
Gate Drive Optocoupler, High Noise Immunity, 2.5 A Output Current

FOD3120

Description

The FOD3120 is a 2.5 A Output Current Gate Drive Optocoupler, capable of driving most medium power IGBT/MOSFET. It is ideally suited for fast switching driving of power IGBT and MOSFETs used in motor control inverter applications, and high performance power system.

It utilizes **onsemi's** coplanar packaging technology, OPTOPLANAR[®], and optimized IC design to achieve high noise immunity, characterized by high common mode rejection.

It consists of a gallium aluminum arsenide (AlGaAs) light emitting diode optically coupled to an integrated circuit with a high-speed driver for push-pull MOSFET output stage.

Features

- High Noise Immunity Characterized by 35 kV/μs Minimum Common Mode Rejection
- 2.5 A Peak Output Current Driving Capability for Most 1200 V/20 A IGBT
- Use of P-Channel MOSFETs at Output Stage Enables Output Voltage Swing Close to the Supply Rail
- Wide Supply Voltage Range from 15 V to 30 V
- Fast Switching Speed

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Table 1. TRUTH TABLE

LED	V _{DD} – V _{SS} “Positive Going” (Turn-on)	V _{DD} – V _{SS} “Negative Going” (Turn-off)	V _O
Off	0 V to 30 V	0 V to 30 V	Low
On	0 V to 11.5 V	0 V to 10 V	Low
On	11.5 V to 13.5 V	10 V to 12 V	Transition
On	13.5 V to 30 V	12 V to 30 V	High

Table 2. PIN DEFINITIONS

Pin #	Name	Description
1	NC	Not Connected
2	Anode	LED Anode
3	Cathode	LED Cathode
4	NC	Not Connected
5	V _{SS}	Negative Supply Voltage
6	V _{O2}	Output Voltage 2 (internally connected to V _{O1})
7	V _{O1}	Output Voltage 1
8	V _{DD}	Positive Supply Voltage

Table 3. SAFETY AND INSULATION RATINGS

As per DIN EN/IEC 60747-5-5. This optocoupler is suitable for “safe electrical insulation” only within the safety limit data. Compliance with the safety ratings shall be ensured by means of protective circuits.

Symbol	Parameter	Min.	Typ.	Max.	Unit
	Installation Classifications per DIN VDE 0110/1.89 Table 1, For Rated Mains Voltage	< 150 V _{RMS}		I-IV	
		< 300 V _{RMS}		I-IV	
		< 450 V _{RMS}		I-III	
		< 600 V _{RMS}		I-III	
		< 1000 V _{RMS} (Option T, TS)		I-III	
	Climatic Classification		40/100/21		
	Pollution Degree (DIN VDE 0110/1.89)		2		
CTI	Comparative Tracking Index	175			
V _{PR}	Input to Output Test Voltage, Method A, V _{IORM} x 1.6 = V _{PR} , Type and Sample Test with t _m				

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Table 4. ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ unless otherwise specified.)

Symbol	Parameter	Value	Units
T_{STG}	Storage Temperature	-55 to +125	$^\circ\text{C}$
T_{OPR}	Operating Temperature	-40 to +100	$^\circ\text{C}$
T_J	Junction Temperature	-40 to +125	$^\circ\text{C}$
T_{SOL}	Lead Wave Solder Temperature (refer to page 13 for reflow solder profile)	260 for 10 s	$^\circ\text{C}$
$I_{F(AVG)}$	Average Input Current	25	mA
$I_{F(PEAK)}$	Peak Transient Forward Current (Note 2)	1	A
f	Operating Frequency (Note 3)	50	kHz
V_R	Reverse Input Voltage	5	V
$I_{O(PEAK)}$	Peak Output Current (Note 4)	3.0	A
$V_{DD} - V_{SS}$	Supply Voltage		0 to 35
		$T_A \geq 90^\circ\text{C}$	0 to 30
$V_{O(PEAK)}$	Peak Output Voltage	0 to V_{DD}	V
$t_{R(IN)}, t_{F(IN)}$	Input Signal Rise and Fall Time	500	ns
PD_I	Input Power Dissipation (Note 5, Note 7)	45	mW
PD_O	Output Power Dissipation (Note 6, Note 7)	250	mW

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

- Pulse Width, $PW \leq 1 \mu\text{s}$, 300 pps
- Exponential Waveform, $I_{O(PEAK)} \leq |2.5 \text{ A}| (\leq 0.3 \mu\text{s})$
- Maximum pulse width = 10 μs , maximum duty cycle = 1.1%
- Derate linearly above 87 $^\circ\text{C}$, free air temperature at a rate of 0.77 mW/ $^\circ\text{C}$
- No derating required across temperature range.
- Functional operation under these conditions is not implied. Permanent damage may occur if the device is subjected to conditions outside these ratings.

Table 5. RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Units
T_A	Ambient Operating Temperature	-40 to +100	$^\circ\text{C}$
$V_{DD} - V_{SS}$	Power Supply	15 to 30	V
$I_{F(ON)}$	Input Current (ON)	7 to 16	mA
$V_{F(OFF)}$	Input Voltage (OFF)	0 to 0.8	V

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

Table 6. ISOLATION CHARACTERISTICS

Apply over all recommended conditions, typical value is measured at $T_A = 25^\circ\text{C}$

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
V_{ISO}	Input-Output Isolation Voltage	$T_A = 25^\circ\text{C}$, R.H. < 50 %, $t = 1.0 \text{ min.}$, $I_{I-O} \leq 10 \mu\text{A}$, 50 Hz (Note 8, Note 9)	5000			V_{RMS}
R_{ISO}	Isolation Resistance	$V_{I-O} = 500 \text{ V}$ (Note 8)		10^{11}		Ω
C_{ISO}	Isolation Capacitance	$V_{I-O} = 0 \text{ V}$, Frequency = 1.0 MHz (Note 8)		1		pF

- Device is considered a two terminal device: pins 2 and 3 are shorted together

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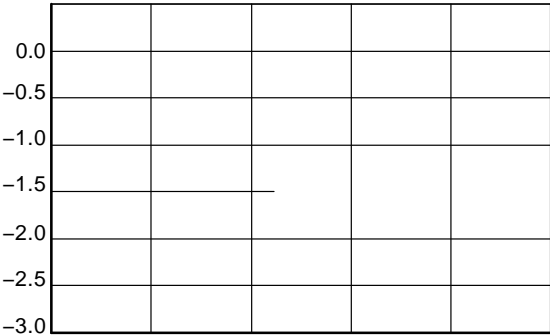
Table 7. ELECTRICAL CHARACTERISTICS

Apply over all recommended conditions, typical value is measured at $V_{DD} = 30\text{ V}$, $V_{SS} = \text{Ground}$, $T_A = 25^\circ\text{C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
V_F	Input Forward Voltage	$I_F = 10\text{ mA}$	1.2	1.5	1.8	V
$\Delta(V_F/T_A)$	Temperature Coefficient of Forward Voltage			-1.8		mV/°C
BV_R	Input Reverse Breakdown Voltage	$I_R = 10\text{ }\mu\text{A}$	5			V
C_{IN}	Input Capacitance	$f = 1\text{ MHz}$, $V_F = 0\text{ V}$		60		pF
I_{OH}	High Level Output Current (Note 3)	$V_O = V_{DD} - 3\text{ V}$	-1.0	-2.0	-2.5	A
		$V_O = V_{DD} - 6\text{ V}$	-2.0		-2.5	
I_{OL}	Low Level Output Current (Note 3)	$V_O = V_{SS} + 3\text{ V}$	1.0	2.0	2.5	A
		$V_O = V_{SS} + 6\text{ V}$	2.0		2.5	
V_{OH}	High Level Output Voltage	I_F				

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TYPICAL PERFORMANCE CHARACTERISTICS



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TYPICAL PERFORMANCE CHARACTERISTICS (continued)

Figure 7. Output Low Current vs. Ambient Temperature

Figure 8. Output Low Current vs. Ambient Temperature

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TEST CIRCUIT

Figure 20. I_{OL}

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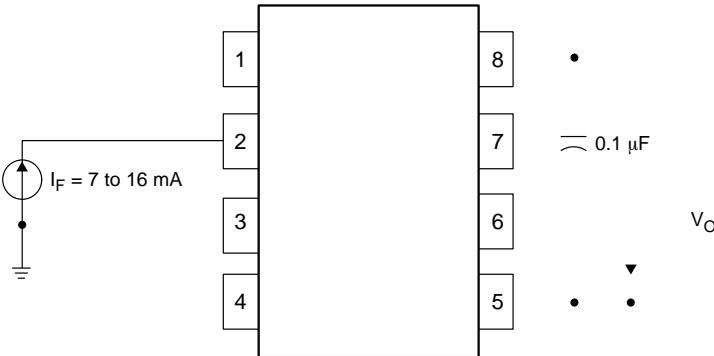


Figure 22. V_{OH} Test Circuit

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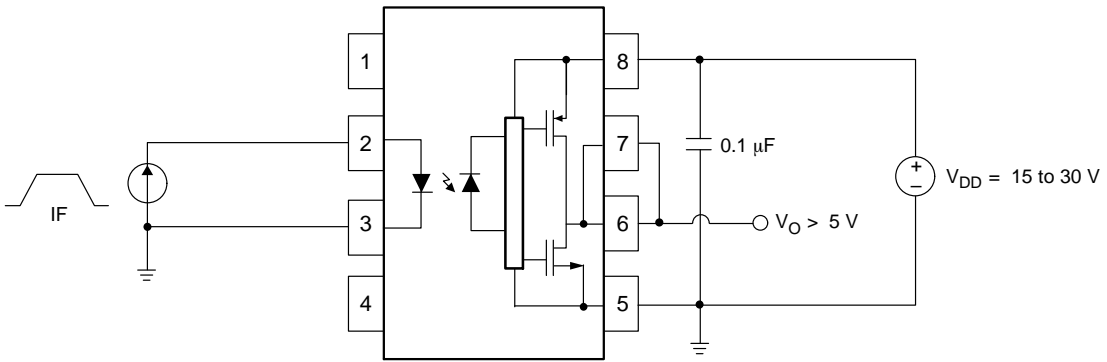


Figure 26. I_{FLH} Test Circuit

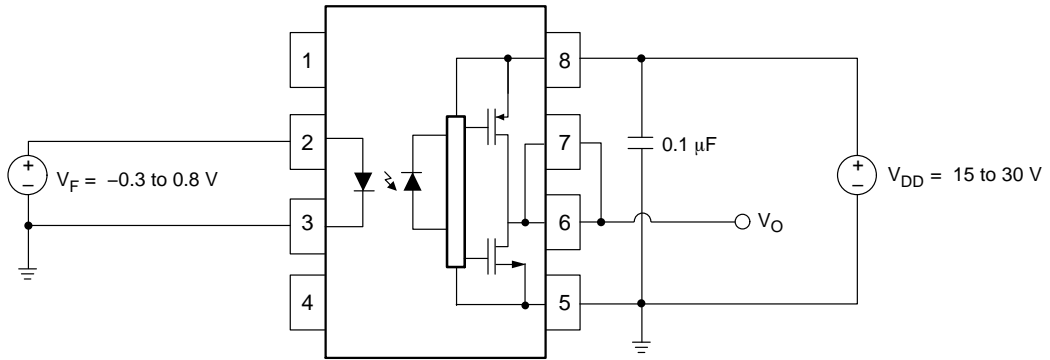


Figure 27. V_{FHL} Test Circuit

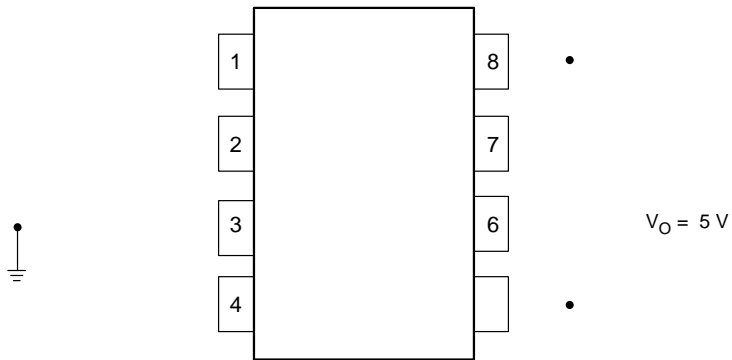


Figure 28. UVLO Test Circuit

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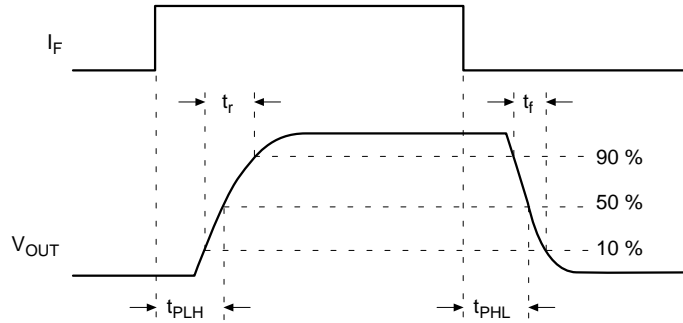
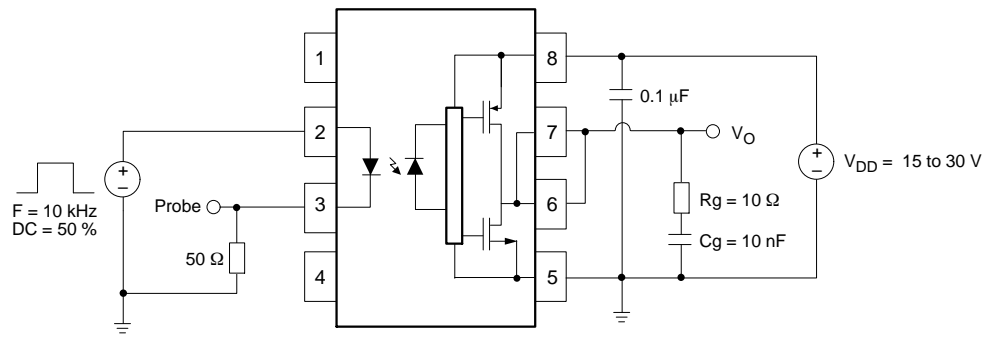


Figure 29. t_{PHL} , t_{PLH} , t_R and t_F Test Circuit and Waveforms

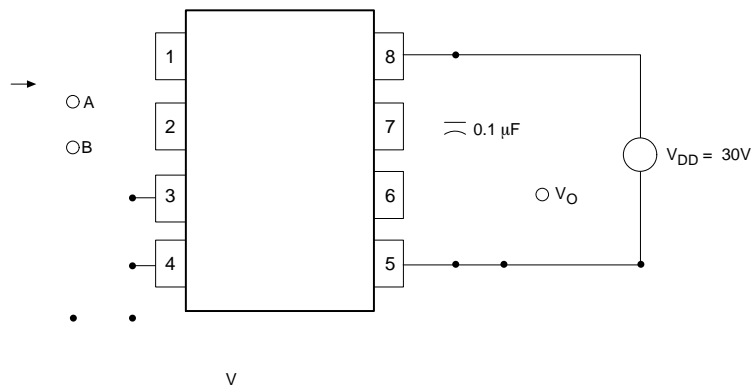


Figure 30. CMR Test Circuit and Waveforms

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REFLOW PROFILE

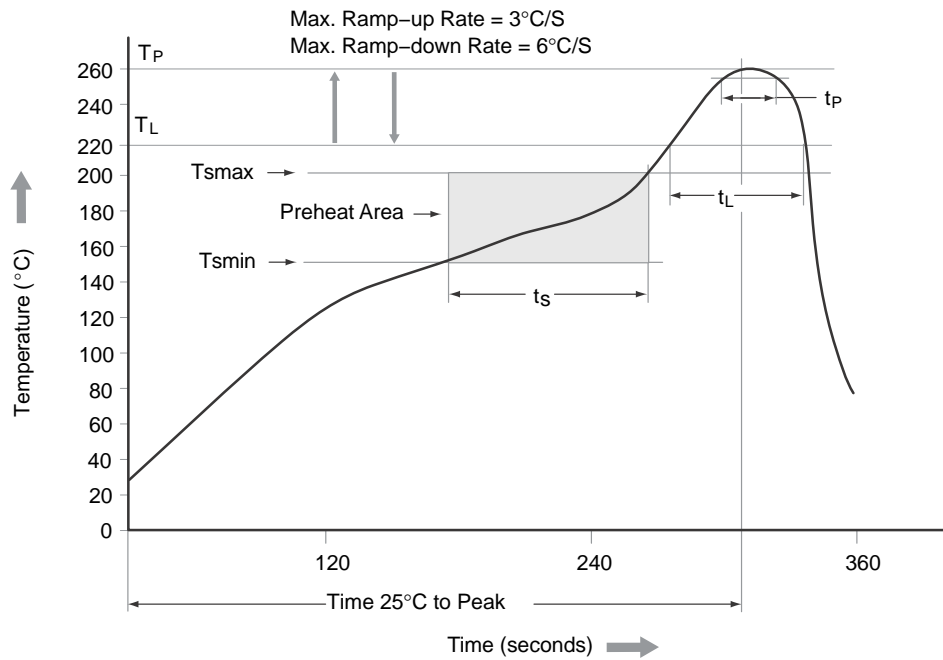


Figure 31. Reflow Profile

Table 9. REFLOW PROFILE

Profile Feature	Pb-Free Assembly Profile
Temperature Min. (Tsmmin)	150°C
Temperature Max. (Tsmmax)	200°C
Time (ts) from (Tsmmin to Tsmmax)	60–120 s
Ramp-up Rate (tL to tp)	3°C/s max.
Liquidous Temperature (TL)	217°C
Time (tL) Maintained Above (TL)	60–150 s
Peak Body Package Temperature	260°C +0°C / -5°C
Time (tp) within 5°C of 260°C	30 s
Ramp-down Rate (TP to TL)	6°C/s max.
Time 25°C to Peak Temperature	8 min. max.

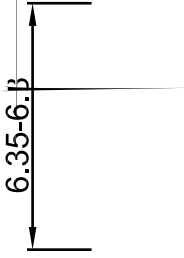
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ORDERING INFORMATION

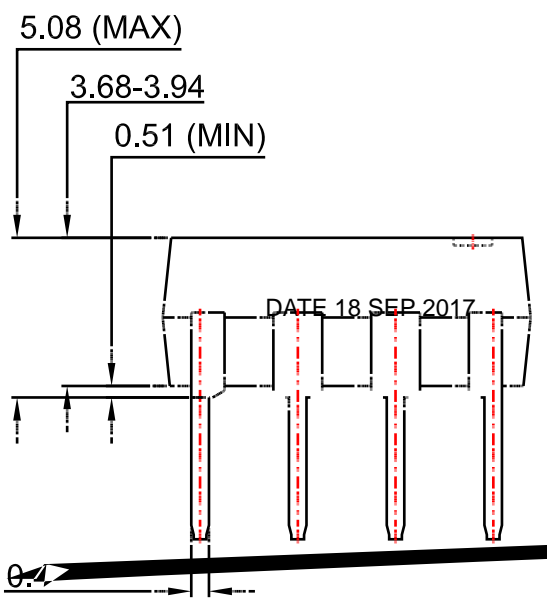
Part Number	Package	Shipping†
FOD3120	DIP 8-Pin	50 / Tube
FOD3120S	SMT 8-Pin (Lead Bend)	50 / Tube
FOD3120SD	SMT 8-Pin (Lead Bend)	1000 / Tape & Reel
FOD3120V	DIP 8-Pin, DIN EN/IEC60747-5-5 option	50 / Tube

PDIP8 6.6x3.81, 2.54P

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PDIP8 9.655x6.6, 2.54P
CASE 646CQ
ISSUE O



PDIP8 GW
CASE 709AC
ISSUE 0

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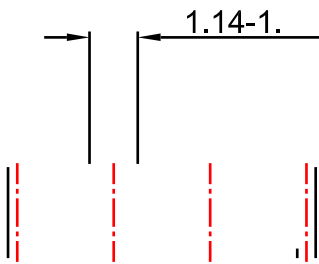
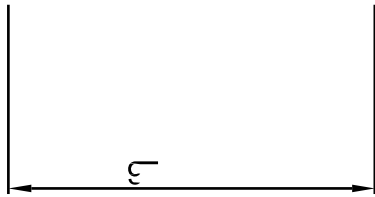
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NOTES:
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