

## 3A Gate Drive Photocoupler

### Product Description

The EMD2A341 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 3.0A peak output current is capable of directly driving most IGBTs with ratings up to 1200V/50A. For IGBTs with higher ratings, the EMD2A341 series can be used to drive a discrete power stage which drives the IGBT gate.

The Photo coupler operational parameters are guaranteed over the temperature range from -40°C ~ +110°C.

### Applications

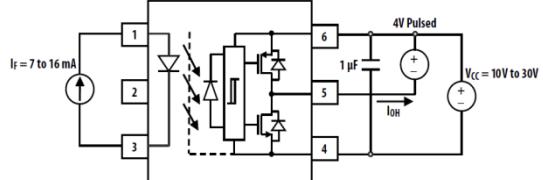
- IGBT/ MOSFET gate drive
- Photovoltaic (PV) power conditioning systems
- Industrial inverters
- AC Servos and DC brushless motor drivers
- Switching power supply
- Induction cook-top

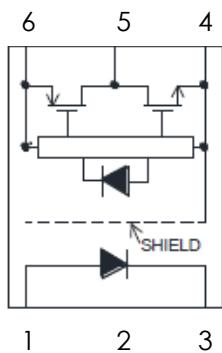
### Features

- 3.0 A maximum peak output current
- 2.5 A minimum peak output current
- Rail-to-rail output voltage
- 110 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°C.

### Safety approved

- UL1577 recognized with 3750 Vrms for 1 minute for EMD2A341-SK and 5000 Vrms for 1 minute for EMD2A341-SL  
Certificate No. E529603
- IEC/EN/DIN EN 60747-5-5 Approved  
 $V_{IORM} = 891$  Vpeak for EMD2A341-SK  
 $V_{IORM} = 1140$  Vpeak for EMD2A341-SL  
Certificate No. 40055846
- CQC approved: GB4943.1-2011  
Certificate No. CQC22001358589

SCHEMATIC	PIN DEFINITION	PACKAGE
	1.Anode 2.NC 3.Cathode 4.V <sub>ss</sub> 5.V <sub>O</sub> 6.V <sub>CC</sub>	

**Connection Diagram****Order Information**

EMD2A341-00S###%FR1  
EMD2A 341 00 Internal control Code  
S### SK06: LSOP-6 Package 7mm clearance  
SL06: LSOP-6 Package 8mm clearance  
% E: RoHS & Halogen free package with VDE  
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	EMD2A341-00SK06EFR1 EMD2A341-00SL06EFR1		E : ESMT YY : Date code (Year) WW : Date code (Week) 341 : Part Number H : Internal Tracking Code V : VDE Option
	EMD2A341-00SK06NFR1 EMD2A341-00SL06NFR1		

**Truth Table**

LED	V <sub>CC</sub> -V <sub>SS</sub> (Turn-ON)	V <sub>CC</sub> -V <sub>SS</sub> (Turn-OFF)	V <sub>O</sub>
OFF	0 - 30 V	0 - 30 V	Low
ON	0 - 6.9 V	0 - 5.9 V	Low
ON	6.9 - 8.7 V	5.9 - 7.5 V	Transition
ON	8.7 - 30 V	7.5 - 30 V	High

Note 1: A 0.1 $\mu$ F bypass capacitor must be connected between V<sub>CC</sub> and V<sub>SS</sub>.

**Absolute Maximum Ratings** (T<sub>A</sub> = 25°C unless otherwise specified)

Parameter	Symbol	Min	Max	Unit
Storage Temperature	T <sub>STG</sub>	-55	125	°C
Operating Temperature	T <sub>OPR</sub>	-40	110	°C
Output IC Junction Temperature	T <sub>J</sub>	-	125	°C
Total Output Supply Voltage	(V <sub>CC</sub> - V <sub>SS</sub> )	0	35	V
Average Forward Input Current	I <sub>F</sub>	-	20	mA
Reverse Input Voltage	V <sub>R</sub>	-	5	V
"High" Peak Output Current (Note 3)	I <sub>O(H)</sub> (PEAK)	-	3.0	A
"Low" Peak Output Current (Note 3)	I <sub>O(L)</sub> (PEAK)	-	3.0	A
Output Voltage	V <sub>O</sub> (PEAK)	-0.5	V <sub>CC</sub>	V
Power Dissipation	P <sub>I</sub>	-	45	mW
Output IC Power Dissipation	P <sub>O</sub>	-	700	mW
Lead Solder Temperature	T <sub>SOL</sub>	-	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  $\leq$  10  $\mu$ s, f  $\leq$  15 kHz

**Recommended Operation Condition**

Parameter	Symbol	Min	Max	Unit
Operating Temperature	T <sub>A</sub>	-40	110	°C
Supply Voltage	V <sub>CC</sub>	10	30	V
Input Current (ON)	I <sub>F(ON)</sub>	5	16	mA
Input Voltage (OFF)	V <sub>F(OFF)</sub>	-3.0	0.8	V

## IEC/EN/DIN EN 60747-5-5 Insulation Characteristics

Description	Symbol	EMD2A341-SK	EMD2A341-SL	Unit
Climatic Classification	--	55/100/21	55/100/21	--
Pollution Degree (DIN VDE 0110/1.89)	--	2	2	--
Maximum Working Insulation Voltage	$V_{IORM}$	891	1140	$V_{peak}$
Input to Output Test Voltage, Method a (Note 4) $V_{IORM} \times 1.875 = V_{PR}$ , 100% Production Test With $t_m = 10\text{sec}$ , Partial discharge < 5pC	$V_{PR}$	1671	2137	$V_{peak}$
Input to Output Test Voltage, Method a (Note 4) $V_{IORM} \times 1.875 = V_{PR}$ , 100% Production Test With $t_m = 10\text{sec}$ , Partial discharge < 5pC	$V_{PR}$	1426	1824	$V_{peak}$
Highest Allowable Overvoltage (Transient Overvoltage $t_{ini} = 60\text{sec}$ )	$V_{IOTM}$	6000	8000	$V_{peak}$
Safety-limiting values – maximum values allowed in the event of a failure				
Case Temperature	$T_s$	175	175	°C
Input Current	$I_s, INPUT$	150	150	mA
Output Power	$P_s, OUTPUT$	600	600	mW
Insulation Resistance at $T_s$ , $V_{IO} = 500\text{ V}$	$R_s$	$>10^9$	$>10^9$	Ω

Note 4 : Refer to the optocoupler section of the Isolation and Control Components Designer's Catalog, under Product Safety Regulations section, (IEC/EN/DIN EN 60747-5-5) for a detailed description of Method a and Method b partial discharge test profiles.

These optocouplers are suitable for "safe electrical isolation" only within the safety limit data. Maintenance of the safety data shall be ensured by means of protective circuits. Surface mount classification is Class A accordance with CECC 00802.

## Insulation and Safety-Related Specifications

Parameter	Symbol	EMD2A		Unit	Conditions
		341-SK	341-SL		
Minimum External Air Gap (External Clearance)	$L(101)$	7.0	8.0	mm	Measured from input terminals to output terminals, shortest distance through air.
Minimum External Tracking (External Creepage)	$L(102)$	8.0	8.0	mm	Measured from input terminals to output terminals, shortest distance path along body.
Tracking Resistance (Comparative Tracking Index)	CTI	$>175$	$>175$	V	DIN IEC 112/VDE 0303 Part 1.

### 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
<b>Input Characteristics</b>						
Input Forward Voltage	VF	1.6	1.9	2.4	V	IF=10mA
Input Forward Voltage Temperature Coefficient	$\Delta V_F / \Delta T$	-	-1.237	-	mV/°C	IF=10mA
Input Reverse Voltage	BVR	5	-	-	V	$IR = 10\mu\text{A}$
Input Threshold Current (Low to High)	IFLH	-	0.9	2	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	$f = 1\text{ MHz}$ , $VF = 0\text{ V}$
<b>Output Characteristics</b>						
High Level Supply Current	ICCH	-	1.70	3	mA	$I_F = 10\text{ mA}$ , $V_{CC} = 30\text{V}$ , $V_O = \text{Open}$ , $R_g = 10\Omega$ , $C_g = 6\text{ nF}$
Low Level Supply Current	ICCL	-	2.11	3	mA	$I_F = 0\text{ mA}$ , $V_{CC} = 30\text{V}$ , $V_O = \text{Open}$ , $R_g = 10\Omega$ , $C_g = 6\text{ nF}$
High level output current (Note 5)	IOH	2.5	-	-	A	$I_F = 10\text{ mA}$ , $V_{CC} = 30\text{V}$ $V_O = V_{CC} - 15\text{V}$
Low level output current (Note 5)	IOL	2.5	-	-	A	$I_F = 0\text{ mA}$ , $V_{CC} = 30\text{V}$ $V_O = V_{SS} + 15\text{V}$
High level output voltage (Note 6, 7)	VOH	29.7	29.88	-	V	$I_F = 10\text{mA}$ , $I_O = -100\text{mA}$
Low level output voltage	VOL	-	0.1	0.3	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 5: Maximum pulse width = 10  $\mu\text{s}$ .

Note 6: 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 7: Maximum pulse width = 1 ms.

## Switching Specification

All Typical values at TA = 25°C and V<sub>CC</sub> – V<sub>SS</sub> = 30 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	$t_{PLH}$	-	61.3	110	ns	$R_g = 10\Omega$ , $C_g = 25\text{ nF}$ , $f = 10\text{ kHz}$ , Duty Cycle = 50% $IF = 10\text{ mA}$ , $VCC = 30\text{ V}$
Propagation Delay Time toLow Output Level	$t_{PHL}$	-	70.0	110		
Pulse Width Distortion	PWD	-	22	70		
Propagation Delay Difference Between Any Two Parts	$PDD$ ( $t_{PHL} - t_{PLH}$ )	-100	-	+100		
Output Rise Time (10 to 90%)	$t_r$	-	20	-		
Output Fall Time (90 to 10%)	$t_f$	-	15	-		
Common mode transient immunity at high level output (Note 8, 9)	$ CM_H $	20	40	-	$\text{kV}/\mu\text{s}$	$IF = 7 \text{ to } 16\text{ mA}$ $VCC = 30\text{ V}$ , $TA = 25\text{ }^\circ\text{C}$ , $VCM = 1\text{ kV}$
Common mode transient immunity at low level output (Note 8, 10)	$ CM_L $	20	40	-	$\text{kV}/\mu\text{s}$	$IF = 0\text{ mA}$ $VCC = 30\text{ V}$ , $TA = 25\text{ }^\circ\text{C}$ , $VCM = 1\text{ kV}$

Note 8: Pin 2 needs to be connected to LED common.

Note 9: Common mode transient immunity in the high state is the maximum tolerable  $dVCM/dt$  of the common mode pulse, VCM, to assure that the output will remain in the high state (meaning  $VO > 15.0V$ ).

Note 10: Common mode transient immunity in a low state is the maximum tolerable  $dVCM/dt$  of the common mode pulse, VCM, to assure that the output will remain in a low state (meaning  $VO < 1.0V$ ).

## 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	Symbol	Device	Min.	Typ.	Max.	Unit	Test Condition
Withstand Insulation Test Voltage (Note 11, 12)	V <sub>ISO</sub>	EMD2A341-SK	5000	-	-	V	RH ≤ 40%-60%, t = 1min, T <sub>A</sub> = 25 °C
Input-Output Resistance (Note 11)		EMD2A341-SL					
	R <sub>I-O</sub>	-	-	10 <sup>12</sup>	-	Ω	V <sub>I-O</sub> = 500V DC

Note 11: Device is considered a two terminal device: pins 1, 2, 3 are shorted together and pins 4, 5, 6 are shorted together.

Note 12: 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 &amp; Test Circuits

Fig.1 High output rail voltage vs. Temperature

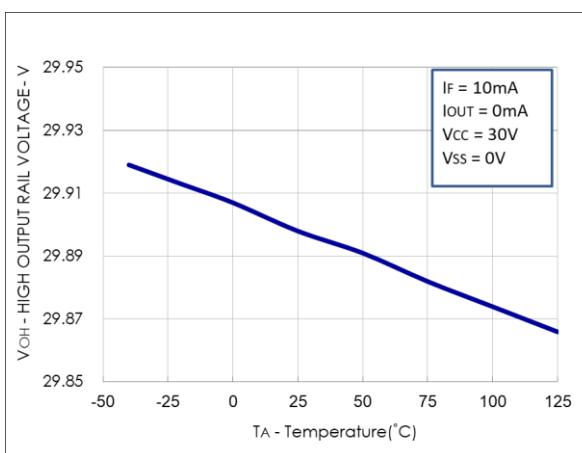


Fig.2 Voh vs. Temperature

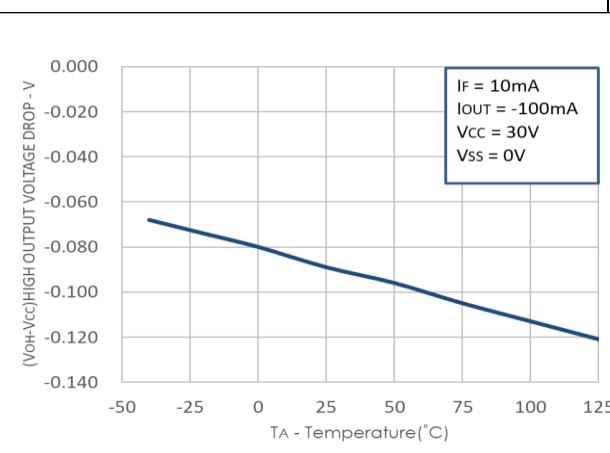


Fig.3 Vol vs. Temperature

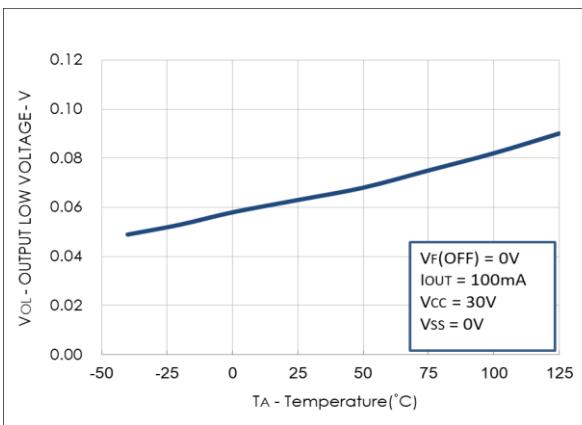


Fig.4 Icc vs. Temperature

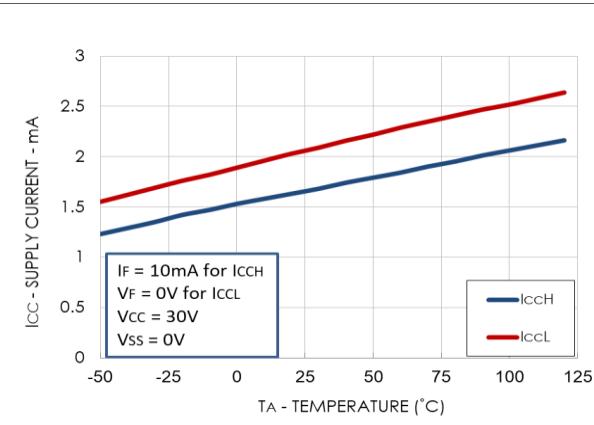


Fig.5 Icc vs. Vcc

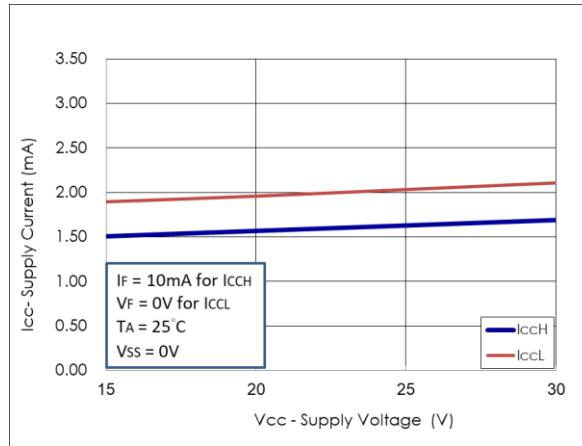
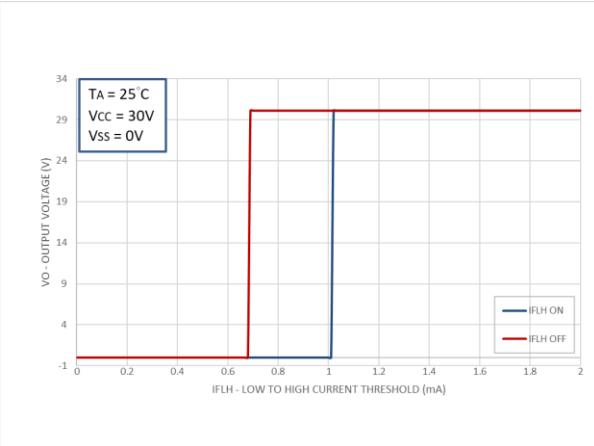
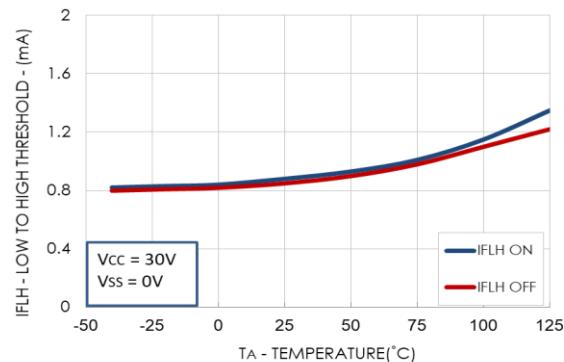
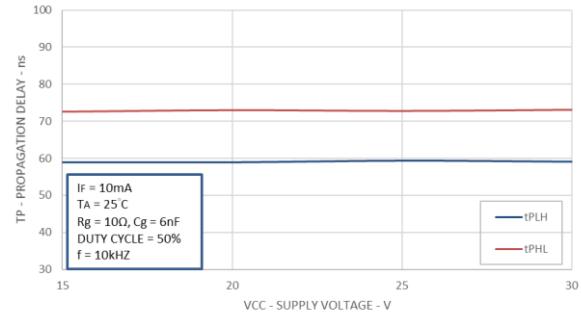
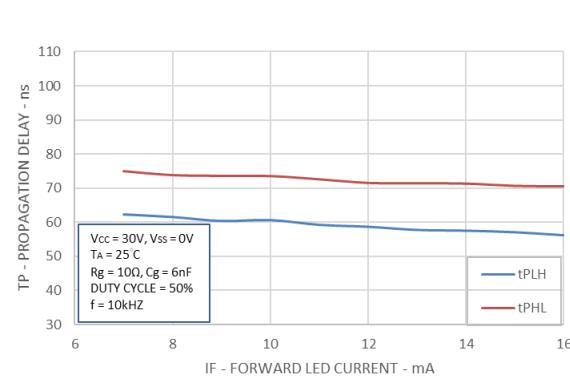
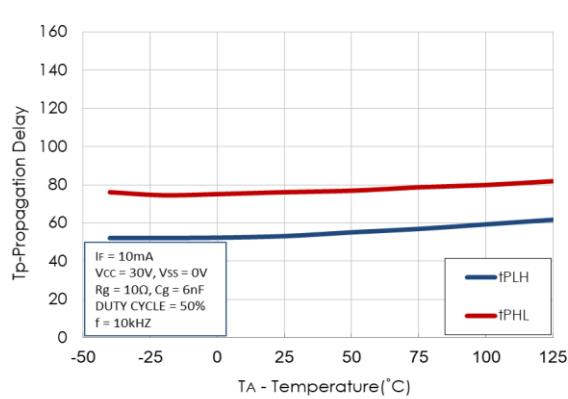
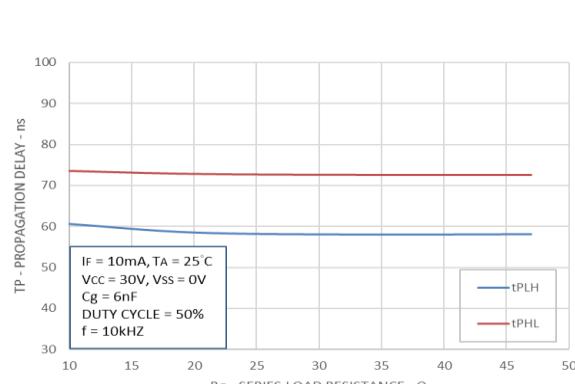
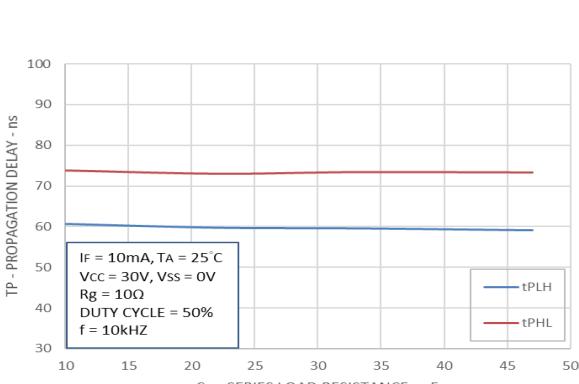
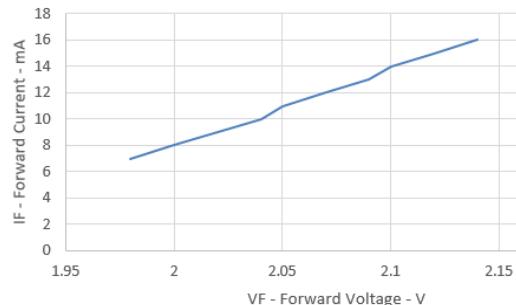


Fig.6 Iflh vs. Hysteresis

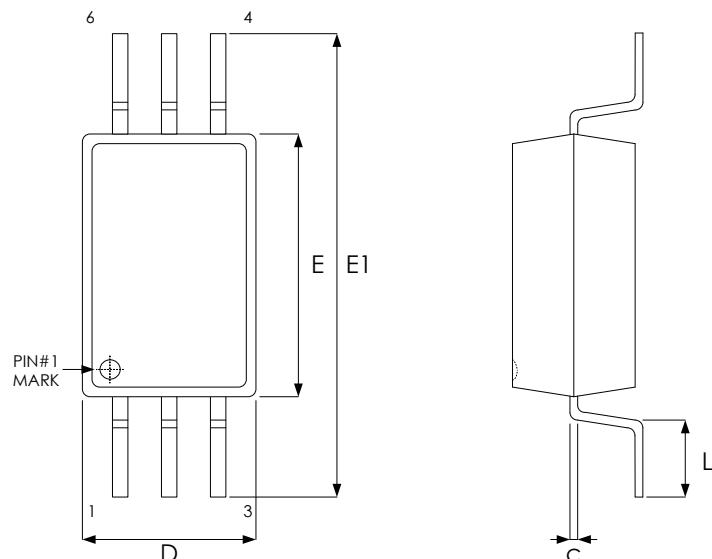
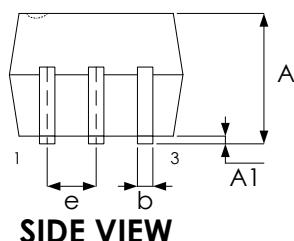


**Fig.7 IfH vs. Temperature****Fig.8 Propagation Delays vs. Vcc****Fig.9 Propagation Delays vs. If****Fig.10 Propagation Delays vs. Temperature****Fig.11 Propagation Delays vs. Rg****Fig.12 Propagation Delays vs. Cg**

**Fig.13 Input Current vs. Forward Voltage**

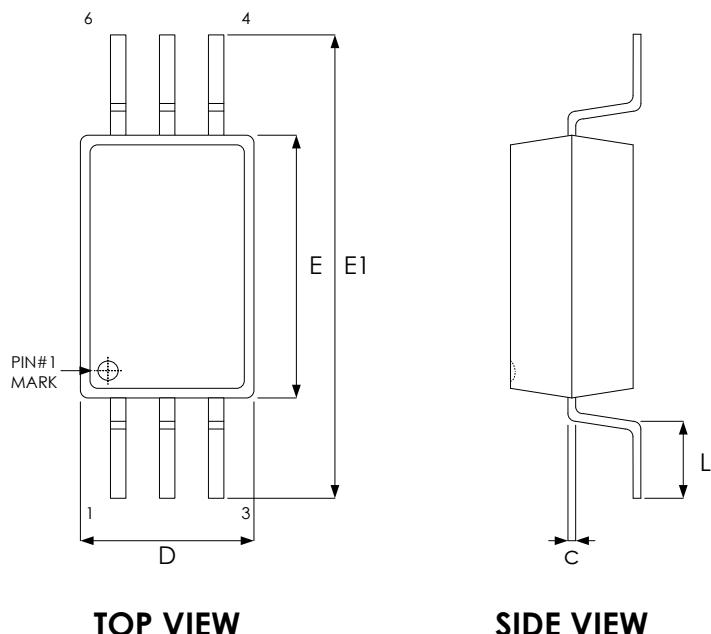
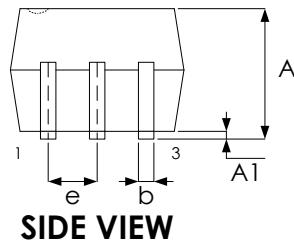


**Package Outline Drawing**  
**L-SOP 6L (277mil, 7mm clearance)**

**TOP VIEW****SIDE VIEW****SIDE VIEW**

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	9.40	10.00
e	1.27 BSC	
L	0.70	1.20

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

**TOP VIEW****SIDE VIEW****SIDE VIEW**

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	2021.12.15	Preliminary version
0.2	2022.04.12	Modify IOH and IOL value
0.3	2022.10.06	Update: Safety information Clearance information
0.4	2022.11.07	Update: Application & Safety information Marking information
0.5	2022.12.29	Update: Safety approved information
1.0	2023.11.02	Remove "preliminary" to V1.0 and update POD
1.1	2024.02.20	Update: Operating range, schematic (page1) Mark (page2) Truth table, Recommended Operation Condition (page3) UVLO Threshold (page5) Switching Specification (page6)

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