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April 2016

# FODM100x Series Single Channel, DC Sensing Input, Phototransistor Optocoupler In Stretched Body SOP 4-Pin

## Features

- $\geq 8$  mm Creepage and Clearance Distance, and  $\geq 0.4$  mm Insulation Distance to Achieve Reliable and High Voltage Insulation
- Safety and Regulatory Approvals
- UL1577, 5,000 VAC<sub>RMS</sub> for 1 min.
- DIN\_EN/IEC60747-5-5, 890 V<sub>Peak</sub> Working Voltage (pending approval)
- High Breakdown Collector to Emitter Voltage, BV<sub>CEO</sub> = 70 V minimum
- Extended Industrial Temperature Range, -40 to 110°C
- Current Transfer Ratio at I<sub>F</sub> = 5 mA, V<sub>CE</sub> = 5 V, T<sub>A</sub> = 25°C
- FODM1007: 80 to 160%
- FODM1008: 130 to 260%
- FODM1009: 200 to 400%

## Related Resources

- [www.fairchildsemi.com/products/optoelectronics/](http://www.fairchildsemi.com/products/optoelectronics/)
- [www.fairchildsemi.com/datasheets/HM/HMHA2801.pdf](http://www.fairchildsemi.com/datasheets/HM/HMHA2801.pdf)

## Description

The FODM100x Series, single channel, DC sensing input, optocoupler consists of one gallium arsenide (GaAs) infrared light emitting diode optically coupled to one phototransistor, in a stretched body SOP 4-pin package. The input-output isolation voltage, V<sub>ISO</sub>, is rated at 5,000 VAC<sub>RMS</sub>.

## Applications

- Primarily suited for DC-DC Converters
- For ground loop isolation, signal to noise isolation
- Communications – adapters, chargers
- Consumer – appliances, set top boxes
- Industrial – power supplies, motor control, programmable logic control

## Schematic

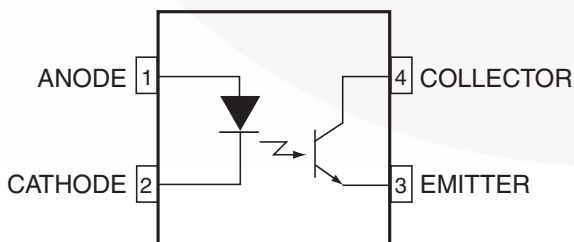


Figure 1. Schematic

## Package

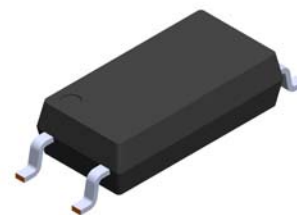


Figure 2. Package Outline

FODM100x Series Single Channel, DC Sensing Input, Phototransistor Optocoupler In Stretched Body SOP 4-Pin

## Safety and Insulation Ratings

As per DIN EN/IEC 60747-5-5 (pending approval), 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.

Parameter		Characteristics
Installation Classifications per DIN VDE 0110/1.89 Table 1, For Rated Mains Voltage	< 150 V <sub>RMS</sub>	I–IV
	< 300 V <sub>RMS</sub>	I–III
Climatic Classification		40/110/21
Pollution Degree (DIN VDE 0110/1.89)		2
Comparative Tracking Index		175

Symbol	Parameter	Value	Unit
V <sub>PR</sub>	Input-to-Output Test Voltage, Method A, V <sub>IORM</sub> × 1.6 = V <sub>PR</sub> , Type and Sample Test with t <sub>m</sub> = 10 s, Partial Discharge < 5 pC	1,426	V <sub>peak</sub>
	Input-to-Output Test Voltage, Method B, V <sub>IORM</sub> × 1.875 = V <sub>PR</sub> , 100% Production Test with t <sub>m</sub> = 1 s, Partial Discharge < 5 pC	1,671	V <sub>peak</sub>
V <sub>IORM</sub>	Maximum Working Insulation Voltage	890	V <sub>peak</sub>
V <sub>IOTM</sub>	Highest Allowable Over-Voltage	6,000	V <sub>peak</sub>
	External Creepage	≥ 8.0	mm
	External Clearance	≥ 8.0	mm
DTI	Distance Through Insulation (Insulation Thickness)	≥ 0.4	mm
T <sub>S</sub>	Case Temperature <sup>(1)</sup>	150	°C
I <sub>S,INPUT</sub>	Input Current <sup>(1)</sup>	200	mA
P <sub>S,OUTPUT</sub>	Output Power <sup>(1)</sup>	300	mW
R <sub>IO</sub>	Insulation Resistance at T <sub>S</sub> , V <sub>IO</sub> = 500 V <sup>(1)</sup>	> 10 <sup>9</sup>	Ω

**Note:**

1. Safety limit values – maximum values allowed in the event of a failure

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.  $T_A = 25^\circ\text{C}$  unless otherwise specified.

Symbol	Parameter	Value	Unit
<b>TOTAL PACKAGE</b>			
$T_{STG}$	Storage Temperature	-55 to +150	$^\circ\text{C}$
$T_{OPR}$	Operating Temperature	-40 to +110	$^\circ\text{C}$
$T_J$	Junction Temperature	-40 to +125	$^\circ\text{C}$
<b>EMITTER</b>			
$I_F$ (avg)	Continuous Forward Current	50	mA
$I_F$ (pk)	Peak Forward Current (1 $\mu\text{s}$ pulse, 300 pps)	1	A
$V_R$	Reverse Input Voltage	6	V
$PD_{LED}$	LED Power Dissipation @ $T_A = 25^\circ\text{C}$ <sup>(2)</sup>	100	mW
	Derate Above $25^\circ\text{C}$	0.9	$\text{mW}/^\circ\text{C}$
<b>DETECTOR</b>			
$I_C$	Continuous Collector Current	50	mA
$V_{CEO}$	Collector-Emitter Voltage	70	V
$V_{ECO}$	Emitter-Collector Voltage	7	V
$PD_C$	Detector Power Dissipation @ $T_A = 25^\circ\text{C}$ <sup>(2)</sup>	150	mW
	Derate Above $25^\circ\text{C}$	1.47	$\text{mW}/^\circ\text{C}$

**Note:**

- Functional operation under these conditions is not implied. Permanent damage may occur if the device is subjected to conditions outside these ratings.

## Electrical Characteristics

$T_A = 25^\circ\text{C}$  unless otherwise specified.

### Individual Component Characteristics

Symbol	Parameter	Device	Test Conditions	Min.	Typ.	Max.	Unit
<b>EMITTER</b>							
$V_F$	Forward Voltage	All	$I_F = 50\text{ mA}$		1.4	1.6	V
$I_R$	Reverse Current	All	$V_R = 4\text{ V}$			10	$\mu\text{A}$
<b>DETECTOR</b>							
$BV_{CEO}$	Breakdown Voltage Collector to Emitter	All	$I_C = 1\text{ mA}, I_F = 0$	70			V
$BV_{ECO}$	Emitter to Collector	All	$I_E = 0.1\text{ mA}, I_F = 0$	7			V
$I_{CEO}$	Collector Dark Current	All	$V_{CE} = 70\text{ V}, I_F = 0$			100	nA
$C_{CE}$	Capacitance	All	$V_{CE} = 0\text{ V}, f = 1\text{ MHz}$		5		pF

### DC Transfer Characteristics

Symbol	Parameter	Device	Test Conditions	Min.	Typ.	Max.	Unit
CTR	DC Current Transfer Ratio	FODM1007	$I_F = 5\text{ mA}, V_{CE} = 5\text{ V}$	80		160	%
		FODM1008		130		260	
		FODM1009		200		400	
$V_{CE(SAT)}$	Saturation Voltage	All	$I_F = 10\text{ mA}, I_C = 1\text{ mA}$			0.3	V

### AC Transfer Characteristics

Symbol	Parameter	Device	Test Conditions	Min.	Typ.	Max.	Unit
$t_r$	Rise Time (Non-Saturated)	All	$I_C = 2\text{ mA}, V_{CE} = 5\text{ V}, R_L = 100\ \Omega$		5.7	18.0	$\mu\text{s}$
$t_f$	Fall Time (Non-Saturated)	All	$I_C = 2\text{ mA}, V_{CE} = 5\text{ V}, R_L = 100\ \Omega$		8.5	18.0	

### Isolation Characteristics

Symbol	Parameter	Device	Test Conditions	Min.	Typ.	Max.	Unit
$V_{ISO}$	Steady State Isolation Voltage	All	$T_A = 25^\circ\text{C}, \text{R.H.} < 50\%, t = 1.0\text{ minute}, I_{I-O} \leq 20\ \mu\text{A}$	5,000			$V_{AC_{RMS}}$

## Typical Performance Characteristics

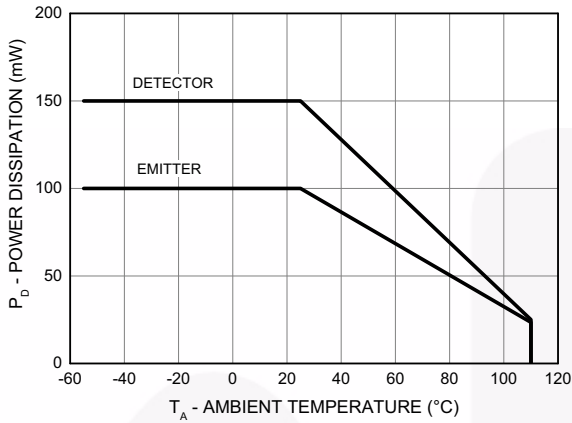


Figure 3. Power Dissipation vs. Ambient Temperature

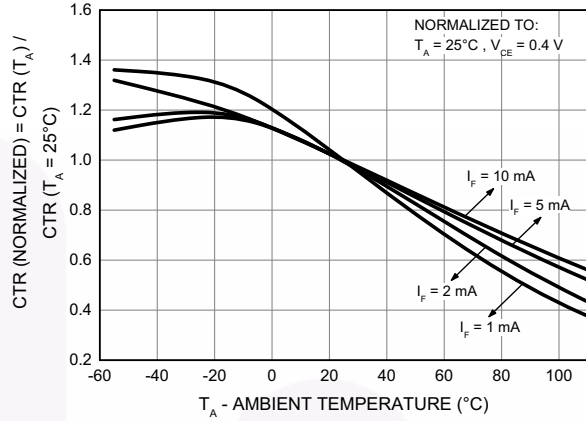


Figure 4. Saturated Normalized Current Transfer Ratio vs. Ambient Temperature

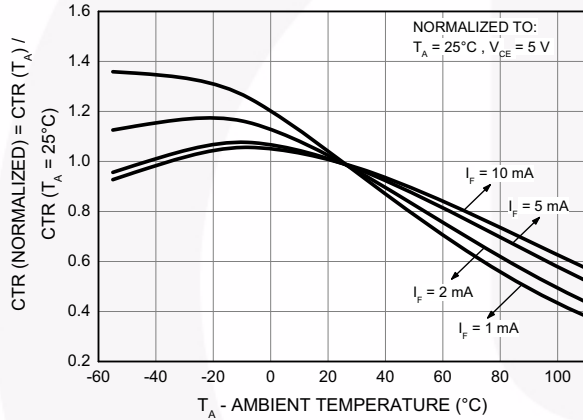


Figure 5. Non-Saturated Normalized Current Transfer Ratio vs. Ambient Temperature

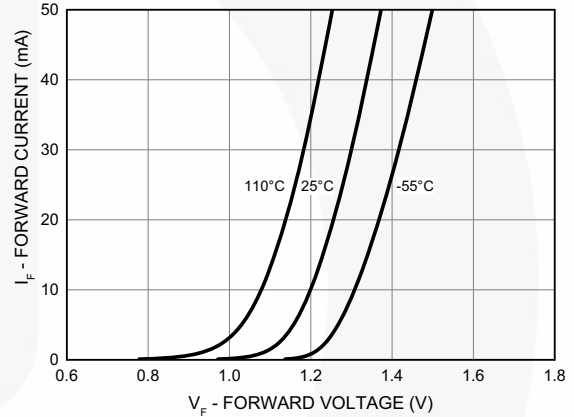


Figure 6. Forward Current vs. Forward Voltage

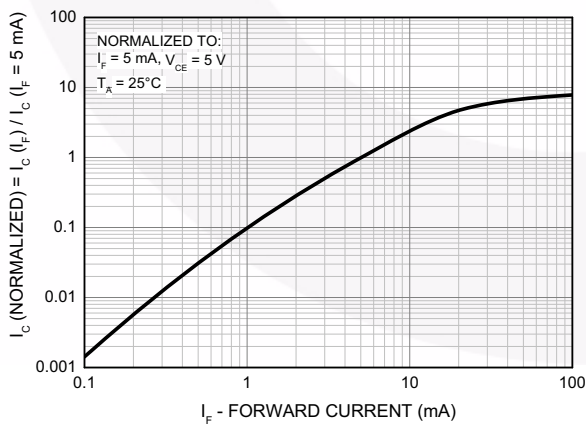


Figure 7. Normalized Current Collector vs. Forward Current

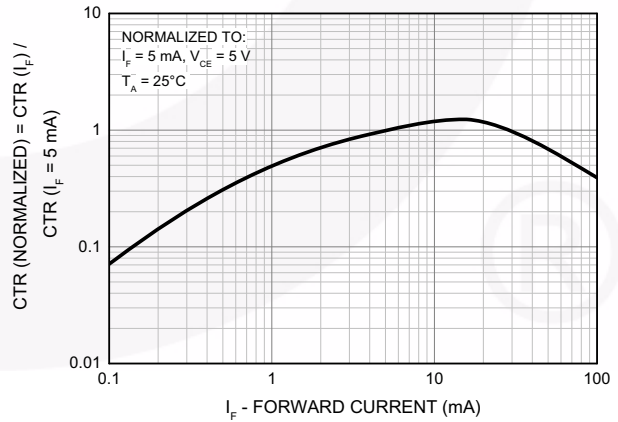
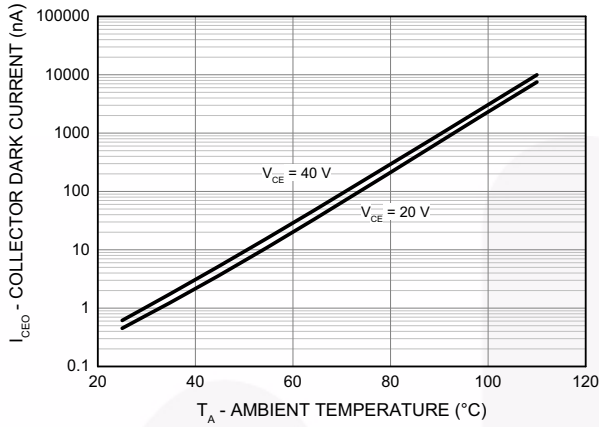
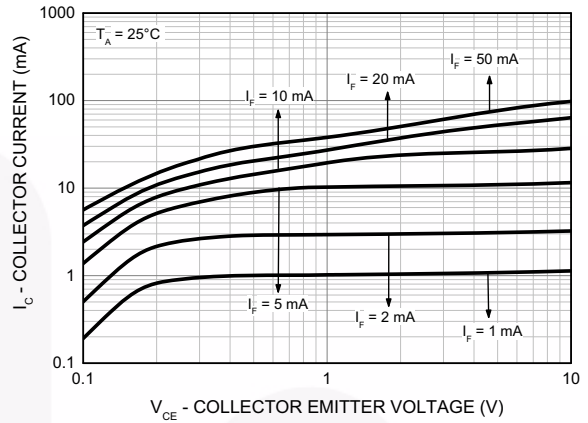


Figure 8. Normalized Current Transfer Ratio vs. Forward Current

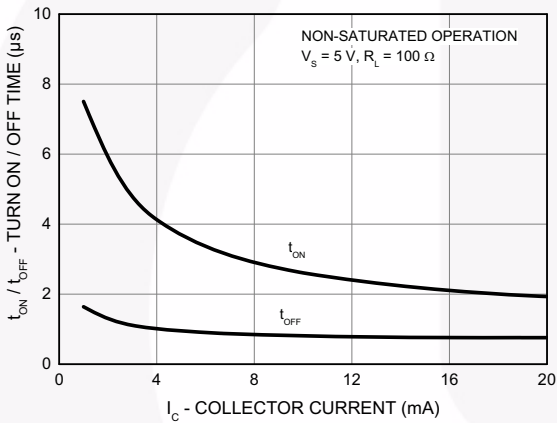
**Typical Performance Characteristics** (Continued)



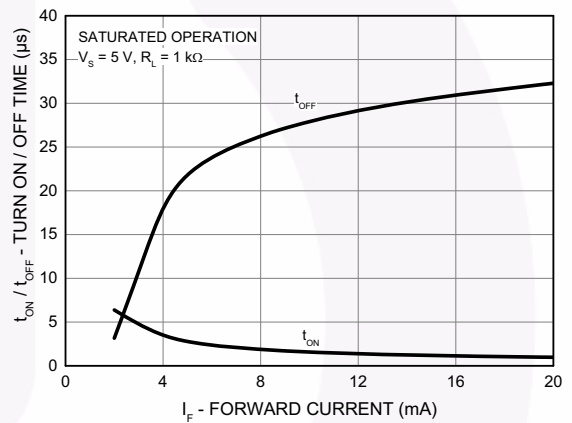
**Figure 9. Collector Dark Current vs. Ambient Temperature**



**Figure 10. Collector Current vs. Collector Emitter Voltage**

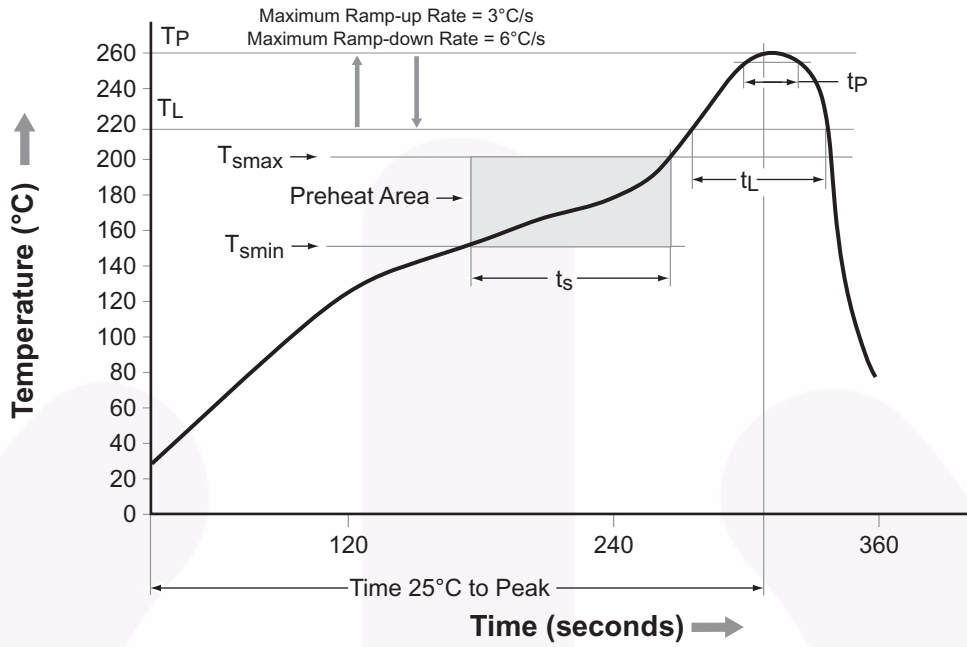


**Figure 11. Turn On/ Turn Off Time vs. Collector Current**



**Figure 12. Turn On/ Turn Off Time vs. Forward Current**

## Reflow Profile



Profile Feature	Pb-Free Assembly Profile
Temperature Minimum ( $T_{smin}$ )	150°C
Temperature Maximum ( $T_{smax}$ )	200°C
Time ( $t_s$ ) from ( $T_{smin}$ to $T_{smax}$ )	60 s to 120 s
Ramp-up Rate ( $t_L$ to $t_P$ )	3°C/second maximum
Liquidous Temperature ( $T_L$ )	217°C
Time ( $t_L$ ) Maintained Above ( $T_L$ )	60 s to 150 s
Peak Body Package Temperature	260°C +0°C / -5°C
Time ( $t_p$ ) within 5°C of 260°C	30 s
Ramp-Down Rate ( $T_P$ to $T_L$ )	6°C/s maximum
Time 25°C to Peak Temperature	8 minutes maximum

Figure 13. Reflow Profile



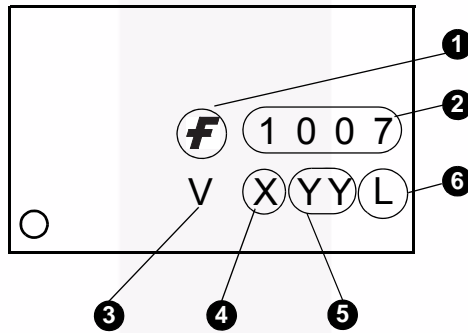
## Ordering Information

Part Number	Package	Packing Method
FODM1007	Stretched Body SOP 4-Pin	Tube (100 units per tube)
FODM1007R2	Stretched Body SOP 4-Pin	Tape and Reel (3,000 units per reel)
FODM1007V	Stretched Body SOP 4-Pin, DIN EN/IEC60747-5-5 Option (pending approval)	Tube (100 units per tube)
FODM1007R2V	Stretched Body SOP 4-Pin, DIN EN/IEC60747-5-5 Option (pending approval)	Tape and Reel (3,000 units per reel)

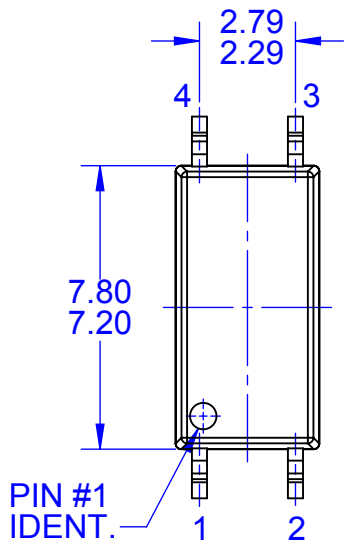
**Note:**

2. The product orderable part number system listed in this table also applies to the FODM1008, and FODM1009 products.

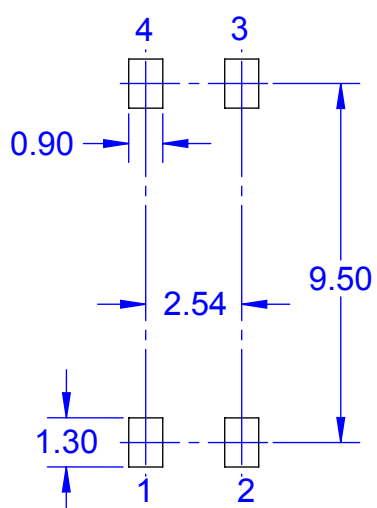
## Marking Information



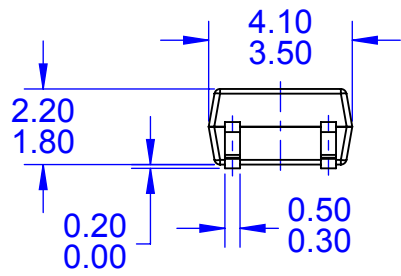
Definitions	
1	Fairchild Logo
2	Device Number, e.g. 1007
3	DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option) (pending for approval)
4	Last Digit Year Code, e.g. '6'
5	Two Digit Work Week Ranging from '01' to '53'
6	Assembly Package Code



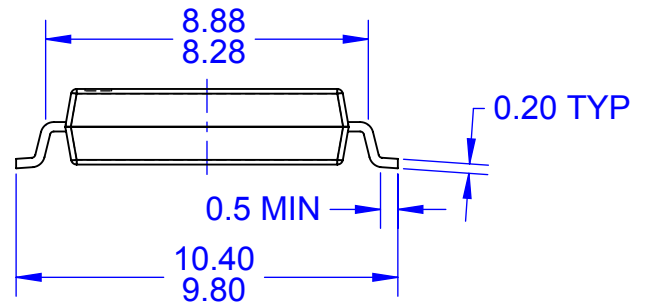
TOP VIEW



LAND PATTERN RECOMMENDATION



FRONT VIEW



SIDE VIEW

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**Телефон:** 8 (812) 309 58 32 (многоканальный)

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**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

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