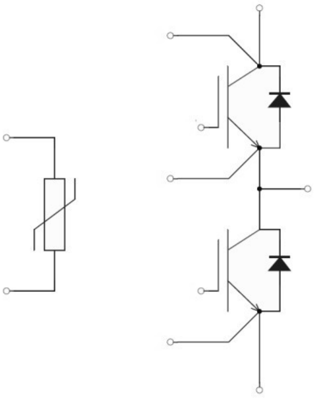
IGBT - Field Stop,Trench,Soft Fast Recovery Diode

1700V/600A

Features

- Electrical features
  - V_{CES}=1700V
  - $I_{C\ nom}$=600A / I_{CRM}=1200A
  - Low switching losses
  - Low inductance
  - Fast switching and short tail current
  - Integrated NTC temperature sensor
  - High power and thermal cycling capability
- Mechanical features
  - Integrated NTC temperature sensor
  - High power and thermal cycling capability
  - Al_2O_3 substrate with low thermal resistance
  - Copper base plate
- Potential Applications
  - Switching mode power supply
  - Drive inverters with brake system
  - Uninterruptible power supply
  - AC and DC servo drive amplifier



Device	Package	Shipping
SPM600V170D3HS	ED3	Tray

IGBT, Inverter

Maximum Rated Values

Parameter	Note or test condition	Symbol	Values	Unit
Collector-emitter voltage	T_{vj} = 25°C	V_{CES}	1700	V
Continuous DC collector current	T_C = 100°C, $T_{vj,\,max}$ = 150°C	$I_{C\,nom}$	600	A
Repetitive peak collector current	t_P = 1 ms	I_{CRM}	1200	A
Total power dissipation	T_C = 25°C, $T_{vj,\,max}$ = 175 °C	P_{tot}	1595	W
Gate-emitter peak voltage		V_{GES}	+/- 20	V

Characteristic value

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	I_C = 600 A, V_{GE} = 15 V	T_{vj} = 25°C	$V_{CE,sat}$		1.72		V
		T_{vj} = 125°C			2.12		V
		T_{vj} = 150°C			2.23		V
Gate threshold voltage	I_C = 3mA, V_{CE} = V_{GE}, T_{vj} = 25°C		$V_{GE,th}$	5.1	5.5	6.1	V
Gate charge	V_{GE} = -15 V ... +15 V		Q_G		4.5		µC
Internal gate resistor	T_{vj} = 25°C		R_{Gint}		3.60		Ω
Input capacitance	f=1MHz, T_{vj}=25°C, V_{CE}=25V, V_{GE}=0V		C_{ies}		68.9		nF
Reverse transfer capacitance	f=1MHz, T_{vj}=25°C, V_{CE}=25V, V_{GE}=0V		C_{res}		2.9		nF
Collector-emitter cut-off current	V_{CE} = 1700 V, V_{GE} = 0 V, T_{vj} = 25°C		I_{CES}			5	mA
Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25°C		I_{GES}			300	nA
Turn-on delay time, inductive load	I_C = 600A, V_{CE} = 900V	T_{vj} = 25°C	$t_{d,on}$		0.225		us
	V_{GE} = +15/-15V	T_{vj} = 125°C			0.240		us
	$R_{G,on}$ = 3.3Ω	T_{vj} = 150°C			0.245		us
Rise time, inductive load	I_C = 600A, V_{CE} = 900V	T_{vj} = 25°C	t_r		0.122		us
	V_{GE} = +15/-15V	T_{vj} = 125°C			0.144		us
	$R_{G,on}$ = 3.3Ω	T_{vj} = 150°C			0.152		us

(table continues...)

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Turn-off delay time, inductive load	I_C = 600A, V_{CE} = 900V	T_{vj} = 25°C	$t_{d,off}$		0.647		us
	V_{GE} = +15/-15V	T_{vj} = 125°C			0.730		us
	$R_{G,off}$ = 3.3Ω	T_{vj} = 150°C			0.743		us
Fall time, inductive load	I_C = 600A, V_{CE} = 900V	T_{vj} = 25°C	t_f		0.202		us
	V_{GE} = +15/-15V	T_{vj} = 125°C			0.193		us
	$R_{G,off}$ = 3.3Ω	T_{vj} = 150°C			0.193		us
Turn-on energy loss per pulse	I_C = 600A, V_{CE} = 900V, L_s=35nH	T_{vj} = 25°C	E_{on}		55		mJ
	V_{GE} = +15/-15V, di/dt =3100A/µs	T_{vj} = 125°C			114		mJ
	$R_{G,on}$ = 3.3Ω (T_{vj} = 150°C)	T_{vj} = 150°C			127		mJ
Turn-off energy loss per pulse	I_C = 600A, V_{CE} = 900V, L_s=35nH	T_{vj} = 25°C	E_{off}		131		mJ
	V_{GE} = +15/-15V, dv/dt =4500V/µs	T_{vj} = 125°C			157		mJ
	$R_{G,off}$ = 3.3Ω (T_{vj} = 150°C)	T_{vj} = 150°C			167		mJ
SC data	V_{GE} ≤15V, V_{CC} =900 V, t_P ≤ 8 µs, T_{vj} = 150°C , C_{GE} = 0.0uF , V_{CEmax} = V_{CES} -L_{sCE} ·di/dt		I_{SC}		3000		A
Thermal resistance, junction to case	Per IGBT		$R_{th,JC}$			0.055	K/W

Diode, Inverter

Maximum Rated Values

Parameter	Note or test condition	Symbol	Values	Unit
Repetitive peak reverse voltage	T_{vj} = 25°C	V_{RRM}	1700	V
Continuous DC forward current		I_F	600	A
Repetitive peak forward current	t_P = 1 ms	I_{FRM}	1200	A

Characteristic value

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Forward voltage	I_F = 600 A, V_{GE} = 0 V	T_{vj} = 25°C	V_F		2.07		V
		T_{vj} = 125°C			2.31		V
		T_{vj} = 150°C			2.35		V
Peak reverse recovery current	I_F = 600A, V_R = 900V	T_{vj} = 25°C	I_{RM}		636		A
	V_{GE} = -15V , - di_F/dt = 3100 A/µs	T_{vj} = 125°C			627		A
	(T_{vj}=150°C)	T_{vj} = 150°C			617		A
Recovered charge	I_F = 600A, V_R = 900V	T_{vj} = 25°C	Q_r		128		µC
	V_{GE} = -15V , - di_F/dt = 3100 A/µs	T_{vj} = 125°C			164		µC
	(T_{vj}=150°C)	T_{vj} = 150°C			173		µC
Reverse recovery energy	I_F = 600A, V_R = 900V	T_{vj} = 25°C	E_{rec}		86		mJ
	V_{GE} = -15V , - di_F/dt = 3100 A/µs	T_{vj} = 125°C			107		mJ
	(T_{vj}=150°C)	T_{vj} = 150°C			117		mJ
Thermal resistance, junction to case	Per diode		$R_{th,JC}$			0.1	K/W

NTC-Thermistor

Characteristic value

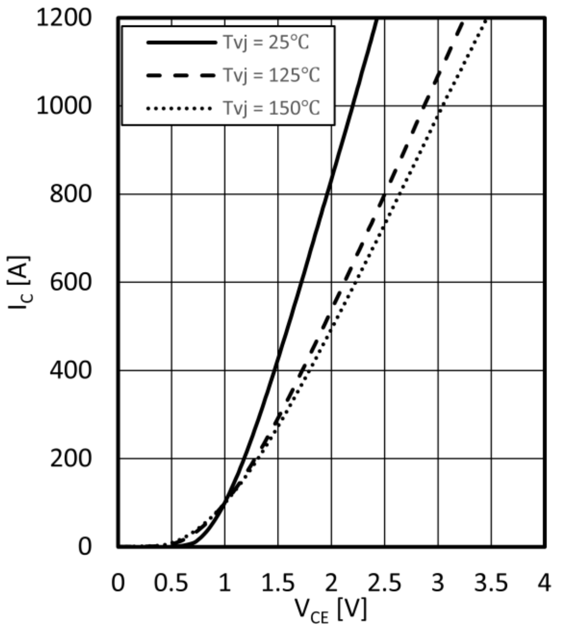
Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	Tc = 25°C	R_{25}		5.00		KΩ
Power dissipation	Tc = 25°C	P_{25}			20	mW
B-value B-Z	$R_2=R_{25}exp[B_{25/50}(1/T_2-1/(298, 15K))]$	B_{25}/B_{50}		3375		K
B-value B-Z	$R_2=R_{25}exp[B_{25/75}(1/T_2-1/(298, 15K))]$	B_{25}/B_{75}		3408		K
B-value B-Z	$R_2=R_{25}exp[B_{25/100}(1/T_2-1/(298, 15K))]$	B_{25}/B_{100}		3436		K

Module

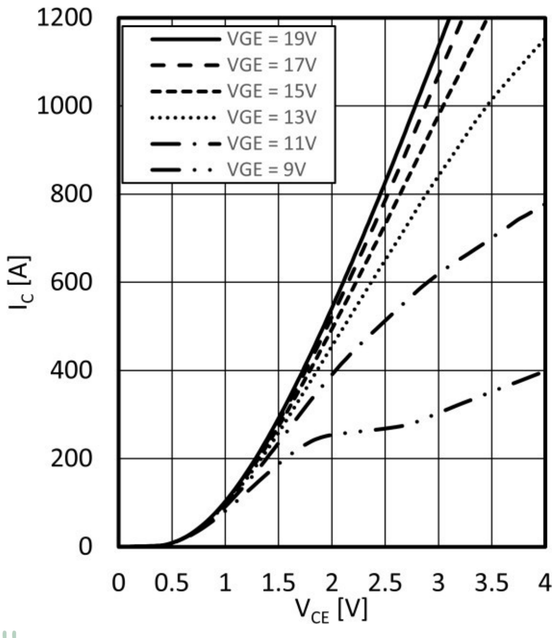
Characteristic value

Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Isolation Voltage	RMS, f=50HZ,1min	V_{ISOL}			3400	V
Stray inductance module		L_{sCE}		35		nH
Operation Junction Temperature		T_{jop}	-40		150	°C
Storage Temperature Range		T_{stg}	-40		125	°C
Mounting Torque	Screw M5	M	3		6	N.m
Weight of Module		G		350		g

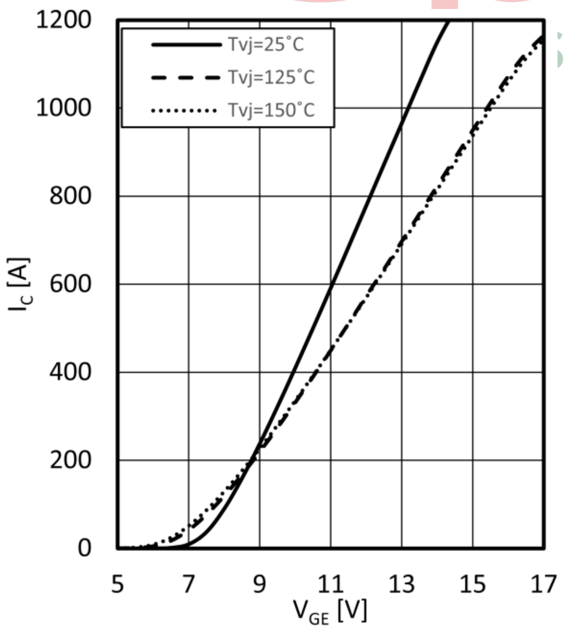
Characteristics diagrams



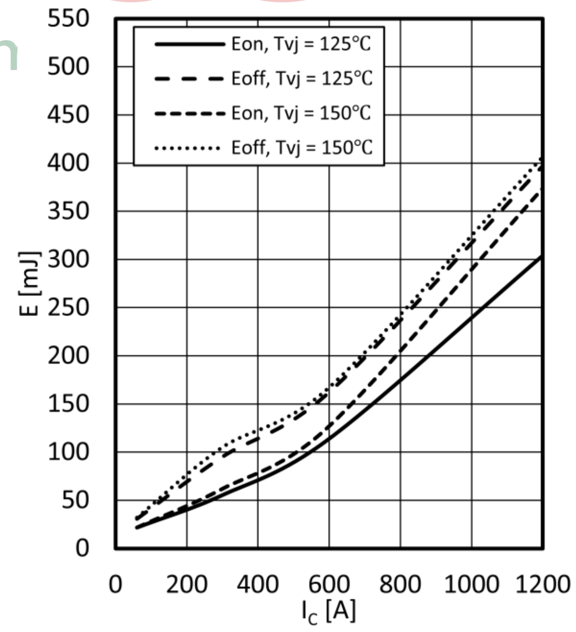
Output characteristic IGBT, Inverter (typical)
$I_C = f(V_{CE})$ $V_{GE} = 15V$



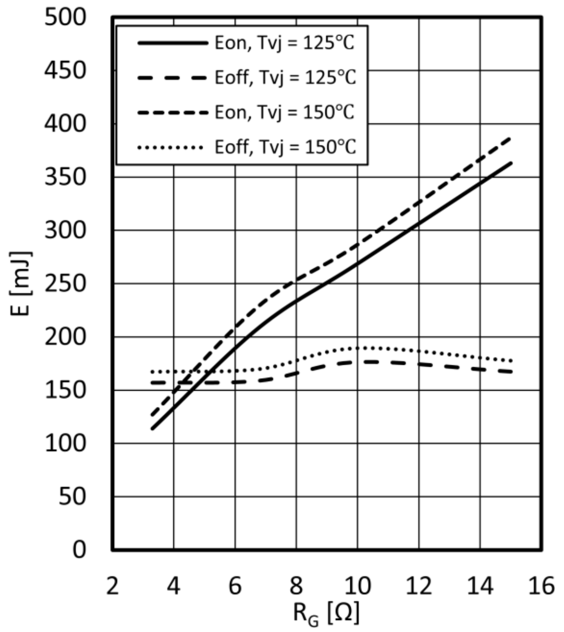
Output characteristic IGBT, Inverter (typical)
$I_C = f(V_{CE})$ $T_{vj} = 150°C$



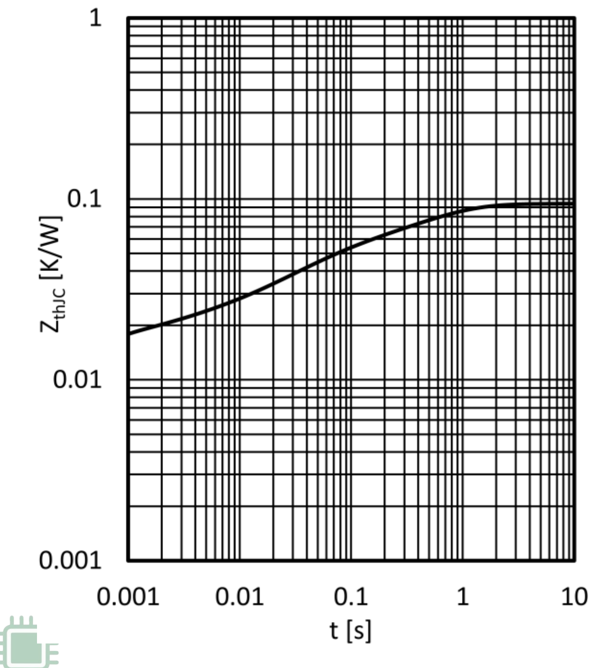
Transfer characteristic IGBT, Inverter (typical)
$I_C = f(V_{GE})$ $V_{CE} = 20V$



Switching losses IGBT, Inverter (typical)
$E_{on}=f(I_C)$, $E_{off} = f(I_C)$ $V_{GE} = ±15V$, $R_{Gon} = 3.3\ \Omega$ $R_{Goff} = 3.3\ \Omega$, $V_{CE} = 900V$

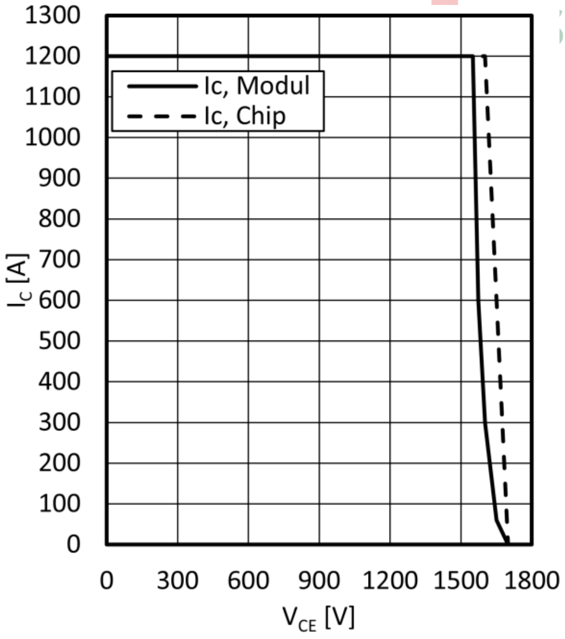


Switching losses IGBT, Inverter (typical)
E_{on} = f (R_G), E_{off} = f (R_G) V_{GE} = ±15V, I_C = 600A, V_{CE} = 900V

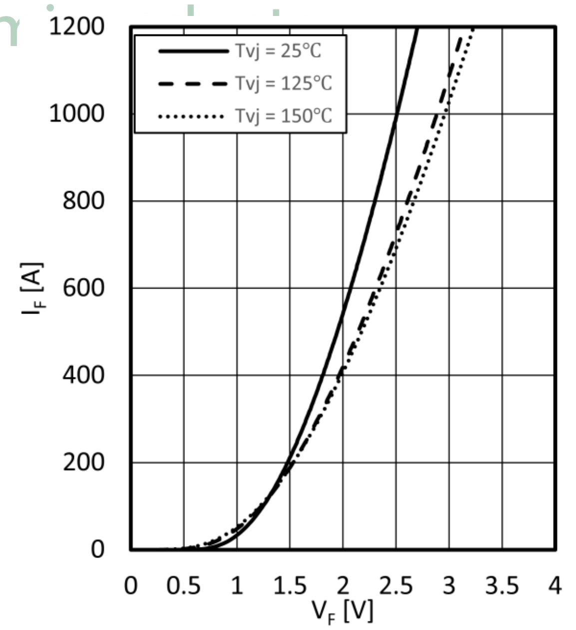


Transient thermal impedance IGBT, Inverter

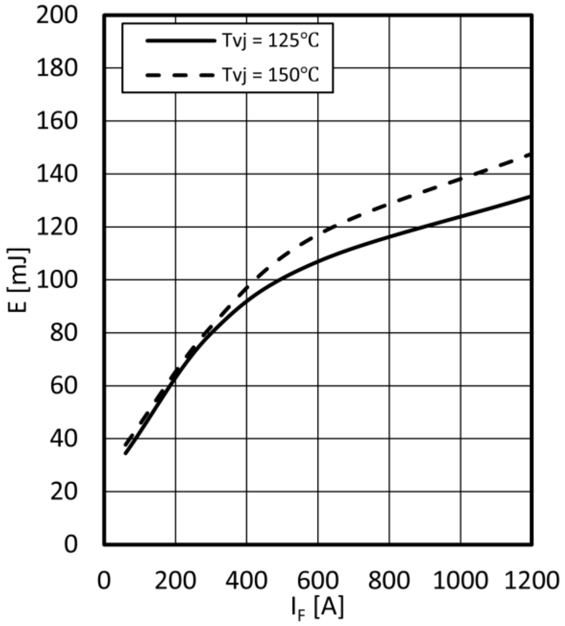
Z_{thJC} = f (t)



Reverse bias safe operating area IGBT, Inverter (RBSOA)
I_C = f (V_{CE}) V_{GE} = ±15V R_{Goff} = 3.3Ω, T_{vj} = 150°C

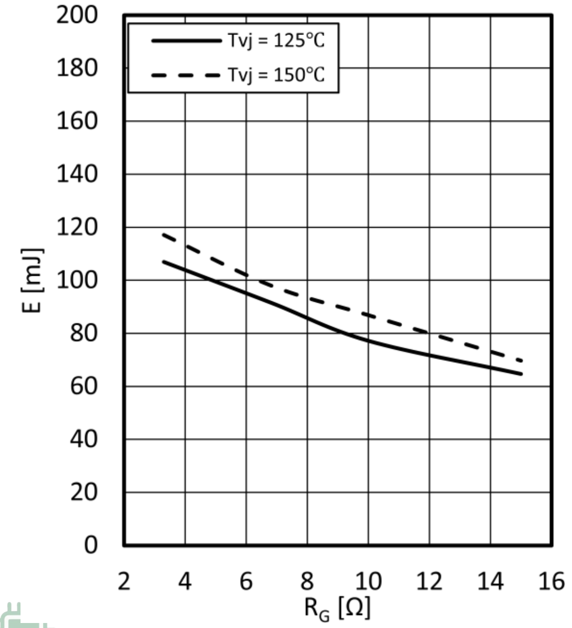


Forward characteristic of Diode, Inverter (typical)
I_F = f (V_F)



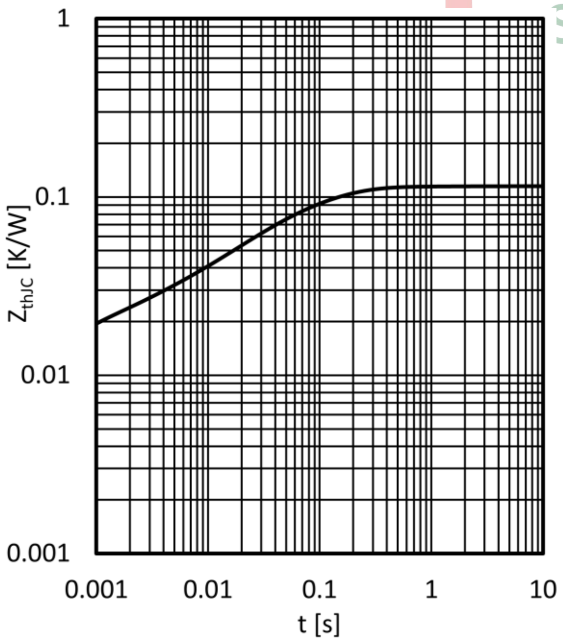
Switching losses Diode, Inverter (typical)

E_{rec} = f (I_F) R_{Gon} = 3.3 Ω, V_{CC} = 900V



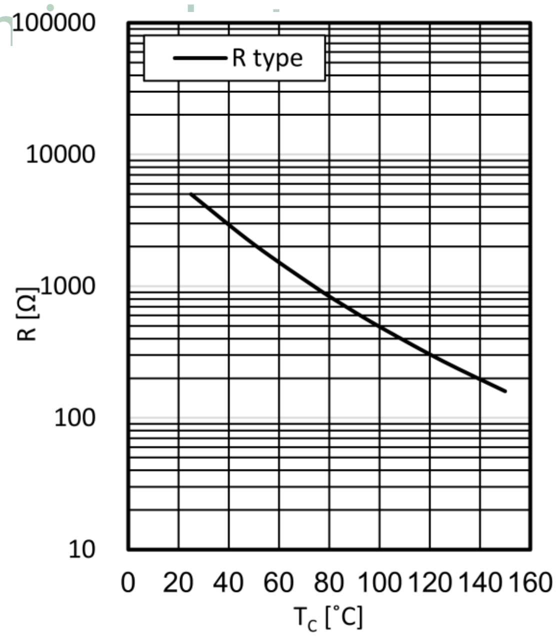
Switching losses Diode, Inverter (typical)

E_{rec} = f (R_G) I_F = 600 A, V_{CC} = 900V



Transient thermal impedance Diode Inverter

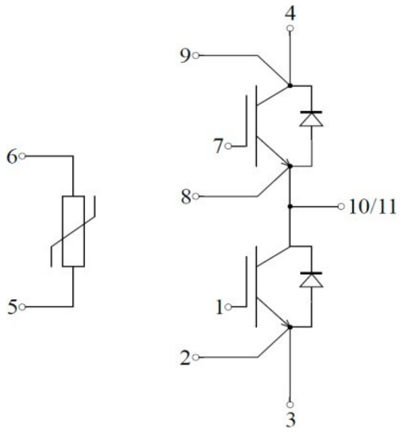
Z_{thJC} = f (t)



NTC-Thermistor-temperature characteristic (typical)

R=f(T)

Circuit Diagram



Package Outlines