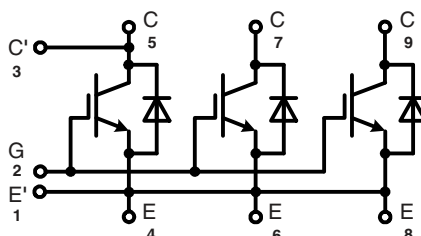


# IGBT Module

## Single switch

Short Circuit SOA Capability  
Square RBSOA

$I_{C80}$  = 600 A  
 $V_{CES}$  = 6500 V  
 $V_{CE(sat) typ}$  = 4.2 V



### IGBT

Symbol	Conditions	Maximum Ratings
$V_{CES}$	$V_{GE} = 0 V$	6500 V
$V_{GES}$		$\pm 20 V$
$I_{C85}$	$T_C = 85^\circ C$	600 A
$I_{CM}$	$t_p = 1 ms; T_C = 85^\circ C$	1200 A
$t_{sc}$	$V_{CC} = 4400 V; V_{CEM CHIP} \leq 6500 V;$ $V_{GE} \leq 15 V; T_{VJ} \leq 125^\circ C$	10 $\mu s$

### Features

- NPT<sup>®</sup> IGBT
- Low-loss
- Smooth switching waveforms for good EMC
- Industry standard package
- High power density
- AISiC base-plate for high power cycling capacity
- AlN substrate for low thermal resistance

### Typical Applications

- AC power converters for
  - industrial drives
  - windmills
  - traction
- LASER pulse generator

Symbol	Conditions	Characteristic Values ( $T_{VJ} = 25^\circ C$ , unless otherwise specified)		
		min.	typ.	max.
$V_{CE(sat)} *$	$I_C = 600 A; V_{GE} = 15 V; T_{VJ} = 25^\circ C$ $T_{VJ} = 125^\circ C$		4.2 5.4	V V
$V_{GE(th)}$	$I_C = 240 mA; V_{CE} = V_{GE}$	6		8 V
$I_{CES}$	$V_{CE} = 6500 V; V_{GE} = 0 V; T_{VJ} = 125^\circ C$			120 mA
$I_{GES}$	$V_{CE} = 0 V; V_{GE} = \pm 20 V; T_{VJ} = 125^\circ C$			500 nA
$t_{d(on)}$	Inductive load; $T_{VJ} = 125^\circ C;$ $V_{GE} = \pm 15 V; V_{CC} = 3600 V;$ $I_C = 600 A; L_\sigma = 280 nH$	$R_G = 3.9 \Omega$	620	ns
$t_r$		$R_G = 3.9 \Omega$	270	ns
$t_{d(off)}$		$R_G = 2.7 \Omega$	1500	ns
$t_f$		$R_G = 2.7 \Omega$	930	ns
$E_{on}$		$R_G = 3.9 \Omega$	4250	mJ
$E_{off}$		$R_G = 2.7 \Omega$	3250	mJ
$C_{ies}$	$V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz$		150	nF
$C_{oes}$			7.57	nF
$C_{res}$			1.46	nF
$Q_{ge}$	$I_C = 600 A; V_{CE} = 3600 V; V_{GE} = \pm 15 V$		9.65	$\mu C$
$R_{thJC}$				0.011 K/W

\* Collector emitter saturation voltage is given at chip level

Diode			
Symbol	Conditions	Maximum Ratings	
$I_{F80}$	$T_C = 80^\circ\text{C}$	600	A
$I_{FSM}$	$V_R = 0\text{ V}; T_{VJ} = 125^\circ\text{C}; t_p = 10\text{ ms};$ half-sinewave	6000	A

Symbol	Conditions	Characteristic Values		
		min.	typ.	max.
$V_F$ *	$I_F = 600\text{ A};$ $T_{VJ} = 25^\circ\text{C}$ $T_{VJ} = 125^\circ\text{C}$	3.2		V
		3.4		V
$I_{RM}$ $t_{rr}$ $Q_{RR}$ $E_{rec}$	$V_{CC} = 3600\text{ V}; I_C = 600\text{ A};$ $V_{GE} = \pm 15\text{ V}; R_G = 3.9\ \Omega; T_{VJ} = 125^\circ\text{C}$ Inductive load; $L_\sigma = 280\text{ nH}$	930		A
		2200		ns
		1150		$\mu\text{C}$
		2100		mJ
$R_{thJC}$			0.021	K/W

\* Forward voltage is given at chip level

Symbol	Conditions	Maximum Ratings	
$T_{JM}$	max junction temperature	+125	$^\circ\text{C}$
$T_{VJ}$	Operating temperature	-40...+125	$^\circ\text{C}$
$T_{stg}$	Storage temperature	-40...+125	$^\circ\text{C}$
$V_{ISOL}$	50 Hz, 1 min	10200	V~
$M_d$	Mounting torque	Base- heatsink, M6 screws	4 - 6 Nm
		Main terminals, M8 screws	8 - 10 Nm
		Auxiliary terminals, M4 screws	2 - 3 Nm

Symbol	Conditions	Characteristic Values		
		min.	typ.	max.
$d_A$	Clearance distance	terminal to base	40	mm
		IEC 60664-1/EN 50124-1 terminal to terminal	26	mm
$d_S$	Surface creepage dist.	terminal to base	64	mm
		IEC 60664-1/EN 50124-1 terminal to terminal	56	mm
$V_E$	Partial discharge extinction voltage $f = 50\text{ Hz}, Q_{pd} \leq 10\text{ pC}$ (IEC 61287)	5100		V
CTI	Comperative tracking index	600		
$L_\sigma$	Module stray inductance, C to E terminal		18	nH
$R_{term-chip}$ *	Resistance terminal to chip		0.12	m $\Omega$
$R_{thCH}$	per module; $\lambda$ grease = 1 W/m $\cdot$ K		0.006	K/W
Weight			1760	g

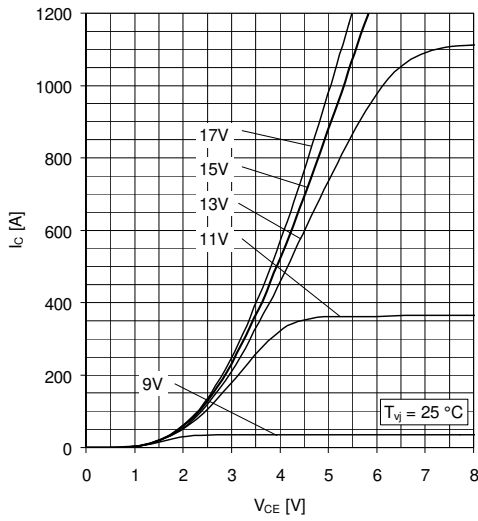


Fig. 1 Typical output characteristics, chip level

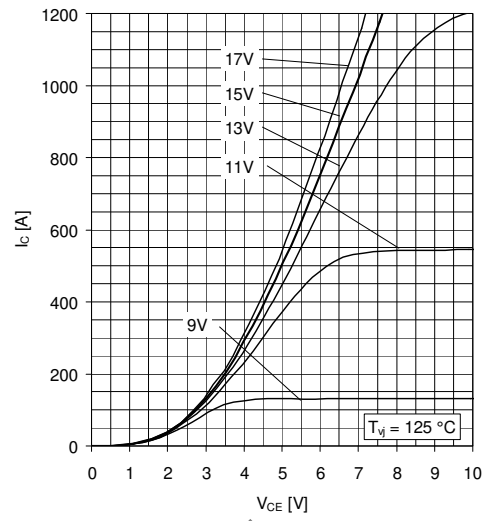


Fig. 2 Typical output characteristics, chip level

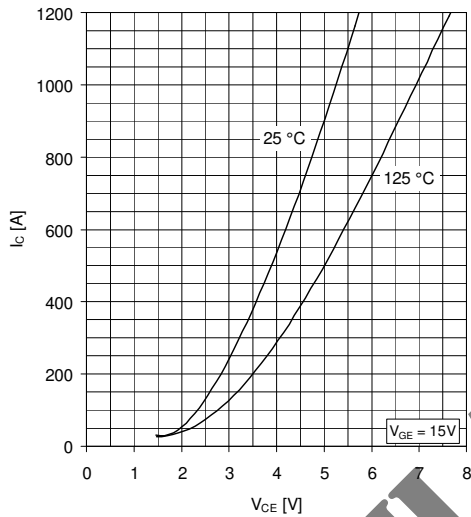


Fig. 3 Typical on-state characteristics, chip level

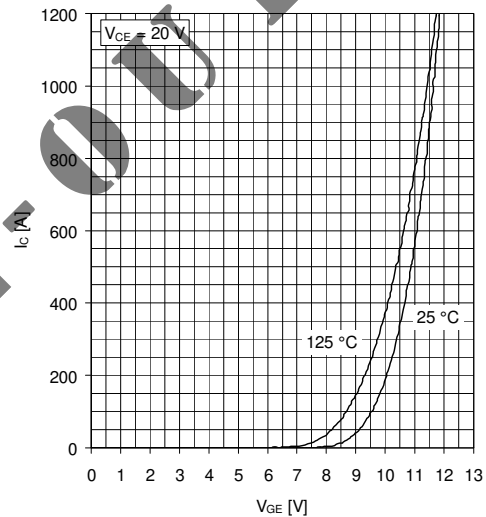


Fig. 4 Typical transfer characteristics, chip level

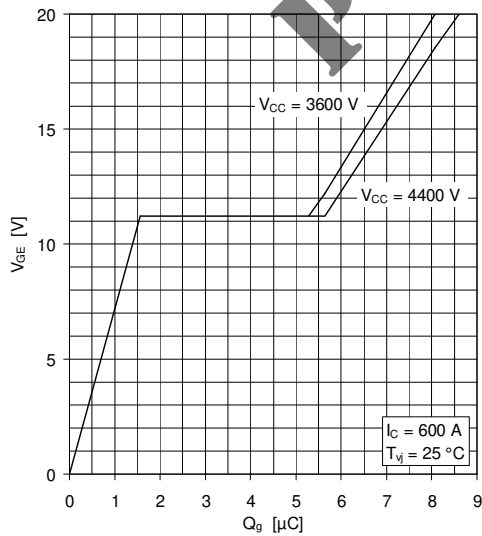


Fig. 5 Typical gate charge characteristics

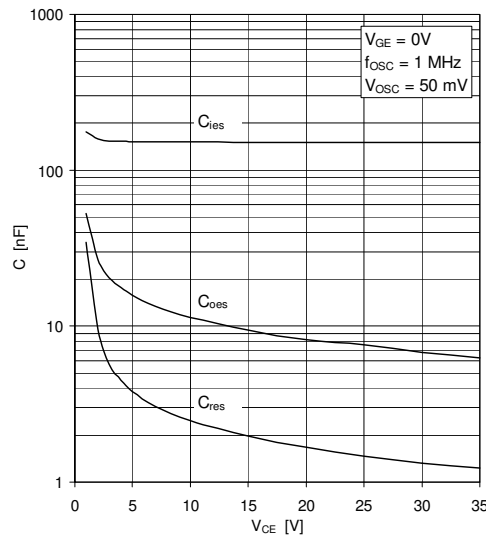


Fig. 6 Typical capacitances vs collector-emitter voltage

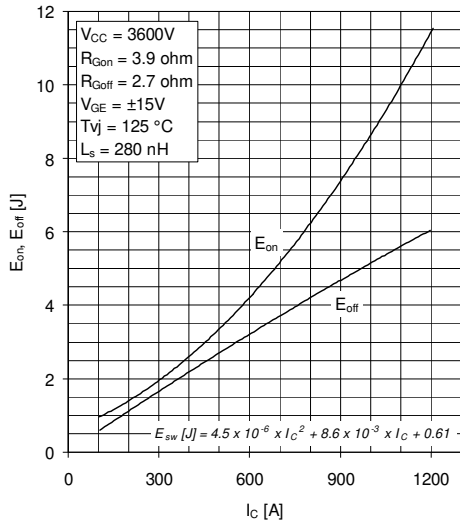


Fig. 7 Typical switching energies per pulse versus collector current

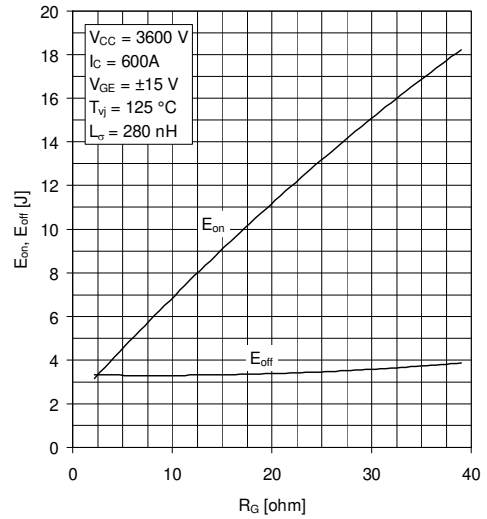


Fig. 8 Typical switching energies per pulse versus gate resistor

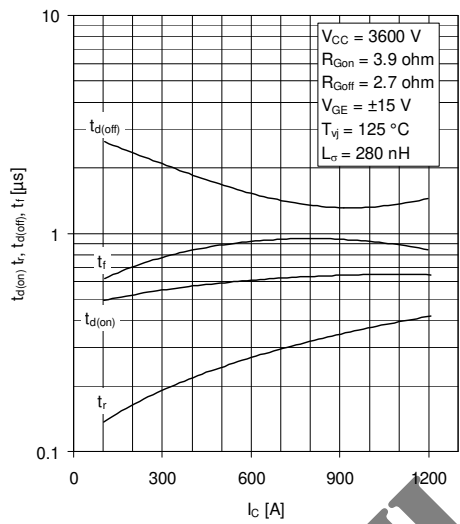


Fig. 9 Typical switching times vs. collector current

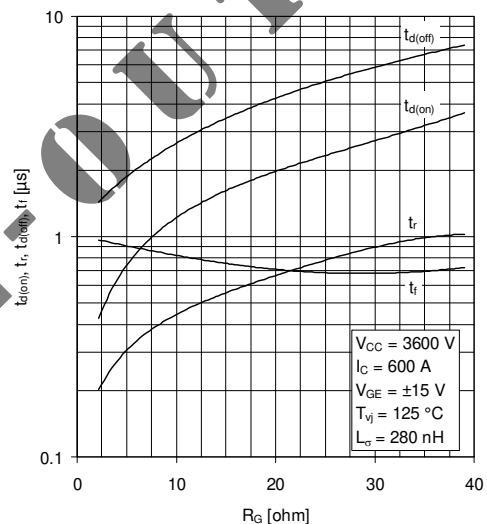


Fig. 10 Typical switching times vs. gate resistor

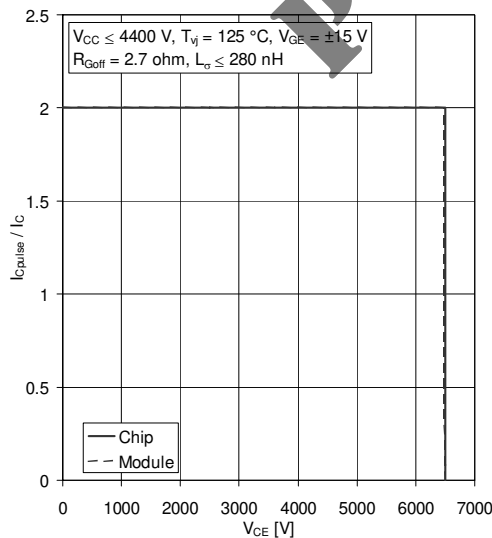


Fig. 11 Turn-off safe operating area (RBSOA)

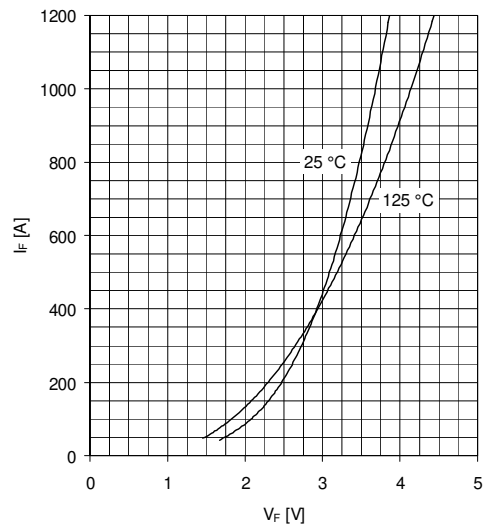


Fig. 12 Typ. diode forward characteristics, chip level

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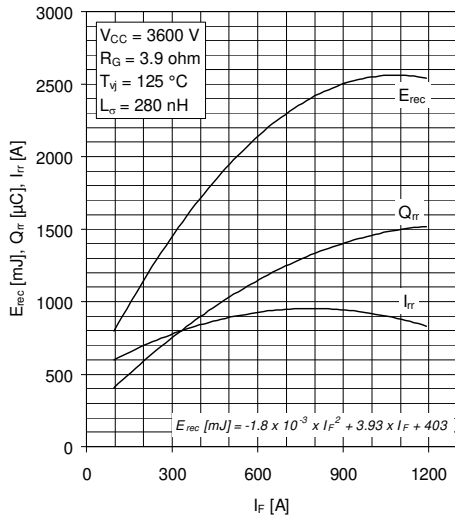


Fig. 13 Typ. reverse recovery characteristics versus forward current

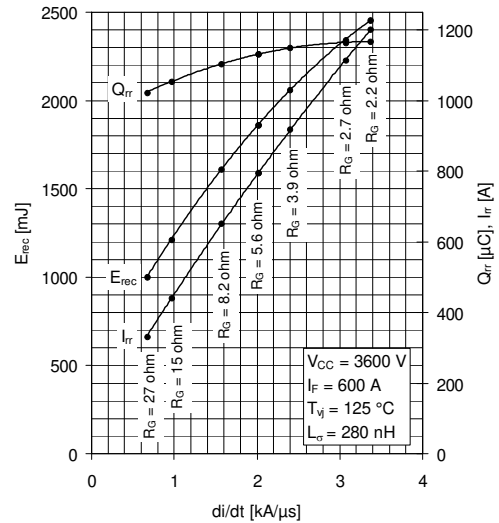


Fig. 14 Typ. reverse recovery characteristics versus di/dt

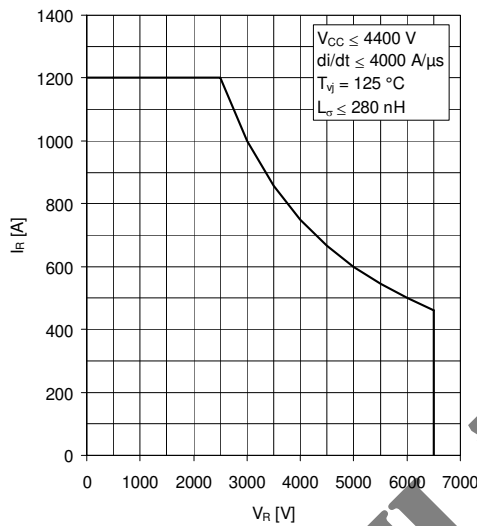


Fig. 15 Safe operating area diode (SOA)

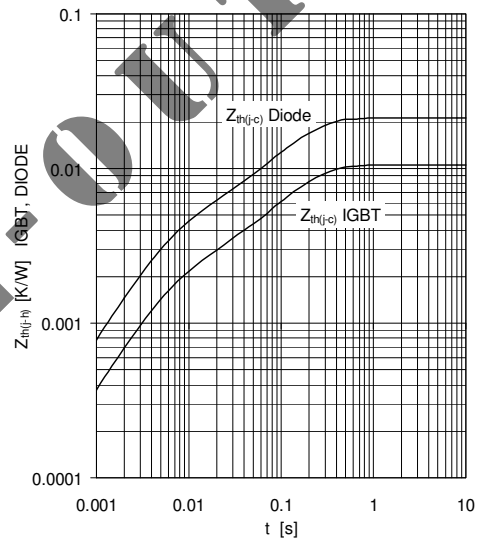
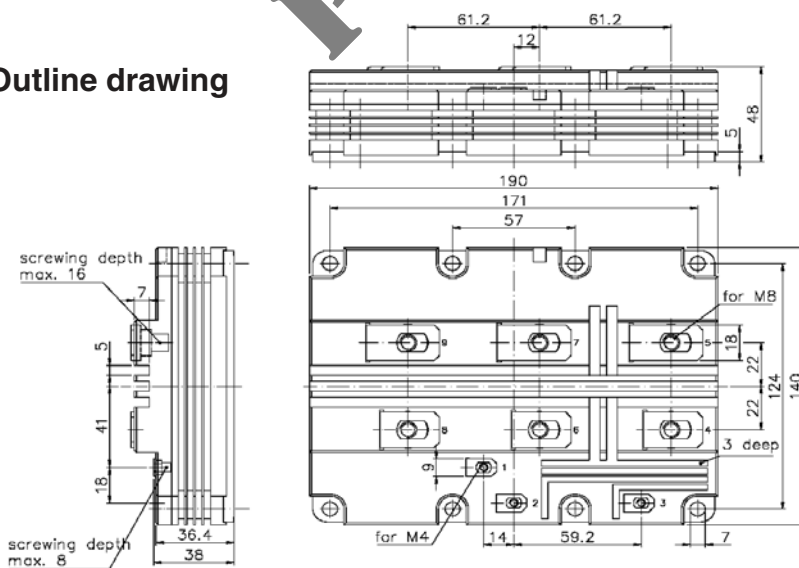


Fig. 16 Thermal impedance vs. time

**Outline drawing**



$$Z_{th(j-c)}(t) = \sum_{i=1}^n R_i (1 - e^{-t/\tau_i})$$

	i	1	2
IGBT	$R_i$ [K/kW]	8.5	2
	$t_i$ [ms]	151	5.84
DIODE	$R_i$ [K/kW]	17	4.2
	$t_i$ [ms]	144	5.83