

# MOC223M

## Small Outline Optocouplers Darlington Output

### Features

- U.L. Recognized (File #E90700, Volume 2)
- VDE Recognized (File #136616) (add option "V" for VDE approval, i.e., MOC223VM)
- Industry Standard SOIC-8 Surface Mountable Package with 0.050" Lead Spacing
- High Current Transfer Ratio of 500% Minimum at  $I_F = 1 \text{ mA}$
- Standard SOIC-8 Footprint, with 0.050" Lead Spacing
- High Input-Output Isolation Voltage of 2500  $V_{AC(rms)}$  Guaranteed

### 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. It is ideally suited for high density applications, and eliminates the need for through the board mounting.

### Schematic

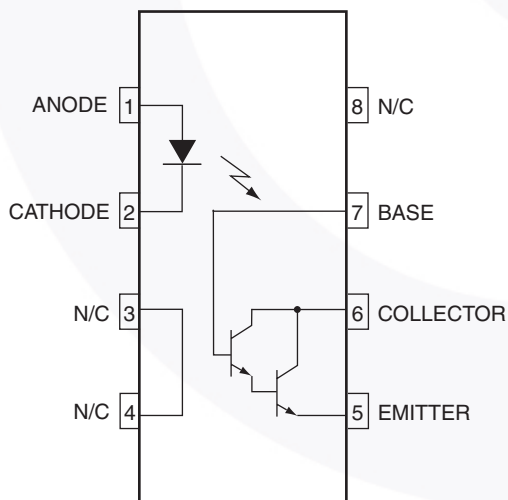


Figure 1. Schematic

### Package Outline

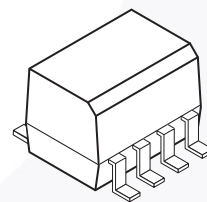


Figure 2. Package Outline

## 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>Emitter</b>			
$I_F$	Forward Current – Continuous	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 @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	90 0.8	mW mW/ $^\circ\text{C}$
<b>Detector</b>			
$V_{CEO}$	Collector-Emitter Voltage	30	V
$V_{ECO}$	Emitter-Collector Voltage	7.0	V
$V_{CBO}$	Collector-Base Voltage	70	V
$I_C$	Collector Current-Continuous	150	mA
$P_D$	Detector Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	150 1.76	mW mW/ $^\circ\text{C}$
<b>Total Device</b>			
$V_{ISO}$	Input-Output Isolation Voltage (f = 60 Hz, t = 1 minute)	2500	Vac(rms)
$P_D$	Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	250 2.94	mW mW/ $^\circ\text{C}$
$T_A$	Ambient Operating Temperature Range	-40 to +100	$^\circ\text{C}$
$T_{stg}$	Storage Temperature Range	-40 to +150	$^\circ\text{C}$

## 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
$I_{CEO2}$		$V_{CE} = 5.0\text{ V}, T_A = 100^\circ\text{C}$		10		$\mu\text{A}$
$BV_{CEO}$	Collector-Emitter Breakdown Voltage	$I_C = 100\ \mu\text{A}$	30	100		V
$BV_{ECO}$	Emitter-Collector Breakdown Voltage	$I_E = 100\ \mu\text{A}$	7.0	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 <sup>(3)</sup>	$I_F = 1.0\text{ mA}, V_{CE} = 5.0\text{ V}$	500	1000		%
$V_{ISO}$	Isolation Surge Voltage <sup>(1)(2)</sup>	$f = 60\text{ Hz AC Peak}, t = 1\text{ minute}$	2500			Vac(rms)
$R_{ISO}$	Isolation Resistance <sup>(2)</sup>	$V = 500\text{ V}$	$10^{11}$			$\Omega$
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 500\ \mu\text{A}, I_F = 1.0\text{ mA}$			1.0	V
$C_{ISO}$	Isolation Capacitance <sup>(2)</sup>	$V_{I-O} = 0\text{ V}, f = 1\text{ MHz}$		0.2		pF
$t_{on}$	Turn-On Time	$I_F = 5.0\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\ \Omega$ (Fig. 8)		10		$\mu\text{s}$
$t_{off}$	Turn-Off Time	$I_F = 5.0\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\ \Omega$ (Fig. 8)		125		ns
$t_r$	Rise Time	$I_F = 5.0\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\ \Omega$ (Fig. 8)		8		$\mu\text{s}$
$t_f$	Fall Time	$I_F = 5.0\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\ \Omega$ (Fig. 8)		110		$\mu\text{s}$

\*All typicals at  $T_A = 25^\circ\text{C}$

### Notes:

1. Isolation Surge Voltage,  $V_{ISO}$ , is an internal device dielectric breakdown rating.
2. For this test, pins 1 and 2 are common and pins 5, 6 and 7 are common.
3. Current Transfer Ratio (CTR) =  $I_C / I_F \times 100\%$ .

### Typical Performance Curves

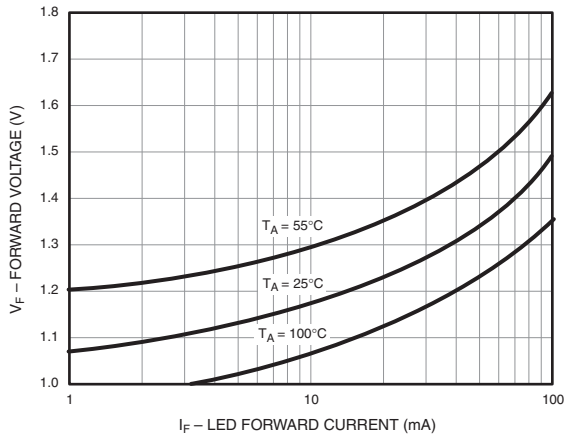


Figure 3. LED Forward Voltage vs. Forward Current

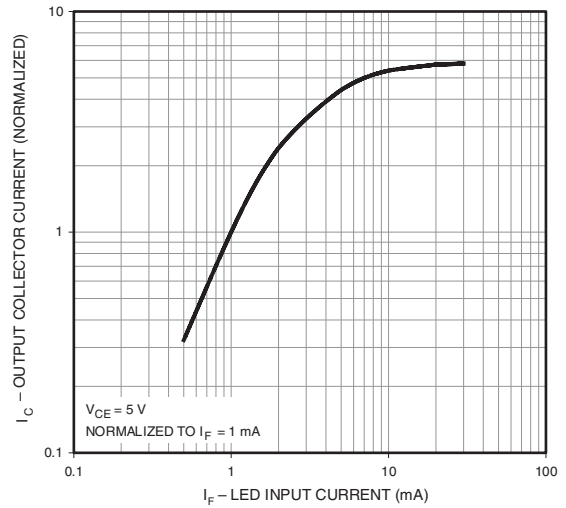


Figure 4. Output Current vs. Input Current

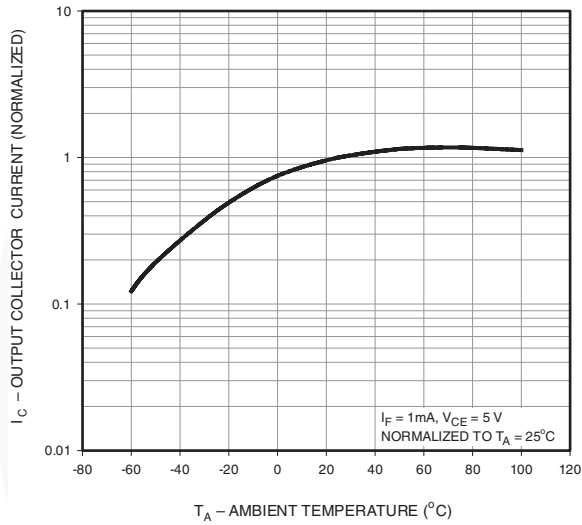


Figure 5. Output Current vs. Ambient Temperature

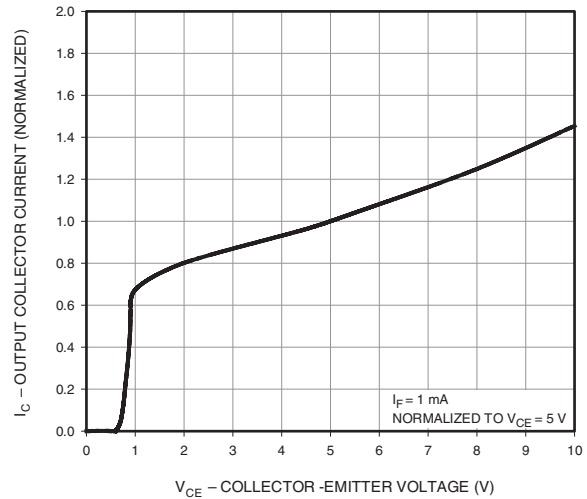


Figure 6. Output Current vs. Collector - Emitter Voltage

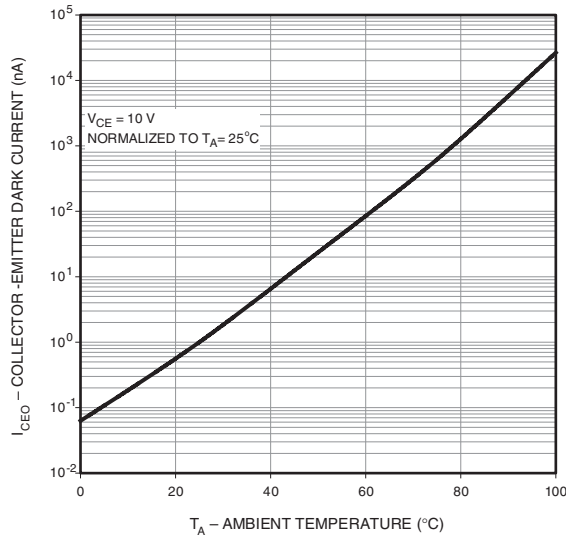


Figure 7. Dark Current vs. Ambient Temperature

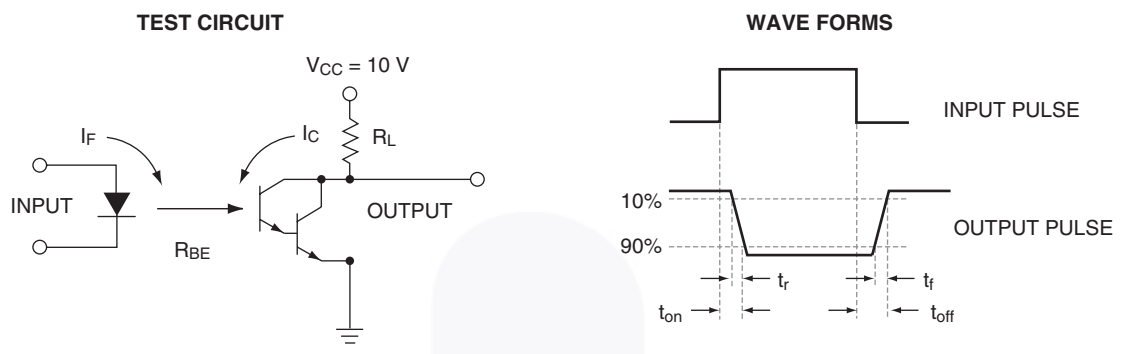
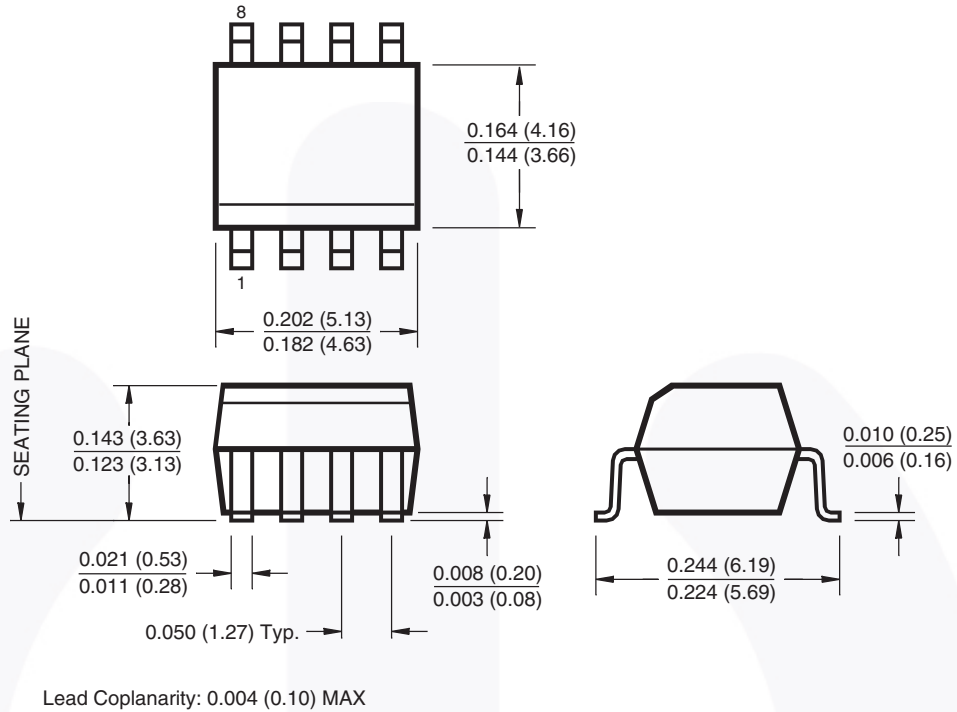


Figure 8. Switching Time Test Circuit and Waveform

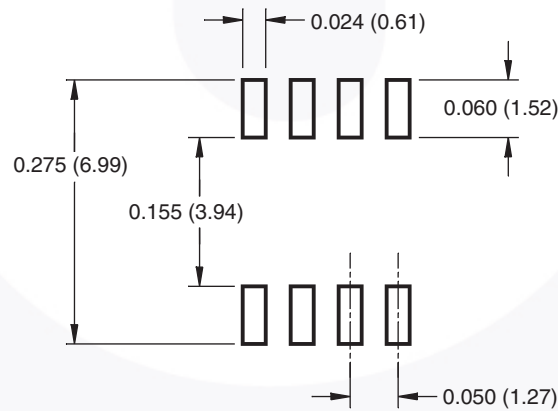


## Package Dimensions

### 8-pin SOIC Surface Mount



### Recommended Pad Layout



Dimensions in inches (mm).

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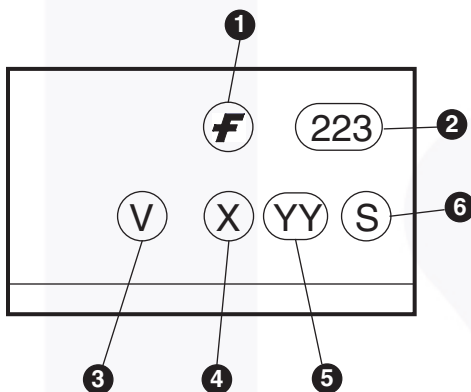
Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

<http://www.fairchildsemi.com/packaging/>

### Ordering Information

Option	Order Entry Identifier	Description
V	V	VDE 0884
R2	R2	Tape and Reel (2500 units per reel)
R2V	R2V	VDE 0884, Tape and Reel (2500 units per reel)

### Marking Information

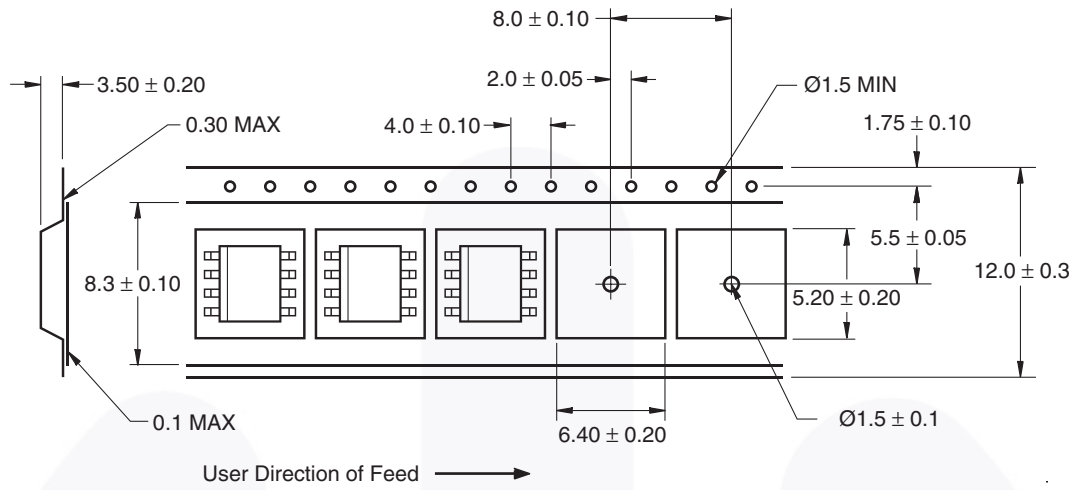


#### Definitions

1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One digit year code, e.g., '3'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

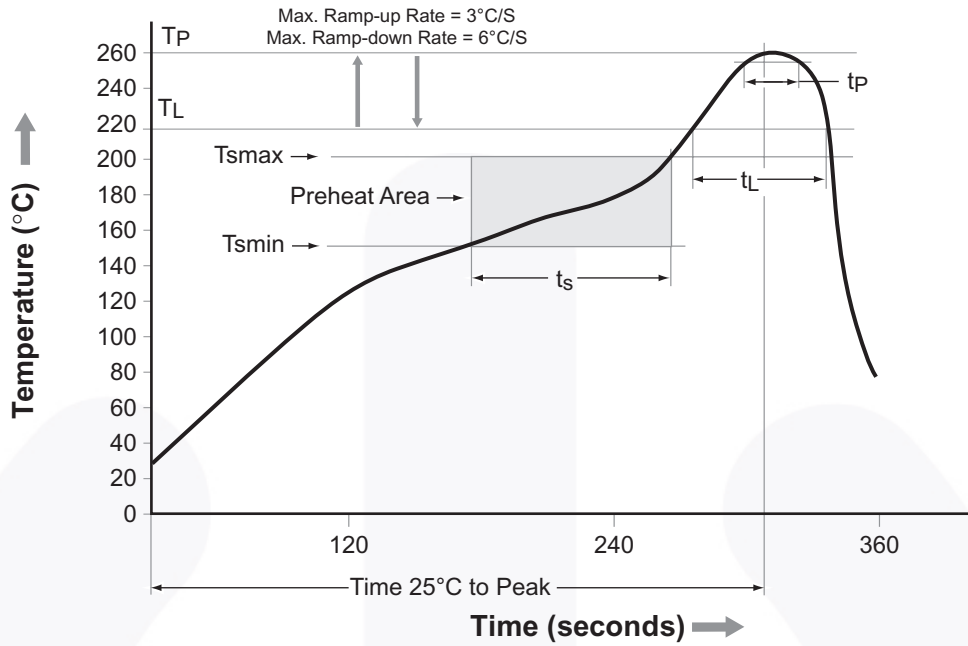
\*Note – 'V' option parts marked with date code '325' or earlier are marked in portrait format.

### Carrier Tape Specifications





## Reflow Profile





Profile Feature	Pb-Free Assembly Profile
Temperature Minimum (T <sub>smín</sub> )	150°C
Temperature Maximum (T <sub>smáx</sub> )	200°C
Time (t <sub>s</sub> ) from (T <sub>smín</sub> to T <sub>smáx</sub> )	60–120 seconds
Ramp-up Rate (t <sub>L</sub> to t <sub>p</sub> )	3°C/second maximum
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 maximum
Time 25°C to Peak Temperature	8 minutes maximum



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| BitSiC™   | Global Power Resource™                         | Programmable Active Droop™  | TinyBuck™   |
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Rev. I64

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