

STARPOWER

SEMICONDUCTOR

IGBT

GD30PJX65L2S_B20

650V/30A PIM in one-package

General Description

STARPOWER IGBT Power Module provides ultra low conduction loss as well as short circuit ruggedness. They are designed for the applications such as general inverters and UPS.

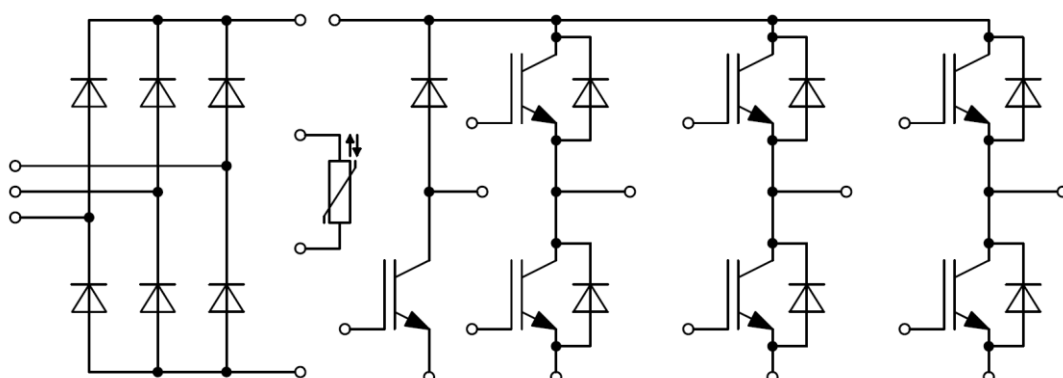
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 6 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated heatsink using DBC technology

Typical Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- Uninterruptible power supply

Equivalent Circuit Schematic



Absolute Maximum Ratings $T_C=25^{\circ}\text{C}$ unless otherwise noted**IGBT-inverter**

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	650	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	55	A
	@ $T_C=100^{\circ}\text{C}$	30	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	60	A
P_D	Maximum Power Dissipation @ $T_{vj}=175^{\circ}\text{C}$	163	W

Diode-inverter

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	30	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	60	A

Diode-rectifier

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1600	V
I_O	Average Output Current 50Hz/60Hz,sine wave	30	A
I_{FSM}	Surge Forward Current $t_p=10\text{ms}$ @ $T_{vj}=25^{\circ}\text{C}$	300	A
	@ $T_{vj}=150^{\circ}\text{C}$	245	
I^2t	I^2t -value, $t_p=10\text{ms}$ @ $T_{vj}=25^{\circ}\text{C}$	450	A^2s
	@ $T_{vj}=150^{\circ}\text{C}$	300	

IGBT-brake

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	650	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	40	A
	@ $T_C=100^{\circ}\text{C}$	20	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	40	A
P_D	Maximum Power Dissipation @ $T_{vj}=175^{\circ}\text{C}$	134	W

Diode-brake

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	10	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	20	A

Module

Symbol	Description	Value	Unit
T_{vjmax}	Maximum Junction Temperature(inverter,brake)	175	$^{\circ}\text{C}$
	Maximum Junction Temperature (rectifier)	150	
T_{vjop}	Operating Junction Temperature	-40 to +150	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-40 to +125	$^{\circ}\text{C}$
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}$, $t=1\text{min}$	2500	V

IGBT-inverter Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=30\text{A}, V_{GE}=15\text{V}, T_{vj}=25^{\circ}\text{C}$		1.45	1.90	V
		$I_C=30\text{A}, V_{GE}=15\text{V}, T_{vj}=125^{\circ}\text{C}$		1.60		
		$I_C=30\text{A}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}$		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=0.48\text{mA}, V_{CE}=V_{GE}, T_{vj}=25^{\circ}\text{C}$	5.1	5.8	6.5	V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			400	nA
R_{Gint}	Internal Gate Resistance			0		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		3.48		nF
C_{res}	Reverse Transfer Capacitance			0.07		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.21		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=30\text{A}, R_G=15\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=25^{\circ}\text{C}$		26		ns
t_r	Rise Time			35		ns
$t_{d(off)}$	Turn-Off Delay Time			89		ns
t_f	Fall Time			130		ns
E_{on}	Turn-On Switching Loss			0.67		mJ
E_{off}	Turn-Off Switching Loss			0.48		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=30\text{A}, R_G=15\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=125^{\circ}\text{C}$		26		ns
t_r	Rise Time			37		ns
$t_{d(off)}$	Turn-Off Delay Time			100		ns
t_f	Fall Time			175		ns
E_{on}	Turn-On Switching Loss			0.85		mJ
E_{off}	Turn-Off Switching Loss			0.64		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=30\text{A}, R_G=15\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=150^{\circ}\text{C}$		27		ns
t_r	Rise Time			37		ns
$t_{d(off)}$	Turn-Off Delay Time			103		ns
t_f	Fall Time			183		ns
E_{on}	Turn-On Switching Loss			0.92		mJ
E_{off}	Turn-Off Switching Loss			0.67		mJ
I_{SC}	SC Data	$t_p \leq 6\mu\text{s}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}, V_{CC}=360\text{V}, V_{CEM} \leq 650\text{V}$		150		A

Diode-inverter Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_C=30\text{A}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$		1.35	1.80	V
		$I_C=30\text{A}, V_{GE}=0\text{V}, T_{vj}=125^{\circ}\text{C}$		1.30		
		$I_C=30\text{A}, V_{GE}=0\text{V}, T_{vj}=150^{\circ}\text{C}$		1.30		
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=30\text{A},$ $-di/dt=889\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=25^{\circ}\text{C}$		0.88		μC
I_{RM}	Peak Reverse Recovery Current			20		A
E_{rec}	Reverse Recovery Energy			0.12		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=30\text{A},$ $-di/dt=806\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=125^{\circ}\text{C}$		1.60		μC
I_{RM}	Peak Reverse Recovery Current			22		A
E_{rec}	Reverse Recovery Energy			0.26		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=30\text{A},$ $-di/dt=787\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=150^{\circ}\text{C}$		1.84		μC
I_{RM}	Peak Reverse Recovery Current			23		A
E_{rec}	Reverse Recovery Energy			0.30		mJ

Diode-rectifier Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=30\text{A}, V_{GE}=0\text{V}, T_{vj}=150^{\circ}\text{C}$		0.95		V
I_R	Reverse Current	$T_{vj}=150^{\circ}\text{C}, V_R=1600\text{V}$			1.0	mA

IGBT-brake Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=20\text{A}, V_{GE}=15\text{V}, T_{vj}=25^{\circ}\text{C}$		1.45	1.90	V
		$I_C=20\text{A}, V_{GE}=15\text{V}, T_{vj}=125^{\circ}\text{C}$		1.60		
		$I_C=20\text{A}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}$		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=0.32\text{mA}, V_{CE}=V_{GE}, T_{vj}=25^{\circ}\text{C}$	5.1	5.8	6.5	V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			400	nA
R_{Gint}	Internal Gate Resistance			0		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		2.32		nF
C_{res}	Reverse Transfer Capacitance			0.05		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.14		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=20\text{A}, R_G=18\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=25^{\circ}\text{C}$		29		ns
t_r	Rise Time			39		ns
$t_{d(off)}$	Turn-Off Delay Time			111		ns
t_f	Fall Time			144		ns
E_{on}	Turn-On Switching Loss			0.43		mJ
E_{off}	Turn-Off Switching Loss			0.39		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=20\text{A}, R_G=18\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=125^{\circ}\text{C}$		30		ns
t_r	Rise Time			41		ns
$t_{d(off)}$	Turn-Off Delay Time			124		ns
t_f	Fall Time			203		ns
E_{on}	Turn-On Switching Loss			0.50		mJ
E_{off}	Turn-Off Switching Loss			0.55		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=20\text{A}, R_G=18\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=150^{\circ}\text{C}$		31		ns
t_r	Rise Time			41		ns
$t_{d(off)}$	Turn-Off Delay Time			128		ns
t_f	Fall Time			207		ns
E_{on}	Turn-On Switching Loss			0.52		mJ
E_{off}	Turn-Off Switching Loss			0.56		mJ
I_{SC}	SC Data	$t_p \leq 6\mu\text{s}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}, V_{CC}=360\text{V}, V_{CEM} \leq 650\text{V}$		100		A

Diode-brake Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_C=10\text{A}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$		1.35	1.80	V
		$I_C=10\text{A}, V_{GE}=0\text{V}, T_{vj}=125^{\circ}\text{C}$		1.30		
		$I_C=10\text{A}, V_{GE}=0\text{V}, T_{vj}=150^{\circ}\text{C}$		1.30		
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=10\text{A},$ $-di/dt=448\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=25^{\circ}\text{C}$		0.28		μC
I_{RM}	Peak Reverse Recovery Current			6		A
E_{rec}	Reverse Recovery Energy			0.04		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=10\text{A},$ $-di/dt=448\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=125^{\circ}\text{C}$		0.49		μC
I_{RM}	Peak Reverse Recovery Current			7		A
E_{rec}	Reverse Recovery Energy			0.08		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=10\text{A},$ $-di/dt=448\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=150^{\circ}\text{C}$		0.54		μC
I_{RM}	Peak Reverse Recovery Current			8		A
E_{rec}	Reverse Recovery Energy			0.09		mJ

NTC Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated Resistance			5.0		$\text{k}\Omega$
$\Delta R/R$	Deviation of R_{100}	$T_C=100^{\circ}\text{C}, R_{100}=493.3\Omega$	-5		5	%
P_{25}	Power Dissipation				20.0	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$		3375		K
$B_{25/80}$	B-value	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15\text{K}))]$		3411		K
$B_{25/100}$	B-value	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15\text{K}))]$		3433		K

Module Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance		30		nH
$R_{CC'+EE'}$ $R_{AA'+CC'}$	Module Lead Resistance, Terminal to Chip		8.00 6.00		m Ω
R_{thJC}	Junction-to-Case (per IGBT-inverter)		0.835	0.919	K/W
	Junction-to-Case (per Diode-inverter)		1.091	1.200	
	Junction-to-Case (per Diode-rectifier)		0.839	0.923	
	Junction-to-Case (per IGBT-brake)		1.012	1.113	
	Junction-to-Case (per Diode-brake)		1.802	1.982	
R_{thCH}	Case-to-Heatsink (per IGBT-inverter)		1.036		K/W
	Case-to-Heatsink (per Diode-inverter)		1.352		
	Case-to-Heatsink (per Diode-rectifier)		1.040		
	Case-to-Heatsink (per IGBT-brake)		1.254		
	Case-to-Heatsink (per Diode-brake)		2.234		
	Case-to-Heatsink (per Module)		0.058		
F	Mounting Force Per Clamp	20		50	N
G	Weight of Module		24		g

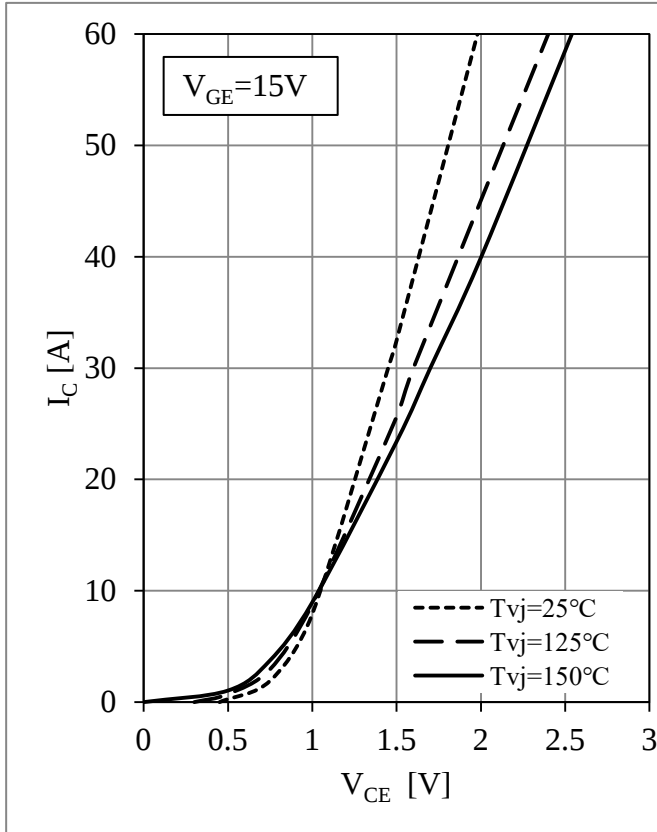


Fig 1. IGBT-inverter Output Characteristics

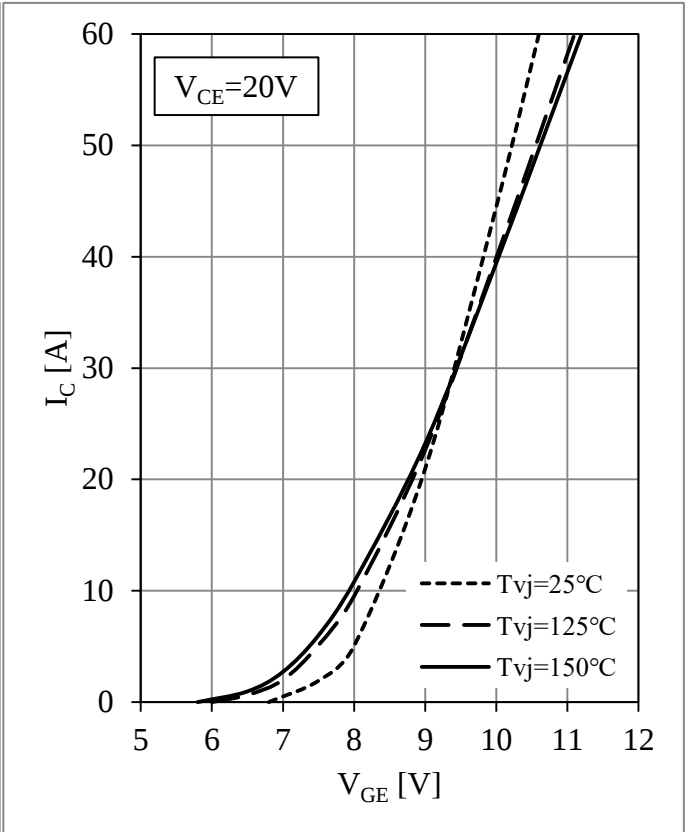
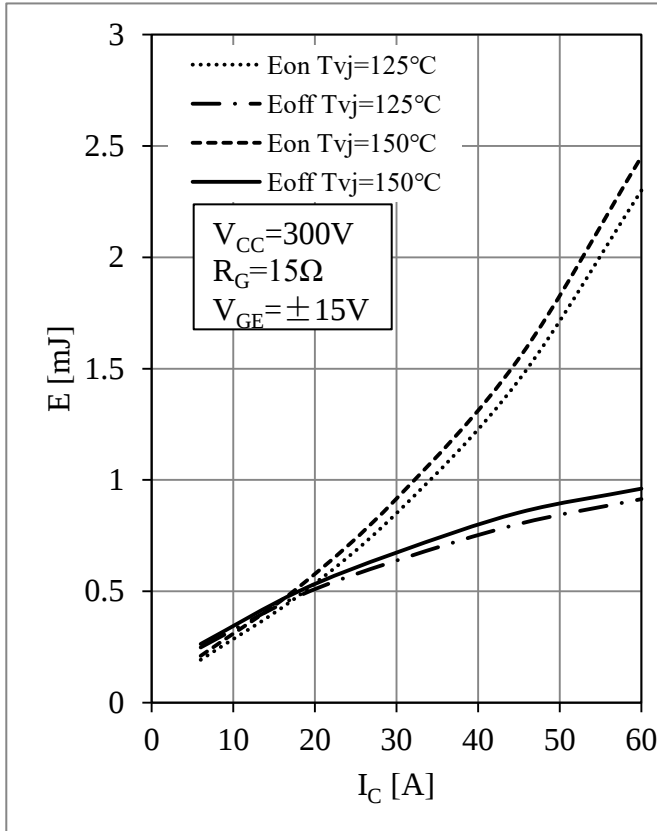
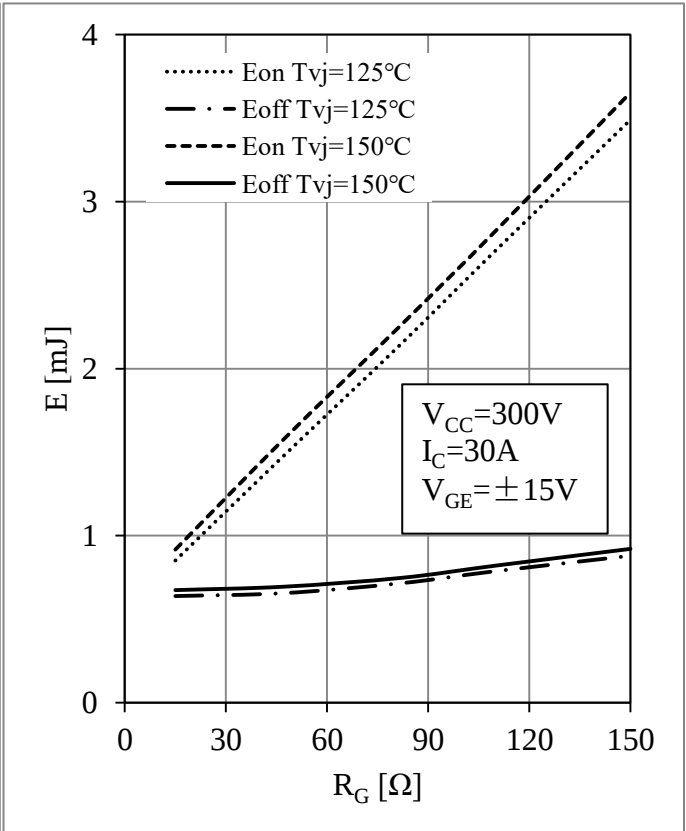


Fig 2. IGBT-inverter Transfer Characteristics

Fig 3. IGBT-inverter Switching Loss vs. I_C Fig 4. IGBT-inverter Switching Loss vs. R_G

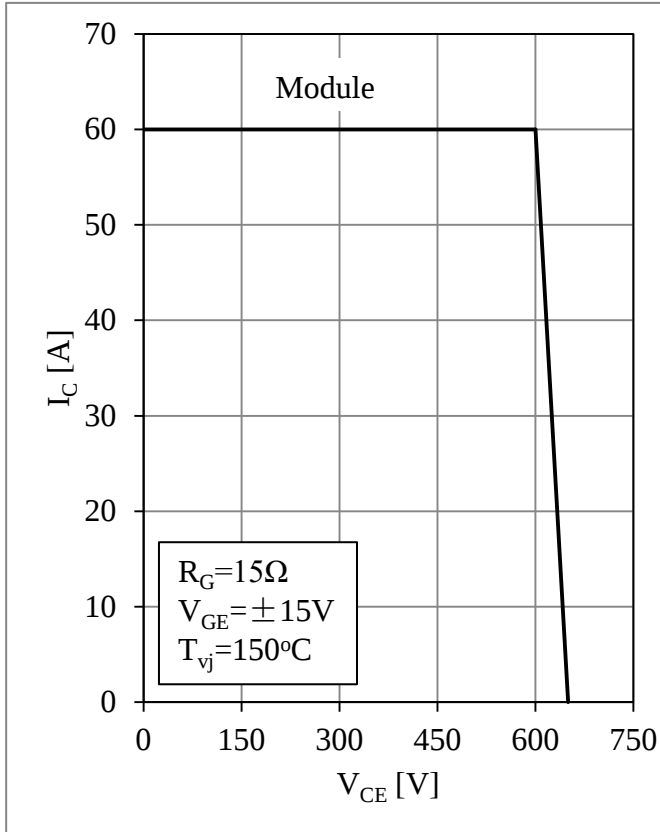


Fig 5. IGBT-inverter RBSOA

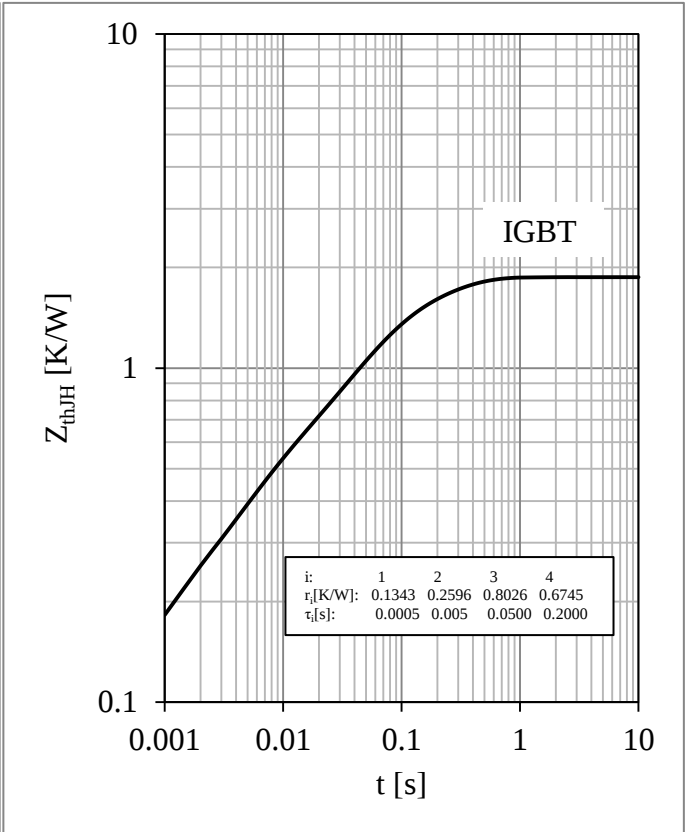


Fig 6. IGBT-inverter Transient Thermal Impedance

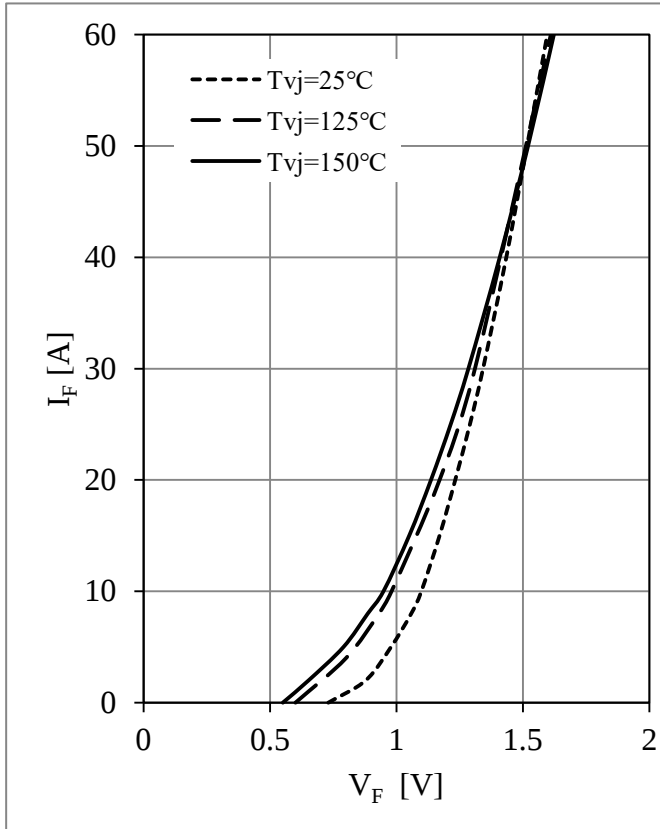
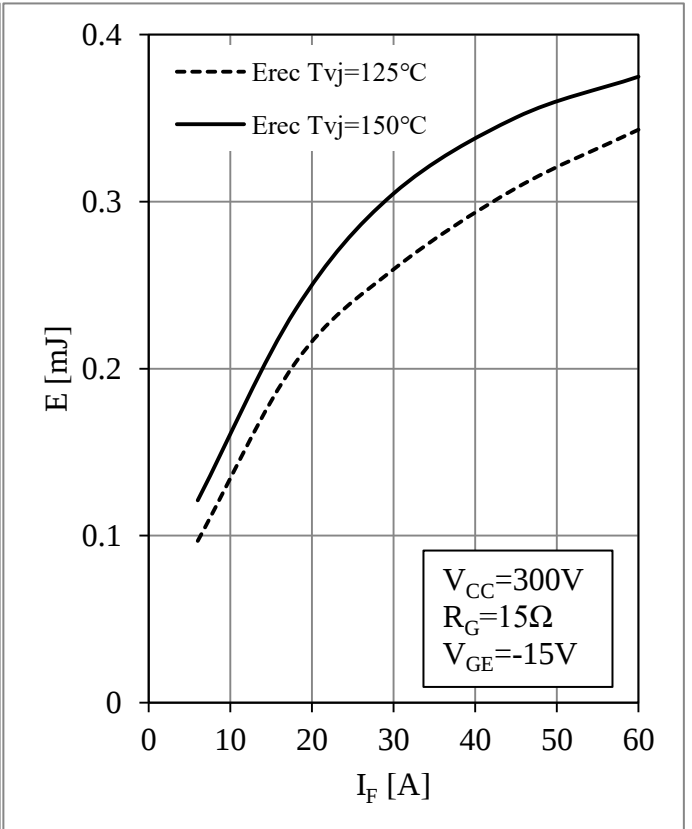
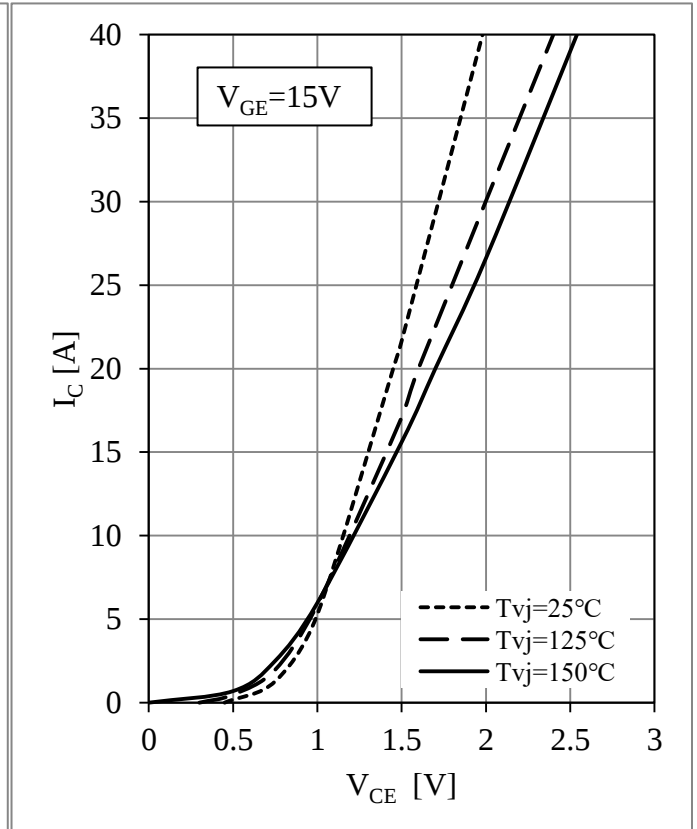
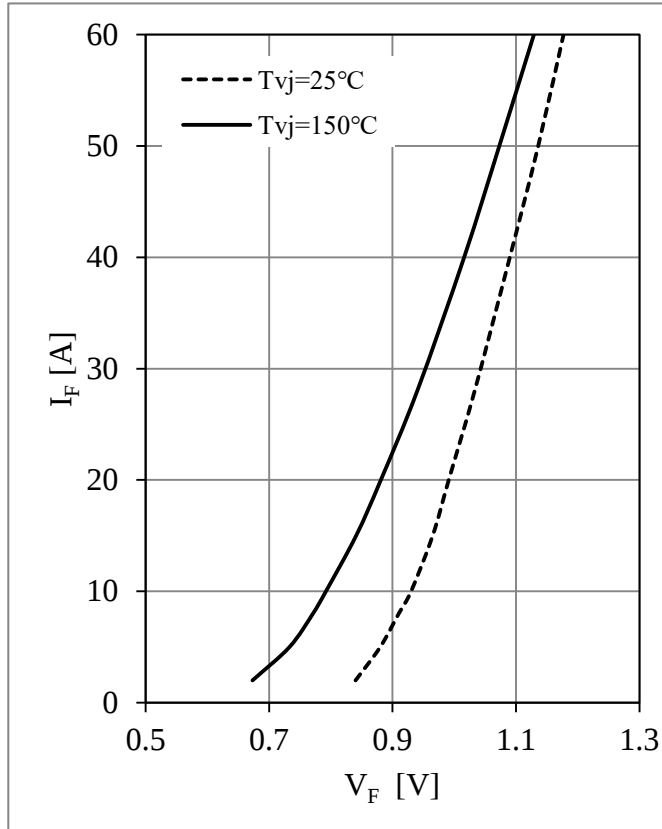
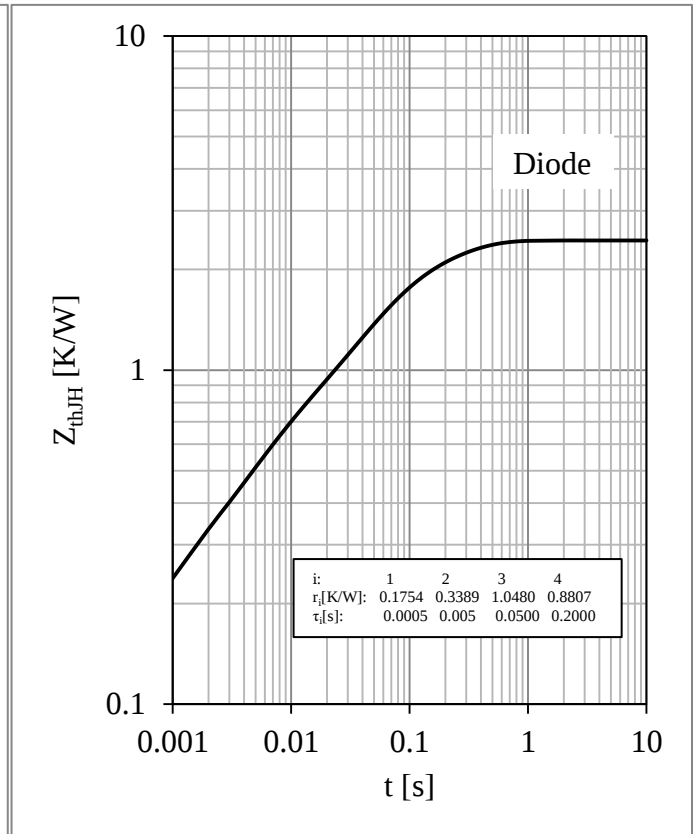
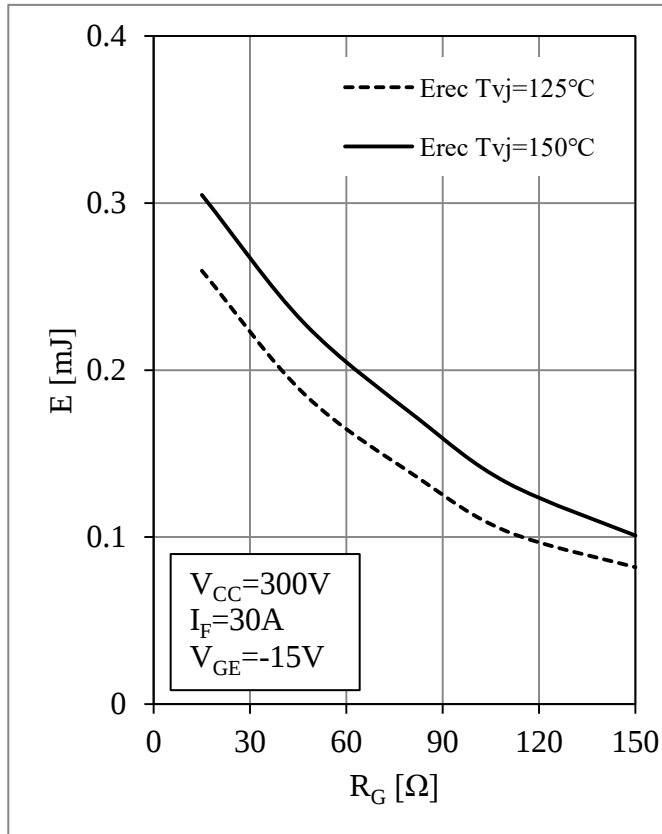


Fig 7. Diode-inverter Forward Characteristics

Fig 8. Diode-inverter Switching Loss vs. I_F



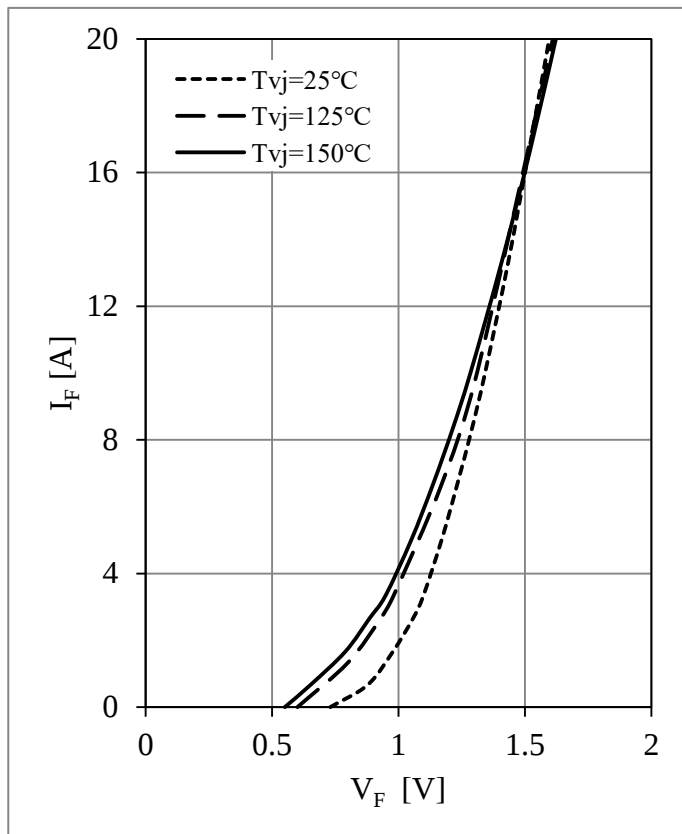


Fig 13. Diode-brake-chopper Forward Characteristics

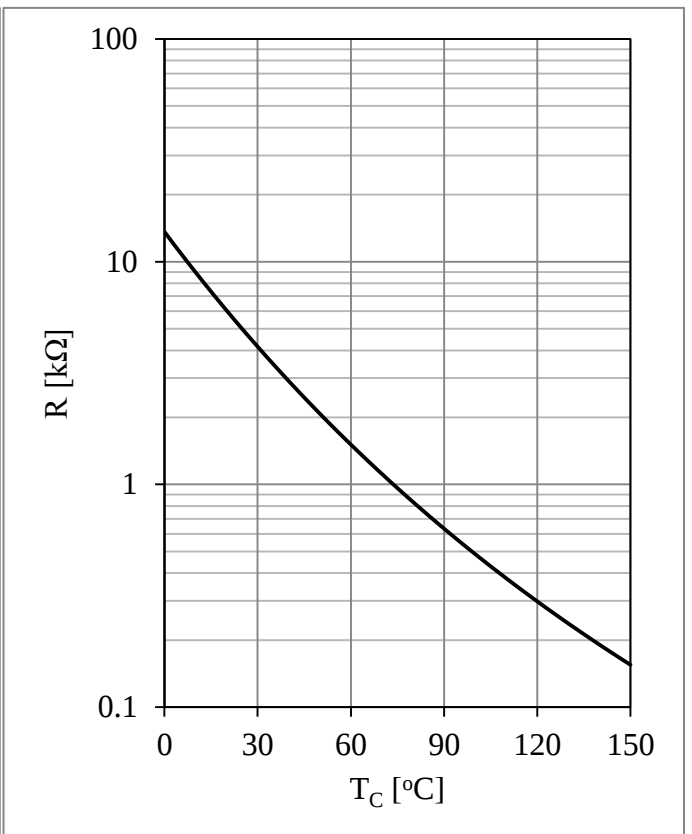
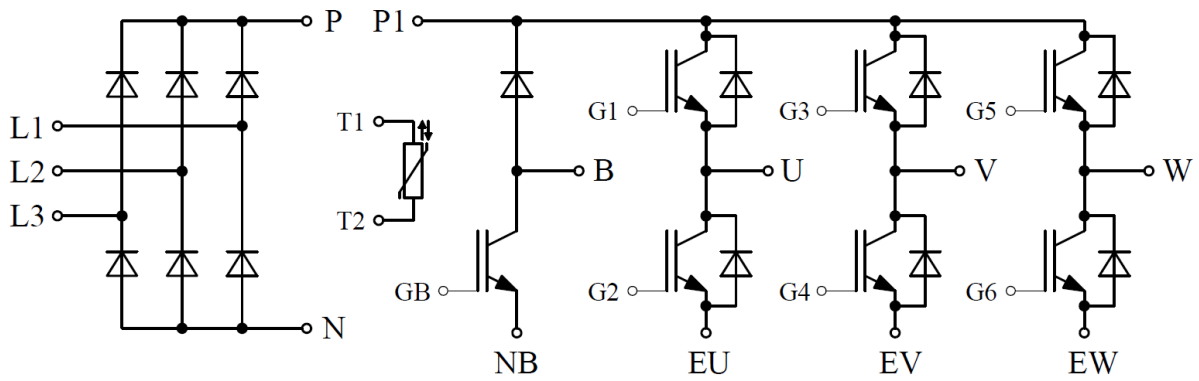


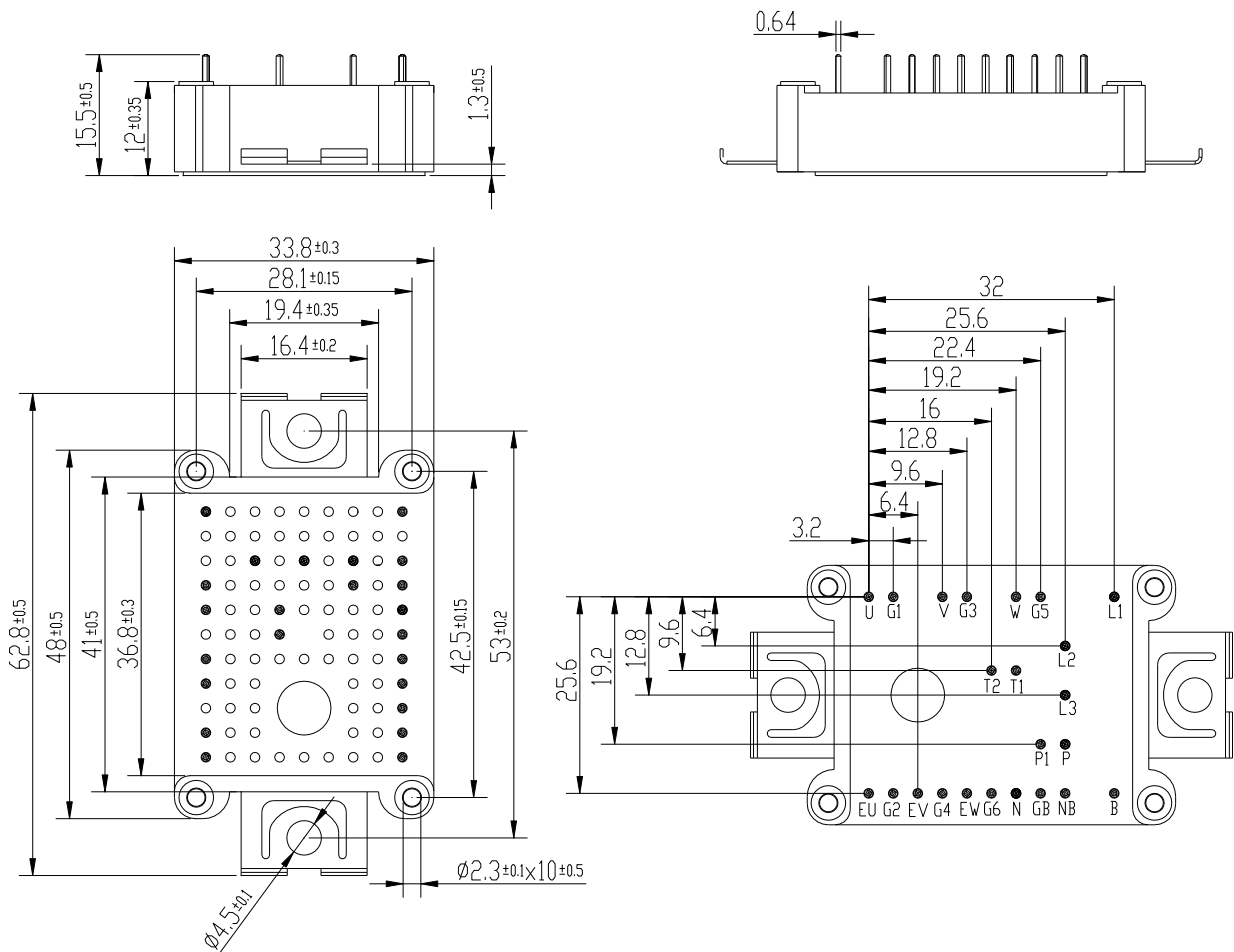
Fig 14. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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