | Max | Unit |
|----------------|---------|-----|-----|-----|------|
|----------------|---------|-----|-----|-----|------|

**INPUTS : Pins IN0 to IN7**

|   |           |            |    |            |    |
|---|-----------|------------|----|------------|----|
| Input Voltage Low (Full Spec)                     | Vil       |            |    | 0,4 x VDD1 | V  |
| Input Voltage Low (Extended Limit)                | Vil       |            |    | 0,3 x VDD1 | V  |
| Input Voltage High (Full Spec and Extended Limit) | Vih       | 0,7 x VDD1 |    |            | V  |
| Hysteresis (5V ≤ VDD1 ≤ 16V)                      | Vhys      | 0,5        | 1  |            | V  |
| Input Current (Vin ≤ 16V)                         | Ileakage  | - 5        |    | 5          | μA |
| Input Voltage Clamp (I = 100μA)                   | Vin clamp | 17         | 20 | 23         | V  |

**INPUTS : AD0, AD1, AD2 Pins**

|                    |          |            |     |            |    |
|--------------------|----------|------------|-----|------------|----|
| Input Voltage Low  | Vil      |            |     | 0,4 x VDD2 | V  |
| Input Voltage High | Vih      | 0,8 x VDD2 |     |            | V  |
| Hysteresis         | Vhys     | 500        | 750 |            | mV |
| Input Current      | Ileakage | - 5        |     | 5          | μA |

**8 LINE TO 1 LINE DATA MULTIPLEXER FUNCTION TABLE**

| Inputs |     |     | OUT1   |
|--------|-----|-----|--------|
| AD2    | AD1 | AD0 |        |
| x      | x   | x   | -      |
| l      | l   | l   | in0    |
| l      | l   | h   | in1    |
| l      | h   | l   | in2    |
| l      | h   | h   | in3    |
| h      | l   | l   | in4    |
| h      | l   | h   | in5    |
| h      | h   | l   | in6    |
| h      | h   | h   | DIAGDi |

h = High Level, l = Low Level, x = high impedance, - unknown.  
DIAGDi is the value of the selectionned internal fault detector (See below)  
in0, in1...in6 are the normalised values of the INi respectives inputs  
(INi = Vbat -ini = VDD2)

**FAULT DETECTOR SELECTION.** This table presents the sequential patterns which enable to select the diagnostic of driver 1 (diagd1) or driver 2 (diagd2)

| Inputs |     |     | OUTi   |
|--------|-----|-----|--------|
| AD2    | AD1 | AD0 |        |
| -      | -   | -   | -      |
| -      | l   | h   | -      |
| h      | h   | h   | DIAGD1 |
| -      | -   | -   | -      |
| -      | h   | l   | -      |
| h      | h   | h   | DIAGD2 |

h = High Level, l = Low Level, x = high impedance, - unknown.

**OUTPUTS : OUT1 AND OUT7 PINS**

| Parameters                          | Symbols | Min      | Typ | Max      | Unit |
|-------------------------------------|---------|----------|-----|----------|------|
| Output Voltage Low (Iload = 2mA)    | Vol     |          |     | 0,2 VDD2 | V    |
| Output Voltage High (Iload = - 2mA) | Voh     | 0,8 VDD2 |     |          | V    |

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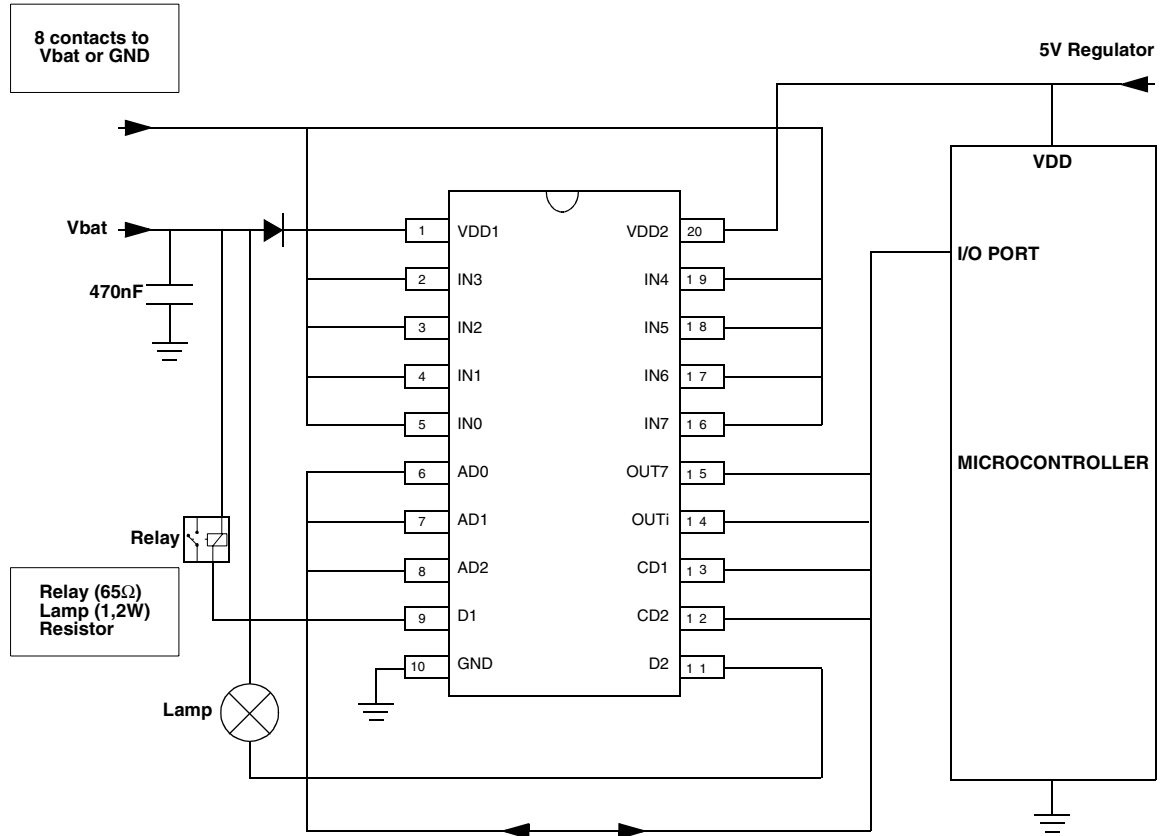
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**PINS FUNCTION DESCRIPTION**

| Pin Number | Name  | Description                                       |
|------------|-------|---|
| 1          | VDD1  | High Voltage Power Supply (Vbat)                  |
| 2          | IN3   | High Voltage Input 3                              |
| 3          | IN2   | High Voltage Input 2                              |
| 4          | IN1   | High voltage input 1                              |
| 5          | IN0   | High Voltage Input 0                              |
| 6          | AD0   | Adress for Mode and Input Selection               |
| 7          | AD1   | Adress for Mode and Input Selection               |
| 8          | AD2   | Adress for Mode and Input Selection               |
| 9          | OUTD1 | Output Driver 2 (Drain)                           |
| 10         | GND   | Common Ground                                     |
| 11         | OUTD2 | Output Driver 2 (Drain)                           |
| 12         | CD2   | Driver 2 command                                  |
| 13         | CD1   | Driver 1 command                                  |
| 14         | OUTI  | Output (Multiplexed output i = 0 to 6) and Diagi2 |
| 15         | OUT7  | Output 7 (Direct Output from IN7)                 |
| 16         | IN7   | High Voltage Input 7                              |
| 17         | IN6   | High Voltage Input 6                              |
| 18         | IN5   | High Voltage Input 5                              |
| 19         | IN4   | High Voltage Input 4                              |
| 20         | VDD2  | Low Voltage Power Supply (5v)                     |

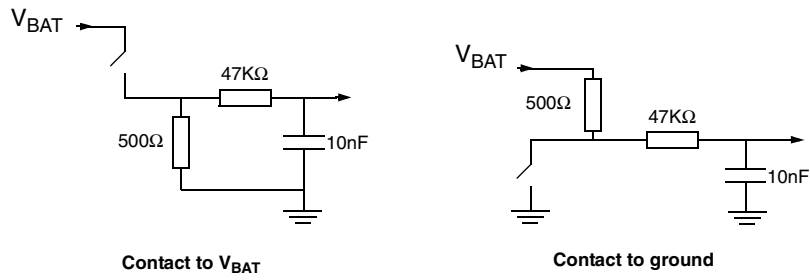
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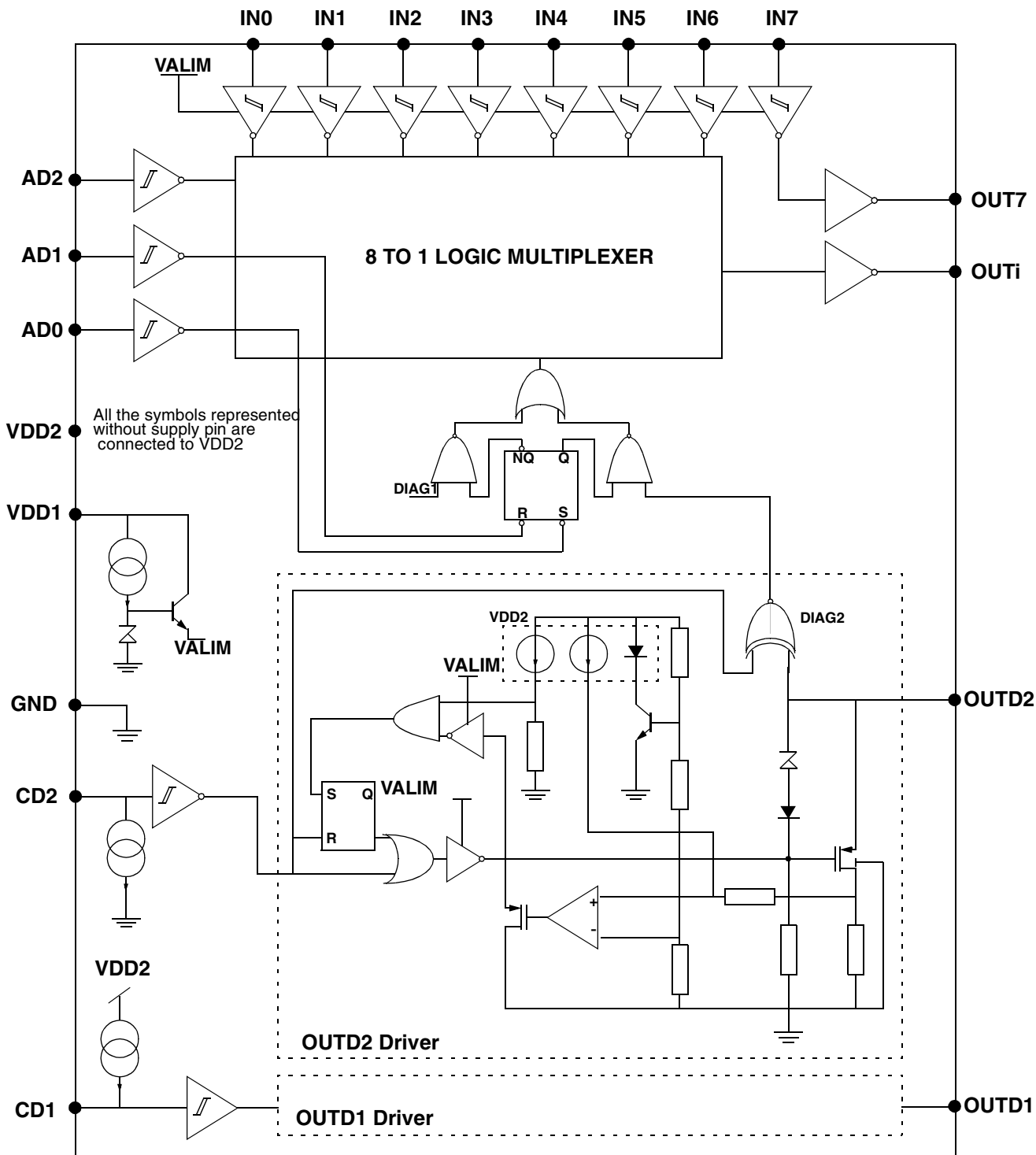
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 APPLICATION

**Figure 3. Typical Application Configuration**



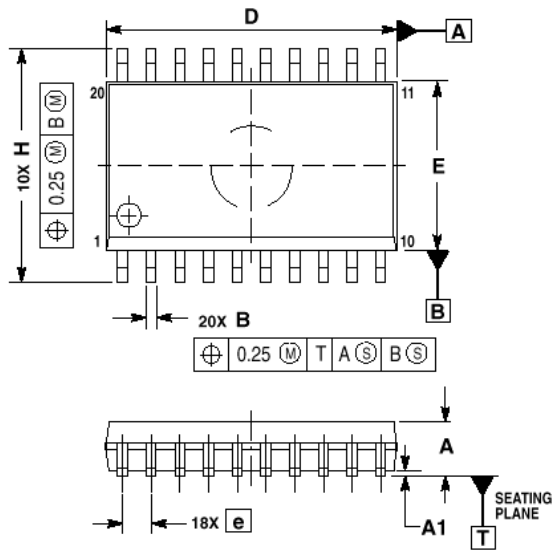
**Figure 4. Contact Configuration**






**NOTE :** The only difference between the low side driver 1 and 2 is the polarity of the command. Also, there are an internal pull-up at pin CD1, an internal pull-down at pin CD2 and an extra inverted is placed after the CD1 input trigger.





- NOTES:
1. DIMENSIONS ARE IN MILLIMETERS.
  2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
  3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
  4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
  5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF B DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS |       |
|-----|-------------|-------|
|     | MIN         | MAX   |
| A   | 2.35        | 2.65  |
| A1  | 0.10        | 0.25  |
| B   | 0.35        | 0.49  |
| C   | 0.23        | 0.32  |
| D   | 12.65       | 12.95 |
| E   | 7.40        | 7.60  |
| e   | 1.27 BSC    |       |
| H   | 10.05       | 10.55 |
| h   | 0.25        | 0.75  |
| L   | 0.50        | 0.90  |
| θ   | 0           | 7     |

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