EVL6699-HVSL

Data brief

150 V - 150 W LED driver with the L6564H and the L6699 transition mode PFC pre-regulator, half bridge LCC resonant converter

Features

- Universal input mains range: 90 to 264 Vac - frequency 45 to 65 Hz
- Half BridgeTopology : LCC
- Max. output voltage and current:150 V at 1 A continuous operation
- Mains harmonics: EN61000-3-2 Class-C and JEITA-MITI Class-C
- No-load mains consumption: < 0.5 W
- THD < 10% at 230 Vac from 35 to 100% of the full load
- No need of Auxiliary SMPS (Viper or equivalent)
- Efficiency: >91 % at full load
- Conducted EMC: within EN55022-Class-C limits
- Safety: meets EN60950
- Dimming: analog, resistive, PWM (open collector)
- Feedback loops: constant current and constant voltage
- Protections: LED short-circuit, LED string open, regulation loop failure
- Dimensions: 69x157mm, 28 mm components maximum height
- Start-up time : < 400 ms, from main connection to steady state
- PCB: Double side, 70 µm, FR-4, Mixed PTH/SMT

Product status link
EVL6699-HVSL

Description

The EVL6699-HVSL is an evaluation board of a 150 W / 1 A LED driver with wide input mains range. The electrical specification is tailored on a typical hi-power street lighting application.

It based on a two stages architecture, a front-end PFC pre-regulator, featuring the L6564H, and a downstream half-bridge LCC resonant converter, featuring the L6699. LCC topology has been chosen because it allows to build, in practice and in brief, a current source that is the natural choice to drive a LED string.

Overall, the main features of this design are high efficiency, low open load input power, reduced harmonics compliant with the EN61000-3-2 Class-C and conducted EMC within the relevant EN55022 limits. Another noticeable feature of this LED driver is the extremely wide dimming capability, the board can actually regulate the current from maximum level down to less than 10% with analog dimming and to 1% in PWM dimming. The PWM dimming is perfectly flicker free, because even in case of very low current it is kept continuous (DC) in the LED and thus independent of the frequency of PWM dimming signal.

The board also has protection features in case of overload, short-circuit, open loop by each section. For this particular application, all protections in case of intervention have an auto-restart functionality.

The board is composed by a mother board (common to the HVL150W-HVSL) which houses the power section and a daughter board which house the two controllers, L6564H and L6699.

1 Electrical diagram

Figure 1. Electrical diagram

2 Bill of material

Table 1. **EVL6699-HVSL Evaluation board: Bill of Material**

Ref	Value/PN	Case	Description	Supplier
C1	470N-X2	9.0 × 18.0 p15mm	X2 - FILM CAP - B32922C3474K	Epcos
C2	2N2-Y1	p10mm	Y1 SAFETY CAP. DE1E3KX222M	Murata
C3	2N2-Y1	p10mm	Y1 SAFETY CAP. DE1E3KX222M	Murata
C4	470N-X2	9.0 × 18.0 p15mm	X2 - FILM CAP - B32922C3474K	Epcos
C5	470N - 630V	8.5 x 26.5 p22.5mm	630V - FILM CAP - B32673Z6474K	Epcos
C6	4N7	5.0 x 13.0 p10mm	450VAC - FILM CAP - B32651A7472K	Epcos
C7	22uF	2220	CERCAP - 50V - X7R - 20%	TDK
C8	22uF	2220	CERCAP - 50V - X7R - 20%	TDK
C9	100uF-450V	DIA 18 x 35.5 mm	ALUMINIUM ELCAP - CY SERIES - 105°C	Nichicon
C10	2N2-Y1	p10mm	Y1 SAFETY CAP. DE1E3KX222M	Murata
C11	2N2-Y1	p10mm	Y1 SAFETY CAP. DE1E3KX222M	Murata
C12	33pF - 1KV	1206	1KV CERCAP - X7R - 10%	Murata
C13	220pF	1206	630V CERCAP - GRM31A7U2J220JW31	Murata
C14	47nF 1KV	7.0 x 18.0 p15mm	1KV - FILM CAP - B32652A0473K	Epcos
C15	470N	6.0x13 p10 mm	MKT FILM CAP - B32521C3474M - 250V - 20%	Epcos
C16	470N	6.0x13 p10 mm	MKT FILM CAP - B32521C3474M - 250V - 20%	Epcos
C17	470N	6.0x13 p10 mm	MKT FILM CAP - B32521C3474M - 250V - 20%	Epcos
C18	470N	6.0x13 p10 mm	MKT FILM CAP - B32521C3474M - 250V - 20%	Epcos
C19	N.M.	1210	CERCAP - 50V - X7R - 20%	TDK
C20	1uF	1206	CERCAP - 50V - X7R - 20%	TDK
C21	2N2	0805	50V CERCAP - C0G - 10%	AVX
C22	N.M.	0805	Not mounted	
C23	4.7uF	8.5x7.2 p5 mm	MKS2 FILM CAP - MKS2C044701M00 - 63V - 5%	Wima
C24	4.7uF	8.5x7.2 p5 mm	MKS2 FILM CAP - MKS2C044701M00 - 63V - 5%	Wima
C25	N.M.	0805	Not mounted	
C26	10N-500V	1206	CERCAP - 500V - X7R - 10%	Kemet
C27	100N	0805	CERCAP - 50V - X7R - 10%	Kemet
C101	68N	0805	CERCAP - 25V - C0G - 10%	AVX
C102	5.6N	1206	CERCAP - 25V - X7R - 20%	AVX

Ref	Value/PN	Case	Description	Supplier
C103	100N	1206	CERCAP - 50V - X7R - 10%	AVX
C104	2N2	0805	CERCAP - 50V - C0G - 10%	AVX
C105	220PF	0805	CERCAP - 50V - C0G - 5%	AVX
	Replace with 560pF for optimization			
C106	1uF	0805	CERCAP - 25V - X7R - 10%	AVX
C107	4.7uF	1206	CERCAP - 50V - X7R - 20%	AVX
C108	10uF	1206	CERCAP - 25V - X7R - 20%	TDK
C109	2x 10uF	1206	CERCAP - 25V - X7R - 20%	TDK
C110	1uF	1206	CERCAP - 50V - X7R - 10%	AVX
C111	2N2	1206	2 KV CERCAP - X7R - 10%	AVX
C112	1N0	0805	CERCAP - 50V - X7R - 10%	AVX
C113	100N	0805	CERCAP - 50V - X7R - 10%	AVX
C114	100N	0805	CERCAP - 50V - X7R - 10%	Kemet
C115	1.0uF	1206	CERCAP - 25V - X7R - 20%	AVX
C116	DNM	0805	CERCAP - 50V - X7R - 10%	AVX
C117	220PF	0805	CERCAP - 50V - C0G - 5%	AVX
C118	10N	0805	CERCAP - 50V - C0G - 5%	AVX
C119	10uF	1206	CERCAP - 25V - X7R - 20%	TDK
C120	10N	0805	CERCAP - 50V - X7R - 10%	AVX
C121	10N	0805	CERCAP - 50V - X7R - 10%	AVX
C122	4N7	0805	CERCAP - 50V - C0G - 10%	AVX
C123	10N	0805	CERCAP - 50V - X7R - 10%	AVX
C124	680P	0805	CERCAP - 50V - C0G - 10%	AVX
C201	100N	0805	CERCAP - 50V - X7R - 10%	Kemet
C202	5.6N	0805	CERCAP - 50V - X7R - 10%	Kemet
C203	100N	0805	CERCAP - 50V - X7R - 10%	Kemet
C204	100N	0805	CERCAP - 50V - X7R - 10%	Kemet
C205	100N	0805	CERCAP - 50V - X7R - 10%	Kemet
C206	N.M.	0805	Not mounted	
D1	GBU8J	STYLE GBU	SINGLE PHASE BRIDGE RECTIFIER	Vishay
D2	1N4148WS	SOD-323	HIGH SPEED SIGNAL DIODE	Vishay
D3	1N4005	DO-41 DO - 41	GENERAL PURPOSE RECTIFIER	Vishay
D4	STTH5L06	DO-201	ULTRAFAST HIGH VOLTAGE RECTIFIER	ST Microelectronis
D5	1N4148WS	SOD-323	HIGH SPEED SIGNAL DIODE	Vishay
D6	N.M.	DO214AC	Not mounted	
D7	N.M.	DO214AC	Not mounted	
D8	1N4148WS	SOD-323	HIGH SPEED SIGNAL DIODE	Vishay
D9	STTH3R02Q	DO-15	ULTRA FAST RECTIFIER	ST Microelectronis
D10	STTH3R02Q	DO-15	ULTRA FAST RECTIFIER	ST Microelectronis

Ref	Value/PN	Case	Description	Supplier
D11	STTH3R02Q	DO-15	ULTRA FAST RECTIFIER	ST Microelectronis
D12	STTH3R02Q	DO-15	ULTRA FAST RECTIFIER	ST Microelectronis
D13	STPS1H100A	SMA	POWER SCHOTTKY DIODE	ST Microelectronis
D14	BAV21W-V	SOD-123	SMALL SIGNAL DIODE HIGH VOLTAGE	Vishay
D18	BAV99	SOT-23	DUAL SMALL SIGNAL DIODE	Vishay
D101	1N4148WS	SOD-323	HIGH SPEED SIGNAL DIODE	Vishay
D102	1N4148WS	SOD-323	HIGH SPEED SIGNAL DIODE	Vishay
D103	1N4148WS	SOD-323	HIGH SPEED SIGNAL DIODE	Vishay
D104	STPS140Z	SOD-123	POWER SCHOTTKY DIODE	ST Microelectronis
D105	MMSZ13T1	SOD-123	13V ZENER DIODE	Onsemi
D106	DNM	SOD-123	39V ZENER DIODE	Onsemi
F1	FUSE T4A	8.5x4 p.5.08mm	FUSE 4A - TIME LAG - 3921400	Littlefuse
HS1	HEAT-SINK	DWG	HEAT SINK FOR D1, Q1, Q2, Q3	
J1	MKDS 1,5/ 3-5,08	DWG	PCB TERM. BLOCK, SCREW CONN., PITCH 5MM - 3 W.	Phoenix Contact
J2	MKDS 1/2-5.0	DWG	PCB TERM. BLOCK, SCREW CONN., PITCH 5MM - 2 W.	Phoenix Contact
J3	Molex2P	HEADER 2.54	MALE HEADER 2.54mm - 2P	Molex
JP1	FEMALE HEADER 20	DWG	FEMALE HEADER p.2,54mm PRECI-DIP	
JP2	FEMALE HEADER 9	DWG	FEMALE HEADER p.2,54mm PRECI-DIP	
JP101	MALE HEADER 20P 90°	DWG	DWG MALE HEADER p.2,54mm 90°	
JP201	MALE HEADER 7P 90°	DWG	DWG MALE HEADER p.2,54mm 90°	
JPX1	JUMPER			
JPX51	SHORTED		WIRE JUMPER (See mech part)	
L1	2019.0002	DWG	INPUT EMI FILTER	Magnetica
L2	1975.0004	DWG	PFC INDUCTOR - 0.31mH - PQ26/25	Magnetica
L3	10uH	dia 8.8, p 5 mm	DRUM COIL RFB0807-100	Coilcraft
Q1	STF24N60M2	TO-220FP	N-CHANNEL POWER MOSFET	ST Microelectronis
Q2	STF13N60M2	TO-220FP	N-CHANNEL POWER MOSFET	ST Microelectronis
Q3	STF13N60M2	TO-220FP	N-CHANNEL POWER MOSFET	ST Microelectronis
Q4	BSS169	SOT-23	N-CH DEPLETION MOSFET	Infineon
Q101	BC847C	SOT-23	NPN SMALL SIGNAL BJT	Vishay
Q102	BC847C	SOT-23	NPN SMALL SIGNAL BJT	Vishay
Q201	BC857C	SOT-23	PNP SMALL SIGNAL BJT	Vishay
R002	2.4K	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R003	3.0K	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R1	NTC 2R5-S237	DWG	NTC RESISTOR P/N B57237S0259M000	Epcos

Ref	Value/PN	Case	Description	Supplier
R2	5R6	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R3	5R6	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R4-JPX1	SHORTED	PTH	SHORT BY WIRE	
R5	N.M.	0805	Not mounted	
R6	3R3	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R7	22R	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R8	100K	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R9	0R27	PTH	RSMF1TB - METAL FILM RES - 1W - 2% - 200ppm/°C	Akaneohm
R10-JPX2	0R47	PTH	RSMF1TB - METAL FILM RES - 1W - 2% - 200ppm/°C	Akaneohm
R11	56R	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R12	100K	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R13	56R	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R14	100K	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R15	100R	1206	SMD STANDARD FILM RES - 1/4W - 1% - 100ppm/°C	Vishay
R16	N.M.	0805	Not mounted	
R17	1R0	2512	SMD CURRENT SENSE RESISTOR - 1W - 1%	Panasonic
R18	1R0	2512	SMD CURRENT SENSE RESISTOR - 1W - 1%	Panasonic
R19	7K5	0805	SMD STANDARD FILM RES - 1/8W - 5% - 200ppm/°C	Vishay
R20	130K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R21	10R	0805	SMD STANDARD FILM RES - 1/8W - 5% - 200ppm/°C	Vishay
R22	15K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R23	1R0	1206	SMD STANDARD FILM RES - 1/4W - 5% - 250ppm/°C	Vishay
R24	2R2	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R25	62K	0805	SMD STANDARD FILM RES - 1/8W - 5% - 200ppm/°C	Vishay
R26	3K9	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R27	N.M.	0805	Not mounted	
R28	N.M.	0805	Not mounted	

Ref	Value/PN	Case	Description	Supplier
R29	150K	1206	SMD STANDARD FILM RES - 1/4W - 5% - 250ppm/°C	Vishay
	Remove for optimization			
R30	180K	1206	SMD STANDARD FILM RES - 1/4W - 5% - 250ppm/°C	Vishay
	Remove for optimization			
R31	N.M.	PTH	Not mounted	
R32	100K	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R33	100K	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R39	4K7	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R40	N.M.	0805	Not mounted	
R42	2K7	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R44	470K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R45	150K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R46	15K	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R50	5K6	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R51	47K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R52	470R	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R101	750K	1206	SMD STANDARD FILM RES - 1/4W - 1% - 100ppm/°C	Vishay
R102	750K	1206	SMD STANDARD FILM RES - 1/4W - 1% - 100ppm/°C	Vishay
R103	750K	1206	SMD STANDARD FILM RES - 1/4W - 1% - 100ppm/°C	Vishay
R104	3K9	1206	SMD STANDARD FILM RES - 1/4W - 1% - 100ppm/°C	Vishay
R105	3K9	PTH	STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R106	82K	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R107	10R	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R108	16K	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R109	56K	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R110	1M0	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay

Ref	Value/PN	Case	Description	Supplier
R111	2M2	PTH	STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R112	2M2	1206	SMD STANDARD FILM RES - 1/4W - 1% - 100ppm/°C	Vishay
R113	2M2	1206	SMD STANDARD FILM RES - 1/4W - 1% - 100ppm/°C	Vishay
R114	1M0	PTH	STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R115	1M0	1206	SMD STANDARD FILM RES - 1/4W - 1% - 100ppm/°C	Vishay
R116	1M0	1206	SMD STANDARD FILM RES - 1/4W - 1% - 100ppm/°C	Vishay
R117	27K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R118	62K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R119	4K7	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R120	470R	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R121	0R0	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R122	1K0	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R123	33K	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R124	62K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R125	0R0	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R126	220K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R127	8K2	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R128	27K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
	Add RC series = 430R / 1nF between RFMIN pin and GND (in // to R128), for optimization			
R129	4K3	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R130	3K0	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R131	47R	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R132	SHORTED	PTH	WIRE JUMPER	
R133	N.M.	0805	Not mounted	
R134	0R0	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R135	0R0	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay

Ref	Value/PN	Case	Description	Supplier
R136	1K0	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R137	270R	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R138	10R	1206	SMD STANDARD FILM RES - 1/4W - 1% - 100ppm/°C	Vishay
R139	68R	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R140	33K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R141	180K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R142	N.M.	PTH	Not mounted	
R201	1K0	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R202	22R	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R203	10K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R204	10K	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R205	27K	0805	SMD STANDARD FILM RES - 1/8W - 5% - 250ppm/°C	Vishay
R206	N.M.	0805	Not mounted	
R207	27K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R208	180K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R209	18K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R210	20K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R211	N.M.	0805	Not mounted	
R212	620K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R213	0R0	0805	SMD STANDARD FILM RES - 1/8W - 5% - 200ppm/°C	Vishay
R214	0R0	0805	SMD STANDARD FILM RES - 1/8W - 5% - 200ppm/°C	Vishay
R215	12K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R216	12K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R217	200K	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
R218	1K0	0805	SMD STANDARD FILM RES - 1/8W - 1% - 100ppm/°C	Vishay
RV1	300Vac	dia.15x5 p7.5 mm	300V METAL OXIDE VARISTOR - B72214S0301K101	Epcos

Ref	Value/PN	Case	Description	Supplier
T1	1860.0152	DWG	RESONANT TRANSFORMER	Magnetica
U1	TLVH431AIL3T	SOT23-3L	1.24V PROGRAMMABLE SHUNT VOLTAGE REFERENCE	ST Microelectronis
U2	SFH617A-2	DIP-4 - 10.16MM	OPTOCOUPLER	Vishay
U3	SFH617A-2	DIP-4 - 10.16MM	OPTOCOUPLER	Vishay
U6	TLVH431AIL3T	SOT23-3L	1.24V PROGRAMMABLE SHUNT VOLTAGE REFERENCE	ST Microelectronis
U101	L6564H	SO-14	HV STARTUP TRANSITION MODE PFC	ST Microelectronis
U102	L6699D	SO-16	IMPROVED HV RESONANT CONTROLLER	ST Microelectronis
U201	LM258AD	SO-8	LOW POWER DUAL OP AMP	ST Microelectronis
U202	LM258AD	SO-8	LOW POWER DUAL OP AMP	ST Microelectronis
Z1	PCB REV. 2.0		STCMB1 POWER BOARD	
Z101	PCB REV. 1.0		PFC & LLC CONTROL DAUGHTER BOARD	
Z201	PCB REV. 1.0		CC CONTROL DAUGHTER BOARD	

Revision history

Table 2. Document revision history

Date	Version	Changes
19-June-2019	1	Initial release.

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