



**SEMITOP® 3**

## IGBT module

### Engineering Sample SK75GHL07F3TD1

#### Target Data

#### Features

- Compact design
- One screw mounting module
- Optimum heat transfer and insulation through direct copper bonding aluminum oxide ceramic (DBC)
- 650V Trench3 Fast IGBT technology
- 650V Rapid switching diode
- Integrated NTC temperature sensor
- UL recognized, file no. E 63 532

#### Typical Applications\*

- Inverter
- Welding
- UPS

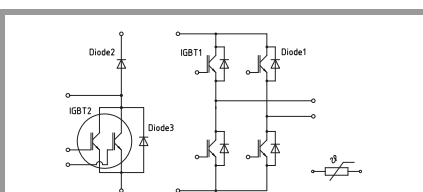
#### Remarks

IGBT2 table values, static and dynamic, all refer to the parallel of the two IGBTs (pin 16 and pin 17 virtually shorted)

Absolute Maximum Ratings			
Symbol	Conditions	Values	Unit
<b>IGBT 1</b>			
$V_{CES}$	$T_j = 25\text{ °C}$	650	V
$I_C$	$T_j = 150\text{ °C}$	$T_s = 25\text{ °C}$	58
		$T_s = 70\text{ °C}$	43
$I_C$	$T_j = 175\text{ °C}$	$T_s = 25\text{ °C}$	65
		$T_s = 70\text{ °C}$	51
$I_{Cnom}$		75	A
$I_{CRM}$	$I_{CRM} = 3 \times I_{Cnom}$	225	A
$V_{GES}$		-20 ... 20	V
$t_{psc}$	$V_{CC} = 400\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 650\text{ V}$	$T_j = 150\text{ °C}$	5
$T_j$		-40 ... 175	°C

Absolute Maximum Ratings			
Symbol	Conditions	Values	Unit
<b>IGBT 2</b>			
$V_{CES}$	$T_j = 25\text{ °C}$	650	V
$I_C$	$T_j = 150\text{ °C}$	$T_s = 25\text{ °C}$	107
		$T_s = 70\text{ °C}$	79
$I_C$	$T_j = 175\text{ °C}$	$T_s = 25\text{ °C}$	120
		$T_s = 70\text{ °C}$	95
$I_{Cnom}$		150	A
$I_{CRM}$	$I_{CRM} = 3 \times I_{Cnom}$	450	A
$V_{GES}$		-20 ... 20	V
$t_{psc}$	$V_{CC} = 400\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 650\text{ V}$	$T_j = 150\text{ °C}$	5
$T_j$		-40 ... 175	°C

Absolute Maximum Ratings			
Symbol	Conditions	Values	Unit
<b>Diode 1</b>			
$V_{RRM}$	$T_j = 25\text{ °C}$	650	V
$I_F$	$T_j = 150\text{ °C}$	$T_s = 25\text{ °C}$	54
		$T_s = 70\text{ °C}$	39
$I_F$	$T_j = 175\text{ °C}$	$T_s = 25\text{ °C}$	61
		$T_s = 70\text{ °C}$	47
$I_{Fnom}$		75	A
$I_{FRM}$	$I_{FRM} = 2 \times I_{Fnom}$	150	A
$I_{FSM}$	10 ms, sin 180°, $T_j = 150\text{ °C}$	t.b.d.	A
$T_j$		-40 ... 175	°C



**GHL-T**



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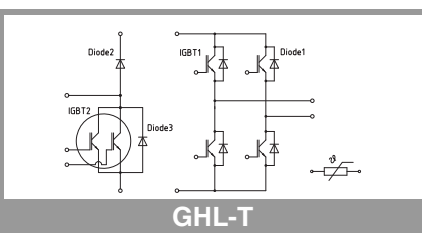
Absolute Maximum Ratings			
Symbol	Conditions	Values	Unit
<b>Diode 2</b>			
$V_{RRM}$	$T_j = 25\text{ °C}$	650	V
$I_F$	$T_j = 150\text{ °C}$	$T_s = 25\text{ °C}$	50
		$T_s = 70\text{ °C}$	36
$I_F$	$T_j = 175\text{ °C}$	$T_s = 25\text{ °C}$	57
		$T_s = 70\text{ °C}$	44
$I_{Fnom}$		60	A
$I_{FRM}$	$I_{FRM} = 2 \times I_{Fnom}$	120	A
$I_{FSM}$	10 ms, sin 180°, $T_j = 150\text{ °C}$	t.b.d.	A
$T_j$		-40 ... 175	°C

Absolute Maximum Ratings			
Symbol	Conditions	Values	Unit
<b>Diode 3</b>			
$V_{RRM}$	$T_j = 25\text{ °C}$	650	V
$I_F$	$T_j = 150\text{ °C}$	$T_s = 25\text{ °C}$	87
		$T_s = 70\text{ °C}$	63
$I_F$	$T_j = 175\text{ °C}$	$T_s = 25\text{ °C}$	99
		$T_s = 70\text{ °C}$	77
$I_{Fnom}$		100	A
$I_{FRM}$	$I_{FRM} = 2 \times I_{Fnom}$	200	A
$I_{FSM}$	10 ms, sin 180°, $T_j = 150\text{ °C}$	680	A
$T_j$		-40 ... 175	°C

Absolute Maximum Ratings			
Symbol	Conditions	Values	Unit
<b>Module</b>			
$I_{t(RMS)}$			A
$T_{stg}$		-40 ... 125	°C
$V_{isol}$	AC, sinusoidal, t = 1 min	2500	V

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
<b>Temperature Sensor</b>					
$R_{100}$	$T_c = 100\text{ °C}$ ( $R_{25} = 5\text{ k}\Omega$ )		493 ± 5%		Ω
$B_{100/125}$	$R(T) = R_{100} \exp[B_{100/125}(1/T - 1/T_{100})]$ ; T[K];		3550 ± 2%		K

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
<b>Module</b>					
$M_s$	to heatsink	2.25		2.5	Nm
w	weight		29		g





## IGBT module Engineering Sample SK75GHL07F3TD1

### Target Data

### Features

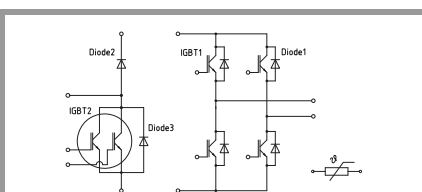
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### Remarks

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GHL-T

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>IGBT 1</b>						
$V_{CE(sat)}$	$I_C = 75\text{ A}$ $V_{GE} = 15\text{ V}$ chipllevel	$T_j = 25\text{ °C}$		1.85	2.22	V
		$T_j = 150\text{ °C}$		2.18	2.55	V
$V_{CE0}$	chipllevel	$T_j = 25\text{ °C}$		1.10	1.20	V
		$T_j = 150\text{ °C}$		1.00	1.10	V
$r_{CE}$	$V_{GE} = 15\text{ V}$ chipllevel	$T_j = 25\text{ °C}$		10	14	mΩ
		$T_j = 150\text{ °C}$		16	19	mΩ
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 1.2\text{ mA}$		4.2	5.1	5.6	V
$I_{CES}$	$V_{GE} = 0\text{ V}$ $V_{CE} = 650\text{ V}$	$T_j = 25\text{ °C}$			0.1	mA
				-		mA
$C_{ies}$	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$		4.62		nF
$C_{oes}$		$f = 1\text{ MHz}$		240		nF
$C_{res}$		$f = 1\text{ MHz}$		0.137		nF
$Q_G$	$V_{GE} = -15\text{ V} \dots +15\text{ V}$			750		nC
$R_{Gint}$	$T_j = 25\text{ °C}$			0		Ω
$t_{d(on)}$	$V_{CC} = 300\text{ V}$	$T_j = 150\text{ °C}$		194		ns
$t_r$	$I_C = 75\text{ A}$	$T_j = 150\text{ °C}$		80		ns
$E_{on}$	$V_{GE\ neg} = -15\text{ V}$ $V_{GE\ pos} = 15\text{ V}$	$T_j = 150\text{ °C}$		4.5		mJ
$t_{d(off)}$	$R_{G\ on} = 8.2\text{ Ω}$	$T_j = 150\text{ °C}$		374		ns
$t_f$	$R_{G\ off} = 8.2\text{ Ω}$	$T_j = 150\text{ °C}$		27		ns
$E_{off}$	$di/dt_{on} = 1650\text{ A/μs}$ $di/dt_{off} = 5083\text{ A/μs}$	$T_j = 150\text{ °C}$		0.66		mJ
$R_{th(j-s)}$	per IGBT			0.96		K/W

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>IGBT 2</b>						
$V_{CE(sat)}$	$I_C = 150\text{ A}$ $V_{GE} = 15\text{ V}$ chipllevel	$T_j = 25\text{ °C}$		1.85	2.22	V
		$T_j = 150\text{ °C}$		2.18	2.55	V
$V_{CE0}$	chipllevel	$T_j = 25\text{ °C}$		1.10	1.20	V
		$T_j = 150\text{ °C}$		1.00	1.10	V
$r_{CE}$	$V_{GE} = 15\text{ V}$ chipllevel	$T_j = 25\text{ °C}$		5.0	6.8	mΩ
		$T_j = 150\text{ °C}$		7.9	9.7	mΩ
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 2.4\text{ mA}$		4.2	5.1	5.6	V
$I_{CES}$	$V_{GE} = 0\text{ V}$ $V_{CE} = 650\text{ V}$	$T_j = 25\text{ °C}$		-	0.3	mA
		$T_j = 150\text{ °C}$		-		mA
$C_{ies}$	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$		9.24		nF
$C_{oes}$		$f = 1\text{ MHz}$		480		nF
$C_{res}$		$f = 1\text{ MHz}$		0.274		nF
$Q_G$	$V_{GE} = -15\text{ V} \dots +15\text{ V}$			1500		nC
$R_{Gint}$	$T_j = 25\text{ °C}$			0		Ω
$t_{d(on)}$	$V_{CC} = 300\text{ V}$	$T_j = 150\text{ °C}$		82		ns
$t_r$	$I_C = 60\text{ A}$	$T_j = 150\text{ °C}$		39		ns
$E_{on}$	$V_{GE\ neg} = -15\text{ V}$ $V_{GE\ pos} = 15\text{ V}$	$T_j = 150\text{ °C}$		3.1		mJ
$t_{d(off)}$	$R_{G\ on} = 4.2\text{ Ω}$	$T_j = 150\text{ °C}$		318		ns
$t_f$	$R_{G\ off} = 4.2\text{ Ω}$	$T_j = 150\text{ °C}$		35		ns
$E_{off}$	$di/dt_{on} = 1650\text{ A/μs}$ $di/dt_{off} = 5083\text{ A/μs}$	$T_j = 150\text{ °C}$		0.7		mJ
$R_{th(j-s)}$	per IGBT			0.54		K/W



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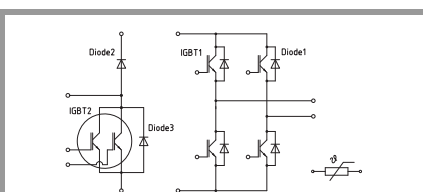
#### Remarks

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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>Diode 1</b>						
$V_F$	$I_F = 75 \text{ A}$	$T_j = 25 \text{ °C}$		1.35	1.77	V
	chipelevel	$T_j = 150 \text{ °C}$		1.30	1.72	V
$V_{F0}$	chipelevel	$T_j = 25 \text{ °C}$		0.95	1.15	V
		$T_j = 150 \text{ °C}$		0.75	0.95	V
$r_F$	chipelevel	$T_j = 25 \text{ °C}$		5.3	8.3	mΩ
		$T_j = 150 \text{ °C}$		7.3	10	mΩ
$I_{RRM}$	$I_F = 75 \text{ A}$	$T_j = 150 \text{ °C}$		28		A
$Q_{rr}$	$di/dt_{off} = 1650 \text{ A/}\mu\text{s}$	$T_j = 150 \text{ °C}$		4		μC
$E_{rr}$	$V_{GE} = 15 \text{ V}$	$T_j = 150 \text{ °C}$		0.7		mJ
$E_{rr}$	$V_{CC} = 300 \text{ V}$	$T_j = 150 \text{ °C}$		0.7		mJ
$R_{th(j-s)}$	per Diode			1.57		K/W

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>Diode 2</b>						
$V_F$	$I_F = 60 \text{ A}$	$T_j = 25 \text{ °C}$		1.35	1.77	V
	chipelevel	$T_j = 150 \text{ °C}$		1.30	1.72	V
$V_{F0}$	chipelevel	$T_j = 25 \text{ °C}$		0.95	1.15	V
		$T_j = 150 \text{ °C}$		0.75	0.95	V
$r_F$	chipelevel	$T_j = 25 \text{ °C}$		6.7	10	mΩ
		$T_j = 150 \text{ °C}$		9.2	13	mΩ
$I_{RRM}$	$I_F = 60 \text{ A}$	$T_j = 150 \text{ °C}$		21		A
$Q_{rr}$	$di/dt_{off} = 1650 \text{ A/}\mu\text{s}$	$T_j = 150 \text{ °C}$		3.8		μC
$E_{rr}$	$V_{GE} = -15 \text{ V}$	$T_j = 150 \text{ °C}$		0.3		mJ
$E_{rr}$	$V_{CC} = 300 \text{ V}$	$T_j = 150 \text{ °C}$		0.3		mJ
$R_{th(j-s)}$	per Diode			1.6		K/W

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>Diode 3</b>						
$V_F$	$I_F = 100 \text{ A}$	$T_j = 25 \text{ °C}$		1.40	1.76	V
	chipelevel	$T_j = 150 \text{ °C}$		1.38	1.77	V
$V_{F0}$	chipelevel	$T_j = 25 \text{ °C}$		1.04	1.24	V
		$T_j = 150 \text{ °C}$		0.85	0.99	V
$r_F$	chipelevel	$T_j = 25 \text{ °C}$		3.6	5.3	mΩ
		$T_j = 150 \text{ °C}$		5.3	7.8	mΩ
$I_{RRM}$	$I_F = 100 \text{ A}$					A
$Q_{rr}$						μC
$E_{rr}$						mJ
$E_{rr}$						mJ
$R_{th(j-s)}$	per Diode			0.9		K/W



**GHL-T**

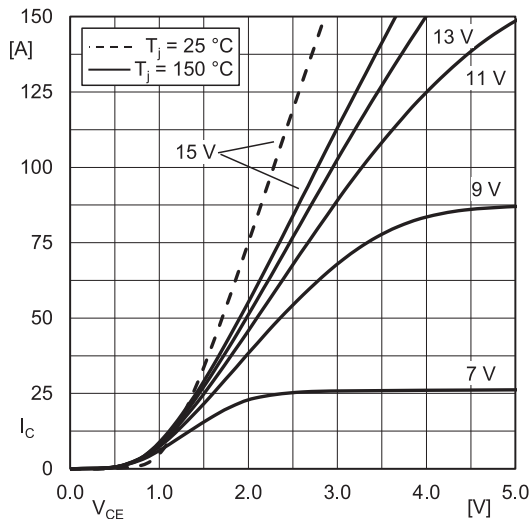


Fig. 1: Typ. IGBT1 output characteristic, incl.  $R_{CC'+EE'}$

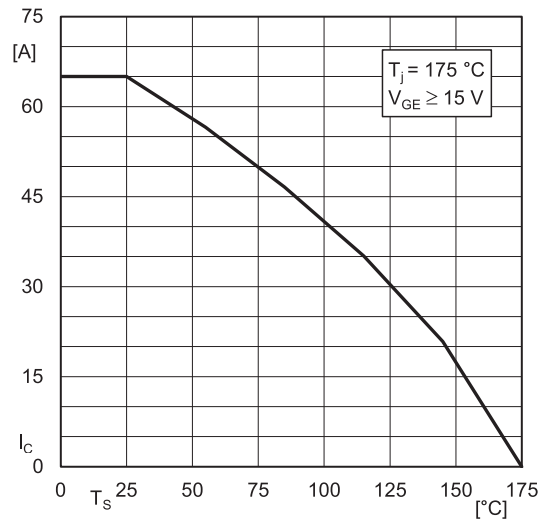


Fig. 2: IGBT1 rated current vs. Temperature  $I_c=f(T_s)$

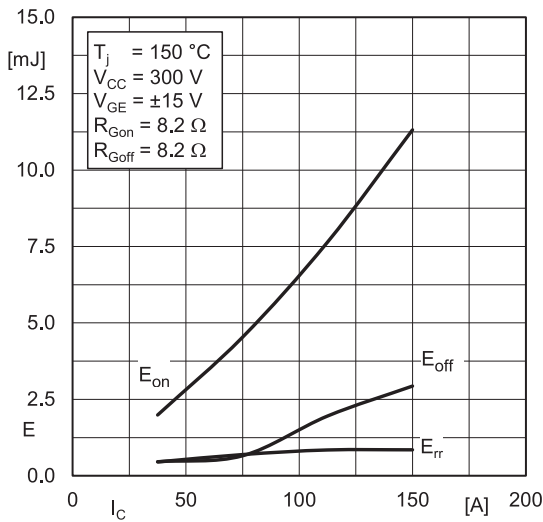


Fig. 3: Typ. IGBT1 & Diode1 turn-on /-off energy =  $f(I_c)$

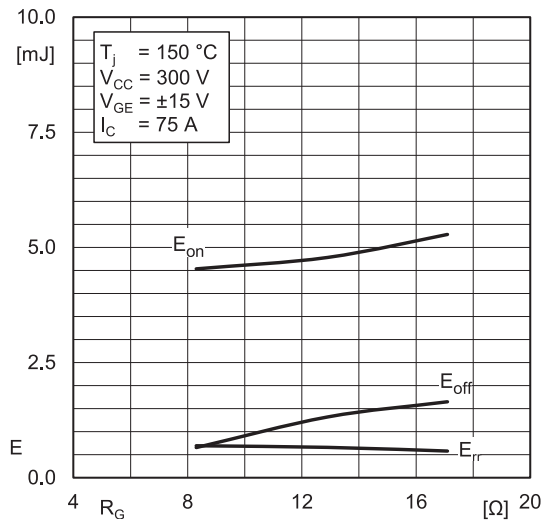


Fig. 4: Typ. IGBT1 & Diode1 turn-on /-off energy =  $f(R_G)$

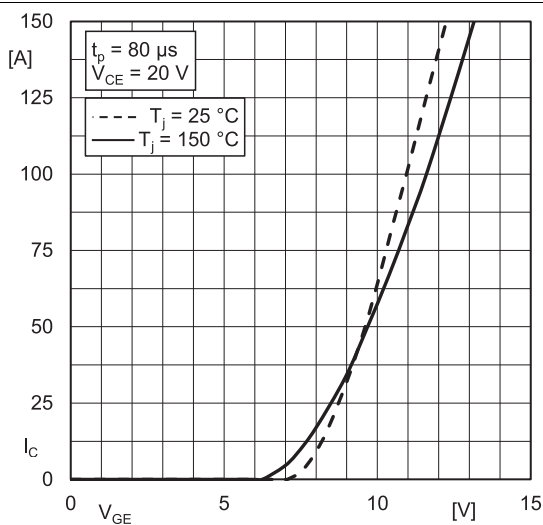


Fig. 5: Typ. IGBT1 transfer characteristic

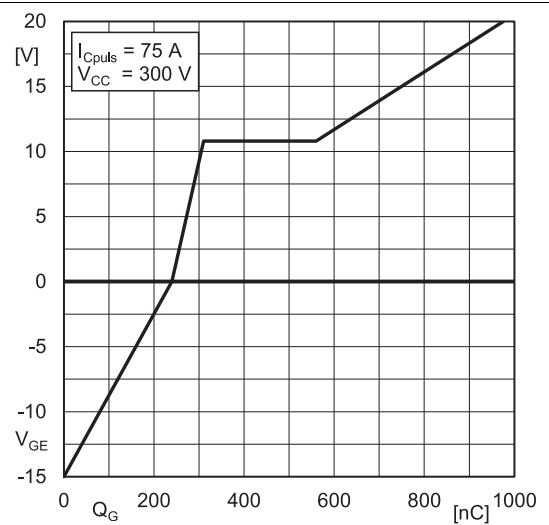


Fig. 6: Typ. IGBT1 gate charge characteristic

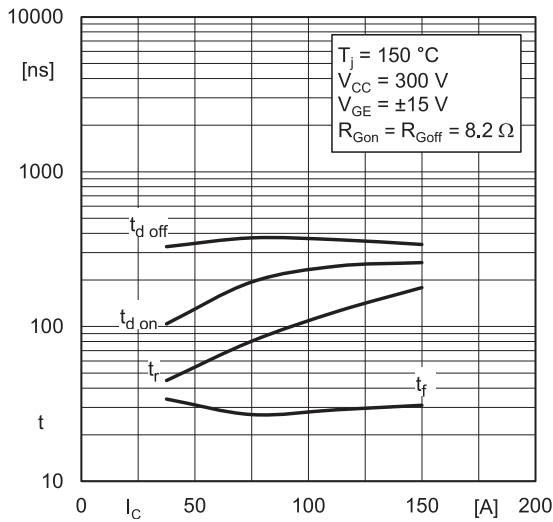


Fig. 7: Typ. IGBT1 switching times vs.  $I_C$

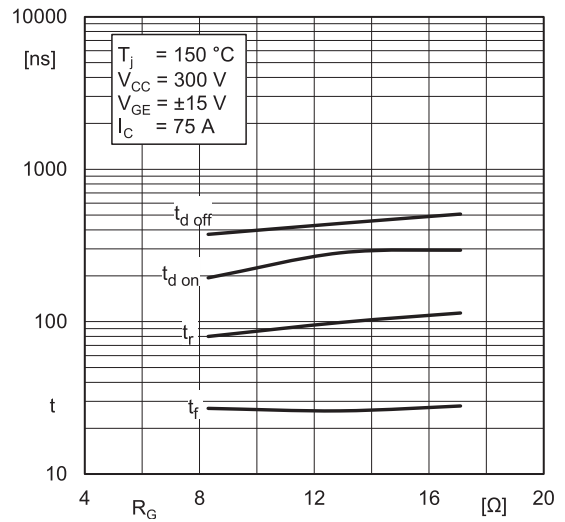


Fig. 8: Typ. IGBT1 switching times vs. gate resistor  $R_G$

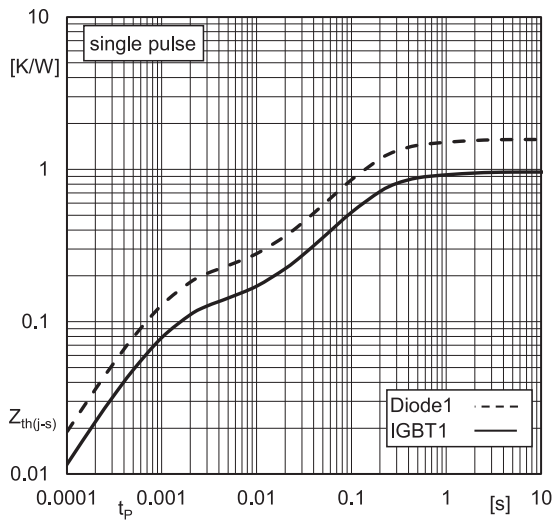


Fig. 9: Transient thermal impedance of IGBT1 & Diode 1

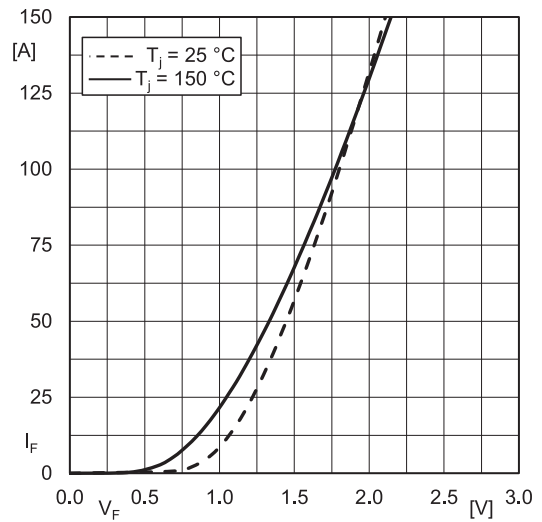


Fig. 10: Typ. Diode1 forward characteristic, incl.  $R_{CC+EE'}$

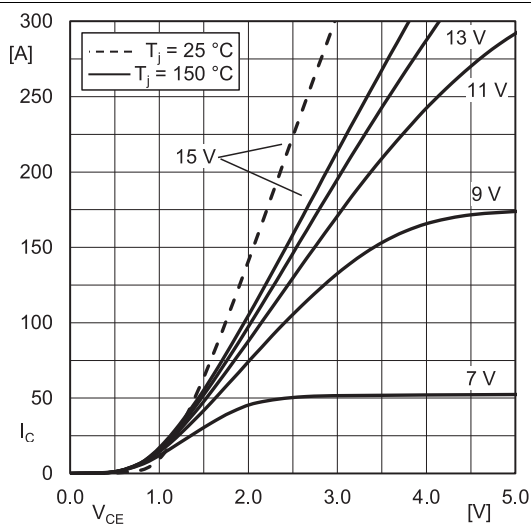


Fig. 13: Typ. IGBT2 output characteristic, incl.  $R_{CC+EE'}$

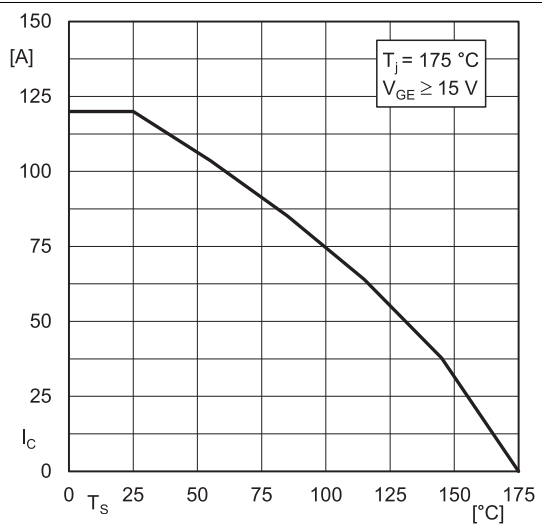


Fig. 14: IGBT2 Rated current vs. Temperature  $I_C = f(T_s)$

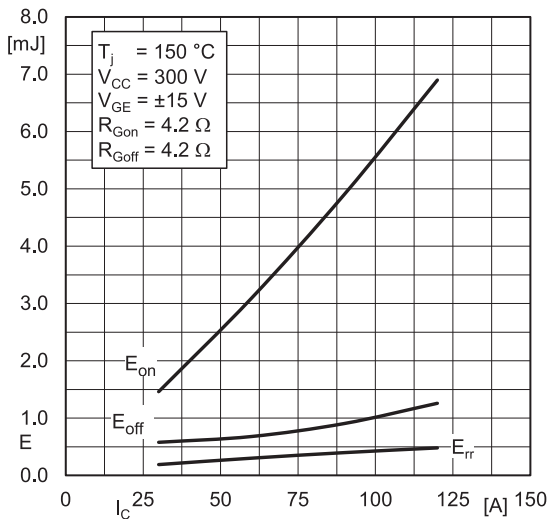


Fig. 15: Typ. IGBT2 & Diode2 turn-on /-off energy =  $f(I_c)$

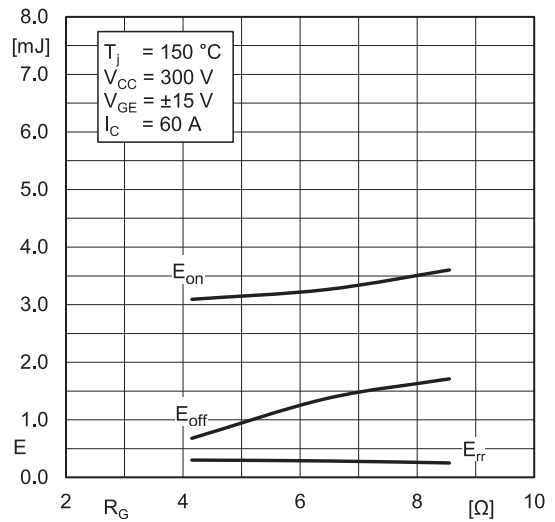


Fig. 16: Typ. IGBT2 & Diode2 turn-on / -off energy =  $f(R_G)$

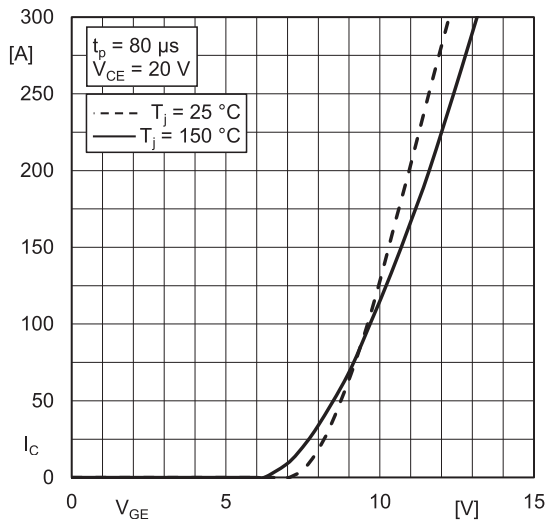


Fig. 17: Typ. IGBT2 transfer characteristic

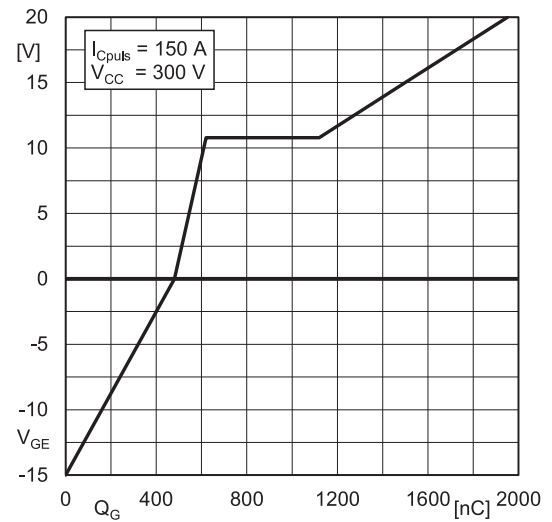


Fig. 18: Typ. IGBT2 gate charge characteristic

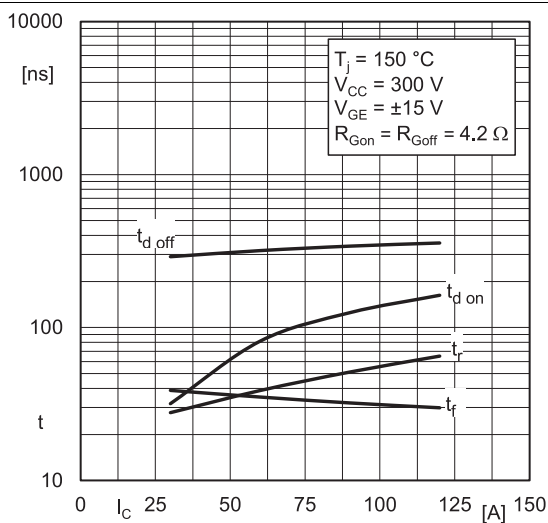


Fig. 19: Typ. IGBT2 switching times vs.  $I_c$

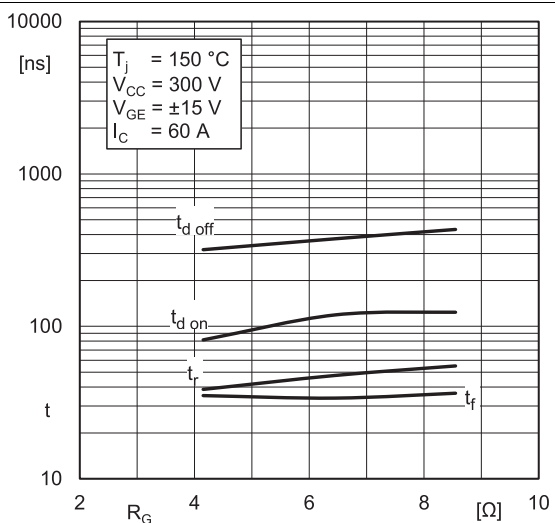


Fig. 20: Typ. IGBT2 switching times vs. gate resistor  $R_G$

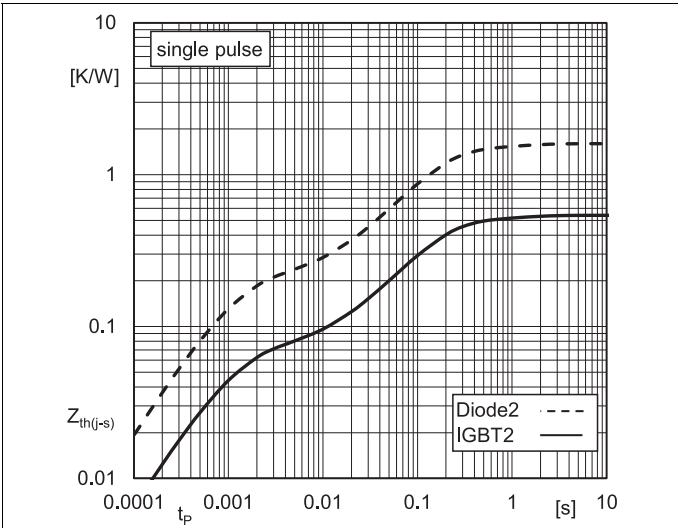


Fig. 21: Transient thermal impedance of IGBT2 & Diode2

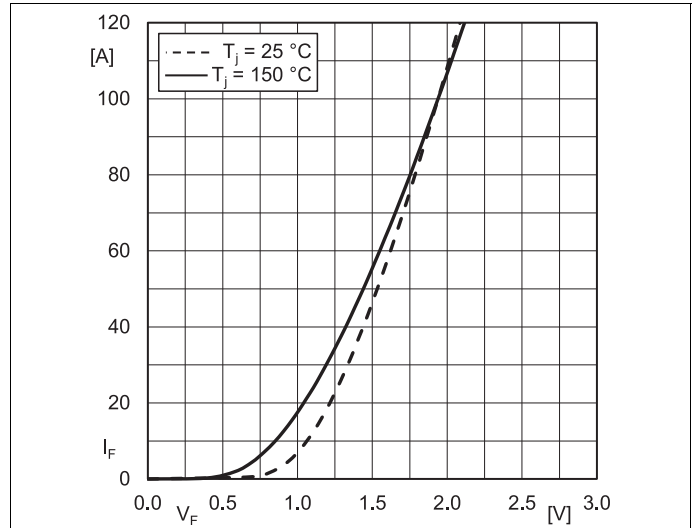


Fig. 22: Typ. Diode2 forward characteristic, incl.  $R_{CC+EE'}$



This is an electrostatic discharge sensitive device (ESDS), international standard IEC 60747-1, chapter IX.

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