

Features

- Floating channel designed for bootstrap operation
- Fully operational to +600 V
- Tolerant to negative transient voltage, dV/dt immune
- Gate drive supply range from 10 V to 20 V
- Undervoltage lockout
- 3.3 V, 5 V, and 15 V input logic compatible
- Cross-conduction prevention logic
- Internally set deadtime
- High-side output in phase with input
- Shutdown input turns off both channels
- Matched propagation delay for both channels
- RoHS compliant

Description

The IRS2104 is a high voltage, high speed power MOSFET and IGBT driver with dependent high- and low-side referenced output channels. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. The logic input is compatible with standard CMOS or LSTTL output, down to 3.3 V

HALF-BRIDGE DRIVER

Product Summary

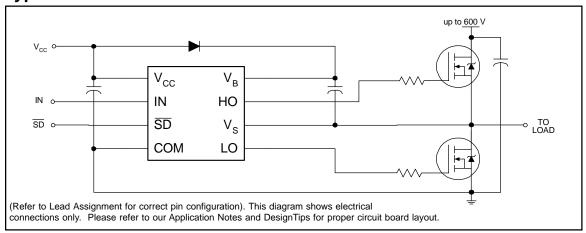
Voffset	600 V max.
l _O +/-	130 mA/270 mA
Vout	10 V - 20 V
t _{on/off} (typ.)	680 ns/150 ns
Deadtime (typ.)	520 ns

Packages



logic. The output drivers feature a high pulse current buffer stage designed for minimum driver cross-conduction. The floating channel can be used to drive an N-channel power MOSFET or IGBT in the high-side configuration which operates from 10 V to 600 V.

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.

Symbol	Definition	Min.	Max.	Units	
V _B	High-side floating absolute voltage		-0.3	625	
Vs	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	
Vcc	Low-side and logic fixed supply voltage		-0.3	25	V
V _{LO}	Low-side output voltage		-0.3	V _{CC} + 0.3	
V _{IN}	Logic input voltage (IN & SD)	-0.3	V _{CC} + 0.3		
dV _S /dt	Allowable offset supply voltage transient		_	50	V/ns
Do	P _D Package power dissipation @ T _A ≤ +25 °C (8 lead PDIP) (8 lead SOIC)		_	1.0	10/
ן יט			_	0.625	W
Dth	Thermal registance junction to embient	(8 lead PDIP)	_	125	°C/W
KuijĄ	Rth _{JA} Thermal resistance, junction to ambient (8 lead SOIC)		_	200	C/VV
TJ	Junction temperature		_	150	
T _S	Storage temperature		-55	150	°C
TL	Lead temperature (soldering, 10 seconds)		_	300	

Recommended Operating Conditions

The input/output logic timing diagram is shown in Fig. 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 a 15 V differential.

Symbol	Definition	Min.	Max.	Units	
V _B	High-side floating supply absolute voltage	V _S + 10	V _S + 20		
Vs	High-side floating supply offset voltage	oply offset voltage Note 1 600			
V _{HO}	High-side floating output voltage	Vs	V _B	v	
V _{CC}	Low-side and logic fixed supply voltage	10	20]	
V _{LO}	Low-side output voltage	0	Vcc		
V _{IN}	Logic input voltage (IN & SD)	0	Vcc		
T _A	Ambient temperature	-40	125	°C	

Note 1: Logic operational for V_S of -5 V to +600 V. Logic state held for V_S of -5 V to -V_{BS}. (Please refer to the Design Tip DT97-3 for more details).

 $\label{eq:Dynamic Electrical Characteristics} $$V_{BIAS} (V_{CC}, V_{BS}) = 15 \text{ V}, C_L = 1000 \text{ pF} \text{ and } T_A = 25 \text{ °C unless otherwise specified.}$

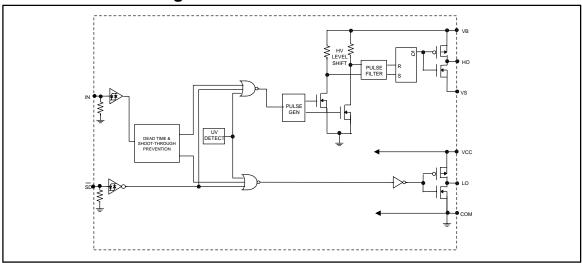
Symbol	Definition	Min.	Тур.	Max.	Units	Test Conditions
ton	Turn-on propagation delay	_	680	820		V _S = 0 V
toff	Turn-off propagation delay	_	150	220		V _S = 600 V
t _{sd}	Shutdown propagation delay	_	160	220		
t _r	Turn-on rise time	_	70	170	ns	
tf	Turn-off fall time	_	35	90		
DT	Deadtime, LS turn-off to HS turn-on & HS turn-on to LS turn-off	400	520	650		
MT	Delay matching, HS & LS turn-on/off	_		60		

Static Electrical Characteristics

 V_{BIAS} (V_{CC} , V_{BS}) = 15 V 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.	Тур.	Max.	Units	Test Conditions
VIH	Logic "1" (HO) & Logic "0" (LO) input voltage	2.5	_	_		
V _{IL}	Logic "0" (HO) & Logic "1" (LO) input voltage	_	_	0.8		10 1/1- 20 1/
V _{SD,TH+}	SD input positive going threshold	2.5	_	_		$V_{CC} = 10 \text{ V to } 20 \text{ V}$
V _{SD,TH} -	SD input negative going threshold	_	_	0.8	V	
V _{OH}	High level output voltage, V _{BIAS} - V _O	_	0.05	0.2		I _O = 2 mA
Vol	Low level output voltage, VO	_	0.02	0.1		10 – 2 1117
I _{LK}	Offset supply leakage current	_	_	50		$V_{B} = V_{S} = 600 \text{ V}$
I _{QBS}	Quiescent V _{BS} supply current	_	30	55		V _{IN} = 0 V or 5 V
IQCC	Quiescent V _{CC} supply current	_	150	270	μΑ	
I _{IN+}	Logic "1" input bias current	_	3	10		V _{IN} = 5 V
I _{IN-}	Logic "0" input bias current	_	_	5		V _{IN} = 0 V
V _{CCUV+}	V _{CC} supply undervoltage positive going threshold	8	8.9	9.8	V	
V _{CCUV} -	V _{CC} supply undervoltage negative going threshold	7.4	8.2	9	V	
I _{O+}	Output high short circuit pulsed current	130	290	_	- mA	V _O = 0 V PW ≤ 10 μs
I _{O-}	Output low short circuit pulsed current	270	600		111/4	V _O = 15 V PW ≤ 10 μs

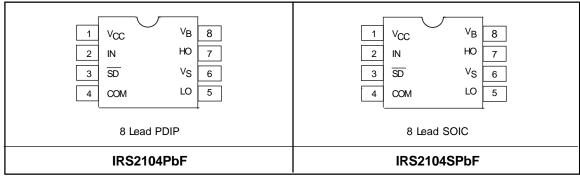
Functional Block Diagram



Lead Definitions

Symbol	Description
IN	Logic input for high-side and low-side gate driver outputs (HO and LO), in phase with HO
SD	Logic input for shutdown
VB	High-side floating supply
НО	High-side gate drive output
Vs	High-side floating supply return
Vcc	Low-side and logic fixed supply
LO	Low-side gate drive output
COM	Low-side return

Lead Assignments



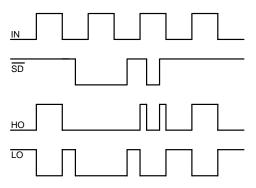


Figure 1. Input/Output Timing Diagram

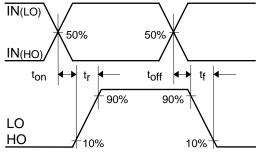


Figure 2. Switching Time Waveform Definitions

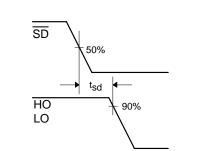


Figure 3. Shutdown Waveform Definitions

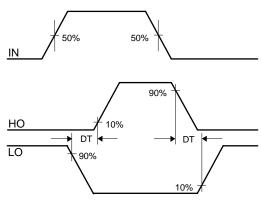


Figure 4. Deadtime Waveform Definitions

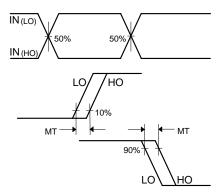


Figure 5. Delay Matching Waveform Definitions

International IOR Rectifier

IRS2104(S) PbF

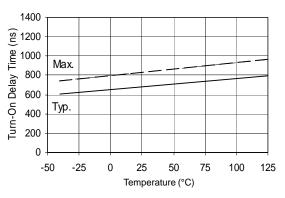


Figure 6A. Turn-On Time vs. Temperature

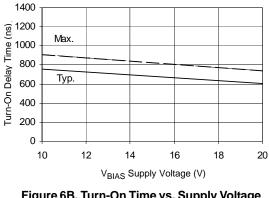


Figure 6B. Turn-On Time vs. Supply Voltage

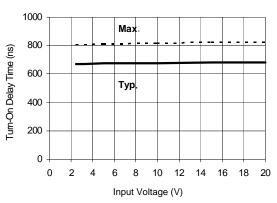


Figure 6C. Turn-On Time vs. Input Voltage

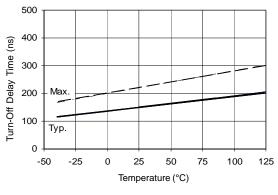


Figure 7A. Turn-Off Time vs. Temperature

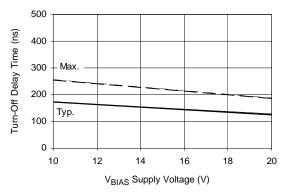


Figure 7B. Turn-Off Time vs. Supply Voltage

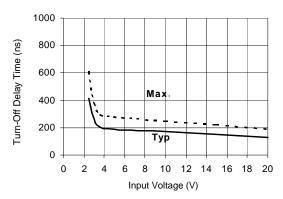


Figure 7C. Turn-Off Time vs. Input Voltage

International TOR Rectifier

IRS2104(S)PbF

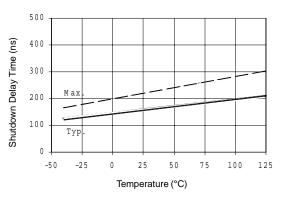


Figure 8A. Shutdown Time vs. Temperature

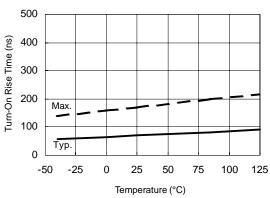


Figure 9A. Turn-On Rise Time vs. Temperature

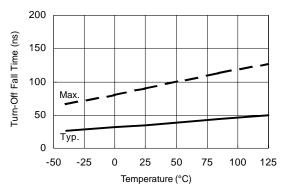


Figure 10A. Turn-Off Fall Time vs. Temperature

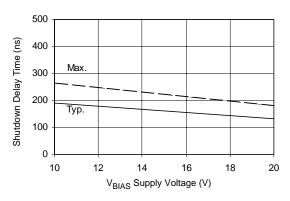


Figure 8B. Shutdown Time vs. Voltage

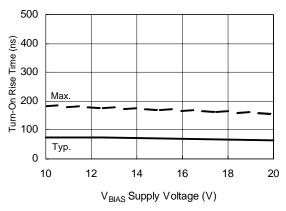


Figure 9B. Turn-On Rise Time vs. Voltage

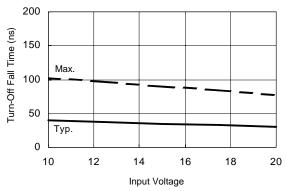


Figure 10B. Turn-Off Fall Time vs. Input Voltage

International TOR Rectifier

IRS2104(S)PbF

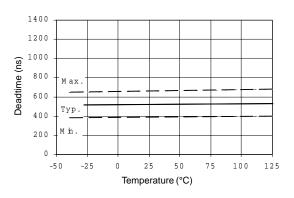


Figure 11A. Deadtime vs. Temperature

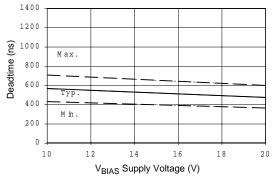


Figure 11B. Deadtime vs. Voltage

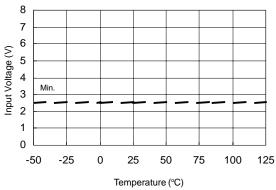


Figure12A. Logic "1" Input Voltage vs. Temperature

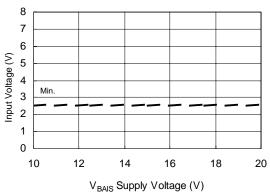


Figure 12B. Logic "1" Input Voltage vs. Supply Voltage

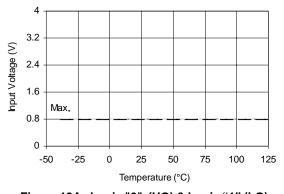


Figure 13A. Logic "0" (HO) & Logic "1" (LO) & Active SD Input Voltage vs. Temperature

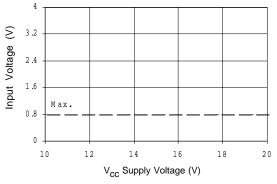


Figure 13B. Logic "0" (HO) & Logic "1" (LO) & Active SD Input Voltage vs. Voltage

International TOR Rectifier

IRS2104(S)PbF

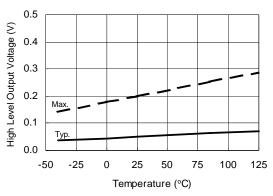


Figure 14A. High Level Output Voltage vs. Temperature

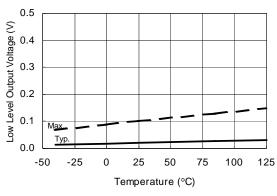


Figure 15A. Low Level Output Voltage vs. Temperature

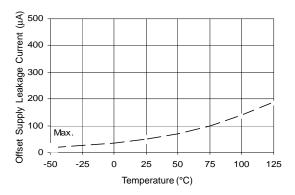


Figure 16A. Offset Supply Current vs. Temperature

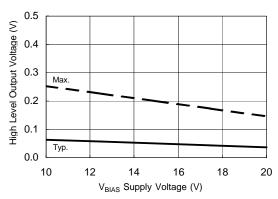


Figure 14B. High Level Output Voltage vs. Supply Voltage

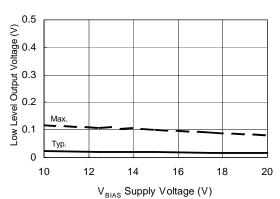


Figure 15B. Low Level Output Voltage vs. Supply Voltage

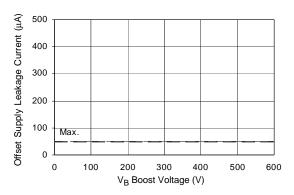


Figure 16B. Offset Supply Current vs. Voltage

International **IOR** Rectifier

IRS2104(S) PbF

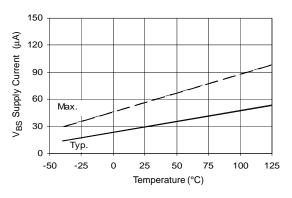


Figure 17A. V_{BS} Supply Current vs. Temperature

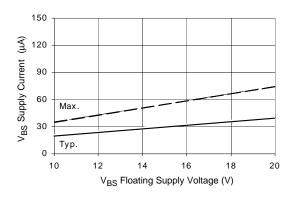


Figure 17B. V_{BS} Supply Current vs. Voltage

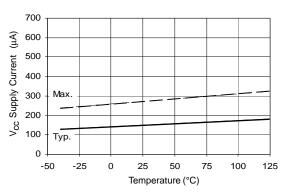


Figure 18A. V_{CC} Supply Current vs. Temperature

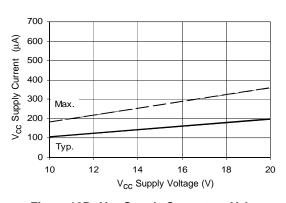


Figure 18B. V_{CC} Supply Current vs. Voltage

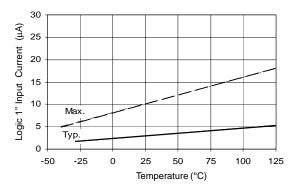


Figure 19A. Logic"1" Input Current vs. Temperature

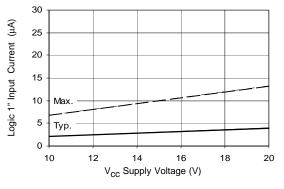


Figure 19B. Logic"1" Input Current vs. Voltage

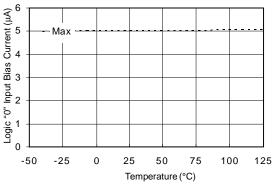
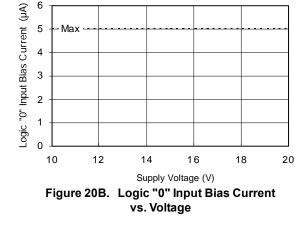


Figure 20A. Logic "0" Input Bias Current vs. Temperature



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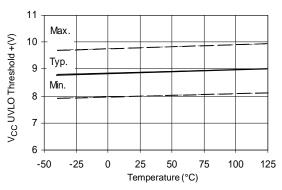


Figure 21A. V_{CC} Undervoltage Threshold(+) vs. Temperature

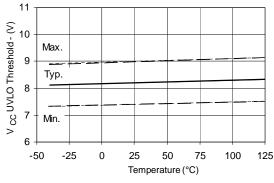


Figure 21B. V_{CC} Undervoltage Threshold(-) vs. Temperature

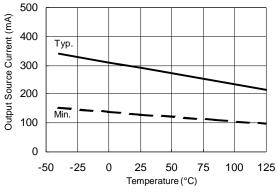


Figure 22A. Output Source Current vs. Temperature

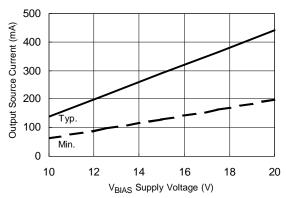
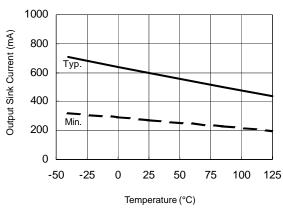


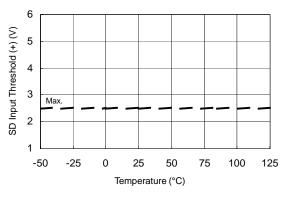
Figure 22B. Output Source Current vs. Voltage



1000 Output Sink Current (mA) 800 600 400 Тур. 200 Min. 0 20 10 12 14 16 18 V_{BIAS} Supply Voltage (V)

Figure 23A. Output Sink Current vs. Temperature

Figure 23B. Output Sink Current vs. Supply Voltage



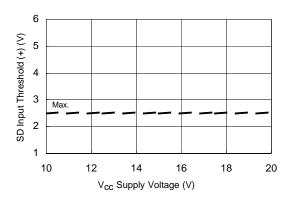
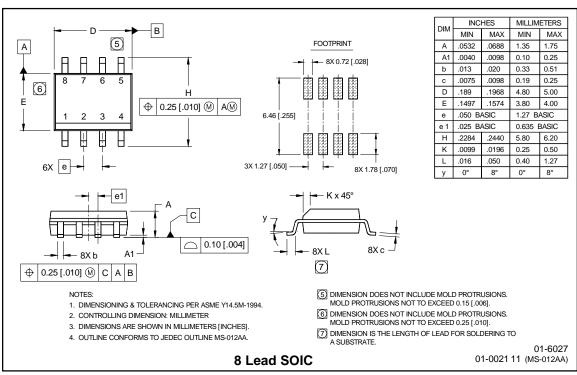
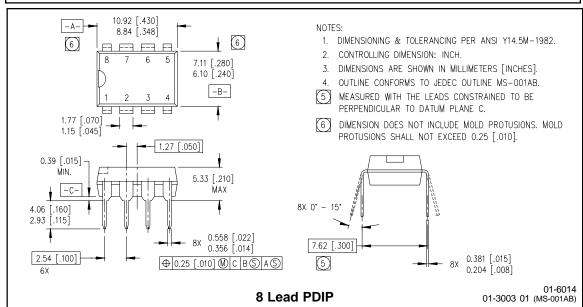


Figure 24A. SD Input Positive Going Threshold (+) vs. Temperature

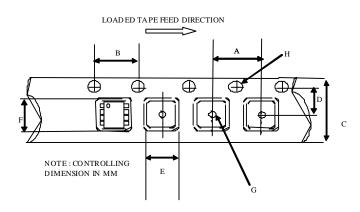
Figure 24B. SD Input Positive Going Threshold (+) vs. Supply Voltage

Case Outline



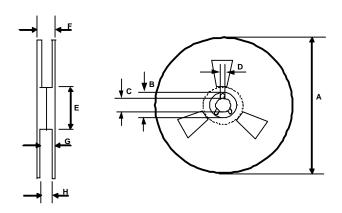


Tape & Reel 8-lead SOIC



CARRIER TAPE DIMENSION FOR 8SOICN

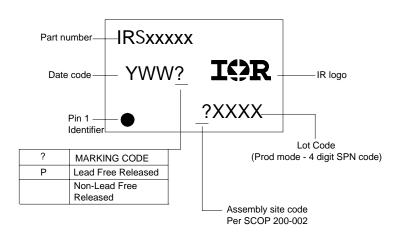
	M e	tric	lm p erial	
Code	Min	Max	Min	Max
Α	7.90	8.10	0.311	0.318
В	3.90	4.10	0.153	0.161
С	11.70	12.30	0.46	0.484
D	5.45	5.55	0.214	0.218
E	6.30	6.50	0.248	0.255
F	5.10	5.30	0.200	0.208
G	1.50	n/a	0.059	n/a
Н	1.50	1.60	0.059	0.062



REEL DIMENSIONS FOR 8SOICN

	M etric		Im p erial		
Code	Min	Max	Min	Max	
Α	329.60	330.25	12.976	13.001	
В	20.95	21.45	0.824	0.844	
С	12.80	13.20	0.503	0.519	
D	1.95	2.45	0.767	0.096	
E	98.00	102.00	3.858	4.015	
F	n/a	18.40	n/a	0.724	
G	14.50	17.10	0.570	0.673	
Н	12.40	14.40	0.488	0.566	

LEADFREE PART MARKING INFORMATION



ORDER INFORMATION

8-Lead PDIP IRS2104PbF 8-Lead SOIC IRS2104SPbF 8-Lead SOIC Tape & Reel IRS2104STRPbF



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The SOIC-8 is MSL2 qualified.

This product has been designed and qualified for the industrial level.

Qualification standards can be found at www.irf.com

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245 Tel: (310) 252-7105

Data and specifications subject to change without notice. 11/27/2006