Data Sheet No. PD-6.062-G

International
IOR Rectifier

IR2153/IR2153D

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

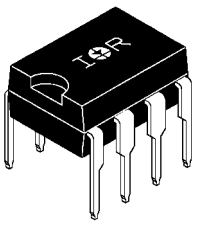
$$f = \frac{1}{1.4 \times (R_T + 75\Omega) \times C_T}$$

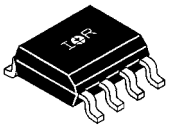
- Matched propagation delay for both channels
- Micropower supply startup current of 90 µA.
- Shutdown function turns off both channels
- Low side output in phase with R_T
- IR2153D has built in bootstrap diode

Product Summary

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

Packages



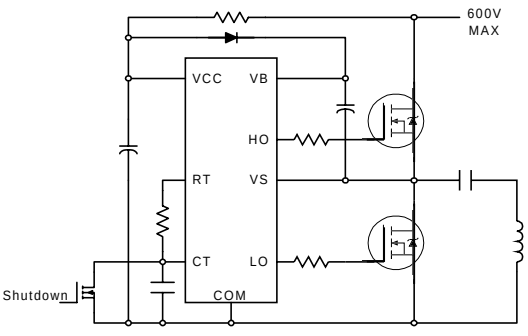


Description

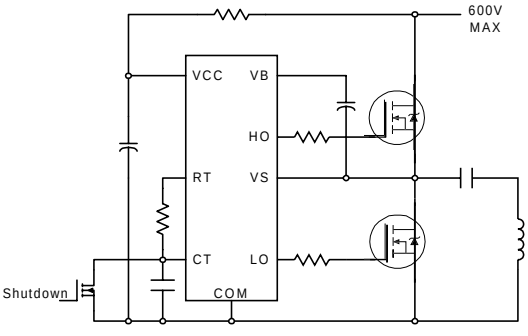
The IR2153/IR2153D is a high voltage, high speed, self-oscillating power MOSFET and IGBT driver with both high and low side referenced output channels. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. The front end features a programmable oscillator which is similar to the 555 timer. The output drivers feature a high pulse current buffer stage and 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. In IR2153D a bootstrap diode is included.

Typical Connections

IR2153



IR2153D



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	Value Min.	Value Max.	Units
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_{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	mA
I_{RT}	R_T Output Current	-5	5	
dV_S/dt	Allowable Offset Supply Voltage Transient	—	50	V/ns
P_D	Package Power Dissipation @ $T_A \leq +25°C$ (8 Lead DIP)	—	1.0	W
	(8 Lead SOIC)	—	0.625	
Rth_{JA}	Thermal Resistance, Junction to Ambient (8 Lead DIP)	—	125	°C/W
	(8 Lead SOIC)	—	200	
T_J	Junction Temperature	—	150	°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	Definition	Value Min.	Value 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
T_A	Ambient Temperature	-40	125	°C

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}.

Dynamic Electrical Characteristics

V_{BIAS} (V_{CC}, V_{BS}) = 12V, C_L = 1000 pF and T_A = 25°C unless otherwise specified.

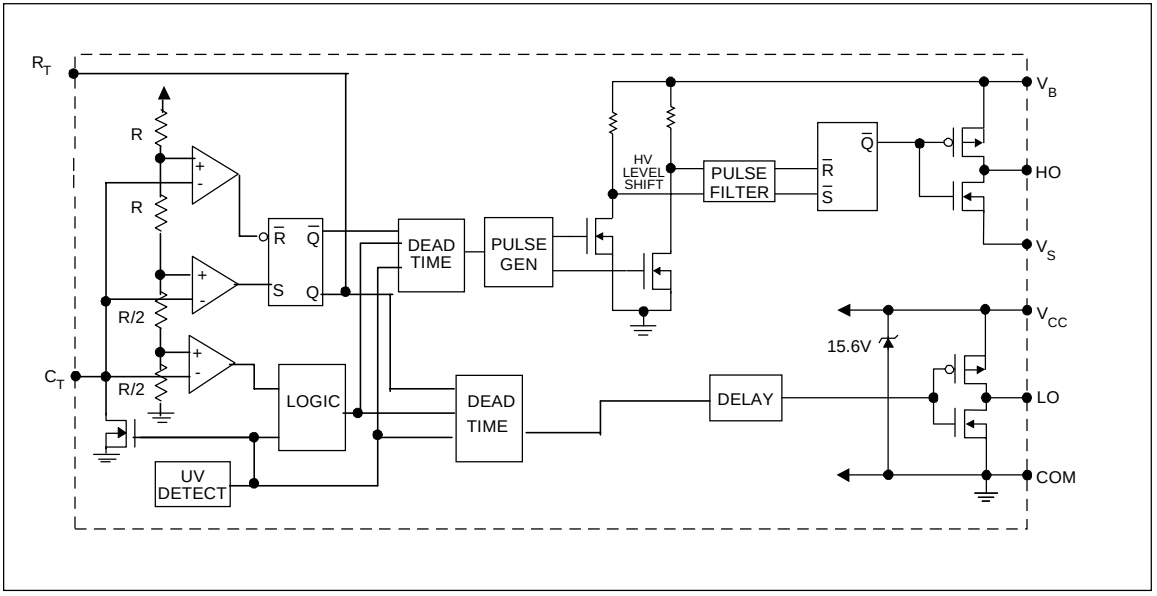
Symbol	Definition	Value			Units	Test Conditions
		Min.	Typ.	Max.		
t_r	Turn-On Rise Time	—	80	—	ns	
t_f	Turn-Off Fall Time	—	35	—		
t_{sd}	Shutdown Propagation Delay	—	660	—		
DT	Deadtime	—	1.2	—	µs	
D	R_T Duty Cycle	—	50	—	%	

Static Electrical Characteristics

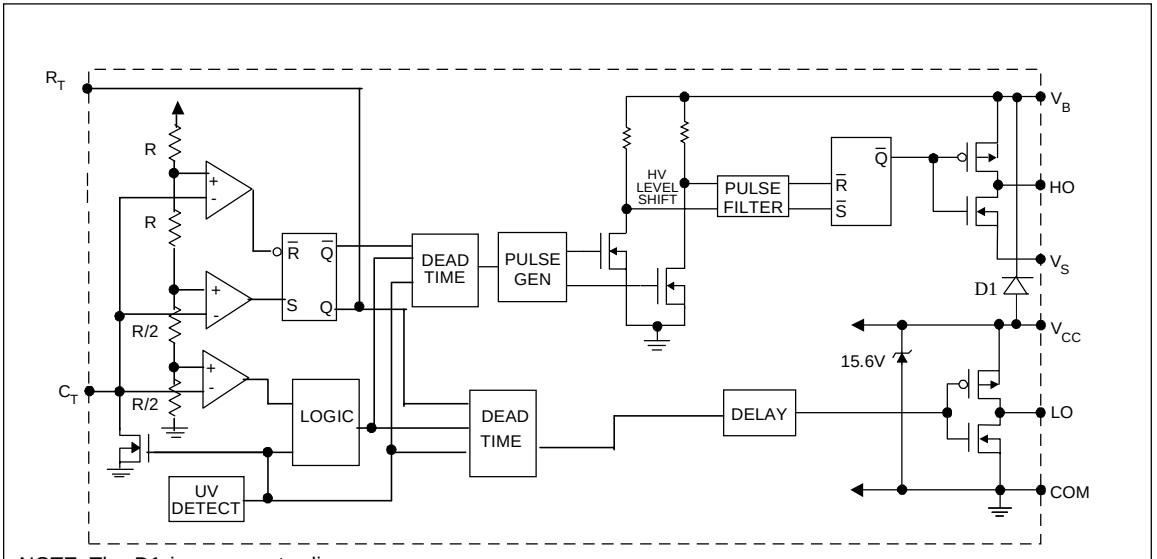
V_{BIAS} (V_{CC}, V_{BS}) = 12V, C_L = 1000 pF, C_T = 1 nF and T_A = 25°C unless otherwise specified. The V_{IN}, V_{TH} and I_{IN} parameters are referenced to COM. The V_O and I_O parameters are referenced to COM and are applicable to the respective output leads: HO or LO.

Symbol	Definition	Value			Units	Test Conditions
		Min.	Typ.	Max.		
f_{OSC}	Oscillator Frequency	—	20.0	—	kHz	R_T = 35.7 kΩ
		—	100	—		R_T = 7.04 kΩ
V_{CLAMP}	V_{CC} Zener Shunt Clamp Voltage	—	15.6	—	V	I_{CC} = 5 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 µA
		—	200	300		I_{RT} = -1 mA
V_{RT-}	R_T Low Level Output Voltage	—	20	50		I_{RT} = 100 µA
		—	200	300		I_{RT} = 1 mA
V_{OH}	High Level Output Voltage, V_{BIAS} - V_O	—	—	100		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	—	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 = 0V
I_{O-}	Output Low Short Circuit Pulsed Current	—	400	—		V_O = 15V

Functional Block Diagram for IR2153



Functional Block Diagram for IR2153D

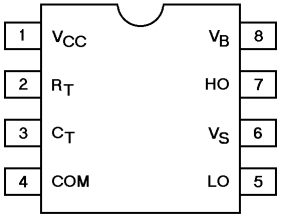


NOTE: The D1 is a separate die.

Lead Definitions

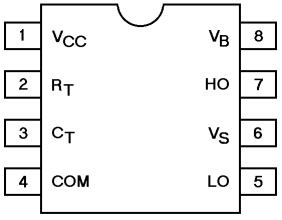
Lead Symbol	Description
R_T	Oscillator timing resistor input,in phase with HO for normal IC operation
C_T	Oscillator timing capacitor input, the oscillator frequency according to the following equation: $f = \frac{1}{1.4 \times (R_T + 75\Omega) \times C_T}$ where 75Ω is the effective impedance of the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

Lead Assignments



8 Lead DIP

IR2153/IR2153D



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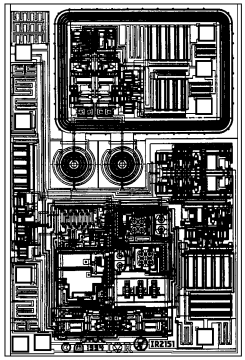
IR2153S

NOTE: The IR2153D is offered in 8 lead DIP only.

Device Information

Process & Design Rule			HVDCMOS 4.0 µm
Transistor Count			231
Die Size			68 X 101 X 26 (mil)
Die Outline			
Thickness of Gate Oxide			800Å
Connections		Material	Poly Silicon
	First Layer	Width	5 µm
		Spacing	6 µm
		Thickness	5000Å
		Material	Al - Si - Cu (Si: 1.0%, Cu: 0.5%)
	Second Layer	Width	6 µm
		Spacing	9 µm
		Thickness	20,000Å
Contact Hole Dimension			5 µm X 5 µm
Insulation Layer		Material	PSG (SiO_2)
		Thickness	1.7 µm
Passivation		Material	PSG (SiO_2)
		Thickness	1.7 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:			

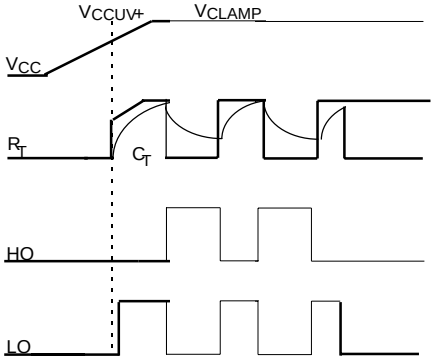


Figure 1. Input/Output Timing Diagram

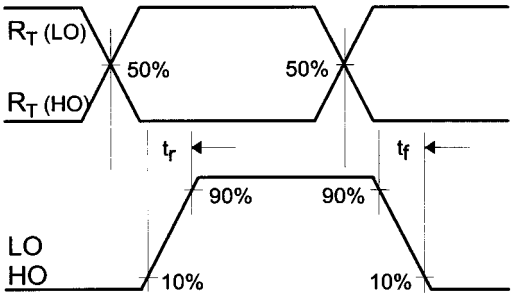


Figure 2. Switching Time Waveform Definitions

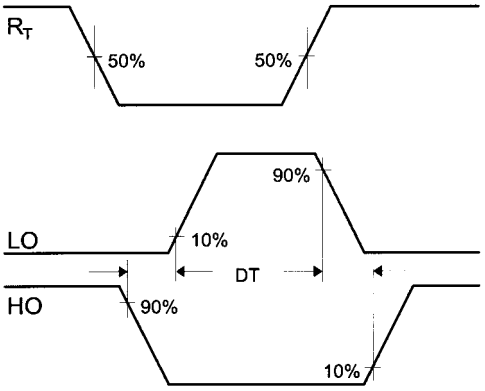
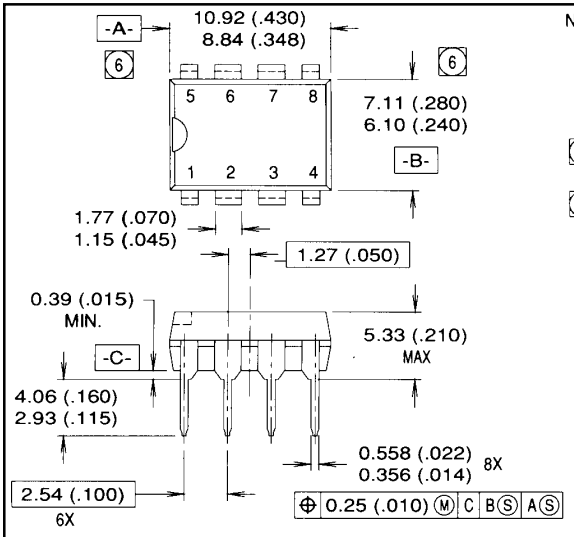
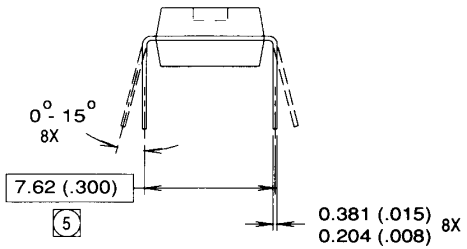


Figure 3. Deadtime Waveform Definitions

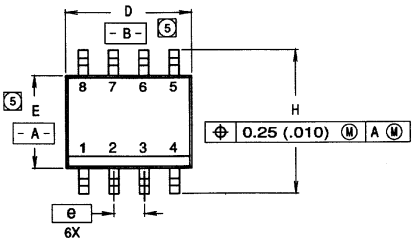


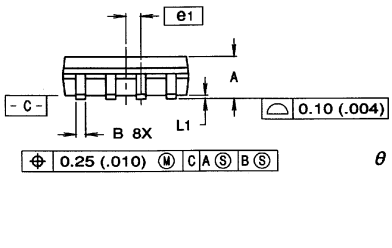
NOTES:

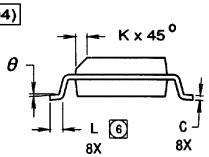
1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1982.
2 CONTROLLING DIMENSION: INCH.
3 DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
4 OUTLINE CONFORMS TO JEDEC OUTLINE MS-001AB.
5 MEASURED WITH THE LEADS CONSTRAINED TO BE PERPENDICULAR TO DATUM PLANE C.
6 DIMENSION DOES NOT INCLUDE MOLD PROTUSIONS. MOLD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



8 Lead DIP







DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.0532	.0688	1.35	1.75
A1	.0040	.0098	0.10	0.25
B	.014	.018	0.36	0.46
C	.0075	.0098	0.19	0.25
D	.189	.196	4.80	4.98
E	.150	.157	3.81	3.99
e	.050 BASIC		1.27 BASIC	
e1	.025 BASIC		0.635 BASIC	
H	.2284	.2440	5.80	6.20
K	.011	.019	0.28	0.48
L	.016	.050	0.41	1.27
θ	0°	8°	0°	8°

NOTES:

1 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1982.
2 CONTROLLING DIMENSION: INCH.
3 DIMENSIONS DO NOT INCLUDE MOLD FLASH.
4 DIMENSIONS SHOWN IN MILLIMETERS (INCHES).
5 OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.

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