



6-Pin DIP Optoisolators Transistor Output

The 4N38 and 4N38A(1) devices consist of a gallium arsenide infrared emitting diode optically coupled to a monolithic silicon phototransistor detector.

- Guaranteed 80 Volt Collector-to-Emitter Breakdown ((BR)CEO) Minimum
- Meets or Exceeds All JEDEC Registered Specifications
- **To order devices that are tested and marked per VDE 0884 requirements, the suffix "V" must be included at end of part number. VDE 0884 is a test option.**

Applications

- General Purpose Switching Circuits
- Interfacing and coupling systems of different potentials and impedances
- Monitor and Detection Circuits

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

Rating	Symbol	Value	Unit
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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 Derate above 25°C	P _D	150	mW
		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 Derate above 25°C	P _D	150	mW
		1.76	mW/°C

TOTAL DEVICE

Isolation Surge Voltage ⁽²⁾ (Peak ac Voltage, 60 Hz, 1 sec Duration)	V _{ISO}	7500	Vac(pk)
Total Device Power Dissipation @ T _A = 25°C Derate above 25°C	P _D	250 2.94	mW mW/°C
Ambient Operating Temperature Range ⁽³⁾	T _A	-55 to +100	°C
Storage Temperature Range ⁽³⁾	T _{stg}	-55 to +150	°C
Soldering Temperature (10 sec, 1/16" from case)	T _L	260	°C

1. 4N38 does not require UL approval; 4N38A does. Otherwise both parts are identical. Both parts built by Motorola have UL approval.
2. Isolation surge voltage is an internal device dielectric breakdown rating.
For this test, Pins 1 and 2 are common, and Pins 4, 5 and 6 are common.
3. Refer to Quality and Reliability Section in Opto Data Book for information on test conditions.

Preferred devices are Motorola recommended choices for future use and best overall value.

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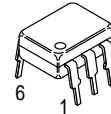
4N38

4N38A*

[CTR = 20% Min]

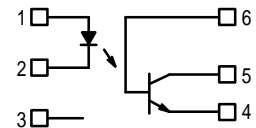
*Motorola Preferred Device

STYLE 1 PLASTIC



STANDARD THRU HOLE
CASE 730A-04

SCHEMATIC



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

4N38 4N38A

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)⁽¹⁾

Characteristic	Symbol	Min	Typ	Max	Unit	
INPUT LED						
Forward Voltage ($I_F = 10\text{ mA}$)	V_F	—	1.15	1.5	Volts	
		$T_A = 25^\circ\text{C}$	—	1.3		—
		$T_A = -55^\circ\text{C}$	—	1.05		—
Reverse Leakage Current ($V_R = 3\text{ V}$)	I_R	—	—	100	μA	
Capacitance ($V = 0\text{ V}$, $f = 1\text{ MHz}$)	C_J	—	18	—	pF	

OUTPUT TRANSISTOR

Collector–Emitter Dark Current	$(V_{CE} = 60\text{ V}, T_A = 25^\circ\text{C})$ $(V_{CE} = 60\text{ V}, T_A = 100^\circ\text{C})$	I_{CEO}	— —	20 6	50 —	nA μA
Collector–Base Dark Current ($V_{CB} = 60\text{ V}$)		I_{CBO}	—	2	20	nA
Collector–Emitter Breakdown Voltage ($I_C = 1\text{ mA}$)		$V_{(BR)CEO}$	80	120	—	Volts
Collector–Base Breakdown Voltage ($I_C = 1\text{ }\mu\text{A}$)		$V_{(BR)CBO}$	80	120	—	Volts
Emitter–Collector Breakdown Voltage ($I_E = 100\text{ }\mu\text{A}$)		$V_{(BR)ECO}$	7	7.8	—	Volts
DC Current Gain ($I_C = 2\text{ mA}$, $V_{CE} = 5\text{ V}$)		h_{FE}	—	400	—	—
Collector–Emitter Capacitance ($f = 1\text{ MHz}$, $V_{CE} = 0$)		C_{CE}	—	8	—	pF
Collector–Base Capacitance ($f = 1\text{ MHz}$, $V_{CB} = 0$)		C_{CB}	—	21	—	pF
Emitter–Base Capacitance ($f = 1\text{ MHz}$, $V_{EB} = 0$)		C_{EB}	—	8	—	pF

COUPLED

Output Collector Current ($I_F = 20\text{ mA}$, $V_{CE} = 1\text{ V}$)	$I_C\text{ (CTR)}^{(2)}$	4 (20)	7 (35)	—	mA (%)
Collector–Emitter Saturation Voltage ($I_C = 4\text{ mA}$, $I_F = 20\text{ mA}$)	$V_{CE(sat)}$	—	—	1	Volts
Turn–On Time ($I_C = 2\text{ mA}$, $V_{CC} = 10\text{ V}$, $R_L = 100\text{ }\Omega$) ⁽³⁾	t_{on}	—	5	—	μs
Turn–Off Time ($I_C = 2\text{ mA}$, $V_{CC} = 10\text{ V}$, $R_L = 100\text{ }\Omega$) ⁽³⁾	t_{off}	—	4	—	μs
Rise Time ($I_C = 2\text{ mA}$, $V_{CC} = 10\text{ V}$, $R_L = 100\text{ }\Omega$) ⁽³⁾	t_r	—	2	—	μs
Fall Time ($I_C = 2\text{ mA}$, $V_{CC} = 10\text{ V}$, $R_L = 100\text{ }\Omega$) ⁽³⁾	t_f	—	3	—	μs
Isolation Voltage ($f = 60\text{ Hz}$, $t = 1\text{ sec}$) ⁽⁴⁾	V_{ISO}	7500	—	—	Vac(pk)
Isolation Resistance ($V = 500\text{ V}$) ⁽⁴⁾	R_{ISO}	10^{11}	—	—	Ω
Isolation Capacitance ($V = 0\text{ V}$, $f = 1\text{ MHz}$) ⁽⁴⁾	C_{ISO}	—	0.2	—	pF

1. Always design to the specified minimum/maximum electrical limits (where applicable).
2. Current Transfer Ratio (CTR) = $I_C/I_F \times 100\%$.
3. For test circuit setup and waveforms, refer to Figure 11.
4. For this test, Pins 1 and 2 are common, and Pins 4, 5 and 6 are common.

TYPICAL CHARACTERISTICS

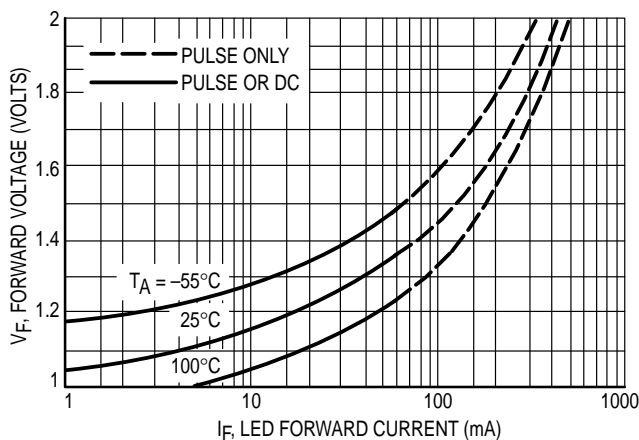


Figure 1. LED Forward Voltage versus Forward Current

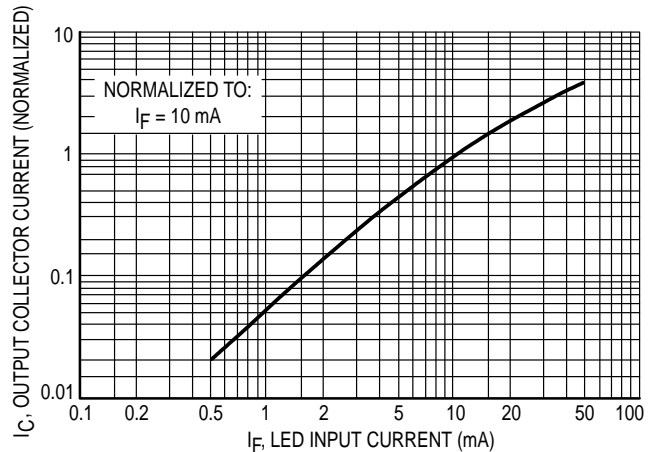


Figure 2. Output Current versus Input Current

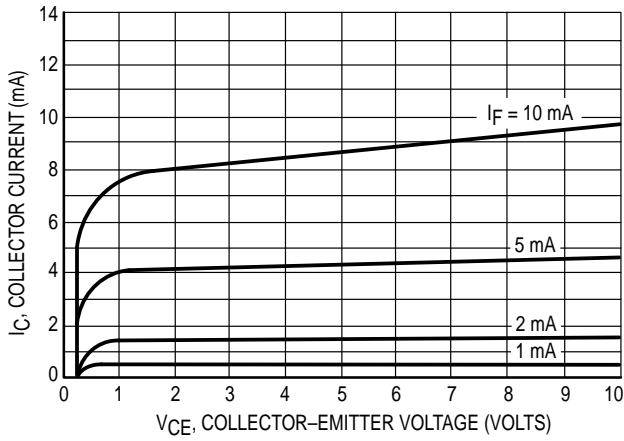


Figure 3. Collector Current versus Collector-Emitter Voltage

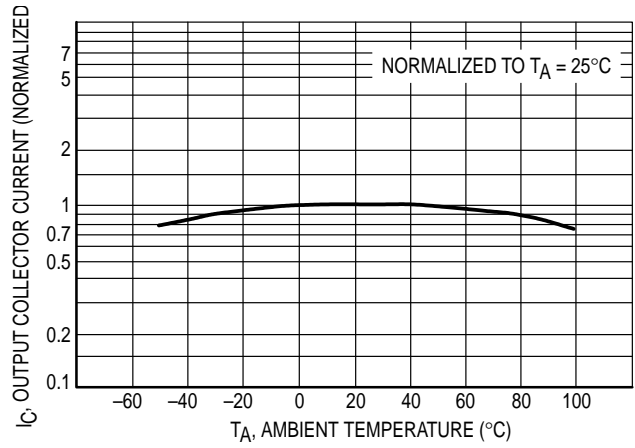


Figure 4. Output Current versus Ambient Temperature

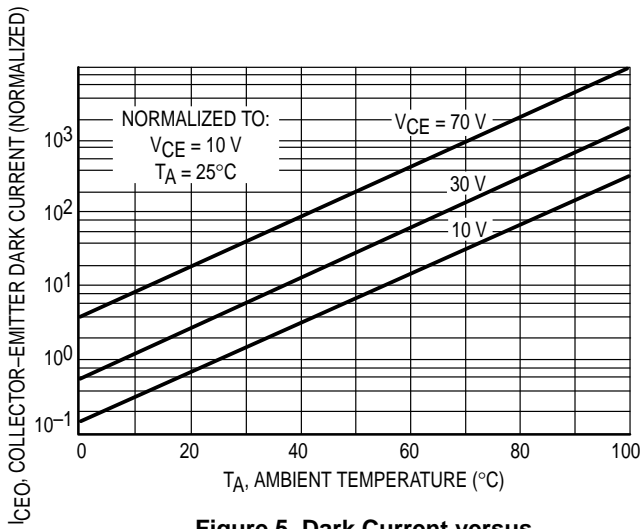


Figure 5. Dark Current versus Ambient Temperature

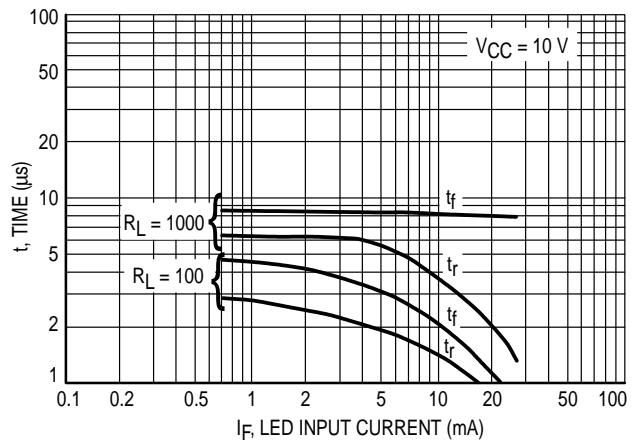


Figure 6. Rise and Fall Times (Typical Values)

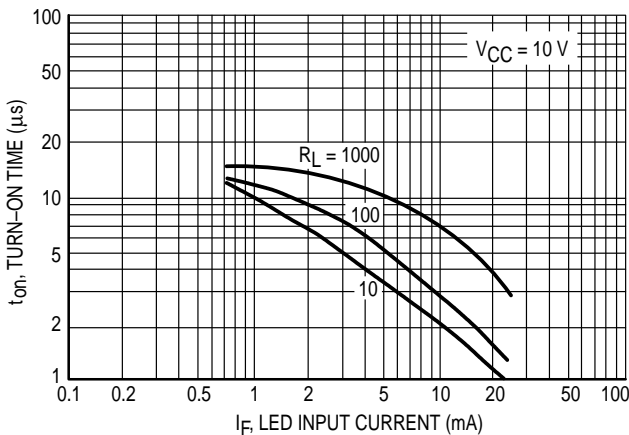


Figure 7. Turn-On Switching Times (Typical Values)

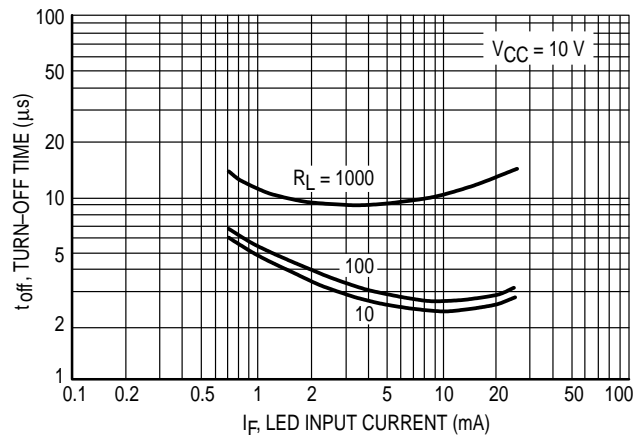


Figure 8. Turn-Off Switching Times (Typical Values)

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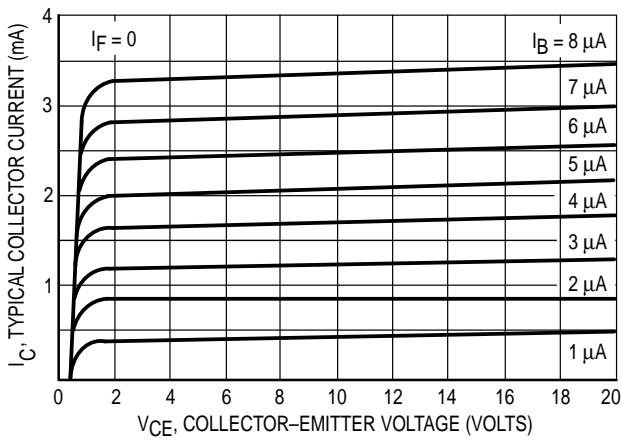


Figure 9. DC Current Gain (Detector Only)

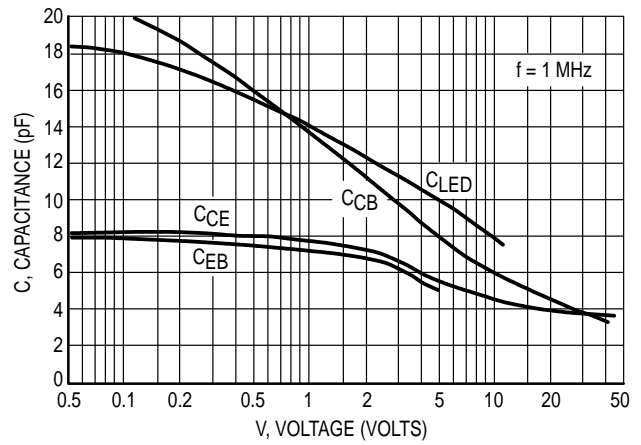


Figure 10. Capacitances versus Voltage

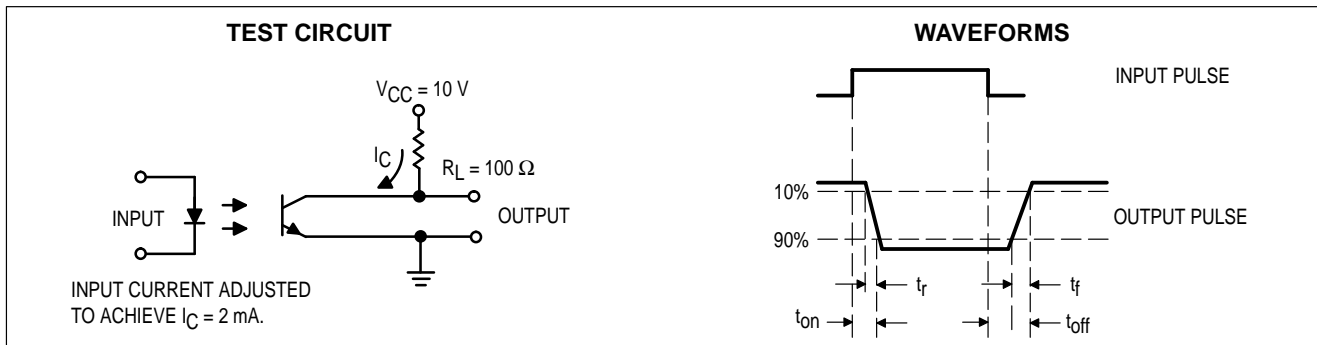
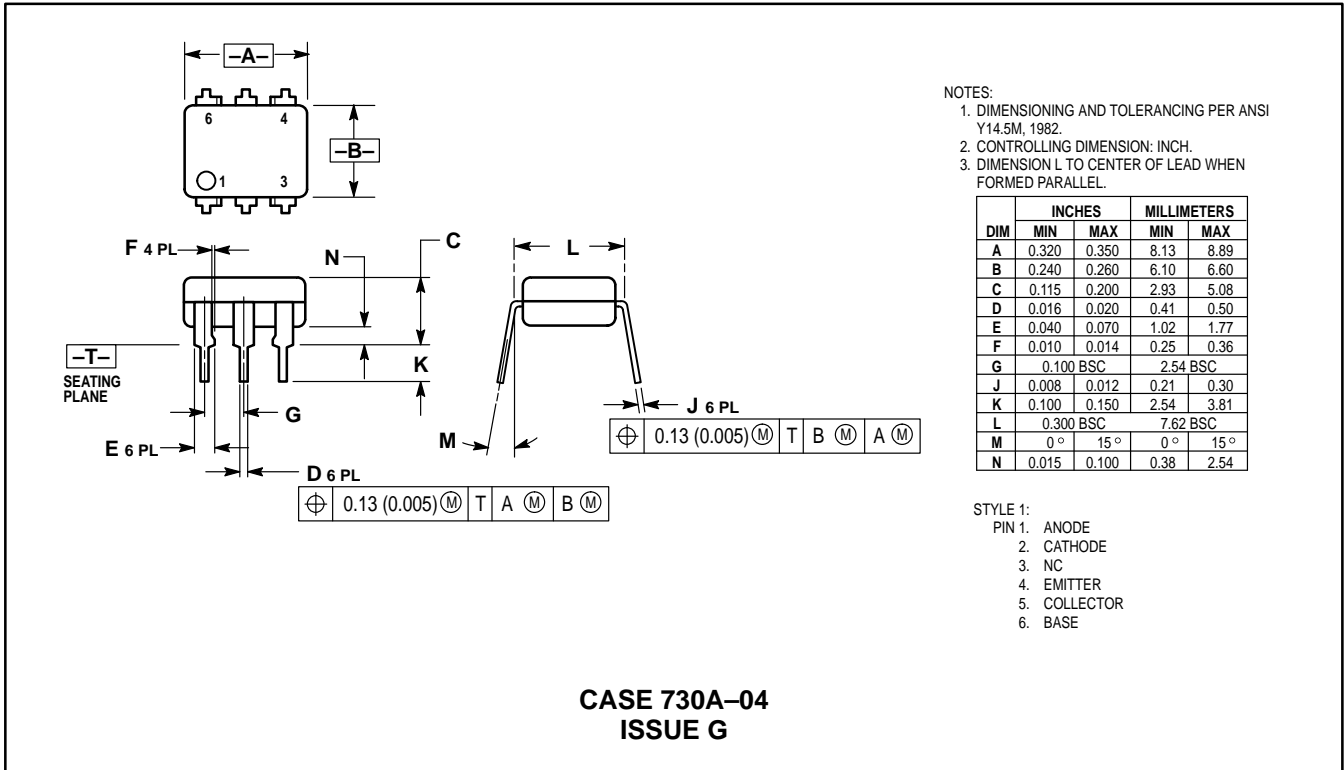


Figure 11. Switching Time Test Circuit and Waveforms

PACKAGE DIMENSIONS



4N38 4N38A



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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.320	0.350	8.13	8.89
B	0.240	0.260	6.10	6.60
C	0.115	0.200	2.93	5.08
D	0.016	0.020	0.41	0.50
E	0.040	0.070	1.02	1.77
F	0.010	0.014	0.25	0.36
G	0.100 BSC		2.54 BSC	
J	0.008	0.012	0.21	0.30
K	0.100	0.150	2.54	3.81
L	0.400	0.425	10.16	10.80
N	0.015	0.040	0.38	1.02

***Consult factory for leadform option availability**

**CASE 730D-05
ISSUE D**

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