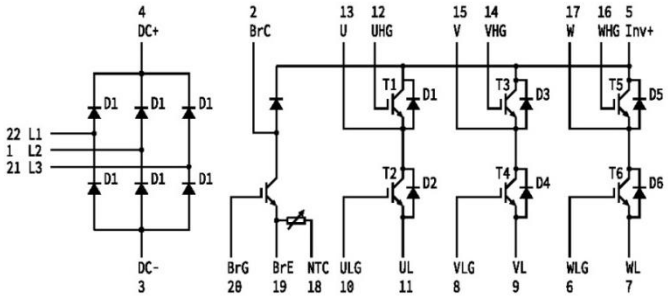
GK20PI60C6H

IGBT Module
Without Fixing Sticks



Features:

- Non Punch Through (NPT) Technology
- Short Circuit Rated >10μs
- Low Saturation Voltage
- Low Switching Loss
- 100% RBSOA Tested(2×Ic)
- Low Stray Inductance
- Lead Free, Compliant with RoHS Requirement

Applications:

- Industrial Inverters

IGBT, Inverter

Maximum Rated Values (T_C=25℃ unless otherwise specified)

V_{CES}	Collector-Emitter Blocking Voltage		600	V
V_{GES}	Gate-Emitter Voltage		±20	V
I_C	Continuous Collector Current	T_C=80℃	20	A
		T_C=25℃	40	A
I_{CM}	Repetitive Peak Collector Current	T_J=150℃	40	A
t_{SC}	Short Circuit Withstand Time		>10	μs
P_D	Maximum Power Dissipation per IGBT	T_C=25℃ T_{Jmax}=150℃	148	W

Electrical Characteristics of IGBT (T_C=25℃ unless otherwise specified)

Static Characteristics

Symbol	Description	Conditions		Min	Typ	Max	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=1mA, V_{CE}=V_{GE}		4.0	4.8	5.8	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=20A, V_{GE}=15V	T_J=25℃		2.00		V
			T_J=125℃		2.15		V
I_{CES}	Collector-Emitter Leakage Current	V_{GE}=0V, V_{CE}=V_{CES}, T_J=25℃				1	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=±20V, V_{CE}=0V, T_J=25℃				200	nA
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f=100kHz			1.33		nF
C_{oes}	Output Capacitance				0.16		nF
C_{res}	Reverse Transfer Capacitance				0.04		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	V_{CC}=300V, I_C=20A, R_{Gon}=30Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		88		ns
			T_J=125℃		96		
t_r	Rise Time		T_J=25℃		28		ns
			T_J=125℃		29		
$t_{d(off)}$	Turn-off Delay Time	V_{CC}=300V, I_C=20A, R_{Goff}=30Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		158		ns
			T_J=125℃		164		
t_f	Fall Time		T_J=25℃		129		ns
			T_J=125℃		167		
E_{on}	Turn-on Switching Loss	V_{CC}=300V, I_C=20A, R_{Gon}=30Ω, V_{GE}=±15V, di/dt=559A/μs (T_J=125℃) Inductive Load	T_J=25℃		0.48		mJ
			T_J=125℃		0.56		
E_{off}	Turn-off Switching Loss	V_{CC}=300V, I_C=20A, R_{Goff}=30Ω,V_{GE}=±15V, du/dt=3121V/μs (T_J=125℃) Inductive Load	T_J=25℃		0.22		mJ
			T_J=125℃		0.36		
Q_g	Total Gate Charge	V_{GE}=+15V…-15V	T_J=25℃		121		nC
RBSOA	I_C=40A,V_{CC}=480V,Vp=600V, R_{Goff}=30 Ω, V_{GE}=+15V to 0V, T_J=125°C			Trapezoid			
SCSOA	V_{CC}=300V, V_{GE}=15V, T_J=125℃			10			μs
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-To-Case(Per Leg)					0.84	℃/W

Diode, Inverter

Maximum Rated Values (T_C=25℃ unless otherwise specified)

V_{RRM}	Repetitive Peak Reverse Voltage	600	V
I_F	Diode Continuous Forward Current	20	A
I_{FM}	Diode Maximum Forward Current	40	A

Electrical Characteristics of Diode (T_C=25℃ unless otherwise specified)

Symbol	Description	Conditions		Min	Typ	Max	Unit
V_{FM}	Forward Voltage	I_F=20A	T_J=25℃		1.50		V
			T_J=125℃		1.55		
I_{rr}	Peak Reverse Recovery Current	I_F=20A, -diF/dt=227A/μs(T_J=125℃), V_{rr}=300V, V_{GE}=-15V	T_J=25℃		15.3		A
			T_J=125℃		18.4		
Q_{rr}	Reverse Recovery Charge		T_J=25℃		0.94		μC
			T_J=125℃		1.41		
E_{rec}	Reverse Recovery Energy		T_J=25℃		0.14		mJ
			T_J=125℃		0.31		
$R_{\theta JC}$	Diode Thermal Resistance: Junction-To-Case(Per Leg)					1.89	℃/W

IGBT, Brake-Chopper

Maximum Rated Values (T_C=25℃ unless otherwise specified)

V_{CES}	Collector-Emitter Blocking Voltage		600	V
V_{GES}	Gate-Emitter Voltage		±20	V
I_C	Continuous Collector Current	T_C=80℃	20	A
		T_C=25℃	40	A
I_{CM}	Repetitive Peak Collector Current	T_J=150℃	40	A
t_{SC}	Short Circuit Withstand Time		>10	μs
P_D	Maximum Power Dissipation per IGBT	T_C=25℃ T_{Jmax}=150℃	148	W

Electrical Characteristics of IGBT (T_C=25℃ unless otherwise specified)

Static Characteristics

Symbol	Description	Conditions		Min	Typ	Max	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=1mA, V_{CE}=V_{GE}		4.0	4.8	5.8	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=20A, V_{GE}=15V	T_J=25℃		2.00		V
			T_J=125℃		2.15		V
I_{CES}	Collector-Emitter Leakage Current	V_{GE}=0V, V_{CE}=V_{CES}, T_J=25℃				1	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=±20V, V_{CE}=0V, T_J=25℃				200	nA
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f=100kHz			1.33		nF
C_{oes}	Output Capacitance				0.16		nF
C_{res}	Reverse Transfer Capacitance				0.04		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	V_{CC}=300V, I_C=20A, R_{Gon}=30Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		88		ns
			T_J=125℃		96		
t_r	Rise Time		T_J=25℃		28		ns
			T_J=125℃		29		
$t_{d(off)}$	Turn-off Delay Time	V_{CC}=300V, I_C=20A, R_{Goff}=30Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		158		ns
			T_J=125℃		164		
t_f	Fall Time		T_J=25℃		129		ns
			T_J=125℃		167		
E_{on}	Turn-on Switching Loss	V_{CC}=300V, I_C=20A, R_{Gon}=30Ω, V_{GE}=±15V, di/dt=559A/μs (T_J=125℃) Inductive Load	T_J=25℃		0.48		mJ
			T_J=125℃		0.56		
E_{off}	Turn-off Switching Loss	V_{CC}=300V, I_C=20A, R_{Goff}=30Ω,V_{GE}=±15V, du/dt=3121V/μs (T_J=125℃) Inductive Load	T_J=25℃		0.22		mJ
			T_J=125℃		0.36		
Q_g	Total Gate Charge	V_{GE}=+15V…-15V	T_J=25℃		121		nC
RBSOA	I_C=40A,V_{CC}=480V,Vp=600V, R_{Goff}=30 Ω, V_{GE}=+15V to 0V, T_J=125°C			Trapezoid			
SCSOA	V_{CC}=300V, V_{GE}=15V, T_J=125℃			10			μs
$R_{θJC}$	IGBT Thermal Resistance: Junction-To-Case(Per Leg)					0.84	℃/W

Diode, Brake-Chopper

Maximum Rated Values (T_C=25℃ unless otherwise specified)

V_{RRM}	Repetitive Peak Reverse Voltage	600	V
I_F	Diode Continuous Forward Current	10	A
I_{FM}	Diode Maximum Forward Current	20	A

Electrical Characteristics of Diode (T_C=25℃ unless otherwise specified)

Symbol	Description	Conditions		Min	Typ	Max	Unit
V_{FM}	Forward Voltage	I_F=10A	T_J=25℃		1.55		V
			T_J=125℃		1.55		
I_{rr}	Peak Reverse Recovery Current	I_F=10A, -diF/dt =1066A/μs(T_J=125℃), V_{rr}=300V, V_{GE}=-15V	T_J=25℃		26.9		A
			T_J=125℃		28.4		
Q_{rr}	Reverse Recovery Charge		T_J=25℃		0.47		μC
			T_J=125℃		0.67		
E_{rec}	Reverse Recovery Energy		T_J=25℃		0.05		mJ
			T_J=125℃		0.10		
$R_{\theta JC}$	Diode Thermal Resistance: Junction-To-Case(Per Leg)					2.31	℃/W

Diode, Rectifier

Maximum Rated Values (T_C=25℃unless otherwise specified)

V_{RRM}	Repetitive Peak Reverse Voltage	T_J=25℃	1600	V
I_{FRMSM}	Maximum RMS Forward Current per Chip	T_J=80℃	20	A
I_{RMSM}	Maximum RMS Current at Rectifier Output	T_J=80℃	30	A
I_{FSM}	Surge Current @t_p=10 ms	T_J=25℃	300	A
		T_J=150℃	250	
I^2t	I²t - value	T_J=25℃	450	A^2s
		T_J=150℃	300	

Electrical Characteristics of Diode (T_C=25℃unless otherwise specified)

Symbol	Description	Conditions		Min	Typ	Max	Unit
V_F	Forward Voltage	I_F=20 A	T_J=25℃		1.20		V
			T_J=150℃		1.20		
I_R	Reverse Current	V_R=1200V	T_J=25℃			50	uA
$R_{\theta JC}$	Diode Thermal Resistance: Junction-To-Case					1.08	℃/W

Internal NTC-Thermistor Characteristics

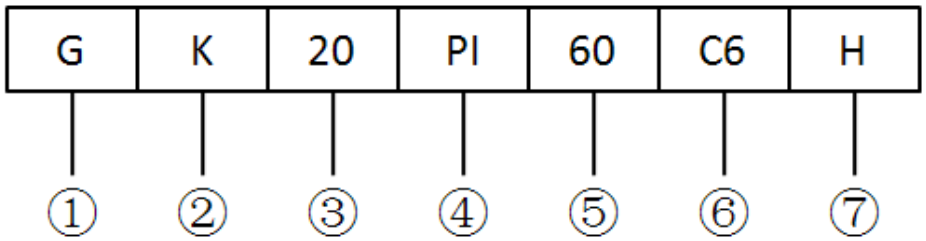
Symbol	Description	Min	Typ	Max	Unit
R_{25}	T_C =25℃		22.7		kΩ
△R/R	T_C =100℃，R_{100} =1481Ω	-3		+3	%
P_{25}	T_C =25℃			5	mW
$B_{25/50}$	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$		3950		K
$B_{25/80}$	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15K))]$		4000		K

Module

Symbol	Description		Min	Typ	Max	Unit
V_{iso}	Isolation Voltage (All Terminals Shorted)	RMS, f=50Hz, 1minute	2500			V
T_J	Maximum Junction Temperature				150	℃
T_{JOP}	Maximum Operating Junction Temperature Range		-40		+150	℃
T_{stg}	Storage Temperature		-40		+125	℃
CTI	Comparative Tracking Index		200			
$R_{\theta CS}$	Case-To-Sink Thermally (Conductive Grease Applied)				0.13	℃/W
T	Mounting Torque(Screw M4)		1.0		1.5	N·m
G	Weight			39		g

Ordering Information Table

Device code



① - IGBT Module
② - Non Punch Through (NPT) Technology
③ - Rated Current (20=20A)
④ - Circuit Configuration (Power Integrated)
⑤ - Rated Voltage (60=600V)
⑥ - Package Type
⑦ - Test Level (Pass the Important Reliability Test-Industrial Grade)

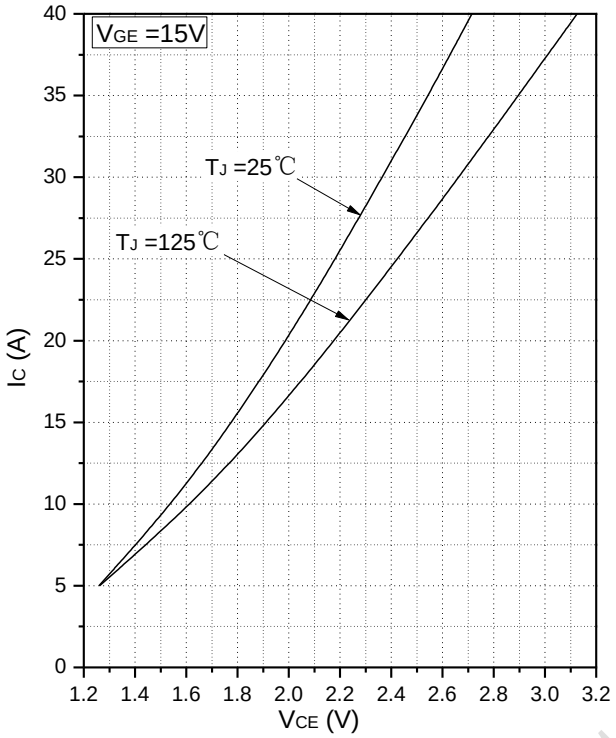


Fig.1 Typical Saturation Voltage Characteristics

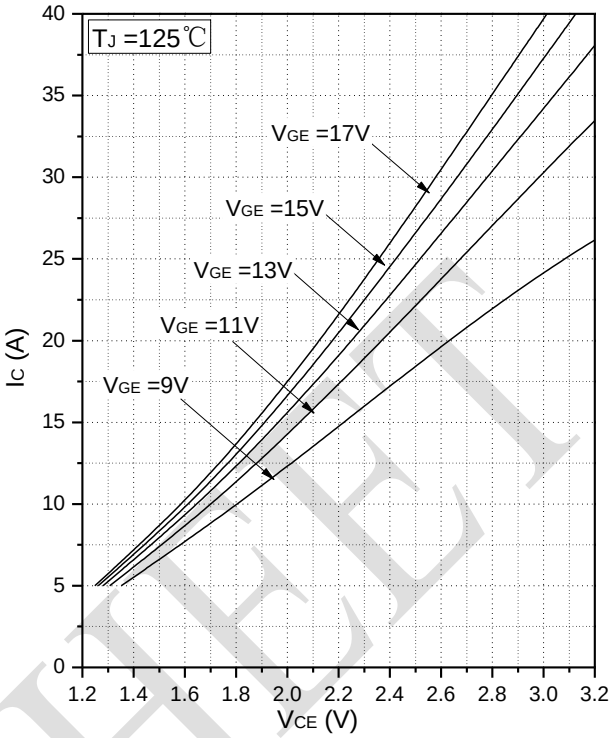


Fig.2 Typical Output Characteristics

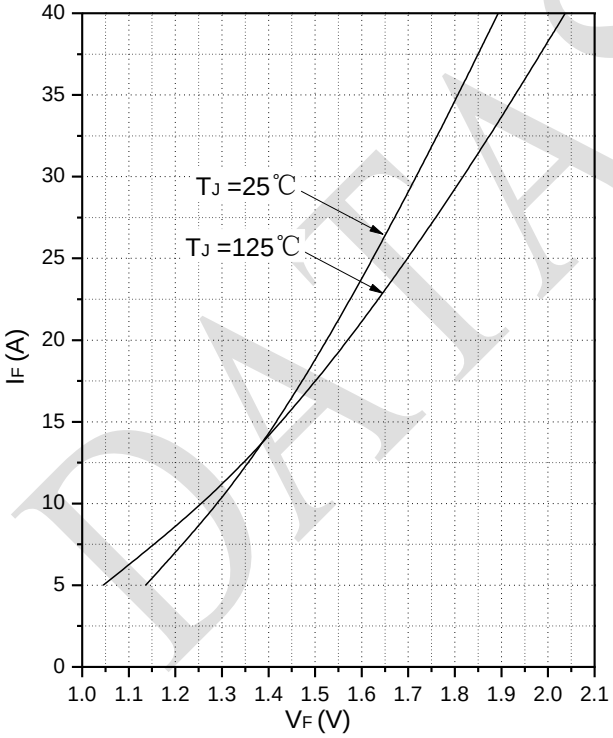


Fig.3 Forward Characteristics of Diode

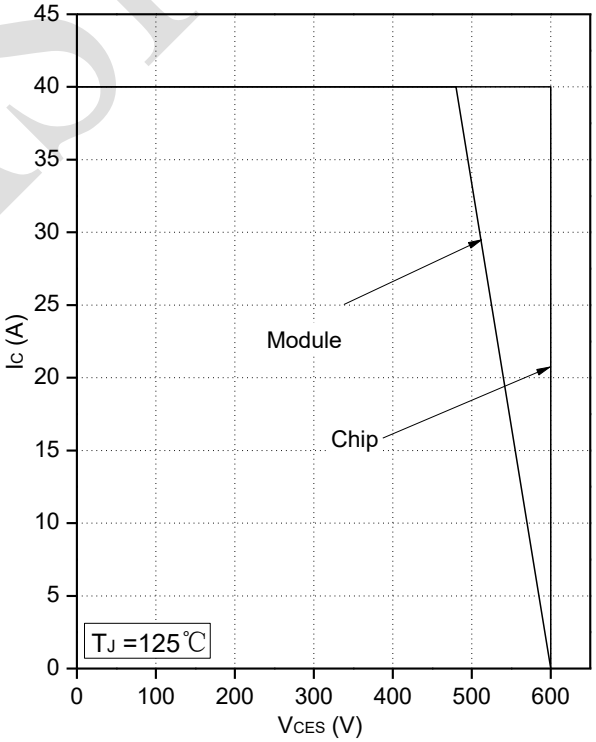


Fig.4 Reverse Bias Safe Operation Area (RBSOA)

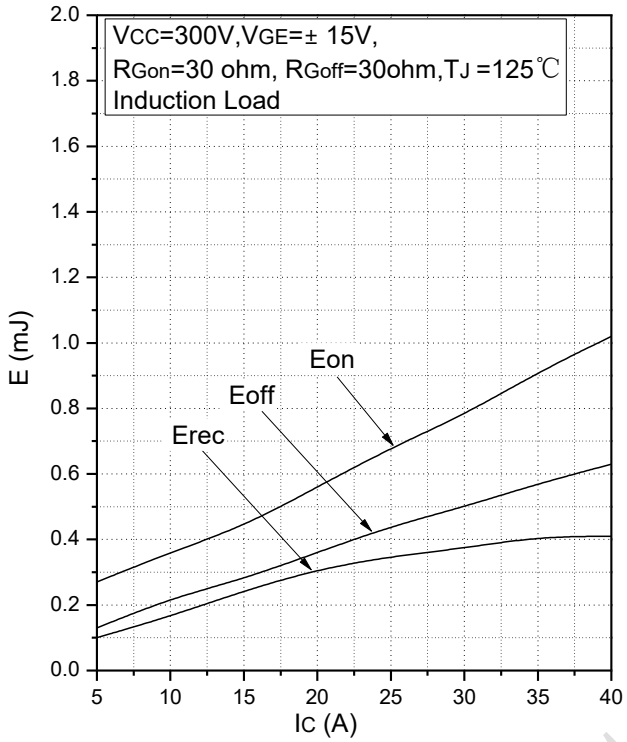


Fig.5 Typical Switching Loss vs. Collector Current

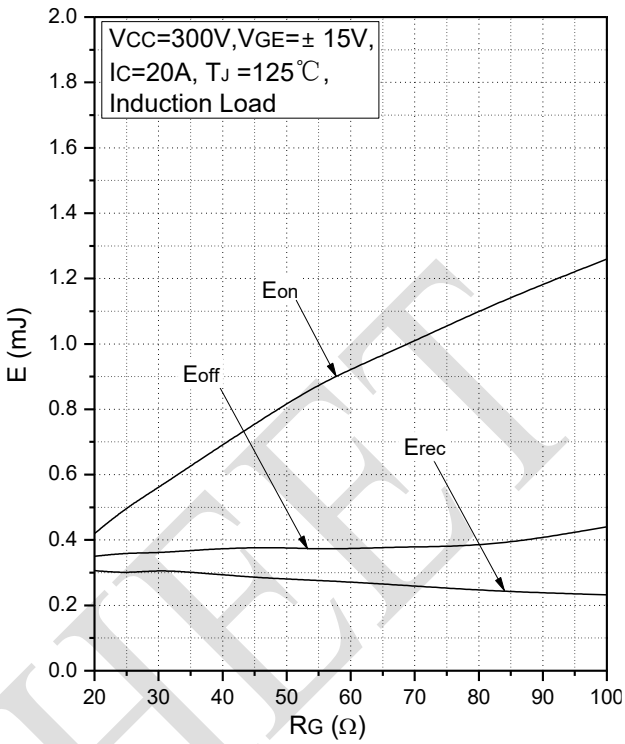


Fig.6 Typical Switching Loss vs. Gate Resistance

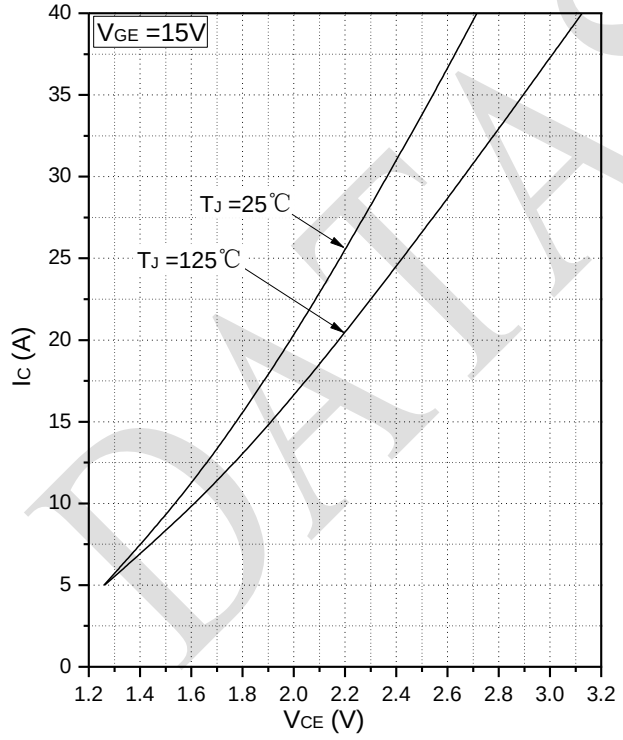


Fig.7 Typical Saturation Voltage Characteristics
(Brake-Chopper)

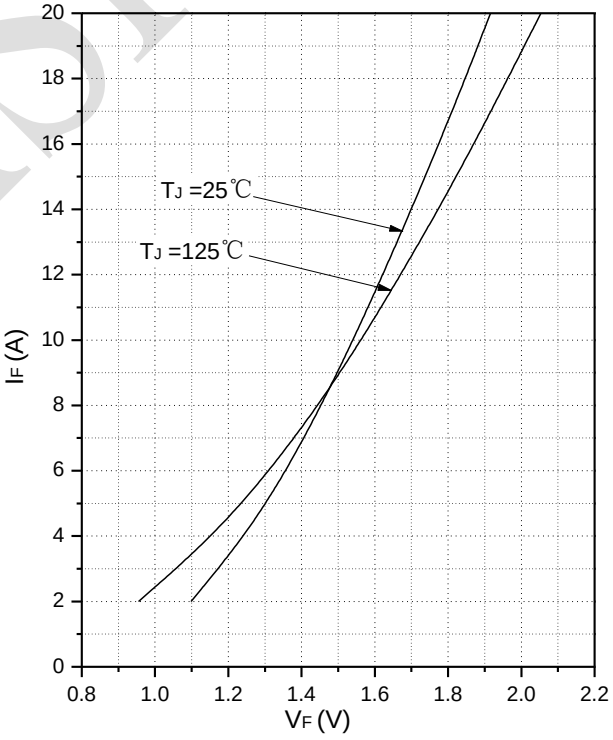


Fig.8 Forward Characteristics of Diode
(Brake-Chopper)

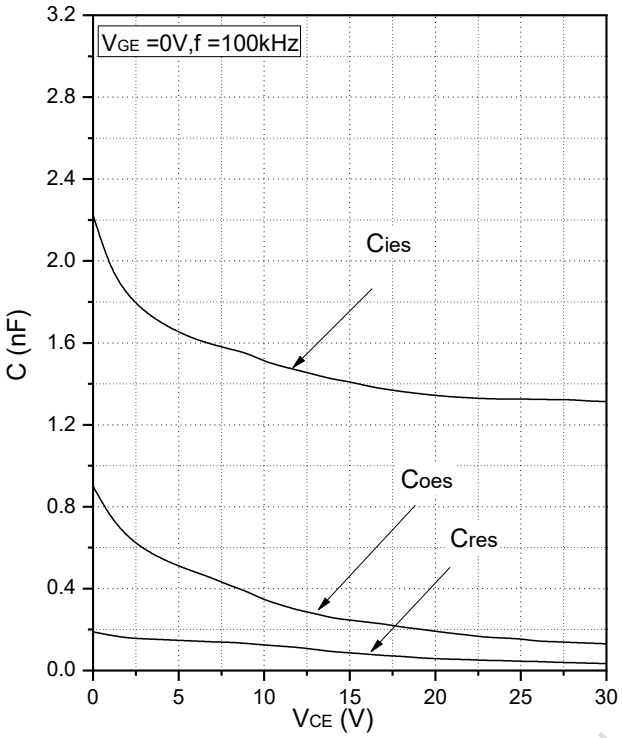


Fig.9 Capacitance Characteristics

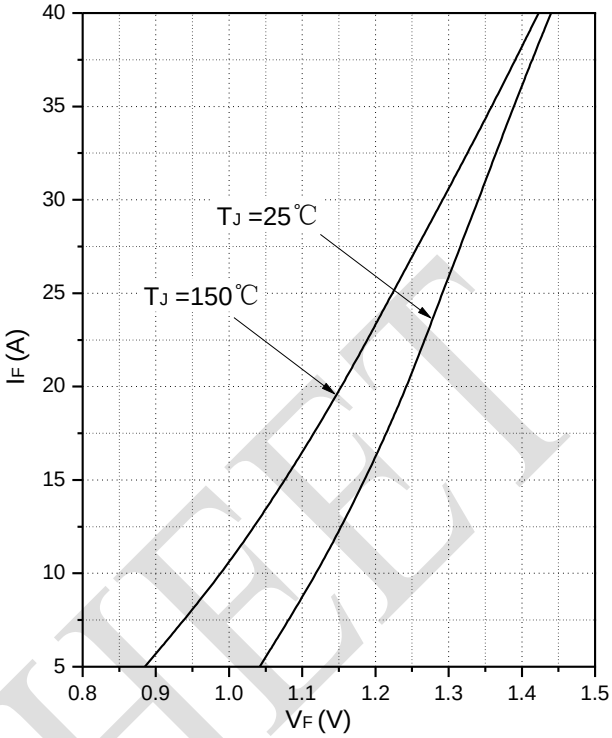


Fig.10 Forward Characteristics of Diode (Rectifier)

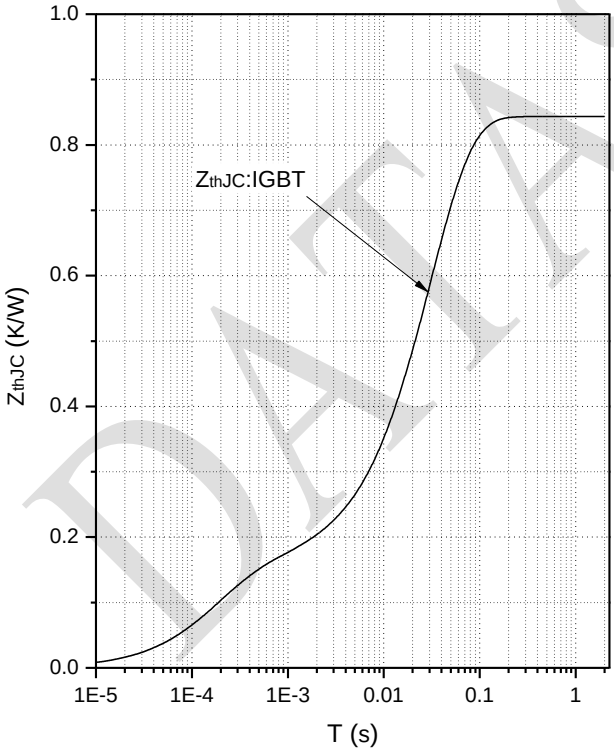


Fig.11 Transient Thermal Impedance IGBT (Inverter)

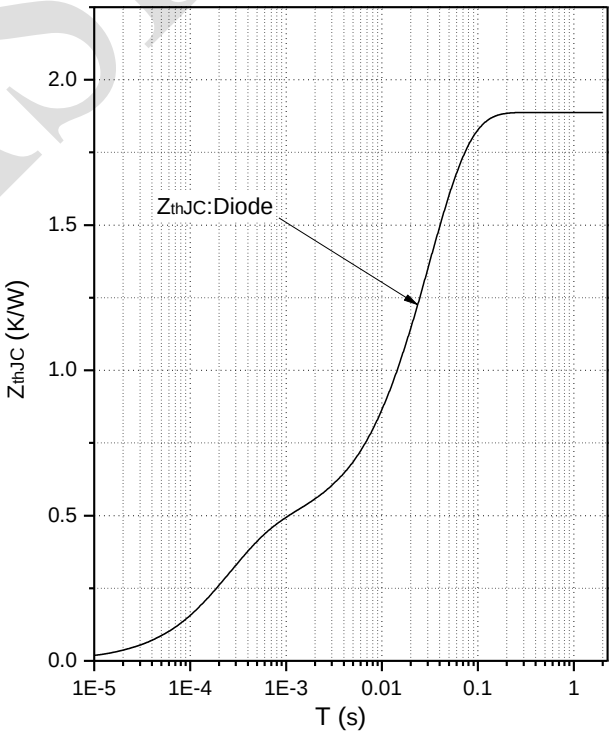


Fig.12 Transient Thermal Impedance Diode (Inverter)

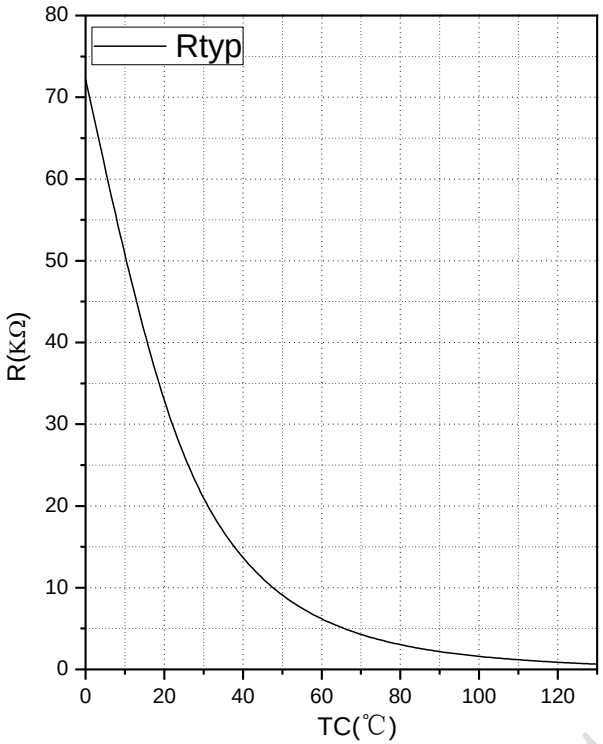
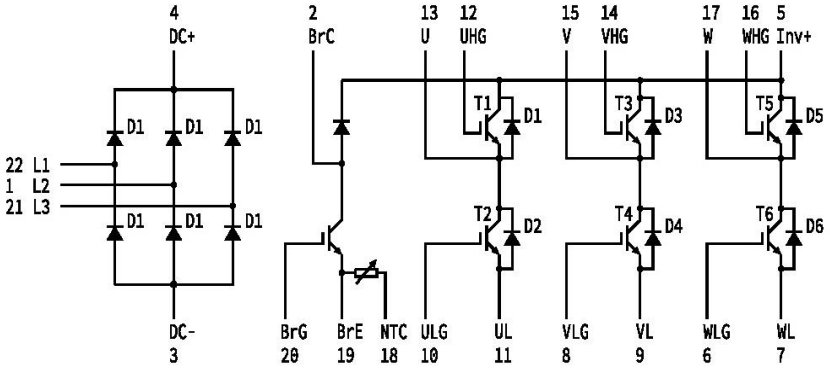
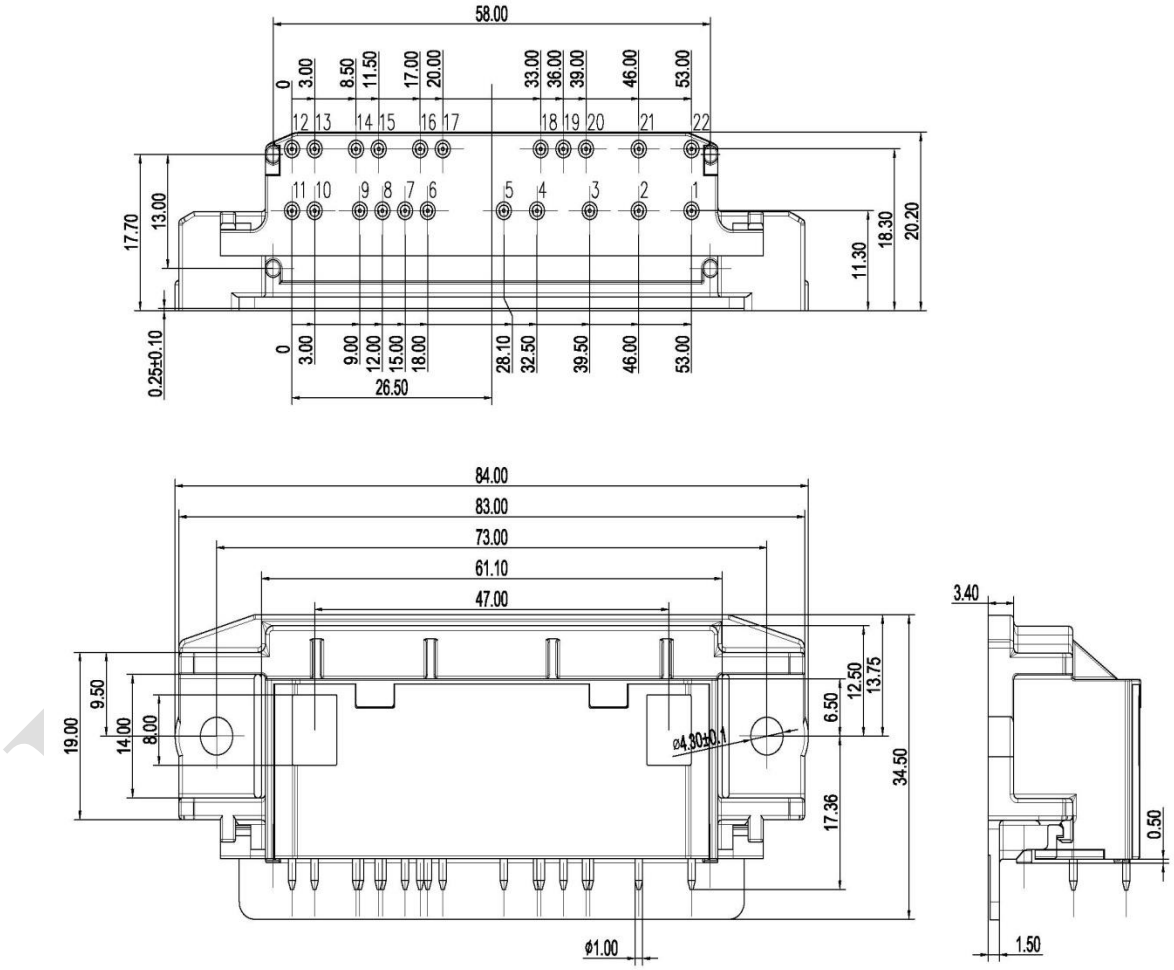


Fig.13 NTC Temperature Characteristics

Internal Circuit



Package Outline – Without Fixing Sticks (Unit: mm):



Date	Revision	Notes
08/13/2018	01	Initial Release
01/18/2022	02	Revised Package Outline
03/18/2022	A	Final Version
05/07/2022	B	Extend the Current Values to 40A of Diagram(Rectifier's I_F-V_F)

Announcement

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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".