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# FOD073L

## LVTTL/LVCMOS Compatible Low Input Current High Gain Split Darlington Optocoupler

### Features

- Low power consumption
- Low input current: 0.5mA
- Dual channel 8-pin SOIC package
- High CTR: 400% minimum
- High CMR: 10kV/μs
- Guaranteed performance over temperature 0°C to 70°C
- U.L. recognized (File # E90700)
- LVTTL/LVCMOS Compatible output

### Applications

- Digital logic ground isolation – LVTTL/LVCMOS
- Telephone ring detector
- EIA-RS-232C line receiver
- High common mode noise line receiver
- μP bus isolation
- Current loop receiver

### Description

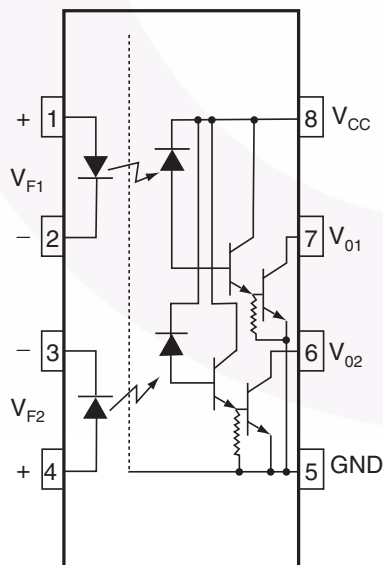
The FOD073L optocoupler consists of an AlGaAs LED optically coupled to a high gain split darlington photo-detector. This device is specified to operate at a 3.3V supply voltage.

An integrated emitter – base resistor provides superior stability over temperature.

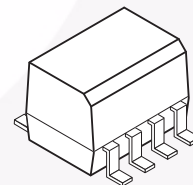
The combination of a very low input current of 0.5mA and a high current transfer ratio of 2000% (typical) makes this device particularly useful for input interface to MOS, CMOS, LSTTL and EIA RS232C, while output compatibility is ensured to LVCMOS as well as high fan-out LVTTL requirements.

An internal noise shield provides exceptional common mode rejection of 10kV/μs.

### Schematic



### Package Outline



### Truth Table

| LED | V <sub>O</sub> |
|-----|----------------|
| ON  | LOW            |
| OFF | HIGH           |

**Absolute Maximum Ratings** (No derating required up to 85°C)

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                           | Parameter   |              | Value          | Units |
|----------------------------------|---|--------------|----------------|-------|
| T <sub>STG</sub>                 | Storage Temperature   |              | -40 to +125    | °C    |
| T <sub>OPR</sub>                 | Operating Temperature   |              | -40 to +85     | °C    |
| T <sub>SOL</sub>                 | Lead Solder Temperature<br>(Wave solder only. See reflow profile for surface mount devices) |              | 260 for 10 sec | °C    |
| <b>EMITTER</b>                   |   |              |                |       |
| I <sub>F</sub> (avg)             | DC/Average Forward Input Current  | Each Channel | 20             | mA    |
| I <sub>F</sub> (pk)              | Peak Forward Input Current<br>(50% duty cycle, 1ms P.W.)                                    | Each Channel | 40             | mA    |
| I <sub>F</sub> (trans)           | Peak Transient Input Current (≤1μs P. W., 300 pps)  | Each Channel | 1.0            | A     |
| V <sub>R</sub>                   | Reverse Input Voltage   | Each Channel | 5              | V     |
| P <sub>D</sub>                   | Input Power Dissipation   | Each Channel | 35             | mW    |
| <b>DETECTOR</b>                  |   |              |                |       |
| I <sub>O</sub> (avg)             | Average Output Current  | Each Channel | 60             | mA    |
| V <sub>EB</sub>                  | Emitter-Base Reverse Voltage (FOD070L, FOD270L)   | Each Channel | 0.5            | V     |
| V <sub>CC</sub> , V <sub>O</sub> | Supply Voltage, Output Voltage  | Each Channel | -0.5 to 7      | V     |
| P <sub>D</sub>                   | Output power dissipation  | Each Channel | 100            | mW    |

## Electrical Characteristics (T<sub>A</sub> = 0 to 70°C unless otherwise specified)

### Individual Component Characteristics

| Symbol           | Parameter                       | Test Conditions   | Min. | Typ.* | Max. | Unit |
|------------------|---------------------------------|---|------|-------|------|------|
| <b>EMITTER</b>   |                                 |   |      |       |      |      |
| V <sub>F</sub>   | Input Forward Voltage           | T <sub>A</sub> = 25°C<br>I <sub>F</sub> = 1.6mA (Each Channel)  |      | 1.35  | 1.7  | V    |
| BV <sub>R</sub>  | Input Reverse Breakdown Voltage | T <sub>A</sub> = 25°C, I <sub>R</sub> = 10μA (Each Channel)   | 5.0  |       | 1.75 | V    |
| <b>DETECTOR</b>  |                                 |   |      |       |      |      |
| I <sub>OH</sub>  | Logic High Output Current       | I <sub>F</sub> = 0 mA, V <sub>O</sub> = V <sub>CC</sub> = 3.3V (Each Channel)                               |      | 0.05  | 25   | μA   |
| I <sub>CCL</sub> | Logic Low Supply Current        | I <sub>F1</sub> = I <sub>F2</sub> = 1.6mA, V <sub>O1</sub> = V <sub>O2</sub> = Open, V <sub>CC</sub> = 3.3V |      | 0.8   | 3    | mA   |
| I <sub>CCH</sub> | Logic High Supply Current       | I <sub>F1</sub> = I <sub>F2</sub> = 0mA, V <sub>O1</sub> = V <sub>O2</sub> = Open, V <sub>CC</sub> = 3.3V   |      | 0.01  | 2    | μA   |

### Transfer Characteristics

| Symbol          | Parameter                               | Test Conditions   | Min. | Typ.* | Max. | Unit |
|-----------------|---|---|------|-------|------|------|
| CTR             | COUPLED Current Transfer Ratio (Note 1) | I <sub>F</sub> = 0.5mA, V <sub>O</sub> = 0.4V, V <sub>CC</sub> = 3.3V | 400  |       | 7000 | %    |
| V <sub>OL</sub> | Logic Low Output Voltage                | I <sub>F</sub> = 1.6mA, I <sub>O</sub> = 8mA, V <sub>CC</sub> = 3.3V  |      | 0.07  | 0.3  | V    |
|                 |   | I <sub>F</sub> = 5mA, I <sub>O</sub> = 15mA, V <sub>CC</sub> = 3.3V   |      | 0.07  | 0.4  |      |

### Switching Characteristics (V<sub>CC</sub> = 3.3 V)

| Symbol             | Parameter                                    | Test Conditions   | Min.  | Typ.*  | Max. | Unit |
|--------------------|--|---|-------|--------|------|------|
| T <sub>PHL</sub>   | Propagation Delay Time to Logic LOW          | R <sub>L</sub> = 4.7kΩ, I <sub>F</sub> = 0.5mA (Fig. 9)   |       | 5      | 30   | μs   |
| T <sub>PLH</sub>   | Propagation Delay Time to Logic HIGH         | R <sub>L</sub> = 4.7kΩ, I <sub>F</sub> = 0.5mA (Fig. 9)   |       | 25     | 90   | μs   |
| ICM <sub>H</sub> I | Common Mode Transient Immunity at Logic HIGH | I <sub>F</sub> = 0 mA,  V <sub>CM</sub>   = 10 V <sub>P-P</sub> , T <sub>A</sub> = 25°C, R <sub>L</sub> = 2.2kΩ (Note 2) (Fig. 10)  | 1,000 | 10,000 |      | V/μs |
| ICM <sub>L</sub> I | Common Mode Transient Immunity at Logic LOW  | I <sub>F</sub> = 1.6mA,  V <sub>CM</sub>   = 10 V <sub>P-P</sub> , R <sub>L</sub> = 2.2kΩ, T <sub>A</sub> = 25°C (Note 2) (Fig. 10) | 1,000 | 10,000 |      | V/μs |

\*All typicals at T<sub>A</sub> = 25°C

**Electrical Characteristics** (Continued) ( $T_A = 0$  to  $70^\circ\text{C}$  unless otherwise specified)**Isolation Characteristics**

| Symbol    | Characteristics                         | Test Conditions   | Min.  | Typ.*     | Max. | Unit          |
|-----------|---|---|-------|-----------|------|---------------|
| $I_{I-O}$ | Input-Output Insulation Leakage Current | Relative humidity = 45%, $T_A = 25^\circ\text{C}$ ,<br>$t = 5$ s, $V_{I-O} = 3000$ VDC (Note 3)     |       |           | 1.0  | $\mu\text{A}$ |
| $V_{ISO}$ | Withstand Insulation Test Voltage       | $R_H \leq 50\%$ , $T_A = 25^\circ\text{C}$ , $I_{I-O} \leq 2\mu\text{A}$ ,<br>$t = 1$ min. (Note 3) | 2500  |           |      | $V_{RMS}$     |
| $R_{I-O}$ | Resistance (Input to Output)            | $V_{I-O} = 500$ VDC (Note 3)  |       | $10^{12}$ |      | $\Omega$      |
| $C_{I-O}$ | Capacitance (Input to Output)           | $f = 1$ MHz (Notes 3, 4)  |       | 0.7       |      | pF            |
| $I_{I-I}$ | Input-Input Insulation Leakage Current  | $R_H \leq 45\%$ , $V_{I-I} = 500$ VDC (Note 5)  | 0.005 |           |      | $\mu\text{A}$ |
| $R_{I-I}$ | Input-Input Resistance                  | $V_{I-I} = 500$ VDC (Note 5)  |       | $10^{11}$ |      | $\Omega$      |
| $C_{I-I}$ | Input-Input Capacitance                 | $f = 1$ MHz (Note 5)  |       | 0.03      |      | pF            |

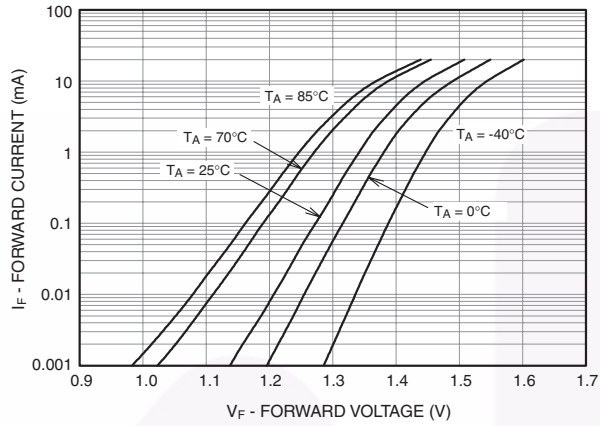
\*All typicals at  $T_A = 25^\circ\text{C}$

**Notes:**

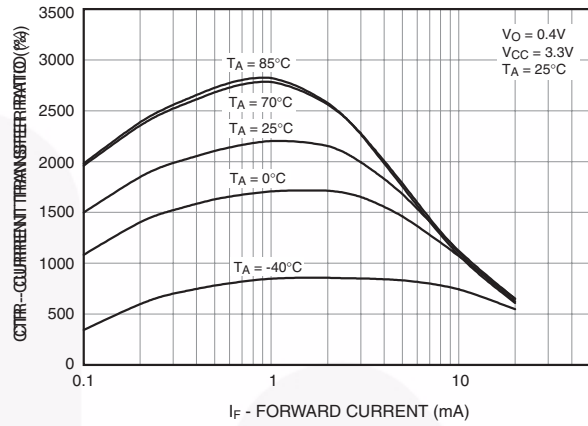
- Current Transfer Ratio is defined as a ratio of output collector current,  $I_O$ , to the forward LED input current,  $I_F$ , times 100%.
- Common mode transient immunity in logic high level is the maximum tolerable (positive)  $dV_{CM}/dt$  on the leading edge of the common mode pulse signal,  $V_{CM}$ , to assure that the output will remain in a logic high state (i.e.,  $V_O > 2.0\text{V}$ ). Common mode transient immunity in logic low level is the maximum tolerable (negative)  $dV_{CM}/dt$  on the trailing edge of the common mode pulse signal,  $V_{CM}$ , to assure that the output will remain in a logic low state (i.e.,  $V_O < 0.8\text{V}$ ).
- Device is considered a two terminal device: Pins 1, 2, 3 and 4 are shorted together and Pins 5, 6, 7 and 8 are shorted together.
- CI-O is measured by shorting pins 1 and 2 or pins 3 and 4 together and pins 5 through 8 shorted together.
- Measured between pins 1 and 2 shorted together, and pins 3 and 4 shorted together.

## Typical Performance Curves

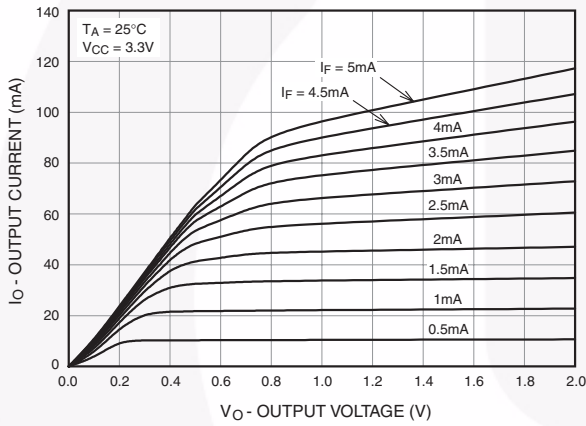
**Fig. 1 Input Forward Current vs Forward Voltage**



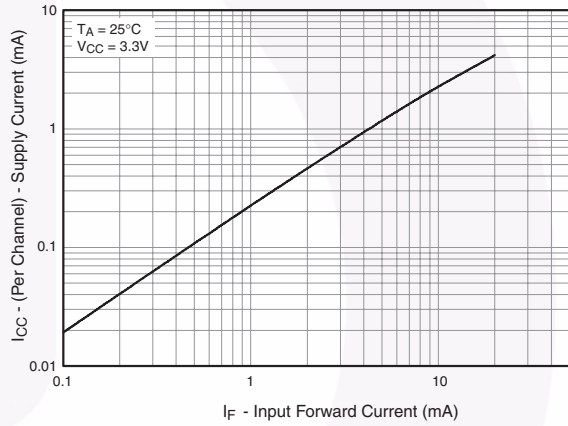
**Fig. 2 Current Transfer Ratio vs. Input Forward Current**



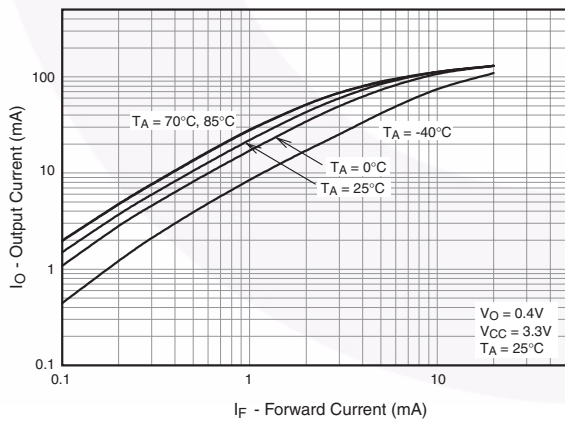
**Fig. 3 DC Transfer Characteristics**



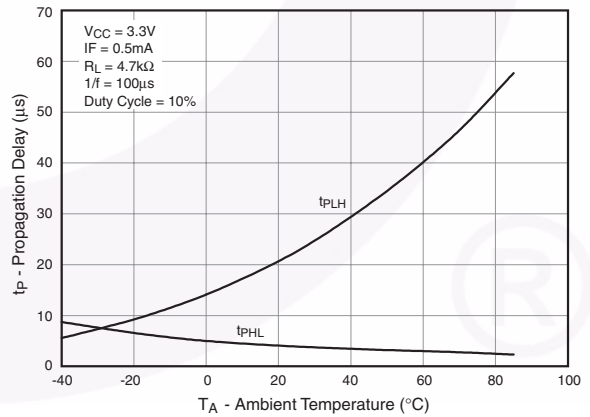
**Fig. 4 Supply Current vs Input Forward Current**



**Fig. 5 Output Current vs Input Forward Current**

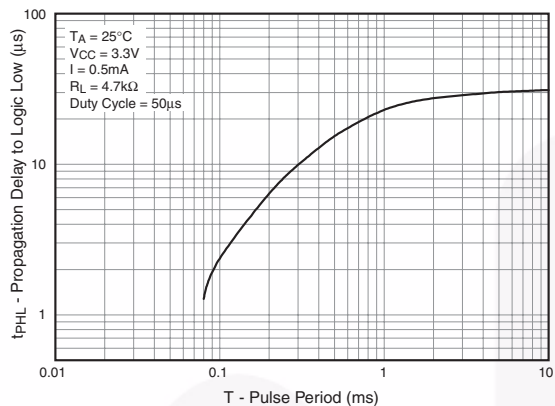


**Fig. 6 Propagation Delay vs. Ambient Temperature**

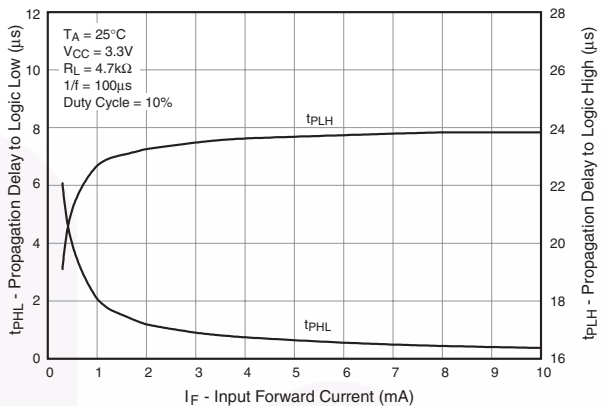


## Typical Performance Curves (Continued)

**Fig. 7 Propagation Delay To Logic Low vs Pulse Period**



**Fig. 8 Propagation Delay vs. Input Forward Current**



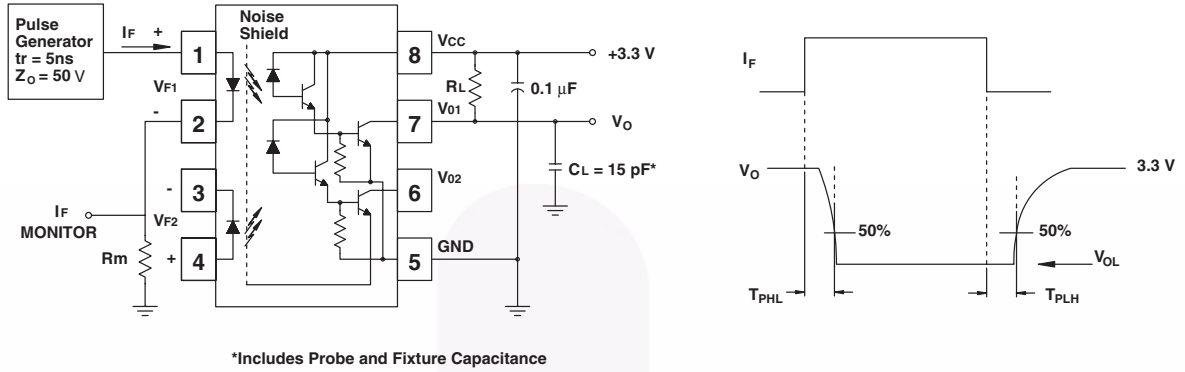


Fig. 9 Switching Time Test Circuit

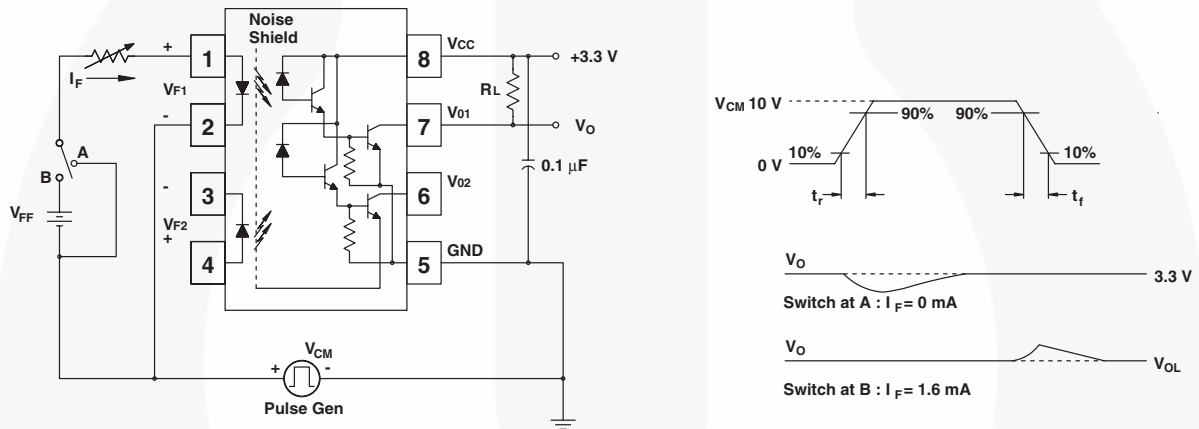


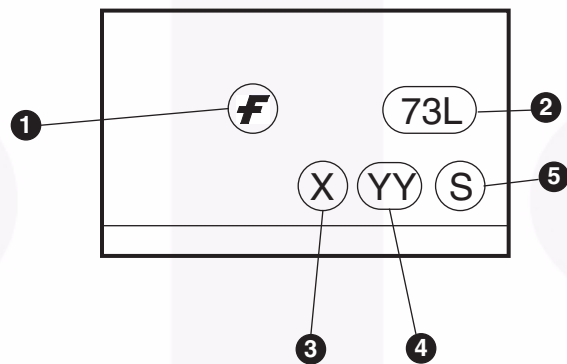
Fig. 10 Common Mode Immunity Test Circuit



### Ordering Information

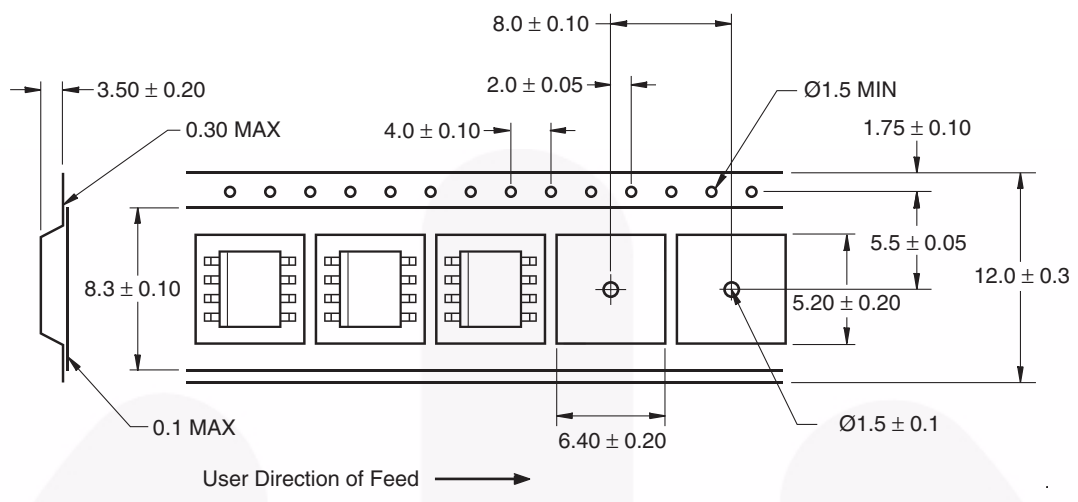
| Option    | Order Entry Identifier | Description                          |
|-----------|------------------------|--------------------------------------|
| No Suffix | FOD073L                | Shipped in tubes (50 units per tube) |
| R2        | FOD073LR2              | Tape and reel (2,500 units per reel) |

### Marking Information

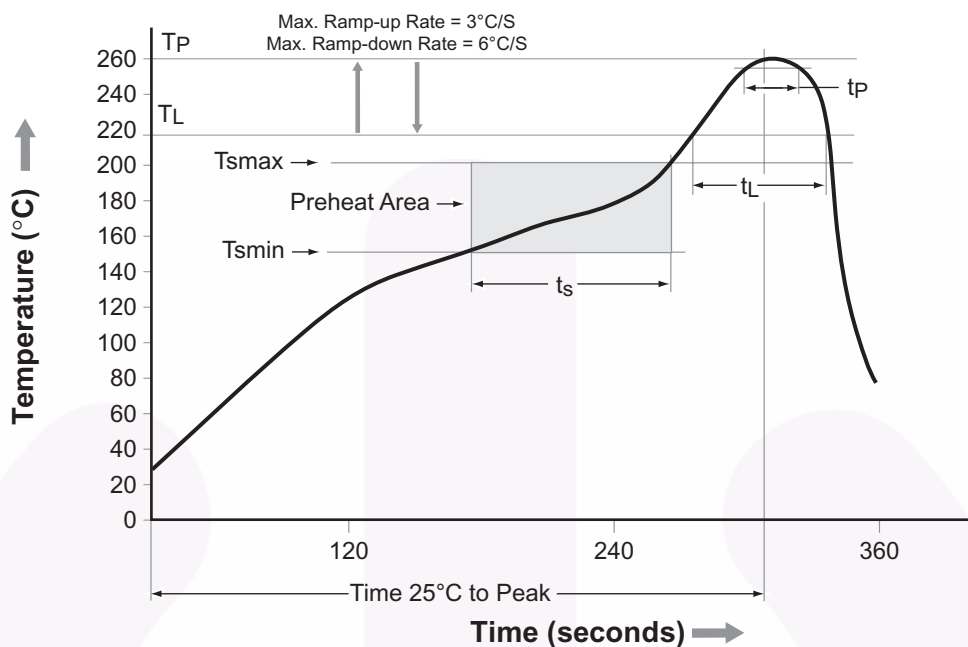


| Definitions |   |
|-------------|---|
| 1           | Fairchild logo                                |
| 2           | Device number                                 |
| 3           | One digit year code, e.g., '3'                |
| 4           | Two digit work week ranging from '01' to '53' |
| 5           | Assembly package code                         |

### Carrier Tape Specifications



## Reflow Profile



| Profile Feature                                  | Pb-Free Assembly Profile |
|--|--------------------------|
| Temperature Min. ( $T_{smin}$ )                  | 150°C                    |
| Temperature Max. ( $T_{smax}$ )                  | 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 max.          |
| 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 max.          |
| Time 25°C to Peak Temperature                    | 8 minutes max.           |



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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