# TLE42664

## Low Dropout Fixed Voltage Regulator

## Automotive Power



Never stop thinking



### Low Dropout Fixed Voltage Regulator

### **TLE42664G**



#### **Overview** 1

### **Features**

- Output Voltage 5 V ±2 % up to Output Currents of 50 mA
- Output Voltage 5 V ±3 % up to Output Currents 100 mA
- Very Low Dropout Voltage
- Very Low Current Consumption: typ. 40 µA
- Enable Input
- **Output Current Limitation**
- **Reverse Polarity Protection**
- **Overtemperature Shutdown**
- Wide Temperature Range From -40 °C up to 150 °C
- Suitable for Use in Automotive Electronics
- Green Product (RoHS compliant)
- AEC Qualified



#### Description

The TLE42664 is a monolithic integrated low dropout fixed voltage regulator for load currents up to 100 mA. It is the 1-to-1 replacement product for the TLE4266-2. It is functional compatible to the TLE4266, but has a reduced quiescent current of typ. 40µA. The TLE42664 is especially designed for applications requiring very low standby currents, e.g. with a permanent connection to the car's battery. It can be disabled/enabled by the integrated EN pin. The device is available in the small surface mounted PG-SOT223-4 package and is pin compatible to the TLE4266-2 and the TLE4266. The device is designed for the harsh environment of automotive applications. Therefore it is protected against overload, short circuit and overtemperature conditions by the implemented output current limitation and the overtemperature shutdown circuit. The TLE42664 can be also used in all other applications requiring a stabilized 5 V voltage.

An input voltage up to 45 V is regulated to  $V_{\rm Q,nom}$  = 5 V with a precision of ±3 %. An accuracy of ±2 % is kept for load currents up to 50 mA. A logical "HIGH" at the ENABLE pin enables the device.

Туре	Package	Marking
TLE42664G	PG-SOT223-4	42664



**Block Diagram** 

#### **Block Diagram** 2

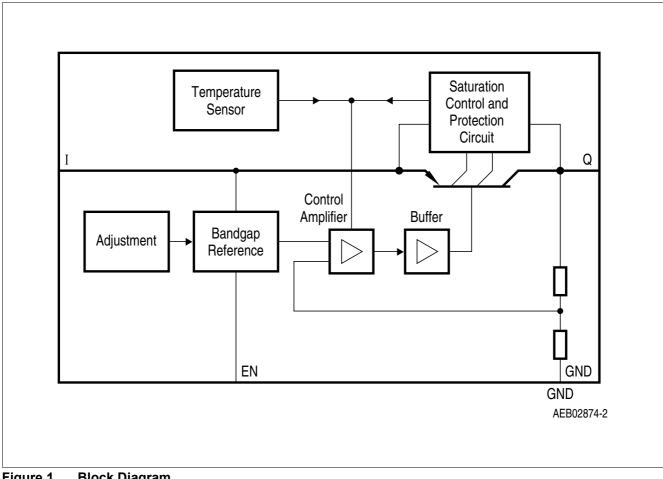


Figure 1 **Block Diagram** 



### **Pin Configuration**

### 3 Pin Configuration

### 3.1 Pin Assignment PG-SOT223-4

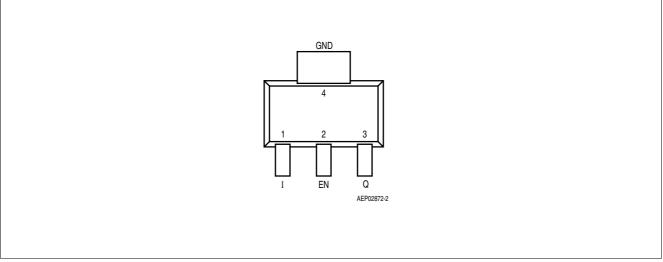


Figure 2 Pin Configuration (top view)

### 3.2 Pin Definitions and Functions PG-SOT223-4

Pin No.	Symbol	Function
1	I	Input
		block to ground directly at the IC with a ceramic capacitor
2	EN	Enable Input
		high level enables the device;
		low level disables the device;
		integrated pull-down resistor
3	Q	Output
		block to ground with a capacitor close to the IC terminals, respecting the values given
		for its capacitance and ESR in "Functional Range" on Page 5
4 / Heat Slug	GND	Ground / Heat Slug
_		internally connected to leadframe and GND;
		connect to GND and heatsink area



### 4 General Product Characteristics

### 4.1 Absolute Maximum Ratings

### Absolute Maximum Ratings<sup>1)</sup>

### $T_i$ = -40 °C to 150 °C; all voltages with respect to ground, (unless otherwise specified)

Pos.	Parameter	Symbol	Limit Values		Unit	<b>Test Condition</b>
			Min.	Max.		
Input I,	Enable EN	I	I			
4.1.1	Voltage	$V_{\rm I}, V_{\rm EN}$	-30	45	V	-
Output	Q					
4.1.2	Voltage	V <sub>Q</sub>	-0.3	32	V	-
Tempe	rature					
4.1.3	Junction temperature	Tj	-40	150	°C	-
4.1.4	Storage temperature	T <sub>stg</sub>	-50	150	°C	-
ESD Su	usceptibility					
4.1.5	ESD Absorption	$V_{\rm ESD,HBM}$	-3	3	kV	Human Body Model (HBM) <sup>2)</sup>
4.1.6		V <sub>ESD,CDM</sub>	-1500	1500	V	Charge Device Model (CDM) <sup>3)</sup> at all pins

1) not subject to production test, specified by design

2) ESD susceptibility Human Body Model "HBM" according to AEC-Q100-002 - JESD22-A114

3) ESD susceptibility Charged Device Model "CDM" according to ESDA STM5.3.1

- Note: Stresses above the ones listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
- Note: Integrated protection functions are designed to prevent IC destruction under fault conditions described in the data sheet. Fault conditions are considered as "outside" normal operating range. Protection functions are not designed for continuous repetitive operation.

### 4.2 Functional Range

Pos.	Parameter	Symbol	Lim	imit Values Unit		Remarks
			Min.	Max.		
4.2.1	Input voltage	V <sub>1</sub>	5.5	40	V	
4.2.2	Output Capacitor's	C <sub>Q</sub>	10	-	μF	-
4.2.3	Requirements for Stability	$ESR(C_Q)$	-	2	Ω	1)
4.2.4	Junction temperature	$T_{i}$	-40	150	°C	-

1) relevant ESR value at f = 10 kHz

Note: Within the functional or operating range, the IC operates as described in the circuit description. The electrical characteristics are specified within the conditions given in the Electrical Characteristics table.



### **General Product Characteristics**

### 4.3 Thermal Resistance

Note: This thermal data was generated in accordance with JEDEC JESD51 standards. For more information, go to www.jedec.org.

Pos.	Parameter	Symbol	Limit Values			Unit	Conditions
			Min.	Тур.	Max.		
TLE42	664G (PG-SOT223-4)	N	_1	<b>I</b>	<b>I</b>		
4.3.1	Junction to Case <sup>1)</sup>	R <sub>thJC</sub>	-	17	-	K/W	measured to heat slug
4.3.2	Junction to Ambient <sup>1)</sup>	R <sub>thJA</sub>	_	54	_	K/W	2)
4.3.3			_	139	-	K/W	footprint only <sup>3)</sup>
4.3.4			-	73	-	K/W	300 mm <sup>2</sup> heatsink area <sup>3)</sup>
4.3.5			-	64	-	K/W	600 mm <sup>2</sup> heatsink area <sup>3)</sup>

1) Not subject to production test, specified by design.

 Specified R<sub>thJA</sub> value is according to Jedec JESD51-2,-5,-7 at natural convection on FR4 2s2p board; The Product (Chip+Package) was simulated on a 76.2 x 114.3 x 1.5 mm<sup>3</sup> board with 2 inner copper layers (2 x 70µm Cu, 2 x 35µm Cu). Where applicable a thermal via array under the exposed pad contacted the first inner copper layer.

3) Specified  $R_{\text{thJA}}$  value is according to Jedec JESD 51-3 at natural convection on FR4 1s0p board; The Product (Chip+Package) was simulated on a 76.2 × 114.3 × 1.5 mm<sup>3</sup> board with 1 copper layer (1 x 70µm Cu).



### 5 Electrical Characteristics

### 5.1 Electrical Characteristics Voltage Regulator

### **Electrical Characteristics**

V.=13.5 V: T.	= -40 °C to 1	150 °C: all volta	aes with res	pect to around (	(unless otherwise s	specified)
· · · · · · · · · · · · · · · · · · ·			3			

Parameter	Symbol	Limit Values			Unit	Measuring Condition	
		Min. Typ. Max.					
Q		1	1	1			
Output Voltage	VQ	4.9	5.0	5.1	V	5 mA < $I_Q$ < 50 mA 6 V < $V_I$ < 16 V	
		4.85	5.0	5.15	V	5 mA < $I_Q$ <100 mA 6 V < $V_I$ < 21 V	
Output Voltage At Low Output Currents	V <sub>Q</sub>	4.80	5.0	5.20	V	100 μA < I <sub>Q</sub> <5 mA 6 V < V <sub>I</sub> < 21 V	
Dropout Voltage	V <sub>dr</sub>	-	250	500	mV	$I_{\rm Q} = 100 \text{ mA}$ $V_{\rm dr} = V_{\rm I} - V_{\rm Q}^{-1}$	
Load Regulation	$\Delta V_{ m Q, \ lo}$	-	50	90	mV	$I_{\rm Q}$ = 1 mA to 100 mA $V_{\rm I}$ = 13.5 V	
Line Regulation	$\Delta V_{ m Q,  li}$	-	5	30	mV	$V_1 = 6 V \text{ to } 28 V$ $I_Q = 1 \text{ mA}$	
Output Current Limitation	IQ	150	200	500	mA	1)	
Power Supply Ripple Rejection <sup>2)</sup>	PSRR	-	68	_	dB	<i>f</i> <sub>r</sub> = 100 Hz; <i>V</i> <sub>r</sub> = 0.5 Vpp	
Overtemperature Shutdown Threshold <sup>2)</sup>	$T_{\rm j,sd}$	151	-	200	°C	$T_{\rm j}$ increasing	
Overtemperature Shutdown Threshold Hysteresis <sup>2)</sup>	$T_{\rm j,sdh}$	-	25	-	°C	$T_{\rm j}$ decreasing	
t Consumption				1			
Current Consumption Device Disabled	$I_{q,OFF}$	-	0	1	μA	$V_{\rm EN}$ = 0 V; $T_{\rm j}$ < 100 °C	
Quiescent Current	Iq	-	40	60	μA	I <sub>Q</sub> = 100 μA, T <sub>j</sub> < 85 °C	
$I_{\rm q} = I_{\rm I} - I_{\rm Q}$		_	40	70	μA	I <sub>Q</sub> = 100 μA	
Current Consumption $I_{q} = I_{1} - I_{Q}$	Iq	-	1.7	4	mA	<i>I</i> <sub>Q</sub> = 50 mA	
Input							
High Level Input Voltage	$V_{\rm EN.ON}$	3.5	-	-	V	-	
Low Level Input Voltage		-	-	0.8	V	-	
Enable Input Current		-	4	8	μA	V <sub>EN</sub> = 5 V	
Pull-down Resistor	R <sub>EN</sub>	-	1.0	-	MΩ	-	
	QOutput VoltageOutput Voltage At Low Output CurrentsDropout VoltageLoad RegulationLine RegulationOutput Current LimitationPower Supply Ripple Rejection <sup>2)</sup> Overtemperature Shutdown Threshold <sup>2)</sup> Overtemperature Shutdown Threshold Hysteresis <sup>2)</sup> Consumption Device DisabledQuiescent Current $I_q = I_1 - I_Q$ Current Consumption $I_q = I_1 - I_Q$ High Level Input Voltage Low Level Input Voltage Enable Input Current	QOutput Voltage $V_Q$ Output Voltage At Low Output Currents $V_Q$ Dropout Voltage $V_{dr}$ Load Regulation $\Delta V_{Q, lo}$ Line Regulation $\Delta V_{Q, lo}$ Line Regulation $\Delta V_{Q, li}$ Output Current Limitation $I_Q$ Power Supply Ripple Rejection <sup>2)</sup> <i>PSRR</i> Overtemperature Shutdown Threshold <sup>2)</sup> $T_{j,sd}$ Overtemperature Shutdown Threshold <sup>2)</sup> $T_{j,sdh}$ Current Consumption Device Disabled $I_q, OFF$ Quiescent Current $I_q = I_1 - I_Q$ $I_q$ Current Consumption $I_q = I_1 - I_Q$ $I_q$ InputHigh Level Input Voltage $V_{EN,OFF}$ Enable Input Current $I_{EN,ON}$	Min.QOutput Voltage $V_Q$ 4.9 $Q$ 4.85Output Voltage At Low Output Currents $V_Q$ 4.80Dropout Voltage $V_{dr}$ -Load Regulation $\Delta V_{Q, lo}$ -Line Regulation $\Delta V_{Q, lo}$ -Output Current Limitation $I_Q$ 150Power Supply Ripple Rejection <sup>2)</sup> <i>PSRR</i> -Overtemperature Shutdown Threshold <sup>2)</sup> $T_{j,sd}$ 151Overtemperature Shutdown Threshold Hysteresis <sup>2)</sup> $I_{q,OFF}$ -Consumption Device Disabled $I_q$ -Quiescent Current $I_q = I_1 - I_Q$ $I_q$ -ImputHigh Level Input Voltage $V_{EN,OFF}$ -High Level Input Voltage $V_{EN,OFF}$ -Enable Input Current $I_{EN,ON}$ -	Min.Typ.QMin.Typ.Output Voltage $V_Q$ 4.95.0Output Voltage At Low Output Currents $V_Q$ 4.805.0Dropout Voltage $V_{dr}$ -250Load Regulation $\Delta V_{Q, lo}$ -50Line Regulation $\Delta V_{Q, lo}$ -50Line Regulation $I_Q$ 150200Power Supply Ripple Rejection <sup>2)</sup> <i>PSRR</i> -68Overtemperature Shutdown Threshold <sup>2)</sup> $T_{j,sdh}$ 151-Overtemperature Shutdown Threshold Hysteresis <sup>2)</sup> $T_{q,OFF}$ -0Quiescent Current $I_q = I_1 - I_Q$ $I_q$ -40Current Consumption $I_q = I_1 - I_Q$ $I_q$ -1.7InputHigh Level Input Voltage $V_{EN,OFF}$ High Level Input Voltage $V_{EN,OFF}$ Low Level Input Current $I_{EN,ON}$ -4	Min.Typ.Max.QOutput Voltage $V_Q$ 4.95.05.1 $0$ Utput Voltage At Low Output $V_Q$ 4.805.05.15Output Voltage At Low Output $V_Q$ 4.805.05.20Dropout Voltage $V_{dr}$ -250500Load Regulation $\Delta V_{Q, lo}$ -5090Line Regulation $\Delta V_{Q, lo}$ -5090Output Current Limitation $I_Q$ 150200500Power Supply Ripple Rejection <sup>2)</sup> <i>PSRR</i> -68-Overtemperature Shutdown Threshold <sup>2)</sup> $T_{j,sdh}$ 151-200Overtemperature Shutdown Threshold Hysteresis <sup>2)</sup> $T_{q,oFF}$ -01Current Consumption Device Disabled $I_q$ -4060 $I_q = I_1 - I_Q$ $I_q$ -4070Current Consumption $I_q = I_1 - I_Q$ $I_q$ -0.8-High Level Input Voltage $V_{EN,OFF}$ -0.8-Enable Input Current $I_{EN,ON}$ -48	Min.Typ.Max.QOutput Voltage $V_Q$ 4.95.05.1V $A.85$ 5.05.15V4.855.05.15VOutput Voltage At Low Output Currents $V_Q$ 4.805.05.20VDropout Voltage $V_{dr}$ -250500mVLoad Regulation $\Delta V_{Q, lo}$ -5090mVLine Regulation $\Delta V_{Q, li}$ -530mVOutput Current Limitation $I_Q$ 150200500mAPower Supply Ripple Rejection <sup>2)</sup> <i>PSRR</i> -68-dBOvertemperature Shutdown Threshold <sup>2)</sup> $T_{j,sd}$ 151-200°COvertemperature Shutdown Threshold Hysteresis <sup>2)</sup> $T_{q,OFF}$ -01 $\mu A$ Quiescent Current $I_q = I_1 - I_Q$ $I_q$ -4060 $\mu A$ $I_q = I_1 - I_Q$ $I_q$ -1.74mAInputHigh Level Input Voltage $V_{EN,OFF}$ 0.8VEnable Input Current $I_{EN,ON}$ -48 $\mu A$	

1) Measured when the output voltage  $V_{\rm Q}$  has dropped 100 mV from the nominal value obtained at  $V_{\rm I}$  = 13.5 V.

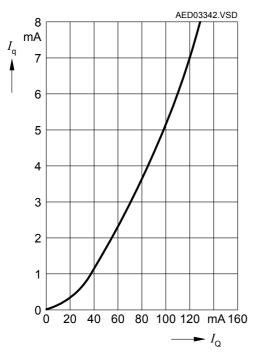
2) not subject to production test, specified by design



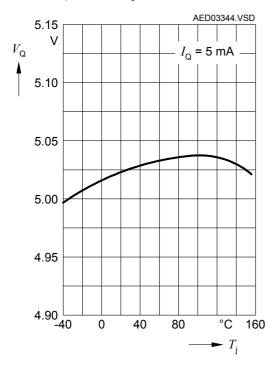
#### **Electrical Characteristics**

### 5.2 Typical Performance Characteristics Voltage Regulator

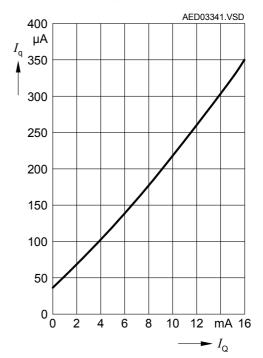
# Current Consumption $I_{\rm q}$ versus Output Current $I_{\rm Q}$



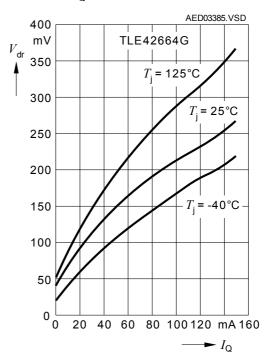
# Output Voltage Variation $\Delta V_{\rm Q}$ versus Junction Temperature $T_{\rm J}$



### Current Consumption $I_q$ versus Low Output Current $I_Q$

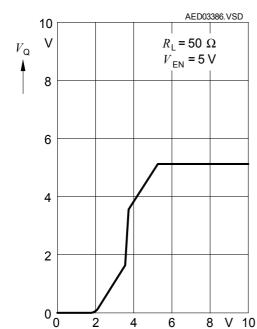


### Dropout Voltage $V_{dr}$ versus Output Current $I_{O}$





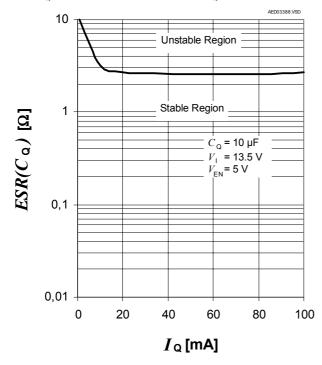
### **Electrical Characteristics**



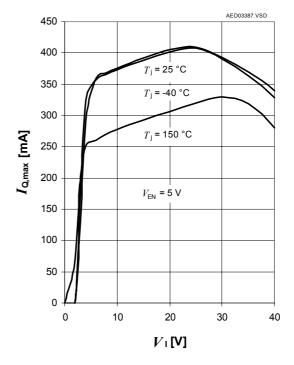
Output Voltage  $V_{\rm Q}$  versus Input Voltage  $V_{\rm I}$ 

Region Of Stability: Output Capacitor's ESR  $ESR(C_{Q})$  versus Output Current  $I_{Q}$ 

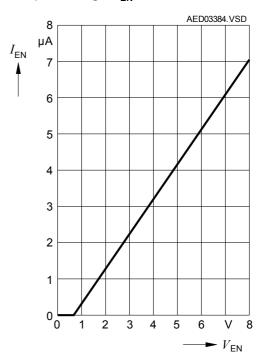
 $- V_{I}$ 



### Maximum Output Current $I_{Q}$ versus Input Voltage $V_{I}$



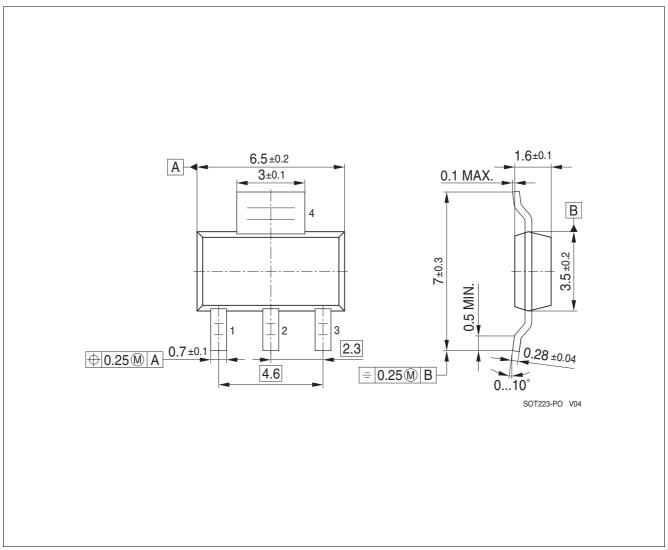
Enable Input Current  $I_{\rm EN}$  versus Enable Input Voltage  $V_{\rm EN}$ 





### **Package Outlines**

### 6 Package Outlines





### Green Product (RoHS compliant)

To meet the world-wide customer requirements for environmentally friendly products and to be compliant with government regulations the device is available as a green product. Green products are RoHS-Compliant (i.e Pb-free finish on leads and suitable for Pb-free soldering according to IPC/JEDEC J-STD-020).

For further information on alternative packages, please visit our website: http://www.infineon.com/packages.



**Revision History** 

### 7 Revision History

Revision	Date	Changes
1.0	2009-06-26	initial version data sheet
1.01	2009-09-30	updated version data sheet; typing error corrected in <b>Table 4.1 "Absolute</b> <b>Maximum Ratings" on Page 5</b> : In <b>Item 4.1.1</b> min. value corrected from "-42V" to "-30V"

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