

Annexe

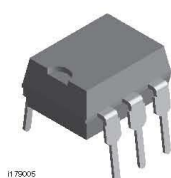
Annexe 1 : Data sheet de l'optocoupleur 4N32.



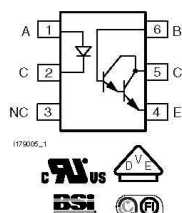
4N32, 4N33

Vishay Semiconductors

Optocoupler, Photodarlington Output, High Gain, with Base Connection



1179005



FEATURES

- Very high current transfer ratio, 500 % min.
- High isolation resistance, $10^{11} \Omega$ typical
- Standard plastic DIP package
- Compliant to RoHS Directive to 2002/95/EC and in accordance WEEE 2002/96/EC



RoHS COMPLIANT

AGENCY APPROVALS

- UL1577, file no. E52744 system code H
- DIN EN 60747-5-2 (VDE 0884)/DIN EN 60747-5-5 (pending), available with option 1
- BSI IEC60950; IEC60065
- FIMKO

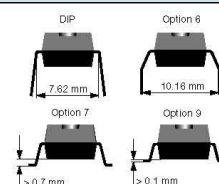
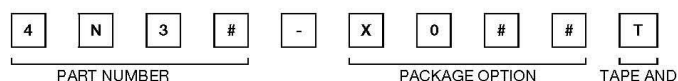
DESCRIPTION

The 4N32 and 4N33 are optically coupled isolators with a gallium arsenide infrared LED and a silicon photodarlington sensor.

Switching can be achieved while maintaining a high degree of isolation between driving and load circuits.

These optocouplers can be used to replace reed and mercury relays with advantages of long life, high speed switching and elimination of magnetic fields.

ORDERING INFORMATION



AGENCY CERTIFIED/PACKAGE	CTR (%)	
	≥ 500	≥ 500
UL, BSI, FIMKO		
DIP-6	4N32	4N33
DIP-6, 400 mil, option 6	4N32-X006	-
SMD-6, option 7	4N32-X007T ⁽¹⁾	4N33-X007T ⁽¹⁾
SMD-6, option 9	4N32-X009T ⁽¹⁾	4N33-X009T ⁽¹⁾
VDE, UL, BSI, FIMKO	≥ 500	≥ 500
DIP-6	4N32-X001	4N33-X001
SMD-6, option 7	4N32-X017T	4N33-X017T ⁽¹⁾

Notes

- Additional options may be possible, please contact sales office.

⁽¹⁾ Also available in tubes, do not put T on the end.

Annexe 2 : Data sheet de l'Ampli-Op LM358.



Dual Low Power Operational Amplifiers

Utilizing the circuit designs perfected for recently introduced Quad Operational Amplifiers, these dual operational amplifiers feature 1) low power drain, 2) a common mode input voltage range extending to ground/ V_{EE} , 3) single supply or split supply operation and 4) pinouts compatible with the popular MC1558 dual operational amplifier. The LM158 series is equivalent to one-half of an LM124.

These amplifiers have several distinct advantages over standard operational amplifier types in single supply applications. They can operate at supply voltages as low as 3.0 V or as high as 32 V, with quiescent currents about one-fifth of those associated with the MC1741 (on a per amplifier basis). The common mode input range includes the negative supply, thereby eliminating the necessity for external biasing components in many applications. The output voltage range also includes the negative power supply voltage.

- Short Circuit Protected Outputs
- True Differential Input Stage
- Single Supply Operation: 3.0 V to 32 V
- Low Input Bias Currents
- Internally Compensated
- Common Mode Range Extends to Negative Supply
- Single and Split Supply Operation
- Similar Performance to the Popular MC1558
- ESD Clamps on the Inputs Increase Ruggedness of the Device without Affecting Operation

MAXIMUM RATINGS ($T_A = +25^\circ\text{C}$, unless otherwise noted.)

Rating	Symbol	LM258 LM358	LM2904 LM2904V	Unit
Power Supply Voltages				Vdc
Single Supply	V_{CC}	32	26	
Split Supplies	V_{CC}, V_{EE}	± 16	± 13	
Input Differential Voltage Range (Note 1)	V_{IDR}	± 32	± 26	Vdc
Input Common Mode Voltage Range (Note 2)	V_{ICR}	-0.3 to 32	-0.3 to 26	Vdc
Output Short Circuit Duration	t_{SC}	Continuous		
Junction Temperature	T_J	150		$^\circ\text{C}$
Storage Temperature Range	T_{stg}	-55 to +125		$^\circ\text{C}$
Operating Ambient Temperature Range	T_A			$^\circ\text{C}$
LM258		-25 to +85	-	
LM358		0 to +70	-	
LM2904		-	-40 to +105	
LM2904V		-	-40 to +125	

NOTES: 1. Split Power Supplies.

2. For Supply Voltages less than 32 V for the LM258/358 and 26 V for the LM2904, the absolute maximum input voltage is equal to the supply voltage.

Order this document by LM358/D

LM358, LM258, LM2904, LM2904V

DUAL DIFFERENTIAL INPUT OPERATIONAL AMPLIFIERS

SEMICONDUCTOR TECHNICAL DATA

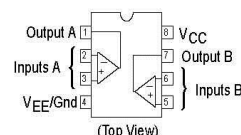


N SUFFIX
PLASTIC PACKAGE
CASE 626



D SUFFIX
PLASTIC PACKAGE
CASE 751
(SO-8)

PIN CONNECTIONS



ORDERING INFORMATION

Device	Operating Temperature Range	Package
LM2904D	$T_A = -40^\circ\text{ to } +105^\circ\text{C}$	SO-8
LM2904N		Plastic DIP
LM2904VD	$T_A = -40^\circ\text{ to } +125^\circ\text{C}$	SO-8
LM2904VN		Plastic DIP
LM258D	$T_A = -25^\circ\text{ to } +85^\circ\text{C}$	SO-8
LM258N		Plastic DIP
LM358D	$T_A = 0^\circ\text{ to } +70^\circ\text{C}$	SO-8
LM358N		Plastic DIP

LM358, LM258, LM2904, LM2904V

ELECTRICAL CHARACTERISTICS ($V_{CC} = 5.0\text{ V}$, $V_{EE} = \text{Gnd}$, $T_A = 25^\circ\text{C}$, unless otherwise noted.)

Characteristic	Symbol	LM258			LM358			LM2904			LM2904V			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage $V_{CC} = 5.0\text{ V}$ to 30 V (26 V for LM2904, V), $V_{IC} = 0\text{ V}$ to $V_{CC} - 1.7\text{ V}$, $V_O = 1.4\text{ V}$, $R_S = 0\ \Omega$ $T_A = 25^\circ\text{C}$ $T_A = T_{\text{high}}$ (Note 1) $T_A = T_{\text{low}}$ (Note 1)	V_{IO}	—	2.0	5.0	—	2.0	7.0	—	2.0	7.0	—	—	—	mV
Average Temperature Coefficient of Input Offset Voltage $T_A = T_{\text{high}}$ to T_{low} (Note 1)	$\Delta V_{IO}/\Delta T$	—	7.0	—	—	7.0	—	—	7.0	—	—	7.0	—	$\mu\text{V}/^\circ\text{C}$
Input Offset Current $T_A = T_{\text{high}}$ to T_{low} (Note 1)	I_{IO}	—	3.0	30	—	5.0	50	—	5.0	50	—	5.0	50	nA
Input Bias Current $T_A = T_{\text{high}}$ to T_{low} (Note 1)	I_{IB}	—	—	100	—	—	150	—	45	200	—	45	200	nA
Average Temperature Coefficient of Input Offset Current $T_A = T_{\text{high}}$ to T_{low} (Note 1)	$\Delta I_{IO}/\Delta T$	—	10	—	—	10	—	—	10	—	—	10	—	$\text{pA}/^\circ\text{C}$
Input Common Mode Voltage Range (Note 2), $V_{CC} = 30\text{ V}$ (26 V for LM2904, V), $V_{CC} = 30\text{ V}$ (26 V for LM2904, V), $T_A = T_{\text{high}}$ to T_{low}	V_{ICR}	0	—	28.3	0	—	28.3	0	—	24.3	0	—	24.3	V
Differential Input Voltage Range	V_{IDR}	—	—	V_{CC}	—	—	V_{CC}	—	—	V_{CC}	—	—	V_{CC}	V
Large Signal Open Loop Voltage Gain $R_L = 2.0\text{ k}\Omega$, $V_{CC} = 15\text{ V}$, For Large V_O Swing, $T_A = T_{\text{high}}$ to T_{low} (Note 1)	A_{VOL}	50	100	—	25	100	—	25	100	—	25	100	—	V/mV
Channel Separation $1.0\text{ kHz} \leq f \leq 20\text{ kHz}$, Input Referenced	CS	—	-120	—	—	-120	—	—	-120	—	—	-120	—	dB
Common Mode Rejection $R_S \leq 10\text{ k}\Omega$	CMR	70	85	—	65	70	—	50	70	—	50	70	—	dB
Power Supply Rejection	PSR	65	100	—	65	100	—	50	100	—	50	100	—	dB
Output Voltage—High Limit ($T_A = T_{\text{high}}$ to T_{low}) (Note 1) $V_{CC} = 5.0\text{ V}$, $R_L = 2.0\text{ k}\Omega$, $T_A = 25^\circ\text{C}$ $V_{CC} = 30\text{ V}$ (26 V for LM2904, V), $R_L = 2.0\text{ k}\Omega$ $V_{CC} = 30\text{ V}$ (26 V for LM2904, V), $R_L = 10\text{ k}\Omega$	V_{OH}	3.3	3.5	—	3.3	3.5	—	3.3	3.5	—	3.3	3.5	—	V
Output Voltage—Low Limit $V_{CC} = 5.0\text{ V}$, $R_L = 10\text{ k}\Omega$, $T_A = T_{\text{high}}$ to T_{low} (Note 1)	V_{OL}	—	5.0	20	—	5.0	20	—	5.0	20	—	5.0	20	mV
Output Source Current $V_{ID} = +1.0\text{ V}$, $V_{CC} = 15\text{ V}$	I_{O+}	20	40	—	20	40	—	20	40	—	20	40	—	mA
Output Sink Current $V_{ID} = -1.0\text{ V}$, $V_{CC} = 15\text{ V}$ $V_{ID} = -1.0\text{ V}$, $V_O = 200\text{ mV}$	I_{O-}	10	20	—	10	20	—	10	20	—	10	20	—	mA
Output Short Circuit to Ground (Note 3)	I_{SC}	—	40	60	—	40	60	—	40	60	—	40	60	mA
Power Supply Current ($T_A = T_{\text{high}}$ to T_{low}) (Note 1) $V_{CC} = 30\text{ V}$ (26 V for LM2904, V), $V_O = 0\text{ V}$, $R_L = \infty$ $V_{CC} = 5\text{ V}$, $V_O = 0\text{ V}$, $R_L = \infty$	I_{CC}	—	1.5	3.0	—	1.5	3.0	—	1.5	3.0	—	1.5	3.0	mA

NOTES: 1. $T_{\text{low}} = -40^\circ\text{C}$ for LM2904
 $= -40^\circ\text{C}$ for LM2904V
 $= -25^\circ\text{C}$ for LM258
 $= 0^\circ\text{C}$ for LM358
 $T_{\text{high}} = +105^\circ\text{C}$ for LM2904
 $= +125^\circ\text{C}$ for LM2904V
 $= +85^\circ\text{C}$ for LM258
 $= +70^\circ\text{C}$ for LM358

2. The input common mode voltage or either input signal voltage should not be allowed to go negative by more than 0.3 V . The upper end of the common mode voltage range is $V_{CC} - 1.7\text{ V}$.
3. Short circuits from the output to V_{CC} can cause excessive heating and eventual destruction. Destructive dissipation can result from simultaneous shorts on all amplifiers.

Annexe 3 : Data sheet du thyristor BT150.

Philips Semiconductors

Product specification

Thyristors logic level

BT150 series

GENERAL DESCRIPTION

Glass passivated, sensitive gate thyristors in a plastic envelope, intended for use in general purpose switching and phase control applications. These devices are intended to be interfaced directly to microcontrollers, logic integrated circuits and other low power gate trigger circuits.

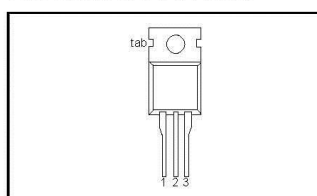
QUICK REFERENCE DATA

SYMBOL	PARAMETER	MAX.	MAX.	MAX.	UNIT
V_{DRM} , V_{RRM}	BT150- Repetitive peak off-state voltages	500R 500	600R 600	800R 800	V
$I_{T(AV)}$	Average on-state current	2.5	2.5	2.5	A
$I_{T(RMS)}$	RMS on-state current	4	4	4	A
I_{TSM}	Non-repetitive peak on-state current	35	35	35	A

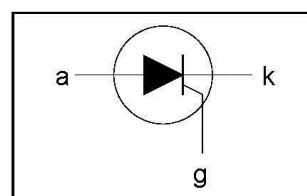
PINNING - TO220AB

PIN	DESCRIPTION
1	cathode
2	anode
3	gate
tab	anode

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.			UNIT
V_{DRM} , V_{RRM}	Repetitive peak off-state voltages		-	-500R 500 ¹	-600R 600 ¹	-800R 800	V
$I_{T(AV)}$	Average on-state current	half sine wave; $T_{mb} \leq 113^\circ\text{C}$	-	2.5			A
$I_{T(RMS)}$	RMS on-state current	all conduction angles	-	4			A
I_{TSM}	Non-repetitive peak on-state current	half sine wave; $T_J = 25^\circ\text{C}$ prior to surge	-	35			A
		$t = 10\text{ ms}$	-	38			A
		$t = 8.3\text{ ms}$	-	6.1			A ² s
I^2t	I^2t for fusing	$t = 10\text{ ms}$	-	50			A/μs
di_T/dt	Repetitive rate of rise of on-state current after triggering	$I_{TM} = 10\text{ A}$; $I_G = 50\text{ mA}$; $di_G/dt = 50\text{ mA}/\mu\text{s}$	-	50			A/μs
I_{GM}	Peak gate current		-	2			A
V_{GM}	Peak gate voltage		-	5			V
V_{RGM}	Peak reverse gate voltage		-	5			V
P_{GM}	Peak gate power		-	5			W
$P_{G(AV)}$	Average gate power	over any 20 ms period	-	0.5			W
T_{stg}	Storage temperature		-40	150			°C
T_J	Operating junction temperature		-	125 ²			°C

1 Although not recommended, off-state voltages up to 800V may be applied without damage, but the thyristor may switch to the on-state. The rate of rise of current should not exceed 15 A/μs.

2 Note: Operation above 110°C may require the use of a gate to cathode resistor of 1kΩ or less.

Thyristors
logic level

BT150 series

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$R_{th\ j-mb}$	Thermal resistance junction to mounting base	in free air	-	-	2.5	K/W
$R_{th\ j-a}$	Thermal resistance junction to ambient		-	60	-	K/W

STATIC CHARACTERISTICS

 $T_j = 25\ ^\circ\text{C}$ unless otherwise stated

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{GT}	Gate trigger current	$V_D = 12\text{ V}; I_T = 0.1\text{ A}$	-	15	200	μA
I_L	Latching current	$V_D = 12\text{ V}; I_{GT} = 0.1\text{ A}$	-	0.17	10	mA
I_H	Holding current	$V_D = 12\text{ V}; I_{GT} = 0.1\text{ A}$	-	0.10	6	mA
V_T	On-state voltage	$I_T = 5\text{ A}$	-	1.23	1.8	V
V_{GT}	Gate trigger voltage	$V_D = 12\text{ V}; I_T = 0.1\text{ A}$	-	0.4	1.5	V
I_D, I_R	Off-state leakage current	$V_D = V_{DRM(max)}; I_T = 0.1\text{ A}; T_j = 110\ ^\circ\text{C}$	0.1	0.2	-	V
		$V_D = V_{DRM(max)}; V_R = V_{RRM(max)}; T_j = 125\ ^\circ\text{C}$	-	0.1	0.5	mA

DYNAMIC CHARACTERISTICS

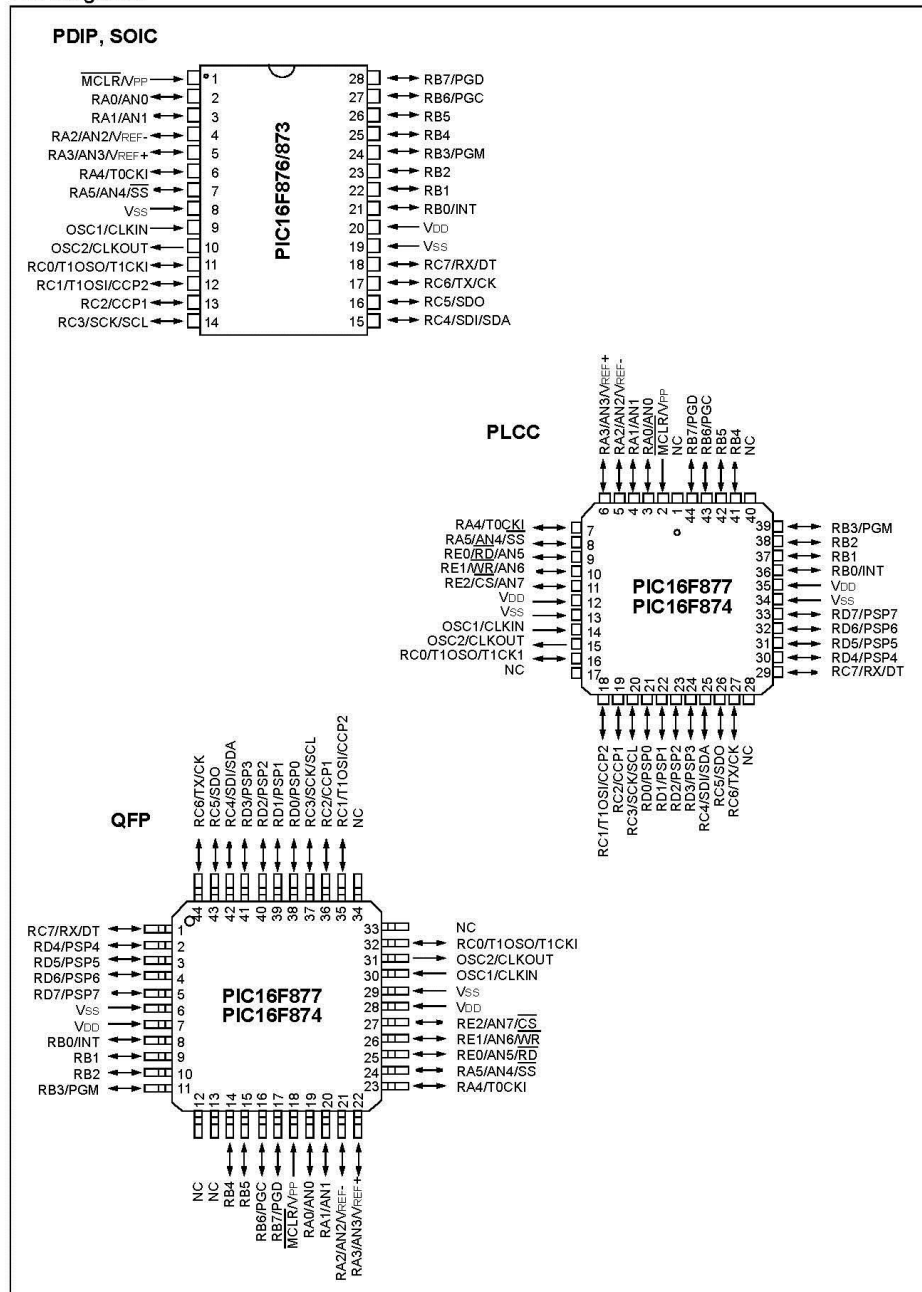
 $T_j = 25\ ^\circ\text{C}$ unless otherwise stated

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
dV_D/dt	Critical rate of rise of off-state voltage	$V_{DM} = 67\% V_{DRM(max)}; T_j = 125\ ^\circ\text{C};$ exponential waveform; $R_{GK} = 100\ \Omega$	-	50	-	V/ μs
t_{gt}	Gate controlled turn-on time	$I_{TM} = 10\text{ A}; V_D = V_{DRM(max)}; I_G = 5\text{ mA};$ $dI_G/dt = 0.2\text{ A}/\mu\text{s}$	-	2	-	μs
t_q	Circuit commutated turn-off time	$V_D = 67\% V_{DRM(max)}; T_j = 125\ ^\circ\text{C}; I_{TM} = 8\text{ A};$ $V_R = 10\text{ V}; dI_{TM}/dt = 10\text{ A}/\mu\text{s};$ $dV_D/dt = 2\text{ V}/\mu\text{s}; R_{GK} = 1\text{ k}\Omega$	-	100	-	μs

Annexe 3 : Data sheet du PIC 16F876.

PIC16F87X

Pin Diagrams



PIC16F87X

Key Features PICmicro™ Mid-Range Reference Manual (DS33023)	PIC16F873	PIC16F874	PIC16F876	PIC16F877
Operating Frequency	DC - 20 MHz	DC - 20 MHz	DC - 20 MHz	DC - 20 MHz
RESETS (and Delays)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)
FLASH Program Memory (14-bit words)	4K	4K	8K	8K
Data Memory (bytes)	192	192	368	368
EEPROM Data Memory	128	128	256	256
Interrupts	13	14	13	14
I/O Ports	Ports A,B,C	Ports A,B,C,D,E	Ports A,B,C	Ports A,B,C,D,E
Timers	3	3	3	3
Capture/Compare/PWM Modules	2	2	2	2
Serial Communications	MSSP, USART	MSSP, USART	MSSP, USART	MSSP, USART
Parallel Communications	—	PSP	—	PSP
10-bit Analog-to-Digital Module	5 input channels	8 input channels	5 input channels	8 input channels
Instruction Set	35 instructions	35 instructions	35 instructions	35 instructions