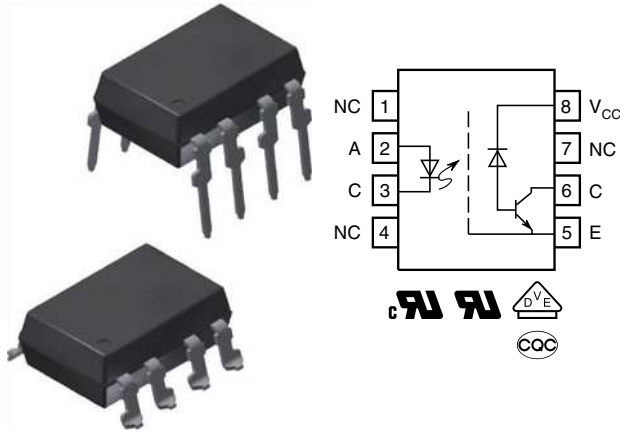


## Analog High Speed Coupler, High Noise Immunity, 1 MBd, 15 kV/μs



### DESCRIPTION

The SFH6345 is an optocoupler with a GaAlAs infrared emitting diode, optically coupled to an integrated photo detector consisting of a photo diode and a high speed transistor in a DIP-8 plastic package. The device is similar to the 6N135 but has an additional Faraday shield on the detector which enhances the input-output dV/dt immunity. Signals can be transmitted between two electrically separated circuits up to frequencies of 2 MHz. This is an ideal solution for industrial communication bus isolation, as well as isolated drive circuit applications such as IPM (intelligent power module) drivers.

### FEATURES

- High-speed optocoupler without base connection
- Isolation test voltage: 5300 V<sub>RMS</sub>
- GaAlAs emitter
- Integrated detector with photo diode and transistor
- High data transmission rate: 1 MBit/s
- TTL compatible
- Open collector output
- Good CTR linearity relative to forward current
- Field effect stable
- Low coupling capacitance
- Very high common mode transient immunity dV/dt: ≥ 15 kV/μs at V<sub>CM</sub> = 1500 V
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



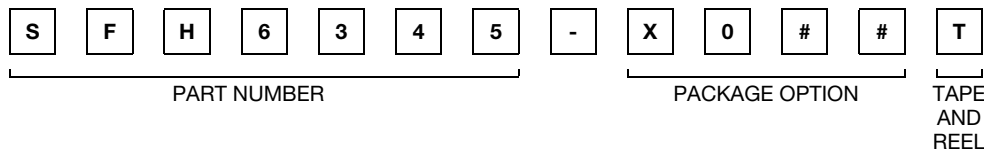
### APPLICATIONS

- Data communications
- IGBT drivers
- Programmable controllers
- IPM (intelligent power module) drivers

### AGENCY APPROVALS

- UL1577 file no. E52744, double protection
- DIN EN 60747-5-5 (VDE0884-5) available with option 1
- cUL components acceptance service no. 5A
- CQC GB8898-2001, GB4943.1-2011

### ORDERING INFORMATION



AGENCY CERTIFIED/PACKAGE	CMR (kV/μs)
<b>UL, cUL, CQC</b>	<b>≥ 15</b>
DIP-8	SFH6345
SMD-8, option 7	SFH6345-X007T <sup>(1)</sup>
SMD-8, option 9	SFH6345-X009T <sup>(1)</sup>
<b>VDE, UL, cUL, CQC</b>	
DIP-8	SFH6345-X001
DIP-8, 400 mil, option 6	SFH6345-X016
SMD-8, option 7	SFH6345-X017T <sup>(1)</sup>
SMD-8, option 9	SFH6345-X019T <sup>(1)</sup>

### Note

<sup>(1)</sup> Also available in tubes; do not add T to end



ABSOLUTE MAXIMUM RATINGS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Reverse voltage		$V_R$	3	V
DC forward current		$I_F$	25	mA
Surge forward current	$t_p = 1\text{ }\mu\text{s}$ , 300 pulses/s	$I_{FSM}$	1	A
Power dissipation		$P_{diss}$	45	mW
<b>OUTPUT</b>				
Supply voltage		$V_S$	-0.5 to 30	V
Output voltage		$V_O$	-0.5 to 25	V
Output current		$I_O$	8	mA
Power dissipation		$P_{diss}$	100	mW
<b>COUPLER</b>				
Storage temperature range		$T_{stg}$	-55 to +150	$^{\circ}\text{C}$
Ambient temperature range		$T_{amb}$	-55 to +100	$^{\circ}\text{C}$
Junction temperature		$T_j$	125	$^{\circ}\text{C}$
Soldering temperature	max. 10 s, max. dip soldering: distance to seating plane $\geq 1.5\text{ mm}$	$T_{sld}$	260	$^{\circ}\text{C}$

**Note**

- 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.

ELECTRICAL CHARACTERISTICS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
Forward voltage	$I_F = 16\text{ mA}$	$V_F$	-	1.33	1.9	V
Reverse current	$V_R = 3\text{ V}$	$I_R$	-	0.5	10	$\mu\text{A}$
Capacitance	$V_R = 0\text{ V}$ , $f = 1\text{ MHz}$	$C_O$	-	30	-	pF
Thermal resistance		$R_{thja}$	-	700	-	K/W
<b>OUTPUT</b>						
Supply current, logic high	$I_F = 0\text{ V}$ , $V_O = \text{open}$ , $V_{CC} = 15\text{ V}$	$I_{CCH}$	-	0.01	1	$\mu\text{A}$
		$I_{CCH}^{(1)}$	-	0.01	2	$\mu\text{A}$
Output current, output high	$I_F = 0\text{ V}$ , $V_O = V_{CC} = 5.5\text{ V}$	$I_{OH}$	-	0.003	0.5	$\mu\text{A}$
		$I_{OH}$	-	0.01	1	$\mu\text{A}$
	$I_F = 0\text{ V}$ , $V_O = V_{CC} = 15\text{ V}$	$I_{OH}^{(1)}$	-	-	50	$\mu\text{A}$
Collector emitter capacitance	$V_{CE} = 5\text{ V}$ , $f = 1\text{ MHz}$	$C_{CE}$	-	3	-	pF
Thermal resistance		$R_{thja}$	-	300	-	K/W
<b>COUPLER</b>						
Coupling capacitance		$C_C$	-	0.6	-	pF
Collector emitter saturation voltage	$I_F = 16\text{ mA}$ , $I_O = 2.4\text{ mA}$ , $V_{CC} = 4.5\text{ V}$	$V_{OL}$	-	0.1	0.4	V
Logic low supply current	$I_F = 16\text{ mA}$ , $V_O = \text{open}$ , $V_{CC} = 15\text{ V}$	$I_{CCL}$	-	80	200	$\mu\text{A}$

**Notes**

- 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.

(1)  $T_{amb} = 0\text{ }^{\circ}\text{C}$  to  $70\text{ }^{\circ}\text{C}$ , unless otherwise specified, typical values  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

<b>CURRENT TRANSFER RATIO</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Current transfer ratio	$I_F = 16\text{ mA}$ , $V_O = 0.4\text{ V}$ , $V_{CC} = 4.5\text{ V}$	CTR	19	30	-	%
	$I_F = 16\text{ mA}$ , $V_O = 0.5\text{ V}$ , $V_{CC} = 4.5\text{ V}$ , $T_{amb} = 0\text{ }^{\circ}\text{C}$ to $70\text{ }^{\circ}\text{C}$	CTR	15	-	-	%

<b>SWITCHING CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Propagation delay time (high to low), see fig. 1	$I_F = 16\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 1.9\text{ k}\Omega$	$t_{PHL}$	-	0.3	0.8	$\mu\text{s}$
Propagation delay time (low to high), see fig. 1	$I_F = 16\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 1.9\text{ k}\Omega$	$t_{PLH}$	-	0.3	0.8	$\mu\text{s}$

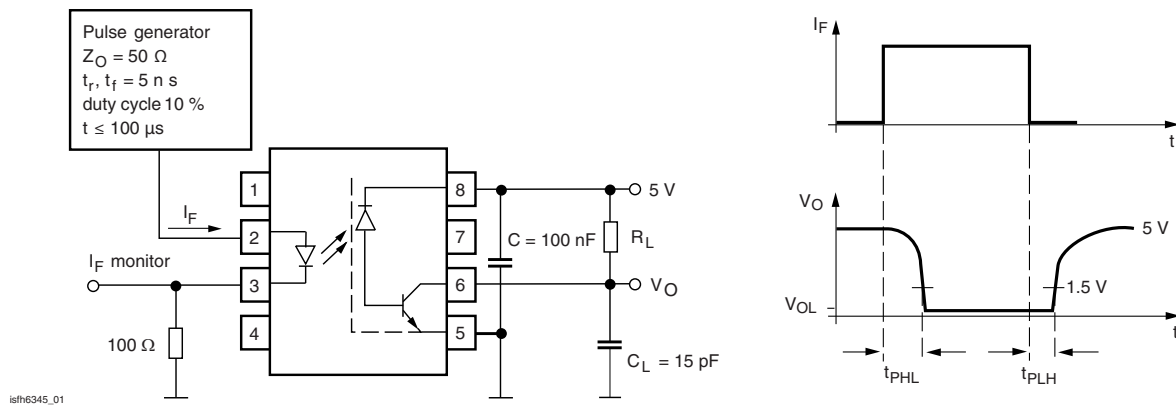


Fig. 1 - Switching Times (Typ.)

<b>COMMON MODE TRANSIENT IMMUNITY</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Common mode transient immunity (high), see fig. 2	$I_O = 0\text{ mA}$ , $V_{CM} = 1500\text{ V}_{P-P}$ , $R_L = 1.9\text{ k}\Omega$ , $V_{CC} = 5\text{ V}$	$ CM_H $	15 000	30 000	-	$\text{V}/\mu\text{s}$
Common mode transient immunity (low), see fig. 2	$I_O = 16\text{ mA}$ , $V_{CM} = 1500\text{ V}_{P-P}$ , $R_L = 1.9\text{ k}\Omega$ , $V_{CC} = 5\text{ V}$	$ CM_L $	15 000	30 000	-	$\text{V}/\mu\text{s}$

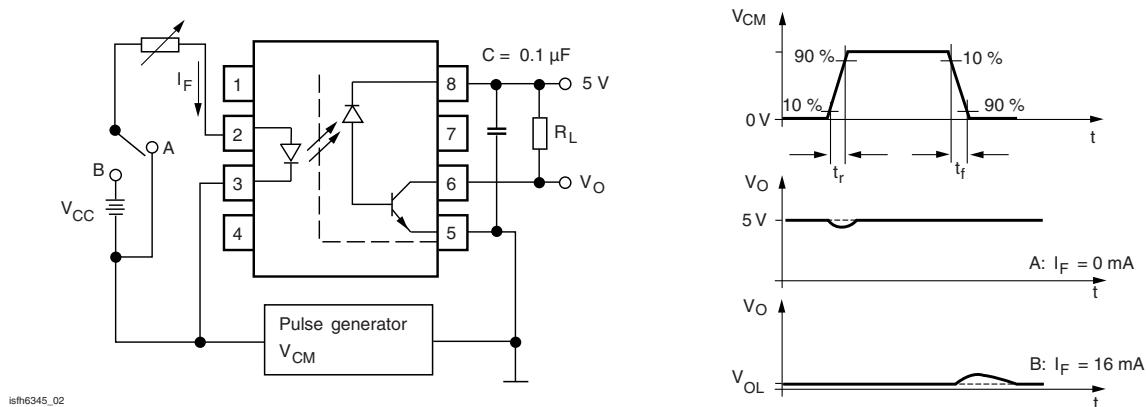


Fig. 2 - Common Mode Transient Immunity

<b>SAFETY AND INSULATION RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Climatic classification	According to IEC 68 part 1		55/100/21	
Pollution degree	According to DIN VDE 0109		2	
Comparative tracking index	Insulation group IIIa	CTI	175	
Maximum rated withstanding isolation voltage	According to UL1577, $t = 1\text{ min}$	$V_{ISO}$	5300	$V_{RMS}$
Maximum transient isolation voltage	According to DIN EN 60747-5-5	$V_{IOTM}$	8000	$V_{peak}$
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5	$V_{IORM}$	890	$V_{peak}$
Isolation resistance	$T_{amb} = 25\text{ }^{\circ}\text{C}$ , $V_{IO} = 500\text{ V}$	$R_{IO}$	$\geq 10^{12}$	$\Omega$
	$T_{amb} = 100\text{ }^{\circ}\text{C}$ , $V_{IO} = 500\text{ V}$	$R_{IO}$	$\geq 10^{11}$	$\Omega$
Output safety power		$P_{SO}$	500	mW
Input safety current		$I_{SI}$	300	mA
Input safety temperature		$T_S$	175	$^{\circ}\text{C}$
Creepage distance	DIP-8		$\geq 7$	mm
Clearance distance	DIP-8		$\geq 7$	mm
Creepage distance	DIP-8, 400 mil, option 6		$\geq 8$	mm
Clearance distance	DIP-8, 400 mil, option 6		$\geq 8$	mm
Creepage distance	SMD-8, option 7		$\geq 8$	mm
Clearance distance	SMD-8, option 7		$\geq 8$	mm
Creepage distance	SMD-8, option 9		$\geq 8$	mm
Clearance distance	SMD-8, option 9		$\geq 8$	mm
Insulation thickness		DTI	$\geq 0.4$	mm

**Note**

- As per IEC 60747-5-5, § 7.4.3.8.2, 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.

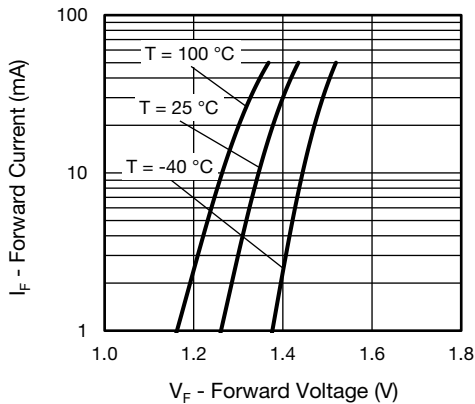
**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)


Fig. 3 - LED Forward Current vs. Forward Voltage

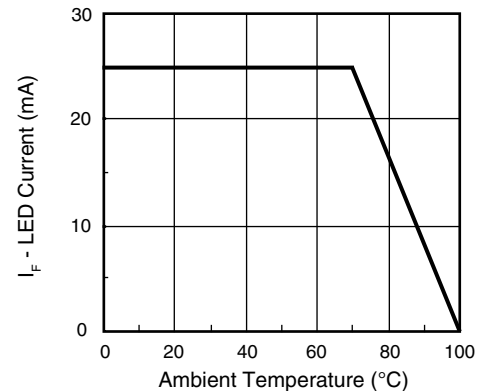


Fig. 4 - Permissible Forward LED Current vs. Temperature

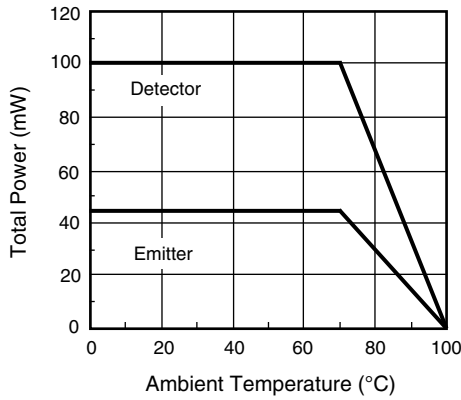


Fig. 5 - Permissible Power Dissipation vs. Temperature

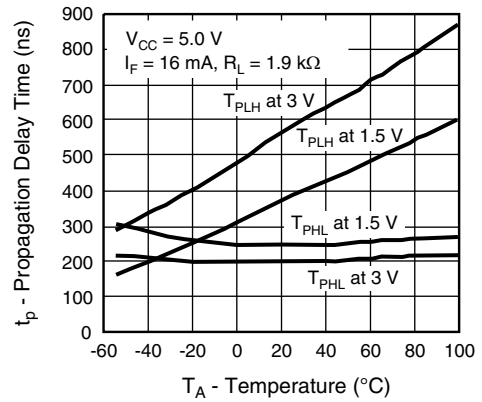


Fig. 8 - Propagation Delay vs. Ambient Temperature

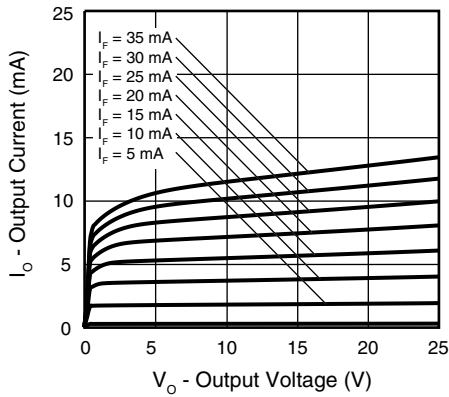


Fig. 6 - Output Current vs. Output Voltage

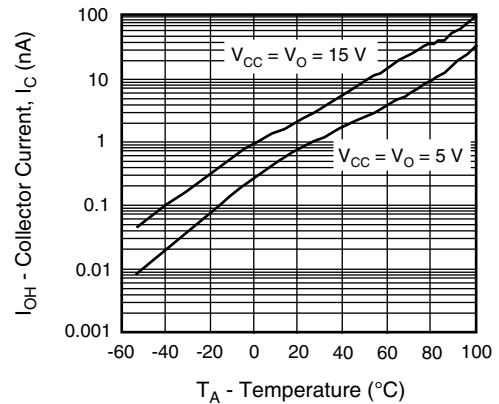


Fig. 9 - Logic High Output Current vs. Temperature

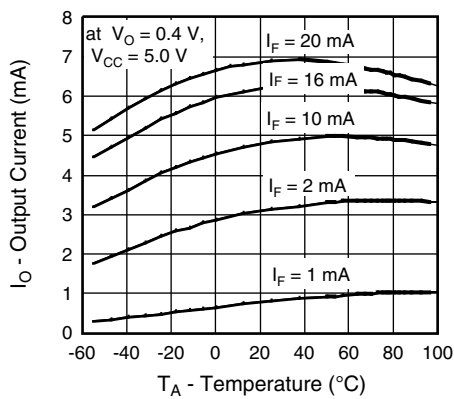


Fig. 7 - Output Current vs. Temperature

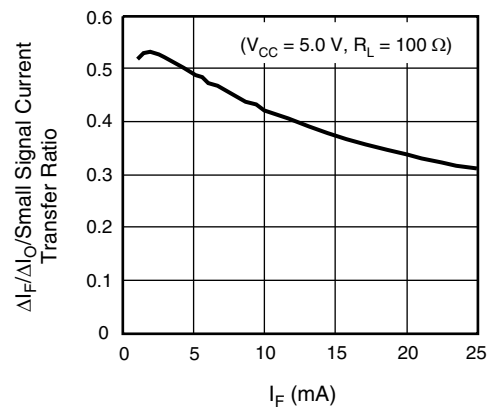
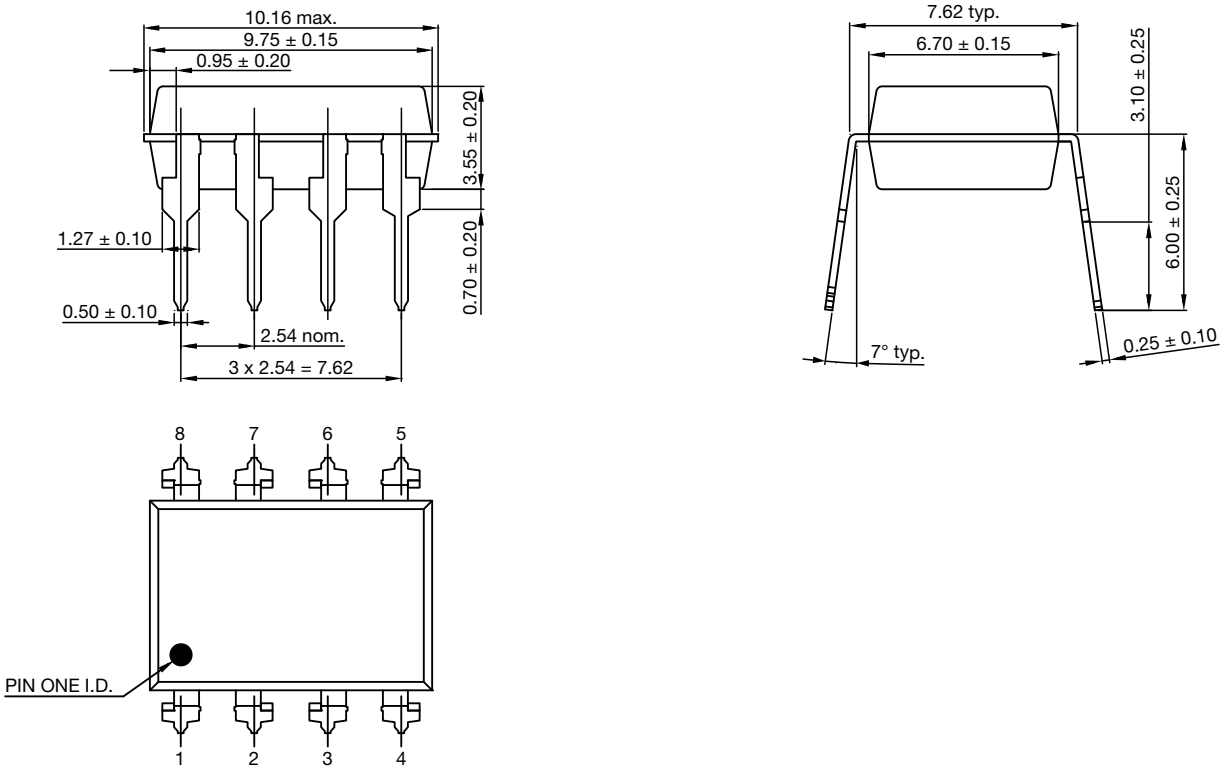


Fig. 10 - Small Signal Current Transfer Ratio vs. Input Current

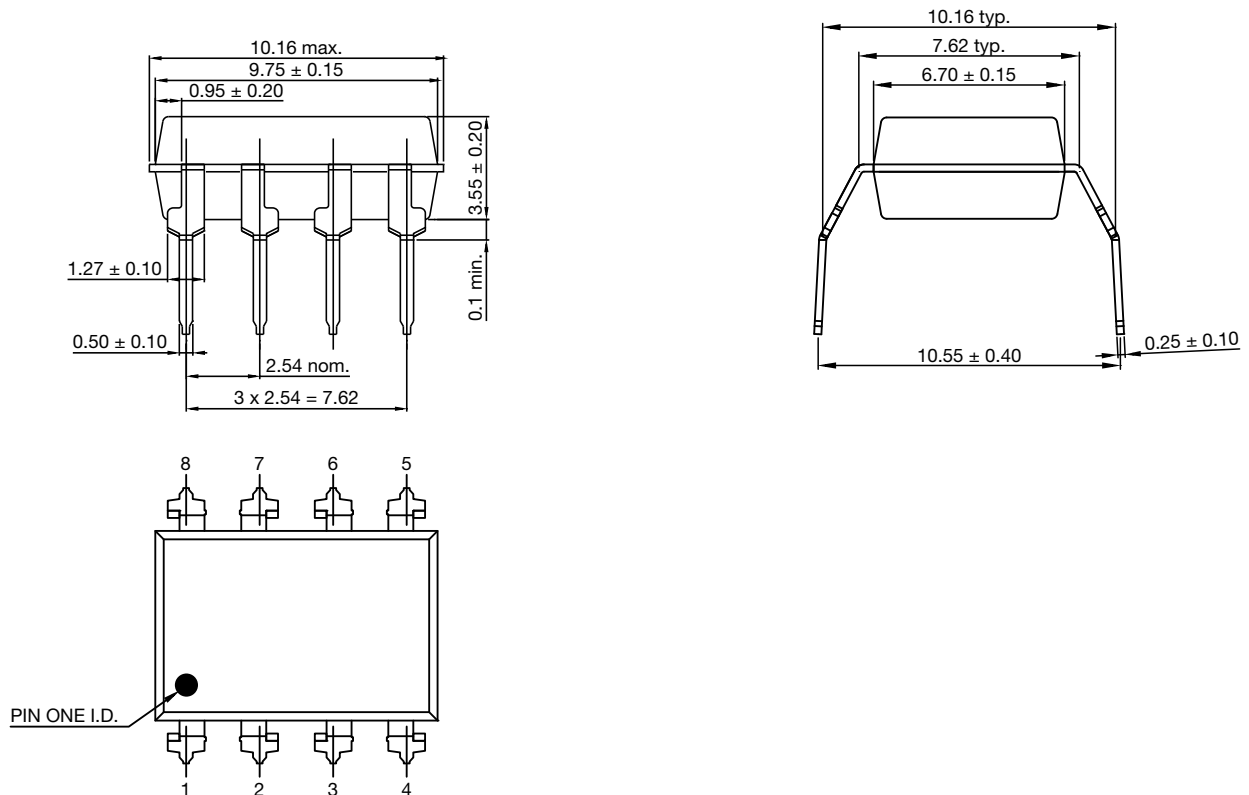


**PACKAGE DIMENSIONS** (in millimeters)

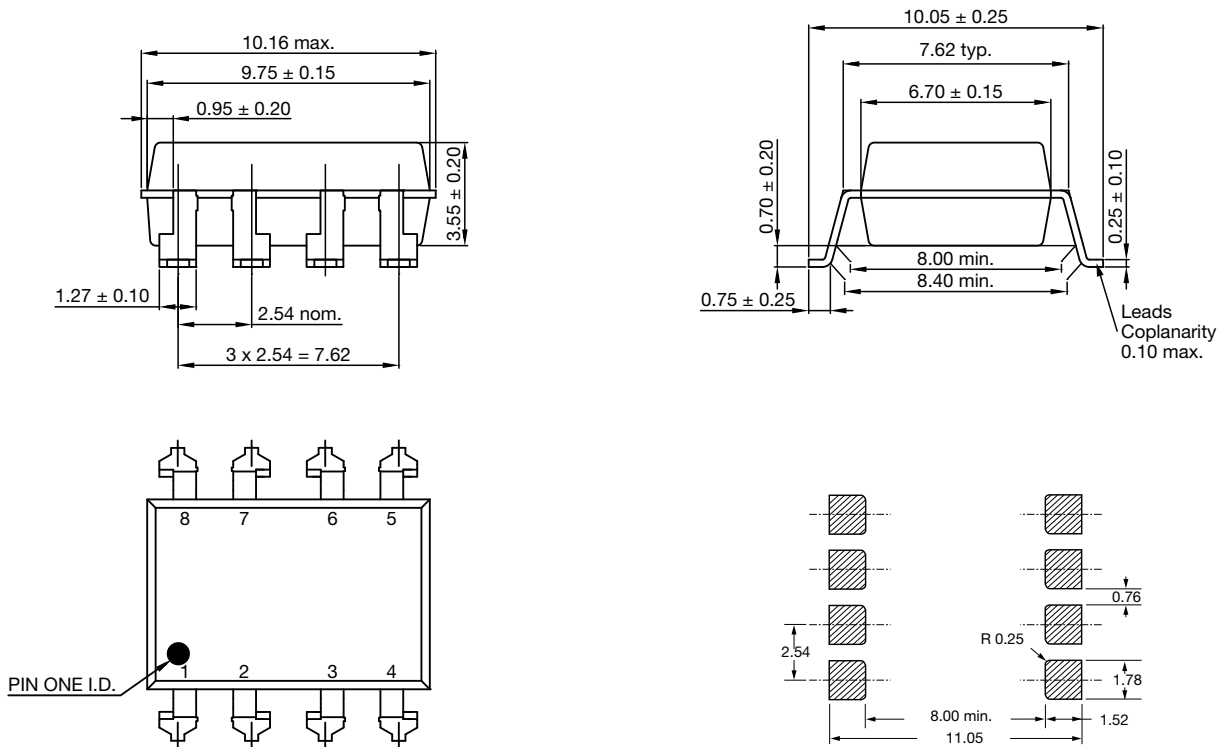
**DIP-6**



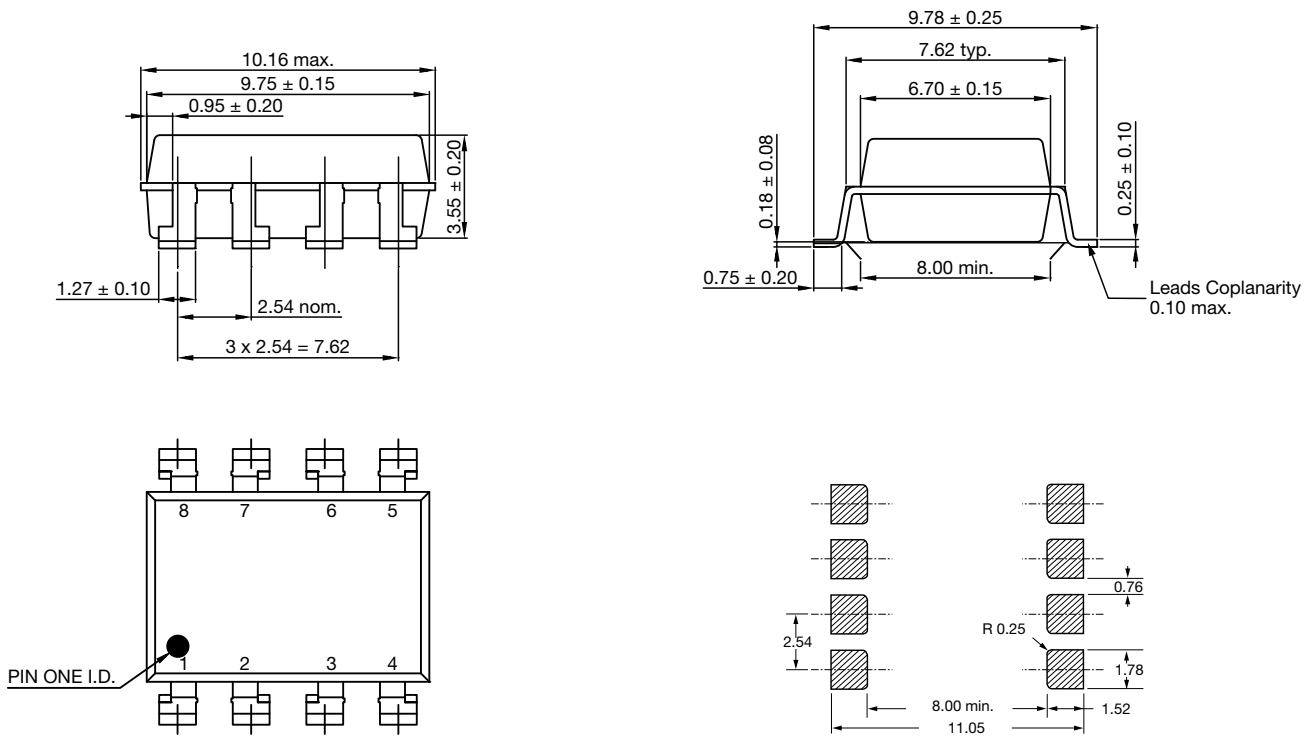
**DIP-6, Option 6**



SMD-6, Option 7



SMD-6, Option 9



**PACKAGE MARKING**

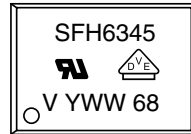


Fig. 11 - SFH6345

**Notes**

- The VDE logo is only marked on option 1 parts.
- Tape and reel suffix (T) is not part of the package marking.

**PACKAGING INFORMATION** (in millimeters)

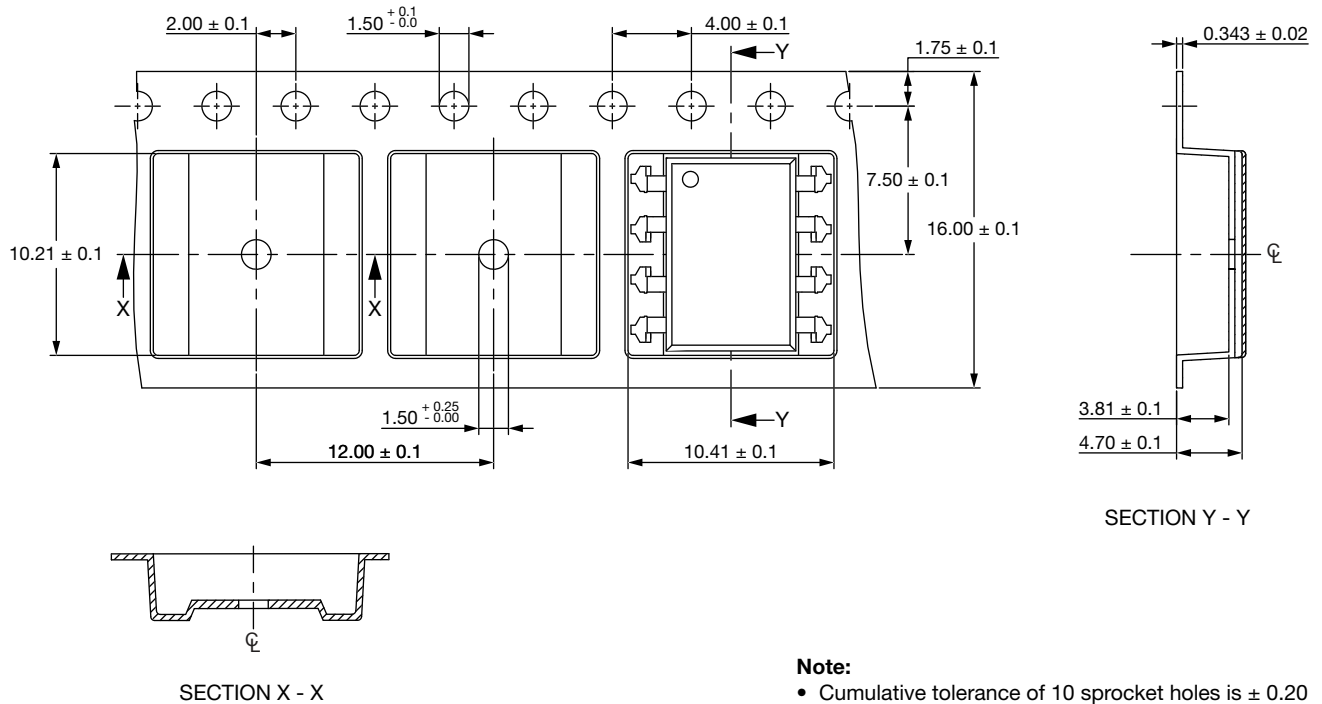


Fig. 12 - Tape and Reel Packing for SMD-8, Option 7 (1000 pieces on reel)



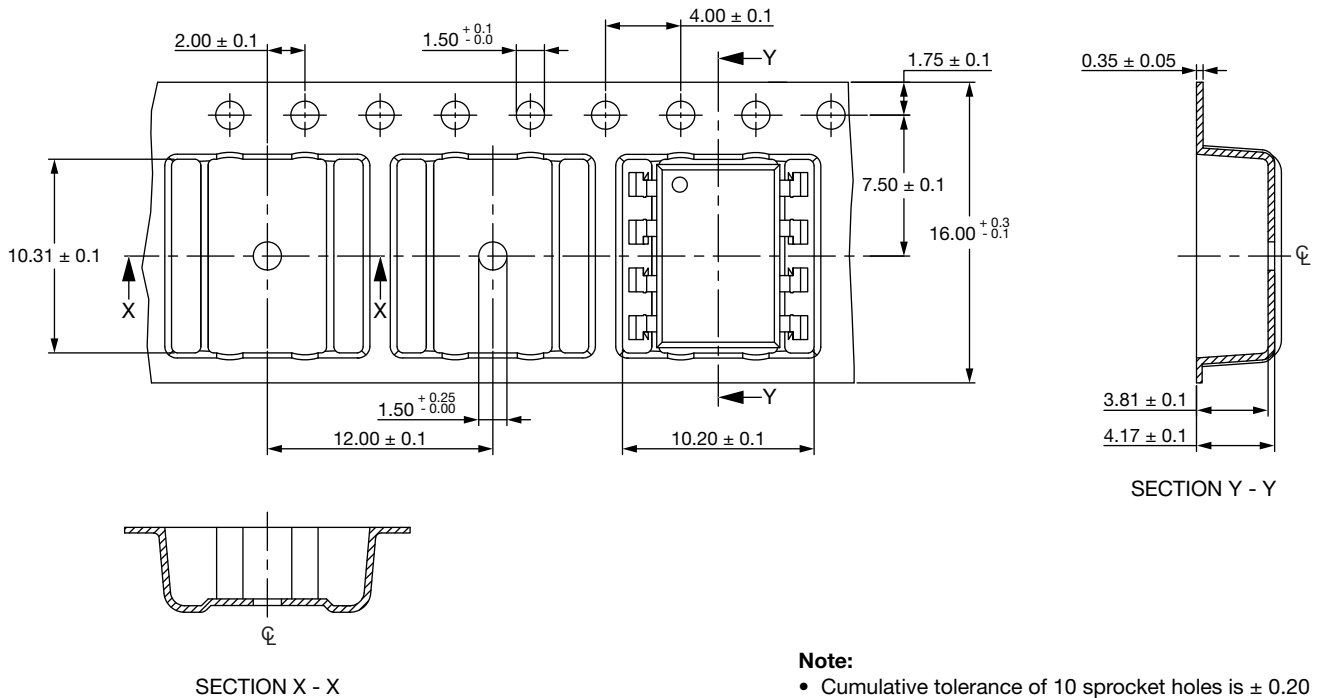


Fig. 13 - Tape and Reel Packing for SMD-8, Option 9 (1000 pieces on reel)

**SOLDER PROFILES**

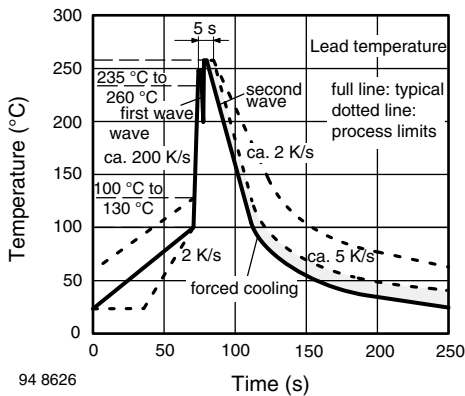


Fig. 14 - Wave Soldering Double Wave Profile According to J-STD-020 for DIP-8 Devices

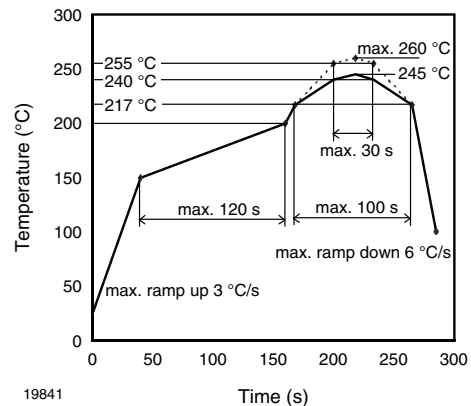


Fig. 15 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD-8 Devices

**HANDLING AND STORAGE CONDITIONS**

ESD level: HBM class 2

Floor life: unlimited

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

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



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