

Final datasheet

EconoDUAL™3 module with TRENCHSTOP™ IGBT7 and emitter controlled 7 diode and NTC

Features

- Electrical features
 - $V_{CES} = 1700\text{ V}$
 - $I_{C\text{ nom}} = 450\text{ A} / I_{CRM} = 900\text{ A}$
 - Integrated temperature sensor
 - High current density
 - Low $V_{CE,sat}$
 - Overload operation up to 175°C
 - TRENCHSTOP™ IGBT7
 - $V_{CE,sat}$ with positive temperature coefficient
 - Suitable Infineon gate drivers can be found under <https://www.infineon.com/gdfinder>
- Mechanical features
 - High power density
 - Isolated base plate
 - PressFIT contact technology
 - Standard housing



Potential applications

- High-power converters
- Medium-voltage converters
- Motor drives
- Wind turbines

Product validation

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

Description

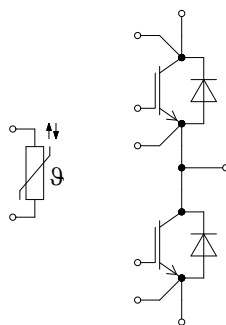


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1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, $f = 50 \text{ Hz}$, $t = 1 \text{ min}$	3.4	kV
Material of module baseplate			Cu	
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Creepage distance	d_{Creep}	terminal to heatsink	15.0	mm
Creepage distance	d_{Creep}	terminal to terminal	13.0	mm
Clearance	d_{Clear}	terminal to heatsink	12.5	mm
Clearance	d_{Clear}	terminal to terminal	10.0	mm
Comparative tracking index	CTI		> 200	
Relative thermal index (electrical)	RTI	housing	140	°C

Table 2 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Stray inductance module	L_{sCE}			20		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	$T_C = 25 \text{ °C}$, per switch		0.8		mΩ
Storage temperature	T_{stg}		-40		125	°C
Mounting torque for module mounting	M	- Mounting according to valid application note	M5, Screw	3	6	Nm
Terminal connection torque	M	- Mounting according to valid application note	M6, Screw	3	6	Nm
Weight	G			345		g

2 IGBT, T1 / T2

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		$T_{vj} = 25 \text{ °C}$	1700	V
Implemented collector current	I_{CN}			450	A
Continuous DC collector current	I_{CDC}	$T_{vj \text{ max}} = 175 \text{ °C}$	$T_C = 90 \text{ °C}$	450	A

(table continues...)

Table 3 (continued) Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Maximum RMS module DC-terminal current	I_{tRMS}	$T_{\text{Terminal}} = 90\text{ °C}$, $T_{\text{C}} = 90\text{ °C}$	580	A
		$T_{\text{Terminal}} = 105\text{ °C}$, $T_{\text{C}} = 90\text{ °C}$	565	
Repetitive peak collector current	I_{CRM}	t_{p} limited by $T_{\text{vj op}}$	900	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	$V_{\text{CE sat}}$	$I_{\text{C}} = 450\text{ A}$, $V_{\text{GE}} = 15\text{ V}$	$T_{\text{vj}} = 25\text{ °C}$	1.70	1.85	V
			$T_{\text{vj}} = 125\text{ °C}$	1.95		
			$T_{\text{vj}} = 150\text{ °C}$	2.05		
			$T_{\text{vj}} = 175\text{ °C}$	2.10		
Gate threshold voltage	V_{GEth}	$I_{\text{C}} = 9.3\text{ mA}$, $V_{\text{CE}} = V_{\text{GE}}$, $T_{\text{vj}} = 25\text{ °C}$	5.15	5.80	6.45	V
Gate charge	Q_{G}	$V_{\text{GE}} = \pm 15\text{ V}$, $V_{\text{CC}} = 900\text{ V}$		4.2		μC
Internal gate resistor	R_{Gint}	$T_{\text{vj}} = 25\text{ °C}$		0.57		Ω
Input capacitance	C_{ies}	$f = 100\text{ kHz}$, $T_{\text{vj}} = 25\text{ °C}$, $V_{\text{CE}} = 25\text{ V}$, $V_{\text{GE}} = 0\text{ V}$		45.9		nF
Reverse transfer capacitance	C_{res}	$f = 100\text{ kHz}$, $T_{\text{vj}} = 25\text{ °C}$, $V_{\text{CE}} = 25\text{ V}$, $V_{\text{GE}} = 0\text{ V}$		0.162		nF
Collector-emitter cut-off current	I_{CES}	$V_{\text{CE}} = 1700\text{ V}$, $V_{\text{GE}} = 0\text{ V}$, $T_{\text{vj}} = 25\text{ °C}$			5	mA
Gate-emitter leakage current	I_{GES}	$V_{\text{CE}} = 0\text{ V}$, $V_{\text{GE}} = 20\text{ V}$, $T_{\text{vj}} = 25\text{ °C}$			100	nA
Turn-on delay time (inductive load)	t_{don}	$I_{\text{C}} = 450\text{ A}$, $V_{\text{CC}} = 900\text{ V}$, $V_{\text{GE}} = \pm 15\text{ V}$, $R_{\text{Gon}} = 0.62\text{ Ω}$	$T_{\text{vj}} = 25\text{ °C}$	0.144		μs
			$T_{\text{vj}} = 125\text{ °C}$	0.162		
			$T_{\text{vj}} = 150\text{ °C}$	0.165		
			$T_{\text{vj}} = 175\text{ °C}$	0.168		
Rise time (inductive load)	t_{r}	$I_{\text{C}} = 450\text{ A}$, $V_{\text{CC}} = 900\text{ V}$, $V_{\text{GE}} = \pm 15\text{ V}$, $R_{\text{Gon}} = 0.62\text{ Ω}$	$T_{\text{vj}} = 25\text{ °C}$	0.034		μs
			$T_{\text{vj}} = 125\text{ °C}$	0.038		
			$T_{\text{vj}} = 150\text{ °C}$	0.040		
			$T_{\text{vj}} = 175\text{ °C}$	0.043		

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Turn-off delay time (inductive load)	t_{doff}	$I_C = 450 \text{ A}$, $V_{CC} = 900 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 5.1 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$	0.599		μs
			$T_{vj} = 125 \text{ }^\circ\text{C}$	0.678		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	0.684		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	0.689		
Fall time (inductive load)	t_f	$I_C = 450 \text{ A}$, $V_{CC} = 900 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 5.1 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$	0.248		μs
			$T_{vj} = 125 \text{ }^\circ\text{C}$	0.443		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	0.515		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	0.587		
Turn-on energy loss per pulse	E_{on}	$I_C = 450 \text{ A}$, $V_{CC} = 900 \text{ V}$, $L_\sigma = 25 \text{ nH}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Gon} = 0.62 \Omega$, $di/dt = 9000 \text{ A}/\mu\text{s}$ ($T_{vj} = 175 \text{ }^\circ\text{C}$)	$T_{vj} = 25 \text{ }^\circ\text{C}$	44.4		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$	87.1		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	100		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	114		
Turn-off energy loss per pulse	E_{off}	$I_C = 450 \text{ A}$, $V_{CC} = 900 \text{ V}$, $L_\sigma = 25 \text{ nH}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 5.1 \Omega$, $dv/dt = 3800 \text{ V}/\mu\text{s}$ ($T_{vj} = 175 \text{ }^\circ\text{C}$)	$T_{vj} = 25 \text{ }^\circ\text{C}$	72.1		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$	111		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	125		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	139		
SC data	I_{SC}	$V_{GE} = 15 \text{ V}$, $V_{CC} = 1000 \text{ V}$, $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$	$t_p \leq 8 \mu\text{s}$, $T_{vj} = 150 \text{ }^\circ\text{C}$	1600		A
			$t_p \leq 6 \mu\text{s}$, $T_{vj} = 175 \text{ }^\circ\text{C}$	1500		
Thermal resistance, junction to case	R_{thJC}	per IGBT			0.0812	K/W
Thermal resistance, case to heat sink	R_{thCH}	per IGBT, $\lambda_{grease} = 1 \text{ W}/(\text{m} \cdot \text{K})$		0.0368		K/W
Temperature under switching conditions	$T_{vj \text{ op}}$		-40		175	$^\circ\text{C}$

Note: $T_{vj \text{ op}} > 150 \text{ }^\circ\text{C}$ is only allowed for operation at overload conditions. For detailed specifications please refer to AN 2018-14.

3 Diode, D1 / D2

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Repetitive peak reverse voltage	V_{RRM}	$T_{vj} = 25 \text{ }^\circ\text{C}$	1700	V

(table continues...)

Table 5 (continued) Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Continuous DC forward current	I_F		450	A
Repetitive peak forward current	I_{FRM}	$t_P = 1 \text{ ms}$	900	A
I^2t - value	I^2t	$t_P = 10 \text{ ms}, V_R = 0 \text{ V}$	$T_{vj} = 125 \text{ °C}$	A^2s
			$T_{vj} = 175 \text{ °C}$	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 450 \text{ A}, V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ °C}$		2.35	V
			$T_{vj} = 125 \text{ °C}$		2.25	
			$T_{vj} = 150 \text{ °C}$		2.20	
			$T_{vj} = 175 \text{ °C}$		2.10	
Peak reverse recovery current	I_{RM}	$V_{CC} = 900 \text{ V}, I_F = 450 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 9300 \text{ A}/\mu\text{s} (T_{vj} = 175 \text{ °C})$	$T_{vj} = 25 \text{ °C}$		574	A
			$T_{vj} = 125 \text{ °C}$		605	
			$T_{vj} = 150 \text{ °C}$		605	
			$T_{vj} = 175 \text{ °C}$		605	
Recovered charge	Q_r	$V_{CC} = 900 \text{ V}, I_F = 450 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 9300 \text{ A}/\mu\text{s} (T_{vj} = 175 \text{ °C})$	$T_{vj} = 25 \text{ °C}$		59.4	μC
			$T_{vj} = 125 \text{ °C}$		113	
			$T_{vj} = 150 \text{ °C}$		130	
			$T_{vj} = 175 \text{ °C}$		146	
Reverse recovery energy	E_{rec}	$V_{CC} = 900 \text{ V}, I_F = 450 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 9300 \text{ A}/\mu\text{s} (T_{vj} = 175 \text{ °C})$	$T_{vj} = 25 \text{ °C}$		32.9	mJ
			$T_{vj} = 125 \text{ °C}$		66.6	
			$T_{vj} = 150 \text{ °C}$		76.1	
			$T_{vj} = 175 \text{ °C}$		85.5	
Thermal resistance, junction to case	R_{thJC}	per diode			0.143	K/W
Thermal resistance, case to heat sink	R_{thCH}	per diode, $\lambda_{grease} = 1 \text{ W}/(\text{m}\cdot\text{K})$		0.0479		K/W
Temperature under switching conditions	$T_{vj op}$		-40		175	°C

Note: $T_{vj op} > 150 \text{ °C}$ is only allowed for operation at overload conditions. For detailed specifications please refer to AN 2018-14.

4 NTC-Thermistor

Table 7 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	R_{25}	$T_{NTC} = 25\text{ °C}$		5		kΩ
Deviation of R_{100}	$\Delta R/R$	$T_{NTC} = 100\text{ °C}, R_{100} = 493\text{ Ω}$	-5		5	%
Power dissipation	P_{25}	$T_{NTC} = 25\text{ °C}$			20	mW
B-value	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298,15\text{ K}))]$		3375		K
B-value	$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298,15\text{ K}))]$		3411		K
B-value	$B_{25/100}$	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298,15\text{ K}))]$		3433		K

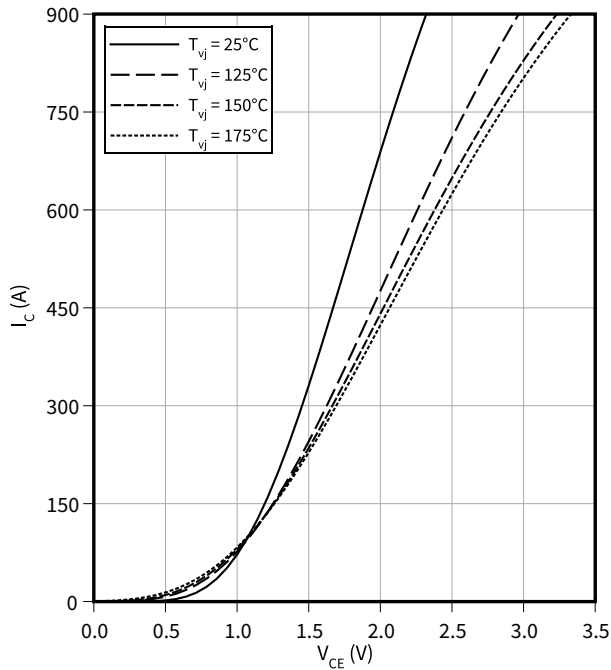
Note: For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4

5 Characteristics diagrams

Output characteristic (typical), IGBT, T1 / T2

$I_C = f(V_{CE})$

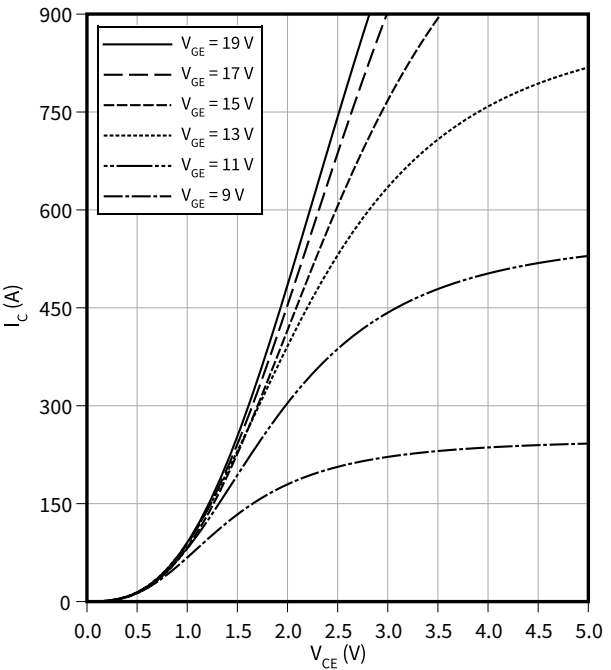
$V_{GE} = 15\text{ V}$



Output characteristic field (typical), IGBT, T1 / T2

$I_C = f(V_{CE})$

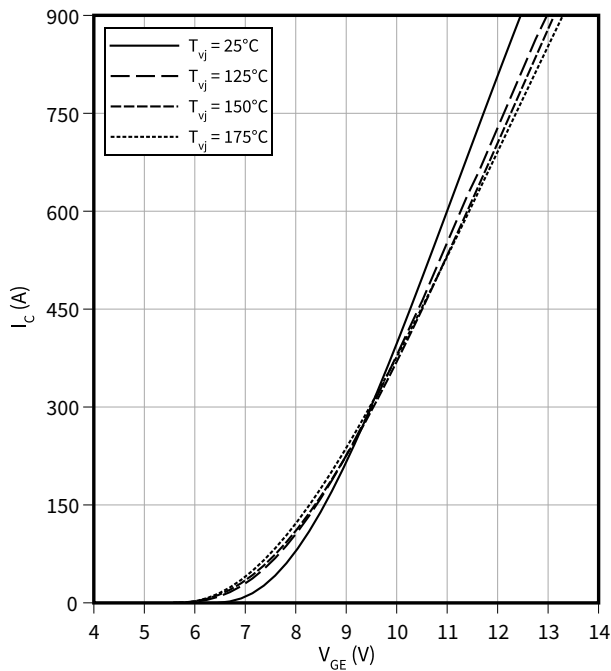
$T_{vj} = 175\text{ °C}$



Transfer characteristic (typical), IGBT, T1 / T2

$I_C = f(V_{GE})$

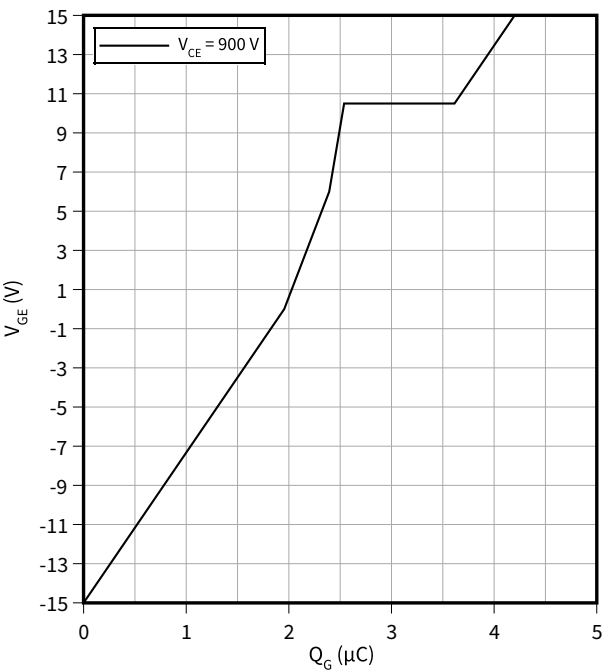
$V_{CE} = 20\text{ V}$



Gate charge characteristic (typical), IGBT, T1 / T2

$V_{GE} = f(Q_G)$

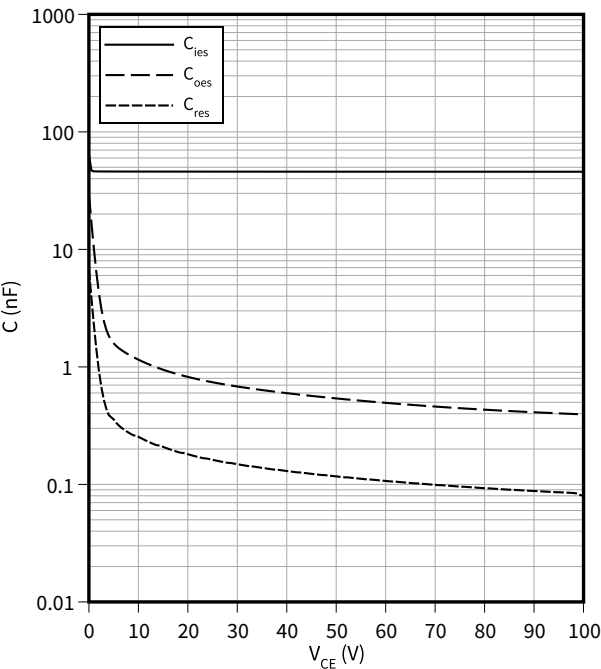
$I_C = 450\text{ A}, T_{vj} = 25\text{ °C}$



5 Characteristics diagrams

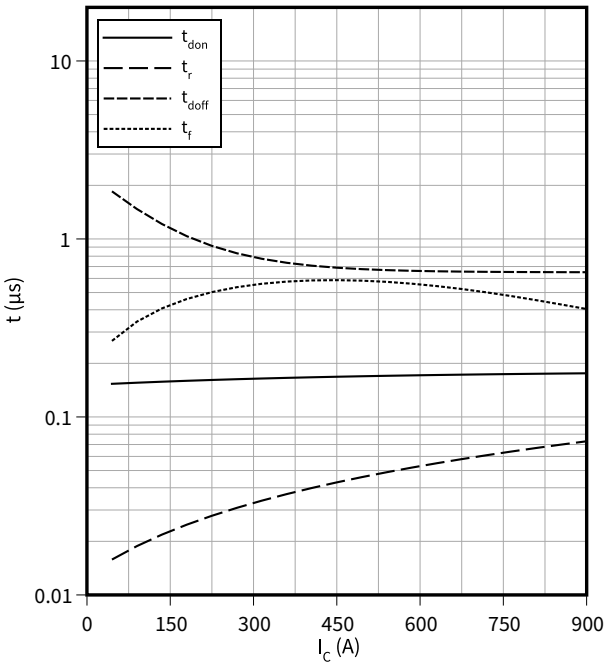
Capacity characteristic (typical), IGBT, T1 / T2

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



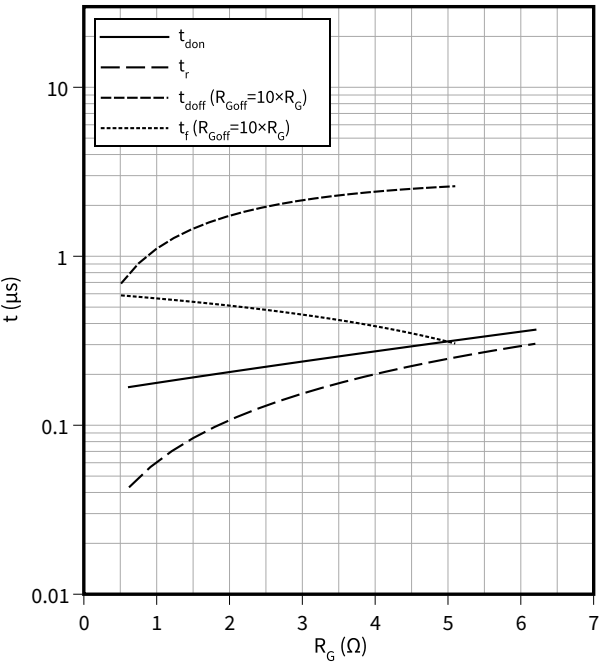
Switching times (typical), IGBT, T1 / T2

$t = f(I_C)$
 $R_{Goff} = 5.1\text{ }\Omega$, $R_{Gon} = 0.62\text{ }\Omega$, $V_{CC} = 900\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $T_{vj} = 175\text{ }^{\circ}\text{C}$



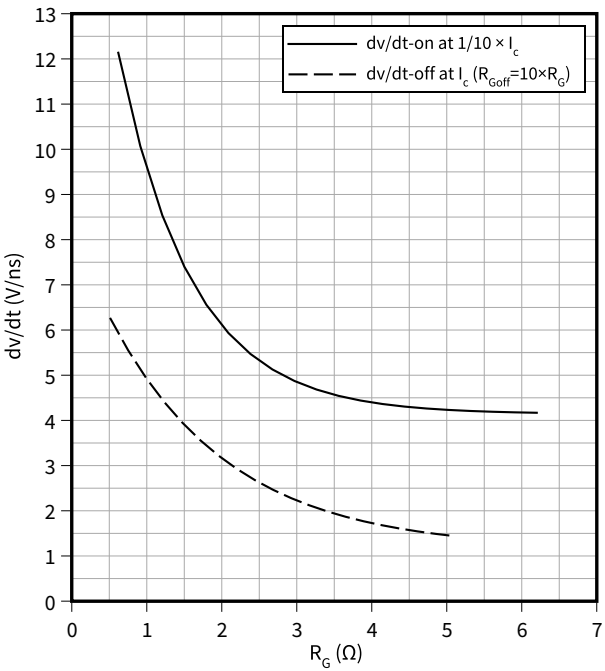
Switching times (typical), IGBT, T1 / T2

$t = f(R_G)$
 $I_C = 450\text{ A}$, $V_{CC} = 900\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $T_{vj} = 175\text{ }^{\circ}\text{C}$



Voltage slope (typical), IGBT, T1 / T2

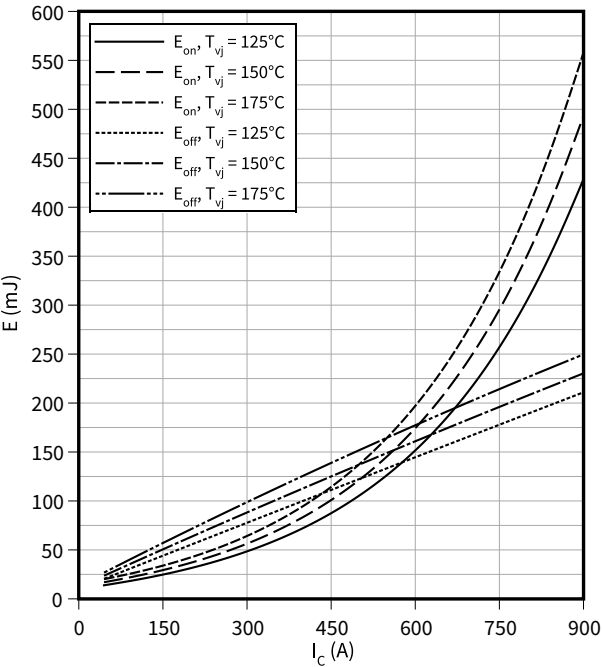
$dv/dt = f(R_G)$
 $I_C = 450\text{ A}$, $V_{CC} = 900\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $T_{vj} = 25\text{ }^{\circ}\text{C}$



5 Characteristics diagrams

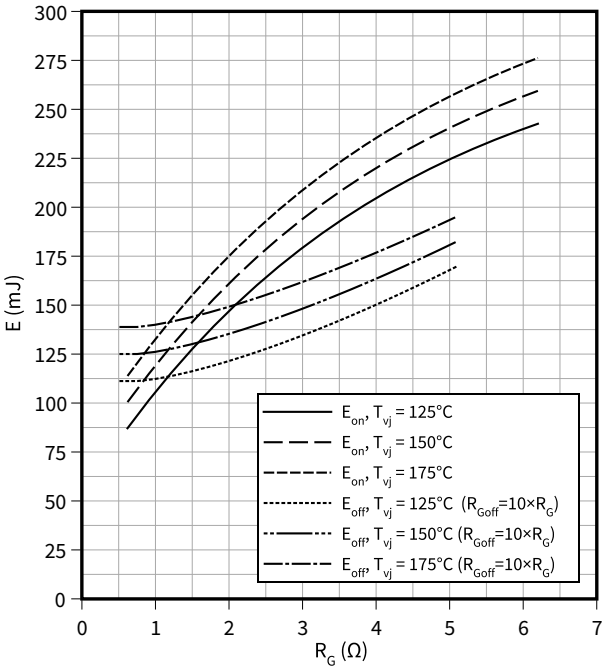
Switching losses (typical), IGBT, T1 / T2

$E = f(I_C)$
 $R_{Goff} = 5.1 \Omega$, $R_{Gon} = 0.62 \Omega$, $V_{CC} = 900 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$



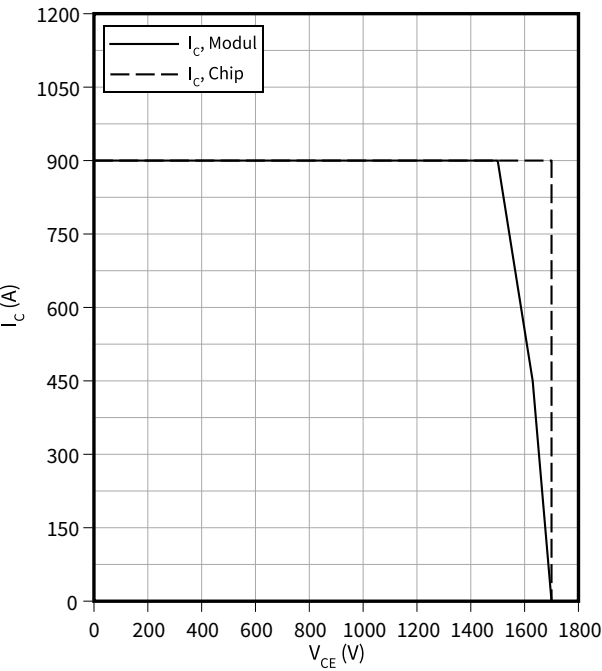
Switching losses (typical), IGBT, T1 / T2

$E = f(R_G)$
 $I_C = 450 \text{ A}$, $V_{CC} = 900 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$



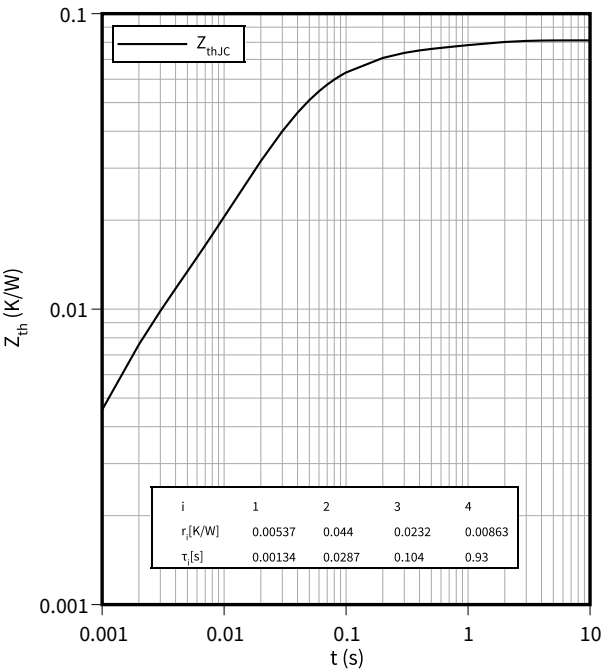
Reverse bias safe operating area (RBSOA), IGBT, T1 / T2

$I_C = f(V_{CE})$
 $R_{Goff} = 5.1 \Omega$, $V_{GE} = \pm 15 \text{ V}$, $T_{vj} = 175 \text{ °C}$



Transient thermal impedance, IGBT, T1 / T2

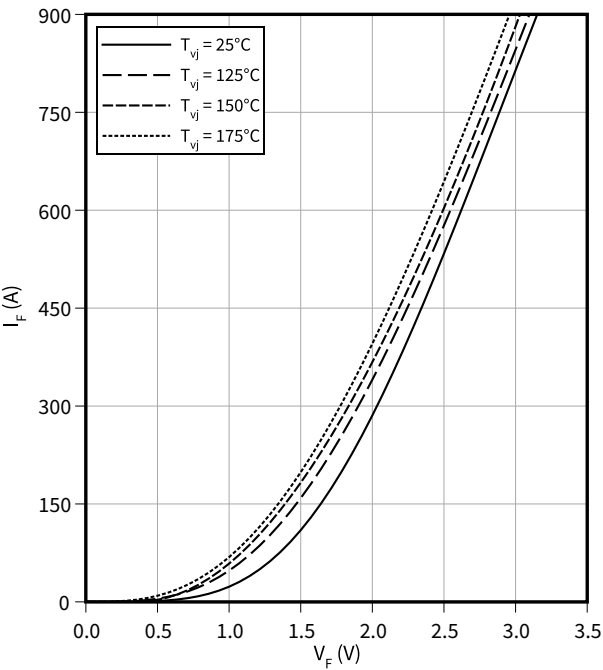
$Z_{th} = f(t)$



5 Characteristics diagrams

Forward characteristic (typical), Diode, D1 / D2

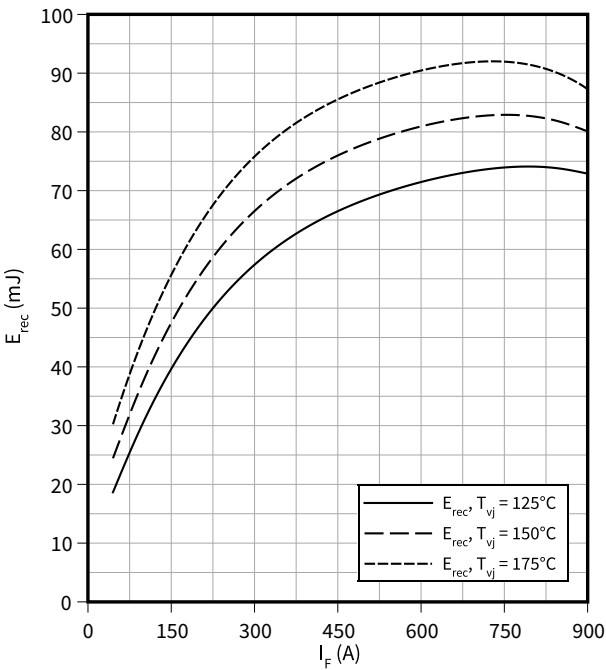
$I_F = f(V_F)$



Switching losses (typical), Diode, D1 / D2

$E_{rec} = f(I_F)$

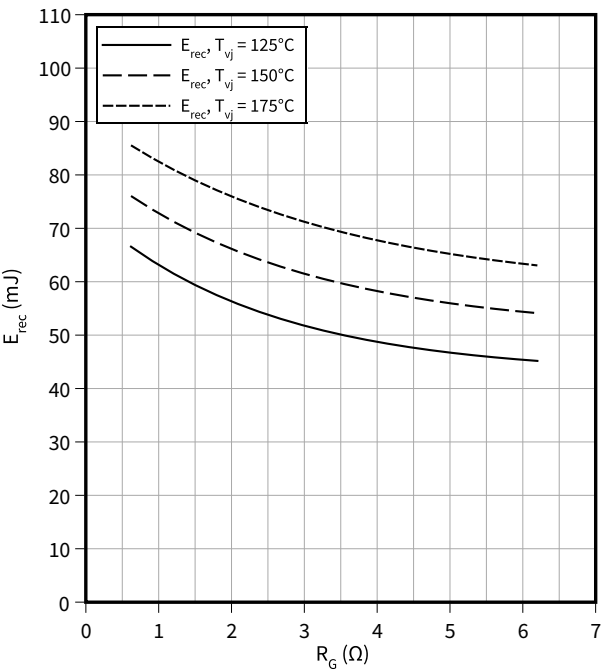
$R_{Gon} = 0.62 \, \Omega, V_{CC} = 900 \, V$



Switching losses (typical), Diode, D1 / D2

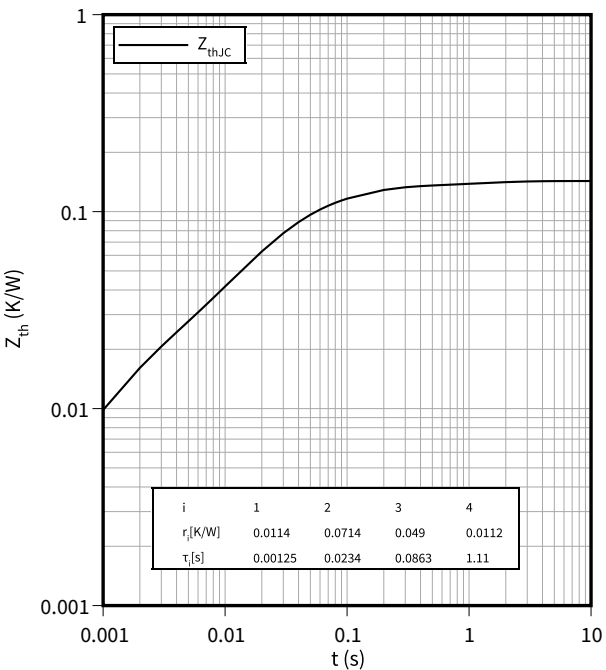
$E_{rec} = f(R_G)$

$I_F = 450 \, A, V_{CC} = 900 \, V$



Transient thermal impedance, Diode, D1 / D2

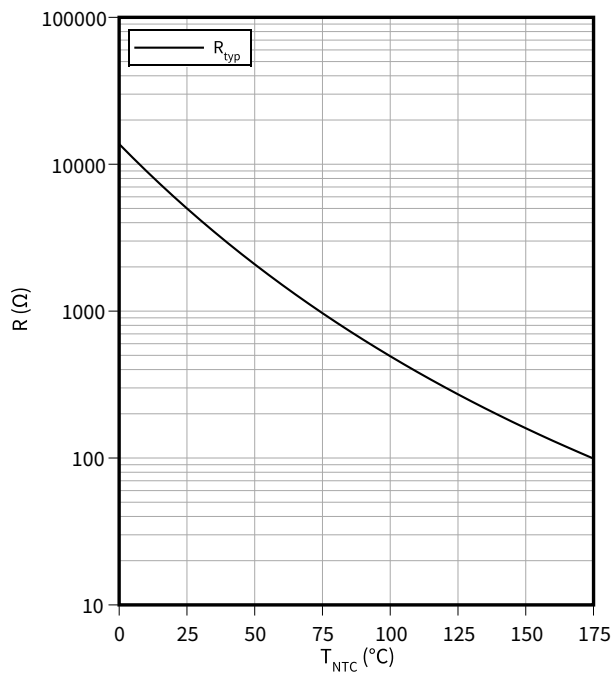
$Z_{th} = f(t)$



5 Characteristics diagrams

Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



6 Circuit diagram

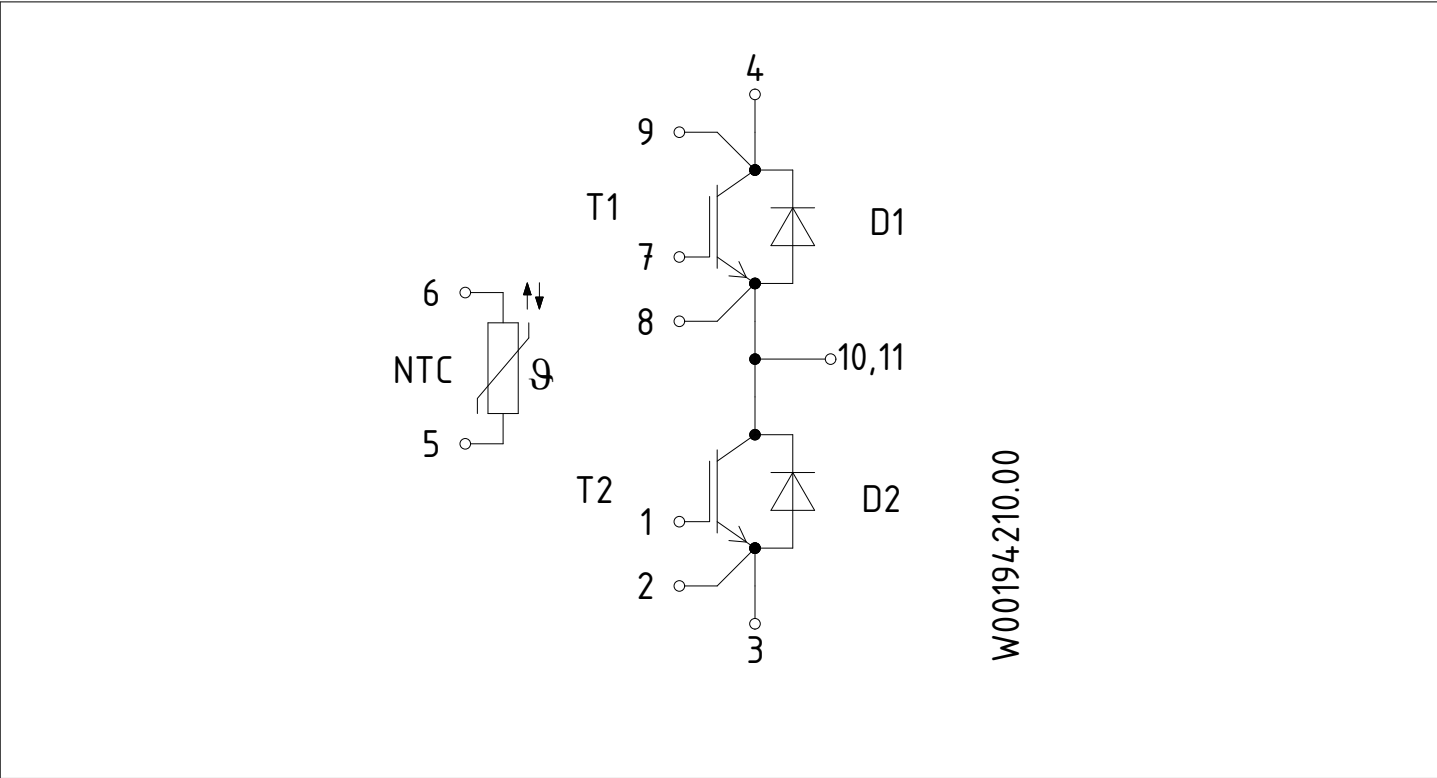


Figure 1



8 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 3

Revision history

Document revision	Date of release	Description of changes
0.10	2023-04-06	Initial version
1.00	2023-08-07	Final datasheet

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