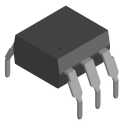
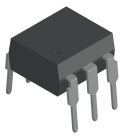
6-Pin General Purpose Phototransistor Optocouplers

Product Preview

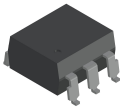
4N35



PDIP6
M TYPE
CASE 646CG



PDIP6
STD TYPE
CASE 646CU



PDIP6
S TYPE
CASE 646CV

Description

The general purpose optocouplers consist of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a standard plastic 6−pin dual−in−line package.

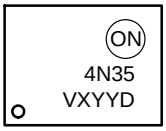
Features

- Minimum Current Transfer Ratio at I_F = 10 mA, V_{CE} = 10 V:
- 100% for 4N35
- Safety and Regulatory Approvals:
  - UL1577, 5,000 VAC_{RMS} for 1 Minute
  - DIN−EN/IEC60747−5−5, 850 V Peak Working Insulation Voltage (Pending)

Applications

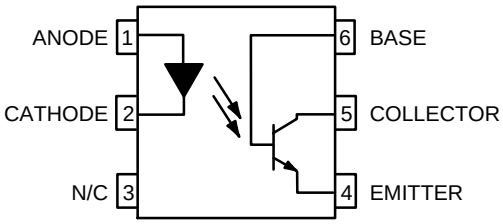
- Power Supply Regulators
- Digital Logic Inputs
- Microprocessor Inputs

MARKING DIAGRAM



ON	= Logo
4N35	= Specific Device Code
V	= DIN EN/IEC60747−5−5 Option (only appears on component ordered with this option)
X	= One−Digit Year Code
YY	= Digit Work Week
D	= Assembly Package Code

SCHEMATIC



ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

This document contains information on a product under development. **onsemi** reserves the right to change or discontinue this product without notice.

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		55/110/21
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} x 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} x 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)	≥0.4	mm
T_S	Case Temperature (Note 1)	175	°C
R_{IO}	Insulation Resistance at T_S, V_{IO} = 500 V (Note 1)	$>10^9$	Ω

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

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Max	Unit
TOTAL DEVICE			
T_{STG}	Storage Temperature	−55 to +125	°C
T_{OPR}	Operating Temperature	−55 to +110	°C
T_{SOL}	Lead Solder Temperature	260 for 10 seconds	°C
P_D	Total Device Power Dissipation	200	mW
EMITTER			
I_F	DC / Average Forward Input Current	50	mA
V_R	Reverse Input Voltage	6	V
P_D	LED Power Dissipation @ T_A = 25°C	70	mW
	Derate Above 100°C	3.8	mW/°C
DETECTOR			
V_{CEO}	Collector−to−Emitter Voltage	80	V
V_{CBO}	Collector−to−Base Voltage	80	V
V_{ECO}	Emitter−to−Collector Voltage	7	V
P_D	Detector Power Dissipation @ T_A = 25°C	150	mW
	Derate Above 100°C	9	mW/°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

ELECTRICAL CHARACTERISTICS − INDIVIDUAL COMPONENT CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
EMITTER						
V_F	Input Forward Voltage	I_F = 10 mA	−	1.20	1.50	V
I_R	Reverse Leakage Current	V_R = 6.0 V	−	−	10	μA
C_{in}	Input Capacitance	V = 0, f = 1 MHz	−	30	−	pF
DETECTOR						
BV_{CEO}	Collector−to−Emitter Breakdown Voltage	I_C = 1.0 mA, I_F = 0	80	−	−	V
BV_{CBO}	Collector−to−Base Breakdown Voltage	I_C = 0.1 mA, I_F = 0	80	−	−	V
BV_{ECO}	Emitter−to−Collector Breakdown Voltage	I_E = 0.1 mA, I_F = 0	7	−	−	V
BV_{EBO}	Emitter−to−Base Breakdown Voltage	I_E = 0.1 mA, I_F = 0	7	−	−	V
I_{CEO}	Collector−to−Emitter Dark Current	V_{CE} = 10 V, I_F = 0	−	−	50	nA
I_{CBO}	Collector−to−Base Dark Current	V_{CB} = 10 V	−	−	20	nA
C_{CE}	Capacitance	V_{CE} = 0 V, f = 1 MHz	−	8	−	pF

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

ELECTRICAL CHARACTERISTICS − TRANSFER CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
DC CHARACTERISTICS						
CTR	Current Transfer Ratio, Collector−to−Emitter	I_F = 10 mA, V_{CE} = 10 V	100	−	−	%
$V_{CE\ (SAT)}$	Collector−to−Emitter Saturation Voltage	I_C = 0.5 mA, I_F = 10 mA	−	−	0.3	V
AC CHARACTERISTIC						
Ton	Turn−on Time	I_C = 2 mA, V_{CC} = 10 V, R_L = 100 (Figure 11)	−	10	12	μs
Toff	Turn−off Time	I_C = 2 mA, V_{CC} = 10 V, R_L = 100 (Figure 11)	−	9	12	μs

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

ELECTRICAL CHARACTERISTICS − ISOLATION CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{ISO}	Input−Output Isolation Voltage	t = 1 Minute	5000	−	−	VAC_{RMS}
C_{ISO}	Isolation Capacitance	V_{I-O} = 0 V, f = 1 MHz	−	0.2	−	pF
R_{ISO}	Isolation Resistance	V_{I-O} = ±500 VDC, T_A = 25°C	10^{11}	−	−	

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

TYPICAL PERFORMANCE CURVES

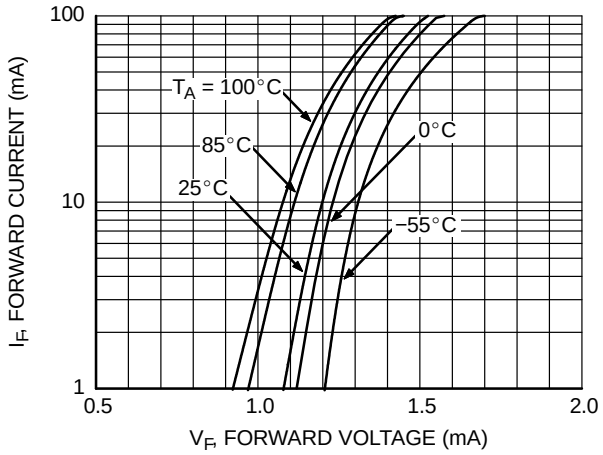


Figure 1. LED Forward Current vs. Forward Voltage

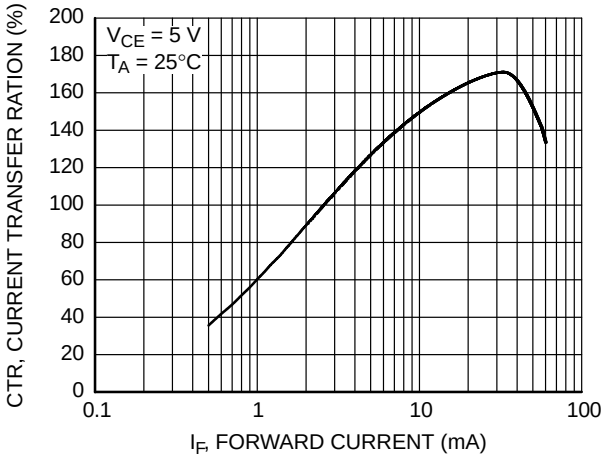


Figure 2. Current Transfer Ratio vs. Forward Current

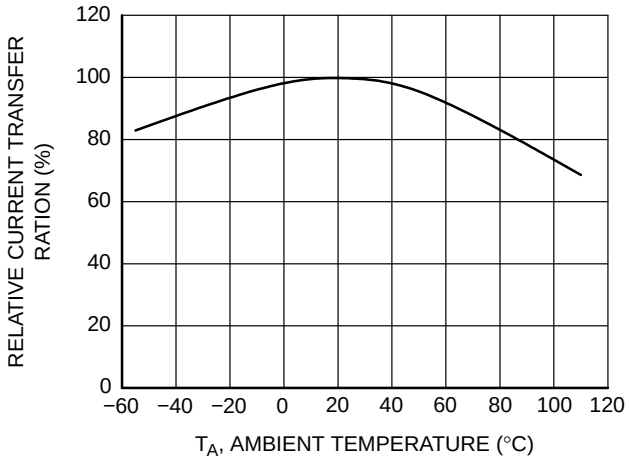


Figure 3. Relative Current Ratio vs. Ambient Temperature

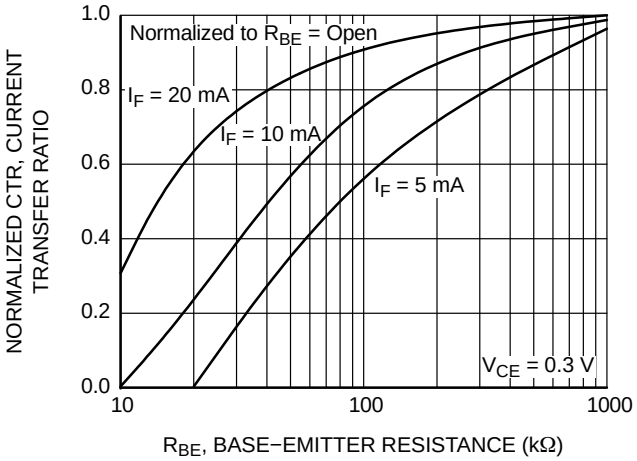


Figure 4. Current Transfer Ratio (Saturated) vs. Base−Emitter Resistance

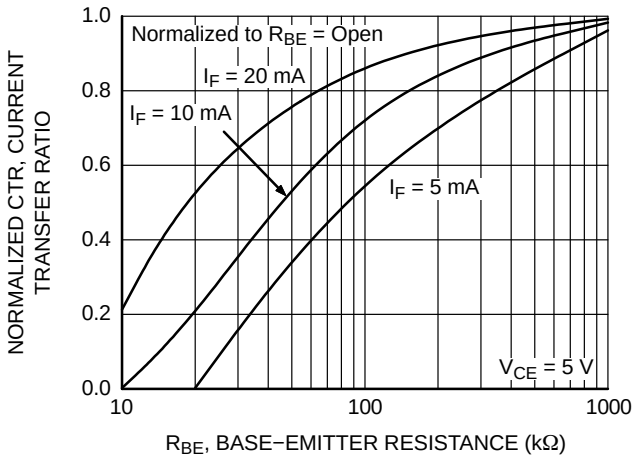


Figure 5. Current Transfer Ratio (Unsaturated) vs. Base−Emitter Resistance

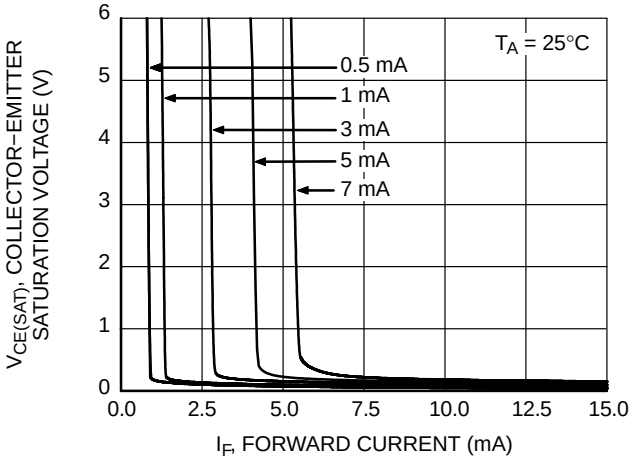


Figure 6. Collector−Emitter Saturation Voltage vs. Forward Current

TYPICAL PERFORMANCE CURVES (continued)

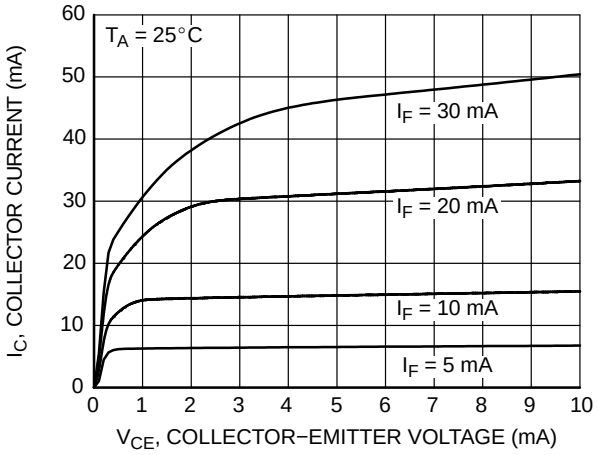


Figure 7. Collector Current vs. Collector−Emitter Voltage

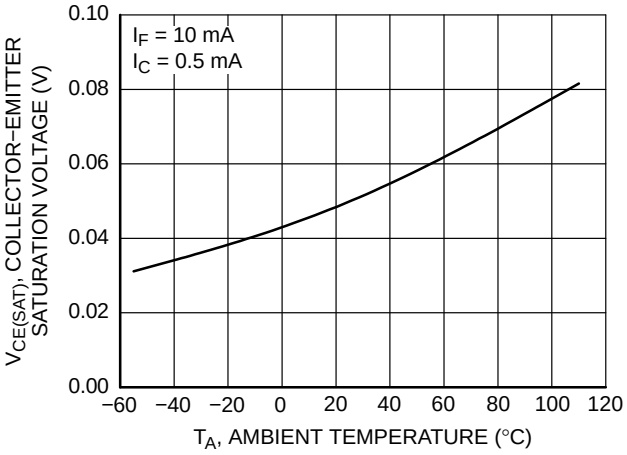


Figure 8. Collector−Emitter Saturation Voltage vs. Ambient Temperature

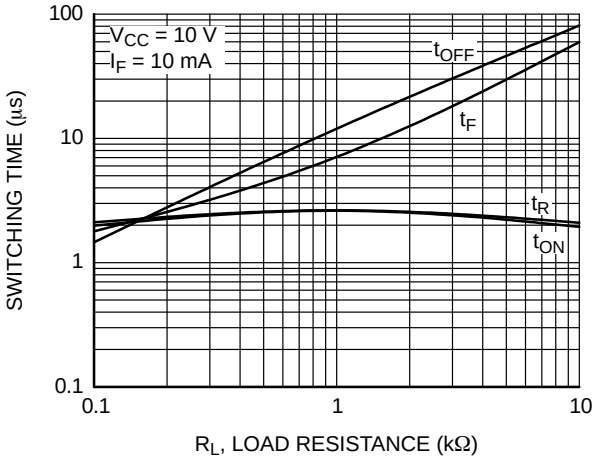


Figure 9. Switching Time vs. Load Resistance

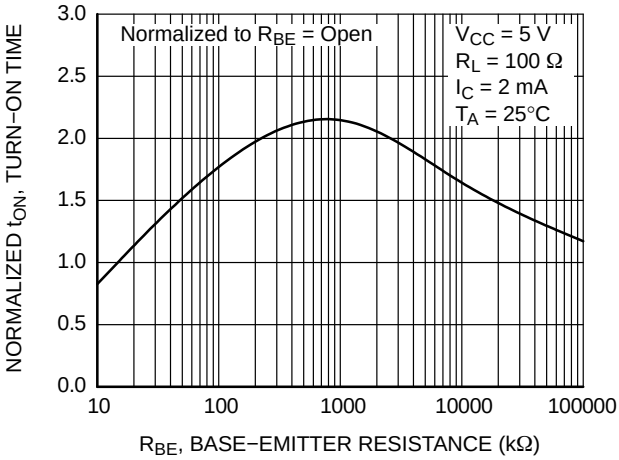


Figure 10. Turn−on Time vs. Base−Emitter Resistance

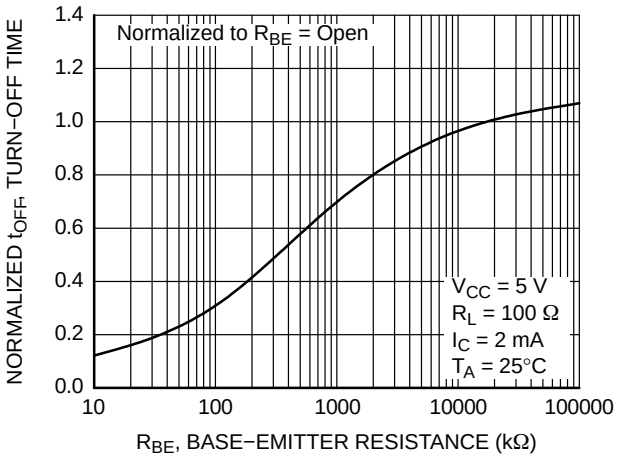


Figure 11. Turn−off Time vs. Base−Emitter Resistance

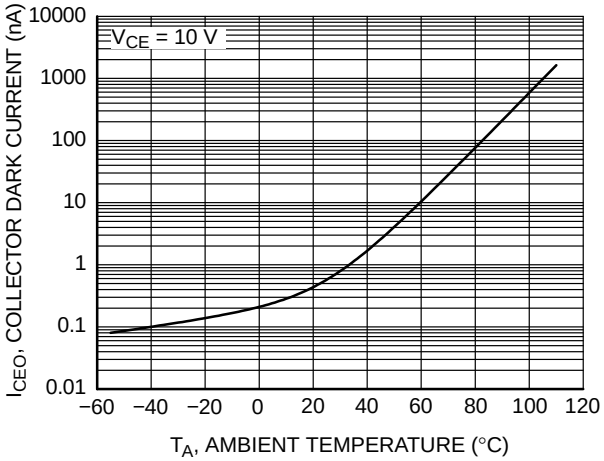


Figure 12. Collector Dark Current vs. Ambient Temperature

TYPICAL PERFORMANCE CURVES (continued)

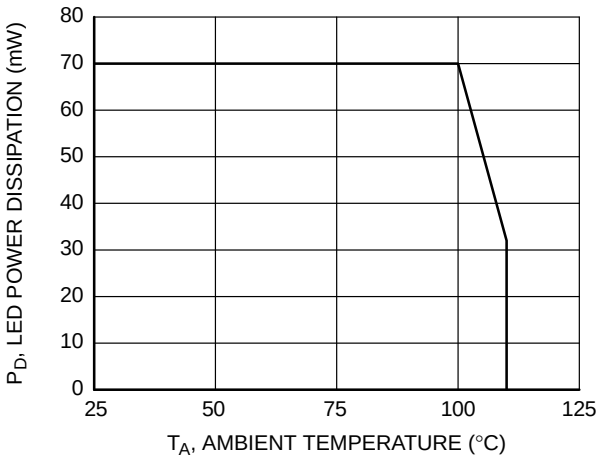


Figure 13. Max Allowable Power Dissipation (LED) vs. Ambient Temperature

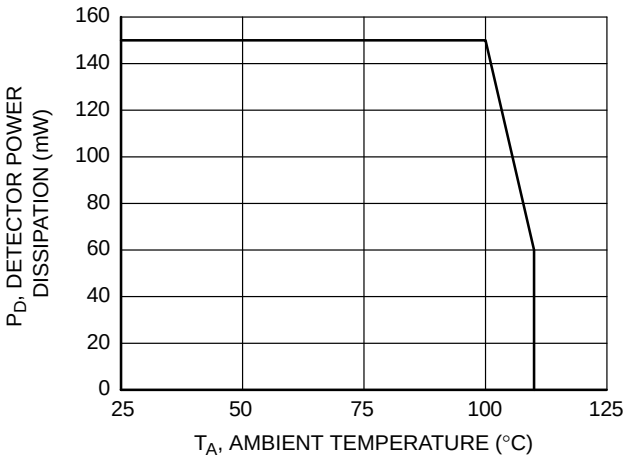


Figure 14. Max Allowable Power Dissipation (Detector) vs. Ambient Temperature

SWITCHING TIME TEST CIRCUIT AND WAVEFORMS

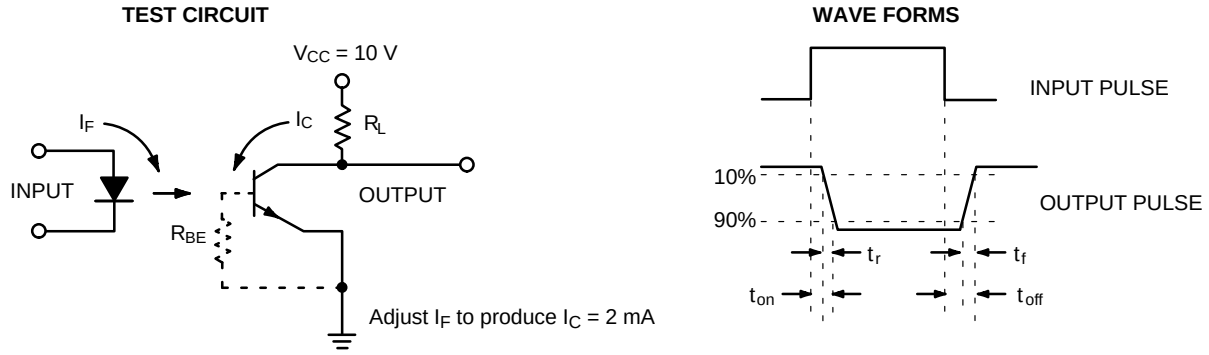
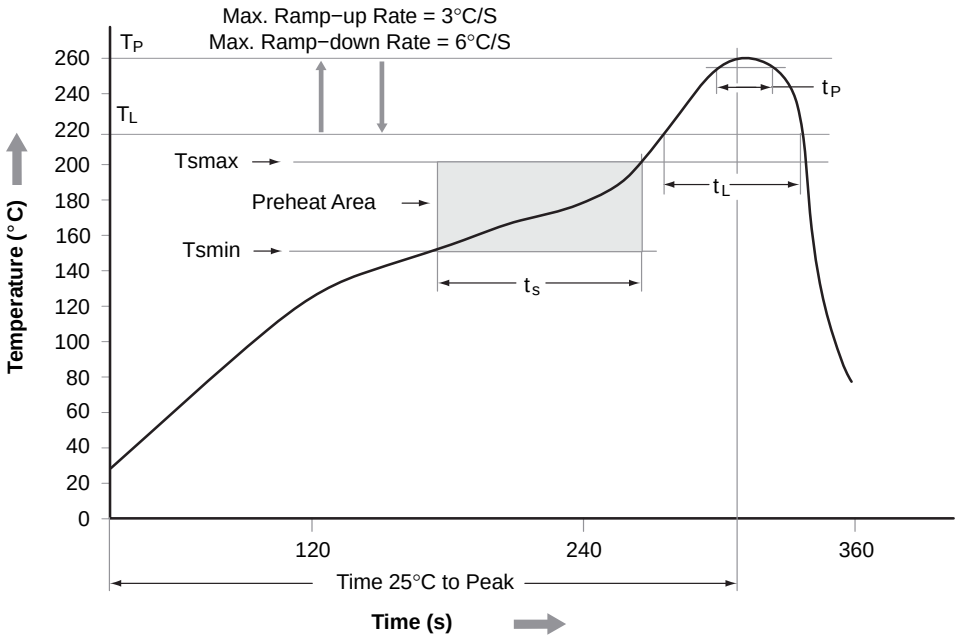


Figure 15. Switching Time Test Circuit and Waveform

REFLOW PROFILE



Profile Feature	Pb−Free Assembly Profile
Temperature Min. (Tsmin)	150°C
Temperature Max. (Tsmax)	200°C
Time (t_S) from (Tsmin to Tsmax)	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.

Figure 16. Reflow Profile

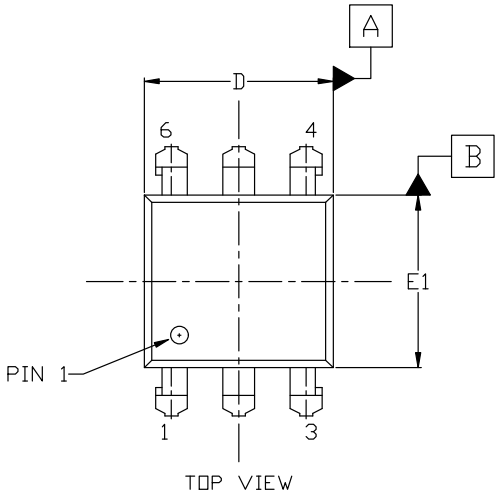
ORDERING INFORMATION

Part Number	Package	Shipping†
4N35	DIP 6−Pin	65 Units / Tube
4N35SR2	SMT 6−Pin (Lead Bend)	1000 Units / Tape & Reel
4N35SR2V	SMT 6−Pin (Lead Bend), DIN EN/IEC60747−5−5 Option	1000 Units / Tape & Reel
4N35TV	DIP 6−Pin, 0.4” Lead Spacing, DIN EN/IEC60747−5−5 Option	65 Units / Tube

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

PACKAGE DIMENSIONS

PDIP6 7.12x6.50, 2.54P (M TYPE)
CASE 646CG
ISSUE O



NOTES:

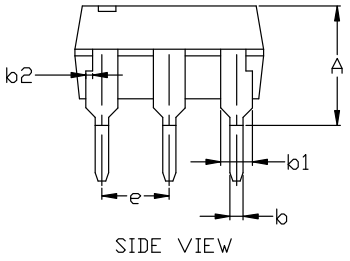
A) NO STANDARD APPLIES TO THIS PACKAGE.

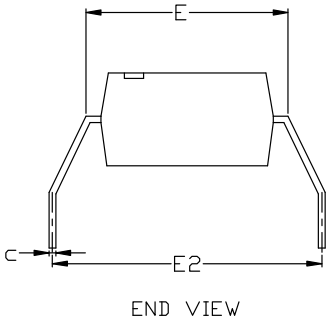
B) ALL DIMENSIONS ARE IN MILLIMETERS.

C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION

D) DRAWING FILENAME AND REVSION: MKT-N06Drev4

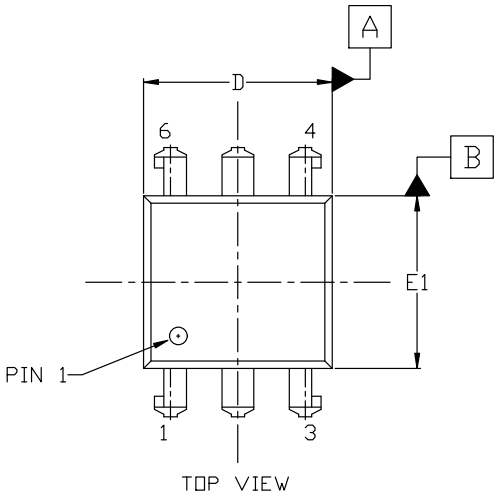
DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	4.20	4.50	4.80
b	0.40	0.50	0.60
b1	1.10	1.20	1.30
b2	0.24	0.25	026
c	0.25 REF		
D	6.82	7.12	7.32
E	7.62 TYP		
E1	6.20	6.50	6.80
E2	10.16 TYP		
e	2.54 TYP		





PACKAGE DIMENSIONS

PDIP6 7.12x6.50, 2.54P (STD TYPE)
CASE 646CU
ISSUE O



TOP VIEW

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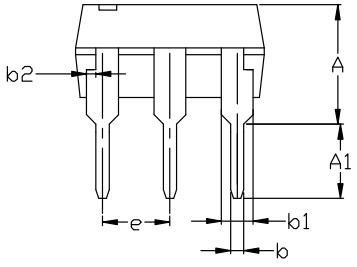
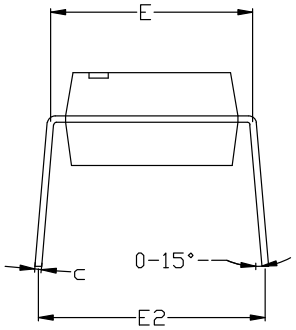
DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	4.20	4.50	4.80
A1	2.30	2.80	3.30
b	0.40	0.50	0.60
b1	1.10	1.20	1.30
b2	0.34	0.35	0.36
c	0.25 REF		
D	6.82	7.12	7.32
E	7.62 TYP		
E1	6.20	6.50	6.80
E2	7.62	---	9.50
e	2.54 TYP		



SIDE VIEW

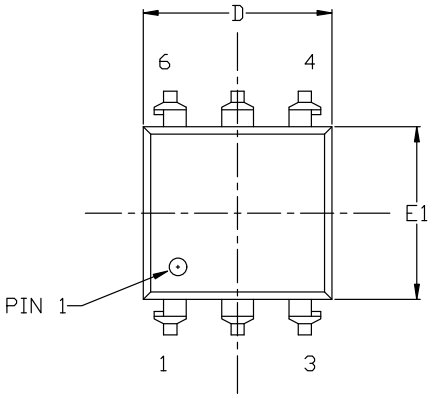


END VIEW

4N35

PACKAGE DIMENSIONS

PDIP6 7.12x6.50, 2.54P (S TYPE)
CASE 646CV
ISSUE O



TOP VIEW

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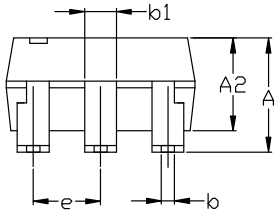
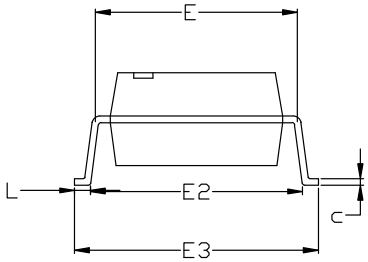
DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	4.00	4.30	4.60
A2	3.20	3.50	3.80
b	0.40	0.50	0.60
b1	1.10	1.20	1.30
c	0.25 REF		
D	6.82	7.12	7.32
E	7.62 TYP		
E1	6.20	6.50	6.80
E2	8.00	---	---
E3	---	---	10.3
e	2.54 TYP		



SIDE VIEW



END VIEW

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Email Requests to: orderlit@onsemi.com

onsemi Website: www.onsemi.com

TECHNICAL SUPPORT
North American Technical Support:
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