onsemi

High-Speed 10 MBit/s Logic Gate Optocouplers

Single-Channel: 6N137, HCPL2601, HCPL2611 Dual-Channel: HCPL2630, HCPL2631

Description

The 6N137, HCPL2601, HCPL2611 single-channel and HCPL2630, HCPL2631 dual-channel optocouplers consist of a 850 nm AlGaAS LED, optically coupled to a very high speed integrated photo-detector logic gate with a strobable output. This output features an open collector, thereby permitting wired OR outputs. The coupled parameters are guaranteed over the temperature range of -40° C to $+85^{\circ}$ C. A maximum input signal of 5 mA will provide a minimum output sink current of 13 mA (fan out of 8).

An internal noise shield provides superior common mode rejection of typically 10 kV/ μ s. The HCPL2601 and HCPL2631 has a minimum CMR of 5 kV/ μ s. The HCPL2611 has a minimum CMR of 10 kV/ μ s.

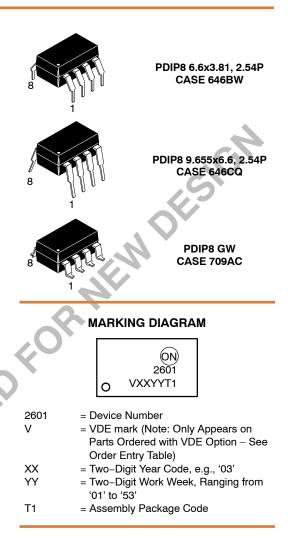
COMMENT

Features

- Very High Speed 10 MBit/s
- Superior CMR 10 kV/μs
- Double working voltage 480 V
- Fan-out of 8 Over -40°C to +85°C
- Logic Gate Output
- Strobable Output
- Wired OR-open Collector
- U.L. Recognized (File # E90700)

Applications

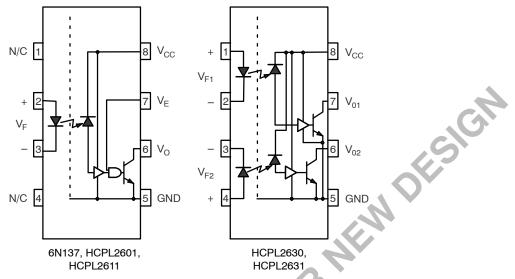
- Ground Loop Elimination
- LSTTL to TTL, LSTTL or 5-volt CMOS
- Line Receiver, Data Transmission
- Data Multiplexing
- Switching Power Supplies
- Pulse Transformer Replacement
- Computer-peripheral Interface



ORDERING INFORMATION

See detailed ordering and shipping information on page 10 of this data sheet.

SCHEMATICS



A 0.1 µF bypass capacitor must be connected between pins 8 and 5 (Note 1).

Figure 1. Schematics

TRUTH TABLE (Positive Logic)

Input	Enable	Output	
Н	Н	L	
L	Н	Н	
Н	L	н	
L	L	н	
Н	NC	1	
L	NC	Н	
	NO		

Symbol	Parameter		Value	Unit
T _{STG}	Storage Temperature		–55 to +125	°C
T _{OPR}	Operating Temperature		-40 to +85	°C
T _{SOL}	Lead Solder Temperature (for Wave Soldering Only)*		260 for 10 s	°C

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

EMITTER

	-			÷
١ _F	DC/Average Forward Input Current	Single Channel	50	mA
		Dual Channel (Each Channel)	30	
V _E	Enable Input Voltage Not to Exceed $V_{\mbox{CC}}$ by More than 500 \mbox{mV}	Single Channel	5.5	V
V _R	Reverse Input Voltage	Each Channel	5.0	V
Pl	Power Dissipation	Single Channel	100	mW
		Dual Channel (Each Channel)	45	1
DETECTOR				

DETECTOR

DETECTOR				
V _{CC} (1 Minute Max)	Supply Voltage	A.	7.0	V
Ι _Ο	Output Current	Single Channel	25	mA
		Dual Channel (Each Channel)	50	mA
V _O	Output Voltage	Each Channel	7.0	V
P _O	Collector Output Power Dissipation	Single Channel	85	mW
		Dual Channel (Each Channel)	60	

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. *For peak soldering reflow, please refer to the <u>Reflow Profile</u> on page 9.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
I _{FL}	Input Current, Low Level	0	250	μA
I _{FH}	Input Current, High Level	*6.3	15	mA
V _{CC}	Supply Voltage, Output	4.5	5.5	V
V _{EL}	Enable Voltage, Low Level	0	0.8	V
V _{EH}	Enable Voltage, High Level	2.0	V _{CC}	V
T _A	Low Level Supply Current	-40	+85	°C
N	Fan Out (TTL Load)	-	8	

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

*6.3 mA is a guard banded value which allows for at least 20% CTR degradation. Initial input current threshold value is 5.0 mA or less.

Symbol	Parameter	Test Conditions		Min	Тур	Max	Unit
INDIVIDUAL	COMPONENT CHARACTERIS	ARACTERISTICS					
EMITTER							
V _F	Input Forward Voltage	I _F = 10 mA		-	-	1.8	V
			T _A = 25°C	_	1.4	1.75	
B _{VR}	Input Reverse Breakdown Voltage	I _R = 10 μA	I	5.0	-	-	V
C _{IN}	Input Capacitance	V _F = 0, f = 1 MHz		-	60	-	pF
$\Delta V_{F} / \Delta T_{A}$	Input Diode Temperature Coefficient	I _F = 10 mA		-	-1.4	5	mV/°C
DETECTOR	1						
I _{CCH}	High Level Supply Current	$V_{CC} = 5.5 \text{ V}, \text{ I}_{F} = 0 \text{ mA},$	Single Channel	-	7	10	mA
		V _E = 0.5 V	Dual Channel	-	10	15	
I _{CCL}	Low Level Supply Current	Single Channel	V _{CC} = 5.5 V, I _F = 10 mA		9	13	mA
		Dual Channel	V _E = 0.5 V		14	21	
I _{EL}	Low Level Enable Current	$V_{CC} = 5.5 \text{ V}, \text{ V}_{E} = 0.5 \text{ V}$		-	-0.8	-1.6	mA
I _{EH}	High Level Enable Current	$V_{CC} = 5.5 \text{ V}, \text{ V}_{E} = 2.0 \text{ V}$		-	-0.6	-1.6	mA
V _{EH}	High Level Enable Voltage	$V_{CC} = 5.5 \text{ V}, \text{ I}_{\text{F}} = 10 \text{ mA}$	N N	2.0	-	_	V
V _{EL}	Low Level Enable Voltage	$V_{CC} = 5.5 \text{ V}, \text{ I}_{\text{F}} = 10 \text{ mA}$ (I	Note 3)	-	-	0.8	V
SWITCHING	G CHARACTERISTICS (T _A = -40	0°C to +85°C, V _{CC} = 5 V, I _F	= 7.5 mA unless otherwise	e specified)		
T _{PLH}	Propagation Delay Time to	$R_L = 350 \Omega_{,C_L} = 15 pF$	T _A = 25°C	20	45	75	ns
	Output HIGH Level	(Note 4) (Figure 13)		-	-	100	
T _{PHL}	Propagation Delay Time to	T _A = 25°C (Note 5)		25	45	75	ns
	Output LOW Level	R_L = 350 Ω, C_L = 15 pF (F	Figure 13)	-	-	100	
T _{PHL} T _{PLH}	Pulse Width Distortion	R_L = 350 Ω, C_L = 15 pF (F	Figure 13)	-	3	35	ns
t _r	Output Rise Time (10–90%)	R_L = 350 Ω, C_L = 15 pF (N	Note 6) (Figure 13)	-	50	_	ns
t _f	Output Rise Time (90–10%)	R_L = 350 Ω, C_L = 15 pF (N	Note 7) (Figure 13)	-	12	_	ns
t _{ELH}	Enable Propagation Delay Time to Output HIGH Level	I _F = 7.5 mA, V _{EH} = 3.5 V, (Note 8) (Figure 14)	R _L = 350 Ω, C _L = 15 pF	-	20	-	ns
t _{EHL}	Enable Propagation Delay Time to Output LOW Level	I _F = 7.5 mA, V _{EH} = 3.5 V, (Note 9) (Figure 14)	R _L = 350 Ω, C _L = 15pF	-	20	-	ns
CM _H	Common Mode Transient Immunity (at Output HIGH	$T_A = 25^{\circ}C, V_{CM} = 50 V$ (Peak), $I_F = 0 mA$,	6N137, HCPL2630	-	10,000	-	V/μs
	Level)	V_{OH} (Min.) = 2.0 V, R _L = 350 Ω (Note 10) (Figure 15)	HCPL2601, HCPL2631	5000	10,000	-	
		V _{CM} = 400 V	HCPL2611	10,000	15,000	_	V/μs
CML	Common Mode Transient Immunity (at Output LOW	$R_L = 350 \Omega$, $I_F = 7.5 mA$, V _{OL} (Max.) = 0.8 V,	6N137, HCPL2630	_	10,000	_	
V	Level)	T _A = 25°C (Note 11) (Figure 15)	HCPL2601, HCPL2631	5000	10,000	_	
		V _{CM} = 400 V	HCPL2611	10,000	15,000	-	
TRANSFER	CHARACTERISTICS (T _A = -40						
I _{OH}	HIGH Level Output Current	V _{CC} = 5.5 V, V _O = 5.5 V, I (Note 2)	_F = 250 μA, V _E = 2.0V	-	-	100	μA

ELECTRICAL CHARACTERISTICS ($T_A = 0^{\circ}C$ to 70°C unless otherwise specified)

 V_{CC} = 5.5 V, I_F = 5 mA, V_E = 2.0 V, I_{CL} = 13 mA

.35

_

0.6

5

V

mΑ

LOW Level Output Current

VOL

 I_{FT}

Symbol	Parameter	Test Conditions		Тур	Max	Unit	
ISOLATION	ISOLATION CHARACTERISTICS ($T_A = -40^{\circ}C$ to +85°C unless otherwise specified)						
I _{I–O}	Input-Output Insulation Leakage Current	Relative Humidity = 45%, T_A = 25°C, t = 5 s, V_{I-O} = 3000 VDC (Note 12)	-	-	1.0*	μΑ	
V _{ISO}	Withstand Insulation Test Voltage	RH < 50%, T_A = 25°C, I_{I-O} \leq 2 $\mu A,$ t = 1 min. (Note 12)	2500	-	-	V _{RMS}	
R _{I-O}	Resistance (Input to Output)	V _{I-O} = 500 V (Note 12)	-	10 ¹²	-	Ω	
C _{I-O}	Capacitance (Input to Output)	f = 1 MHz (Note 12)	-	0.6	-	рF	

ELECTRICAL CHARACTERISTICS (T_A = 0°C to 70°C unless otherwise specified) (continued)

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.

*All Typicals at $V_{CC} = 5 \text{ V}, T_A = 25^{\circ}\text{C}$

1. The V_{CC} supply to each optoisolator must be bypassed by a 0.1 µF capacitor or larger. This can be either a ceramic or solid tantalum capacitor with good high frequency characteristic and should be connected as close as possible to the package V_{CC} and GND pins of each device. 2. Each channel.

3. Enable Input - No pull up resistor required as the device has an internal pull up resistor.

4. t_{PLH} - Propagation delay is measured from the 3.75 mA level on the HIGH to LOW transition of the input current pulse to the 1.5 V level on the LOW to HIGH transition of the output voltage pulse.

5. t_{PHI} - Propagation delay is measured from the 3.75 mA level on the LOW to HIGH transition of the input current pulse to the 1.5 V level on the HIGH to LOW transition of the output voltage pulse.

6. t_r – Rise time is measured from the 10% to the 90% levels on the LOW to HIGH transition of the output pulse.

7. t_f - Fall time is measured from the 90% to the 10% levels on the HIGH to LOW transition of the output pulse.

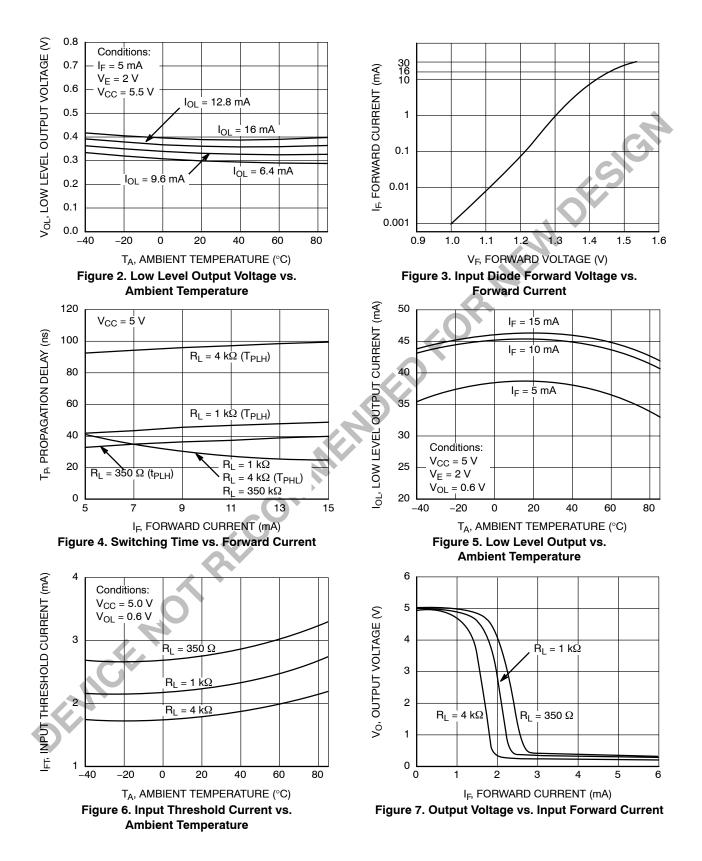
8. tELH - Enable input propagation delay is measured from the 1.5 V level on the HIGH to LOW transition of the input voltage pulse to the 1.5 V level on the LOW to HIGH transition of the output voltage pulse.

9. t_{EHL} - Enable input propagation delay is measured from the 1.5 V level on the LOW to HIGH transition of the input voltage pulse to the 1.5 V level on the HIGH to LOW transition of the output voltage pulse.

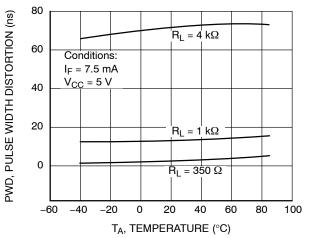
10. CM_H - The maximum tolerable rate of rise of the common mode voltage to ensure the output will remain in the HIGH state (i.e., V_{OUT} > 2.0 V). Measured in volts per microsecond (V/us).

11. CML - The maximum tolerable rate of rise of the common mode voltage to ensure the output will remain in the LOW output state (i.e., .d .d 4 short $V_{OUT} < 0.8$ V). Measured in volts per microsecond (V/µs).

12. Device considered a two-terminal device: Pins 1, 2, 3 and 4 shorted together, and Pins 5, 6, 7 and 8 shorted together.



TYPICAL PERFORMANCE CURVES



TYPICAL PERFORMANCE CURVES (Continued)



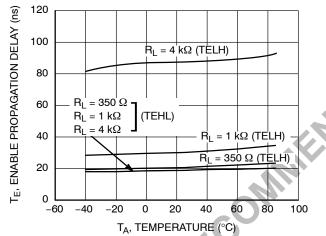


Figure 10. Enable Propagation Delay vs. Temperature

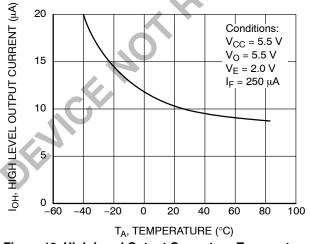
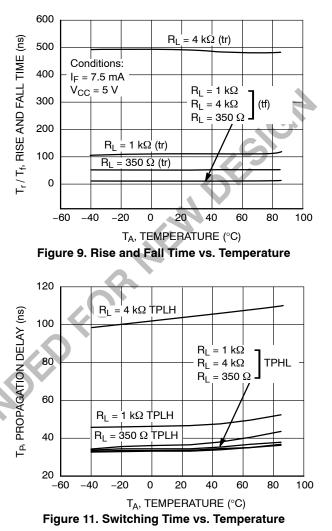
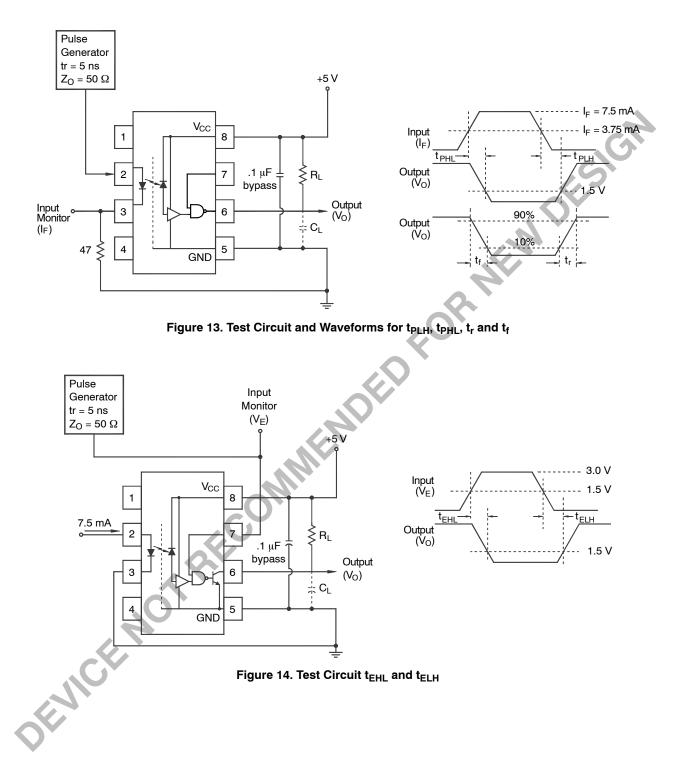


Figure 12. High Level Output Current vs. Temperature





TEST CIRCUITS



TEST CIRCUITS (Continued)

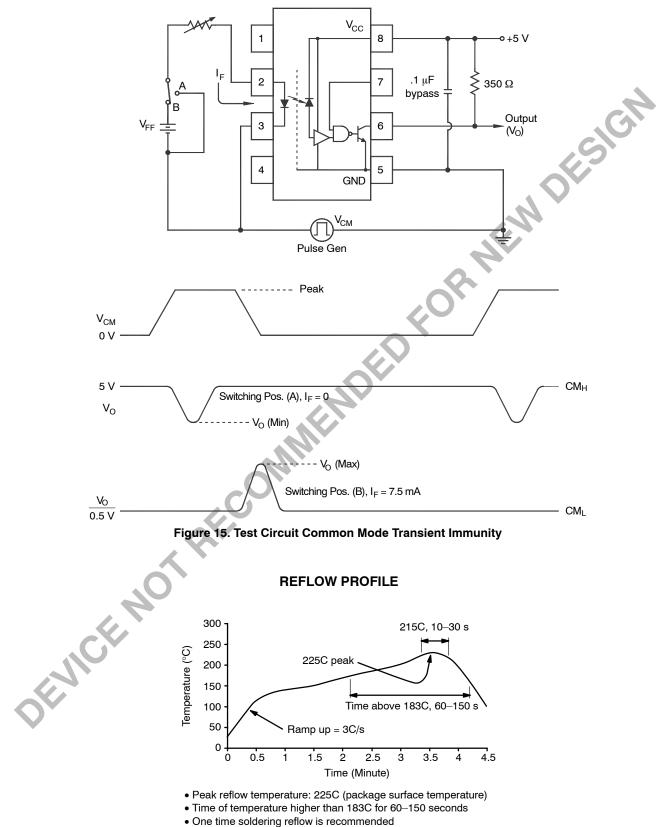


Figure 16. Reflow Profile

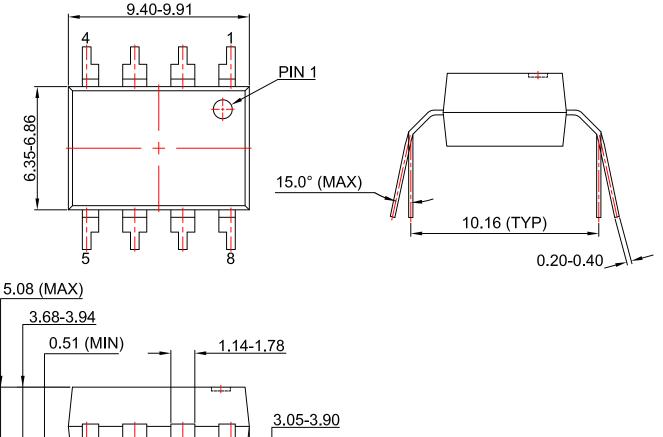
ORDERING INFORMATION

Option	Example Part Number	Description [†]
S	6N137S	PDIP8 GW, CASE 709AC Surface Mount Lead Bend
SD	6N137SD	PDIP8 GW, CASE 709AC Surface Mount; Tape and Reel
W	6N137W	PDIP8 6.6x3.81, 2.54P, CASE 646BW 0.4" Lead Spacing
V	6N137V	PDIP8 9.655x6.6, 2.54P, CASE 646CQ VDE0884
WV	6N137WV	PDIP8 6.6x3.81, 2.54P, CASE 646BW VDE0884; 0.4" Lead Spacing
SV	6N137SV	PDIP8 GW, CASE 709AC VDE0884; Surface Mount
SDV	6N137SDV	PDIP8 GW, CASE 709AC VDE0884; Surface Mount; Tape and Reel
	cifications, including part orientation and tap	



PDIP8 6.6x3.81, 2.54P CASE 646BW ISSUE O

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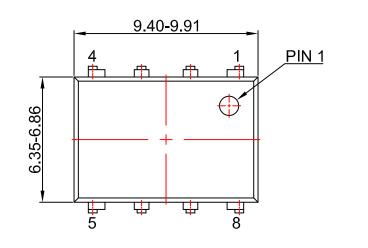
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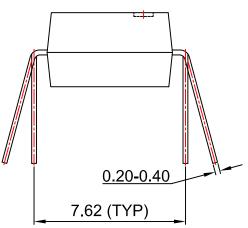
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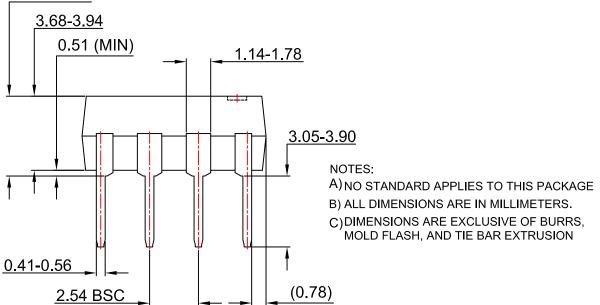
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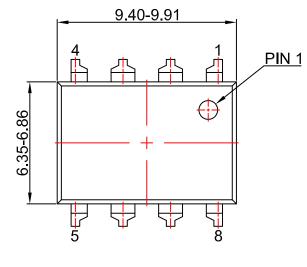


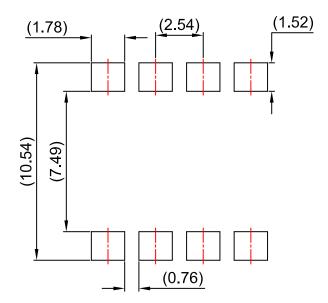
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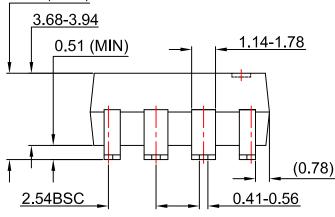
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LAND PATTERN RECOMMENDATION

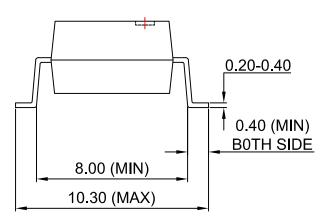
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