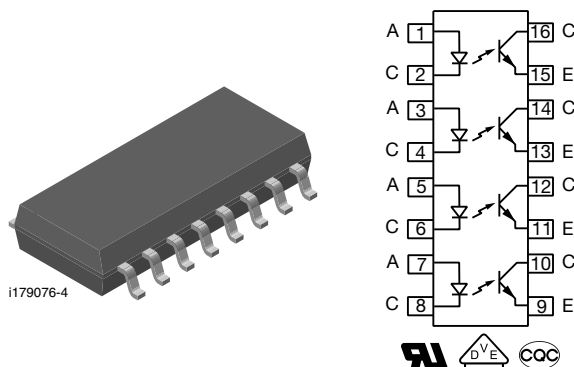


# Optocoupler, Phototransistor Output, Quad Channel, SSOP-16, Half Pitch Mini-Flat Package



## FEATURES

- SSOP (shrink small outline package)
- Isolation test voltage, 3750 V<sub>RMS</sub>
- High collector emitter voltage, V<sub>CEO</sub> = 70 V
- Low saturation voltage
- Fast switching times
- Temperature stable
- Low coupling capacitance
- End stackable, 0.050" (1.27 mm) spacing
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



## LINKS TO ADDITIONAL RESOURCES



3D Models



Design Tools



Related Documents

## DESCRIPTION

The SFH6916 has a GaAs infrared emitter, which is optically coupled to a silicon planar phototransistor detector, and is incorporated in a 16 pin 50 mil lead pitch miniflat package. It features a high current transfer ratio, low coupling capacitance, and high isolation voltage.

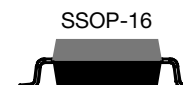
The coupling devices are designed for signal transmission between two electrically separated circuits.

## AGENCY APPROVALS

- [UL](#)
- [cUL](#)
- [DIN EN 60747-5-5 \(VDE 0884-5\)](#), available with option 1
- [BSI](#)
- [CQC GB4943.1-2011](#)
- [CQC GB8898-2011](#) (suitable for installation altitude below 2000 m)
- [FIMKO](#)

## ORDERING INFORMATION

|             |          |          |          |          |          |          |          |            |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|------------|----------|----------|----------|---------------|
| <b>S</b>    | <b>F</b> | <b>H</b> | <b>6</b> | <b>9</b> | <b>1</b> | <b>6</b> | <b>-</b> | <b>X</b>   | <b>0</b> | <b>0</b> | <b>1</b> | <b>T</b>      |
| PART NUMBER |          |          |          |          |          |          |          | VDE OPTION |          |          |          | TAPE AND REEL |



| AGENCY CERTIFIED / PACKAGE                      | CTR (%)                 |
|-------------------------------------------------|-------------------------|
| <b>UL, cUL, BSI, CQC, FIMKO</b>                 | <b>50 to 300</b>        |
| SSOP-16, quad channel                           | SFH6916T <sup>(1)</sup> |
| <b>UL, cUL, BSI, CQC, FIMKO, VDE (option 1)</b> | <b>50 to 300</b>        |
| SSOP-16, quad channel                           | SFH6916-X001            |

## Notes

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



| <b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                                                                        |            |             |                    |
|--------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|------------|-------------|--------------------|
| PARAMETER                                                                                              | TEST CONDITION                                                         | SYMBOL     | VALUE       | UNIT               |
| <b>INPUT</b>                                                                                           |                                                                        |            |             |                    |
| Reverse voltage                                                                                        |                                                                        | $V_R$      | 6           | V                  |
| DC forward current                                                                                     |                                                                        | $I_F$      | 50          | mA                 |
| Surge forward current                                                                                  | $t_p \leq 10\text{ }\mu\text{s}$                                       | $I_{FSM}$  | 1.5         | A                  |
| Total power dissipation                                                                                |                                                                        | $P_{diss}$ | 80          | mW                 |
| <b>OUTPUT</b>                                                                                          |                                                                        |            |             |                    |
| Collector emitter voltage                                                                              |                                                                        | $V_{CEO}$  | 70          | V                  |
| Emitter collector voltage                                                                              |                                                                        | $V_{ECO}$  | 7           | V                  |
| Collector current                                                                                      |                                                                        | $I_C$      | 50          | mA                 |
|                                                                                                        | $t_p = 1.0\text{ ms}$                                                  | $I_C$      | 100         | mA                 |
| Total power dissipation per channel                                                                    |                                                                        | $P_{diss}$ | 150         | mW                 |
| <b>COUPLER</b>                                                                                         |                                                                        |            |             |                    |
| Storage temperature range                                                                              |                                                                        | $T_{stg}$  | -55 to +125 | $^{\circ}\text{C}$ |
| Ambient temperature range                                                                              |                                                                        | $T_{amb}$  | -55 to +100 | $^{\circ}\text{C}$ |
| Junction temperature                                                                                   |                                                                        | $T_j$      | 125         | $^{\circ}\text{C}$ |
| Soldering temperature <sup>(1)</sup>                                                                   | Max. 10 s dip soldering distance to seating plane $\geq 1.5\text{ mm}$ |            | 260         | $^{\circ}\text{C}$ |
| Total power dissipation                                                                                |                                                                        | $P_{tot}$  | 250         | mW                 |

**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 reflow profile for soldering conditions for surface mounted devices

| <b>ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                                            |             |      |      |      |               |
|----------------------------------------------------------------------------------------------------------|--------------------------------------------|-------------|------|------|------|---------------|
| PARAMETER                                                                                                | TEST CONDITION                             | SYMBOL      | MIN. | TYP. | MAX. | UNIT          |
| <b>INPUT</b>                                                                                             |                                            |             |      |      |      |               |
| Forward voltage                                                                                          | $I_F = 5\text{ mA}$                        | $V_F$       | -    | 1.15 | 1.4  | V             |
| Reverse current                                                                                          | $V_R = 6\text{ V}$                         | $I_R$       | -    | 0.01 | 10   | $\mu\text{A}$ |
| Capacitance                                                                                              | $C_O$                                      | $C_O$       | -    | 8    | -    | pF            |
| <b>OUTPUT</b>                                                                                            |                                            |             |      |      |      |               |
| Collector emitter leakage current                                                                        | $V_{CE} = 20\text{ V}$                     | $I_{CEO}$   | -    |      | 100  | nA            |
| Collector emitter capacitance                                                                            | $V_{CE} = 5\text{ V}$ , $f = 1\text{ MHz}$ | $C_{CE}$    | -    | 6.0  | -    | pF            |
| <b>COUPLER</b>                                                                                           |                                            |             |      |      |      |               |
| Collector emitter saturation voltage                                                                     | $I_F = 20\text{ mA}$ , $I_C = 1\text{ mA}$ | $V_{CEsat}$ | -    | 0.1  | 0.4  | V             |
| Coupling capacitance                                                                                     | $f = 1\text{ MHz}$                         | $C_C$       | -    | 1    | -    | 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

| <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                                                                               | $I_F = 5\text{ mA}$ , $V_{CC} = 5\text{ V}$ | CTR    | 50   | -    | 300  | %    |

| <b>SWITCHING CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                                                                         |           |      |      |      |               |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|-----------|------|------|------|---------------|
| PARAMETER                                                                                               | TEST CONDITION                                                          | SYMBOL    | MIN. | TYP. | MAX. | UNIT          |
| <b>NON-SATURATED</b>                                                                                    |                                                                         |           |      |      |      |               |
| Rise time                                                                                               | $I_C = 2\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 100\text{ }\Omega$ | $t_r$     | -    | 5.5  | -    | $\mu\text{s}$ |
| Fall time                                                                                               | $I_C = 2\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 100\text{ }\Omega$ | $t_f$     | -    | 7    | -    | $\mu\text{s}$ |
| Turn-on time                                                                                            | $I_C = 2\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 100\text{ }\Omega$ | $t_{on}$  | -    | 9.5  | -    | $\mu\text{s}$ |
| Turn-off time                                                                                           | $I_C = 2\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 100\text{ }\Omega$ | $t_{off}$ | -    | 8.5  | -    | $\mu\text{s}$ |
| <b>SATURATED</b>                                                                                        |                                                                         |           |      |      |      |               |
| Turn-on time                                                                                            | $I_F = 10\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 1\text{ k}\Omega$ | $t_{on}$  | -    | 3    | -    | $\mu\text{s}$ |
| Turn-off time                                                                                           | $I_F = 10\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 1\text{ k}\Omega$ | $t_{off}$ | -    | 20   | -    | $\mu\text{s}$ |

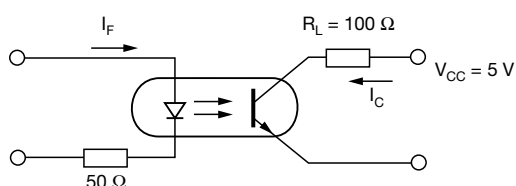


Fig. 1 - Switching Operation (without saturation)

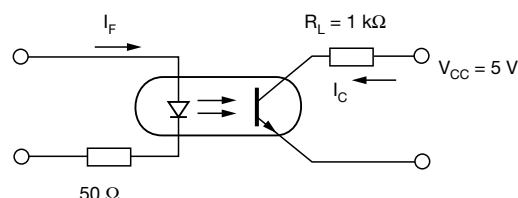


Fig. 2 - Switching Operation (with saturation)

| <b>SAFETY AND INSULATION RATINGS</b>         |                                                                   |            |                |                    |
|----------------------------------------------|-------------------------------------------------------------------|------------|----------------|--------------------|
| PARAMETER                                    | TEST CONDITION                                                    | SYMBOL     | VALUE          | UNIT               |
| Climatic classification                      | According to IEC 68 part 1                                        |            | 55 / 100 / 21  |                    |
| Comparative tracking index                   |                                                                   | CTI        | 175            |                    |
| Maximum rated withstanding isolation voltage | According to UL1577, $t = 1\text{ min}$                           | $V_{ISO}$  | 3750           | $V_{RMS}$          |
| Maximum transient isolation voltage          | According to DIN EN 60747-5-5                                     | $V_{IOTM}$ | 6000           | $V_{peak}$         |
| Maximum repetitive peak isolation voltage    | According to DIN EN 60747-5-5                                     | $V_{IORM}$ | 707            | $V_{peak}$         |
| Isolation resistance                         | $V_{IO} = 500\text{ V}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$  | $R_{IO}$   | $\geq 10^{12}$ | $\Omega$           |
|                                              | $V_{IO} = 500\text{ V}$ , $T_{amb} = 100\text{ }^{\circ}\text{C}$ | $R_{IO}$   | $\geq 10^{11}$ | $\Omega$           |
| Output safety power                          |                                                                   | $P_{SO}$   | 350            | mW                 |
| Input safety current                         |                                                                   | $I_{SI}$   | 200            | mA                 |
| Safety temperature                           |                                                                   | $T_S$      | 175            | $^{\circ}\text{C}$ |
| Creepage distance                            |                                                                   |            | $\geq 5$       | mm                 |
| Clearance distance                           |                                                                   |            | $\geq 5$       | 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

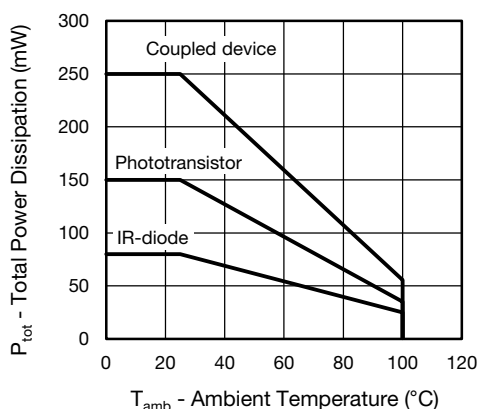
**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)


Fig. 3 - Total Power Dissipation vs. Ambient Temperature

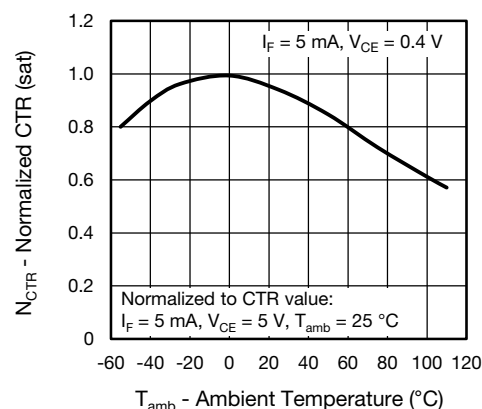


Fig. 6 - Normalized Current Transfer Ratio (saturated) vs. Ambient Temperature

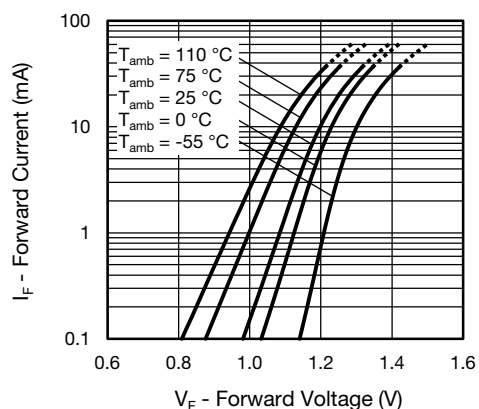


Fig. 4 - Forward Voltage vs. Forward Current

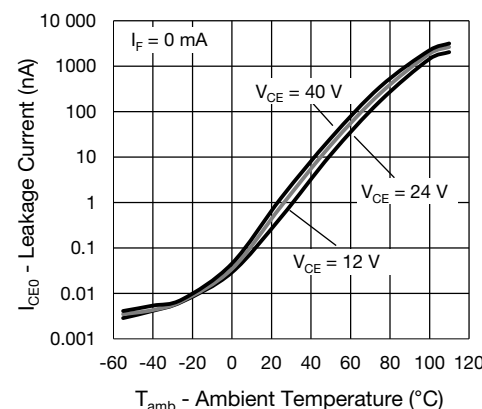


Fig. 7 - Collector Dark Current vs. Ambient Temperature

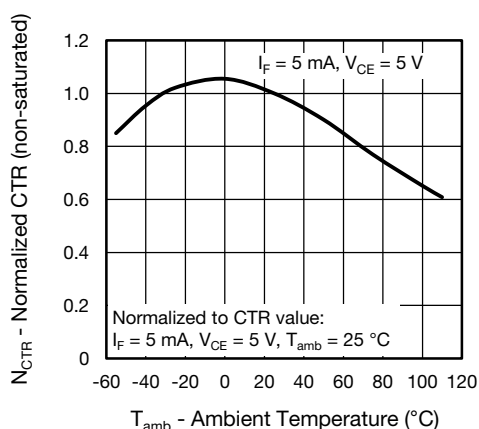


Fig. 5 - Normalized Current Transfer Ratio (non-saturated) vs. Ambient Temperature

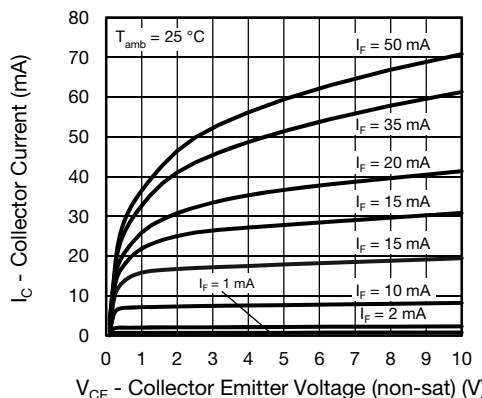


Fig. 8 - Collector Current vs. Collector Emitter Voltage (non-saturated)

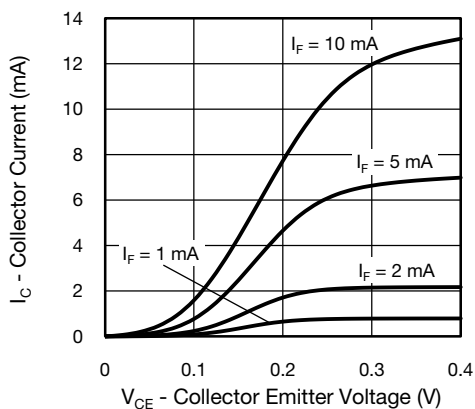


Fig. 9 - Collector Current vs. Collector Emitter Voltage (saturated)

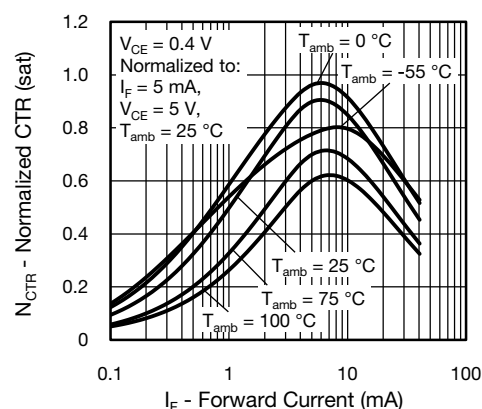


Fig. 12 - Normalized CTR (saturated) vs. Forward Current

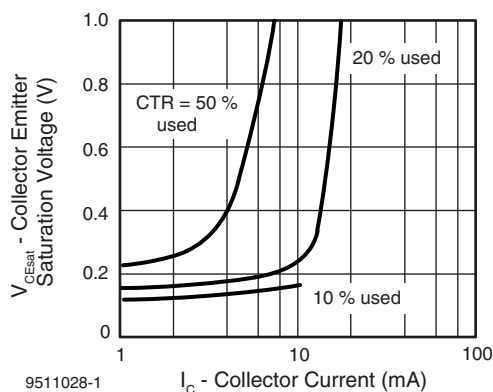


Fig. 10 - Collector Emitter Saturated Voltage vs. Collector Current

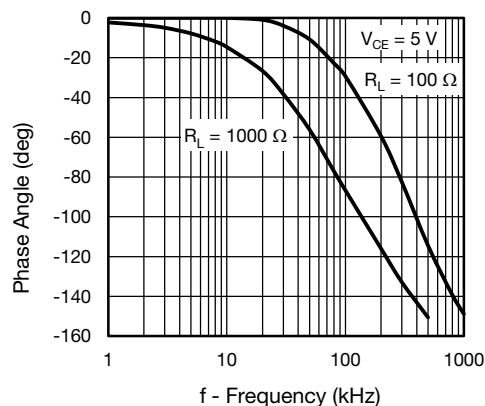
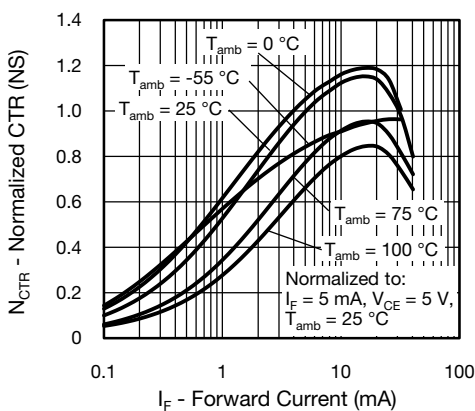
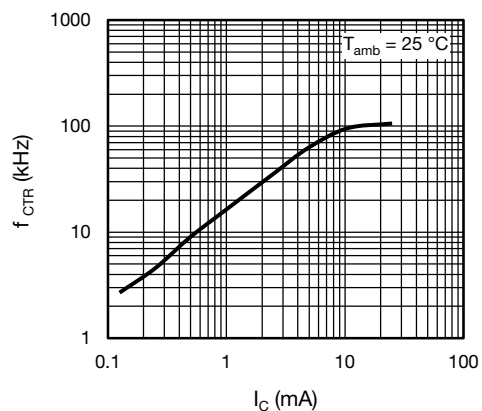

Fig. 13 -  $F_{CTR}$  vs. Phase Angle


Fig. 11 - Normalized CTR (non-saturated) vs. Forward Current


Fig. 14 -  $f_{CTR}$  vs. Collector Current

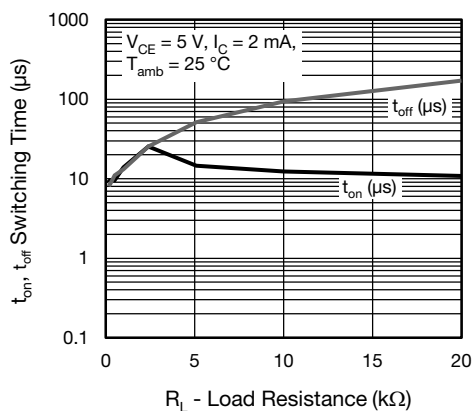
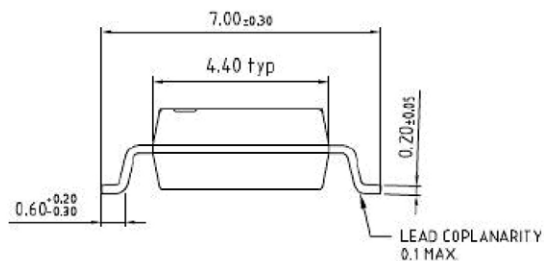
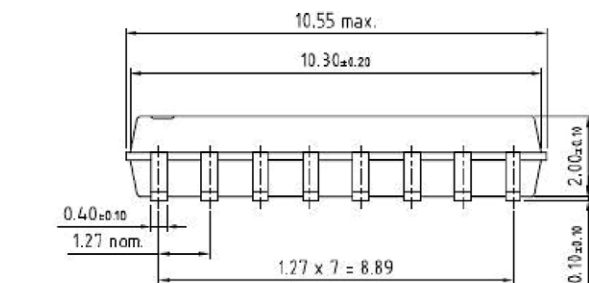
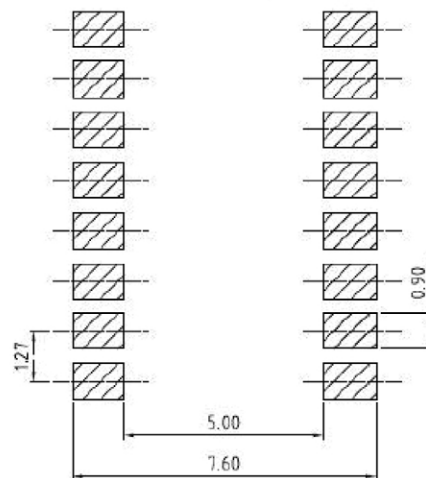
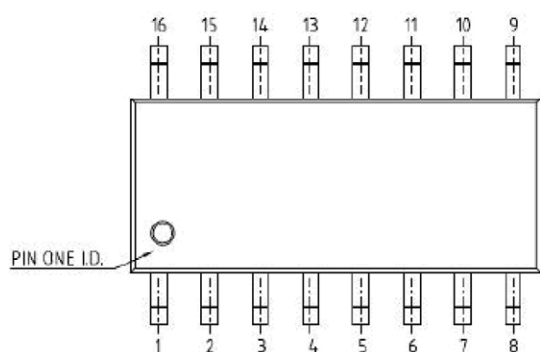
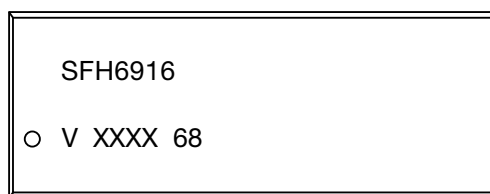


Fig. 15 - Switching Time vs. Load Resistance

**PACKAGE DIMENSIONS** in millimeters


## Possible footprint


**PACKAGE MARKING**

**Note**

- XXXX = LMC (lot marking code)

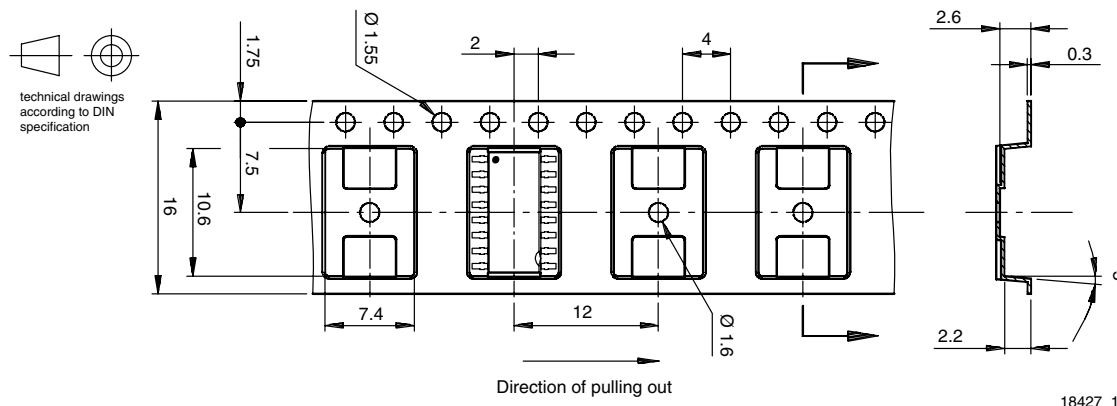
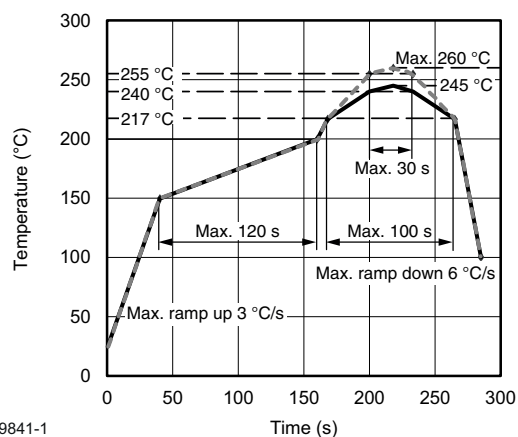
**TAPE AND REEL PACKAGING** in millimeters


Fig. 16 - 2000 pcs/reel

**SOLDER PROFILE**


19841-1

Fig. 17 - Lead (Pb)-free Reflow Solder Profile according to J-STD-020

**HANDLING AND STORAGE CONDITIONS**

ESD level: HBM class 2

Floor life: unlimited

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

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



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