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# 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
- 260°C reflow capability for Pb-free assembly

### Applications

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

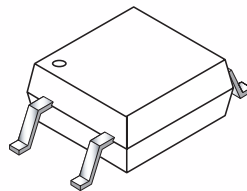
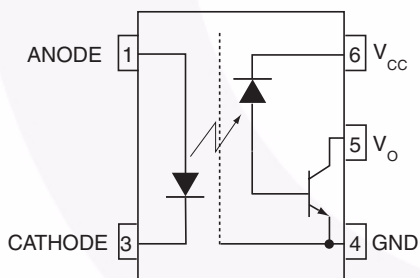
### Description

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.

### Related Resources

- [www.fairchildsemi.com/products/opto/](http://www.fairchildsemi.com/products/opto/)
- [www.fairchildsemi.com/pf/FO/FODM611.html](http://www.fairchildsemi.com/pf/FO/FODM611.html)
- [www.fairchildsemi.com/pf/FO/FODM8061.html](http://www.fairchildsemi.com/pf/FO/FODM8061.html)
- [www.fairchildsemi.com/pf/FO/FODM8071.html](http://www.fairchildsemi.com/pf/FO/FODM8071.html)

### Functional Schematic



### Truth Table

LED	Output
Off	High
On	Low

## Pin Definitions

Number	Name	Function Description
1	ANODE	Anode
3	CATHODE	Cathode
4	GND	Output Ground
5	$V_O$	Output Voltage
6	$V_{CC}$	Output Supply Voltage

## Safety and Insulation Ratings for Mini-Flat Package (SO5 Pin)

As per IEC60747-5-2 (Pending Certification). This optocoupler is suitable for “safe electrical insulation” only within the safety limit data. Compliance with the safety ratings shall be ensured by means of protective circuits.

Symbol	Parameter	Min.	Typ.	Max.	Unit
	Installation Classifications per DIN VDE 0110/1.89 Table 1				
	For rated main voltage < 150Vrms		I-IV		
	For rated main voltage < 300Vrms		I-III		
	Climatic Classification		40/85/21		
	Pollution Degree (DIN VDE 0110/1.89)		2		
CTI	Comparative Tracking Index	175			
$V_{PR}$	Input to Output Test Voltage, Method b, $V_{IORM} \times 1.875 = V_{PR}$ , 100% Production Test with $t_m = 1$ sec, Partial Discharge < 5 pC	1060			
$V_{PR}$	Input to Output Test Voltage, Method a, $V_{IORM} \times 1.5 = V_{PR}$ , Type and Sample Test with $t_m = 60$ sec, Partial Discharge < 5 pC	848			
$V_{IORM}$	Max Working Insulation Voltage	565			$V_{peak}$
$V_{IOTM}$	Highest Allowable Over Voltage	4000			$V_{peak}$
	External Creepage	5.0			mm
	External Clearance	5.0			mm
	Insulation thickness	0.5			mm
$T_{Case}$	Safety Limit Values, Maximum Values allowed in the event of a failure, Case Temperature	150			°C
$R_{IO}$	Insulation Resistance at $T_S$ , $V_{IO} = 500V$	$10^9$			$\Omega$

**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 (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 (No derating required over specified operating temp range)	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	I <sub>F</sub> = 16mA, T <sub>A</sub> = 25°C		1.60	1.7	V
		I <sub>F</sub> = 16mA			1.8	
B <sub>VR</sub>	Input Reverse Breakdown Voltage	I <sub>R</sub> = 10μA	5.0			V
ΔV <sub>F</sub> /ΔT <sub>A</sub>	Temperature Coefficient of Forward Voltage	I <sub>F</sub> = 16mA		-1.8		mV/°C
<b>DETECTOR</b>						
I <sub>OH</sub>	Logic High Output Current	I <sub>F</sub> = 0mA, V <sub>O</sub> = V <sub>CC</sub> = 5.5V, T <sub>A</sub> = 25°C		.001	0.5	μA
		I <sub>F</sub> = 0 mA, V <sub>O</sub> = V <sub>CC</sub> = 15V, T <sub>A</sub> = 25°C		.001	1	
		I <sub>F</sub> = 0mA, V <sub>O</sub> = V <sub>CC</sub> = 15V			50	
I <sub>CCL</sub>	Logic Low Supply Current	I <sub>F</sub> = 16mA, V <sub>O</sub> = Open, V <sub>CC</sub> = 15V		100	200	μA
I <sub>CCH</sub>	Logic high supply current	I <sub>F</sub> = 0 mA, V <sub>O</sub> = Open, V <sub>CC</sub> = 15V, T <sub>A</sub> = 25°C		0.05	1	μA
		I <sub>F</sub> = 0mA, V <sub>O</sub> = Open, V <sub>CC</sub> = 15V			2	

### Transfer Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.*	Max	Unit	
<b>COUPLED</b>							
CTR	Current Transfer Ratio <sup>(1)</sup>	I <sub>F</sub> = 16mA, V <sub>CC</sub> = 4.5V	T <sub>A</sub> = 25°C V <sub>OL</sub> =0.4V	20		50	%
			V <sub>OL</sub> =0.5V	15			
V <sub>OL</sub>	Logic LOW Output Voltage	I <sub>F</sub> = 16mA, I <sub>O</sub> = 3mA, V <sub>CC</sub> = 4.5V, T <sub>A</sub> = 25°C			0.4	V	
		I <sub>F</sub> = 16mA, I <sub>O</sub> = 2.4mA, V <sub>CC</sub> = 4.5 V			0.5		

### Switching Characteristics (V<sub>CC</sub> = 5V)

Symbol	Parameter	Test Conditions	Device	Min.	Typ.*	Max.	Unit
T <sub>PHL</sub>	Propagation Delay Time to Logic LOW	R <sub>L</sub> = 1.9kΩ, I <sub>F</sub> = 16mA, T <sub>A</sub> = 25°C <sup>(2)</sup> (Fig. 9)			0.40	0.8	μs
		R <sub>L</sub> = 1.9kΩ, I <sub>F</sub> = 16mA <sup>(2)</sup> (Fig. 9)				1.0	μs
T <sub>PLH</sub>	Propagation Delay Time to Logic HIGH	R <sub>L</sub> = 1.9kΩ, I <sub>F</sub> = 16mA, T <sub>A</sub> = 25°C <sup>(2)</sup> (Fig. 9)			0.35	0.8	μs
		R <sub>L</sub> = 1.9kΩ, I <sub>F</sub> = 16mA <sup>(2)</sup> (Fig. 9)				1.0	μs
CM <sub>H</sub>	Common Mode Transient Immunity at Logic HIGH	I <sub>F</sub> = 0mA, V <sub>CM</sub> = 10V <sub>P-P</sub> , R <sub>L</sub> = 1.9kΩ, T <sub>A</sub> = 25°C <sup>(3)</sup> (Fig. 10)	FODM452	5	15		KV/μs
		I <sub>F</sub> = 0mA, V <sub>CM</sub> = 1500V <sub>P-P</sub> , R <sub>L</sub> = 1.9kΩ, T <sub>A</sub> = 25°C <sup>(3)</sup> (Fig. 10)	FODM453	15	40		KV/μs
CM <sub>L</sub>	Common Mode Transient Immunity at Logic LOW	I <sub>F</sub> = 16mA, V <sub>CM</sub> = 10V <sub>P-P</sub> , R <sub>L</sub> = 1.9kΩ, T <sub>A</sub> = 25°C <sup>(3)</sup> (Fig. 10)	FODM452	5	15		KV/μs
		I <sub>F</sub> = 16mA, V <sub>CM</sub> = 1500V <sub>P-P</sub> , R <sub>L</sub> = 1.9kΩ, T <sub>A</sub> = 25°C <sup>(3)</sup> (Fig. 10)	FODM453	15	40		KV/μs
BW	Bandwidth	R <sub>L</sub> = 100Ω			3		MHz

### Isolation Characteristics

Symbol	Characteristics	Test Conditions	Min.	Typ.*	Max.	Unit
V <sub>ISO</sub>	Withstand Insulation Test Voltage	RH ≤ 50%, T <sub>A</sub> = 25°C, t = 1 min. <sup>(4)</sup>	3750			V <sub>RMS</sub>
C <sub>I-O</sub>	Capacitance (Input to Output)	f = 1MHz <sup>(4)</sup>		0.2		pF

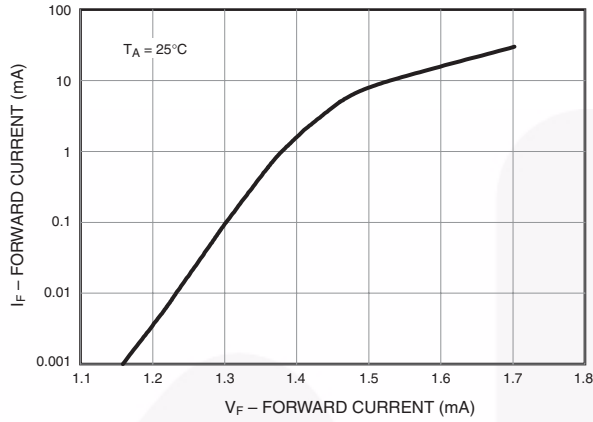
\*All Typicals at T<sub>A</sub> = 25°C

**Notes:**

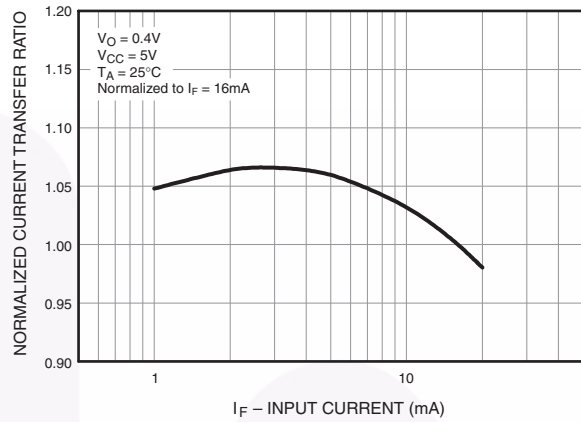
1. Current Transfer Ratio is defined as a ratio of output collector current,  $I_O$ , to the forward LED input current,  $I_F$ , times 100%.
2. The 1.9k $\Omega$  load represents 1 TTL unit load of 1.6mA and 5.6k $\Omega$  pull-up resistor.
3. Common mode transient immunity in logic high level is the 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

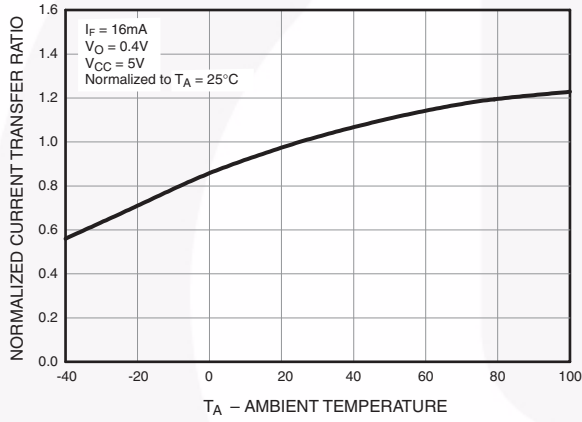
**Fig. 1 Input Forward Current vs Forward Voltage**



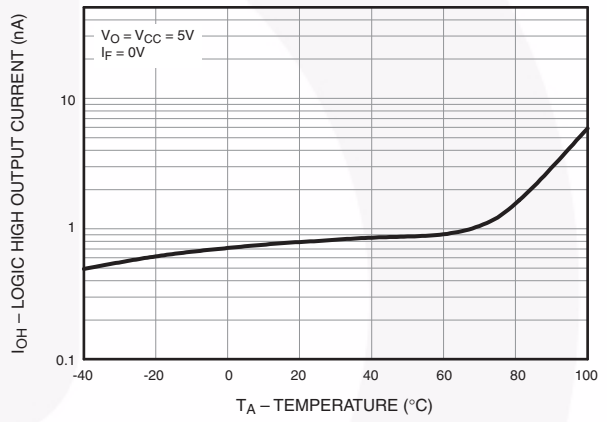
**Fig. 2 Normalized Current Transfer Ratio vs. Input Current**



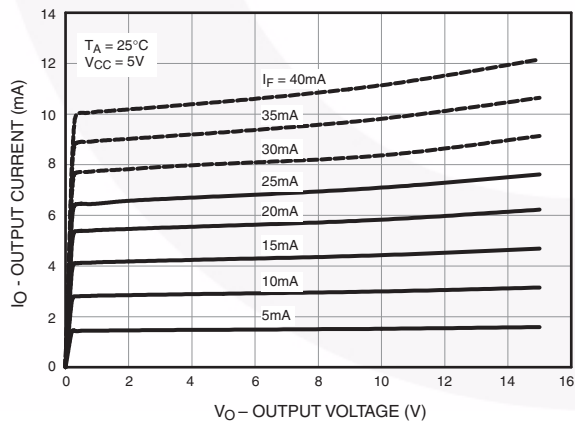
**Fig. 3 Normalized Current Transfer Ratio vs. Ambient Temperature**



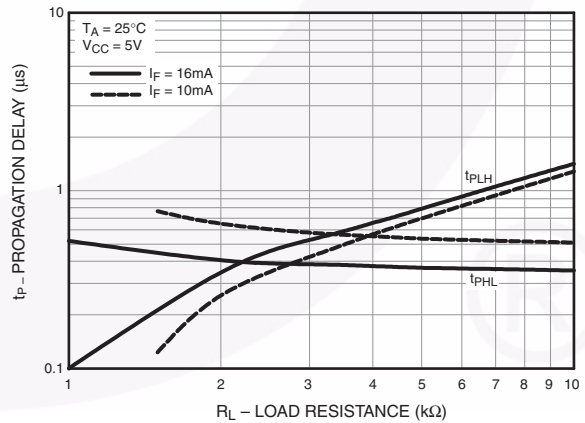
**Fig. 4 Logic High Output Current vs. Ambient Temperature**



**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

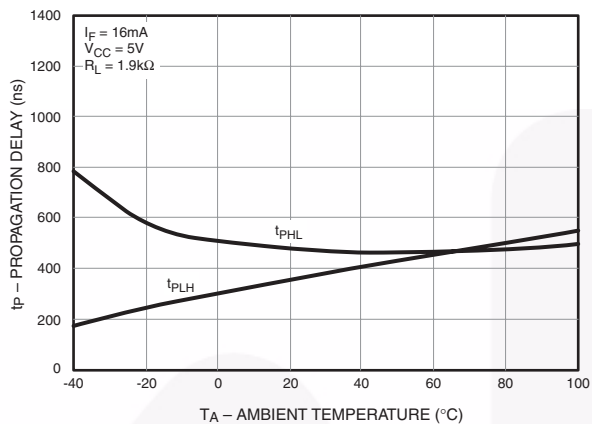
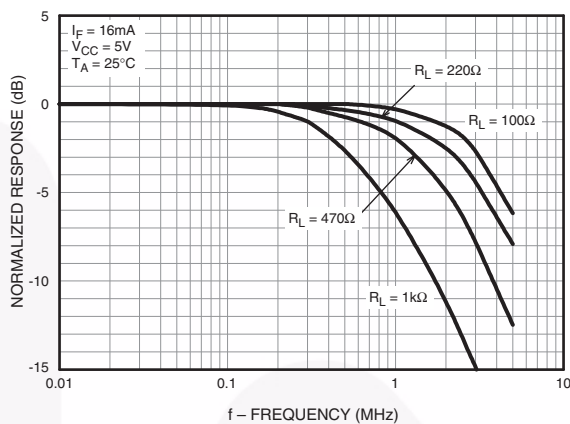
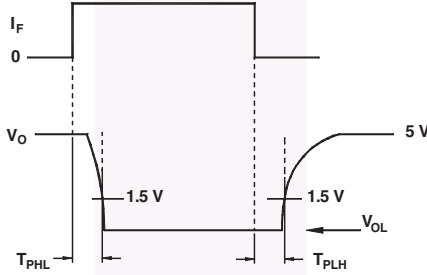
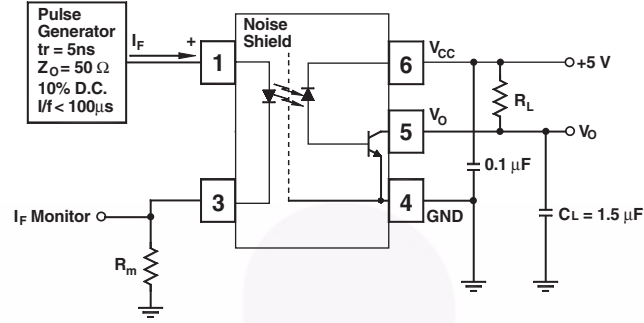
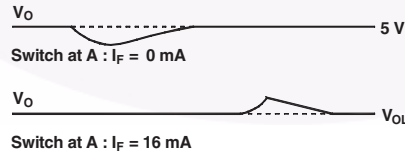
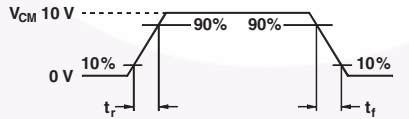
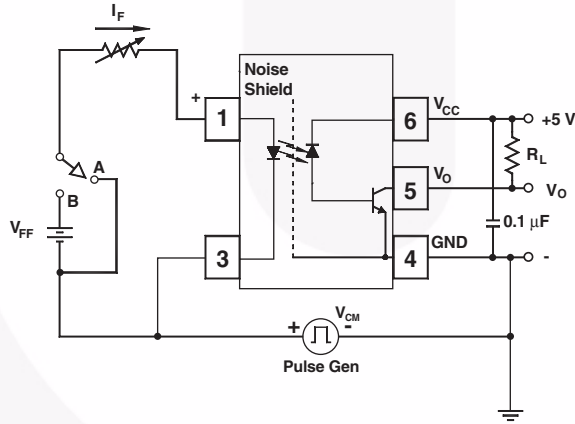


Fig. 8 Frequency Response





**Fig. 9 Switching Time Test Circuit**

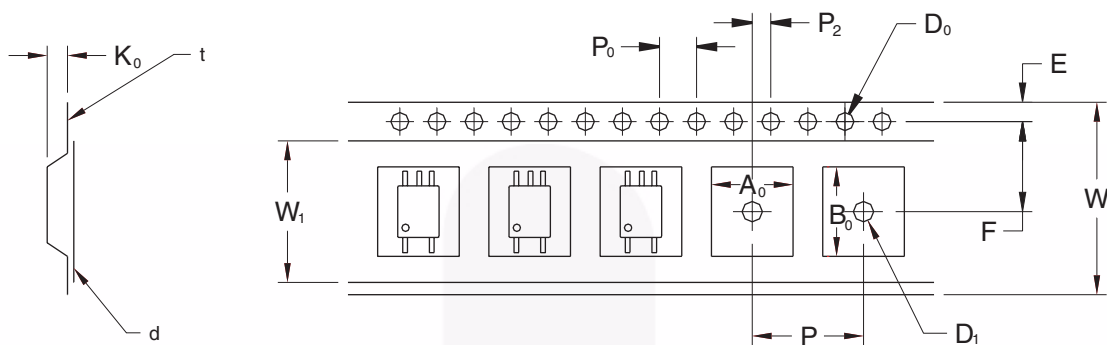


**Fig. 10 Common Mode Immunity Test Circuit**





## Tape and Reel Dimensions

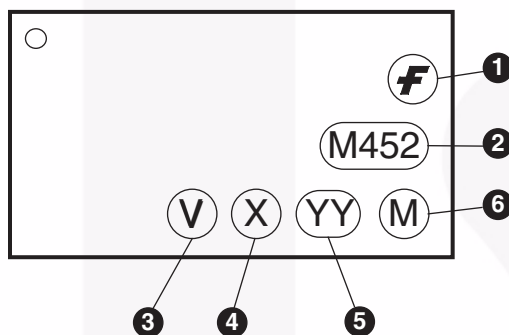


		2.54 Pitch
Description	Symbol	Dimensions (mm)
Tape Width	W	12.00 +0.30/-0.10
Tape Thickness	t	0.30 ±0.05
Sprocket Hole Pitch	P <sub>0</sub>	4.00 ±0.10
Sprocket Hole Diameter	D <sub>0</sub>	1.50 +0.10/-0.0
Sprocket Hole Location	E	1.75 ±0.10
Pocket Location	F	5.50 ±0.10
	P <sub>2</sub>	2.00 ±0.10
Pocket Pitch	P	8.00 ±0.10
Pocket Dimension	A <sub>0</sub>	4.40 ±0.10
	B <sub>0</sub>	7.30 ±0.10
	K <sub>0</sub>	2.30 ±0.10
Pocket Hole Diameter	D <sub>1</sub>	1.50 Min.
Cover Tape Width	W <sub>1</sub>	9.20
Cover Tape Thickness	d	0.065 ±0.010
Max. Component Rotation or Tilt		10° Max.
Devices Per Reel		2500
Reel Diameter		330mm (13")

### Ordering Information

Option	Order Entry Identifier (example)	Description
R2	FODM452R2	Tape and Reel (2500 per reel)
V	FODM452V	IEC60747-5-2
R2V	FODM452R2V	IEC60747-5-2, Tape and Reel (2500 per reel)

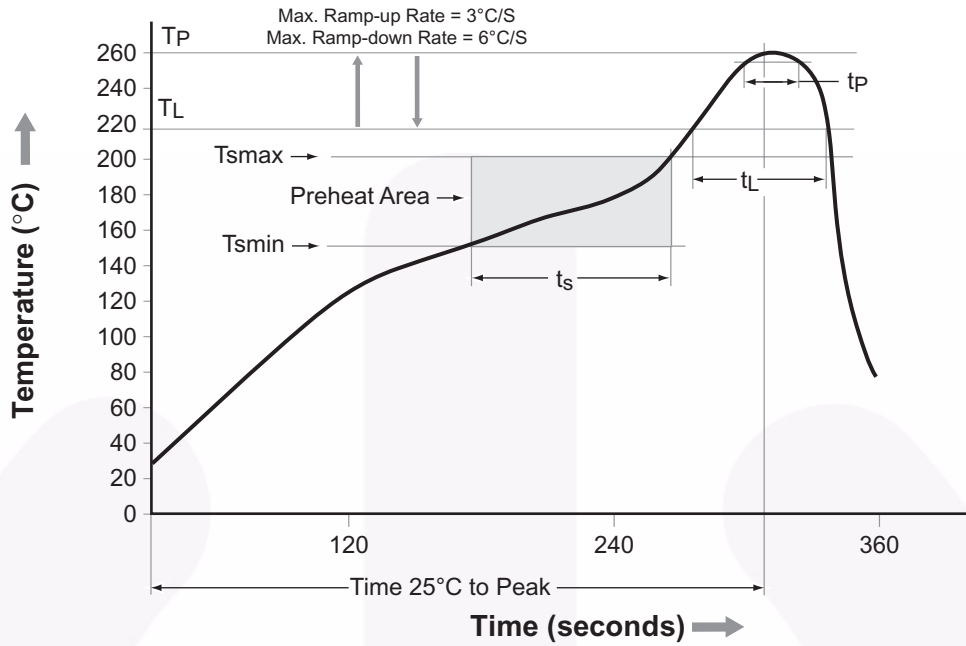
### Marking Information



#### Definitions

1	Fairchild logo
2	Device number
3	IEC60747-5-2 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

## 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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