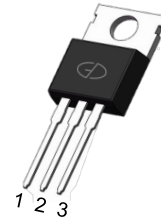


## 650mΩ,650V (D-S) Super Junction Power MOSFET

### Features

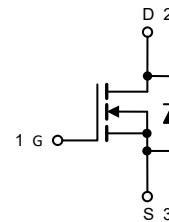
- 100% Avalanche Tested
- Extremely Low Losses with Low FOM  $R_{ds(on)} \cdot Q_g$
- Halogen Free, Pb-Free
- RoHS Compliant



TO-220AB

### Applications

- Solar inverter
- Telecom/Sever
- AC/DC power supply



### Absolute Maximum Ratings ( $T_J=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$V_{DS}$	650	V
Gate Source Voltage	$V_{GS}$	$\pm 30$	V
Drain Current, Continuous $V_{GS}=10\text{V}$	$I_D$	$T_C=25^\circ\text{C}$	8
		$T_C=100^\circ\text{C}$	4.5
Drain Current, Pulsed (Note 1)	$I_{DM}$	14	A
Single Avalanche Energy (Note 2)	$E_{AS}$	156	mJ
Power Dissipation	$P_D$	$T_C=25^\circ\text{C}$	62.5
		$T_C=100^\circ\text{C}$	25
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 ~ +150	$^\circ\text{C}$

Note 1: Single pulse;  $t_p \leq 1\mu\text{s}$ .

Note 2:  $V_{DD} = 50\text{V}$ ,  $I_D=2.5\text{A}$ ,  $V_{GS} = 10\text{V}$ ,  $L = 0.5\text{mH}$ ,  $R_G = 25\Omega$ , starting  $T_J = 25^\circ\text{C}$ .

### Thermal Characteristics

Parameter	Symbol	Max.	Unit
Thermal Resistance Junction-to-Case	$R_{\theta JC}$	2	$^\circ\text{C/W}$
Thermal Resistance Junction-to-Ambient (Note 3)	$R_{\theta JA}$	62	$^\circ\text{C/W}$

Note 3: Device mounted on 1 square inch FR4 PCB board, with 2oz single-sided copper, in a  $25^\circ\text{C}$  still air environment.

## Electrical Characteristics (T<sub>J</sub> =25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	650	--	--	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =650V, V <sub>GS</sub> =0V	--	--	1	uA
Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250uA	2.0	--	4.0	V
Gate Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±10V, V <sub>DS</sub> =0V	--	--	±100	nA
Drain-Source On-state Resistance (Note 4)	R <sub>DS(on)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =20A	--	0.56	0.65	Ω
Total Gate Charge	Q <sub>g</sub>	V <sub>GS(off)</sub> =0V, V <sub>GS(on)</sub> =10V, V <sub>DD</sub> =480V, I <sub>D</sub> =3.2A	--	12	--	nC
Gate- Source Charge	Q <sub>gs</sub>		--	1.6	--	
Gate- Drain Charge	Q <sub>gd</sub>		--	5	--	
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>GS</sub> =13V, V <sub>DD</sub> =400V, I <sub>D</sub> =3.2	--	5.3	--	ns
Turn-on Rise Time	t <sub>r</sub>		--	20.5	--	
Turn-off Delay Time	t <sub>d(off)</sub>		--	23	--	
Turn-off Fall Time	t <sub>f</sub>		--	24	--	
Gate Resistance	R <sub>g</sub>	V <sub>GS</sub> =0V, f=1MHz, open drain	--	2.3	--	Ω
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =50V, f=1MHz	--	430	--	pF
Output Capacitance	C <sub>oss</sub>		--	25	--	
Reverse Transfer Capacitance	C <sub>rss</sub>		--	1.8	--	

## Reverse Diode Characteristics (T<sub>J</sub> =25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Forward Current, Continuous	I <sub>SD</sub>	T <sub>C</sub> =25°C	--	--	8	A
Diode Forward Voltage (Note 4)	V <sub>SD</sub>	I <sub>F</sub> =3.2A, V <sub>GS</sub> =0V	--	--	1.2	V
Reverse Recovery Time	T <sub>rr</sub>	V <sub>R</sub> =400V, I <sub>F</sub> =3.2A, di/dt = 100 A/μs	--	171	--	ns
Reverse Recovery Charge	Q <sub>rr</sub>		--	1.12	--	uC

Note 4: Pulse test; pulse width ≤ 380μs, duty cycle ≤ 1%.

## Typical Characteristics Curves ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Fig.1 - Output Characteristics

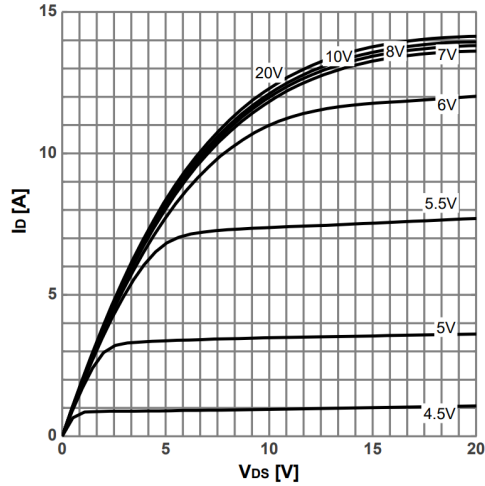


Fig.2 - Transfer Characteristics

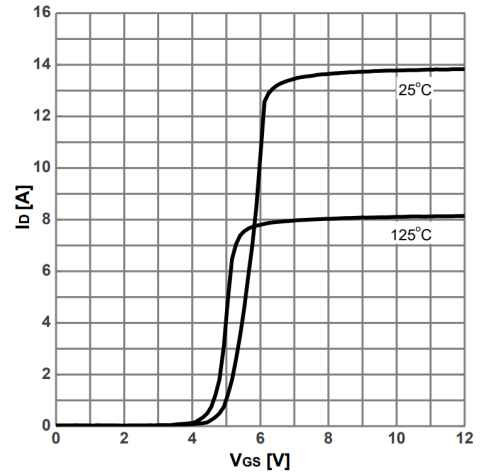


Fig.3 - Drain-Source On-Resistance

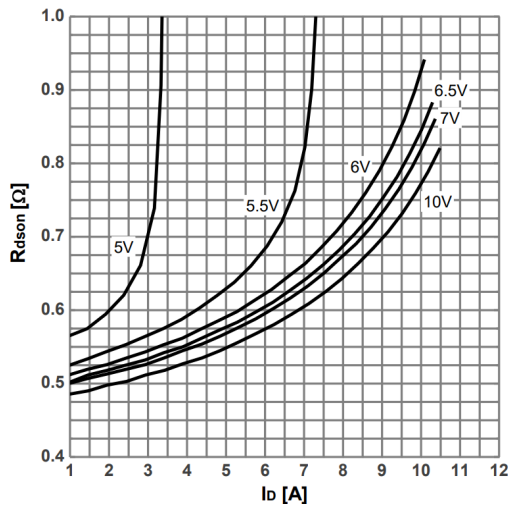


Fig.4 - Normalized On-Resistance

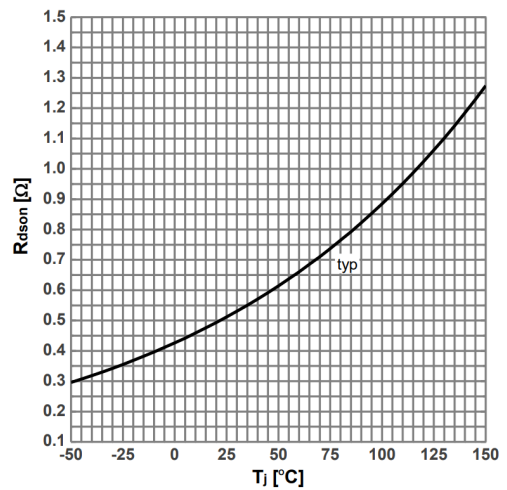


Fig.5 - Capacitance

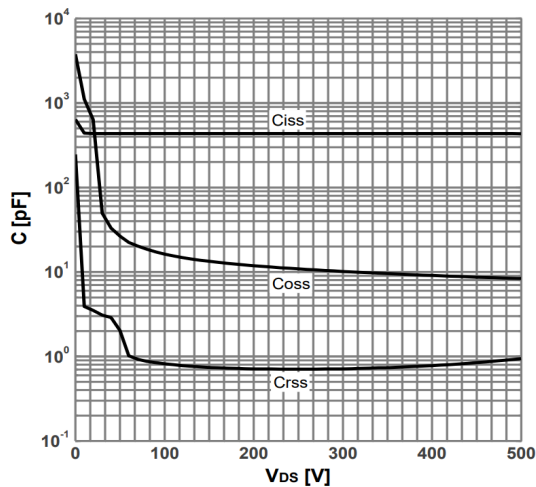
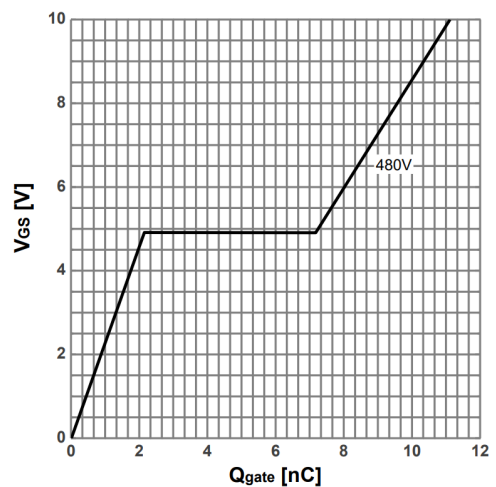


Fig.6 - Gate charge



## Typical Characteristics Curves ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Fig.7 - Forward Characteristic

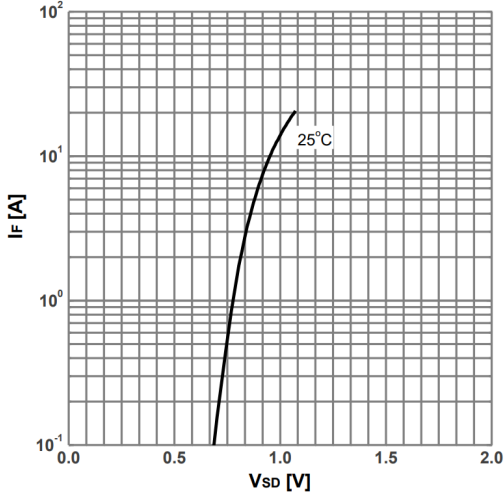


Fig.8 - Safe Operating Area

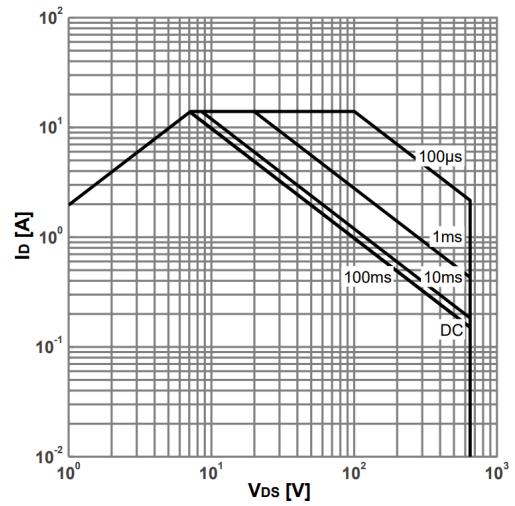


Fig.9 - Forward Characteristic

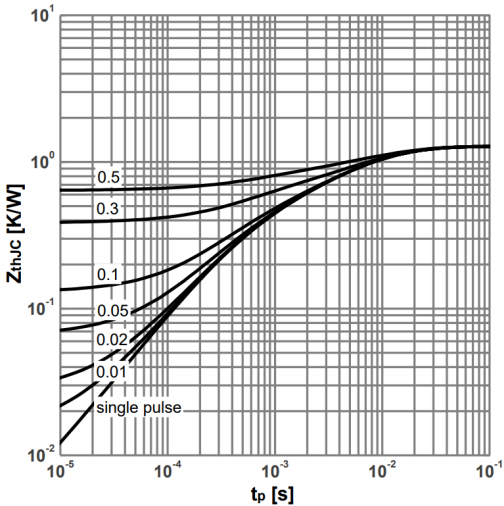


Fig.10 - Power Derating

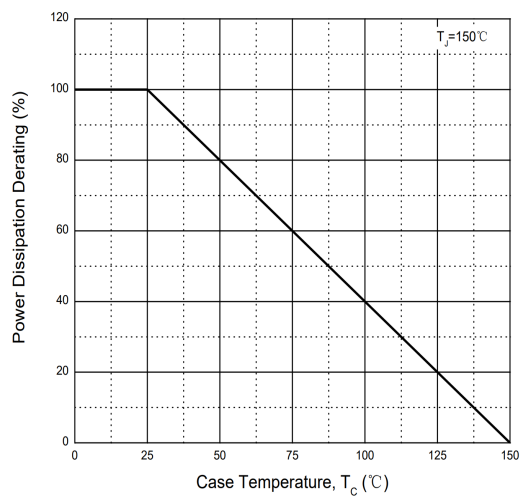
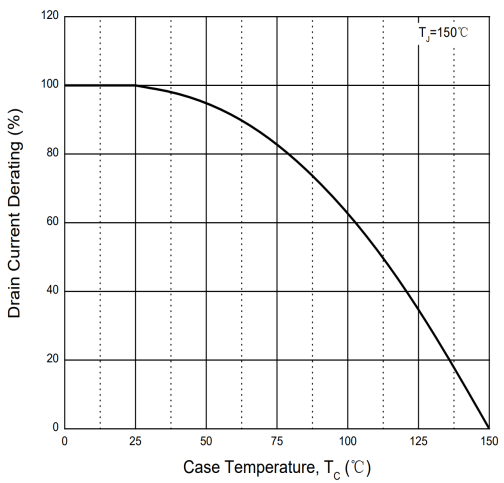
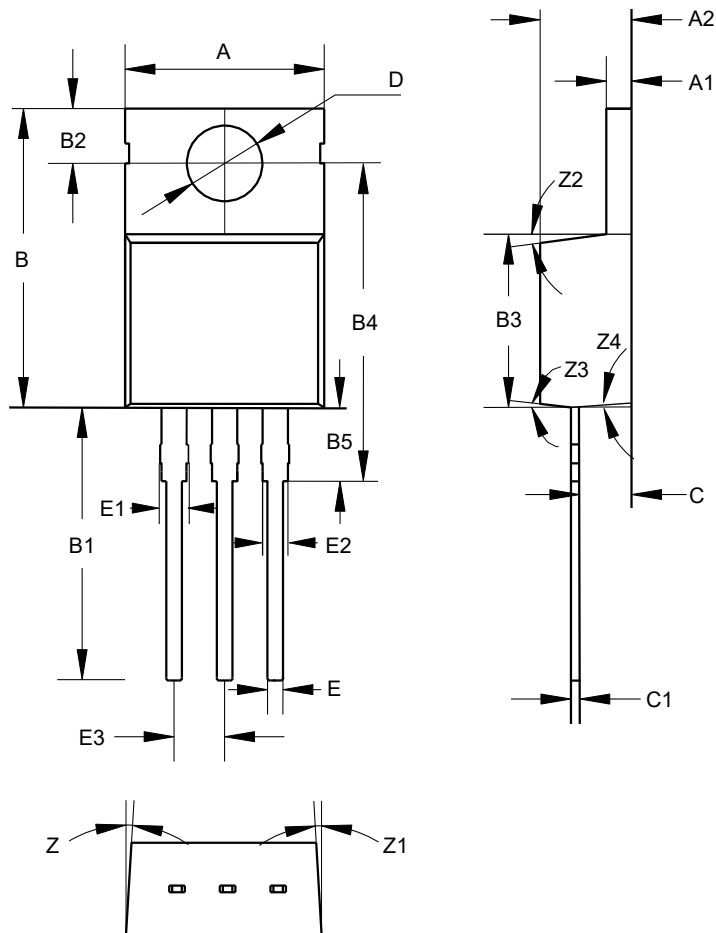


Fig.11 - Drain Current Derating



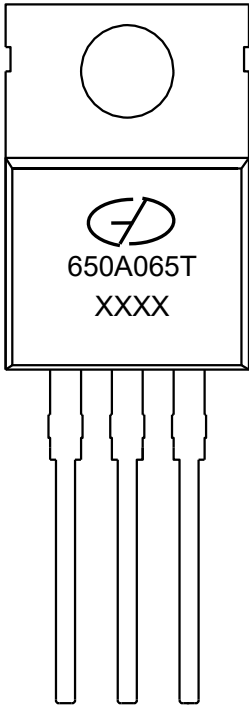
**Package Outline Dimensions** (Unit: millimeters)


**TO-220AB**



TO-220AB							
	Min.	Nom.	Max.		Min.	Nom.	Max.
A	9.8	10	10.2	D	3.7	3.8	3.9
A1	1.17	1.27	1.37	E	0.68	0.78	0.88
A2	4.5	4.6	4.7	E1	1.2	1.4	1.6
B	14.5	15	15.5	E2	1.17	1.27	1.37
B1	13.2	13.7	14.2	E3	2.44	2.54	2.64
B2	2.65	2.75	2.85	Z	-	3°	-
B3	8.5	8.7	8.9	Z1	-	3°	-
B4	15.5	16	16.5	Z2	-	7°	-
B5	3.4	3.7	4.0	Z3	-	7°	-
C	2.3	2.6	2.9	Z4	-	1.5°	-
C1	0.28	0.38	0.48	-	-	-	-

**Marking Outline**



Part Name: GMN650A065T
1. Logo Mark: 
2. P/N Mark: 650A065T
3. Date Code: XXXX

**Revision History**

Version	Date	Major Changes
Rev.A	2024.05.20	Official Release

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