

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 $-40^{\circ}\text{C} \sim +110^{\circ}\text{C}$.

Applications

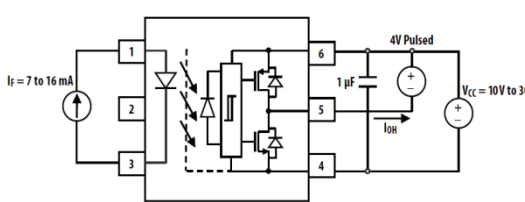

- IGBT/ MOSFET gate drive
- Photovoltaic (PV) power conditioning systems
- Industrial inverters
- AC Servos and DC brushless motor drivers
- Switching power supply
- Induction cook-top

Features

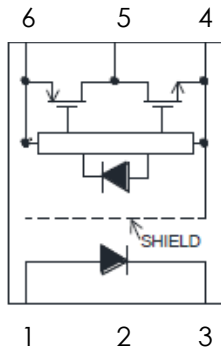
- 3.0 A maximum peak output current
- 2.5 A minimum peak output current
- Rail-to-rail output voltage
- 110 ns maximum propagation delay
- Under Voltage Lock Out protection (UVLO) with hysteresis
- Wide operating range: 10 to 30 Volts (VCC)
- Guaranteed performance over temperature $-40^{\circ}\text{C} \sim +110^{\circ}\text{C}$.

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
 $V_{IORM} = 891 V_{peak}$ for EMD2A341-SK
 $V_{IORM} = 1140 V_{peak}$ for EMD2A341-SL Certificate No. 40055846
- CQC approved: GB4943.1-2011 Certificate No. CQC22001358589

SCHEMATIC	PIN DEFINITION	PACKAGE
	<ol style="list-style-type: none"> 1. Anode 2. NC 3. Cathode 4. VSS 5. VO 6. VCC 	

Connection Diagram



Order Information

EMD2A341-00S###%FR1

EMD2A Photo coupler product series

341 Part Number

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		Tape & Reel 3Kpcs
	EMD2A341-00SK06NFR1 EMD2A341-00SL06NFR1		

Truth Table

LED	V _{CC} -V _{SS} (Turn-ON)	V _{CC} -V _{SS} (Turn-OFF)	V _o
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 0.1µF 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 (Note 3)	I _{OH} (PEAK)	-	3.0	A
"Low" Peak Output Current (Note 3)	I _{OL} (PEAK)	-	3.0	A
Output Voltage	V _O (PEAK)	-0.5	V _{CC}	V
Power Dissipation	P _I	-	45	mW
Output IC Power Dissipation	P _O	-	700	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)	5	16	mA
Input Voltage (OFF)	V _F (OFF)	-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
Input Characteristics						
Input Forward Voltage	VF	1.6	1.9	2.4	V	IF=10mA
Input Forward Voltage Temperature Coefficient	$\Delta\text{VF}/\Delta\text{T}$	-	-1.237	-	mV/°C	IF=10mA
Input Reverse Voltage	BVR	5	-	-	V	IR = 10 μ 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 MHz, VF = 0 V
Output Characteristics						
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	IF = 10mA, IO = -100mA
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	$V_O > 5\text{V}$, IF = 10 mA
	VUVLO-	5.9	6.8	7.5	V	$V_O < 5\text{V}$, IF = 10 mA

Note 5: Maximum pulse width = 10 μ 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 $T_A = 25^\circ\text{C}$ 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}	-	61.3	110	ns	Rg = 10 Ω , Cg = 25 nF, f = 10kHz, Duty Cycle = 50% IF = 10mA, VCC = 30V
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	-	kV/ μ s	IF= 7 to 16mA VCC= 30V, TA= 25 °C, VCM= 1kV
Common mode transient immunity at low level output (Note 8, 10)	CM _L	20	40	-	kV/ μ s	IF=0mA VCC= 30V, TA= 25 °C, VCM= 1kV

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 dV_{CM}/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 dV_{CM}/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 _{ISO}	EMD2A341-SK	5000	-	-	V	RH ≤ 40%-60%, t = 1min, T _A = 25 °C
		EMD2A341-SL					
Input-Output Resistance (Note 11)	R _{I-O}	-	-	10 ¹²	-	Ω	V _{I-O} = 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 & Test Circuits

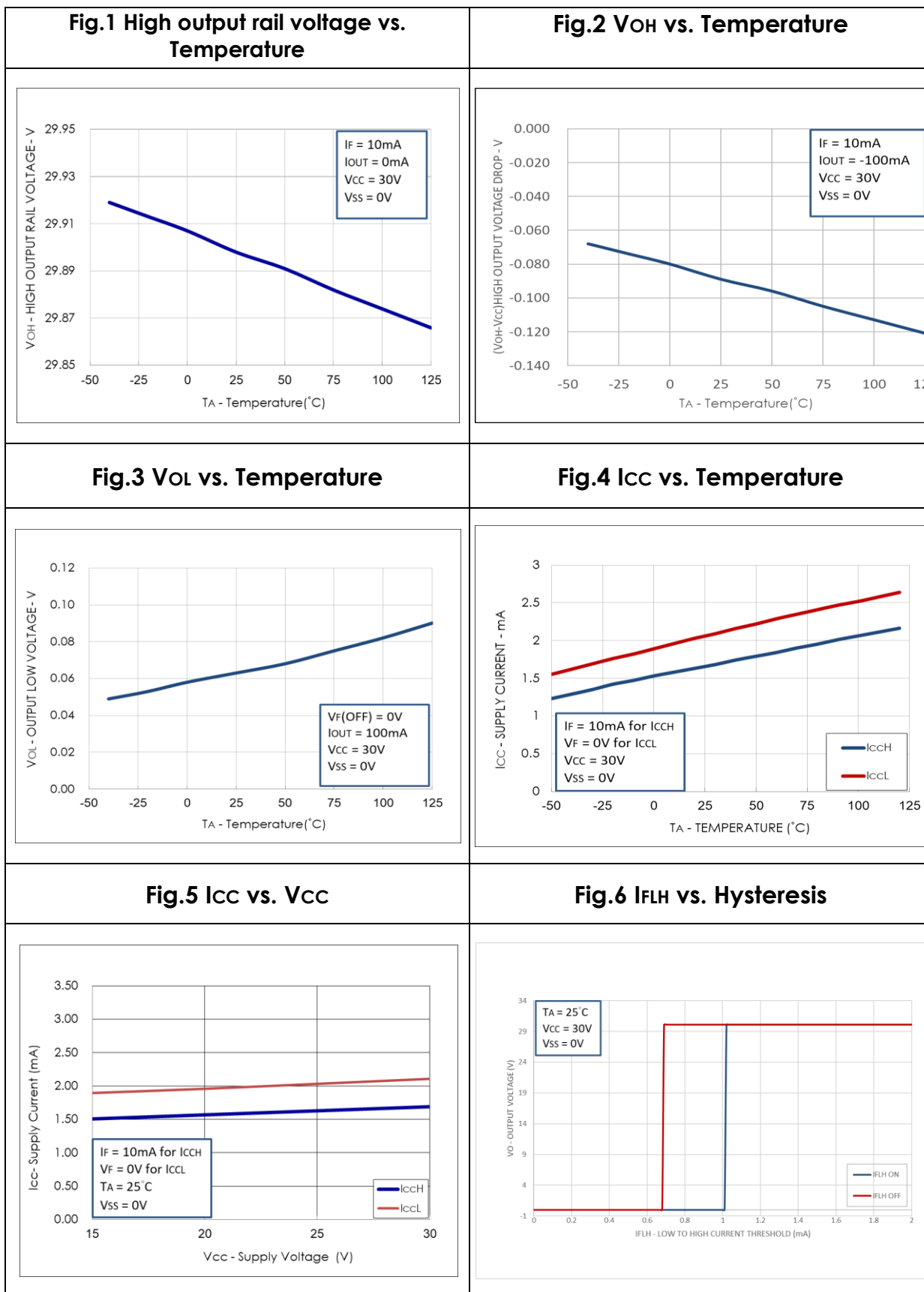


Fig.7 I_{FH} vs. Temperature

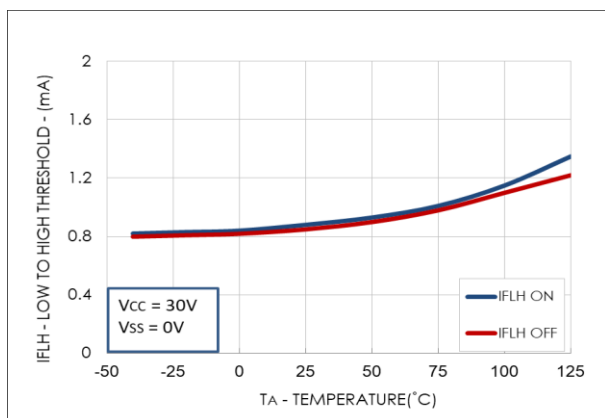


Fig.8 Propagation Delays vs. V_{cc}

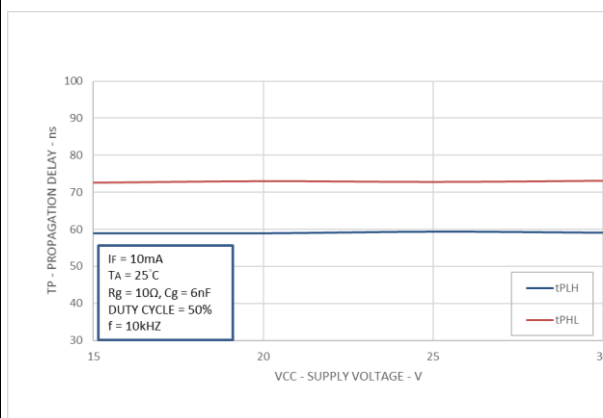


Fig.9 Propagation Delays vs. I_f

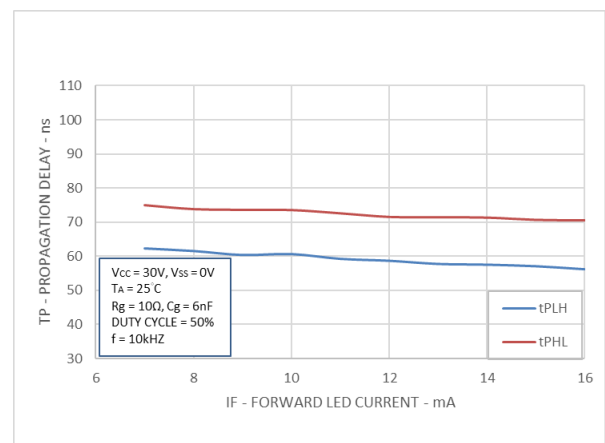


Fig.10 Propagation Delays vs. Temperature

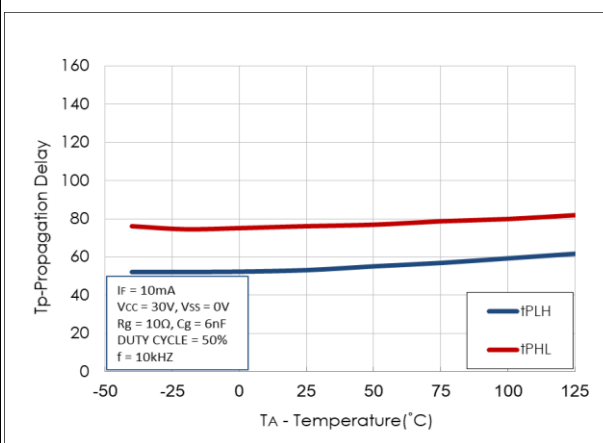


Fig.11 Propagation Delays vs. R_g

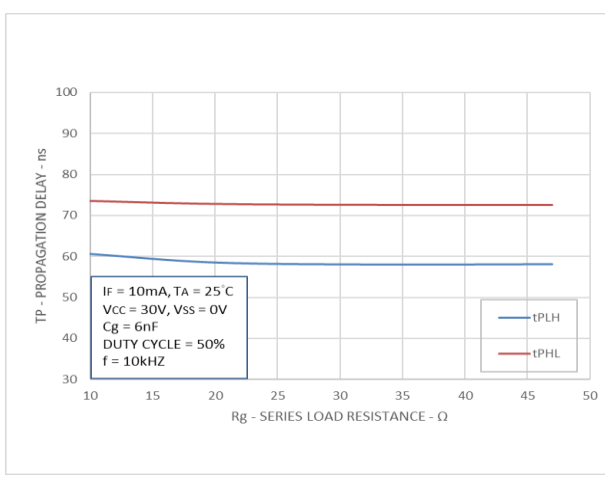


Fig.12 Propagation Delays vs. C_g

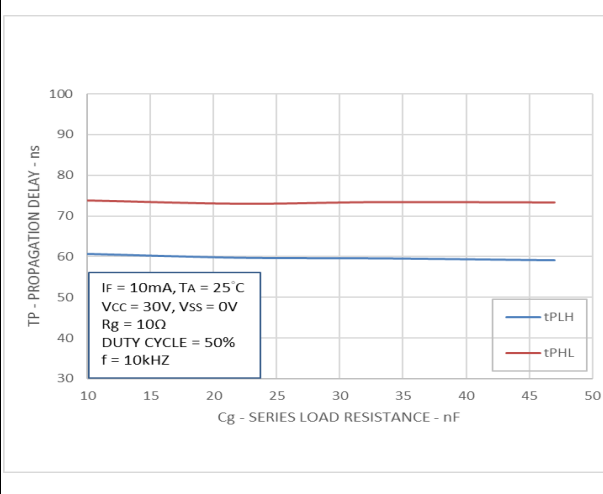
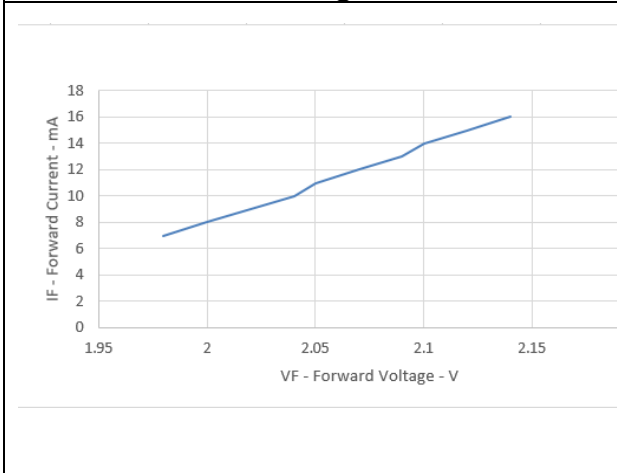
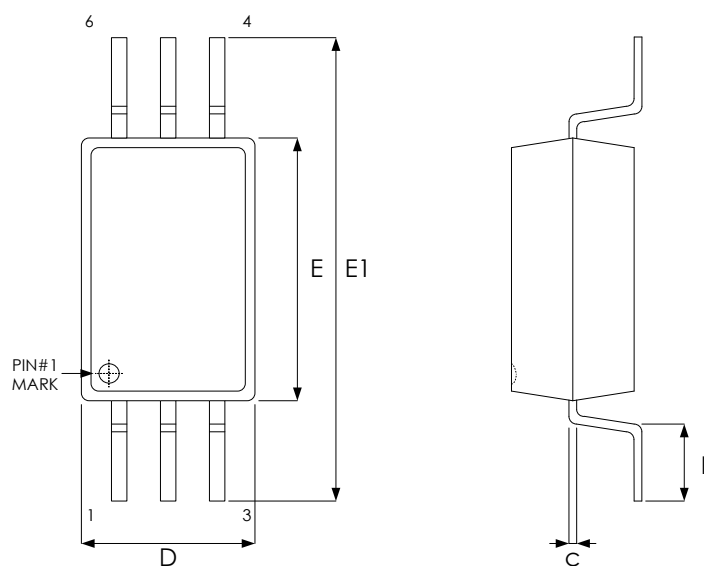


Fig.13 Input Current vs. Forward Voltage

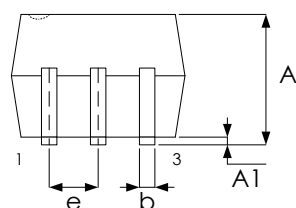


Package Outline Drawing L-SOP 6L (277mil, 7mm clearance)



TOP VIEW

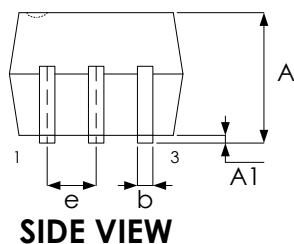
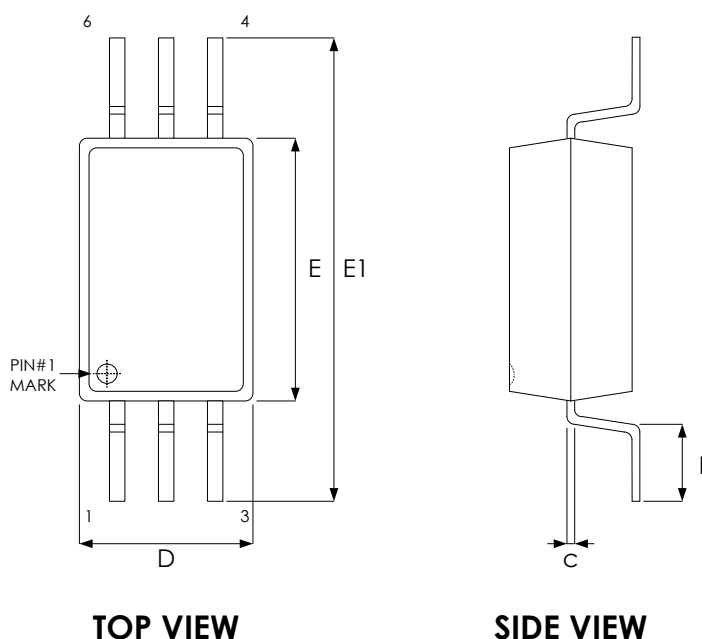
SIDE VIEW



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)



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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