Power through Innovation

TRENCH
Gen5 TMOS

Preliminary Information

DIM3600ESM17-PT500

Single Switch IGBT Module

DS6328-1 May 2020 (LN39883)

FEATURES

- Trench Gate IGBT
- 10µs Short Circuit Withstand
- High Thermal Cycling Capability
- Low $V_{ce(sat)}$ Device
- High Current Density
- Isolated AlSiC Base with AlN Substrates

APPLICATIONS

- High Reliability Inverters
- Motor Controllers
- Smart Grid
- Traction Drives

The Powerline range of high power modules includes half bridge, chopper, dual, single and bi-directional switch configurations covering voltages from 1200V to 6500V and currents up to 2400A.

The DIM3600ESM17-PT500 is a single switch 1700V, trench gate, insulated gate bipolar transistor (IGBT) module with enhanced field stop and implantation technology. The IGBT has a wide reverse bias safe operating area (RBSOA) plus 10µs short circuit withstand. This device is optimised for traction drives and other applications requiring high thermal cycling capability.

The module incorporates an electrically isolated base plate and low inductance construction enabling circuit designers to optimise circuit layouts and utilise grounded heat sinks for safety.

ORDERING INFORMATION

Order As:

DIM3600ESM17-PT500

Note: When ordering, please use the complete part number

KEY PARAMETERS

V_{CES}		**1700V**
$V_{CE(sat)}$ *	(typ)	**1.95V**
I_C	(max)	**3600A**
$I_{C(PK)}$	(max)	**7200A**

* Measured at the the auxiliary terminals

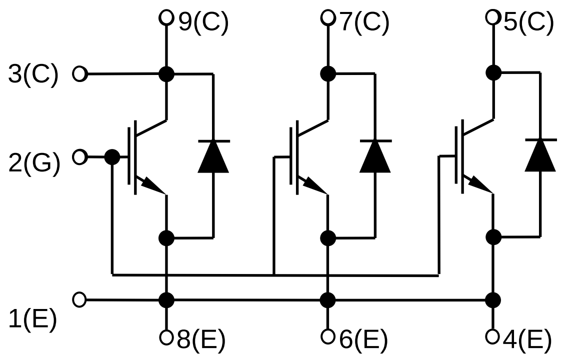


Fig. 1 Circuit configuration

Outline type code: E

(See Fig. 11 for further information)

Fig. 2 Package

ABSOLUTE MAXIMUM RATINGS

Stresses above those listed under 'Absolute Maximum Ratings' may cause permanent damage to the device. In extreme conditions, as with all semiconductors, this may include potentially hazardous rupture of the package. Appropriate safety precautions should always be followed. Exposure to Absolute Maximum Ratings may affect device reliability.

T_{case} = 25°C unless stated otherwise

Symbol	Parameter	Test Conditions	Max.	Units
V_{CES}	Collector-emitter voltage	V_{GE} = 0V	1700	V
V_{GES}	Gate-emitter voltage		±20	V
I_C	Continuous collector current	T_{case} = 95°C, T_{vj} max = 175°C	3600	A
$I_{C(PK)}$	Peak collector current	1ms,	7200	A
P_{max}	Max. transistor power dissipation	T_{case} = 25°C, T_{vj} = 175°C	20	kW
I^2t	Diode I^2t value	V_R = 0, t_p = 10ms, T_{vj} = 150°C	2200	kA^2s
V_{isol}	Isolation voltage – per module	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	4000	V
Q_{PD}	Partial discharge – per module	IEC1287, V_1 = 1800V, V_2 = 1300V, 50Hz RMS	10	pC

THERMAL AND MECHANICAL RATINGS

Internal insulation material:	AlN
Baseplate material:	AlSiC
Creepage distance:	33mm
Clearance:	20mm
CTI (Comparative Tracking Index):	>600

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$R_{th(j-c)}$	Thermal resistance – IGBT	Continuous dissipation - junction to case			7.5	°C/kW
$R_{th(j-c)}$	Thermal resistance – diode	Continuous dissipation - junction to case			9.5	°C/kW
$R_{th(c-h)}$	Thermal resistance – case to heatsink (IGBT)	Mounting torque 5Nm (with mounting grease)		9.7		°C/kW
$R_{th(c-h)}$	Thermal resistance – case to heatsink (diode)	Mounting torque 5Nm (with mounting grease)		10.5		°C/kW
T_j	Junction temperature	Transistor	-40		150	°C
		Diode	-40		150	°C
T_{stg}	Storage temperature range	-	-40		150	°C
	Screw torque	Mounting – M6			5	Nm
		Electrical connections – M4			2	Nm
		Electrical connections – M8			10	Nm

ELECTRICAL CHARACTERISTICS

T_{case} = 25°C unless stated otherwise.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I_{CES}	Collector cut-off current	V_{GE} = 0V, V_{CE} = V_{CES}			1	mA
		V_{GE} = 0V, V_{CE} = V_{CES}, T_{case} = 125°C			60	mA
		V_{GE} = 0V, V_{CE} = V_{CES}, T_{case} = 150°C			100	mA
I_{GES}	Gate leakage current	V_{GE} = ± 20V, V_{CE} = 0V			1	μA
$V_{GE(TH)}$	Gate threshold voltage	I_C = 120mA, V_{GE} = V_{CE}	5.5	6.3	7.00	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15V, I_C = 3600A		1.95		V
		V_{GE} = 15V, I_C = 3600A, T_j = 125°C		2.20		V
		V_{GE} = 15V, I_C = 3600A, T_j = 150°C		2.25		V
I_F	Diode forward current	DC		3600		A
I_{FM}	Diode maximum forward current	t_p = 1ms		7200		A
V_F	Diode forward voltage	I_F = 3600A		1.80		V
		I_F = 3600A, T_j = 125°C		1.85		V
		I_F = 3600A, T_j = 150°C		1.85		V
C_{ies}	Input capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		612		nF
Q_g	Gate charge	±15V		38.7		μC
C_{res}	Reverse transfer capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		1.04		nF
L_M	Module inductance			6		nH
R_{INT}	Internal transistor resistance			85		μΩ
SC_{Data}	Short circuit current, I_{SC}	T_j = 150°C, V_{CC} = 1000V t_p ≤ 10μs, V_{GE} ≤ 15V $V_{CE\ (max)}$ = V_{CES} – L^* x dI/dt IEC 60747-9		14400		A

Note:
* L is the circuit inductance + L_M

ELECTRICAL CHARACTERISTICS

T_{case} = 25°C unless stated otherwise

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$t_{d(off)}$	Turn-off delay time	I_C = 3600A V_{GE} = ±15V V_{CE} = 900V $R_{G(ON)}$ = 0.5Ω $R_{G(OFF)}$ = 0.5Ω L_S ~ 60nH		2110		ns
t_f	Fall time			240		ns
E_{OFF}	Turn-off energy loss			1610		mJ
$t_{d(on)}$	Turn-on delay time			940		ns
t_r	Rise time			310		ns
E_{ON}	Turn-on energy loss			460		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 3600A V_{CE} = 900V dI_F/dt = 11000A/μs		1020		μC
I_{rr}	Diode reverse recovery current			2070		A
E_{rec}	Diode reverse recovery energy			760		mJ

T_{case} = 125°C unless stated otherwise

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$t_{d(off)}$	Turn-off delay time	I_C = 3600A V_{GE} = ±15V V_{CE} = 900V $R_{G(ON)}$ = 0.5Ω $R_{G(OFF)}$ = 0.5Ω L_S ~ 60nH		2260		ns
t_f	Fall time			280		ns
E_{OFF}	Turn-off energy loss			1730		mJ
$t_{d(on)}$	Turn-on delay time			960		ns
t_r	Rise time			320		ns
E_{ON}	Turn-on energy loss			600		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 3600A V_{CE} = 900V dI_F/dt = 11000A/μs		1560		μC
I_{rr}	Diode reverse recovery current			2440		A
E_{rec}	Diode reverse recovery energy			1180		mJ

T_{case} = 150°C unless stated otherwise

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$t_{d(off)}$	Turn-off delay time	I_C = 3600A V_{GE} = ±15V V_{CE} = 900V $R_{G(ON)}$ = 0.5Ω $R_{G(OFF)}$ = 0.5Ω L_S ~ 60nH		2290		ns
t_f	Fall time			300		ns
E_{OFF}	Turn-off energy loss			1800		mJ
$t_{d(on)}$	Turn-on delay time			990		ns
t_r	Rise time			330		ns
E_{ON}	Turn-on energy loss			660		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 3600A V_{CE} = 900V dI_F/dt = 11000A/μs		1790		μC
I_{rr}	Diode reverse recovery current			2600		A
E_{rec}	Diode reverse recovery energy			1350		mJ

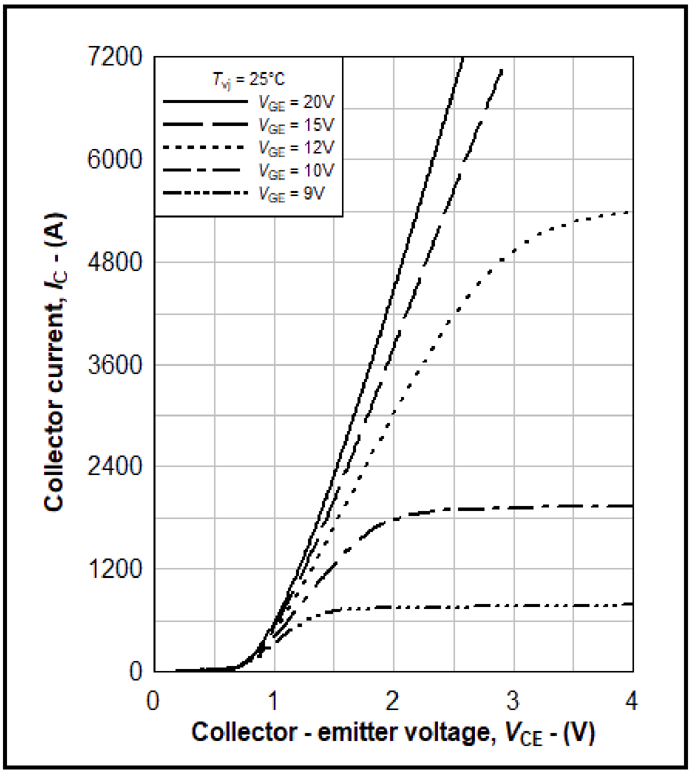


Fig. 3 Typical output characteristics

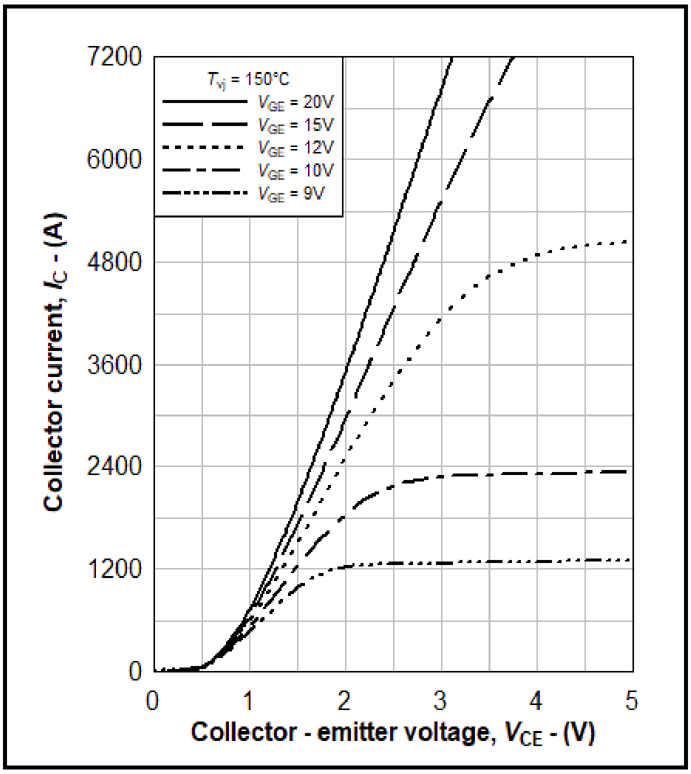


Fig. 4 Typical output characteristics

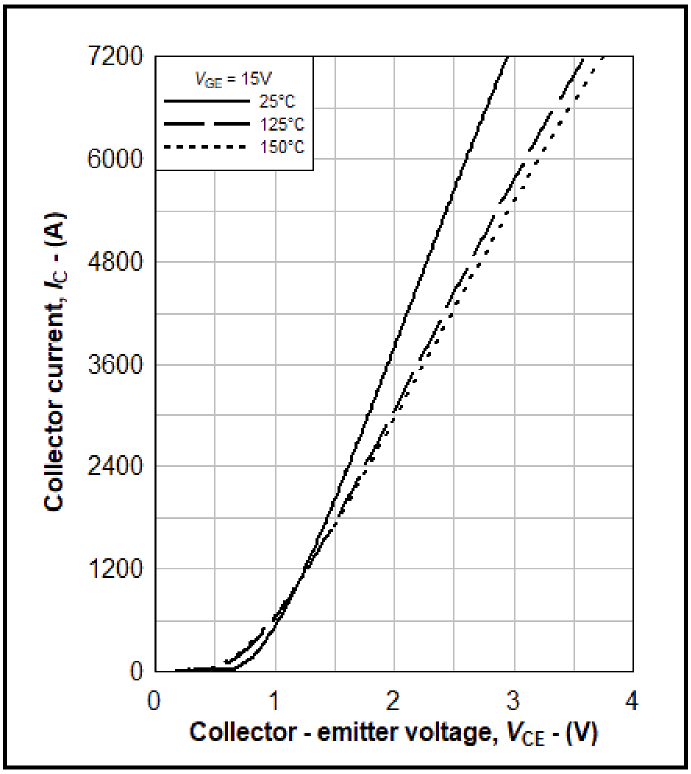


Fig. 5 Typical IGBT output characteristics, I_C = f(V_{CE})

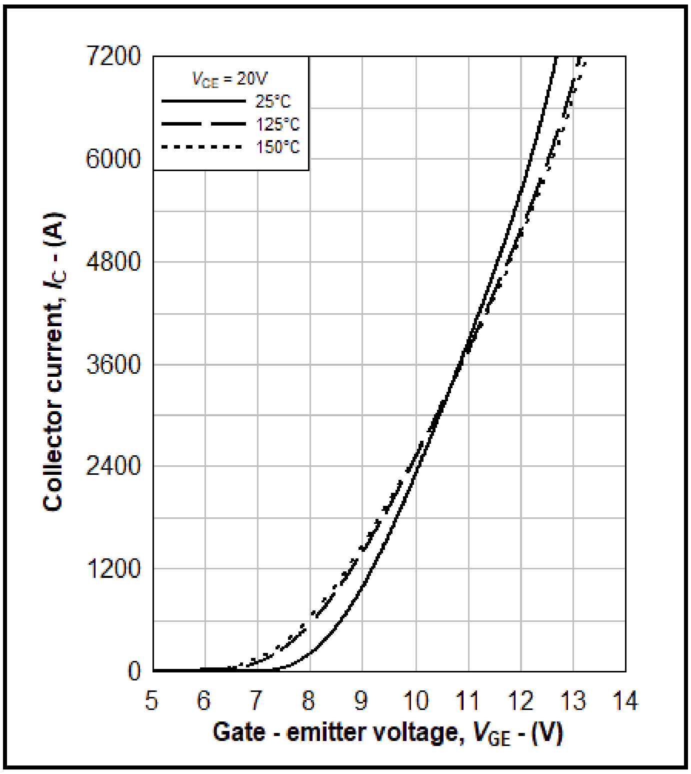


Fig. 6 Diode typical forward characteristics, I_F = f(V_F)

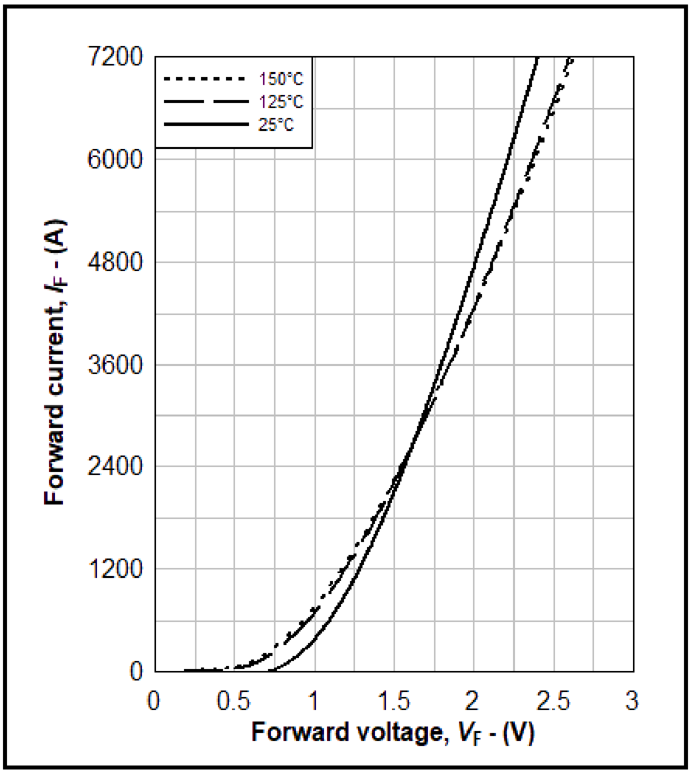


Fig. 7 Typical FRD output characteristics, $I_F = f(V_F)$

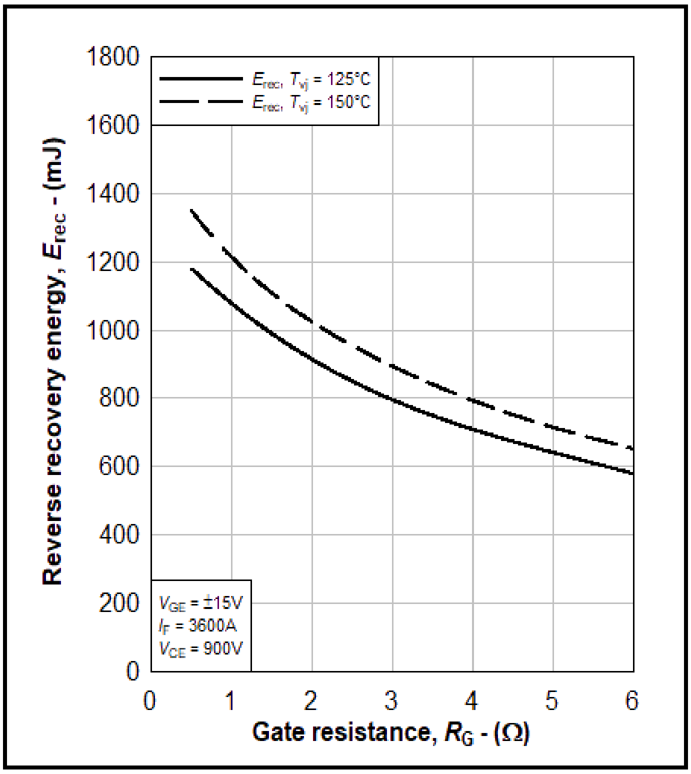


Fig. 8 Typical FRD E_{rec}, $E_{rec} = f(R_G)$

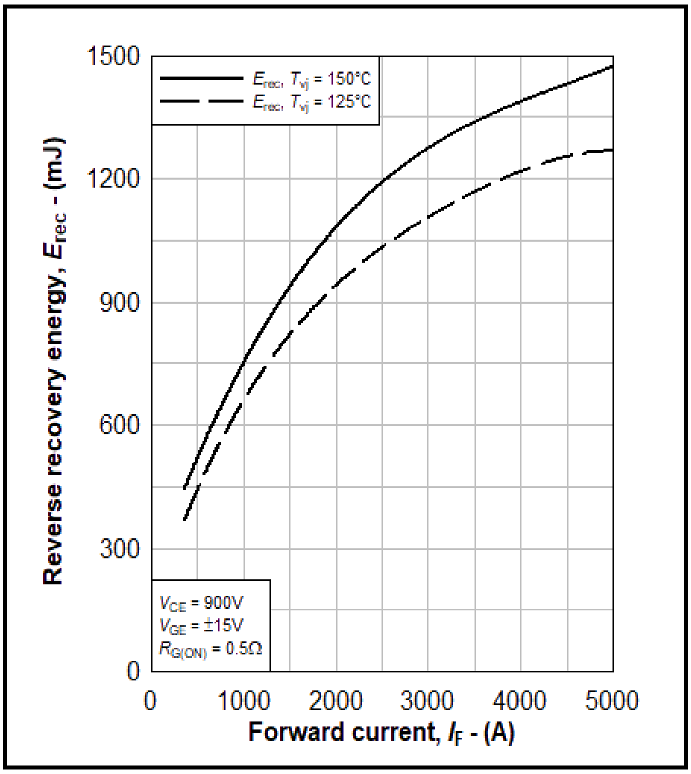


Fig. 9 Typical FRD E_{rec}, $E_{rec} = f(I_F)$

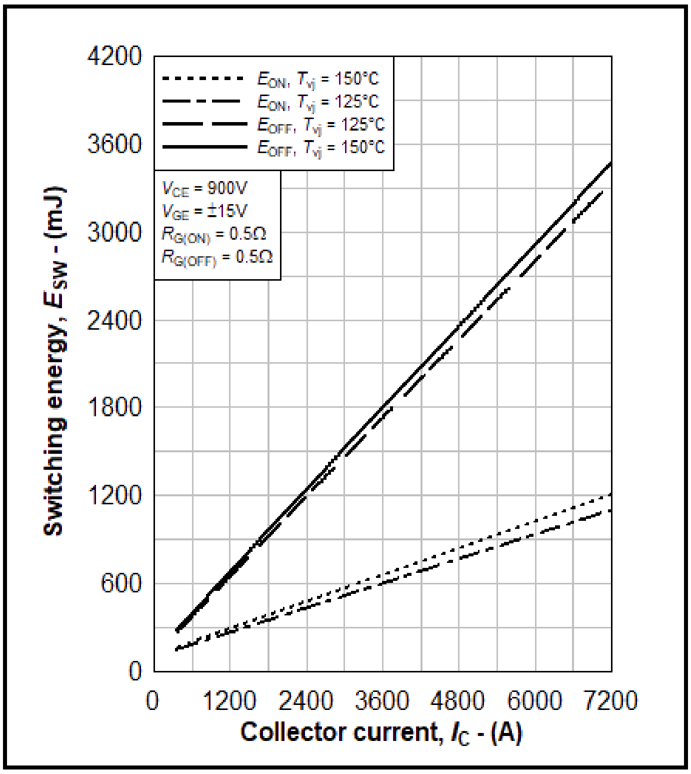


Fig. 10 Typical IGBT switching energy,
$E_{ON} = f(I_C)$, $E_{OFF} = f(I_C)$

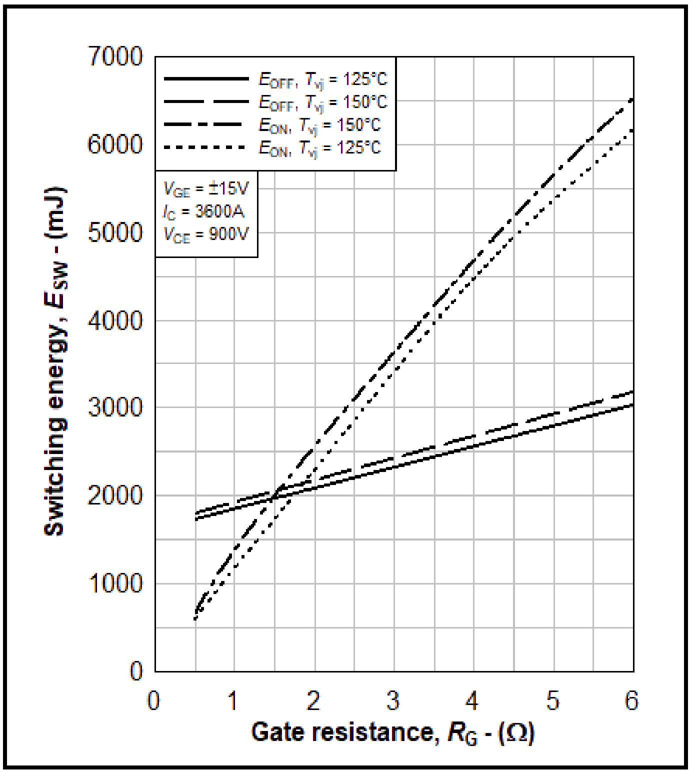


Fig. 11 Typical IGBT switching energy
E_{ON} = f(R_G), E_{OFF} = fR_G)

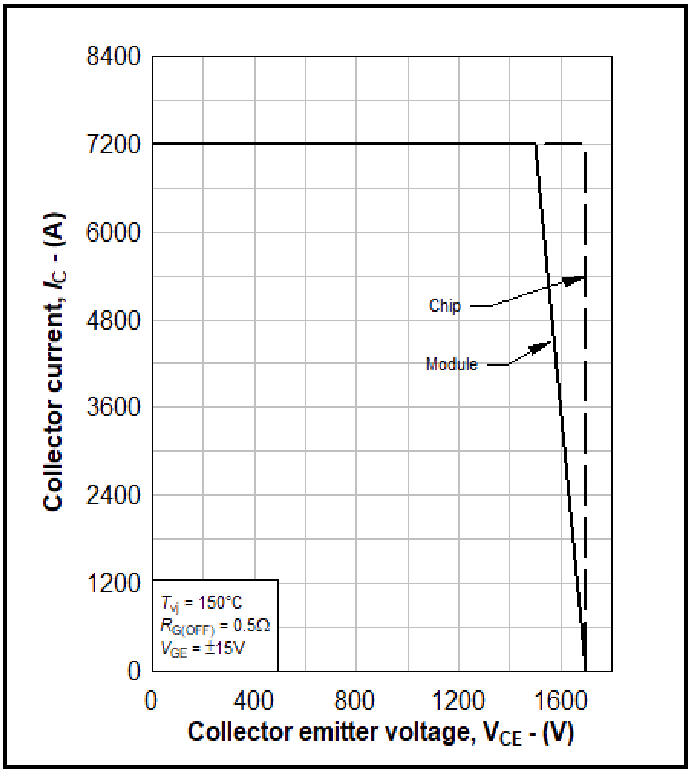


Fig. 12 Reverse bias safe operating area of IGBT,
I_C = f(V_{CE})

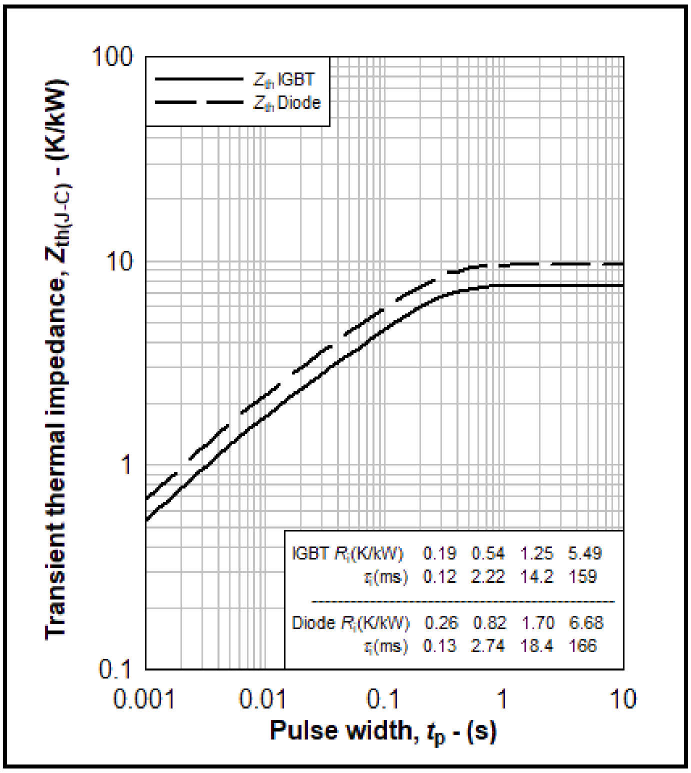
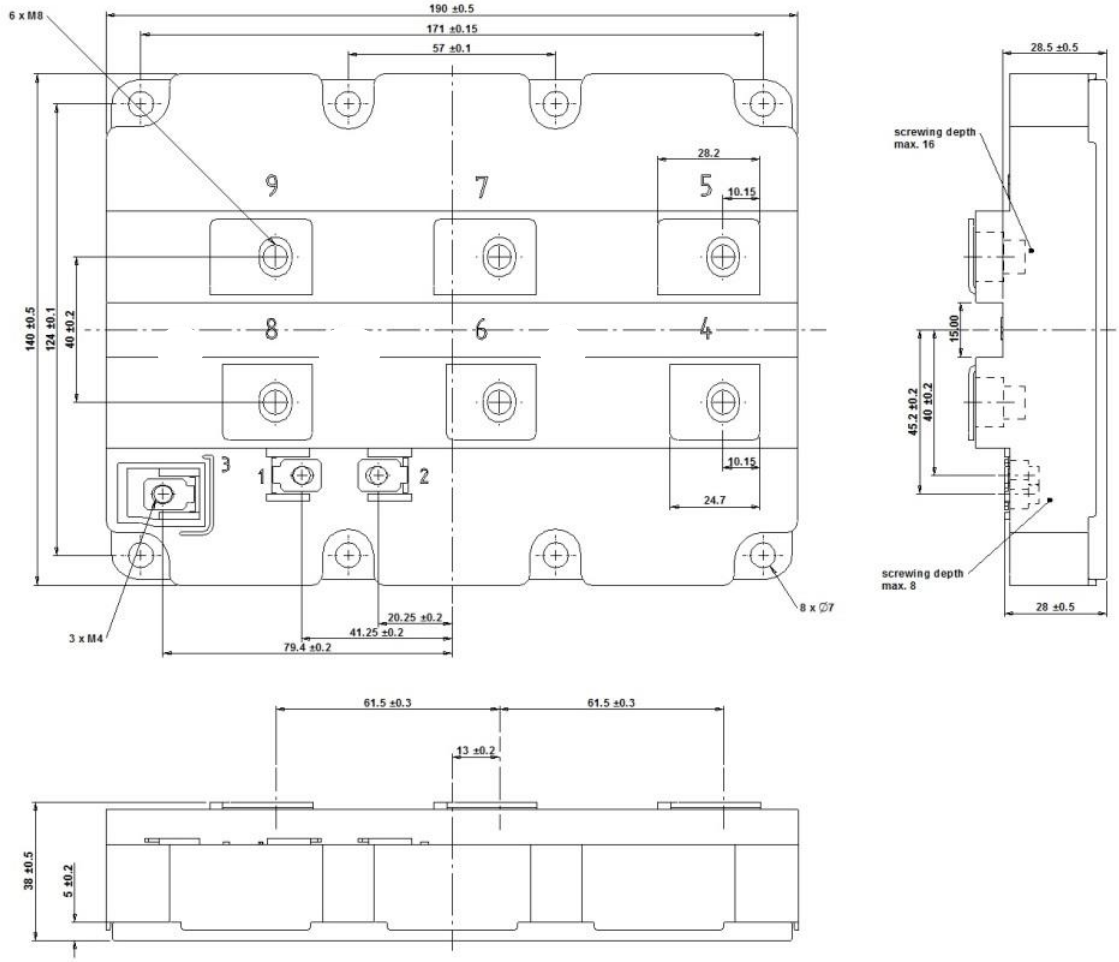


Fig. 13 Transient thermal impedance, $Z_{th(J-C)}$ = f(t)

PACKAGE DETAILS

For further package information, please visit our website or contact Customer Services.
All dimensions in mm, unless stated otherwise.
DO NOT SCALE.



Nominal Weight: 1400g

Module Outline Type Code: E

Fig. 14 Module outline drawing

Caution: This device is sensitive to electrostatic discharge. Users should follow ESD handling procedures.

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The products must not be touched when operating because there is a danger of electrocution or severe burning. Always use protective safety equipment such as appropriate shields for the product and wear safety glasses. Even when disconnected any electric charge remaining in the product must be discharged and allowed to cool before safe handling using protective gloves.

Extended exposure to conditions outside the product ratings may affect reliability leading to premature product failure. Use outside the product ratings is likely to cause permanent damage to the product. In extreme conditions, as with all semiconductors, this may include potentially hazardous rupture, a large current to flow or high voltage arcing, resulting in fire or explosion. Appropriate application design and safety precautions should always be followed to protect persons and property.

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