

Description

The IRS2004S is a high voltage, high speed power MOSFET drivers with dependent high- and low-side referenced output channels. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. The logic input is compatible with standard CMOS or LSTTL output, down to 3.3 V logic. The output drivers feature a high pulse current buffer stage designed for minimum driver cross-conduction. The floating channel can be used to drive an N-channel power MOSFET in the high-side configuration which operates up to 250 V.

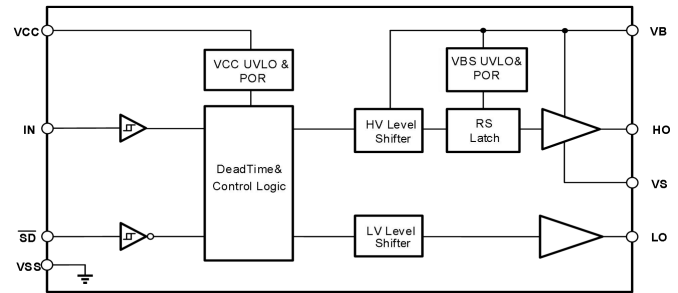
Features and Benefits

- Floating channel designed for bootstrap operation
- Fully operational to +250 V
- 3.3V, 5V and 15V input logic compatible
- dV/dt noise Immunity ± 50 V/nsec
- Allowable negative Vs capability: -9V
- Gate drive supply range from 10V to 20V
- Undervoltage lockout for both channels
 - UVLO forward 8.9V
 - UVLO reverse 8.2V
- Cross-conduction prevention logic
 - Deadtime 520ns
- Propagation delay
 - Ton/Toff =680ns/150ns
- Wide operating temperature range -40°C ~125°C
- Typically output Source/Sink current capability: 290mA/600mA

Application

- Motor Control
- Air Conditioners/ Washing Machines
- General Purpose Inverters
- Micro/Mini Inverter Drives

Functional Block Diagram



Function Pin Description

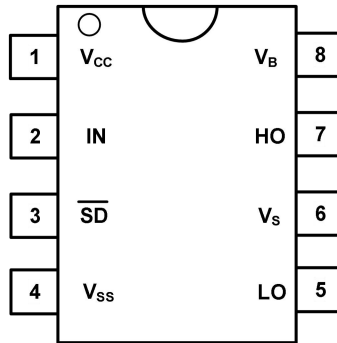


Figure7-1 8-Pin SOP8 Top view

Table7-1 Lead Definitions

Number	Symbol	Description
1	V _{CC}	Low side and logic fixed supply
2	IN	Logic input for high side gate driver output (HO), in phase
3	\overline{SD}	Logic input for low side gate driver output (LO), out of phase
4	V _{SS}	Low side return
5	LO	Low side gate drive output
6	V _S	High side floating supply return
7	HO	High side gate drive output
8	V _B	High side floating supply

Absolute Maximum Ratings

Exceeding the limit maximum rating may cause permanent damage to the device. All voltage parameters are rated with reference to VSS and an ambient temperature of 25°C.

Symbol	Definition	MIN.	MAX.	Units
V _B	High side floating supply	-0.3	275	V
V _S	High side floating supply return	V _B - 25	V _B + 0.3	
V _{HO}	High side gate drive output	V _S - 0.3	V _B + 0.3	
V _{CC}	Low side and main power supply	-0.3	25 ^{Note1}	
V _{LO}	Low side gate drive output	-0.3	V _{CC} + 0.3	
V _{IN}	Logic input of IN & \overline{SD}	-0.3	V _{CC} + 0.3	
dV _S /dt	Allowable Offset Supply Voltage Transient		50	V/ns

ESD rating

Symbol	Definition	MIN.	MAX.	Units
ESD	HBM Model	1500		V
	Machine Model	500		V

Rated power

Symbol	Definition	MIN.	MAX.	Units
P _D	Package Power Dissipation @ TA ≤ 25°C		625	mW

Thermal information

Symbol	Definition	MIN.	MAX.	Units
R _{thJA}	Thermal Resistance, Junction to Ambient		200	°C/W
T _J	Junction Temperature		150	°C
T _S	Storage Temperature	-55	150	
T _L	Lead Temperature (Soldering, 10 seconds)		300	

Recommended Operating Conditions

For proper operation, the device should be used under the following recommended conditions. The bias ratings of V_S and V_{SS} are measured at a supply voltage of 15V, and unless otherwise specified, the ratings of all voltage parameters are referenced to V_{SS} and the ambient temperature is 25°C.

Symbol	Definition	MIN.	MAX.	Units
V _B	High side floating supply	V _S + 10	V _S + 20	V
V _S	High side floating supply return	-9 ^{Note2}	250	
V _{HO}	High side gate drive output	V _S	V _B	
V _{CC}	Low side and main power supply	10	20	
V _{LO}	Low side gate drive output	0	V _{CC}	
V _{IN}	Logic input of IN & \overline{SD}	0	V _{CC}	
T _A	Ambient temperature	-40	125	°C

Note1: All power supplies tested at 25V.

Note2: In order to ensure that the IC works, the range of the V_S should be between -8V to 200V.

Electrical Characteristics

Valid for temperature range at $T_A = 25^\circ\text{C}$, $V_{CC} = V_B = 15\text{V}$, $C_L = 1\text{nF}$, unless otherwise specified

Dynamical electrical characteristics

Symbol	Definition	MIN	TYP	MAX	Units	Test Condition
t_{ON}	Turn-on propagation delay		680	870	ns	$V_S = 0/250\text{V}$
t_{OFF}	Turn-off propagation delay		150	220	ns	$V_S = 0\text{V}$
t_R	Turn-on rise time		70	170	ns	
t_F	Turn-off fall time		30	90	ns	
DT	Deadtime	400	520	650	ns	
MT	Matching delay ON and OFF			60	ns	
t_{SD}	Shutdown delay		150	220	ns	$V_S = 0\text{V}$

Static electrical characteristics

Valid for temperature range at $T_A = 25^\circ\text{C}$, $V_{CC} = V_B = 15\text{V}$, $C_L = 1\text{nF}$, unless otherwise specified.

Symbol	Definition	MIN.	TYP.	MAX.	Units	Test Condition
V_{CCUV+}	VCC supply UVLO threshold	8.0	8.9	9.8	V	
V_{CCUV-}		7.4	8.2	9	V	
V_{BSUV+}	VBS supply UVLO threshold	8.0	8.9	9.8	V	
V_{BSUV-}		7.4	8.2	9	V	
I_{LK}	High-side floating supply leakage current			50	μA	$V_B = V_S = 250\text{V}$
I_{QBS}	Quiescent VB supply current		45	70	μA	
I_{QCC}	Quiescent VCC supply current		300	520	μA	
V_{IH}	Logic "1" ($\overline{\text{IN}}$ & $\overline{\text{SD}}$) input voltage	2.5			V	$V_{CC} = 10\text{V to } 20\text{V}$
V_{IL}	Logic "0" ($\overline{\text{IN}}$ & $\overline{\text{SD}}$) input voltage			0.8	V	$V_{CC} = 10\text{V to } 20\text{V}$
V_{OH}	High level output voltage, $V_{BIAS} - V_O$		0.05	0.2	V	$I_O = 2\text{mA}$
V_{OL}	Low level output voltage, V_O		0.02	0.1	V	
I_{IN+}	Logic "1" Input bias current		7	15	μA	$V_{IN} = 5\text{V}$
I_{IN-}	Logic "0" Input bias current		0	1	μA	$V_{IN} = 0\text{V}$
I_{O+}	Output high short circuit pulsed current	200	290		mA	$V_O = 0\text{V}$ $PW \leq 10\mu\text{s}$
I_{O-}	Output low short circuit pulsed current	420	600		mA	$V_O = 15\text{V}$ $PW \leq 10\mu\text{s}$

Function Description

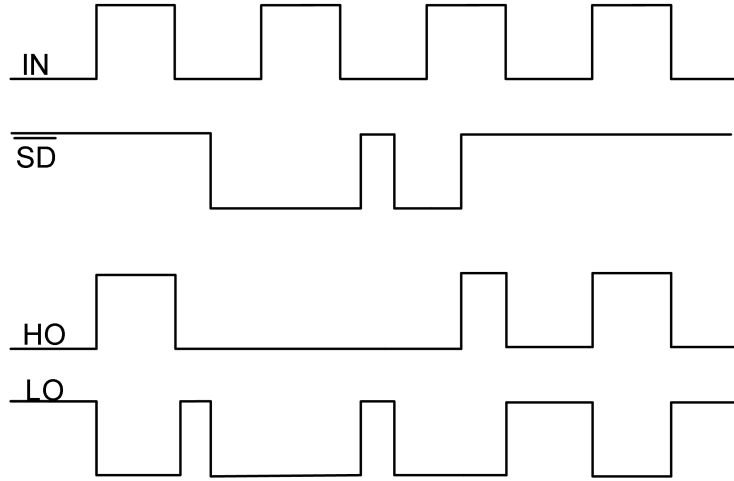


Figure 9-1 IRS2004S Input and output timing waveform

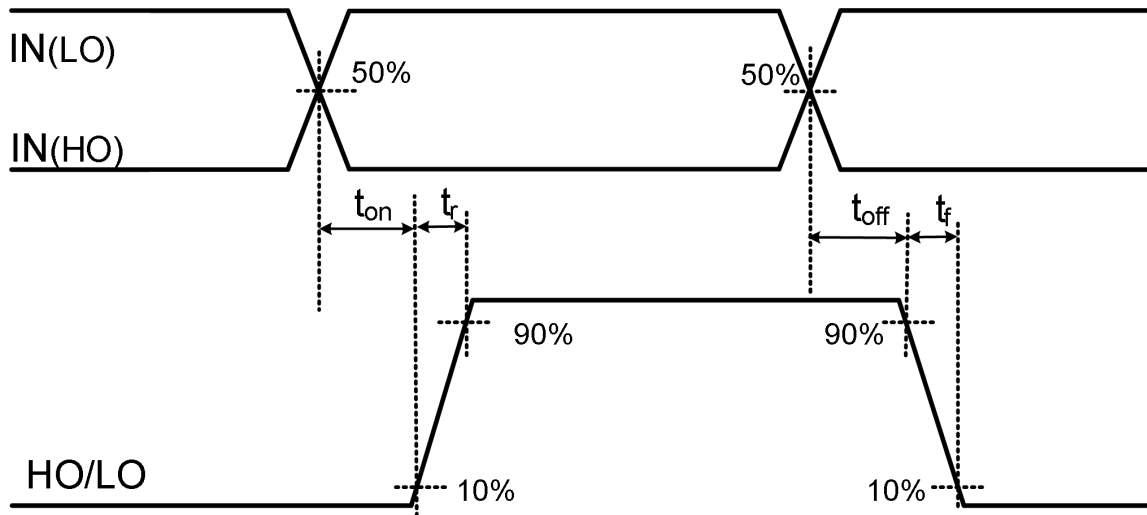


Figure 9-2 Propagation Time Waveform Definition

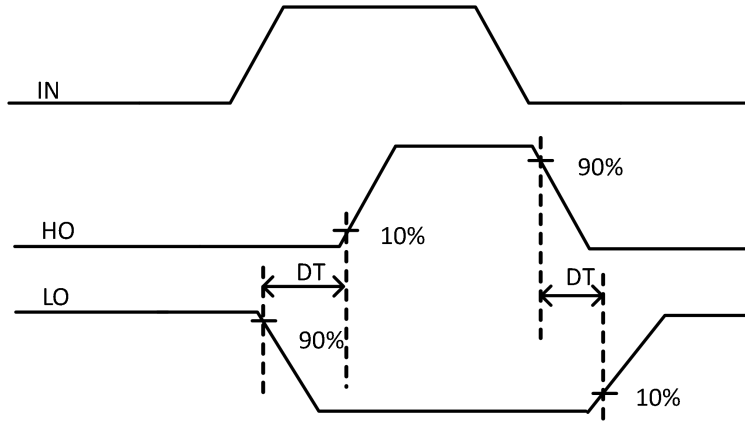


Figure 9-3 Cross Conduction Prevention Delay Time Waveform Definition

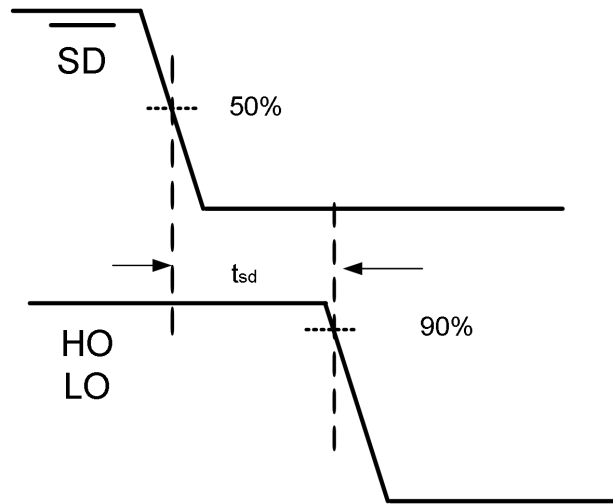


Figure 9-4 Shutdown Delay Time Waveform Definition

Function Block Diagram

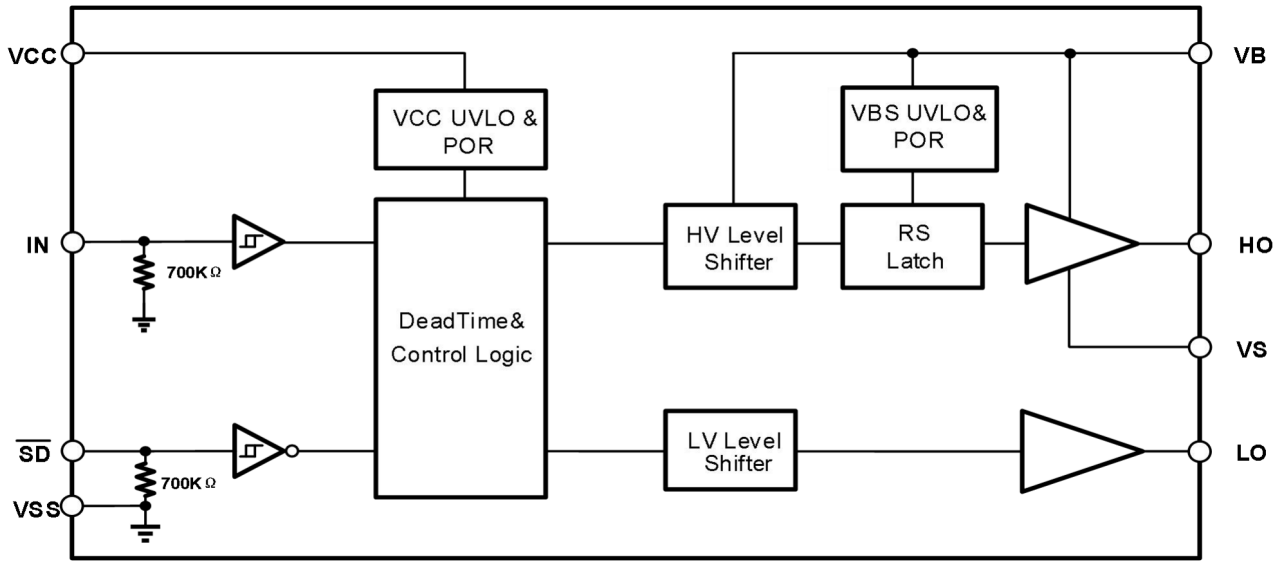


Figure10-1 Function Block Diagram of IRS2004S

Application message

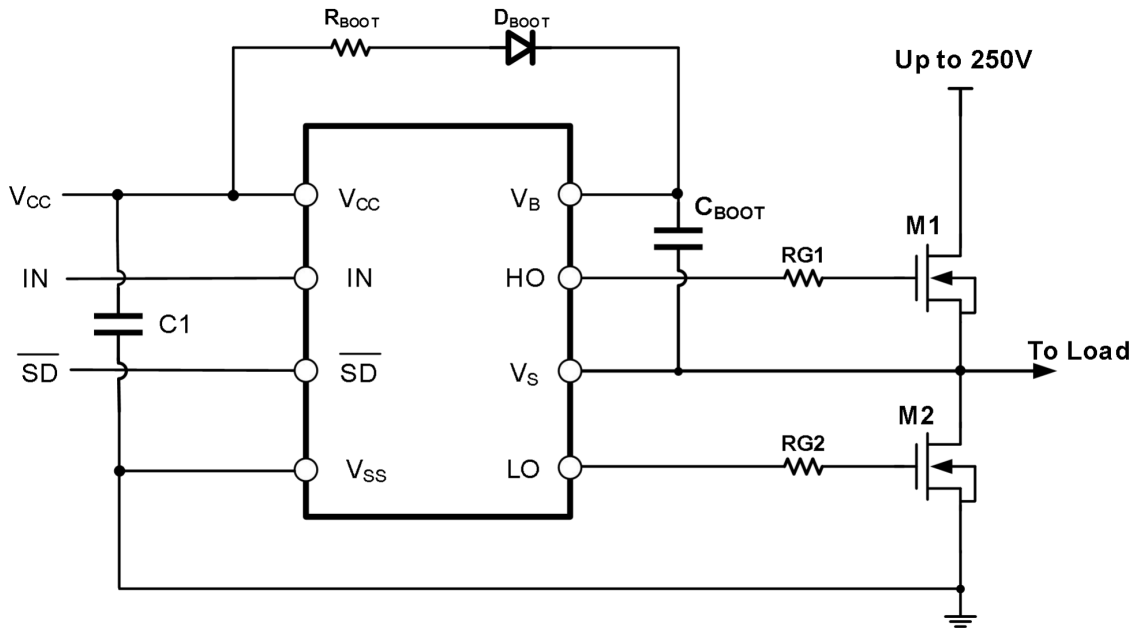
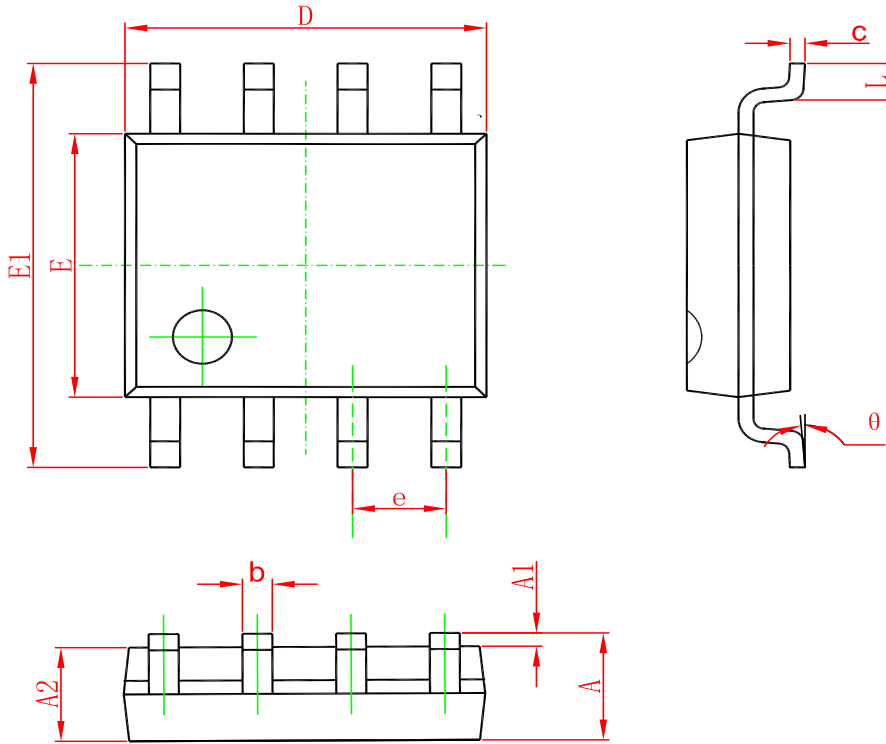


Figure10-2 Typical application circuit of IRS2004S

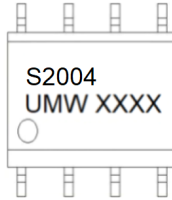
PACKAGE OUTLINE DIMENSIONS

SOP-8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

Marking



Ordering information

Order code	Package	Baseqty	Deliverymode
UMW IRS2004STR	SOP-8	2500	Tape and reel