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August 2015

# MOC223M, MOCD223M 8-pin SOIC Darlington Output Optocouplers

## Features

- High Current Transfer Ratio of 500% Minimum at  $I_F = 1 \text{ mA}$
- Minimum  $BV_{CEO}$  of 30 V Guaranteed
- Convenient Plastic SOIC-8 Surface Mountable Package Style, with 0.050" Lead Spacing
- Safety and Regulatory Approvals:
  - UL1577, 2,500 VAC<sub>RMS</sub> for 1 Minute
  - DIN-EN/IEC60747-5-5, 565 V Peak Working Insulation Voltage

## Applications

- Low Power Logic Circuits
- Interfacing and Coupling Systems of Different Potentials and Impedances
- Telecommunications Equipment
- Portable Electronics
- Solid State Relays

## Description

The MOC223M consists of a gallium arsenide infrared emitting diode optically coupled to a monolithic silicon photodarlington detector, in a surface mountable, small outline, plastic package. The MOCD223M is a dual-channel version of the MOC223M. They are ideally suited for high density applications, and eliminates the need for through the board mounting.

## Package Outline

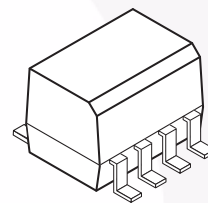


Figure 1. Package Outline

## Schematics

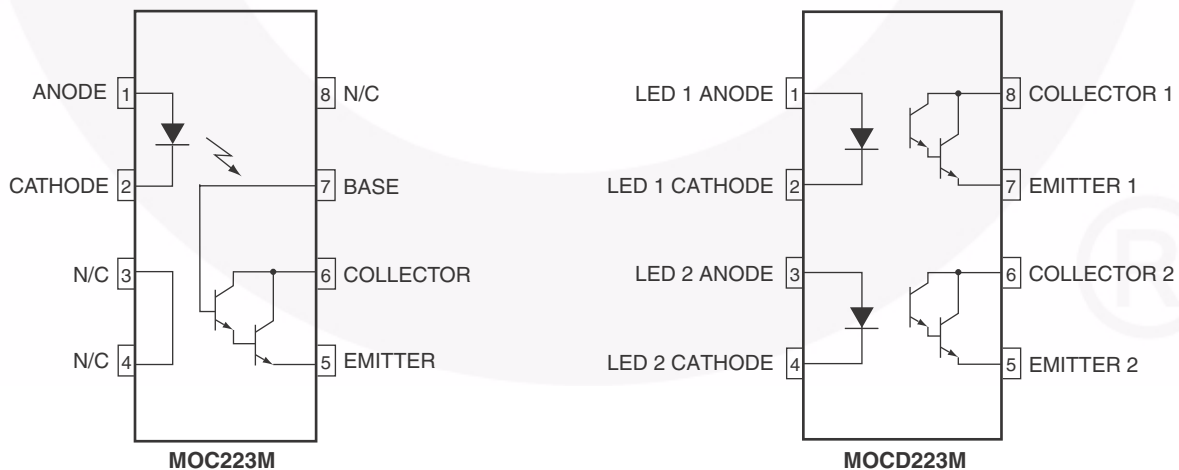


Figure 2. Schematics

## 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		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	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	4000	V <sub>peak</sub>
	External Creepage	≥ 4	mm
	External Clearance	≥ 4	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	Rating	Value	Unit
<b>TOTAL DEVICE</b>			
$T_{STG}$	Storage Temperature	-40 to +125	$^\circ\text{C}$
$T_A$	Ambient 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 seconds	$^\circ\text{C}$
$P_D$	Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$	240	mW
	Derate Above $25^\circ\text{C}$	2.94	mW/ $^\circ\text{C}$
<b>EMITTER</b>			
$I_F$	Continuous Forward Current	60	mA
$I_F$ (pk)	Forward Current – Peak (PW = 100 $\mu\text{s}$ , 120 pps)	1.0	A
$V_R$	Reverse Voltage	6.0	V
$P_D$	LED Power Dissipation @ $T_A = 25^\circ\text{C}$	90	mW
	Derate Above $25^\circ\text{C}$	0.8	mW/ $^\circ\text{C}$
<b>DETECTOR</b>			
$I_C$	Continuous Collector Current	150	mA
$V_{CEO}$	Collector-Emitter Voltage	30	V
$V_{CBO}$	Collector-Base Voltage, MOC223M	70	V
$V_{ECO}$	Emitter-Collector Voltage	7	V
$P_D$	Detector Power Dissipation @ $T_A = 25^\circ\text{C}$	150	mW
	Derate Above $25^\circ\text{C}$	1.76	mW/ $^\circ\text{C}$

## Electrical Characteristics

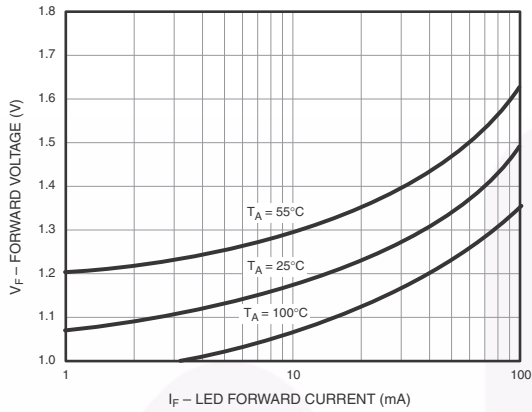
$T_A = 25^\circ\text{C}$  unless otherwise specified.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>EMITTER</b>						
$V_F$	Input Forward Voltage	$I_F = 1.0 \text{ mA}$		1.08	1.3	V
$I_R$	Reverse Leakage Current	$V_R = 6.0 \text{ V}$		0.001	100	$\mu\text{A}$
$C_{IN}$	Input Capacitance			18		pF
<b>DETECTOR</b>						
$I_{CEO1}$	Collector-Emitter Dark Current	$V_{CE} = 5.0 \text{ V}, T_A = 25^\circ\text{C}$		1.0	50	nA
$I_{CEO2}$		$V_{CE} = 5.0 \text{ V}, T_A = 100^\circ\text{C}$		1.0		$\mu\text{A}$
$BV_{CEO}$	Collector-Emitter Breakdown Voltage	$I_C = 100 \mu\text{A}$	30	100		V
$BV_{CBO}$	Collector-Base Breakdown Voltage	$I_C = 100 \mu\text{A}$	70	120		V
$BV_{ECO}$	Emitter-Collector Breakdown Voltage	$I_E = 100 \mu\text{A}$	7	10		V
$C_{CE}$	Collector-Emitter Capacitance	$f = 1.0 \text{ MHz}, V_{CE} = 0$		5.5		pF
<b>COUPLED</b>						
CTR	Current Transfer Ratio	$I_F = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V}$	500	1000		%
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 500 \mu\text{A}, I_F = 1.0 \text{ mA}$			1.0	V
$t_{on}$	Turn-On Time	$I_F = 5.0 \text{ mA}, V_{CC} = 10 \text{ V}, R_L = 100 \Omega$ (Figure 8)		10		$\mu\text{s}$
$t_{off}$	Turn-Off Time	$I_F = 5.0 \text{ mA}, V_{CC} = 10 \text{ V}, R_L = 100 \Omega$ (Figure 8)		125		ns
$t_r$	Rise Time	$I_F = 5.0 \text{ mA}, V_{CC} = 10 \text{ V}, R_L = 100 \Omega$ (Figure 8)		8		$\mu\text{s}$
$t_f$	Fall Time	$I_F = 5.0 \text{ mA}, V_{CC} = 10 \text{ V}, R_L = 100 \Omega$ (Figure 8)		110		$\mu\text{s}$

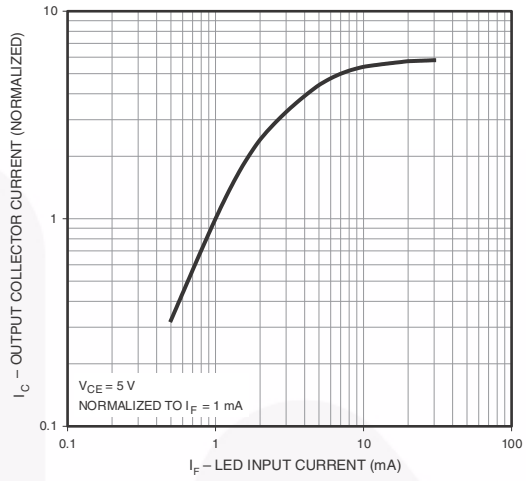
## Isolation Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
$V_{ISO}$	Input-Output Isolation Voltage	$t = 1 \text{ Minute}$	2500			$V_{AC_{RMS}}$
$C_{ISO}$	Isolation Capacitance	$V_{I-O} = 0 \text{ V}, f = 1 \text{ MHz}$		0.2		pF
$R_{ISO}$	Isolation Resistance	$V_{I-O} = \pm 500 \text{ VDC}, T_A = 25^\circ\text{C}$	$10^{11}$			$\Omega$

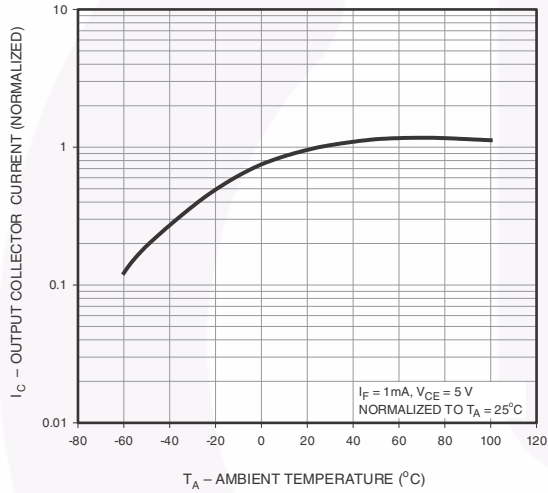
### Typical Performance Curves



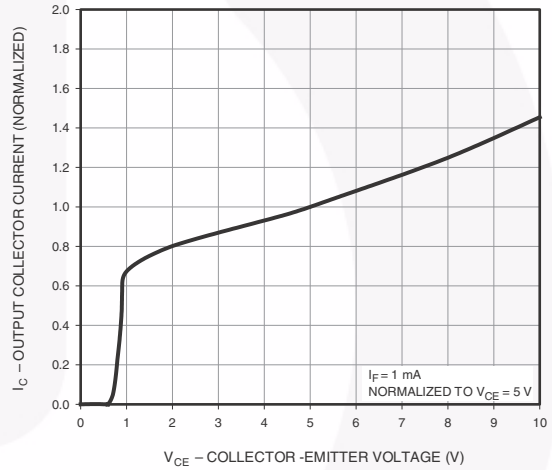
**Figure 3. LED Forward Voltage vs. Forward Current**



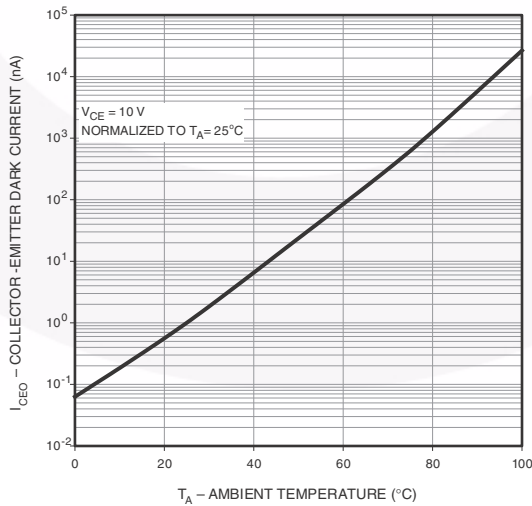
**Figure 4. Output Current vs. Input Current**



**Figure 5. Output Current vs. Ambient Temperature**



**Figure 6. Output Current vs. Collector - Emitter Voltage**



**Figure 7. Dark Current vs. Ambient Temperature**

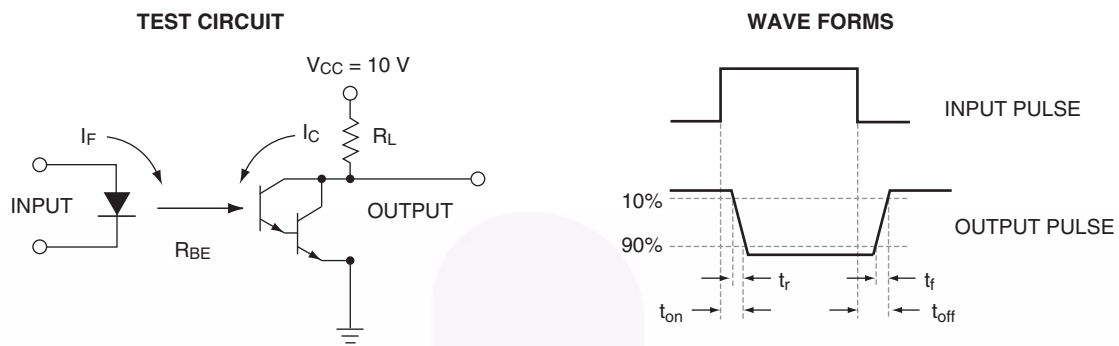


Figure 8. Switching Time Test Circuit and Waveform



### Reflow Profile

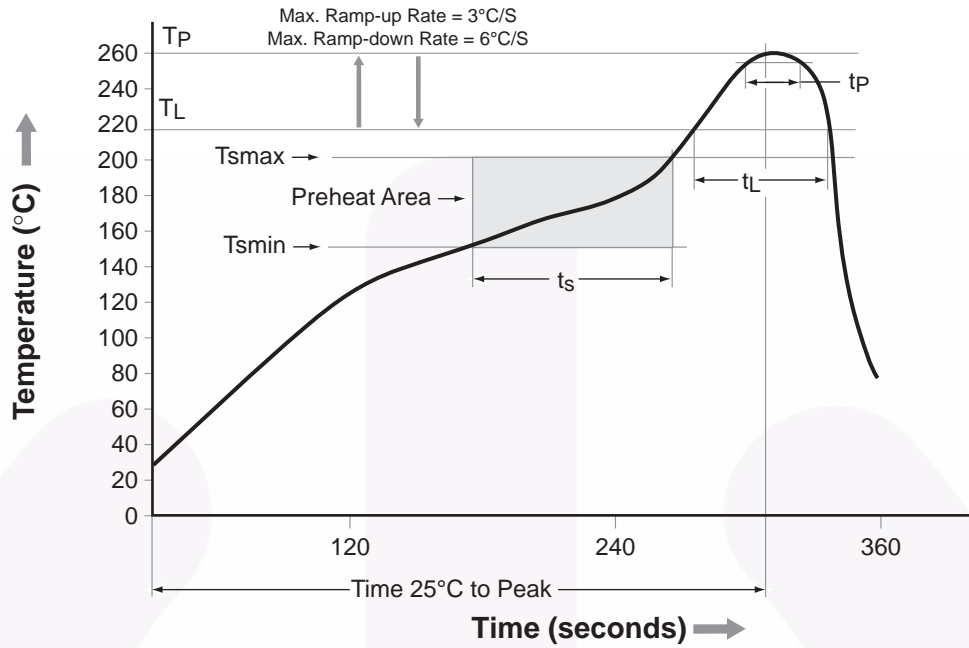


Figure 9. Reflow Profile

Profile Feature	Pb-Free Assembly Profile
Temperature Minimum ( $T_{smin}$ )	150°C
Temperature Maximum ( $T_{smax}$ )	200°C
Time ( $t_s$ ) from ( $T_{smin}$ to $T_{smax}$ )	60–120 seconds
Ramp-up Rate ( $t_L$ to $t_P$ )	3°C/second maximum
Liquidous Temperature ( $T_L$ )	217°C
Time ( $t_L$ ) Maintained Above ( $T_L$ )	60–150 seconds
Peak Body Package Temperature	260°C +0°C / -5°C
Time ( $t_P$ ) within 5°C of 260°C	30 seconds
Ramp-down Rate ( $T_P$ to $T_L$ )	6°C/second maximum
Time 25°C to Peak Temperature	8 minutes maximum



## Ordering Information

Part Number	Package	Packing Method
MOC223M	Small Outline 8-Pin	Tube (100 Units)
MOC223R2M	Small Outline 8-Pin	Tape and Reel (2500 Units)
MOC223VM	Small Outline 8-Pin, DIN EN/IEC60747-5-5 Option	Tube (100 Units)
MOC223R2VM	Small Outline 8-Pin, DIN EN/IEC60747-5-5 Option	Tape and Reel (2500 Units)
MOCD223M	Small Outline 8-Pin	Tube (100 Units)
MOCD223R2M	Small Outline 8-Pin	Tape and Reel (2500 Units)
MOCD223VM	Small Outline 8-Pin, DIN EN/IEC60747-5-5 Option	Tube (100 Units)
MOCD223R2VM	Small Outline 8-Pin, DIN EN/IEC60747-5-5 Option	Tape and Reel (2500 Units)

## Marking Information

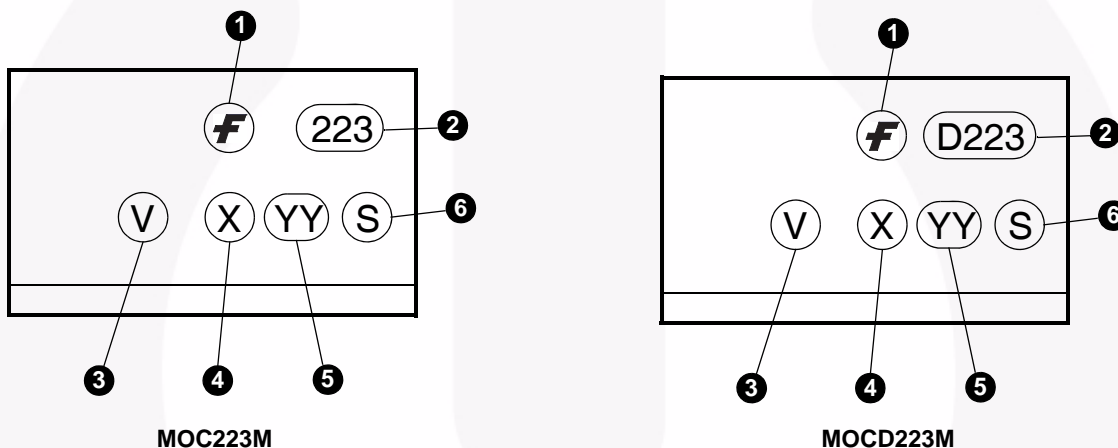


Figure 10. Top Marks

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., "4"
5	Digit Work Week, Ranging from "01" to "53"
6	Assembly Package Code



NOTES:

- A) NO STANDARD APPLIES TO THIS PACKAGE
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
- D) LANDPATTERN STANDARD: SOIC127P600X175-8M.
- E) DRAWING FILENAME: MKT-M08Erev5



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