Data Sheet No. PD60209 revC

International
IOR Rectifier

# IR2308(S) & (PbF)

## HALF-BRIDGE DRIVER

### Features

- Floating channel designed for bootstrap operation
  Fully operational to +600V
  Tolerant to negative transient voltage
  dV/dt immune
- Gate drive supply range from 10 to 20V
- Undervoltage lockout for both channels
- 3.3V, 5V and 15V input logic compatible
- Cross-conduction prevention logic
- Matched propagation delay for both channels
- Outputs in phase with inputs
- Logic and power ground +/- 5V offset.
- Internal 540ns dead-time
- Lower di/dt gate driver for better noise immunity
- Also available LEAD_FREE

### Packages

8-Lead SOIC - IR2308S
Also available
LEAD-FREE (PbF)

8-Lead PDIP
IR2308

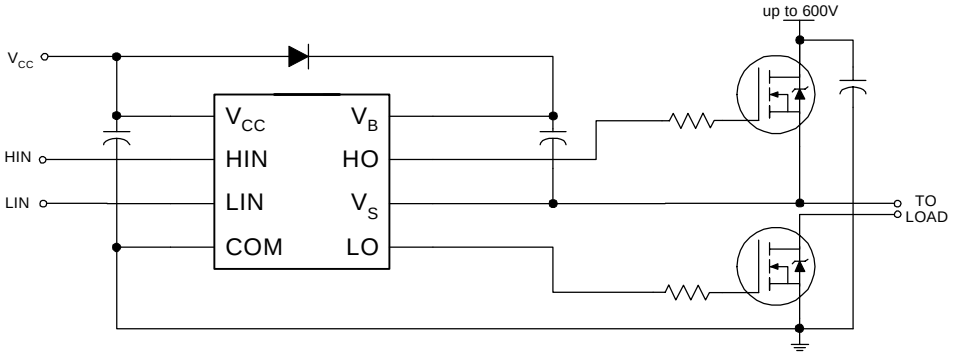
**2106//2108//2109/2304/2308 Feature Comparison**

| Part | Input logic | Cross-conduction prevention logic | Dead-Time | Ground Pins |
|---|---|---|---|---|
| 2106 | HIN/LIN | no | none | COM |
| 21064 | | | | VSS/COM |
| 2108 | HIN/$\overline{\text{LIN}}$ | yes | Internal 540ns | COM |
| 21084 | | | Programmable 0.54~5 µs | VSS/COM |
| 2109 | IN/$\overline{\text{SD}}$ | yes | Internal 540ns | COM |
| 21094 | | | Programmable 0.54~5 µs | VSS/COM |
| 2304 | HIN/LIN | yes | Internal 100ns | COM |
| 2308 | HIN/LIN | yes | Internal 540ns | COM |

### Description

The IR2308(S) are high voltage, high speed power MOSFET and IGBT 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 3.3V 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 or IGBT in the high side configuration which operates up to 600 volts.

### Typical Connection




(Refer to Lead Assignments for correct pin configuration). This/These diagram(s) show electrical connections only. Please refer to our Application Notes and 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. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions.

| Symbol | Definition | | Min. | Max. | Units |
|---|---|---|---|---|---|
| $V_B$ | High side floating absolute voltage | | -0.3 | 625 | V |
| $V_S$ | High side floating supply offset voltage | | $V_B$ - 25 | $V_B$ + 0.3 | |
| $V_{HO}$ | High side floating output voltage | | $V_S$ - 0.3 | $V_B$ + 0.3 | |
| $V_{CC}$ | Low side and logic fixed supply voltage | | -0.3 | 25 | |
| $V_{LO}$ | Low side output voltage | | -0.3 | $V_{CC}$ + 0.3 | |
| $V_{IN}$ | Logic input voltage (HIN & LIN ) | | $V_{SS}$ - 0.3 | $V_{CC}$ + 0.3 | |
| $dV_S/dt$ | Allowable offset supply voltage transient | | — | 50 | V/ns |
| $P_D$ | Package power dissipation @ $T_A \leq +25°C$ | (8 lead PDIP) | — | 1.0 | W |
| | | (8 lead SOIC) | — | 0.625 | |
| $Rth_{JA}$ | Thermal resistance, junction to ambient | (8 lead PDIP) | — | 125 | °C/W |
| | | (8 lead SOIC) | — | 200 | |
| $T_J$ | Junction temperature | | — | 150 | °C |
| $T_S$ | Storage temperature | | -50 | 150 | |
| $T_L$ | Lead temperature (soldering, 10 seconds) | | — | 300 | |

## Recommended Operating Conditions

The Input/Output logic timing diagram is shown in figure 1. For proper operation the device should be used within the recommended conditions. The $V_S$ and $V_{SS}$ offset rating are tested with all supplies biased at 15V differential.

| Symbol | Definition | Min. | Max. | Units |
|---|---|---|---|---|
| VB | High side floating supply absolute voltage | $V_S$ + 10 | $V_S$ + 20 | V |
| $V_S$ | High side floating supply offset voltage | Note 1 | 600 | |
| $V_{HO}$ | High side floating output voltage | $V_S$ | $V_B$ | |
| $V_{CC}$ | Low side and logic fixed supply voltage | 10 | 20 | |
| $V_{LO}$ | Low side output voltage | 0 | $V_{CC}$ | |
| $V_{IN}$ | Logic input voltage | COM | $V_{CC}$ | |
| $T_A$ | Ambient temperature | -40 | 125 | °C |

Note 1: Logic operational for $V_S$ of -5 to +600V. Logic state held for $V_S$ of -5V to $-V_{BS}$. (Please refer to the Design Tip DT97-3 for more details).

## Dynamic Electrical Characteristics

$V_{BIAS}$ ($V_{CC}$, $V_{BS}$) = 15V, $V_{SS}$ = COM, $C_L$ = 1000 pF, $T_A$ = 25°C, DT = VSS unless otherwise specified.

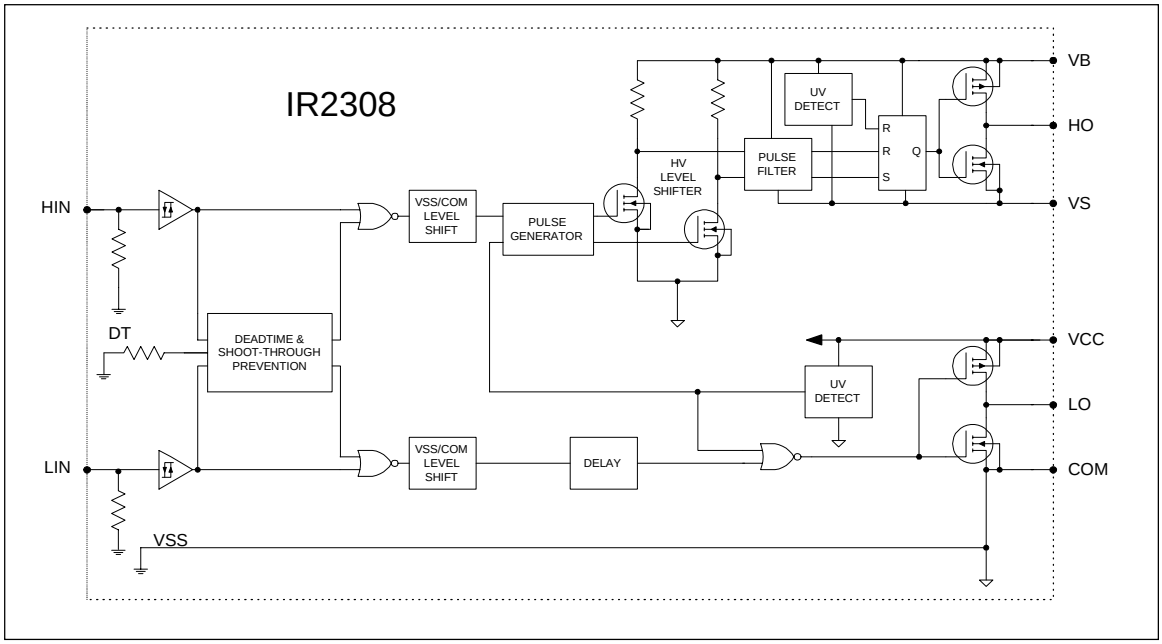
| Symbol | Definition | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $t_{on}$ | Turn-on propagation delay | — | 220 | 300 | nsec | $V_S$ = 0V |
| $t_{off}$ | Turn-off propagation delay | — | 200 | 280 | | $V_S$ = 0V or 600V |
| MT | Delay matching $\lvert t_{on} - t_{off} \rvert$ | — | 0 | 46 | | |
| $t_r$ | Turn-on rise time | — | 150 | 220 | | $V_S$ = 0V |
| $t_f$ | Turn-off fall time | — | 50 | 80 | | $V_S$ = 0V |
| DT | Deadtime: LO turn-off to HO turn-on($DT_{LO-HO}$) & HO turn-off to LO turn-on ($DT_{HO-LO}$) | 400 | 540 | 680 | | |
| MDT | Deadtime matching = $\lvert DT_{LO-HO} - DT_{HO-LO} \rvert$ | — | 0 | 60 | | |

## Static Electrical Characteristics

$V_{BIAS}$ ($V_{CC}$, $V_{BS}$) = 15V, $V_{SS}$ = COM, DT= $V_{SS}$ and $T_A$ = 25°C unless otherwise specified. The $V_{IL}$, $V_{IH}$ and $I_{IN}$ parameters are referenced to $V_{SS}$/COM and are applicable to the respective input leads: HIN and LIN. The $V_O$, $I_O$ and Ron parameters are referenced to COM and are applicable to the respective output leads: HO and LO.

| Symbol | Definition | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $V_{IH}$ | Logic “1” input voltage for HIN & LIN | 2.9 | — | — | V | $V_{CC}$ = 10V to 20V |
| $V_{IL}$ | Logic “0” input voltage for HIN & LIN | — | — | 0.8 | | $V_{CC}$ = 10V to 20V |
| $V_{OH}$ | High level output voltage, $V_{BIAS}$ - $V_O$ | — | 0.8 | 1.4 | | $I_O$ = 20 mA |
| $V_{OL}$ | Low level output voltage, $V_O$ | — | 0.3 | 0.6 | | $I_O$ = 20 mA |
| $I_{LK}$ | Offset supply leakage current | — | — | 50 | µA | $V_B$ = $V_S$ = 600V |
| $I_{QBS}$ | Quiescent $V_{BS}$ supply current | 20 | 60 | 150 | | $V_{IN}$ = 0V or 5V |
| $I_{QCC}$ | Quiescent $V_{CC}$ supply current | 0.4 | 1.0 | 1.6 | mA | $V_{IN}$ = 0V or 5V |
| $I_{IN+}$ | Logic “1” input bias current | — | 5 | 20 | µA | HIN = 5V, LIN = 5V |
| $I_{IN-}$ | Logic “0” input bias current | — | 1 | 2 | | HIN = 0V, LIN = 0V |
| $V_{CCUV+}$ $V_{BSUV+}$ | $V_{CC}$ and $V_{BS}$ supply undervoltage positive going threshold | 8.0 | 8.9 | 10 | V | |
| $V_{CCUV-}$ $V_{BSUV-}$ | $V_{CC}$ and $V_{BS}$ supply undervoltage negative going threshold | 7.4 | 8.2 | 9.0 | | |
| $V_{CCUVH}$ $V_{BSUVH}$ | Hysteresis | 0.3 | 0.7 | — | | |
| $I_{O+}$ | Output high short circuit pulsed current | 97 | 200 | — | mA | $V_O$ = 0V, PW ≤ 10 µs |
| $I_{O-}$ | Output low short circuit pulsed current | 250 | 350 | — | | $V_O$ = 15V, PW ≤ 10 µs |

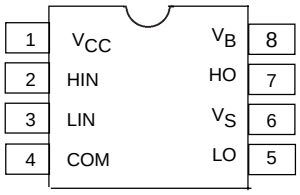
## Functional Block Diagram



## Lead Definitions

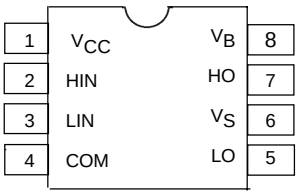
| Symbol | Description |
|---|---|
| HIN | Logic input for high side gate driver output (HO), in phase |
| LIN | Logic input for low side gate driver output (LO), in phase |
| $V_B$ | High side floating supply |
| HO | High side gate driver output |
| $V_S$ | High side floating supply return |
| $V_{CC}$ | Low side and logic fixed supply |
| LO | Low side gate driver output |
| COM | Low side return |

## Lead Assignments




8 Lead PDIP

**IR2308**




8 Lead SOIC
Also available LEAD-FREE(PbF)

**IR2308S**

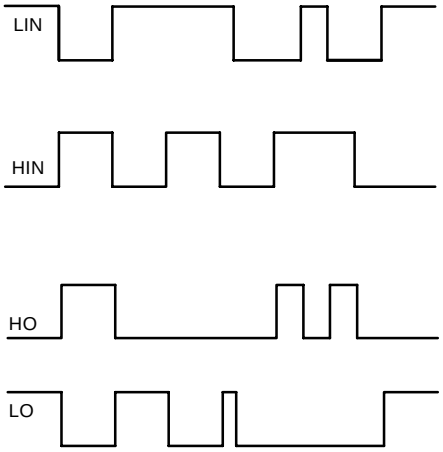



**Figure 1. Input/Output Timing Diagram**

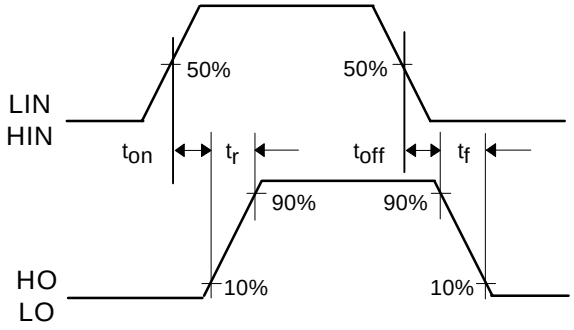



**Figure 2. Switching Time Waveform Definitions**

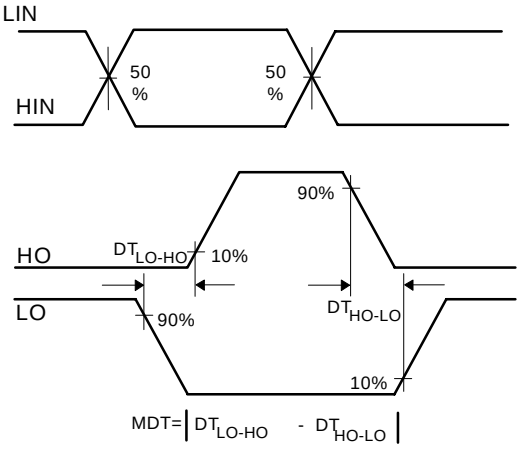
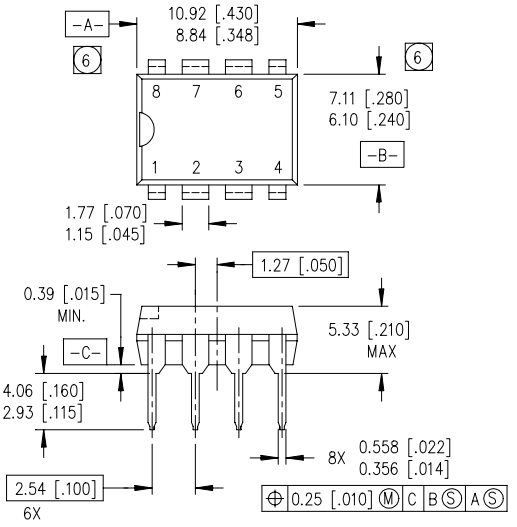
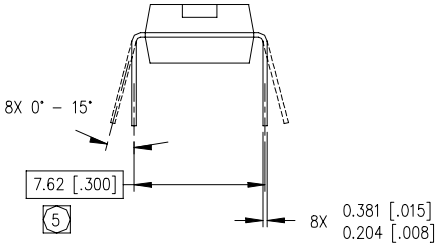



**Figure 3. Deadtime Waveform Definitions**

## Case outlines

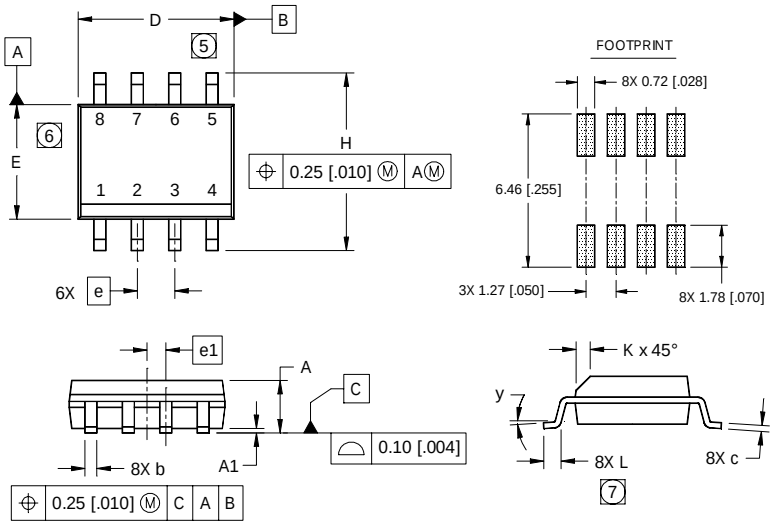



NOTES:
1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M–1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS–001AB.
5. MEASURED WITH THE LEADS CONSTRAINED TO BE PERPENDICULAR TO DATUM PLANE C.
6. DIMENSION DOES NOT INCLUDE MOLD PROTUSIONS. MOLD PROTUSIONS SHALL NOT EXCEED 0.25 [.010].




**8-Lead PDIP**

01-6014
01-3003 01 (MS-001AB)




| DIM | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | .0532 | .0688 | 1.35 | 1.75 |
| A1 | .0040 | .0098 | 0.10 | 0.25 |
| b | .013 | .020 | 0.33 | 0.51 |
| c | .0075 | .0098 | 0.19 | 0.25 |
| D | .189 | .1968 | 4.80 | 5.00 |
| E | .1497 | .1574 | 3.80 | 4.00 |
| e | .050 BASIC | | 1.27 BASIC | |
| e 1 | .025 BASIC | | 0.635 BASIC | |
| H | .2284 | .2440 | 5.80 | 6.20 |
| K | .0099 | .0196 | 0.25 | 0.50 |
| L | .016 | .050 | 0.40 | 1.27 |
| y | 0° | 8° | 0° | 8° |

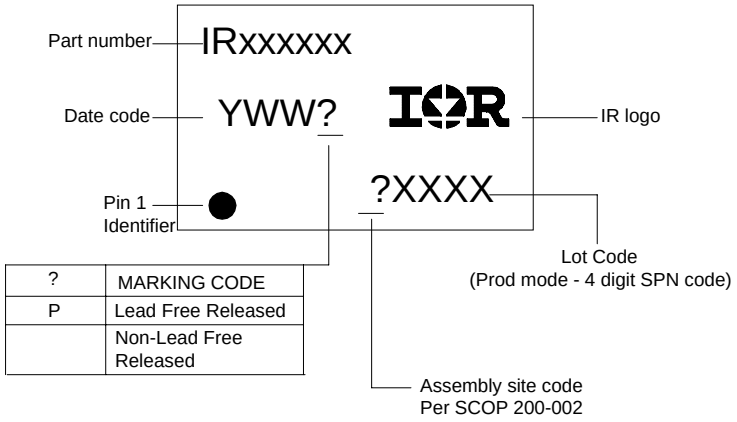
NOTES:
1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: MILLIMETER
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.

5. DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.15 [.006].
6. DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.25 [.010].
7. DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.

**8-Lead SOIC**

01-6027
01-0021 11 (MS-012AA)

## LEADFREE PART MARKING INFORMATION




| ? | MARKING CODE |
|---|---|
| P | Lead Free Released |
| | Non-Lead Free Released |

## ORDER INFORMATION

**Basic Part (Non-Lead Free)**
8-Lead PDIP IR2308 order IR2308
8-Lead SOIC IR2308S order IR2308S

**Leadfree Part**
8-Lead PDIP R2308 not available
8-Lead SOIC IR2308S order IR2308SPbF



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**Qualification Standards can be found on IR's Web Site** *http://www.irf.com*
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