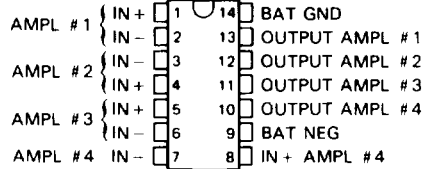


# DS3680I QUAD TELEPHONE RELAY DRIVER

D2758, MARCH 1986 - REVISED MARCH 1990

- **Designed for -52-V Battery Operation**
- **50-mA Output Current Capability**
- **Input Compatible with TTL and CMOS**
- **High Common-Mode Input Voltage Range**
- **Very Low Input Current**
- **Fail-Safe Disconnect Feature**
- **Built-In Output Clamp Diode**
- **Direct Replacement for National DS3680 and Fairchild  $\mu$ A3680**

**D OR N PACKAGE  
(TOP VIEW)**

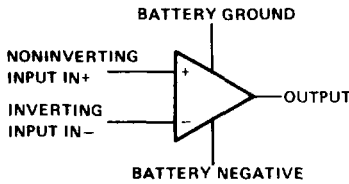


## description

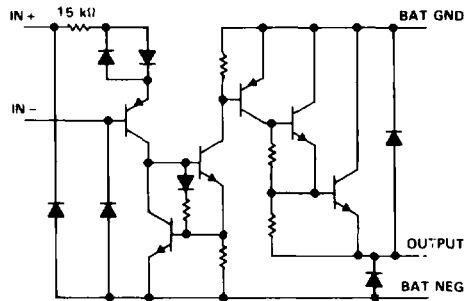
The DS3680I telephone relay driver is a monolithic integrated circuit designed to interface -48-V relay systems to TTL or other systems in telephone applications. It is capable of sourcing up to 50 mA from standard -52-V battery power. To reduce the effects of noise and IR drop between logic ground and battery ground, these drivers are designed to operate with a common-mode input range of  $\pm 20$  V referenced to battery ground. The common-mode input voltages for the four drivers can be different, so a wide range of input elements can be accommodated. The high-impedance inputs are compatible with positive TTL and CMOS levels or negative logic levels. A clamp network is included in the driver outputs to limit high-voltage transients generated by the relay coil during switching. The complementary inputs ensure that the driver output will be "off" as a fail-safe condition when either output is open.

The DS3680I is characterized for operation from -40°C to 85°C.

## symbol (each driver)



## schematic diagram (each driver)



All resistor values shown are nominal.

**PRODUCTION DATA** documents contain information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



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**DS36801**  
**QUAD TELEPHONE RELAY DRIVER**

**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)**

Supply voltage range at BAT NEG, $V_{B-}$ (see Note 1)	-70 V to 0.5 V
Input voltage range with respect to BAT GND	-70 V to 20 V
Input voltage range with respect to BAT NEG	-0.5 V to 70 V
Differential input voltage, $V_{ID}$ (see Note 2)	$\pm 20$ V
Output current: resistive load	-100 mA
inductive load	-50 mA
Inductive output load	5 H
Continuous total power dissipation	See Dissipation Rating Table
Operating free-air temperature range, $T_A$	-40°C to 85°C
Storage temperature range	-65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C

- NOTES: 1. All voltages are with respect to the BAT GND terminal unless otherwise specified.  
 2. Differential input voltages are at the noninverting input terminal IN+ with respect to the inverting input terminal IN-.

**DISSIPATION RATING TABLE**

PACKAGE	$T_A \leq 25^\circ\text{C}$	DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$	$T_A = 85^\circ\text{C}$
	POWER RATING		POWER RATING	POWER RATING
D	950 mW	7.6 mW/°C	608 mW	494 mW
N	1150 mW	9.2 mW/°C	736 mW	598 mW

**recommended operating conditions**

	MIN	MAX	UNIT
Supply voltage, $V_{B-}$	-10	-60	V
Input voltage, either input	-20 <sup>†</sup>	20	V
High-level differential input voltage, $V_{IDH}$	2	20	V
Low-level differential input voltage, $V_{IDL}$	-20 <sup>†</sup>	0.8	V
Operating free-air temperature, $T_A$	-40	85	°C

<sup>†</sup>The algebraic convention, in which the less positive (more negative) limit is designated minimum, is used in this data sheet for input voltage levels.

**electrical characteristics over recommended operating free-air temperature range,  $V_{B-} = -52$  V (unless otherwise noted)**

PARAMETER	TEST CONDITIONS	MIN	TYP <sup>‡</sup>	MAX	UNIT
$I_{IH}$ High-level input current (into IN+)	$V_{ID} = 2$ V		40	100	$\mu\text{A}$
	$V_{ID} = 7$ V		375	1000	
$I_{IL}$ Low-level input current (into IN+)	$V_{ID} = 0.4$ V		0.01	5	$\mu\text{A}$
	$V_{ID} = -7$ V		-1	-100	
$V_{O(on)}$ On-state output voltage	$I_O = -50$ mA, $V_{ID} = 2$ V		-1.6	-2.1	V
$I_{O(off)}$ Off-state output current	$V_O = V_{B-}$ Inputs open		-2	-100	$\mu\text{A}$
			-2	-100	
$I_R$ Clamp diode reverse current	$V_O = 0$		2	100	$\mu\text{A}$
$V_{OK}$ Output clamp voltage	$I_O = 50$ mA		0.9	1.2	V
	$I_O = -50$ mA, $V_{B-} = 0$		-0.9	-1.2	
$I_{B(on)}$ On-state battery current	All drivers on		-2	-4.4	mA
$I_{B(off)}$ Off-state battery current	All drivers off		-1	-100	$\mu\text{A}$

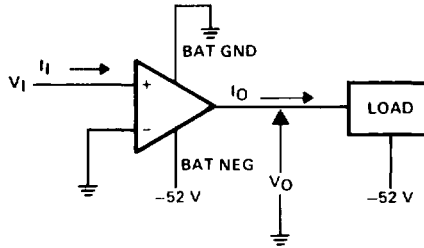
<sup>‡</sup>All typical values are at  $T_A = 25^\circ\text{C}$ .



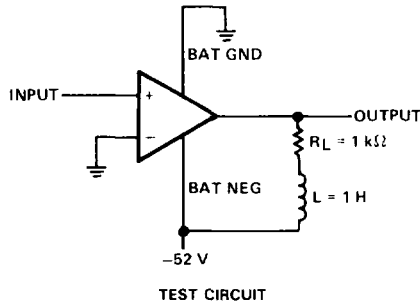
switching characteristics  $V_{B-} = -52\text{ V}$ ,  $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{on}$ Turn-on time	$V_{ID} = 3\text{-V pulse}$ , $R_L = 1\text{ k}\Omega$ ,		1	10	$\mu\text{s}$
$t_{off}$ Turn-off time	$L = 1\text{ H}$ , See Figure 2		1	10	$\mu\text{s}$

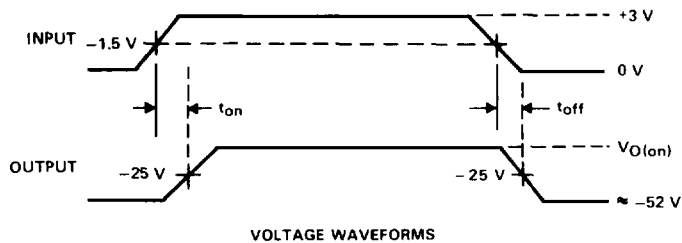
**PARAMETER MEASUREMENT INFORMATION**



**FIGURE 1. GENERALIZED TEST CIRCUIT, EACH DRIVER**



**TEST CIRCUIT**

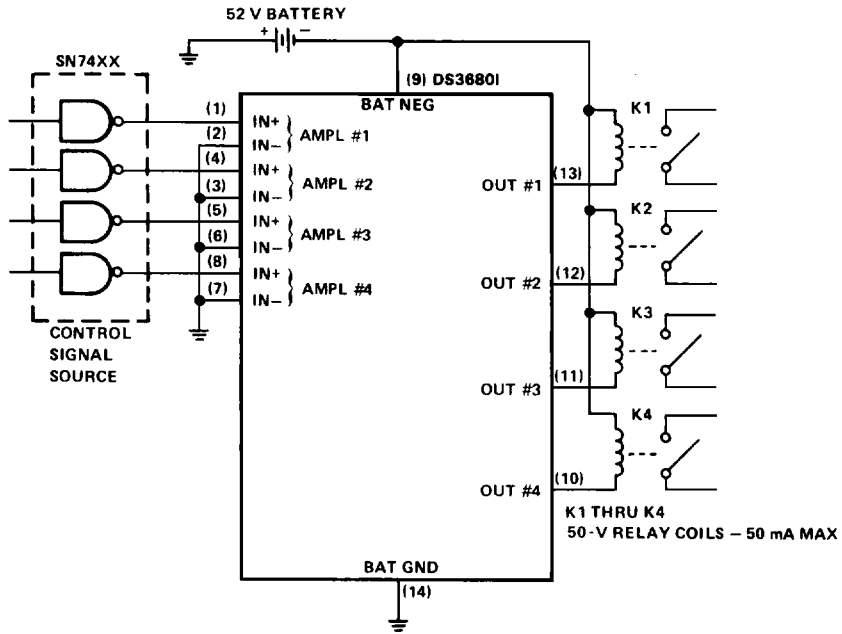


**VOLTAGE WAVEFORMS**

**FIGURE 2. SWITCHING CHARACTERISTICS, EACH DRIVER**

**DS36801  
QUAD TELEPHONE RELAY DRIVER**

**APPLICATION INFORMATION**



**FIGURE 3. RELAY DRIVER**