Product Datasheet

PIM Module
IGBT Module

STN40T120S

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S5 Module with low loss IGBT and Fast recovery diode.

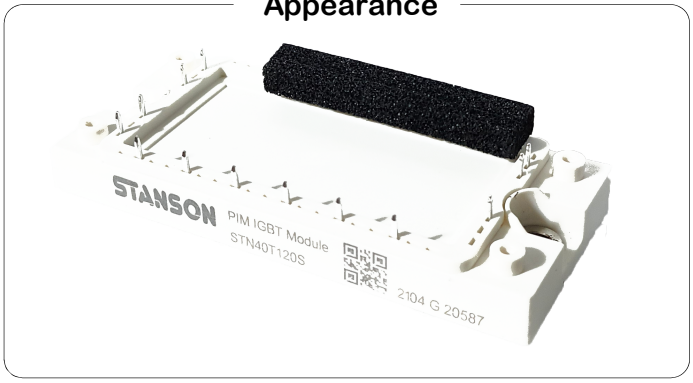
Feature

- Low $V_{CE(sat)}$ Trench IGBT technology
- 10μs short circuit capability
- Maximum junction temperature 175℃

Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- Uninterruptible power supply

Appearance



Maximum Ratings of Inverter IGBT (T_{vj}=25 ℃ unless otherwise noted)

Items	Symbol	Condition	Maximum Rating	Units
Collector-emitter voltage	V_{CES}		1200	V
Gate-emitter voltage	V_{GES}		±20	V
Collector current	I_C	T_{vj}=25℃	80	A
		T_{vj}=100℃	40	A
Pulsed collector current	I_{CM}	t_P=1ms	80	A
Short circuit current	I_{sc}	V_{GE}≤ 15V,V_{CC}=600V,t_P=10us V_{CEmax}=V_{CES}-L_{sCE} ·di/dt	160	A
Maximum power dissipation	P_D	T_c=25℃,T_{vj}=150℃	210	W

Electrical Characteristics of Inverter IGBT(T_{vj}=25 ℃ unless otherwise noted)

Items	Symbol	Conditions	Min.	typ.	Max.	Units
Collector-emitter breakdown voltage	V_{CES}	V_{GE}=0V,I_C=1mA	1200			V
Collector -emitter leakage current	I_{CES}	V_{CE}=1200V,V_{GE}=0V			2.0	mA
Gate leakage current, forward	I_{GES}	V_{GE}=20V,V_{CE}=0V			400	nA
		V_{GE}=20-V,V_{CE}=0V			-400	nA
Gate threshold voltage	$V_{GE(th)}$	V_{GE}=V_{CE},I_C=24mA	5.0	5.8	7.0	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE}=15V,I_C=40A,T_{vj}=25℃		1.9	2.2	V
		V_{GE}=15V,I_C=40A,T_{vj}=125℃		2.1		V
Integrated gate resistor	R_{Gint}	f=1M;V_{pp}=1V		6.0		Ω
Input capacitance	C_{ies}	V_{CE}=25V		2.50		nF
Output capacitance	C_{oes}	V_{GE}=0V		0.20		nF
Reverse transfer capacitance	C_{res}	f=1MHz		0.09		nF
Total gate charge	Q_g	V_{GE}=15±V		0.33		uC
Turn-on delay time	$t_{d(on)}$	V_{CC}=600V		90		ns
Rise time	t_r	V_{GE}=15±V		30		ns
Turn-off delay time	$t_{d(off)}$	I_C=40A		420		ns
Fall time	t_f	R_G=22Ω		70		ns
Turn-on energy loss per pulse	E_{on}	Inductive Load		4.10		mJ
Turn-off energy loss per pulse	E_{off}	T_{vj}=25℃		3.60		mJ
Turn-on delay time	$t_{d(on)}$	V_{CC}=600V		90		ns
Rise time	t_r	V_{GE}=15±V		50		ns
Turn-off delay time	$t_{d(off)}$	I_C=40A		520		ns
Fall time	t_f	R_G=22Ω		90		ns
Turn-on energy loss per pulse	E_{on}	Inductive Load		5.80		mJ
Turn-off energy loss per pulse	E_{off}	T_{vj}=25℃		4.20		mJ
Temperature under switching conditions	$T_{vj\ op}$		-55		150	℃

Maximum Ratings of Inverter Diode

Items	Symbol	Conditions	Maximum Rating	Units
Repetitive peak reverse voltage	V_{RRM}	T_{vj}=25℃	1200	V
Diode continuous forward current	I_F	T_{vj}=25℃	80	A
		T_{vj}=100℃	40	A
Diode maximum forward current	I_{FM}	t_P=1ms,T_{vj}=25℃	80	A

Electricals Characteristics of Inverter Diode(T_{vj}=25℃ unless otherwise noted)

Items	Symbol	Conditions	Min.	typ.	Max.	Units
Diode forward voltage	V_F	I_F=40A,T_{vj}=25℃		1.80		V
		I_F=40A,T_{vj}=125℃		1.80		V
Diode peak reverse recovery current	I_{rr}	V_{CE}=600V,I_F=40A		45		A
Diode reverse recovery charge	Q_{rr}	dI_F/dt=900A/μs		4.40		uC
Reverse recovery energy	E_{rec}	T_{vj}=25℃		1.55		mJ
Diode peak reverse recovery current	I_{rr}	V_{CE}=600V,I_F=40A		46		A
Diode reverse recovery charge	Q_{rr}	dI_F/dt=900A/μs		8.40		nC
Reverse recovery energy	E_{rec}	T_{vj}=25℃		3.10		mJ

Maximum Ratings of Rectifier Diode

Items	Symbol	Conditions	Maximum Rating	Units
Repetitive peak reverse voltage	V_{RRM}	T_C=25℃	1600	V
Maximum RMS forward current per chip	I_{FRMSM}	T_C=80℃	50	A
Maximum RMS current at rectifier output	I_{RMSM}	T_C=80℃	50	A
Surge forward current	I_{FSM}	T_{vj}=80℃,tp=10ms	400	A
I^2t - value	I^2t	tp = 10 ms, Tvj = 25°C	900	A^2s

Electricals Characteristics of Rectifier Diode(T_{vj}=25℃ unless otherwise noted)

Items	Symbol	Conditions	Min.	typ.	Max.	Units
Forward voltage	V_F	I_F=25A,T_{vj}=25℃		1.00		V
Reverse current	I_r	V_{CE}=1600V		2.00		mA
Temperature under switching conditions	$T_{vj\ op}$		-40		150	℃

Maximum Ratings of Inverter Brake IGBT(T_{vj}=25 ℃ unless otherwise noted)

Items	Symbol	Conditions	Maximum Rating	Units
Collector-emitter voltage	V_{CES}		1200	V
Gate-emitter voltage	V_{GES}		±20	V
Collector current	I_C	T_{vj}=25℃	50	A
		T_{vj}=100℃	25	A
Pulsed collector current	I_{CM}	t_P=1ms	50	A
Short circuit current	I_{sc}	V_{GE}≤ 15V,V_{CC}=600V,t_P=10us $V_{CEmax}=V_{CES}-L_{sCE}\cdot di/dt$	90	A
Maximum power dissipation	P_D	T_c=25℃,T_{vj}=150℃	160	W

Electrical Characteristics of Brake IGBT(T_{vj}=25 ℃ unless otherwise noted)

Items	Symbol	Conditions	Min.	typ.	Max.	Units
Collector-emitter breakdown voltage	V_{CES}	V_{GE}=0V,I_C=1mA	1200			V
Collector -emitter leakage current	I_{CES}	V_{CE}=1200V,V_{GE}=0V			1.0	mA
Gate leakage current, forward	I_{GES}	V_{GE}=20V,V_{CE}=0V			100	nA
		V_{GE}=-20V,V_{CE}=0V			-100	nA
Gate threshold voltage	$V_{GE(th)}$	V_{GE}=V_{CE},I_C=24mA	5.0	5.8	7.0	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE}=15V,I_C=25A,T_{vj}=25℃		1.9	2.2	V
		V_{GE}=15V,I_C=25A,T_{vj}=125℃		2.1		V
Integrated gate resistor	R_{Gint}	f=1M;V_{pp}=1V		0.0		Ω
Input capacitance	C_{ies}	V_{CE}=25V		1.40		nF
Output capacitance	C_{oes}	V_{GE}=0V		0.10		nF
Reverse transfer capacitance	C_{res}	f=1MHz		0.05		nF
Total gate charge	Q_g	V_{CC}=600V, V_{GE}=15V,I_C=25A		0.20		uC
Turn-on delay time	$t_{d(on)}$	V_{CC}=600V		160		ns
Rise time	t_r	V_{GE}=±15V		30		ns
Turn-off delay time	$t_{d(off)}$	I_C=25A		330		ns
Fall time	t_f	R_G=20Ω		80		ns
Turn-on energy loss per pulse	E_{on}	Inductive Load		1.85		mJ
Turn-off energy loss per pulse	E_{off}	T_{vj}=25℃		1.43		mJ
Turn-on delay time	$t_{d(on)}$	V_{CC}=600V		170		ns
Rise time	t_r	V_{GE}=±15V		40		ns
Turn-off delay time	$t_{d(off)}$	I_C=25A		430		ns
Fall time	t_f	R_G=20Ω		150		ns
Turn-on energy loss per pulse	E_{on}	Inductive Load		2.50		mJ
Turn-off energy loss per pulse	E_{off}	T_{vj}=25℃		2.10		mJ
Temperature under switching conditions	$T_{vj\ op}$		-55		150	℃

Maximum Ratings of Brake Diode

Items	Symbol	Conditions	Maximum Rating	Units
Repetitive peak reverse voltage	V_{RRM}	T_{vj}=25℃	1200	V
Diode continuous forward current	I_F	T_{vj}=25℃	30	A
		T_{vj}=100℃	15	A
Diode maximum forward current	I_{FM}	t_P=1ms,T_{vj}=25℃	30	A

Electricals Characteristics of Brake Diode(T_{vj}=25℃ unless otherwise noted)

Items	Symbol	Conditions	Min.	typ.	Max.	Units
Diode forward voltage	V_F	I_F=15A,T_{vj}=25℃		1.80		V
		I_F=15A,T_{vj}=125℃		1.80		V
Diode peak reverse recovery current	I_{rr}	V_{CE}=600V,IF=25A		20		A
Diode reverse recovery charge	Q_{rr}	dI_F/dt=900A/μs		1.50		uC
Reverse recovery energy	E_{rec}	T_{vj}=25℃		0.40		mJ
Diode peak reverse recovery current	I_{rr}	V_{CE}=600V,IF=25A		30		A
Diode reverse recovery charge	Q_{rr}	dI_F/dt=900A/μs		2.70		nC
Reverse recovery energy	E_{rec}	T_{vj}=25℃		0.90		mJ

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Characteristics of NTC(T_{vj}=25℃ unless otherwise noted)

Items	Symbol	Conditions	Min.	typ.	Max.	Units
Rated resistance	R_{25}			5.00		
Deviation of R100	△R/R	T_C = 100°C, R_{100}= 493 W	-5		5	%
Power dissipation	P_{25}				20.0	mW
B-value	$B_{25/50}$	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298,15\ K))]$		3375		K
B-value	$B_{25/80}$	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298,15\ K))]$		3411		K
B-value	$B_{25/100}$	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298,15\ K))]$		3433		K

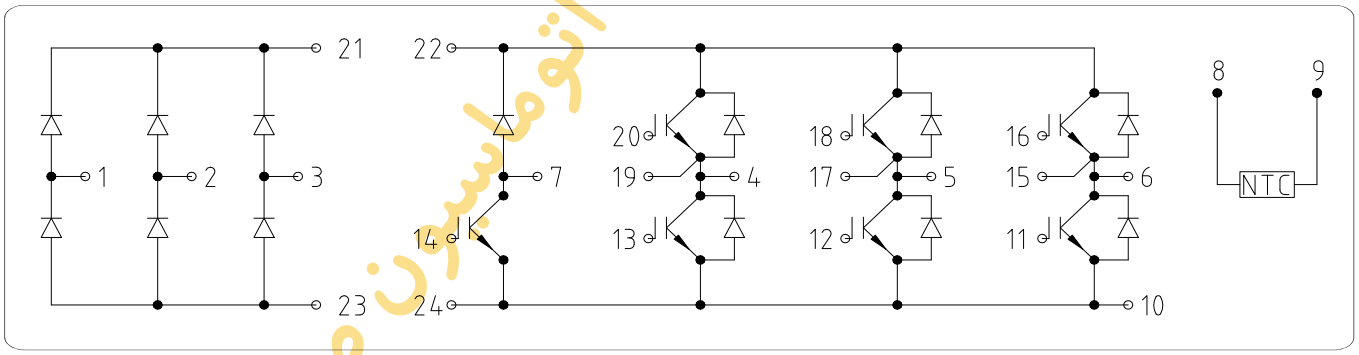
Thermal Characteristics

Items	Symbol	Min.	typ.	Max.	Units
Thermal resistance, junction to case for Inverter IGBT	$R_{th\ j-c}$			0.60	℃/W
Thermal resistance, junction to case for Inverter Diode	$R_{th\ j-c}$			0.95	℃/W
Thermal resistance, junction to case for Rectifier Diode	$R_{th\ j-c}$			1.00	℃/W
Thermal resistance, junction to case for Brake IGBT	$R_{th\ j-c}$			1.20	℃/W
Thermal resistance, junction to case for Brake Diode	$R_{th\ j-c}$			2.30	℃/W
Thermal resistance, case to sink	R_{thC-S}		0.03		℃/W

Module Characteristics

Items	Symbol	Conditions	Min.	typ.	Max.	Units
Material of module baseplate				Cu		
Internal isolation		terminal to terminal		Al_2O_3		
Isolation test voltage	V_{isol}	RMS, f = 50 Hz, t = 1 min.	2.5			kV
Stray inductance module	L_{sCE}			30		nH
Mounting torque for modul mounting	M	Screw M5	3.0		5.0	Nm
Storage temperature range	T_{STG}		-55		150	℃
Weight of Module	W_t			180		g

Internal Circuit:



Representative Characteristics

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

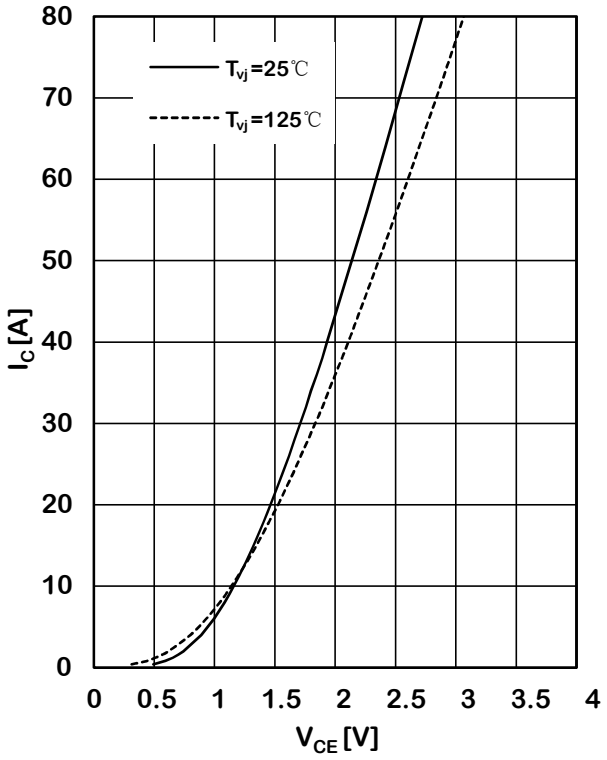


Fig 2. Output characteristic IGBT
$I_C=f(V_{CE})$
$T_{vj}=125℃$

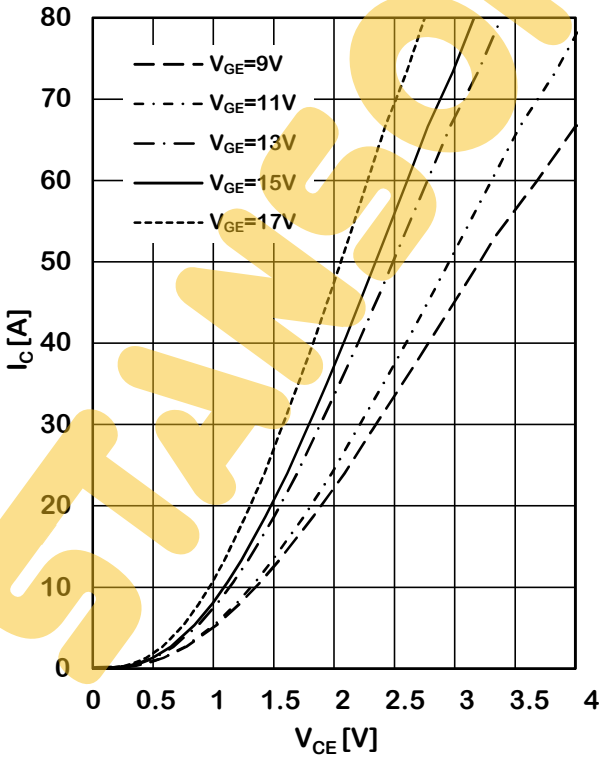


Fig 3. Transfer characteristic IGBT
$I_C=f(V_{GE})$
$V_{CE}=20V$

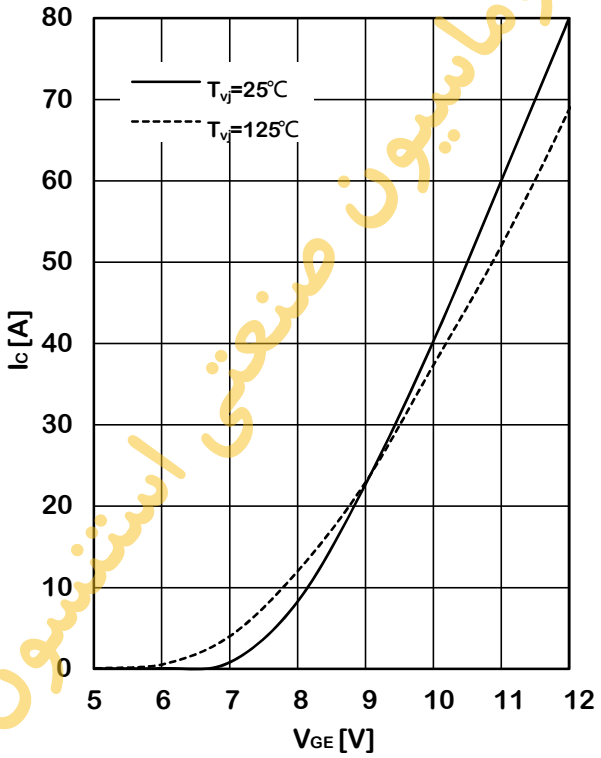


Fig 4. Switching losses IGBT
$E_{on}=f(I_C),E_{off}=f(I_C)$,
$V_{GE}=\pm15V,R_G=22\Omega,V_{CE}=600V$

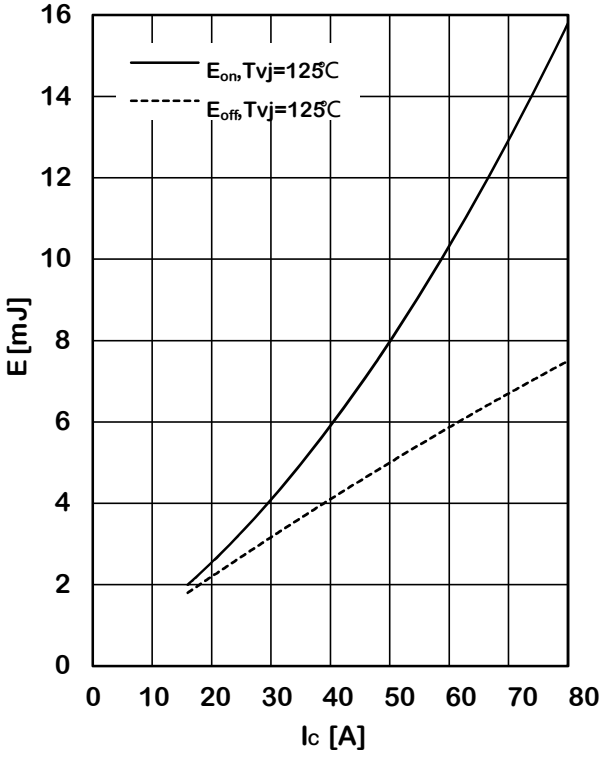


Fig 5. Switching losses IGBT
$E_{on}=f(R_G), E_{off}=f(R_G),$
$V_{GE}=\pm15V, I_C=40A, V_{CE}=600V$

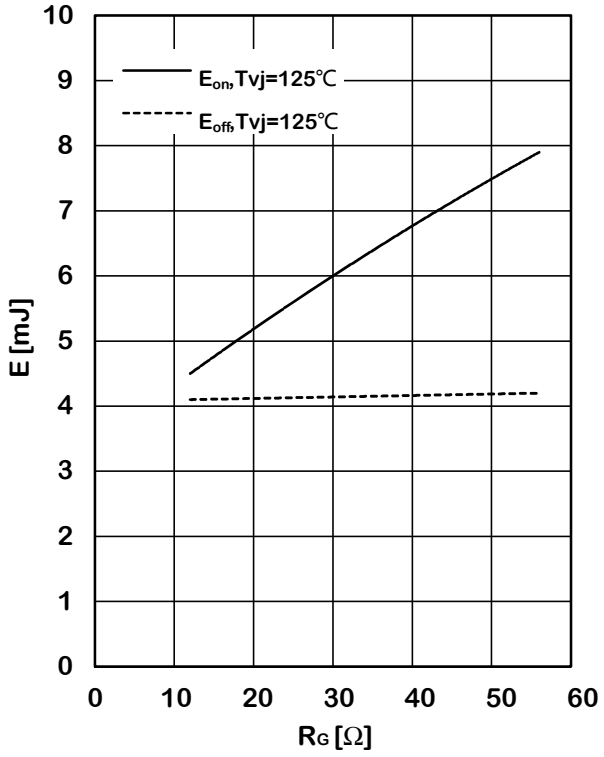


Fig 6. Transient thermal impedance IGBT
$Z_{thjc}=f(t)$

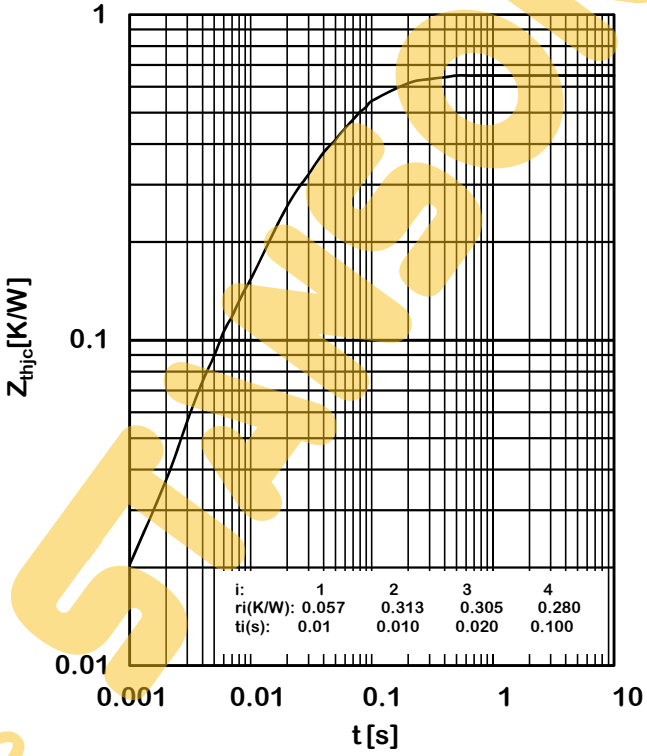


Fig 7. Reverse bias safe operating area IGBT
$I_C=f(V_{CE})$
$V_{GE}=\pm15V, R_{Goff}=22\Omega, T_{vj}=125℃$

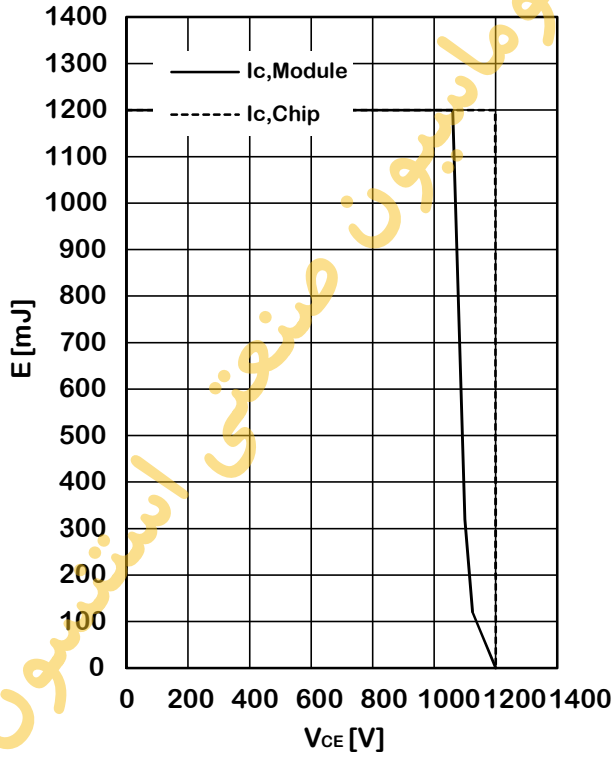


Fig 8. Forward characteristic of Diode
$I_F=f(V_F)$

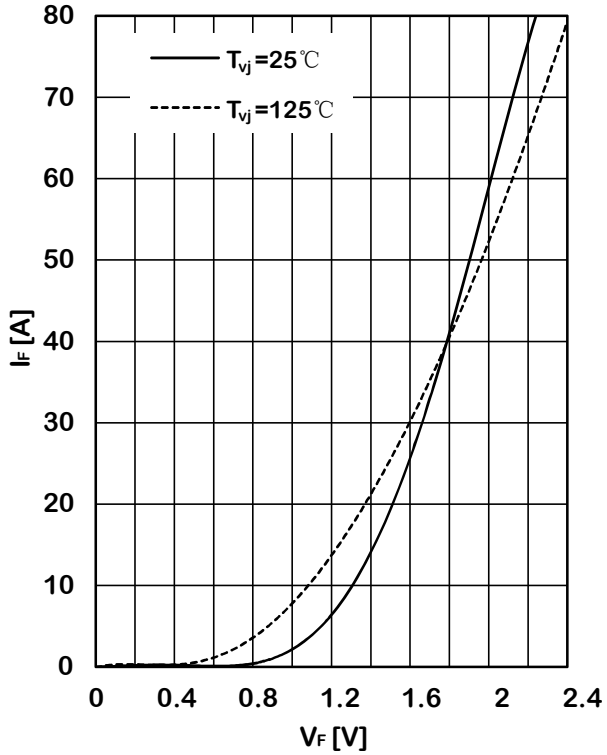


Fig 9. Switching losses Diode
$E_{rec}=f(I_F)$
$R_G=22\Omega, V_{CE}=600V$

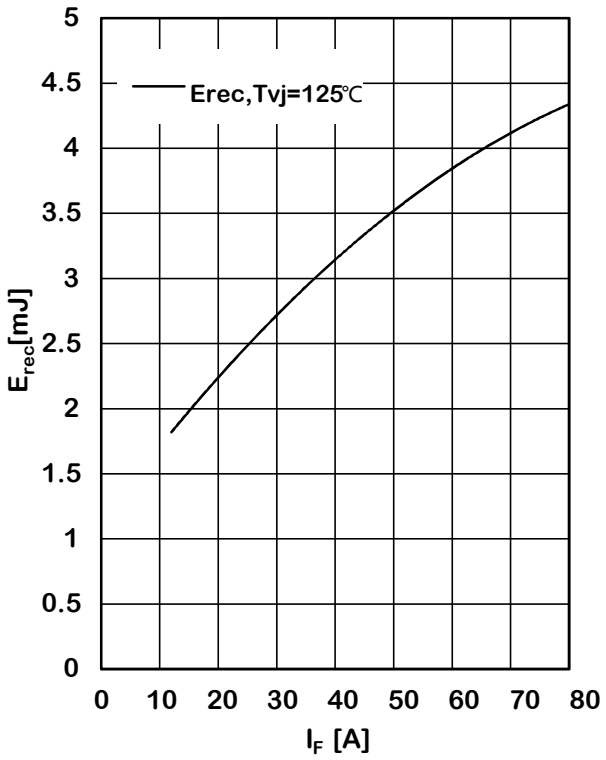


Fig 10. Switching losses Diode
$E_{rec}=f(R_G)$
$I_F=40A, V_{CE}=600V$

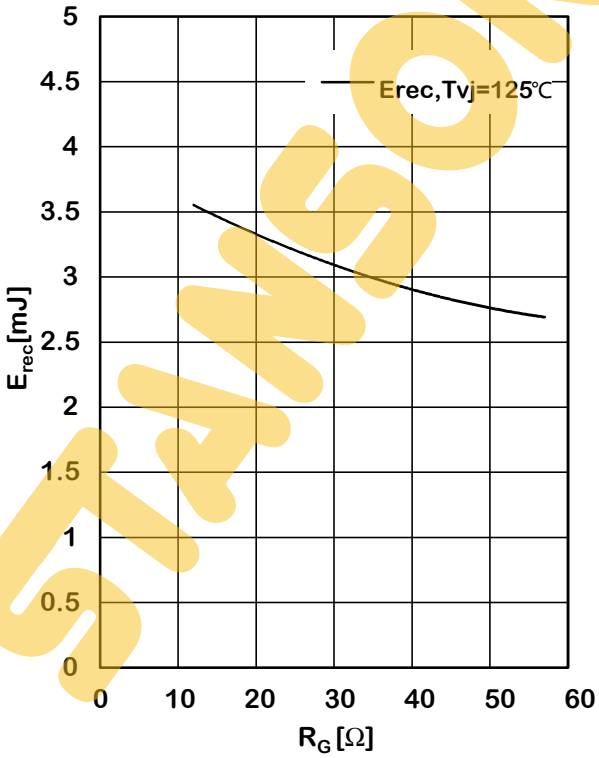


Fig 11. transient thermal impedance Inverter Diode
Zthjc=f(t)

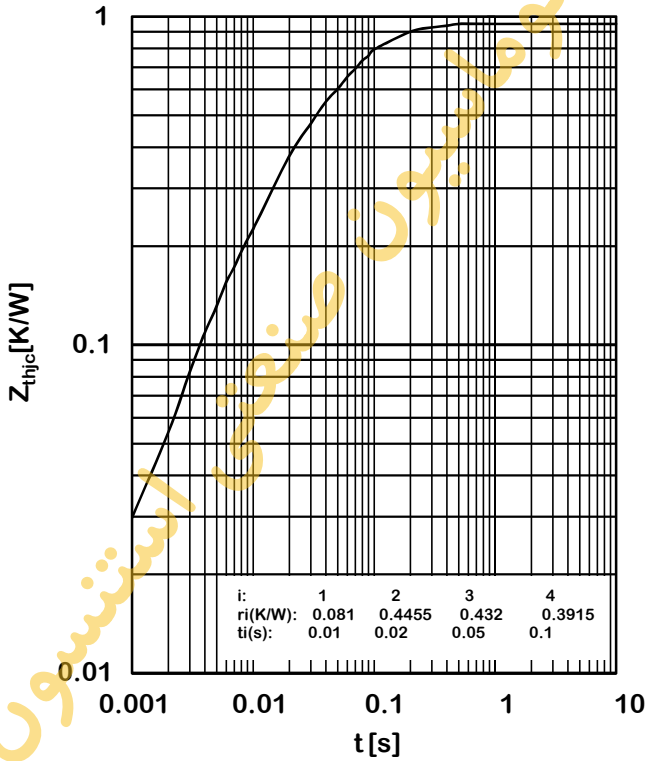
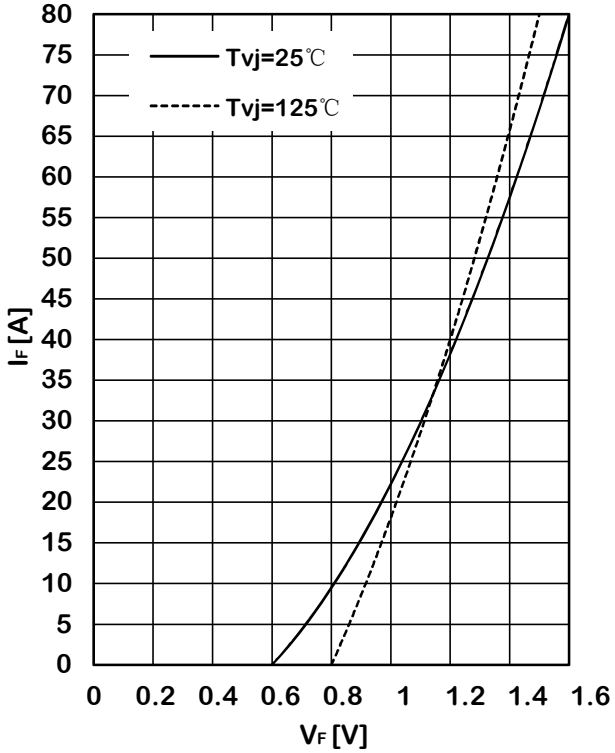
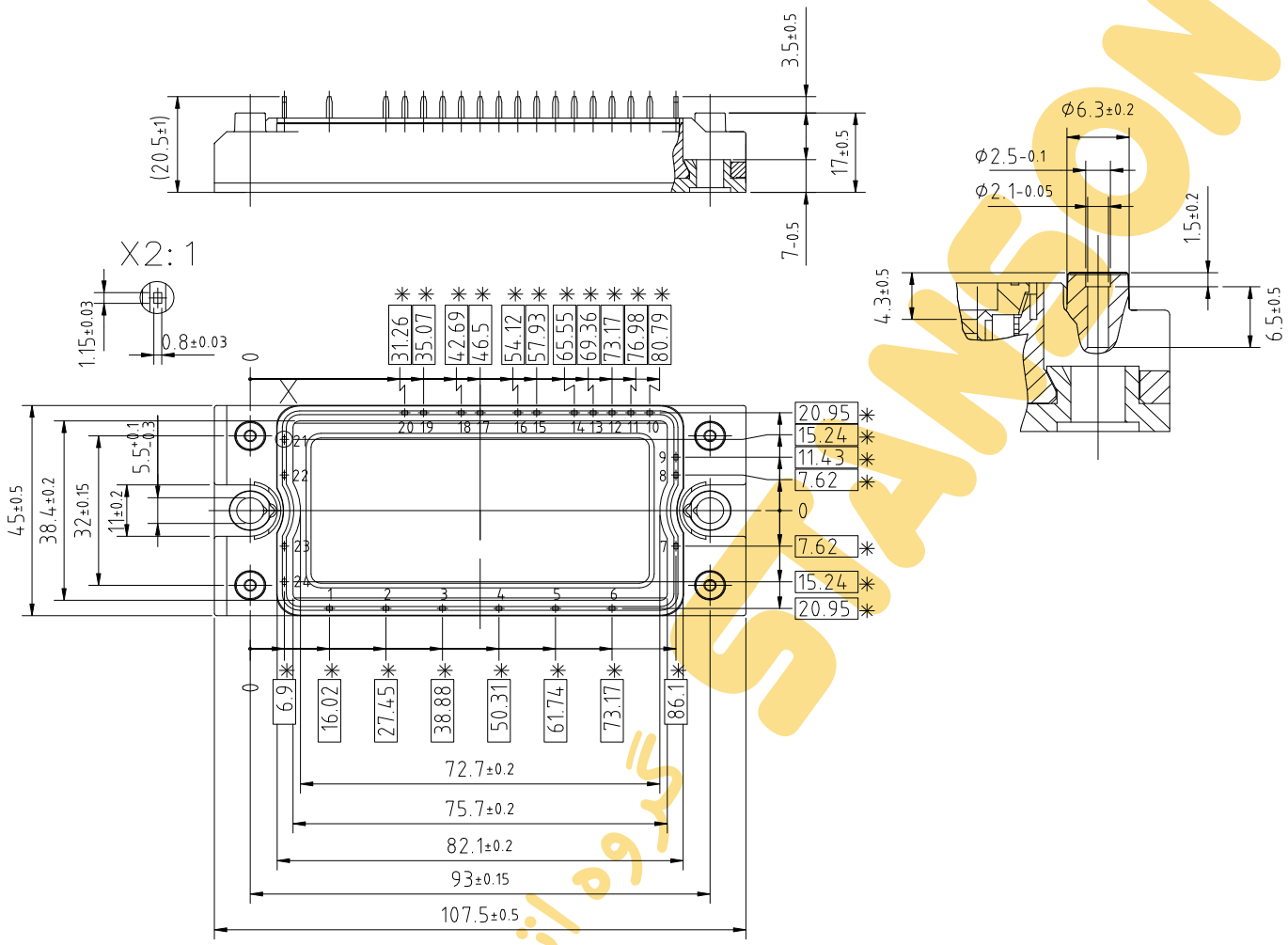


Fig12. Forward characteristic of Rectifier Diode
$I_F=f(V_F)$



Package Dimensions

Dimensions in Millimeters



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