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International
IOR Rectifier

Data Sheet No. PD60174 revG

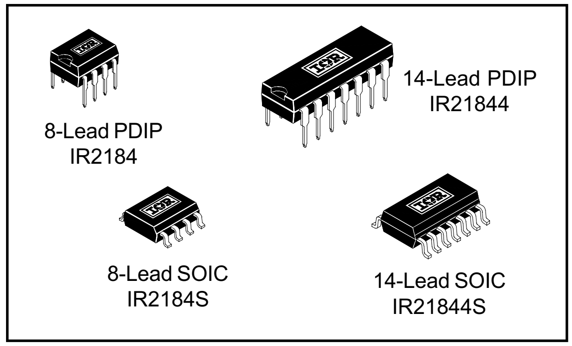
IR2184(4)(S) & (PbF)

HALF-BRIDGE 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 for both channels
- 3.3V and 5V input logic compatible
- Matched propagation delay for both channels
- Logic and power ground +/- 5V offset.
- Lower di/dt gate driver for better noise immunity
- Output source/sink current capability 1.4A/1.8A
- Also available LEAD-FREE (PbF)

Packages



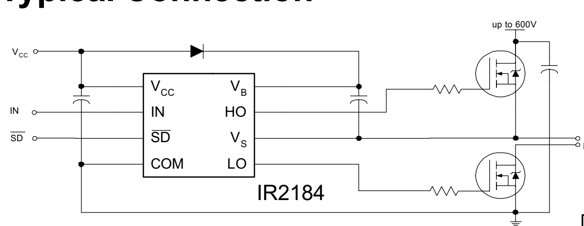
Description

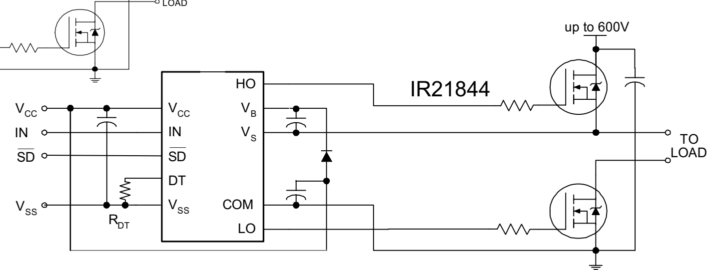
The IR2184(4)(S) are high voltage, high speed power MOSFET and IGBT drivers with dependent high and low side referenced output channels. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. The logic input is compatible with standard CMOS or LSTTL output, down to 3.3V 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 volts.

IR2181/IR2183/IR2184 Feature Comparison

Part	Input logic	Cross-conduction prevention logic	Dead-Time	Ground Pins	Ton/Toff
2181	HIN/LIN	no	none	COM	180/220 ns
21814				VSS/COM	
2183	HIN/$\overline{LIN}$	yes	Internal 500ns	COM	180/220 ns
21834			Program 0.4 ~ 5 us	VSS/COM	
2184	IN/$\overline{SD}$	yes	Internal 500ns	COM	680/270 ns
21844			Program 0.4 ~ 5 us	VSS/COM	

Typical Connection





(Refer to Lead Assignments for correct configuration). This/These diagram(s) 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 dead-time pin voltage (IR21844 only)		V_{SS} - 0.3	V_{CC} + 0.3	
V_{IN}	Logic input voltage (IN & $\overline{SD}$)		V_{SS} - 0.3	V_{SS} + 10	
V_{SS}	Logic ground (IR21844 only)		V_{CC} - 25	V_{CC} + 0.3	
dV_S/dt	Allowable offset supply voltage transient		—	50	V/ns
P_D	Package power dissipation @ $T_A \le$ +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		-50	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 rating are tested with all supplies biased at 15V 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 (IN & $\overline{SD}$)	V_{SS}	V_{SS} + 5	
DT	Programmable dead-time pin voltage (IR21844 only)	V_{SS}	V_{CC}	
V_{SS}	Logic ground (IR21844 only)	-5	5	
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}. (Please refer to the Design Tip DT97-3 for more details).
Note 2: IN and SD are internally clamped with a 5.2V zener diode.

Dynamic Electrical Characteristics

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

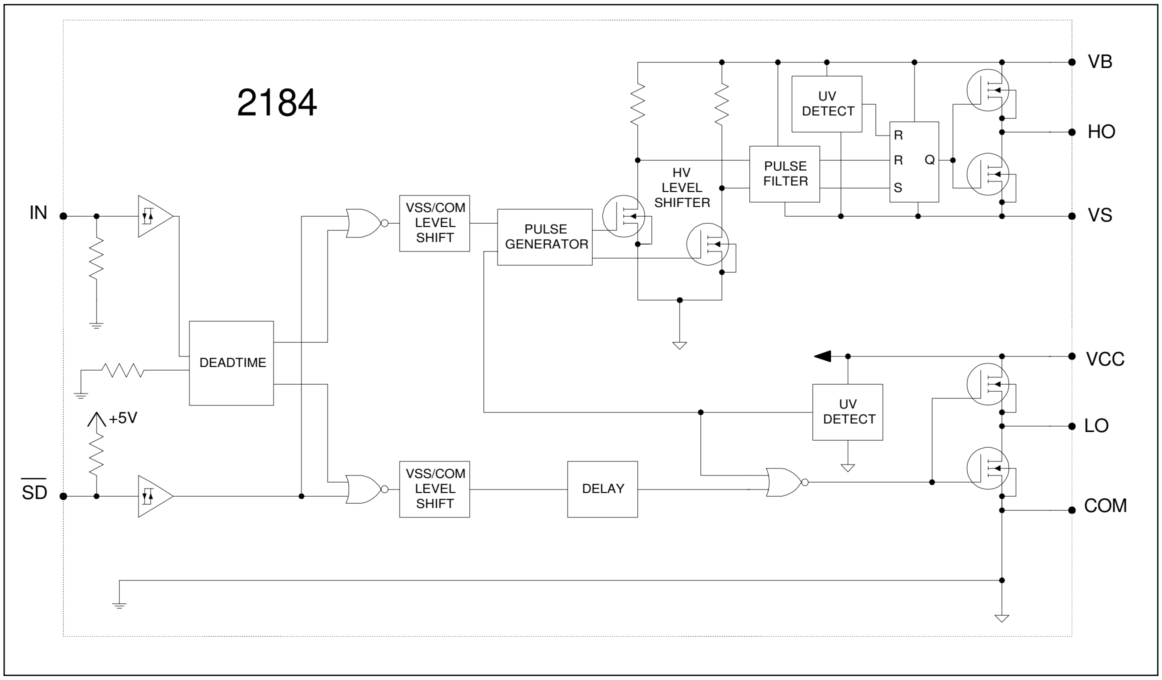
Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
t_{on}	Turn-on propagation delay	—	680	900	nsec	V_S = 0V
t_{off}	Turn-off propagation delay	—	270	400		V_S = 0V or 600V
t_{sd}	Shut-down propagation delay	—	180	270		
MTon	Delay matching, HS & LS turn-on	—	0	90		
MToff	Delay matching, HS & LS turn-off	—	0	40		
t_r	Turn-on rise time	—	40	60		V_S = 0V
t_f	Turn-off fall time	—	20	35		V_S = 0V
DT	Deadtime: LO turn-off to HO turn-on(DT_{LO-HO}) &	280	400	520		RDT= 0
	HO turn-off to LO turn-on (DT_{HO-LO})	4	5	6	µsec	RDT = 200k
MDT	Deadtime matching = $DT_{LO - HO}$ - DT_{HO-LO}	—	0	50	nsec	RDT=0
		—	0	600		RDT = 200k

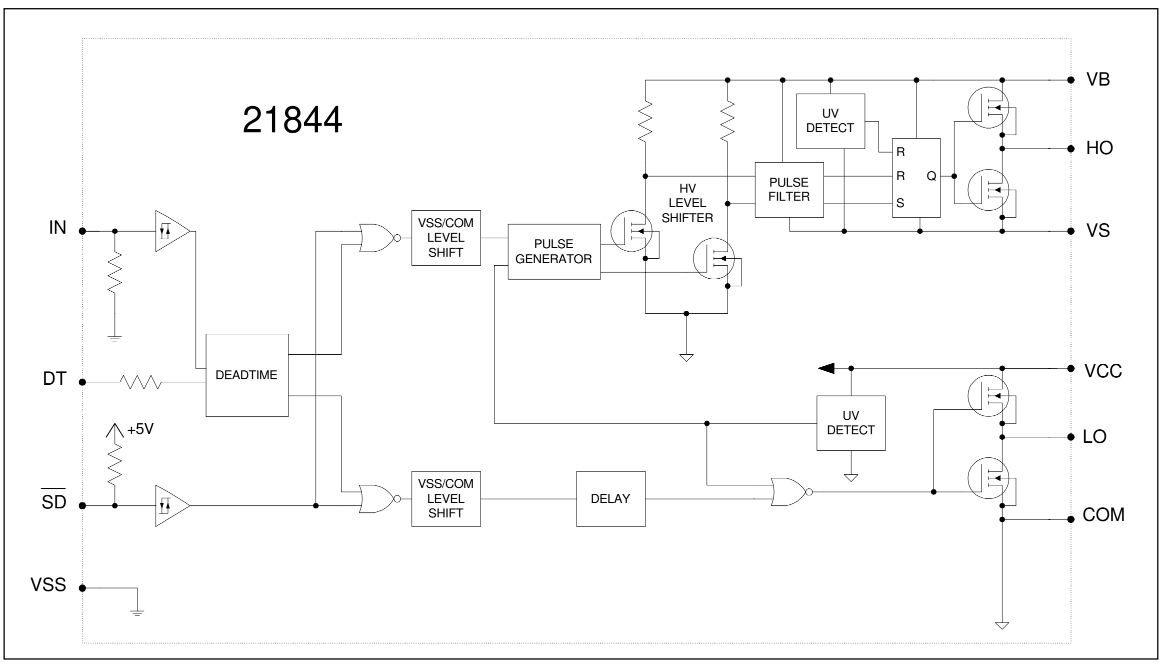
Static Electrical Characteristics

V_{BIAS} (V_{CC}, V_{BS}) = 15V, 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: IN and $\overline{SD}$. The V_O, I_O and Ron 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 HO & logic "0" for LO	2.7	—	—	V	V_{CC} = 10V to 20V
V_{IL}	Logic "0" input voltage for HO & logic "1" for LO	—	—	0.8		V_{CC} = 10V to 20V
$V_{SD,TH+}$	$\overline{SD}$ input positive going threshold	2.7	—	—		V_{CC} = 10V to 20V
$V_{SD,TH-}$	$\overline{SD}$ input negative going threshold	—	—	0.8		V_{CC} = 10V to 20V
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 = 600V
I_{QBS}	Quiescent V_{BS} supply current	20	60	150		V_{IN} = 0V or 5V
I_{QCC}	Quiescent V_{CC} supply current	0.4	1.0	1.6	mA	V_{IN} = 0V or 5V
I_{IN+}	Logic "1" input bias current	—	25	60	µA	IN = 5V, $\overline{SD}$ = 0V
I_{IN-}	Logic "0" input bias current	—	—	1.0		IN = 0V, $\overline{SD}$ = 5V
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	1.4	1.9	—	A	V_O = 0V, PW ≤ 10 µs
I_{O-}	Output low short circuit pulsed current	1.8	2.3	—		V_O = 15V, PW ≤ 10 µs

Functional Block Diagrams

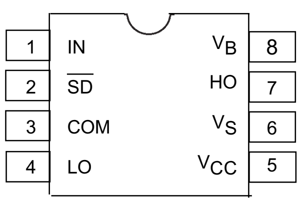




Lead Definitions

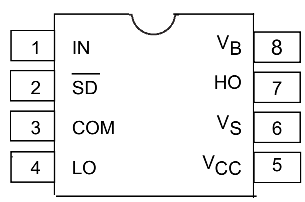
Symbol	Description
IN	Logic input for high and low side gate driver outputs (HO and LO), in phase with HO (referenced to COM for IR2184 and VSS for IR21844)
$\overline{SD}$	Logic input for shutdown (referenced to COM for IR2184 and VSS for IR21844)
DT	Programmable dead-time lead, referenced to VSS. (IR21844 only)
VSS	Logic Ground (21844 only)
V_B	High side floating supply
HO	High side gate drive output
V_S	High side floating supply return
V_{CC}	Low side and logic fixed supply
LO	Low side gate drive output
COM	Low side return

Lead Assignments



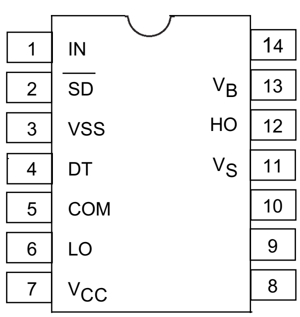
8-Lead PDIP

IR2184



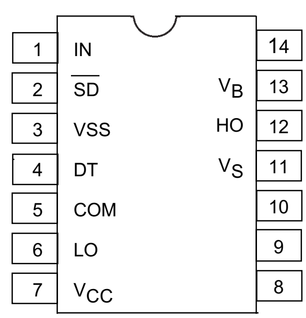
8-Lead SOIC

IR2184S



14-Lead PDIP

IR21844



14-Lead SOIC

IR21844S

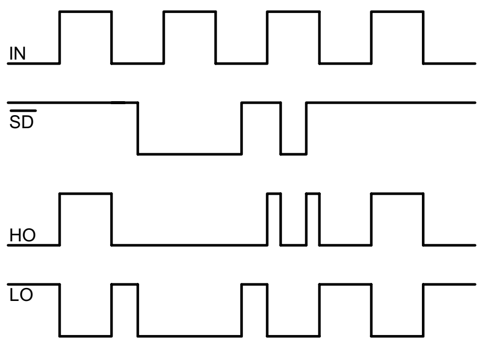


Figure 1. Input/Output Timing Diagram

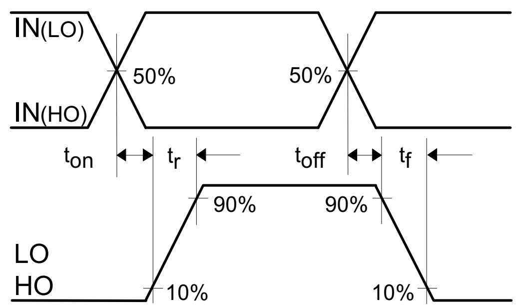


Figure 2. Switching Time Waveform Definitions

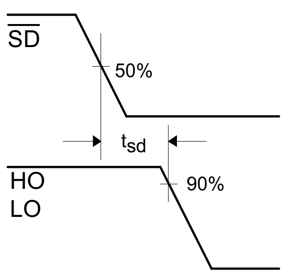


Figure 3. Shutdown Waveform Definitions

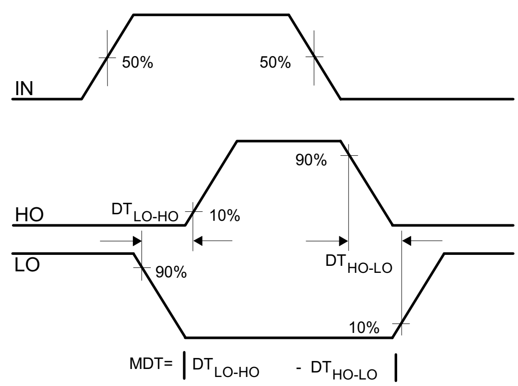


Figure 4. Deadtime Waveform Definitions

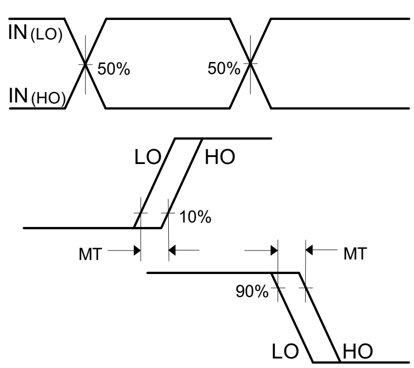


Figure 5. Delay Matching Waveform Definitions

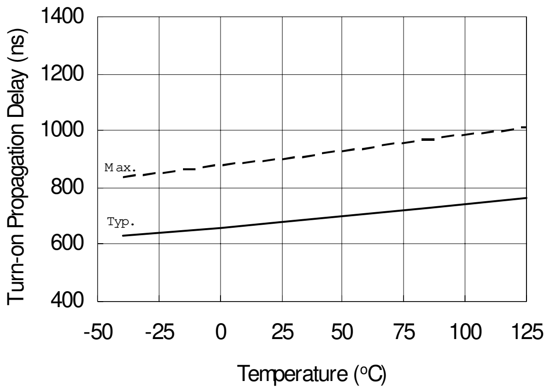


Figure 4A. Turn-on Propagation Delay vs. Temperature

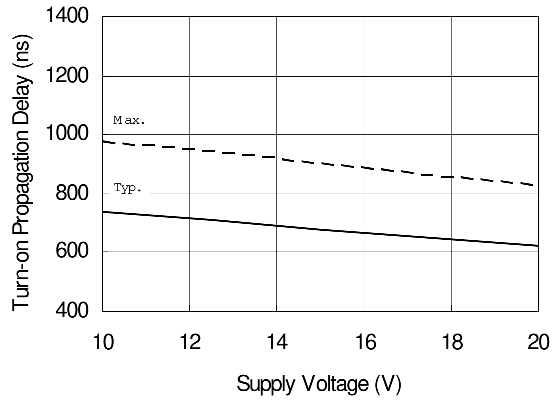


Figure4B. Turn-on Propagation Delay vs. Supply Voltage

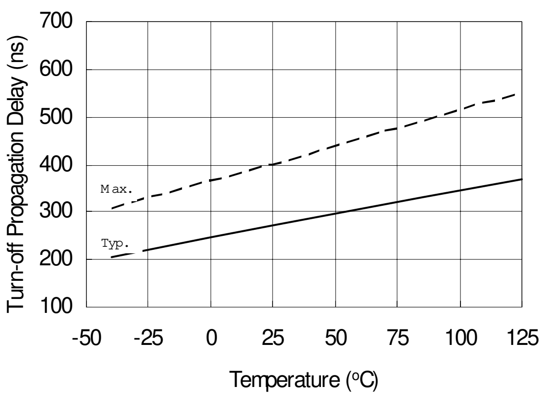


Figure 5A. Turn-off Propagation Delay vs. Temperature

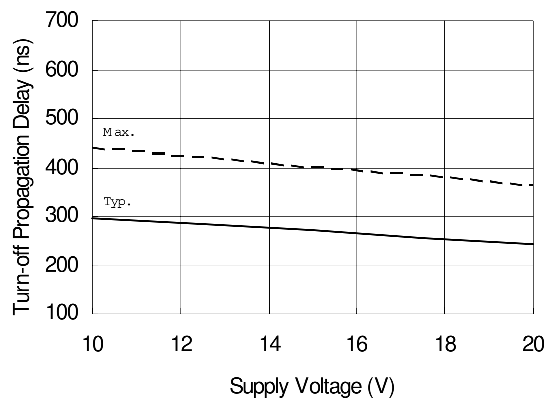


Figure 5B. Turn-off Propagation Delay vs. Supply Voltage

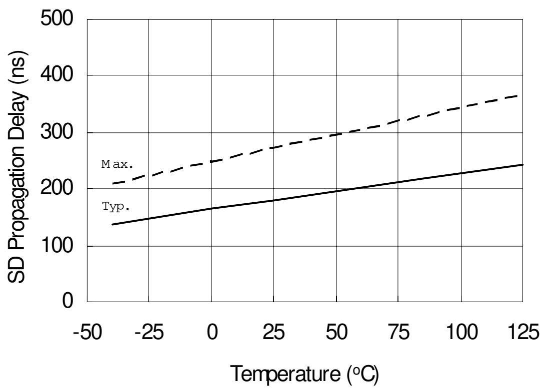


Figure 6A. SD Propagation Delay vs. Temperature

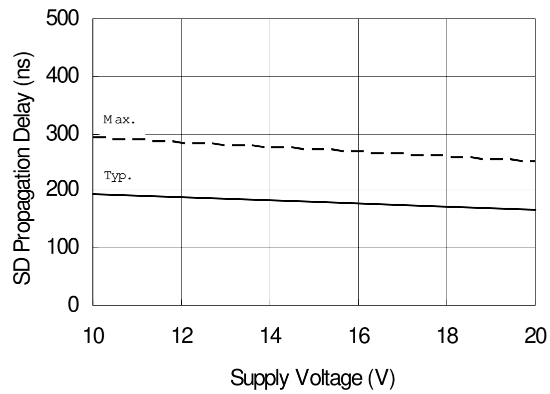


Figure 6B. SD Propagation Delay vs. Supply Voltage

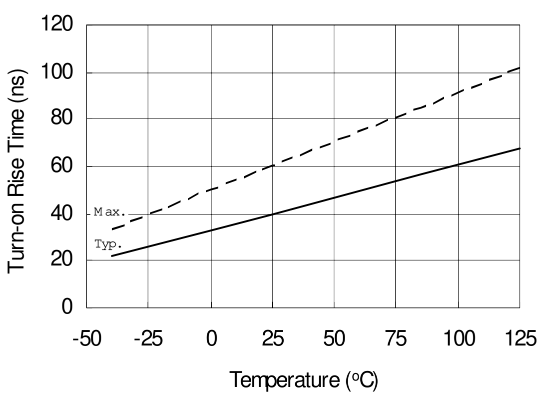


Figure 7A. Turn-on Rise Time vs. Temperature

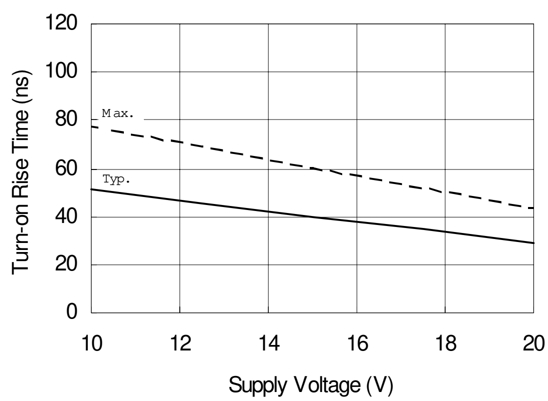


Figure 7B. Turn-on Rise Time vs. Supply Voltage

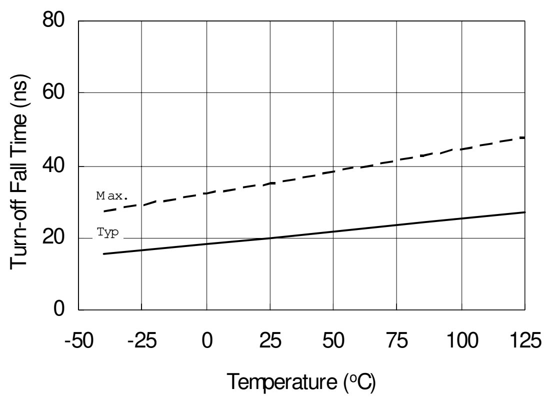


Figure 8A. Turn-off Fall Time vs. Temperature

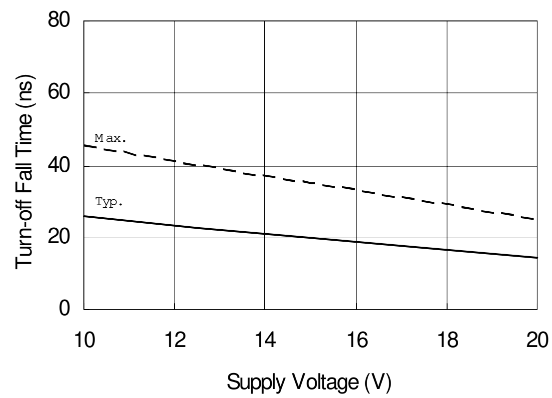


Figure 8B. Turn-off Fall Time vs. Supply Voltage

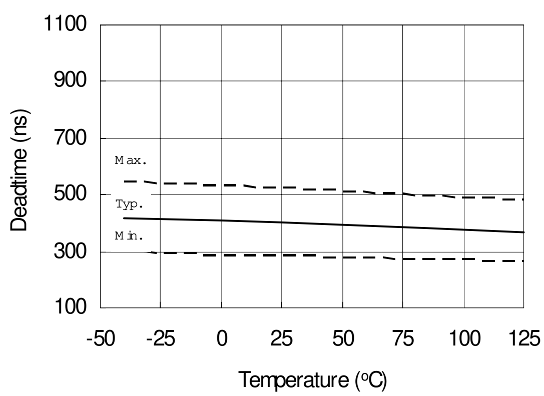


Figure 9A. Deadtime vs. Temperature

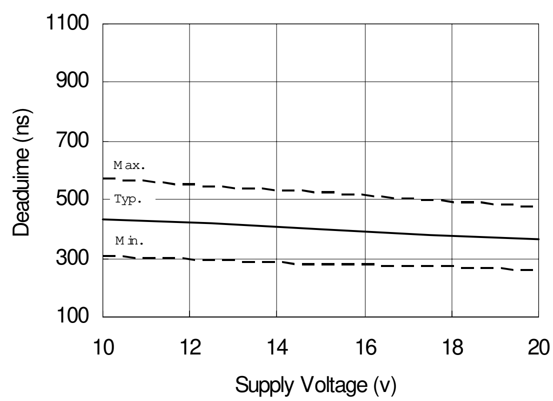


Figure 9B. Deadtime vs. Supply Voltage

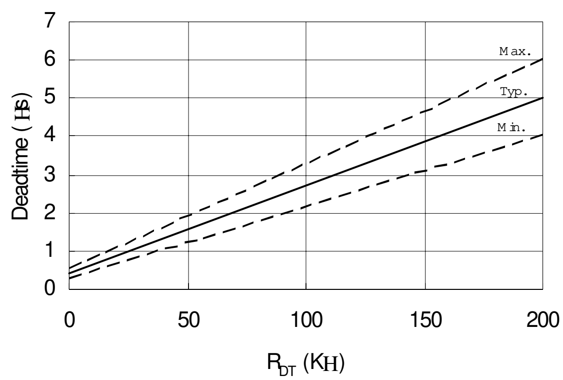


Figure 9C. Deadtime vs. R_{DT}

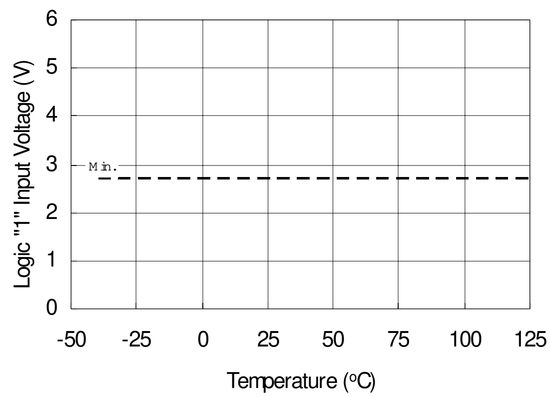


Figure 10A. Logic "1" Input Voltage vs. Temperature

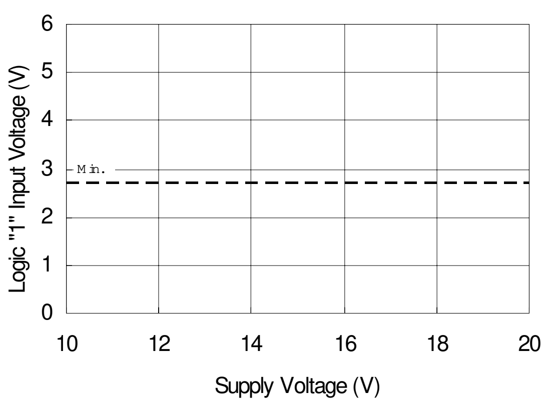


Figure 10B. Logic "1" Input Voltage vs. Supply Voltage

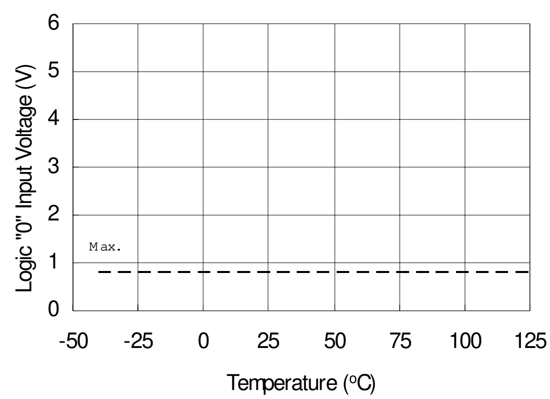


Figure 11A. Logic "0" Input Voltage vs. Temperature

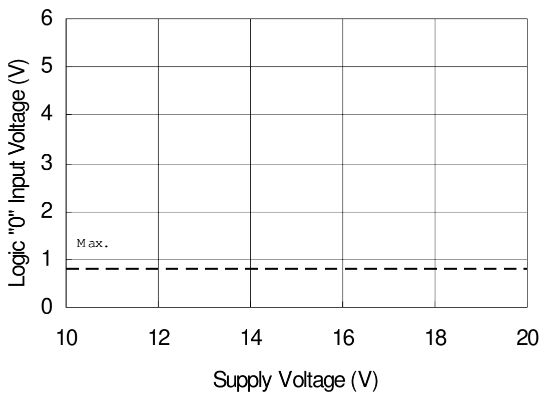


Figure 11B. Logic "0" Input Voltage vs. Supply Voltage

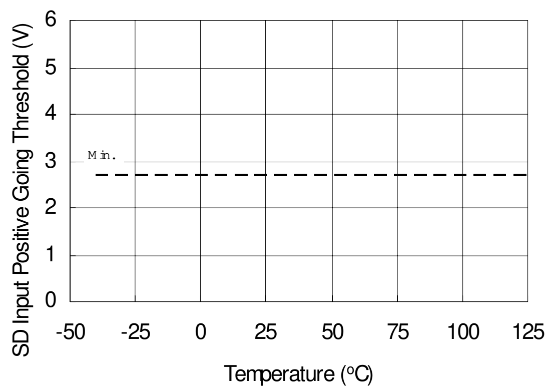


Figure 12A. SD Input Positive Going Threshold vs. Temperature

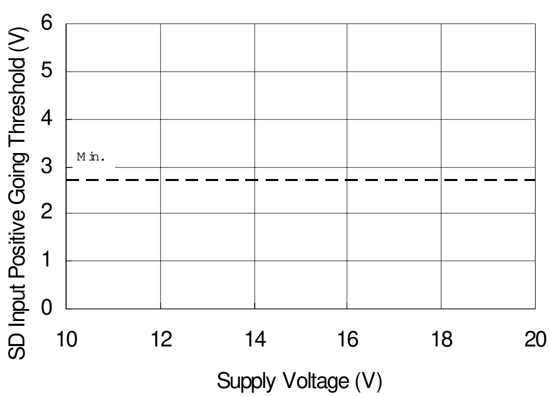


Figure 12B. SD Input Positive Going Threshold vs. Supply Voltage

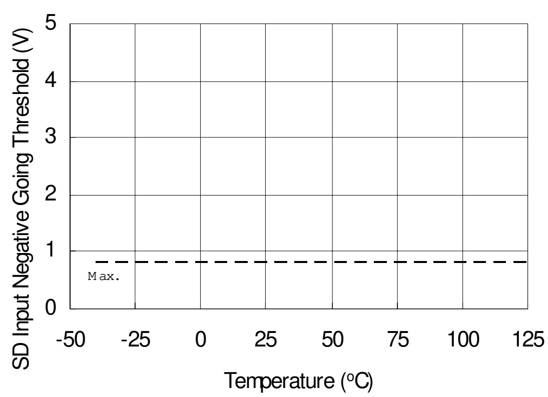


Figure 13A. SD Input Negative Going Threshold vs. Temperature

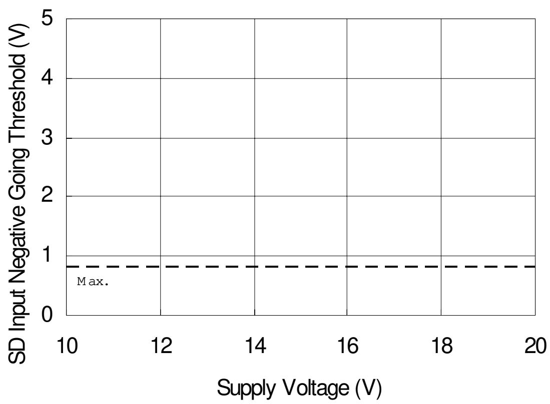


Figure 13B. SD Input Negative Going Threshold vs. Supply Voltage

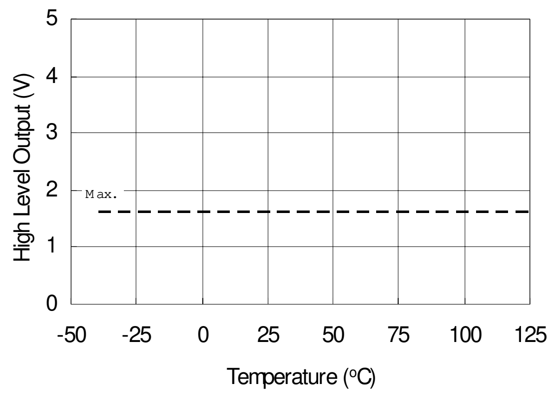


Figure 14A. High Level Output vs. Temperature

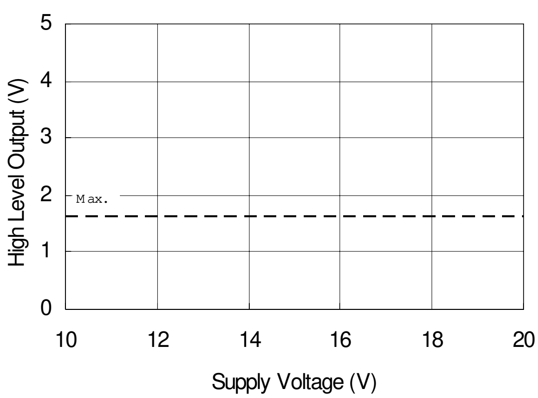


Figure 14B. High Level Output vs. Supply Voltage

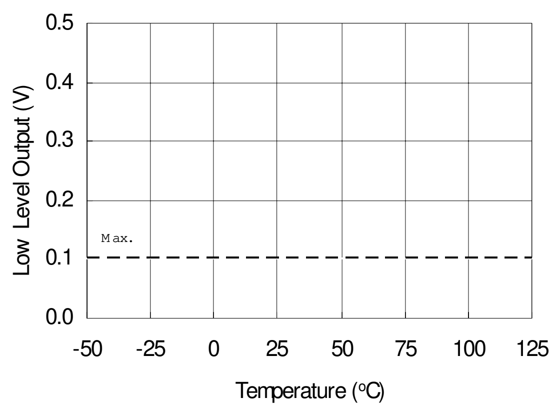


Figure 15A. Low Level Output vs. Temperature

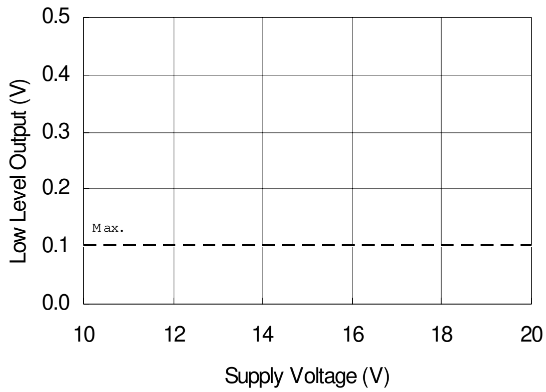


Figure 15B. Low Level Output vs. Supply Voltage

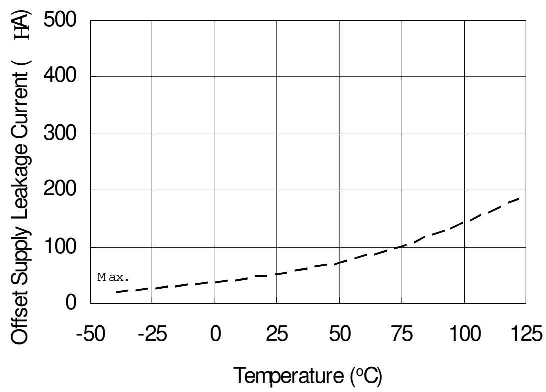


Figure 16A. Offset Supply Leakage Current vs. Temperature

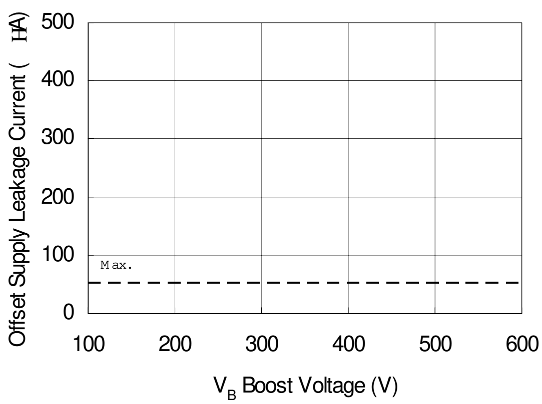


Figure 16B. Offset Supply Leakage Current vs. V_B Boost Voltage

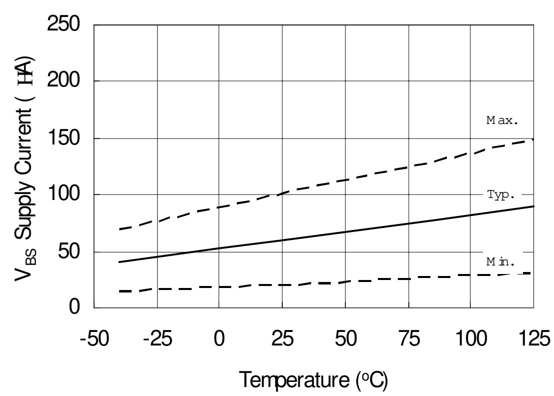


Figure 17A. V_{BS} Supply Current vs. Temperature

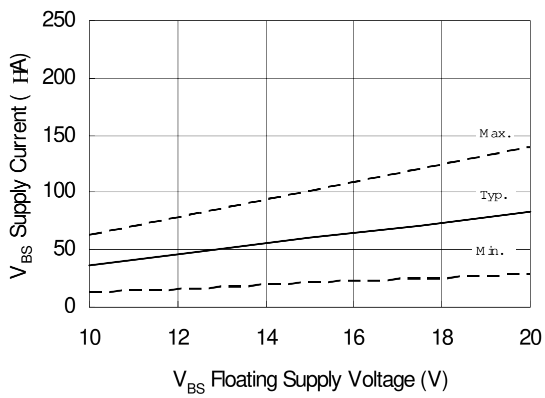


Figure 17B. V_{BS} Supply Current vs. V_{BS} Floating Supply Voltage

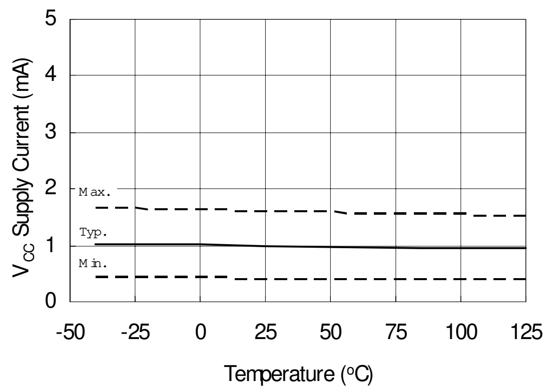


Figure 18A. V_{CC} Supply Current vs. Temperature

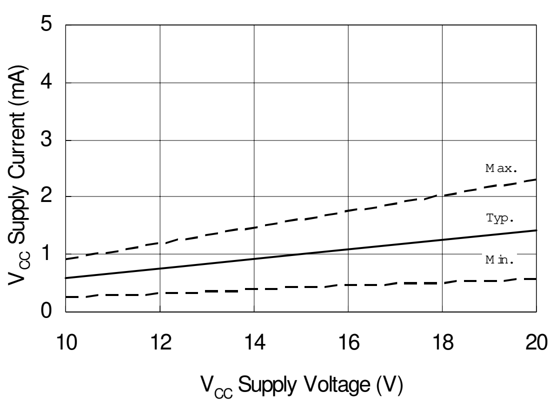


Figure 18B. V_{CC} Supply Current vs. V_{CC} Supply Voltage

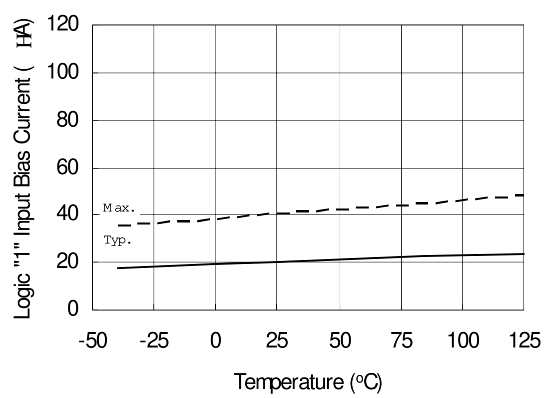


Figure 19A. Logic "1" Input Bias Current vs. Temperature

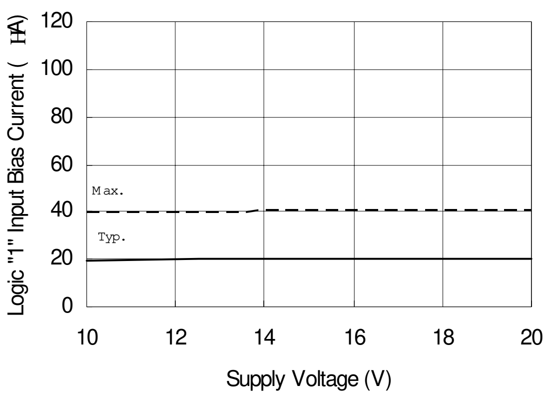


Figure 19B. Logic "1" Input Bias Current vs. Supply Voltage

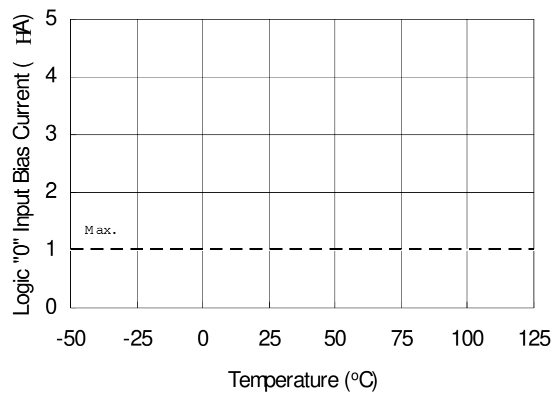


Figure 20A. Logic "0" Input Bias Current vs. Temperature

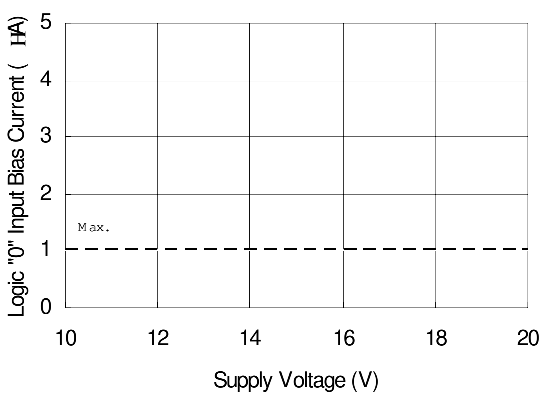


Figure 20B. Logic "0" Input Bias Current vs. Supply Voltage

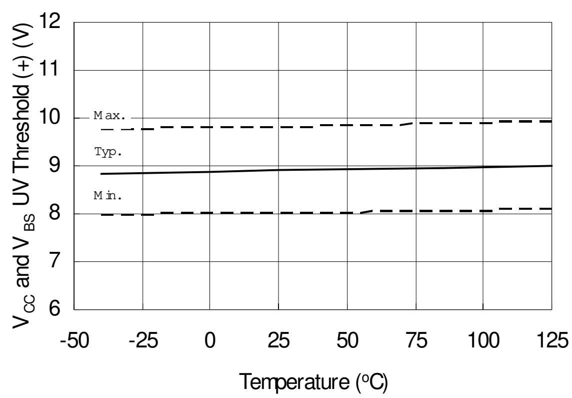


Figure 21. V_{CC} and V_{BS} Undervoltage Threshold (+) vs. Temperature

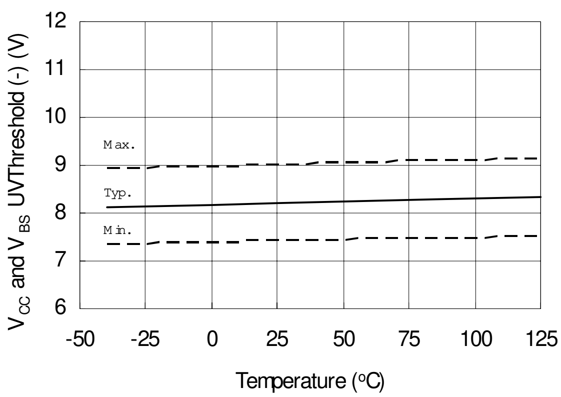


Figure 22. V_{CC} and V_{BS} Undervoltage Threshold (-) vs. Temperature

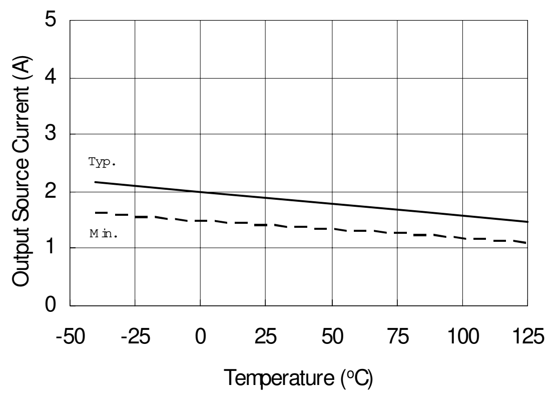


Figure 23A. Output Source Current vs. Temperature

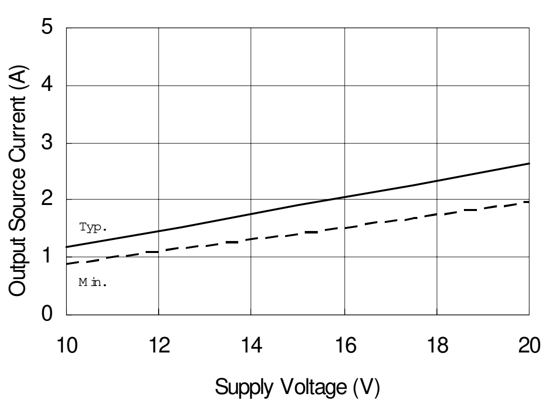


Figure 23B. Output Source Current vs. Supply Voltage

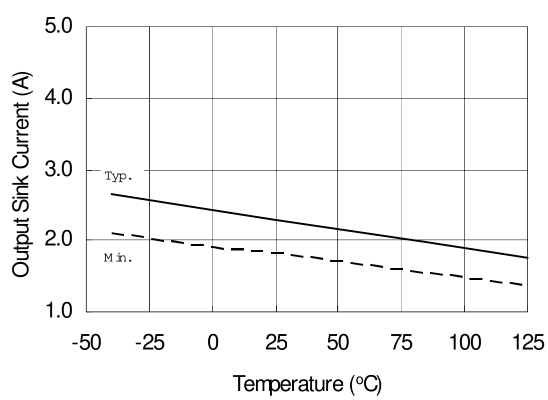


Figure 24A. Output Sink Current vs. Temperature

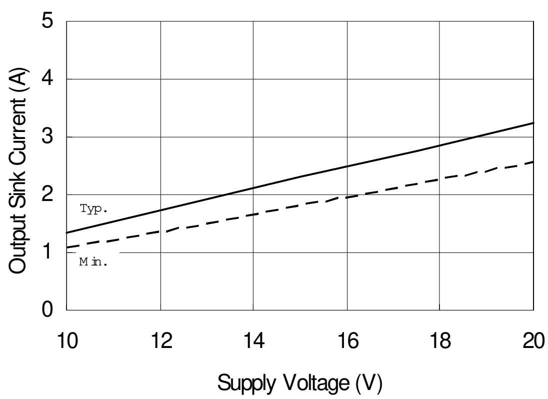


Figure 24B. Output Sink Current vs. Supply Voltage

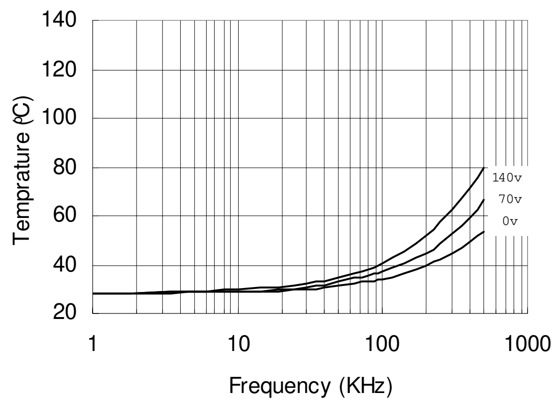


Figure 21. IR2181 vs. Frequency (IRFBC20), $R_{gate}=33\Omega$, $V_{CC}=15V$

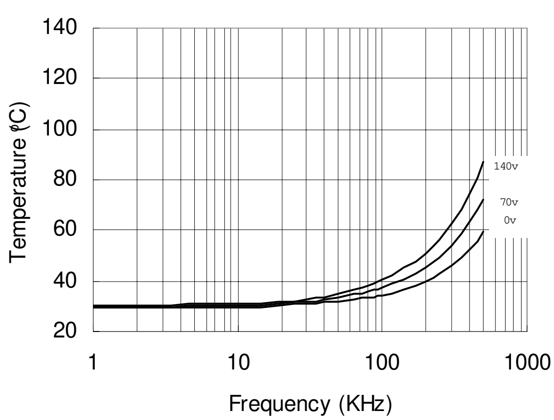


Figure 22. IR2181 vs. Frequency (IRFBC30), $R_{gate}=22\Omega$, $V_{CC}=15V$

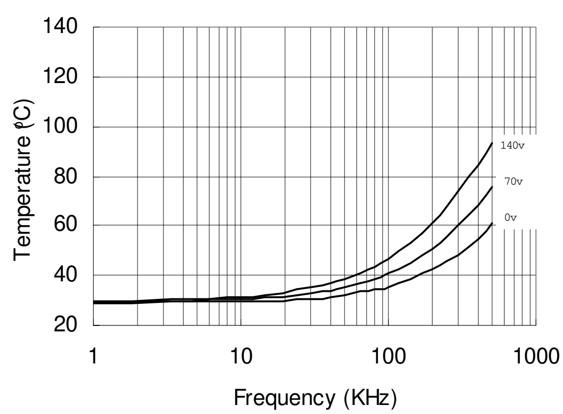


Figure 23. IR2181 vs. Frequency (IRFBC40), $R_{gate}=15\Omega$, $V_{CC}=15V$

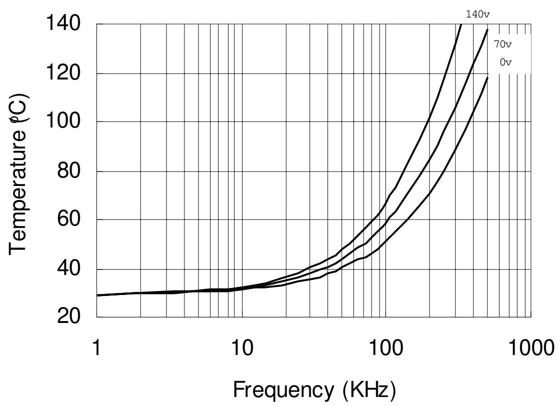


Figure 24. IR2181 vs. Frequency (IRFPE50), R_{gate}=10Ω, V_{CC}=15V

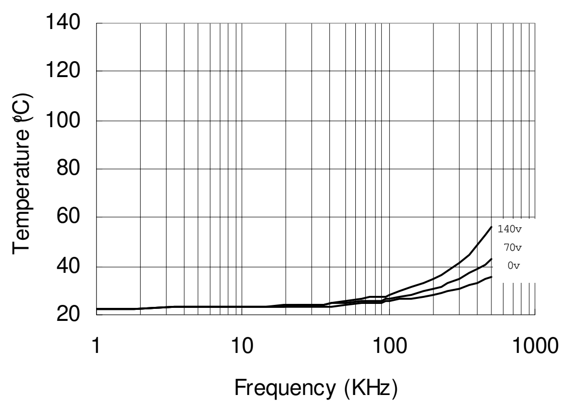


Figure 25. IR21814 vs. Frequency (IRFBC20), R_{gate}=33Ω, V_{CC}=15V

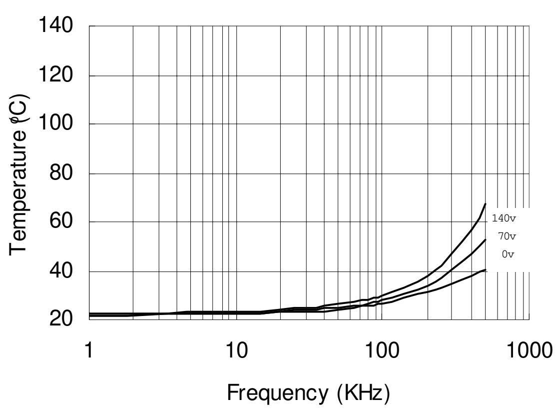


Figure 26. IR21814 vs. Frequency (IRFBC30), R_{gate}=22Ω, V_{CC}=15V

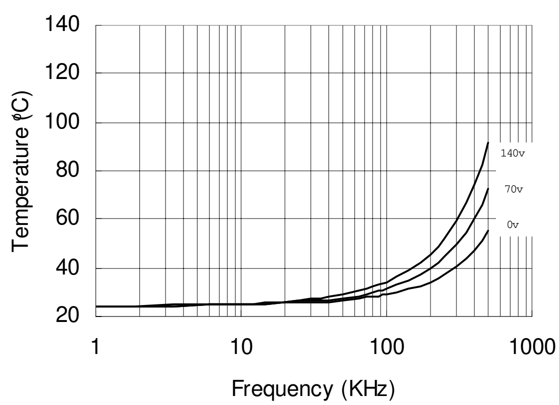


Figure 27. IR21814 vs. Frequency (IRFBC40), R_{gate}=15Ω, V_{CC}=15V

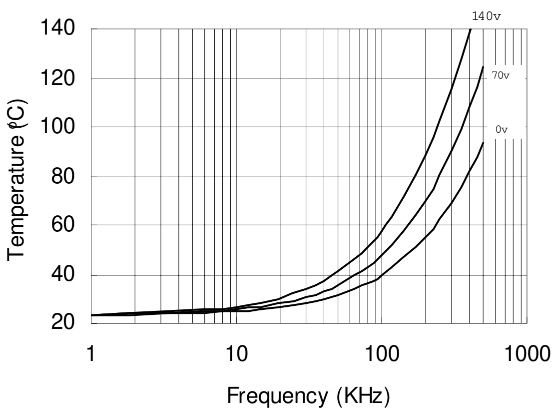


Figure 28. IR21814 vs. Frequency (IRFPE50), $R_{gate}=10\Omega$, $V_{CC}=15V$

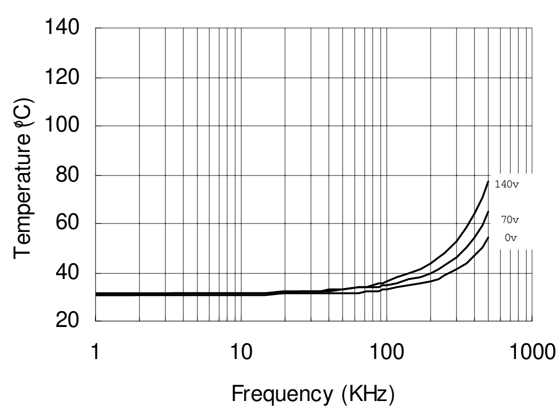


Figure 29. IR2181s vs. Frequency (IRFBC20), $R_{gate}=33\Omega$, $V_{CC}=15V$

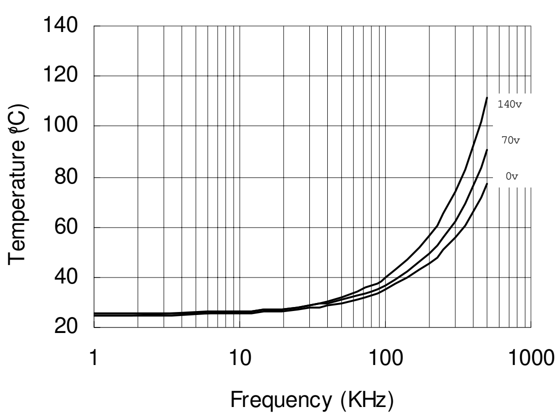


Figure 30. IR2181s vs. Frequency (IRFBC30), $R_{gate}=22\Omega$, $V_{CC}=15V$

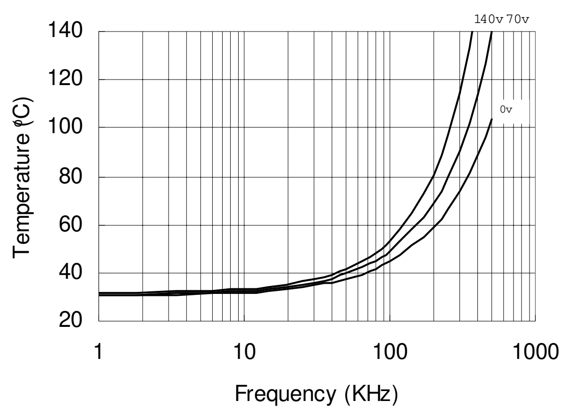


Figure 31. IR2181s vs. Frequency (IRFBC40), $R_{gate}=15\Omega$, $V_{CC}=15V$

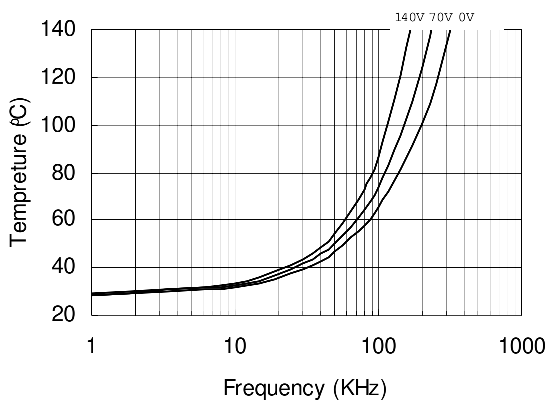


Figure 32. IR2181s vs. Frequency (IRFPE50), R_{gate}=10Ω, V_{CC}=15V

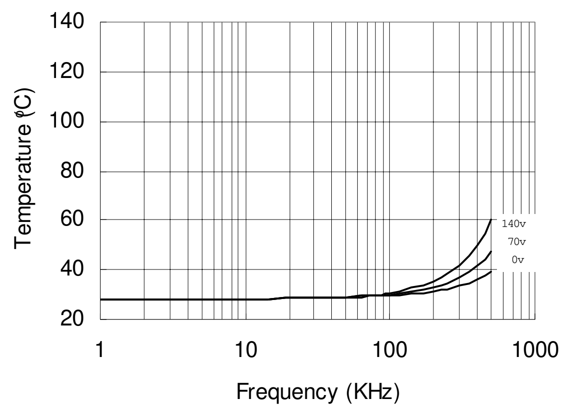


Figure 33. IR21814s vs. Frequency (IRFBC20), R_{gate}=33Ω, V_{CC}=15V

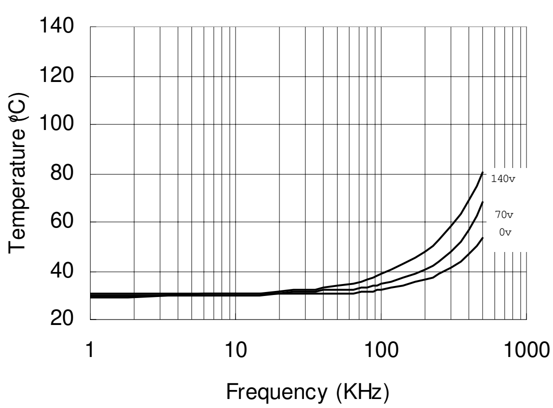


Figure 34. IR21814s vs. Frequency (IRFBC30), R_{gate}=22Ω, V_{CC}=15V

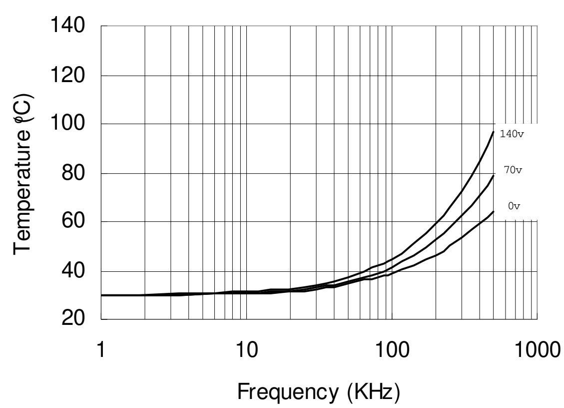


Figure 35. IR21814s vs. Frequency (IRFBC40), R_{gate}=15Ω, V_{CC}=15V

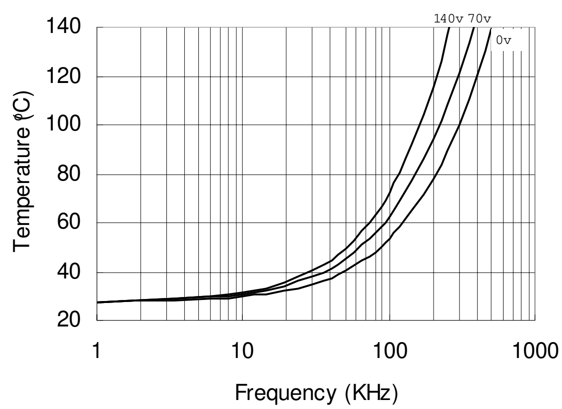
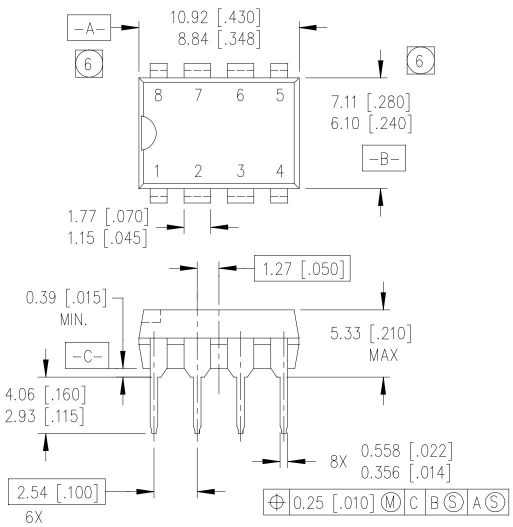
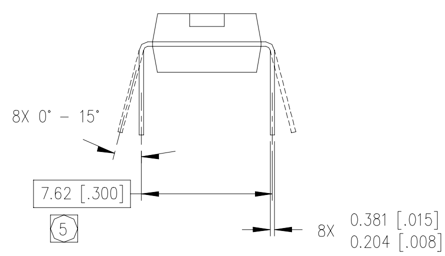


Figure 36. IR21814s vs. Frequency (IRFPE50), R_{gate}=10Ω, V_{CC}=15V



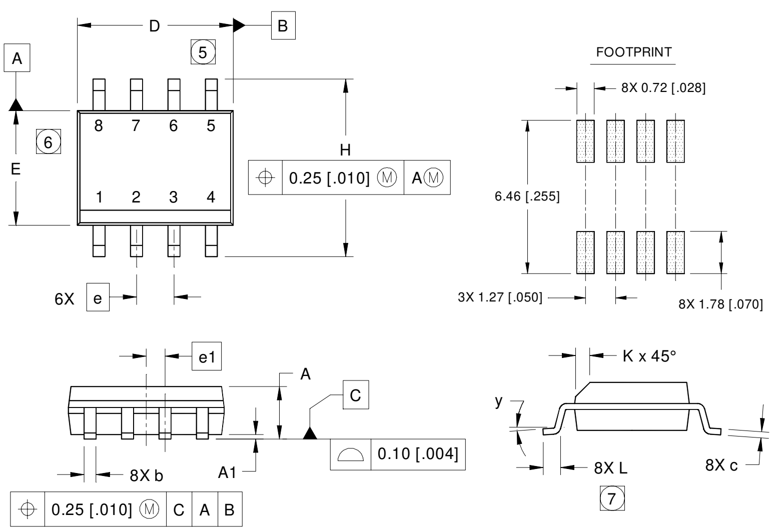
NOTES:

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)



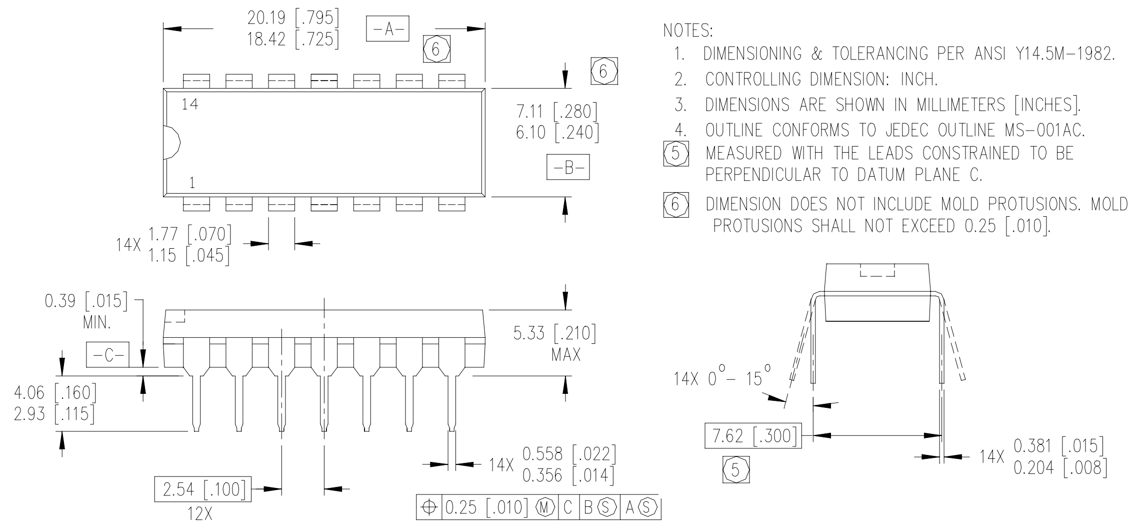
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.0532	.0688	1.35	1.75
A1	.0040	.0098	0.10	0.25
b	.013	.020	0.33	0.51
c	.0075	.0098	0.19	0.25
D	.189	.1968	4.80	5.00
E	.1497	.1574	3.80	4.00
e	.050 BASIC		1.27 BASIC	
e 1	.025 BASIC		0.635 BASIC	
H	.2284	.2440	5.80	6.20
K	.0099	.0196	0.25	0.50
L	.016	.050	0.40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

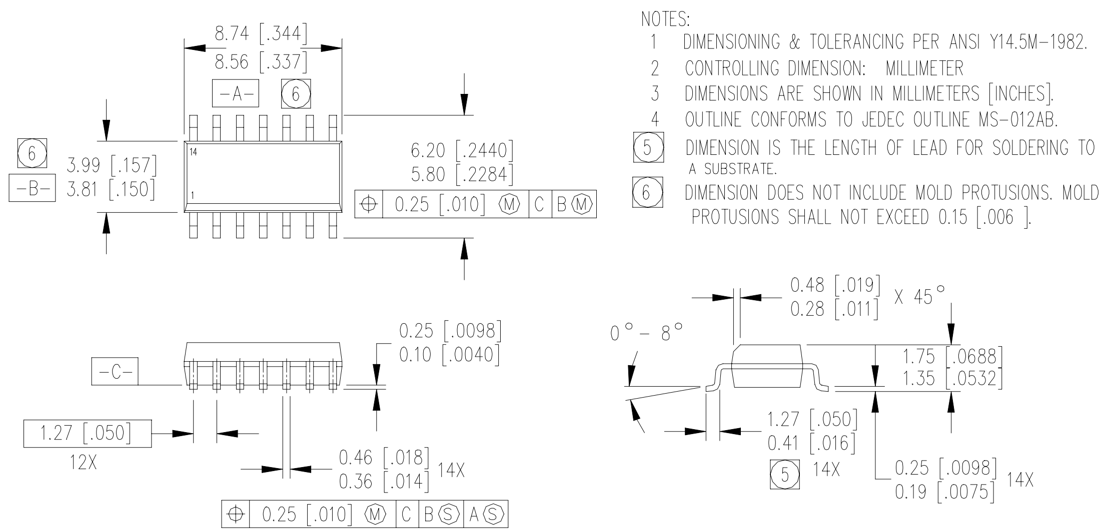
8-Lead SOIC

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



14-Lead PDIP

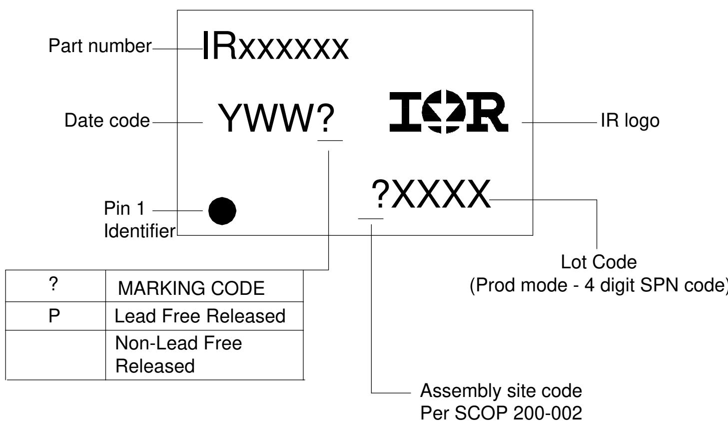
01-6010
01-3002 03 (MS-001AC)



14-Lead SOIC (narrow body)

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

LEADFREE PART MARKING INFORMATION



ORDER INFORMATION

Basic Part (Non-Lead Free)
8-Lead PDIP IR2184 order IR2184
8-Lead SOIC IR2184S order IR2184S
14-Lead PDIP IR21844 order IR21844
14-Lead SOIC IR21844 order IR21844S

Leadfree Part
8-Lead PDIP IR2184 order IR2184PbF
8-Lead SOIC IR2184S order IR2184SPbF
14-Lead PDIP IR21844 order IR21844PbF
14-Lead SOIC IR21844 order IR21844SPbF

International Rectifier

Thisproduct has been designed and qualified for the industrial market.
Qualification Standards can be found on IR's Web Site *http://www.irf.com*
Data and specifications subject to change without notice.

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

4/4/2006