

# 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
- 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

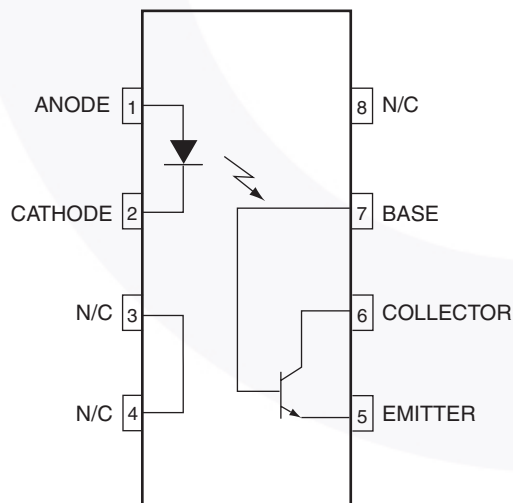


Figure 1. Schematic

### Package Outline

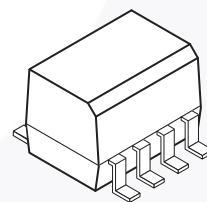


Figure 2. Package Outline

## 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	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 = 60 Hz, t = 1 minute) <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 second 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 minute is equivalent to a rating of 3,000  $V_{AC(rms)}$  for t = 1 second.

## 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	$I_C = 100\text{ }\mu\text{A}$	30	100		V
$BV_{ECO}$	Emitter-Collector Breakdown Voltage	$I_E = 100\text{ }\mu\text{A}$	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>	$f = 60\text{ Hz AC Peak}, t = 1\text{ minute}$	2500			Vac(rms)
$R_{ISO}$	Isolation Resistance <sup>(2)</sup>	$V = 500\text{ V}$	$10^{11}$			$\Omega$
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 2.0\text{ mA}, I_F = 10\text{ mA}$			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	$I_C = 2.0\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\text{ }\Omega$ (Fig. 12)		7.5		$\mu\text{s}$
$t_{off}$	Turn-Off Time	$I_C = 2.0\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\text{ }\Omega$ (Fig. 12)		5.7		$\mu\text{s}$
$t_r$	Rise Time	$I_C = 2.0\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\text{ }\Omega$ (Fig. 12)		3.2		$\mu\text{s}$
$t_f$	Fall Time	$I_C = 2.0\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\text{ }\Omega$ (Fig. 12)		4.7		$\mu\text{s}$

\*Typical values 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.  $V_{ISO}$  rating of  $2500\text{ V}_{AC(rms)}$  for  $t = 1\text{ minute}$  is equivalent to a rating of  $3,000\text{ V}_{AC(rms)}$  for  $t = 1\text{ second}$ .
4. Current Transfer Ratio (CTR) =  $I_C / I_F \times 100\%$ .

## Typical Performance Curves

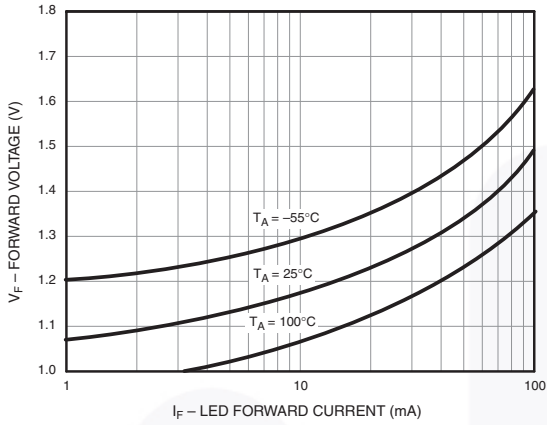


Figure 3. LED Forward Voltage vs. Forward Current

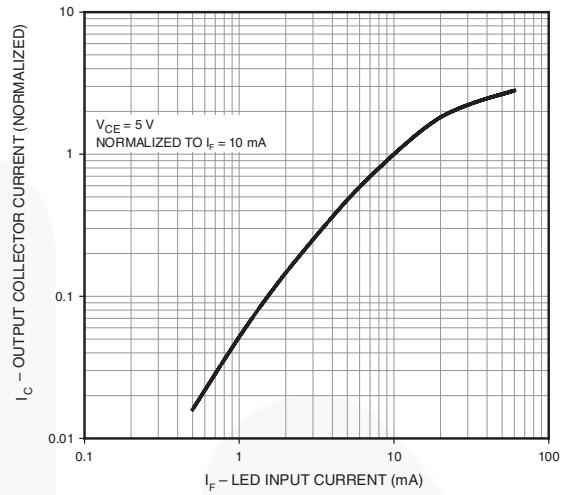


Figure 4. Output Current vs. Input Current

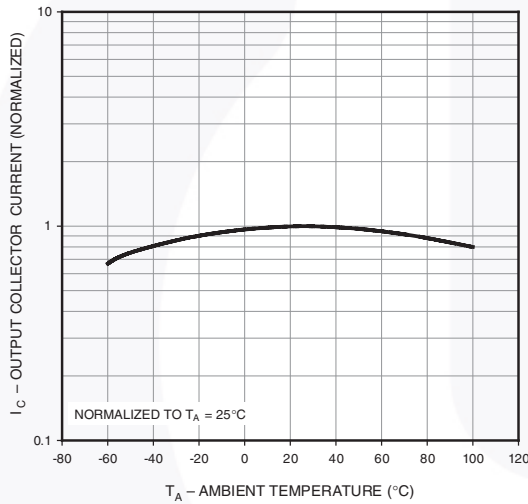


Figure 5. Output Current vs. Ambient Temperature

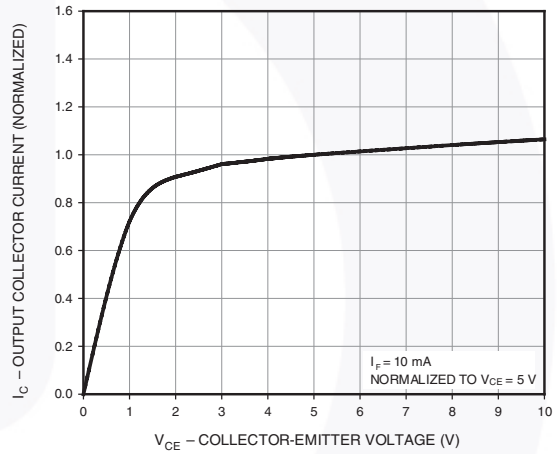


Figure 6. Output Current vs. Collector-Emitter Voltage

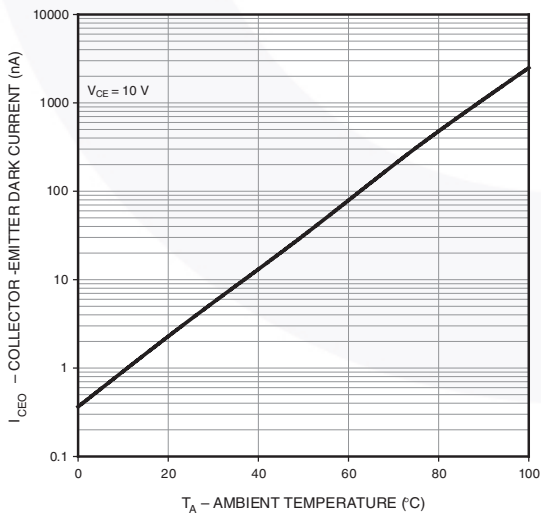


Figure 7. Dark Current vs. Ambient Temperature

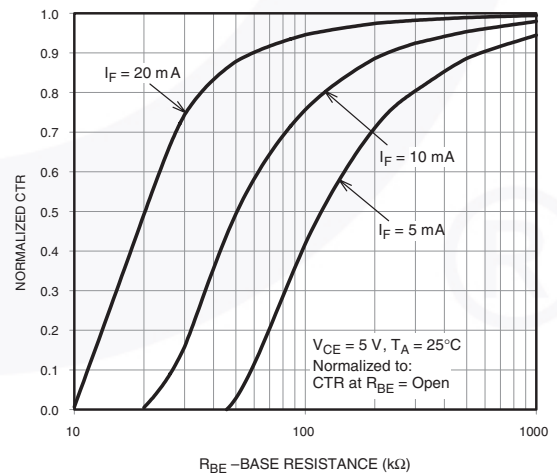
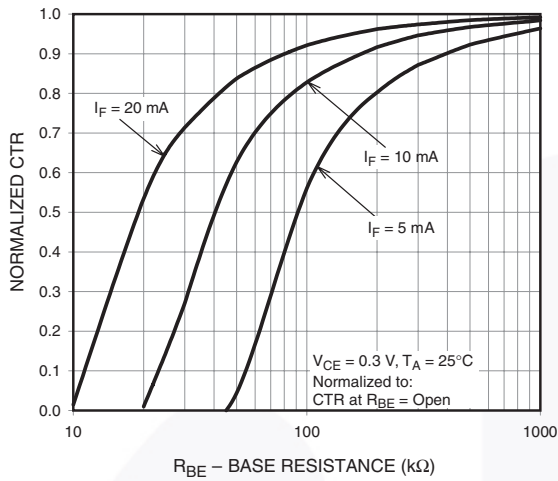
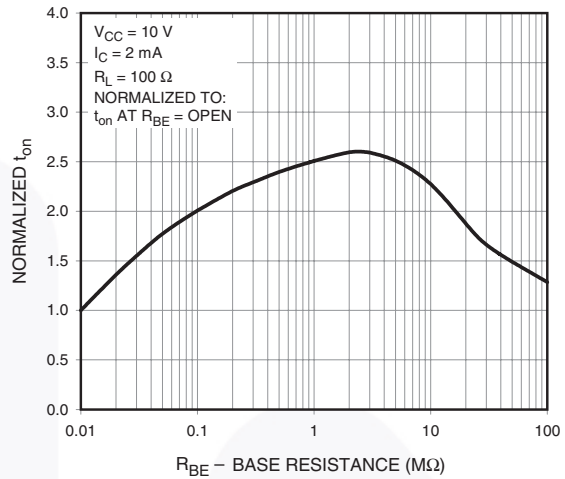


Figure 8. CTR vs. RBE (Unsatrated)

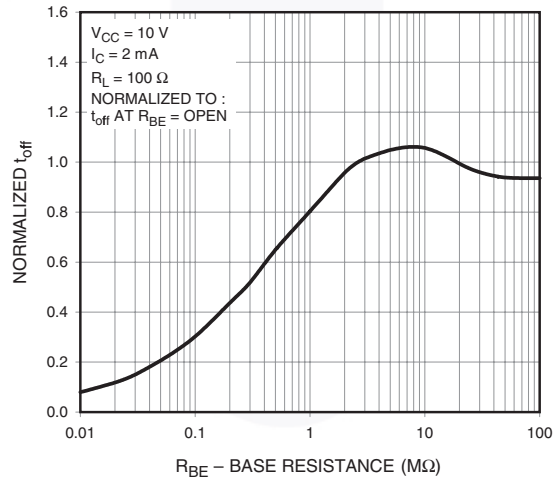
**Typical Performance Curves (Continued)**



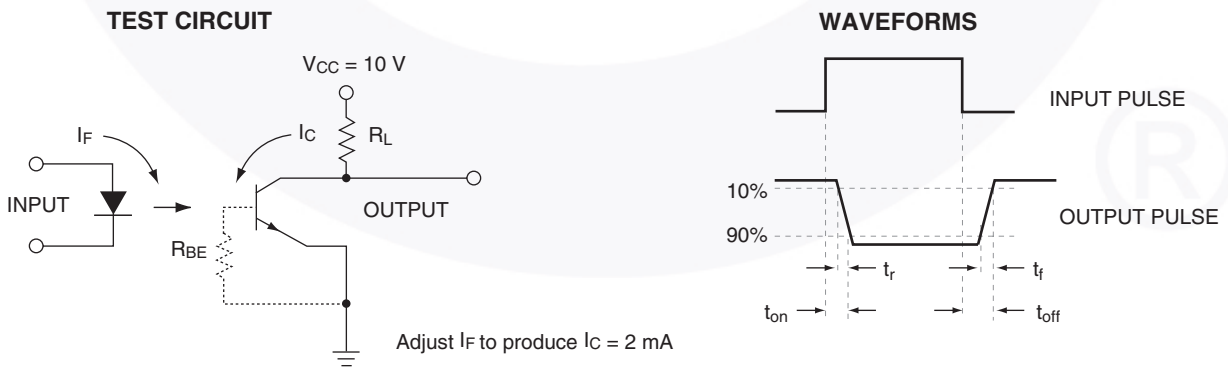
**Figure 9. CTR vs. RBE (Saturated)**



**Figure 10. Normalized  $t_{on}$  vs. RBE**



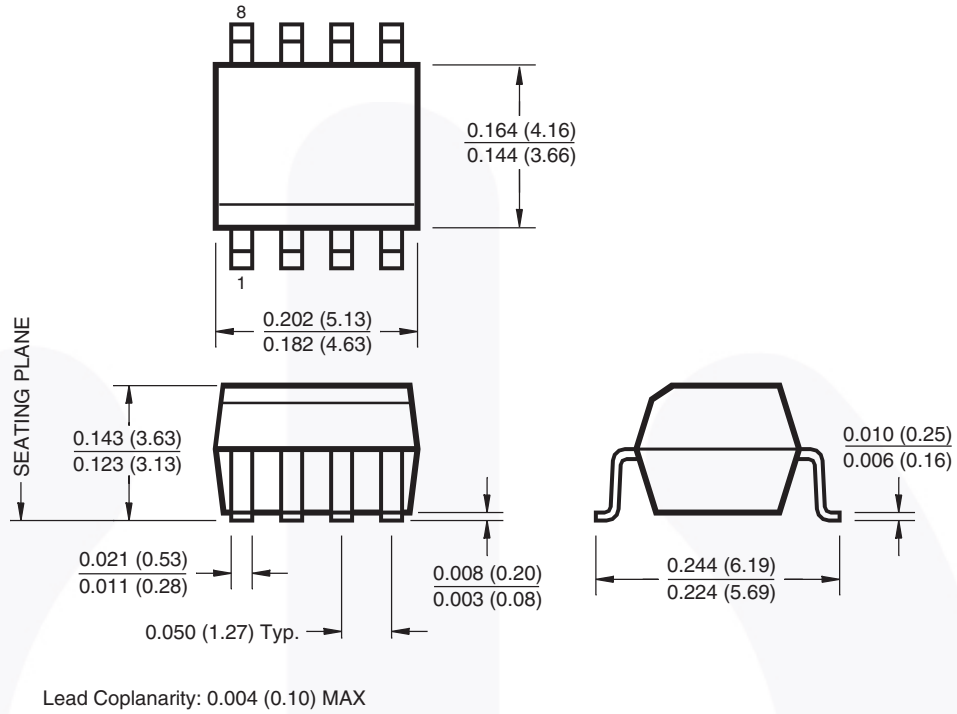
**Figure 11. Normalized  $t_{off}$  vs. RBE**



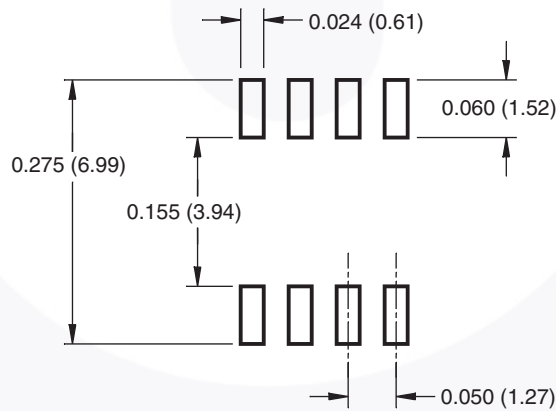
**Figure 12. Switching Time Test Circuit and Waveforms**

## Package Dimensions

### 8-pin SOIC Surface Mount



### Recommended Pad Layout



Dimensions in inches (mm).

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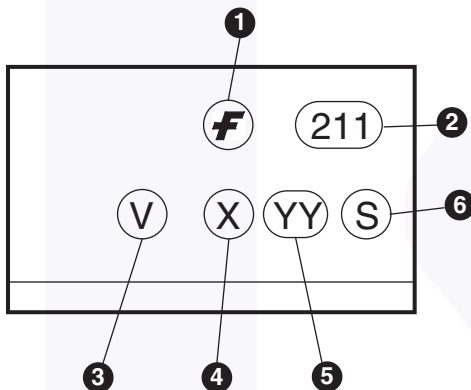
Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

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### 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)

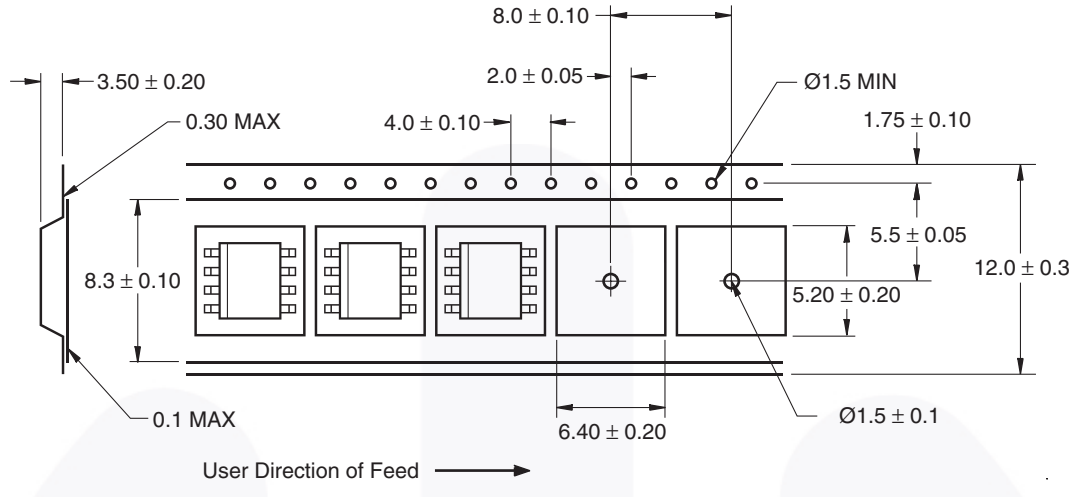
### Marking Information



#### Definitions

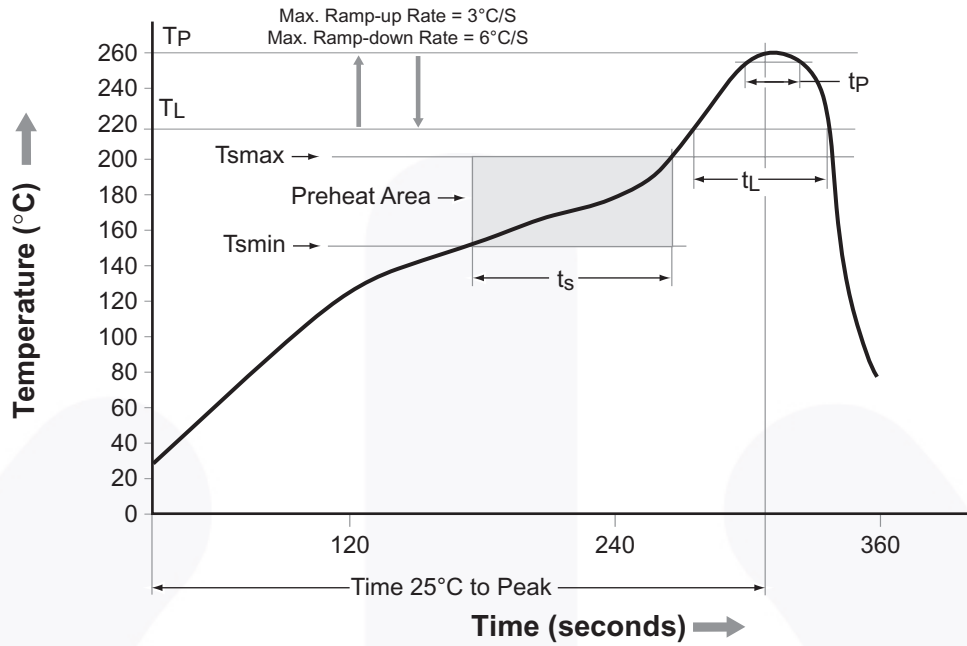
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One digit year code, e.g., '8'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

### Carrier Tape Specifications





### Reflow Profile


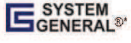




Profile Feature	Pb-Free Assembly Profile
Temperature Minimum (Tsmín)	150°C
Temperature Maximum (Tsmáx)	200°C
Time (ts) from (Tsmín to Tsmáx)	60–120 seconds
Ramp-up Rate (tL to tp)	3°C/second maximum
Liquidous Temperature (TL)	217°C
Time (tL) Maintained Above (TL)	60–150 seconds
Peak Body Package Temperature	260°C +0°C / -5°C
Time (tp) within 5°C of 260°C	30 seconds
Ramp-down Rate (TP to TL)	6°C/second maximum
Time 25°C to Peak Temperature	8 minutes maximum



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| Build it Now™   | GreenBridge™                                   | QS™   | TinyCalc™   |
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