

1200V/600A IGBT Module, E6 Package, with FWD

Features

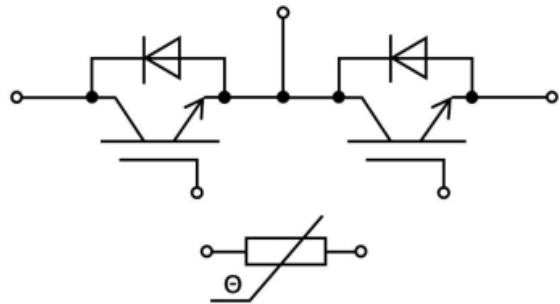
- 1200V 600A, $V_{CE(sat)} (typ.) = 1.75V$
- Lower losses and higher energy
- Excellent short circuit ruggedness
- High reliability
- Positive temperature coefficient



Applications

- Solar Inverter
- Uninterrupted Power Supply
- Servo Driver
- Motor Driver

Equivalent Circuit Schematic



IGBT - Inverter

Maximum Rated Values

Symbol	Description	Conditions	Values	Unit
V_{CES}	Collector-Emitter Voltage	$T_{vj} = 25^{\circ}C$	1200	V
V_{GES}	Gate-Emitter Peak Voltage	$T_{vj} = 25^{\circ}C$	± 20	V
I_C	Continuous DC Collector Current	$T_C = 100^{\circ}C$	600	A
I_{CRM}	Repetitive Peak Collector Current	$t_p = 1ms$	1200	A
P_{tot}	Total Power Dissipation	$T_C = 25^{\circ}C, T_{vj\ max} = 175^{\circ}C$	3950	W
$T_{vj,max}$	Maximum Junction Temperature		175	$^{\circ}C$
$T_{vj,op}$	Operating Junction Temperature		-40~150	$^{\circ}C$
T_{stg}	Storage Temperature Range		-40~125	$^{\circ}C$

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE}=15V, I_C=600A, T_{vj}=25^{\circ}C$	---	1.75	2.15	V
		$V_{GE}=15V, I_C=600A, T_{vj}=125^{\circ}C$	---	2.2	--	V
		$V_{GE}=15V, I_C=600A, T_{vj}=150^{\circ}C$	---	2.25	--	V
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE}=V_{CE}, I_C=23.0mA$	5.2	5.8	6.4	V
I_{CES}	Collector-Emitter Cut-Off Current	$V_{CE}=1200V, V_{GE}=0V$	---	---	1	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=20V, V_{CE}=0V$	---	---	100	nA
R_{Gint}	Internal Gate Resistance		---	1.2	---	Ω
Q_G	Gate Charge	$V_{GE}=-15V\sim+15V$	---	7.4	---	μC
C_{ies}	Input Capacitance	$V_{GE}=0V, V_{CE}=25V, f=1MHz$	---	128	---	nF
C_{res}	Reverse Transfer Capacitance		---	1.47	---	nF
$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=600V$ $V_{GE}=\pm 15V$ $I_C=600A$ $R_{Gon}=1.5\Omega$ $R_{Goff}=1.5\Omega$ Inductive Load $T_{vj}=25^{\circ}C$	---	435	---	ns
t_r	Turn-on Rise Time		---	115	---	ns
$t_{d(off)}$	Turn-off Delay Time		---	625	---	ns
t_f	Turn-off Fall Time		---	90	---	ns
E_{on}	Turn-on Switching Loss		---	55	---	mJ
E_{off}	Turn-off Switching Loss		---	35	---	mJ
I_{SC}	Short Circuit Data	$V_{GE}\leq 15V, V_{CC}=800V$ $t_p\leq 10\mu s, T_{vj}=150^{\circ}C$	---	2650	---	A
R_{thJC}	Thermal Resistance, Junction to Case	Per IGBT	---	---	0.038	K/W

Diode - Inverter

Maximum Rated Values

Symbol	Description	Conditions	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	$T_{vj}=25^{\circ}C$	1200	V
I_F	Continuous DC Forward Current		600	A
I_{FRM}	Repetitive Peak Collector Current	$t_p=1ms$	1200	A
$T_{vj,max}$	Maximum Junction Temperature		175	$^{\circ}C$
$T_{vj,op}$	Operating Junction Temperature		-40~150	$^{\circ}C$
T_{stg}	Storage Temperature Range		-40~125	$^{\circ}C$

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
V _F	Forward Voltage	I _F =600A, V _{GE} =0V, T _{vj} =25°C	---	1.75	2.15	V
		I _F =600A, V _{GE} =0V, T _{vj} =125°C	---	1.9	---	V
		I _F =600A, V _{GE} =0V, T _{vj} =150°C	---	1.9	---	V
I _{RM}	Peak Reverse Recovery Current	I _F =600A, V _R =600V, V _{GE} =-15V, T _{vj} =25°C (-di _F /dt=2700A/us, T _{vj} =150°C)	---	460	---	A
Q _r	Recovered Charge		---	50	---	uC
E _{rec}	Reverse Recovery Energy		---	12	---	mJ
R _{thJC}	Thermal Resistance, Junction to Case	Per Diode	---	---	0.063	K/W

NTC-Thermistor Characteristic Values

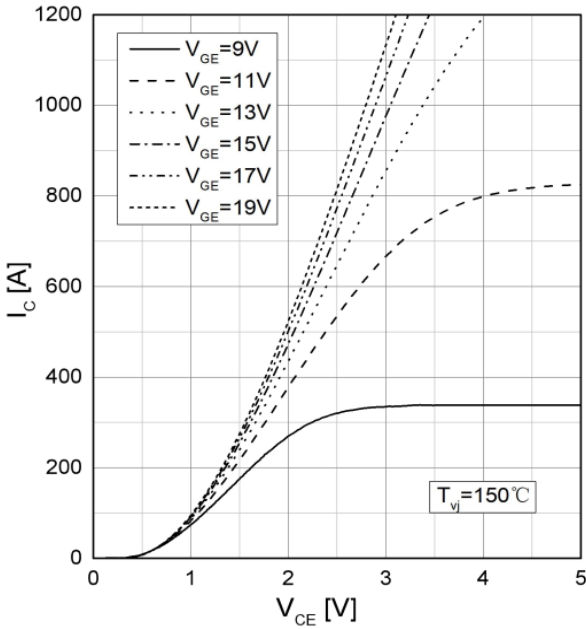
Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
R ₂₅	Rated Resistance	T _C =25°C	---	5	---	KΩ
P ₂₅	Power Dissipation	T _C =25°C	---	---	10	mW
B _{25/50}	B Value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298 \text{ K}))]$	---	3375	---	K

Module

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
V _{ISOL}	Isolation Test Voltage	RMS, f=50Hz, t=1min	3.4			KV
d _{cr}	Creepage Distance	Terminal to Heatsink	14			mm
		Terminal to Terminal	13.5			mm
d _{cl}	Clearance Distance	Terminal to Heatsink	12.5			mm
		Terminal to Terminal	10			mm
CTI	Comparative Tracking Index		>200			
L _{s,CE}	Stray Inductance Module	per Switch	---	20	---	nH
R _{CC+EE}	Module lead resistance, terminals-chip	per Switch	---	1.1	---	mΩ
M _t	Mounting Torques	Main terminals M6 Screw	3.0	---	6.0	Nm
G	Weight		---	350	---	g

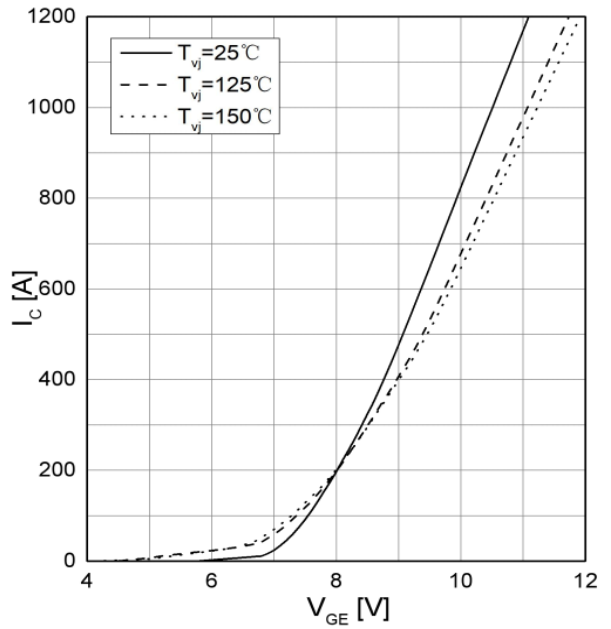
Typical Characteristics

Fig. 1



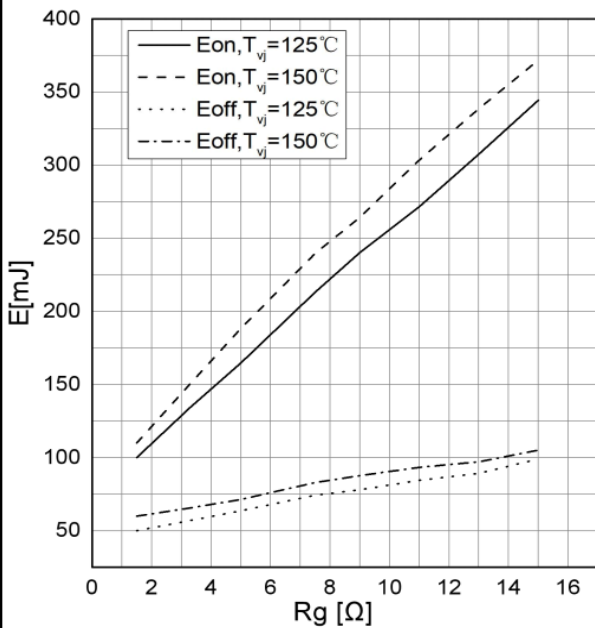
Output characteristic IGBT
 $I_C = f(V_{CE})$, $T_{vj} = 150^\circ\text{C}$

Fig. 2



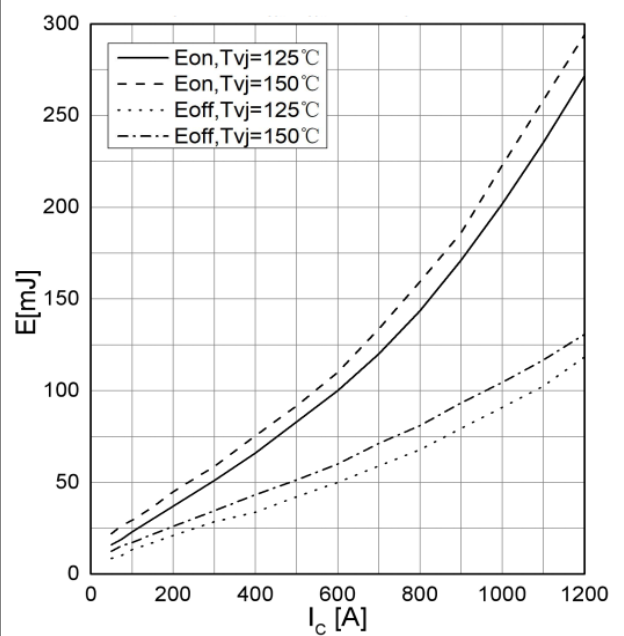
Transfer characteristic IGBT
 $I_C = f(V_{GE})$ at $V_{CE} = 10\text{V}$

Fig. 3



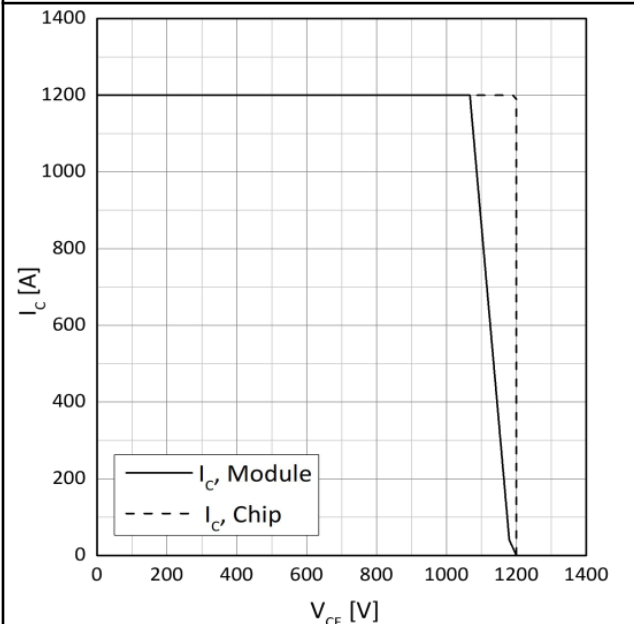
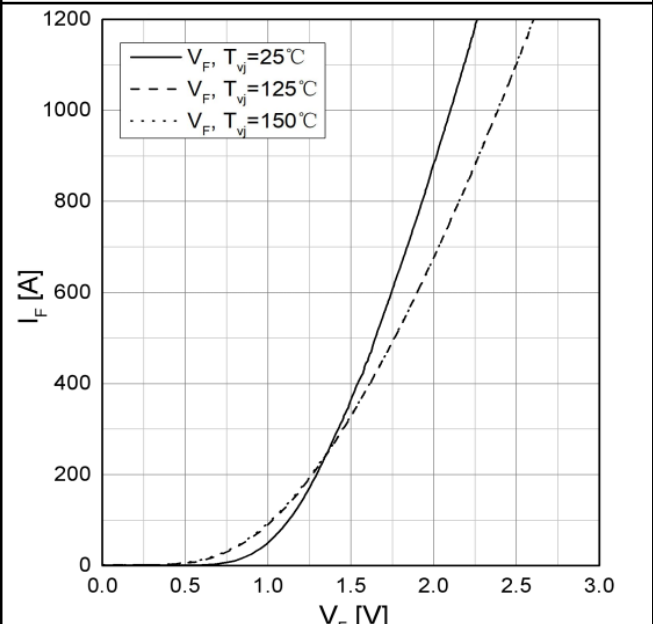
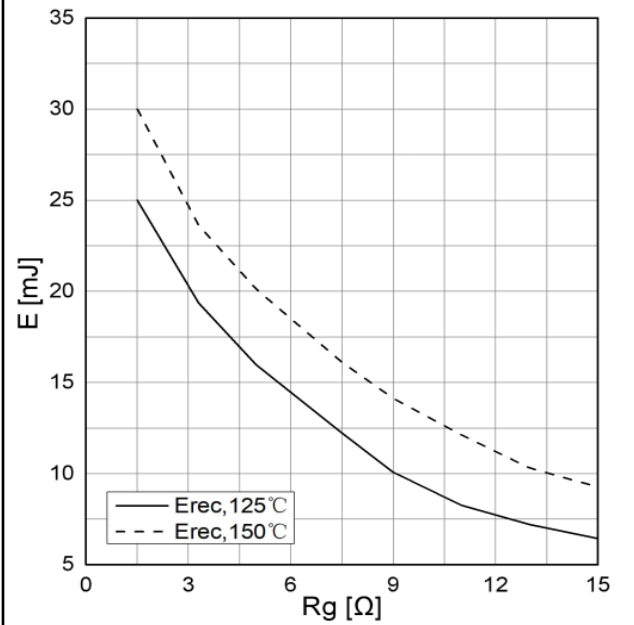
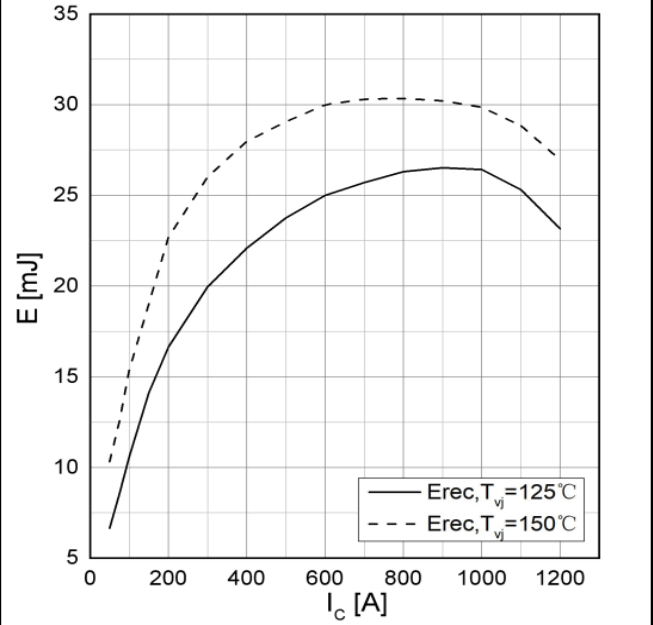
Switching losses IGBT
 $E_{on} = f(R_g)$, $E_{off} = f(R_g)$ at $V_{GE} = \pm 15\text{V}$, $I_C = 600\text{A}$ and $V_{CE} = 600\text{V}$

Fig. 4

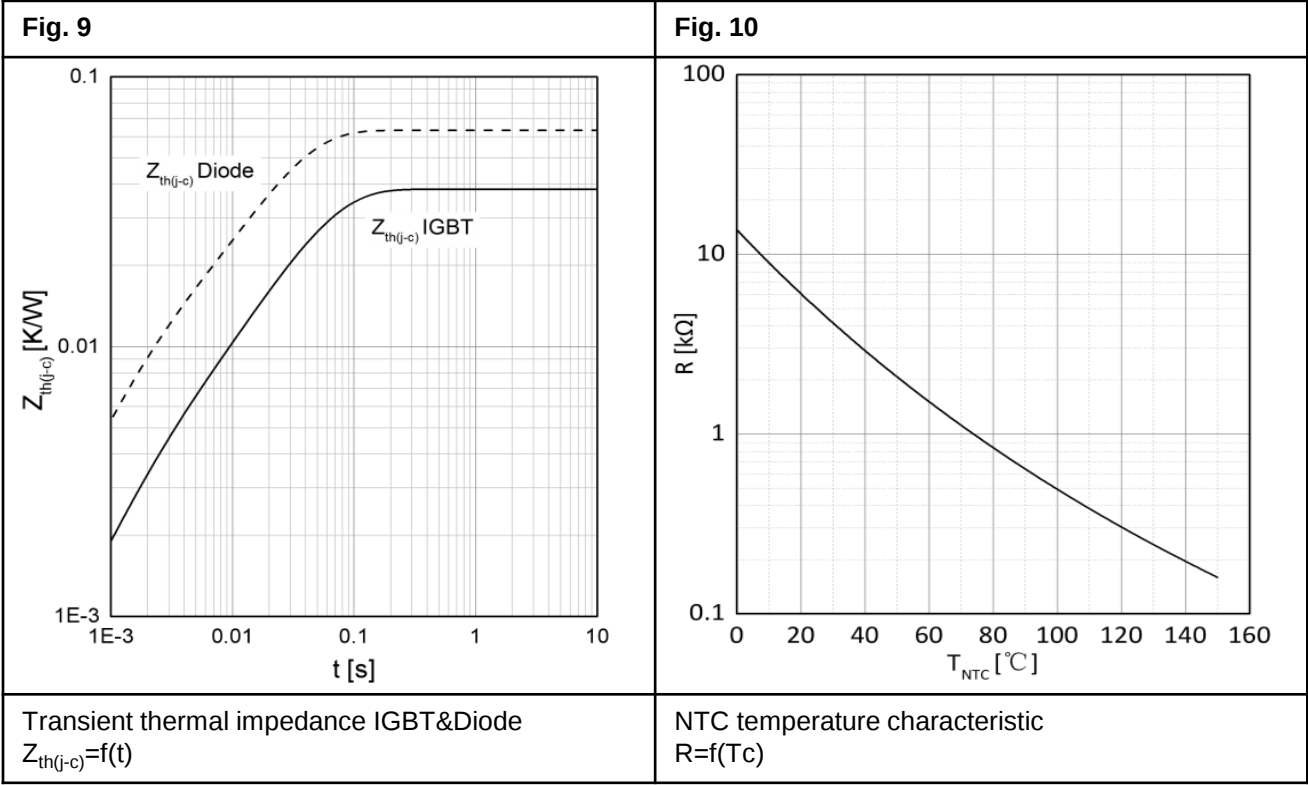


Switching losses IGBT
 $E_{on} = f(I_C)$, $E_{off} = f(I_C)$ at $V_{GE} = \pm 15\text{V}$, $R_g = 1.5\Omega$ and $V_{CE} = 600\text{V}$

Typical Characteristics

Fig. 5  RBSOA IGBT $I_C = f(V_{CE}), V_{GE} = \pm 15V, R_{Goff} = 1.5\Omega, T_{vj} = 150^\circ C$	Fig. 6  Forward characteristic of Diode $I_F = f(V_F)$
Fig. 7  Switching Losses Diode $E_{rec} = f(R_G)$ at $I_F = 600A$ and $V_{CE} = 600V$	Fig. 8  Switching losses Diode $E_{rec} = f(I_F)$ at $R_G = 1.5\Omega$ and $V_{CE} = 600V$

Typical Characteristics



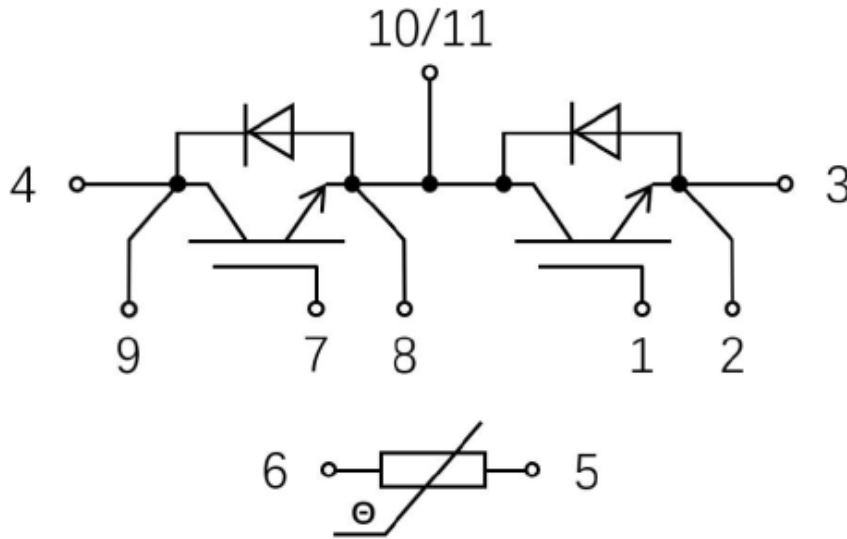
Analytical function for transient thermal impedance:

$$Z_{th(j-c)}(t) = \sum_{i=1}^n R_i(1 - e^{-t/\tau_i})$$

IGBT	i	1	2	3	4
	Ri (K/kW)	2.07	33.85	0.045	2.34
	τi (ms)	8.07	46.79	0.011	2.06

DIODE	Ri (K/kW)	18.21	7.41	16.16	21.58
	τi (ms)	28.29	1.7	24.03	28.28

Circuit Diagram



Package Outlines (mm)

