International IR Rectifier

High and Low Side Driver

Features

- Floating channel designed for bootstrap operation
- Fully operational to +600V
- Tolerant to negative transient voltage
- dV/dt immune
- Gate drive supply range from 10 to 20V
- Undervoltage lockout for both channels
- 3.3V, 5V and 15V input logic compatible
- Matched propagation delay for both channels
- Logic and power ground +/-5V offset
- Lower di/dt gate driver for better noise immunity
- Outputs in phase with inputs

Product Summary

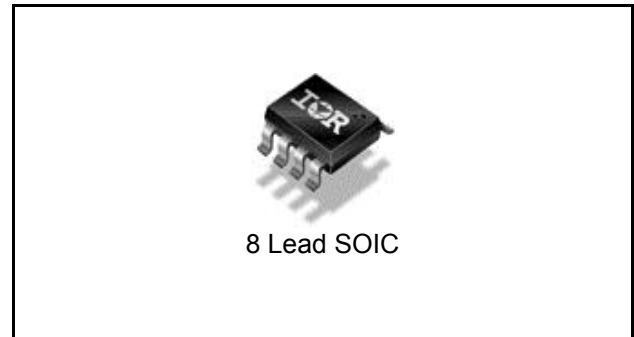|	
V_{OFFSET}	600V max.
$I_{O+/-}$	200 mA / 350 mA
V_{OUT}	10 – 20V
Ton/off (typ.)	220 & 200 ns

Description

The IR25604 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. 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 V.

Package Options

8 Lead SOIC

Ordering Information

Base Part Number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IR25604SPBF	SO8N	Tube	95	IR25604SPBF
IR25604SPBF	SO8N	Tape and Reel	2500	IR25604STRPBF

Typical Connection Diagram

up to 600V

V_{CC}	

V_{CC}

HIN

LIN

V_{CC}

HIN

LIN

COM

V_B

HO

V_S

LO

TO
LOAD
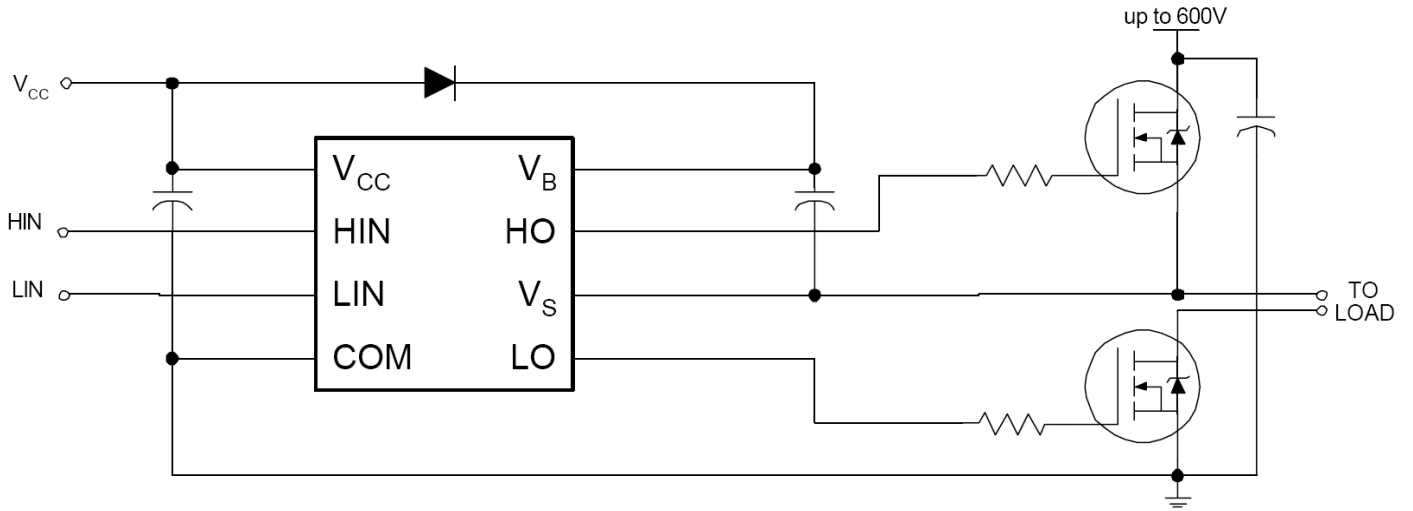
Absolute Maximum Ratings

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	$V_{CC} + 0.3$	
V_{IN}	Logic input voltage	-0.3	$V_{CC} + 0.3$	
dVs/dt	Allowable offset supply voltage transient	—	50	V/ns
P_D	Package power dissipation @ TA ≤ +25°C	—	0.625	W
Rth_{JA}	Thermal resistance, junction to ambient	—	200	°C/W
T_J	Junction temperature	—	150	°C
T_S	Storage temperature	-55	150	
T_L	Lead temperature (soldering, 10 seconds)	—	300	

Recommended Operating Conditions

For proper operation the device should be used within the recommended conditions. The V_S offset rating is tested with all supplies biased at 15V differential.

Symbol	Definition	Min.	Max.	Units
V_B	High side floating supply absolute voltage	$V_S + 10$	$V_S + 20$	V
V_S	High side floating supply offset voltage	†	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	0	V_{CC}	
T_A	Ambient temperature	-40	125	°C

† Logic operational for V_S of -5 to +600V. Logic state held for V_S of -5V to -VBS. (Please refer to Design Tip DT97-3 for more details).

Dynamic Electrical Characteristics

V_{BIAS} (V_{CC}, V_{BS}) = 15V, CL = 1000 pF and T_A = 25°C unless otherwise specified.

Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
t_{on}	Turn-on propagation delay	—	220	300	ns	V_S = 0V
t_{off}	Turn-off propagation delay	—	200	280		V_S = 0V or 600V
t_r	Turn-on rise time	—	150	220		V_S = 0V
t_f	Turn-off fall time	—	50	80		V_S = 0V
MT	Delay matching, HS & LS turn-on/off	—	0	30		

Static Electrical Characteristics

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

Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
V_{IH}	Logic "1" input voltage	2.9	—	—	V	V_{CC} = 10V to 20V
V_{IL}	Logic "0" input voltage	—	—	0.8		V_{CC} = 10V to 20V
V_{OH}	High level output voltage, V_{BIAS} - V_O	—	0.8	1.4		I_O = 20 mA
V_{OL}	Low level output voltage, V_O	—	0.3	0.6		I_O = 20 mA
I_{LK}	Offset supply leakage current	—	—	50	µA	V_B = V_S = 600V
I_{QBS}	Quiescent V_{BS} supply current	20	75	130		V_{IN} = 0V or 5V
I_{QCC}	Quiescent V_{CC} supply current	60	120	180		V_{IN} = 0V or 5V
I_{IN+}	Logic "1" input bias current	—	5	20		V_{IN} = 5V
I_{IN-}	Logic "0" input bias current	—	—	2		V_{IN} = 0V
V_{CCUV+} V_{BSUV+}	V_{CC} and V_{BS} supply undervoltage positive going threshold	8	8.9	9.8	V	
V_{CCUV-} V_{BSUV-}	V_{CC} and V_{BS} supply undervoltage negative going threshold	7.4	8.2	9		
V_{CCUVH} V_{BSUVH}	Hysteresis	0.3	0.7	---		
I_{O+}	Output high short circuit pulsed current	120	200	—	mA	V_O = 0V PW ≤ 10 µs
I_{O-}	Output low short circuit pulsed current	250	350	—		V_O = 15V PW ≤ 10 µs

Functional Block Diagram
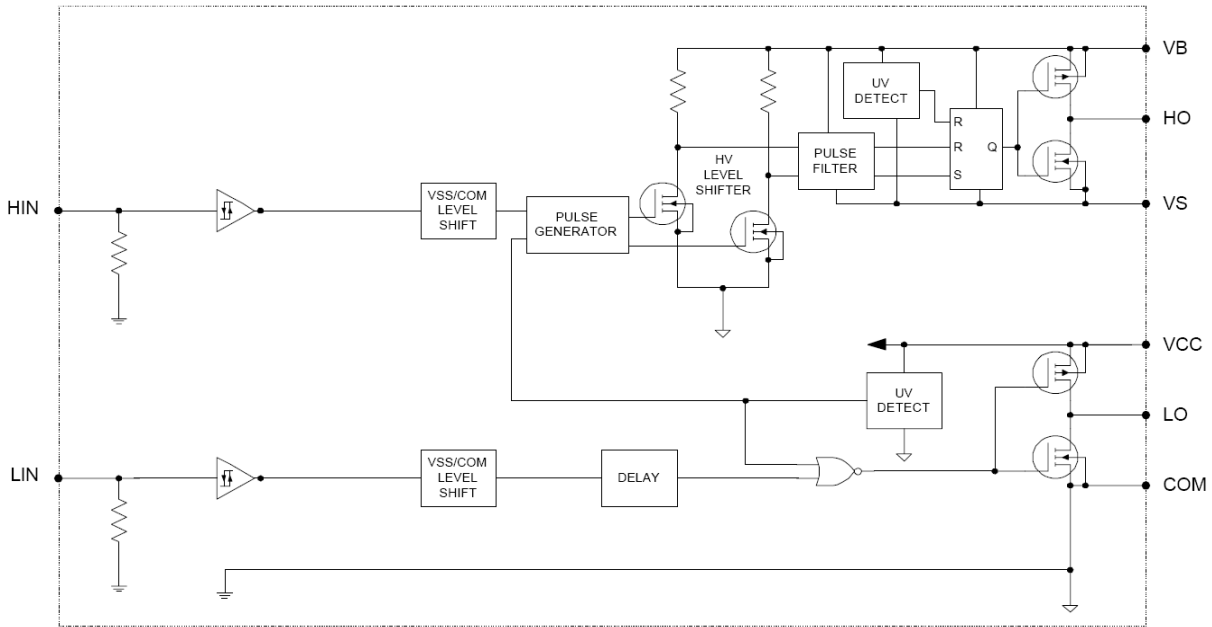
Lead Definitions

Symbol	Description
HIN	Logic input for high side gate driver outputs (HO), in phase
LIN	Logic input for high side gate driver outputs (LO), in phase
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

1	V_{CC}		V_B	8
2	HIN		HO	7
3	LIN		V_S	6
4	COM		LO	5
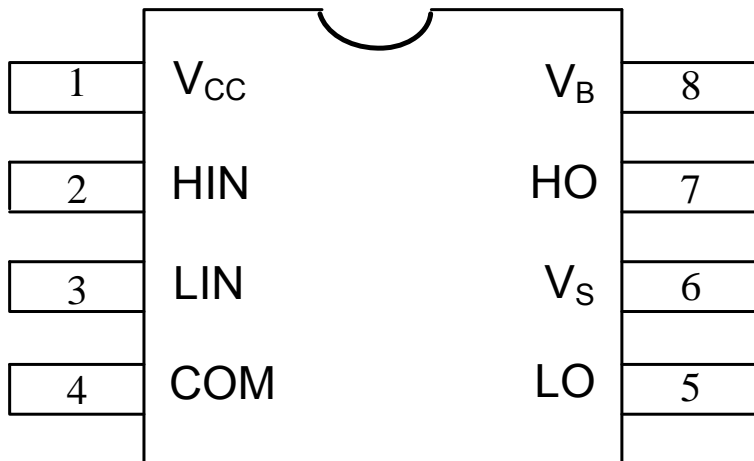
Application Information and Additional Details
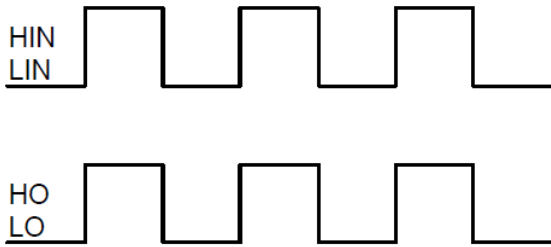
Figure 1. Input/Output Timing Diagram
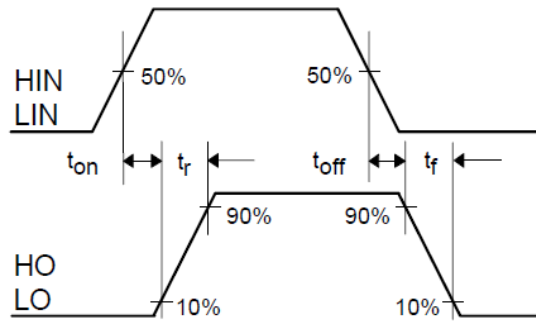
Figure 2. Switching Time Waveform Definitions
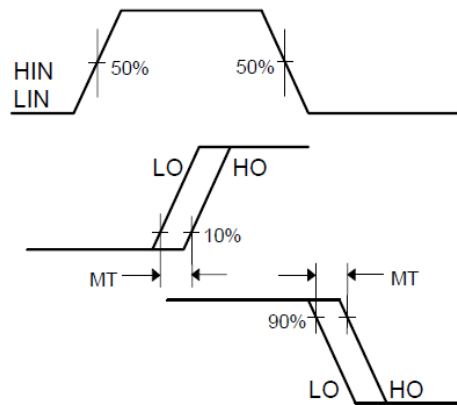
Figure 3. Delay Matching Waveform Definitions
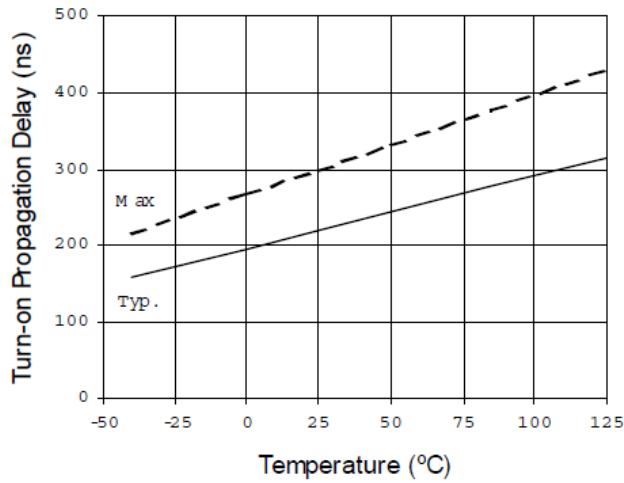
**Figure 4A. Turn-on Propagation Delay
vs. Temperature**
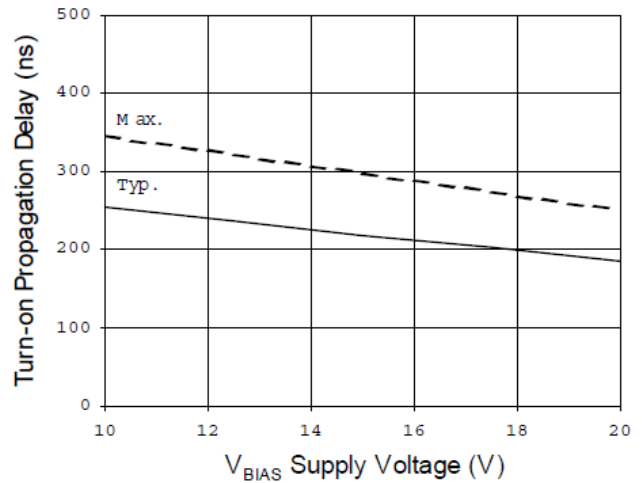
**Figure 4B. Turn-on Propagation Delay
vs. Supply Voltage**
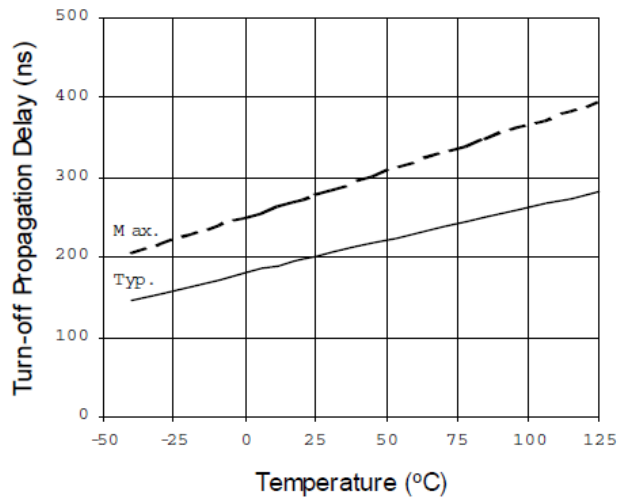
**Figure 5A. Turn-off Propagation Delay
vs. Temperature**
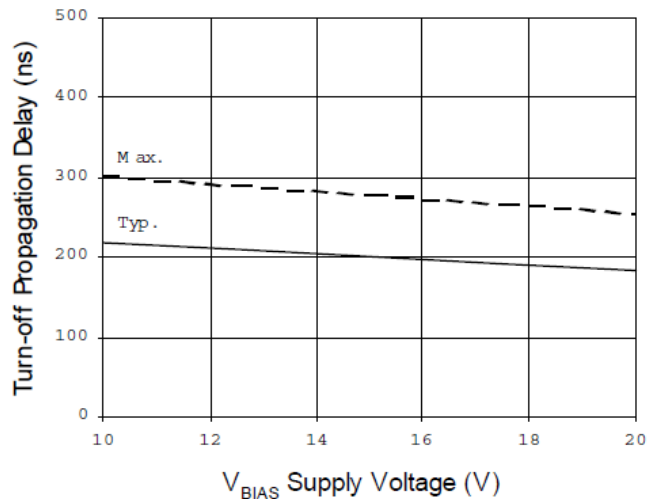
**Figure 5B. Turn-off Propagation Delay
vs. Supply Voltage**
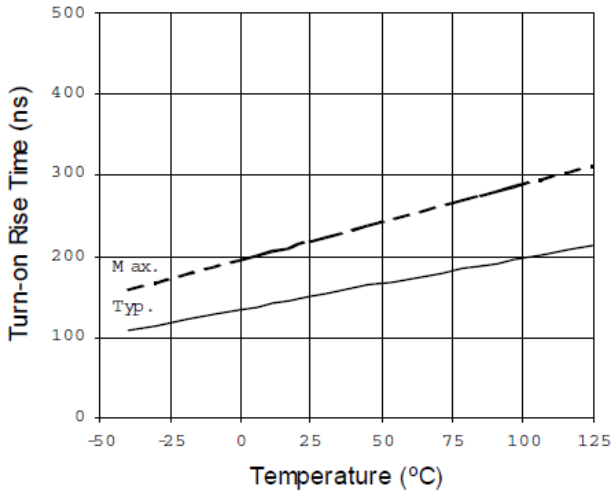
**Figure 6A. Turn-on Rise Time
vs. Temperature**
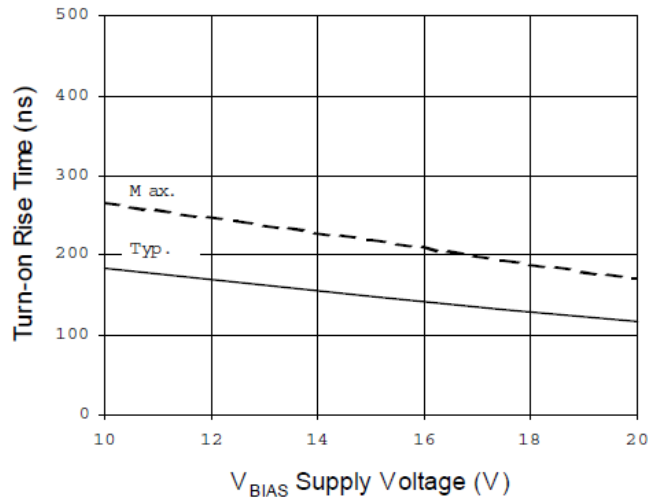
**Figure 6B. Turn-on Rise Time
vs. Supply Voltage**
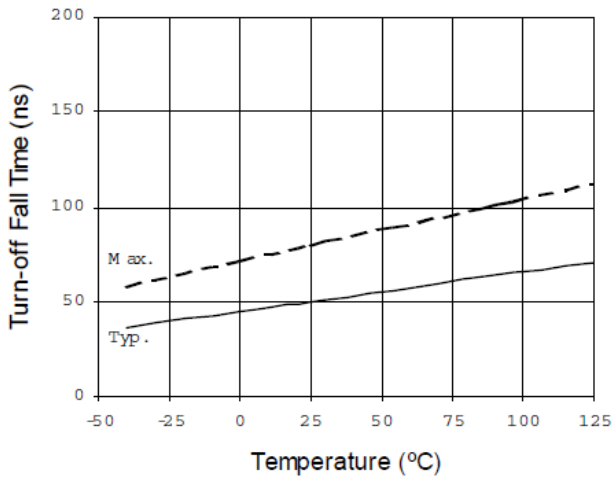
**Figure 7A. Turn-off Fall Time
vs. Temperature**
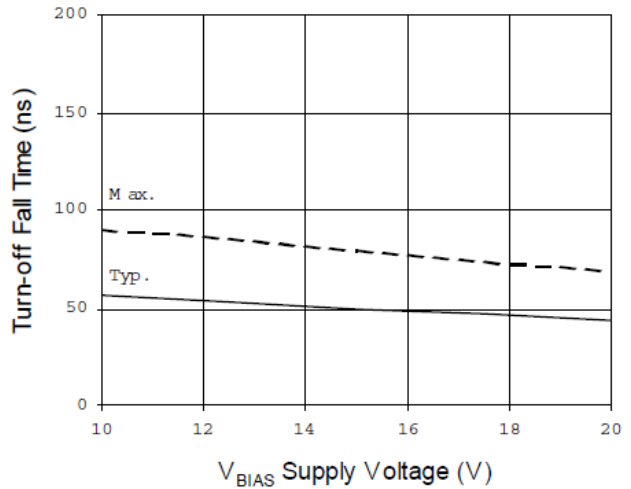
**Figure 7B. Turn-off Fall Time
vs. Supply Voltage**
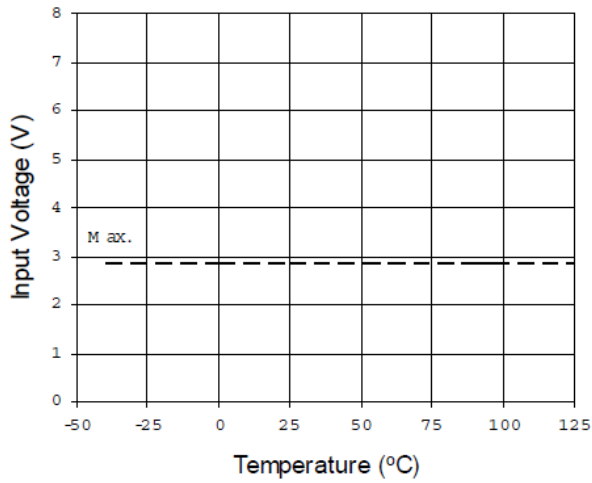
Figure 8A. Logic "1" Input Voltage
vs. Temperature
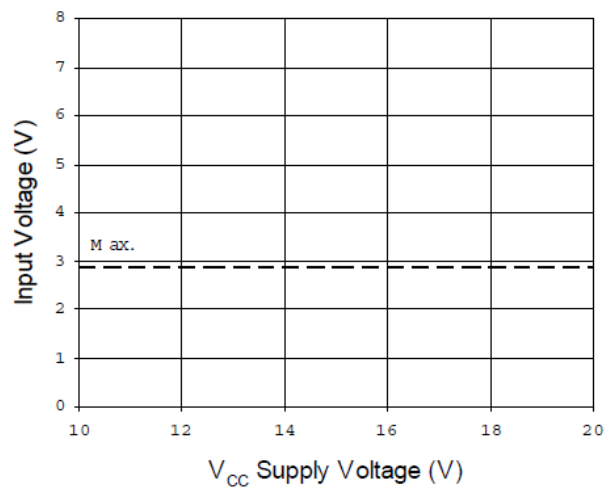
Figure 8B. Logic "1" Input Voltage
vs. Supply Voltage
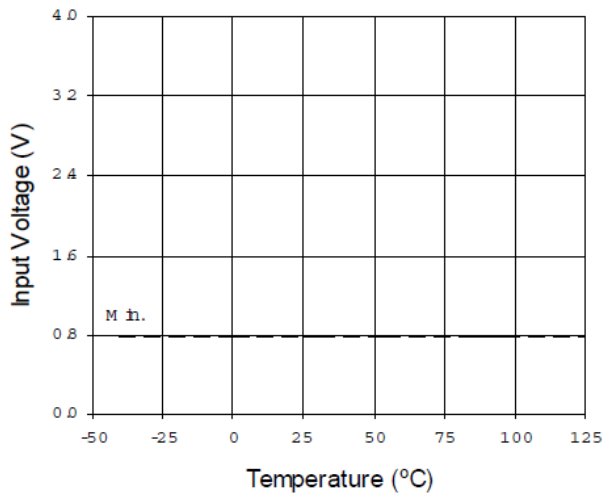
Figure 9A. Logic "0" Input Voltage
vs. Temperature
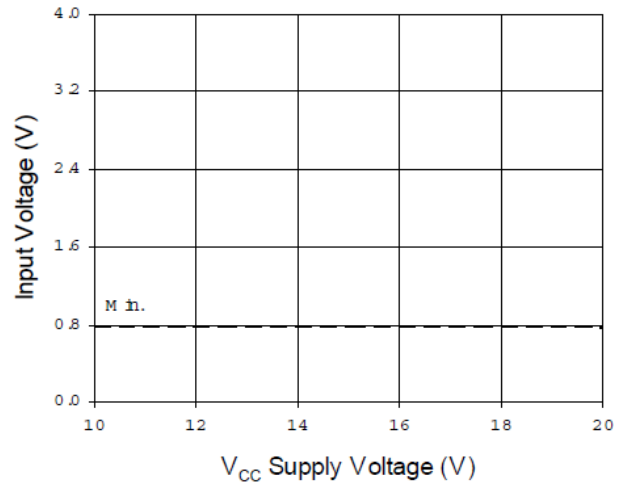
Figure 9B. Logic "0" Input Voltage
vs. Supply Voltage
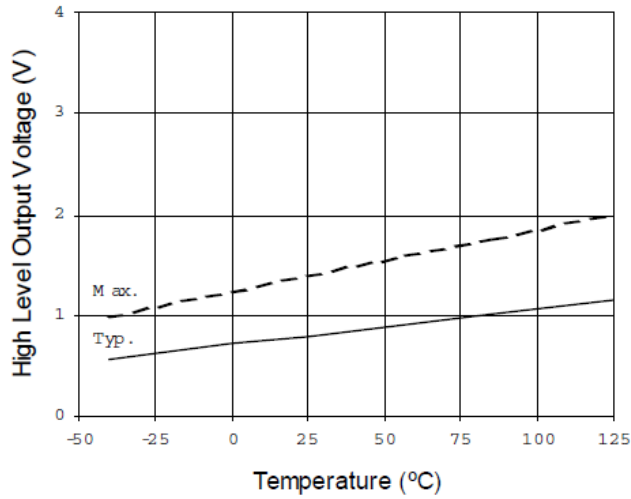
Figure 10A. High Level Output Voltage
vs. Temperature
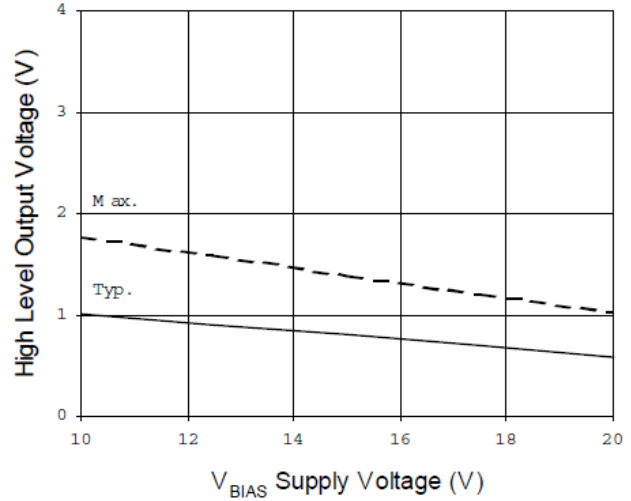
Figure 10B. High Level Output Voltage
vs. Supply Voltage
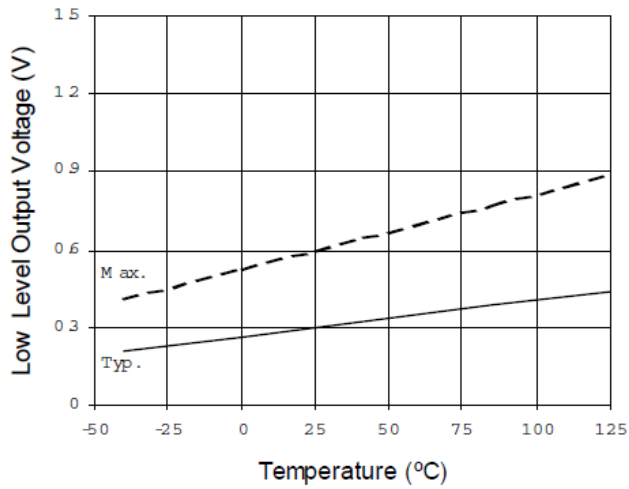
Figure 11A. Low Level Output Voltage
vs. Temperature
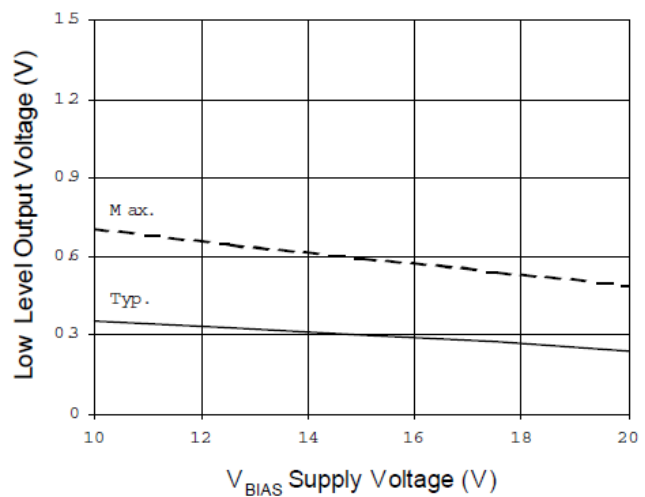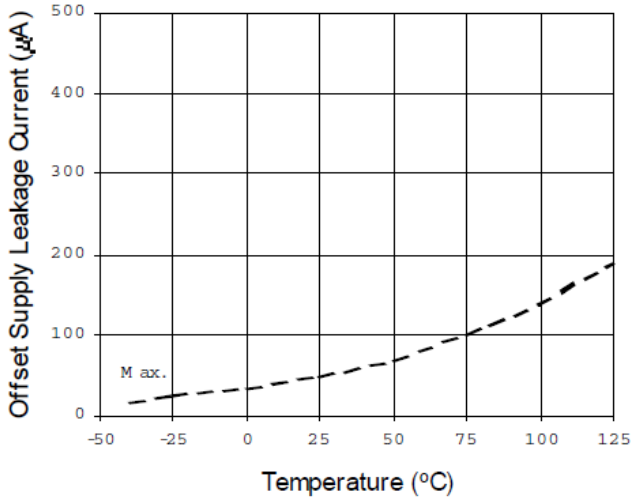
Figure 11B. Low Level Output Voltage
vs. Supply Voltage

Figure 12A. Offset Supply Leakage Current
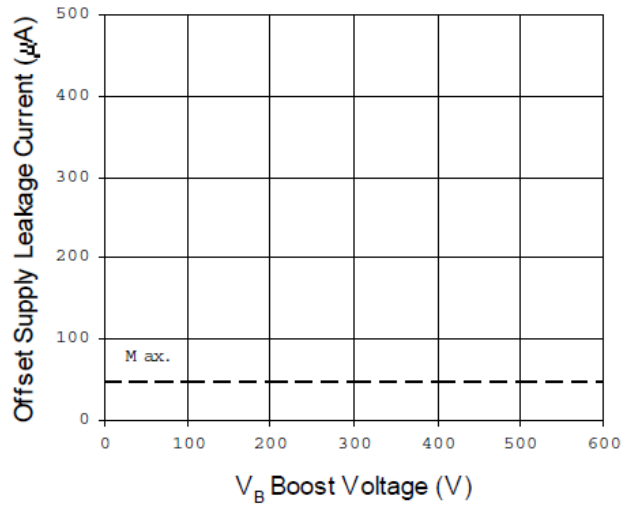vs. Temperature

Figure 12B. Offset Supply Leakage Current
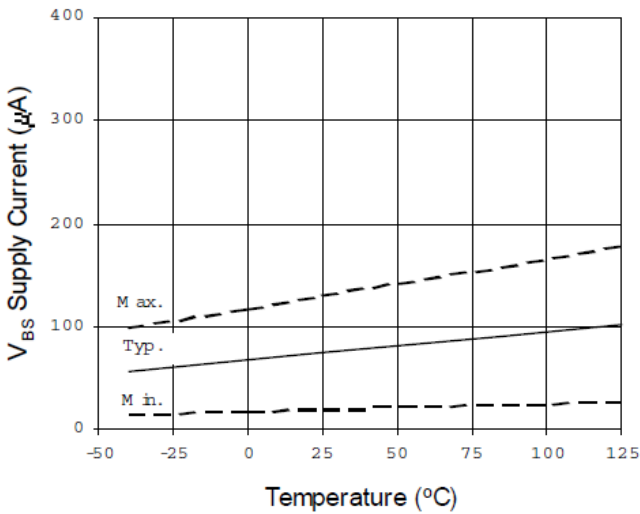vs. Supply Voltage

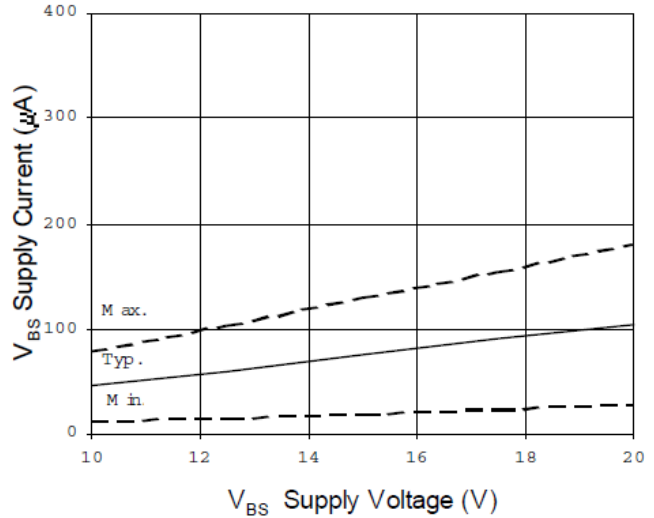Figure 13A. V$_{BS}$ Supply Current
vs. Temperature
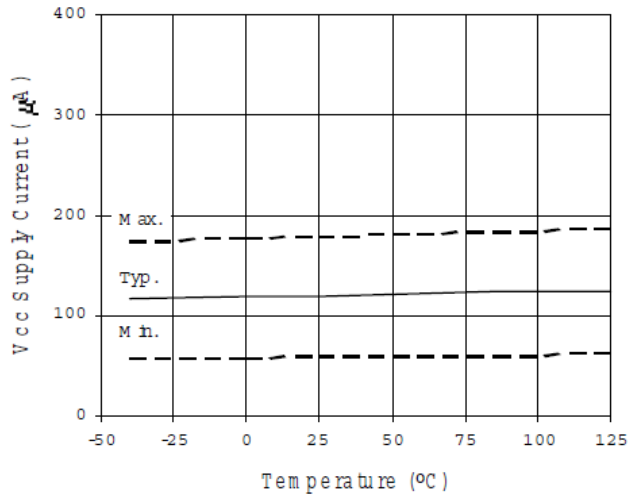

Figure 13B. V$_{BS}$ Supply Current
vs. Supply Voltage

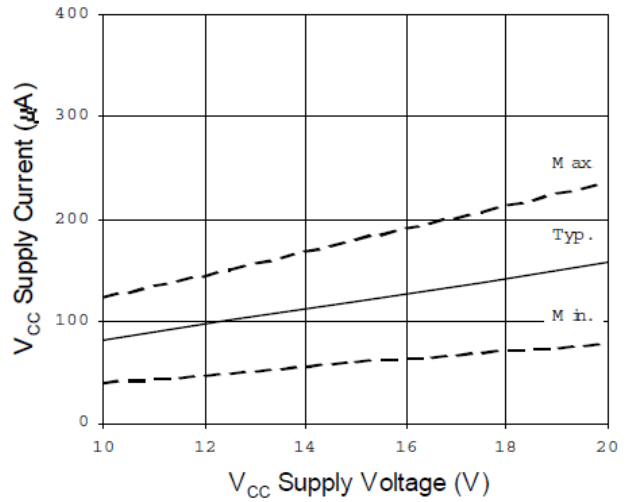Figure 14A. Quiescent V_{CC} Supply Current
vs. Temperature

Figure 14B. Quiescent V_{CC} Supply Current
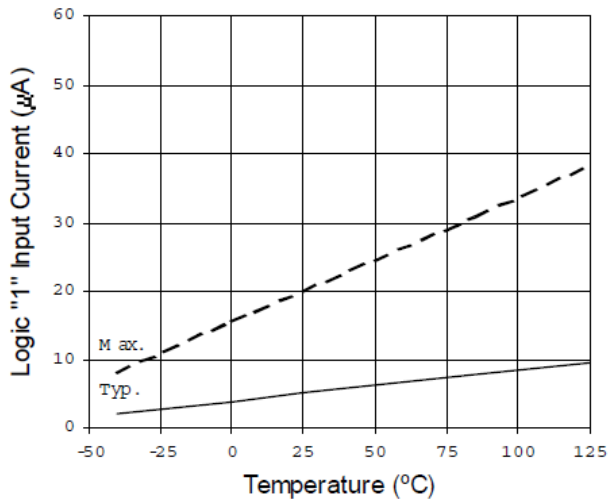vs. V_{CC} Supply Voltage

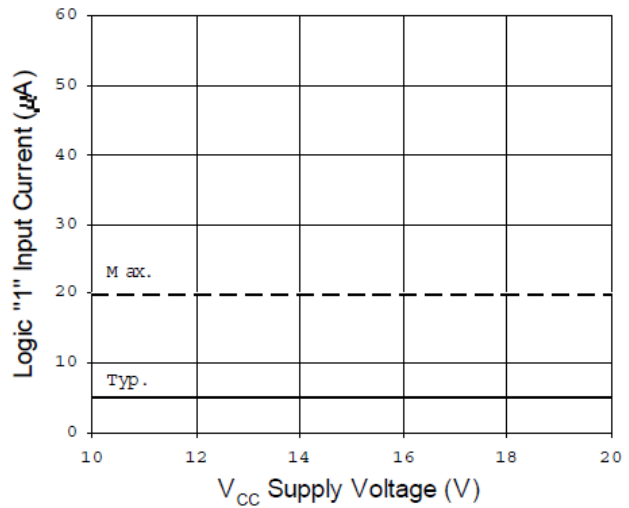Figure 15A. Logic "1" Input Current
vs. Temperature
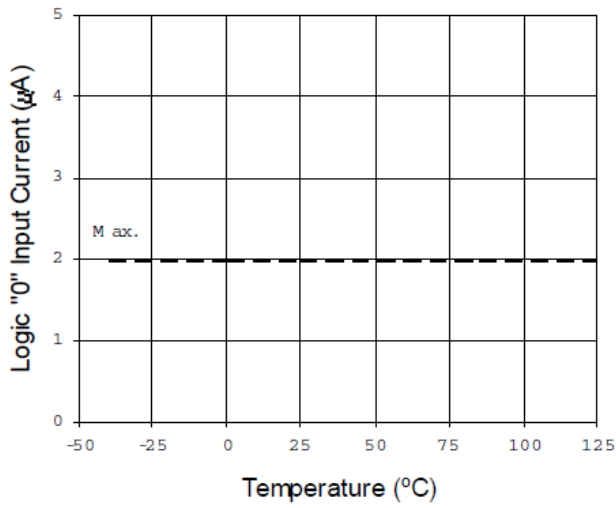

Figure 15B. Logic "1" Bias Current
vs. Supply Voltage
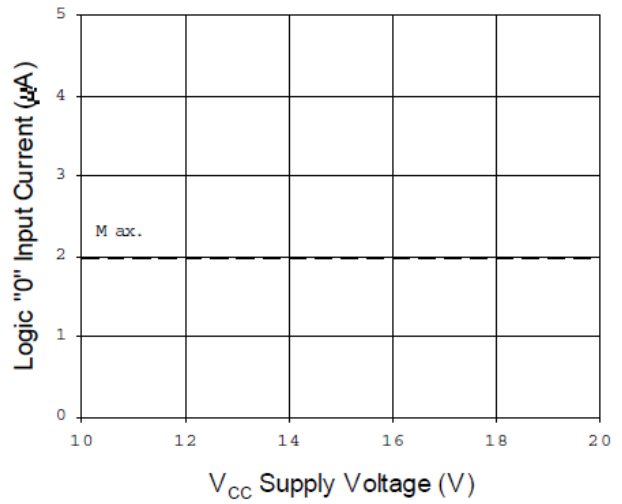
Figure 16A. Logic "0" Input Current
vs. Temperature

Figure 16B. Logic "0" Input Currentt
vs. Supply Voltage

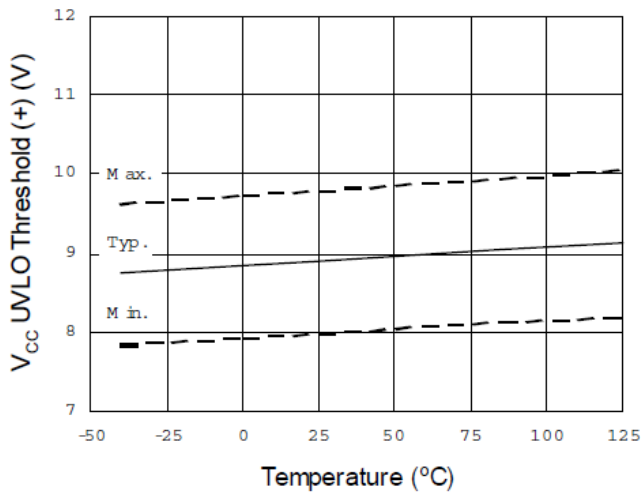Figure 17. V$_{CC}$ Undervoltage Threshold (+)
vs. Temperature
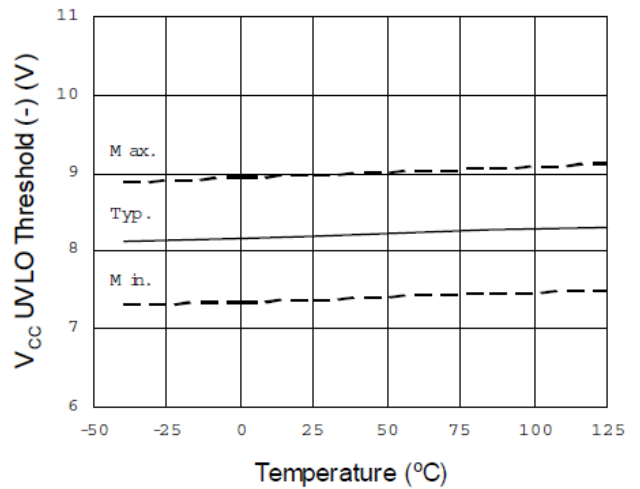
Figure 18. V$_{CC}$ Undervoltage Threshold (-)
vs. Temperature

Figure 19. V$_{BS}$ Undervoltage Threshold (+)
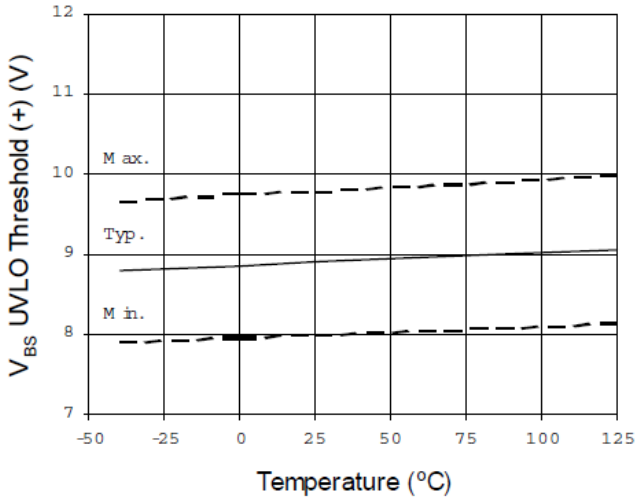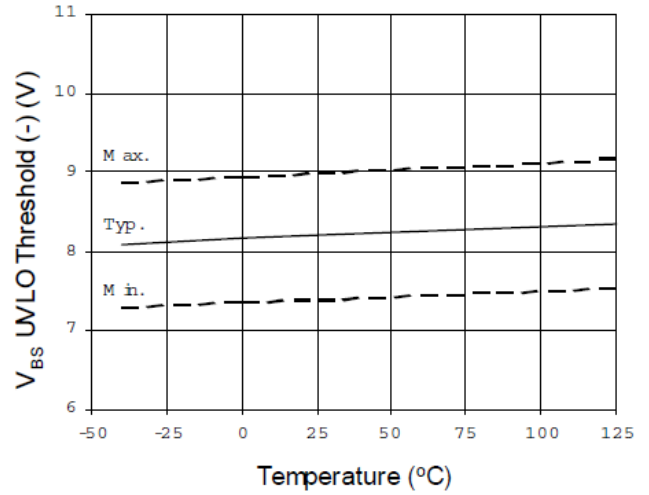vs. Temperature

Figure 20. V$_{BS}$ Undervoltage Threshold (-)
vs. Temperature
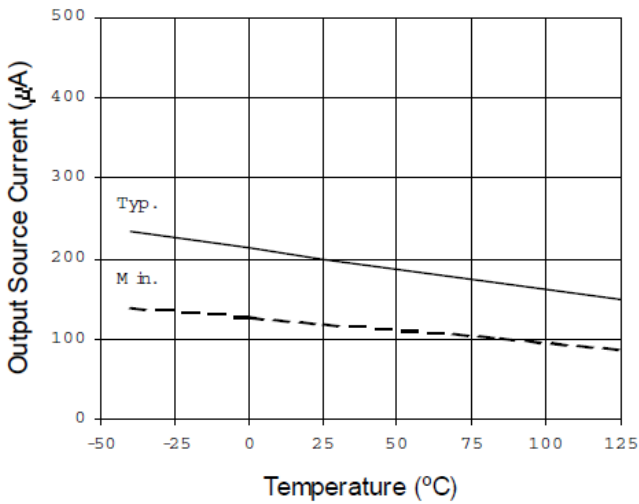
Figure 21A. Output Source Current
vs. Temperature

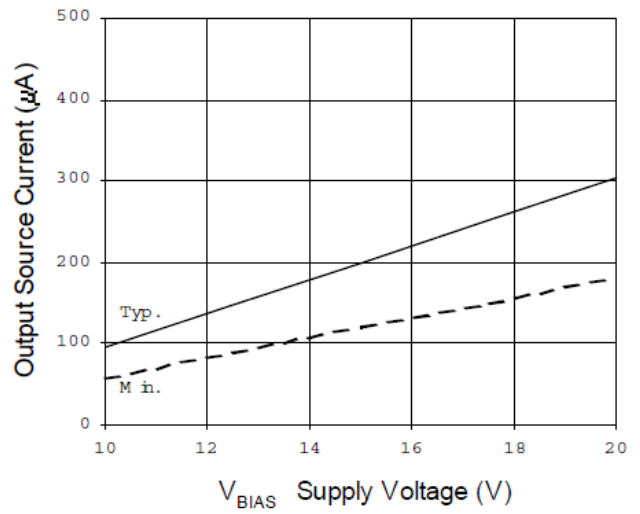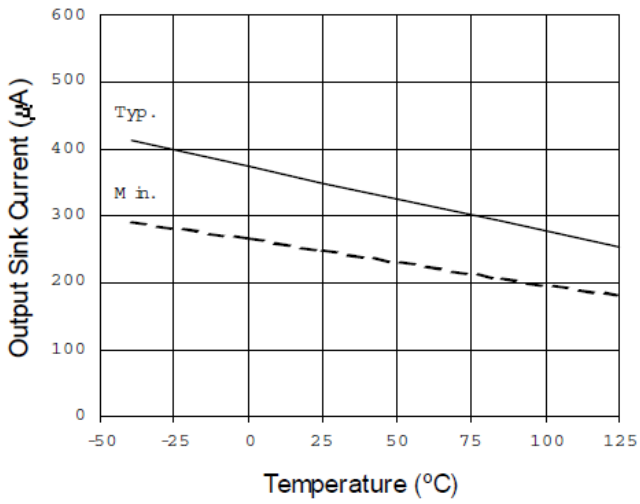Figure 21B. Output Source Current
vs. Supply Voltage

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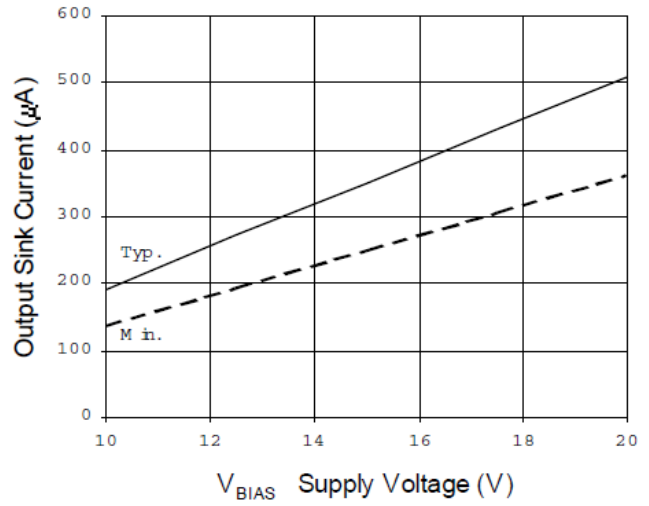Figure 22A. Output Sink Current
vs. Temperature

Figure 22B. Output Sink Currentt
vs. Supply Voltage
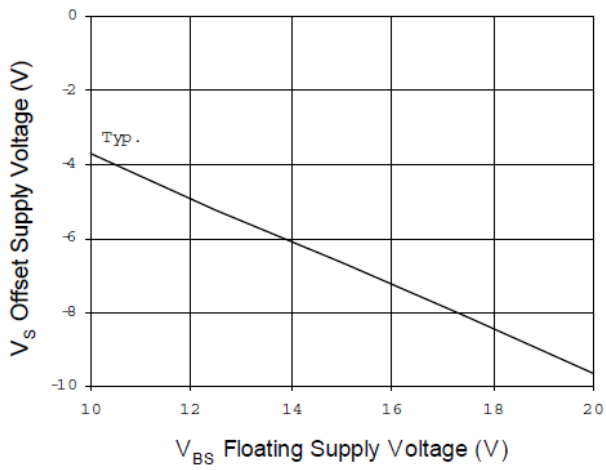
Figure 23. Maximum V$_S$ Negative Offset
vs. Supply Voltage

Package Details

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	
e1	.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°

FOOTPRINT

8X 0.72 [.028]

6.46 [.255]

3X 1.27 [.050]   8X 1.78 [.070]

0.25 [.010] Ⓜ A Ⓜ

6X e

e1

0.10 [.004]

8X b   A1

0.25 [.010] Ⓜ C A B

K x 45°

8X L   8X c

⑦
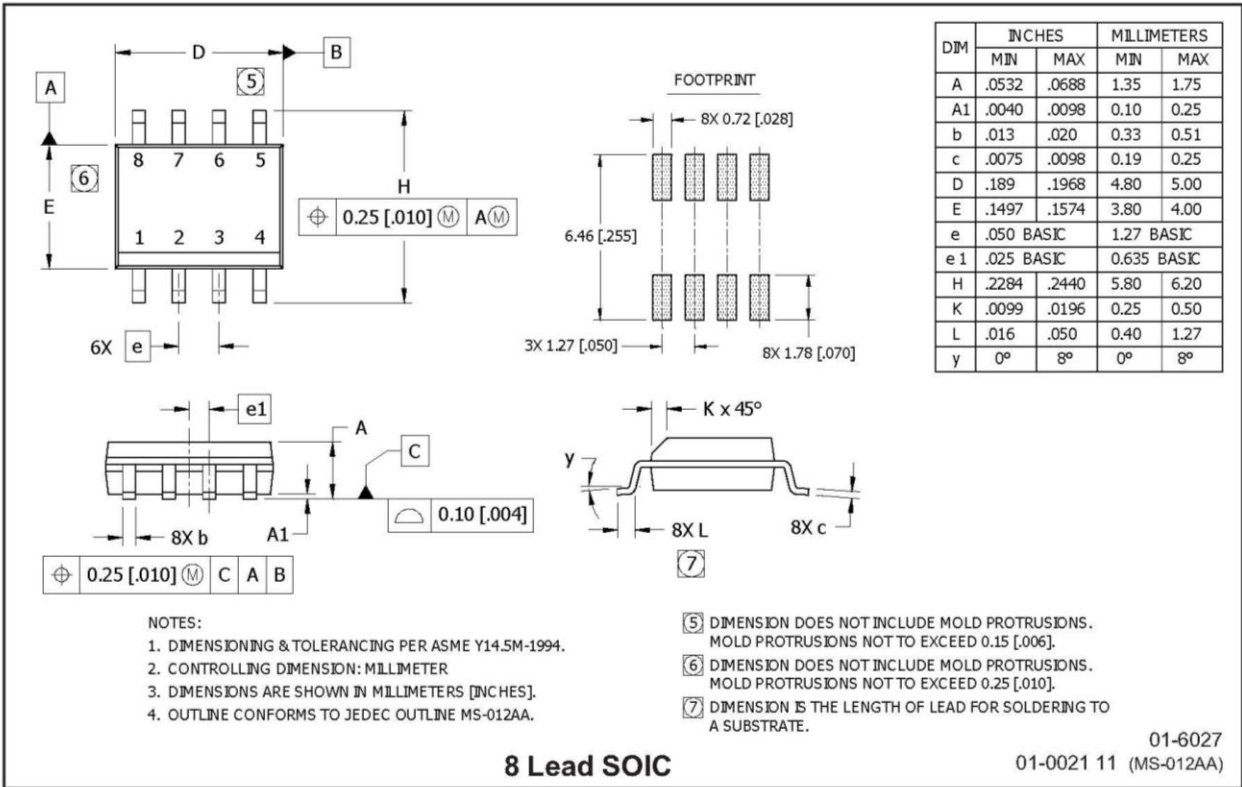
NOTES:
1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: MILLIMETER
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.

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.

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

8 Lead SOIC

Tape and Reel Details

LOADED TAPE FEED DIRECTION

NOTE : CONTROLLING
DIMENSION IN MM
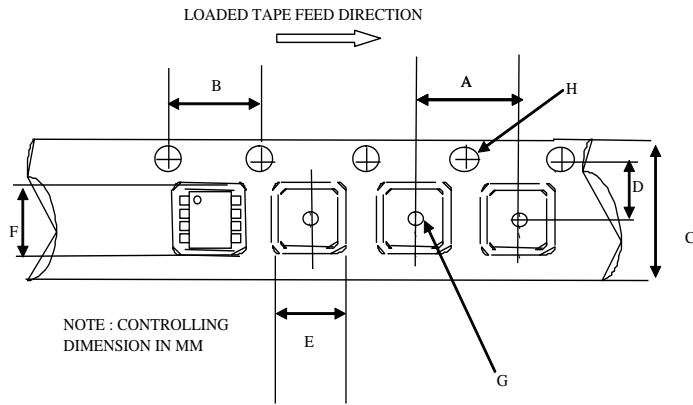
CARRIER TAPE DIMENSION FOR 8SOICN

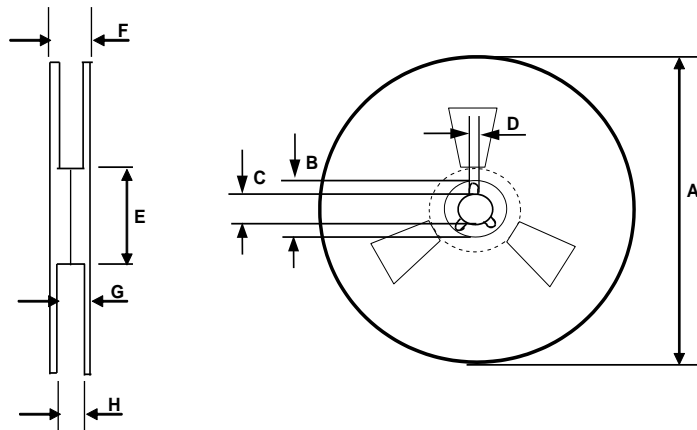| Code	Metric		Imperial	
	Min	Max	Min	Max
A	7.90	8.10	0.311	0.318
B	3.90	4.10	0.153	0.161
C	11.70	12.30	0.46	0.484
D	5.45	5.55	0.214	0.218
E	6.30	6.50	0.248	0.255
F	5.10	5.30	0.200	0.208
G	1.50	n/a	0.059	n/a
H	1.50	1.60	0.059	0.062

REEL DIMENSIONS FOR 8SOICN

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	18.40	n/a	0.724
G	14.50	17.10	0.570	0.673
H	12.40	14.40	0.488	0.566

Part Marking Information

Part number —— **IRxxxxx**

Date code —— **YWW ?**

Pin 1
Identifier ●

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

IƟR —— IR logo

? XXXX —— Lot Code
(Prod mode –
4 digit SPN code)

Assembly site code
Per SCOP 200-002
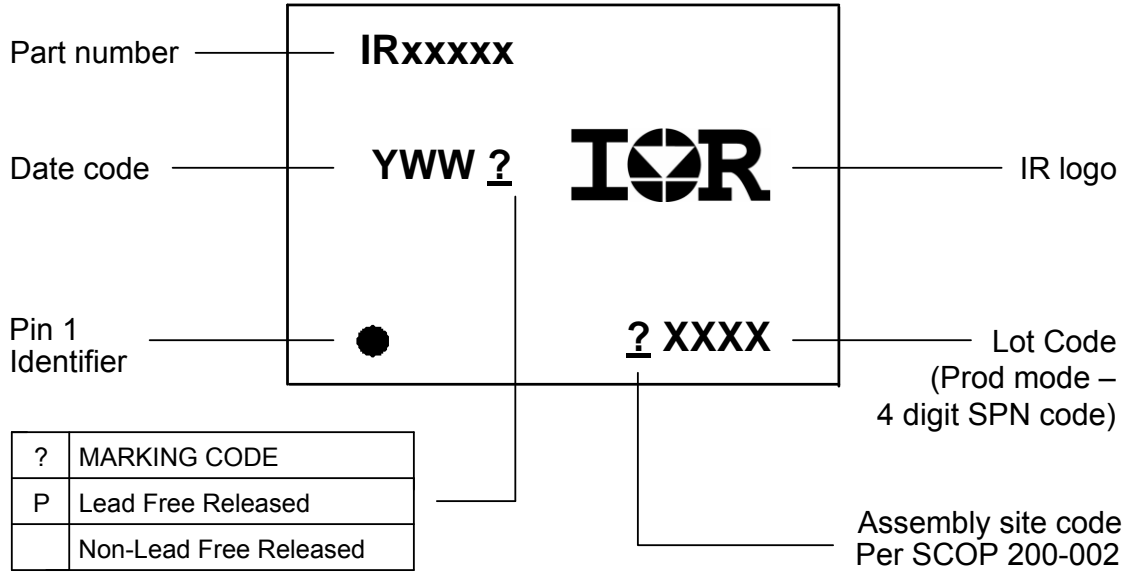
Qualification Information[†]

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	MSL2[†††] (per IPC/JEDEC J-STD-020)
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.

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

WORLD HEADQUARTERS:
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Tel: (310) 252-7105

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