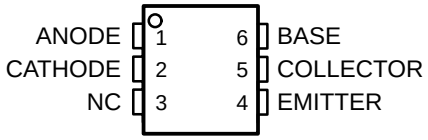
SOES023 – MARCH 1983 – REVISED OCTOBER 1995

COMPATIBLE WITH STANDARD TTL INTEGRATED CIRCUITS

- **Gallium Arsenide Diode Infrared Source Optically Coupled to a Silicon npn Phototransistor**
- **High Direct-Current Transfer Ratio**
- **Base Lead Provided for Conventional Transistor Biasing**
- **High-Voltage Electrical Isolation . . . 1.5-kV, or 3.55-kV Rating**
- **Plastic Dual-In-Line Package**
- **High-Speed Switching:**
  t_r = 5 μs, t_f = 5 μs Typical
- **Designed to be Interchangeable with General Instruments MCT2 and MCT2E**

MCT2 OR MCT2E . . . PACKAGE
(TOP VIEW)



NC – No internal connection

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

Input-to-output voltage: MCT2	± 1.5 kV
MCT2E	± 3.55 kV
Collector-base voltage	70 V
Collector-emitter voltage (see Note 1)	30 V
Emitter-collector voltage	7 V
Emitter-base voltage	7 V
Input-diode reverse voltage	3 V
Input-diode continuous forward current	60 mA
Input-diode peak forward current ($t_w \leq 1$ ns, PRF ≤ 300 Hz)	3 A
Continuous power dissipation at (or below) 25°C free-air temperature:	
Infrared-emitting diode (see Note 2)	200 mW
Phototransistor (see Note 2)	200 mW
Total, infrared-emitting diode plus phototransistor (see Note 3)	250 mW
Operating free-air temperature range, T_A	–55°C to 100°C
Storage temperature range, T_{stg}	–55°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. This value applies when the base-emitter diode is open-circulated.
2. Derate linearly to 100 °C free-air temperature at the rate of 2.67 mW/°C.
3. Derate linearly to 100 °C free-air temperature at the rate of 3.33 mW/°C.

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

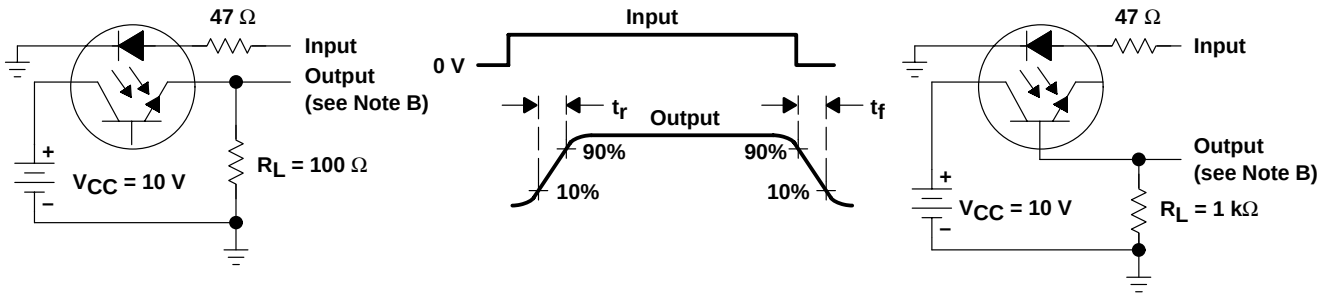
PARAMETER			TEST CONDITIONS		MIN	TYP	MAX	UNIT
$V_{(BR)CBO}$	Collector-base breakdown voltage		I_C = 10 μA, I_E = 0, I_F = 0		70			V
$V_{(BR)CEO}$	Collector-emitter breakdown voltage		I_C =1 mA, I_B = 0, I_F = 0		30			V
$V_{(BRECO)}$	Emitter-collector breakdown voltage		I_E = 100 μA, I_B = 0, I_F = 0		7			V
I_R	Input diode static reverse current		V_R = 3 V				10	μA
$I_{C(on)}$	On-state collector current	Phototransistor operation	V_{CE} = 10 V, I_B = 0, I_F = 10 mA		2	5		mA
		Photodiode operation	V_{CB} = 10 V, I_E = 0, I_F = 10 mA			20		μA
$I_{C(off)}$	Off-state collector current	Phototransistor operation	V_{CE} = 10 V, I_B = 0, I_F = 0			1	50	nA
		Photodiode operation	V_{CB} = 10 V, I_E = 0, I_F = 0			0.1	20	nA
H_{FE}	Transistor static forward current transfer ratio		V_{CE} = 5 V, I_C = 100 μA, I_F = 0	MCT2		250		
				MCT2E	100	300		
V_F	Input diode static forward voltage		I_F = 20 mA			1.25	1.5	V
$V_{CE(sat)}$	Collector-emitter saturation voltage		I_C = 2 mA, I_B = 0, I_F = 16 mA			0.25	4	V
r_{IO}	Input-to-output internal resistance		V_{in-out} = ±1.5 kV for MCT2, ±3.55 kV for MCT2E, See Note 4		10^{11}			Ω
C_{io}	Input-to-output capacitance		V_{in-out} = 0, f = 1 MHz, See Note 4			1		pF

NOTE 4: These parameters are measured between both input diode leads shorted together and all the phototransistor leads shorted together.

switching characteristics

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_r	Rise time	Phototransistor operation	V_{CC} = 10 V, $I_{C(on)}$ = 2 mA, R_L = 100 Ω, See Test Circuit A of Figure 1		5		μs
t_f	Fall time						
t_r	Rise time	Photodiode operation	V_{CC} = 10 V, $I_{C(on)}$ 20 μA, R_L = 1 kΩ, See Test Circuit B of Figure 1		1		μs
t_f	Fall time						

PARAMETER MEASUREMENT INFORMATION



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_O = 50 Ω, $t_r \le 15$ ns, duty cycle ≈ 1%, t_W = 100 μs.
B. The output waveform is monitored on an oscilloscope with the following characteristics: $t_r \le 12$ ns, $R_{in} \ge 1$ MΩ, $C_{in} \le 20$ pF.

Figure 1. Switching Times

TYPICAL CHARACTERISTICS

COLLECTOR CURRENT vs INPUT-DIODE FORWARD CURRENT

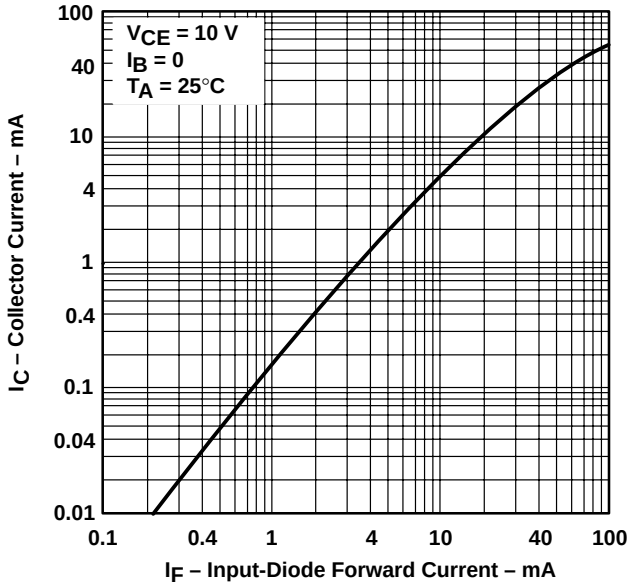
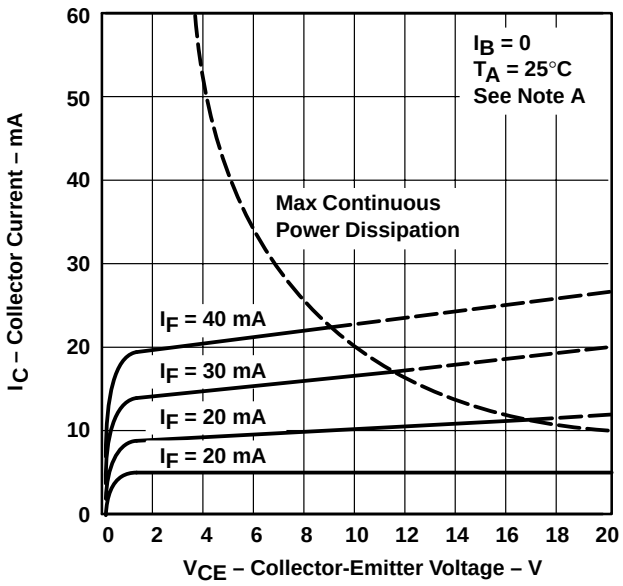


Figure 2

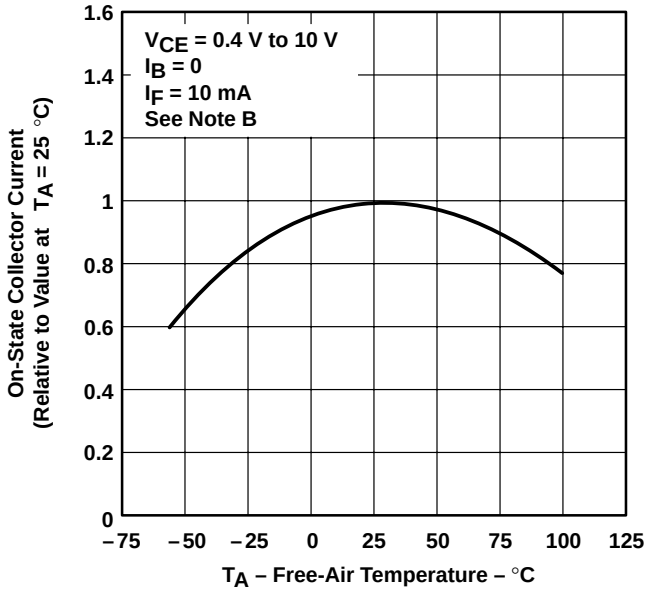
COLLECTOR CURRENT vs COLLECTOR-EMITTER VOLTAGE



NOTE A: Pulse operation of input diode is required for operation beyond limits shown by dotted lines.

Figure 3

ON-STATE COLLECTOR CURRENT (RELATIVE TO VALUE AT 25°C) vs FREE-AIR TEMPERATURE

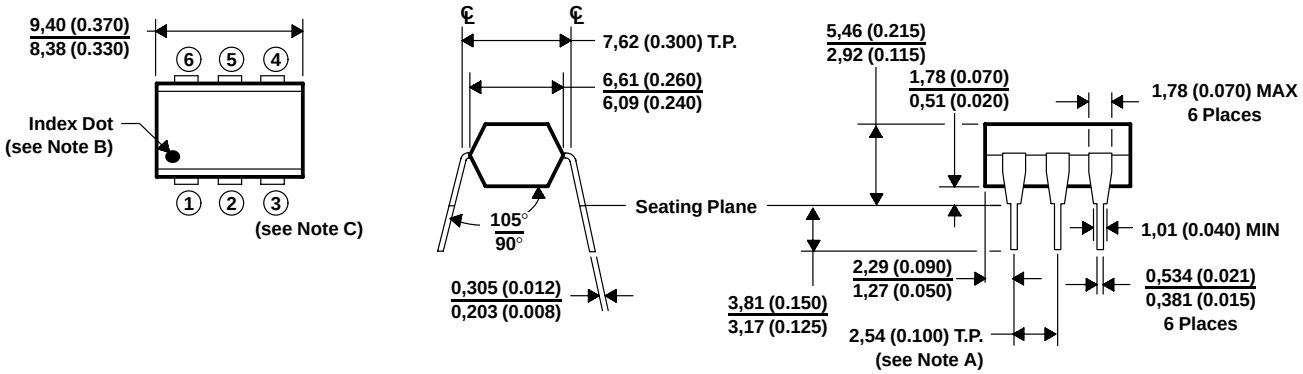


NOTE B: These parameters were measured using pulse techniques, t_W = 1 ms, duty cycle ≤ 2 %.

Figure 4

MECHANICAL INFORMATION

The package consists of a gallium-arsenide infrared-emitting diode and an npn silicon phototransistor mounted on a 6-lead frame encapsulated within an electrically nonconductive plastic compound. The case can withstand soldering temperature with no deformation and device performance characteristics remain stable when operated in high-humidity conditions. Unit weight is approximately 0.52 grams.



NOTES: A. Leads are within 0,13 (0.005) 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 the infrared-emitting diode)
2. Cathode (part of the infrared-emitting diode)
3. No internal connection
4. Emitter (part of the phototransistor)
5. Collector (part of the phototransistor)
6. Base (part of the phototransistor)
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 5. Mechanical Information

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
MCT2	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI
MCT2E	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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