JJMICROELECTRONICS

PIM with 1200V 15A Trench FS IGBT

JP15Z12K1L1

Key performance:

- V_{CE}=1200V
- I_C=15A@T_C=100℃
- $V_{CE(sat)}$=1.75V

Benefits:

- High efficiency for application
- Convenient for mounting
- RoHS compliant.

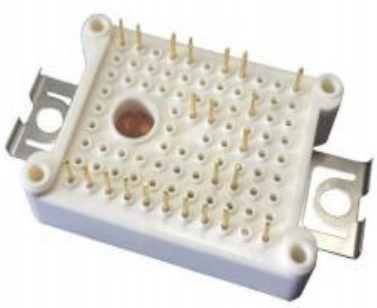
Features:

- Low V_{CEsat}.
- Low switching losses
- Low stray inductance design
- Positive V_{CEsat} temperature coefficient
- 10us short circuits capability

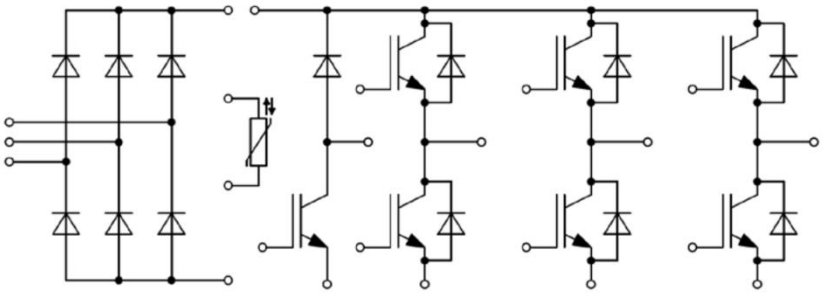
Applications:

- Motor drives
- Servo drives
- Auxiliary inverters

Typical Appearance:



Equivalent Circuit Schematic:



IGBT, Inverter
Maximum rated values

Parameter	Conditions	Symbol	Values	Unit
Collector-emitter voltage	T_{vj} = 25°C	V_{CES}	1200	V
Continuous collector current	T_C = 100°C, $T_{vj\ max}$ = 175°C	I_C	15	A
Repetitive peak collector current	t_P = 1 ms	I_{CRM}	30	A
Total power dissipation	T_C = 25°C, $T_{vj\ max}$ = 175°C	P_{tot}	132	W
Gate-emitter peak voltage		V_{GES}	±20	V

Characteristic values

Parameter	Conditions	Symbol	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter saturation voltage	I_C = 15A, V_{GE} = 15 V T_{vj} = 25°C I_C = 15A, V_{GE} = 15 V T_{vj} = 125°C I_C = 15A, V_{GE} = 15 V T_{vj} = 150°C	V_{CEsat}	- - -	1.75 2.10 2.15	- - -	V
Gate threshold voltage	I_C = 1 mA, V_{CE} = V_{GE} ,T_{vj} = 25°C	V_{GEth}	-	6.2	-	V
Gate charge	V_{GE} = -15 / 15 V	Q_G	-	0.15	-	µC
Input capacitance	f = 1 MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V	C_{ies}	-	1.29	-	nF
Reverse transfer capacitance		C_{res}	-	13.5	-	pF
Collector-emitter leakage current	V_{CE} = 1200 V, V_{GE} = 0 V, T_{vj} = 25°C	I_{CES}	-	-	1.0	mA
Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25°C	I_{GES}	-	-	500	nA
Turn-on delay time, inductive load	I_C =15A, V_{CE} = 600 V T_{vj} = 25°C V_{GE} = -15 / 15 V T_{vj} = 125°C R_G = 5.1Ω T_{vj} = 150°C	$t_{d(on)}$	-	10.2 12.8 10.6	-	ns
Rise time, inductive load	I_C =15A, V_{CE} = 600 V T_{vj} = 25°C V_{GE} = -15 / 15 V , T_{vj} = 125°C R_G = 5.1Ω T_{vj} = 150°C	t_r	-	21.0 20.5 22.4	-	ns
Turn-off delay time, inductive load	I_C =15A, V_{CE} = 600 V T_{vj} = 25°C V_{GE} = -15 / 15 V T_{vj} = 125°C R_G = 5.1Ω T_{vj} = 150°C	$t_{d(off)}$	-	152 176 191	-	ns
Fall time, inductive load	I_C =15A, V_{CE} = 600 V T_{vj} = 25°C V_{GE} = -15 / 15 V T_{vj} = 125°C R_G = 5.1Ω T_{vj} = 150°C	t_f	-	97 137 142	-	ns

Characteristic values

Turn-on energy loss per pulse	I_C =15A, V_{CE} = 600 V V_{GE} = -15 / 15 V R_G = 5.1Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{on}	- - -	0.90 1.50 1.70	-	mJ
Turn-off energy loss per pulse	I_C =15A, V_{CE} = 600 V V_{GE} = -15 / 15 V R_G = 5.1Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{off}	- - -	0.65 0.95 1.00	-	mJ
SC data	V_{GE} ≤ 15 V, V_{CC} = 800 V t_P ≤ 10 µs, T_{vj} = 25°C		I_{SC}	-	66	-	A
Thermal resistance, junction to case	per IGBT		R_{thJC}	-	-	1.14	K/W
Thermal resistance, case to heatsink	per IGBT		R_{thCH}	-	1.02	-	K/W
Temperature under switching conditions			$T_{vj\ op}$	-40	-	150	°C

Diode, Inverter
Maximum rated values

Parameter	Conditions	Symbol	Values	Unit
Repetitive peak reverse voltage	T_{vj} = 25°C	V_{RRM}	1200	V
Continuous DC forward current		I_F	15	A
Repetitive peak forward current	t_P = 1 ms	I_{FRM}	30	A

Characteristic values

Parameter	Conditions		Symbol	Values			Unit
				Min.	Typ.	Max.	
Forward voltage	I_F =15 A, V_{GE} = 0 V I_F =15 A, V_{GE} = 0 V I_F =15 A, V_{GE} = 0 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	V_F	- -	1.90 1.62 1.56	- -	V
Peak reverse recovery current	I_F = 15 A,V_R = 600 V V_{GE} = -15 V - d_{iF}/d_t = 750A/µs	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	I_{RR}	- -	11.8 15.9 17.4	- -	A
Recovered charge	I_F = 15 A,V_R = 600 V V_{GE} = -15 V - d_{iF}/d_t = 750A/µs	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	Q_{RR}	- -	0.99 2.16 2.80	- -	µC
Reverse recovery energy	I_F = 15 A,V_R = 600 V V_{GE} = -15 V - d_{iF}/d_t = 750A/µs	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{rec}	- -	0.33 0.71 0.94	- -	mJ
Thermal resistance, junction to case	per diode		R_{thJC}	-	-	1.8	K/W
Thermal resistance, case to heatsink	per diode		R_{thCH}	-	1.2	-	K/W
Temperature under switching conditions			$T_{vj\ op}$	-40	-	150	°C

IGBT, Brake-Chopper
Maximum rated values

Parameter	Conditions	Symbol	Values	Unit
Collector-emitter voltage	T_{vj} = 25°C	V_{CES}	1200	V
Continuous collector current	T_C = 100°C, $T_{vj\ max}$ = 175°C	I_C	15	A
Repetitive peak collector current	t_P = 1 ms	I_{CRM}	30	A
Total power dissipation	T_C = 25°C, $T_{vj\ max}$ = 175°C	P_{tot}	132	W
Gate-emitter peak voltage		V_{GES}	±20	V

Characteristic values

Parameter	Conditions	Symbol	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter saturation voltage	I_C = 15A, V_{GE} = 15 V T_{vj} = 25°C I_C = 15A, V_{GE} = 15 V T_{vj} = 125°C I_C = 15A, V_{GE} = 15 V T_{vj} = 150°C	V_{CEsat}	-	1.75 2.10 2.15	-	V
Gate threshold voltage	I_C = 1 mA, V_{CE} = V_{GE} ,T_{vj} = 25°C	V_{GEth}	-	6.2	-	V
Gate charge	V_{GE} = -15 / 15 V	Q_G	-	0.15	-	µC
Input capacitance	f = 1 MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V	C_{ies}	-	1.29	-	nF
Reverse transfer capacitance		C_{res}	-	13.5	-	nF
Collector-emitter leakage current	V_{CE} = 1200 V, V_{GE} = 0 V, T_{vj} = 25°C	I_{CES}	-	-	1.0	mA
Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25°C	I_{GES}	-	-	500	nA
Turn-on delay time, inductive load	I_C =15A, V_{CE} = 600 V T_{vj} = 25°C V_{GE} = -15 / 15 V T_{vj} = 125°C R_G = 5.1Ω T_{vj} = 150°C	$t_{d(on)}$	-	10.2 10.5 10.6	-	ns
Rise time, inductive load	I_C =15A, V_{CE} = 600 V T_{vj} = 25°C V_{GE} = -15 / 15 V , T_{vj} = 125°C R_G = 5.1Ω T_{vj} = 150°C	t_r	-	21.0 21.5 22.4	-	ns
Turn-off delay time, inductive load	I_C =15A, V_{CE} = 600 V T_{vj} = 25°C V_{GE} = -15 / 15 V T_{vj} = 125°C R_G = 5.1Ω T_{vj} = 150°C	$t_{d(off)}$	-	152 176 191	-	ns
Fall time, inductive load	I_C =15A, V_{CE} = 600 V T_{vj} = 25°C V_{GE} = -15 / 15 V T_{vj} = 125°C R_G = 5.1Ω T_{vj} = 150°C	t_f	-	97 137 142	-	ns

Characteristic values

Turn-on energy loss per pulse	I_C =15A, V_{CE} = 600 V V_{GE} = -15 / 15 V R_G = 5.1Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{on}	-	0.90 1.50 1.70	-	mJ
Turn-off energy loss per pulse	I_C =15A, V_{CE} = 600 V V_{GE} = -15 / 15 V R_G = 5.1Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{off}	-	0.65 0.95 1.00	-	mJ
SC data	$V_{GE} \leq$ 15 V, V_{CC} = 800 V $t_P \leq$ 10 µs, T_{vj} = 25°C		I_{SC}	-	66	-	A
Thermal resistance, junction to case	per IGBT		R_{thJC}	-	-	1.14	K/W
Thermal resistance, case to heatsink	per IGBT		R_{thCH}	-	1.02	-	K/W
Temperature under switching conditions			$T_{vj\ op}$	-40	-	150	°C

Diode, Brake-Chopper
Maximum rated values

Parameter	Conditions	Symbol	Values	Unit
Repetitive peak reverse voltage	T_{vj} = 25°C	V_{RRM}	1200	V
Continuous DC forward current		I_F	10	A
Repetitive peak forward current	t_P = 1 ms	I_{FRM}	20	A

Characteristic values

Parameter	Conditions		Symbol	Values			Unit
				Min.	Typ.	Max.	
Forward voltage	I_F =10 A, V_{GE} = 0 V I_F =10 A, V_{GE} = 0 V I_F =10 A, V_{GE} = 0 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	V_F	-	1.60 1.35 1.25	-	V
Peak reverse recovery current	I_F = 10 A,V_R = 600 V V_{GE} = -15 V - d_{iF}/d_t = 750A/µs	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	I_{RR}	-	17.5 21.0 22.3	-	A
Recovered charge	I_F = 10 A,V_R = 600 V V_{GE} = -15 V - d_{iF}/d_t = 750A/µs	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	Q_{RR}	-	1.05 1.85 2.06	-	µC
Reverse recovery energy	I_F = 10 A,V_R = 600 V V_{GE} = -15 V - d_{iF}/d_t = 750A/µs	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{rec}	-	0.43 0.58 0.82	-	mJ
Thermal resistance, junction to case	per diode		R_{thJC}	-	1.20	1.40	K/W
Thermal resistance, case to heatsink	per diode		R_{thCH}	-	1.15	-	K/W
Temperature under switching conditions			$T_{vj\ op}$	-40		150	°C

Diode, Rectifier
Maximum rated values

Parameter	Conditions	Symbol	Values	Unit
Repetitive peak reverse voltage	T_{vj} = 25°C	V_{RRM}	1600	V
Maximum RMS current at rectifier output	T_c = 100°C	I_F	30	A
Surge forward current	t_p = 10 ms, T_{vj} = 25°C	I_{FSM}	300	A
I^2t - value	t_p = 10 ms, T_{vj} = 25°C	I^2t	450	A^2s

Characteristic values

Parameter	Conditions	Symbol	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	I_F =15 A, T_{vj} = 150°C	V_F	-	0.98	-	V
Reverse recovery energy	V_R = 1600 V, T_{vj} = 150°C	I_R	-	-	1.0	mA
Thermal resistance, junction to case	per diode	R_{thJC}	-	1.23	1.4	K/W
Thermal resistance, case to heatsink	per diode	R_{thCH}	-	1.10	-	K/W
Temperature under switching conditions		$T_{vj\ op}$	-40	-	150	°C

NTC, Thermistor
Characteristic values

Parameter	Conditions	Symbol	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	T_{NTC} = 25°C	R_{25}	-	5	-	kΩ
Deviation of R100	T_{NTC} = 100°C, R_{100} = 493 Ω	ΔR/R	-5	-	5	%
Power dissipation	T_{NTC} = 25°C	P_{25}	-	-	20	mW

Module characteristic values

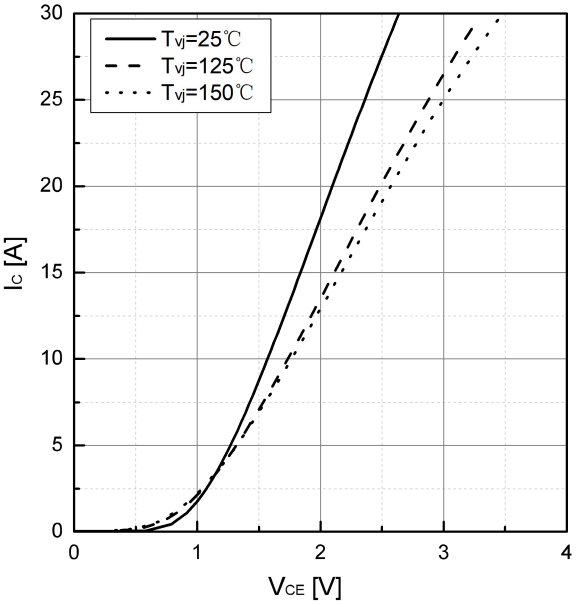
Parameter	Conditions	Symbol	Values	Unit
Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V_{ISOL}	2.5	kV
Internal isolation	basic insulation (class 1, IEC 61140)		Al_2O_3	
Creepage distance	terminal to heatsink terminal to terminal		11.5 6.3	mm
Clearance	terminal to heatsink terminal to terminal		10 5	mm
Comperative tracking index		CTI	＞200	

Parameter	Conditions	Symbol	Values	Unit
Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V_{ISOL}	2.5	kV
Internal isolation	basic insulation (class 1, IEC 61140)		Al_2O_3	
Creepage distance	terminal to heatsink terminal to terminal		11.5 6.3	mm
Clearance	terminal to heatsink terminal to terminal		10 5	mm
Comperative tracking index		CTI	＞200	

Output characteristic, IGBT

$I_C=f(V_{CE})$

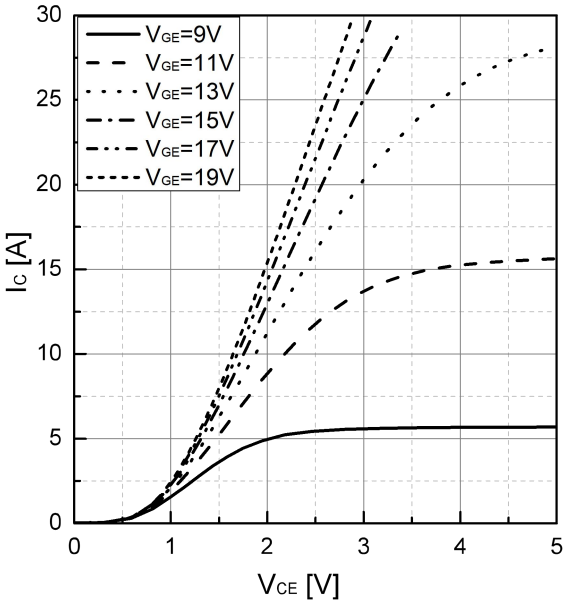
$V_{GE}=15V$



Output characteristic, IGBT

$I_C=f(V_{CE})$

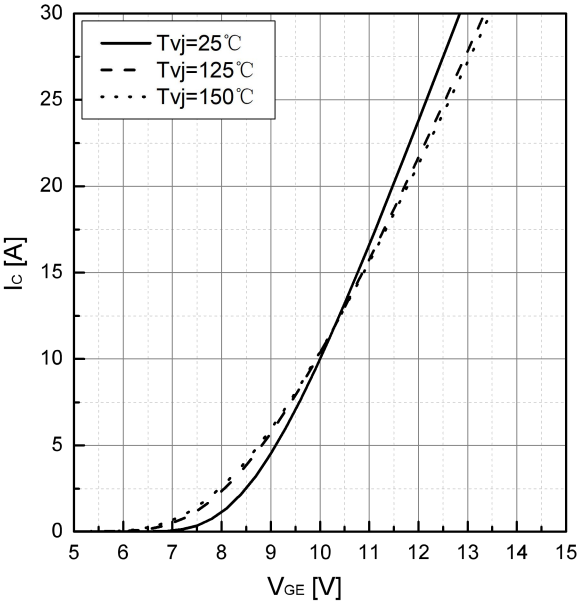
$T_{vj}=150℃$



Transfer characteristic, IGBT

$I_C=f(V_{CE})$

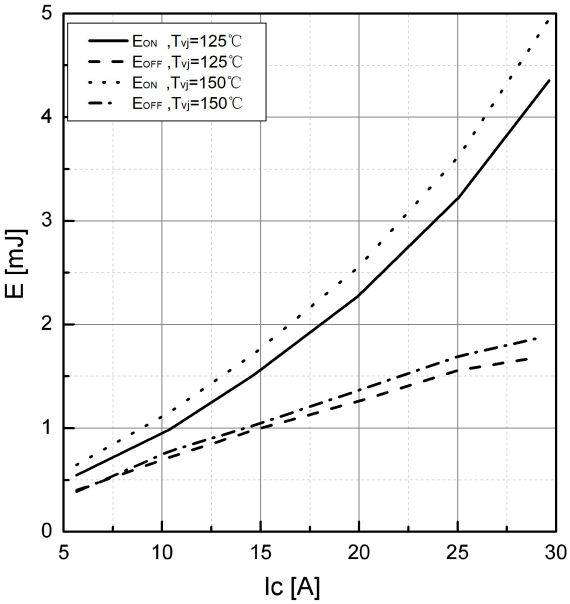
$V_{CE}=20V$



Switching losses vs. I_C, IGBT

$E_{on}=f(I_C)$,$E_{off}=f(I_C)$

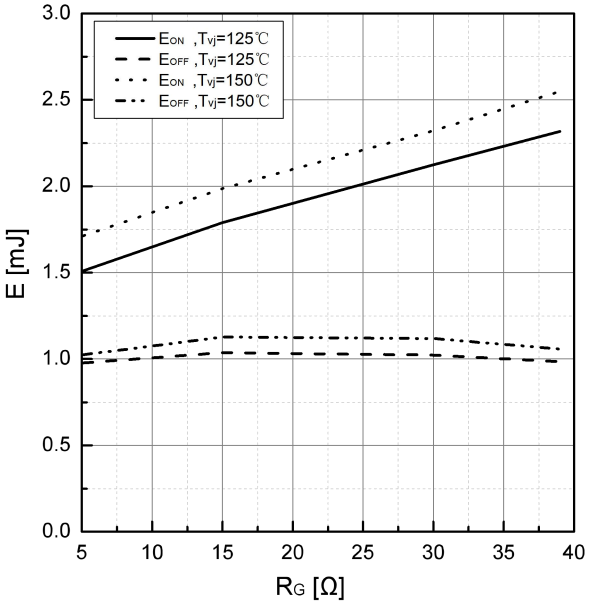
$V_{CE}=600V$, $V_{GE}=15/-15V$, $R_G=5.1\ \Omega$



Switching losses vs. R_G, IGBT

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

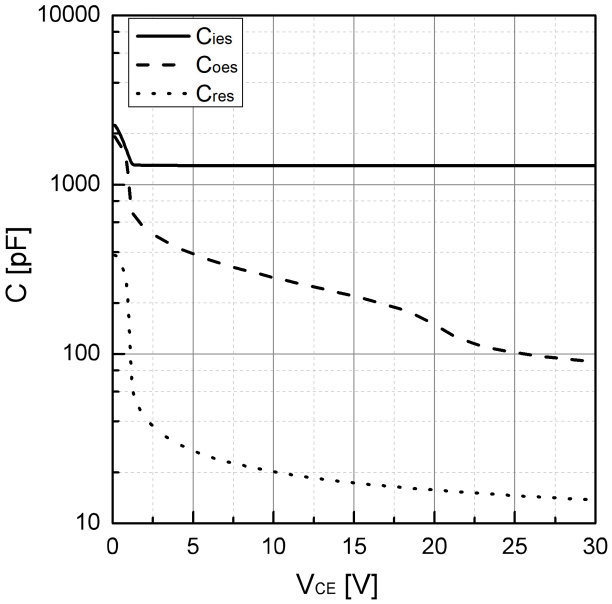
$V_{CE}=600V$, $V_{GE}=15/-15V$, $I_C=15A$



Capacity characteristic, IGBT

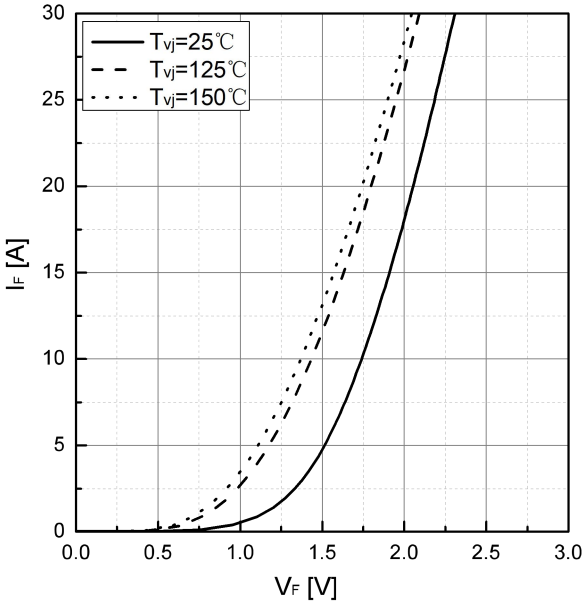
$C=f(V_{CE})$

$f=100KHz$, $V_{GE}=0V$, $T_{vj}=25℃$



Forward characteristic, Diode

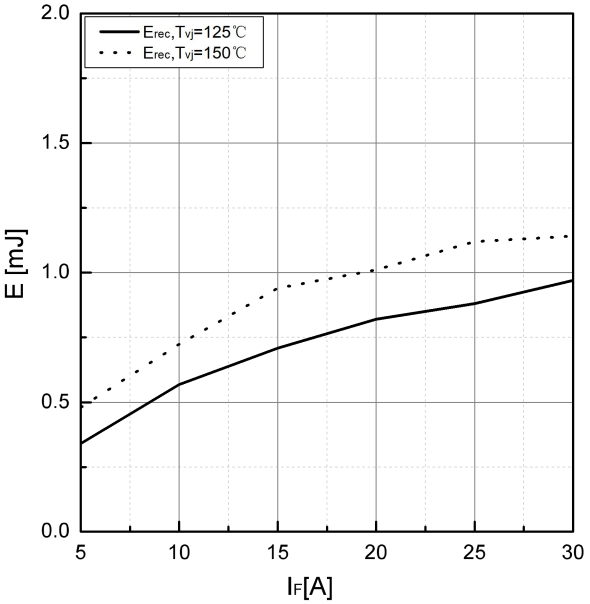
$I_F=f(V_F)$



Switching losses vs. I_F, Diode

$E_{rec}=f(I_F)$

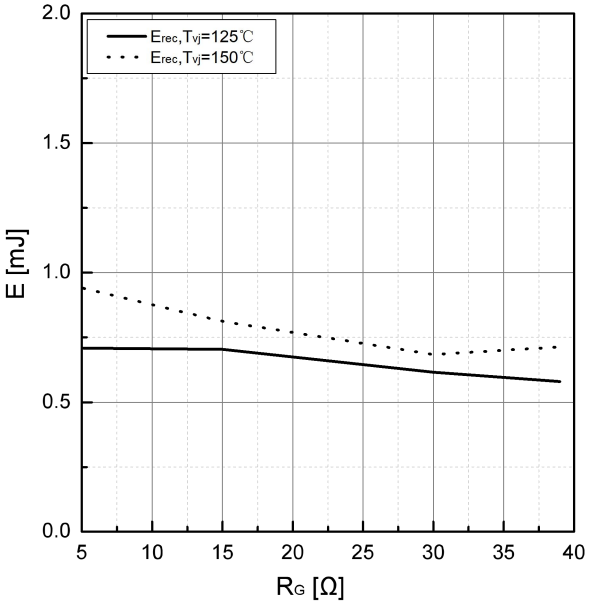
$V_R=600V$, $R_G=5.1\ \Omega$



Switching losses vs. R_G , Diode

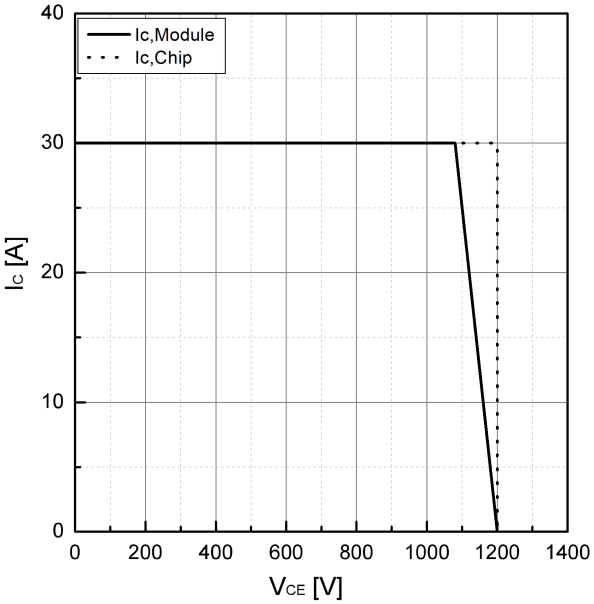
$E_{rec}=f(R_G)$

$V_R=600V$, $I_F=15A$

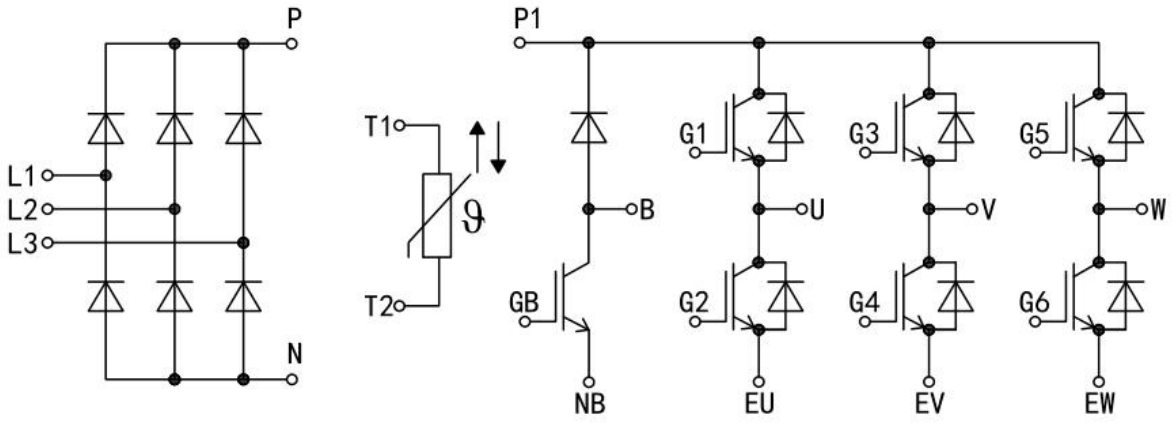


Reverse bias safe operating area (RBSOA)

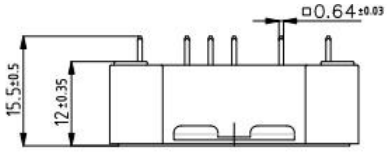
$V_{CE}=600V$, $V_{GE}=15/-15V$, $R_G=5.1\ \Omega$

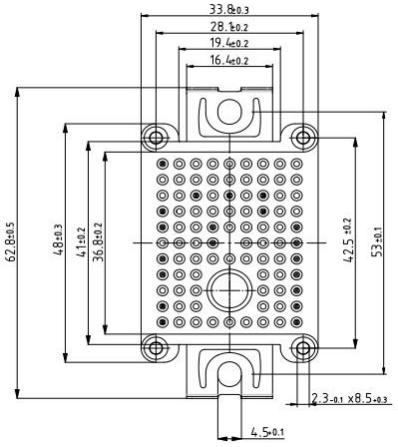


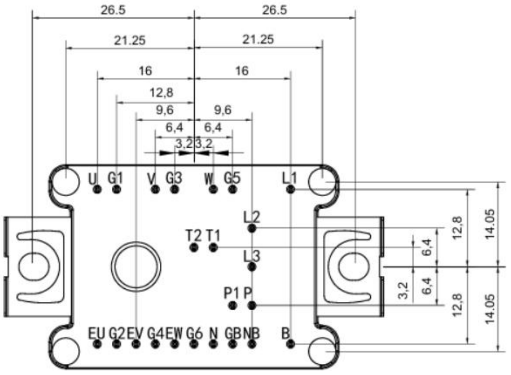
Circuit diagram



Package outlines (mm)







Revision history

Date	Revision	Changes
Sep 17, 2024	Rev 1.0	Release of the final datasheet.

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