

## EasyPACK™ module with TRENCHSTOP™ 5 and Emitter Controlled 3 diode and PressFIT / NTC

### Features

- Electrical features
  - $V_{CES} = 650\text{ V}$
  - $I_{C\text{nom}} = 100\text{ A} / I_{CRM} = 200\text{ A}$
  - Low switching losses
- Mechanical features
  - $\text{Al}_2\text{O}_3$  substrate with low thermal resistance
  - Integrated NTC temperature sensor
  - PressFIT contact technology



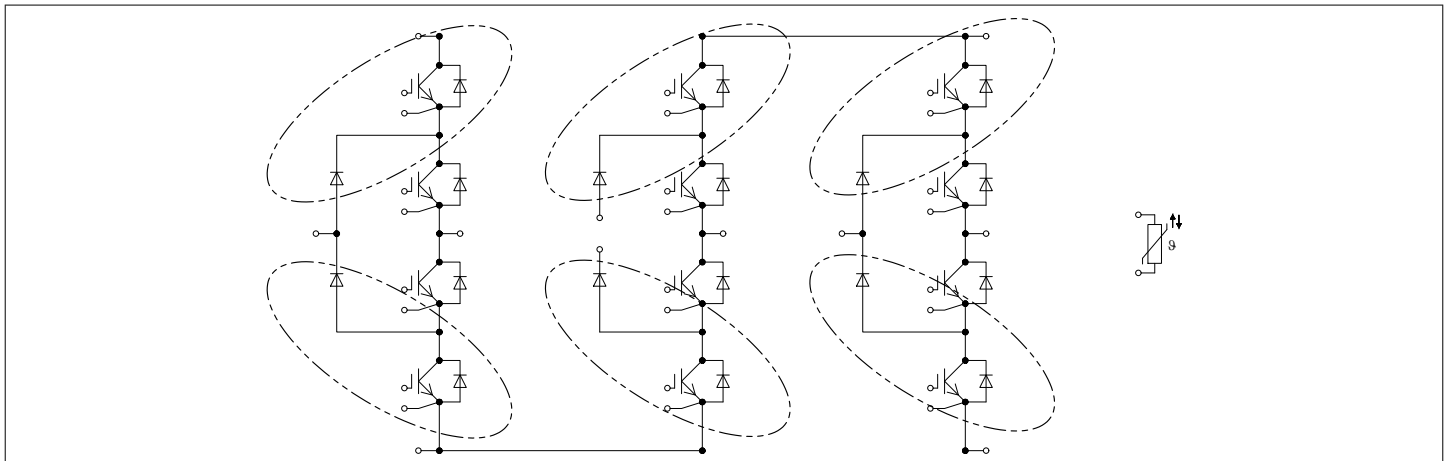
### Potential applications

- Solar applications
- 3-level-applications

### Product validation

- Qualified for industrial applications according to the relevant tests of IEC 60747, 60749 and 60068

### Description



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## 1 Package

**Table 1** Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	$V_{ISOL}$	RMS, $f = 50 \text{ Hz}$ , $t = 1 \text{ min}$	3.0	kV
Internal Isolation		basic insulation (class 1, IEC 61140)	$Al_2O_3$	
Creepage distance	$d_{Creep}$	terminal to heatsink	9.6	mm
Creepage distance	$d_{Creep}$	terminal to terminal	6.8	mm
Clearance	$d_{Clear}$	terminal to heatsink	9.4	mm
Clearance	$d_{Clear}$	terminal to terminal	5.5	mm
Comparative tracking index	$CTI$		> 400	
RTI Elec.	$RTI$	housing	140	°C

**Table 2** Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Stray inductance module	$L_{SCE}$			28		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	$T_H = 25^\circ\text{C}$ , per switch		1.6		mΩ
Storage temperature	$T_{stg}$		-40		125	°C
Mounting torque for modul mounting	$M$	- Mounting according to valid application note	M5, Screw	1.3	1.5	Nm
Weight	$G$			78		g

Note: The current under continuous operation is limited to 25 A rms per connector pin.

## 2 IGBT,3-Level

**Table 3** Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Collector-emitter voltage	$V_{CES}$	$T_{vj} = 25^\circ\text{C}$	650	V
Implemented collector current	$I_{CN}$		100	A
Continuous DC collector current	$I_{CDC}$	$T_{vj \max} = 175^\circ\text{C}$ $T_H = 65^\circ\text{C}$	70	A
Repetitive peak collector current	$I_{CRM}$	$t_p = 1 \text{ ms}$	200	A
Gate-emitter peak voltage	$V_{GES}$		±20	V

**Table 4 Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE\ sat}$	$I_C = 50\ A, V_{GE} = 15\ V$	$T_{vj} = 25\ ^\circ C$	1.17	1.38	V
			$T_{vj} = 125\ ^\circ C$	1.20		
			$T_{vj} = 150\ ^\circ C$	1.21		
Gate threshold voltage	$V_{GEth}$	$I_C = 1\ mA, V_{CE} = V_{GE}, T_{vj} = 25\ ^\circ C$	3.25	4	4.75	V
Gate charge	$Q_G$	$V_{GE} = \pm 15\ V, V_{CE} = 400\ V$		0.42		$\mu C$
Internal gate resistor	$R_{Gint}$	$T_{vj} = 25\ ^\circ C$		0		$\Omega$
Input capacitance	$C_{ies}$	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$		7.1		nF
Reverse transfer capacitance	$C_{res}$	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$		0.025		nF
Collector-emitter cut-off current	$I_{CES}$	$V_{CE} = 650\ V, V_{GE} = 0\ V$	$T_{vj} = 25\ ^\circ C$		0.007	mA
Gate-emitter leakage current	$I_{GES}$	$V_{CE} = 0\ V, V_{GE} = 20\ V, T_{vj} = 25\ ^\circ C$			100	nA
Turn-on delay time (inductive load)	$t_{don}$	$I_C = 50\ A, V_{CE} = 300\ V, V_{GE} = \pm 15\ V, R_{Gon} = 8.2\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.026		$\mu s$
			$T_{vj} = 125\ ^\circ C$	0.028		
			$T_{vj} = 150\ ^\circ C$	0.028		
Rise time (inductive load)	$t_r$	$I_C = 50\ A, V_{CE} = 300\ V, V_{GE} = \pm 15\ V, R_{Gon} = 8.2\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.011		$\mu s$
			$T_{vj} = 125\ ^\circ C$	0.012		
			$T_{vj} = 150\ ^\circ C$	0.012		
Turn-off delay time (inductive load)	$t_{doff}$	$I_C = 50\ A, V_{CE} = 300\ V, V_{GE} = \pm 15\ V, R_{Goff} = 8.2\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.140		$\mu s$
			$T_{vj} = 125\ ^\circ C$	0.170		
			$T_{vj} = 150\ ^\circ C$	0.180		
Fall time (inductive load)	$t_f$	$I_C = 50\ A, V_{CE} = 300\ V, V_{GE} = \pm 15\ V, R_{Goff} = 8.2\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.020		$\mu s$
			$T_{vj} = 125\ ^\circ C$	0.050		
			$T_{vj} = 150\ ^\circ C$	0.050		
Turn-on energy loss per pulse	$E_{on}$	$I_C = 50\ A, V_{CE} = 300\ V, L_\sigma = 35\ nH, V_{GE} = \pm 15\ V, R_{Gon} = 8.2\ \Omega, di/dt = 2900\ A/\mu s (T_{vj} = 150\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$	0.45		mJ
			$T_{vj} = 125\ ^\circ C$	0.66		
			$T_{vj} = 150\ ^\circ C$	0.72		
Turn-off energy loss per pulse	$E_{off}$	$I_C = 50\ A, V_{CE} = 300\ V, L_\sigma = 35\ nH, V_{GE} = \pm 15\ V, R_{Goff} = 8.2\ \Omega, dv/dt = 4500\ V/\mu s (T_{vj} = 150\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$	0.65		mJ
			$T_{vj} = 125\ ^\circ C$	0.92		
			$T_{vj} = 150\ ^\circ C$	1.02		
SC data	$I_{SC}$	$V_{GE} \leq 15\ V, V_{CC} = 360\ V, V_{CEmax} = V_{CES} - L_{sCE} * di/dt$	$t_p \leq 0\ \mu s, T_{vj} = 150\ ^\circ C$	800		A
Thermal resistance, junction to heatsink	$R_{thJH}$	per IGBT		0.886		K/W

**Table 4** Characteristic values (continued)

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Temperature under switching conditions	$T_{vj\ op}$		-40		150	°C

### 3 IGBT, Inverter

**Table 5** Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Collector-emitter voltage	$V_{CES}$	$T_{vj} = 25\ ^\circ\text{C}$	650	V
Implemented collector current	$I_{CN}$		75	A
Continuous DC collector current	$I_{CDC}$	$T_{vj\ max} = 175\ ^\circ\text{C}$ $T_H = 65\ ^\circ\text{C}$	75	A
Repetitive peak collector current	$I_{CRM}$	$t_p = 1\ \text{ms}$	150	A
Gate-emitter peak voltage	$V_{GES}$		±20	V

**Table 6** Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE\ sat}$	$I_C = 50\ \text{A}, V_{GE} = 15\ \text{V}$	$T_{vj} = 25\ ^\circ\text{C}$	0.99	1.43	V
			$T_{vj} = 125\ ^\circ\text{C}$	0.94		
			$T_{vj} = 150\ ^\circ\text{C}$	0.91		
Gate threshold voltage	$V_{GEth}$	$I_C = 1\ \text{mA}, V_{CE} = 20\ \text{V}, T_{vj} = 25\ ^\circ\text{C}$	4.25	5	5.75	V
Gate charge	$Q_G$	$V_{GE} = \pm 15\ \text{V}, V_{CE} = 400\ \text{V}$		0.92		μC
Internal gate resistor	$R_{Gint}$	$T_{vj} = 25\ ^\circ\text{C}$		0		Ω
Input capacitance	$C_{ies}$	$f = 100\ \text{kHz}, T_{vj} = 25\ ^\circ\text{C}, V_{CE} = 25\ \text{V}, V_{GE} = 0\ \text{V}$		11.8		nF
Reverse transfer capacitance	$C_{res}$	$f = 100\ \text{kHz}, T_{vj} = 25\ ^\circ\text{C}, V_{CE} = 25\ \text{V}, V_{GE} = 0\ \text{V}$		0.042		nF
Collector-emitter cut-off current	$I_{CES}$	$V_{CE} = 650\ \text{V}, V_{GE} = 0\ \text{V}$ $T_{vj} = 25\ ^\circ\text{C}$			0.007	mA
Gate-emitter leakage current	$I_{GES}$	$V_{CE} = 0\ \text{V}, V_{GE} = 20\ \text{V}, T_{vj} = 25\ ^\circ\text{C}$			100	nA
Turn-on delay time (inductive load)	$t_{don}$	$I_C = 50\ \text{A}, V_{CE} = 300\ \text{V}, V_{GE} = \pm 15\ \text{V}, R_{Gon} = 8.2\ \Omega$	$T_{vj} = 25\ ^\circ\text{C}$	0.053		μs
			$T_{vj} = 125\ ^\circ\text{C}$	0.049		
			$T_{vj} = 150\ ^\circ\text{C}$	0.048		

**Table 6** Characteristic values (continued)

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rise time (inductive load)	$t_r$	$I_C = 50 \text{ A}, V_{CE} = 300 \text{ V}, V_{GE} = \pm 15 \text{ V}, R_{Gon} = 8.2 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$	0.017		$\mu\text{s}$
			$T_{vj} = 125 \text{ }^\circ\text{C}$	0.018		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	0.019		
Turn-off delay time (inductive load)	$t_{doff}$	$I_C = 50 \text{ A}, V_{CE} = 300 \text{ V}, V_{GE} = \pm 15 \text{ V}, R_{Goff} = 8.2 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$	0.330		$\mu\text{s}$
			$T_{vj} = 125 \text{ }^\circ\text{C}$	0.370		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	0.380		
Fall time (inductive load)	$t_f$	$I_C = 50 \text{ A}, V_{CE} = 300 \text{ V}, V_{GE} = \pm 15 \text{ V}, R_{Goff} = 8.2 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$	0.130		$\mu\text{s}$
			$T_{vj} = 125 \text{ }^\circ\text{C}$	0.210		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	0.240		
Turn-on energy loss per pulse	$E_{on}$	$I_C = 50 \text{ A}, V_{CE} = 300 \text{ V}, L_\sigma = 35 \text{ nH}, V_{GE} = \pm 15 \text{ V}, R_{Gon} = 8.2 \Omega, di/dt = 2400 \text{ A}/\mu\text{s} (T_{vj} = 150 \text{ }^\circ\text{C})$	$T_{vj} = 25 \text{ }^\circ\text{C}$	0.29		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$	0.34		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	0.36		
Turn-off energy loss per pulse	$E_{off}$	$I_C = 50 \text{ A}, V_{CE} = 300 \text{ V}, L_\sigma = 35 \text{ nH}, V_{GE} = \pm 15 \text{ V}, R_{Goff} = 8.2 \Omega, dv/dt = 1600 \text{ V}/\mu\text{s} (T_{vj} = 150 \text{ }^\circ\text{C})$	$T_{vj} = 25 \text{ }^\circ\text{C}$	2.48		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$	3.45		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	3.69		
SC data	$I_{SC}$	$V_{GE} \leq 15 \text{ V}, V_{CC} = 360 \text{ V}, V_{CEmax} = V_{CES} - L_{sCE} * di/dt$	$t_p \leq 0 \mu\text{s}, T_{vj} \leq 150 \text{ }^\circ\text{C}$	900		A
Thermal resistance, junction to heatsink	$R_{thJH}$	per IGBT		0.902		K/W
Temperature under switching conditions	$T_{vj op}$			-40	150	$^\circ\text{C}$

## 4 Diode, 3-Level

**Table 7** Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Repetitive peak reverse voltage	$V_{RRM}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	650	V
Implemented forward current	$I_{FN}$		75	A
Continuous DC forward current	$I_F$		40	A
Repetitive peak forward current	$I_{FRM}$	$t_p = 1 \text{ ms}$	150	A

**Table 7** Maximum rated values (continued)

Parameter	Symbol	Note or test condition	Values	Unit	
I <sup>2</sup> t - value	I <sup>2</sup> t	V <sub>R</sub> = 0 V, t <sub>p</sub> = 10 ms	T <sub>vj</sub> = 125 °C	370	A <sup>2</sup> s
			T <sub>vj</sub> = 150 °C	360	

**Table 8** Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V <sub>F</sub>	I <sub>F</sub> = 40 A, V <sub>GE</sub> = 0 V	T <sub>vj</sub> = 25 °C	1.30	1.64	V
			T <sub>vj</sub> = 125 °C	1.20		
			T <sub>vj</sub> = 150 °C	1.15		
Peak reverse recovery current	I <sub>RM</sub>	I <sub>F</sub> = 40 A, V <sub>R</sub> = 300 V, V <sub>GE</sub> = -15 V, -di <sub>F</sub> /dt = 2900 A/μs (T <sub>vj</sub> = 150 °C)	T <sub>vj</sub> = 25 °C	47		A
			T <sub>vj</sub> = 125 °C	60		
			T <sub>vj</sub> = 150 °C	66		
Recovered charge	Q <sub>r</sub>	I <sub>F</sub> = 40 A, V <sub>R</sub> = 300 V, V <sub>GE</sub> = -15 V, -di <sub>F</sub> /dt = 2900 A/μs (T <sub>vj</sub> = 150 °C)	T <sub>vj</sub> = 25 °C	2.13		μC
			T <sub>vj</sub> = 125 °C	4.18		
			T <sub>vj</sub> = 150 °C	4.9		
Reverse recovery energy	E <sub>rec</sub>	I <sub>F</sub> = 40 A, V <sub>R</sub> = 300 V, V <sub>GE</sub> = -15 V, -di <sub>F</sub> /dt = 2900 A/μs (T <sub>vj</sub> = 150 °C)	T <sub>vj</sub> = 25 °C	0.55		mJ
			T <sub>vj</sub> = 125 °C	1.04		
			T <sub>vj</sub> = 150 °C	1.23		
Thermal resistance, junction to heatsink	R <sub>thJH</sub>	per diode		1.21		K/W
Temperature under switching conditions	T <sub>vj op</sub>		-40		150	°C

## 5 Diode, Inverter

**Table 9** Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Repetitive peak reverse voltage	V <sub>RRM</sub>	T <sub>vj</sub> = 25 °C	650	V
Implemented forward current	I <sub>FN</sub>		75	A
Continuous DC forward current	I <sub>F</sub>		40	A
Repetitive peak forward current	I <sub>FRM</sub>	t <sub>p</sub> = 1 ms	150	A

**Table 9** Maximum rated values (continued)

Parameter	Symbol	Note or test condition	Values	Unit	
I <sup>2</sup> t - value	I <sup>2</sup> t	V <sub>R</sub> = 0 V, t <sub>p</sub> = 10 ms	T <sub>vj</sub> = 125 °C	370	A <sup>2</sup> s
			T <sub>vj</sub> = 150 °C	360	

**Table 10** Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit	
			Min.	Typ.	Max.		
Forward voltage	V <sub>F</sub>	I <sub>F</sub> = 40 A, V <sub>GE</sub> = 0 V	T <sub>vj</sub> = 25 °C		1.30	1.64	V
			T <sub>vj</sub> = 125 °C		1.20		
			T <sub>vj</sub> = 150 °C		1.15		
Peak reverse recovery current	I <sub>RM</sub>	I <sub>F</sub> = 40 A, V <sub>R</sub> = 300 V, V <sub>GE</sub> = -15 V, -di <sub>F</sub> /dt = 2400 A/μs (T <sub>vj</sub> = 150 °C)	T <sub>vj</sub> = 25 °C		42		A
			T <sub>vj</sub> = 125 °C		55		
			T <sub>vj</sub> = 150 °C		59		
Recovered charge	Q <sub>r</sub>	I <sub>F</sub> = 40 A, V <sub>R</sub> = 300 V, V <sub>GE</sub> = -15 V, -di <sub>F</sub> /dt = 2400 A/μs (T <sub>vj</sub> = 150 °C)	T <sub>vj</sub> = 25 °C		1.73		μC
			T <sub>vj</sub> = 125 °C		4.11		
			T <sub>vj</sub> = 150 °C		4.47		
Reverse recovery energy	E <sub>rec</sub>	I <sub>F</sub> = 40 A, V <sub>R</sub> = 300 V, V <sub>GE</sub> = -15 V, -di <sub>F</sub> /dt = 2400 A/μs (T <sub>vj</sub> = 150 °C)	T <sub>vj</sub> = 25 °C		0.21		mJ
			T <sub>vj</sub> = 125 °C		1.03		
			T <sub>vj</sub> = 150 °C		1.18		
Thermal resistance, junction to heatsink	R <sub>thJH</sub>	per diode		1.04		K/W	
Temperature under switching conditions	T <sub>vj op</sub>		-40		150	°C	

## 6 NTC-Thermistor

**Table 11** Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	R <sub>25</sub>	T <sub>NTC</sub> = 25 °C		5		kΩ
Deviation of R <sub>100</sub>	ΔR/R	T <sub>NTC</sub> = 100 °C, R <sub>100</sub> = 493 Ω	-5		5	%
Power dissipation	P <sub>25</sub>	T <sub>NTC</sub> = 25 °C			20	mW
B-value	B <sub>25/50</sub>	R <sub>2</sub> = R <sub>25</sub> exp[B <sub>25/50</sub> (1/T <sub>2</sub> -1/(298,15 K))]		3375		K
B-value	B <sub>25/80</sub>	R <sub>2</sub> = R <sub>25</sub> exp[B <sub>25/80</sub> (1/T <sub>2</sub> -1/(298,15 K))]		3411		K
B-value	B <sub>25/100</sub>	R <sub>2</sub> = R <sub>25</sub> exp[B <sub>25/100</sub> (1/T <sub>2</sub> -1/(298,15 K))]		3433		K

Note: Specification according to the valid application note.

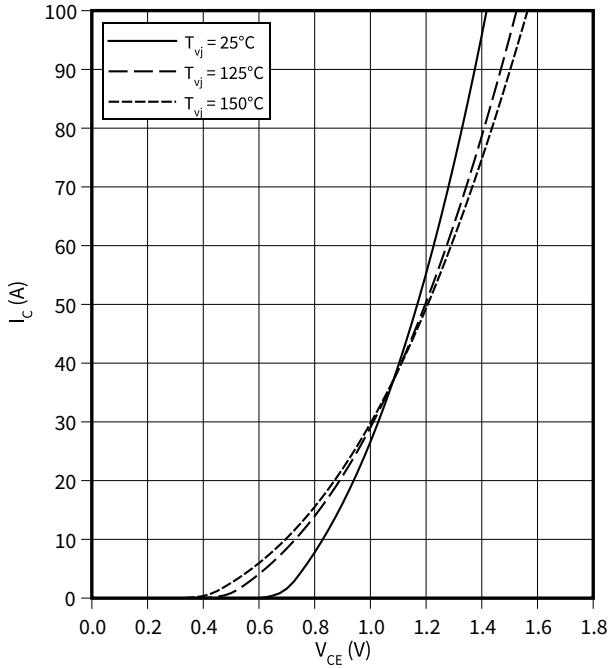


## 7 Characteristics diagrams

### output characteristic (typical), IGBT,3-Level

$$I_C = f(V_{CE})$$

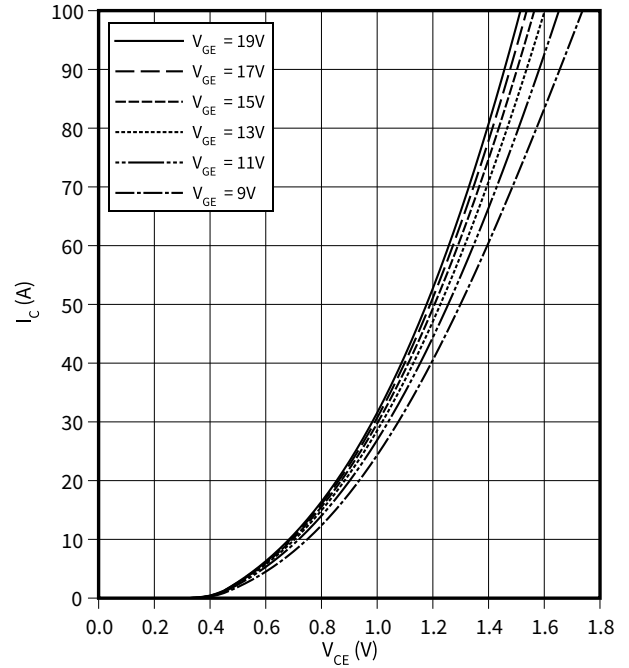
$$V_{GE} = 15 \text{ V}$$



### output characteristic (typical), IGBT,3-Level

$$I_C = f(V_{CE})$$

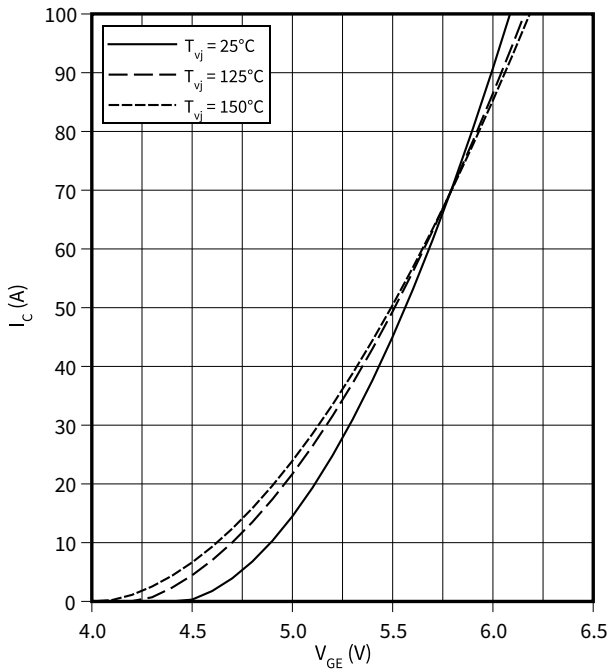
$$T_{vj} = 150 \text{ °C}$$



### transfer characteristic (typical), IGBT,3-Level

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

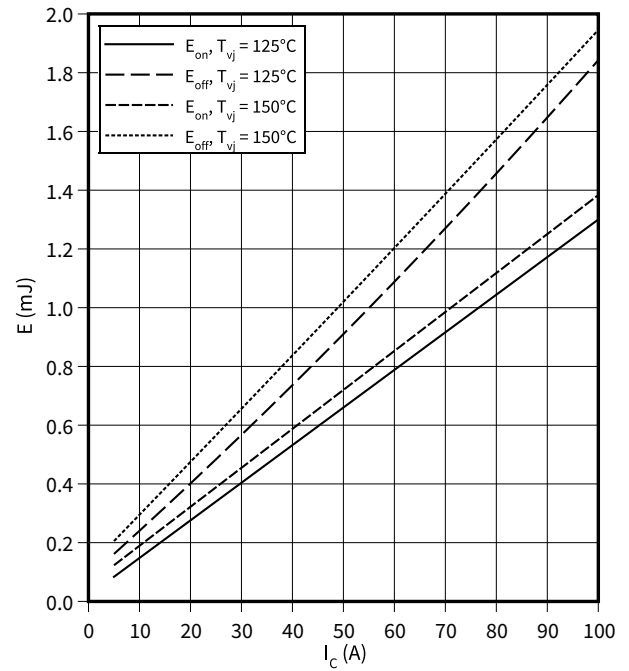
$$V_{CE} = 20 \text{ V}$$



### switching losses (typical), IGBT,3-Level

$$E = f(I_C)$$

$$R_{Goff} = 8.2 \text{ } \Omega, R_{Gon} = 8.2 \text{ } \Omega, V_{CE} = 300 \text{ V}, V_{GE} = \pm 15 \text{ V}$$

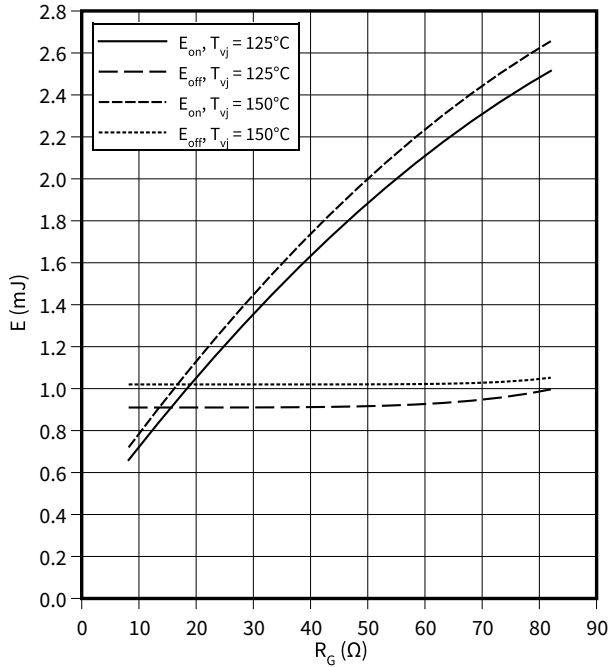


7 Characteristics diagrams

**switching losses (typical), IGBT,3-Level**

$E = f(R_G)$

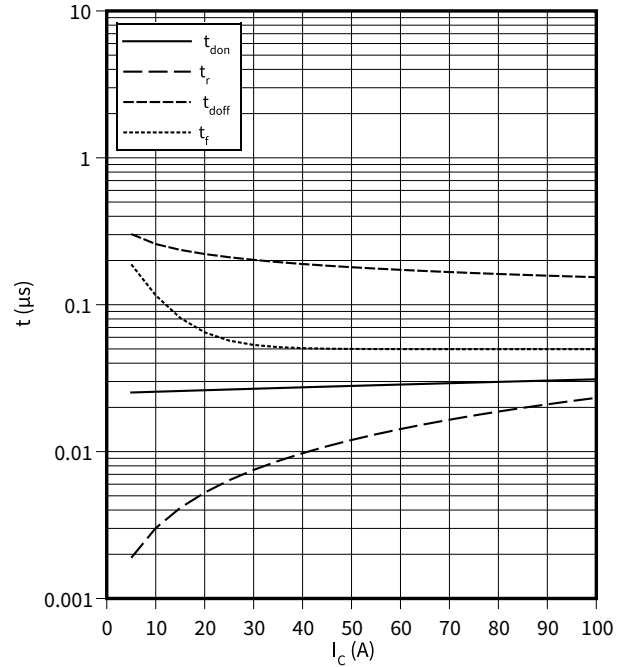
$I_C = 50 \text{ A}, V_{CE} = 300 \text{ V}, V_{GE} = \pm 15 \text{ V}$



**switching times (typical), IGBT,3-Level**

$t = f(I_C)$

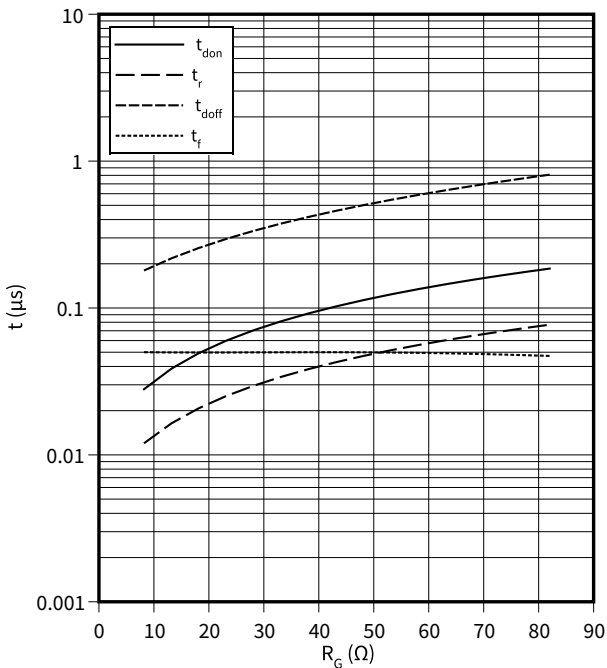
$R_{Goff} = 8.2 \Omega, R_{Gon} = 8.2 \Omega, V_{CE} = 300 \text{ V}, V_{GE} = \pm 15 \text{ V}, T_{vj} = 150 \text{ }^\circ\text{C}$



**switching times (typical), IGBT,3-Level**

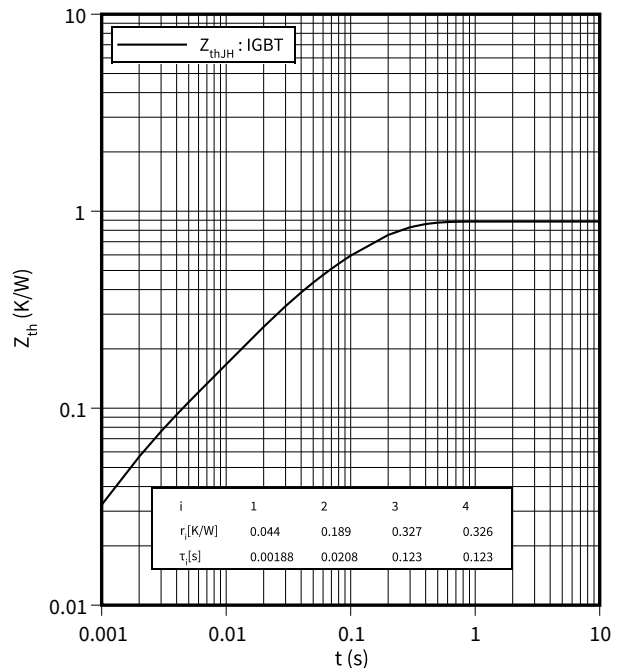
$t = f(R_G)$

$I_C = 50 \text{ A}, V_{CE} = 300 \text{ V}, V_{GE} = \pm 15 \text{ V}, T_{vj} = 150 \text{ }^\circ\text{C}$



**transient thermal impedance, IGBT,3-Level**

$Z_{th} = f(t)$

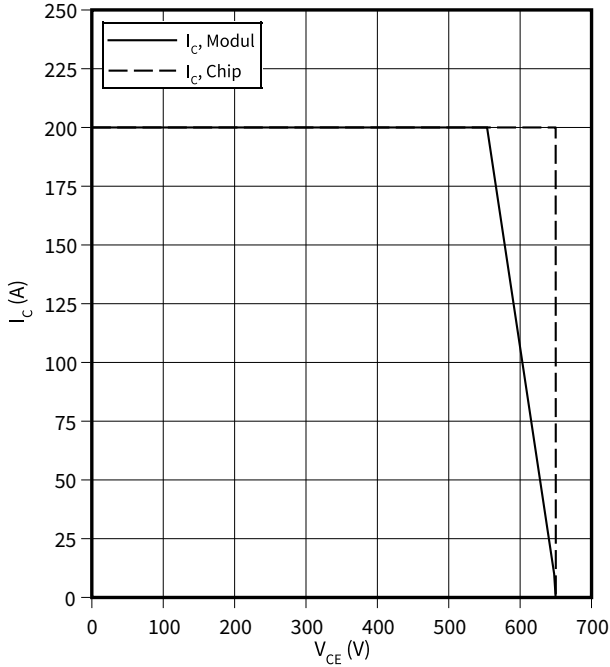


7 Characteristics diagrams

**reverse bias safe operating area (RBSOA), IGBT,3-Level**

$I_C = f(V_{CE})$

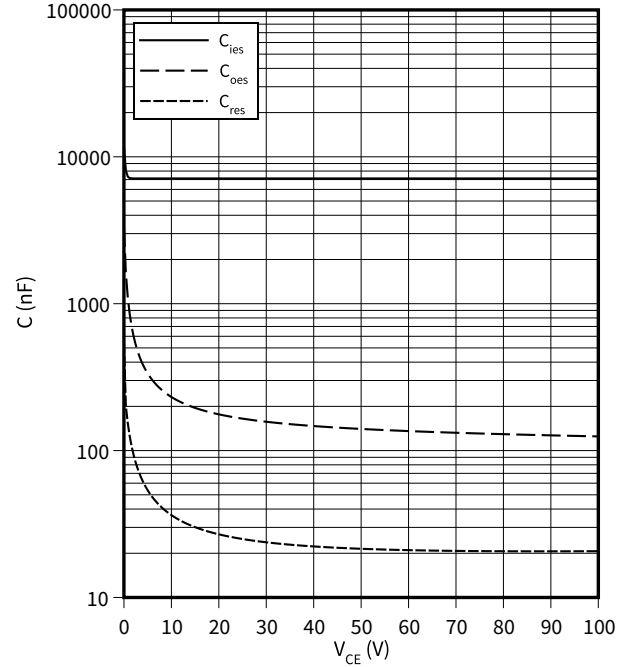
$R_{Goff} = 8.2 \Omega$ ,  $V_{GE} = \pm 15 V$ ,  $T_{vj} = 150 \text{ }^\circ\text{C}$



**capacity characteristic (typical), IGBT,3-Level**

$C = f(V_{CE})$

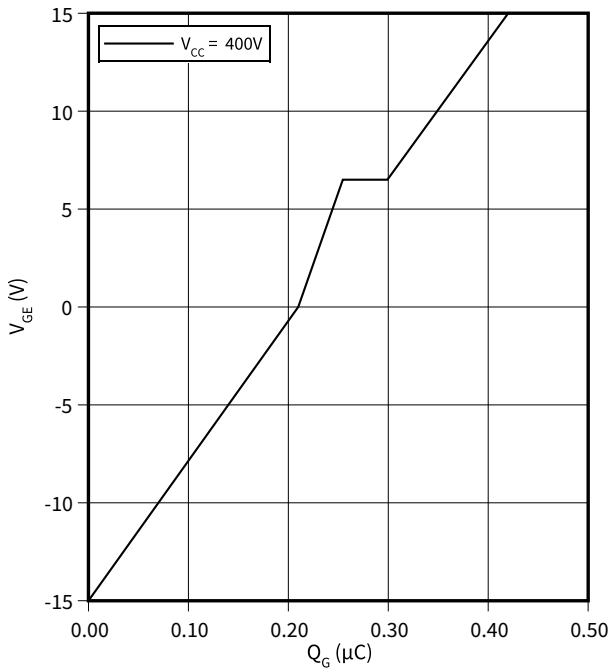
$f = 100 \text{ kHz}$ ,  $V_{GE} = 0 V$ ,  $T_{vj} = 25 \text{ }^\circ\text{C}$



**gate charge characteristic (typical), IGBT,3-Level**

$V_{GE} = f(Q_G)$

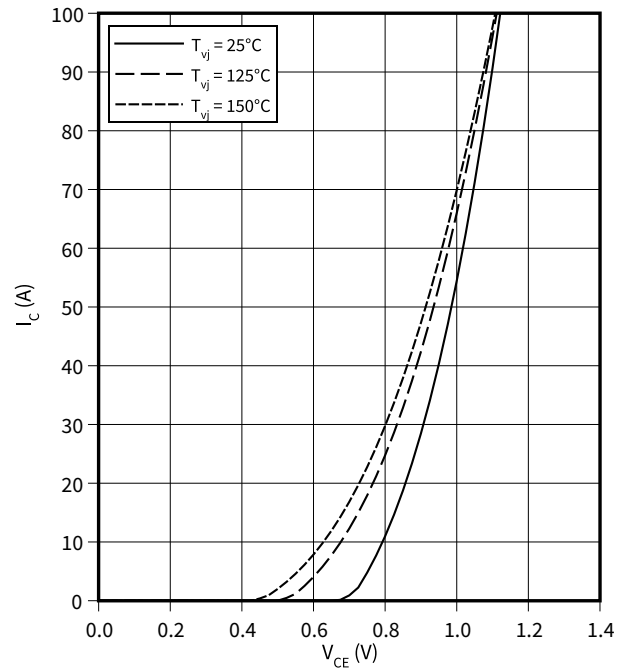
$I_C = 50 A$ ,  $T_{vj} = 25 \text{ }^\circ\text{C}$



**output characteristic (typical), IGBT, Inverter**

$I_C = f(V_{CE})$

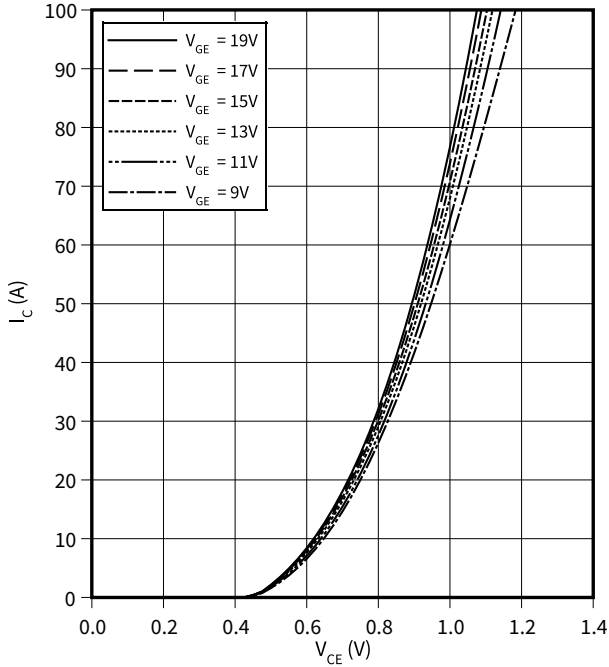
$V_{GE} = 15 V$



7 Characteristics diagrams

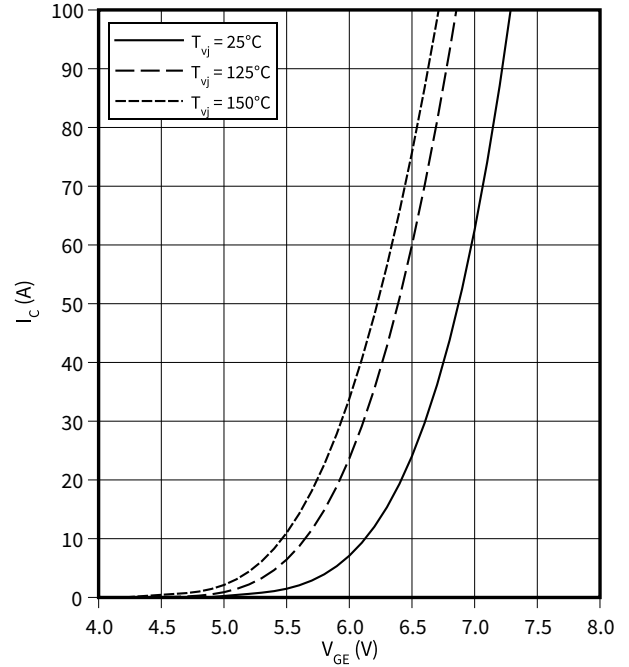
**output characteristic (typical), IGBT, Inverter**

$I_C = f(V_{CE})$   
 $T_{vj} = 150\text{ °C}$



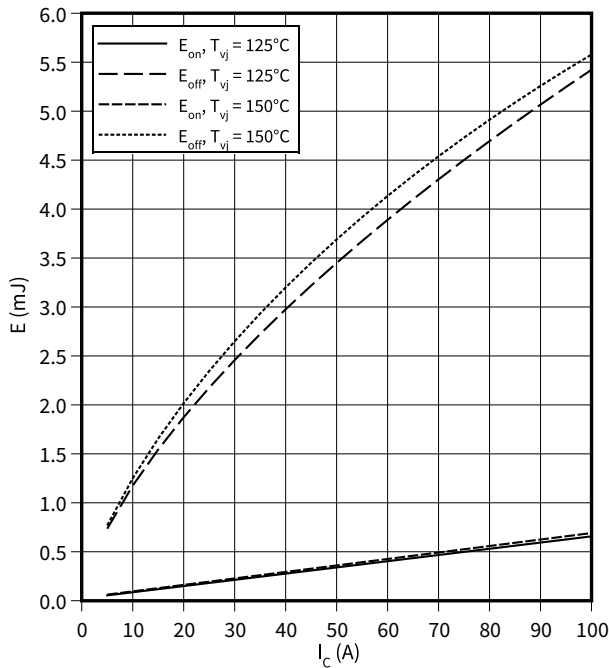
**transfer characteristic (typical), IGBT, Inverter**

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



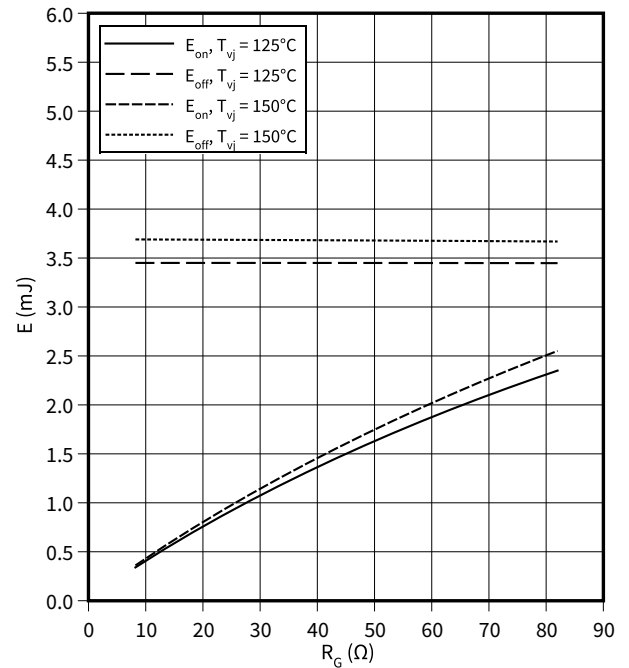
**switching losses (typical), IGBT, Inverter**

$E = f(I_C)$   
 $R_{Goff} = 8.2\ \Omega$ ,  $R_{Gon} = 8.2\ \Omega$ ,  $V_{CE} = 300\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$



**switching losses (typical), IGBT, Inverter**

$E = f(R_G)$   
 $I_C = 50\text{ A}$ ,  $V_{CE} = 300\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$

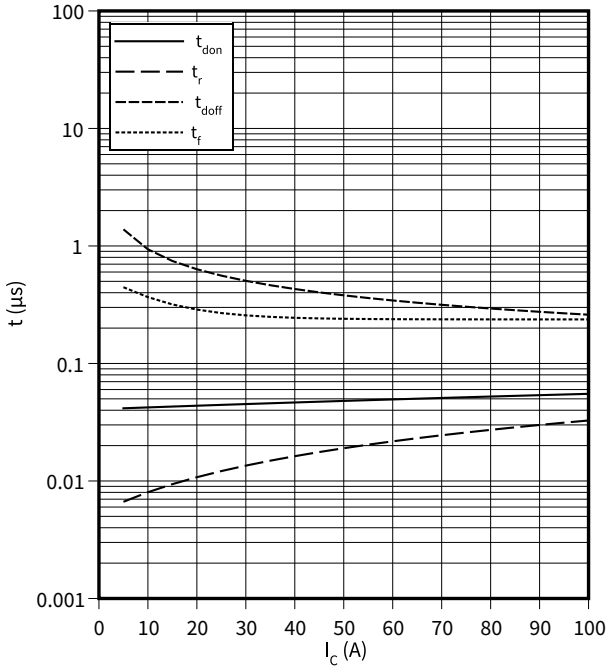


7 Characteristics diagrams

**switching times (typical), IGBT, Inverter**

$t = f(I_C)$

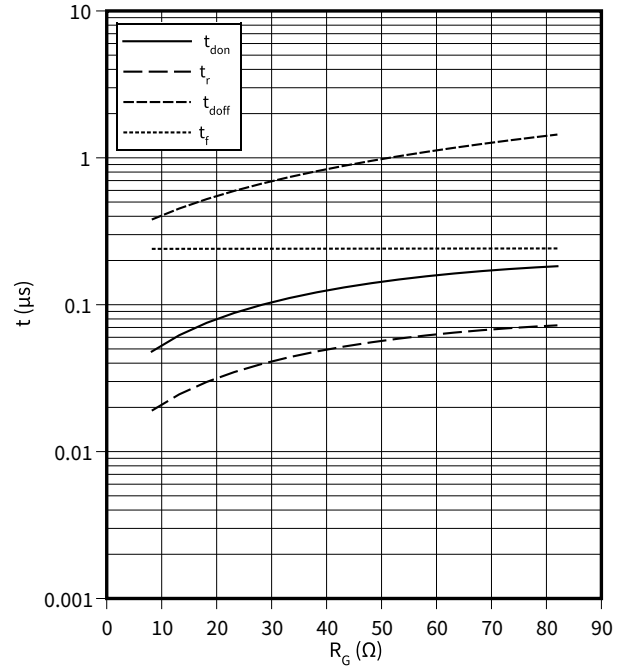
$R_{Goff} = 8.2 \Omega$ ,  $R_{Gon} = 8.2 \Omega$ ,  $V_{CE} = 300 \text{ V}$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  $T_{vj} = 150 \text{ }^\circ\text{C}$



**switching times (typical), IGBT, Inverter**

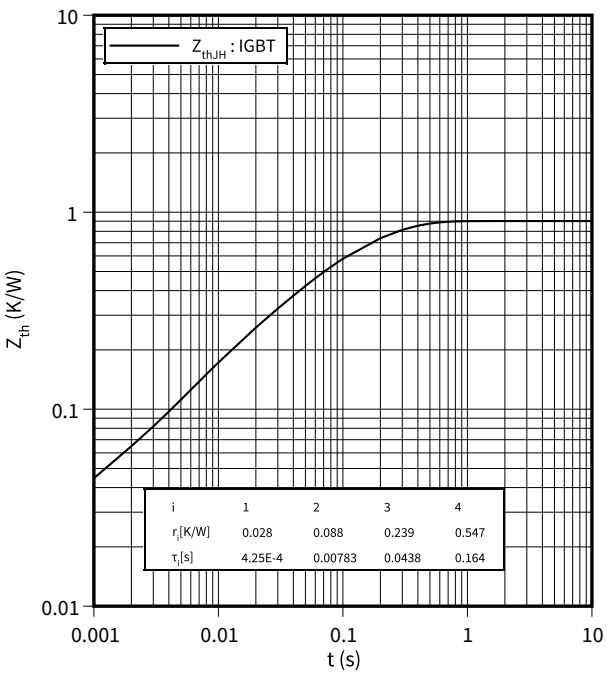
$t = f(R_G)$

$I_C = 50 \text{ A}$ ,  $V_{CE} = 300 \text{ V}$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  $T_{vj} = 150 \text{ }^\circ\text{C}$



**transient thermal impedance, IGBT, Inverter**

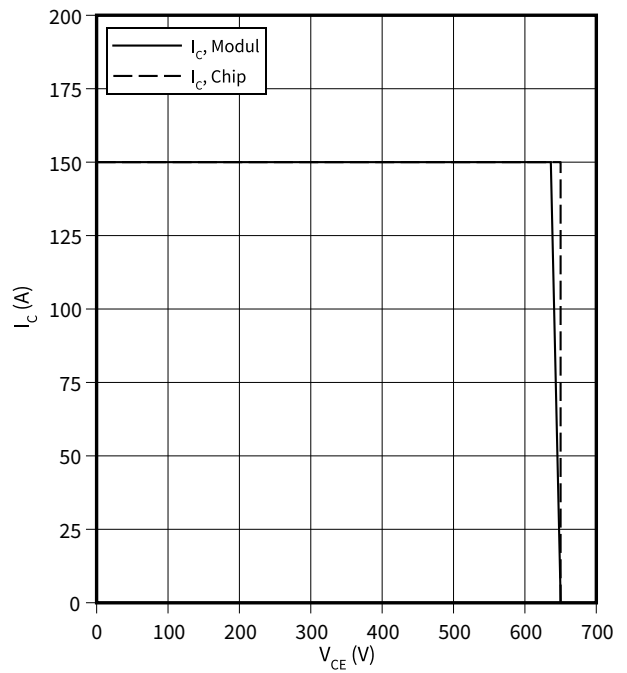
$Z_{th} = f(t)$



**reverse bias safe operating area (RBSOA), IGBT, Inverter**

$I_C = f(V_{CE})$

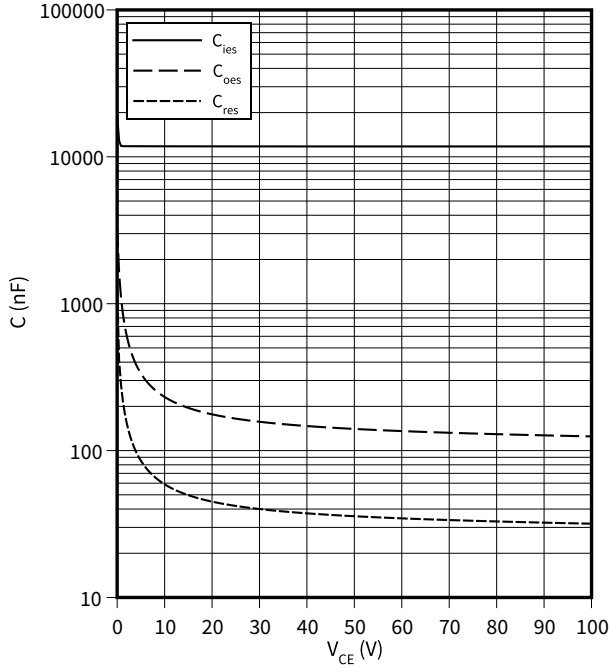
$R_{Goff} = 8.2 \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  $T_{vj} = 150 \text{ }^\circ\text{C}$



7 Characteristics diagrams

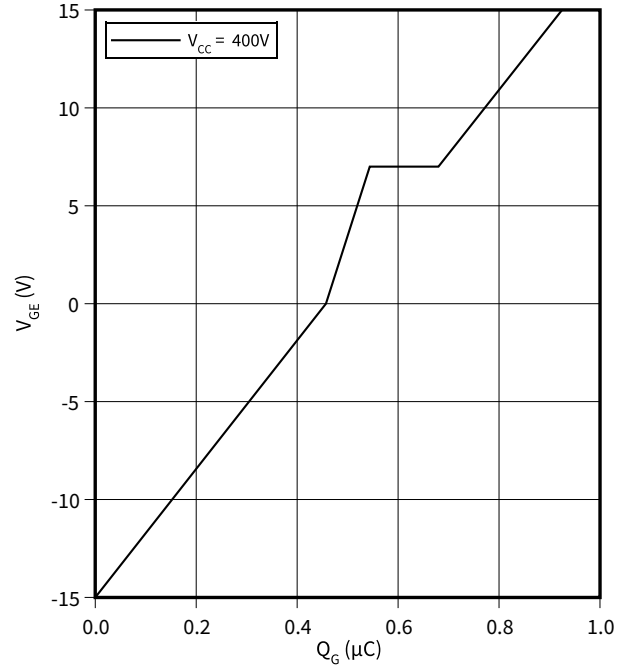
**capacity characteristic (typical), IGBT, Inverter**

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



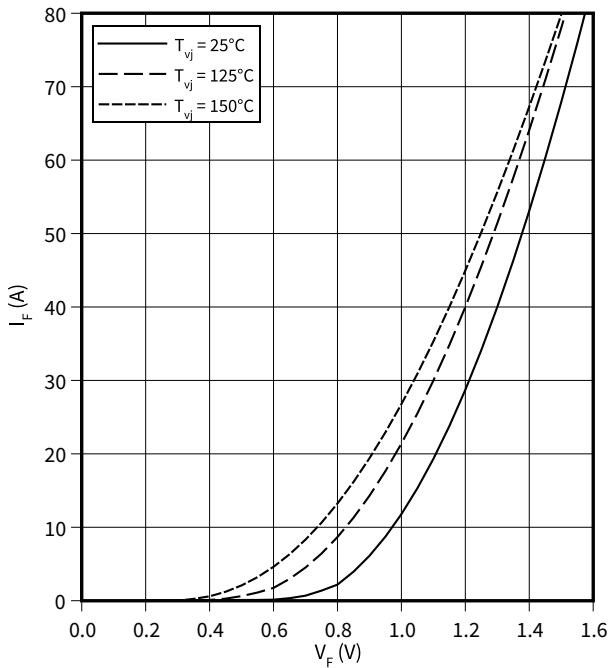
**gate charge characteristic (typical), IGBT, Inverter**

$V_{GE} = f(Q_G)$   
 $I_C = 50 \text{ A}, T_{vj} = 25 \text{ }^\circ\text{C}$



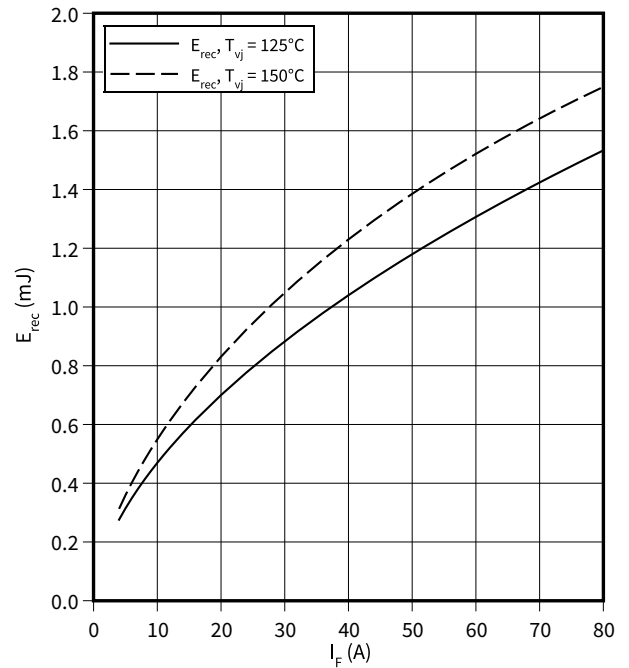
**forward characteristic of (typical), Diode, 3-Level**

$I_F = f(V_F)$



**switching losses (typical), Diode, 3-Level**

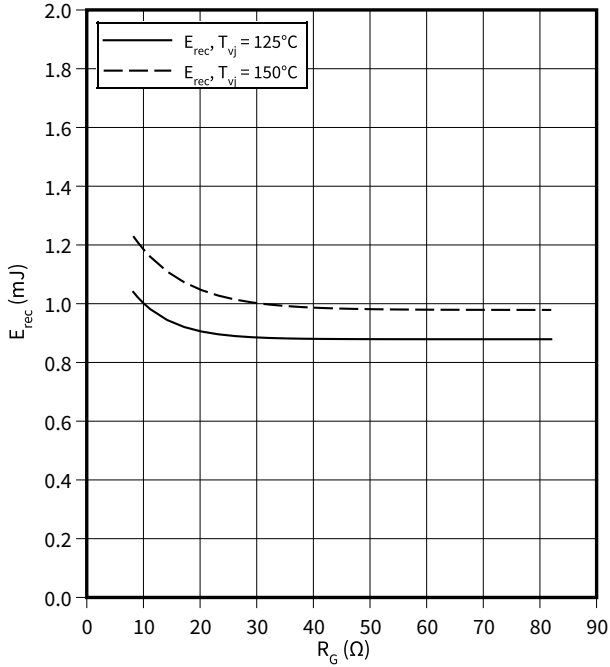
$E_{rec} = f(I_F)$   
 $R_{Gon} = 8.2 \text{ } \Omega, V_{CE} = 300 \text{ V}$



7 Characteristics diagrams

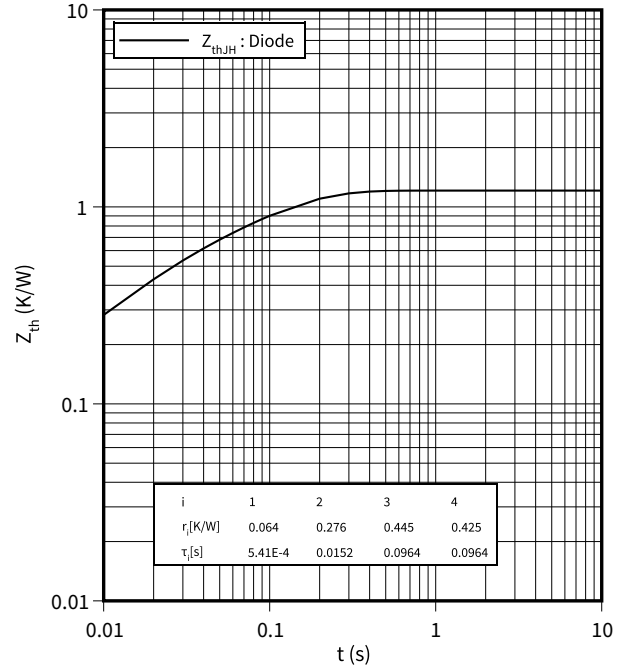
**switching losses (typical), Diode, 3-Level**

$E_{rec} = f(R_G)$   
 $V_{CE} = 300\text{ V}, I_F = 40\text{ A}$



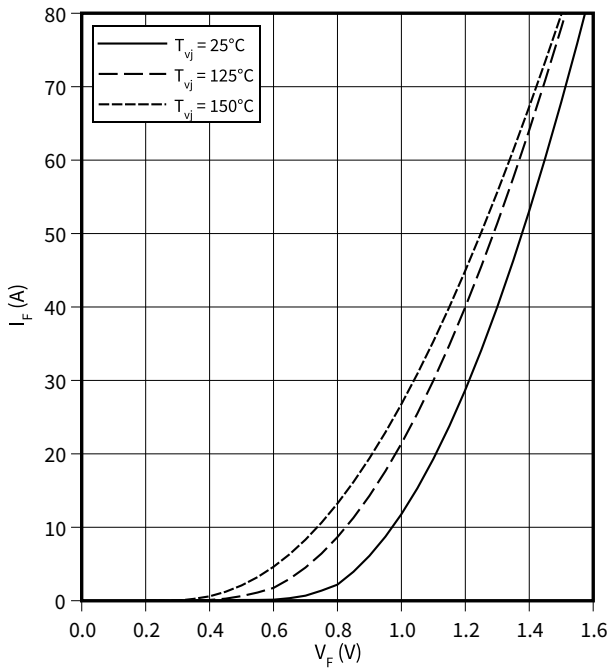
**transient thermal impedance, Diode, 3-Level**

$Z_{th} = f(t)$



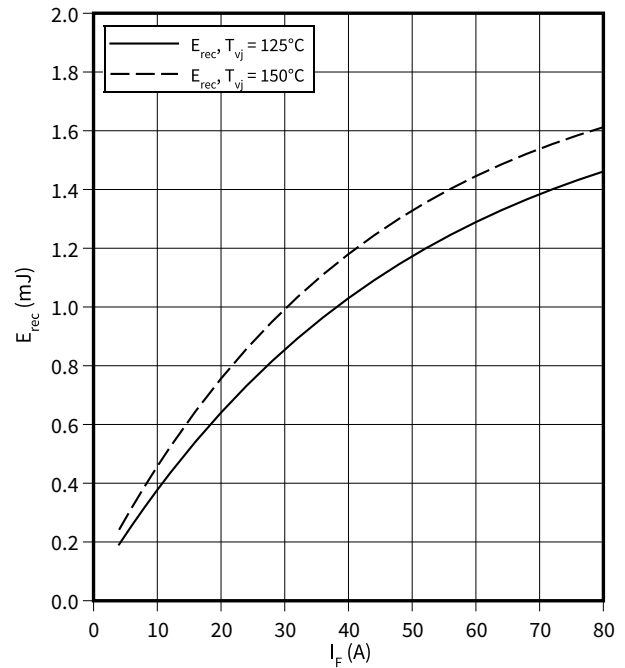
**forward characteristic of (typical), Diode, Inverter**

$I_F = f(V_F)$



**switching losses (typical), Diode, Inverter**

$E_{rec} = f(I_F)$   
 $R_{Gon} = 8.2\ \Omega, V_{CE} = 300\text{ V}$

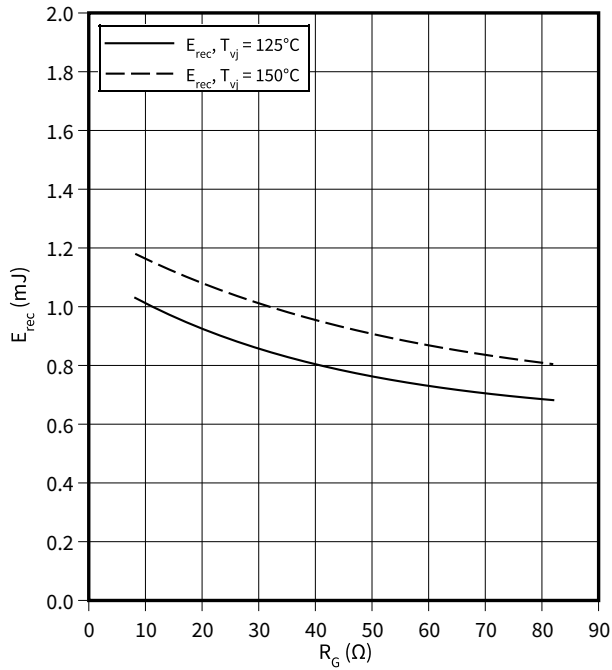


7 Characteristics diagrams

**switching losses (typical), Diode, Inverter**

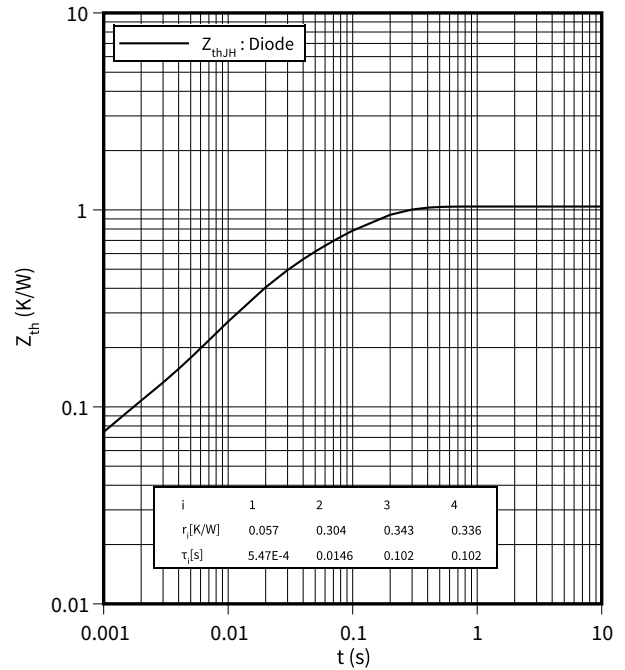
$E_{rec} = f(R_G)$

$V_{CE} = 300\text{ V}, I_F = 40\text{ A}$



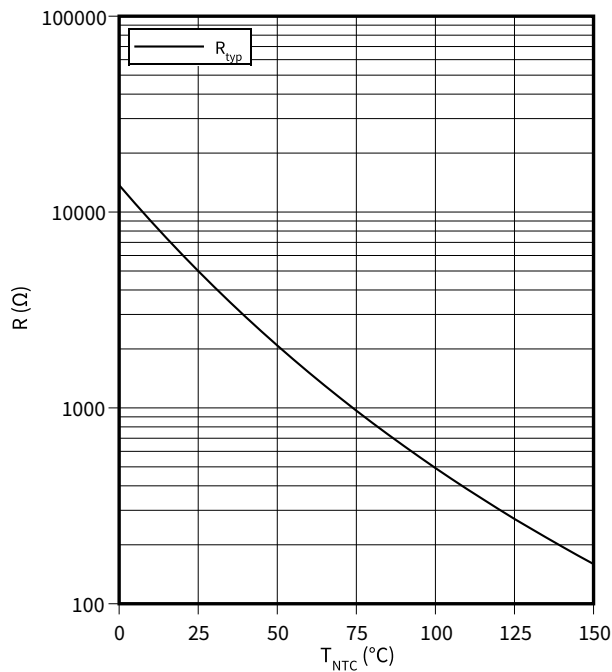
**transient thermal impedance , Diode, Inverter**

$Z_{th} = f(t)$



**temperature characteristic (typical), NTC-Thermistor**

$R = f(T_{NTC})$





## 8 Circuit diagram

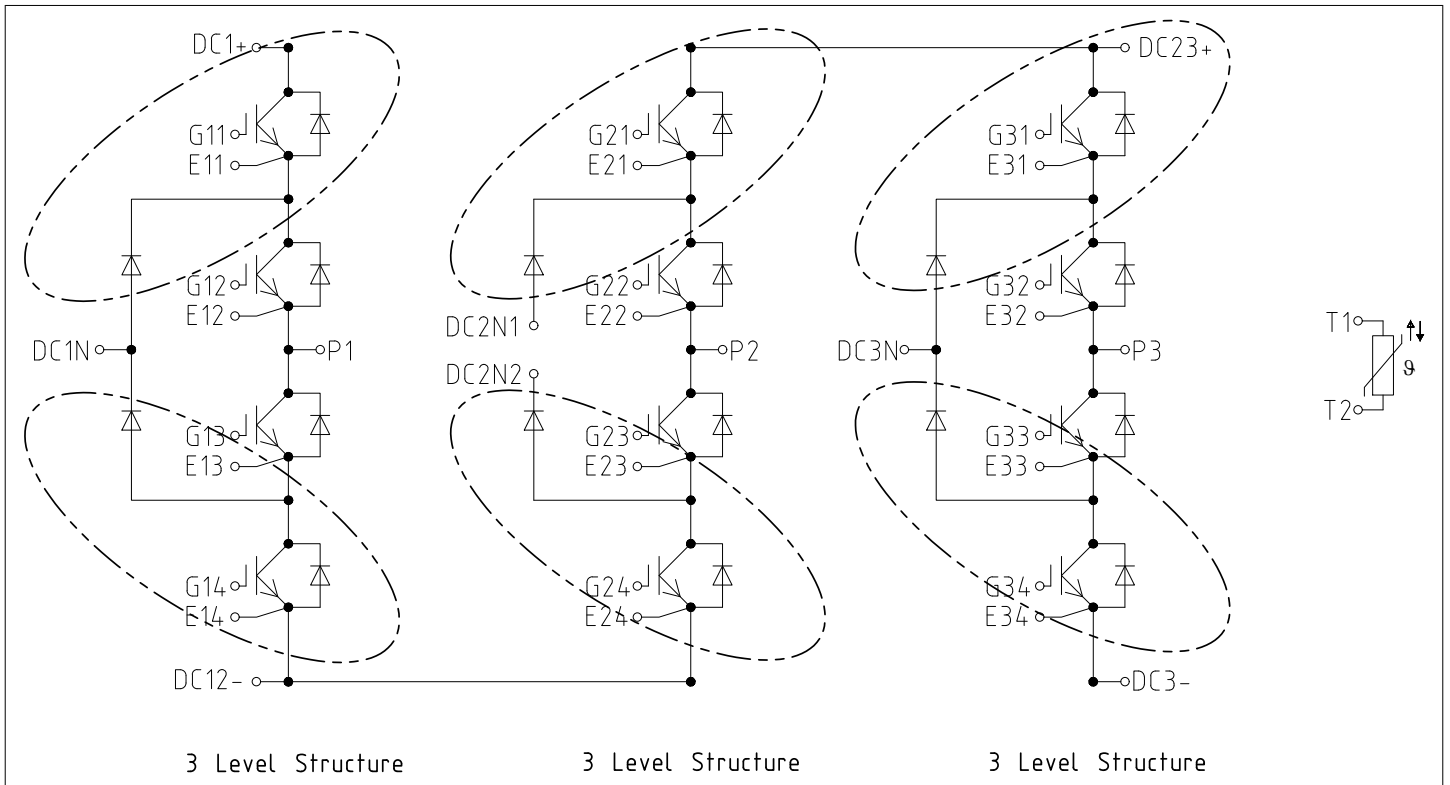


Figure 2

## 9 Package outlines

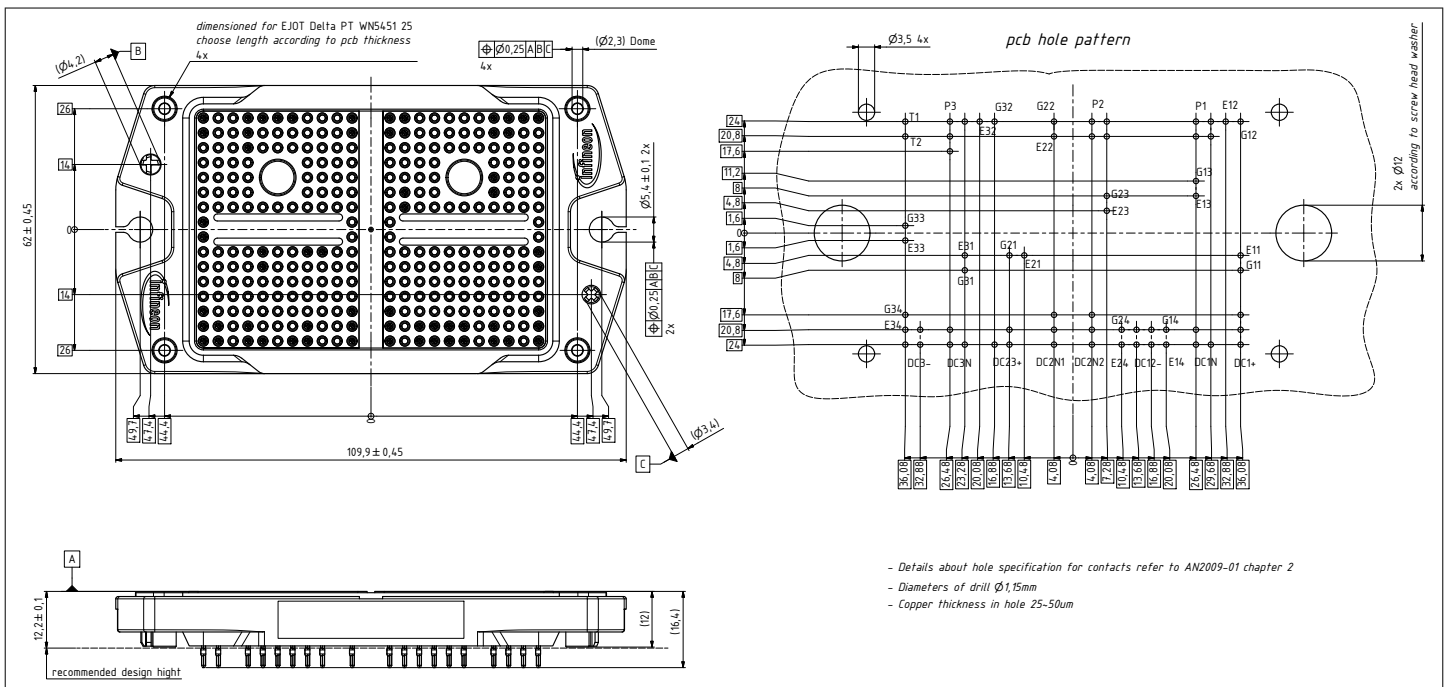




Figure 3

## 10 Module label code

Module label code			
Code format	Data Matrix	Barcode Code128	
Encoding	ASCII text	Code Set A	
Symbol size	16x16	23 digits	
Standard	IEC24720 and IEC16022	IEC8859-1	
Code content	<i>Content</i>	<i>Digit</i>	<i>Example</i>
	Module serial number	1 - 5	71549
	Module material number	6 - 11	142846
	Production order number	12 - 19	55054991
	Date code (production year)	20 - 21	15
	Date code (production week)	22 - 23	30
Example	 		
	71549142846550549911530		71549142846550549911530

**Figure 4**

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Revision history

## Revision history

Document revision	Date of release	Description of changes
V1.0	2020-04-03	
1.00	2021-04-22	Final

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**Document reference**

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