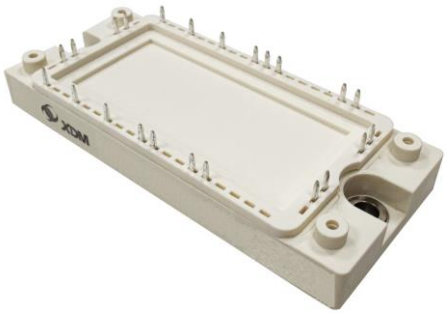
PIM with Trench Field-Stop IGBT, Emitter Controlled Diode and NTC

Features

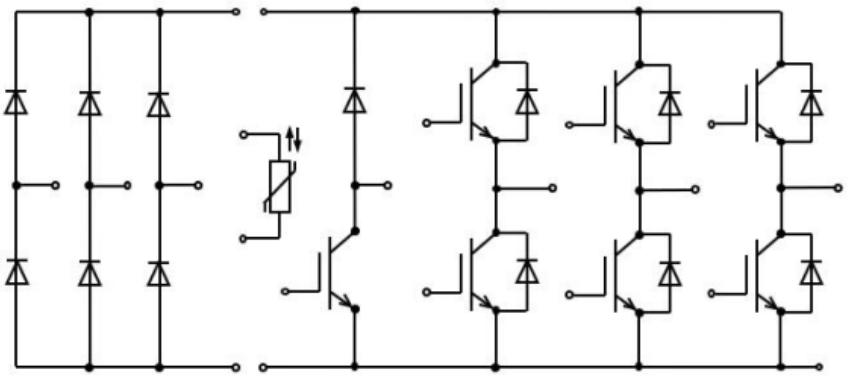
- V_{CE}=1200V I_C=50A
- Low $V_{CE(sat)}$ with Positive Temperature Coefficient
- Trench+ Field Stop Technology

Applications

- Industrial Inverters
- Servo Applications



Equivalent Circuit Schematic



IGBT - Inverter

Maximum Rated Values

Symbol	Description	Conditions	Values	Unit
V_{CES}	Collector-Emitter Voltage	T_{vj}=25℃	1200	V
V_{GES}	Gate-Emitter Peak Voltage	T_{vj}=25℃	±20	V
I_C	Continuous DC Collector Current	T_C=100℃	50	A
I_{CRM}	Repetitive Peak Collector Current	t_P=1ms	100	A
P_{tot}	Total Power Dissipation	T_C=25℃, $T_{vj\ max}$=175℃	277	W

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE}=15V, I_C=50A, T_{vj}=25℃	---	2.1	2.16	V
		V_{GE}=15V, I_C=50A, T_{vj}=125℃	---	2.28	--	V
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE}=V_{CE}, I_C=1.0mA	5.4	5.6	6.03	V
I_{CES}	Collector-Emitter Cut-Off Current	V_{CE}=1200V, V_{GE}=0V	---	---	1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=20V, V_{CE}=0V	---	---	300	nA
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f=1MHz	---	10.4	---	nF
C_{oes}	Output Capacitance		---	0.56	---	nF
$t_{d(on)}$	Turn-on Delay Time	V_{CC}=600V V_{GE}=±15V I_C=50A R_G=22Ω Inductive Load T_{vj}=25℃	---	151	---	ns
t_r	Turn-on Rise Time		---	60	---	ns
$t_{d(off)}$	Turn-off Delay Time		---	478	---	ns
t_f	Turn-off Fall Time		---	266	---	ns
E_{on}	Turn-on Switching Loss		---	5.1	---	mJ
E_{off}	Turn-off Switching Loss		---	3.0	---	mJ
R_{thJC}	Thermal Resistance, Junction to Case	Per IGBT	---	---	0.541	K/W
$T_{VJ\ OP}$	Virtual Junction Temperature	Under Switching	-40	---	175	℃

Diode - Inverter

Maximum Rated Values

Symbol	Description	Conditions	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	T_{vj}=25℃	1200	V
I_F	Continuous DC Forward Current		50	A
I_{FRM}	Repetitive Peak Collector Current	t_P=1ms	100	A

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
V_F	Forward Voltage	I_F=50A, V_{GE}=0V, T_{vj}=25℃	---	2.0	2.18	V
		I_F=50A, V_{GE}=0V, T_{vj}=125℃	---	2.19	---	V
I_{RM}	Peak Reverse Recovery Current	I_F=50A, di/dt=750A/us V_R=600V, V_{GE}=-15V T_{vj}=25℃	---	38.2	---	A
Q_r	Recovered Charge		---	3.1	---	uC
E_{rec}	Reverse Recovery Energy		---	1.3	---	mJ
$T_{VJ\ OP}$	Virtual Junction Temperature	Under Switching	-40	---	150	℃

Diode - Rectifier

Maximum Rated Values

Symbol	Description	Conditions	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	T_{vj}=25℃	1600	V
I_R	Forward Current RMS Maximum Per Diode	T_C=125℃	50	A
I_{FSM}	Surge Forward Current	t_P=10ms	400	A
I^2t	I^2t Value	t_P=10ms, sin180°, T_j=25℃	800	A^2s

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
V_F	Forward Voltage	I_F=50A, V_{GE}=0V, T_{vj}=25℃	---	1.34	1.49	V
$T_{VJ\ OP}$	Virtual Junction Temperature	Under Switching	-40	---	150	℃

IGBT – Brake

Maximum Rated Values

Symbol	Description	Conditions	Values	Unit
V_{CES}	Collector-Emitter Voltage	T_{vj}=25℃	1200	V
V_{GES}	Gate-Emitter Peak Voltage	T_{vj}=25℃	±20	V
I_C	Continuous DC Collector Current	T_C=100℃	50	A
I_{CRM}	Repetitive Peak Collector Current	t_P=1ms	80	A

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE}=15V, I_C=50A, T_{vj}=25℃	---	2.25	2.3	V
		V_{GE}=15V, I_C=50A, T_{vj}=125℃	---	2.50	2.68	V
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE}=V_{CE}, I_C=1.0mA	4.7	5.6	6.0	V
I_{CES}	Collector-Emitter Cut-Off Current	V_{CE}=1200V, V_{GE}=0V	---	---	300	uA
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	---	4.9	---	nF
C_{oes}	Output Capacitance		---	0.3	---	nF
$t_{d(on)}$	Turn-on Delay Time	V_{CC}=600V V_{GE}=±15V I_C=50A R_G=22Ω Inductive Load T_{vj}=25℃	---	53	---	ns
t_r	Turn-on Rise Time		---	89	---	ns
$t_{d(off)}$	Turn-off Delay Time		---	383	---	ns
t_f	Turn-off Fall Time		---	176	---	ns
E_{on}	Turn-on Switching Loss		---	5.06	---	mJ
E_{off}	Turn-off Switching Loss		---	2.6	---	mJ
$T_{VJ\ OP}$	Virtual Junction Temperature	Under Switching	-40	---	150	℃

Diode - Brake

Maximum Rated Values

Symbol	Description	Conditions	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	T_{vj}=25℃	1200	V
I_F	Continuous DC Forward Current		25	A
I_{FRM}	Repetitive Peak Collector Current	t_P=1ms	50	A

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
V_F	Forward Voltage	I_F=50A, V_{GE}=0V, T_{vj}=25℃	---	2.0	2.2	V
		I_F=50A, V_{GE}=0V, T_{vj}=125℃	---	2.1	---	V
I_{RM}	Peak Reverse Recovery Current	I_F=50A, V_R=600V, di/dt=850A/us,T_{vj}=25℃	---	30	---	A
Q_r	Recovered Charge		---	2.0	---	uC
E_{rec}	Reverse Recovery Energy		---	1.0	---	mJ
$T_{VJ\ OP}$	Virtual Junction Temperature	Under Switching	-40	---	150	℃

NTC-Thermistor

Characteristic Values

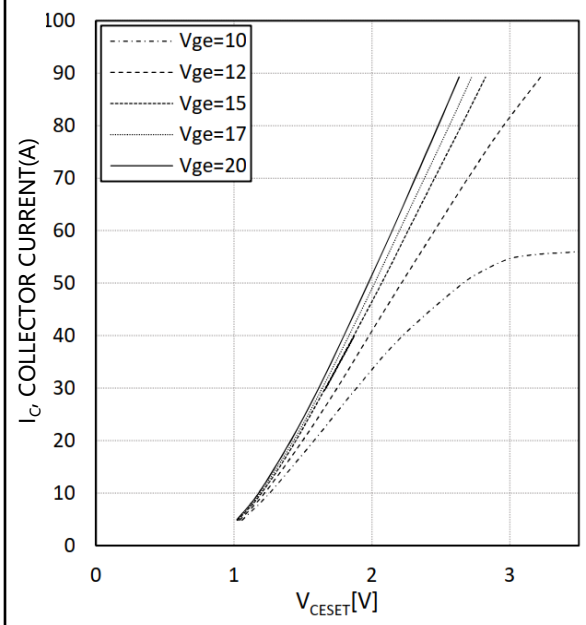
Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
R_{25}	Rated Resistance	T_C=25℃	---	5	---	KΩ
$B_{25/50}$	B Value	$R_2 = R_{25}\ \exp\ [B_{25/50}(1/T_2 - 1/(298\ K))]$	---	3380	---	K

Module

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
V_{ISOL}	Isolation Test Voltage	RMS, f=50Hz, t=1min	---	2.5	---	KV
M	Mounting Torque for Modul Mounting		4.0	---	6.0	Nm
T_{stg}	Storage Temperature		-40	---	125	℃
G	Weight		---	---	180	g

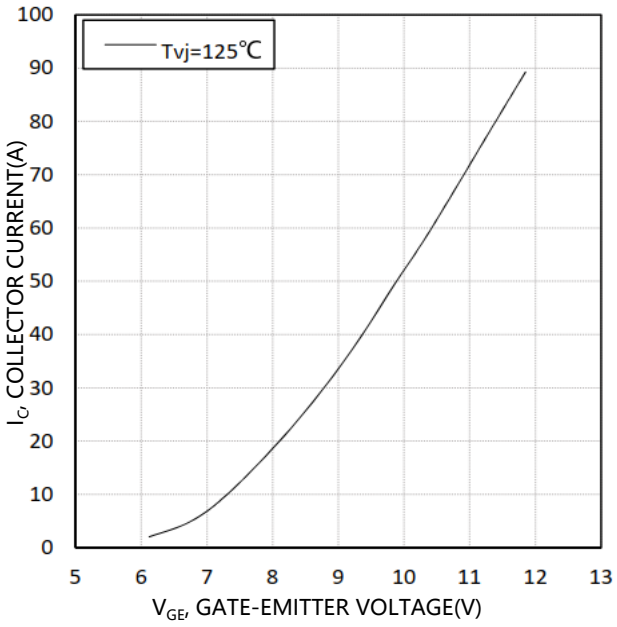
Typical Characteristics

Fig. 1



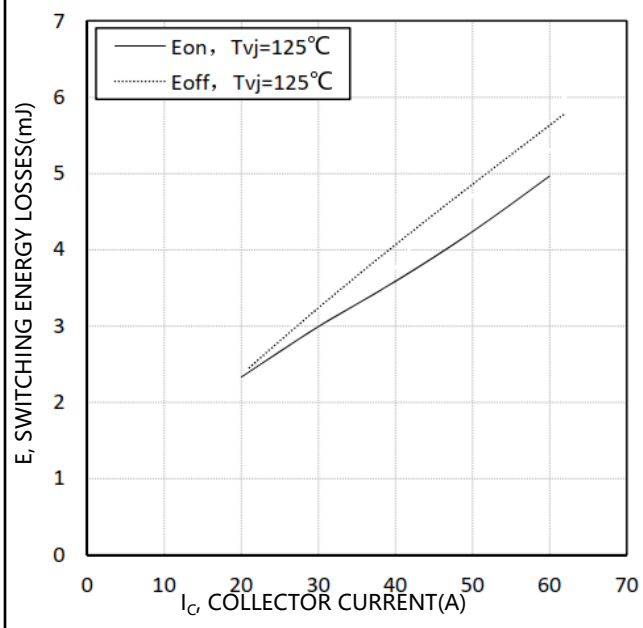
Typical Saturation Voltage Characteristics at T_{vj}=25℃

Fig. 2



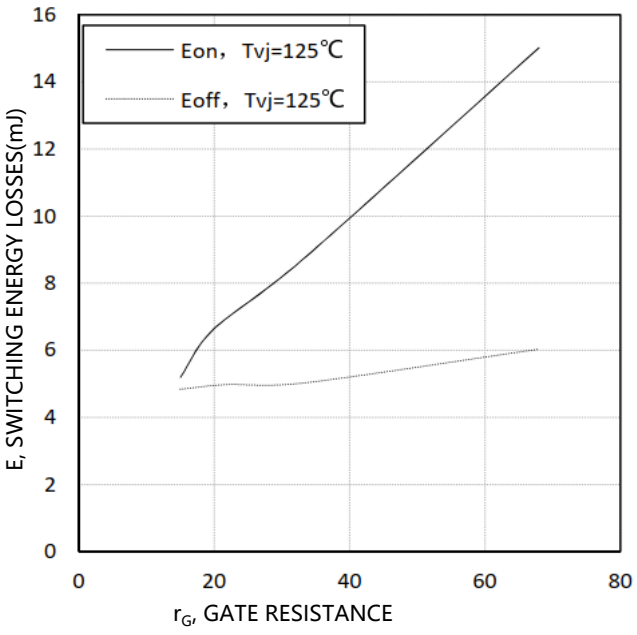
Transfer characteristic IGBT-Inverter (typical)
I_C=f(V_{GE}) at V_{CE}=20V

Fig. 3



Switching losses IGBT-Inverter (typical)
E_{on}=f(I_C), E_{off}=f(I_C) at V_{GE}=±15V , R_G=22Ω and V_{CE}=600V

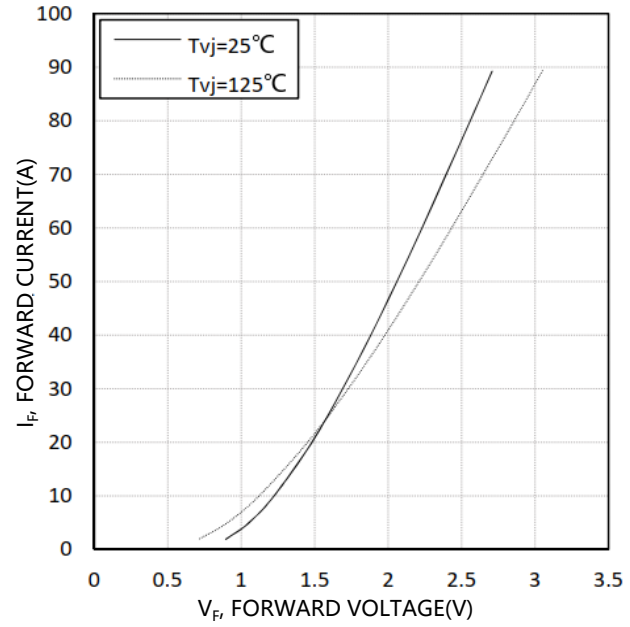
Fig. 4



Switching losses IGBT-Inverter (typical)
E_{on}=f(R_G), E_{off}=f(R_G) at V_{GE}=±15V, I_C=50A and V_{CE}=600V

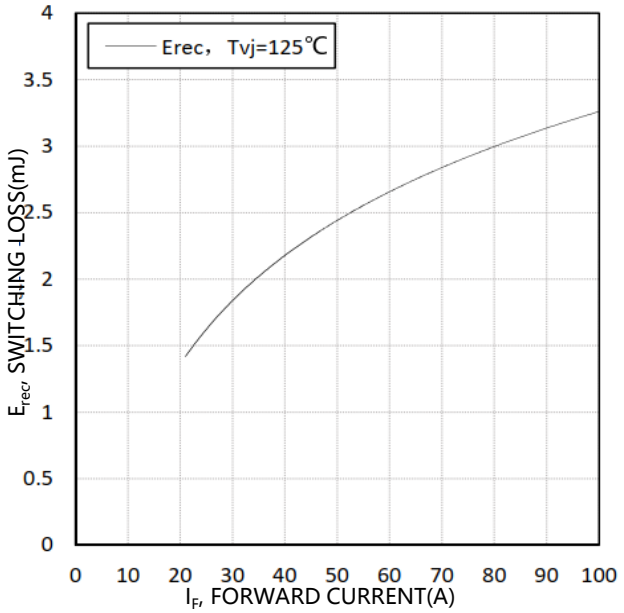
Typical Characteristics

Fig. 5



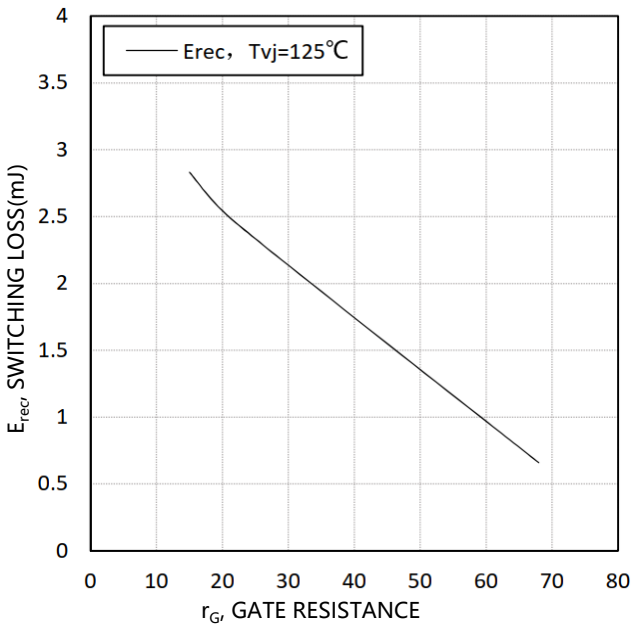
Forward characteristic of Diode-Inverter (typical)
$I_F=f(V_F)$

Fig. 6



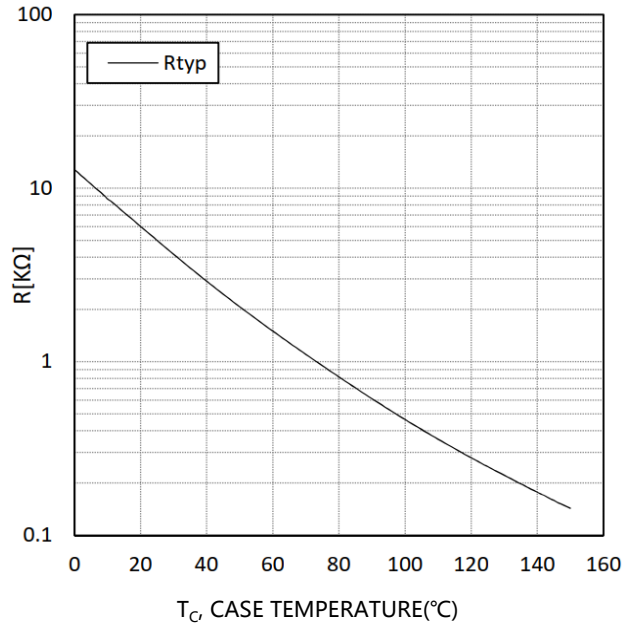
Switching losses Diode-Inverter (typical)
$E_{rec}=f(I_F)$ at $R_G=22\Omega$ and $V_{CE}=600V$

Fig. 7



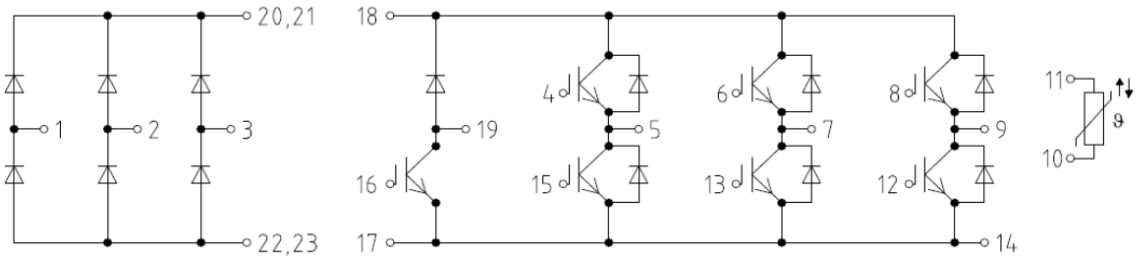
Switching losses Diode-Inverter (typical)
$E_{rec}=f(I_F)$ at $I_F=50A$ and $V_{CE}=600V$

Fig. 8



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

Circuit Diagram



Package Outlines (mm)