Optocoupler, Phototransistor Output (Dual, Quad Channel), 110 °C Rated

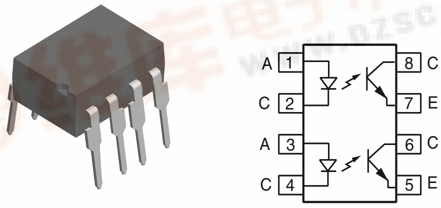
Features

- Operating temperature from - 55 °C to + 110 °C
- Identical Channel to Channel Footprint
- Dual and Quad Packages Feature:
  - Reduced Board Space
  - Lower Pin and Parts Count
  - Better Channel to Channel CTR Match
  - Improved Common Mode Rejection
- Isolation Test Voltage, 5300 V_{RMS}
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

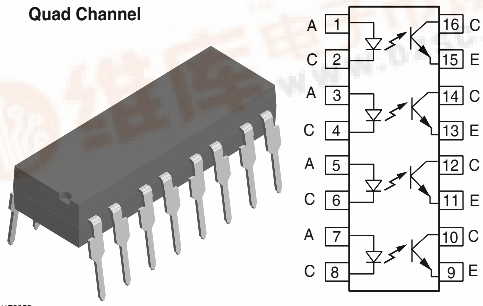
Pb-free

e3

Dual Channel



Quad Channel



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Agency Approvals

- UL1577, File No. E52744 System Code H or J, Double Protection
- CSA 93751
- BSI IEC60950 IEC60065
- DIN EN 60747-5-2 (VDE0884)
  DIN EN 60747-5-5 pending
  Available with Option 1

Description

The ILD/Q1615 are multi-channel 110 °C rated phototransistor optocouplers that use GaAs IRLED emiters and high gain NPN phototransistors. These devices are constructed using over/under leadframe optical coupling and double molded insulation technology resulting a withstand test voltage of 7500 VAC_{PEAK} and a working voltage of 1700 V_{RMS}.

The binned min./max. and linear CTR characteristics make these devices well suited for DC or AC voltage detection. Eliminating the phototransistor base connection provides added electrical noise immunity from the transients found in many industrial control environments.

Because of guaranteed maximum non-saturated and saturated switching characteristics, the ILD/Q1615 can be used in medium speed data I/O and control systems. The binned min./max. CTR specification allow easy worst case interface calculations for both level detection and switching applications. Interfacing with a CMOS logic is enhanced by the guaranteed CTR at I_F = 1.0 mA.

Order Information

Part	Remarks
ILD1615-1	CTR 40 - 80 %, DIP-8
ILQ1615-1	CTR 40 - 80 %, DIP-16
ILD1615-2	CTR 63 - 125 %, DIP-8
ILQ1615-2	CTR 63 - 125 %, DIP-16
ILD1615-3	CTR 100 - 200 %, DIP-8
ILQ1615-3	CTR 100 - 200 %, DIP-16
ILD1615-4	CTR 160 - 320 %, DIP-8
ILQ1615-4	CTR 160 - 320 %, DIP-16

For additional information on the available options refer to Option Information.

Absolute Maximum Ratings

T_{amb} = 25 °C, unless otherwise specified
Stresses in excess of the absolute Maximum Ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to absolute Maximum Rating for extended periods of the time can adversely affect reliability.

Input

Parameter	Test condition	Symbol	Value	Unit
Reverse voltage		V_R	6.0	V
Forward current		I_F	60	mA
Surge current		I_{FSM}	1.5	A
Power dissipation		P_{diss}	100	mW
Derate linearly from 25 °C			1.0	mW/°C

Output

Parameter	Test condition	Symbol	Value	Unit
Collector-emitter breakdown voltage		BV_{CEO}	70	V
Emitter-collector breakdown voltage		BV_{ECO}	7.0	V
Collector current		I_C	50	mA
	t < 1.0 ms	I_C	100	mA
Power dissipation		P_{diss}	150	mW
Derate linearly from 25 °C			1.5	mW/°C

Coupler

Parameter	Test condition	Symbol	Value	Unit
Storage temperature		T_{stg}	- 55 to + 150	°C
Operating temperature		T_{amb}	- 55 to + 110	°C
Soldering temperature	2.0 mm distance from case bottom	T_{sld}	260	°C
Package power dissipation, ILD1615			400	mW
Derate linearly from 25 °C			5.33	mW/°C
Package power dissipation, ILQ1615			500	mW
Derate linearly from 25 °C			6.67	mW/°C
Isolation test voltage	t = 1.0 sec.	V_{ISO}	5300	V_{RMS}
Creepage			≥ 7.0	mm
Clearance			≥ 7.0	mm
Isolation resistance	V_{IO} = 500 V, T_{amb} = 25 °C	R_{IO}	$\geq 10^{12}$	Ω
	V_{IO} = 500 V, T_{amb} = 100 °C	R_{IO}	$\geq 10^{11}$	Ω

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Electrical Characteristics

T_{amb} = 25 °C, unless otherwise specified
Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements.

Input

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Forward voltage	I_F = 10 mA	V_F	1.0	1.15	1.3	V
Breakdown voltage	I_R = 10 µA	V_{BR}	6.0	30		V
Reverse current	V_R = 6.0 V	I_R		0.01	10	µA
Capacitance	V_R = 0 V, f = 1.0 MHz	C_O		25		pF

Output

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Collector-emitter capacitance	V_{CE} = 5.0 V, f = 1.0 MHz	C_{CE}		6.8		pF
Collector-emitter leakage current, -1, -2	V_{CE} = 10 V	I_{CEO}		2.0	50	nA
Collector-emitter leakage, -3, -4	V_{CE} = 10 V	I_{CEO}		5.0	100	nA
Collector-emitter breakdown voltage	I_{CE} = 0.5 mA	BV_{CEO}	70			V
Emitter-collector breakdown voltage	I_E = 0.1 mA	BV_{ECO}	7.0			V
Package transfer characteristics						
Channel/Channel CTR match	I_F = 10 mA, V_{CE} = 5.0 V	CTRX/ CTRY	1 to 1		2 to 1	

Coupler

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Capacitance (input-output)	V_{IO} = 0 V, f = 1.0 MHz	C_{IO}		0.8		pF
Insulation resistance	V_{IO} = 500 V, T_A = 25 °C	R_S	10^{12}	10^{14}		Ω
Channel to channel isolation			500			VAC

Current Transfer Ratio

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
Current Transfer Ratio (collector-emitter saturated)	I_F = 10 mA, V_{CE} = 0.4 V	ILD1615-1 ILQ1615-1	CTR_{CEsat}		25		%
		ILD1615-2 ILQ1615-2	CTR_{CEsat}		40		%
		ILD1615-3 ILQ1615-3	CTR_{CEsat}		60		%
		ILD1615-4 ILQ1615-4	CTR_{CEsat}		100		%

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
Current Transfer Ratio (collector-emitter)	I_F = 10 mA, V_{CE} = 5.0 V	ILD1615-1 ILQ1615-1	CTR_{CE}	40	60	80	%
	I_F = 1.0 mA, V_{CE} = 5.0 V	ILD1615-1 ILQ1615-1	CTR_{CE}	13	30		%
	I_F = 10 mA, V_{CE} = 5.0 V	ILD1615-2 ILQ1615-2	CTR_{CE}	63	80	125	%
	I_F = 1.0 mA, V_{CE} = 5.0 V	ILD1615-2 ILQ1615-2	CTR_{CE}	22	45		%
	I_F = 10 mA, V_{CE} = 5.0 V	ILD1615-3 ILQ1615-3	CTR_{CE}	100	150	200	%
	I_F = 1.0 mA, V_{CE} = 5.0 V	ILD1615-3 ILQ1615-3	CTR_{CE}	34	70		%
	I_F = 10 mA, V_{CE} = 5.0 V	ILD1615-4 ILQ1615-4	CTR_{CE}	160	200	320	%
	I_F = 1.0 mA, V_{CE} = 5.0 V	ILD1615-4 ILQ1615-4	CTR_{CE}	56	90		%

Switching Characteristics

Non-saturated

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Turn-on time	I_F = 10 mA, V_{CC} = 5.0 V, R_L = 75 Ω, 50 % of V_{PP}	t_{on}		3.0		µs
Rise time	I_F = 10 mA, V_{CC} = 5.0 V, R_L = 75 Ω, 50 % of V_{PP}	t_r		2.0		µs
Turn-off time	I_F = 10 mA, V_{CC} = 5.0 V, R_L = 75 Ω, 50 % of V_{PP}	t_{off}		2.3		µs
Fall time	I_F = 10 mA, V_{CC} = 5.0 V, R_L = 75 Ω, 50 % of V_{PP}	t_f		2.0		µs
Propagation H-L	I_F = 10 mA, V_{CC} = 5.0 V, R_L = 75 Ω, 50 % of V_{PP}	t_{PHL}		1.1		µs
Propagation L-H	I_F = 10 mA, V_{CC} = 5.0 V, R_L = 75 Ω, 50 % of V_{PP}	t_{PLH}		2.5		µs

Saturated

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
Turn-on time	I_F = 20 mA, V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{HT} 1.5 V	ILD1615-1 ILQ1615-1	t_{on}		3.0		µs
	I_F = 10 mA, V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{HT} 1.5 V	ILD1615-2 ILQ1615-2	t_{on}		4.3		µs
		ILD1615-3 ILQ1615-3	t_{on}		4.3		µs
	I_F = 5.0 mA, V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{HT} 1.5 V	ILD1615-4 ILQ1615-4	t_{on}		6.0		µs
Rise time	I_F = 20 mA, V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{HT} 1.5 V	ILD1615-1 ILQ1615-1	t_r		2.0		µs
	I_F = 10 mA, V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{HT} 1.5 V	ILD1615-2 ILQ1615-2	t_r		2.8		µs
		ILD1615-3 ILQ1615-3	t_r		2.8		µs
	I_F = 5.0 mA, V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{HT} 1.5 V	ILD1615-4 ILQ1615-4	t_r		4.6		µs

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
Turn-off time	I_F = 20 mA, V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{HT} 1.5 V	ILD1615-1 ILQ1615-1	t_{off}		18		µs
	I_F = 10 mA, V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{HT} 1.5 V	ILD1615-2 ILQ1615-2	t_{off}		25		µs
		ILD1615-3 ILQ1615-3	t_{off}		25		µs
	I_F = 5.0 mA, V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{HT} 1.5 V	ILD1615-4 ILQ1615-4	t_{off}		25		µs
Fall time	I_F = 20 mA, V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{HT} 1.5 V	ILD1615-1 ILQ1615-1	t_f		11		µs
	I_F = 10 mA, V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{HT} 1.5 V	ILD1615-2 ILQ1615-2	t_f		14		µs
		ILD1615-3 ILQ1615-3	t_f		14		µs
	I_F = 5.0 mA, V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{HT} 1.5 V	ILD1615-4 ILQ1615-4	t_f		15		µs
Propagation H-L	I_F = 5.0 mA, V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{HT} 1.5 V	ILD1615-1 ILQ1615-1	t_{PHL}		1.6		µs
		ILD1615-2 ILQ1615-2	t_{PHL}		2.6		µs
		ILD1615-3 ILQ1615-3	t_{PHL}		2.6		µs
		ILD1615-4 ILQ1615-4	t_{PHL}		5.4		µs
Propagation L-H	I_F = 5.0 mA, V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{HT} 1.5 V	ILD1615-1 ILQ1615-1	t_{PLH}		8.6		µs
		ILD1615-2 ILQ1615-2	t_{PLH}		7.2		µs
		ILD1615-3 ILQ1615-3	t_{PLH}		7.2		µs
		ILD1615-4 ILQ1615-4	t_{PLH}		7.4		µs

Common Mode Transient Immunity

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Common mode rejection output high	V_{CM} = 50 V_{P-P}, R_L = 1.0 kΩ, I_F = 0 mA	CM_H		5000		V/µs
Common mode rejection output low	V_{CM} = 50 V_{P-P}, R_L = 1.0 kΩ, I_F = 10 mA	CM_L		5000		V/µs
Common mode coupling capacitance		C_{CM}		0.01		pF

Typical Characteristics

T_{amb} = 25 °C, unless otherwise specified

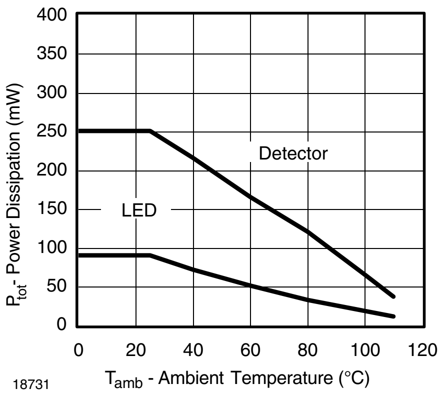

Figure 1. Permissible Power Dissipation vs. Temperature Non-Saturation Operation

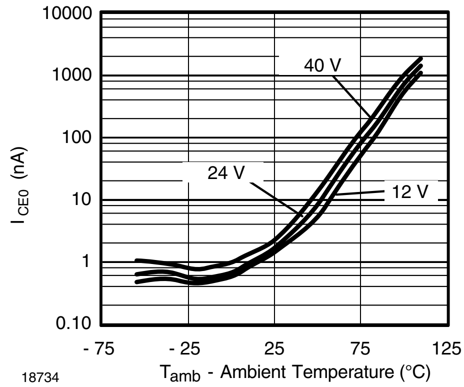

Figure 4. Collector to Emitter Dark Current vs. Ambient Temperature

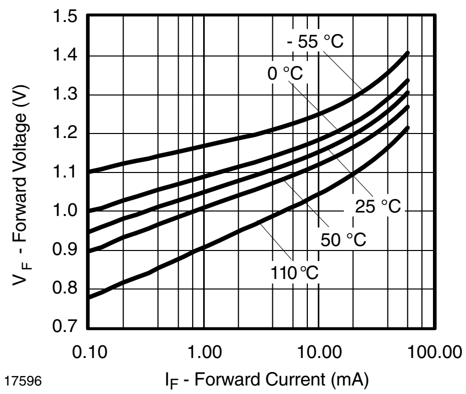

Figure 2. Forward Voltage vs. Forward Current

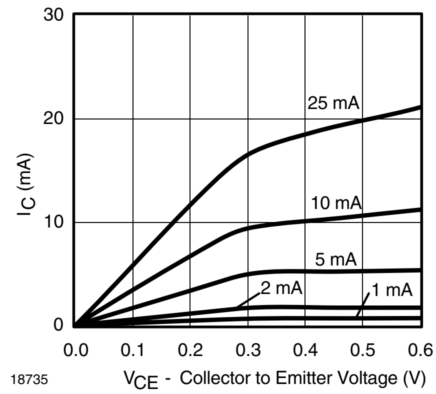

Figure 5. Normalized Current vs. Collector Emitter Saturation Voltage

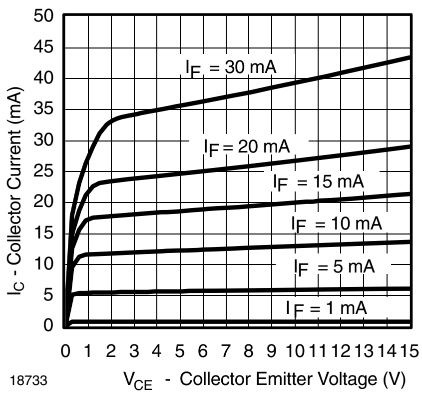

Figure 3. Collector Current vs. Collector Emitter Voltage

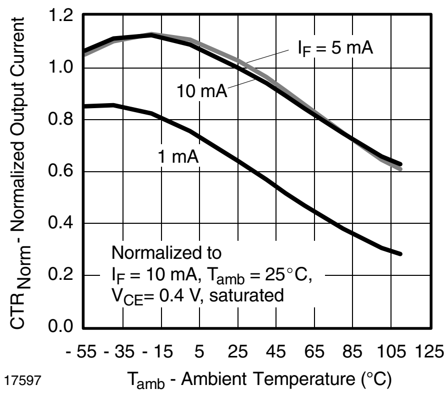

Figure 6. Normalized Current Transfer Ratio vs. Ambient Temperature

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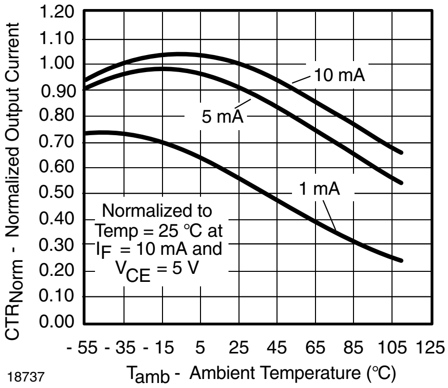


Figure 7. Normalized CTR vs. Temperature

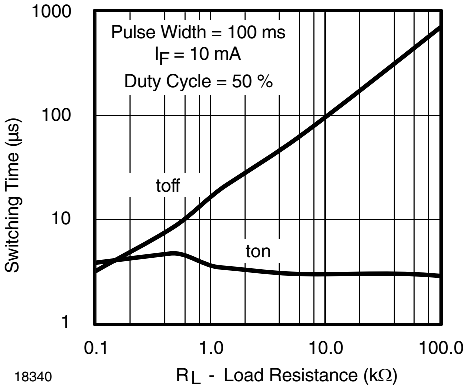


Figure 10. Forward Resistance vs. Forward Current

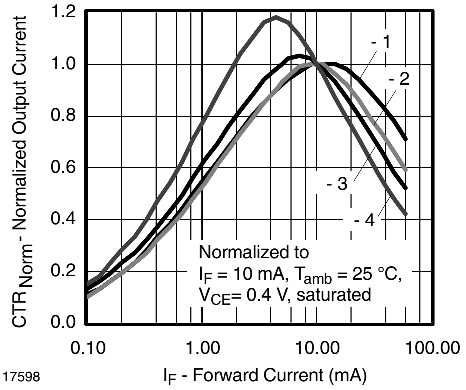


Figure 8. Normalized CTR vs. Forward Current

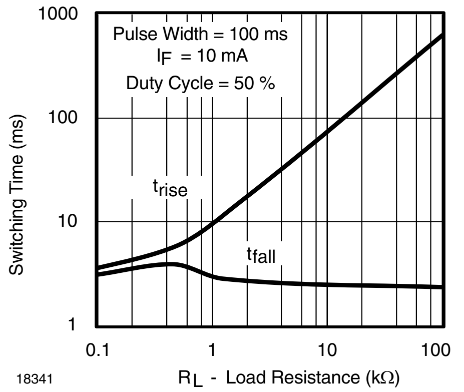


Figure 11. Forward Resistance vs. Forward Current

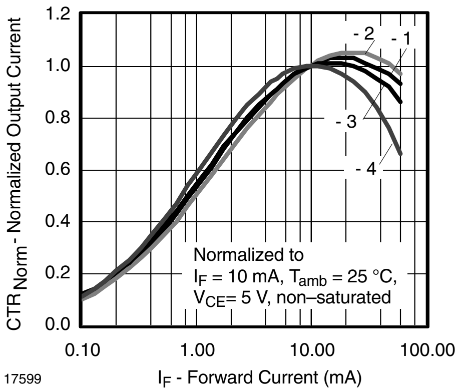
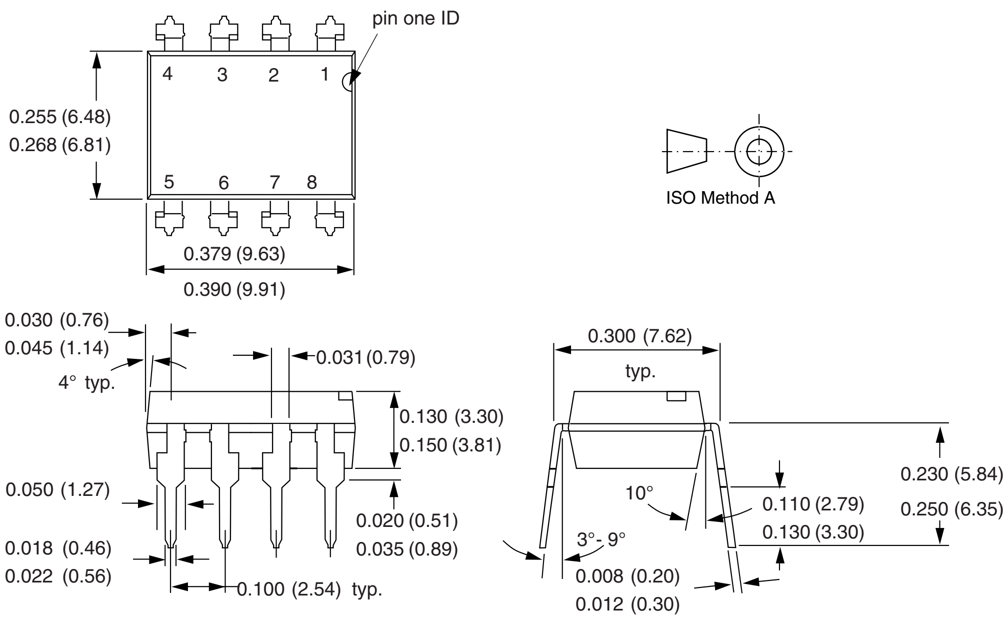


Figure 9. Normalized CTR vs. Forward Current

Package Dimensions in Inches (mm)



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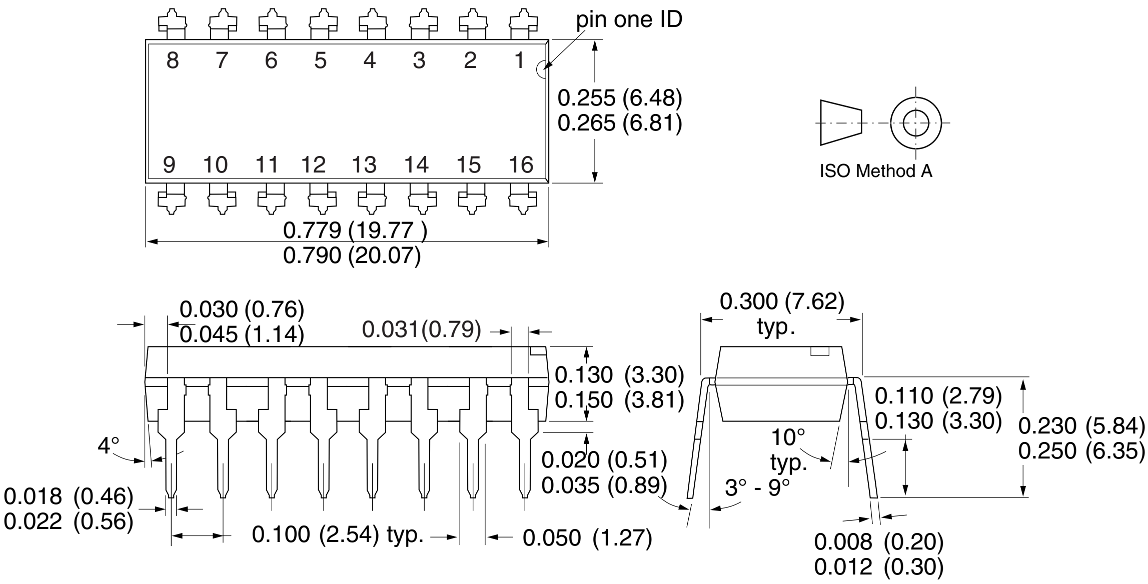
Package Dimensions in Inches (mm)



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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.

Vishay Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany

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