

IRS2001(S)PbF

HIGH AND LOW SIDE DRIVER

Features

- Floating channel designed for bootstrap operation
- Fully operational to +200 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 logic input compatible
- Matched propagation delay for both channels
- Outputs in phase with inputs
- RoHS compliant

Description

The IRS2001 is a high voltage, high speed power MOSFET and IGBT driver with independent high-side 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 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 up to 200 V.

Product Summary

V_{OFFSET}	200 V max.
$I_{\text{O+/-}}$	200 mA/420 mA
V_{OUT}	10 V - 20 V
$t_{\text{on/off (typ.)}}$	160 ns/150 ns
Delay Matching	50 ns

Packages

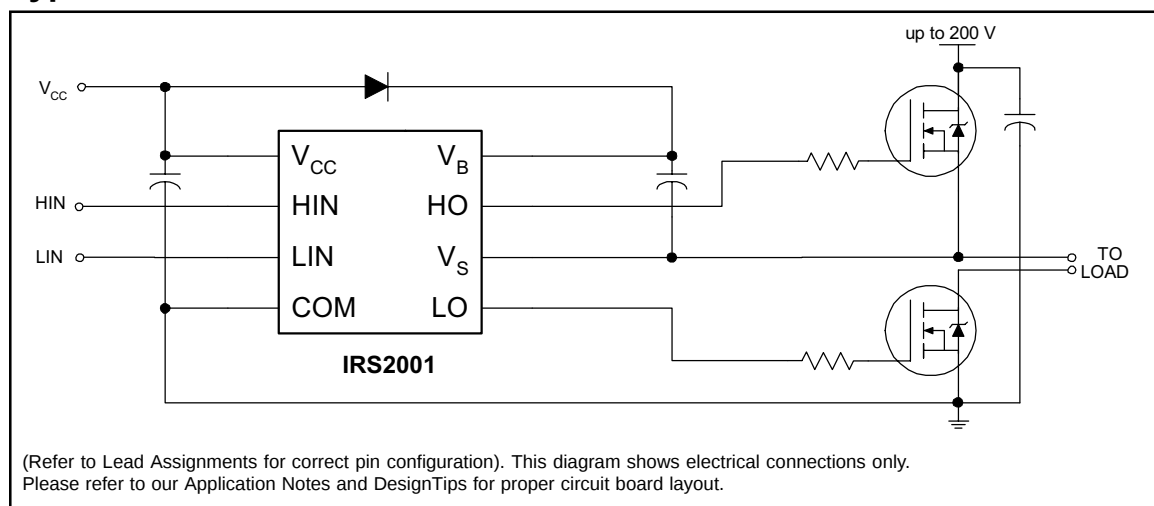


8-Lead SOIC
IRS2001S



8-Lead PDIP
IRS2001

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 supply voltage		-0.3	225	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	
V _{LO}	Low-side output voltage		-0.3	V _{CC} + 0.3	
V _{IN}	Logic input voltage (HIN & LIN)		-0.3	V _{CC} + 0.3	
dV _S /dt	Allowable offset supply voltage transient		—	50	V/ns
P _D	Package power dissipation @ T _A ≤ +25 °C	(8 lead PDIP)	—	1.0	W
		(8 lead SOIC)	—	0.625	
R _{thJA}	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	

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 1	200	
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 (HIN & LIN)	0	V_{CC}	
T_A	Ambient temperature	-40	125	$^\circ\text{C}$

Note 1: Logic operational for V_S of -5 V to +200 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.

Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
t _{on}	Turn-on propagation delay	—	160	220	ns	V _S = 0 V
t _{off}	Turn-off propagation delay	—	150	220		V _S = 200 V
t _r	Turn-on rise time	—	70	100		
t _f	Turn-off fall time	—	35	60		
MT	Delay matching, HS & LS turn-on/off	—	—	50		

Static Electrical Characteristics

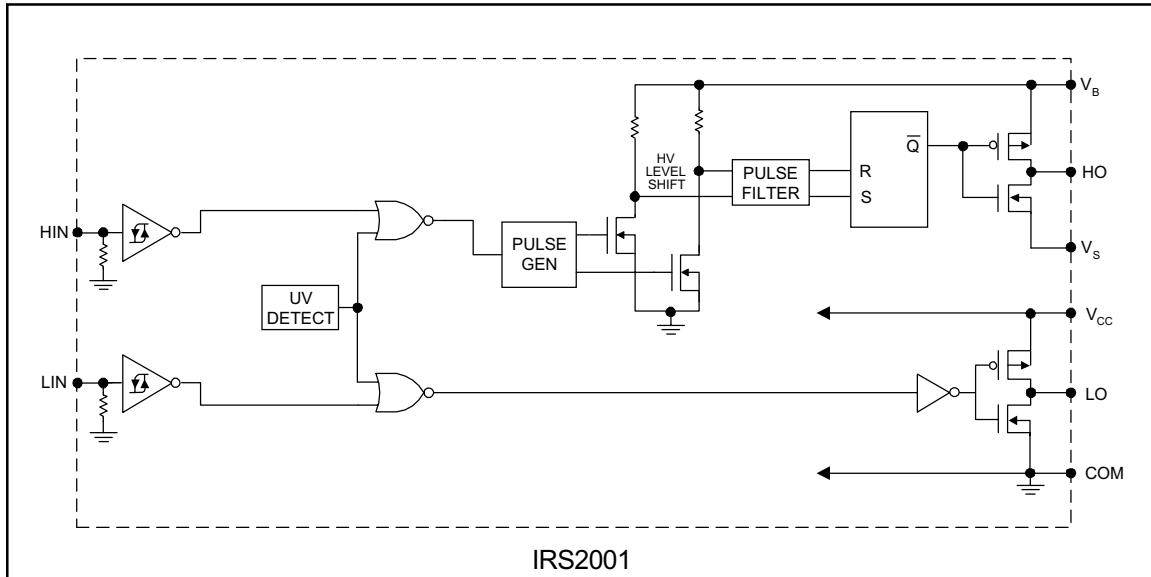
V_{BIAS} (V_{CC}, V_{BS}) = 15 V and T_A = 25 °C unless otherwise specified. The V_{IN}, V_{TH}, and I_{IN} parameters are referenced to COM. The V_O and I_O parameters are referenced to COM and are applicable to the respective output leads: HO or LO.

Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
V _{IH}	Logic "1" input voltage	2.5	—	—	V	V _{CC} = 10 V to 20 V
V _{IL}	Logic "0" input voltage	—	—	0.8		
V _{OH}	High level output voltage, V _{BIAS} - V _O	—	0.05	0.1		I _O = 2 mA
V _{OL}	Low level output voltage, V _O	—	0.02	0.05		
I _{LK}	Offset supply leakage current	—	—	50	μA	V _B = V _S = 200 V
I _{QBS}	Quiescent V _{BS} supply current	—	30	55		V _{IN} = 0 V or 5 V
I _{QCC}	Quiescent V _{CC} supply current	—	150	270		
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		
I _{O+}	Output high short circuit pulsed current	200	290	—	mA	V _O = 0 V V _{IN} = Logic "1" PW ≤ 10 μs
I _{O-}	Output low short circuit pulsed current	420	600	—		V _O = 15 V V _{IN} = Logic "0" PW ≤ 10 μs

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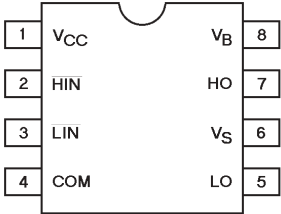
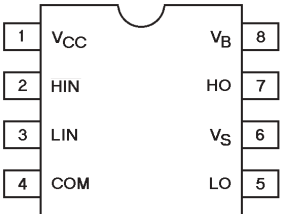
Functional Block Diagram



Lead Definitions

Symbol	Description
HIN	Logic input for high-side gate driver output (HO), in phase
LIN	Logic input for low-side gate driver output (LO), in phase
VB	High-side floating supply
HO	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

 8 Lead PDIP	 8 Lead SOIC
IRS2001PbF	IRS2001SPbF
Part Number	

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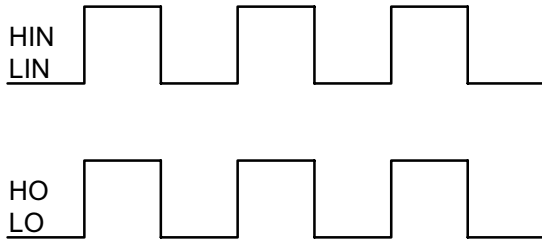


Figure 1. Input/Output Timing Diagram

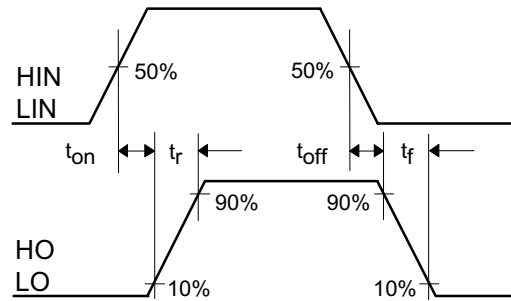


Figure 2. Switching Time Waveform Definitions

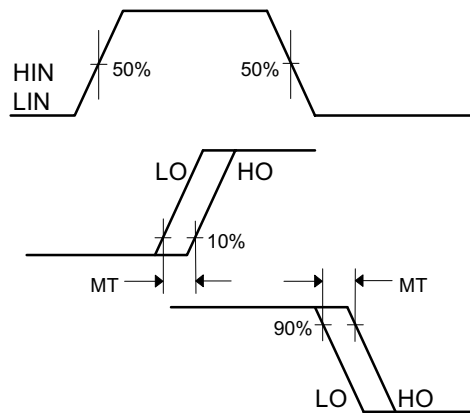


Figure 3. Delay Matching Waveform Definitions

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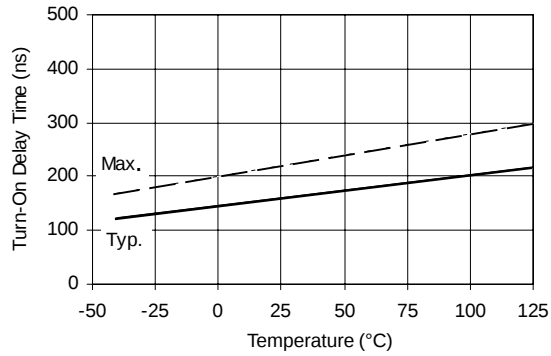


Figure 6A. Turn-On Time vs. Temperature

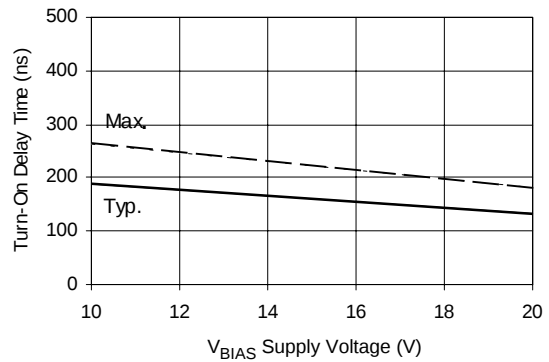


Figure 6B. Turn-On Time vs. Supply Voltage

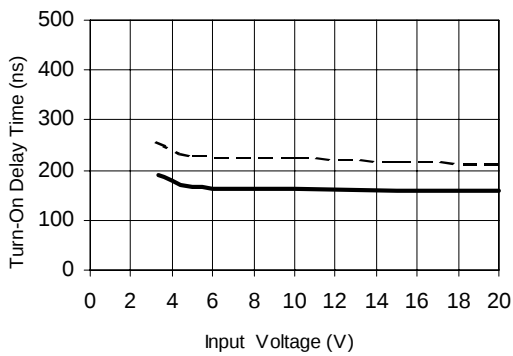


Figure 6C. Turn-On Time vs. Input Voltage

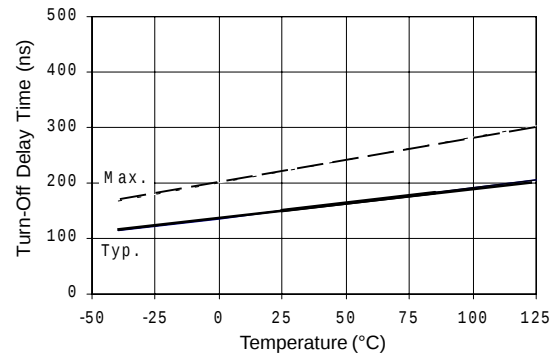


Figure 7A. Turn-Off Time vs. Temperature

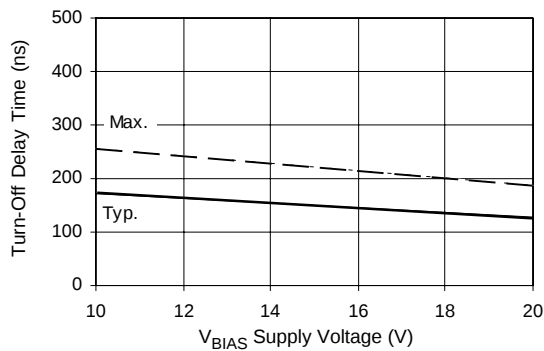


Figure 7B. Turn-Off Time vs. Supply Voltage

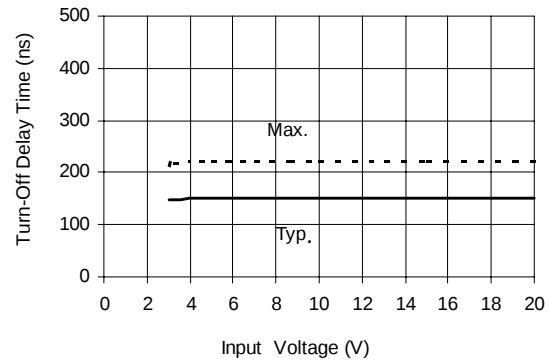


Figure 7C. Turn-Off Time vs. Input Voltage

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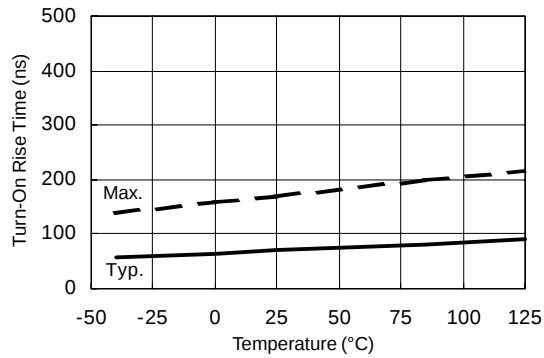


Figure 9A. Turn-On Rise Time vs. Temperature

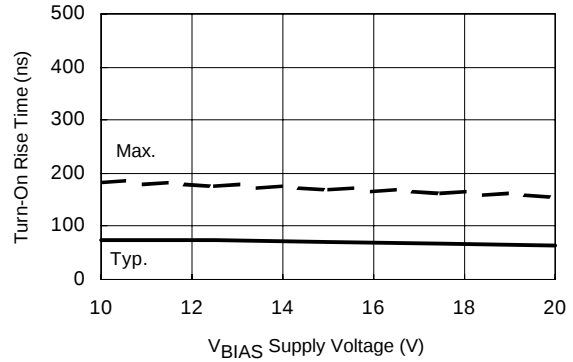


Figure 9B. Turn-On Rise Time vs. Voltage

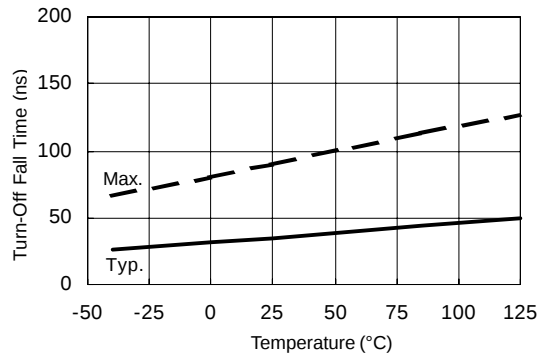


Figure 10A. Turn-Off Fall Time vs. Temperature

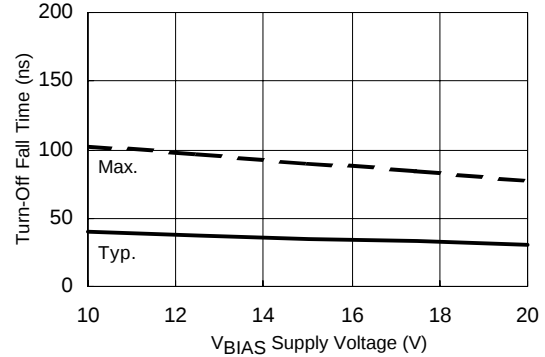


Figure 10B. Turn-Off Fall Time vs. Voltage

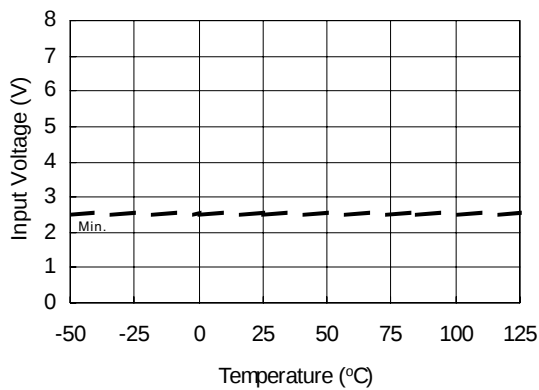


Figure 12A. Logic "1" Input Voltage
vs. Temperature

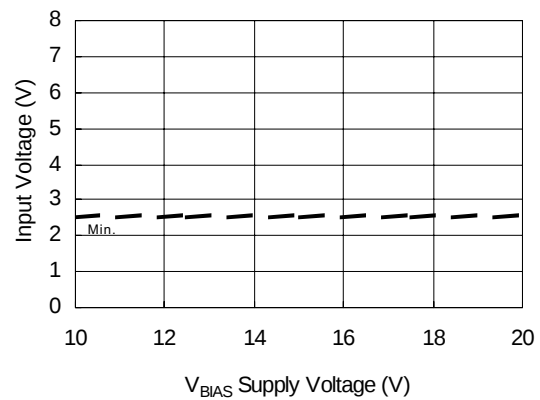


Figure 12B. Logic "1" Input Voltage
vs. Voltage

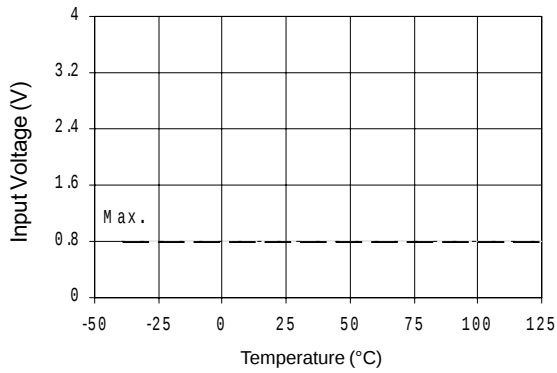


Figure 13A. Logic "0" Input Voltage vs. Temperature

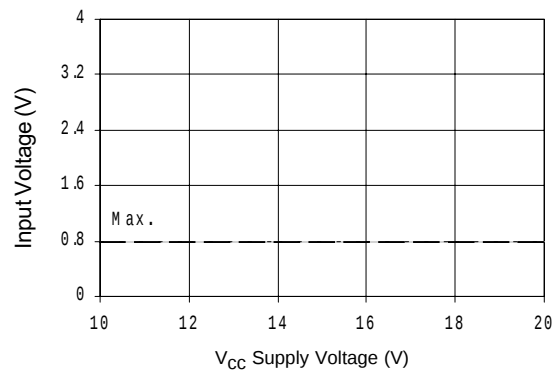


Figure 13B. Logic "0" Input Voltage vs. Supply Voltage

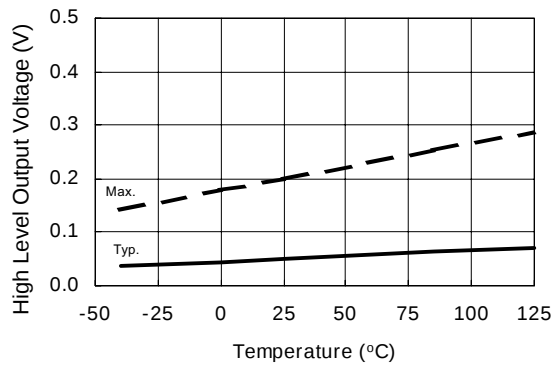


Figure 14A. High Level Output Voltage vs. Temperature

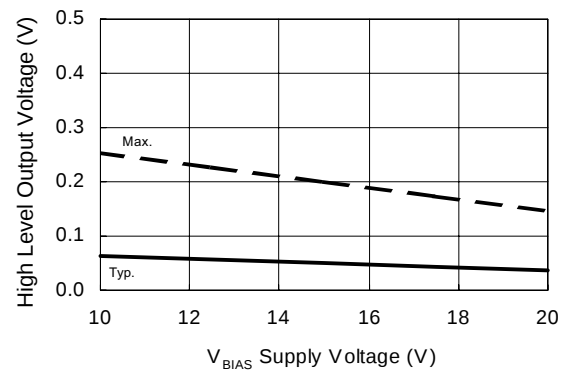


Figure 14B. High Level Output vs. Supply Voltage

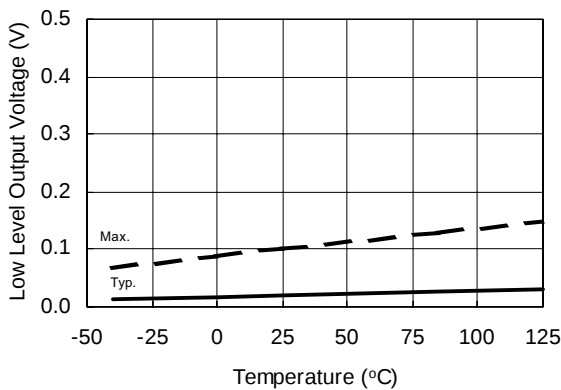


Figure 15A. Low Level Output Voltage vs. Temperature

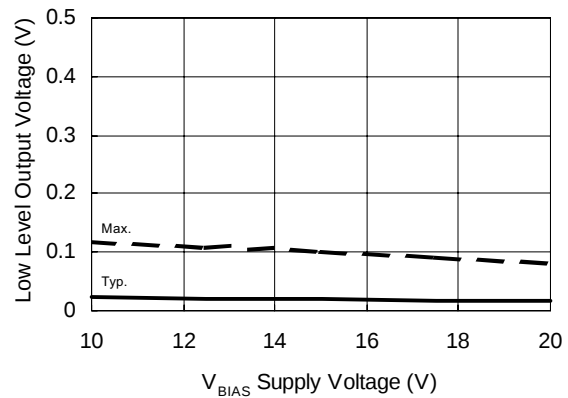


Figure 15B. Low level Output vs. Supply Voltage

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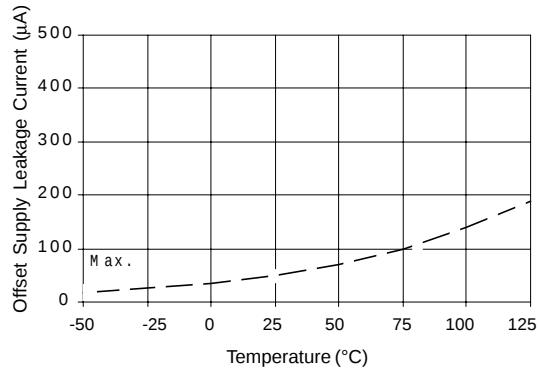


Figure 16A. Offset Supply Current vs. Temperature

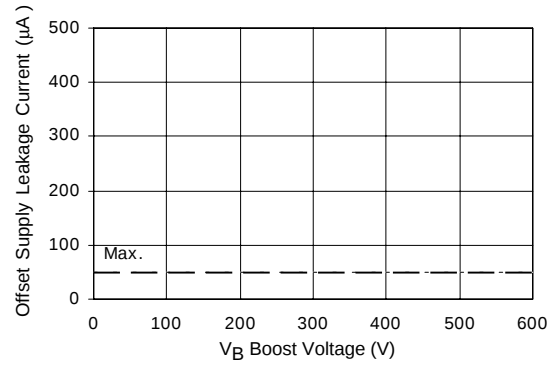


Figure 16B. Offset Supply Current vs. Voltage

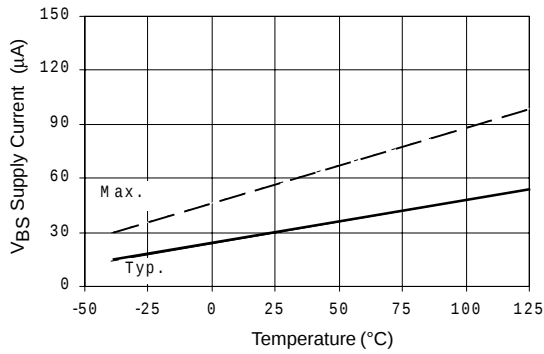


Figure 17A. V_{BS} Supply Current vs. Temperature

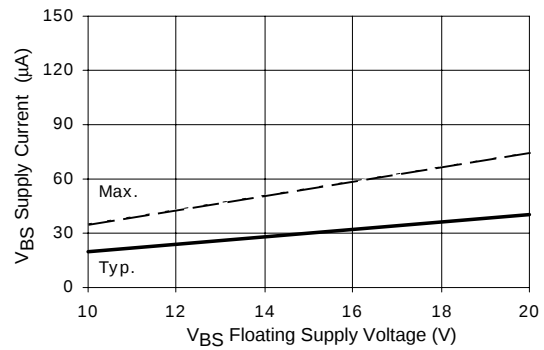


Figure 17B. V_{BS} Supply Current vs. Voltage

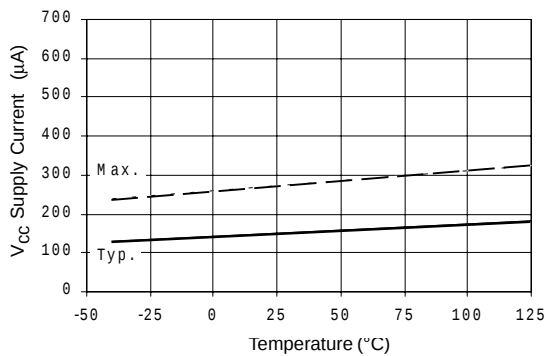


Figure 18A. V_{CC} Supply Current vs. Temperature

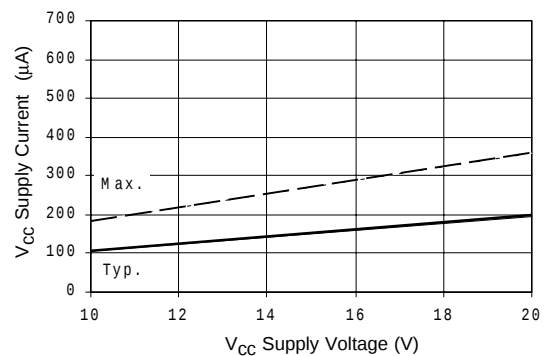


Figure 18B. V_{CC} Supply Current vs. Voltage

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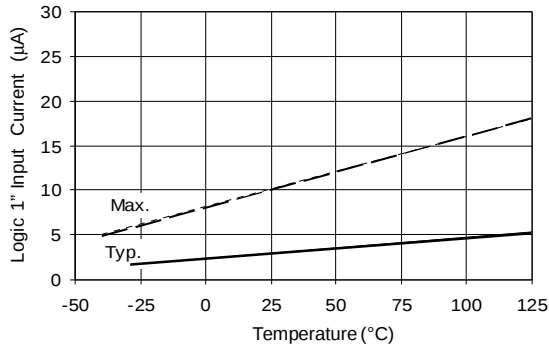


Figure 19A. Logic "1" Input Current vs. Temperature

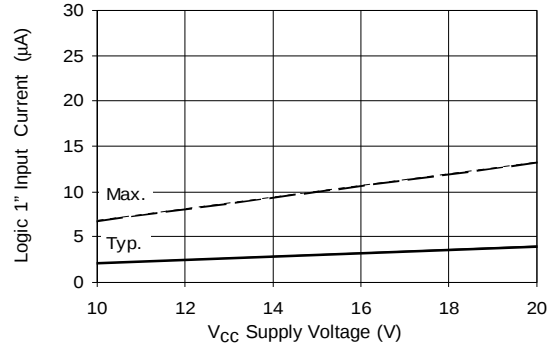


Figure 19B. Logic "1" Input Current vs. Voltage

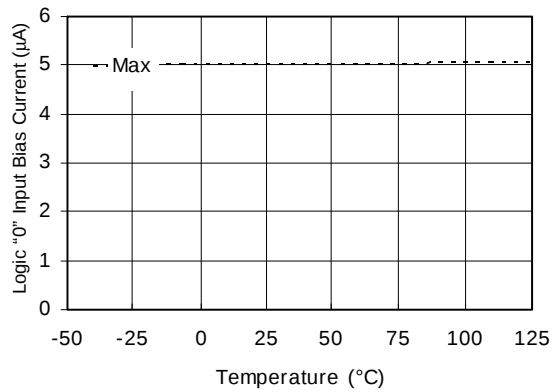


Figure 20A. Logic "0" Input Bias Current vs. Temperature

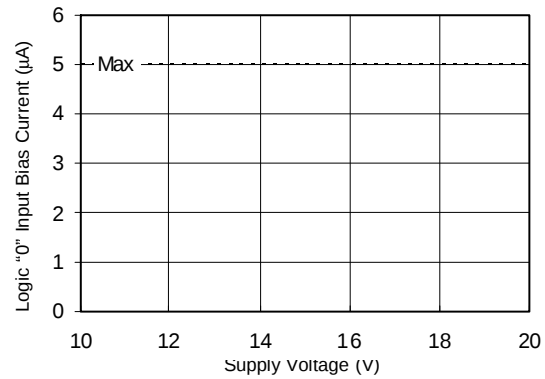


Figure 20B. Logic "0" Input Bias Current vs. Voltage

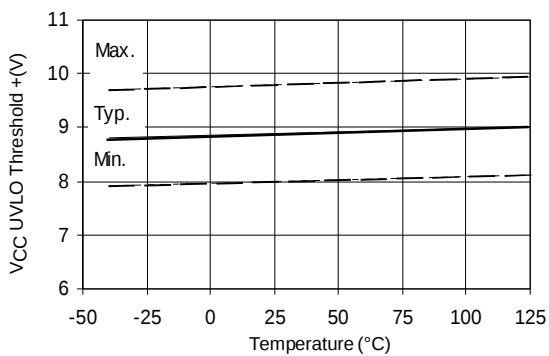


Figure 21A. V_{CC} Undervoltage Threshold(+) vs. Temperature

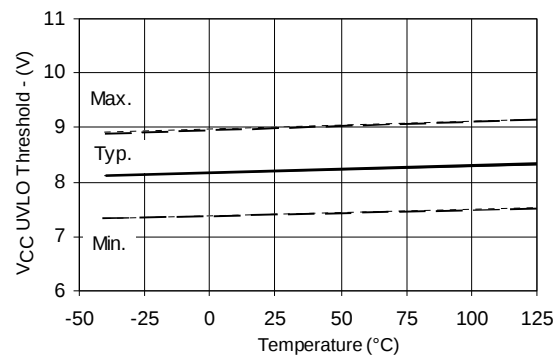


Figure 21B. V_{CC} Undervoltage Threshold(-) vs. Temperature

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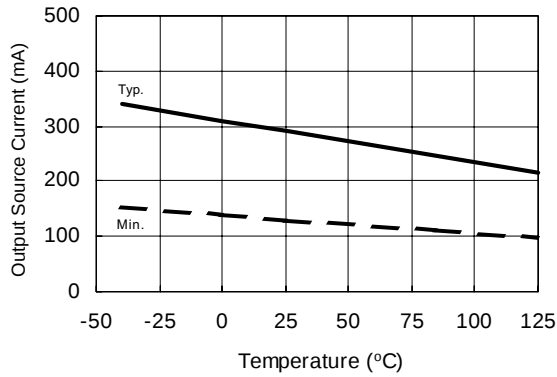


Figure 22A. Output Source Current vs. Temperature

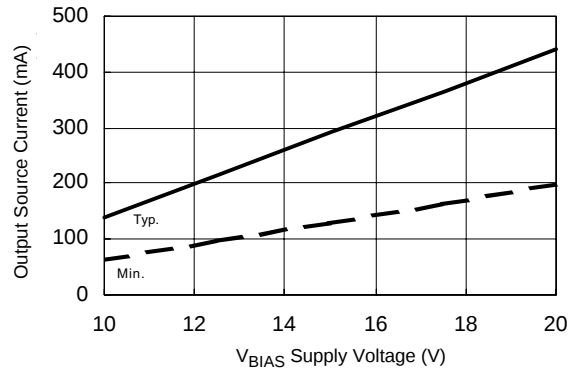


Figure 22B. Output Source Current vs. Supply Voltage

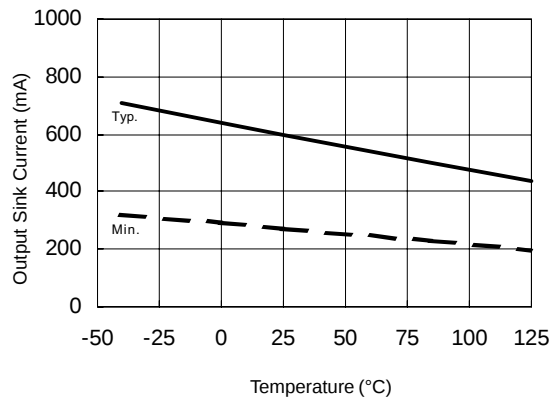


Figure 23A. Output Sink Current vs. Temperature

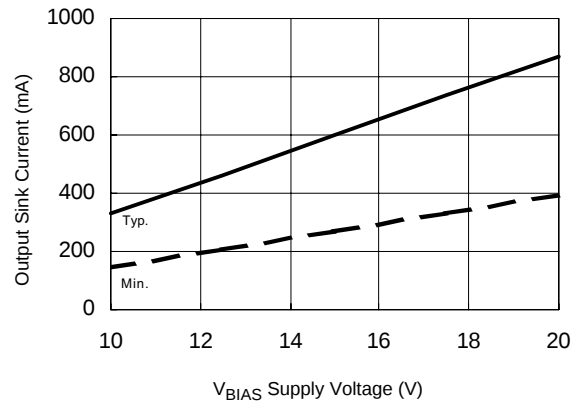
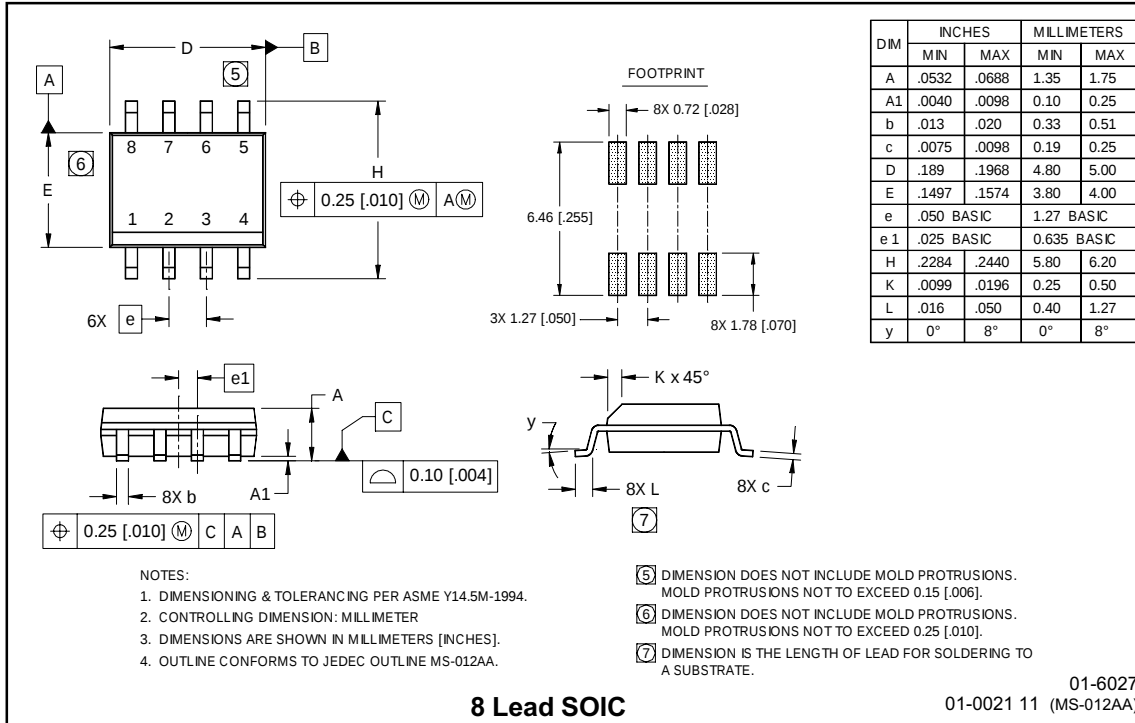
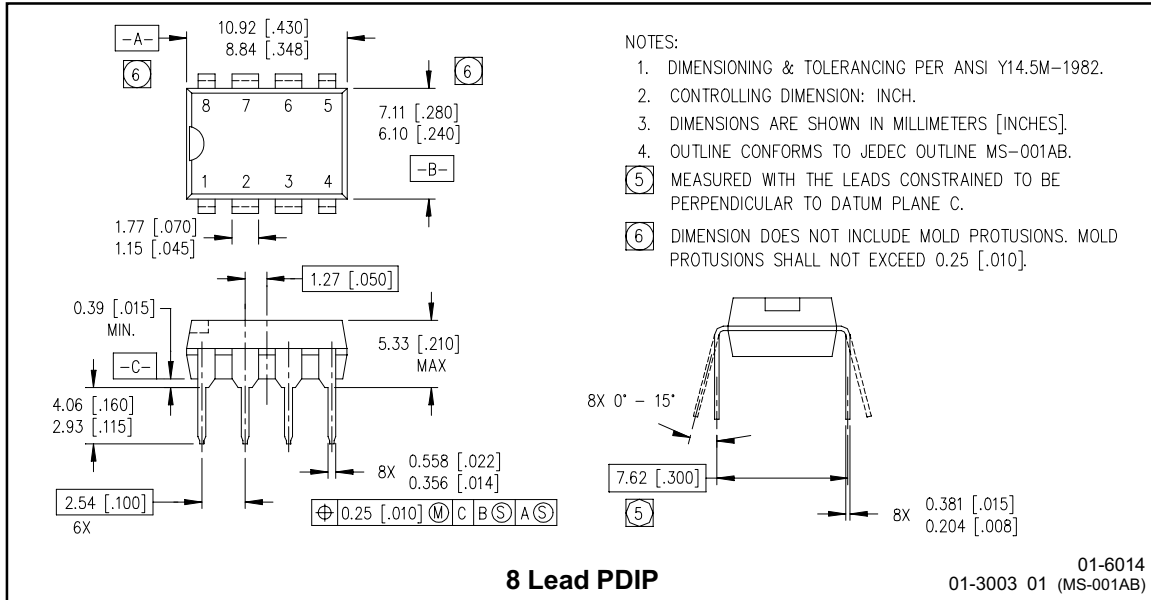


Figure 23B. Output Sink Current vs. Supply Voltage

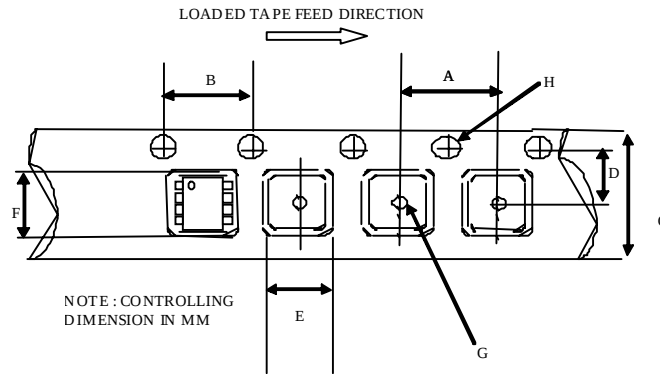
Case Outlines



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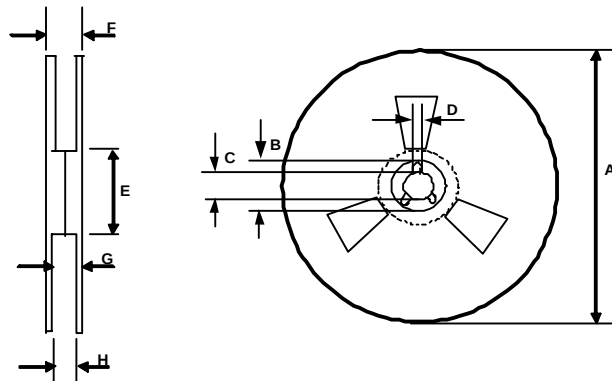
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Tape & Reel 8-lead SOIC



CARRIER TAPE DIMENSION FOR 8SOICN

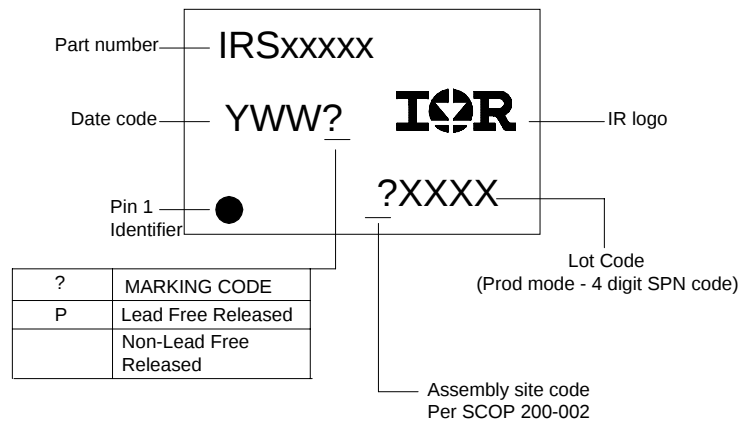
Code	Metric		Imperial	
	Min	Max	Min	Max
A	7.90	8.10	0.311	0.318
B	3.90	4.10	0.153	0.161
C	11.70	12.30	0.46	0.484
D	5.45	5.55	0.214	0.218
E	6.30	6.50	0.248	0.255
F	5.10	5.30	0.200	0.208
G	1.50	n/a	0.059	n/a
H	1.50	1.60	0.059	0.062



REEL DIMENSIONS FOR 8SOICN

Code	Metric		Imperial	
	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



ORDER INFORMATION

8-Lead PDIP IRS2001PbF
8-Lead SOIC IRS2001SPbF
8-Lead SOIC Tape & Reel IRS2001STRPbF