
Harmonized system of quality assessment for electronic components: Generic specification: Semiconductor optoelectronic and liquid crystal devices

Système harmonisé d'assurance de la qualité des composants électroniques
Spécification générique: Dispositifs à semiconducteurs optoélectroniques et à cristaux liquides

Harmonisiertes Gütebestätigungssystem für Bauelemente der Elektronik
Fachgrundspezifikation: optoelektronische Halbleiter und Flüssigkristallbauelemente

National foreword

This British Standard has been prepared under the direction of the Electronic Components Standards Committee. It is identical with CENELEC Electronic Components Committee (CECC) 20 000 'Harmonized system of quality assessment : for electronic components. Generic specification: Semiconductor optoelectronic and liquid crystal devices'.

This standard gives the terminology, quality assessment procedures and test and measurement conditions applicable to semiconductor optoelectronic and liquid crystal devices. It specifies the use of substances and/or test procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and in no way absolves either the supplier or user from statutory obligations relating to health and safety at any stage of manufacture or use.

Terminology and conventions. The text of the CECC specification has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards; attention is drawn especially to the following.

The comma has been used as a decimal marker. In British Standards it is current practice to use a full point on the baseline as the decimal marker.

Cross-references

International standard	Corresponding British Standard
ISO 497-1973	BS 2045 : 1965 Preferred numbers (Technically equivalent)
ISO 1000-1973*	BS 5555 : 1976 SI units and recommendations for the use of their multiples and of certain other units (Identical)
IEC 68	BS 2011 Basic environmental testing procedures
IEC 68-1:1978	Part 1.1 : 1980 General (Identical)
IEC 68-2-2 : 1974	Part 2.1B : 1977 Tests B. Dry heat (Identical)
IEC 68-2-3 : 1969	Part 2.1Ca : 1977 Test Ca. Damp heat, steady state (Identical)
IEC 68-2-4 : 1960	Part 2.1Da : 1977 Test Da. Accelerated damp heat (Identical)
IEC 68-2-6 : 1970	Part 2.1Fc : 1977 Test Fc. Vibration (sinusoidal) (Identical)
IEC 68-2-7 : 1968	Part 2.1Ga : 1977 Test Ga. Acceleration, steady state (Identical)
IEC 68-2-14 : 1974	Part 2.1N : 1977 Test N. Change of temperature (Identical)
IEC 68-2-17 : 1978	Part 2.1Q : 1981 Tests Q. Sealing (Identical)
IEC 68-2-20 : 1979	Part 2.1T : 1981 Test T. Soldering (Identical)
IEC 68-2-21 : 1975	Part 2.1U : 1977 Test U. Robustness of terminations and integral mounting devices (Identical)
IEC 68-2-27 : 1972	Part 2.1Ea : 1977 Test Ea. Shock (Identical)
IEC 68-2-30 : 1980	Part 2.1Db : 1981 Test Db and guidance : Damp heat, cyclic (12 + 12 hour cycle) (Identical)
IEC 68-2-38 : 1974	Part 2.1Z/AD : 1977 Test Z/AD. Composite temperature/humidity cyclic test (Identical)
IEC 148:1969	BS 3363 : 1980 Letter symbols for semiconductor devices and integrated microcircuits (Identical)
IEC 191:1966 (example A46)	BS 3934 : 1965 Dimensions of semiconductor devices (Outline drawing SO-123 is identical)
CECC 00 007:1973	BS E9007 : 1975 Harmonized system of quality assessment for electrical components : Basic specification : sampling plans and procedures for inspection by attributes (Identical)

*ISO 1000-1973 has been superseded by ISO 1000-1981 which is identical with BS 5555 : 1981 'Specification for SI units and recommendations for the use of their multiples and of certain other units'.



Amendment No. 0
published and effective from 31 October 1984
to BS CECC 20000 : 1983

Harmonized system of quality assessment for
electronic components: Generic specification:
semiconductor optoelectronic and liquid
crystal devices

NOTE. This Amendment implements Supplement 1 to CECC 20000 Issue 1 (1982).
An additional sentence to the national foreword has also been included in this Amendment.

Instructions for the insertion of new and revised pages
and minor revisions to existing pages.

Revised text

AMD 4606
October 1984

National foreword

At the end of paragraph 1 insert the following:
'Supplement 1 to CECC 20000, Issue 1 was implemented as Amendment No. 0 to this
British Standard.'

AMD 4606
October 1984

Contents

Appendix E. Delete '(under consideration)' and add in page number: '61'.

Instructions for the insertion of new and revised pages

AMD 4606
October 1984

Replace page 3 by the new sheet pages 3 and 3a, Supplement 1. Retain existing page 4.
Replace page 32 by the new sheet page 32, Supplement 1. Retain existing page 31.
Add the new sheet page 33, Supplement 1.
Re-number pages 33 to 46 accordingly.
Add the new sheets pages 48 to 63, Supplement 1.

FOREWORD

The CENELEC Electronic Components Committee (CECC) is composed of those member countries of the European Committee for Electrotechnical Standardization (CENELEC) who wish to take part in a harmonized System for electronic components of assessed quality.

The Object of the System is to facilitate international trade by the harmonization of the specifications and quality assessment procedures for electronic components, and by the grant of an internationally recognized Mark, or Certificate, of Conformity. The components produced under the System are thereby accepted by all member countries without further testing.

This specification has been formally approved by the CECC, and has been prepared for those countries taking part in the System who wish to issue national harmonized specifications for SEMICONDUCTOR OPTOELECTRONIC AND LIQUID CRYSTAL DEVICES. It should be read in conjunction with document CECC 00 100 : Basic Rules (1974).

At the date of printing of this specification the member countries of the CECC are Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom, and copies of it can be obtained from the addresses shown on the blue fly sheet.

PREFACE

This generic specification (GS) was prepared by CECC Working Group 20 : "SEMICONDUCTOR OPTOELECTRONIC AND LIQUID CRYSTAL DEVICES".

In accordance with the requirements of the documents CECC 00 100 to 00 113 it is based, wherever possible, on the Recommendations of the International Electrotechnical Commission and in particular on IEC 147 : Essential ratings and characteristics of semiconductor devices and general principles of measuring methods.

This specification will be supplemented by blank detail specifications (BDS) specific to each sub-family of semiconductor optoelectronic and liquid crystal devices.

When first published the generic specification did not contain all measuring methods for electrical and optical parameters. These will be issued for voting and published with the individual BDS and added to the generic specification by amendment.

This Supplement 1 was prepared by CECC Working Group 20 and provides measuring methods for photocouplers with phototransistor output.

The text of this generic specification was initially circulated to the CECC for voting in the documents listed below, and was ratified by the President of the CECC for printing as a CECC Specification.

<u>Document</u>	<u>Voting date</u>	<u>Report on the voting</u>
CECC(Secretariat)619	October 1977	CECC(Secretariat)722
CECC(Secretariat)1014	April 1981	CECC(Secretariat)1137
CECC(Secretariat)1037	June 1981	CECC(Secretariat)1146

The text of Supplement 1 was circulated to the CECC for voting in the document listed below, and was ratified by the President of the CECC for printing as a CECC Specification.

<u>Document</u>	<u>Voting date</u>	<u>Report on the voting</u>
CECC(Secretariat)1213	November 1982	CECC(Secretariat)1332

NOTE

This supplement is published initially in English and French. The German text will follow as soon as it has been prepared.

APPENDIX D

ELECTRICAL AND OPTICAL MEASUREMENTS

This contains supplements relating to clause 4.3.4 - Methods for electrical and optical measurements.

References to IEC Publications are listed, measurements not defined in IEC Publications are described herein.

This appendix will be supplemented as and when necessary.

List of methods for electrical and optical measurements

Ref.	Symbol	Title	IEC method or as described on page :
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1. Light emitting diodes, infrared emitting diodes, General measurements,

L-001	$\begin{cases} I_v \\ I_e \end{cases}$	Luminous intensity and radiant intensity	p 34
L-002	$\begin{cases} L_v \\ L_e \end{cases}$	Luminance and radiance	p 36
L-003	$\begin{cases} \lambda_p \\ \Delta\lambda \end{cases}$	Wavelength at peak emission and spectral bandwidth	p 39
L-004	$\begin{cases} \theta_{I/2} \\ \Delta\theta \end{cases}$	Radiation diagram, Half intensity angle and misalignment	p 41
L-005	t_{on}, t_{off}	Switching times	p 45
L-006	V_F	Forward voltage	IEC 147-2B, Ch. I, Sec. 1, cl. 2
L-007	I_R	Reverse current	IEC 147-2B, Ch. I, Sec. 1, cl. 1
L-008	C_{tot}	Capacitance	IEC 147-2B, Ch. I, Sec 1, cl. 3
L-009	$\begin{cases} \phi_v \\ \phi_e \end{cases}$	Luminous flux Radiant flux	p 47

List of methods for electrical and optical measurements (continued)

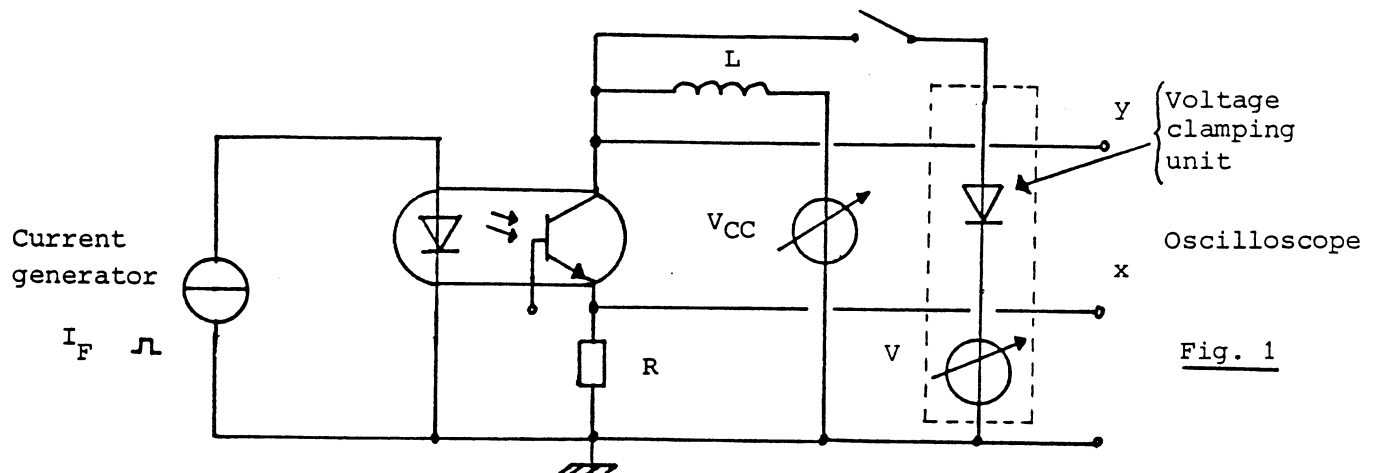
Ref.	Symbol	Title	IEC Method or as described on page :
2.- Photocouplers			
C-001	$V_{CEO(sus)}$	Collector-emitter sustaining voltage	p 48
C-002	$V_{(BR)ECO}$	Emitter-collector breakdown voltage	p 51
C-003	$V_{(BR)CBO}$	Collector-base breakdown voltage	IEC 147-2, Chapter II clause 11
C-004	$V_{(BR)EBO}$	Emitter-base breakdown voltage	
C-005	$V_{CE(sat)}$	Collector-emitter saturation voltage	p 52
C-006	V_{IO} or V_{IORM}	Continuous or repetitive peak isolation voltage (Test)	p 53
C-007	V_{IOSM}	Surge isolation voltage (Test)	p 54
C-008	I_{CEO}	Collector-emitter cut-off current	IEC 147-2 chapter II clause 17
C-009	I_{CBO}	Collector-base cut-off current	IEC 147-2 chapter II clause 2
C-010	I_C/I_F	Current transfer ratio	p 55
C-011	h_{FE}	Static value of the forward current transfer ratio	IEC 147-2 chapter II sub-clause 10.1
C-012	R_{IO}	Isolation resistance between input and output	p 57
C-013	C_{IO}	Input to output capacitance	p 58
C-014	t_{on}, t_{off}	Switching times	p 59

COLLECTOR-EMITTER SUSTAINING VOLTAGE $V_{CEO(sus)}$

1. PURPOSE

To ensure that the collector-emitter sustaining voltage of a phototransistor under specified conditions not less than the specified minimum value.

2. CIRCUIT DIAGRAM



3. DESCRIPTION

- the phototransistor is operated in saturated condition under pulse operation
- opening the input circuit causes, by means of the inductance, the phototransistor to be swept through a current-voltage cycle
- the generator V_{CC} is adjustable, it enables the collector current to be set to the specified value
- R is a resistor
- a voltage clamping unit, indicated in Fig.1 as a variable voltage source in series with a diode, limits the voltage V_{CE} to the specified minimum value $V_{CEO(sus)}$

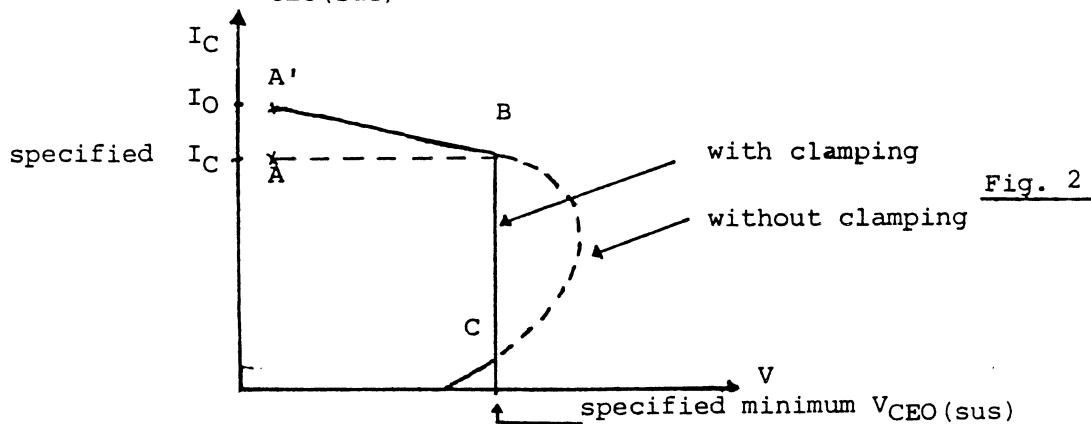
As an alternative, the clamping unit may be removed if so prescribed by the detail specification

- the essential characteristics of inductance L shall be given in the detail specification, for example it may be required that :

$$L_{min} = V_{CEO(sus)} \times \frac{t_{off(max)}}{0,1 I_C} \quad \text{to ensure that } I_C \text{ does not drop by more than 10 \% during } t_{off} .$$

4. PROCEDURE

4.1 the clamping unit is adjusted to operate at the specified minimum $V_{CEO(sus)}$



4.2 with voltage V_{CC} set at 0, current I_F is adjusted so that the specified current I_C can be reached for a V_{CE} value less than a few volts (point A in figure 2) (that is in the saturated condition)

4.3 the voltage V_{CC} is progressively increased until the specified current I_C is reached for the specified minimum voltage $V_{CEO(sus)}$ (point B in figure 2)

As a result, the current at which the cycle starts may reach a value I_O slightly higher than the specified value of I_C (point A' in figure 2)

5. PRECAUTION

In a preliminary test, the action of the clamping unit shall be verified by decreasing its adjustable voltage ; then the clamping unit shall be adjusted to the desired value of V_{CEO} which corresponds to the specified current I_C (point B of the figure 2)

6. REQUIREMENTS

- the phototransistor is satisfactory when the trace moving vertically from point B to point C, does not pass to the left of the line B-C
- when the clamping unit is not used, the phototransistor is satisfactory if the trace effectively turns around point B as shown in figure 2.

7. SPECIFIED CONDITIONS

- Case or ambient temperature T_{case} or T_{amb}
- collector current I_{C}
- minimum sustaining voltage $V_{\text{CEO(sus)}}$
- essential characteristics of inductance L where appropriate
- if no clamping unit is used, this shall be stated
- frequency of the pulse generator I_{F} , if different from 50 Hz .

Method C-002

EMITTER-COLLECTOR BREAKDOWN VOLTAGE $V_{(BR)ECO}$

When the measurement of the emitter-base breakdown voltage (C-003) is not possible because the base connection is not accessible, this method gives an approximate value of $V_{(BR)EBO}$.

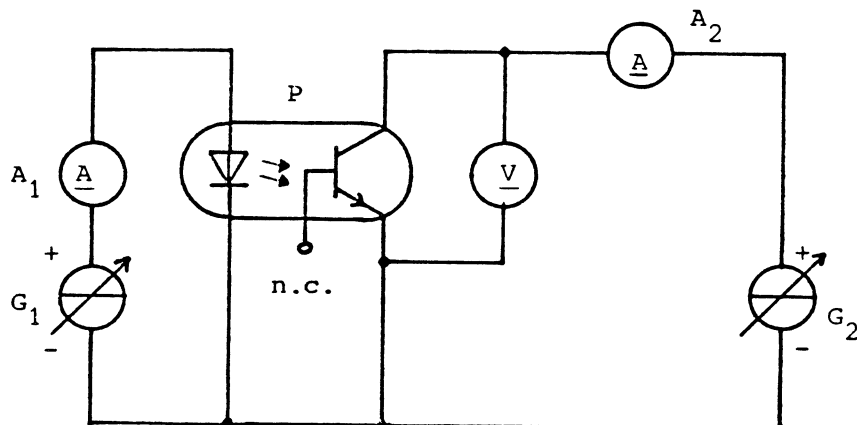
The measurement is made in the same manner as described in IEC 147-2 chapter two sub-clause 11.2.1 except that the reverse bias voltage is applied between the emitter and the collector (the base connection is open-circuited).

Method C-005

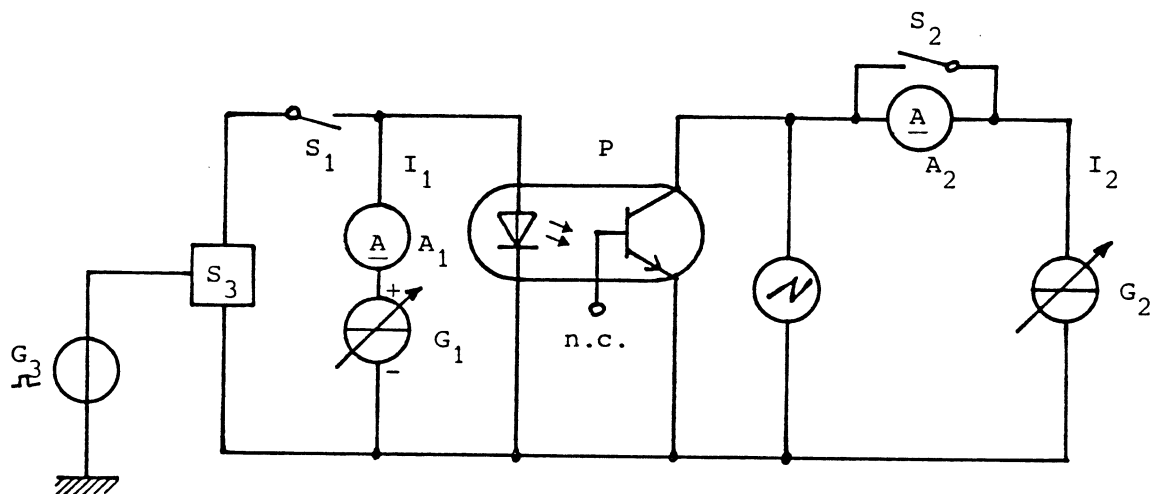
COLLECTOR-EMITTER SATURATION VOLTAGE $V_{CE(sat)}$

As in IEC 147-2 chapter two, clause 4 with the following modifications :

1) Replace figure 14 by the following :



Replace figure 15 by the following :



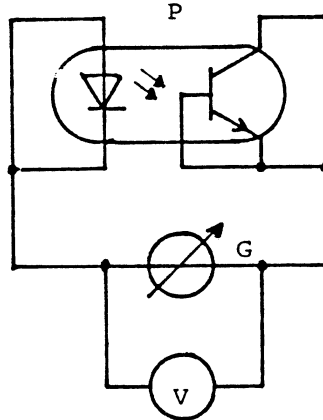
2) In the text replace "base current", " I_B " by "input forward current", " I_F ".

CONTINUOUS OR REPETITIVE PEAK ISOLATION VOLTAGE V_{IO} , V_{IORM} (ISOLATION TEST)

1. PURPOSE

To verify the ability of the device to withstand the isolation test voltage under specified conditions.

2. CIRCUIT DIAGRAM



P = Photocoupler under test

Figure 4

3. TEST PROCEDURE

The test should be carried out under the standard atmospheric conditions in IEC 68-1, sub-clause 5.3.1.

The device is inserted into the test socket so that the photoemitter terminals, as well as the photodetector terminals, are shorted together.

The d.c. or a.c. test voltage is increased from zero to the specified value at a rate of about 100 volts per second if the specified value is lower than or equal to 1 000 volts or at 500 volts per second if the specified value is higher than 1 000 volts.

The voltage is maintained for one minute for qualification testing and for 10 seconds (minimum) for acceptance testing.

4. REQUIREMENTS

External or internal flash-over shall not occur during the test.

The device shall pass the post-test measurements.

5. SPECIFIED CONDITIONS

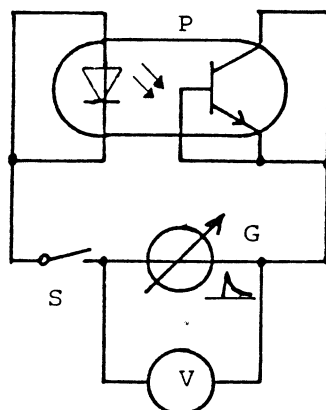
- Isolation voltage (V_{IO} or V_{IORM})
- Test time (if different from 1 minute or 10 seconds, respectively)
- Post-test measurements.

SURGE ISOLATION VOLTAGE (TEST) V_{IOSM}

1. PURPOSE

To verify the ability of the device to withstand the surge isolation test voltage under specified conditions.

2. CIRCUIT DIAGRAM



P = photocoupler under test
G = 1,2 μ s/50 μ s exponential pulse generator
V = peak reading voltmeter
S = switch

3. TEST PROCEDURE

The test shall be carried out under standard atmospheric conditions (IEC 68-1 Sub-Clause 5.3.1).

Before the device is connected (S open), the output voltage of the generator G is increased until the specified value of the surge isolation voltage is reached. The time interval between two pulses is 10 s.

The device is inserted into the test socket so that the photoemitter terminals, as well as the photodetector terminals, are short-circuited together.

S is closed and the specified number of pulses is applied to the device under test.

4. REQUIREMENTS

External or internal flash-over shall not occur during the test.

The device shall pass the post-test measurements.

5. SPECIFIED CONDITIONS

- Surge isolation voltage
- Number of pulses
- Post-test measurements.

CURRENT TRANSFER RATIO I_C/I_F

1. PURPOSE

To measure the static value of the forward current transfer ratio of photocouplers under specified conditions.

2. CIRCUIT DIAGRAM

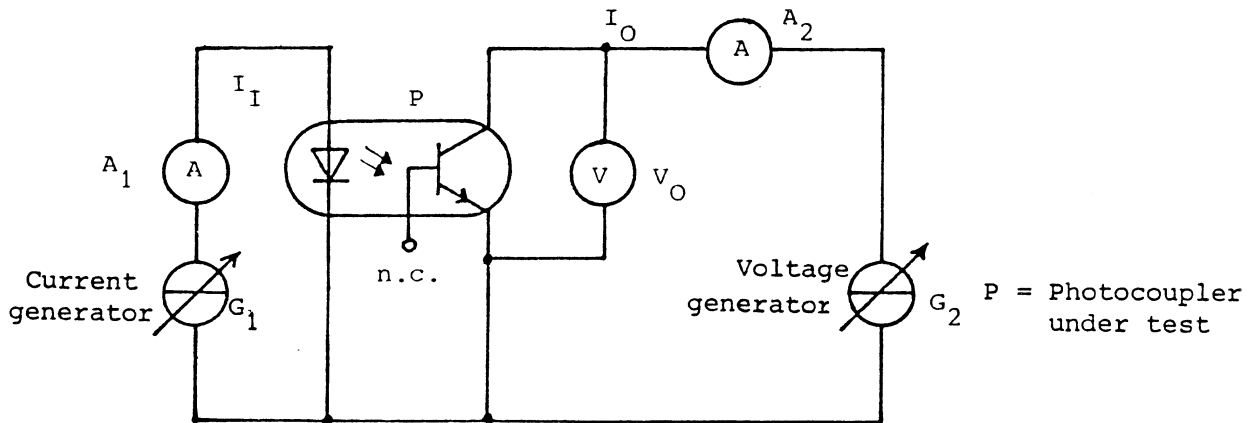


Figure 1 : Basic circuit

3. CIRCUIT DESCRIPTION AND REQUIREMENTS

I_I = input current = forward current I_F of the emitting diode.

I_O = output current = reverse current I_R of the photodiode or collector current I_C of the phototransistor.

V_O = output voltage = reverse voltage V_R of the photodiode or collector-emitter voltage V_{CE} of the phototransistor.

A_1, A_2 = ammeters.

4. MEASUREMENT PROCEDURE

The measurement is performed at standard atmospheric conditions, unless otherwise specified.

The constant current source is adjusted to obtain the specified input current through the emitting diode.

The voltage source is adjusted to the specified value V_R or V_{CE} and the output current I_R or I_C , respectively, is measured with the ammeter A_2 .

The current transfer ratio is calculated by the following formula : $\frac{I_O}{I_I}$

or for a photocoupler with diode output : $\frac{I_R}{I_F}$

or for a photocoupler with transistor output : $\frac{I_C}{I_F}$

5. PRECAUTIONS TO BE OBSERVED

When the photocoupler may be sensitive to external radiation, the precautions to be taken in measurement shall be stated and observed.

6. SPECIFIED CONDITIONS

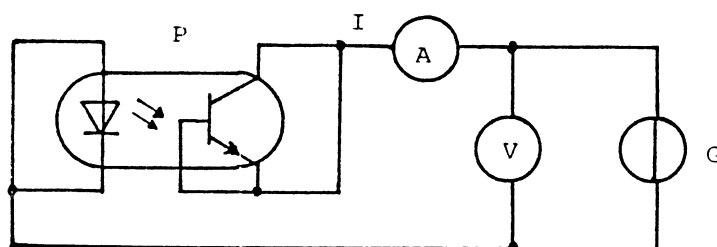
- Ambient temperature
- Input or output current, d.c. or pulsed
- Output voltage (V_R or V_{CE})
- When appropriate, the atmospheric conditions.

ISOLATION RESISTANCE BETWEEN INPUT AND OUTPUT R_{IO}

1. PURPOSE

To measure the isolation resistance between the input and output terminals of a photocoupler when subjected to d.c. voltage under specified conditions.

2. CIRCUIT DIAGRAM



P = Photocoupler under test

Figure 3 : Basic circuit

3. PRECAUTIONS TO BE OBSERVED

Proper guarding techniques shall be used to prevent false readings.

4. MEASUREMENT PROCEDURE

The photoemitter terminals, as well as the photodetector terminals, are shorted together.

The specified isolation voltage is applied between the photoemitter and photodetector terminals for 60 seconds.

The isolation resistance is calculated as V/I .

5. SPECIFIED CONDITIONS

- Ambient temperature
- Measurement voltage
- Time after which the measurement is made, if different from 60 seconds.

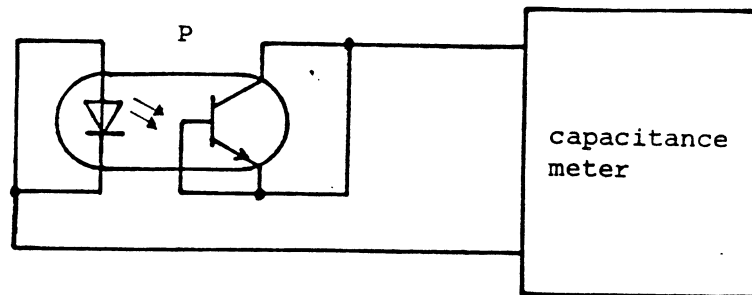
Method C-013

INPUT TO OUTPUT CAPACITANCE C_{IO}

1. PURPOSE

To measure the capacitance between the input and output terminals of a photocoupler under specified conditions.

2. CIRCUIT DIAGRAM



P = Photocoupler under test

Figure 2 : Basic circuit

3. MEASUREMENT PROCEDURE

The photoemitter terminals as well as the photodetector terminals are shorted together. The capacitance between the photoemitter and the photodetector terminals is measured at a frequency of 1 MHz (unless otherwise specified), using a suitable capacitance meter.

4. PRECAUTIONS TO BE OBSERVED

Allowance should be made for the stray capacitance of the test fixture and the leads.

5. SPECIFIED CONDITIONS

- Ambient temperature
- Measurement frequency, if different from 1 MHz.

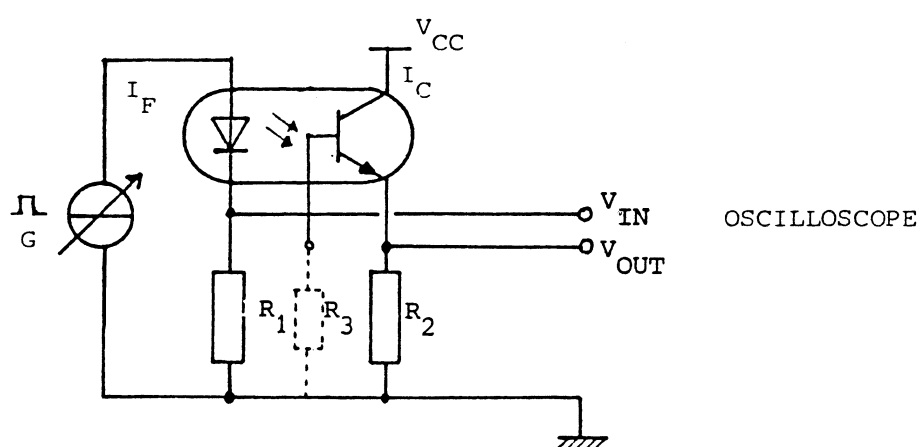
Method C-014

SWITCHING TIMES t_{on} , t_{off}

1. PURPOSE

To measure the turn-on and the turn-off times of a photocoupler under specified conditions.

2. CIRCUIT DIAGRAM



$$R_1 = 50 \, \Omega$$

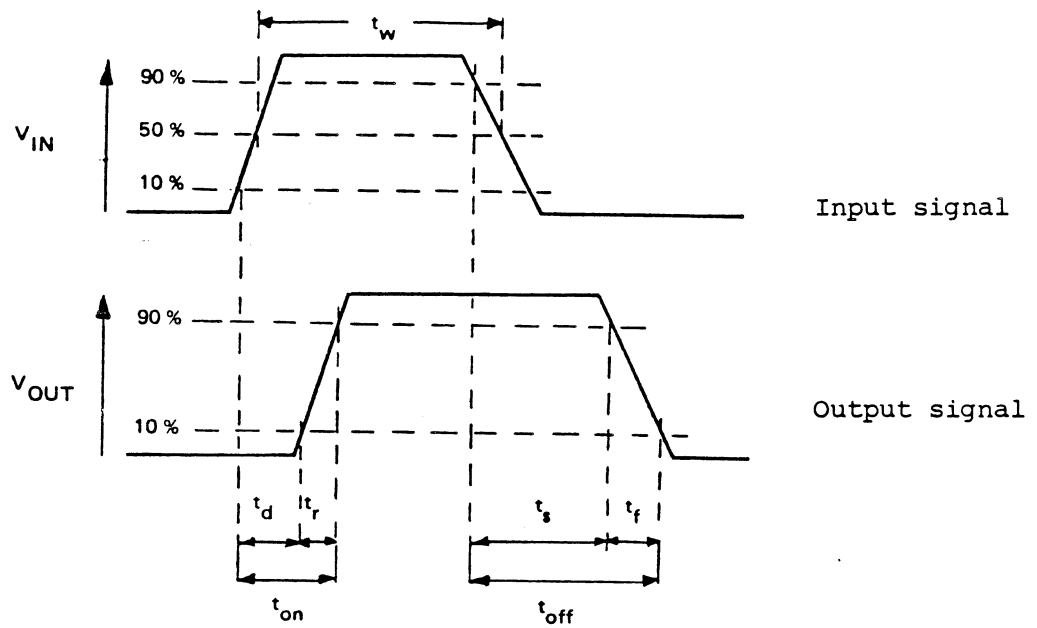
$$R_2 = 100 \, \Omega \text{ unless otherwise specified}$$

Figure 1

3. MEASUREMENT PROCEDURE

The supply voltage V_{CC} is applied to the output circuit of the device under test. Pulses delivered by generator G are applied to the input of the device ; the magnitude of the pulses is increased until the specified input current I_F or collector current I_C value is reached.

The switching times are determined by observing the oscilloscope traces (see figure 2).



t_d = delay time

t_r = rise time

$t_{on} = t_d + t_r$ = turn-on time

t_s = storage time

t_f = fall time

$t_{off} = t_s + t_f$ = turn-off time

Figure 2

4. SPECIFIED CONDITIONS

- Ambient temperature
- Input or output current
- Output circuit supply voltage
- Pulse width t_w and duty cycle δ
- R_2 value if other than 100Ω
- R_3 value if used

APPENDIX E

SPECIAL CLIMATIC AND MECHANICAL TESTS

1- TEMPERATURE CYCLING FOR DETECTION OF THERMAL INTERMITTENCE OF PHOTOCOUPPLERS

1. PURPOSE

To determine the failures caused by intermittent short-circuits or open circuits which can appear in operating temperature range limits.

2. CIRCUIT DIAGRAMS AND CIRCUIT DESCRIPTION

2.1 Circuit 1 as described in figure 1 allows the detection of :

- input diode open or short circuit
- output transistor collector or emitter open circuit
- output transistor base-emitter short circuit

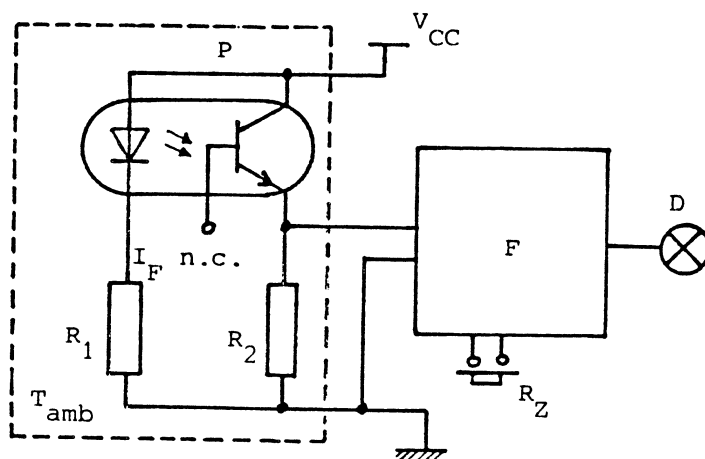


Figure 1

R_Z = Reset

Description : The input current I_F as determined by V_{CC} and R_1 is such that the output transistor is saturated when supplied by V_{CC} and loaded by R_2 .

Any of the above mentioned short or open circuit conditions would cause a voltage change at the R_2 terminals.

2.2 Circuit 2 as described in figure 2 is only applicable when the base
----- terminal is present. It allows the detection of :

- input diode open circuit
- Output transistor emitter or base open-circuit.

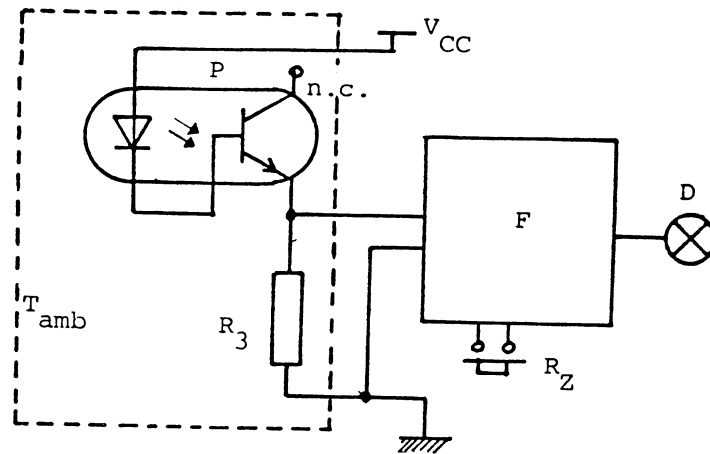


Figure 2

R_Z = Reset

Description : The input diode junction and the base-emitter junction are forward biased by V_{CC} and R_3 . Any of the above mentioned open circuit conditions would cause a voltage change at the R_3 terminals.

- 2.3 For both circuits : Any voltage change at R_2 or R_3 terminals is ----- detected by the failure detection system F, which records any failure with a duration higher than 5 μ s.

The display D indicates the failure until the system is reset.

3. TEST PROCEDURE

When the device has been connected as described, the voltage V_{CC} is applied and the failure detection system is reset.

The ambient temperature of the device is increased from 25 °C to $T_{amb\ max}$ in not less than 30 s.

After thermal equilibrium has been reached, the electrical continuity of the internal wire bonds is monitored over the range of 25 °C to $T_{amb\ max}$ continuously (at a rate of variation not exceeding 10 °C/minute). The next cycle shall not start before thermal equilibrium is reached.

4. REQUIREMENT

Any open or short circuit detected by the system constitutes a failure.

5. SPECIFIED CONDITIONS

- Supply voltage V_{CC} (if other than 5 V)
 - Circuit(s) used for the test
 - R_1 and R_2 values for circuit 1
 - R_3 value for circuit 2 (if other than 2,7 k Ω)
 - Maximum operating ambient temperature
 - Number of cycles (if other than 5).
-



Amendment No. 1
published and effective from 28 February 1989
to BS CECC 20000 : 1983

Harmonized system of quality assessment for electronic components: Generic specification: Semiconductor optoelectronic and liquid crystal devices

NOTE. This amendment implements Supplement 2 to CECC 20000 Issue 1 (1982). An additional sentence to the national foreword has been included in this amendment.

Instructions for the insertion of new and revised pages and minor revisions to existing pages

Revised text

AMD 5800
February 1989

National foreword (as amended by Amendment No. 0)

At the end of paragraph 1 insert the following.
'Supplement 2 to CECC 20000 was implemented as
Amendment No. 1 to this British Standard.'

AMD 5800
February 1989

Contents (as amended by Amendment No. 0)

Appendix E. Delete page number '61' and substitute '74'.
Appendix F. Delete '(under consideration)' and add the page number '77'.

Instructions for the insertion of new and revised pages

AMD 5800
February 1989

Replace page 3a, Supplement 1 by the new sheet page 3a, Supplement 2. Retain existing page 3, Supplement 1.
Insert the new sheet page 33a, Supplement 2.
Remove the sheet pages 60 and 61, Supplement 1.
Insert the new sheet page 60 to 74, Supplement 2.
Renummer the sheet pages 62 and 63, Supplement 1 to 75 and 76.
Add the new sheet page 77, Supplement 2.

The text of Supplement 1 was circulated to the CECC for voting in the document listed below, and was ratified by the President of the CECC for printing as a CECC Specification.

<u>Document</u>	<u>Voting Date</u>	<u>Report on the Voting</u>
CECC(Secretariat)1213	November 1982	CECC(Secretariat)1332

The text of Supplement 2 was circulated to the CECC for voting in the documents listed below, and was ratified by the President of the CECC for printing as a CECC Specification.

<u>Documents</u>	<u>Voting Dates</u>	<u>Reports on the Voting</u>
CECC(Secretariat)1454	April 1984	CECC(Secretariat)1624
CECC(Secretariat)1601	December 1984	CECC(Secretariat)1781
CECC(Secretariat)1830	October 1985	CECC(Secretariat)1899

Note

These supplements are published initially in English and French. The German text will follow as soon as it has been prepared.

