

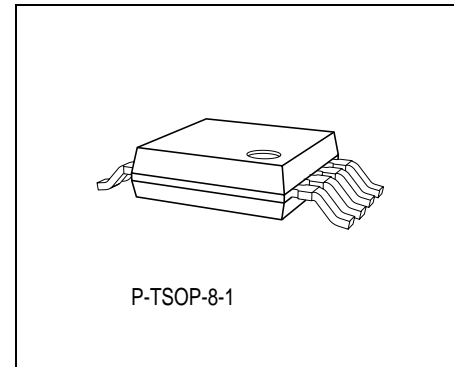
LED Driver with Adjustable Current

TLE 4241 G

Target Data

Features

- Adjustable constant output current
- Wide input voltage range
- Low drop voltage
- Open load detection
- Overtemperature protection
- Short circuit proof
- Reverse polarity proof
- Wide temperature range : $-40\text{ °C} < T_j < 150\text{ °C}$
- Very small SMD-Package



Type	Ordering Code	Package
▼ TLE 4241 G	Q67006-A9519	P-TSOP-8 (SMD)

▼ New type

Functional Description

The **TLE 4241 G** is an integrated adjustable constant current source. The IC is designed to supply LEDs under the severe conditions of automotive applications resulting in constant brightness and extended LED lifetime. It is provided in the very small P-TSOP-8 (Micro 8) package. Protection circuits prevent damage to the device in case of overload, short circuit, reverse polarity and overtemperature. The connected LEDs are protected against reverse polarity as well as excess voltages up to 45 V. A status output allows handling of open load and short circuit at the main output.

A PWM input offers the possibility to adjust the LED brightness by pulse width modulation.

With an implemented high/low current switch the output current level can be reduced by a fixed factor e.g. for brake/tail light application.

The implemented features such as adjustable output current, the high/low current switch and the provided PWM input make the device well suited for a broad range of LED and other applications.

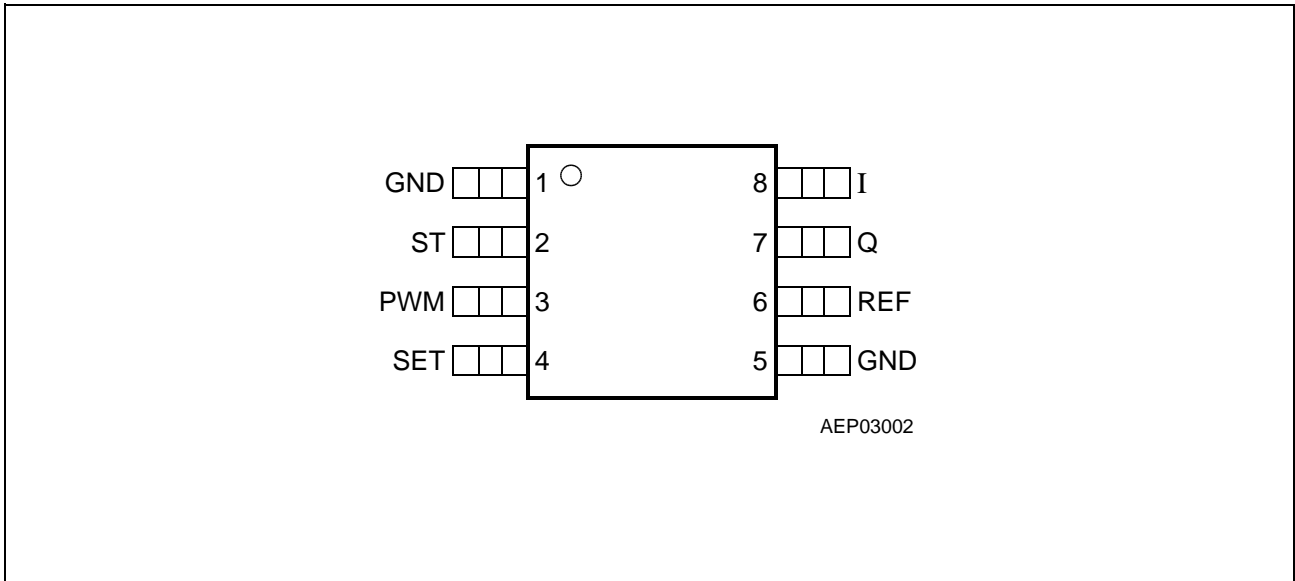


Figure 1 Pin Configuration (top view)

Pin Definitions and Functions

Pin No.	Symbol	Function
1	GND	Ground ; internally connected to pin 5
2	ST	Status Output ; open collector output, connect to external pull up resistor
3	PWM	Pulse Width Modulation Input ; if not needed connect to V_1
4	SET	High/Low Current Input ; choice of current level
5	GND	Ground ; internally connected to pin 1
6	REF	Reference Input ; connect to GND via an external resistor to adjust the output current
7	Q	Output
8	I	Input ; block to GND directly at the IC with a 100 nF ceramic capacitor.

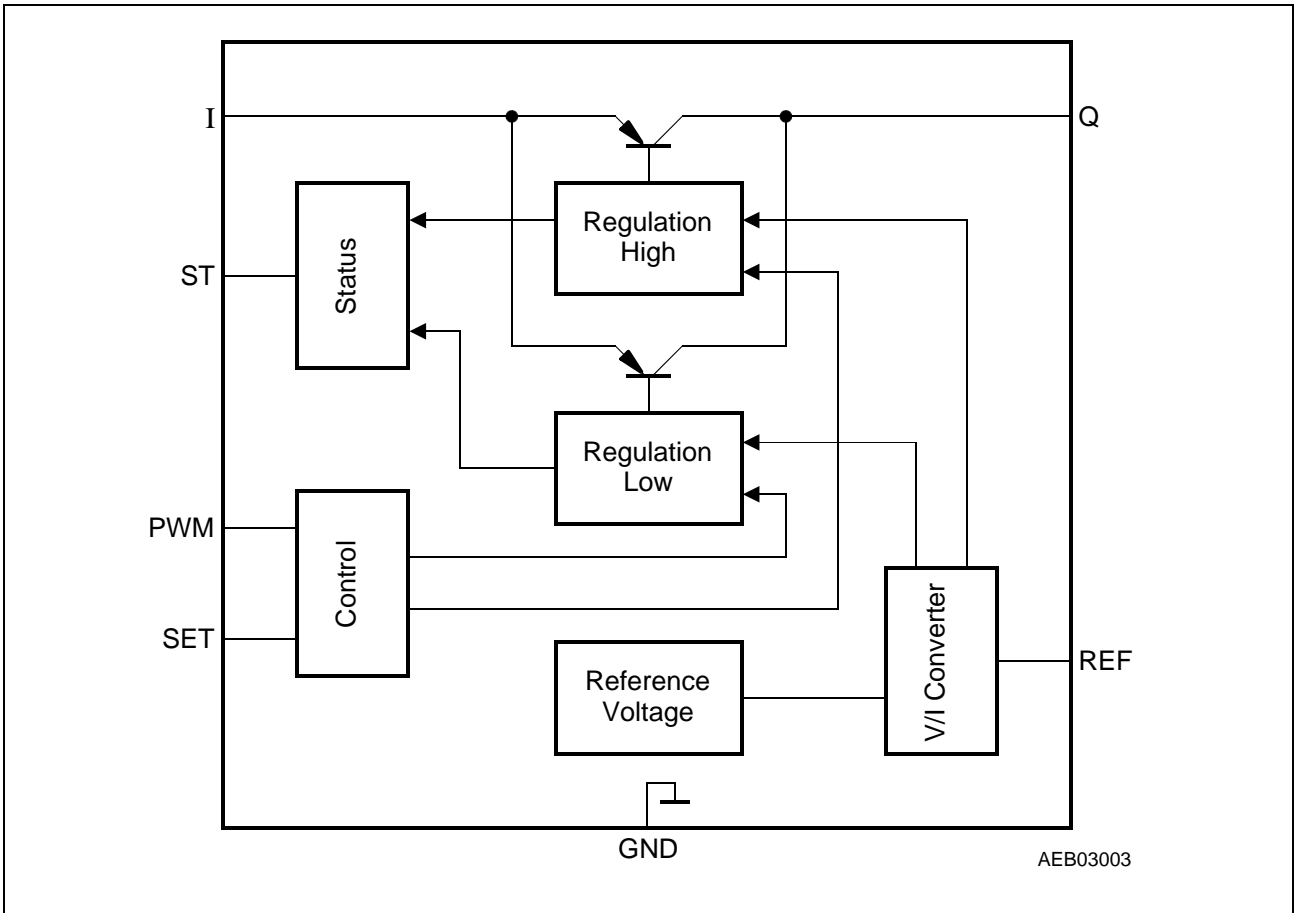


Figure 2 Block Diagram

Absolute Maximum Ratings
 $-40\text{ °C} < T_j < 150\text{ °C}$

Parameter	Symbol	Limit Values		Unit	Remarks
		min.	max.		

Input

Voltage	V_I	- 42	45	V	-
Current	I_I	-	-	mA	internally limited

Output

Voltage	V_Q	- 1	40	V	-
Current	I_Q	-	-	mA	internally limited

Status Output

Voltage	V_{ST}	- 0.3	40	V	-
Current	I_{ST}	- 5	5	mA	internally limited

Reference Input

Voltage	V_{REF}	- 0.3	7	V	-
Current	I_{REF}	- 2	2	mA	-

Pulse Width Modulation Input

Voltage	V_{PWM}	- 40	40	V	-
Current	-	- 1	1	mA	-

High/Low Current Input

Voltage	V_{SET}	- 40	40	V	-
Current	I_{SET}	- 1	1	mA	-

Temperatures

Junction temperature	T_j	- 40	150	°C	-
Storage temperature	T_{stg}	- 50	150	°C	-

Absolute Maximum Ratings (cont'd)
 $-40\text{ °C} < T_j < 150\text{ °C}$

Parameter	Symbol	Limit Values		Unit	Remarks
		min.	max.		

Thermal Resistances

Junction ambient	R_{thja}	–	135	K/W	– ¹⁾
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¹⁾ Worst case regarding peak temperature; mounted on PCB $80 \times 80 \times 1.5\text{ mm}^3$, $35\text{ }\mu\text{m Cu}$, 300 mm^2 heat sink area.

Note: Maximum ratings are absolute ratings; exceeding any one of these values may cause irreversible damage to the integrated circuit

Operating Range

Parameter	Symbol	Limit Values		Unit	Remarks
		min.	max.		
Input voltage	V_I	3	45	V	–
Status output voltage	V_{ST}	–	16	V	–
SET voltage	V_{SET}	0	40	V	–
PWM voltage	V_{PWM}	0	40	V	–
Junction temperature	T_j	– 40	150	°C	–
Reference Resistor	R_{REF}	7	100	k Ω	–

Electrical Characteristics

$9\text{ V} \leq V_1 \leq 16\text{ V}$; $R_{REF} = 12\text{ k}\Omega$; $V_{PWM} \geq V_{PWM,H}$; $-40\text{ }^\circ\text{C} < T_j < 150\text{ }^\circ\text{C}$; all voltages with respect to ground; positive current defined flowing into pin; unless otherwise specified

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Current consumption off mode	I_{qOFF}	–	–	10	μA	PWM = L
Current consumption	I_{qL}	–	0.5	1.0	mA	SET = L; $V_Q = 6\text{ V}$
Current consumption	I_{qH}	–	3.0	10.0	mA	SET = H; $V_Q = 6\text{ V}$
Current consumption open load	$I_{qL,O}$	–	–	3.0	mA	SET = L; V_Q open
Current consumption open load	$I_{qH,O}$	–	–	3.0	mA	SET = H; V_Q open

Output

Output current	I_Q	6.4	8.0	9.6	mA	SET = L
Output current	I_Q	52	65	78	mA	SET = H
Output current limit	I_{Qmax}	–	50	–	mA	SET = L; $R_{REF} = 0\ \Omega$
Output current limit	I_{Qmax}	–	150	–	mA	SET = H; $R_{REF} = 0\ \Omega$
Drop voltage	V_{dr}	–	0.2	0.5	V	SET = L; $I_Q = 8\text{ mA}$
Drop voltage	V_{dr}	–	0.3	0.5	V	SET = H; $I_Q = 65\text{ mA}$

PWM Input

PWM high level	$V_{PWM,H}$	2.0	–	–	V	–
PWM low level	$V_{PWM,L}$	–	–	0.6	V	–
PWM input current high level	$I_{PWM,H}$	–	220	500	μA	$V_{PWM} = 5.0\text{ V}$
PWM input current low level	$I_{PWM,L}$	– 10	–	10	μA	$V_{PWM} = 0.0\text{ V}$
Turn on delay time	$t_{PWM,ON}$	10	25	50	μs	see Fig. 3
Turn off delay time	$t_{PWM,OFF}$	5	10	20	μs	see Fig. 3

Electrical Characteristics (cont'd)

$9\text{ V} \leq V_1 \leq 16\text{ V}$; $R_{REF} = 12\text{ k}\Omega$; $V_{PWM} \geq V_{PWM,H}$; $-40\text{ }^\circ\text{C} < T_j < 150\text{ }^\circ\text{C}$; all voltages with respect to ground; positive current defined flowing into pin; unless otherwise specified

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		

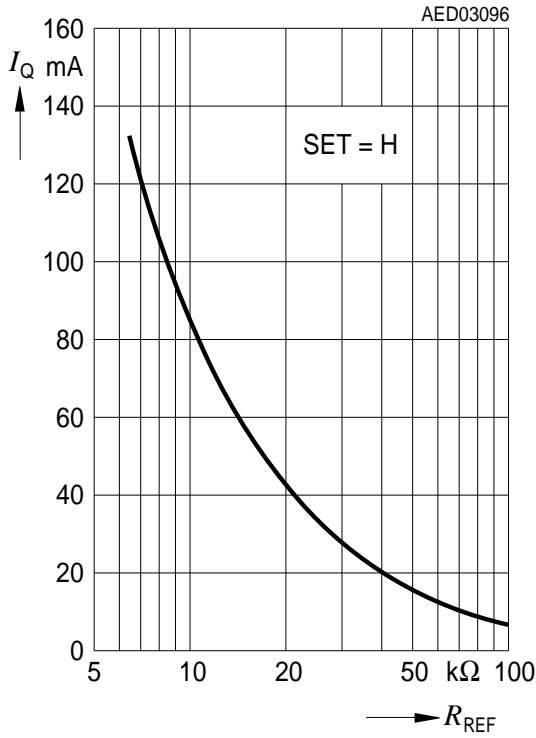
SET Input

SET high level	$V_{SET,H}$	2.0	–	–	V	–
SET low level	$V_{SET,L}$	–	–	0.6	V	–
SET input current high level	$I_{SET,H}$	–	220	500	μA	$V_{SET} = 5.0\text{ V}$
SET input current low level	$I_{SET,L}$	– 10	–	10	μA	$V_{SET} = 0.0\text{ V}$
Delay time L -> H	$I_{SET,H}$	–	–	45	μs	see Fig. 3
Delay time H -> L	$I_{SET,L}$	–	–	15	μs	see Fig. 3

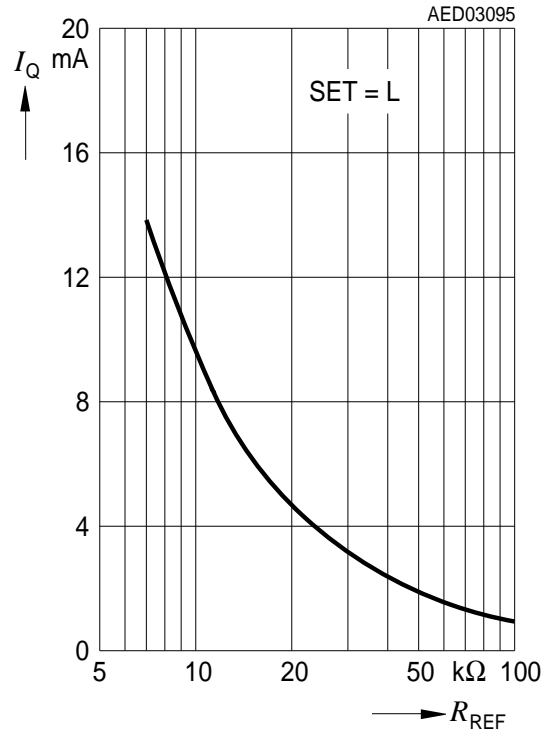
Status Output

Lower status switching threshold	I_{QLL}	0.2	–	–	mA	SET = L; ST = L
Upper status switching threshold	I_{QLH}	–	–	1	mA	SET = L; ST = H
Lower status switching threshold	I_{QHL}	5	–	–	mA	SET = H; ST = L
Upper status switching threshold	I_{QHH}	–	–	10	mA	SET = H; ST = H
Status low voltage	V_{STL}	–	–	0.4	V	$I_{ST} = 2.0\text{ mA}$
Leakage current	I_{STLK}	–	–	10	μA	$V_{ST} = 5.0\text{ V}$

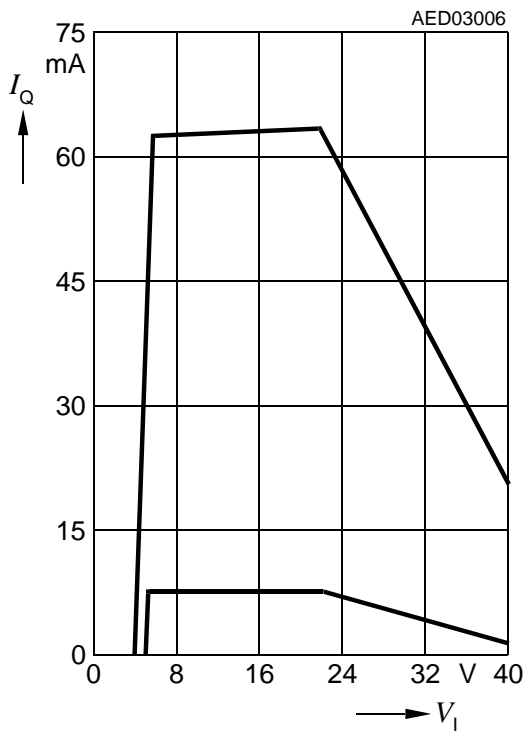
Output Current versus External Resistor R_{REF} , SET = H



Output Current versus Temperature, External Resistor R_{REF} , SET = L



Output Current and Output Voltage versus Input Voltage



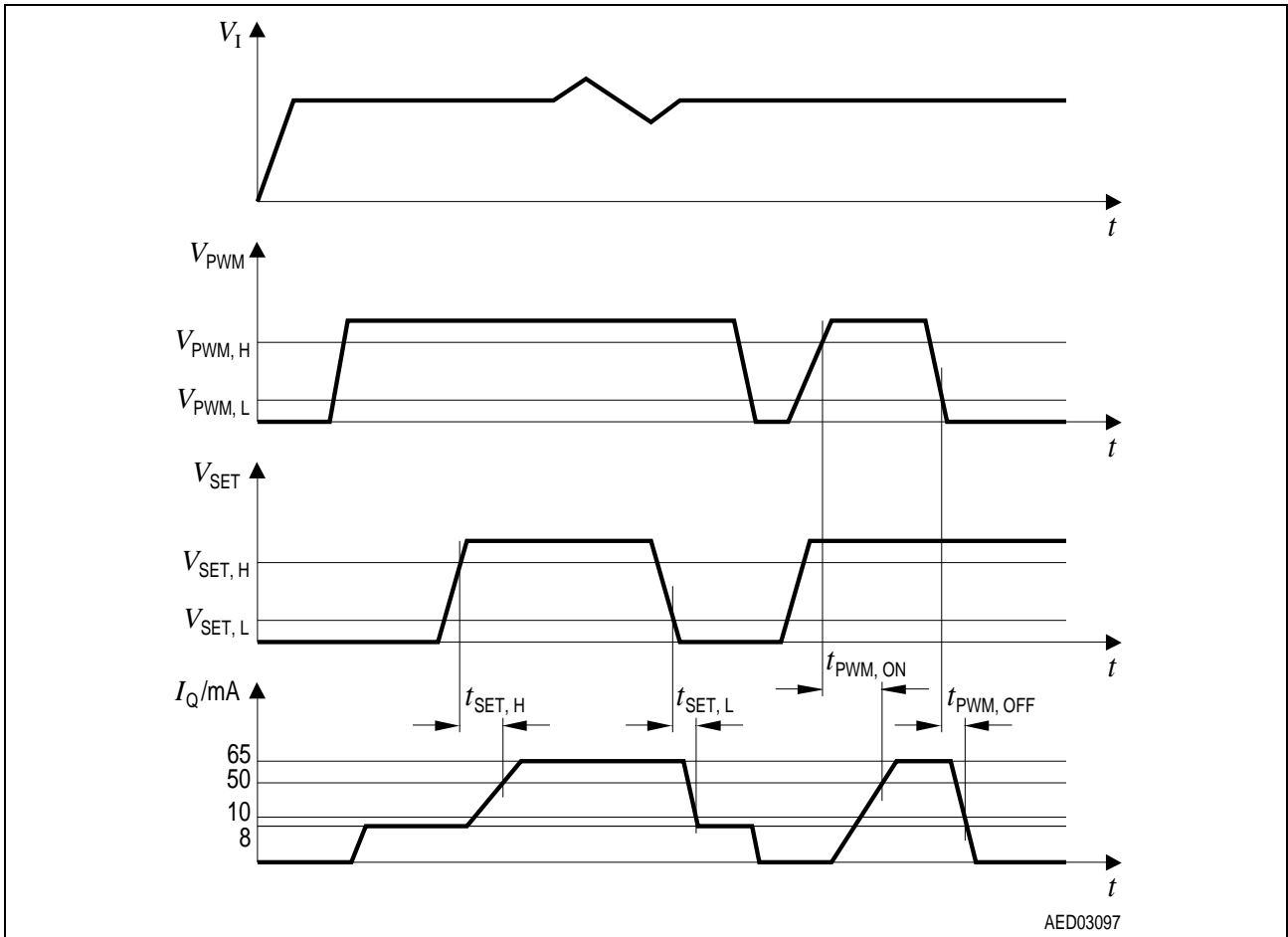


Figure 3 Timing and Function Diagram, $R_{REF} = 12\text{ K}\Omega$

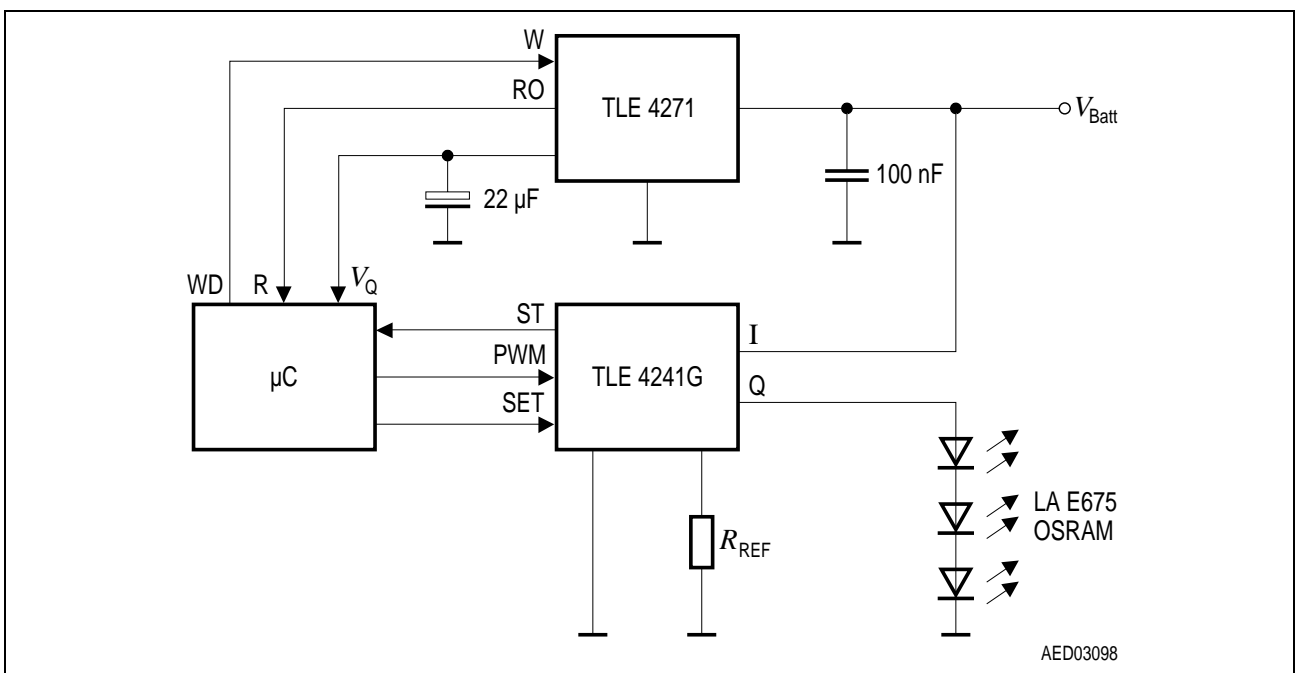
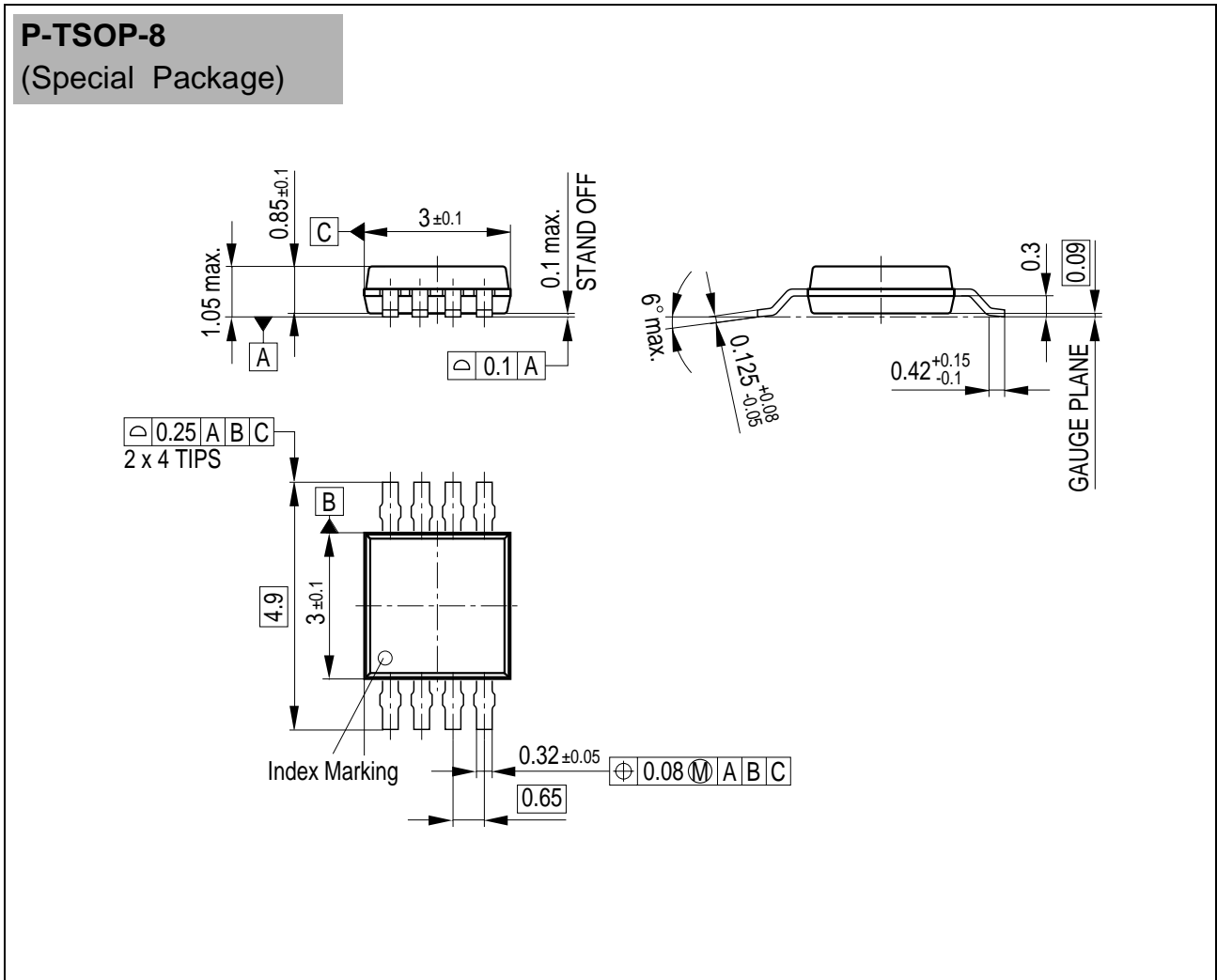


Figure 4 Application Circuit

Package Outlines



Sorts of Packing

Package outlines for tubes, trays etc. are contained in our Data Book "Package Information".

SMD = Surface Mounted Device

Dimensions in mm

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