IR2101/IR21014
IR2102/IR21024

HIGH AND LOW SIDE DRIVER

Features

- Floating channel designed for bootstrap operation
  Fully operational to +600V
  Tolerant to negative transient voltage
  dV/dt immune
- Gate drive supply range from 10 to 20V
- Undervoltage lockout
- 5V Schmitt-triggered input logic
- Matched propagation delay for both channels
- Outputs in phase with inputs (IR2101/IR21014) or out of phase with inputs (IR2102/IR21024)

Description

The IR2101/IR21014/IR2102/IR21024 are high voltage, high speed power MOSFET and IGBT drivers with independent 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. 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 600 volts.
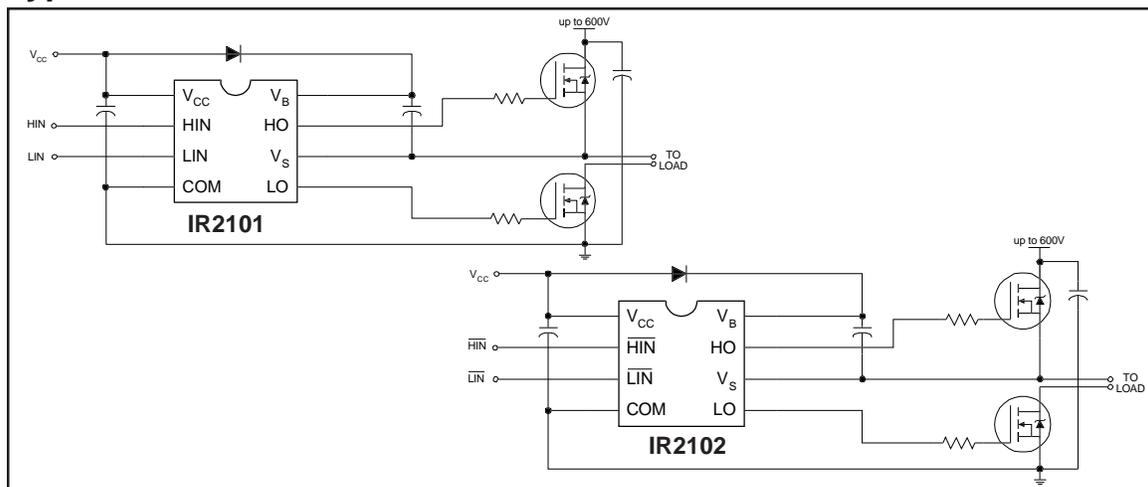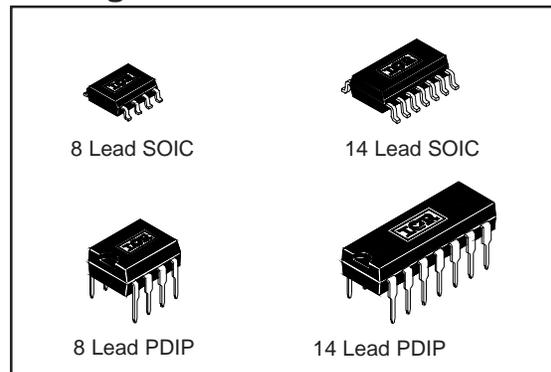
Product Summary

V_{OFFSET}	600V max.
I_O +/-	130 mA / 270 mA
V_{OUT}	10 - 20V
$t_{on/off}$ (typ.)	160 & 150 ns
Delay Matching	50 ns

Packages

8 Lead SOIC   14 Lead SOIC

8 Lead PDIP   14 Lead PDIP

Typical Connection

IR2101/IR21014/IR2102/IR21024

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	625	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 @ $T_A \leq$ +25°C	(8 lead PDIP)	—	1.0	W
		(8 lead SOIC)	—	0.625	
		(14 lead PDIP)	—	1.6	
		(14 lead SOIC)	—	1.0	
Rth_{JA}	Thermal resistance, junction to ambient	(8 lead PDIP)	—	125	°C/W
		(8 lead SOIC)	—	200	
		(14 lead PDIP)	—	75	
		(14 lead SOIC)	—	120	
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 figure 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 15V 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	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 (HIN & LIN) (IR2101) & ($\overline{HIN}$ & $\overline{LIN}$) (IR2102)	0	V_{CC}	
T_A	Ambient temperature	-40	125	°C

Note 1: Logic operational for V_S of -5 to +600V. Logic state held for V_S of -5V to -V_{BS}.

Dynamic Electrical Characteristics

V_{BIAS} (V_{CC}, V_{BS}) = 15V, 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		$V_S = 0V$
t_{off}	Turn-off propagation delay	—	150	220		$V_S = 600V$
t_r	Turn-on rise time	—	100	170	ns	
t_f	Turn-off fall time	—	50	90		
MT	Delay matching, HS & LS turn-on/off	—	—	50		

Static Electrical Characteristics

V_{BIAS} (V_{CC}, V_{BS}) = 15V 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.

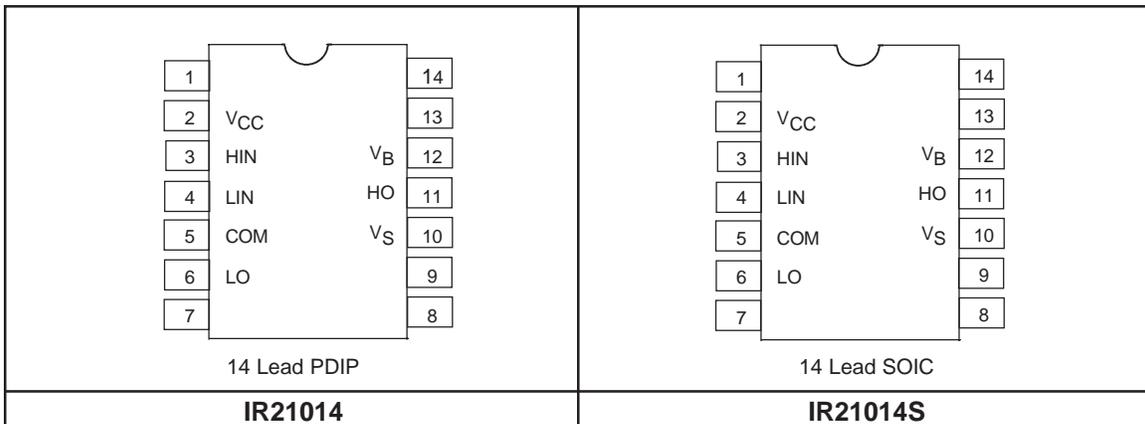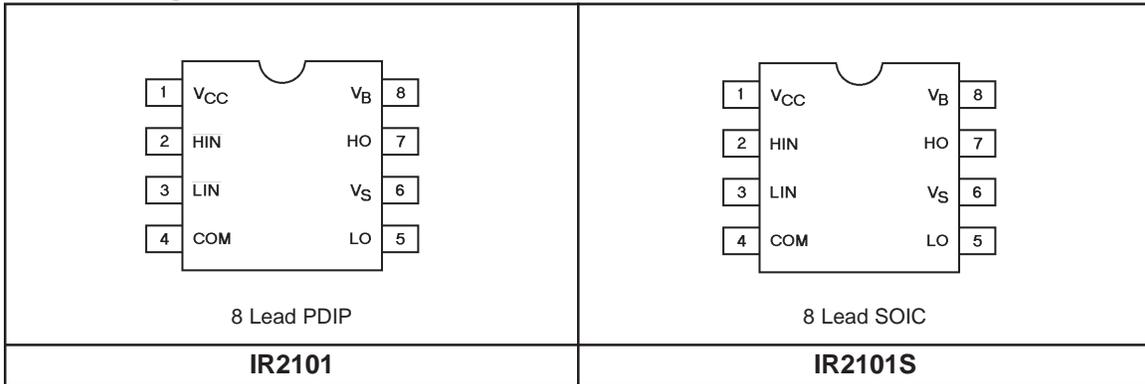| Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
V_{IH}	Logic "1" input voltage (IR2101) Logic "0" input voltage (IR2102)	3	—	—	V	V_{CC} = 10V to 20V
V_{IL}	Logic "0" input voltage (IR2101) Logic "1"input voltage (IR2102)	—	—	0.8		V_{CC} = 10V to 20V
V_{OH}	High level output voltage, V_{BIAS} - V_O	—	—	100	mV	$I_O = 0A$
V_{OL}	Low level output voltage, V_O	—	—	100		$I_O = 0A$
I_{LK}	Offset supply leakage current	—	—	50		$V_B = V_S = 600V$
I_{QBS}	Quiescent V_{BS} supply current	—	30	55		V_{IN} = 0V or 5V
I_{QCC}	Quiescent V_{CC} supply current	—	150	270		V_{IN} = 0V or 5V
I_{IN+}	Logic "1" input bias current	—	3	10	µA	V_{IN} = 5V (IR2101) V_{IN} = 0V (IR2102)
I_{IN-}	Logic "0" input bias current	—	—	1		V_{IN} = 0V (IR2101) V_{IN} = 5V (IR2102)
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	130	210	—	mA	$V_O = 0V$ V_{IN} = Logic "1" PW ≤ 10 µs
I_{O-}	Output low short circuit pulsed current	270	360	—		$V_O = 15V$ V_{IN} = Logic "0" PW ≤ 10 µs

IR2101/IR21014/IR2102/IR21024

Functional Block Diagram

IR2101/IR21014
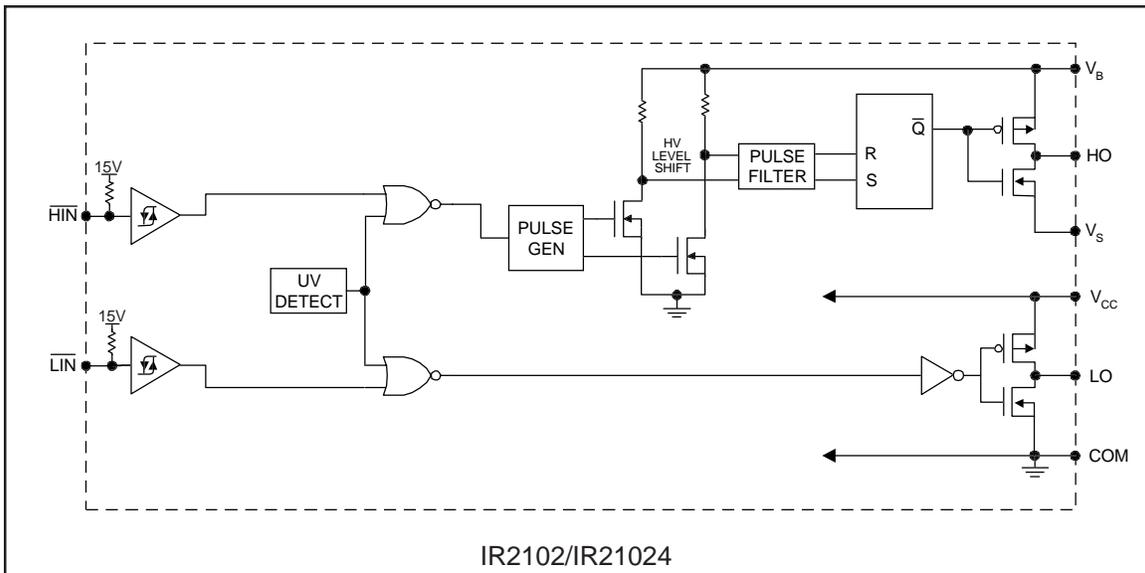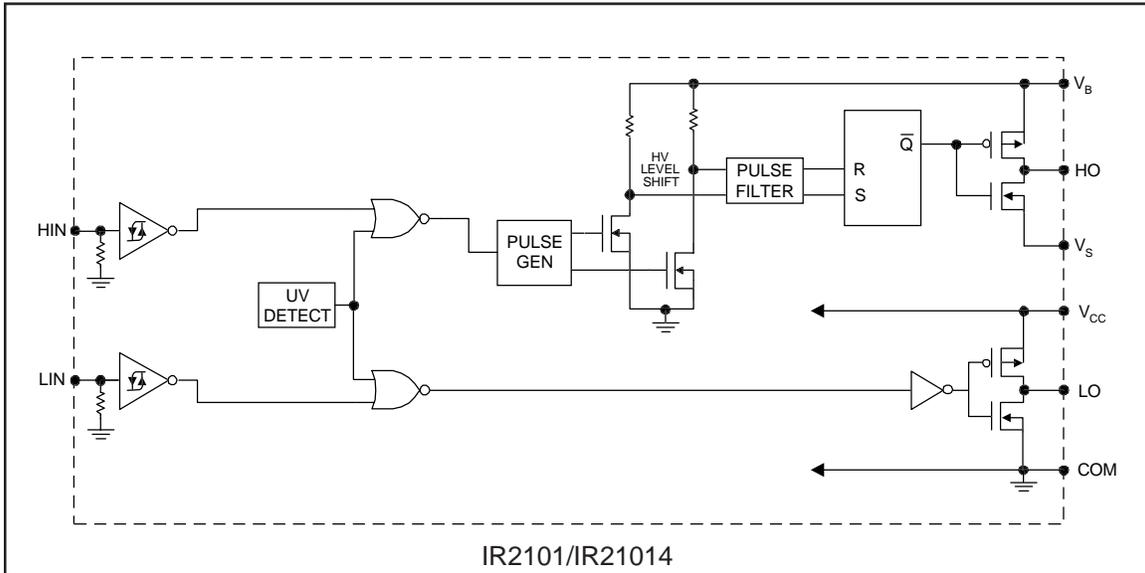
IR2102/IR21024

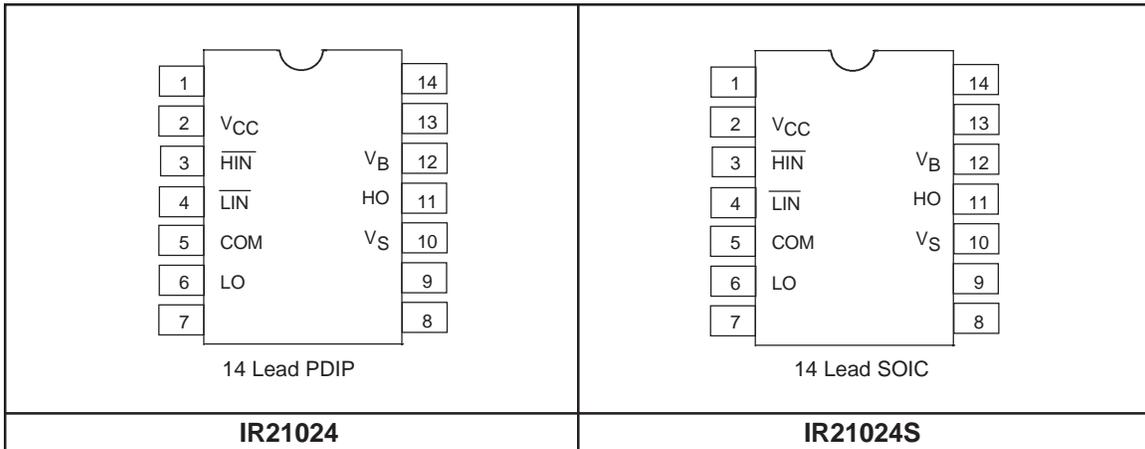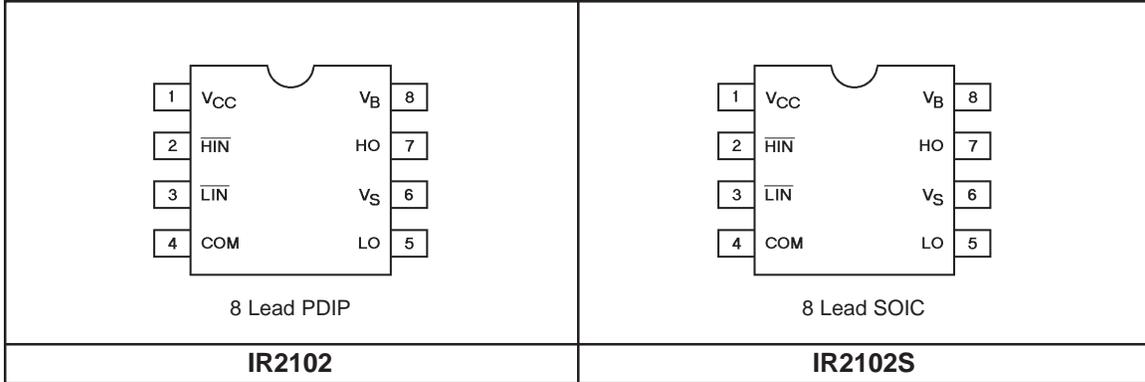## Lead Definitions

Symbol	Description
HIN	Logic input for high side gate driver output (HO), in phase (IR2101)
$\overline{\text{HIN}}$	Logic input for high side gate driver output (HO), out of phase (IR2102)
LIN	Logic input for low side gate driver output (LO), in phase (IR2101)
$\overline{\text{LIN}}$	Logic input for low side gate driver output (LO), out of phase (IR2102)
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 IR2101

8 Lead PDIP

IR2101

8 Lead SOIC

IR2101S

14 Lead PDIP

IR21014

14 Lead SOIC

IR21014S

IR2101/IR21014/IR2102/IR21024

International **IGR** Rectifier

Lead Assignments IR2102

1 V$_{CC}$ V$_B$ 8 2 $\overline{HIN}$ HO 7 3 $\overline{LIN}$ V$_S$ 6 4 COM LO 5 8 Lead PDIP	1 V$_{CC}$ V$_B$ 8 2 $\overline{HIN}$ HO 7 3 $\overline{LIN}$ V$_S$ 6 4 COM LO 5 8 Lead SOIC
IR2102	**IR2102S**

1
2 V$_{CC}$ 14
3 $\overline{HIN}$ 13
4 $\overline{LIN}$ V$_B$ 12
5 COM HO 11
6 LO V$_S$ 10
7 9
  8
 	
14 Lead PDIP
	1
	2 V$_{CC}$ 14
	3 $\overline{HIN}$ 13
	4 $\overline{LIN}$ V$_B$ 12
	5 COM HO 11
	6 LO V$_S$ 10
	7 9
	  8
	
	14 Lead SOIC

IR21024	**IR21024S**

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NOTES:

1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-001AB.
5. MEASURED WITH THE LEADS CONSTRAINED TO BE PERPENDICULAR TO DATUM PLANE C.
6. DIMENSION DOES NOT INCLUDE MOLD PROTUSIONS. MOLD PROTUSIONS SHALL NOT EXCEED 0.25 [.010].

8 Lead PDIP

01-3003 01

RECOMMENDED FOOTPRINT

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.0532	.0688	1.35	1.75
A1	.0040	.0098	0.10	0.25
B	.014	.018	0.36	0.46
C	.0075	.0098	0.19	0.25
D	.189	.196	4.80	4.98
E	.150	.157	3.81	3.99
e	.050	BASIC	1.27	BASIC
e1	.025	BASIC	0.635	BASIC
H	.2284	.2440	5.80	6.20
K	.011	.019	0.28	0.48
L	.016	.050	0.41	1.27
y	0°	8°	0°	8°

NOTES:

1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1982.
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 0.25 [.006].
6. DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.

8 Lead SOIC

01-0021 08

International
IQR Rectifier

NOTES:
1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-001AC.
5. MEASURED WITH THE LEADS CONSTRAINED TO BE PERPENDICULAR TO DATUM PLANE C.
6. DIMENSION DOES NOT INCLUDE MOLD PROTUSIONS. MOLD PROTUSIONS SHALL NOT EXCEED 0.25 [.010].

20.19 [.795]
18.42 [.725]
−A−

7.11 [.280]
6.10 [.240]
−B−

14

1

14X 1.77 [.070]
1.15 [.045]

0.39 [.015]
MIN.
−C−

4.06 [.160]
2.93 [.115]

5.33 [.210]
MAX

14X 0° − 15°

2.54 [.100]
12X

14X 0.558 [.022]
0.356 [.014]

⊕ 0.25 [.010] Ⓜ C B Ⓢ A Ⓢ

7.62 [.300]
5

14X 0.381 [.015]
0.204 [.008]

14 Lead PDIP

01-3002 03

NOTES:
1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1982.
2. CONTROLLING DIMENSION: MILLIMETER
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AB.
5. DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.
6. DIMENSION DOES NOT INCLUDE MOLD PROTUSIONS. MOLD PROTUSIONS SHALL NOT EXCEED 0.15 [.006].

8.74 [.344]
8.56 [.337]

−A− 6

6
3.99 [.157]
3.81 [.150]
−B−

14

1

6.20 [.2440]
5.80 [.2284]

⊕ 0.25 [.010] Ⓜ C B Ⓜ

−C−

0.25 [.0098]
0.10 [.0040]

1.27 [.050]
12X

0.46 [.018]
0.36 [.014] 14X

⊕ 0.25 [.010] Ⓜ C B Ⓢ A Ⓢ

0.48 [.019]
0.28 [.011] X 45°

0° − 8°

1.75 [.0688]
1.35 [.0532]

1.27 [.050]
0.41 [.016]

5 14X

0.25 [.0098]
0.19 [.0075] 14X

14 Lead SOIC (narrow body)

01-3063 00

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IR2101/IR21014/IR2102/IR21024

Figure 1. Input/Output Timing Diagram

Figure 2. Switching Time Waveform Definitions

Figure 3. Delay Matching Waveform Definitions

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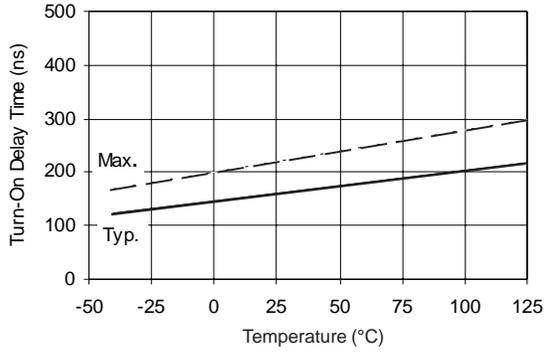
Figure 6A. Turn-On Time vs Voltage
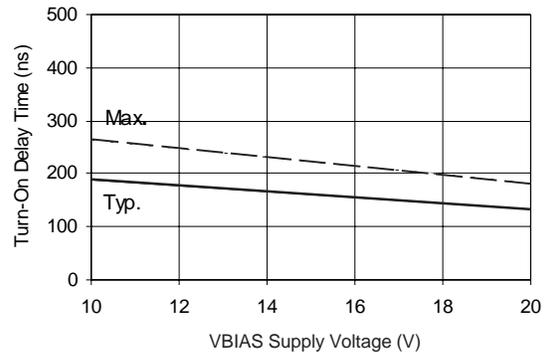
Figure 6B. Turn-On Time vs Voltage
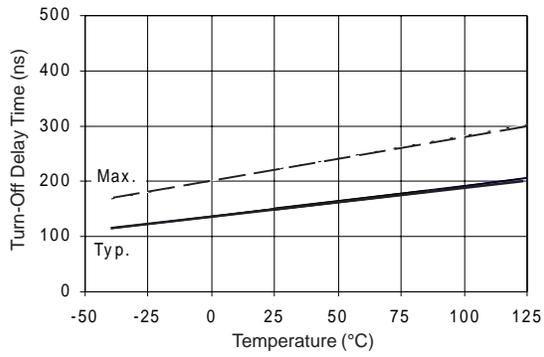
Figure 7A. Turn-Off Time vs Temperature
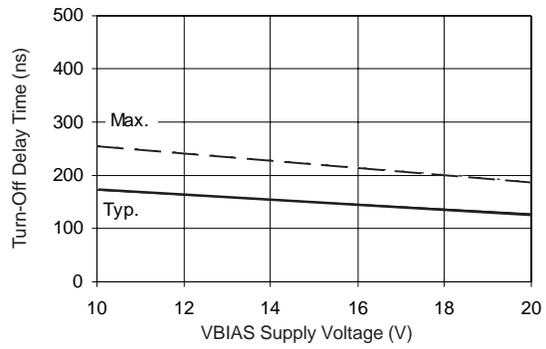
Figure 7B. Turn-Off Time vs Voltage
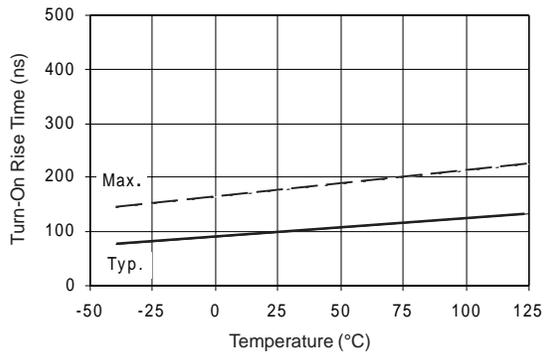
Figure 9A. Turn-On Rise Time vs Temperature
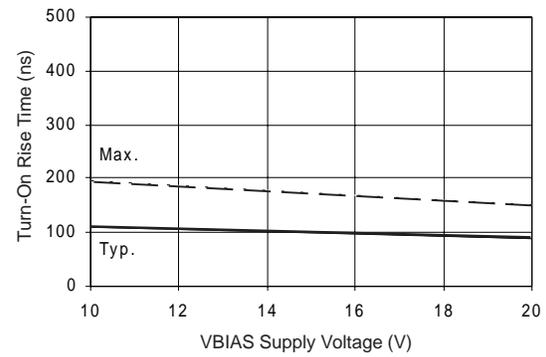
Figure 9B. Turn-On Rise Time vs Voltage

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International **IZR** Rectifier

IR2101/IR21014/IR2102/IR21024
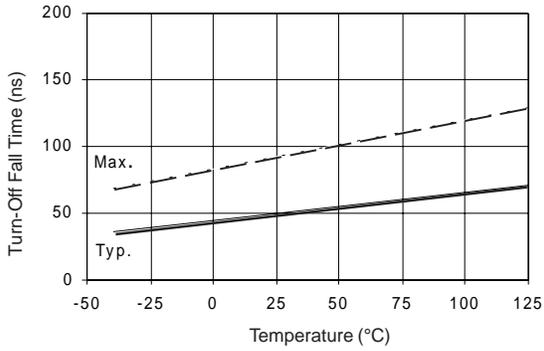
Figure 10A. Turn-Off Fall Time vs Temperature
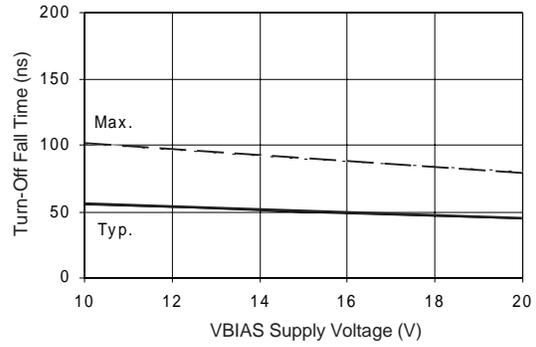
Figure 10B. Turn-Off Fall Time vs Voltage
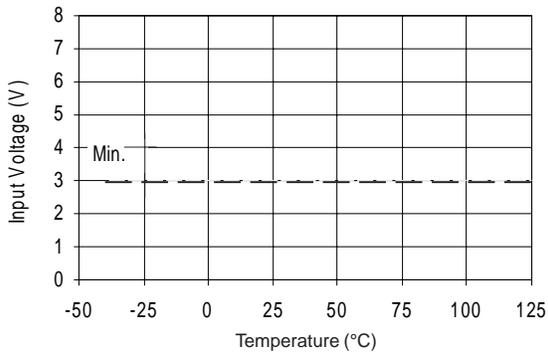
Figure 12A. Logic "1" Input Voltage (IR2101)
Logic "0" Input Voltage (IR2102)
vs Temperature
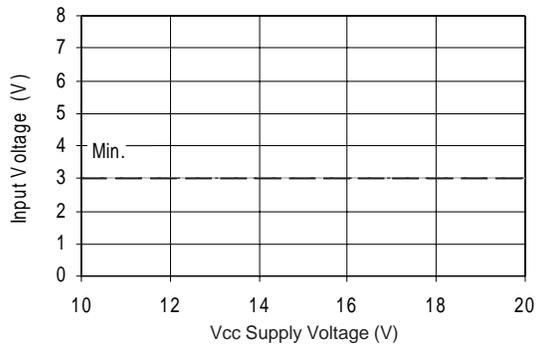
Figure 12B. Logic "1" Input Voltage (IR2101)
Logic "0" Input Voltage (IR2102)
vs Voltage
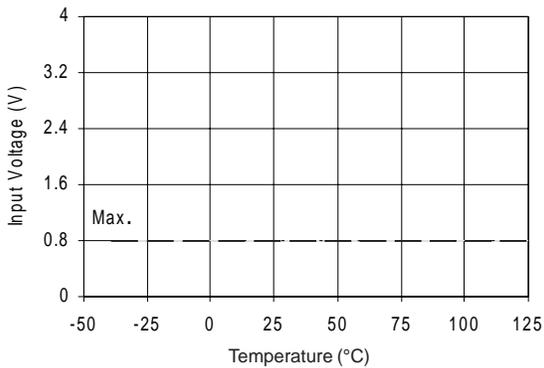
Figure 13A. Logic "0" Input Voltage (IR2101)
Logic "1" Input Voltage (IR2102)
vs Temperature
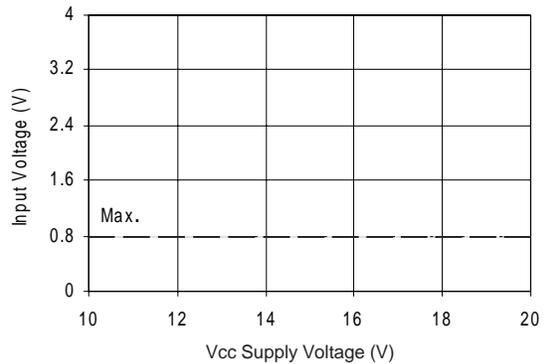
Figure 13B. Logic "0" Input Voltage (IR2101)
Logic "1" Input Voltage (IR2102)
vs Voltage

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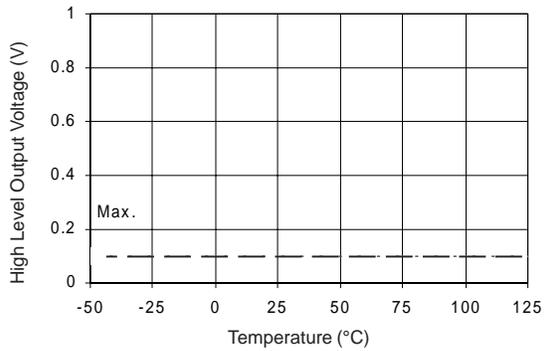
**Figure 14A. High Level Output
vs Temperature**
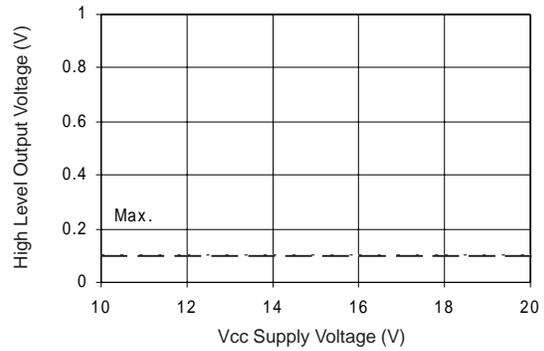
Figure 14B. High Level Output vs Voltage
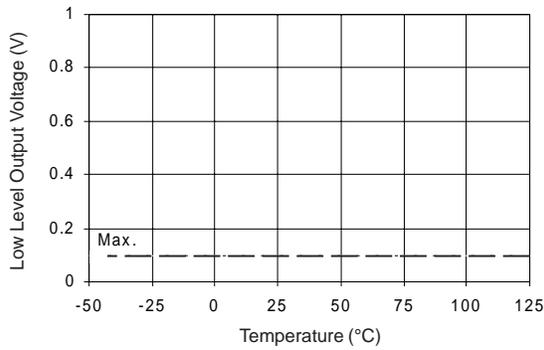
**Figure 15A. Low Level Output
vs Temperature**
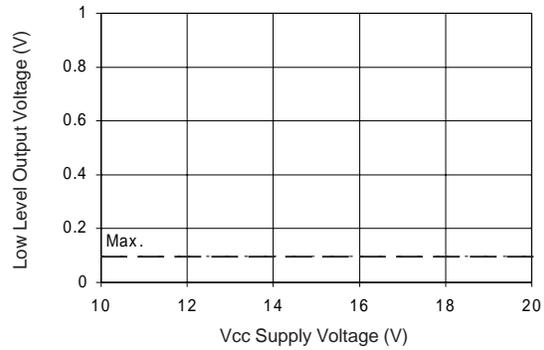
Figure 15B. Low level Output vs Voltage
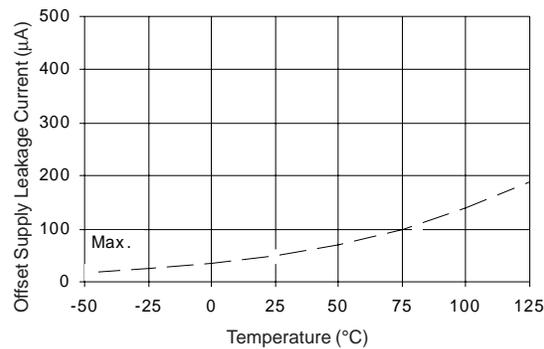
**Figure 16A. Offset Supply Current
vs Temperature**
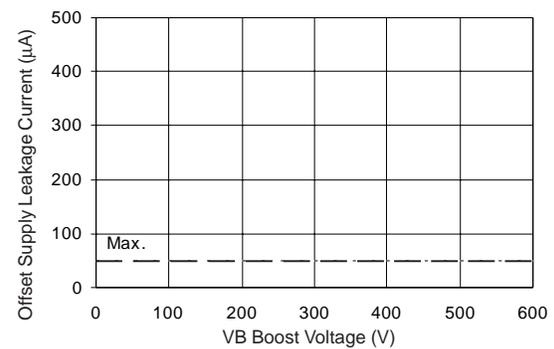
**Figure 16B. Offset Supply Current
vs Voltage**
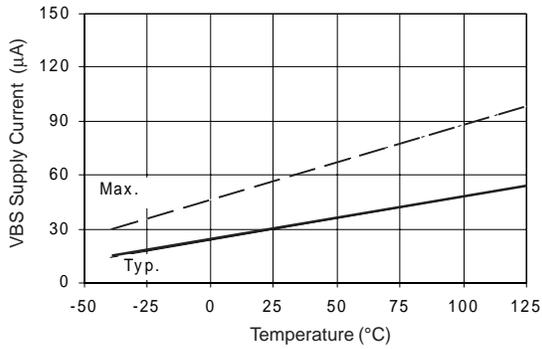
**Figure 17A. V_BS Supply Current
vs Temperature**
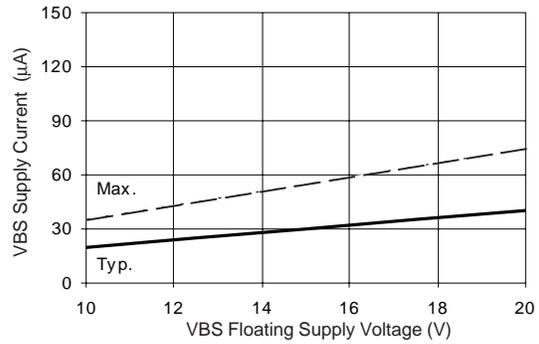
**Figure 17B. V_BS Supply Current
vs Voltage**
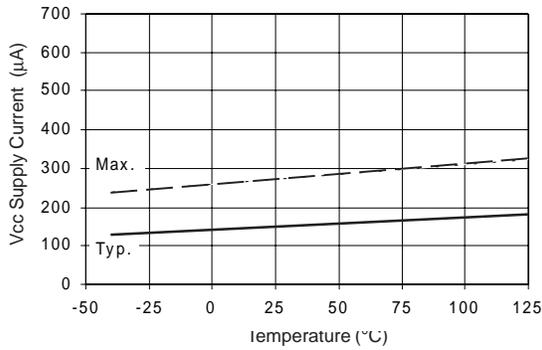
**Figure 18A. Vcc Supply Current
vs Temperature**
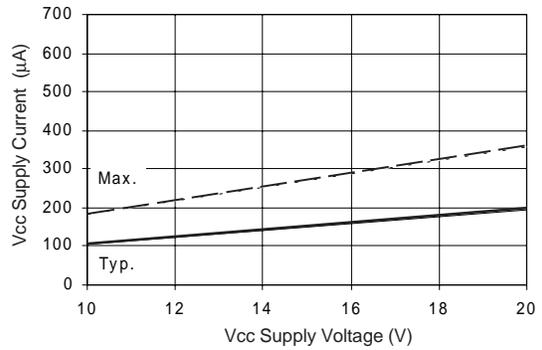
**Figure 18B. Vcc Supply Current
vs Voltage**
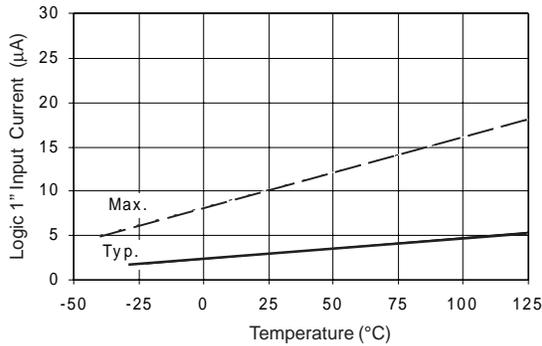
**Figure 19A. Logic"1" Input Current
vs Temperature**
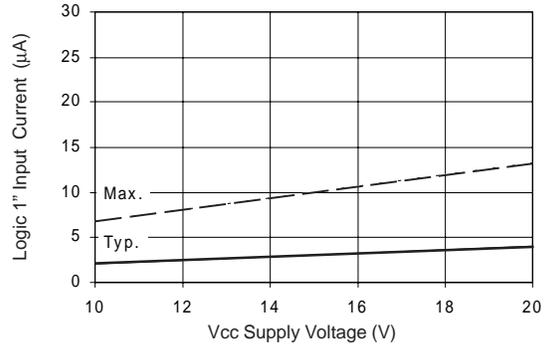
**Figure 19B. Logic"1" Input Current
vs Voltage**
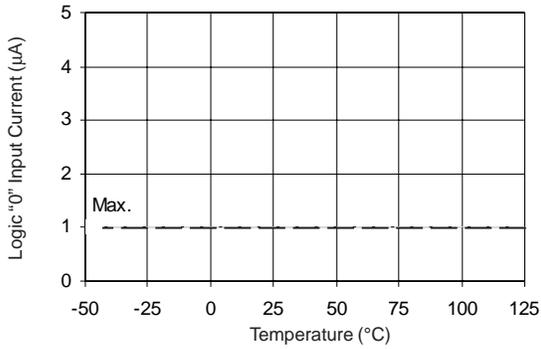
**Figure 20A. Logic "0" Input Current
vs Temperature**
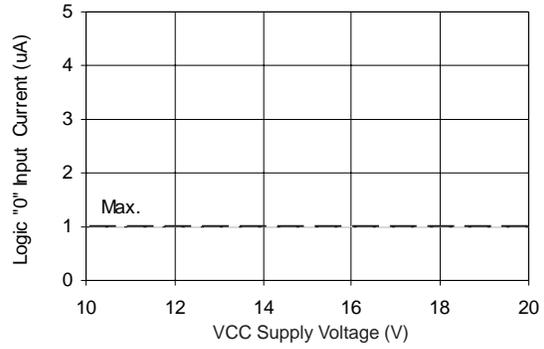
**Figure 20B.   Logic "0" Input Current
vs Voltage**
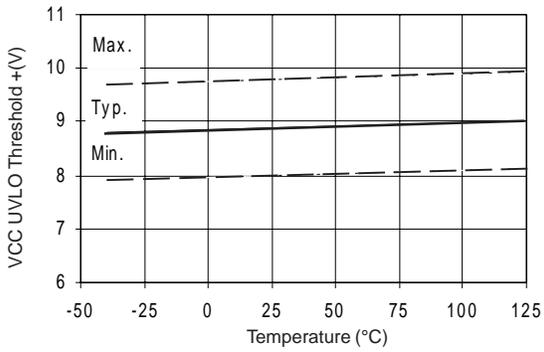
**Figure 21A. Vcc Undervoltage Threshold(+)
vs Temperature**
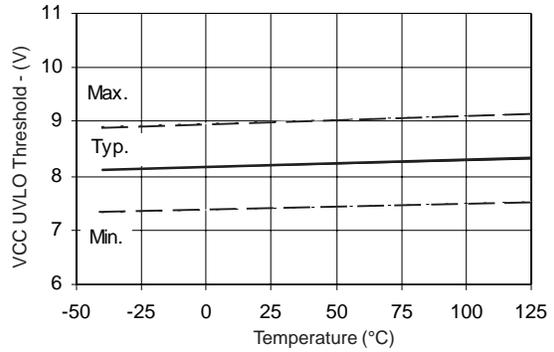
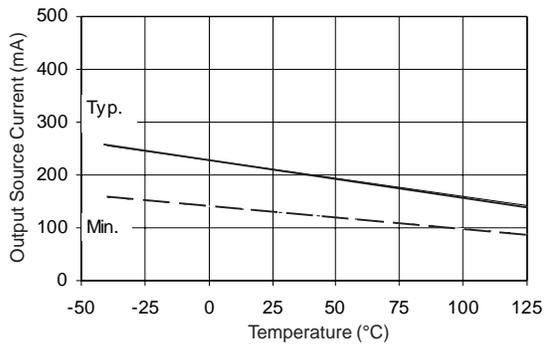**Figure 21B. Vcc Undervoltage Threshold(-)
vs Temperature**

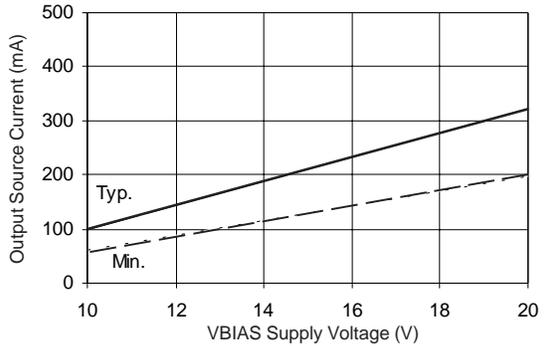**Figure 22A. Output Source Current
vs Temperature**

**Figure 22B. Output Source Current
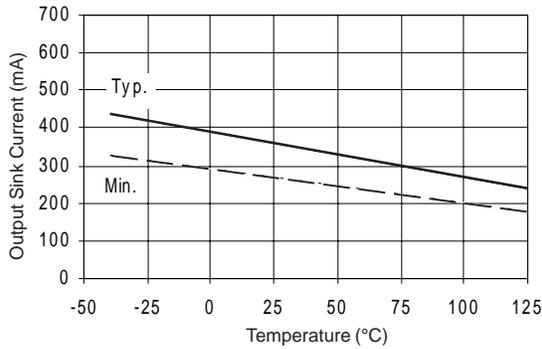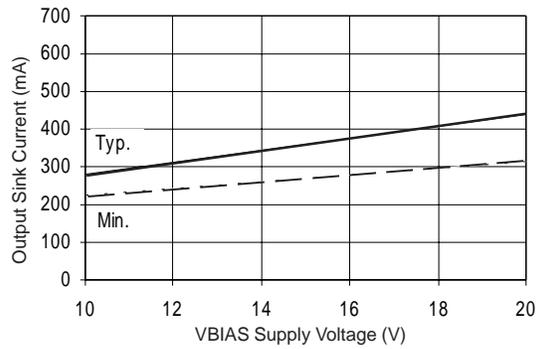vs Voltage**

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**Figure 23A. Output Sink Current
vs Temperature**

**Figure 23B. Output Sink Current
vs Voltage**