

# DS3668

*DS3668 Quad Fault Protected Peripheral Driver*



Literature Number: SNLS351A

# DS3668

## Quad Fault Protected Peripheral Driver

### General Description

The DS3668 quad peripheral driver is designed for those applications where low operating power, high breakdown voltage, high output current and low output ON voltage are required. Unlike most peripheral drivers available, a unique fault protected circuit is incorporated on each output. When the load current exceeds 1.0A (approximately) on any output for more than a built-in delay time, nominally 12  $\mu$ s, that output will be shut off by its protection circuitry with no effect on other outputs. This condition will prevail until that protection circuitry is reset by toggling the corresponding input or the enable pin low for at least 1.0  $\mu$ s. This built-in delay is provided to ensure that the protection circuitry is not triggered by turn-on surge currents associated with certain kinds of loads.

The DS3668's inputs combine TTL compatibility with high input impedance. In fact, its extreme low input current allows it to be driven directly by a MOS device. The outputs are capable of sinking 600 mA each and offer a 70V breakdown. However, for inductive loads the output should be clamped to 35V or less to avoid latch up during turn off (inductive fly-back protection — refer AN-213). An on-chip clamp diode capable of handling 800 mA is provided at each output for this purpose. In addition, the DS3668 incorporates circuitry that guarantees glitch-free power up or down operation and a fail-safe feature which puts the output in a high impedance state when the input is open.

The molded package is specifically constructed to allow increased power dissipation over conventional packages. The four ground pins are directly connected to the device chip with a special copper lead frame. When the quad driver is soldered into a PC board, the power rating of the device improves significantly.

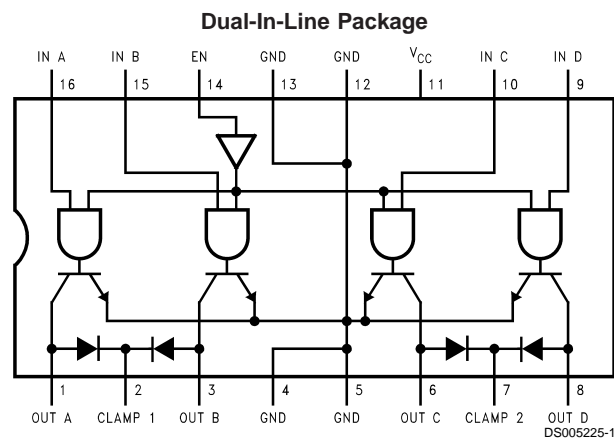
### Applications

- Relay drivers
- Solenoid drivers
- Hammer drivers
- Stepping motor drivers
- Triac drivers
- LED drivers
- High current, high voltage drivers
- Level translators
- Fiber optic LED drivers

### Features

- Output fault protection
- High impedance TTL compatible inputs
- High output current—600 mA per output
- No output latch-up at 35V
- Low output ON voltage (550 mV typ @ 600 mA)
- High breakdown voltage (70V)
- Open collector outputs
- Output clamp diodes for inductive fly-back protection
- NPN inputs for minimal input currents (1  $\mu$ A typical)
- Low operating power
- Standard 5V power supply
- Power up/down protection
- Fail-safe operation
- 2W power package
- Pin-for-pin compatible with SN75437

### Connection Diagram



**Top View**  
**Order Number DS3668N**  
**See NS Package Number N16E**

## Truth Table

IN	EN	OUT
H	H	L
L	H	Z
H	L	Z
L	L	Z

H = High state

L = Low state

Z = High impedance state

**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	7.0V
Input Voltage	15V
Output Voltage	70V
Continuous Power Dissipation @ 25°C Free-Air (Note 5)	2075 mW

Storage Temperature Range -65°C to +150°C

Lead Temperature (Soldering, 4 seconds) 260

**Operating Conditions**

	Min	Max	Units
Supply Voltage	3.00	5.25	V
Ambient Temperature	-40	125	°C

**Electrical Characteristics** (Notes 2, 3, 6)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$V_{IH}$	Input High Voltage		2.0			V
$V_{IL}$	Input Low Voltage				0.8	V
$I_{IH}$	Input High Current	$V_{IN} = 5.25V, V_{CC} = 5.25V$		1.0	20	$\mu A$
$I_{IL}$	Input Low Current	$V_{IN} = 0.4V$			$\pm 10$	$\mu A$
$V_{IK}$	Input Clamp Voltage	$I_I = -12 \text{ mA}$		-0.8	-1.5	V
$V_{OL}$	Output Low Voltage	$I_L = 300 \text{ mA}$		0.2	0.7	V
		$I_L = 600 \text{ mA}$ (Note 4)		0.55	1.5	V
$I_{CEX}$	Output Leakage Current	$V_{CE} = 70V, V_{IN} = 0.8V$			100	$\mu A$
$V_F$	Diode Forward Voltage	$I_F = 800 \text{ mA}$		1.2	1.6	V
$I_R$	Diode Leakage Current	$V_R = 70V$			100	$\mu A$
$I_{CC}$	Supply Current	All Inputs High		62	80	mA
		All Inputs Low		20		mA
$I_{TH}$	Protection Circuit Threshold Current			1	1.4	A

**Switching Characteristics** (Notes 2, 6)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$t_{PHL}$	Turn On Delay	$R_L = 60\Omega, V_L = 30V$		0.3	1.0	$\mu s$
$t_{PLH}$	Turn Off Delay	$R_L = 60\Omega, V_L = 30V$		2	10.0	$\mu s$
$t_{FZ}$	Protection Enable Delay (after Detection of Fault)		6	12		$\mu s$
$t_{RL}$	Input Low Time for Protection Circuit Reset		1.0			$\mu s$

**Note 1:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" specifies conditions of actual device operation.

**Note 2:** Unless otherwise specified, min/max limits apply across the 0°C to +70°C temperature range and the 4.75V to 5.25V power supply range. All typical values are for  $T_A = 25^\circ C$  and  $V_{CC} = 5.0V$ .

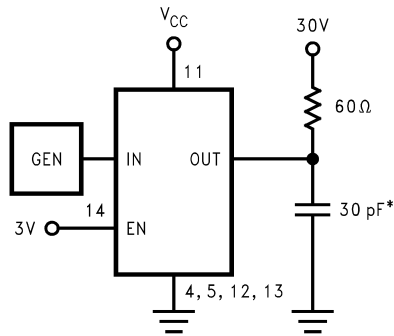
**Note 3:** All currents into device pins are shown as positive; all currents out of device pins are shown as negative; all voltages are referenced to ground, unless otherwise specified. All values shown as max or min are so classified on absolute value basis.

**Note 4:** All sectors of this quad circuit may conduct rated current simultaneously, however, power dissipation averaged over a short interval of time must fall within specified continuous dissipation ratings.

**Note 5:** For operation over 25°C free-air temperature, derate linearly to 1328 mW @ 70°C @ the rate of 16.6 mW/°C.

**Note 6:** Datasheet min/max specification limits are guaranteed by design, test, or statistical analysis.

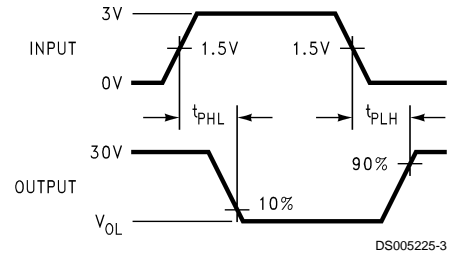
### AC Test Circuit



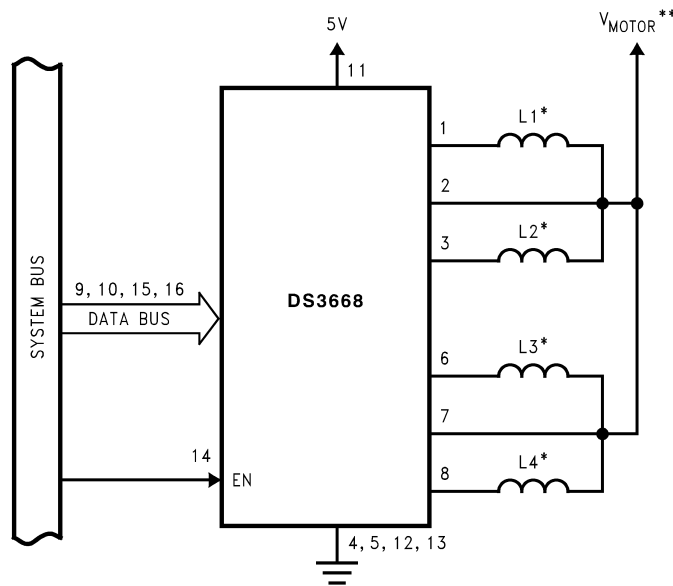
\*Includes probe and jig capacitance.

DS005225-2

### Switching Waveforms



### Typical Application

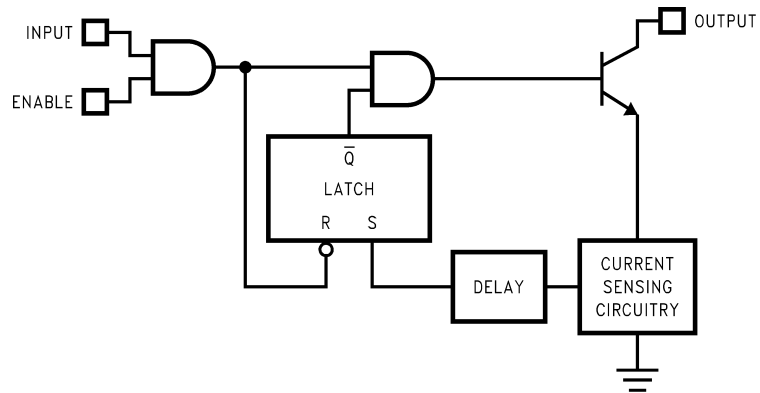


\*L1, L2, L3, L4 are the windings of a bifilar stepping motor.

\*\*V<sub>MOTOR</sub> is the supply voltage of the motor.

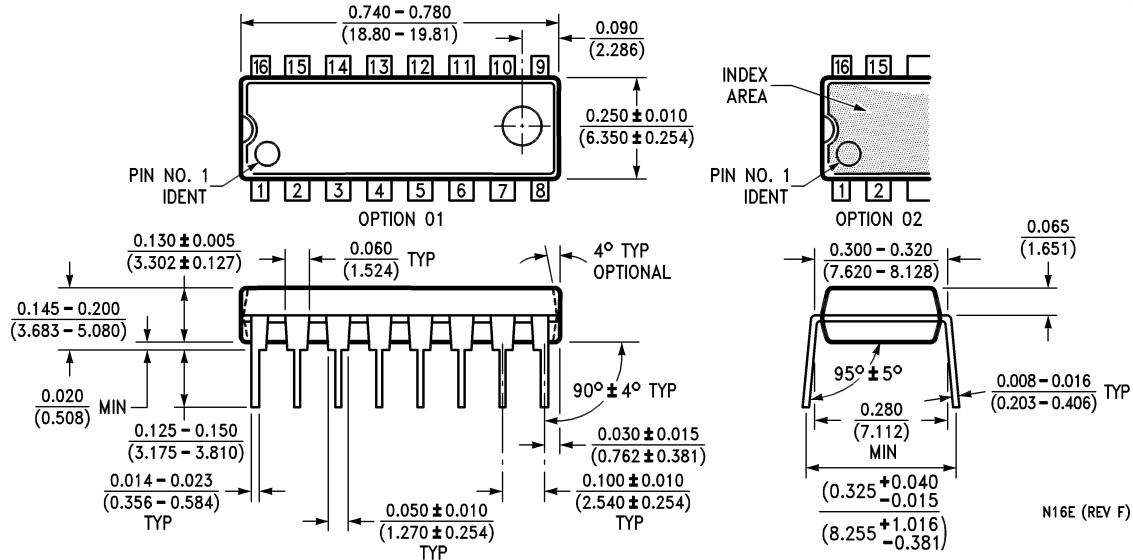
DS005225-4

### Protection Circuit Block Diagram



DS005225-5

**Physical Dimensions** inches (millimeters) unless otherwise noted



**Molded Dual-In-Line Package (N)**  
**Order Number DS3668N**  
**NS Package Number N16E**

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**PACKAGING INFORMATION**

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">DS3668N/NOPB</a>	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	Level-1-NA-UNLIM	-40 to 125	DS3668N
DS3668N/NOPB.B	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	Level-1-NA-UNLIM	-40 to 125	DS3668N
DS3668N/NOPBG4	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	Level-1-NA-UNLIM	-40 to 125	DS3668N
DS3668N/NOPBG4.B	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	Level-1-NA-UNLIM	-40 to 125	DS3668N

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
DS3668N/NOPB	N	PDIP	16	25	502	14	11938	4.32
DS3668N/NOPB.B	N	PDIP	16	25	502	14	11938	4.32
DS3668N/NOPBG4	N	PDIP	16	25	502	14	11938	4.32
DS3668N/NOPBG4.B	N	PDIP	16	25	502	14	11938	4.32

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