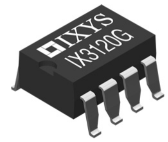
IX3120
2.5A Output Current Gate Driver Optocoupler

INTEGRATED CIRCUITS DIVISION



Features

- 2.5A Maximum Peak Output Current
- 25kV/µs Minimum Common Mode Rejection (CMR) at 1500V_{CM}
- Wide Operating Voltage Range: 15V to 30V
- Under Voltage Lockout with Hysteresis
- 3750V_{rms} Input to Output Isolation
- Wide Temperature Range: -40°C to +100°C

Applications

- Isolated IGBT/MOSFET Gate Drive
- Switch Mode Power Supplies
- Industrial Inverters
- Motor Drivers

Description

The IX3120 gate driver includes an input infrared LED that is optically coupled to a power output stage. The power output stage is capable of sourcing or sinking 2A of peak current, which is ideal for driving IGBTs and MOSFETs in the mid-power range.

The gate driver optocoupler with its low input LED current, high output peak current, and high noise immunity (25kV/µs) is ideally suited for use in motor control and inverter applications.

The IX3120 is provided in an 8-pin DIP package and an 8-pin surface mount package.

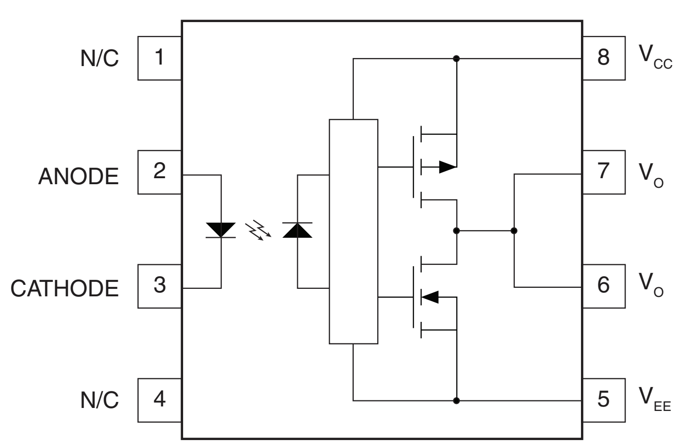
Approvals

- UL Recognized Component: File E76270
- IEC/EN/DIN EN 60747-5-5 (“GE” Versions)

Ordering Information

Part	Description
IX3120G	8-Pin DIP Package (50/Tube)
IX3120GS	8-Pin Surface Mount (50/Tube)
IX3120GSTR	8-Pin Surface Mount Tape & Reel (1000/Reel)
IX3120GE	8-Pin DIP Package (50/Tube), IEC 60747-5-5 Option
IX3120GES	8-Pin Surface Mount (50/Tube), IEC 60747-5-5 Option
IX3120GESTR	8-Pin Surface Mount Tape & Reel (1000/Reel), IEC 60747-5-5 Option

Figure 1. IX3120 Block Diagram



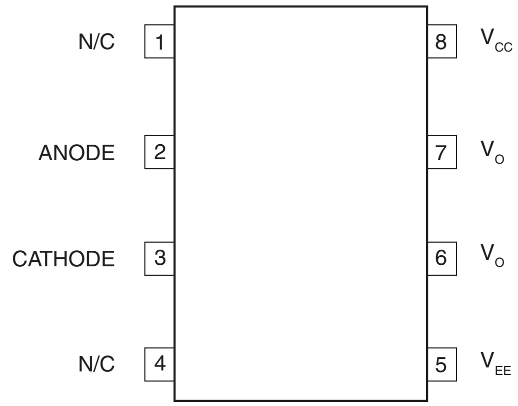
TRUTH TABLE

LED	V_{CC}-V_{EE} Positive Going (i.e. Turn-On)	V_{CC}-V_{EE} Negative Going (i.e. Turn-Off)	V_O
OFF	0V - 30V	0V - 30V	LOW
ON	0V - 11V	0V - 9.5V	LOW
ON	11V - 13.5V	9.5V - 12V	TRANSITION
ON	13.5V - 30V	12V - 30V	HIGH

Note: A 0.1µF bypass capacitor must be connected between pins 5 and 8.

1. Specifications

1.1 Package Pinout



1.2 Pin Description

Pin#	Name	Description
1	N/C	No connection
2	ANODE	Anode of input LED
3	CATHODE	Cathode of input LED
4	N/C	No connection
5	V_{EE}	Negative Supply Voltage
6	V_O	Gate Drive Output
7	V_O	Gate Drive Output
8	V_{CC}	Positive Supply Voltage

1.3 Absolute Maximum Ratings

Absolute maximum ratings are at 25°C.

Parameter	Symbol	Limit	Units
Supply Voltage	V_{CC} - V_{EE}	0 to 35	V
Output Voltage	$V_{O(PEAK)}$	0 to V_{CC}	V
"High" Peak Output Current [1]	$I_{OH(PEAK)}$	- 2.5	A
"Low" Peak Output Current [1]	$I_{OL(PEAK)}$	2.5	A
Reverse Input Voltage	V_R	5	V
Average Input Current	$I_{F(AVG)}$	20	mA
Peak Transient Input Current (<1μs pulse width, 300pps)	$I_{F(TRAN)}$	1	A
Input Power Dissipation [2]	P_{IN}	50	mW
Total Power Dissipation [3]	P_T	800	mW
Isolation Voltage, Input to Output	V_{IO}	3750	V_{rms}
Operating Temperature	T_A	-40 to +100	°C
Storage Temperature	T_{STG}	-55 to +125	°C

Notes:
[1] Maximum pulse width=10μs, maximum duty cycle=0.2%.
[2] Derate linearly 1.33mW/°C
[3] Derate linearly 7.5mW/°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	Min	Max	Units
Power Supply Voltage	V_{CC} - V_{EE}	15	30	V
Input Current (ON)	$I_{F(on)}$	7	16	mA
Input Voltage (OFF)	$V_{F(off)}$	-3.6	0.8	V
Operating Temperature	T_A	-40	100	°C

1.5 Electrical Specifications (DC)

Over recommended operating conditions unless otherwise specified. Typical values are at T_A=25°C,V_{CC}=30V, and V_{EE}=Ground.

Parameter	Conditions	Symbol	Min	Typ	Max	Units
High Level Output Current	V_O=(V_{CC}-4V) [1]	I_{OH}	- 0.5	-1.5	-	A
	V_O=(V_{CC}-15V) [2]		- 2	-	-	
Low Level Output Current	V_O=(V_{EE}+2.5V) [1]	I_{OL}	0.5	1.4	-	A
	V_O=(V_{EE}+15V) [2]		2	-	-	
High Level Output Voltage	I_O=-100mA	V_{OH}	V_{CC}- 4	V_{CC}- 3	-	V
Low Level Output Voltage	I_O=100mA	V_{OL}	-	0.1	0.5	V
High Level Supply Current	Output Open, I_F=7 to 16mA	I_{CCH}	-	4.5	6	mA
Low Level Supply Current	Output Open, V_F=- 3 to +0.8V	I_{CCL}	-	2.6	6	
Threshold Input Current, Low-to-High	I_O=0mA, V_O>5V	I_{FLH}	-	0.7	5	mA
Threshold Input Voltage, High-to-Low	-	V_{FHL}	0.8	-	-	V
Input Forward Voltage	I_F=10mA	V_F	1	1.24	1.5	V
Temperature Coefficient of Forward Voltage	I_F=10mA	$\Delta V_F/\Delta T_A$	-	-1.6	-	mV/°C
Input Reverse Breakdown Voltage	I_R=10µA	BV_R	5	-	-	V
Input Capacitance	f=1MHz, V_F=0V	C_{IN}	-	60	-	pF
UVLO Threshold	V_O>5V, I_F=10mA	V_{UVLO+}	11	12.3	13.5	V
		V_{UVLO-}	9.5	10.7	12	
UVLO Hysteresis	V_O>5V, I_F=10mA	$UVLO_{HYS}$	-	1.6	-	V

[1] Maximum pulse width = 50µs, maximum duty cycle = 0.5%.
[2] Maximum pulse width = 10µs, maximum duty cycle = 0.2%.

See **"Test Circuits" on page 9** for more information.

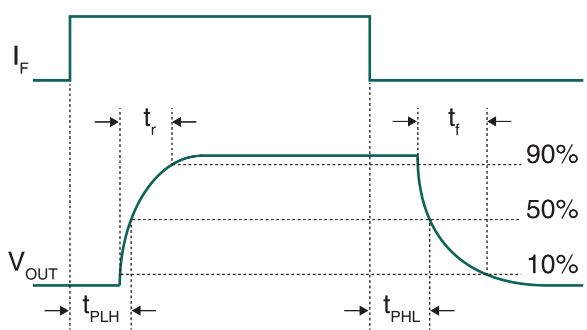
1.6 Switching Characteristics (AC)

Over recommended operating conditions, unless otherwise specified.

Parameter	Conditions	Symbol	Min	Typ	Max	Units
Propagation Delay Time to High Output Level	R_G=10Ω, C_G=10nF f=10kHz, Duty Cycle=50%	t_{PLH}	0.1	0.3	0.5	µs
Propagation Delay Time to Low Output Level		t_{PHL}	0.1	0.3	0.5	
Pulse Width Distortion		PWD $\|t_{PHL}-t_{PLH}\|$	-	-	0.3	
Propagation Delay Difference Between any Two Parts[1]		PDD $(t_{PHL}-t_{PLH})$	-0.35	-	0.35	
Rise Time		t_r	-	0.1	-	
Fall Time		t_f	-	0.1	-	
UVLO Turn-On Delay	V_O>5V, I_F=10mA	$t_{UVLO(on)}$	-	0.8	-	µs
UVLO Turn-Off Delay	V_O<5V, I_F=10mA	$t_{UVLO(off)}$	-	0.6	-	
Output High Level Common Mode Transient Immunity	I_F=10 to 16mA, V_{CM}=1500V, V_{CC}=30V, T_A=25°C	$\|CM_H\|$	25	35	-	kV/µs
Output Low Level Common Mode Transient Immunity	V_F=0V, V_{CM}=1500V, V_{CC}=30V, T_A=25°C	$\|CM_L\|$	25	35	-	

[1] The difference between t_{PHL} and t_{PLH} of any two IX3120 devices operating under the same conditions and temperature.

Figure 2. Timing Waveforms



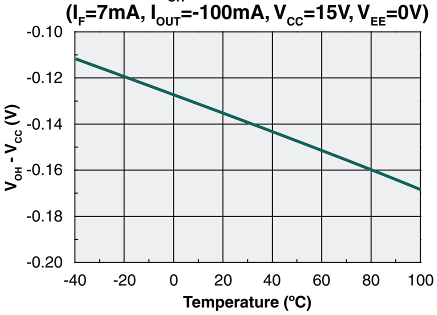
1.7 Safety and Insulation Ratings

As per IEC 60747-5-5.

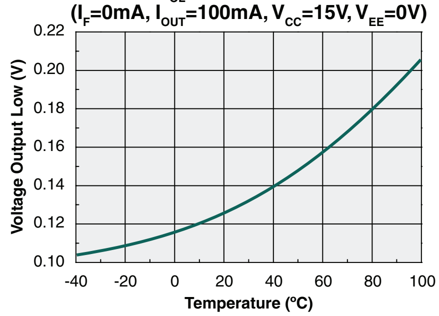
Parameter	Conditions	Symbol	Rating	Units
Minimum External Air Gap (Clearance)	Measured from input terminals to output terminals, shortest distance through air.	L(101)	7.62	mm
Minimum External Tracking (Creepage)	Measured from input terminals to output terminals, shortest distance path along body.	L(102)	7.50	mm
Distance Through Insulation (Internal Clearance)	Insulation thickness between emitter and detector	-	0.48	mm
Tracking Resistance (Comparative Tracking Index)	DIN IEC 60112/VDE 0303 Part 1	CTI	>175	V
Isolation Group	DIN VDE 0110, 1/89, Table 1 Material Group	-	IIIa	-
Installation classification	DIN VDE 0110/1.89, Table 1 Rated mains voltage ≤ 300V_{rms}	-	I-IV	-
	DIN VDE 0110/1.89, Table 1 Rated mains voltage ≤ 1000V_{rms}	-	I-III	-
Climatic Classification	-	-	55/100/21	-
Input to Output Test Voltage	IEC EN 60747-5-5 Method b, V_{IORM} x 1.875 = V_{PR}, 100% Production Test with tm = 1 sec., Partial Discharge < 5pC	V_{PR}	3750	V_{PEAK}
	IEC EN 60747-5-5 Method a, V_{IORM} x 1.6 = V_{PR}, Type and Sample Test with tm = 10 sec., Partial Discharge < 5pC		3200	
Insulation Resistance	T_S, V_{IO} = 500V_{DC}	R_S	10^9	Ω
Pollution Degree	DIN VDE 0109	-	2	-
Highest Allowable Over-Voltage	Transient Over-Voltage	V_{IOTM}	6000	V_P
Maximum Working Insulation Voltage	Recurring Voltage	V_{IORM}	2000	V_P
Partial Discharge Test Voltage	DIN EN 60747-5-5 Method B	V_{PR}	3750	V_P
Isolation Test Voltage	-	V_{ISO}	3750	V_{rms}
Input-Output Momentary Withstand Voltage	RH < 50%, t = 1 min, T_A = 25°C	V_{ISO}	3750	V_{rms}
Resistance (Input-Output), Typical	V_{I-O} = 500V_{DC}	R_{I-O}	10^{12}	Ω
Capacitance (Input-Output), Typical	f = 1 MHz	C_{I-O}	0.6	pF

2. Performance Data

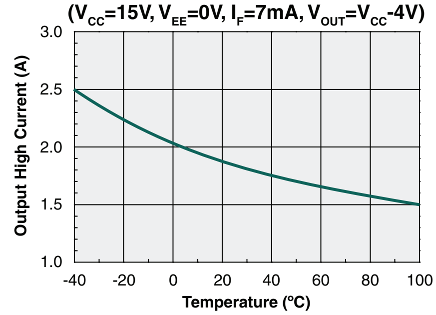
V_{OH} vs. Temperature (I_F=7mA, I_{OUT}=-100mA, V_{CC}=15V, V_{EE}=0V)



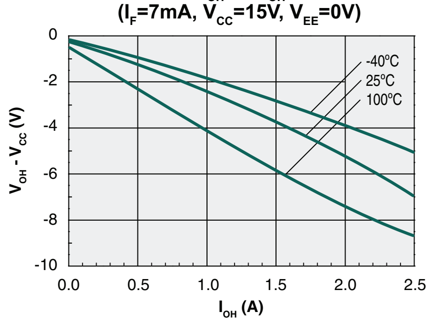
V_{OL} vs. Temperature (I_F=0mA, I_{OUT}=100mA, V_{CC}=15V, V_{EE}=0V)



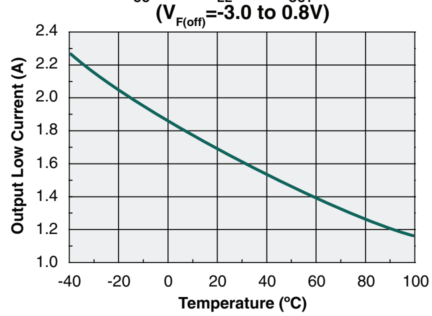
Output High Current vs. Temperature (V_{CC}=15V, V_{EE}=0V, I_F=7mA, V_{OUT}=V_{CC}-4V)



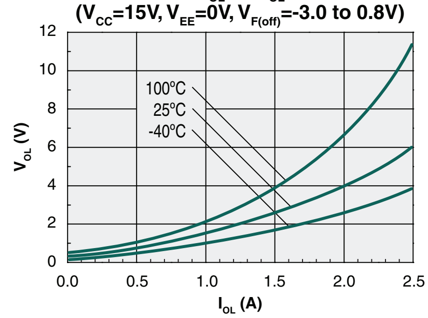
V_{OH} vs. I_{OH} (I_F=7mA, V_{CC}=15V, V_{EE}=0V)



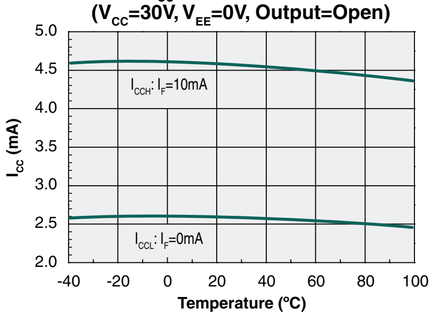
Output Low Current vs. Temperature (V_{CC}=15V, V_{EE}=0V, V_{OUT}=2.5V) ($V_{F(off)}$=-3.0 to 0.8V)



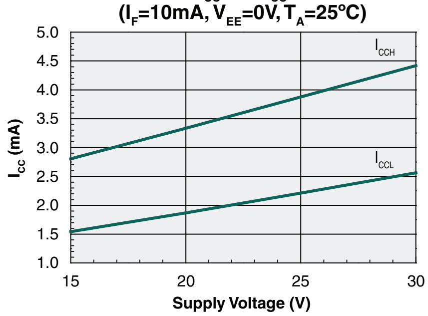
V_{OL} vs. I_{OL} (V_{CC}=15V, V_{EE}=0V, $V_{F(off)}$=-3.0 to 0.8V)



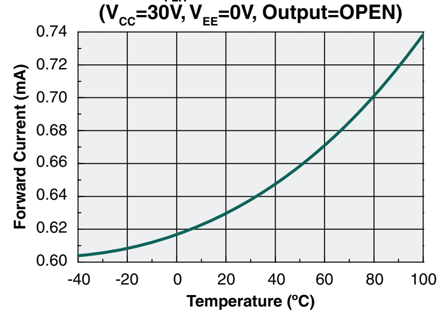
I_{CC} vs. Temperature (V_{CC}=30V, V_{EE}=0V, Output=Open)



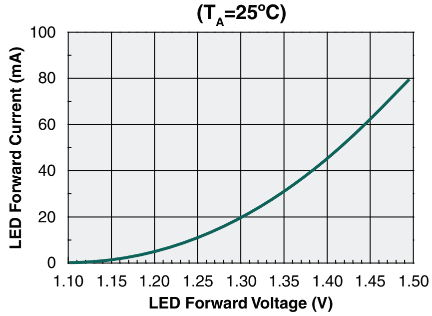
I_{CC} vs. V_{CC} (I_F=10mA, V_{EE}=0V, T_A=25ºC)



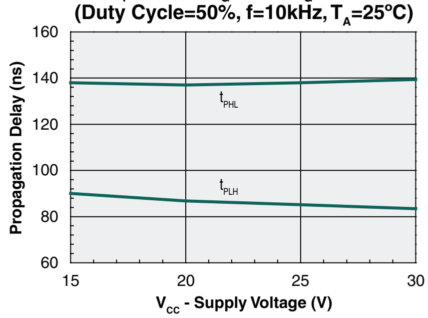
I_{FLH} vs. Temperature (V_{CC}=30V, V_{EE}=0V, Output=OPEN)



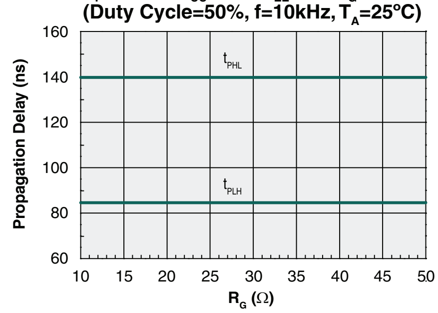
LED Forward Current vs. Forward Voltage (T_A=25ºC)



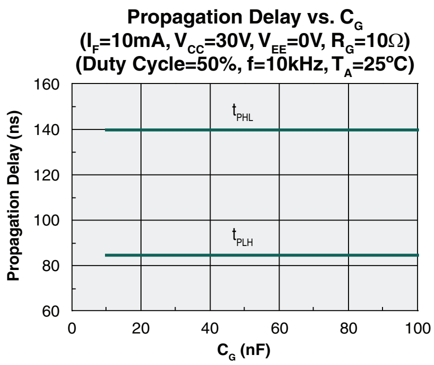
Propagation Delay vs. V_{CC} (I_F=10mA, R_G=10Ω, C_G=10nF) (Duty Cycle=50%, f=10kHz, T_A=25ºC)

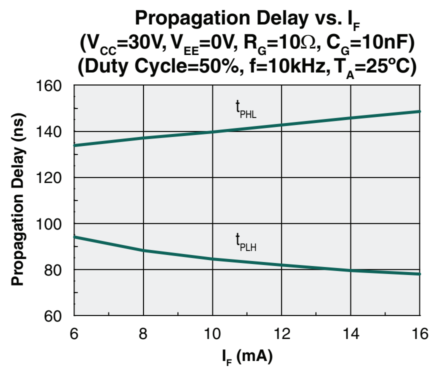


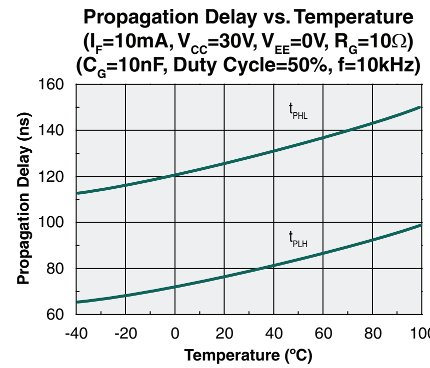
Propagation Delay vs. R_G (I_F=10mA, V_{CC}=30V, V_{EE}=0V, C_G=10nF) (Duty Cycle=50%, f=10kHz, T_A=25ºC)

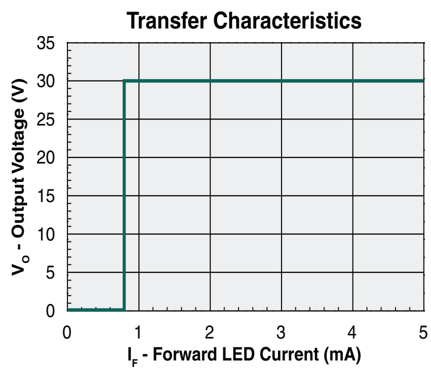


Performance Data (Cont.)

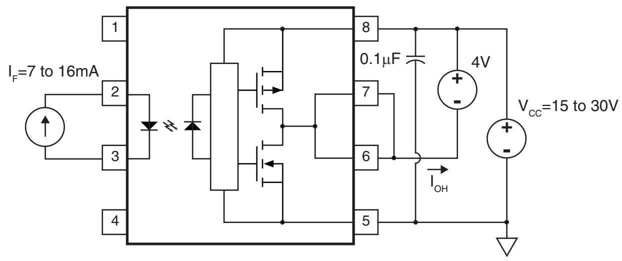




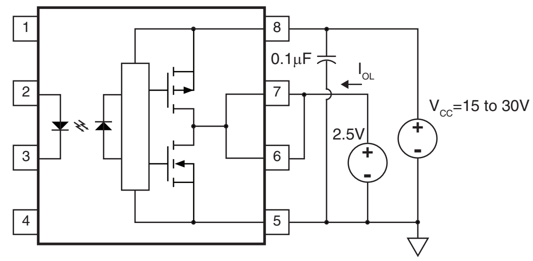




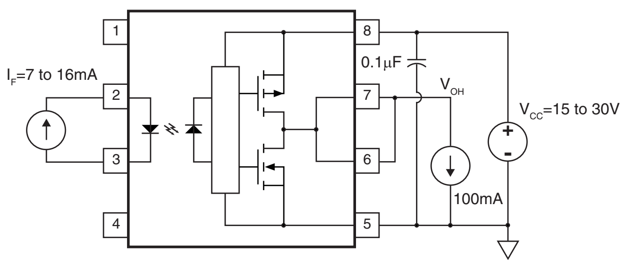
3. Test Circuits



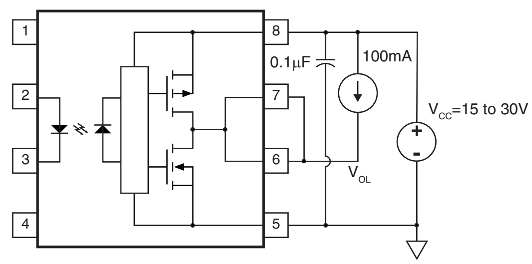
I_{OH} Test Circuit



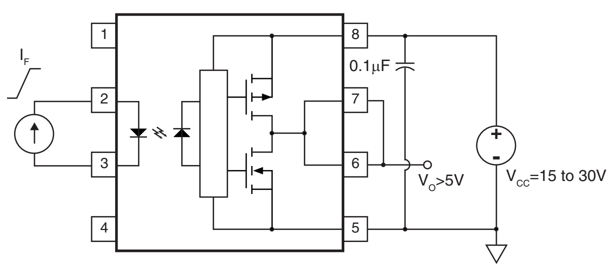
I_{OL} Test Circuit



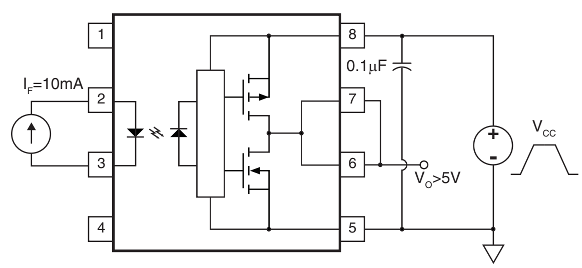
V_{OH} Test Circuit



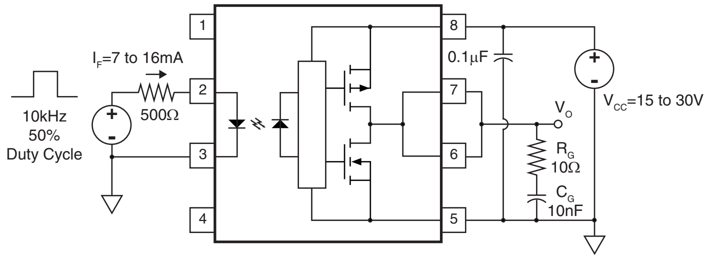
V_{OL} Test Circuit



I_{FLH} Test Circuit



UVLO Test Circuit



t_{PLH}, t_{PHL}, t_r, t_f Test Circuit

4. Manufacturing Information

4.1 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** as shown below, and should be handled according to the requirements of the latest version of the joint industry standard **IPC/JEDEC J-STD-033**.

Device	Moisture Sensitivity Level (MSL) Rating
IX3120G / IX3120GS / IX3120GE / IX3120GES	MSL 1

4.2 ESD Sensitivity

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

4.3 Soldering Profile

This product has a maximum body temperature and time rating as shown below. All other guidelines of **J-STD-020** must be observed.

Device	Maximum Temperature x Time	Maximum Reflow Cycles
IX3120G / IX3120GS / IX3120GE / IX3120GES	250°C for 30 seconds	3

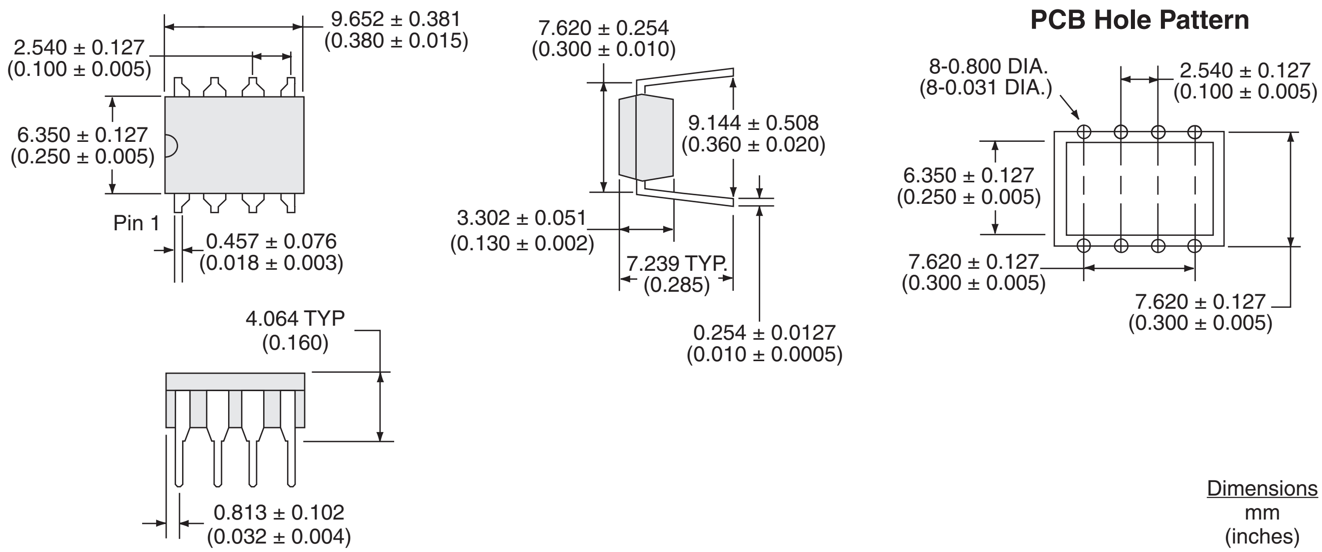
4.4 Board Wash

IXYS Integrated Circuits Division recommends the use of no-clean flux formulations. However, board washing to remove flux residue is acceptable. Since IXYS Integrated Circuits Division employs the use of silicone coating as an optical waveguide in many of its optically isolated products, the use of a short drying bake may be necessary if a wash is used after solder reflow processes. Chlorine-based or Fluorine-based solvents or fluxes should not be used. Cleaning methods that employ ultrasonic energy should not be used.

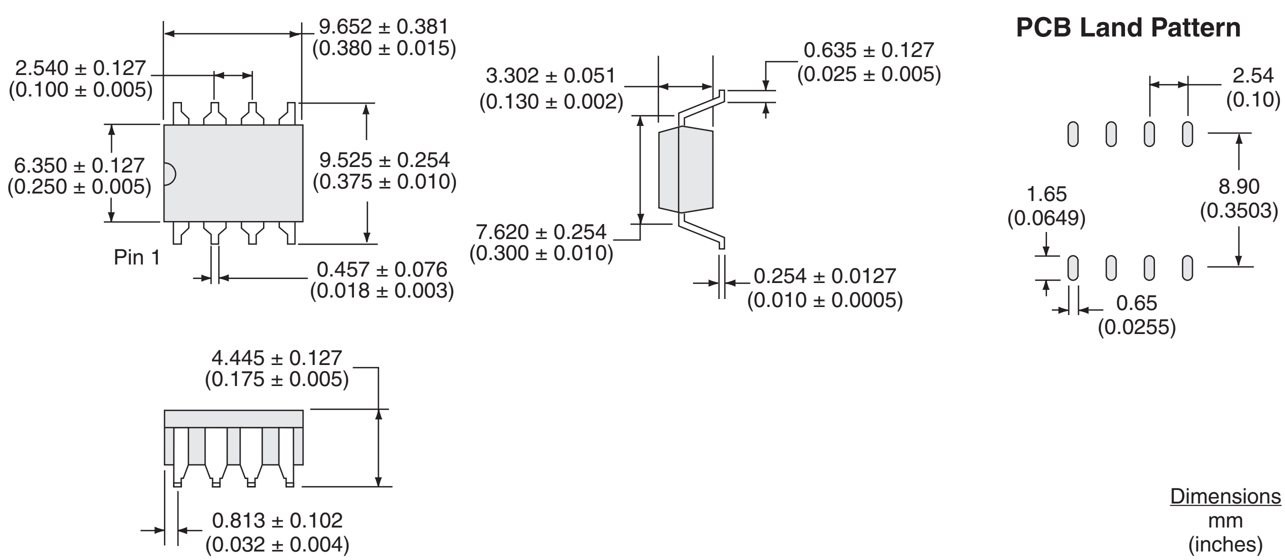
Pb RoHS e3

4.5 Package Mechanical Dimensions

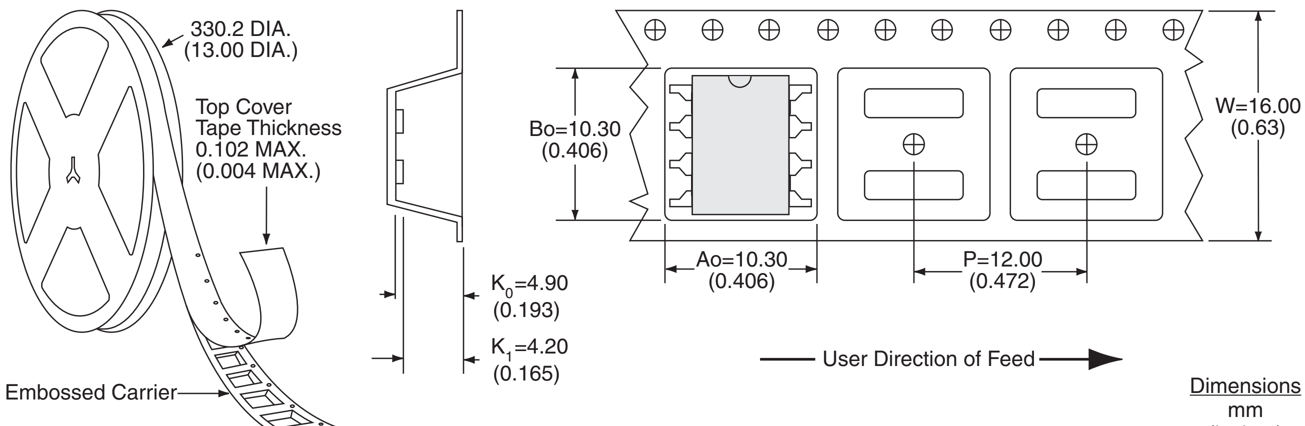
4.5.1 IX3120G & IX3120GE 8-Pin DIP



4.5.2 IX3120GS & IX3120GES 8-Pin Surface Mount

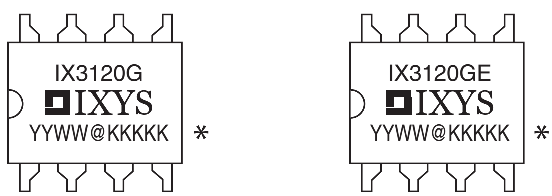


4.5.3 IX3120GSTR & IX3120GESTR Tape & Reel



NOTES:
1. Dimensions carry tolerances of EIA Standard 481-2
2. Tape complies with all “Notes” for constant dimensions listed on page 5 of EIA-481-2

4.6 Device Branding



IX3120G
IX3120GS

IX3120GE
IX3120GES

* YYWW@KKKKK
YYWW = date code (year/year/week/week)
@KKKKK = sequentially assigned kit code with assembly location identifier

For additional information please visit our website at: www.ixysic.com

Specification: DS-IX3120-R04

9/26/2014