

PIM with Trench Field-Stop IGBT, Emitter Controlled Diode and NTC

Features

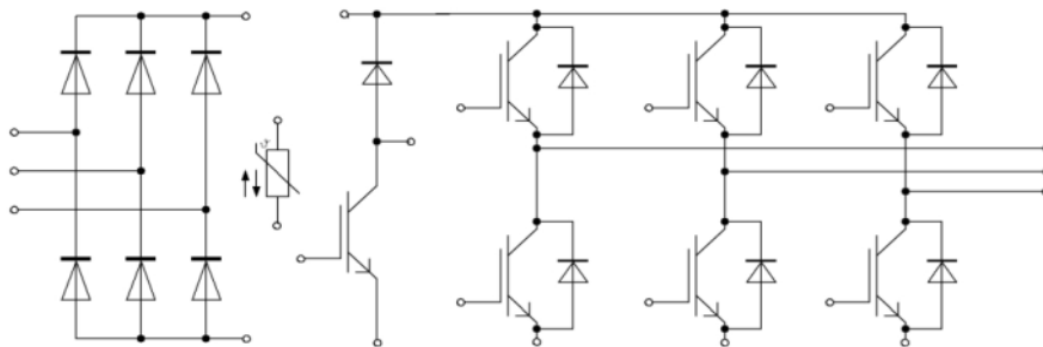
- Trench+ Field Stop Technology
- 1200V Trench Field-Stop IGBT
- Low $V_{CE(sat)}$ with Low Switching Losses

Applications

- Frequency Converters
- Motor Drives
- Auxiliary Inverters



Equivalent Circuit Schematic



IGBT - Inverter

Maximum Rated Values

Symbol	Description	Conditions	Values	Unit
V_{CES}	Collector-Emitter Voltage	$T_{vj}=25^{\circ}C$	1200	V
V_{GES}	Gate-Emitter Peak Voltage	$T_{vj}=25^{\circ}C$	± 20	V
I_C	Continuous DC Collector Current	$T_C=100^{\circ}C$	15	A
I_{CRM}	Repetitive Peak Collector Current	$t_p=1ms$	30	A
P_{tot}	Total Power Dissipation	$T_C=25^{\circ}C, T_{vj\ max}=175^{\circ}C$	130	W

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE}=15V, I_C=15A, T_{vj}=25^{\circ}C$	---	2.12	---	V
		$V_{GE}=15V, I_C=15A, T_{vj}=125^{\circ}C$	---	2.48	--	V
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE}=V_{CE}, I_C=0.48mA$		5.6		V
I_{CES}	Collector-Emitter Cut-Off Current	$V_{CE}=1200V, V_{GE}=0V$	---	---	1	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=20V, V_{CE}=0V$	---	---	100	nA
C_{ies}	Input Capacitance	$V_{CE}=25V, V_{GE}=0V, f=1MHz$	---	990	---	pF
C_{oes}	Output Capacitance		---	85	---	pF
C_{res}	Reverse Transfer Capacitance		---	36	---	pF
$t_{d(on)}$	Turn-on Delay Time	$V_{CE}=600V$ $V_{GE}=\pm 15V$ $I_C=15A$ $R_G=39\Omega$ Inductive Load $T_{vj}=25^{\circ}C$	---	38	---	ns
t_r	Turn-on Rise Time		---	25	---	ns
$t_{d(off)}$	Turn-off Delay Time		---	150	---	ns
t_f	Turn-off Fall Time		---	180	---	ns
E_{on}	Turn-on Switching Loss		---	1.11	---	mJ
E_{off}	Turn-off Switching Loss		---	0.95	---	mJ
I_{SC}	Short Circuit data	$V_{GE}\leq 15V, V_{CC}=800V$ $t_p\leq 10\mu s, T_{vj}=150^{\circ}C$	---	62	---	A
R_{thJC}	Thermal Resistance, Junction to Case	Per IGBT	---	---	1.15	K/W
$T_{VJ OP}$	Virtual Junction Temperature	Under Switching	-40	---	150	$^{\circ}C$

Diode - Inverter Maximum Rated Values

Symbol	Description	Conditions	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	$T_{vj}=25^{\circ}C$	1200	V
I_F	Continuous DC Forward Current		15	A
I_{FRM}	Repetitive Peak Collector Current	$t_p=1ms$	30	A

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
V_F	Forward Voltage	$I_F=15A, V_{GE}=0V, T_{vj}=25^{\circ}C$	---	1.97	---	V
		$I_F=15A, V_{GE}=0V, T_{vj}=125^{\circ}C$	---	1.59	---	V
I_{RM}	Peak Reverse Recovery Current	$I_F=15A, V_R=600V, V_{GE}=-15V, T_{vj}=25^{\circ}C$	---	8	---	A
Q_r	Recovered Charge		---	4.7	---	uC
E_{rec}	Reverse Recovery Energy		---	0.05	---	mJ
R_{thJC}	Thermal Resistance, Junction to Case	Per Diode	---	---	1.3	K/W
$T_{VJ OP}$	Virtual Junction Temperature	Under Switching	-40	---	150	$^{\circ}C$

Diode - Rectifier Maximum Rated Values

Symbol	Description	Conditions	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	$T_{vj}=25^{\circ}C$	1600	V
$I_{F(AV)}$	Average Output Current	$T_{vj}=25^{\circ}C$	16	A
I_{FSM}	Surge Forward Current	$t_p=10ms, \sin 180^{\circ}, T_j=25^{\circ}C$	32	A
I^2t	I^2t Value	$t_p=10ms, \sin 180^{\circ}, T_j=25^{\circ}C$	180	A^2s

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
V_F	Forward Voltage	$I_F=16A, V_{GE}=0V, T_{vj}=25^{\circ}C$	---	0.95	---	V
I_R	Recovery Current	$V_R=1600V, T_{vj}=25^{\circ}C$	---	5	---	uA
$T_{VJ OP}$	Virtual Junction Temperature	Under Switching	-40	---	150	$^{\circ}C$

IGBT – Brake

Maximum Rated Values

Symbol	Description	Conditions	Values	Unit
V_{CES}	Collector-Emitter Voltage	$T_{vj}=25^{\circ}\text{C}$	1200	V
V_{GES}	Gate-Emitter Peak Voltage	$T_{vj}=25^{\circ}\text{C}$	± 20	V
I_C	Continuous DC Collector Current	$T_C=100^{\circ}\text{C}$	15	A
I_{CRM}	Repetitive Peak Collector Current	$t_p=1\text{ms}$	30	A

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE}=15\text{V}, I_C=15\text{A}, T_{vj}=25^{\circ}\text{C}$	---	2.04	--	V
		$V_{GE}=15\text{V}, I_C=15\text{A}, T_{vj}=125^{\circ}\text{C}$	---	2.42	--	V
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE}=V_{CE}, I_C=480\mu\text{A}$	---	5.6	---	V
I_{CES}	Collector-Emitter Cut-Off Current	$V_{CE}=1200\text{V}, V_{GE}=0\text{V}$	---	---	1	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=20\text{V}, V_{CE}=0\text{V}$	---	---	100	nA
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$	---	990	---	pF
C_{oes}	Output Capacitance		---	53	---	pF
C_{res}	Reverse Transfer Capacitance		---	36	---	pF
$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=600\text{V}$ $V_{GE}=\pm 15\text{V}$ $I_C=15\text{A}$ $R_G=39\Omega$ Inductive Load $T_{vj}=25^{\circ}\text{C}$	---	39	---	ns
t_r	Turn-on Rise Time		---	28	---	ns
$t_{d(off)}$	Turn-off Delay Time		---	163	---	ns
t_f	Turn-off Fall Time		---	176	---	ns
E_{on}	Turn-on Switching Loss		---	1.1	---	mJ
E_{off}	Turn-off Switching Loss		---	0.96	---	mJ
I_{SC}	Short Circuit Data	$V_{GE}\leq 15\text{V}, V_{CC}=800\text{V}$ $t_p\leq 10\mu\text{s}, T_{vj}=25^{\circ}\text{C}$	---	62	---	A
$T_{VJ OP}$	Virtual Junction Temperature	Under Switching	-40	---	150	$^{\circ}\text{C}$

Diode - Brake

Maximum Rated Values

Symbol	Description	Conditions	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	$T_{vj}=25^{\circ}C$	1200	V
I_F	Continuous DC Forward Current		15	A
I_{FRM}	Repetitive Peak Collector Current	$t_p=1ms$	30	A

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
V_F	Forward Voltage	$I_F=15A, V_{GE}=0V, T_{vj}=25^{\circ}C$	---	1.95	---	V
		$I_F=15A, V_{GE}=0V, T_{vj}=125^{\circ}C$	---	1.56	---	V
I_{RM}	Peak Reverse Recovery Current	$I_F=15A, di/dt=1000A/us$ $V_R=600V, V_{GE}=-15V$ $T_{vj}=25^{\circ}C$	---	11	---	A
Q_r	Recovered Charge		---	0.95	---	μC
E_{rec}	Reverse Recovery Energy		---	0.3	---	mJ
$T_{VJ OP}$	Virtual Junction Temperature	Under Switching	-40	---	150	$^{\circ}C$

NTC-Thermistor

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
R_{25}	Rated Resistance	$T_C=25^{\circ}C$	---	5	---	K Ω
$B_{25/50}$	B Value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298 K))]$	---	3380	---	K

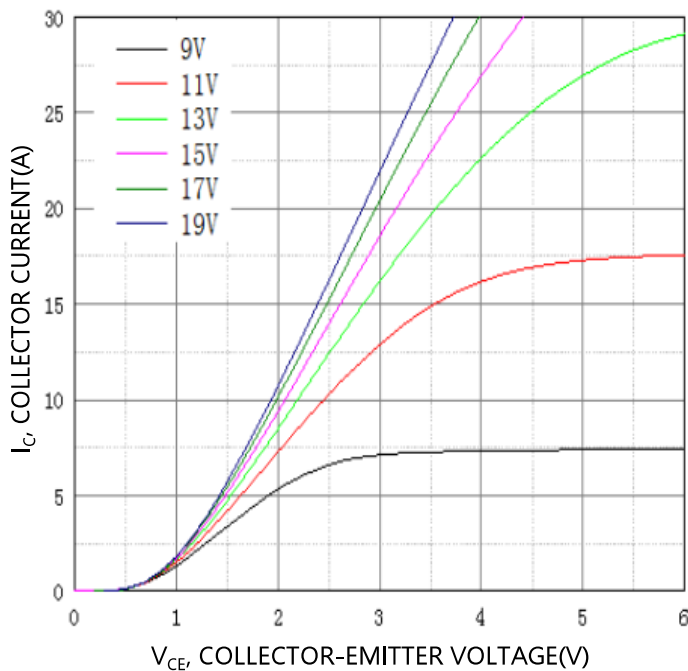
Module

Symbol	Description	Conditions	Values	Unit
V _{ISOL}	Isolation Test Voltage	RMS, f=50Hz, t=1min	3	KV
	Internal Isolation	Basic Insulation (Class 1, IEC 61140)	Al ₂ O ₃	
	Creepage Distance	Terminal to Heatsink Terminal to Terminal	11.8 6	mm
	Clearance	Terminal to Heatsink Terminal to Terminal	10.2 5.1	mm

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
L _{sCE}	Stray Inductance Module		---	30	---	nH
T _{stg}	Storage Temperature		-40	---	125	°C
R _{CC'+EE'}	Module lead resistance, terminals-chip		---	8.0	---	mΩ
G	Weight		---	23.8	---	g

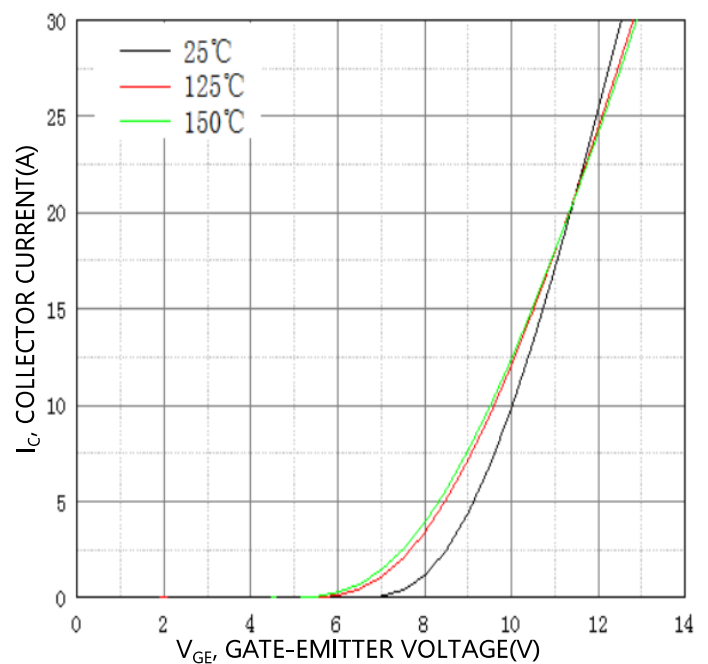
Typical Characteristics

Fig. 1



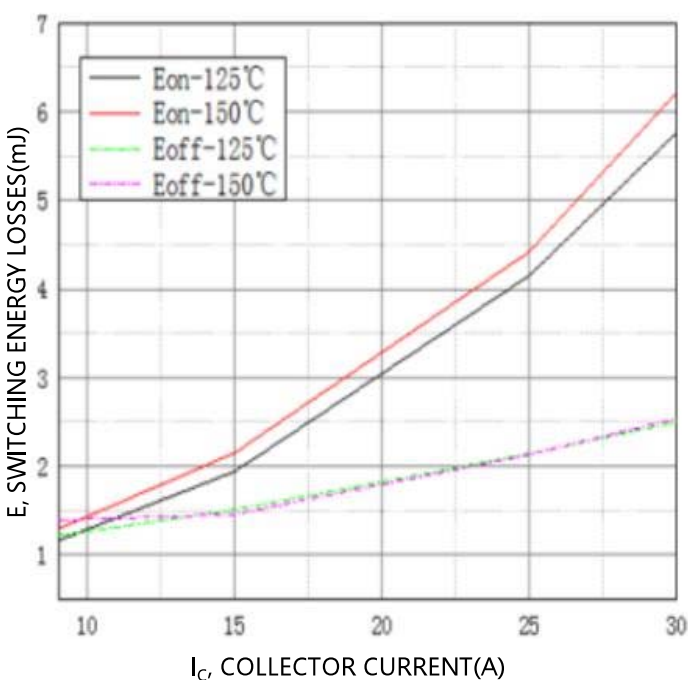
Output characteristic IGBT-Inverter (typical)
 $I_C = f(V_{CE})$ at $T_j = 150^\circ\text{C}$

Fig. 2



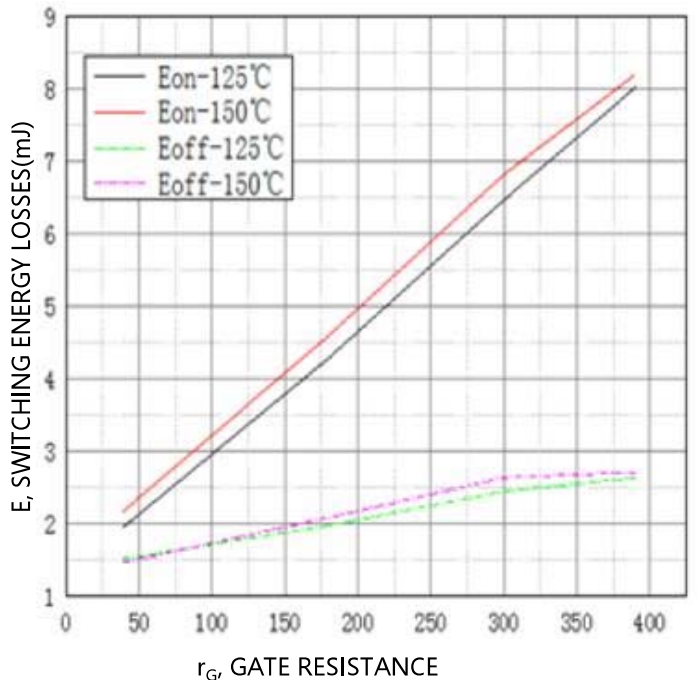
Transfer characteristic IGBT-Inverter (typical)
 $I_C = f(V_{GE})$ at $V_{CE} = 20\text{V}$

Fig. 3



Switching losses IGBT-Inverter (typical)
 $E_{on} = f(I_C)$, $E_{off} = f(I_C)$ at $V_{GE} = \pm 15\text{V}$, $R_G = 39\Omega$ and $V_{CE} = 600\text{V}$

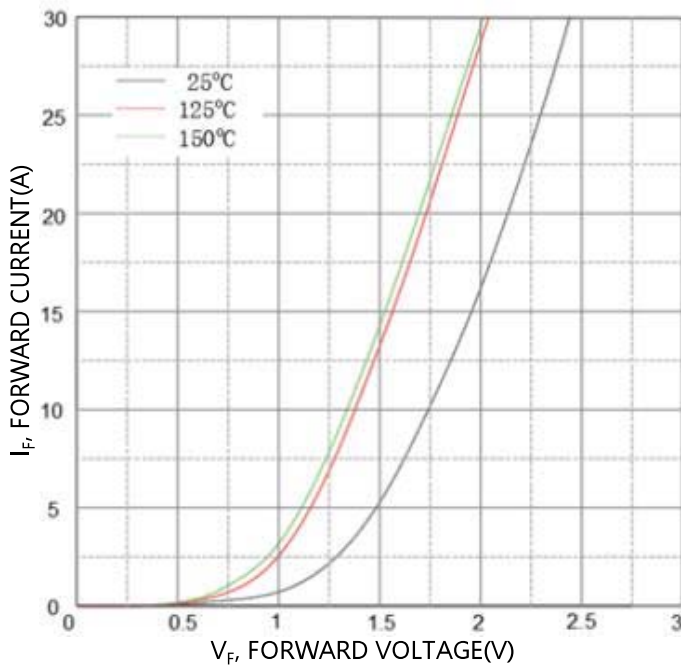
Fig. 4



Switching losses IGBT-Inverter (typical)
 $E_{on} = f(R_G)$, $E_{off} = f(R_G)$ at $V_{GE} = \pm 15\text{V}$, $I_C = 15\text{A}$ and $V_{CE} = 600\text{V}$

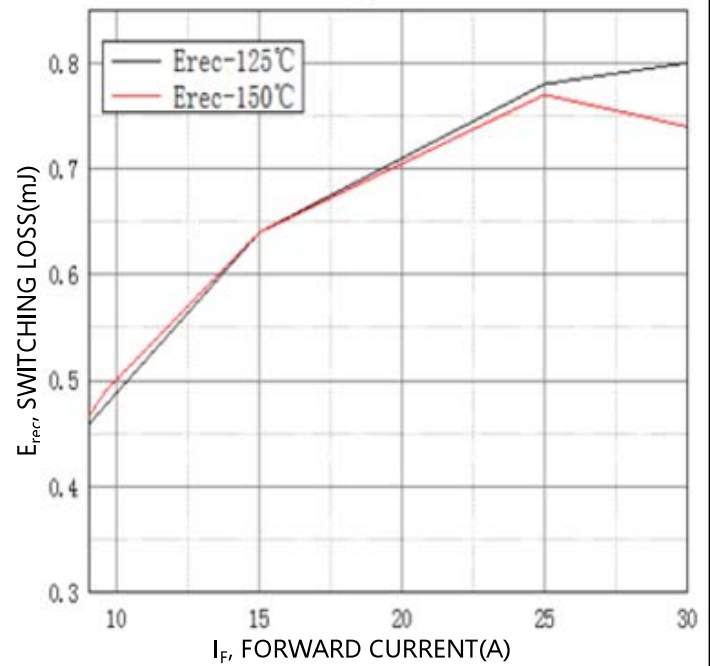
Typical Characteristics

Fig. 5



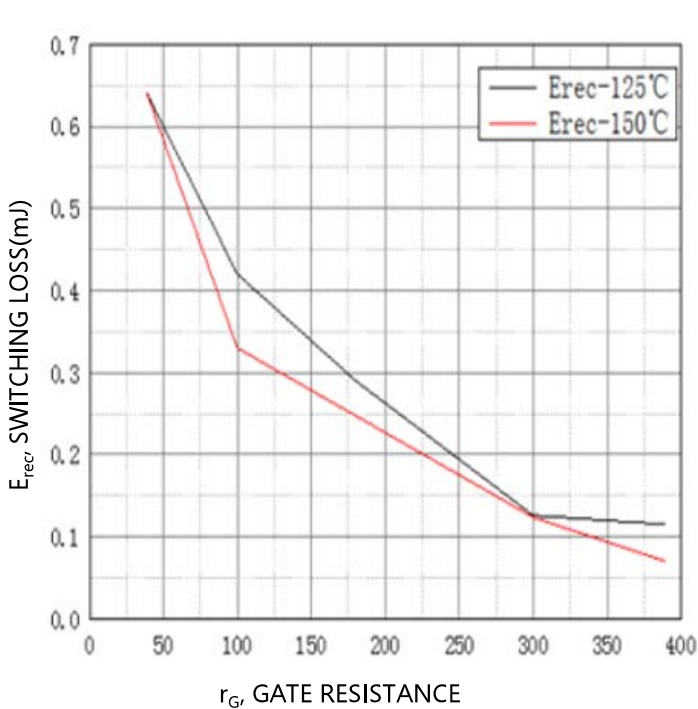
Forward characteristic of Diode-Inverter (typical)
 $I_F = f(V_F)$

Fig. 6



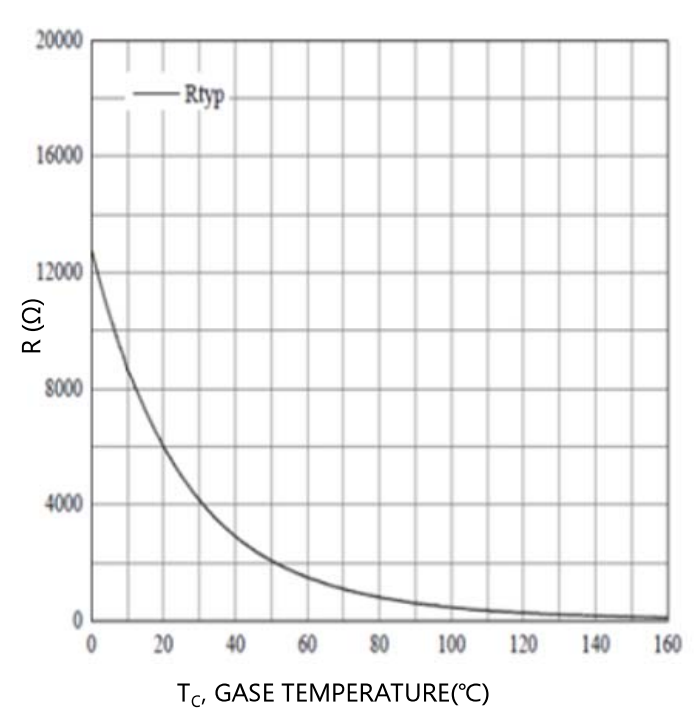
Switching losses Diode-Inverter (typical)
 $E_{rec} = f(I_F)$ at $R_G = 39\Omega$ and $V_{CE} = 600V$

Fig. 7



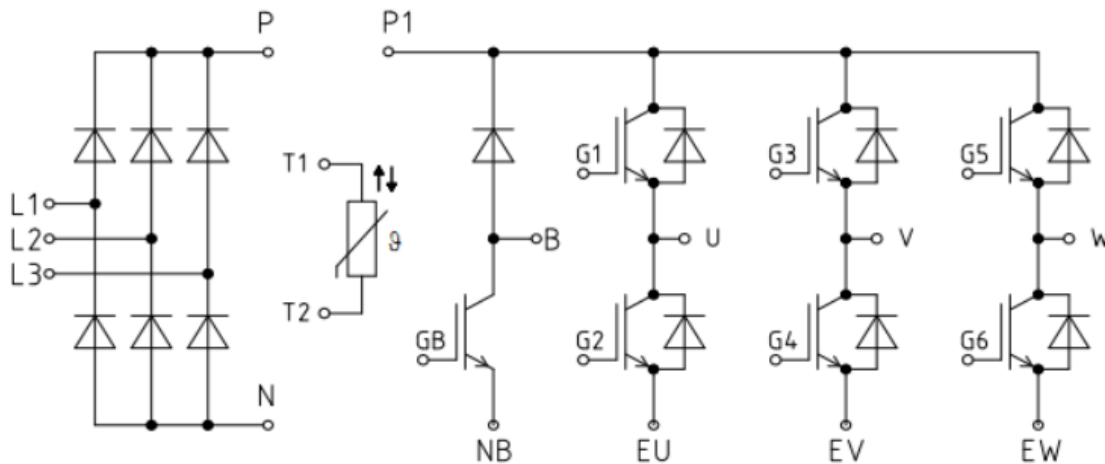
Switching losses Diode-Inverter (typical)
 $E_{rec} = f(I_F)$ at $I_F = 15A$ and $V_{CE} = 600V$

Fig. 8



NTC-Thermistor-Temperature Characteristic (typical), $R = f(T)$

Circuit Diagram



Package Outlines (mm)

