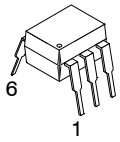
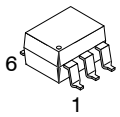
6-Pin DIP General Purpose Photodarlington Optocoupler

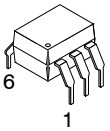
4N29M, 4N30M, 4N32M, 4N33M, H11B1M, TIL113M



PDIP6
CASE 646BX



PDIP6
S SUFFIX
CASE 646BY



PDIP6
T SUFFIX
CASE 646BZ

Description

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

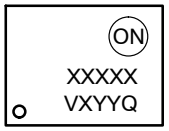
Features

- 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

Applications

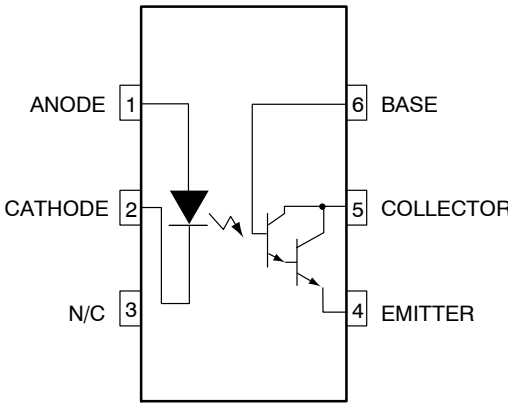
- Low Power Logic Circuits
- Telecommunications Equipment
- Portable Electronics
- Solid State Relays
- Interfacing Coupling Systems of Different Potentials and Impedances

MARKING DIAGRAM



ON	=	Logo
XXXXX	=	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
Q	=	Assembly Package Code

SCHEMATIC



ORDERING INFORMATION

See detailed ordering and shipping information on page 8 of this data sheet.

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} 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)	≥0.5	mm
T_S	Case Temperature (Note 1)	175	°C
$I_{S,INPUT}$	Input Current (Note 1)	350	mA
$P_{S,OUTPUT}$	Output Power (Note 1)	800	mW
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	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°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°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°C	150	mW
	Derate Above 25°C	2.0	mW/°C
I_C	Continuous Collector Current	150	mA

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

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.

2. Indicates JEDEC registered data.

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

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

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.

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

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	4170	–	–	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}	–	–	Ω

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

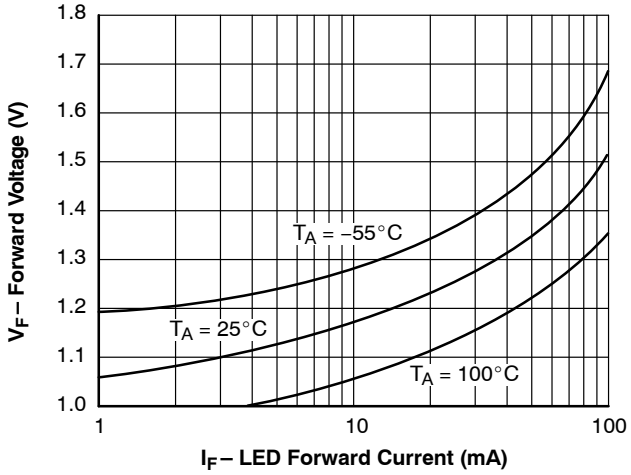


Figure 1. LED Forward Voltage vs. Forward Current

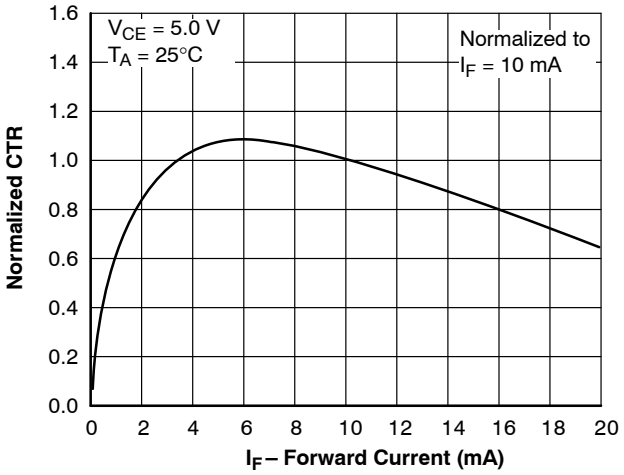


Figure 2. Normalized CTR vs. Forward Current

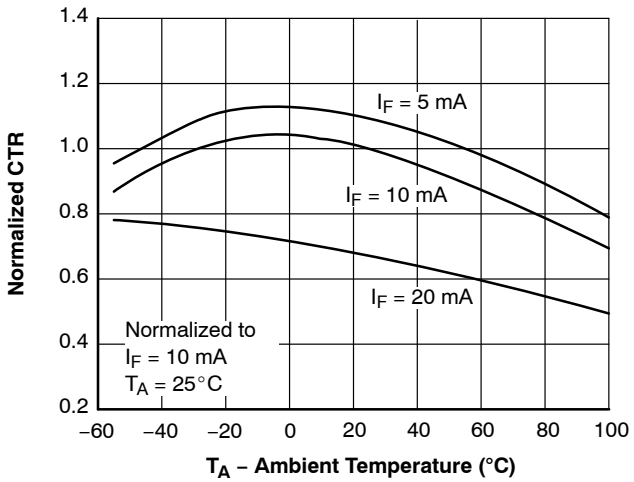


Figure 3. Normalized CTR vs. Ambient Temperature

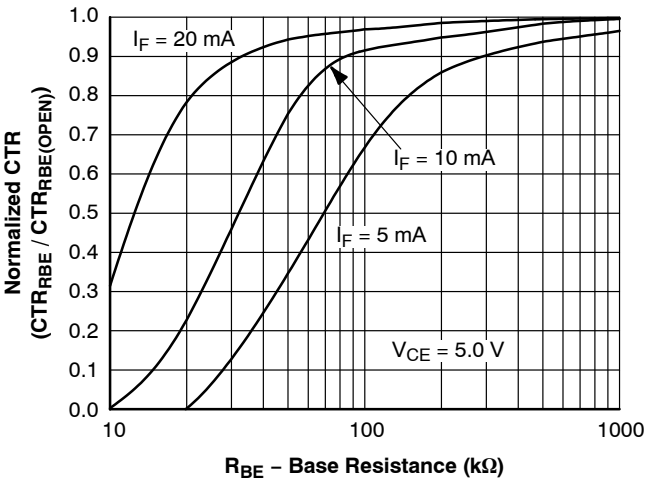


Figure 4. CTR vs. RBE (Unsaturated)

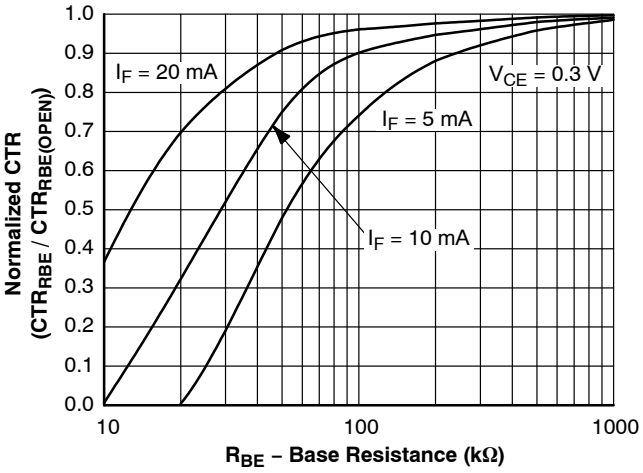


Figure 5. CTR vs. RBE (Saturated)

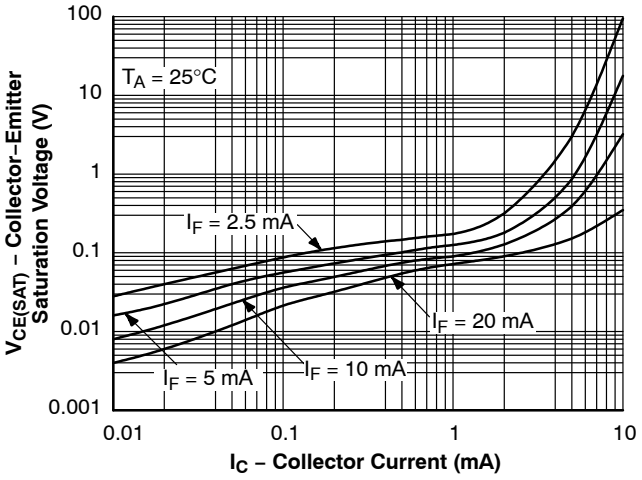


Figure 6. Collector–Emitter Saturation Voltage vs. Collector Current

TYPICAL PERFORMANCE CURVES (continued)

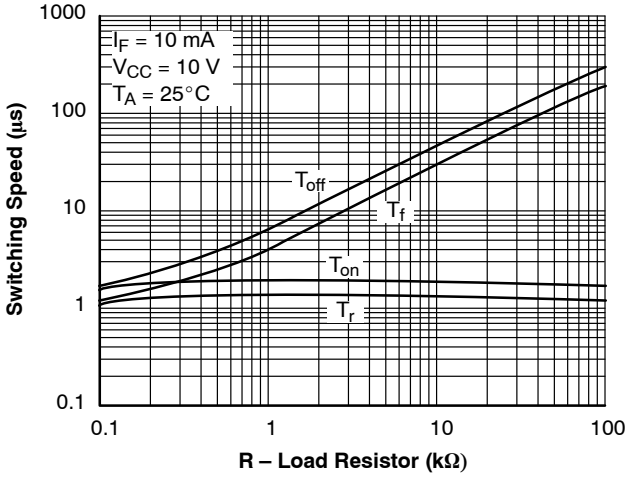


Figure 7. Switching Speed vs. Load Resistor

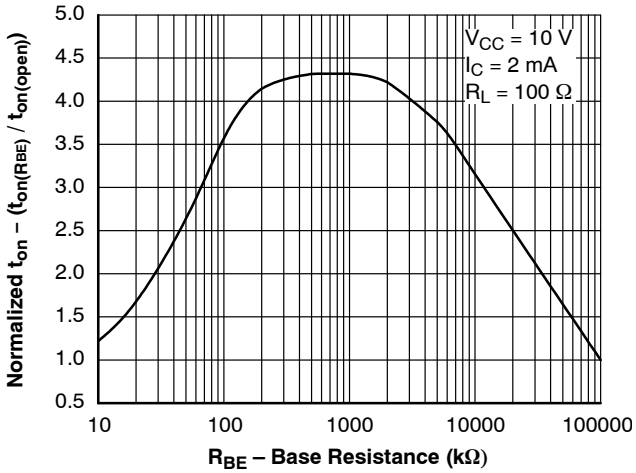


Figure 8. Normalized t_{on} vs. R_{BE}

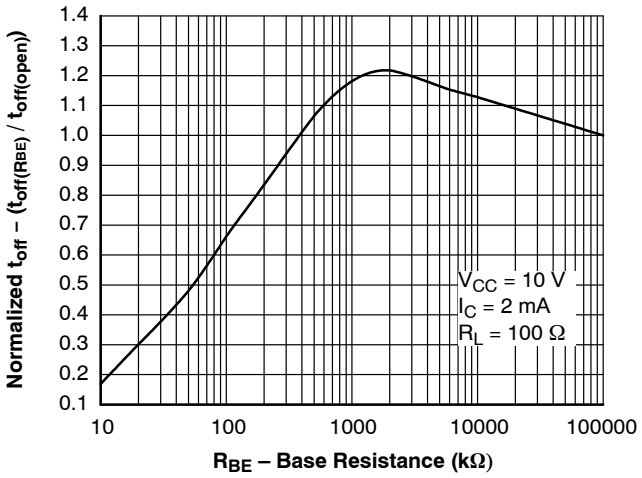


Figure 9. Normalized t_{off} vs. R_{BE}

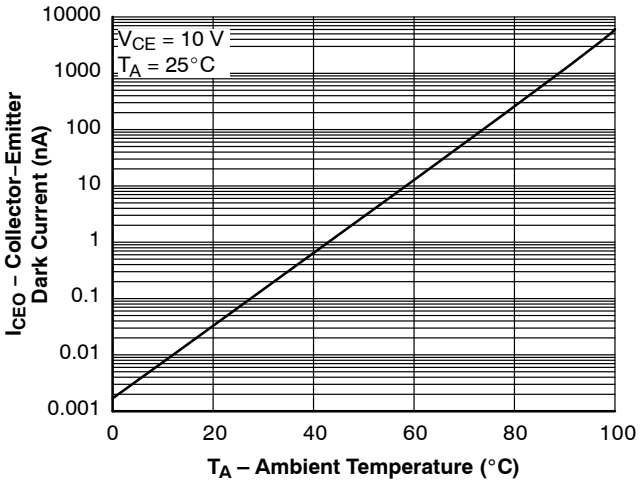


Figure 10. Dark Current vs. Ambient Temperature

SWITCHING TIME TEST CIRCUIT AND WAVEFORMS

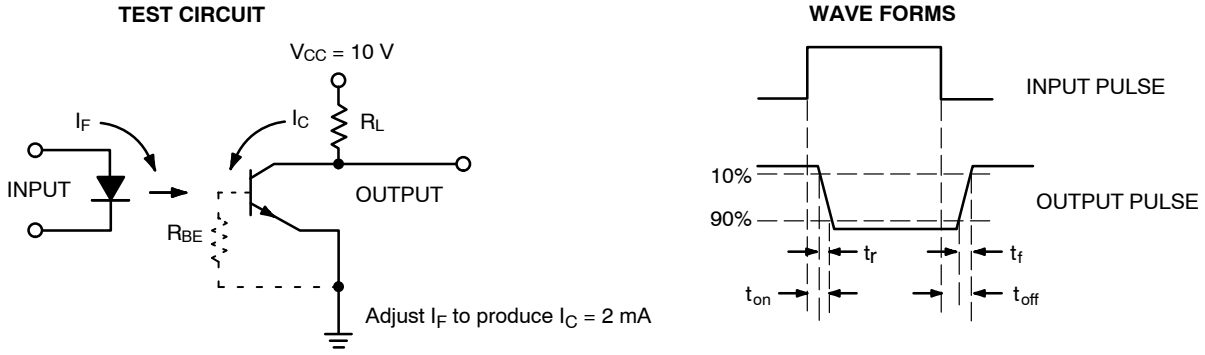


Figure 11. Switching Time Test Circuit and Waveforms

REFLOW PROFILE

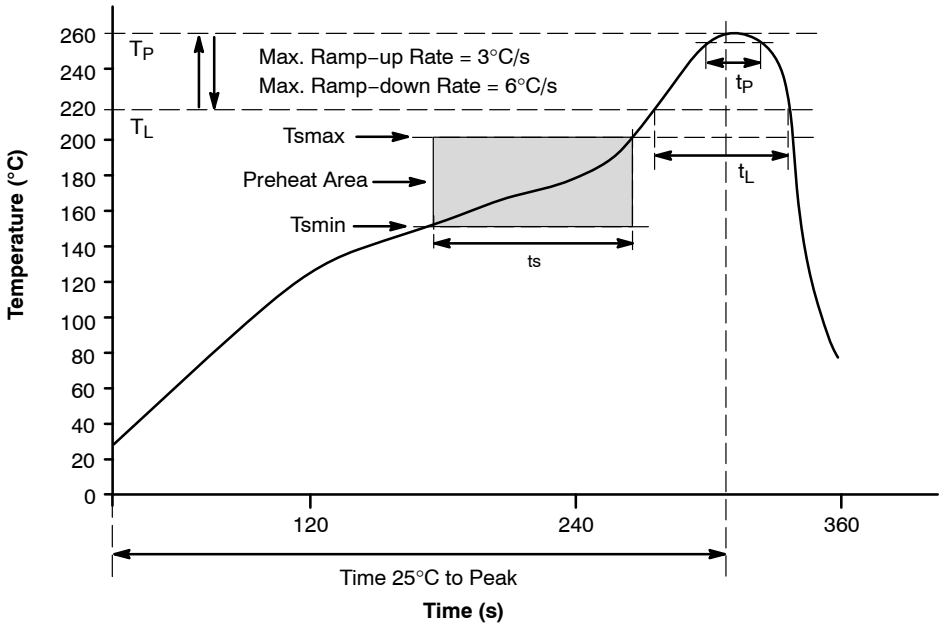


Figure 12. Reflow Profile

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 s
Ramp−up Rate (t_L to t_P)	3°C/s max.
Liquidous Temperature (T_L)	217°C
Time (t_L) Maintained Above (T_L)	60−150 s
Peak Body Package Temperature	260°C +0°C / −5°C
Time (t_P) within 5°C of 260°C	30 s
Ramp−down Rate (T_P to T_L)	6°C/s max.
Time 25°C to Peak Temperature	8 min max.

ORDERING INFORMATION

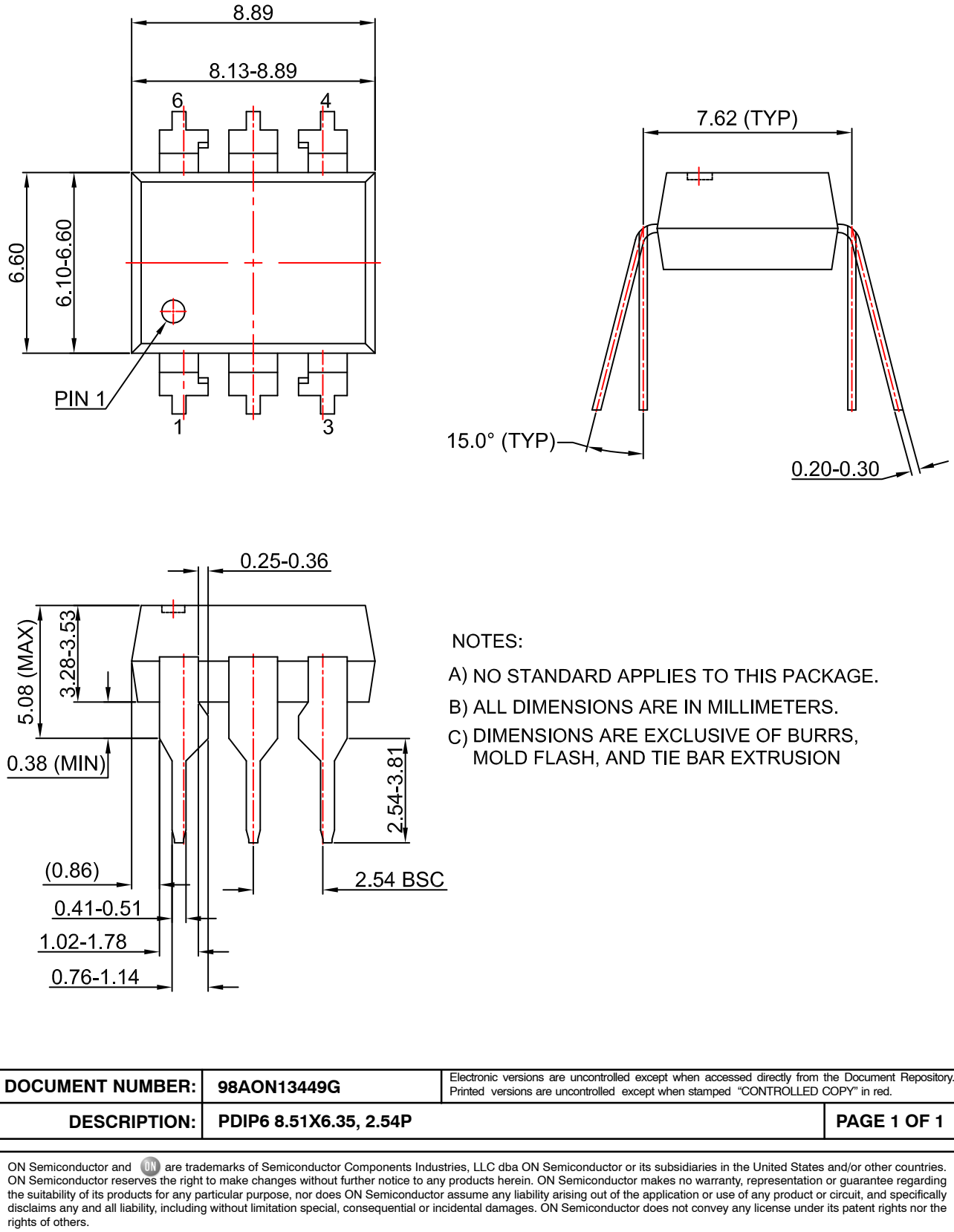
Part Number	Package	Packing Method†
4N29M	DIP 6−Pin	50 Units / Tube
4N29SM	SMT 6−Pin (Lead Bend)	50 Units / Tube
4N29SR2M	SMT 6−Pin (Lead Bend)	1000 / Tape & Reel
4N29VM	DIP 6−Pin, DIN EN/IEC60747−5−5 Option	50 Units / Tube
4N29SVM	SMT 6−Pin (Lead Bend), DIN EN/IEC60747−5−5 Option	50 Units / Tube
4N29SR2VM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

8. The product orderable part number system listed in this table also applies to the 4N30M, 4N32M, 4N33M, H11B1M and TIL113M devices.

PDIP6 8.51x6.35, 2.54P
CASE 646BX
ISSUE O

DATE 31 JUL 2016



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PDIP6 8.51x6.35, 2.54P
CASE 646BY
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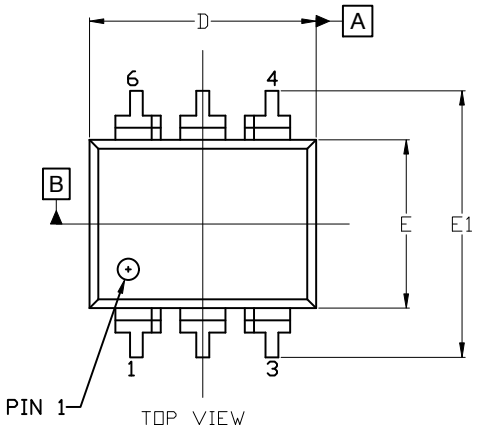
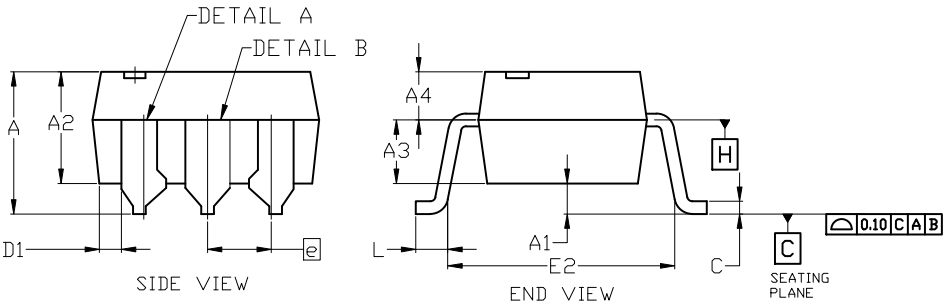
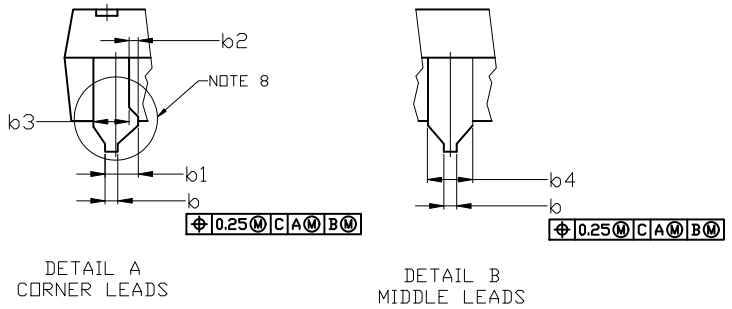
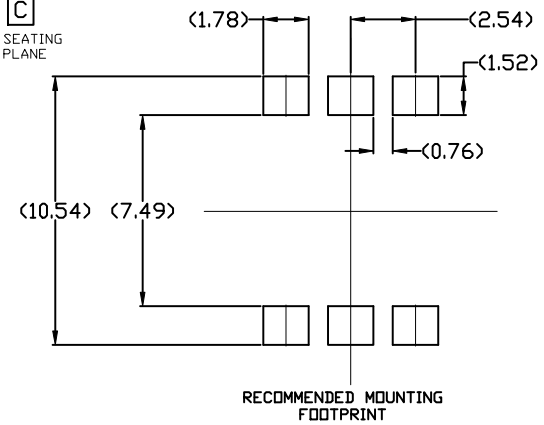


NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS A, A1, AND L ARE MEASURED WITH THE PACKAGE SEATED.
4. DIMENSIONS D, D1, AND E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS ARE NOT TO EXCEED 2.54mm.
5. PACKAGE CONTOUR IS OPTIONAL (ROUNDED OR SQUARE CORNERS).
6. CENTER LINE OF CORNER LEADS ARE LOCATED BY LOCATING THE CENTER OF FEATURE b2 AND b3.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	---	---	4.80
A1	0.38	---	---
A2	3.28	3.40	3.53
A3		2.49 REF	
A4		1.89 REF	
b	0.41	0.46	0.51
b1	0.76	0.92	1.14
b2	0.25	0.28	0.36
b3	1.02	1.40	1.78
b4		1.778 REF	
c	0.20	0.25	0.30
D	8.13	8.51	8.89
D1		0.86 REF	
E	6.10	6.35	6.60
E1	8.43	9.17	9.90
E2		8.13 REF	
e		2.54 BSC	
L	0.16	0.52	0.88







* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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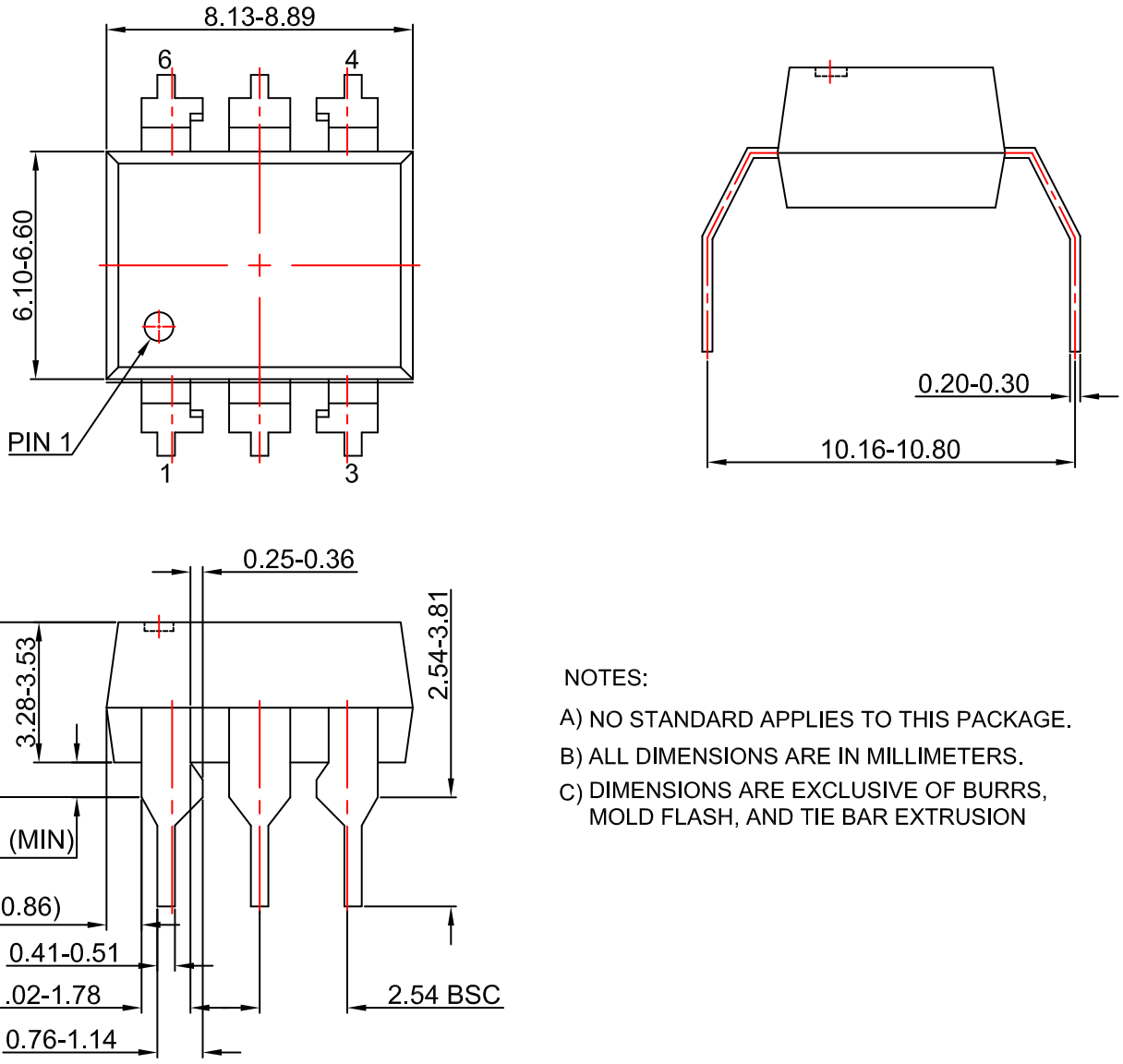
CASE 646BZ
ISSUE O

DATE 31 JUL 2016



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