PIM IGBT Module

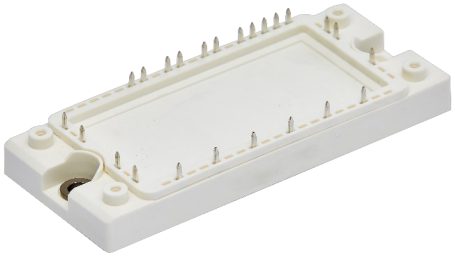
V_{CES} =1200V， $I_{C\ nom}$ =40A / I_{CRM} =80A

Features：

- 1200V Trench /Field Stop process
- Low switching losses
- Vcesat has a positive temperature coefficient

Applications:

- Variable Frequency Drive
- Servo drive
- Inverter



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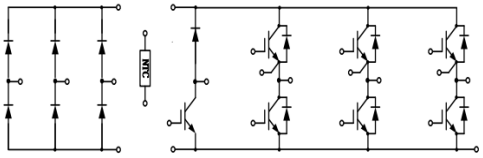


Equivalent Circuit

IGBT, Inverter

Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Collector-Emitter voltage	T_{vj}=25°C	V_{CES}	1200	V
Continuous DC collector current	T_C=100°C, $T_{vj\ max}$=175°C	$I_{C\ nom}$	40	A
Repetitive peak collector current	t_P=1 ms	I_{CRM}	80	A
Total power dissipation	T_C = 25°C, $T_{vj\ max}$ = 175°C	P_{tot}	250	W
Gate emitter voltage		V_{GE}	±20	V

Characteristic Values

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
Collector-Emitter saturation voltage	V_{GE}=15V, I_C=40A V_{GE}=15V, I_C=40A V_{GE}=15V, I_C=40A	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	V_{CEsat}		1.71 2.02 2.09	2.0	V
Gate-Emitter threshold voltage	I_C=1.5mA, V_{GE}= V_{CE}	T_{vj}=25°C	$V_{GE(th)}$	5.0	5.6	6.2	

Internal gate resistor		R_{Gint}		None		Ω
Input capacitance	f=1MHz, V_{CE}=25 V, V_{GE}=0 V T_{vj}=25°C	C_{ies}		2.71		nF
Reverse transfer capacitance		C_{res}		0.13		
Collector-emitter cut-off current	V_{CE}=1200V , V_{GE}= 0 V T_{vj}=25°C	I_{CES}			1	mA
Gate-emitter leakage current	V_{CE}=0 V, V_{GE}= 20 V T_{vj}=25°C	I_{GES}			100	nA
Turn-on delay time	I_C=40A, V_{CE}=600 V T_{vj}=25°C V_{GE}=±15 V, R_G=30Ω T_{vj}=125°C (inductive load) T_{vj}=150°C	$t_{d\ on}$		72 68 61		ns
Rise time	I_C=40A, V_{CE}=600 V T_{vj}=25°C V_{GE}=±15 V, R_G=30Ω T_{vj}=125°C (inductive load) T_{vj}=150°C	t_r		58 60 67		
Turn-off delay time	I_C=40A, V_{CE}=600 V T_{vj}=25°C V_{GE}=±15 V, R_G=30Ω T_{vj}=125°C (inductive load) T_{vj}=150°C	$t_{d\ off}$		356 397 404		
Fall time	I_C=40A, V_{CE}=600 V T_{vj}=25°C V_{GE}=±15 V, R_G=30Ω T_{vj}=125°C (inductive load) T_{vj}=150°C	t_f		196 245 252		
Turn-on energy loss per pulse	I_C=40A, V_{CE}=600 V T_{vj}=25°C V_{GE}=±15 V, R_G=30Ω T_{vj}=125°C (inductive load) T_{vj}=150°C	E_{on}		4.33 5.97 6.27		mJ
Turn-off energy loss per pulse	I_C=40A, V_{CE}=600 V T_{vj}=25°C V_{GE}=±15 V, R_G=30Ω T_{vj}=125°C (inductive load) T_{vj}=150°C	E_{off}		2.65 3.67 3.71		
SC data	V_{GE}≤15V, Vcc=800V V_{CEmax}=V_{CES}-L_{sCE}·di/dt t_P≤8us, T_{vj}=150°C	I_{SC}		208		A
Thermal resistance, junction to case	per IGBT	R_{thJC}			0.60	K/W
Temperature under switching conditions		$T_{vj\ op}$	-40		150	°C

Diode, Inverter

Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	T_{vj}=25°C	V_{RRM}	1200	V
Continuous DC forward current		I_F	30	A
Repetitive peak forward current	t_p=1ms	I_{FRM}	60	A
I^2t-value	t_p=10ms，sin180° ，T_j=125°C	I^2t	365	A^2s

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	I_F=30A, V_{GE}=0V T_{vj}=25°C I_F=30A, V_{GE}=0V T_{vj}=125°C I_F=30A, V_{GE}=0V T_{vj}=150°C	V_F		2.03 1.67 1.59	2.55	V
Peak reverse recovery current	I_F=30A, T_{vj}=25°C -di$_F$/dt=480A/μs(T_{vj}=150°C) T_{vj}=125°C V_R=600V, V_{GE}=-15V T_{vj}=150°C	I_{RM}		18 29 31		A
Recovered charge	I_F=30A, T_{vj}=25°C -di$_F$/dt=480A/μs(T_{vj}=150°C) T_{vj}=125°C V_R=600V, V_{GE}=-15V T_{vj}=150°C	Q_r		2.25 5.43 6.34		μC
Reverse recovered energy	I_F=30A, T_{vj}=25°C -di$_F$/dt=480A/μs(T_{vj}=150°C) T_{vj}=125°C V_R=600V, V_{GE}=-15V T_{vj}=150°C	E_{rec}		0.68 1.69 2.00		mJ
Thermal resistance, junction to case	per diode	R_{thJC}			0.95	K/W
Temperature under switching conditions		$T_{vj\ op}$	-40		150	°C

Diode，Rectifier

Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	T_{vj}=25°C，I_{RRM}=0.05mA	V_{RRM}	1600	V
Non-Repetitive peak reverse voltage	T_{vj}=25°C，I_{RRM}=0.05mA	V_{RSM}	1800	V
Maximum Average Forward Current	Ts=80°C，T_{vj}=25°C	$I_{F(AV)}$	35	A
Surge forward current	t_p=10ms，sin180°，T_{vj}=25°C	I_{FSM}	420	A
I^2t-value	t_p=10ms，sin180°，T_{vj}=25°C	I^2t	880	A^2s

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	I_F=5A, T_{vj}=25°C	V_F		0.9	1	V
Reverse current	V_R=V_{RRM} T_{vj}=25°C	I_R			50	μA
Temperature under switching conditions		$T_{vj\ op}$	-40		150	°C

IGBT, Brake-Chopper

Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Collector-Emitter voltage	T_{vj}=25°C	V_{CES}	1200	V
Continuous DC collector current	T_C=100°C, $T_{vj\ max}$=175°C	$I_{C\ nom}$	25	A
Repetitive peak collector current	t_P=1 ms	I_{CRM}	50	A
Total power dissipation	T_C = 25°C, $T_{vj\ max}$ = 175°C	P_{tot}	125	W
Gate emitter voltage		V_{GE}	±20	V

Characteristic Values

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
Collector-Emitter saturation voltage	V_{GE}=15V, I_C=25A V_{GE}=15V, I_C=25A V_{GE}=15V, I_C=25A	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	V_{CEsat}		2.16 2.69 2.82	2.5	V
Gate-Emitter threshold voltage	I_C=1mA, V_{GE}= V_{CE}	T_{vj}=25°C	$V_{GE(th)}$	5.2	5.75	6.4	
Internal gate resistor			R_{Gint}		None		Ω
Input capacitance	f=1 MHz, V_{CE}=25 V, V_{GE}=0 V	T_{vj}=25°C	C_{ies}		1.46		nF
Reverse transfer capacitance			C_{res}		0.06		
Collector-emitter cut-off current	V_{CE}=1200V , V_{GE}= 0 V	T_{vj}=25°C	I_{CES}			1	mA
Gate-emitter leakage current	V_{CE}=0 V, V_{GE}= 20 V	T_{vj}=25°C	I_{GES}			100	nA
Turn-on delay time	I_C=25A, V_{CE}=600 V V_{GE}=±15 V, R_G=75Ω (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	$t_{d\ on}$		106 95 93		ns
Rise time	I_C=25A, V_{CE}=600 V V_{GE}=±15 V, R_G=75Ω (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	t_r		54 54 53		
Turn-off delay time	I_C=25A, V_{CE}=600 V V_{GE}=±15 V, R_G=75Ω (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	$t_{d\ off}$		285 325 328		
Fall time	I_C=25A, V_{CE}=600 V V_{GE}=±15 V, R_G=75Ω (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	t_f		214 281 272		

Turn-on energy loss per pulse	I_C=25A, V_{CE}=600 V V_{GE}=±15 V, R_G=75Ω (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	E_{on}		2.26 3.02 3.37		mJ
Turn-off energy loss per pulse	I_C=25A, V_{CE}=600 V V_{GE}=±15 V, R_G=75Ω (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	E_{off}		1.56 2.02 2.19		
Thermal resistance, junction to case	per IGBT		R_{thJC}			1.20	K/W
Temperature under switching conditions			$T_{vj\ op}$	-40		150	°C

Diode, Brake-Chopper

Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	T_{vj}=25°C	V_{RRM}	1200	V
Continuous DC forward current		I_F	8	A
Repetitive peak forward current	t_p=1ms	I_{FRM}	16	A
I^2t-value	V_R=0V, t_p=10ms, T_{vj}=125 °C	I^2t	32	A^2s

Characteristic Values

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
Forward voltage	I_F=8A, V_{GE}=0V I_F=8A, V_{GE}=0V I_F=8A, V_{GE}=0V	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	V_F		1.98 1.68 1.61	2.6	V
Peak reverse recovery current	I_F=8A, -di$_F$/dt=322A/µs(T_{vj}=150°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	I_{RM}		7 9 10		A
Recovered charge	I_F=8A, -di$_F$/dt=322A/µs(T_{vj}=150°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	Q_r		0.67 1.42 1.73		µC
Reverse recovered energy	I_F=8A, -di$_F$/dt=322A/µs(T_{vj}=150°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	E_{rec}		0.20 0.44 0.57		mJ
Thermal resistance, junction to case	per diode		R_{thJC}			2.30	K/W

Temperature under switching conditions		$T_{vj\ op}$	-40		150	°C

NTC-Thermistor

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Rated resistances	T_c=25°C， ±5%	R_{25}		5.0		KΩ
B-value	±1%	$B_{25/50}$		3380		K

Module

Parameter	Conditions	Symbol	Value			Unit
Isolation test voltage	RMS, f=50Hz, t=1min	V_{ISOL}	2500			V
Internal isolation			Al_2O_3			
Storage temperature		T_{stg}	-40		125	°C
Mounting torque for modul mounting		M	3.0		6.0	Nm
Weight		W		170		g

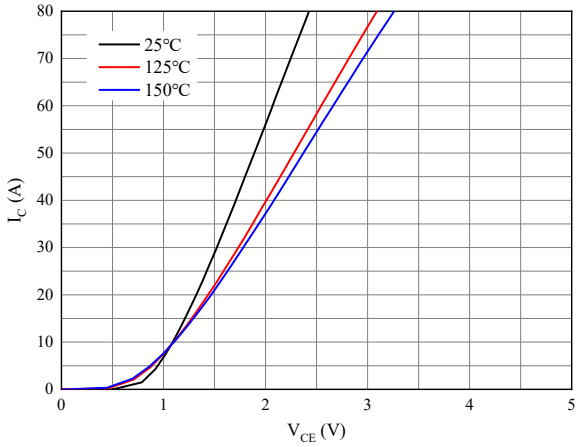


Fig 1. Typical output characteristics (V_{GE}=15V)

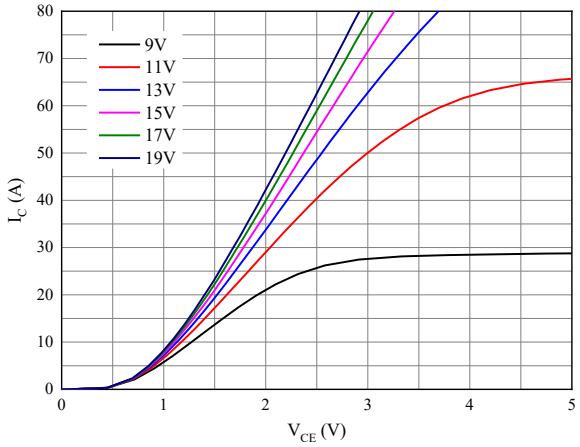


Fig 2. Typical output characteristics (T_{vj}=150℃)

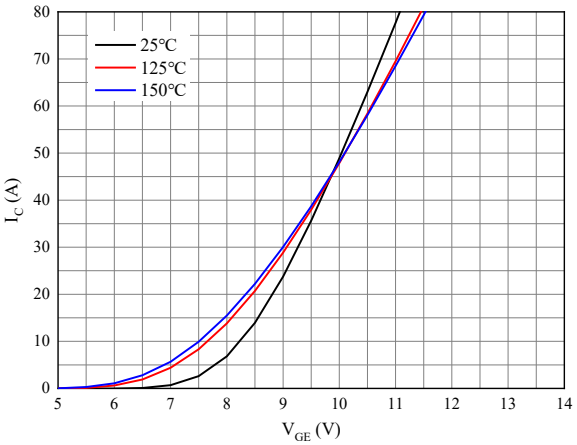


Fig 3. Typical transfer characteristic(V_{CE}=20V)

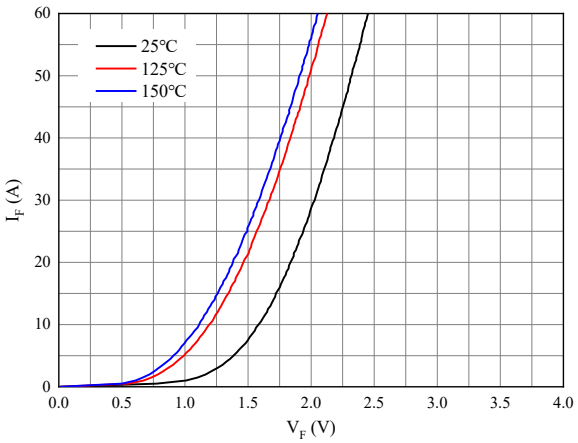


Fig 4. Forward characteristic of Diode

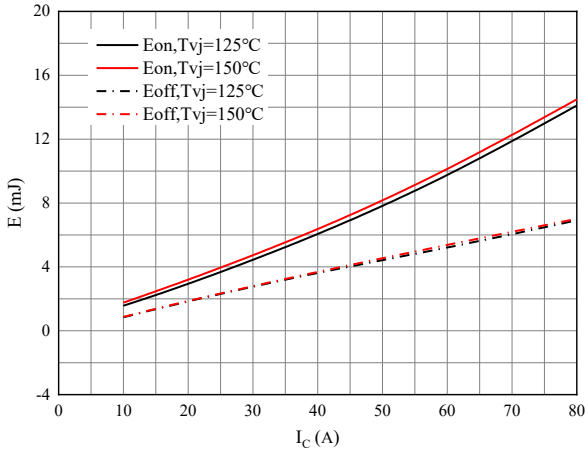


Fig 5. Switching losses of IGBT

VGE=±15V, RGon=30Ω, RGoff=30Ω, VCE=600V

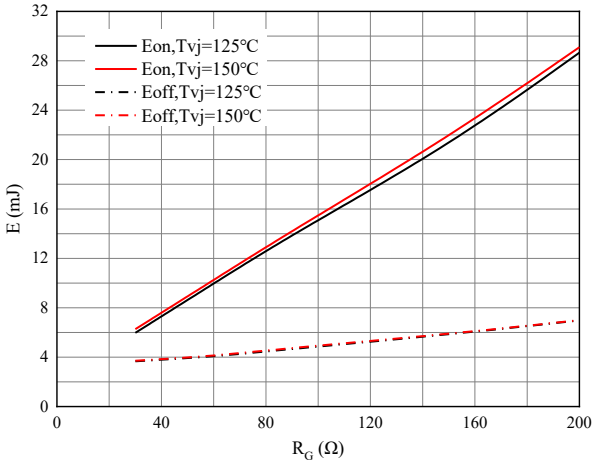


Fig 6. Switching losses of IGBT

VGE=±15V, IC=40A, VCE=600V

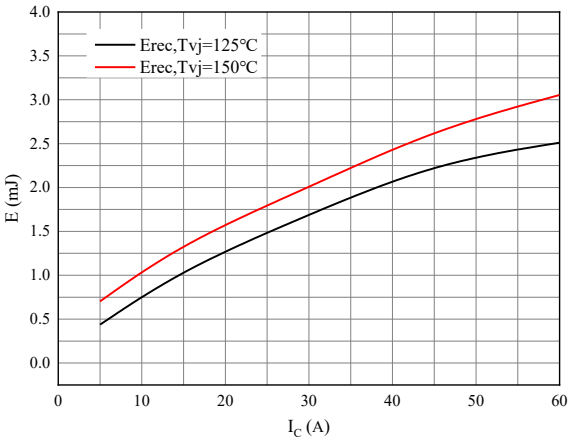


Fig 7. Switching losses of Diode

RGon=30Ω, VCE=600V

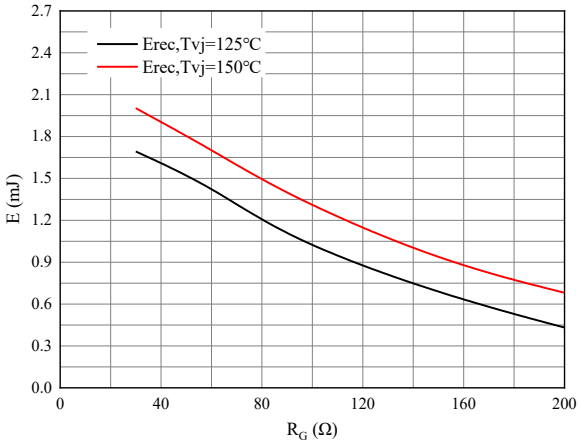


Fig 8. Switching losses of Diode

IF=30A, VCE=600V

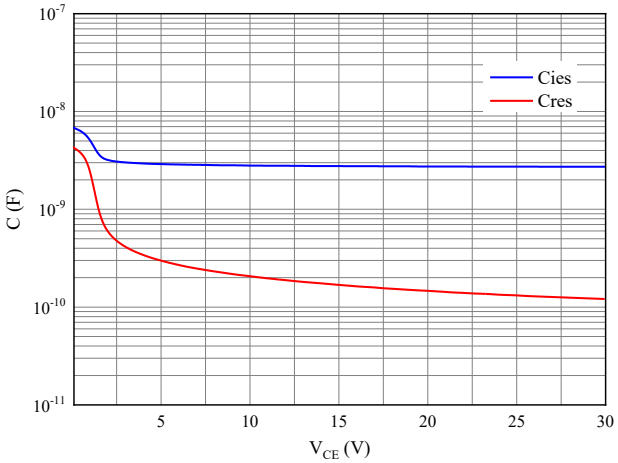


Fig 9. Capacitance characteristic

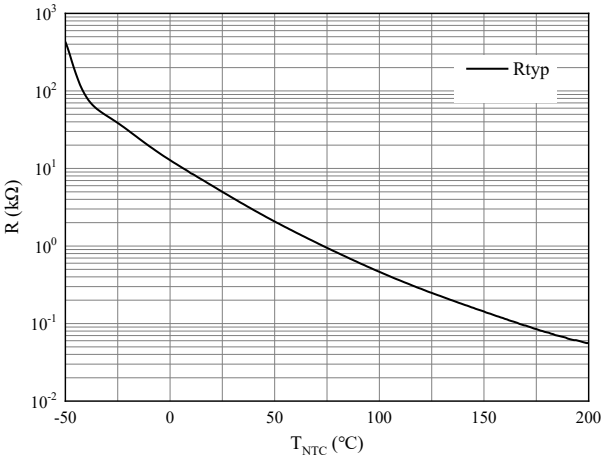
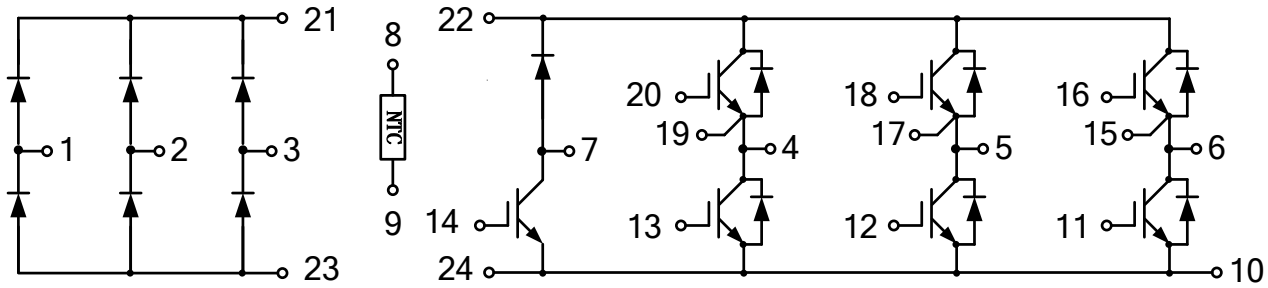


Fig 10. NTC-Themistor-temperature characteristic

Circuit diagram



Package outlines