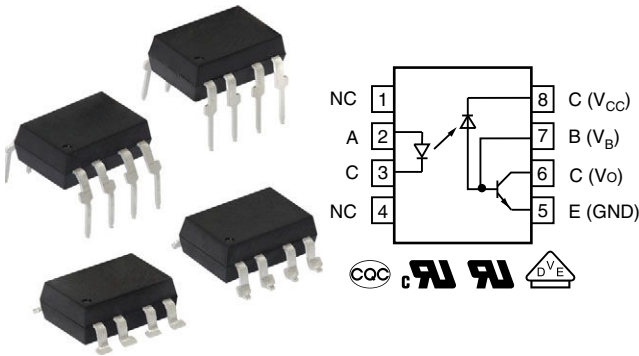




**THE DATASHEET OF  
SFH6135-X001**



# High Speed Optocoupler, 1 MBd, Transistor Output



## FEATURES

- Isolation test voltage 5300 V<sub>RMS</sub>
- TTL compatible
- High bit rates: 1 MBit/s
- High common mode interference immunity
- Bandwidth 2 MHz
- Open collector output
- External base wiring possible
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

## LINKS TO ADDITIONAL RESOURCES


**SPICE**  
Models

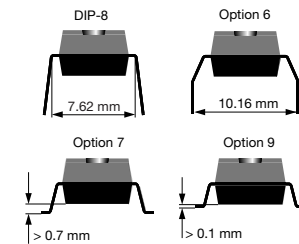
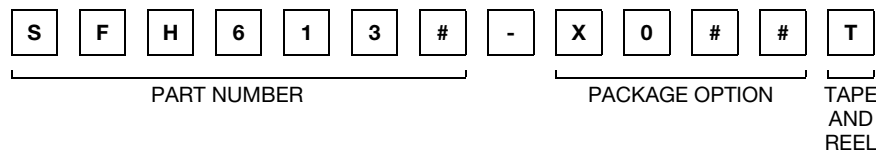
## AGENCY APPROVALS

- [UL](#)
- [cUL](#)
- [DIN EN 60747-5-5 \(VDE 0884-5\)](#), available with option 1
- [CQC](#)

## DESCRIPTION

The SFH6135 and SFH6136 optocouplers feature a high signal transmission rate and a high isolation resistance. They have a GaAlAs infrared emitting diode, optically coupled with an integrated photo detector which consists of a photo diode and a high-speed transistor in a DIP-8 plastic package. Signals can be transmitted between two electrically separated circuits up to frequencies of 2 MHz. The potential difference between the circuits to be coupled should not exceed the maximum permissible reference voltages.

## ORDERING INFORMATION



AGENCY CERTIFIED / PACKAGE	CTR (%)	
<b>UL, cUL, CQC</b>	≥ 7	≥ 19
DIP-8	SFH6135	SFH6136
SMD-8, option 9	-	SFH6136-X009T
<b>UL, cUL, CQC, VDE (option 1)</b>	≥ 7	≥ 19
DIP-8	-	SFH6136-X001
DIP-8, 400 mil, option 6	-	SFH6136-X016
SMD-8, option 7	-	SFH6136-X017T <sup>(1)</sup>

## Notes

- Additional options may be possible, please contact sales office
- <sup>(1)</sup> Also available in tubes; do not add T to end



ABSOLUTE MAXIMUM RATINGS (T <sub>amb</sub> = 25 °C, unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Reverse voltage		V <sub>R</sub>	3	V
Forward current		I <sub>F</sub>	25	mA
Peak forward current	t = 1 ms, duty cycle 50 %	I <sub>FM</sub>	50	mA
Maximum surge forward current	t ≤ 1 μs, 300 pulses/s	I <sub>FSM</sub>	1	A
Thermal resistance		R <sub>thja</sub>	700	K/W
Power dissipation		P <sub>diss</sub>	45	mW
<b>OUTPUT</b>				
Supply voltage		V <sub>S</sub>	-0.5 to 30	V
Output voltage		V <sub>O</sub>	-0.5 to 25	V
Emitter base voltage		V <sub>EBO</sub>	5	V
Output current		I <sub>O</sub>	8	mA
Maximum output current		I <sub>O</sub>	16	mA
Base current		I <sub>B</sub>	5	mA
Thermal resistance		R <sub>thja</sub>	300	K/W
Power dissipation	T <sub>amb</sub> = 70 °C	P <sub>diss</sub>	100	mW
<b>COUPLER</b>				
Isolation test voltage		V <sub>ISO</sub>	5300	V <sub>RMS</sub>
Pollution degree (DIN VDE 0110)			2	
Isolation resistance	V <sub>IO</sub> = 500 V, T <sub>amb</sub> = 25 °C	R <sub>IO</sub>	≥ 10 <sup>12</sup>	Ω
	V <sub>IO</sub> = 500 V, T <sub>amb</sub> = 100 °C	R <sub>IO</sub>	≥ 10 <sup>11</sup>	Ω
Storage temperature range		T <sub>stg</sub>	-55 to +125	°C
Ambient temperature range		T <sub>amb</sub>	-55 to +100	°C
Soldering temperature <sup>(1)</sup>	Max. ≤ 10 s, dip soldering ≥ 0.5 mm distance from case bottom	T <sub>slid</sub>	260	°C

**Notes**

- 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 ratings for extended periods of the time can adversely affect reliability.

<sup>(1)</sup> Refer to wave profile for soldering conditions for through hole devices

ELECTRICAL CHARACTERISTICS (T <sub>amb</sub> = 25 °C, unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>							
Forward voltage	I <sub>F</sub> = 16 mA		V <sub>F</sub>	-	1.6	1.9	V
Breakdown voltage	I <sub>R</sub> = 10 μA		V <sub>BR</sub>	3	-	-	V
Reverse current	V <sub>R</sub> = 3 V		I <sub>R</sub>	-	0.5	10	μA
Capacitance	V <sub>R</sub> = 0 V, f = 1 MHz		C <sub>O</sub>	-	125	-	pF
Temperature coefficient of forward voltage	I <sub>F</sub> = 16 mA		ΔV <sub>F</sub> /ΔT <sub>amb</sub>	-	1.7	-	mV/°C
<b>OUTPUT</b>							
Logic low supply current	I <sub>F</sub> = 16 mA, V <sub>O</sub> = open, V <sub>CC</sub> = 15 V		I <sub>CCL</sub>	-	150	-	μA
Logic high supply current	I <sub>F</sub> = 0 V, V <sub>O</sub> = open, V <sub>CC</sub> = 15 V		I <sub>CCH</sub>	-	0.01	1	μA
Output voltage, output low	I <sub>F</sub> = 16 mA, V <sub>CC</sub> = 4.5 V, I <sub>O</sub> = 1.1 mA	SFH6135	V <sub>OL</sub>	-	0.1	0.4	V
	I <sub>F</sub> = 16 mA, V <sub>CC</sub> = 4.5 V, I <sub>O</sub> = 2.4 mA	SFH6136	V <sub>OL</sub>	-	0.1	0.4	V
Output current, output high	I <sub>F</sub> = 0 mA, V <sub>O</sub> = V <sub>CC</sub> = 5.5 V		I <sub>OH</sub>	-	3	500	nA
	I <sub>F</sub> = 0 mA, V <sub>O</sub> = V <sub>CC</sub> = 15 V		I <sub>OH</sub>	-	0.01	1	μA

ELECTRICAL CHARACTERISTICS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>COUPLER</b>							
Capacitance (input to output)	$f = 1\text{ MHz}$		$C_{IO}$	-	0.6	-	pF

**Note**

- 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.

CURRENT TRANSFER RATIO							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Current transfer ratio	$I_F = 16\text{ mA}$ , $V_O = 0.4\text{ V}$ , $V_{CC} = 4.5\text{ V}$	SFH6135	CTR	7	16	-	%
		SFH6136	CTR	19	35	-	%
	$I_F = 16\text{ mA}$ , $V_O = 0.5\text{ V}$ , $V_{CC} = 4.5\text{ V}$	SFH6135	CTR	5	-	-	%
		SFH6136	CTR	15	-	-	%

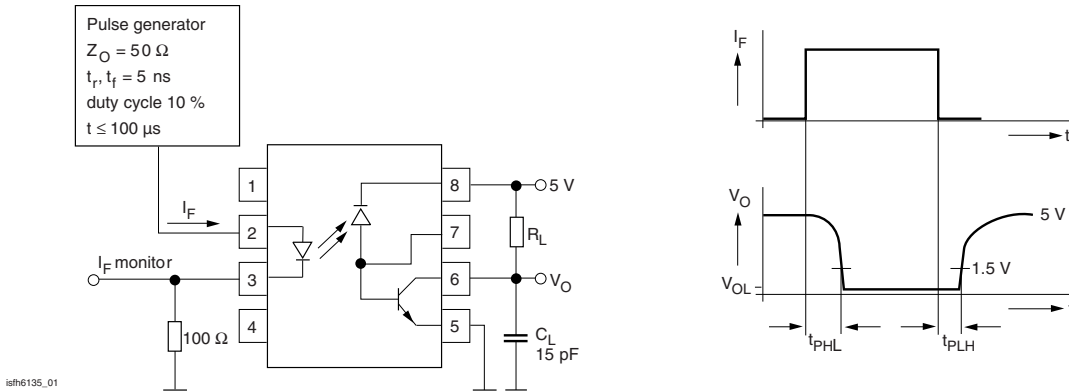


Fig. 1 - Schematics

SWITCHING CHARACTERISTICS							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
High to low	$I_F = 16\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 4.1\text{ k}\Omega$	SFH6135	$t_{PHL}$	-	0.3	1.5	$\mu\text{s}$
	$I_F = 16\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 1.9\text{ k}\Omega$	SFH6136	$t_{PHL}$	-	0.2	0.8	$\mu\text{s}$
Low to high	$I_F = 16\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 4.1\text{ k}\Omega$	SFH6135	$t_{PLH}$	-	0.3	1.5	$\mu\text{s}$
	$I_F = 16\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 1.9\text{ k}\Omega$	SFH6136	$t_{PLH}$	-	0.2	0.8	$\mu\text{s}$

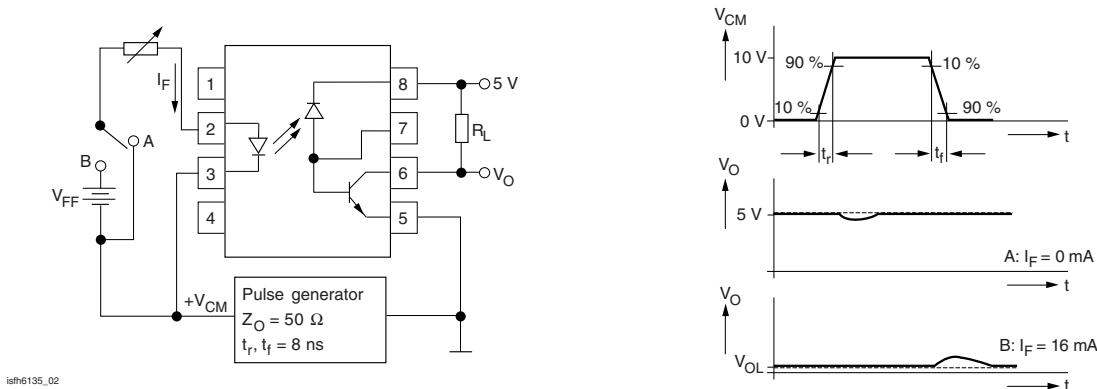


Fig. 2 - Common Mode Interference Immunity

COMMON MODE TRANSIENT IMMUNITY							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
High	$V_{CM} = 10 V_{P-P}$ , $V_{CC} = 5 V$ , $I_F = 0 mA$ , $R_L = 4.1 k\Omega$	SFH6135	CM <sub>H</sub>	-	1000	-	V/ $\mu$ s
	$V_{CM} = 10 V_{P-P}$ , $V_{CC} = 5 V$ , $I_F = 0 mA$ , $R_L = 1.9 k\Omega$	SFH6136	CM <sub>H</sub>	-	1000	-	V/ $\mu$ s
Low	$V_{CM} = 10 V_{P-P}$ , $V_{CC} = 5 V$ , $I_F = 0 mA$ , $R_L = 4.1 k\Omega$	SFH6135	CM <sub>L</sub>	-	1000	-	V/ $\mu$ s
	$V_{CM} = 10 V_{P-P}$ , $V_{CC} = 5 V$ , $I_F = 0 mA$ , $R_L = 1.9 k\Omega$	SFH6136	CM <sub>L</sub>	-	1000	-	V/ $\mu$ s

SAFETY AND INSULATION RATINGS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Climatic classification (according to IEC 68 part 1)			-	55 / 100 / 21	-	
Comparative tracking index		CTI	175	-	399	
V <sub>IOTM</sub>			8000	-	-	V
V <sub>IORM</sub>			890	-	-	V
P <sub>SO</sub>			-	-	500	mW
I <sub>SI</sub>			-	-	300	mA
T <sub>SI</sub>			-	-	175	°C
Creepage distance	Standard DIP-8		7	-	-	mm
Clearance distance	Standard DIP-8		7	-	-	mm
Creepage distance	400 mil DIP-8		8	-	-	mm
Clearance distance	400 mil DIP-8		8	-	-	mm

**Note**

- As per IEC 60747-5-5, §7.4.3.8.1, this optocoupler is suitable for “safe electrical insulation” only within the safety ratings. Compliance with the safety ratings shall be ensured by means of protective circuits.

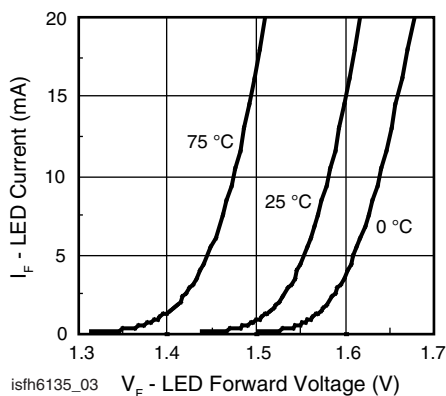
**TYPICAL CHARACTERISTICS** (T<sub>amb</sub> = 25 °C, unless otherwise specified)


Fig. 3 - LED Forward Current vs. Forward Voltage

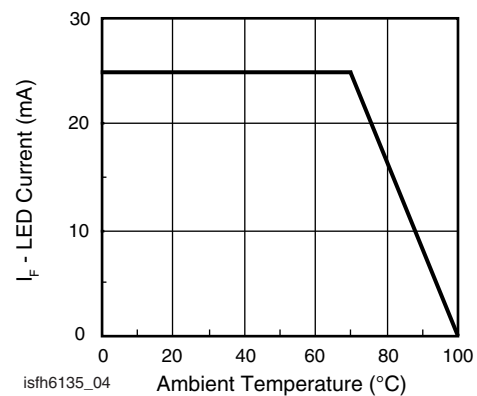


Fig. 4 - Permissible Forward LED Current vs. Temperature

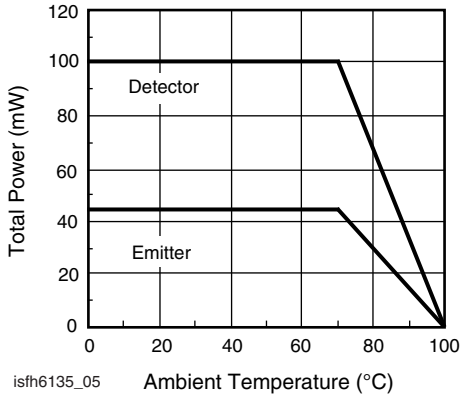


Fig. 5 - Permissible Power Dissipation vs. Temperature

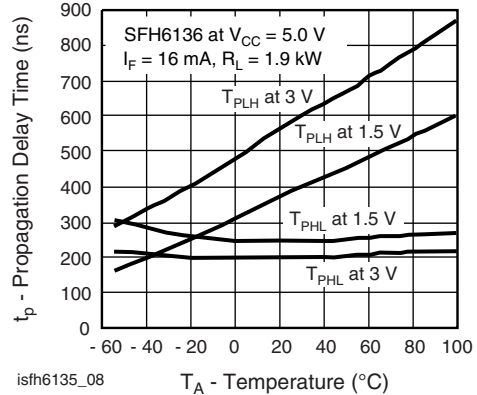


Fig. 8 - Propagation Delay vs. Ambient Temperature - SFH6136

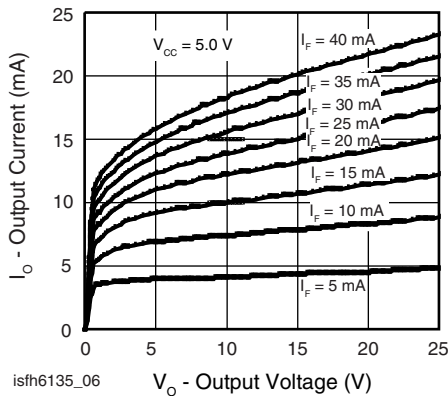


Fig. 6 - Output Current vs. Output Voltage

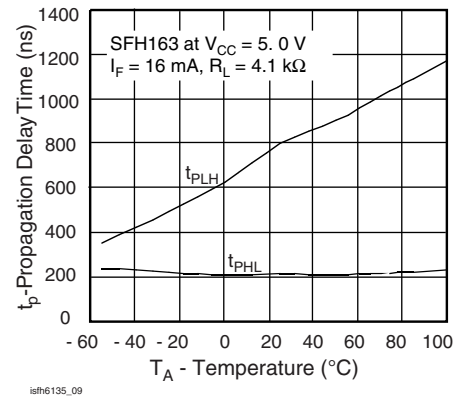


Fig. 9 - Propagation Delay vs. Ambient Temperature - SFH6135

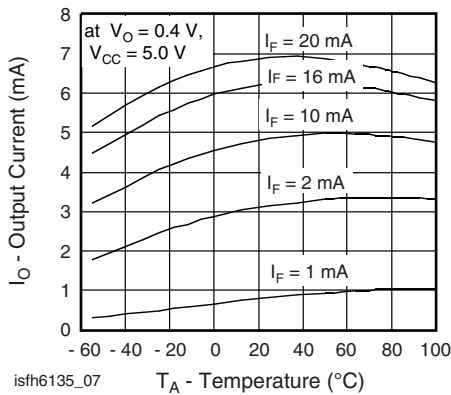


Fig. 7 - Output Current vs. Temperature

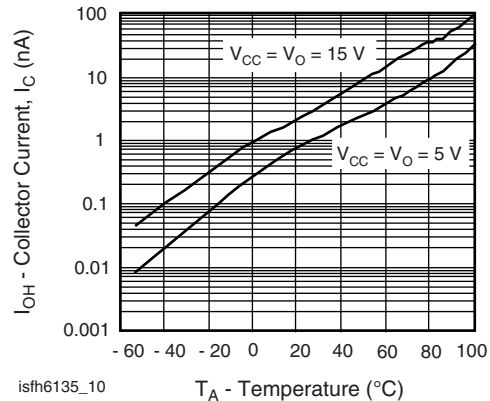


Fig. 10 - Logic High Output Current vs. Temperature

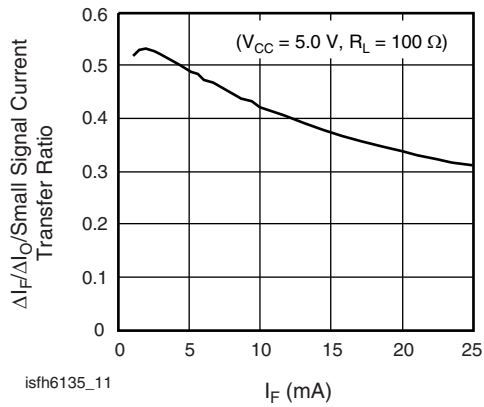
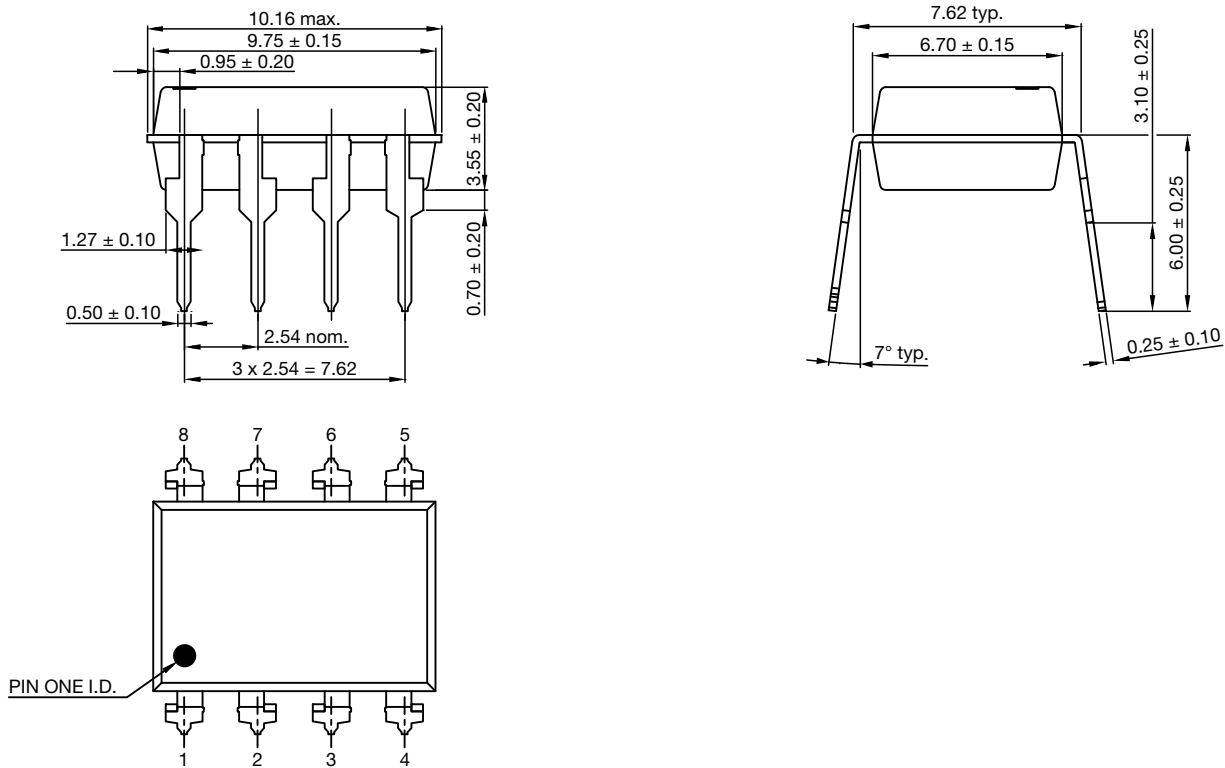


Fig. 11 - Small Signal Current Transfer Ratio vs. Quiescent Input Current

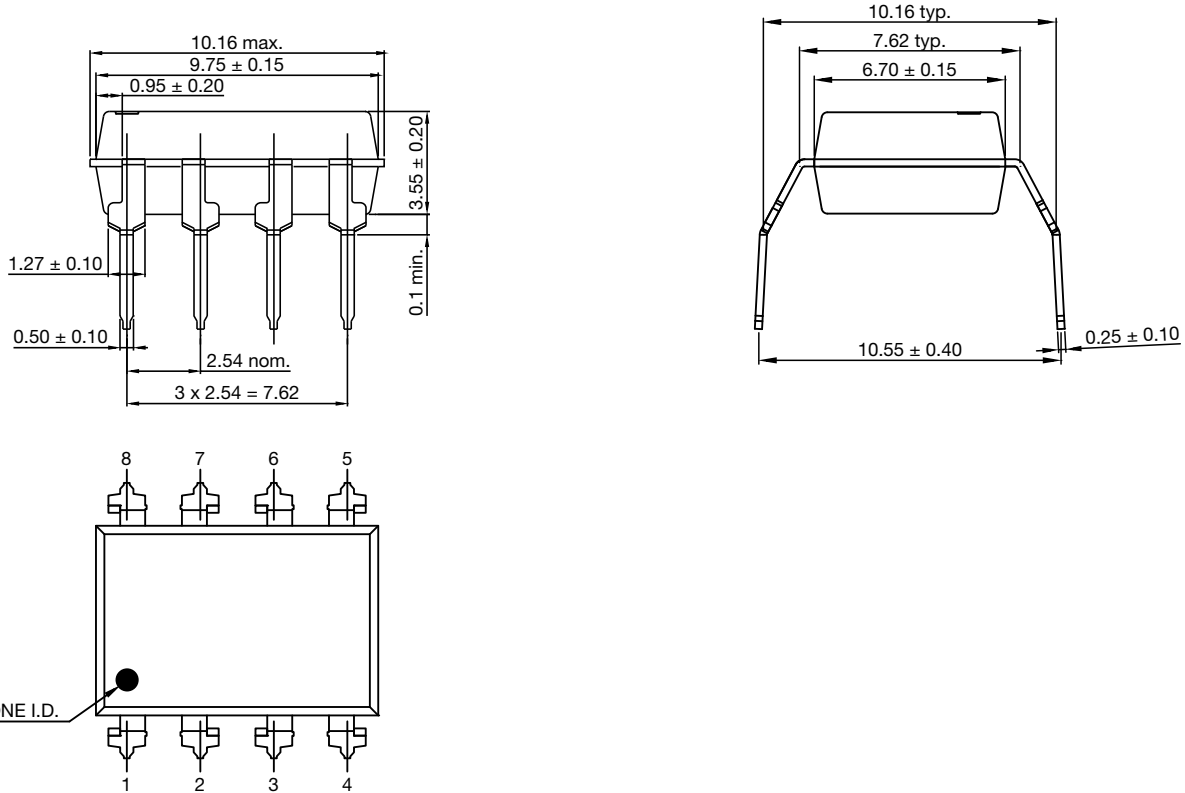
**PACKAGE DIMENSIONS** (in millimeters)

**DIP-8**

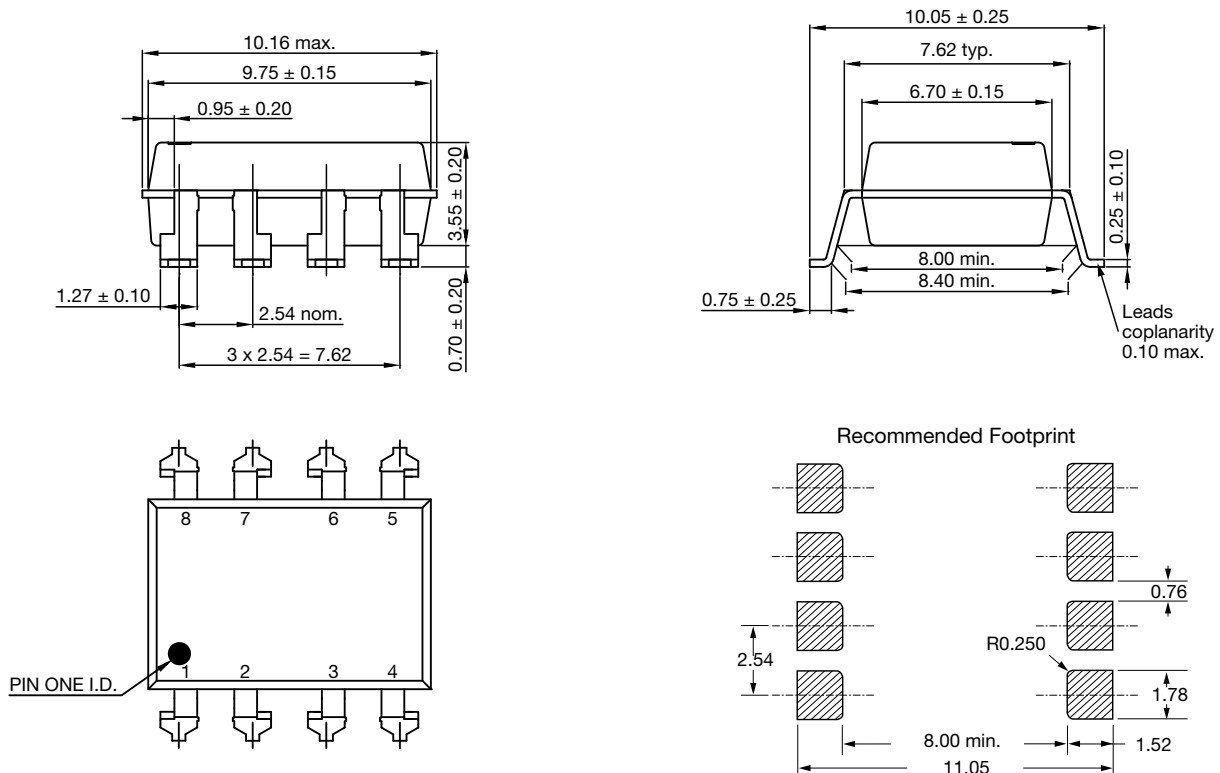




### DIP-8, 400 mil (option 6)

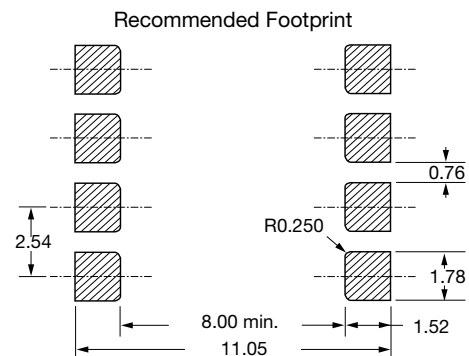
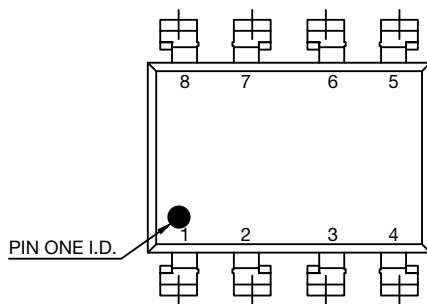
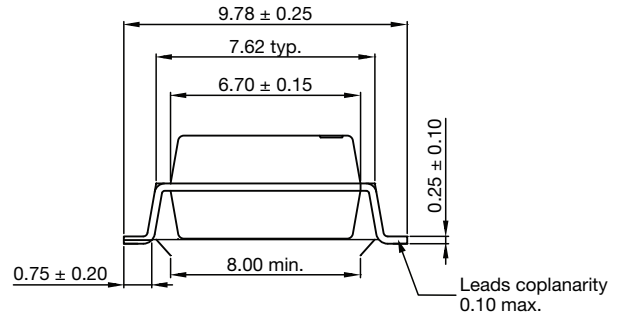
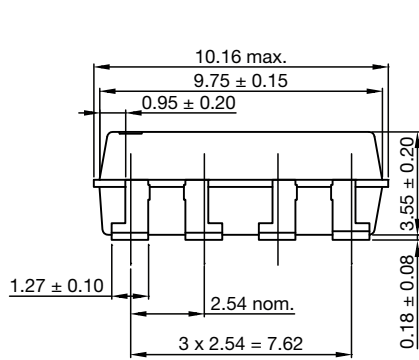


### SMD-8 (option 7)





### SMD-8 (option 9)



### PACKAGE MARKING

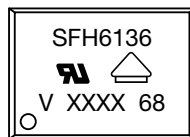


Fig. 12 - Example of SFH6136-X017T

#### Notes

- XXXX = LMC (lot marking code)
- VDE logo is only marked on option 1 parts
- Tape and reel suffix (T) is not part of the package marking

**PACKING INFORMATION** (in millimeters)

**Tube**

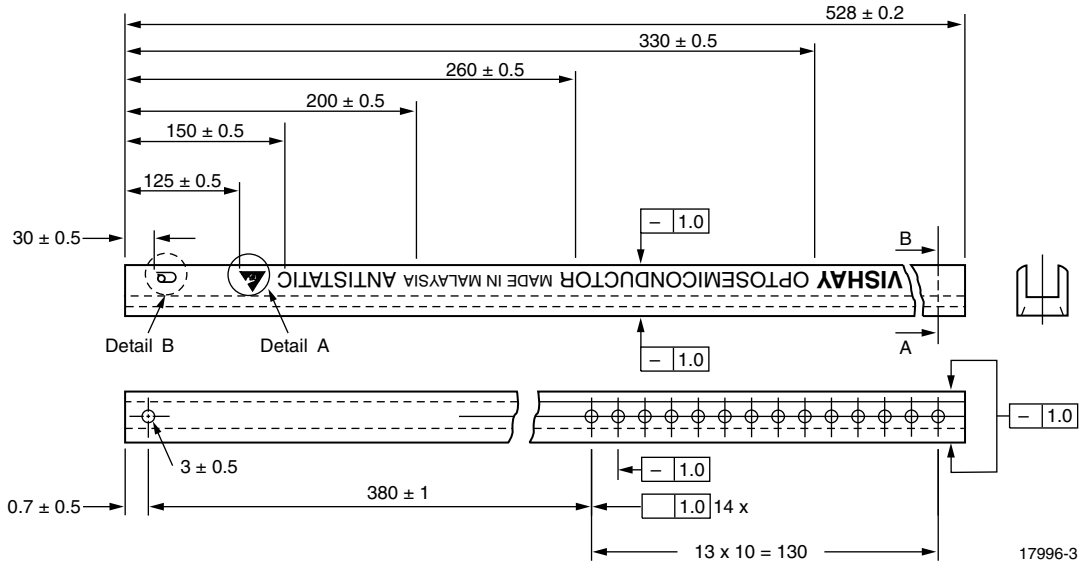


Fig. 13 - Shipping Tube Specifications for DIP-8 Packages

DEVICES PER TUBS			
TYPE	UNITS/TUBE	TUBES/BOX	UNITS/BOX
DIP-8	50	40	2000

**DIP-8**

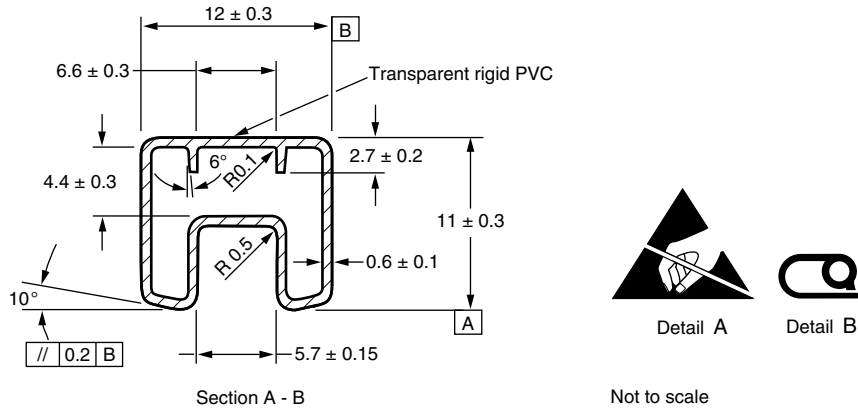


Fig. 14 - Tube Shipping Medium

DIP-8, 400 mil (option 6)

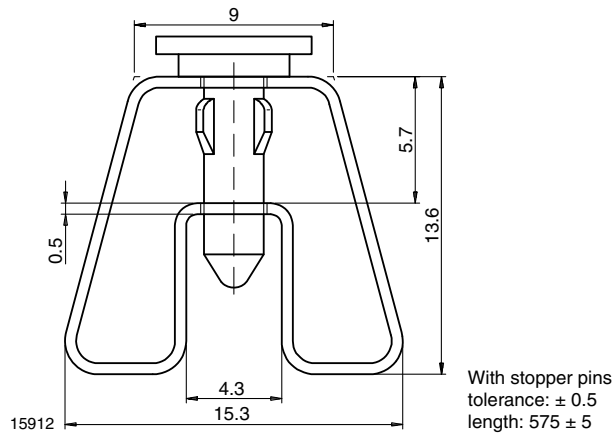
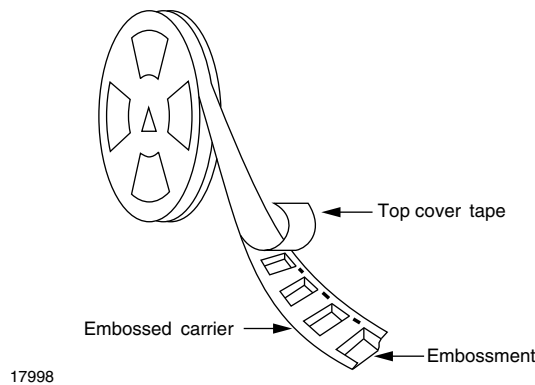


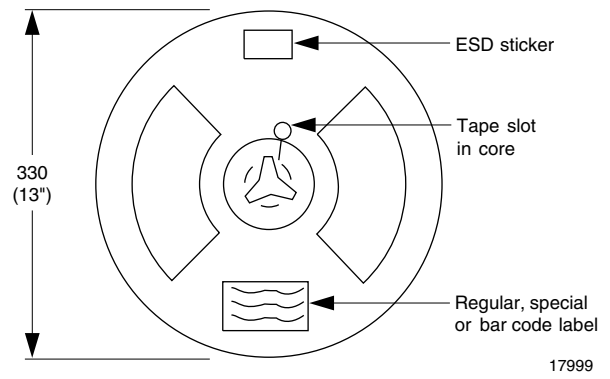
Fig. 15 - Tube Shipping Medium

Tape and Reel



17998

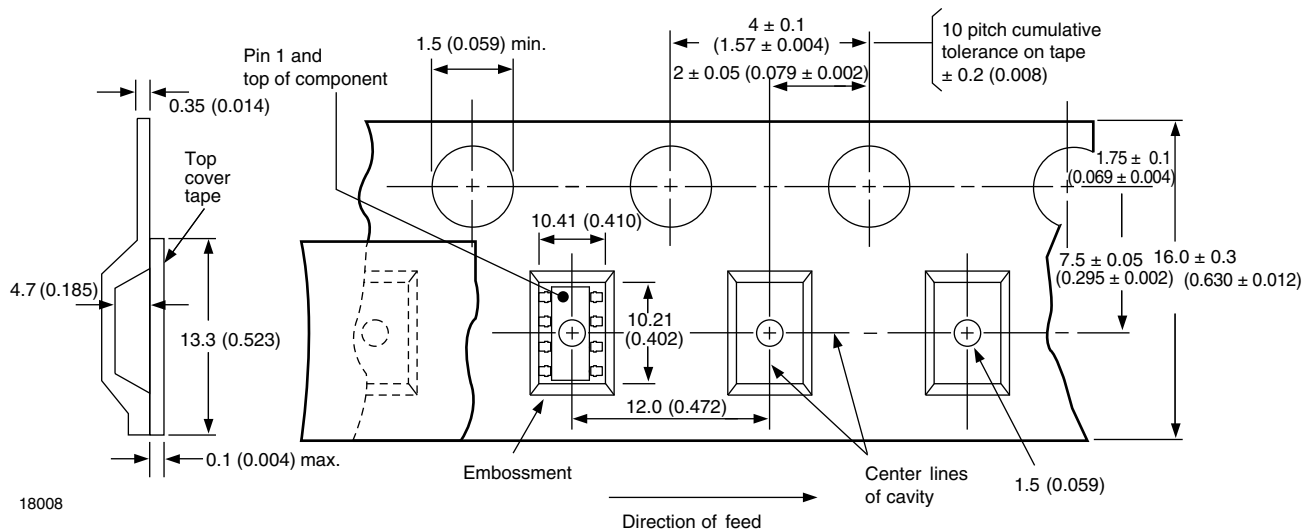
Fig. 16 - Tape and Reel Shipping Medium



17999

Fig. 17 - Tape and Reel Shipping Medium

SMD-8 (option 7)



18008

Fig. 18 - Tape and Reel Packing (1000 pieces on Reel)

SMD-8 (option 9)

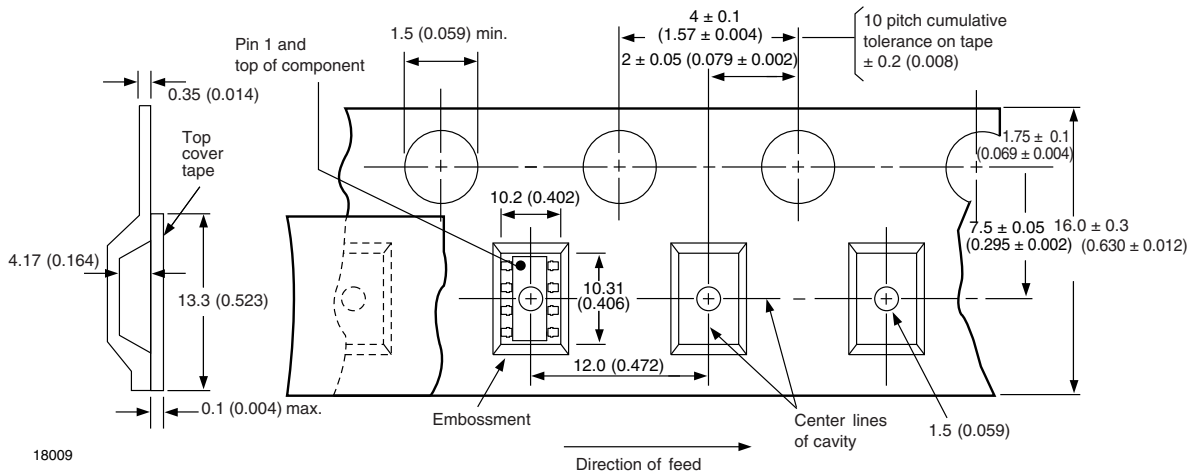
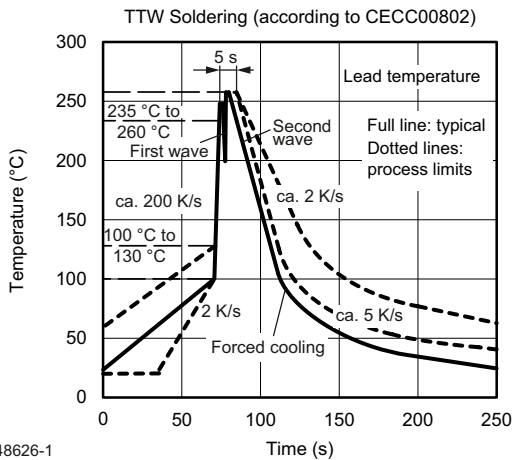


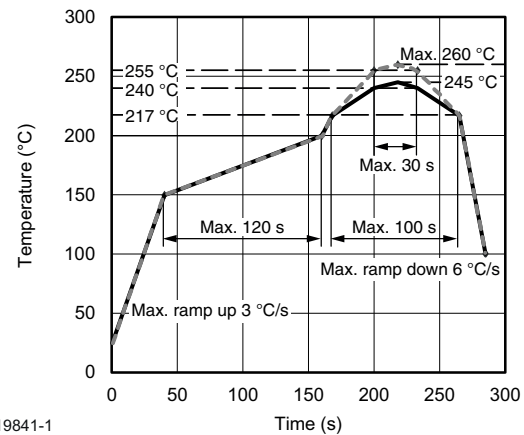
Fig. 19 - Tape and Reel Shipping Medium

SOLDER PROFILES



948626-1

Fig. 20 - Wave Soldering Double Wave Profile According to J-STD-020 for DIP Devices



19841-1

Fig. 21 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD Devices

HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2

Floor life: unlimited

Conditions:  $T_{amb} < 30\text{ }^{\circ}\text{C}$ , RH < 85 %

Moisture sensitivity level 1, according to J-STD-020



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