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International
IOR Rectifier

Data Sheet No. PD60206 Rev.D

IR2085S & (PbF)

HIGH SPEED, 100V, SELF OSCILLATING 50% DUTY CYCLE, HALF-BRIDGE DRIVER

Features

- Simple primary side control solution to enable half-bridge DC-Bus Converters for 48V distributed systems with reduced component count and board space
- Integrated 50% duty cycle oscillator & half-bridge driver IC in a single SO-8 package
- Programmable switching frequency with up to 500kHz max per channel
- +/- 1A drive current capability optimized for low charge MOSFETs
- Adjustable dead-time 50ns – 200ns
- Floating channel designed for bootstrap operation up to +100Vdc
- High and low side pulse width matching to +/- 25ns
- Adjustable overcurrent protection
- Undervoltage lockout and internal soft start
- Also available Leadfree

Product Summary

Topology	Half-Bridge
V_{OFFSET}	≤ 100 V
I_{o+} & I_{o-} (typical)	1.0A & 1.0A
f_{OSC} (max)	500kHz
Deadtime	50ns – 200ns
HO/LO Pulse Matching	+/- 25ns

Package

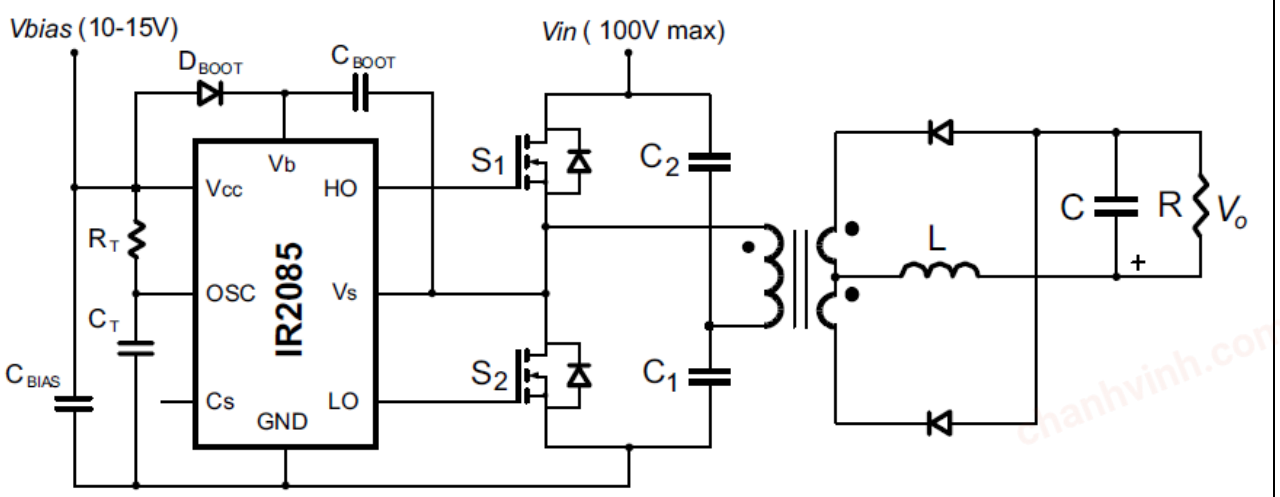


8 - Lead SOIC

Description

The IR2085S is a self-oscillating half-bridge driver IC with 50% duty cycle ideally suited for 36V – 75V half-bridge DC-bus converters.
This product is also suitable for push-pull converters without restriction on input voltage.
Each channel frequency is equal to $f_{OSC,}$ which can be set by selecting R_T & C_T, where $f_{OSC} = 1/(2*R_T.C_T)$.
Dead-time can be controlled through proper selection of C_T and can range from 50ns to 200ns. Internal soft-start increases the pulse width during power up and maintains pulse width matching for the high and low outputs throughout the start up cycle. The IR2085S initiates a soft start at power up and after every overcurrent condition. Undervoltage lockout prevents operation if V_{CC} is less than 7.5V.

Typical Connection Diagram



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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. 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	Min.	Max.	Units
V_b	High side floating supply voltage	-0.3	150	V
V_{CC}	Low side supply voltage	—	25	
V_S	High side floating supply offset voltage	V_b - 25	V_b + 0.3	
V_{HO}	High side floating output voltage	V_b - 0.3	V_b + 0.3	
V_{LO}	Low side output voltage	-0.3	V_{CC} + 0.3	
OSC	OSC pin voltage	-0.3	V_{CC} + 0.3	
V_{CS}	Cs pin voltage	-0.3	V_{CC} + 0.3	
dV_S/dt	Allowable offset voltage slew rate	-50	+50	V/ns
I_{CC}	Supply current	—	20	mA
P_D	Package power dissipation	—	1.0	W
Rth_{JA}	Thermal resistance, junction to ambient	—	200	°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

For proper operation the device should be used within the recommended conditions.

Symbol	Definition	Min.	Max.	Units
Vb	High side floating supply voltage	V_{dd} -0.7	15	Vdc
V_S	Steady state high side floating supply offset voltage	-5	100	
V_{CC}	Supply voltage	10	15	
I_{CC}	Supply current (Note 2)	—	5	mA
R_T	Timing resistor	10	100	KΩ
C_T	Timing capacitor	47	1000	pF
fosc(max)	Operating frequency (per channel)	—	500	KHz
T_J	Junction temperature	-40	125	°C

Note1: Care should be taken to avoid output switching conditions where the Vs node flies inductively below ground by more than 5V.

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Dynamic Electrical Characteristics

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

Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
t_r	Turn-on rise time	—	40	60	nsec	V_S = 0V
t_f	Turn-off fall time	—	20	30		
fosc	Per channel output frequency	500	—	—	KHz	C_T =100pF, R_T =10Kohm
tdt	High/low output dead time	50	—	—	nsec	
t_{dcs}	Overcurrent shut down delay	—	200	—		pulse on CS
PM	High/low pulse width mismatch	-25	—	25		V_S = 0V ~ 100V

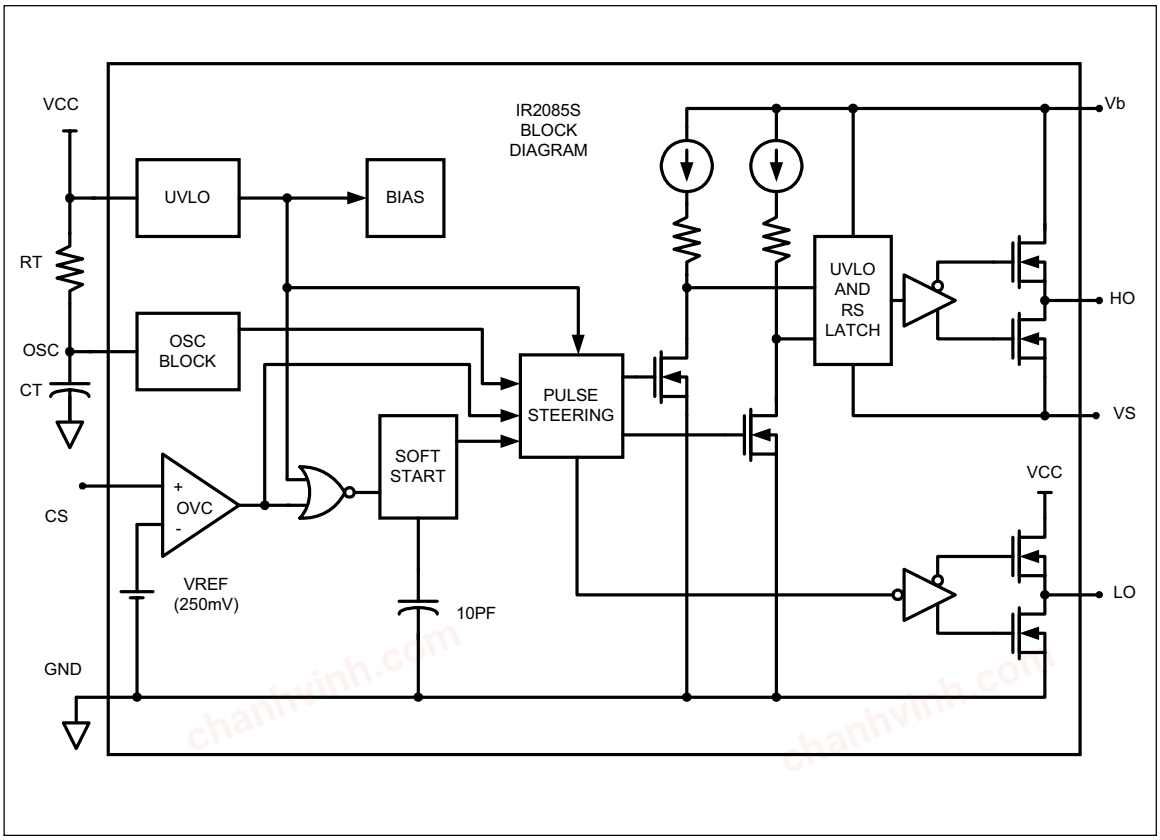
Static Electrical Characteristics

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

Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
V_{OH}	High level output voltage, (V_{BIAS} - V_O)	—	—	1.5	V	
V_{OL}	Low level output voltage	—	—	0.1		
I_{leak}	Offset supply leakage current	—	—	50	µA	
I_{QBS}	Quiescent V_{BS} supply current	—	—	150		
I_{QCC}	Quiescent V_{CC} supply current	—	—	1.5	mA	
V_{CS+}	Overcurrent shutdown threshold	250	300	350	mV	
V_{CS-}	Overcurrent shutdown threshold	150	200	250	mV	
U_{VCC+}	Undervoltage positive going threshold	6.8	7.3	7.8	V	
U_{VCC-}	Undervoltage negative going threshold	6.3	6.8	7.3		
U_{VBS+}	High side undervoltage positive going threshold	6.8	7.3	7.8		
U_{VBS-}	High side undervoltage negative going threshold	6.3	6.8	7.3		
I_{O+}	Output high short circuit current	—	1.0	—	A	
I_{O-}	Output low short circuit current	—	1.0	—		

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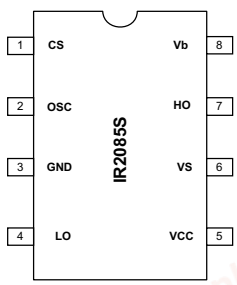
Functional Block Diagrams



Lead Definitions

Symbol	Description
VCC	Logic supply
GND	Logic supply return
Vb	High side floating supply
VS	Floating supply return
HO	High side output
LO	Low side output
CS	Current sense input
OSC	Oscillator pin

Lead Assignments



Also available LEAD-FREE (PbF)

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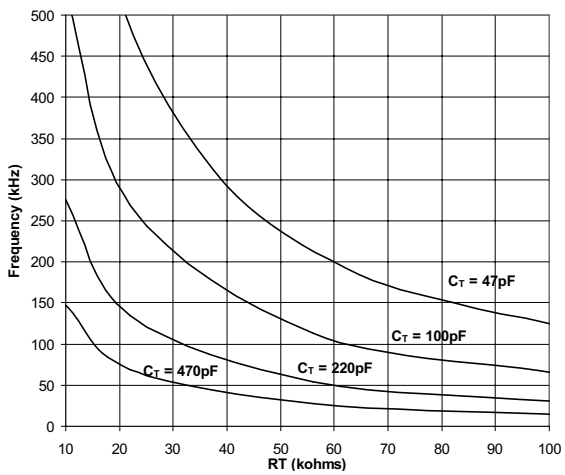


Fig. 1 Typical Output Frequency (-25°C to 125°C)

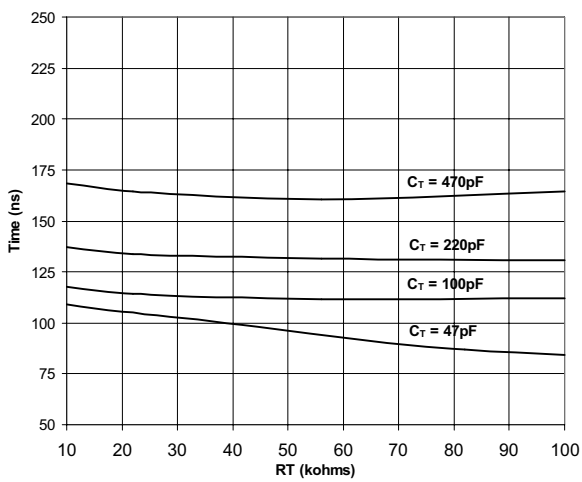


Fig. 2 Typical Dead Time (@25°C)

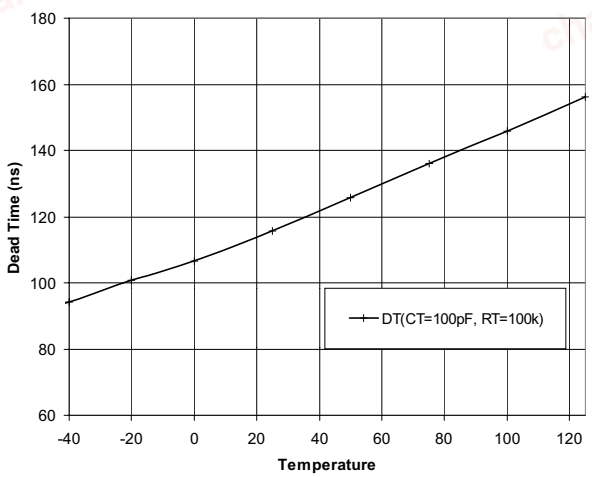


Fig. 3 Typical Dead Time vs Temperature

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Pin Descriptions

Cs: The input pin to the overcurrent comparator. Exceeding the overcurrent threshold value specified in "Static Electrical Parameters" Section will terminate output pulses and start a new soft start cycle as soon as the voltage on the pin reduce below the threshold value.

OSC: The oscillator-programming pin. Only two components are required to program the internal oscillator frequency: a resistor connected between the V_{CC} pin and the OSC pin, and a capacitor connected from the OSC to COM. The approximate oscillator frequency is determined by the following simple formula:

$$f_{OSC} = 1 / (2 \cdot R_T \cdot C_T)$$

Where frequency is in Hertz (Hz), RT resistance in Ohms (Ω) and CT capacitance in Farads (F). The recommended range of timing resistors is between 10kΩ and 100kΩ and range of time capacitances is between 47pF and 470pF. The timing resistors less than 10kΩ should be avoided. The value of the timing capacitor determines the amount of dead time between the two output drivers: lower the CT, shorter the dead time and vice versa. It is not recommended to use a timing capacitor below 47pF, for best performance keep the timing components physically as close as possible to the IR2085S. Separated ground and V_{CC} traces to the timing components are encouraged.

COM: Signal ground and power ground for all functions. Due to high current and high frequency operation, a low impedance circuit board ground plane is highly recommended.

HO, LO: High side and low side gate drive pins. The high and low side drivers can directly drive the gate of a power MOSFET. The drivers are capable of 1A peak source and sink currents. It is recommended that the high and low drive pins be very close to the gates of the high side and low side MOSFETs to prevent any delay and distortion of the drive signals.

V_B: The high side power input connection. The high side supply is derived from a bootstrap circuit using a low-leakage Schottky diode and a ceramic capacitor. To prevent noise, the Schottky diode and bypass capacitor should be very close to the IR2085S.

V_S: The high side power return connection. V_S should be connected directly to the source terminal of high side MOSFET with a trace as short as possible.

V_{CC}: The IC bias input connection for the device. Although the quiescent V_{CC} current is very low, total supply current will be higher, depending on the gate charge of the MOSFETs connected to the HO and LO pins, and the programmed oscillator frequency, total V_{CC} current is the sum of quiescent V_{CC} current and the average current at HO and LO. Knowing the operating frequency and the MOSFET gate charge (Qg) at selected V_{CC} voltage, the average current can be calculated from:

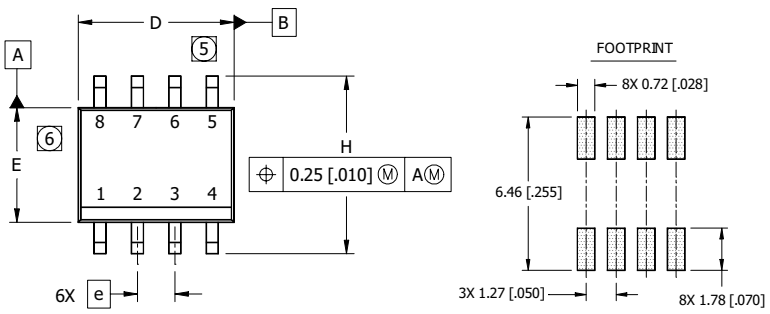
$$Iave = 2 \times Qg \times f_{OSC}$$

To prevent noise problem, a bypass ceramic capacitor connected to V_{CC} and COM should be placed as close as possible to the IR2085S.

IR2085S has an under voltage lookout feature for the IC bias supply, V_{CC}. The minimum voltage required on V_{CC} to make sure that IC will work within specifications must be higher than 8.5V (9.5V minimum V_{CC} is recommended to prevent asymmetrical gates signal on HO and LO pins that are expected when V_{CC} is between 7.5V and 8.5V).

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Case outline



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].

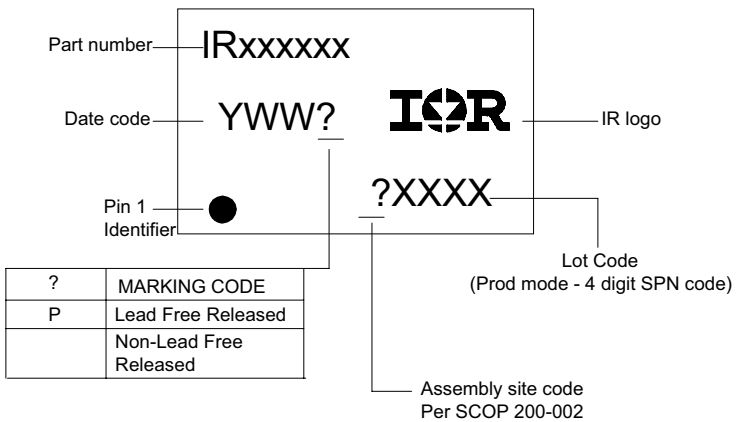
7 DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.

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

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LEADFREE PART MARKING INFORMATION



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

ORDERING INFORMATION

PKG DESIG	PART NUMBER	LEADFREE PART NUMBER	PIN COUNT	PARTS PER TUBE	PARTS PER REEL
S	IR2085S	IR2085SPbF	8	95	------
S	IR2085STR	IR2085STRPbF	8	------	4000

This product has been designed and qualified for the industrial market.
Qualification Standards can be found on IR's Web Site *http://www.irf.com/*.
Data and specifications subject to change without notice
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