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April 2015

# MOC8021M, MOC8050M 6-Pin DIP Photodarlington Optocoupler (No Base Connection)

## Features

- High  $BV_{CEO}$ :
  - Minimum 50 V (MOC8021M)
  - Minimum 80 V (MOC8050M)
- High Current Transfer Ratio:
  - Minimum 1000% (MOC8021M)
  - Minimum 500% (MOC8050M)
- No Base Connection for Improved Noise Immunity
- Safety and Regulatory Approvals:
  - UL1577, 4,170  $V_{AC_{RMS}}$  for 1 Minute
  - DIN-EN/IEC60747-5-5, 850 V Peak Working Insulation Voltage

## Applications

- Appliances, Measuring Instruments
- I/O Interface for Computers
- Programmable Controllers
- Portable Electronics
- Interfacing and Coupling Systems of Different Potentials and Impedance
- Solid State Relays

## Description

The MOC8021M and MOC8050M are photodarlington-type optically coupled optocouplers. The devices have a gallium arsenide infrared emitting diode coupled with a silicon darlington phototransistor.

## Schematic

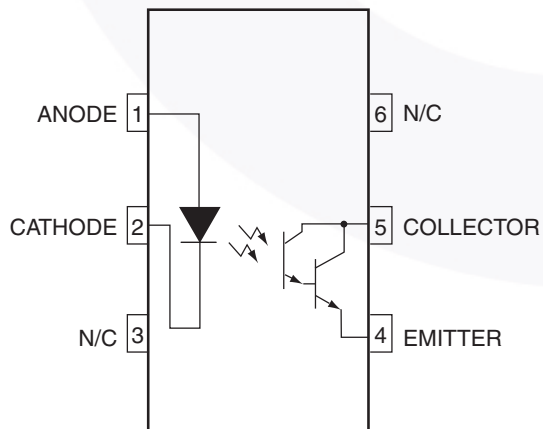


Figure 1. Schematic

## Package Outlines

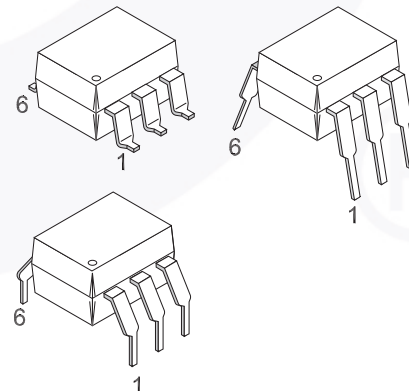


Figure 2. Package Outlines

MOC8021M, MOC8050M — 6-Pin DIP Photodarlington Optocoupler (No Base Connection)

## 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–IV
Climatic Classification		55/100/21
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	1360	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	1594	V <sub>peak</sub>
V <sub>IORM</sub>	Maximum Working Insulation Voltage	850	V <sub>peak</sub>
V <sub>IOTM</sub>	Highest Allowable Over-Voltage	6000	V <sub>peak</sub>
	External Creepage	≥ 7	mm
	External Clearance	≥ 7	mm
	External Clearance (for Option TV, 0.4" Lead Spacing)	≥ 10	mm
DTI	Distance Through Insulation (Insulation Thickness)	≥ 0.5	mm
T <sub>S</sub>	Case Temperature <sup>(1)</sup>	175	°C
I <sub>S,INPUT</sub>	Input Current <sup>(1)</sup>	350	mA
P <sub>S,OUTPUT</sub>	Output Power <sup>(1)</sup>	800	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.

Symbol	Parameter	Value	Unit
<b>TOTAL DEVICE</b>			
$T_{STG}$	Storage Temperature	-40 to +125	°C
$T_{OPR}$	Operating Temperature	-40 to +100	°C
$T_J$	Junction Temperature	-40 to +125	°C
$T_{SOL}$	Lead Solder Temperature	260 for 10 seconds	°C
$P_D$	Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$	270	mW
	Derate Above 25°C	2.94	mW/°C
<b>EMITTER</b>			
$I_F$	DC/Average Forward Input Current	60	mA
$V_R$	Reverse Input Voltage	3	V
$P_D$	LED Power Dissipation @ $T_A = 25^\circ\text{C}$	120	mW
	Derate Above 25°C	1.41	mW/°C
<b>DETECTOR</b>			
$I_C$	Continuous Collector Current	150	mA
$V_{CEO}$	Collector-Emitter Voltage MOC8021M	50	V
	MOC8050M	80	V
$P_D$	Detector Power Dissipation @ $T_A = 25^\circ\text{C}$	150	mW
	Derate Above 25°C	1.76	mW/°C

## Electrical Characteristics

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

### Individual Component Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>EMITTER</b>						
$V_F$	Input Forward Voltage	$I_F = 10\text{ mA}$		1.18	2.00	V
$I_R$	Reverse Leakage Current	$V_R = 3.0\text{ V}$		0.001	10	$\mu\text{A}$
<b>DETECTOR</b>						
$BV_{CEO}$	Collector-Emitter Breakdown Voltage MOC8021M	$I_C = 1.0\text{ mA}, I_F = 0$	50	100		V
	MOC8050M		80	100		V
$BV_{ECO}$	Emitter-Collector Breakdown Voltage	$I_E = 100\ \mu\text{A}, I_F = 0$	5	10		V
$I_{CEO}$	Collector-Emitter Dark Current	$V_{CE} = 60\text{ V}, I_F = 0$			1	$\mu\text{A}$
$C_{CE}$	Capacitance	$V_{CE} = 0\text{ V}, f = 1\text{ MHz}$		8		pF

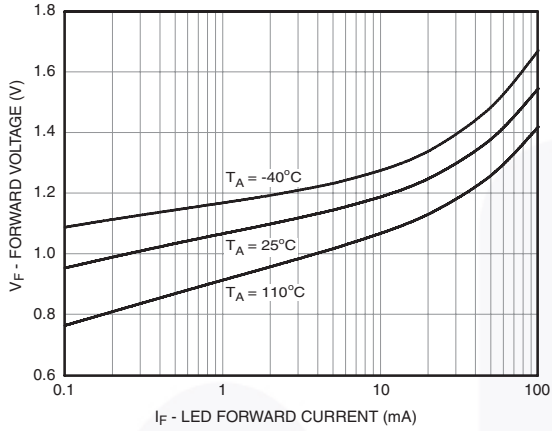
### Transfer Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>DC CHARACTERISTICS</b>						
CTR	Current Transfer Ratio, Collector to Emitter MOC8021M	$I_F = 10\text{ mA}, V_{CE} = 5\text{ V}$	1,000			%
	MOC8050M	$I_F = 10\text{ mA}, V_{CE} = 1.5\text{ V}$	500			%
<b>AC CHARACTERISTICS</b>						
$t_{on}$	Turn-on Time	$I_F = 5\text{ mA}, V_{CC} = 10\text{ V},$ $R_L = 100\ \Omega$		8.5		$\mu\text{s}$
$t_{off}$	Turn-off Time	$I_F = 5\text{ mA}, V_{CC} = 10\text{ V},$ $R_L = 100\ \Omega$		95		$\mu\text{s}$

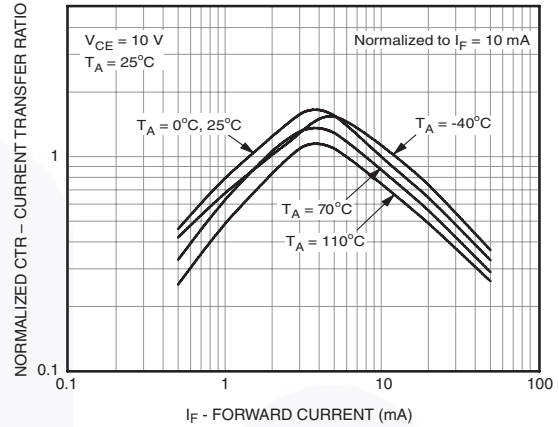
### Isolation Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
$V_{ISO}$	Input-Output Isolation Voltage	$t = 1\text{ Minute}$	4170			$V_{AC_{RMS}}$
$C_{ISO}$	Isolation Capacitance	$V_{I-O} = 0\text{ V}, f = 1\text{ MHz}$		0.2		pF
$R_{ISO}$	Isolation Resistance	$V_{I-O} = \pm 500\text{ VDC}, T_A = 25^\circ\text{C}$	$10^{11}$			$\Omega$

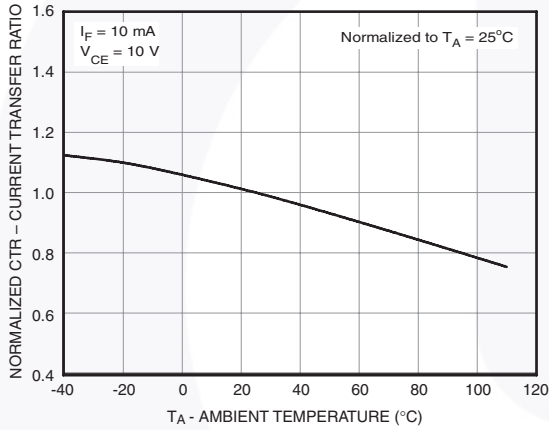
### Typical Performance Curves



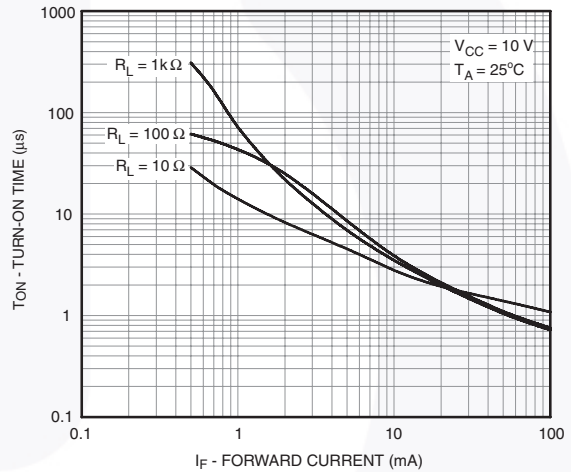
**Figure 3. LED Forward Voltage vs. Forward Current**



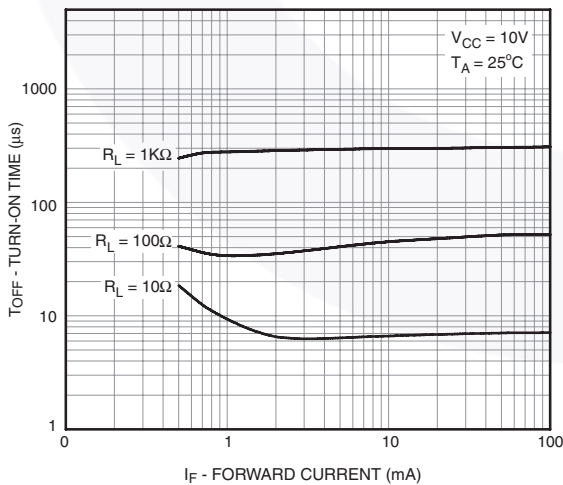
**Figure 4. Normalized CTR vs. Forward Current**



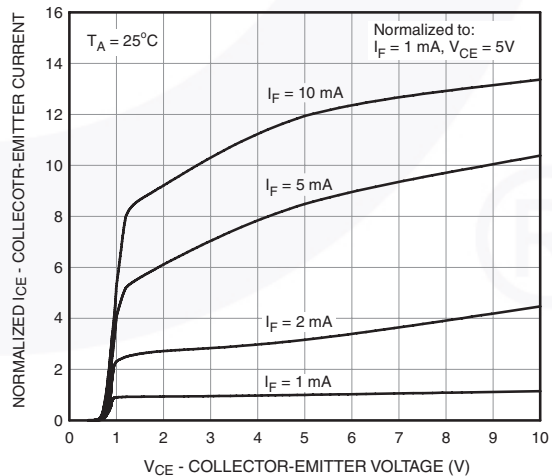
**Figure 5. Normalized CTR vs. Ambient Temperature**



**Figure 6. Turn-on Time vs. Forward Current**



**Figure 7. Turn-off Time vs. Forward Current**



**Figure 8. Normalized Collector-Emitter Current vs. Collector-Emitter Voltage**

### Typical Performance Curves (Continued)

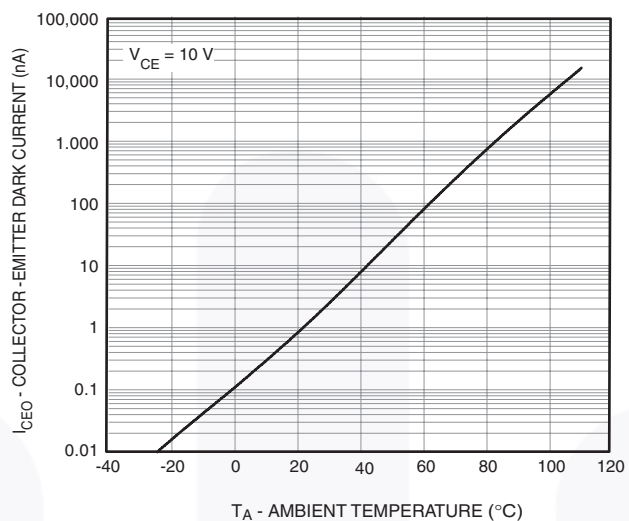


Figure 9. Dark Current vs. Ambient Temperature

### Switching Time Test Circuit and Waveform

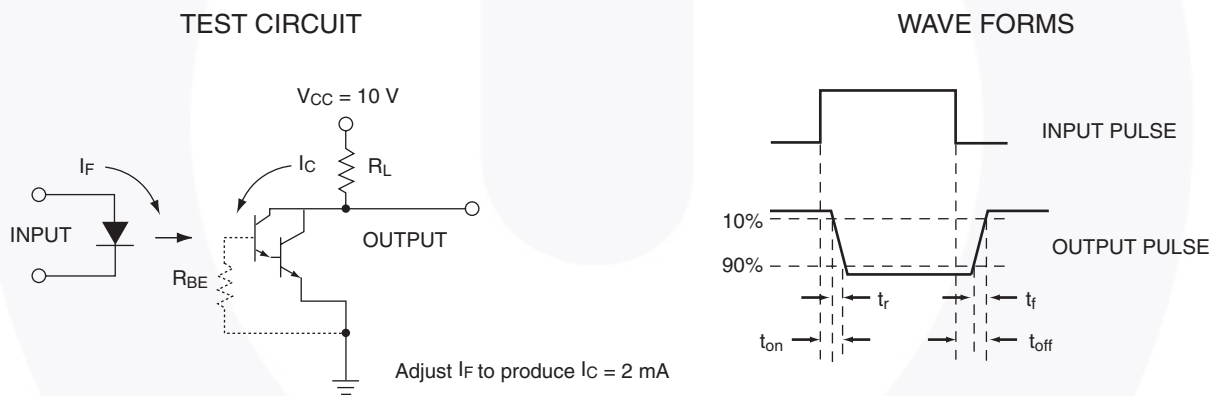


Figure 10. Switching Time Test Circuit and Waveform

### Reflow Profile

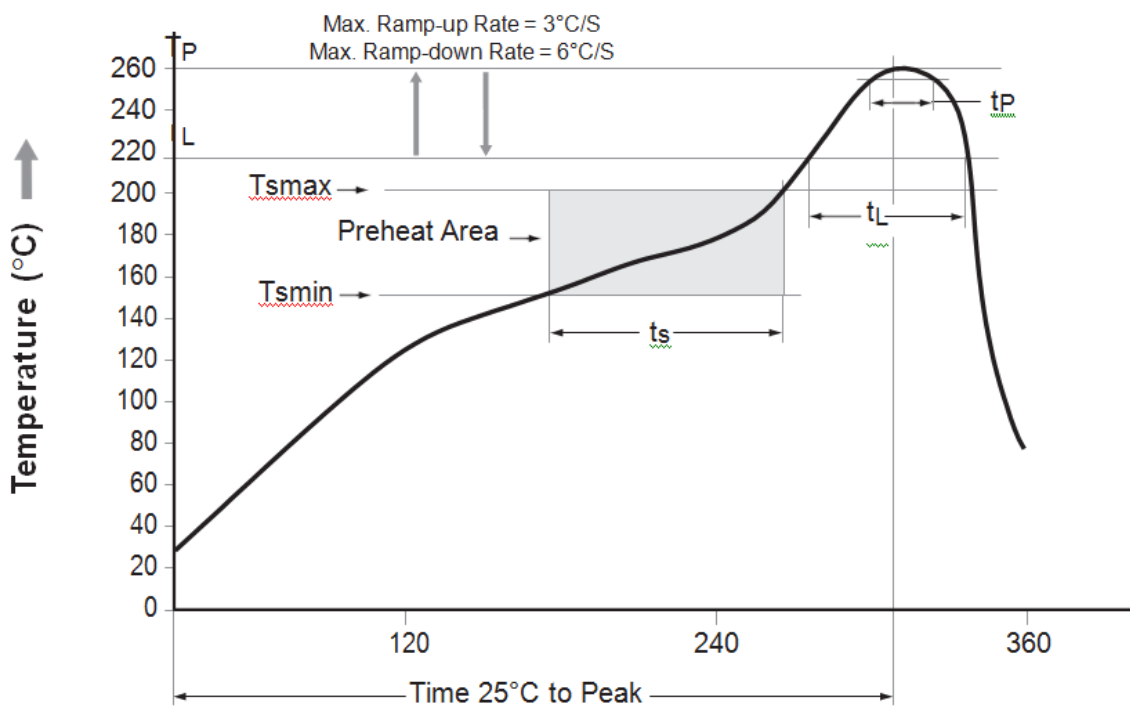


Figure 11. Reflow Profile



## Ordering Information

Part Number	Package	Packing Method
MOC8021M	DIP 6-Pin	Tube (50 Units)
MOC8021SM	SMT 6-Pin (Lead Bend)	Tube (50 Units)
MOC8021SR2M	SMT 6-Pin (Lead Bend)	Tape and Reel (1000 Units)
MOC8021VM	DIP 6-Pin, DIN EN/IEC60747-5-5 Option	Tube (50 Units)
MOC8021SVM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tube (50 Units)
MOC8021SR2VM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tape and Reel (1000 Units)
MOC8021TVM	DIP 6-Pin, 0.4" Lead Spacing, DIN EN/IEC60747-5-5 Option	Tube (50 Units)

**Note:**

2. The product orderable part number system listed in this table also applies to the MOC8050M device.

## Marking Information

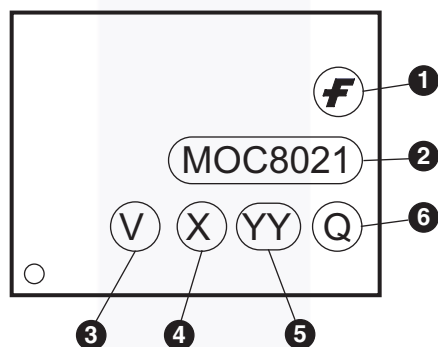


Figure 12. Top Mark

Table 1. Top Mark Definitions

1	Fairchild 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., "5"
5	Digit Work Week, Ranging from "01" to "53"
6	Assembly Package Code



- NOTES:
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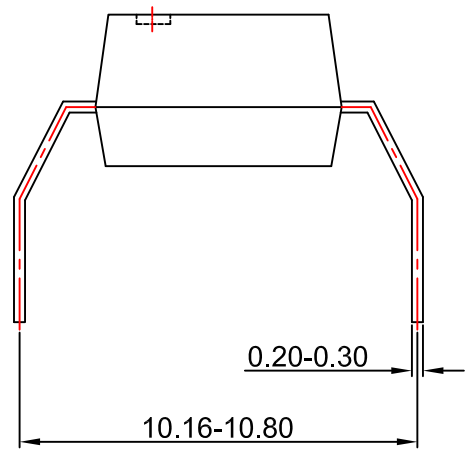
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