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4N25M, 4N26M, 4N27M, 4N28M, 4N35M, 4N36M, 4N37M 6-Pin General Purpose Phototransistor Optocouplers

Features

- Minimum Current Transfer Ratio at $I_F = 10 \text{ mA}$, $V_{CE} = 10 \text{ V}$:
 - 10% for 4N27M and 4N28M
 - 20% for 4N25M and 4N26M
 - 100% for 4N35M, 4N36M and 4N37M
- Safety and Regulatory Approvals:
 - UL1577, 4,170 $V_{AC_{RMS}}$ for 1 Minute
 - DIN-EN/IEC60747-5-5, 850 V Peak Working Insulation Voltage

Applications

- Power Supply Regulators
- Digital Logic Inputs
- Microprocessor Inputs

Description

The general purpose optocouplers consist of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a standard plastic six-pin dual-in-line package.

Schematic



- PIN 1. ANODE
2. CATHODE
3. NO CONNECTION
4. EMITTER
5. COLLECTOR
6. BASE

Figure 1. Schematic

Package Outlines



Figure 2. Package Outlines

4N25M, 4N26M, 4N27M, 4N28M, 4N35M, 4N36M, 4N37M — 6-Pin General Purpose Phototransistor Optocouplers

Safety and Insulation Ratings

As per DIN EN/IEC 60747-5-5, 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.

Parameter		Characteristics
Installation Classifications per DIN VDE 0110/1.89 Table 1, For Rated Mains Voltage	< 150 V _{RMS}	I–IV
	< 300 V _{RMS}	I–IV
Climatic Classification		55/100/21
Pollution Degree (DIN VDE 0110/1.89)		2
Comparative Tracking Index		175

Symbol	Parameter	Value	Unit
V _{PR}	Input-to-Output Test Voltage, Method A, V _{IORM} × 1.6 = V _{PR} , Type and Sample Test with t _m = 10 s, Partial Discharge < 5 pC	1360	V _{peak}
	Input-to-Output Test Voltage, Method B, V _{IORM} × 1.875 = V _{PR} , 100% Production Test with t _m = 1 s, Partial Discharge < 5 pC	1594	V _{peak}
V _{IORM}	Maximum Working Insulation Voltage	850	V _{peak}
V _{IOTM}	Highest Allowable Over-Voltage	6000	V _{peak}
	External Creepage	≥ 7	mm
	External Clearance	≥ 7	mm
	External Clearance (for Option TV, 0.4" Lead Spacing)	≥ 10	mm
DTI	Distance Through Insulation (Insulation Thickness)	≥ 0.5	mm
T _S	Case Temperature ⁽¹⁾	175	°C
I _{S,INPUT}	Input Current ⁽¹⁾	350	mA
P _{S,OUTPUT}	Output Power ⁽¹⁾	800	mW
R _{IO}	Insulation Resistance at T _S , V _{IO} = 500 V ⁽¹⁾	> 10 ⁹	Ω

Note:

1. Safety limit values – maximum values allowed in the event of a failure.

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	Parameter	Value	Unit
TOTAL DEVICE			
T_{STG}	Storage Temperature	-40 to +125	$^\circ\text{C}$
T_{OPR}	Operating Temperature	-40 to +100	$^\circ\text{C}$
T_J	Junction Temperature	-40 to +125	$^\circ\text{C}$
T_{SOL}	Lead Solder Temperature	260 for 10 seconds	$^\circ\text{C}$
P_D	Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$	270	mW
	Derate Above 25°C	2.94	mW/ $^\circ\text{C}$
EMITTER			
I_F	DC/Average Forward Input Current	60	mA
V_R	Reverse Input Voltage	6	V
$I_F(\text{pk})$	Forward Current – Peak (300 μs , 2% Duty Cycle)	3	A
P_D	LED Power Dissipation @ $T_A = 25^\circ\text{C}$	120	mW
	Derate Above 25°C	1.41	mW/ $^\circ\text{C}$
DETECTOR			
V_{CEO}	Collector-to-Emitter Voltage	30	V
V_{CBO}	Collector-to-Base Voltage	70	V
V_{ECO}	Emitter-to-Collector Voltage	7	V
P_D	Detector Power Dissipation @ $T_A = 25^\circ\text{C}$	150	mW
	Derate Above 25°C	1.76	mW/ $^\circ\text{C}$

Electrical Characteristics

$T_A = 25^\circ\text{C}$ unless otherwise specified.

Individual Component Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
EMITTER						
V_F	Input Forward Voltage	$I_F = 10\text{ mA}$		1.18	1.50	V
I_R	Reverse Leakage Current	$V_R = 6.0\text{ V}$		0.001	10	μA
DETECTOR						
BV_{CEO}	Collector-to-Emitter Breakdown Voltage	$I_C = 1.0\text{ mA}, I_F = 0$	30	100		V
BV_{CBO}	Collector-to-Base Breakdown Voltage	$I_C = 100\text{ }\mu\text{A}, I_F = 0$	70	120		V
BV_{ECO}	Emitter-to-Collector Breakdown Voltage	$I_E = 100\text{ }\mu\text{A}, I_F = 0$	7	10		V
I_{CEO}	Collector-to-Emitter Dark Current	$V_{CE} = 10\text{ V}, I_F = 0$		1	50	nA
I_{CBO}	Collector-to-Base Dark Current	$V_{CB} = 10\text{ V}$			20	nA
C_{CE}	Capacitance	$V_{CE} = 0\text{ V}, f = 1\text{ MHz}$		8		pF

Transfer Characteristics

Symbol	Parameter	Test Conditions	Device	Min.	Typ.	Max.	Unit
DC CHARACTERISTICS							
CTR	Current Transfer Ratio, Collector-to-Emitter	$I_F = 10\text{ mA}, V_{CE} = 10\text{ V}$	4N35M, 4N36M, 4N37M	100			%
			4N25M, 4N26M	20			%
			4N27M, 4N28M	10			%
		$I_F = 10\text{ mA}, V_{CE} = 10\text{ V}, T_A = -55^\circ\text{C}$	4N35M, 4N36M, 4N37M	40			%
		$I_F = 10\text{ mA}, V_{CE} = 10\text{ V}, T_A = +100^\circ\text{C}$	4N35M, 4N36M, 4N37M	40			%
$V_{CE(SAT)}$	Collector-to-Emitter Saturation Voltage	$I_C = 2\text{ mA}, I_F = 50\text{ mA}$	4N25M, 4N26M, 4N27M, 4N28M			0.5	V
		$I_C = 0.5\text{ mA}, I_F = 10\text{ mA}$	4N35M, 4N36M, 4N37M			0.3	V
AC CHARACTERISTICS							
T_{ON}	Non-Saturated Turn-on Time	$I_F = 10\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\text{ }\Omega$ (Figure 13)	4N25M, 4N26M, 4N27M, 4N28M		2		μs
		$I_C = 2\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\text{ }\Omega$ (Figure 13)	4N35M, 4N36M, 4N37M		2	10	μs
T_{OFF}	Turn-off Time	$I_F = 10\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\text{ }\Omega$ (Figure 13)	4N25M, 4N26M, 4N27M, 4N28M		2		μs
		$I_C = 2\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\text{ }\Omega$ (Figure 13)	4N35M, 4N36M, 4N37M		2	10	μs

Isolation Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
V_{ISO}	Input-Output Isolation Voltage	$t = 1\text{ Minute}$	4170			$V_{AC(RMS)}$
C_{ISO}	Isolation Capacitance	$V_{I-O} = 0\text{ V}, f = 1\text{ MHz}$		0.2		pF
R_{ISO}	Isolation Resistance	$V_{I-O} = \pm 500\text{ VDC}, T_A = 25^\circ\text{C}$	10^{11}			Ω

Typical Performance Curves



Figure 3. LED Forward Voltage vs. Forward Current



Figure 4. Normalized CTR vs. Forward Current



Figure 5. Normalized CTR vs. Ambient Temperature



Figure 6. CTR vs. R_{BE} (Unsaturated)



Figure 7. CTR vs. R_{BE} (Saturated)



Figure 8. Collector-Emitter Saturation Voltage vs. Collector Current

Typical Performance Curves (Continued)



Figure 9. Switching Speed vs. Load Resistor



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



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



Figure 12. Dark Current vs. Ambient Temperature

Switching Time Test Circuit and Waveforms



Figure 13. Switching Time Test Circuit and Waveforms

Reflow Profile



Figure 14. Reflow Profile

Ordering Information

Part Number	Package	Packing Method
4N25M	DIP 6-Pin	Tube (50 Units)
4N25SM	SMT 6-Pin (Lead Bend)	Tube (50 Units)
4N25SR2M	SMT 6-Pin (Lead Bend)	Tape and Reel (1000 Units)
4N25VM	DIP 6-Pin, DIN EN/IEC60747-5-5 Option	Tube (50 Units)
4N25SVM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tube (50 Units)
4N25SR2VM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tape and Reel (1000 Units)
4N25TVM	DIP 6-Pin, 0.4" Lead Spacing, DIN EN/IEC60747-5-5 Option	Tube (50 Units)

Note:

2. The product orderable part number system listed in this table also applies to the 4N26M, 4N27M, 4N28M, 4N35M, 4N36M, and 4N37M devices.

Marking Information



Figure 15. Top Mark

Table 1. Top Mark Definitions

1	Fairchild Logo
2	Device Number
3	DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)
4	One-Digit Year Code, e.g., "5"
5	Digit Work Week, Ranging from "01" to "53"
6	Assembly Package Code



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