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- 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 μA3680

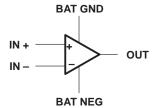
description

The DS3680 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 ±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 is off as a fail-safe condition when either output is open.

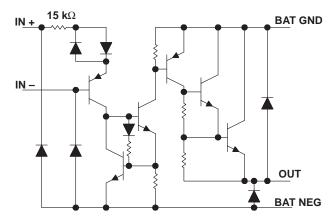
The DS3680 is characterized for operation from 0° C to 70° C.

D OR N PACKAGE (TOP VIEW)							
1 IN+[1 IN-[2 IN-[2 IN+[3 IN+[3 IN+[4 IN-[1 2 3 4 5 6 7	υ	14 13 12 11 10 9 8	BAT GND 1 OUT 2 OUT 3 OUT 4 OUT BAT NEG 4 IN+			

symbol (each driver)



schematic diagram (each driver)



All resistor values shown are nominal.

PRODUCTION DATA information is 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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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage range at BAT NEG, V _{BAT} (see Note 1) Input voltage range with respect to BAT GND Input voltage range with respect to BAT NEG Differential input voltage, V _{ID} (see Note 2) Output current, I _O : Resistive load Inductive load Inductive output load Operating free-air temperature range, T _A	−70 V to 20 V −0.5 V to 70 V ±20 V −100 mA −50 mA 5 H See Dissipation Rating Table 0°C to 70°C −65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds .	

NOTES: 1. All voltages are with respect to BAT GND, 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 ≤ 25°C POWER RATING	DERATING FACTOR ABOVE T _A = 25°C	T _A = 70°C POWER RATING					
D	950 mW	7.6 mW/°C	608 mW					
N	1150 mW	9.2 mW/°C	736 mW					

recommended operating conditions

	MIN	MAX	UNIT
Supply voltage, VBAT-	-10	-60	V
Input voltage, either input	-20†	20	V
High-level differential input voltage, VIDH	2	20	V
Low-level differential input voltage, VIDL	-20†	0.8	V
Operating free-air temperature, T _A	0	70	°C

[†] 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, $V_{BAT-} = -52 V$ (unless otherwise noted)

	PARAMETER	TEST CON	DITIONS	MIN	TYP [‡]	MAX	UNIT
	High lovel input ourrept (into IN)	$V_{ID} = 2 V$			40	100	۸
ін	High-level input current (into IN+)	V _{ID} = 7 V			375	1000	μA
1	Low-level input current (into IN+)	V _{ID} = 0.4 V			0.01	5	μA
۱Ľ	Low-level input current (into int+)	$V_{ID} = -7 V$		-1	-100	μΑ	
V _{O(on)}	On-stage output voltage	I _O = 50 mA,	$V_{ID} = 2 V$		-1.6	-2.1	V
IO(off)	Off-stage output current		V _{ID} = 0.8 V		-2	-100	۸
	On-stage output current	VO = VBAT-	Inputs open		- 2	-100	μA
IR	Clamp diode reverse current	$V_{O} = 0$			2	100	μΑ
Var	Output clamp voltage	I _O = 50 mA			0.9	1.2	V
VOK	Output clamp voltage	$I_{O} = -50 \text{ mA},$	$V_{BAT-} = 0$		-0.9	-1.2	v
IBAT(on)	On-state battery current	All drivers on			-2	-4.4	mA
IBAT(off)	Off-state battery current	All drivers off			-1	-100	μA

[‡] All typical values are at $T_A = 25^{\circ}C$.



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switching characteristics V_{BAT-} = -52 V, T_A = 25° C

	PARAMETER	TEST CON	DITIONS	MIN	TYP	MAX	UNIT
ton	Turn-on time	V _{ID} = 3-V pulse,	$R_L = 1 k\Omega$,		1	10	μs
toff	Turn-off time	L = 1 H,	See Figure 2		1	10	μs

PARAMETER MEASUREMENT INFORMATION

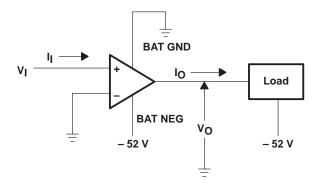


Figure 1. Generalized Test Circuit, Each Driver

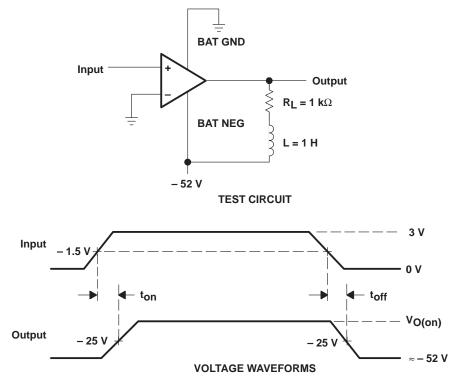
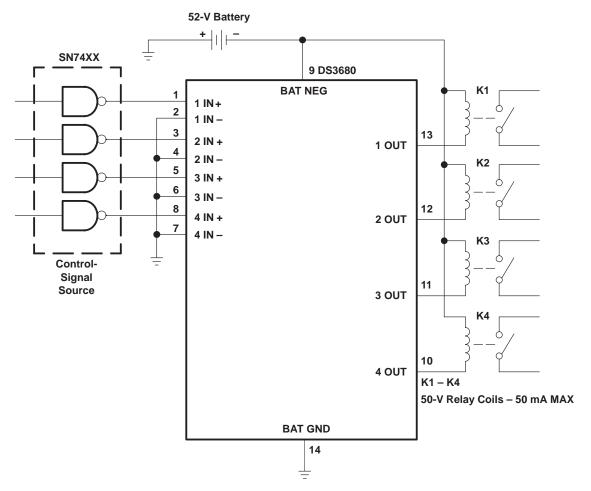


Figure 2. Test Circuit and Voltage Waveforms, Each Driver



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APPLICATION INFORMATION

Figure 3. Relay Driver



PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	e Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
DS3680D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
DS3680DE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
DS3680DG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
DS3680DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
DS3680DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
DS3680DRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
DS3680N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
DS3680NE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details. TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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TAPE AND REEL INFORMATION





QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nomina	l
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Device		Package Drawing			Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
DS3680DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1



PACKAGE MATERIALS INFORMATION

11-Mar-2008



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
DS3680DR	SOIC	D	14	2500	346.0	346.0	33.0

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



NOTES:

- A. All linear dimensions are in inches (millimeters).B. This drawing is subject to change without notice.
- Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
- \triangle The 20 pin end lead shoulder width is a vendor option, either half or full width.



D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



NOTES: A. All linear dimensions are in inches (millimeters).

- B. This drawing is subject to change without notice.
- Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
- Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
- E. Reference JEDEC MS-012 variation AB.





NOTES: A. All linear dimensions are in millimeters.

- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate designs.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



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