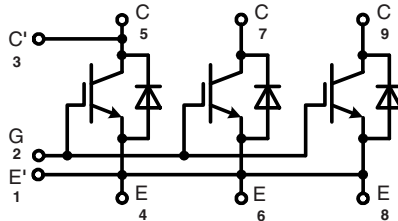


# IGBT Module

## Single switch

Short Circuit SOA Capability  
Square RBSOA

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



### IGBT

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

### Features

- NPT<sup>3</sup> IGBT
  - Low-loss
  - Smooth switching waveforms for good EMC
- Industry standard package
  - High power density
  - AlSiC 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 ( $T_{VJ} = 25^\circ\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
$V_{CE(sat)} \star$	$I_C = 600 \text{ A}; V_{GE} = 15 \text{ V}; T_{VJ} = 25^\circ\text{C}$ $T_{VJ} = 125^\circ\text{C}$		4.2 5.4	V V
$V_{GE(th)}$	$I_C = 240 \text{ mA}; V_{CE} = V_{GE}$	6		8 V
$I_{CES}$	$V_{CE} = 6500 \text{ V}; V_{GE} = 0 \text{ V}; T_{VJ} = 125^\circ\text{C}$			120 mA
$I_{GES}$	$V_{CE} = 0 \text{ V}; V_{GE} = \pm 20 \text{ V}; T_{VJ} = 125^\circ\text{C}$			500 nA
$t_{d(on)}$ $t_r$ $t_{d(off)}$ $t_f$	Inductive load; $T_{VJ} = 125^\circ\text{C};$ $V_{GE} = \pm 15 \text{ V}; V_{CC} = 3600 \text{ V};$ $I_C = 600 \text{ A}; L_\sigma = 280 \text{ nH}$	$R_G = 3.9 \Omega$	620	ns
$E_{on}$		$R_G = 3.9 \Omega$	270	ns
$E_{off}$		$R_G = 2.7 \Omega$	1500	ns
		$R_G = 2.7 \Omega$	930	ns
		$R_G = 3.9 \Omega$	4250	mJ
		$R_G = 2.7 \Omega$	3250	mJ
$C_{ies}$ $C_{oes}$ $C_{res}$	$V_{CE} = 25 \text{ V}; V_{GE} = 0 \text{ V}; f = 1 \text{ MHz}$		150	nF
			7.57	nF
			1.46	nF
$Q_{ge}$	$I_C = 600 \text{ A}; V_{CE} = 3600 \text{ V}; V_{GE} = \pm 15 \text{ V}$		9.65	$\mu\text{C}$
$R_{thJC}$				0.011 K/W

\* Collector emitter saturation voltage is given at chip level

IXYS reserves the right to change limits, test conditions and dimensions.

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**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 °C
$T_{VJ}$	Operating temperature	-40...+125 °C
$T_{stg}$	Storage temperature	-40...+125 °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

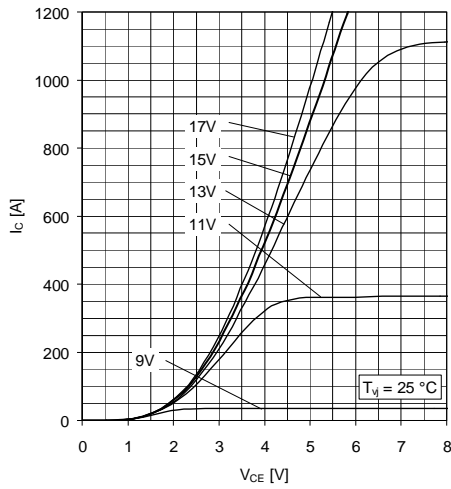


Fig. 1 Typical output characteristics, chip level

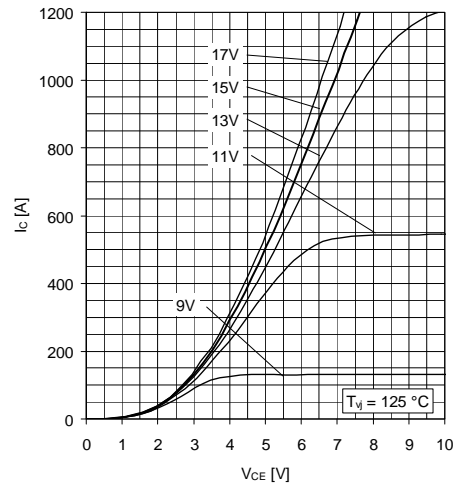


Fig. 2 Typical output characteristics, chip level

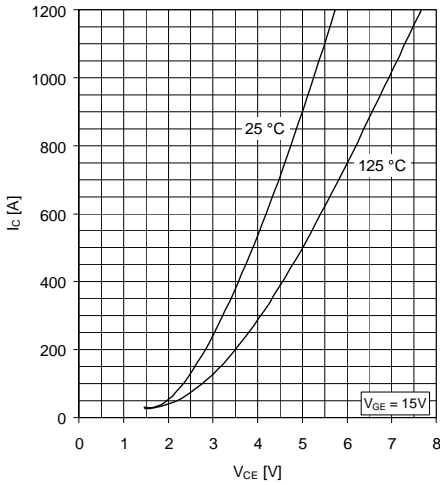


Fig. 3 Typical on-state characteristics, chip level

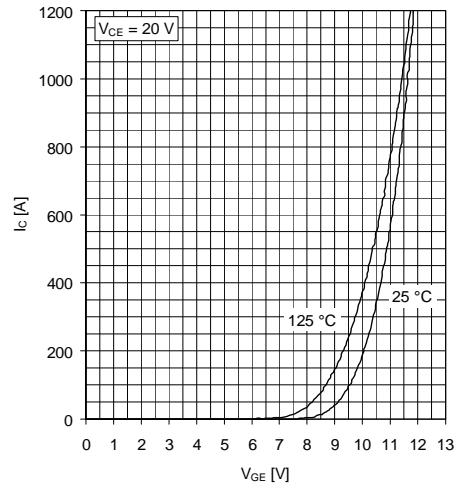


Fig. 4 Typical transfer characteristics, chip level

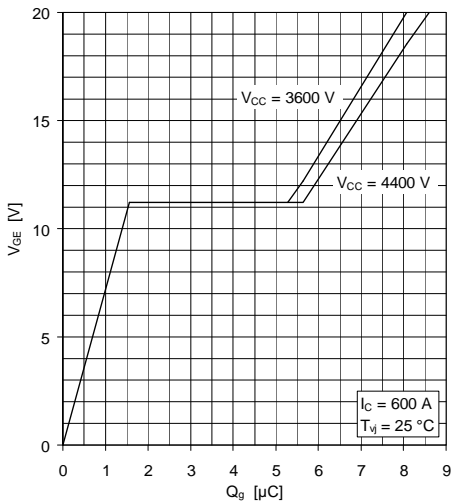


Fig. 5 Typical gate charge characteristics

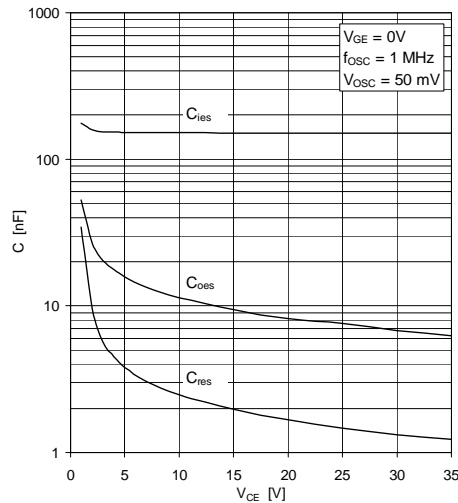


Fig. 6 Typical capacitances vs collector-emitter voltage

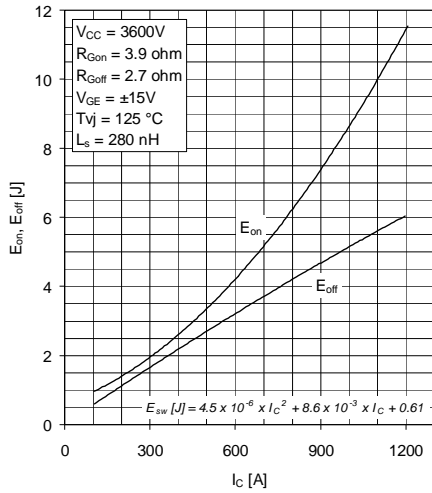


Fig. 7 Typical switching energies per pulse versus collector current

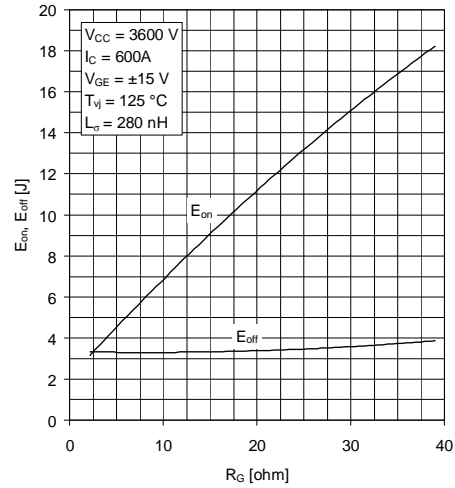


Fig. 8 Typical switching energies per pulse versus gate resistor

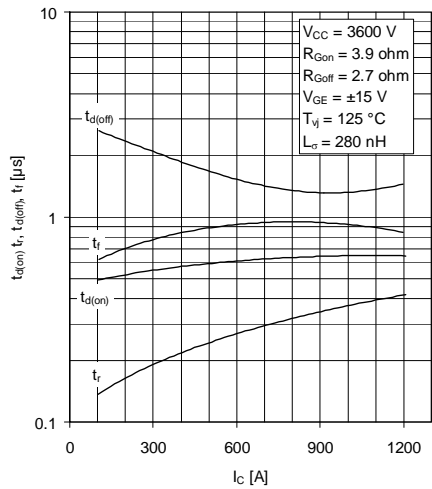


Fig. 9 Typical switching times vs. collector current

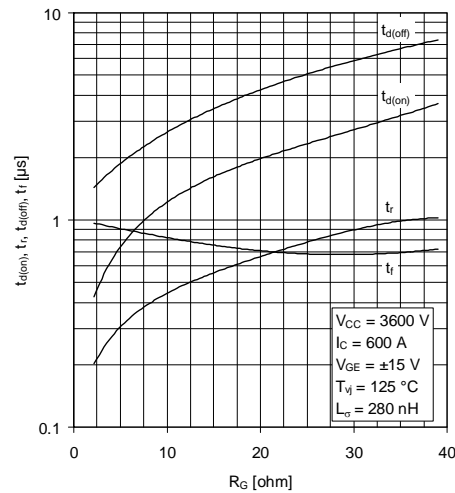


Fig. 10 Typical switching times vs. gate resistor

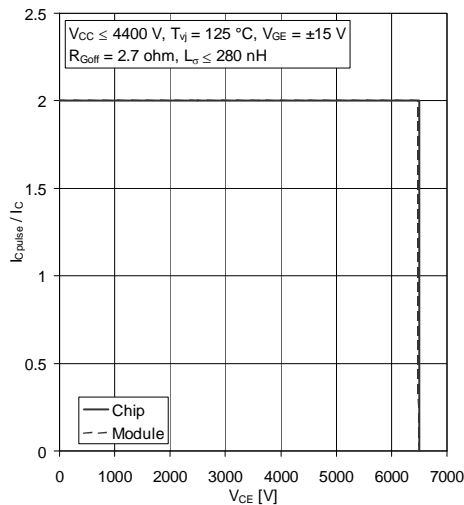


Fig. 11 Turn-off safe operating area (RBSOA)

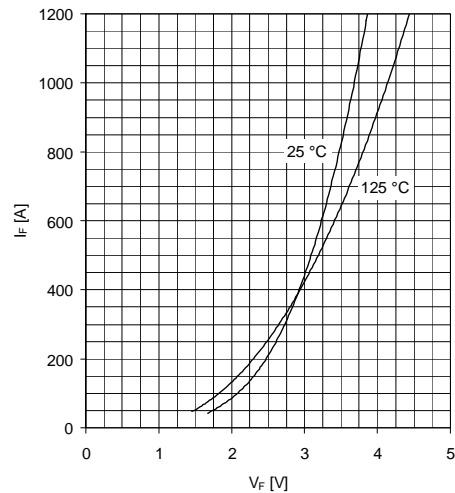


Fig. 12 Typ. diode forward characteristics, chip level

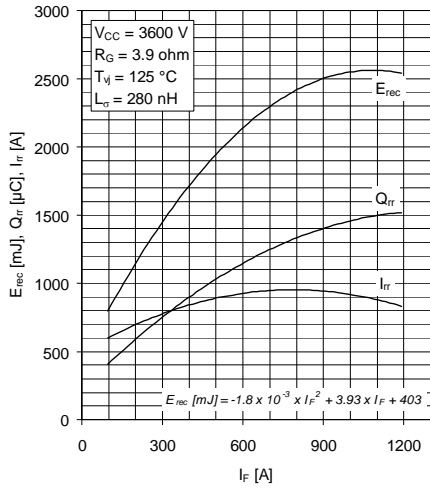


Fig. 13 Typ. reverse recovery characteristics versus forward current

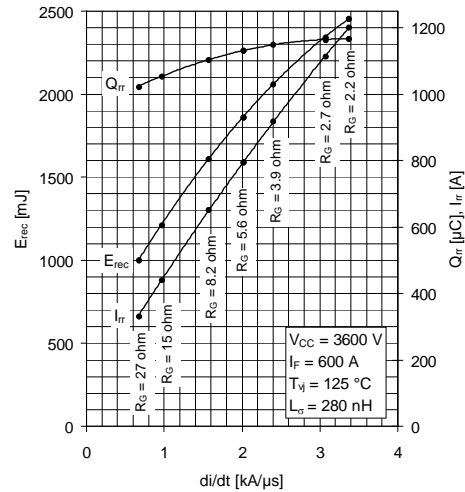


Fig. 14 Typ. reverse recovery characteristics versus di/dt

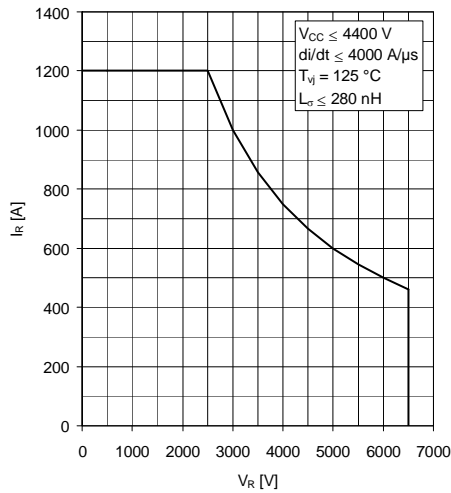


Fig. 15 Safe operating area diode (SOA)

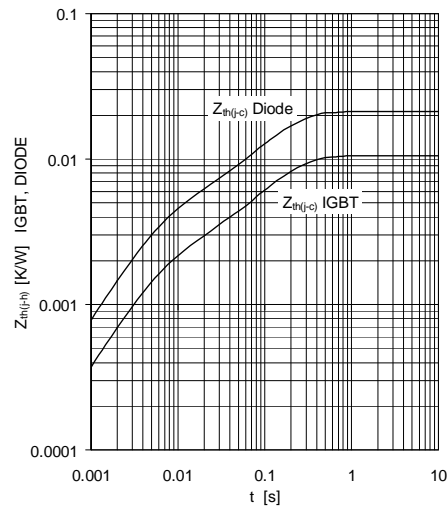
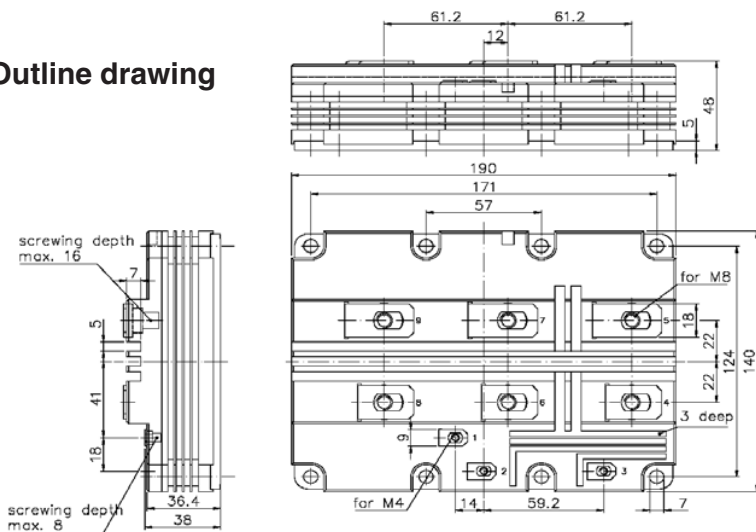


Fig. 16 Thermal impedance vs. time

## 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
	$\tau_i$ [ms]	151	5.84
DIODE	$R_i$ [K/kW]	17	4.2
	$\tau_i$ [ms]	144	5.83