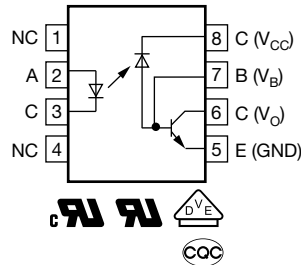
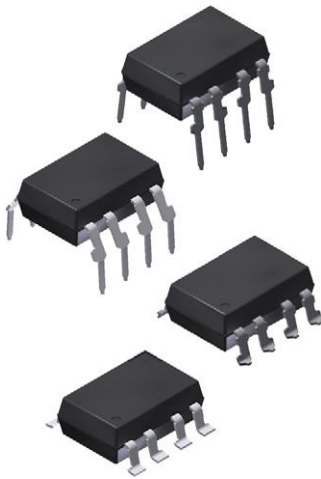




**THE DATASHEET OF  
6N136-X009T**



## High Speed Optocoupler, 1 MBd, Photodiode with Transistor Output



### DESCRIPTION

The 6N135 and 6N136 are optocouplers with 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.

### FEATURES

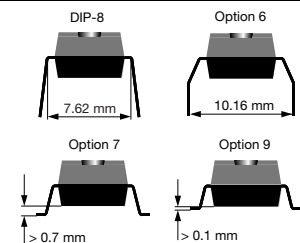
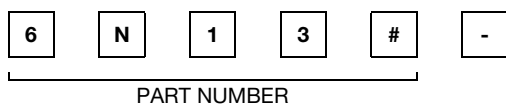
- Isolation test voltages: 5300 V<sub>RMS</sub>
- TTL compatible
- High bit rates: 1 Mbit/s
- High common-mode interference immunity
- Bandwidth 2 MHz
- Open-collector output
- External base wiring possible
- Material categorization:  
for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



### 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 GB8898-2011, GB4943.1-2011

### ORDERING INFORMATION



AGENCY CERTIFIED / PACKAGE	CTR (%)	
<b>UL, CSA</b>	<b>≥ 7</b>	<b>≥ 19</b>
DIP-8	6N135	6N136
DIP-8, 400 mil, option 6	-	6N136-X006
SMD-8, option 7	6N135-X007T <sup>(1)</sup>	6N136-X007T <sup>(1)</sup>
SMD-8, option 9	-	6N136-X009T <sup>(1)</sup>
<b>VDE, UL, CSA</b>	<b>≥ 7</b>	<b>≥ 19</b>
DIP-8	-	6N136-X001
SMD-8, option 7	6N135-X017T <sup>(1)</sup>	6N136-X017T
SMD-8, option 9	-	6N136-X019T

#### Note

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



<b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)				
PARAMETER	CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Reverse voltage		$V_R$	5	V
Forward current		$I_F$	25	mA
Peak forward current	$t = 1\text{ ms}$ , duty cycle 50 %	$I_{FSM}$	50	mA
Maximum surge forward current	$t \leq 1\text{ }\mu\text{s}$ , 300 pulses/s		1	A
Thermal resistance		$R_{th}$	700	K/W
Power dissipation	$T_{amb} = 70\text{ }^{\circ}\text{C}$	$P_{diss}$	45	mW
<b>OUTPUT</b>				
Supply voltage		$V_S$	-0.5 to 15	V
Output voltage		$V_O$	-0.5 to 15	V
Emitter base voltage		$V_{EBO}$	5	V
Output current		$I_O$	8	mA
Maximum output current			16	mA
Base current		$I_B$	5	mA
Thermal resistance			300	K/W
Power dissipation	$T_{amb} = 70\text{ }^{\circ}\text{C}$	$P_{diss}$	100	mW
<b>COUPLER</b>				
Storage temperature range		$T_{stg}$	-55 to +150	$^{\circ}\text{C}$
Ambient temperature range		$T_{amb}$	-55 to +100	$^{\circ}\text{C}$
Soldering temperature	max. $\leq 10\text{ s}$ , dip soldering $\geq 0.5\text{ mm}$ from case bottom	$T_{sld}$	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.

<b>ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>							
Forward voltage	$I_F = 16\text{ mA}$		$V_F$	-	1.33	1.9	V
Breakdown voltage	$I_R = 10\text{ }\mu\text{A}$		$V_{BR}$	5	-	-	V
Reverse current	$V_R = 5\text{ V}$		$I_R$	-	0.5	10	$\mu\text{A}$
Capacitance	$V_R = 0\text{ V}$ , $f = 1\text{ MHz}$		$C_O$	-	30	-	pF
Temperature coefficient, forward voltage	$I_F = 16\text{ mA}$		$\Delta V_F/\Delta T_A$	-	-1.7	-	mV/ $^{\circ}\text{C}$
<b>OUTPUT</b>							
Logic low supply current	$I_F = 16\text{ mA}$ , $V_O = \text{open}$ , $V_{CC} = 15\text{ V}$		$I_{CCL}$	-	150	-	$\mu\text{A}$
Logic high supply current	$I_F = 0\text{ mA}$ , $V_O = \text{open}$ , $V_{CC} = 15\text{ V}$		$I_{CCH}$	-	0.01	1	$\mu\text{A}$
Output voltage, output low	$I_F = 16\text{ mA}$ , $I_O = 1.1\text{ mA}$ , $V_{CC} = 4.5\text{ V}$	6N135	$V_{OL}$	-	0.1	0.4	V
	$I_F = 16\text{ mA}$ , $I_O = 3.0\text{ mA}$ , $V_{CC} = 4.5\text{ V}$	6N136	$V_{OL}$	-	0.1	0.4	V
Output current, output high	$I_F = 0\text{ mA}$ , $V_O = V_{CC} = 5.5\text{ V}$		$I_{OH}$	-	3	500	nA
	$I_F = 0\text{ mA}$ , $V_O = V_{CC} = 15\text{ V}$		$I_{OH}$	-	0.01	1	$\mu\text{A}$
<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.



<b>CURRENT TRANSFER RATIO</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Current transfer ratio	$I_F = 16\text{ mA}$ , $V_O = 0.4\text{ V}$ , $V_{CC} = 4.5\text{ V}$	6N135	CTR	7	16	-	%
		6N136	CTR	19	35	-	%
	$I_F = 16\text{ mA}$ , $V_O = 0.5\text{ V}$ , $V_{CC} = 4.5\text{ V}$	6N135	CTR	5	-	-	%
		6N136	CTR	15	-	-	%

<b>SWITCHING CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
High to low	$I_F = 16\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 4.1\text{ k}\Omega$	6N135	$t_{PHL}$	-	0.3	1.5	$\mu\text{s}$
	$I_F = 16\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 1.9\text{ k}\Omega$	6N136	$t_{PHL}$	-	0.2	0.8	$\mu\text{s}$
Low to high	$I_F = 16\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 4.1\text{ k}\Omega$	6N135	$t_{PLH}$	-	0.3	1.5	$\mu\text{s}$
	$I_F = 16\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 1.9\text{ k}\Omega$	6N136	$t_{PLH}$	-	0.2	0.8	$\mu\text{s}$

<b>COMMON MODE TRANSIENT IMMUNITY</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
High	$I_F = 0\text{ mA}$ , $V_{CM} = 10\text{ V}_{P-P}$ , $V_{CC} = 5\text{ V}$ , $R_L = 4.1\text{ k}\Omega$	6N135	$ CM_H $	-	1000	-	$\text{V}/\mu\text{s}$
	$I_F = 0\text{ mA}$ , $V_{CM} = 10\text{ V}_{P-P}$ , $V_{CC} = 5\text{ V}$ , $R_L = 1.9\text{ k}\Omega$	6N136	$ CM_H $	-	1000	-	$\text{V}/\mu\text{s}$
Low	$I_F = 16\text{ mA}$ , $V_{CM} = 10\text{ V}_{P-P}$ , $V_{CC} = 5\text{ V}$ , $R_L = 4.1\text{ k}\Omega$	6N135	$ CM_L $	-	1000	-	$\text{V}/\mu\text{s}$
	$I_F = 16\text{ mA}$ , $V_{CM} = 10\text{ V}_{P-P}$ , $V_{CC} = 5\text{ V}$ , $R_L = 1.9\text{ k}\Omega$	6N136	$ CM_L $	-	1000	-	$\text{V}/\mu\text{s}$

<b>SAFETY AND INSULATION RATINGS</b>				
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)

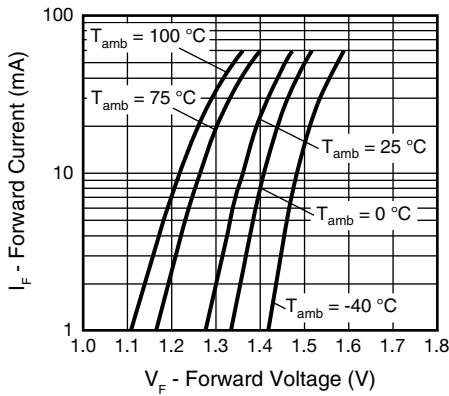


Fig. 1 - LED Forward Current vs. Forward Voltage

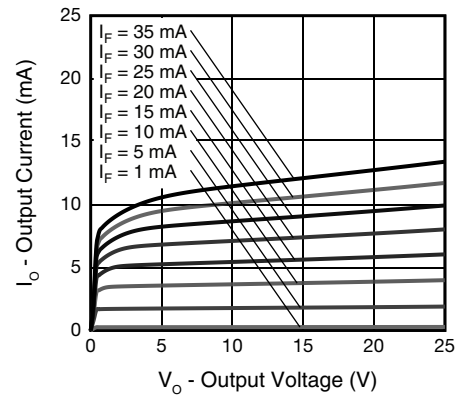


Fig. 4 - Output Current vs. Output Voltage

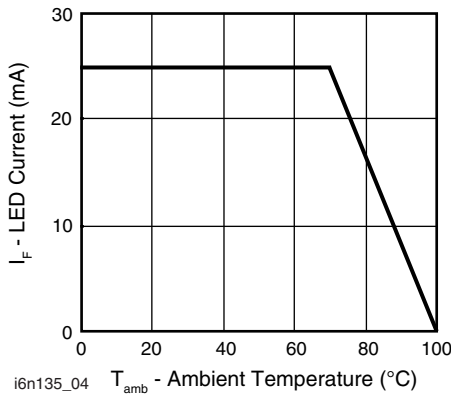


Fig. 2 - Permissible Forward LED Current vs. Temperature

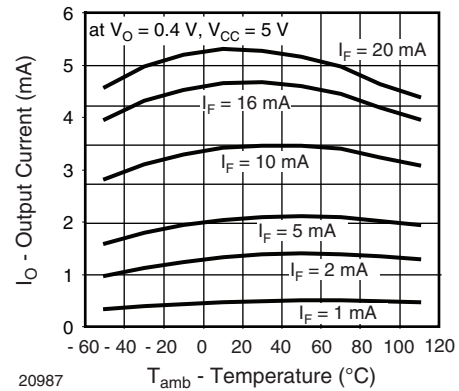


Fig. 5 - Output Current vs. Temperature

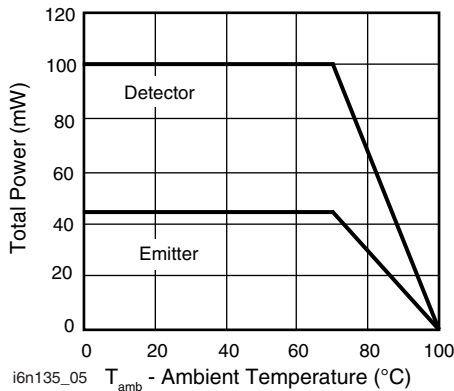


Fig. 3 - Permissible Power Dissipation vs. Temperature

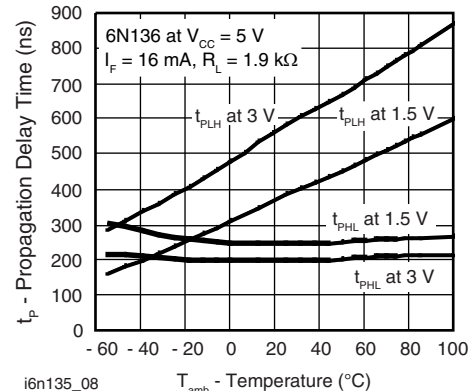


Fig. 6 - Propagation Delay vs. Ambient Temperature

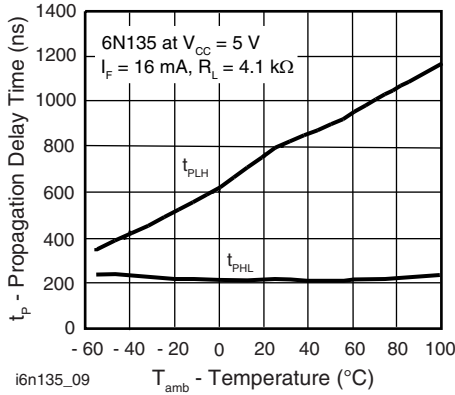


Fig. 7 - Propagation Delay vs. Ambient Temperature

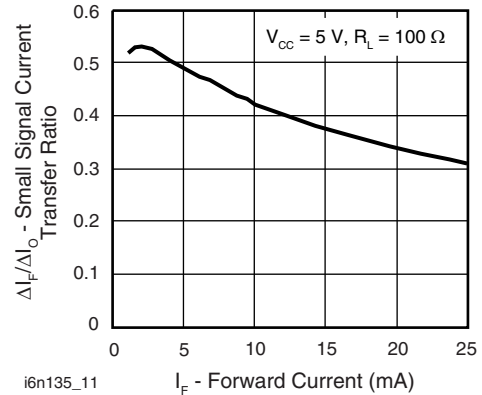


Fig. 9 - Small Signal Current Transfer Ratio vs. Quiescent Input Current

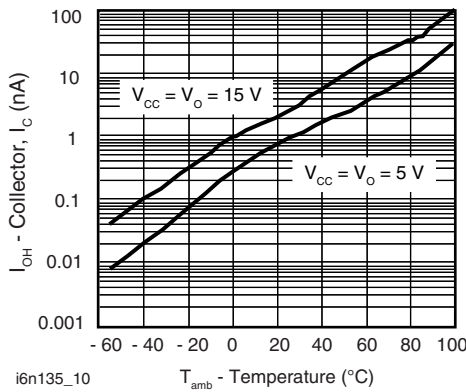


Fig. 8 - Logic High Output Current vs. Temperature

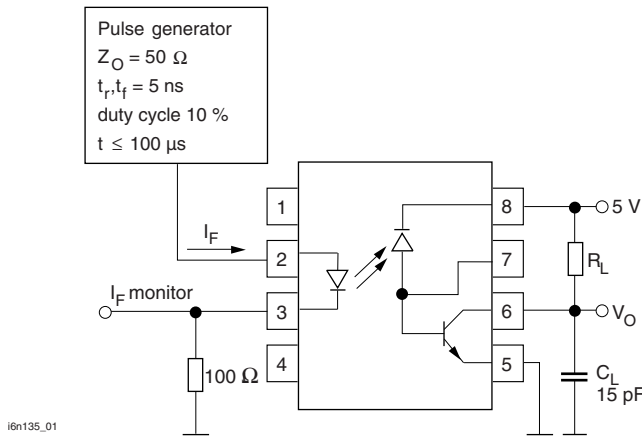
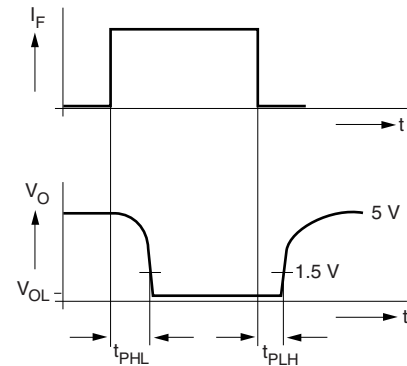


Fig. 10 - Switching Times



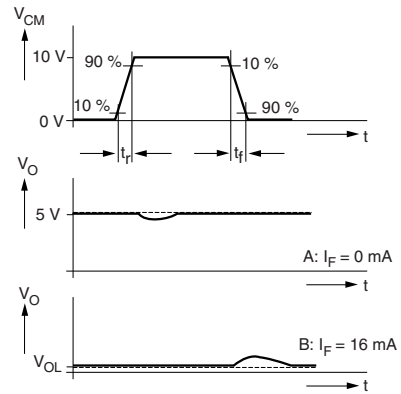
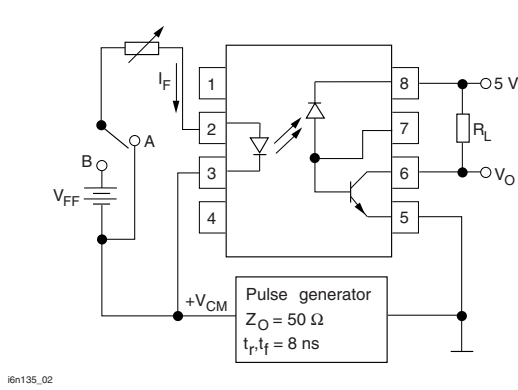
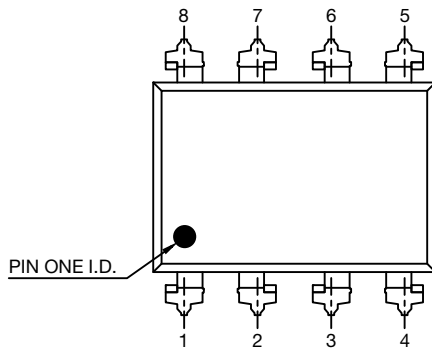
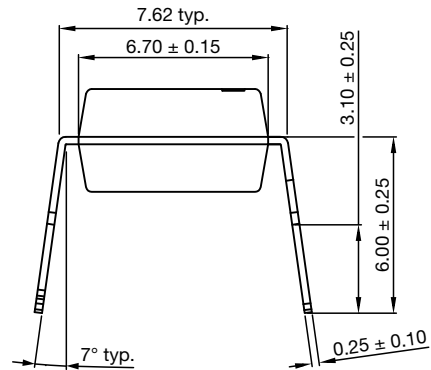
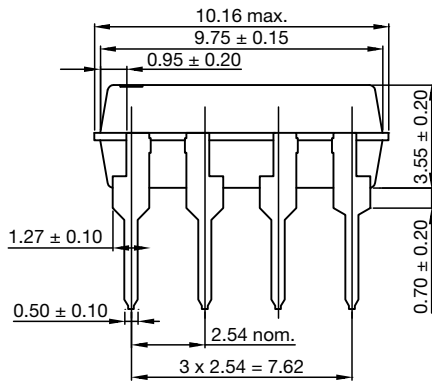


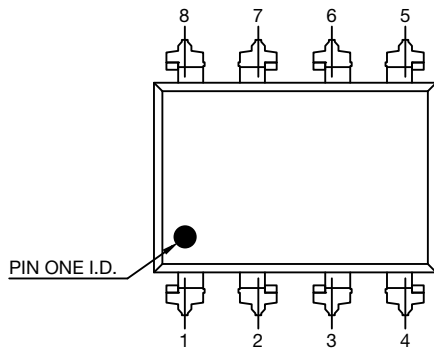
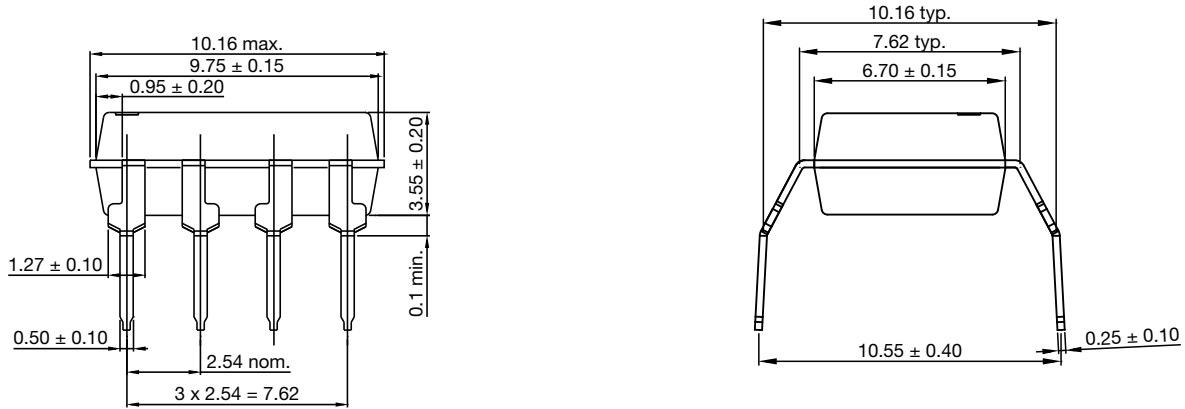
Fig. 11 - Common-Mode Interference Immunity

**PACKAGE DIMENSIONS** (in millimeters)

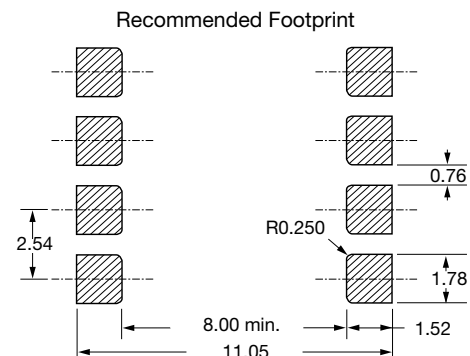
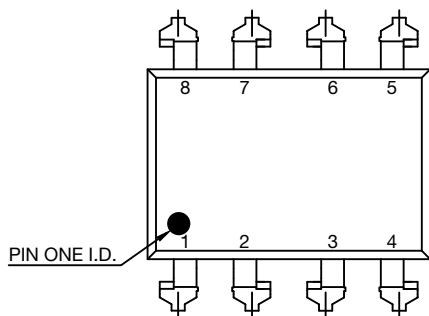
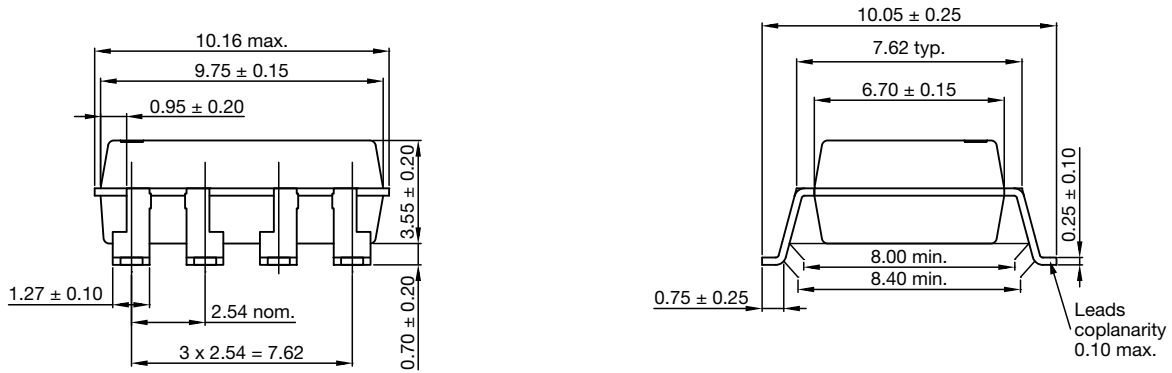
**DIP-8, Standard**



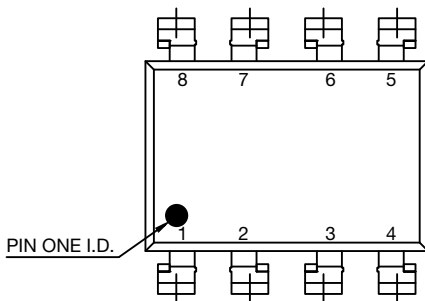
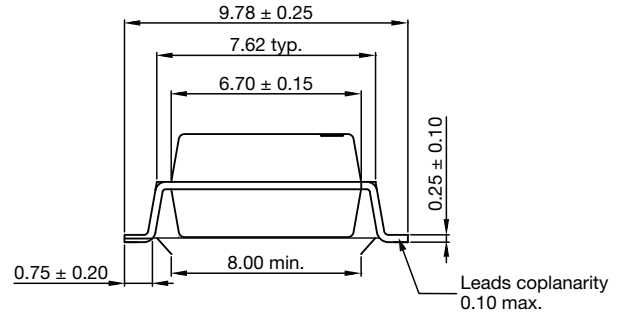
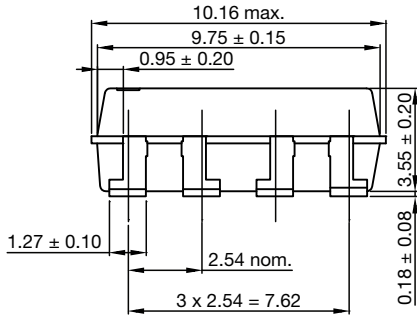
DIP-8, Option 6



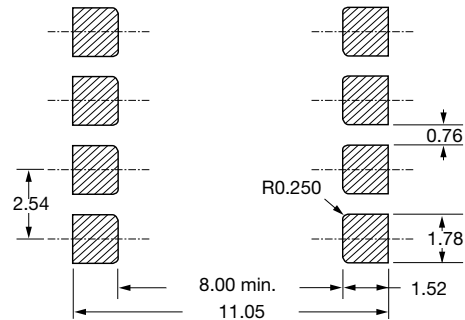
DIP-8, Option 7



DIP-8, Option 9



Recommended Footprint



PACKAGE MARKING

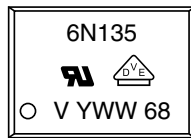


Fig. 12 - 6N135

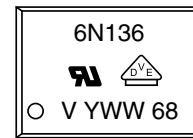


Fig. 13 - 6N136

Notes

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

SOLDER PROFILES

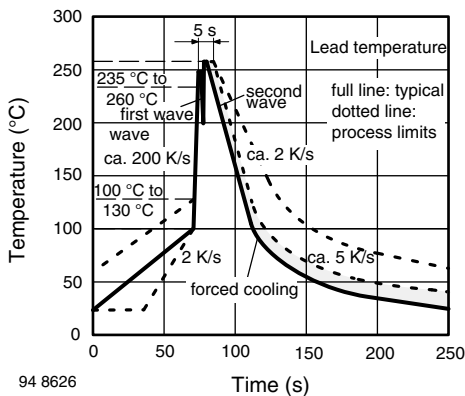


Fig. 14 - Wave Soldering Double Wave Profile According to J-STD-020 for DIP-8 Devices

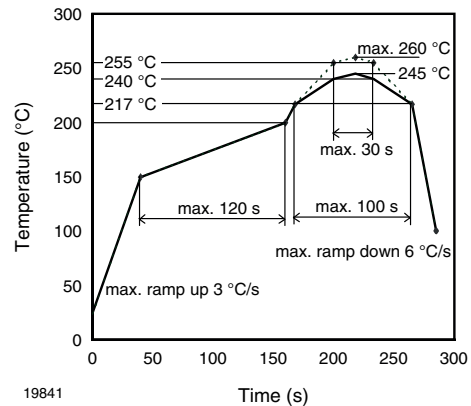


Fig. 15 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD-8 Devices



**HANDLING AND STORAGE CONDITIONS**

ESD level: HBM class 2

Floor life: unlimited

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

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



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