

0.8A Gate Drive Photocoupler

Product Description

The EMD2A681 series Photo coupler is ideally suited for driving power IGBTs and MOSFETs used in motor control inverter applications and inverters in power supply system. It contains an LED optically coupled to an integrated circuit with a power output stage.

The 0.8A peak output current is capable of directly driving most MOSFETs. For MOSFETs with higher ratings, the EMD2A681 series can be used to drive a discrete power stage which drives the MOSFET gate.

The Photo coupler operational parameters are guaranteed over the temperature range from -40°C ~ $+110^{\circ}\text{C}$.

Features

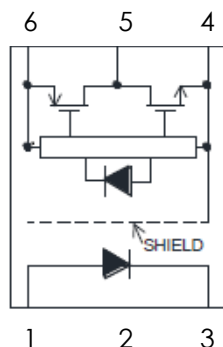
- Floating channel designed for bootstrap operation
Fully operational to +600V
- 0.8 A maximum peak output current
- Rail-to-rail output voltage
- 120 ns maximum propagation delay
- Under Voltage Lock Out protection (UVLO) with hysteresis
- Wide operating range: 10 to 30 Volts (VCC)
- Guaranteed performance over temperature -40°C ~ $+110^{\circ}\text{C}$.

Applications

- Isolated IGBT/ MOSFET gate drive
- Industrial inverters
- AC Servos and DC brushless motor drivers
- Switching power supply
- Induction cook-top

SCHEMATIC	PIN DEFINITION	PACKAGE
	1. Anode 2. NC 3. Cathode 4. Vss 5. VO 6. Vcc	

Connection Diagram



Order Information

EMD2A681-00S###NFR1

00	Internal control Code
S###	SK06: LSOP-6 Package 7mm clearance SL06: LSOP-6 Package 8mm clearance
N	RoHS & Halogen free package
F	-40 to 110°C temperature rating
R1	Packing in Tape & Reel

Order, Mark & Packing Information

Package	Product ID	Mark		Packing
LSOP-6	EMD2A681-00SK06NFR1 EMD2A681-00SL06NFR1		E : ESMT YY : Date code (Year) WW : Date code (Week) 681 : Part Number H : Internal Tracking Code	Tape & Reel 3Kpcs

Truth Table

LED	V _{CC} -V _{SS} (Turn-ON)	V _{CC} -V _{SS} (Turn-OFF)	VO
OFF	0V to 30V	30V to 0V	Low
ON	0V to 6.9V	5.9V to 0V	Low
ON	6.9V to 8.7V	7.5V to 5.9V	Transition
ON	8.7V to 30V	30V to 7.5V	High

Note 1: A 0.1μF bypass capacitor must be connected between V_{CC} and V_{SS}.

Absolute Maximum Ratings (T_a = 25°C unless otherwise specified)

Parameter	Symbol	Min	Max	Unit
Storage Temperature	T _{stg}	-55	125	°C
Operating Temperature	T _{opr}	-40	110	°C
Output IC Junction Temperature	T _J	-	125	°C
Total Output Supply Voltage	(V _{CC} - V _{SS})	0	35	V
Average Forward Input Current	I _F	-	20	mA
Reverse Input Voltage	V _R	-	5	V
"High" Peak Output Current (Note3)	I _{OH} (PEAK)	-	0.8	A
"Low" Peak Output Current (Note3)	I _{OL} (PEAK)	-	0.8	A
Output Voltage	V _O (PEAK)	-0.5	V _{CC}	V
Power Dissipation	P _I	-	45	mW
Output IC Power Dissipation	P _O	-	250	mW
Lead Solder Temperature	T _{sol}	-	260	°C

Note 2: Ambient temperature = 25°C, unless otherwise specified. Stresses exceeding the absolute maximum ratings can cause permanent damage to the device. Exposure to absolute maximum ratings for long periods of time can adversely affect reliability.

Note 3: Exponential waveform. Pulse width ≤ 10 μs, f ≤ 15 kHz

Recommended Operation Condition

Parameter	Symbol	Min	Max	Unit
Operating Temperature	T _A	-40	110	°C
Supply Voltage	V _{CC}	10	30	V
Input Current (ON)	I _{F(ON)}	6	16	mA
Input Voltage (OFF)	V _{F(OFF)}	0	0.8	V

Electrical Characteristics

All Typical values at $T_A = 25^\circ\text{C}$ and $V_{CC} - V_{SS} = 30\text{ V}$, unless otherwise specified; all minimum and maximum specifications are at recommended operating condition.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition
Input Characteristics						
Input Forward Voltage	VF	1.6	2.0	2.4	V	$I_F = 10\text{mA}$
Input Forward Voltage Temperature Coefficient	$\Delta VF / \Delta T$	-	-1.237	-	mV/ $^\circ\text{C}$	$I_F = 10\text{mA}$
Input Reverse Voltage	BVR	5	-	-	V	$I_R = 10\mu\text{A}$
Input Threshold Current (Low to High)	IFLH	-	1.0	5	mA	$V_O > 5\text{V}$, $I_O = 0\text{A}$
Input Threshold Voltage (High to Low)	VFHL	0.8	-	-	V	$V_{CC} = 30\text{ V}$, $V_O < 5\text{V}$
Input Capacitance	CIN	-	60	-	pF	$V_F = 0\text{V}$, $f = 1\text{ MHz}$
Output Characteristics						
High Level Supply Current	ICCH	-	2	3	mA	$I_F = 10\text{ mA}$, $V_{CC} = 30\text{ V}$, $V_O = \text{Open}$
Low Level Supply Current	ICCL	-	2.6	3.5	mA	$I_F = 0\text{ mA}$, $V_{CC} = 30\text{ V}$, $V_O = \text{Open}$
High level output current (Note 4)	IOH	-	-	-0.8	A	$I_F = 10\text{ mA}$, $V_{CC} = 30\text{V}$ $V_O = V_{CC} - 6\text{V}$
Low level output current (Note 4)	IOL	0.8	-	-	A	$I_F = 0\text{ mA}$, $V_{CC} = 30\text{V}$ $V_O = V_{SS} + 6\text{V}$
High level output voltage (Note 5, 6)	VOH	$V_{CC} - 1.0\text{V}$	$V_{CC} - 0.4\text{V}$	-	V	$I_F = 10\text{mA}$, $I_O = -100\text{mA}$
Low level output voltage	VOL	-	0.25	1	V	$I_F = 0\text{ mA}$, $I_O = 100\text{ mA}$
UVLO Threshold	VUVLO+	6.9	7.9	8.7	V	$V_O > 5\text{V}$, $I_F = 10\text{ mA}$
	VUVLO-	5.9	6.8	7.5	V	$V_O < 5\text{V}$, $I_F = 10\text{ mA}$

Note 4: Maximum pulse width = 10 μs .

Note 5: In this test VOH is measured with a dc load current. When driving capacitive loads, VOH will approach VCC as IOH approaches zero amps.

Note 6: Maximum pulse width = 1 ms.

Switching Specification

All Typical values at $T_A = 25^\circ\text{C}$ and $V_{CC} - V_{SS} = 30\text{ V}$, unless otherwise specified; all minimum and maximum specifications are at recommended operating condition.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition
Propagation Delay Time toHigh Output Level	t_{PLH}	-	55	120	ns	R _g = 47Ω, C _g = 3 nF, f = 10kHz, Duty Cycle = 50% I _F = 10mA, V _{CC} = 30V
Propagation Delay Time toLow Output Level	t_{PHL}	-	60	120		
Pulse Width Distortion	PWD	-	5	80		
Propagation Delay Difference Between Any Two Parts	PDD ($t_{PHL} - t_{PLH}$)	-100	-	+100		
Output Rise Time (10 to 90%)	t_r	-	6	-		
Output Fall Time (90 to 10%)	t_f	-	5	-		
Common mode transient immunity at high level output (Note 7, 8)	C _{MH}	10		-	kV/μs	I _F = 7 to 16mA V _{CC} = 30V, T _A = 25 °C, V _{CM} = 1kV
Common mode transient immunity at low level output (Note 7, 9)	C _{ML}	10		-	kV/μs	I _F = 0mA V _{CC} = 30V, T _A = 25 °C, V _{CM} = 1kV

Note 7: Pin 2 needs to be connected to LED common.

Note 8: Common mode transient immunity in the high state is the maximum tolerable dV_{CM}/dt of the common mode pulse, V_{CM}, to assure that the output will remain in the high state (meaning V_O > 10.0V).

Note 9: Common mode transient immunity in a low state is the maximum tolerable dV_{CM}/dt of the common mode pulse, V_{CM}, to assure that the output will remain in a low state (meaning V_O < 1.0V).

Isolation characteristic

All Typical values at $T_A = 25^\circ\text{C}$ and $V_{CC} - V_{SS} = 30\text{ V}$, unless otherwise specified; all minimum and maximum specifications are at recommended operating condition.

Parameter	Symbo	Device	Min.	Typ.	Max.	Unit	Test Condition
Withstand Insulation Test Voltage (Note 10, 11)	V _{ISO}	EMD2A681-SK	5000	-	-	V	RH ≤ 40%-60%, t = 1min, T _A = 25 °C
		EMD2A681-SL					
Input-Output Resistance (Note 10)	R _{I-O}	-	-	10 ¹²	-	Ω	V _{I-O} = 500V DC

Note 10: Device is considered a two terminal device: pins 1, 2, 3 are shorted together and pins 4, 5, 6 are shorted together.

Note 11: According to UL1577, each photo coupler is tested by applying an insulation test voltage 6000VRMS for one second (leakage current less than 10uA). This test is performed before the 100% production test for partial discharge.

Typical Performance Curves & Test Circuits

Fig.1 High output rail voltage vs. Temperature

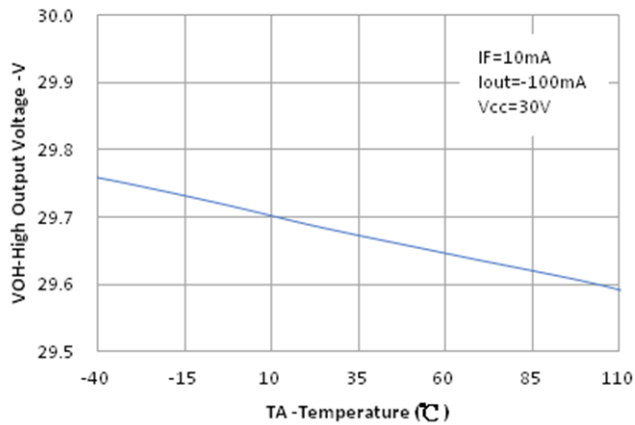


Fig.2 VOH vs. Temperature

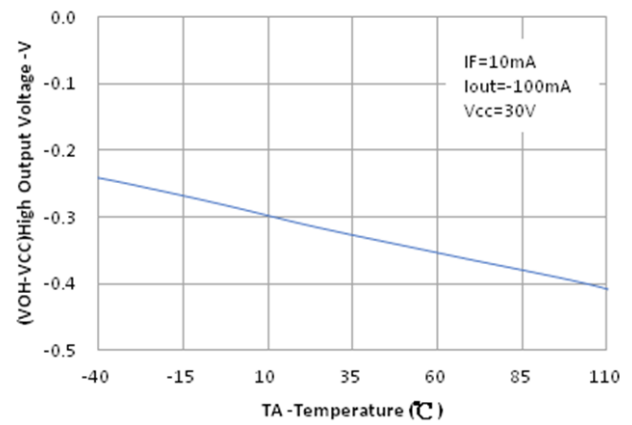


Fig.3 VOL vs. Temperature

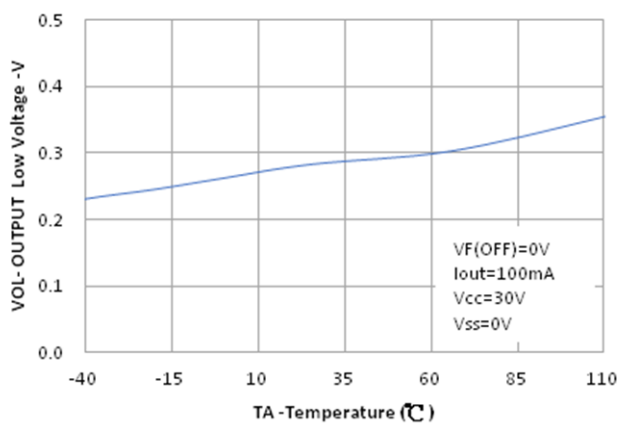


Fig.4 ICC vs. Temperature

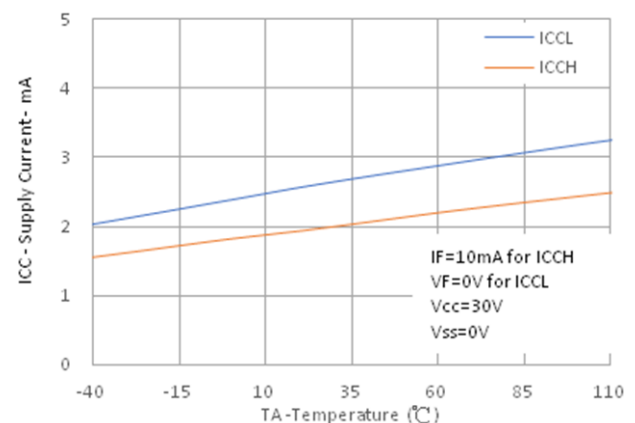


Fig.5 ICC vs. Vcc

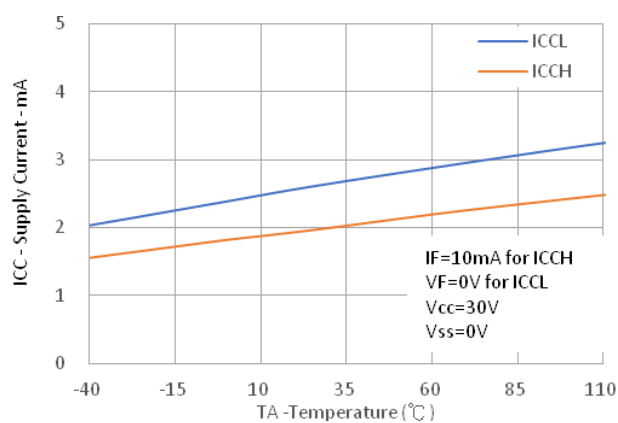


Fig.6 IFLH vs. Hysteresis

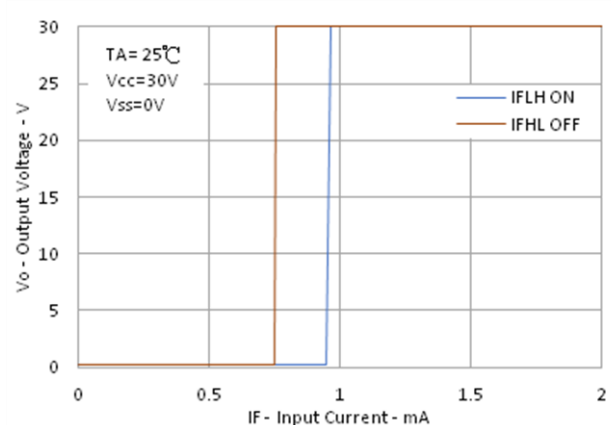


Fig.7 I_{FH} vs. Temperature

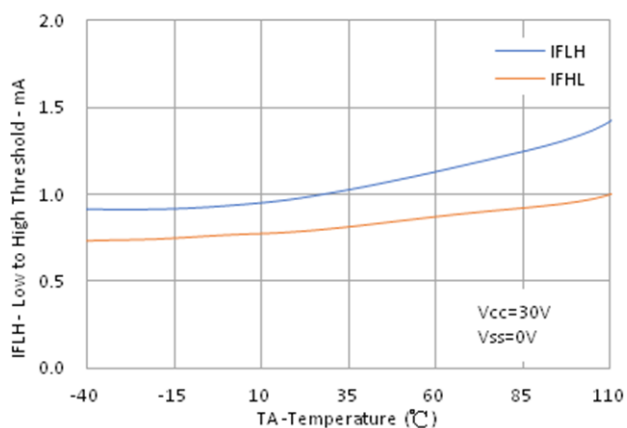


Fig.8 Propagation Delays vs. V_{CC}

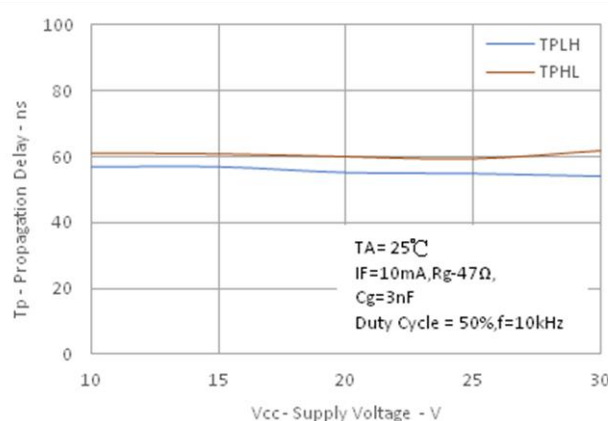


Fig.9 Propagation Delays vs. I_F

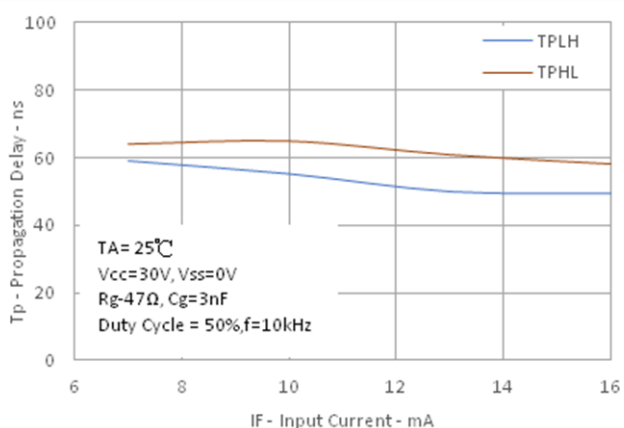


Fig.10 Propagation Delays vs. Temperature

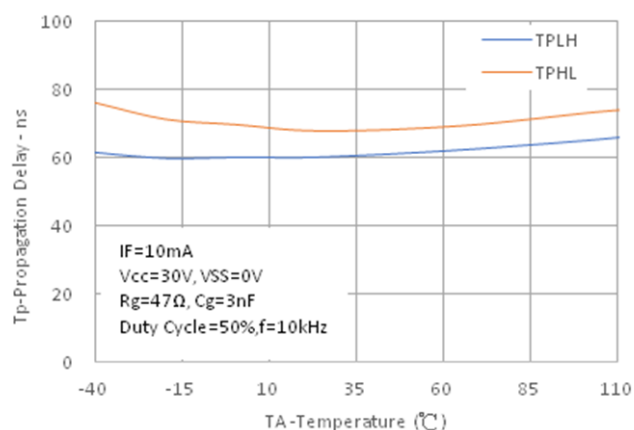


Fig.11 Propagation Delays vs. R_g

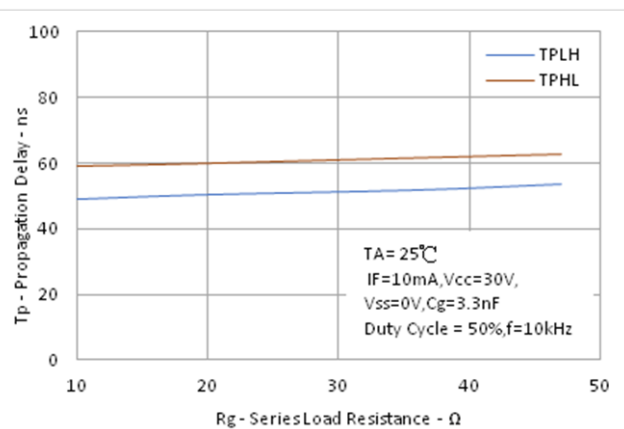


Fig.12 Propagation Delays vs. C_g

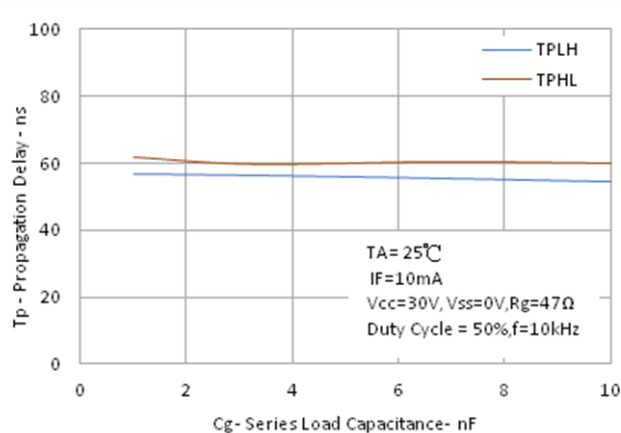
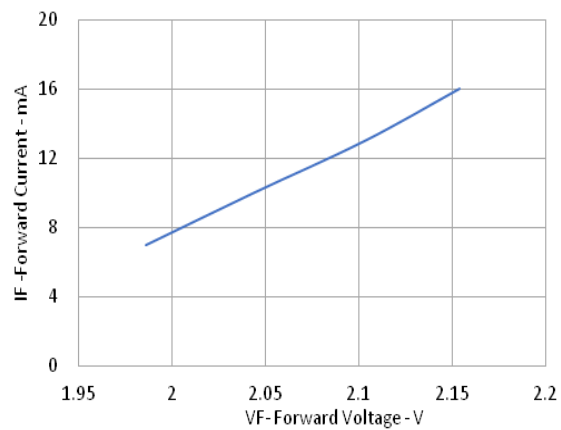
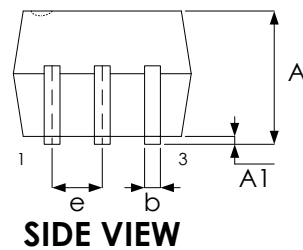
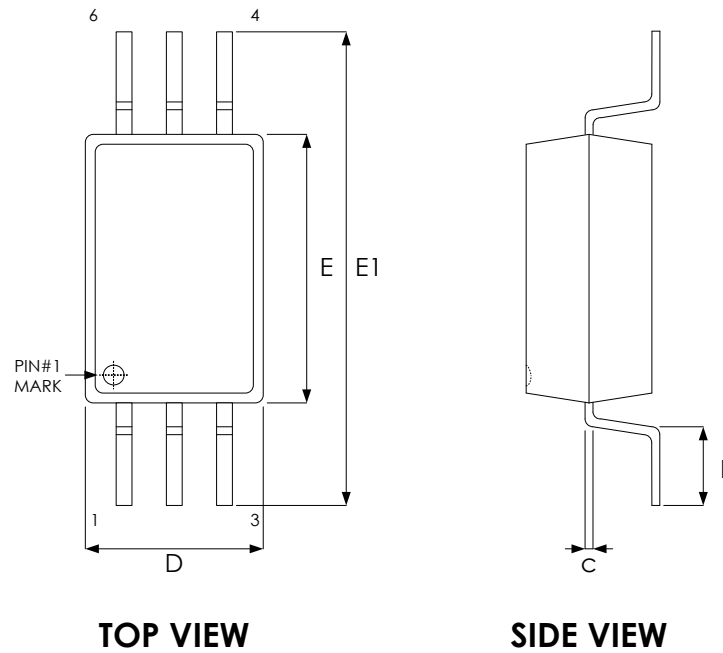


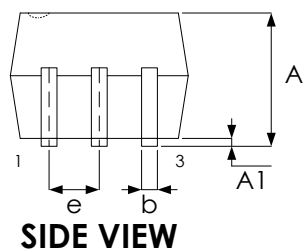
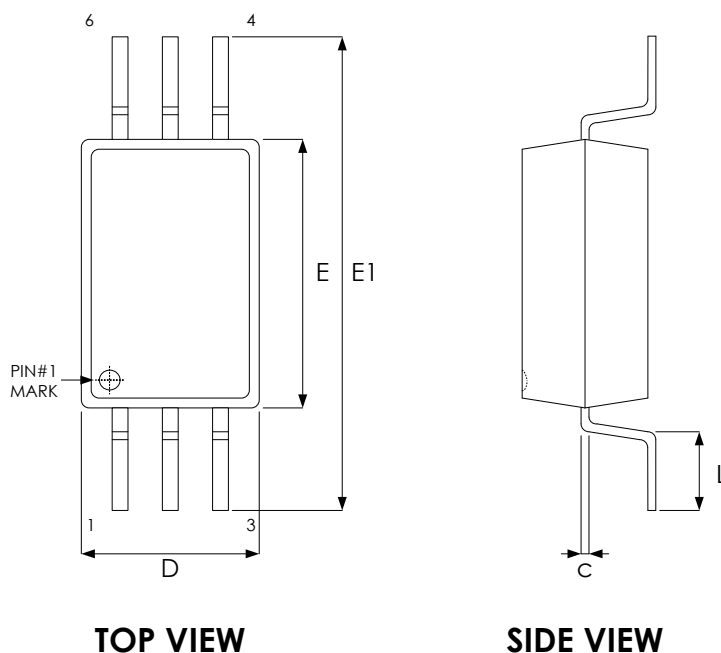
Fig.13 Input Current vs. Forward Voltage



Package Outline Drawing
L-SOP 6L (277mil, 7mm clearance)

Symbol	Dimension in mm	
	Min.	Max.
A	1.70	2.30
A1	0.10	0.30
b	0.30	0.50
c	0.20	0.30
D	4.20	4.80
E	6.50	7.10
E1	9.40	10.00
e	1.27 BSC	
L	0.70	1.20

Package Outline Drawing
L-SOP 6L (277mil, 8mm clearance)



Symbol	Dimension in mm	
	Min.	Max.
A	1.70	2.30
A1	0.10	0.30
b	0.30	0.50
c	0.20	0.30
D	4.20	4.80
E	6.51	7.11
E1	11.20	11.80
e	1.27 BSC	
L	0.50	1.00

Revision History

Revision	Date	Description
0.1	2024.02.27	Initial version
1.0	2024.06.05	Remove "preliminary" to V1.0

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