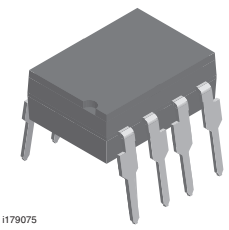
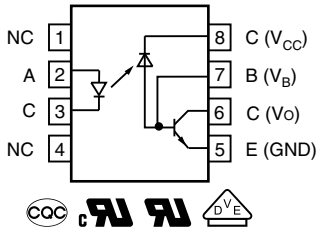
# High Speed Optocoupler, 1 MBd, Transistor Output




## FEATURES

- Isolation test voltage 5300 $V_{RMS}$
- 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

Pb-free

e3

RoHS COMPLIANT

## LINKS TO ADDITIONAL RESOURCES

Related Documents | Design Tools | 3D Models | Footprints | Schematics | SPICE Models

## DESCRIPTION

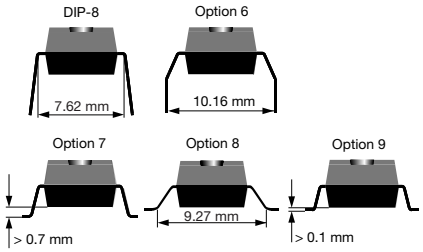
The SFH6135 and SFH6136 optocouplers feature a high signal transmission rate and a high isolation resistance. They have a GaAlAs infrared emitting diode, optically coupled with an integrated photo detector which consists of a photo diode and a high-speed transistor in a DIP-8 plastic package. Signals 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.

## AGENCY APPROVALS

- UL 1577
- cUL 1577
- DIN EN 60747-5-5 (VDE 0884-5)
- CQC

## ORDERING INFORMATION

| S | F | H | 6 | 1 | 3 | # | - | X | 0 | # | # | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PART NUMBER | | | | | | | | PACKAGE OPTION | | | | TAPE AND REEL |




| AGENCY CERTIFIED / PACKAGE | CTR (%) | |
|---|---|---|
| **UL, cUL, CQC** | **≥ 7** | **≥ 19** |
| DIP-8 | SFH6135 | SFH6136 |
| SMD-8, option 7 | SFH6135-X007T | SFH6136-X007 |
| SMD-8, option 9 | - | SFH6136-X009T |
| **VDE, UL, cUL, CQC** | **≥ 7** | **≥ 19** |
| DIP-8 | - | SFH6136-X001 |
| DIP-8, 400 mil, option 6 | - | SFH6136-X016 |
| SMD-8, option 7 | - | SFH6136-X017T (1) |
| SMD-8, option 8 | - | SFH6136-X018 |
| SMD-8, option 9 | - | SFH6136-X019 |

**Notes**

- Additional options may be possible, please contact sales office

(1) Also available in tubes; do not add T to end

| **ABSOLUTE MAXIMUM RATINGS** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | |
|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **VALUE** | **UNIT** |
| **INPUT** | | | | |
| Reverse voltage | | $V_R$ | 3 | V |
| Forward current | | $I_F$ | 25 | mA |
| Peak forward current | t = 1 ms, duty cycle 50 % | $I_{FM}$ | 50 | mA |
| Maximum surge forward current | t ≤ 1 µs, 300 pulses/s | $I_{FSM}$ | 1 | A |
| Thermal resistance | | $R_{thja}$ | 700 | K/W |
| Power dissipation | | $P_{diss}$ | 45 | mW |
| **OUTPUT** | | | | |
| Supply voltage | | $V_S$ | -0.5 to 30 | V |
| Output voltage | | $V_O$ | -0.5 to 25 | V |
| Emitter base voltage | | $V_{EBO}$ | 5 | V |
| Output current | | $I_O$ | 8 | mA |
| Maximum output current | | $I_O$ | 16 | mA |
| Base current | | $I_B$ | 5 | mA |
| Thermal resistance | | $R_{thja}$ | 300 | K/W |
| Power dissipation | $T_{amb}$ = 70 °C | $P_{diss}$ | 100 | mW |
| **COUPLER** | | | | |
| Isolation test voltage | | $V_{ISO}$ | 5300 | $V_{RMS}$ |
| Pollution degree (DIN VDE 0110) | | | 2 | |
| Isolation resistance | $V_{IO}$ = 500 V, $T_{amb}$ = 25 °C | $R_{IO}$ | ≥ $10^{12}$ | Ω |
| | $V_{IO}$ = 500 V, $T_{amb}$ = 100 °C | $R_{IO}$ | ≥ $10^{11}$ | Ω |
| Storage temperature range | | $T_{stg}$ | -55 to +125 | °C |
| Ambient temperature range | | $T_{amb}$ | -55 to +100 | °C |
| Soldering temperature (1) | Max. ≤ 10 s, dip soldering ≥ 0.5 mm distance from case bottom | $T_{sld}$ | 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

(1) Refer to wave profile for soldering conditions for through hole devices

| **ELECTRICAL CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **INPUT** | | | | | | | |
| Forward voltage | $I_F$ = 16 mA | | $V_F$ | - | 1.6 | 1.9 | V |
| Breakdown voltage | $I_R$ = 10 µA | | $V_{BR}$ | 3 | - | - | V |
| Reverse current | $V_R$ = 3 V | | $I_R$ | - | 0.5 | 10 | µA |
| Capacitance | $V_R$ = 0 V, f = 1 MHz | | $C_O$ | - | 125 | - | pF |
| Temperature coefficient of forward voltage | $I_F$ = 16 mA | | $\Delta V_F/\Delta T_{amb}$ | - | 1.7 | - | mV/°C |
| **OUTPUT** | | | | | | | |
| Logic low supply current | $I_F$ = 16 mA, $V_O$ = open, $V_{CC}$ = 15 V | | $I_{CCL}$ | - | 150 | - | µA |
| Logic high supply current | $I_F$ = 0 V, $V_O$ = open, $V_{CC}$ = 15 V | | $I_{CCH}$ | - | 0.01 | 1 | µA |
| Output voltage, output low | $I_F$ = 16 mA, $V_{CC}$ = 4.5 V, $I_O$ = 1.1 mA | SFH6135 | $V_{OL}$ | - | 0.1 | 0.4 | V |
| | $I_F$ = 16 mA, $V_{CC}$ = 4.5 V, $I_O$ = 2.4 mA | SFH6136 | $V_{OL}$ | - | 0.1 | 0.4 | V |
| Output current, output high | $I_F$ = 0 mA, $V_O$ = $V_{CC}$ = 5.5 V | | $I_{OH}$ | - | 3 | 500 | nA |
| | $I_F$ = 0 mA, $V_O$ = $V_{CC}$ =15 V | | $I_{OH}$ | - | 0.01 | 1 | µA |

| ELECTRICAL CHARACTERISTICS ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **COUPLER** | | | | | | | |
| Capacitance (input to output) | f = 1 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 mA, $V_O$ = 0.4 V, $V_{CC}$ = 4.5 V | SFH6135 | CTR | 7 | 16 | - | % |
| | | SFH6136 | CTR | 19 | 35 | - | % |
| | $I_F$ = 16 mA, $V_O$ = 0.5 V, $V_{CC}$ = 4.5 V | SFH6135 | CTR | 5 | - | - | % |
| | | SFH6136 | CTR | 15 | - | - | % |

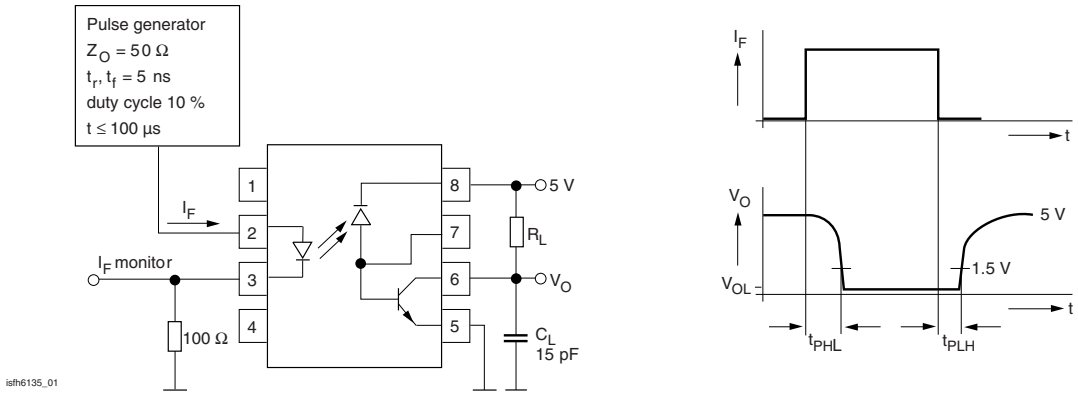



Fig. 1 - Schematics

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

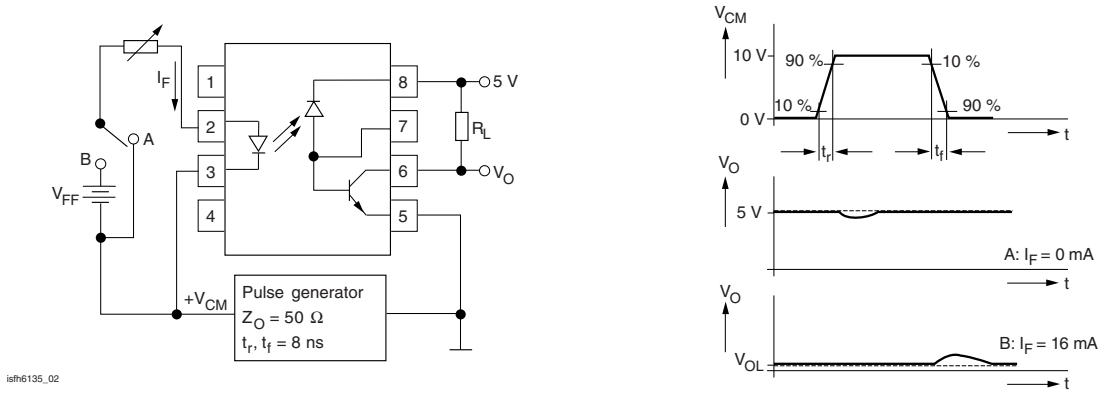



Fig. 1 - Common Mode Interference Immunity

| 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 kΩ | SFH6135 | $CM_H$ | - | 1000 | - | V/µs |
| | $V_{CM}$ = 10 $V_{P-P}$, $V_{CC}$ = 5 V, $I_F$ = 0 mA, $R_L$ = 1.9 kΩ | SFH6136 | $CM_H$ | - | 1000 | - | V/µs |
| Low | $V_{CM}$ = 10 $V_{P-P}$, $V_{CC}$ = 5 V, $I_F$ = 0 mA, $R_L$ = 4.1 kΩ | SFH6135 | $CM_L$ | - | 1000 | - | V/µs |
| | $V_{CM}$ = 10 $V_{P-P}$, $V_{CC}$ = 5 V, $I_F$ = 0 mA, $R_L$ = 1.9 kΩ | SFH6136 | $CM_L$ | - | 1000 | - | V/µs |

| 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 | |
| $V_{IOTM}$ | | | 8000 | - | - | V |
| $V_{IORM}$ | | | 890 | - | - | V |
| $P_{SO}$ | | | - | - | 500 | mW |
| $I_{SI}$ | | | - | - | 300 | mA |
| $T_{SI}$ | | | - | - | 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 ($T_{amb}$ = 25 °C, unless otherwise specified)

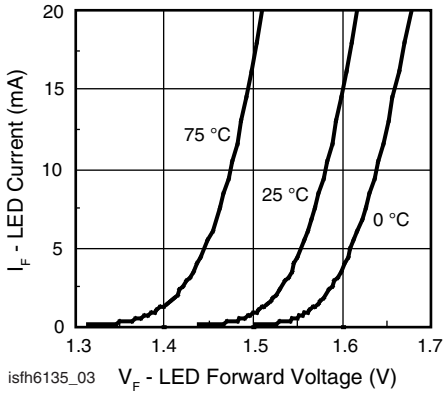



Fig. 3 - LED Forward Current vs. Forward Voltage

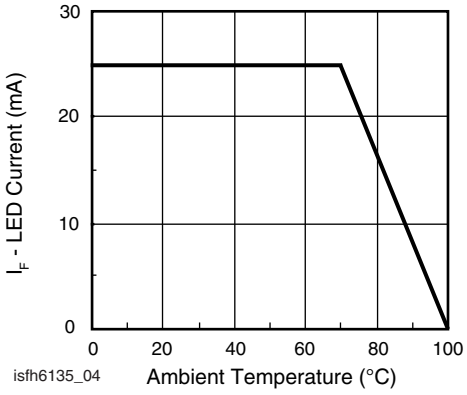



Fig. 4 - Permissible Forward LED Current vs. Temperature

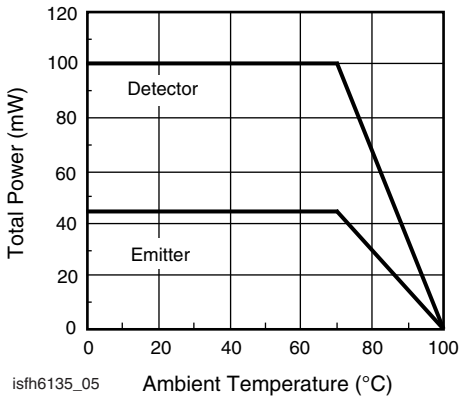



Fig. 5 - Permissible Power Dissipation vs. Temperature

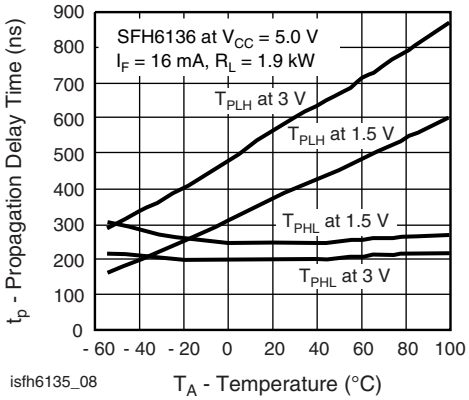



Fig. 8 - Propagation Delay vs. Ambient Temperature - SFH6136

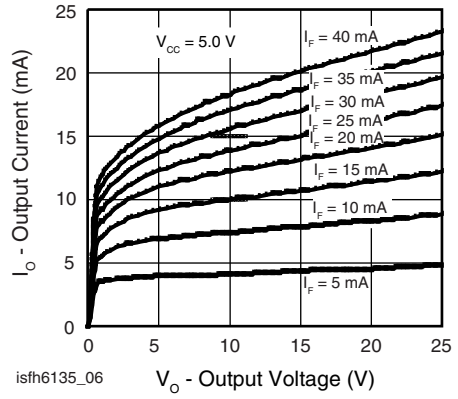



Fig. 6 - Output Current vs. Output Voltage

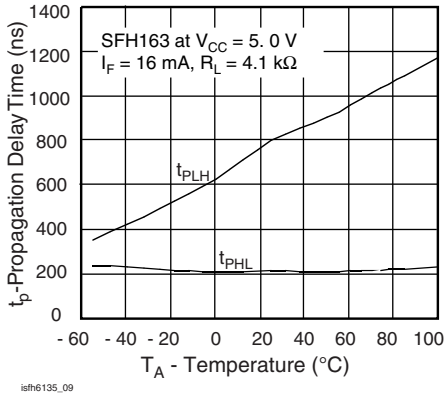



Fig. 9 - Propagation Delay vs. Ambient Temperature - SFH6135

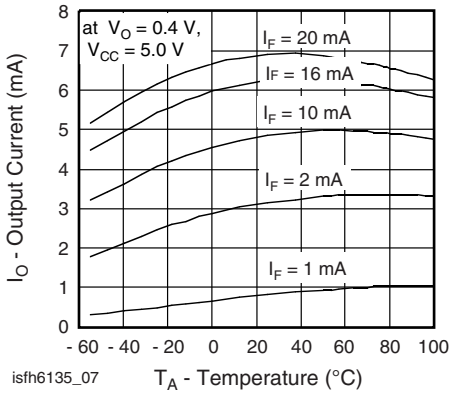



Fig. 7 - Output Current vs. Temperature

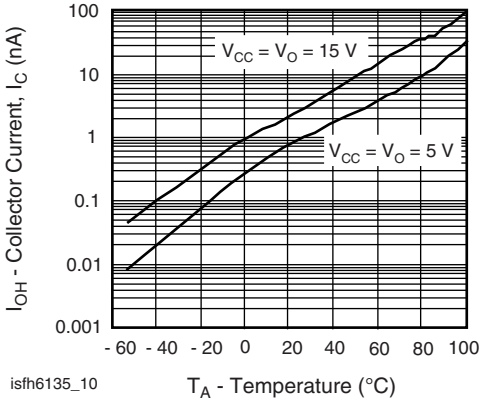



Fig. 10 - Logic High Output Current vs. Temperature

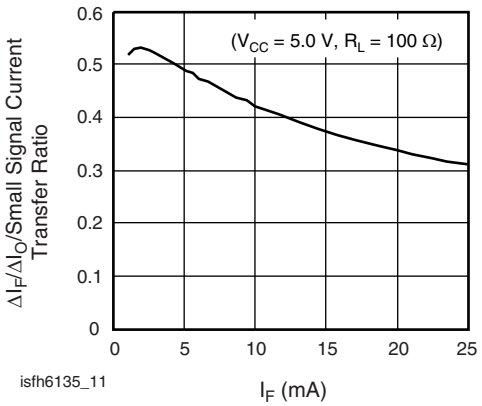
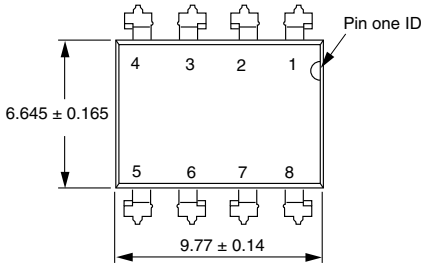
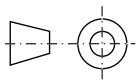
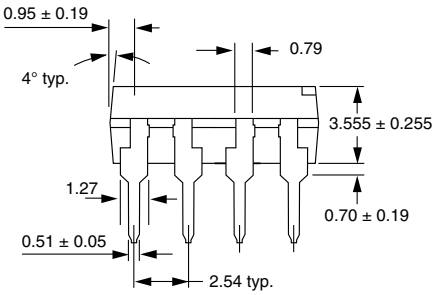


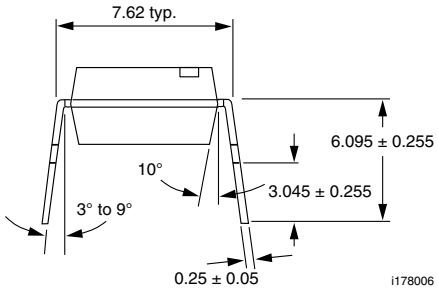

Fig. 11 - Small Signal Current Transfer Ratio vs. Quiescent Input Current

## **PACKAGE DIMENSIONS** in millimeters

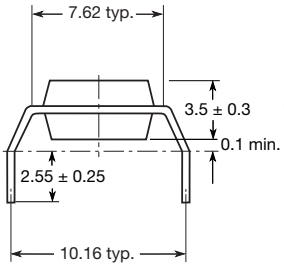



**Option 6**

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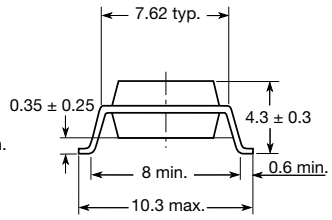
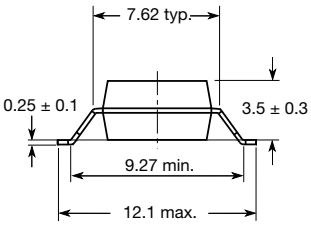



**Option 8**

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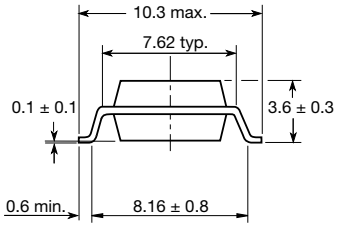


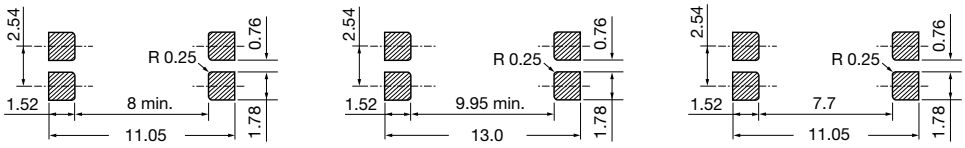


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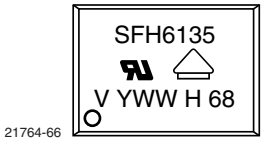
## PACKAGE MARKING



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