

## Advance Information

# Contact Monitoring and Dual Low Side Protected Driver

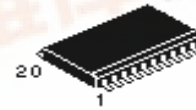
The MC33287 has been designed to interface between switching contacts (to battery or ground) and a microcontroller. This circuit includes 2 low side drivers, resistive and inductive loads or lamps.

- 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

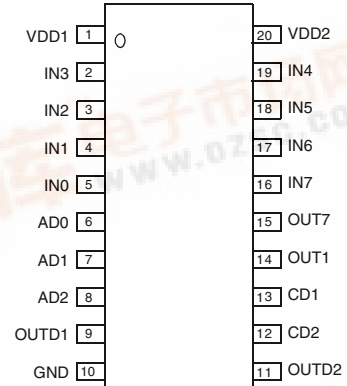
### Contact Monitoring and Dual Low Side Protected Driver

SEMICONDUCTOR  
TECHNICAL DATA



**DW SUFFIX**  
PLASTIC PACKAGE  
SO20L

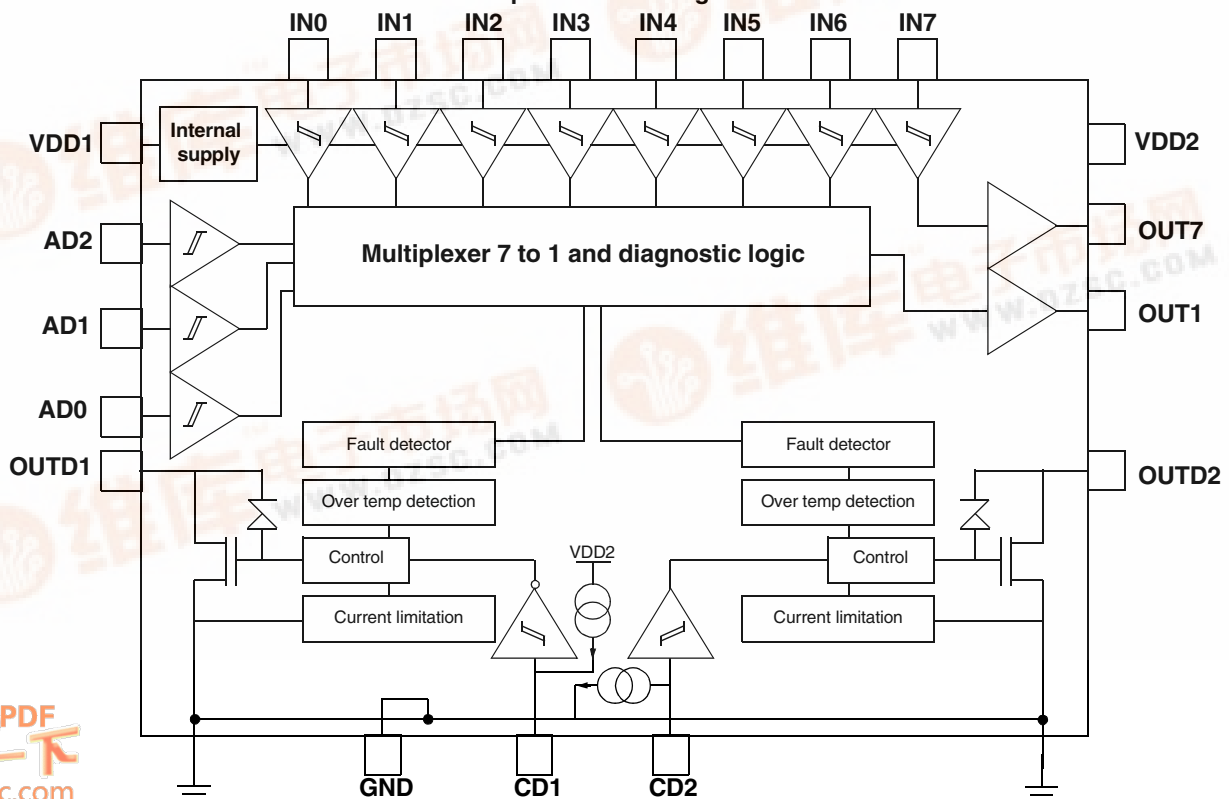
#### PIN ASSIGNMENT



#### ORDERING INFORMATION

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

#### Simplified Block Diagram



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# Freescale Semiconductor, Inc. MC33287

## 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 $\geq 25k\Omega$ )	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 (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 functional with downgraded characteristics.

Parameters	Symbol	Min	Typ	Max	Unit
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### 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 ( $V_{DD1} \leq 14V$ ; $V_{CD1} = V_{DD2}$ , $V_{CD2} = 0V$ ) All IN1 and AD1 inputs connected to ground	IVDD1-0 IVDD2-0		55	110	$\mu A$
Supply Current in Drivers on Configuration (Full Spec ; $V_{CD1} = 0V$ ; $V_{CD2} = V_{DD2}$ ) All INi and ADi inputs connected to ground	IVDD1-1 IVDD2-1		250	1500	$\mu A$
			650	1500	$\mu A$

### 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	$\Omega$
Output Resistance (Extend limit and $T_j \leq 130^{\circ}C$ )	Rdson			5.00	$\Omega$
Leakage Current (Internal current source)	ILeakage	1		13	$\mu A$
Turn On Delay Time	t <sub>ON</sub>		1.3	10	$\mu s$
Turn Off Delay Time	t <sub>OFF</sub>		2.1	10	$\mu s$
Output Rising Edge	t <sub>RISE</sub>		2.8	10	$\mu s$
Output Falling Edge	t <sub>FALL</sub>		1.0	10	$\mu s$
Difference between command duration and bit duration	$\Delta bit$	- 5		5	$\mu s$

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Figure 1. Timing Test Configuration

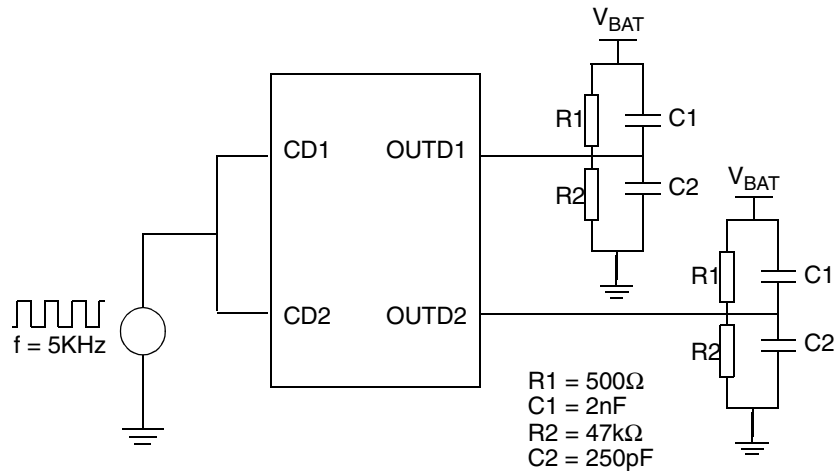
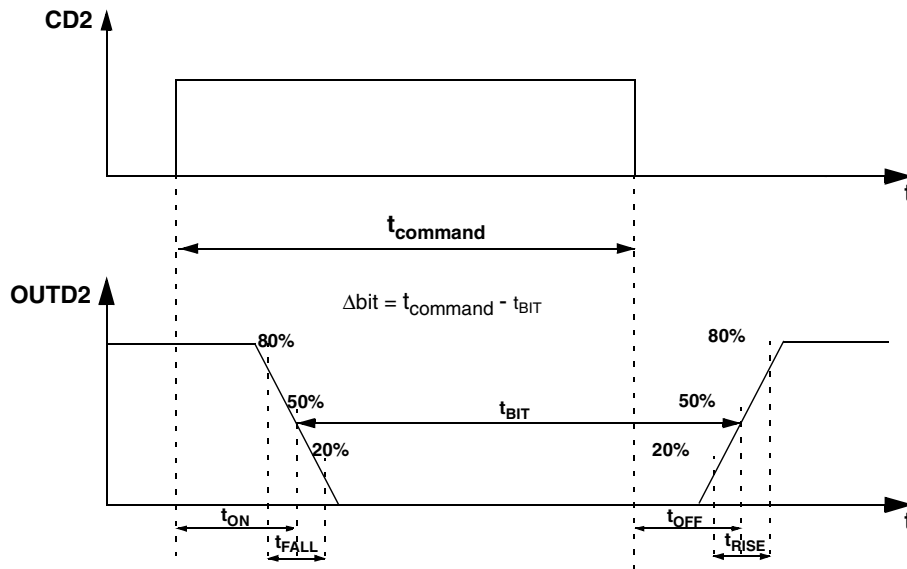


Figure 2. Timing Characteristics



**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 ≥ T <sub>J</sub> )	I <sub>lim</sub>	300	535	750	mA
Output Fault Detector Level	V <sub>fault</sub>	2,00	2,75	3,5	V
Overtemperature Detection (At 25°C by function simulation)	T <sub>detec</sub>	145	160	175	°C

**INPUTS : CD1 AND CD2 PINS**

Input Voltage Low	V <sub>il</sub>			0,4 x VDD2	V
Input Voltage High	V <sub>ih</sub>	0,8 x VDD2			V
Hysteresis	V <sub>hys</sub>	500	800		mV
Input Current on Pin CD1 (Internal pull up and CD1 connected to ground)	I <sub>CD1</sub>	-100	-30	-10	μA
Leakage Current on Pin CD1 (Internal pull-up CD1 connected to VDD2)	I <sub>leakage</sub>	-5		5	μA
Input Current on Pin CD2 (Internal pull down CD2 connected to VDD2)	I <sub>CD2</sub>	10	30	100	μA

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## PROTECTION AND LEVEL DETECTION : OUTD1 AND OUTD2 PINS

Parameters	Symbol	Min	Typ	Max	Unit
Leakage Current on Pin CD2 (Internal pull-up CD1 connected to ground)	Ileakage	-5		5	$\mu\text{A}$

### 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 DIAGDI output is neither latched for filtered.

### LOGIC CHARACTERISTICS

Characteristic	Symbols	Min	Typ	Max	Unit
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#### 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 ( $5\text{V} \leq \text{VDD1} \leq 16\text{V}$ )	Vhys	0,5	1		V
Input Current ( $V_{in} \leq 16\text{V}$ )	Ileakage	- 5		5	$\mu\text{A}$
Input Voltage Clamp ( $I = 100\mu\text{A}$ )	Vin clamp	17	20	23	V

#### INPUTS : AD0, AD1, AD2 Pins

Input Voltage Low	Vil			0,4 x VDD2	V
Input VoltageHigh	Vih	0,8 x VDD2			V
Hysteresis	Vhys	500	750		mV
Input Current	Ileakage	- 5		5	$\mu\text{A}$

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**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**

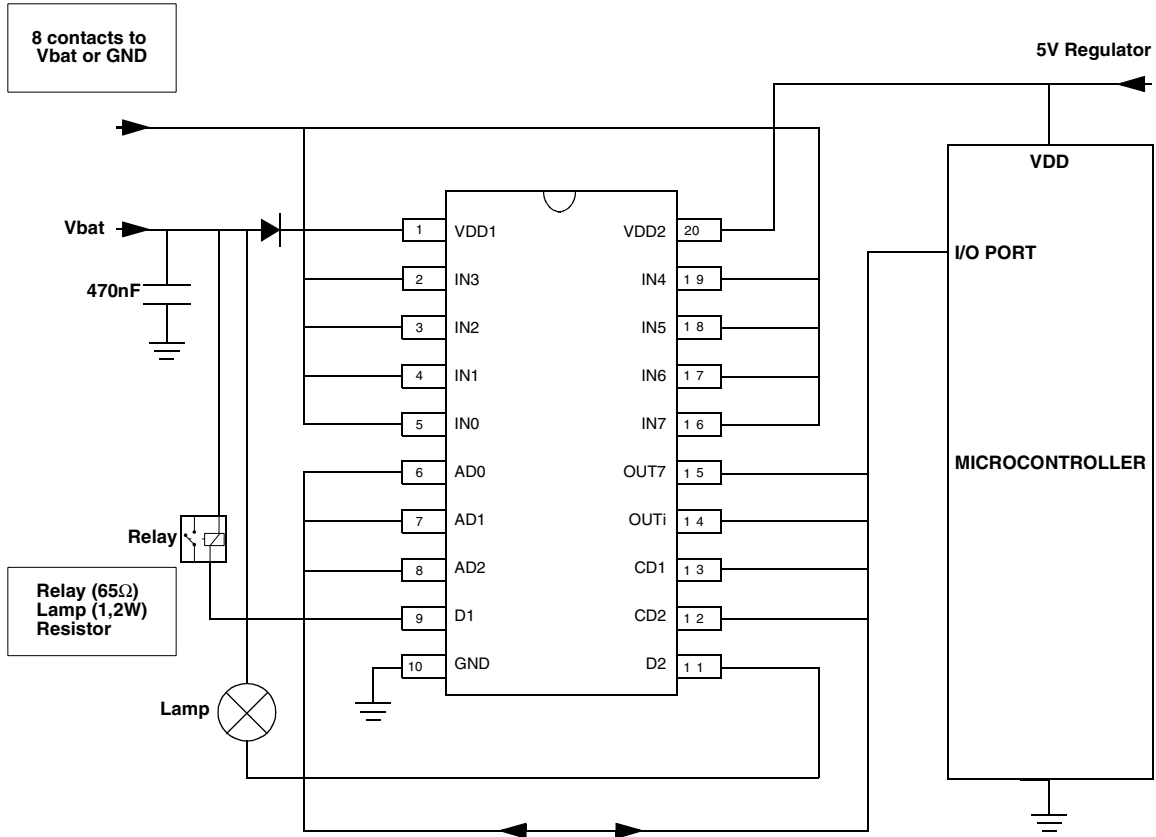
Parameters	Symbols	Min	Typ	Max	Unit
Output Voltage Low (Iload = 2mA)	Vol			0,2 VDD2	V
Output Voltage High (Iload = - 2mA)	Voh	0,8 VDD2			V

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**PINS FUNCTION DESCRIPTION**

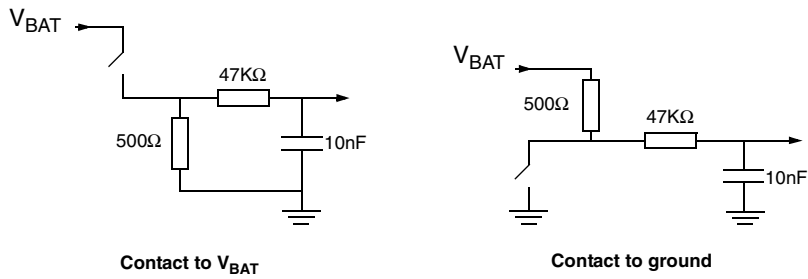
Pin Number	Name	Description
1	VDD1	High Voltage Power Supply (Vbat)
2	IN3	High Voltage Input 3
3	IN2	High Voltage Input 2
4	IN1	High voltage input 1
5	IN0	High Voltage Input 0
6	AD0	Adress for Mode and Input Selection
7	AD1	Adress for Mode and Input Selection
8	AD2	Adress for Mode and Input Selection
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	OUT1	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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 APPLICATION

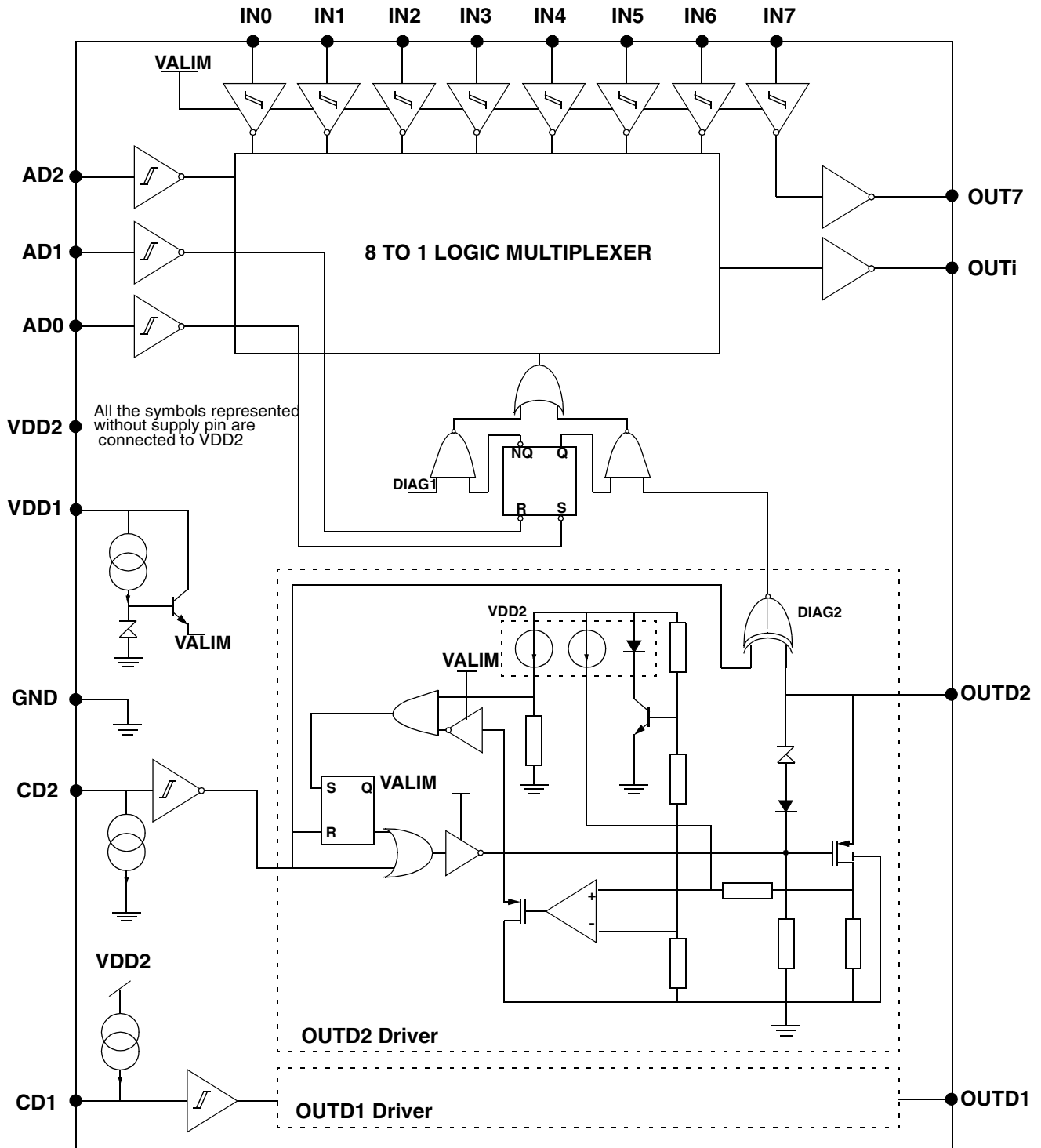
**Figure 3. Typical Application Configuration**



**Figure 4. Contact Configuration**



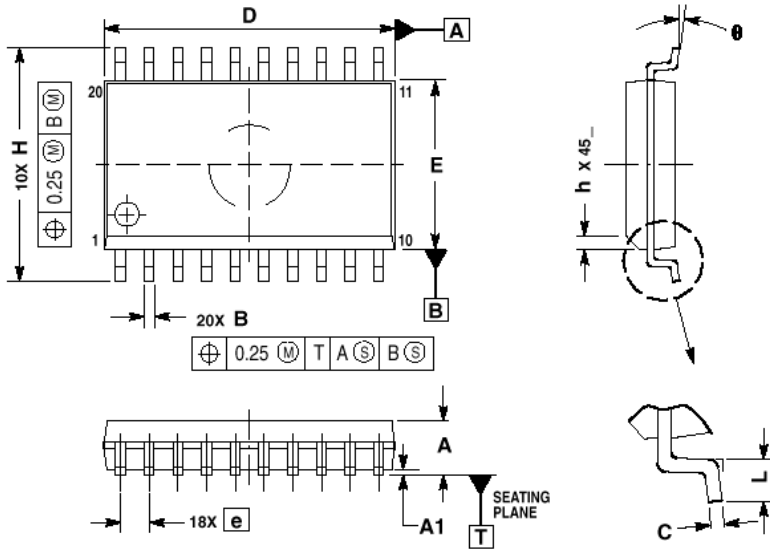
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 Figure 5. Electrical Schematic



**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.



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- 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
$\theta$	0	7

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