

SELF-OSCILLATING HALF-BRIDGE DRIVER

Features

- Floating channel designed for bootstrap operation
 Fully operational to +600V
 Tolerant to negative transient voltage
 dV/dt immune
- Undervoltage lockout
- Programmable oscillator frequency

$$f = \frac{1}{1.4 \times (R_T + 75\Omega) \times C_T}$$

- Matched propagation delay for both channels
- Micropower supply startup current of 90 μ A.
- Shutdown function turns off both channels
- Low side output in phase with R_T

Description

The IR2153Z is a high voltage, high speed, self-oscillating power MOSFET and IGBT driver with both high and low side referenced output channels. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. The front end features a programmable oscillator which is similar to the 555 timer. The output drivers feature a high pulse current buffer stage and

Product Summary

V_{OFFSET}	600V max.
Duty Cycle	50%
I_{O+/-}	200 mA / 400 mA
V_{clamp}	15.6V
Deadtime (typ.)	1.2 μs

an internal deadtime designed for minimum driver cross-conduction. Propagation delays for the two channels are matched to simplify use in 50% duty cycle applications. The floating channel can be used to drive an N-channel power MOSFET or IGBT in the high side configuration that operates off a high voltage rail up to 600 volts.

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	Parameter	Min.	Max.	Units
V _B	High Side Floating Supply Voltage	-0.3	625	
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
V _{LO}	Low Side Output Voltage	-0.3	V _{CC} + 0.3	
V _{RT}	R _T Voltage	-0.3	V _{CC} + 0.3	
V _{CT}	C _T Voltage	-0.3	V _{CC} + 0.3	
I _{CC}	Supply Current (Note 1)	—	25	
I _{RT}	R _T Output Current	-5	5	mA
dV _S /dt	Allowable Offset Supply Voltage Transient	—	50	V/ns
P _D	Package Power Dissipation @ T _A \pm 25°C	—	1.0	W
R _{thJA}	Thermal Resistance, Junction to Ambient	—	100	°C/W
T _J	Junction Temperature	-55	125	
T _S	Storage Temperature	-55	150	°C
T _L	Lead Temperature (Soldering, 10 seconds)	—	300	

Recommended Operating Conditions

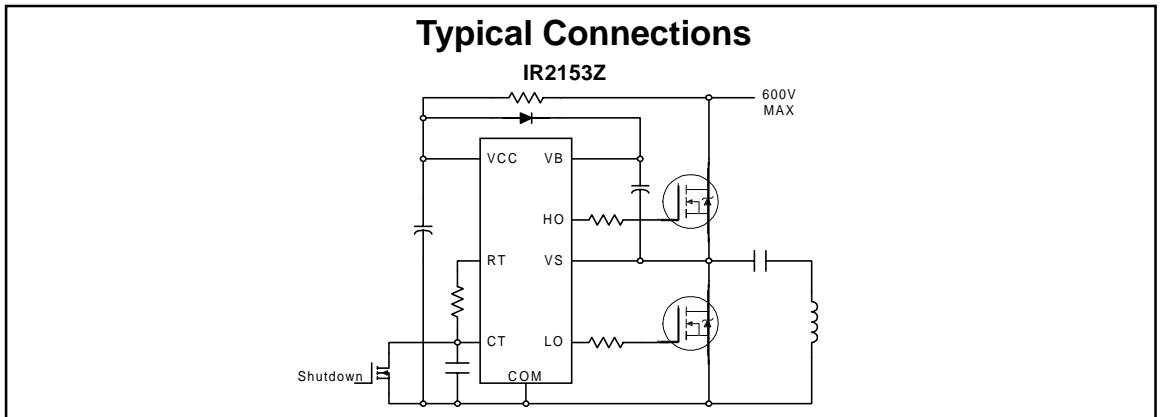
The Input/Output logic timing diagram is shown in Figure 1. For proper operation the device should be used within the recommended conditions. The V_S offset rating is tested with all supplies biased at 15V differential.

Symbol	Definition	Min.	Max.	Units
V_B	High Side Floating Supply Absolute Voltage	$V_S + 10$	$V_S + 20$	V
V_S	High Side Floating Supply Offset Voltage	—	600	
V_{HO}	High Side Floating Output Voltage	V_S	V_B	
V_{LO}	Low Side Output Voltage	0	V_{CC}	
I_{CC}	Supply Current (Note 1)	—	5	mA

Dynamic Electrical Characteristics

$V_{BIAS} (V_{CC}, V_{BS}) = 12V$, $C_L = 1000 \text{ pF}$ and $T_A = 25^\circ C$ unless otherwise specified.

Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
t_r	Turn-On Rise Time	—	80	165	ns	
t_f	Turn-Off Fall Time	—	35	100		
t_{sd}	Shutdown Propagation Delay	—	660	—		
DT	Deadtime	—	1.2	—	μs	
D	R_T Duty Cycle	—	50	—	%	



Note 1: Because of the IR2153's application specificity toward off-line supply systems, this IC contains a zener clamp structure between the chip V_{CC} and COM which has a nominal breakdown voltage of 15.6V. Therefore, the IC supply voltage is normally derived by forcing current into the supply lead (typically by means of a high value resistor connected between the chip V_{CC} and the rectified line voltage and a local decoupling capacitor from V_{CC} to COM) and allowing the internal zener clamp circuit to determine the nominal supply voltage. Therefore, this circuit should not be driven by a DC, low impedance power source of greater than V_{CLAMP} .

Static Electrical Characteristics

V_{BIAS} (V_{CC} , V_{BS}) = 12V, C_L = 1000 pF, C_T = 1 nF and T_A = 25°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	Definition	Min.	Typ.	Max.	Units	Test Conditions
f_{OSC}	Oscillator Frequency	—	20.0	—	kHz	$R_T = 35.7 \text{ kW}$
		—	100	—		$R_T = 7.04 \text{ kW}$
V_{CLAMP}	V_{CC} Zener Shunt Clamp Voltage	—	15.6	—	V	$I_{CC} = 5 \text{ mA}$
V_{CT+}	$2/3 V_{CC}$ Threshold	—	8.0	—		
V_{CT-}	$1/3 V_{CC}$ Threshold	—	4.0	—		
V_{CTSD}	C_T shutdown Input Threshold	—	2.2	—		
V_{RT+}	R_T High Level Output Voltage, $V_{CC} - R_T$	—	0	100	mV	$I_{RT} = -100 \text{ }\mu\text{A}$
		—	200	300		$I_{RT} = -1 \text{ mA}$
V_{RT-}	R_T Low Level Output Voltage	—	20	50		$I_{RT} = 100 \text{ }\mu\text{A}$
		—	200	300		$I_{RT} = 1 \text{ mA}$
V_{OH}	High Level Output Voltage, $V_{BIAS} - V_O$	—	—	100		$I_O = 0 \text{ A}$
V_{OL}	Low Level Output Voltage, V_O	—	—	100		$I_O = 0 \text{ A}$
I_{LK}	Offset Supply Leakage Current	—	—	50	μA	$V_B = V_S = 600 \text{ V}$
I_{QBS}	Quiescent V_{BS} Supply Current	—	10	—		
I_{QCCUV}	Micropower V_{CC} Supply Startup Current	—	90	—		$V_{CC} < V_{CCUV}$
I_{QCC}	Quiescent V_{CC} Supply Current	—	400	—		$V_{CC} > V_{CCUV}$
I_{CT}	C_T Input Current	—	0.001	1.0		
V_{CCUV+}	V_{CC} Supply Undervoltage Positive Going Threshold	—	9.0	—	V	
V_{CCUV-}	V_{CC} Supply Undervoltage Negative Going Threshold	—	8.0	—		
V_{CCUVH}	V_{CC} Supply Undervoltage Lockout Hysteresis	—	1.0	—	V	
I_{O+}	Output High Short Circuit Pulsed Current	—	200	—	mA	$V_O = 0 \text{ V}$
I_{O-}	Output Low Short Circuit Pulsed Current	—	400	—		$V_O = 15 \text{ V}$

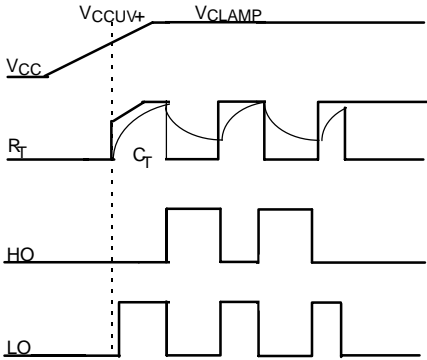


Figure 1. Input/Output Timing Diagram

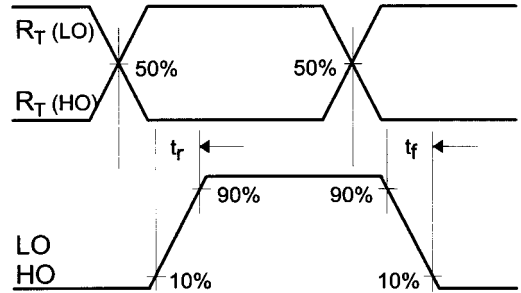


Figure 2. Switching Time Waveform Definitions

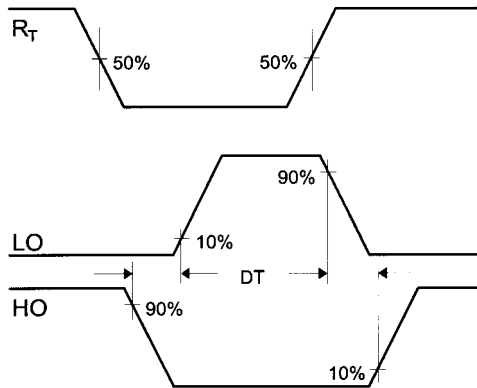
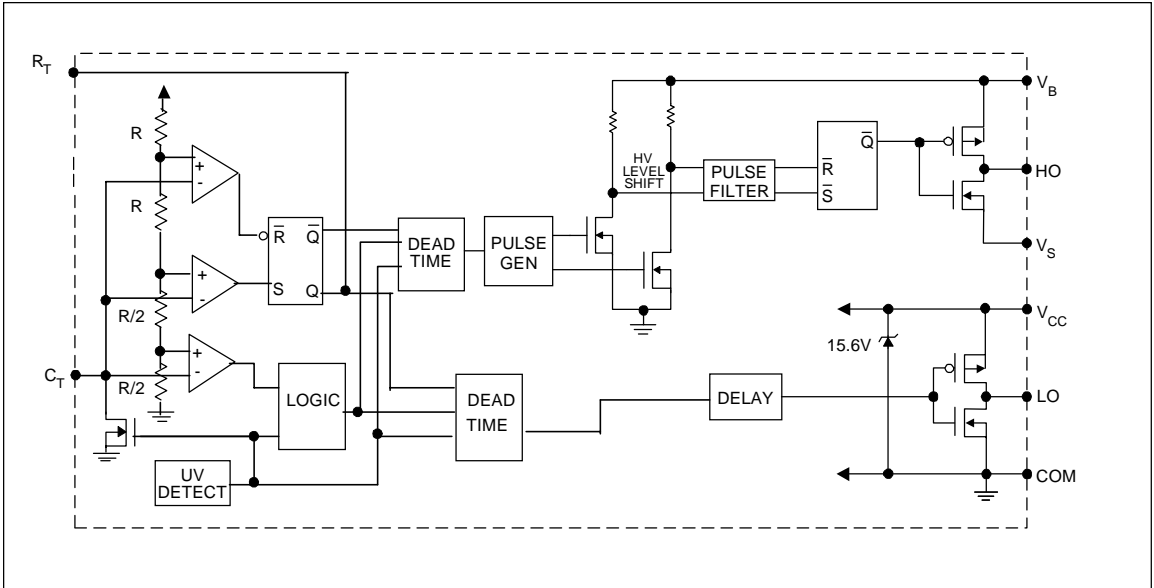


Figure 3. Deadtime Waveform Definitions

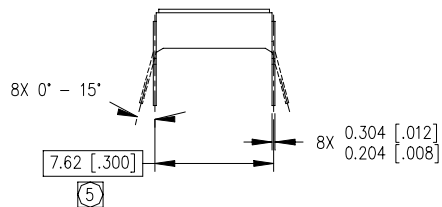
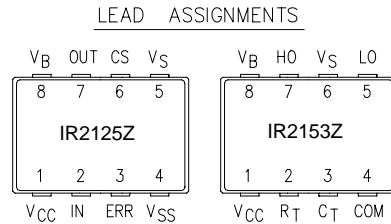
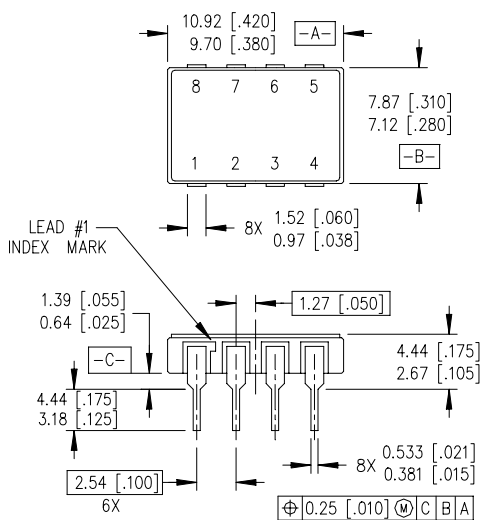
Functional Block Diagram



Lead Definitions

Lead	
Symbol	Description
R _T	Oscillator timing resistor input, in phase with HO for normal IC operation
C _T	Oscillator timing capacitor input, the oscillator frequency according to the following equation: $f = \frac{1}{1.4 \times (R_T + 75\Omega) \times C_T}$ where 75Ω is the effective impedance of the R _T output stage
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

Case Outline and Dimensions MO-036AA



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 MO-036AA.
- ⑤ MEASURED WITH THE LEADS CONSTRAINED TO BE PERPENDICULAR TO DATUM PLANE C.