IPM and Gate Drive Interface Photo Coupler

Product Description

The EMD2A456 contain a LED optically coupled to an integrated high-gain photo detector. Minimized propagation delay difference between devices make these optocouplers excellent solutions for improving inverter efficiency through reduced switching dead time. Specifications and performance plots are given for typical IPM applications.

Applications

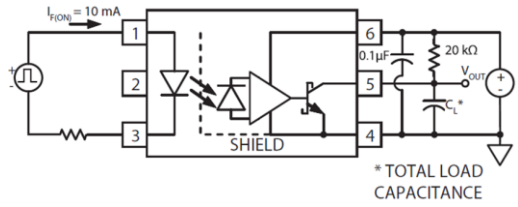
- IPM Isolation
- Isolated IGBT/MOSFET Gate Drive
- AC and Brushless DC Motor Drives
- Industrial Inverters

Features

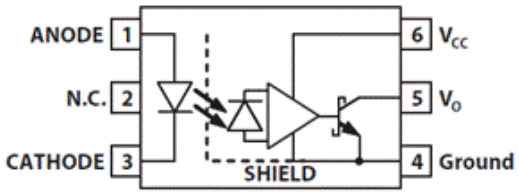
- Performance Specified for Common IPM Applications Over Industrial Temperature Range
- Short Maximum Propagation Delays
- Minimized Pulse Width Distortion (PWD)
- Very High Common Mode Rejection (CMR)
- High CTR
- Available in Stretched SO-6 Package with 8 mm creepage and clearance

Safety approved

- UL1577 recognized with 3750 Vrms for 1 minute for EMD2A456-SK and 5000 Vrms for 1 minute for EMD2A456-SL
  Certificate No. E529603
- IEC/EN/DIN EN 60747-5-5 Approved
  V_{IORM} = 891 Vpeak for EMD2A456-SK
  V_{IORM} = 1140 Vpeak for EMD2A456-SL
  Certificate No. 40055846
- CQC approved: GB4943.1-2011
  Certificate No. CQC22001358589

SCHEMATIC	PIN DEFINITION	PACKAGE
	1.ANODE 2.N.C. 3.CATHODE 4.Ground 5.VO 6.V_{CC}	

Connection Diagram



Order Information

EMD2A456-00S###%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	EMD2A456-00SK06EFR1 EMD2A456-00SL06EFR1	EYYWW 456 HV	E : ESMT YY : Date code (Year) WW : Date code (Week) 456 : Part Number H : Internal Tracking Code V : VDE Option	Tape & Reel 3Kpcs
	EMD2A456-00SK06NFR1 EMD2A456-00SL06NFR1	EYYWW 456 H		

Truth Table (Positive Logic)

LED	VO
ON	Low
OFF	High

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

Parameter	SYMBOL	Min	Max	UNIT
Storage Temperature	Ts	-55	125	°C
Operating Temperature	TA	-40	110	°C
Average Forward Input Current	IF(AVG)	-	20	mA
Reverse Input Voltage	VR	5		V
Average Output Current	IO(AVG)	-	25	mA
Output Voltage	VO	-0.5	30	V
Supply Voltage	VCC	-0.5	30	V
Output Power Dissipation	PO		150	mW
Total Power Dissipation	PT		210	mW
Lead Solder Temperature	Tsol	-	260	°C

Note: 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

Recommended Operation Condition

Parameter	Symbol	Min	Max	Unit
Operating Temperature	T_A	-40	110	°C
Supply Voltage	V_{CC}	4.5	30	V
Output Voltage	V_O	0	30	V
Input Current (ON)	$I_{F(ON)}$	5	15	mA
Input Voltage (OFF)	$V_{F(OFF)}$	-3.0	0.8	V

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

Description	Symbol	EMD2A456-SK	EMD2A456-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=1sec, Partial discharge < 5pC	V_{PR}	1671	2137	V_{peak}
Input to Output Test Voltage, Method a (Note 4) 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	$I_{S, INPUT}$	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
		456-SK	456-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 Optical Characteristics (Ta = 25°C unless otherwise specified)

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Current Transfer Ratio	CTR	44	200		%	IF = 10 mA, VO = 0.6V
Low Level Output Current	IOL	4.4	20		mA	IF = 10 mA, VO = 0.6V
Low Level Output Voltage	VOL		0.05	0.6	V	IO = 2.4 mA
Input Threshold Current	ITH		0.15	5.0	mA	VO = 0.8V, IO = 0.75 mA
High Level Output Current	IOH		0.1	50	µA	VF = 0.8V
High Level Supply Current	ICCH		0.8	1.3	mA	VF = 0.8V, VO = Open
Low Level Supply Current	ICCL		0.85	1.3	mA	IF = 10 mA, VO = Open
Input Forward Voltage	VF		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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition
Propagation Delay Time to Low Output Level	t_{PHL}	-	140	400	ns	IF(ON) = 10 mA, VF(OFF) = 0.8V, VCC = 15.0V, VTHLH = 2.0V, VTHHL = 1.5V
Propagation Delay Time to High Output Level	t_{PLH}	-	490	600		
Pulse Width Distortion	PWD	-	350	500		
Propagation Delay Difference Between Any Two Parts	$t_{PLH} – t_{PHL}$	-200	-	+500		
Common mode transient immunity at high level output	$\|CM_H\|$	15	30	-	kV/µs	VCC = 15.0V, CL = 100 pF, VCM = 1500 V
Common mode transient immunity at low level output	$\|CM_L\|$	15	30	-	kV/µs	

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.

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}	EMD2A456-SK	5000	-	-	V	RH ≤ 40%-60%, t = 1min, T_A = 25 °C
		EMD2A456-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 Typical Transfer Characteristics

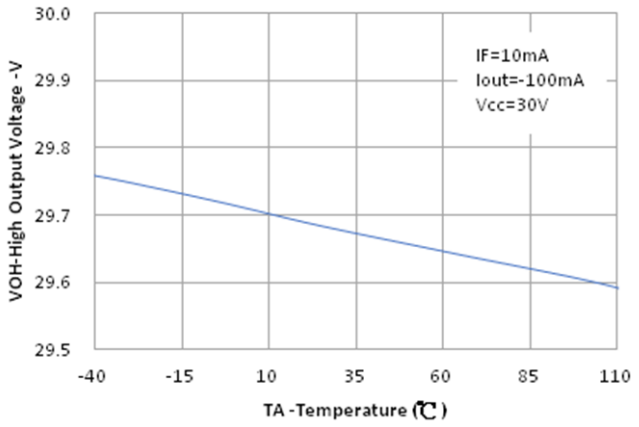


Fig.2 Normalized Output Current vs. Temperature

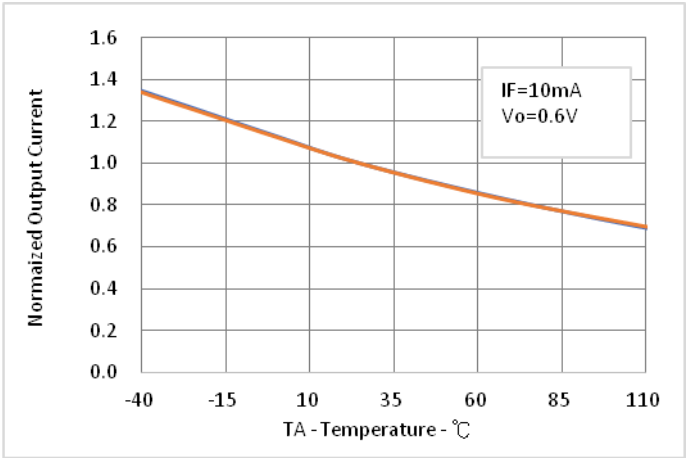


Fig.3 High Level Output Current vs. Temperature

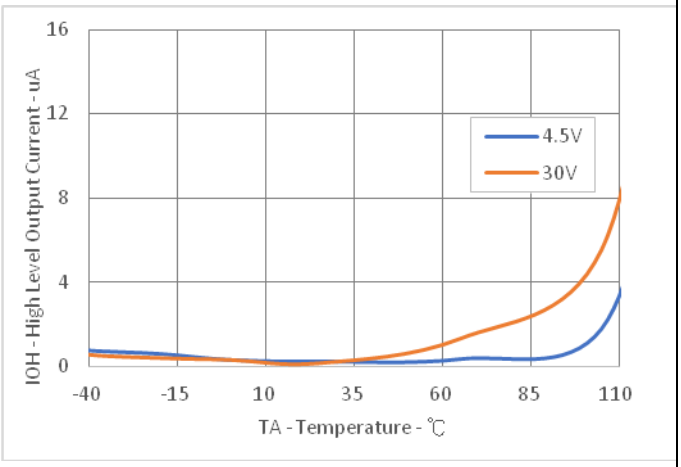


Fig.4 Input Current vs. Forward Voltage

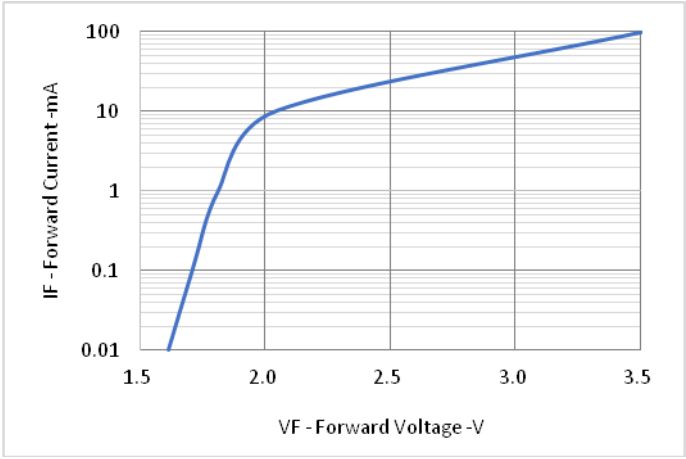


Fig.5 Propagation Delay with RL vs. Temp.

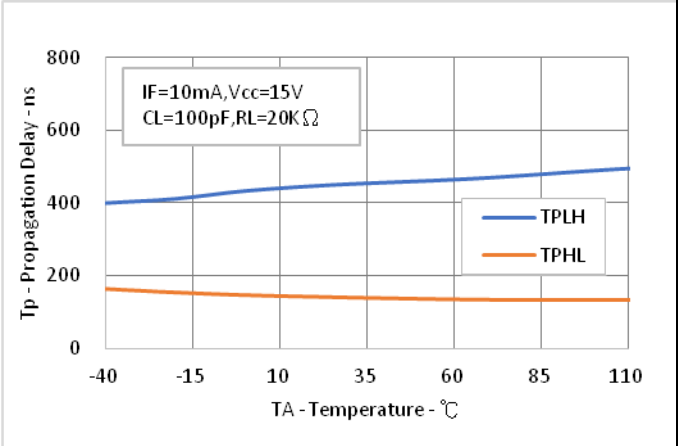


Fig.6 Propagation Delay vs. Load Resistance

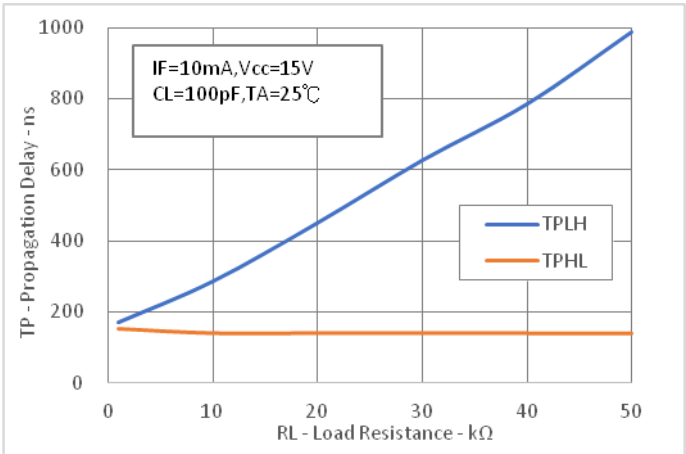


Fig.7 Propagation Delay vs. Load Capacitance

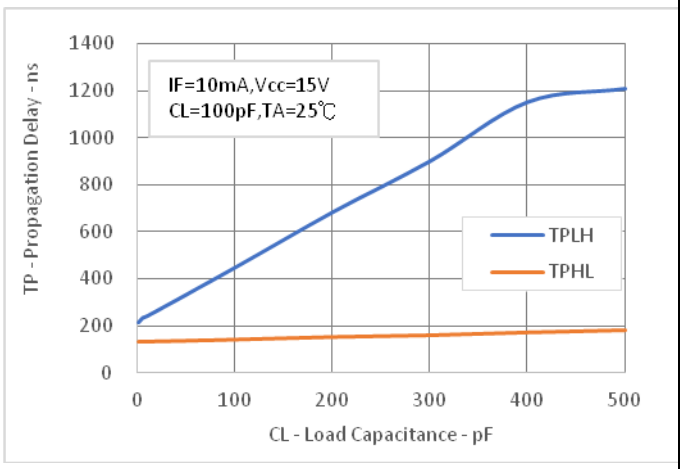


Fig.8 Propagation Delay vs. Supply Voltage

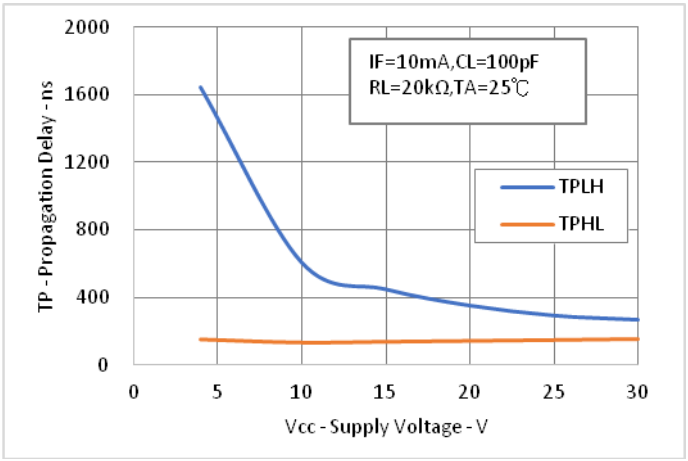
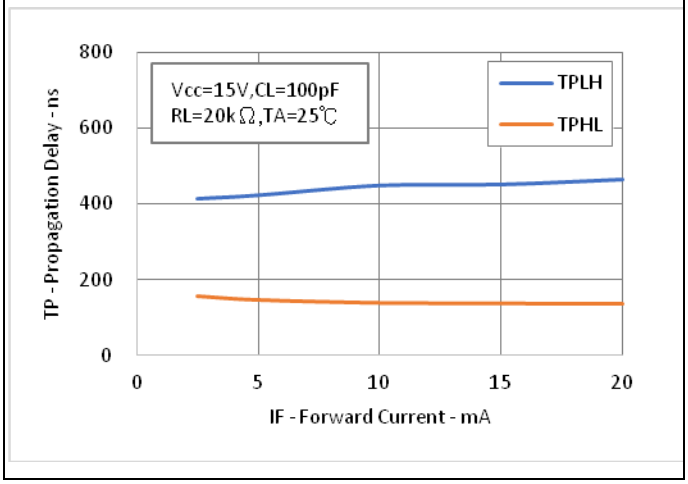
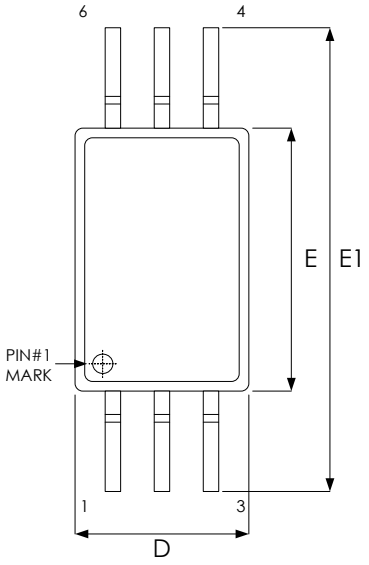


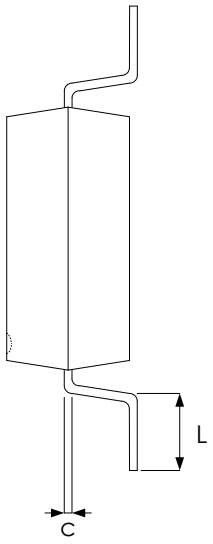
Fig.9 Propagation Delays vs. I_F



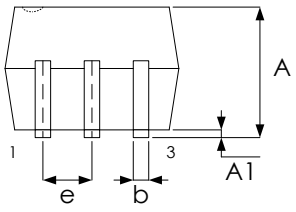
Package Outline Drawing
L-SOP 6L (277mil, 7mm clearance)



TOP VIEW



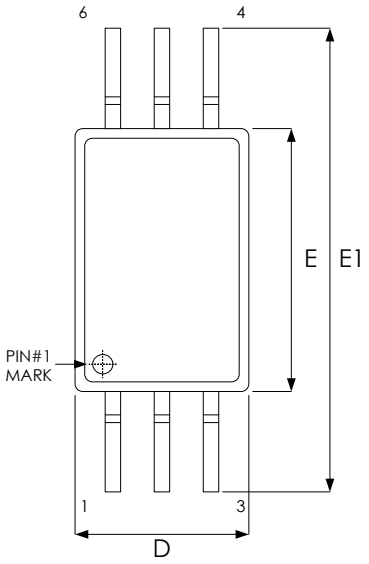
SIDE VIEW



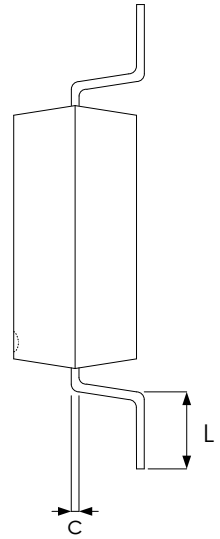
SIDE VIEW

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	6.50	7.10
E1	9.40	10.00
e	1.27 BSC	
L	0.70	1.20

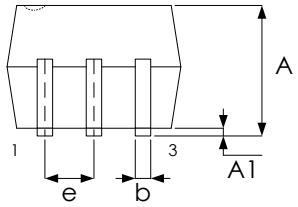
Package Outline Drawing
L-SOP 6L (277mil, 8mm clearance)



TOP VIEW



SIDE VIEW



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	2023.08.09	Initial version
1.0	2024.03.26	1.Update POD 2.Remove “preliminary” to V1.0

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