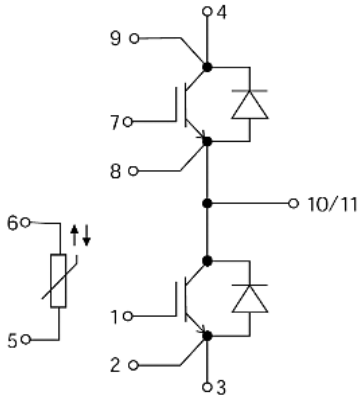
IGBT Modules

V_{CES}	1200V
I_C	750A

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, T_{vj} = 25 °C	1200	V
Continuous Collector Current	I_C	T_c = 110 °C, T_{vj} = 175 °C	750	A
Repetitive Peak Collector Current	I_{CRM}	Tp = 1 ms	1500	A
Gate-Emitter Voltage	V_{GES}		±20	V
Total Power Dissipation	P_{tot}	T_c = 25 °C T_{vjmax} = 175 °C	3750	W

Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Gate-emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$, I_C = 37.5 mA, T_{vj} = 25 °C	5	6.2	7.5	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 = 750 A, V_{GE} = 15 V, T_{vj} = 25 °C		1.65	2	V
		I_c = 750 A, V_{GE} = 15 V, T_{vj} = 125 °C		1.95		
		I_c = 750 A, V_{GE} = 15 V, T_{vj} = 175 °C		2.1		
Gate Charge	Q_G	I_c = 750 A, V_{GE} = 600 V		5.3		uC
Internal Gate Resistance	R_{Gint}			1.2		Ω
Input Capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz, T_{vj} = 25 °C		44		nF
Reverse Transfer Capacitance	C_{res}			2.1		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 = 750 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_G = 0.47 Ω, T_{vj} = 25 °C		120		ns
Rise Time	t_r			70		ns
Turn-off Delay Time	$t_{d(off)}$	I_C = 750 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_G = 1.5 Ω, T_{vj} = 25 °C		550		ns
Fall Time	t_f			165		ns
Energy Dissipation During Turn-on Time	E_{on}	I_C = 750 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_G = 0.47 Ω, T_{vj} = 25 °C		33		mJ
Energy Dissipation During Turn-off Time	E_{off}	I_C = 750 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_G = 1.5 Ω, T_{vj} = 25 °C		82		mJ
Turn-on Delay Time	$t_{d(on)}$	I_C = 750 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_G = 0.47 Ω, T_{Vj} = 125 °C		145		ns
Rise Time	t_r			80		ns
Turn-off Delay Time	$t_{d(off)}$	I_C = 750 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_G = 1.5 Ω, T_{Vj} = 125 °C		650		ns
Fall Time	t_f			285		ns
Energy Dissipation During Turn-on Time	E_{on}	I_C = 750 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_G = 0.47 Ω, T_{vj} = 125 °C		82		mJ
Energy Dissipation During Turn-off Time	E_{off}	I_C = 750 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_G = 1.5 Ω, T_{vj} = 125 °C		110		mJ
Turn-on Delay Time	$t_{d(on)}$	I_C = 750 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_G = 0.47 Ω, T_{Vj} = 175 °C		155		ns
Rise Time	t_r			80		ns
Turn-off Delay Time	$t_{d(off)}$	I_C = 750 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_G = 1.5 Ω, T_{vj} = 175 °C		690		ns
Fall Time	t_f			325		ns
Energy Dissipation During Turn-on Time	E_{on}	I_C = 750 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_G = 0.47 Ω, T_{vj} = 175 °C		115		mJ
Energy Dissipation During Turn-off Time	E_{off}	I_C = 750 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_G = 1.5 Ω, T_{vj} = 175 °C		120		mJ
SC Data	I_{sc}	$T_p \leq$ 10 us, V_{GE} = 15 V, T_{vj} = 175 °C, V_{cc} = 800 V, $V_{CEM} \leq$ 1200V		2000		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		750	A
Repetitive Peak Forward Current	I_{FRM}	t_p = 1 ms	1500	A
I^2t-value	I^2t	V_R = 0 V, t_p = 10 ms, T_j=150 °C	37500	A^2s

Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	V_F	I_F = 750 A, T_{vj} = 25 °C		2	2.5	V
		I_F = 750 A, T_{vj} = 125 °C		2.15		
		I_F = 750 A, T_{vj} = 175 °C		2.15		
Recovered Charge	Q_{rr}	I_F = 750 A V_R = 600 V di_F/dt = 9100 A/µs T_{vj} = 25 °C		60		uC
Peak Reverse Recovery Current	I_{rr}			515		A
Reverse Recovery Energy	E_{rec}			30		mJ
Recovered Charge	Q_{rr}	I_F = 750 A V_R = 600 V di_F/dt = 9100 A/µs T_{vj} =125 °C		110		uC
Peak Reverse Recovery Current	I_{rr}			590		A
Reverse Recovery Energy	E_{rec}			45		mJ
Recovered Charge	Q_{rr}	I_F = 750 A V_R = 600 V di_F/dt = 9100 A/µs T_{vj} = 175 °C		145		uC
Peak Reverse Recovery Current	I_{rr}			610		A
Reverse Recovery Energy	E_{rec}			55		mJ

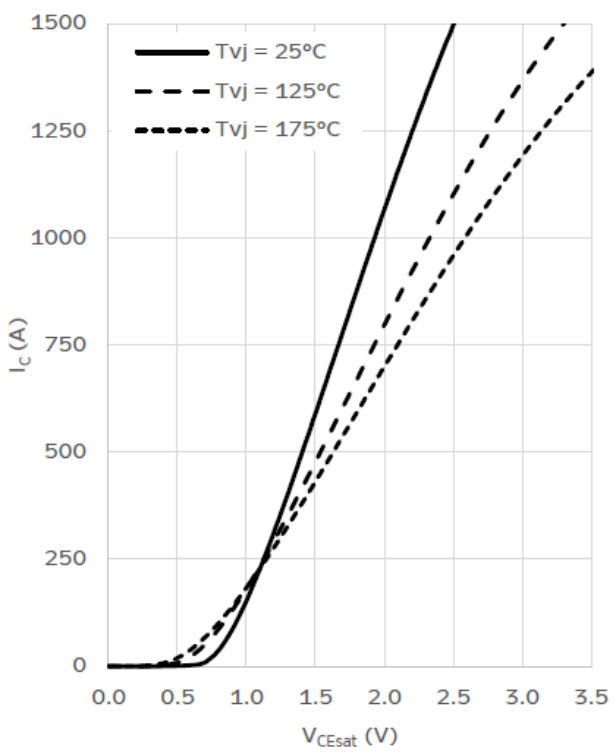
Module Characteristics

T_c=25°C unless otherwise specified

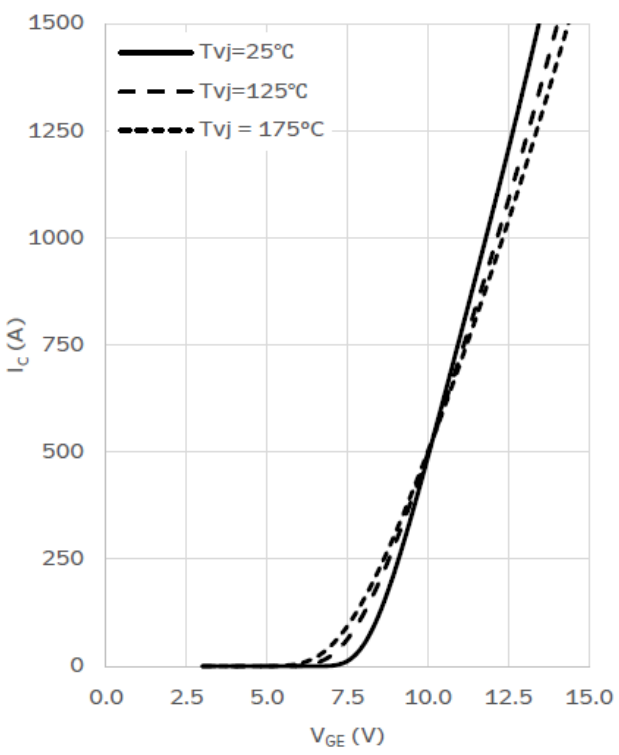
Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Isolation voltage	V_{isol}	t =1 min, f = 50 Hz			3400	V
Maximum Junction Temperature	T_{jmax}				175	°C
Operating Junction Temperature	$T_{vj(op)}$		-40		175	°C
Storage Temperature	T_{stg}		-40		125	°C
Thermal Resistance Junction-to Case	$R_{\theta JC}$	per IGBT			0.04	K/W
		per Diode			0.067	
Comparative Tracking Index	CTI		200			
Thermal Resistance Case-to Sink	$R_{\theta CS}$	Conductive grease applied		0.030		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

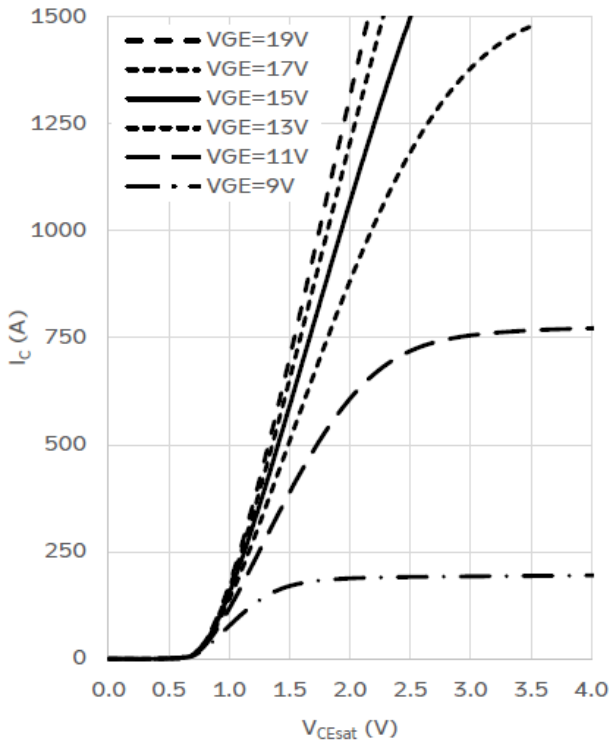
IGBT on-state characteristics (typical)
$I_C = f(V_{CE})$
V_{GE} = 15 V



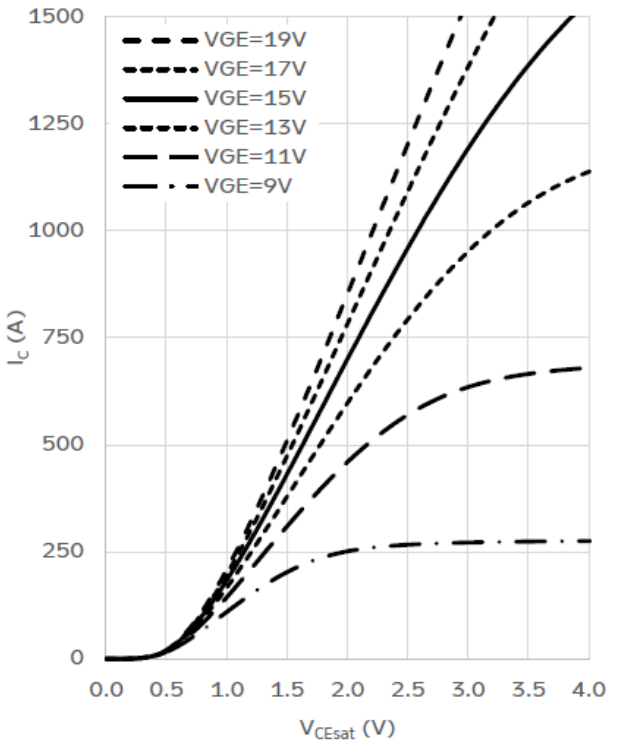
IGBT transfer characteristics (typical)
$I_C = f(V_{GE})$
V_{CE} = 20V



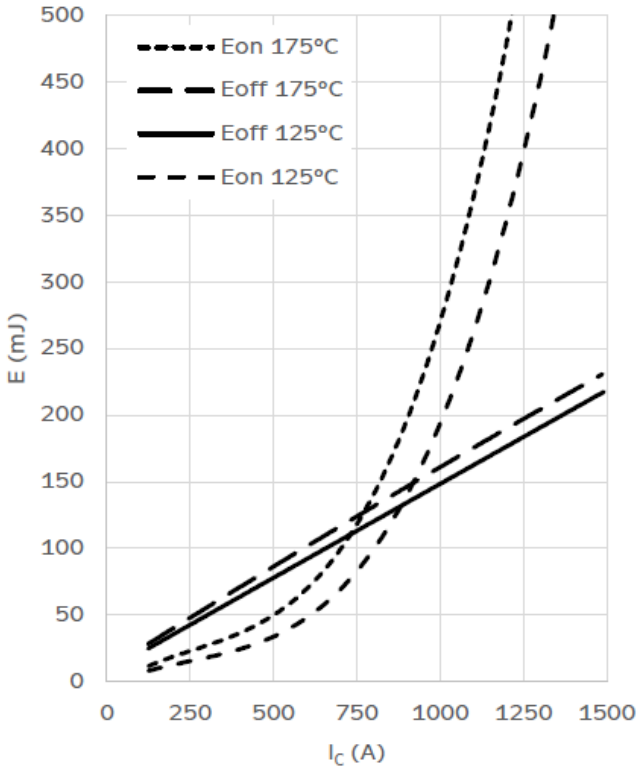
IGBT output characteristics (typical)
$I_C = f(V_{CE})$
T_{vj} = 25 °C



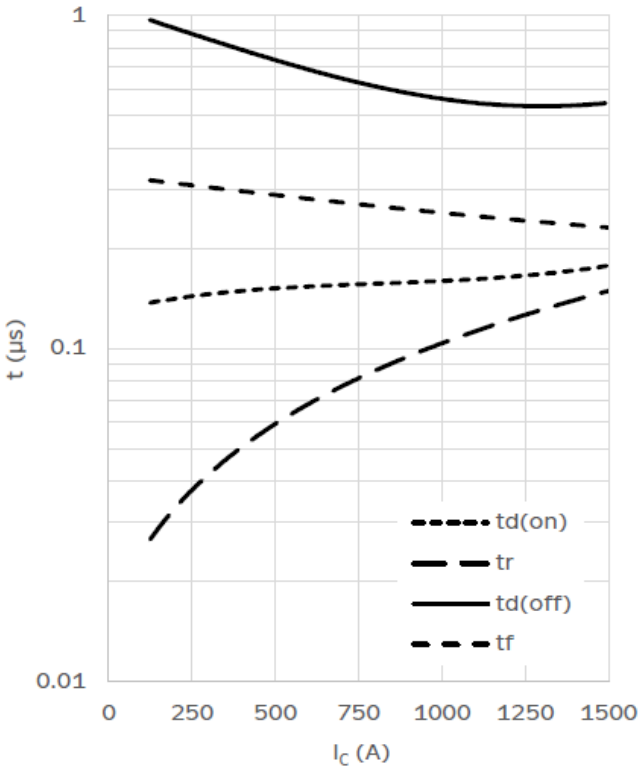
IGBT output characteristics (typical)
$I_C = f(V_{CE})$
T_{vj} = 175 °C



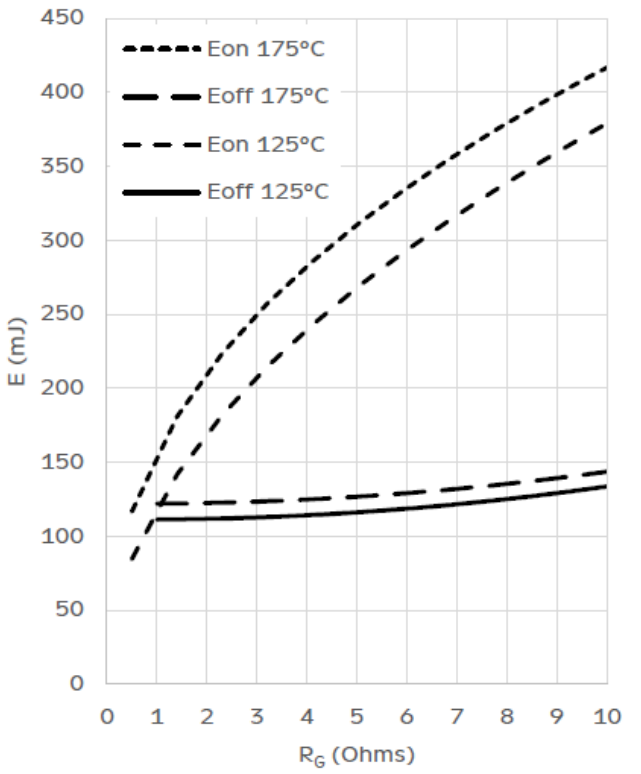
IGBT switching losses (typical)
E = f(I_{CE})
V_{CE} = 600 V, R_{Gon} = 0.47 Ω, R_{Goff} = 1.5 Ω, V_{GE} = -15/+15 V



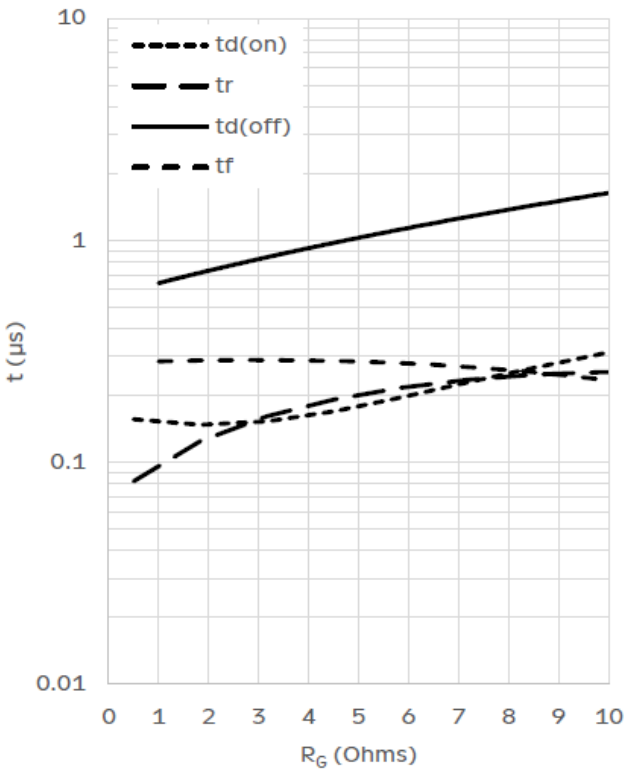
IGBT switching times (typical)
t = f(I_{CE}), T_{vj} = 175 °C
V_{CE} = 600 V, R_{Gon} = 0.47 Ω, R_{Goff} = 1.5 Ω, V_{GE} =-15/+15 V



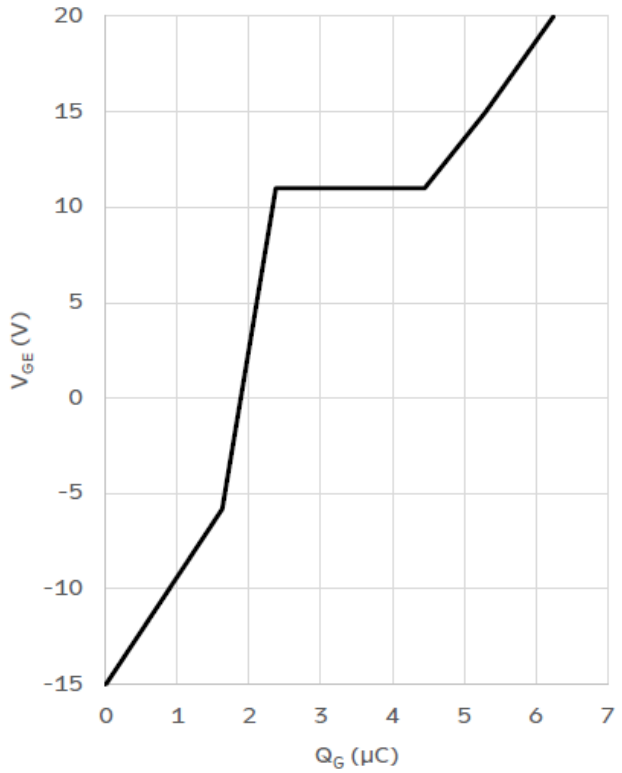
IGBT switching losses (typical)
E = f(R_G)
V_{CE} = 600 V, I_C = 750 A, V_{GE} = -15/+15 V



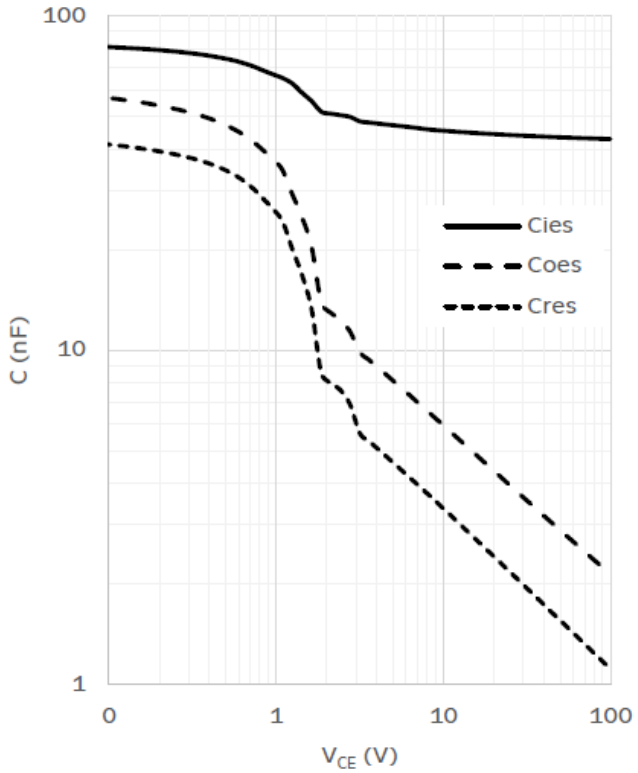
IGBT switching times (typical)
t = f(R_G), T_{vj} = 175 °C
V_{CE} = 600 V, I_C = 750 A, V_{GE} = -15/+15 V



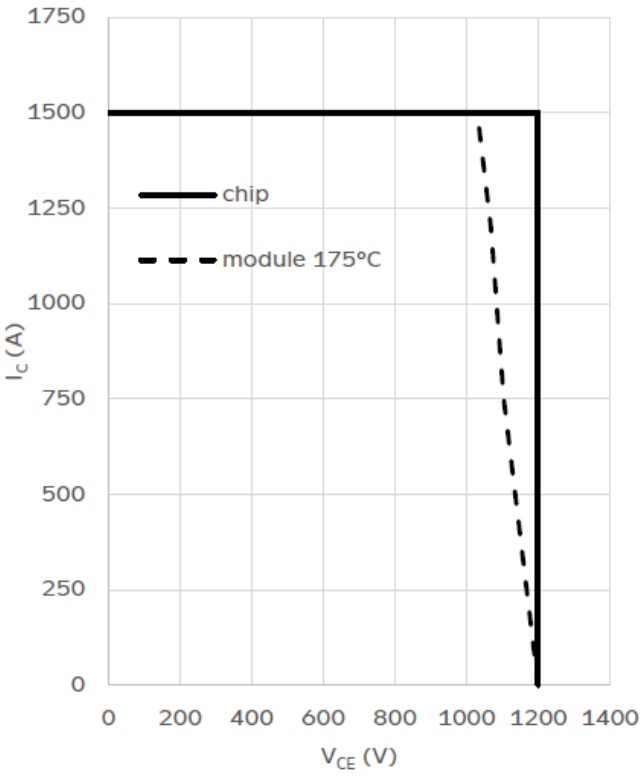
IGBT gate charge (typical)
$V_{GE} = f(Q_G)$, $T_{vj} = 25$ °C
$V_{CE} = 600$ V, $I_C = 750$ A



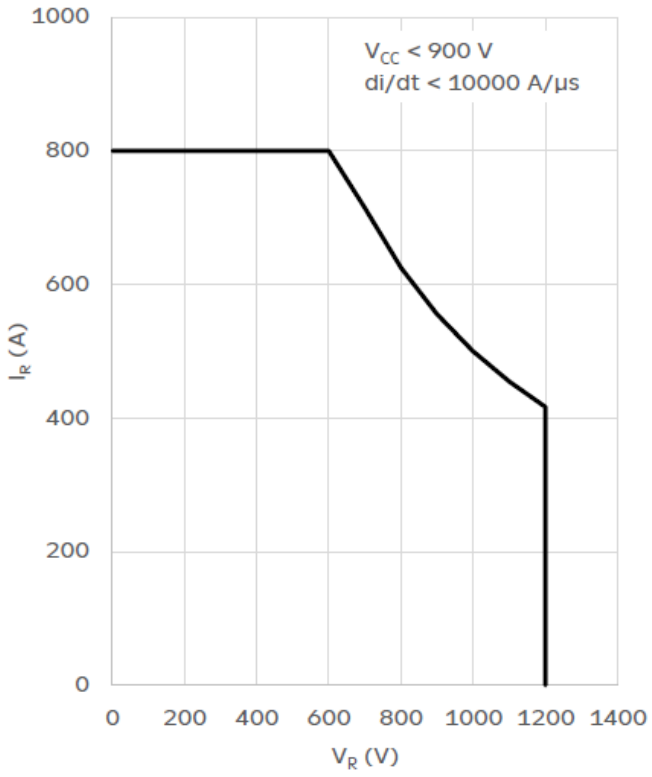
Capacitance characteristics (typical)
$C = f(V_{CE})$, $T_{vj} = 25$ °C
$f = 100$ kHz, $V_{GE} = 0$ V



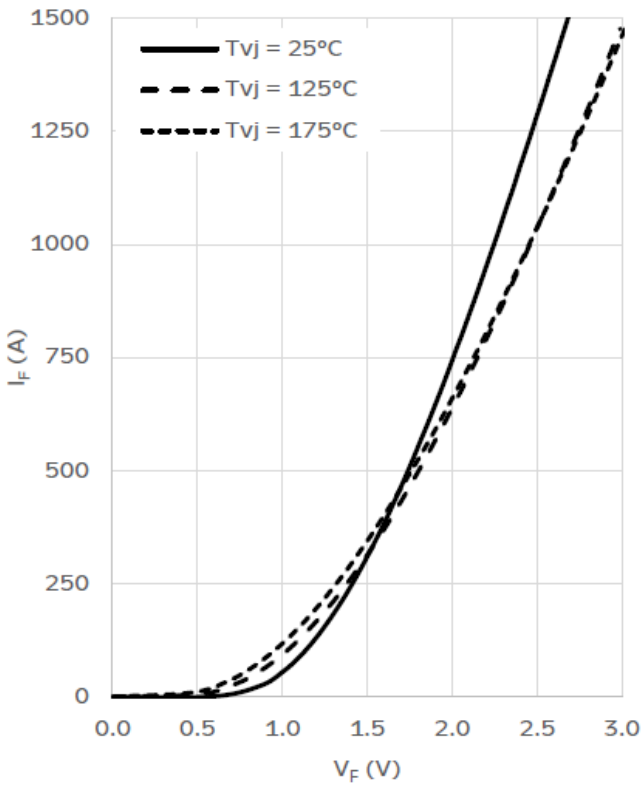
IGBT RBSOA
$I_C = f(V_{CEm})$
$R_{Goff} = 1.5\ \Omega$, $V_{GE} = \pm 15$ V



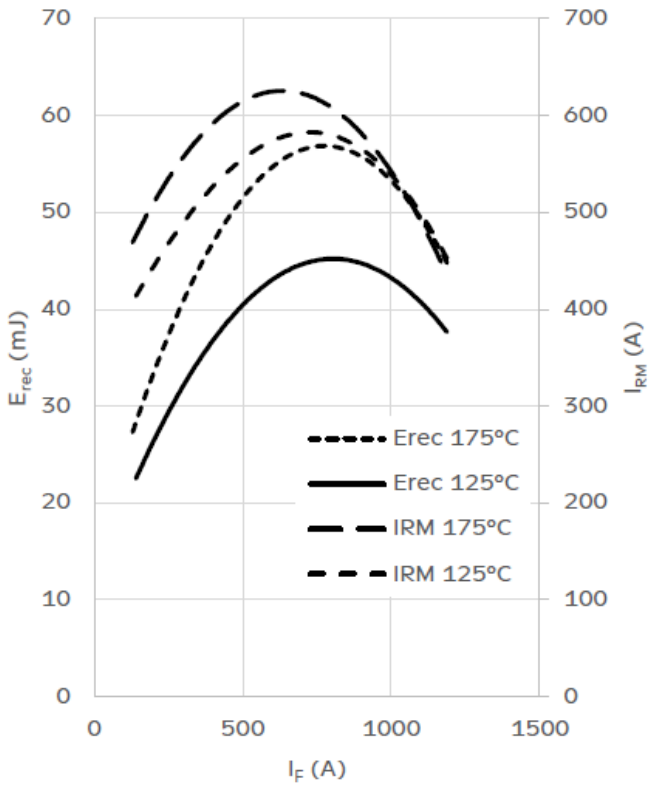
Diode SOA
$T_{vj} \leq 175$ °C



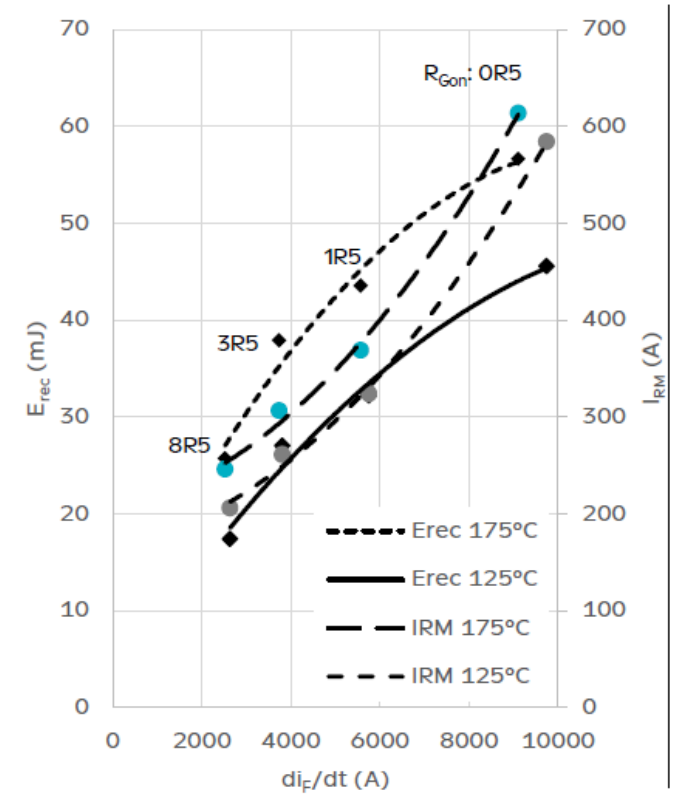
Diode forward characteristic (typical)
$I_F = f(V_F)$



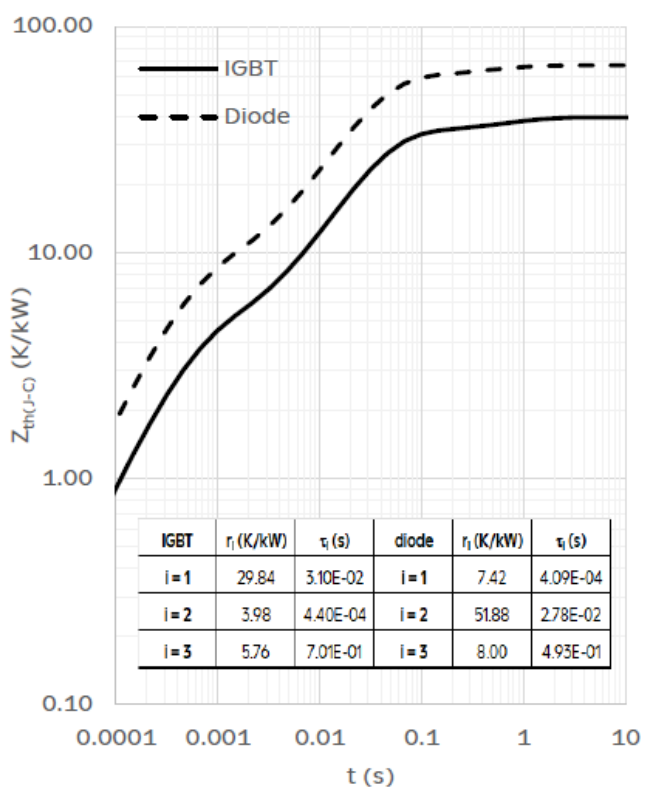
Diode switching characteristics (typical)
$E_{rec} = f(I_F)$, $I_{RM} = f(I_F)$
V_{DC} = 600 V, R_{Gon} = 0.47 Ω (IGBT), V_{GE} =-15/+15 V (IGBT)



Diode switching characteristics (typical)
$E_{rec} = f(di/dt)$, $I_{RM} = f(di/dt)$
V_{DC} = 600 V, I_F = 750 A, V_{GE} =-15/+15 V (IGBT)

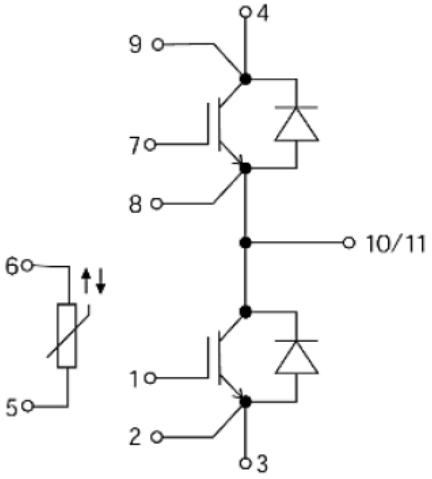


Thermal impedance (typical)
$Z_{th(j-c)} = f(t)$



IGBT	r_i (K/kW)	τ_i (s)	diode	r_i (K/kW)	τ_i (s)
i = 1	29.84	3.10E-02	i = 1	7.42	4.09E-04
i = 2	3.98	4.40E-04	i = 2	51.88	2.78E-02
i = 3	5.76	7.01E-01	i = 3	8.00	4.93E-01

- **Circuit Diagram**



- **Package Outline Information**