

High and Low Side Driver

Features

- Floating channel designed for bootstrap operation
- Fully operational to +1200 V
- Tolerant to negative transient voltage
- dV/dt immune
- Gate drive supply range from 12 V to 20 V
- Undervoltage lockout for both channels
- 3.3 V logic compatible
- Separate logic supply range from 3.3 V to 20 V
- Logic and power ground ± 5 V offset
- CMOS Schmitt-triggered inputs with pull-down
- Cycle by cycle edge-triggered shutdown logic
- Matched propagation delay for both channels
- Outputs in phase with inputs

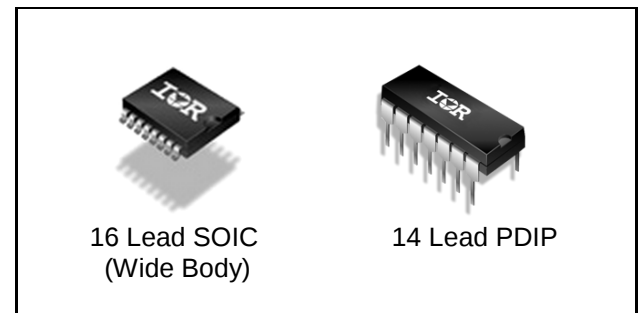
Product Summary

V_{OFFSET} (max)	1200 V
$I_{\text{O+/-}}$	1.7 A / 2 A
V_{OUT}	12 V – 20 V
$t_{\text{on/off}}$ (typical)	280 ns / 225 ns
Delay Matching	30 ns

Description

The IR2213(S) is a high voltage, high speed power MOSFET and IGBT driver with independent high and low side referenced output channels. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. Logic inputs are compatible with standard CMOS or LSTTL outputs, down to 3.3 V logic. The output drivers feature a high pulse current buffer stage designed for minimum driver cross-conduction. Propagation delays are matched to simplify use in high frequency applications. The floating channel can be used to drive an N-channel power MOSFET or IGBT in the high side configuration which operates up to 1200 V.

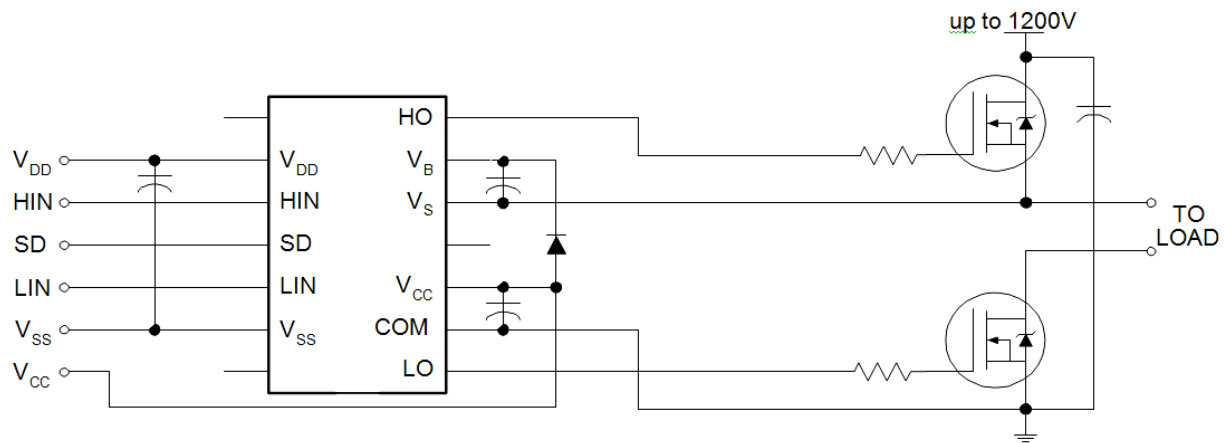
Package Options



Ordering Information

Base Part Number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IR2213SPBF	SO16WB	Tube	45	IR2213SPBF
IR2213SPBF	SO16WB	Tape and Reel	1000	IR2213STRPBF
IR2213PBF	PDIP14	Tube	25	IR2213PBF

Typical Connection Diagram



Refer to Lead Assignments for correct pin configuration. This/These diagram(s) show electrical connections only. Please refer to our Application Notes and Design Tips 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 Supply Voltage	-0.3	1225	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 Fixed Supply Voltage	-0.3	25	
V_{LO}	Low Side Output Voltage	-0.3	$V_{CC} + 0.3$	
V_{DD}	Logic Supply Voltage	-0.3	$V_{SS} + 25$	
V_{SS}	Logic Supply Offset Voltage	$V_{CC} - 25$	$V_{CC} + 0.3$	
V_{IN}	Logic Input Voltage (HIN, LIN & SD)	$V_{SS} - 0.3$	$V_{DD} + 0.3$	
dV_S/dt	Allowable Offset Supply Voltage Transient (Figure 2)	—	50	V/ns
P_D	Package Power Dissipation @ $T_A \leq +25^\circ\text{C}$	(14 Lead PDIP)	1.3	W
		(16 Lead SOIC)	1.0	
R_{THJA}	Thermal Resistance, Junction to Ambient	(14 Lead PDIP)	75	$^\circ\text{C/W}$
		(16 Lead SOIC)	100	
T_J	Junction Temperature	—	125	$^\circ\text{C}$
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 and V_{SS} offset ratings are tested with all supplies biased at 15 V differential.

Symbol	Definition	Min.	Max.	Units
V_B	High Side Floating Supply Absolute Voltage	$V_S + 12$	$V_S + 20$	V
V_S	High Side Floating Supply Offset Voltage	$\dagger$	1200	
V_{HO}	High Side Floating Output Voltage	V_S	V_B	
V_{CC}	Low Side Fixed Supply Voltage	12	20	
V_{LO}	Low Side Output Voltage	0	V_{CC}	
V_{DD}	Logic Supply Voltage	$V_{SS} + 3$	$V_{SS} + 20$	
V_{SS}	Logic Supply Offset Voltage	-5 $\dagger\dagger$	5	
V_{IN}	Logic Input Voltage (HIN, LIN & SD)	V_{SS}	V_{DD}	

$\dagger$ Logic operational for V_S of -5 to +1200V. Logic state held for V_S of -5V to $-V_{BS}$. (Please refer to the Design Tip DT97-3 for more details).

$\dagger\dagger$ When $V_{DD} < 5V$, the minimum V_{SS} offset is limited to $-V_{DD}$

Dynamic Electrical Characteristics

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

Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
t_{on}	Turn-On Propagation Delay	—	280	—	ns	$V_S = 0V$
t_{off}	Turn-Off Propagation Delay	—	225	—		$V_S = 1200V$
t_{sd}	Shutdown Propagation Delay	—	230	—		$V_S = 1200V$
t_r	Turn-On Rise Time	—	25	—		
t_f	Turn-Off Fall Time	—	17	—		
MT	Delay Matching, HS & LS Turn-On/Off	—	—	30		

Static Electrical Characteristics

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

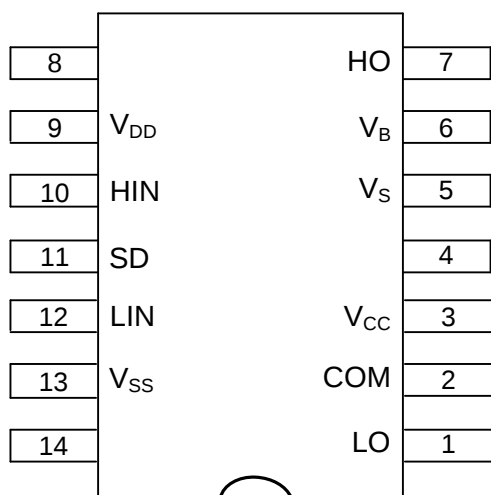
Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
V_{IH}	Logic "1" Input Voltage	9.5	—	—	V	
V_{IL}	Logic "0" Input Voltage	—	—	6.0		
V_{OH}	High Level Output Voltage, $V_{BIAS} - V_O$	—	—	1.2		$I_O = 0A$
V_{OL}	Low Level Output Voltage, V_O	—	—	0.1		$I_O = 0A$
I_{LK}	Offset Supply Leakage Current	—	—	50	μA	$V_B = V_S = 1200V$
I_{QBS}	Quiescent V_{BS} Supply Current	—	125	230		$V_{IN} = 0V$ or V_{DD}
I_{QCC}	Quiescent V_{CC} Supply Current	—	180	340		$V_{IN} = 0V$ or V_{DD}
I_{QDD}	Quiescent V_{DD} Supply Current	—	15	30		$V_{IN} = 0V$ or V_{DD}
I_{IN+}	Logic "1" Input Bias Current	—	20	40		$V_{IN} = V_{DD}$
I_{IN-}	Logic "0" Input Bias Current	—	—	1.0		$V_{IN} = 0V$
V_{BSUV+}	V_{BS} Supply Undervoltage Positive Going Threshold	8.7	10.2	11.7	V	
V_{BSUV-}	V_{BS} Supply Undervoltage Negative Going Threshold	7.9	9.3	10.7		
V_{CCUV+}	V_{CC} Supply Undervoltage Positive Going Threshold	8.7	10.2	11.7		
V_{CCUV-}	V_{CC} Supply Undervoltage Negative Going Threshold	7.9	9.3	10.7		
I_{O+}	Output High Short Circuit Pulsed Current	1.7	2.0	—	A	$V_O = 0V, V_{IN} = V_{DD}$ $PW \leq 10 \mu s$
I_{O-}	Output Low Short Circuit Pulsed Current	2.0	2.5	—		$V_O = 15V, V_{IN} = 0V$ $PW \leq 10 \mu s$

The schematic diagram illustrates a 3T1C1D CMOS circuit for UV detection. The circuit is divided into two main sections by a dashed line. On the left, the input stage features three input nodes: V_{DD} , HIN , and SD . HIN is connected to a PMOS transistor (P1) and an NMOS transistor (N1). SD is connected to a PMOS transistor (P2) and an NMOS transistor (N2). The gates of P1 and P2 are connected to V_{DD} . The gates of N1 and N2 are connected to V_{SS} . The outputs of P1 and N1 are connected to an RS flip-flop (R, S). The outputs of P2 and N2 are connected to an SR flip-flop (S, R). The outputs of these flip-flops are connected to two V_{DD}/V_{CC} LEVEL SHIFT blocks. The output of the first level shift block is connected to a PULSE GEN block. The output of the second level shift block is connected to a UV DETECT block. The PULSE GEN block is connected to an HV LEVEL SHIFT block. The HV LEVEL SHIFT block is connected to a UV DETECT block and a PULSE FILTER block. The UV DETECT block is connected to an RS flip-flop (R, S). The PULSE FILTER block is connected to an RS flip-flop (R, S). The outputs of these flip-flops are connected to a PMOS transistor (P3) and an NMOS transistor (N3). The gates of P3 and N3 are connected to V_{DD} and V_{SS} respectively. The outputs of P3 and N3 are connected to the HO and LO nodes. The HO node is connected to V_B and the LO node is connected to V_S . The V_{CC} node is connected to V_B and the COM node is connected to V_S . The circuit is powered by V_{DD} and V_{SS} .

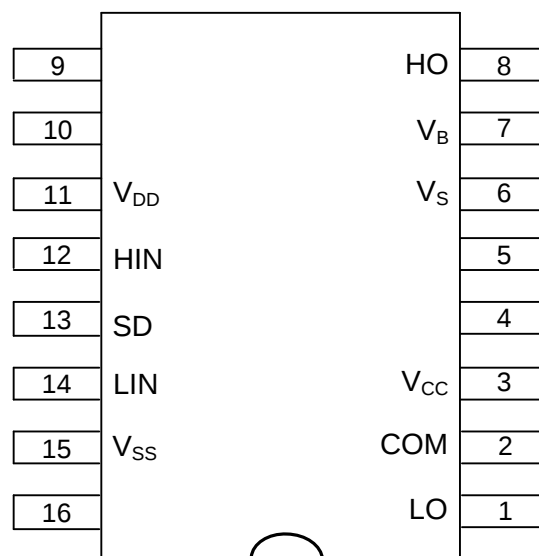
Lead Definitions

Symbol	Description
V_{DD}	Logic Supply
HIN	Logic Input for High Side Gate Driver Output (HO), In Phase
SD	Logic Input for Shutdown
LIN	Logic Input for Low Side Gate Driver Output (LO), In Phase
V_{SS}	Logic Ground
V_B	High Side Floating Supply
HO	High Side Gate Drive Output
V_S	High Side Floating Supply Return
V_{CC}	Low Side Supply
LO	Low Side Gate Drive Output
COM	Low Side Return

Lead Assignments



14-Lead PDIP



16-Lead SOIC
(Wide Body)

Application Information and Additional Information

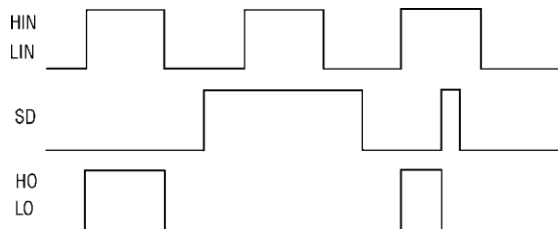


Figure 1. Input / Output Timing Diagram

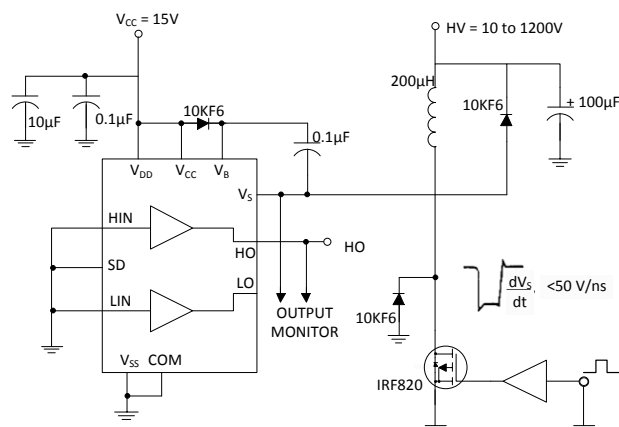


Figure 2. Floating Supply Voltage Transient Test Circuit

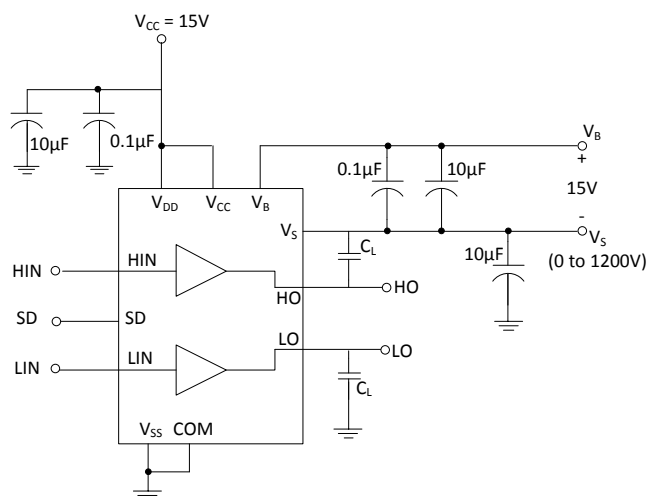


Figure 3. Switching Time Test Circuit

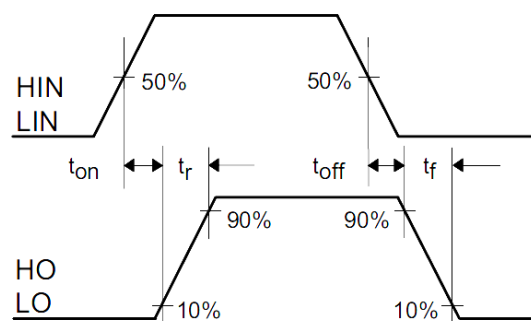


Figure 4. Switching Time Waveform Definition

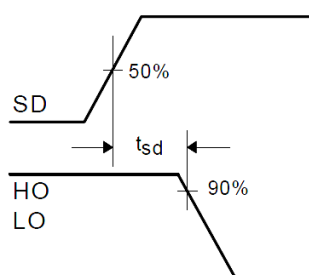


Figure 5. Shutdown Waveform Definitions

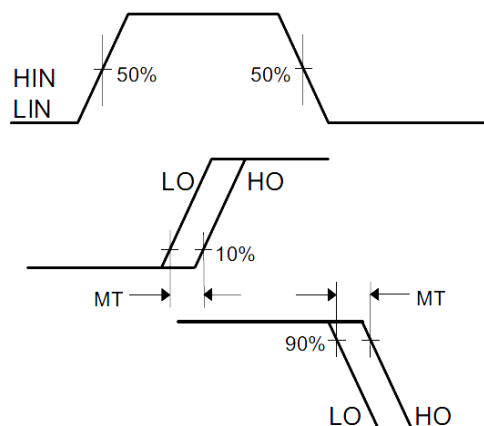
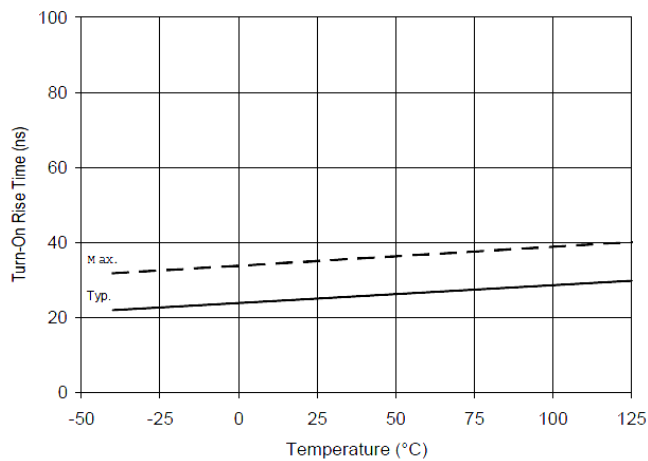
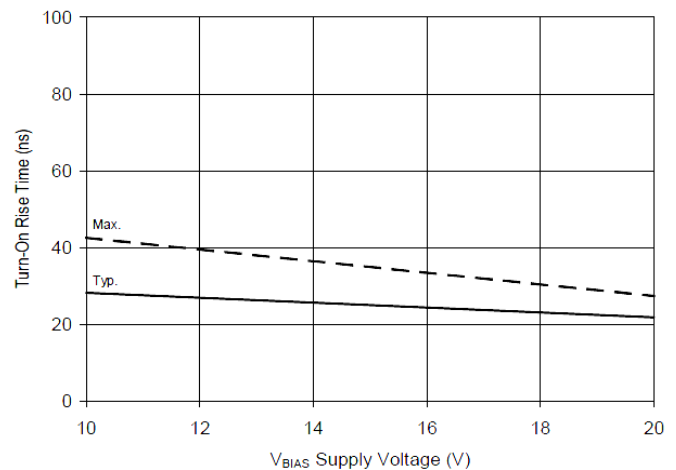
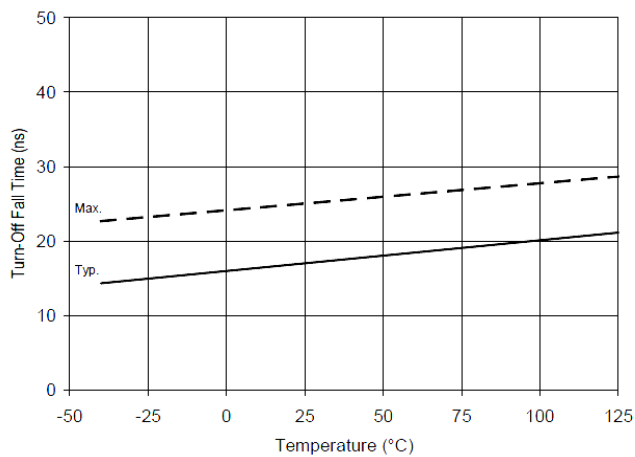
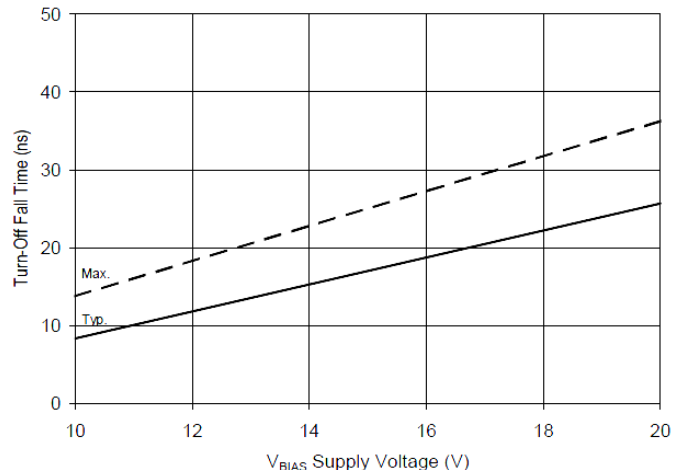
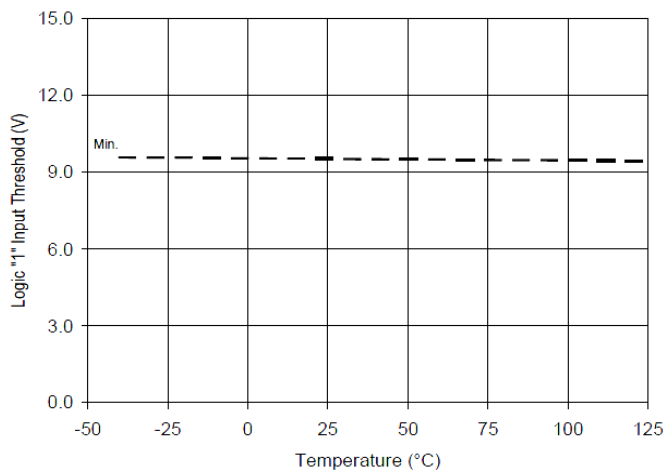
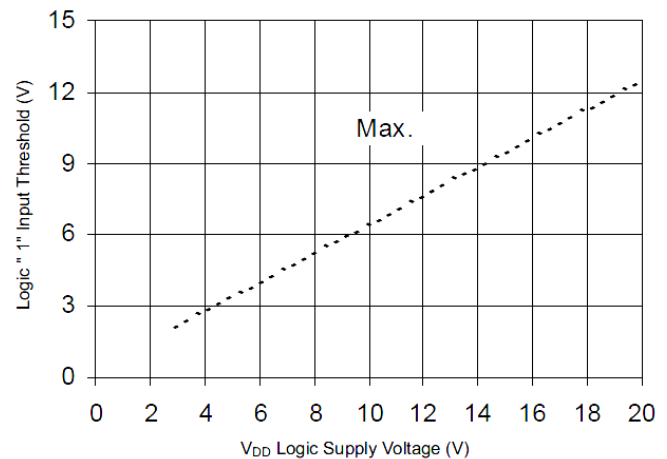
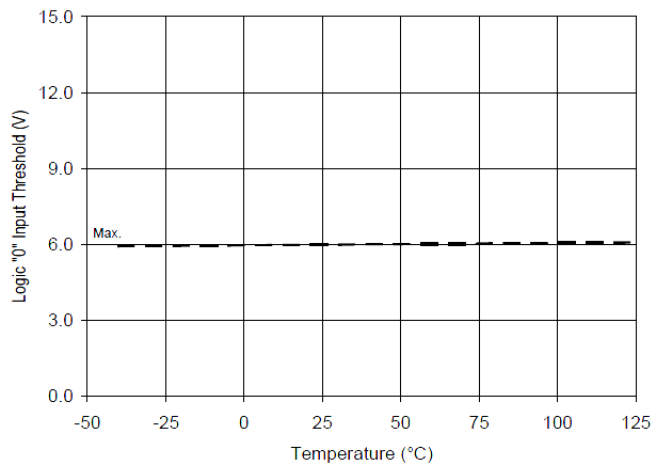
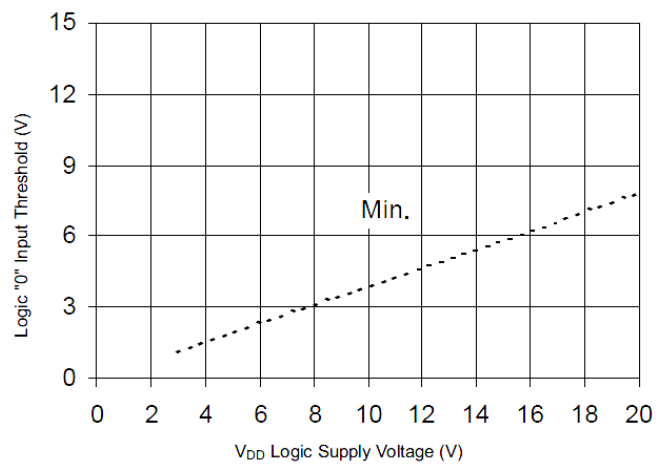
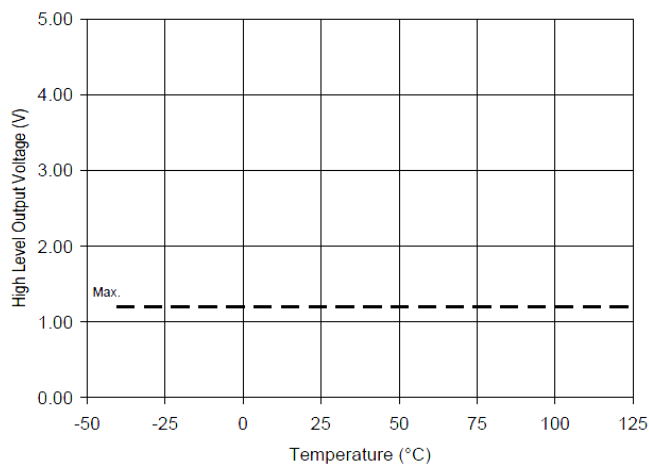
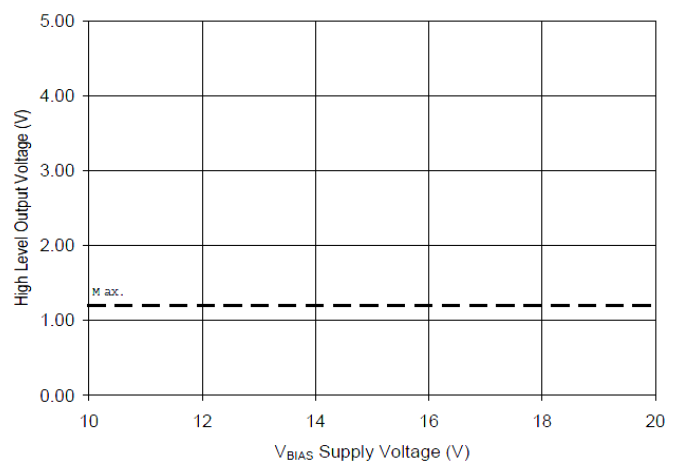
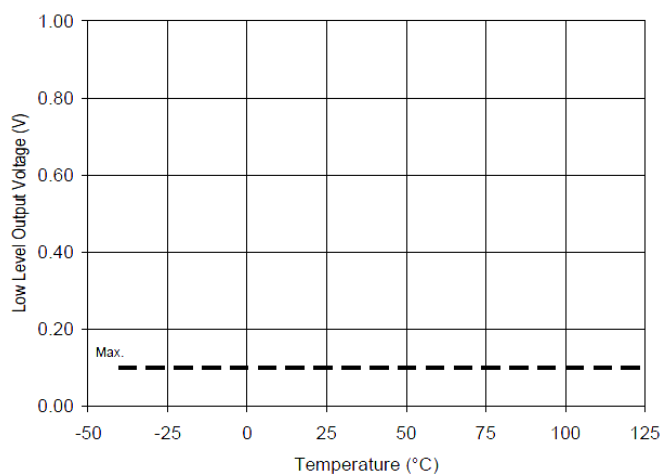
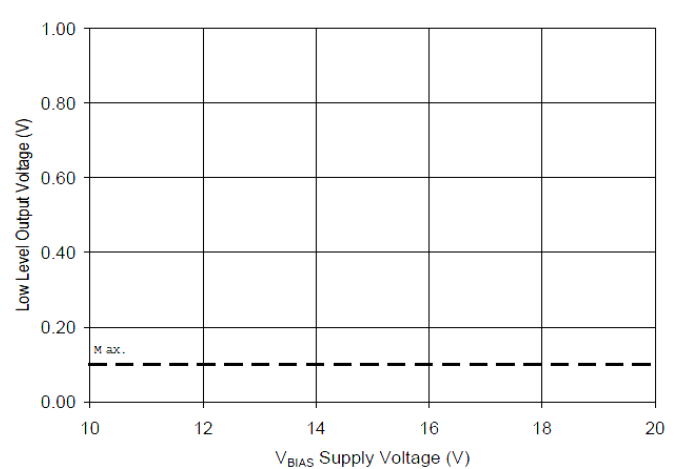
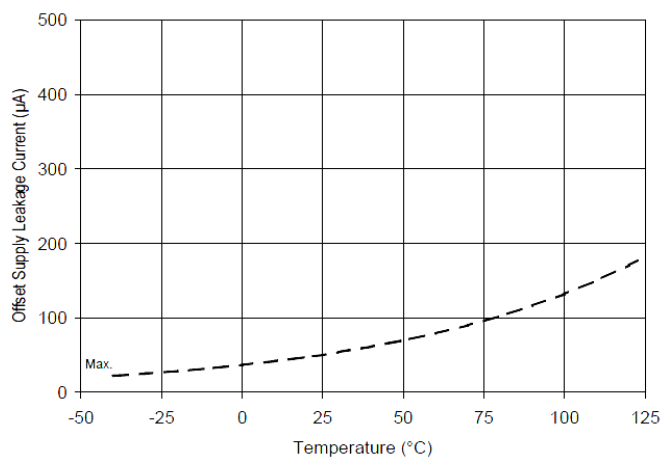
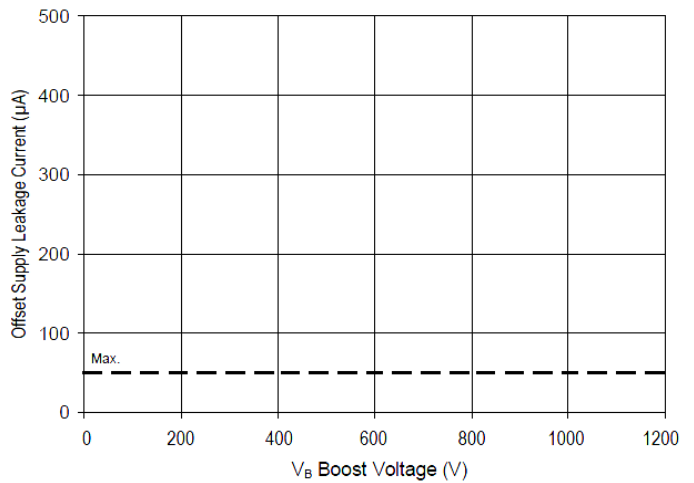
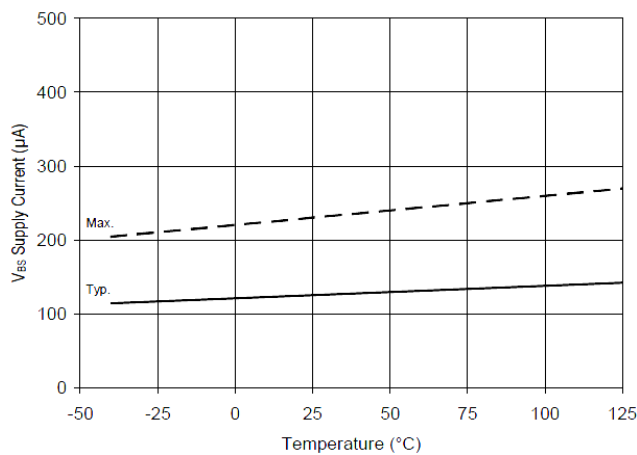
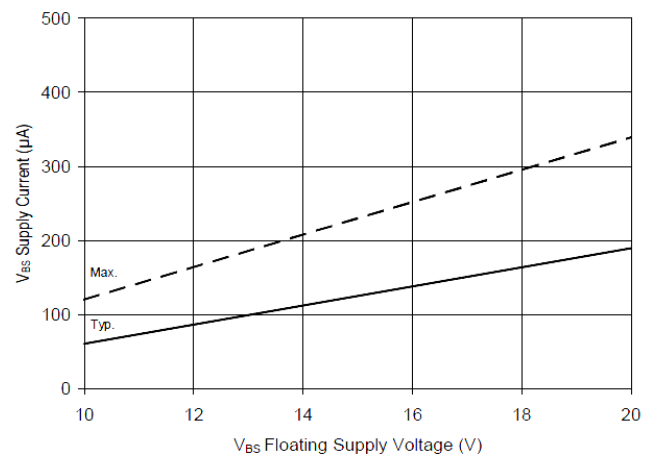
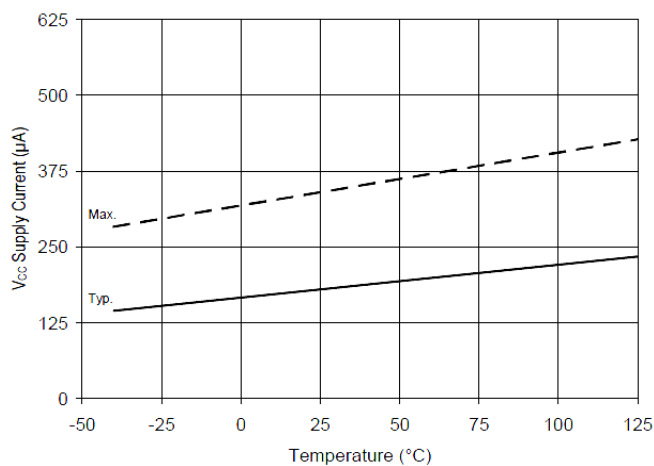
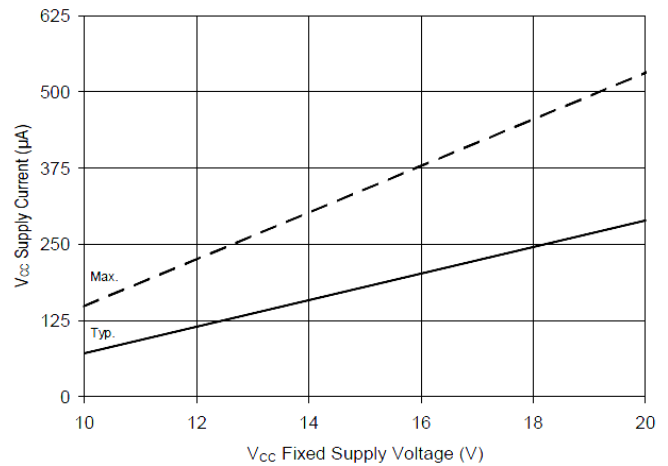
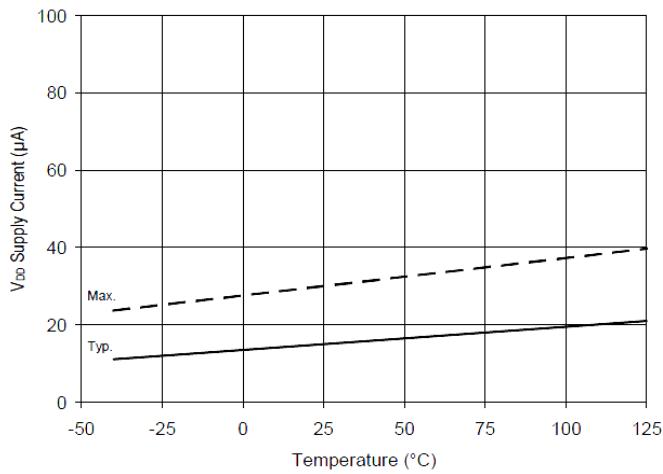
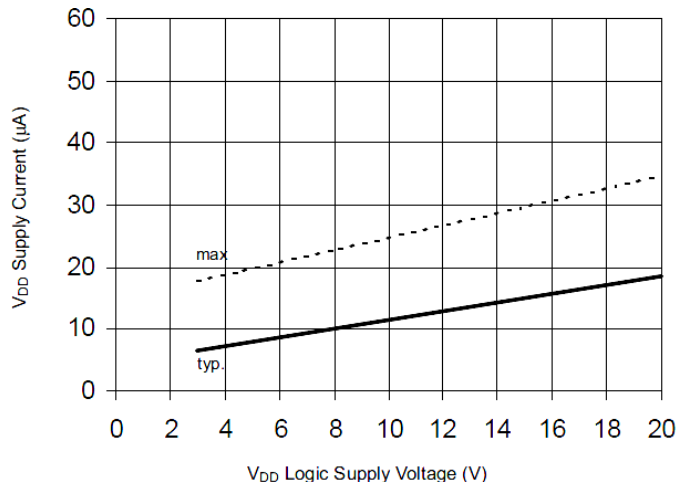
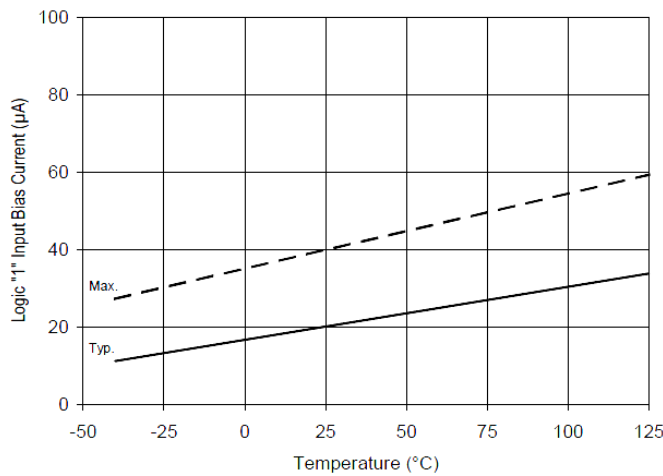
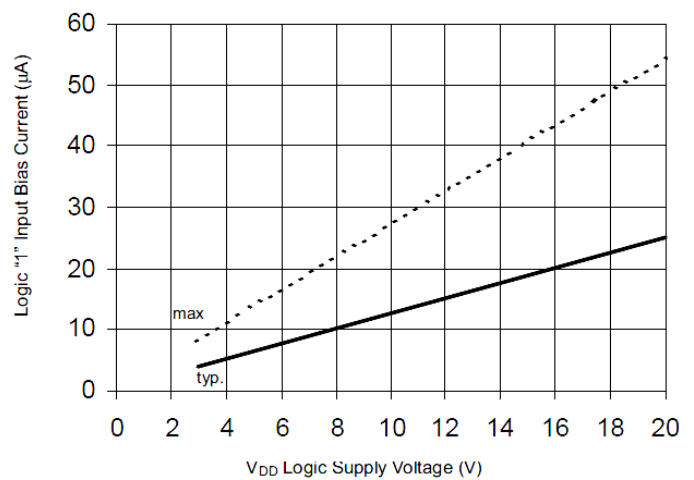
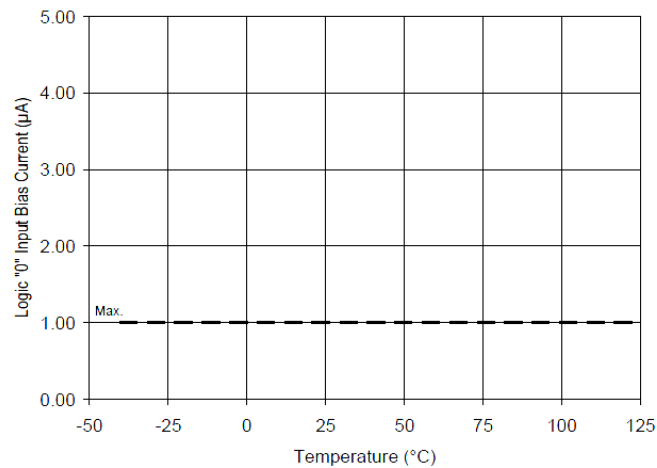
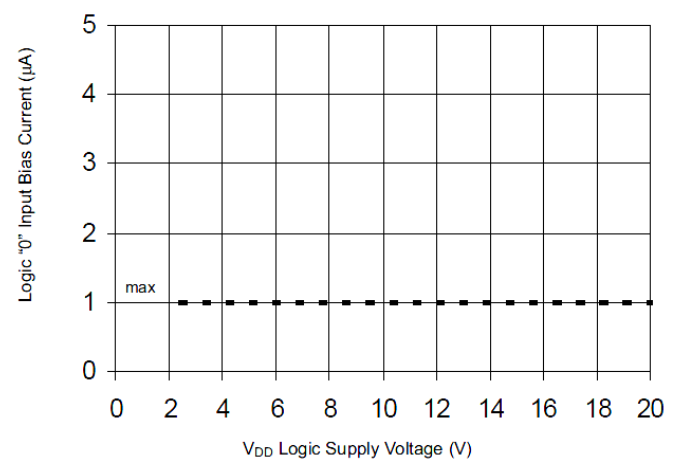


Figure 6. Delay Matching Waveform Definitions


Figure 7A. Turn-On Rise Time vs. Temperature

Figure 7B. Turn-On Rise Time vs. Voltage

Figure 8A. Turn-Off Fall Time vs. Temperature

Figure 8B. Turn-Off Fall Time vs. Voltage

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

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


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

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

Figure 11A. High Level Output vs. Temperature

Figure 11B. High Level Outputs vs. Voltage

Figure 12A. Low Level Output vs. Temperature

Figure 12B. Low Level Output vs. Voltage


Figure 13A. Offset Supply Current vs. Temperature

Figure 13B. Offset Supply Current vs. Voltage

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

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

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

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


Figure 16A. V_{DD} Supply Current vs. Temperature

Figure 16B. V_{DD} Supply Current vs. V_{DD} Voltage

Figure 17A. Logic "1" Input Current vs. Temperature

Figure 17B. Logic "1" Input Current vs. V_{DD} Voltage

Figure 18A. Logic "0" Input Current vs. Temperature

Figure 18B. Logic "0" Input Current vs. V_{DD} Voltage

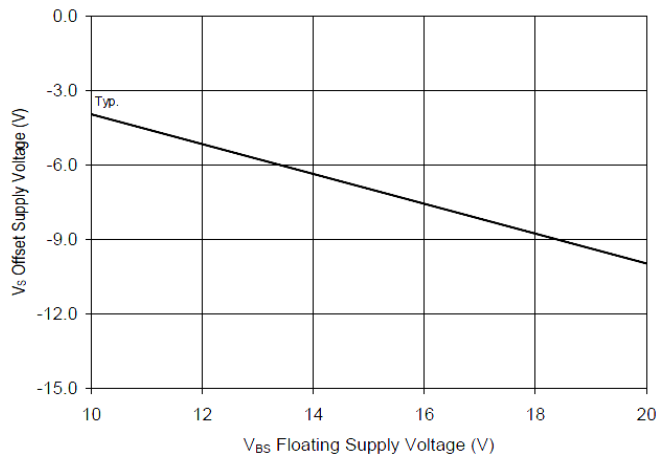


Figure 19. Maximum V_S Negative Offset vs. V_{BS} Supply Voltage

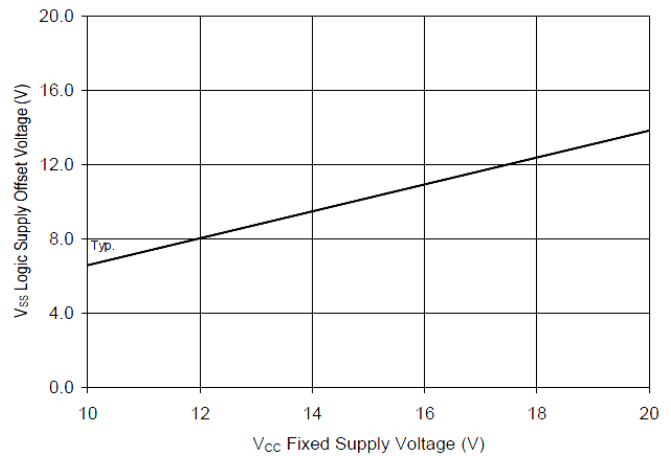


Figure 20. Maximum V_{SS} Positive Offset vs. V_{CC} Supply Voltage

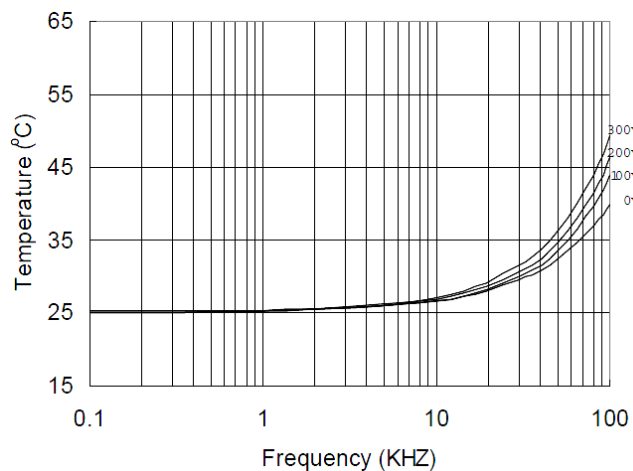


Figure 21. IR2213S vs. Frequency (IRFBC20)
R_{gate}=33Ω, V_{CC}=15V

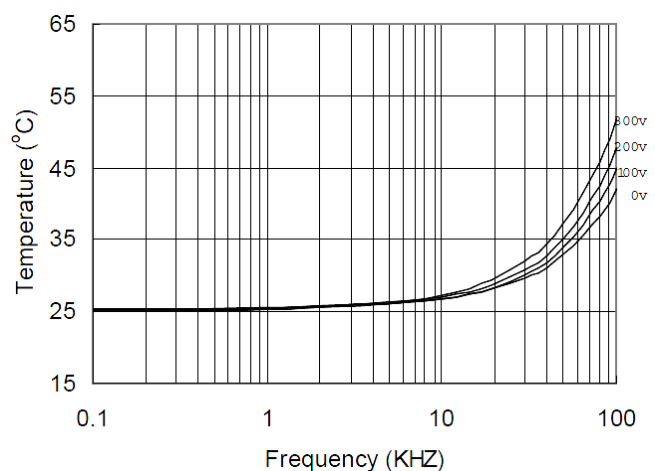


Figure 22. IR2213S vs. Frequency (IRFBC30)
R_{gate}=22Ω, V_{CC}=15V

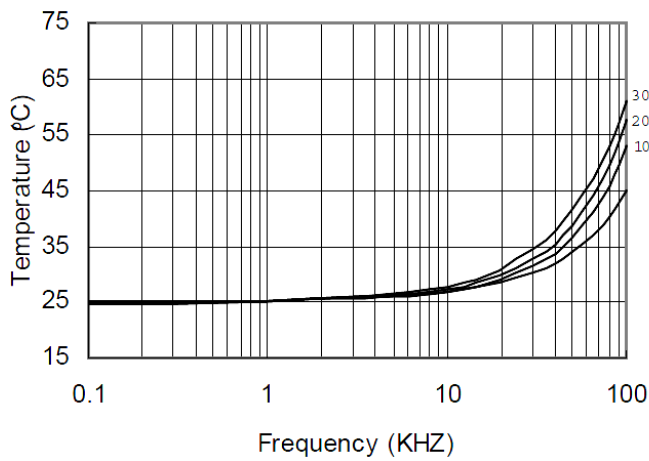


Figure 23. IR2213S vs. Frequency (IRFBC40)
 $R_{gate}=15\Omega$, $V_{CC}=15V$

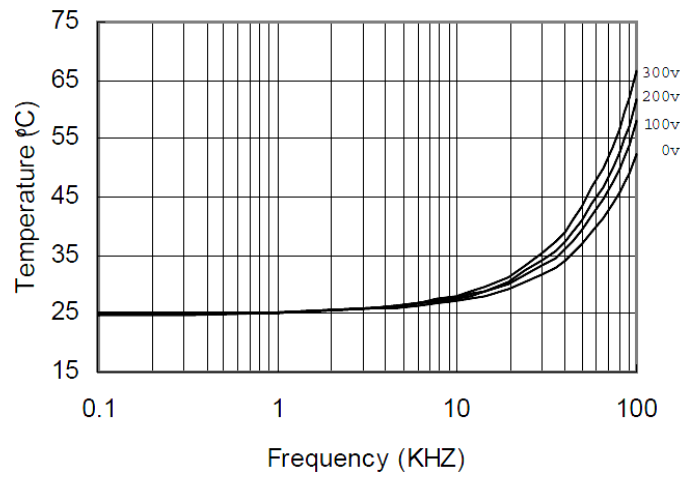


Figure 24. IR2213S vs. Frequency (IRFBC50)
 $R_{gate}=10\Omega$, $V_{CC}=15V$

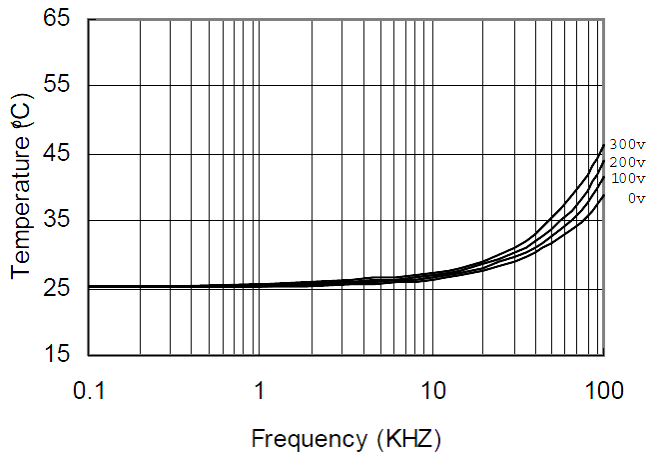


Figure 25. IR2213 vs. Frequency (IRFBC20)
 $R_{gate}=33\Omega$, $V_{CC}=15V$

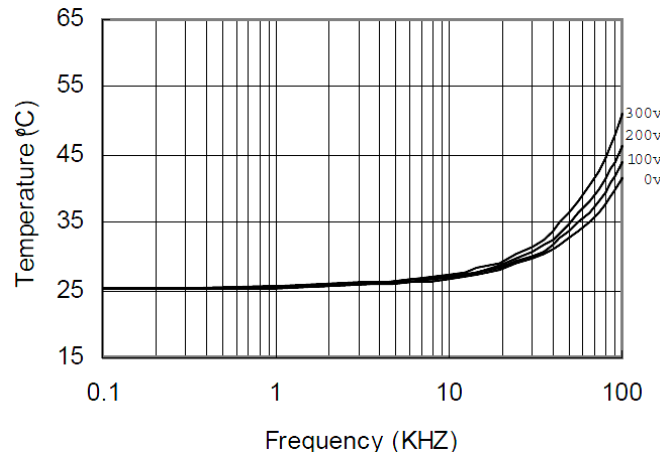


Figure 26. IR2213 vs. Frequency (IRFBC30)
 $R_{gate}=22\Omega$, $V_{CC}=15V$

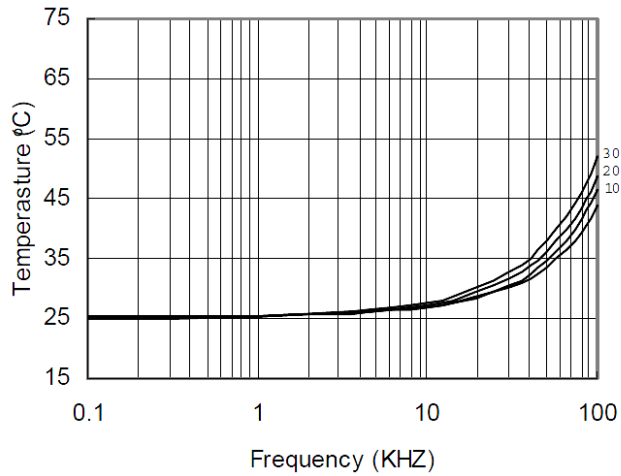


Figure 27. IR2213 vs. Frequency (IRFBC40)
 $R_{gate}=15\Omega$, $V_{CC}=15V$

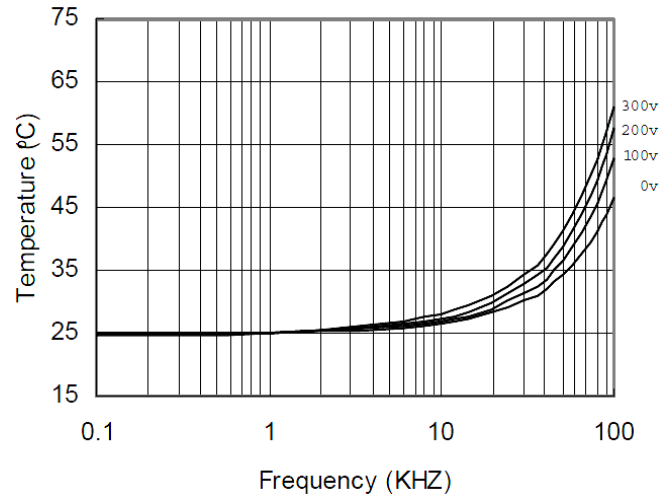
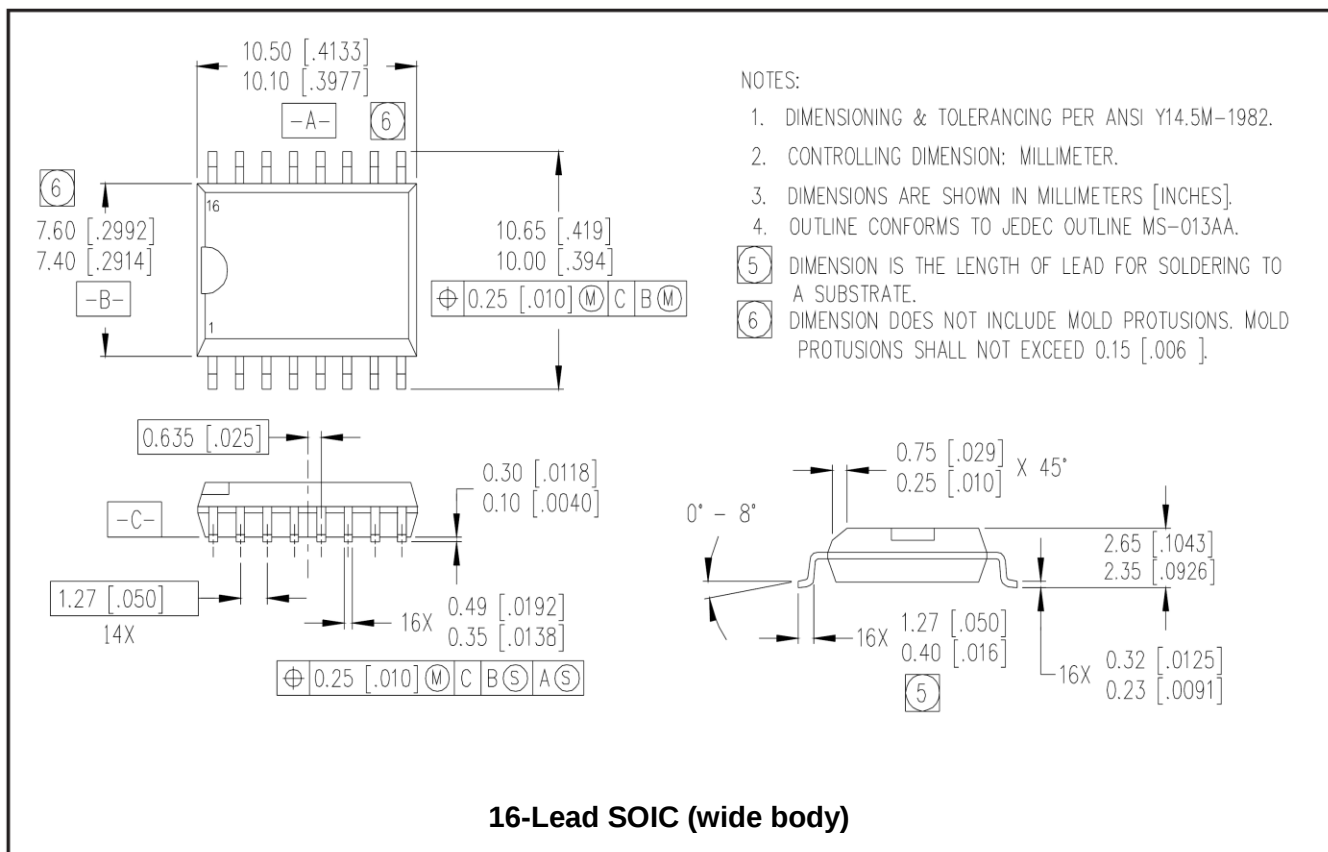
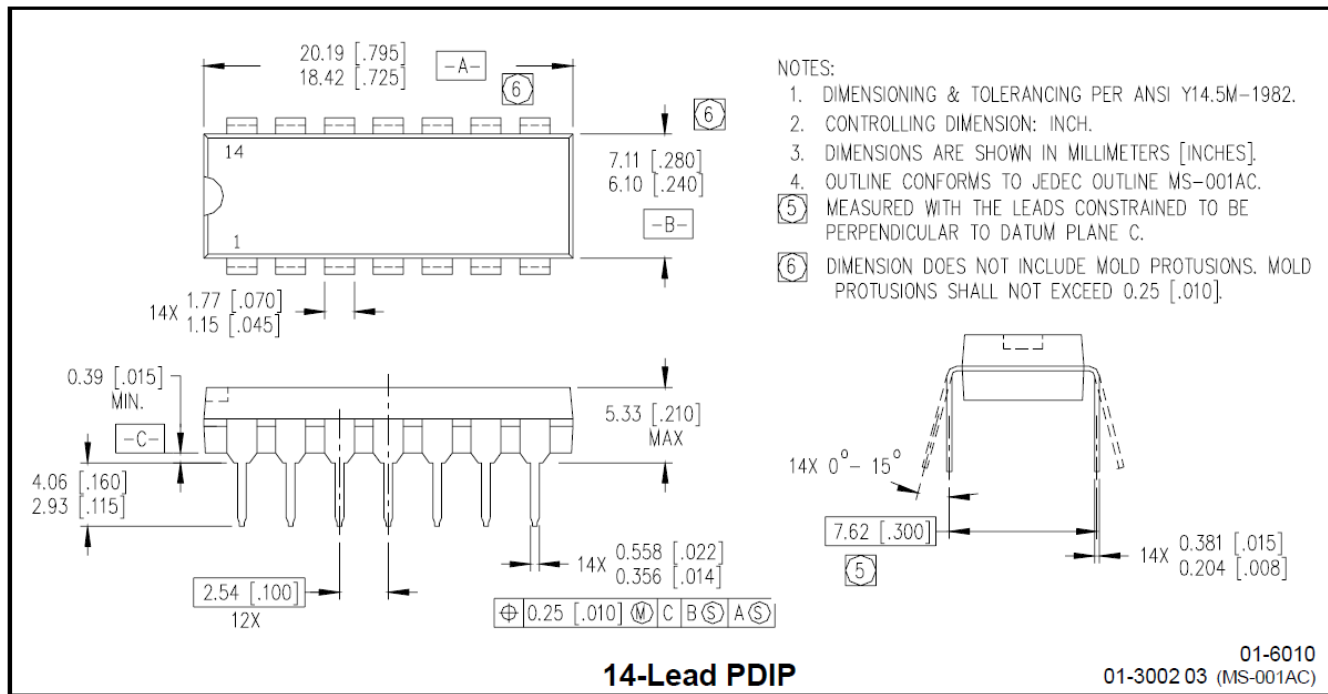
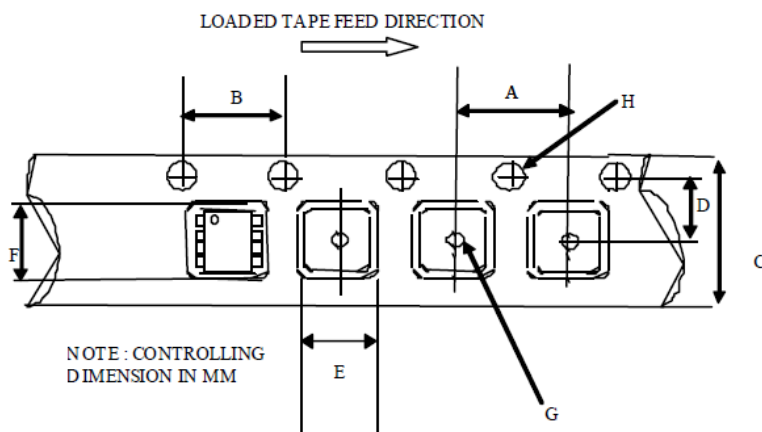


Figure 28. IR2213 vs. Frequency (IRFBC50)
 $R_{gate}=10\Omega$, $V_{CC}=15V$

Package Details

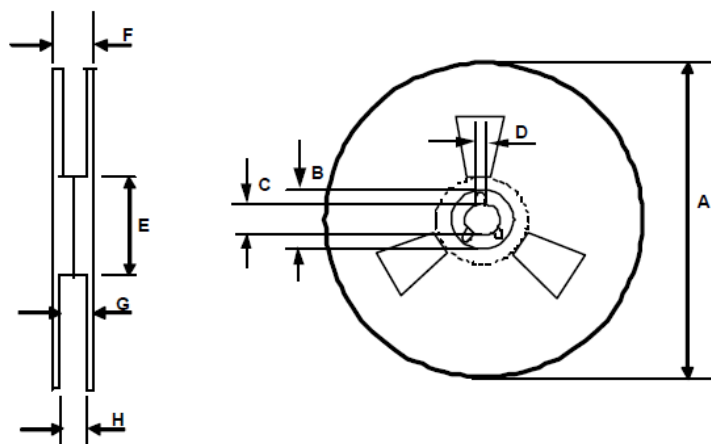


Tape and Reel Details, SO16WB



CARRIER TAPE DIMENSION FOR 16SOICW

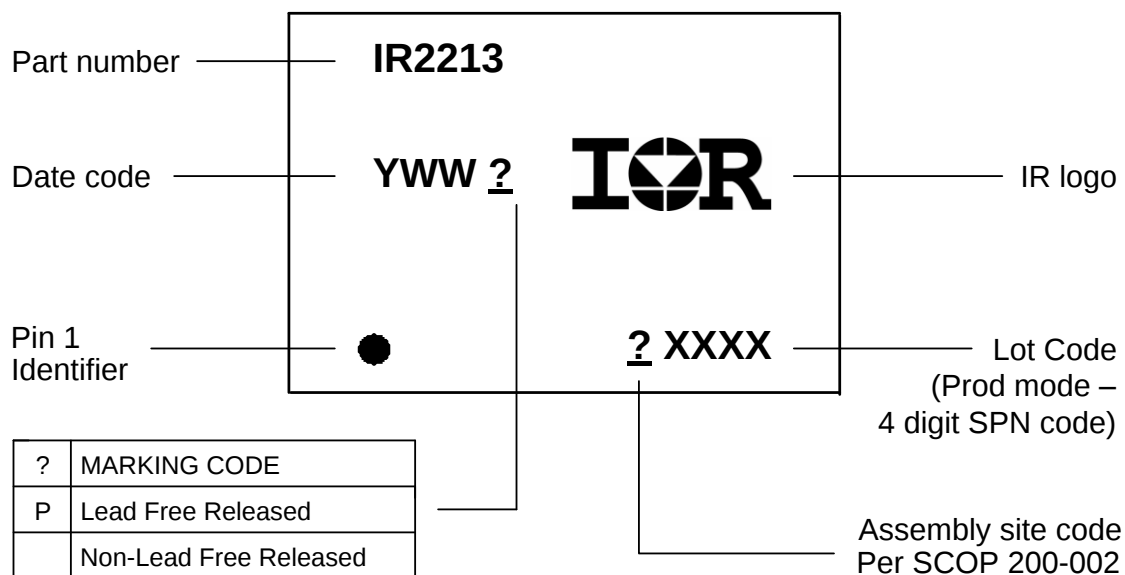
Code	Metric		Imperial	
	Min	Max	Min	Max
A	11.90	12.10	0.468	0.476
B	3.90	4.10	0.153	0.161
C	15.70	16.30	0.618	0.641
D	7.40	7.60	0.291	0.299
E	10.80	11.00	0.425	0.433
F	10.60	10.80	0.417	0.425
G	1.50	n/a	0.059	n/a
H	1.50	1.60	0.059	0.062



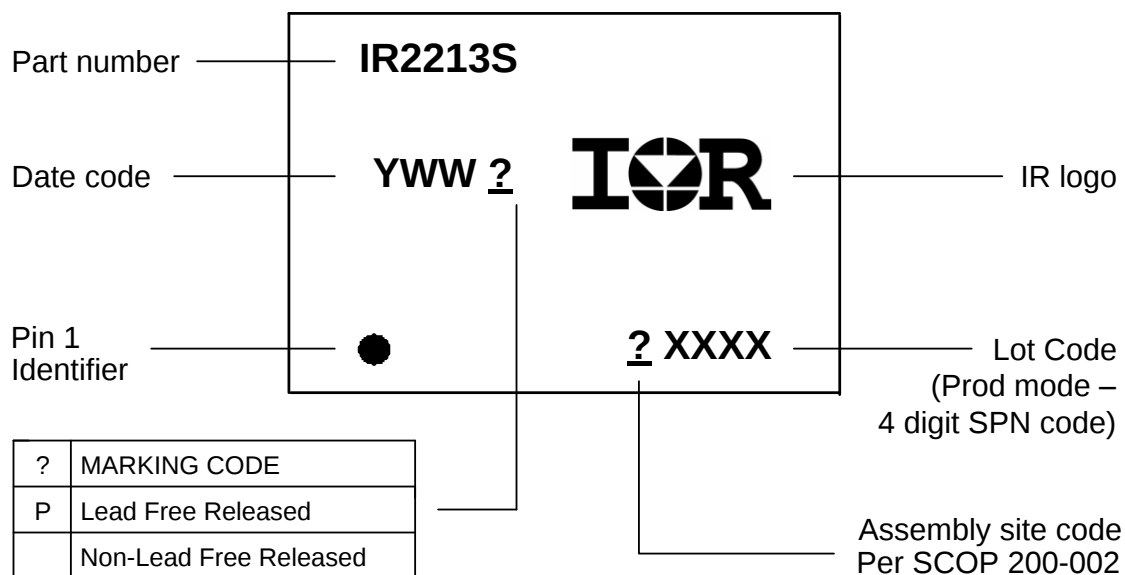
REEL DIMENSIONS FOR 16SOICW

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

Part Marking Information



14-Lead PDIP



16-Lead SOIC (wide body)

Qualification Information[†]

Qualification Level	Industrial ^{††} (per JEDEC JESD 47)	
	Comments: This family of ICs has passed JEDEC's Industrial qualification. IR's Consumer qualification level is granted by extension of the higher Industrial level.	
Moisture Sensitivity Level	SOIC16WB	MSL3 ^{†††} (per IPC/JEDEC J-STD 020)
	PDIP14	Not applicable (non-surface mount package style)
RoHS Compliant	Yes	

† Qualification standards can be found at International Rectifier's web site <http://www.irf.com/>

†† Higher qualification ratings may be available should the user have such requirements. Please contact your International Rectifier sales representative for further information.

††† Higher MSL ratings may be available for the specific package types listed here. Please contact your International Rectifier sales representative for further information.

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For technical support, please contact IR's Technical Assistance Center
<http://www.irf.com/technical-info/>

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

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Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru

moschip.ru_4

moschip.ru_6

moschip.ru_9