D910, SEPTEMBER 1970—REVISED NOVEMBER 1974

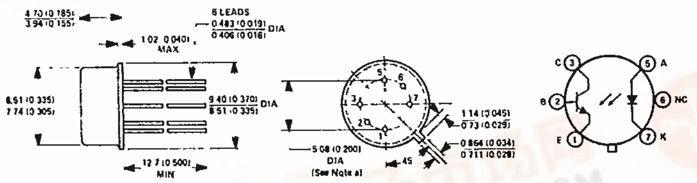
T-41-83

GALLIUM ARSENIDE DIODE INFRARED SOURCE OPTICALLY COUPLED TO A HIGH-GAIN N-P-N SILICON PHOTOTRANSISTOR

- Photon Coupling for Isolator Applications
- Base Lead Provided for Conventional Transistor Biasing
- High Overall Current Gain . . . 1.5 Typ (TIL103)
- High-Voltage Transistor . . . $V_{(BR)CEO}$ = 35 V Min
- High-Voltage Electrical Isolation . . . 1-kV Rating
- Stable over Wide Temperature Range

mechanical data

THE COLLECTOR IS IN ELECTRICAL CONTACT WITH THE CASE



NOTE a: Leads having maximum diameter shall be with 0,18 mm (0.007 inches) of true position relative to a maximum-width tab when measured in the gaging plane between 1,371 mm (0.054 inches) and 1,397 mm (0.055 inches) below the seating plane.

ALL LINEAR DIMENSIONS ARE IN MILLIMETERS AND PARENTHETICALLY IN INCHES.

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

Input-to-Output Voltage	±1 kV
Collector-Emitter Voltage	35 V
Collector-Base Voltage	35 V
Emitter-Base Voltage	4 V
Input Diode Reverse Voltage	2 V
Input Diode Continuous Forward Current at (or below) 65°C Free-Air Temperature (See Note 1)	40 mA
Continuous Collector Current	50 mA
Continuous Transistor Power Dissipation at (or below) 25°C Free-Air Temperature (See Note 2)	300 mW
Storage Temperature Range	−55°C to 125°C
Lead Temperature 1,6 mm (1/16 Inch) from Case for 10 Seconds	240°C

NOTES: 1. Derate linearly to 125°C free air temperature at the rate of 0.67 mA/°C.
2. Derate linearly to 125°C free air temperature at the rate of 3 mW/°C.

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T-41-83

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

PARAMETER			TEST CONDITIONS	TIL102 MIN	TIL102 TYP	TIL102 MAX	TIL103 MIN	TIL103 TYP	TIL103 MAX	UNIT
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage		$I_C = 100\ \mu A$, $I_E = 0$, $I_F = 0$	35			35			V
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		$I_C = 1\ mA$, $I_B = 0$, $I_F = 0$	35			35			V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage		$I_E = 100\ \mu A$, $I_C = 0$, $I_F = 0$	4			4			V
I_R	Input Diode Static Reverse Current		$V_R = 2\ V$			100			100	µA
$I_{C(on)}$	On-State Collector Current	Phototransistor Operation	$V_{CE} = 5\ V$, $I_B = 0$, $I_F = 10\ mA$	2.5	6		10	15		mA
		Photodiode Operation	$V_{CB} = 5\ V$, $I_E = 0$, $I_F = 10\ mA$		40			40		µA
$I_{C(off)}$	Off-State Collector Current	Phototransistor Operation	$V_{CE} = 20\ V$, $I_B = 0$, $I_F = 0$		6	100		6	100	nA
			$V_{CE} = 20\ V$, $I_B = 0$, $I_F = 0$, $T_A = 100\ C$		4			4		µA
		Photodiode Operation	$V_{CB} = 20\ V$, $I_E = 0$, $I_F = 0$		0.1			0.1		nA
h_{FE}	Transistor Static Forward Current Transfer Ratio		$V_{CE} = 5\ V$, $I_C = 10\ mA$, $I_F = 0$		300			500		
V_F	Input Diode Static Forward Voltage		$I_F = 10\ mA$			1.3			1.3	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage		$I_C = 2.5\ mA$, $I_B = 0$, $I_F = 20\ mA$			0.3				V
			$I_C = 10\ mA$, $I_B = 0$, $I_F = 20\ mA$						0.3	
r_{IO}	Input-to-Output Internal Resistance		$V_{in\text{-}out} = \pm 1\ kV$, See Note 3	10^{11}	10^{12}		10^{11}	10^{12}		Ω
C_{io}	Input-to-Output Capacitance		$V_{in\text{-}out} = 0$, $f = 1\ MHz$, See Note 3		2.5			2.5		pF

NOTE 3: These parameters are measured between both input diode leads shorted together and all the phototransistor leads shorted together.

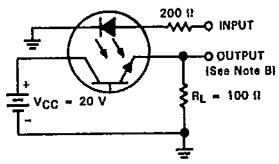
switching characteristics at 25°C free-air temperature

PARAMETER			TEST CONDITIONS	TIL102 TYP	TIL103 TYP	UNIT
t_r	Rise Time	Phototransistor Operation	$V_{CC} = 20\ V$, $I_B = 0$, $I_{C(on)} = 5\ mA$, $R_L = 100\ \Omega$, See Test Circuit A of Figure 1	3	6	µs
t_f	Fall Time			3	6	
t_r	Rise Time	Photodiode Operation	$V_{CC} = 20\ V$, $I_E = 0$, $I_{C(on)} = 50\ \mu A$, $R_L = 100\ \Omega$, See Test Circuit B of Figure 1	150	150	ns
t_f	Fall Time			150	150	

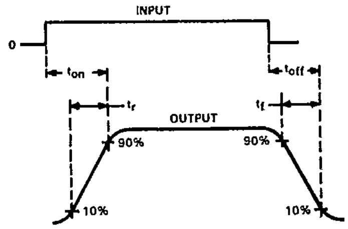
T-41-83

PARAMETER MEASUREMENT INFORMATION

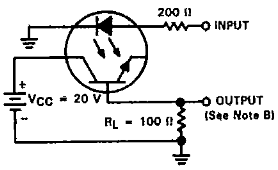
Adjust amplitude of input pulse for:
$I_{C(on)}$ = 5 mA (Test Circuit A) or
$I_{C(on)}$ = 50 μA (Test Circuit B)



TEST CIRCUIT A
PHOTOTRANSISTOR OPERATION



VOLTAGE WAVEFORMS



TEST CIRCUIT B
PHOTODIODE OPERATION

NOTES: a. The input waveform is supplied by a generator with the following characteristics: z_{out} = 50 Ω, $t_r \leq$ 15 ns, duty cycle ≈ 1%. For Test Circuit A, t_w = 100 μs. For Test Circuit B, t_w = 1 μs.

b. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq$ 12 ns, $R_{in} \geq$ 1MΩ, $C_{in} \leq$ 20 pF.

FIGURE 1—SWITCHING TIMES

TYPICAL CHARACTERISTICS

TIL102
COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

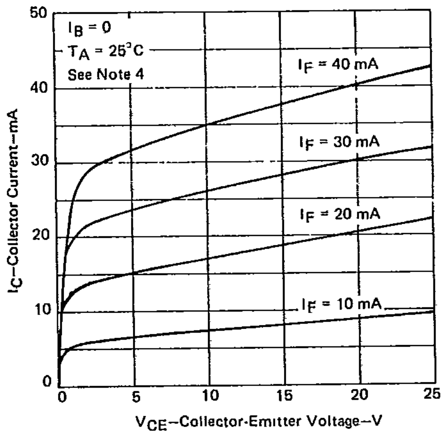


FIGURE 2

TIL103
COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

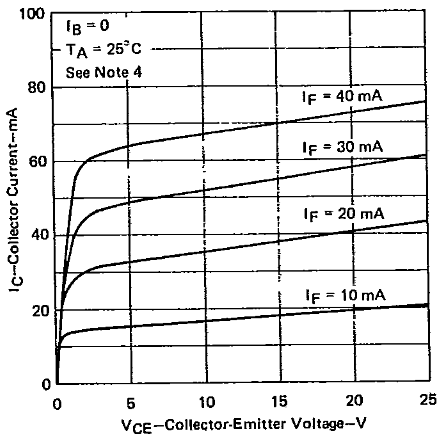


FIGURE 3

NOTE 4: This parameter was measured using pulse techniques. t_w = 100 μs, duty cycle = 1%.

3

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T-41-83

TYPICAL CHARACTERISTICS

INPUT DIODE FORWARD CONDUCTION CHARACTERISTICS

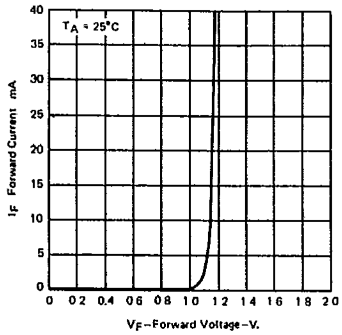
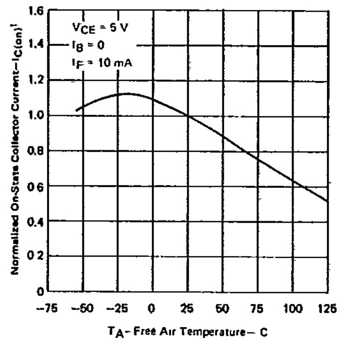


FIGURE 4

NORMALIZED ON-STATE COLLECTOR CURRENT†
vs
FREE-AIR TEMPERATURE



†Normalized to value at T_A = 25°C

FIGURE 5

PHOTOTRANSISTOR COLLECTOR CURRENT
vs
INPUT-DIODE FORWARD CURRENT

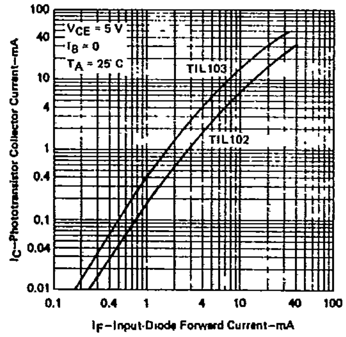


FIGURE 6

OFF-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

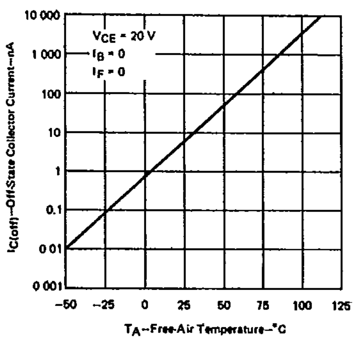


FIGURE 7

TIL102
AVERAGE SWITCHING TIME
vs
LOAD RESISTANCE

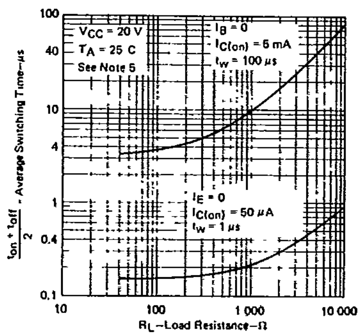


FIGURE 8

NOTE 5: These parameters were measured in Test Circuits A and B of Figure 1 with R_L varied between 40 Ω and 10 kΩ.

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