700V Half-Bridge Driver

Features

- Drives IGBT/MOSFET power devices
- Gate drive supplies up to 20V per channel
- Integrated deadtime protection 100ns
- Shoot-through (cross-conduction) protection
- Undervoltage lockout for V_{CC} and for V_{BS}
- 3.3V, 5V, 15V input logic compatible
- Output in phase with input
- Tolerant to negative transient voltage
- Designed for use with bootstrap power supplies
- Matched propagation delays
- RoHS compliant
- Lead-Free

Description

The IR7304S is a high voltage, high speed, power MOSFET and IGBT gate driver with high-side and low-side referenced output channel. This IC is designed to be used with low-cost bootstrap power supplies. Proprietary HVIC and latch immune CMOS technologies have been implemented in a rugged monolithic structure. The floating logic input is compatible with standard CMOS or LSTTL outputs (down to 3.3 V logic). The output drivers feature a high-pulse current buffer stage designed for minimum driver cross-conduction. Shoot-through protection circuitry and a minimum deadtime circuitry have been integrated into this IC. Propagation delays are matched to simplify the HVIC's use in high frequency applications. The floating channels can be used to drive N-channel power MOSFETs or IGBTs in the high-side configuration, which operate up to 700 V.

Product Summary

VOFFSET	≤ 700V
V _{OUT}	10V – 20V
I _{o+} & I _{o-} (min.)	60mA / 130mA
t _{ON} & t _{OFF} (typ.)	220ns & 220ns
Deadtime (typ.)	100ns

Package Options



Typical Applications

- Appliance motor drives
- Servo drives
- Micro inverter drives
- General purpose three phase inverters

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Base Part Number	Package Type	Form	Quantity	Orderable Part Number
IR7304SPBF	SO8N	Tube	95	IR7304SPBF
IR7304SPBF	SO8N	Tape and Reel	2500	IR7304STRPBF

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Typical Connection Diagram



(Refer to Lead Assignments for correct pin configuration). This diagram shows electrical connections only. Please refer tour Application Notes & DesignTips for proper circuit board layout.

Absolute Maximum Ratings

Absolute maximum ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are absolute voltages referenced to COM unless otherwise stated in the table. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions.

Symbol	Definition	Min.	Max.	Units
Vcc	Low side supply voltage	-0.3	25 [†]	
V _{IN}	Logic input voltage	COM - 0.3	V _{CC} + 0.3	
VB	High-side floating well supply voltage	-0.3	725	
Vs	High-side floating well supply return voltage	V _B - 25	V _B + 0.3	V
V _{HO}	Floating gate drive output voltage	V _S - 0.3	V _B + 0.3	
V _{LO}	Low-side output voltage	COM - 0.3	V _{CC} + 0.3	
COM	Power ground	V _{CC} - 25	V _{CC} + 0.3	
dV _S /dt	Allowable V_S offset supply transient relative to V_{SS}	_	50	V/ns
P _D	Package power dissipation @ T _A ≤+25 ^o C	_	0.625	W
Rth _{JA}	Thermal resistance, junction to ambient	_	200	°C/W
TJ	Junction temperature —		150	
Ts	Storage temperature	-55	150	°C
T∟	Lead temperature (soldering, 10 seconds)	_	300	

† All supplies are tested at 25V.

Recommended Operating Conditions

For proper operation, the device should be used within the recommended conditions. All voltage parameters are absolute voltages referenced to COM unless otherwise stated in the table. The offset rating is tested with supplies of (V_{CC} - COM) = (V_B - V_S) = 15V.

Symbol	Definition	Min	Max	Units
V _{CC}	Low-side supply voltage	10	20	
V _{IN}	IN, /SD input voltage	COM	Vcc	
VB	High-side floating well supply voltage	V _S + 10	V _S + 20	
Vs	High-side floating well supply offset voltage [†]	†	700	V
V _{HO}	Floating gate drive output voltage	Vs	V _B	
V _{LO}	Low-side output voltage	COM	V _{CC}	
COM	Power ground	-5	5	
PW _{HIN}	High side Input pulse	500	—	ns
T _A	Ambient temperature	-40	125	°C

Logic operation for Vs of –5V to 700V. Logic state held for Vs of –5V to –V_{BS}. Please refer to Design Tip DT97-3 for more details.

Static Electrical Characteristics

 $(V_{CC} - COM) = (V_B - V_S) = 15V$. $T_A = 25^{\circ}C$ unless otherwise specified. The V_{IN} and I_{IN} parameters are referenced to COM. The V_O and I_O parameters are referenced to respective V_S and COM and are applicable to the respective output leads HO or LO. The V_{CCUV} parameters are referenced to COM. The V_{BSUV} parameters are referenced to V_S .

Symbol	Definition	Min.	Тур.	Max.	Units	Test Conditions
V _{CCUV+}	V _{CC} supply undervoltage positive going threshold	8	8.9	9.8		
V _{CCUV} -	V _{cc} supply undervoltage negative going threshold	7.4	8.2	9		
V _{CCUVHY}	V _{CC} supply undervoltage hysteresis	0.3	0.7	—	v	
V _{BSUV+}	V _{BS} supply undervoltage positive going threshold	8	8.9	9.8	V	
V _{BSUV} -	V _{BS} supply undervoltage negative going threshold	7.4	8.2	9		
V _{BSUVHY}	V _{BS} supply undervoltage hysteresis	0.3	0.7	—		
I _{LK}	High-side floating well offset supply leakage	_	—	50		$V_B = V_S = 700V$
I _{QBS}	Quiescent V _{BS} supply current	_	60	150	μA	$V_{IN} = 0V, V_{IN} = 5V$
I _{QCC}	Quiescent V _{CC} supply current	_	120	240		
V _{OH}	High level output voltage drop, V _{BIAS} -V _O	_	—	2.8	v	L 00
V _{OL}	Low level output voltage drop, Vo	_	—	1.2	v	I ₀ = 20mA
I _{o+}	Output high short circuit pulsed current	60	_	_	mA	V _O = 15 V,V _{IN} = 5V, PW ≤ 10µs
I _{o-}	Output low short circuit pulsed current	130	—	_	IIIA	V _O = 0V,V _{IN} = 0V, PW ≤ 10μs
V _{IH}	Logic "1" input voltage	2.3	—	—	v	
V _{IL}	Logic "0" input voltage	_	—	0.8		
I _{IN+}	Input bias current (HO = High)	_	5	40		$V_{IN} = 5V$
I _{IN-}	Input bias current (HO = Low)	_	1	2	μA	$V_{IN} = 0V$

Dynamic Electrical Characteristics

 $V_{CC} = V_B = 15V$, $V_S = COM$, $T_A = 25^{\circ}C$, and $C_L = 1000pF$ unless otherwise specified.

Symbol	Definition	Min.	Тур.	Max.	Units	Test Conditions
t _{ON}	Turn-on propagation delay	—	220	320		$V_{\rm S} = 0V$
t _{OFF}	Turn-off propagation delay	—	220	330		$V_{\rm S} = 0V \text{ or } 700V$
t _R	Turn-on rise time	—	200	300	20	
t _F	Turn-off fall time	—	100	170	ns	
DT	Deadtime	_	100	190		
MT	Delay matching time	—	—	50		

International

IR7304SPBF

Functional Block Diagram



Lead Definitions

Symbol	Description
VCC	Low-side and logic supply voltage
VB	High-side gate drive floating supply
VS	High voltage floating supply return
HIN	Logic input for high-side driver output
LIN	Logic input for low-side driver output
HO	High-side driver output
LO	Low-side driver output
COM	Low-side gate drive return

Lead Assignments



Application Information and Additional Details







Figure 2. Switch Timing Waveforms

Figure 3. Internal Deadtime Timing

Figure X. Internal Deadtime Timing

Package Details



Tape and Reel Details



CARRIER TAPE DIMENSION FOR 8SOICN

	Metric		Imp	erial
Code	Min	Max	Min	Max
A	7.90	8.10	0.311	0.318
В	3.90	4.10	0.153	0.161
С	11.70	12.30	0.46	0.484
D	5.45	5.55	0.214	0.218
E	6.30	6.50	0.248	0.255
F	5.10	5.30	0.200	0.208
G	1.50	n/a	0.059	n/a
Н	1.50	1.60	0.059	0.062



REEL DIMENSIONS FOR 8SOICN

	Metric		Imperial		
Code	Min	Max	Min	Max	
A	329.60	330.25	12.976	13.001	
В	20.95	21.45	0.824	0.844	
C	12.80	13.20	0.503	0.519	
D	1.95	2.45	0.767	0.096	
E F	98.00	102.00	3.858	4.015	
	n/a	18.40	n/a	0.724	
G H	14.50	17.10	0.570	0.673	
Н	12.40	14.40	0.488	0.566	



Part Marking Information



Qualification Information[†]

			Industrial ^{††}		
Qualification Level		Comments: This family of ICs has passed JEDEC's Industrial qualification. IR's Consumer qualification level is granted by extension of the higher Industrial level.			
Moisture Sensitivit	y Level	8 Lead SOIC	MSL2 ^{†††} , 260°C (per IPC/JEDEC J-STD-020)		
FSD	ESD Human Body Model Machine Model		Class 1C (per JEDEC standard JS-001-2012)		
ESD			Class B (per EIA/JEDEC standard EIA/JESD22-A115)		
IC Latch-Up Test		Class I, Level A			
		(per JESD78)			
RoHS Compliant		Yes			

Qualification standards can be found at International Rectifier's web site http://www.irf.com/

† †† Higher qualification ratings may be available should the user have such requirements. Please contact your International Rectifier sales representative for further information. Higher MSL ratings may be available for the specific package types listed here. Please contact your International

††† Rectifier sales representative for further information.