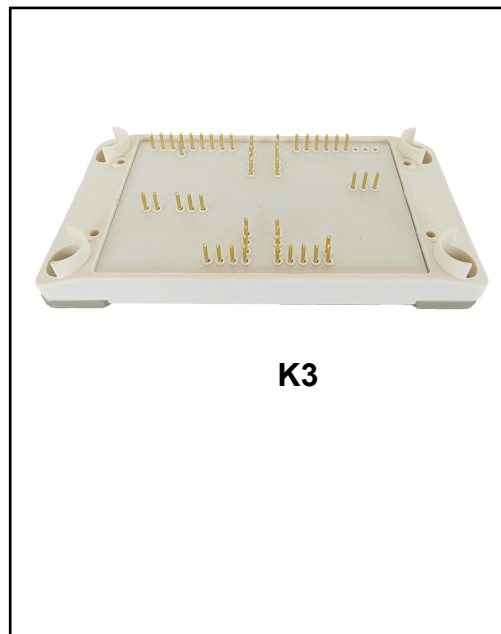


3-Level INPC Inverter Module with 1100V Trench Stop IGBTs

Features

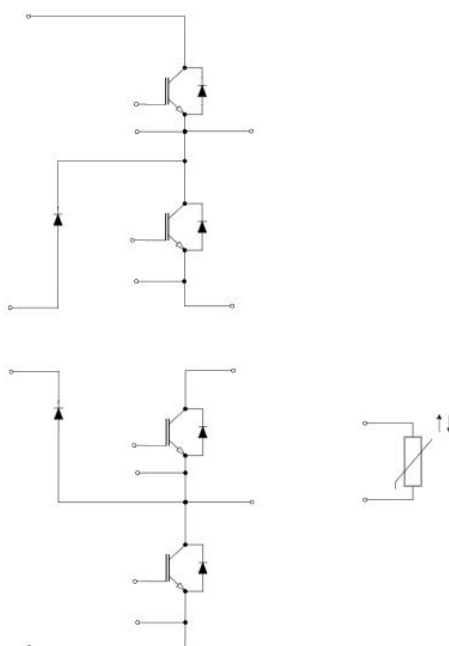
- Electrical features
 - Neutral Point Clamped Three-level Inverter Module
 - 1100V Low $V_{CE(sat)}$ Trench Stop IGBTs
 - $V_{CE(sat)}$ with positive temperature coefficient
 - Maximum junction temperature 175°C
 - Low Inductive Layout
- Mechanical features
 - Package with CTI >600
 - Solderable Pins
 - Isolated copper baseplate using AMB technology



Typical Applications

- Solar Inverters
- Energy Storage System

Description



Package Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, f=50Hz, t=60s	4.0	kV
Internal isolation		basic insulation(class 1, IEC 61140)	Si_3N_4	
Creepage distance	d_{creep}	terminal to heatsink	14.2	mm
Clearance	d_{clear}	terminal to heatsink	12.4	mm
Comparative tracking index (electrical)	CTI		>600	

Package Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Stray Inductance	LCE			--	15	--	nH
Storage Temperature Range	T_{STG}			-40		125	°C
Mounting torque for module mounting	M	-Mounting according to valid application note	M5, Screw	3		5	Nm
Weight	G				250		g

IGBT (T1,T2,T3,T4)

Absolute Maximum Ratings (T_C = 25°C unless otherwise noted)

Symbol	Description	Value	Unit
V _{CES}	Collector-Emitter Voltage	1100	V
V _{GE}	Gate- Emitter Voltage	±30	V
I _C	Continuous Collector Current @ T _C = 80°C, T _J = 175°C	600	A
I _{C(RM)}	T _p =1ms	1200	A

Characteristics (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Note or Test Condition		Min	Typ	Max	Unit
V _{CE(sat)}	Collector–Emitter Saturation Voltage	V _{GE} = 15V, I _C =600 A	T _J = 25°C	--	1.65	2.3	V
			T _J = 150°C	--	2.1	--	
V _{GE(TH)}	Gate–Emitter Threshold Voltage	V _{GE} = V _{CE} , I _C =15 mA		4.0	5.0	6.0	V
I _{CES}	Collector–Emitter Cutoff Current	V _{GE} = 0 V, V _{CE} =1100V ,T _{vj} = 25°C		--	--	1	mA
I _{GES}	Gate Leakage Current	V _{GE} = ±20 V, V _{CE} = 0 V		--	--	400	nA
R _{Gint}	Internal Gate Resistance			--	1.46	--	Ω
C _{iss}	Input Capacitance	V _{CE} = 25 V, V _{GE} = 0 V, f = 100 kHz		--	45.7	--	nF
C _{oss}	Output Capacitance			--	4.3	--	
C _{rss}	Reverse Transfer Capacitance			--	0.133	--	
Q _g	Total Gate Charge	V _{GE} = ± 15 V		--	1.44	--	μC
t _{d(on)}	Turn–On Delay Time	T _J = 25°C V _{CE} =600V, I _C =200A V _{GE} = ± 15 V, R _{Gon} =10Ω, R _{Goff} =10Ω		--	0.13	--	μs
t _r	Rise Time			--	0.1	--	
t _{d(off)}	Turn–off Delay Time			--	0.79	--	
t _f	Fall Time			--	0.04	--	
E _{on}	Turn–On Switching Loss per Pulse			T _J = 150°C V _{CE} =600V, I _C =200A V _{GE} = ± 15 V, R _{Gon} =10Ω, R _{Goff} = 10Ω		--	10.49
E _{off}	Turn Off Switching Loss per Pulse	--	7.64			--	
t _{d(on)}	Turn–On Delay Time	--	0.13			--	μs
t _r	Rise Time	--	0.09			--	
t _{d(off)}	Turn–off Delay Time	--	1.0			--	
t _f	Fall Time	--	0.05	--			
E _{on}	Turn–on Switching Loss per Pulse			--	23.34	--	mJ
E _{off}	Turn Off Switching Loss per Pulse			--	9.76	--	
R _{thJC}	Thermal Resistance – Chip–to–Case			--	0.062	--	K/W
T _{vj op}		Temperature under switching conditions		-40		175 ¹⁾	°C

¹⁾T_{vj op} > 150°C is only allowed for operation at overload conditions.

DIODE (D5, D6)

Absolute Maximum Ratings (T_C = 25°C unless otherwise noted)

Symbol	Description	Value	Unit
V _{RRM}	Peak Repetitive Reverse Voltage	1100	V
I _F	Continuous Forward Current @T _J = 150°C	375	A
I _{FRM}	Repetitive Peak Forward Current @T _J = 150°C	750	A

Characteristics (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Note or Test Condition		Min	Typ	Max	Unit
V _F	Diode Forward Voltage	I _F = 375A, V _{GE} = 0 V	T _J = 25°C	--	1.75	2.95	V
			T _J = 150°C	--	1.68	--	
Q _{rr}	Reverse Recovery Charge	T _J = 25°C V _R =600V, I _F =200A V _{GE} = ± 15 V, R _{Gon} = 10Ω, R _{Goff} =10Ω		--	85.3	--	μC
I _{RRM}	Peak Reverse Recovery Current			--	360.53	--	A
E _{REC}	Reverse Recovery Energy			--	10.63	--	mJ
Q _{rr}	Reverse Recovery Charge	T _J = 150°C V _R =600V, I _F =200A V _{GE} = ± 15 V, R _{Gon} =10Ω, R _{Goff} =10Ω		--	104.9	--	μC
I _{RRM}	Peak Reverse Recovery Current			--	397.3	--	A
E _{REC}	Reverse Recovery Energy			--	20.12	--	mJ
R _{thJC}	Thermal Resistance – Chip-to-Case				0.129		K/W
T _{vj op}		Temperature under switching conditions		-40		175 ²⁾	°C

²⁾T_{vj op} > 150°C is only allowed for operation at overload conditions.

DIODE (D1, D2, D3, D4)

Absolute Maximum Ratings (T_C = 25°C unless otherwise noted)

Symbol	Description	Value	Unit
V _{RRM}	Peak Repetitive Reverse Voltage	1100	V
I _F	Continuous Forward Current @T _J = 150°C	500	A
I _{FRM}	Repetitive Peak Forward Current @T _J = 150°C	1000	A

Characteristics (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Note or Test Condition		Min	Typ	Max	Unit
V _F	Diode Forward Voltage	I _F = 500A, V _{GE} = 0 V	T _J = 25°C	--	1.72	2.55	V
			T _J = 150°C	--	1.63	--	
Q _{rr}	Reverse Recovery Charge	T _J = 25°C V _R = 600V, I _F = 200A V _{GE} = ± 15 V, R _{Gon} = 10Ω, R _{Goff} = 10Ω		--	89.6	--	μC
I _{RRM}	Peak Reverse Recovery Current			--	329.6	--	A
E _{REC}	Reverse Recovery Energy			--	9.16	--	mJ
Q _{rr}	Reverse Recovery Charge	T _J = 150°C V _R = 600V, I _F = 200A V _{GE} = ± 15 V, R _{Gon} = 10Ω, R _{Goff} = 10Ω		--	115.6	--	μC
I _{RRM}	Peak Reverse Recovery Current			--	362.7	--	A
E _{REC}	Reverse Recovery Energy			--	19.2	--	mJ
R _{thJC}	Thermal Resistance – Chip-to–Case				0.096		K/W
T _{vj op}		Temperature under switching conditions		-40		175 ³⁾	°C

³⁾T_{vj op} > 150°C is only allowed for operation at overload conditions.

THERMISTOR PROPERTIES

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
R ₂₅	Rated Resistance	T=25℃	-	5	-	KΩ
R ₁₀₀	Rated Resistance	T=100℃	-	478.5	-	Ω
▲R/R	Deviation of R25		-1	-	1	%
P ₂₅	Power Dissipation			210		mW
	Power Dissipation Constant			3.5		mW/K
B _{25/85}	B-value	B(25/80),tolerance ±1%	-	3480	-	K
B _{25/50}	B-value	B(25/50),tolerance ±1%	-	3473	-	K
B _{25/100}	B-value	B(25/100),tolerance ±1%	-	3481	-	K

Figure1.output characteristic IGBT(typical)

$T_{vj}=25^{\circ}\text{C}$

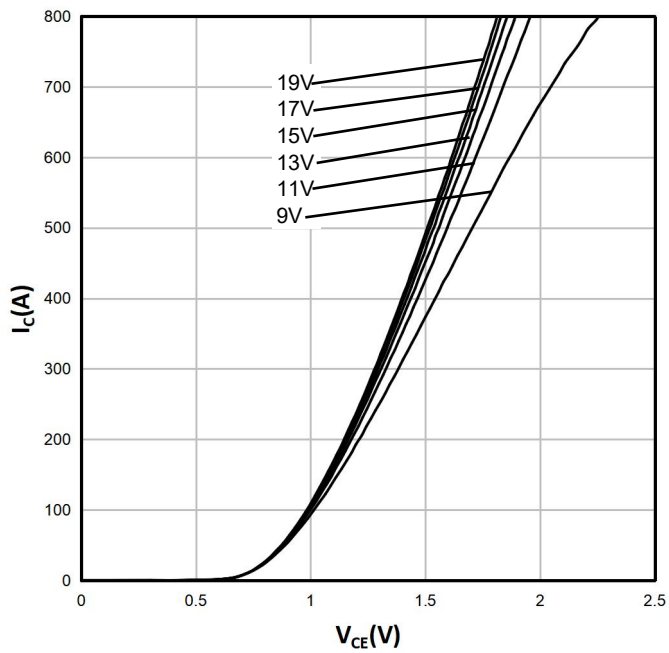


Figure2.output characteristic IGBT(typical)

$T_{vj}=150^{\circ}\text{C}$

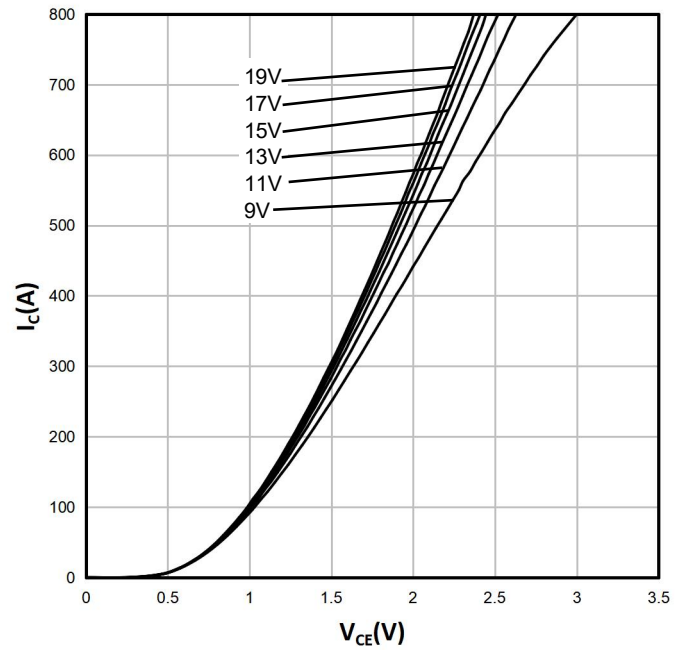


Figure3. $V_{CE(sat)}$ vs. Temperature

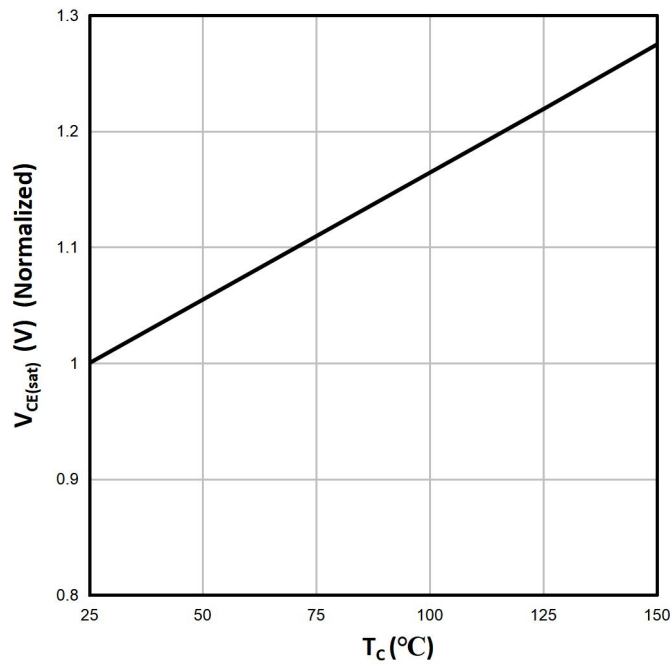


Figure4.transfer characteristic IGBT(typical)

$V_{CE}=20\text{V}$

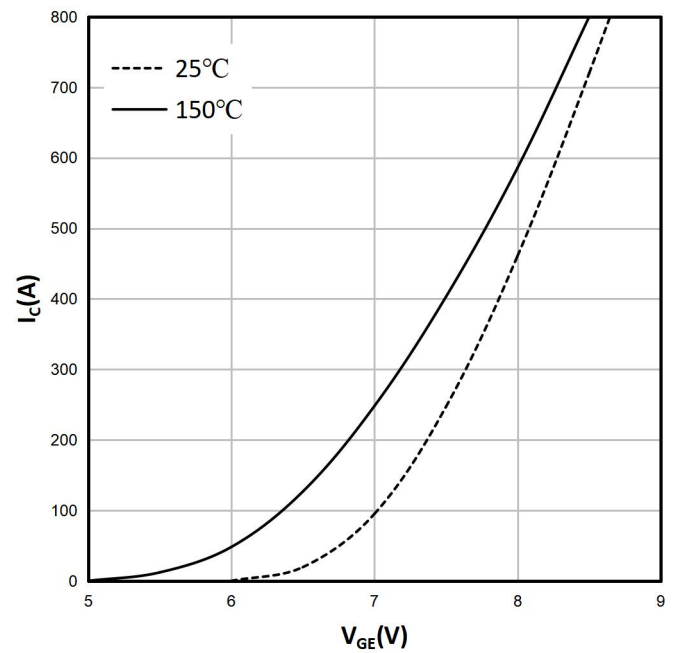


Figure5. FBSOA IGBT(typical)

$D=0$, $T_c=25^\circ\text{C}$, $T_j \leq 175^\circ\text{C}$, $V_{ge}=15\text{V}$

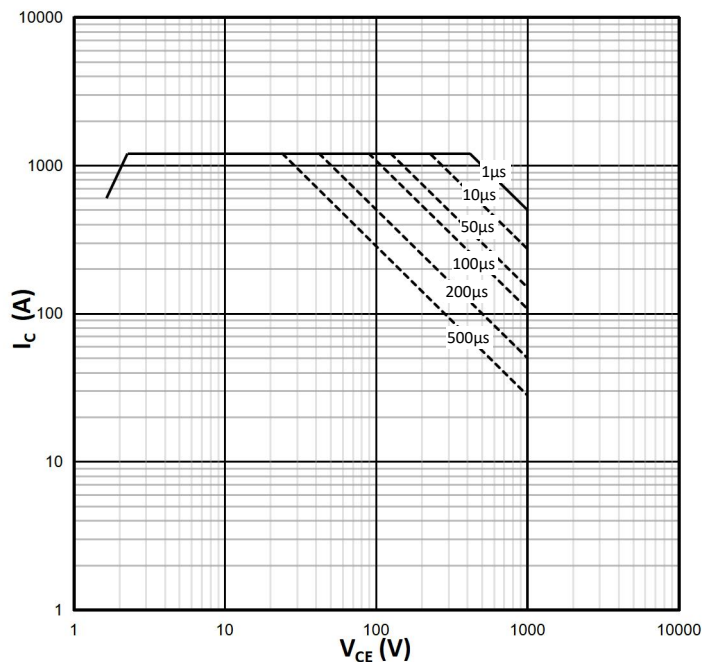


Figure6. Gate Charge Waveform

$V_{cc}=600\text{V}$

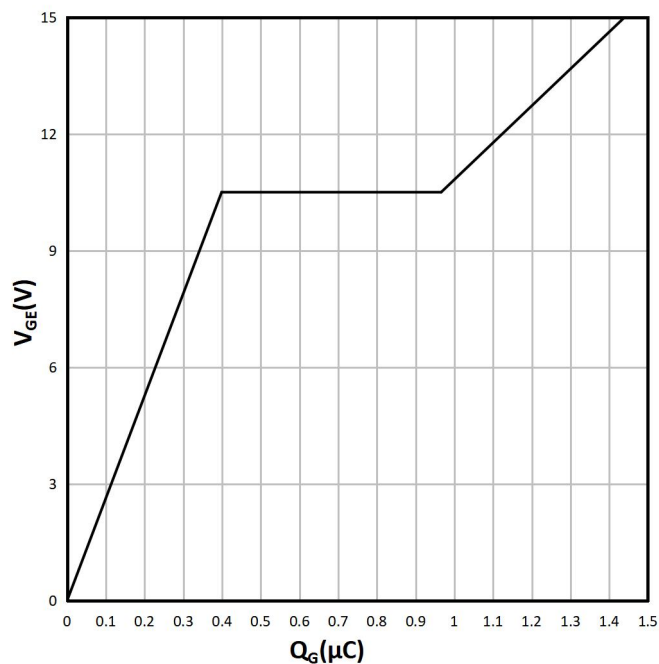


Figure7. switching losses IGBT(typical)

$V_{cc}=600\text{V}$, $R_{Gon}=10\Omega$, $R_{Goff}=10\Omega$, $V_{ge}=\pm 15\text{V}$

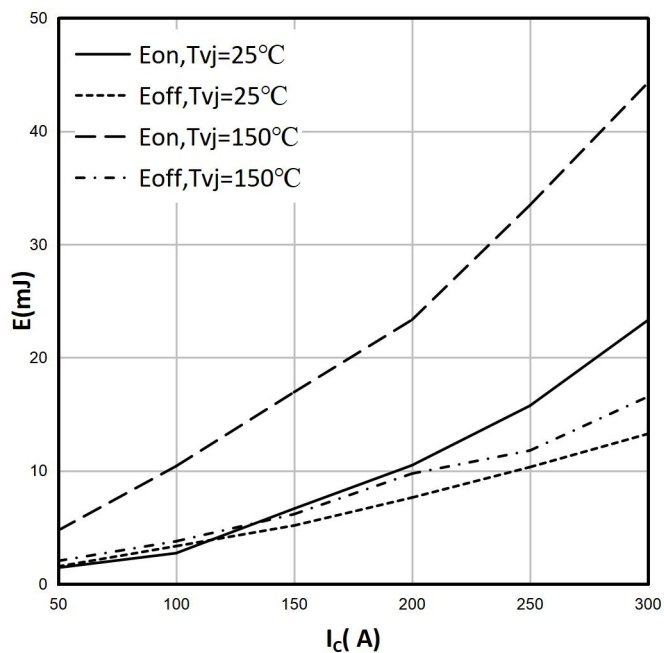


Figure 8. switching losses IGBT, Inverter (typical)

$V_{cc}=600\text{V}$, $I_c=200\text{A}$, $V_{ge}=\pm 15\text{V}$

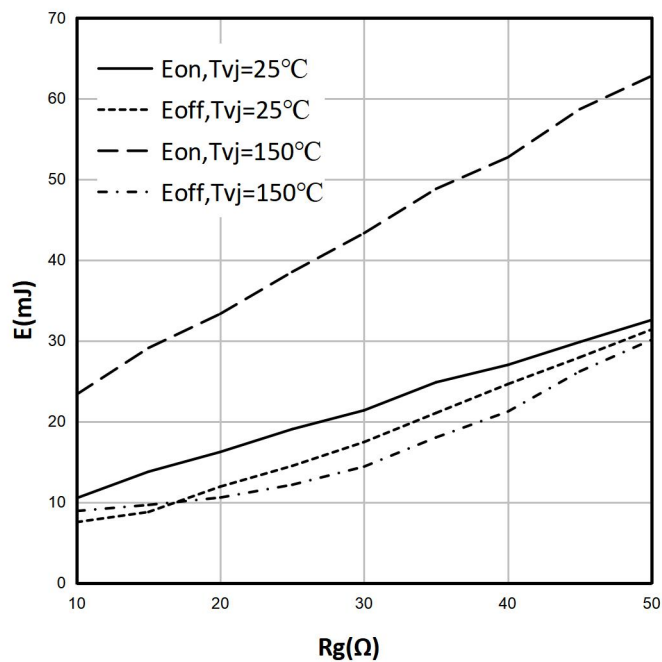
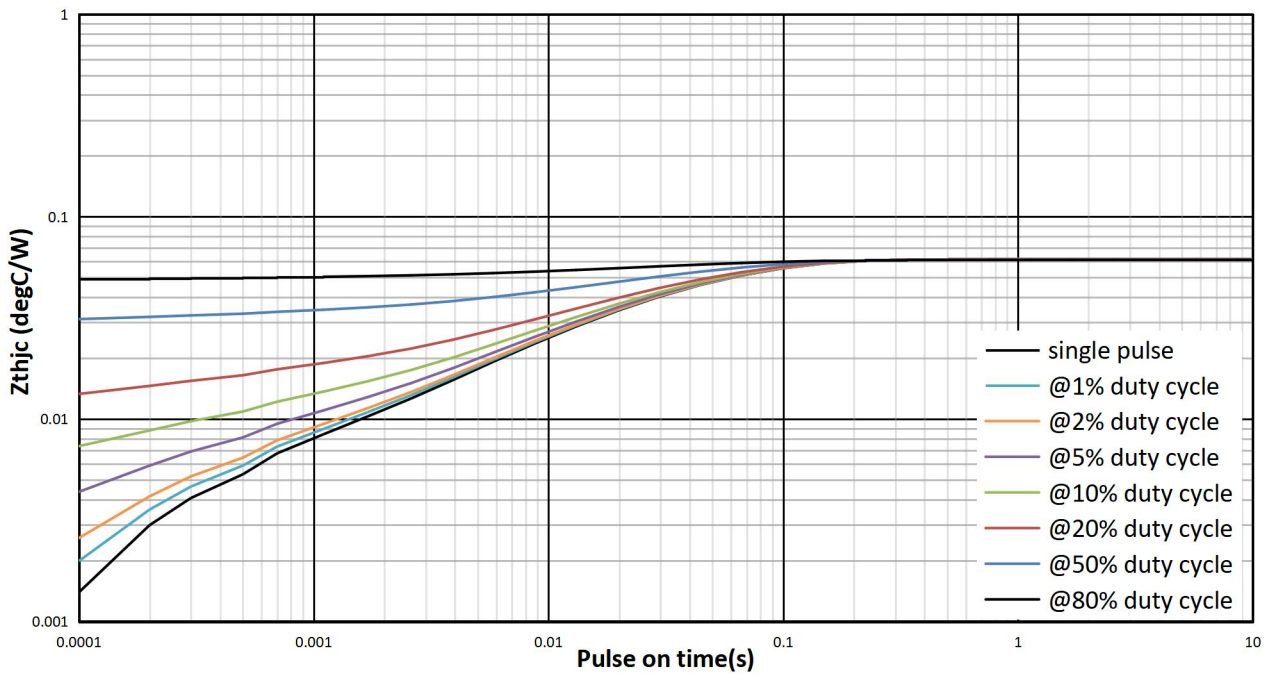
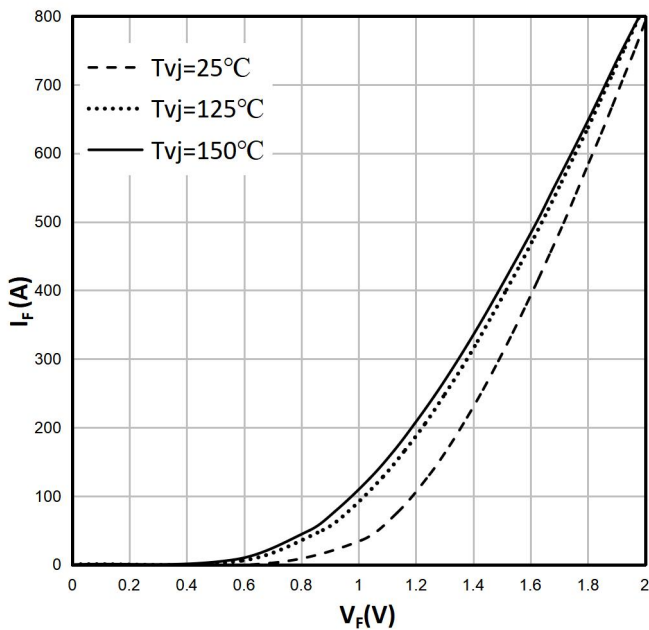


Figure9. transient thermal impedance IGBT (T1, T2, T3, T4)



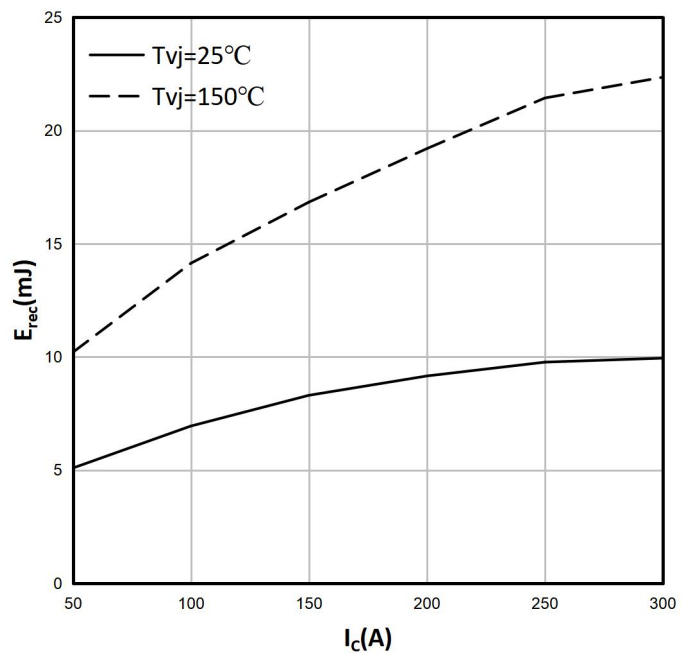
**Figure10. forward characteristic of Diode(typical)
(D1, D2, D3, D4)**

$V_{GE}=0V$



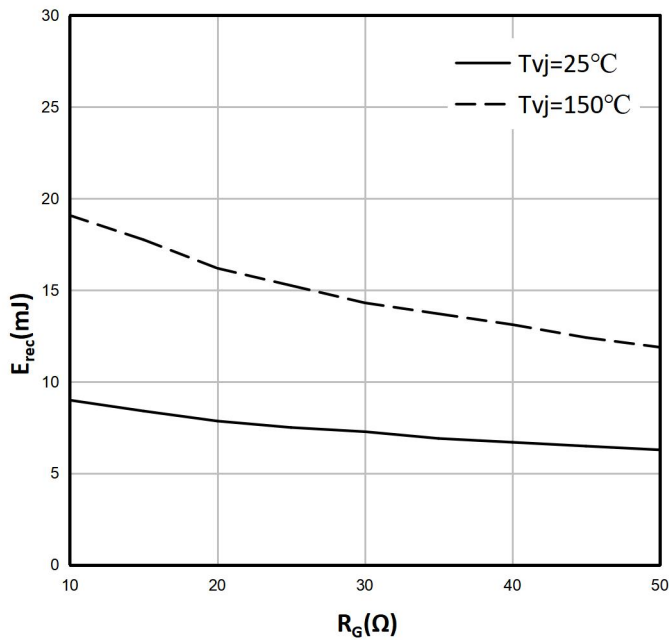
**Figure11.Reverse Recovery Energy Loss vs. IC
(D1, D2, D3, D4)**

$V_{CC}=600V$, $R_{Gon}=10\Omega$, $R_{Goff}=10\Omega$, $V_{ge}=\pm 15V$



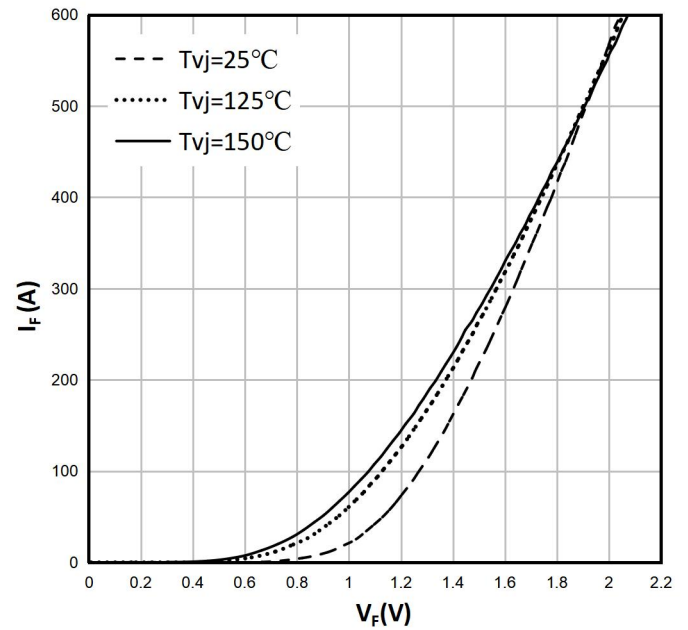
**Figure12.Reverse Recovery Energy Loss vs.RG
(D1, D2, D3, D4)**

$V_{cc}=600V, I_c=200A, V_{ge}=\pm 15V$



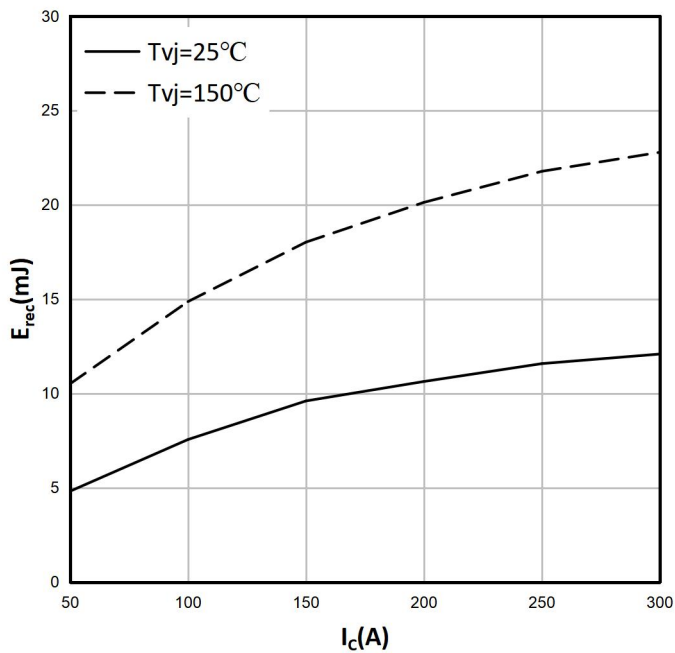
**Figure13. forward characteristic of Diode(typical)
(D5, D6)**

$V_{GF}=0V$



**Figure14.Reverse Recovery Energy Loss vs. IC
(D5, D6)**

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



**Figure15.Reverse Recovery Energy Loss vs.RG
(D5, D6)**

$V_{cc}=600V, I_c=200A, V_{ge}=\pm 15V$

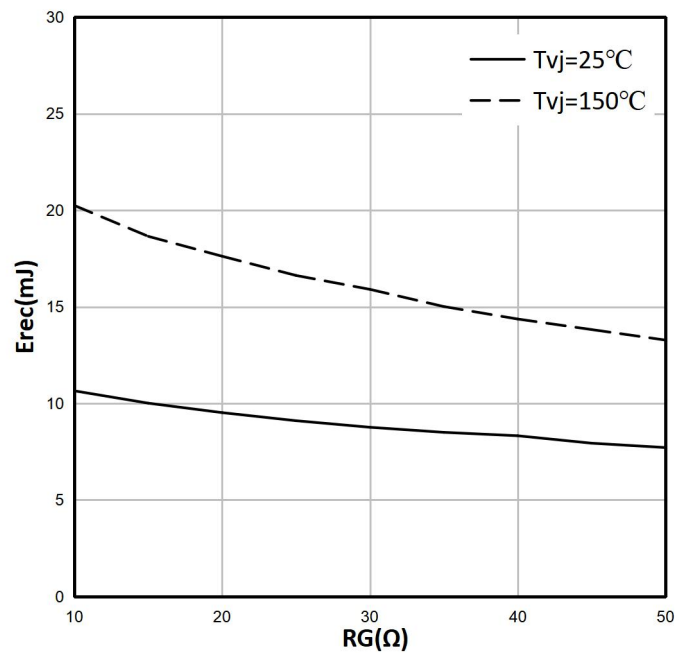


Figure16. transient thermal impedance Diode (D1, D2, D3, D4)

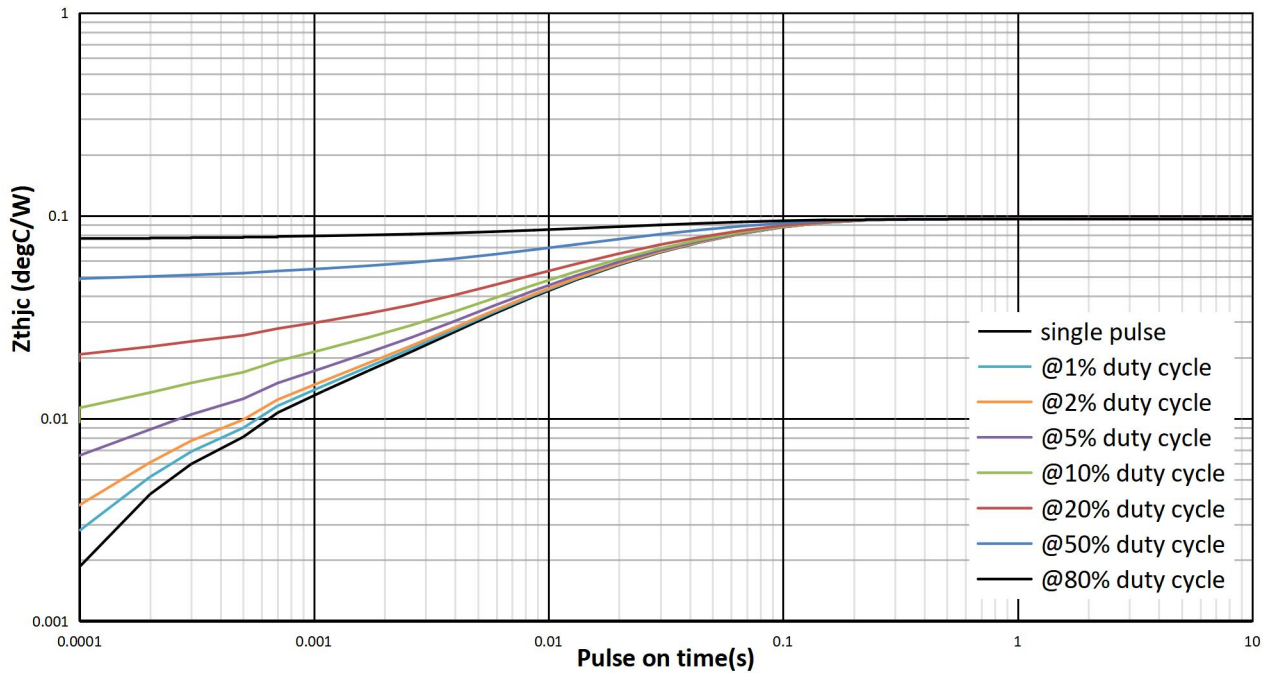
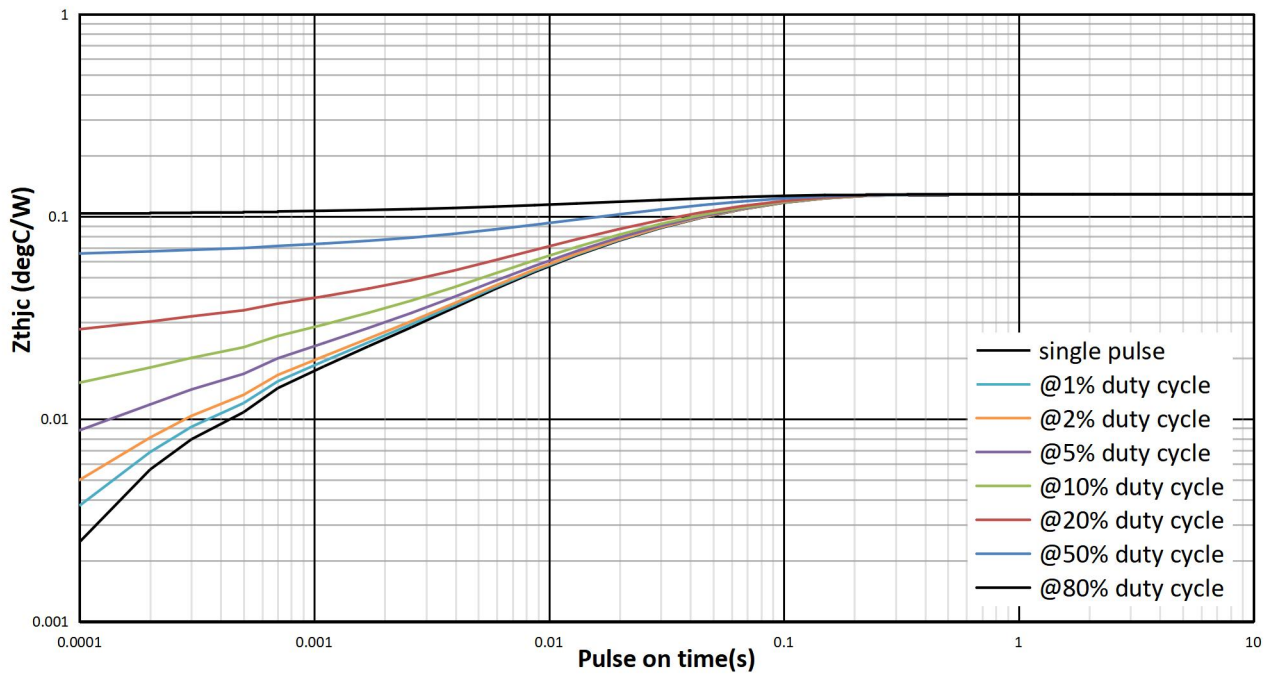
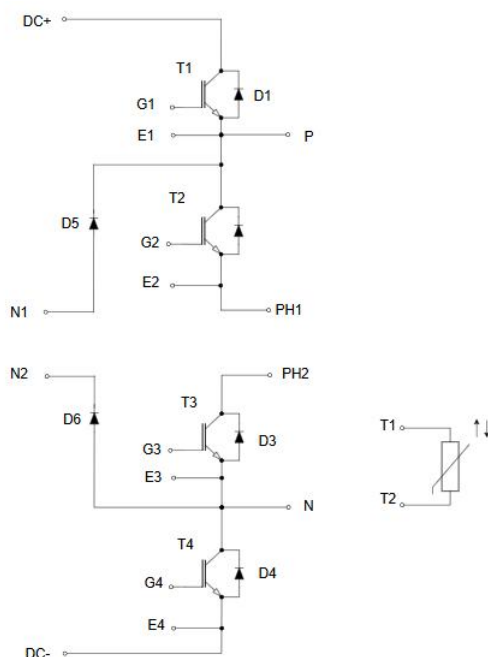


Figure17. transient thermal impedance Diode (D5, D6)



CIRCUIT DIAGRAM



PACKAGE DIMENSIONS

