



ON Semiconductor®

# FODM3011, FODM3012, FODM3022, FODM3023, FODM3052, FODM3053

## 4-Pin Full Pitch Mini-Flat Package Random-Phase Triac Driver Output Optocouplers

### Features

- Compact 4-pin Surface Mount Package (2.4 mm Maximum Standoff Height)
- Peak Blocking Voltage
  - 250V (FODM301X)
  - 400V (FODM302X)
  - 600V (FODM305X)
- Safety and Regulatory Approvals:
  - UL1577, 3,750 VAC<sub>RMS</sub> for 1 Minute
  - DIN-EN/IEC60747-5-5, 565 V Peak Working Insulation Voltage

### Applications

- Industrial Controls
- Traffic Lights
- Vending Machines
- Solid State Relay
- Lamp Ballasts
- Solenoid/Valve Controls
- Static AC Power Switch
- Incandescent Lamp Dimmers
- Motor Control

### Description

The FODM301X, FODM302X, and FODM305X series consists of a GaAs infrared emitting diode driving a silicon bilateral switch housed in a compact 4-pin mini-flat package. The lead pitch is 2.54 mm. They are designed for interfacing between electronic controls and power triacs to control resistive and inductive loads for 115 V/240 V operations.

### Functional Schematic

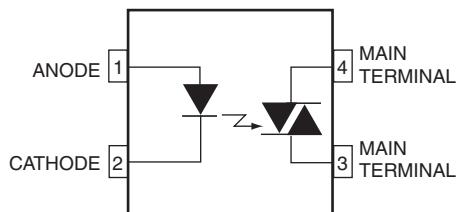


Figure 1. Functional Schematic

### Package Outlines

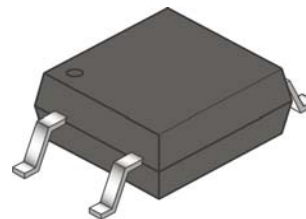


Figure 2. Package Outlines

## Safety and Insulation Ratings

As per DIN EN/IEC 60747-5-5, this optocoupler is suitable for “safe electrical insulation” only within the safety limit data. Compliance with the safety ratings shall be ensured by means of protective circuits.

Parameter		Characteristics
Installation Classifications per DIN VDE 0110/1.89 Table 1, For Rated Mains Voltage	< 150 V <sub>RMS</sub>	I–IV
	< 300 V <sub>RMS</sub>	I–III
Climatic Classification		40/100/21
Pollution Degree (DIN VDE 0110/1.89)		2
Comparative Tracking Index		175

Symbol	Parameter	Value	Unit
V <sub>PR</sub>	Input-to-Output Test Voltage, Method A, V <sub>IORM</sub> × 1.6 = V <sub>PR</sub> , Type and Sample Test with t <sub>m</sub> = 10 s, Partial Discharge < 5 pC	904	V <sub>peak</sub>
	Input-to-Output Test Voltage, Method B, V <sub>IORM</sub> × 1.875 = V <sub>PR</sub> , 100% Production Test with t <sub>m</sub> = 1 s, Partial Discharge < 5 pC	1060	V <sub>peak</sub>
V <sub>IORM</sub>	Maximum Working Insulation Voltage	565	V <sub>peak</sub>
V <sub>IOTM</sub>	Highest Allowable Over-Voltage	6000	V <sub>peak</sub>
	External Creepage	≥ 5	mm
	External Clearance	≥ 5	mm
DTI	Distance Through Insulation (Insulation Thickness)	≥ 0.4	mm
T <sub>S</sub>	Case Temperature <sup>(1)</sup>	150	°C
I <sub>S,INPUT</sub>	Input Current <sup>(1)</sup>	200	mA
P <sub>S,OUTPUT</sub>	Output Power <sup>(1)</sup>	300	mW
R <sub>IO</sub>	Insulation Resistance at T <sub>S</sub> , V <sub>IO</sub> = 500 V <sup>(1)</sup>	> 10 <sup>9</sup>	Ω

**Note:**

1. Safety limit values – maximum values allowed in the event of a failure.

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.  $T_A = 25^\circ\text{C}$  unless otherwise specified.

Symbol	Parameter	Value	Unit
$T_{STG}$	Storage Temperature	-55 to +150	$^\circ\text{C}$
$T_{OPR}$	Operating Temperature	-40 to +100	$^\circ\text{C}$
$T_J$	Junction Temperature	-40 to +125	$^\circ\text{C}$
$T_{SOL}$	Lead Solder Temperature	260 for 10 sec	$^\circ\text{C}$
<b>EMITTER</b>			
$I_F$ (avg)	Continuous Forward Current	60	mA
$I_F$ (pk)	Peak Forward Current (1 $\mu\text{s}$ pulse, 300 pps.)	1	A
$V_R$	Reverse Input Voltage	3	V
$P_D$	Power Dissipation (No derating required over operating temp. range)	100	mW
<b>DETECTOR</b>			
$I_{T(RMS)}$	On-State RMS Current	70	mA (RMS)
$V_{DRM}$	Off-State Output Terminal Voltage	FODM3011, FODM3012	250
		FODM3022, FODM3023	400
		FODM3052, FODM3053	600
$P_D$	Power Dissipation (No derating required over operating temp. range)	300	mW

## Electrical Characteristics

$T_A = 25^\circ\text{C}$  unless otherwise specified.

### Individual Component Characteristics

Symbol	Parameter	Test Conditions	Device	Min.	Typ.	Max.	Unit
<b>EMITTER</b>							
$V_F$	Input Forward Voltage	$I_F = 10\text{ mA}$	All		1.20	1.50	V
$I_R$	Reverse Leakage Current	$V_R = 3\text{ V}, T_A = 25^\circ\text{C}$	All		0.01	100	$\mu\text{A}$
<b>DETECTOR</b>							
$I_{\text{DRM}}$	Peak Blocking Current Either Direction	Rated $V_{\text{DRM}}, I_F = 0^{(2)}$	All		2	100	nA
$dv/dt$	Critical Rate of Rise of Off-State Voltage	$I_F = 0$ (Figure 8) <sup>(3)</sup>	FODM3011, FODM3012, FODM3022, FODM3023 FODM3052, FODM3053		10		$\text{V}/\mu\text{s}$
				1,000			

#### Notes:

- Test voltage must be applied within  $dv/dt$  rating.
- This is static  $dv/dt$ . See Figure 1 for test circuit. Commutating  $dv/dt$  is function of the load-driving thyristor(s) only.

### Transfer Characteristics

Symbol	Parameter	Test Conditions	Device	Min.	Typ.	Max.	Unit
$I_T$	LED Trigger Current	Main Terminal Voltage = $3\text{ V}^{(4)}$	FODM3011, FODM3022, FODM3052 FODM3012, FODM3023, FODM3053			10 5	mA
$I_H$	Holding Current, Either Direction		All		450		$\mu\text{A}$
$V_{\text{TM}}$	Peak On-State Voltage Either Direction	$I_{\text{TM}} = 100\text{ mA peak}$	All		2.2	3	V

#### Notes:

- All devices are guaranteed to trigger at an  $I_F$  value of less than or equal to the max  $I_{\text{FT}}$  specification. For optimum operation over temperature and lifetime of the device, the LED should be biased with an  $I_F$  that is at least 50% higher than the maximum  $I_{\text{FT}}$  specification. The  $I_{\text{FT}}$  should not exceed the absolute maximum rating of 60 mA.  
Example: For FODM0353M, the minimum  $I_F$  bias should be  $5\text{ mA} \times 150\% = 7.5\text{ mA}$

### Isolation Characteristics

Symbol	Parameter	Test Conditions	Device	Min.	Typ.	Max.	Unit
$V_{\text{ISO}}$	Steady State Isolation Voltage	1 Minute, R.H. = 40% to 60%	All	3,750			$\text{VAC}_{\text{RMS}}$

## Typical Performance Characteristics

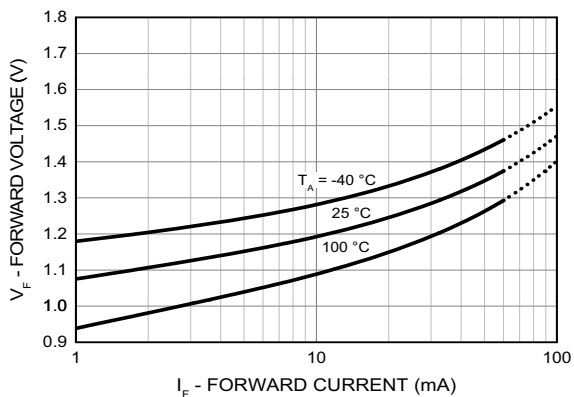


Fig 3. LED Forward Voltage vs. Forward Current

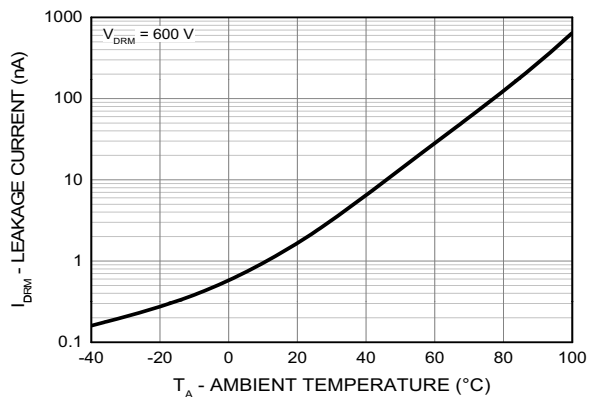


Fig 4. Leakage Current vs. Ambient Temperature

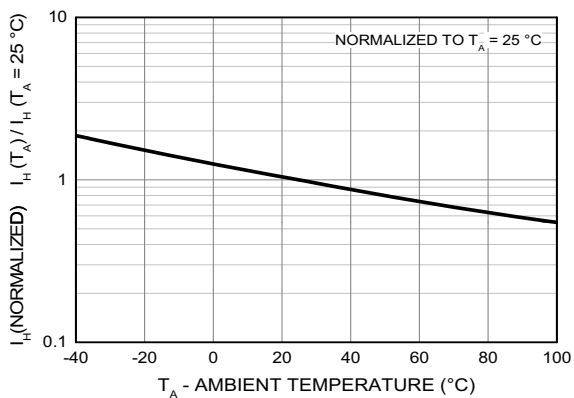


Fig 5. Normalized Holding Current vs. Ambient Temperature

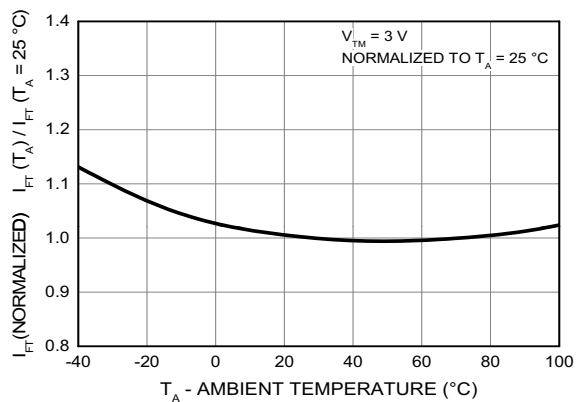


Fig 6. Normalized Trigger Current vs. Ambient Temperature

**Typical Performance Characteristics** (Continued)

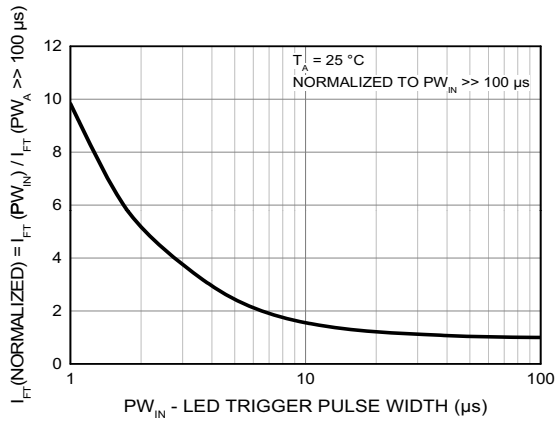


Fig 7. LED Current Required to Trigger vs. LED Pulse Width

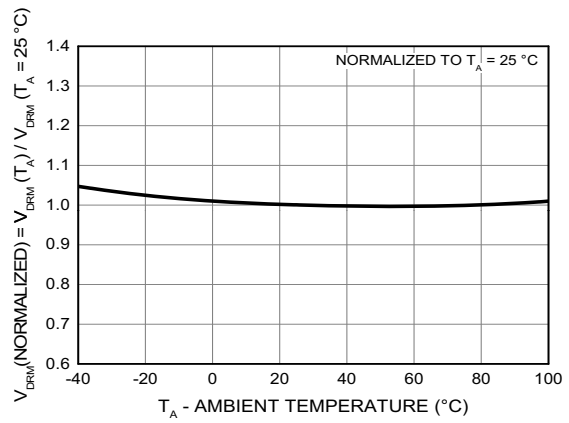


Fig 8. Normalized Off-State Output Terminal Voltage vs. Ambient Temperature

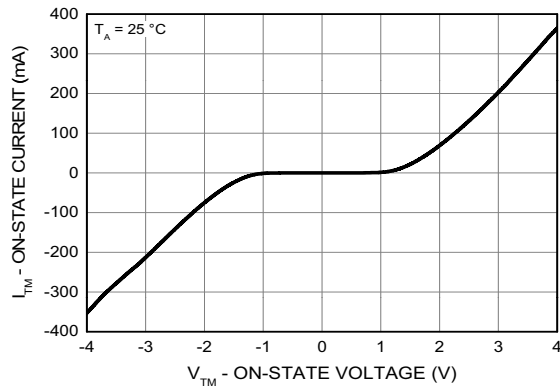


Fig 9. On-State Characteristics

## Typical Application Information

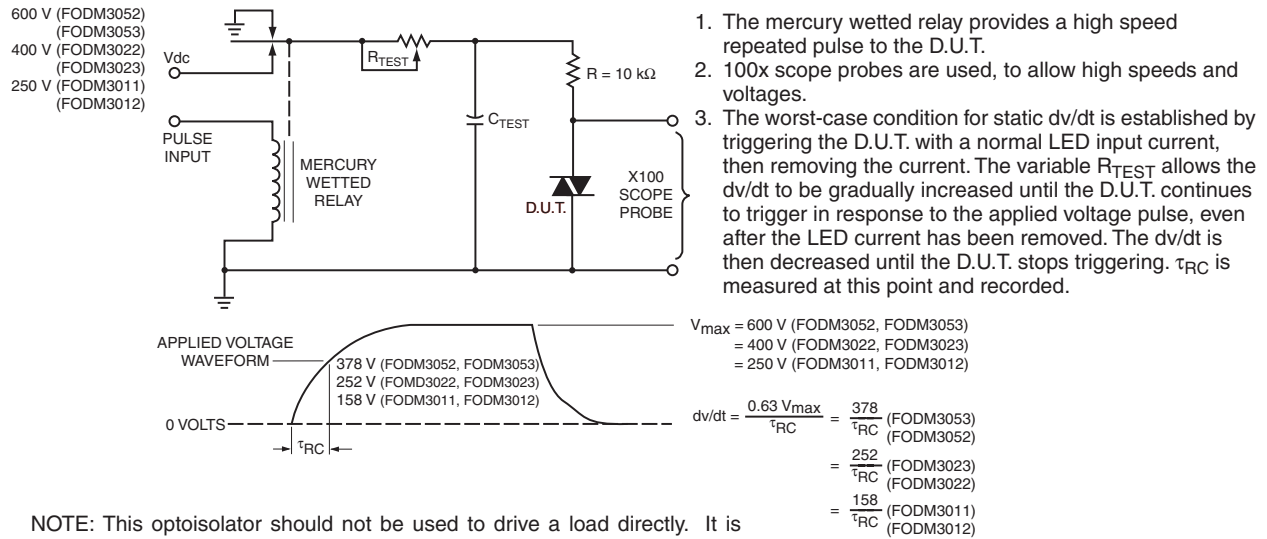


Figure 10. Static dv/dt Test Circuit

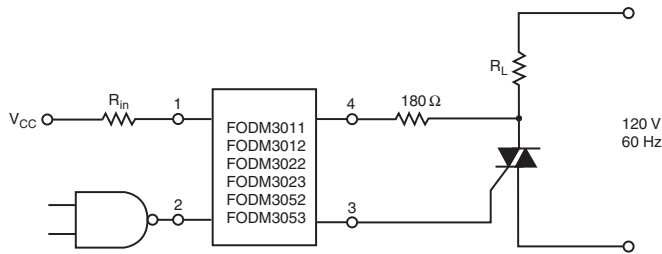


Figure 11. Resistive Load

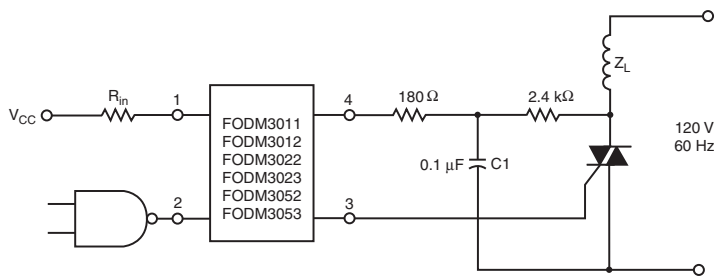
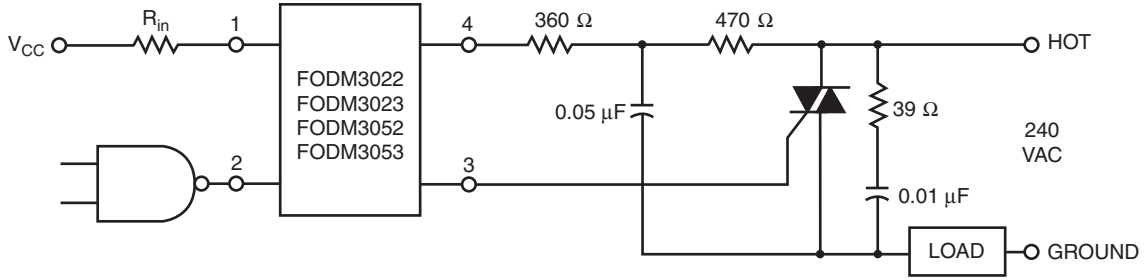


Figure 12. Inductive Load with Sensitive Gate Triac ( $I_{GT} \leq 15\text{ mA}$ )

**Typical Application Information** (Continued)



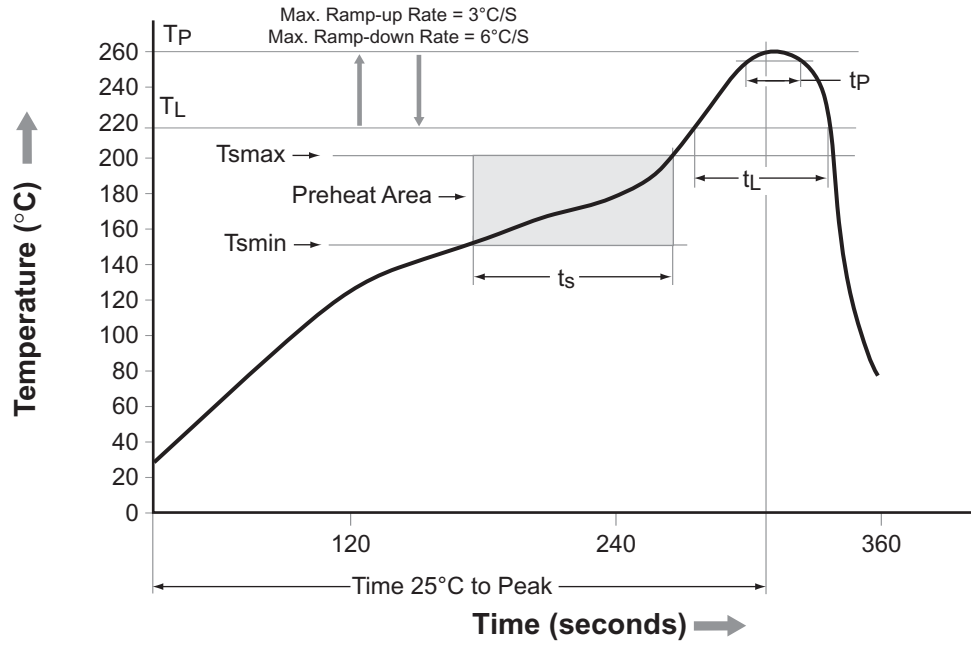
In this circuit the “hot” side of the line is switched and the load connected to the cold or ground side.

The 39 Ω resistor and 0.01μF capacitor are for snubbing of the triac, and the 470 Ω resistor and 0.05 μF capacitor are for snubbing the coupler. These components may or may not be necessary depending upon the particular and load used.

**Figure 13. Typical Application Circuit**



## Reflow Profile



Profile Feature	Pb-Free Assembly Profile
Temperature Min. (T <sub>smin</sub> )	150°C
Temperature Max. (T <sub>smax</sub> )	200°C
Time (t <sub>s</sub> ) from (T <sub>smin</sub> to T <sub>smax</sub> )	60–120 seconds
Ramp-up Rate (t <sub>L</sub> to t <sub>p</sub> )	3°C/second max.
Liquidous Temperature (T <sub>L</sub> )	217°C
Time (t <sub>L</sub> ) Maintained Above (T <sub>L</sub> )	60–150 seconds
Peak Body Package Temperature	260°C +0°C / -5°C
Time (t <sub>p</sub> ) within 5°C of 260°C	30 seconds
Ramp-down Rate (T <sub>P</sub> to T <sub>L</sub> )	6°C/second max.
Time 25°C to Peak Temperature	8 minutes max.

## Ordering Information

Part Number	Package	Packing Method
FODM3011	Full Pitch Mini-Flat 4-Pin	Tube (100 units)
FODM3011R2	Full Pitch Mini-Flat 4-Pin	Tape and Reel (2500 Units)
FODM3011V	Full Pitch Mini-Flat 4-Pin, DIN EN/IEC60747-5-5 Option	Tube (100 Units)
FODM3011R2V	Full Pitch Mini-Flat 4-Pin, DIN EN/IEC60747-5-5 Option	Tape and Reel (2500 Units)

**Note:**

The product orderable part number system listed in this table also applies to the FODM3012, FODM3022, FODM3023, FODM3052, and FODM3053 products.

## Marking Information

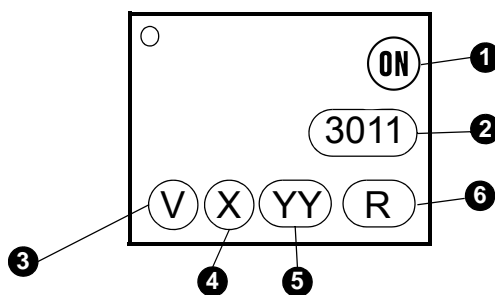
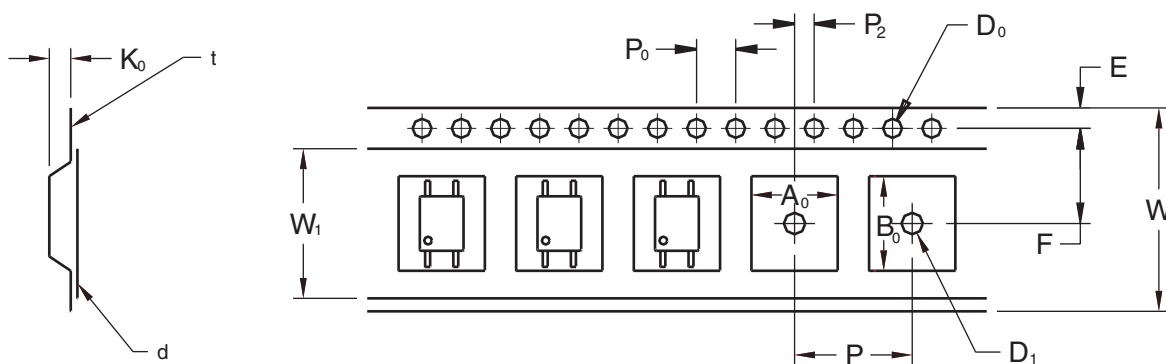


Figure 14. Top Mark

Table 1. Top Mark Definitions

1	ON Semiconductor Logo
2	Device Number
3	DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)
4	One-Digit Year Code, e.g., "6"
5	Digit Work Week, Ranging from "01" to "53"
6	Assembly Package Code

## Tape Specifications



Description	Symbol	2.54 Pitch
		Dimensions
Tape Width	W	12.00±0.4
Tape Thickness	t	0.35±0.02
Sprocket Hole Pitch	P <sub>0</sub>	4.00±0.20
Sprocket Hole Dia.	D <sub>0</sub>	1.55±0.20
Sprocket Hole Location	E	1.75±0.20
Pocket Location	F	5.50±0.20
	P <sub>2</sub>	2.00±0.20
Pocket Pitch	P	8.00±0.20
Pocket Dimension	A <sub>0</sub>	4.75±0.20
	B <sub>0</sub>	7.30±0.20
	K <sub>0</sub>	2.30±0.20
Pocket Hole Dia.	D <sub>1</sub>	1.55±0.20
Cover Tape Width	W <sub>1</sub>	9.20
Cover Tape Thickness	d	0.065±0.02
Max. Component Rotation or Tilt		20° max
Devices Per Reel		2500
Reel Diameter		330 mm (13")

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