NCV7701

2.0 Amp H-Bridge Driver

This automotive grade H−Bridge driver provides a flexible means for controlling loads requiring bidirectional drive currents. Bridge outputs are protected from overcurrent at each switch and overtemperature shutdown provides product robustness. The NCV7701 inputs can be interfaced to a range of voltages, including vehicle battery voltage. The product features a low quiescent current mode, allowing unswitched connection to the power source. The NCV7701 is produced using ON Semiconductor's POWERSENSE™ BCD technology.

Features

- Forward, Reverse, Brake High, Brake Low Modes
- 1.0 A Output Current Capability (DC)
- Supply Voltage Range 7.0 V to 26 V
- 0.25 Ω $R_{DS(ON)}$ per Driver @ 25°C
- Sleep Mode (I_Q < 10 µA)
- Overvoltage Protection
- Thermal Protection
- Undervoltage Disable Function
- Short Circuit Protection
- Cross Conduction Protection
- Synchronous Low−Side Rectification for Lower Power Dissipation
- Diagnostic Output (Open Drain)
- TTL/CMOS/Pullup to Battery Compatible Inputs
- 20 Lead SO Package with 8 Internally Fused Leads
- AEC Qualified
- PPAP Capable
- These are Pb−Free Devices*

Typical Applications
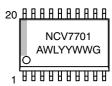
- DC Motors
- Stepper Motors
- Modulator Valves

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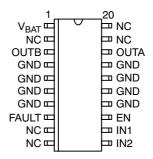**http://onsemi.com**

MARKING DIAGRAM

SOIC−20 WB
CASE 751D
DW SUFFIX

20

NCV7701
AWLYYWWG

1

A	= Assembly Location
WL	= Wafer Lot
YY	= Year
WW	= Work Week
G	= Pb−Free Package

PIN CONNECTIONS

1	20
V_{BAT}	NC
NC	NC
OUTB	OUTA
GND	GND
GND	GND
GND	GND
GND	GND
FAULT	EN
NC	IN1
NC	IN2

ORDERING INFORMATION

Device	Package	Shipping[†]
NCV7701DWG	SOIC−20W (Pb−Free)	38 Units/Rail
NCV7701DWR2G	SOIC−20W (Pb−Free)	1000 Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.
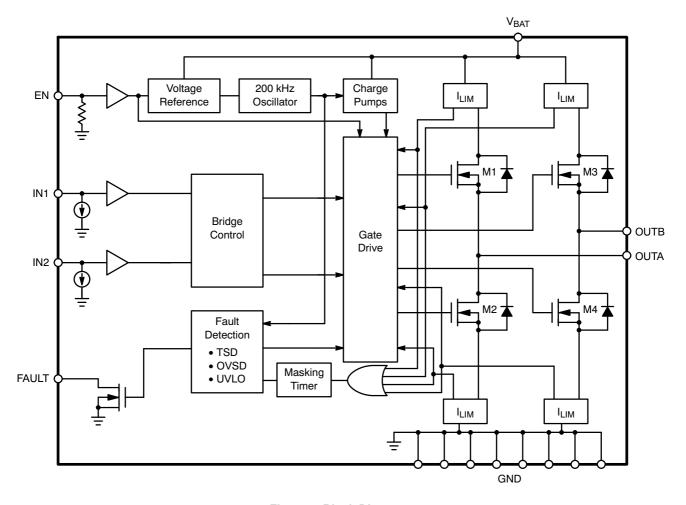
NCV7701

Figure 1. Block Diagram

MAXIMUM RATINGS

Rating	Value	Unit
Supply Voltage (DC) – V_{BAT} (Note 1)	–0.3 to 45	V
Logic Input Voltage (DC)	–0.3 to 12	V
Junction Temperature Range	–40 to 150	°C
Storage Temperature Range	–65 to 150	°C
Peak Transient (1.0 ms rise time, 300 ms period, 31 V Load Dump @ V_{BAT} = 14 V) (Note 1)	45	V
ESD Susceptibility Human Body Model Machine Model	±4.0 ±200	kV V

Package Thermal Resistance
        Junction–to–Case, $R_{\theta JC}$
        Junction–to–Ambient, $R_{\theta JA}$
	9.0
	55
		°C/W
		°C/W

Lead Temperature Soldering: Reflow: (SMD styles only) (Note 2)	230 peak	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.
1. External reverse–battery and transient voltage suppression (TVS) required.
2. 60 second maximum above 183°C.

NCV7701

ELECTRICAL CHARACTERISTICS (7.0 V $\leq$ V$_{BAT}$ $\leq$ 26 V, $-40°$C $\leq$ T$_J$ $\leq$ 125°C; unless otherwise specified.) Note 3

Characteristic	Test Conditions	Min	Typ	Max	Unit
GENERAL					
V$_{BAT}$ Quiescent Current: Low Quiescent Normal Operation	EN = 0 V, V$_{BAT}$ $\leq$ 12.8 V 2.5 V $\leq$ EN $\leq$ V$_{BAT}$, V$_{BAT}$ = 14 V	– –	– –	10 8.0	µA mA
EN LOGIC INPUT					
Low Level Input Voltage	–	–	–	0.7	V
High Level Input Voltage	–	2.5	–	–	V
Input Bias Current	EN = 5.0 V	15	50	100	µA
Input Leakage Current	EN = 0 V	–	–	1.0	µA
IN1, IN2, LOGIC INPUTS					
Low Level Input Voltage	–	–	–	0.8	V
High Level Input Voltage	–	2.0	–	–	V
Input Bias Current	5.0 V on Logic Input, EN = 5.0 V	5.0	20	40	µA
Input Leakage Current	0 V on Logic Input, EN = 0 V	–	–	1.0	µA
IC PROTECTION					
Overvoltage Shutdown	–	27	32	37	V
Overvoltage Hysteresis	–	0.2	0.5	1.0	V
Undervoltage Voltage Lockout	–	–	–	6.5	V
Undervoltage Hysteresis	–	100	200	400	mV
Thermal Shutdown	(Guaranteed by Design)	160	185	210	°C
Thermal Hysteresis	(Guaranteed by Design)	10	22.5	35	°C
DRIVERS OUTA, OUTB					
Output High Voltage (V$_H$)	V$_{BAT}$ = 14 V, I$_{SOURCE}$ = 1.0 A, V$_H$ = V$_{BAT}$ – OUT$_X$	–	0.4	0.75	V
Output Low Voltage (V$_L$)	V$_{BAT}$ = 14 V, I$_{SOURCE}$ = 1.0 A, V$_L$ = OUT$_X$ – V$_{GND}$	–	0.4	0.75	V
Current Limit	V$_{BAT}$ = 14 V	3.0	4.0	5.0	A
FAULT OUTPUT					
Output Leakage Current	V$_{FAULT}$ = 5.0 V, Fault Absent	–	–	10	µA
Output Low Voltage	I$_{FAULT}$ = 0.5 mA, Fault Present	–	–	1.0	V
AC CHARACTERISTICS					
Output Turn–On Delay	–	–	5.0	10	µs
Output Turn–Off Delay	–	–	5.0	10	µs
Current Limit Mask Time	–	20	40	60	µs

3. Designed to meet these characteristics over the stated voltage and temperature ranges, though may not be 100% parametrically tested in production.

Table 1. H−Bridge Mode Control

EN	IN1	IN2	H−Bridge	OUTA	OUTB
0	X	X	Off (Sleep Mode)	Off	Off
1	0	0	Brake Low	Low	Low
1	0	1	Forward	High	Low
1	1	0	Reverse	Low	High
1	1	1	Brake High	High	High

Table 2. Fault Diagnostics

Fault Condition	Fault Pin	H−Bridge
No Faults	High Z	Normal Operation
Undervoltage	Low	Off
Overvoltage	Low	Off
Thermal Shutdown	Low	Off
Current Limit	Low	1 or more Drivers in Current Limit

PACKAGE PIN DESCRIPTION

Pin No.	Symbol	Description
1	V_{BAT}	IC supply voltage
2, 9, 10, 19, 20	NC	No connection
3	OUTB	Bridge output
4, 5, 6, 7, 14, 15, 16, 17	GND	Power ground
8	FAULT	Diagnostic output
11	IN2	Mode control input
12	IN1	Mode control input
13	EN	Chip enable
18	OUTA	Bridge output

Operating Description

During powerup, the outputs are HI−Z regardless of the input states. When the undervoltage lockout threshold is exceeded, the outputs will reflect the input states. Outputs change to HI−Z whenever an undervoltage, overvoltage or thermal shutdown fault is detected. Normal operation will resume when faults are resolved.

Overcurrent Protection

Current is monitored continuously in each switch of each half bridge when the ENA input is in a high state thus protecting each switch from faults due to short to GND, short to V_{BAT} or shorted load conditions. Only the affected half−bridge is disabled for short to V_{BAT} or short to GND faults. A mask timer is initiated after a fault is detected and prevents recognition of an overcurrent event until the mask time expires. Persistence of an overcurrent condition causes the bridge output to change to HI−Z and the FAULT output to latch low until the next transition occurs on either the input related to the faulted output or the ENA input is brought low then high again. This method of protection provides current limiting on a cycle−by−cycle basis and helps allow a stall torque current to be ignored during motor start. Continued overcurrent may eventually result in activation of the thermal shutdown circuitry, thus activating a second level of protection for the NCV7701.
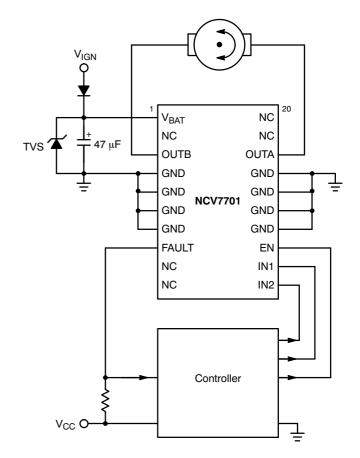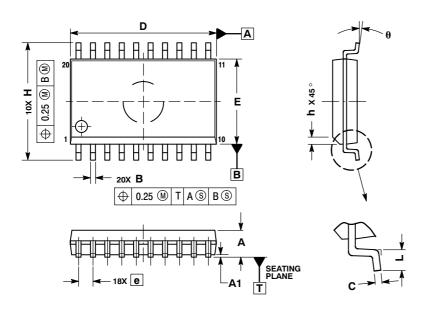

Figure 2. Application Diagram

PACKAGE DIMENSIONS

SOIC–20 WB
CASE 751D–05
ISSUE G

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
θ	0°	7°

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