PD-6140-G

International
IOR Rectifier

IR53H420/IR53HD420

SELF-OSCILLATING HALF BRIDGE

Features

- Output Power MOSFETs in half-bridge configuration
  500V Rated Breakdown Voltage
- High side gate drive designed for bootstrap operation
- Bootstrap diode integrated into package (HD type)
- Accurate timing control for both Power MOSFETs
  Matched delay to get 50% duty cycle
  Matched deadtime of 1.2us
- Internal oscillator with programmable frequency

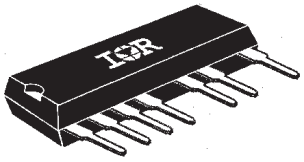
$$f = \frac{1}{1.4 \times (R_T + 75\Omega) \times C_T}$$

- Zener clamped Vcc for offline operation
- Half-bridge output is out of phase with R_T
- Micropower startup
- Fast shutdown feature

Product Summary

V_{IN} (max)	500V
Duty Cycle	50%
Deadtime	1.2µs
$R_{DS(on)}$	3.0Ω
P_D (T_A = 25 °C)	2.0W

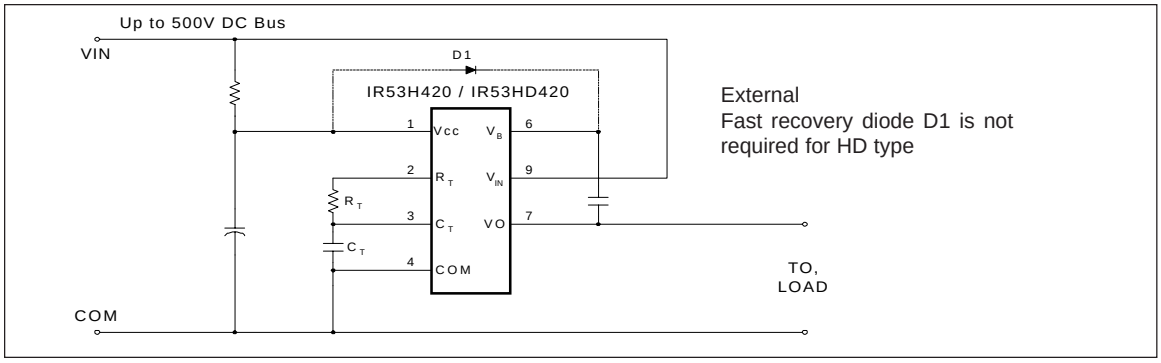
Package



Description

The IR53H420/IR53HD420 are complete high voltage, high speed, self-oscillating half-bridge circuits. Proprietary HVIC and latch immune CMOS technologies, along with the HEXFET® power MOSFET technology, enable ruggedized single package construction. The front-end features a programmable oscillator which functions similar to the CMOS 555 timer. The supply to the control circuit has a zener clamp to simplify offline operation. The output features two HEXFETs in a half-bridge configuration with an internally set deadtime designed for minimum cross-conduction in the half-bridge. Propagation delays for the high and low side power MOSFETs are matched to simplify use in 50% duty cycle applications. The device can operate up to 500 volts.

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, unless stated otherwise. All currents are defined positive into any lead. The Thermal Resistance and Power Dissipation ratings are measured under board mounted and still air conditions.

Symbol	Definition	Value		Units
		Minimum	Maximum	
V_{IN}	High Voltage Supply	- 0.3	500	V
V_B	High Side Floating Supply	V_O- 0.3	V_O+ 25	
V_O	Half-Bridge Output	-0.3	V_{IN} + 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/dt	Peak Diode Recovery	—	3.50	V/ns
P_D	Package Power Dissipation @ $T_A \leq +25°C$	—	2	W
Rth_{JA}	Thermal Resistance, Junction to Ambient	—	60	°C/W
T_J	Junction Temperature	-55	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.

Symbol	Definition	Value		Units
		Minimum	Maximum	
V_B	High Side Floating Supply Absolute Voltage	V_O + 10	V_O + V_{CLAMP}	V
V_{IN}	High Voltage Supply	—	500	
V_O	Half-Bridge Output Voltage	-5	500	
I_D	Continuous Drain Current T_A = 25°C	—	0.7	A
	T_A = 85°C	—	0.5	
I_{CC}	Supply Current (Note 1)	—	5	mA
T_A	Ambient Temperature	-40	125	°C

NOTE 1:

To simplify use in off-line applications, this IC contains a zener clamp between V_{CC} and COM. Therefore, this circuit should not be driven from a low impedance source of greater than V_{CLAMP}.

NOTE 2:

Shutdown function in invoked using the C_T pin. Both FETS are switched off when $V_{CT} < V_{CTSD}$.

P_{DD}: Shutdown threshold is derived internally and set at 1/6 X V_{CC} nominal.

Dynamic Electrical Characteristics

V_{BIAS} (V_{CC}, V_{BS}) = 12V unless otherwise specified.

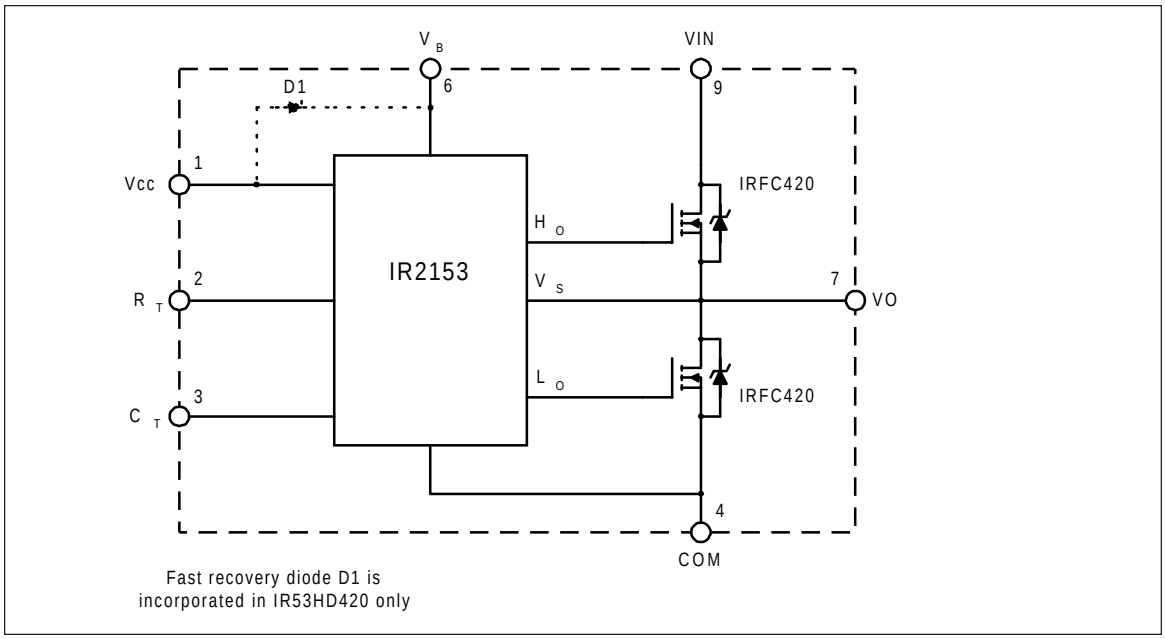
Symbol	Definition	TA = 25°C Minimum	Typical	Maximum	Units	Test Conditions
t_{rr}	Reverse Recovery Time (MOSFET Body Diode)	—	240	—	ns	I_F = 600mA
Q_{rr}	Reverse Recovery Charge (MOSFET Body Diode)	—	0.7	—	µC	di/dt = 100A/ms
D_T	Deadtime, LS Turn-Off to HS Turn-On & HS Turn-Off to LS Turn-On	—	1.2	—	µs	
D	R_T Duty Cycle	—	50	—	%	fosc = 20 kHz

Static Electrical Characteristics

V_{BIAS} (V_{CC}, V_B) = 12V unless otherwise specified.

Symbol	Definition	TA = 25°C Minimum	Typical	Maximum	Units	Test Conditions
V_{CCUV+}	V_{CC} Supply Undervoltage Positive Going Threshold	—	9.0	—	V	
V_{CCUV-}	V_{CC} Supply Undervoltage Negative Going Threshold	—	8.0	—	V	
V_{CCUVH}	Under Voltage Lockout Hysteruis	—	1.0	—	V	
I_{QCCUV}	Micropower V_{CC} Startup Current	—	90	—	µA	
I_{QCC}	Quiescent V_{CC} Supply Current	—	400	—	µA	V_{CC} > V_{CCUV}
V_{CLAMP}	V_{CC} Zener Shunt Clamp Voltage	—	15.6	—	V	I_{CC} = 5mA
I_{QBS}	Quiescent V_{BS} Supply Current	—	10	50	µA	
I_{os}	Offset Supply Leakage Current	—	—	50		V_B = V_{IN} = 500V
f_{osc}	Oscillator Frequency	—	20	—	kHz	R_T = 35.7 kW C_T = 1 nF
		—	100	—	kHz	R_T = 7.04 kW C_T = 1 nF
I_{CT}	C_T Input Current	—	0.001	1.0	µA	
V_{CTSD}	C_T Shutdown Input Threshold	—	2.2	—	V	Note 2
V_{RT+}	R_T High Level Output Voltage, V_{CC} - R_T	— —	20 200	100 300	mV	I_{RT} = 100µA I_{RT} = -1mA
V_{RT-}	R_T Low Level Output Voltage	— —	20 200	50 300		I_{RT} = 100µA I_{RT} = -1mA
V_{CT+}	2/3 V_{CC} Threshold	—	8.0	—	V	
V_{CT-}	1/3 V_{CC} Threshold	—	4.0	—	V	
$R_{ds(on)}$	Static Drain-to-Source On-Resistance	—	3.0	—	Ω	I_D = 500 mA
V_{ISD}	Diode Forward Voltage	—	0.8	—	V	T_J = 150°C

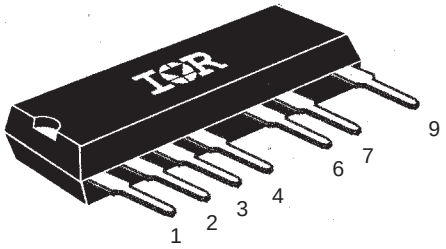
Functional Block Diagram



Lead Definitions

Symbol	Lead Description
V_{CC}	Logic and internal gate drive supply voltage. An internal zener clamp diode at 15.6 V nominal is included to allow the V_{CC} to be current fed directly from VIN typically by means of a high value resistor.
R_T	Oscillator timing resistor output; a resistor is connected from R_T to C_T. RT is out of phase with the half-bridge output (VO).
C_T	Oscillator timing capacitor input; a capacitor is connected from C_T to COM in order to program the oscillator frequency according to the following equation: $$f = \frac{1}{1.4 \times (R_T + 75\Omega) \times C_T}$$ C_T PIN also invokes shutdown function (see note 2) where 75Ω is the effective impedence of the R_T output stage.
V_B	High side gate drive floating supply. For bootstrap operation a high voltage fast recovery diode is needed to feed from V_{CC} to V_B. (HD type circuits incorporate this diode).
V_{IN}	High voltage supply
VO	Half Bridge output
COM	Logic and low side of half bridge return

Lead Assignments



1	V_{CC}	6	V_B
2	R_T	7	VO
3	C_T	9	V_{IN}
4	COM		

9 Lead SIP without Leads 5 and 8

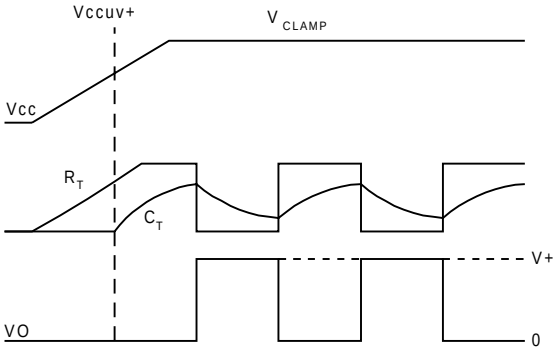


Figure 1. Input/Output Timing Diagram

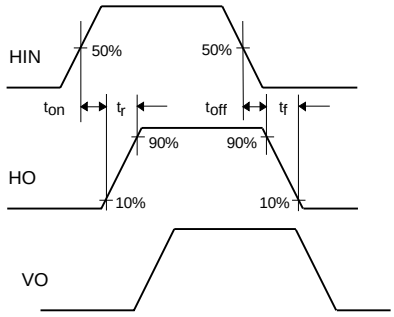
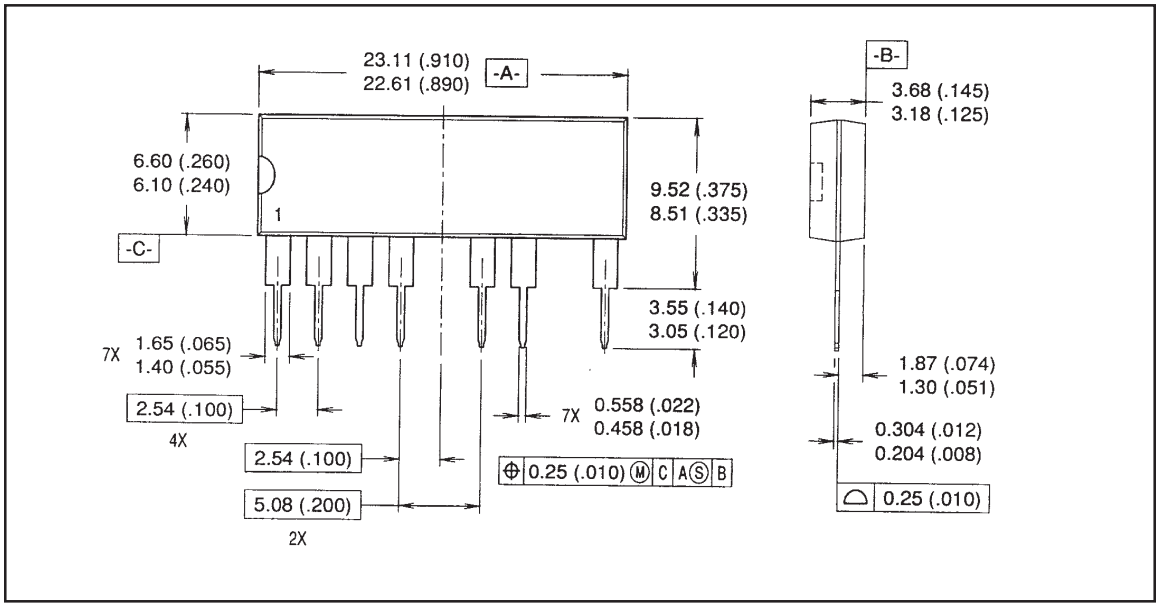


Figure 2. Switching Time Waveform Definitions



NOTES:
1. Dimensioning and tolerancing per ANSI Y14.5M-1982
2. Controlling Dimension: INCH
3. Dimensions are shown in millimeters (inches)

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