IXYS
INTEGRATED CIRCUITS DIVISION

IXD_604SI & SIA
Automotive Grade
4-Ampere, Dual Low-Side, Ultrafast MOSFET Drivers

Features

- AEC Q100 Qualified
- 4A Peak Source/Sink Drive Current
- Wide Operating Voltage Range: 4.5V to 35V
- AEC Q100 Grade 1 -40°C to +125°C Operating Temperature Range
- Logic Input Withstands Negative Swing of up to 5V
- Outputs May be Connected in Parallel for Higher Drive Current
- Matched Rise and Fall Times
- Low Propagation Delay Time
- Low, 10µA Supply Current
- Low Output Impedance

Features

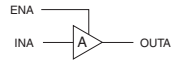
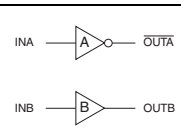
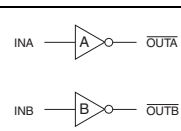
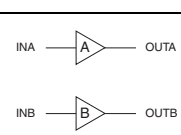
- Automotive DC/DC regulators
- Electronic Power Steering
- Electric Vehicle Power Train Drives
- Brushless DC motors

Description

The IXD_604SI and IXD_604SIA are automotive grade, dual high-speed gate drivers that are qualified according to AEC Q100 standards. Each of the two outputs can source and sink 4A of peak current, while producing rise and fall times of less than 10ns. The outputs and inputs are rated to 35V. The input of each driver is virtually immune to latch-up, and proprietary circuitry eliminates cross-conduction and "shoot-through." The IXD_604 has a Grade 1, -40°C to +125°C ambient operating temperature range.

The IXDD604 is a dual non-inverting driver with an enable. The IXDN604 is a dual non-inverting driver, the IXDI604 is a dual inverting driver, and the IXDF604 has one inverting driver and one non-inverting driver. The AEC Q100 qualified IXD_604SIA is available in a standard 8-pin SOIC package, and the IXD_604SI is available in an 8-pin Power SOIC package with an exposed metal back.

Ordering Information

Part Number	Logic Configuration	Package Type	Packing Method	Quantity
IXDD604SI		8-Pin Power SOIC with Exposed Metal Back	Tube	100
IXDD604SITR		8-Pin Power SOIC with Exposed Metal Back	Tape & Reel	2000
IXDD604SIA		8-Pin SOIC	Tube	100
IXDD604SIATR		8-Pin SOIC	Tape & Reel	2000
IXDF604SI		8-Pin Power SOIC with Exposed Metal Back	Tube	100
IXDF604SITR		8-Pin Power SOIC with Exposed Metal Back	Tape & Reel	2000
IXDF604SIA		8-Pin SOIC	Tube	100
IXDF604SIATR		8-Pin SOIC	Tape & Reel	2000
IXDI604SI		8-Pin Power SOIC with Exposed Metal Back	Tube	100
IXDI604SITR		8-Pin Power SOIC with Exposed Metal Back	Tape & Reel	2000
IXDI604SIA		8-Pin SOIC	Tube	100
IXDI604SIATR		8-Pin SOIC	Tape & Reel	2000
IXDN604SI		8-Pin Power SOIC with Exposed Metal Back	Tube	100
IXDN604SITR		8-Pin Power SOIC with Exposed Metal Back	Tape & Reel	2000
IXDN604SIA		8-Pin SOIC	Tube	100
IXDN604SIATR		8-Pin SOIC	Tape & Reel	2000

1. Specifications 3
1.1 Pin Configurations 3
1.2 Pin Definitions 3
1.3 Absolute Maximum Ratings 3
1.4 Recommended Operating Conditions 3
1.5 Electrical Characteristics: T_A = 25°C 4
1.6 Electrical Characteristics: -40°C ≤ T_A ≤ +125°C 4
1.7 Thermal Characteristics 5

2. IXD_604 Performance 5
2.1 Timing Diagrams 5
2.2 Characteristics Test Diagram 5

3. Block Diagrams & Truth Tables 6
3.1 IXDD604 6
3.2 IXDI604 6
3.3 IXDF604 6
3.4 IXDN604 6

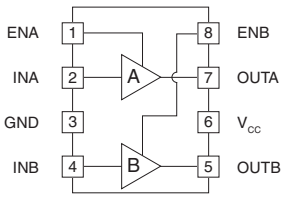
4. Typical Performance Characteristics 7

5. Manufacturing Information 10
5.1 Moisture Sensitivity 10
5.2 ESD Sensitivity 10
5.3 Reflow Profile 10
5.4 Mechanical Dimensions 11

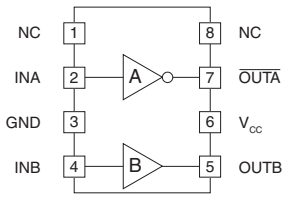
1 Specifications

1.1 Pin Configurations

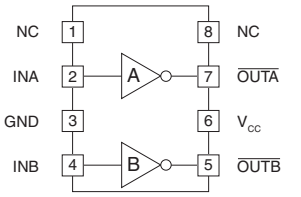
IXDD604SI/SIA



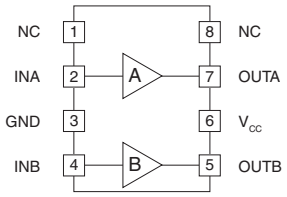
IXDF604SI/SIA



IXDI604SI/SIA



IXDN604SI/SIA



1.2 Pin Definitions

Pin Name	Description
INA	Channel A Logic Input
INB	Channel B Logic Input
ENA	Channel A Enable Input - Drive pin low to disable Channel A and force Channel A Output to a high impedance state
ENB	Channel B Enable Input - Drive pin low to disable Channel A and force Channel A Output to a high impedance state
OUTA / $\overline{OUTA}$	Channel A Output - Sources or sinks current to turn-on or turn-off a discrete MOSFET or IGBT
OUTB / $\overline{OUTB}$	Channel B Output - Sources or sinks current to turn-on or turn-off a discrete MOSFET or IGBT
V_{CC}	Supply Voltage - Provides power to the device
GND	Ground - Common ground reference for the device

1.3 Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Supply Voltage	V_{CC}	-0.3	40	V
Input Voltage	V_{INx} , V_{ENx}	-5	V_{CC}+0.3	V
Output Current	I_{OUT}	-	±4	A
Junction Temperature	T_J	-55	+150	°C
Storage Temperature	T_{STG}	-65	+150	°C

Absolute maximum electrical ratings are at 25°C

Absolute maximum ratings are stress ratings. Stresses in excess of these ratings can cause permanent damage to the device. Functional operation of the device at conditions beyond those indicated in the operational sections of this data sheet is not implied.

1.4 Recommended Operating Conditions

Parameter	Symbol	Range	Units
Supply Voltage	V_{CC}	4.5 to 35	V
Operating Temperature Range	T_A	-40 to +125	°C

1.5 Electrical Characteristics: T_A = 25°C

Test Conditions: 4.5V ≤ V_{CC} ≤ 35V, one channel (unless otherwise noted).

Parameter	Conditions	Symbol	Minimum	Typical	Maximum	Units
Input Voltage, High	4.5V ≤ V_{CC} ≤ 18V	V_{IH}	3.0	-	-	V
Input Voltage, Low	4.5V ≤ V_{CC} ≤ 18V	V_{IL}	-	-	0.8	
Input Current	0V ≤ V_{IN} ≤ V_{CC}	I_{IN}	-	-	±10	µA
High EN Input Voltage	IXDD604 only	V_{ENH}	2/3V_{CC}	-	-	V
Low EN Input Voltage	IXDD604 only	V_{ENL}	-	-	1/3V_{CC}	
Output Voltage, High	-	V_{OH}	V_{CC}-0.025	-	-	V
Output Voltage, Low	-	V_{OL}	-	-	0.025	
Output Resistance, High State	V_{CC}=18V, I_{OUT}=-10mA	R_{OH}	-	1.3	2.5	Ω
Output Resistance, Low State	V_{CC}=18V, I_{OUT}=10mA	R_{OL}	-	1.1	2	
Output Current, Continuous	Limited by package power dissipation	I_{DC}	-	-	±1	A
Rise Time	V_{CC}=18V, C_{LOAD}=1000pF	t_r	-	9	16	ns
Fall Time	V_{CC}=18V, C_{LOAD}=1000pF	t_f	-	8	14	
On-Time Propagation Delay	V_{CC}=18V, C_{LOAD}=1000pF	t_{ondly}	-	29	50	
Off-Time Propagation Delay	V_{CC}=18V, C_{LOAD}=1000pF	t_{offdly}	-	35	50	
Enable to Output-High Delay Time	IXDD604 only, V_{CC}=18V	t_{ENOH}	-	35	55	
Disable to High Impedance State Delay Time	IXDD604 only, V_{CC}=18V	t_{DOLD}	-	40	55	
Enable Pull-Up Resistor	-	R_{EN}	-	200	-	kΩ
Power Supply Current	V_{CC}=18V, V_{IN}=3.5V	I_{CC}	-	1	3	mA
	V_{CC}=18V, V_{IN}=0V		-	<1	10	µA
	V_{CC}=18V, V_{IN}=V_{CC}		-	<1	10	

1.6 Electrical Characteristics: -40°C ≤ T_A ≤ +125°C

Test Conditions: 4.5V ≤ V_{CC} ≤ 35V, one channel (unless otherwise noted).

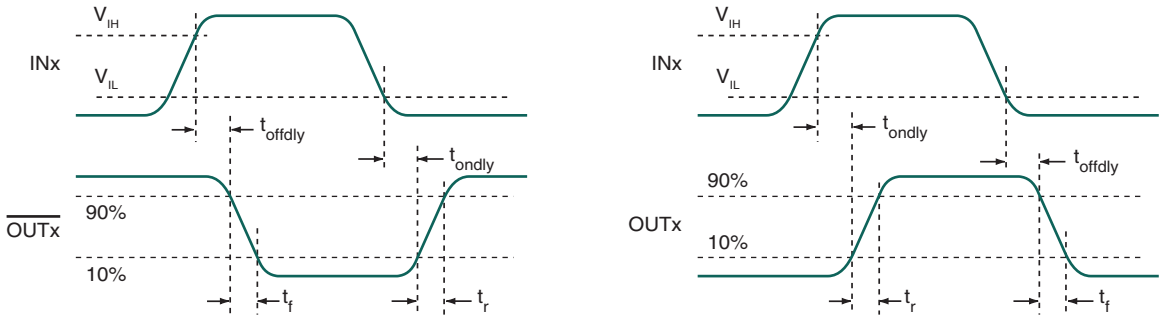
Parameter	Conditions	Symbol	Minimum	Maximum	Units
Input Voltage, High	4.5V ≤ V_{CC} ≤ 18V	V_{IH}	3.3	-	V
Input Voltage, Low	4.5V ≤ V_{CC} ≤ 18V	V_{IL}	-	0.65	
Input Current	0V ≤ V_{IN} ≤ V_{CC}	I_{IN}	-10	10	µA
Output Voltage, High	-	V_{OH}	V_{CC}-0.025	-	V
Output Voltage, Low	-	V_{OL}	-	0.025	
Output Resistance, High State	V_{CC}=18V, I_{OUT}=-10mA	R_{OH}	-	3	Ω
Output Resistance, Low State	V_{CC}=18V, I_{OUT}=10mA	R_{OL}	-	2.5	
Output Current, Continuous	Limited by package power dissipation	I_{DC}	-	±1	A
Rise Time	V_{CC}=18V, C_{LOAD}=1000pF	t_r	-	16	ns
Fall Time	V_{CC}=18V, C_{LOAD}=1000pF	t_f	-	14	
On-Time Propagation Delay	V_{CC}=18V, C_{LOAD}=1000pF	t_{ondly}	-	65	
Off-Time Propagation Delay	V_{CC}=18V, C_{LOAD}=1000pF	t_{offdly}	-	65	
Enable to Output-High Delay Time	IXDD604 only, V_{CC}=18V	t_{ENOH}	-	65	
Disable to High Impedance State Delay Time	IXDD604 only, V_{CC}=18V	t_{DOLD}	-	65	
Power Supply Current	V_{CC}=18V, V_{IN}=3.5V	I_{CC}	-	3.5	mA
	V_{CC}=18V, V_{IN}=0V		-	150	µA
	V_{CC}=18V, V_{IN}=V_{CC}		-	150	

1.7 Thermal Characteristics

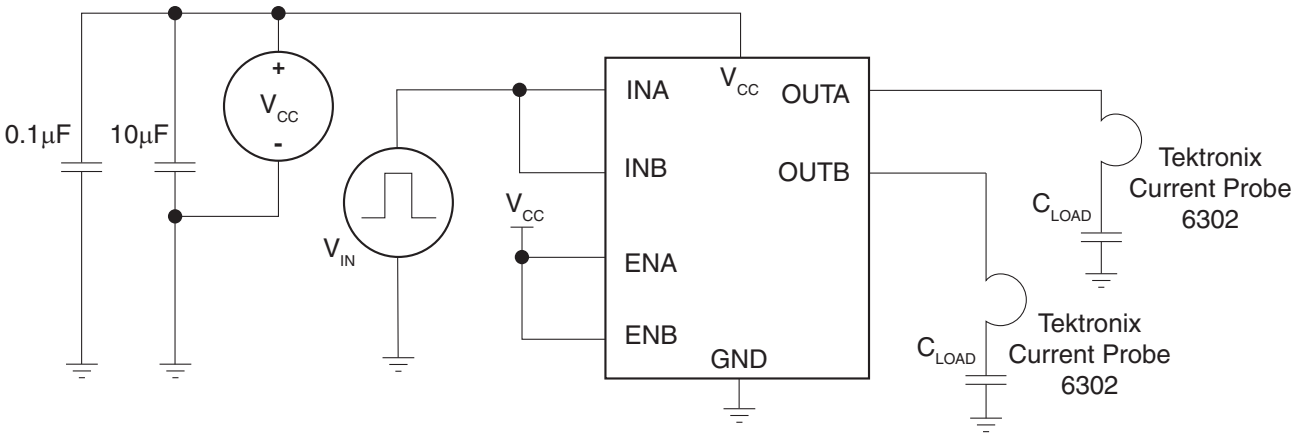
Package	Parameter	Symbol	Rating	Units
SI (8-Pin Power SOIC)	Thermal Resistance, Junction-to-Ambient	θ_{JA}	85	°C/W
SIA (8-Pin SOIC)			120	
SI (8-Pin Power SOIC)	Thermal Resistance, Junction-to-Case	θ_{JC}	10	

2 IXD_604 Performance

2.1 Timing Diagrams

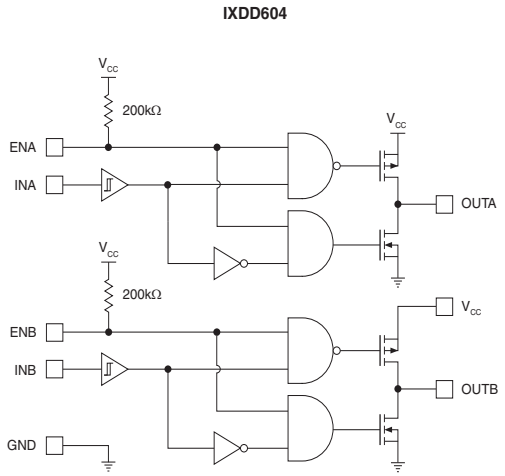


2.2 Characteristics Test Diagram



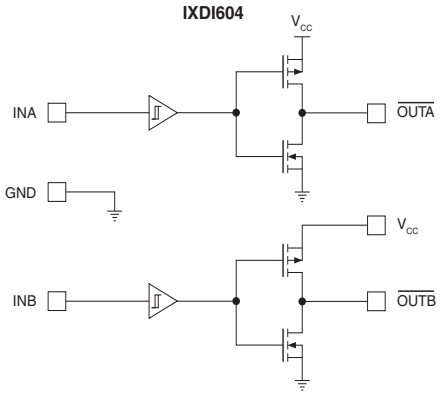
3 Block Diagrams & Truth Tables

3.1 IXDD604



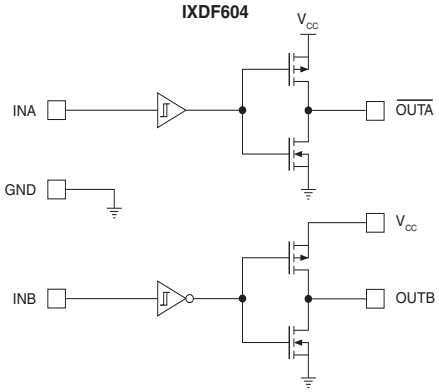
IN_X	EN_X	OUT_X
0	1 or open	0
1	1 or open	1
0	0	Z
1	0	Z

3.2 IXDI604



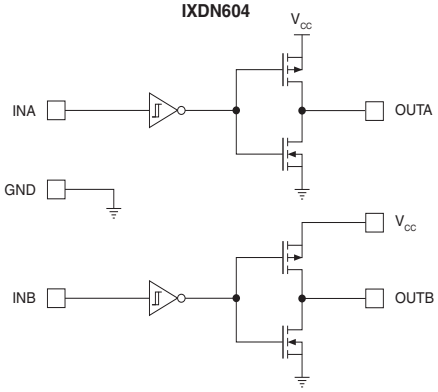
IN_X	$\overline{OUT}_X$
0	1
1	0

3.3 IXDF604



INA	$\overline{OUTA}$
0	1
1	0
INB	**OUTB**
0	0
1	1

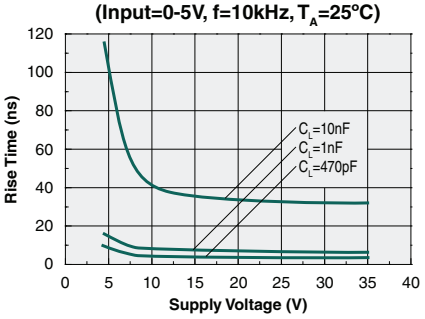
3.4 IXDN604



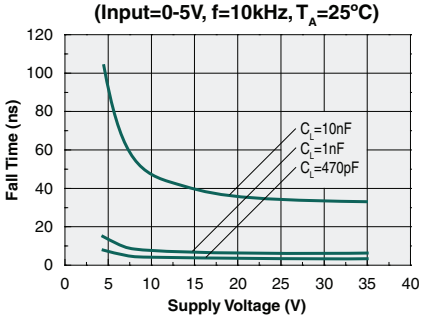
IN_X	OUT_X
0	0
1	1

4 Typical Performance Characteristics

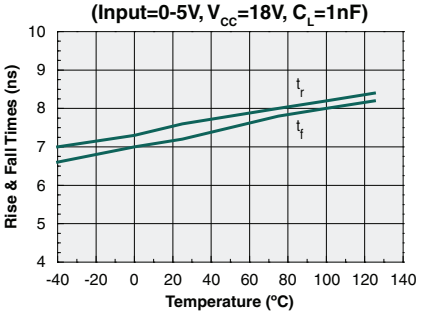
A&B Rise Times vs. Supply Voltage
(Input=0-5V, f=10kHz, T_A=25°C)



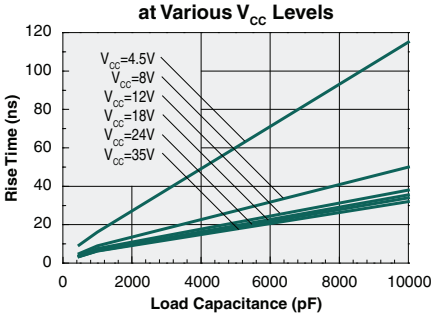
A&B Fall Times vs. Supply Voltage
(Input=0-5V, f=10kHz, T_A=25°C)



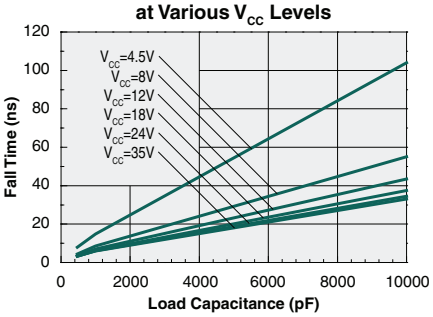
A&B Rise and Fall Times
vs. Temperature
(Input=0-5V, V_{CC}=18V, C_L=1nF)



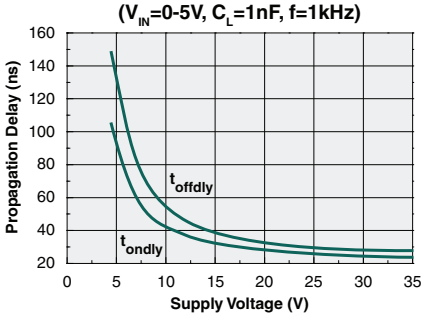
A&B Rise Time vs. Load Capacitance
at Various V_{CC} Levels



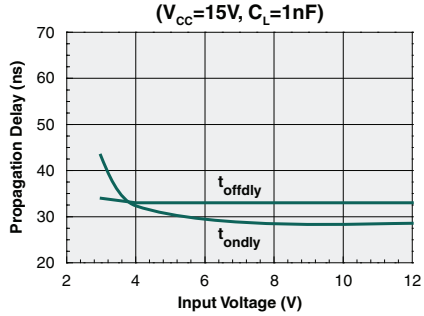
A&B Fall Time vs. Load Capacitance
at Various V_{CC} Levels



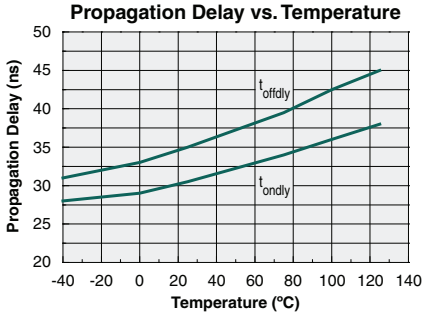
Propagation Delay vs. Supply Voltage
(V_{IN}=0-5V, C_L=1nF, f=1kHz)



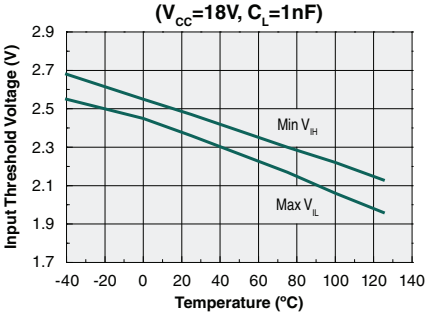
Propagation Delay vs. Input Voltage
(V_{CC}=15V, C_L=1nF)



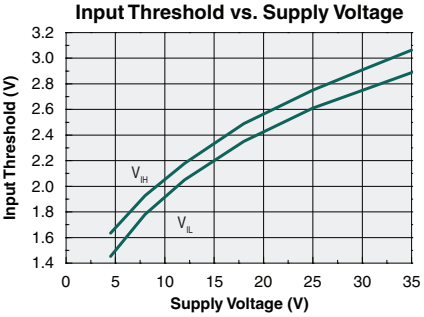
Propagation Delay vs. Temperature



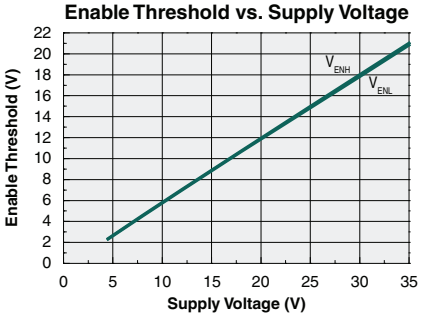
Input Threshold Voltage
vs. Temperature
(V_{CC}=18V, C_L=1nF)



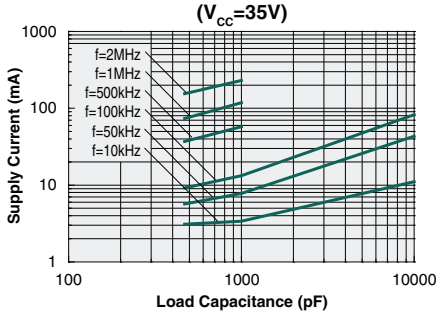
Input Threshold vs. Supply Voltage



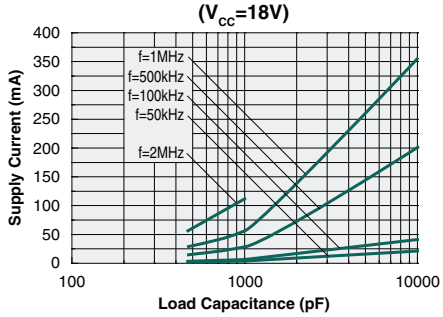
Enable Threshold vs. Supply Voltage



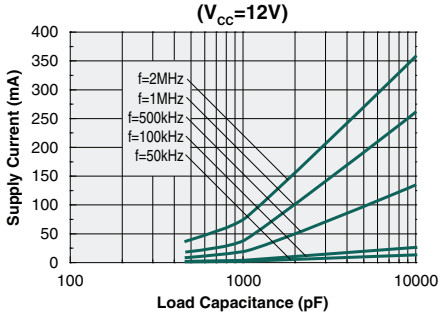
Supply Current vs. Load Capacitance Both Outputs Active (V_{CC}=35V)



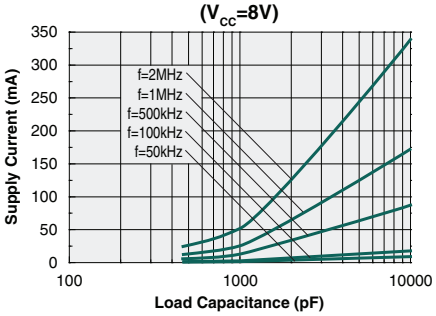
Supply Current vs. Load Capacitance Both Outputs Active (V_{CC}=18V)



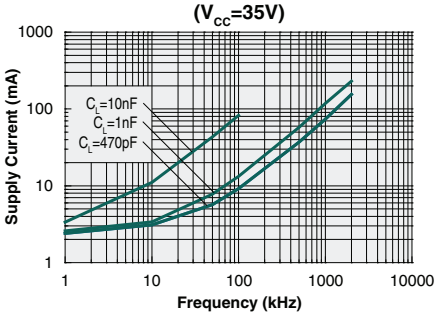
Supply Current vs. Load Capacitance Both Outputs Active (V_{CC}=12V)



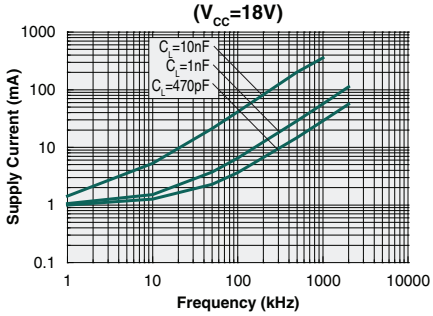
Supply Current vs. Load Capacitance Both Outputs Active (V_{CC}=8V)



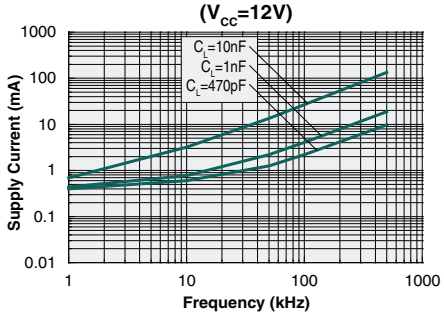
Supply Current vs. Frequency Both Outputs Active (V_{CC}=35V)



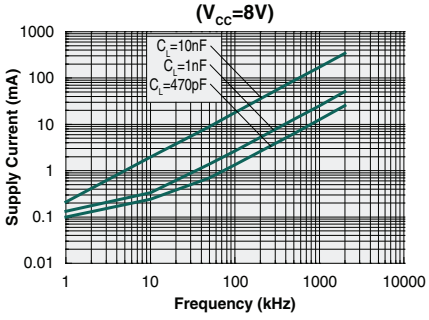
Supply Current vs. Frequency Both Outputs Active (V_{CC}=18V)



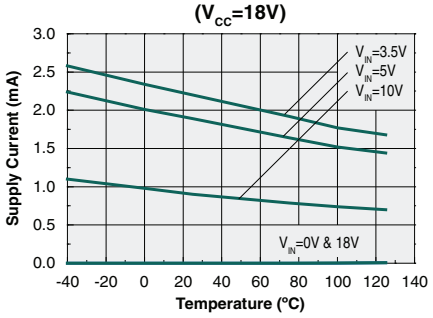
Supply Current vs. Frequency Both Outputs Active (V_{CC}=12V)



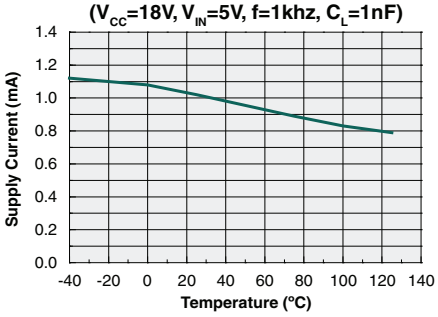
Supply Current vs. Frequency Both Outputs Active (V_{CC}=8V)



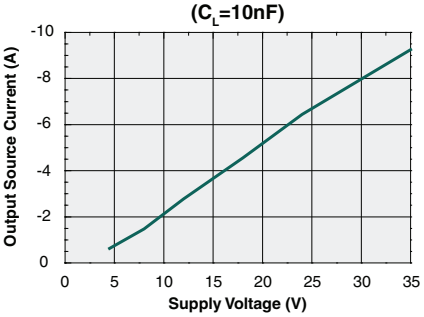
Quiesent Supply Current vs. Temperature (V_{CC}=18V)



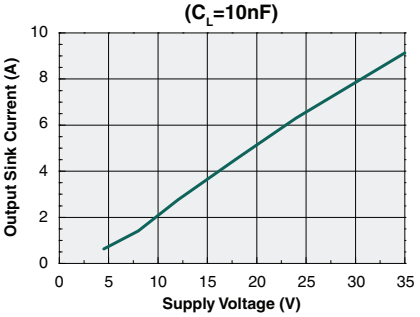
Dynamic Supply Current vs. Temperature (V_{CC}=18V, V_{IN}=5V, f=1khz, C_L=1nF)



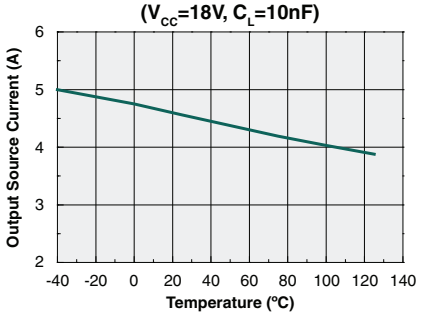
Output Source Current vs. Supply Voltage (C_L=10nF)



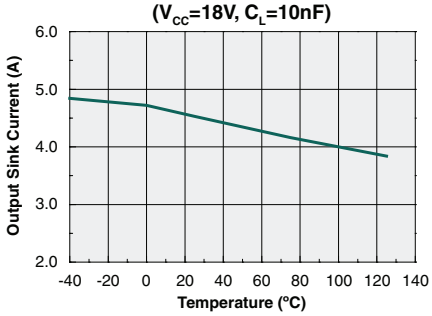
Output Sink Current vs. Supply Voltage (C_L=10nF)



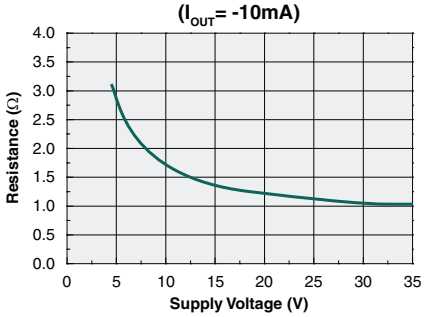
Output Source Current vs. Temperature (V_{CC}=18V, C_L=10nF)



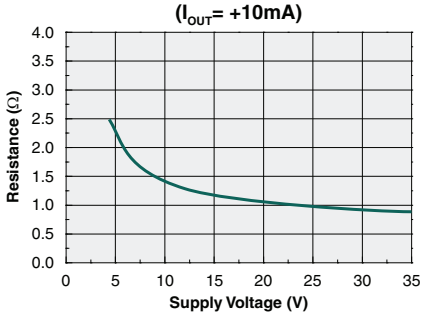
Output Sink Current vs. Temperature (V_{CC}=18V, C_L=10nF)



High State Output Resistance vs. Supply Voltage (I_{OUT}= -10mA)



Low State Output Resistance vs. Supply Voltage (I_{OUT}= +10mA)



5 Manufacturing Information

5.1 Moisture Sensitivity



All plastic encapsulated semiconductor packages are susceptible to moisture ingression. IXYS Integrated Circuits Division classified all of its plastic encapsulated devices for moisture sensitivity according to the latest version of the joint industry standard, **IPC/JEDEC J-STD-020**, in force at the time of product evaluation. We test all of our products to the maximum conditions set forth in the standard, and guarantee proper operation of our devices when handled according to the limitations and information in that standard as well as to any limitations set forth in the information or standards referenced below.

Failure to adhere to the warnings or limitations as established by the listed specifications could result in reduced product performance, reduction of operable life, and/or reduction of overall reliability.

This product carries a **Moisture Sensitivity Level (MSL) rating of 1**, and should be handled according to the requirements of the latest version of the joint industry standard **IPC/JEDEC J-STD-033**.

5.2 ESD Sensitivity



This product is **ESD Sensitive**, and should be handled according to the industry standard **JESD-625**.

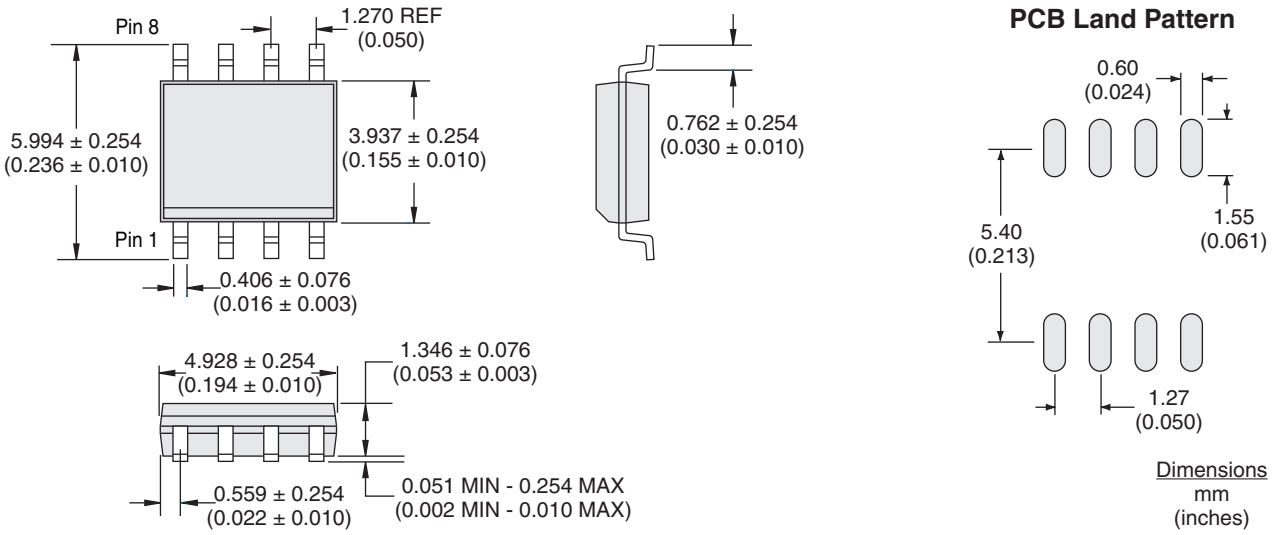
5.3 Reflow Profile

This product has a **maximum body temperature and time rating of 260°C for 30 seconds**. All other guidelines of **J-STD-020** must be observed.

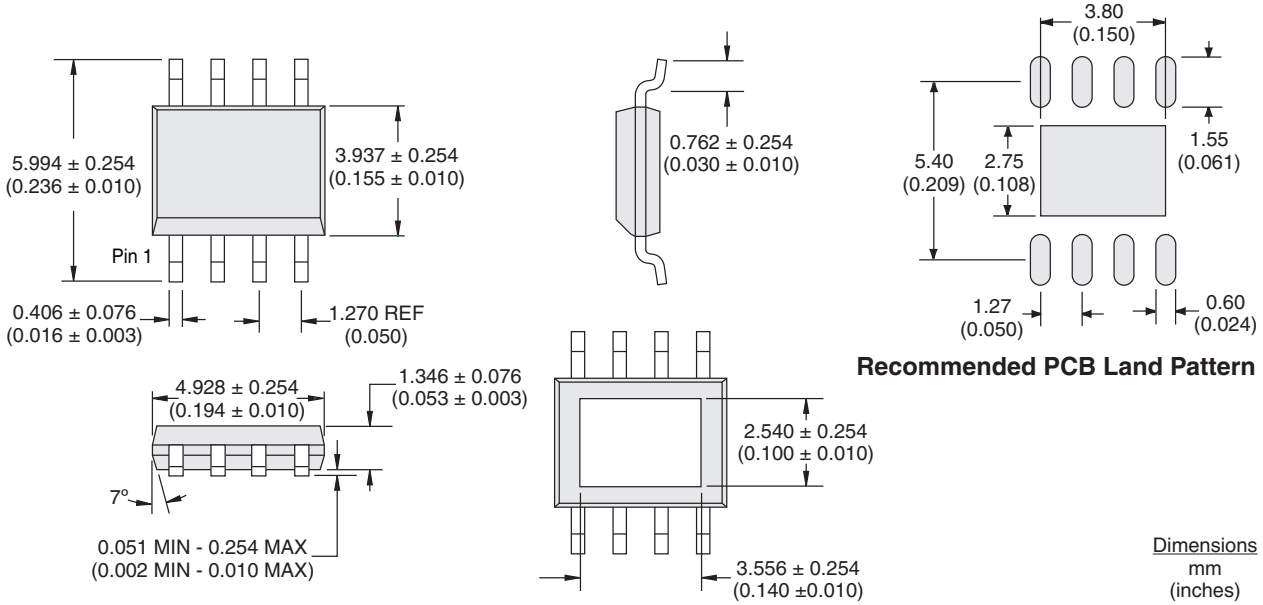


5.4 Mechanical Dimensions

5.4.1 SIA Package (8-Pin SOIC)

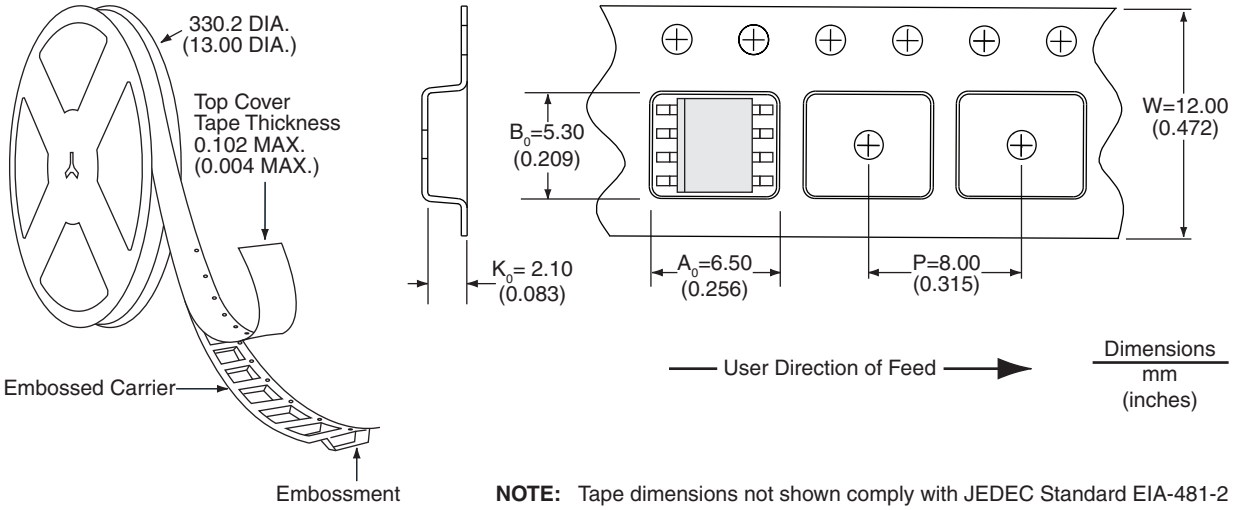


5.4.2 SI Package (8-Pin Power SOIC with Exposed Metal Back)



Note: *The exposed metal pad on the back of the SI package should be connected to GND. It is not suitable for carrying current.*

5.4.3 Tape & Reel Information for SI and SIA Packages



NOTE: Tape dimensions not shown comply with JEDEC Standard EIA-481-2

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