

# MOC205M, MOC206M, MOC207M

## Small Outline Optocouplers Transistor Output

### Features

- U.L. Recognized (File #E90700, Volume 2)
- VDE Recognized (File #136616)  
(add option "V" for VDE approval, i.e., MOC205VM)
- Closely Matched Current Transfer Ratios
- Convenient Plastic SOIC-8 Surface Mountable Package Style
- Minimum  $BV_{CEO}$  of 70 V Guaranteed
- Standard SOIC-8 Footprint, with 0.050" Lead Spacing
- High Input-Output Isolation of 2500 V<sub>AC(rms)</sub> Guaranteed

### Applications

- Feedback Control Circuits
- Interfacing and Coupling Systems of Different Potentials and Impedances
- General Purpose Switching 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-the-board mounting.

### Schematic

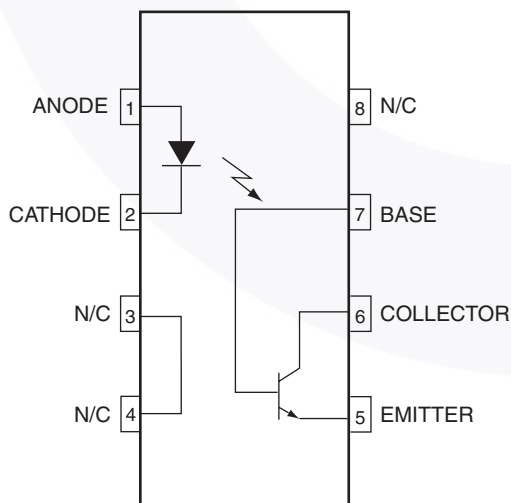


Figure 1. Schematic

### Package Outline

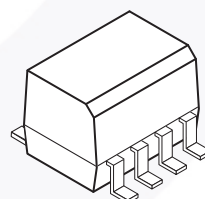


Figure 2. Package Outline

## 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     |
|---------------------|----------------------------------------------------------------------------------|-------------|----------|
| Emitter             |                                                                                  |             |          |
| I <sub>F</sub>      | Forward Current – Continuous                                                     | 60          | mA       |
| I <sub>F</sub> (pk) | Forward Current – Peak (PW = 100 μs, 120 pps)                                    | 1.0         | A        |
| V <sub>R</sub>      | Reverse Voltage                                                                  | 6.0         | V        |
| P <sub>D</sub>      | LED Power Dissipation @ T <sub>A</sub> = 25°C<br>Derate above 25°C               | 90          | mW       |
|                     |                                                                                  | 0.8         | mW/°C    |
| Detector            |                                                                                  |             |          |
| V <sub>CEO</sub>    | Collector-Emitter Voltage                                                        | 70          | V        |
| V <sub>ECO</sub>    | Emitter-Collector Voltage                                                        | 7.0         | V        |
| V <sub>CBO</sub>    | Collector-Base Voltage                                                           | 70          | V        |
| I <sub>C</sub>      | Collector Current-Continuous                                                     | 150         | mA       |
| P <sub>D</sub>      | Detector Power Dissipation @ T <sub>A</sub> = 25°C<br>Derate above 25°C          | 150         | mW       |
|                     |                                                                                  | 1.76        | mW/°C    |
| Total Device        |                                                                                  |             |          |
| V <sub>ISO</sub>    | Input-Output Isolation Voltage<br>(f = 60 Hz, t = 1 minute) <sup>(1)(2)(3)</sup> | 2500        | Vac(rms) |
| P <sub>D</sub>      | Total Device Power Dissipation @ T <sub>A</sub> = 25°C<br>Derate above 25°C      | 250         | mW       |
|                     |                                                                                  | 2.94        | mW/°C    |
| T <sub>A</sub>      | Ambient Operating Temperature Range                                              | -40 to +100 | °C       |
| T <sub>stg</sub>    | Storage Temperature Range                                                        | -40 to +150 | °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>          |                                                                          |                                                                                                   |                 |            |                  |                     |
| $I_{CEO1}$<br>$I_{CEO2}$ | Collector-Emitter Dark Current                                           | $V_{CE} = 10\text{ V}, T_A = 25^\circ\text{C}$<br>$V_{CE} = 10\text{ V}, T_A = 100^\circ\text{C}$ |                 | 1.0<br>1.0 | 50               | nA<br>$\mu\text{A}$ |
| $BV_{CEO}$               | Collector-Emitter Breakdown Voltage                                      | $I_C = 100\text{ }\mu\text{A}$                                                                    | 70              | 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><br>MOC205M<br>MOC206M<br>MOC207M | $I_F = 10\text{ mA}, V_{CE} = 10\text{ V}$                                                        | 40<br>63<br>100 |            | 80<br>125<br>200 | %                   |
| $V_{ISO}$                | Isolation Surge Voltage <sup>(1)(2)(3)</sup>                             | $f = 60\text{ Hz AC Peak},$<br>$t = 1\text{ minute}$                                              | 2500            |            |                  | Vac(rms)            |
| $R_{ISO}$                | Isolation Resistance <sup>(2)</sup>                                      | $V = 500\text{ V}$                                                                                | $10^{11}$       |            |                  | $\Omega$            |
| $V_{CE(sat)}$            | Collector-Emitter Saturation Voltage                                     | $I_C = 2\text{ mA}, I_F = 10\text{ mA}$                                                           |                 |            | 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                                                             | $I_C = 2.0\text{ mA}, V_{CC} = 10\text{ V},$<br>$R_L = 100\text{ }\Omega$ (Fig. 12)               |                 | 7.5        |                  | $\mu\text{s}$       |
| $t_{off}$                | Turn-Off Time                                                            | $I_C = 2.0\text{ mA}, V_{CC} = 10\text{ V},$<br>$R_L = 100\text{ }\Omega$ (Fig. 12)               |                 | 5.7        |                  | $\mu\text{s}$       |
| $t_r$                    | Rise Time                                                                | $I_C = 2.0\text{ mA}, V_{CC} = 10\text{ V},$<br>$R_L = 100\text{ }\Omega$ (Fig. 12)               |                 | 3.2        |                  | $\mu\text{s}$       |
| $t_f$                    | Fall Time                                                                | $I_C = 2.0\text{ mA}, V_{CC} = 10\text{ V},$<br>$R_L = 100\text{ }\Omega$ (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  $V_{AC(rms)}$  for  $t = 1\text{ minute}$  is equivalent to a rating of 3,000  $V_{AC(rms)}$  for  $t = 1\text{ second}$ .
4. Current Transfer Ratio (CTR) =  $I_C/I_F \times 100\%$ .

## Typical Performance Curves

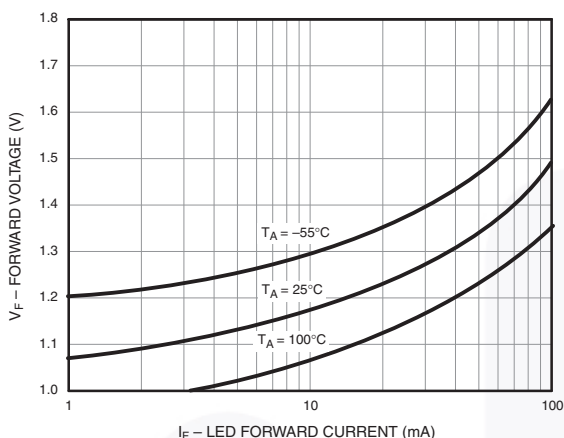


Figure 3. LED Forward Voltage vs. Forward Current

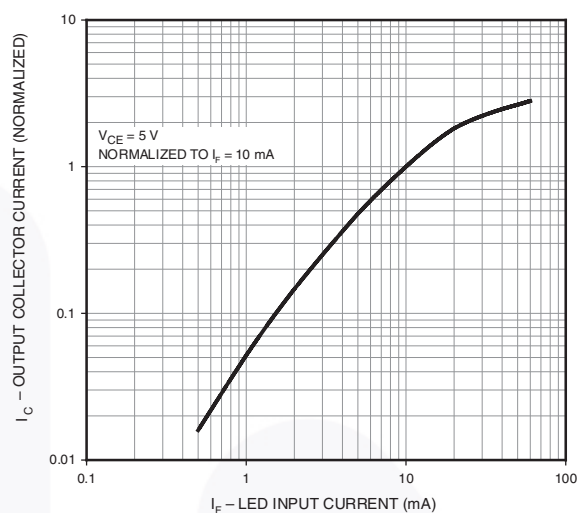


Figure 4. Output Current vs. Input Current

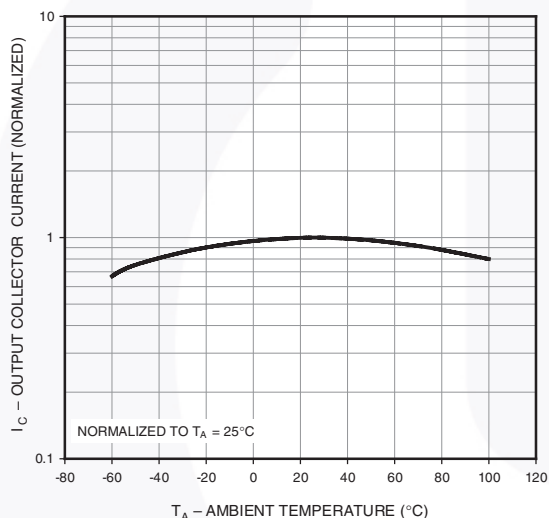


Figure 5. Output Current vs. Ambient Temperature

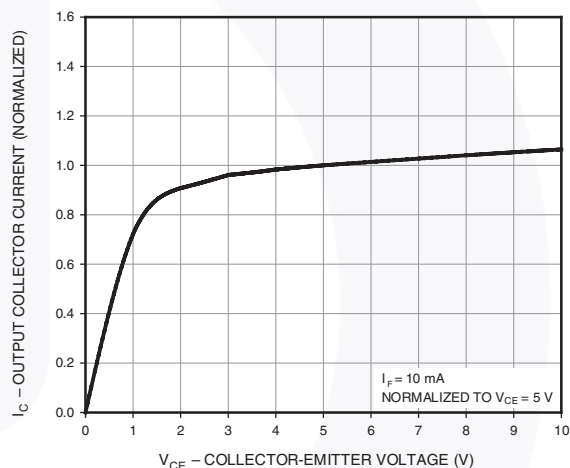


Figure 6. Output Current vs. Collector-Emitter Voltage

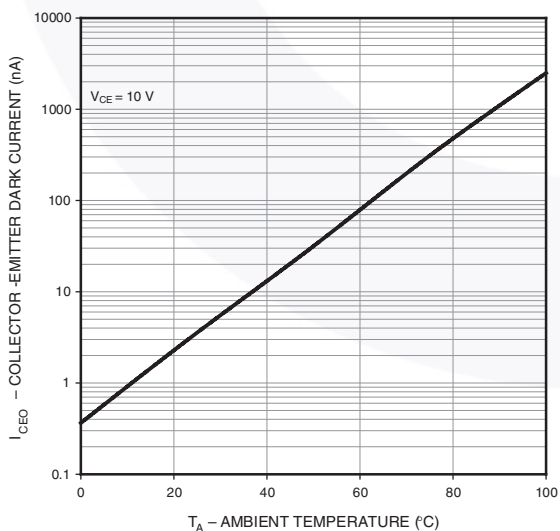


Figure 7. Dark Current vs. Ambient Temperature

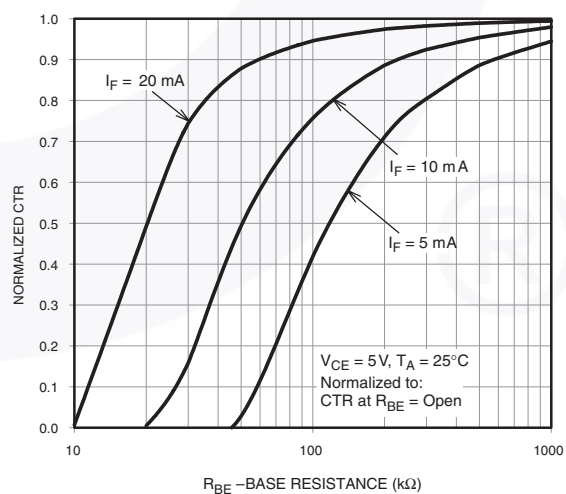


Figure 8. CTR vs. R\_BE (Unsaturated)

## Typical Performance Curves (Continued)

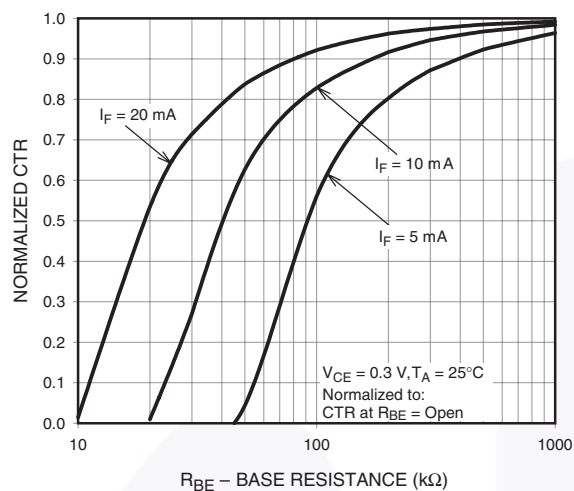


Figure 9. CTR vs.  $R_{BE}$  (Saturated)

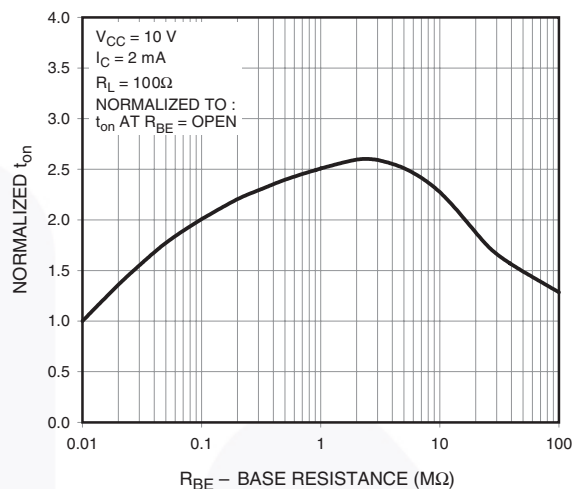


Figure 10. Normalized  $t_{on}$  vs.  $R_{BE}$

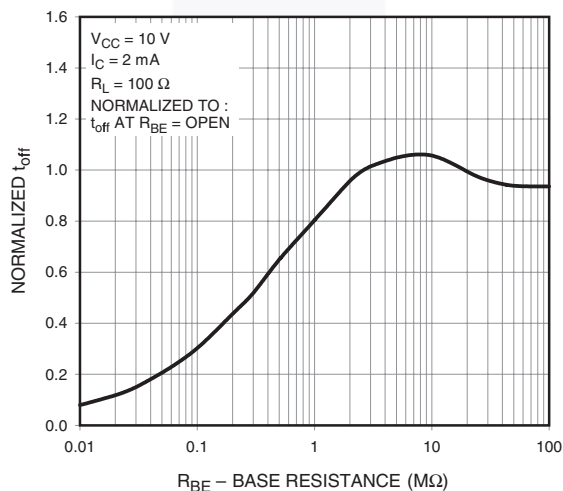


Figure 11. Normalized  $t_{off}$  vs.  $R_{BE}$

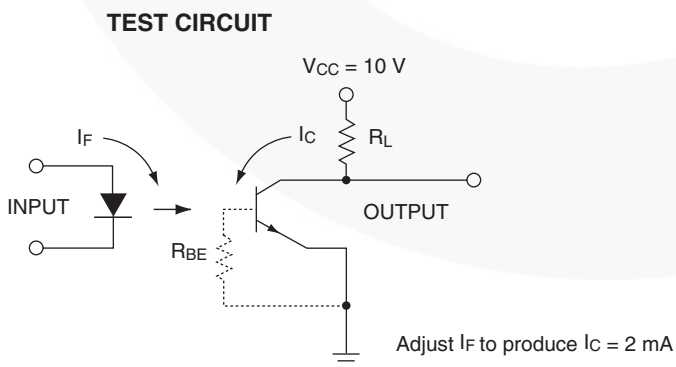
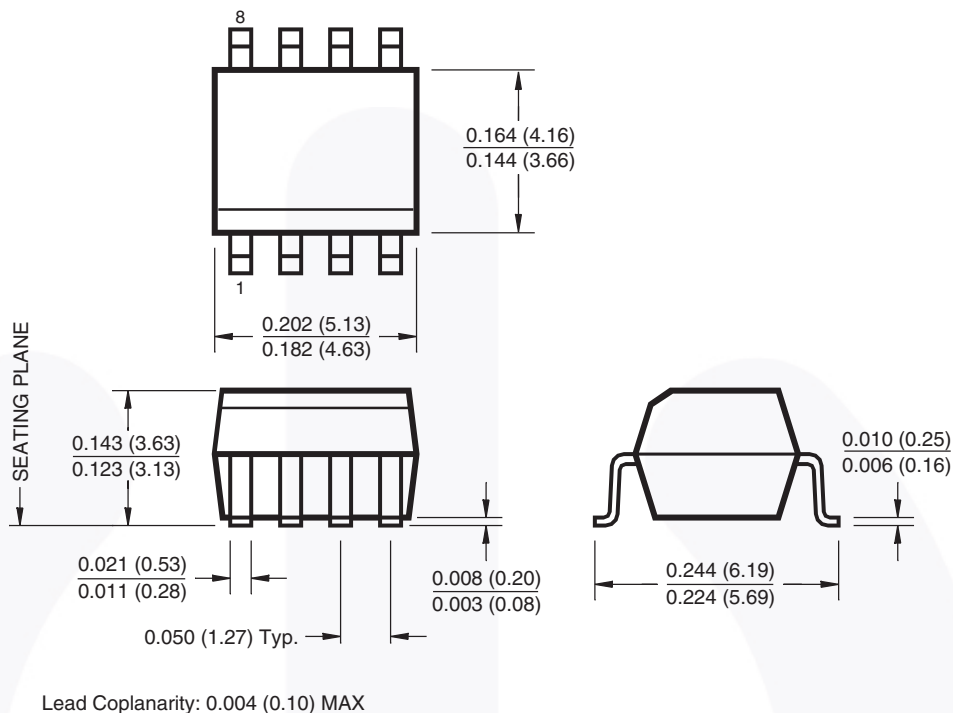


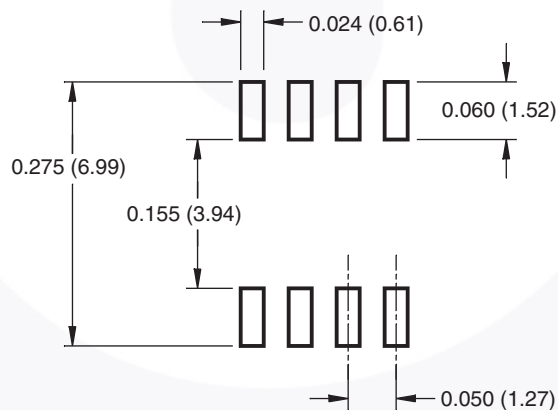
Figure 12. Switching Time Test Circuit and Waveforms

## 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.

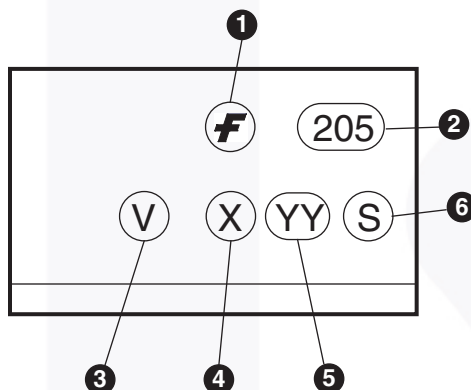
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<http://www.fairchildsemi.com/packaging/>

## 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) |

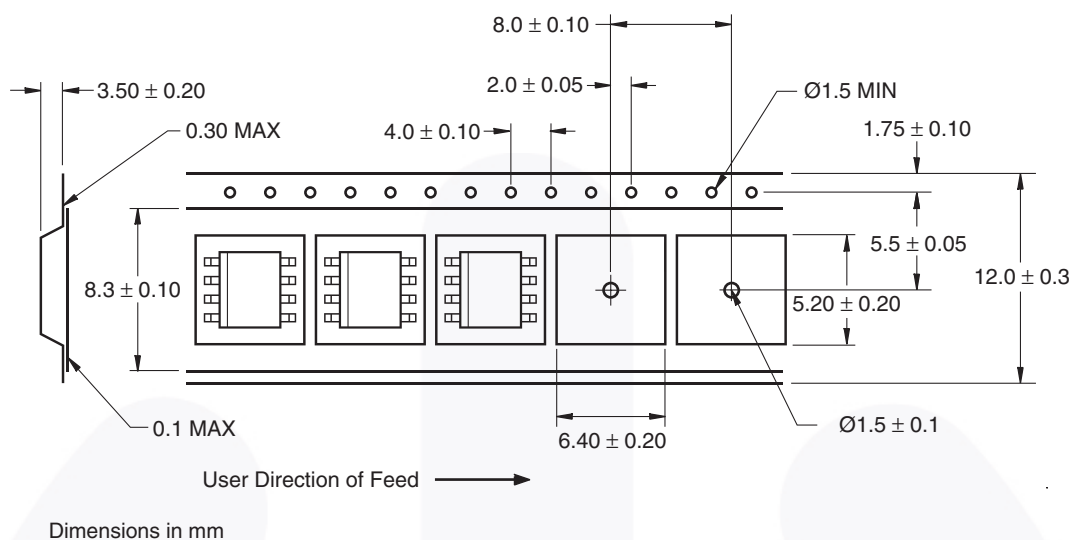
## Marking Information



### Definitions

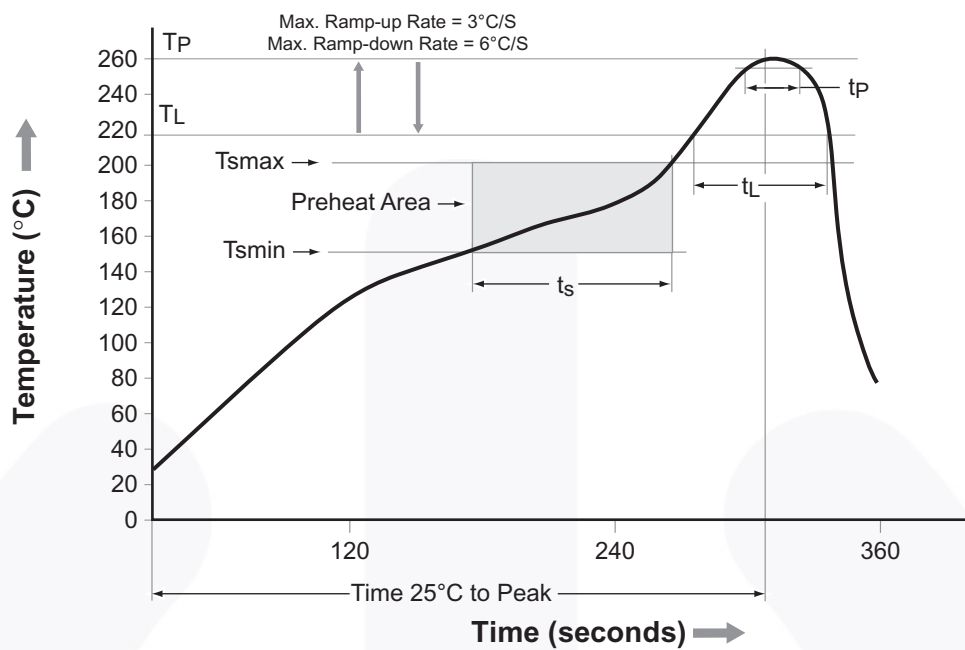
|   |                                                                                        |
|---|----------------------------------------------------------------------------------------|
| 1 | Fairchild logo                                                                         |
| 2 | Device number                                                                          |
| 3 | VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table) |
| 4 | One digit year code, e.g., '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 (T <sub>min</sub> )                             | 150°C                    |
| Temperature Maximum (T <sub>max</sub> )                             | 200°C                    |
| Time (t <sub>s</sub> ) from (T <sub>min</sub> to T <sub>max</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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| AccuPower™                                                                        | F-PFS™                                         | PowerXS™                                                                          |  |
| AX-CAP®*                                                                          | FRFET®                                         | Programmable Active Droop™                                                        | TinyBoost™                                                                          |
| BitSiC™                                                                           | Global Power Resource™                         | QFET®                                                                             | TinyBuck™                                                                           |
| Build it Now™                                                                     | GreenBridge™                                   | QS™                                                                               | TinyCalc™                                                                           |
| CorePLUS™                                                                         | Green FPS™                                     | Quiet Series™                                                                     | TinyLogic®                                                                          |
| CorePOWER™                                                                        | Green FPS™ e-Series™                           | RapidConfigure™                                                                   | TINYOPTO™                                                                           |
| CROSSVOLT™                                                                        | Gmax™                                          |  | TinyPower™                                                                          |
| CTL™                                                                              | GTO™                                           | Saving our world, 1mW/W/kW at a time™                                             | TinyPwm™                                                                            |
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| EcoSPARK®                                                                         | MegaBuck™                                      | SPM®                                                                              | TRUECURRENT®*                                                                       |
| EfficientMax™                                                                     | MICROCOUPLER™                                  | STEALTH™                                                                          | µSerDes™                                                                            |
| ESBC™                                                                             | MicroFET™                                      | SuperFET®                                                                         |  |
|  | MicroPak™                                      | SuperSOT™-3                                                                       | UHC®                                                                                |
| Fairchild®                                                                        | MicroPak2™                                     | SuperSOT™-6                                                                       | Ultra FRFET™                                                                        |
| Fairchild Semiconductor®                                                          | MillerDrive™                                   | SuperSOT™-8                                                                       | UniFET™                                                                             |
| FACT Quiet Series™                                                                | MotionMax™                                     | SupreMOS®                                                                         | VCX™                                                                                |
| FACT®                                                                             | mVSaver™                                       | SyncFET™                                                                          | VisualMax™                                                                          |
| FAST®                                                                             | OptoHiT™                                       |                                                                                   | VoltagePlus™                                                                        |
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| FETBench™                                                                         | OPTOPLANAR®                                    |                                                                                   |                                                                                     |

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