

SKiM609GAL12E4



SKiM® 93

Trench IGBT Modules

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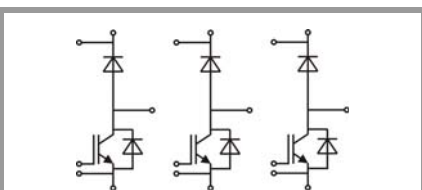
Target Data

Features

- IGBT 4 Trench Gate Technology
- Solderless sinter technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Isolated by Al_2O_3 DCB (Direct Copper Bonded) ceramic substrate
- Pressure contact technology for thermal contacts and electrical contacts
- High short circuit capability, self limiting to $6 \times I_C$
- Integrated temperature sensor

Typical Applications

- Automotive inverter
- High reliability AC inverter wind
- High reliability AC inverter drives



GAL

Absolute Maximum Ratings					
Symbol	Conditions		Values	Unit	
IGBT					
V_{CES}			1200	V	
I_C	$T_j = 175\text{ °C}$	$T_s = 25\text{ °C}$	748	A	
		$T_s = 70\text{ °C}$	608	A	
I_{Cnom}			600	A	
I_{CRM}	$I_{CRM} = 3 \times I_{Cnom}$		1800	A	
V_{GES}			-20 ... 20	V	
t_{psc}	$V_{CC} = 800\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 1200\text{ V}$	$T_j = 150\text{ °C}$	10		μs
T_j			-40 ... 175	°C	
Inverse diode					
I_F	$T_j = 175\text{ °C}$	$T_s = 25\text{ °C}$	139	A	
		$T_s = 70\text{ °C}$	110	A	
I_{Fnom}			150	A	
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$		450	A	
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25\text{ °C}$		900	A	
T_j			-40 ... 175	°C	
Freewheeling diode					
I_F	$T_j = 175\text{ °C}$	$T_s = 25\text{ °C}$	1397	A	
		$T_s = 70\text{ °C}$	1107	A	
I_{Fnom}			1350	A	
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$		4050	A	
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25\text{ °C}$		6480	A	
T_j			-40 ... 175	°C	
Module					
$I_{t(RMS)}$			700	A	
T_{stg}			-40 ... 125	°C	
V_{isol}	AC sinus 50 Hz, $t = 1\text{ min}$		2500	V	

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
$V_{CE(sat)}$	$I_C = 600\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25\text{ °C}$	1.85	2.10	V	
		$T_j = 150\text{ °C}$	2.25	2.45	V	
V_{CE0}		$T_j = 25\text{ °C}$	0.8	0.9	V	
		$T_j = 150\text{ °C}$	0.7	0.8	V	
r_{CE}	$V_{GE} = 15\text{ V}$	$T_j = 25\text{ °C}$	1.8	2.0	m Ω	
		$T_j = 150\text{ °C}$	2.6	2.8	m Ω	
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 24\text{ mA}$		5	5.8	6.5	V
I_{CES}	$V_{GE} = 0\text{ V}$ $V_{CE} = 1200\text{ V}$	$T_j = 25\text{ °C}$	0.1		0.3	mA
						mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	35.2		nF	
C_{oes}		$f = 1\text{ MHz}$	2.32		nF	
C_{res}		$f = 1\text{ MHz}$	1.88		nF	
Q_G	$V_{GE} = -8\text{ V...} + 15\text{ V}$		3400		nC	
R_{Gint}	$T_j = 25\text{ °C}$		1.3		Ω	

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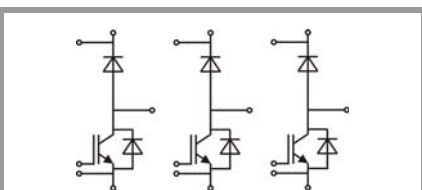
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
$t_{d(on)}$	$V_{CC} = 600 V$	$T_j = 150 ^\circ C$		150		ns
t_r	$I_C = 600 A$	$T_j = 150 ^\circ C$		121		ns
E_{on}	$V_{GE} = 15 V$	$T_j = 150 ^\circ C$		136		mJ
$t_{d(off)}$	$R_{G on} = 4.1 \Omega$	$T_j = 150 ^\circ C$		808		ns
	$R_{G off} = 4.1 \Omega$	$T_j = 150 ^\circ C$		100		ns
t_f	$di/dt_{on} = 5000 A/\mu s$	$T_j = 150 ^\circ C$		100		ns
E_{off}	$di/dt_{off} = 4400 A/\mu s$	$T_j = 150 ^\circ C$		83		mJ
$R_{th(j-s)}$	per IGBT				0.068	K/W
Inverse diode						
$V_F = V_{EC}$	$I_F = 150 A$	$T_j = 25 ^\circ C$		2.1	2.5	V
	$V_{GE} = 0 V$ chip	$T_j = 150 ^\circ C$		2.1	2.4	V
V_{F0}		$T_j = 25 ^\circ C$		1.3	1.5	V
		$T_j = 150 ^\circ C$		0.9	1.1	V
r_F		$T_j = 25 ^\circ C$		5.6	6.4	m Ω
		$T_j = 150 ^\circ C$		7.8	8.5	m Ω
I_{RRM}	$I_F = 150 A$	$T_j = 150 ^\circ C$		153		A
Q_{rr}	$di/dt_{off} = 3300 A/\mu s$	$T_j = 150 ^\circ C$		15		μC
E_{rr}	$V_{GE} = -15 V$ $V_{CC} = 600 V$	$T_j = 150 ^\circ C$		9		mJ
$R_{th(j-s)}$	per diode				0.501	K/W
Freewheeling diode						
$V_F = V_{EC}$	$I_F = 600 A$	$T_j = 25 ^\circ C$		1.7	1.9	V
	$V_{GE} = 0 V$ chip	$T_j = 150 ^\circ C$		1.4	1.7	V
V_{F0}		$T_j = 25 ^\circ C$		1.3	1.5	V
		$T_j = 150 ^\circ C$		0.9	1.1	V
r_F		$T_j = 25 ^\circ C$		0.6	0.7	m Ω
		$T_j = 150 ^\circ C$		0.9	0.9	m Ω
I_{RRM}	$I_F = 600 A$	$T_j = 150 ^\circ C$		510		A
Q_{rr}	$di/dt_{off} = 5300 A/\mu s$	$T_j = 150 ^\circ C$		123		μC
E_{rr}	$V_{GE} = -15 V$ $V_{CC} = 600 V$	$T_j = 150 ^\circ C$		39		mJ
$R_{th(j-s)}$					0.048	K/W
Module						
L_{CE}				10	15	nH
R_{CC+EE}	terminal-chip	$T_s = 25 ^\circ C$		0.3		m Ω
		$T_s = 125 ^\circ C$		0.5		m Ω
M_s	to heat sink (M4)			2.5	4	Nm
M_t				to terminals (M6)		
				3	5	Nm
						Nm
W					1100	g
Temperatur Sensor						
R_{100}	$T_{Sensor} = 100 ^\circ C$ ($R_{25} = 5 k\Omega$)			339		Ω
$B_{100/125}$	$R_{(T)} = R_{100} \exp[B_{100/125}(1/T - 1/373)];$ $T[K];$			4096		K



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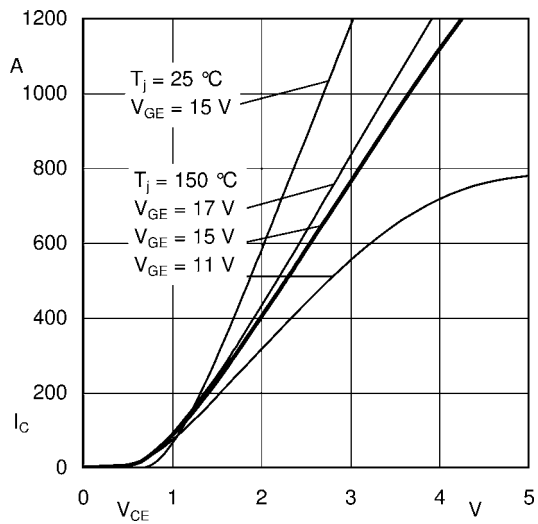


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

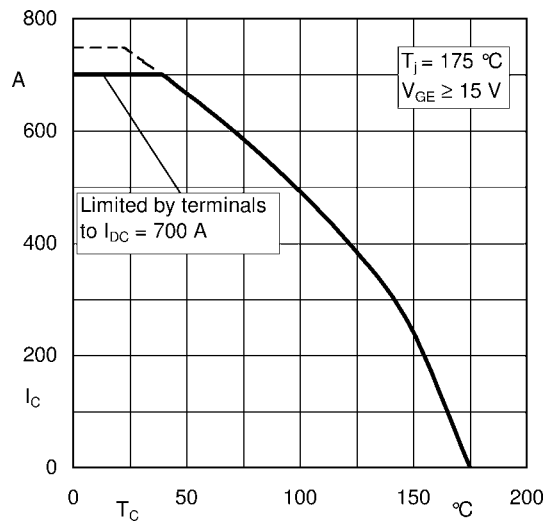


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

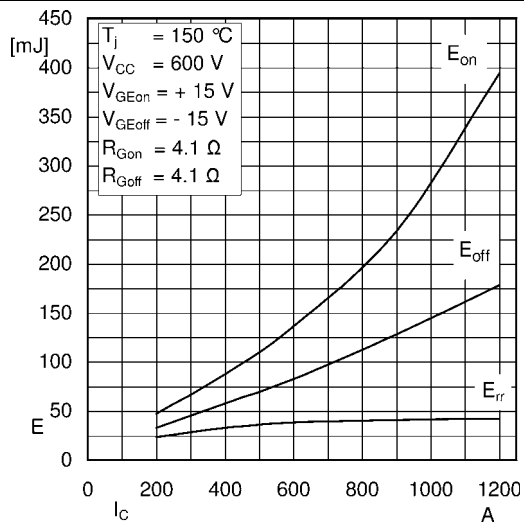


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

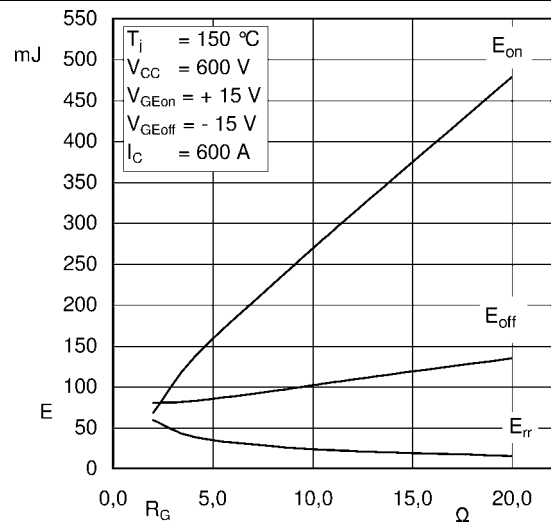


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

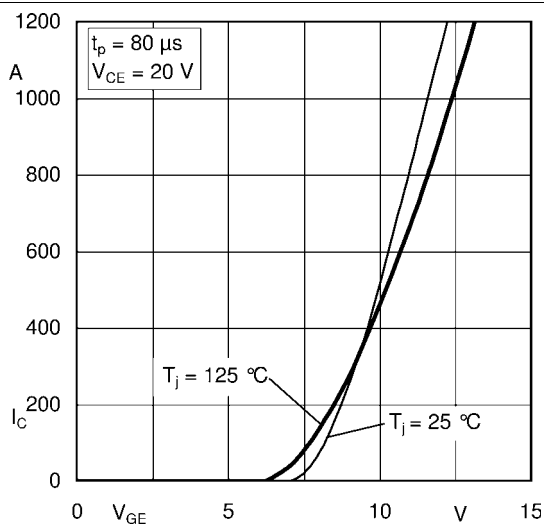


Fig. 5: Typ. transfer characteristic

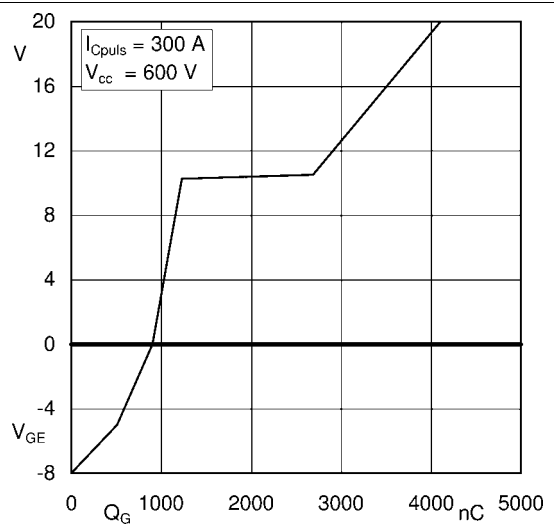


Fig. 6: Typ. gate charge characteristic

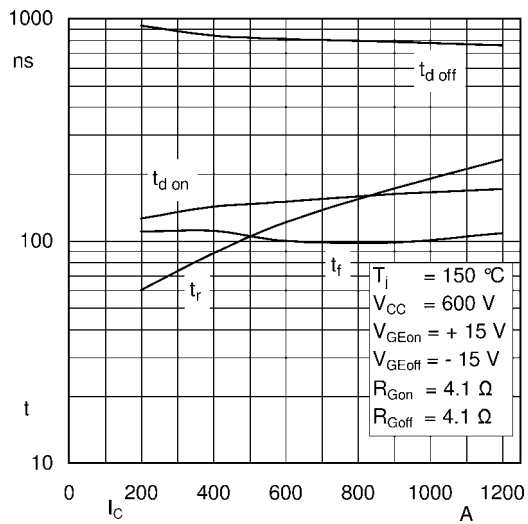


Fig. 7: Typ. switching times vs. I_C

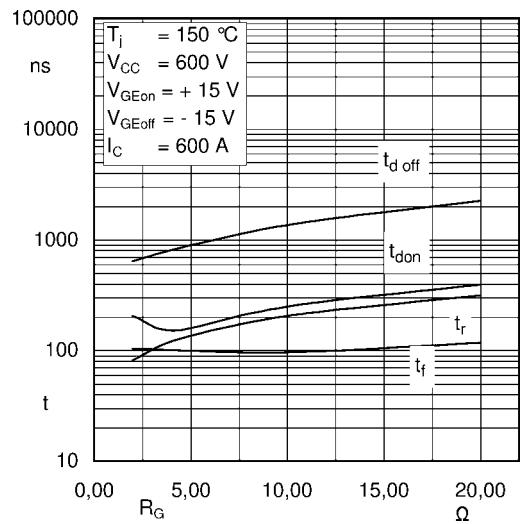


Fig. 8: Typ. switching times vs. gate resistor R_G

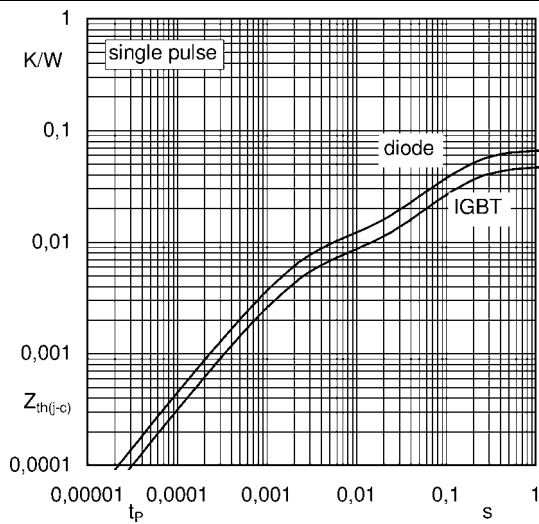


Fig. 9: Typ. transient thermal impedance

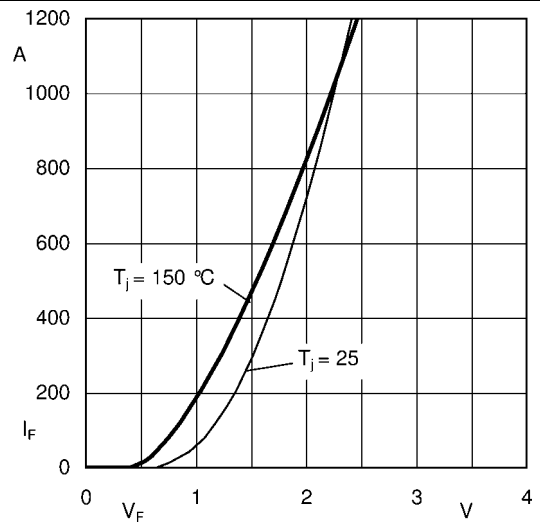


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC+EE'}$

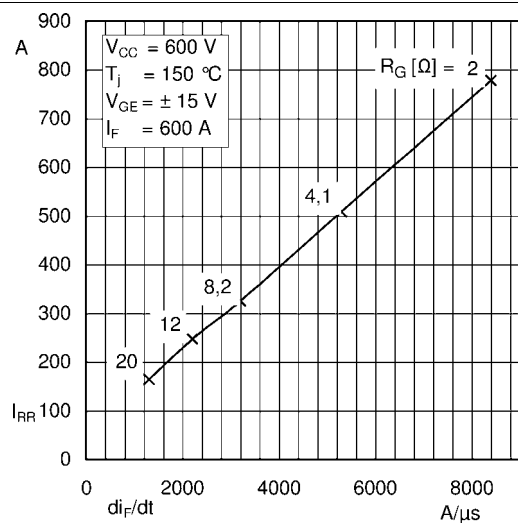


Fig. 11: Typ. CAL diode peak reverse recovery current

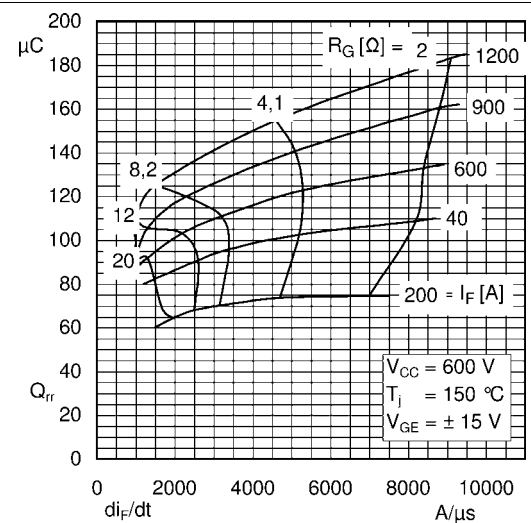
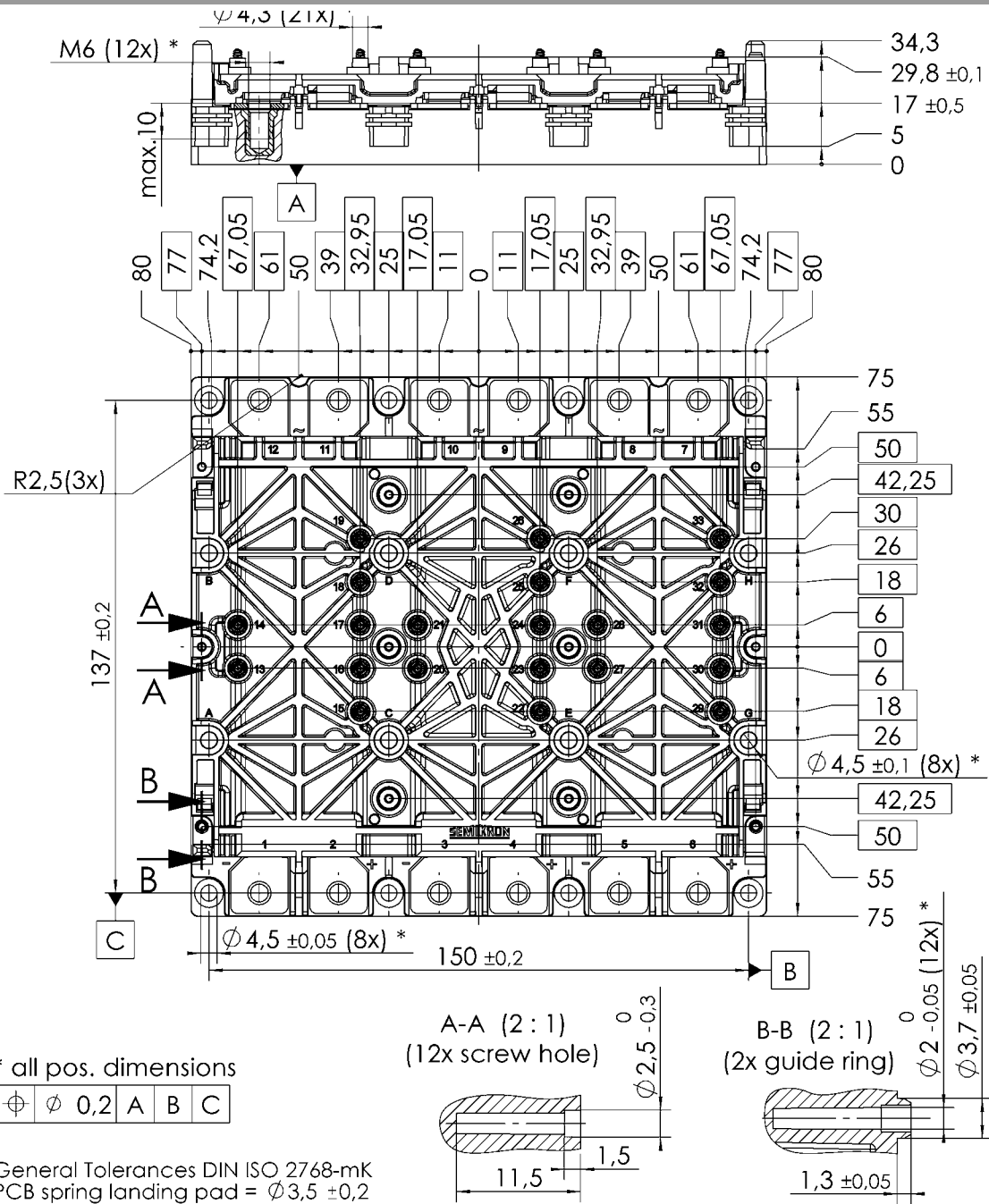
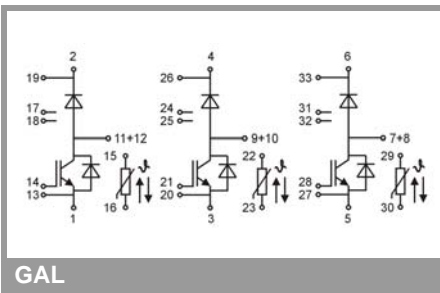


Fig. 12: Typ. CAL diode recovery charge

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

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