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GlobalOptoisolator™

VDE | UL | CSA | SETI | SEMKO | DEMKO | NEMKO | BABT

6-Pin DIP Optoisolators Transistor Output

4N38

4N38A*

[CTR = 20% Min]

***Motorola Preferred Device**

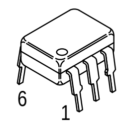
The 4N38 and 4N38A(1) devices consist of a gallium arsenide infrared emitting diode optically coupled to a monolithic silicon phototransistor detector.

- 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

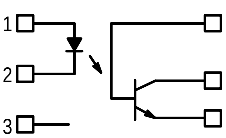
- General Purpose Switching Circuits
- Interfacing and coupling systems of different potentials and impedances
- Monitor and Detection Circuits

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

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 Derate above 25°C	P_D	150 1.41	mW 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 1.76	mW 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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REV 2

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)(1)

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) (V_{CE} = 60 V, T_A = 100°C)	I_{CEO}	— —	20 6	50 —	nA 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 (CTR)(2)	4 (20)	7 (35)	—	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)(3)		t_{on}	—	5	—	μs
Turn–Off Time (I_C = 2 mA, V_{CC} = 10 V, R_L = 100 Ω)(3)		t_{off}	—	4	—	μs
Rise Time (I_C = 2 mA, V_{CC} = 10 V, R_L = 100 Ω)(3)		t_r	—	2	—	μs
Fall Time (I_C = 2 mA, V_{CC} = 10 V, R_L = 100 Ω)(3)		t_f	—	3	—	μs
Isolation Voltage (f = 60 Hz, t = 1 sec)(4)		V_{ISO}	7500	—	—	Vac(pk)
Isolation Resistance (V = 500 V)(4)		R_{ISO}	10^{11}	—	—	Ω
Isolation Capacitance (V = 0 V, f = 1 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 x 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

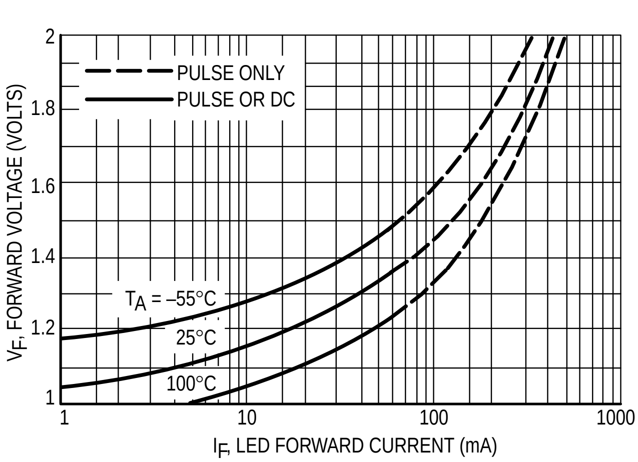


Figure 1. LED Forward Voltage versus Forward Current

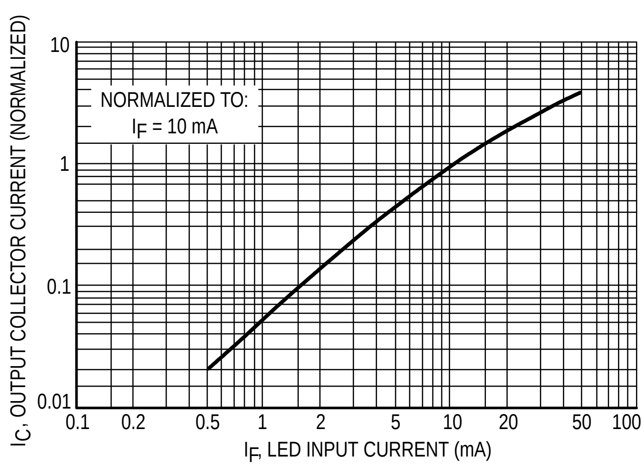


Figure 2. Output Current versus Input Current

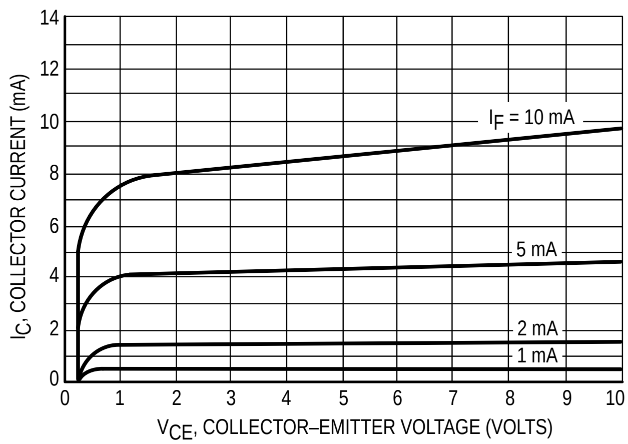


Figure 3. Collector Current versus Collector–Emitter Voltage

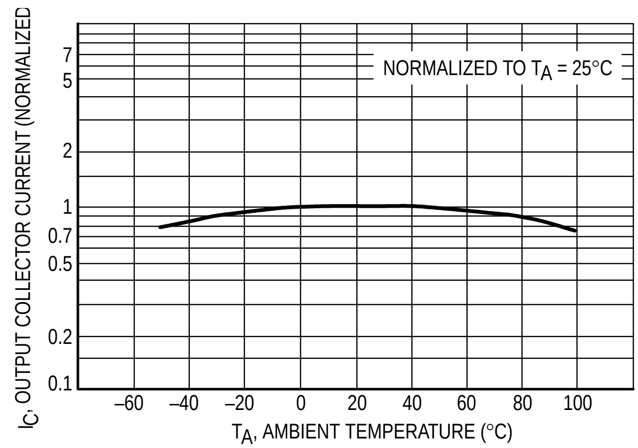


Figure 4. Output Current versus Ambient Temperature

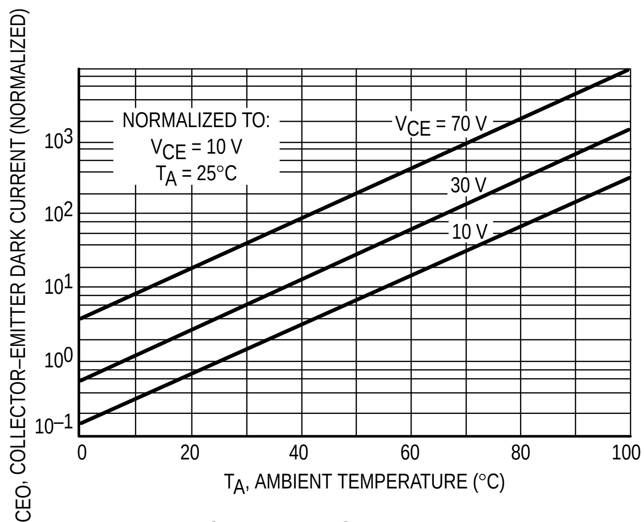


Figure 5. Dark Current versus Ambient Temperature

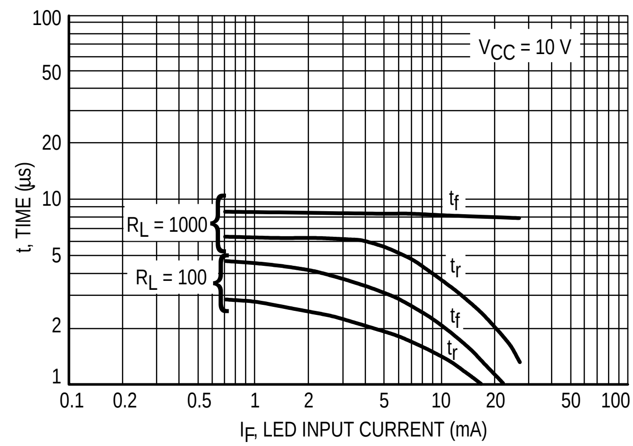


Figure 6. Rise and Fall Times (Typical Values)

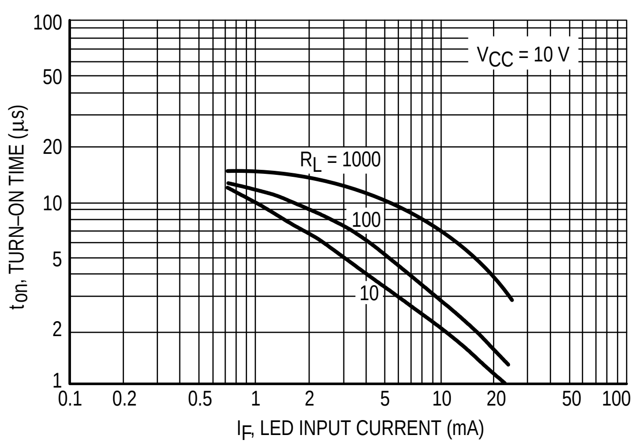


Figure 7. Turn–On Switching Times (Typical Values)

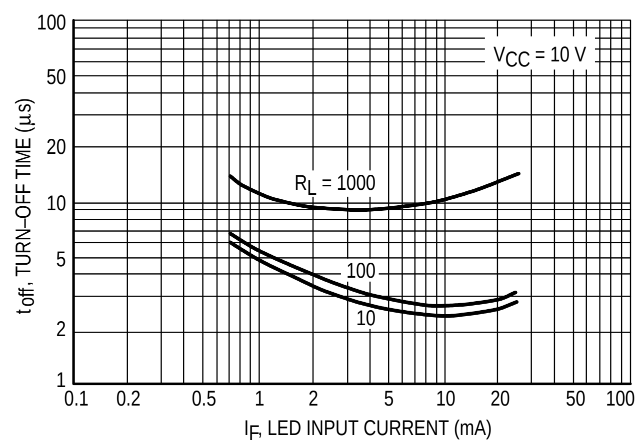


Figure 8. Turn–Off Switching Times (Typical Values)

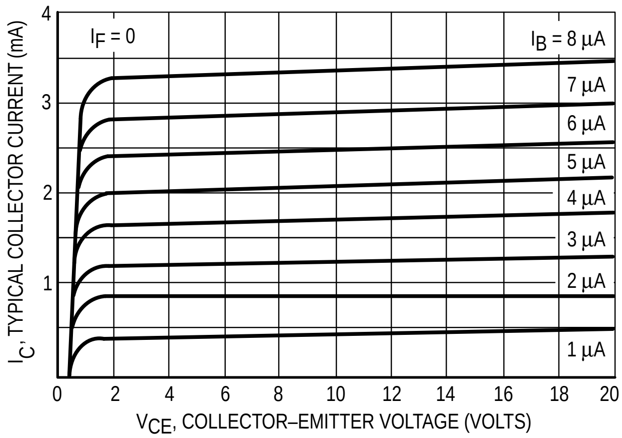


Figure 9. DC Current Gain (Detector Only)

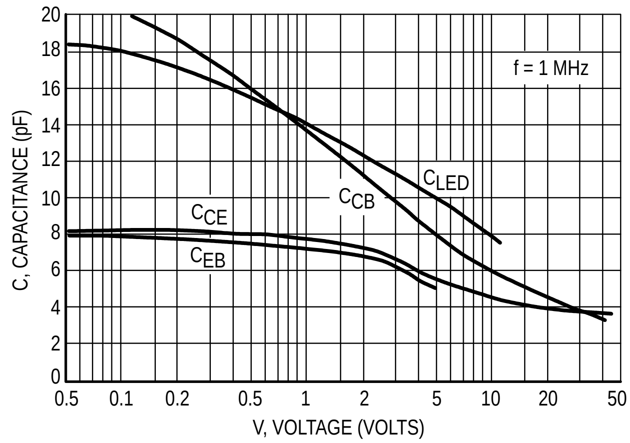


Figure 10. Capacitances versus Voltage

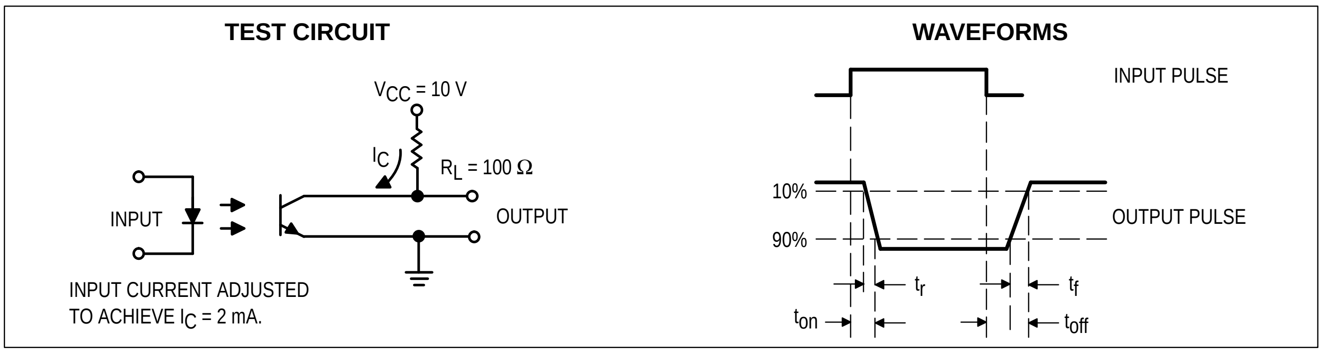
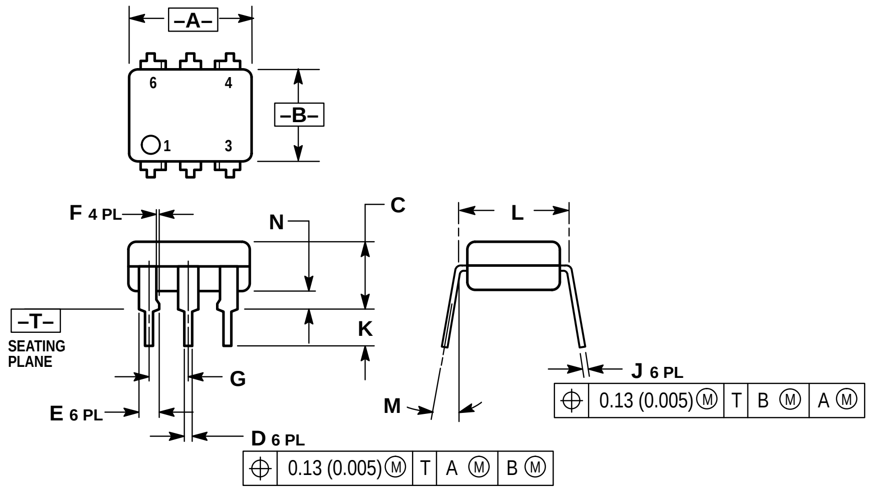


Figure 11. Switching Time Test Circuit and Waveforms

PACKAGE DIMENSIONS

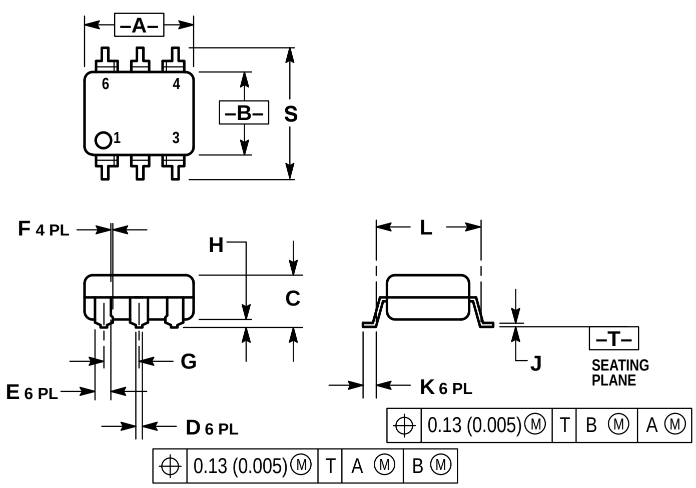


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS 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	0.300 BSC		7.62 BSC	
M	0°	15°	0°	15°
N	0.015	0.100	0.38	2.54

STYLE 1:
PIN 1. ANODE
2. CATHODE
3. NC
4. EMITTER
5. COLLECTOR
6. BASE

CASE 730A–04
ISSUE G



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2. CONTROLLING DIMENSION: INCH.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
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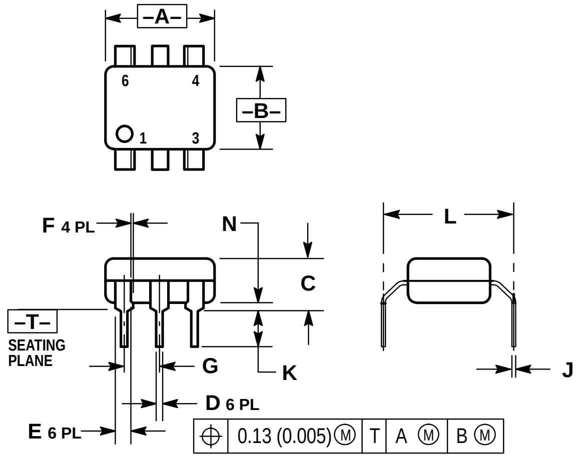
B	0.240	0.260	6.10	6.60
C	0.115	0.200	2.93	5.08
D	0.016	0.020	0.41	0.50
E	0.040	0.070	1.02	1.77
F	0.010	0.014	0.25	0.36
G	0.100 BSC		2.54 BSC	
H	0.020	0.025	0.51	0.63
J	0.008	0.012	0.20	0.30
K	0.006	0.035	0.16	0.88
L	0.320 BSC		8.13 BSC	
S	0.332	0.390	8.43	9.90

***Consult factory for leadform option availability**

CASE 730C–04
ISSUE D



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 MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS 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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