Data Sheet No. PD60107 revY

International
IOR Rectifier

IR2133/IR2135(J&S)&(PbF)
IR2233/IR2235(J&S)&(PbF)

3-PHASE BRIDGE DRIVER

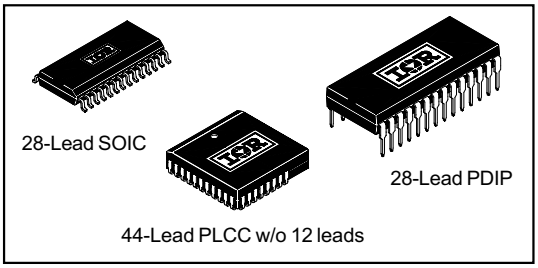
Features

- Floating channel designed for bootstrap operation
  Fully operational to +600V or+1200V
  Tolerant to negative transient voltage
  dV/dt immune
- Gate drive supply range from 10V/12V to 20V DC and up to 25V for transient
- Undervoltage lockout for all channels
- Over-current shut down turns off all six drivers
- Independent 3 half-bridge drivers
- Matched propagation delay for all channels
- 2.5V logic compatible
- Outputs out of phase with inputs
- All parts are also available LEAD-FREE

Product Summary

V_{OFFSET}	600V or 1200V max.
$I_{O+/-}$	200 mA / 420 mA
V_{OUT}	10 - 20V or 12 - 20V
$t_{on/off}$ (typ.)	750/700 ns
Deadtime (typ.)	250 ns

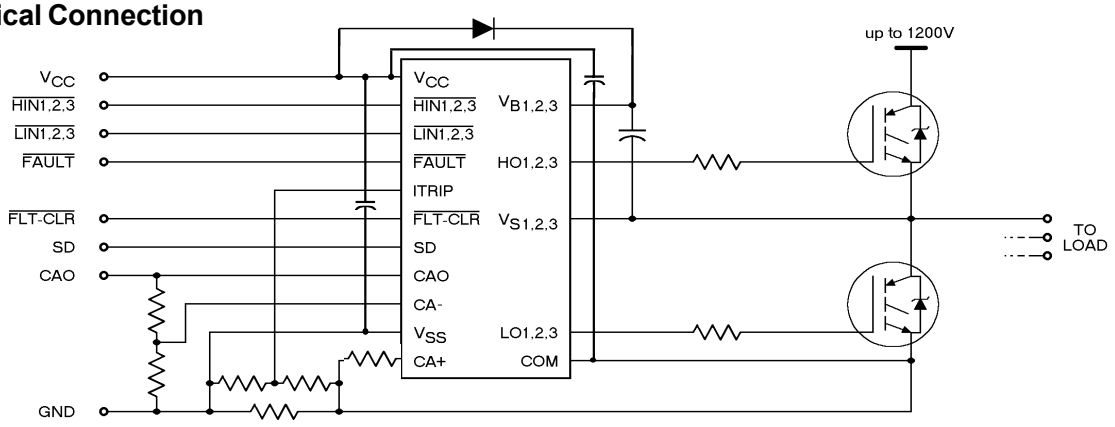
Packages



Description

The IR2133IR2135/IR2233IR2355 (J&S) are high voltage, high speed power MOSFET and IGBT driver with three independent high side and low side referenced output channels for 3-phase applications. Proprietary HVIC technology enables ruggedized monolithic construction. Logic inputs are compatible with CMOS or LSTTL outputs, down to 2.5V logic. An independent operational amplifier provides an analog feedback of bridge current via an external current sense resistor. A current trip function which terminates all six outputs can also be derived from this resistor. A shutdown function is available to terminate all six outputs. An open drain $\overline{\text{FAULT}}$ signal is provided to indicate that an over-current or undervoltage shutdown has occurred. Fault conditions are cleared with the $\overline{\text{FLT-CLR}}$ lead. 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 channels can be used to drive N-channel power MOSFETs or IGBTs in the high side configuration which operates up to 600 volts or 1200 volts.

Typical Connection



(Refer to Lead Assignments for correct pin 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
$V_{B1,2,3}$	High side floating supply voltage	(IR2133/IR2135)	-0.3	625	V
		(IR2233/IR2235)	-0.3	1225	
$V_{S1,2,3}$	High side floating supply offset voltage		$V_{B1,2,3}$ - 25	$V_{B1,2,3}$ + 0.3	
$V_{HO1,2,3}$	High side floating output voltage		$V_{S1,2,3}$ - 0.3	$V_{B1,2,3}$ + 0.3	
V_{CC}	Fixed supply voltage		-0.3	25	
V_{SS}	Logic ground		V_{CC} - 25	V_{CC} + 0.3	
$V_{LO1,2,3}$	Low side output voltage		-0.3	V_{CC} + 0.3	
V_{IN}	Logic input voltage ($\overline{HIN}$, $\overline{LIN}$, ITRIP, SD & $\overline{FLT\text{-}CLR}$)		V_{SS} - 0.3	(V_{SS} + 15) or (V_{CC} + 0.3) whichever is lower	
$V_{IN,AMP}$	Op amp input voltage (CA+ & CA-)		V_{SS} - 0.3	V_{CC} + 0.3	
$V_{OUT,AMP}$	Op amp output voltage (CAO)		V_{SS} - 0.3	V_{CC} + 0.3	
V_{FLT}	FAULT output voltage		V_{SS} - 0.3	V_{CC} + 0.3	
dV_S/dt	Allowable offset supply voltage transient		—	50	V/ns
P_D	Package power dissipation @ $T_A \leq 25ºC$	(28 Lead PDIP)	—	1.5	W
		(28 Lead SOIC)	—	1.6	
		(44 lead PLCC)	—	2.0	
Rth_{JA}	Thermal resistance, junction to ambient	(28 Lead PDIP)	—	83	ºC/W
		(28 Lead SOIC)	—	78	
		(44 lead PLCC)	—	63	
T_J	Junction temperature		—	125	ºC
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. All voltage parameters are absolute voltages referenced to COM. The V_S offset rating is tested with all supplies biased at 15V differential.

Symbol	Parameter Definition		Min.	Max.	Units
$V_{B1,2,3}$	High side floating supply voltage		$V_{S1,2,3}$ + 10/12	$V_{S1,2,3}$ + 20	V
$V_{S1,2,3}$	High side floating supply offset voltage	(IR2133/IR2135)	Note 1	600	
		(IR2233/IR2235)	Note 1	1200	
$V_{HO1,2,3}$	High side floating output voltage		$V_{S1,2,3}$	$V_{B1,2,3}$	
V_{CC}	Fixed supply voltage		10 or 12	20	
V_{SS}	Low side driver return		-5	5	
$V_{LO1,2,3}$	Low side output voltage		0	V_{CC}	
V_{IN}	Logic input voltage ($\overline{HIN}$, $\overline{LIN}$, ITRIP, SD & $\overline{FLT\text{-}CLR}$)		V_{SS}	V_{SS} + 5	
$V_{IN,AMP}$	Op amp input voltage (CA+ & CA-)		V_{SS}	V_{SS} + 5	
$V_{OUT,AMP}$	Op amp output voltage (CAO)		V_{SS}	V_{SS} + 5	
V_{FLT}	$\overline{FAULT}$ output voltage		V_{SS}	V_{CC}	

Note 1: Logic operational for V_S of COM - 4V to COM + 600V/1200V. Logic state held for V_S of COM -4V to COM -V_{BS}. (Please refer to the Design Tip DT97-3 for more details).

Note 2: All input pins, op amp input and output pins are internally clamped with a 5.2V zener diode.

Dynamic Electrical Characteristics

V_{BIAS} (V_{CC}, $V_{BS1,2,3}$) = 15V, $V_{S1,2,3}$ = V_{SS}, T_A = 25°C and C_L = 1000 pF unless otherwise specified.

Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
t_{on}	Turn-on propagation delay	500	750	1000	ns	V_{IN} = 0 & 5V $V_{S1,2,3}$ = 0 to 600V or 1200V
t_{off}	Turn-off propagation delay	450	700	950		
t_r	Turn-on rise time	—	90	150		
t_f	Turn-off fall time	—	40	70		
t_{sd}	SD to output shutdown propagation delay	500	750	1000		V_{IN},V_{SD} = 0 & 5V
t_{itrip}	ITRIP to output shutdown propagation delay	600	850	1100		V_{IN},V_{ITRIP} = 0 & 5V
t_{bl}	ITRIP blanking time	—	400	—		ITRIP = 1V
t_{flt}	ITRIP to $\overline{FAULT}$ propagation delay	400	650	900		V_{IN},V_{ITRIP} = 0 & 5V
$t_{fil,in}$	Input filter time ($\overline{HIN}$, $\overline{LIN}$ and SD)	—	310	—		V_{IN} = 0 & 5V
t_{fltclr}	$\overline{FLT\text{-}CLR}$ to $\overline{FAULT}$ clear time	600	850	1100		V_{IN},V_{ITRIP} = 0 & 5V
DT	Deadtime, LS turn-off to HS turn-on & HS turn-off to LS turn-on	100	250	400		V_{IN} = 0 & 5V
SR+	Amplifier slew rate (positive)	5	10	—	V/µs	
SR-	Amplifier slew rate (negative)	2	2.5	—		

NOTE: For high side PWM, HIN pulse width must be ≥ 1µ sec

Static Electrical Characteristics

V_{BIAS} (V_{CC}, $V_{BS1,2,3}$) = 15V unless otherwise specified and T_A = 25°C. All static parameters other than IO and VO are referenced to V_{SS} and are applicable to all six channels ($H_{S1,2,3}$ & $L_{S1,2,3}$). The VO and IO parameters are referenced to COM and $V_{S1,2,3}$ and are applicable to the respective output leads: $H_{O1,2,3}$ or $L_{O1,2,3}$.

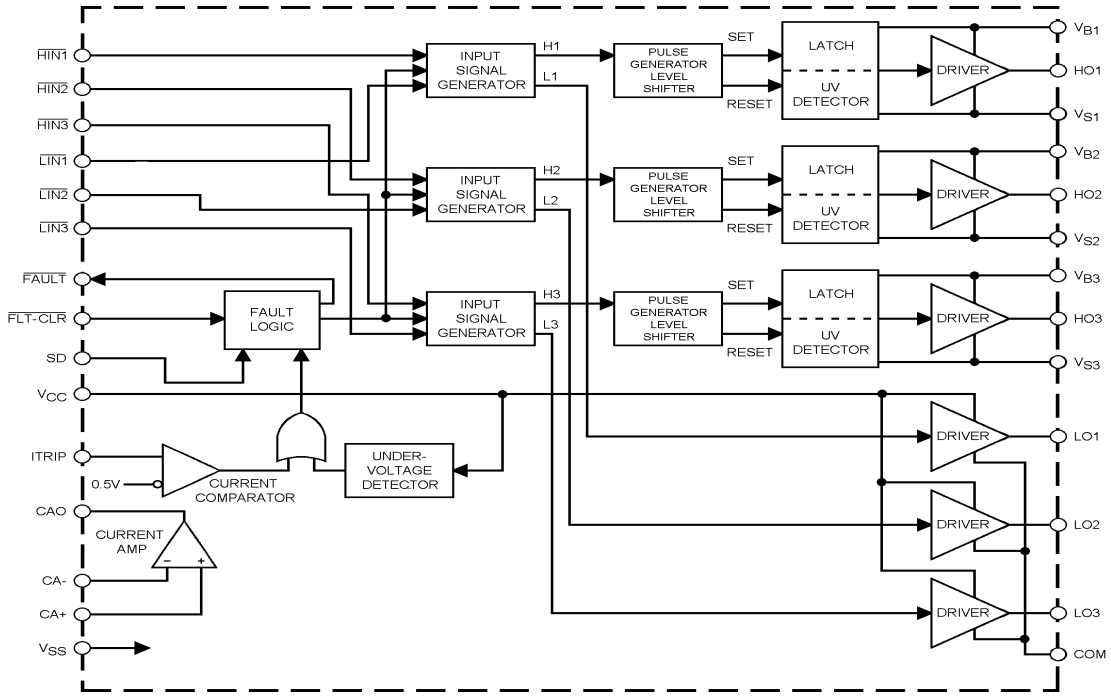
Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
V_{IH}	Logic "0" Input Voltage (OUT = LO)	2.2	—	—	V	
V_{IL}	Logic "1" Input Voltage (OUT = HI)	—	—	0.8		
$V_{FCLR,IH}$	Logic "0" Fault Clear Input Voltage	2.2	—	—		
$V_{FCLR,IL}$	Logic "1" Fault Clear Input Voltage	—	—	0.8		
$V_{SD,TH+}$	SD Input Positive Going Threshold	1.6	1.9	2.2		
$V_{SD,TH-}$	SD Input Negative Going Threshold	1.4	1.7	2.0		
$V_{IT,TH+}$	I_{ITRIP} Input Positive Going Threshold	470	570	670	mV	
$V_{IT,TH-}$	I_{ITRIP} Input Negative Going Threshold	360	460	560		
V_{OH}	High Level Output Voltage, V_{BIAS} - V_O	—	—	100		V_{IN} = 0V, I_O = 0A
V_{OL}	Low Level Output Voltage, V_O	—	—	100		V_{IN} = 5V, I_O = 0A
I_{LK}	Offset Supply Leakage Current (IR2133/IR2135)	—	—	50	µA	$V_{B1,2,3}$=$V_{S1,2,3}$ = 600V
	(IR2233/IR2235)	—	—	50		$V_{B1,2,3}$=$V_{S1,2,3}$ = 1200V
I_{QBS}	Quiescent V_{BS} Supply Current	—	50	100		V_{IN} = 0V or 5V
I_{QCC}	Quiescent V_{CC} Supply Current	—	4	8	mA	V_{IN} = 0V or 5V
I_{IN+}	Logic "1" Input Bias Current (OUT = HI)	—	200	350	µA	V_{IN} = 0V
I_{IN-}	Logic "0" Input Bias Current (OUT = LO)	—	100	250		V_{IN} = 5V
I_{SD+}	"High" Shutdown Bias Current	—	30	100		SD = 5V
I_{SD-}	"Low" Shutdown Bias Current	—	—	100	nA	SD = 0V
I_{ITRIP+}	"High" I_{ITRIP} Bias Current	—	30	100	µA	I_{ITRIP} = 5V
I_{ITRIP-}	"Low" I_{ITRIP} Bias Current	—	—	100	nA	I_{ITRIP} = 0V

Static Electrical Characteristics — Continued

V_{BIAS} (V_{CC}, $V_{BS1,2,3}$) = 15V unless otherwise specified and T_A = 25°C. All static parameters other than IO and VO are referenced to V_{SS} and are applicable to all six channels ($H_{S1,2,3}$ & $L_{S1,2,3}$). The VO and IO parameters are referenced to COM and $V_{S1,2,3}$ and are applicable to the respective output leads: $H_{O1,2,3}$ or $L_{O1,2,3}$.

Symbol	Parameter Definition	Min.	Typ.	Max.	Units	Test Conditions
I_{FLTCLR}+	"High" Fault Clear Input Bias Current	—	200	350	µA	$\overline{\text{FLT-CLR}}$ = 0V
I_{FLTCLR}-	"Low" Fault Clear Input Bias Current	—	100	250		$\overline{\text{FLT-CLR}}$ = 5V
V_{BSUV+}	V_{BS} Supply Undervoltage Positive Going Threshold (for IR2133/IR2233)	7.6	8.6	9.6	V	
	(for IR2135/IR2235)	9.2	10.4	11.6		
V_{BSUV-}	V_{BS} Supply Undervoltage Negative Going Threshold (for IR2133/IR2233)	7.2	8.2	9.2		
	(for IR2135/IR2235)	8.3	9.4	10.5		
V_{BSUVH}	V_{BS} Supply Undervoltage Lockout Hysteresis (for IR2133/IR2233)	—	0.4	—		
	(for IR2135/IR2235)	—	1	—		
V_{CCUV+}	V_{CC} Supply Undervoltage Positive Going Threshold (for IR2133/IR2233)	7.6	8.6	9.6		
	(for IR2135/IR2235)	9.2	10.4	11.6		
V_{CCUV-}	V_{CC} Supply Undervoltage Negative Going Threshold (for IR2133/IR2233)	7.2	8.2	9.2		
	(for IR2135/IR2235)	8.3	9.4	10.5		
V_{CCUVH}	V_{CC} Supply Undervoltage Lockout Hysteresis (for IR2133/IR2233)	—	0.4	—		
	(for IR2135/IR2235)	—	1	—		
$R_{on,FLT}$	FAULT- Low On Resistance	—	70	100	Ω	
I_{O+}	Output High Short Circuit Pulsed Current	200	250	—	mA	V_{OUT} = 0V, V_{IN} = 0V PW ≤ 10 µs
I_{O-}	Output Low Short Circuit Pulsed Current	420	500	—		V_{OUT} = 15V, V_{IN} = 5V PW ≤ 10 µs
V_{OS}	Amplifier Input Offset Voltage	—	0	30	mV	CA+=0.2V, CA-=CAO
$I_{IN,AMP}$	Amplifier Input Bias Current	—	—	4	nA	CA+ = CA- = 2.5V
CMRR	Amplifier Common Mode Rejection Ratio	50	70	—	dB	CA+ = 0.1V & 5V, CA- = CAO
PSRR	Amplifier Power Supply Rejection Ratio	50	70	—		CA+=0.2V, CA-=CAO V_{CC} = 10V & 20V
$V_{OH,Amp}$	Amplifier High Level Output Voltage	5	5.2	5.4	V	CA+ = 1V, CA- = 0V
$V_{OL,Amp}$	Amplifier Low Level Output Voltage	—	—	20	mV	CA+ = 0V, CA- = 1V
$I_{SRC,Amp}$	Amplifier Output Source Current	4	7	—	mA	CA+ = 1V, CA- = 0V, CAO = 4V
$I_{SNK,Amp}$	Amplifier Output Sink Current	0.5	1	—		CA+ = 0V, CA- = 1V, CAO = 2V
$I_{O+,Amp}$	Amplifier Output High Short Circuit Current	—	10	—		CA+ = 5V, CA- = 0V, CAO = 0V
$I_{O-,Amp}$	Amplifier Output Low Short Circuit Current	—	4	—		CA+ = 0V, CA- = 5V, CAO = 5V

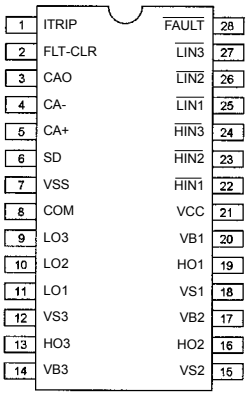
Functional Block Diagram



Lead Definitions

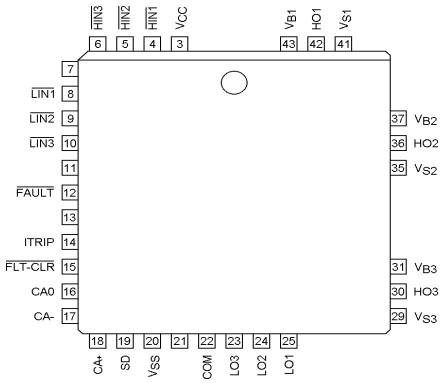
Symbol	Lead Description
$\overline{\text{HIN1,2,3}}$	Logic inputs for high side gate driver outputs (HO1,2,3), out of phase.
$\overline{\text{LIN1,2,3}}$	Logic inputs for low side gate driver outputs (LO1,2,3), out of phase.
$\overline{\text{FAULT}}$	Indicates over-current or undervoltage lockout (low side) has occurred, negative logic.
V_{CC}	Logic and low side fixed supply.
ITRIP	Input for over-current shut down.
$\overline{\text{FLT-CLR}}$	Logic input for fault clear, negative logic.
SD	Logic input for shut down.
CAO	Output of current amplifier.
CA-	Negative input of current amplifier.
CA+	Positive input of current amplifier.
V_{SS}	Logic ground.
COM	Low side return.
$V_{B1,2,3}$	High side floating supplies.
HO1,2,3	High side gate drive outputs.
$V_{S1,2,3}$	High side floating supply returns.
LO1,2,3	Low side gate drive outputs

Lead Assignments



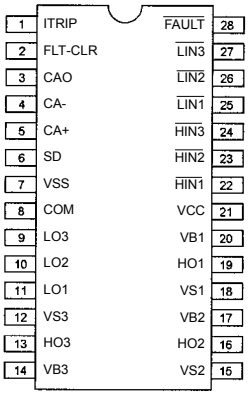
28 Lead DIP

IR2133
IR2135



44 Lead PLCC w/o 12 Leads

IR2133J
IR2135J
IR2233J
IR2235J



28 Lead SOIC (Wide Body)

IR2133S
IR2135S
IR2233S
IR2235S

Part Number

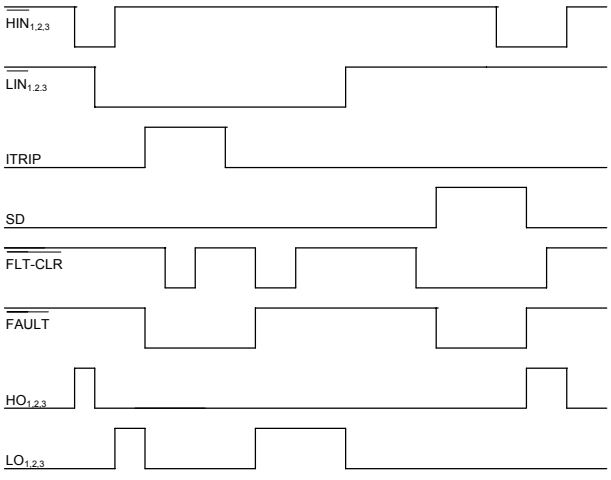


Figure 1. Input/Output Timing Diagram

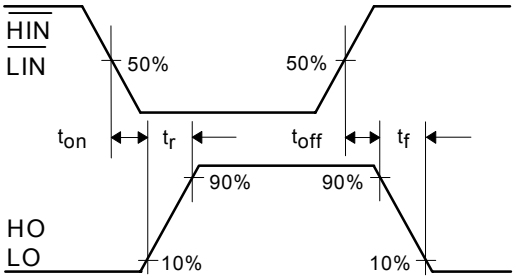


Figure 2. Switching Time Waveform Definitions

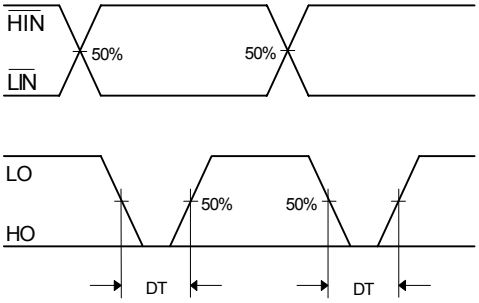


Figure 3. Deadtime Waveform Definitions

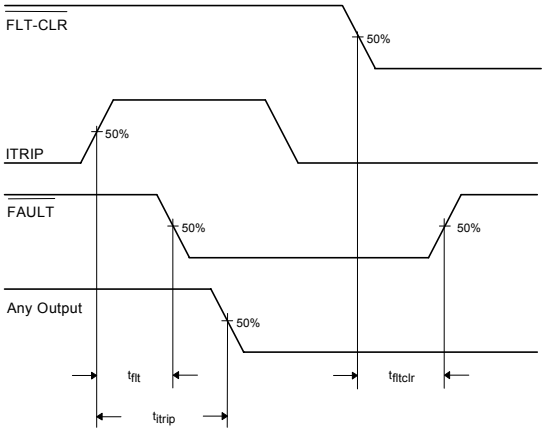


Figure 4. Overcurrent Shutdown Waveform

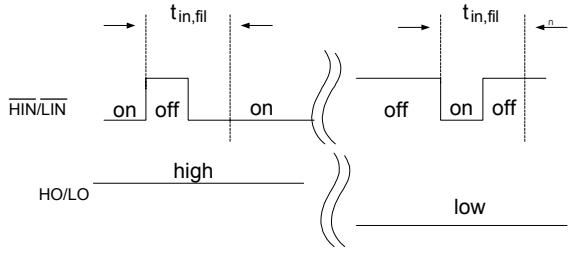


Figure 4.5. Input Filter Function

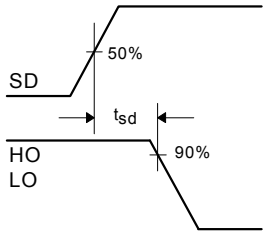


Figure 5. Shutdown Waveform Definitions

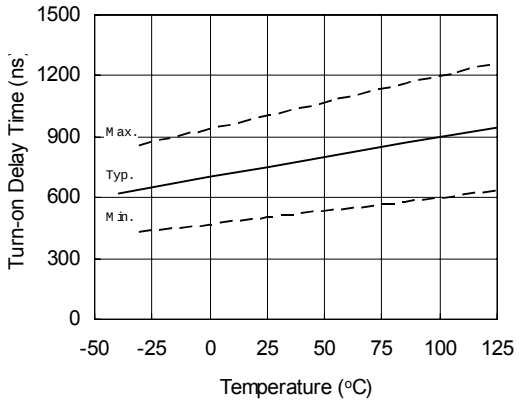


Figure 6A. Turn-On Time vs. Temperature

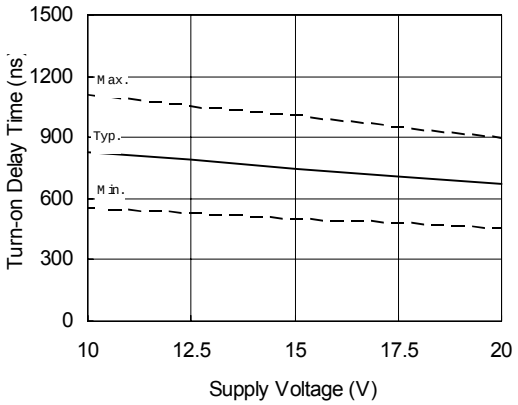


Figure 6B. Turn-On Time vs. Voltage

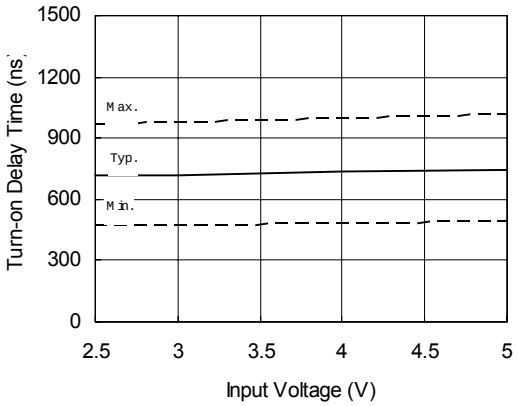


Figure 6C. Turn-On Time vs. Input Voltage

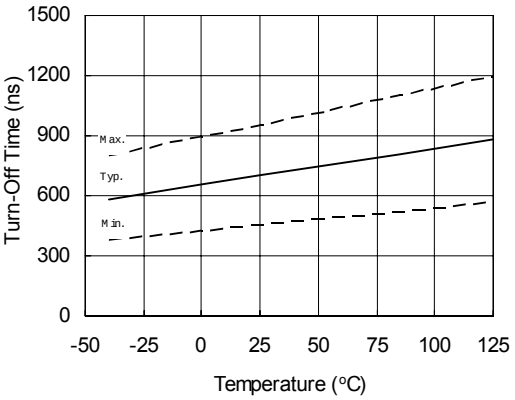


Figure 7A. Turn-Off Time vs. Temperature

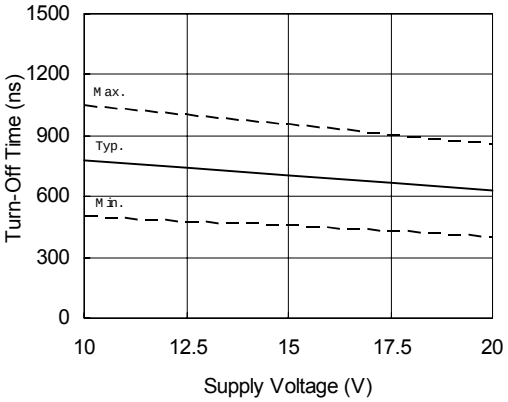


Figure 7B. Turn-Off Time vs. Voltage

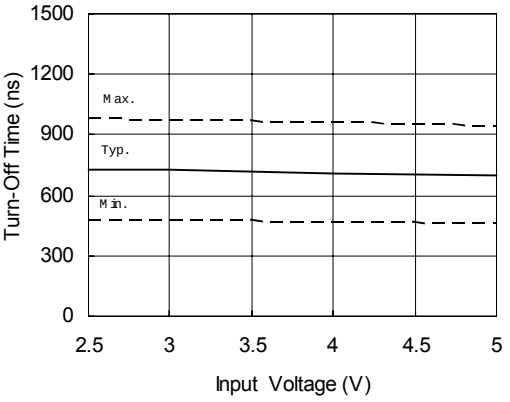
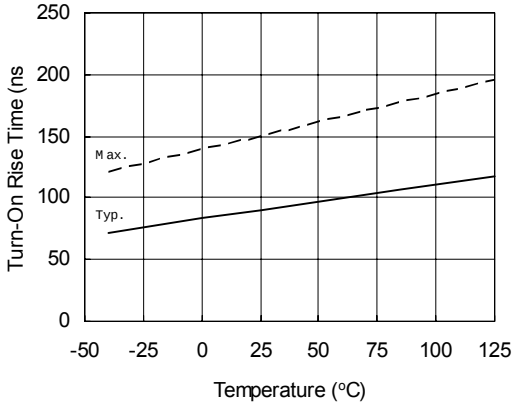
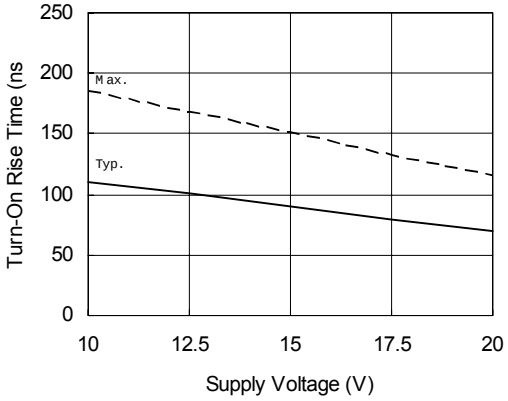


Figure 7C. Turn-Off Time vs. Input Voltage



Fiure 8A. Turn-On Rise Time vs.Temperature



Fiure 8B. Turn-On Rise Time vs.Voltage

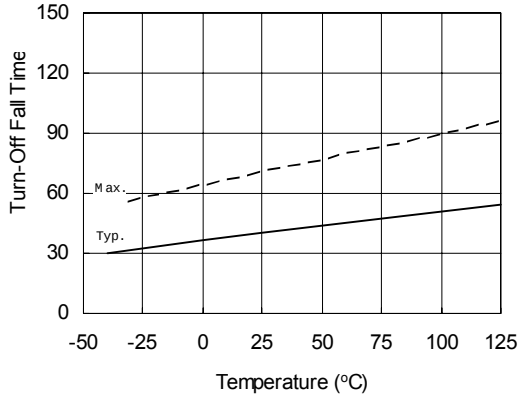


Figure 9A. Turn-Off Fall Time vs. Temperature

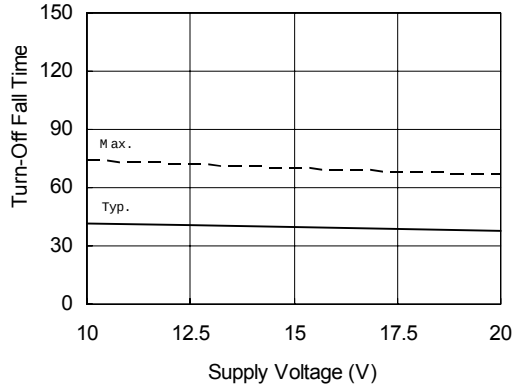


Figure 9B. Turn-Off Fall Time vs. Voltage

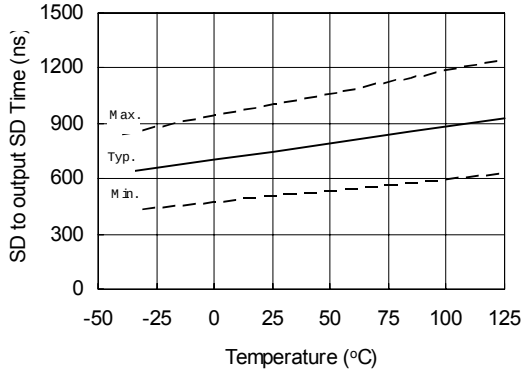


Figure 10A. SD to Output shutdown Time vs. Temperature

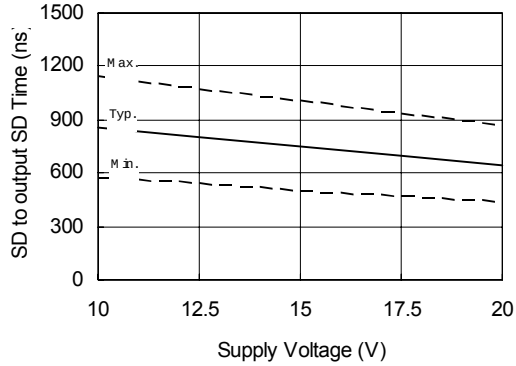


Figure 10B. SD to Output shutdown Time vs. Voltage

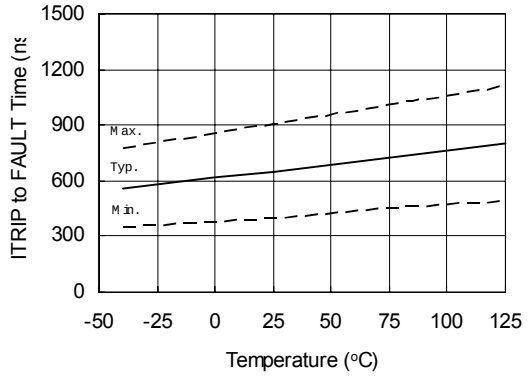


Figure 11A. ITRIP to $\overline{\text{FAULT}}$ Time vs. Temperature

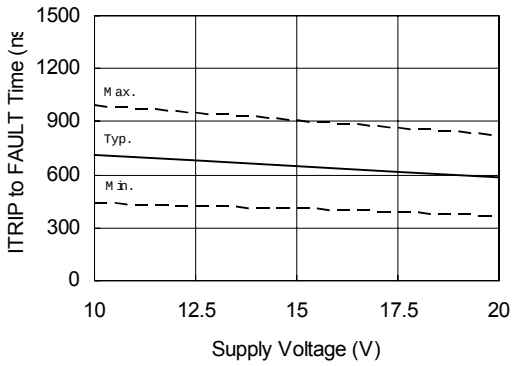


Figure 11B. ITRIP to $\overline{\text{FAULT}}$ Time vs. Voltage

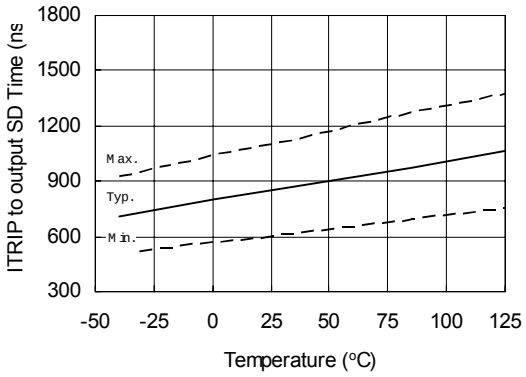


Figure 12A. ITRIP to output shutdown Time vs. Temperature

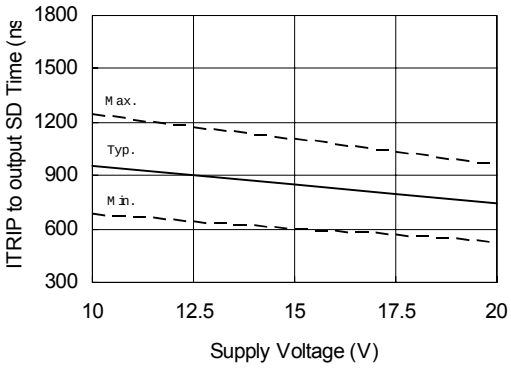


Figure 12B. ITRIP to output shutdown Time vs. Voltage

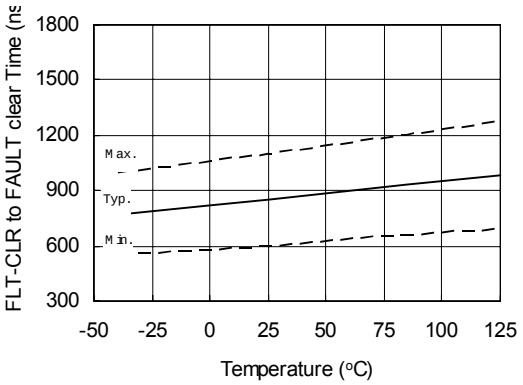


Figure 13A. $\overline{\text{FLT-CLR}}$ to $\overline{\text{FAULT}}$ clear Time vs. Temperature

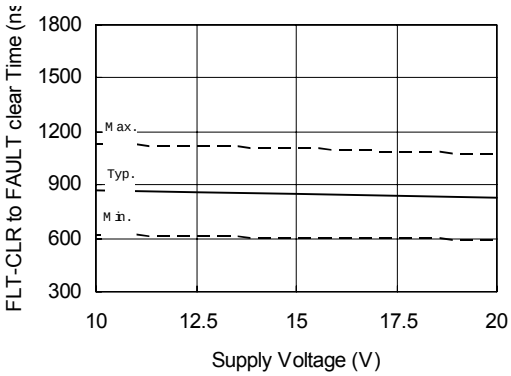


Figure 13B. $\overline{\text{FLT-CLR}}$ to $\overline{\text{FAULT}}$ clear Time vs. Voltage

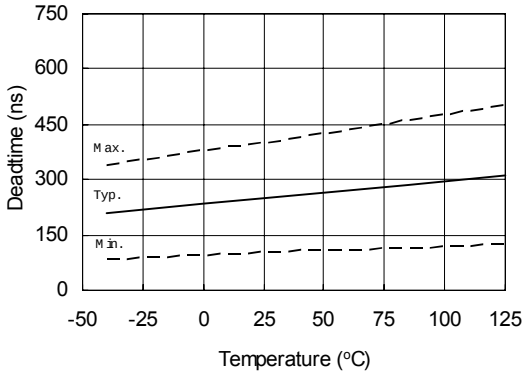


Figure 14A. Deadtime vs. Temperature

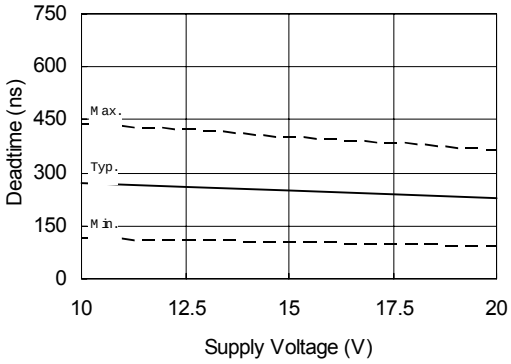


Figure 14B. Deadtime vs. Voltage

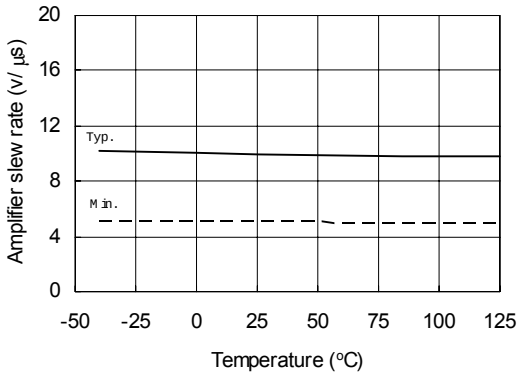


Figure 15A. Amplifier slew rate (+) vs. Temperature

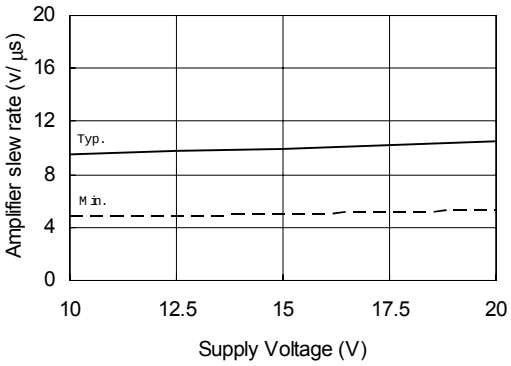


Figure 15B. Amplifier slew rate (+) vs. Voltage

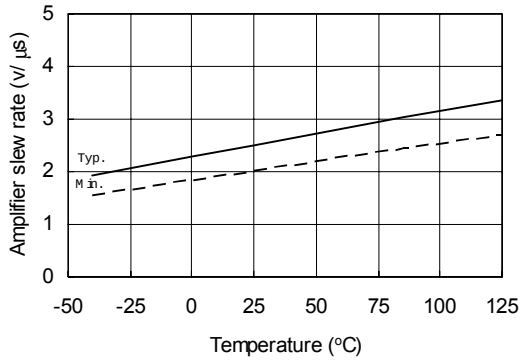


Figure 16A. Amplifier slew rate (-) vs. Temperature

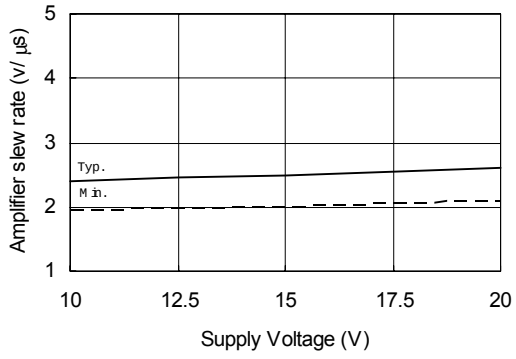


Figure 16B. Amplifier slew rate (-) vs. Voltage

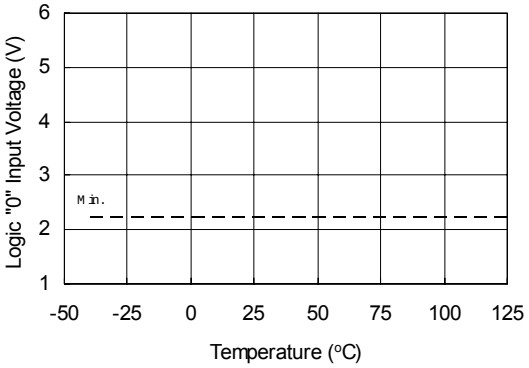


Figure 17A. Logic "0" Input Voltage (OUT=LO), Fault Clear Voltage vs. Temperature

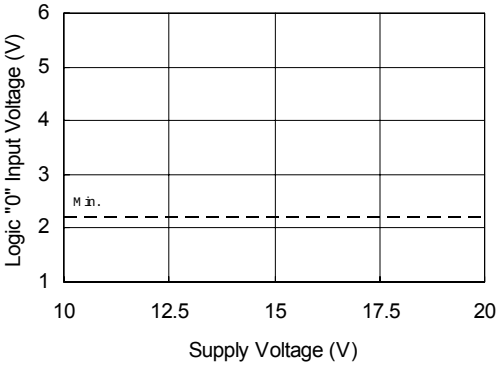


Figure 17B. Logic "0" Input Voltage (OUT=LO), Fault Clear Voltage vs. Voltage

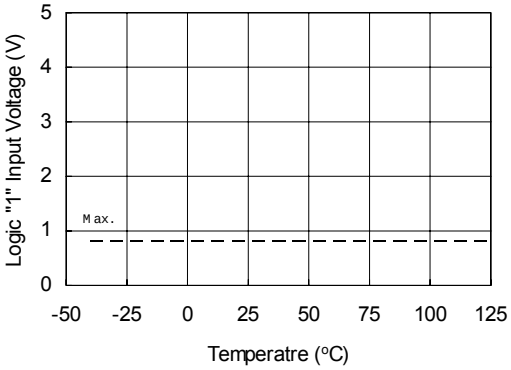


Figure 18A. Logic "1" Input (OUT=HI), Fault Clear Input Voltage vs. Temperature

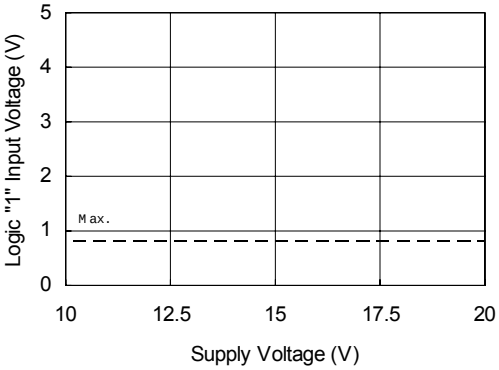


Figure 18B. Logic "1" Input (OUT=HI), Fault Clear Input Voltage vs. Voltage

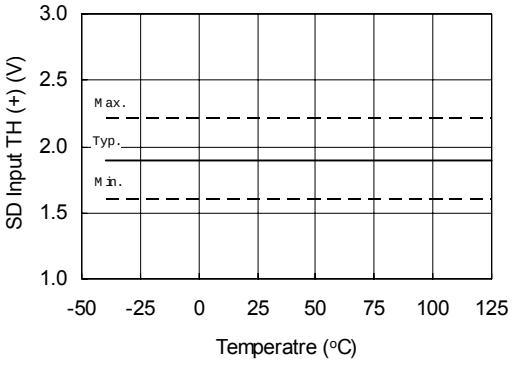


Figure 21A. SD Input TH(+) vs. Temperature

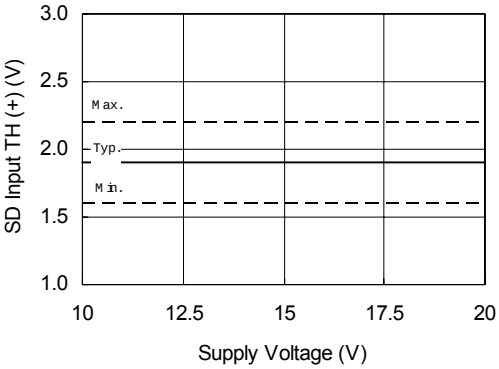


Figure 21B. SD Input TH(+) vs. Voltage

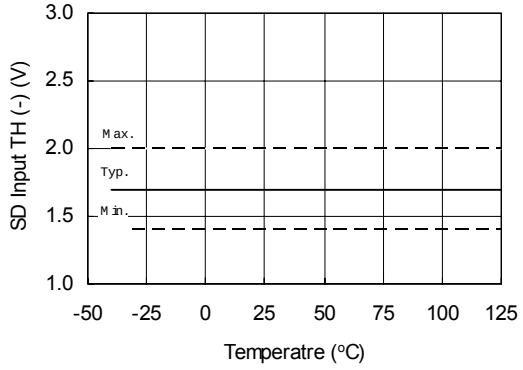


Figure 22A. SD Input TH(-) vs. Temperature

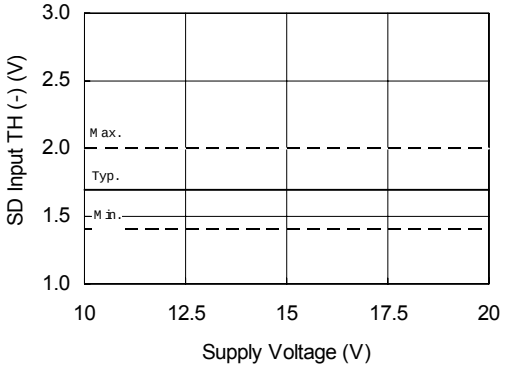


Figure 22B. SD Input TH(-) vs. Voltage

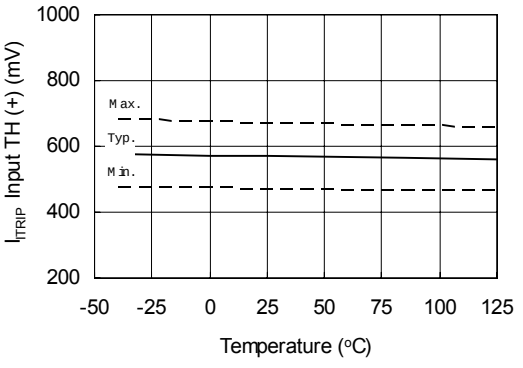


Figure 23A. I_{ITRIP} Input TH(+) vs. Temperature

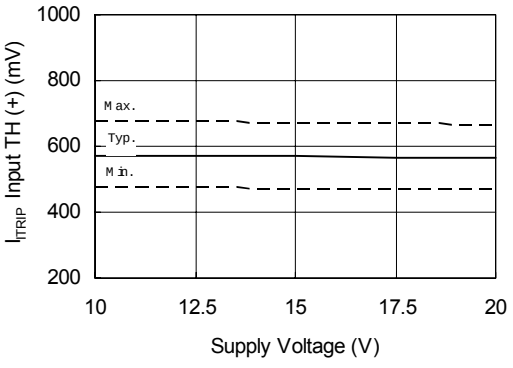


Figure 23B. I_{ITRIP} Input TH(+) vs. Voltage

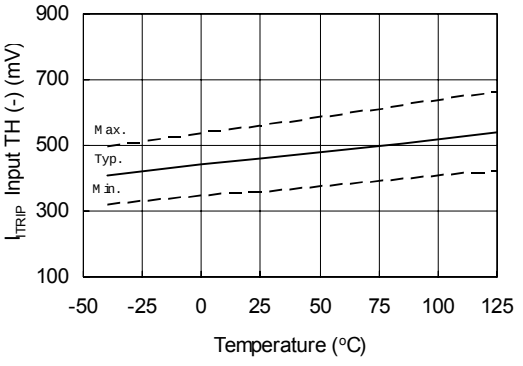


Figure 24A. I_{ITRIP} Input TH(-) vs.Temperature

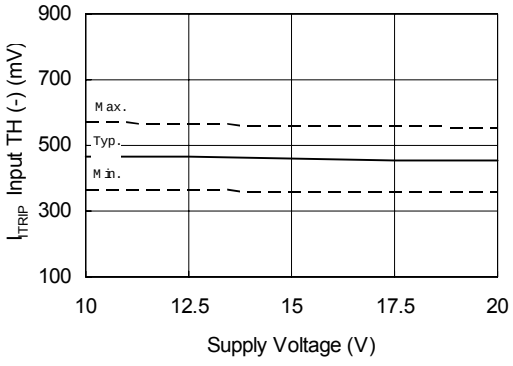


Figure 24B. I_{ITRIP} Input TH(-) vs. Voltage

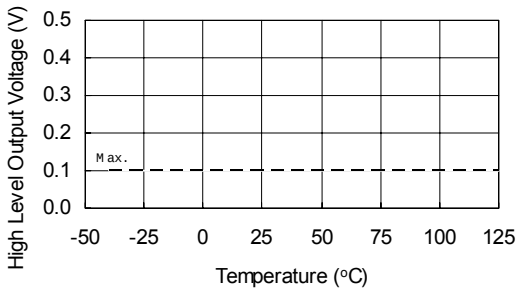


Figure 25A. High Level Output vs. Temperature

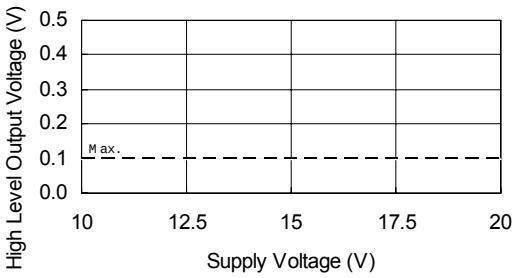


Figure 25B. High Level Output vs. Voltage

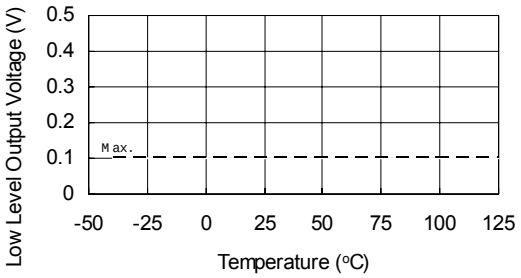


Figure 26A. Low Level Output vs. Temperature

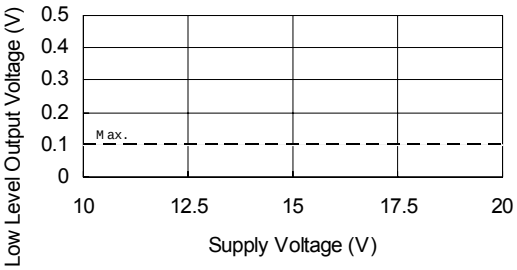


Figure 26B. Low Level Output vs. Voltage

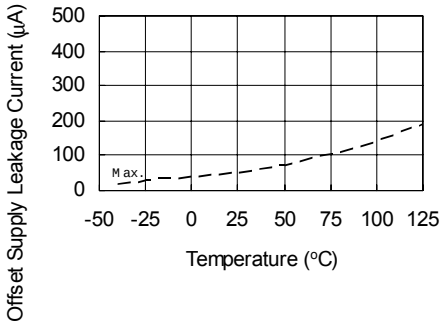


Figure 27A. Offset Supply Leakage Current vs. Temperature

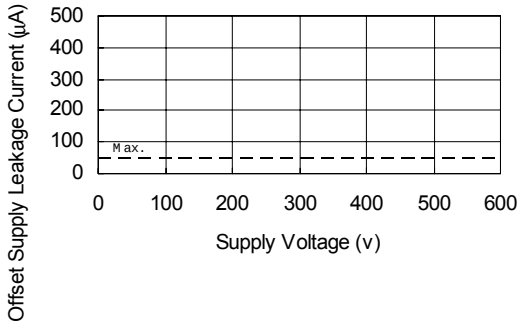


Figure 27B. Offset Supply Leakage Current vs. Voltage

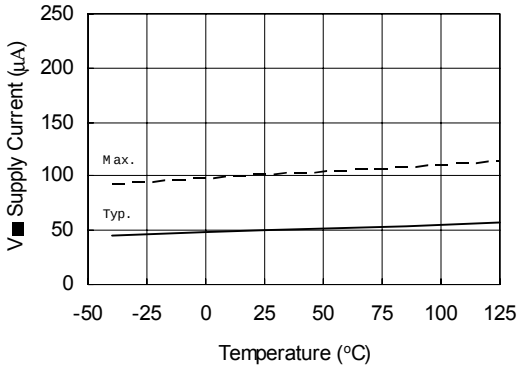


Figure 28A. V_{BS} Supply Current vs. Temperature

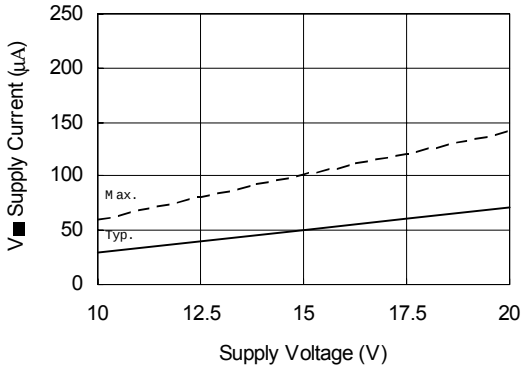


Figure 28B. V_{BS} Supply Current vs. Voltage

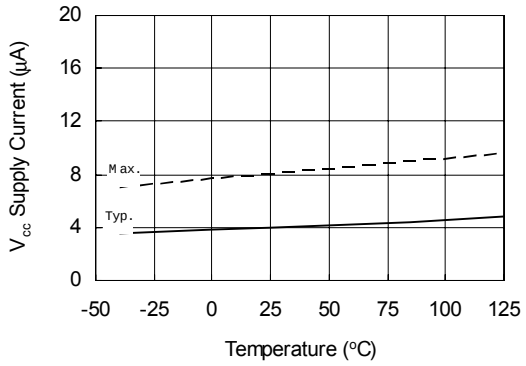


Figure 29A. V_{cc} Supply Current vs. Temperature

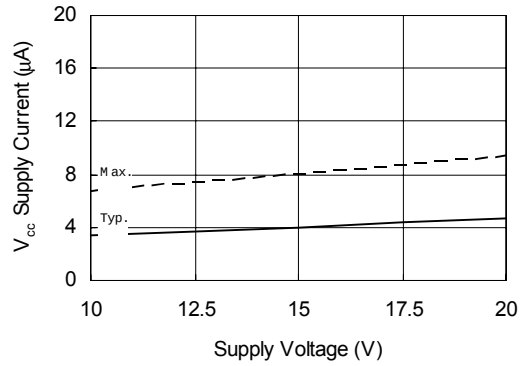


Figure 29B. V_{cc} Supply Current vs. Voltage

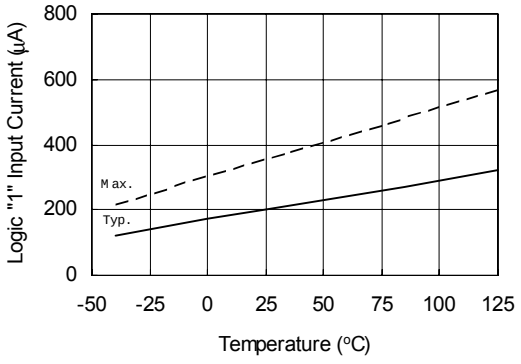


Figure 30A. Logic "1" Input Bais Current vs. Temperature

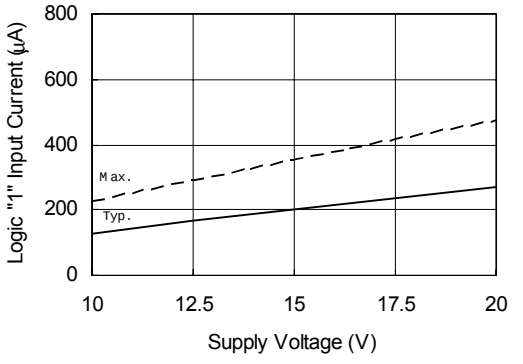


Figure 30B. Logic "1" Input Bais Current vs. Voltage

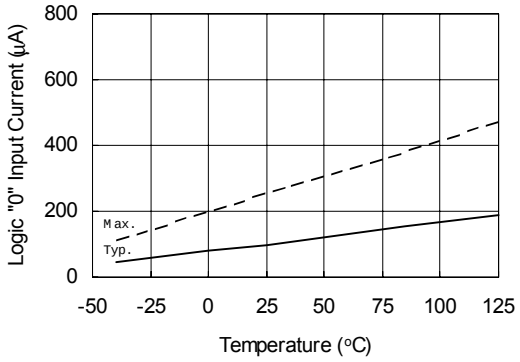


Figure 31A. Logic "0" Input Bais Current vs. Temperature

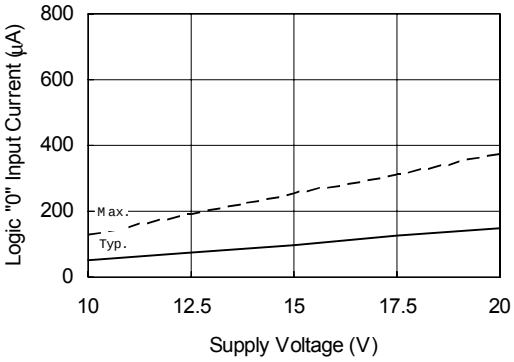


Figure 31B. Logic "0" Input Bais Current vs. Supply Voltage

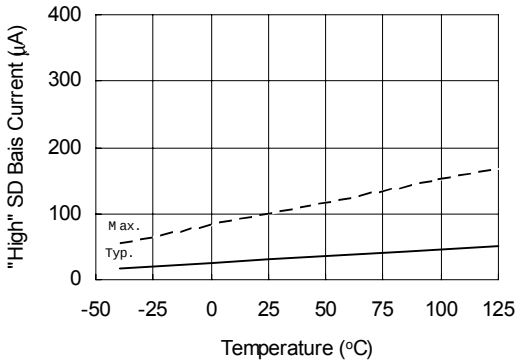


Figure 32A. "High" Shutdown Bais Current vs. Temperature

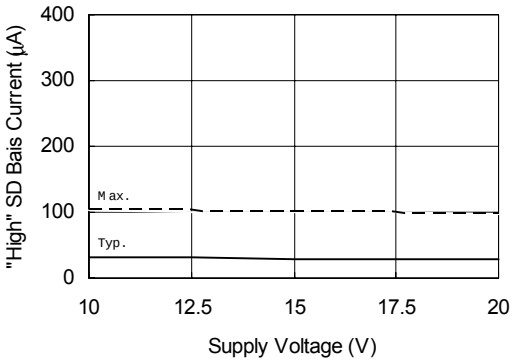


Figure 32B. "High" Shutdown Bais Current vs. Supply Voltage

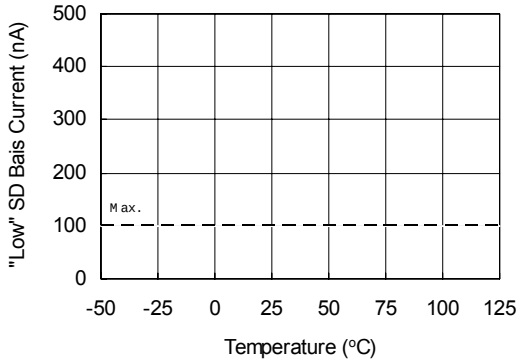


Figure 33A. "Low" Shutdown Bais Current vs. Temperature

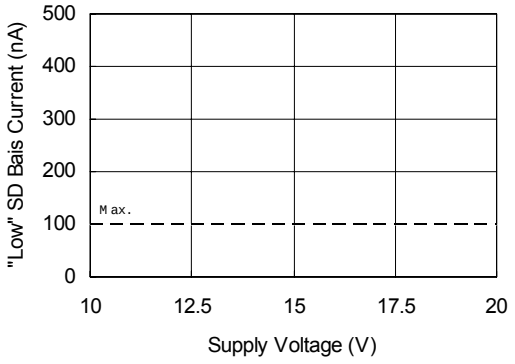


Figure 33B. "Low" Shutdown Bais Current vs. Supply Voltage

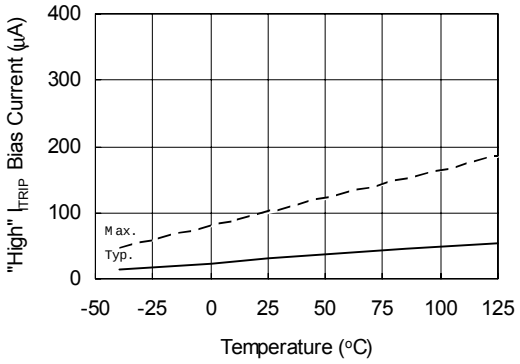


Figure 34A. "High" I_{ITRIP} Bais Current vs. Temperature

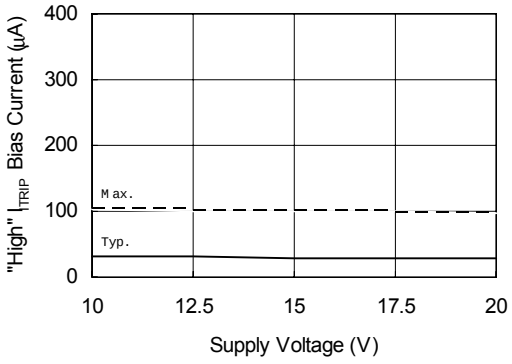


Figure 34B. "High" I_{ITRIP} Bais Current vs. Supply Voltage

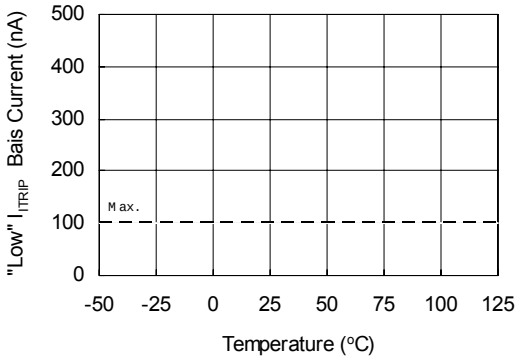


Figure 35A. "Low" I_{ITRIP} Bais Current vs. Temperature

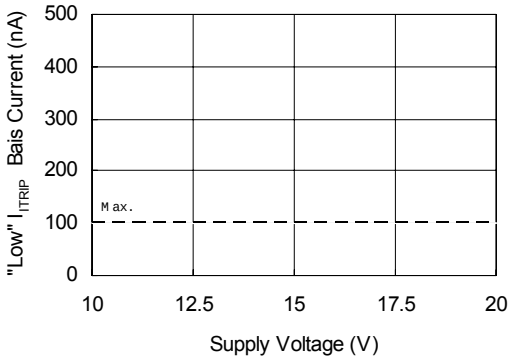


Figure 35B. "Low" I_{ITRIP} Bais Current vs. Supply Voltage

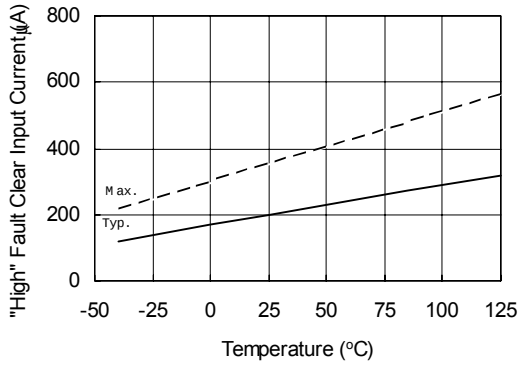


Figure 36A. "High" Fault Clear Input Bais Current vs. Temperature

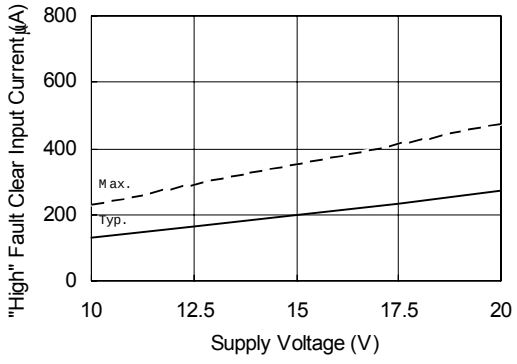


Figure 36B. "High" Fault Clear Input Bais Current vs. Supply voltage

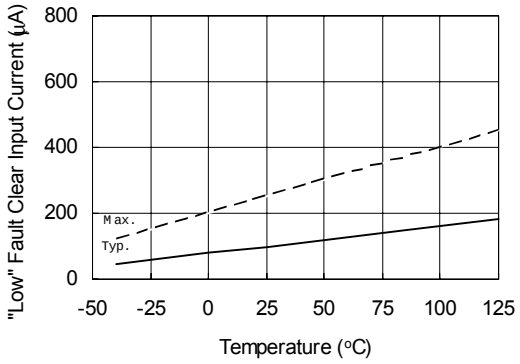


Figure 37A. "Low" Fault Clear Input Bais Current vs. Temperature

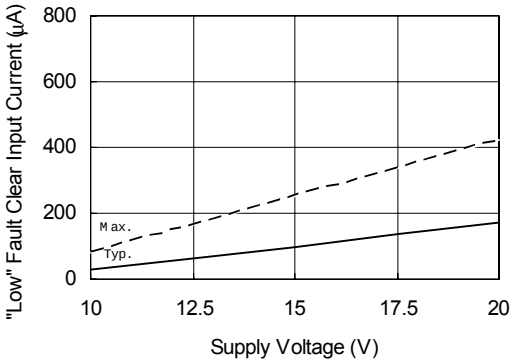


Figure 37B. "Low" Fault Clear Input Bais Current vs. Supply Voltage

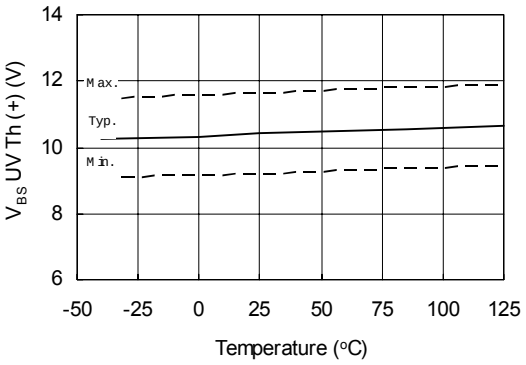


Figure 38A. IR2135/IR2235 V_{BS} Undervoltage Threshold (+) vs. Temperature

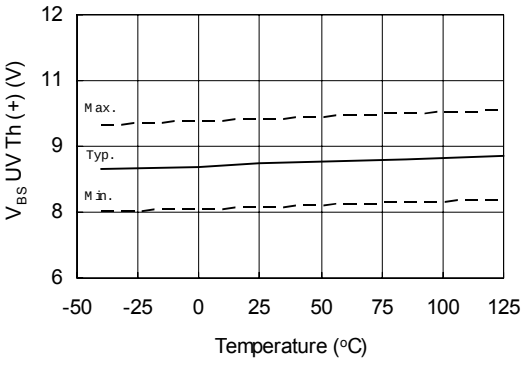


Figure 38B. IR2133/IR2233 V_{BS} Undervoltage Threshold (+) vs. Temperature

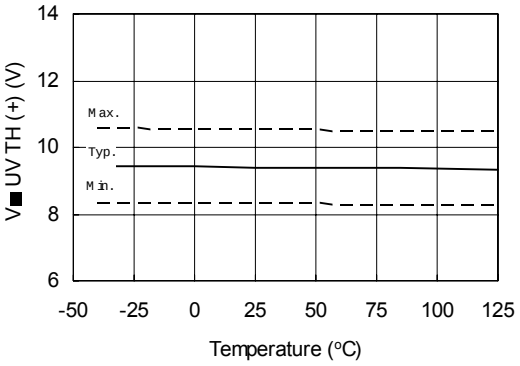


Figure 39A. IR2135/IR2235 V_{BS} Undervoltage Threshold (-) vs. Temperature

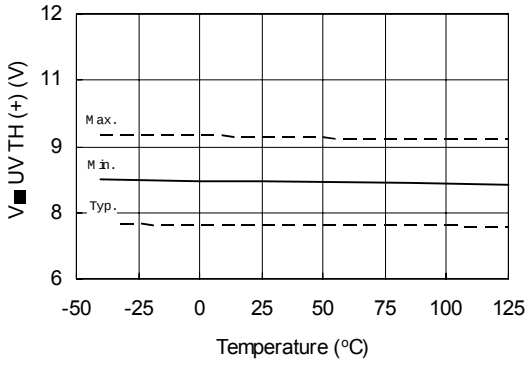


Figure 39B. IR2133/IR2233 V_{BS} Undervoltage Threshold (-) vs. Temperature

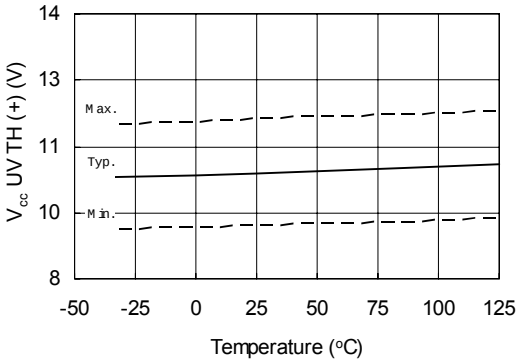


Figure 40A. IR2135/IR2235 V_{cc} Undervoltage Threshold (+) vs. Temperature

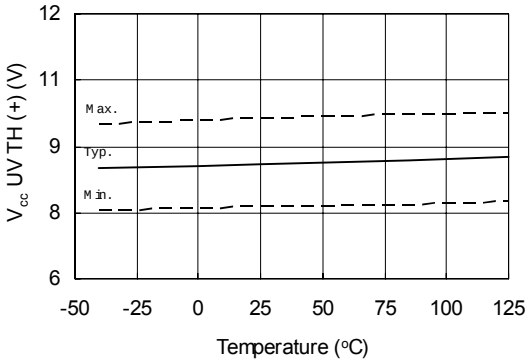


Figure 40B. IR2133/IR2233 V_{cc} Undervoltage Threshold (+) vs. Temperature

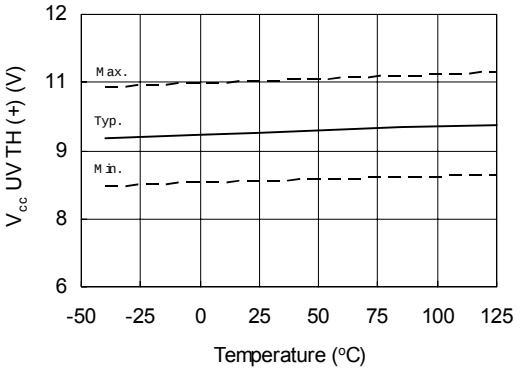


Figure 41A. IR2135/IR2235 V_{cc} Undervoltage Threshold (-) vs. Temperature

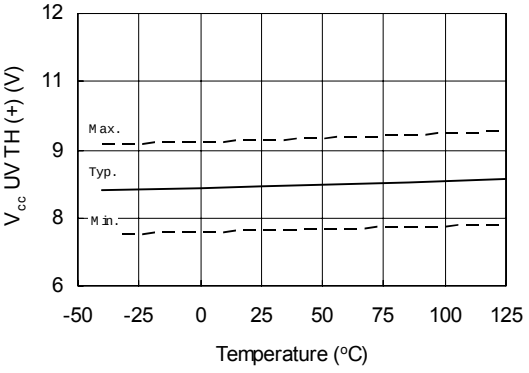


Figure 41B. IR2133/IR2233 V_{cc} Undervoltage Threshold (-) vs. Temperature

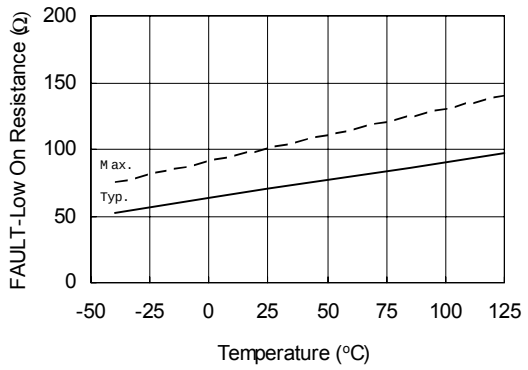


Figure 42A. FAULT- Low On Resistance vs. Temperature

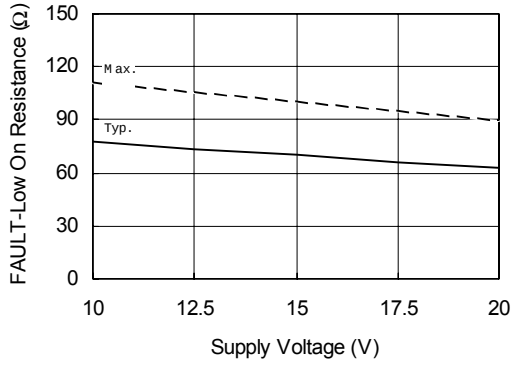


Figure 42B. FAULT- Low On Resistance vs. Supply Voltage

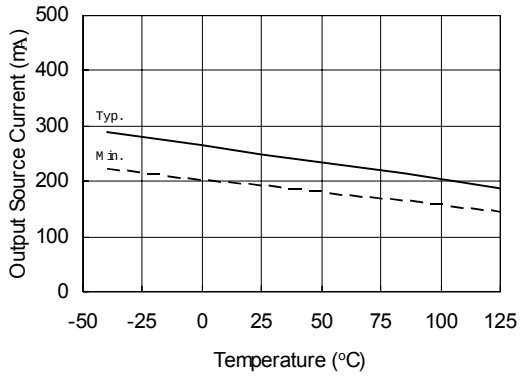


Figure 43A. Output Source Current vs. Temperature

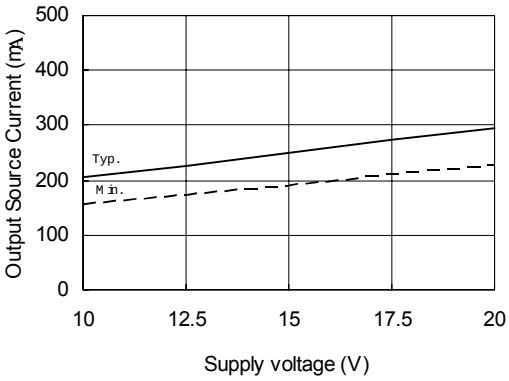


Figure 43B. Output Source Current vs. Supply Voltage

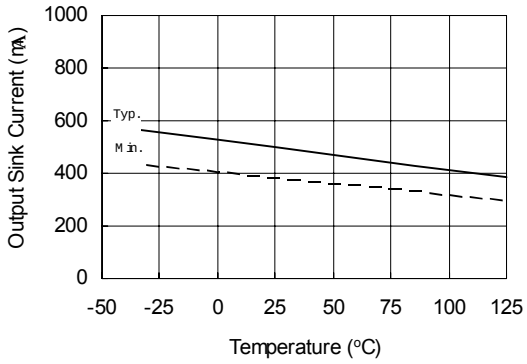


Figure 44A. Ourput Sink Current vs. Temperature

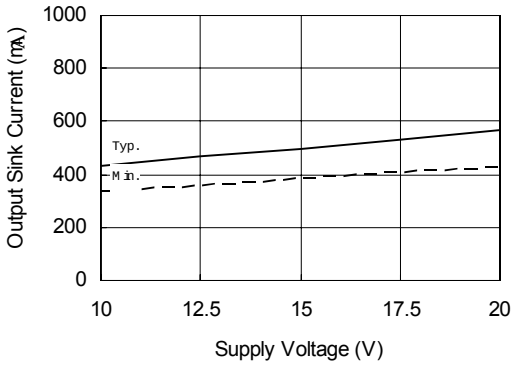


Figure 44B. Ourput Sink Current vs. Supply Voltage

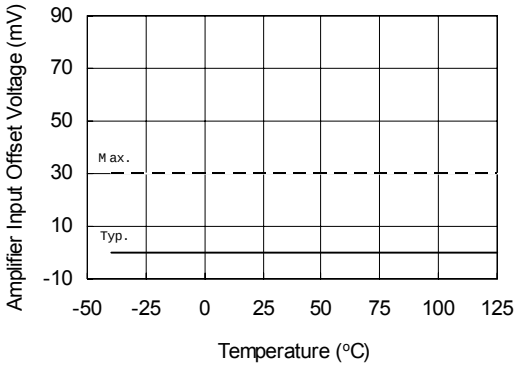


Figure 45A. Amplifier Input Offest Voltage vs. Temperature

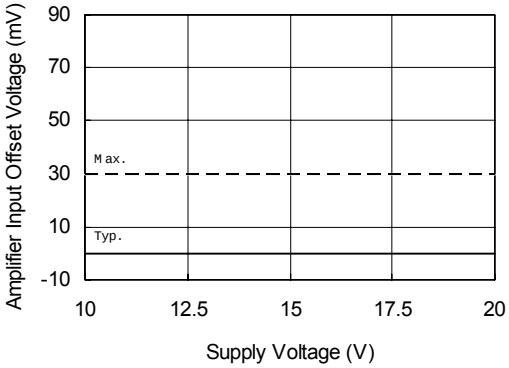


Figure 45B. Amplifier Input Offest Voltage vs. Supply Voltage

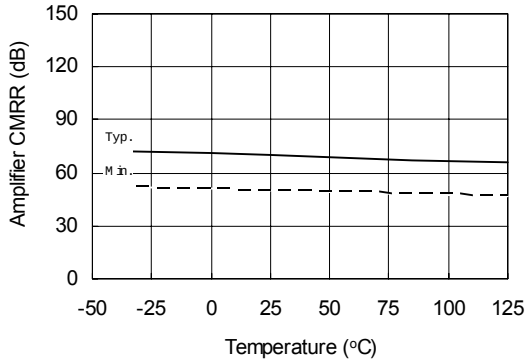


Figure 46A. Amplifier Common Mode Rejection Ratio vs. Temperature

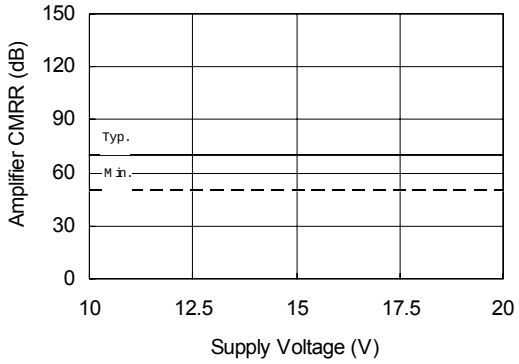


Figure 46B. Amplifier Common Mode Rejection Ratio vs. Supply Voltage

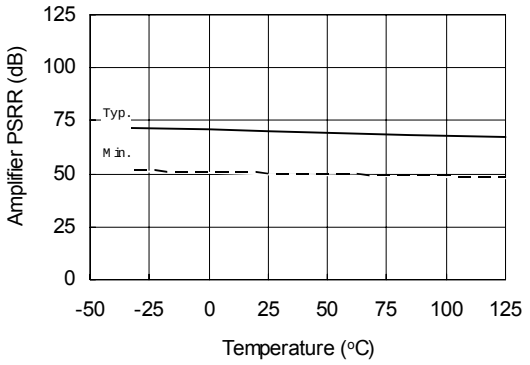


Figure 47A. Amplifier Power Supply Rejection Ratio vs. Temperature

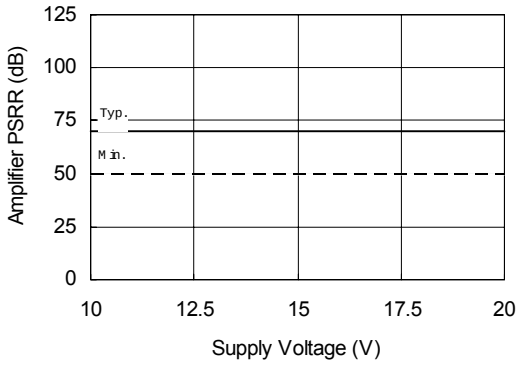


Figure 47B. Amplifier Power Supply Rejection Ratio vs. Supply Voltage

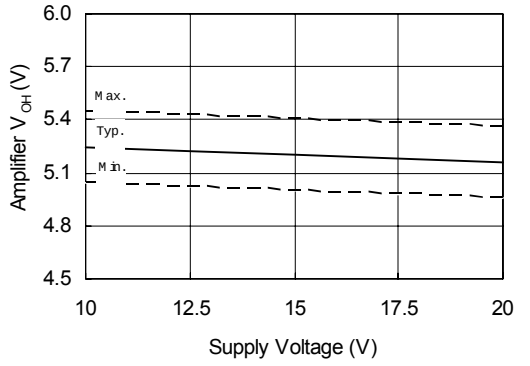


Figure 48. Amplifier High Level Output Voltage vs. Supply Voltage

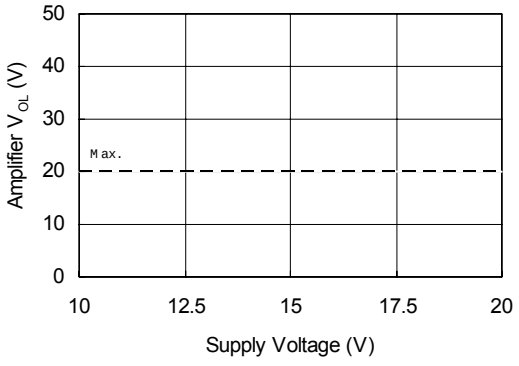


Figure 49. Amplifier Low Level Output Voltage vs. Supply Voltage

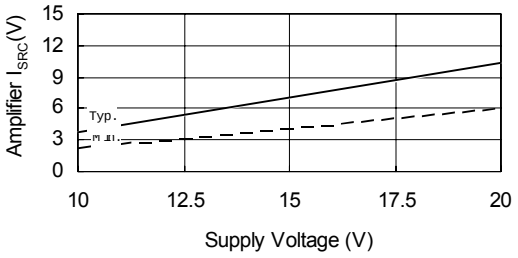


Figure 50. Amplifier Output Source Current vs. Supply Voltage

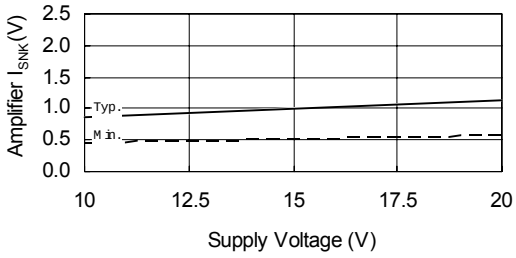


Figure 51. Amplifier Output Sink Current vs. Supply Voltage

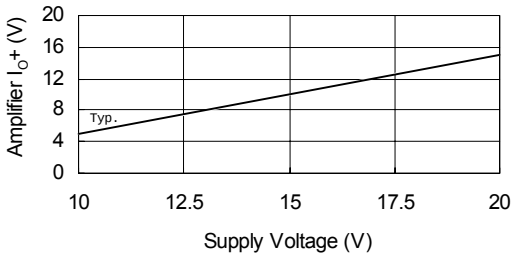


Figure 52. Amplifier Output High Short Circuit Current vs. Supply Voltage

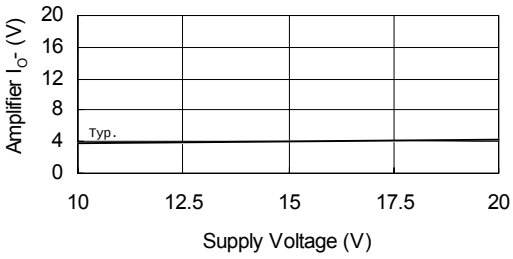


Figure 53. Amplifier Output Low Short Circuit Current vs. Supply Voltage

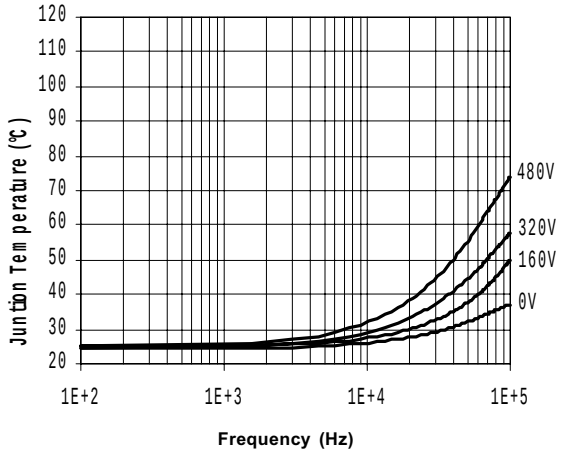


Figure 7. IR2133J Junction Temperature vs Frequency Driving (IRGPC20KD2) Rgate = 5.1Ω @ Vcc = 15V

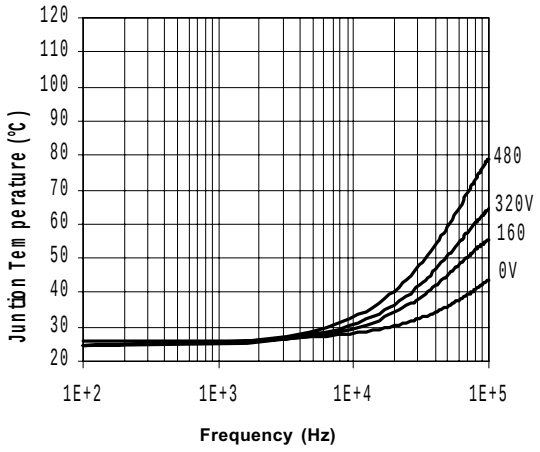


Figure 8. IR2133J Junction Temperature vs Frequency Driving (IRGPC30KD2) Rgate = 5.1Ω @ Vcc = 15V

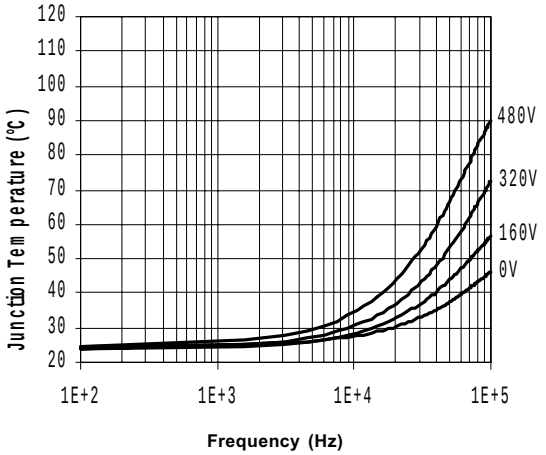


Figure 9. IR2133J Junction Temperature vs Frequency Driving (IRGPC40KD2) Rgate = 5.1Ω @ Vcc = 15V

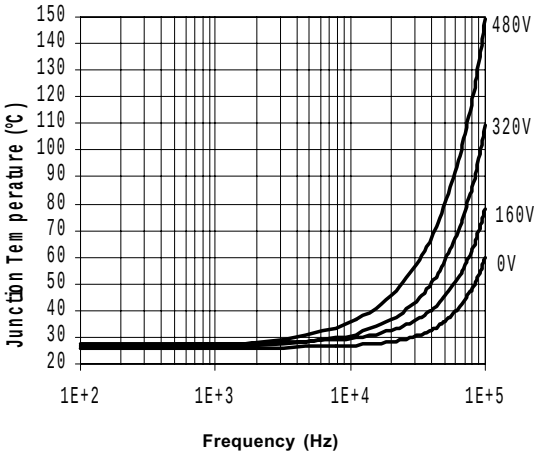


Figure 10. IR2133J Junction Temperature vs Frequency Driving (IRGPC50KD2) Rgate = 5.1Ω @ Vcc = 15V

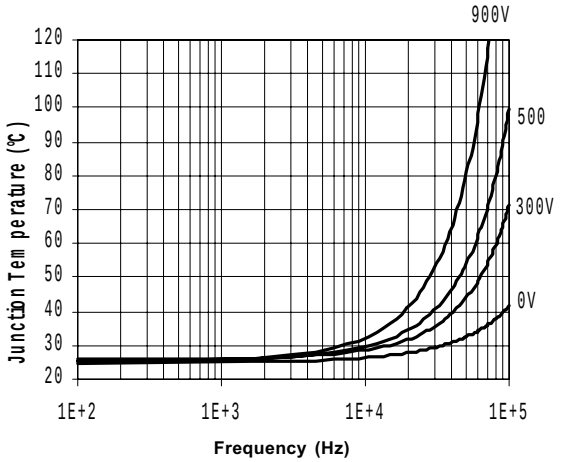


Figure 11. IR2233J Junction Temperature vs Frequency Driving (IRG4PH30KD) Rgate = 20Ω @ Vcc = 15V

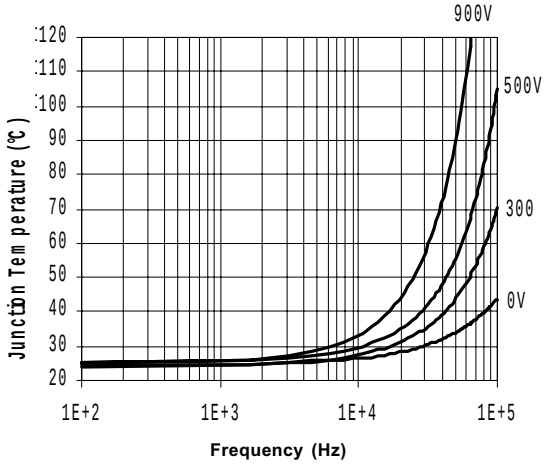


Figure 12. IR2233J Junction Temperature vs Frequency Driving (IRG4PH40KD) Rgate = 15Ω @ Vcc = 15V

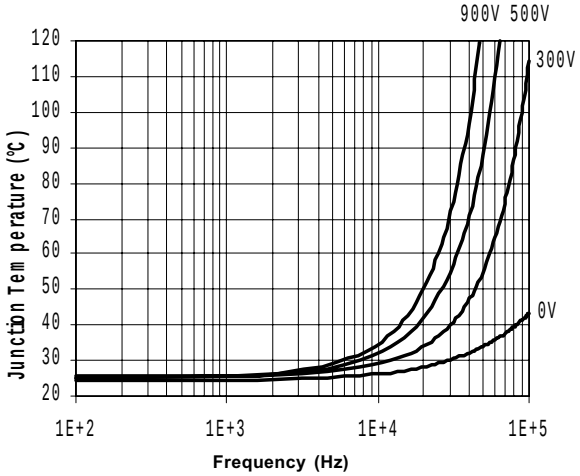


Figure 13. IR2233J Junction Temperature vs Frequency Driving (IRG4PH50KD) Rgate = 10Ω @ Vcc = 15V

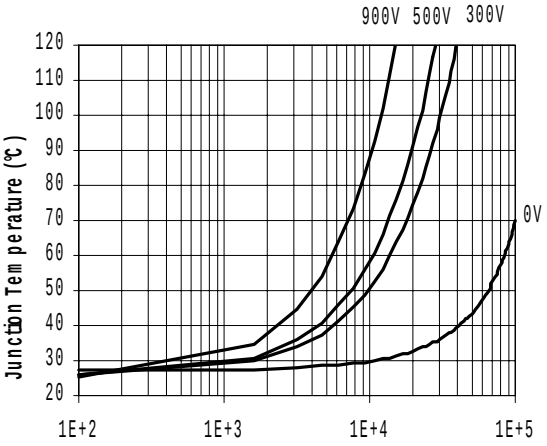
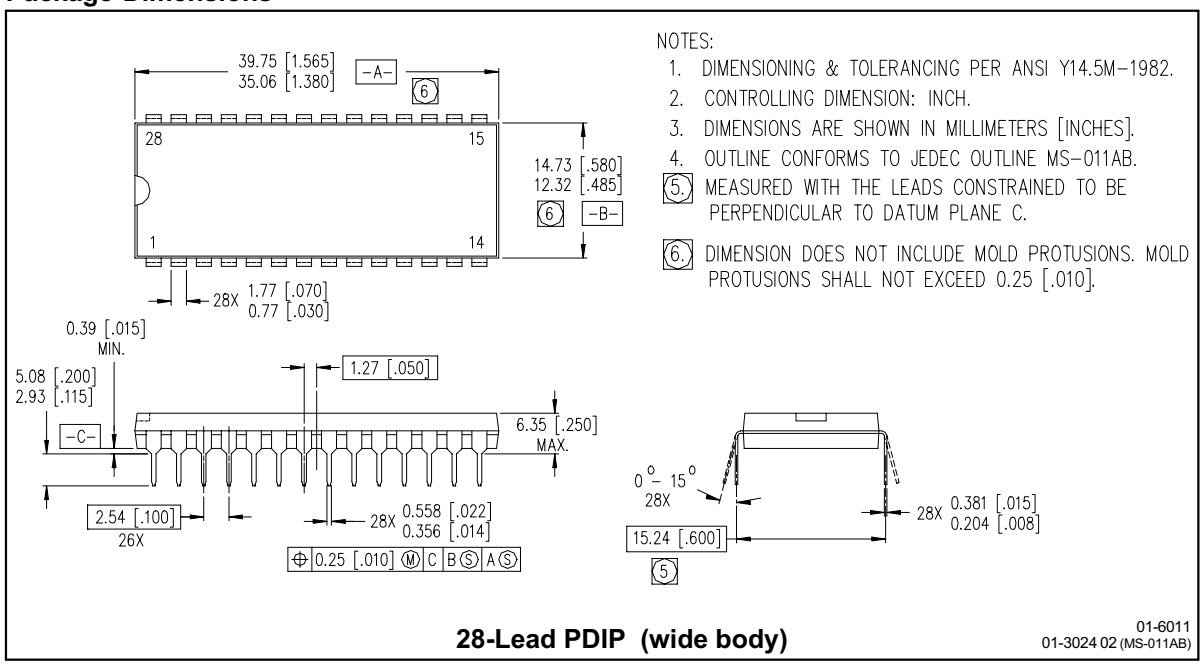


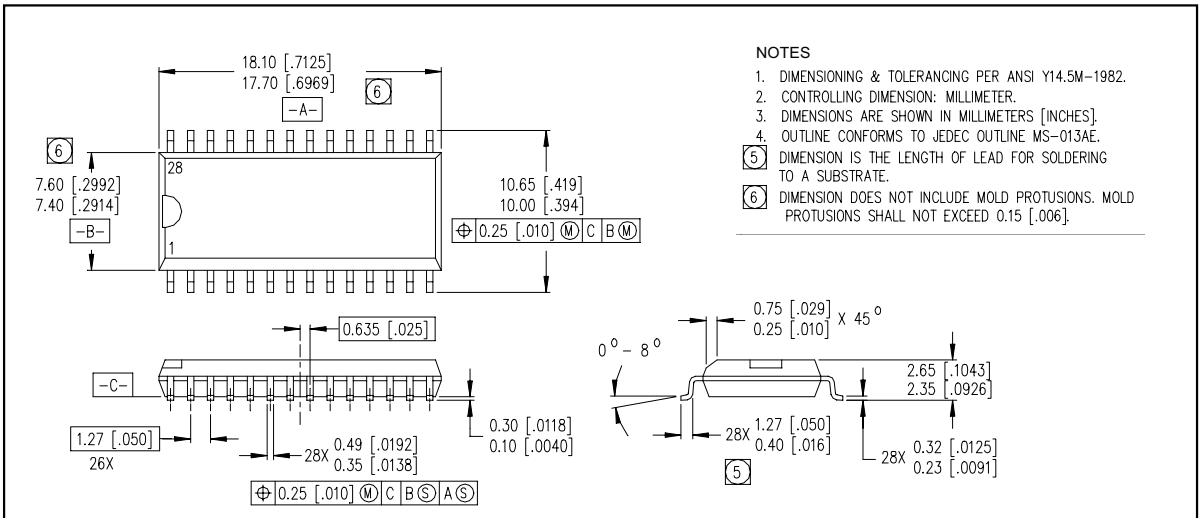
Figure 14. IR2233J Junction Temperature vs Frequency Driving (IRG4ZH71KD) Rgate = 5Ω @ Vcc = 15V

Package Dimensions



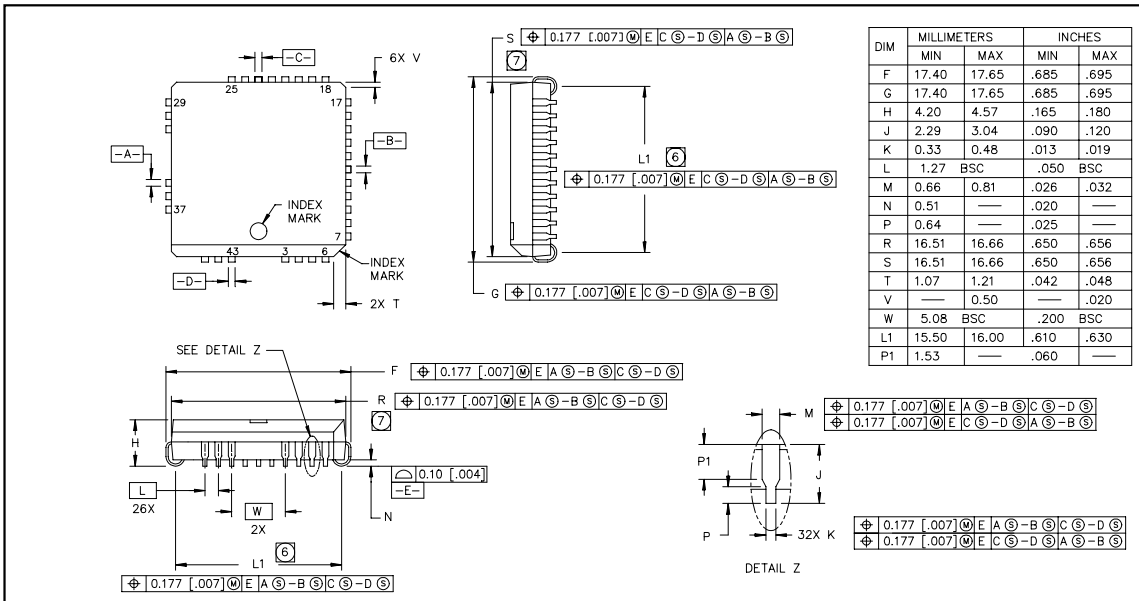
28-Lead PDIP (wide body)

01-6011
01-3024 02 (MS-011AB)



28-Lead SOIC (wide body)

01-6013
01-3040 02 (MS-013AE)



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
F	17.40	17.65	.685	.695
G	17.40	17.65	.685	.695
H	4.20	4.57	.165	.180
J	2.29	3.04	.090	.120
K	0.33	0.48	.013	.019
L	1.27 BSC		.050 BSC	
M	0.66	0.81	.026	.032
N	0.51	—	.020	—
P	0.64	—	.025	—
R	16.51	16.66	.650	.656
S	16.51	16.66	.650	.656
T	1.07	1.21	.042	.048
V	—	0.50	—	.020
W	5.08 BSC		.200 BSC	
L1	15.50	16.00	.610	.630
P1	1.53	—	.060	—

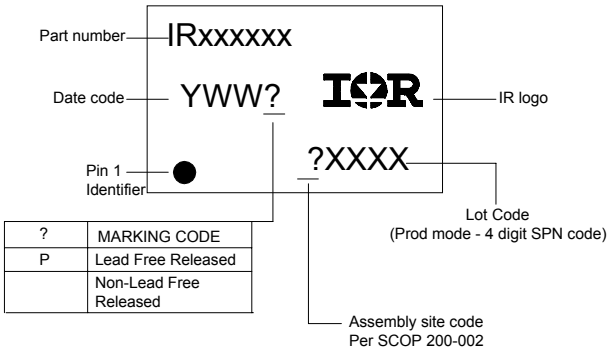
NOTES:

1. DIMENSIONING & TOLERENCING PER ANSI Y14.5M-1982.
2. DIMENSIONS SHOWN IN MILLIMETERS [INCHES].
3. CONTROLLING DIMENSION: INCH.
4. CONFORMS TO JEDEC OUTLINE MS-018AC.
5. DATUMS -A-, -B-, -C-, & -D- ARE DETERMINED BY WHERE THE TOP OF THE LEADS EXIT PLASTIC BODY AT MOLD PARTING LINE.
6. TO BE MEASURED AT -E- SEATING PLANE.
7. DIMENSIONS DO NOT INCLUDE MOLD FLASH, ALLOWABLE FLASH IS 0.254 [.010].

44-Lead PLCC w/o 12 leads

01-600900
01-3004 02(mod.) (MS-018AC)

LEADFREE PART MARKING INFORMATION



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

ORDER INFORMATION

Basic Part (Non-Lead Free)				
28-Lead	PDIP	IR2133	order	IR2133 2
8-Lead	SOIC	IR2133S	order	IR2133S
28-Lead	PDIP	IR2135	order	IR2135
28-Lead	SOIC	IR2135S	order	IR2135S
28-Lead	PDIP	IR2233	not available	
28-Lead	SOIC	IR2233S	order	IR2233S
28-Lead	PDIP	IR2235	not available	
28-Lead	SOIC	IR2235S	order	IR2235S
44-Lead	PLCC	IR2133J	order	IR2133J
44-Lead	PLCC	IR2135J	order	IR2135J
44-Lead	PLCC	IR2233J	order	IR2233J
44-Lead	PLCC	IR2235J	order	IR2235J

Leadfree Part				
28-Lead	PDIP	IR2133	order	IR2133PbF
28-Lead	SOIC	IR2133S	order	IR2133SPbF
28-Lead	PDIP	IR2135	order	IR2135PbF
28-Lead	SOIC	IR2135S	order	IR2135SPbF
28-Lead	PDIP	IR2233	order	IR2233PbF
28-Lead	SOIC	IR2233S	order	IR2233SPbF
28-Lead	PDIP	IR2235	order	IR2235PbF
28-Lead	SOIC	IR2235S	order	IR2235SPbF
44-Lead	PLCC	IR2133J	order	IR2133JPbF
44-Lead	PLCC	IR2135J	order	IR2135JPbF
44-Lead	PLCC	IR2233J	order	IR2233JPbF
44-Lead	PLCC	IR2235J	order	IR2235JPbF

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

This product has been qualified per industrial level

Data and specifications subject to change without notice. 9/22/2005