

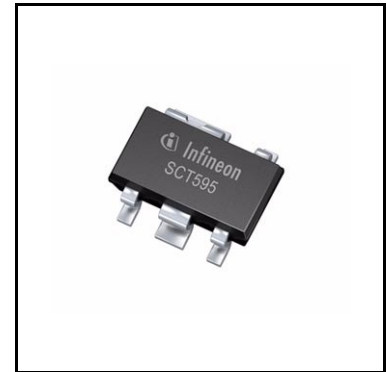
# OPTIREG™ linear TLE4296G

## Low drop voltage regulator



### Features

- Two output voltage versions: 3.3 V, 5.0 V
- Output voltage tolerance  $\leq \pm 4\%$
- Very low drop voltage
- Output current: 30 mA
- Inhibit function
- Low quiescent current consumption
- Input voltage up to 45 V
- Wide temperature range:  $T_j = -40^\circ\text{C}$  to  $+150^\circ\text{C}$
- Output protected against short circuit
- Overtemperature protection
- Reverse polarity proof
- Very small and thermally enhanced package
- Green Product (RoHS compliant)



### Potential applications

General automotive applications

### Product validation

Qualified for automotive applications. Product validation according to AEC-Q100.

### Description

The OPTIREG™ linear TLE4296G is a monolithic integrated low drop voltage regulator in very small SMD package PG-SCT595-5. It is designed to supply various loads (e.g. microcontrollers, sensors, or as stand-by supply, etc.) under severe conditions. Therefore the device is equipped with additional protection functions against overload, short circuit and reverse polarity. In case of an overtemperature condition the regulator is automatically turned off by the integrated thermal protection circuit.

# OPTIREG™ linear TLE4296G

## Low drop voltage regulator

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Input voltages up to 40 V are regulated to  $V_{Q,nom} = 3.3$  V (V33 version) or 5.0 V (V50 version). The output is able to drive a load of 30 mA while it regulates the output voltage within a 4% accuracy. To save energy the device can be switched to stand-by mode via an inhibit input which causes the current consumption to drop below 5  $\mu$ A.

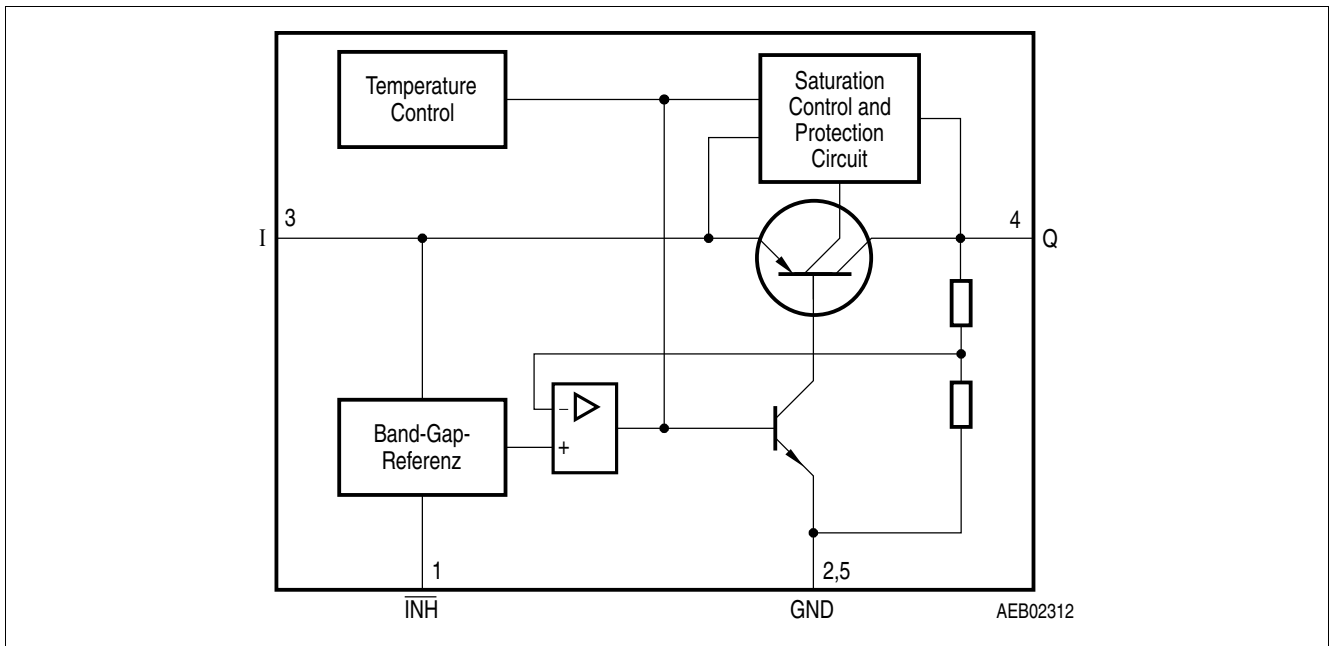
Type	Package	Marking
TLE4296GV33	PG-SCT595-5	C2
TLE4296GV50	PG-SCT595-5	C1

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**Block diagram**

**1 Block diagram**



**Figure 1 Block diagram**

Pin configuration

## 2 Pin configuration

### 2.1 Pin assignment

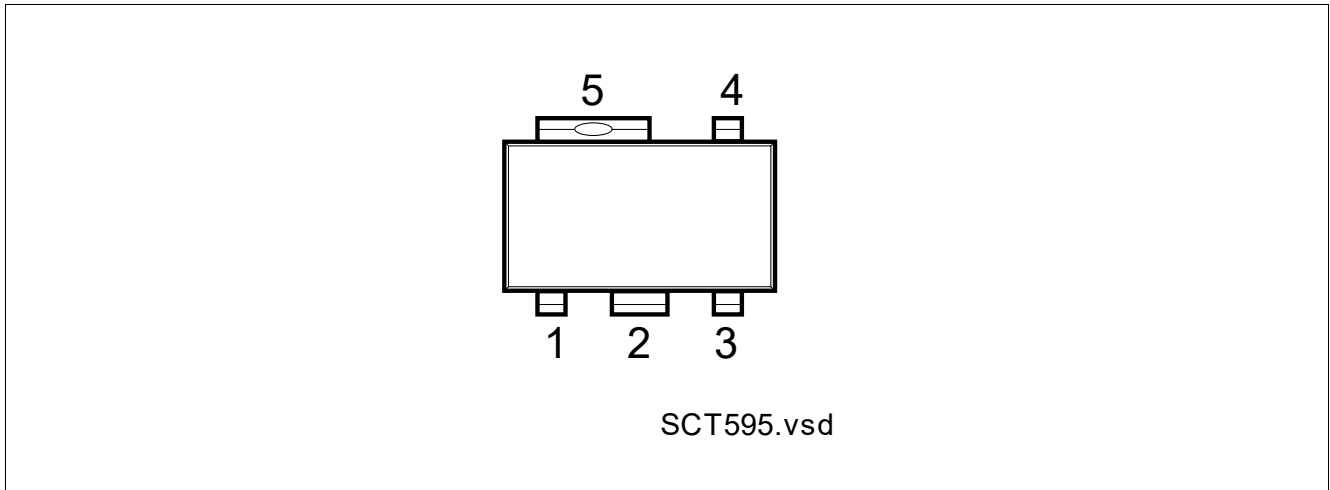


Figure 2 Pin configuration (top view)

### 2.2 Pin definitions and functions

Table 1 Pin definitions and functions

Pin	Symbol	Function
1	$\overline{\text{INH}}$	<b>Inhibit input</b> High level to turn on the IC.
2	GND	<b>Ground</b> Connected to pin 5.
3	I	<b>Input voltage</b>
4	Q	<b>Output voltage</b> Must be blocked with a ceramic capacitor $C_Q \geq 2.2 \mu\text{F}$ , ESR $3 \Omega$ to $10 \Omega$ .
5	GND	<b>Ground</b> Connected to pin 2.

**General product characteristics**

### 3 General product characteristics

#### 3.1 Absolute maximum ratings

**Table 2 Absolute maximum ratings<sup>1)</sup>**

$T_j = -40^\circ\text{C}$  to  $150^\circ\text{C}$ ; all voltages with respect to ground, positive current flowing into pin (unless otherwise specified)

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
<b>Input</b>							
Voltage	$V_I$	-42	-	45	V	-	P_3.1.1
Current	$I_I$	-	-	-		<sup>2)</sup>	
<b>Output</b>							
Voltage	$V_Q$	-6	-	30	V	-	P_3.1.2
Current	$I_I$	-	-	-		<sup>2)</sup>	
<b>Inhibit</b>							
Voltage	$V_{\overline{\text{INH}}}$	-42	-	45	V	-	P_3.1.3
Current	$I_{\overline{\text{INH}}}$	-500	-	<sup>2)</sup>	$\mu\text{A}$	-	P_3.1.4
		-5	-	5	mA	$-0.3\text{ V} \leq V_I \leq 45\text{ V};$ $t_p < 1\text{ ms}$	P_3.1.5
<b>Temperatures</b>							
Junction temperature	$T_j$	-40	-	150	$^\circ\text{C}$	-	P_3.1.6
Storage temperature	$T_{\text{stg}}$	-50	-	150	$^\circ\text{C}$	-	P_3.1.7

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

2) Internally limited.

#### Notes

1. 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.
2. 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.

**General product characteristics**

**3.2 Functional range**

**Table 3 Functional range**

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Input voltage	$V_I$	4.0	–	45	V	TLE4296GV33	P_3.2.1
		5.5	–	45	V	TLE4296GV50	P_3.2.2
Inhibit voltage	$V_{INH}$	-0.3	–	40	V	–	P_3.2.3
Junction temperature	$T_j$	-40	–	150	°C	–	P_3.2.4

*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.

**3.3 Thermal resistance**

*Note:* This thermal data was generated in accordance with JEDEC JESD51 standards. For more information, go to [www.jedec.org](http://www.jedec.org).

**Table 4 Thermal resistance**

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Junction to ambient	$R_{thJA}$	–	179	–	K/W	Zero airflow zero heat sink area <sup>1)</sup>	P_3.4.1
Junction to soldering point	$R_{thJSP}$	–	30	–	K/W	measured to Pin 5	P_3.4.2

1) Worst case regarding peak temperature.

**Electrical characteristics**

**4 Electrical characteristics**

**4.1 Electrical characteristics voltage regulator**

**Table 5 Electrical characteristics voltage regulator**

$V_I = 13.5\text{ V}$ ;  $V_{\text{INH}} > 2.5\text{ V}$ ;  $T_j = -40^\circ\text{C}$  to  $+150^\circ\text{C}$ ; all voltages with respect to ground (unless otherwise specified)

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Output voltage TLE4296GV33	$V_Q$	3.17	3.30	3.43	V	$1\text{ mA} \leq I_Q \leq 30\text{ mA}$ $V_I = 13.5\text{ V}$	P_5.1.1
		3.17	3.30	3.43	V	$I_Q = 10\text{ mA}$ ; $4.3\text{ V} \leq V_I \leq 40\text{ V}$	P_5.1.2
Output voltage TLE4296GV50	$V_Q$	4.80	5.00	5.20	V	$1\text{ mA} \leq I_Q \leq 30\text{ mA}$ $V_I = 13.5\text{ V}$	P_5.1.18
		4.80	5.00	5.20	V	$I_Q = 10\text{ mA}$ ; $6\text{ V} \leq V_I \leq 40\text{ V}$	P_5.1.19
Output current limitation	$I_Q$	30	–	–	mA	<sup>1)</sup>	P_5.1.3
Dropout voltage <sup>1)</sup>	$V_{\text{dr}}$	–	250	300	mV	$I_Q = 20\text{ mA}$	P_5.1.4
Output capacitor	$C_Q$	2.2	–	–	$\mu\text{F}$	ESR $3\ \Omega$ to $10\ \Omega$ at $100\text{ kHz}$	P_4.1.1
Current consumption $I_q = I_I - I_Q$	$I_q$	–	2	4.5	mA	$I_Q < 30\text{ mA}$	P_5.1.6
		–	110	170	$\mu\text{A}$	$I_Q < 1\text{ mA}$ ; $T_j < 85^\circ\text{C}$	P_5.1.7
Quiescent current (stand-by) $I_q = I_I - I_Q$	$I_q$	–	–	1	$\mu\text{A}$	$V_{\text{INH}} = 0.4\text{ V}$ ; $T_j < 85^\circ\text{C}$	P_5.1.8
		–	–	5	$\mu\text{A}$	$V_{\text{INH}} = 0.4\text{ V}$	P_5.1.9
Load regulation	$\Delta V_Q$	–	10	20	mV	$1\text{ mA} < I_Q < 25\text{ mA}$ ; $T_j = 25^\circ\text{C}$ ;	P_5.1.10
Line regulation	$\Delta V_Q$	–	5	20	mV	$V_I = (V_{Q,\text{nom}} + 0.5\text{ V})$ to $36\text{ V}$ ; $I_Q = 5\text{ mA}$ ; $T_j = 25^\circ\text{C}$	P_5.1.12
Power supply ripple rejection	PSRR	–	60	–	dB	$f_r = 100\text{ Hz}$ ; $V_r = 0.5\text{ V}_{\text{pp}}$	P_5.1.13

**Logic Inhibit input**

Inhibit, turn-on voltage	$V_{\text{INH},\text{high}}$	–	–	2.2	V	$V_Q > 0.95 \times V_{Q,\text{nom}}$	P_5.1.14
Inhibit, turn-off voltage	$V_{\text{INH},\text{low}}$	0.4	–	–	V	$V_Q < 0.1\text{ V}$	P_5.1.15
H-input current	$V_{\text{INH},\text{high}}$	–	8	12	$\mu\text{A}$	$V_{\text{INH}} = 5\text{ V}$	P_5.1.16
L-input current	$V_{\text{INH},\text{low}}$	-2	–	2	$\mu\text{A}$	$V_{\text{INH}} = 0\text{ V}$	P_5.1.17

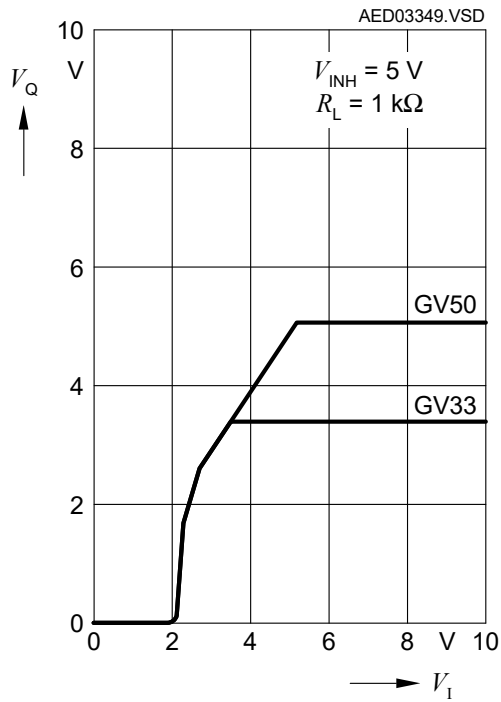
<sup>1)</sup> Measured when the output voltage  $V_Q$  has dropped 100 mV from the nominal value.



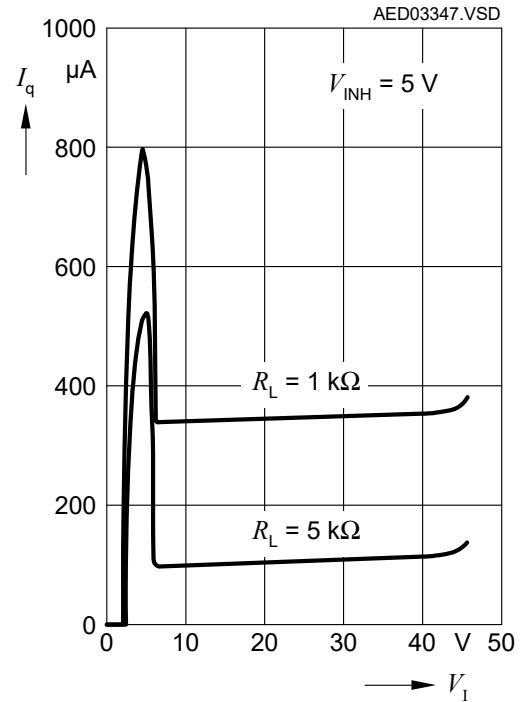
**Electrical characteristics**

**4.2 Typical performance characteristics voltage regulator**

**Output voltage  $V_Q$  vs. input voltage  $V_I$**



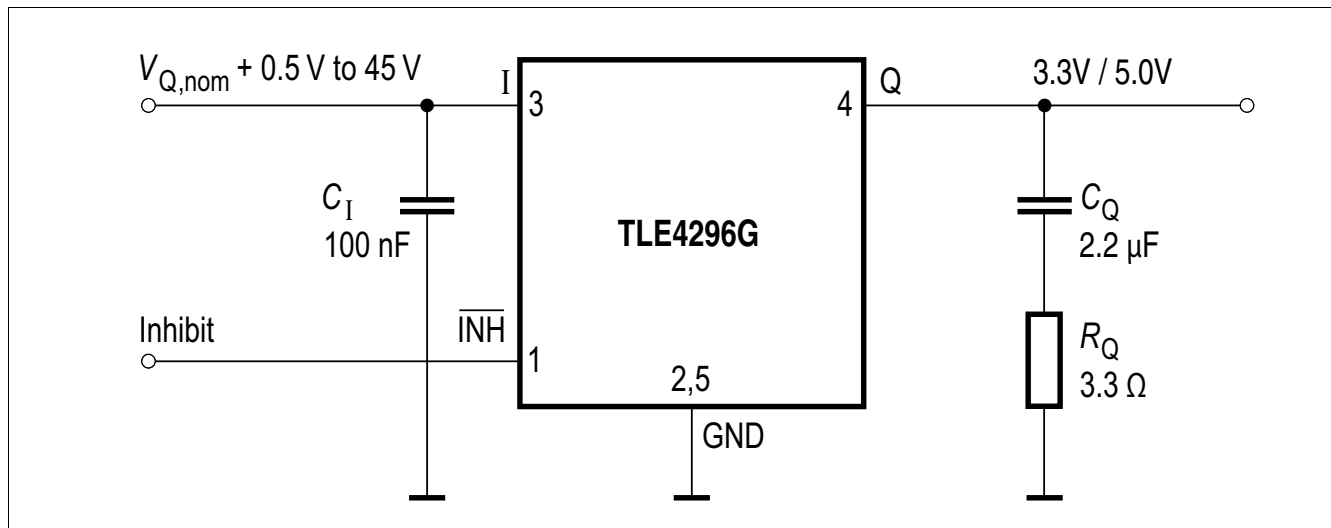
**Current consumption  $I_q$  vs. input voltage  $V_I$**



**Application information**

**5 Application information**

*Note: The following information is given as a hint for the implementation of the device only and shall not be regarded as a description or warranty of a certain functionality, condition or quality of the device.*



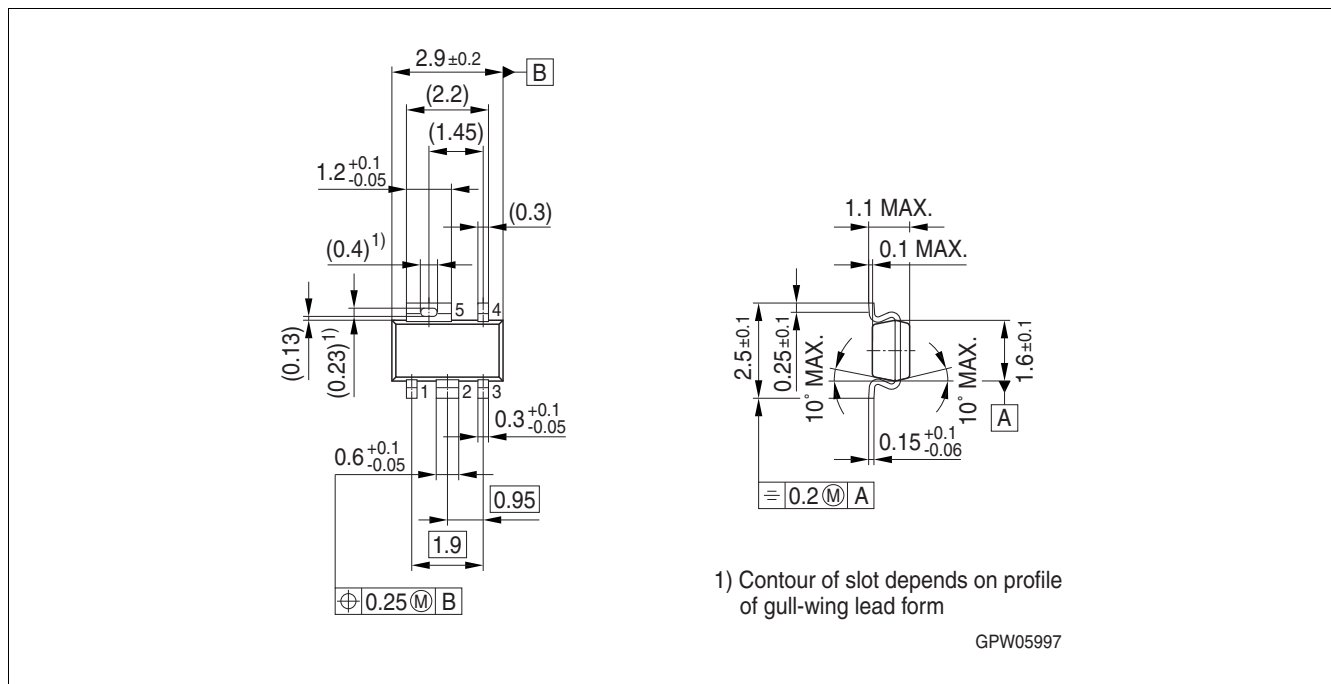
**Figure 3 Application diagram**

The output voltage of the TLE4296G is divided and compared to an internal reference of 2.5 V typical. A regulation loop controls the output to achieve a stabilized output voltage.

**Figure 3** shows a typical application circuit. In order to maintain the stability of the control loop the TLE4296G output requires an output capacitor  $C_Q$  of at least 2.2  $\mu\text{F}$  with a minimum required ESR of 3  $\Omega$  and a maximum allowed ESR of 10  $\Omega$ . It is recommended to use for  $C_Q$  a suitable tantalum capacitor (e.g. the EPCOS 3.3  $\mu\text{F}$  / 16V B45196P3335M209 or 4.7  $\mu\text{F}$  / 10V B45196-P247M109) or a multilayer ceramic capacitor with a sufficiently dimensioned series resistor in order to cover the required ESR range over the full operating temperature range of  $T_j = -40^\circ\text{C}$  to  $+150^\circ\text{C}$ .

At the input of the regulator a capacitor is required for compensating line influences (100 nF ceramic capacitor recommended). A resistor of approximately 1  $\Omega$  in series with the input capacitor  $C_I$  can dampen oscillations that could occur due to the input line inductance and the input capacitor.

## 6 Package information



**Figure 4 PG-SCT595-5<sup>1)</sup>**

### 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).

### Further information on packages

<https://www.infineon.com/packages>

1) Dimensions in mm

**Revision history**

## **7 Revision history**

<b>Revision</b>	<b>Date</b>	<b>Changes</b>
1.2	2021-05-05	Updated layout and structure Deleted 3.0 V version Editorial changes Added TOC
1.1	2008-04-21	Initial version of RoHS-compliant derivate of TLE4296 Page 1: AEC certified statement and Marking information added Chapter 6: RoHS compliance and Green product feature added Further editorial changes
1.0	2004-01-01	Initial release

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