



1200V IGBT ED3 Power Module

ADP600B12TFNF

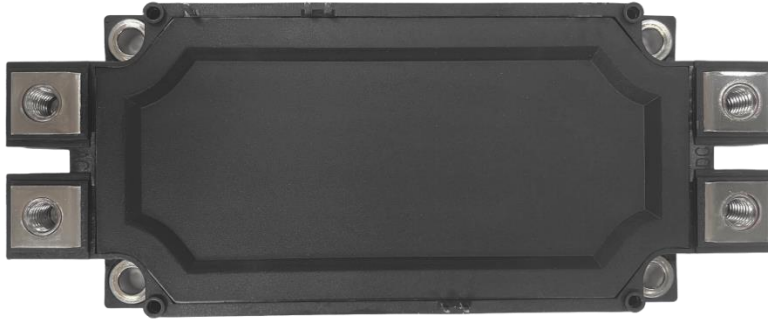
DATASHEET

V1.0, 2025/05



ACTRON TECHNOLOGY CORP.

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

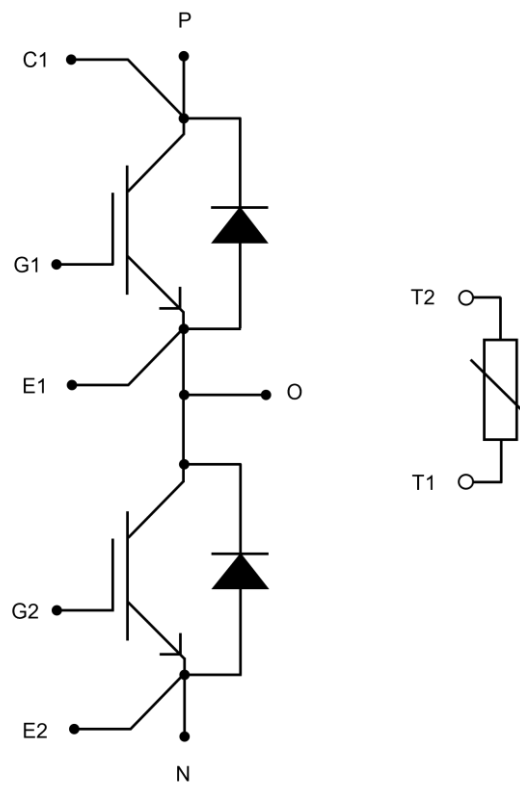
- Low Q_G
- Low $V_{CE,sat}$
- $T_{j,op} = 150^{\circ}C$
- Low Inductance Design
- Blocking Voltage 1200V
- Fast and Soft Reverse Recovery

Mechanical Features

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



Circuit Diagram





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IGBT

Maximum Rated Values

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

Characteristics Values

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



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Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Turn-on delay time, inductive load	$I_C = 600A$, $V_{CE} = 600V$, $V_{GE} = -15V / +15V$ $R_{G,on} = 2.5 \Omega$	$T_J = 25^\circ C$ $T_J = 125^\circ C$ $T_J = 150^\circ C$ $t_{d(on)}$		0.40 0.50 0.51		μs
Rise time, inductive load	$I_C = 600A$, $V_{CE} = 600V$, $V_{GE} = -15V / +15V$ $R_{G,on} = 2.5 \Omega$	$T_J = 25^\circ C$ $T_J = 125^\circ C$ $T_J = 150^\circ C$ t_r		0.10 0.11 0.11		μs
Turn-on energy loss per pulse	$I_C = 600A$, $V_{CE} = 600V$, $L_S = 25 nH$ $V_{GE} = -15V / +15V$, $R_{G,on} = 2.5 \Omega$ $di/dt = 7.0 A/ns (25^\circ C)$ $di/dt = 6.8 A/ns (150^\circ C)$	$T_J = 25^\circ C$ $T_J = 125^\circ C$ $T_J = 150^\circ C$ E_{on}		20.2 60.0 75.7		mJ
Turn-off delay time, inductive load	$I_C = 600A$, $V_{CE} = 600V$, $V_{GE} = -15V / +15V$ $R_{G,off} = 2.5 \Omega$	$T_J = 25^\circ C$ $T_J = 125^\circ C$ $T_J = 150^\circ C$ $t_{d(off)}$		0.95 1.08 1.10		μs
Fall time, inductive load	$I_C = 600A$, $V_{CE} = 600V$, $V_{GE} = -15V / +15V$ $R_{G,off} = 2.5 \Omega$	$T_J = 25^\circ C$ $T_J = 125^\circ C$ $T_J = 150^\circ C$ t_f		0.27 0.43 0.44		μs
Turn-off energy loss per pulse	$I_C = 600A$, $V_{CE} = 600V$, $L_S = 25 nH$ $V_{GE} = -15V / +15V$, $R_{G,off} = 2.5 \Omega$ $dv/dt = 4.7 V/ns (25^\circ C)$ $dv/dt = 3.8 V/ns (150^\circ C)$	$T_J = 25^\circ C$ $T_J = 125^\circ C$ $T_J = 150^\circ C$ E_{off}		81.5 103.0 108.5		mJ
Short circuit current	$V_{GE} = -15V / +15V$ $V_{CC} = 800V$ $R_{G,on} = 2.5 \Omega$ $R_{G,off} = 2.5 \Omega$ $t_p = 10 \mu s$	$T_J = 150^\circ C$ 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	$^\circ C$



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Diode

Maximum Rated Values

Parameter	Conditions	Symbol	Values	Unit
Repetitive peak reverse voltage	$T_J = 25^{\circ}\text{C}$	V_{RRM}	1200	V
Continuous DC forward current	$T_C = 85^{\circ}\text{C}$, $T_{J,max} = 175^{\circ}\text{C}$	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	$I_F = 600\text{A}$, $V_{GE} = 0\text{V}$	V_F	1.85	2.15	V
	$I_F = 600\text{A}$, $V_{GE} = 0\text{V}$		2.15		
	$I_F = 600\text{A}$, $V_{GE} = 0\text{V}$		2.15		
Peak reverse recovery current	$I_F = 600\text{A}$, $V_R = 600\text{V}$, $V_{GE} = -15\text{V}$, $-di_F/dt = 5.8\text{ A/ns}$ (25°C)	I_{RM}	285		A
	$-di_F/dt = 5.5\text{ A/ns}$ (150°C)		315		
			330		
Recovered charge	$I_F = 600\text{A}$, $V_R = 600\text{V}$, $V_{GE} = -15\text{V}$, $-di_F/dt = 5.8\text{ A/ns}$ (25°C)	Q_{rr}	27.5		μC
	$-di_F/dt = 5.5\text{ A/ns}$ (150°C)		50.0		
			71.5		
Reverse recovery energy	$I_F = 600\text{A}$, $V_R = 600\text{V}$, $V_{GE} = -15\text{V}$	E_{rec}	11.0		mJ
			28.7		
			34.0		
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	$T_c = 25^\circ\text{C}$	R_{25}		5.0		k Ω
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, $f = 0 \text{ Hz}$, $t = 1 \text{ min}$	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	$d_{\text{Creep,TH}}$	14.5	mm
Creepage distance	Terminal to terminal	$d_{\text{Creep,TT}}$	13.0	mm
Clearance distance	Terminal to heatsink	$d_{\text{Clear,TH}}$	12.5	mm
Clearance distance	Terminal to terminal	$d_{\text{Clear,TT}}$	10.0	mm
Comparative tracking index ¹⁾		CTI	> 200	

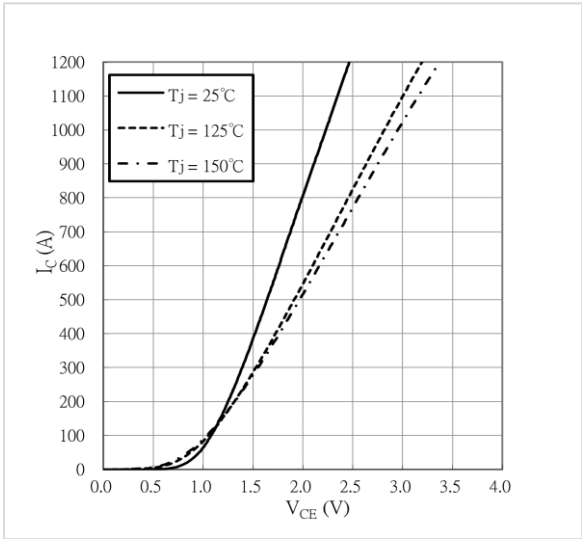
Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Module stray inductance		L_{sCE}		18		nH
Storage temperature		T_{stg}	-40		125	$^\circ\text{C}$
Mounting torque for module mounting	Screw M5 - Mounting according to valid application note	M	3		6	Nm
Terminal connection torque	Screw M6 - Mounting according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

¹⁾ Extracted by following UL 746A

Characteristics Diagrams

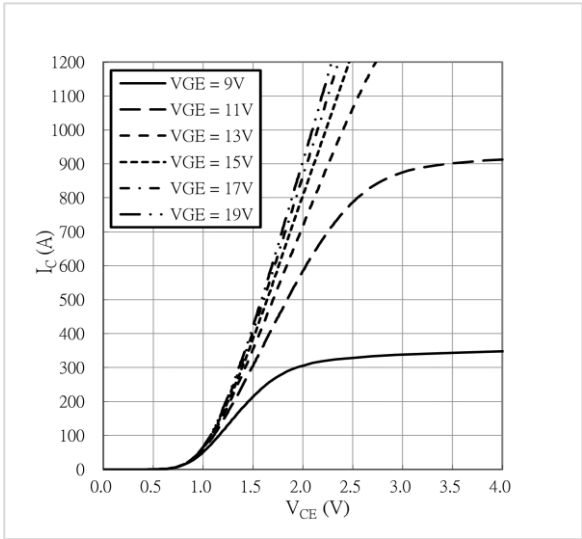
Output characteristics IGBT

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



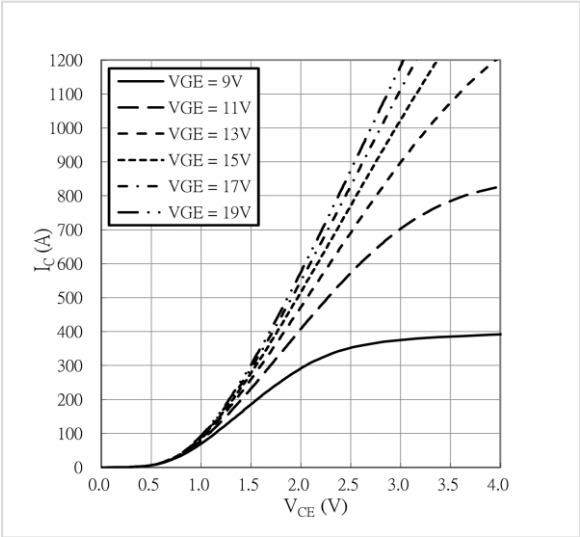
Output characteristics IGBT

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



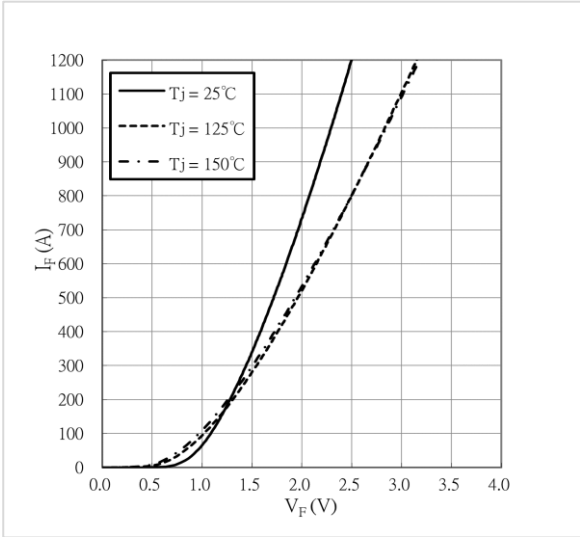
Output characteristics IGBT

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



Forward characteristics of Diode

$I_F = f(V_F)$





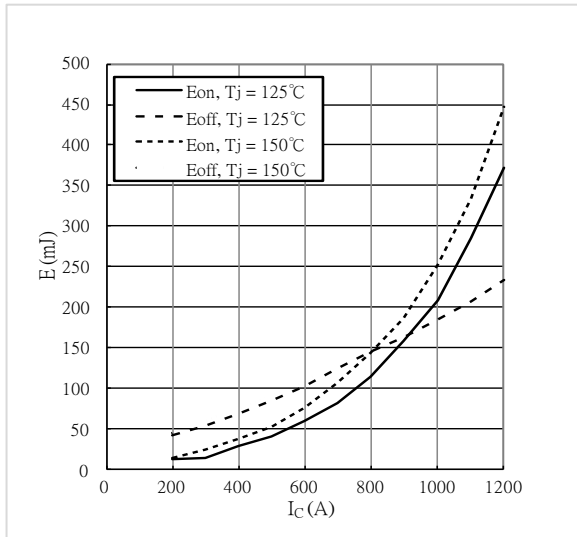
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IGBT, Switching losses vs. I_C

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

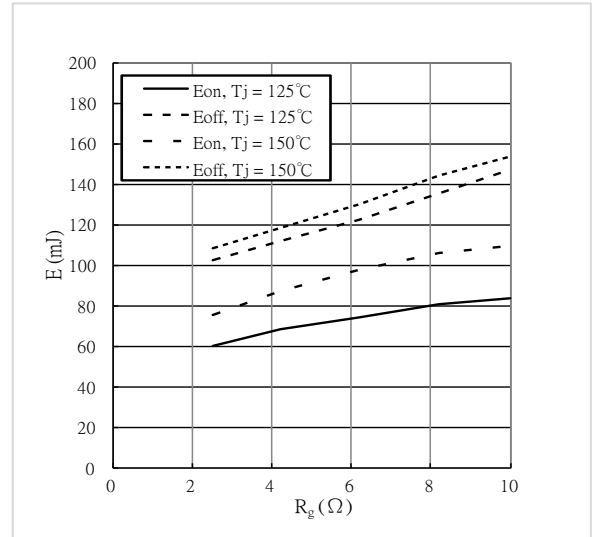
$R_{G,off} = 2.5 \Omega$, $V_{CE} = 600V$, E_{on} & $E_{off} = f(I_C)$



IGBT, Switching losses vs. R_G

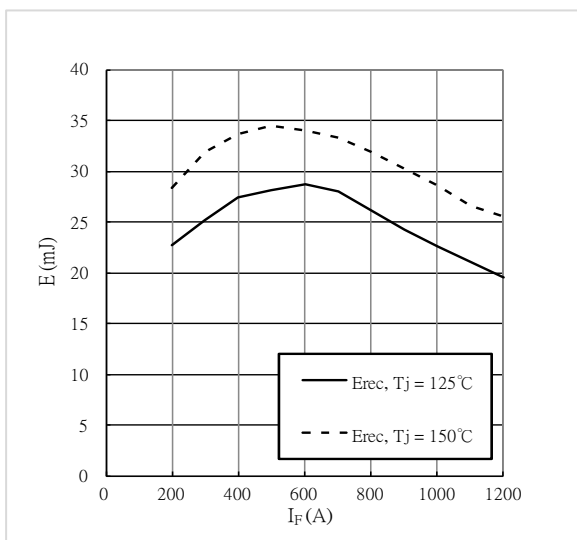
$V_{GE} = -15V / +15V$, $V_{CE} = 600V$, $I_C = 600A$

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



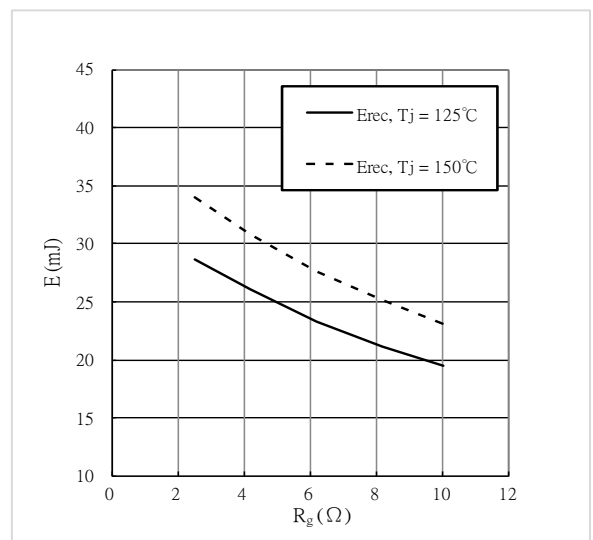
Diode, Switching losses vs. I_F

$R_{G,on} = 2.5 \Omega$, $V_R = 600V$, $E_{rec} = f(I_F)$



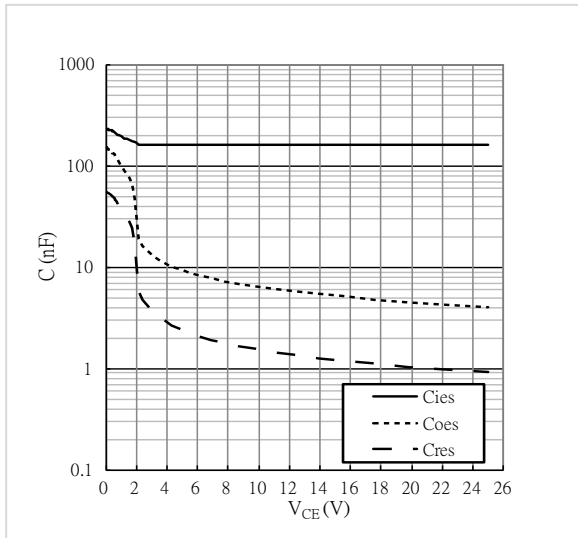
Diode, Switching losses vs. R_G

$I_F = 600A$, $V_R = 600V$, $E_{rec} = f(R_{G,on})$



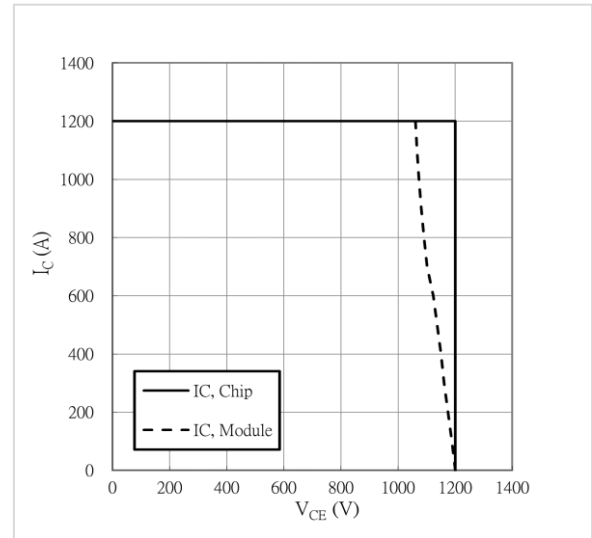
Capacitance characteristics IGBT

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



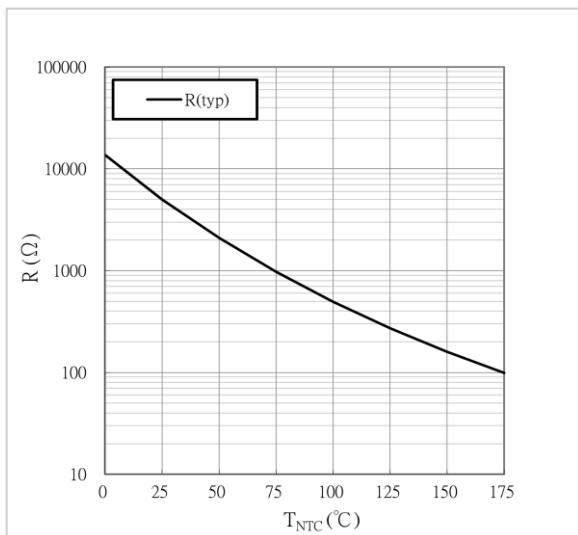
Reverse bias safe operating area (RBSOA)

$V_{GE} = -15V / +15V$, $R_{G,off} = 2.5 \Omega$, $T_j = 150^\circ C$



NTC-Thermistor-temperature characteristics

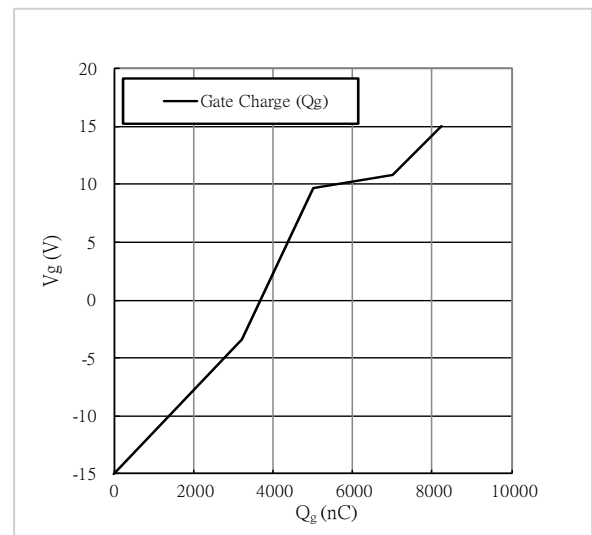
$R = f(T_{NTC})$



IGBT Total gate charge characteristic

$V_{CE} = 600V$, $I_C = 250A$, $T_j = 25^\circ C$

$V_{GE} = F(Q_G)$

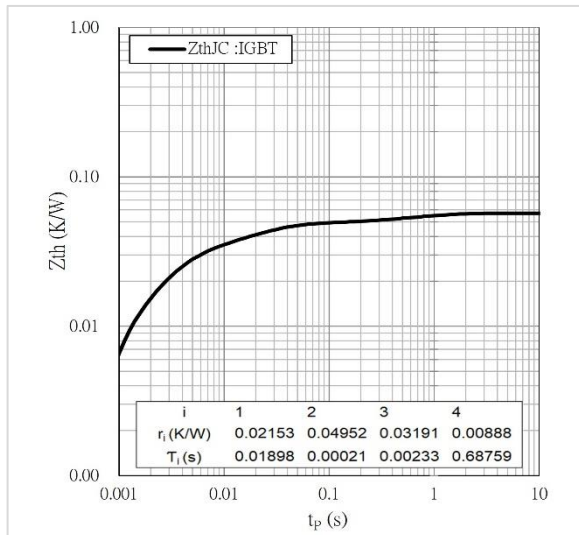




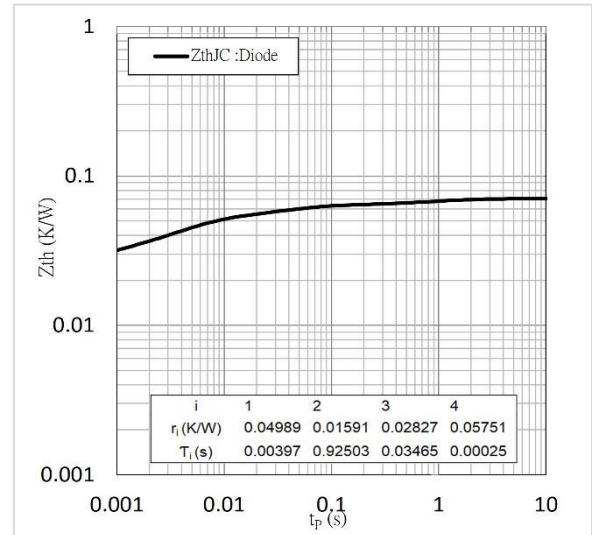
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IGBT, Transient thermal impedance
 $Z_{thJC} = f(t_p)$



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





Package Outlines



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