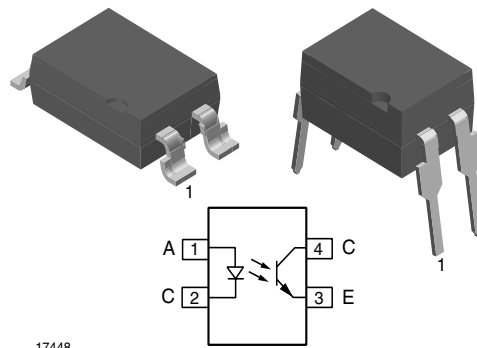


Optocoupler, Phototransistor Output, High Reliability, 5300 V_{RMS}

Features

- Excellent CTR Linearity Depending on Forward Current
- Isolation Test Voltage, 5300 V_{RMS}
- Fast Switching Times
- Low CTR Degradation
- Low Coupling Capacitance
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



17448

Agency Approvals

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

Applications

- Switchmode power supply
- Telecom
- Battery powered equipment

Description

The SFH615A (DIP) and SFH6156 (SMD) feature a variety of transfer ratios, low coupling capacitance and high isolation voltage. These couplers have a GaAs infrared diode emitter, which is optically coupled to a silicon planar phototransistor detector, and is incorporated in a plastic DIP-4 or SMD package.

The coupling devices are designed for signal transmission between two electrically separated circuits.

The couplers are end-stackable with 2.54 mm lead spacing.

Creepage and clearance distances of > 8.0 mm are achieved with option 6. This version complies with IEC 60950 (DIN VDE 0805) for reinforced insulation up to an operation voltage of 400 V_{RMS} or DC.

Specifications subject to change.

Order Information

Part	Remarks
SFH615A-1	CTR 40 - 80 %, DIP-4
SFH615A-2	CTR 63 - 125 %, DIP-4
SFH615A-3	CTR 100 - 200 %, DIP-4
SFH615A-4	CTR 160 - 320 %, DIP-4
SFH6156-1	CTR 40 - 80 %, SMD-4
SFH6156-2	CTR 63 - 125 %, SMD-4
SFH6156-3	CTR 100 - 200 %, SMD-4
SFH6156-4	CTR 160 - 320 %, SMD-4
SFH615A-1X006	CTR 40 - 80 %, DIP-4 400 mil (option 6)
SFH615A-1X007	CTR 40 - 80 %, SMD-4 (option 7)
SFH615A-2X006	CTR 63 - 125 %, DIP-4 400 mil (option 6)
SFH615A-2X007	CTR 63 - 125 %, SMD-4 (option 7)
SFH615A-2X009	CTR 63 - 125 %, SMD-4 (option 9)
SFH615A-3X006	CTR 100 - 200 %, DIP-4 400 mil (option 6)
SFH615A-3X007	CTR 100 - 200 %, SMD-4 (option 7)
SFH615A-3X008	CTR 100 - 200 %, SMD-4 (option 8)
SFH615A-3X009	CTR 100 - 200 %, SMD-4 (option 9)
SFH615A-4X006	CTR 160 - 320 %, DIP-4 400 mil (option 6)
SFH615A-4X007	CTR 160 - 320 %, SMD-4 (option 7)
SFH615A-4X008	CTR 160 - 320 %, SMD-4 (option 8)
SFH615A-4X009	CTR 160 - 320 %, SMD-4 (option 9)

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

See TAPE AND REEL Section for 4-pin optocouplers T0 with 90° rotation.

Absolute Maximum Ratings

$T_{amb} = 25\text{ }^{\circ}\text{C}$, 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
DC Forward current		I_F	60	mA
Surge forward current	$t_p \leq 10\text{ }\mu\text{s}$	I_{FSM}	2.5	A

Output

Parameter	Test condition	Symbol	Value	Unit
Collector-emitter voltage		V_{CE}	70	V
Emitter-collector voltage		V_{CEO}	7.0	V
Collector current		I_C	50	mA
	$t_p \leq 1.0\text{ ms}$	I_C	100	mA

Coupler

Parameter	Test condition	Symbol	Value	Unit
Isolation test voltage (between emitter and detector, referred to climate DIN 40046, part 2, Nov. 74)	$t = 1.0\text{ s}$	V_{ISO}	5300	V_{RMS}
Creepage			≥ 7.0	mm
Clearance			≥ 7.0	mm
Insulation thickness between emitter and detector			≥ 0.4	mm
Comparative tracking index per DIN IEC 112/VDE 0303, part 1			≥ 175	
Isolation resistance	$V_{IO} = 500\text{ V}$, $T_{amb} = 25\text{ }^{\circ}\text{C}$	R_{IO}	$\geq 10^{12}$	Ω
	$V_{IO} = 500\text{ V}$, $T_{amb} = 100\text{ }^{\circ}\text{C}$	R_{IO}	$\geq 10^{11}$	Ω
Storage temperature range		T_{stg}	- 55 to + 150	$^{\circ}\text{C}$
Ambient temperature range		T_{amb}	- 55 to + 100	$^{\circ}\text{C}$
Soldering temperature	max. 10 s, Dip soldering distance to seating plane $\geq 1.5\text{ mm}$	T_{sld}	260	$^{\circ}\text{C}$

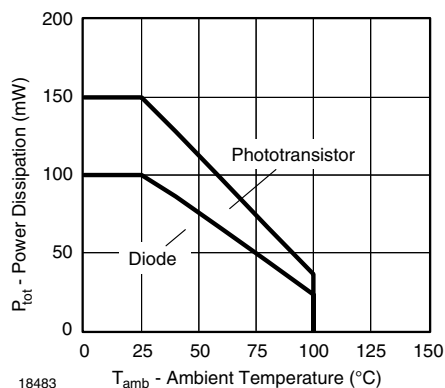


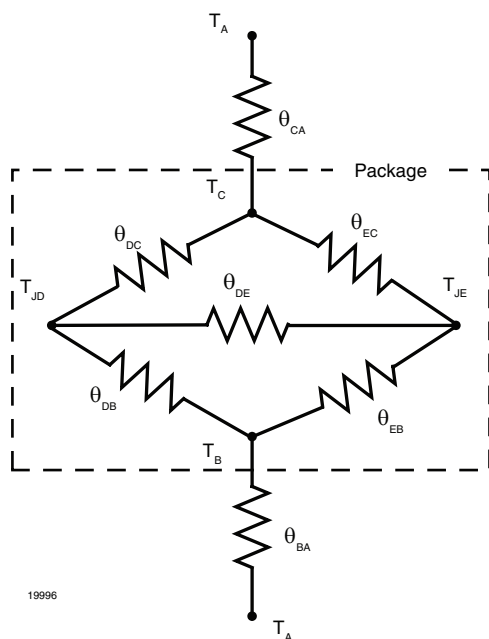
Figure 1. Permissible Power Dissipation vs. Ambient Temperature

Thermal Characteristics

The thermal model is represented in the thermal network below. Each resistance value given in this model can be used to calculate the temperatures at each node for a given operating condition. The thermal resistance from board to ambient will be dependent on the type of PCB, layout and thickness of copper traces. For a detailed explanation of the thermal model, please reference Vishay's Thermal Characteristics of Optocouplers Application note.

Parameter	Test condition	Symbol	Value	Unit
LED Power dissipation	at 25 °C	P_{diss}	100	mW
Output Power dissipation	at 25 °C	P_{diss}	150	mW
Maximum LED junction temperature		T_{jmax}	125	°C
Maximum output die junction temperature		T_{jmax}	125	°C
Thermal resistance, Junction Emitter to Board		θ_{EB}	173	°C/W
Thermal resistance, Junction Emitter to Case		θ_{EC}	149	°C/W
Thermal resistance, Junction Detector to Board		θ_{DB}	111	°C/W
Thermal resistance, Junction Detector to Case		θ_{DC}	127	°C/W
Thermal resistance, Junction Emitter to Junction Detector		θ_{ED}	95	°C/W
Thermal resistance, Board to Ambient*		θ_{BA}	195	°C/W
Thermal resistance, Case to Ambient*		θ_{CA}	3573	°C/W

* For 2 layer FR4 board (4" x 3" x 0.062)



Electrical Characteristics

$T_{amb} = 25\text{ }^{\circ}\text{C}$, 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	$I_F = 60\text{ mA}$	V_F		1.25	1.65	V
Reverse current	$V_R = 6.0\text{ V}$	I_R		0.01	10	μA
Capacitance	$V_R = 0\text{ V}$, $f = 1.0\text{ MHz}$	C_O		13		pF

Output

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
Collector-emitter capacitance	$V_{CE} = 5.0\text{ V}$, $f = 1.0\text{ MHz}$		C_{CE}		5.2		pF
Collector-emitter leakage current	$V_{CE} = 10\text{ V}$	SFH615A-1 SFH6156-1	I_{CEO}		2.0	50	nA
		SFH615A-2 SFH6156-2	I_{CEO}		2.0	50	nA
		SFH615A-3 SFH6156-3	I_{CEO}		5.0	100	nA
		SFH615A-4 SFH6156-4	I_{CEO}		5.0	100	nA

Coupler

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Collector-emitter saturation voltage	$I_F = 10\text{ mA}$, $I_C = 2.5\text{ mA}$	V_{CEsat}		0.25	0.4	V
Coupling capacitance		C_C		0.4		pF

Current Transfer Ratio

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
I_C/I_F	$I_F = 10\text{ mA}$, $V_{CE} = 5.0\text{ V}$	SFH615A-1 SFH6156-1	CTR	40		80	%
		SFH615A-2 SFH6156-2	CTR	63		125	%
		SFH615A-3 SFH6156-3	CTR	100		200	%
		SFH615A-4 SFH6156-4	CTR	160		320	%
	$I_F = 1.0\text{ mA}$, $V_{CE} = 5.0\text{ V}$	SFH615A-1 SFH6156-1	CTR	13	30		%
		SFH615A-2 SFH6156-2	CTR	22	45		%
		SFH615A-3 SFH6156-3	CTR	34	70		%
		SFH615A-4 SFH6156-4	CTR	56	90		%



Switching Characteristics

Switching Non-saturated

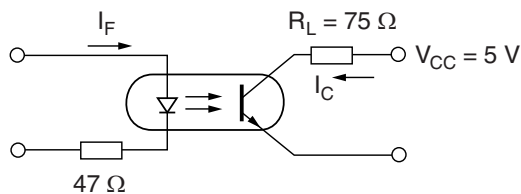
Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Rise Time	$I_F = 10\text{ mA}$, $V_{CC} = 5.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, $R_L = 75\text{ }\Omega$	t_r		2.0		μs
Fall Time	$I_F = 10\text{ mA}$, $V_{CC} = 5.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, $R_L = 75\text{ }\Omega$	t_f		2.0		μs
Turn-on time	$I_F = 10\text{ mA}$, $V_{CC} = 5.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, $R_L = 75\text{ }\Omega$	t_{on}		3.0		μs
Turn-off time	$I_F = 10\text{ mA}$, $V_{CC} = 5.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, $R_L = 75\text{ }\Omega$	t_{off}		2.3		μs
Cut-off frequency	$I_F = 10\text{ mA}$, $V_{CC} = 5.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, $R_L = 75\text{ }\Omega$	f_{ctr}		250		kHz

Switching Saturated

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
Rise time	$V_{CC} = 5.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, $R_L = 1\text{ k}\Omega$, $I_F = 20\text{ mA}$	SFH615A-1 SFH6156-1	t_r		2.0		μs
	$V_{CC} = 5.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, $R_L = 1\text{ k}\Omega$, $I_F = 10\text{ mA}$	SFH615A-2 SFH6156-2	t_r		3.0		μs
		SFH615A-3 SFH6156-3	t_r		3.0		μs
	$V_{CC} = 5.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, $R_L = 1\text{ k}\Omega$, $I_F = 5.0\text{ mA}$	SFH615A-4 SFH6156-4	t_r		4.6		μs
Fall time	$V_{CC} = 5.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, $R_L = 1\text{ k}\Omega$, $I_F = 20\text{ mA}$	SFH615A-1 SFH6156-1	t_f		11		μs
	$V_{CC} = 5.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, $R_L = 1\text{ k}\Omega$, $I_F = 10\text{ mA}$	SFH615A-2 SFH6156-2	t_f		14		μs
		SFH615A-3 SFH6156-3	t_f		14		μs
	$V_{CC} = 5.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, $R_L = 1\text{ k}\Omega$, $I_F = 5.0\text{ mA}$	SFH615A-4 SFH6156-4	t_f		15		μs
Turn-on time	$V_{CC} = 5.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, $R_L = 1\text{ k}\Omega$, $I_F = 20\text{ mA}$	SFH615A-1 SFH6156-1	t_{on}		3.0		μs
	$V_{CC} = 5.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, $R_L = 1\text{ k}\Omega$, $I_F = 10\text{ mA}$	SFH615A-2 SFH6156-2	t_{on}		4.2		μs
		SFH615A-3 SFH6156-3	t_{on}		4.2		μs
	$V_{CC} = 5.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, $R_L = 1\text{ k}\Omega$, $I_F = 5.0\text{ mA}$	SFH615A-4 SFH6156-4	t_{on}		6.0		μs
Turn-off time	$V_{CC} = 5.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, $R_L = 1\text{ k}\Omega$, $I_F = 20\text{ mA}$	SFH615A-1 SFH6156-1	t_{off}		18		μs
	$V_{CC} = 5.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, $R_L = 1\text{ k}\Omega$, $I_F = 10\text{ mA}$	SFH615A-2 SFH6156-2	t_{off}		23		μs
		SFH615A-3 SFH6156-3	t_{off}		23		μs
	$V_{CC} = 5.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, $R_L = 1\text{ k}\Omega$, $I_F = 5.0\text{ mA}$	SFH615A-4 SFH6156-4	t_{off}		25		μs

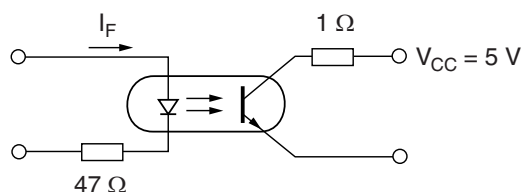
Typical Characteristics

$T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified



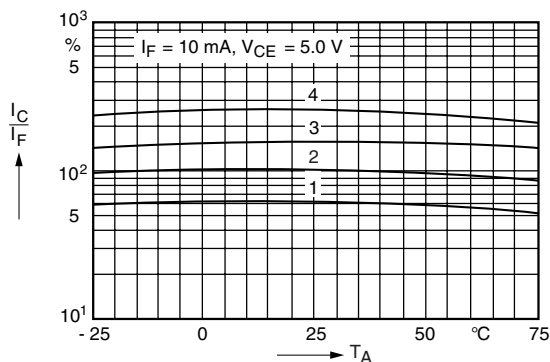
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Figure 2. Linear Operation (without Saturation)



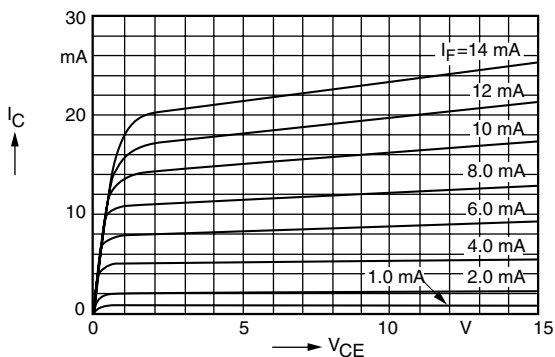
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Figure 3. Switching Operation (with Saturation)



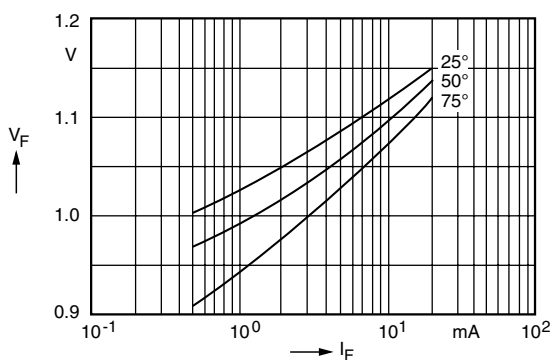
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Figure 4. Current Transfer Ratio (typical) vs. Temperature



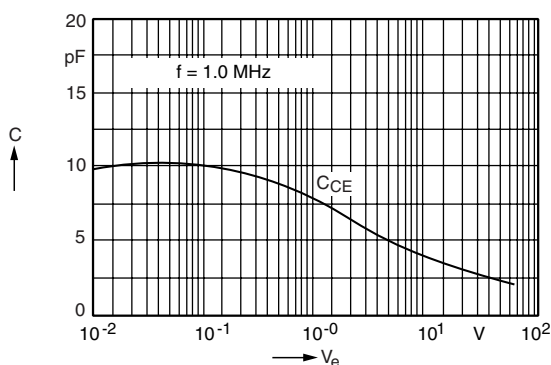
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Figure 5. Output Characteristics (typ.) Collector Current vs. Collector-Emitter Voltage



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Figure 6. Diode Forward Voltage (typ.) vs. Forward Current



isfh615a_06

Figure 7. Transistor Capacitance (typ.) vs. Collector-Emitter Voltage

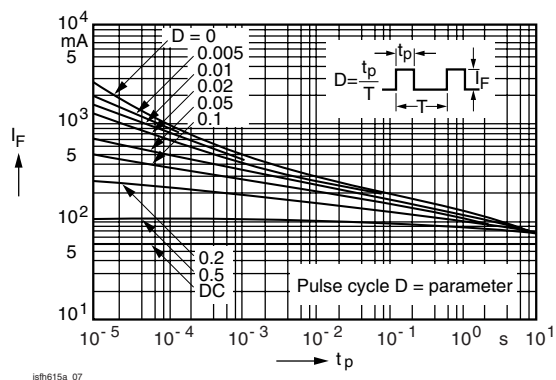
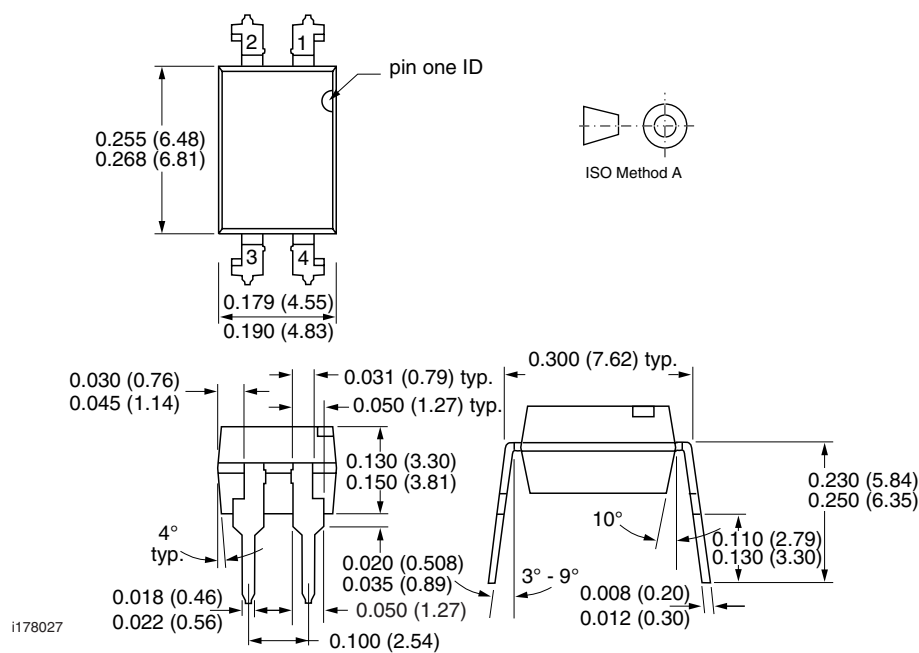
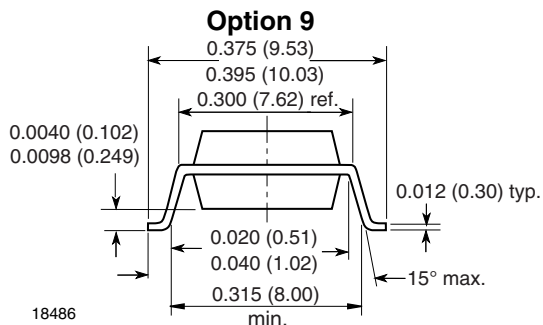
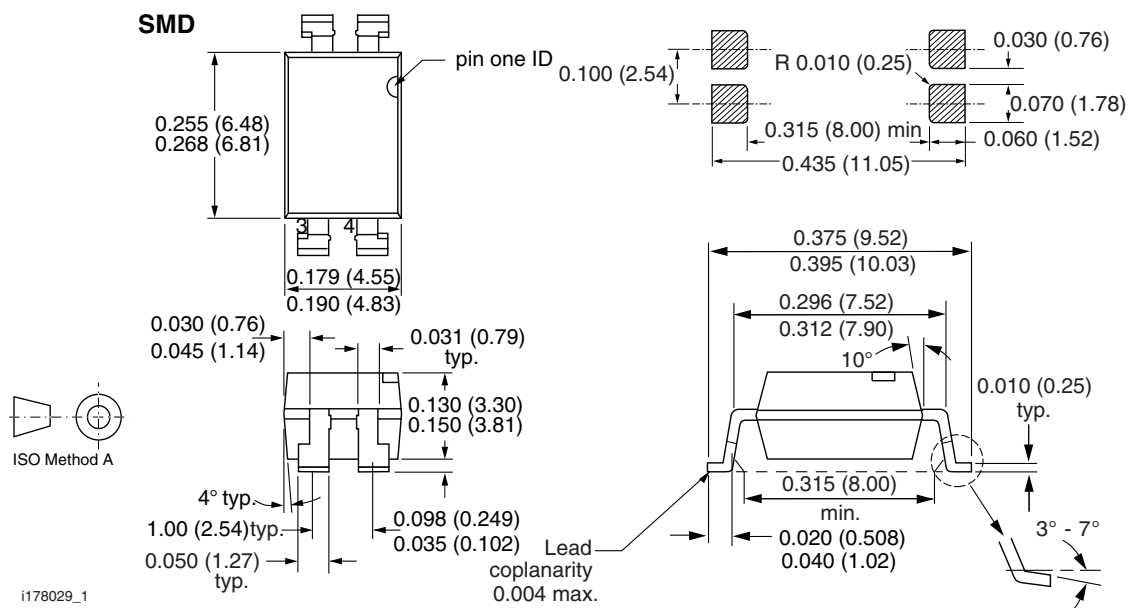


Figure 8. Permissible Pulse Handling Capability Forward Current vs. Pulse Width

Package Dimensions in Inches (mm)



Package Dimensions in Inches (mm)





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 Semiconductors products for any unintended or unauthorized application, the buyer shall indemnify Vishay Semiconductors 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



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Packaging, Tape and Reel Information

Description

Optocouplers are available in plastic dual-in-line packages (DIP), SOP packages, and in a surface-mount, gull-wing, lead bend configuration. Optocouplers purchased in the DIP configuration are shipped in tubes. Optocouplers purchased in a gull-wing configuration can be shipped in tubes or on carrier tape. This section provides stick specifications, tape and reel specifications, and component information.

The following table lists the number of parts per tube.

Devices per Tube

Package	Quantity
4-pin DIP	90
6-pin DIP	50
6-pin gull wing	50
8-pin DIP	50
8-pin gull wing	50
8-pin SOP	90
16-pin DIP	20
16-pin SOP	40

Tube Specifications

Figure 1 shows the physical dimensions of transparent, antistatic, plastic shipping tubes. Figure 2 shows tube safety agency labeling and orientation information.

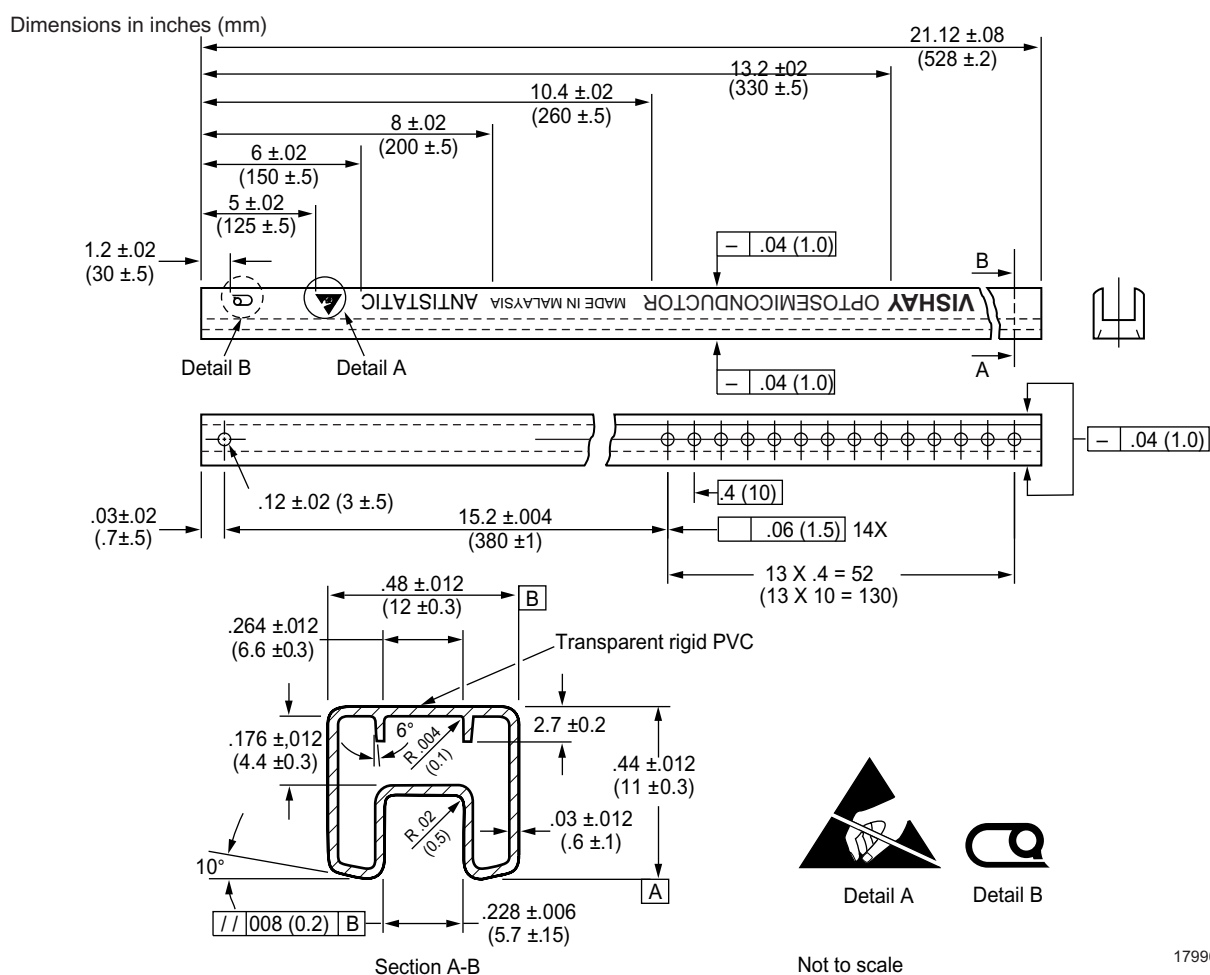


Figure 1. Shipping Tube Specifications for DIP Packages

Dimensions in inches (mm)

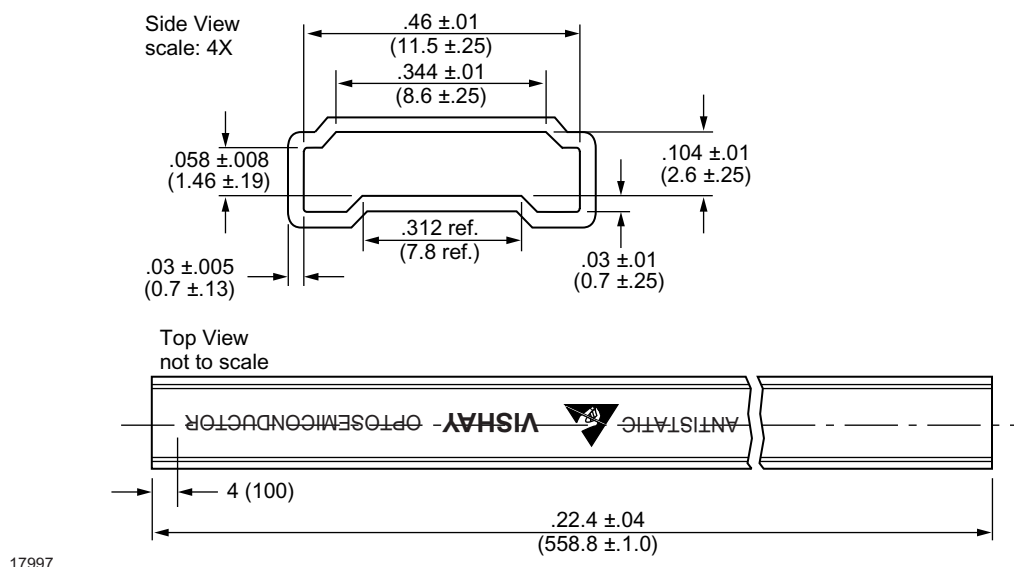


Figure 2. Shipping Tube Specifications for SOP Packages

Tube Specifications for DIP and High Isolation Voltage Packages

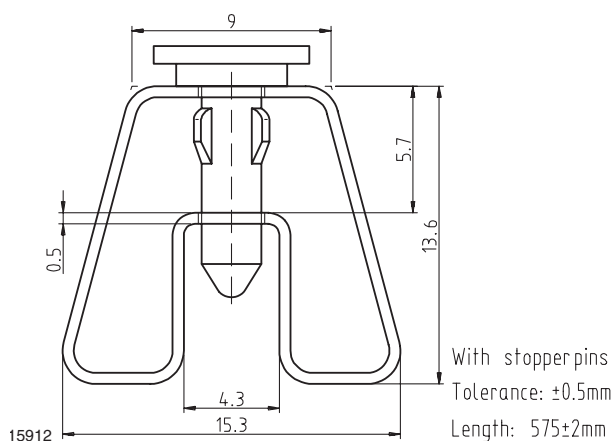


Figure 3. DIP-6 N, G

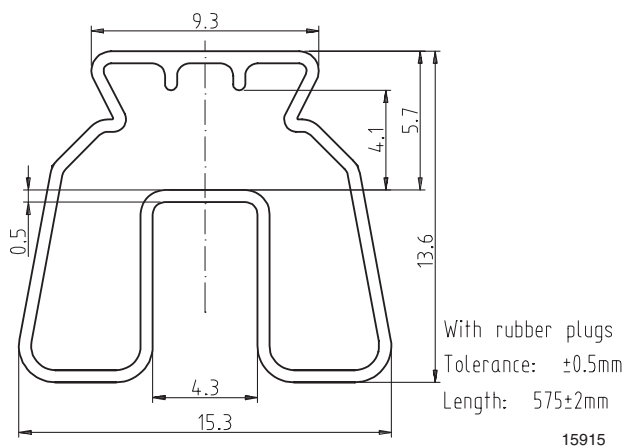


Figure 4. DIP-4, -2, -16 N, G

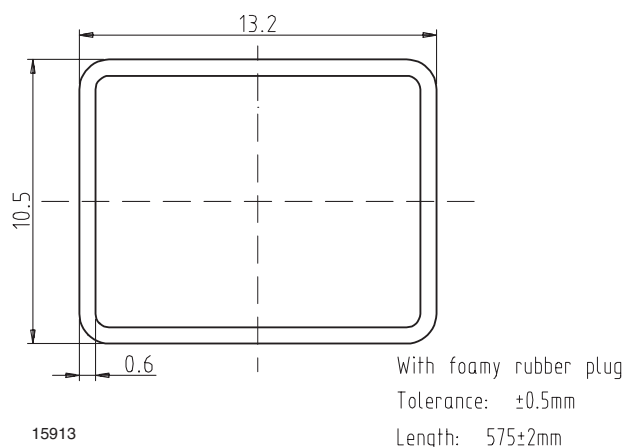


Figure 5. CNY64

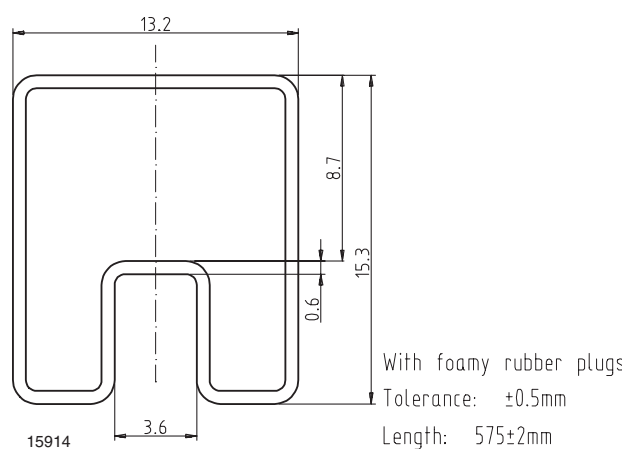


Figure 6. CNY65, 66

Tape and Reel Specifications

Surface-mounted devices are packaged in embossed tape and wound onto 13-inch molded plastic reels for shipment, to comply with Electronics Industries Association Standard EIA-481, revision A.

Leaders and Trailers

The carrier tape and cover tape are not spliced. Both tapes are one single uninterrupted piece from end to end, as shown in Figure 2. Both ends of the tape have empty pockets meeting these requirements.

- Trailer end (inside hub of reel) is 200 mm minimum.
- Leader end (outside of reel) is 400 mm minimum and 560 mm maximum.
- Unfilled leader and trailer pockets are sealed.
- Leaders and trailers are taped to tape and hub, respectively, with masking tape.
- All materials are static-dissipative

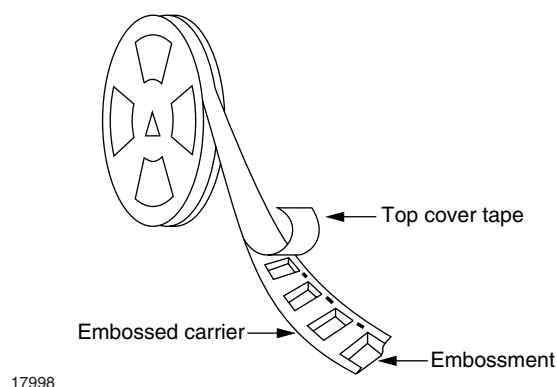


Figure 7. Tape and Reel Shipping Medium

Reels

- As shown in Figure 4, all reels contain standard areas for the placement of ESD stickers and labels. Each reel also has a tape slot in its core. The overall reel dimension is 13 inches. Reels contain 1000 6- or 8-pin gull-wing parts and could have up to three inspection lots.

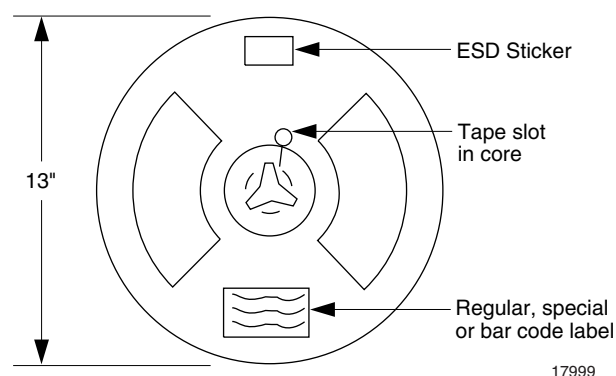


Figure 8.

The tape is 12 mm wide on a 33 cm reel. There are 200 parts per reel. Taped and reeled SOIC8-A optocouplers conform to EIA-481-2.



The tape is 16 mm and is wound on a 33 cm reel. There are 2000 parts per reel. Taped and reeled dual SOIC8 optocouplers conform to EIA-481-2.



Selected 4-pin optocouplers are available in tape and reel format. To order any SFH6XX6 optocoupler on tape and reel, add a suffix "T" after the part number, i.e., SFH6156-3T.

5



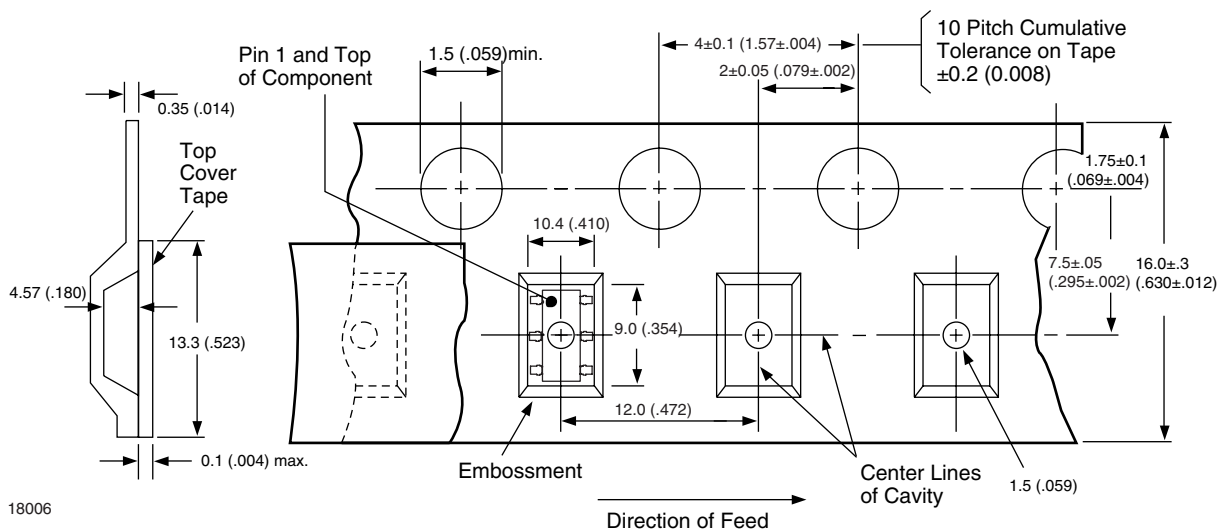
Selected 4-pin optocouplers are available in tape and reel format.



Tape and Reel Packaging for DIP-6 Optocouplers with Option 7

Selected 6-pin optocouplers with Option 7 are available in tape and reel format. To order 6-pin optocoupler with Option 7 on tape and reel, add a suffix "T" after the option, i.e., CNY17-3X007T.

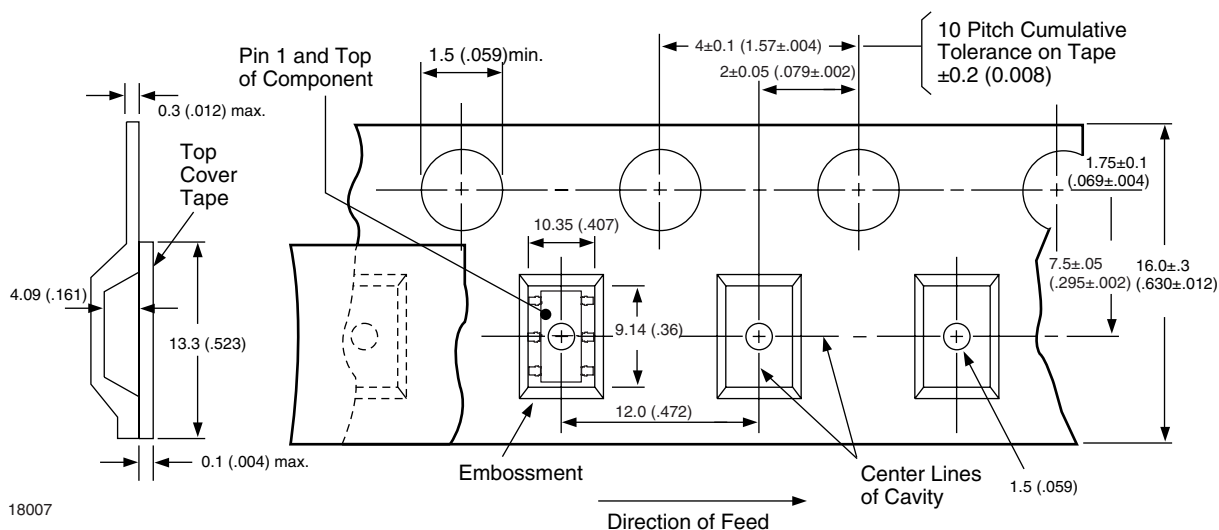
The tape is 16 mm and is wound on a 33 cm reel. There are 1000 parts per reel. Taped and reeled 6-pin optocouplers conform to EIA-481-2.



Tape and Reel Packaging for DIP-6 Optocouplers with Option 9

Selected 6-pin optocouplers with Option 9 are available in tape and reel format. To order 6-pin optocoupler with Option 9 on tape and reel, add a suffix "T" after the option, i.e., CNY17-3X009T.

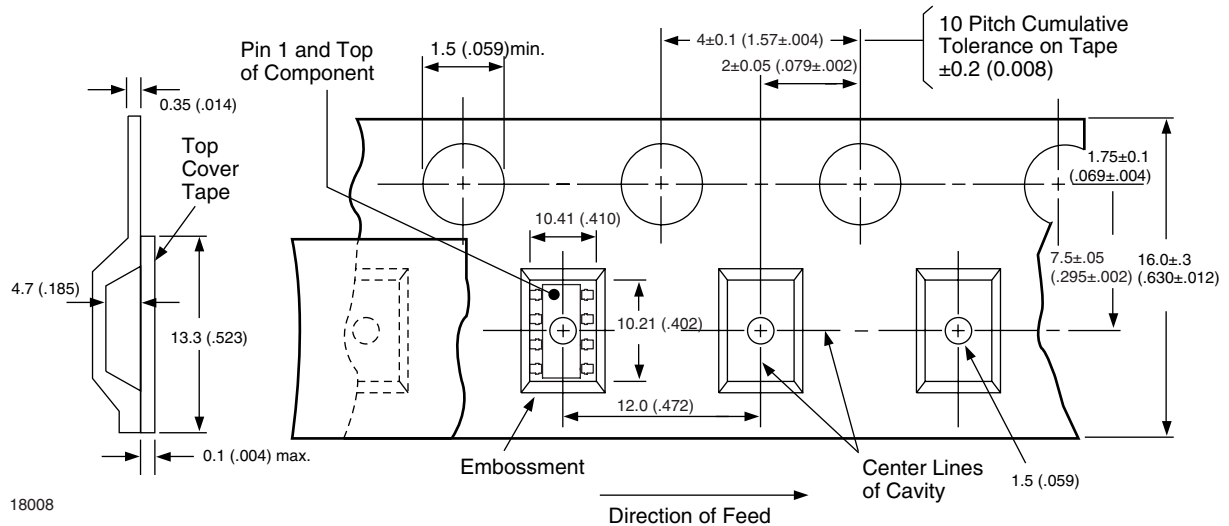
The tape is 16 mm and is wound on a 33 cm reel. There are 1000 parts per reel. Taped and reeled 6-pin optocouplers conform to EIA-481-2.



Tape and Reel Packaging for DIP-8 Optocouplers with Option 7

Selected 8-pin optocouplers with Option 9 are available in tape and reel format. To order 8-pin optocoupler with Option 7 on tape and reel, add a suffix "T" after the option, i.e., ILCT6-X007T.

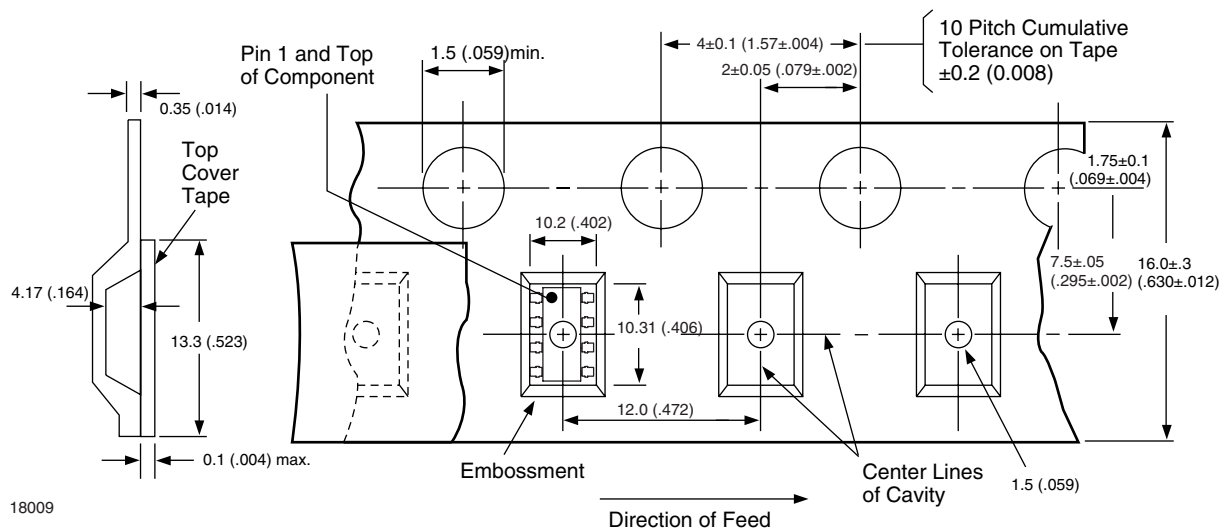
The tape is 16 mm and is wound on a 33 cm reel. There are 1000 parts per reel. Taped and reeled 8-pin optocouplers conform to EIA-481-2.



Tape and Reel Packaging for DIP-8 Optocouplers with Option 9

Selected 8-pin optocouplers with Option 9 are available in tape and reel format. To order 8-pin optocoupler with Option 9 on tape and reel, add a suffix "T" after the option, i.e., ILCT6-X009T.

The tape is 16 mm and is wound on a 33 cm reel. There are 1000 parts per reel. Taped and reeled 8-pin optocouplers conform to EIA-481-2.



Selected 16-pin optocouplers with Option 7 are available in tape and reel format. To order 16-pin optocoupler with Option 7 on tape and reel, add a suffix "T" after the option, i.e., ILQ-X007T.

Technical drawing of a 10 Pitch Cumulative Tolerance on Tape. The drawing shows a side view of the tape with dimensions and tolerances in inches and millimeters.

Dimensions and Tolerances:

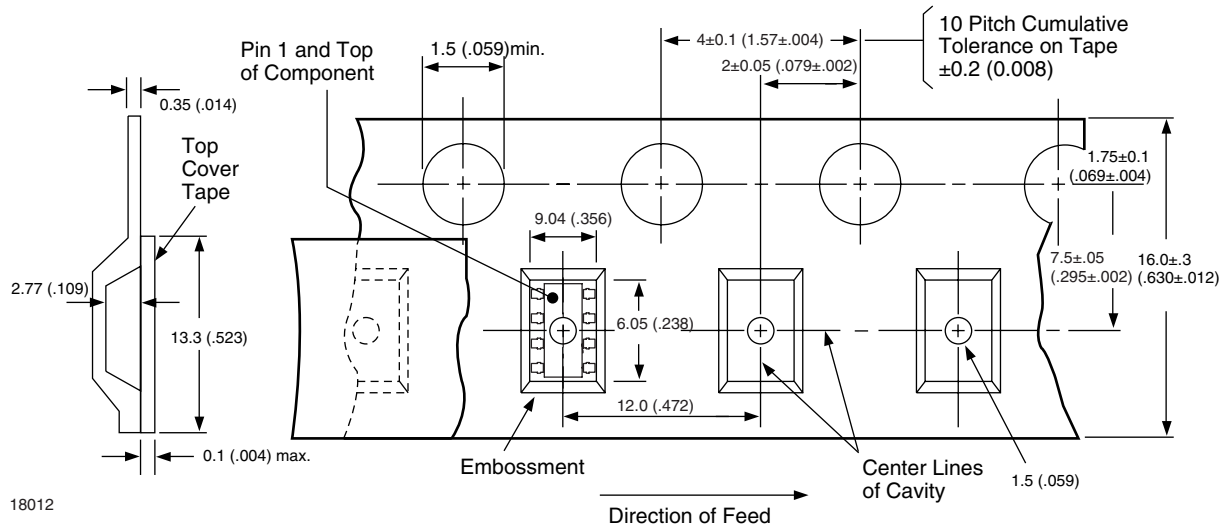
- Pin 1 and Top of Component: 1.5 (.059) min.
- Top Cover Tape: 0.35 (.014) max.
- Embossment: 10.41 (.410)
- Center Lines of Cavity: 2.0 (.079)
- Direction of Feed: Indicated by an arrow pointing right.
- 10 Pitch Cumulative Tolerance on Tape: ± 0.2 (0.008)
- Other dimensions: 4.72 (.186), 25.5 (1.004), 0.1 (.004) max., 16.0 (.630), 20.29 (.799), 14.2 $\pm$.05 (.559 $\pm$.002), 32 (1.260), 1.75 $\pm$ 0.1 (.069 $\pm$.004), 4 $\pm$ 0.1 (1.57 $\pm$.004), 2 $\pm$ 0.05 (.079 $\pm$.002).

Selected 16-pin optocouplers with Option 9 are available in tape and reel format. To order 16-pin optocoupler with Option 9 on tape and reel, add a suffix "T" after the option, i.e., ILQ1-X009T.

Tape and Reel Packaging for SOP-8 Optocouplers

Selected 8-pin 2 mm optocouplers are available in tape and reel format. To order 8-pin 2 mm optocoupler on tape and reel, add a suffix "T" after the part number.

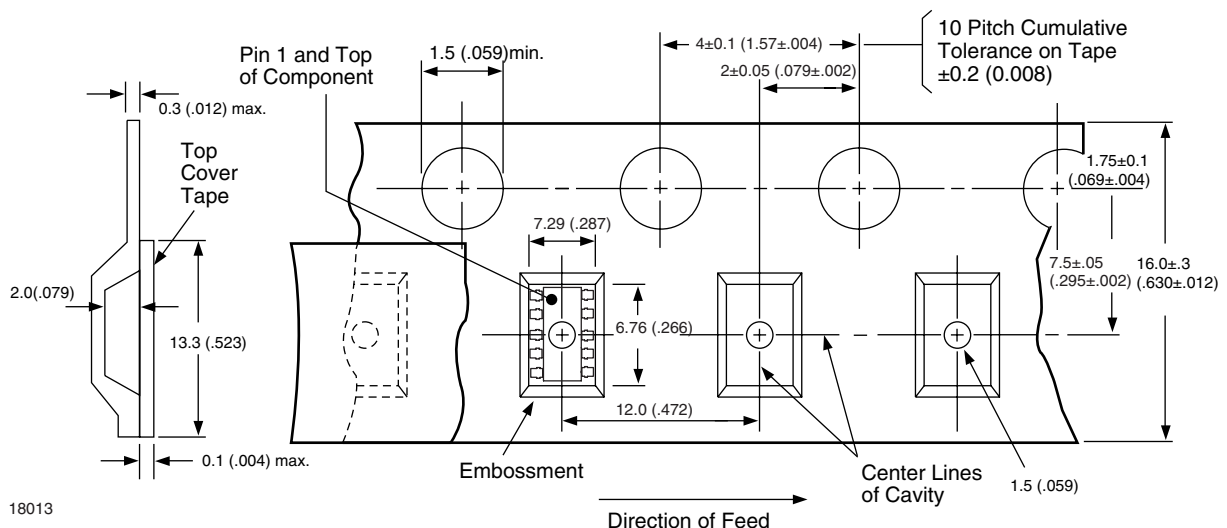
The tape is 16 mm and is wound on a 33 cm reel. There are 2000 parts per reel. Taped and reeled 8-pin 2mm optocouplers conform to EIA-481.



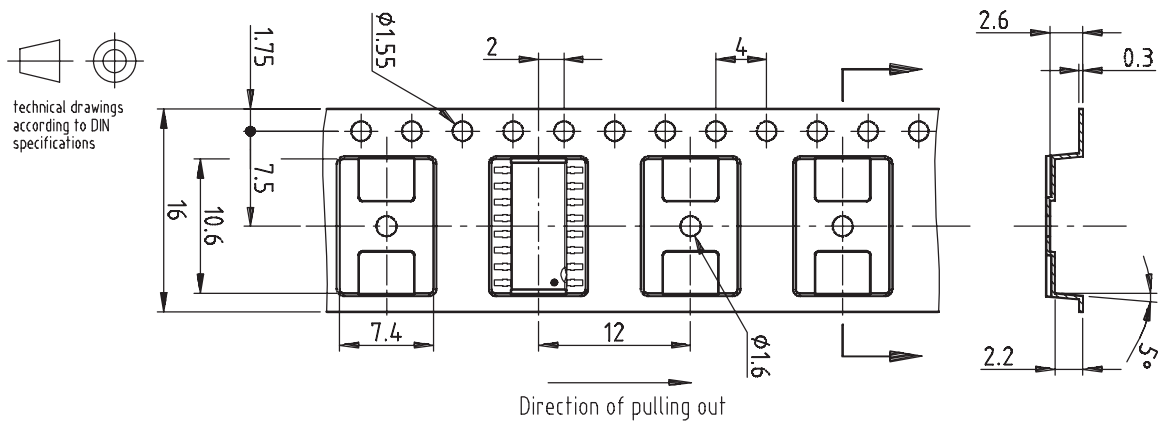
Tape and Reel Packaging for SOT223/10 Mini-couplers

Selected 10-pin mini-couplers are available in tape and reel format. To order surface mount optocoupler on tape and reel, add a suffix "T" after the part number.

The tape is 16 mm and is wound on a 33 cm reel. There are 2000 parts per reel. Taped and reeled 10-pin mini-couplers conform to EIA-481.

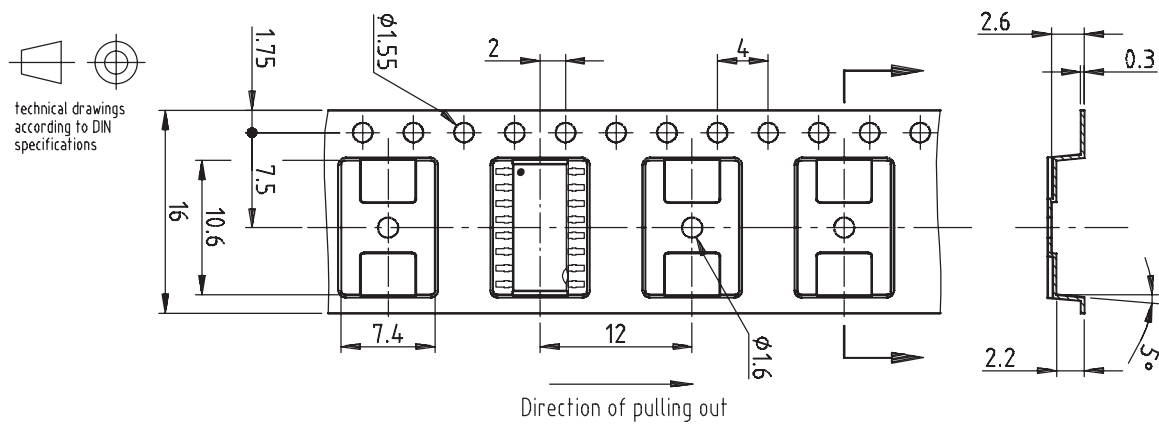


Tape and Reel Packaging for TCMT4100



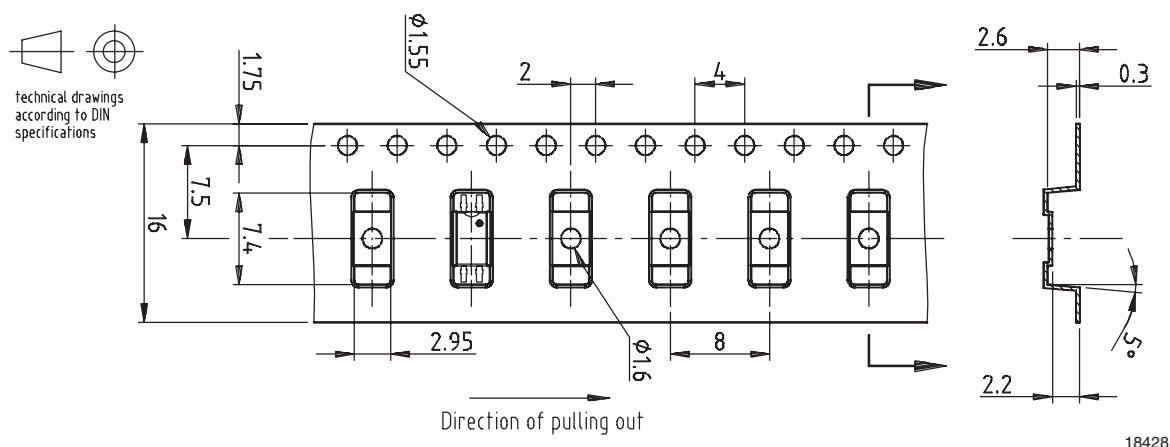
18427

Tape and Reel Packaging for TCMT4600T0

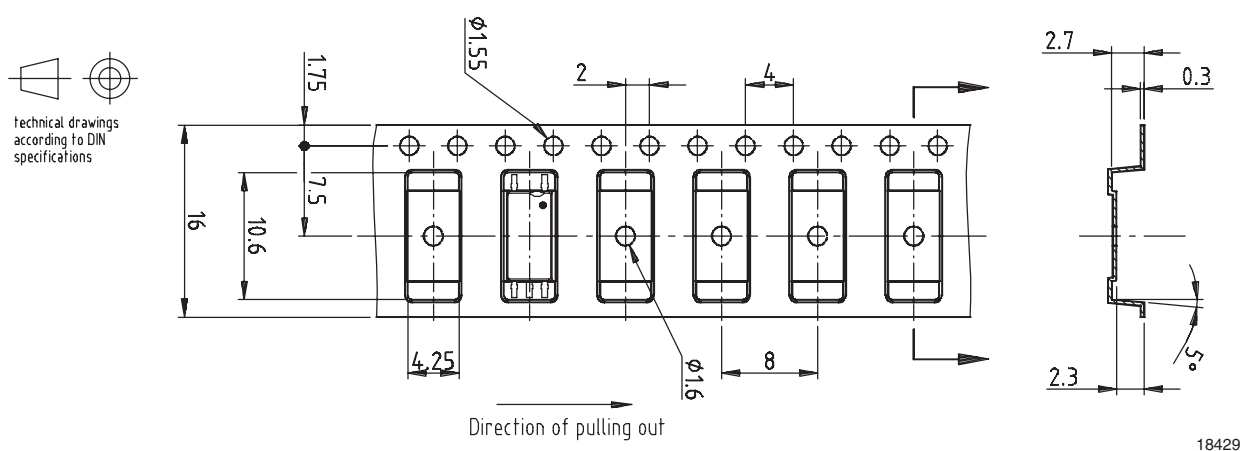


18427_1

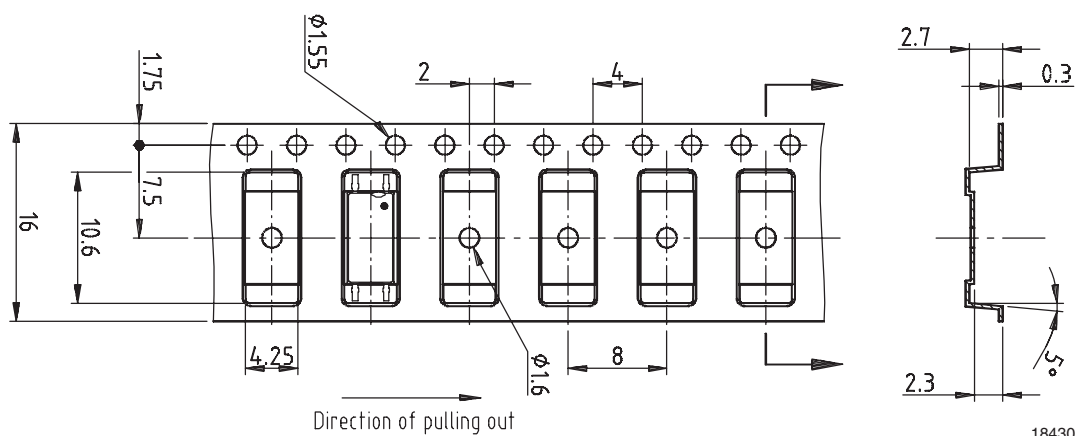
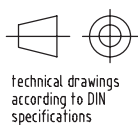
Tape and Reel Packaging for TCMT11xx Series



Tape and Reel Packaging for TCLT11xx Series

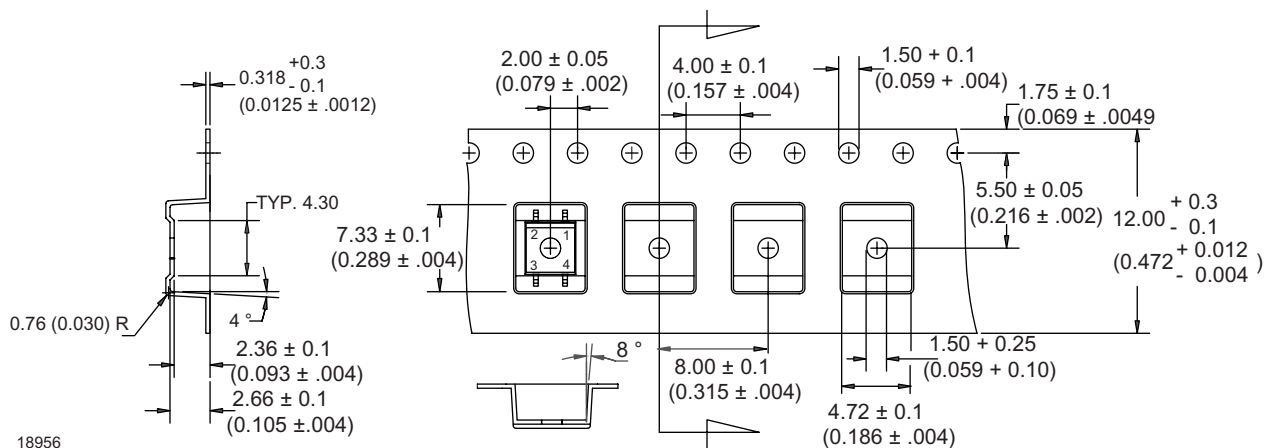


Tape and Reel Packaging for TCLT1600



18430

Tape and Reel Packaging 4-pin Miniflat for SFH690ABT/ AT/ BT/ CCT



18956

Tape and Reel Packaging 4-pin Miniflat, 180° rotation

Selected 4-pin miniflats are available in tape and reel format with the part rotated by 180°. To order this version, the tape and reel suffix "T" is augmented by the

numeral "3" eg. SFH690BT3. The tape is 16 mm and is wound on a 33 cm reel. There are 2000 parts per reel.

