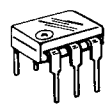
6-Pin DIP Optoisolators
Transistor Output

4N38
4N38A

6-PIN DIP
OPTOISOLATORS
TRANSISTOR OUTPUT

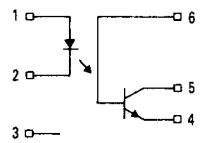
These devices consist of a gallium arsenide infrared emitting diode optically coupled to a monolithic silicon phototransistor detector.

- Convenient Plastic Dual-in-Line Package
- Guaranteed 80 Volt $V_{(BR)CEO}$ Minimum
- High Input-Output Isolation Guaranteed — 7500 Volts Peak
- Meets or Exceeds All JEDEC Registered Specifications
- UL Recognized. (1) File Number E54915
- VDE approved per standard 0883/6.80 (Certificate number 41853), with additional approval to DIN IEC380/VDE0806, IEC435/VDE0805, IEC65/VDE0860, VDE0110b, covering all other standards with equal or less stringent requirements, including IEC204/VDE0113, VDE0160, VDE0832, VDE0833, etc. 883
- Special lead form available (add suffix "T" to part number) which satisfies VDE0883/6.80 requirement for 8 mm minimum creepage distance between input and output solder pads.
- Various lead form options available. Consult "Optoisolator Lead Form Options" data sheet for details.



CASE 730A-02
PLASTIC

SCHEMATIC



1. LED ANODE
2. LED CATHODE
3. N.C.
4. EMITTER
5. COLLECTOR
6. BASE

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

Rating	Symbol	Value	Unit
INPUT LED			
Reverse Voltage	V_R	3	Volts
Forward Current — Continuous	I_F	80	mA
Forward Current — Pk (PW = 300 μs, 2% duty cycle)	$I_{F(pk)}$	3	A
LED Power Dissipation @ T_A = 25°C with Negligible Power in Output Detector	P_D	150	mW
Derate above 25°C		1.41	mW/°C
OUTPUT TRANSISTOR			
Collector-Emitter Voltage	V_{CEO}	80	Volts
Emitter-Collector Voltage	V_{ECO}	7	Volts
Collector-Base Voltage	V_{CBO}	80	Volts
Collector Current — Continuous	I_C	100	mA
Detector Power Dissipation @ T_A = 25°C with Negligible Power in Input LED	P_D	150	mW
Derate above 25°C		1.76	mW/°C
TOTAL DEVICE			
Isolation Surge Voltage (1) (Peak ac Voltage, 60 Hz, 1 sec Duration)	V_{ISO}	7500	Vac
Total Device Power Dissipation @ T_A = 25°C	P_D	250	mW
Derate above 25°C		2.94	mW/°C
Ambient Operating Temperature Range	T_A	−55 to +100	°C
Storage Temperature Range	T_{stg}	−55 to +150	°C
Soldering Temperature (10 sec, 1/16" from case)	T_{sol}	260	°C

Note: (1) 4N38 does not require UL approval; 4N38A does. Otherwise both parts are identical. Both parts built by Motorola have UL approval.

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

Characteristic		Symbol	Min	Typ	Max	Unit
INPUT LED						
Forward Voltage (I_F = 10 mA)	T_A = 25°C T_A = −55°C T_A = 100°C	V_F	— — —	1.15 1.3 1.05	1.5 — —	Volts
Reverse Leakage Current (V_R = 3 V)		I_R	—	—	100	μA
Capacitance (V = 0 V, f = 1 MHz)		C_J	—	18	—	pF
OUTPUT TRANSISTOR						
Collector-Emitter Dark Current	(V_{CE} = 60 V, T_A = 25°C)	I_{CEO}	—	20	50	nA
	(V_{CE} = 60 V, T_A = 100°C)	I_{CEO}	—	6	—	μA
Collector-Base Dark Current (V_{CB} = 60 V)		I_{CBO}	—	2	20	nA
Collector-Emitter Breakdown Voltage (I_C = 1 mA)		$V_{(BR)CEO}$	80	120	—	Volts
Collector-Base Breakdown Voltage (I_C = 1 μA)		$V_{(BR)CBO}$	80	120	—	Volts
Emitter-Collector Breakdown Voltage (I_E = 100 μA)		$V_{(BR)ECO}$	7	7.8	—	Volts
DC Current Gain (I_C = 2 mA, V_{CE} = 5 V)		h_{FE}	—	400	—	—
Collector-Emitter Capacitance (f = 1 MHz, V_{CE} = 0)		C_{CE}	—	8	—	pF
Collector-Base Capacitance (f = 1 MHz, V_{CB} = 0)		C_{CB}	—	21	—	pF
Emitter-Base Capacitance (f = 1 MHz, V_{EB} = 0)		C_{EB}	—	8	—	pF
COUPLED						
Output Collector Current (I_F = 20 mA, V_{CE} = 1 V)		I_C	4	7	—	mA
Collector-Emitter Saturation Voltage (I_C = 4 mA, I_F = 20 mA)		$V_{CE(sat)}$	—	—	1	Volts
Turn-On Time (I_C = 2 mA, V_{CC} = 10 V, R_L = 100 Ω, Figure 11)		t_{on}	—	3	—	μs
Turn-Off Time (I_C = 2 mA, V_{CC} = 10 V, R_L = 100 Ω, Figure 11)		t_{off}	—	2.8	—	μs
Rise Time (I_C = 2 mA, V_{CC} = 10 V, R_L = 100 Ω, Figure 11)		t_r	—	1.6	—	μs
Fall Time (I_C = 2 mA, V_{CC} = 10 V, R_L = 100 Ω, Figure 11)		t_f	—	2.2	—	μs
Isolation Voltage (f = 60 Hz, t = 1 sec)		V_{ISO}	7500	—	—	Vac(pk)
Isolation Resistance (V = 500 V)		R_{ISO}	10^{11}	—	—	Ω
Isolation Capacitance (V = 0 V, f = 1 MHz)		C_{ISO}	—	0.2	—	pF

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TYPICAL CHARACTERISTICS

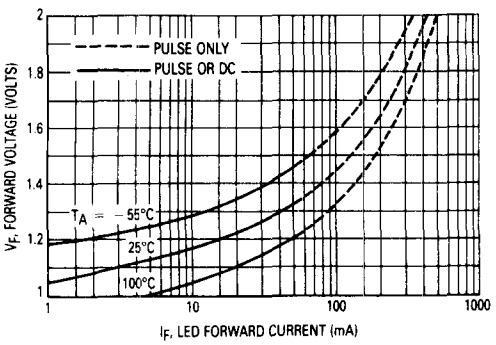


Figure 1. LED Forward Voltage versus Forward Current

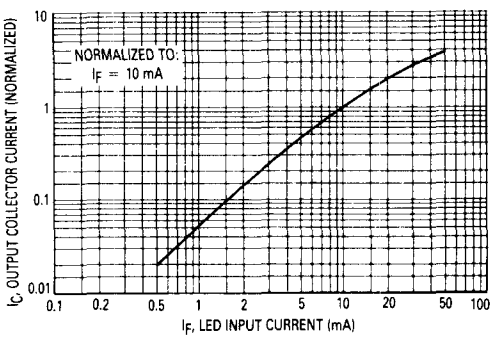


Figure 2. Output Current versus Input Current

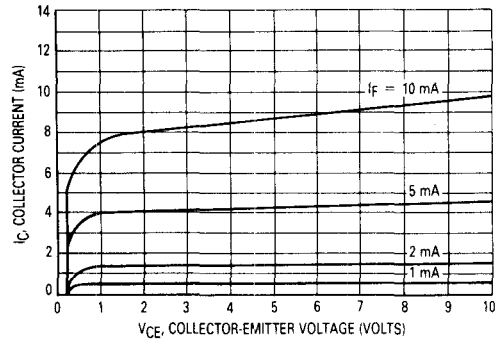


Figure 3. Collector Current versus Collector-Emitter Voltage

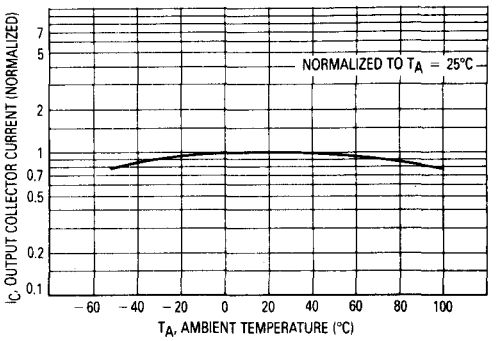


Figure 4. Output Current versus Ambient Temperature

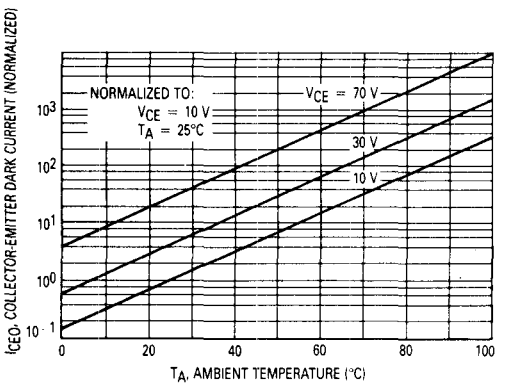


Figure 5. Dark Current versus Ambient Temperature

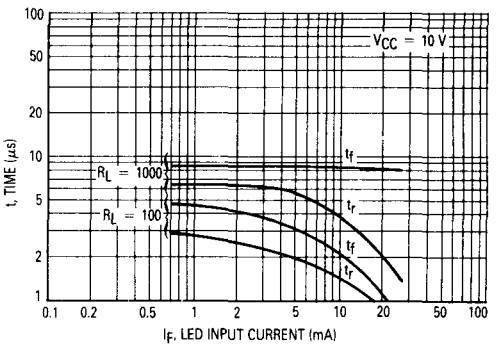


Figure 6. Rise and Fall Times

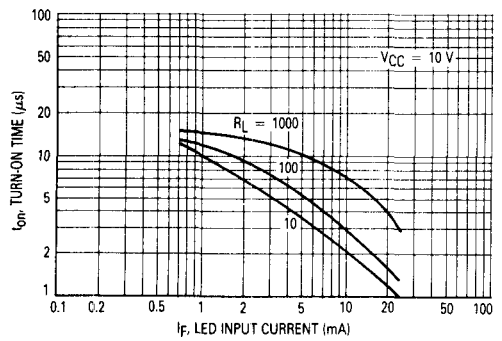


Figure 7. Turn-On Switching Times

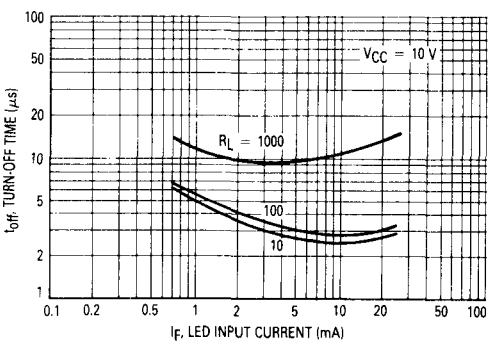


Figure 8. Turn-Off Switching Times

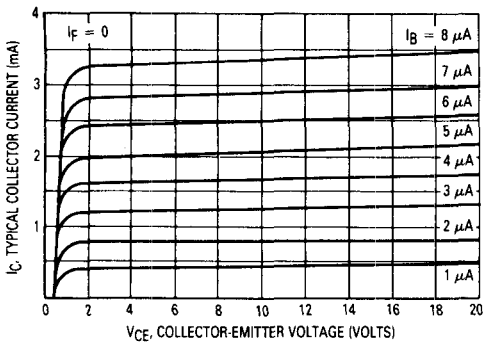


Figure 9. DC Current Gain (Detector Only)

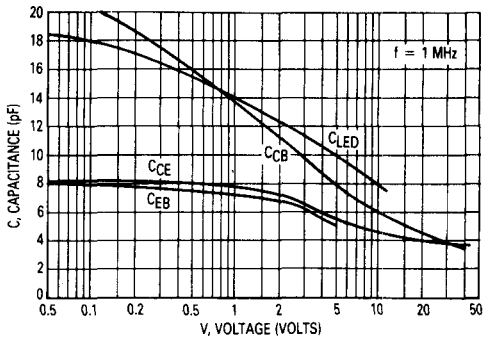


Figure 10. Capacitances versus Voltage

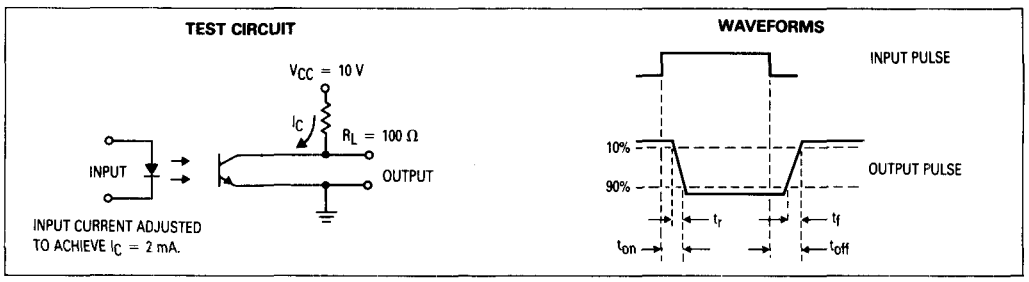
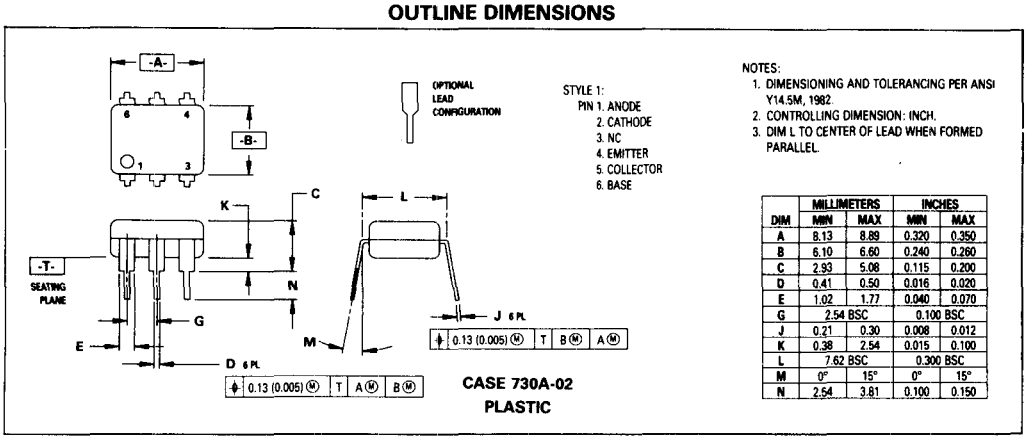


Figure 11. Switching Times

OUTLINE DIMENSIONS



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIM L TO CENTER OF LEAD WHEN FORMED PARALLEL.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	8.13	8.89	0.320	0.350
B	6.10	6.60	0.240	0.260
C	2.93	5.08	0.115	0.200
D	0.41	0.50	0.016	0.020
E	1.02	1.77	0.040	0.070
G	2.54 BSC		0.100 BSC	
J	0.21	0.30	0.008	0.012
K	0.38	2.54	0.015	0.100
L	7.62 BSC		0.300 BSC	
M	0°	15°	0°	15°
N	2.54	3.81	0.100	0.150

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