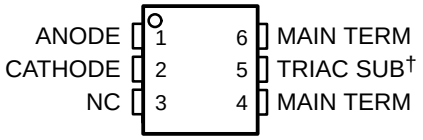
SOES027 – DECEMBER 1987 – REVISED OCTOBER 1995

- **250-V Phototriac Driver Output**
- **Gallium-Arsenide-Diode Infrared Source and Optically-Coupled Silicon Triac Driver (Bilateral Switch)**
- **UL Recognized . . . File Number E65085**
- **High Isolation . . . 3535 V peak**
- **Output Driver Designed for 115 V AC**
- **Standard 6-Pin Plastic DIP**

TIL30209– TIL3012 . . . PACKAGE
(TOP VIEW)

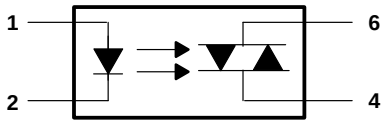


† Do not connect this terminal
NC – No internal connection

description

Each device consists of a gallium-arsenide infrared-emitting diode optically coupled to a silicon phototriac mounted on a 6-pin lead frame encapsulated within an electrically nonconductive plastic compound. The case withstands soldering temperature with no deformation. Device performance characteristics remain stable when operated in high-humidity conditions.

logic diagram



absolute maximum ratings at 25°C free-air (unless otherwise noted)†

Input-to-output peak voltage, 5 s maximum duration, 60 Hz (see Note 1)	3.535 kV
Input diode reverse voltage	3 V
Input diode forward current, continuous	50 mA
Output repetitive peak off-state voltage	250 V
Output on-state current, total rms value (50-60 Hz, full sine wave):	
T_A = 25°	100 mA
T_A = 70°	50 mA
Output driver nonrepetitive peak on-state current (t_w = 10 ms, duty cycle = 10%, see Figure 7)	1.2 mA
Continuous power dissipation at (or below) 25°C free-air temperature:	
Infrared-emitting diode (see Note 2)	100 mW
Phototriac (see Note 3)	300 mW
Total device (see Note 4)	330 mW
Operating junction temperature range, T_J	–40°C to 100°C
Storage temperature range, T_{stg}	–40°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

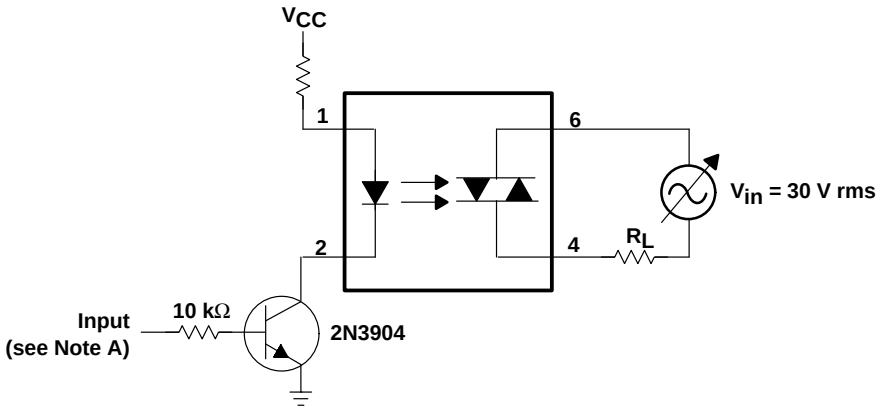
NOTES: 1. Input-to-output peak voltage is the internal device dielectric breakdown rating.
2. Derate linearly to 100°C free-air temperature at the rate of 1.33 mW/°C.
3. Derate linearly to 100°C free-air temperature at the rate of 4 mW/°C.
4. Derate linearly to 100°C free-air temperature at the rate of 4.4 mW/°C.

electrical characteristics 25°C free-air temperature range (unless otherwise noted)

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
I_R	Static reverse current		V_R = 3 V		0.05	100	µA
V_F	Static forward voltage		I_F = 10 mA		1.2	1.5	V
I_{DRM}	Repetitive off-state current, either direction		V_{DRM} = 250 V, See Note 5		10	100	nA
dv/dt	Critical rate of rise of off-state voltage		See Figure 1		12		V/µs
dv/dt(c)	Critical rate of rise of communication voltage		I_O = 15 mA, See Figure 1		0.15		V/µs
I_{FT}	Input trigger current either direction	TIL3009	Output supply voltage = 3 V		15	30	mA
		TIL3010			8	15	
		TIL3011			5	10	
		TIL3012				5	
V_{TM}	Peak on-state voltage, either direction		I_{TM} = 100 mA		1.8	3	V
I_H	Holding current, either direction				100		µA

NOTE 5: Test voltage must be applied within dv/dt rating.

PARAMETER MEASUREMENT INFORMATION



NOTE A. The critical rate of rise of off-state voltage, dv/dt, is measured with the input of 0 volts. The frequency of V_{in} is increased until the phototriac turns on. This frequency is then used to calculate the dv/dt according to the following formula:

$$dv/dt = 2\sqrt{2}\pi f V_{in}$$

The critical rate of rise of commutating voltage, dv/dt(c), is measured by applying occasional 5-volt pulses to the input and increasing the frequency of V_{in} until the phototriac remains on (latches) after the input pulse has ceased. With no further input pulses., the frequency of V_{in} is then gradually decreased until the phototriac turns off. The frequency at which turn-off occurs can then be used to calculate the dv/dt(c) according to the formula shown above.

Figure 1. CRITICAL RATE OF RISE TEST CIRCUIT

TYPICAL CHARACTERISTICS

**EMITTING DIODE TRIGGER CURRENT (NORMALIZED)
vs
FREE-AIR TEMPERATURE**

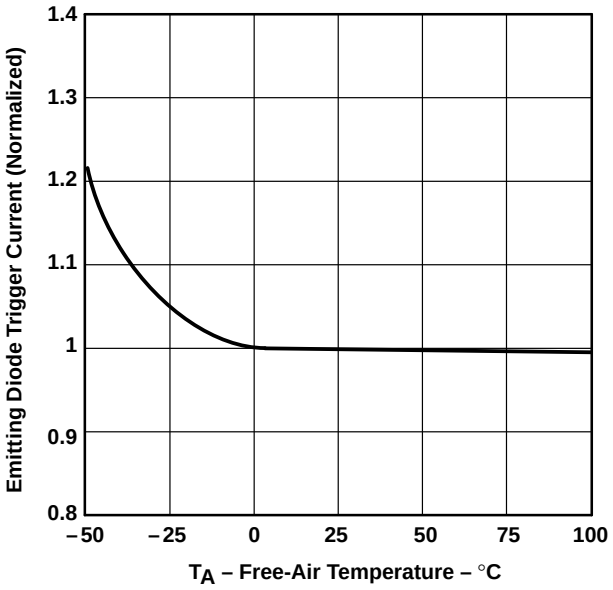


Figure 2

ON-STATE CHARACTERISTICS

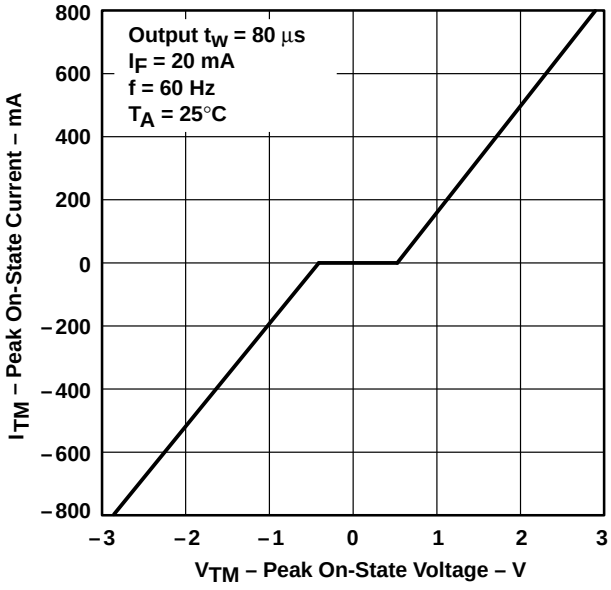


Figure 3

**CRITICAL RATE OF RISE OF OUTPUT VOLTAGE
OFF-STATE dv/dt AND COMMUTATING dv/dt(c)
vs
LOAD RESISTANCE**

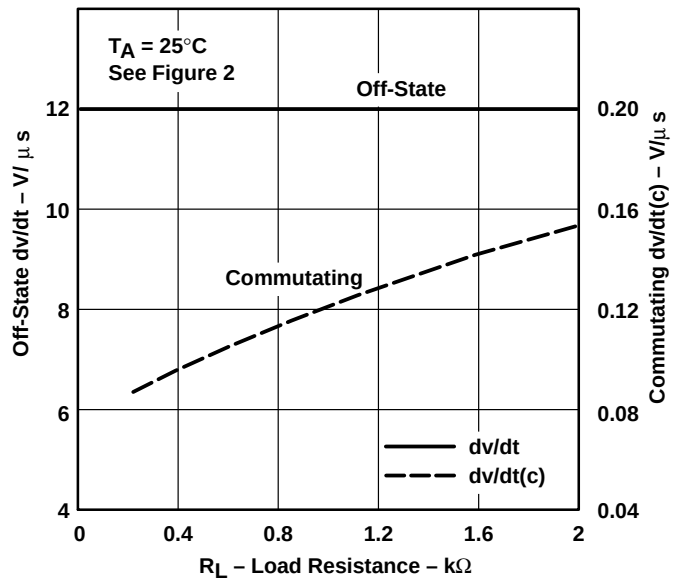


Figure 4

**CRITICAL RATE OF RISE OF OUTPUT VOLTAGE
OFF-STATE dv/dt AND COMMUTATING dv/dt(c)
vs
FREE-AIR TEMPERATURE**

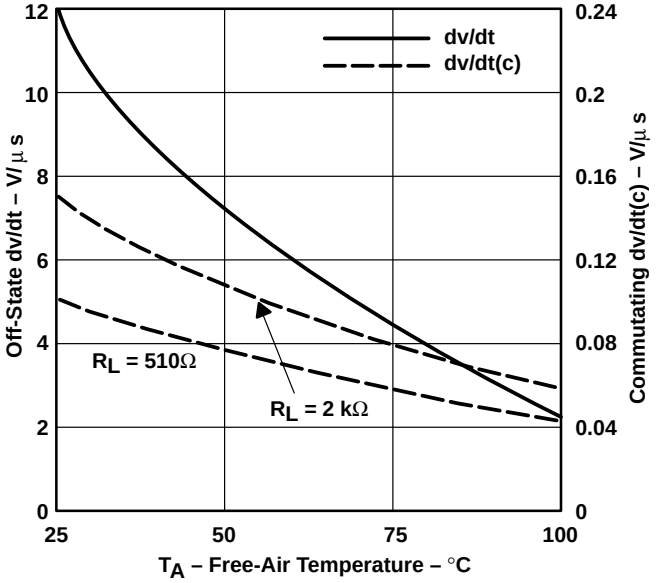


Figure 5

TYPICAL CHARACTERISTICS

**RMS APPLIED VOLTAGE
(FOR dv/dt(c) = 0.15 V/μs)
vs
FREQUENCY**

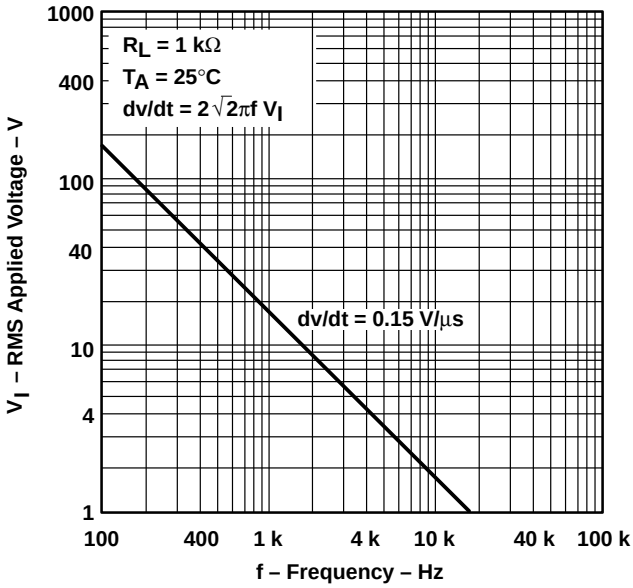


Figure 6

**NONREPETITIVE PEAK ON-STATE CURRENT
vs
PULSE DURATION**

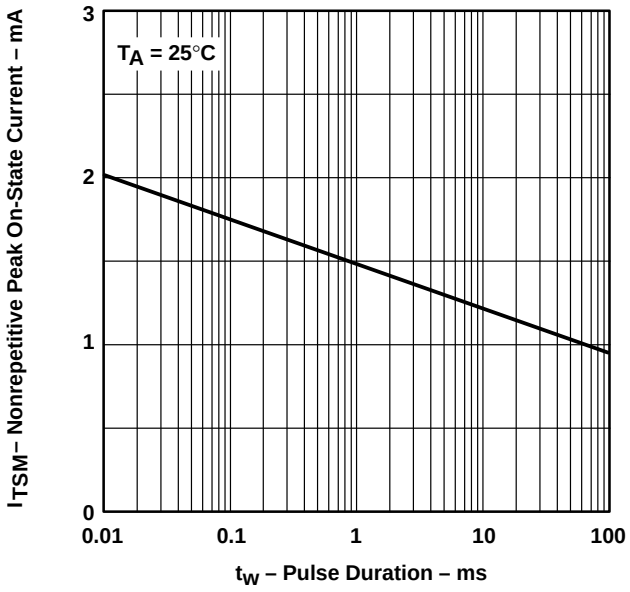


Figure 7

APPLICATION INFORMATION

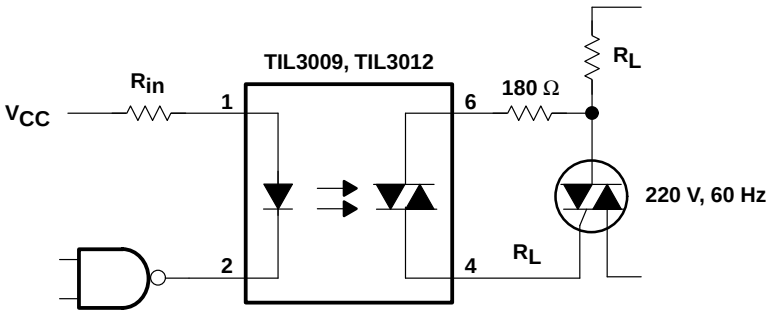
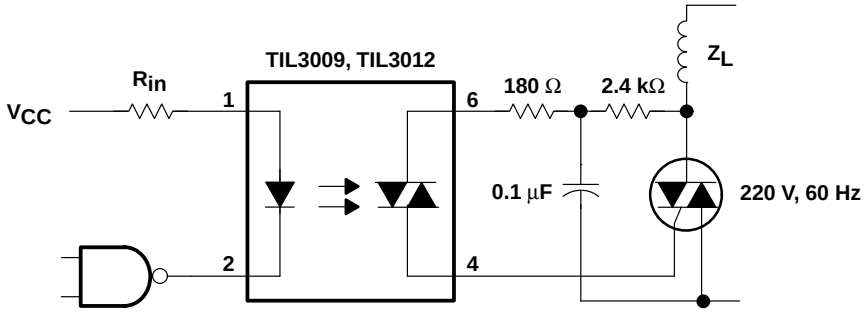
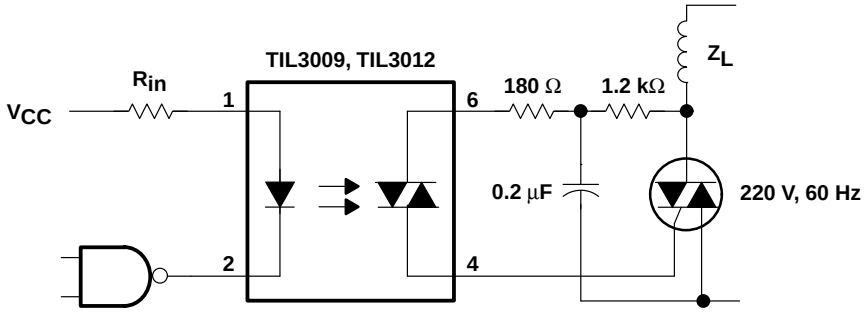


Figure 8. Resistive Load



$I_{GT} \leq 15$ mA

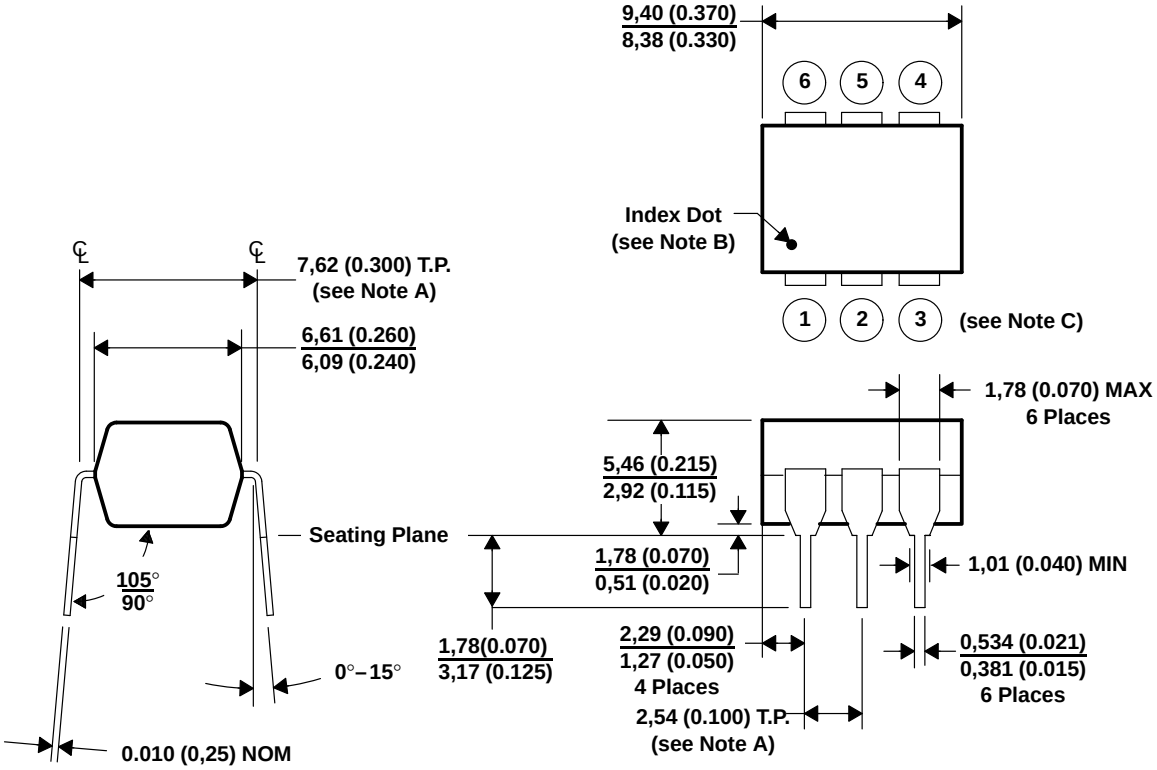
Figure 9. Inductive Load With Sensitive-Gate Traic



15 mA < I_{GT} < 50 mA

Figure 10. Inductive Load With Nonsensitive-Gate Triac

MECHANICAL INFORMATION



NOTES: A. Leads are within 0,13 mm (0.005 inch) radius of true position (T.P.) with maximum material condition and unit installed.
B. Pin 1 identified by index dot.
C. Terminal connections:
1. Anode (part of infrared-emitting diode)
2. Cathode (part of infrared-emitting diode)
3. No internal connection
4. Main terminal (part of phototriac)
5. Triac Substrate (DO NOT connect) (part of phototriac)
6. Main terminal (part of phototriac)
D. The dimensions given fall within JEDEC MO-001 AM dimensions.
E. All linear dimensions are given in millimeters and parenthetically given in inches.

Figure 11. Mechanical Information

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