

SKiM® 63

## Trench IGBT Modules

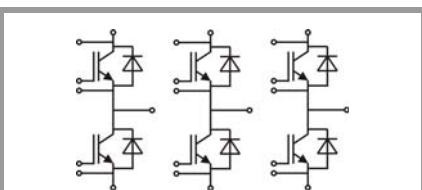
### SKiM606GD066HD

#### Features

- IGBT 3 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

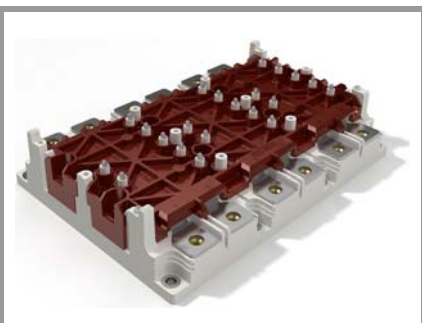
- Automotive inverter
- High reliability AC inverter wind
- High reliability AC inverter drives



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Absolute Maximum Ratings				
Symbol	Conditions	Values	Unit	
<b>IGBT</b>				
$V_{CES}$		600	V	
$I_C$	$T_j = 175\text{ °C}$	$T_s = 25\text{ °C}$	587	A
		$T_s = 70\text{ °C}$	467	A
$I_{Cnom}$		600	A	
$I_{CRM}$	$I_{CRM} = 2 \times I_{Cnom}$	1200	A	
$V_{GES}$		-20 ... 20	V	
$t_{psc}$	$V_{CC} = 360\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 600\text{ V}$	$T_j = 150\text{ °C}$	6	$\mu\text{s}$
$T_j$		-40 ... 175	$^{\circ}\text{C}$	
<b>Inverse diode</b>				
$I_F$	$T_j = 175\text{ °C}$	$T_s = 25\text{ °C}$	441	A
		$T_s = 70\text{ °C}$	342	A
$I_{Fnom}$		400	A	
$I_{FRM}$	$I_{FRM} = 2 \times I_{Fnom}$	800	A	
$I_{FSM}$	$t_p = 10\text{ ms, sin } 180^{\circ}, T_j = 25\text{ °C}$	2880	A	
$T_j$		-40 ... 175	$^{\circ}\text{C}$	
<b>Module</b>				
$I_{t(RMS)}$		700	A	
$T_{stg}$		-40 ... 125	$^{\circ}\text{C}$	
$V_{isol}$	AC sinus 50 Hz, $t = 1\text{ min}$	2500	V	

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
<b>IGBT</b>					
$V_{CE(sat)}$	$I_C = 600\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25\text{ °C}$	1.45	1.85	V
		$T_j = 150\text{ °C}$	1.70	2.10	V
$V_{CE0}$		$T_j = 25\text{ °C}$	0.9	1	V
		$T_j = 150\text{ °C}$	0.85	0.9	V
$r_{CE}$	$V_{GE} = 15\text{ V}$	$T_j = 25\text{ °C}$	0.9	1.4	$\text{m}\Omega$
		$T_j = 150\text{ °C}$	1.4	2.0	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 9.6\text{ mA}$	5	5.8	6.5	V
$I_{CES}$	$V_{GE} = 0\text{ V}$ $V_{CE} = 600\text{ V}$	$T_j = 25\text{ °C}$	0.1	0.3	$\text{mA}$
		$T_j = 150\text{ °C}$			$\text{mA}$
$C_{ies}$	$V_{CE} = 25\text{ V}$		36.96		nF
$C_{oes}$	$V_{GE} = 0\text{ V}$		2.304		nF
$C_{res}$			1.096		nF
$Q_G$	$V_{GE} = -8\text{ V...} + 15\text{ V}$		4800		nC
$R_{Gint}$	$T_j = 25\text{ °C}$		0.5		$\Omega$
$t_{d(on)}$	$V_{CC} = 300\text{ V}$		150		ns
$t_r$	$I_C = 600\text{ A}$	$T_j = 150\text{ °C}$	120		ns
$E_{on}$	$R_{Gon} = 3\text{ }\Omega$		16		mJ
$t_{d(off)}$	$R_{Goff} = 5\text{ }\Omega$	$T_j = 150\text{ °C}$	1400		ns
$t_f$	$di/dt_{on} = 5500\text{ A}/\mu\text{s}$ $di/dt_{off} = 6200\text{ A}/\mu\text{s}$	$T_j = 150\text{ °C}$	75		ns
$E_{off}$			53		mJ
$R_{th(j-s)}$	per IGBT			0.121	K/W



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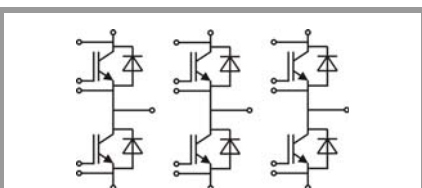
### SKiM606GD066HD

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GD

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>Inverse diode</b>						
$V_F = V_{EC}$	$I_F = 600 \text{ A}$ $V_{GE} = 0 \text{ V}$ chip	$T_j = 25 \text{ }^\circ\text{C}$	1.6	1.9		V
		$T_j = 150 \text{ }^\circ\text{C}$	1.7	1.9		V
$V_{F0}$		$T_j = 25 \text{ }^\circ\text{C}$	1	1.1		V
		$T_j = 150 \text{ }^\circ\text{C}$	0.85	0.95		V
$r_F$		$T_j = 25 \text{ }^\circ\text{C}$	1.0	1.3		m $\Omega$
		$T_j = 150 \text{ }^\circ\text{C}$	1.4	1.6		m $\Omega$
$I_{RRM}$	$I_F = 600 \text{ A}$ $di/dt_{off} = 5600 \text{ A}/\mu\text{s}$ $V_{GE} = -15 \text{ V}$ $V_{CC} = 300 \text{ V}$	$T_j = 150 \text{ }^\circ\text{C}$	390			A
$Q_{rr}$		$T_j = 150 \text{ }^\circ\text{C}$	85			$\mu\text{C}$
$E_{rr}$		$T_j = 150 \text{ }^\circ\text{C}$	21			mJ
$R_{th(j-s)}$	per diode				0.209	K/W
<b>Module</b>						
$L_{CE}$			9	13		nH
$R_{CC'+EE'}$	terminal-chip	$T_s = 25 \text{ }^\circ\text{C}$	0.3			m $\Omega$
		$T_s = 125 \text{ }^\circ\text{C}$	0.5			m $\Omega$
$M_s$	to heat sink (M4)		2.5	4		Nm
$M_t$		to terminals (M6)	3	5		Nm
						Nm
$w$				750		g
<b>Temperature sensor</b>						
$R_{100}$	$T_{Sensor} = 100 \text{ }^\circ\text{C}$ ( $R_{25} = 5 \text{ k}\Omega$ )		339			$\Omega$
$B_{100/125}$	$R_{(T)} = R_{100} \exp[B_{100/125}(1/T - 1/373)];$ $T[\text{K}];$		4096			K

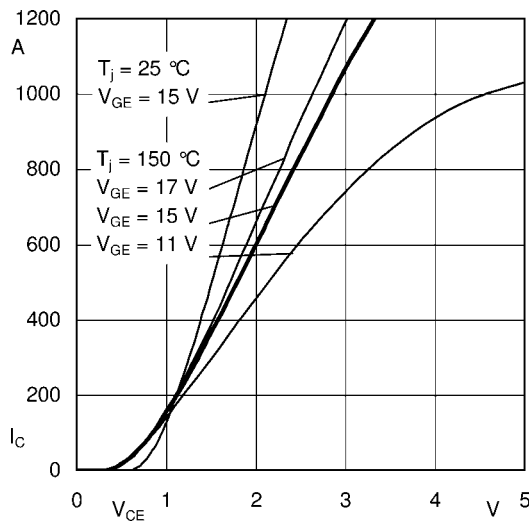


Fig. 1: Typ. output characteristic, inclusive  $R_{CC'+EE'}$

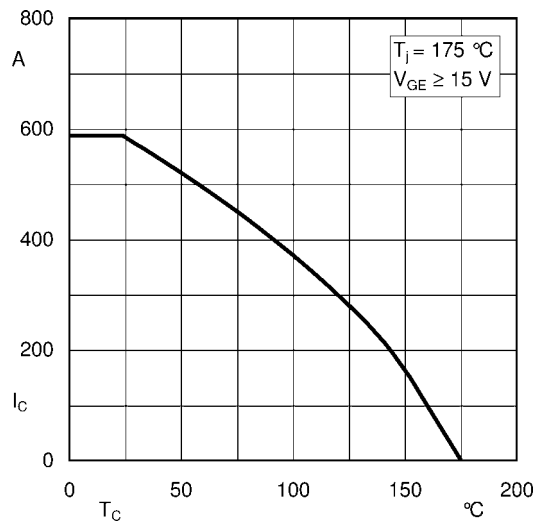


Fig. 2: Rated current vs. temperature  $I_c = f(T_c)$

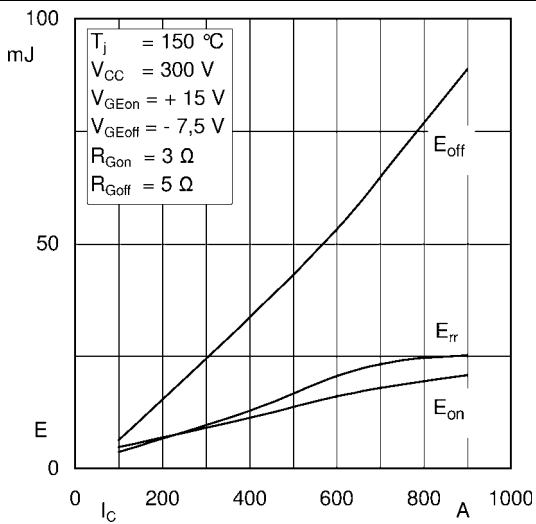


Fig. 3: Typ. turn-on /-off energy =  $f(I_c)$

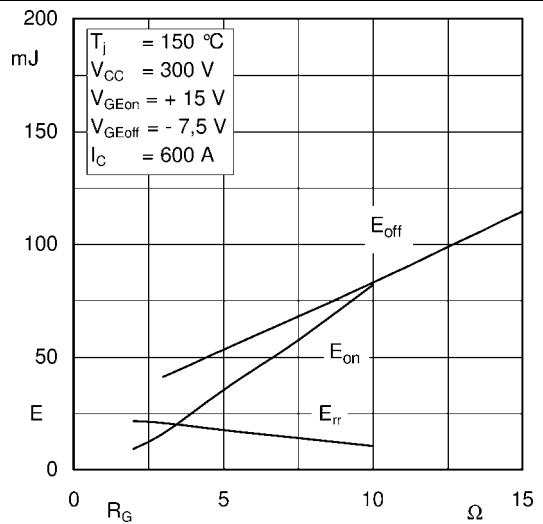


Fig. 4: Typ. turn-on /-off energy =  $f(R_G)$

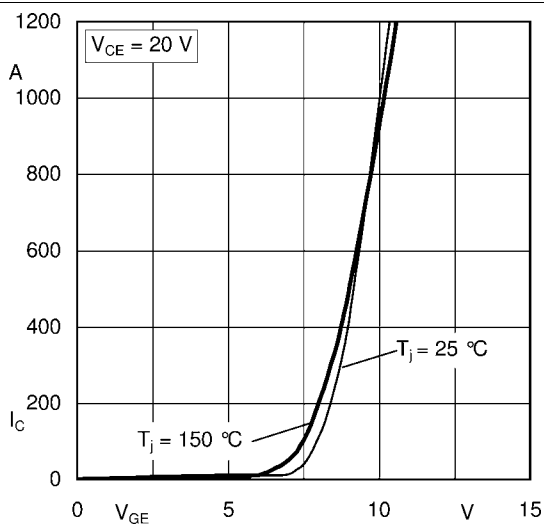


Fig. 5: Typ. transfer characteristic

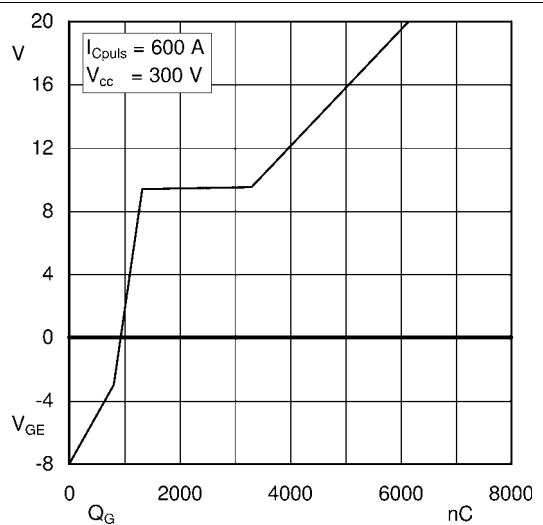


Fig. 6: Typ. gate charge characteristic

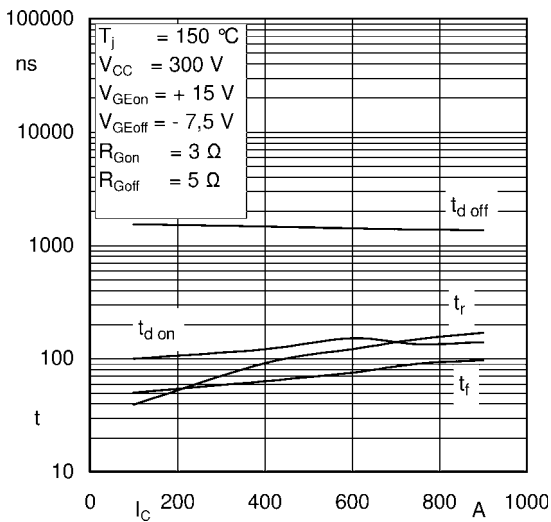


Fig. 7: Typ. switching times vs.  $I_C$

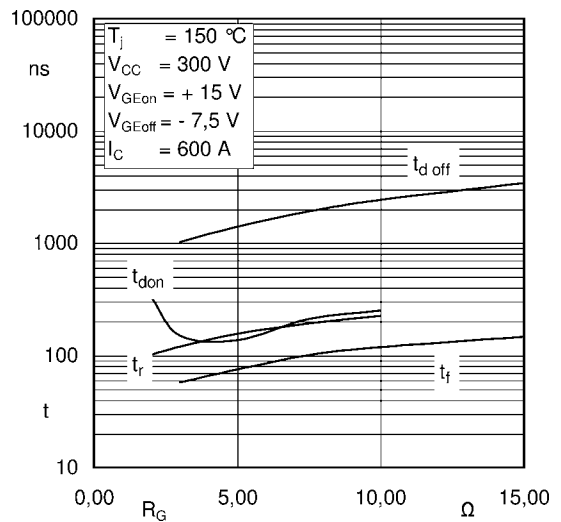


Fig. 8: Typ. switching times vs. gate resistor  $R_G$

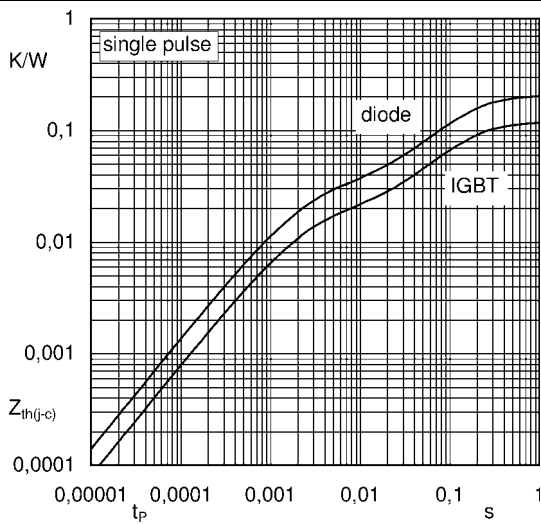


Fig. 9: Typ. transient thermal impedance

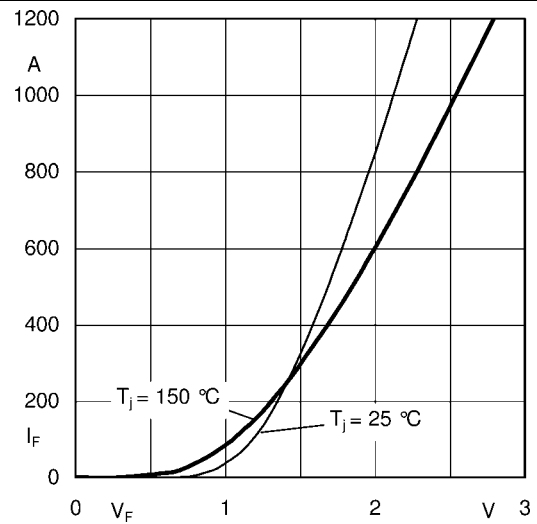


Fig. 10: Typ. CAL diode forward charact., incl.  $R_{CC+EE'}$

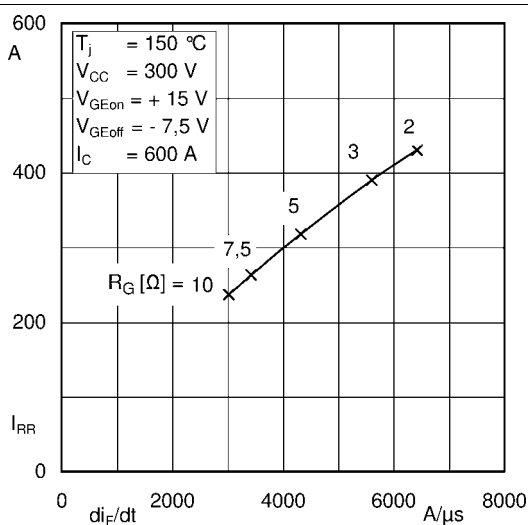


Fig. 11: Typ. CAL diode peak reverse recovery current

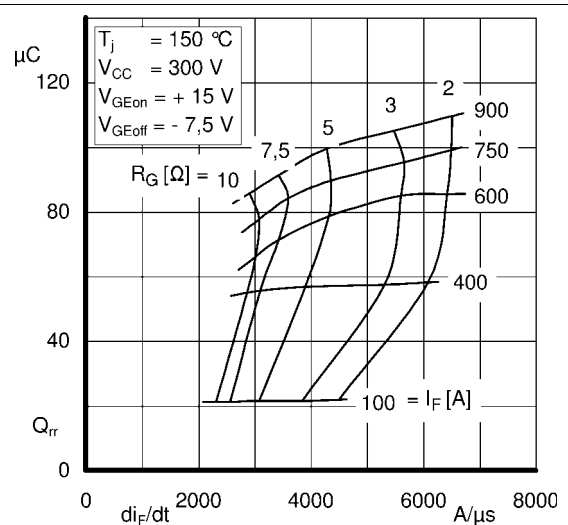
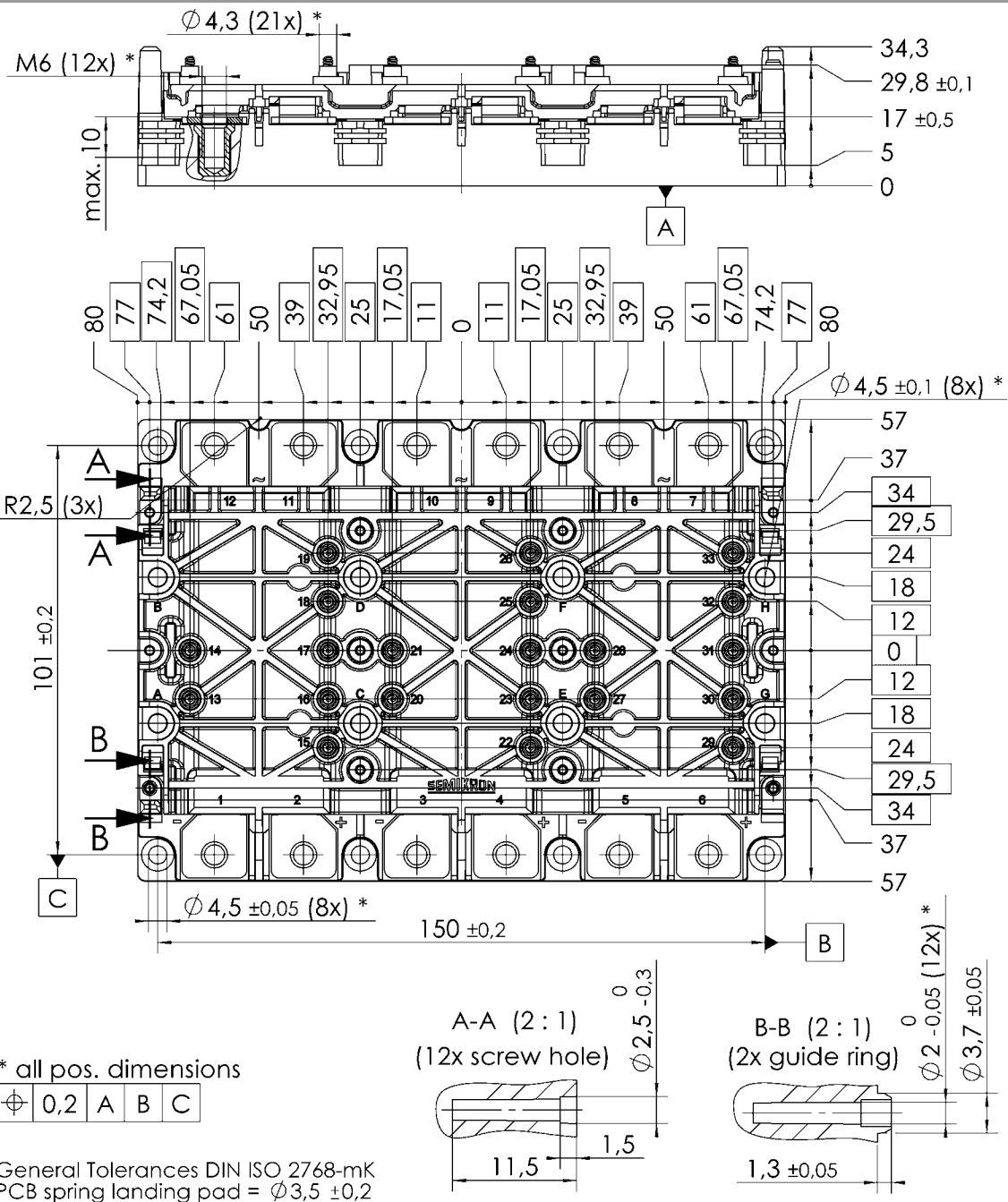
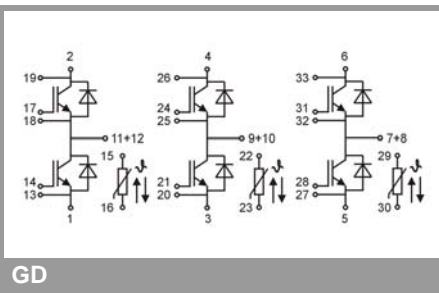


Fig. 12: Typ. CAL diode recovery charge

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

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