1.5A Gate Drive Photocoupler

Product Description

The EMD2A314 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 1.5A peak output current is capable of directly driving most MOSFETs. For MOSFETs with higher ratings, the EMD2A314 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°C.

Applications

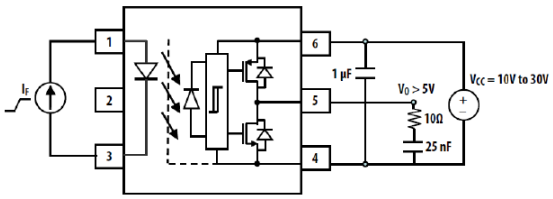
- IGBT/ MOSFET gate drive
- Photovoltaic (PV) power conditioning systems
- Industrial inverters
- AC Servos and DC brushless motor drivers
- Switching power supply
- Induction cook-top

Features

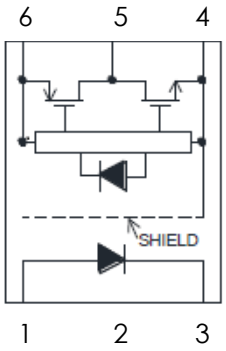
- 1.5 A maximum peak output current
- 0.8A minimum peak output current
- Rail-to-rail output voltage
- 110 ns maximum propagation delay
- Under Voltage Lock Out protection (UVLO) with hysteresis
- Wide operating range: 10 to 30 Volts (VCC)
- Guaranteed performance over temperature -40°C ~ +110°C.

Safety approved

- UL1577 recognized with 3750 Vrms for 1 minute for EMD2A314-SK and 5000 Vrms for 1 minute for EMD2A314-SL Certificate No. E529603
- IEC/EN/DIN EN 60747-5-5 Approved
  V_{IORM} = 891 Vpeak for EMD2A314-SK
  V_{IORM} = 1140 Vpeak for EMD2A314-SL
  Certificate No. 40055846
- CQC approved: GB4943.1-2011 Certificate No. CQC22001358589

SCHEMATIC	PIN DEFINITION	PACKAGE
	1.Anode 2.NC 3.Cathode 4.V_{SS} 5.VO 6.V_{CC}	

Connection Diagram



Order Information

EMD2A314-00S###%FR1

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	EMD2A314-00SK06EFR1 EMD2A314-00SL06EFR1	EYYWW 314 HV	E : ESMT YY : Date code (Year) WW : Date code (Week) 314 : Part Number H : Internal Tracking Code V : VDE Option	Tape & Reel 3Kpcs
	EMD2A314-00SK06NFR1 EMD2A314-00SL06NFR1	EYYWW 314 H		

Truth Table

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

Note 1: A 0.1μF bypass capacitor must be connected between Vcc and Vss.

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

Parameter	Symbol	Min	Max	Unit
Storage Temperature	Tstg	-55	125	°C
Operating Temperature	Topr	-40	110	°C
Output IC Junction Temperature	TJ	-	125	°C
Total Output Supply Voltage	(VCC –VSS)	0	35	V
Average Forward Input Current	IF	-	20	mA
Reverse Input Voltage	VR	-	5	V
"High" Peak Output Current (Note3)	IOH (PEAK)	0.8	1.5	A
"Low" Peak Output Current (Note3)	IOL (PEAK)	0.8	1.5	A
Output Voltage	VO (PEAK)	-0.5	Vcc	V
Power Dissipation	PI	-	45	mW
Output IC Power Dissipation	PO	-	250	mW
Lead Solder Temperature	Tsol	-	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)	$I_{F(ON)}$	7	16	mA
Input Voltage (OFF)	$V_{F(OFF)}$	-3.0	0.8	V

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

Description	Symbol	EMD2A314-SK	EMD2A314-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} x 1.875=V_{PR}, 100% Production Test With t_m=10sec, Partial discharge < 5pC	V_{PR}	1671	2137	V_{peak}
Input to Output Test Voltage, Method a (Note 4) V_{IORM} x 1.875=V_{PR}, 100% Production Test With t_m=10sec, Partial discharge < 5pC	V_{PR}	1426	1824	V_{peak}
Highest Allowable Overvoltage (Transient Overvoltage t_{ini} = 60sec)	V_{IOTM}	6000	8000	V_{peak}
Safety-limiting values – maximum values allowed in the event of a failure				
Case Temperature	Ts	175	175	℃
Input Current	$I_{S, INPUT}$	150	150	mA
Output Power	$P_{S, OUTPUT}$	600	600	mW
Insulation Resistance at TS, V_{IO} = 500 V	Rs	$>10^9$	$>10^9$	Ω

Note 4 : Refer to the optocoupler section of th 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
		314-SK	314-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°C and $V_{CC} – V_{SS}$ = 30 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	ΔVF/ ΔT	-	-1.237	-	mV/°C	IF=10mA
Input Reverse Voltage	BVR	5	-	-	V	IR = 10μA
Input Threshold Current (Low to High)	IFLH	-	0.6	2	mA	V_O> 5V, I_O = 0A
Input Threshold Voltage (High to Low)	VFHL	0.8	-	-	V	VCC = 30 V, VO< 5V
Input Capacitance	CIN	-	60	-	pF	f = 1 MHz, VF = 0 V
Output Characteristics						
High Level Supply Current	ICCH	-	1.55	3	mA	I_F = 10 mA, V_{CC} = 30 V, V_O = Open, Rg = 30Ω, Cg = 3 nF
Low Level Supply Current	ICCL	-	1.92	3	mA	I_F = 0 mA, V_{CC} = 30 V, V_O = Open, Rg = 30Ω, Cg = 3 nF
High level output current (Note 5)	IOH	0.8	-	-	A	I_F = 10 mA, VCC = 30V VO = VCC – 4V
Low level output current (Note 5)	IOL	0.8	-	-	A	I_F = 0 mA, VCC = 30V VO = VSS + 4V
High level output voltage (Note 6, 7)	VOH	29.4	29.69	-	V	IF = 10mA, IO = -100mA
Low level output voltage	VOL	-	0.17	0.4	V	I_F = 0 mA, IO = 100 mA
UVLO Threshold	VUVLO+	6.9	7.8	8.7	V	VO> 5V, IF = 10 mA
	VUVLO-	5.9	6.9	7.5	V	VO< 5V, IF = 10 mA

Note 5: Maximum pulse width = 10 μs.

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_{CC} – V_{SS} = 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}	-	54	110	ns	Rg = 30Ω, Cg = 3 nF, f = 10kHz, Duty Cycle = 50% IF = 10mA, VCC = 30V
Propagation Delay Time toLow Output Level	t_{PHL}	-	69	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	-	10	-		
Output Fall Time (90 to 10%)	t_f	-	10	-		
Common mode transient immunity at high level output (Note 8, 9)	$\|CM_H\|$	20	40	-	kV/μs	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/μs	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 dVCM/dt of the common mode pulse, VCM, to assure that the output will remain in the high state (meaning VO > 10.0V).

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°C and V_{CC} – V_{SS}= 30 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 11, 12)	V_{ISO}	EMD2A314-SK	5000	-	-	V	RH ≤ 40%-60%, t = 1min, T_A = 25 °C
		EMD2A314-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.1 High output rail voltage vs. Temperature

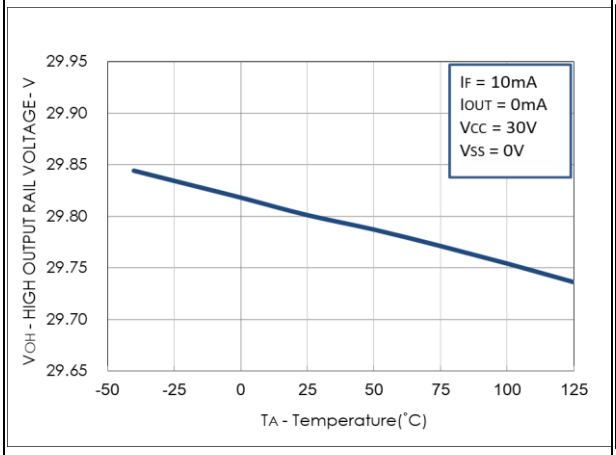


Fig.2 VOH vs. Temperature

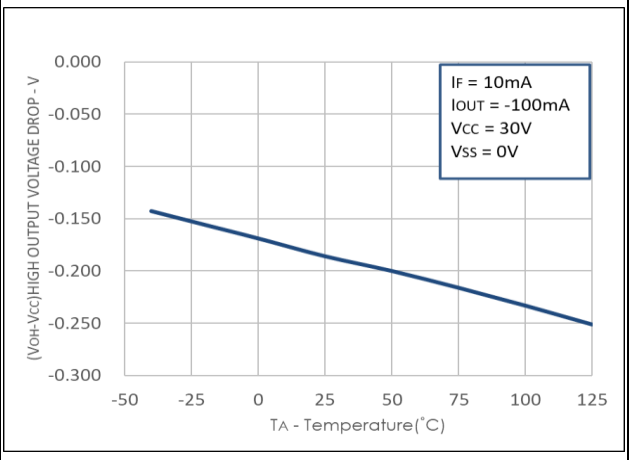


Fig.3 VOL vs. Temperature

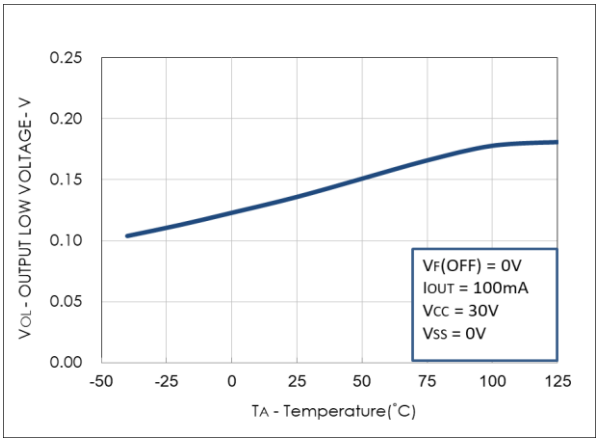


Fig.4 ICC vs. Temperature

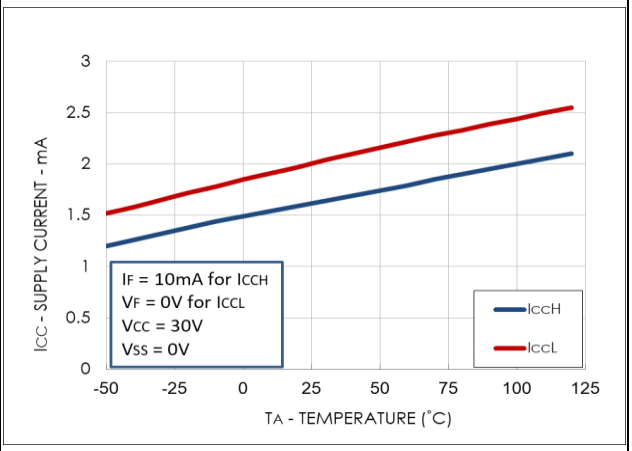


Fig.5 ICC vs. VCC

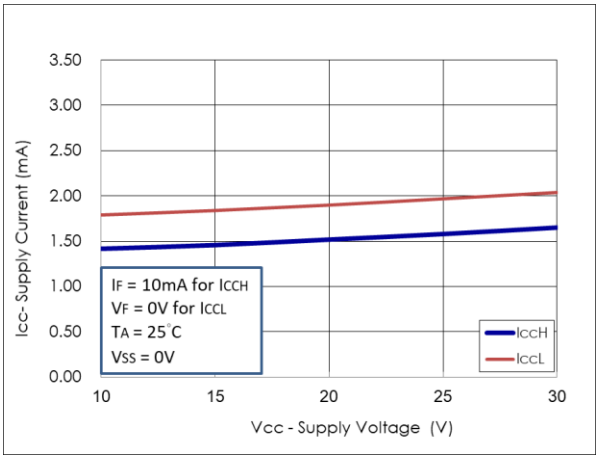


Fig.6 IFLH vs. Hysteresis

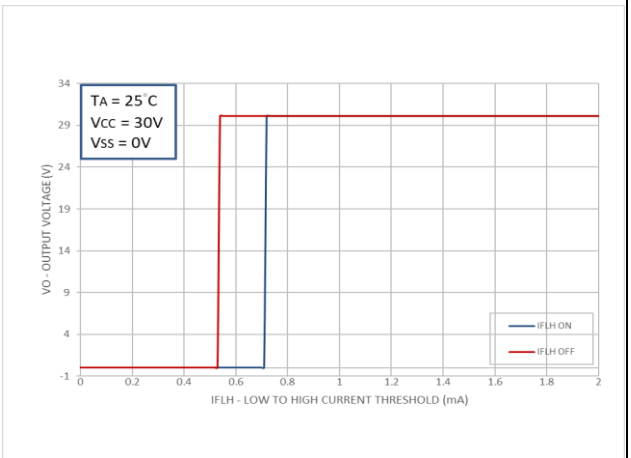


Fig.7 I_{FH} vs. Temperature

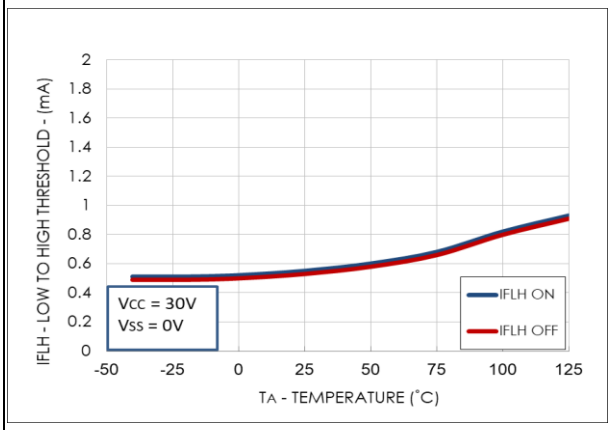


Fig.8 Propagation Delays vs. V_{CC}

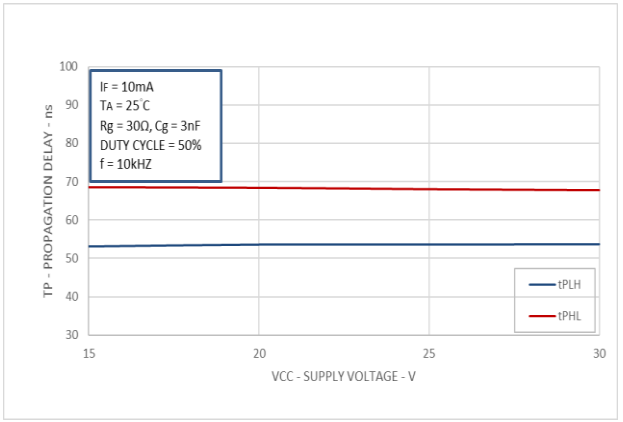


Fig.9 Propagation Delays vs. I_F

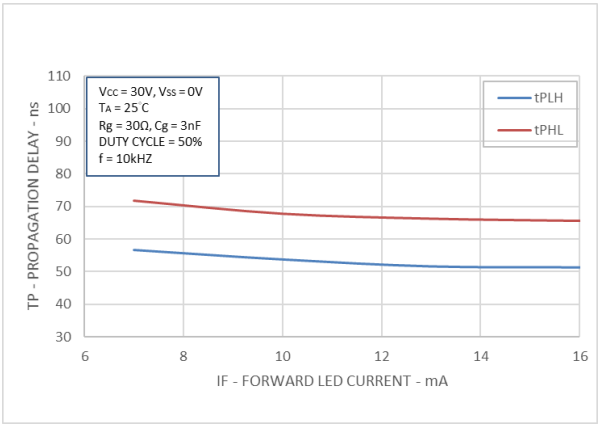


Fig.10 Propagation Delays vs. Temperature

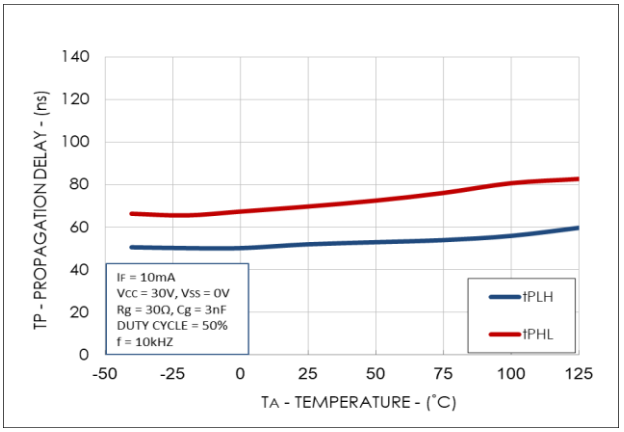


Fig.11 Propagation Delays vs. Rg

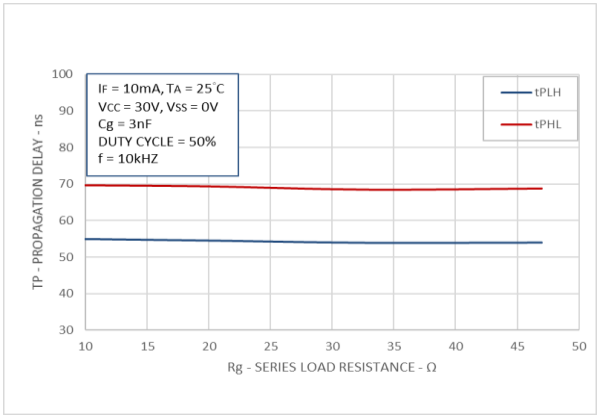
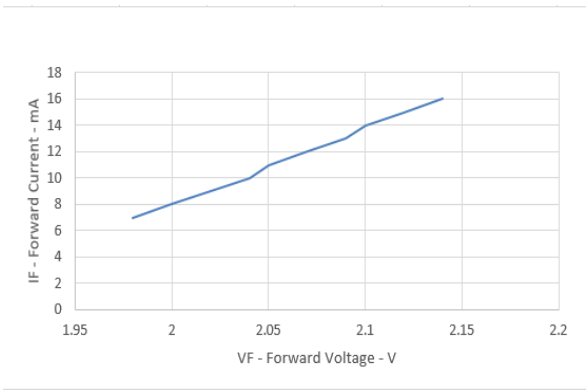
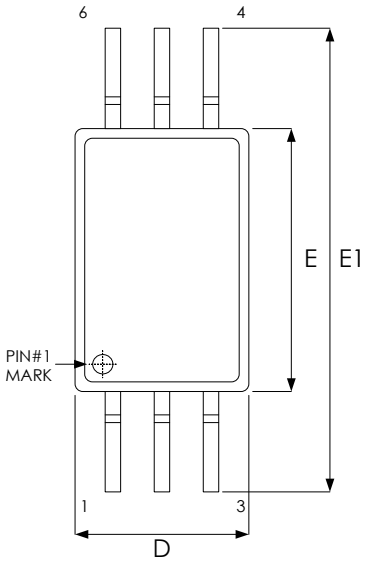


Fig.12 Propagation Delays vs. Cg

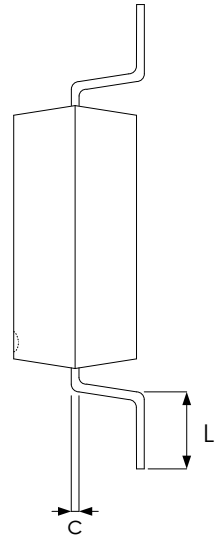
Fig.13 Input Current vs. Forward Voltage



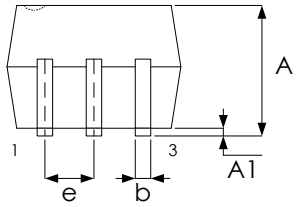
Package Outline Drawing
L-SOP 6L (277mil, 7mm clearance)



TOP VIEW



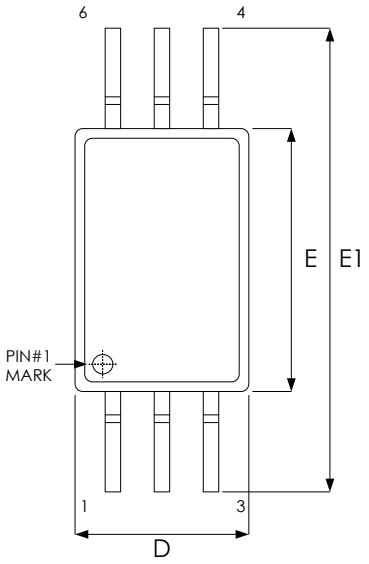
SIDE VIEW



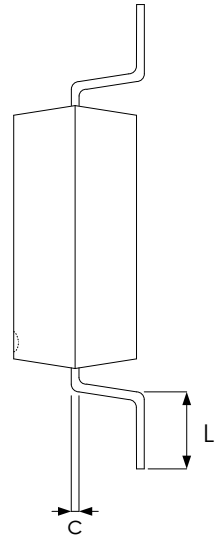
SIDE VIEW

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



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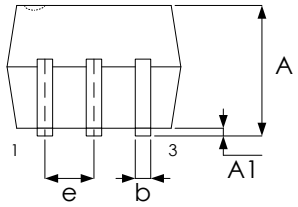

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E1	11.20	11.80
e	1.27 BSC	
L	0.50	1.00

Revision History

Revision	Date	Description
0.1	2021.12.15	Preliminary version
0.2	2022.10.06	Update: Safety information Clearance information Peak current
0.3	2022.11.04	Update: Application & Safety information Marking information
1.0	2023.11.02	Remove "preliminary" to V1.0 and update POD

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