



SEMiX® 3s

Trench IGBT Modules

SEMiX603GAR066HDs

Features

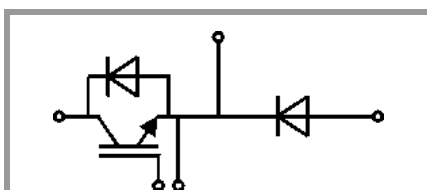
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- UL recognised file no. E63532

Typical Applications*

- Matrix Converter
- Resonant Inverter
- Current Source Inverter

Remarks

- Case temperature limited to $T_C=125^\circ\text{C}$ max.
- Product reliability results are valid for $T_J=150^\circ\text{C}$
- For short circuit: Soft R_{Goff} recommended
- Take care of over-voltage caused by stray inductance



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Absolute Maximum Ratings

Symbol	Conditions	Values	Unit
IGBT			
V_{CES}	$T_J = 25^\circ\text{C}$	600	V
I_C	$T_J = 175^\circ\text{C}$	$T_C = 25^\circ\text{C}$	720
		$T_C = 80^\circ\text{C}$	541
I_{Cnom}		600	A
I_{CRM}	$I_{CRM} = 2 \times I_{Cnom}$	1200	A
V_{GES}		-20 ... 20	V
t_{psc}	$V_{CC} = 360\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 600\text{ V}$	$T_J = 150^\circ\text{C}$	6
T_J		-40 ... 175	$^\circ\text{C}$
Inverse diode			
I_F	$T_J = 175^\circ\text{C}$	$T_C = 25^\circ\text{C}$	771
		$T_C = 80^\circ\text{C}$	562
I_{Fnom}		600	A
I_{FRM}	$I_{FRM} = 2 \times I_{Fnom}$	1200	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_J = 25^\circ\text{C}$	1800	A
T_J		-40 ... 175	$^\circ\text{C}$
Freewheeling diode			
I_F	$T_J = 175^\circ\text{C}$	$T_C = 25^\circ\text{C}$	795
		$T_C = 80^\circ\text{C}$	577
I_{Fnom}		600	A
I_{FRM}	$I_{FRM} = 2 \times I_{Fnom}$	1200	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_J = 25^\circ\text{C}$	1800	A
T_J		-40 ... 175	$^\circ\text{C}$
Module			
$I_{t(RMS)}$	$T_{terminal} = 80^\circ\text{C}$	600	A
T_{stg}		-40 ... 125	$^\circ\text{C}$
V_{isol}	AC sinus 50Hz, $t = 1\text{ min}$	4000	V

Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
$V_{CE(sat)}$	$I_C = 600\text{ A}$ $V_{GE} = 15\text{ V}$ chipllevel	$T_J = 25^\circ\text{C}$	1.45	1.85	V
		$T_J = 150^\circ\text{C}$	1.7	2.1	V
V_{CE0}		$T_J = 25^\circ\text{C}$	0.9	1	V
		$T_J = 150^\circ\text{C}$	0.85	0.9	V
r_{CE}	$V_{GE} = 15\text{ V}$	$T_J = 25^\circ\text{C}$	0.9	1.4	m Ω
		$T_J = 150^\circ\text{C}$	1.4	2.0	m Ω
$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C = 9.6\text{ mA}$	5	5.8	6.5	V
I_{CES}	$V_{GE} = 0\text{ V}$ $V_{CE} = 600\text{ V}$	$T_J = 25^\circ\text{C}$	0.15	0.45	mA
		$T_J = 150^\circ\text{C}$			mA
C_{ies}	$V_{CE} = 25\text{ V}$	$f = 1\text{ MHz}$	37.0		nF
C_{oes}	$V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	2.31		nF
C_{res}		$f = 1\text{ MHz}$	1.10		nF
Q_G	$V_{GE} = -8\text{ V...} + 15\text{ V}$		4800		nC
R_{Gint}	$T_J = 25^\circ\text{C}$		0.67		Ω



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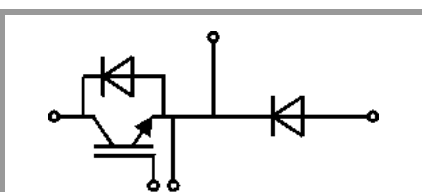
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Remarks

- Case temperature limited to $T_C=125^\circ\text{C}$ max.
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
t _{d(on)}	V _{CC} = 300 V	T _j = 150 °C		150		ns
t _r	I _C = 600 A	T _j = 150 °C		145		ns
E _{on}	V _{GE} = ±15 V	T _j = 150 °C		12		mJ
t _{d(off)}	R _{G on} = 3 Ω	T _j = 150 °C		1050		ns
t _f	R _{G off} = 3 Ω	T _j = 150 °C		105		ns
E _{off}		T _j = 150 °C		43		mJ
R _{th(j-c)}	per IGBT				0.087	K/W
Inverse diode						
V _F = V _{EC}	I _F = 600 A	T _j = 25 °C		1.4	1.60	V
	V _{GE} = 0 V	T _j = 150 °C		1.4	1.6	V
	chip					
V _{F0}		T _j = 25 °C	0.9	1	1.1	V
		T _j = 150 °C	0.75	0.85	0.95	V
r _F		T _j = 25 °C	0.5	0.7	0.8	mΩ
		T _j = 150 °C	0.8	0.9	1.1	mΩ
I _{RRM}	I _F = 600 A	T _j = 150 °C		350		A
Q _{rr}	di/dt _{off} = 3800 A/μs	T _j = 150 °C		63		μC
E _{rr}	V _{GE} = -8 V	T _j = 150 °C		13		mJ
	V _{CC} = 300 V					
R _{th(j-c)}	per diode				0.11	K/W
Freewheeling diode						
V _F = V _{EC}	I _F = 600 A	T _j = 25 °C		1.3	1.53	V
	V _{GE} = 0 V	T _j = 150 °C		1.3	1.5	V
	chip					
V _{F0}		T _j = 25 °C	0.9	1	1.1	V
		T _j = 150 °C	0.75	0.85	0.95	V
r _F		T _j = 25 °C	0.4	0.6	0.7	mΩ
		T _j = 150 °C	0.7	0.8	0.9	mΩ
I _{RRM}	I _F = 600 A	T _j = 150 °C		350		A
Q _{rr}	di/dt _{off} = 3800 A/μs	T _j = 150 °C		63		μC
E _{rr}	V _{GE} = -8 V	T _j = 150 °C		13		mJ
	V _{CC} = 300 V					
R _{th(j-c)}	per diode				0.11	K/W
Module						
L _{CE}				20		nH
R _{CC'+EE'}	res., terminal-chip	T _C = 25 °C		0.7		mΩ
		T _C = 125 °C		1		mΩ
R _{th(c-s)}	per module			0.04		K/W
M _s	to heat sink (M5)		3		5	Nm
M _t		to terminals (M6)	2.5		5	Nm
						Nm
w					300	g
Temperatur Sensor						
R ₁₀₀	T _C =100°C (R ₂₅ =5 kΩ)			493 ± 5%		Ω
B _{100/125}	R(T)=R ₁₀₀ exp[B _{100/125} (1/T-1/T ₁₀₀)]; T[K];			3550 ±2%		K



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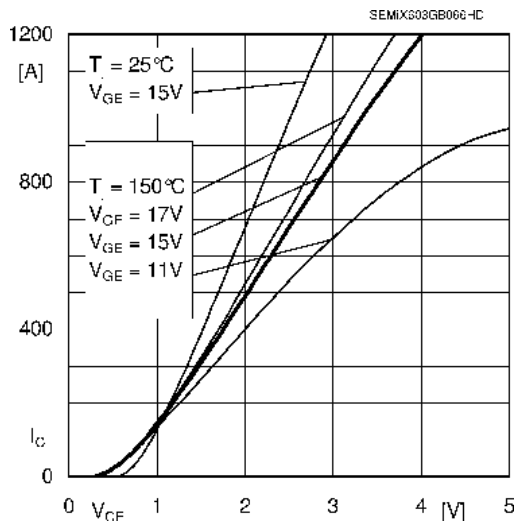


Fig. 1: Typ. output characteristic, inclusive $R_{CC'} + E_{E'}$

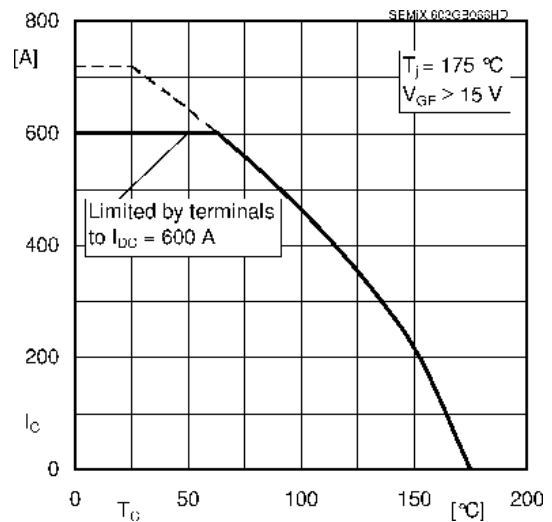


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

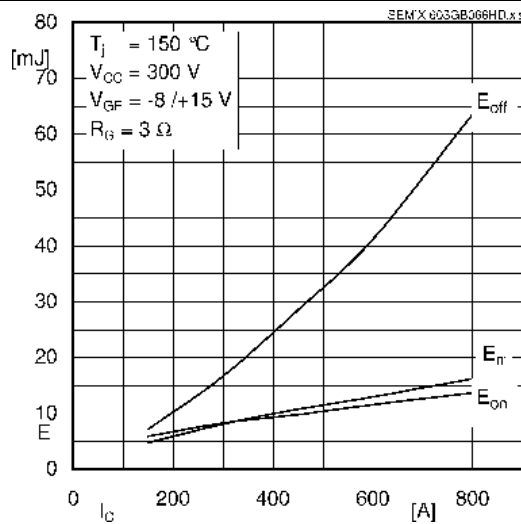


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

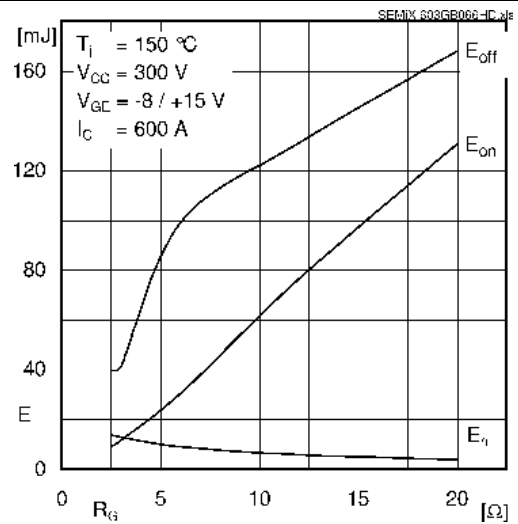


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

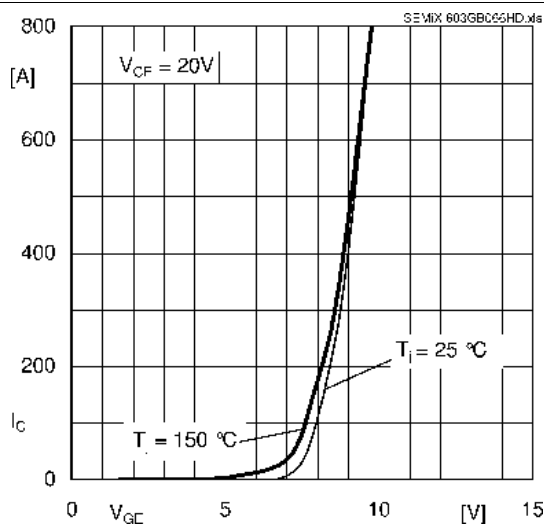


Fig. 5: Typ. transfer characteristic

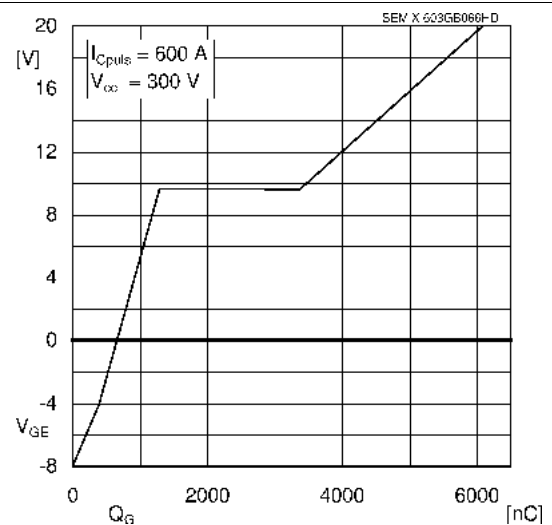


Fig. 6: Typ. gate charge characteristic

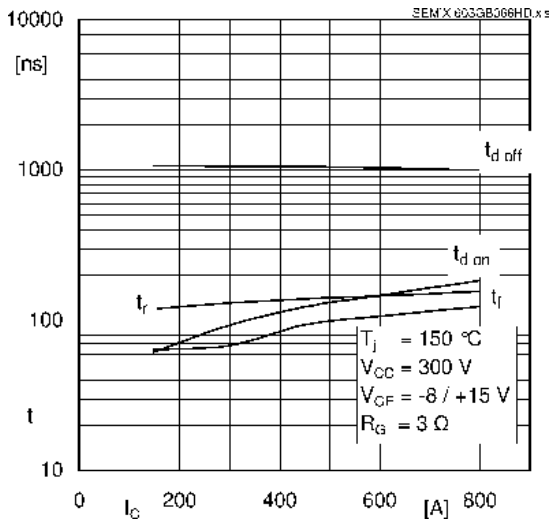


Fig. 7: Typ. switching times vs. I_C

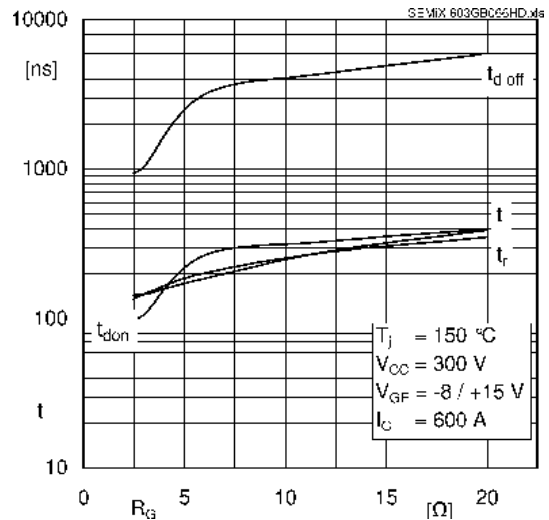


Fig. 8: Typ. switching times vs. gate resistor R_G

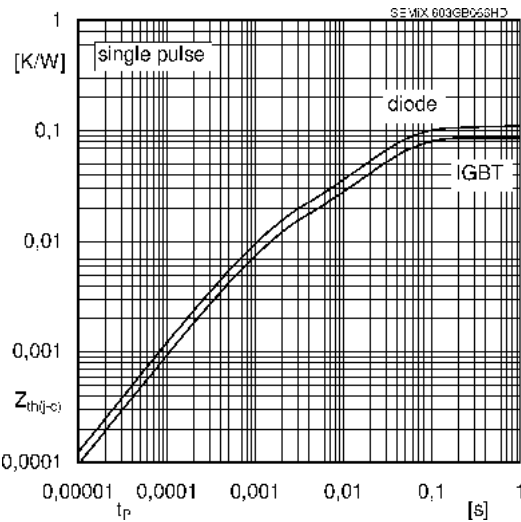


Fig. 9: Typ. transient thermal impedance

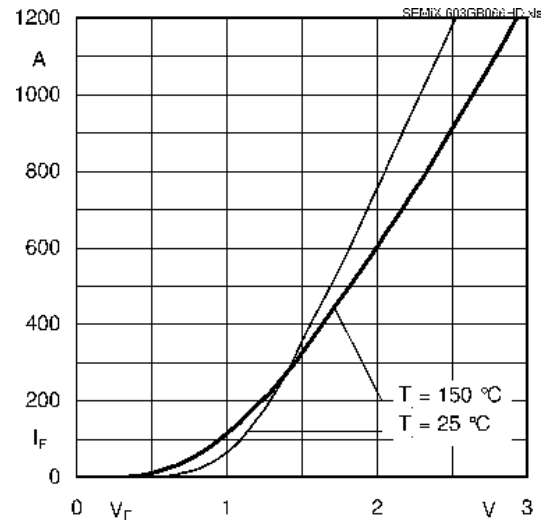


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

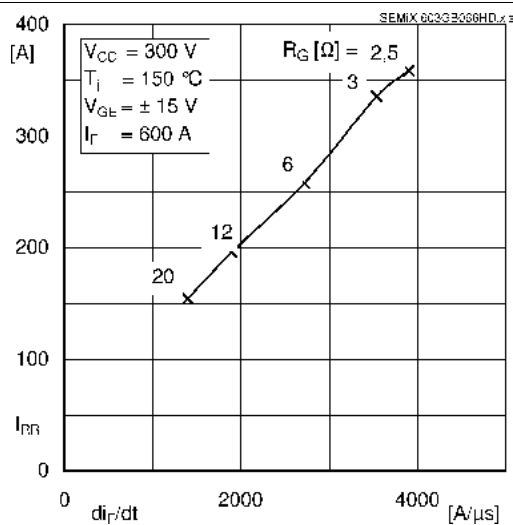


Fig. 11: Typ. CAL diode peak reverse recovery current

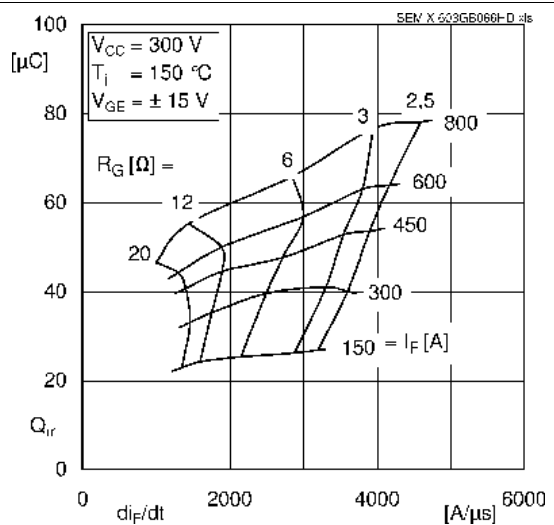
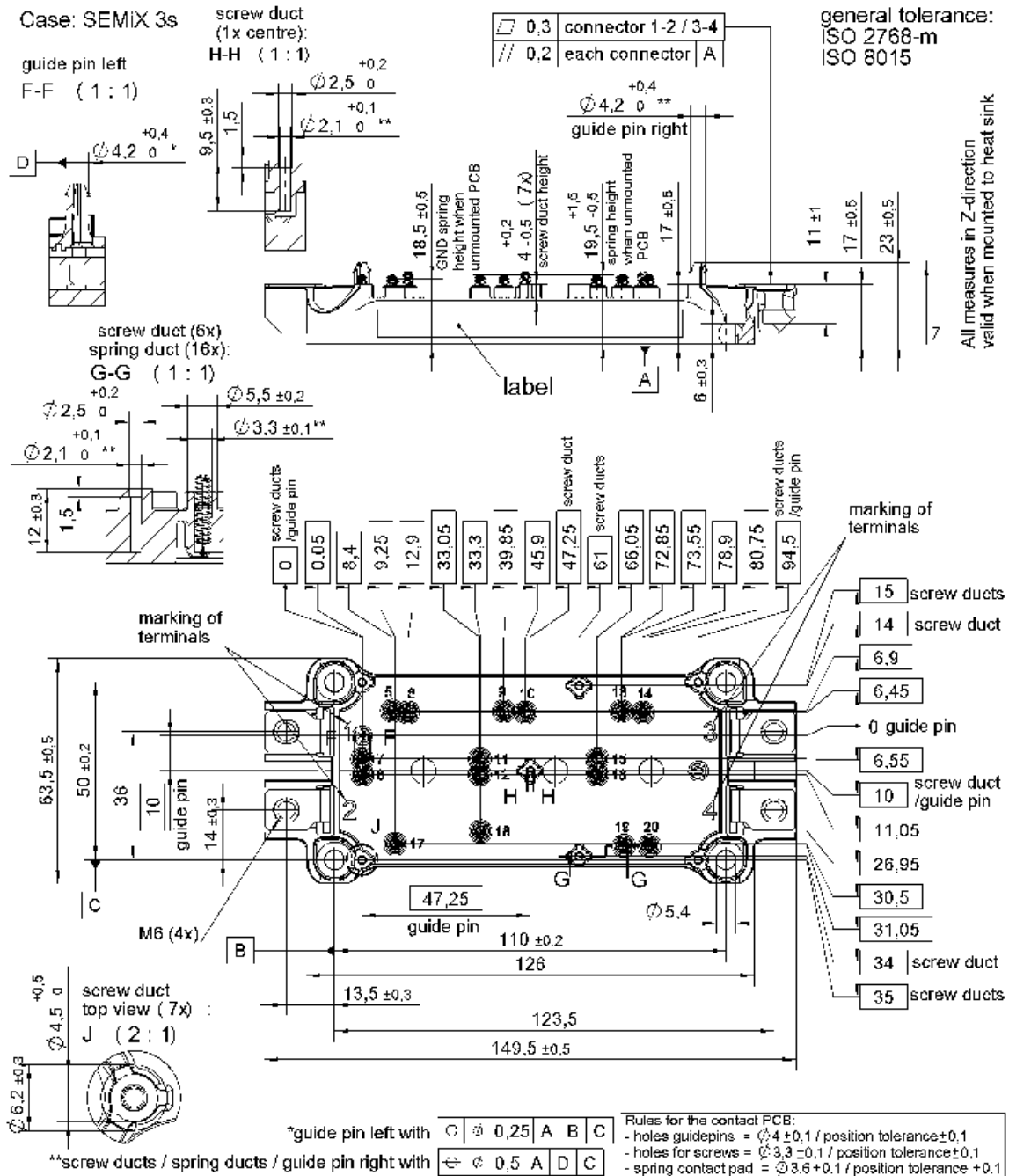
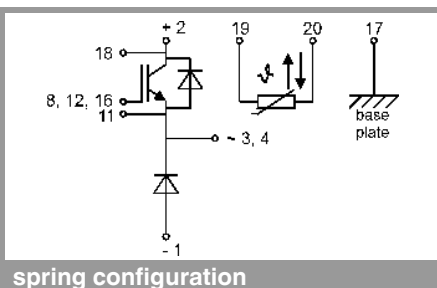


Fig. 12: Typ. CAL diode recovery charge



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

* The specifications of our components may not be considered as an assurance of component characteristics. Components have to be tested for the respective application. Adjustments may be necessary. The use of SEMIKRON products in life support appliances and systems is subject to prior specification and written approval by SEMIKRON. We therefore strongly recommend prior consultation of our staff.