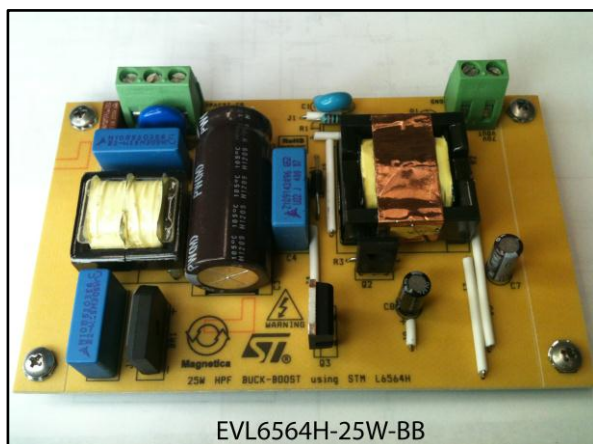


25 W wide-range high power factor buck-boost converter demonstration board using the L6564H

Data brief



Features

- Line voltage range: 85 to 265 V_{ac}
- Minimum line frequency (fL): 47-63 Hz
- LED string voltage drop: 70 V ±10% (23 LED p.n. X42182)
- LED nominal current: 350 mA ±1%
- LED current ripple pk-pk: 100 mA
- Rated output power: 25 W
- Power factor > 0.9
- Efficiency: > 89 % at 230 V
- Maximum ambient temperature: 50 °C
- Conducted EMI: In acc. with EN55022 class-B

- Overvoltage, open loop and short-circuit protection

Description

This demonstration board implements a wide-range non-isolated 25 W regulated LED driver with high power factor. The EVL6564H-25W-BB demonstration board is well-suited to the Japanese market due to the broad use of standard 100 V_{ac} lighting applications and also 200 V_{ac} tubes in building automation systems.

The EVL6564H-25W-BB demonstration board has been designed in order to obtain the highest possible power factor over the entire input mains voltage, remaining compliant to EN55022 Class-B and keeping the average output current in a tight band with different LED characteristics.

The board is based on ST's L6564H power factor controller and the SEA05L CC-CV controller for LED current regulation in a non-isolated flyback configuration.

The form factor has been designed to fit into a standard LED driver case, facilitating the replacement of the incandescent flood lamps up to 80-100 W power.

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1 Electrical diagram and bill of material

Figure 1: EVL6564H-25W-BB demonstration board: electrical schematic

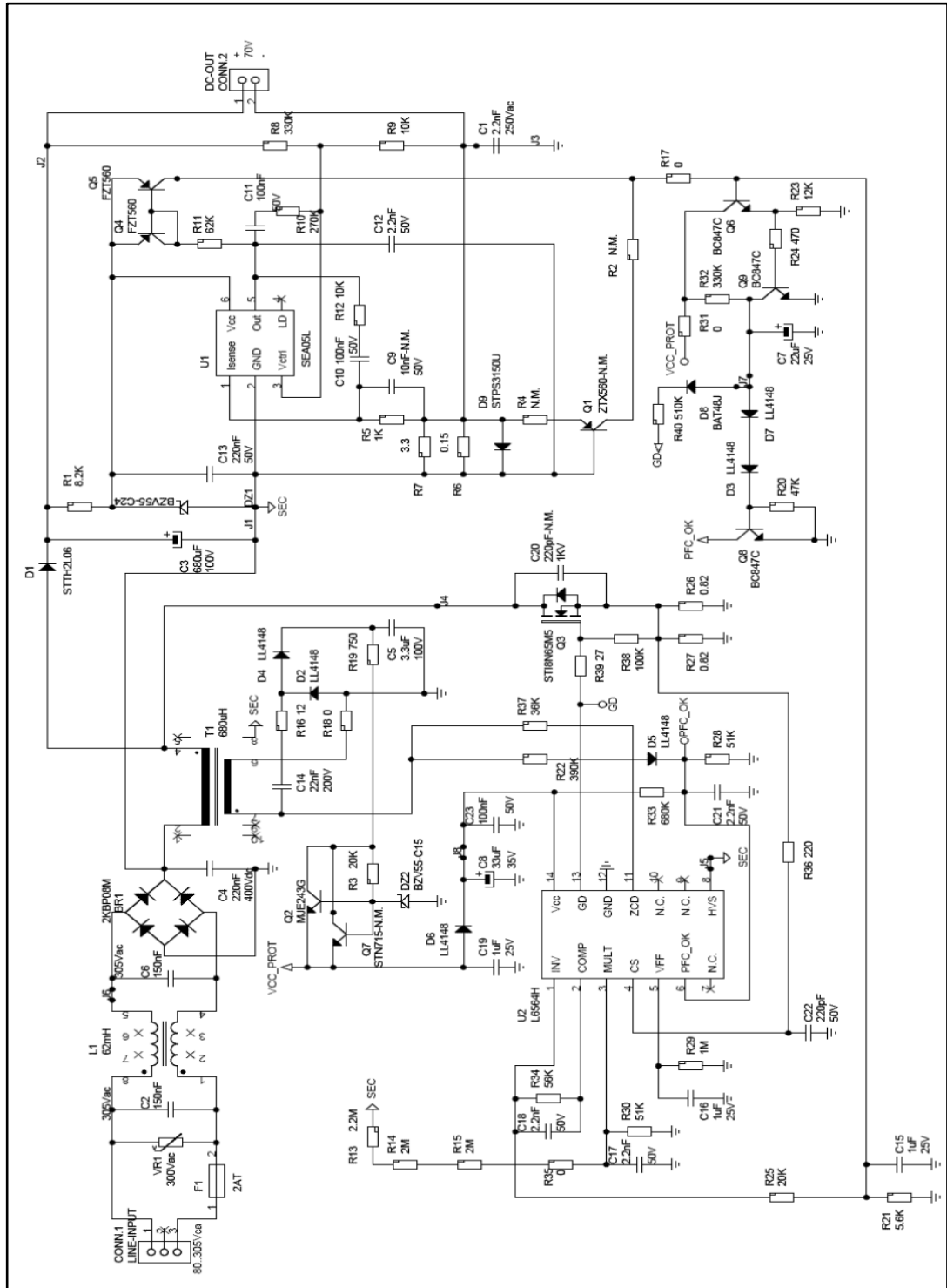


Table 1: Bill of material

Ref.	Part N.	Type	Supplier
BR1	2KBP08M	Bridge rect. 2 A 800 V	Vishay
Conn.1	Line-input	Connector MKDS 1.5/3-5.08-PS.5.08	Phoenix contact
Conn.2	DC-OUT	Connector MKDS 1.5/2-5.08-PS.5.08	Phoenix contact
C1	2.2 nF	Ceramic capacitor X1/Y2+-20 %-P. 7.5 mm	Murata
C2	150 nF	Capacitor MKP+-20 %-PS15-X2	Epcos
C6	150 nF	Capacitor MKP+-20 %-PS15-X2	Epcos
C3	680 µF	Electrolytic capacitor V.105 °C-PW-8000h	Nichicon
C4	220 nF	Capacitor MKP+-5 %-200 V _{ac} -PS15	Epcos
C5	3.3 µF	Ceramic capacitor X7S 10 % EIA1210-SMD	Kemet
C7	22 µF	Electrolytic capacitor V.105 °C-2000h-PW	Nichicon
C8	33 µF	Electrolytic capacitor V.105 °C-10000h-YXM	Rubycon
C9	10 nF N.M.	Capacitor X7R 10 % EIA0805-SMD	Murata
C10	100 nF	Ceramic capacitor X7R 10 % EIA1206-SMD	Yageo
C11	100 nF	Ceramic capacitor X7R 10 % EIA0805-SMD	Kemet
C23	100 µF	Ceramic capacitor X7R 10 % EIA0805-SMD	Kemet
C12	2.2 nF	Capacitor X7R 10 % EIA0805-SMD	Kemet
C17	2.2 nF	Capacitor X7R 10 % EIA0805-SMD	Kemet
C18	2.2 nF	Capacitor X7R 10 % EIA0805-SMD	Kemet
C21	2.2 nF	Capacitor X7R 10 % EIA0805-SMD	Kemet
C13	220 nF	Ceramic capacitor Y5V -20+80 % EIA0805-SMD	AVX
C14	22 nF	Ceramic capacitor X7R 5% EIA1206-SMD	Kemet
C15	1 µF	Ceramic capacitor X7R 10 %-EIA0805-SMD	Murata
C16	1 µF	Ceramic capacitor X7R 10 %-EIA0805-SMD	Murata
C19	1 µF	Ceramic capacitor X7R 5 %-EIA0805-SMD	Kemet
C20	220 pF N.M.	Capacitor HV-U2J-5% EIA1206-SMD	Murata
C22	220 pF	Ceramic capacitor C0G 5 % EIA0805-SMD	Kemet
DZ1	BZV55-C24	Zener-diode 5 %-Sz 19.6 mV/K-SMD	NXP
DZ2	BZV55-C15	Zener-diode 5 %-Sz 11.4 mV/K-SMD	NXP
D1	STTH2L06	Ultrafast-diode 85ns	STMicroelectronics
D2	LL4148	Fast-diode 4 ns SMD	Vishay
D3	LL4148	Fast-diode 4 ns SMD	Vishay
D4	LL4148	Fast-diode 4 ns SMD	Vishay
D5	LL4148	Fast-diode 4 ns SMD	Vishay

Ref.	Part N.	Type	Supplier
D6	LL4148	Fast-diode 4 ns SMD	Vishay
D7	LL4148	Fast-diode 4 ns SMD	Vishay
D8	BAT48J	Schottky-diode SMD-MK 48	STMicroelectronics
D9	STPS3150U	Schottky-diode $V_f 0, 82 V @ 25 ^\circ C$ 3A-SMD-MKG315	STMicroelectronics
F1	2AT	Fuse 2 A 250 V 8.5 x 4-392/TE05-TIME-LAG	Littelfuse
J1	PS10mm	Wire jumper 0 Ω	-
J2	PS30mm	Wire jumper 0 Ω	-
J3	PS23mm	Wire jumper 0 Ω	-
J4	PS20mm	Wire jumper 0 Ω	-
J5	PS29mm	Wire jumper 0 Ω	-
J6	PS12mm	Wire jumper 0 Ω	-
J7	PS24mm	Wire jumper 0 Ω	-
J8	PS5mm	Wire jumper 0 Ω	-
L1	62 mH	Common mode chokes-270 $V_{ac max}$	Magnetica
Q1	ZTX560-N.M.	BJT.PNP-hfe 50 to 300	Diode Inc.
Q2	MJE243G	BJT.NPN-hfe 40 to 180	ON
Q3	STI8N65M5	Power MOSFET-N-channel, 0.6 Ω -tr/14/11 ns-trr 200 ns	STMicroelectronics
Q4	FZT560	BJT.PNP-SMD-hfe 50 to 300	Diode Inc.
Q5	FZT560	BJT.PNP-SMD-hfe 50 to 300	Diode Inc.
Q6	BC847C	BJT.NPN-hfe 420 to 800-SMD-MK1G	NXP
Q8	BC847C	BJT.NPN-hfe 420 to 800-SMD-MK1G	NXP
Q9	BC847C	BJT.NPN-hfe 420 to 800-SMD-MK1G	NXP
Q7	STN715-N.M.	BJT.NPN-SMD-hfe80-MK N715	STMicroelectronics
R1	8.2 K	Resistor 1 %	TE-LR1F8K2
R2	N.M.	Resistor 1 %	TE-LR1F8K2
R3	20 K	Resistor 1 %	TE-LR1F20K
R4	N.M.	Resistor 1% -150 $V_{ac/dc}$ - EIA0805-SMD	Vishay
R5	1 K	Resistor 1 % -150 $V_{ac/dc}$ - EIA0805-SMD	Vishay
R6	0.15	Resistor 1 % -200 $V_{ac/dc}$ - EIA1206-SMD	IRC-LRC
R7	3.3	Resistor 1 % -200 $V_{ac/dc}$ - EIA1206-SMD	Vishay
R8	330 K	Resistor 1 % -200 $V_{ac/dc}$ - EIA1206-SMD	Vishay
R9	10 K	Resistor 1 % -150 $V_{ac/dc}$ - EIA0805-SMD	Vishay

Ref.	Part N.	Type	Supplier
R10	270 K	Resistor 1 % -150 V _{ac/dc} - EIA0805-SMD	Vishay
R11	62 K	Resistor 1 % -150 V _{ac/dc} - EIA0805-SMD	Vishay
R12	10 K	Resistor 1 % -200 V _{ac/dc} - EIA1206-SMD	Vishay
R13	2.2M	Resistor 1 % -200 V _{ac/dc} - EIA1206-SMD	Vishay
R14	2M	Resistor 1 % -200 V _{ac/dc} - EIA1206-SMD	Vishay
R15	2M	Resistor 1 % -200 V _{ac/dc} - EIA1206-SMD	Vishay
R16	12	Resistor 1 % -200 V _{ac/dc} - EIA1206-SMD	Vishay
R17	0	Resistor 1 % -200 V _{ac/dc} - EIA1206-SMD	Vishay
R18	0	Resistor 1 % -200 V _{ac/dc} - EIA1206-SMD	Vishay
R31	0	Resistor 1 % -200 V _{ac/dc} - EIA1206-SMD	Vishay
R19	750	Resistor 1 % -200 V _{ac/dc} - EIA1206-SMD	Vishay
R20	47 K	Resistor 1 % -150 V _{ac/dc} - EIA0805-SMD	Vishay
C//R20 ^(*)	10 nF	Ceramic capacitor X7R 10% EIA0805-SMD	Kemet
R21	5.6 K	Resistor 1 % -150 V _{ac/dc} - EIA0805-SMD	Vishay
R22	390 K	Resistor 1 % -150 V _{ac/dc} - EIA0805-SMD	Vishay
R23	12 K	Resistor 1 % -150 V _{ac/dc} - EIA0805-SMD	Vishay
R24	470	Resistor 1 % -150 V _{ac/dc} - EIA0805-SMD	Vishay
R25	20 K	Resistor 1 % -150 V _{ac/dc} - EIA0805-SMD	Vishay
R26	0.82	Resistor 1 % EIA1210-SMD	Rohm
R27	0.82	Resistor 1 % EIA1210-SMD	Rohm
R28	51 K	Resistor 1 % -150 V _{ac/dc} - EIA0805-SMD	Vishay
R29	1M	Resistor 1 % -50 V _{ac/dc} - EIA0805-SMD	Vishay
R30	51 K	Resistor 5 % -50 V _{ac/dc} - EIA0805-SMD	Vishay
R32	330 K	Resistor 1 % -150 V _{ac/dc} - EIA0805-SMD	Vishay
R33	680 K	Resistor 5 % -200 V _{ac/dc} - EIA1206-SMD	Vishay
R34	56 K	Resistor 5 % -150 V _{ac/dc} - EIA0805-SMD	Vishay
R35	0	Resistor 1 % -150 V _{ac/dc} - EIA0805-SMD	Vishay
R36	220	Resistor 5 % -200 V _{ac/dc} - EIA1206-SMD	Vishay
R37	36 K	Resistor 1 % -150 V _{ac/dc} - EIA0805-SMD	Vishay
R38	100 K	Resistor 5 % -150 V _{ac/dc} - EIA0805-SMD	Vishay
R39	27	Resistor 5 % -200 V _{ac/dc} - EIA1206-SMD	Vishay
R40	510 K	Resistor 1 % -150 V _{ac/dc} - EIA0805-SMD	Vishay
T1	680 µH	Lighting buck/boost induct. 40 KHz	Magnetica
U1	SEA05L	I.C.-CC/CV CTR.-3,5..36 V-V _{ac} 0.5 %-I _{acc} 4 %-MK S5L-SMD	STMicroelectronics

Ref.	Part N.	Type	Supplier
U2	L6564H	I.C.-PFC-CTR.-HVS-TM-SMD	STMicroelectronics
VR1	300 V _{ac}	VDR-300 V _{ac} - 385 V _{dc} - 47J-D12mm	Epcos

Notes:

⁽¹⁾Add a 10 nF capacitor in parallel to R20 (0805).

2 Power factor vs. line with LED load

Figure 2: Power factor vs. line voltage

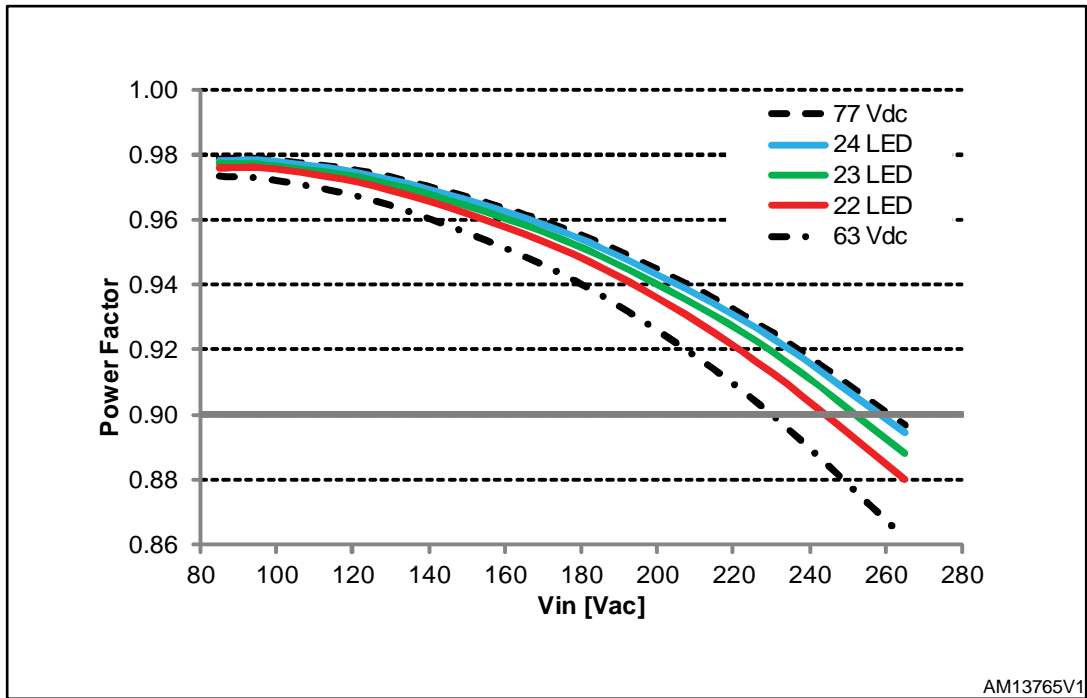


Figure 3: LED current vs. line voltage

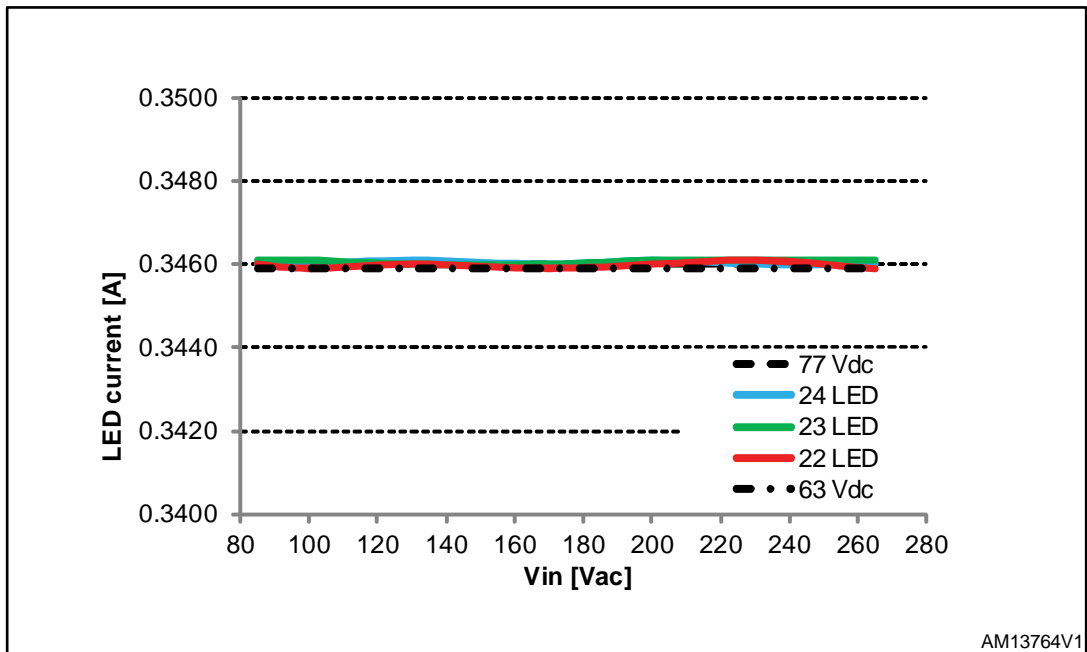
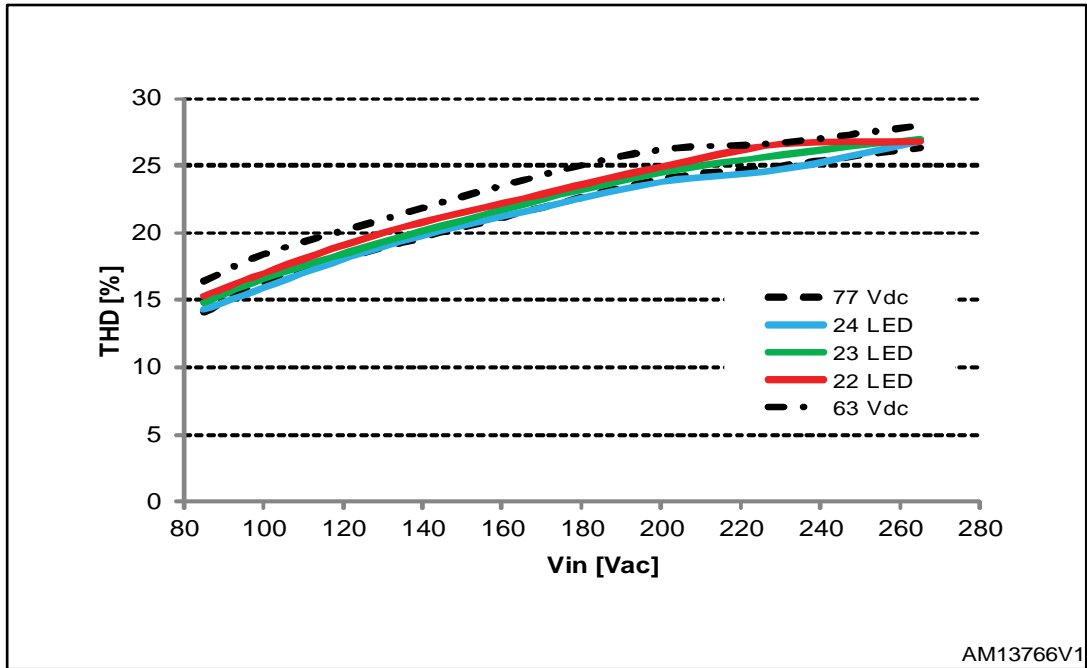


Figure 4: THD vs. line voltage



3 References

1. AN1059 - Design equation of high-power-factor flyback converters based on the L6561
2. AN1060 - Flyback converters with the L6561 PFC controller
3. L6564H - Datasheet
4. SEA05L - Datasheet
5. ST18N65M5 - Datasheet

4 Revision history

Table 2: Document revision history

Date	Revision	Changes
15-Jul-2013	1	Initial release.
18-Jul-2013	2	Updated description in cover page and the Table 1: "Bill of material" .

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