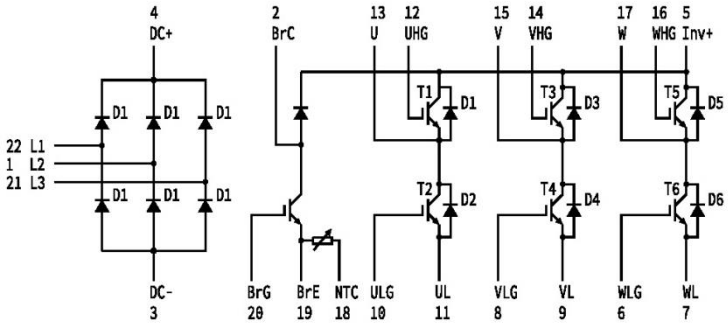
GK10PI60C6H

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℃	10	A
		T_C=25℃	20	A
I_{CM}	Repetitive Peak Collector Current	T_J=150℃	20	A
t_{SC}	Short Circuit Withstand Time		>10	μs
P_D	Maximum Power Dissipation per IGBT	T_C=25℃ T_{Jmax}=150℃	78	W

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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}		4.5	5.0	6.0	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=10A, V_{GE} =15V	T_J=25℃		2.10		V
			T_J=125℃		2.50		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			0.52		nF
C_{oes}	Output Capacitance				0.08		nF
C_{res}	Reverse Transfer Capacitance				0.02		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	V_{CC}=300V, I_C=10A, R_{Gon}=36Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		54		ns
			T_J=125℃		57		
t_r	Rise Time		T_J=25℃		24		ns
			T_J=125℃		25		
$t_{d(off)}$	Turn-off Delay Time	V_{CC}=300V, I_C=10A, R_{Goff} =36Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		98		ns
			T_J=125℃		99		
t_f	Fall Time		T_J=25℃		210		ns
			T_J=125℃		215		
E_{on}	Turn-on Switching Loss	V_{CC}=300V, I_C=10A, R_{Gon}=36Ω, V_{GE}=±15V, di/dt=323A/μs (T_J=125℃) Inductive Load	T_J=25℃		0.39		mJ
			T_J=125℃		0.43		
E_{off}	Turn-off Switching Loss	V_{CC}=300V, I_C=10A, R_{Goff} =36Ω,V_{GE}=±15V, du/dt=1945V/μs (T_J=125℃) Inductive Load	T_J=25℃		0.13		mJ
			T_J=125℃		0.20		
Q_g	Total Gate Charge	V_{GE}=+15V…-15V	T_J=25℃		35		nC
RBSOA	I_C=20A,V_{CC}=480V,Vp=600V, R_{Goff} =36 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)					1.61	℃/W

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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	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		
t_{rr}	Reverse Recovery Time	I_F=10A, -diF/dt =1066A/μs(T_J=125℃), V_{rr} =300V, V_{GE}=-15V	T_J=25℃		109		ns
			T_J=125℃		119		
I_{rr}	Peak Reverse Recovery Current		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

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℃	10	A
		T_C=25℃	20	A
I_{CM}	Repetitive Peak Collector Current	T_J=150℃	20	A
t_{SC}	Short Circuit Withstand Time		>10	μs

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P_D	Maximum Power Dissipation per IGBT	T_C=25℃ T_{Jmax}=150℃	78	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}		4.5	5.0	6.0	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=10A, V_{GE} =15V	T_J=25℃		2.10		V
			T_J=125℃		2.50		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			0.52		nF
C_{oes}	Output Capacitance				0.08		nF
C_{res}	Reverse Transfer Capacitance				0.02		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	V_{CC}=300V, I_C=10A, R_{Gon}=36Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		54		ns
			T_J=125℃		57		
t_r	Rise Time		T_J=25℃		24		ns
			T_J=125℃		25		
$t_{d(off)}$	Turn-off Delay Time	V_{CC}=300V, I_C=10A, R_{Goff} =36Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		98		ns
			T_J=125℃		99		
t_f	Fall Time		T_J=25℃		210		ns
			T_J=125℃		215		
E_{on}	Turn-on Switching Loss	V_{CC}=300V, I_C=10A, R_{Gon}=36Ω, V_{GE}=±15V, di/dt=323A/μs (T_J=125℃) Inductive Load	T_J=25℃		0.39		mJ
			T_J=125℃		0.43		
E_{off}	Turn-off Switching Loss	V_{CC}=300V, I_C=10A, R_{Goff} =36Ω,V_{GE}=±15V, du/dt=1945V/μs (T_J=125℃) Inductive Load	T_J=25℃		0.13		mJ
			T_J=125℃		0.20		
Q_g	Total Gate Charge	V_{GE}=+15V…-15V	T_J=25℃		35		nC

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RBSOA	I_C=20A,V_{CC}=480V,Vp=600V, R_{Goff}=36 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)			1.61	℃/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		
t_{rr}	Reverse Recovery Time	I_F=10A, -diF/dt =1066A/μs(T_J=125℃), V_{rr}=300V, V_{GE}=-15V	T_J=25℃		109		ns
			T_J=125℃		119		
I_{rr}	Peak Reverse Recovery Current		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

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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	I^2t - 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=10 A	T_J=25℃		1.10		V
			T_J=150℃		1.00		
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

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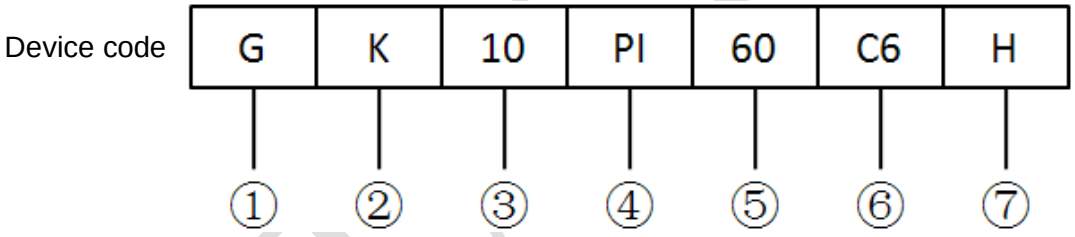
Module

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



① - IGBT Module
② - Non Punch Through (NPT) Technology
③ - Rated Current (10=10A)
④ - Circuit Configuration (Power Integrated)
⑤ - Rated Voltage (60=600V)
⑥ - Package Type
⑦ - Test Level (Pass the Important Reliability Test-Industrial Grade)

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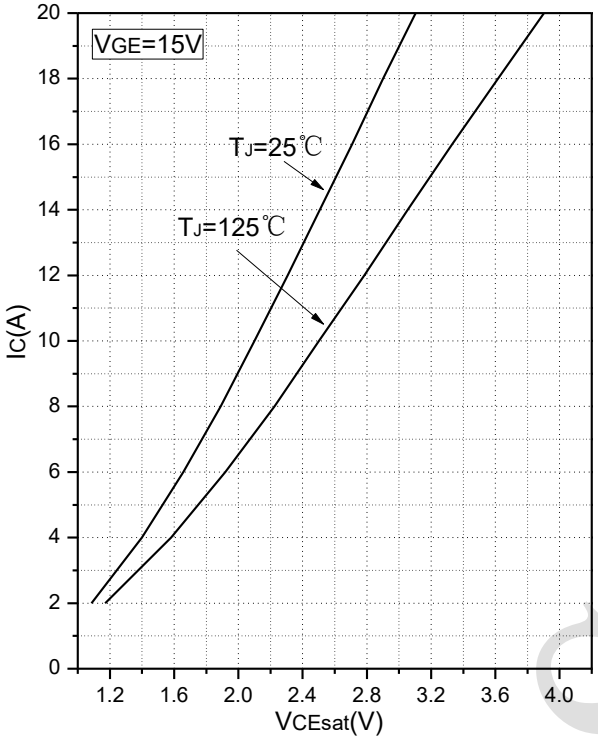

Fig.1 Typical Saturation Voltage Characteristics

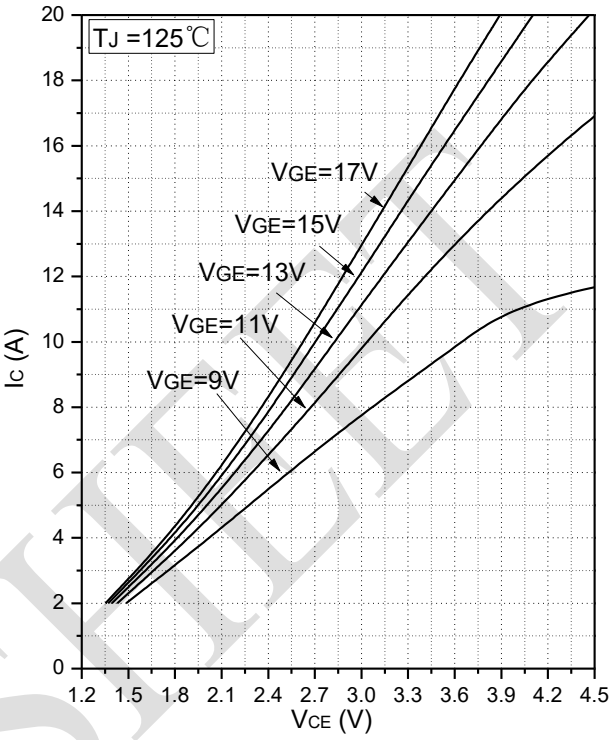

Fig.2 Typical Output Characteristics

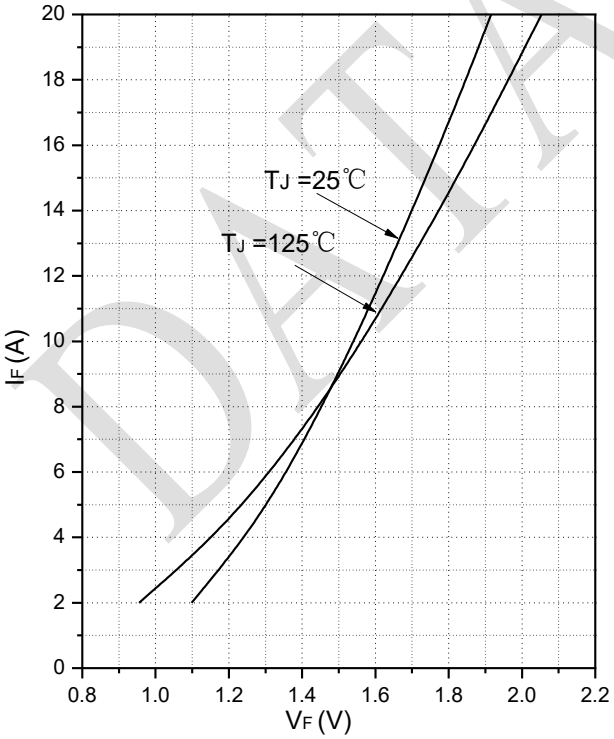

Fig.3 Forward Characteristics of Diode

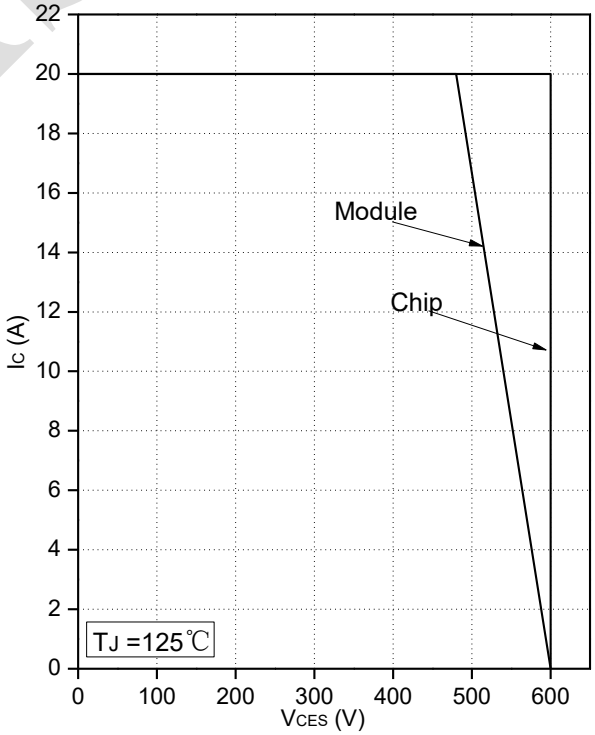

Fig.4 Reverse Bias Safe Operation Area (RBSOA)

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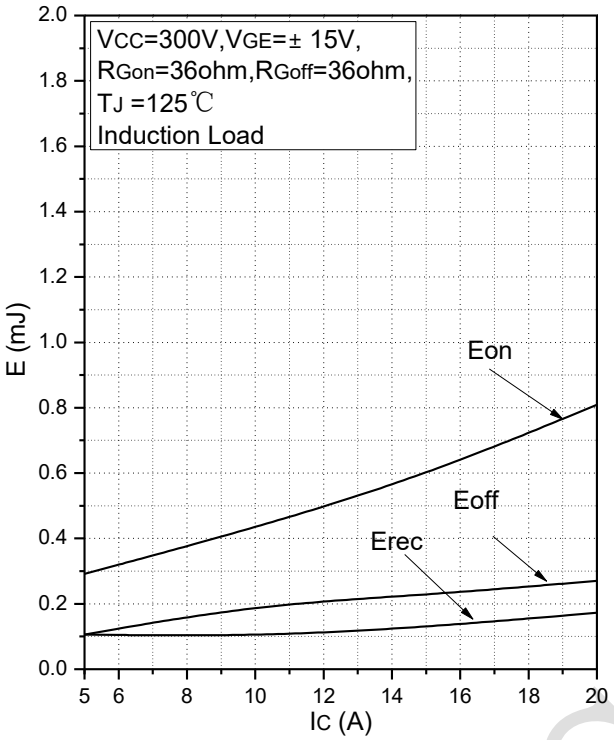

Fig.5 Typical Switching Loss vs. Collector Current

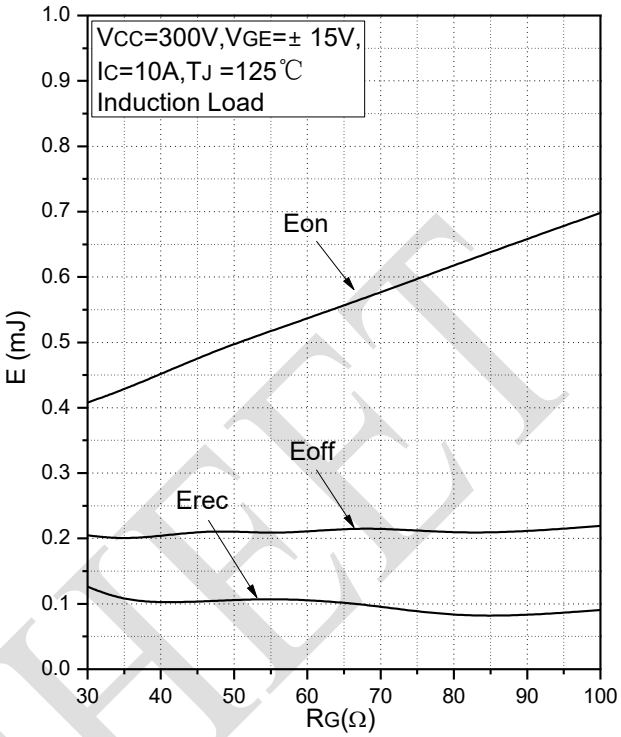

Fig.6 Typical Switching Loss vs. Gate Resistance

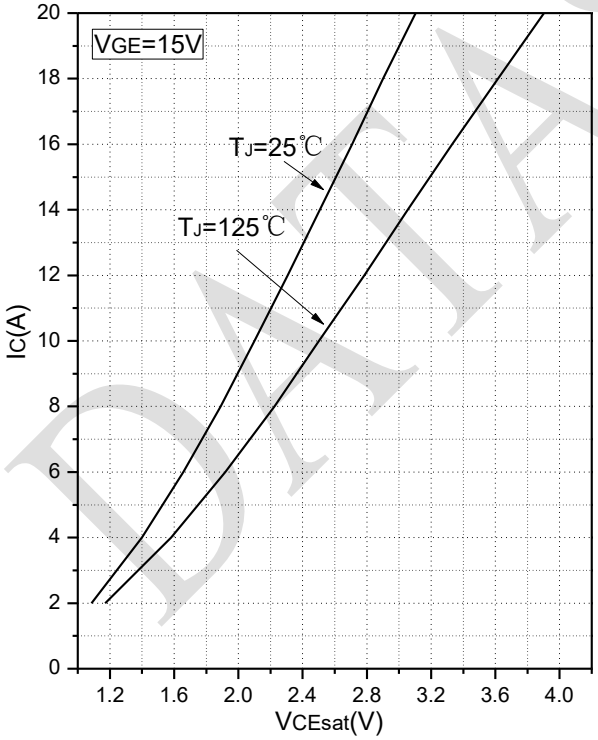

Fig.7 Typical Saturation Voltage Characteristics
(Brake-Chopper)

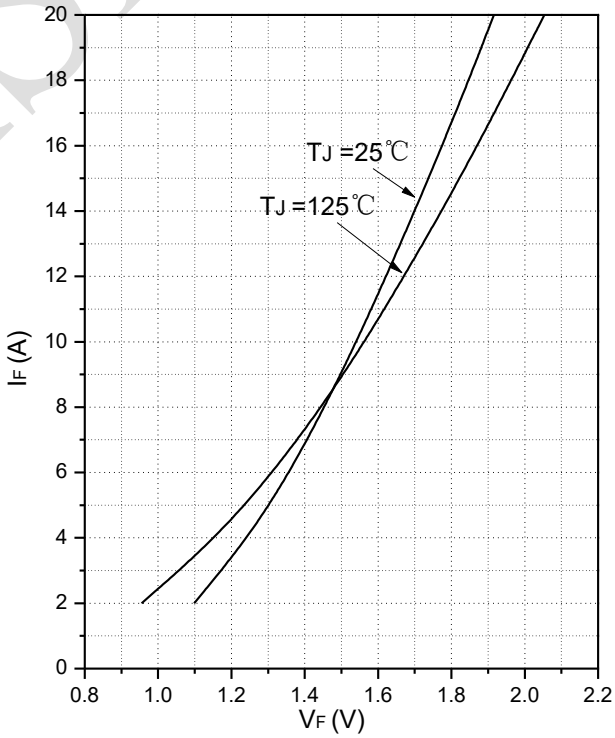

Fig.8 Forward Characteristics of Diode
(Brake-Chopper)

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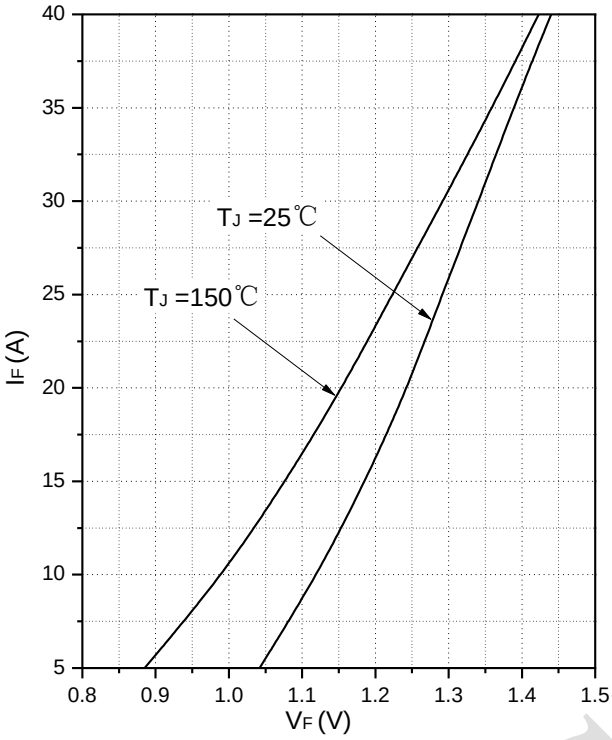

Fig.9 Forward Characteristics of Diode (Rectifier)

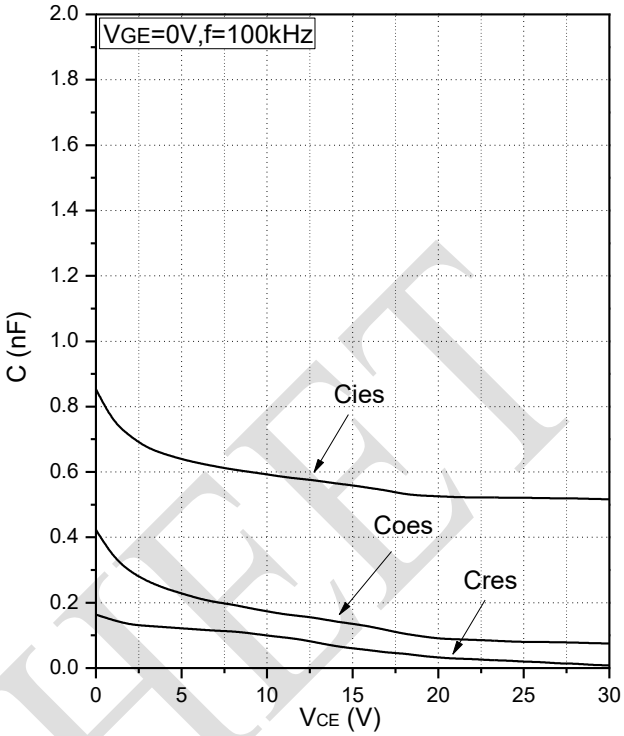

Fig.10 Capacitance Characteristics

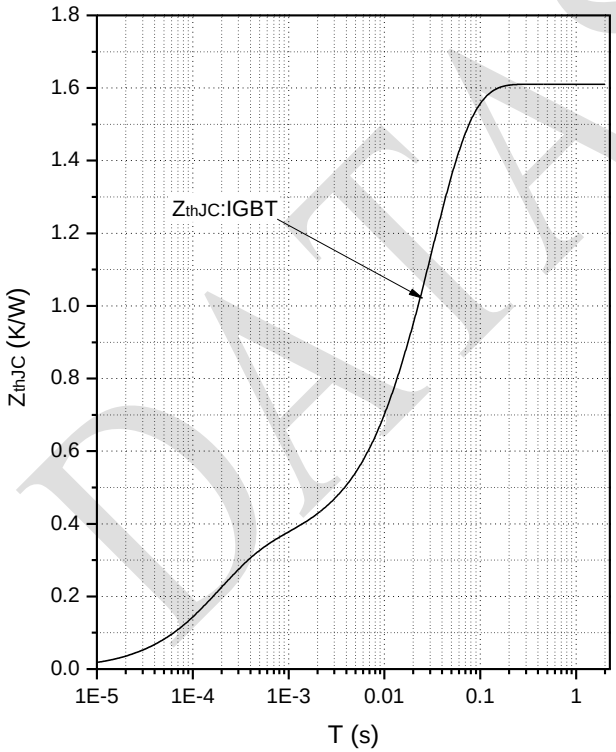

Fig.11 Transient Thermal Impedance IGBT (Inverter)

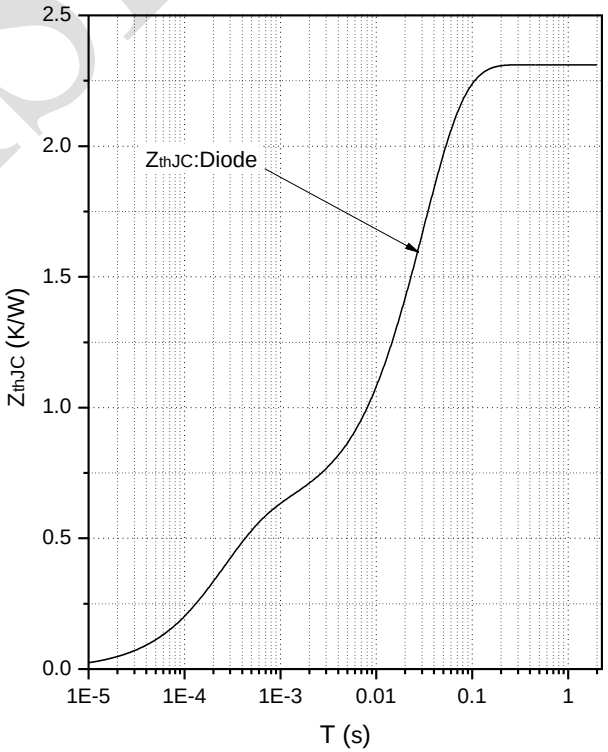

Fig.12 Transient Thermal Impedance Diode (Inverter)

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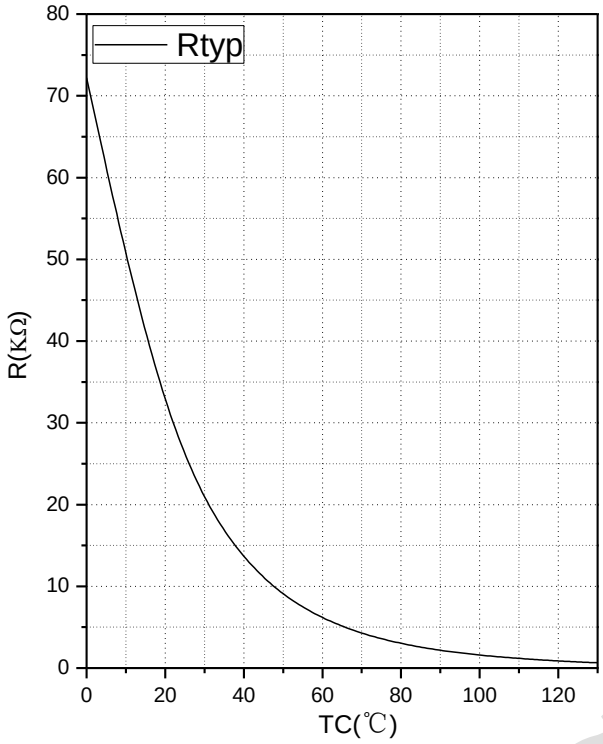

Fig.13 NTC Temperature Characteristics

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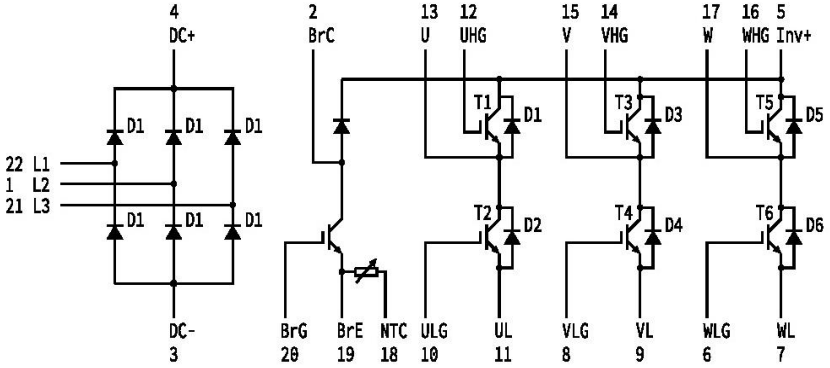
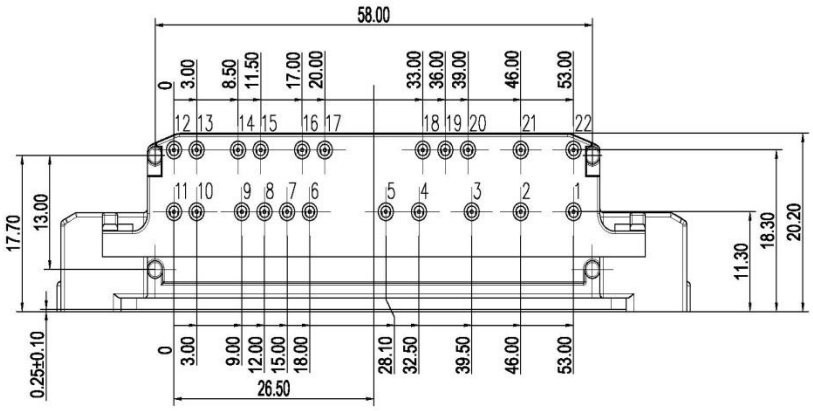
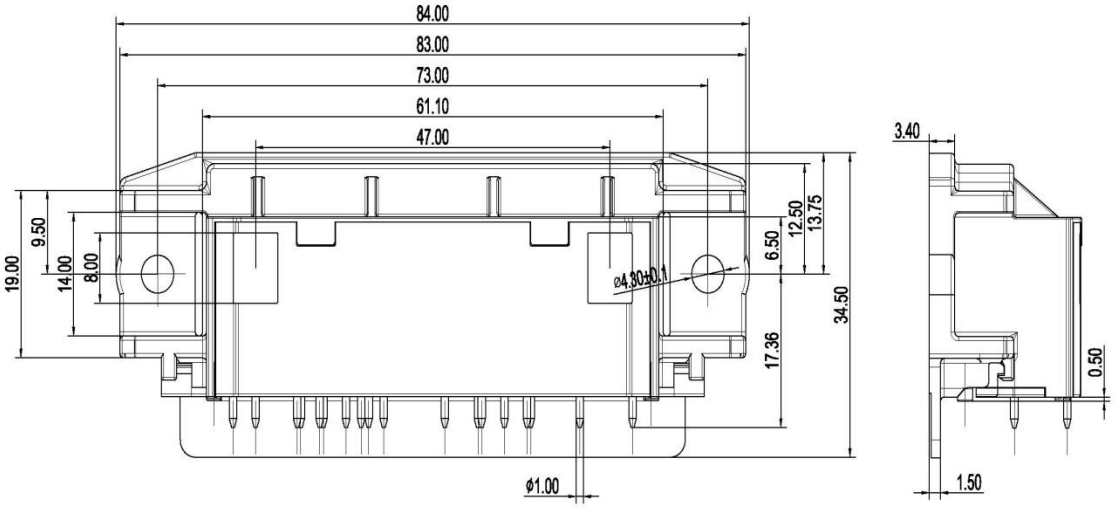
Internal Circuit



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





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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".

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