International
IOR Rectifier

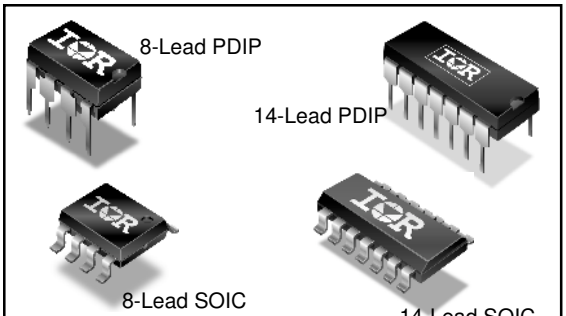
IRS2108/IRS21084(S)PbF

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
- 3.3 V, 5 V, and 15 V input logic compatible
- Cross-conduction prevention logic
- Matched propagation delay for both channels
- High-side output in phase with HIN input
- Low-side output out of phase with $\overline{\text{LIN}}$ input
- Logic and power ground +/- 5 V offset
- Internal 540 ns deadtime, and programmable up to 5 μs with one external R_{DT} resistor (IRS21084)
- Lower di/dt gate driver for better noise immunity
- RoHS compliant

Packages



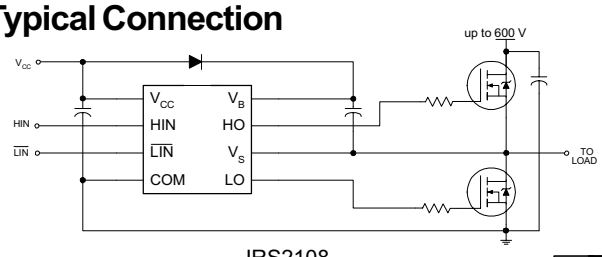
Description

The IRS2108/IRS21084 are high voltage, high speed power MOSFET and IGBT drivers 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 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 600 V.

Feature Comparison

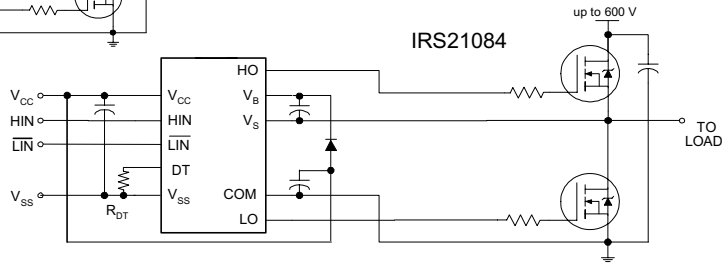
Part	Input logic	Cross-conduction prevention logic	Deadtime (ns)	Ground Pins	t_{on}/t_{off} (ns)
2106/2301	HIN/LIN	no	none	COM	220/200
21064				Vss/COM	
2108	HIN/$\overline{\text{LIN}}$	yes	Internal 540	COM	220/200
21084			Programmable 540 - 5000	Vss/COM	
2109/2302	IN/$\overline{\text{SD}}$	yes	Internal 540	COM	750/200
21094			Programmable 540 - 5000	Vss/COM	
2304	HIN/LIN	yes	Internal 100	COM	160/140

Typical Connection



IRS2108

IRS21084



(Refer to Lead Assignments for correct pin configuration). These diagrams show 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.

Symbol	Definition		Min.	Max.	Units
V_B	High-side floating absolute 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	
DT	Programmable deadtime pin voltage (IRS21084 only)		V_{SS} - 0.3	V_{CC} + 0.3	
V_{IN}	Logic input voltage (HIN & $\overline{LIN}$)		V_{SS} - 0.3	V_{CC} + 0.3	
V_{SS}	Logic ground (IRS21084 only)		V_{CC} - 25	V_{CC} + 0.3	
dV_S/dt	Allowable offset supply voltage transient		—	50	V/ns
P_D	Package power dissipation @ $T_A \leq +25\ ^oC$	(8 lead PDIP)	—	1.0	W
		(8 lead SOIC)	—	0.625	
		(14 lead PDIP)	—	1.6	
		(14 lead SOIC)	—	1.0	
R_{thJA}	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		-50	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 and V_{SS} offset rating are tested with all supplies biased at a 15 V differential.

Symbol	Definition		Min.	Max.	Units
VB	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	IRS2108	COM	V_{CC}	
		IRS21084	V_{SS}	V_{CC}	
DT	Programmable deadtime pin voltage (IRS21084 only)		V_S	V_{CC}	
V_{SS}	Logic ground (IRS21084 only)		-5	5	
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).

Dynamic Electrical Characteristics

V_{BIAS} (V_{CC}, V_{BS}) = 15 V, V_{SS} = COM, C_L = 1000 pF, T_A = 25 °C, DT = V_{SS} unless otherwise specified.

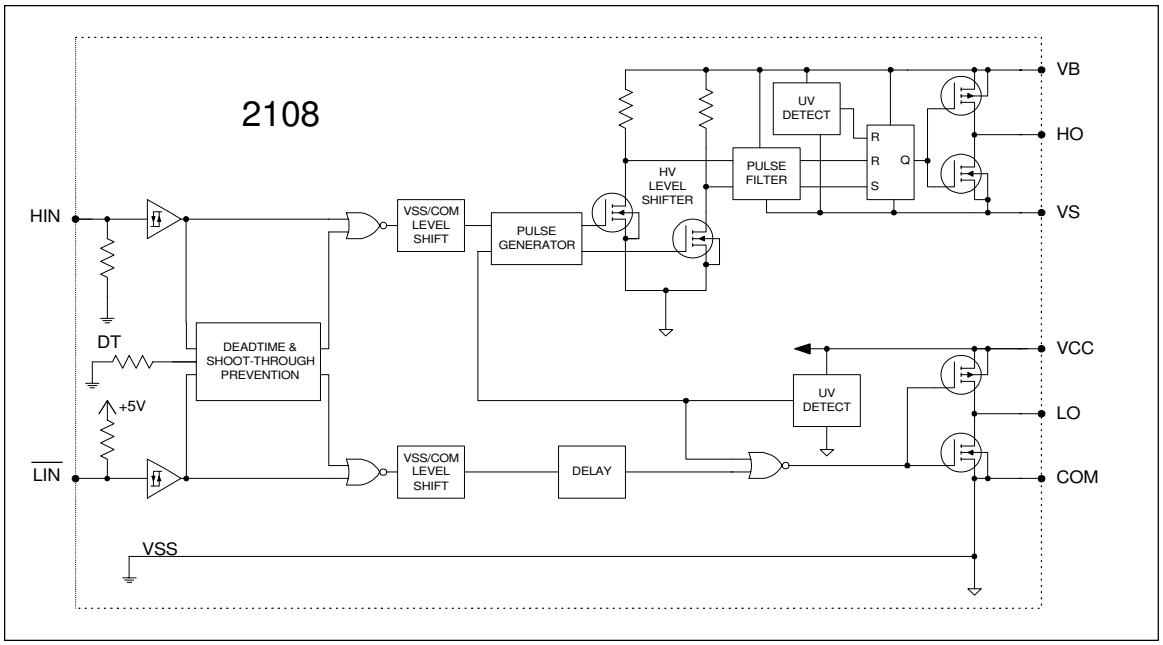
Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
t_{on}	Turn-on propagation delay	—	220	300		V_S = 0 V
t_{off}	Turn-off propagation delay	—	200	280		V_S = 0 V or 600 V
MT	Delay matching | t_{on} - t_{off} |	—	0	30		
t_r	Turn-on rise time	—	100	220		
t_f	Turn-off fall time	—	35	80		
DT	Deadtime: LO turn-off to HO turn-on(DT_{LO-HO}) &	400	540	680		R_{DT}= 0 Ω
	HO turn-off to LO turn-on (DT_{HO-LO})	4	5	6	µs	R_{DT} = 200 kΩ (IR21084)
MDT	Deadtime matching = | DT_{LO-HO} - DT_{HO-LO} |	—	0	60	ns	R_{DT}=0 Ω
		—	0	600		R_{DT}= 200 kΩ (IR21084)

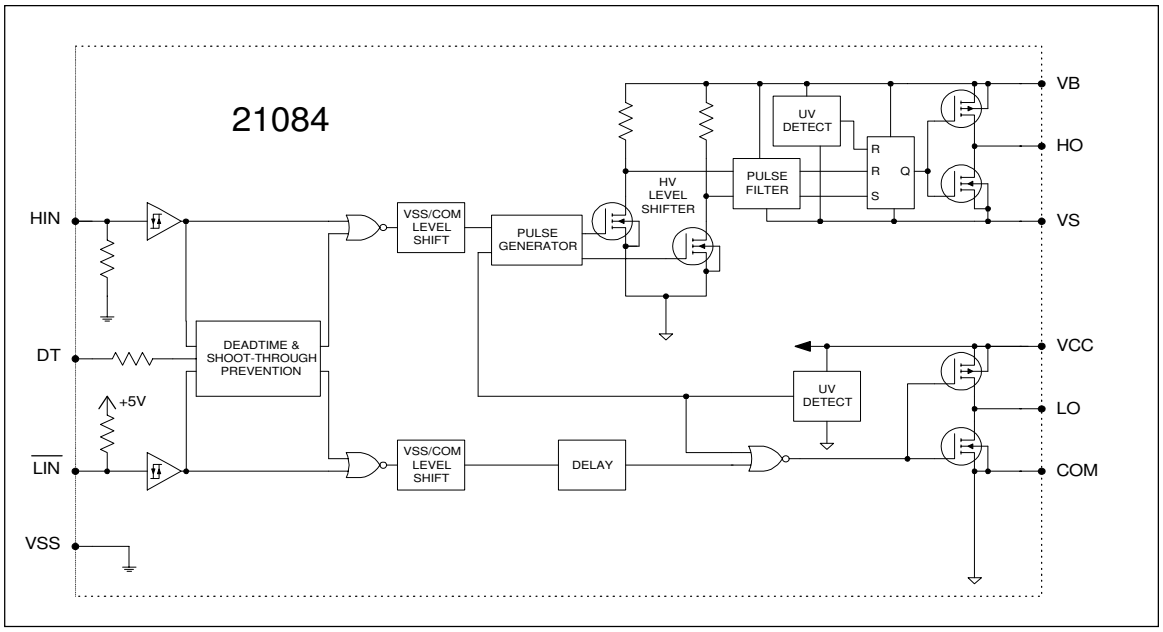
Static Electrical Characteristics

V_{BIAS} (V_{CC}, V_{BS}) = 15 V, V_{SS} = COM, DT= V_{SS} and T_A = 25 °C unless otherwise specified. The V_{IL}, V_{IH}, and I_{IN} parameters are referenced to V_{SS}/COM and are applicable to the respective input leads: HIN and $\overline{LIN}$. The V_O, I_O, and R_{on} parameters are referenced to COM and are applicable to the respective output leads: HO and LO.

Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
V_{IH}	Logic "1" input voltage for HIN & logic "0" for $\overline{LIN}$	2.5	—	—		V_{CC} = 10 V to 20 V
V_{IL}	Logic "0" input voltage for HIN & logic "1" for $\overline{LIN}$	—	—	0.8		
V_{OH}	High level output voltage, V_{BIAS} - V_O	—	0.05	0.2		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	20	75	130		V_{IN} = 0 V or 5 V
I_{QCC}	Quiescent V_{CC} supply current	0.4	1.0	1.6	mA	V_{IN} = 0 V or 5 V RDT=0 Ω
I_{IN+}	Logic "1" input bias current	—	5	20	µA	HIN = 5 V, $\overline{LIN}$ = 0 V
I_{IN-}	Logic "0" input bias current	—	—	5		HIN = 0 V, $\overline{LIN}$ = 5 V
V_{CCUV+} V_{BSUV+}	V_{CC} and V_{BS} supply undervoltage positive going threshold	8.0	8.9	9.8	V	
V_{CCUV-} V_{BSUV-}	V_{CC} and V_{BS} supply undervoltage negative going threshold	7.4	8.2	9.0		
V_{CCUVH} V_{BSUVH}	Hysteresis	0.3	0.7	—		
I_{O+}	Output high short circuit pulsed current	120	290	—		V_O = 0 V, PW ≤ 10 µs
I_{O-}	Output low short circuit pulsed current	250	600	—		V_O = 15 V, PW ≤ 10 µs

Functional Block Diagram

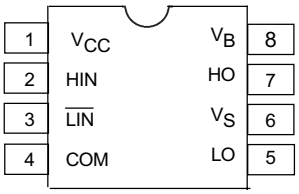




Lead Definitions

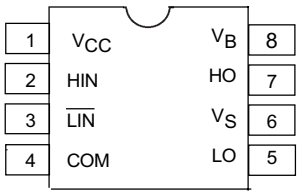
Symbol	Description
HIN	Logic input for high-side gate driver output (HO), in phase (referenced to COM for IRS2108 and VSS for IRS21084)
$\overline{\text{LIN}}$	Logic input for low-side gate driver output (LO), out of phase (referenced to COM for IRS2108 and VSS for IRS21084)
DT	Programmable deadtime lead, referenced to VSS (IR21084 only)
VSS	Logic ground (IRS21084 only)
V_B	High-side floating supply
HO	High-side gate driver output
V_S	High-side floating supply return
V_{CC}	Low-side and logic fixed supply
LO	Low-side gate driver output
COM	Low-side return

Lead Assignments



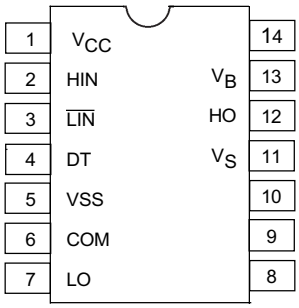
8 Lead PDIP

IRS2108PbF



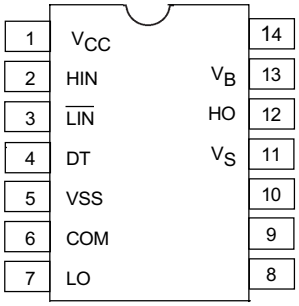
8 Lead SOIC

IRS2108SPbF



14 Lead PDIP

IRS21084PbF



14 Lead SOIC

IRS21084SPbF

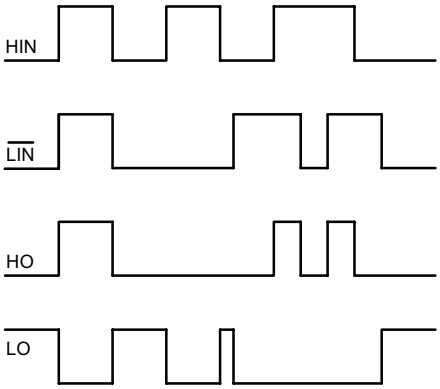
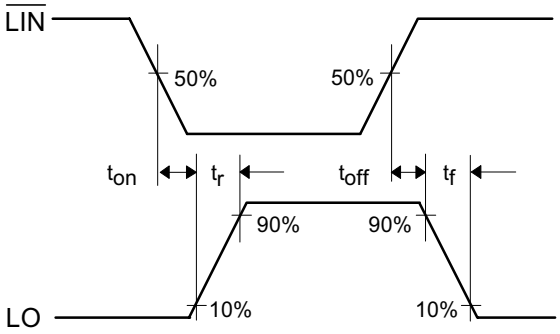


Figure 1. Input/Output Timing Diagram



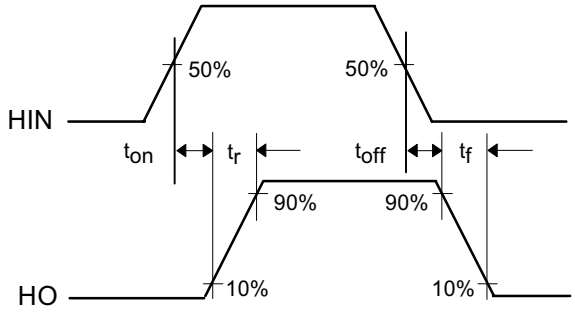


Figure 2. Switching Time Waveform Definitions

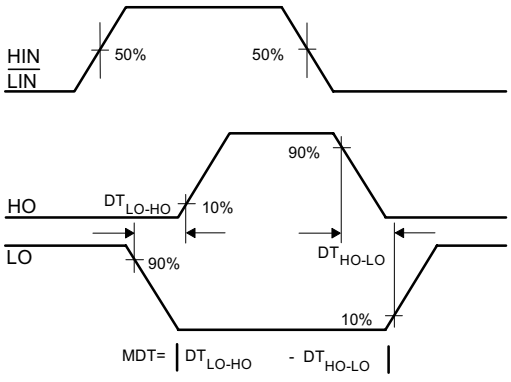


Figure 3. Deadtime Waveform Definitions

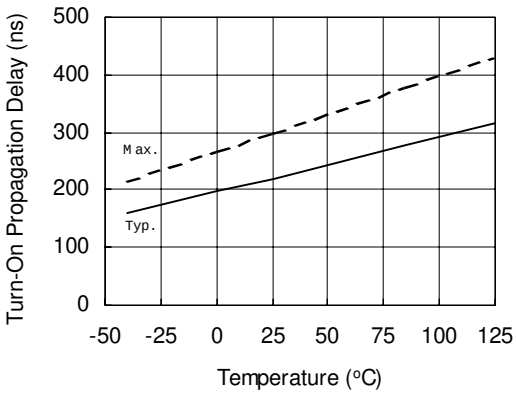


Figure 4A. Turn-On Propagation Delay vs. Temperature

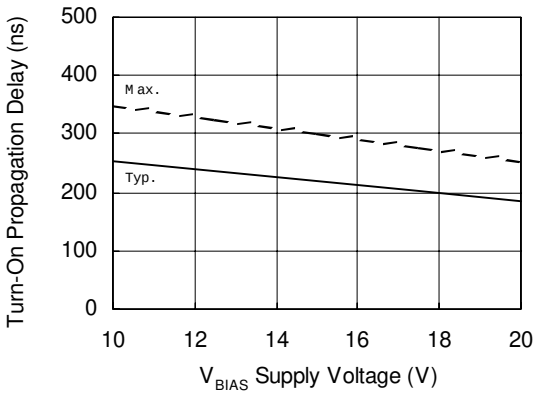


Figure 4B. Turn-On Propagation Delay vs. Supply Voltage

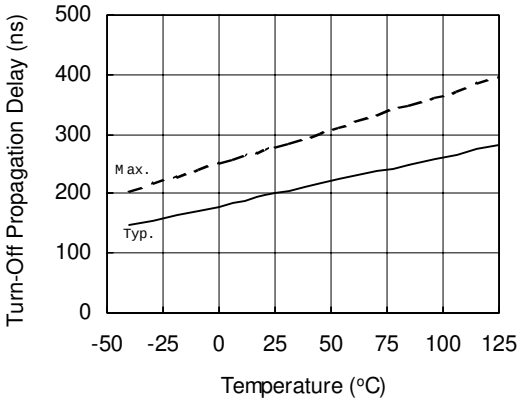


Figure 5A. Turn-Off Propagation Delay vs.Temperature

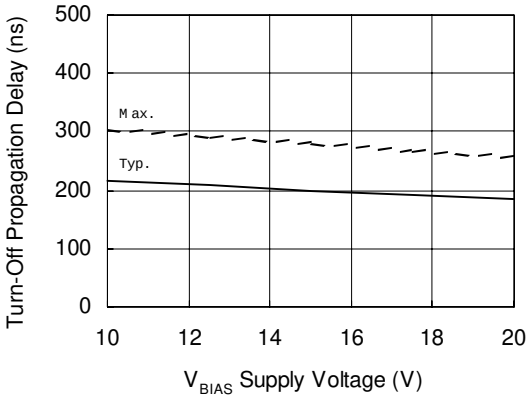


Figure 5B. Turn-Off Propagation Delay vs. Supply Voltage

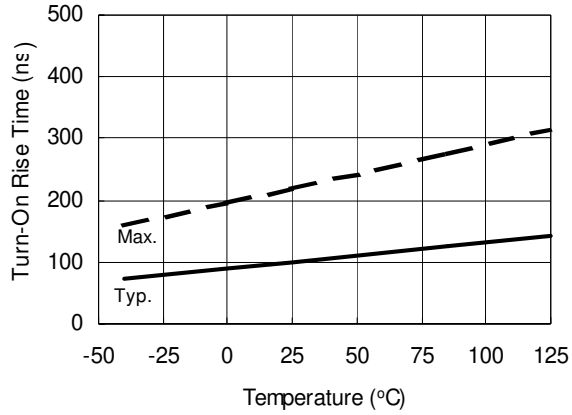


Figure 6A. Turn-On Rise Time vs.Temperature

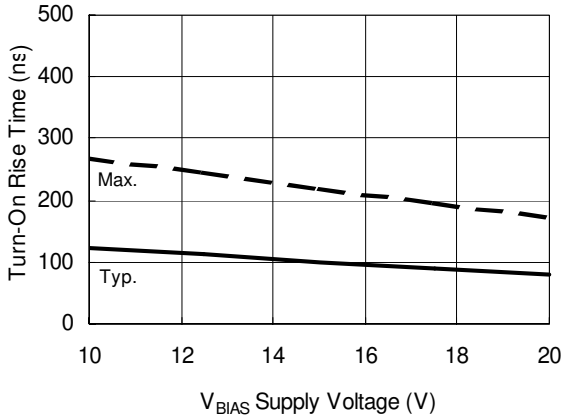


Figure 6B. Turn-On Rise Time vs. Supply Voltage

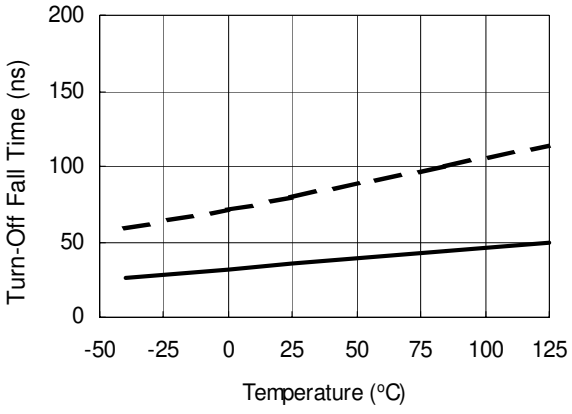


Figure 7A. Turn-Off Fall Time vs. Temperature

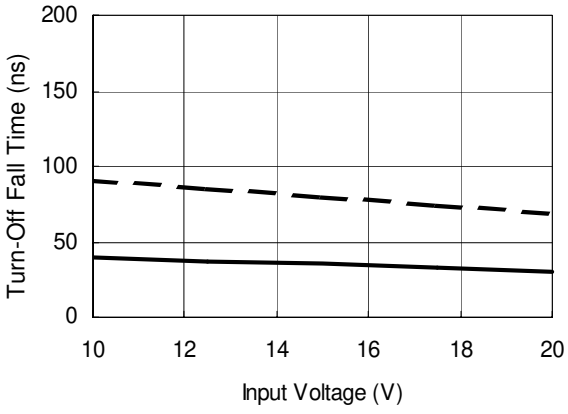


Figure 7B. Turn-Off Fall Time vs. Input voltage

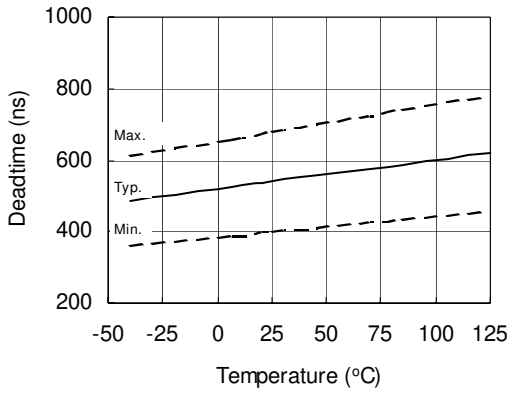


Figure 8A. Deadtime vs. Temperature

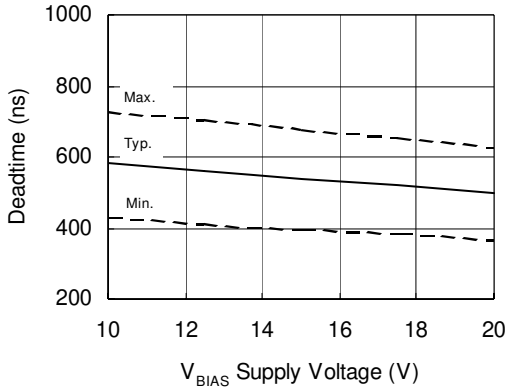


Figure 8B. Deadtime vs. Supply Voltage

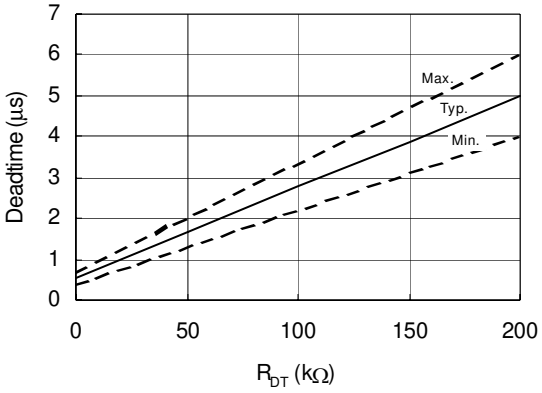


Figure 8C. Deadtime vs. R_{DT} (IR21084 Only)

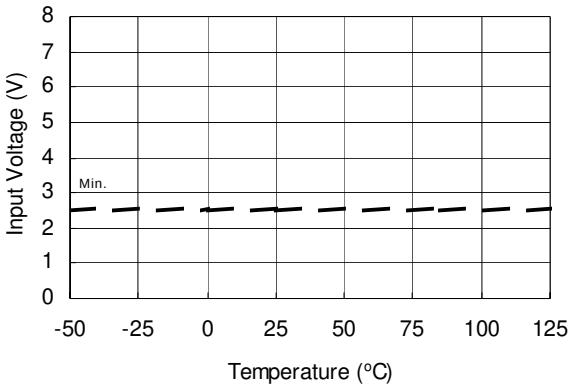


Figure 9A. Logic "1" Input Voltage vs. Temperature

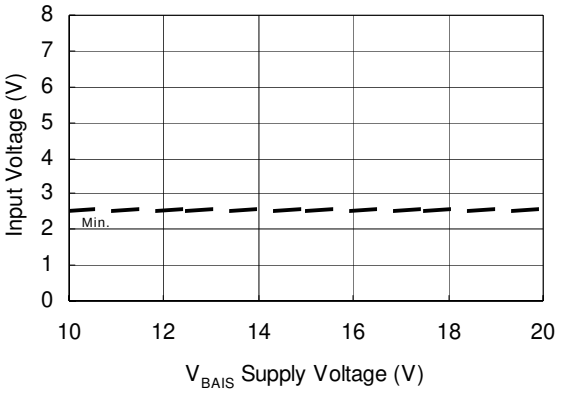


Figure 9B. Logic "1" Input Voltage vs. Supply Voltage

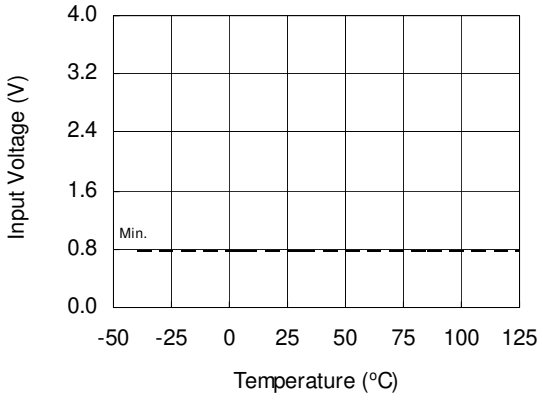


Figure 10A. Logic "0" Input Voltage vs. Temperature

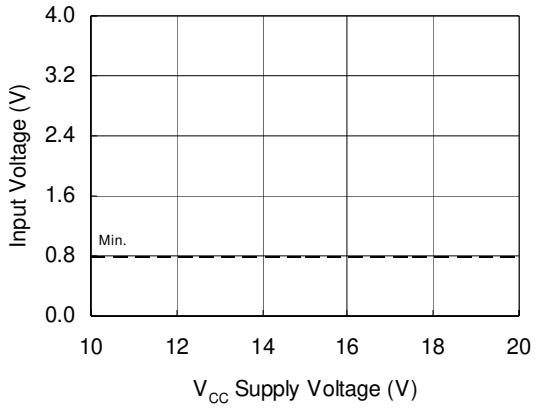


Figure 10B. Logic "0" Input Voltage vs. Supply Voltage

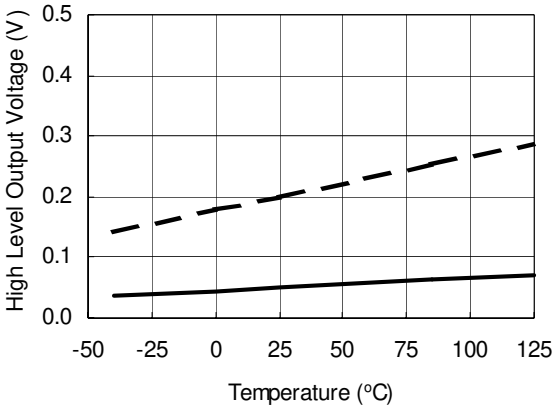


Figure 11A. High Level Output Voltage vs. Temperature

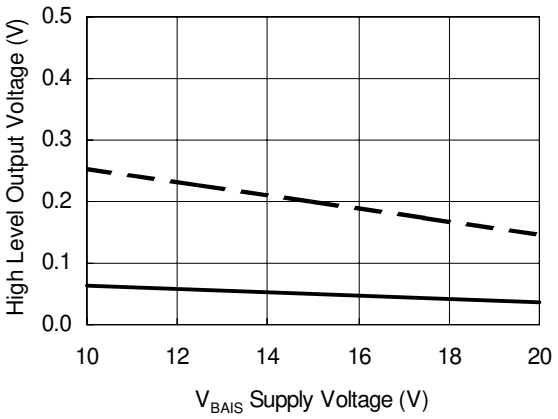


Figure 11B. High Lovel Output Voltage vs. Supply Voltage

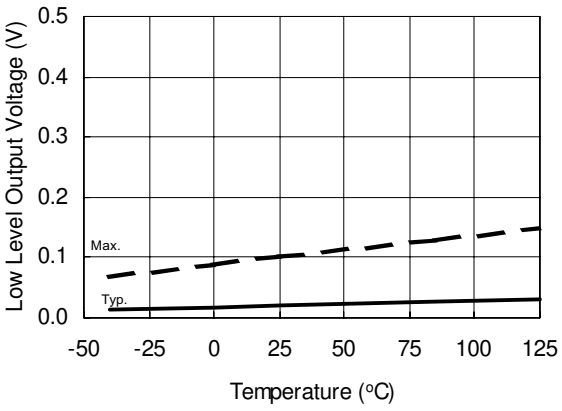


Figure 12A. Low Level Output Voltage vs.Temperature

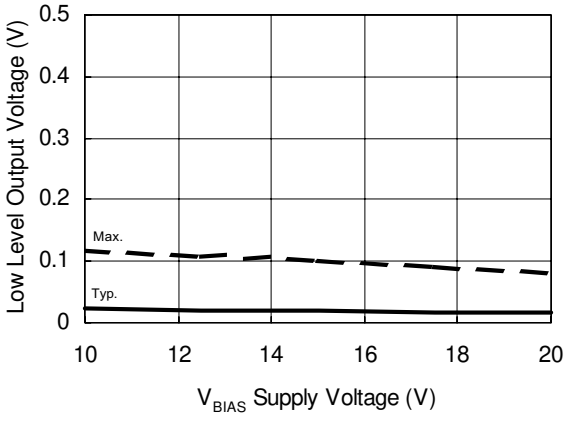


Figure 12B. Low Level Output Voltage vs. Supply Voltage

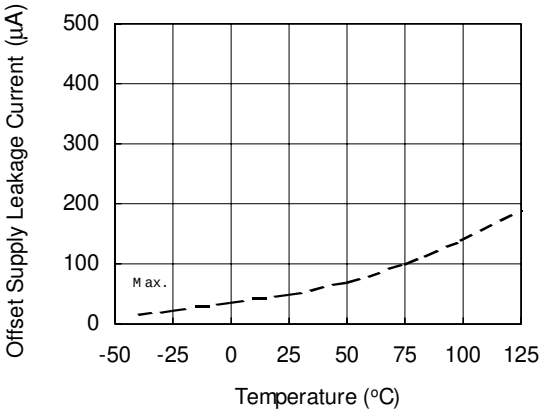


Figure 13A. Offset Supply Leakage Current vs. Temperature

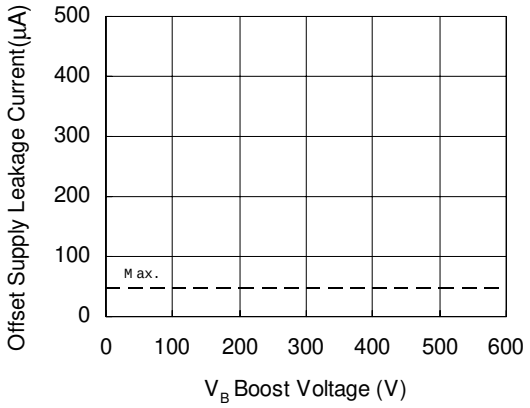


Figure 13B. Offset Supply Leakage Current vs. Temperature

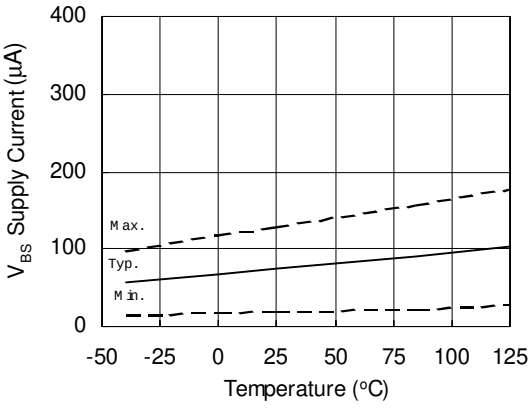


Figure 14A. V_{BS} Supply Current vs. Temperature

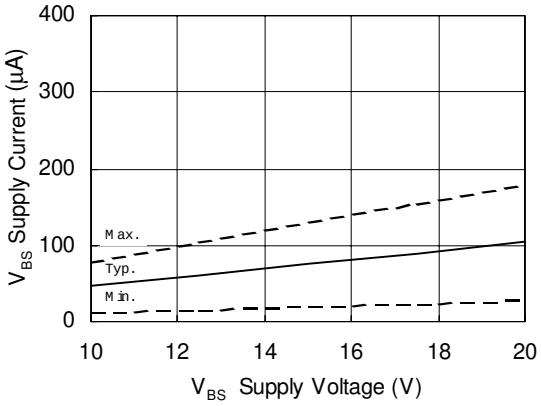


Figure 14B. V_{BS} Supply Current vs. Supply Voltage

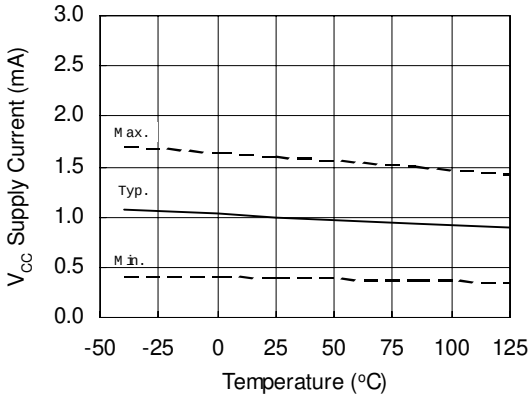


Figure 15A. V_{CC} Supply Current vs. Temperature

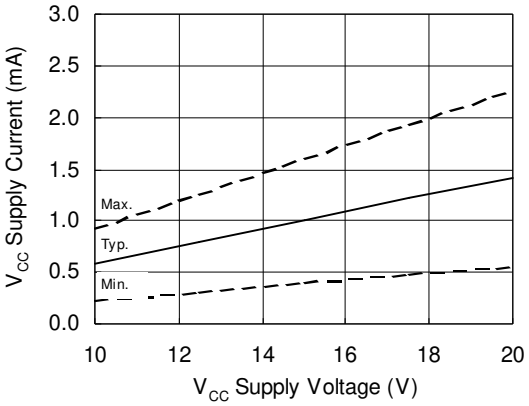


Figure 15B. V_{CC} Supply Current vs. Supply Voltage

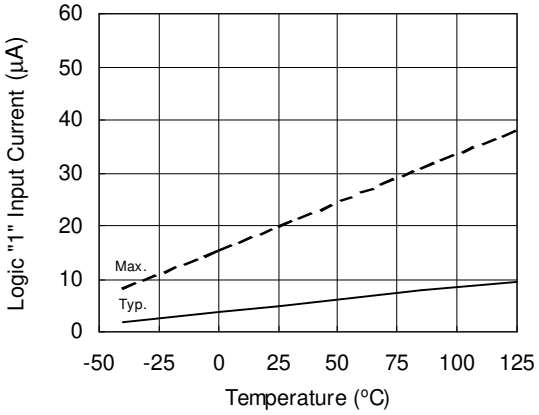


Figure 16A. Logic "1" Input Current vs. Temperature

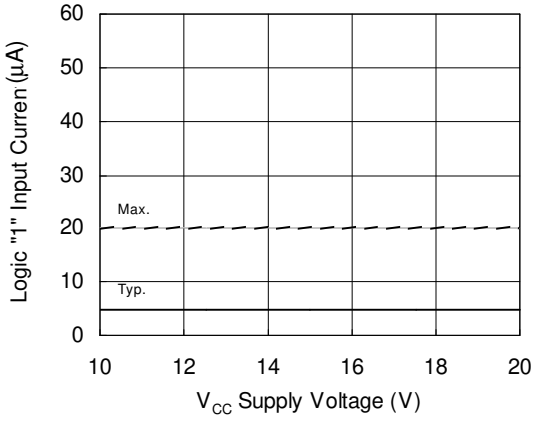


Figure 16B. Logic "1" Input Current vs. Supply Voltage

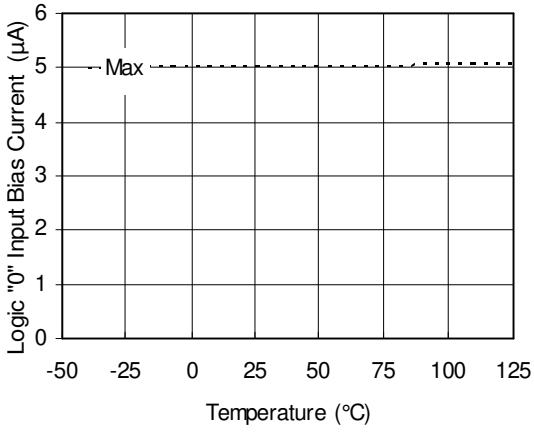


Figure 17A. Logic "0" Input Bias Current vs. Temperature

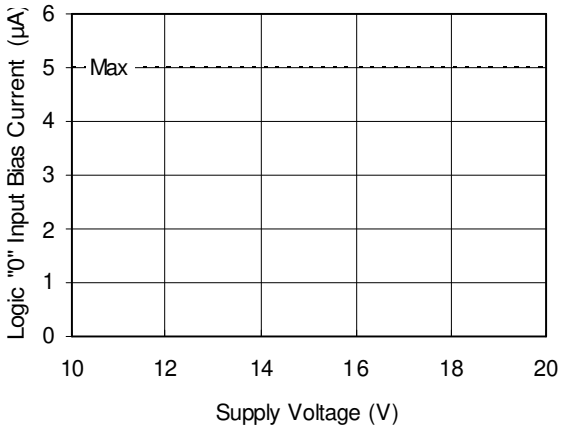


Figure 17B. Logic "0" Input Bias Current vs. Voltage

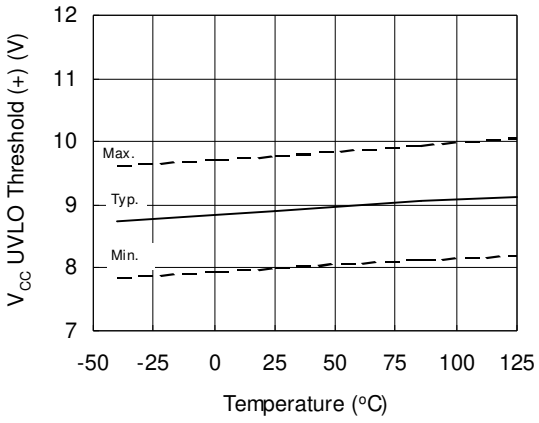


Figure 18. V_{CC} Undervoltage Threshold (+) vs. Temperature

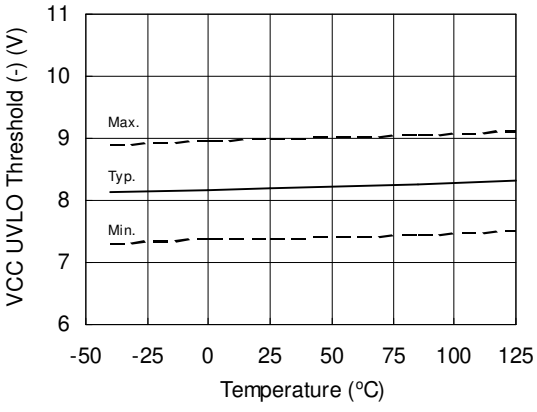


Figure 19. V_{CC} Undervoltage Threshold (-) vs. Temperature

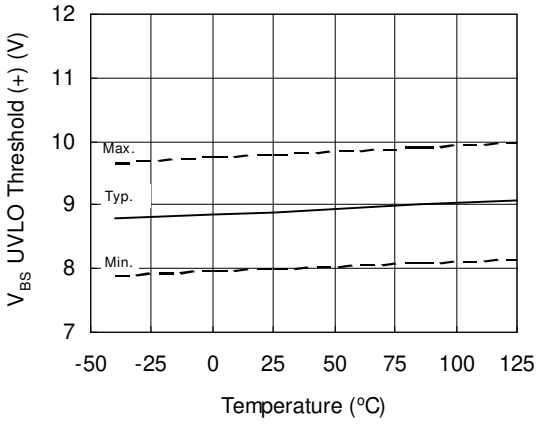


Figure 20. V_{BS} Undervoltage Threshold (+) vs. Temperature

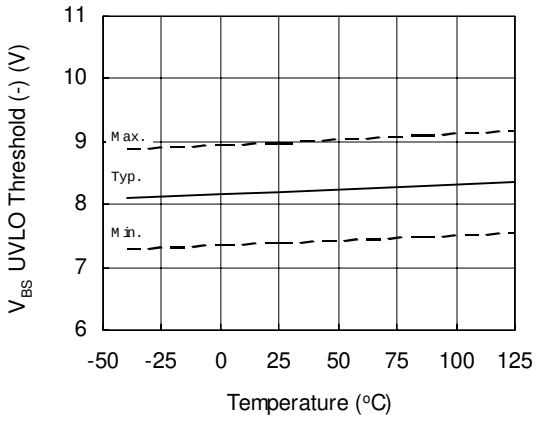


Figure 21. V_{BS} Undervoltage Threshold (-) vs. Temperature

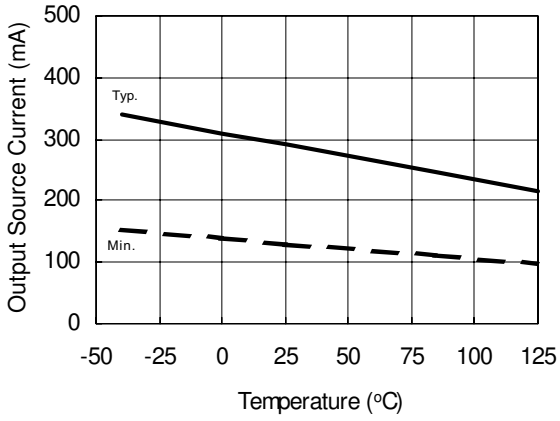


Figure 22A. Output Source Current vs. Temperature

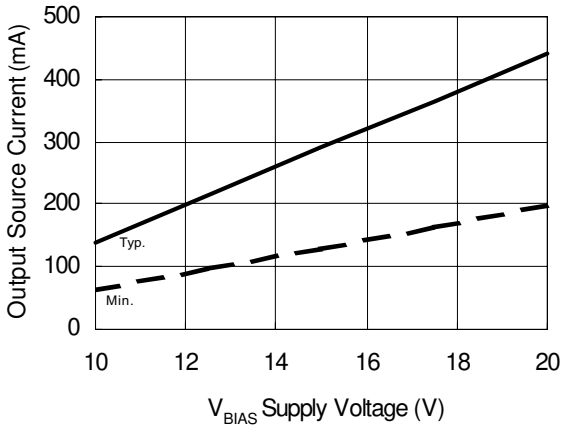


Figure 22B. Output Source Current vs. Supply Voltage

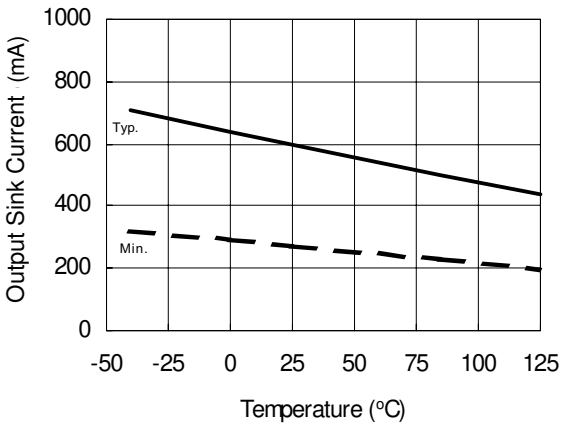


Figure 23A. Output Sink Current vs.Temperature

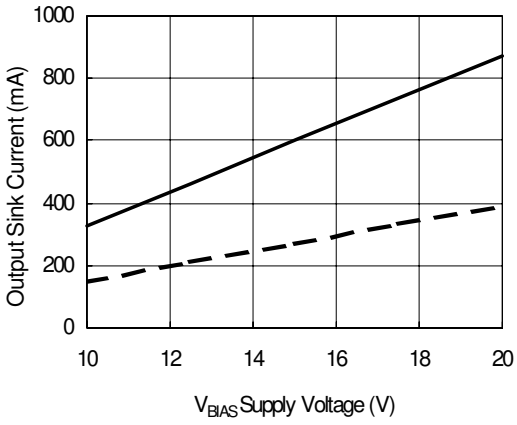


Figure 23B. Output Sink Current vs. Supply Voltage

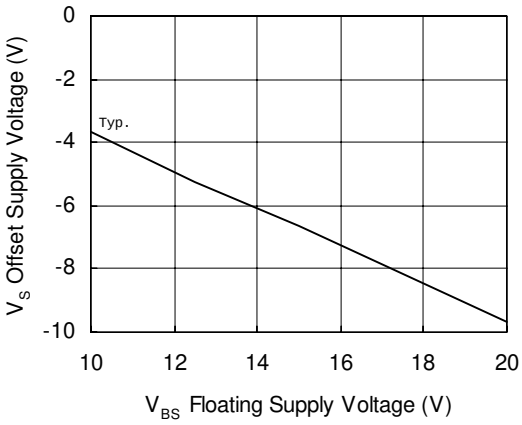


Figure 24. Maximum V_s Negative Offset vs. Supply Voltage

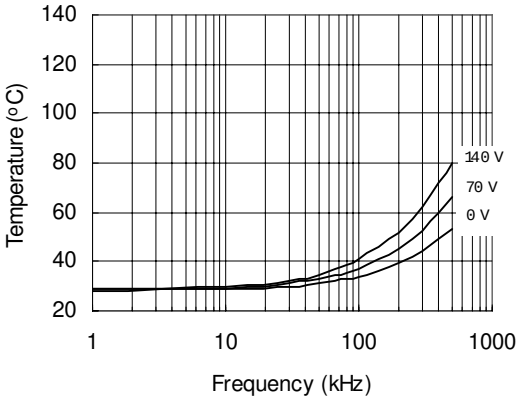


Figure 25. IRS2108 vs. Frequency (IRFBC20), R_{gate}=33 Ω, V_{CC}=15 V

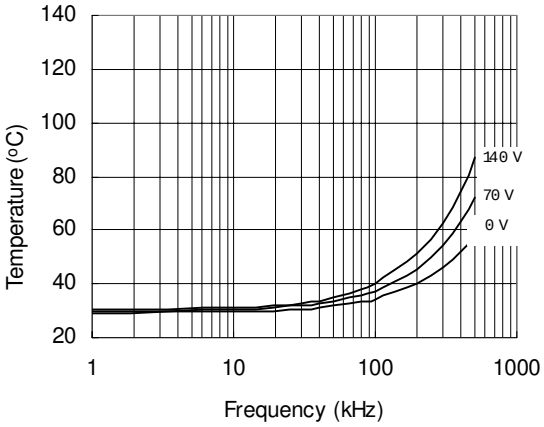


Figure 26. IRS2108 vs. Frequency (IRFBC30), R_{gate}=22 Ω, V_{CC}=15 V

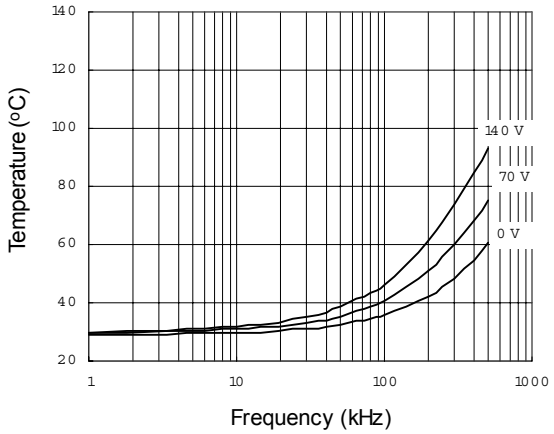


Figure 27. IRS2108 vs. Frequency (IRFBC40), R_{gate}=15 Ω, V_{CC}=15 V

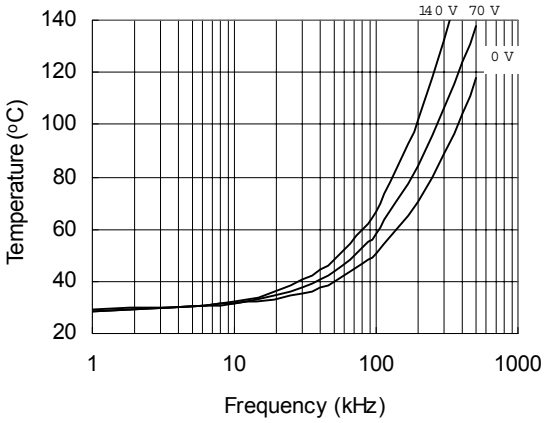


Figure 28. IRS2108 vs. Frequency (IRFPE50), R_{gate}=10 Ω, V_{CC}=15 V

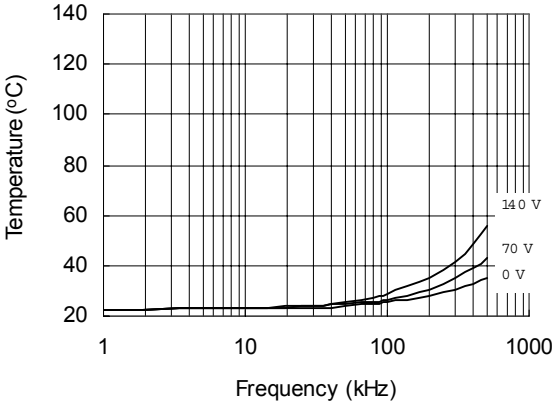


Figure 29. IRS21084 vs. Frequency (IRFBC20), R_{gate}=33 Ω, V_{CC}=15 V

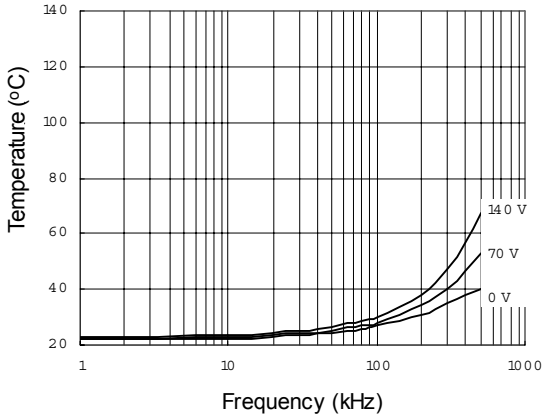


Figure 30. IRS21084 vs. Frequency (IRFBC30), R_{gate}=22 Ω, V_{CC}=15 V

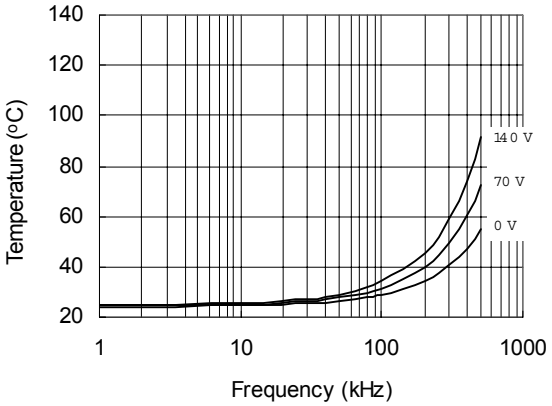


Figure 31. IRS21084 vs. Frequency (IRFBC40), R_{gate}=15 Ω, V_{CC}=15 V

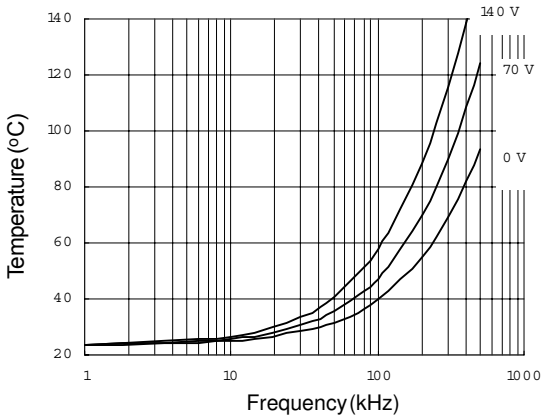


Figure 32. IRS21084 vs. Frequency (IRFPE50), R_{gate}=10 Ω, V_{CC}=15 V

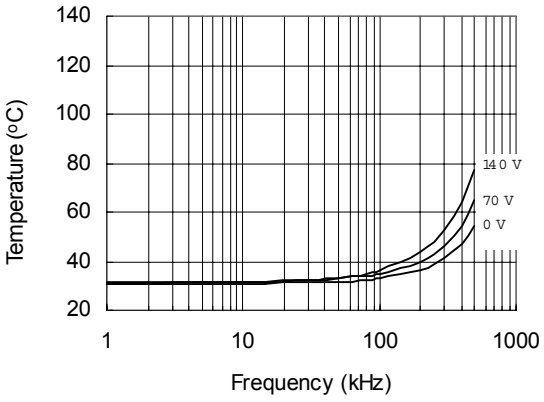


Figure 33. IRS2108S vs. Frequency (IRFBC20), R_{gate}=33 Ω, V_{CC}=15 V

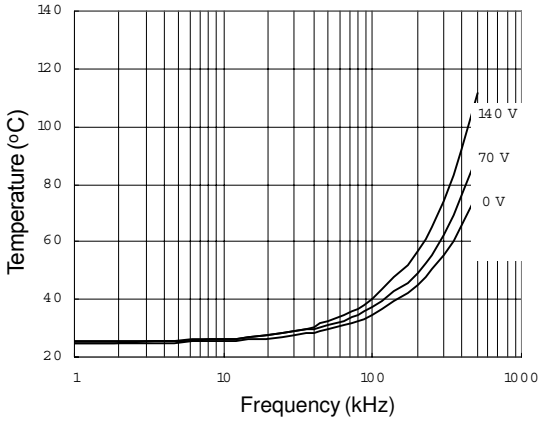


Figure 34. IRS2108S vs. Frequency (IRFBC30), R_{gate}=22 Ω, V_{CC}=15 V

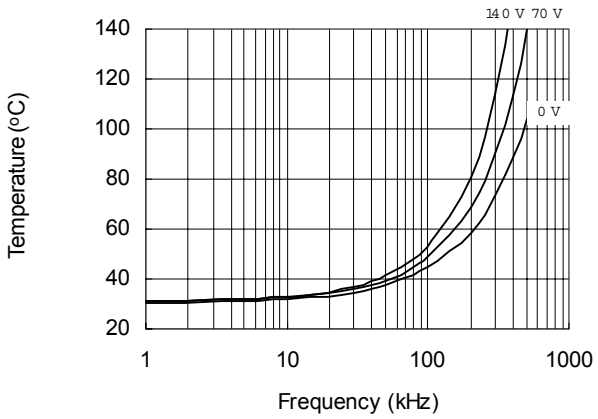


Figure 35. IRS2108S vs. Frequency (IRFBC40), R_{gate}=15 Ω, V_{CC}=15 V

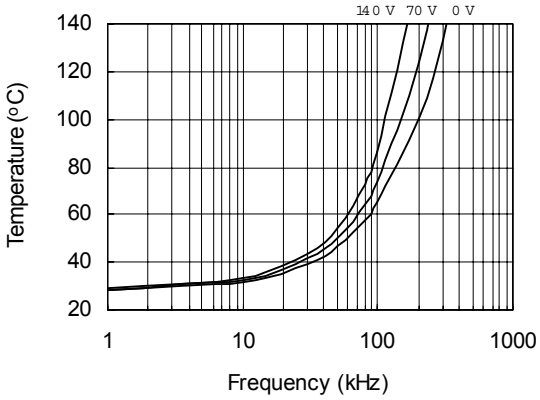


Figure 36. IRS2108S vs. Frequency (IRFPE50), R_{gate}=10 Ω, V_{CC}=15 V

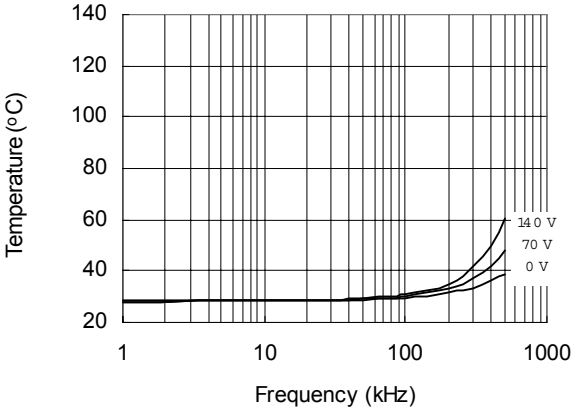


Figure 37. IRS21084S vs. Frequency (IRFBC20), R_{gate}=33 Ω, V_{CC}=15 V

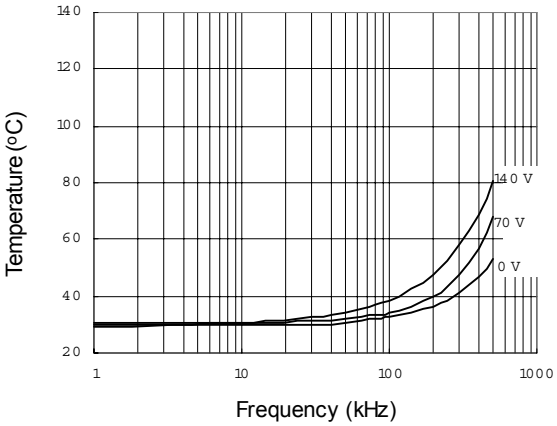


Figure 38. IR21084S vs. Frequency (IRFBC30), R_{gate}=22 Ω, V_{CC}=15 V

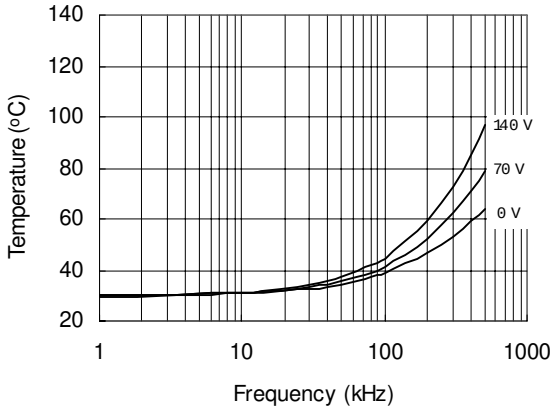


Figure 39. IRS21084S vs. Frequency (IRFBC40), R_{gate}=15 Ω, V_{CC}=15 V

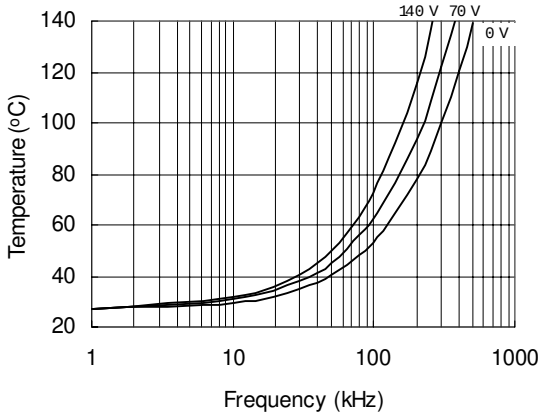
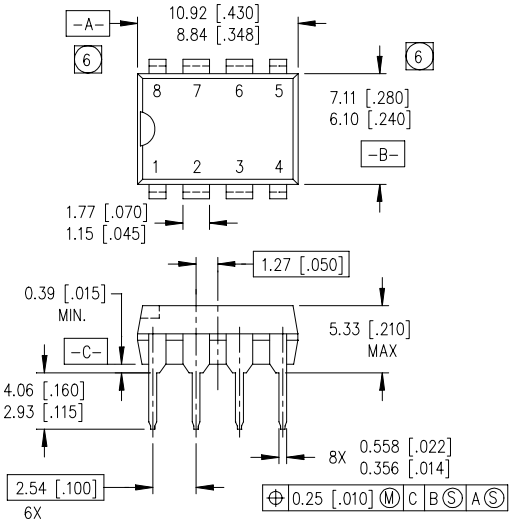
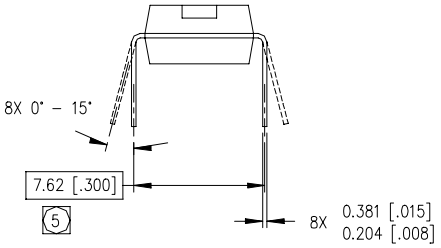


Figure 40. IRS21084S vs. Frequency (IRFPE50), R_{gate}=10 Ω, V_{CC}=15 V

Case outlines

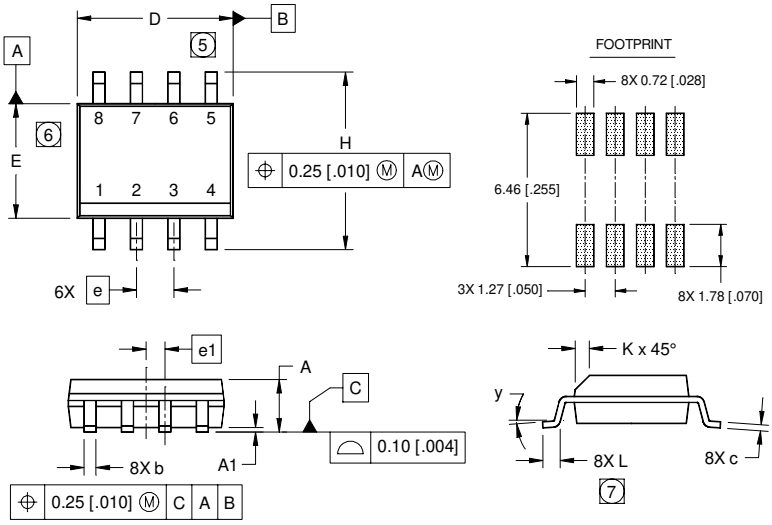


NOTES:
1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M–1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS–001AB.
5. MEASURED WITH THE LEADS CONSTRAINED TO BE PERPENDICULAR TO DATUM PLANE C.
6. DIMENSION DOES NOT INCLUDE MOLD PROTUSIONS.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



8-Lead PDIP

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

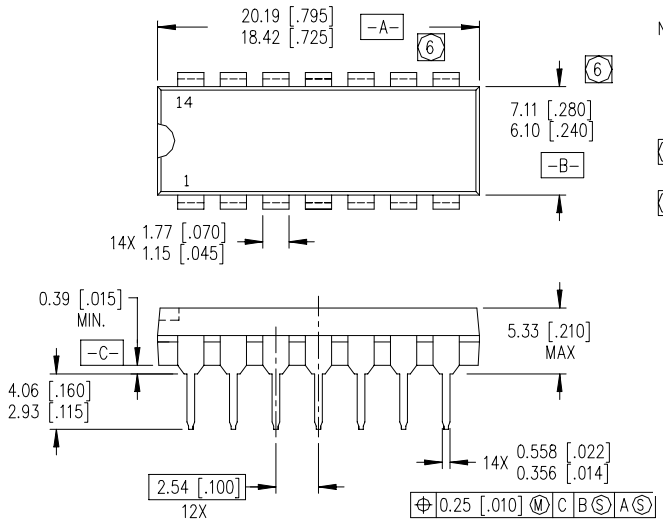


DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.0532	.0688	1.35	1.75
A1	.0040	.0098	0.10	0.25
b	.013	.020	0.33	0.51
c	.0075	.0098	0.19	0.25
D	.189	.1968	4.80	5.00
E	.1497	.1574	3.80	4.00
e	.050 BASIC		1.27 BASIC	
e 1	.025 BASIC		0.635 BASIC	
H	.2284	.2440	5.80	6.20
K	.0099	.0196	0.25	0.50
L	.016	.050	0.40	1.27
y	0°	8°	0°	8°

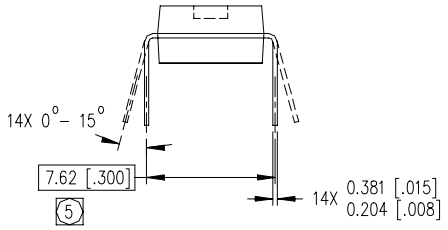
NOTES:
1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: MILLIMETER
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.
5. DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.15 [.006].
6. DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.25 [.010].
7. DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.

8-Lead SOIC

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

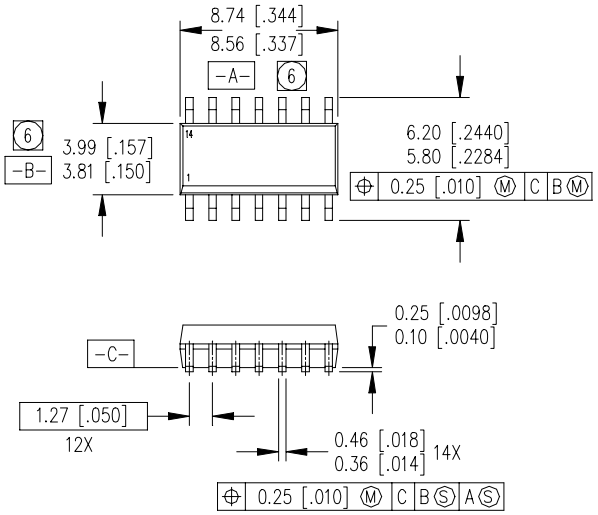


NOTES:
1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M–1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS–001AC.
5. MEASURED WITH THE LEADS CONSTRAINED TO BE PERPENDICULAR TO DATUM PLANE C.
6. DIMENSION DOES NOT INCLUDE MOLD PROTUSIONS.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

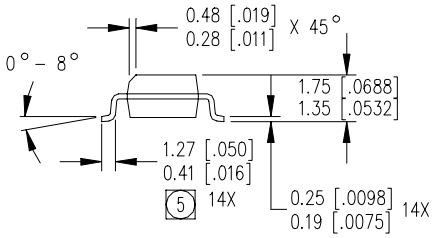


14 Lead PDIP

01-6010
01-3002 03 (MS-001AC)



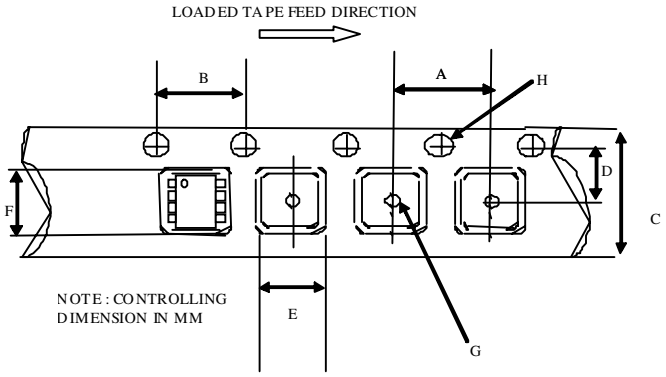
NOTES:
1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M–1982.
2 CONTROLLING DIMENSION: MILLIMETER
3 DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4 OUTLINE CONFORMS TO JEDEC OUTLINE MS–012AB.
5 DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.
6 DIMENSION DOES NOT INCLUDE MOLD PROTUSIONS. MOLD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



14-Lead SOIC (narrow body)

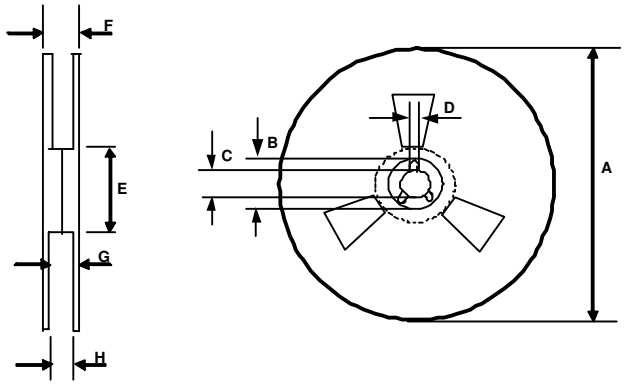
01-6019
01-3063 00 (MS-012AB)

Tape & Reel
8-lead SOIC



CARRIER TAPE DIMENSION FOR 8SOICN

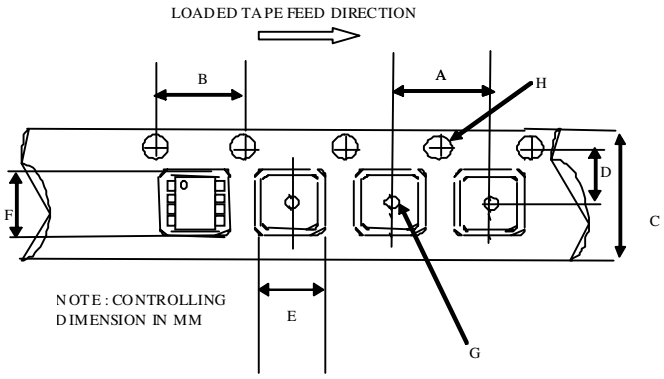
	Metric		Imperial	
Code	Min	Max	Min	Max
A	7.90	8.10	0.311	0.318
B	3.90	4.10	0.153	0.161
C	11.70	12.30	0.46	0.484
D	5.45	5.55	0.214	0.218
E	6.30	6.50	0.248	0.255
F	5.10	5.30	0.200	0.208
G	1.50	n/a	0.059	n/a
H	1.50	1.60	0.059	0.062



REEL DIMENSIONS FOR 8SOICN

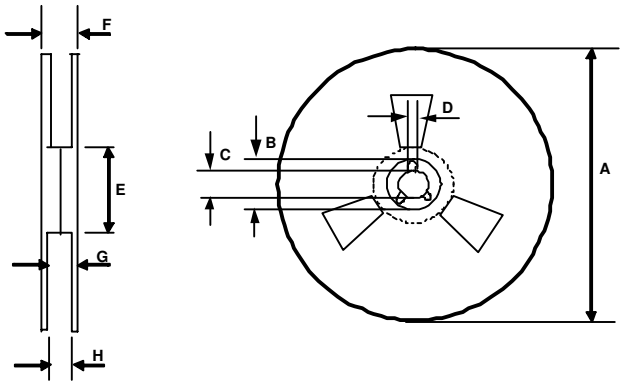
	Metric		Imperial	
Code	Min	Max	Min	Max
A	329.60	330.25	12.976	13.001
B	20.95	21.45	0.824	0.844
C	12.80	13.20	0.503	0.519
D	1.95	2.45	0.767	0.096
E	98.00	102.00	3.858	4.015
F	n/a	18.40	n/a	0.724
G	14.50	17.10	0.570	0.673
H	12.40	14.40	0.488	0.566

Tape & Reel
14-lead SOIC



CARRIER TAPE DIMENSION FOR 14SOICN

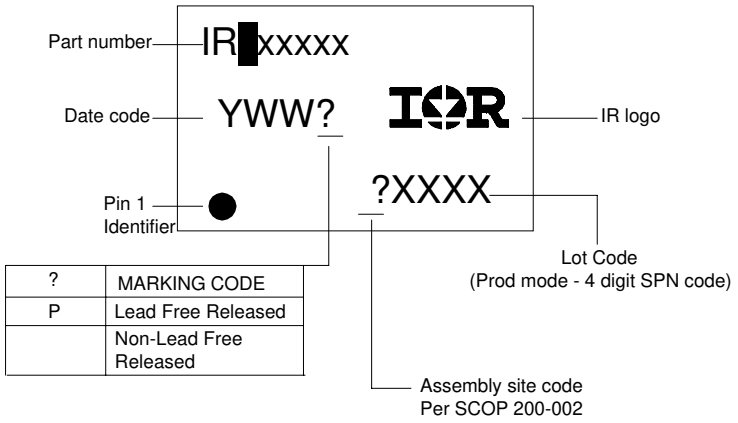
	Metric		Imperial	
Code	Min	Max	Min	Max
A	7.90	8.10	0.311	0.318
B	3.90	4.10	0.153	0.161
C	15.70	16.30	0.618	0.641
D	7.40	7.60	0.291	0.299
E	6.40	6.60	0.252	0.260
F	9.40	9.60	0.370	0.378
G	1.50	n/a	0.059	n/a
H	1.50	1.60	0.059	0.062



REEL DIMENSIONS FOR 14SOICN

	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	22.40	n/a	0.881
G	18.50	21.10	0.728	0.830
H	16.40	18.40	0.645	0.724

LEADFREE PART MARKING INFORMATION



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

ORDER INFORMATION

8-Lead PDIP IRS2108PbF	14-Lead PDIP IRS21084PbF
8-Lead SOIC IRS2108SPbF	14-Lead SOIC IRS21084SPbF
8-Lead SOIC Tape & Reel IRS2108STRPbF	14-Lead SOIC Tape & Reel IRS21084STRPbF

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

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

Data and specifications subject to change without notice. 12/4/2006