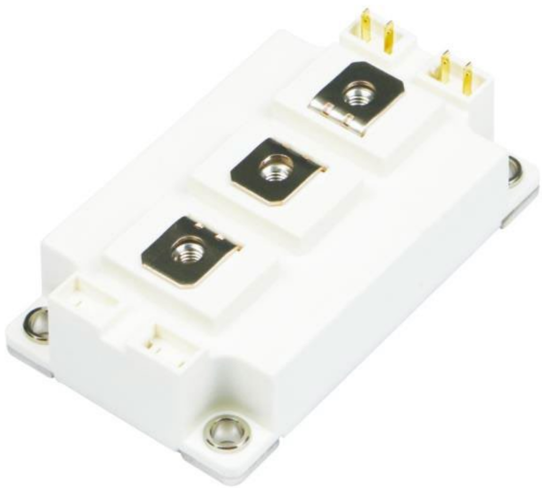


IGBT Modules

V_{CES} 1200V

I_C 300A

Applications

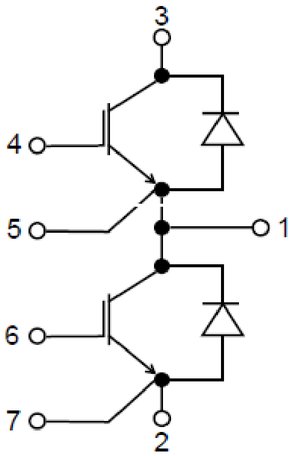
·Motion/servo control

·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	1200	V
Continuous Collector Current	I_C	T_c = 100 °C	300	A
Repetitive Peak Collector Current	I_{CRM}	Tp = 1 ms	600	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	1550	W

Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Gate-emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$, I_C = 22.5 mA, T_{vj} = 25 °C	5	6.0	7.1	V
Collector-Emitter Cut-off Current	I_{CES}	V_{CE} = 1200 V, V_{GE} = 0 V, T_{vj} = 25 °C			1	mA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_c = 300 A, V_{GE} = 15 V, T_{vj} = 25 °C		1.7	2	V
		I_c = 300 A, V_{GE} = 15 V, T_{vj} = 125 °C		2.05		
		I_c =300 A, V_{GE} = 15 V, T_{vj} = 175 °C		2.15		
Gate Charge	Q_G			2.0		uC
Internal Gate Resistance	R_{Gint}			2.75		Ω
Input Capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz, T_{vj} = 25 °C		17.0		nF
Reverse Transfer Capacitance	C_{res}			0.7		nF
Gate-Emitter leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = ±20 V, T_{vj} = 25 °C			500	nA
Turn-on Delay Time	$t_{d(on)}$	I_C = 300 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 25 °C		160		ns
Rise Time	t_r			40		ns
Turn-off Delay Time	$t_{d(off)}$	I_C = 300 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 25 °C		478		ns
Fall Time	t_f			228		ns
Energy Dissipation During Turn-on Time	E_{on}	I_C = 300 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 25 °C		15		mJ
Energy Dissipation During Turn-off Time	E_{off}	I_C = 300 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 25 °C		30		mJ
Turn-on Delay Time	$t_{d(on)}$	I_C = 300 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 125 °C		178		ns
Rise Time	t_r			45		ns
Turn-off Delay Time	$t_{d(off)}$	I_C = 300 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 125 °C		555		ns
Fall Time	t_f			337		ns
Energy Dissipation During Turn-on Time	E_{on}	I_C = 300 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 125 °C		25		mJ
Energy Dissipation During Turn-off Time	E_{off}	I_C = 300 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 125 °C		40		mJ
Turn-on Delay Time	$t_{d(on)}$	I_C = 300 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 175 °C		185		ns
Rise Time	t_r			50		ns
Turn-off Delay Time	$t_{d(off)}$	I_C = 300 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 175 °C		600		ns
Fall Time	t_f			387		ns
Energy Dissipation During Turn-on Time	E_{on}	I_C = 300 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 175 °C		37		mJ
Energy Dissipation During Turn-off Time	E_{off}	I_C = 300 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_G = 2 Ω, T_{vj} = 175 ℃		45		mJ
SC Data	I_{sc}	T_p≤ 10 us, V_{GE} = 15 V, T_{vj} = 150 °C, V_{cc} = 900 V, V_{CEM} ≤ 1200V		1035		A

Diode

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Repetitive Peak Reverse Voltage	V_{RRM}	T_{vj} = 25 °C	1200	V
Continuous DC Forward Current	I_F		300	A
Repetitive Peak Forward Current	I_{FRM}	t_p = 1 ms	600	A
I^2t-value	I^2t	V_R = 0 V, t_p = 10 ms, T_j=125 °C	5650	A^2s
		V_R = 0 V, t_p = 10 ms, T_j=150 °C	5530	

Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	V_F	I_F = 300 A, T_{vj} = 25 °C		1.75	2.5	V
		I_F = 300 A, T_{vj} = 125 °C		1.85		
		I_F = 300 A, T_{vj} = 175 °C		1.85		
Recovered Charge	Q_{rr}	I_F = 300 A V_R = 600 V -di_F/dt = 6600 A/us T_{vj} = 25 °C		27		uC
Peak Reverse Recovery Current	I_{rr}			290		A
Reverse Recovery Energy	E_{rec}			10		mJ
Recovered Charge	Q_{rr}	I_F = 300 A V_R = 600 V -di_F/dt = 6600 A/us T_{vj} =125 °C		45		uC
Peak Reverse Recovery Current	I_{rr}			326		A
Reverse Recovery Energy	E_{rec}			15		mJ
Recovered Charge	Q_{rr}	I_F = 300 A V_R = 600 V -di_F/dt = 6600 A/us T_{vj} = 175 °C		56		uC
Peak Reverse Recovery Current	I_{rr}			340		A
Reverse Recovery Energy	E_{rec}			20		mJ

Module Characteristics

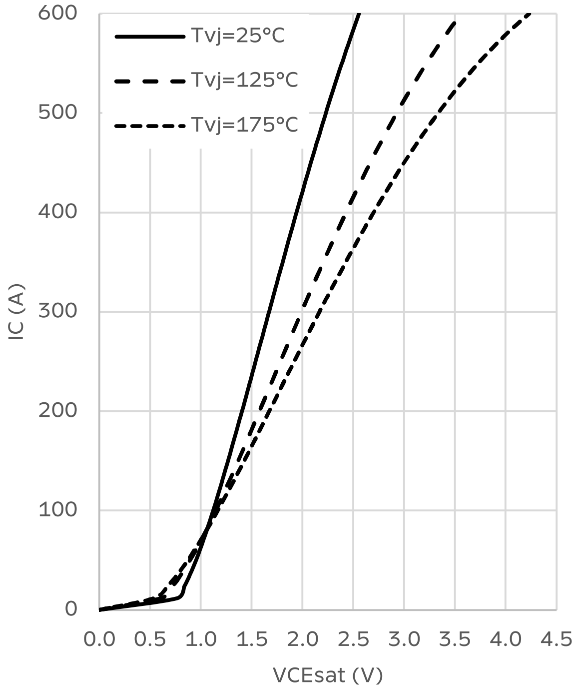
T_c=25°C unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Isolation voltage	V_{isol}	t =1 min, f = 50 Hz			4000	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			0.105	K/W
		per Diode			0.154	
Comparative Tracking Index	CTI		>400			
Thermal Resistance Case-to Sink	$R_{\theta CS}$	Conductive grease applied		0.045		K/W
Module ElectrodesTorque	M_t	Recommended(M6)	2.5		5.0	N·m
Module-to-SinkTorque	M_s	Recommended(M5)	3.0		6.0	N·m
Mass	m			311		g

Characteristics

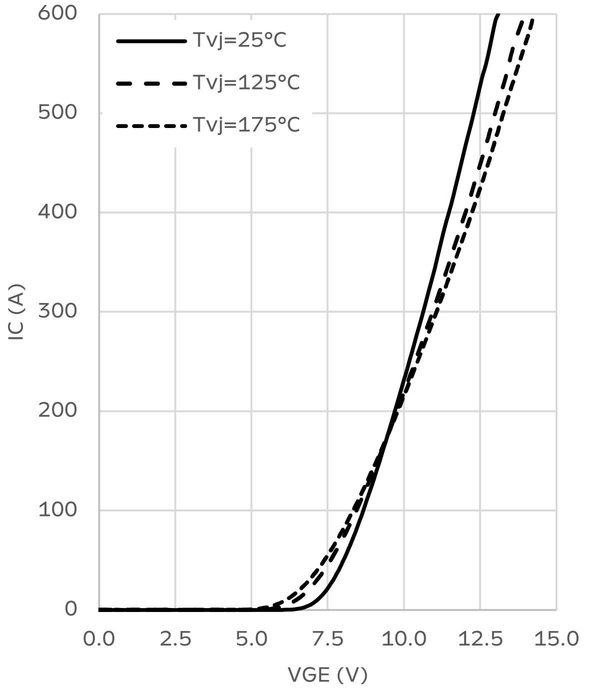
IGBT on-state characteristics (typical)

$I_C = f(V_{CE})$
$V_{GE} = 15\ V$



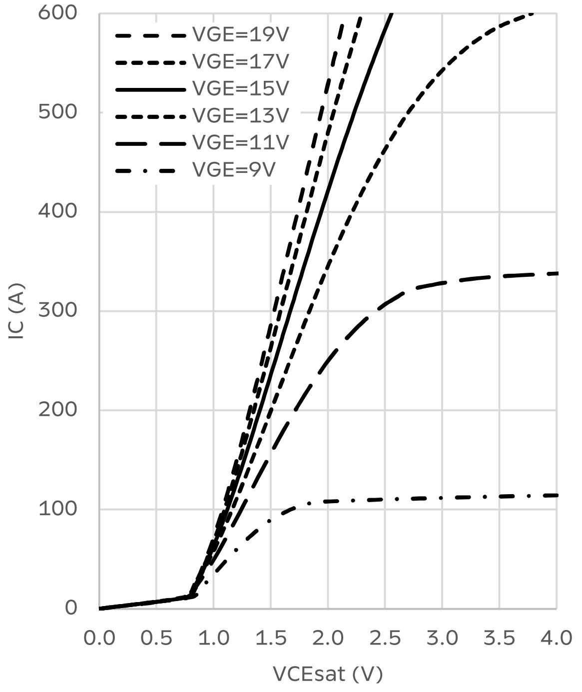
IGBT transfer characteristics (typical)

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



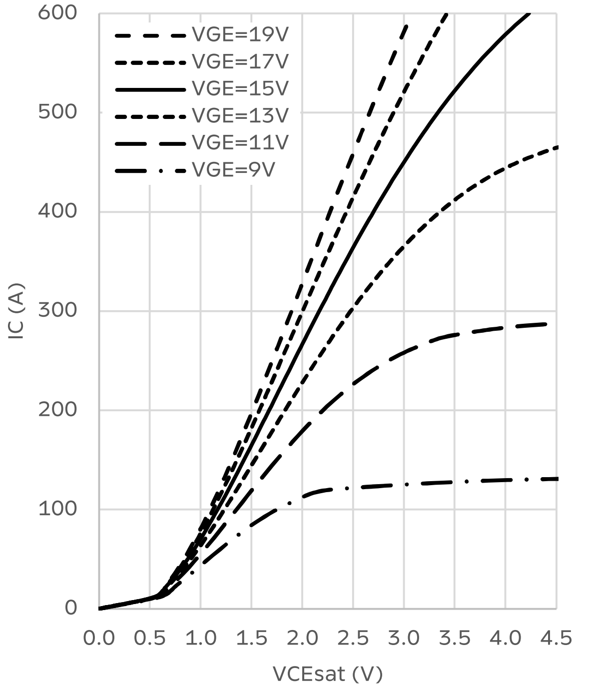
IGBT output characteristics (typical)

$I_C = f(V_{CE})$
$T_{vj} = 25\ °C$



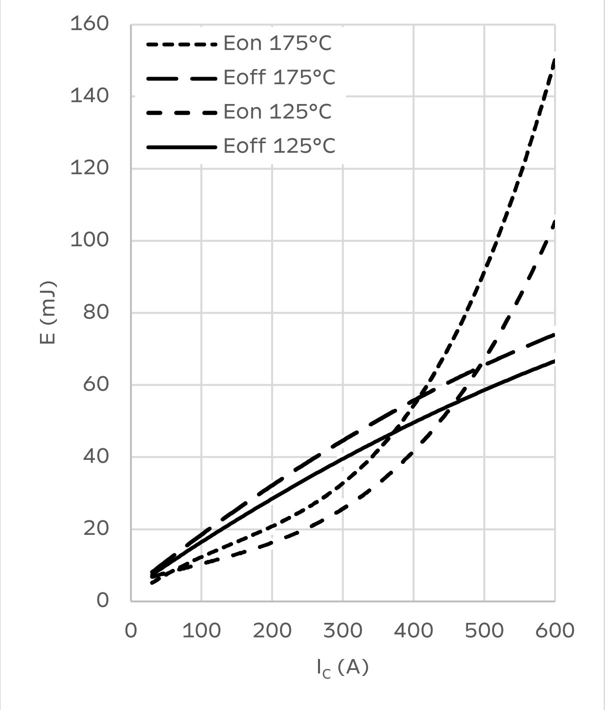
IGBT output characteristics (typical)

$I_C = f(V_{CE})$
$T_{vj} = 175\ °C$



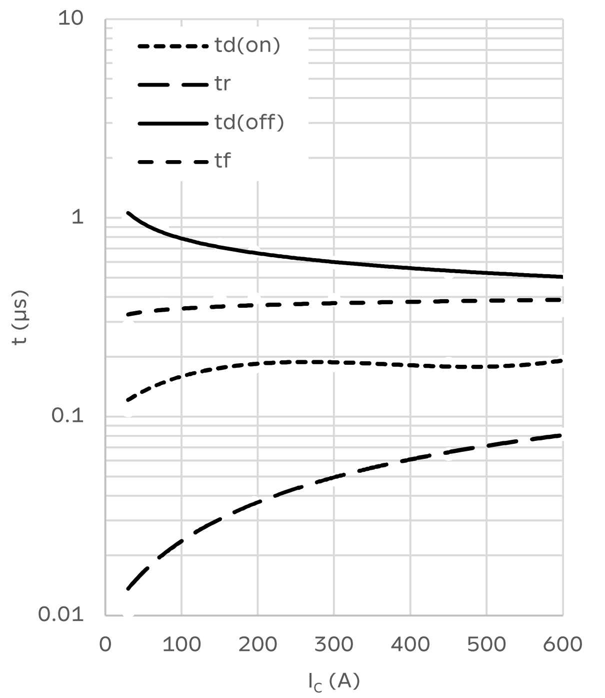
IGBT switching losses (typical)

E = f(I_{CE})
V_{CE} = 600 V, R_{Gon} = 1.5 Ω, R_{Goff} = 3.5 Ω, V_{GE} = -15/+15 V



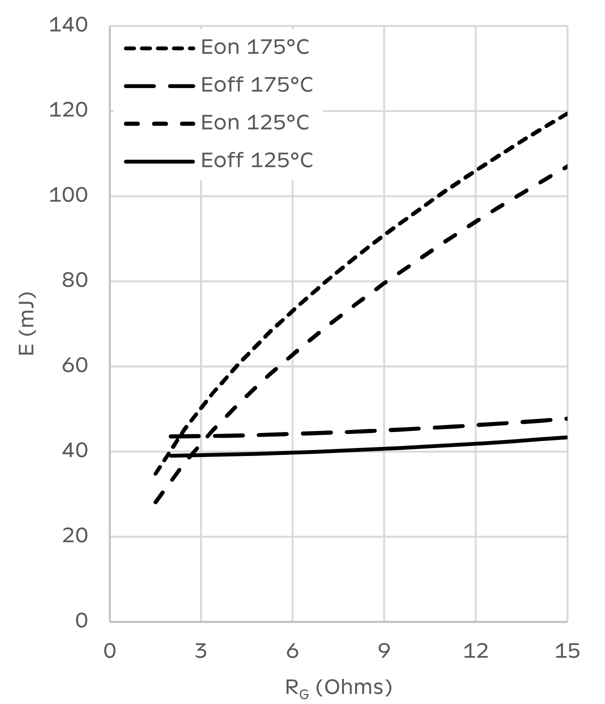
IGBT switching times (typical)

t = f(I_{CE}), T_{vj} = 175 °C
V_{CE} = 600 V, R_{Gon} = 1.5 Ω, R_{Goff} = 3.5 Ω, V_{GE} =-15/+15 V



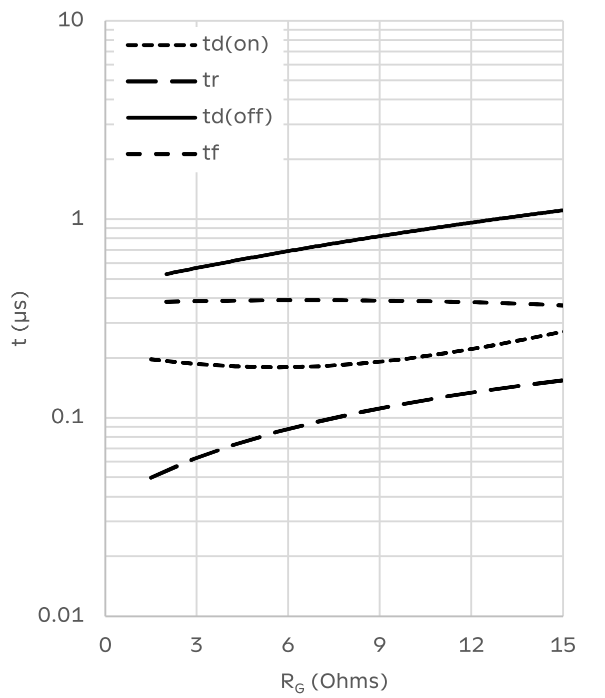
IGBT switching losses (typical)

E = f(R_G)
V_{CE} = 600 V, I_C = 300 A, V_{GE} = -15/+15 V



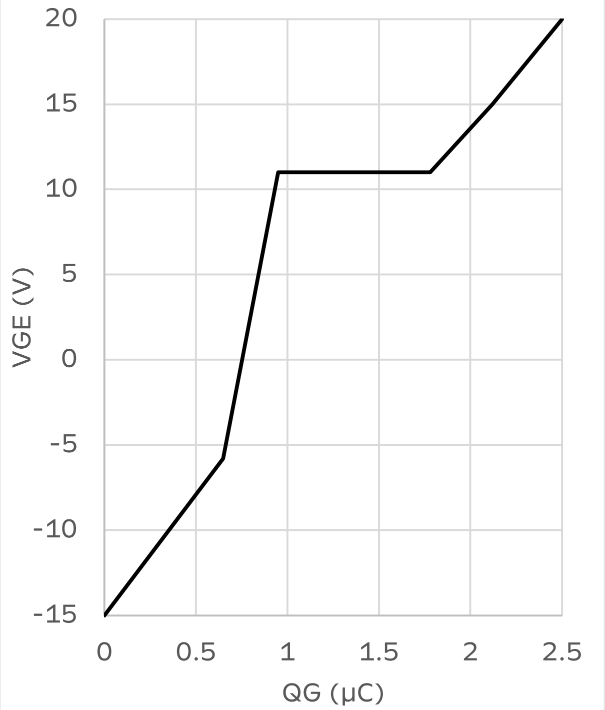
IGBT switching times (typical)

t = f(R_G), T_{vj} = 175 °C
V_{CE} = 600 V, I_C = 300 A, V_{GE} = -15/+15 V



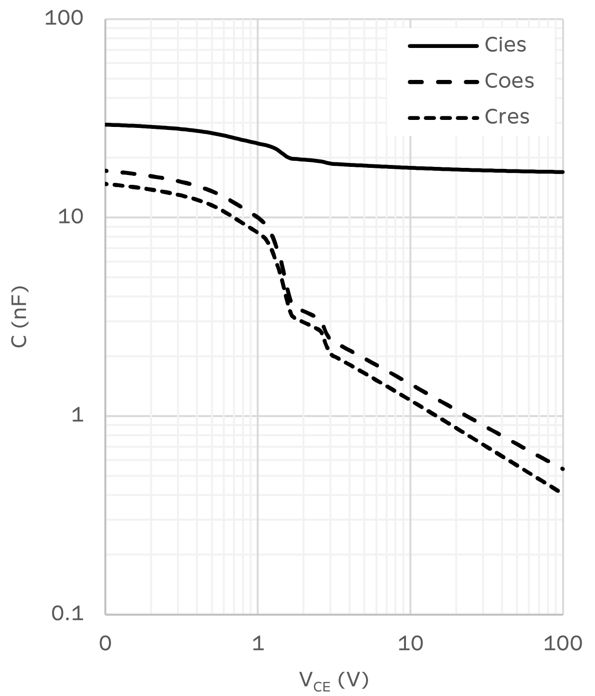
IGBT gate charge (typical)

$V_{GE} = f(Q_G)$, $T_{vj} = 25$ °C
$V_{CE} = 600$ V, $I_C = 300$ A



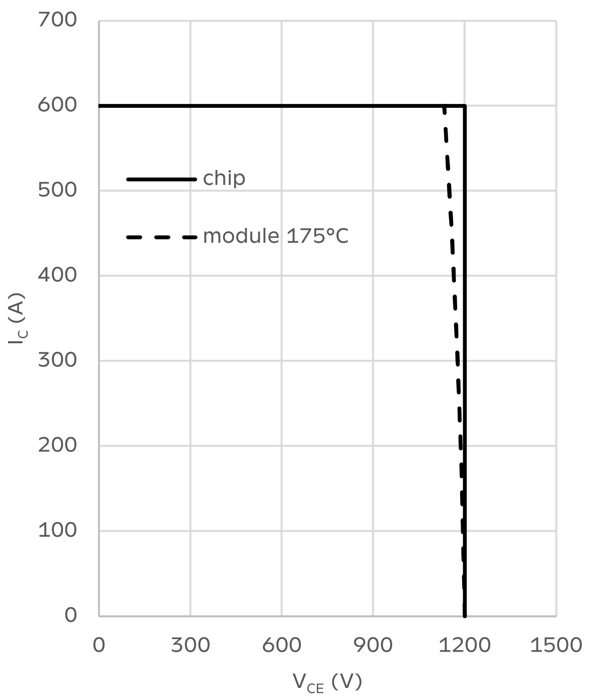
Capacitance characteristics (typical)

$C = f(V_{CE})$, $T_{vj} = 25$ °C
f = 100 kHz, $V_{GE} = 0$ V



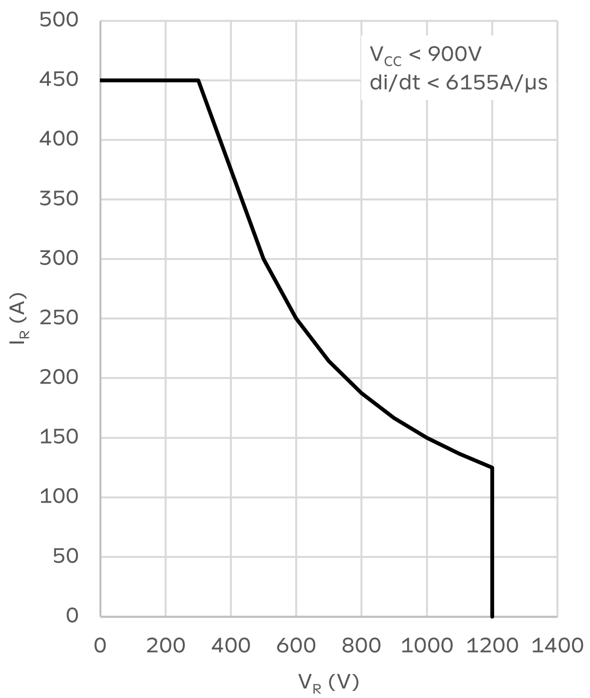
IGBT RBSOA

$I_C = f(V_{CEm})$
$R_{Goff} = 3.5\ \Omega$, $V_{GE} = \pm15$ V



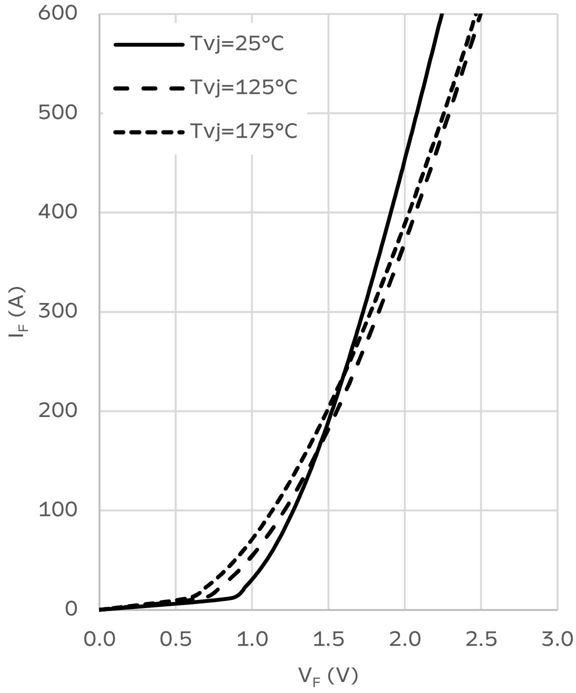
Diode SOA

$T_{vj} \leq 175$ °C



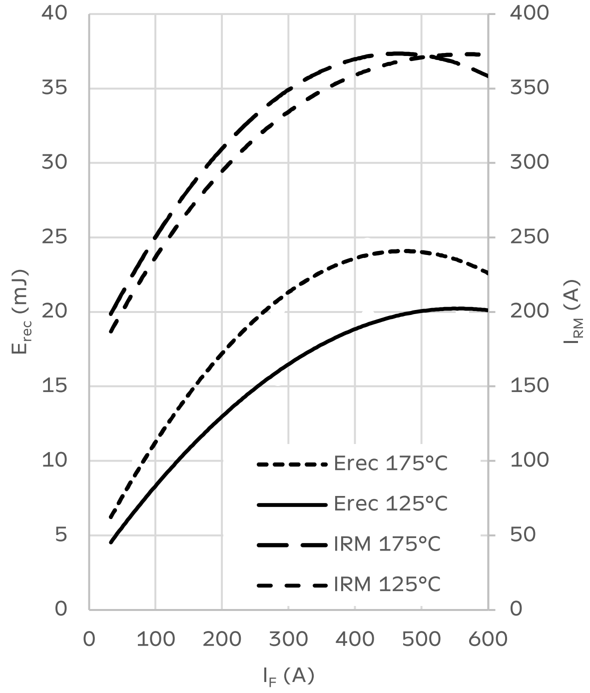
Diode forward characteristic (typical)

$I_F = f(V_F)$



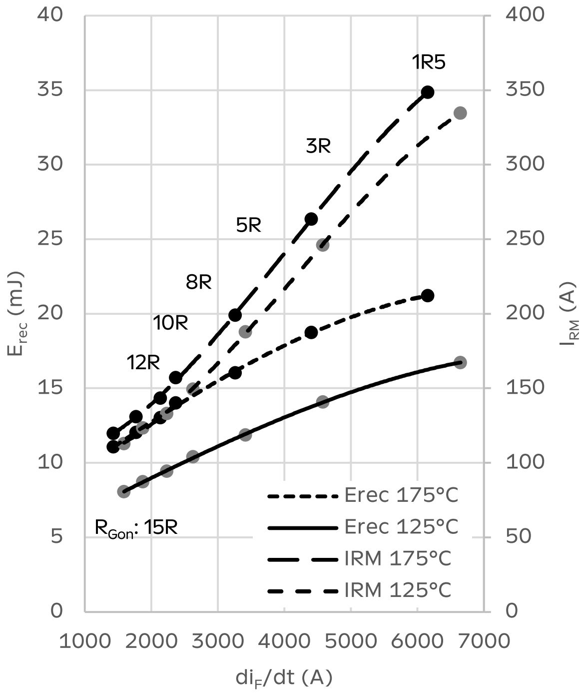
Diode switching characteristics (typical)

$E_{rec} = f(I_F)$, $I_{RM} = f(I_F)$
$V_{DC} = 600$ V, $R_{Gon} = 1.5\ \Omega$ (IGBT), $V_{GE} = -15/+15$ V (IGBT)



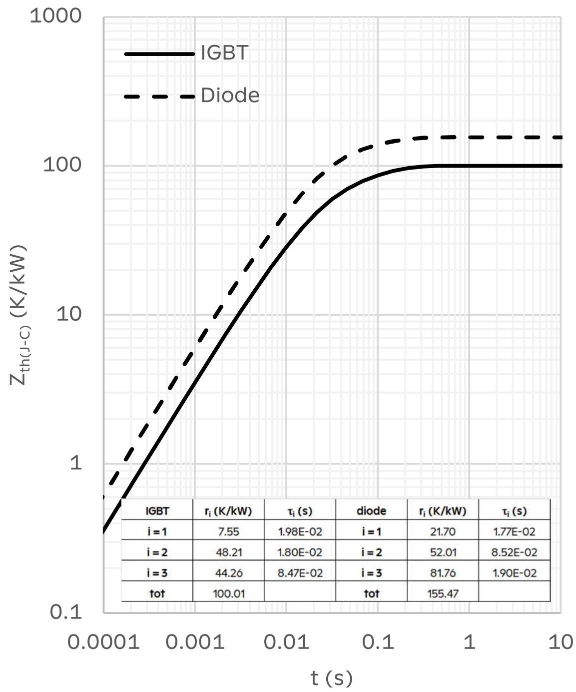
Diode switching characteristics (typical)

$E_{rec} = f(di/dt)$, $I_{RM} = f(di/dt)$
$V_{DC} = 600$ V, $I_F = 300$ A, $V_{GE} = -15/+15$ V (IGBT)



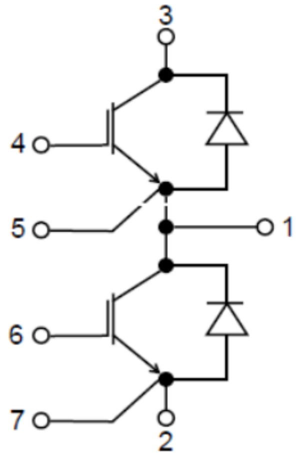
Thermal impedance (typical)

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



IGBT	r_i (K/kW)	τ_i (s)	diode	r_i (K/kW)	τ_i (s)
i = 1	7.55	1.98E-02	i = 1	21.70	1.77E-02
i = 2	48.21	1.80E-02	i = 2	52.01	8.52E-02
i = 3	44.26	8.47E-02	i = 3	81.76	1.90E-02
tot	100.01		tot	155.47	

- **Circuit Diagram**



- **Package Outline Information**