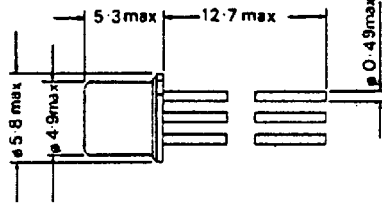
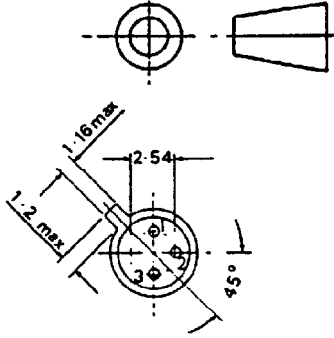


BRITISH STANDARDS INSTITUTION 2 PARK STREET, LONDON W1A 2BS	BS CECC 50 012-006
Specification available from:- as shown in PD 9002, CECC 00200 and SILICONIX LIMITED MORRISTON, SWANSEA (UK), SA6 6NE TELEPHONE 0792 74681 TELEX 48197	ISSUE 2 MAR 1982  Page 1 of 16 pages
ELECTRONIC COMPONENTS OF ASSESSED QUALITY DETAIL SPECIFICATION IN ACCORDANCE WITH BS CECC 50 000: 1980	MANUFACTURER'S TYPE NUMBER 2N4856A 2N4857A 2N4858A 2N4859A 2N4860A 2N4861A
Outline and dimensions All dimensions in millimetres  For detail dimensions see:- IEC 191-2 B11 and C7 Marking information see clause 6	Third angle projection  Terminal connections 1. Source 2. Drain 3. Gate (connected to case) For ordering information see clause 7 SINGLE GATE FIELD EFFECT TRANSISTOR SILICON N-CHANNEL JUNCTION-GATE TYPE FOR SWITCHING AND CHOPPER APPLICATIONS AMBIENT RATED METAL CASE LEVELS OF QUALITY ASSESSMENT E - F - L

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	-65	150	$^{\circ}\text{C}$
4.2	T_{stg}	Storage temperature range	-65	200	$^{\circ}\text{C}$
4.3	V_{DS}	Drain-source voltage ($T_{amb} = 25^{\circ}\text{C}$)		40	V
		2N4856A, 2N4857A, 2N4858A 2N4859A, 2N4860A, 2N4861A		30	V
4.4	$-V_{GSR}$	Gate-source reverse voltage ($V_{DS} = 0$)		40	V
		2N4856A, 2N4857A, 2N4858A 2N4859A, 2N4860A, 2N4861A		30	V
4.5	$-V_{GDO}$	Gate-drain voltage with source open-circuited		40	V
		2N4856A, 2N4857A, 2N4858A 2N4859A, 2N4860A, 2N4861A		30	V
4.6	I_{GF}	Forward gate current		50	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 ($T_{case} = 25^{\circ}\text{C}$) Lead temperature 1.5 mm from case for 10 s.		1.8	W
				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
$-I_{GSS(1)}$	Maximum leakage current with drain short-circuited to source †					
	$-V_{GS} = 20\text{ V}$	$V_{DS} = 0$	2N4856A		250	pA
			2N4857A		250	pA
			2N4858A		250	pA
	$-V_{GS} = 15\text{ V}$	$V_{DS} = 0$	2N4859A		250	pA
			2N4860A		250	pA
			2N4861A		250	pA
$-I_{GSS(2)}$	Maximum leakage current with drain short-circuited to source †					
	$-V_{GS} = 20\text{ V}$	$V_{DS} = 0$	$T_{amb} = 150^{\circ}\text{C}$	2N4856A	500	nA
				2N4857A	500	nA
				2N4858A	500	nA
	$-V_{GS} = 15\text{ V}$	$V_{DS} = 0$	$T_{amb} = 150^{\circ}\text{C}$	2N4859A	500	nA
				2N4860A	500	nA
				2N4861A	500	nA
$-V_{GSoff}$	Minimum and maximum gate-source cut-off voltage †					
	$V_{DS} = 15\text{ V}$	$I_D = 0.5\text{ nA}$	2N4856A	4.0	10.0	V
			2N4857A	2.0	6.0	V
			2N4858A	0.8	4.0	V
			2N4859A	4.0	10.0	V
			2N4860A	2.0	6.0	V
			2N4861A	0.8	4.0	V
$I_{DSX(1)}$	Maximum drain cut-off current †					
	$-V_{GS} = 10\text{ V}$	$V_{DS} = 15\text{ V}$	All types		250	pA
$I_{DSX(2)}$	Maximum drain cut-off current †					
	$-V_{GS} = 10\text{ V}$	$V_{DS} = 15\text{ V}$	$T_{amb} = 150^{\circ}\text{C}$ All types		500	nA
I_{DSS}^*	Minimum and maximum drain current †					
	$V_{DS} = 15\text{ V}$	$V_{GS} = 0$	2N4856A	50	250	mA
			2N4857A	20	100	mA
			2N4858A	8	80	mA
			2N4859A	50	250	mA
			2N4860A	20	100	mA
			2N4861A	8	80	mA
V_{DSSat} ($V_{DS(ON)}$)	Maximum drain-source saturation voltage †					
	$V_{GS} = 0$	$I_D = 20\text{ mA}$	2N4856A		0.75	V
	$V_{GS} = 0$	$I_D = 10\text{ mA}$	2N4857A		0.50	V
	$V_{GS} = 0$	$I_D = 5\text{ mA}$	2N4858A		0.50	V
	$V_{GS} = 0$	$I_D = 20\text{ mA}$	2N4859A		0.75	V
	$V_{GS} = 0$	$I_D = 10\text{ mA}$	2N4860A		0.50	V
	$V_{GS} = 0$	$I_D = 5\text{ mA}$	2N4861A		0.50	V

* Pulse test required, pulse width = 100 μs , duty cycle = 10 %

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 † $V_{DS} = 0$ $-V_{GS} = 10\text{ V}$ $f = 1\text{ MHz}$ All types		10	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 † $V_{DS} = 0$ $-V_{GS} = 10\text{ V}$ $f = 1\text{ MHz}$		4.0	pF
	2N4856A		3.5	pF
	2N4857A		3.5	pF
	2N4858A		4.0	pF
	2N4859A		3.5	pF
	2N4860A		3.5	pF
	2N4861A			
$t_{d(on)}$	Turn-on delay time ***† $V_{DD} = 10\text{ V}$ $V_{GS(ON)} = 0$ $C_L = 0$ $-V_{GS(off)} = 10\text{ V}$ $R_L = 464\ \Omega$ 2N4856A $-V_{GS(off)} = 6\text{ V}$ $R_L = 953\ \Omega$ 2N4857A $-V_{GS(off)} = 4\text{ V}$ $R_L = 1910\ \Omega$ 2N4858A $-V_{GS(off)} = 10\text{ V}$ $R_L = 464\ \Omega$ 2N4859A $-V_{GS(off)} = 6\text{ V}$ $R_L = 953\ \Omega$ 2N4860A $-V_{GS(off)} = 4\text{ V}$ $R_L = 1910\ \Omega$ 2N4861A		5 6 8 5 6 8	ns ns ns ns ns ns
t_{off}	Turn-off time ***† $V_{DD} = 10\text{ V}$ $V_{GS(ON)} = 0$ $C_L = 0$ $-V_{GS(off)} = 10\text{ V}$ $R_L = 464\ \Omega$ 2N4856A $-V_{GS(off)} = 6\text{ V}$ $R_L = 953\ \Omega$ 2N4857A $-V_{GS(off)} = 4\text{ V}$ $R_L = 1910\ \Omega$ 2N4858A $-V_{GS(off)} = 10\text{ V}$ $R_L = 464\ \Omega$ 2N4859A $-V_{GS(off)} = 6\text{ V}$ $R_L = 953\ \Omega$ 2N4860A $-V_{GS(off)} = 4\text{ V}$ $R_L = 1910\ \Omega$ 2N4861A		20 40 80 20 40 80	ns ns ns ns ns ns
t_r	Rise time ***† $V_{DD} = 10\text{ V}$ $V_{GS(ON)} = 0$ $C_L = 0$ $-V_{GS(off)} = 10\text{ V}$ $R_L = 464\ \Omega$ 2N4856A $-V_{GS(off)} = 6\text{ V}$ $R_L = 953\ \Omega$ 2N4857A $-V_{GS(off)} = 4\text{ V}$ $R_L = 1910\ \Omega$ 2N4858A $-V_{GS(off)} = 10\text{ V}$ $R_L = 464\ \Omega$ 2N4859A $-V_{GS(off)} = 6\text{ V}$ $R_L = 953\ \Omega$ 2N4860A $-V_{GS(off)} = 4\text{ V}$ $R_L = 1910\ \Omega$ 2N4861A		3 4 8 3 4 8	ns ns ns ns ns ns
$r_{DS(ON)}$	Maximum drain-source on-state resistance † $-I_D = 1\text{ mA}$ $V_{GS} = 0$ $I_D = 1\text{ mA}$ $V_{GS} = 0$		25 40 60 25 40 60 25 40 60 25 40 60	Ω Ω Ω Ω Ω Ω Ω Ω Ω Ω Ω Ω

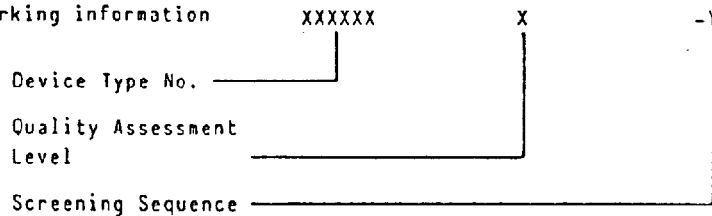
** For pulse waveforms see Appendix 2.

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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



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 of quality assessment as defined in Appendix II A of CECC 50 000, and, if required, screening sequence as defined in Appenx 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 2N4856AX - Y to	BS CECC 50 012 - 006 Issue 2 dated Mar. 1982	2N4856AX - Y
BS 2N4857AX - Y to	BS CECC 50 012 - 006 Issue 2 dated Mar. 1982	2N4857AX - Y
BS 2N4858AX - Y to	BS CECC 50 012 - 006 Issue 2 dated Mar. 1982	2N4848AX - Y
BS 2N4859AX - Y to	BS CECC 50 012 - 006 Issue 2 dated Mar. 1982	2N4859AX - Y
BS 2N4860AX - Y to	BS CECC 50 012 - 006 Issue 2 dated Mar. 1982	2N4860AX - Y
BS 2N4861AX - Y to	BS CECC 50 012 - 006 Issue 2 dated Mar. 1982	2N4861AX - 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	
							IL	AQL	IL	AQL	IL	AQL
SUBGROUP A1												
Visual inspection	ND	4.2.1					I	0.65	I	0.65	I	0.65
SUBGROUP A2a												
Leakage current with drain short-circuited to source $-I_{GSS}(1)$	ND	4.3.4 T.071	$-V_{GS} = 20\text{ V}$ $V_{DS} = 0$ 2N4856A 2N4857A 2N4858A $-V_{GS} = 15\text{ V}$ $V_{DS} = 0$ 2N4859A 2N4860A 2N4861A		2.5 2.5 2.5 2.5 2.5 2.5	nA nA nA nA nA nA	II	0.15	II	0.15	II	0.15
Gate-source cut-off voltage $-V_{GSoff}$	ND	4.3.4 T.074	$V_{DS} = 15\text{ V}$ $I_D = 0.5\text{ nA}$ 2N4856A 2N4857A 2N4858A 2N4859A 2N4860A 2N4861A	0.4 0.2 0.08 0.4 0.2 0.08	20.0 18.0 12.0 20.0 18.0 12.0	V V V V V V						
SUBGROUP A2b												
Leakage current with drain short-circuited to source $I_{GSS}(1)$	ND	4.3.4 T.071	$-V_{GS} = 20\text{ V}$ $V_{DS} = 0$ 2N4856A 2N4857A 2N4858A $-V_{GS} = 15\text{ V}$ $V_{DS} = 0$ 2N4859A 2N4860A 2N4861A		250 250 250 250 250 250	pA pA pA pA pA pA	II	0.4	II	1.0	II	1.0
Gate-source cut-off voltage $-V_{GSoff}$	ND	4.3.4 T.074	$V_{DS} = 15\text{ V}$ $I_D = 0.5\text{ nA}$ 2N4856A 2N4857A 2N4858A 2N4859A 2N4860A 2N4861A	4.0 2.0 0.8 4.0 2.0 0.8	10.0 6.0 4.0 10.0 6.0 4.0	V V V V V V						
Drain current I_{DSS}^*	ND	4.3.4 T.072	$V_{DS} = 15\text{ V}$ $V_{GS} = 0$ 2N4856A 2N4857A 2N4858A 2N4859A 2N4860A 2N4861A	50 20 8 50 20 8	250 100 80 250 100 80	mA mA mA mA mA mA						
Drain cut-off current $I_{DSX}(1)$	ND	4.3.4 T.073	$V_{DS} = 15\text{ V}$ $-V_{GS} = 10\text{ V}$ All types		250	pA						