



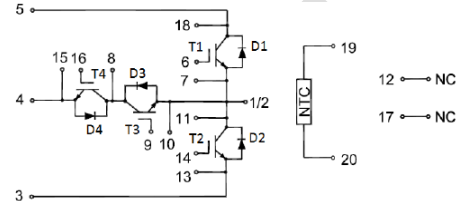
GT200TT120A8H

IGBT Module

Preliminary Data

Features:

- Field Stop Trench Gate IGBT
- Short Circuit Rated > 10μs
- Low Saturation Voltage
- Low Switching Loss
- 100% RBSOA Tested (2xIc)
- Low Stray Inductance
- Lead Free, Compliant with RoHS Requirement



Applications:

- 3-Level-Applications
- Motor Drives
- Solar Applications
- UPS Systems

IGBT, T1/T2

Maximum Rated Values of IGBT (T_C=25°C unless otherwise specified)

V _{CES}	Collector-Emitter Blocking Voltage		1200	V
V _{GES}	Gate-Emitter Voltage		±20	V
I _C	Continuous Collector Current	T _C =100°C	200	A
		T _C =25°C	400	A
I _{CM}	Repetitive Peak Collector Current	T _J =175°C	400	A
t _{sc}	Short Circuit Withstand Time		>10	μs
P _D	Maximum Power Dissipation per IGBT	T _C =25°C	1440	W
		T _{Jmax} =175°C		



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	$I_C=4\text{mA}$, $V_{CE}=V_{GE}$	5.0	5.7	6.8	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=200\text{A}$, $V_{GE}=15\text{V}$	$T_J=25^\circ\text{C}$	1.60		V
			$T_J=125^\circ\text{C}$	1.80		V
			$T_J=150^\circ\text{C}$	1.90		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	$V_{GE}=\pm 20\text{V}$, $V_{CE}=0\text{V}$, $T_J=25^\circ\text{C}$			400	nA
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$, $f=1\text{MHz}$		16.4		nF
C_{oes}	Output Capacitance			1.21		nF
C_{res}	Reverse Transfer Capacitance			0.58		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=600\text{V}$, $I_C=200\text{A}$, $R_{Gon}=2\Omega$, $V_{GE}=\pm 15\text{V}$, Inductive Load	$T_J=25^\circ\text{C}$	0.31		μs
			$T_J=125^\circ\text{C}$	0.31		
			$T_J=150^\circ\text{C}$	0.31		
t_r	Rise Time		$T_J=25^\circ\text{C}$	0.10		μs
			$T_J=125^\circ\text{C}$	0.11		
			$T_J=150^\circ\text{C}$	0.11		
$t_{d(off)}$	Turn-off Delay Time		$T_J=25^\circ\text{C}$	0.31		μs
			$T_J=125^\circ\text{C}$	0.33		
			$T_J=150^\circ\text{C}$	0.34		
t_f	Fall Time	$T_J=25^\circ\text{C}$	0.18		μs	
		$T_J=125^\circ\text{C}$	0.32			
		$T_J=150^\circ\text{C}$	0.34			



E _{on}	Turn-on Switching Loss	V _{CC} = 600V, I _C =200A, R _{Gon} = 2Ω, V _{GE} = ±15V, di/dt=1620A/μs (T _J =150°C) Inductive Load	T _J =25°C	14.7	mJ
			T _J =125°C	18.9	
			T _J =150°C	20.2	
E _{off}	Turn-off Switching Loss	V _{CC} = 600V, I _C =200A, R _{Goff} = 2Ω, V _{GE} = ±15V, du/dt=3765V/μs (T _J =150°C) Inductive Load	T _J =25°C	15.7	mJ
			T _J =125°C	22.7	
			T _J =150°C	24.7	
Q _g	Total Gate Charge	V _{GE} =+15V...-15V	T _J =25°C	1.07	μC
R _{g internal}	Internal Gate Resistance		T _J =25°C	3.3	Ω
RBSOA	I _C =400A, V _{CC} =1050V, V _p =1200V, R _{Goff} = 2Ω, V _{GE} =+15V to 0V, T _J =150°C			Trapezoid	
I _{sc}	SC Data	V _{CC} =600V, V _{GE} =±15V, R _{Gon} =4.7ohm, R _{Goff} =4.7ohm, tp=10us, T _J =150°C, Inductive Load		994	A
R _{θJC}	IGBT Thermal Resistance: Junction-To-Case(per leg)				0.10 °C/W

Diode, D3/D4

Maximum Rated Values (T_C = 25°C unless otherwise specified)

V _{RRM}	Repetitive Peak Reverse Voltage	650	V
I _F	Diode Continuous Forward Current	200	A
I _{FM}	Peak FWD Current Repetitive	400	A

Electrical Characteristics of FWD (T_C=25°C unless otherwise specified)

Symbol	Description	Conditions	Min	Typ	Max	Unit
V _{FM}	Forward Voltage	I _F =200A	T _J =25°C	1.60		V
			T _J =125°C	1.70		
			T _J =150°C	1.70		
t _{rr}	Reverse Recovery Time	I _F =200A, -diF/dt=1550A/μs T _J =150°C, V _R =300V, V _{GE} =-15V	T _J =25°C	122		ns
			T _J =125°C	154		
			T _J =150°C	167		



I _{rr}	Peak Reverse Recovery Current	I _F =200A, -diF/dt=1510A/μs T _J =150°C, V _R =300V, V _{GE} =-15V	T _J =25°C	75	A
			T _J =125°C	96	
			T _J =150°C	103	
Q _{rr}	Reverse Recovery Charge		T _J =25°C	5.54	μC
			T _J =125°C	9.98	
			T _J =150°C	11.48	
E _{rec}	Reverse Recovery Energy		T _J =25°C	0.44	mJ
			T _J =125°C	1.55	
			T _J =150°C	1.92	
R _{θJC}	Diode Thermal Resistance: Junction-To-Case (per leg)			0.25	°C/W

IGBT, T3/T4

Maximum Rated Values (T_C = 25°C unless otherwise specified)

V _{CES}	Collector-Emitter Blocking Voltage		650	V
V _{GES}	Gate-Emitter Voltage		±20	V
I _C	Continuous Collector Current	T _C =100°C	200	A
		T _C =25°C	335	A
I _{CM}	Repetitive Peak Collector Current	T _J =175°C	400	A
t _{sc}	Short Circuit Withstand Time		>10	μs
P _D	Maximum Power Dissipation per IGBT	T _C =25°C T _{Jmax} =175°C	1000	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	$I_C=2\text{mA}$, $V_{CE}=V_{GE}$	5.0	5.9	6.8	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=200\text{A}$, $V_{GE}=15\text{V}$	$T_J=25^\circ\text{C}$	1.50		V
			$T_J=125^\circ\text{C}$	1.60		V
			$T_J=150^\circ\text{C}$	1.65		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	$V_{GE}=\pm 20\text{V}$, $V_{CE}=V_{CES}$, $T_J=25^\circ\text{C}$			400	nA
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$, $f=1\text{MHz}$		14.84		nF
C_{oes}	Output Capacitance			1.04		nF
C_{res}	Reveres Transfer Capacitance			0.61		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=300\text{V}$, $I_C=200\text{A}$, $R_{Gon}=0\Omega$, $V_{GE}=\pm 15\text{V}$, Inductive Load	$T_J=25^\circ\text{C}$		173		ns
			$T_J=125^\circ\text{C}$		166		
			$T_J=150^\circ\text{C}$		164		
t_r	Rise Time		$T_J=25^\circ\text{C}$		105		ns
			$T_J=125^\circ\text{C}$		109		
			$T_J=150^\circ\text{C}$		110		
$t_{d(off)}$	Turn-off Delay Time		$T_J=25^\circ\text{C}$		207		ns
			$T_J=125^\circ\text{C}$		205		
			$T_J=150^\circ\text{C}$		204		
t_f	Fall Time	$T_J=25^\circ\text{C}$		115		ns	
		$T_J=125^\circ\text{C}$		153			
		$T_J=150^\circ\text{C}$		170			



E _{on}	Turn-on Switching Loss	V _{CC} =300V, I _C =200A, R _{Gon} =0Ω, V _{GE} = ±15V, di/dt=1445A/ μ s(T _J =150°C) Inductive Load	T _J =25°C	0.9	mJ
			T _J =125°C	1.29	
			T _J =150°C	1.41	
E _{off}	Turn-off Switching Loss	V _{CC} =300V, I _C =200A, R _{Goff} =0Ω, V _{GE} =±15V, du/dt=4945V/ μ s(T _J =150°C) Inductive Load	T _J =25°C	4.41	mJ
			T _J =125°C	6.45	
			T _J =150°C	6.96	
Q _g	Total Gate Charge	V _{GE} =-15V...+15V	T _J =25°C	1.18	μC
RBSOA	I _C =400A, V _{CC} =600V, V _p =650V, R _{Goff} = 0Ω, V _{GE} =+15V to 0V, T _J =150°C			Trapezoid	
SCSOA	V _{CC} =300V, V _{GE} =15V, T _J =150°C			10	μs
R _{θJC}	IGBT Thermal Resistance: Junction-To-Case (per leg)			0.15	°C/W

Diode, D1/D2

Maximum Rated Values (T_C=25°C unless otherwise specified)

V _{RRM}	Repetitive Peak Reverse Voltage	1200	V
I _F	Diode Continuous Forward Current	200	A
I _{FM}	Peak FWD Current Repetitive	400	A

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

Symbol	Description	Conditions	Min	Typ	Max	Unit
V _{FM}	Forward Voltage	I _F =200A	T _J =25°C	1.60		V
			T _J =125°C	1.70		
			T _J =150°C	1.70		
t _{rr}	Reverse Recovery Time	I _F =200A, -di _F /dt =1855A/μs(T _J =150°C), V _R = 600V, V _{GE} = -15V	T _J =25°C	0.32		μs
			T _J =125°C	0.53		
			T _J =150°C	0.56		



I _{rr}	Peak Reverse Recovery Current	I _F = 200A, -diF/dt = 1855A/μs(T _J = 150°C), V _R = 600V, V _{GE} = -15V	T _J = 25°C	128	A
			T _J = 125°C	144	
			T _J = 150°C	150	
Q _{rr}	Reverse Recovery Charge		T _J = 25°C	20.7	μC
			T _J = 125°C	34.5	
			T _J = 150°C	38.8	
E _{rec}	Reverse Recovery Energy		T _J = 25°C	8.5	mJ
			T _J = 125°C	14.1	
			T _J = 150°C	16.5	
R _{θJC}	Diode Thermal Resistance: Junction-To-Case (per leg)			0.17	°C/W

Internal NTC-Thermistor Characteristics

R ₂₅	T _C = 25°C	5		kΩ
ΔR/R	T _C = 100°C, R ₁₀₀ = 481Ω		±5	%
P ₂₅	T _C = 25°C	10		mW
B _{25/50}	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298.15K))]$	3380		K
B _{25/80}	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298.15K))]$	3440		K



Module

Symbol	Description	Min	Typ	Max	Unit
V _{iso}	Isolation Voltage (All Terminals Shorted)	RMS, f = 50Hz, 1minute	2500		V
Internal Isolation		Al2O3			
Material of Module Base plate		Copper			
T _J	Maximum Junction Temperature			175	°C
T _{JOP}	Maximum Operating Junction Temperature Range	-40		+150	°C
T _{stg}	Storage Temperature	-40		+125	°C
CTI	Comparative Tracking Index	200			
R _{ecs}	Case-To-Sink Thermally (Conductive Grease Applied)			0.02	°C/W
M	Power Terminals Connection Torque (Screw M6)	3.0		6.0	N·m
M	Mounting Torque for Module Mounting (Screw M5)	3.0		6.0	N·m
G	Weight		390		g

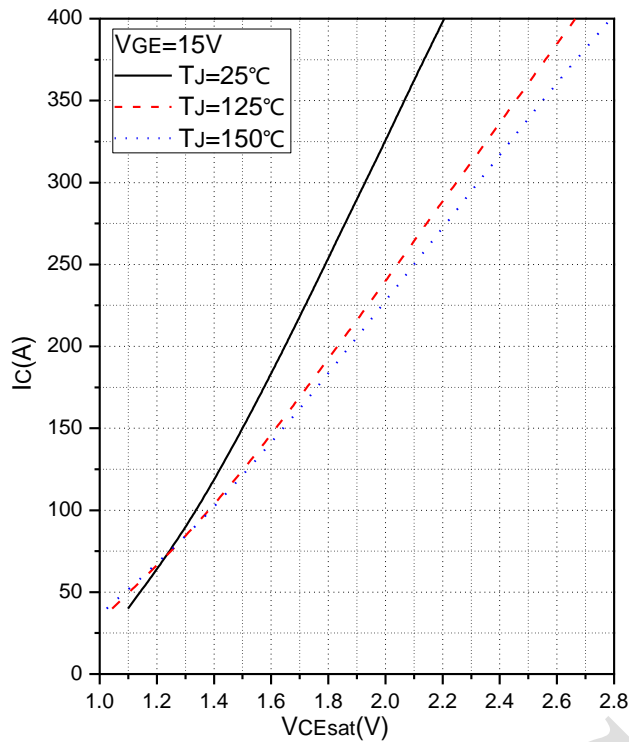


Fig.1 Typical Saturation Voltage Characteristics (IGBT T1/T2)

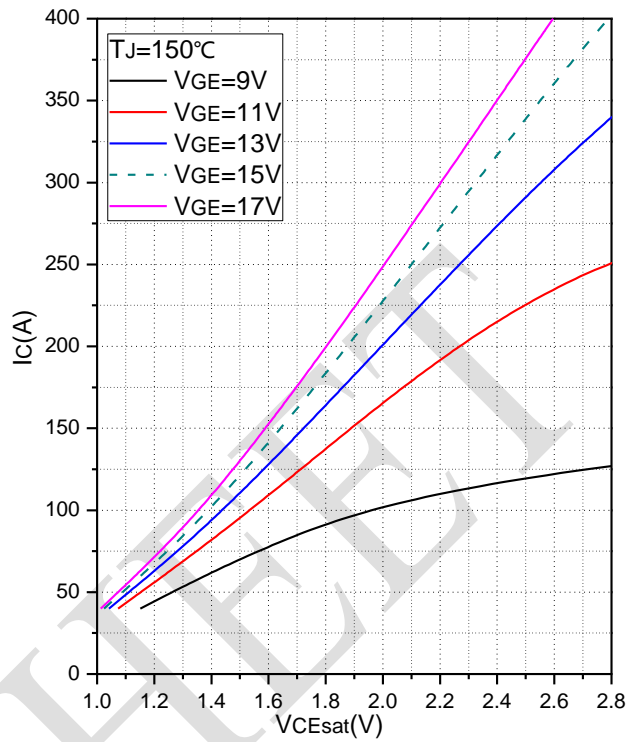


Fig.2 Typical Output Characteristics (IGBT T1/T2)

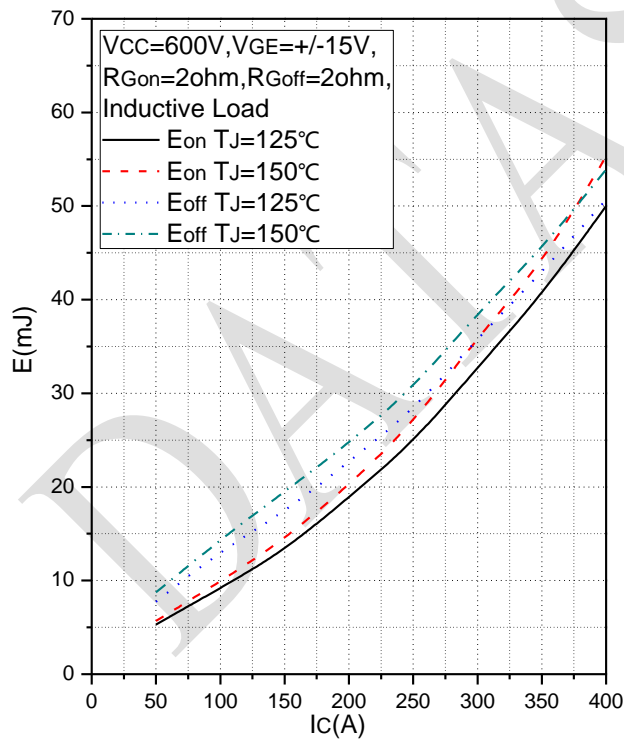


Fig.3 Typical Switching Loss vs. Collector Current (IGBT T1/T2)

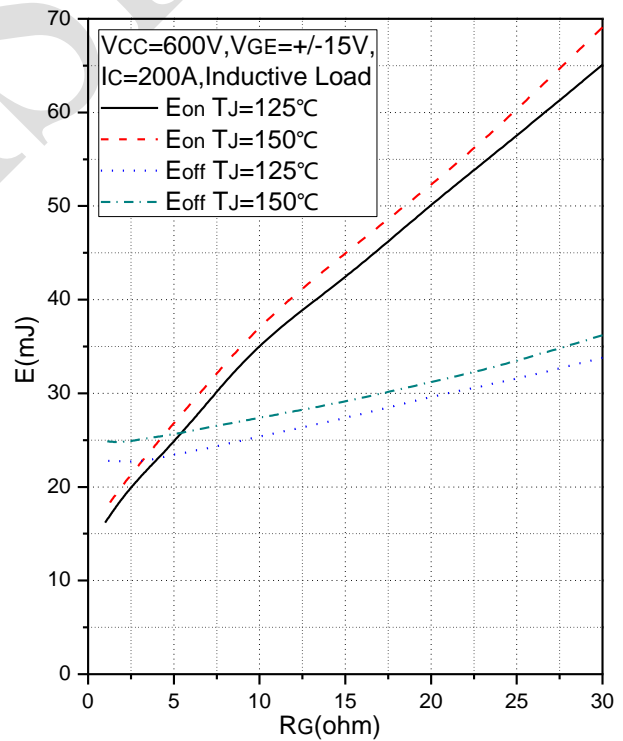


Fig.4 Typical Switching Loss vs. Gate Resistance (IGBT T1/T2)

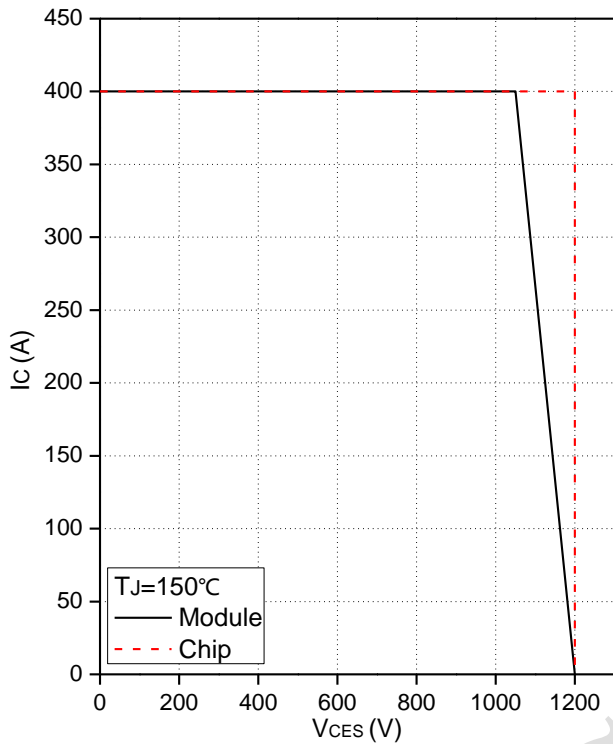


Fig.5 Reverse Bias Safe Operation Area (RBSOA) (IGBT T1/T2)

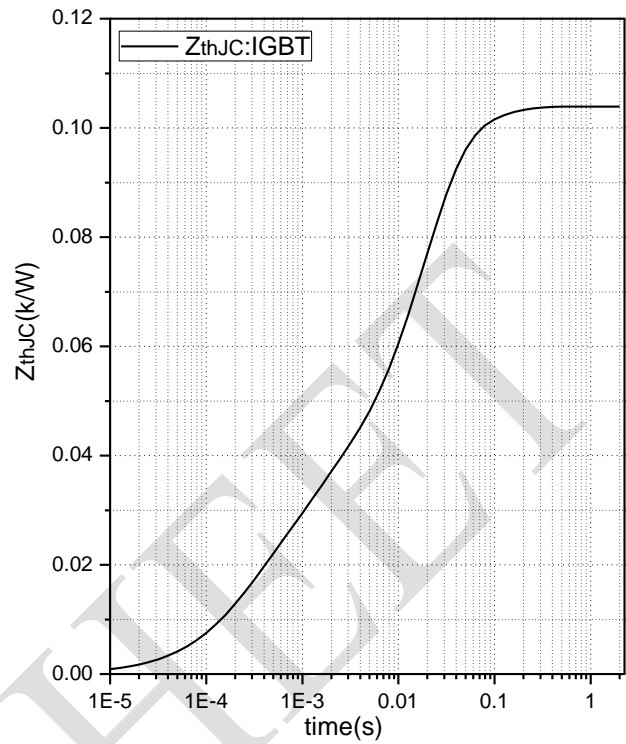


Fig.6 Transient Thermal Impedance (IGBT T1/T2)

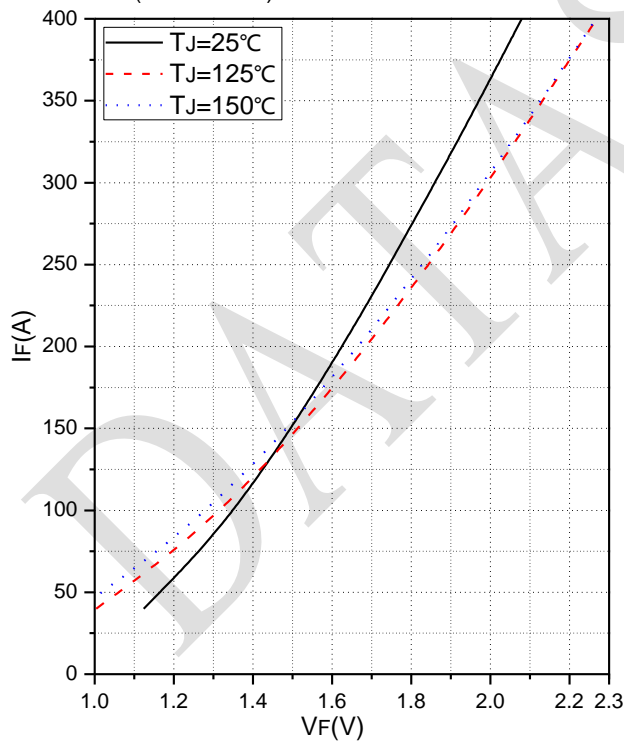


Fig.7 Forward Characteristics of Diode (Diode D3/D4)

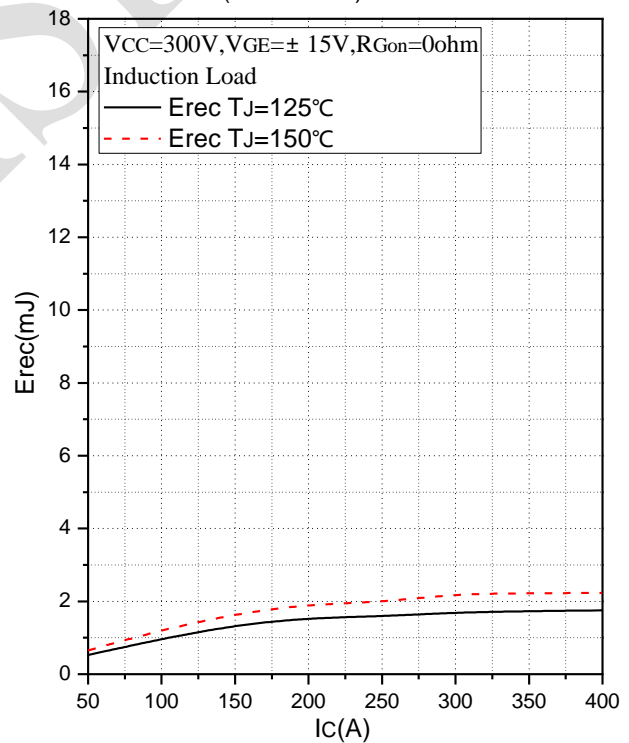


Fig.8 Typical Switching Loss vs. Collector Current (Diode D3/D4)

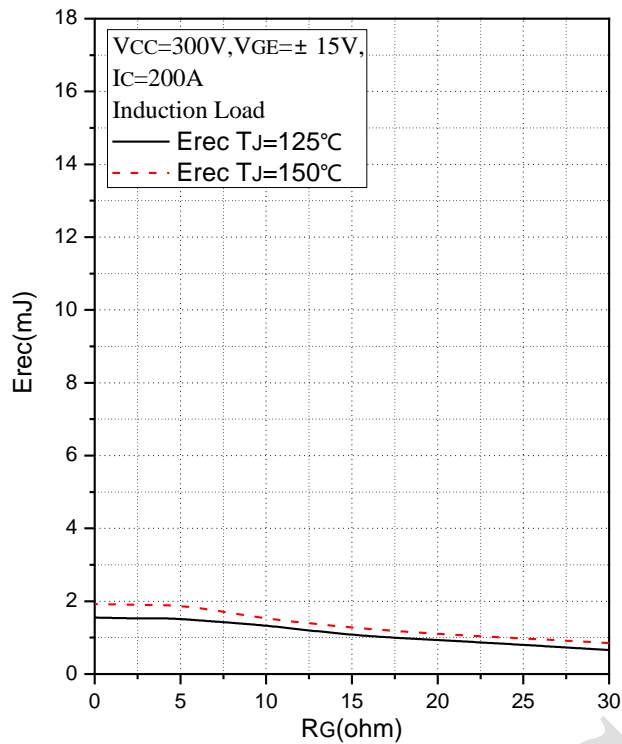


Fig.9 Typical Switching Loss vs. Gate Resistance (Diode D3/D4)

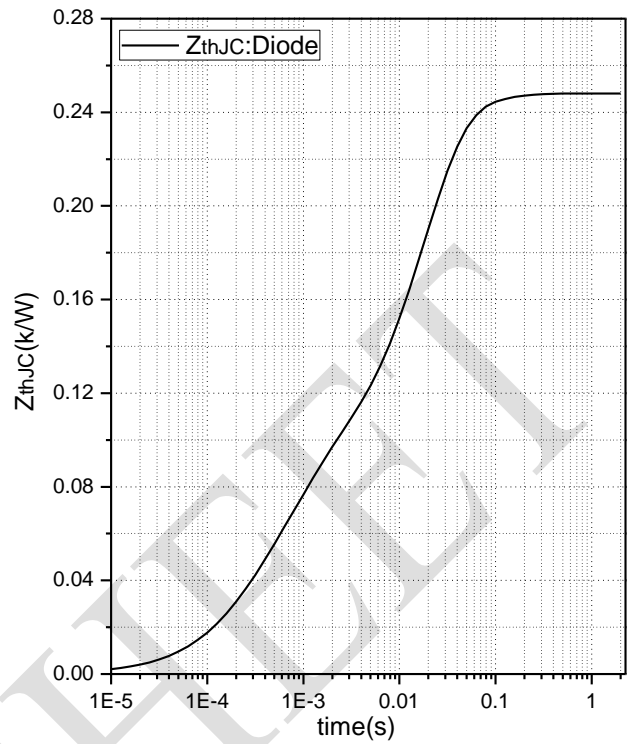


Fig.10 Transient Thermal Impedance (Diode D3/D4)

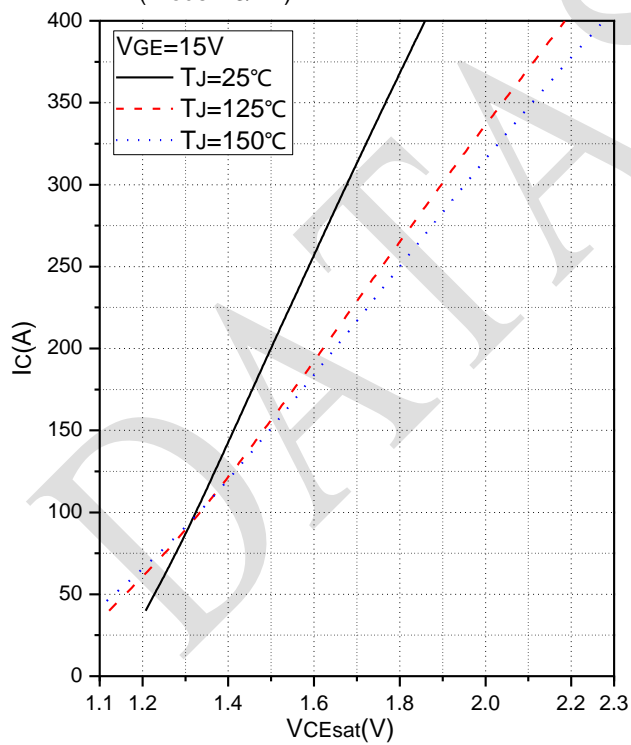


Fig.11 Typical Saturation Voltage Characteristics (IGBT T3/T4)

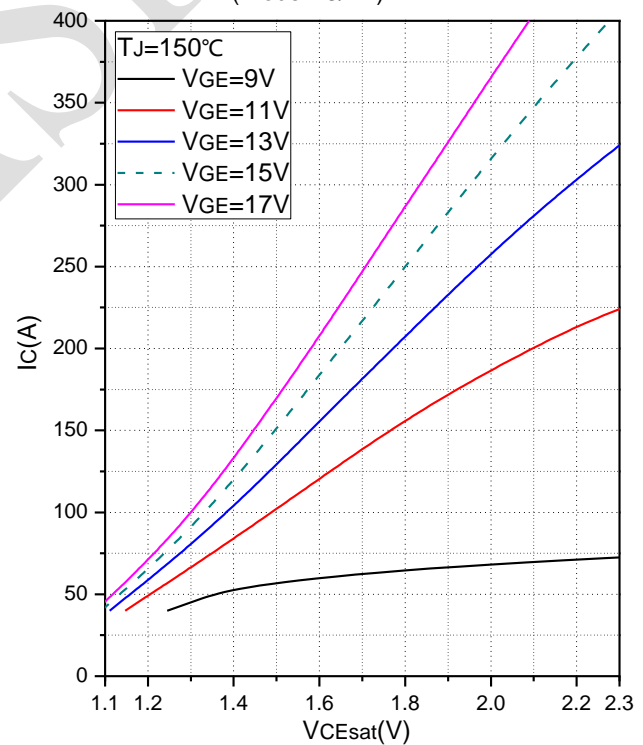


Fig.12 Typical Output Characteristics (IGBT T3/T4)

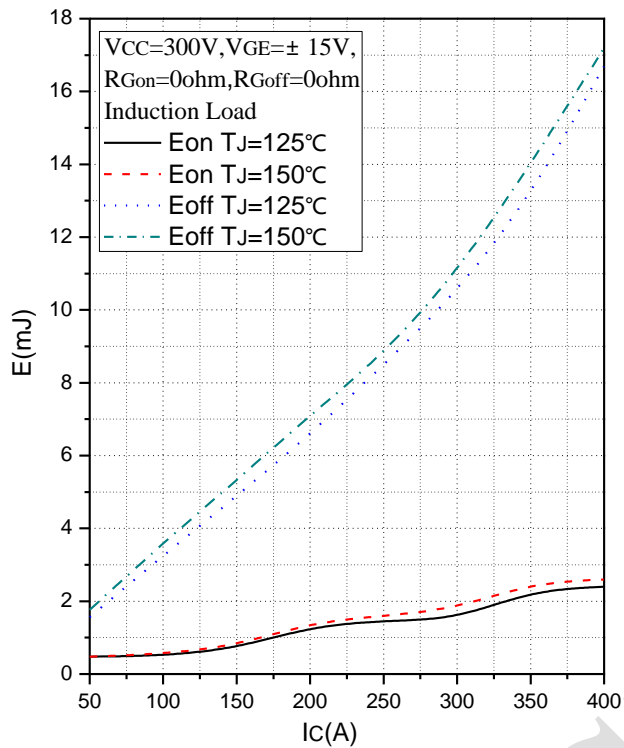


Fig.13 Typical Switching Loss vs. Collector Current (IGBT T3/T4)

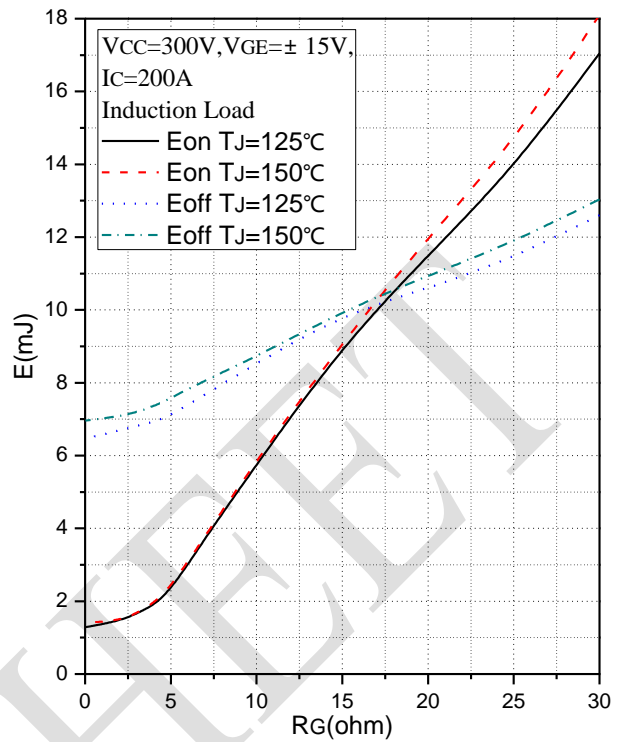


Fig.14 Typical Switching Loss vs. Gate Resistance (IGBT T3/T4)

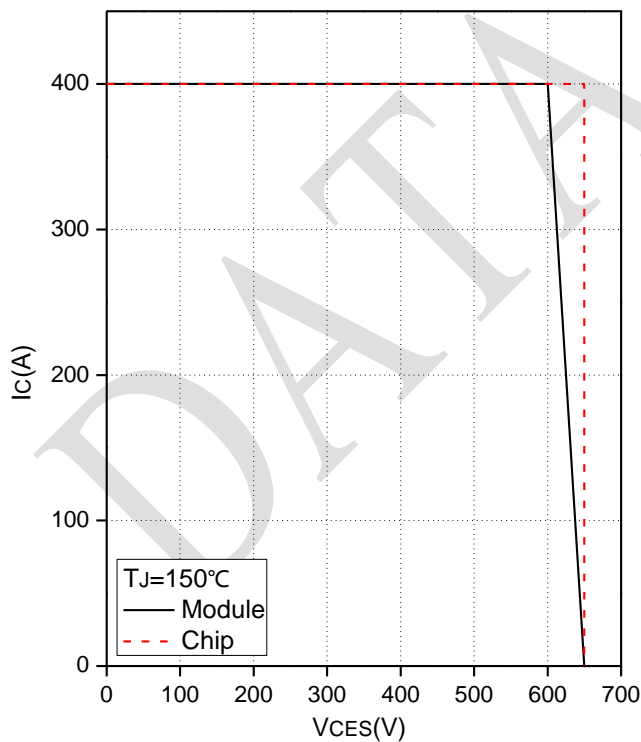


Fig.15 Reverse Bias Safe Operation Area (RBSOA) (IGBT T3/T4)

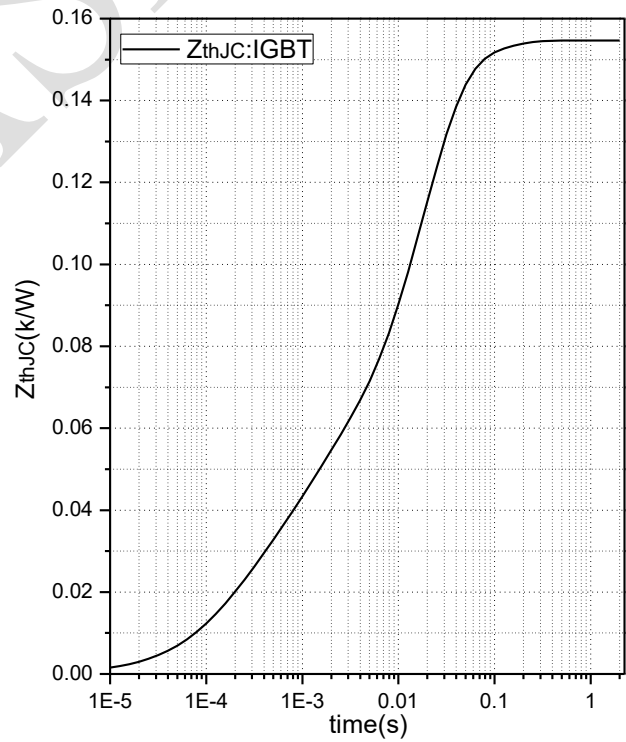


Fig.16 Transient Thermal Impedance (IGBT T3/T4)

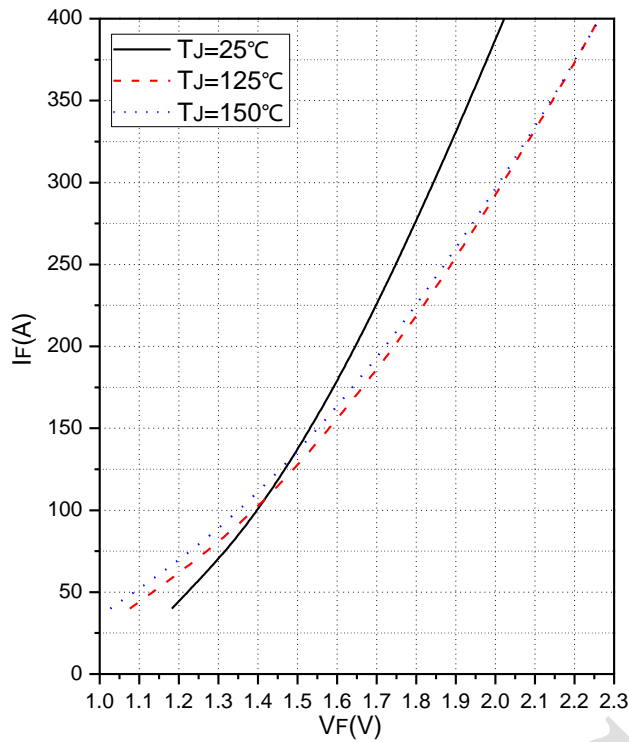


Fig.17 Forward Characteristics (Diode D1/D2)

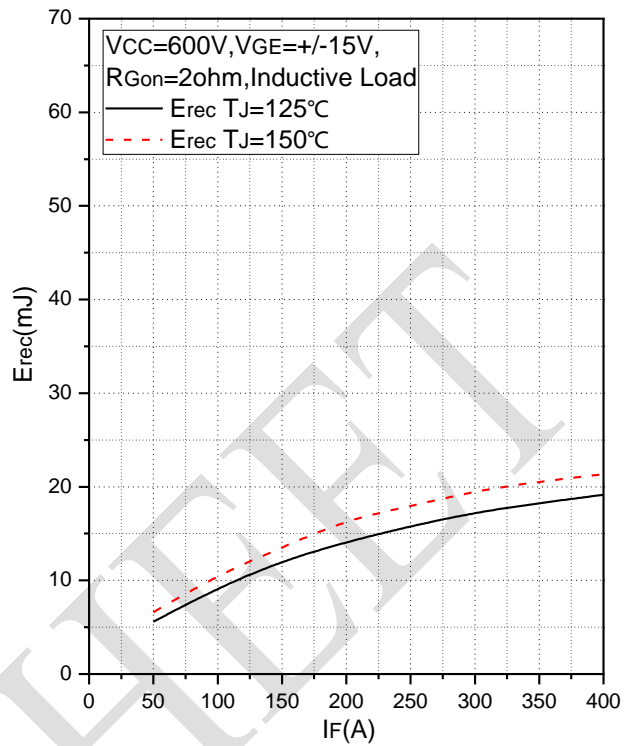


Fig.18 Typical Switching Loss vs. Collector Current (Diode D1/D2)

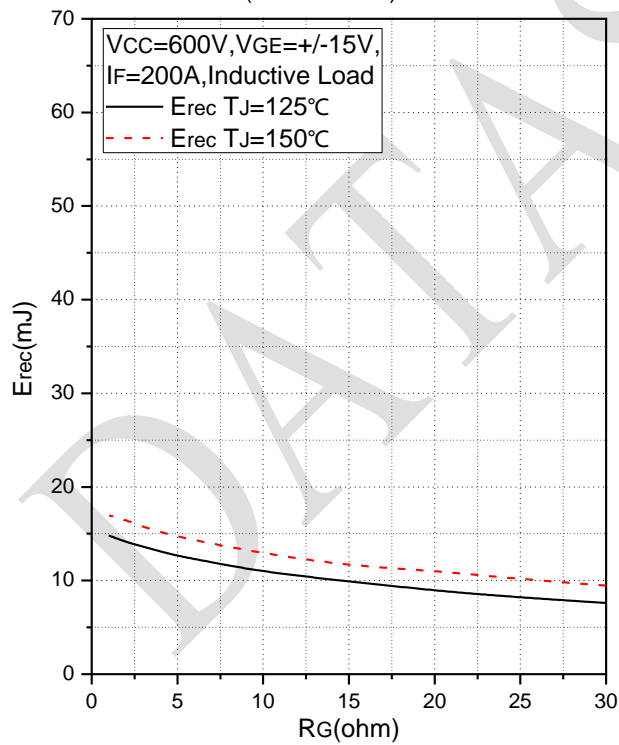


Fig.19 Typical Switching Loss vs. Gate Resistance (Diode D1/D2)

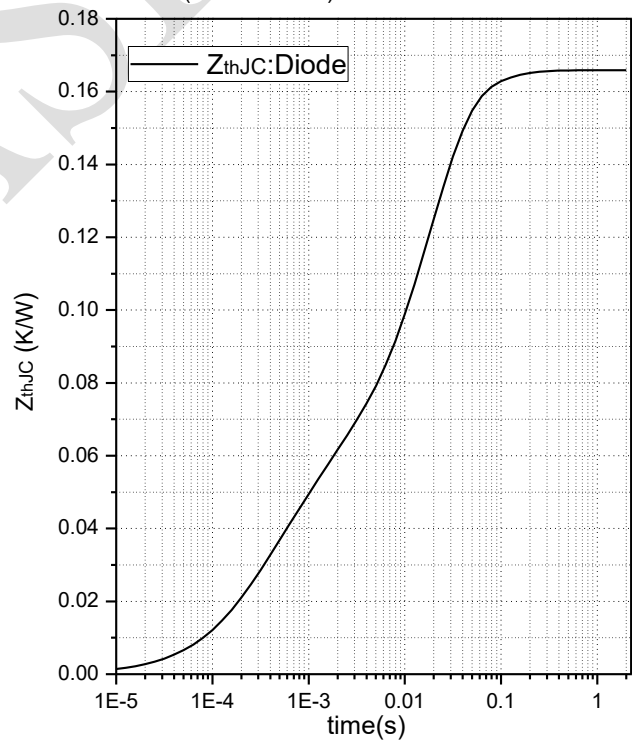


Fig.20 Transient Thermal Impedance (Diode D1/D2)

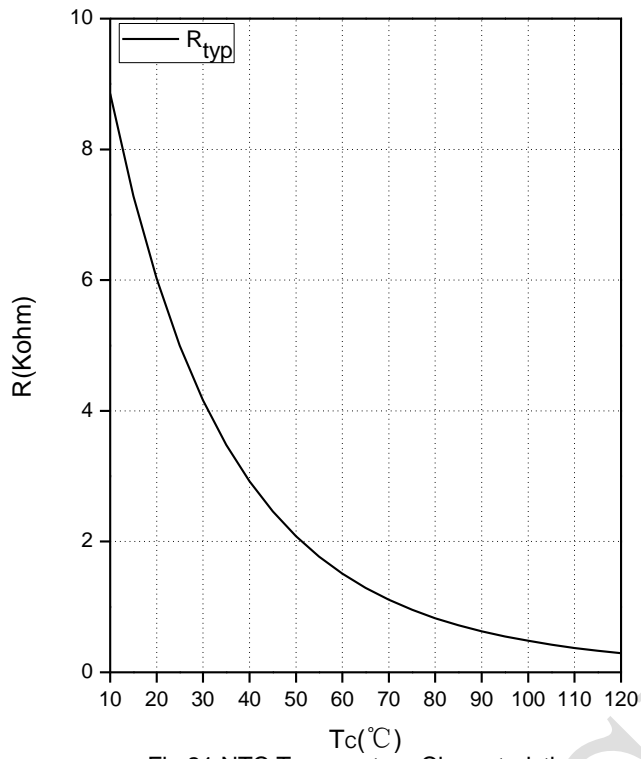
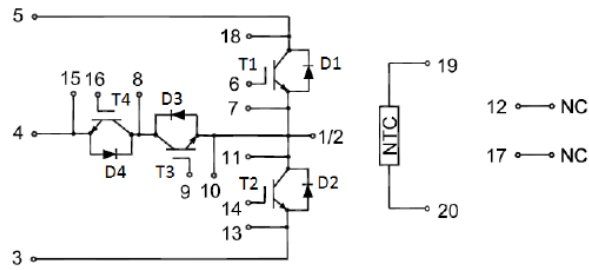


Fig.21 NTC Temperature Characteristics

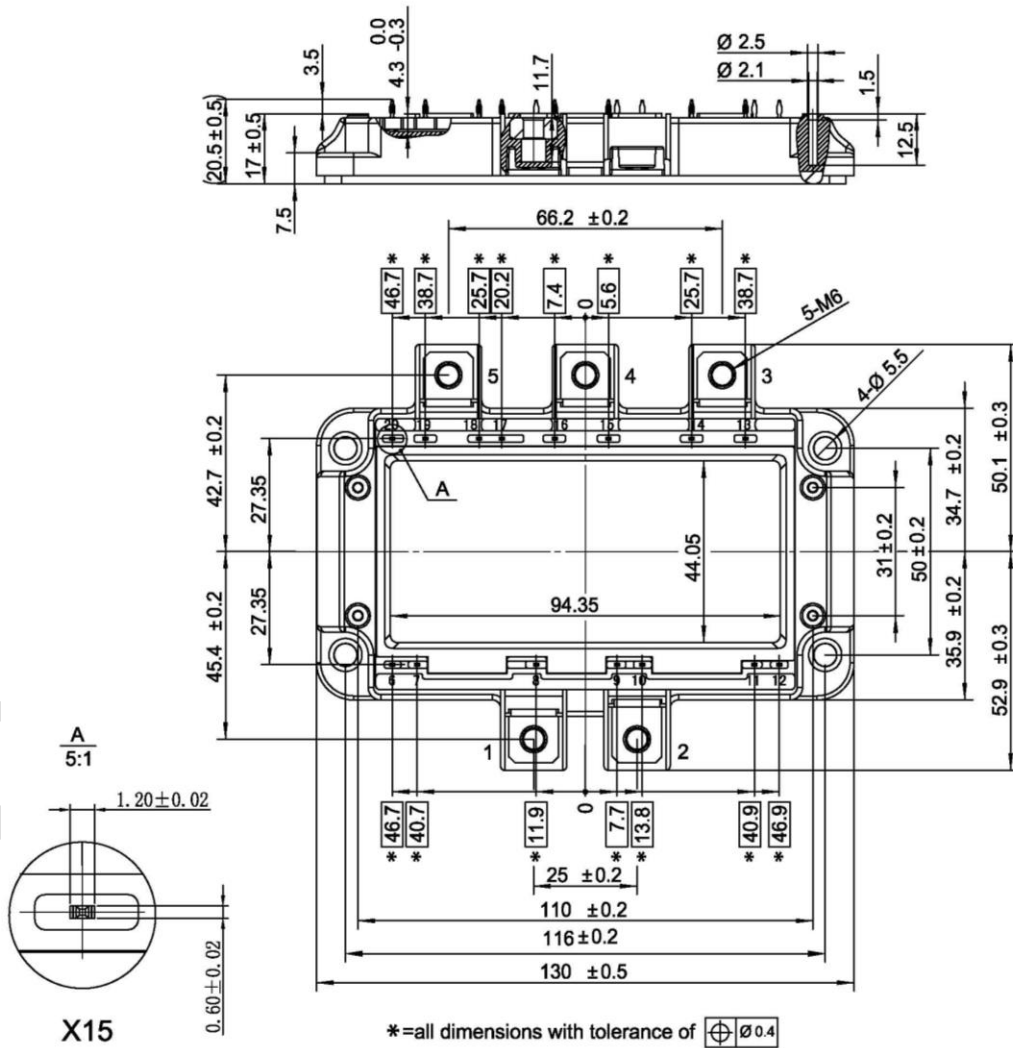
DATA SHEET



Internal Circuit



Package Outline (Unit: mm):





Date	Revision	Notes
05/21/2020	01	Initial Release

Announcement

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DATA SHEET