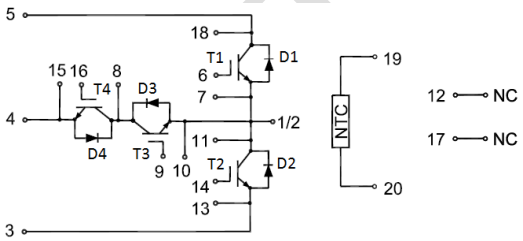
GT400TT120A8H

IGBT Module

Features：

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

Circuit Diagram



Applications：

- Solar Applications
- UPS Systems

IGBT, Buck Switch

Maximum Rated Values (T_C=25℃ 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℃	400	A
		T_C=25℃	800	A
I_{CM}	Repetitive Peak Collector Current	T_J=175℃	800	A
t_{SC}	Short Circuit Withstand Time		>10	μs
P_D	Maximum Power Dissipation per IGBT	T_C=25℃ T_{Jmax}=175℃	2580	W

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

Static Characteristics

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=4mA, V_{CE}=V_{GE}		5.0	5.6	6.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=400A, V_{GE}=15V	T_J=25℃		1.75	1.95	V
			T_J=125℃		1.95		V
			T_J=150℃		2.00		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℃				400	nA
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f=100kHz			33.0		nF
C_{oes}	Output Capacitance				2.42		nF
C_{res}	Reverse Transfer Capacitance				1.35		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	V_{CC}=600V, I_C=400A, R_{Gon}=1Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		435		ns
			T_J=125℃		446		
			T_J=150℃		453		
t_r	Rise Time		T_J=25℃		153		ns
			T_J=125℃		167		
			T_J=150℃		163		
$t_{d(off)}$	Turn-off Delay Time	V_{CC}=600V, I_C=400A, R_{Goff}=1Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		435		ns
			T_J=125℃		465		
			T_J=150℃		468		
t_f	Fall Time		T_J=25℃		116		ns
			T_J=125℃		163		
			T_J=150℃		181		
E_{on}	Turn-on Switching Loss	V_{CC}=600V, I_C=400A, R_{Gon}=1Ω, V_{GE}=±15V, di/dt=2056A/μs (T_J=150℃) Inductive Load	T_J=25℃		28.0		mJ
			T_J=125℃		39.8		
			T_J=150℃		42.7		

E_{off}	Turn-off Switching Loss	V_{CC}=600V, I_C=400A, R_{Goff}=1Ω, V_{GE}=±15V, du/dt=3115V/μs (T_J=150℃) Inductive Load	T_J=25℃		39.1		mJ
			T_J=125℃		51.2		
			T_J=150℃		54.6		
Q_g	Total Gate Charge	V_{GE}=+15V…-15V	T_J=25℃		2.18		μC
$R_{g\ internal}$	Internal gate resistance		T_J=25℃		1.65		Ω
RBSOA	I_C=800A,V_{CC}=1050V, Vp=1200V, R_{Goff} = 1Ω, V_{GE}=+15V to 0V, T_J =125°C			Trapezoid			
I_{SC}	V_{GE}=±15V,V_{CC}=600V, R_{Gon}=1Ω, R_{Goff}=1Ω, tp=10us, T_J=150℃ Inductive Load				1931		A
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-to-Case (per IGBT)					0.058	℃/W

Buck Diode

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

V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	400	A
I_{FM}	Diode Maximum Forward Current	800	A

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

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V_{FM}	Forward Voltage	I_F=400A	T_J=25℃		1.80		V
			T_J=125℃		1.75		
			T_J=150℃		1.75		
I_{rr}	Peak Reverse Recovery Current	I_F=400A, di/dt =1500A/μs (T_J=150℃), V_{rr}=300V, V_{GE}=-15V	T_J=25℃		59		A
			T_J=125℃		108		
			T_J=150℃		119		
t_{rr}	Reverse Recovery Time		T_J=25℃		185		ns
			T_J=125℃		268		
			T_J=150℃		298		
Q_{rr}	Reverse Recovery Charge		T_J=25℃		6.9		μC
			T_J=125℃		17.5		
			T_J=150℃		21.1		

E_{rec}	Reverse Recovery Energy	I_F=400A, di/dt =1500A/μs (T_J=150℃), V_{rr}=300V, V_{GE}=-15V	T_J=25℃		1.3		mJ
			T_J=125℃		3.5		
			T_J=150℃		4.7		
$R_{\theta JC}$	Diode Thermal Resistance: Junction-to-Case (per Diode)					0.179	℃/W

IGBT, Boost Switch

Maximum Rated Values (T_C=25℃ 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℃	400	A
		T_C=25℃	800	A
I_{CM}	Repetitive Peak Collector Current	T_J=175℃	800	A
t_{SC}	Short Circuit Withstand Time		>5	μs
P_D	Maximum Power Dissipation per IGBT	T_C=25℃ T_{Jmax}=175℃	1640	W

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

Static Characteristics

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=9.6mA, V_{CE}=V_{GE}		5.0	5.9	6.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=400A, V_{GE}=15V	T_J=25℃		1.60	1.90	V
			T_J=125℃		1.65		V
			T_J=150℃		1.65		V
I_{CES}	Collector-Emitter Leakage Current	V_{GE}=0V, V_{CE}=V_{CES}				1	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=±20V, V_{CE}=0V				400	nA
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f=100kHz			31.6		nF
C_{oes}	Output Capacitance				1.93		nF
C_{res}	Reverse Transfer Capacitance				1.32		nF

Switching Characteristics

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-on Delay Time	V_{CC}=300V, I_C=400A, R_{Gon}=2Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		410		ns
			T_J=125℃		437		
			T_J=150℃		438		
t_r	Rise Time		T_J=25℃		260		ns
			T_J=125℃		255		
			T_J=150℃		249		
$t_{d(off)}$	Turn-off Delay Time	V_{CC}=300V, I_C=400A, R_{Goff}=2Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		444		ns
			T_J=125℃		429		
			T_J=150℃		424		
t_f	Fall Time		T_J=25℃		132		ns
			T_J=125℃		167		
			T_J=150℃		181		
E_{on}	Turn-on Switching Loss	V_{CC}=300V, I_C=400A, R_{Gon}=2Ω, V_{GE}=±15V, di/dt=1340A/μs(T_J=150℃), Inductive Load	T_J=25℃		3.6		mJ
			T_J=125℃		6.3		
			T_J=150℃		6.8		
E_{off}	Turn-off Switching Loss	V_{CC}=300V, I_C=400A, R_{Goff}=2Ω, V_{GE}=±15V, du/dt=2100V/μs(T_J=150℃), Inductive Load	T_J=25℃		14.0		mJ
			T_J=125℃		27.8		
			T_J=150℃		28.0		
Q_g	Total Gate Charge	V_{GE}=+15V…-15V	T_J=25℃		2.24		μC
$R_{g\ internal}$	Internal Gate Resistor		T_J=25℃		0		Ω
RBSOA	I_C=800A, V_{CC}=600V, V_p=650V, R_G=2Ω, V_{GE}=+15V to 0V, T_J=125℃			Trapezoid			
SCSOA	Vcc=300V, t_p=10us, V_{GE}=+/-15V, R_G=2Ω, T_J=150℃			10			μs
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-to-Case (per IGBT)					0.091	℃/W

Boost Diode

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

V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	400	A
I_{FM}	Diode Maximum Forward Current	800	A

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

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V_{FM}	Forward Voltage	I_F=400A	T_J=25℃		1.40		V
			T_J=125℃		1.50		
			T_J=150℃		1.45		
t_{rr}	Reverse Recovery Time	I_F=400A, -diF/dt =2380A/μs (T_J=150℃), V_R=600V, V_{GE}=-15V	T_J=25℃		0.46		μs
			T_J=125℃		0.66		
			T_J=150℃		0.74		
I_{rr}	Peak Reverse Recovery Current		T_J=25℃		263		A
			T_J=125℃		300		
			T_J=150℃		306		
Q_{rr}	Reverse Recovery Charge		T_J=25℃		64		μC
			T_J=125℃		101		
			T_J=150℃		115		
E_{rec}	Reverse Recovery Energy		T_J=25℃		28.9		mJ
			T_J=125℃		44.8		
			T_J=150℃		51.4		
$R_{\theta JC}$	Diode Thermal Resistance: Junction-to-Case (per Diode)					0.097	℃/W

Internal NTC-Thermistor Characteristics

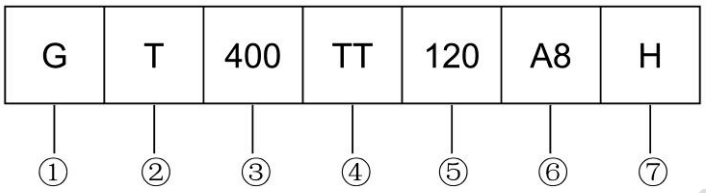
R_{25}	T_C=25℃	5		kΩ
△R/R	T_C=100℃, R_{100}=481Ω		±5	%
P_{25}	T_C=25℃	10		mW
$B_{25/50}$	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$	3380		K
$B_{25/80}$	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15K))]$	3440		K

Module

Symbol	Description		Min.	Typ.	Max.	Units
V_{ISO}	Isolation Voltage (All Terminals Shorted)	f=50Hz, 1minute	2500			V
Internal Isolation				Al_2O_3		
d_{creep}	Creepage Distance: Terminal to Baseplate				25	mm
	Creepage Distance: Terminal to Terminal				12.5	mm
d_{clear}	Clearance Distance: Terminal to Baseplate				11	mm
	Clearance Distance: Terminal to Terminal				7	mm
L_{SCE}	Stray Inductance Module	Measured between terminals 2 and 3			38	nH
T_J	Maximum Junction Temperature				175	℃
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)				0.03	℃/W
M	Power Terminals Screw:M6		3.0		6.0	N·m
M	Mounting Screw:M5		3.0		6.0	N·m
G	Weight			390		g

Ordering Information Table

Device code



① - IGBT Module
② - Trench, Low Switching Losses IGBT
③ - Rated Current (400=400A)
④ - Circuit Configuration (Three Level, T Type)
⑤ - Rated Voltage (120=1200V)
⑥ - Package Type
⑦ - Test Level (Pass the Important Reliability Test-Industrial Grade)

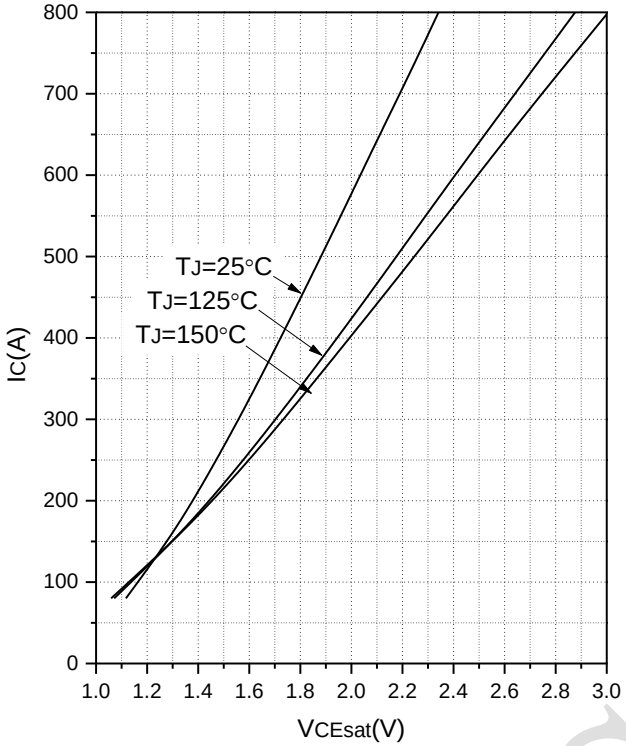


Fig.1 Typical Saturation Voltage Characteristics (Buck Switch)

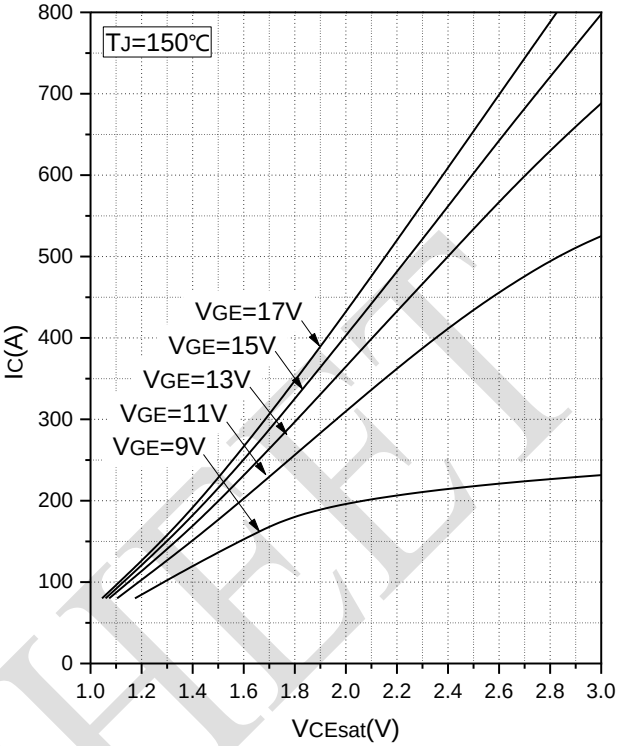


Fig.2 Typical Output Characteristics (Buck Switch)

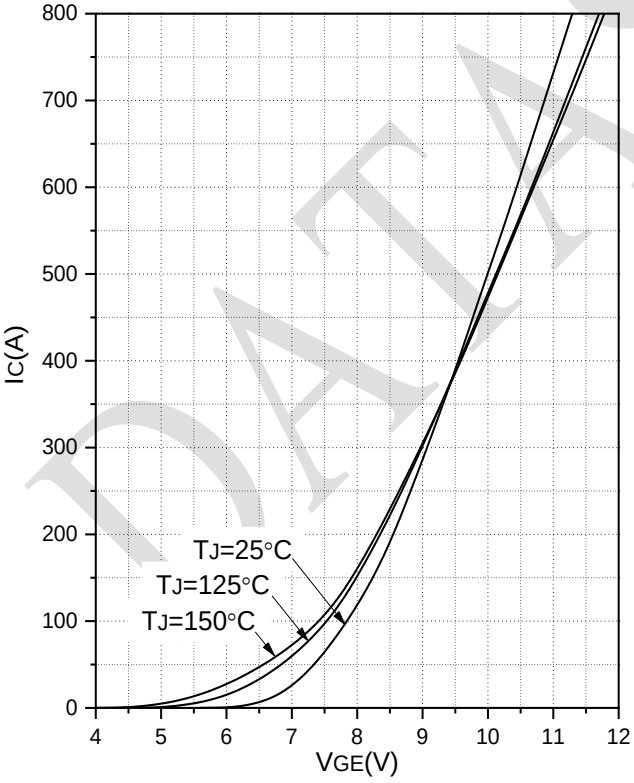


Fig.3 Transfer Characteristic (Buck Switch)

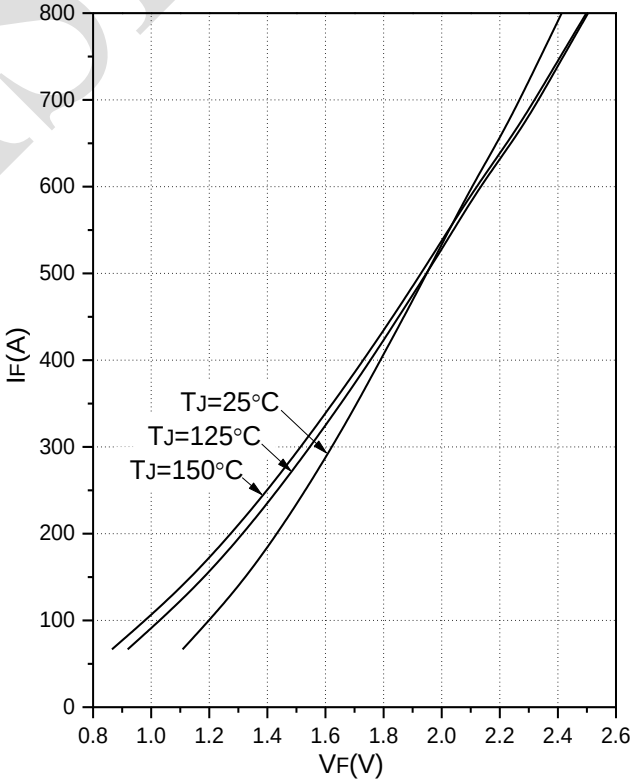


Fig.4 Forward Characteristics of Diode (Buck Diode)

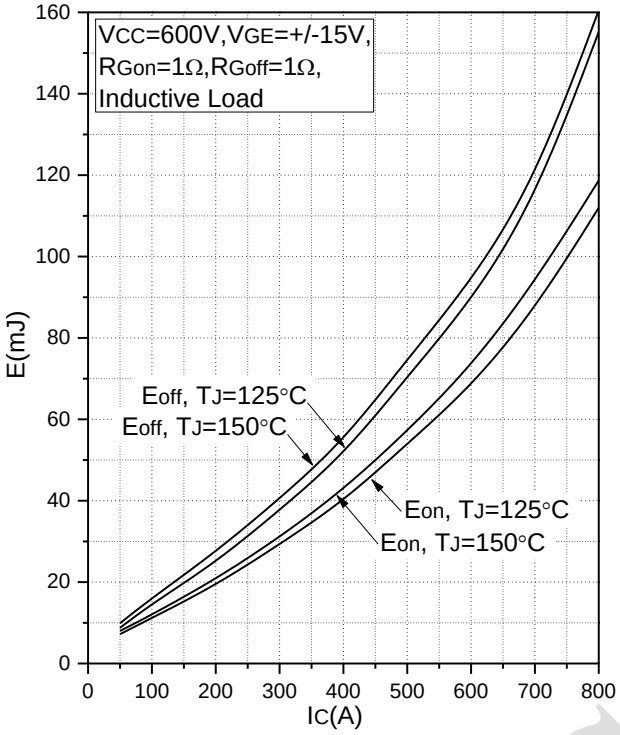


Fig.5 Typical Switching Loss vs. Collector Current (Buck Switch)

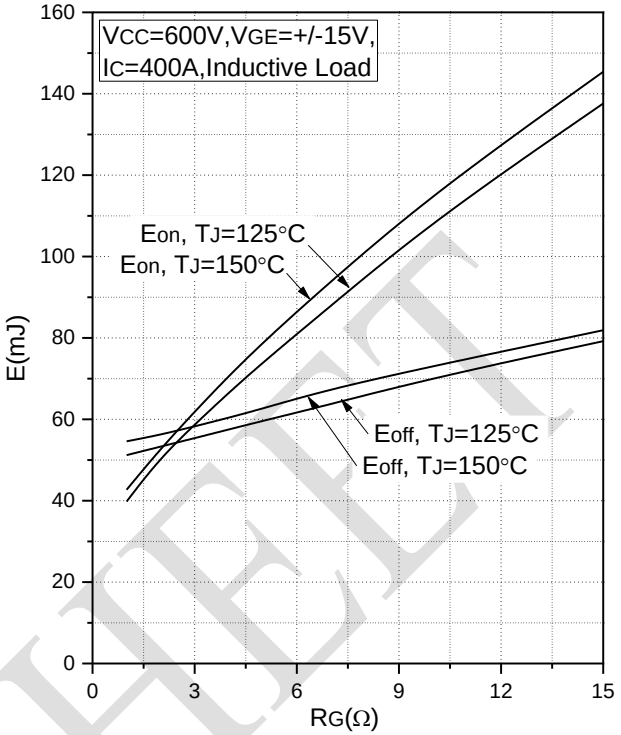


Fig.6 Typical Switching Loss vs. Gate Resistance (Buck Switch)

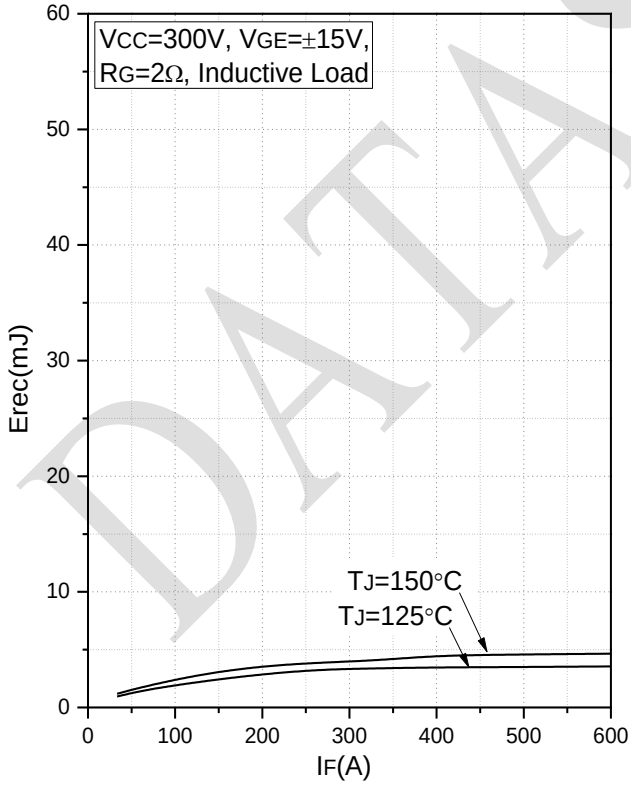


Fig.7 Typical Switching Loss vs. Forward Current (Buck Diode)

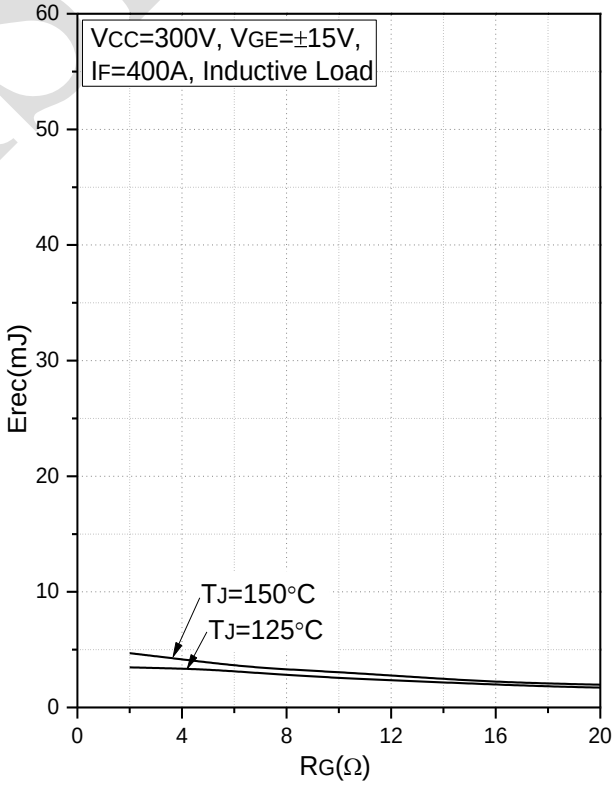


Fig.8 Typical Switching Loss vs. Gate Resistance (Buck Diode)

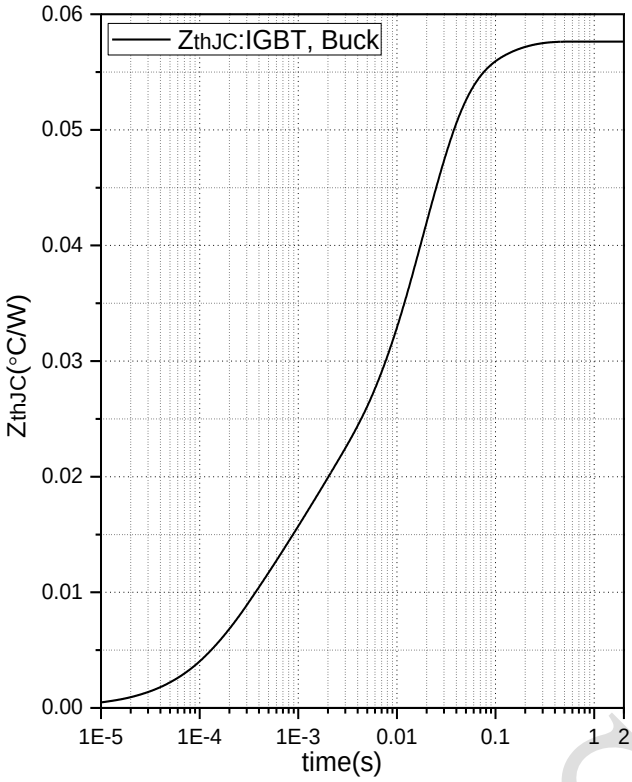


Fig.9 Transient Thermal Impedance (Buck Switch)

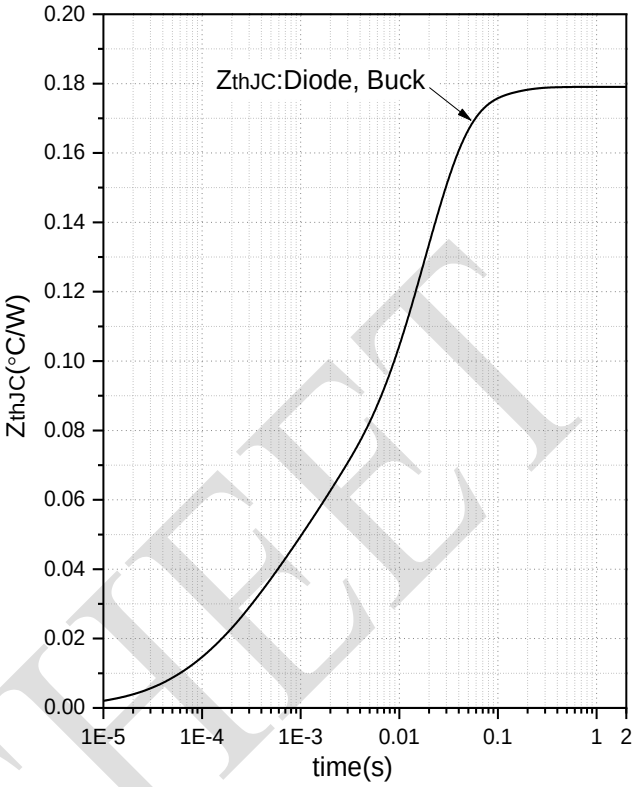


Fig.10 Transient Thermal Impedance (Buck Diode)

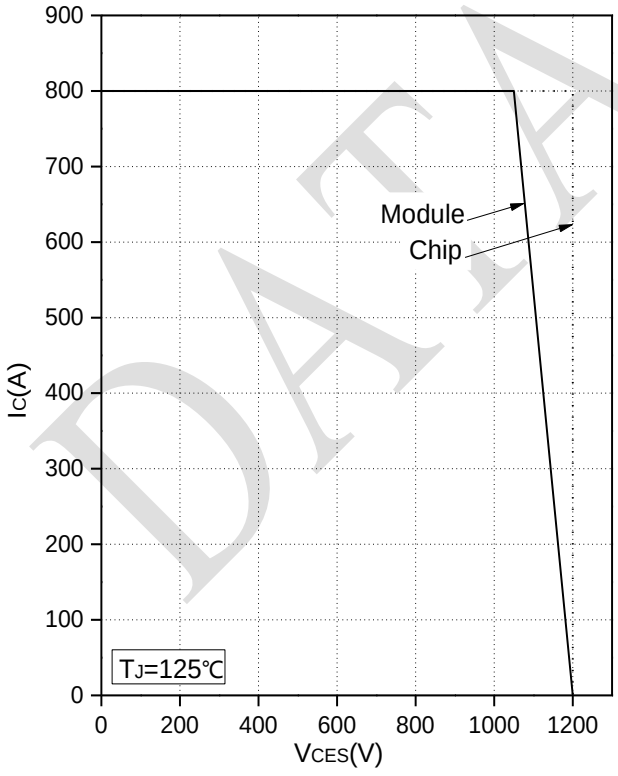


Fig.11 Reverse Bias Safe Operation Area (Buck Switch)

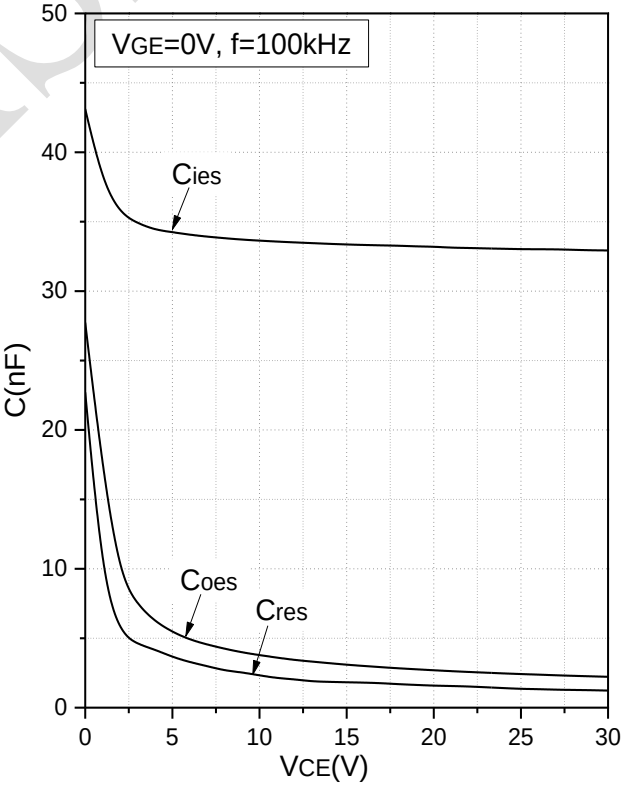


Fig.12 Capacitance Characteristics (Buck Switch)

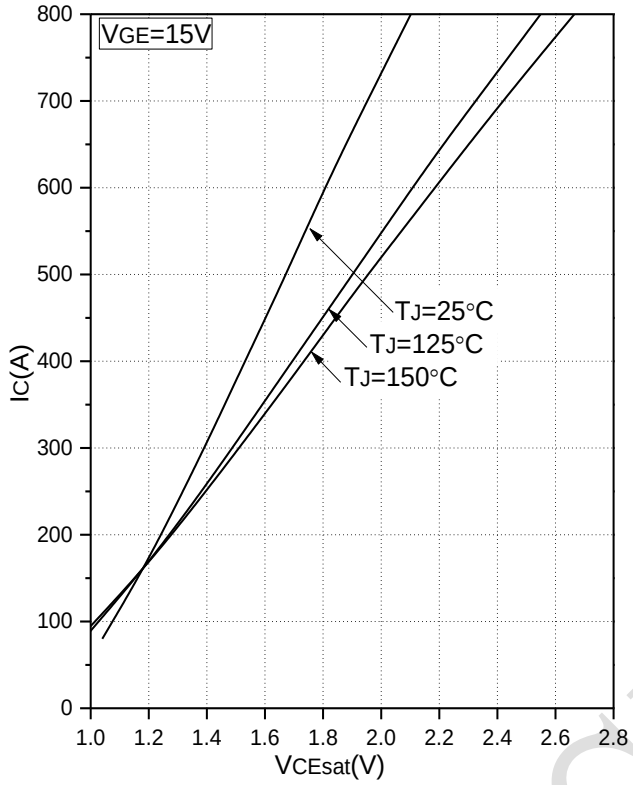


Fig.13 Typical Saturation Voltage Characteristics (Boost Switch)

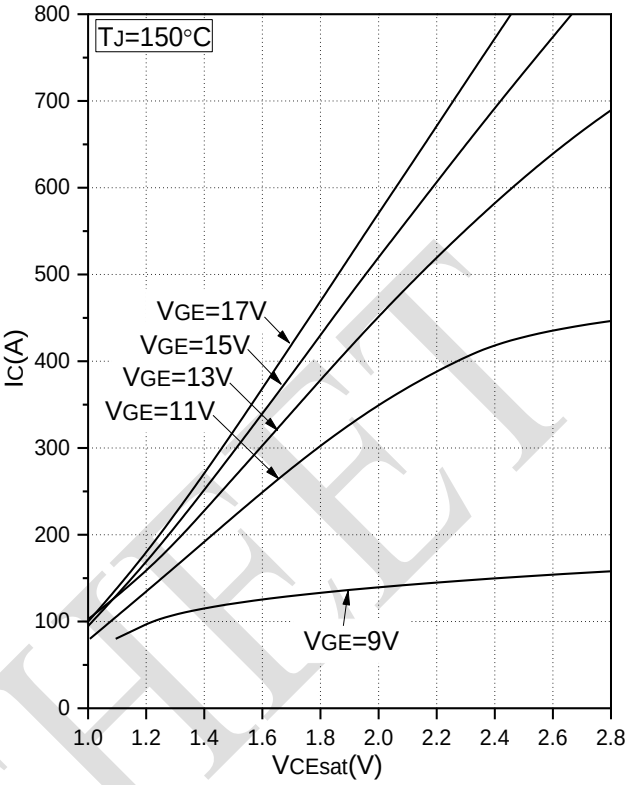


Fig.14 Typical Output Characteristics (Boost Switch)

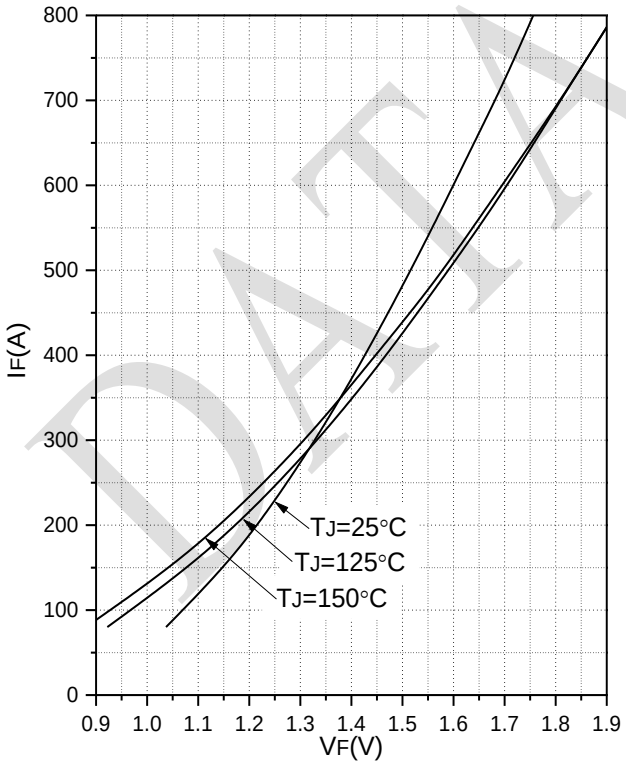


Fig.15 Forward Characteristics of Diode (Boost Diode)

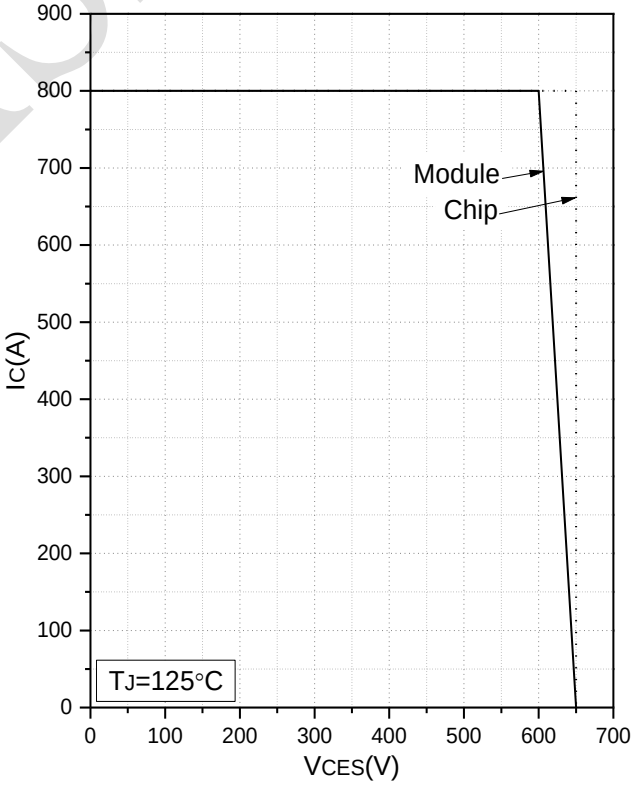


Fig.16 Reverse Bias Safe Operation Area (Boost Switch)

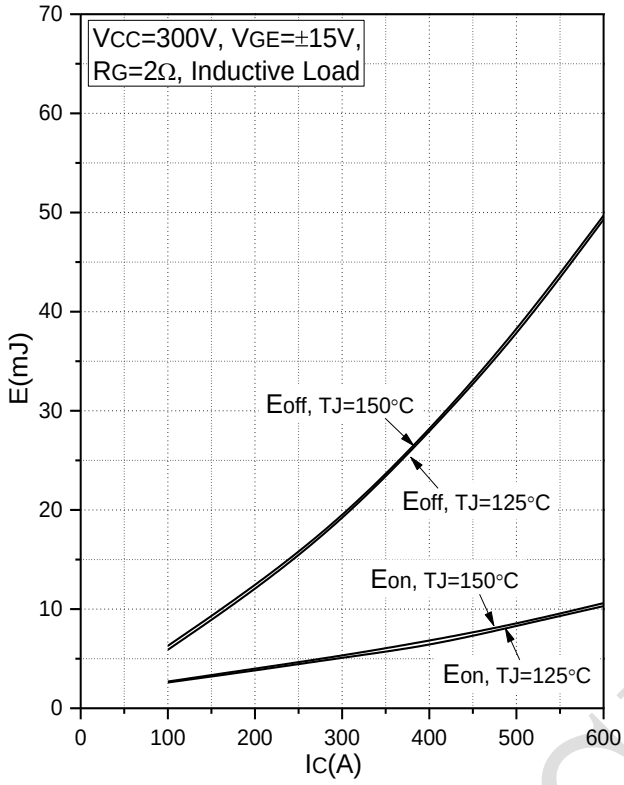


Fig.17 Typical Switching Loss vs. Collector Current (Boost Switch)

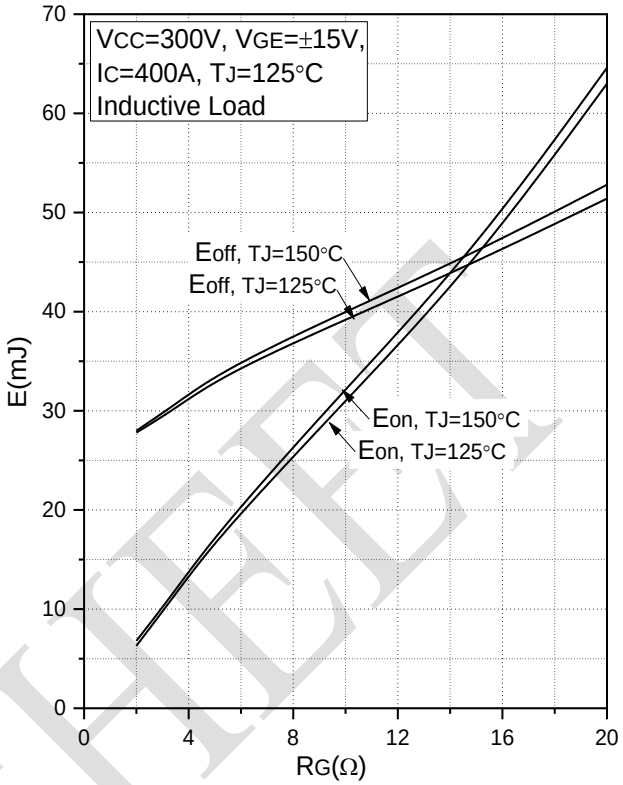


Fig.18 Typical Switching Loss vs. Gate Resistance (Boost Switch)

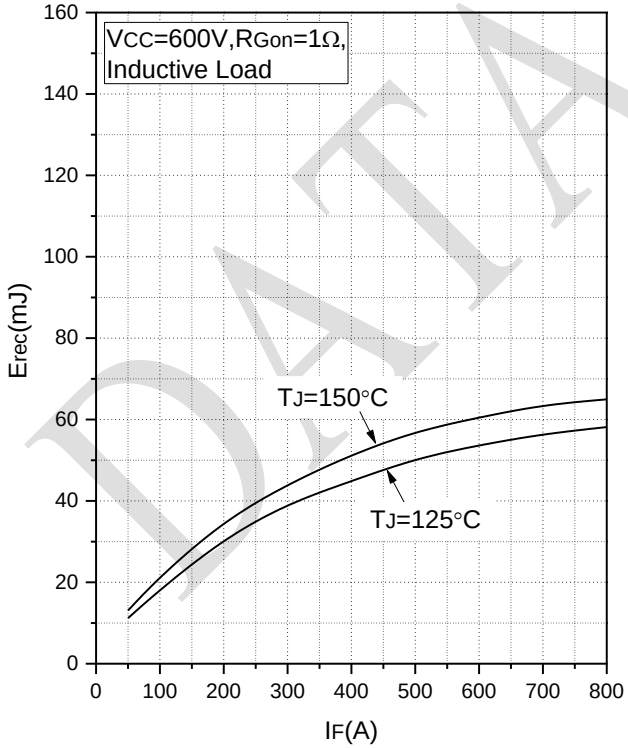


Fig.19 Typical Switching Loss vs. Forward Current (Boost Diode)

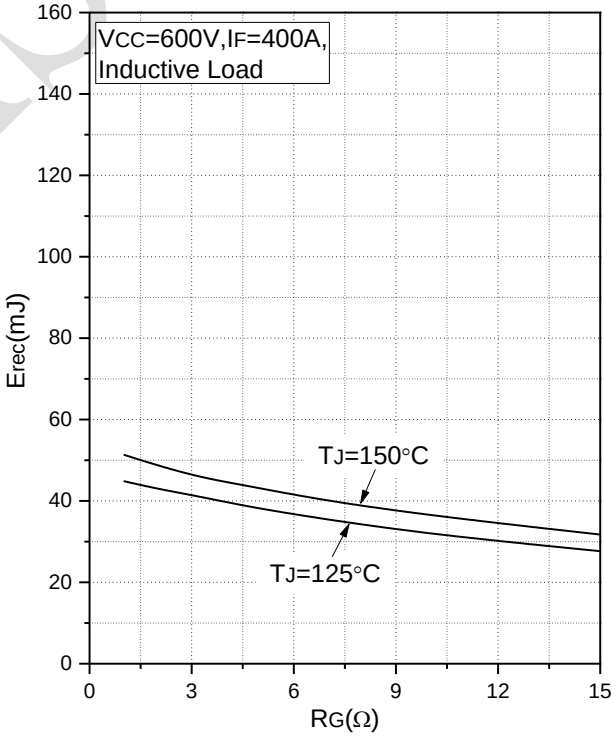


Fig.20 Typical Switching Loss vs. Gate Resistance (Boost Diode)

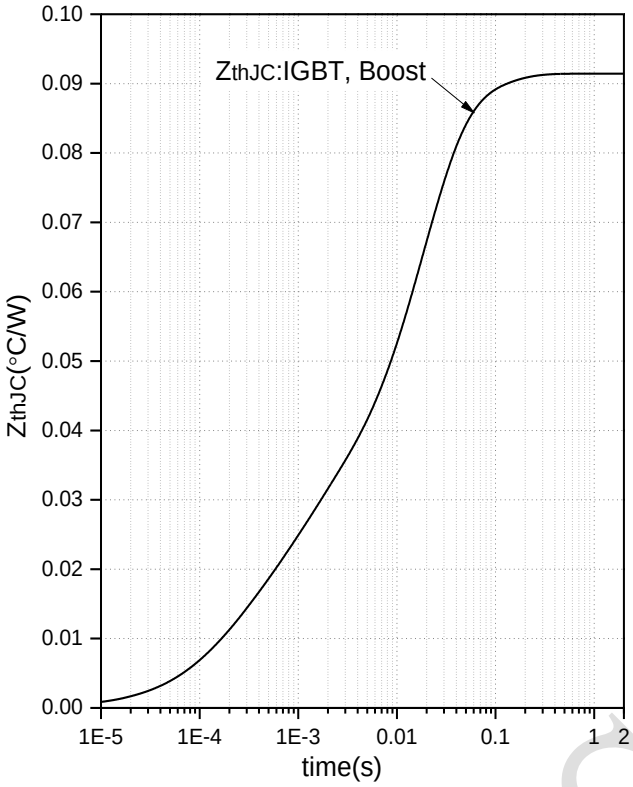


Fig.21 Transient Thermal Impedance (Boost Switch)

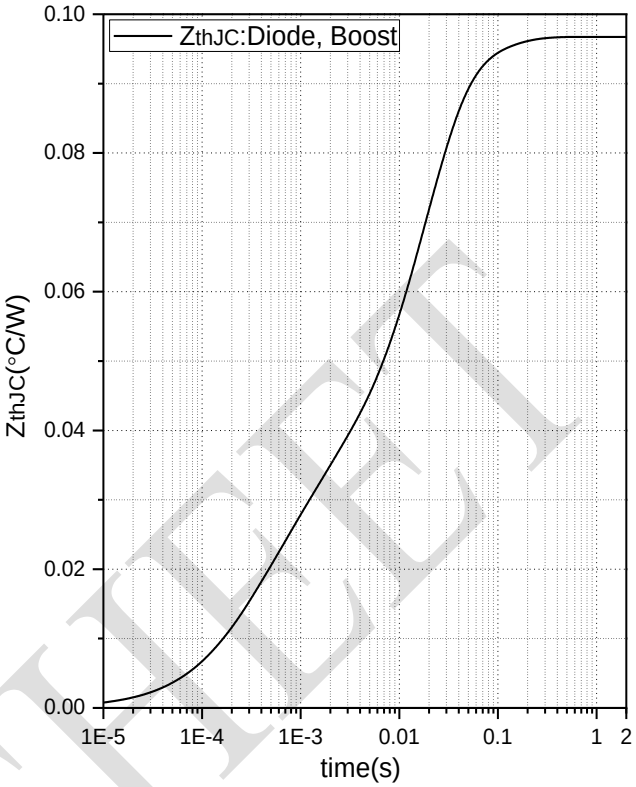


Fig.22 Transient Thermal Impedance (Boost Diode)

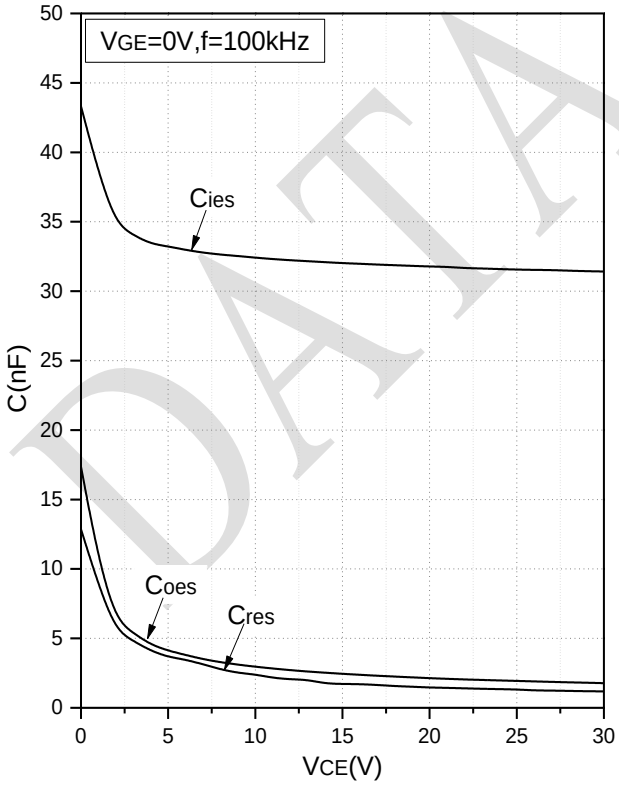


Fig.23 Capacitance Characteristics (Boost Switch)

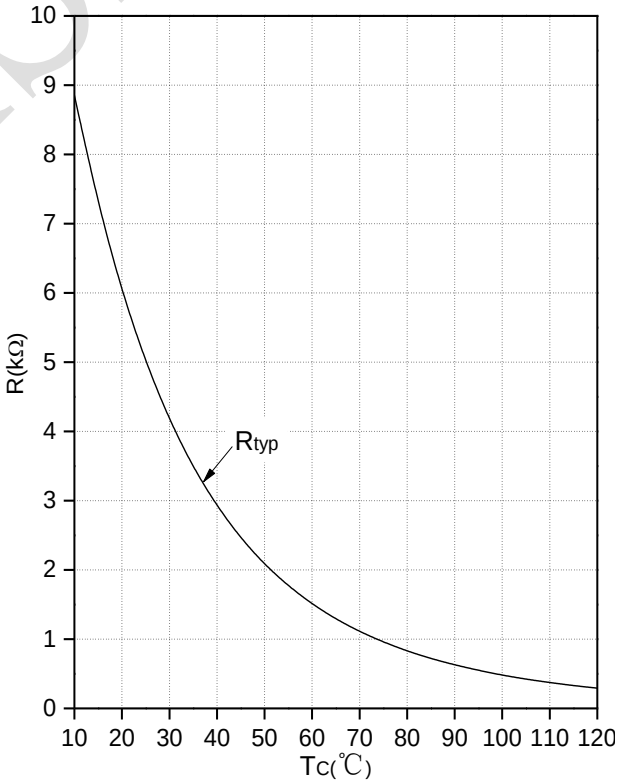
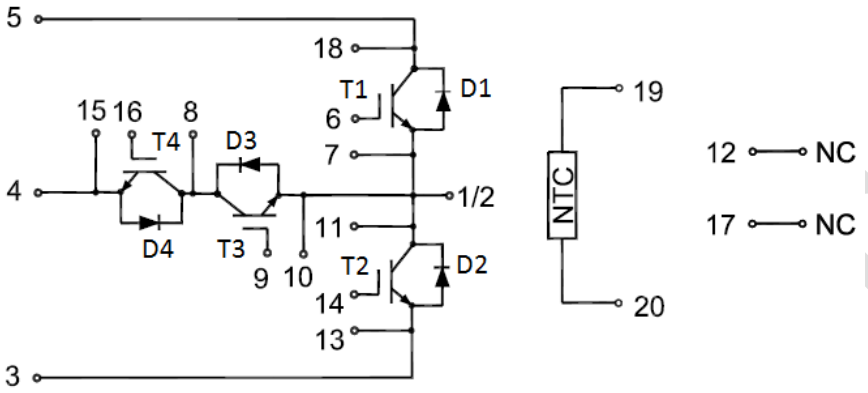
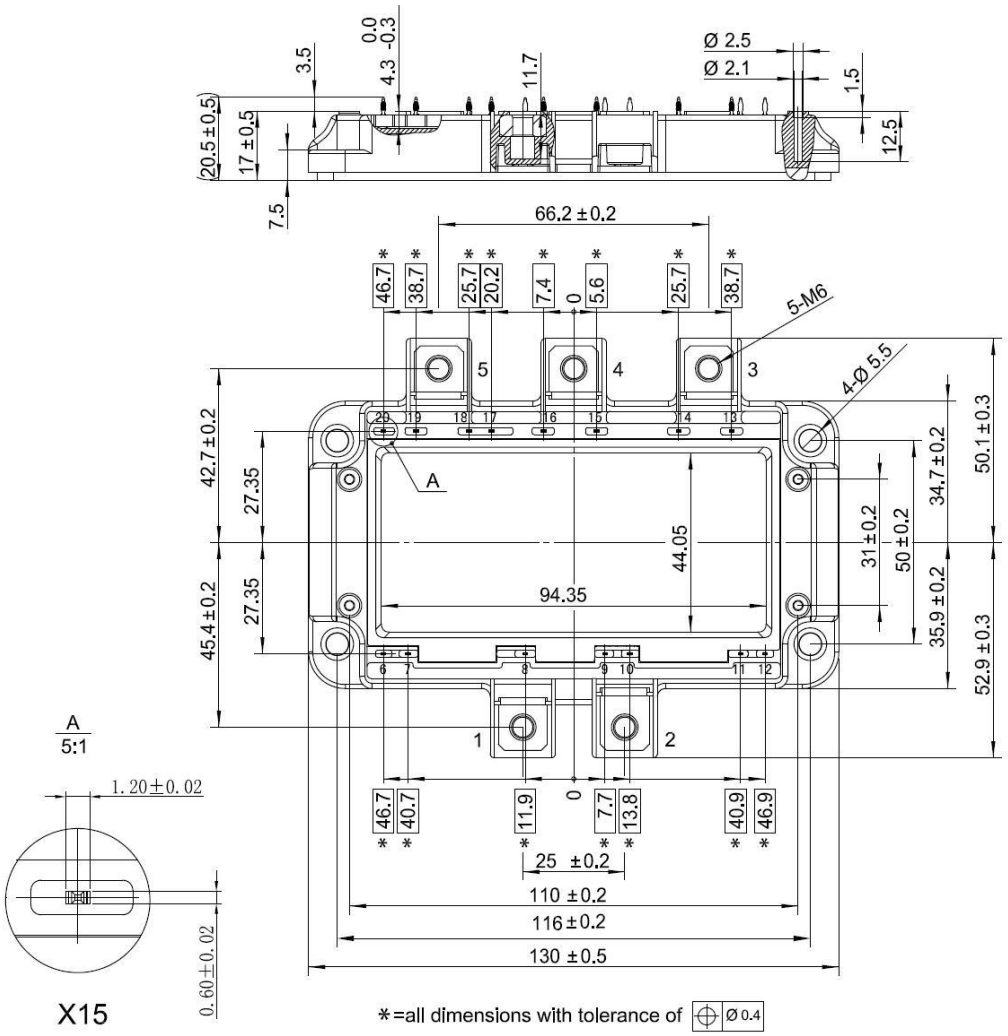


Fig.24 NTC Temperature Characteristics

Internal Circuit



Package Outline (Unit: mm):



Date	Revision	Notes
11/16/2022	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”.