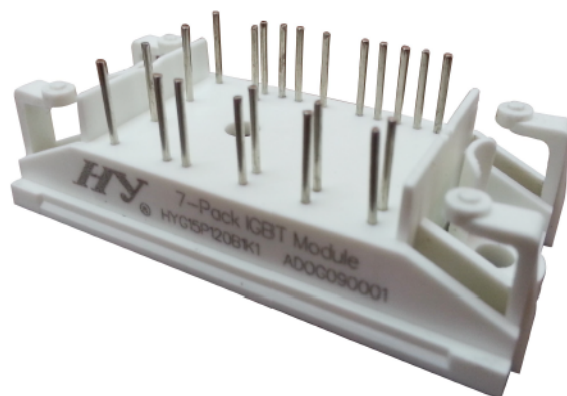


IGBT Module

Features

- Low $V_{CE(sat)}$ trench IGBT
- Low switching losses
- 10 μ s short circuit capability
- Fast & soft reverse recovery FRD
- Maximum junction temperature 175°C
- Temperature sense included
- Industry standard package with soldering pins for PCB mounting



Typical Applications

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

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

Maximum Rated Values

Symbol	Description	HYG15P120B1K1	Units
V_{CES}	Collector-Emitter Voltage $T_j=25^{\circ}\text{C}$	1200	V
V_{GES}	Gate-Emitter Voltage $T_j=25^{\circ}\text{C}$	± 20	V
I_c	Collector Current	20	A
	Collector Current $T_c=80^{\circ}\text{C}$	15	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	30	A
P_{tot}	Total Power Dissipation $T_j=175^{\circ}\text{C}$	156	W

Characteristics Values

Symbol	Parameter		Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$T_j=25^{\circ}\text{C}$	1200			V
I_{CES}	Collector Cut- Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$			0.1	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_j=25^{\circ}\text{C}$	-400		400	nA
$V_{GE(th)}$	Gate to Emitter Threshold Voltage	$I_C=1.2\text{mA}, V_{GE}=V_{CE}, T_j=25^{\circ}\text{C}$	4.6	5.2	6.0	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=15\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		2.1	2.5	V
		$I_C=15\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		2.4		
R_{Gint}	Integrated Gate Resistor			0		Ω
Q_g	Gate Charge	$V_{CE}=600\text{V}, I_C=15\text{A}, V_{GE}=15\text{V}$		0.1		μC
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$		1.38		nF
C_{res}	Reverse Transfer Capacitance			0.03		nF
$t_{d(on)}$	Turn - on Delay Time	$V_{CC}=600\text{V}, I_C=15\text{A}, T_{vj}=25^{\circ}\text{C}$		35		ns
		$R_G=30\Omega, T_{vj}=125^{\circ}\text{C}$		40		ns
t_r	Rise Time	$V_{GE}=\pm 15\text{V}, T_{vj}=25^{\circ}\text{C}$		40		ns
		Inductive Load $T_{vj}=125^{\circ}\text{C}$		45		ns
$t_{d(off)}$	Turn - off Delay Time	$V_{CC}=600\text{V}, I_C=15\text{A}, T_{vj}=25^{\circ}\text{C}$		240		ns
		$R_G=30\Omega, T_{vj}=125^{\circ}\text{C}$		270		ns
t_f	Fall Time	$V_{GE}=\pm 15\text{V}, T_{vj}=25^{\circ}\text{C}$		100		ns
		Inductive Load $T_{vj}=125^{\circ}\text{C}$		130		ns
E_{on}	Turn - on Energy	$V_{CC}=600\text{V}, I_C=15\text{A}, T_{vj}=25^{\circ}\text{C}$		0.7		mJ
		$R_G=30\Omega, T_{vj}=125^{\circ}\text{C}$		1.0		mJ
E_{off}	Turn - off Energy	$V_{GE}=\pm 15\text{V}, T_{vj}=25^{\circ}\text{C}$		1.0		mJ
		Inductive Load $T_{vj}=125^{\circ}\text{C}$		1.2		mJ
I_{sc}	Short Circuit Current	$t_{ps} \leq 10\mu\text{s}, V_{GE}=15\text{V}$ $T_{vj}=125^{\circ}\text{C}, V_{CC}=600\text{V}$		75		A
R_{thJC}	Junction-to-Case Thermal Resistance (Per IGBT)				0.8	K /W

DIODE-inverter $T_c=25^{\circ}\text{C}$ unless otherwise noted

Maximum Rated Values

Symbol	Description	HYG15P120B1K1	Units
V_{RRM}	Repetitive Peak Reverse Voltage $T_j=25^{\circ}\text{C}$	1200	V
I_F	DC Forward Current $T_c=80^{\circ}\text{C}$	15	A
I_{FRM}	Repetitive Peak Forward Current	30	A

Characteristics Values

Symbol	Parameter		Min.	Typ.	Max.	Units
V _F	Forward Voltage	IF=15A , VGE=0V, T _{Vj} =25°C IF=15A , VGE=0V, T _{Vj} =125°C		2.2 2.4	2.6	V
t _{rr}	Reverse Recovery Time	IF=15A , VR=600V diF/dt=-400A/μs T _{Vj} =125°C		150		ns
I _{RRM}	Max. Reverse Recovery Current			23		A
E _{rec}	Reverse Recovery Charge			0.8		mJ
R _{thJC}	Junction-to-Case Thermal Resistance (Per DIODE)				1.8	K /W

DIODE-rectifier Tc=25°C unless otherwise noted

Maximum Rated Values

Symbol	Description	HYG15P120B1K1	Units
V_{RRM}	Repetitive Peak Reverse Voltage T _j =25°C	1600	V
$I_{F(AV)}$	Average On-state Current per Diode Tc=80°C	20	A
I_{RMSM}	Maximum RMS Current at rectifier Output	tdb	A
I^2t	VR=0V, tp=10ms, T _j =45°C	360	A²t
I_{FSM}	Surge Forward Current VR=0V, tp=10ms, T _j =45°C	270	A

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V _F	Diode Forward Voltage	IF=30A	Tj=25°C			1.29	V
			Tj=125°C			1.31	
I _R	Reverse Current	VR=1600V	Tj=25°C			10	uA
			Tj=125°C			1	mA
R _{thJC}	Junction-to-Case Thermal Resistance (Per DIODE)					1.9	K /W

IGBT-brake-chopper Tc=25°C unless otherwise noted

Maximum Rated Values

Symbol	Description	HYG15P120B1K1	Units
V_{CES}	Collector-Emitter Voltage T _j =25°C	1200	V
V_{GES}	Gate-Emitter Voltage T _j =25°C	±20	V
I_C	Collector Current	20	A
	Collector Current TC=80°C	15	
I_{CM}	Pulsed Collector Current tp=1ms	30	A
P_{tot}	Total Power Dissipation T _j =175°C	156	W

Characteristics Values

Symbol	Parameter	Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage $T_J=25^{\circ}\text{C}$	1200			V
I_{CES}	Collector Cut- Off Current $V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_J=25^{\circ}\text{C}$			5	mA
I_{GES}	Gate-Emitter Leakage Current $V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_J=25^{\circ}\text{C}$	-500		500	nA
$V_{GE(th)}$	Gate to Emitter Threshold Voltage $I_C=1.2\text{mA}, V_{GE}=V_{CE}, T_J=25^{\circ}\text{C}$	5	5.8	7.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage $I_C=15\text{A}, V_{GE}=15\text{V}, T_J=25^{\circ}\text{C}$ $I_C=15\text{A}, V_{GE}=15\text{V}, T_J=125^{\circ}\text{C}$		1.9	2.3	V
			2.3		
R_{Gint}	Integrated Gate Resistor		0		Ω
Q_g	Gate Charge $V_{CE}=600\text{V}, I_C=15\text{A}, V_{GE}=15\text{V}$		0.09		μC
C_{ies}	Input Capacitance		1.39		nF
C_{res}	Reverse Transfer Capacitance $V_{CE}=30\text{V}, V_{GE}=0\text{V}, f=0.1\text{MHz}$		0.06		nF
$t_{d(on)}$	Turn - on Delay Time $V_{CC}=600\text{V}, I_C=15\text{A}, R_G=56\Omega,$	$T_{vj}=25^{\circ}\text{C}$	60		ns
		$T_{vj}=125^{\circ}\text{C}$	70		ns
t_r	Rise Time $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_{vj}=25^{\circ}\text{C}$	30		ns
		$T_{vj}=125^{\circ}\text{C}$	40		ns
$t_{d(off)}$	Turn - off Delay Time $V_{CC}=600\text{V}, I_C=15\text{A}, R_G=56\Omega,$	$T_{vj}=25^{\circ}\text{C}$	220		ns
		$T_{vj}=125^{\circ}\text{C}$	250		ns
t_f	Fall Time $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_{vj}=25^{\circ}\text{C}$	80		ns
		$T_{vj}=125^{\circ}\text{C}$	100		ns
E_{on}	Turn - on Energy $V_{CC}=600\text{V}, I_C=15\text{A}, R_G=56\Omega,$	$T_{vj}=25^{\circ}\text{C}$	1.2		mJ
		$T_{vj}=125^{\circ}\text{C}$	1.55		mJ
E_{off}	Turn - off Energy $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_{vj}=25^{\circ}\text{C}$	1.4		mJ
		$T_{vj}=125^{\circ}\text{C}$	1.7		mJ
I_{sc}	Short Circuit Current $t_{psc}\leq 10\mu\text{S}, V_{GE}=15\text{V}$ $T_{vj}=125^{\circ}\text{C}, V_{CC}=900\text{V}$		60		A
R_{thJC}	Junction-to-Case Thermal Resistance (Per IGBT)			1.8	K / W

DIODE-brake-chopper $T_c=25^{\circ}\text{C}$ unless otherwise noted

Maximum Rated Values

Symbol	Description	HYG15P120B1K1	Units
V_{RRM}	Repetitive Peak Reverse Voltage $T_J=25^{\circ}\text{C}$	1200	V
I_F	DC Forward Current $T_c=80^{\circ}\text{C}$	10	A
I_{FRM}	Repetitive Peak Forward Current	15	A

Characteristics Values

Symbol	Parameter		Min.	Typ.	Max.	Units
V _F	Forward Voltage	IF=5A , VGE=0V, T _{Vj} =25°C IF=5A , VGE=0V, T _{Vj} =125°C		2.0 1.95	2.2	V
t _{rr}	Reverse Recovery Time	IF=5A , VR=600V diF/dt=-200A/μs T _{Vj} =125°C		350		ns
I _{RRM}	Max. Reverse Recovery Current			6		A
E _{rec}	Reverse Recovery Charge			0.15		mJ
R _{thJC}	Junction-to-Case Thermal Resistance (Per DIODE)				2.5	K /W

Electrical Characteristics of NTC $T_c=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
R25	Rated Resistance	$T_c=25^{\circ}\text{C}$		20.0		k Ω
$\Delta R/R$	Deviation of R100	$T_c=100^{\circ}\text{C}$, R100=1354 Ω	-5		5	
P25	Power Dissipation	$T_c=25^{\circ}\text{C}$			20	mW
B25/50	B value			3940		K

Module Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units
V_{iso}	Isolation Voltage RMS, f=50Hz, t=1min		2500		V
T_{Vjmax}	Maximum Junction Temperature			150	$^{\circ}\text{C}$
T_{Vjop}	Operating Temperature	-40		125	$^{\circ}\text{C}$
Md	Mounting Screw:M4	3		5	N·m
T_{STG}	Storage Temperature range	-40		125	$^{\circ}\text{C}$
Weight				23.5	g

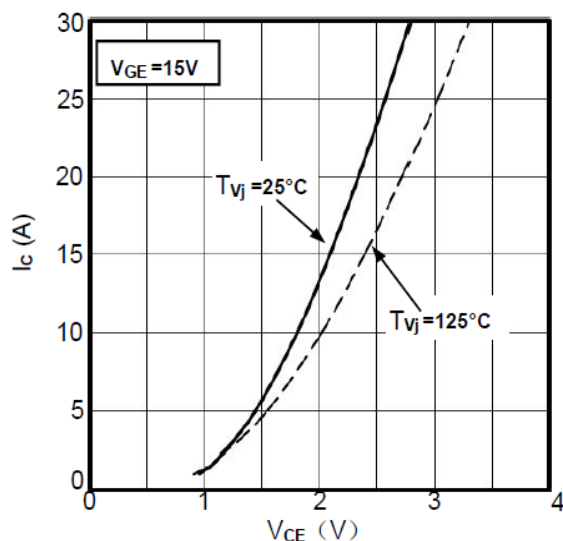


Figure1. Typical Output Characteristics

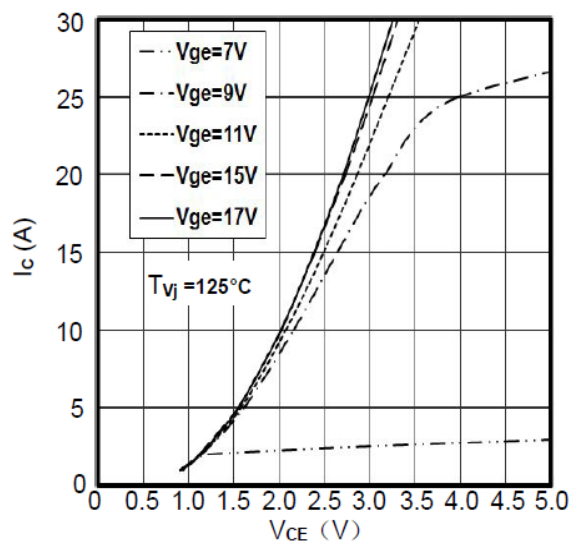


Figure2. Typical Output Characteristics

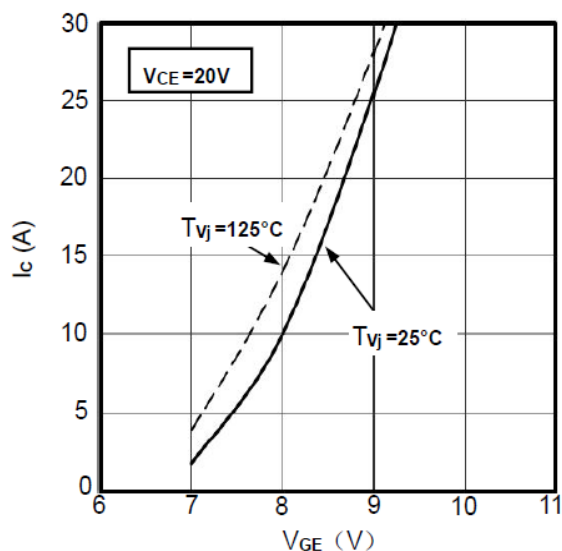


Figure3. Typical Transfer characteristics

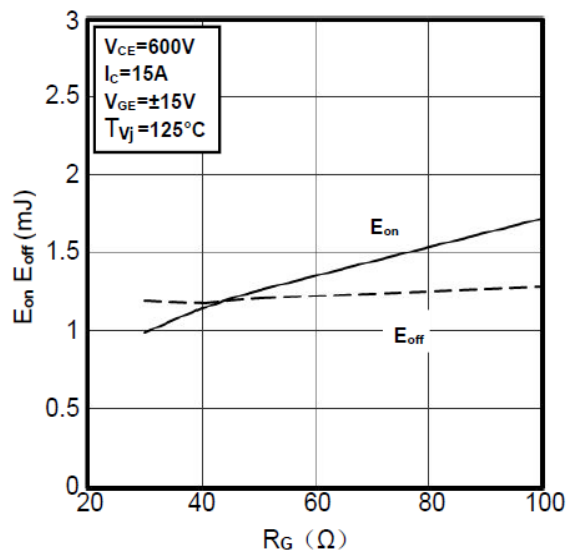


Figure4. Switching Energy vs. Gate Resistor

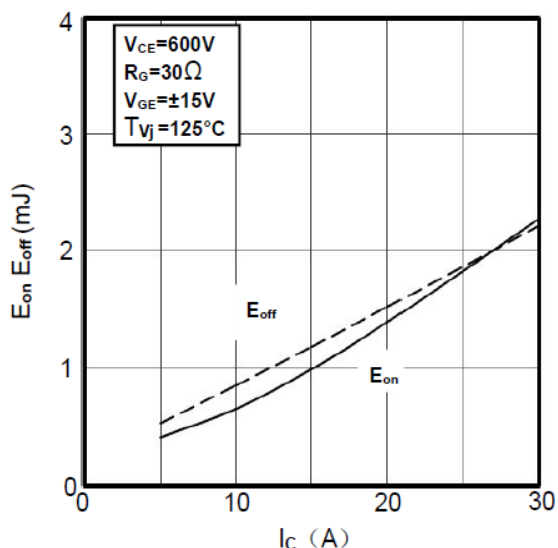


Figure5. Switching Energy vs. Collector Current

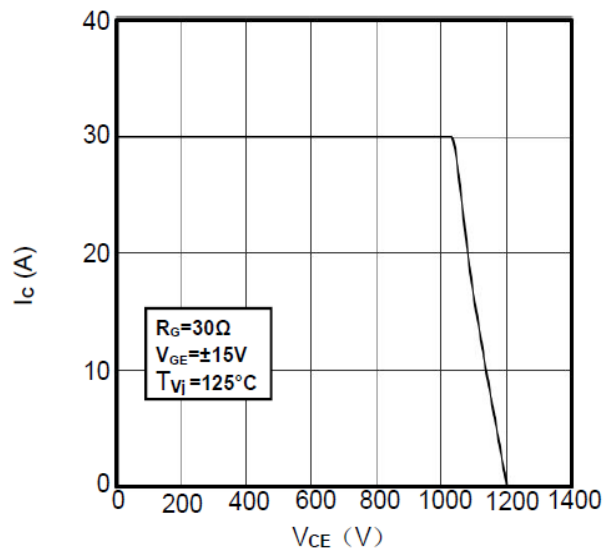


Figure6. Reverse Biased Safe Operating Area

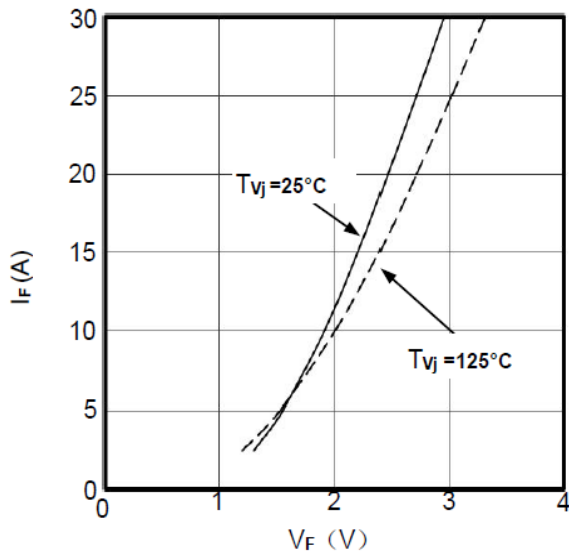


Figure7. Diode Forward Characteristics

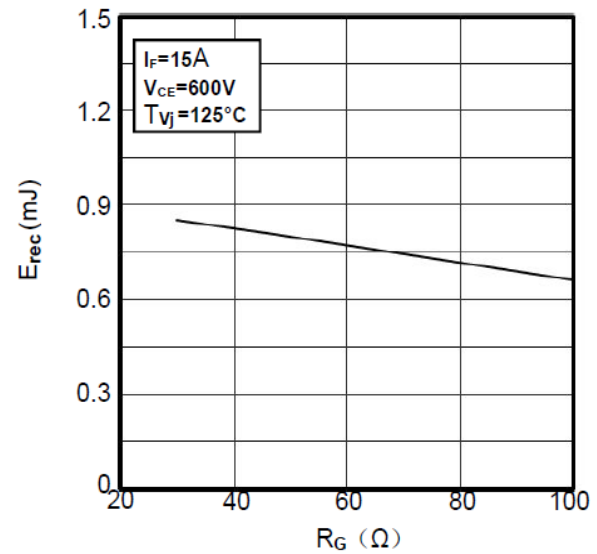


Figure8. Switching Energy vs. Gate Resistor

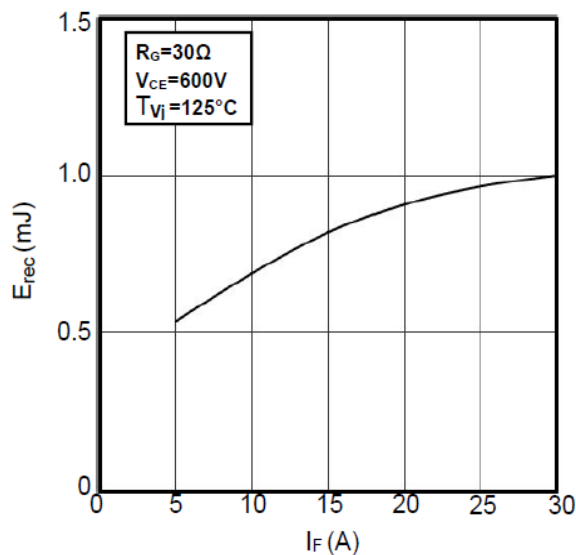


Figure9. Switching Energy vs. Forward Current

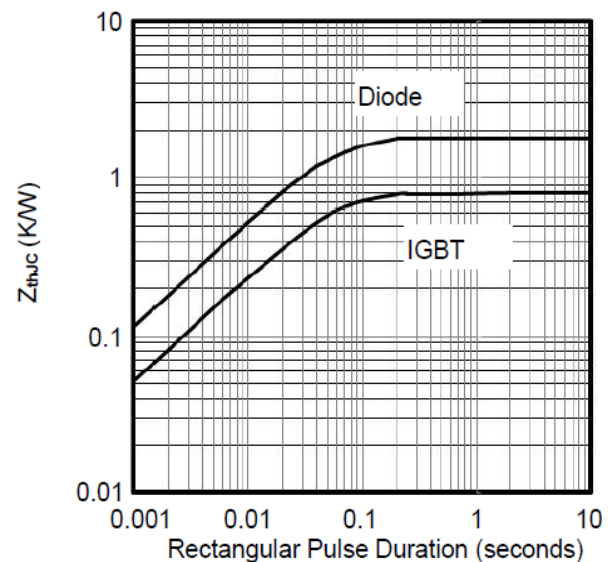


Figure10. Transient Thermal Impedance

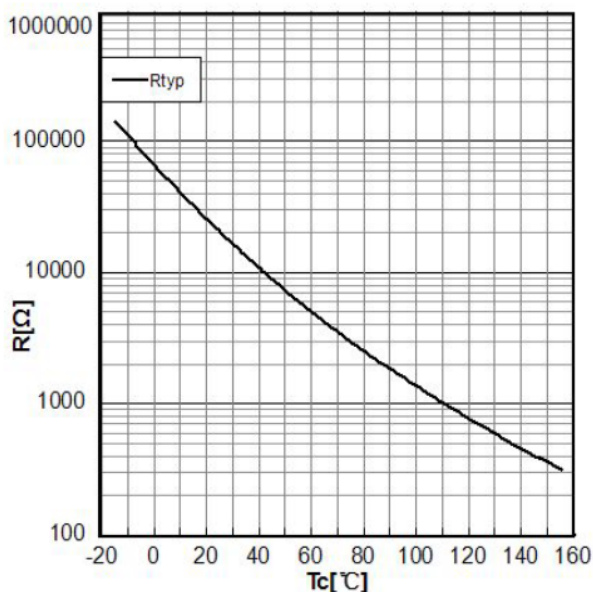


Figure11. NTC-Thermistor-temperature characteristic

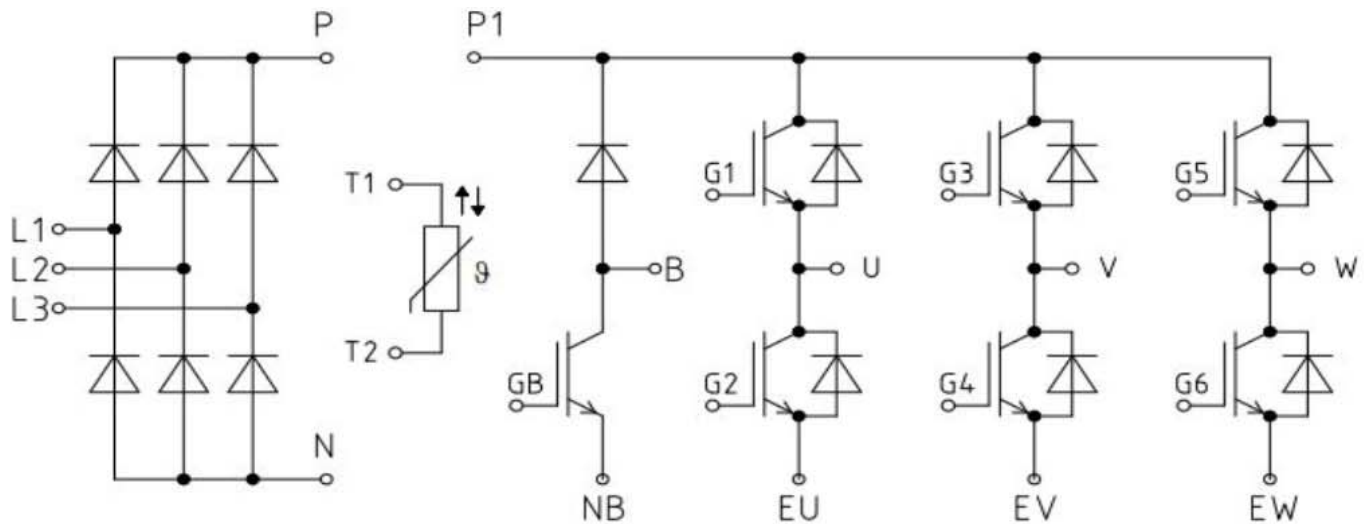


Figure11. Circuit Diagram

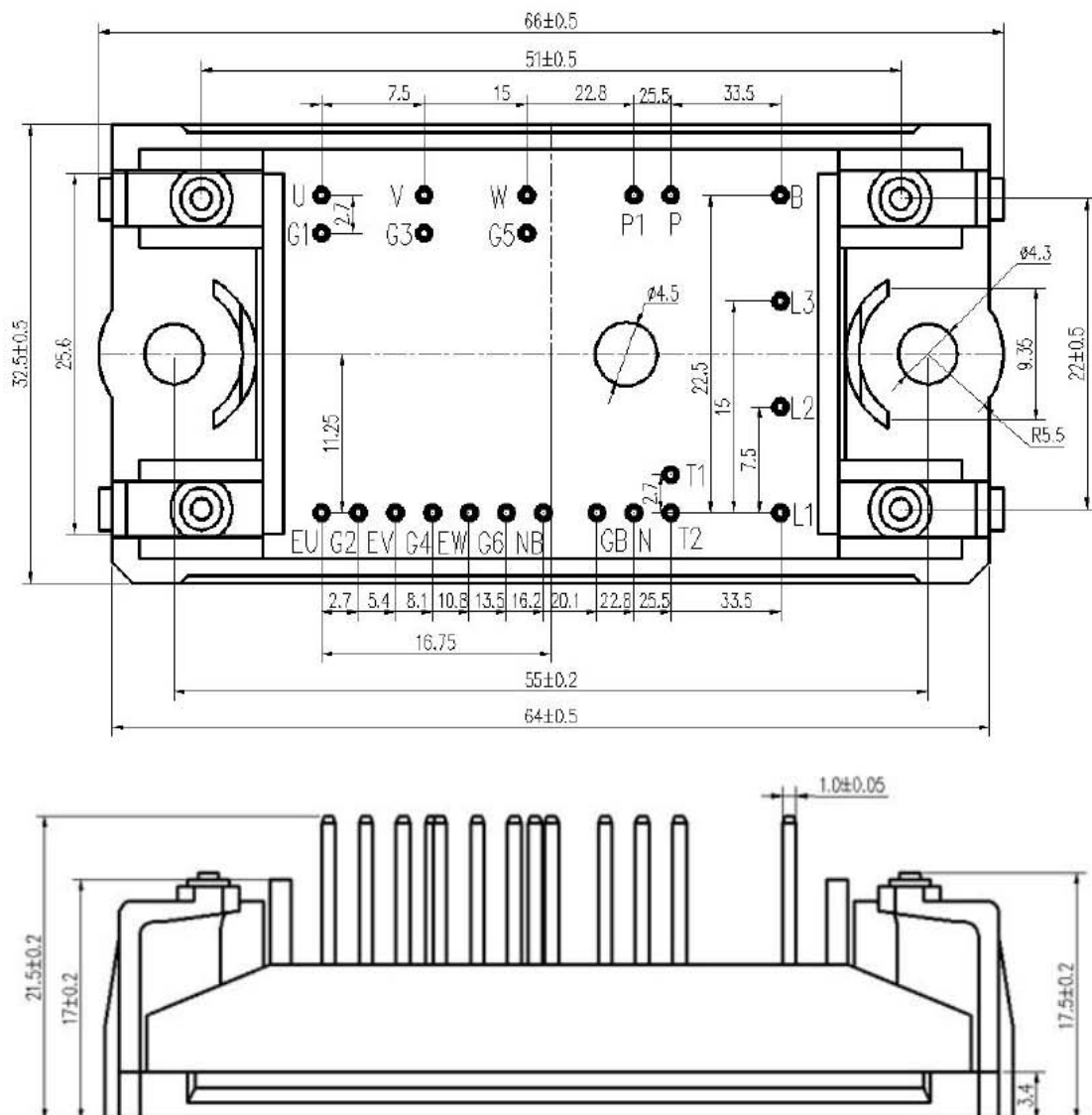


Figure12. Package Dimensions (mm)