DIM3600ESM17-PT500

TRENCH
Gen5 TMOS

Single Switch IGBT Module

Replaces DS6328-3

DS6328-4 October 2024 (LN43694)

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 3600A.

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

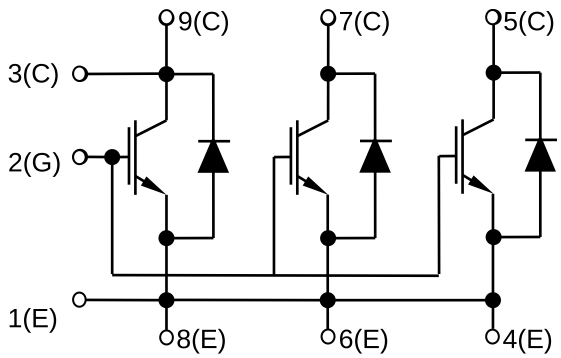


Fig. 1 Circuit configuration

Outline type code: E

(See Fig. 17 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	5000	V
PDEV	Extinction voltage – per module	After 1 minute of V_{isol}	≥2600	V

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

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

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	6.1	6.7	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15V, I_C = 3600A		1.95	2.35	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		601		nF
Q_g	Gate charge	±15V		37.8		µC
C_{res}	Reverse transfer capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		0.4		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		2175		ns
t_f	Fall time			245		ns
E_{OFF}	Turn-off energy loss			1585		mJ
$t_{d(on)}$	Turn-on delay time			970		ns
t_r	Rise time			310		ns
E_{ON}	Turn-on energy loss			370		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 3600A V_{CE} = 900V dI_F/dt = 11000A/μs		845		μC
I_{rr}	Diode reverse recovery current			1960		A
E_{rec}	Diode reverse recovery energy			650		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		2280		ns
t_f	Fall time			300		ns
E_{OFF}	Turn-off energy loss			1760		mJ
$t_{d(on)}$	Turn-on delay time			970		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		1410		μC
I_{rr}	Diode reverse recovery current			2390		A
E_{rec}	Diode reverse recovery energy			1120		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		2310		ns
t_f	Fall time			315		ns
E_{OFF}	Turn-off energy loss			1790		mJ
$t_{d(on)}$	Turn-on delay time			970		ns
t_r	Rise time			330		ns
E_{ON}	Turn-on energy loss			650		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 3600A V_{CE} = 900V dI_F/dt = 11000A/μs		1660		μC
I_{rr}	Diode reverse recovery current			2550		A
E_{rec}	Diode reverse recovery energy			1240		mJ

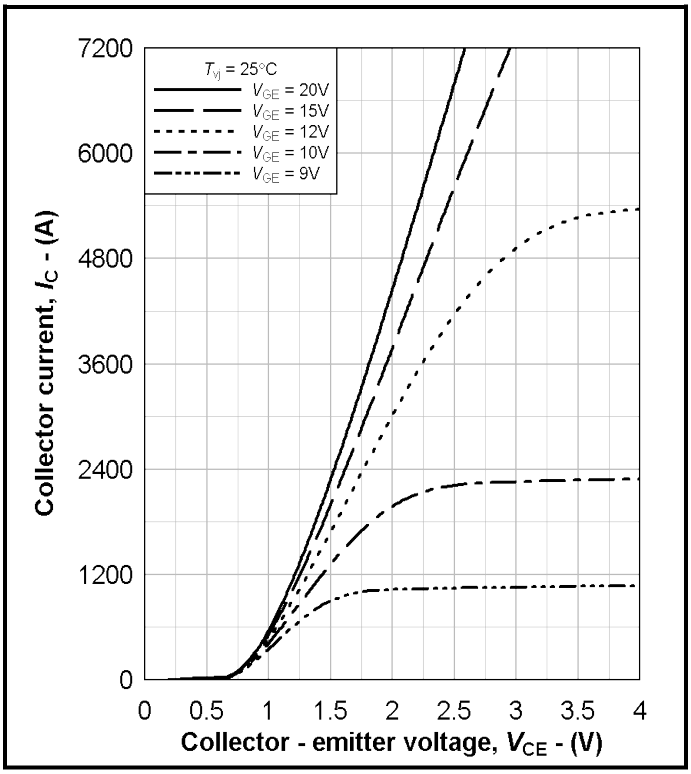


Fig. 3 Typical IGBT output characteristics

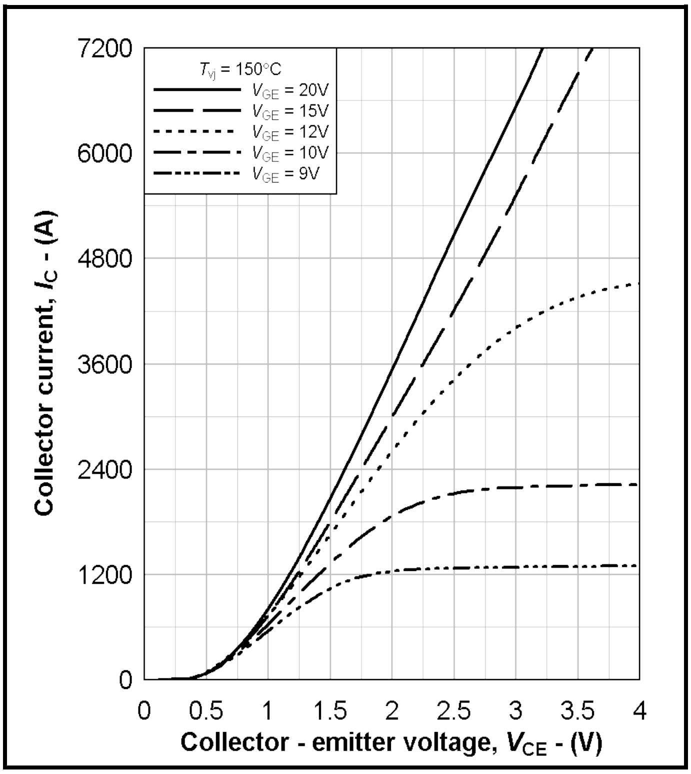


Fig. 4 Typical IGBT output characteristics

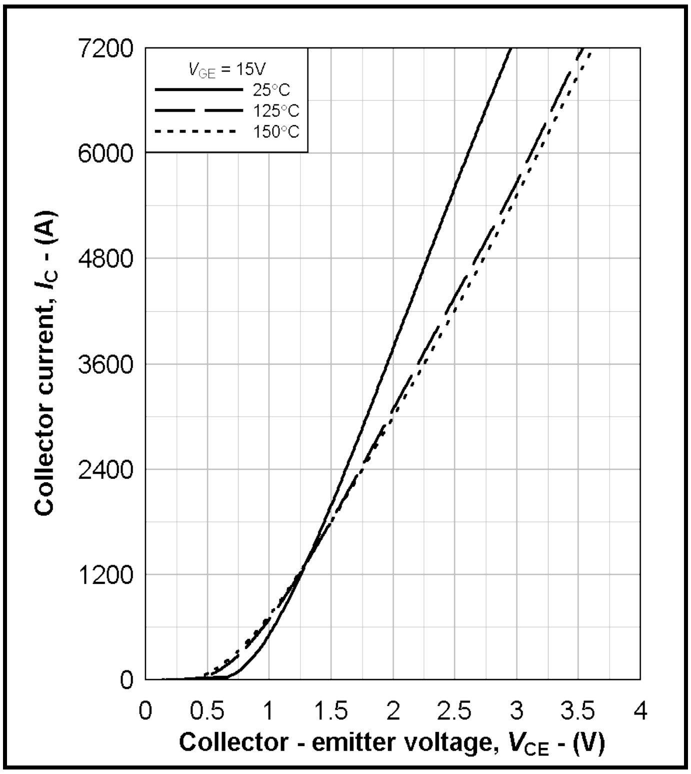


Fig. 5 Typical IGBT output characteristics, $I_C = f(V_{CE})$

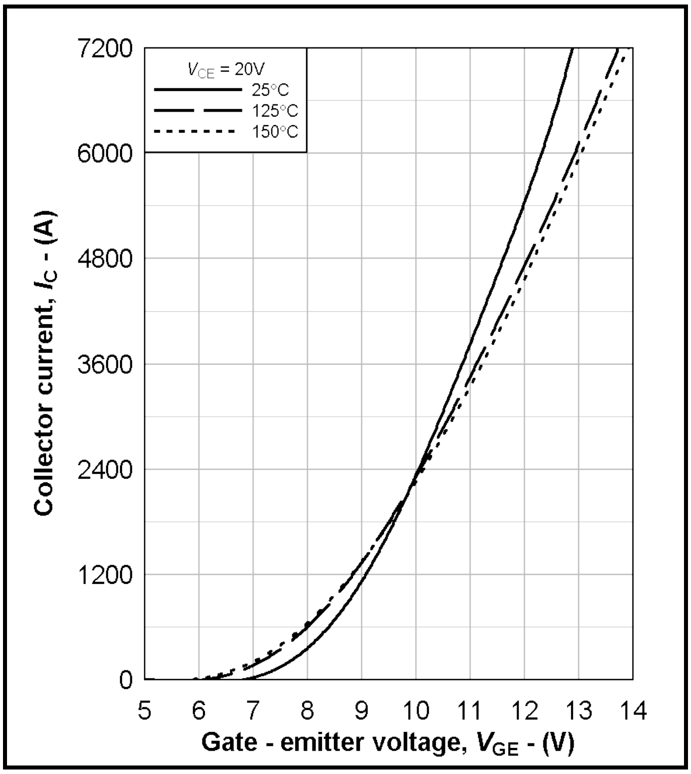


Fig. 6 typical IGBT transfer characteristics, $I_C = f(V_{GE})$

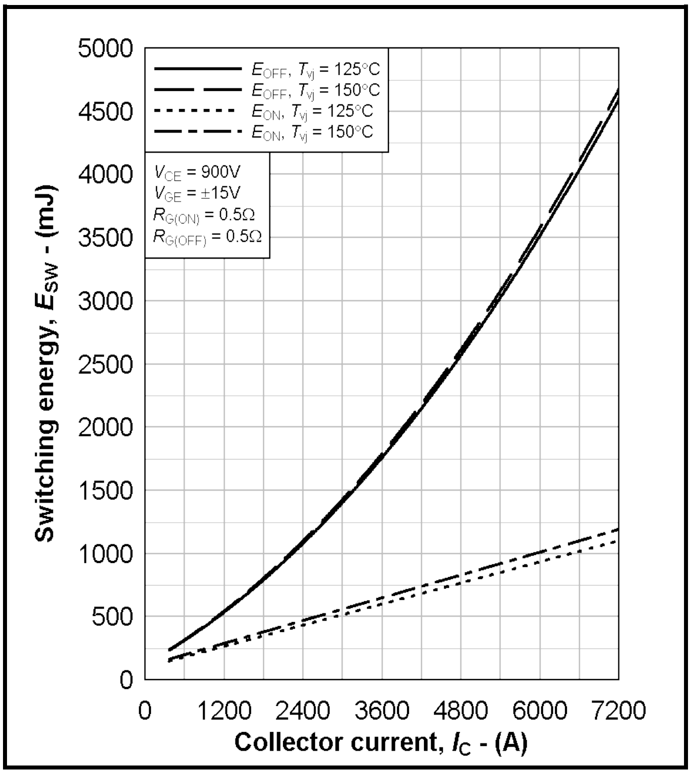


Fig. 7 Typical IGBT switching energy, E_{ON} = f(I_C), E_{OFF} = f(I_C)

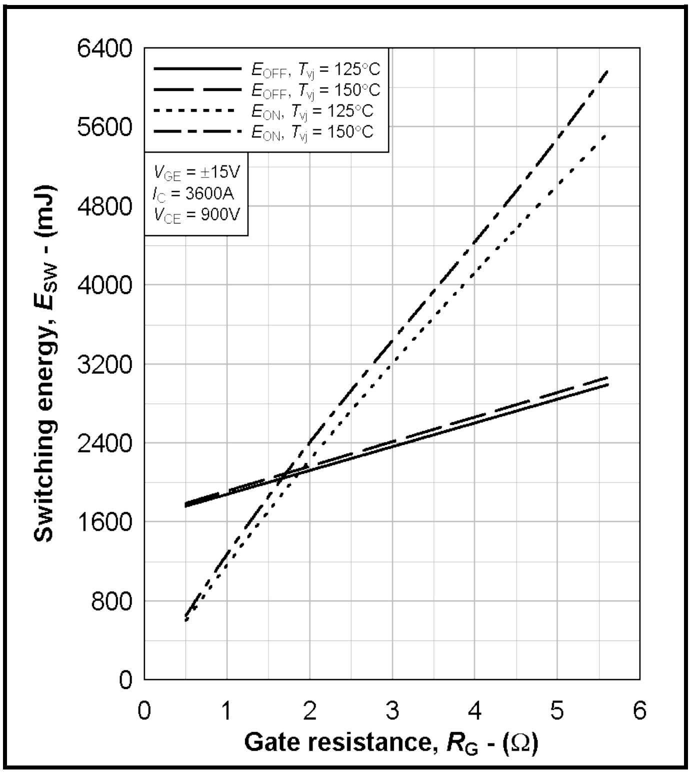


Fig. 8 Typical IGBT switching energy E_{ON} = f(R_G), E_{OFF} = fR_G)

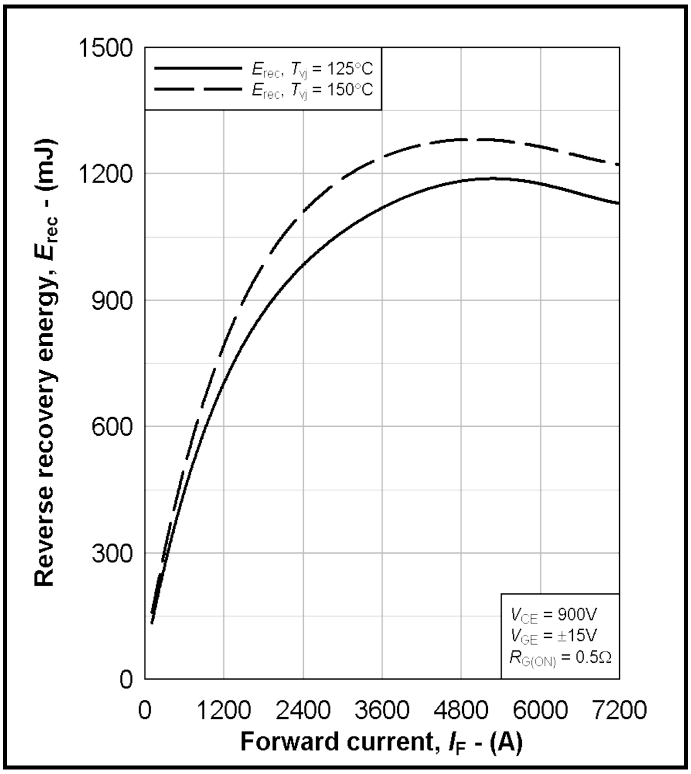


Fig. 9 Typical FRD E_{rec}, E_{rec} = f(I_F)

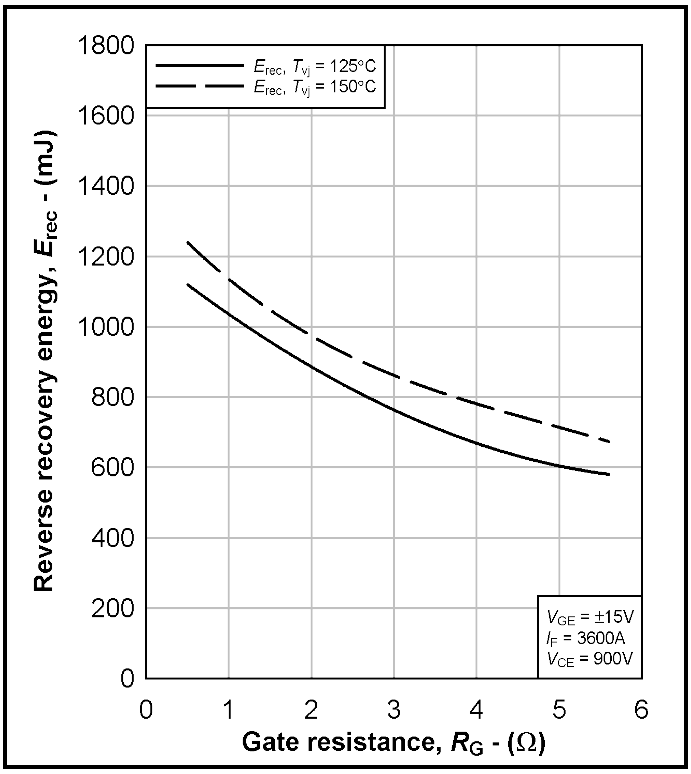


Fig. 10 Typical FRD E_{rec}, E_{rec} = f(R_G)

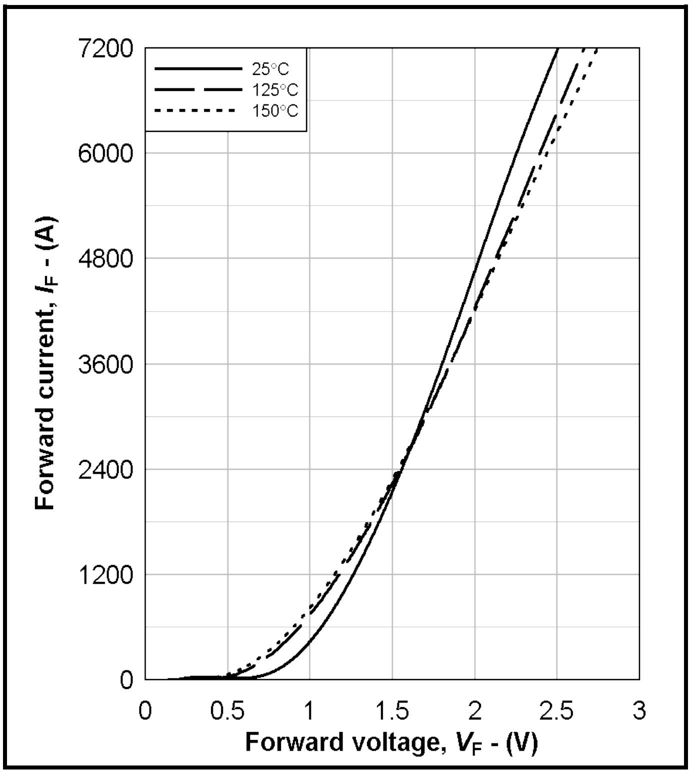


Fig. 11 Typical FRD output characteristics, I_F = f(V_F)

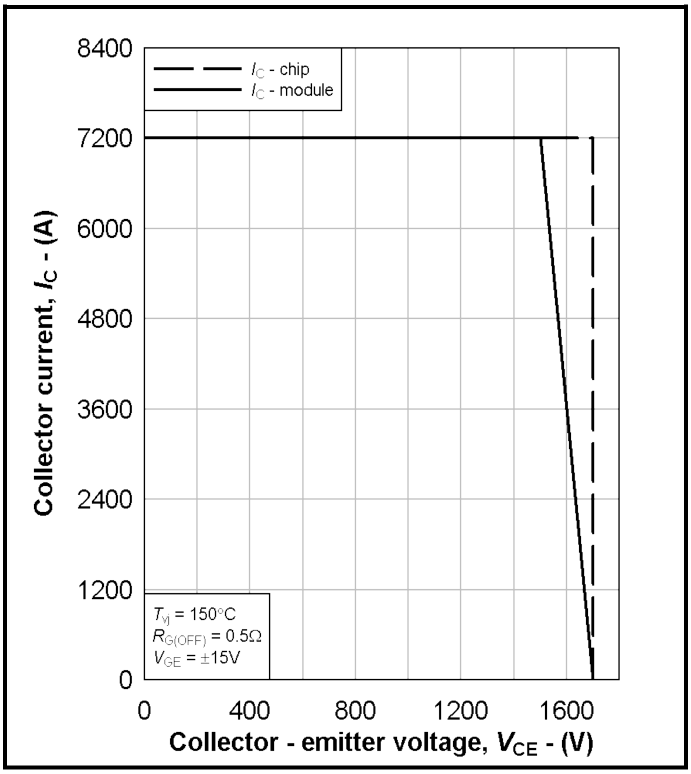


Fig. 12 Reverse bias safe operating area of IGBT, I_C = f(V_{CE})

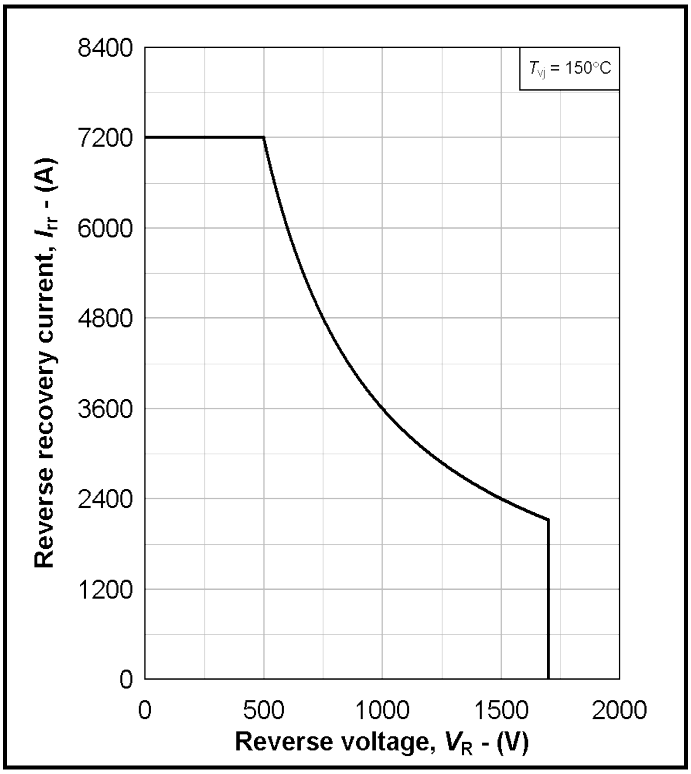
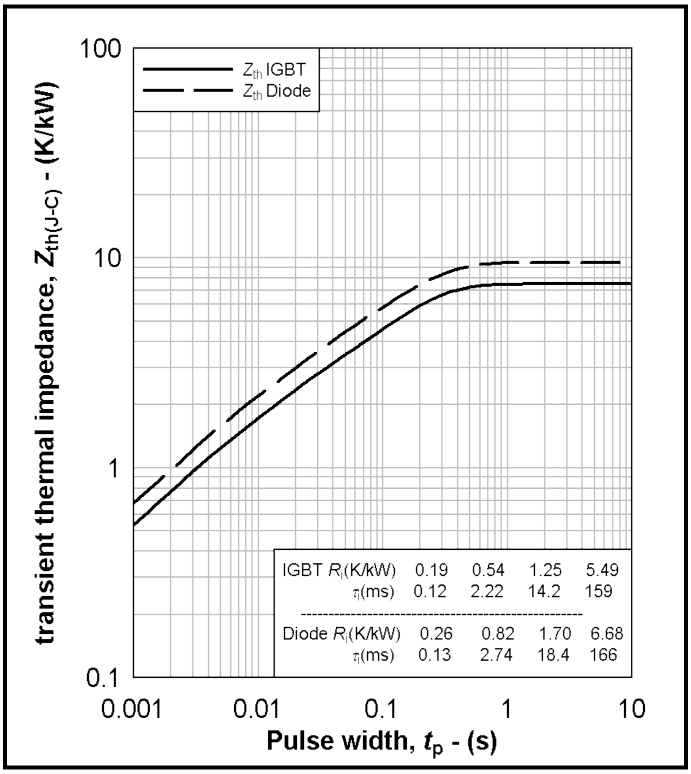


Fig. 13 Diode reverse bias safe operating area



IGBT R_i(K/kW)	0.19	0.54	1.25	5.49
τ_i(ms)	0.12	2.22	14.2	159
Diode R_i(K/kW)	0.26	0.82	1.70	6.68
τ_i(ms)	0.13	2.74	18.4	166

Fig. 14 Transient thermal impedance, $Z_{th(J-C)}$ = f(t)

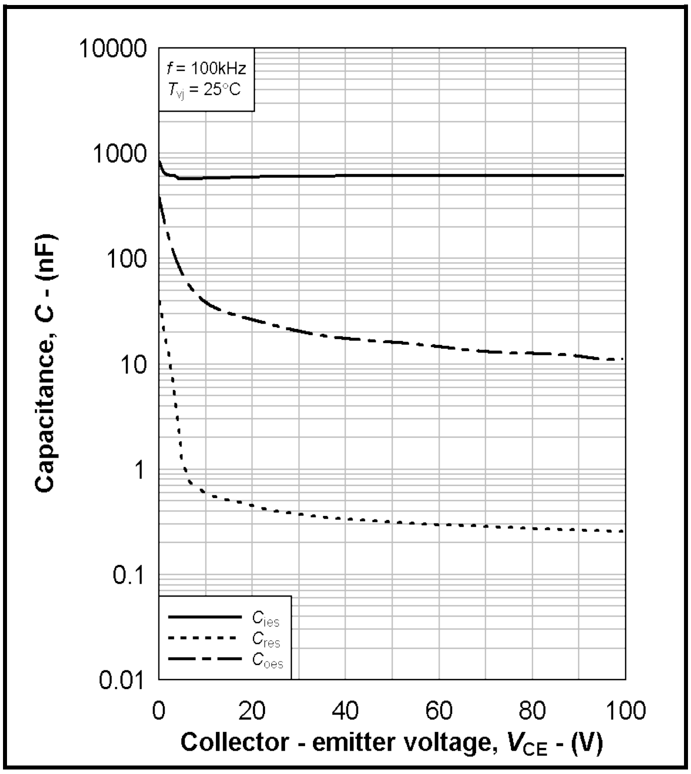


Fig. 15 Typical capacitor characteristic, C = f (V_{CE})

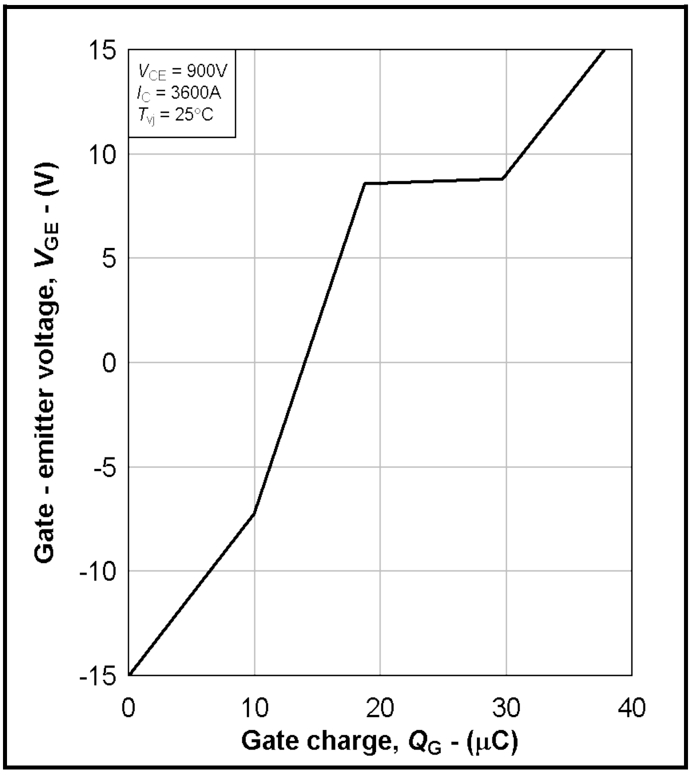
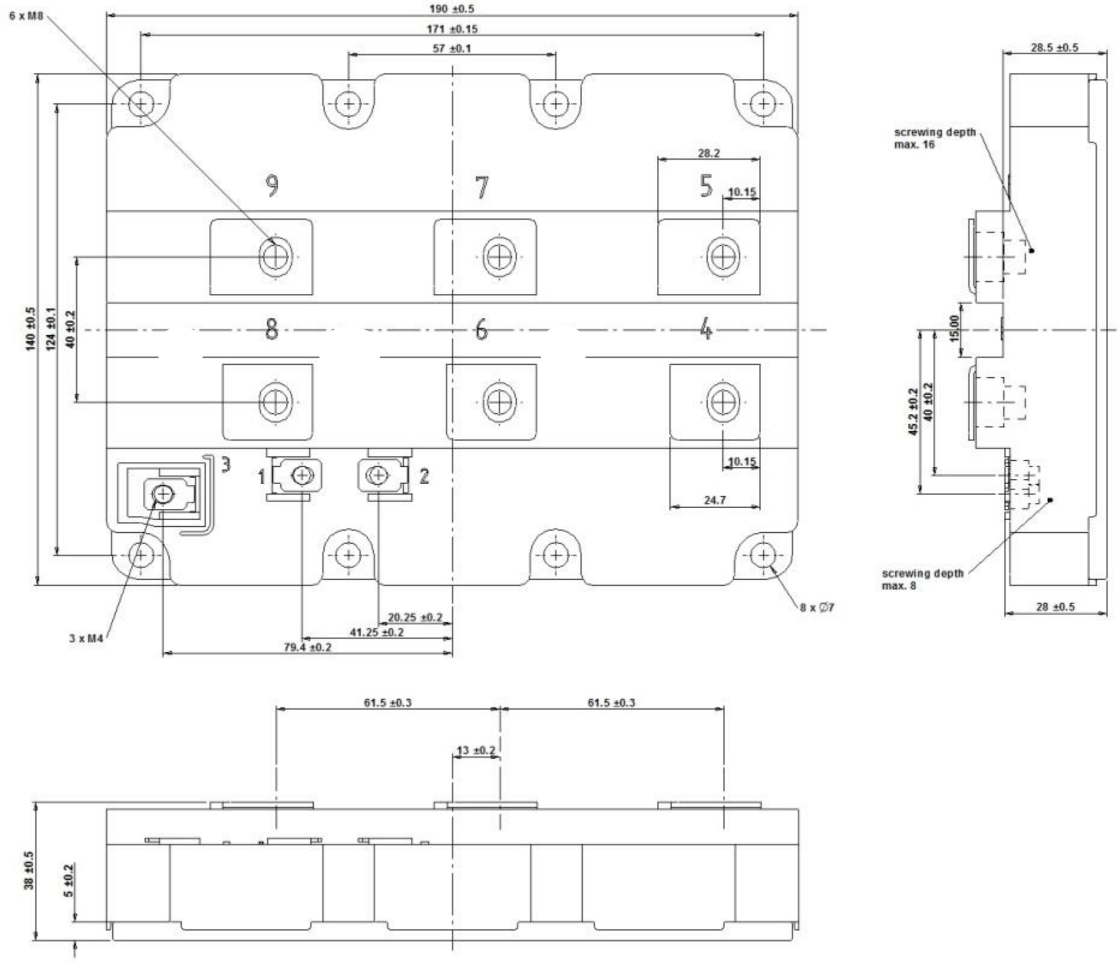


Fig. 16 Typical gate charge characteristic, V_{GE} = f (Q_G)

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: 1100g

Module Outline Type Code: E

Fig. 17 Module outline drawing

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