RSPP1512FW1

FPM1 PIM

1200V 15A, 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

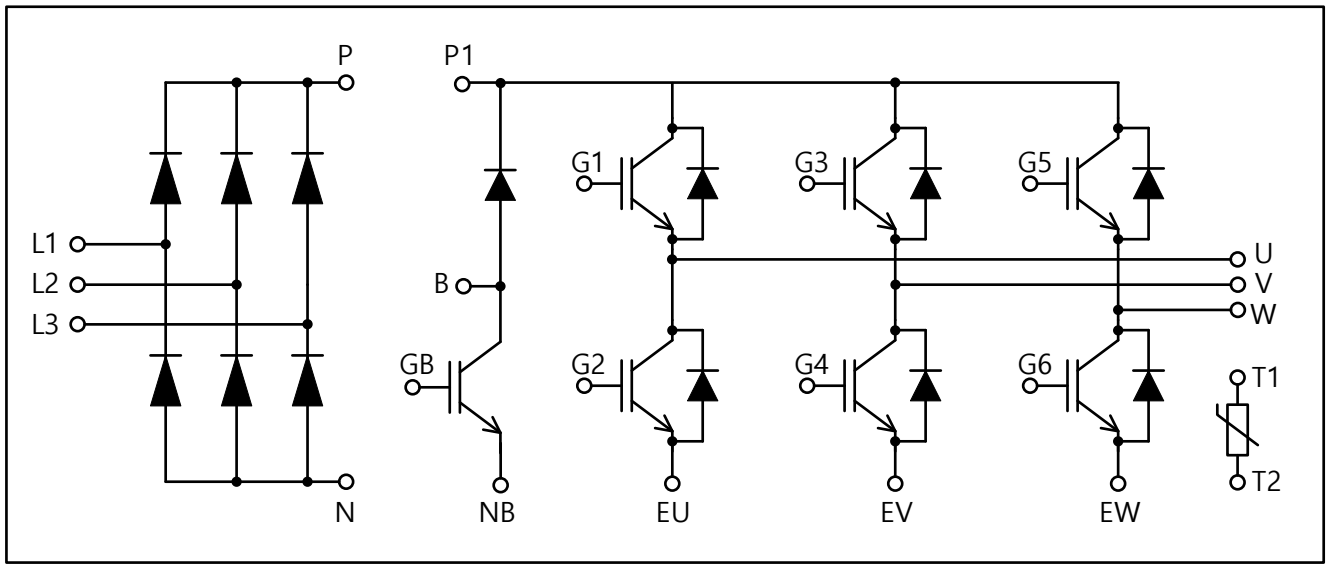


Figure 1. Internal Circuit

ABSOLUTE MAXIMUM RATINGS (T_j = 25°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°C, T_j≤175°C	15	A
I_{CRM}	Repetitive Peak Collector Current	Under 1ms Pulse Width	30	A
Diode, INVERTER				
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	t_p=10ms, T_j=150°C	18	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°C, T_j≤175°C	15	A
I_{CRM}	Repetitive Peak Collector Current	Under 1ms Pulse Width	30	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=0V, t_p=10ms, T_j=150°C	18	A^2s
Diode, Rectifier				
V_{RRM}	Repetitive Peak Reverse Voltage		1600	V
I_{FRMSM}	Maximum RMS Forward Current per Chip	T_C=100°C	25	A
I_{RMSM}	Maximum RMS Forward Current at Rectifier Output	T_C=100°C	25	A
I_{FSM}	Surge Forward Current	t_p=10ms, T_j=150°C	210	A
I^2t	I^2t Value	t_p=10ms, T_j=150°C	220	A^2s

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

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
IGBT, INVERTER							
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=15A, V_{GE}=15V	T_j=25°C		1.65		V
			T_j=125°C		1.75		
			T_j=175°C		1.85		
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			0.08		uC
R_{Gint}	Internal Gate Resistance				0		Ω
C_{ies}	Input Capacitance	V_{CE}=30V, V_{GE}=0V, f=1.0MHz			1400		pF
C_{oes}	Output Capacitance				45.5		
C_{res}	Reverse Transfer Capacitance				7.5		

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
IGBT, INVERTER (Continued)							
t_{don}	Turn-on Delay Time	V_{CE}=600V, I_C=15A, V_{GE}=0/15V, R_{G_ON}=7.5Ω, R_{G_OFF}=7.5Ω	T_j=25℃		29		ns
			T_j=125℃		28		
			T_j=175℃		26		
t_r	Rise Time	V_{CE}=600V, I_C=15A, V_{GE}=0/15V, R_{G_ON}=7.5Ω, R_{G_OFF}=7.5Ω	T_j=25℃		11		ns
			T_j=125℃		13		
			T_j=175℃		15		
t_{doff}	Turn-off Delay Time	V_{CE}=600V, I_C=15A, V_{GE}=0/15V, R_{G_ON}=7.5Ω, R_{G_OFF}=7.5Ω	T_j=25℃		167		ns
			T_j=125℃		184		
			T_j=175℃		201		
t_f	Fall Time	V_{CE}=600V, I_C=15A, V_{GE}=0/15V, R_{G_ON}=7.5Ω, R_{G_OFF}=7.5Ω	T_j=25℃		138		ns
			T_j=125℃		227		
			T_j=175℃		285		
E_{on}	Turn-on Energy Loss per Pulse	V_{CE}=600V, I_C=15A, V_{GE}=0/15V, R_{G_ON}=7.5Ω, R_{G_OFF}=7.5Ω	T_j=25℃		0.48		mJ
			T_j=125℃		0.61		
			T_j=175℃		0.78		
E_{off}	Turn-off Energy Loss per Pulse	V_{CE}=600V, I_C=15A, V_{GE}=0/15V, R_{G_ON}=7.5Ω, R_{G_OFF}=7.5Ω	T_j=25℃		0.91		mJ
			T_j=125℃		1.21		
			T_j=175℃		1.46		
I_{SC}	Short-circuit Current	V_{CC}=600V, V_{GE}≤15V, V_{CEmax}≤1200V, T_j=150℃ t_p≤10us			43		A
R_{thJC}	Thermal Resistance, Junction to Case	Per IGBT			1.8		℃/W
T_{jop}	Temperature under Switching Conditions			-40		175	℃
Diode, INVERTER							
V_F	Forward Voltage	I_F=15A, V_{GE}=0V	T_j=25℃		2.0		V
			T_j=125℃		2.2		
			T_j=175℃		2.3		
I_{RM}	Peak Reverse Recovery Current	V_R=600V, I_F=15A, V_{GE}=0V, R_G=7.5Ω	T_j=25℃		27.7		A
			T_j=125℃		28.2		
			T_j=175℃		29.5		
t_{rr}	Reverse Recovery Time	V_R=600V, I_F=15A, V_{GE}=0V, R_G=7.5Ω	T_j=25℃		180		ns
			T_j=125℃		267		
			T_j=175℃		381		
Q_r	Recovered Charge	V_R=600V, I_F=15A, V_{GE}=0V, R_G=7.5Ω	T_j=25℃		1.03		uC
			T_j=125℃		1.5		
			T_j=175℃		1.95		
E_{rec}	Reverse Recovery Energy	V_R=600V, I_F=15A, V_{GE}=0V, R_G=7.5Ω	T_j=25℃		0.21		mJ
			T_j=125℃		0.27		
			T_j=175℃		0.34		
R_{thJC}	Thermal Resistance, Junction to Case	Per Diode			2.5		℃/W
T_{jop}	Temperature under Switching Conditions			-40		175	℃

ELECTRICAL CHARACTERISTICS (Tj = 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=15A, V_{GE}=15V	T_j=25°C		1.65		V
			T_j=125°C		1.78		
			T_j=175°C		1.85		
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	VCE=1200V, VGE=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			0.08		uC
R_{Gint}	Internal Gate Resistance				0		Ω
C_{ies}	Input Capacitance	V_{CE}=30V, V_{GE}=0V, f=1.0MHz			1400		pF
C_{oes}	Output Capacitance				45.5		
C_{res}	Reverse Transfer Capacitance				7.5		
t_{don}	Turn-on Delay Time	V_{CE}=600V, I_C=15A, V_{GE}=0/15V, R_{G_ON}=7.5Ω, R_{G_OFF}=7.5Ω	T_j=25℃		29		ns
			T_j=125℃		28		
			T_j=175℃		26		
t_r	Rise Time	V_{CE}=600V, I_C=15A, V_{GE}=0/15V, R_{G_ON}=7.5Ω, R_{G_OFF}=7.5Ω	T_j=25℃		11		ns
			T_j=125℃		13		
			T_j=175℃		15		
t_{doff}	Turn-off Delay Time	V_{CE}=600V, I_C=15A, V_{GE}=0/15V, R_{G_ON}=7.5Ω, R_{G_OFF}=7.5Ω	T_j=25℃		167		ns
			T_j=125℃		184		
			T_j=175℃		201		
t_f	Fall Time	V_{CE}=600V, I_C=15A, V_{GE}=0/15V, R_{G_ON}=7.5Ω, R_{G_OFF}=7.5Ω	T_j=25℃		138		ns
			T_j=125℃		227		
			T_j=175℃		285		
E_{on}	Turn-on Energy Loss per Pulse	V_{CE}=600V, I_C=15A, V_{GE}=0/15V, R_{G_ON}=7.5Ω, R_{G_OFF}=7.5Ω	T_j=25℃		0.48		mJ
			T_j=125℃		0.61		
			T_j=175℃		0.78		
E_{off}	Turn-off Energy Loss per Pulse	V_{CE}=600V, I_C=15A, V_{GE}=0/15V, R_{G_ON}=7.5Ω, R_{G_OFF}=7.5Ω	T_j=25℃		0.91		mJ
			T_j=125℃		1.21		
			T_j=175℃		1.46		
I_{SC}	Short-circuit Current	V_{CC}=600V, V_{GE}≤15V, V_{CEmax}≤1200V, T_j=150℃ t_p≤10us			43		A
R_{thJC}	Thermal Resistance, Junction to Case	Per IGBT			1.8		℃/W
T_{jop}	Temperature under Switching Conditions			-40		175	℃

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

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Diode, Brake-Chopper							
V_F	Forward Voltage	I_F=15A, V_{GE}=0V	T_j=25℃		2.0		V
			T_j=125℃		2.2		
			T_j=175℃		2.3		
I_{RM}	Peak Reverse Recovery Current	V_R=600V, I_F=15A, V_{GE}=0V, R_G=7.5Ω	T_j=25℃		27.7		A
			T_j=125℃		28.2		
			T_j=175℃		29.5		
t_{rr}	Reverse Recovery Time	V_R=600V, I_F=15A, V_{GE}=0V, R_G=7.5Ω	T_j=25℃		180		ns
			T_j=125℃		267		
			T_j=175℃		381		
Q_r	Recovered Charge	V_R=600V, I_F=15A, V_{GE}=0V, R_G=7.5Ω	T_j=25℃		1.03		uC
			T_j=125℃		1.5		
			T_j=175℃		1.95		
E_{rec}	Reverse Recovery Energy	V_R=600V, I_F=15A, V_{GE}=0V, R_G=7.5Ω	T_j=25℃		0.21		mJ
			T_j=125℃		0.27		
			T_j=175℃		0.34		
R_{thJC}	Thermal Resistance, Junction to Case	Per Diode			2.4		℃/W
T_{jop}	Temperature under Switching Conditions			-40		175	℃
Diode, Rectifier							
V_F	Forward Voltage	I_F=15A, T_j=150℃			0.96		V
I_r	Reverse Current	V_R=1600V, T_j=150℃			1		mA
R_{thJC}	Thermal Resistance, Junction to Case	Per Diode			1.5		℃/W
T_{jop}	Temperature under Switching Conditions			-40		175	℃
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

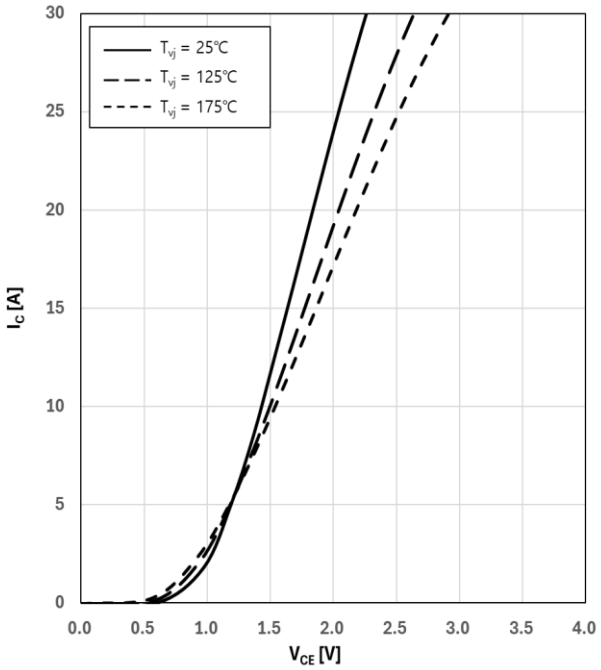
Package

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	-

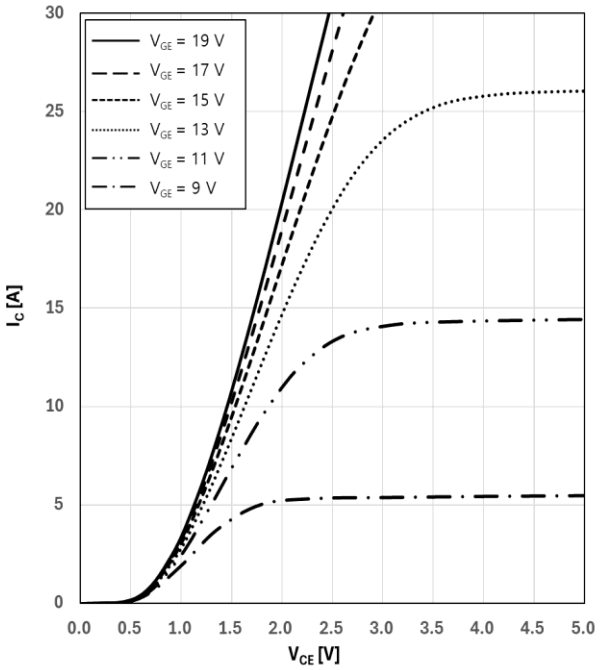
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{stg}	Storage Temperature		-40		125	℃
G	Weight			22		g
F	Mounting Force per Clamp		20		50	N

CHARACTERISTICS DIAGRAMS

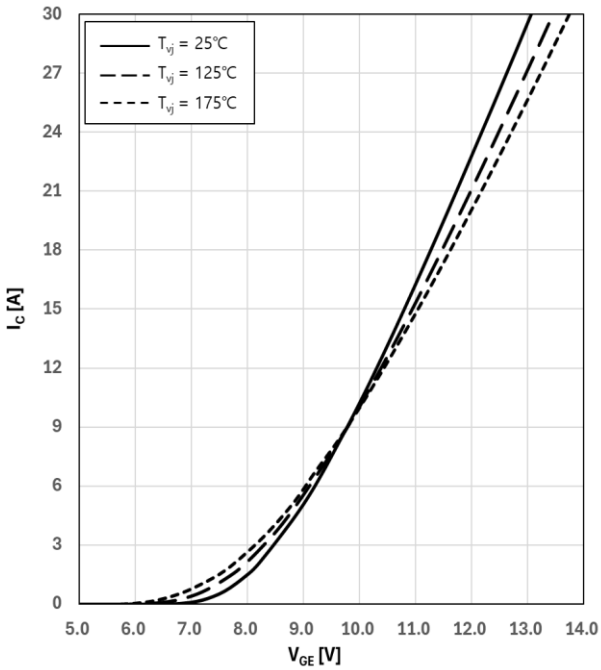
Output characteristic (typical), IGBT, Inverter
$I_C=f(V_{CE})$
$V_{GE}=15V$



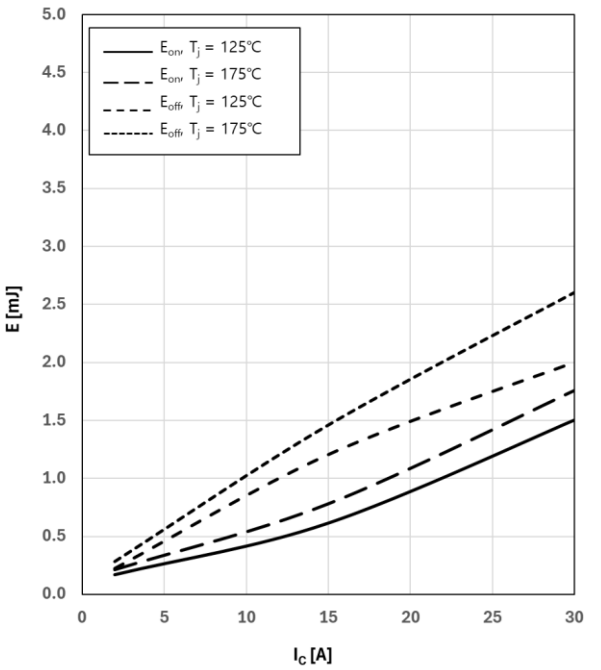
Output characteristic (typical), IGBT, Inverter
$I_C=f(V_{CE})$
$T_j=175°C$



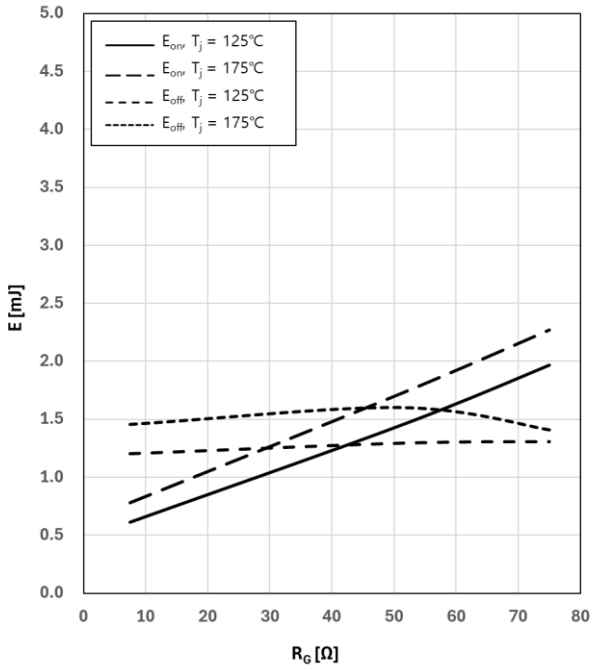
Transfer characteristic (typical), IGBT, Inverter
$I_C=f(V_{GE})$
$V_{CE}=20V$



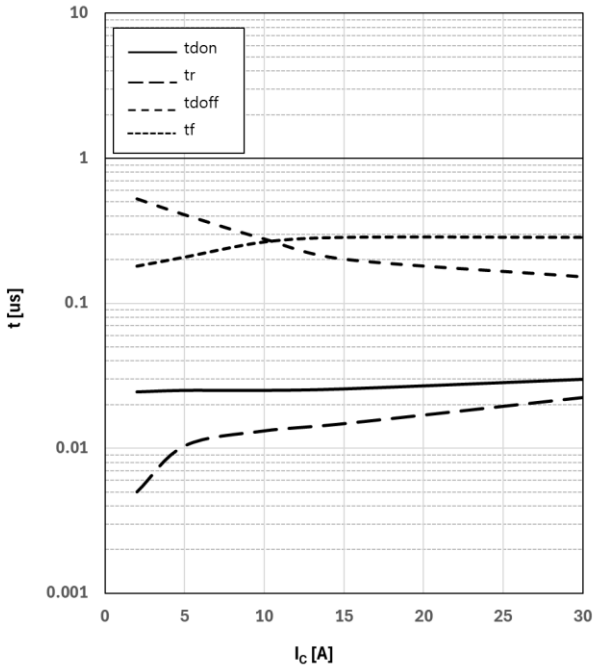
Switching losses (typical), IGBT, Inverter
$E=f(I_C)$
$R_{Goff}=7.5\Omega$, $R_{Gon}=7.5\Omega$, $V_{CE}=600V$, $V_{GE}=\pm15V$



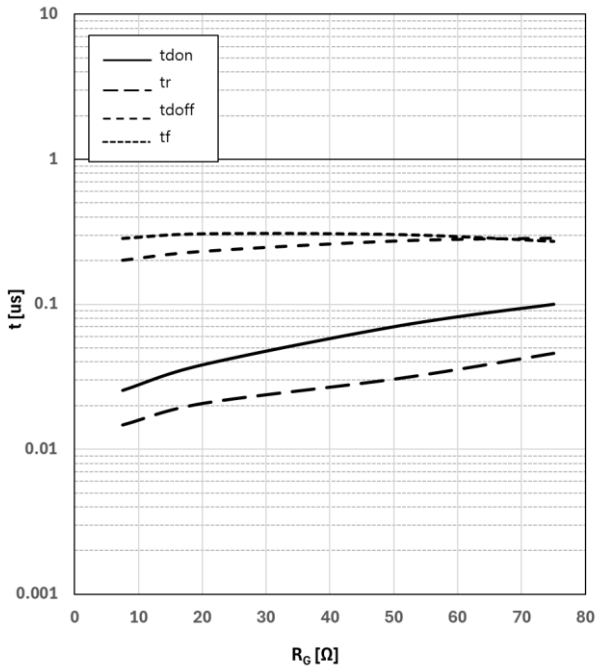
Switching losses (typical), IGBT, Inverter
E=f(R_G)
I_C=15A, V_{CE}=600V, V_{GE}=±15V



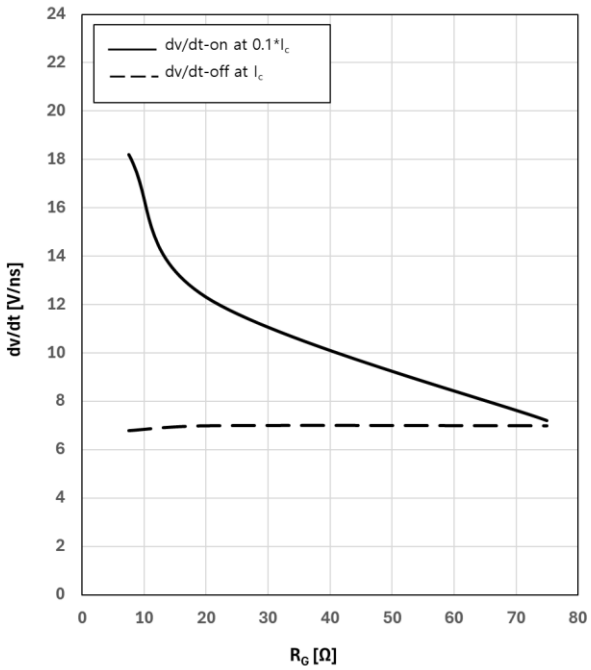
Switching times (typical), IGBT, Inverter
t=f(I_C)
R_{Goff}=7.5Ω, R_{Gon}=7.5Ω, V_{CE}=600V, V_{GE}=±15V, T_j=175°C



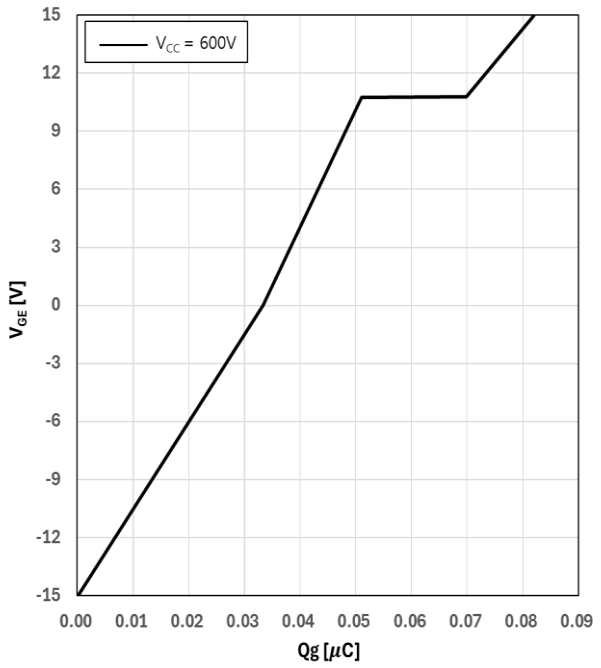
Switching times (typical), IGBT, Inverter
t=f(R_G)
I_C=15A, V_{CE}=600V, V_{GE}=±15V, T_j=175°C



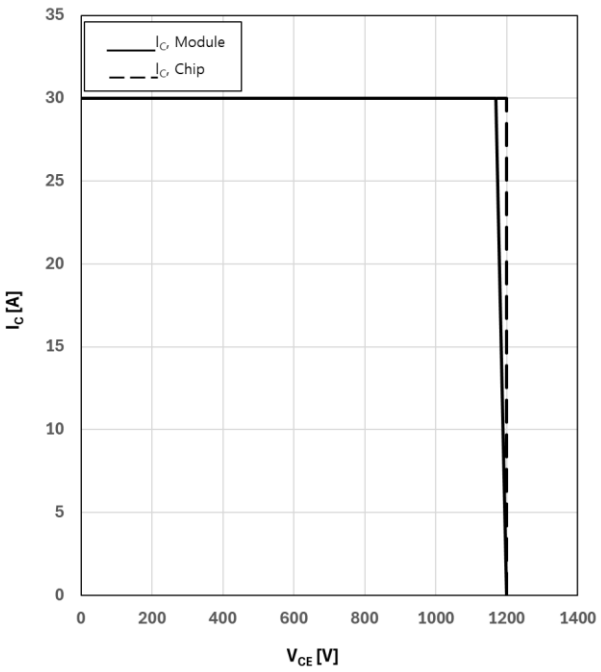
dv/dt (typical), IGBT, Inverter
dv/dt=f(R_G)
I_C=15A, V_{CE}=600V, V_{GE}=±15V, T_j=25°C



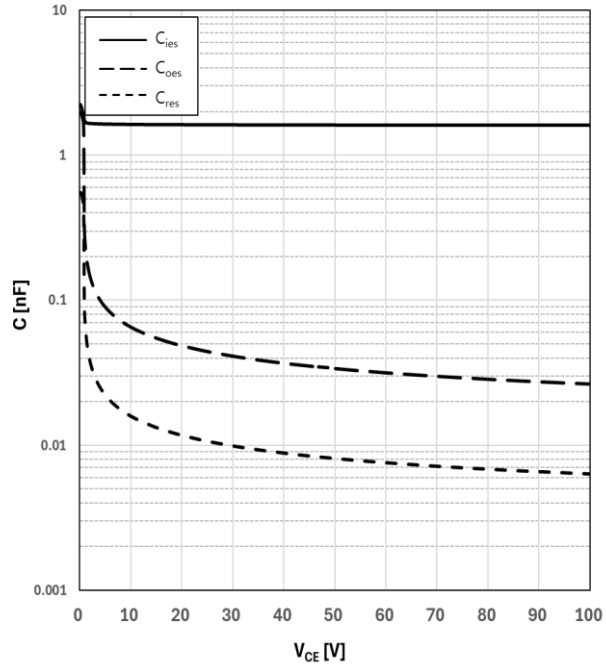
Gate charge characteristic (typical), IGBT, Inverter
$V_{GE}=f(Q_G)$
$T_j=25°C$, $I_C=15A$



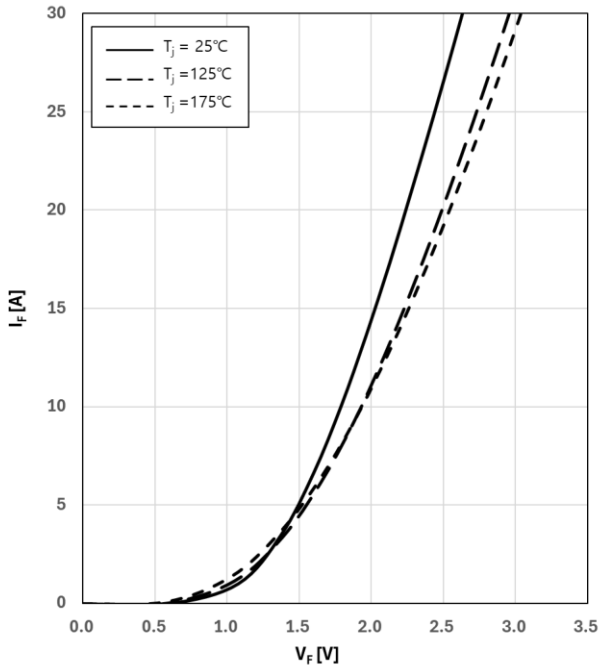
Reverse bias safe operating area (RBSOA), IGBT, Inverter
$I_C=f(V_{CE})$
$R_{Goff}=7.5Ω$, $V_{GE}=±15V$, $T_j=175°C$



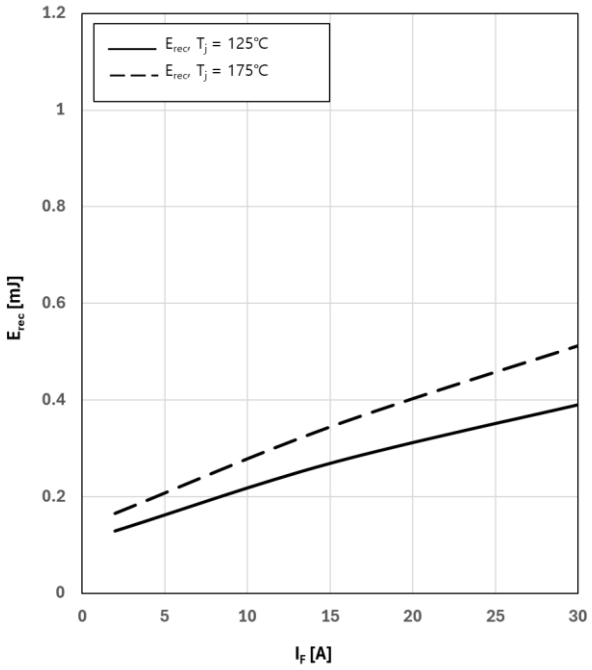
Capacity characteristic (typical), IGBT, Inverter
$C=f(V_{CE})$
$f=100kHz$, $T_j=25°C$, $V_{GE}=0V$



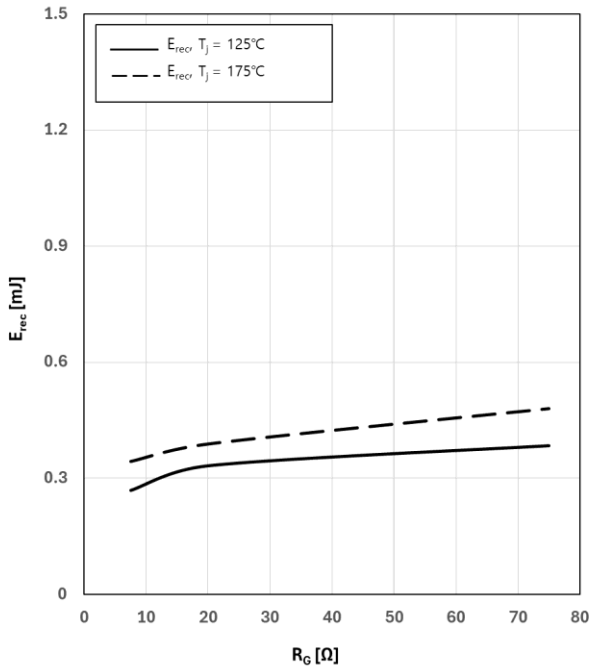
Forward characteristic (typical), Diode, Inverter
$I_F=f(V_F)$



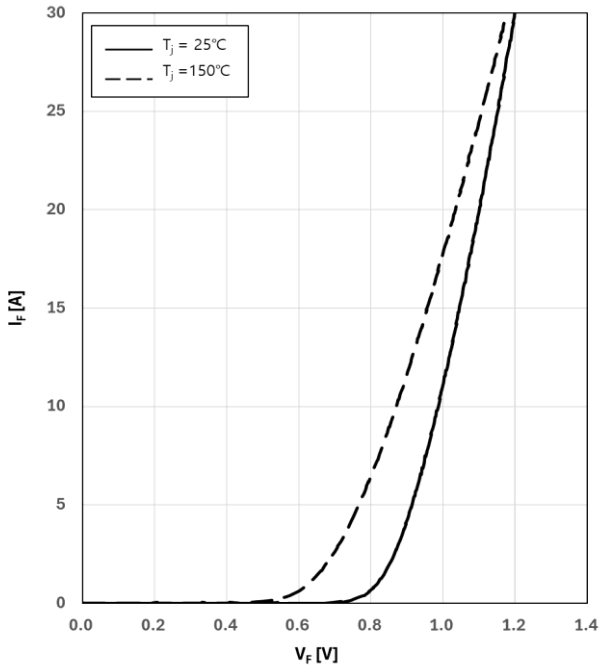
Switching losses (typical), Diode, Inverter
$E_{rec}=f(I_F)$
$R_{Gon}=7.5\Omega$, $V_{CE}=600V$



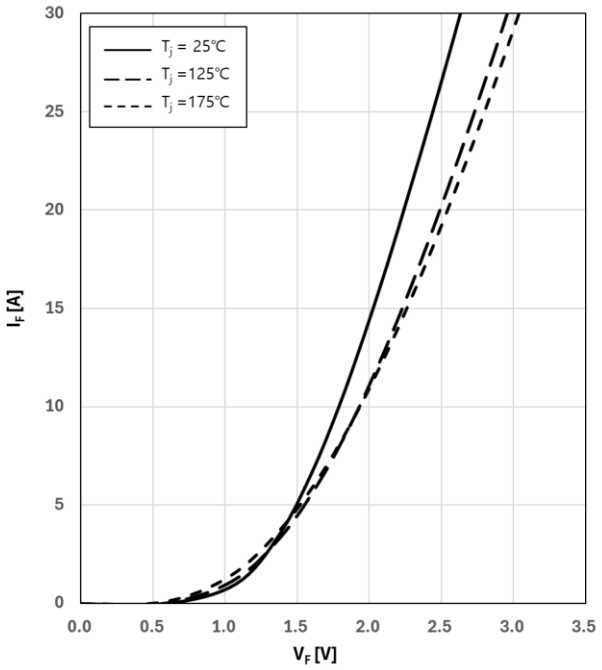
Switching losses (typical), Diode, Inverter
$E_{rec}=f(R_G)$
$V_{CE}=600V$, $I_F=15A$



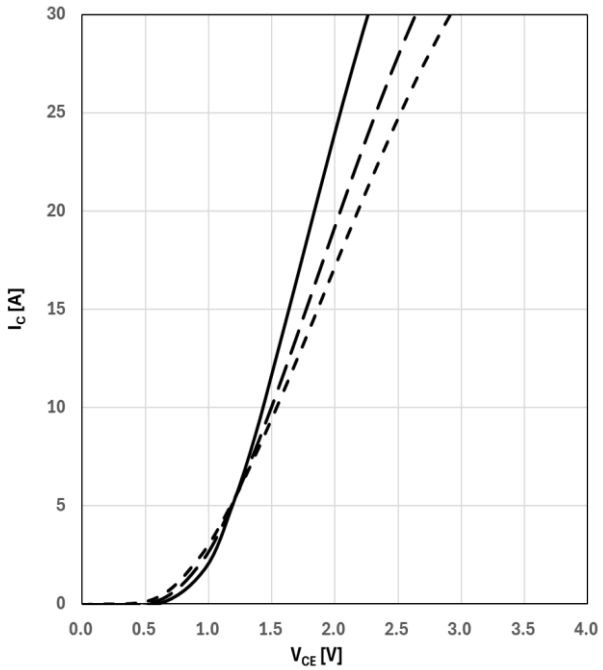
Forward characteristic (typical), Diode, Rectifier
$I_F=f(V_F)$



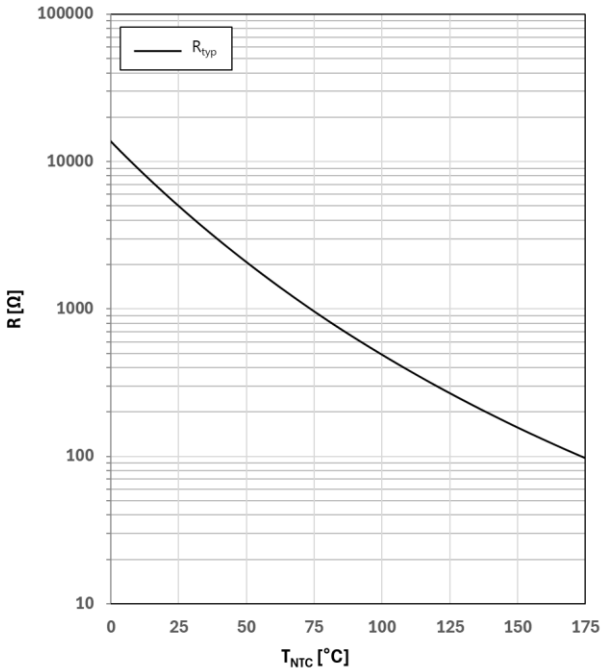
Forward characteristic (typical), Diode, Brake-Chopper
$I_F=f(V_F)$



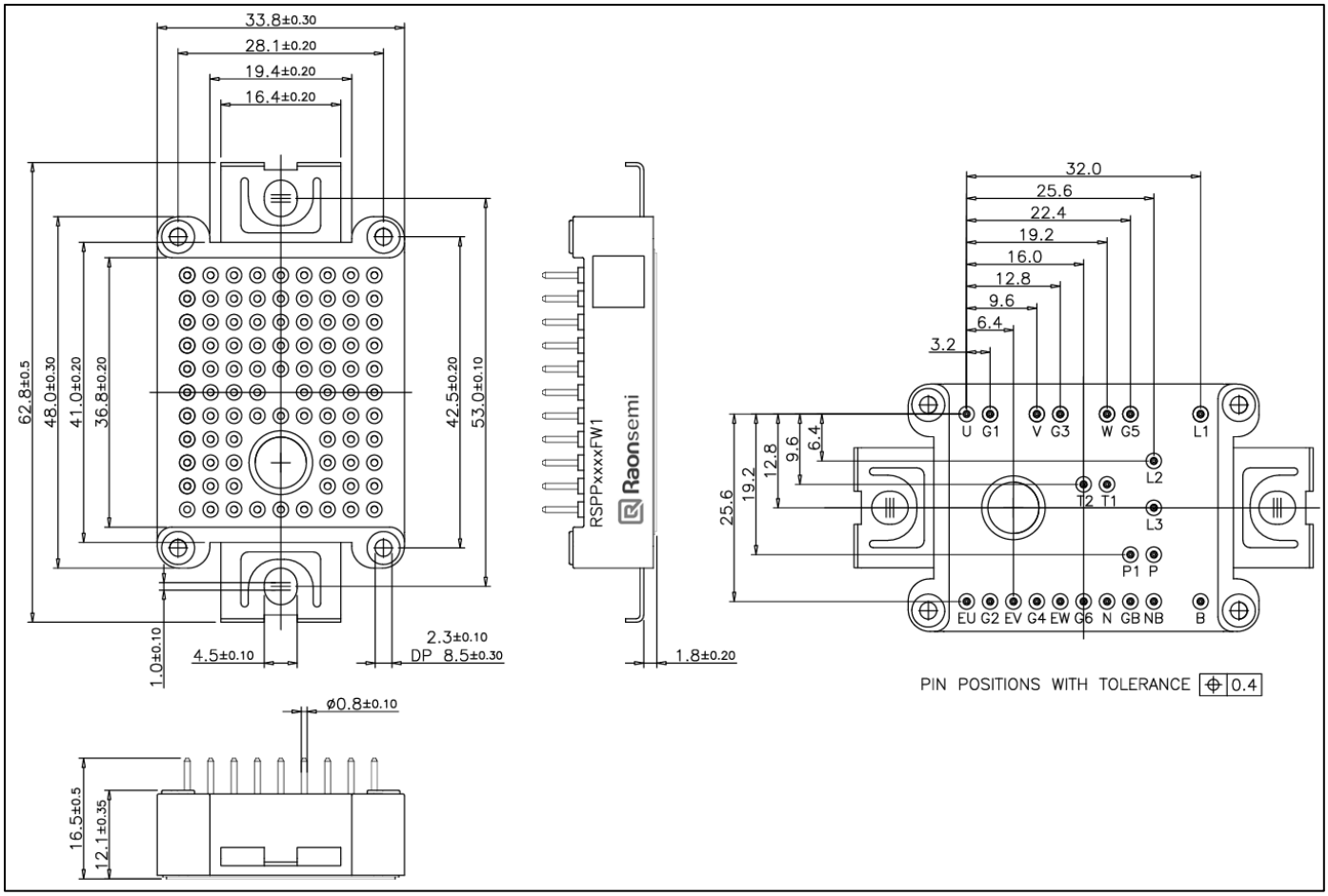
Output characteristic (typical), IGBT, Brake-Chopper
$I_C=f(V_{CE})$
$V_{GE}=15V$



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



PACKAGE DIMENSIONS



Disclaimer

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