

IR2111

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
- CMOS Schmitt-triggered inputs with pull-down
- Matched propagation delay for both channels
- Internally set deadtime
- High side output in phase with input

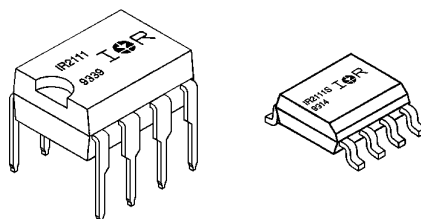
Description

The IR2111 is a high voltage, high speed power MOSFET and IGBT driver with dependent high and low side referenced output channels designed for half-bridge applications. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. Logic input is compatible with standard CMOS outputs. The output drivers feature a high pulse current buffer stage designed for minimum driver cross-conduction. Internal deadtime is provided to avoid shoot-through in the output half-bridge. 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.

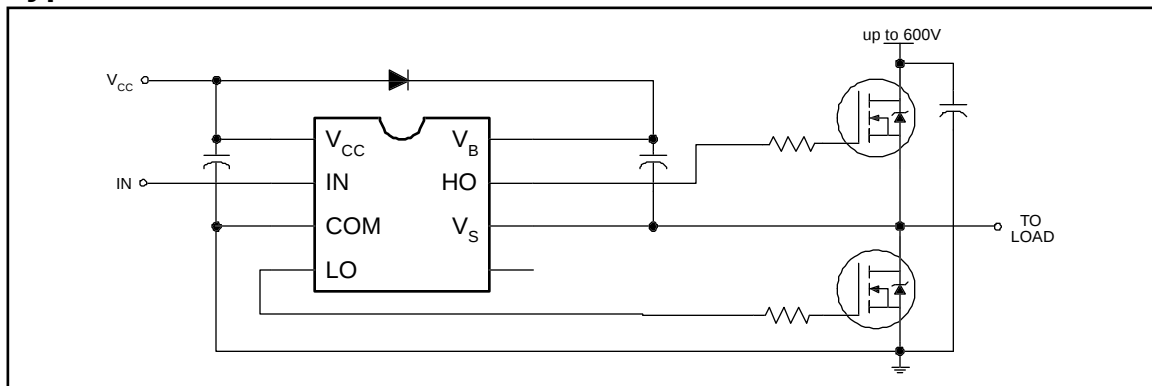
Product Summary

V_{OFFSET}	600V max.
$I_{\text{O+/-}}$	200 mA / 420 mA
V_{OUT}	10 - 20V
$t_{\text{on/off (typ.)}}$	850 & 150 ns
Deadtime (typ.)	700 ns

Packages



Typical Connection



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. Additional information is shown in Figures 7 through 10.

Symbol	Parameter Definition	Value		Units
		Min.	Max.	
V_B	High Side Floating Supply 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	-0.3	$V_{CC} + 0.3$	
dV_S/dt	Allowable Offset Supply Voltage Transient (Figure 2)	—	50	V/ns
P_D	Package Power Dissipation @ $T_A \leq +25^\circ\text{C}$ (8 Lead DIP)	—	1.0	W
	(8 Lead SOIC)	—	0.625	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (8 Lead DIP)	—	125	$^\circ\text{C}/\text{W}$
	(8 Lead SOIC)	—	200	
T_J	Junction Temperature	—	150	$^\circ\text{C}$
T_S	Storage Temperature	-55	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 offset rating is tested with all supplies biased at 15V differential.

Symbol	Parameter Definition	Value		Units
		Min.	Max.	
V_B	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	0	V_{CC}	
T_A	Ambient Temperature	-40	125	$^\circ\text{C}$

Note 1: Logic operational for V_S of -5 to +600V. Logic state held for V_S of -5V to $-V_{BS}$.

Dynamic Electrical Characteristics

$V_{BIAS} (V_{CC}, V_{BS}) = 15V$, $C_L = 1000 \text{ pF}$ and $T_A = 25^\circ\text{C}$ unless otherwise specified. The dynamic electrical characteristics are measured using the test circuit shown in Figure 3.

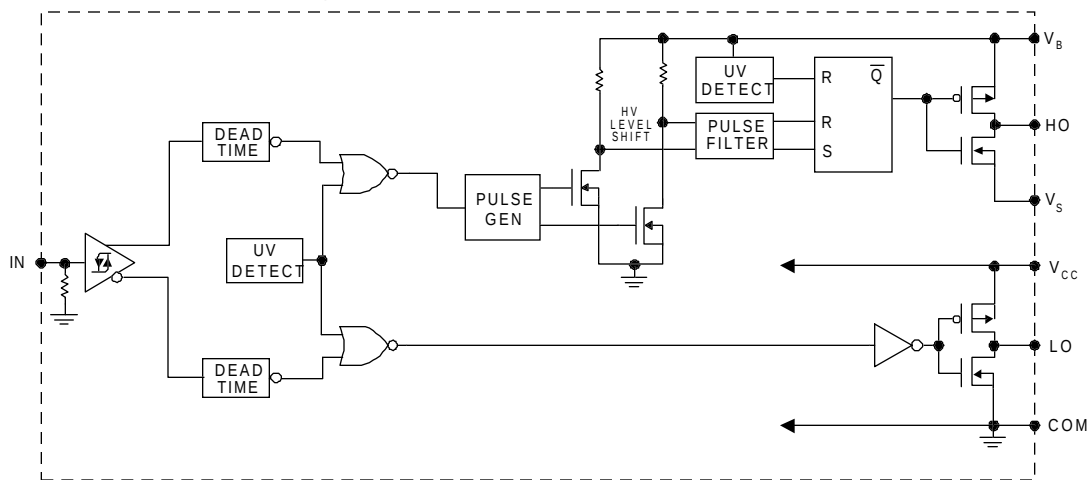
Symbol	Parameter Definition	Value			Units	Test Conditions
		Min.	Typ.	Max.		
t_{on}	Turn-On Propagation Delay	—	850	1,000	ns	$V_S = 0V$
t_{off}	Turn-Off Propagation Delay	—	150	180		$V_S = 600V$
t_r	Turn-On Rise Time	—	80	130		
t_f	Turn-Off Fall Time	—	40	65		
DT	Deadtime, LS Turn-Off to HS Turn-On & HS Turn-Off to LS Turn-On	—	700	900		
MT	Delay Matching, HS & LS Turn-On/Off	—	30	—		

Static Electrical Characteristics

$V_{BIAS} (V_{CC}, V_{BS}) = 15V$ and $T_A = 25^\circ\text{C}$ unless otherwise specified. The V_{IN} , V_{TH} and I_{IN} parameters are referenced to COM. The V_O and I_O parameters are referenced to COM and are applicable to the respective output leads: HO or LO.

Symbol	Parameter Definition	Value			Units	Test Conditions
		Min.	Typ.	Max.		
V_{IH}	Logic "1" Input Voltage for HO & Logic "0" for LO	6.4	—	—	V	$V_{CC} = 10V$
		9.5	—	—		$V_{CC} = 15V$
		12.6	—	—		$V_{CC} = 20V$
V_{IL}	Logic "0" Input Voltage for HO & Logic "1" for LO	—	—	3.8		$V_{CC} = 10V$
		—	—	6.0		$V_{CC} = 15V$
		—	—	8.3		$V_{CC} = 20V$
V_{OH}	High Level Output Voltage, $V_{BIAS} - V_O$	—	—	100	mV	$I_O = 0A$
V_{OL}	Low Level Output Voltage, V_O	—	—	100		$I_O = 0A$
I_{LK}	Offset Supply Leakage Current	—	—	50	μA	$V_B = V_S = 600V$
I_{QBS}	Quiescent V_{BS} Supply Current	—	50	100		$V_{IN} = 0V$ or V_{CC}
I_{QCC}	Quiescent V_{CC} Supply Current	—	70	180		$V_{IN} = 0V$ or V_{CC}
I_{IN+}	Logic "1" Input Bias Current	—	20	40		$V_{IN} = V_{CC}$
I_{IN-}	Logic "0" Input Bias Current	—	—	1.0		$V_{IN} = 0V$
V_{BSUV+}	V_{BS} Supply Undervoltage Positive Going Threshold	7.3	8.4	9.5	V	
V_{BSUV-}	V_{BS} Supply Undervoltage Negative Going Threshold	7.0	8.1	9.2		
V_{CCUV+}	V_{CC} Supply Undervoltage Positive Going Threshold	7.6	8.6	9.6		
V_{CCUV-}	V_{CC} Supply Undervoltage Negative Going Threshold	7.2	8.2	9.2		
I_{O+}	Output High Short Circuit Pulsed Current	200	250	—	mA	$V_O = 0V$, $V_{IN} = V_{CC}$ $PW \leq 10 \mu s$
I_{O-}	Output Low Short Circuit Pulsed Current	420	500	—		$V_O = 15V$, $V_{IN} = 0V$ $PW \leq 10 \mu s$

Functional Block Diagram



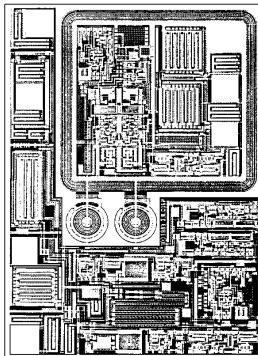
Lead Definitions

Lead	
Symbol	Description
IN	Logic input for high side and low side gate driver outputs (HO & LO), in phase with HO
V _B	High side floating supply
HO	High side gate drive output
V _S	High side floating supply return
V _{CC}	Low side and logic fixed supply
LO	Low side gate drive output
COM	Low side return

Lead Assignments

8 Lead DIP	SO-8
IR2111	IR2111S
Part Number	

Device Information

Process & Design Rule			HVDCMOS 4.0 μm		
Transistor Count			164		
Die Size			70 X 96 X 26 (mil)		
Die Outline					
Thickness of Gate Oxide			800Å		
Connections	First Layer	Material	Poly Silicon		
		Width	4 μm		
		Spacing	6 μm		
		Thickness	5000Å		
	Second Layer	Material	Al - Si (Si: 1.0% ±0.1%)		
		Width	6 μm		
		Spacing	9 μm		
		Thickness	20,000Å		
Contact Hole Dimension			8 μm X 8 μm		
Insulation Layer	Material	PSG (SiO ₂)			
	Thickness	1.5 μm			
Passivation	Material	PSG (SiO ₂)			
	Thickness	1.5 μm			
Method of Saw			Full Cut		
Method of Die Bond			Ablebond 84 - 1		
Wire Bond	Method	Thermo Sonic			
	Material	Au (1.0 mil / 1.3 mil)			
Leadframe	Material	Cu			
	Die Area	Ag			
	Lead Plating	Pb : Sn (37 : 63)			
Package	Types	8 Lead PDIP / SO-8			
	Materials	EME6300 / MP150 / MP190			
Remarks:					

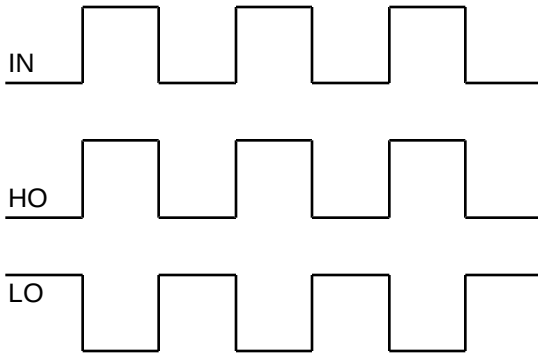


Figure 1. Input/Output Timing Diagram

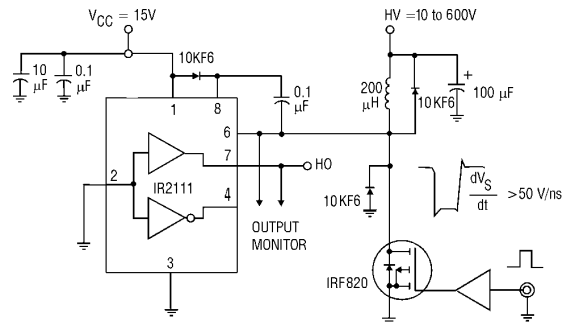


Figure 2. Floating Supply Voltage Transient Test Circuit

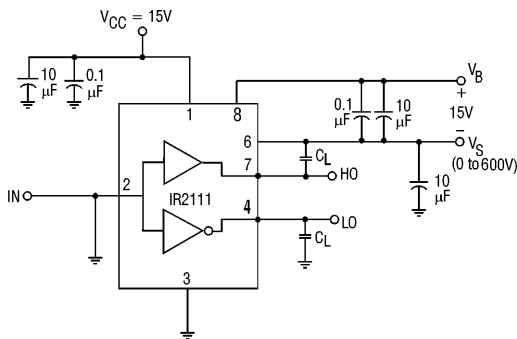


Figure 3. Switching Time Test Circuit

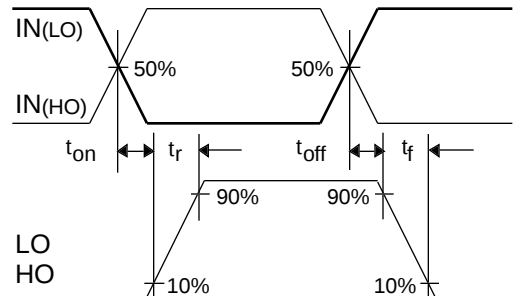


Figure 4. Switching Time Waveform Definition

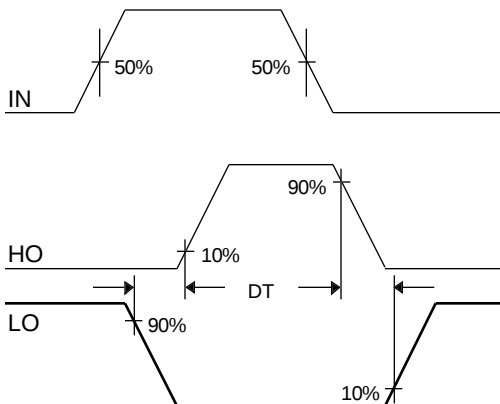


Figure 5. Deadtime Waveform Definitions

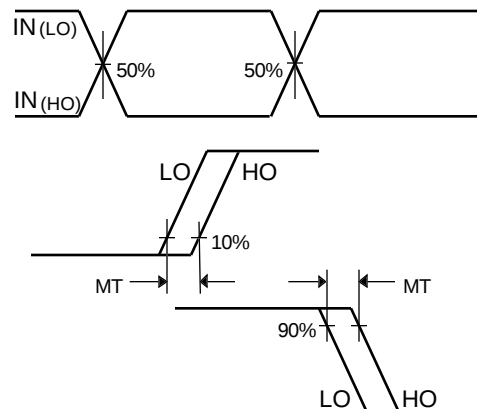


Figure 6. Delay Matching Waveform Definitions

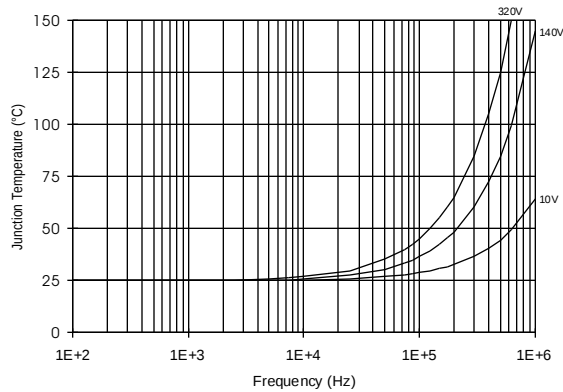


Figure 7. IR2111 T_J vs. Frequency (IRFBC20)
 $R_{GATE} = 33\Omega$, $V_{CC} = 15V$

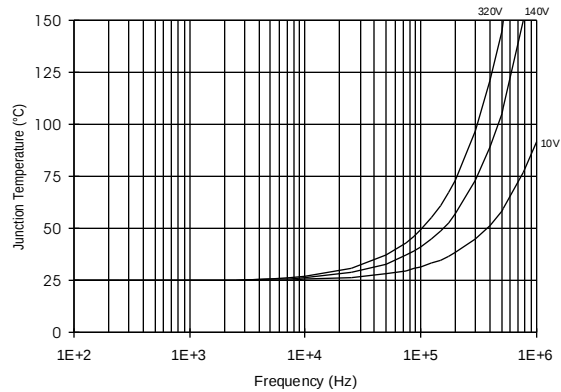


Figure 8. IR2111 T_J vs. Frequency (IRFBC30)
 $R_{GATE} = 22\Omega$, $V_{CC} = 15V$

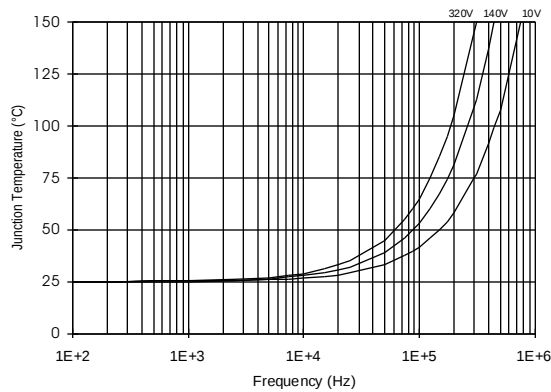


Figure 9. IR2111 T_J vs. Frequency (IRFBC40)
 $R_{GATE} = 15\Omega$, $V_{CC} = 15V$

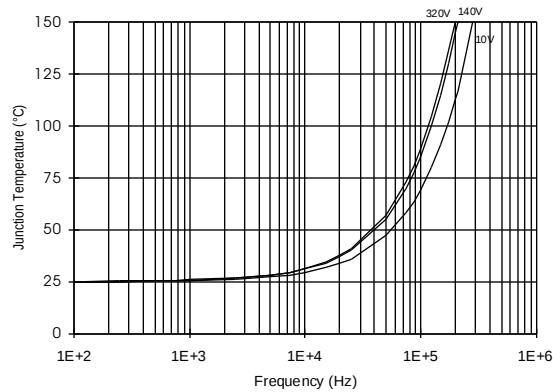


Figure 10. IR2111 T_J vs. Frequency (IRFPE50)
 $R_{GATE} = 10\Omega$, $V_{CC} = 15V$