

Integrated Low Profile Transceiver Module for Telecom Applications – IrDA Standard



Description

The miniaturized TFDU4202 is an ideal transceiver for applications in telecommunications like mobile phones and pagers. The device is mechanically designed for lowest profile with a height of only 2.8 mm. The infrared transceiver is compatible to the latest IrDA® IrPHY specification up to a data rate of 115 kbit/s. At lower operating voltages up to 3.3 V the transceiver can be operated without external current limiting resistor to achieve a range > 1 m.

The added feature is a split power supply for IRED – driver (V_{CCP}) and ASIC (V_{CCP}).

For operating only in the distance limited low power range (20 cm/ 30 cm), TFDU4201 with built-in current control is recommended. For these devices see the equivalent data sheets.

Features

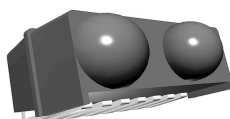
- Package Dimension μ Face **TFDU4202**:
L 7.1 mm x W 4.7 mm x H 2.8 mm
- Compatible to latest IrDA IrPHY Standard
- SMD Side View
- Lowest Power Consumption
65 μ A, Receive Mode, 0.01 μ A Shutdown
- Built-in Current Limitation
- Output Intensity Adjustable by External Resistor
- Wide Supply Voltage Range (2.4 V to 5.5 V)
- **Split Power Supply *)**
- Operational down to 2.0 V
- Fewest External Components
- Eye Safety: Double Safety Measures:
Limited Optical Output Pulse Duration
Limited Optical Output Intensity
- Push–pull Output (Rxd)
- High EMI Immunity

Applications

Mobile Phones, Pagers,
Personal Digital Assistants (PDA),
Hand–held battery operated equipment

Package

TFDU4202
 μ Face Side View
weight: 0.10 g



*) US Patent # 08995536

µFace SIR Selector Guide

Part Number	Main Feature	Rxd Output in Txd Mode	IRE Drive Capability	IrDA Compliance	Power Supply
TFDU4201	Low Power 20 cm/ 30 cm IrDA Standard SD pin	Optical Feedback**) (for e.g. self-test mode)	Internally current controlled, adjusted for $I_e > 4 \text{ mW/sr}$	Low Power SIR, pairs of TFDU4201 operate typically over a range of $> 70 \text{ cm}$ on axis	One power supply only, due to the very low current consumption no need for split power supply
TFDU4202	Split Power Supply Increased Range 70 cm	Quiet**) necessary for some WinCE® applications, Rxd grounded when $V_{CC} = 0 \text{ V}$	Internally current controlled to cover extended range of 70 cm. Current level can be reduced by an external resistor	Low Power SIR as e.g. TFDU4201, pairs of TFDU4202 operate typically up to full IrDA SIR distance $> 1 \text{ m}$	Split power supply*) can be used when operated at higher IRED current levels
TFDU4203	Similar to TFDU4201 with increased range 70 cm, SD pin	Quiet**) necessary for some WinCE® applications	Internally current controlled to cover extended range of 70 cm. Current level can be reduced by an external resistor	Low Power SIR as e.g. TFDU4201, pairs of TFDU4203 operate typically up to full IrDA SIR distance $> 1 \text{ m}$	One power supply only
TFDU4204	Similar to TFDU4202, Logic Input and Output Levels Adapted to 1.8 V Logic	Quiet**) necessary for some WinCE® applications, Rxd output is floating when supply voltage below 0.7 V	Internally current controlled to cover extended range of 70 cm. Current level can be reduced by an external resistor	Low Power SIR as e.g. TFDU4201, pairs of TFDU4204 operate typically up to full IrDA SIR distance $> 1 \text{ m}$	Split power supply*) can be used when operated at higher IRED current levels

*) Split power supply: The receiver circuit only is connected to a regulated power supply. The high IRED current can be supplied by a less controlled power line or directly from the battery. That feature saves power supply costs. TELEFUNKEN introduced this feature as the world first with the 4000 series (US Patent # 08995536)

**) Depending on the designs different applications need an optical feedback for test purposes or must be quiet (e.g. in Windows CE® applications).

Ordering Information

Part Number	Qty / Reel	Description
TFDU4202-TR1	750	Orientated in carrier tape for side view mounting
TFDU4202-TR3	2250	Orientated in carrier tape for side view mounting

Functional Block Diagram

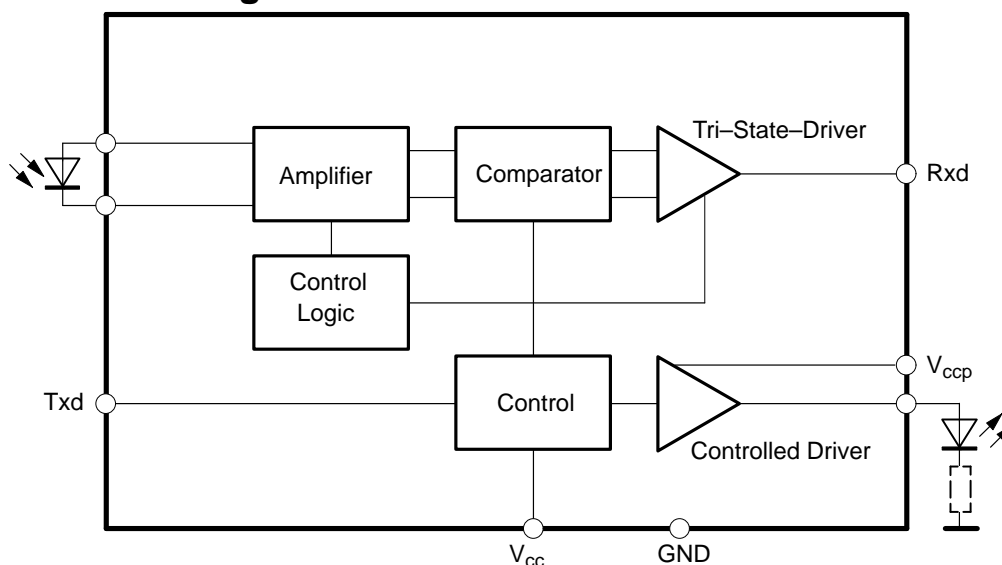


Figure 1. Functional Block Diagram

Pin Description TFDU4202

Pin	Symbol	Description	I/O	Active
1	IRED GND	IRED Cathode, Ground		
2	IRED GND	IRED Cathode, Ground		
3	Rxd	Output, Received Data, Push-pull output	O	LOW
4	V _{CCP}	IRED Supply Voltage		
5	GND	Ground		
6	GND	Ground		
7	Txd	Input, Transmit Data	I	HIGH
8	V _{CC} *)	Power Supply Voltage	I	HIGH

*) V_{CC} is allowed to be switched off for standby with V_{CCP} applied.

Absolute Maximum Ratings

Reference Point Pin 8, unless otherwise noted.

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Unit	Remarks
Supply Voltage Range		V_{CC}	-0.5		6	V	
		V_{CCP}	-0.5		6	V	
Input Current					10	mA	all pins
Output Sink Current					25	mA	
Power Dissipation		P_{tot}			200	mW	
Junction Temperature		T_J			125	°C	
Ambient Temperature Range (Operating)		T_{amb}	-25		85	°C	
Storage Temperature Range		T_{stg}	-40		100	°C	
Soldering Temperature	$t = 20 \text{ s @ } 215^\circ\text{C}$			215	240	°C	see Vishay Telefunken IrDA Design Guide
Average IRED Current		$I_{IRED(DC)}$			125	mA	
Repetitive Pulsed IRED Current		$I_{IRED(RP)}$			500	mA	$<90 \mu\text{s}$, $t_{on} < 20\%$
Transmitter Data Input Voltage		V_{Txd}	-0.5		6	V	
Receiver Data Output Voltage		V_{Rxd}	-0.5		6	V	
Virtual source size	Method: (1-1/e) encircled energy	d		2		mm	
Compatible to Class 1 operation of IEC 60825 or EN60825 with worst case IrDA SIR pulse pattern, 115.2 kbit/s							



Electrical Characteristics

Tested for the following parameters ($V_{CC} = 2.4\text{ V}$ to 5.5 V , -25°C to 85°C , unless otherwise stated)

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Unit	Remarks
Transceiver							
Supported Data Rates	Base band		9.6		115.2	kbit/s	
Supply Voltage Range		V_{CC}	2.4		5.5	V	Operational Down to 2.0 V
Supply Current	$V_{CC} = 2.4\text{ V}$ to 5.5 V $E_e = 0$	I_S		65	100	μA	Receive Mode, full Temperature Range
	$V_{CC} = 2.4\text{ V}$ to 5.5 V 10 klx sunlight	I_S		70	100	μA	Receive Mode or Transmit Mode, full Temperature Range, no signal
	$V_{CC} = 2.7\text{ V}$, $V_{CCP} = 2.7\text{ V}$, 115.2 kbit/s transmission	I_S		1		mA	Receive Mode, Nose to Nose operation
Supply Current, @ V_{CCP}	Shutdown mode $V_{CC} = 0\text{ V}$	$I_{S\text{shutdown}}$		0.02	1 10	μA nA	Entire Temperature Range 20°C
IRED Peak Current transmitting	$I_e = 40\text{ mW/sr}$, no external resistor $V_{CCP} = 2.7\text{ V}$	I_{Str}			360	mA	SIR Standard
Transceiver "Power On" Settling Time					1	ms	Time from Switching on V_{CC} to Established Specified Operation

Optoelectronic Characteristics

Tested for the following parameters ($V_{CC} = 2.4 \text{ V}$ to 5.5 V , -25°C to 85°C , unless otherwise stated)

Parameter	Test Conditions	Symbol	Min.	Typ	Max	Unit	Remarks
Receiver							
Min. Detection Threshold Irradiance (Logic High Receiver Input Irradiance)	$ \alpha \leq \pm 15^{\circ}$ $V_{CC} = 2.4 \text{ V}$ to 5.5 V 2.0 V	$E_{e, \min}$		25 (2.5)	50 (5)	mW/m^2 $\mu\text{W}/\text{cm}^2$	
				50	100	mW/m^2	25°C tested
Max. Detection Threshold Irradiance	$ \alpha \leq \pm 90^{\circ}$ $V_{CC} = 5 \text{ V}$	$E_{e, \max}$	3300 (330)	5000 (500)		W/m^2 mW/cm^2	
	$ \alpha \leq \pm 90^{\circ}$ $V_{CC} = 3 \text{ V}$	$E_{e, \max}$	8000 (800)	15000 (1500)		W/m^2 mW/cm^2	
Logic Low Receiver Input Irradiance		$E_{e, \max, \text{low}}$			4 (0.4)	mW/m^2 $\mu\text{W}/\text{cm}^2$	
Output Voltage Rxd	Active	V_{OL}	0		0.5	V	C = 15 pF
	Non Active	V_{OH}	$V_{CC} - 0.5$			V	C = 15 pF
Output Current Rxd $V_{OL} < 0.5 \text{ V}$					4	mA	
Rise Time @Load: C = 15 pF, R = 2.2k		t_r	20		70	ns	
Fall Time @Load: C = 15 pF, R = 2.2k		t_f	20		70	ns	
Rxd Signal Electrical Output Pulse Width	2.4 kbit/s, Input Pulse Width 1.41 μs to 3/16 of bit Duration	t_p	1.41		20	μs	
	115.2 kbit/s, Input Pulse Width 1.41 μs to 3/16 of bit Duration	t_p	1.41		4.5	μs	
Output Delay Time (Rxd), Leading Edge, Optical Input to electrical output	Output Level = $0.5 \times V_{CC}$ @ 40 mW/m^2	t_{dl}		1	2	μs	
Jitter, Leading Edge of Output Signal	Over a Period of 10 bit, 115.2 kbit/s	t_j			400	ns	
Output Delay Time (Rxd), Trailing Edge, Optical Input to electrical output	Output Level = $0.5 \times V_{CC}$ 40 mW/m^2	t_{dt}			6.5	μs	
Power on time, SD recovery time				0.1	1	ms	
Latency		t_L		100	200	μs	

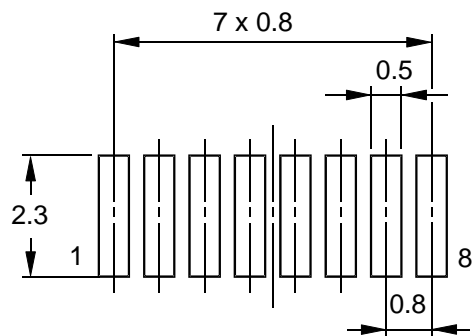


Optoelectronic Characteristics (continued)

Tested for the following parameters ($V_{CC} = 2.4 \text{ V to } 5 \text{ V}$, -25°C to 85°C , unless otherwise stated)

Parameter	Test Conditions	Symbol	Min.	Typ	Max.	Unit	Remarks
Transmitter							
Logic Low Transmitter Input Voltage		$V_{IL}(\text{Txd})$	-0.5		$0.15 \times V_{CC}$	V	
Logic High Transmitter Input Voltage		$V_{IH}(\text{Txd})$	$0.8 \times V_{CC}$		6	V	
Optical Output Radiant Intensity, $ \alpha \leq \pm 15^{\circ}$	$I_{F1} = 320 \text{ mA}$, Current Controlled by External Resistor	I_e	45			mW/sr	Voltage Range 2.7 V to 5.5 V
Peak Emission Wavelength		λ_p	850		900	nm	
Spectral Emission Bandwidth				60		nm	
Optical Rise/Falltime	115.2 kHz Square Wave Signal (duty cycle 1:1)				200	ns	
Optical Output Pulse Duration	Input Pulse Duration 1.6 μs		1.5	1.6	1.7	μs	
	Input Pulse Duration > 25 μs				25	μs	Safety Protection
Output Radiant Intensity	Logic Low Level				0.04	$\mu\text{W/sr}$	
Overshoot, Optical					25	%	
Rising Edge Peak to Peak Jitter	Over a Period of 10 bits, Independent of Information Content	t_j			0.2	μs	

Recommended SMD Pad Layout



Transceiver leads to be soldered symmetrically on pads

Figure 2. Pad Layout

Temperature Derating

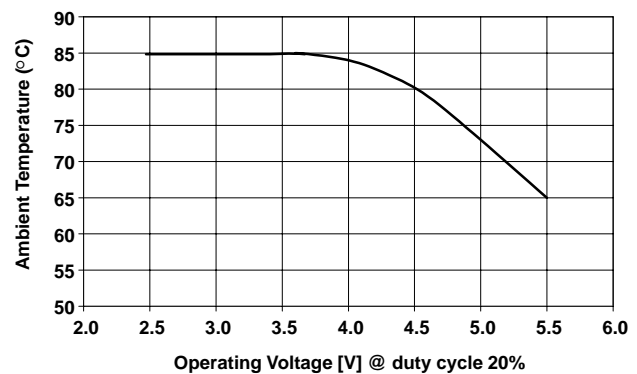
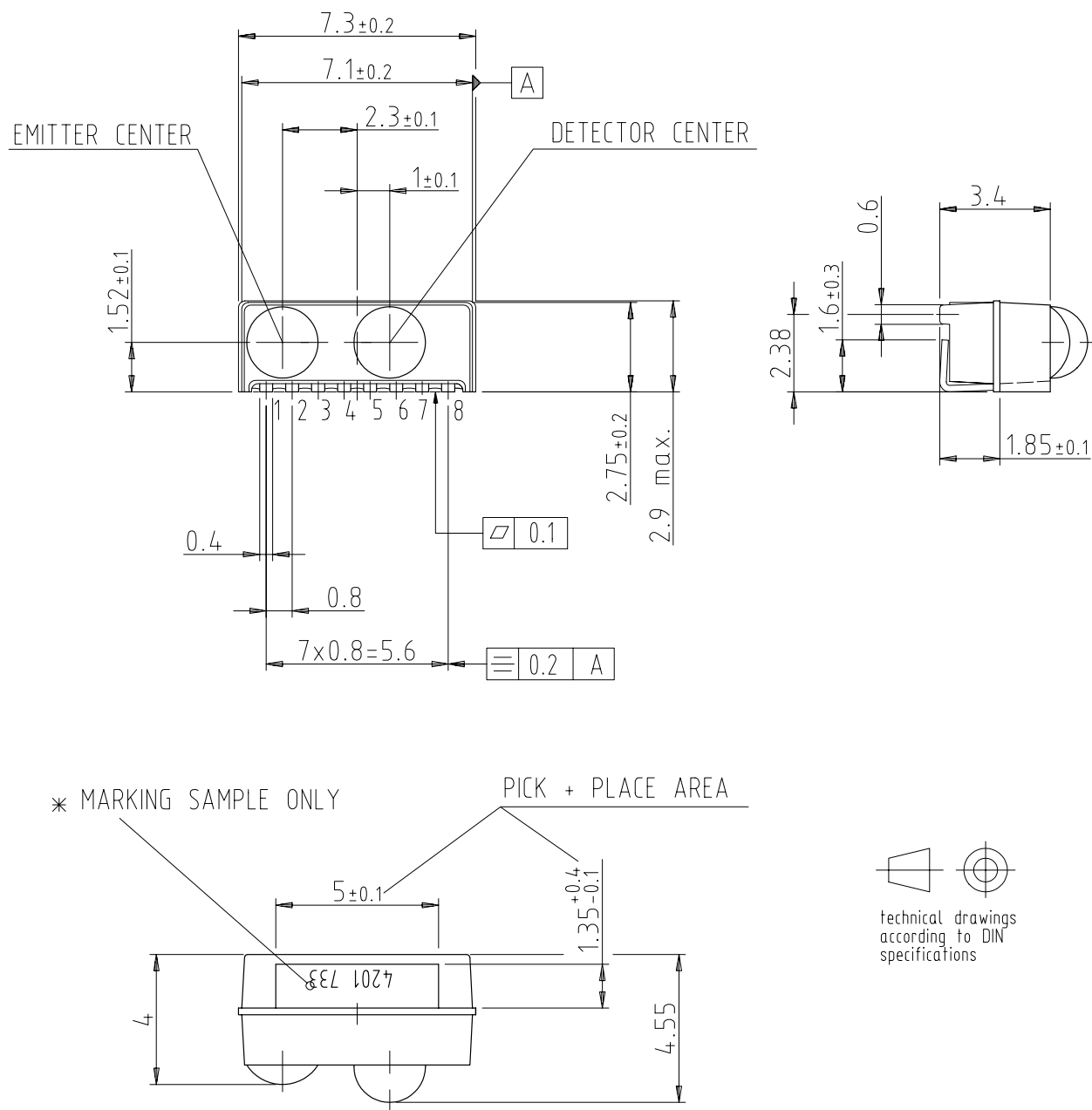


Figure 3. shows the maximum operating temperature when the device is operated without external current limiting resistor. A power dissipating resistor of 2 Ω is recommended from the cathode of the IRED to Ground for supply voltages above 4 V. In that case the device can be operated up to 85°C, too.

Table 1. Truth table

Inputs			Outputs	
V _{CC}	Txd	Optical input Irradiance mW/ m ²	Rxd	Transmitter
low	x	x	low	0
high	high	x	high	I _e
high	high > 25 μ s	x	high	0
high	low	< 4	high	0
high	low	> Min Detection Threshold Irradiance < Max Detection Threshold Irradiance	low	0
high	low	> Max Detection Threshold Irradiance	x	0

TFDU4202--(Mechanical Dimensions)



* MARKING ORIENTATION
180 DEGREES ALLOWED

Drawing-No.: 6.550-5185.01-4
Issue: 3; 01.04.99

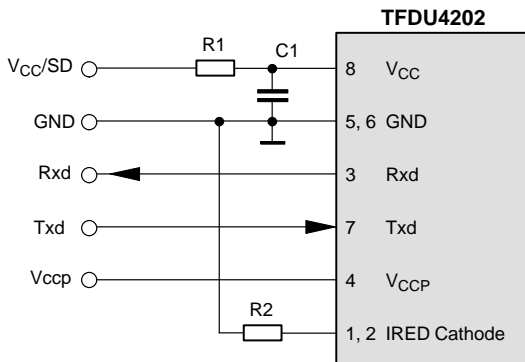
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Appendix

Application Hints

The TFDU4202 does not need any external components when operated at a "clean" power supply. In a more noisy ambient it is recommended to add a capacitor C1 and a resistor R1 for noise suppression. A combination of a tantalum with a ceramics capacitor will be efficient to attenuate both, RF and LF. The power supply V_{ccp} must be able to source up to 550 mA current with a fast rise time. If that cannot be guaranteed an additional capacitor near pin 4 (V_{ccp}) should be included. The value is depended on the power supply quality. A good choice between 4.7 μ F and 10 μ F.

Recommended Circuit Diagram



Shut down

The TFDU4202 can be shut down (disabled) by setting the V_{CC} pin 8 low.

The Rxd output is floating when the devices are in shut down mode. The Txd input is high impedance in shut down mode.

Latency

The receiver is in specified conditions after the defined latency. In a UART related application after that time (typically 50 μ s) the receiver buffer of the UART must be cleared. Therefore the transceiver has to wait at least the specified latency after receiving the last bit before starting the transmission to be sure that the corresponding receiver is in a defined state.

For more application circuits, see IrDC Design Guide and TOIM3...-series data.

Table 1. Recommended Application Circuit Components *)

Component	Recommended Value	Vishay Part Number
C1	4.7 μ F, 16 V	293D 475X9 016B 2T
R1	5 Ω (2 Ω to 47 Ω)	

*) This is a recommendation for a combination to start with to exclude power supply effects. Optimum, from a costs point of view, to work without both.



Revision History:

A1.0, 21/06/1999: First edition of the target data sheet.

A1.0a, 03/08/1999: Comparison of features added on page 1, ordering information: pcs per reel changed.

A1.1, 22/09/1999: Babyface and dracula packages added.

A1.3, 26/10/1999: Derating curve included.

A1.4, 13/10/2000: First public release

A1.5, 14/02/2001: Operating conditions changed: Sensitivity, max operating current, timing parameters



Ozone Depleting Substances Policy Statement

It is the policy of **Vishay Semiconductor GmbH** to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

We reserve the right to make changes to improve technical design and may do so without further notice.

Parameters can vary in different applications. All operating parameters must be validated for each customer application by the customer. Should the buyer use Vishay Telefunken products for any unintended or unauthorized application, the buyer shall indemnify Vishay Telefunken against all claims, costs, damages, and expenses, arising out of, directly or indirectly, any claim of personal damage, injury or death associated with such unintended or unauthorized use.

Vishay Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany
Telephone: 49 (0) 7131 67 2831, Fax number: 49 (0) 7131 67 2423