High Speed 10M bit/s Photocoupler

Product Description

The EMD2A611 is an optically coupled gate that combines a light emitting diode and an integrated high gain photo detector. The output of the detector IC is an open collector Schottky clamped transistor.
The internal shield provides a guaranteed common mode transient immunity specification of 10,000 V/μs for the EMD2A611.

This unique design provides maximum AC and DC circuit isolation while achieving TTL compatibility. The optocoupler AC and DC operational parameters are guaranteed from –40°C to +110°C, allowing trouble-free system performance.

The EMD2A611 is suitable for high-speed logic interfacing, input/output buffering, as line receivers in environments that conventional line receivers cannot tolerate and are recommended for use in extremely high ground or induced noise environments.

Features

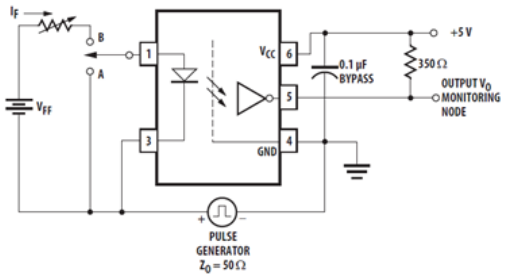
- 10 kV/μs minimum Common Mode Rejection (CMR) at VCM = 1000V
- High speed: 10M bit/s typical
- VCC range: 4.5~5.5V
- LSTTL/TTL compatible
- Inverter logic type
- Low input current capability: 5 mA
- Guaranteed ac and dc performance over -40°C ~ +110°C.

Applications

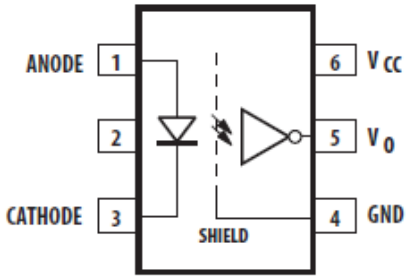
- Isolated line receiver
- Computer-peripheral interfaces
- Microprocessor system interfaces
- Digital isolation for A/D, D/A conversion
- Switching power supply
- Instrument input/output isolation
- Ground loop elimination
- Pulse transformer replacement
- Power transistor isolation in motor drives
- Isolation of high speed logic systems

Safety approved

- UL1577 recognized with 3750 Vrms for 1 minute for EMD2A611-SK and 5000 Vrms for 1 minute for EMD2A611-SL
  Certificate No. E529603
- IEC/EN/DIN EN 60747-5-5 Approved
  V_{IORM} = 891 Vpeak for EMD2A611-SK
  V_{IORM} = 1140 Vpeak for EMD2A611-SL
  Certificate No. 40055846
- CQC approved: GB4943.1-2011
  Certificate No. CQC22001358589

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

Connection Diagram



Order Information

EMD2A611-00S###%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	EMD2A611-00SK06EFR1 EMD2A611-00SL06EFR1	EYYWW 611 HV	E : ESMT YY : Date code (Year) WW : Date code (Week) 611 : Part Number H : Internal Tracking Code V : VDE Option	Tape & Reel 3Kpcs
	EMD2A611-00SK06NFR1 EMD2A611-00SL06NFR1	EYYWW 611 H		

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
Average Forward Input Current(Note 1)	IF	-	20	mA
Reverse Input Voltage	VR	-	5	V
Input Power Dissipation	PI	-	45	mW
Supply Voltage	VCC	-	7	V
Output Collector Current	IO		50	mA
Output Collector Voltage	VO		7	V
Output Collector Power Dissipation	PI	-	85	mW
Lead Solder Temperature	Tsol	-	260	°C

Note 1: Peaking circuits may produce transient input currents up to 50 mA, 50-ns maximum pulse width, provided average current does not exceed 20 mA

Recommended Operation Condition

Parameter	Symbol	Min	Max	Unit
Operating Temperature	TA	-40	110	°C
Supply Voltage	VCC	4.5	5.5	V
Input Current High Level	IFLH	5	15	mA
Input Voltage Low Level	VFHL	-3.0	0.8	V
Fan Out (at RL = 1 KΩ)	N		5	TTL Loads
Output Pull-up Resistor	RL	330	4K	Ω

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

Description	Symbol	EMD2A611-SK	EMD2A611-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 b (Note 2) V_{IORM} x 1.875=V_{PR}, 100% Production Test With t_m=1sec, Partial discharge < 5pC	V_{PR}	1671	2137	V_{peak}
Input to Output Test Voltage, Method a (Note 2) V_{IORM} x 1.6=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	Is, INPUT	150	150	mA
Output Power	Ps, OUTPUT	600	600	mW
Insulation Resistance at TS, V_{IO} = 500 V	Rs	$>10^9$	$>10^9$	Ω

Note 2 : 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
		611-SK	611-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 (DC)

All Typical values at T_A = 25°C and V_{CC} = 5 V, unless otherwise specified; all minimum and maximum specifications are at recommended operating condition.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition
High Level Output Current	IOH	-	0.35	100	µA	VCC = 5.5V, VO = 5.5V, VF = 0.8V
Input Threshold Current	ITH	-	1.0	5.0	mA	VCC = 5.5V, VO = 0.6V, IOL > 13 mA
Low Level Output Voltage	VOL	-	0.25	0.6	V	VCC = 5.5V, IF = 5 mA, IOL(Sinking) = 13 mA
High Level Supply Current	ICCH	-	5.6	7.5	mA	VCC = 5.5V, IF = 0 mA,
Low Level Supply Current	ICCL	-	5.2	10.5	mA	VCC = 5.5V, IF = 10 mA
Input Forward Voltage	VF	1.6	2.0	2.4	V	IF = 10 mA
Input Reverse Breakdown Voltage	BVR	5	-	-	V	IR = 10 µA
Input Capacitance	CIN	-	60	-	pF	f = 1 MHz, VF = 0V

Switching Specification (AC)

All Typical values at TA = 25°C and V_{CC} = 5 V, IF = 7.5mA, unless otherwise specified; all minimum and maximum specifications are at recommended operating condition.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition
Propagation Delay Time to High Output Level	tPLH	-	60	75	ns	VCC = 5V, IF = 7.5 mA, RL = 350Ω, CL = 15 pF
Propagation Delay Time to Low Output Level	tPHL	-	35	75		
Pulse Width Distortion	| tPHL-tPLH |	-	25	40		
Propagation Delay Skew	tPSK	-	-	50		
Output Rise Time (10 to 90%)	tr	-	30	-		
Output Fall Time (90 to 10%)	tf	-	3	-		
Common mode transient immunity at high level output (Note 3)	| CMH |	10	15	-	kV/µs	VCC = 5V, IF = 0 mA, VO(MIN) = 2V,RL = 350Ω, VCM = 1000V
Common mode transient immunity at low level output (Note 4)	| CML |	10	15	-	kV/µs	VCC = 5V, IF = 7.5 mA, VO(MAX) = 0.8V,RL = 350Ω, VCM = 1000V

Note 3 : CMH is the maximum tolerable rate of rise of the common mode voltage to assure that the output will remain in a high logic state (that is, VOUT > 2.0V).
Note 4 : CML is the maximum tolerable rate of fall of the common mode voltage to assure that the output will remain in a low logic state (that is, VOUT > 0.8V).

Isolation characteristic

All Typical values at T_A = 25°C and V_{CC} = 5 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 5, 6)	V_{ISO}	EMD2A611-SK EMD2A611-SL	5000	-	-	V	RH ≤ 40%-60%, t = 1min, T_A = 25 °C
Input-Output Resistance (Note 5)	R_{I-O}	-	-	10^{12}	-	Ω	V_{I-O} = 500V DC

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

Note 6: 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 Level Output Current vs. Temp

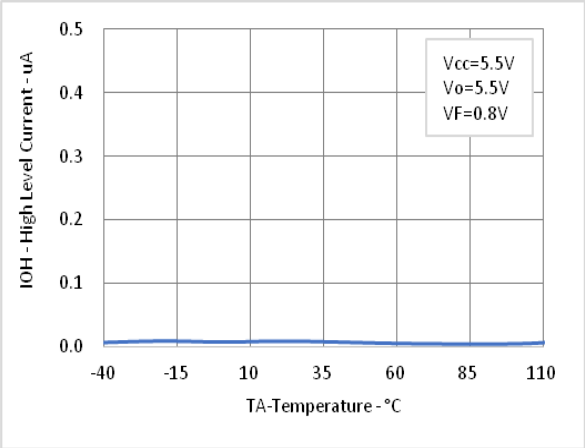


Fig.2 Low Level Output Voltage vs. Temp

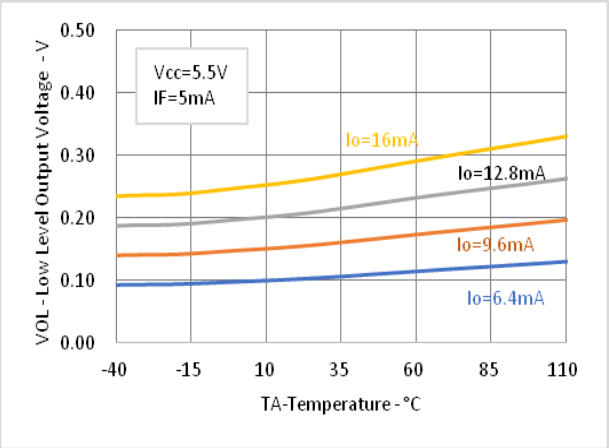


Fig.3 Input Diode Forward Characteristic

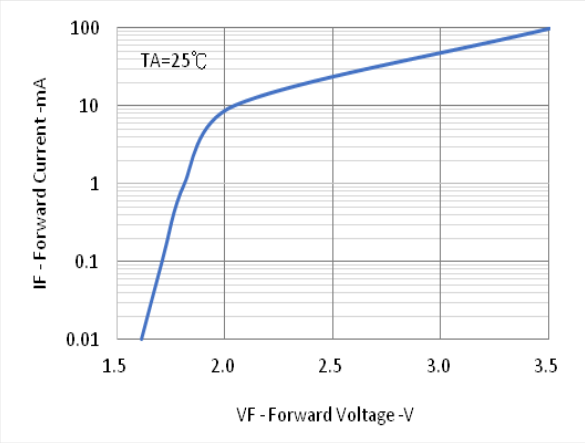


Fig.4 Output Voltage vs. Input Current

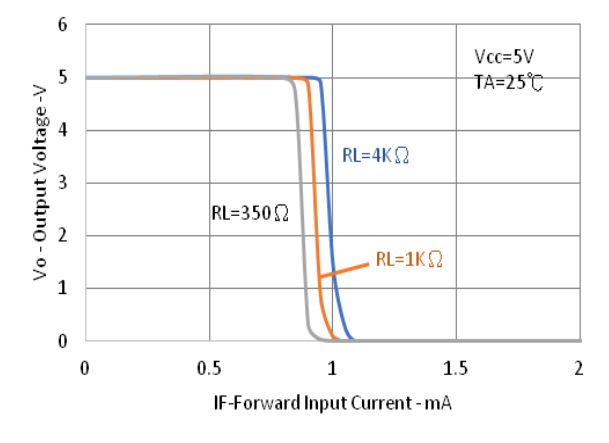


Fig.5 Low Level Output Current vs. Temp

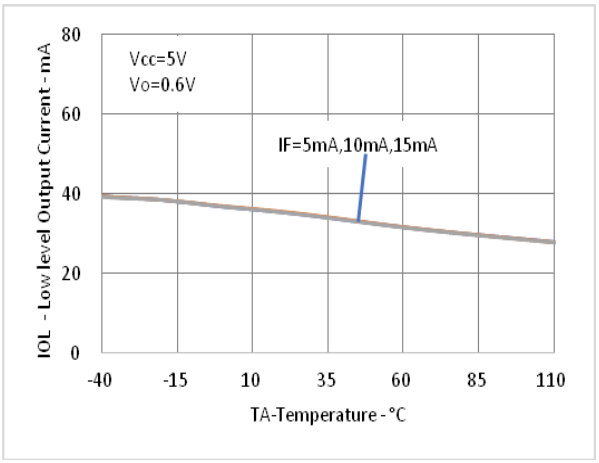


Fig.6 Propagation Delay vs. Temperature

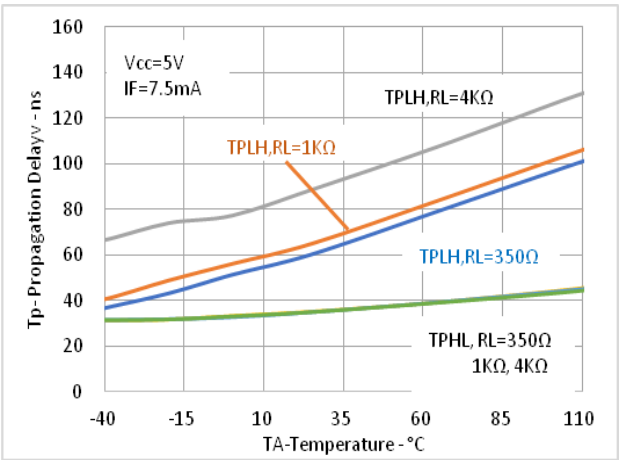


Fig.7 Propagation Delay vs. Input Current

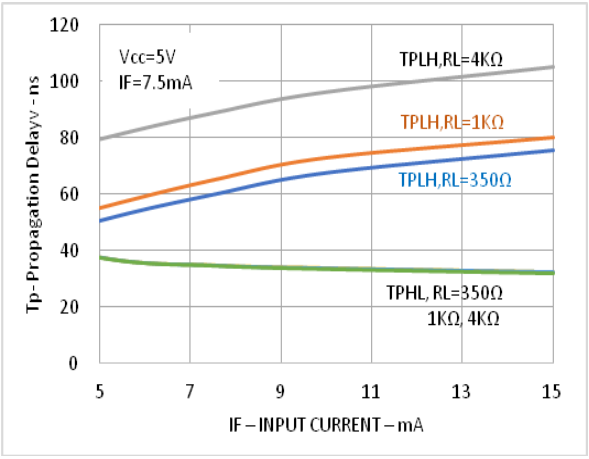


Fig.8 Pulse Width Distortion vs. Temperature

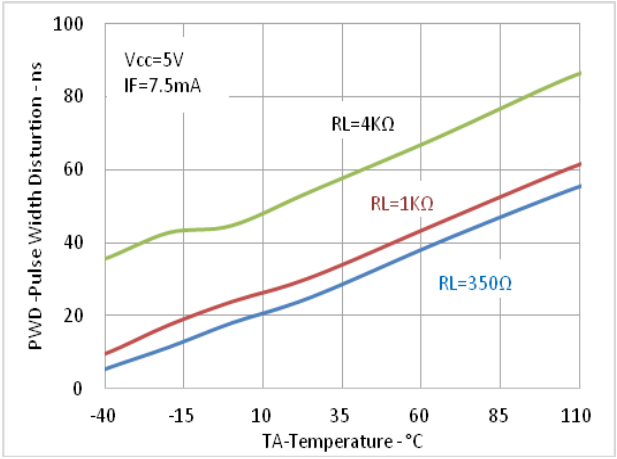


Fig.9 Rise and Fall Time vs. Temperature

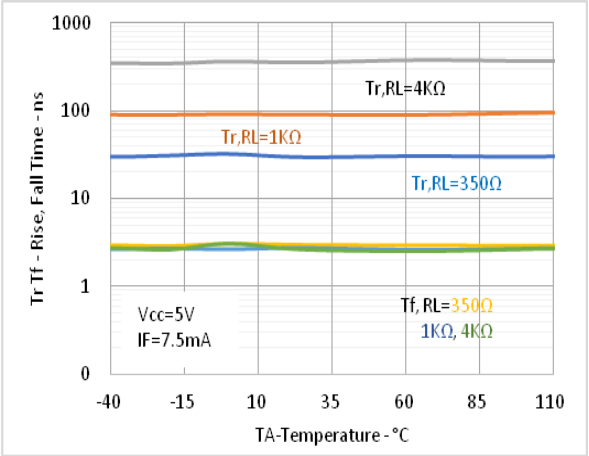
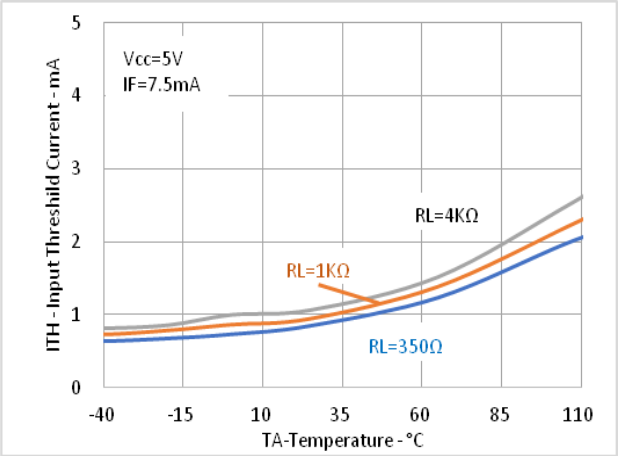
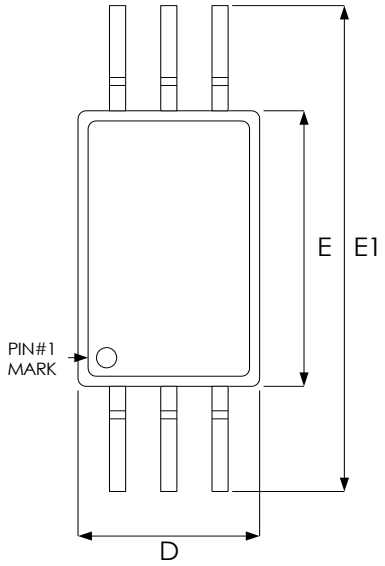


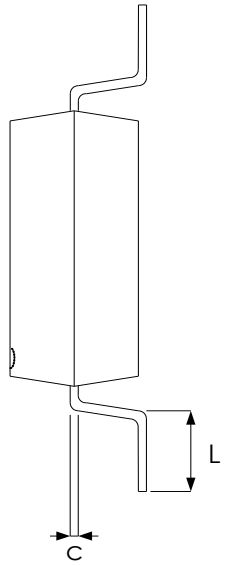
Fig.10 Input Threshold Current vs. Temp



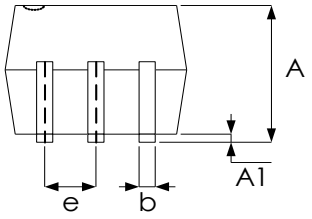
Package Outline Drawing
L-SOP 6L (277mil, 7mm clearance)



TOP VIEW



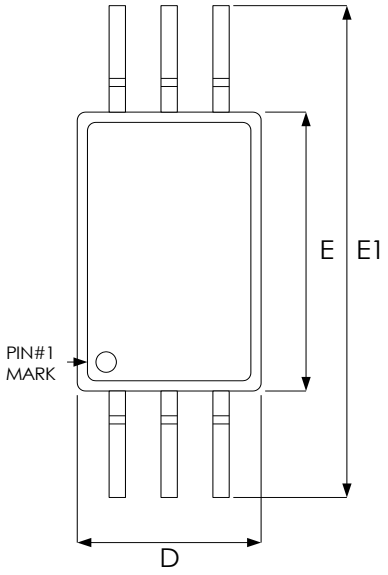
SIDE VIEW



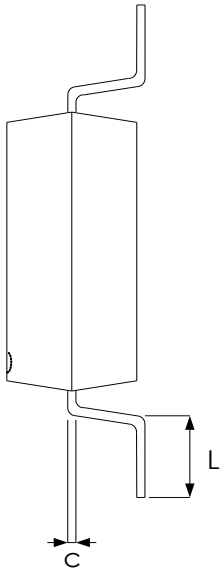
BOTTOM VIEW

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	6.50	7.10
E1	9.40	10.00
e	1.27 BSC	
L	0.70	1.20

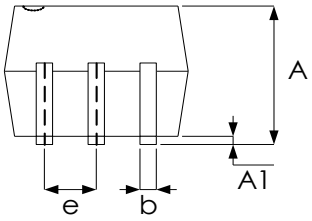
Package Outline Drawing
L-SOP 6L (277mil, 8mm clearance)



TOP VIEW



SIDE VIEW



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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	2023.02.03	Preliminary version
0.2	2023.06.01	Update: 1. High Speed Information (page1) 2. Insulation Characteristics (page4)

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