

# MOC211M, MOC212M, MOC213M

## Small Outline Optocouplers Transistor Output

### Features

- UL recognized (File #E90700, Volume 2)
- VDE recognized (File #136616) (add option 'V' for VDE approval, e.g., MOC211VM)
- Convenient plastic SOIC-8 surface mountable package style
- Standard SOIC-8 footprint, with 0.050" lead spacing
- Compatible with dual wave, vapor phase and IR reflow soldering
- High input-output isolation of 2500 V<sub>AC(rms)</sub> guaranteed
- Minimum BV<sub>CEO</sub> of 30V guaranteed

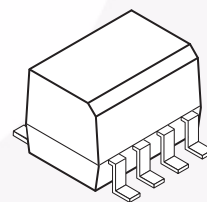
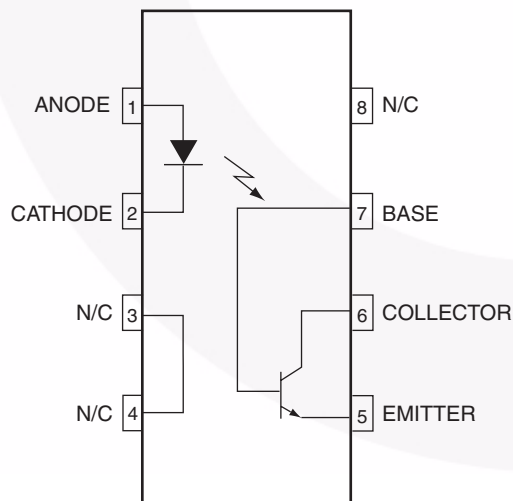
### Applications

- General purpose switching circuits
- Interfacing and coupling systems of different potentials and impedances
- Regulation feedback circuits
- Monitor and detection circuits

### Description

These devices consist of a gallium arsenide infrared emitting diode optically coupled to a monolithic silicon phototransistor detector, in a surface mountable, small outline, plastic package. They are ideally suited for high density applications, and eliminate the need for through-board mounting.

### Schematic



**Absolute Maximum Ratings** ( $T_A = 25^\circ\text{C}$  Unless otherwise specified)

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	Rating	Value	Unit
<b>EMITTER</b>			
$I_F$	Forward Current – Continuous	60	mA
$I_F$ (pk)	Forward Current – Peak (PW = 100 $\mu$ s, 120pps)	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	mW
		0.8	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	mW
		1.76	mW/ $^\circ\text{C}$
<b>TOTAL DEVICE</b>			
$V_{ISO}$	Input-Output Isolation Voltage (f = 60Hz, t = 1 min.) <sup>(1)(2)(3)</sup>	2500	Vac(rms)
$P_D$	Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	250	mW
		2.94	mW/ $^\circ\text{C}$
$T_A$	Ambient Operating Temperature Range	-40 to +100	$^\circ\text{C}$
$T_{stg}$	Storage Temperature Range	-40 to +150	$^\circ\text{C}$
$T_L$	Lead Soldering Temperature (1/16" from case, 10 sec. duration)	260	$^\circ\text{C}$

**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.  $V_{ISO}$  rating of 2500  $V_{AC(rms)}$  for t = 1 min. is equivalent to a rating of 3,000  $V_{AC(rms)}$  for t = 1 sec.

**Electrical Characteristics** ( $T_A = 25^\circ\text{C}$  unless otherwise specified)

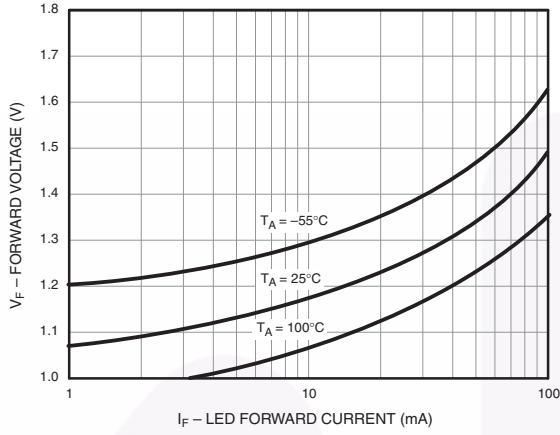
Symbol	Parameter	Test Conditions	Min.	Typ.*	Max.	Unit
<b>EMITTER</b>						
$V_F$	Input Forward Voltage	$I_F = 10\text{mA}$		1.15	1.5	V
$I_R$	Reverse Leakage Current	$V_R = 6.0\text{V}$		0.001	100	$\mu\text{A}$
$C_{IN}$	Input Capacitance			18		pF
<b>DETECTOR</b>						
$I_{CEO1}$ $I_{CEO2}$	Collector-Emitter Dark Current	$V_{CE} = 10\text{V}, T_A = 25^\circ\text{C}$ $V_{CE} = 10\text{V}, T_A = 100^\circ\text{C}$		1.0 1.0	50	nA $\mu\text{A}$
$BV_{CEO}$	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	$f = 1.0\text{MHz}, V_{CE} = 0$		7.0		pF
<b>COUPLED</b>						
CTR	Collector-Output Current <sup>(4)</sup> MOC211M MOC212M MOC213M	$I_F = 10\text{mA}, V_{CE} = 10\text{V}$	20 50 100			%
$V_{ISO}$	Isolation Surge Voltage <sup>(1)(2)(3)</sup>	$f = 60\text{ Hz AC Peak}, t = 1\text{ min.}$	2500			Vac(rms)
$R_{ISO}$	Isolation Resistance <sup>(2)</sup>	$V = 500\text{V}$	$10^{11}$			$\Omega$
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 2.0\text{mA}, I_F = 10\text{mA}$			0.4	V
$C_{ISO}$	Isolation Capacitance <sup>(2)</sup>	$V = 0\text{V}, f = 1\text{MHz}$		0.2		pF
$t_{on}$	Turn-On Time	$I_C = 2.0\text{mA}, V_{CC} = 10\text{V}, R_L = 100\Omega$ (Fig. 10)		7.5		$\mu\text{s}$
$t_{off}$	Turn-Off Time	$I_C = 2.0\text{mA}, V_{CC} = 10\text{V}, R_L = 100\Omega$ (Fig. 10)		5.7		$\mu\text{s}$
$t_r$	Rise Time	$I_C = 2.0\text{mA}, V_{CC} = 10\text{V}, R_L = 100\Omega$ (Fig. 10)		3.2		$\mu\text{s}$
$t_f$	Fall Time	$I_C = 2.0\text{mA}, V_{CC} = 10\text{V}, R_L = 100\Omega$ (Fig. 10)		4.7		$\mu\text{s}$

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

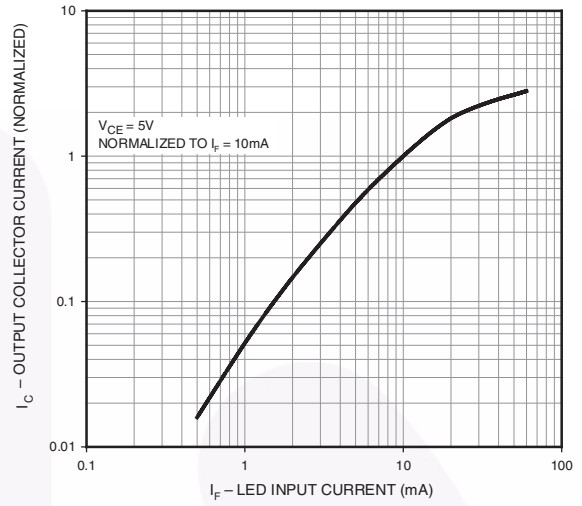
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2. For this test, Pins 1 and 2 are common and Pins 5, 6 and 7 are common.
3.  $V_{ISO}$  rating of 2500  $V_{AC(rms)}$  for  $t = 1\text{ min.}$  is equivalent to a rating of 3,000  $V_{AC(rms)}$  for  $t = 1\text{ sec.}$
4. Current Transfer Ratio (CTR) =  $I_C/I_F \times 100\%$ .

## Typical Performance Curves

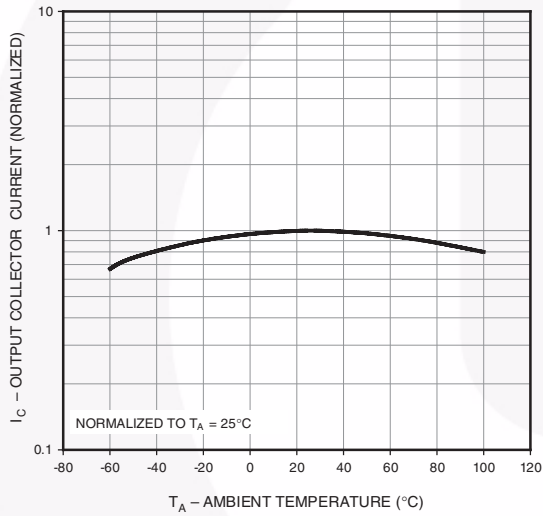
**Fig. 1 LED Forward Voltage vs. Forward Current**



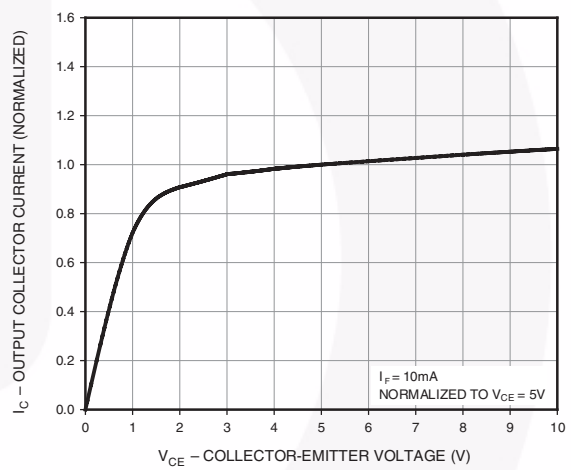
**Fig. 2 Output Current vs. Input Current**



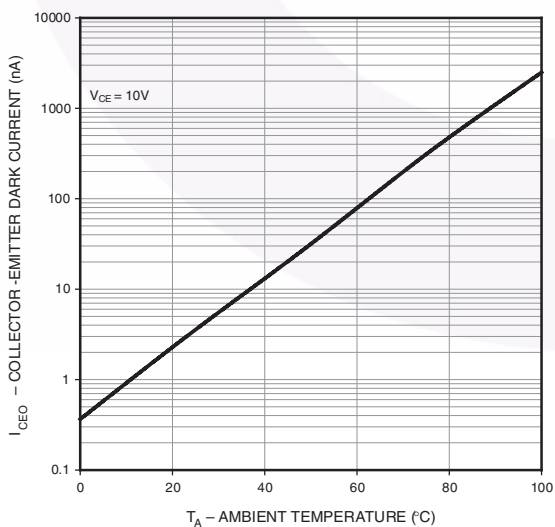
**Fig. 3 Output Current vs. Ambient Temperature**



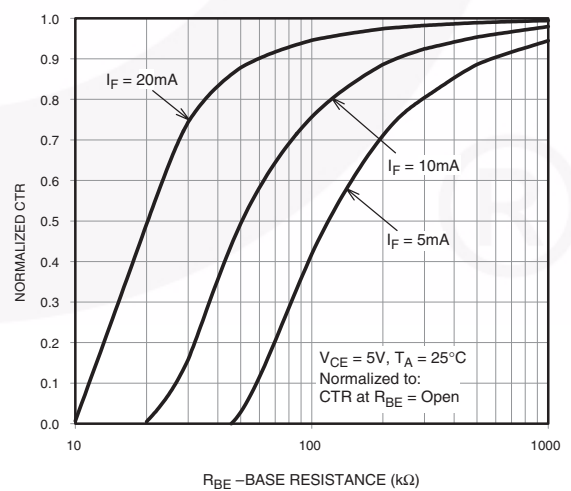
**Fig. 4 Output Current vs. Collector-Emitter Voltage**



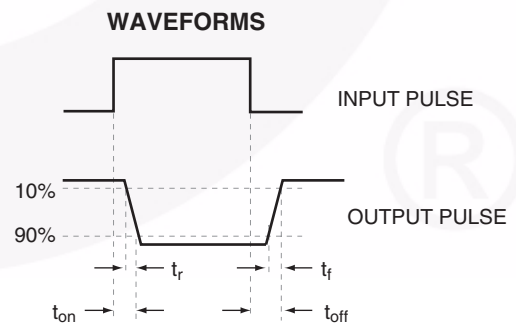
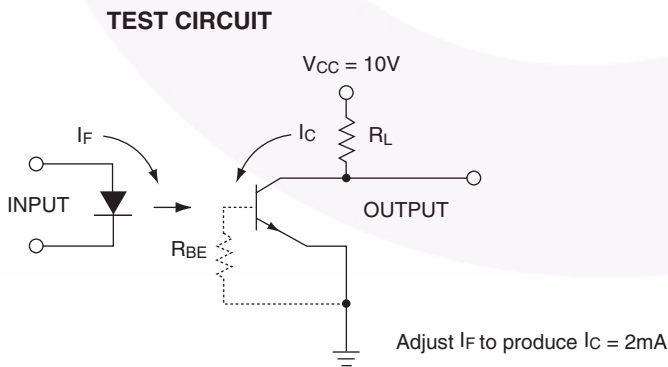
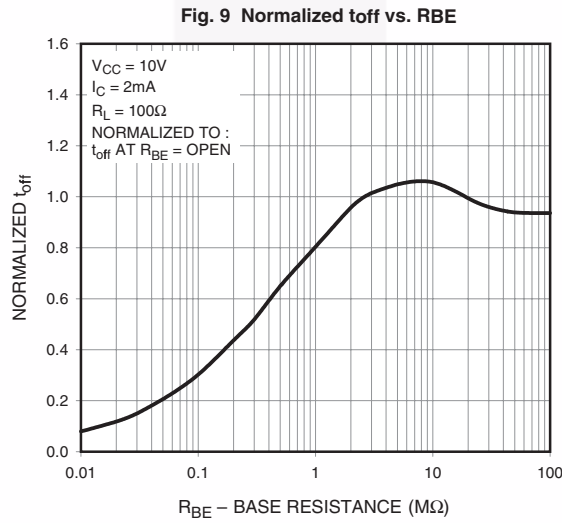
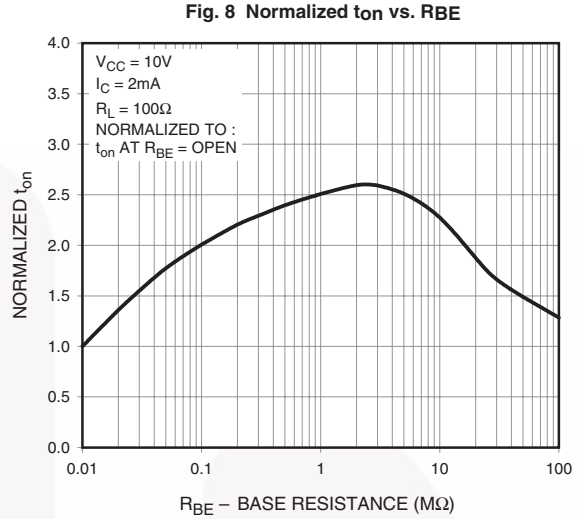
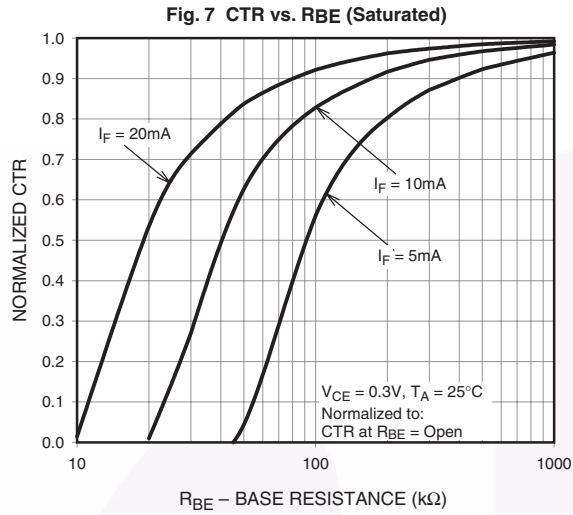
**Fig. 5 Dark Current vs. Ambient Temperature**



**Fig. 6 CTR vs. RBE (Unsaturated)**



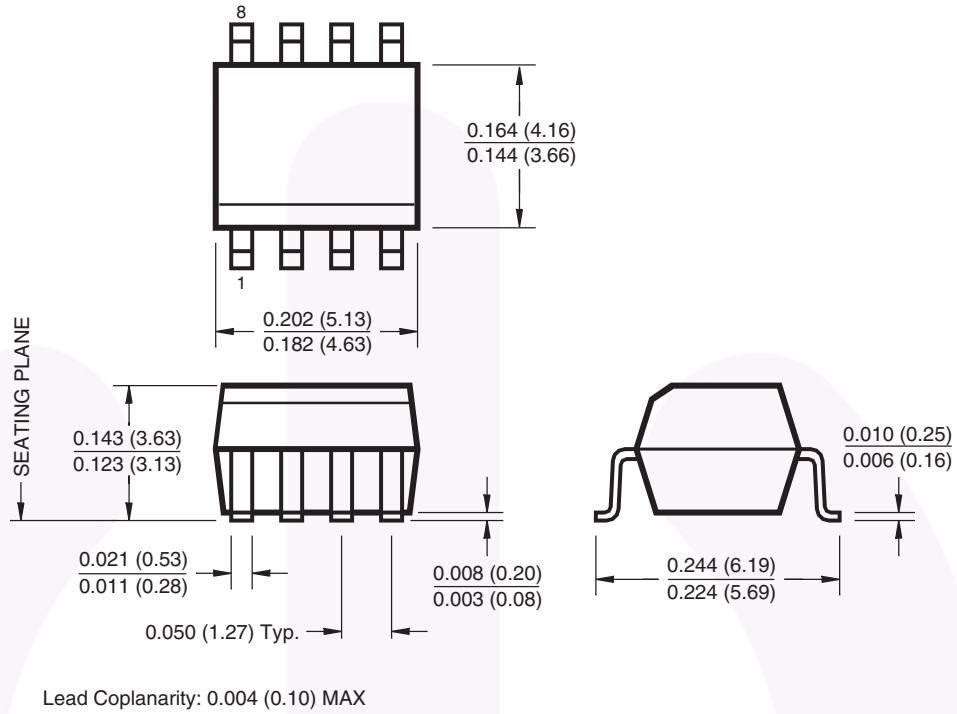
**Typical Performance Curves (Continued)**



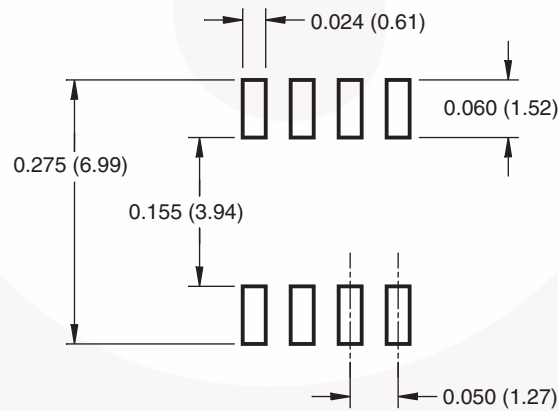
**Figure 10. Switching Time Test Circuit and Waveforms**

## Package Dimensions

### 8-pin SOIC Surface Mount



### Recommended Pad Layout



Dimensions in inches (mm).

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

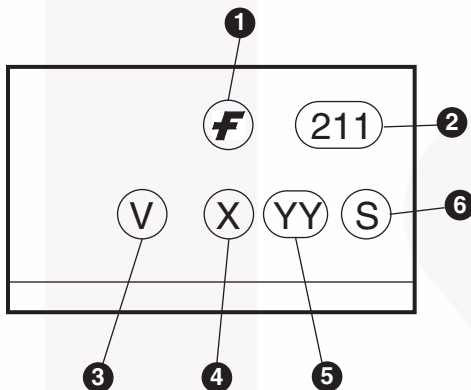
Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

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

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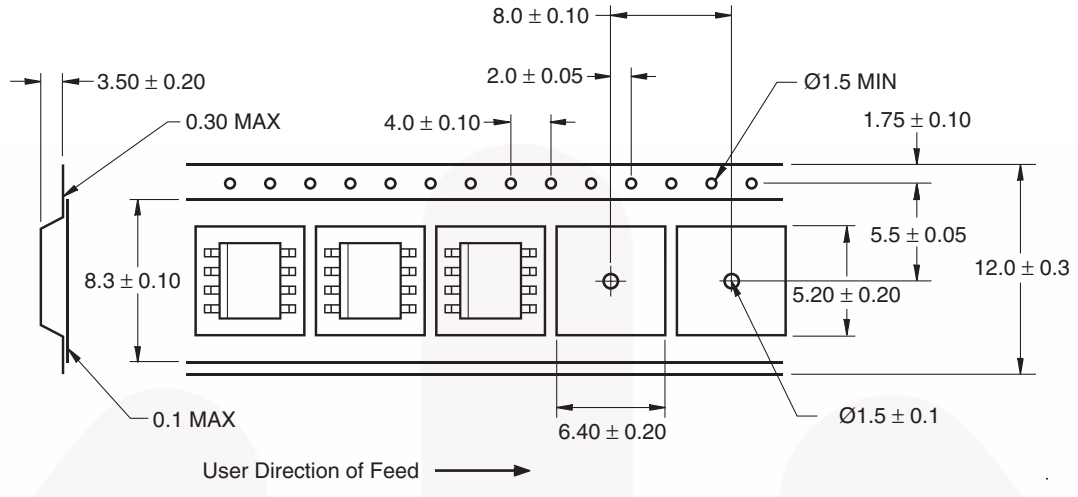
Option	Order Entry Identifier	Description
V	V	VDE 0884
R2	R2	Tape and reel (2500 units per reel)
R2V	R2V	VDE 0884, Tape and reel (2500 units per reel)

### Marking Information



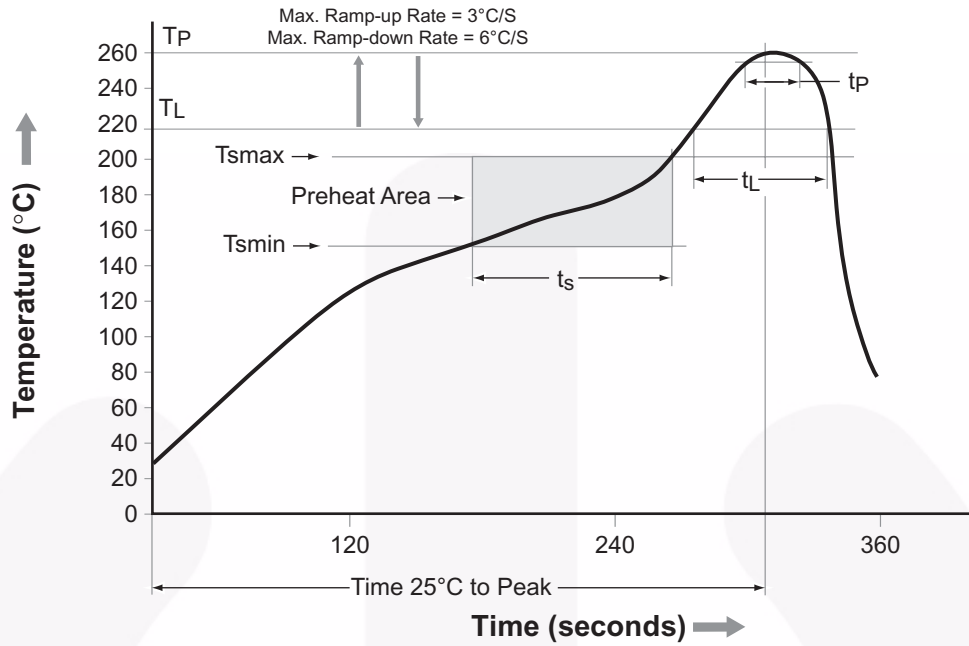
Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One digit year code, e.g., '8'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

### Carrier Tape Specifications





## Reflow Profile








Profile Feature	Pb-Free Assembly Profile
Temperature Min. (T <sub>smín</sub> )	150°C
Temperature Max. (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 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.



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