

F1 PACK with Trench/Fieldstop IGBT and Emitter Controlled diode and Press FIT/NTC

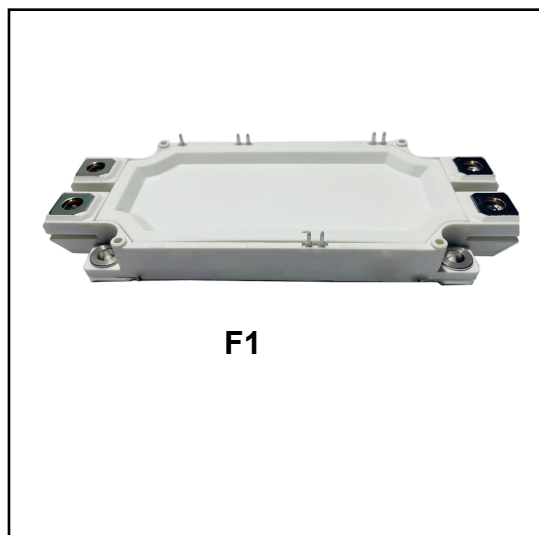
Features

• Electrical features

- Low V_{CEsat}
- $T_{vjop}=150^{\circ}C$
- V_{CEsat} with positive Temperature Coefficient

• Mechanical features

- High Power and Thermal Cycling Capability
- High Power Density
- Isolated Base Plate
- PressFIT Contact Technology



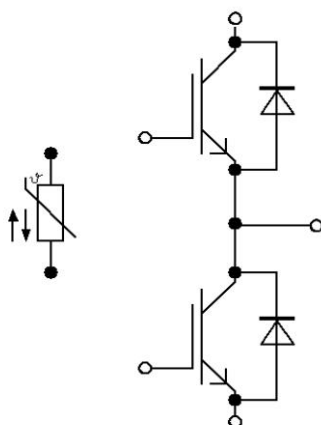
Typical Applications

- Construction, Commercial and Agriculture

Vehicles

- High Power Converters
- Motor Drives
- Servo Drives

Description



Package Insulation coordination

Symbol	Description	Note or test condition	Values	Unit
V_{ISOL}	Isolation test voltage	RMS, f=50Hz, t=60s	4.0	kV
	Material of module baseplate		Cu	
	Internal isolation	basic insulation(class 1, IEC 61140)	Al_2O_3	
d_{creep}	Creepage distance	terminal to heatsink	14.5	mm
d_{creep}	Creepage distance	terminal to terminal	12.1	mm
d_{clear}	Clearance	terminal to heatsink	12.5	mm
d_{clear}	Clearance	terminal to terminal	10.0	mm
CTI	Comparative tracking index (electrical)		>200	

Package Characteristic values

Symbol	Description	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
L_{CE}	Stray Inductance			--	20	--	nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip	$T_c=25^{\circ}C$, per switch		--	0.8	--	m Ω
T_{stg}	Storage temperature			-40	--	125	$^{\circ}C$
M	Mounting torque for module mounting	-Mounting according to valid application note	M5, Screw	3.0	--	6.0	Nm
M	Terminal connection torque	-Mounting according to valid application note	M6, Screw	3.0	--	6.0	Nm
G	Weight			--	345	--	g

Absolute Maximum Ratings

IGBT

Symbol	Description	Note or test condition	Value	Unit
V_{CES}	Collector-Emitter Voltage	$T_{vj} = 25\text{ }^{\circ}\text{C}$	1200	V
$I_{C\text{ nom}}$	Continuous DC collector current	$T_C = 100\text{ }^{\circ}\text{C}, T_{vj\text{ max}} = 175\text{ }^{\circ}\text{C}$	600	A
I_C		$T_C = 25\text{ }^{\circ}\text{C}, T_{vj\text{ max}} = 175\text{ }^{\circ}\text{C}$	900	A
I_{CRM}	Repetitive peak collector current	$t_p = 1\text{ ms}$	1200	A
V_{GES}	Gate-emitter peak voltage		± 20	V

Diode

Symbol	Description	Note or test condition	Value	Unit
V_{RRM}	Repetitive peak reverse voltage	$T_{vj} = 25\text{ }^{\circ}\text{C}$	1200	V
I_F	Continuous DC forward current		600	A
I_{FRM}	Repetitive peak forward current	$t_P = 1\text{ ms}$	1200	A
I^2t	I^2t - value	$t_P = 10\text{ ms}, V_R = 0\text{ V}$	$T_{vj} = 125\text{ }^{\circ}\text{C}$	A ² s
			$T_{vj} = 150\text{ }^{\circ}\text{C}$	

IGBT Characteristics

Symbol	Parameter	Note or Test Condition		Min	Typ	Max	Unit
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 600\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	--	1.40	2.00	V
			$T_{vj} = 150\text{ }^{\circ}\text{C}$	--	1.60	--	
$V_{GE(TH)}$	Gate-Emitter Threshold Voltage	$V_{GE} = V_{CE}, I_C = 12\text{ mA}, T_{vj} = 25\text{ }^{\circ}\text{C}$		5.5	--	6.8	V
I_{CES}	Collector-Emitter Cutoff Current	$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}, T_{vj} = 25\text{ }^{\circ}\text{C}$		--	--	2	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE} = 20\text{ V}, V_{CE} = 0\text{ V}, T_{vj} = 25\text{ }^{\circ}\text{C}$		--	--	± 200	nA
R_{Gint}	Internal Gate Resistance	$T_{vj} = 25\text{ }^{\circ}\text{C}$		--	1.62	--	Ω
C_{ies}	Input Capacitance	$f = 100\text{ KHz}, T_{vj} = 25\text{ }^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		--	101	--	nF
C_{oes}	Out Capacitance			--	2.57	--	nF
C_{res}	Reverse Transfer Capacitance			--	0.372	--	nF
Q_G	Gate Charge	$V_{GE} = 15\text{ V}, V_{CE} = 600\text{ V}$		--	2.98	--	μC
$t_{d(on)}$	Turn-On Delay Time	$I_C = 600\text{ A}, V_{CE} = 600\text{ V}, V_{GE} = \pm 15\text{ V}, R_{Gon} = 10\text{ }\Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	--	1.05	--	μs
			$T_{vj} = 150\text{ }^{\circ}\text{C}$	--	1.03	--	
t_r	Rise Time	$I_C = 600\text{ A}, V_{CE} = 600\text{ V}, V_{GE} = \pm 15\text{ V}, R_{Gon} = 10\text{ }\Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	--	0.2	--	μs
			$T_{vj} = 150\text{ }^{\circ}\text{C}$	--	0.33	--	
$t_{d(off)}$	Turn-off Delay Time	$I_C = 600\text{ A}, V_{CE} = 600\text{ V}, V_{GE} = \pm 15\text{ V}, R_{Goff} = 15\text{ }\Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	--	2.69	--	μs
			$T_{vj} = 150\text{ }^{\circ}\text{C}$	--	2.88	--	
t_f	Fall Time	$I_C = 600\text{ A}, V_{CE} = 600\text{ V}, V_{GE} = \pm 15\text{ V}, R_{Goff} = 15\text{ }\Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	--	0.27	--	μs
			$T_{vj} = 150\text{ }^{\circ}\text{C}$	--	0.24	--	
E_{on}	Turn-On Switching Loss per Pulse	$I_C = 600\text{ A}, V_{CE} = 600\text{ V}, V_{GE} = \pm 15\text{ V}, R_{Gon} = 10\text{ }\Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	--	171	--	mJ
			$T_{vj} = 150\text{ }^{\circ}\text{C}$	--	253	--	
E_{off}	Turn Off Switching Loss per Pulse	$I_C = 600\text{ A}, V_{CE} = 600\text{ V}, V_{GE} = \pm 15\text{ V}, R_{Goff} = 15\text{ }\Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	--	116	--	mJ
			$T_{vj} = 150\text{ }^{\circ}\text{C}$	--	137	--	
I_{sc}	SC Data	$V_{GE} \leq 15\text{ V}, V_{CC} = 800\text{ V}, V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$	$t_p \leq 10\text{ }\mu\text{s}, T_{vj} = 25\text{ }^{\circ}\text{C}$	--	3370	--	A
			$t_p \leq 10\text{ }\mu\text{s}, T_{vj} = 150\text{ }^{\circ}\text{C}$	--	2700	--	
R_{thJC}	Thermal resistance, junction to case	per IGBT		--	0.054	--	K/W
$T_{vj op}$		Temperature under switching conditions		-40		175 ¹⁾	$^{\circ}\text{C}$

¹⁾ $T_{vj op} > 150\text{ }^{\circ}\text{C}$ is only allowed for operation at overload conditions.

Diode Characteristics

Symbol	Parameter	Note or Test Condition		Min	Typ	Max	Unit
V_F	Diode Forward Voltage	$I_F = 600\text{ A}$, $V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	--	1.80	2.80	V
			$T_{vj} = 150\text{ }^{\circ}\text{C}$	--	1.70	--	
Q_{rr}	Recovered Charge	$V_R = 600\text{ V}$, $I_F = 600\text{ A}$, $V_{GE} = \pm 15\text{ V}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	--	58.01	--	μC
			$T_{vj} = 150\text{ }^{\circ}\text{C}$	--	136.42	--	
I_{RM}	Peak Reverse Recovery Current	$V_R = 600\text{ V}$, $I_F = 600\text{ A}$, $V_{GE} = \pm 15\text{ V}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	--	126.92	--	A
			$T_{vj} = 150\text{ }^{\circ}\text{C}$	--	196.83	--	
E_{rec}	Reverse recovery energy	$V_R = 600\text{ V}$, $I_F = 600\text{ A}$, $V_{GE} = \pm 15\text{ V}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	--	19	--	mJ
			$T_{vj} = 150\text{ }^{\circ}\text{C}$	--	45	--	
R_{thJC}	Thermal resistance, junction to case	per diode		--	0.103	--	K/W
$T_{vj\text{ op}}$		Temperature under switching conditions		-40		175 ²⁾	$^{\circ}\text{C}$

²⁾ $T_{vj\text{ op}} > 150\text{ }^{\circ}\text{C}$ is only allowed for operation at overload conditions.

NTC Characteristics

Symbol	Parameter	Note or Test Condition	Value			Unit
			Min	Typ	Max	
R_{25}	Rated Resistance	$T_C = 25\text{ }^{\circ}\text{C}$	--	5	--	k Ω
$\Delta R/R$	Deviation of R100	$T_C = 100\text{ }^{\circ}\text{C}$, $R_{100} = 493\Omega$	-5	--	5	%
P_{25}	Power Dissipation	$T_C = 25\text{ }^{\circ}\text{C}$	--	--	20	mW
$B_{25/50}$	B-value	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298.15\text{K}))]$	--	3375	--	K
$B_{25/80}$	B-value	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298.15\text{K}))]$	--	3411	--	K
$B_{25/100}$	B-value	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298.15\text{K}))]$	--	3433	--	K

Figure1. Output characteristic IGBT, Inverter (typical)
 $T_{vj}=25^{\circ}\text{C}$

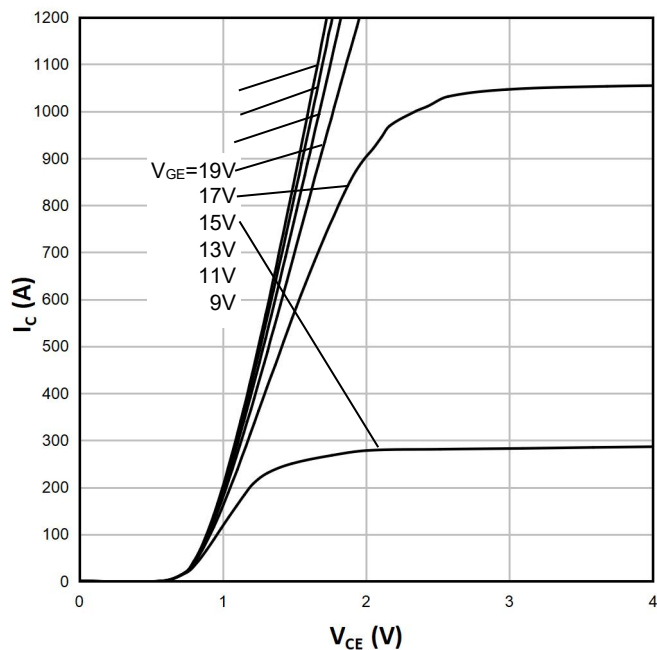


Figure2. Output characteristic IGBT, Inverter (typical)
 $T_{vj}=150^{\circ}\text{C}$

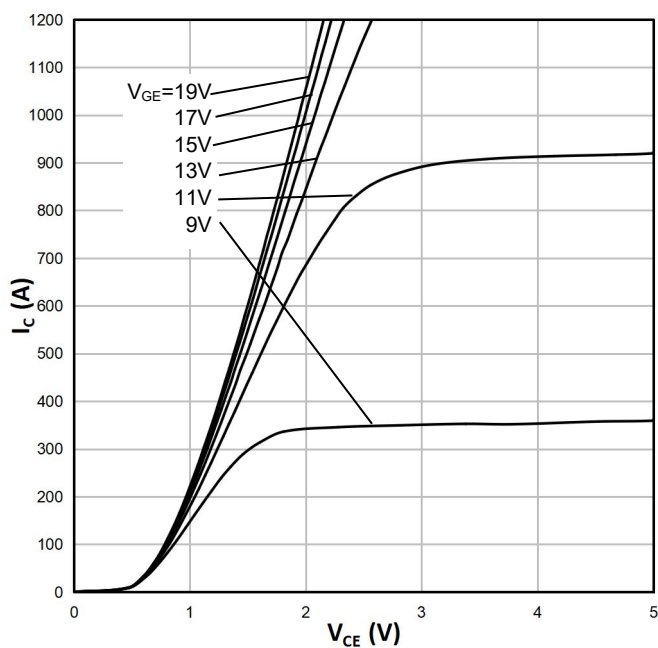


Figure3. $V_{CE(sat)}$ vs. Temperature

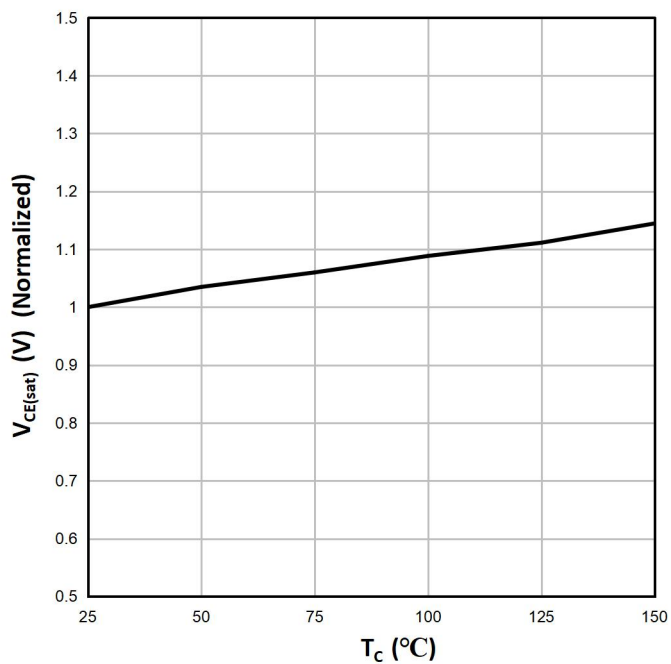


Figure4. transfer characteristic IGBT, Inverter (typical)
 $V_{CE}=20\text{V}$

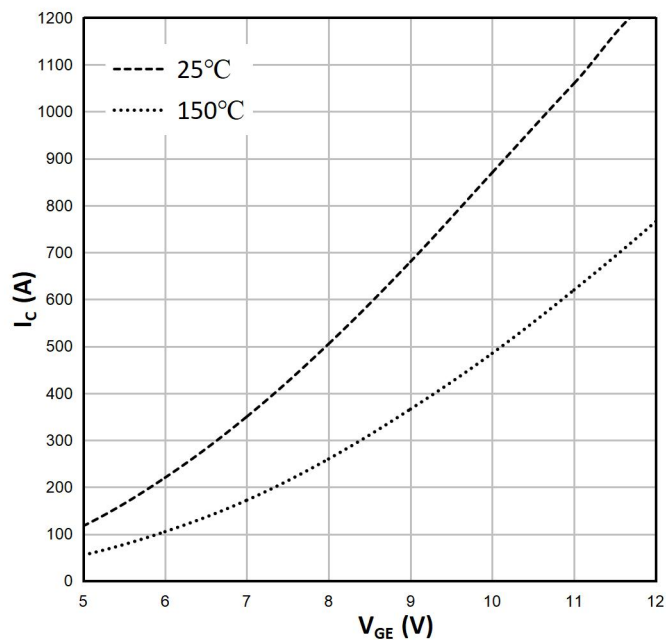


Figure5. V_{TH} vs. Temperature

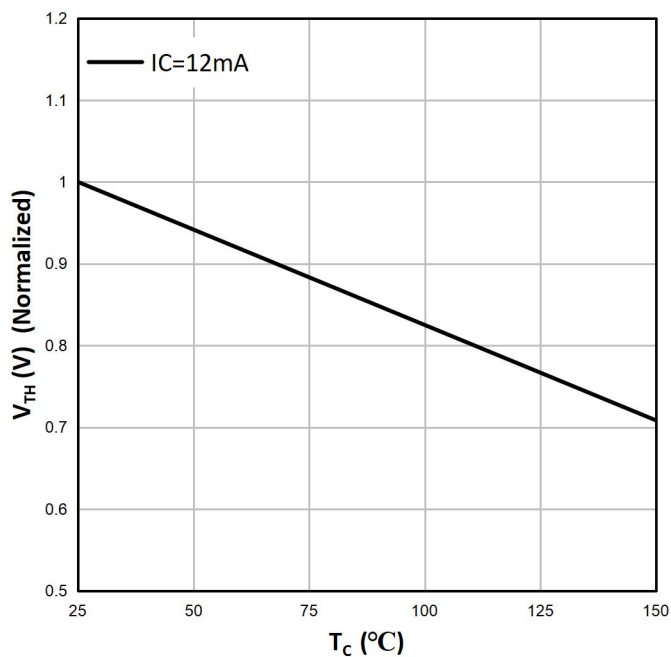


Figure6. Gate Charge Waveform

$V_{cc}=600V, V_{GE}=15V, T_{vj}=25^{\circ}C$

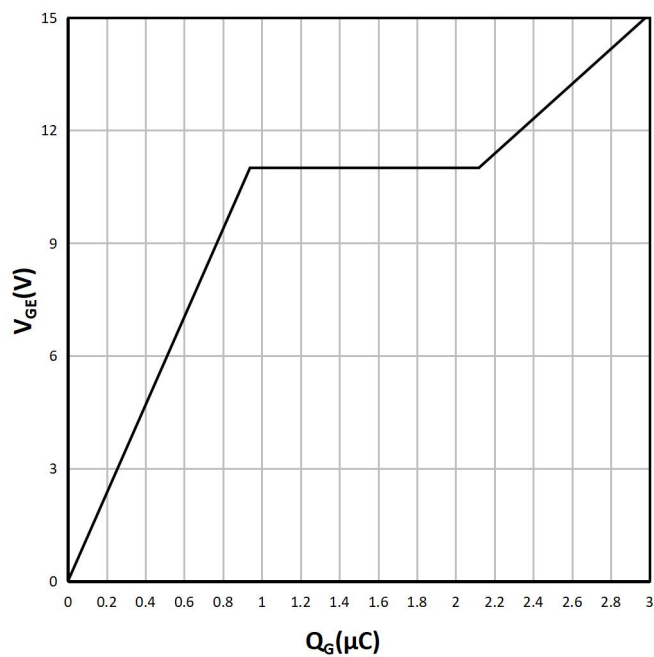


Figure7. P_{tot} vs. Case Temperature

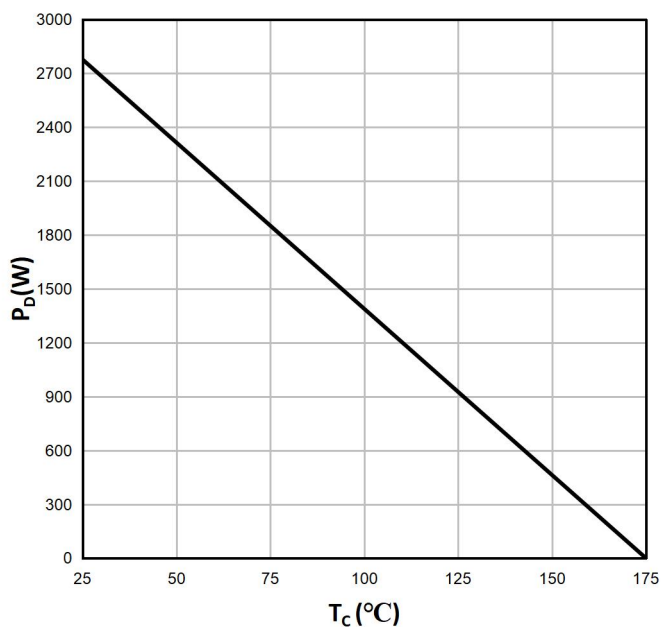


Figure8. FBSOA IGBT

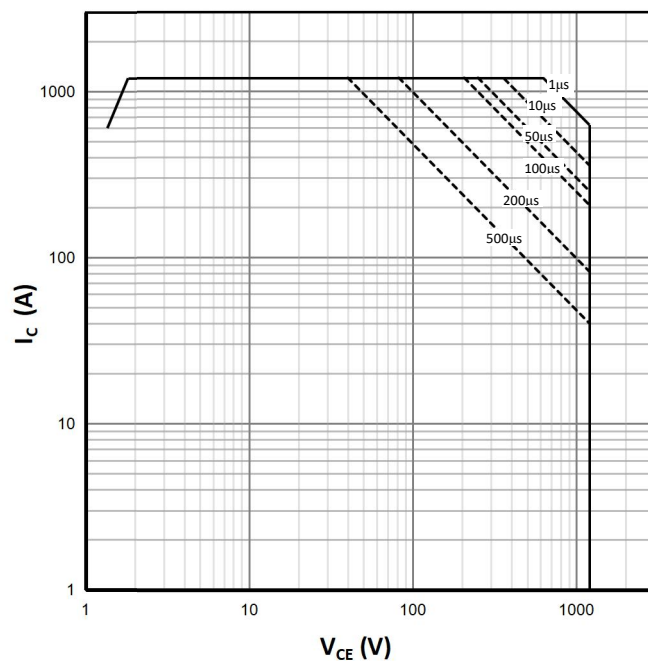


Figure9.RBSOA IGBT

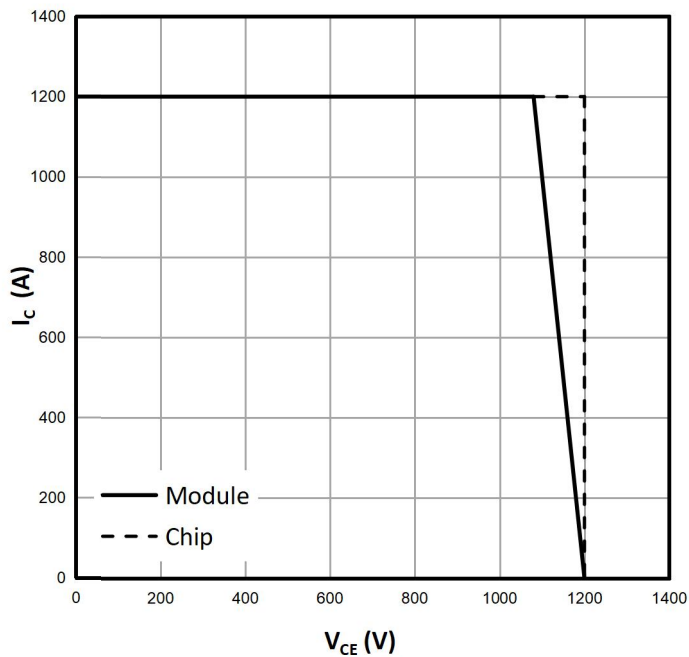


Figure10.switching losses IGBT,Inverter(typical)

$V_{cc}=600V, R_{gon}=10\Omega, R_{goff}=15\Omega, V_{ge}=\pm 15V$

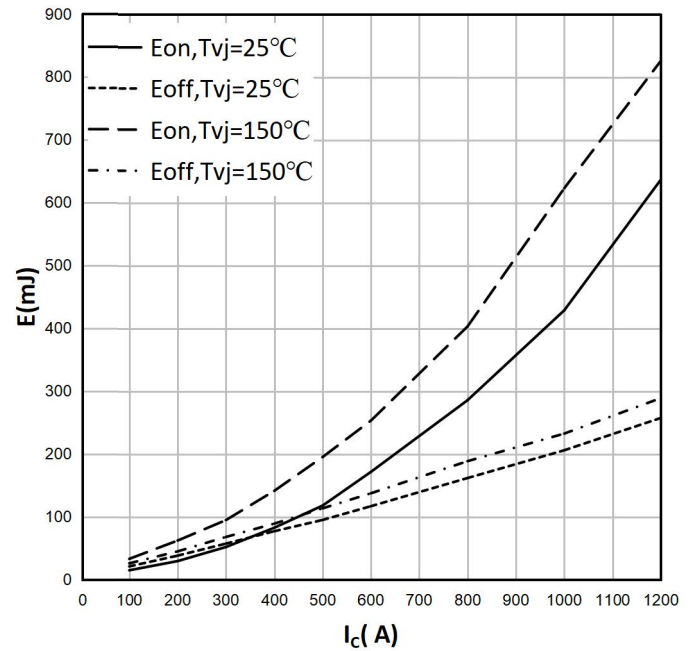


Figure11.switching losses IGBT,Inverter(typical)

$V_{cc}=600V, I_c=600A, V_{ge}=\pm 15V$

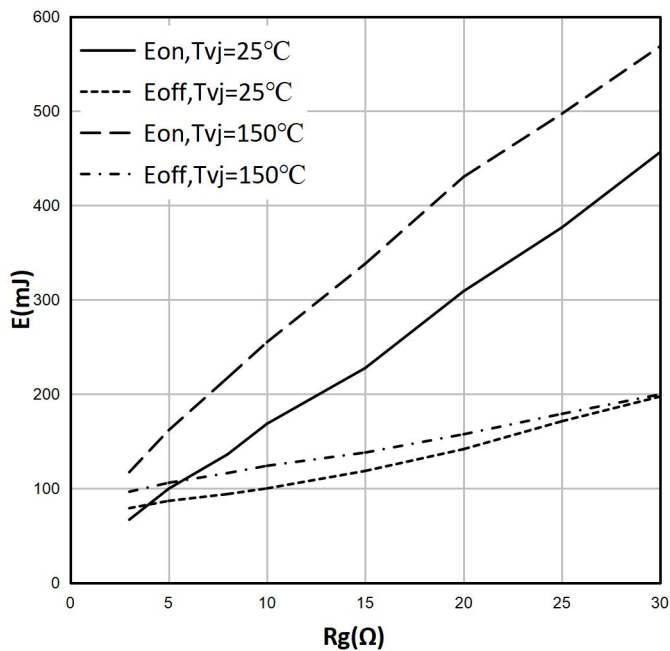


Figure12.transient thermal impedance

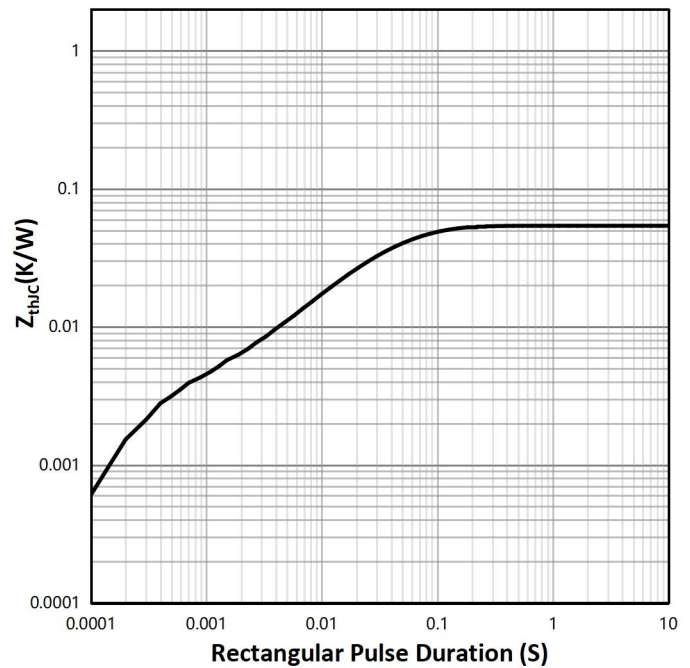


Figure13. forward characteristic of Diode,Inverter(typical)
 $V_{GE}=0V$

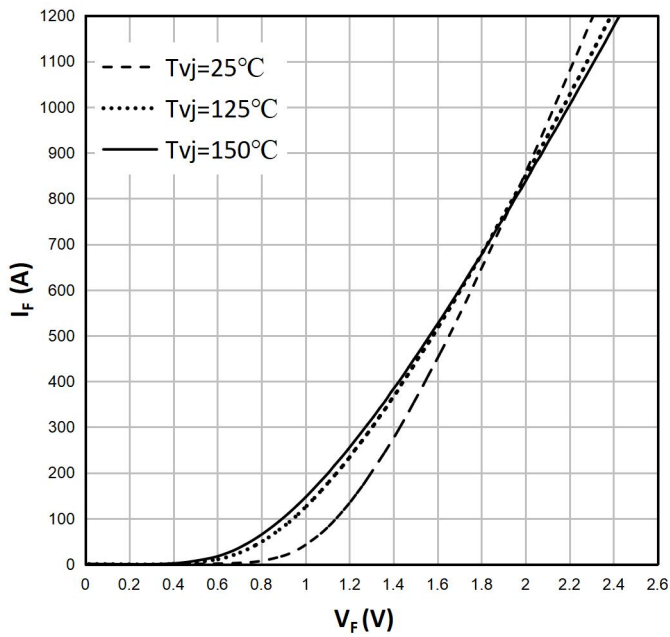


Figure 14.Reverse Recovery Energy Loss vs. I_C
 $V_{cc}=600V, R_{gon}=10\Omega, R_{goff}=15\Omega, V_{ge}=\pm 15V$

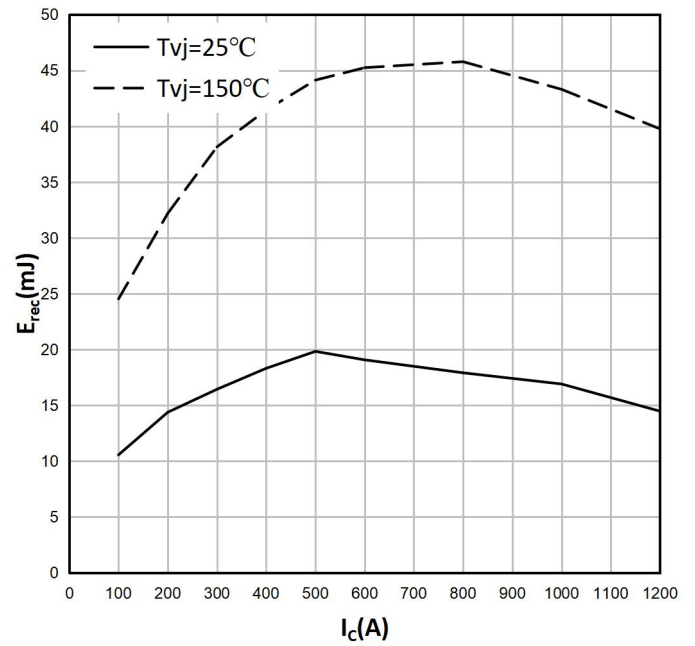


Figure 15.Reverse Recovery Energy Loss vs. R_G
 $V_{cc}=600V, I_C=600A, V_{ge}=\pm 15V$

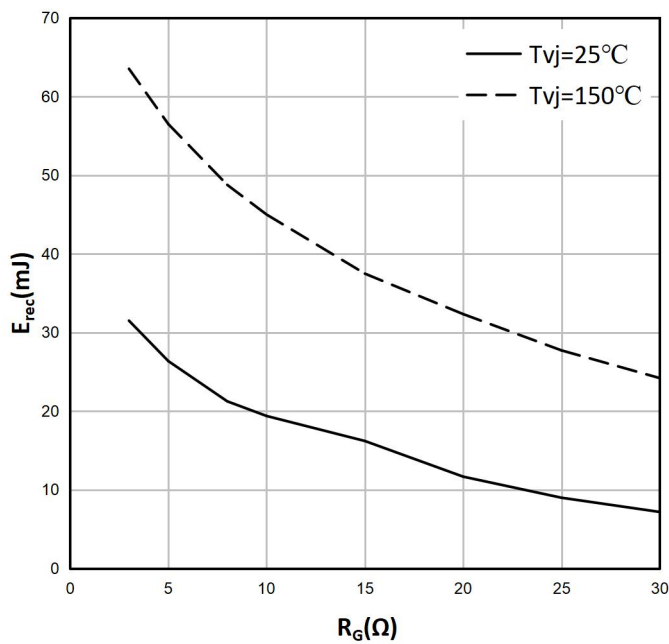
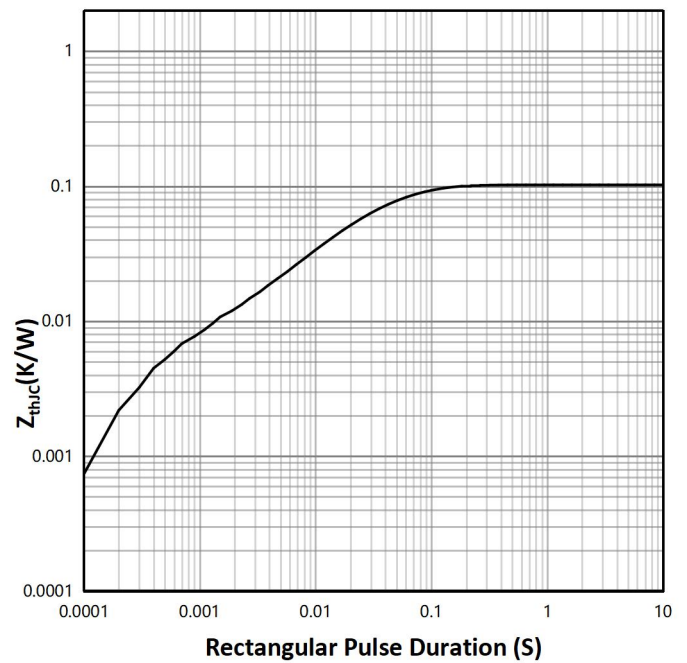
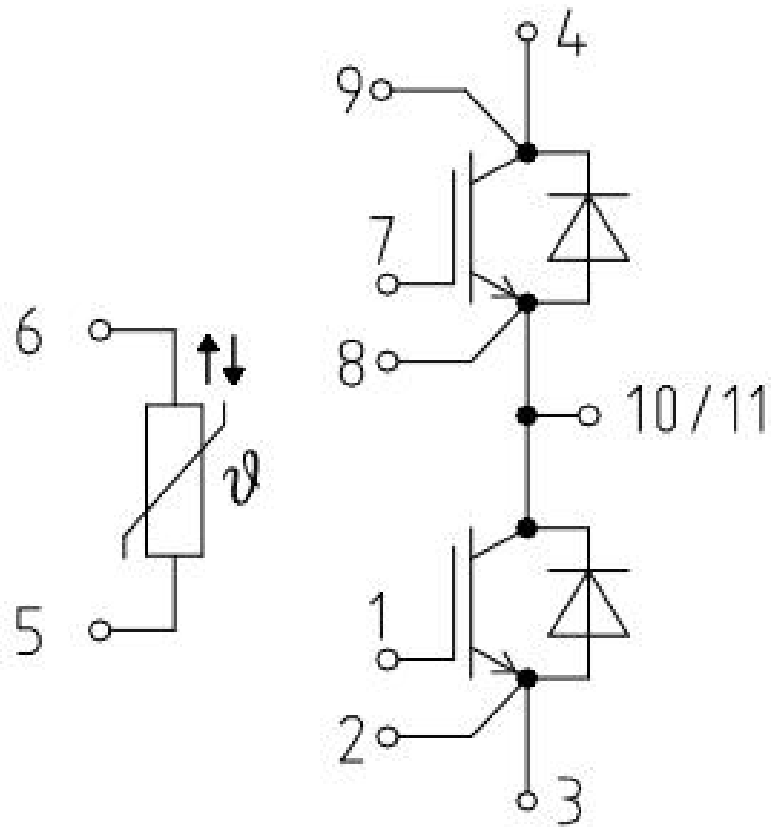


Figure16.transient thermal impedance



CIRCUIT DIAGRAM



PACKAGE DIMENSION

