



SMGQ120J65ADB

650V 120A Trench and Super Junction IGBT

Preliminary Data

Features:

- Low $V_{CE(sat)}$ Trench IGBT Technology
- Low Switching Loss
- Low Stray Inductance
- Maximum Junction Temperature 175°C
- Positive $V_{CE(sat)}$ Temperature Coefficient
- Lead Free, Compliant with RoHS Requirement

Applications:

- UPS
- Motor Driver

Absolute Maximum Rated Values ($T_J=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Description	Conditions	Values	Units
V_{CES}	Collector-Emitter Blocking Voltage		650	V
V_{GES}	Continuous Gate-Emitter Voltage		± 20	V
	Transient Gate-Emitter Voltage		± 30	V
I_C	Continuous Collector Current	$T_C=100^{\circ}\text{C}$	120	A
		$T_C=25^{\circ}\text{C}$	140	A
I_{CM}	Pulse Collector Current		480	A
I_F	Continuous Forward Current	$T_C=100^{\circ}\text{C}$	120	A
		$T_C=25^{\circ}\text{C}$	140	A
I_{FM}	Pulse Forward Current		480	A
t_{sc}	Short Circuit Withstand Time	$V_{GE}=15\text{V}, V_{CE}\leq 400\text{V}, T_C=150^{\circ}\text{C}$	5	μs
P_D	Maximum Power Dissipation	$T_C=25^{\circ}\text{C}$	400	W
T_J	Maximum Junction Temperature		-40~175	$^{\circ}\text{C}$



T _{JOP}	Maximum Operating Junction Temperature Range	-40~175	°C
	Soldering Temperature, for 10 sec.	260 (0.063 in. (1.6mm) from case)	°C

Electrical Characteristics of IGBT (T_J=25°C unless otherwise specified)

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
V _{(BR)CES}	Collector-to-Emitter Breakdown Voltage	V _{GE} =0V, I _C =250μA	650			V
V _{GE(th)}	Gate-Emitter Threshold Voltage	I _C =250μA, V _{CE} =V _{GE}	4.0	4.7	6.0	V
V _{CE(sat)}	Collector-Emitter Saturation Voltage	I _C =120A, V _{GE} =15V	T _J =25°C	1.55	1.90	V
			T _J =150°C	2.00		V
I _{CES}	Collector-Emitter Leakage Current	V _{GE} =0V, V _{CE} =V _{CES}	T _J =25°C	1	20	uA
			T _J =150°C		10	mA
I _{GES}	Gate-Emitter Leakage Current	V _{GE} =±20V, V _{CE} =0V	T _J =25°C		±200	nA
g _{FS}	Forward Transconductance	V _{CE} =20V, I _C =120A		80		S

Switching Characteristics of IGBT (T_J=25°C unless otherwise specified)

C _{ies}	Input Capacitance	V _{CE} =25V, V _{GE} =0V, f=250kHz			4290		pF
C _{oes}	Output Capacitance				262		pF
C _{res}	Reverse Transfer Capacitance				90		pF
t _{d(on)}	Turn-on Delay Time	V _{CC} =400V, I _C =120A, R _{Gon} =10Ω, V _{GE} =0V/15V, Inductive Load	T _J =25℃		58		ns
			T _J =150℃		57		ns
t _r	Rise Time		T _J =25℃		70		ns
			T _J =150℃		72		ns
t _{d(off)}	Turn-off Delay Time		T _J =25℃		207		ns
			T _J =150℃		216		ns
t _f	Fall Time		T _J =25℃		81		ns
			T _J =150℃		108		ns



E _{on}	Turn-on Switching Loss	V _{CC} =400V, I _C =120A, R _{Gon} =10Ω, V _{GE} =0V/15V, Inductive Load	T _J =25℃		1.44		mJ
			T _J =150℃		2.72		mJ
E _{off}	Turn-off Switching Loss		T _J =25℃		2.21		mJ
			T _J =150℃		3.38		mJ
Q _g	Total Gate Charge	V _{CC} =400V, I _C =120A, V _{GE} =15V			170		nC
I _{sc}	V _{CC} =400V, V _{GE} =+15V, t _{sc} ≤5us, T _J =25℃				TBD		A

Electrical Characteristics of Diode ($T_C=25^\circ C$ unless otherwise specified)

Symbol	Description	Conditions		Min.	Typ.	Max.	Units	
V _{FM}	Diode Forward Voltage	I _F =120A, T _J =25℃			1.60	2.05	V	
		I _F =120A, T _J =150℃			1.45		V	
t _{rr}	Reverse Recovery Time	I _F =120A, V _{CC} =400V, di/dt=400A/μs, T _J =150℃	T _J =25℃		38		ns	
			T _J =150℃		208		ns	
Q _{rr}	Reverse Recovery Charge		T _J =25℃		4.19		μC	
			T _J =150℃		5.53		μC	
I _{rr}	Peak Reverse Recovery Current		T _J =25℃		21.5		A	
			T _J =150℃		28.4		A	
E _{rec}	Reverse Recovery Energy		T _J =25℃		0.54		mJ	
			T _J =150℃		1.26		mJ	

Thermal Characteristics ($T_C=25^\circ C$ unless otherwise specified)

Symbol	Description	Min.	Typ.	Max.	Units
$R_{\theta JC(IGBT)}$	Thermal Resistance: Junction-to-Case		0.38		$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance: Junction-to-Ambient (Typical Socket Mount)			50	$^\circ C/W$



Inductive Load Switching Circuit and Waveform:

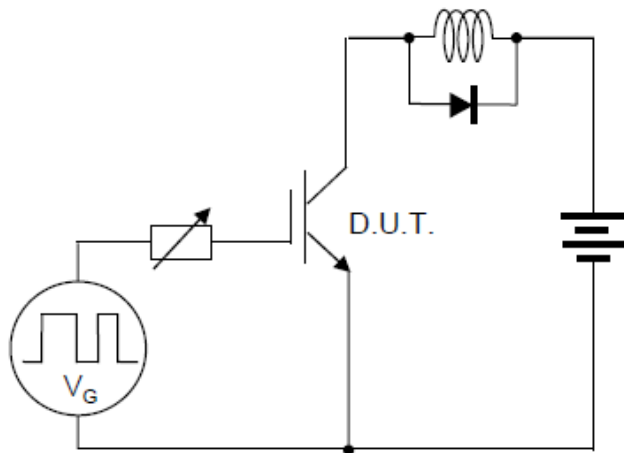


Fig.1 Inductive Load Switching Circuit

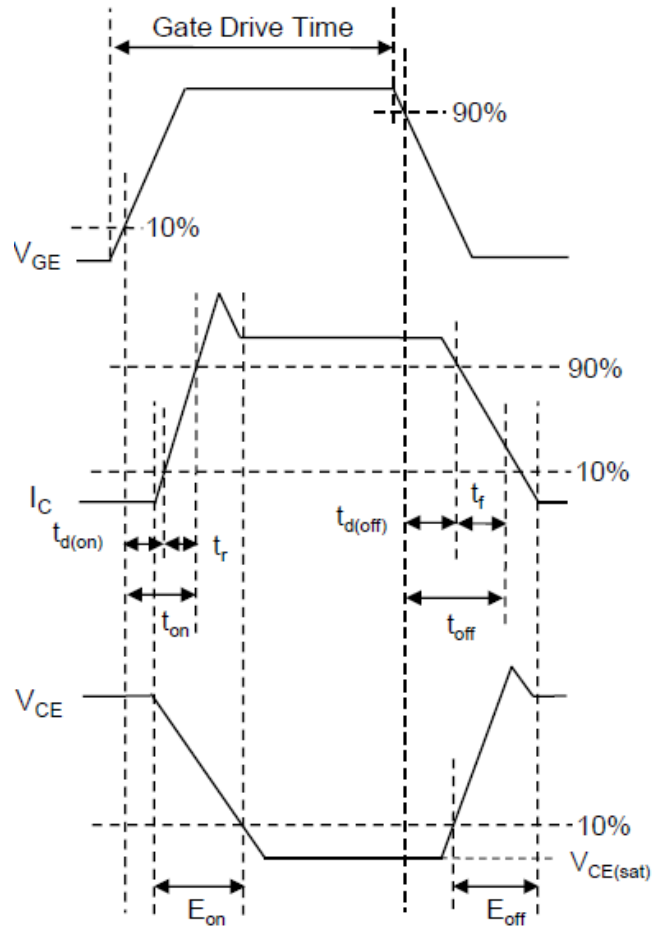
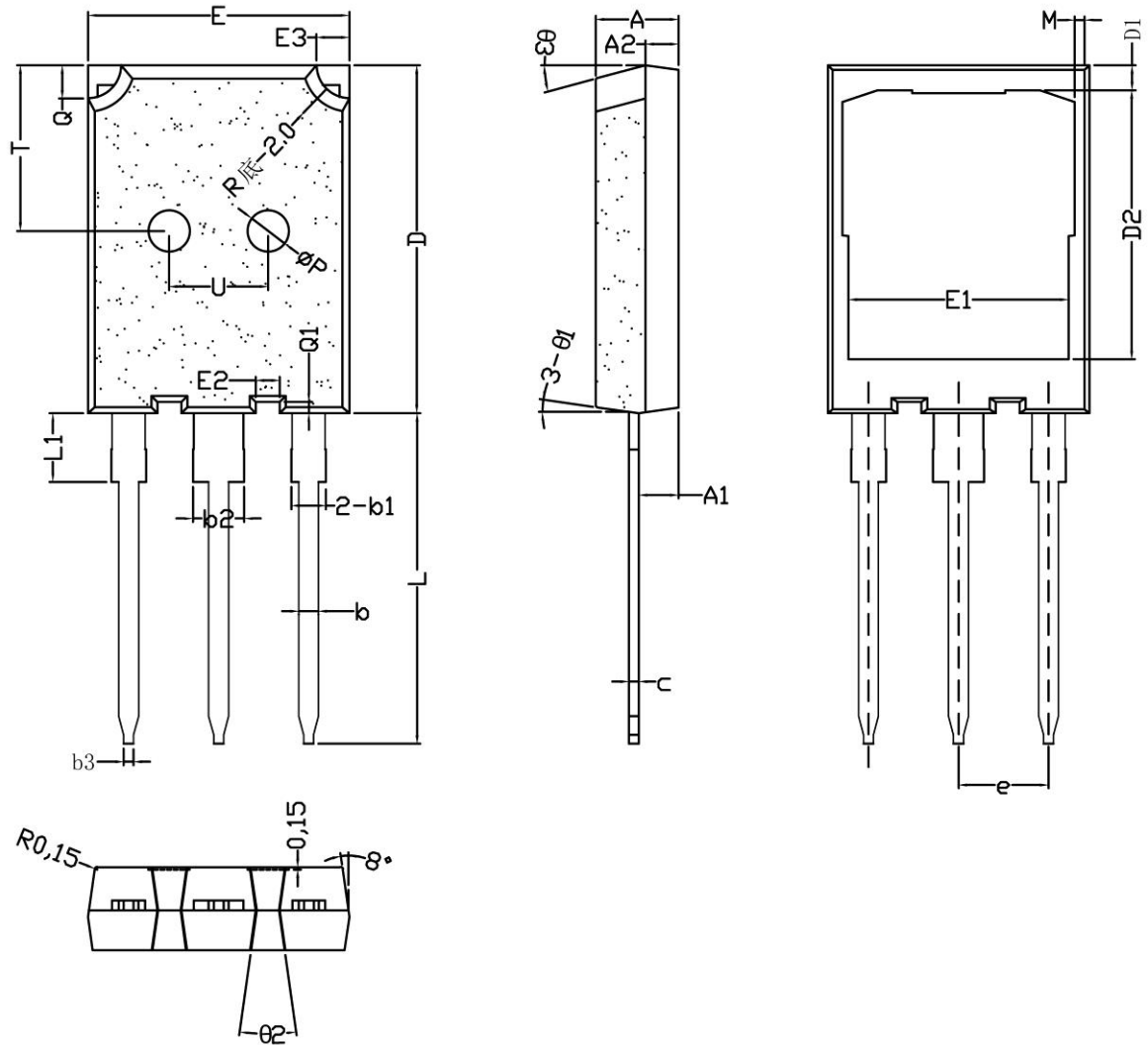


Fig.2 Inductive Load Waveform



TO-247 Plus Package Outline (Unit: mm):





TO-247 Plus Package Mechanical Data:

SYMBOL	mm		
	MIN	NOM	MAX
*A	4.90	5.00	5.10
*A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
*b	1.15	1.20	1.25
*b1	1.95	2.10	2.25
*b2	2.95	3.10	3.25
b3	0.45	0.60	0.75
*c	0.55	0.60	0.68
*D	20.90	21.00	21.10
D1	1.00	1.20	1.40
D2	15.25	16.55	16.85
*E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	1.25	1.45	1.65
E3	1.80	2.00	2.20
*e	5.40	5.44	5.48
*L	19.80	19.92	20.10
*L1	—	—	4.30
M	0.40	0.60	0.80
ΦP	2.30	2.50	2.70
Q	1.80	2.00	2.20
Q1	0.50	0.68	0.80
T	9.80	10.00	10.20
U	5.80	6.00	6.20
θ1	5°	7°	9°
θ2	13°	16°	19°
θ3	13°	15°	17°



Date	Revision	Notes
06/12/2024	01	Initial Release

Announcement

Information in this document is believed to be accurate and reliable. However, NJSME does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information.

Right to Make Changes

NJSME reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

The datasheet with “REV.” + “Arabic numerals” is based on engineering data for initial reference purpose only.

The released datasheet would be issued with “REV.” + “alphabet characters”.