

RSP3512FW2

FPM2 PIM

1200V 35A, IGBT Module



Electrical Features

- Trench Field Stop IGBT
- Very low $V_{CE(sat)}$
- Extremely low switching losses

Mechanical Features

- Very Low Thermal Resistance with DBC Substrate
- High power density
- Compact design
- Isolation Rating of 2500 Vrms/1 min



Typical Applications

- Auxiliary inverters
- Air-conditioner
- Motor drives

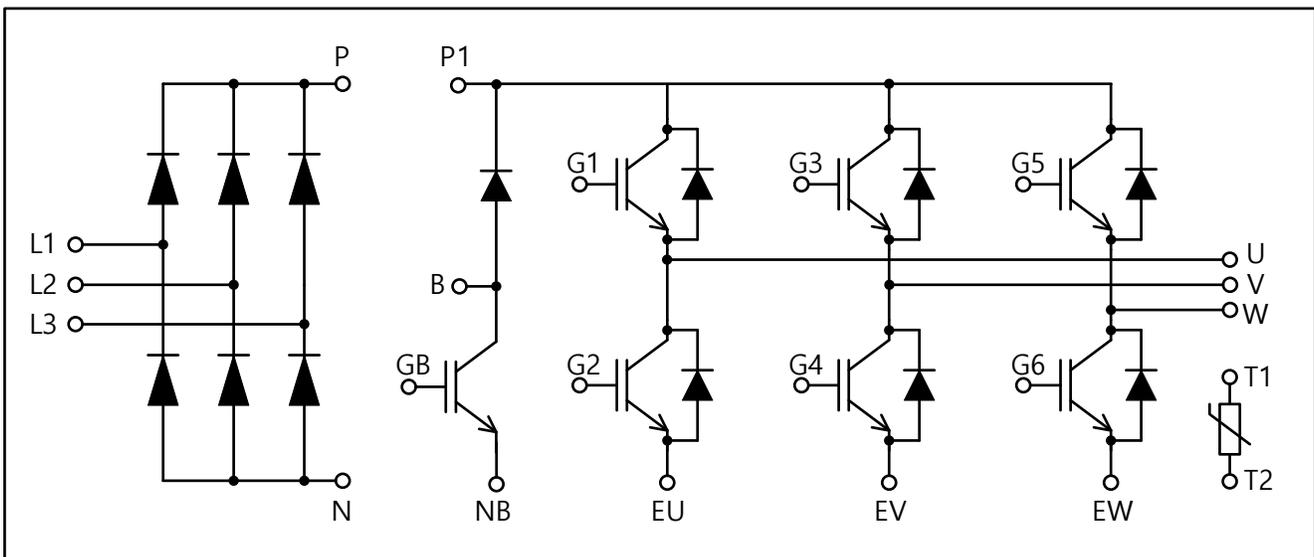


Figure 1. Internal Circuit

ABSOLUTE MAXIMUM RATINGS ($T_j = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Rating	Unit
IGBT, INVERTER				
V_{CES}	Collector-Emitter Voltage		1200	V
V_{GES}	Gate-Emitter Voltage		± 20	V
I_C	DC Collector Current	$T_C=100^\circ\text{C}, T_j \leq 175^\circ\text{C}$	35	A
I_{CRM}	Repetitive Peak Collector Current	Under 1ms Pulse Width	70	A

Diode, INVERTER

V_{RRM}	Repetitive Peak Reverse Voltage		1200	V
I_F	DC Forward Current		35	A
I_{FRM}	Repetitive Peak Forward Current	Under 1ms Pulse Width	70	A
I^2t	I^2t Value	$t_p=10\text{ms}, T_j=150^\circ\text{C}$	200	A^2s

IGBT, Brake-Chopper

V_{CES}	Collector-Emitter Voltage		1200	V
V_{GES}	Gate-Emitter Voltage		± 20	V
I_C	DC Collector Current	$T_C=100^\circ\text{C}, T_j \leq 175^\circ\text{C}$	35	A
I_{CRM}	Repetitive Peak Collector Current	Under 1ms Pulse Width	70	A

Diode, Brake-Chopper

V_{RRM}	Repetitive Peak Reverse Voltage		1200	V
I_F	DC Forward Current		10	A
I_{FRM}	Repetitive Peak Forward Current	Under 1ms Pulse Width	20	A
I^2t	I^2t Value	$V_R=0\text{V}, t_p=10\text{ms}, T_j=150^\circ\text{C}$	18	A^2s

Diode, Rectifier

V_{RRM}	Repetitive Peak Reverse Voltage		1600	V
I_{FRMSM}	Maximum RMS Forward Current per Chip	$T_C=90^\circ\text{C}$	50	A
I_{RMSM}	Maximum RMS Forward Current at Rectifier Output	$T_C=90^\circ\text{C}$	50	A
I_{FSM}	Surge Forward Current	$t_p=10\text{ms}, T_j=150^\circ\text{C}$	410	A
I^2t	I^2t Value	$t_p=10\text{ms}, T_j=150^\circ\text{C}$	840	A^2s

ELECTRICAL CHARACTERISTICS ($T_j = 25^\circ\text{C}$ unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
IGBT, INVERTER							
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=35\text{A}, V_{GE}=15\text{V}$	$T_j=25^\circ\text{C}$	-	1.55	1.8	V
			$T_j=125^\circ\text{C}$		1.73		
			$T_j=175^\circ\text{C}$		1.82		
$V_{GE(th)}$	Gate Threshold Voltage	$I_C=250\mu\text{A}, V_{CE}=V_{GE}$	5.0	5.8	6.6	V	
I_{CES}	Collector-Emitter Cut-off Current	$V_{CE}=1200\text{V}, V_{GE}=0\text{V}$			2.0	μA	
I_{GES}	Gate Leakage Current	$V_{CE}=0\text{V}, V_{GE}=20\text{V}$			100	nA	
Q_G	Total Gate Charge	$V_{GE}=\pm 15\text{V}, V_{CE}=600\text{V}$		0.189		μC	
R_{Gint}	Internal Gate Resistance			0		Ω	
C_{ies}	Input Capacitance	$V_{CE}=30\text{V}, V_{GE}=0\text{V}, f=1.0\text{MHz}$		3730		pF	
C_{oes}	Output Capacitance			107			
C_{res}	Reverse Transfer Capacitance			15.3			

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
IGBT, INVERTER (Continued)						
t_{don}	Turn-on Delay Time	$V_{CE}=600V, I_C=35A,$ $V_{GE}=0/15V,$ $R_{G_ON}=5.5\Omega, R_{G_OFF}=5.5\Omega$	$T_J=25^\circ C$	42		ns
			$T_J=125^\circ C$	46		
			$T_J=175^\circ C$	47		
t_r	Rise Time	$V_{CE}=600V, I_C=35A,$ $V_{GE}=0/15V,$ $R_{G_ON}=5.5\Omega, R_{G_OFF}=5.5\Omega$	$T_J=25^\circ C$	14		ns
			$T_J=125^\circ C$	16		
			$T_J=175^\circ C$	20		
t_{doff}	Turn-off Delay Time	$V_{CE}=600V, I_C=35A,$ $V_{GE}=0/15V,$ $R_{G_ON}=5.5\Omega, R_{G_OFF}=5.5\Omega$	$T_J=25^\circ C$	193		ns
			$T_J=125^\circ C$	225		
			$T_J=175^\circ C$	244		
t_f	Fall Time	$V_{CE}=600V, I_C=35A,$ $V_{GE}=0/15V,$ $R_{G_ON}=5.5\Omega, R_{G_OFF}=5.5\Omega$	$T_J=25^\circ C$	130		ns
			$T_J=125^\circ C$	248		
			$T_J=175^\circ C$	298		
E_{on}	Turn-on Energy Loss per Pulse	$V_{CE}=600V, I_C=35A,$ $V_{GE}=0/15V,$ $R_{G_ON}=5.5\Omega, R_{G_OFF}=5.5\Omega$	$T_J=25^\circ C$	1.08		mJ
			$T_J=125^\circ C$	1.43		
			$T_J=175^\circ C$	1.76		
E_{off}	Turn-off Energy Loss per Pulse	$V_{CE}=600V, I_C=35A,$ $V_{GE}=0/15V,$ $R_{G_ON}=5.5\Omega, R_{G_OFF}=5.5\Omega$	$T_J=25^\circ C$	2.12		mJ
			$T_J=125^\circ C$	3.16		
			$T_J=175^\circ C$	3.7		
I_{SC}	Short-circuit Current	$V_{CC}=600V, V_{GE}\leq 15V, V_{CEmax}\leq 1200V, T_J=150^\circ C$ $t_p\leq 9\mu s$		123		A
R_{thJC}	Thermal Resistance, Junction to Case	Per IGBT		0.9		$^\circ C/W$
T_{Jop}	Temperature under Switching Conditions		-40		175	$^\circ C$

Diode, INVERTER

V_F	Forward Voltage	$I_F=35A, V_{GE}=0V$	$T_J=25^\circ C$	1.74	2.0	V
			$T_J=125^\circ C$	1.9		
			$T_J=175^\circ C$	1.91		
I_{RM}	Peak Reverse Recovery Current	$V_R=600V, I_F=35A$ $V_{GE}=0V, R_G=5.5\Omega$	$T_J=25^\circ C$	56.6		A
			$T_J=125^\circ C$	59.8		
			$T_J=175^\circ C$	62.5		
t_{rr}	Reverse Recovery Time	$V_R=600V, I_F=35A$ $V_{GE}=0V, R_G=5.5\Omega$	$T_J=25^\circ C$	156		ns
			$T_J=125^\circ C$	255		
			$T_J=175^\circ C$	305		
Q_r	Recovered Charge	$V_R=600V, I_F=35A$ $V_{GE}=0V, R_G=5.5\Omega$	$T_J=25^\circ C$	2.45		uC
			$T_J=125^\circ C$	3.07		
			$T_J=175^\circ C$	3.67		
E_{rec}	Reverse Recovery Energy	$V_R=600V, I_F=35A$ $V_{GE}=0V, R_G=5.5\Omega$	$T_J=25^\circ C$	0.44		mJ
			$T_J=125^\circ C$	0.61		
			$T_J=175^\circ C$	0.77		
R_{thJC}	Thermal Resistance, Junction to Case	Per Diode		1.3		$^\circ C/W$
T_{Jop}	Temperature under Switching Conditions		-40		175	$^\circ C$

ELECTRICAL CHARACTERISTICS (T_j = 25°C unless otherwise specified.) (continued)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
IGBT, Brake-Chopper							
V _{CE(sat)}	Collector-Emitter Saturation Voltage	I _C =35A, V _{GE} =15V	T _J =25°C	-	1.55	1.8	V
			T _J =125°C		1.73		
			T _J =175°C		1.82		
V _{GEth}	Gate Threshold Voltage	I _C =250uA, V _{CE} =V _{GE}	5.0	5.8	6.6	V	
I _{CES}	Collector-Emitter Cut-off Current	V _{CE} =1200V, V _{GE} =0V			2.0	uA	
I _{GES}	Gate Leakage Current	V _{CE} =0V, V _{GE} =20V			100	nA	
Q _G	Total Gate Charge	V _{GE} =±15V, V _{CE} =600V		0.189		uC	
R _{Gint}	Internal Gate Resistance			0		Ω	
C _{ies}	Input Capacitance	V _{CE} =30V, V _{GE} =0V, f=1.0MHz		3730		pF	
C _{oes}	Output Capacitance			107			
C _{res}	Reverse Transfer Capacitance			15.3			
t _{don}	Turn-on Delay Time	V _{CE} =600V, I _C =35A, V _{GE} =0/15V, R _{G_ON} =5.5Ω, R _{G_OFF} =5.5Ω	T _J =25°C		109		ns
			T _J =125°C		110		
			T _J =175°C		111		
t _r	Rise Time	V _{CE} =600V, I _C =35A, V _{GE} =0/15V, R _{G_ON} =5.5Ω, R _{G_OFF} =5.5Ω	T _J =25°C		94		ns
			T _J =125°C		97		
			T _J =175°C		99		
t _{doff}	Turn-off Delay Time	V _{CE} =600V, I _C =35A, V _{GE} =0/15V, R _{G_ON} =5.5Ω, R _{G_OFF} =5.5Ω	T _J =25°C		222		ns
			T _J =125°C		263		
			T _J =175°C		281		
t _f	Fall Time	V _{CE} =600V, I _C =35A, V _{GE} =0/15V, R _{G_ON} =5.5Ω, R _{G_OFF} =5.5Ω	T _J =25°C		129		ns
			T _J =125°C		224		
			T _J =175°C		283		
E _{on}	Turn-on Energy Loss per Pulse	V _{CE} =600V, I _C =35A, V _{GE} =0/15V, R _{G_ON} =5.5Ω, R _{G_OFF} =5.5Ω	T _J =25°C		3.25		mJ
			T _J =125°C		3.73		
			T _J =175°C		4.02		
E _{off}	Turn-off Energy Loss per Pulse	V _{CE} =600V, I _C =35A, V _{GE} =0/15V, R _{G_ON} =5.5Ω, R _{G_OFF} =5.5Ω	T _J =25°C		2.25		mJ
			T _J =125°C		3.24		
			T _J =175°C		3.82		
I _{SC}	Short-circuit Current	V _{CC} =600V, V _{GE} ≤15V, V _{CEmax} ≤1200V, T _J =150°C t _p ≤9us		123		A	
R _{thJC}	Thermal Resistance, Junction to Case	Per IGBT		0.9		°C/W	
T _{jop}	Temperature under Switching Conditions		-40		175	°C	

ELECTRICAL CHARACTERISTICS (T_j = 25°C unless otherwise specified.) (continued)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Diode, Brake-Chopper						
V _F	Forward Voltage	I _F =10A, V _{GE} =0V	T _J =25°C	1.80	2.1	V
			T _J =125°C	1.91		
			T _J =175°C	1.89		
I _{RM}	Peak Reverse Recovery Current	V _R =600V, I _F =10A, V _{GE} =0V, R _G =5.5Ω	T _J =25°C	9.19		A
			T _J =125°C	9.93		
			T _J =175°C	10.72		
t _{rr}	Reverse Recovery Time	V _R =600V, I _F =10A, V _{GE} =0V, R _G =5.5Ω	T _J =25°C	172		ns
			T _J =125°C	259		
			T _J =175°C	337		
Q _r	Recovered Charge	V _R =600V, I _F =10A, V _{GE} =0V, R _G =5.5Ω	T _J =25°C	0.63		uC
			T _J =125°C	0.99		
			T _J =175°C	1.28		
E _{rec}	Reverse Recovery Energy	V _R =600V, I _F =10A, V _{GE} =0V, R _G =5.5Ω	T _J =25°C	0.17		mJ
			T _J =125°C	0.22		
			T _J =175°C	0.26		
R _{thJC}	Thermal Resistance, Junction to Case	Per Diode		2.3		°C/W
T _{jop}	Temperature under Switching Conditions		-40		175	°C

Diode, Rectifier

V _F	Forward Voltage	I _F =35A, T _J =150°C		1.1		V
I _r	Reverse Current	V _R =1600V, T _J =150°C		1		mA
R _{thJC}	Thermal Resistance, Junction to Case	Per Diode		1.1		°C/W
T _{jop}	Temperature under Switching Conditions		-40		175	°C

NTC-Thermistor

R ₂₅	Rated Resistance	T _{NTC} =25°C	4.85	5	5.15	kΩ
ΔR/R	Deviation of R100	T _C =100°C, R ₁₀₀ =490Ω	-5		5	%
P ₂₅	Power Dissipation	T _{NTC} =25°C			60	mW
B _{25/50}	B-constant	R ₂ =R ₂₅ exp[B _{25/50} (1/T ₂ -1/(298.15K))]		3375		K
B _{25/80}	B-constant	R ₂ =R ₂₅ exp[B _{25/80} (1/T ₂ -1/(298.15K))]		3425		K
B _{25/100}	B-constant	R ₂ =R ₂₅ exp[B _{25/100} (1/T ₂ -1/(298.15K))]		3443		K

Package

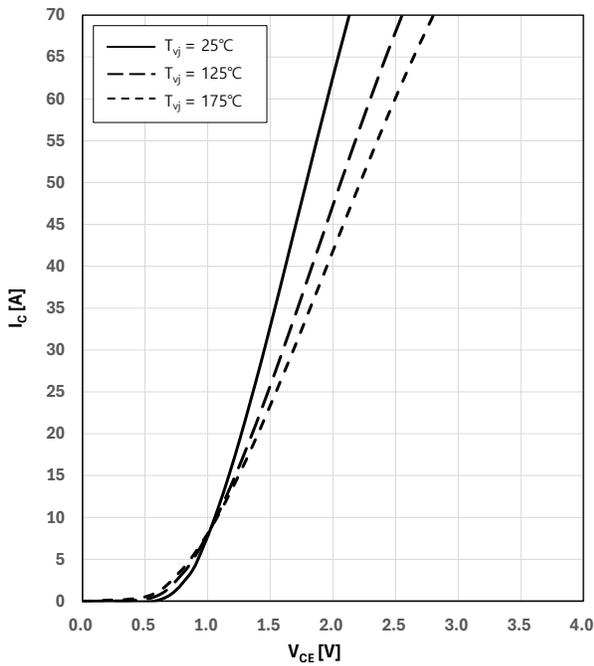
Symbol	Parameter	Conditions	Rating	Unit
V _{ISO}	Isolation Test Voltage	RMS, f=50Hz, t=1min	2500	V
d _{creep}	Creepage Distance	Terminal to Heatsink	11.5	mm
		Terminal to Terminal	6.3	mm
d _{clear}	Clearance	Terminal to Heatsink	10.0	mm
		Terminal to Terminal	5.0	mm
CTI	Comparative Tracking Index		>200	-

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T _{stg}	Storage Temperature		-40		125	°C
G	Weight			43		g
F	Mounting Force per Clamp		20		50	N

CHARACTERISTICS DIAGRAMS

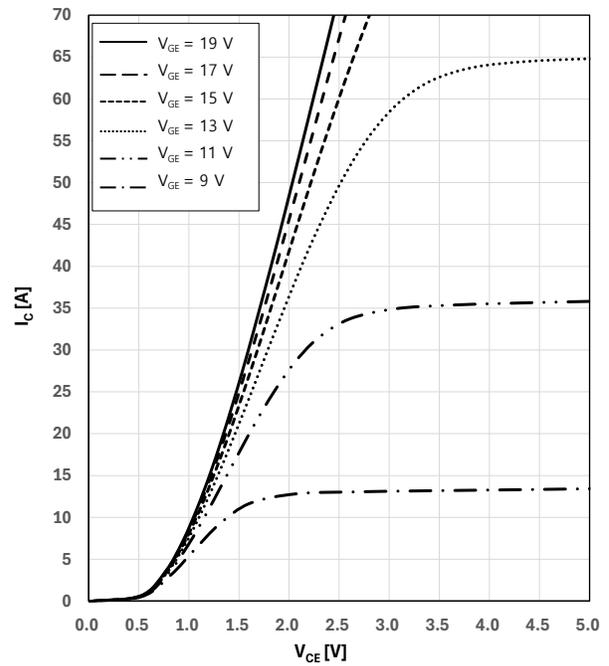
Output characteristic (typical), IGBT, Inverter

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



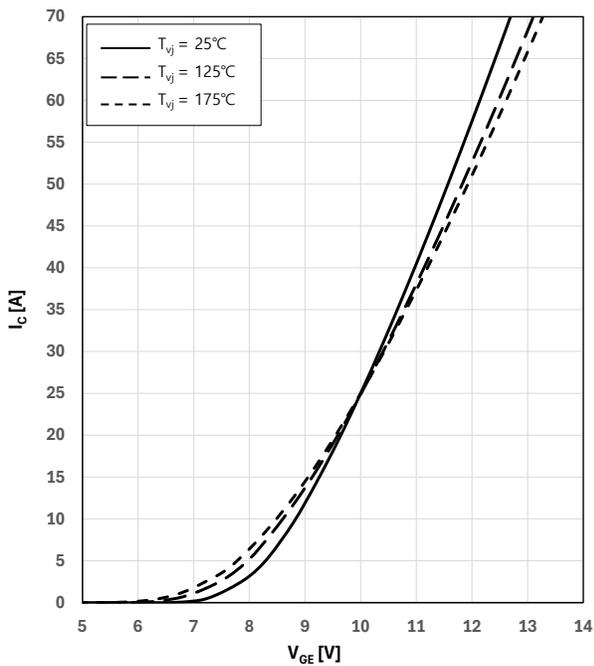
Output characteristic (typical), IGBT, Inverter

$I_C=f(V_{CE})$
 $T_J=175^{\circ}C$



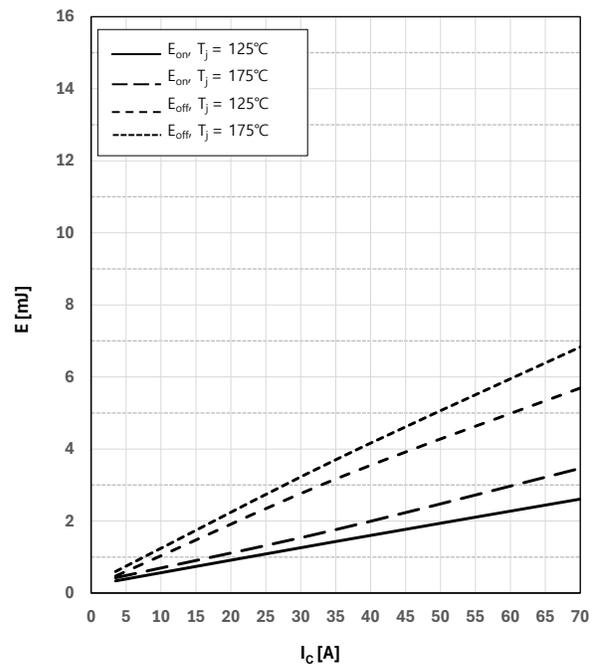
Transfer characteristic (typical), IGBT, Inverter

$I_C=f(V_{GE})$
 $V_{CE}=20V$



Switching losses (typical), IGBT, Inverter

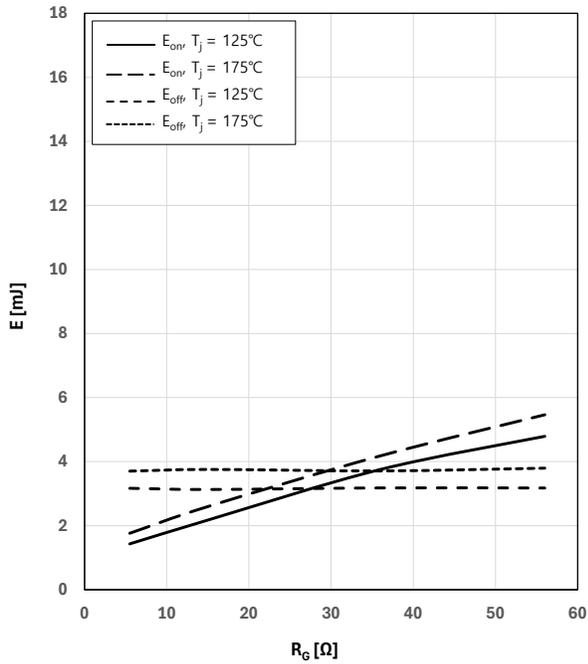
$E=f(I_C)$
 $R_{Goff}=5.5\Omega, R_{Gon}=5.5\Omega, V_{CE}=600V, V_{GE}=\pm 15V$



Switching losses (typical), IGBT, Inverter

$E=f(R_G)$

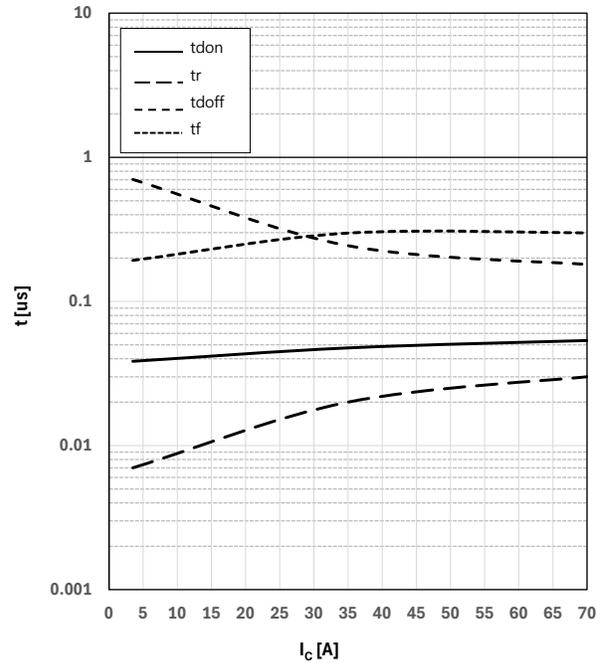
$I_C=35A, V_{CE}=600V, V_{GE}=\pm 15V$



Switching times (typical), IGBT, Inverter

$t=f(I_C)$

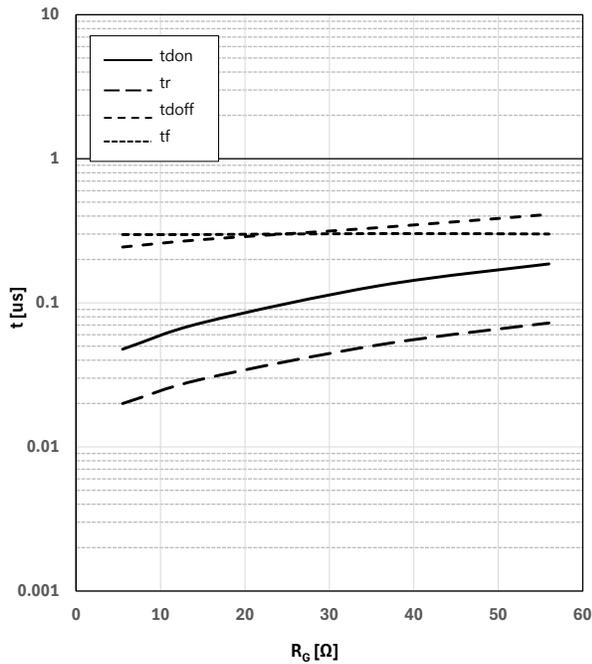
$R_{Goff}=5.5\Omega, R_{Gon}=5.5\Omega, V_{CE}=600V, V_{GE}=\pm 15V, T_j=175^\circ C$



Switching times (typical), IGBT, Inverter

$t=f(R_G)$

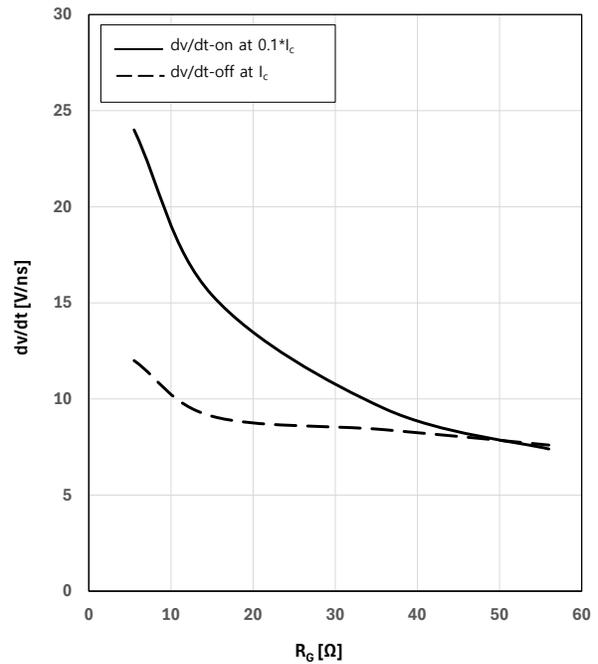
$I_C=35A, V_{CE}=600V, V_{GE}=\pm 15V, T_j=175^\circ C$



dv/dt (typical), IGBT, Inverter

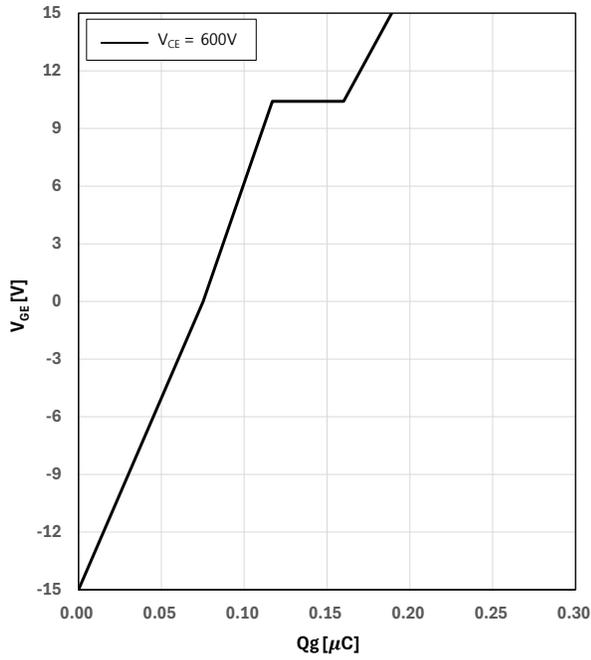
$dv/dt=f(R_G)$

$I_C=35A, V_{CE}=600V, V_{GE}=\pm 15V, T_j=25^\circ C$



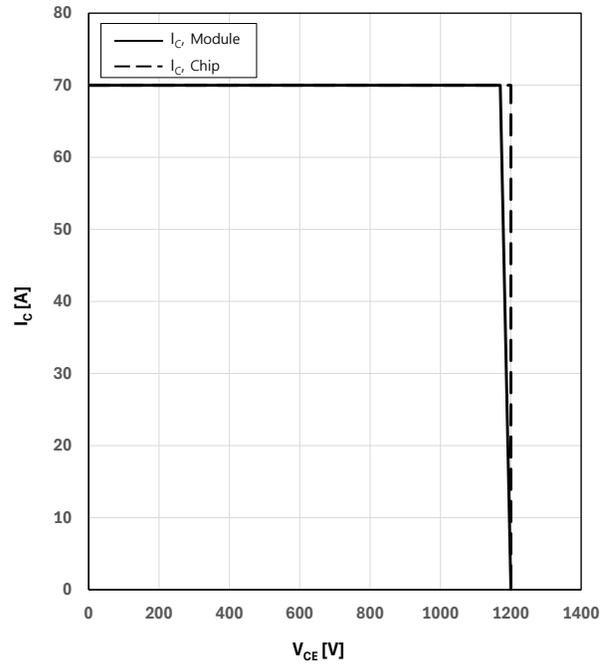
Gate charge characteristic (typical), IGBT, Inverter

$V_{GE}=f(Q_G)$
 $T_J=25^{\circ}C, I_C=35A$



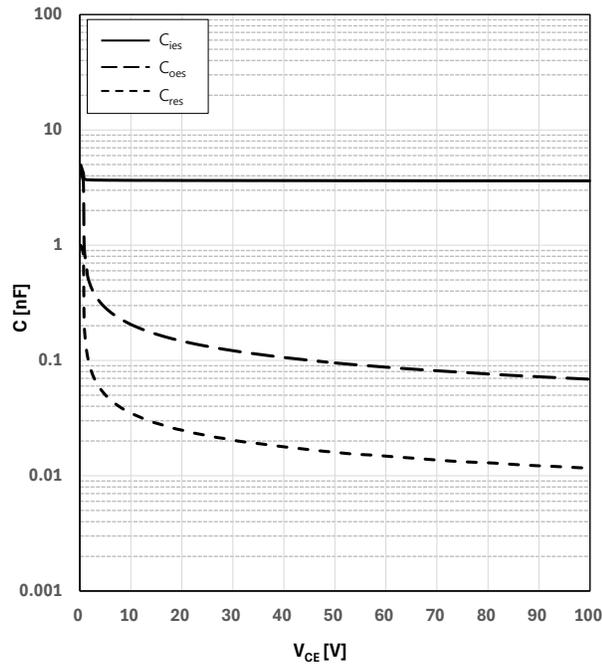
Reverse bias safe operating area (RBSOA), IGBT, Inverter

$I_C=f(V_{CE})$
 $R_{Goff}=5.5\Omega, V_{GE}=\pm 15V, T_J=175^{\circ}C$

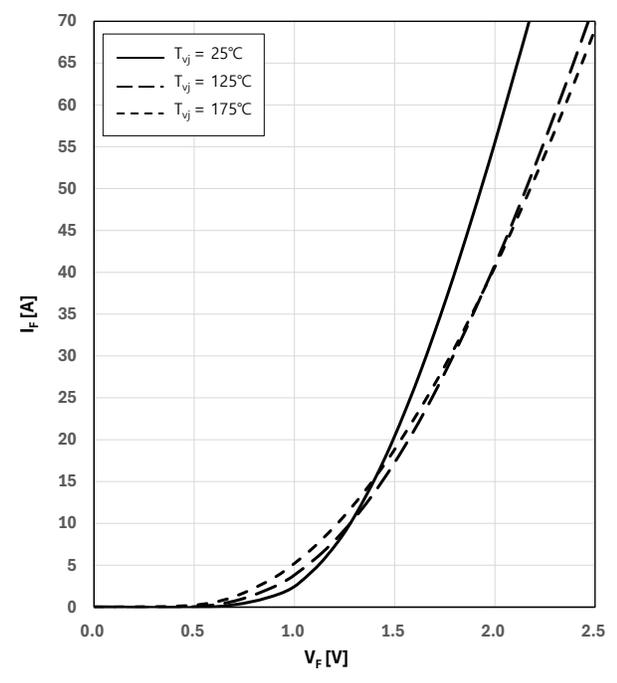


Capacity characteristic (typical), IGBT, Inverter

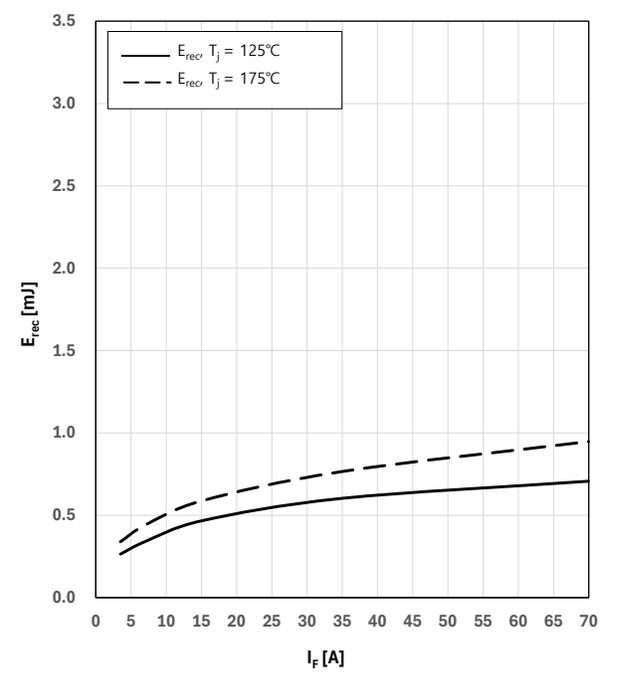
$C=f(V_{CE})$
 $f=100kHz, T_J=25^{\circ}C, V_{GE}=0V$



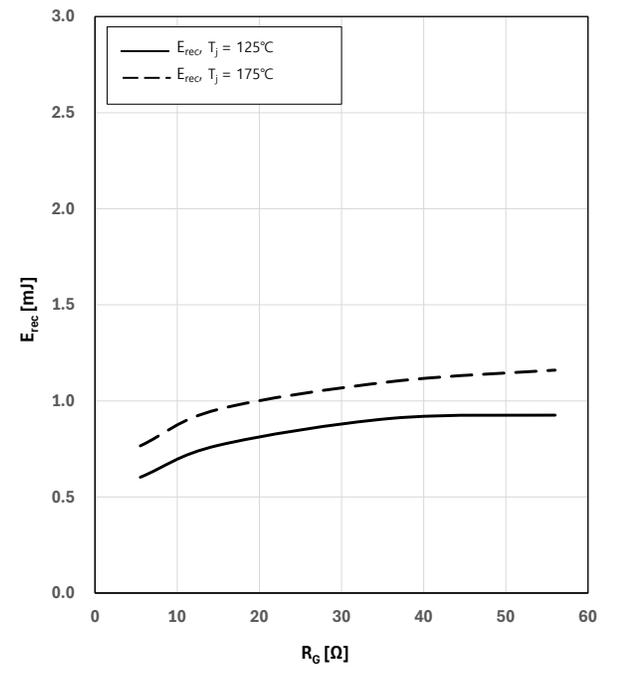
Forward characteristic (typical), Diode, Inverter
 $I_F=f(V_F)$



Switching losses (typical), Diode, Inverter
 $E_{rec}=f(I_F)$
 $R_{Gon}=5.5\Omega, V_{CE}=600V$

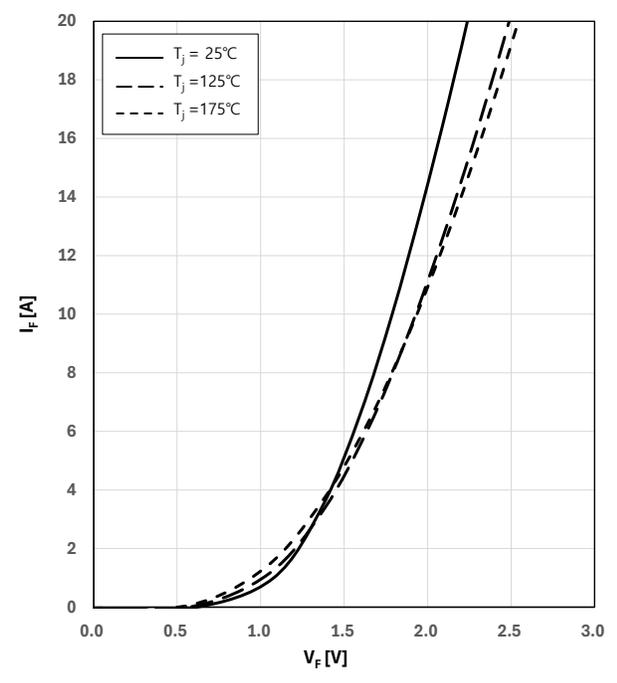


Switching losses (typical), Diode, Inverter
 $E_{rec}=f(R_G)$
 $V_{CE}=600V, I_F=35A$

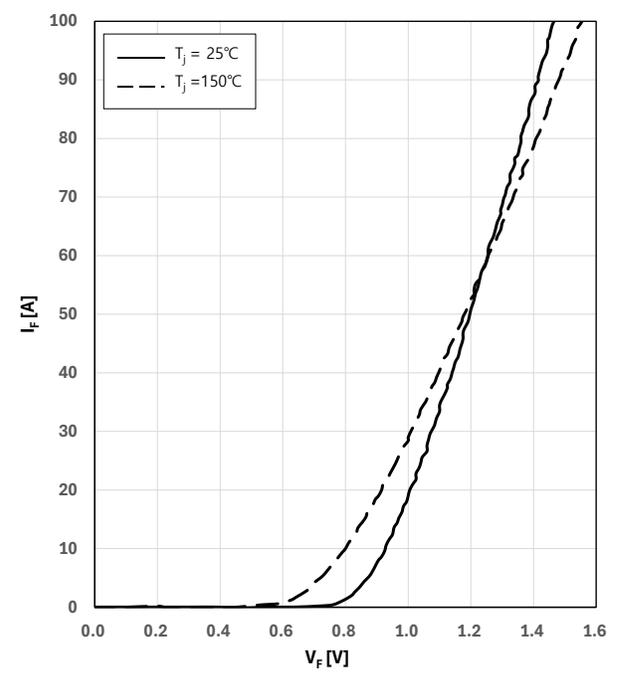


TBD

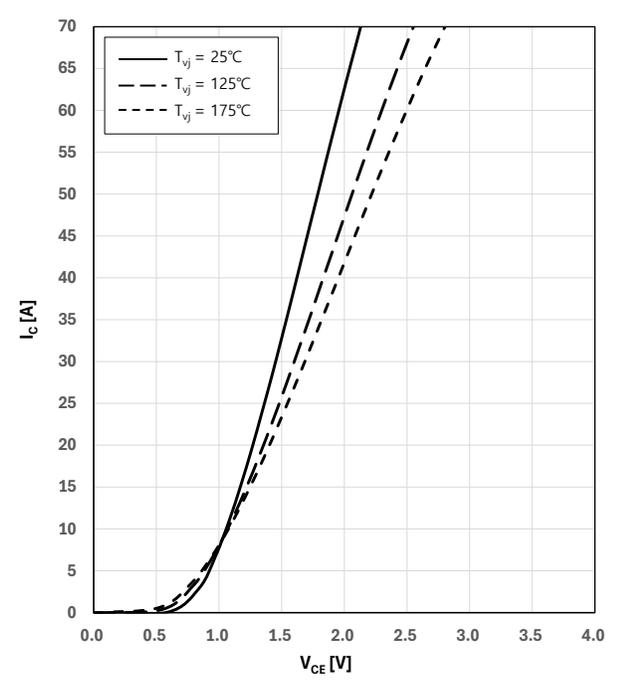
Forward characteristic (typical), Diode, Brake-Chopper
 $I_F=f(V_F)$



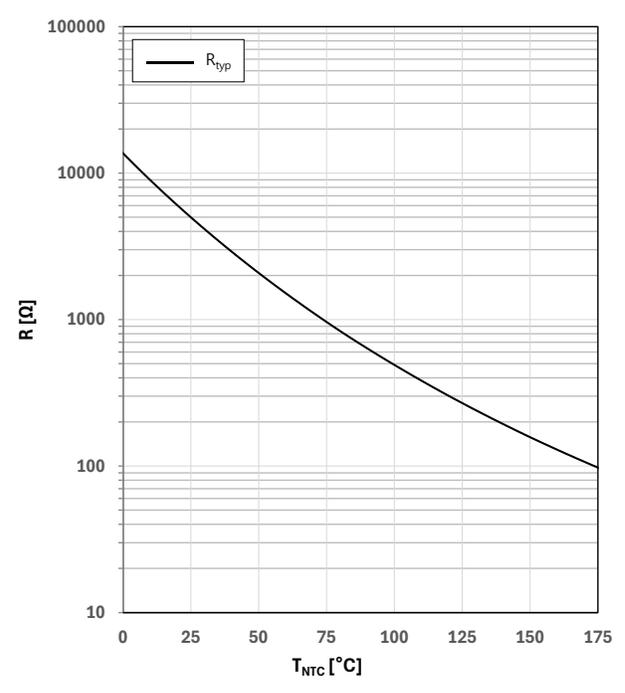
Forward characteristic (typical), Diode, Rectifier
 $I_F=f(V_F)$



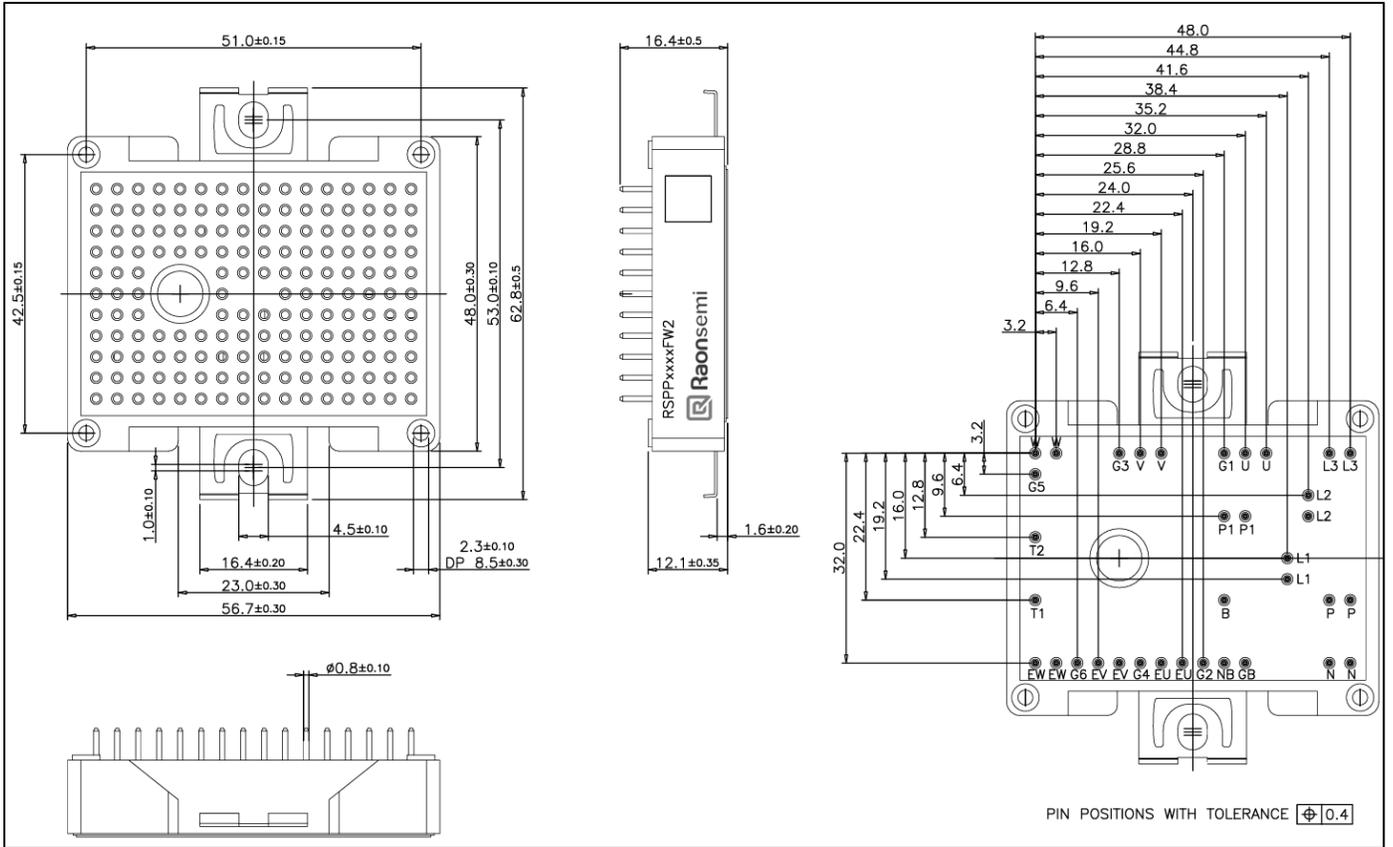
Output characteristic (typical), IGBT, Brake-Chopper
 $I_C=f(V_{CE})$
 $V_{GE}=15\text{V}$



Temperature characteristic (typical), NTC-Thermistor
 $R=f(T_{NTC})$



PACKAGE DIMENSIONS



Disclaimer

- The specifications and performance of the product stated in this document are based on the information provided in the datasheets from Raonsemi. Raonsemi may change the specifications without prior notice. Therefore it is recommended that customer contact Raonsemi for the latest product information.
- The information in this document is provided solely for informational purposes and does not guarantee suitability for specific applications or uses. User must thoroughly review and confirm the product's specifications and performance for their specific applications.
- Raonsemi does not guarantee the accuracy of completeness of the information contained in this document and disclaims all warranties regarding the product's suitability, reliability, or fitness for any particular purpose. All responsibility for the product's performance lies with the user.
- Before using the product, relevant safety regulations and electrical standards must be strictly followed. Users are responsible for reviewing and ensuring the product's safety and compliance with regulations.
- Raonsemi assumes no liability for any direct, indirect, incidental, or consequential damages resulting from the use of this product. The user is responsible for any damages caused by the product's use.
- This document does not guarantee that its content does not infringe on third-party intellectual property rights. Users should ensure that the product's use does not infringe on any third-party rights.