

## CEF38N65SA

650V ▲ 80mΩ ▲ 39A<sup>Note 4</sup> ▲ Si MOSFET

SILICON Si MOSFET ▲ THT type

N-channel enhancement mode

UL94V-0 rated flame retardant epoxy

TO220F-3L package ▲ Electrical insulated mounting tab

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 $T_C = 25^\circ\text{C}$	$I_D$	39A <sup>Note 4</sup>
Continuous Drain Current at $T_C = 100^\circ\text{C}$	$I_D$	24.5A <sup>Note 4</sup>
Pulsed Drain Current <sup>Note 1</sup>	$I_{DM}$ <sup>Note 5</sup>	155.2A <sup>Note 4</sup>
Maximum Power Dissipation at $T_C = 25^\circ\text{C}$	$P_D$	89W
Power Dissipation Derating above $25^\circ\text{C}$	$\Delta P_D$	$0.7\text{W}/^\circ\text{C}$
Single Pulsed Avalanche Energy <sup>Note 6</sup>	$E_{AS}$	735mJ
Single Pulsed Avalanche Current <sup>Note 6</sup>	$I_{AS}$	7A
Operating and Storage Temperature Range	$T_J, T_{STG}$	$-55^\circ\text{C}$ to $+150^\circ\text{C}$

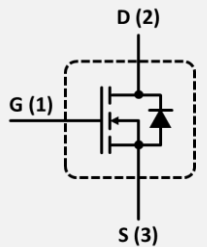
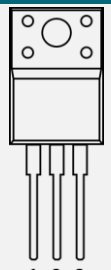
### THERMAL CHARACTERISTICS

Parameter	Symbol	Limit
Thermal Resistance, Junction-to-Case	$R_{TH\_JC}$	$1.4^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient	$R_{TH\_JA}$	$65^\circ\text{C}/\text{W}$

### 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	$V_{GS} = V_{DS}, I_D = 250\mu A$	$V_{GS(th)}$	2.5		4.5	V
Static Drain-Source On-Resistance	$V_{GS} = 10V, I_D = 20A$	$R_{DS(ON)}$		80	95	m $\Omega$
<b>Dynamic Characteristics</b> <sup>Note 3</sup>						
Input Capacitance	$V_{DS} = 150V, V_{GS} = 0V, f = 1MHz$	$C_{ISS}$		1915		pF
Output Capacitance	$V_{DS} = 150V, V_{GS} = 0V, f = 1MHz$	$C_{OSS}$		110		pF
Reverse Transfer Capacitance	$V_{DS} = 150V, V_{GS} = 0V, f = 1MHz$	$C_{RSS}$		5		pF
<b>Switching Characteristics</b> <sup>Note 3</sup>						
Turn-On Delay Time	$V_{DD} = 520V, V_{GS} = 10V, I_D = 20A, R_{G(ext)} = 6\Omega$	$t_{D(ON)}$		37		ns
Turn-On Rise Time	$V_{DD} = 520V, V_{GS} = 10V, I_D = 20A, R_{G(ext)} = 6\Omega$	$t_R$		17		ns
Turn-Off Delay Time	$V_{DD} = 520V, V_{GS} = 10V, I_D = 20A, R_{G(ext)} = 6\Omega$	$t_{D(OFF)}$		95		ns
Turn-Off Fall Time	$V_{DD} = 520V, V_{GS} = 10V, I_D = 20A, R_{G(ext)} = 6\Omega$	$t_F$		9		ns
Total Gate Charge	$V_{DS} = 520V, V_{GS} = 10V, I_D = 20A$	$Q_G$		69		nC
Gate Source Charge	$V_{DS} = 520V, V_{GS} = 10V, I_D = 20A$	$Q_{GS}$		12		nC
Gate Drain Charge	$V_{DS} = 520V, V_{GS} = 10V, I_D = 20A$	$Q_{GD}$		30		nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
Drain-Source Diode Forward Current		$I_S$			19	A
Drain-Source Diode Forward Voltage	$V_{GS} = 0V, I_S = 19A$	$V_{SD}$			1.5	V
Reverse Recovery Time	$V_R = 25V, I_F = 10A, di_F/dt = 100A/\mu s$	$t_{RR}$		324		ns
Reverse Recovery Charge	$V_R = 25V, I_F = 10A, di_F/dt = 100A/\mu s$	$Q_{RR}$		4.2		$\mu C$
Maximum Diode Commutation Speed	$V_{DS} = 0...400V, I_{SD} \leq 20A, T_J = 25^\circ C$	$di_F/dt$			1300	A/ $\mu s$

### 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: Limited only by maximum temperature allowed.
- 5: Pulse width limited by safe operating area.
- 6:  $L = 30mH, I_{AS} = 7A, V_{DD} = 60V, R_G = 25\Omega$ , Starting  $T_J = 25^\circ C$

## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 1 • Output Characteristics

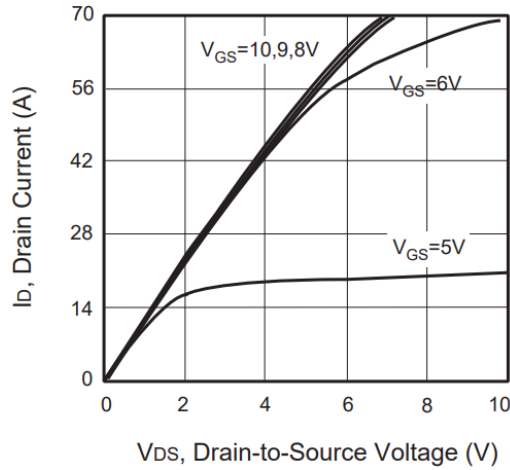


Fig. 2 • Transfer Characteristics

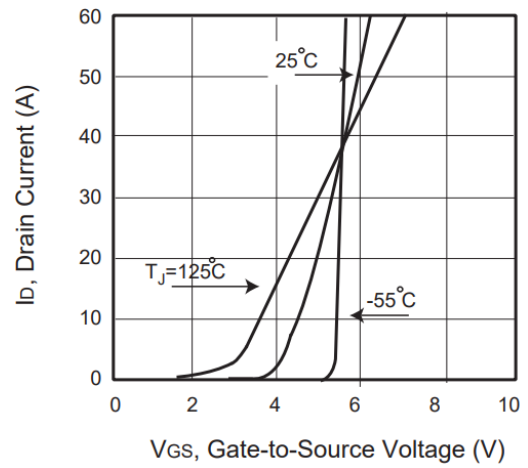


Fig. 3 • Capacitance

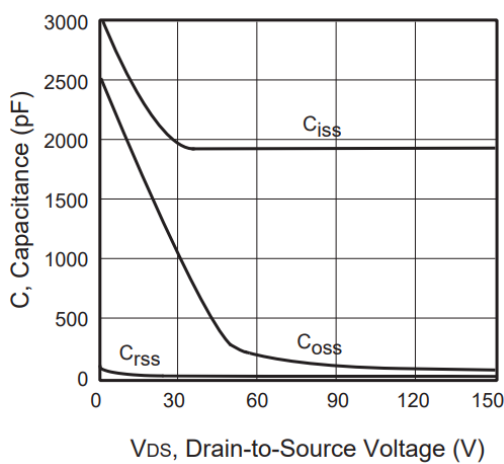


Fig. 4 • On-Resistance Variation with Temperature

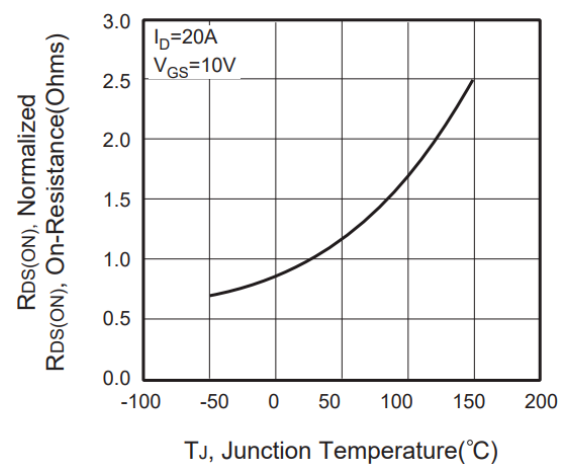


Fig. 5 • Gate Threshold Variation with Temperature

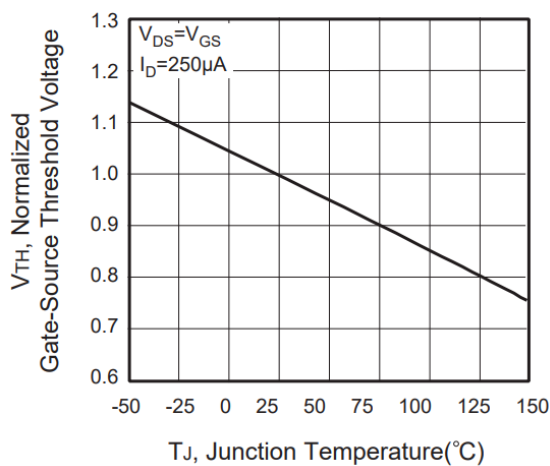
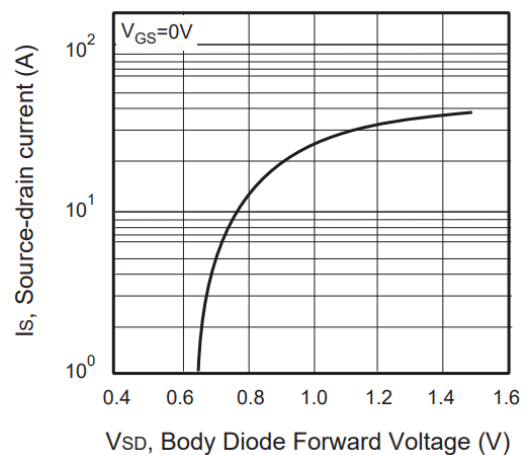


Fig. 6 • Body Diode Forward Voltage Variation with Source Current



## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 7 • Gate Charge

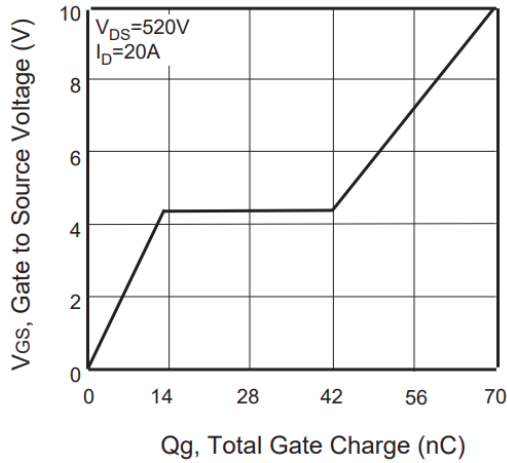


Fig. 8 • Maximum Safe Operating Area

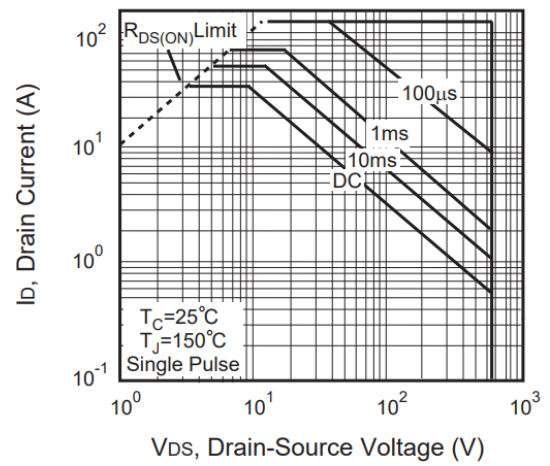


Fig. 9 • Breakdown Voltage Variation vs. Temperature

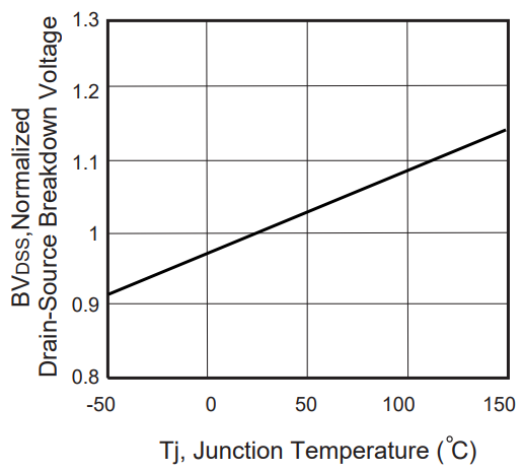


Fig. 10 • Switching Test Circuit

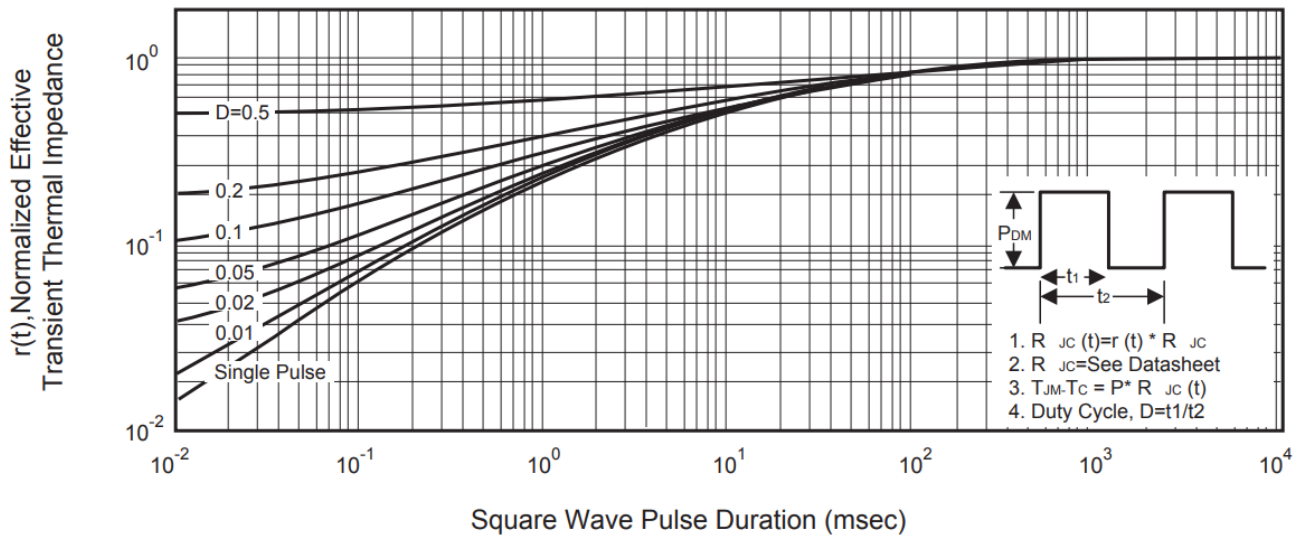


Fig. 11 • Switching Waveforms

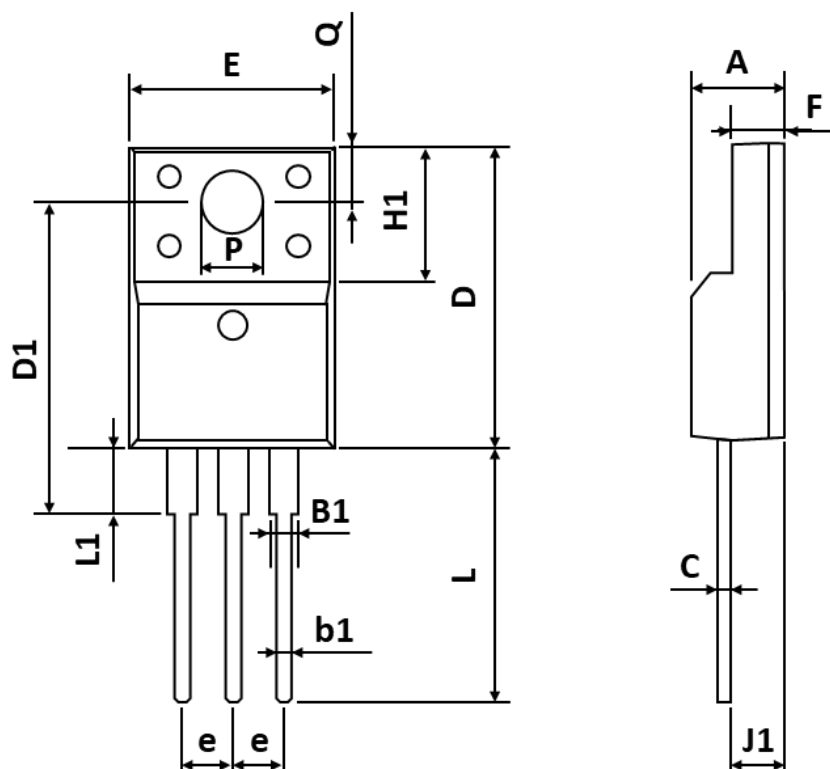


## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 12 ▪ Normalized Thermal Transient Impedance Curve



## PACKAGE OUTLINE

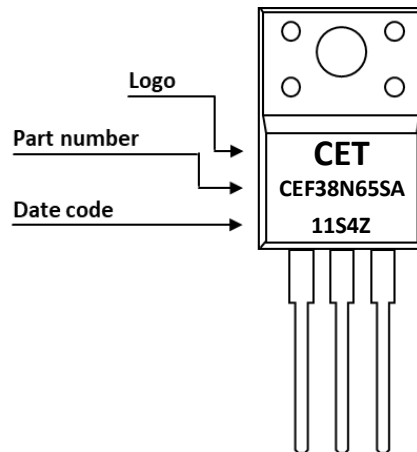


Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
A	4.500	-	5.000
B1	1.000	-	1.500
b1	0.700	-	0.950
C	0.420	-	0.700
D	15.670	-	16.070
D1	14.800	-	16.000
E	9.960	-	10.360
e	2.340	-	2.740
F	2.340	-	2.740
H1	6.480	-	6.900
J1	2.550	-	2.950
L	12.080	-	13.480
L1	2.230	-	3.650
Q	3.100	-	3.500
P	2.980	-	3.380

## ORDERING INFORMATION

Part Number	Package	Packing	Tube Qty.	Inner Box Qty.	Outer Box Qty.
CEF38N65SA	TO-220F-3L	Tube	50pcs	1,000pcs	4,000pcs

## 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

## DISCLAIMER

Except for the written expressed warranties, MGT does not implicitly, by assumption or whatever else, warrant, under-take, promise any other warranty or guaranty for any MGT product.

All information and technical specifications made available by MGT are for guidance only and we reserve the right to change or modify them without prior notice. Unless expressly stated in writing by MGT, we reject any guarantees, obligations, or warranties.

All MGT products with the technical specifications described are suitable for use in certain applications. Operating, production, storage and environmental conditions can have a massive influence on the parameters mentioned in the data sheets, which cause the performance to vary over time.

It is subject to the user's duty of care to design and validate his products in such a way that appropriate measures are taken, such as protective circuits or redundant systems to ensure the safety standards required in the application.

MGT components are not designed or rated for use in life support, rescue, safety critical, military, or aerospace applications where failure or malfunction could result in property or environmental damage, serious injury or death. In the aforementioned cases, please contact us before using MGT products.

In principle, we reserve all rights and MGT's general terms and conditions apply. You can find them on our website [www.mgt.co.com](http://www.mgt.co.com).