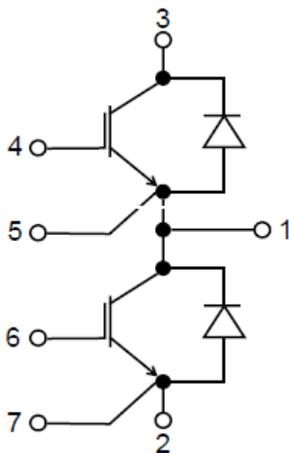# SUNKO | CAHKO

MG600HF12SCC2

IGBT   Modules

V_{CES} 1200V
I_C 600A

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℃

● **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	600	A
Repetitive Peak Collector Current	I_{CRM}	Tp = 1 ms	1200	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	2475	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	6.2	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	$V_{CE(sat)}$	$I_c = 600$ A, $V_{GE} = 15$ V, $T_{vj} = 25$ °C		1.55	2	V
		$I_c = 600$ A, $V_{GE} = 15$ V, $T_{vj} = 125$ °C		1.77		
		$I_c = 600$ A, $V_{GE} = 15$ V, $T_{vj} = 175$ °C		1.87		
Gate Charge	Q_G			5.1		uC
Internal Gate Resistance	R_{Gint}			1.1		Ω
Input Capacitance	C_{ies}	$V_{CE} = 25$ V, $V_{GE} = 0$ V, $f = 100$ kHz, $T_{vj} = 25$ °C		77.0		nF
Reverse Transfer Capacitance	C_{res}			0.7		nF
Gate-Emitter leakage current	I_{GES}	$V_{CE} = 0$ V, $V_{GE} = \pm20$ V, $T_{vj} = 25$ °C			500	nA
Turn-on Delay Time	$t_{d(on)}$	$I_C = 600$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_G = 2$ Ω, $T_{vj} = 25$ °C		340		ns
Rise Time	t_r			74		ns
Turn-off Delay Time	$t_{d(off)}$	$I_C = 600$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_G = 2$ Ω, $T_{vj} = 25$ °C		338		ns
Fall Time	t_f			225		ns
Energy Dissipation During Turn-on Time	E_{on}	$I_C = 600$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_G = 2$ Ω, $T_{vj} = 25$ °C		65		mJ
Energy Dissipation During Turn-off Time	E_{off}	$I_C = 300$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_G = 2$ Ω, $T_{vj} = 25$ °C		52		mJ
Turn-on Delay Time	$t_{d(on)}$	$I_C = 600$ A, $V_{CE} = 600$ V, $V_{GE} = \pm15$ V, $R_G = 2$ Ω, $T_{Vj} = 125$ °C		358		ns
Rise Time	t_r			85		ns
Turn-off Delay Time	$t_{d(off)}$	$I_C = 600$ A, $V_{CE} = 600$ V, $V_{GE} = \pm15$ V, $R_G = 2$ Ω, $T_{Vj} = 125$ °C		400		ns
Fall Time	t_f			313		ns
Energy Dissipation During Turn-on Time	E_{on}	$I_C = 600$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_G = 2$ Ω, $T_{vj} = 125$ °C		92		mJ
Energy Dissipation During Turn-off Time	E_{off}	$I_C = 600$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_G = 2$ Ω, $T_{vj} = 125$ °C		70		mJ
Turn-on Delay Time	$t_{d(on)}$	$I_C = 600$ A, $V_{CE} = 600$ V, $V_{GE} = \pm15$ V, $R_G = 2$ Ω, $T_{Vj} = 175$ °C		365		ns
Rise Time	t_r			95		ns
Turn-off Delay Time	$t_{d(off)}$	$I_C = 600$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_G = 2$ Ω, $T_{vj} = 175$ °C		425		ns
Fall Time	t_f			367		ns
Energy Dissipation During Turn-on Time	E_{on}	$I_C = 600$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_G = 2$ Ω, $T_{vj} = 175$ °C		107		mJ
Energy Dissipation During Turn-off Time	E_{off}	$I_C = 600$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_G = 2$ Ω, $T_{vj} = 175$ °C		80		mJ
SC Data	I_{sc}	$T_p \leq 10$ us, $V_{GE} = 15$ V, $T_{vj} = 150$ °C, $V_{cc} = 900$ V, $V_{CEM} \leq 1200$V		3230		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		600	A
Repetitive Peak Forward Current	I_{FRM}	t_p = 1 ms	1200	A
I^2t-value	I^2t	V_R = 0 V, t_p = 10 ms, T_j=125 °C	43000	A^2s
		V_R = 0 V, t_p = 10 ms, T_j=150 °C	45500	

Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	V_F	I_F = 600 A, T_{vj} = 25 °C		1.7	2.1	V
		I_F = 600 A, T_{vj} = 125 °C		1.75		
		I_F = 600 A, T_{vj} = 175 °C		1.7		
Recovered Charge	Q_{rr}	I_F = 600 A V_R = 600 V -di$_F$/dt = 6600 A/us T_{vj} = 25 °C		61		uC
Peak Reverse Recovery Current	I_{rr}			440		A
Reverse Recovery Energy	E_{rec}			22		mJ
Recovered Charge	Q_{rr}	I_F = 600 A V_R = 600 V -di$_F$/dt = 6600 A/us T_{vj}=125 °C		100		uC
Peak Reverse Recovery Current	I_{rr}			494		A
Reverse Recovery Energy	E_{rec}			40		mJ
Recovered Charge	Q_{rr}	I_F = 600 A V_R = 600 V -di$_F$/dt = 6600 A/us T_{vj} = 175 °C		133		uC
Peak Reverse Recovery Current	I_{rr}			530		A
Reverse Recovery Energy	E_{rec}			50		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			0.06	K/W
		per Diode			0.10	
Comparative Tracking Index	CTI		>400			
Thermal Resistance Case-to Sink	$R_{\theta CS}$	Conductive grease applied		0.035		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			312		g

Characteristics

IGBT on-state characteristics (typical)
$I_C = f(V_{CE})$
V_{GE} = 15 V
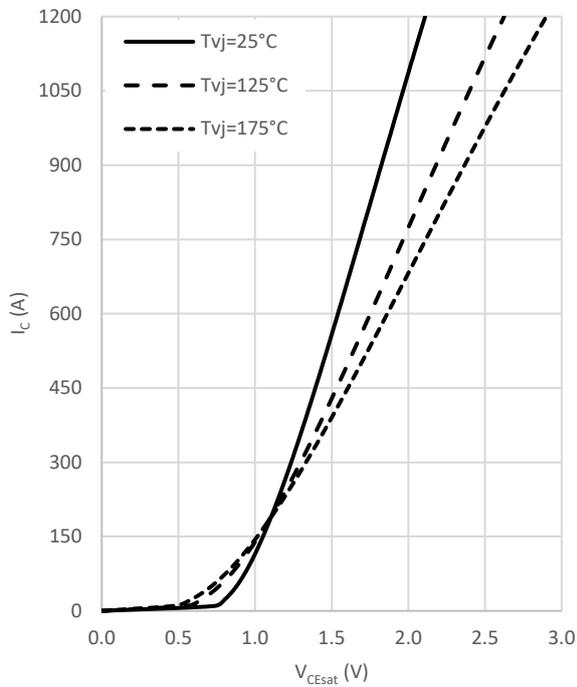
IGBT transfer characteristics (typical)
$I_C = f(V_{GE})$
V_{CE} = 20 V
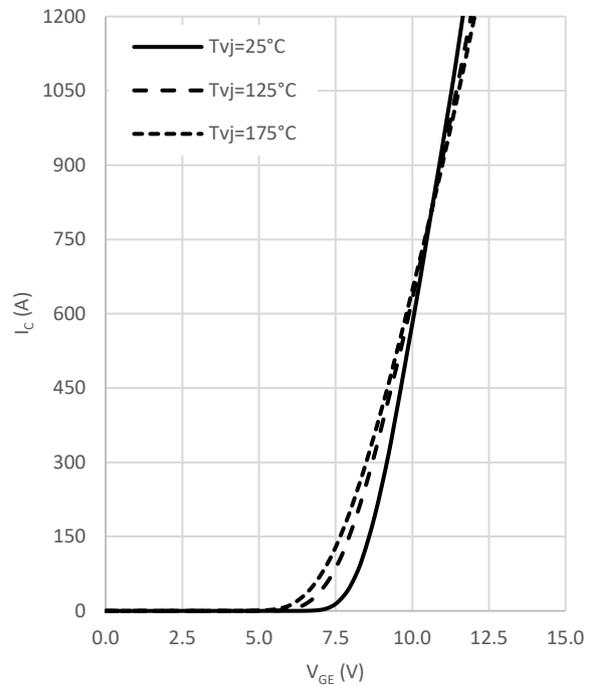
IGBT output characteristics (typical)
$I_C = f(V_{CE})$
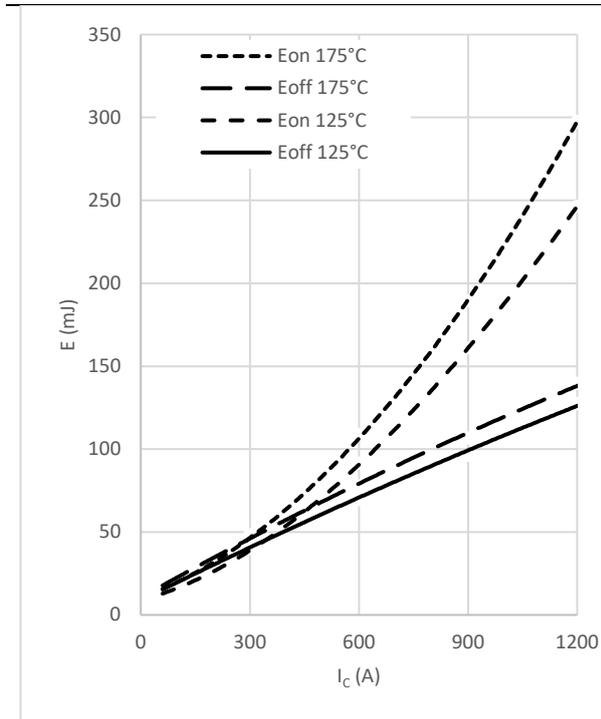T_{vj} = 25 °C
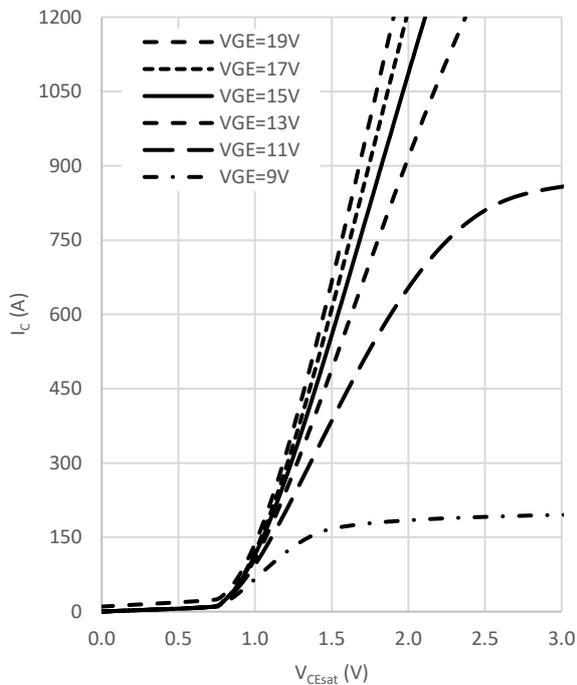
IGBT output characteristics (typical)
$I_C = f(V_{CE})$
T_{vj} = 175 °C
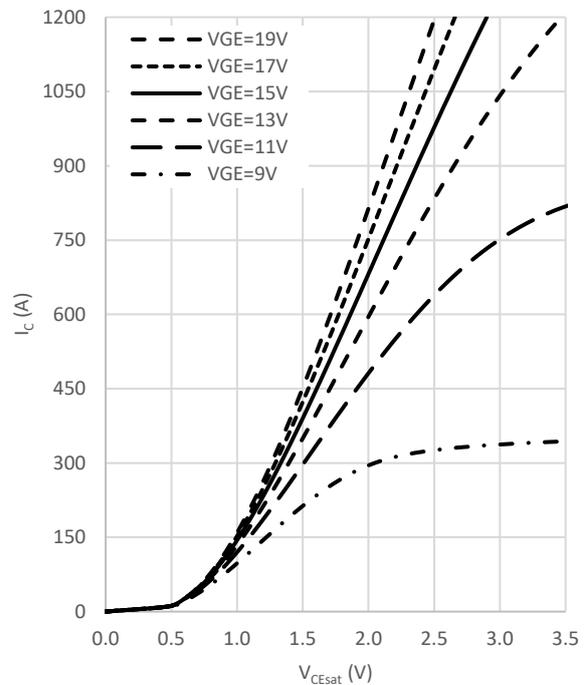
IGBT switching losses (typical)
E = f(I_{CE})
V_{CE} = 600 V, R_{Gon} = 1 Ω, R_{Goff} = 1 Ω, V_{GE} = -15/+15 V

IGBT switching times (typical)
t = f(I_{CE}), T_{vj} = 175 °C
V_{CE} = 600 V, R_{Gon} =1Ω, R_{Goff} = 1 Ω, V_{GE} =-15/+15 V
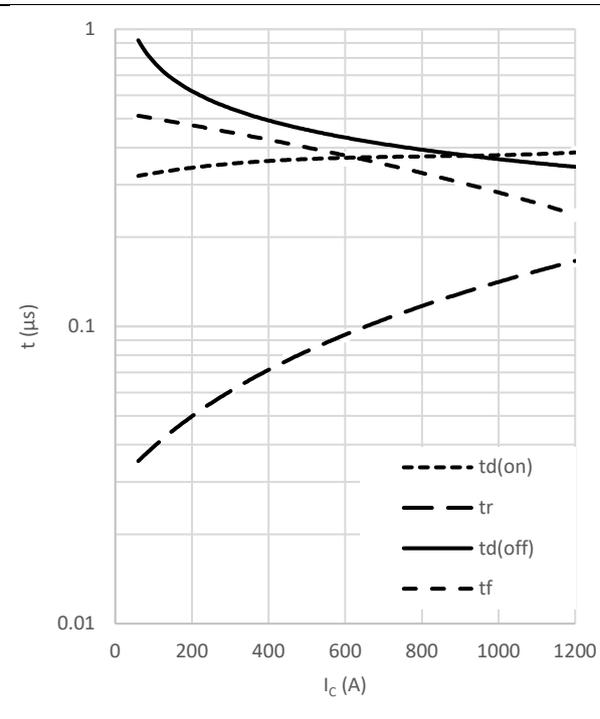
IGBT switching losses (typical)
E = f(R_G)
V_{CE} = 600 V, I_C = 600 A, V_{GE} = -15/+15 V
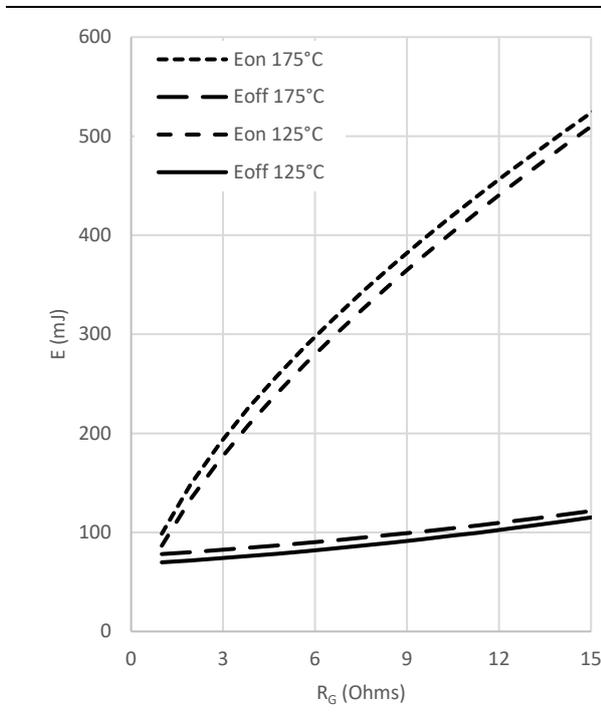
IGBT switching times (typical)
t = f(R_G), T_{vj} = 175 °C
V_{CE} = 600 V, I_C = 600 A, V_{GE} =-15/+15 V
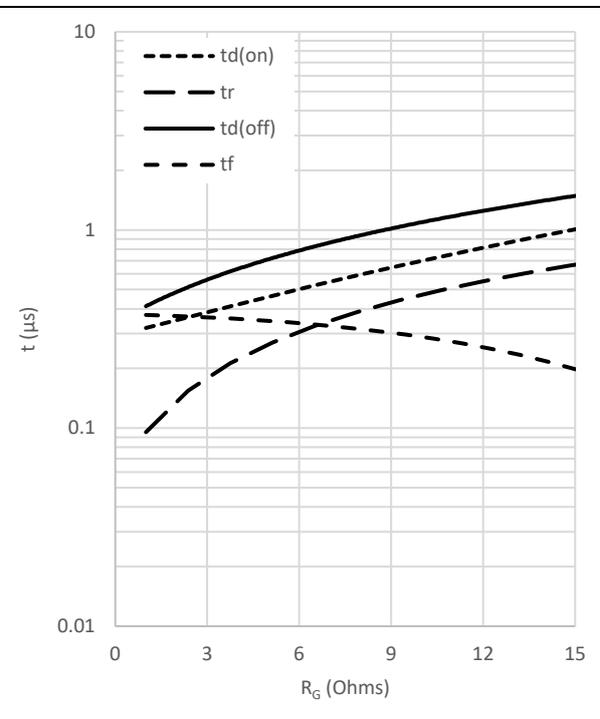
IGBT gate charge (typical)
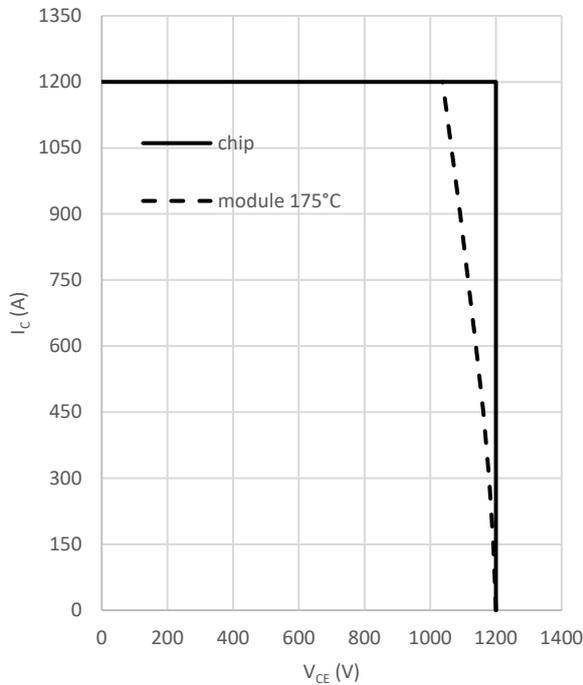
$V_{GE} = f(Q_G)$, $T_{vj} = 25\ °C$ $V_{CE} = 600\ V$, $I_C = 600\ A$
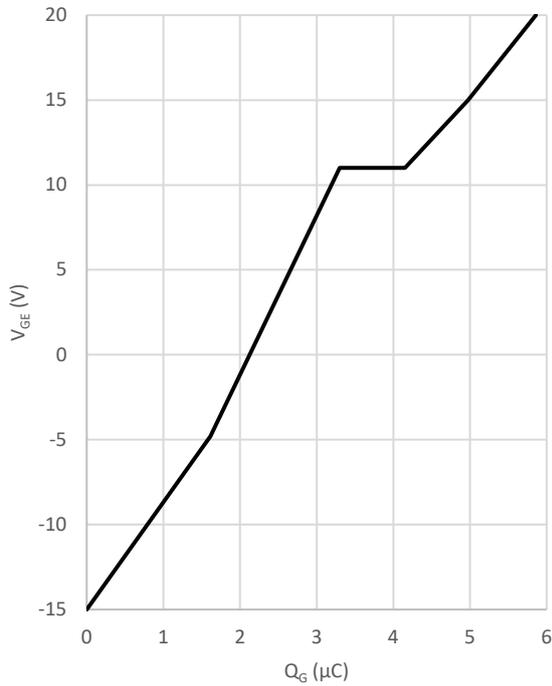
Capacitance characteristics (typical)

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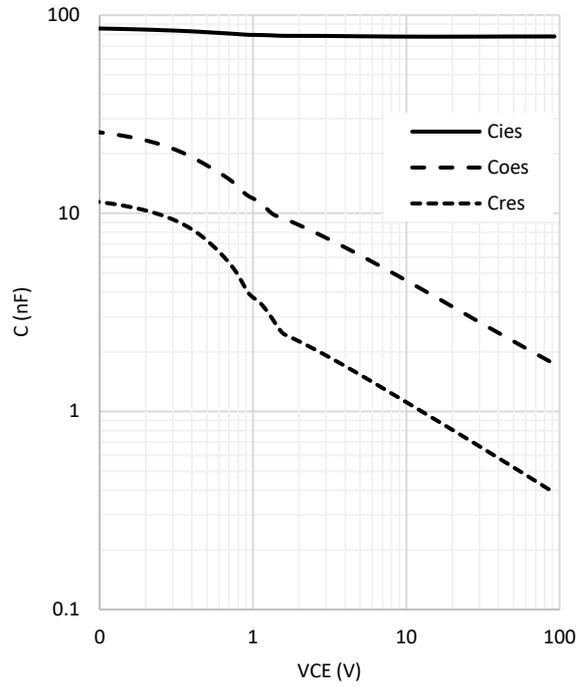
IGBT RBSOA

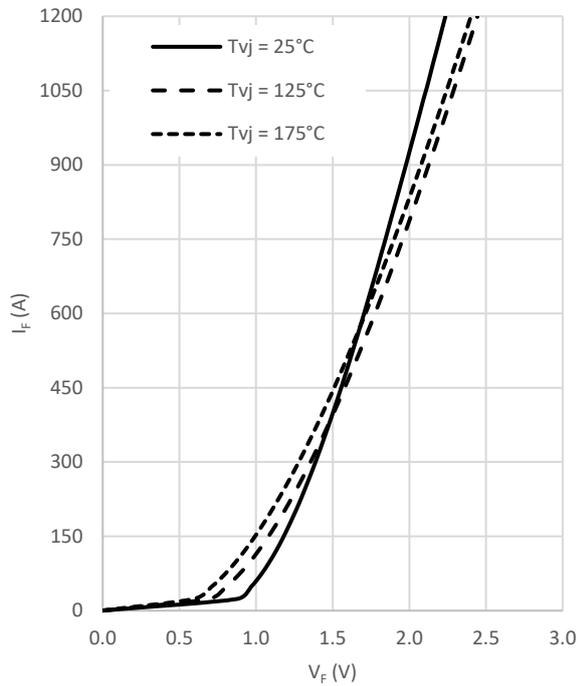$I_C = f(V_{CEm})$
$R_{Goff} = 1\ \Omega$, $V_{GE} = \pm15\ V$

Diode SOA

$T_{vj} \le 175\ °C$
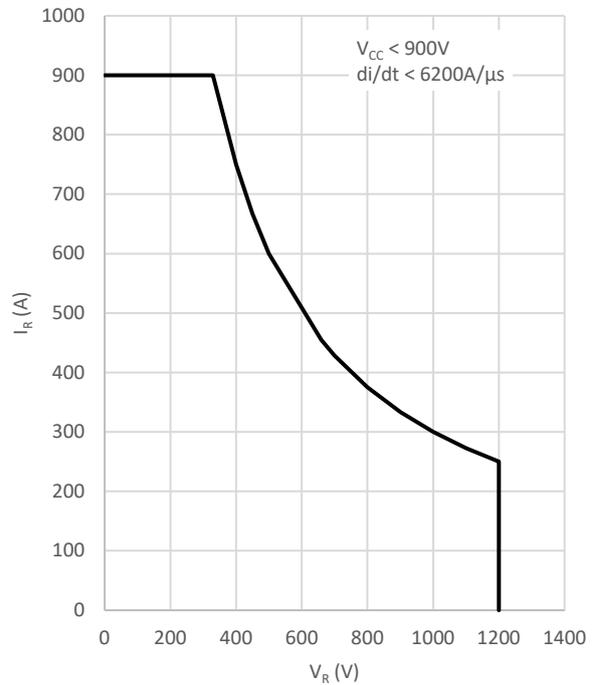
Diode forward characteristic (typical)
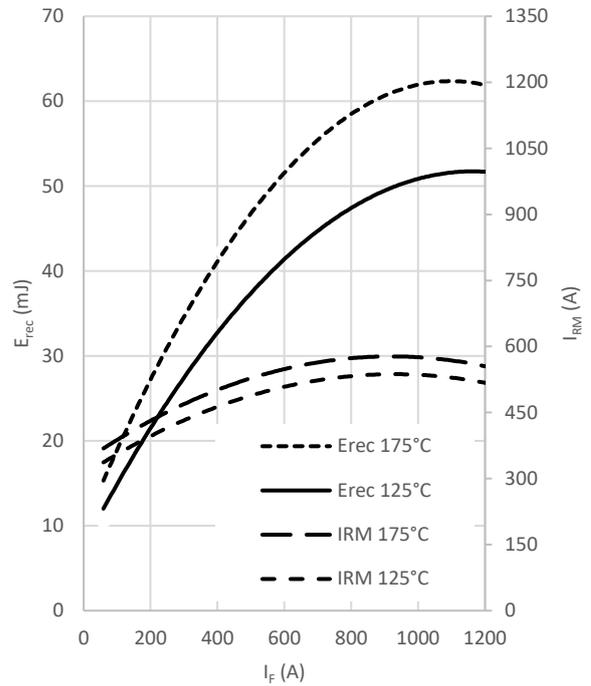$I_F = f(V_F)$

Diode switching characteristics (typical)
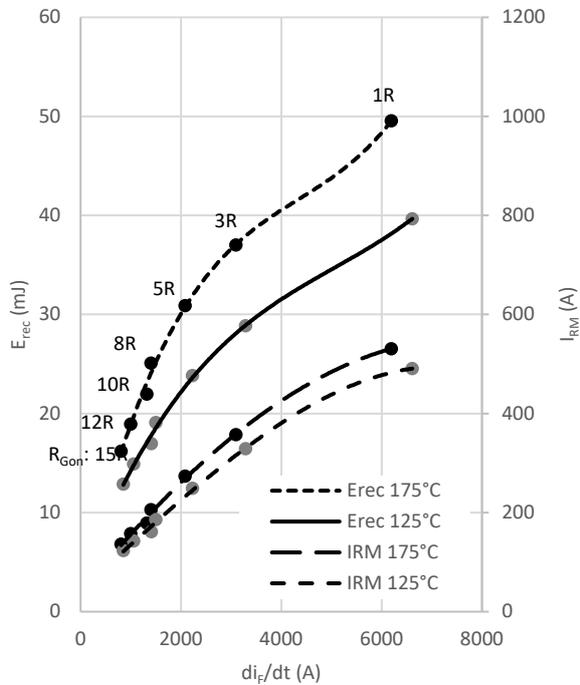$E_{rec} = f(I_F)$, $I_{RM} = f(I_F)$
$V_{DC} = 600$ V, $R_{Gon} = 1$ Ω (IGBT), $V_{GE} = -15/+15$ V (IGBT)

Diode switching characteristics (typical)
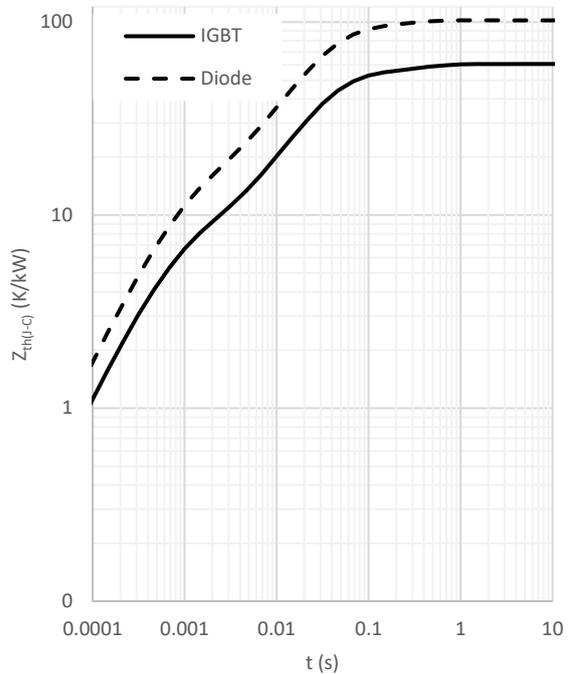$E_{rec} = f(di/dt)$, $I_{RM} = f(di/dt)$
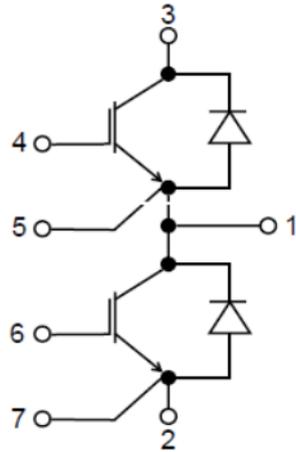$V_{DC} = 600$ V, $I_F = 200$ A, $V_{GE} = -15/+15$ V (IGBT)

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

● Circuit Diagram

● Package Outline Information