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December 2014

4N29M, 4N30M, 4N32M, 4N33M, H11B1M, TIL113M 6-Pin DIP General Purpose Photodarlington Optocoupler

Features

- High Sensitivity to Low Input Drive Current
- Meets or Exceeds All JEDEC Registered Specifications
- Safety and Regulatory Approvals:
 - UL1577, 4,170 VAC_{RMS} for 1 Minute
- DIN-EN/IEC60747-5-5, 850 V Peak Working Insulation Voltage

Description

The 4N29M, 4N30M, 4N32M, 4N33M, H11B1M, and TIL113M have a gallium arsenide infrared emitter optically coupled to a silicon planar photodarlington.

Applications

- Low Power Logic Circuits
- Telecommunications Equipment
- Portable Electronics
- Solid State Relays
- Interfacing Coupling Systems of Different Potentials and Impedances

Schematic

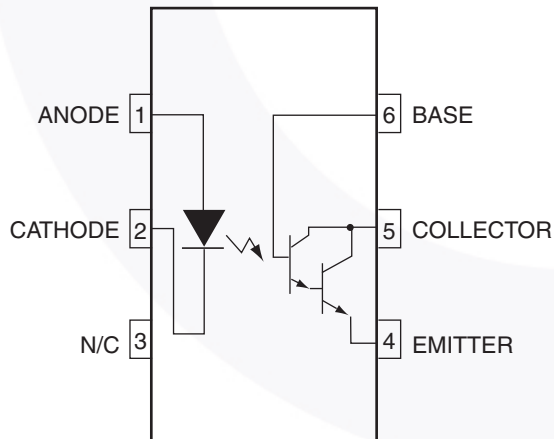


Figure 1. Schematic

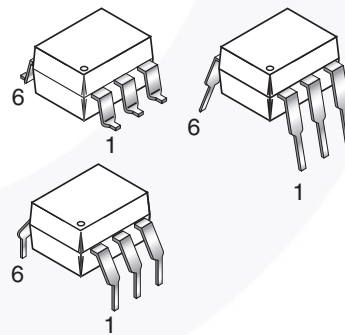


Figure 2. Package Outlines

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.

Symbol	Parameter	Value	Unit
TOTAL DEVICE			
T_{STG}	Storage Temperature	-40 to +125	°C
T_{OPR}	Operating Temperature	-40 to +100	°C
T_J	Junction Temperature	-40 to +125	°C
T_{SOL}	Lead Solder Temperature	260 for 10 seconds	°C
P_D	Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$	270	mW
	Derate Above 25°C	3.3	mW/°C
EMITTER			
I_F	Continuous Forward Current	80	mA
V_R	Reverse Voltage	3	V
$I_F(pk)$	Forward Current – Peak (300 μs , 2% Duty Cycle)	3.0	A
P_D	LED Power Dissipation @ $T_A = 25^\circ\text{C}$	120	mW
	Derate above 25°C	2.0	mW/°C
DETECTOR			
BV_{CEO}	Collector-Emitter Breakdown Voltage	30	V
BV_{CBO}	Collector-Base Breakdown Voltage	30	V
BV_{ECO}	Emitter-Collector Breakdown Voltage	5	V
P_D	Detector Power Dissipation @ $T_A = 25^\circ\text{C}$	150	mW
	Derate Above 25°C	2.0	mW/°C
I_C	Continuous Collector Current	150	mA

Electrical Characteristics

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

Individual Component Characteristics

Symbol	Parameter	Test Conditions	Device	Min.	Typ.	Max.	Unit
EMITTER							
V_F	Input Forward Voltage ⁽²⁾	$I_F = 10\text{ mA}$	4NXXM		1.2	1.5	V
			H11B1M, TIL113M	0.8	1.2	1.5	V
I_R	Reverse Leakage Current ⁽²⁾	$V_R = 3.0\text{ V}$	4NXXM		0.001	100	μA
		$V_R = 6.0\text{ V}$	H11B1M, TIL113M		0.001	10	μA
C	Capacitance ⁽²⁾	$V_F = 0\text{ V}$, $f = 1.0\text{ MHz}$	All		150		pF
DETECTOR							
BV_{CEO}	Collector-Emitter Breakdown Voltage ⁽²⁾	$I_C = 1.0\text{ mA}$, $I_B = 0$	4NXXM, TIL113M	30	60		V
			H11B1M	25	60		V
BV_{CBO}	Collector-Base Breakdown Voltage ⁽²⁾	$I_C = 100\ \mu\text{A}$, $I_E = 0$	All	30	100		V
BV_{ECO}	Emitter-Collector Breakdown Voltage ⁽²⁾	$I_E = 100\ \mu\text{A}$, $I_B = 0$	4NXXM	5.0	10		V
			H11B1M, TIL113M	7	10		V
I_{CEO}	Collector-Emitter Dark Current ⁽²⁾	$V_{CE} = 10\text{ V}$, Base Open	All		1	100	nA

Notes:

2. Indicates JEDEC registered data.

Electrical Characteristics (Continued) $T_A = 25^\circ\text{C}$ Unless otherwise specified.**Transfer Characteristics**

Symbol	Parameter	Test Conditions	Device	Min.	Typ.	Max.	Unit
DC CHARACTERISTICS							
$I_{C(CTR)}$	Collector Output Current ⁽³⁾⁽⁴⁾⁽⁵⁾	$I_F = 10\text{ mA}, V_{CE} = 10\text{ V}, I_B = 0$	4N32M, 4N33M	50 (500)			mA (%)
			4N29M, 4N30M	10 (100)			mA (%)
		$I_F = 1\text{ mA}, V_{CE} = 5\text{ V}$	H11B1M	5 (500)			mA (%)
		$I_F = 10\text{ mA}, V_{CE} = 1\text{ V}$	TIL113M	30 (300)			mA (%)
$V_{CE(SAT)}$	Saturation Voltage ⁽³⁾⁽⁵⁾	$I_F = 8\text{ mA}, I_C = 2.0\text{ mA}$	4NXXM			1.0	V
			TIL113M			1.25	V
		$I_F = 1\text{ mA}, I_C = 1\text{ mA}$	H11B1M			1.0	V
AC CHARACTERISTICS							
t_{on}	Turn-on Time	$I_F = 200\text{ mA}, I_C = 50\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\ \Omega$	4NXXM, TIL113M			5.0	μs
			H11B1M		25		μs
t_{off}	Turn-off Time	$I_F = 200\text{ mA}, I_C = 50\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\ \Omega$	4N32M, 4N33M, TIL113M			100	μs
			4N29M, 4N30M			40	μs
		$I_F = 10\text{ mA}, V_{CE} = 10\text{ V}, R_L = 100\ \Omega$	H11B1M		18		μs
BW	Bandwidth ⁽⁶⁾⁽⁷⁾				30		kHz

Notes:

- Indicates JEDEC registered data.
- The current transfer ratio(I_C / I_F) is the ratio of the detector collector current to the LED input current.
- Pulse test: pulse width = 300 μs , duty cycle $\leq 2.0\%$.
- I_F adjusted to $I_C = 2.0\text{ mA}$ and $I_C = 0.7\text{ mA rms}$.
- The frequency at which I_C is 3 dB down from the 1 kHz value.

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

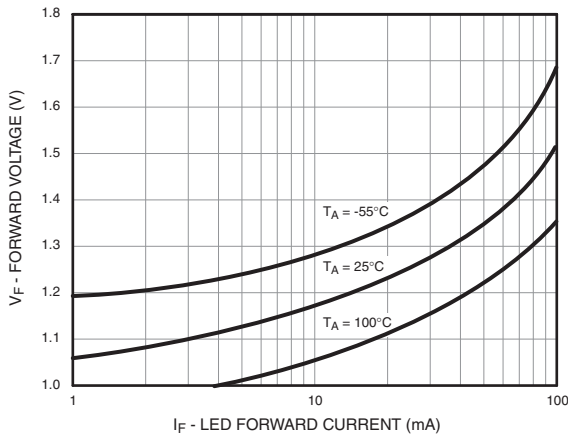


Figure 3. LED Forward Voltage vs. Forward Current

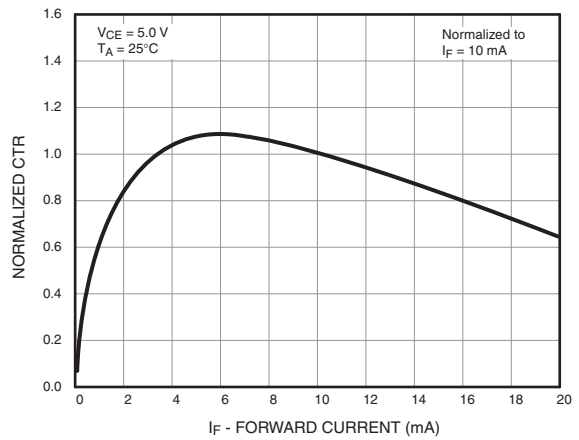


Figure 4. Normalized CTR vs. Forward Current



Figure 5. Normalized CTR vs. Ambient Temperature



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

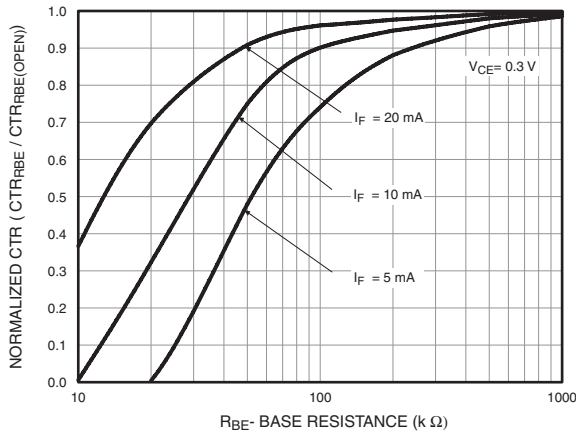


Figure 7. CTR vs. R_{BE} (Saturated)



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

Typical Performance Curves (Continued)

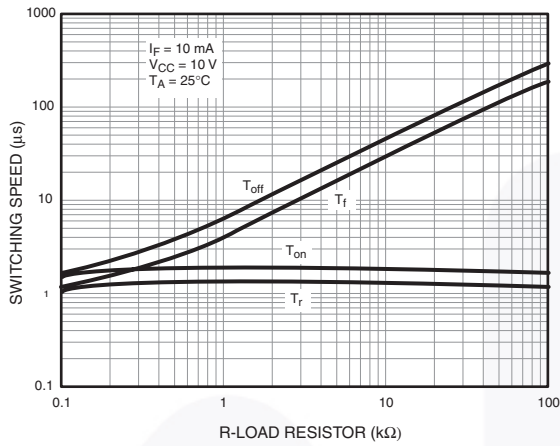


Figure 9. Switching Speed vs. Load Resistor



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 Waveform

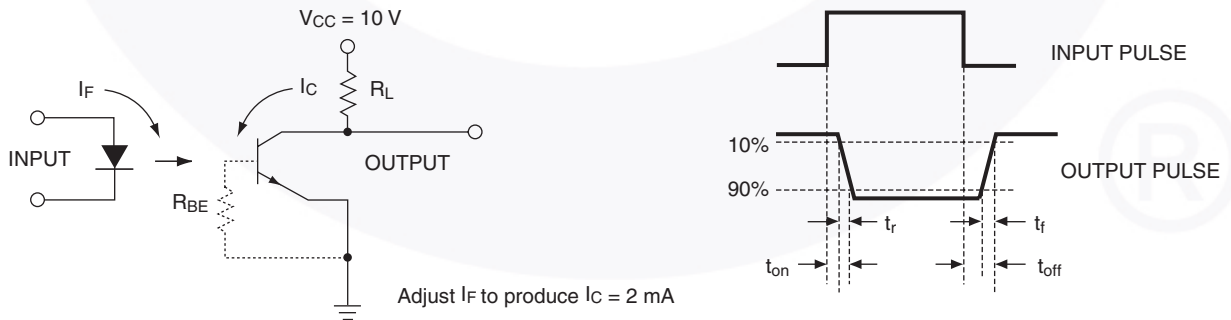


Figure 13. Switching Time Test Circuit and Waveform

Reflow Profile

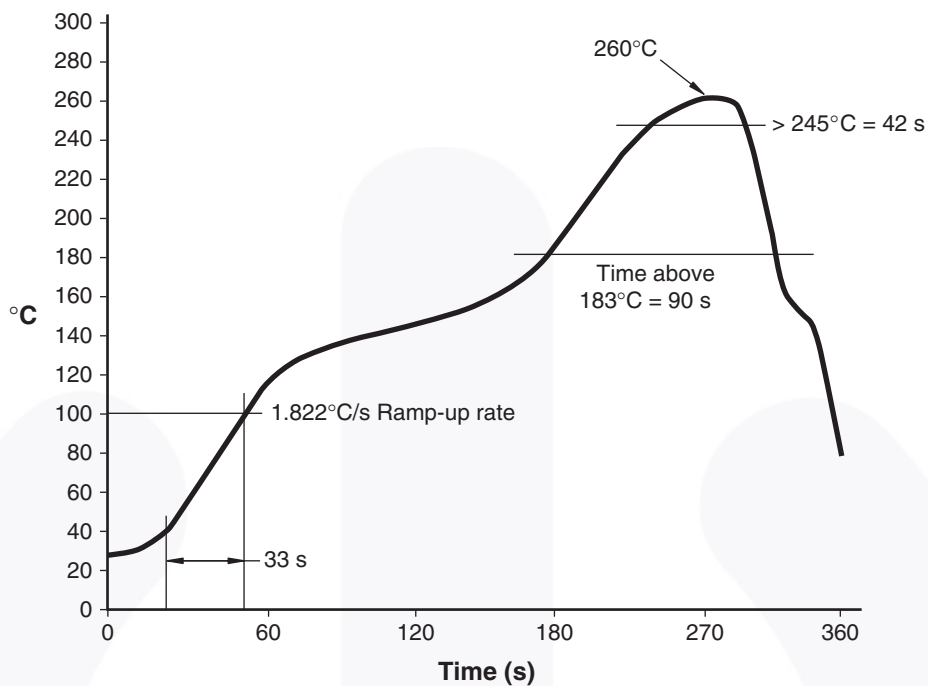


Figure 14. Reflow Profile

Ordering Information

Part Number	Package	Packing Method
4N29M	DIP 6-Pin	Tube (50 Units)
4N29SM	SMT 6-Pin (Lead Bend)	Tube (50 Units)
4N29SR2M	SMT 6-Pin (Lead Bend)	Tape and Reel (1000 Units)
4N29VM	DIP 6-Pin, DIN EN/IEC60747-5-5 Option	Tube (50 Units)
4N29SVM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tube (50 Units)
4N29SR2VM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tape and Reel (1000 Units)
4N29TVM	DIP 6-Pin, 0.4" Lead Spacing, DIN EN/IEC60747-5-5 Option	Tube (50 Units)

Note:

8. The product orderable part number system listed in this table also applies to the 4N30M, 4N32M, 4N33M, H11B1M, and TIL113M 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., "4"
5	Digit Work Week, Ranging from "01" to "53"
6	Assembly Package Code



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