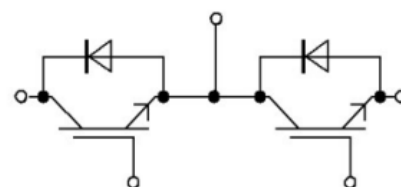


**C1 series package: 1200V 100A IGBT module****Datasheet**

Equivalent  
Circuit Schematic

**Features:**

- IGBT 1200V/100A
- Planar Field Stop Fast IGBT technology
- $V_{CE(sat)}$  with positive temperature coefficient
- High RBSOA capability
- Low turn-off losses

**Options:**

- Pre-applied TIM  
(option +M01)

**Typical Applications:**

- Inductive Heating
- Welding
- High Frequency Switching Application

## IGBT, Inverter / IGBT

### Maximum Rated Values

Collector-emitter Voltage	$T_{vj} = 25^{\circ}\text{C}$	$V_{CES}$	1200	V
Continuous DC Collector Current		$I_{Cnom}$	100	A
	$T_C = 80^{\circ}\text{C}, T_{vj\ max} = 150^{\circ}\text{C}$	$I_C$	107	A
Repetitive Peak Collector Current	$I_{CRM} = 2 \times I_{Cnom}$	$I_{CRM}$	200	A
Total Power Dissipation	$T_C = 25^{\circ}\text{C}, T_{vj\ max} = 150^{\circ}\text{C}$	$P_{tot}$	565	W
Gate-emitter Peak Voltage		$V_{GES}$	$\pm 20$	V

### Characteristic Values

			min.	typ.	max.	
Collector-emitter Saturation Voltage <sup>1)</sup>	$I_C = 100\text{A}, V_{GE} = 15\text{V}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CESat}$		2.50 3.00 3.10	3.00	V
Gate Threshold Voltage	$V_{CE} = V_{GE}, I_C = 1\text{mA}, T_{vj} = 25^{\circ}\text{C}$	$V_{GEth}$	5.0	6.0	7.0	V
Gate Charge	$V_{GE} = -8\text{V}/15\text{V}, V_{CE} = 600\text{V}, T_{vj} = 25^{\circ}\text{C}$	$Q_G$	—	0.30	—	$\mu\text{C}$
Internal Gate Resistor	$T_{vj} = 25^{\circ}\text{C}$	$R_{Gint}$	—	8	—	$\Omega$
Input Capacitance	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$ $f = 100\text{kHz}, T_{vj} = 25^{\circ}\text{C}$	$C_{ies}$	—	4.35	—	nF
Reverse Transfer Capacitance		$C_{res}$	—	0.17	—	nF
Collector-emitter Cutoff Current	$V_{CE} = 1200\text{V}, V_{GE} = 0\text{V}, T_{vj} = 25^{\circ}\text{C}$	$I_{CES}$	—	—	1	$\mu\text{A}$
Gate-emitter Leakage Current	$V_{CE} = 0\text{V}, V_{GE} = \pm 20\text{V}, T_{vj} = 25^{\circ}\text{C}$	$I_{GES}$	—	—	$\pm 200$	nA
Turn-on Delay Time, Inductive Load	$I_C = 100\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{gon} = 4.7\Omega$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{don}$	—	60 61 64	—	ns
Rise Time, Inductive Load	$I_C = 100\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{gon} = 4.7\Omega$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_r$	—	45 51 53	—	ns
Turn-off Delay Time, Inductive Load	$I_C = 100\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Goff} = 4.7\Omega$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{doff}$	—	197 231 246	—	ns
Fall Time, Inductive Load	$I_C = 100\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Goff} = 4.7\Omega$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_f$	—	18 24 28	—	ns
Turn-on Energy Loss per Pulse	$I_C = 100\text{A}, V_{CE} = 600\text{V},$ $L_{\sigma} = 80\text{nH}, V_{GE} = \pm 15\text{V},$ $R_{Gon} = 4.7\Omega$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{on}$	—	8.9 12.9 13.7	—	mJ
Turn-off energy Loss per Pulse	$I_C = 100\text{A}, V_{CE} = 600\text{V},$ $L_{\sigma} = 80\text{nH}, V_{GE} = \pm 15\text{V}$ $R_{Goff} = 4.7\Omega$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{off}$	—	2.5 3.9 5.0	—	mJ

1) Terminal impedance is not included.

Thermal Resistance, Junction to Case	Per IGBT / IGBT	R <sub>thJC</sub>	—	0.22	—	K/W
Temperature under Switching Conditions		T <sub>vj op</sub>	-40		150	°C

## Diode, Inverter Maximum Rated Values

Repetitive Peak Reverse Voltage	T <sub>vj</sub> = 25°C	V <sub>RRM</sub>		1200		V
Continuous DC Forward Current		I <sub>F</sub>		100		A
Repetitive Peak Forward Current	I <sub>CRM</sub> = 2 x I <sub>fnom</sub>	I <sub>FRM</sub>		200		A

## Characteristic Values

				min.	typ.	max.	
Forward Voltage	I <sub>F</sub> = 100A, V <sub>GE</sub> = 0V T <sub>vj</sub> = 25°C T <sub>vj</sub> = 125°C T <sub>vj</sub> = 150°C	V <sub>F</sub>			2.38 2.50 2.47	2.90	V
Peak Reverse Recovery Current	I <sub>F</sub> = 100A, V <sub>R</sub> = 600V -di <sub>F</sub> /dt = 21700A/usn (T <sub>vj</sub> = 150°C) V <sub>GE</sub> = -15V T <sub>vj</sub> = 25°C T <sub>vj</sub> = 125°C T <sub>vj</sub> = 150°C	I <sub>RM</sub>	—		55 55 55	—	A
Recovery Charge	I <sub>F</sub> = 100A, V <sub>R</sub> = 600V -di <sub>F</sub> /dt = 1700A/usn (T <sub>vj</sub> = 150°C) V <sub>GE</sub> = -15V T <sub>vj</sub> = 25°C T <sub>vj</sub> = 125°C T <sub>vj</sub> = 150°C	Q <sub>R</sub>	—		3.50 7.50 9.00	—	µC
Reverse Recovery Energy	I <sub>F</sub> = 100A, V <sub>R</sub> = 600V -di <sub>F</sub> /dt = 1700A/usn (T <sub>vj</sub> = 150°C) V <sub>GE</sub> = -15V T <sub>vj</sub> = 25°C T <sub>vj</sub> = 125°C T <sub>vj</sub> = 150°C	E <sub>rec</sub>	—		2.50 4.20 4.80	—	mJ
Thermal Resistance, Junction to Case	Per Doide / Diode	R <sub>thJC</sub>	—		0.50	—	K/W
Temperature under Switching Conditions		T <sub>vj op</sub>	-40	—		150	°C

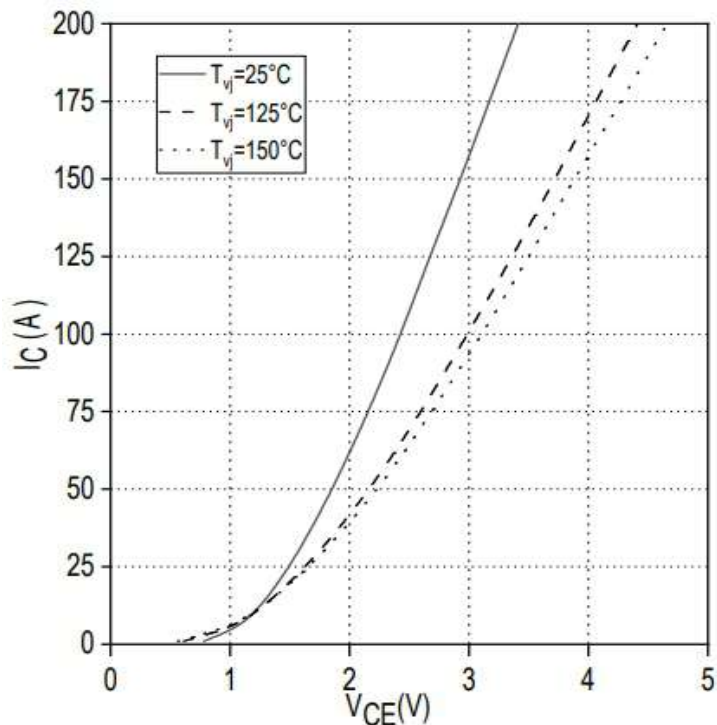
## Module

Isolation Test Voltage	RMS, f = 50Hz, t = 1min	V <sub>ISOL</sub>		3.0		kV
Material of Module Baseplate				Cu		
Internal Isolation	(class 1, IEC 61140) Basic insulation (class 1, IEC 61140)			AL <sub>2</sub> O <sub>3</sub>		
Creepage Distance	Terminal to heatsink Terminal to terminal			17.0 20.0		mm
Clearance	Terminal to heatsink Terminal to terminal			17.0 9.5		mm
Comparative Tracking Index		CTI		>200		

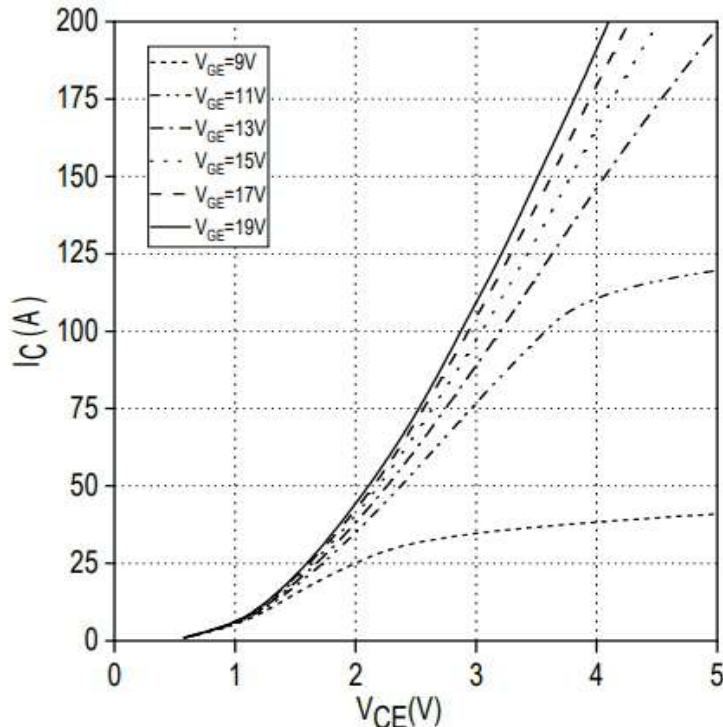
				min.	typ.	max.
Thermal resistance, case to heatsink	per module $\lambda_{\text{Paste}} = 1\text{W}/(\text{m}\cdot\text{K})/\lambda_{\text{grease}} = 1\text{W}/(\text{m}\cdot\text{K})$	$R_{\text{thCH}}$		0.05		K/W
Stray Inductance Module		$L_{\text{sCE}}$	—	30	—	nH
Module Lead Resistance, Terminals-Chip	$T_C = 25^\circ\text{C}$ , Per Switch	$R_{\text{CC}'+\text{EE}'}$	—	0.65	—	mΩ
Storage Temperature		$T_{\text{stg}}$	-40	—	125	°C
Modul MountingTorque	M5	M	4.0	—	6.0	Nm
Terminal MountingTorque	M6	M	3.0	—	6.0	Nm
Weight		G	—	145	—	g

## Circuit Diagram

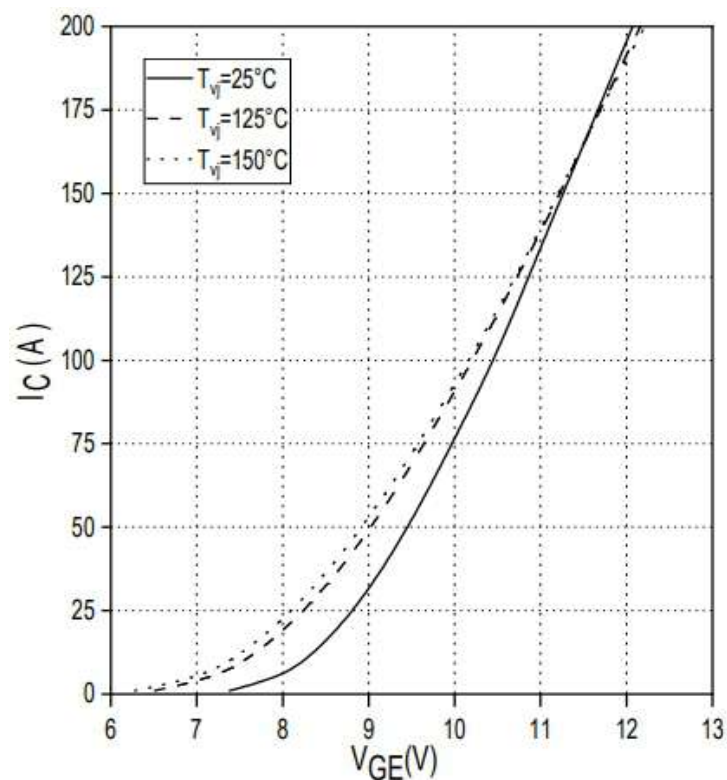
Output characteristic IGBT, Inverter (typical), IGBT  
 $I_c = f(V_{CE})$ ,  $V_{GE} = 15V$



Output characteristic IGBT, Inverter (typical), IGBT  
 $I_c = f(V_{CE})$ ,  $T_{vj} = 150^{\circ}C$



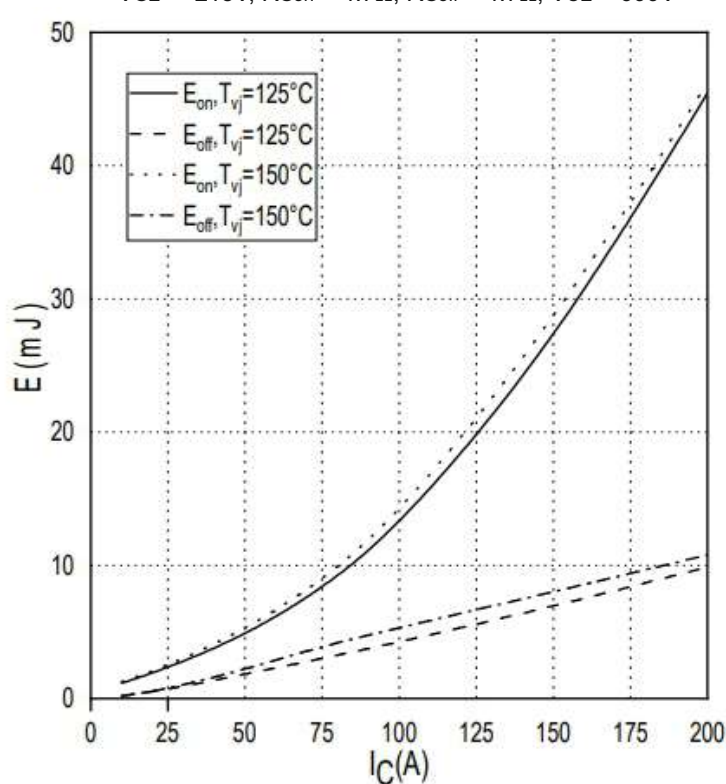
Transfer characteristic IGBT, Inverter (typical), IGBT  
 $I_c = f(V_{GE})$ ,  $V_{CE} = 20V$



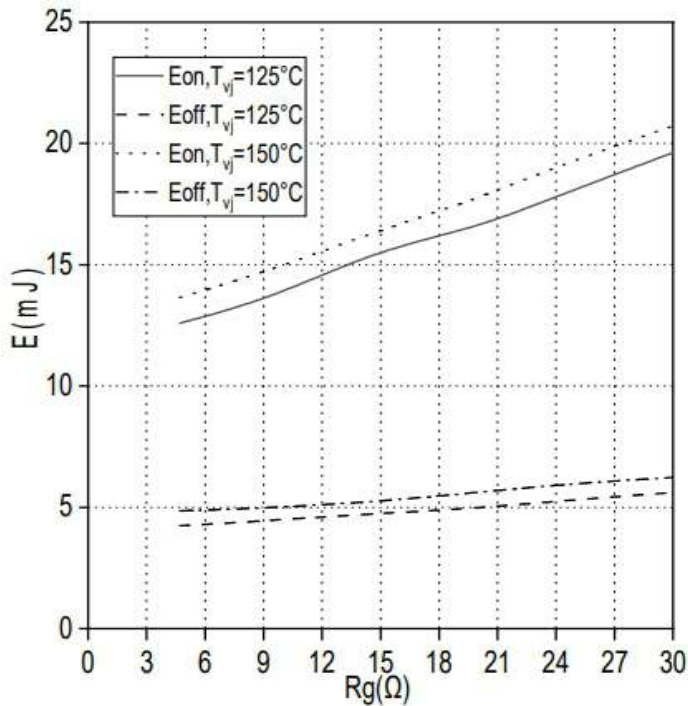
Switching losses IGBT, Inverter (Typical), IGBT

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

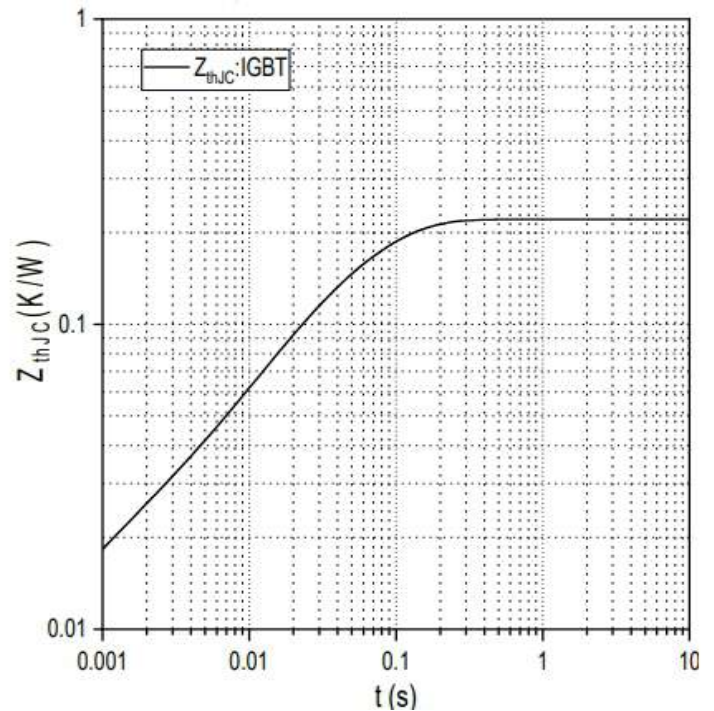
$V_{GE} = \pm 15V$ ,  $R_{Gon} = 4.7\Omega$ ,  $R_{Goff} = 4.7\Omega$ ,  $V_{CE} = 600V$



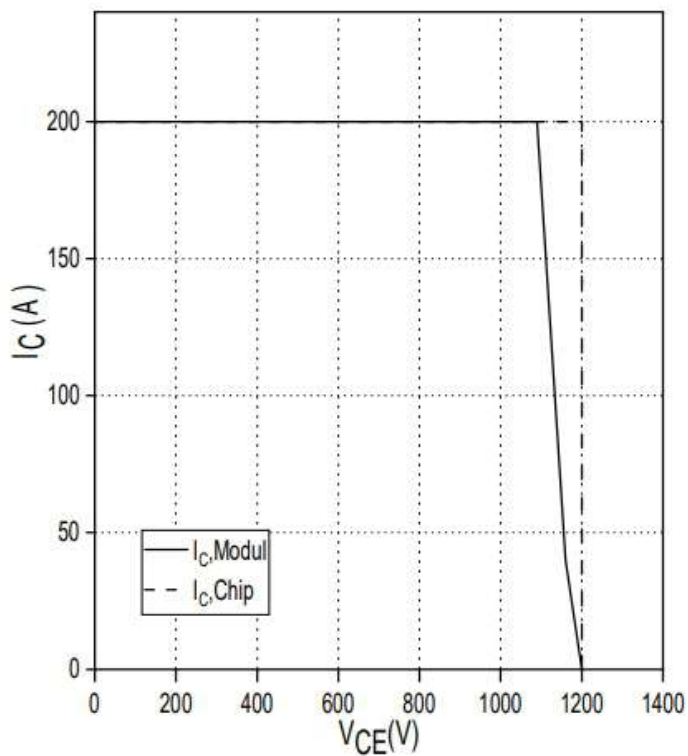
Switching losses IGBT, Inverter (typical), IGBT  
 $V_{GE} = \pm 15V$ ,  $I_C = 100A$ ,  $V_{CE} = 600V$



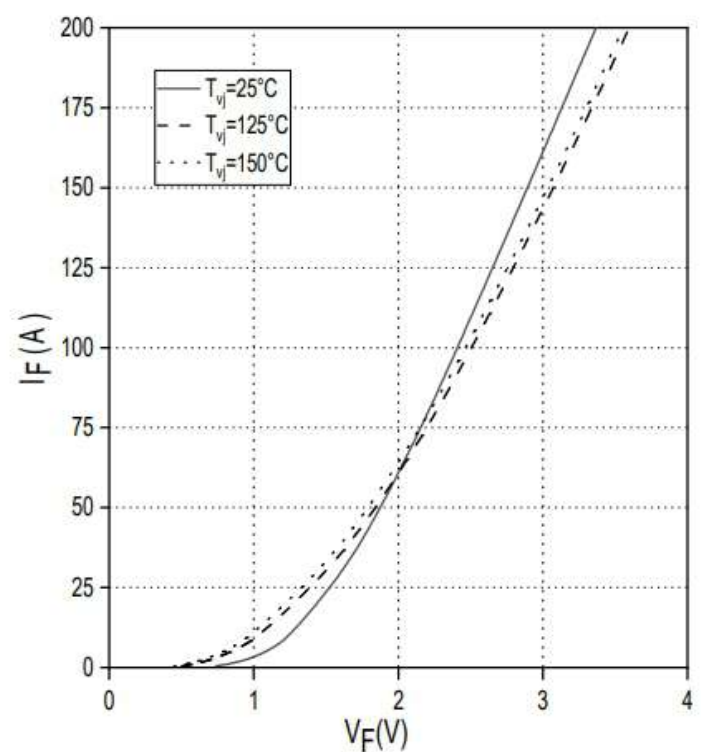
Transient thermal impedance IGBT, Inverter  
 $Z_{thJC} = f(t)$



Reverse bias safe operating area IGBT, Inverter  
 (RBSOA)  $I_C = f(V_{CE})$ ,  
 $V_{GE} = \pm 15V$ ,  $R_{Goff} = 15\Omega$ ,  $T_{vj} = 150^\circ C$



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

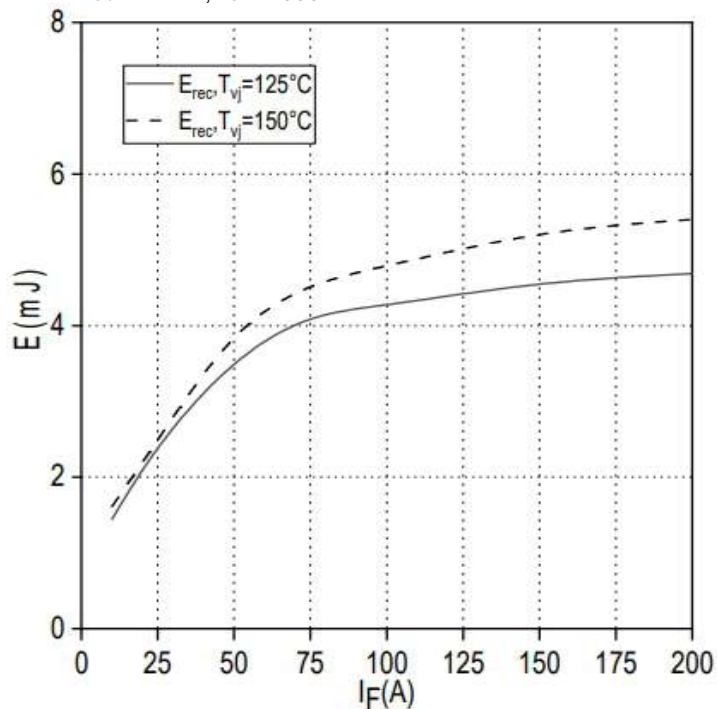




Switching losses Diode, Inverter (typical)

$$E_{rec} = f(I_F)$$

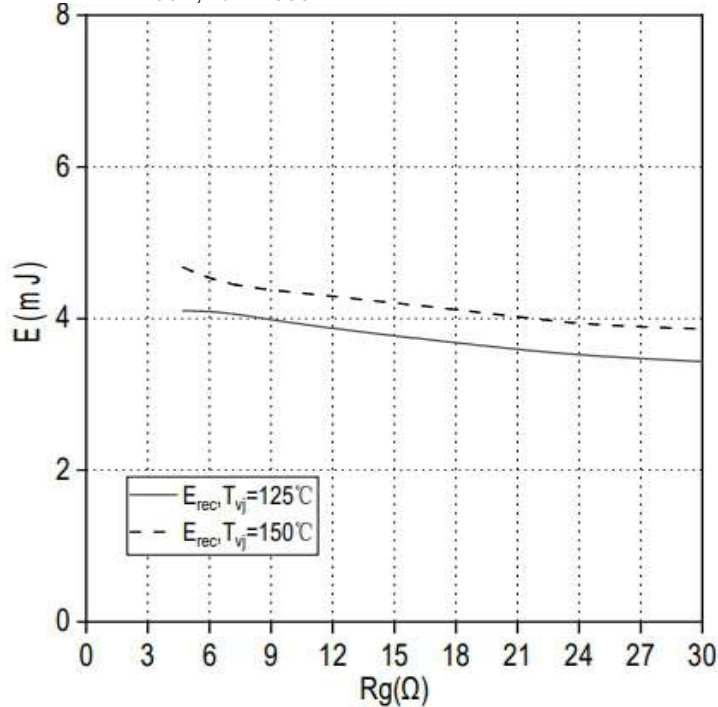
$$R_{Gon} = 4.7\Omega, V_{CE} = 600V$$



Switching losses Diode, Inverter (typical)

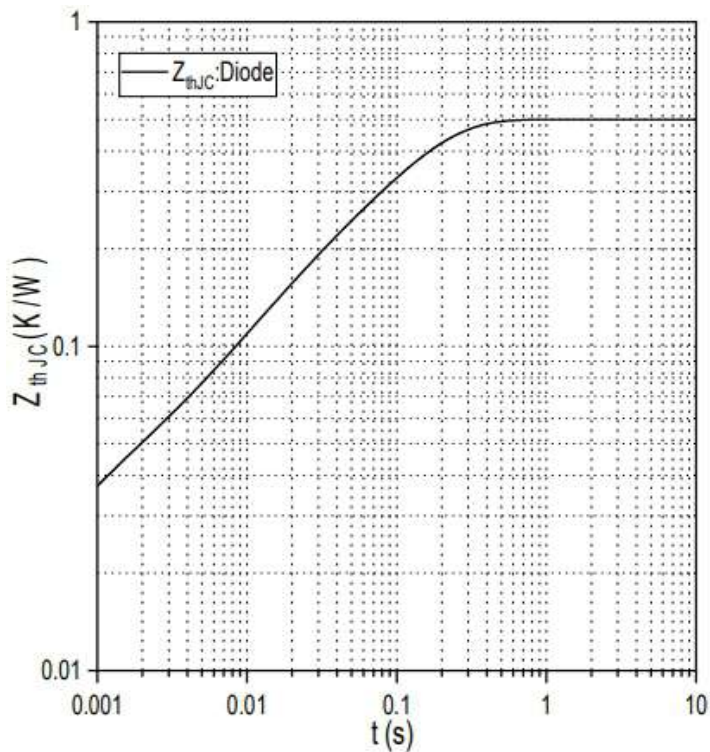
$$E_{rec} = f(R_G)$$

$$I_F = 100A, V_{CE} = 600V$$



Transient thermal impedance Diode, Inverter

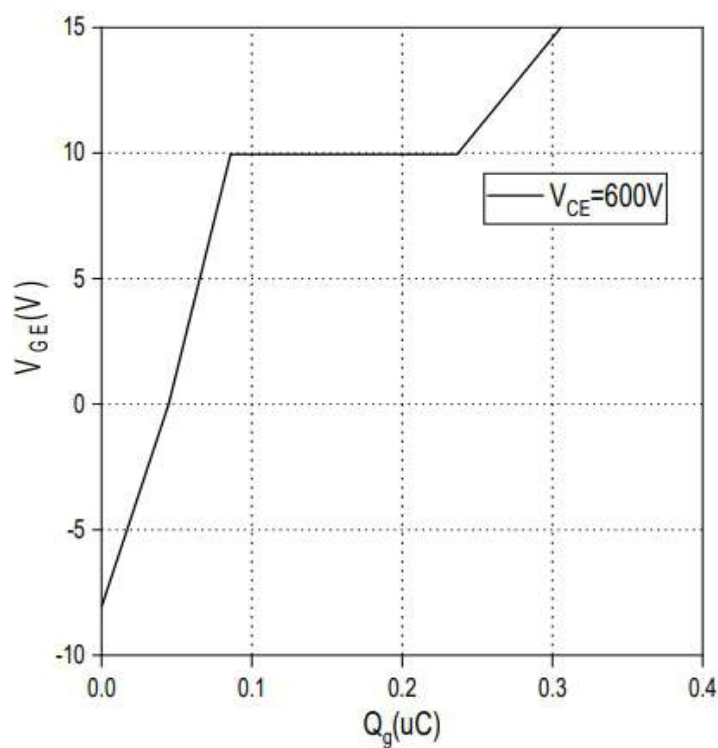
$$Z_{thJC} = f(t)$$



Gate charge characteristic, IGBT, Inverter (typical)

$$V_{GE} = f(Q_g)$$

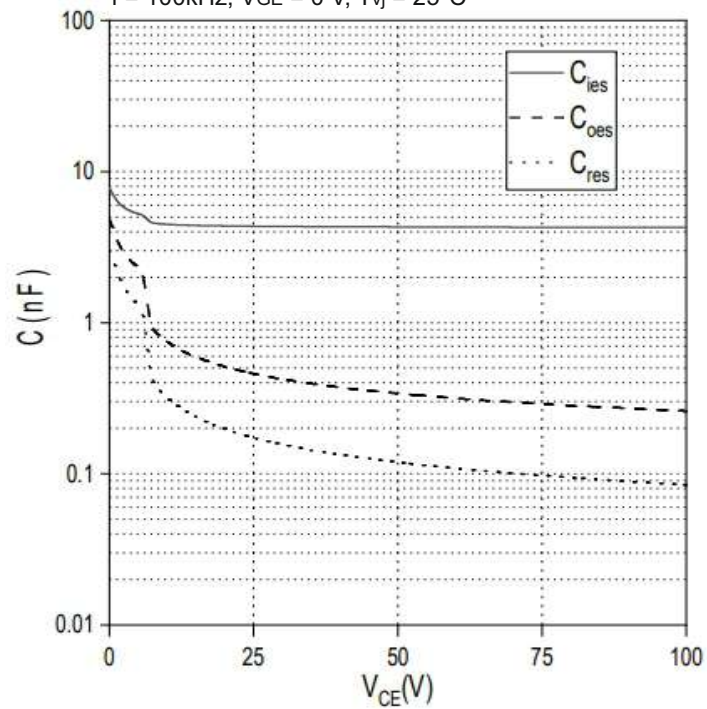
$$I_C = 100A, T_{vj} = 25^{\circ}C$$



Capacity characteristic, IGBT, Inverter (typical)

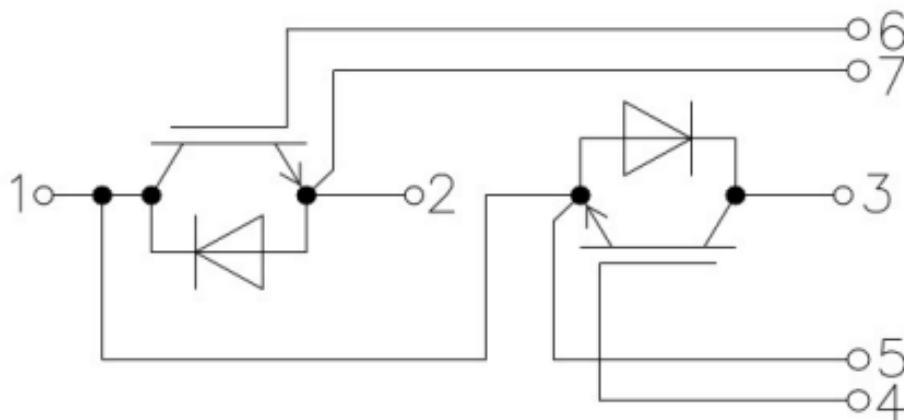
$C = f(V_{CE})$

$f = 100\text{kHz}$ ,  $V_{GE} = 0\text{ V}$ ,  $T_{vj} = 25^\circ\text{C}$

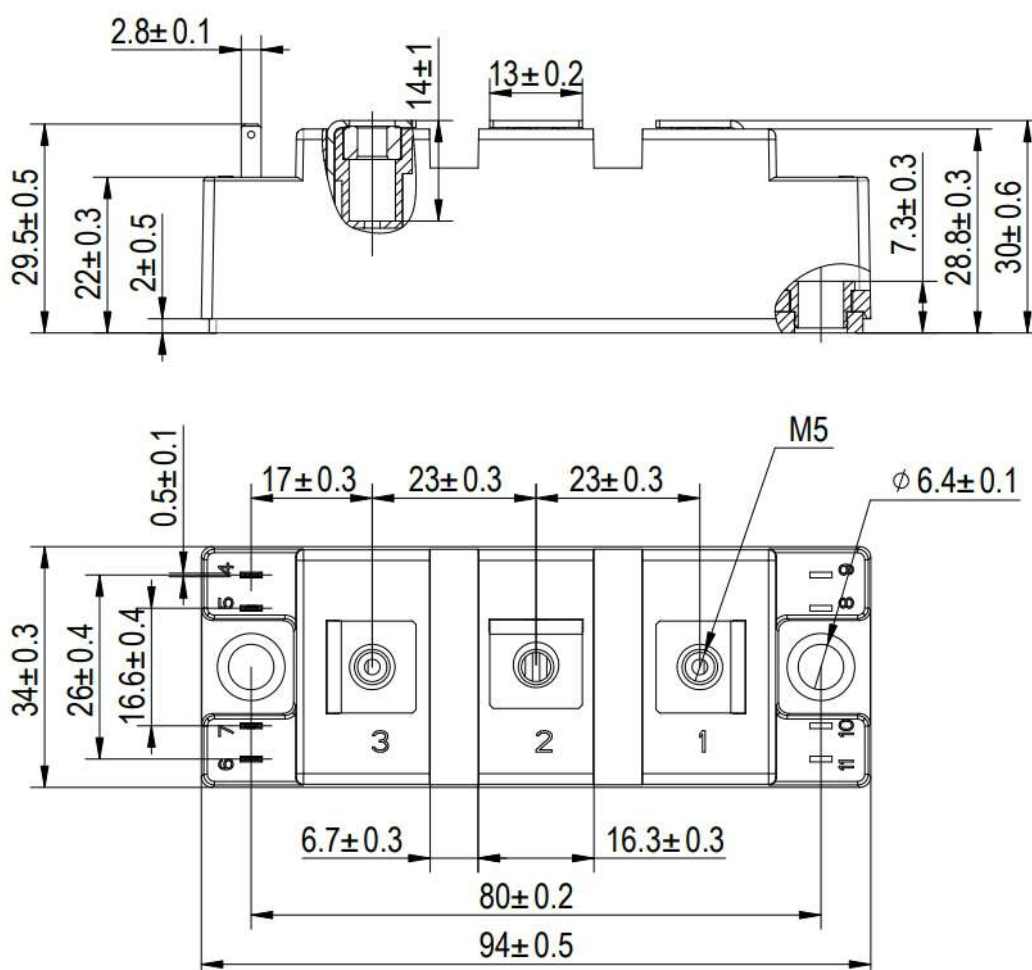




## Internal Circuit



## Package Dimension Dimensions in Millimeters



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