



750V HPD IGBT Power Module

AEP820B08TFSTMM

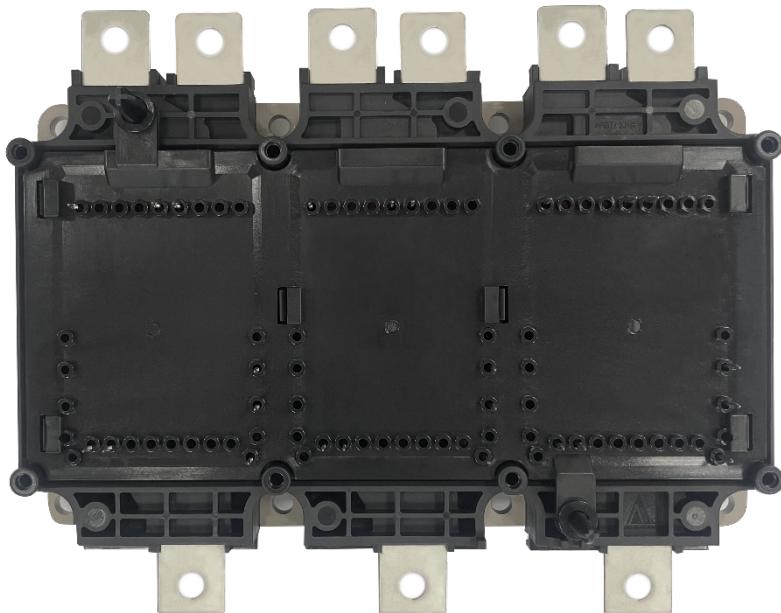
DATASHEET

V1.0, 2024/09



ACTRON TECHNOLOGY CORP.

AEP820B08TFSTMM HPD IGBT Power Module



Applications

- Motor Drives
- All-Terrain Vehicles
- Automotive Applications
- Hybrid Electrical Vehicles (H) EV
- Commercial Agriculture Vehicles

Features

Electrical Features

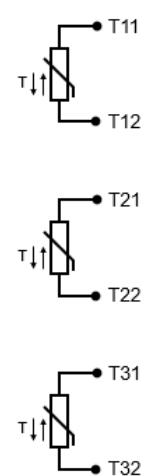
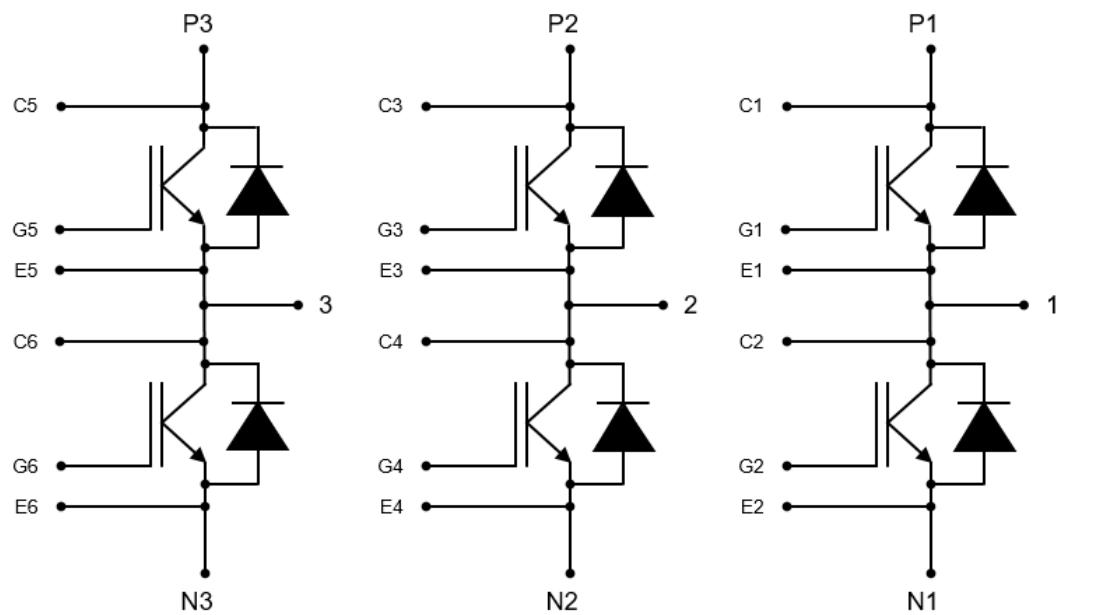
- Low Q_G
- $T_{j,op} = 150^\circ\text{C}$
- Low Inductance Design
- Blocking Voltage 750V
- Fast and Soft Reverse Recovery
- Low $V_{CE,sat}$ and Switching Losses

Mechanical Features

- Compact Design
- 4.2kV DC Insulation
- UL 94 Module Frame
- Temperature Sensor Included
- Direct Water Cooling Pin-Fin Base Plate
- Easy to Integrate 6-pack Topology
- Pb-free Device and RoHS Compliant
- Guiding Elements for PCB and Cooler Assembly



Circuit Diagram





IGBT

I Maximum Rated Values

Parameter	Conditions	Symbol	Values	Unit
Collector-emitter voltage	$T_j = 25^\circ\text{C}$	V_{CES}	750	V
Gate-emitter peak voltage		V_{GES}	± 20	V
Implemented collector current		I_{CN}	820	A
Continuous DC collector current	$T_F = 70^\circ\text{C}, T_{j,max} = 175^\circ\text{C}$	$I_{C,nom}$	450	A
Repetitive peak collector current	$t_p = 1 \text{ ms}$	I_{CRM}	1640	A
Maximum junction temperature		$T_{j,max}$	175	$^\circ\text{C}$

I Characteristics Values

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Collector-emitter saturation voltage	$I_C = 450\text{A}, V_{GE} = 15\text{V}$	$V_{CE,sat}$	$T_j = 25^\circ\text{C}$	1.15	1.45	V
	$I_C = 450\text{A}, V_{GE} = 15\text{V}$			1.25		
	$I_C = 450\text{A}, V_{GE} = 15\text{V}$			1.30		
	$I_C = 820\text{A}, V_{GE} = 15\text{V}$		$T_j = 25^\circ\text{C}$	1.40		
	$I_C = 820\text{A}, V_{GE} = 15\text{V}$		$T_j = 150^\circ\text{C}$	1.60		
	$I_C = 820\text{A}, V_{GE} = 15\text{V}$		$T_j = 175^\circ\text{C}$	1.70		
Gate threshold voltage	$I_C = 9.6 \text{ mA}, V_{CE} = V_{GE}$	$V_{GE,th}$	$T_j = 25^\circ\text{C}$	5.10	5.70	V
	$I_C = 9.6 \text{ mA}, V_{CE} = V_{GE}$		$T_j = 150^\circ\text{C}$		4.20	
	$I_C = 9.6 \text{ mA}, V_{CE} = V_{GE}$		$T_j = 175^\circ\text{C}$		3.95	
Collector-emitter cut-off current	$V_{CE} = 750\text{V}, V_{GE} = 0\text{V}$	I_{CES}	$T_j = 25^\circ\text{C}$		1.0	mA
	$V_{CE} = 750\text{V}, V_{GE} = 0\text{V}$		$T_j = 150^\circ\text{C}$		5.0	
	$V_{CE} = 750\text{V}, V_{GE} = 0\text{V}$		$T_j = 175^\circ\text{C}$		10.0	
Gate-emitter leakage current	$V_{CE} = 0\text{V}, V_{GE} = 20\text{V}$	I_{GES}			400	nA
Gate charge	$V_{GE} = -8 \text{ V} / + 15 \text{ V}$	Q_G	$T_j = 25^\circ\text{C}$	1.8		μC
	$I_C = 450\text{A}, V_{CE} = 400\text{V}$					
Internal gate resistance		$R_{G,int}$	$T_j = 25^\circ\text{C}$	1.7		Ω
Input capacitance	$f = 100\text{kHz}, V_{CE} = 50\text{V}$ $V_{GE} = 0\text{V}$	C_{ies}	$T_j = 25^\circ\text{C}$	43		nF
Output capacitance	$f = 100\text{kHz}, V_{CE} = 50\text{V}$ $V_{GE} = 0\text{V}$	C_{oes}	$T_j = 25^\circ\text{C}$	2.1		nF
Reverse transfer capacitance	$f = 100\text{kHz}, V_{CE} = 50\text{V}$ $V_{GE} = 0\text{V}$	C_{res}	$T_j = 25^\circ\text{C}$	0.6		nF



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Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Turn-on delay time, inductive load	$I_C = 450A$, $V_{CE} = 400V$ $V_{GE} = -8V / + 15V$ $R_{G,on} = 2.5 \Omega$	$T_j = 25^\circ C$ $T_j = 150^\circ C$ $T_j = 175^\circ C$	$t_{d(on)}$	0.14 0.11 0.11		μs
Rise time, inductive load	$I_C = 450A$, $V_{CE} = 400V$ $V_{GE} = -8V / + 15V$ $R_{G,on} = 2.5 \Omega$	$T_j = 25^\circ C$ $T_j = 150^\circ C$ $T_j = 175^\circ C$	t_r	0.069 0.070 0.072		μs
Turn-on energy loss per pulse	$I_C = 450A$, $V_{CE} = 400V$ $L_S = 30nH$ $V_{GE} = -8V / + 15V$ $R_{G,on} = 2.5 \Omega$ $di/dt = 5.5 A/ns (25^\circ C)$ $di/dt = 5.1 A/ns (150^\circ C)$	$T_j = 25^\circ C$ $T_j = 150^\circ C$ $T_j = 175^\circ C$	E_{on}	8.7 12.2 13.2		mJ
Turn-off delay time, inductive load	$I_C = 450A$, $V_{CE} = 400V$ $V_{GE} = -8V / + 15V$ $R_{G,off} = 5.0 \Omega$	$T_j = 25^\circ C$ $T_j = 150^\circ C$ $T_j = 175^\circ C$	$t_{d(off)}$	0.55 0.56 0.57		μs
Fall time, inductive load	$I_C = 450A$, $V_{CE} = 400V$ $V_{GE} = -8V / + 15V$ $R_{G,off} = 5.0 \Omega$	$T_j = 25^\circ C$ $T_j = 150^\circ C$ $T_j = 175^\circ C$	t_f	0.27 0.42 0.45		μs
Turn-off energy loss per pulse	$I_C = 450A$, $V_{CE} = 400V$ $L_S = 30nH$ $V_{GE} = -8V / + 15V$ $R_{G,off} = 5.0 \Omega$ $dv/dt = 2.5 V/ns (25^\circ C)$ $dv/dt = 2.2 V/ns (150^\circ C)$	$T_j = 25^\circ C$ $T_j = 150^\circ C$ $T_j = 175^\circ C$	E_{off}	30.5 40.5 44.7		mJ
Short circuit current	$V_{GE} = 15V$, $V_{CC} = 400V$ $t_p = 6 \mu s$ $t_p = 3 \mu s$	$T_j = 25^\circ C$ $T_j = 175^\circ C$	I_{sc}	4800 3800		A
Thermal resistance, junction to cooling fluid	Per IGBT $dV/dT = 10 dm^3/min$ $T_F = 70^\circ C$		$R_{th,JF}$	0.120	0.140	K/W
Operated temperature condition			$T_{j,op}$	-40	150	$^\circ C$



Diode

Maximum Rated Values

Parameter	Conditions	Symbol	Values	Unit
Repetitive peak reverse voltage	$T_j = 25^\circ\text{C}$	V_{RRM}	750	V
Implemented forward current		I_{FN}	820	A
Continuous DC forward current	$T_F = 70^\circ\text{C}, T_{j,max} = 175^\circ\text{C}$	I_F	450	A
Repetitive peak forward current	$t_p = 1 \text{ ms}$	I_{FRM}	1640	A

Characteristics Values

Parameter	Conditions	Symbol	Typ.	Max.	Unit
Forward voltage	$I_F = 450\text{A}, V_{GE} = 0\text{V}$	V_F	1.45	1.65	V
	$I_F = 450\text{A}, V_{GE} = 0\text{V}$		1.50		
	$I_F = 450\text{A}, V_{GE} = 0\text{V}$		1.55		
	$I_F = 820\text{A}, V_{GE} = 0\text{V}$		1.80		
	$I_F = 820\text{A}, V_{GE} = 0\text{V}$		1.85		
	$I_F = 820\text{A}, V_{GE} = 0\text{V}$		1.90		
Peak reverse recovery current	$I_F = 450\text{A}, V_R = 400\text{V}$	I_{RM}	225		A
	$V_{GE} = -8\text{V}$		275		
	$-di_F/dt = 5.0 \text{ A/ns (25}^\circ\text{C)}$		290		
	$-di_F/dt = 4.1 \text{ A/ns (150}^\circ\text{C)}$				
Recovered charge	$I_F = 450\text{A}, V_R = 400\text{V}$	Q_{rr}	12.5		μC
	$V_{GE} = -8\text{V}$		31.3		
	$-di_F/dt = 5.0 \text{ A/ns (25}^\circ\text{C)}$		35.8		
	$-di_F/dt = 4.1 \text{ A/ns (150}^\circ\text{C)}$				
Reverse recovery energy	$I_F = 450\text{A}, V_R = 400\text{V}$	E_{rec}	3.5		mJ
	$V_{GE} = -8\text{V}$		7.7		
	$-di_F/dt = 5.0 \text{ A/ns (25}^\circ\text{C)}$		9.1		
	$-di_F/dt = 4.1 \text{ A/ns (150}^\circ\text{C)}$				
Thermal resistance, junction to cooling fluid	Per diode $dV/dT = 10 \text{ dm}^3/\text{min}$ $T_F = 70^\circ\text{C}$	$R_{th,JF}$	0.175	0.200	K/W



NTC-Thermistor

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Rated resistance	$T_c = 25^\circ\text{C}$	R_{25}		5.0		$\text{k}\Omega$
Resistance tolerance	$T_c = 100^\circ\text{C}$, $R_{100} = 493 \Omega$	$\Delta R/R$	-5		5	%
B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298 \text{ K}))]$	$B_{25/50}$		3375		K
B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298 \text{ K}))]$	$B_{25/80}$		3411		K
B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298 \text{ K}))]$	$B_{25/100}$		3433		K

Module

Parameter	Conditions	Symbol	Value	Unit
Isolation test voltage	RMS, $f = 0 \text{ Hz}$, $t = 1 \text{ sec}$	V_{ISOL}	4.2	kV
Module baseplate material			Cu + Ni	
Module internal isolation material	Basic isolation (class 1, IEC 61140)		Al_2O_3	
Creepage distance	Terminal to heatsink	$d_{\text{Creep,TH}}$	9.0	mm
Creepage distance	Terminal to terminal	$d_{\text{Creep,TT}}$	9.0	mm
Clearance distance	Terminal to heatsink	$d_{\text{Clear,TH}}$	4.5	mm
Clearance distance	Terminal to terminal	$d_{\text{Clear,TT}}$	4.5	mm
Comparative tracking index ¹⁾		CTI	> 200	

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Module stray inductance		L_{SCE}		7		nH
Storage temperature		T_{stg}	-40		125	°C
Mounting torque for module mounting	Screw M4 baseplate to heatsink	M	1.80	2.00		Nm
Weight		G		750		g

¹⁾ Extracted by following UL 746A



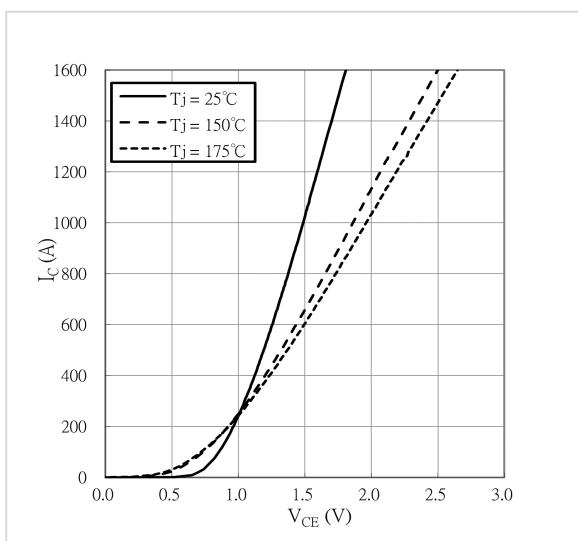
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Characteristics Diagrams

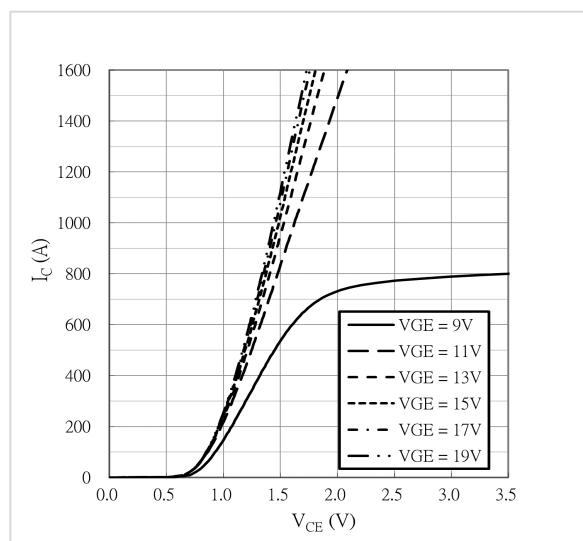
IGBT, Output characteristics

$$V_{GE} = 15V, I_C = f(V_{CE})$$



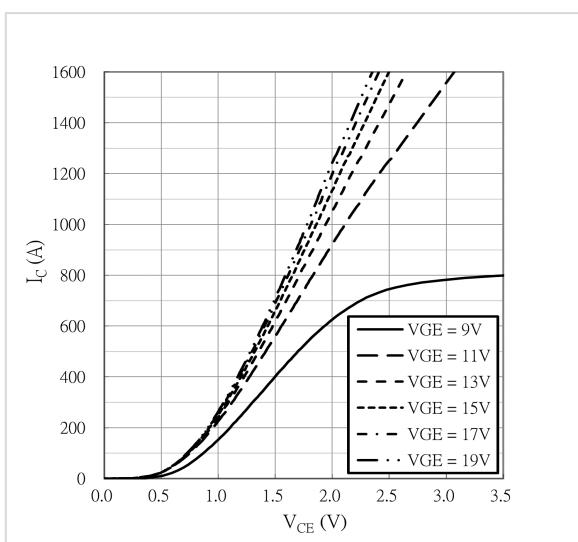
IGBT, Output characteristics

$$T_j = 25^\circ\text{C}, I_C = f(V_{CE})$$



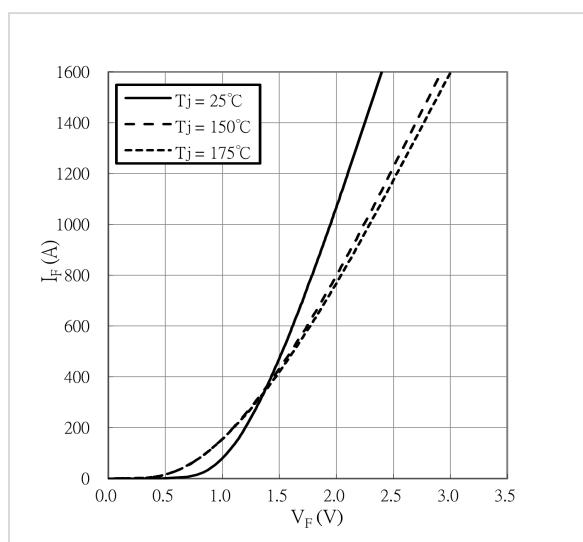
IGBT, Output characteristics

$$T_j = 150^\circ\text{C}, I_C = f(V_{CE})$$



Diode, Forward characteristics

$$I_f = f(V_F)$$





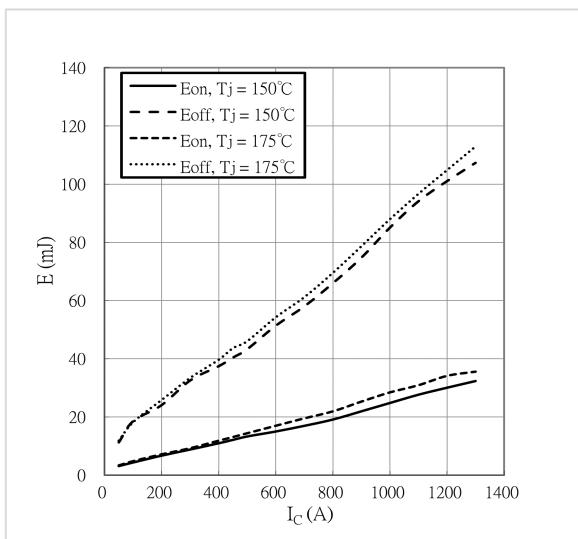
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IGBT, Switching losses vs. I_c

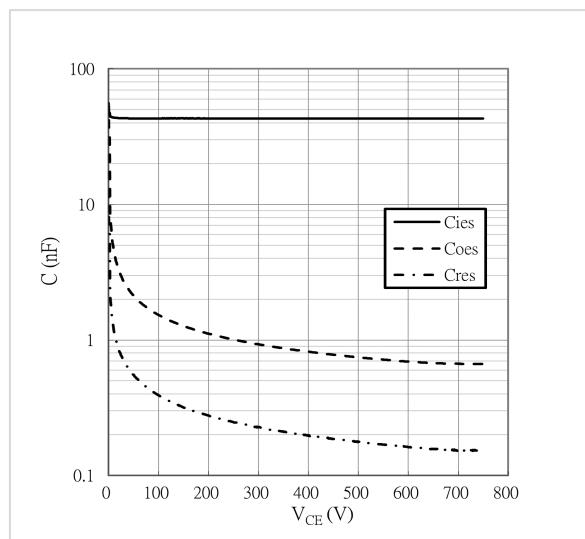
$V_{GE} = -8V / +15V$, $R_{G,on} = 2.5 \Omega$

$R_{G,off} = 5.0 \Omega$, $V_{CE} = 400V$, E_{on} & $E_{off} = f(I_c)$



IGBT, Capacitance characteristics

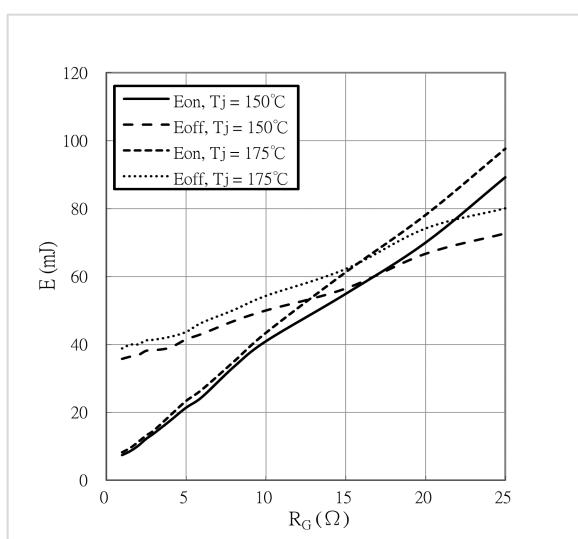
$V_{GE} = 0V$, $T_j = 25^\circ\text{C}$, $f = 100 \text{ kHz}$, $C = f(V_{CE})$



IGBT, Switching losses vs. R_G

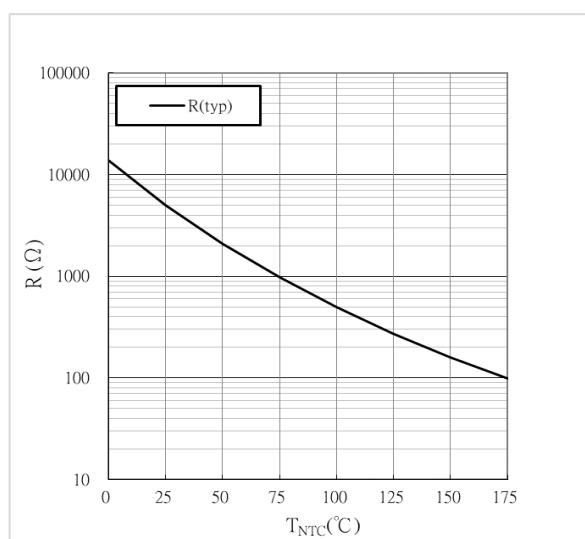
$V_{GE} = -8V / +15V$, $V_{CE} = 400V$, $I_c = 450A$

E_{on} & $E_{off} = f(R_G)$



NTC-Thermistor-temperature characteristic

$R = f(T_{NTC})$



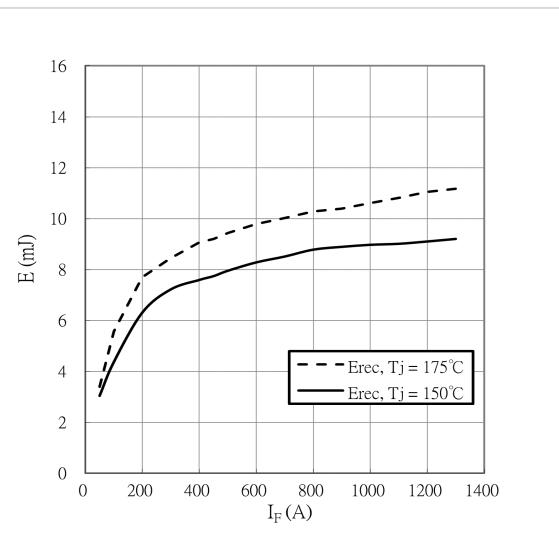


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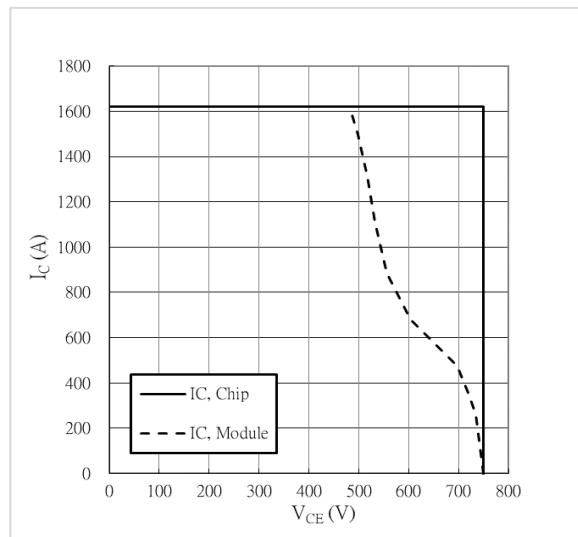
Diode, Switching losses vs. I_F

$R_G = 2.5 \Omega$, $V_R = 400V$, $E_{rec} = f(I_F)$



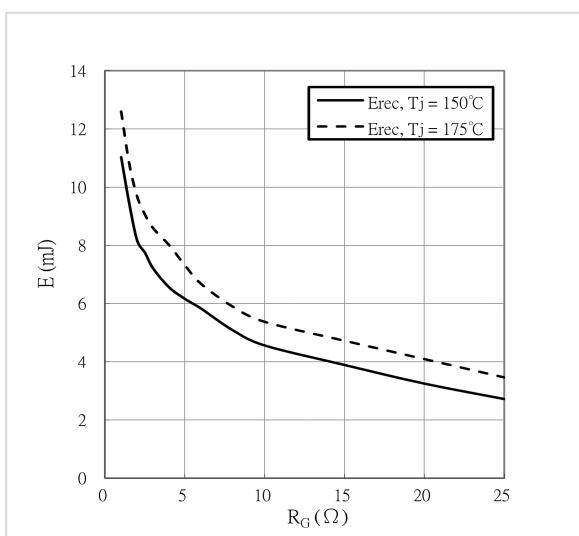
Reverse bias safe operating area (RBSOA)

$V_{GE} = -8V / + 15V$, $R_{G,off} = 5.0 \Omega$, $T_j = 175^\circ C$



Diode, Switching losses vs. R_G

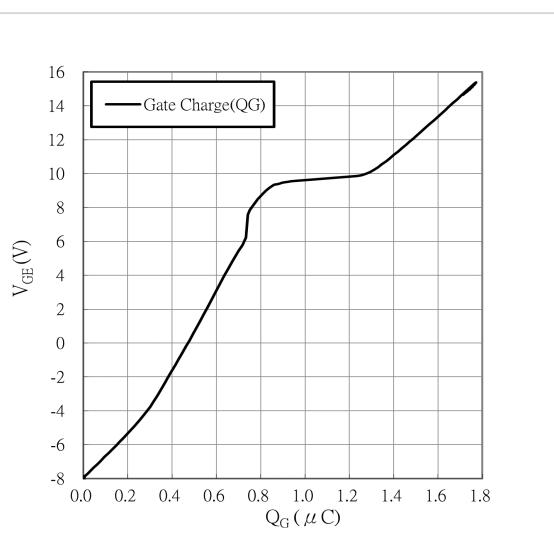
$I_F = 450A$, $V_R = 400V$, $E_{rec} = f(R_G)$



IGBT Total gate charge characteristic

$V_{CE} = 400V$, $I_C = 450A$, $T_j = 25^\circ C$

$V_{GE} = f(Q_G)$





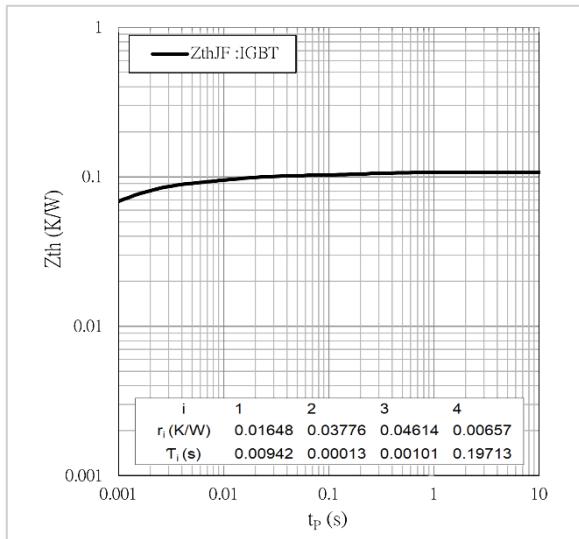
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IGBT Transient thermal impedance

$$Z_{\text{thJF}} = f(t_p)$$

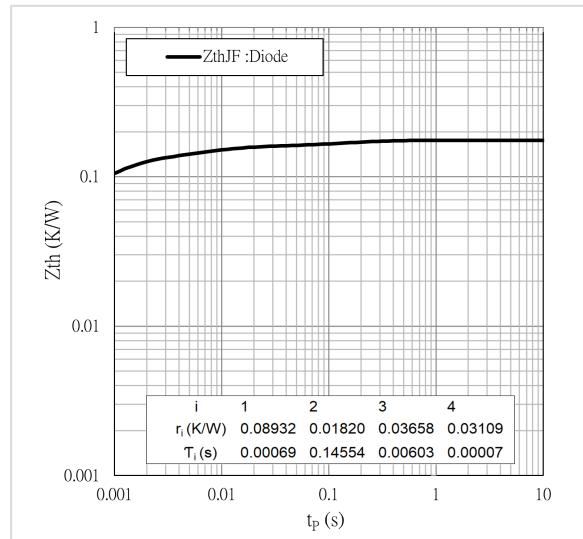
$\Delta V/\Delta t = 10 \text{ dm}^3/\text{min}$, $T_F = 70^\circ\text{C}$



Diode Transient thermal impedance

$$Z_{\text{thJF}} = f(t_p)$$

$\Delta V/\Delta t = 10 \text{ dm}^3/\text{min}$, $T_F = 70^\circ\text{C}$

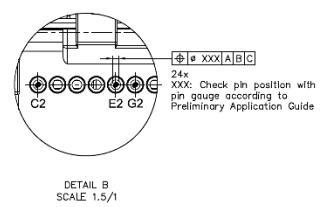
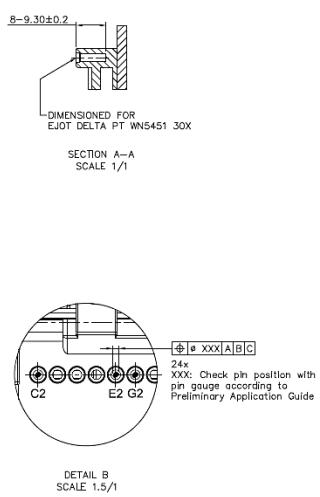
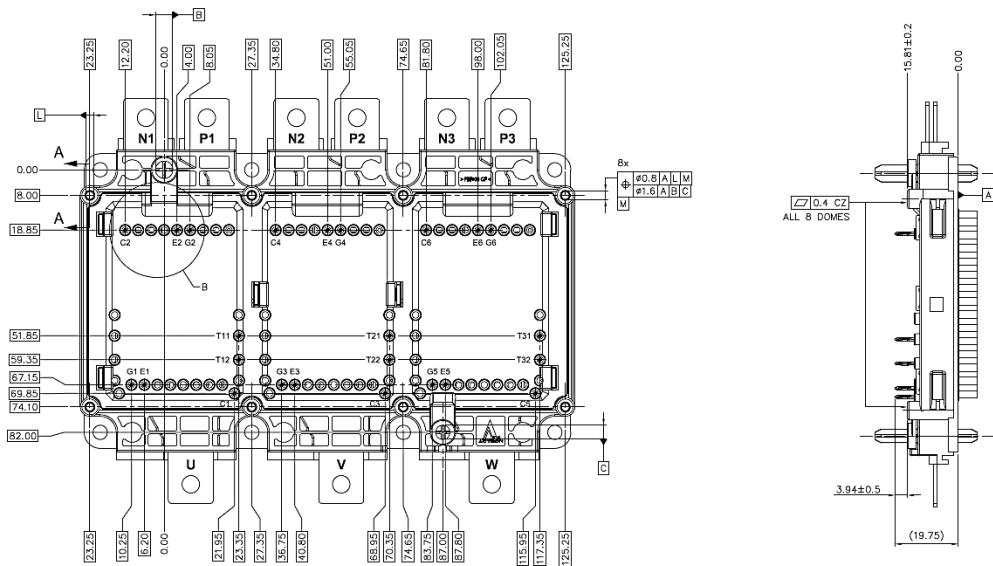
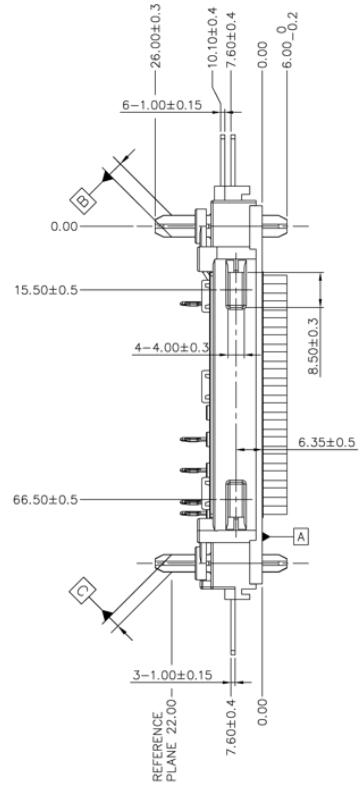
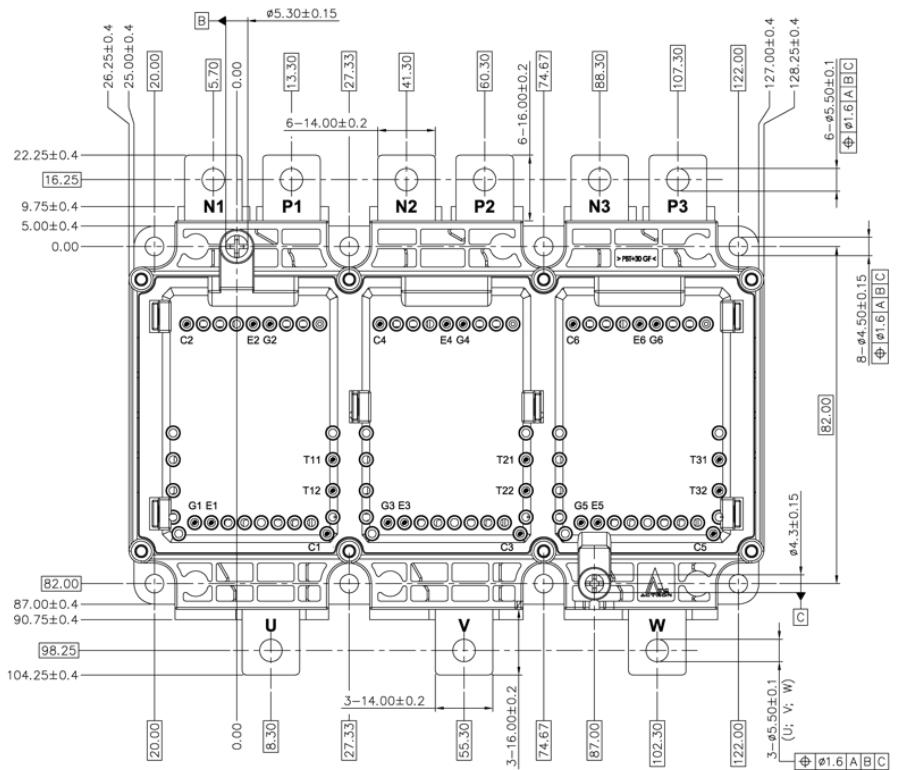




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Package Outlines



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