

FEATURES

- Trench Gate IGBT
- 10 μ s Short Circuit Withstand
- High Thermal Cycling Capability
- Low $V_{ce(sat)}$ Device
- High Current Density
- Isolated AISiC 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 10 μ s 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

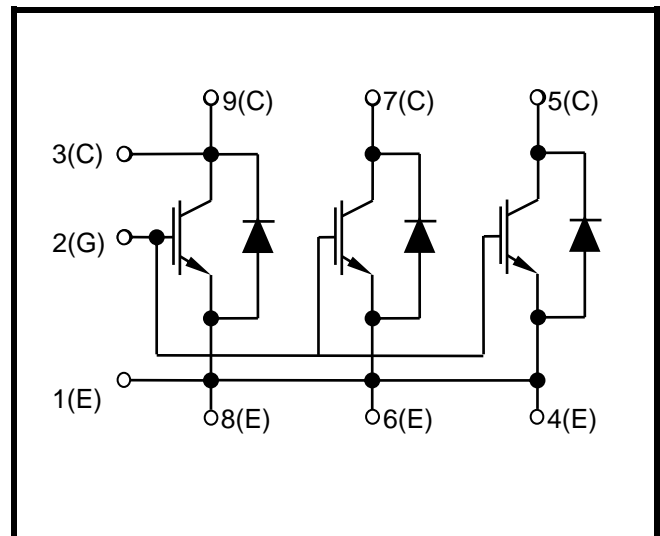
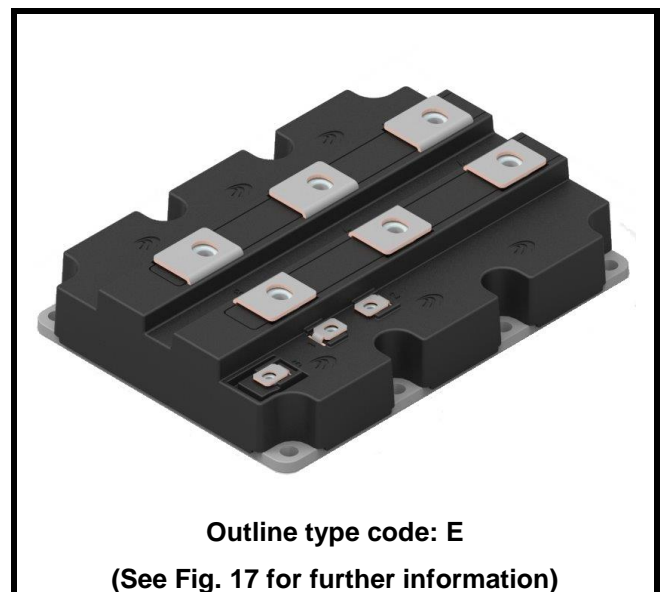


Fig. 1 Circuit configuration



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 ² t	Diode I ² t value	V _R = 0, t _p = 10ms, T _{vj} = 150°C	2200	kA ² s
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

$T_{case} = 25^{\circ}\text{C}$ unless stated otherwise.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I _{CES}	Collector cut-off current	$V_{GE} = 0\text{V}, V_{CE} = V_{CES}$			1	mA
		$V_{GE} = 0\text{V}, V_{CE} = V_{CES}, T_{case} = 125^{\circ}\text{C}$			60	mA
		$V_{GE} = 0\text{V}, V_{CE} = V_{CES}, T_{case} = 150^{\circ}\text{C}$			100	mA
I _{GES}	Gate leakage current	$V_{GE} = \pm 20\text{V}, V_{CE} = 0\text{V}$			1	μA
V _{GE(TH)}	Gate threshold voltage	$I_C = 120\text{mA}, V_{GE} = V_{CE}$	5.5	6.1	6.7	V
V _{CE(sat)}	Collector-emitter saturation voltage	$V_{GE} = 15\text{V}, I_C = 3600\text{A}$		1.95	2.35	V
		$V_{GE} = 15\text{V}, I_C = 3600\text{A}, T_j = 125^{\circ}\text{C}$		2.20		V
		$V_{GE} = 15\text{V}, I_C = 3600\text{A}, T_j = 150^{\circ}\text{C}$		2.25		V
I _F	Diode forward current	DC		3600		A
I _{FM}	Diode maximum forward current	$t_p = 1\text{ms}$		7200		A
V _F	Diode forward voltage	$I_F = 3600\text{A}$		1.80		V
		$I_F = 3600\text{A}, T_j = 125^{\circ}\text{C}$		1.85		V
		$I_F = 3600\text{A}, T_j = 150^{\circ}\text{C}$		1.85		V
C _{ies}	Input capacitance	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 100\text{kHz}$		601		nF
Q _g	Gate charge	$\pm 15\text{V}$		37.8		μC
C _{res}	Reverse transfer capacitance	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 100\text{kHz}$		0.4		nF
L _M	Module inductance			6		nH
R _{INT}	Internal transistor resistance			85		$\mu\Omega$
SC _{Data}	Short circuit current, I _{sc}	$T_j = 150^{\circ}\text{C}, V_{CC} = 1000\text{V}$ $t_p \leq 10\mu\text{s}, V_{GE} \leq 15\text{V}$ $V_{CE(max)} = V_{CES} - L^* \times di/dt$ 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	

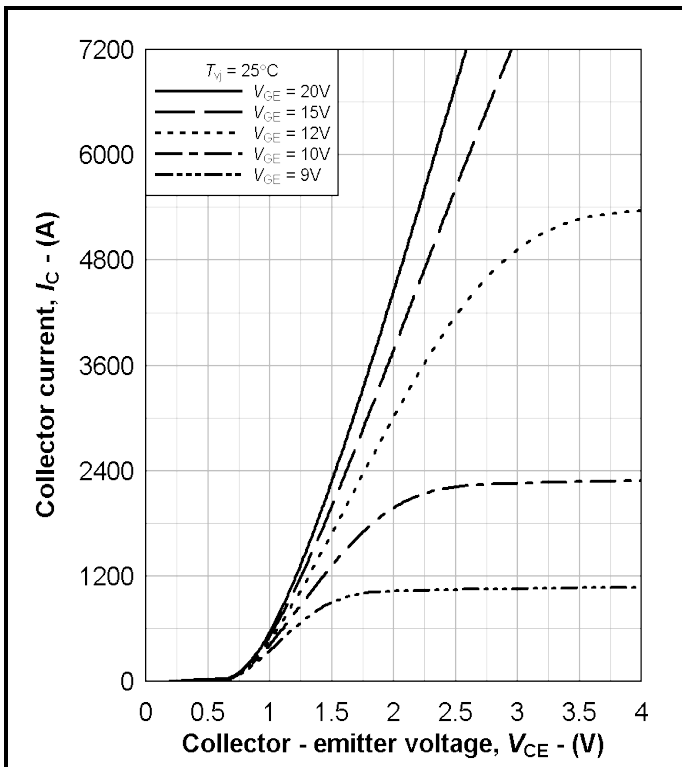


Fig. 3 Typical IGBT output characteristics

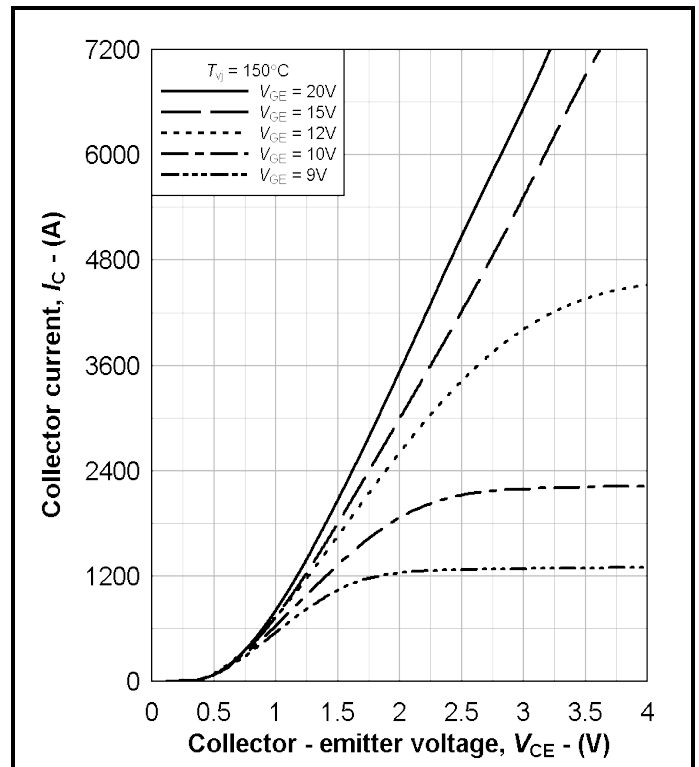


Fig. 4 Typical IGBT output characteristics

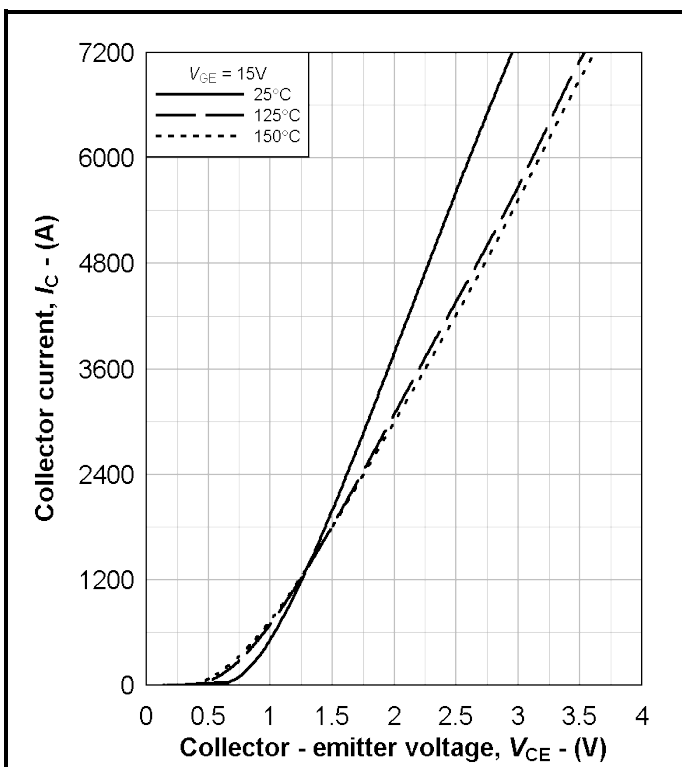


Fig. 5 Typical IGBT output characteristics, $I_c = f(V_{CE})$

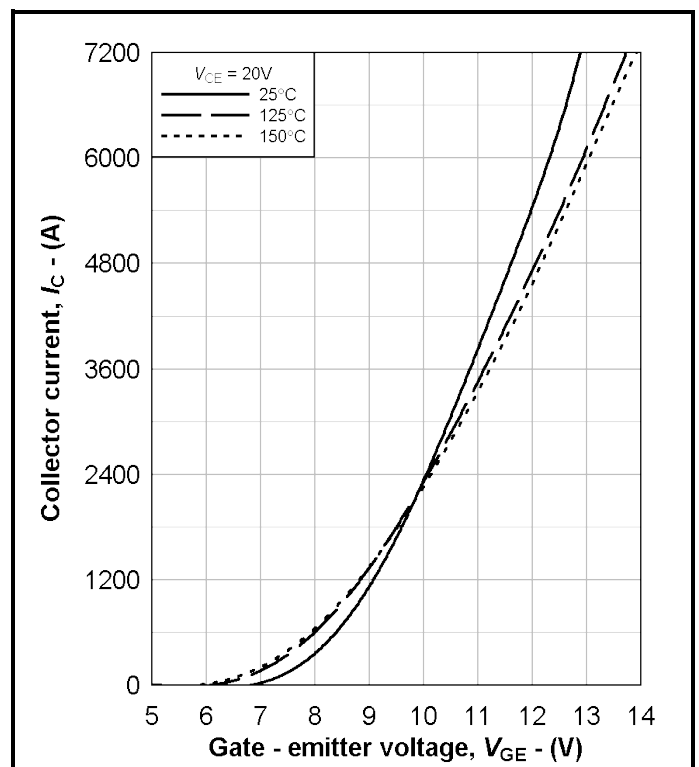


Fig. 6 typical IGBT transfer characteristics, $I_c = f(V_{GE})$

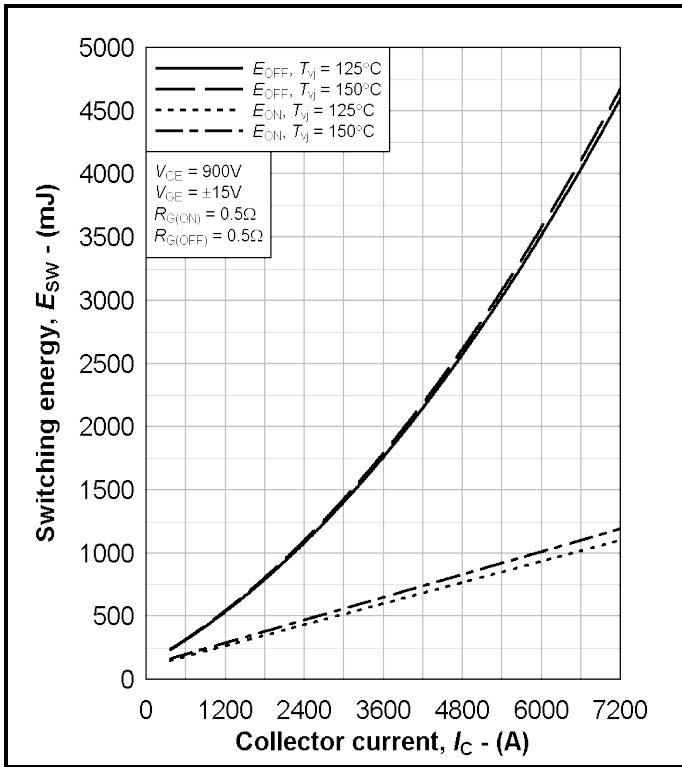


Fig. 7 Typical IGBT switching energy, $E_{ON} = f(I_C), E_{OFF} = f(I_C)$

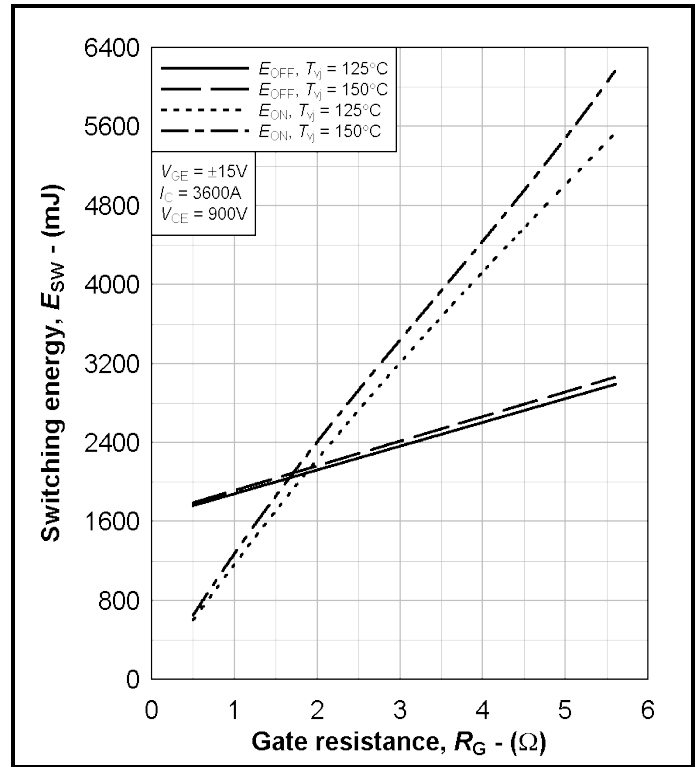


Fig. 8 Typical IGBT switching energy $E_{ON} = f(R_G), E_{OFF} = f(R_G)$

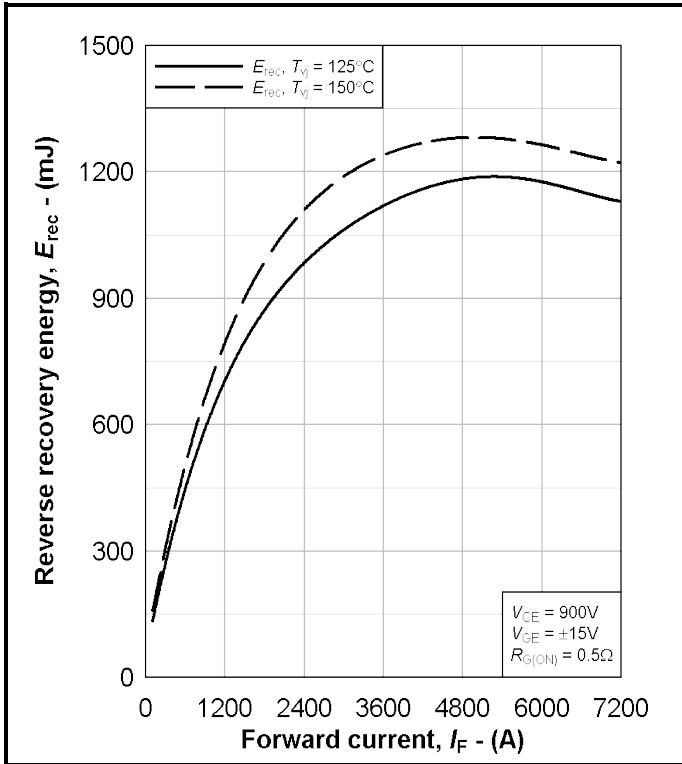


Fig. 9 Typical FRD $E_{rec}, E_{rec} = f(I_F)$

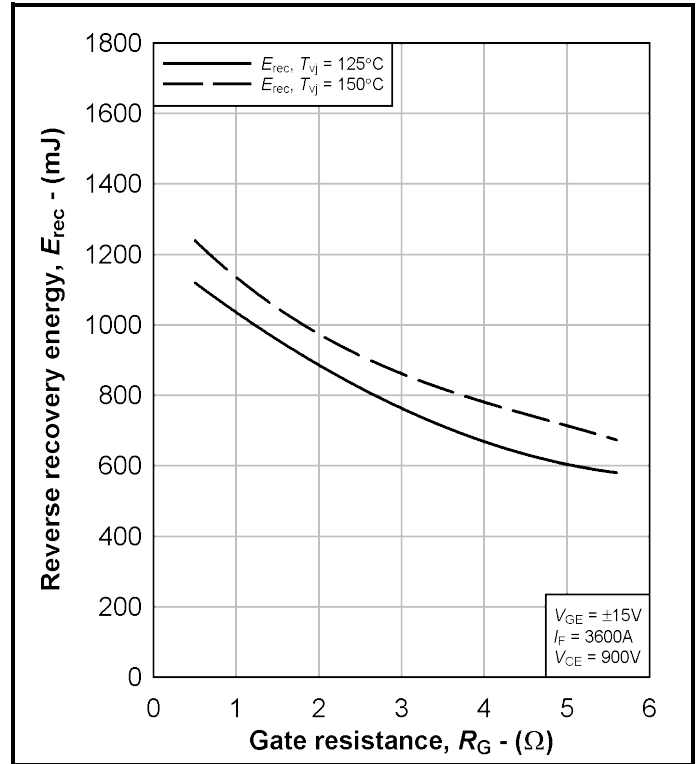


Fig. 10 Typical FRD $E_{rec}, E_{rec} = f(R_G)$

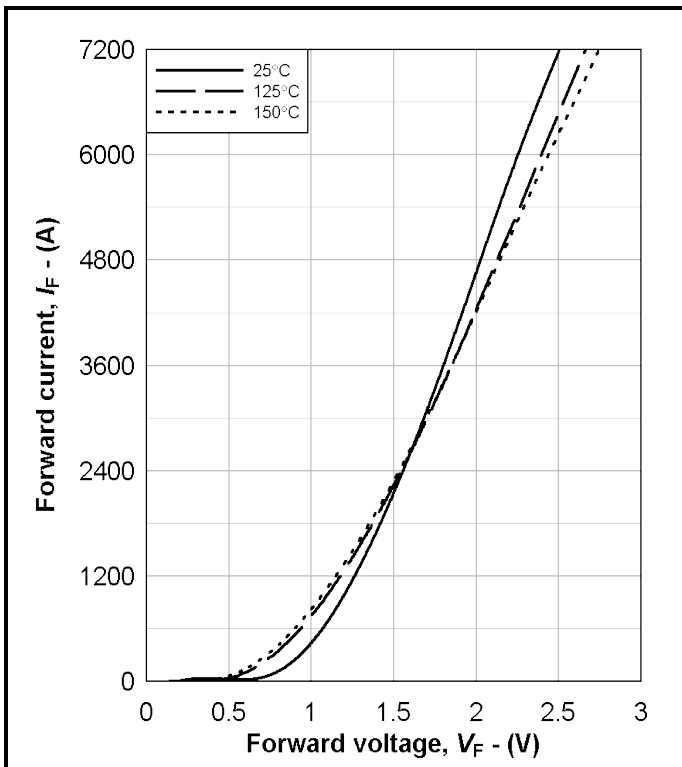


Fig. 11 Typical FRD output characteristics, $I_F = f(V_F)$

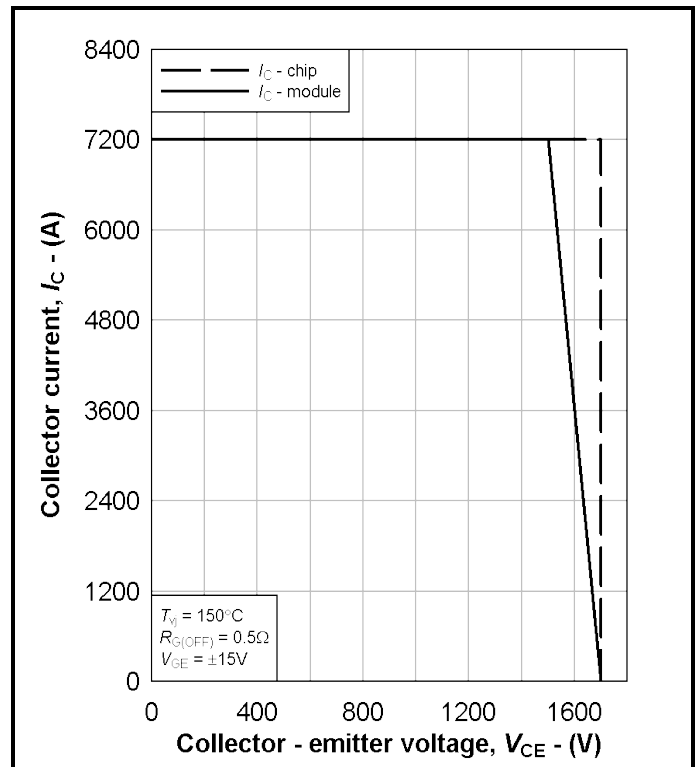


Fig. 12 Reverse bias safe operating area of IGBT, $I_C = f(V_{CE})$

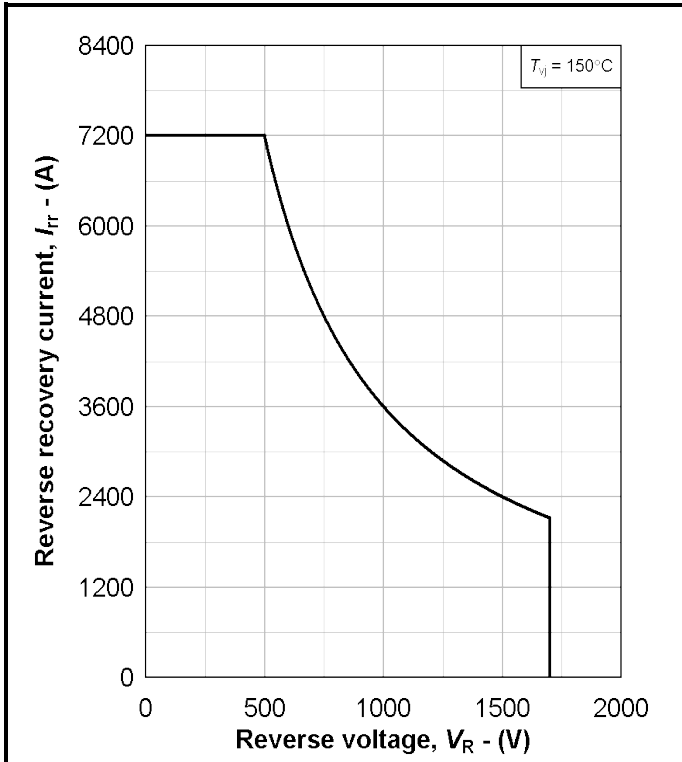


Fig. 13 Diode reverse bias safe operating area

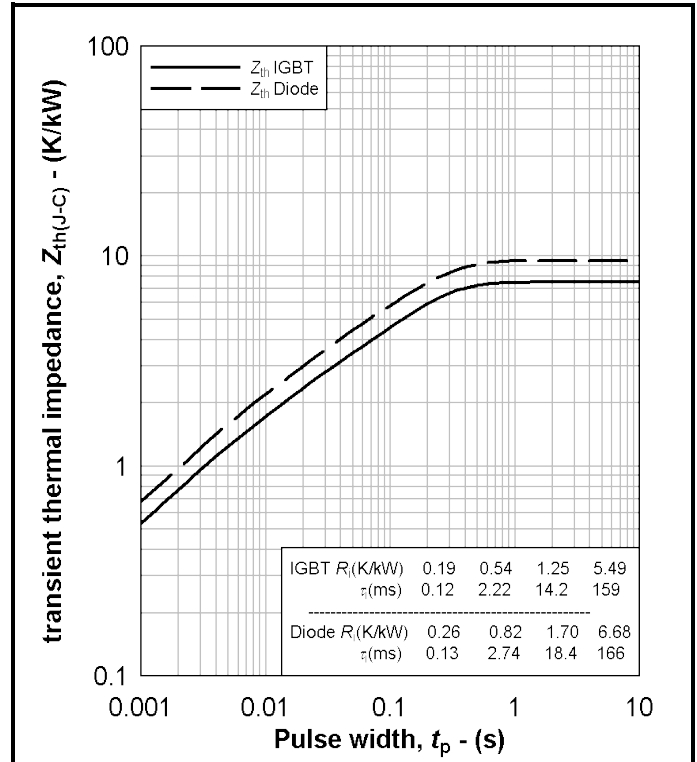


Fig. 14 Transient thermal impedance, $Z_{th(J-C)} = f(t)$

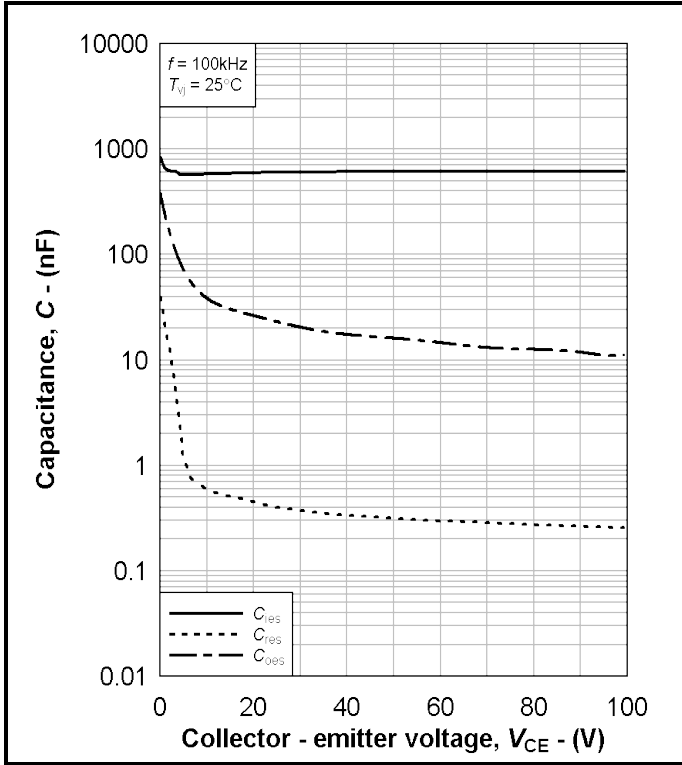


Fig. 15 Typical capacitor characteristic, $C = f(V_{CE})$

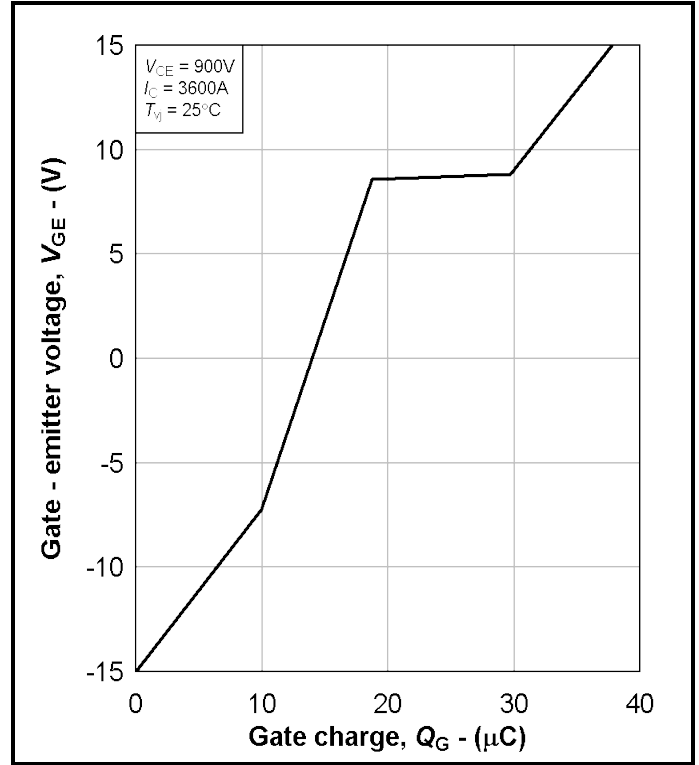
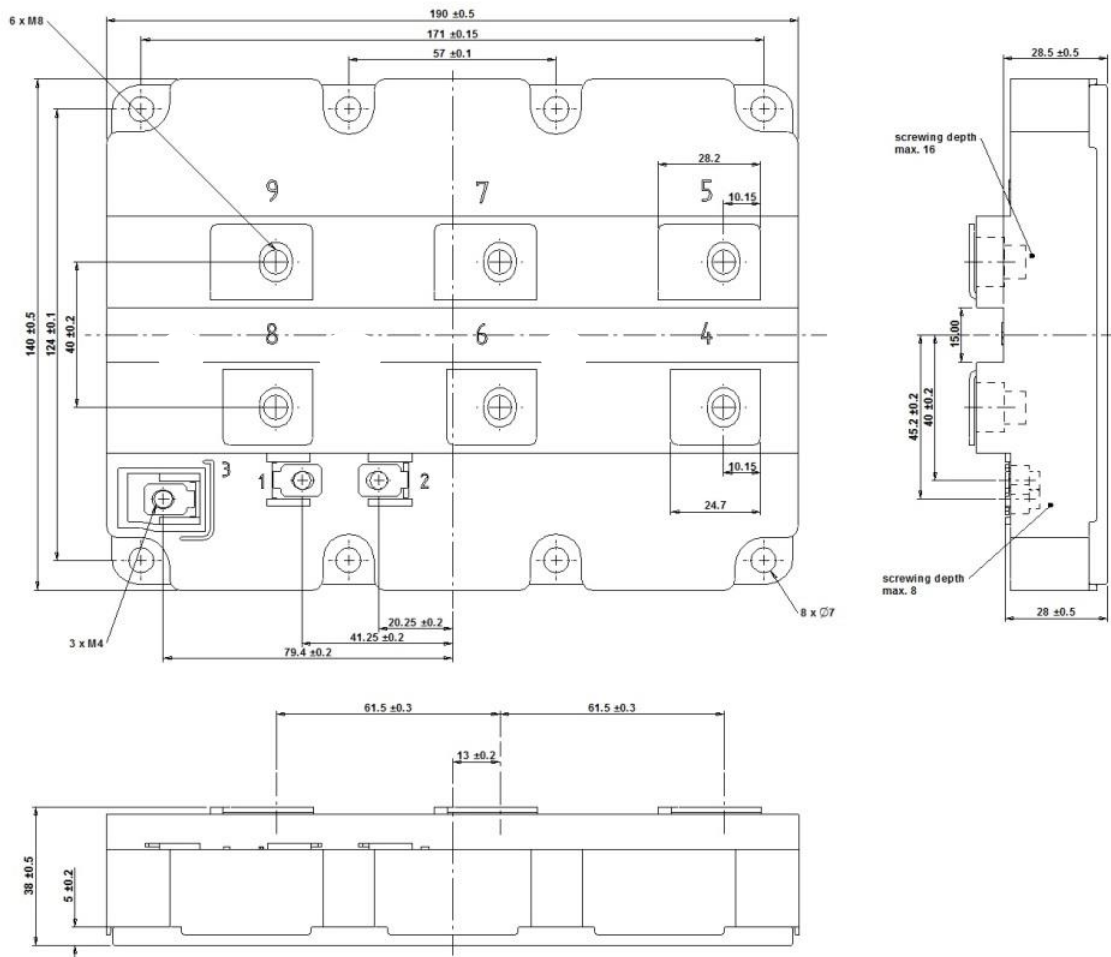


Fig. 16 Typical gate charge characteristic, $V_{GE} = f(Q_G)$

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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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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HEADQUARTERS OPERATIONS

DYNEX SEMICONDUCTOR LTD

Doddington Road, Lincoln, Lincolnshire, LN6 3LF,
United Kingdom

Tel: +44(0)1522 500500

Web: <http://www.dynexsemi.com>

CUSTOMER SERVICE

DYNEX SEMICONDUCTOR LTD

Doddington Road, Lincoln, Lincolnshire, LN6 3LF,
United Kingdom

Tel: +44(0)1522 502753 / 502901

Email: powersolutions@dynexsemi.com