

# FODM452, FODM453

## 5-Pin Mini Flat Package High Speed Transistor Optocoupler

### Features

- Compact 5-pin mini flat package
- High speed-1 MBit/s
- Superior CMR-15kV/μs at  $V_{CM} = 1500V$  (FODM453)
- Performance guaranteed over temperature (0–70°C)
- U.L. recognized (File # E90700)
- VDE0884 recognized (File # 136480)
  - Ordering option V, e.g., FODM452V

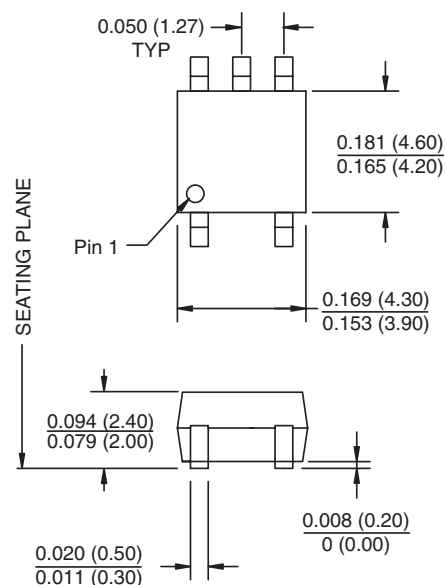
### Applications

- Line receivers
- Pulse transformer replacement
- Output interface to CMOS-LSTTL-TTL
- Wide bandwidth analog coupling

### Description

The FODM452 and FODM453 optocouplers consist of an AlGaAs LED optically coupled to a high speed photo-detector transistor. The devices are housed in a compact 5-pin mini flat package for optimum mounting density. The FODM453 features a high CMR rating for optimum common mode transient immunity.

### Package

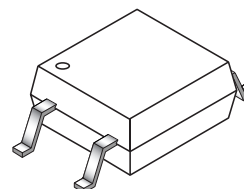
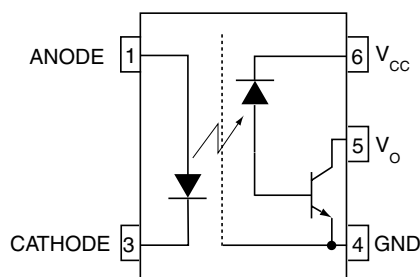


Lead Coplanarity : 0.004 (0.10) MAX

#### Note:

All dimensions are in inches (millimeters).

### Schematic



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

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            |
|-----------------|----------------------------------------------------------------------------------------|-------------|------------------|
| $T_{STG}$       | Storage Temperature                                                                    | -40 to +125 | $^\circ\text{C}$ |
| $T_{OPR}$       | Operating Temperature                                                                  | -40 to +85  | $^\circ\text{C}$ |
| <b>EMITTER</b>  |                                                                                        |             |                  |
| $I_F$ (avg)     | DC/Average Forward Input Current                                                       | 25          | mA               |
| $I_F$ (pk)      | Peak Forward Input Current (50% duty cycle, 1ms P.W.)                                  | 50          | mA               |
| $I_F$ (trans)   | Peak Transient Input Current ( $\leq 1\mu\text{s}$ P.W., 300pps)                       | 1.0         | A                |
| $V_R$           | Reverse Input Voltage                                                                  | 5           | V                |
| $P_D$           | Input Power Dissipation<br>(No derating required over specified operating temp range)  | 45          | mW               |
| <b>DETECTOR</b> |                                                                                        |             |                  |
| $I_O$ (avg)     | Average Output Current                                                                 | 8           | mA               |
| $I_O$ (pk)      | Peak Output Current                                                                    | 16          | mA               |
| $V_{CC}$        | Supply Voltage                                                                         | -0.5 to 30  | V                |
| $V_O$           | Output Voltage                                                                         | -0.5 to 20  | V                |
| $P_D$           | Output Power Dissipation<br>(No derating required over specified operating temp range) | 100         | mW               |

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

| Symbol                  | Parameter                                  | Test Conditions                                                                             | Min. | Typ.* | Max. | Unit                 |
|-------------------------|--------------------------------------------|---------------------------------------------------------------------------------------------|------|-------|------|----------------------|
| <b>EMITTER</b>          |                                            |                                                                                             |      |       |      |                      |
| $V_F$                   | Input Forward Voltage                      | $I_F = 16\text{mA}$ , $T_A = 25^\circ\text{C}$                                              |      | 1.60  | 1.7  | V                    |
|                         |                                            | $I_F = 16\text{mA}$                                                                         |      |       | 1.8  |                      |
| $B_{VR}$                | Input Reverse Breakdown Voltage            | $I_R = 10\mu\text{A}$                                                                       | 5.0  |       |      | V                    |
| $\Delta V_F/\Delta T_A$ | Temperature Coefficient of Forward Voltage | $I_F = 16\text{mA}$                                                                         |      | -1.8  |      | mV/ $^\circ\text{C}$ |
| <b>DETECTOR</b>         |                                            |                                                                                             |      |       |      |                      |
| $I_{OH}$                | Logic High Output Current                  | $I_F = 0\text{mA}$ , $V_O = V_{CC} = 5.5\text{V}$ , $T_A = 25^\circ\text{C}$                |      | .001  | 0.5  | $\mu\text{A}$        |
|                         |                                            | $I_F = 0\text{mA}$ , $V_O = V_{CC} = 15\text{V}$ , $T_A = 25^\circ\text{C}$                 |      | .001  | 1    |                      |
|                         |                                            | $I_F = 0\text{mA}$ , $V_O = V_{CC} = 15\text{V}$                                            |      |       | 50   |                      |
| $I_{CCL}$               | Logic Low Supply Current                   | $I_F = 16\text{mA}$ , $V_O = \text{Open}$ , $V_{CC} = 15\text{V}$                           |      | 100   | 200  | $\mu\text{A}$        |
| $I_{CCH}$               | Logic high supply current                  | $I_F = 0\text{mA}$ , $V_O = \text{Open}$ , $V_{CC} = 15\text{V}$ , $T_A = 25^\circ\text{C}$ |      | 0.05  | 1    | $\mu\text{A}$        |
|                         |                                            | $I_F = 0\text{mA}$ , $V_O = \text{Open}$ , $V_{CC} = 15\text{V}$                            |      |       | 2    |                      |

**Transfer Characteristics**

| Symbol         | Parameter                             | Test Conditions                                                                                  | Min. | Typ.* | Max | Unit |
|----------------|---------------------------------------|--------------------------------------------------------------------------------------------------|------|-------|-----|------|
| <b>COUPLED</b> |                                       |                                                                                                  |      |       |     |      |
| CTR            | Current Transfer Ratio <sup>(1)</sup> | $I_F = 16\text{mA}$ , $V_{CC} = 4.5\text{V}$ , $T_A = 25^\circ\text{C}$ , $V_{OL} = 0.4\text{V}$ | 20   |       | 50  | %    |
|                |                                       | $V_{OL} = 0.5\text{V}$                                                                           | 15   |       |     |      |
| $V_{OL}$       | Logic LOW Output Voltage              | $I_F = 16\text{mA}$ , $I_O = 3\text{mA}$ , $V_{CC} = 4.5\text{V}$ , $T_A = 25^\circ\text{C}$     |      |       | 0.4 | V    |
|                |                                       | $I_F = 16\text{mA}$ , $I_O = 2.4\text{mA}$ , $V_{CC} = 4.5\text{V}$                              |      |       | 0.5 |      |

**Switching Characteristics** ( $V_{CC} = 5\text{V}$ )

| Symbol    | Parameter                                    | Test Conditions                                                                                                              | Device  | Min. | Typ.* | Max. | Unit              |
|-----------|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|---------|------|-------|------|-------------------|
| $T_{PHL}$ | Propagation Delay Time to Logic LOW          | $R_L = 1.9\text{k}\Omega$ , $I_F = 16\text{mA}$ , $T_A = 25^\circ\text{C}$ <sup>(2)</sup> (Fig. 9)                           |         |      | 0.40  | 0.8  | $\mu\text{s}$     |
|           |                                              | $R_L = 1.9\text{k}\Omega$ , $I_F = 16\text{mA}$ <sup>(2)</sup> (Fig. 9)                                                      |         |      |       | 1.0  | $\mu\text{s}$     |
| $T_{PLH}$ | Propagation Delay Time to Logic HIGH         | $R_L = 1.9\text{k}\Omega$ , $I_F = 16\text{mA}$ , $T_A = 25^\circ\text{C}$ <sup>(2)</sup> (Fig. 9)                           |         |      | 0.35  | 0.8  | $\mu\text{s}$     |
|           |                                              | $R_L = 1.9\text{k}\Omega$ , $I_F = 16\text{mA}$ <sup>(2)</sup> (Fig. 9)                                                      |         |      |       | 1.0  | $\mu\text{s}$     |
| $ CM_H $  | Common Mode Transient Immunity at Logic HIGH | $I_F = 0\text{mA}$ , $V_{CM} = 10V_{P-P}$ , $R_L = 1.9\text{k}\Omega$ , $T_A = 25^\circ\text{C}$ <sup>(3)</sup> (Fig. 10)    | FODM452 | 5    | 15    |      | KV/ $\mu\text{s}$ |
|           |                                              | $I_F = 0\text{mA}$ , $V_{CM} = 1500V_{P-P}$ , $R_L = 1.9\text{k}\Omega$ , $T_A = 25^\circ\text{C}$ <sup>(3)</sup> (Fig. 10)  | FODM453 | 15   | 40    |      | KV/ $\mu\text{s}$ |
| $ CM_L $  | Common Mode Transient Immunity at Logic LOW  | $I_F = 16\text{mA}$ , $V_{CM} = 10V_{P-P}$ , $R_L = 1.9\text{k}\Omega$ , $T_A = 25^\circ\text{C}$ <sup>(3)</sup> (Fig. 10)   | FODM452 | 5    | 15    |      | KV/ $\mu\text{s}$ |
|           |                                              | $I_F = 16\text{mA}$ , $V_{CM} = 1500V_{P-P}$ , $R_L = 1.9\text{k}\Omega$ , $T_A = 25^\circ\text{C}$ <sup>(3)</sup> (Fig. 10) | FODM453 | 15   | 40    |      | KV/ $\mu\text{s}$ |
| BW        | Bandwidth                                    | $R_L = 100\Omega$                                                                                                            |         |      | 3     |      | MHz               |

**Isolation Characteristics**

| Symbol    | Characteristics                   | Test Conditions                                                               | Min. | Typ.* | Max. | Unit      |
|-----------|-----------------------------------|-------------------------------------------------------------------------------|------|-------|------|-----------|
| $V_{ISO}$ | Withstand Insulation Test Voltage | $RH \leq 50\%$ , $T_A = 25^\circ\text{C}$ , $t = 1\text{min.}$ <sup>(4)</sup> | 3750 |       |      | $V_{RMS}$ |
| $C_{I-O}$ | Capacitance (Input to Output)     | $f = 1\text{MHz}$ <sup>(4)</sup>                                              |      | 0.2   |      | pF        |

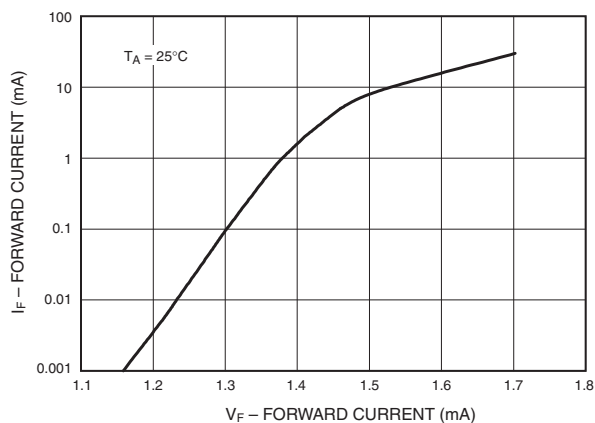
\*All Typicals at  $T_A = 25^\circ\text{C}$

**Notes:**

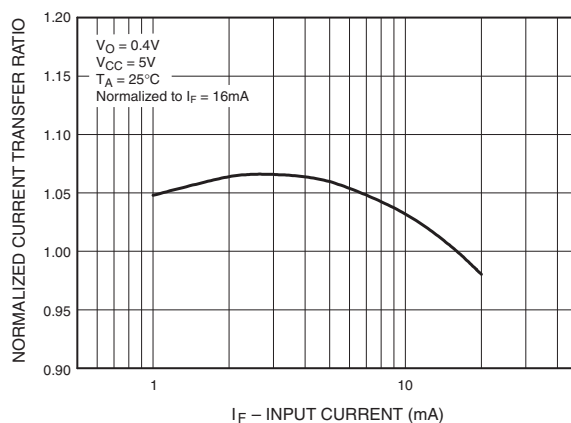
1. Current Transfer Ratio is defined as a ratio of output collector current,  $I_O$ , to the forward LED input current,  $I_F$ , times 100%.
2. The 1.9k $\Omega$  load represents 1 TTL unit load of 1.6mA and 5.6k $\Omega$  pull-up resistor.
3. Common mode transient immunity in logic high level is the 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.,  $V_O > 2.0V$ ). 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.,  $V_O < 0.8V$ ).
4. Device is considered a two terminal device: Pins 1, and 3 are shorted together and Pins 4, 5, and 6 are shorted together.

## Typical Performance Curves

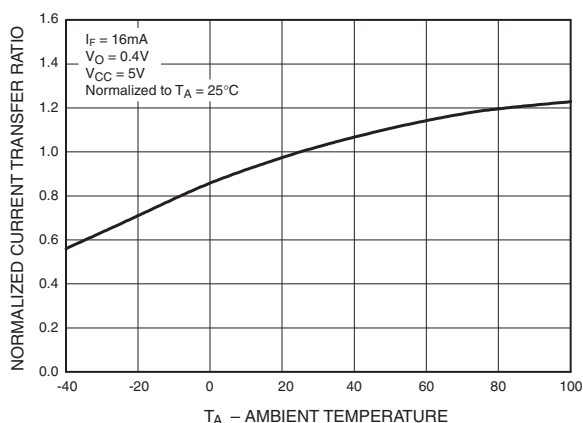
**Fig. 1 Input Forward Current vs Forward Voltage**



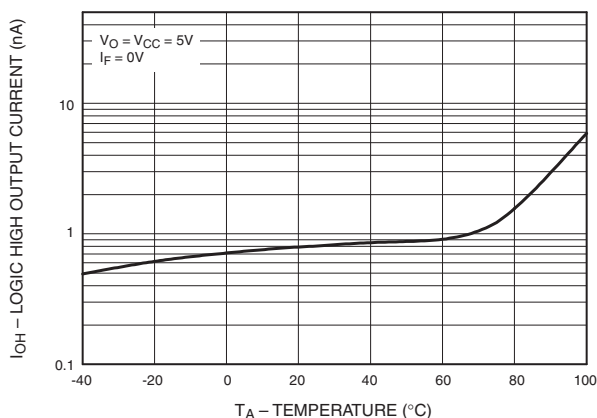
**Fig. 2 Normalized Current Transfer Ratio vs. Input Current**



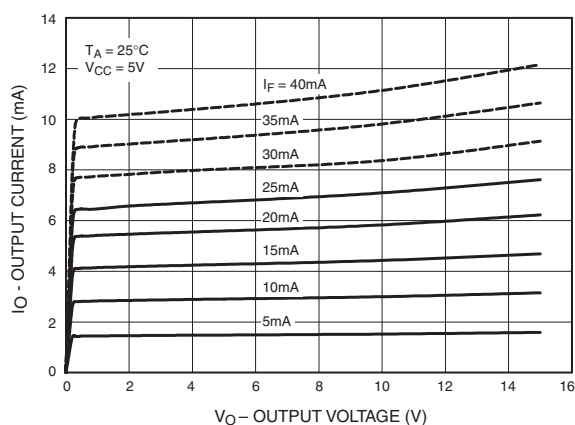
**Fig. 3 Normalized Current Transfer Ratio vs. Ambient Temperature**



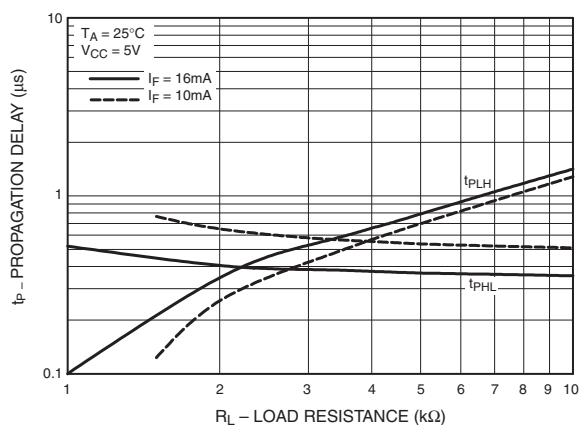
**Fig. 4 Logic High Output Current vs. Ambient Temperature**



**Fig. 5 DC and Pulsed Transfer Characteristics**



**Fig. 6 Propagation Delay vs. Load Resistance**



## Typical Performance Curves (Continued)

Fig. 7 Propagation Delay vs. Ambient Temperature

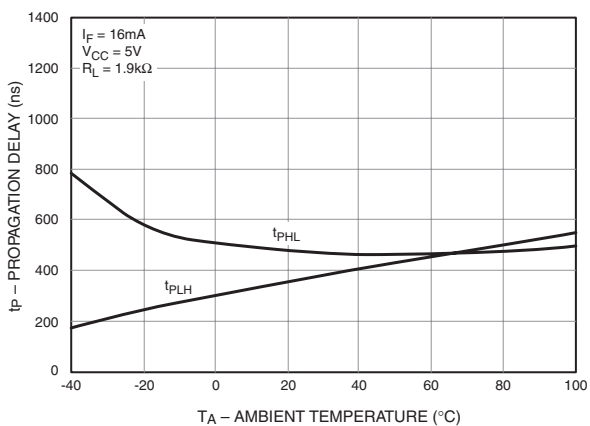
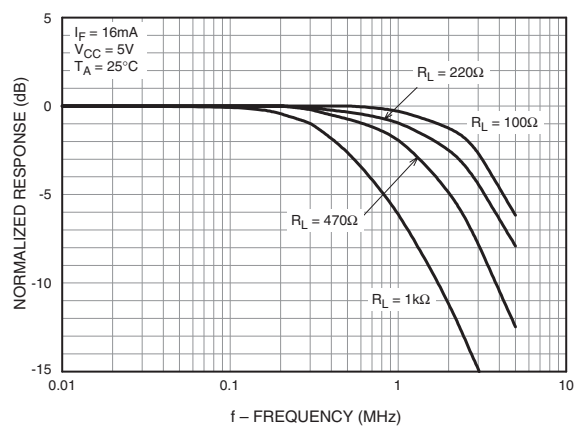


Fig. 8 Frequency Response



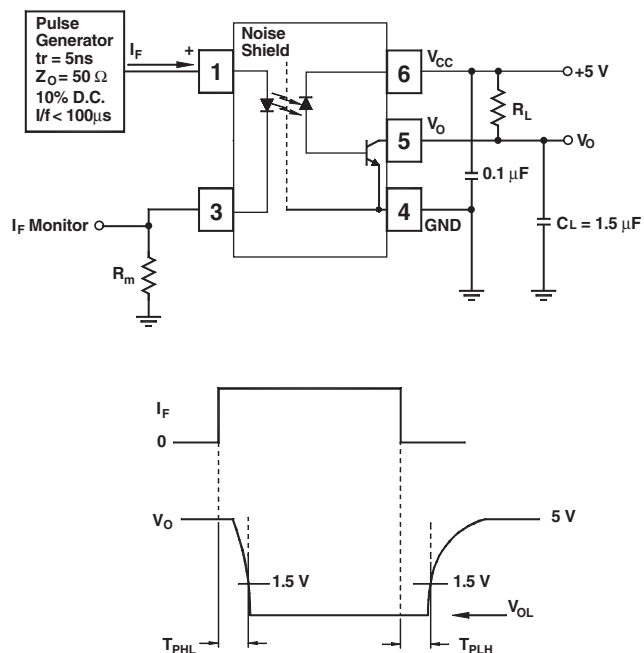


Fig. 9 Switching Time Test Circuit

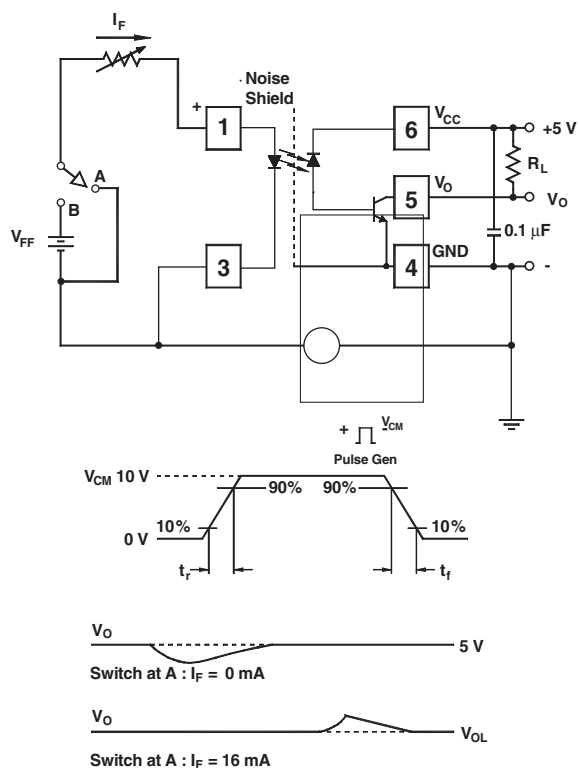
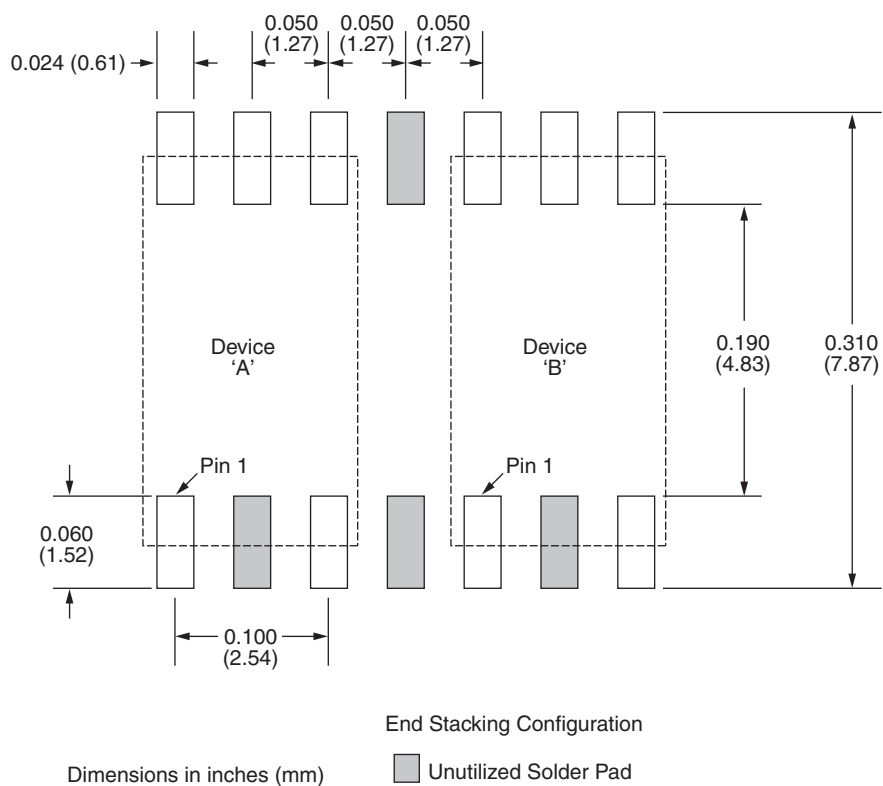


Fig. 10 Common Mode Immunity Test Circuit

## Footprint Drawing for PCB Layout

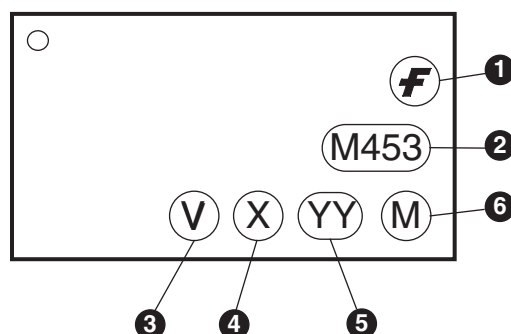




## Ordering Information

| Option | Order Entry Identifier<br>(example) | Description                            |
|--------|-------------------------------------|----------------------------------------|
| R1     | FODM452R1                           | Tape and Reel (500 per reel)           |
| R2     | FODM452R2                           | Tape and Reel (2500 per reel)          |
| V      | FODM452V                            | VDE0884                                |
| R1V    | FODM452R1V                          | VDE0884, Tape and Reel (500 per reel)  |
| R2V    | FODM452R2V                          | VDE0884, Tape and Reel (2500 per reel) |

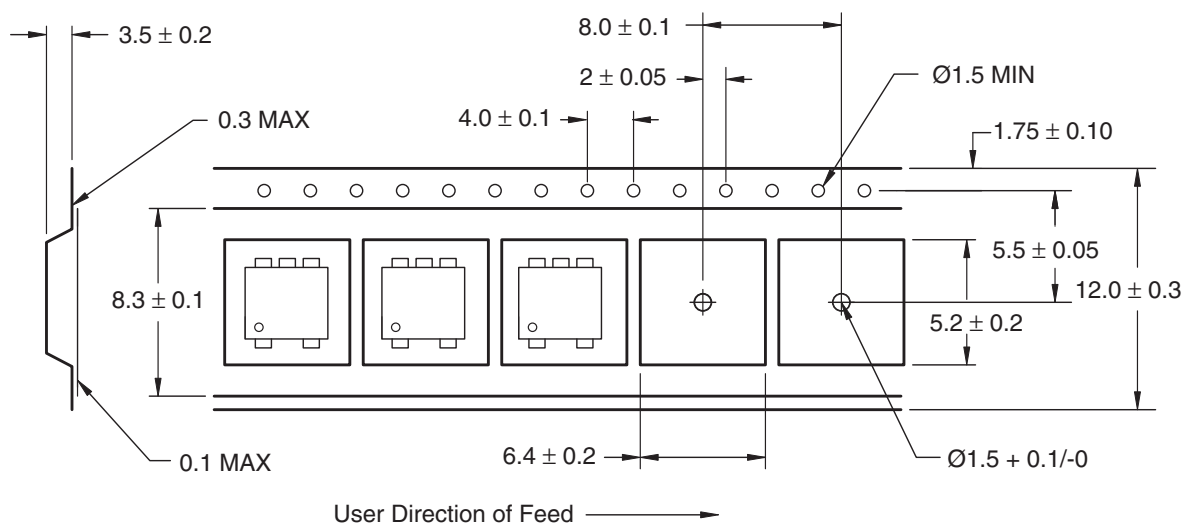
## Marking Information



### 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., '7'                                                         |
| 5 | Two digit work week ranging from '01' to '53'                                          |
| 6 | Assembly package code                                                                  |

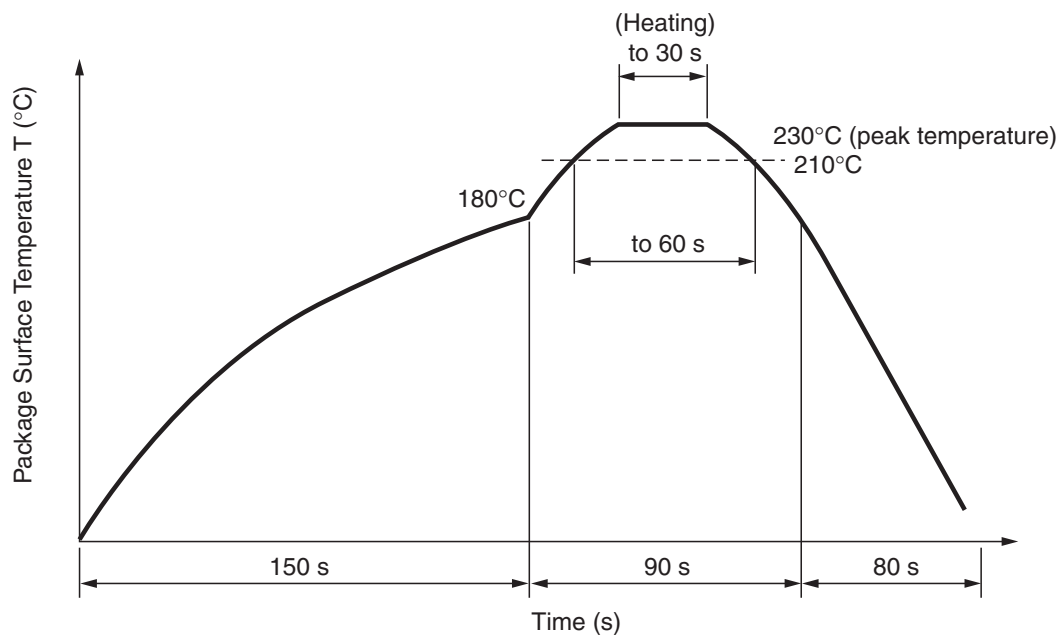
## Carrier Tape Specifications



### Note:

All dimensions are in millimeters.

## Reflow Profile



- Peak reflow temperature:  $230^{\circ}\text{C}$  (package surface temperature) for 30 seconds
- Time of temperature higher than  $210^{\circ}\text{C}$ : 60 seconds or less
- One time soldering reflow is recommended



## TRADEMARKS

The following are registered and unregistered trademarks and service marks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

|                                      |                                                |                                         |                                                                                                   |
|--------------------------------------|------------------------------------------------|-----------------------------------------|---------------------------------------------------------------------------------------------------|
| ACE <sup>x</sup>                     | Green FPS <sup>TM</sup> e-Series <sup>TM</sup> | POWEREDGE <sup>®</sup>                  | SuperSOT <sup>TM</sup> -8                                                                         |
| Build it Now <sup>TM</sup>           | GTO <sup>TM</sup>                              | Power-SPM <sup>TM</sup>                 | SyncFET <sup>TM</sup>                                                                             |
| CorePLUS <sup>TM</sup>               | <i>i-Lo</i> <sup>TM</sup>                      | PowerTrench <sup>®</sup>                | The Power Franchise <sup>®</sup>                                                                  |
| CROSSVOLT <sup>TM</sup>              | IntelliMAX <sup>TM</sup>                       | Programmable Active Droop <sup>TM</sup> |  <sup>TM</sup> |
| CTL <sup>TM</sup>                    | ISOPANAR <sup>TM</sup>                         | QFET <sup>®</sup>                       | TinyBoost <sup>TM</sup>                                                                           |
| Current Transfer Logic <sup>TM</sup> | MegaBuck <sup>TM</sup>                         | QS <sup>TM</sup>                        | TinyBuck <sup>TM</sup>                                                                            |
| EcoSPARK <sup>®</sup>                | MICROCOUPLER <sup>TM</sup>                     | QT Optoelectronics <sup>TM</sup>        | TinyLogic <sup>®</sup>                                                                            |
| FACT Quiet Series <sup>TM</sup>      | MicroFET <sup>TM</sup>                         | Quiet Series <sup>TM</sup>              | TINYOPTO <sup>TM</sup>                                                                            |
| FACT <sup>®</sup>                    | MicroPak <sup>TM</sup>                         | RapidConfigure <sup>TM</sup>            | TinyPower <sup>TM</sup>                                                                           |
| FAST <sup>®</sup>                    | Motion-SPM <sup>TM</sup>                       | SMART START <sup>TM</sup>               | TinyPWM <sup>TM</sup>                                                                             |
| FastvCore <sup>TM</sup>              | OPTOLOGIC <sup>®</sup>                         | SPM <sup>®</sup>                        | TinyWire <sup>TM</sup>                                                                            |
| FPS <sup>TM</sup>                    | OPTOPLANAR <sup>®</sup>                        | STEALTH <sup>TM</sup>                   | μSerDes <sup>TM</sup>                                                                             |
| FRFET <sup>®</sup>                   | PDP-SPM <sup>TM</sup>                          | SuperFET <sup>TM</sup>                  | UHC <sup>®</sup>                                                                                  |
| Global Power Resource <sup>SM</sup>  | Power220 <sup>®</sup>                          | SuperSOT <sup>TM</sup> -3               | UniFET <sup>TM</sup>                                                                              |
| Green FPS <sup>TM</sup>              | Power247 <sup>®</sup>                          | SuperSOT <sup>TM</sup> -6               | VCX <sup>TM</sup>                                                                                 |

## DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

## LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

## PRODUCT STATUS DEFINITIONS

### Definition of Terms

| Datasheet Identification | Product Status         | Definition                                                                                                                                                                                               |
|--------------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Advance Information      | Formative or In Design | This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.                                                                       |
| Preliminary              | First Production       | This datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design. |
| No Identification Needed | Full Production        | This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.                                                   |
| Obsolete                 | Not In Production      | This datasheet contains specifications on a product that has been discontinued by Fairchild Semiconductor. The datasheet is printed for reference information only.                                      |

Rev. I29