Data Sheet No. PD60253

IRS2111(S)PbF

HALF-BRIDGE DRIVER

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 for both channels
- CMOS Schmitt-triggered inputs with pull-down
- Matched propagation delay for both channels
- Internally set deadtime
- High side output in phase with input

Product Summary

V_{OFFSET}	600 V max.
I_O+/-	200 mA / 420 mA
V_{OUT}	10 V - 20 V
$t_{on/off}$ (typ.)	750 ns & 150 ns
Deadtime (typ.)	650 ns

Description

The IRS2111 is a high voltage, high speed power MOSFET and IGBT driver with dependent high and low side referenced output channels designed for half-bridge applications. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. Logic input is compatible with standard CMOS outputs. The output drivers feature a high pulse current buffer stage designed for minimum driver cross-conduction. Internal deadtime is provided to avoid shoot-through in the output half-bridge. The floating channel can be used to drive an N-channel power MOSFET or IGBT in the high side configuration which operates up to 600 V.

Packages

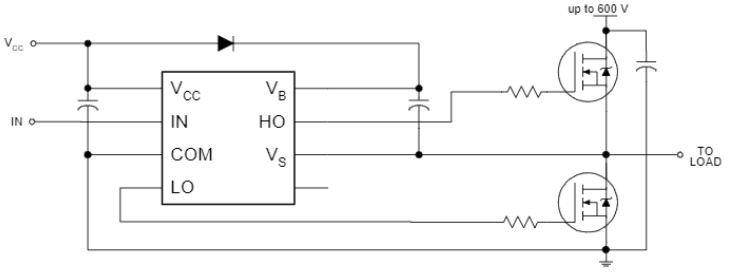


8-Lead PDIP
IRS2111PbF



8-Lead SOIC
IRS21111SPbF

Typical Connection



(Refer to Lead Assignments for correct pin configuration). This diagram shows electrical connections only. Please refer to our Application Notes and DesignTips for proper circuit board layout.

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. Additional information is shown in Figs. 7 through 10.

Symbol	Definition		Min.	Max.	Units
V_B	High side floating supply voltage		-0.3	625 (Note 1)	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_{CC}	Low side and logic fixed supply voltage		-0.3	25 (Note 1)	
V_{LO}	Low side output voltage		-0.3	V_{CC} + 0.3	
V_{IN}	Logic input voltage		-0.3	V_{CC} + 0.3	
dV_S/dt	Allowable offset supply voltage transient (Fig. 2)		—	50	V/ns
P_D	Package power dissipation @ $T_A \leq +25°C$	(8 Lead PDIP)	—	1.0	W
		(8 lead SOIC)	—	0.625	
Rth_{JA}	Thermal resistance, junction to ambient	(8 lead PDIP)	—	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	

Note 1: All supplies are fully tested at 25 V, and an internal 20 V clamp exists for each supply

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	V
V_S	High side floating supply offset voltage	Note 2	600	
V_{HO}	High side floating output voltage	V_S	V_B	
V_{CC}	Low side and logic fixed supply voltage	10	20	
V_{LO}	Low side output voltage	0	V_{CC}	
V_{IN}	Logic input voltage	0	V_{CC}	
T_A	Ambient temperature	-40	125	°C

Note 2: 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).

Dynamic Electrical Characteristics

V_{BIAS} (V_{CC}, V_{BS}) = 15 V, C_L = 1000 pF and T_A = 25 °C unless otherwise specified. The dynamic electrical characteristics are measured using the test circuit shown in Fig. 3.

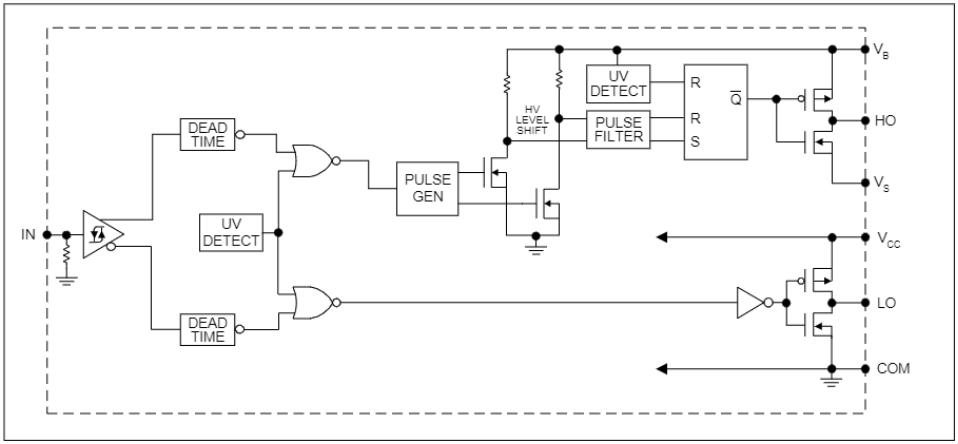
Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
t_{on}	Turn-on propagation delay	550	750	950	ns	V_S = 0 V
t_{off}	Turn-off propagation delay	—	150	180		V_S = 600 V
t_r	Turn-on rise time	—	75	130		
t_f	Turn-off fall time	—	35	65		
DT	Deadtime, LS turn-off to HS turn-on & HS turn-off to LS turn-on	480	650	820		
MT	Delay matching, HS & LS turn-on/off	—	30	—		

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.	Typ.	Max.	Units	Test Conditions
V_{IH}	Logic “1” input voltage for HO & logic “0” for LO	6.4	—	—	V	V_{CC} = 10 V
		9.5	—	—		V_{CC} = 15 V
		12.6	—	—		V_{CC} = 20 V
V_{IL}	Logic “0” input voltage for HO & logic “1” for LO	—	—	3.8		V_{CC} = 10 V
		—	—	6.0		V_{CC} = 15 V
		—	—	8.3		V_{CC} = 20 V
V_{OH}	High level output voltage, V_{BIAS} - V_O	—	0.05	0.2	mV	I_O = 2 mA
V_{OL}	Low level output voltage, V_O	—	0.02	0.1		
I_{LK}	Offset supply leakage current	—	—	50	µA	V_B = V_S = 600 V
I_{QBS}	Quiescent V_{BS} supply current	—	50	100		V_{IN} = 0 V or V_{CC}
I_{QCC}	Quiescent V_{CC} supply current	—	70	180		
I_{IN+}	Logic “1” input bias current	—	30	50		V_{IN} = V_{CC}
I_{IN-}	Logic “0” input bias current	—	—	1.0		V_{IN} = 0 V
V_{BSUV+}	V_{BS} supply undervoltage positive going threshold	7.6	8.6	9.6	V	
V_{BSUV-}	V_{BS} supply undervoltage negative going threshold	7.2	8.2	9.2		
V_{CCUV+}	V_{CC} supply undervoltage positive going threshold	7.6	8.6	9.6		
V_{CCUV-}	V_{CC} supply undervoltage negative going threshold	7.2	8.2	9.2		
I_{O+}	Output high short circuit pulsed current	200	290	—	mA	V_O = 0 V, V_{IN} = V_{CC} PW ≤ 10 µs
I_{O-}	Output low short circuit pulsed current	420	600	—		V_O = 15 V, V_{IN} = 0 V PW ≤ 10 µs

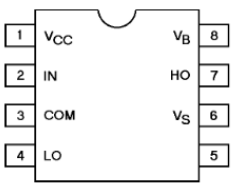
Functional Block Diagram



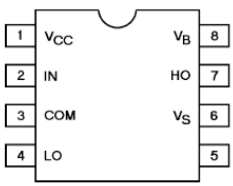
Lead Definitions

Symbol	Description
IN	Logic input for high side and low side gate driver outputs (HO & LO), in phase with HO
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



8 Lead SOIC

IRS2111	IRS2111S
Part Number	

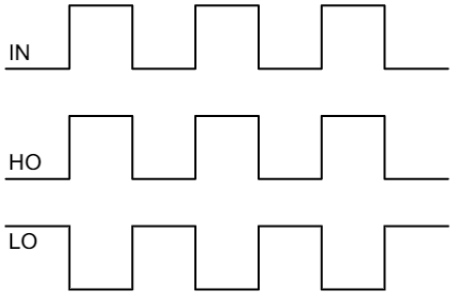


Figure 1. Input/Output Timing Diagram

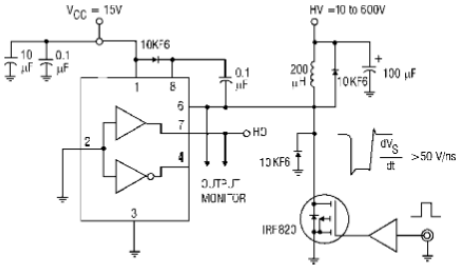


Figure 2. Floating Supply Voltage Transient Test Circuit

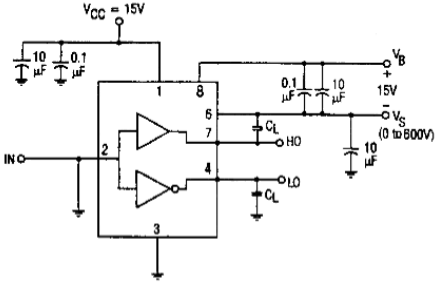


Figure 3. Switching Time Test Circuit

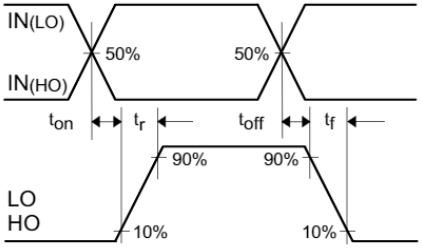


Figure 4. Switching Time Waveform Definition

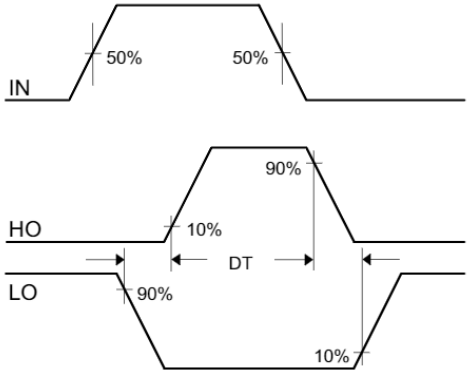


Figure 5. Deadtime Waveform Definitions

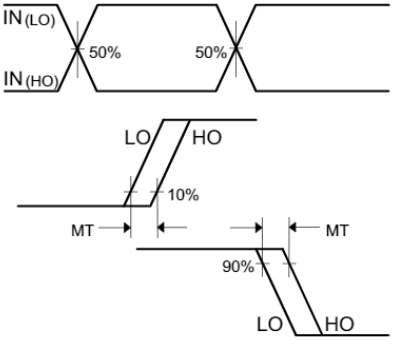


Figure 6. Delay Matching Waveform Definitions

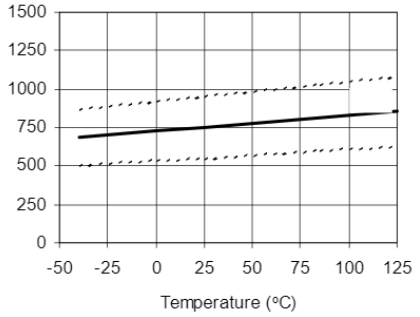


Figure 7A Turn-On Time vs Temperature

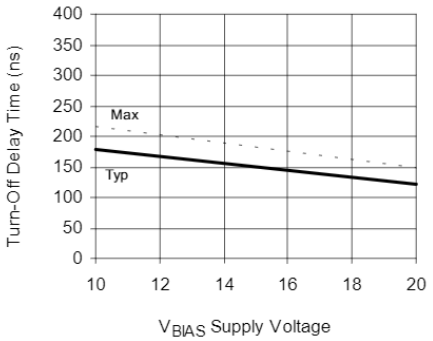


Figure 7B Turn-On Time vs Voltage

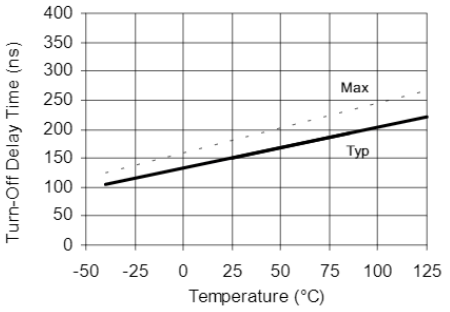


Figure 8A Turn-Off Time vs Temperature

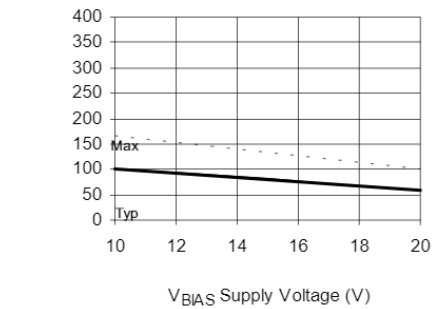


Figure 8B Turn-Off Time vs Voltage

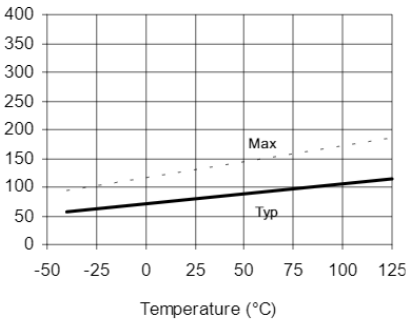


Figure 9A Turn-On Rise Time vs Temperature

Figure 9B Turn-On Rise Time vs Voltage

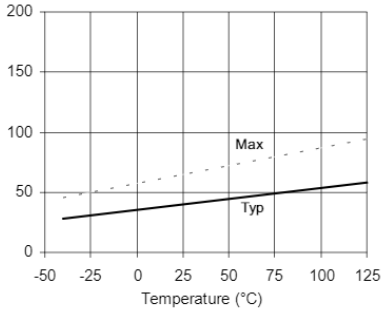


Figure 10A Turn-Off Fall Time vs Temperature

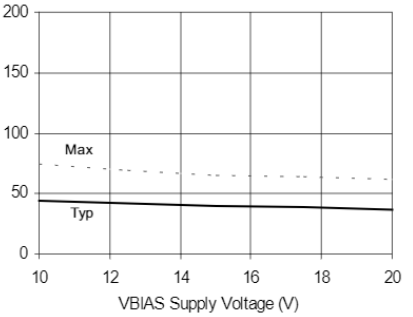


Figure 10B Turn-Off Fall Time vs Voltage

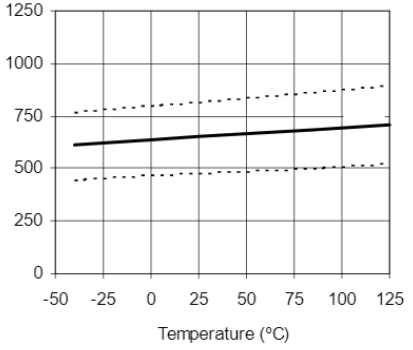


Figure 11A Deadtime vs Temperature

Figure 11B Deadtime vs Voltage

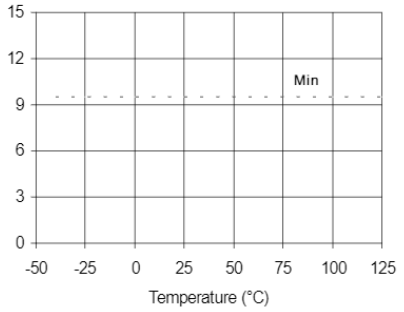


Figure 12A Logic "I" Input voltage for HO & Logic "0" for LO vs Temperature

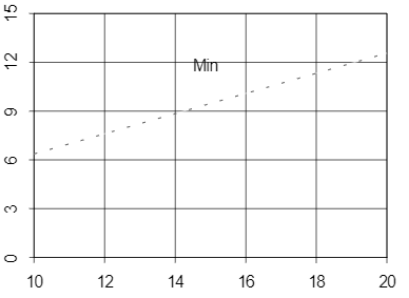


Figure 12B Logic "I" Input voltage for HO & Logic "0" for LO vs Voltage

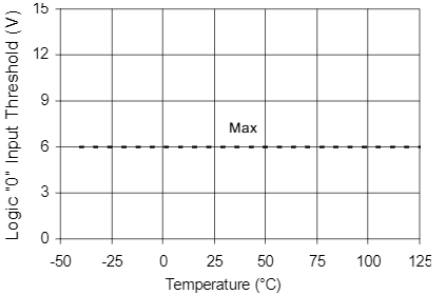


Figure 13A Logic "0" Input voltage for HO & Logic "I" for LO vs Temperature

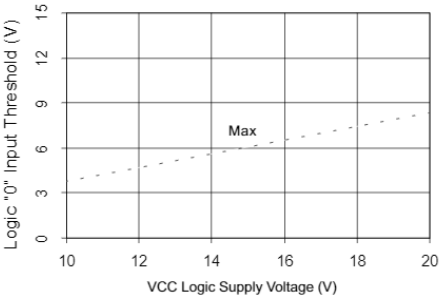


Figure 13B Logic "0" Input voltage for HO & Logic "I" for LO vs Voltage

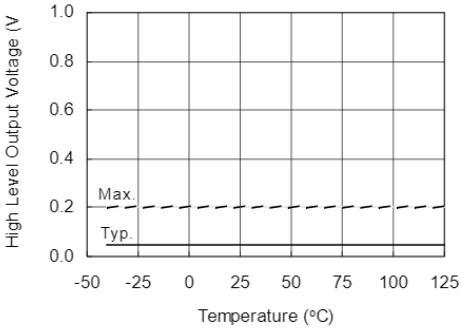


Figure 14A. High Level Output vs. Temperature

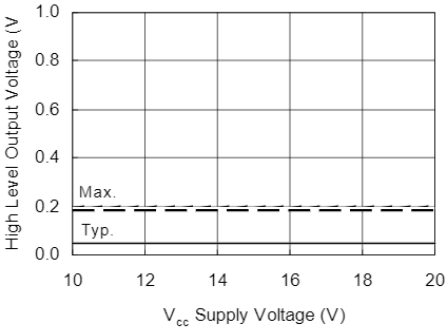


Figure 14B. High Level Output vs. Supply Voltage

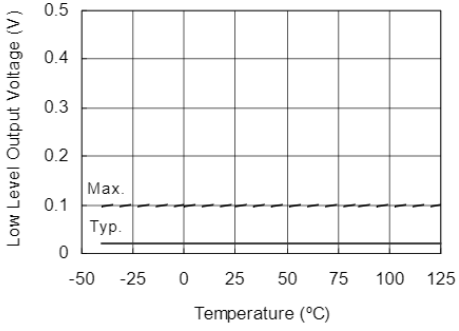


Figure 15A. Low Level Output vs. Temperature

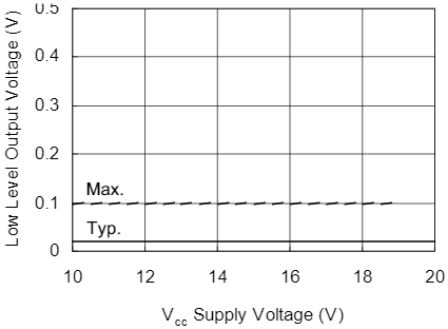


Figure 15B. Low Level Output vs. Voltage

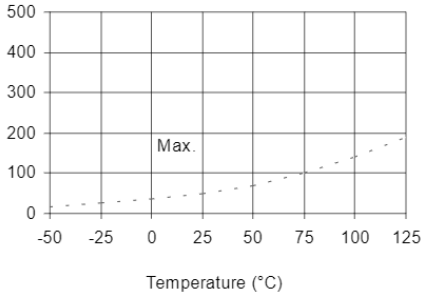


Figure 16A Offset Supply Current vs Temperature

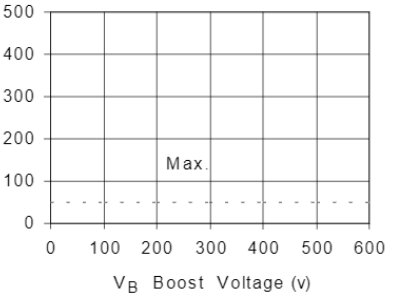


Figure 16B Offset Supply Current vs Voltage

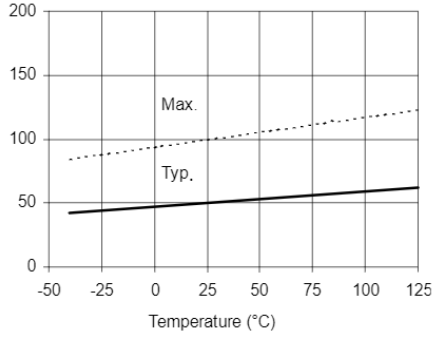


Figure 17A V_{BS} Supply Current vs Temperature

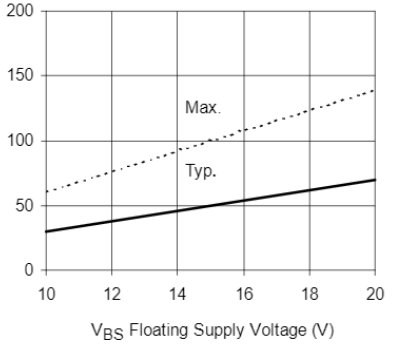


Figure 17B V_{BS} Supply Current vs Voltage

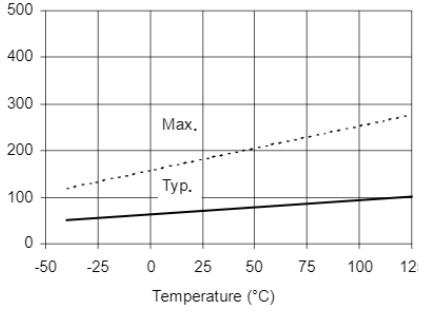


Figure 18A V_{CC} Supply Current vs Temperature

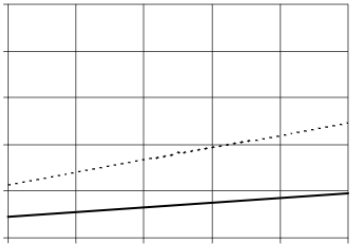


Figure 18B V_{CC} Supply Current vs Voltage

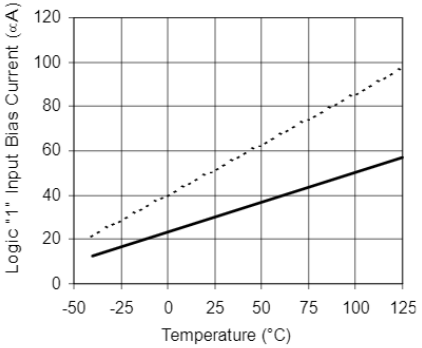


Figure 19A Logic "1" Input Current vs. Temperature

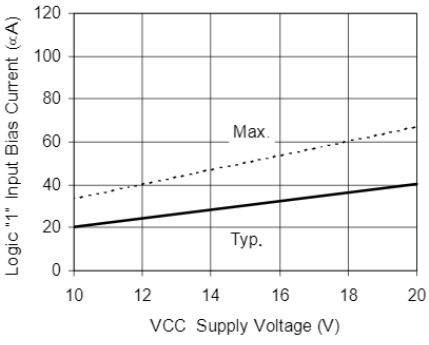


Figure 19B Logic "1" Input Current vs. V_{CC} Voltage

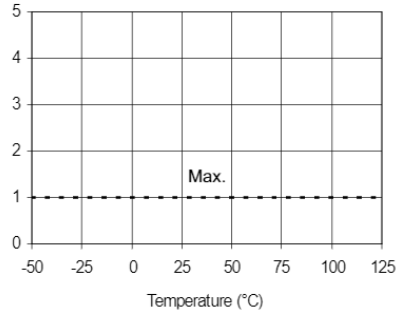


Figure 20A. Logic "0" Input Current vs. Temperature

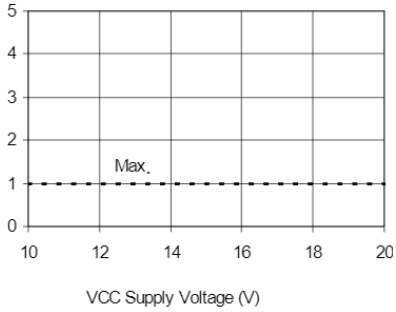


Figure 20B. Logic "0" Input Current vs. V_{CC} Voltage

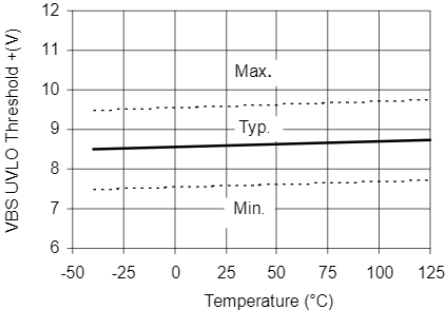


Figure 21 V_{BS} Undervoltage Threshold (+) vs. Temperature

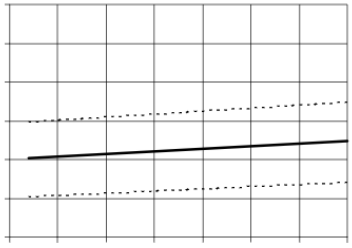


Figure 22 V_{BS} Undervoltage Threshold (-) vs. Temperature

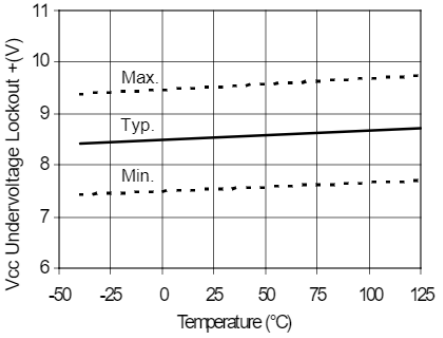


Figure 23 V_{CC} Undervoltage (-) vs Temperature

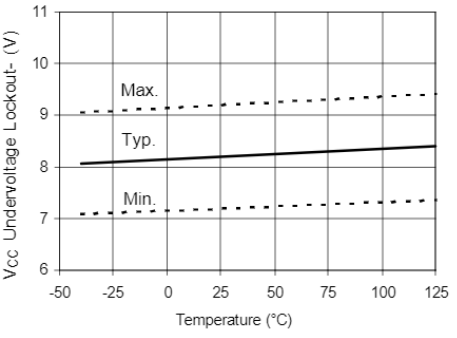


Figure 24 V_{CC} Undervoltage (-) vs Temperature

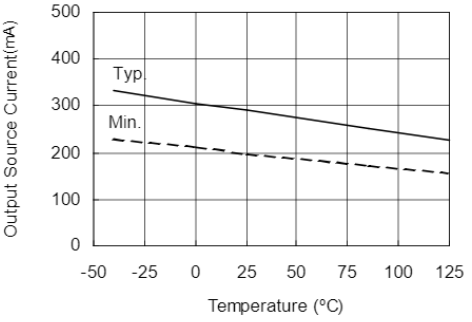


Figure 25A Output Source Current vs Temperature

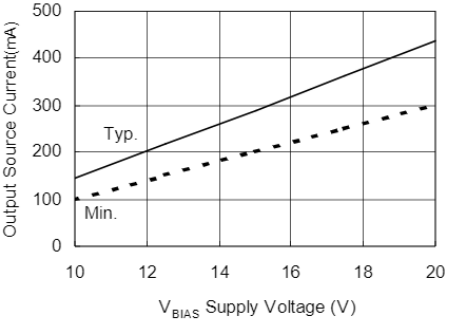


Figure 25B Output Source Current vs Voltage

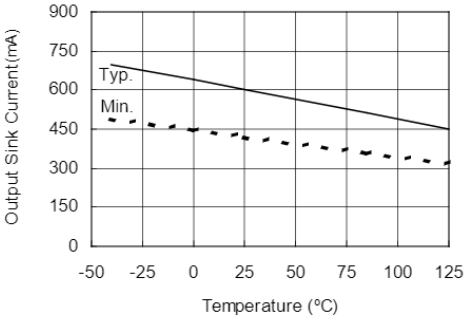


Figure 26A Output Sink Current vs Temperature

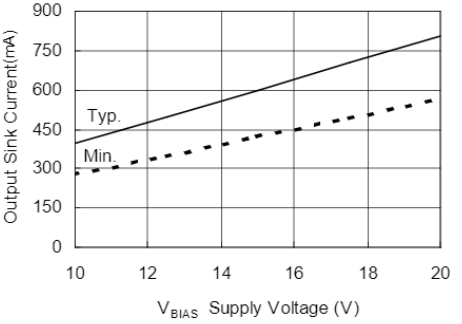
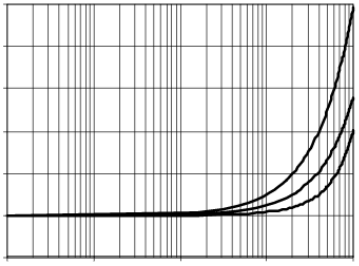


Figure 26B Output Sink Current vs Voltage



Frequency (kHz)

Figure 27. IR2111 T_J vs. Frequency (IRFBC20)
R_{GATE} = 33 Ω, V_{CC} = 15 V

Frequency (kHz)

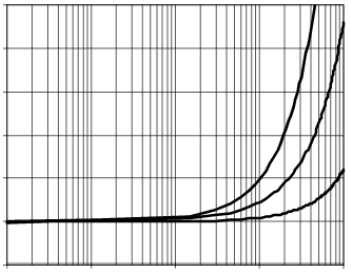
Figure 28. IR2111 T_J vs. Frequency (IRFBC30)
R_{GATE} = 22 Ω, V_{CC} = 15 V

Frequency (kHz)

Figure 29. IR2111 T_J vs. Frequency (IRFBC40)
R_{GATE} = 15 Ω, V_{CC} = 15 V

Frequency (kHz)

Figure 30. IR2111 T_J vs. Frequency (IRFPC50)
R_{GATE} = 10 Ω, V_{CC} = 15 V



Frequency (kHz)

Figure 31. IR2111S T_J vs. Frequency (IRFBC20) R_{GATE} = 33 Ω, V_{CC} = 15 V

Frequency (kHz)

Figure 32. IR2111S T_J vs. Frequency (IRFBC30) R_{GATE} = 22 Ω, V_{CC} = 15 V

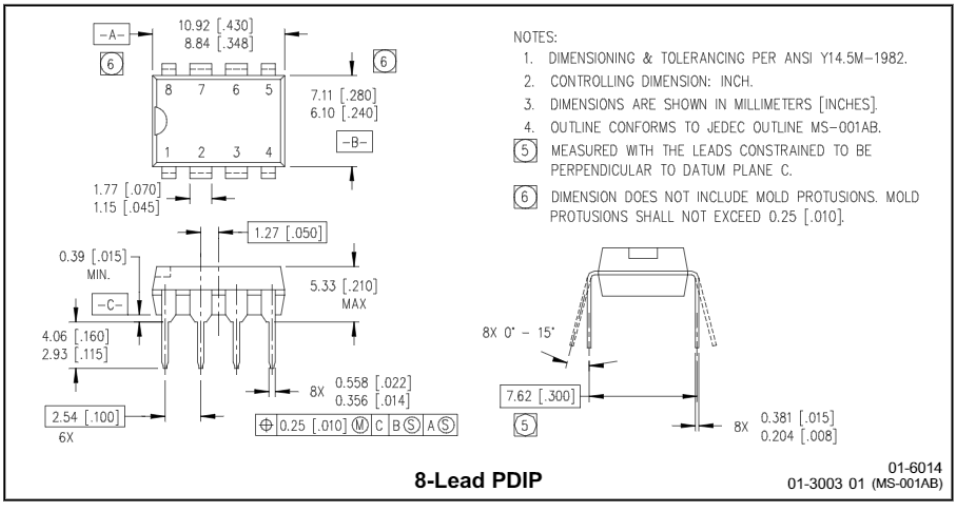
Frequency (kHz)

Figure 33. IR2111S T_J vs. Frequency (IRFBC40) R_{GATE} = 15 Ω, V_{CC} = 15 V

Frequency (kHz)

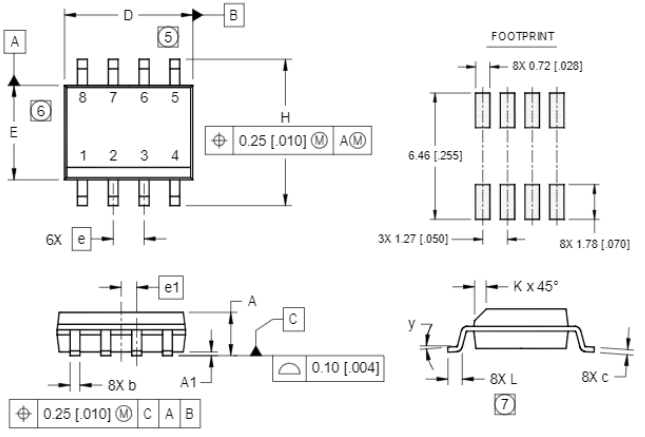
Figure 34. IR2111S T_J vs. Frequency (IRFPC50) R_{GATE} = 10 Ω, V_{CC} = 15 V

Case outlines



8-Lead PDIP

01-6014
01-3003 01 (MS-001AB)



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	
e1	.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°

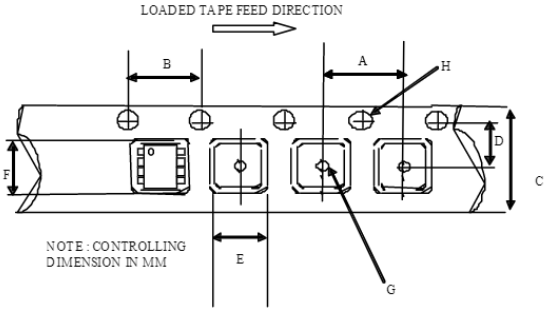
NOTES:
1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.

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.

8-Lead SOIC

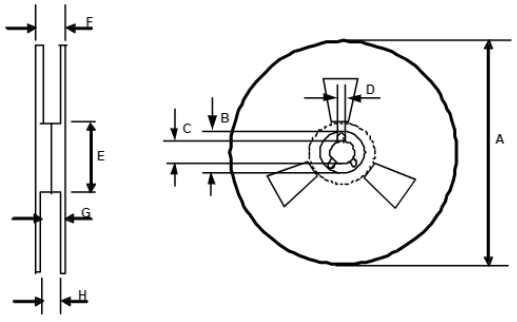
01-6027
01-0021 11 (MS-012AA)

Tape & Reel
8-lead SOIC



CARRIER TAPE DIMENSION FOR 8SOICN

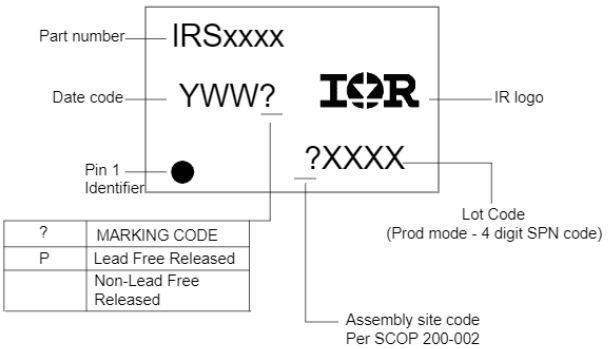
	Metric		Imperial	
Code	Min	Max	Min	Max
A	7.90	8.10	0.311	0.318
B	3.90	4.10	0.153	0.161
C	11.70	12.30	0.46	0.484
D	5.45	5.55	0.214	0.218
E	6.30	6.50	0.248	0.255
F	5.10	5.30	0.200	0.208
G	1.50	n/a	0.059	n/a
H	1.50	1.60	0.059	0.062



REEL DIMENSIONS FOR 8SOICN

	Metric		Imperial	
Code	Min	Max	Min	Max
A	329.60	330.25	12.976	13.001
B	20.95	21.45	0.824	0.844
C	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
H	12.40	14.40	0.488	0.566

LEADFREE PART MARKING INFORMATION



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

ORDER INFORMATION

8-Lead PDIP IRS2111PbF
8-Lead SOIC IRS2111SPbF
8-Lead SOIC Tape & Reel IRS2111STRPbF

International
IOR Rectifier

The SOIC-8 is MSL2 qualified.
The SOIC-14 is MSL3 qualified.
This product has been designed and qualified for the industrial level.
Qualification standards can be found at www.irf.com <http://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. 6/14/2006