Agilent Technologies
Innovating the HP Way

1.5 Amp Output Current IGBT Gate Drive Optocoupler

Technical Data

HCPL-T250

Features

- **Input Threshold Current (I_{FLH}): 5 mA (Max.)**
- **Supply Current (I_{CC}): 11 mA (Max.)**
- **Supply Voltage (V_{CC}): 15-35 V**
- **Output Current (I_O): ± 0.5 A (Min.)**
- **Switching Time (t_{PLH}/t_{PHL}): 0.5 µs (Max.)**
- **Isolation Voltage (V_{ISO}): 2500 Vrms (Min.)**
- **UL 577 Recognized: File No. E55361**
- **CSA Approved**
- **VDE 0884 Approved with V_{IORM} = 630 V_{peak}**
- **8 kV/µs Minimum Common Mode Rejection (CMR) at Vcm = 1500 V**
- **Creepage Distance: 7.4 mm.** Clearance: 7.1 mm.

Applications

- **IGBT/MOSFET Gate Drive**
- **AC/Brushless DC Motor Drives**
- **Industrial Inverters**
- **Switch Mode Power Supplies**

Description

The HCPL-T250 contains GaAs LED. The LED is optically coupled to an integrated circuit with a power output stage. This optocoupler is ideally suited for driving power IGBTs and MOSFETs used in motor control inverter applications. The high operating voltage range of the output stage provides the drive voltages required by gate controlled devices. The voltage and current supplied by this optocoupler makes it ideally suited for directly driving IGBTs with ratings up to 1200 V/25 A. For IGBTs with higher ratings, the HCPL-T250 can be used to drive a discrete power stage which drives the IGBT gate.

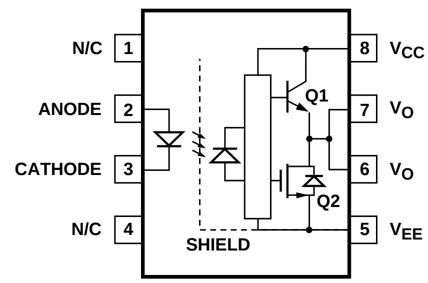
Ordering Information

Specify Part Number followed by Option Number.

Example:
HCPL-T250 #XXX

- No Option = Standard DIP Package, 50 per tube.
- 060 = VDE 0884 V_{IORM} = 630 V_{peak} Option, 50 per tube.
- 300 = Gull Wing Surface Mount Option, 50 per tube.
- 500 = Tape and Reel Packaging Option, 1000 per reel.

Functional Diagram



Truth Table

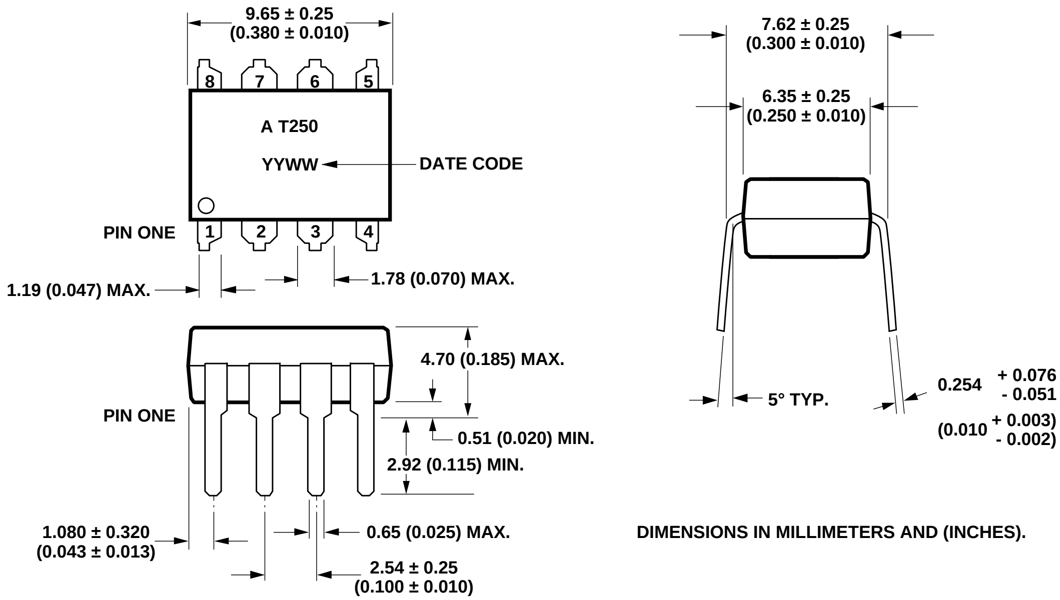
LED	V_{out}
ON	LOW
OFF	HIGH

A 0.1 µF bypass capacitor must be connected between pins 5 and 8.

CAUTION: It is advised that normal static precautions be taken in handling and assembly of this component to prevent damage and/or degradation which may be induced by ESD.

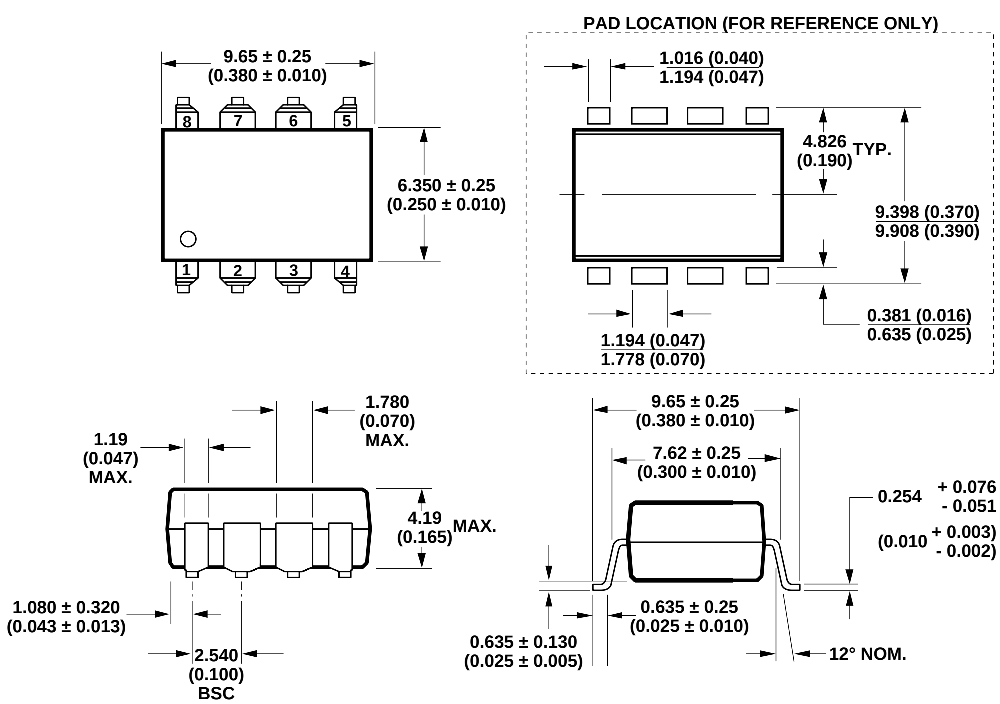
Package Outline Drawings

Standard DIP Package



DIMENSIONS IN MILLIMETERS AND (INCHES).

Gull Wing Surface Mount Option 300



DIMENSIONS IN MILLIMETERS (INCHES).

LEAD COPLANARITY = 0.10 mm (0.004 inches).

Regulatory Information

The HCPL-T250 has been approved by the following organizations:

UL
Recognized under UL 1577, Component Recognition Program, File E55361.

CSA
Approved under CSA Component Acceptance Notice #5, File CA 88324.

VDE
Approved under VDE 0884/06.92 with V_{IORM} = 630 V_{peak}.

Insulation and Safety Related

Parameter	Symbol	Value	Units	Conditions
Minimum External Air Gap (Clearance)	L(101)	7.1	mm	Measured from input terminals to output terminals, shortest distance through air.
Minimum External Tracking (Creepage)	L(102)	7.4	mm	Measured from input terminals to output terminals, shortest distance path along body.
Minimum Internal Plastic Gap (Internal Clearance)		0.08	mm	Insulation thickness between emitter and detector; also known as distance through insulation
Tracking Resistance (Comparative Tracking Index)	CTI	≥ 175	Volts	DIN IEC 112/VDE 0303 Part 1
Isolation Group		IIIa		Material Group (DIN VDE 0110, 1/89, Table 1)

Absolute Maximum Ratings (Compared with HCPL-3120)

Parameter	Symbol	Units	HCPL-3120		HCPL-T250		Note
			Min.	Max.	Min.	Max.	
Operating Temperature	T_A	°C	-40	100	-20	70	
“High” Peak Output Current	$I_{OH(PEAK)}$	A		2.5		1.5	1
“High” Peak Output Current	$I_{OL(PEAK)}$	A		2.5		1.5	
Storage Temperature	T_S	°C	-55	125	-55	125	
Average Input Current	$I_{F(AVG)}$	mA		25		20	2
Peak Transient Input Current (<1 µs Pulse Width, 300 pps)	$I_{F(TRAN)}$	A		1.0		1.0	
Reverse Input Voltage	V_R	V		5		5	
Supply Voltage	$(V_{CC} - V_{EE})$	V	0	35	0	35	
Output Voltage	V_O	V	0	V_{CC}	0	V_{CC}	
Output Power Dissipation	P_O	mW		250		250	3
Lead Solder Temperature	260°C for 10 sec., 1.6 mm below seating plane						
Solder Reflow Temperature Profile	See Package Outline Drawings section						

Notes:
1. Maximum pulse width = 10 µs, maximum duty cycle = 0.2%. See HCPL-3120 Applications section for additional details on limiting $I_{OH(PEAK)}$.
2. Derate linearly above 70°C free-air temperature at a rate of 0.3 mA/°C.
3. Derate lineraly above 70°C free-air temperature at a rate of 4.8 mW/°C.

Recommended Operating Conditions

Parameter	Symbol	Min.	Max.	Units
Power Supply Voltage	V_{CC} - V_{EE}	15	30	V
Input Current (ON)	$I_{F(ON)}$	7	16	mA
Input Voltage (OFF)	$V_{F(OFF)}$	-3.0	0.8	V

DC Electrical Specifications (Compared with HCPL-3120)

Over recommended operating conditions ($I_{F(ON)}$ = 7 to 16 mA, $V_{F(OFF)}$ = -3.0 to 0.8 V, V_{CC} = 15 to 30 V, V_{EE} = Ground) unless otherwise specified.

			HCPL-3120			HCPL-T250			Test	
Parameter	**Symbol**	**Units**	**Min.**	**Typ.***	**Max.**	**Min.**	**Typ.***	**Max.**	**Conditions**	**Note**
Input Forward Voltage	V_F	V	1.2	1.5	1.8		1.6	1.8	I_F = 10 mA	
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta T_A$	mV/°C		-1.6			-2.0		I_F = 10 mA	
Input Reverse Current	I_R	µA			10			10	V_R = 5 V	
Input Capacitance	C_{IN}	pF		60			60	250	V_F = 0 V, F = 1 MHz	
High Level Output Current	I_{OH}	A	0.5	1.5		0.5	1.5		V_O = V_{CC} - 4 V	
			2.0			N.A.			V_O = V_{CC} - 15 V	
Low Level Output Current	I_{OL}	A	0.5	2.0		0.5	2.0		V_O = V_{CC} - 4 V	
			2.0			N.A.			V_O = V_{CC} - 15 V	
High Level Output Voltage	V_{OH}	V	V_{CC} - 4	V_{CC} - 3		V_{CC} - 4	V_{CC} - 3		I_O = -100 mA	
Low Level Output Voltage	V_{OL}	V		V_{EE} +0.1	V_{EE} +0.5		V_{EE} +0.8	V_{EE} +2.5	I_O = 100 mA	
High Level Supply Current	I_{CCH}	mA		2.0	5		7	11	Output Open I_F = 7 to 16 mA	
Low Level Supply Current	I_{CCL}	mA		2.0	5		7.5	11	Output Open V_F = -3.0 to +0.8 V	
Threshold Input Current Low to High	I_{FLH}	mA		2.3	5		1.2	5	I_O = 0 mA, V_O > 5 V	
Threshold Input Voltage High to Low	V_{FHL}	V	0.8			0.8				
Supply Voltage	V_{CC}	V	15		30	15		30		
Capacitance (Input-Output)	C_{I-0}	pF		0.6			1.0			
Resistance (Input-Output)	R_{I-0}	Ω		10^{12}			10^{12}			

*All typical values at T_A = 25°C and V_{CC} - V_{EE} = 3° V, unless otherwise noted.

Switching Specifications (AC) (Compared with HCPL-3120)

Over recommended operating conditions (T_A = -40 to 100℃, $I_{F(ON)}$ = 7 to 16 mA, $V_{F(OFF)}$ = -3.0 to 0.8 V, V_{CC} = 15 to 30 V, V_{EE} = Ground) unless otherwise specified.

Parameter	Symbol	Units	HCPL-3120 (-40℃ ~ 100℃) Min.	Typ.*	Max.	HCPL-T250 (-20℃ ~ 70℃) Min.	Typ.*	Max.	Test Conditions		Note
Propagation Delay Time to High Output Level	t_{PHL}	µs	0.1	0.27	0.5		0.27	0.5	Rg = 10 Ω Cg = 10 nF, f = 10 kHz, Duty Cycle = 50%		
Propagation Delay Time to Low Output Level	T_{PLH}	µs	0.1	0.3	0.5		0.3	0.5			
Output Rise Time	t_R	µs		0.1		N.A.					
Output Fall Time	t_F	µs		0.1		N.A.					
Pulse Width Distortion	PWD	µs			0.3			N.A.			
Propagation Delay Difference Between Any Two Parts	(t_{PHL} - t_{PLH}) PDD	µs	-0.35		0.35	N.A.		N.A.			4
Output High Level Common Mode Transient Immunity	$\|CM_H\|$	kV/µs	15	30		5			T_A = 25℃ V_{CC} = 30 V		5
									HCPL -3120	I_F = 10 mA V_{CM} = 1500 V	
									HCPL -T250	I_F = 10 mA V_{CM} = 600 V	
Output Low Level Common Mode Transient Immunity	$\|CM_L\|$	kV/µs	15	30		5			T_A = 25℃ V_F = 0 V		5
									HCPL -3120	V_{CM} = 1500 V	
									HCPL -T250	V_{CM} = 600 V	

*All typical values at T_A = 25℃ and V_{CC} - V_{EE} = 30 V, unless otherwise noted.

Notes:

4. The difference between t_{PHL} and t_{PLH} between any two HCPL-3120 parts under the same test condition.
5. Common mode transient immunity in the high state is the maximum tolerable dV_{CM}/dt of the common mode pulse, V_{CM}, to assure that the output will remain in the high state (i.e., V_O > 15.0 V).
6. Common mode transient immunity in a low state is the maximum tolerable dV_{CM}/dt of the common mode pulse, V_{CM}, to assure that the output will remain in a low state (i.e., V_O < 1.0 V).

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Data subject to change.

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