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

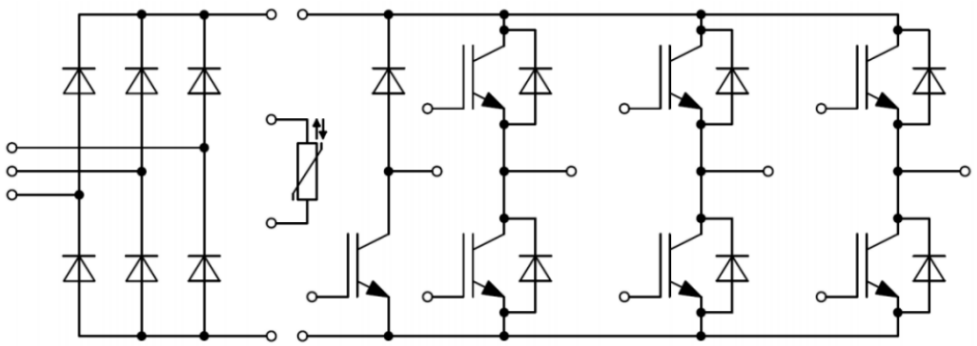
Features

- Low Stray Inductance
- HI-REL Power Terminals
- Lead Free, Compliant With RoHS Requirement

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℃	75	A
I_{CRM}	Repetitive Peak Collector Current	t_P=1ms	150	A
P_{tot}	Total Power Dissipation	T_C=25℃, $T_{vj\ max}$=175℃	455	W

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE}=15V, I_C=75A, T_{vj}=25℃	---	1.90	2.10	V
		V_{GE}=15V, I_C=75A, T_{vj}=125℃	---	2.20	--	V
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE}=V_{CE}, I_C=1mA	4.5	5.4	6.5	V
I_{CES}	Collector-Emitter Cut-Off Current	V_{CE}=1200V, V_{GE}=0V	---	---	500	uA
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=75A R_G=15Ω Inductive Load T_{vj}=25℃	---	190	---	ns
t_r	Turn-on Rise Time		---	100	---	ns
$t_{d(off)}$	Turn-off Delay Time		---	270	---	ns
t_f	Turn-off Fall Time		---	160	---	ns
E_{on}	Turn-on Switching Loss		---	5.2	---	mJ
E_{off}	Turn-off Switching Loss		---	3.6	---	mJ
R_{thJC}	Thermal Resistance, Junction to Case	Per IGBT	---	---	0.33	K/W
$T_{VJ\ OP}$	Virtual Junction Temperature	Under Switching	-40	---	150	℃

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=75A, V_{GE}=0V, T_{vj}=25℃	---	2.0	2.2	V
		I_F=75A, V_{GE}=0V, T_{vj}=150℃	---	2.2	---	V
I_{RM}	Peak Reverse Recovery Current	I_F=75A, V_R=600V, V_{GE}=-15V T_{vj}=25℃	---	46	---	A
Q_r	Recovered Charge		---	4.5	---	uC
E_{rec}	Reverse Recovery Energy		---	1.2	---	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=80℃	80	A
I_{FSM}	Surge current @tp=10 ms	T_j=25℃	500	A
I^2t	I^2t Value	t_P=10ms, T_j=25℃	1250	A^2s

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
V_F	Forward Voltage	I_F=75A, V_{GE}=0V, T_{vj}=125℃	---	1.15	1.35	V

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℃	40	A
I_{CRM}	Repetitive Peak Collector Current	t_P=1ms	80	A
P_{tot}	Total Power Dissipation	T_C=25℃, $T_{vj\ max}$=175℃	375	W

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE}=15V, I_C=40A, T_{vj}=25℃	---	2.0	2.2	V
		V_{GE}=15V, I_C=40A, T_{vj}=125℃	---	2.26	2.46	V
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE}=V_{CE}, I_C=1.7mA	3.5	4.4	5.5	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	---	---	300	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=40A R_G=15Ω Inductive Load T_{vj}=25℃	---	90	---	ns
t_r	Turn-on Rise Time		---	50	---	ns
$t_{d(off)}$	Turn-off Delay Time		---	140	---	ns
t_f	Turn-off Fall Time		---	180	---	ns
E_{on}	Turn-on Switching Loss		---	1.9	---	mJ
E_{off}	Turn-off Switching Loss		---	1.1	---	mJ
R_{thJC}	Thermal Resistance, Junction to Case	Per IGBT	---	---	0.4	K/W
$T_{VJ\ OP}$	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=25A, V_{GE}=0V, T_{vj}=25℃	---	2.0	2.2	V
		I_F=25A, V_{GE}=0V, T_{vj}=125℃	---	2.1	---	V
I_{RM}	Peak Reverse Recovery Current	I_F=25A, di/dt=850A/us V_R=600V, V_{GE}=-15V 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

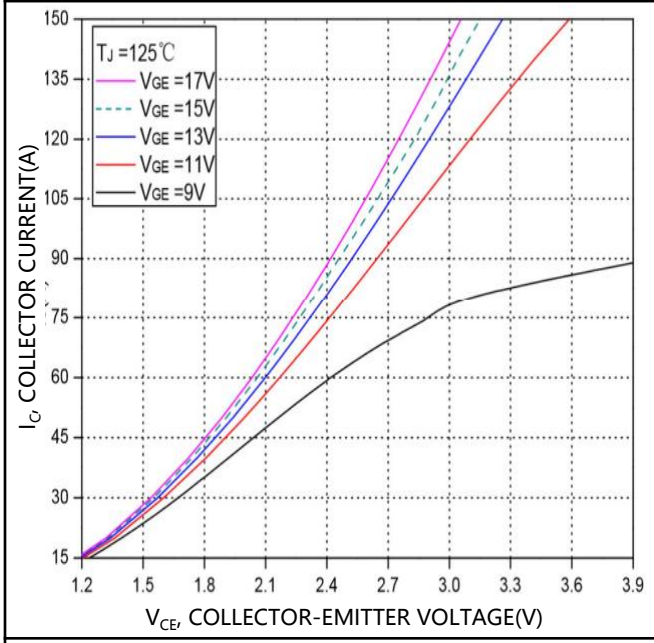
Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
R_{25}	Rated Resistance	T_C=25℃	---	5	---	KΩ
$B_{25/50}$	B Value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 – 1/(298\ K))]$	---	3380	---	K

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		---	---	300	g

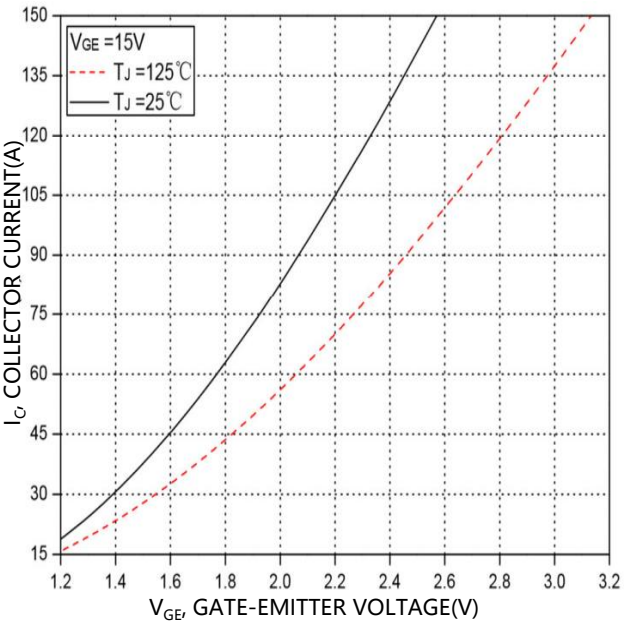
Typical Characteristics

Fig. 1



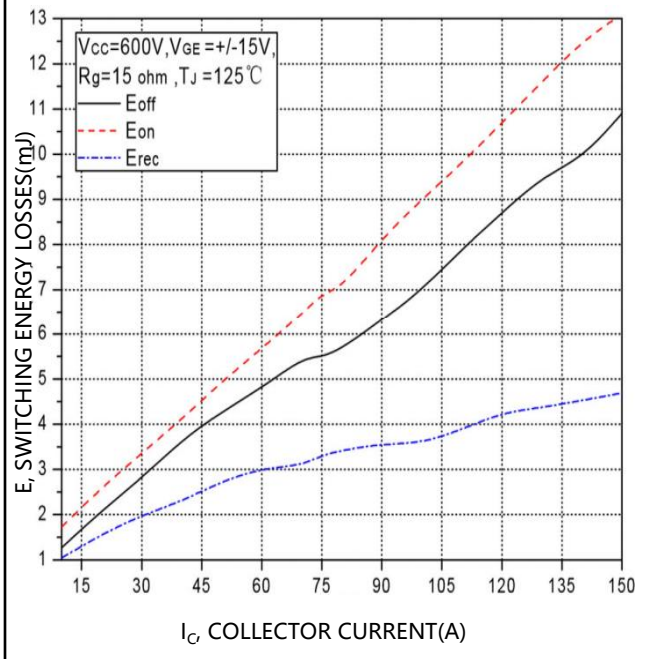
Output characteristic IGBT-Inverter (typical)
$I_C=f(V_{CE})$ at $T_{vj}=125℃$

Fig. 2



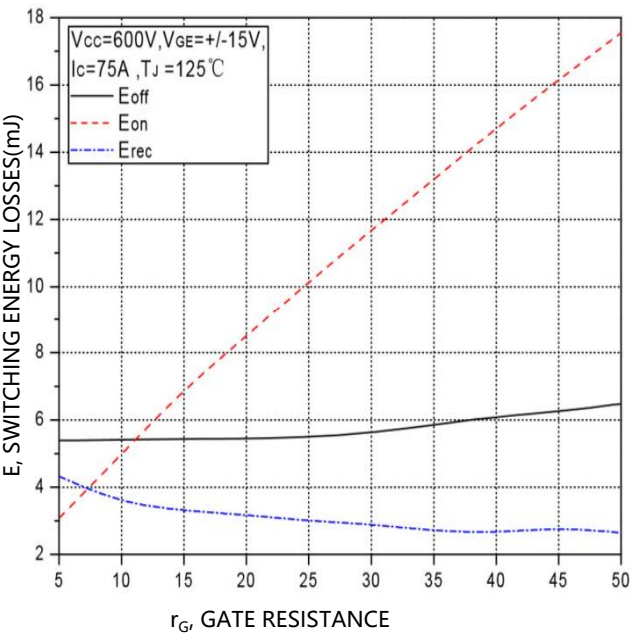
Typical Saturation Voltage Characteristics$I_C=f(V_{GE})$ at $V_{CE}=15V$

Fig. 3



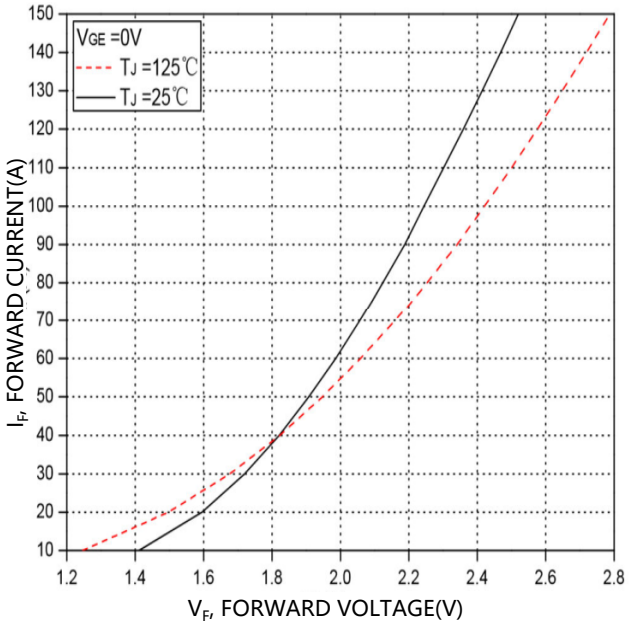
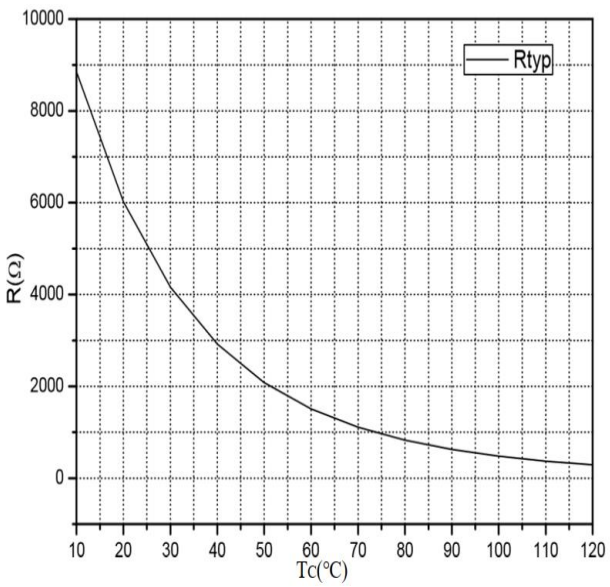
Switching losses IGBT-Inverter (typical)
$E_{on}=f(I_C)$, $E_{off}=f(I_C)$ at $V_{GE}=\pm15V$, $R_G=15\Omega$ and $V_{CE}=600V$

Fig. 4

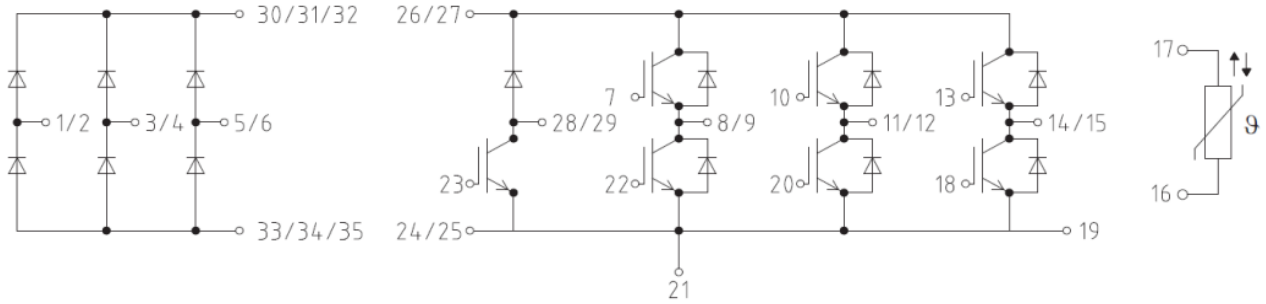


Switching losses IGBT-Inverter (typical)
$E_{on}=f(R_G)$, $E_{off}=f(R_G)$ at $V_{GE}=\pm15V$, $I_C=75A$ and $V_{CE}=600V$

Typical Characteristics

Fig. 5	Fig. 6
	
Forward characteristic of Diode-Inverter (typical) $I_F=f(V_F)$	NTC-Thermistor-Temperature Characteristic (typical), R=f(T)

Circuit Diagram



Package Outlines (mm)