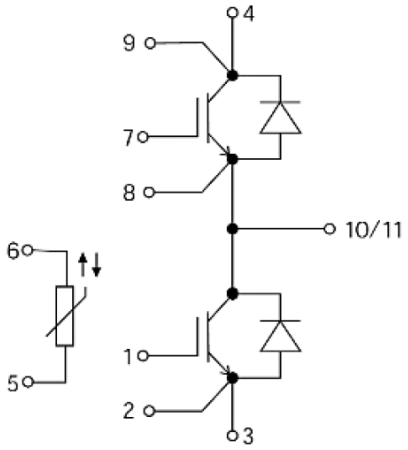
IGBT Modules

V_{CES}	1700V
I_C	900A

Applications

·Motion/servo control
·High frequency switching application
·UPS (Uninterruptible Power Supplies)
·Welding machine

Circuit



Features

·Low $V_{ce(sat)}$ with Trench technology
·Low switching losses especially E_{off}
·$V_{ce(sat)}$ with positive temperature coefficient
·High short circuit capability(10us)
·Including ultra fast & soft recovery anti-parallel FWD
·Low inductance package
·Maximum junction temperature 175°C

● IGBT

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Collector-Emitter Voltage	V_{CES}	V_{GE} = 0 V, I_C = 1 mA, T_{vj} = 25 °C	1700	V
Continuous Collector Current	I_C	T_c = 115 °C, T_{vj} = 175 °C	900	A
Repetitive Peak Collector Current	I_{CRM}	Tp = 1 ms	1800	A
Gate-Emitter Voltage	V_{GES}	T_{vj} = 25 °C	±20	V
Total Power Dissipation	P_{tot}	T_c = 25 °C T_{vjmax} = 175 °C	3700	W

Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Gate-emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$, I_C = 25 mA, T_{vj} = 25 °C	5	6	7.5	V
Collector-Emitter Cut-off Current	I_{CES}	V_{CE} = 1700 V, V_{GE} = 0 V, T_{vj} = 25 °C			1	mA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_c = 900 A, V_{GE} = 15 V, T_{vj} = 25 °C		1.72	2	V
		I_c = 900 A, V_{GE} = 15 V, T_{vj} = 125 °C		2.05		
		I_c =900 A, V_{GE} = 15 V, T_{vj} = 175 °C		2.1		
Gate Charge	Q_G	I_c = 900 A, V_{GE} = 900 V		7.5		uC
Internal Gate Resistance	R_{Gint}			0.35		Ω
Input Capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz, T_{vj} = 25 °C		110		nF
Reverse Transfer Capacitance	C_{res}			0.75		nF
Gate-Emitter leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = ±20 V, T_{vj} = 25 °C	-0.5		0.5	nA
Turn-on Delay Time	$t_{d(on)}$	I_C = 900 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 25 °C		168		ns
Rise Time	t_r			76		ns
Turn-off Delay Time	$t_{d(off)}$	I_C = 900 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 25 °C		520		ns
Fall Time	t_f			372		ns
Energy Dissipation During Turn-on Time	E_{on}	I_C = 900 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 25 °C		149		mJ
Energy Dissipation During Turn-off Time	E_{off}	I_C = 900 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 25 °C		182		mJ
Turn-on Delay Time	$t_{d(on)}$	I_C = 900 A, V_{CE} = 900 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{Vj} = 125 °C		192		ns
Rise Time	t_r			81		ns
Turn-off Delay Time	$t_{d(off)}$	I_C = 900 A, V_{CE} = 900 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{Vj} = 125 °C		600		ns
Fall Time	t_f			530		ns
Energy Dissipation During Turn-on Time	E_{on}	I_C = 900 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 125 °C		230		mJ
Energy Dissipation During Turn-off Time	E_{off}	I_C = 900 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 125 °C		260		mJ
Turn-on Delay Time	$t_{d(on)}$	I_C = 900 A, V_{CE} = 900 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{Vj} = 175 °C		211		ns
Rise Time	t_r			94		ns
Turn-off Delay Time	$t_{d(off)}$	I_C = 900 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 175 °C		652		ns
Fall Time	t_f			603		ns
Energy Dissipation During Turn-on Time	E_{on}	I_C = 900 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 175 °C		288		mJ
Energy Dissipation During Turn-off Time	E_{off}	I_C = 900 A, V_{CC} = 900 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 175 °C		283		mJ
SC Data	I_{sc}	$T_p \leq$ 10 us, V_{GE} = 15 V, T_{vj} = 175 °C, V_{cc} = 1200 V, $V_{CEM} \leq$ 1700V		3570		A

Diode

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Repetitive Peak Reverse Voltage	V_{RRM}	T_{vj} = 25 °C	1700	V
Continuous DC Forward Current	I_F		900	A
Repetitive Peak Forward Current	I_{FRM}	t_p = 1 ms	1800	A
I^2t-value	I^2t	V_R = 0 V, t_p = 10 ms, T_j=150 °C	40500	A^2s

Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	V_F	I_F = 900 A, T_{vj} = 25 °C		2.05		V
		I_F = 900 A, T_{vj} = 125 °C		2.3		
		I_F = 900 A, T_{vj} = 175 °C		2.2		
Recovered Charge	Q_{rr}	I_F = 900 A V_R = 900 V -di_F/dt = 8220 A/us T_{vj} = 25 °C		148		uC
Peak Reverse Recovery Current	I_{rr}			940		A
Reverse Recovery Energy	E_{rec}			83		mJ
Recovered Charge	Q_{rr}	I_F = 900 A V_R = 900 V -di_F/dt = 8220 A/us T_{vj} =125 °C		252		uC
Peak Reverse Recovery Current	I_{rr}			1050		A
Reverse Recovery Energy	E_{rec}			140		mJ
Recovered Charge	Q_{rr}	I_F = 900 A V_R = 900 V -di_F/dt = 8220 A/us T_{vj} = 175 °C		305		uC
Peak Reverse Recovery Current	I_{rr}			1085		A
Reverse Recovery Energy	E_{rec}			172		mJ

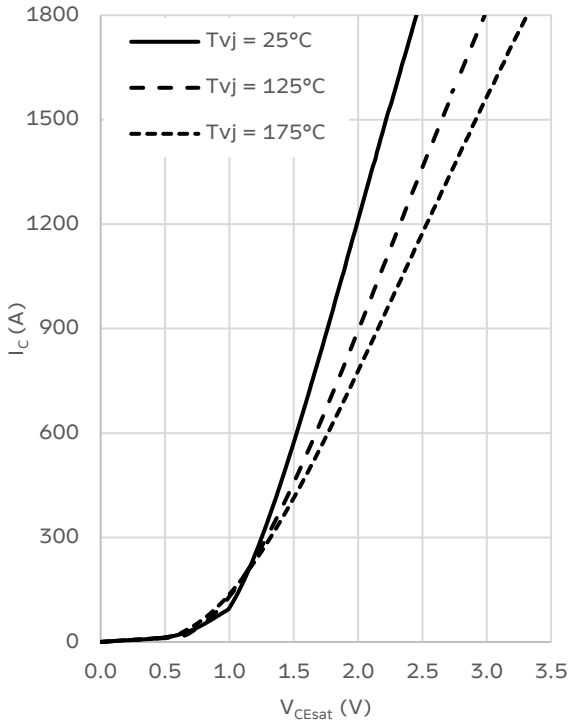
Module Characteristics

T_c=25°C unless otherwise specified

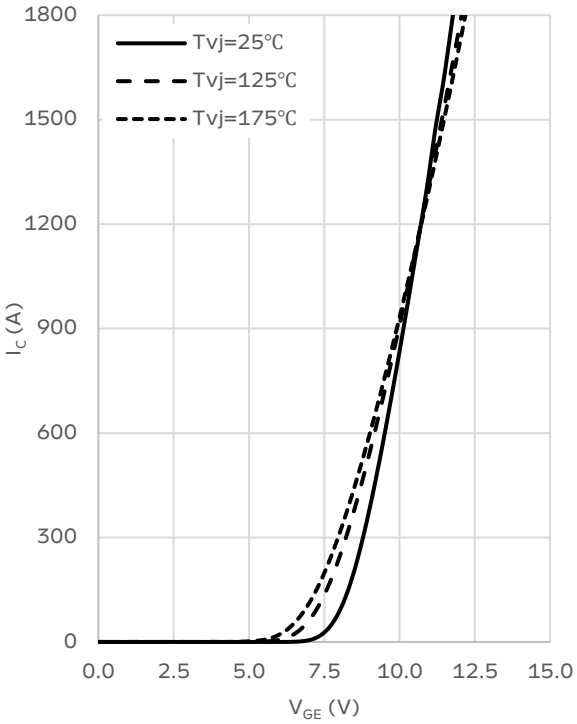
Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Isolation voltage	V_{isol}	t =1 min, f = 50 Hz			3400	V
Maximum Junction Temperature	T_{jmax}				175	°C
Operating Junction Temperature	$T_{vj(op)}$		-40		175	°C
Storage Temperature	T_{stg}		-40		125	°C
Thermal Resistance Junction-to Case	$R_{\theta JC}$	per IGBT			0.043	K/W
		per Diode			0.7	
Comparative Tracking Index	CTI		200			
Thermal Resistance Case-to Sink	$R_{\theta CS}$	Conductive grease applied		0.031		K/W
Module ElectrodesTorque	M_t	Recommended(M6)	3		6	N·m
Module-to-SinkTorque	M_s	Recommended(M5)	3		6	N·m
Mass	m			350		g

Characteristics

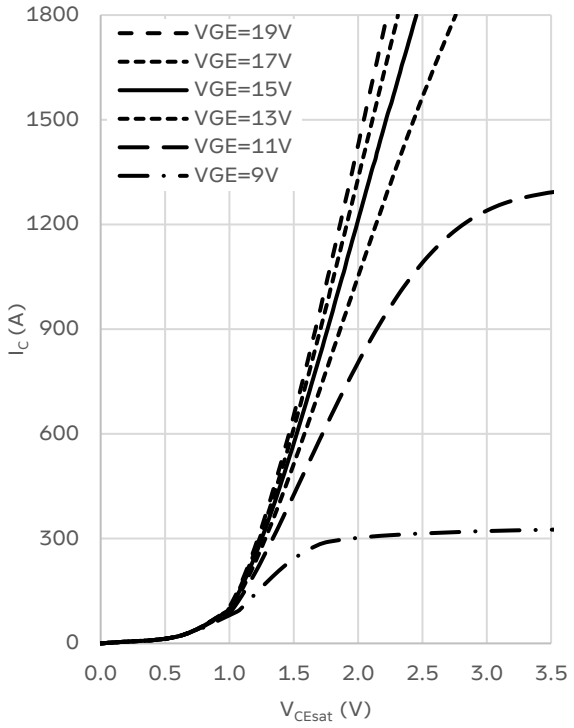
IGBT on-state characteristics (typical)
$I_C = f(V_{CE})$
V_{GE} = 15 V



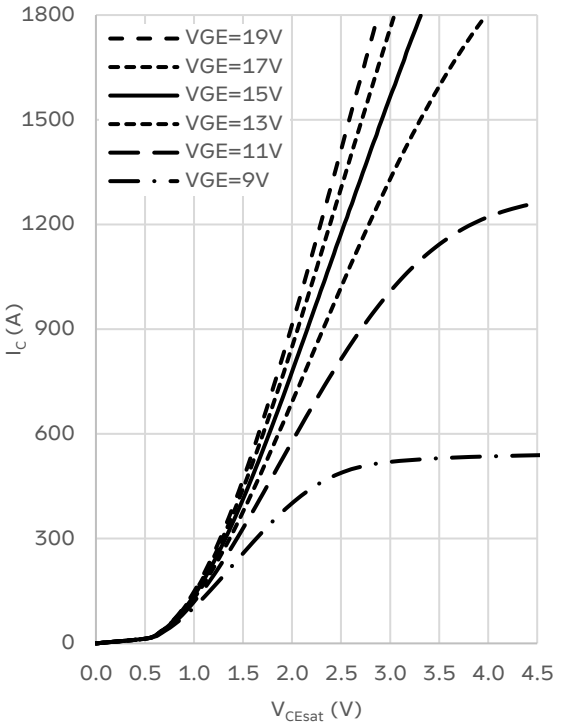
IGBT transfer characteristics (typical)
$I_C = f(V_{GE})$
V_{CE} = 20V



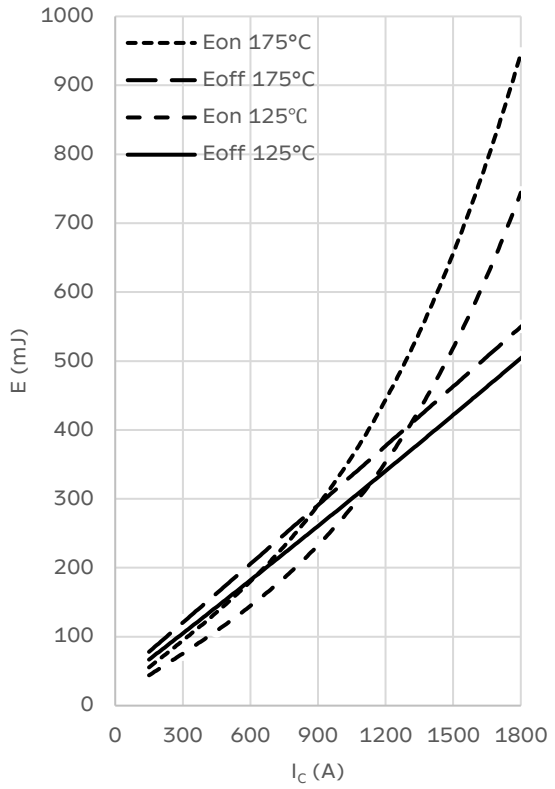
IGBT output characteristics (typical)
$I_C = f(V_{CE})$
T_{vj} = 25 °C



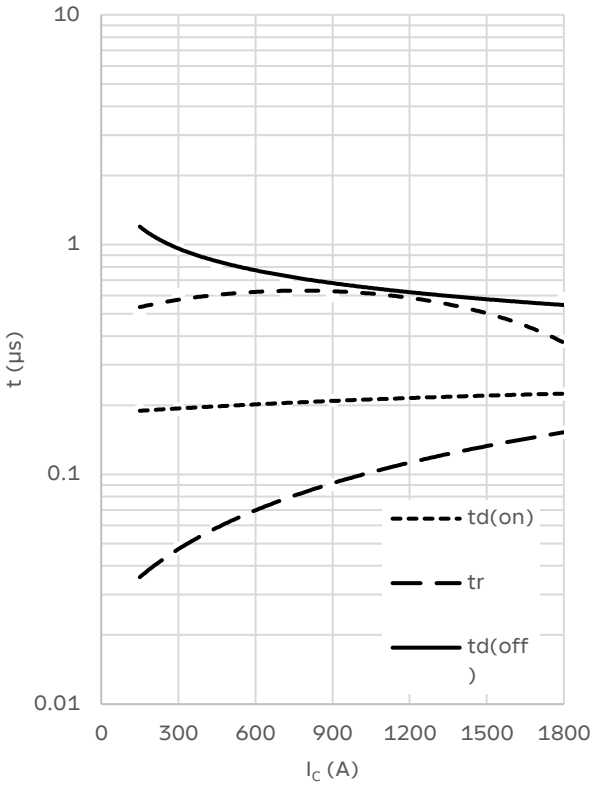
IGBT output characteristics (typical)
$I_C = f(V_{CE})$
T_{vj} = 175 °C



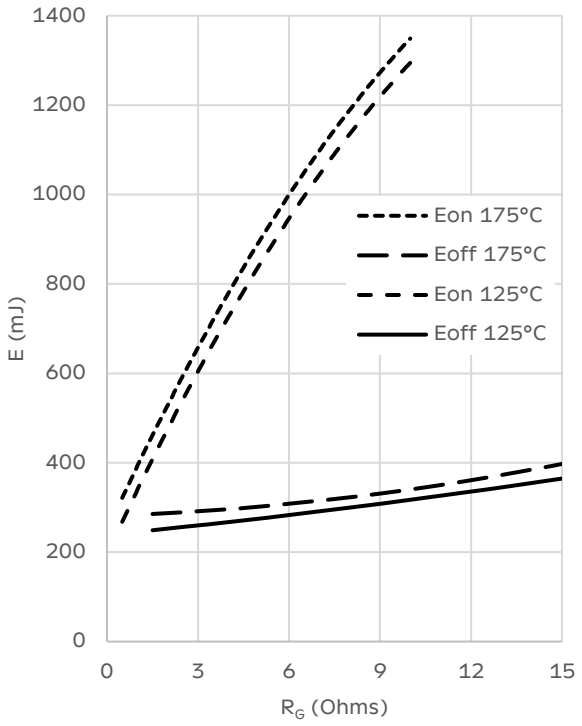
IGBT switching losses (typical)
E = f(I_{CE})
V_{CE} = 900 V, R_{Gon} = 0.5 Ω, R_{Goff} = 1.5 Ω, V_{GE} = -15/+15 V



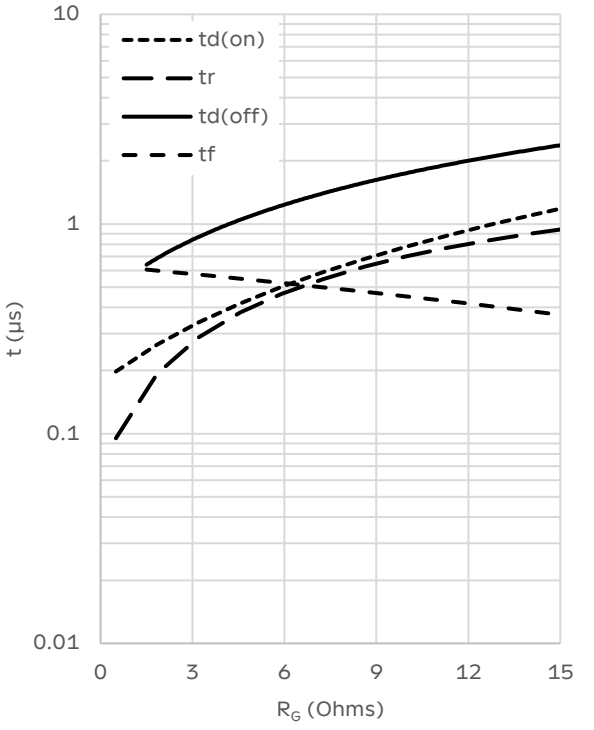
IGBT switching times (typical)
t = f(I_{CE}), T_{vj} = 175 °C
V_{CE} = 900 V, R_{Gon} = 0.5 Ω, R_{Goff} = 1.5 Ω, V_{GE} =-15/+15 V



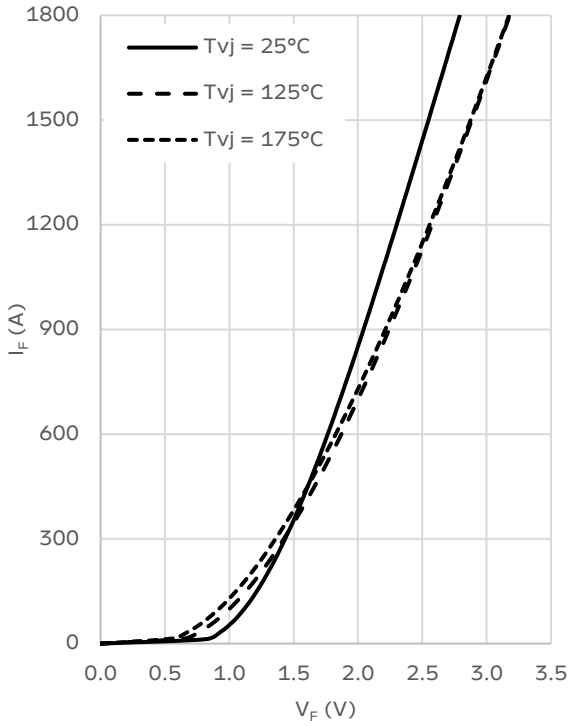
IGBT switching losses (typical)
E = f(R_G)
V_{CE} = 900 V, I_C = 900 A, V_{GE} = -15/+15 V



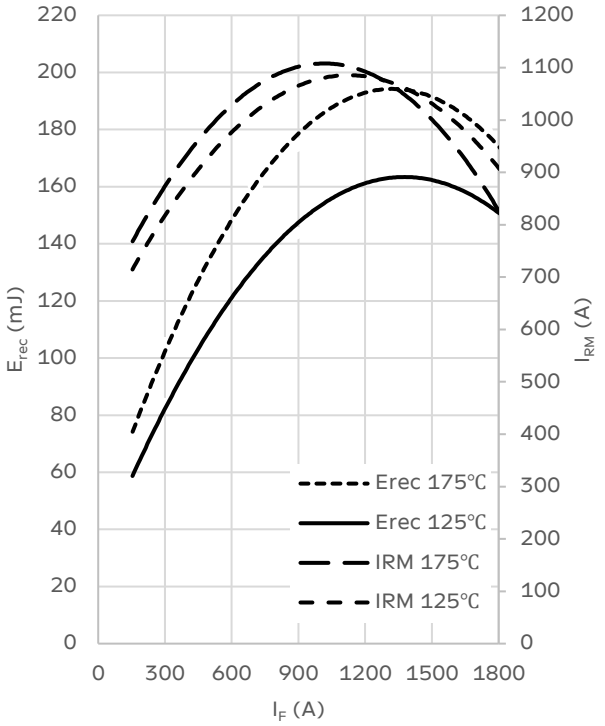
IGBT switching times (typical)
t = f(R_G), T_{vj} = 175 °C
V_{CE} = 900 V, I_C = 900 A, V_{GE} = -15/+15 V



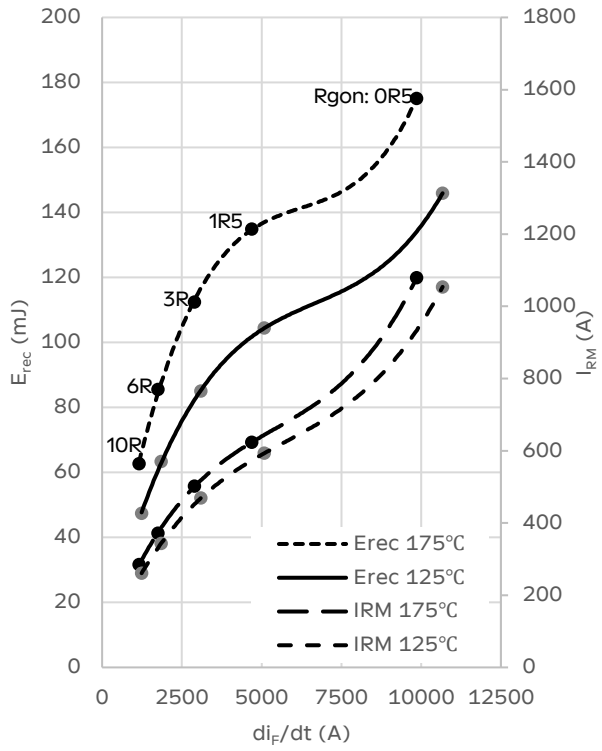
Diode forward characteristic (typical)
$I_F = f(V_F)$



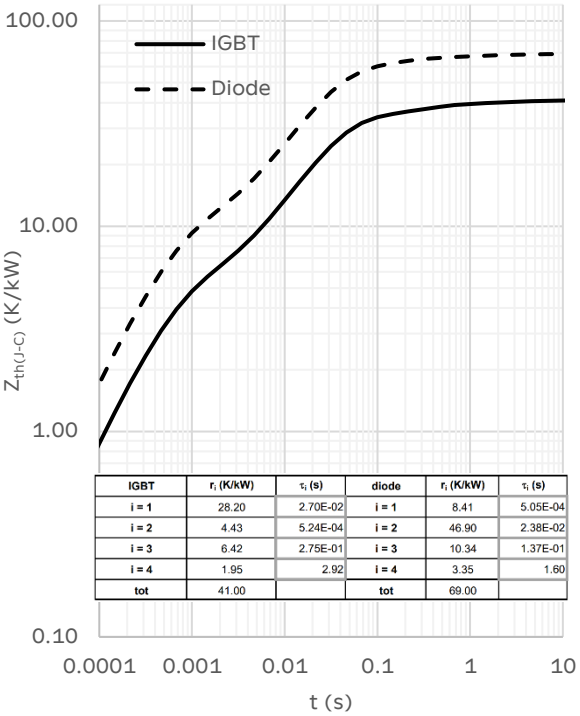
Diode switching characteristics (typical)
$E_{rec} = f(I_F)$, $I_{RM} = f(I_F)$
V_{DC} = 900 V, R_{Gon} = 0.5 Ω (IGBT), V_{GE} =-15/+15 V (IGBT)



Diode switching characteristics (typical)
$E_{rec} = f(di/dt)$, $I_{RM} = f(di/dt)$
V_{DC} = 600 V, I_F = 600 A, V_{GE} =-15/+15 V (IGBT)

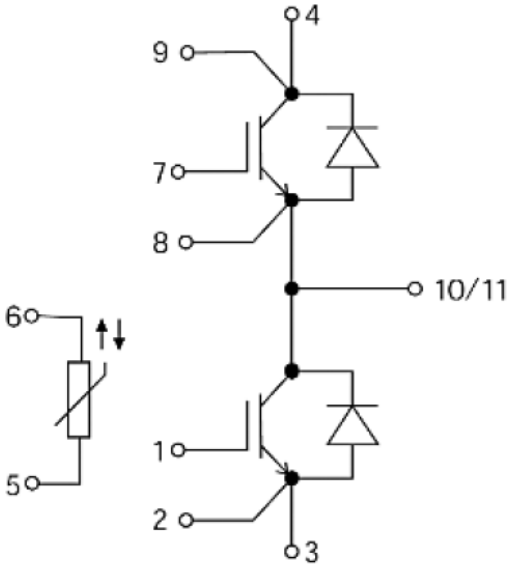


Thermal impedance
$Z_{th(j-c)} = f(t)$



IGBT	r_i (K/kW)	τ_i (s)	diode	r_i (K/kW)	τ_i (s)
i = 1	28.20	2.70E-02	i = 1	8.41	5.05E-04
i = 2	4.43	5.24E-04	i = 2	46.90	2.38E-02
i = 3	6.42	2.75E-01	i = 3	10.34	1.37E-01
i = 4	1.95	2.92	i = 4	3.35	1.60
tot	41.00		tot	69.00	

- **Circuit Diagram**



- **Package Outline Information**