



6N135, 6N136, ICPL4502, ICPL4503



DESCRIPTION

The 6N135, 6N136, ICPL4502 and ICPL4503 devices each consists of an infrared emitting diode, optically coupled to a high speed photo detector transistor. A separate connection for the photodiode bias and output-transistor collector increases the speed by several orders of magnitude over conventional phototransistor couplers by reducing the base-collector capacitance of the input transistor.

FEATURES

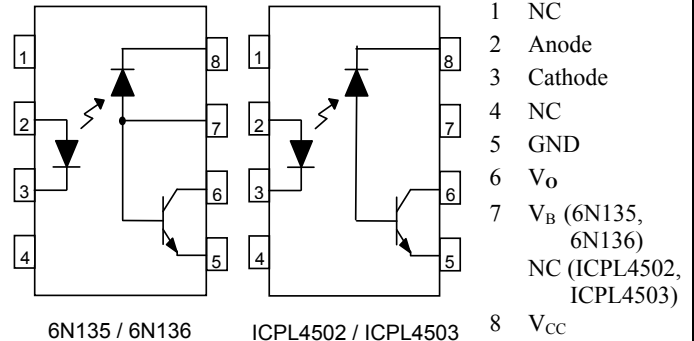
- High speed 1Mbit/s
- High AC Isolation Voltage 5000V_{rms}
- Guaranteed performance from 0°C to 70°C
- Wide Operating temperature range -55°C to 100°C
- Pb Free and RoHS Compliant
- UL File E91231
- VDE Approval Certificate No. 40044376 for 6N135 and 6N136, with suffix "V"

APPLICATIONS

- Line Receivers
- Telecommunication Equipments
- Power Transistor Isolation in Motor Drives
- Replacement of Low Speed Phototransistor Optocouplers
- Feedback Loop in Switch Mode Power Supplies
- High Speed Logic Ground Isolation
- Home Appliances

ORDER INFORMATION

- Add G after PN for 10mm lead spacing
- Add SM after PN for Surface Mount
- Add SMT&R after PN for Surface Mount Tape & Reel



A 0.1μF bypass Capacitor shall be connected between V_{CC} and GND.

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

Stresses exceeding the absolute maximum ratings can cause permanent damage to the device.

Exposure to absolute maximum ratings for long periods of time can adversely affect reliability.

Input

Forward Current	25mA
Forward Peak Current (50% duty cycle, 1ms pulse width)	50mA
Peak Transient Current (≤1μs pulse width, 300pps)	1A
Reverse Voltage	5V
Power dissipation	45mW

Output

Output Current	8mA
Peak Output Current	16mA
Emitter-Base Reverse Voltage (6N135 and 6N136)	5V
Base Current (6N135 and 6N136)	5mA
Supply Voltage	-0.5V to 30V
Output Voltage	-0.5V to 20V
Power Dissipation	100mW

Total Package

Isolation Voltage	5000V _{RMS}
Operating Temperature	-55 to 100 °C
Storage Temperature	-55 to 125 °C
Lead Soldering Temperature (10s)	260°C

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6N135, 6N136, ICPL4502, ICPL4503

ELECTRICAL CHARACTERISTICS ($T_A = 0^\circ\text{C}$ to 70°C unless otherwise specified)

INPUT

Parameter	Symbol	Test Condition	Min	Typ.*	Max	Unit
Forward Voltage	V_F	$I_F = 16\text{mA}$		1.45	1.8	V
Reverse Voltage	V_R	$I_R = 10\mu\text{A}$	5.0			V
Forward Voltage Temperature Coefficient	$\Delta V_F / \Delta T_A$	$I_F = 16\text{mA}$		-1.9		mV/°C

OUTPUT

Parameter	Symbol	Test Condition	Min	Typ.*	Max	Unit
Logic High Output Current	I_{OH}	$I_F = 0\text{mA}, V_O = V_{CC} = 5.5\text{V}, T_A = 25^\circ\text{C}$		0.001	0.5	μA
		$I_F = 0\text{mA}, V_O = V_{CC} = 15\text{V}, T_A = 25^\circ\text{C}$		0.01	1	
		$I_F = 0\text{mA}, V_O = V_{CC} = 15\text{V}$			50	
Logic Low Output Voltage	V_{OL}	6N135		0.18	0.4	V
		$I_F = 16\text{mA}, I_O = 1.1\text{mA}, V_{CC} = 4.5\text{V}, T_A = 25^\circ\text{C}$				
		$I_F = 16\text{mA}, I_O = 0.8\text{mA}, V_{CC} = 4.5\text{V},$			0.5	
		6N136 / ICPL4502 / ICPL4503		0.25	0.4	
$I_F = 16\text{mA}, I_O = 3\text{mA}, V_{CC} = 4.5\text{V}, T_A = 25^\circ\text{C}$						
$I_F = 16\text{mA}, I_O = 2.4\text{mA}, V_{CC} = 4.5\text{V}$			0.5			
Logic Low Supply Current	I_{CCL}	$I_F = 16\text{mA}, V_O = \text{Open}, V_{CC} = 15\text{V}$		140	200	μA
Logic High Supply Current	I_{CCH}	$I_F = 0\text{mA}, V_O = \text{Open}, V_{CC} = 15\text{V}, T_A = 25^\circ\text{C}$		0.01	1	μA
		$I_F = 0\text{mA}, V_O = \text{Open}, V_{CC} = 15\text{V}$			2	

* Typical values at $T_A = 25^\circ\text{C}$



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ELECTRICAL CHARACTERISTICS ($T_A = 0^\circ\text{C}$ to 70°C unless otherwise specified)

COUPLED

Parameter	Symbol	Test Condition	Min	Typ.*	Max	Unit	
Current Transfer Ratio	CTR	6N135	7		50	%	
		6N136 / ICPL4502 / ICPL4503	19		50		
		$I_F = 16\text{mA}$, $V_O = 0.4\text{V}$ $V_{CC} = 4.5\text{V}$, $T_A = 25^\circ\text{C}$					
		6N135	5				
		6N136 / ICPL4502 / ICPL4503	15				
		$I_F = 16\text{mA}$, $V_O = 0.5\text{V}$ $V_{CC} = 4.5\text{V}$					

ISOLATION

Parameter	Symbol	Test Condition	Min	Typ.*	Max	Unit
Insulation Voltage	V_{ISO}	$T_A = 25^\circ\text{C}$, RH = 40 % to 60%, $t = 1 \text{ min}$,	5000			V_{RMS}

* Typical values at $T_A = 25^\circ\text{C}$



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ELECTRICAL CHARACTERISTICS ($T_A = 0^\circ\text{C}$ to 70°C unless otherwise specified)

Switching Characteristics ($T_A = 0^\circ\text{C}$ to 70°C , $I_F = 16\text{mA}$, $V_{CC} = 5\text{V}$ unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ.*	Max	Unit
Propagation Delay Time to Logic Low	T_{PHL}	6N135 $R_L = 4.1\text{k}\Omega$, $T_A = 25^\circ\text{C}$ $R_L = 4.1\text{k}\Omega$		0.35	1.5 2.0	μs
		6N136 / ICPL4502 / ICPL4503 $R_L = 1.9\text{k}\Omega$, $T_A = 25^\circ\text{C}$ $R_L = 1.9\text{k}\Omega$		0.35	0.8 1.0	
Propagation Delay Time to Logic High	T_{PLH}	6N135 $R_L = 4.1\text{k}\Omega$, $T_A = 25^\circ\text{C}$ $R_L = 4.1\text{k}\Omega$		0.5	1.5 2.0	μs
		6N136 / ICPL4502 / ICPL4503 $R_L = 1.9\text{k}\Omega$, $T_A = 25^\circ\text{C}$ $R_L = 1.9\text{k}\Omega$		0.3	0.8 1.0	
Common Mode Transient Immunity at Logic High	CM_H	6N135 $I_F = 0\text{mA}$, $V_{CM} = 10\text{Vp-p}$, $R_L = 4.1\text{k}\Omega$, $T_A = 25^\circ\text{C}$	1000			$\text{V}/\mu\text{s}$
		6N136 / ICPL4502 $I_F = 0\text{mA}$, $V_{CM} = 10\text{Vp-p}$, $R_L = 1.9\text{k}\Omega$, $T_A = 25^\circ\text{C}$	1000			
		ICPL4503 $I_F = 0\text{mA}$, $V_{CM} = 1500\text{Vp-p}$, $R_L = 1.9\text{k}\Omega$, $T_A = 25^\circ\text{C}$	15000	20000		
Common Mode Transient Immunity at Logic Low	CM_L	6N135 $I_F = 16\text{mA}$, $V_{CM} = 10\text{Vp-p}$, $R_L = 4.1\text{k}\Omega$, $T_A = 25^\circ\text{C}$	1000			$\text{V}/\mu\text{s}$
		6N136 / ICPL4502 $I_F = 16\text{mA}$, $V_{CM} = 10\text{Vp-p}$, $R_L = 1.9\text{k}\Omega$, $T_A = 25^\circ\text{C}$	1000			
		ICPL4503 $I_F = 16\text{mA}$, $V_{CM} = 1500\text{Vp-p}$, $R_L = 1.9\text{k}\Omega$, $T_A = 25^\circ\text{C}$	15000	20000		

* Typical values at $T_A = 25^\circ\text{C}$



6N135, 6N136, ICPL4502, ICPL4503

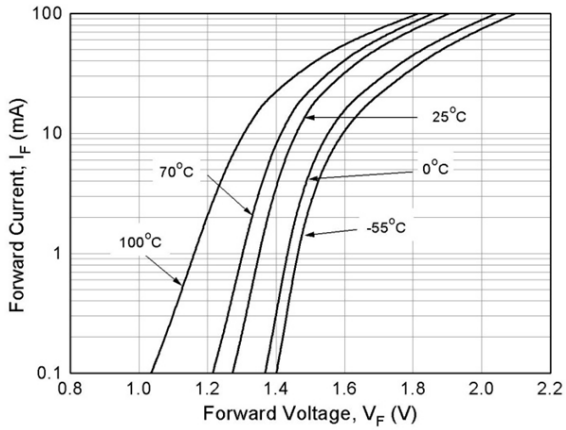


Fig 1 Forward Current vs Forward Voltage

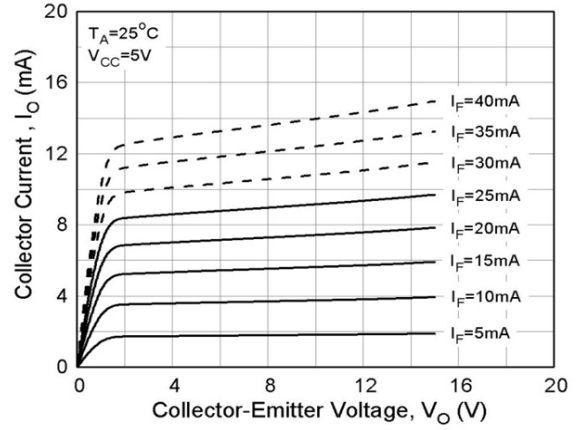


Fig 2 Output Current vs Output Voltage

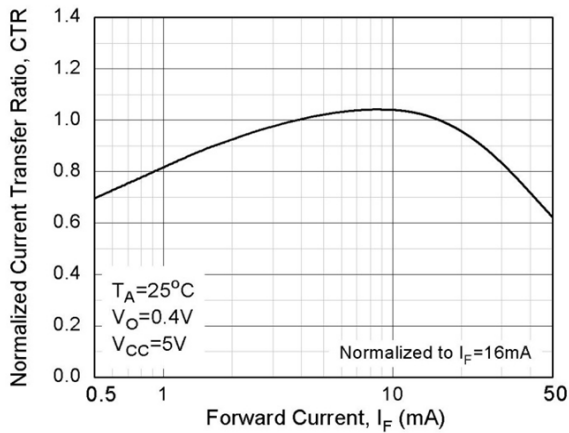


Fig 3 Normalized CTR vs Forward Current

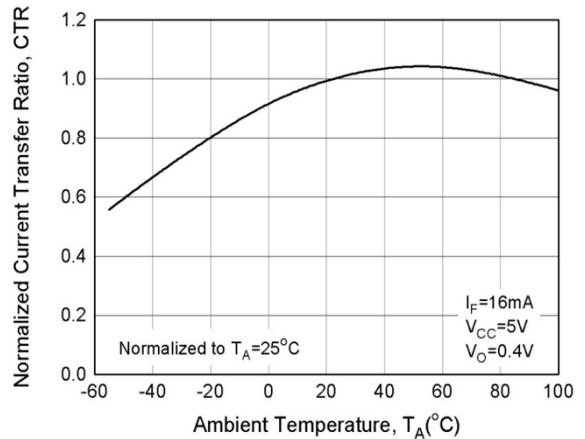


Fig 4 Normalized CTR vs T_A

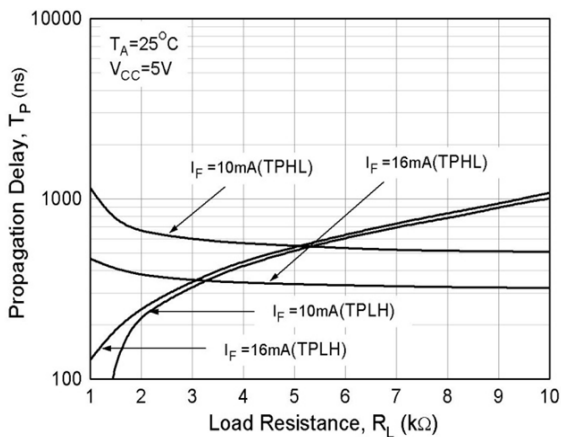


Fig 5 Propagation Delay vs Load Resistance

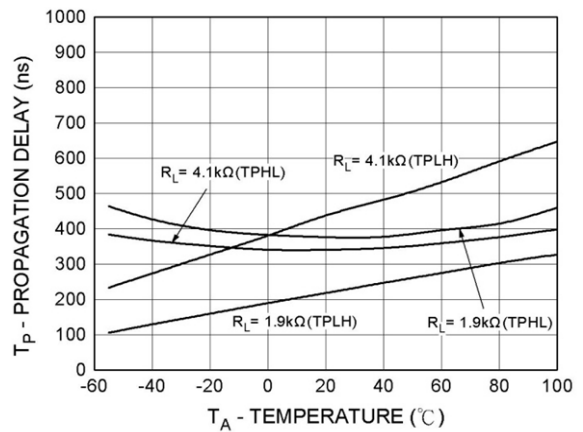


Fig 6 Propagation Delay vs T_A



6N135, 6N136, ICPL4502, ICPL4503

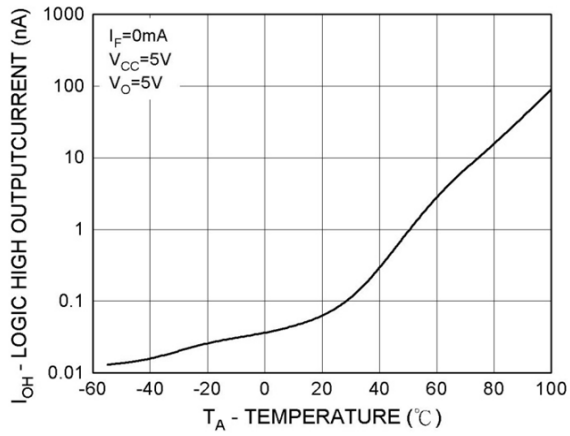
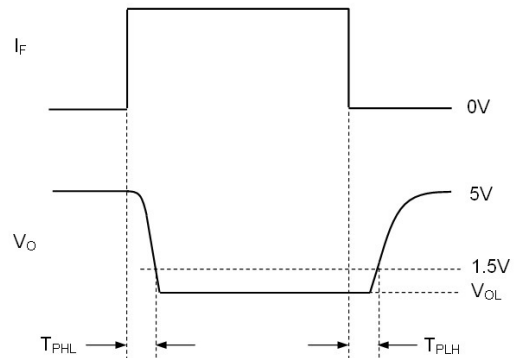
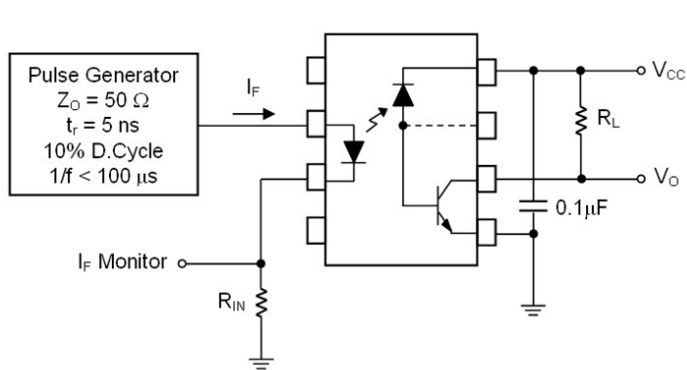


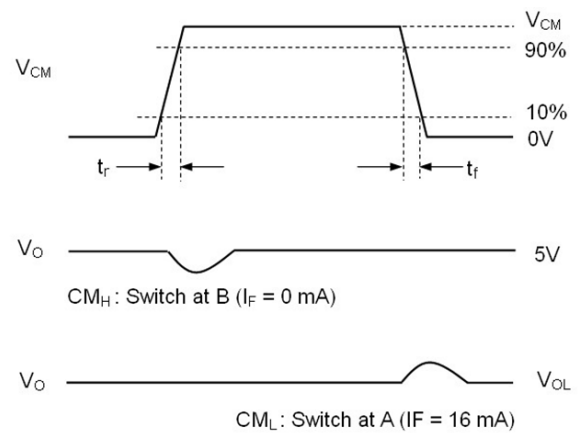
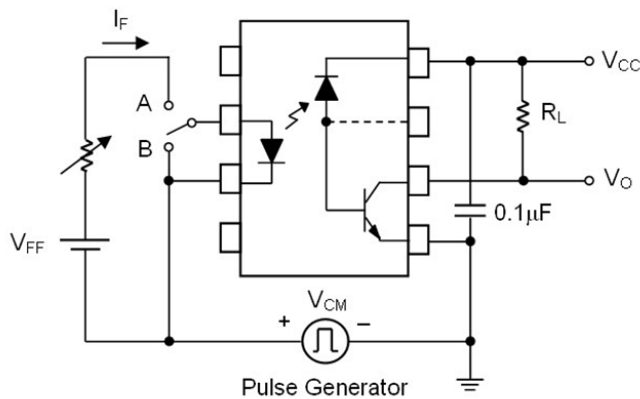
Fig 7 Logic High Output Current vs T_A



Switching Time Test Circuit



6N135, 6N136, ICPL4502, ICPL4503



Common Mode Transient Immunity Test Circuit

Note:

Common mode transient immunity in logic high level is the maximum tolerable (positive) dV_{CM}/dt on the leading edge of the common mode pulse signal V_{CM} , to assure that the output will remain in a logic high state (i.e., $V_O > 2.0V$).

Common mode transient immunity in logic low level is the maximum tolerable (negative) dV_{CM}/dt on the trailing edge of the common mode pulse signal, V_{CM} , to assure that the output will remain in a logic low state (i.e., $V_O < 0.8V$).



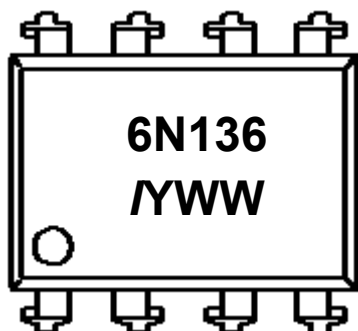
6N135, 6N136, ICPL4502, ICPL4503

ORDER INFORMATION

6N135, 6N136, ICPL4502, ICPL4503 (UL Approval)			
After PN	PN	Description	Packing quantity
None	6N135, 6N136, ICPL4502, ICPL4503	Standard Dip8	45 pcs per tube
G	6N135G, 6N136G, ICPL4502G, ICPL4503G	10mm Lead Spacing	45 pcs per tube
SM	6N135SM, 6N136SM, ICPL4502SM, ICPL4503SM	Surface Mount	45 pcs per reel
SMT&R	6N135SMT&R, 6N136SMT&R, ICPL4502SMT&R, ICPL4503SMT&R	Surface Mount Tape & Reel	1000 pcs per reel

6N135V, 6N136V (UL and VDE Approvals)			
After PN	PN	Description	Packing quantity
None	6N135V, 6N136V	Standard Dip8	45 pcs per tube
G	6N135VG, 6N136VG	10mm Lead Spacing	45 pcs per tube
SM	6N135VSM, 6N136VSM	Surface Mount	45 pcs per reel
SMT&R	6N135VSMT&R, 6N136VSMT&R	Surface Mount Tape & Reel	1000 pcs per reel

DEVICE MARKING (Example : 6N136)



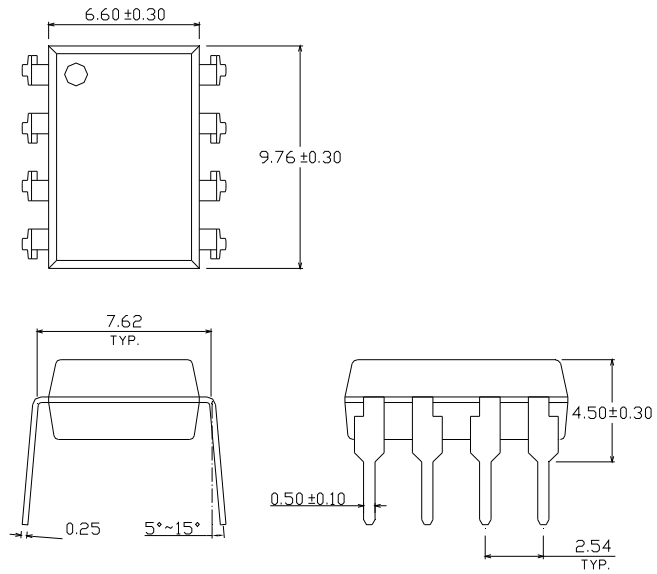
6N136 denotes Device Part Number
 Y denotes 1 digit Year code
 WW denotes 2 digit Week code
 I denoted Isocom



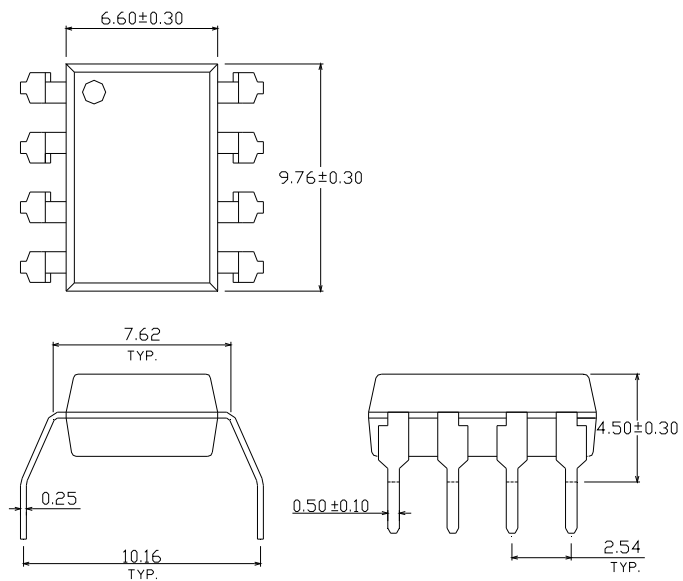
6N135, 6N136, ICPL4502, ICPL4503

PACKAGE DIMENSIONS (mm)

DIP



G-Form

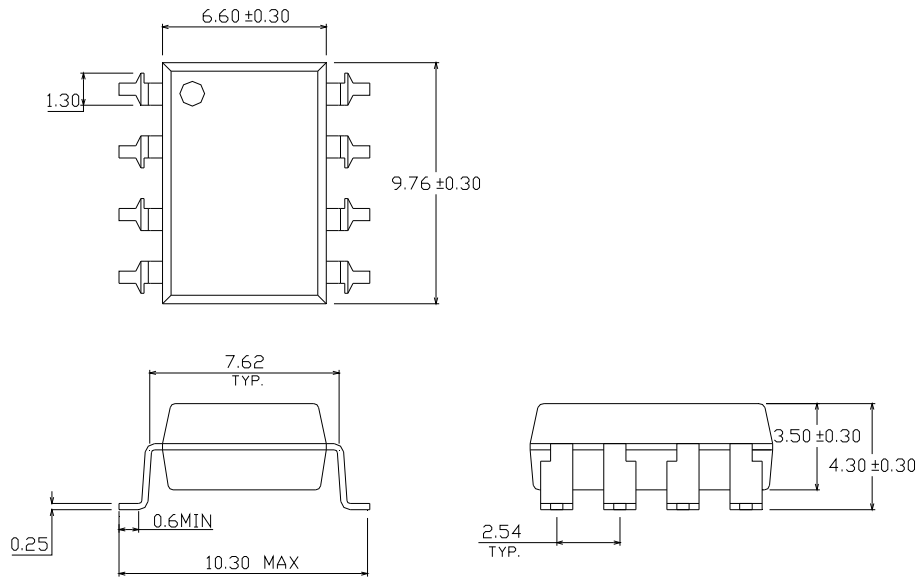




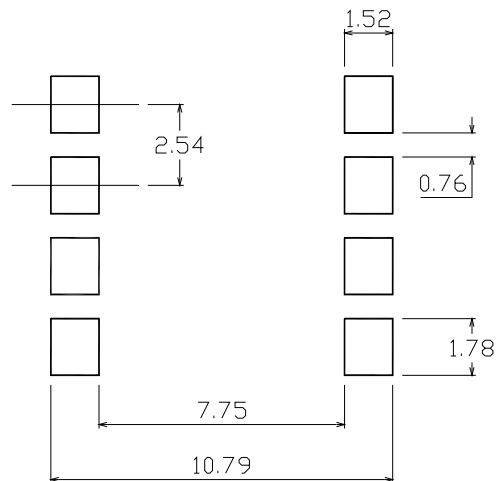
6N135, 6N136, ICPL4502, ICPL4503

PACKAGE DIMENSIONS (mm)

SMD



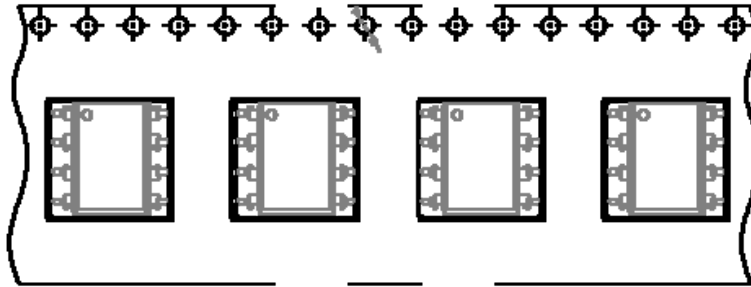
RECOMMENDED PAD LAYOUT FOR SMD (mm)



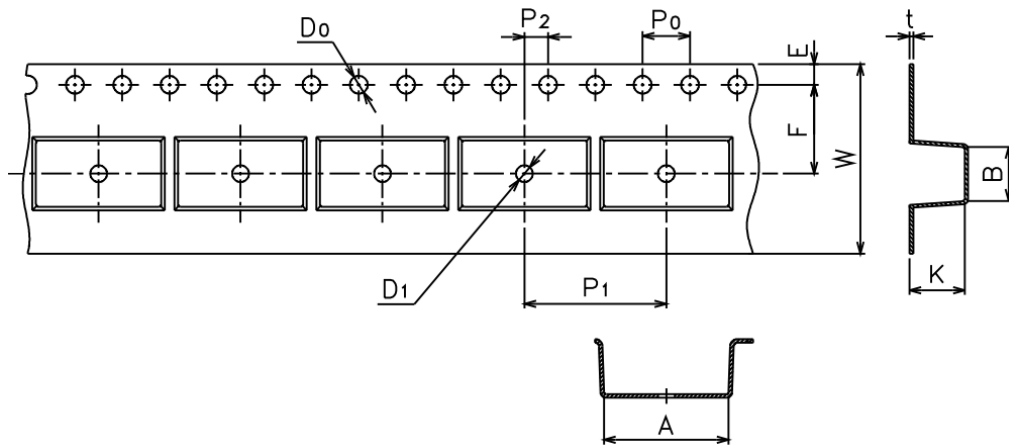


6N135, 6N136, ICPL4502, ICPL4503

TAPE AND REEL PACKAGING



Direction of feed from reel

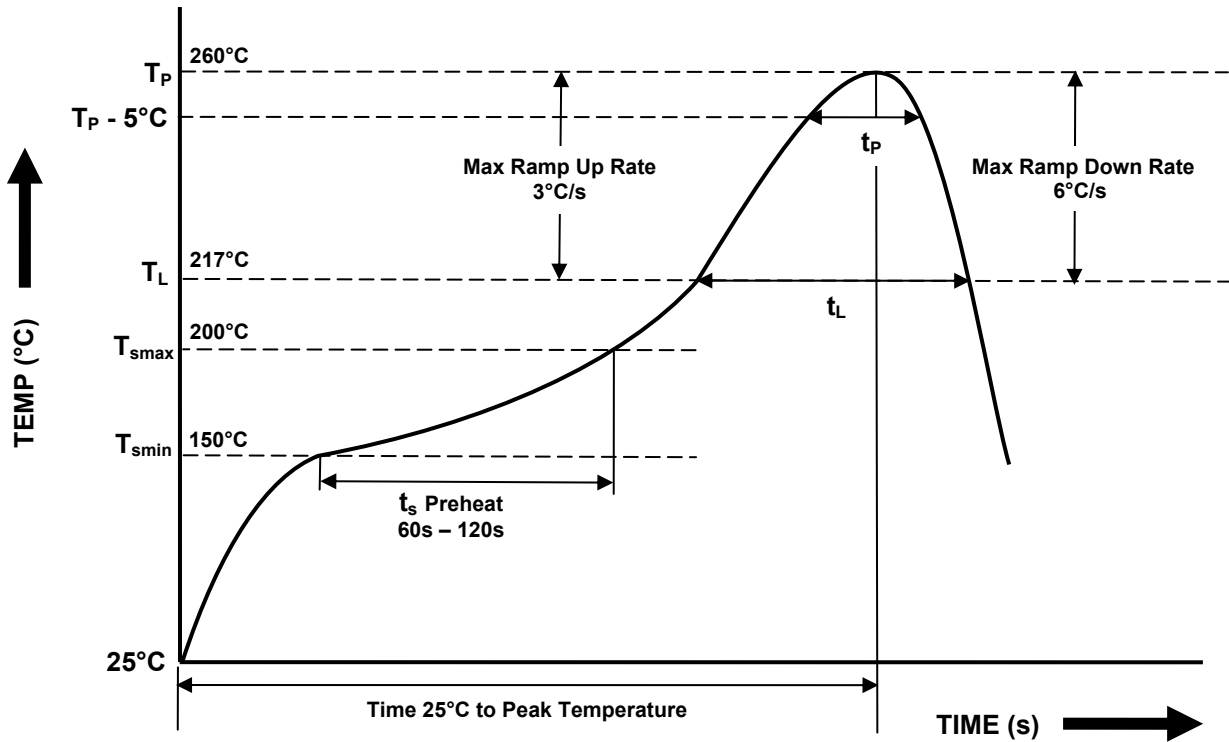


Dimension No.	A	B	D₀	D₁	E	F
Dimension(mm)	10.4±0.1	10.0±0.1	1.5±0.1	1.5±0.1	1.75±0.1	7.5±0.1
Dimension No.	P₀	P₁	P₂	t	W	K
Dimension (mm)	4.0±0.1	12.0±0.1	2.0±0.1	0.4±0.1	16.0 ±0.3 / -0.1	4.5±0.1



6N135, 6N136, ICPL4502, ICPL4503

REFLOW SOLDERING TEMPERATURE PROFILE
(One Time Reflow Soldering is Recommended)



Profile Details	Conditions
Preheat - Min Temperature (T_{SMIN}) - Max Temperature (T_{SMAX}) - Time T_{SMIN} to T_{SMAX} (t_s)	150°C 200°C 60s - 120s
Soldering Zone - Peak Temperature (T_P) - Liquidous Temperature (T_L) - Time within 5°C of Actual Peak Temperature ($T_P - 5^\circ\text{C}$) - Time maintained above T_L (t_L) - Ramp Up Rate (T_L to T_P) - Ramp Down Rate (T_P to T_L)	260°C 217°C 30s 60s - 100s 3°C/s max 6°C/s max
Average Ramp Up Rate (T_{smax} to T_P)	3°C/s max
Time 25°C to Peak Temperature	8 minutes max



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- Do not immerse device body in solder paste.



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