DS3680

DS3680 Quad Negative Voltage Relay Driver

![Texas Instruments logo]

Literature Number: SNOSBM0C

National
Semiconductor

DS3680
Quad Negative Voltage Relay Driver

General Description

The DS3680 is a quad high voltage negative relay driver designed to operate over wide ranges of supply voltage, common-mode voltage, and ambient temperature, with 50 mA sink capability. These drivers are intended for switching the ground end of loads which are directly connected to the negative supply, such as in telephone relay systems.

Since there may be considerable noise and IR drop between logic ground and negative supply ground in many applications, these drivers are designed to operate with a high common-mode range (±20V referenced to negative supply ground). Each driver has a common-mode range separate from the other drivers in the package, which permits input signals from more than one element of the system.
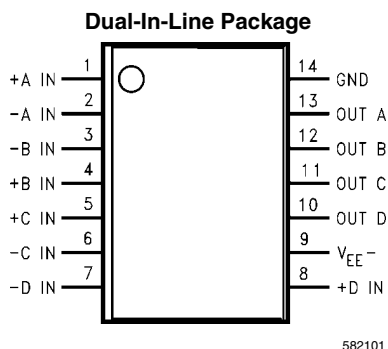
With low differential input current requirements (typically 100 μA), these drivers are compatible with TTL, LS and CMOS logic. Differential inputs permit either inverting or non-inverting operation.

The driver outputs incorporate transient suppression clamp networks, which eliminate the need for external networks when used in applications of switching inductive loads. A fail-safe feature is incorporated to ensure that, if the + IN input or both inputs are open, the driver will be OFF.
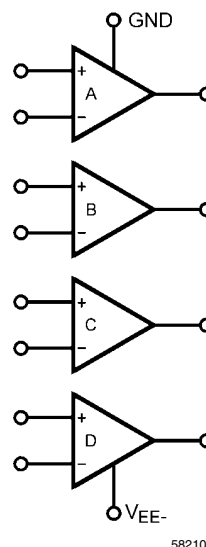
Features

- −10V to −60V operation
- Quad 50 mA sink capability
- TTL/LS/CMOS or voltage comparator input
- High input common-mode voltage range
- Very low input current
- Fail-safe disconnect feature
- Built-in output clamp diode

Connection Diagram

Dual-In-Line Package

	Pin		Pin	
+A IN	1		14	GND
−A IN	2		13	OUT A
−B IN	3		12	OUT B
+B IN	4		11	OUT C
+C IN	5		10	OUT D
−C IN	6		9	V_{EE}−
−D IN	7		8	+D IN

582101

Top View
Order Number DS3680M
See NS Package Number M14A

Block Diagram

582102

Truth Table

Differential Inputs	Outputs
$V_{ID} \geq 2V$	On
$V_{ID} \leq 0.8V$	Off
Open	Off

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

Supply Voltage (GND to V_{EE-}, and Any Pin)	−70V
Positive Input Voltage (Input to GND)	20V
Negative Input Voltage (Input to V_{EE-})	−5V
Differential Voltage (+ IN to − IN)	±20V
Inductive Load	L_L ≤5h
	I_L ≤50 mA
Output Current	−100 mA
Storage Temperature	−65°C to +150°C
Maximum Power Dissipation (Note 2) at 25°C	
SO Package	1002 mW
Lead Temperature (Soldering, 4 seconds)	260°C

Recommended Operating Conditions

	Min	Max	Units
Supply Voltage (GND to V_{EE-})	−10	−60	V
Input Voltage (Input to GND)	−20	20	V
Logic ON Voltage (+IN)			
Referenced to −IN	2	20	V
Logic OFF Voltage (+IN)			
Referenced to −IN	−20	0.8	V
Temperature Range	−25	+85	°C

Electrical Characteristics (Notes 3, 4)

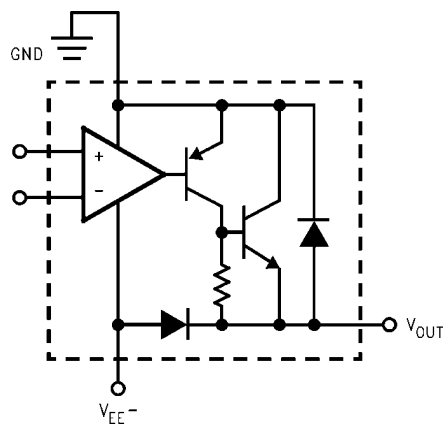| Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_{IH}	Logic "1" Input Voltage		2.0	1.3		V
V_{IL}	Logic "0" Input Voltage			1.3	0.8	V
I_{INH}	Logic "1" Input Current	V_{IN} = 2V		40	100	µA
		V_{IN} = 7V		375	1000	µA
I_{INL}	Logic "0" Input Current	V_{IN} = 0.4V		−0.01	−5	µA
		V_{IN} = −7V		−1	−100	µA
V_{OL}	Output ON Voltage	I_{OL} = 50 mA		−1.6	−2.1	V
I_{OFF}	Output Leakage	V_{OUT} = V_{EE-}		−2	−100	µA
I_{FS}	Fail-Safe Output Leakage	V_{OUT} = V_{EE-} (Inputs Open)		−2	−100	µA
I_{LC}	Output Clamp Leakage Current	V_{OUT} = GND		2	100	µA
V_C	Output Clamp Voltage	I_{CLAMP} = −50 mA Referenced to V_{EE-}		−2	−1.2	V
V_P	Positive Output Clamp Voltage	I_{CLAMP} = 50 mA Referenced to GND		0.9	1.2	V
$I_{EE(ON)}$	ON Supply Current	All Drivers ON		−2	−4.4	mA
$I_{EE(OFF)}$	OFF Supply Current	All Drivers OFF		−1	−100	µA
$t_{PD(ON)}$	Propagation Delay to Driver ON	L = 1h, R_L = 1k, V_{IN} = 3V Pulse		1	10	µs
$t_{PD(OFF)}$	Propagation Delay to Driver OF	L = 1h, R_L = 1k, V_{IN} = 3V Pulse		1	10	µs

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range", they are not meant to imply that the device should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

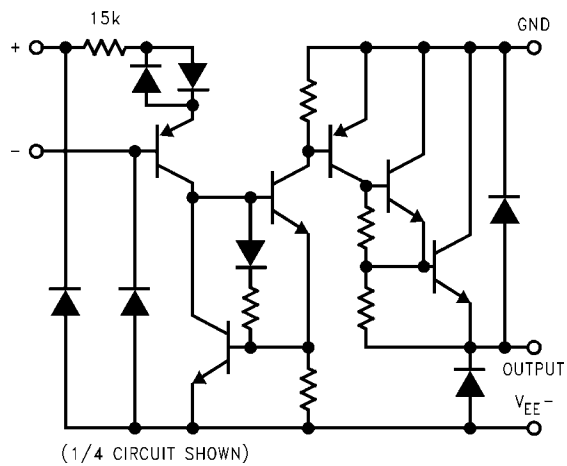**Note 2:** Derate SO package 8.02 mW/°C above 25°C.

Note 3: Unless otherwise specified, the min/max limits of the table of "Electrical Characteristics" apply within the range of the table of "Operating Conditions". All typical values are given for V_{EE-} = 52V, and T_A = 25°C.

Note 4: All currents into device pins shown as positive, out of the device as negative. All voltages are referenced to ground unless otherwise noted.
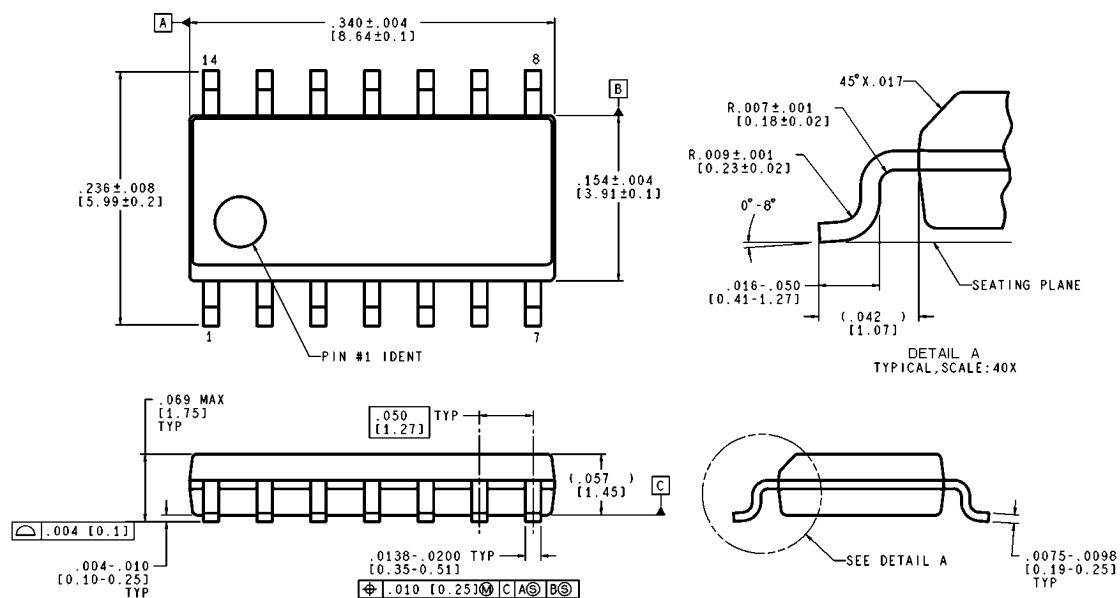
Schematic Diagrams

582103

(1/4 CIRCUIT SHOWN)

582104

Physical Dimensions inches (millimeters) unless otherwise noted

A |← .340±.004 →|
   [8.64±0.1]

14   8
          B

.236±.008   .154±.004
[5.99±0.2]   [3.91±0.1]

1   7

PIN #1 IDENT

45° X .017

R .007±.001
[0.18±0.02]

R .009±.001
[0.23±0.02]

0°–8°

.016–.050
[0.41–1.27]

(.042)
[1.07]

SEATING PLANE

DETAIL A
TYPICAL, SCALE: 40X

.069 MAX
[1.75]
TYP

.050   TYP
[1.27]

(.057)
[1.45]   C

.004 [0.1]

.004–.010
[0.10–0.25]
TYP

.0138–.0200 TYP
[0.35–0.51]

⊕ .010 [0.25] Ⓜ C Ⓐ Ⓢ B Ⓢ

SEE DETAIL A

.0075–.0098
[0.19–0.25]
TYP

CONTROLLING DIMENSION IS INCH
VALUES IN [ ] ARE MILLIMETERS

M14A (Rev J)

SO Package (M)
Order Number DS3680M
NS Package Number M14A

Notes

Notes

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