

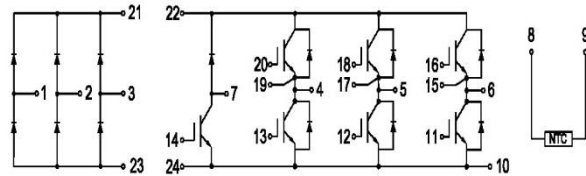


GK20PI60T5H

IGBT Module

Features:

- Non Punch Through (NPT) Technology
- Short Circuit Rated $>10\mu\text{s}$
- Low Saturation Voltage
- Low Switching Loss
- 100% RBSOA Tested($2 \times I_c$)
- Low Stray Inductance
- Lead Free, Compliant with RoHS Requirement



Applications:

- Industrial Inverters

IGBT, Inverter

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

V_{CES}	Collector-Emitter Blocking Voltage		600	V
V_{GES}	Gate-Emitter Voltage		± 20	V
I_c	Continuous Collector Current	$T_C=80^\circ\text{C}$	20	A
		$T_C=25^\circ\text{C}$	40	A
I_{CM}	Repetitive Peak Collector Current	$T_J=150^\circ\text{C}$	40	A
t_{SC}	Short Circuit Withstand Time		>10	μs
P_D	Maximum Power Dissipation per IGBT	$T_C=25^\circ\text{C}$ $T_{Jmax}=150^\circ\text{C}$	156	W



Electrical Characteristics of IGBT ($T_C=25^\circ\text{C}$ unless otherwise specified)

Static Characteristics

Symbol	Description	Conditions	Min	Typ	Max	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1\text{mA}$, $V_{CE}=V_{GE}$	4.0	4.8	5.8	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=20\text{A}$, $V_{GE}=15\text{V}$	$T_J=25^\circ\text{C}$	2.00		V
			$T_J=125^\circ\text{C}$	2.15		V
I_{CES}	Collector-Emitter Leakage Current	$V_{GE}=0\text{V}$, $V_{CE}=V_{CES}$, $T_J=25^\circ\text{C}$			1	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=\pm 20\text{V}$, $V_{CE}=0\text{V}$, $T_J=25^\circ\text{C}$			200	nA
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$, $f=100\text{kHz}$		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	$V_{CC}=300\text{V}$, $I_C=20\text{A}$, $R_{Gon}=30\Omega$, $V_{GE}=\pm 15\text{V}$, Inductive Load	$T_J=25^\circ\text{C}$		88		ns
			$T_J=125^\circ\text{C}$		96		
t_r	Rise Time		$T_J=25^\circ\text{C}$		28		ns
			$T_J=125^\circ\text{C}$		29		
$t_{d(off)}$	Turn-off Delay Time	$V_{CC}=300\text{V}$, $I_C=20\text{A}$, $R_{Goff}=30\Omega$, $V_{GE}=\pm 15\text{V}$, Inductive Load	$T_J=25^\circ\text{C}$		158		ns
			$T_J=125^\circ\text{C}$		164		
t_f	Fall Time		$T_J=25^\circ\text{C}$		129		ns
			$T_J=125^\circ\text{C}$		167		
E_{on}	Turn-on Switching Loss	$V_{CC}=300\text{V}$, $I_C=20\text{A}$, $R_{Gon}=30\Omega$, $V_{GE}=\pm 15\text{V}$, $di/dt=559\text{A}/\mu\text{s}$ ($T_J=125^\circ\text{C}$) Inductive Load	$T_J=25^\circ\text{C}$		0.48		mJ
			$T_J=125^\circ\text{C}$		0.56		
E_{off}	Turn-off Switching Loss		$T_J=25^\circ\text{C}$		0.22		mJ
			$T_J=125^\circ\text{C}$		0.36		
Q_g	Total Gate Charge	$V_{GE}=\pm 15\text{V} \dots -15\text{V}$	$T_J=25^\circ\text{C}$		121		nC
RBSOA	$I_C=40\text{A}$, $V_{CC}=480\text{V}$, $V_p=600\text{V}$, $R_{Goff}=30\Omega$, $V_{GE}=\pm 15\text{V}$ to 0V , $T_J=125^\circ\text{C}$			Trapezoid			
SCSOA	$V_{CC}=300\text{V}$, $V_{GE}=15\text{V}$, $T_J=125^\circ\text{C}$			10			μs
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-To-Case(Per Leg)					0.80	$^\circ\text{C}/\text{W}$



Diode, Inverter

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

Symbol	Description	Conditions	Min	Typ	Max	Unit
V_{FM}	Forward Voltage	$I_F=20\text{A}$	$T_J=25^\circ\text{C}$	1.50		V
			$T_J=125^\circ\text{C}$	1.55		
I_{rr}	Peak Reverse Recovery Current		$T_J=25^\circ\text{C}$	15.3		A
			$T_J=125^\circ\text{C}$	18.4		
Q_{rr}	Reverse Recovery Charge	$I_F=20\text{A}$, $-di_F/dt=227\text{A}/\mu\text{s}(T_J=125^\circ\text{C})$, $V_{rr}=300\text{V}$, $V_{GE}=-15\text{V}$	$T_J=25^\circ\text{C}$	0.94		μC
			$T_J=125^\circ\text{C}$	1.41		
E_{rec}	Reverse Recovery Energy		$T_J=25^\circ\text{C}$	0.14		mJ
			$T_J=125^\circ\text{C}$	0.31		
$R_{\theta JC}$	Diode Thermal Resistance: Junction-To-Case(Per Leg)				1.75	$^\circ\text{C}/\text{W}$

IGBT, Brake-Chopper

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

V_{CES}	Collector-Emitter Blocking Voltage		600	V
V_{GES}	Gate-Emitter Voltage		± 20	V
I_C	Continuous Collector Current	$T_C=80^\circ\text{C}$	20	A
		$T_C=25^\circ\text{C}$	40	A
I_{CM}	Repetitive Peak Collector Current	$T_J=150^\circ\text{C}$	40	A
t_{SC}	Short Circuit Withstand Time		>10	μs
P_D	Maximum Power Dissipation per IGBT	$T_C=25^\circ\text{C}$ $T_{Jmax}=150^\circ\text{C}$	156	W



Electrical Characteristics of IGBT ($T_C=25^\circ\text{C}$ unless otherwise specified)

Static Characteristics

Symbol	Description	Conditions	Min	Typ	Max	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1\text{mA}, V_{CE}=V_{GE}$	4.0	4.8	5.8	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=20\text{A}, V_{GE}=15\text{V}$	$T_J=25^\circ\text{C}$		2.00	V
			$T_J=125^\circ\text{C}$		2.15	V
I_{CES}	Collector-Emitter Leakage Current	$V_{GE}=0\text{V}, V_{CE}=V_{CES}, T_J=25^\circ\text{C}$			1	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=\pm 20\text{V}, V_{CE}=0\text{V}, T_J=25^\circ\text{C}$			200	nA
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=100\text{kHz}$		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	$V_{CC}=300\text{V}, I_C=20\text{A}, R_{Gon}=30\Omega, V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		88	ns
			$T_J=125^\circ\text{C}$		96	
t_r	Rise Time	$V_{CC}=300\text{V}, I_C=20\text{A}, R_{Gon}=30\Omega, V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		28	ns
			$T_J=125^\circ\text{C}$		29	
$t_{d(off)}$	Turn-off Delay Time	$V_{CC}=300\text{V}, I_C=20\text{A}, R_{Goff}=30\Omega, V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		158	ns
			$T_J=125^\circ\text{C}$		164	
t_f	Fall Time	$V_{CC}=300\text{V}, I_C=20\text{A}, R_{Goff}=30\Omega, V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		129	ns
			$T_J=125^\circ\text{C}$		167	
E_{on}	Turn-on Switching Loss	$V_{CC}=300\text{V}, I_C=20\text{A}, R_{Gon}=30\Omega, V_{GE}=\pm 15\text{V},$ $di/dt=559\text{A}/\mu\text{s} (T_J=125^\circ\text{C})$ Inductive Load	$T_J=25^\circ\text{C}$		0.48	mJ
			$T_J=125^\circ\text{C}$		0.56	
E_{off}	Turn-off Switching Loss	$V_{CC}=300\text{V}, I_C=20\text{A}, R_{Goff}=30\Omega, V_{GE}=\pm 15\text{V},$ $du/dt=3121\text{V}/\mu\text{s} (T_J=125^\circ\text{C})$ Inductive Load	$T_J=25^\circ\text{C}$		0.22	mJ
			$T_J=125^\circ\text{C}$		0.36	
Q_g	Total Gate Charge	$V_{GE}=+15\text{V}\dots-15\text{V}$	$T_J=25^\circ\text{C}$		121	nC
RBSOA	$I_C=40\text{A}, V_{CC}=480\text{V}, V_p=600\text{V}, R_{Goff}=30\Omega, V_{GE}=+15\text{V to } 0\text{V}, T_J=125^\circ\text{C}$			Trapezoid		
SCSOA	$V_{CC}=300\text{V}, V_{GE}=15\text{V}, T_J=125^\circ\text{C}$			10		μs
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-To-Case(Per Leg)				0.80	$^\circ\text{C}/\text{W}$



Diode, Brake-Chopper

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

Symbol	Description	Conditions	Min	Typ	Max	Unit
V_{FM}	Forward Voltage	$I_F=10\text{A}$	$T_J=25^\circ\text{C}$	1.55		V
			$T_J=125^\circ\text{C}$	1.55		
I_{rr}	Peak Reverse Recovery Current		$T_J=25^\circ\text{C}$	26.9		A
			$T_J=125^\circ\text{C}$	28.4		
Q_{rr}	Reverse Recovery Charge	$I_F=10\text{A}$, $-diF/dt = 1066\text{A}/\mu\text{s}(T_J=125^\circ\text{C})$, $V_{rr}=300\text{V}$, $V_{GE}=-15\text{V}$	$T_J=25^\circ\text{C}$	0.47		μC
			$T_J=125^\circ\text{C}$	0.67		
E_{rec}	Reverse Recovery Energy		$T_J=25^\circ\text{C}$	0.05		mJ
			$T_J=125^\circ\text{C}$	0.10		
$R_{\theta JC}$	Diode Thermal Resistance: Junction-To-Case(Per Leg)				2.13	$^\circ\text{C}/\text{W}$

Diode, Rectifier

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

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



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

Symbol	Description	Conditions		Min	Typ	Max	Unit
V_F	Forward Voltage	$I_F=20\text{ A}$	$T_J=25^\circ\text{C}$		1.20		V
			$T_J=150^\circ\text{C}$		1.20		
I_R	Reverse Current	$V_R=1200\text{V}$	$T_J=25^\circ\text{C}$			50	μA
$R_{\theta JC}$	Diode Thermal Resistance: Junction-To-Case					1.02	$^\circ\text{C/W}$

Internal NTC-Thermistor Characteristics

Symbol	Description		Min.	Typ.	Max.	Units.
R_{25}	Rated Resistance	$T_C=25^\circ\text{C}$		5		$\text{k}\Omega$
$\Delta R/R$	Deviation of R_{100}	$T_C=100^\circ\text{C}$, $R_{100}=481\Omega$	-5		5	%
P_{25}	Power Dissipation	$T_C=25^\circ\text{C}$			10	mW
$B_{25/50}$	B-Value	$R_2=R_{25} \exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$		3380		K
$B_{25/80}$	B-Value	$R_2=R_{25} \exp[B_{25/80}(1/T_2-1/(298.15\text{K}))]$		3440		K

Module

Symbol	Description		Min	Typ	Max	Unit
V_{iso}	Isolation Voltage (All Terminals Shorted)	RMS, $f=50\text{Hz}$, 1minute	2500			V
L_{sCE}	Stray Inductance Module			60		nH
T_J	Maximum Junction Temperature				150	$^\circ\text{C}$
T_{JOP}	Maximum Operating Junction Temperature Range		-40		+150	$^\circ\text{C}$
T_{stg}	Storage Temperature		-40		+125	$^\circ\text{C}$
CTI	Comparative Tracking Index		200			
$R_{\theta CS}$	Case-To-Sink Thermally (Conductive Grease Applied)				0.03	$^\circ\text{C/W}$
M	Mounting Torque for Module Mounting	Screw M5--Mounting according to valid application note	3.0		5.0	N·m
G	Weight			190		g

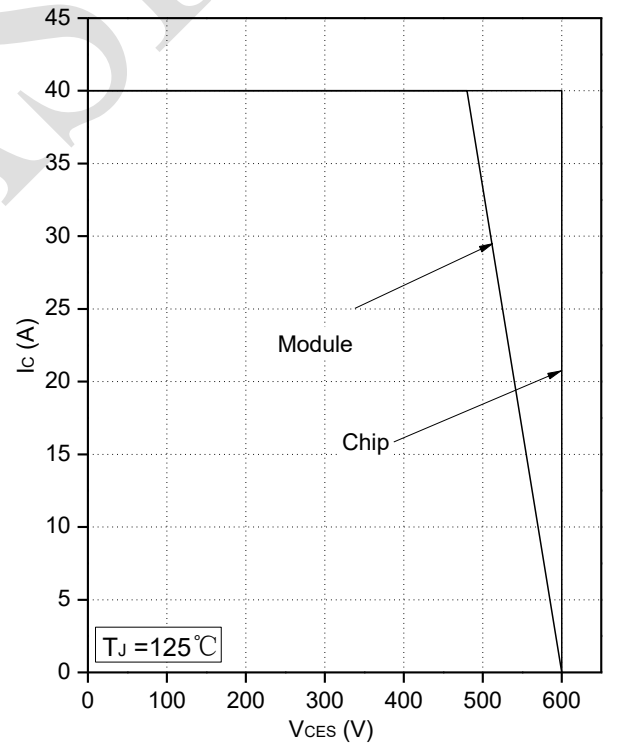
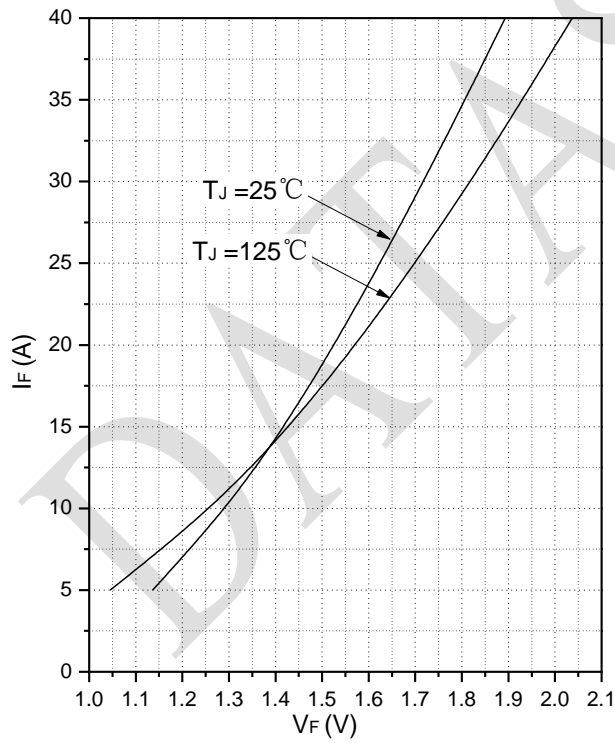
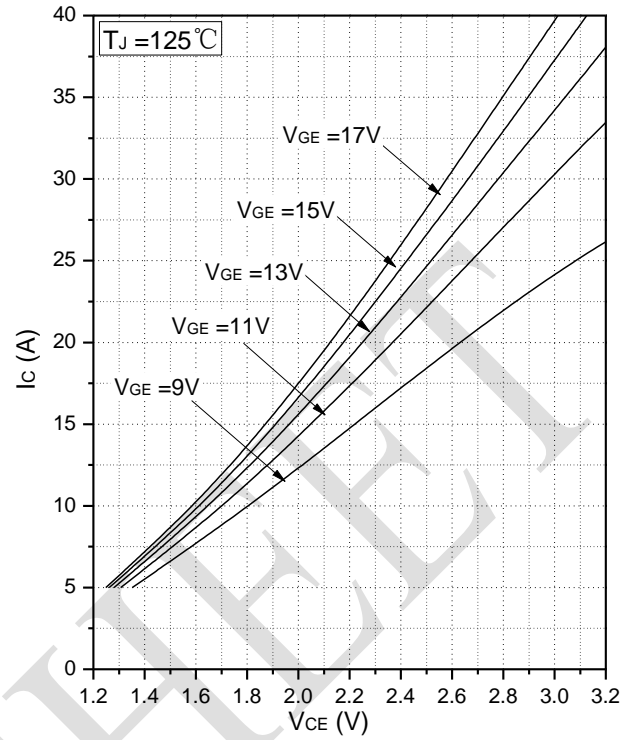
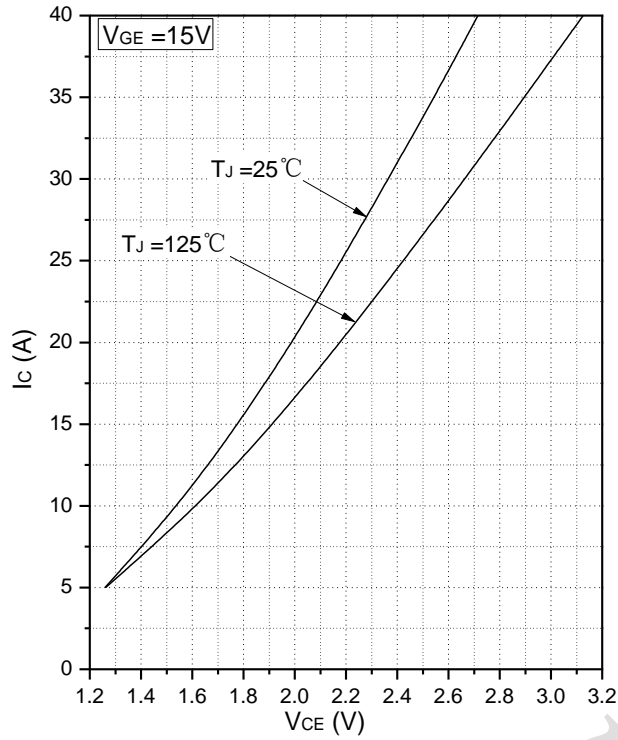


Ordering Information Table

Device code	G	K	20	PI	60	T5	H
	①	②	③	④	⑤	⑥	⑦

- 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)

DATA SHEET



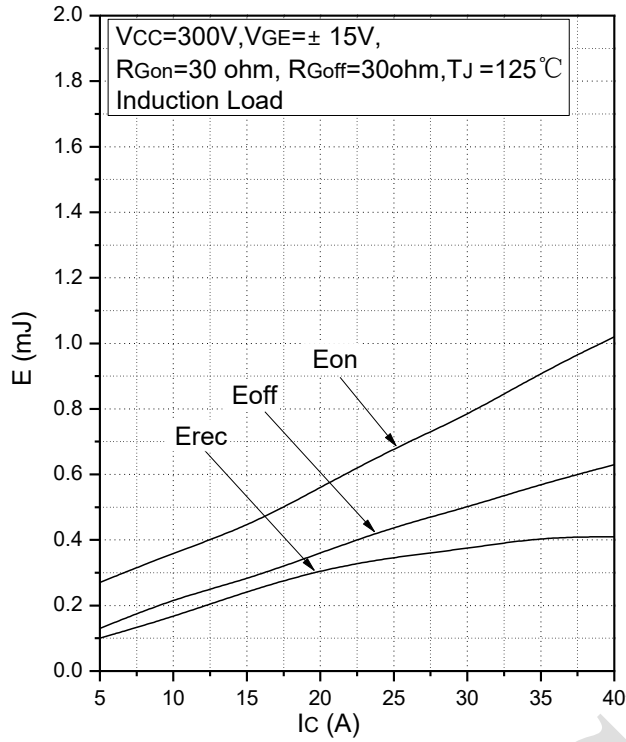


Fig.5 Typical Switching Loss vs. Collector Current

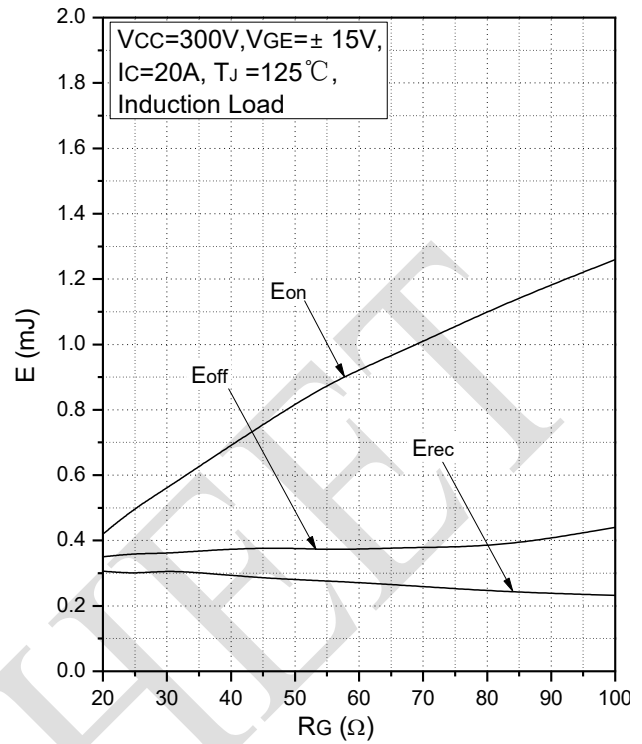


Fig.6 Typical Switching Loss vs. Gate Resistance

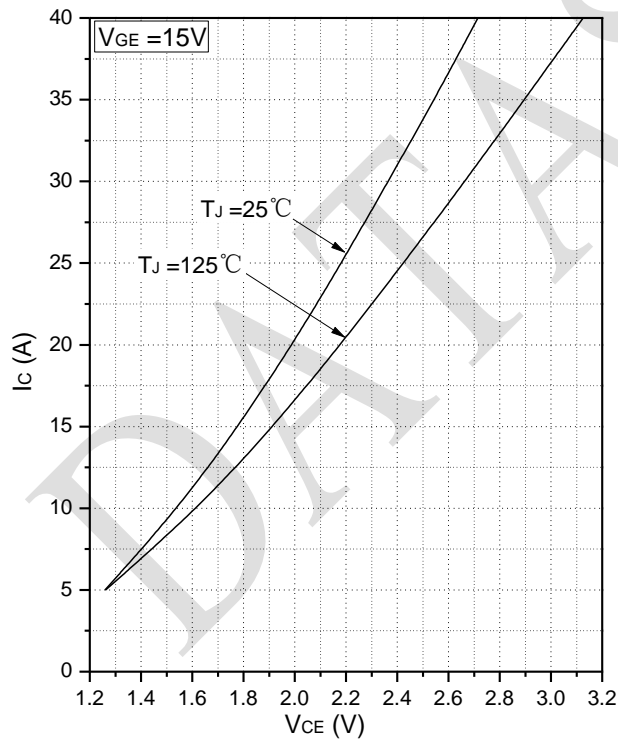


Fig.7 Typical Saturation Voltage Characteristics (Brake-Chopper)

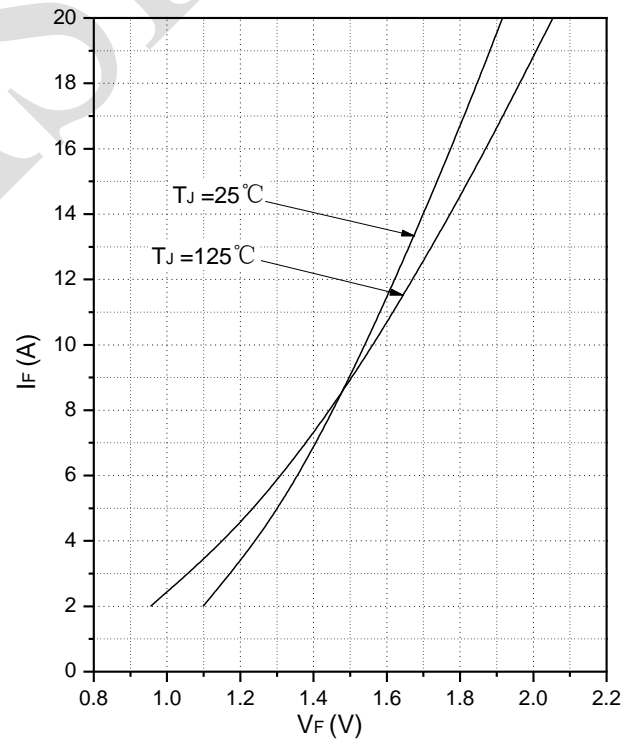


Fig.8 Forward Characteristics of Diode (Brake-Chopper)

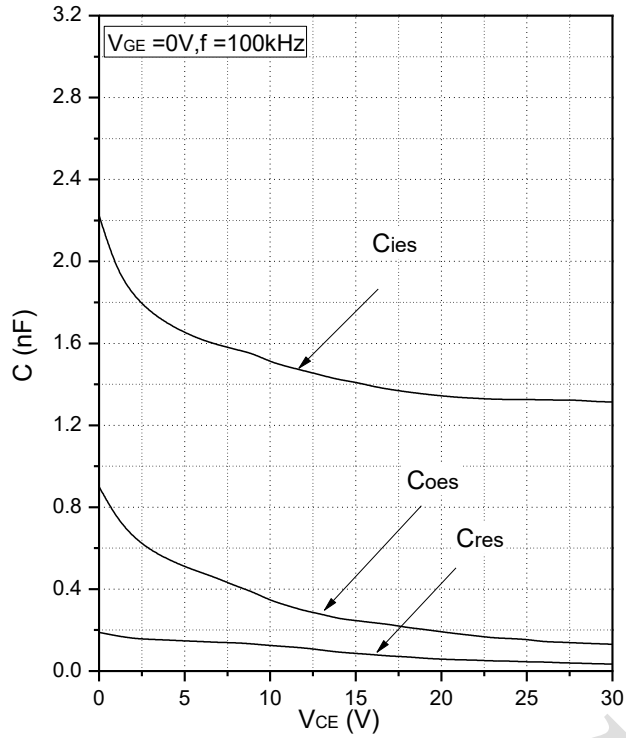


Fig.9 Capacitance Characteristics

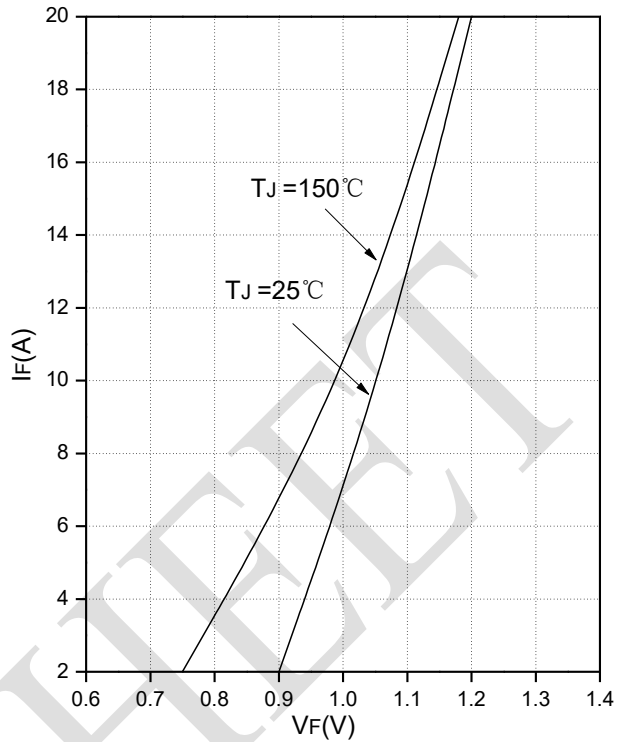


Fig.10 Forward Characteristics of Diode (Rectifier)

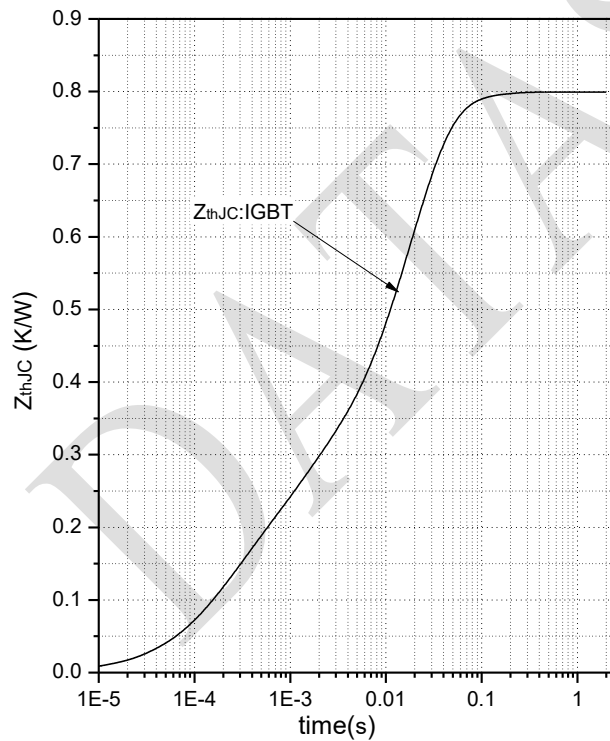


Fig.11 Transient Thermal Impedance IGBT (Inverter)

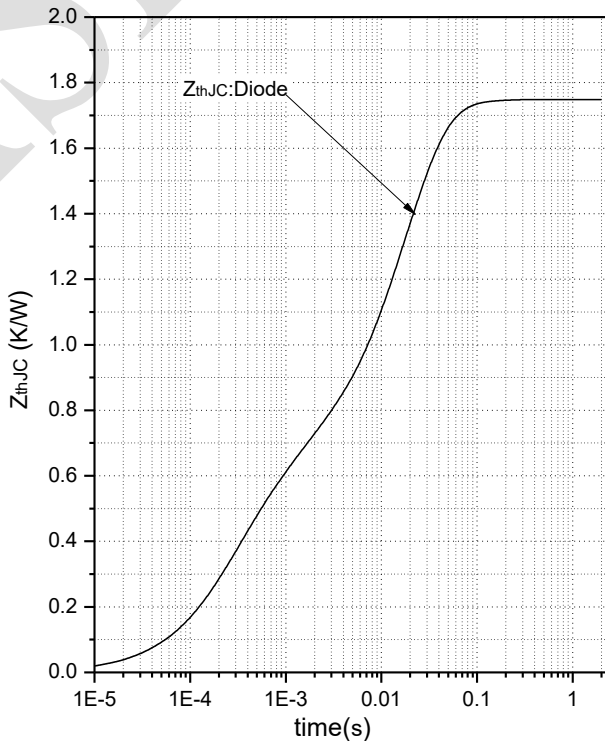


Fig.12 Transient Thermal Impedance Diode (Inverter)

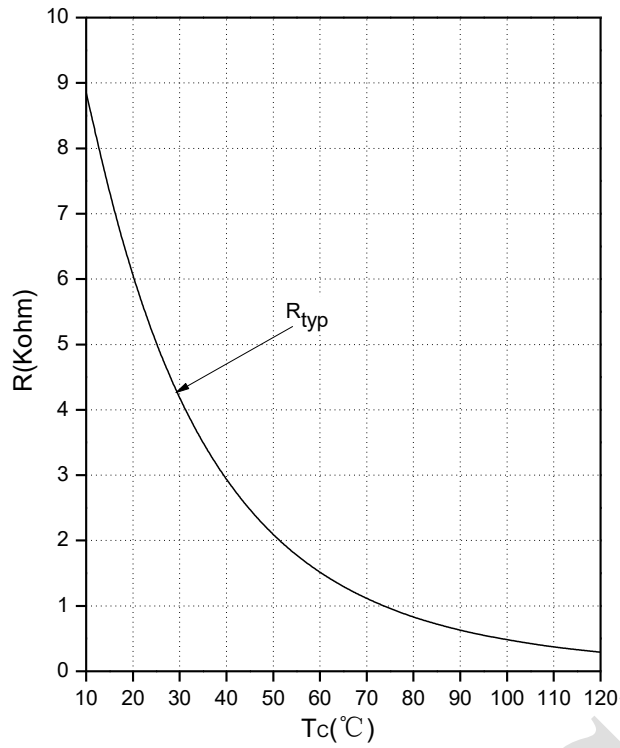
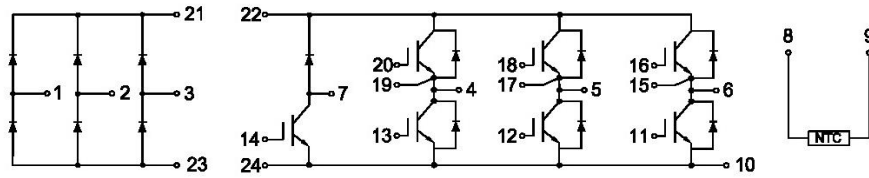


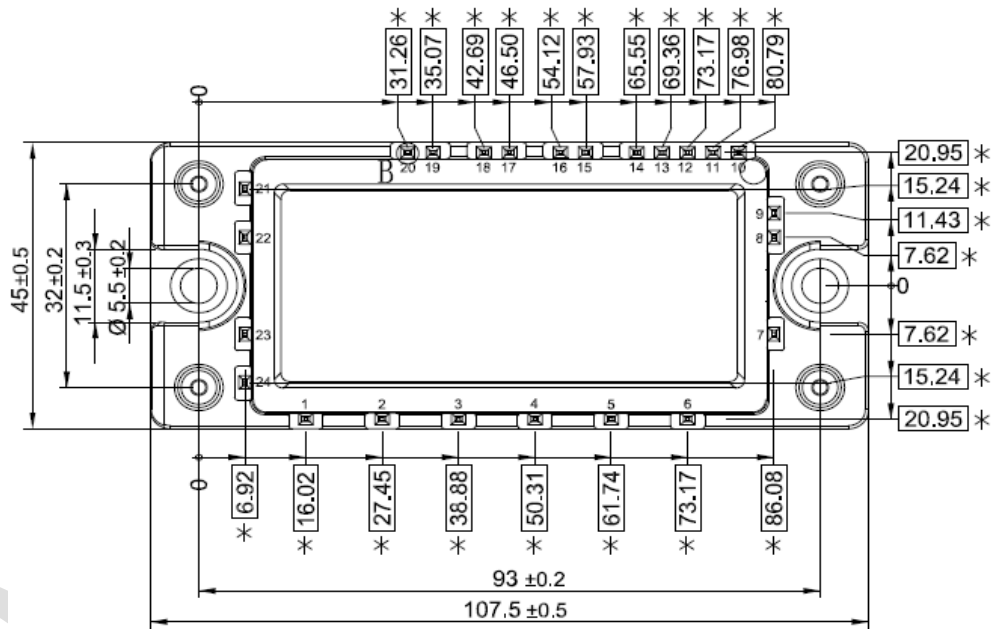
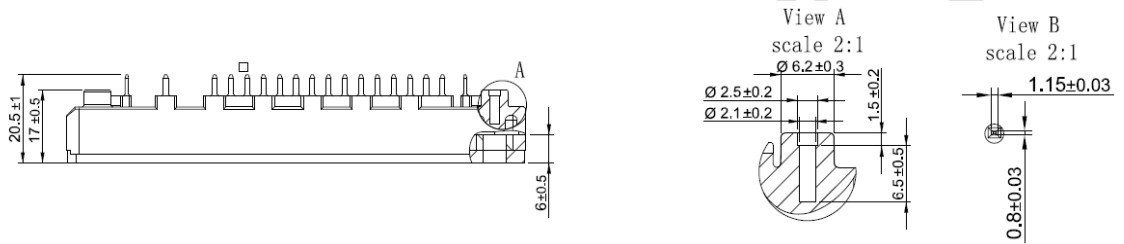
Fig.13 NTC Temperature Characteristics

DATA SHEET

Internal Circuit



Package Outline (Unit: mm):



*=all dimensions with tolerance of ± 0.4



Date	Revision	Notes
01/18/2022	01	Initial Release
02/17/2022	02	Updated the Q_g value
02/24/2022	A	Final Version

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”.