# UMW IRS2004STR

250V Half Bridge MOSFET/IGBT Gate Driver

## 1.Description

The UMW IRS2004STR 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.

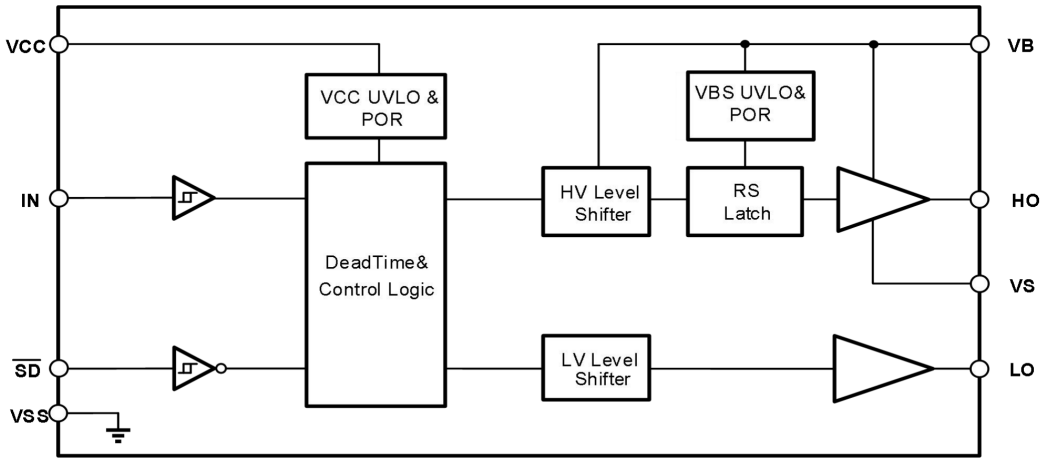
## 2.Application

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

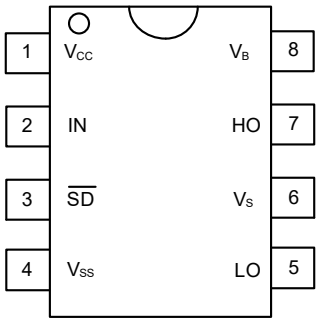
## 3.Features

- 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

## 4.Functional Block Diagram



## 5.Pinning Information




**SOP-8**

Lead Definitions

| Number | Symbol | Description |
|---|---|---|
| 1 | VCC | 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 |

## 6.Absolute Maximum Ratings

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

| Parameter | Symbol | Min | Max | Units |
|---|---|---|---|---|
| High side floating supply | $V_B$ | -0.3 | 275 | V |
| High side floating supply return | $V_S$ | $V_B$-25 | $V_B$+0.3 | V |
| High side gate drive output | $V_{HO}$ | $V_S$-0.3 | $V_B$+0.3 | V |
| Low side and main power supply | $V_{CC}$ | -0.3 | 25 Note1 | V |
| Low side gate drive output | $V_{LO}$ | -0.3 | $V_{CC}$+0.3 | V |
| Logic input of IN & $\overline{SD}$ | $V_{IN}$ | -0.3 | $V_{CC}$+0.3 | V |
| Allowable Offset Supply Voltage Transient | $dV_S/dt$ | - | 50 | V/ns |

## 7.ESD Rating

| Parameter | Symbol | Min | Max | Units |
|---|---|---|---|---|
| HBM Model | ESD | 1500 | - | V |
| Machine Model | | 500 | - | V |

## 8.Rated Power

| Parameter | Symbol | Min | Max | Units |
|---|---|---|---|---|
| Package Power Dissipation @ $T_A$ ≤25°C | PD | - | 625 | mW |

## 9.Thermal Information

| Parameter | Symbol | Min | Max | Units |
|---|---|---|---|---|
| Thermal Resistance, Junction to Ambient | $Rth_{JA}$ | - | 200 | °C/W |
| Junction Temperature | $T_J$ | - | 150 | °C |
| Storage Temperature | $T_S$ | -55 | 150 | °C |
| Lead Temperature (Soldering, 10 seconds) | $T_L$ | - | 300 | °C |

## 10.Recommended Operating Conditions

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

| Parameter | Symbol | Min | Max | Units |
|---|---|---|---|---|
| High side floating supply | $V_B$ | $V_S$ + 10 | $V_S$ + 20 | V |
| High side floating supply return | $V_S$ | -9 Note2 | 250 | V |
| High side gate drive output | $V_{HO}$ | $V_S$ | $V_B$ | V |
| Low side and main power supply | $V_{CC}$ | 10 | 20 | V |
| Low side gate drive output | $V_{LO}$ | 0 | $V_{CC}$ | V |
| Logic input of IN & $\overline{SD}$ | $V_{IN}$ | 0 | $V_{CC}$ | V |
| Ambient temperature | $T_A$ | -40 | 125 | °C |

Note1: All power supplies tested at 25V.

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

## 11.Dynamical Electrical Characteristics

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

| Parameter | Symbol | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Turn-on propagation delay | $t_{ON}$ | $V_S$=0/250V | | 680 | 870 | ns |
| Turn-off propagation delay | $t_{OFF}$ | $V_S$=0V | | 150 | 220 | ns |
| Turn-on rise time | $t_R$ | | | 70 | 170 | ns |
| Turn-off fall time | $t_F$ | | | 30 | 90 | ns |
| Deadtime | DT | | 400 | 520 | 650 | ns |
| Matching delay ON and OFF | MT | | | | 60 | ns |
| Shutdown delay | $t_{SD}$ | $V_S$=0V | | 150 | 220 | ns |

## 12.Static Electrical Characteristics

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

| Parameter | Symbol | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| $V_{CC}$ supply UVLO threshold | $V_{CCUV+}$ | | 8 | 8.9 | 9.8 | V |
| | $V_{CCUV-}$ | | 7.4 | 8.2 | 9 | V |
| $V_{BS}$ supply UVLO threshold | $V_{BSUV+}$ | | 8 | 8.9 | 9.8 | V |
| | $V_{BSUV-}$ | | 7.4 | 8.2 | 9 | V |
| High-side floating supply leakage current | $I_{LK}$ | $V_B$=$V_S$=250V | | | 50 | μA |
| Quiescent $V_B$ supply current | $I_{QBS}$ | | | 45 | 70 | μA |
| Quiescent $V_{CC}$ supply current | $I_{QCC}$ | | | 300 | 520 | μA |
| Logic “1”(IN&$\overline{SD}$) input voltage | $V_{IH}$ | $V_{CC}$=10V to 20V | 2.5 | | | V |
| Logic “0”(IN&$\overline{SD}$) input voltage | $V_{IL}$ | $V_{CC}$=10V to 20V | | | 0.8 | V |
| High level output voltage, $V_{BIAS}$ -$V_O$ | $V_{OH}$ | $I_O$=2mA | | 0.05 | 0.2 | V |
| Low level output voltage, $V_O$ | $V_{OL}$ | $I_O$=2mA | | 0.02 | 0.1 | V |
| Logic “1” input bias current | $I_{IN+}$ | $V_{IN}$=5V | | 7 | 15 | μA |
| Logic “0”input bias current | $I_{IN-}$ | $V_{IN}$=0V | | 0 | 1 | μA |
| Output high short circuit pulsed current | $I_{O+}$ | $V_O$=0V, PW≤10us | 200 | 290 | | mA |
| Output low short circuit pulsed current | $I_{O-}$ | $V_O$=15V, PW≤10us | 420 | 600 | | mA |

## 13.Function Description

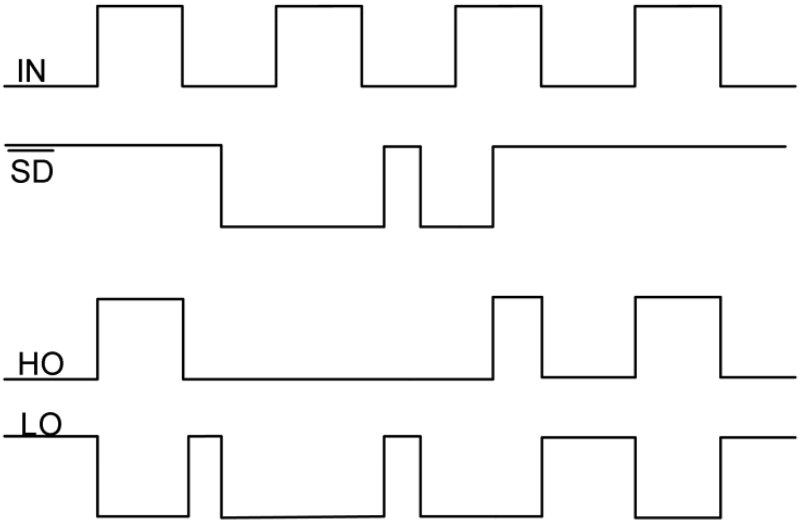



Figure 1. IRS2004S Input and output timing waveform

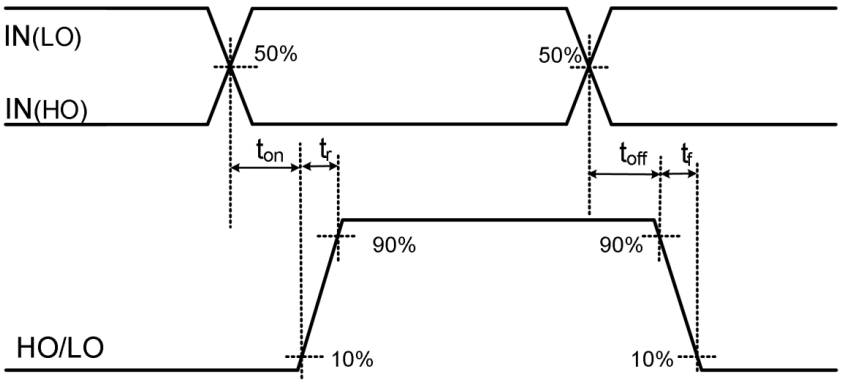



Figure 2. Propagation Time Waveform Definition

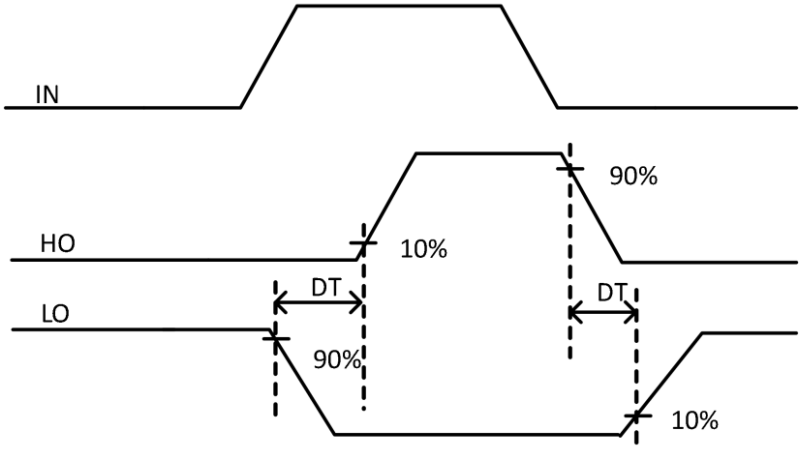



Figure 3. Cross Conduction Prevention Delay Time Waveform Definition

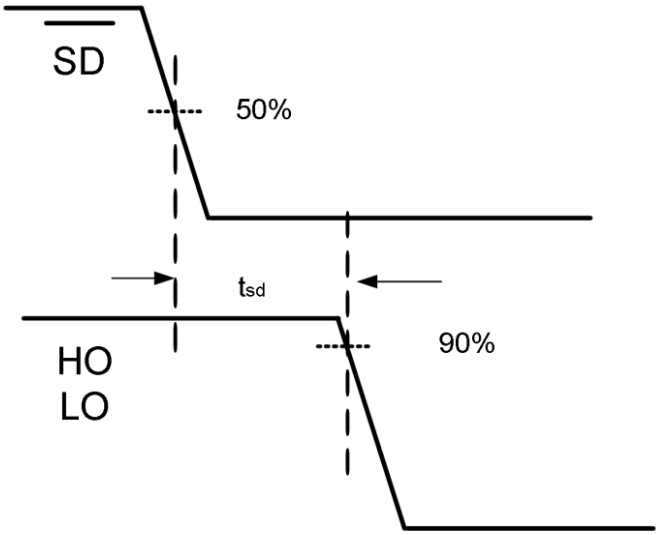



Figure 4. Shutdown Delay Time Waveform Definition

## 14.Function Block Diagram

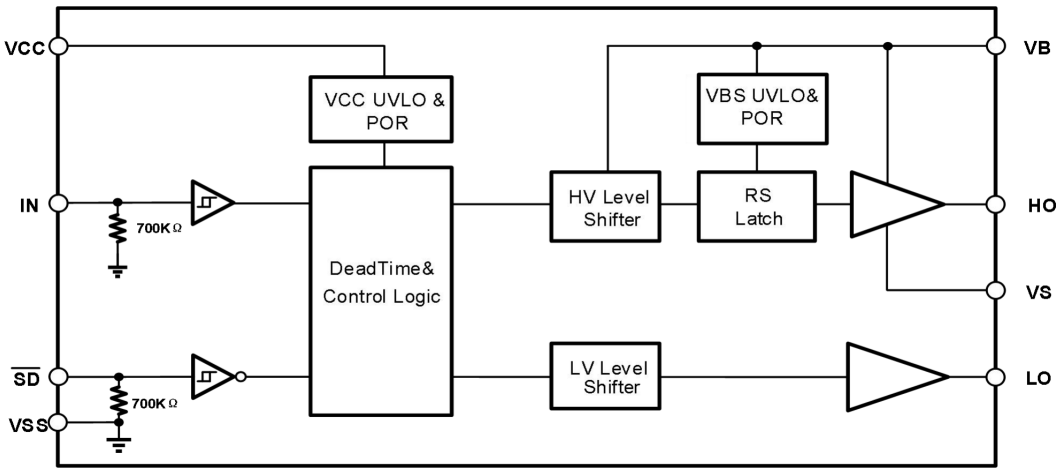



Figure 5. Function Block Diagram of UMW IRS2004STR

## 15.Application Message

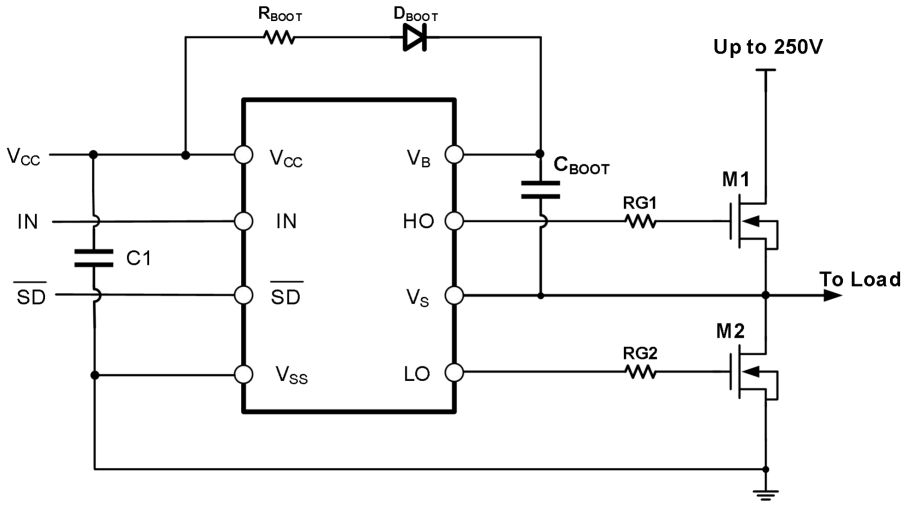
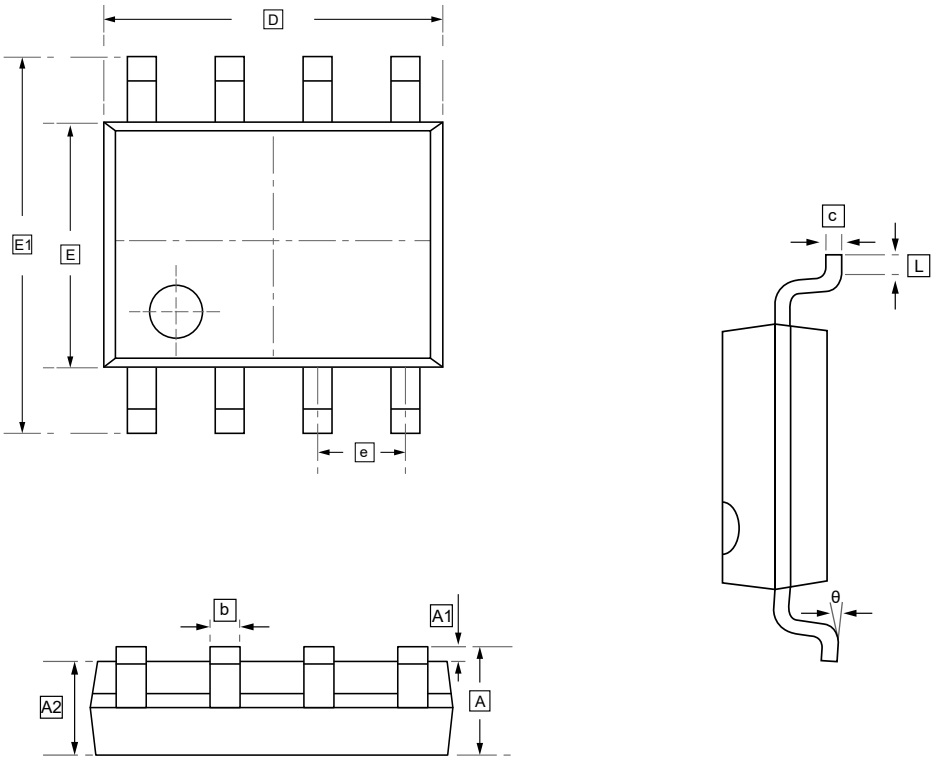



Figure 6. Typical application circuit of UMW IRS2004STR

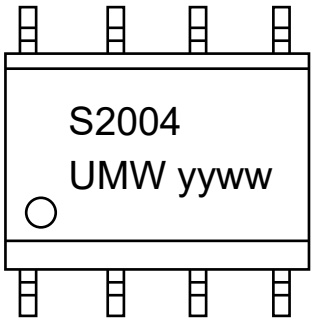
## 16.SOP-8 Package Outline Dimensions




**DIMENSIONS (mm are the original dimensions)**

| Symbol | A | A1 | A2 | b | c | D | E | E1 | e | L | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Min** | 1.350 | 0.000 | 1.350 | 0.330 | 0.170 | 4.700 | 3.800 | 5.800 | 1.270 | 0.400 | 0° |
| **Max** | 1.750 | 0.100 | 1.550 | 0.510 | 0.250 | 5.100 | 4.000 | 6.200 | BSC | 1.270 | 8° |

## 17.Ordering information




yy: Year Code
ww: Week Code

| Order Code | Package | Base QTY | Delivery Mode |
|---|---|---|---|
| UMW IR2004STR | SOP-8 | 2500 | Tape and reel |

## 18.Disclaimer

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