

# CEN7002E

60V ▲ 2Ω ▲ 0.2A ▲ Si MOSFET

SILICON Si MOSFET ▲ SMD type  
N-channel enhancement mode  
UL94V-0 rated flame retardant epoxy  
SOT23T package ▲ MSL 3  
Rugged and reliable  
ESD diode between Gate and Source ▲ Protected up to 2kV

## MAXIMUM RATINGS

Parameter (T <sub>A</sub> = 25°C, unless otherwise noted)		Characteristics
Drain-Source Voltage	V <sub>DS</sub>	60V
Gate-Source Voltage	V <sub>GS</sub>	±20V
Continuous Drain Current at T <sub>A</sub> = 25°C	I <sub>D</sub>	0.2A
Pulsed Drain Current <sup>Note 1</sup>	I <sub>DM</sub>	0.8A
Maximum Power Dissipation	P <sub>D</sub>	0.2W
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55°C to +150°C

## THERMAL CHARACTERISTICS

Parameter	Symbol	Limit
Thermal Resistance, Junction-to-Ambient <sup>Note 2</sup>	R <sub>TH_JA</sub>	600°C/W

## APPLICATIONS

Battery Operated Systems	Display Drivers	Logic Level Interface TTL/CMOS	Solid-State Relays	Transistor Drivers

## PIN DESCRIPTION

Circuit Diagram	Outline - Top View	Pin No.	Description
		1 2 3	Drain Source Gate

## ELECTRICAL CHARACTERISTICS ▲ $T_A = 25^\circ\text{C}$ , unless otherwise noted

Item	Condition	Symbol	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	$BV_{DSS}$	60			V
Zero Gate Voltage Drain Current	$V_{DS} = 60V, V_{GS} = 0V$	$I_{DSS}$			1	$\mu A$
Gate Body Leakage Current, Forward	$V_{GS} = 20V, V_{DS} = 0V$	$I_{GSSF}$			100	nA
Gate Body Leakage Current, Reverse	$V_{GS} = -20V, V_{DS} = 0V$	$I_{GSSR}$			-100	nA
<b>On Characteristics</b> <sup>Note 3</sup>						
Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu A$	$V_{GS(th)}$	1		2.5	V
Static Drain-Source On-Resistance	$V_{GS} = 10V, I_D = 0.2A$	$R_{DS(ON)}$		2	3	$\Omega$
Static Drain-Source On-Resistance	$V_{GS} = 4.5V, I_D = 0.2A$	$R_{DS(ON)}$		2	4	$\Omega$
<b>Dynamic Characteristics</b> <sup>Note 4</sup>						
Input Capacitance	$V_{DS} = 30V, V_{GS} = 0V, f = 1MHz$	$C_{ISS}$		42		pF
Output Capacitance	$V_{DS} = 30V, V_{GS} = 0V, f = 1MHz$	$C_{OSS}$		15		pF
Reverse Transfer Capacitance	$V_{DS} = 30V, V_{GS} = 0V, f = 1MHz$	$C_{RSS}$		3		pF
<b>Switching Characteristics</b> <sup>Note 4</sup>						
Turn-On Delay Time	$V_{DD} = 30V, V_{GS} = 10V, I_D = 0.2A, R_{G(ext)} = 6\Omega$	$t_{D(ON)}$		4.63		ns
Turn-On Rise Time	$V_{DD} = 30V, V_{GS} = 10V, I_D = 0.2A, R_{G(ext)} = 6\Omega$	$t_R$		18.9		ns
Turn-Off Delay Time	$V_{DD} = 30V, V_{GS} = 10V, I_D = 0.2A, R_{G(ext)} = 6\Omega$	$t_{D(OFF)}$		6.8		ns
Turn-Off Fall Time	$V_{DD} = 30V, V_{GS} = 10V, I_D = 0.2A, R_{G(ext)} = 6\Omega$	$t_F$		11.4		ns
Total Gate Charge	$V_{DS} = 25V, V_{GS} = 10V, I_D = 0.2A$	$Q_G$		7.03		nC
Gate Source Charge	$V_{DS} = 25V, V_{GS} = 10V, I_D = 0.2A$	$Q_{GS}$		1.84		nC
Gate Drain Charge	$V_{DS} = 25V, V_{GS} = 10V, I_D = 0.2A$	$Q_{GD}$		0.65		nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
Drain-Source Diode Forward Current <sup>Note 2</sup>		$I_S$			0.15	A
Drain-Source Diode Forward Voltage <sup>Note 3</sup>	$V_{GS} = 0V, I_S = 0.2A$	$V_{SD}$			1.3	V

### Notes

- 1: Repetitive Rating: Pulse width limited by maximum junction temperature
- 2: Surface Mounted on FR4 Board,  $t \leq 10$  sec
- 3: Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
- 4: Guaranteed by design, not subject to production testing.

## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 1 • Output Characteristics

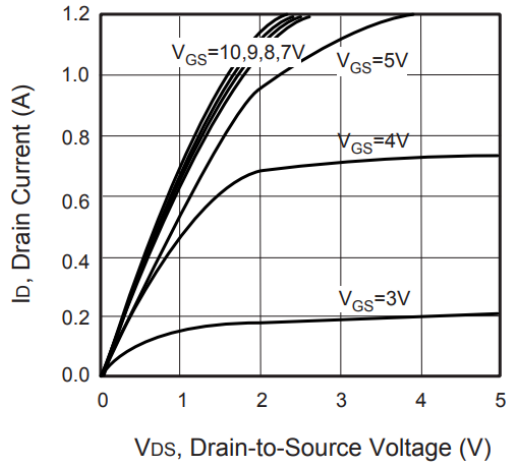


Fig. 2 • Transfer Characteristics

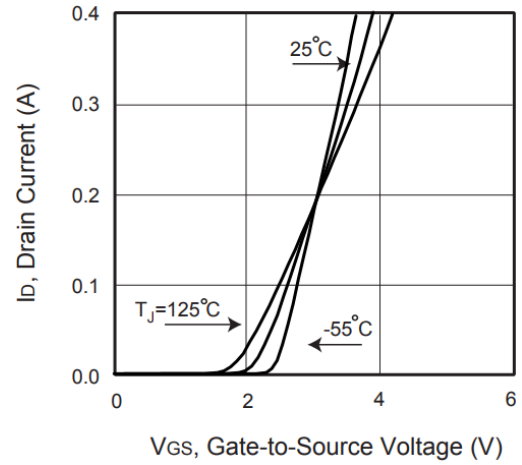


Fig. 3 • Capacitance

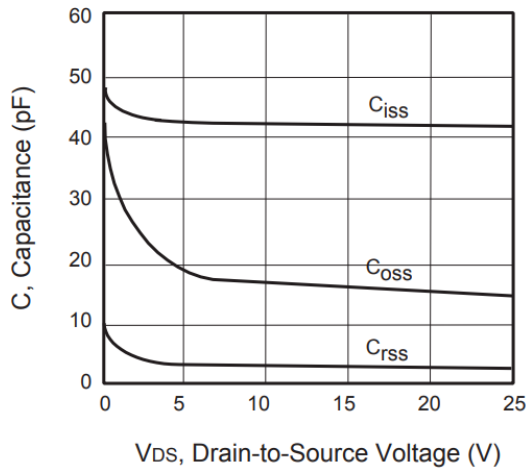


Fig. 4 • On-Resistance Variation with Temperature

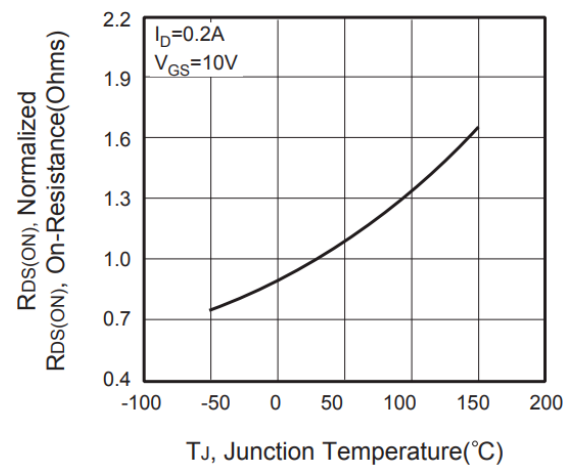


Fig. 5 • Gate Threshold Variation with Temperature

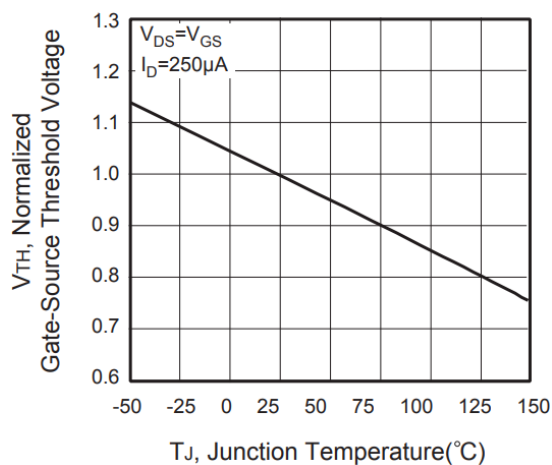
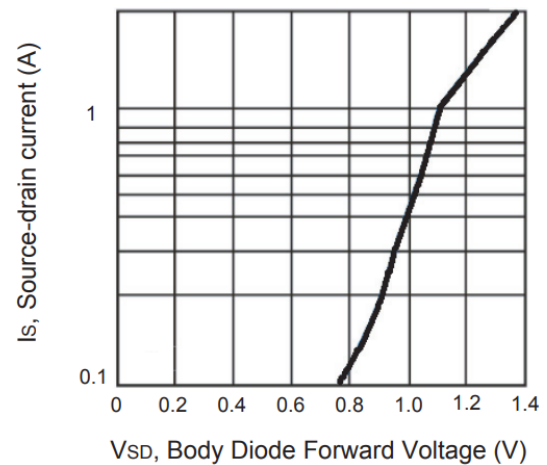


Fig. 6 • Body Diode Forward Voltage Variation with Source Current



## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 7 • Gate Charge

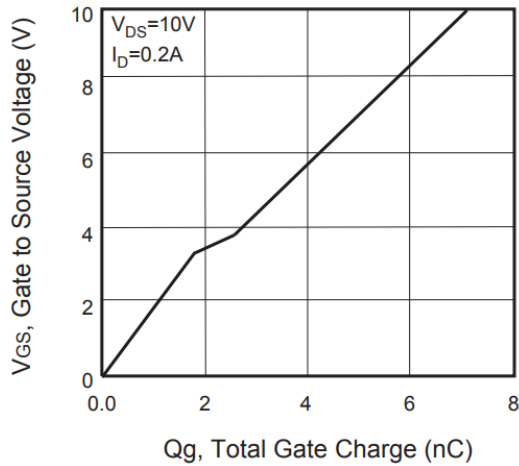


Fig. 8 • Maximum Safe Operating Area

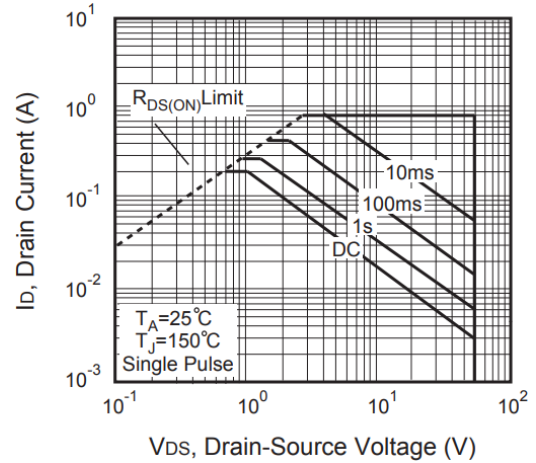


Fig. 9 • Breakdown Voltage Variation vs. Temperature

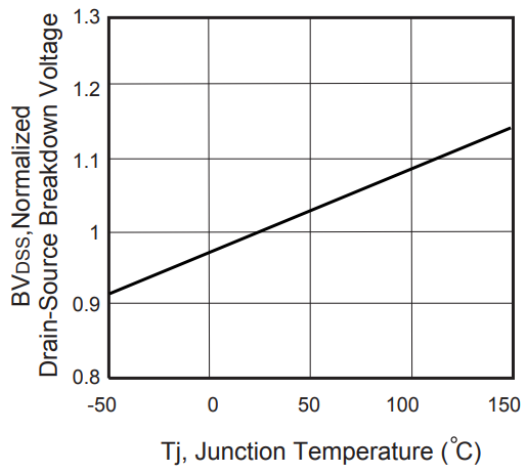
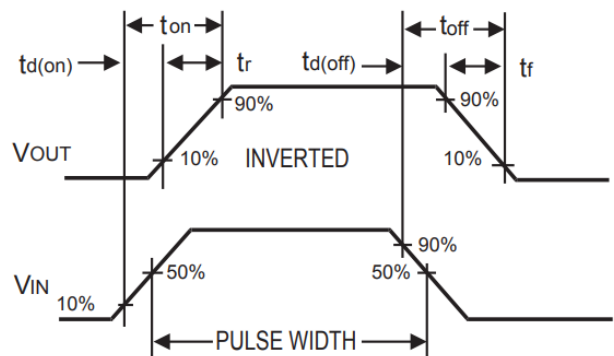


Fig. 10 • Switching Test Circuit

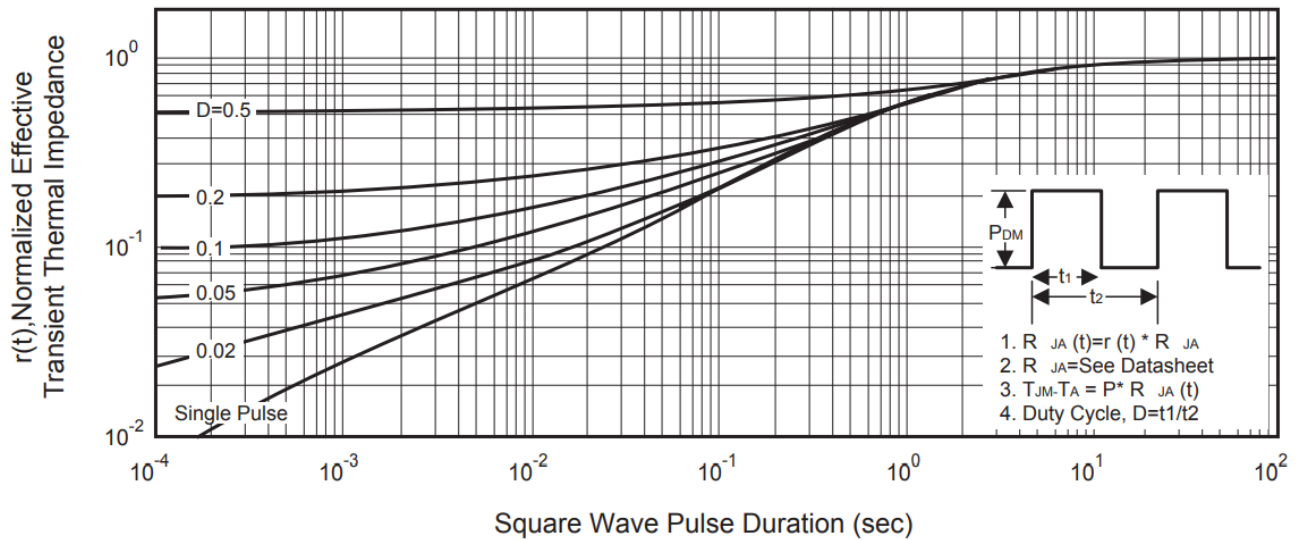


Fig. 11 • Switching Waveforms

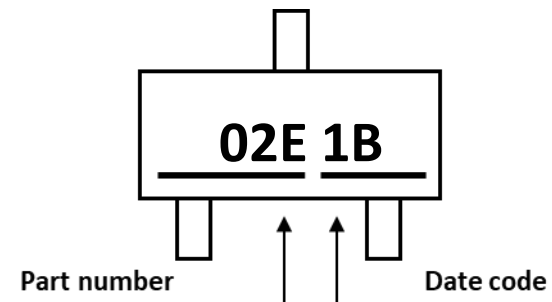


## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 12 • Normalized Thermal Transient Impedance Curve

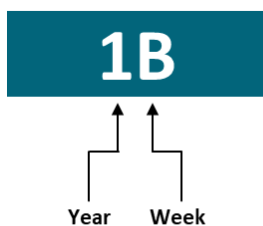


## PART MARKING



## DATE CODE

Example: 1B



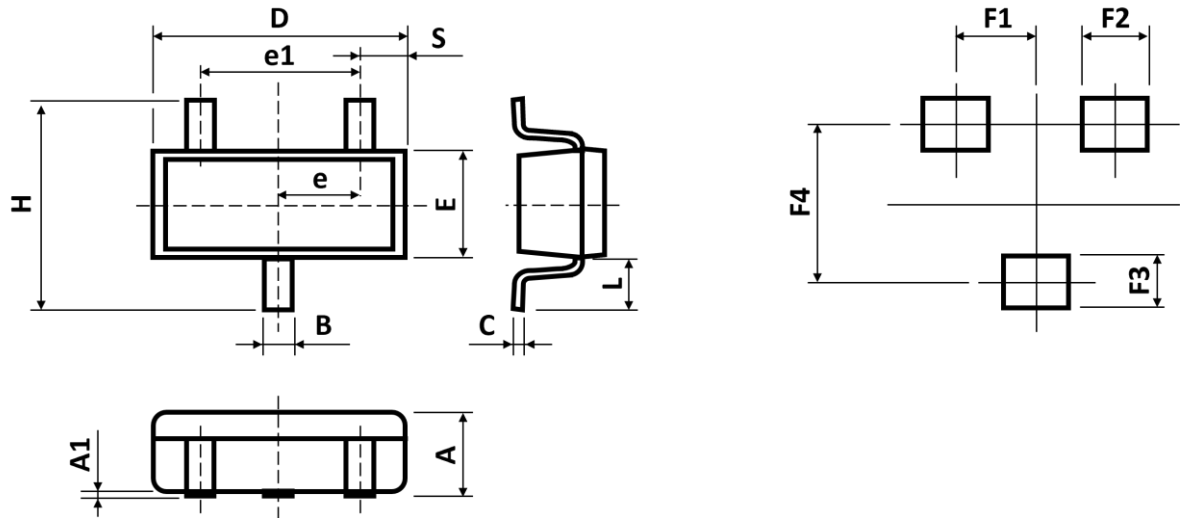
Coding list for „Week“

A	B	C	D	E	F	G	H	I
1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18
J	K	L	M	N	O	P	Q	R
19-20	21-22	23-24	25-26	27-28	29-30	31-32	33-34	35-36
S	T	U	V	W	X	Y	Z	
37-38	39-40	41-42	43-44	45-46	47-48	49-50	51-52	

Coding list for „Year“

0	1	2	3	4
2020	2021	2022	2023	2024
5	6	7	8	9
2025	2026	2027	2028	2029

## PACKAGE OUTLINE AND RECOMMENDED PAD LAYOUT



Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
A	0.950	-	1.100
A1	0.000	-	0.100
B	0.370	-	0.430
C	0.085	-	0.200
D	2.850	-	2.950
E	1.250	-	1.350

Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
e	0.900	-	1.000
e1	1.850	-	1.950
H	2.350	-	2.450
L	0.500	-	0.600
S	0.410	-	0.610

Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
F1	-	0.950	-
F2	-	0.760	-

Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
F3	-	0.760	-
F4	-	2.290	-

Notes: 1. The suggested land pattern dimensions have been provided for reference only.  
2. For further information, please reference document IPC-7351A.

## ORDERING INFORMATION

Part Number	Package	Packing	Reel Qty.	Inner Box Qty.
CEN7002E	SOT23T	7" Reel	3,000pcs	15,000pcs

## REEL DIMENSIONS ▲ All dimensions in mm



Tape Size	Reel Size	M	N	T	H	K	S
8mm	Ø180	Ø178.00 ±1.00	Ø54.00 ±0.50	1.20 ±0.20	20.00 ±1.00	13.30 ±0.30	3.00 ±1.00

## TAPE DIMENSIONS ▲ All dimensions in mm



Package	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
SOT23T	3.25 ±0.10	2.80 ±0.10	1.22 ±0.10	1.00 ±0.10	1.50 ±0.10	8.00 ±0.10	1.75 ±0.10	3.50 ±0.10	4.00 ±0.10	4.00 ±0.10	2.00 ±0.05	0.20 ±0.02

**Note:** All dimensions meet EIA-481-D requirements.

## RECOMMENDED REFLOW SOLDERING PROFILE



### Recommended reflow soldering conditions ▲ Refer to JEDEC J-STD-020E

Profile Features		Sn-Pb Eutetic Assembly	Pb-Free Assembly
Preheat temperature min.	T <sub>s min</sub>	100 °C	150 °C
Preheat temperature max.	T <sub>s max</sub>	150 °C	200 °C
Preheat time t <sub>s</sub> from T <sub>s min</sub> to T <sub>s max</sub>	t <sub>s</sub>	120 seconds	120 seconds
Ramp-up rate (T <sub>L</sub> to T <sub>p</sub> )		max. 3 °C/second	max. 3 °C/second
Liquidous temperature	T <sub>L</sub>	183 °C	217 °C
Time t <sub>L</sub> maintained above T <sub>L</sub>	t <sub>L</sub>	150 seconds max.	150 seconds max.
Peak package body temperature	T <sub>p</sub>	235°C	260°C
Timeframe of within 5°C below and up to max actual peak body temperature	t <sub>p</sub>	20 seconds max.	30 seconds max.
Ramp-down rate (T <sub>L</sub> to T <sub>p</sub> )		max. 6 °C/second	max. 6 °C/second
Time 25°C to peak temperature		max. 6 minutes	max. 8 minutes



## REVISION TABLE

Revision	Date	Status	Notes
001	30/09/2022	Initial release	Initial publication

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