

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

TELEPHONE 0792 74681

TELEX 48197

BS CECC 50 012-005

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

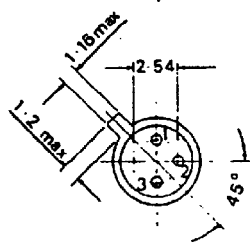
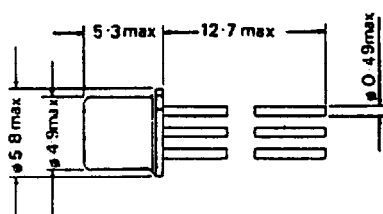
2N4856 2N4857 2N4858

2N4859 2N4860 2N4861

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

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	$^{\circ}C$
4.2	T_{stg} Storage temperature range	-65	200	$^{\circ}C$
4.3	V_{DS} Drain-source voltage ($T_{amb} = 25^{\circ}C$)			
		2N4856, 2N4857, 2N4858	40	V
		2N4859, 2N4860, 2N4861	30	V
4.4	$-V_{GSR}$ Gate-source reverse voltage ($V_{DS} = 0$)			
		2N4856, 2N4857, 2N4858	40	V
		2N4859, 2N4860, 2N4861	30	V
4.5	$-V_{GDO}$ Gate-drain reverse voltage with source open-circuited			
		2N4856, 2N4857, 2N4858	40	V
		2N4859, 2N4860, 2N4861	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 ($T_{amb} = 25^{\circ}C$) See Appendix I for derating curve		0.3	W
	P_{tot} Total power dissipation ($T_{case} = 25^{\circ}C$)		1.8	W
	Lead temperature 1.5 mm from case for 10 s.		300	$^{\circ}C$

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 †					
	$-V_{GS} = 20\text{ V}$	$V_{DS} = 0$	2N4856		250	pA
			2N4857		250	pA
			2N4858		250	pA
	$-V_{GS} = 15\text{ V}$	$V_{DS} = 0$	2N4859		250	pA
			2N4860		250	pA
2N4861				250	pA	
$-I_{GSS(2)}$	Maximum leakage current with drain short-circuited to source †					
	$-V_{GS} = 20\text{ V}$	$V_{DS} = 0$	$T_{amb} = 150^{\circ}\text{C}$ 2N4856		500	nA
			2N4857		500	nA
			2N4858		500	nA
	$-V_{GS} = 15\text{ V}$	$V_{DS} = 0$	$T_{amb} = 150^{\circ}\text{C}$ 2N4859		500	nA
			2N4860		500	nA
2N4861				500	nA	
$-V_{GSoff}$	Minimum and maximum gate-source cut-off voltage †					
	$V_{DS} = 15\text{ V}$	$I_D = 0.5\text{ nA}$	2N4856	4.0	10.0	V
			2N4857	2.0	6.0	V
			2N4858	0.8	4.0	V
			2N4859	4.0	10.0	V
			2N4860	2.0	6.0	V
2N4861			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 †					
	$V_{DS} = 15\text{ V}$	$V_{GS} = 0$	2N4856	50	250	mA
			2N4857	20	100	mA
			2N4858	8	80	mA
			2N4859	50	250	mA
			2N4860	20	100	mA
2N4861			8	80	mA	
V_{DSsat} ($V_{DS(ON)}$)	Maximum drain-source saturation voltage †					
	$V_{GS} = 0$	$I_D = 20\text{ mA}$	2N4856		0.75	V
		$I_D = 10\text{ mA}$	2N4857		0.50	V
		$I_D = 5\text{ mA}$	2N4858		0.50	V
		$I_D = 20\text{ mA}$	2N4859		0.75	V
		$I_D = 10\text{ mA}$	2N4860		0.50	V
$I_D = 5\text{ mA}$		2N4861		0.50	V	

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

5 CHARACTERISTICS

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

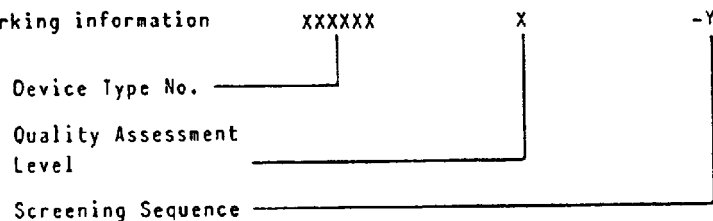
† = Characteristics verified under inspection requirements.

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		18	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 + $V_{DS} = 0$ $-V_{GS} = 10\text{ V}$ $f = 1\text{ MHz}$ All types		8	pF
$t_{d(on)}$	Turn-on delay time *** $V_{DD} = 10\text{ V}$ $V_{GS(ON)} = 0$ $C_L = 0$ $-V_{GSoff} = 10\text{ V}$ $R_L = 464\ \Omega$ 2N4856 $-V_{GSoff} = 6\text{ V}$ $R_L = 953\ \Omega$ 2N4857 $-V_{GSoff} = 4\text{ V}$ $R_L = 1910\ \Omega$ 2N4858 $-V_{GSoff} = 10\text{ V}$ $R_L = 464\ \Omega$ 2N4859 $-V_{GSoff} = 6\text{ V}$ $R_L = 953\ \Omega$ 2N4860 $-V_{GSoff} = 4\text{ V}$ $R_L = 1910\ \Omega$ 2N4861		6 6 10 6 6 10	ns ns ns ns ns ns
t_{off}	Turn-off time *** $V_{DD} = 10\text{ V}$ $V_{GS(ON)} = 0$ $C_L = 0$ $-V_{GSoff} = 10\text{ V}$ $R_L = 464\ \Omega$ 2N4856 $-V_{GSoff} = 6\text{ V}$ $R_L = 953\ \Omega$ 2N4857 $-V_{GSoff} = 4\text{ V}$ $R_L = 1910\ \Omega$ 2N4858 $-V_{GSoff} = 10\text{ V}$ $R_L = 464\ \Omega$ 2N4859 $-V_{GSoff} = 6\text{ V}$ $R_L = 953\ \Omega$ 2N4860 $-V_{GSoff} = 4\text{ V}$ $R_L = 1910\ \Omega$ 2N4861		25 50 100 25 50 100	ns ns ns ns ns ns
t_r	Rise time *** $V_{DD} = 10\text{ V}$ $V_{GS(ON)} = 0$ $C_L = 0$ $-V_{GSoff} = 10\text{ V}$ $R_L = 464\ \Omega$ 2N4856 $-V_{GSoff} = 6\text{ V}$ $R_L = 953\ \Omega$ 2N4857 $-V_{GSoff} = 4\text{ V}$ $R_L = 1910\ \Omega$ 2N4858 $-V_{GSoff} = 10\text{ V}$ $R_L = 464\ \Omega$ 2N4859 $-V_{GSoff} = 6\text{ V}$ $R_L = 953\ \Omega$ 2N4860 $-V_{GSoff} = 4\text{ V}$ $R_L = 1910\ \Omega$ 2N4861		3 4 10 3 4 10	ns ns ns ns ns ns
$r_{DS(ON)}$	Maximum drain-source on-state resistance + $-I_D = 1\text{ mA}$ $V_{GS} = 0$ 2N4856 2N4857 2N4858 2N4859 2N4860 2N4861 $I_D = 1\text{ mA}$ $V_{GS} = 0$ 2N4856 2N4857 2N4858 2N4859 2N4860 2N4861		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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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



KEY:

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

E
 F
 L

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

BLANK
 A
 B
 C
 D

No Screening
 Sequence A
 Sequence B
 Sequence C
 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 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 2N4856X - Y to	BS CECC 50 012 - 005 Issue 2 dated Mar. 1982	2N4856X - Y
BS 2N4857X - Y to	BS CECC 50 012 - 005 Issue 2 dated Mar. 1982	2N4857X - Y
BS 2N4858X - Y to	BS CECC 50 012 - 005 Issue 2 dated Mar. 1982	2N4858X - Y
BS 2N4859X - Y to	BS CECC 50 012 - 005 Issue 2 dated Mar. 1982	2N4859X - Y
BS 2N4860X - Y to	BS CECC 50 012 - 005 Issue 2 dated Mar. 1982	2N4860X - Y
BS 2N4861X - Y to	BS CECC 50 012 - 005 Issue 2 dated Mar. 1982	2N4861X - 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 examination	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	$-V_{GS} = 20\text{ V}$ $V_{DS} = 0$ 2N4856 2N4857 2N4858 $-V_{GS} = 15\text{ V}$ $V_{DS} = 0$ 2N4859 2N4860 2N4861		2.5 2.5 2.5 2.5 2.5 2.5	nA nA nA nA nA nA	I	0.15	II	0.15	II	0.15
Gate-source cut-off voltage $-V_{GSoff}$	ND	4.3.4 T.074	$V_{DS} = 15\text{ V}$ $I_D = 0.5\text{ nA}$ 2N4856 2N4857 2N4858 2N4859 2N4860 2N4861	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	$-V_{GS} = 20\text{ V}$ $V_{DS} = 0$ 2N4856 2N4857 2N4858 $-V_{GS} = 15\text{ V}$ $V_{DS} = 0$ 2N4859 2N4860 2N4861		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	$V_{DS} = 15\text{ V}$ $I_D = 0.5\text{ nA}$ 2N4856 2N4857 2N4858 2N4859 2N4860 2N4861	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	$V_{DS} = 15\text{ V}$ $V_{GS} = 0$ 2N4856 2N4857 2N4858 2N4859 2N4860 2N4861	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						