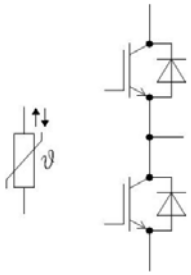
High Speed IGBT in Trench and Fieldstop Technology



Equivalent circuit

Features:

- 1200V 600A, V_{CE} =2.0V@25°C
- High RBSOA capability
- Trench/FS technology
- Low reverse-recovery losses
- High SC capability

Applications:

- Motor drives
- Solar applications
- UPS systems
- Commercial electric vehicles
- Wind turbines

Mechanical Features:

- High power and thermal cycling capability
- Maximum junction temperature 175℃
- High power density
- PressFIT contact technology
- Isolated base plate

Key Performance and Package Parameters

Type	V_{CES}	I_{Cnom}	V_{CEsat}, T_{vj}=25°C	T_{vjmax}	Marking
PM600TA120HS1	1200V	600A	2.0V	150°C	PM600TA120HS1

IGBT Inverter

Maximum Rated Values at T_{vj}=25°C (unless otherwise specified)

Parameter	Symbols	Value	Units
Collector-emitter voltage	V_{CES}	1200	V
Continuous DC collector current T_C= 100°C	I_C	600	A
Pulsed collector current Note *1	I_{CP}	1200	A
Repetitive peak forward current	I_{FRM}	1200	A
Diode forward current	I_F	600	A
Gate-emitter peak voltage	V_{GES}	±30	V
Operating junction temperature	T_{vj}	-40 ~ +150	℃
Storage temperature	T_{stg}	-40 ~ +125	℃

Note *1 : Pulse width limited by T_{vjmax}.

Characteristic Values at T_{vj}=25°C (unless otherwise specified)

Parameter	Symbols	Conditions		Value			Unit
				Min	Typ	Max	
Collector-emitter saturation voltage	V_{CEsat}	I_C=600A, V_{GE}=15V, T_{vj}=25°C		-	2.0	2.4	V
		I_C=600A, V_{GE}=15V, T_{vj}=125°C		-	2.5	-	
		I_C=600A, V_{GE}=15V, T_{vj}=150°C		-	2.7	-	
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=600mA, V_{CE}=V_{GE},		6.2	6.7	7.2	V
Internal gate resistor	R_{Gint}	T_{vj}=25°C		-	1.5	-	Ω
Collector-emitter leakage current	I_{CES}	V_{CE}=1200V, V_{GE}=0V, T_{vj}=25°C		-	-	200	uA
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V=20V		-	-	±300	nA
Input capacitance	C_{ies}	f=1MHz, V_{CE}=25V, V_{GE}=0V		-	128.8	-	nF
Reverse transfer capacitance	C_{res}	f=1MHz, V_{CE}=25V, V_{GE}=0V		-	0.76	-	nF
Gate charge	Q_G	V_{CC}= 600V, V_{GE}= 15V		-	2270	-	nC
Turn-on delay time	$t_{d(on)}$	V_{CE}=600V I_C=600A V_{GE}=±15V R_G=15Ω	T_{vj}=25°C	-	1.09	-	µs
			T_{vj}=125°C	-	1.02	-	
			T_{vj}=150°C	-	0.98	-	
Rise time	t_r		T_{vj}=25°C	-	0.53	-	µs
			T_{vj}=125°C	-	0.55	-	
			T_{vj}=150°C	-	0.57	-	
Turn-off delay time	$t_{d(off)}$		T_{vj}=25°C	-	1.60	-	µs
			T_{vj}=125°C	-	1.65	-	
			T_{vj}=150°C	-	1.67	-	
Fall time	t_f		T_{vj}=25°C	-	0.12	-	µs
			T_{vj}=125°C	-	0.12	-	
			T_{vj}=150°C	-	0.13	-	
Turn-on switching loss	E_{on}		T_{vj}=25°C	-	171	-	mJ
			T_{vj}=125°C	-	210	-	
			T_{vj}=150°C	-	223	-	
Turn-off switching loss	E_{off}		T_{vj}=25°C	-	87	-	mJ
			T_{vj}=125°C	-	95	-	
			T_{vj}=150°C	-	97	-	
SC data	I_{SC}	V_{CC}= 600V R_G= 20Ω V_{GE}≤ 15V V_{CEmax}=V_{CE}-L_{SCE} *di/dt	t_P≤ 10µs T_{vj}= 150°C	-	2400	-	A

Thermal resistance

Parameter	Symbols	Value			Units
		Min	Typ	Max	
Thermal resistance, per IGBT junction to case	$R_{th(j-c)}$	-	-	0.081	K/W
Thermal resistance, per diodes junction to case	$R_{th(j-c)}$	-	-	0.136	

Diode, Inverter
Characteristic Values at T_{vj}=25°C (unless otherwise specified)

Parameter	Symbols	Conditions		Value			Unit
				Min	Typ	Max	
Forward voltage	V_F	I_F=600A, V_{GE}=0V	T_{vj}=25°C	-	2.9	3.5	V
			T_{vj}=125°C	-	2.25	-	
			T_{vj}=150°C	-	2.15	-	
Recovery charge	Q_r	I_F=600A,V_R=600V -diF/dt= 1000A/us, V_{GE}= -8V	T_{vj}=25°C	-	20.1	-	µC
			T_{vj}=125°C	-	36.9	-	
			T_{vj}=150°C	-	48.5	-	
Reverse recovery energy	E_{rec}	I_F=600A,V_R=600V -di$_F$/dt=1000A/us V_{GE}= -8V	T_{vj}=25°C	-	3.9	-	mJ
			T_{vj}=125°C	-	10.6	-	
			T_{vj}=150°C	-	12.7	-	

NTC
Characteristic values

Parameter	Symbols	Conditions	Value			Unit
			Min	Typ	Max	
Rated resistance	R_{25}	T_{NTC}=25°C	-	5.0	-	kΩ
Deviation of R_{100}	△R/R	T_{NTC}=100°C, R_{100}=493Ω	5	-	5	%
Power dissipation	P_{25}		-	-	20	mW
B-value	$B_{25/50}$	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$	-	3380	-	K
B-value	$B_{25/80}$	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15K))]$	-	3468	-	K
B-value	$B_{25/100}$	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15K))]$	-	3523	-	K

Module

Parameter	Symbols	Conditions	Value			Unit
Isolation test voltage	V_{ISOL}	f=50Hz, t=1min, RMS	-	4000	-	V
Material of module base plat			-	Cu	-	
Internal isolation			-	Al_2O_3	-	
Creepage distance	d_{Creep}	Terminal to heatsink	-	14.5	-	mm
		Terminal to terminal	-	12.8	-	mm
Clearance	d_{Clear}	Terminal to heatsink	-	12.5	-	mm
		Terminal to terminal	-	10.1	-	mm
Comparative tracking index	CTI		-	200	-	

Parameter	Symbols	Conditions	Value			Unit
			Min	Typ	Max	
Stray inductance module	L_{sCE}		-	19	-	nH
Module lead Resistance ,terminals-chip	$R_{CC'+EE'}$	Tc= 25°C， per switch	-	1.05	-	mΩ
Mounting torque for module mounting	M	Screw M5	3.0	-	6.0	Nm
Weight	G		-	348	-	g

Typical Characteristics

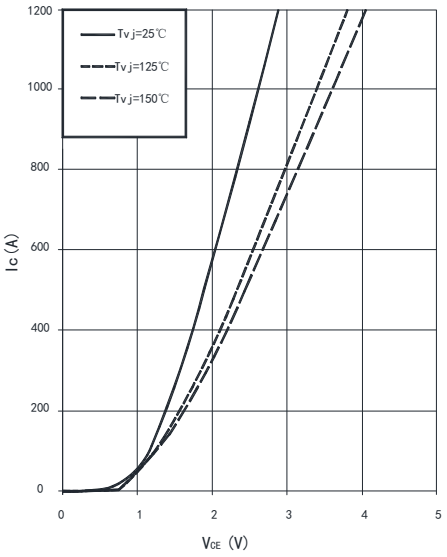


Fig. 1 Output characteristic (typical), IGBT, Inverter I_C= f(V_{CE}), V_{GE}= 15V

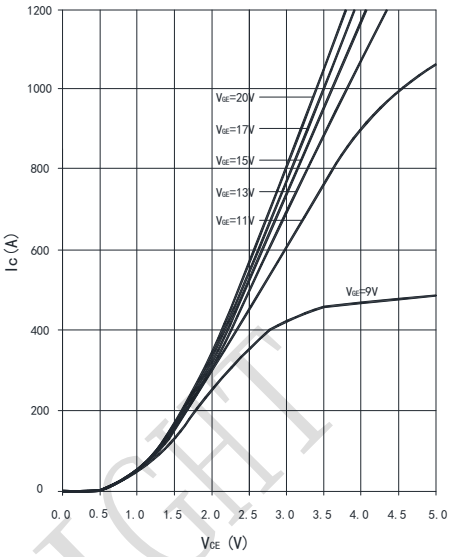


Fig. 2 Output characteristic (typical), IGBT, Inverter I_C= f(V_{CE}), T_{vi}= 150°C

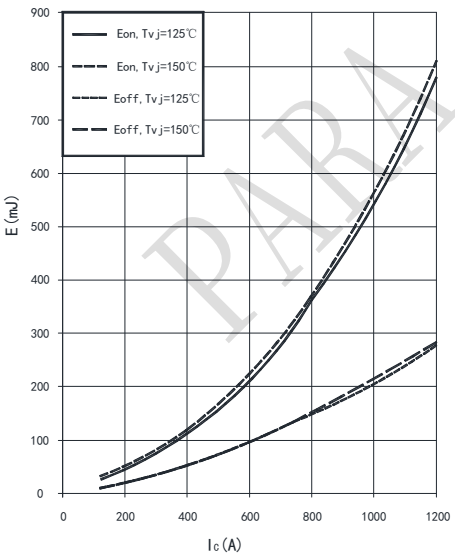


Fig. 3 Switching losses (typical), IGBT, Inverte E= f(I_C) R_{Goff}= 15Ω, R_{Gon}=15Ω, V_{GE}= ±15V, V_{CC}= 600V

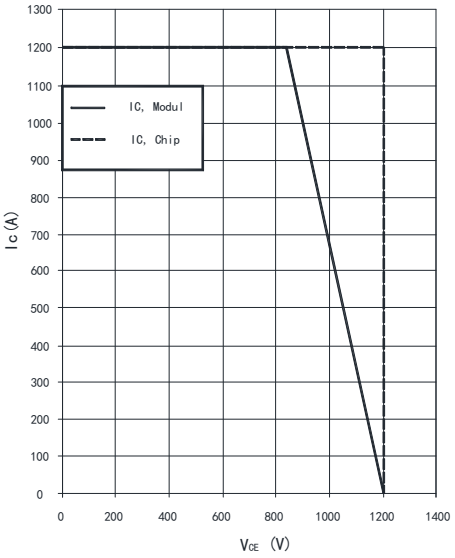


Fig. 4 Reverse bias safe operating area (RBSOA), IGBT, Inverter I_C= f(V_{CE}) R_{Goff}= 15Ω, V_{GE}= ±15V, T_{vj}= 150°C

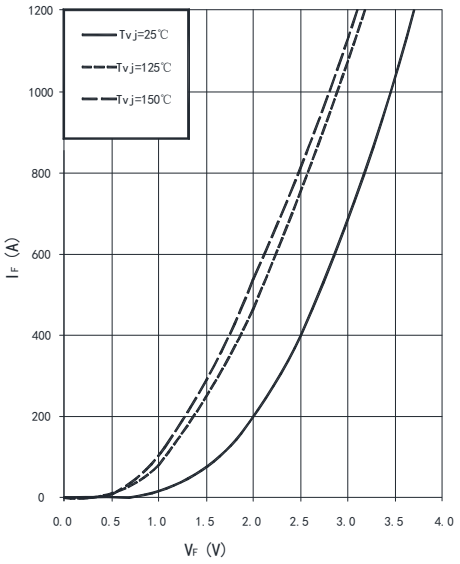


Fig. 5 Forward characteristic (typical), Diode, Inverter $I_F = f(V_f)$

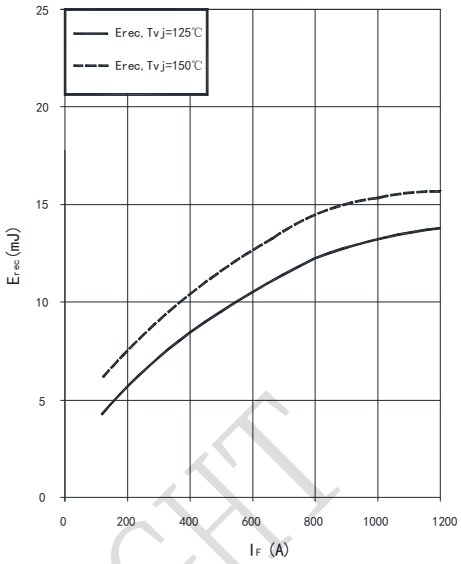


Fig. 6 Switching losses (typical), Diode, Inverter $E_{rec} = f(I_F)$ $R_{Gon} = 15\Omega$, $V_{CC} = 600V$

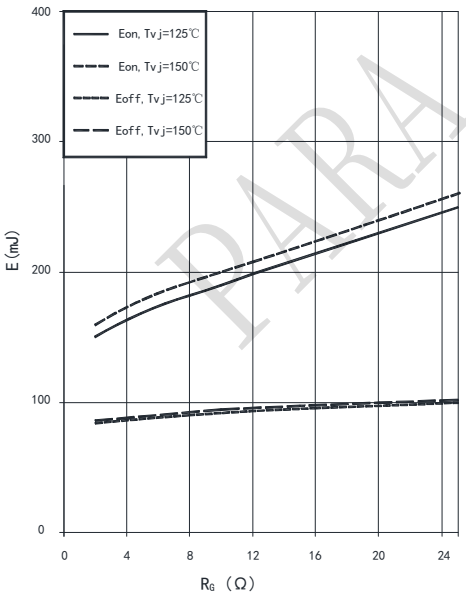
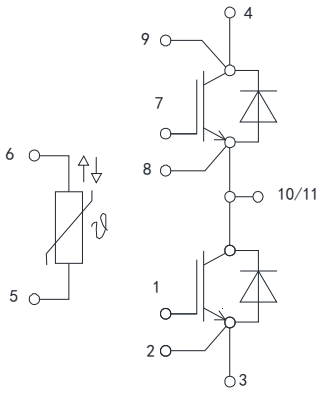
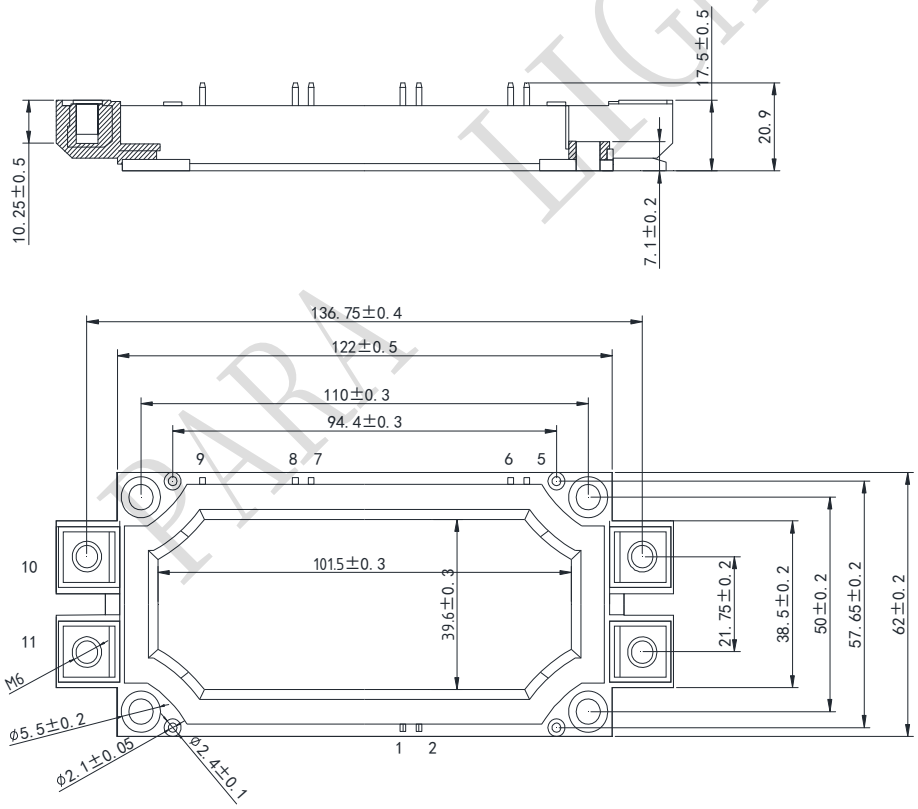


Fig. 7 Switching losses (typical), IGBT, Inverter $E = f(R_G)$ $V_{GE} = 15V$, $I_C = 600A$, $V_{CC} = 600V$

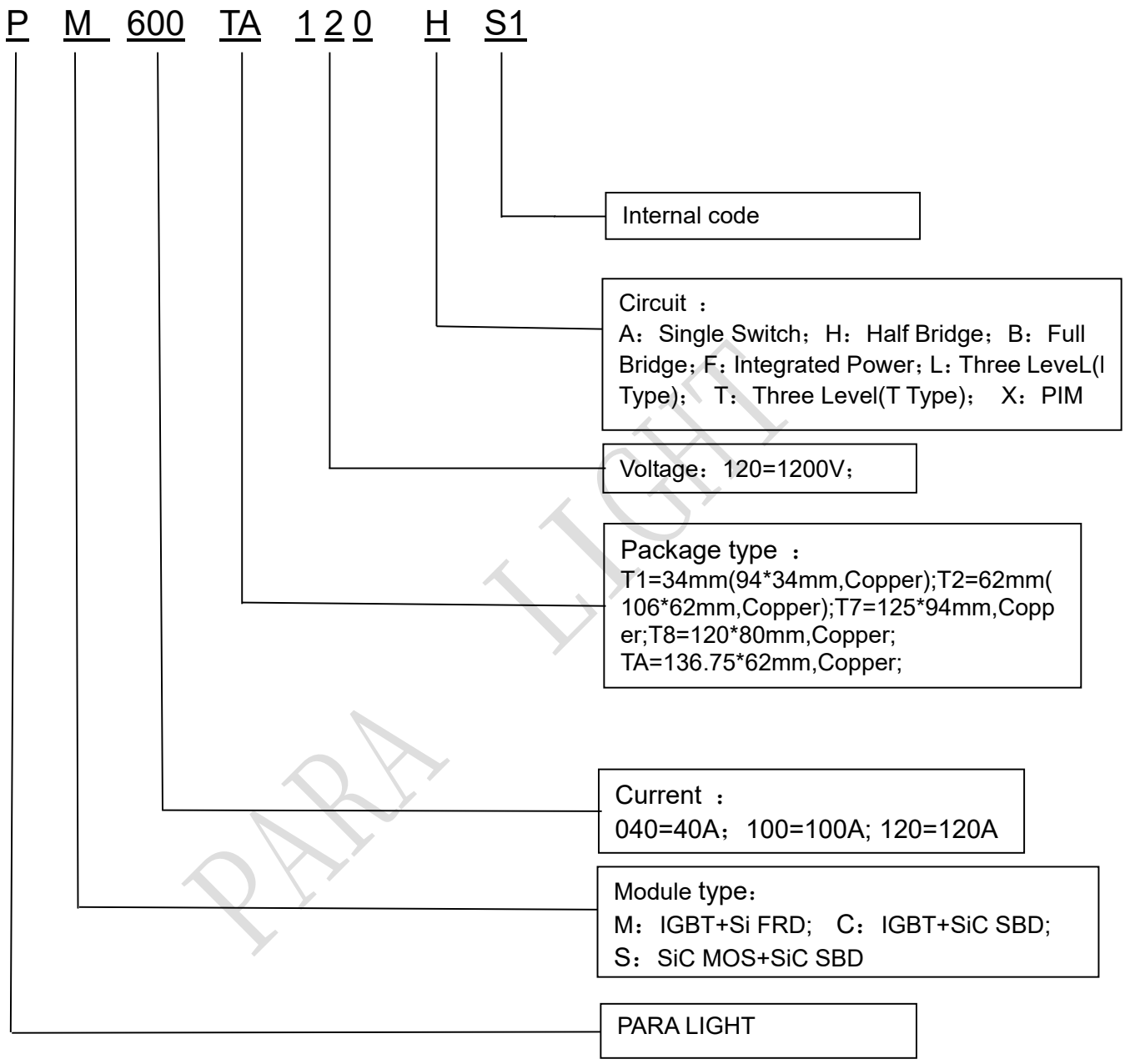
Circuit_diagram_headline



Package outline



PART NO. SYSTEM :



Revision history

Document revision history

Date	Version	Changes
2024.06.08	A / 0	First release.