

BRITISH STANDARDS INSTITUTION

2 PARK STREET, LONDON W1A 2BS

Specification available from:- as shown in PD 9002, CECC 00200 and

SILICONIX LIMITED

MORRISTON, SWANSEA (UK), SA6 6NE

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TELEX 46197

BS CECC 50 012-002

ISSUE 2 MAR 1982



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ELECTRONIC COMPONENTS OF ASSESSED QUALITY

DETAIL SPECIFICATION IN ACCORDANCE WITH

BS CECC 50 000:1980

MANUFACTURER'S TYPE NUMBER

2N4091

2N4092

2N4093

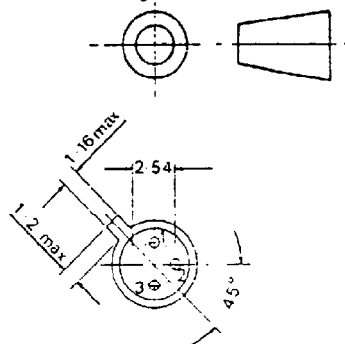
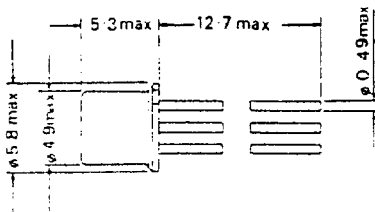
For ordering information
see clause 7SINGLE GATE
FIELD EFFECT TRANSISTORSILICON N-CHANNEL
JUNCTION-GATE TYPE FOR
SWITCHING AND CHOPPER
APPLICATIONS
AMBIENT RATED METAL CASE**LEVELS OF QUALITY ASSESSMENT**

E - F - L

Outline and dimensions

All dimensions in millimetres

Third angle projection



Terminal connections

1. Source
2. Drain
3. Gate (connected to case)

For detail dimensions see:-

IEC 191-2 B11 and C7

Marking information see clause 6

4 LIMITING VALUES (absolute maximum system)

These apply over the operating temperature range, unless otherwise stated.

		Min.	Max.	Unit
4.1	T_{amb} Ambient operating temperature range	-55	150	$^{\circ}\text{C}$
4.2	T_{stg} Storage temperature range	-55	200	$^{\circ}\text{C}$
4.3	V_{DSS} Drain-source voltage ($T_{amb} = 25^{\circ}\text{C}$)		40	V
4.4	$-V_{GSR}$ Gate-source reverse voltage ($V_{DS} = 0$)		40	V
4.5	$-V_{GDO}$ Gate-drain reverse voltage with source open-circuited		40	V
4.6	I_{GF} Forward gate current		10	mA
4.7	I_D Drain current		250	mA
4.8.1	P_{tot} Total power dissipation ($T_{amb} = 25^{\circ}\text{C}$) See Appendix 1 for derating curve		0.3	W
	P_{tot} Total power dissipation ($T_{case} = 25^{\circ}\text{C}$)		1.8	W
	Lead temperature 1.5 mm from case for 60 s.		300	$^{\circ}\text{C}$

Refer to Qualified Products List PD9002 or CECC 00 200 for availability of components approved to this detail specification.

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5 CHARACTERISTICS

$T_{amb} = 25^{\circ}\text{C}$ unless otherwise stated.

† = Characteristics verified under inspection requirements.

PARAMETER AND TEST CONDITIONS		Min.	Max.	Unit
$-I_{GDO(1)}$	Maximum leakage current with source open-circuited † $-V_{GD} = 20\text{ V}$ $I_S = 0$ All types		200	pA
$-I_{GDO(2)}$	Maximum leakage current with source open-circuited † $-V_{GD} = 20\text{ V}$ $I_S = 0$ $T_{amb} = 150^{\circ}\text{C}$ All types		400	nA
$-V_{GSoff}$	Minimum and maximum gate-source cut-off voltage † $V_{DS} = 20\text{ V}$ $I_D = 1\text{ nA}$			
	2N4091	5	10	V
	2N4092	2	7	V
	2N4093	1	5	V
$I_{DSX(1)}$	Maximum drain cut-off current † $-V_{GS} = 12\text{ V}$ $V_{DS} = 20\text{ V}$ 2N4091 $-V_{GS} = 8\text{ V}$ $V_{DS} = 20\text{ V}$ 2N4092 $-V_{GS} = 6\text{ V}$ $V_{DS} = 20\text{ V}$ 2N4093		200 200 200	pA pA pA
$I_{DSX(2)}$	Maximum drain cut-off current † $-V_{GS} = 12\text{ V}$ $V_{DS} = 20\text{ V}$ $T_{amb} = 150^{\circ}\text{C}$ 2N4091 $-V_{GS} = 8\text{ V}$ $V_{DS} = 20\text{ V}$ $T_{amb} = 150^{\circ}\text{C}$ 2N4092 $-V_{GS} = 6\text{ V}$ $V_{DS} = 20\text{ V}$ $T_{amb} = 150^{\circ}\text{C}$ 2N4093		400 400 400	nA nA nA
I_{DSS}^*	Minimum and maximum drain current † $V_{DS} = 20\text{ V}$ $V_{GS} = 0$			
	2N4091	30	250	mA
	2N4092	15	150	mA
	2N4093	8	100	mA
V_{DSsat} ($V_{DS(ON)}$)	Maximum drain-source saturation voltage † $V_{GS} = 0$ $I_D = 6.6\text{ mA}$ 2N4091 $V_{GS} = 0$ $I_D = 4.0\text{ mA}$ 2N4092 $V_{GS} = 0$ $I_D = 2.5\text{ mA}$ 2N4093		0.2 0.2 0.2	V V V

* Pulse test required, pulse width = 300 μs , duty cycle = 3 %

5 CHARACTERISTICS

 $T_{amb} = 25^{\circ}\text{C}$ unless otherwise stated.

† = Characteristics verified under inspection requirements.

PARAMETER AND TEST CONDITIONS		Min.	Max.	Unit
C_{iss}	Maximum small signal common-source input capacitance † $V_{DS} = 20\text{ V}$ $V_{GS} = 0$ $f = 1\text{ MHz}$ All types		16	pF
C_{22ss}	Maximum small signal common-source output capacitance † $V_{DS} = 20\text{ V}$ $-V_{GS} = 12\text{ V}$ $f = 1\text{ MHz}$ All types		5	pF
C_{12ss}	Maximum small signal common-source reverse transfer capacitance † $V_{DS} = 0$ $-V_{GS} = 20\text{ V}$ $f = 1\text{ MHz}$ All types		5	pF
$t_{d(on)}$	Turn-on delay time **† $V_{DD} = 3\text{ V}$ $V_{GS(ON)} = 0$ $C_L = 0$ $-V_{GSoff} = 12\text{ V}$ $R_L = 425\ \Omega$ 2N4091 $-V_{GSoff} = 8\text{ V}$ $R_L = 700\ \Omega$ 2N4092 $-V_{GSoff} = 6\text{ V}$ $R_L = 1120\ \Omega$ 2N4093		15 15 20	ns ns ns
t_{off}	Turn-off time **† $V_{DD} = 3\text{ V}$ $V_{GS(ON)} = 0$ $C_L = 0$ $-V_{GSoff} = 12\text{ V}$ $R_L = 425\ \Omega$ 2N4091 $-V_{GSoff} = 8\text{ V}$ $R_L = 700\ \Omega$ 2N4092 $-V_{GSoff} = 6\text{ V}$ $R_L = 1120\ \Omega$ 2N4093		40 60 80	ns ns ns
t_r	Rise time **† $V_{DD} = 3\text{ V}$ $V_{GS(ON)} = 0$ $C_L = 0$ $-V_{GSoff} = 12\text{ V}$ $R_L = 425\ \Omega$ 2N4091 $-V_{GSoff} = 8\text{ V}$ $R_L = 700\ \Omega$ 2N4092 $-V_{GSoff} = 6\text{ V}$ $R_L = 1120\ \Omega$ 2N4093		10 20 40	ns ns ns
$r_{DS(ON)}$	Maximum drain-source on-state resistance † $I_D = 1\text{ mA}$ $V_{GS} = 0$ 2N4091 2N4092 2N4093 $-I_D = 1\text{ mA}$ $V_{GS} = 0$ 2N4091 2N4092 2N4093		30 50 80 30 50 80	Ω Ω Ω Ω Ω Ω

** For pulse waveforms see Appendix 2.

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6 MARKING

- 1) Each transistor shall bear the following marking:
 - a) The manufacturer's type number (see Table 1).
 - b) The factory identification code.
 - c) The date code.
- 2) Each package containing one or more of these transistors shall bear all the above markings except (b) and in addition
 - d) The detail specification number (see Table 1).
- 3) Interpretation of marking information

XXXXXX

X

-Y

Device Type No.

Quality Assessment
Level

Screening Sequence

KEY:

Quality Assessment Level
(CECC 50,000 ISSUE III APPENDIX IIA)

E
F
L

Screening Sequence
(CECC 50,000 ISSUE III APPENDIX VI)

BLANK	No Screening
A	Sequence A
B	Sequence B
C	Sequence C
D	Sequence D

7 ORDERING INFORMATION

The following minimum information is necessary to order a specific device, unless otherwise specified:

- precise type number
- CECC reference of detail specification with issue number and/or date when relevant
- level or quality assessment as defined in Appendix II A of CECC 50 000, and, if required, screening sequence as defined in Appendix VI of CECC 50 000
- any other particulars

Orders for these transistors shall contain the following minimum information

TABLE 1

ORDER TYPE	SPECIFICATION NUMBER	MARKING
BS 2N4091X - Y to	BS CECC 50 012 - 002 Issue 2 dated Mar. 1982	2N4091X - Y
BS 2N4092X - Y to	BS CECC 50 012 - 002 Issue 2 dated Mar. 1982	2N4092X - Y
BS 2N4093X - Y to	BS CECC 50 012 - 002 Issue 2 dated Mar. 1982	2N4093X - Y

TEST CONDITIONS AND INSPECTION REQUIREMENTS

GROUP A LOT-BY-LOT

ND = NON-DESTRUCTIVE TESTS (See 3.5.6 of BS CECC 50 000)

AQL = given in %

EXAMINATION OR TEST	D or ND	REF. BS CECC 50 000	CONDITIONS $T_{amb} = 25^{\circ}\text{C}$ unless otherwise stated	INSPECTION REQUIREMENTS								
				LIMITS			LEVELS					
				Min.	Max.	Unit	E		F		I	
							LL	AQL	LL	AQL	LL	AQL
<u>SUBGROUP A1</u>												
Visual inspection	ND	4.2.1					I	0.65	I	0.65	I	0.65
<u>SUBGROUP A2a</u>												
Leakage current with source open-circuited $-I_{GDO(1)}$	ND	4.3.4 T.071	$-V_{GD} = 20\text{ V}$ $I_S = 0$ All types		2.0	nA	II	0.15	II	0.15	II	0.15
Drain cut-off current $I_{DSX(1)}$	ND	4.3.4 T.073	$V_{DS} = 20\text{ V}$ $-V_{GS} = 12\text{ V}$ 2N4091 $V_{DS} = 20\text{ V}$ $-V_{GS} = 8\text{ V}$ 2N4092 $V_{DS} = 20\text{ V}$ $-V_{GS} = 6\text{ V}$ 2N4093		2.0 2.0 2.0	nA nA nA						
<u>SUBGROUP A2b</u>												
Leakage current with source open-circuited $-I_{GDO(1)}$	ND	4.3.4 T.071	$-V_{GD} = 20\text{ V}$ $I_S = 0$ All types		200	pA	II	0.4	II	1.0	II	1.0
Gate-source cut-off voltage $-V_{GSoff}$	ND	4.3.4 T.074	$V_{DS} = 20\text{ V}$ $I_D = 1\text{ nA}$ 2N4091 2N4092 2N4032	5 2 1	10 7 5	V V V						
Drain current I_{DSS}^*	ND	4.3.4 T.072	$V_{DS} = 20\text{ V}$ $V_{GS} = 0$ 2N4091 2N4092 2N4093	30 15 8	250 150 100	mA mA mA						
Drain cut-off current $I_{DSX(1)}$	ND	4.3.4 T.073	$V_{DS} = 20\text{ V}$ $-V_{GS} = 12\text{ V}$ 2N4091 $V_{DS} = 20\text{ V}$ $-V_{GS} = 8\text{ V}$ 2N4092 $V_{DS} = 20\text{ V}$ $-V_{GS} = 6\text{ V}$ 2N4093		200 200 200	pA pA pA						
Drain-source saturation voltage V_{DSSat} ($V_{DS(ON)}$)	ND	4.3.4 T.085 IEC 147-2G Clause 15	$V_{GS} = 0$ $I_D = 6.6\text{ mA}$ 2N4091 $V_{GS} = 0$ $I_D = 4.0\text{ mA}$ 2N4092 $V_{GS} = 0$ $I_D = 2.5\text{ mA}$ 2N4093		0.2 0.2 0.2	V V V						
Drain source on-state resistance $r_{DS(ON)}$	ND	4.3.4 T.082	$V_{GS} = 0$ $I_D = 1\text{ mA}$ 2N4091 2N4092 2N4093 $V_{GS} = 0$ $-I_D = 1\text{ mA}$ 2N4091 2N4092 2N4093		30 50 80 30 50 80	Ω Ω Ω Ω Ω Ω						

*Pulse test required, pulse width = 300 μs , duty cycle = 3%