



# CEW20N65SA

650V ▲ 150mΩ ▲ 20A ▲ Si MOSFET

SILICON Si MOSFET ▲ THT type

N-channel enhancement mode

UL94V-0 rated flame retardant epoxy

TO247-3L package

Super high dense cell density for extremely low  $R_{DS(ON)}$

**High power and current handling capability**



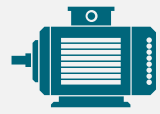




## MAXIMUM RATINGS

Parameter ( $T_C = 25^\circ\text{C}$ , unless otherwise noted)		Characteristics
Drain-Source Voltage	$V_{DS}$	650V
Gate-Source Voltage	$V_{GS}$	$\pm 30\text{V}$
Continuous Drain Current at $T_C = 25^\circ\text{C}$	$I_D$	20A
Continuous Drain Current at $T_C = 100^\circ\text{C}$	$I_D$	13A
Pulsed Drain Current <sup>Note 1</sup>	$I_{DM}$	80A
Maximum Power Dissipation at $T_C = 25^\circ\text{C}$	$P_D$	205W
Power Dissipation Derating above $25^\circ\text{C}$	$\Delta P_D$	$1.64\text{W}/^\circ\text{C}$
Single Pulsed Avalanche Energy <sup>Note 4</sup>	$E_{AS}$	607.5mJ
Single Pulsed Avalanche Current <sup>Note 4</sup>	$I_{AS}$	4.5A
Operating and Storage Temperature Range	$T_J, T_{STG}$	$-55^\circ\text{C}$ to $+150^\circ\text{C}$

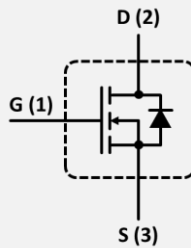
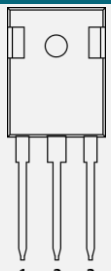
## THERMAL CHARACTERISTICS

Parameter	Symbol	Limit
Thermal Resistance, Junction-to-Case	$R_{TH\_JC}$	$0.61^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient	$R_{TH\_JA}$	$62.5^\circ\text{C}/\text{W}$

## APPLICATIONS

EV Charging	Industrial Inverters	Motors & Drives	Power Factor Correction	Renewable Energy	SMPS	UPS
						

## PIN DESCRIPTION

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

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

Item	Condition	Symbol	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	$BV_{DSS}$	650			V
Zero Gate Voltage Drain Current	$V_{DS} = 650V, V_{GS} = 0V$	$I_{DSS}$			1	$\mu A$
Gate Body Leakage Current, Forward	$V_{GS} = 30V, V_{DS} = 0V$	$I_{GSSF}$			100	nA
Gate Body Leakage Current, Reverse	$V_{GS} = -30V, V_{DS} = 0V$	$I_{GSSR}$			-100	nA
<b>On Characteristics</b> <sup>Note 2</sup>						
Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu A$	$V_{GS(th)}$	2		4	V
Static Drain-Source On-Resistance	$V_{GS} = 10V, I_D = 20A$	$R_{DS(ON)}$		150	180	m $\Omega$
Gate Input Resistance	$f = 1\text{MHz}$ , Open Drain	$R_G$		4.7		$\Omega$
<b>Dynamic Characteristics</b> <sup>Note 3</sup>						
Input Capacitance	$V_{DS} = 150V, V_{GS} = 0V, f = 1\text{MHz}$	$C_{ISS}$		1570		pF
Output Capacitance	$V_{DS} = 150V, V_{GS} = 0V, f = 1\text{MHz}$	$C_{OSS}$		95		pF
Reverse Transfer Capacitance	$V_{DS} = 150V, V_{GS} = 0V, f = 1\text{MHz}$	$C_{RSS}$		15		pF
<b>Switching Characteristics</b> <sup>Note 3</sup>						
Turn-On Delay Time	$V_{DD} = 520V, V_{GS} = 10V, I_D = 10A, R_{G(ext)} = 6\Omega$	$t_{D(ON)}$		29		ns
Turn-On Rise Time	$V_{DD} = 520V, V_{GS} = 10V, I_D = 10A, R_{G(ext)} = 6\Omega$	$t_R$		10		ns
Turn-Off Delay Time	$V_{DD} = 520V, V_{GS} = 10V, I_D = 10A, R_{G(ext)} = 6\Omega$	$t_{D(OFF)}$		76		ns
Turn-Off Fall Time	$V_{DD} = 520V, V_{GS} = 10V, I_D = 10A, R_{G(ext)} = 6\Omega$	$t_F$		8		ns
Total Gate Charge	$V_{DS} = 520V, V_{GS} = 10V, I_D = 10A$	$Q_G$		42		nC
Gate Source Charge	$V_{DS} = 520V, V_{GS} = 10V, I_D = 10A$	$Q_{GS}$		7		nC
Gate Drain Charge	$V_{DS} = 520V, V_{GS} = 10V, I_D = 10A$	$Q_{GD}$		15		nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
Drain-Source Diode Forward Current		$I_S$			20	A
Drain-Source Diode Forward Voltage <sup>Note 2</sup>	$V_{GS} = 0V, I_S = 20A$	$V_{SD}$			1.5	V
Reverse Recovery Time	$I_D = 20A, di_F/dt = 100A/\mu s$	$t_{RR}$		257		ns
Reverse Recovery Charge	$I_D = 20A, di_F/dt = 100A/\mu s$	$Q_{RR}$		3.04		$\mu C$
Peak Reverse Recovery Current	$I_D = 20A, di_F/dt = 100A/\mu s$	$I_{RR}$		22		A
Max. Diode Commutation Speed	$V_{DS} = 0...400V, I_{SD} \leq 20A, T_J = 25^\circ C$	$di_F/dt$			1100	A/ $\mu s$
Reverse Diode dv/dt Ruggedness, $V_{DS} = 0...480V, I_{SD} < I_D$	$I_{DR} = 10A, V_{GS} = 0V, V_{DD} = 400V$	$dv/dt$			50	V/ns
MOSFET dv/dt Ruggedness, $V_{DS} = 0...480V$	$I_{DR} = 10A, V_{GS} = 0V, V_{DD} = 400V$	$dv/dt$			160	V/ns

### Notes

- 1: Repetitive Rating: Pulse width limited by maximum junction temperature**
- 2: Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .**
- 3: Guaranteed by design, not subject to production testing.**
- 4:  $L = 60mH, I_{AS} = 4.5A, V_{DD} = 50V, R_G = 25\Omega$ , Starting  $T_J = 25^\circ C$**

## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 1 • Output Characteristics

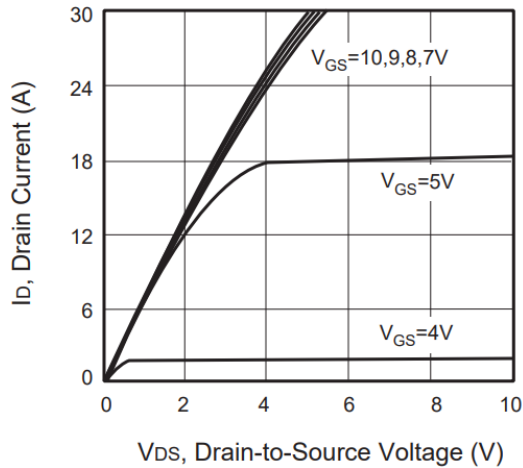


Fig. 2 • Transfer Characteristics

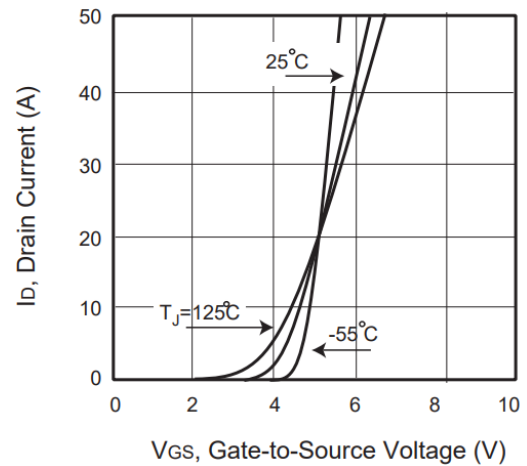


Fig. 3 • Capacitance

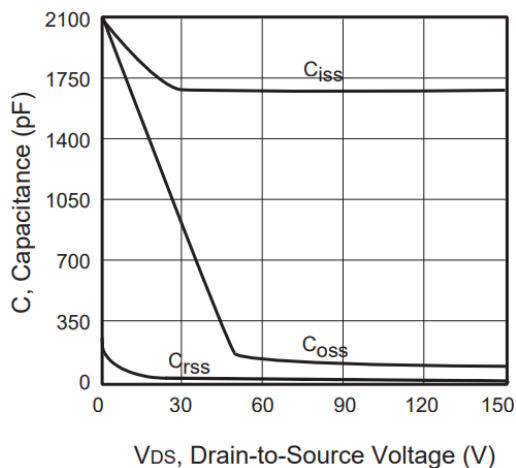


Fig. 4 • On-Resistance Variation with Temperature

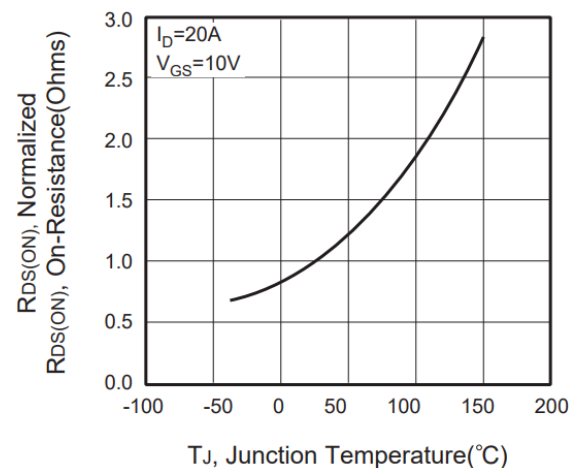


Fig. 5 • Gate Threshold Variation with Temperature

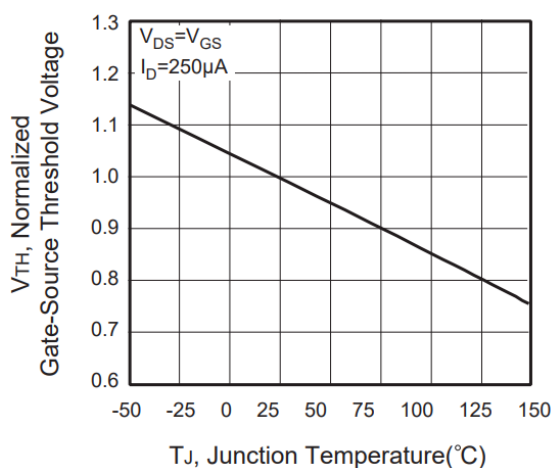
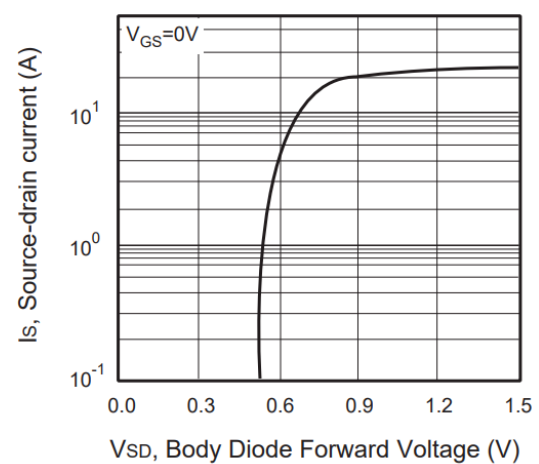


Fig. 6 • Body Diode Forward Voltage Variation with Source Current



## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 7 • Gate Charge

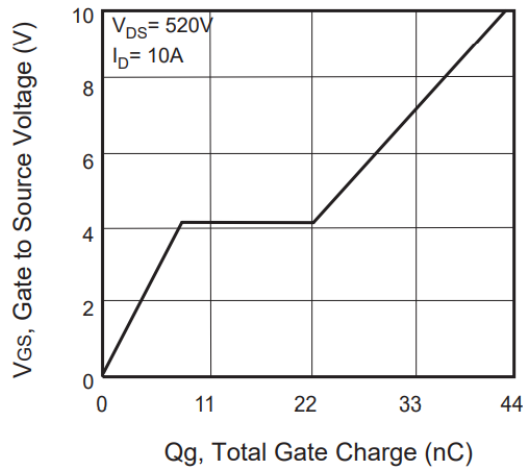


Fig. 8 • Maximum Safe Operating Area

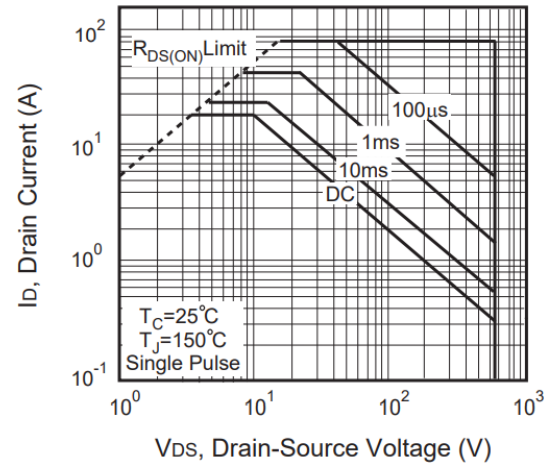


Fig. 9 • Breakdown Voltage Variation vs. Temperature

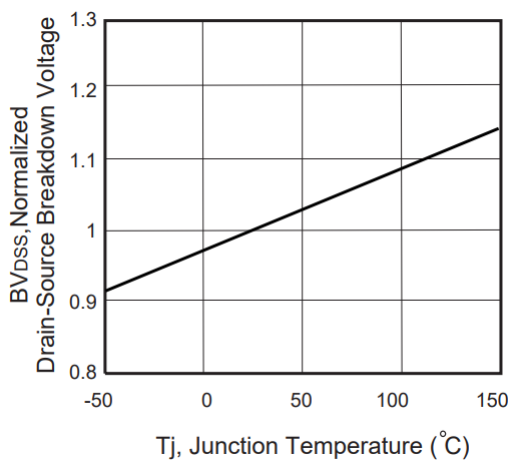


Fig. 10 • Switching Test Circuit

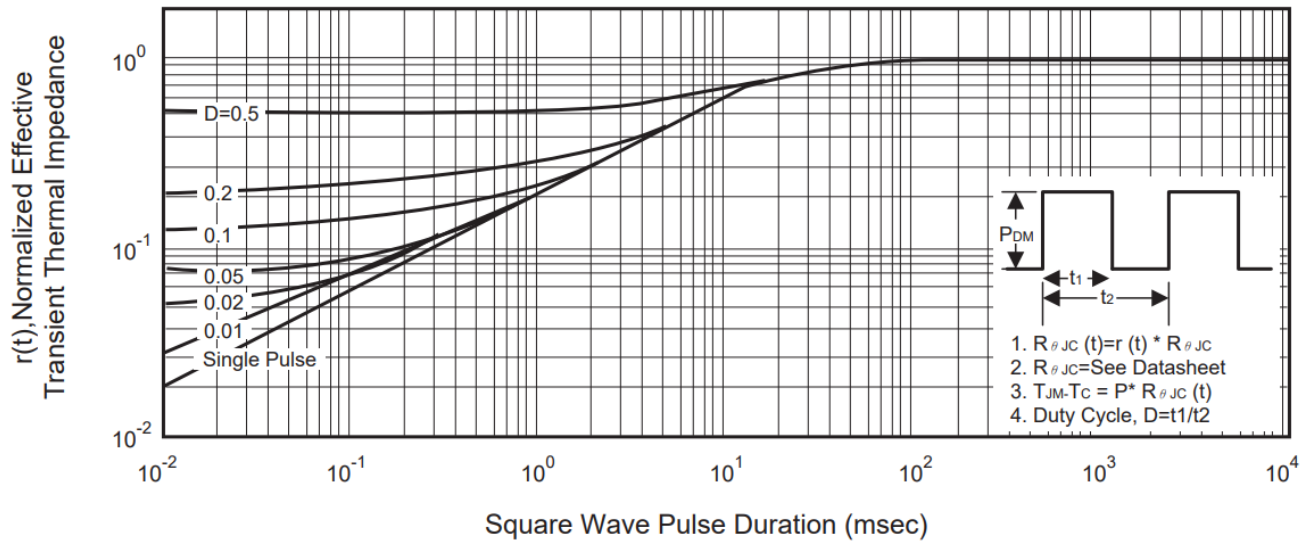


Fig. 11 • Switching Waveforms

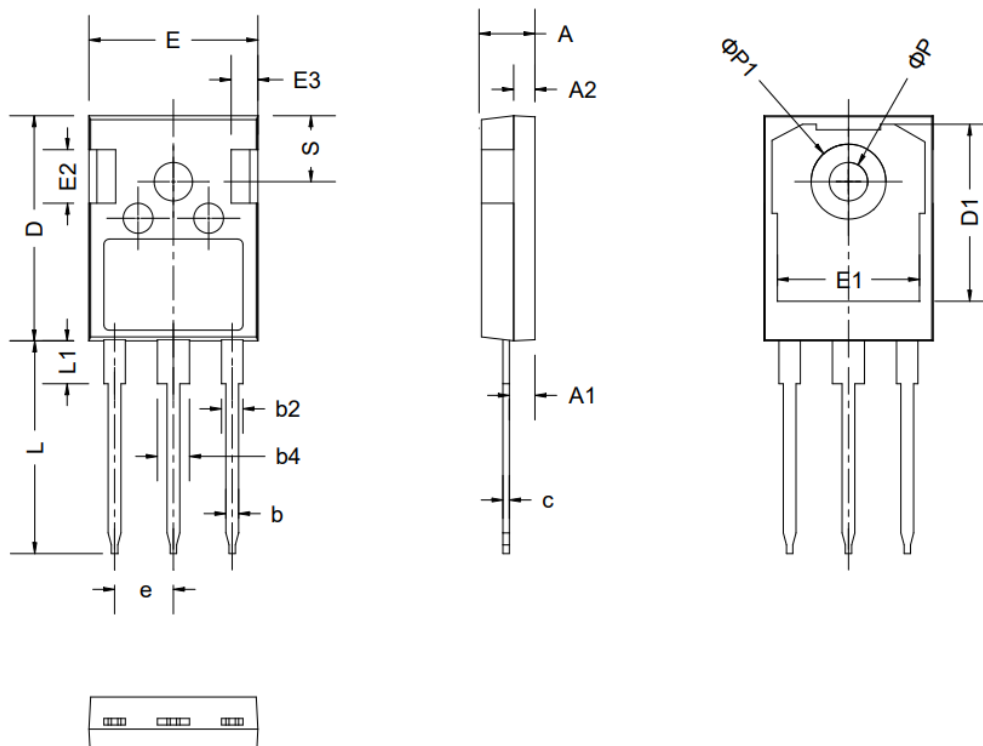


## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 12 • Normalized Thermal Transient Impedance Curve



## PACKAGE OUTLINE



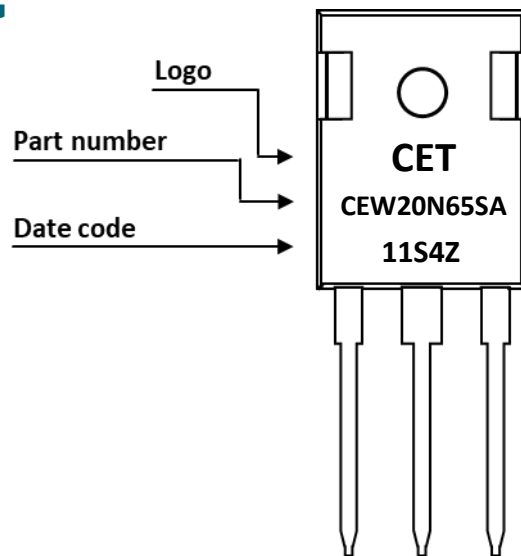
Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
A	4.80	5.00	5.20
A1	2.21	2.41	2.59
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.80	21.00	21.30
D1	16.25	16.55	16.85
E	15.50	15.80	16.10

Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.44 BSC		
L	19.62	19.92	20.22
L1	-	-	4.30
ØP	3.40	3.60	3.80
ØP1	-	-	7.30
S	6.16 BSC		

## ORDERING INFORMATION

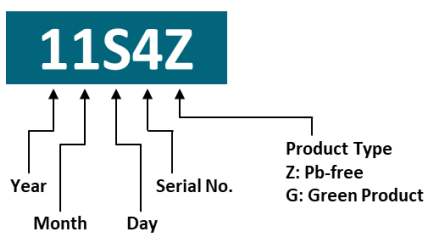
Part Number	Package	Packing	Tube Qty.	Inner Box Qty.	Outer Box Qty.
CEW20N65SA	TO-247-3L	Tube	30pcs	450pcs	1,800pcs

## PART MARKING



## DATE CODE

Example: 11S4Z



Coding list for „Day“

1	2	3	4	5	6	7	8	9	A
01	02	03	04	05	06	07	08	09	10
B	C	D	E	F	G	H	I	J	K
11	12	13	14	15	16	17	18	19	20
L	M	N	O	P	Q	R	S	T	U
21	22	23	24	25	26	27	28	29	30
V									
31									

Coding list for „Month“

1	2	3	4	5	6
Jan	Feb	Mar	Apr	May	Jun
7	8	9	A	B	C
Jul	Aug	Sep	Oct	Nov	Dec

Coding list for „Year“

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

## RECOMMENDED WAVE SOLDERING PROFILE ▲ THT PACKAGE



### Classification wave soldering profile ▲ Refer to EN 61760-1: 2006

Profile Features		Value ▲ Sn-Pb Assembly	Value ▲ Pb-free Assembly
Preheat temperature min.	$T_{s\ min}$	100 °C	100 °C
Preheat temperature typical	$T_{s\ typ}$	120 °C	120 °C
Preheat temperature max.	$T_{s\ max}$	130 °C	130 °C
Preheat time $t_s$ from $T_{s\ min}$ to $T_{s\ max}$	$t_s$	70 seconds	70 seconds
Peak temperature	$T_p$	235 °C to 260 °C	245 °C to 260 °C
Time of actual peak temperature	$t_p$	Max. 10 seconds Max. 5 second each wave	Max. 10 seconds Max. 5 second each wave
Ramp-down rate min.		~ 2 °C/second	~ 2 °C/second
Ramp-down rate typical		~ 3.5 °C/second	~ 3.5 °C/second
Ramp-down rate max.		~ 5 °C/second	~ 5 °C/second
Time 25°C to 25°C		4 minutes	4 minutes



## REVISION TABLE

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

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