1200V IGBT ED3
Power Module
ADP600B12TFNF

DATASHEET

V1.0, 2025/05

ADP600B12TFNF
IGBT ED3 Power Module

Applications

- Automotive Applications
- Electrical Vehicles (xEV)
- Commercial Agriculture Vehicles
- All-Terrain Vehicles
- Motor Drives
- Servo Drives
- UPS Drives

Features

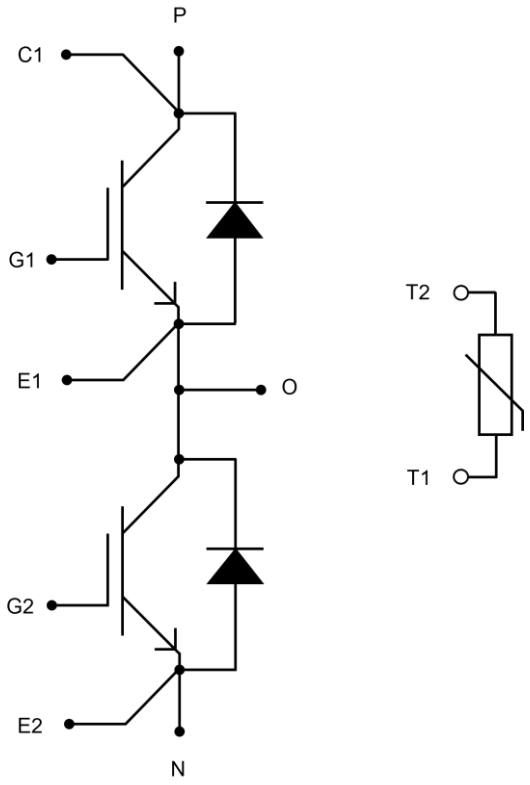
Electrical Features

- Low Q_G
- Low $V_{CE,sat}$
- $T_{j,op}$ = 150°C
- Low Inductance Design
- Blocking Voltage 1200V
- Fast and Soft Reverse Recovery

Mechanical Features

- UL 94 Module Frame
- Temperature Sensor Included
- Pb-free Device and RoHS Compliant

Circuit Diagram



IGBT

Maximum Rated Values

Parameter	Conditions	Symbol	Values	Unit
Collector-emitter voltage	T_j = 25°C	V_{CES}	1200	V
Gate-emitter peak voltage		V_{GES}	±20	V
Continuous DC collector current	T_C = 85°C, $T_{j,max}$= 175°C	$I_{C\ nom}$	600	A
Repetitive peak collector current	Verified by design, t_p limited by $T_{j,max}$	I_{CRM}	1200	A
Maximum junction temperature		$T_{j,max}$	175	°C

Characteristics Values

Parameter	Conditions		Symbol	Min.	Typ.	Max.	Unit
Collector-emitter saturation voltage	I_C = 600A, V_{GE} = 15V I_C = 600A, V_{GE} = 15V I_C = 600A, V_{GE} = 15V	T_j = 25°C T_j = 125°C T_j = 150°C	$V_{CE,sat}$		1.75 2.10 2.15	2.10	V
Gate threshold voltage	I_C = 22 mA, V_{CE} = V_{GE}	T_j = 25°C	$V_{GE,th}$	5.2	5.8	6.4	V
Collector-emitter cut-off current	V_{CE} = 1200V, V_{GE} = 0V	T_j = 25°C	I_{CES}			1.0	mA
Gate-emitter leakage current	V_{CE} = 0V, V_{GE} = 20V	T_j = 25°C	I_{GES}			400	nA
Gate charge	V_{GE} = -15V / +15V, V_{CE} = 600V		Q_g		8.23		µC
Internal gate resistance		T_j = 25°C	$R_{G,int}$		0.58		Ω
Input capacitance	f = 100kHz, V_{CE} = 25V, V_{GE} = 0V	T_j = 25°C	C_{ies}		159.05		nF
Output capacitance	f = 100kHz, V_{CE} = 25V, V_{GE} = 0V	T_j = 25°C	C_{oes}		0.93		nF
Reverse transfer capacitance	f = 100kHz, V_{CE} = 25V, V_{GE} = 0V	T_j = 25°C	C_{res}		4.08		nF

Parameter	Conditions		Symbol	Min.	Typ.	Max.	Unit
Turn-on delay time, inductive load	I_C = 600A, V_{CE} = 600V, V_{GE} = -15V / + 15V $R_{G,on}$ = 2.5 Ω	T_j = 25°C T_j = 125°C T_j = 150°C	$t_{d(on)}$		0.40 0.50 0.51		µs
Rise time, inductive load	I_C = 600A, V_{CE} = 600V, V_{GE} = -15V / + 15V $R_{G,on}$ = 2.5 Ω	T_j = 25°C T_j = 125°C T_j = 150°C	t_r		0.10 0.11 0.11		µs
Turn-on energy loss per pulse	I_C = 600A, V_{CE} = 600V, L_S = 25 nH V_{GE} = -15V / + 15V, $R_{G,on}$ = 2.5 Ω di/dt = 7.0 A/ns (25°C) di/dt = 6.8 A/ns (150°C)	T_j = 25°C T_j = 125°C T_j = 150°C	E_{on}		20.2 60.0 75.7		mJ
Turn-off delay time, inductive load	I_C = 600A, V_{CE} = 600V, V_{GE} = -15V / + 15V $R_{G,off}$ = 2.5 Ω	T_j = 25°C T_j = 125C T_j = 150°C	$t_{d(off)}$		0.95 1.08 1.10		µs
Fall time, inductive load	I_C = 600A, V_{CE} = 600V, V_{GE} = -15V / + 15V $R_{G,off}$ = 2.5 Ω	T_j = 25°C T_j = 125°C T_j = 150°C	t_f		0.27 0.43 0.44		µs
Turn-off energy loss per pulse	I_C = 600A, V_{CE} = 600V, L_S = 25 nH V_{GE} = -15V / + 15V, $R_{G,off}$ = 2.5 Ω dv/dt = 4.7 V/ns (25°C) dv/dt = 3.8 V/ns (150°C)	T_j = 25°C T_j = 125°C T_j = 150°C	E_{off}		81.5 103.0 108.5		mJ
Short circuit current	V_{GE} =-15V / +15V V_{CC} = 800V $R_{G,on}$ = 2.5 Ω $R_{G,off}$ = 2.5 Ω t_p = 10 µs	T_j = 150°C	I_{SC}		2400		A
Thermal resistance, junction to case	Per IGBT;		$R_{th,JC}$			0.060	K/W
Operated temperature condition			$T_{j,op}$	-40		150	°C

Diode

Maximum Rated Values

Parameter	Conditions	Symbol	Values	Unit
Repetitive peak reverse voltage	T_j = 25°C	V_{RRM}	1200	V
Continuous DC forward current	T_C = 85°C, $T_{j,max}$= 175°C	I_F	600	A
Repetitive peak forward current	Verified by design, t_p limited by $T_{j,max}$	I_{FRM}	1200	A

Characteristics Values

Parameter	Conditions		Symbol	Typ.	Max.	Unit
Forward voltage	I_F = 600A, V_{GE} = 0V I_F = 600A, V_{GE} = 0V I_F = 600A, V_{GE} = 0V	T_j = 25°C T_j = 125°C T_j = 150°C	V_F	1.85 2.15 2.15	2.15	V
Peak reverse recovery current	I_F = 600A, V_R = 600V, V_{GE} = -15V, $-di_F/dt$ = 5.8 A/ns (25°C) $-di_F/dt$ = 5.5 A/ns (150°C)	T_j = 25°C T_j = 125°C T_j = 150°C	I_{RM}	285 315 330		A
Recovered charge	I_F = 600A, V_R = 600V, V_{GE} = -15V, $-di_F/dt$ = 5.8 A/ns (25°C) $-di_F/dt$ = 5.5 A/ns (150°C)	T_j = 25°C T_j = 125°C T_j = 150°C	Q_{rr}	27.5 50.0 71.5		µC
Reverse recovery energy	I_F = 600A, V_R = 600V, V_{GE} = -15V	T_j = 25°C T_j = 125°C T_j = 150°C	E_{rec}	11.0 28.7 34.0		mJ
Thermal resistance, junction to case	Per Diode;		$R_{th,JC}$		0.075	K/W

NTC-Thermistor

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

Module

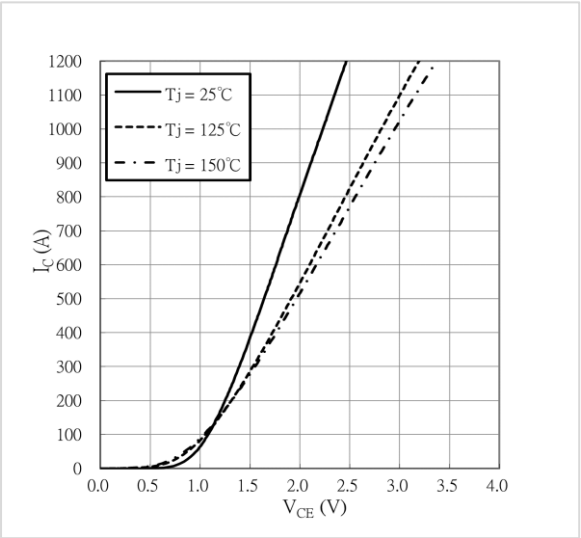
Parameter	Conditions	Symbol	Value	Unit
Isolation test voltage	RMS, f = 0 Hz, t = 1 min	V_{ISOL}	2.5	kV
Module baseplate material			Cu + Ni	
Module internal isolation material	Basic isolation (class 1, IEC 61140)		Al_2O_3	
Creepage distance	Terminal to heatsink	$d_{Creep,TH}$	14.5	mm
Creepage distance	Terminal to terminal	$d_{Creep,TT}$	13.0	mm
Clearance distance	Terminal to heatsink	$d_{Clear,TH}$	12.5	mm
Clearance distance	Terminal to terminal	$d_{Clear,TT}$	10.0	mm
Comparative tracking index [1)]		CTI	> 200	

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Module stray inductance		L_{sCE}		18		nH
Storage temperature		T_{stg}	-40		125	°C
Mounting torque for module mounting	Screw M5 - Mounting according to valid application note	M	3		6	Nm
Terminal connection torque	Screw M6 - Mounting according to valid application note	M	3		6	Nm
Weight		G		340		g

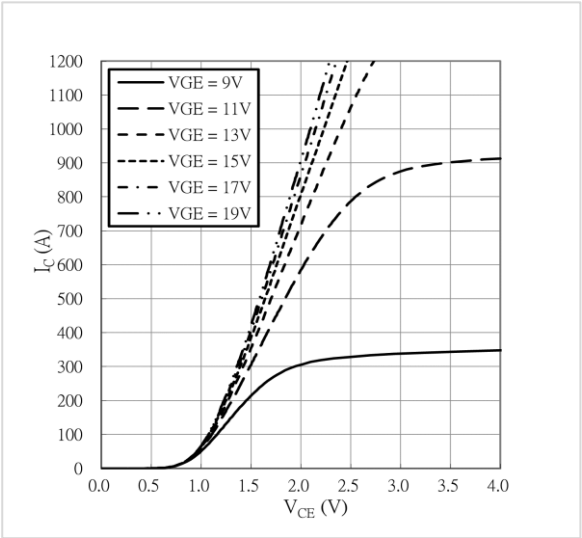
1) Extracted by following UL 746A

Characteristics Diagrams

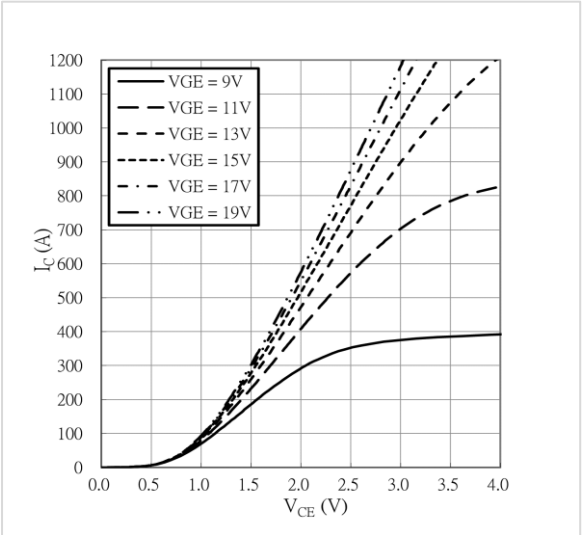
Output characteristics IGBT
V_{GE} = 15V, $I_C = f(V_{CE})$



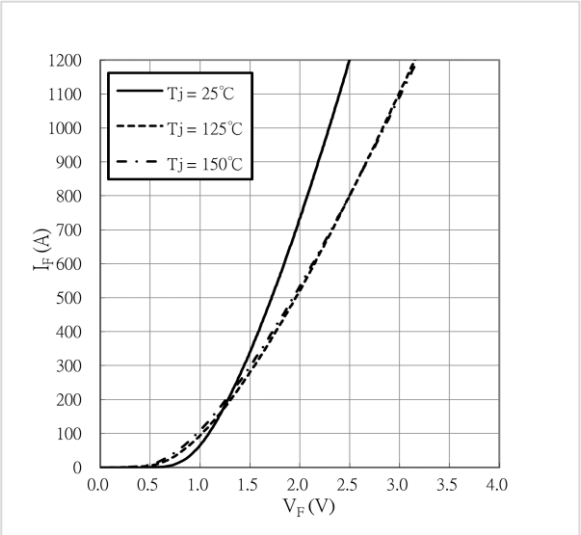
Output characteristics IGBT
T_j = 25°C, $I_C = f(V_{CE})$



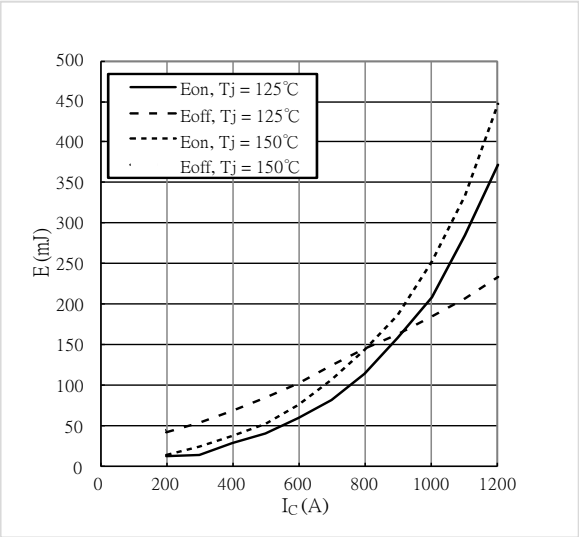
Output characteristics IGBT
T_j = 150°C, $I_C = f(V_{CE})$



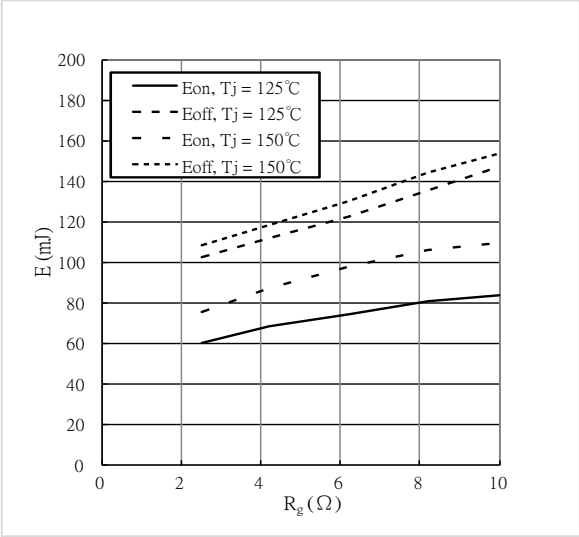
Forward characteristics of Diode
$I_F = f(V_F)$



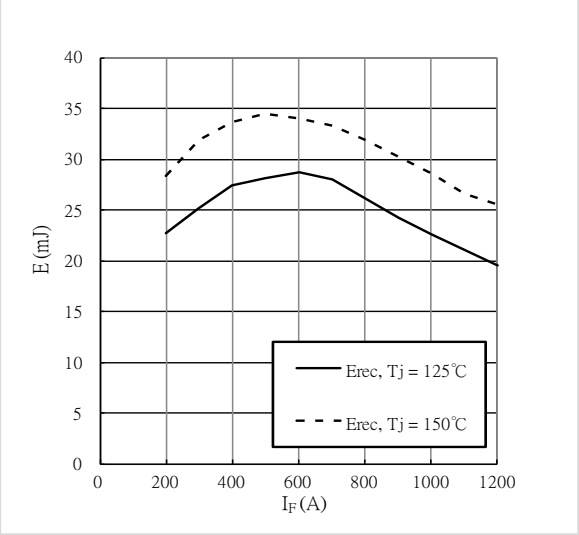
IGBT, Switching losses vs. I_C
V_{GE} = -15V / +15V, $R_{G,on}$ = 2.5 Ω,
$R_{G,off}$ = 2.5 Ω, V_{CE} = 600 V, E_{on} & E_{off} = f(I_c)



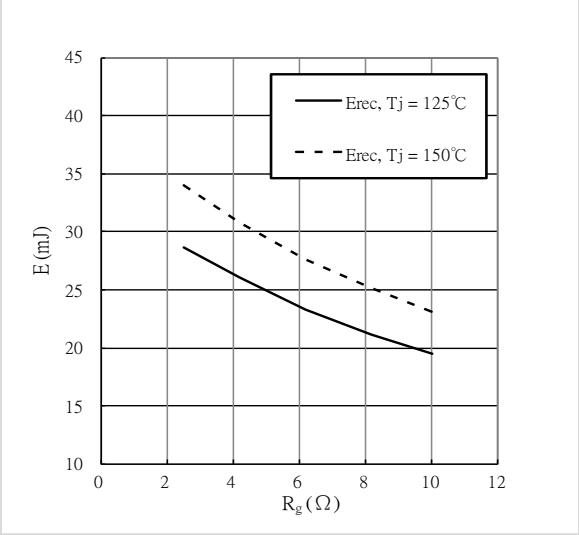
IGBT, Switching losses vs. R_G
V_{GE} = -15V / +15V, V_{CE} = 600V, I_C = 600 A
E_{on} & E_{off} = f(R_G)



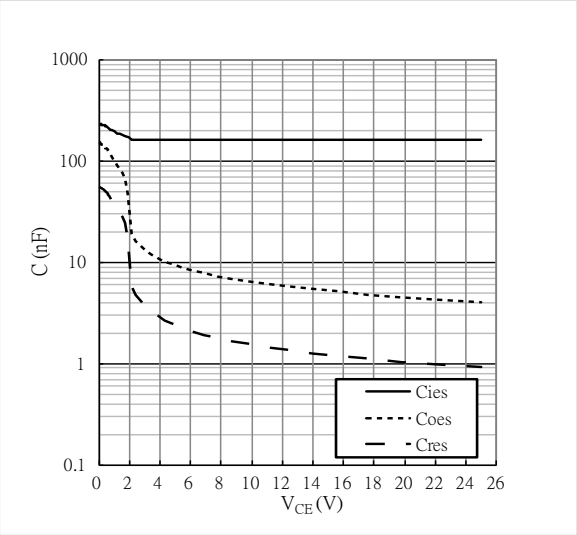
Diode, Switching losses vs. I_F
$R_{G,on}$ = 2.5 Ω, V_R = 600V, E_{rec} = f(I_F)



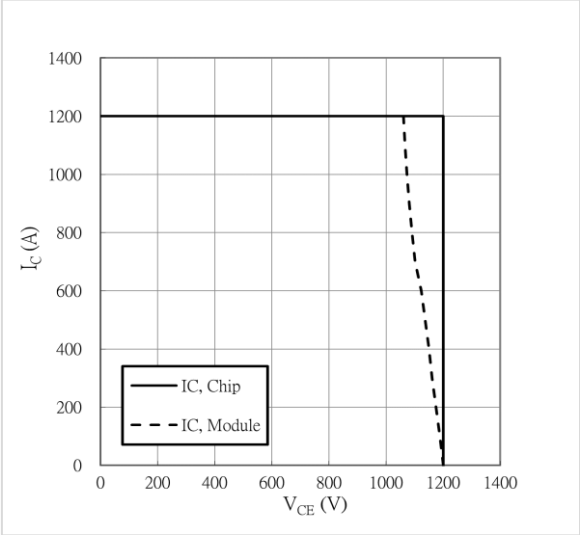
Diode, Switching losses vs. R_G
I_F = 600A, V_R = 600V, E_{rec} = f($R_{G,on}$)



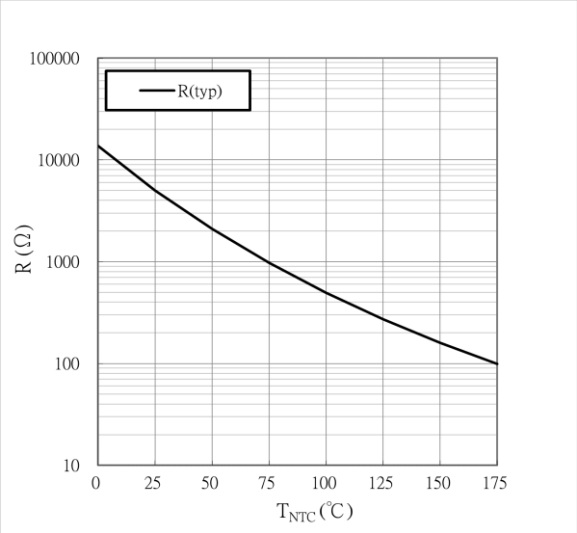
Capacitance characteristics IGBT
V_{GE} = 0V, T_j = 25°C, f = 100KHz, C = f(V_{CE})



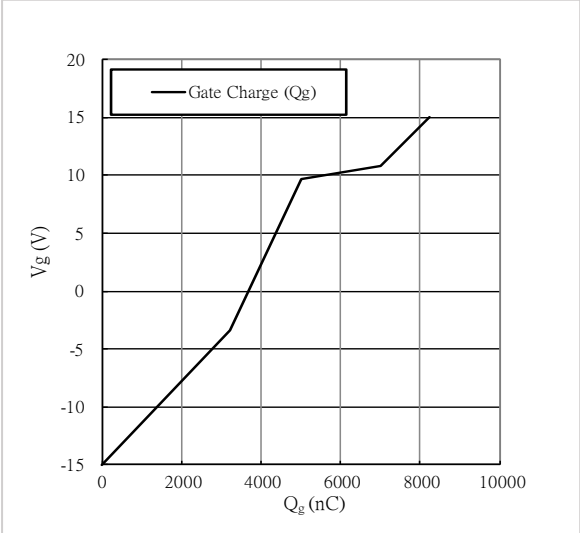
Reverse bias safe operating area (RBSOA)
V_{GE} = -15V / +15V, $R_{G,off}$ = 2.5 Ω, T_j = 150°C



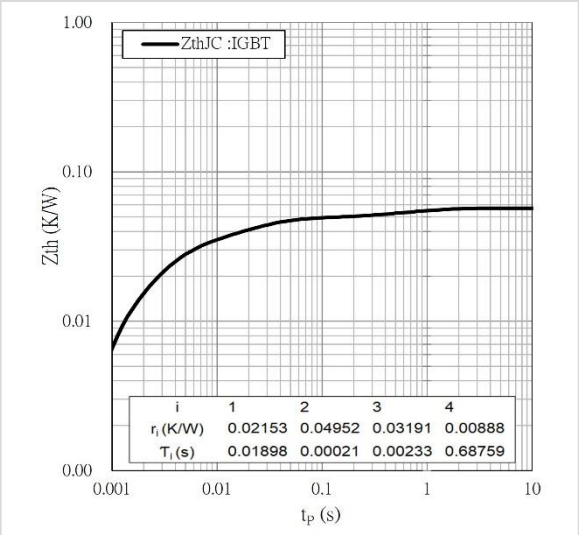
NTC-Thermistor-temperature characteristics
R = f(T_{NTC})



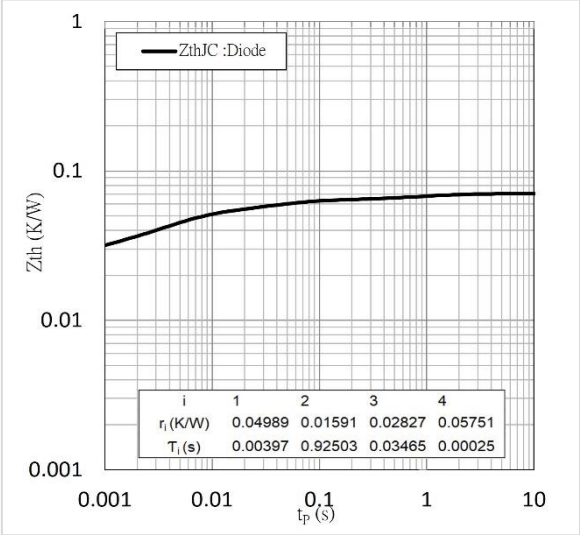
IGBT Total gate charge characteristic
V_{CE} = 600V, I_C = 250A, T_j = 25°C
V_{GE} = F(Q_G)



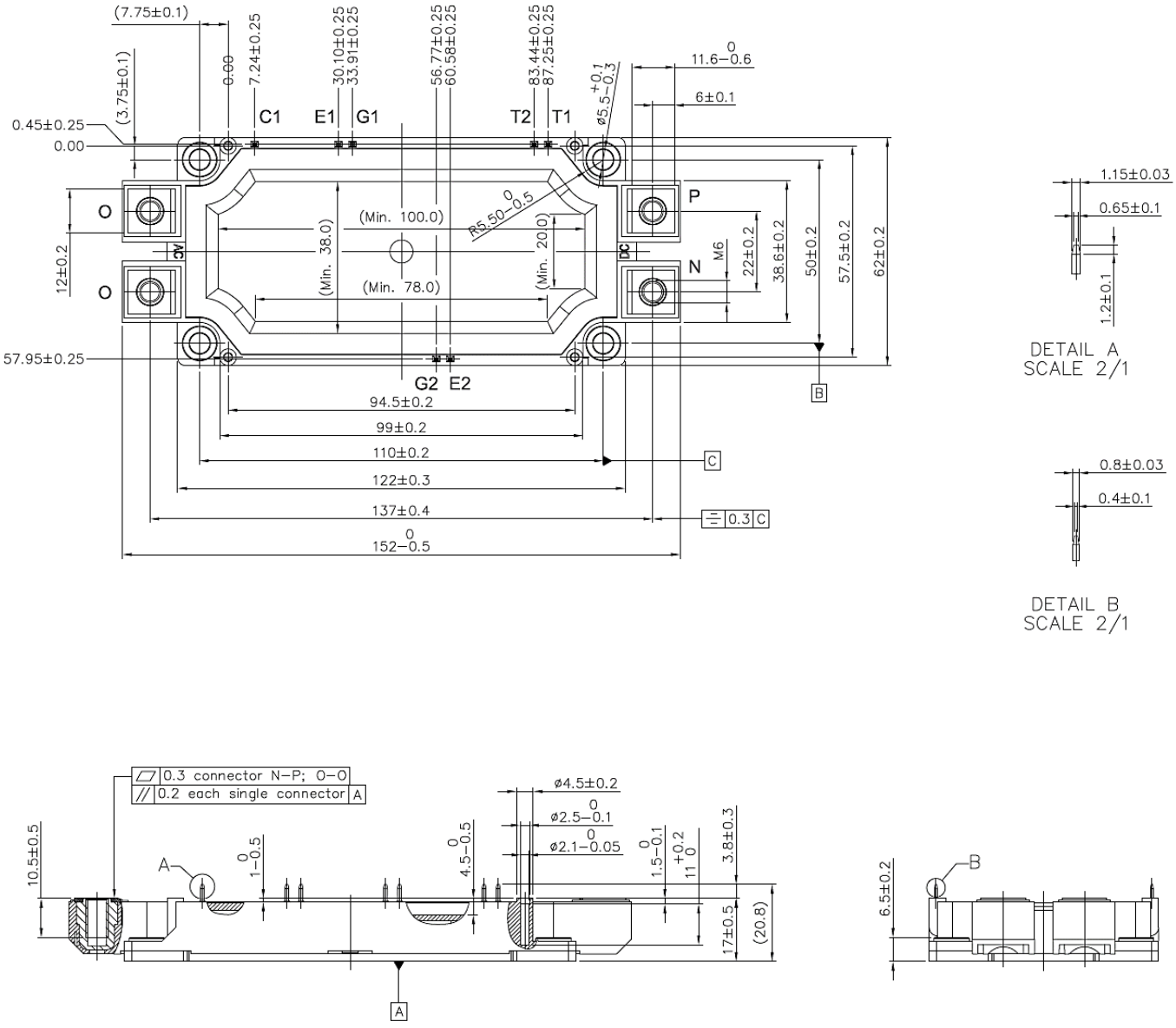
IGBT, Transient thermal impedance
$Z_{thJC} = f(t_P)$



Diode, Transient thermal impedance
$Z_{thJC} = f(t_P)$



Package Outlines



DETAIL A
SCALE 2/1

DETAIL B
SCALE 2/1

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