DIM1200NSM17-RT500

TRENCH
Gen5 TMOS

Single Switch IGBT Module

DS6433-1 February 2024 (LN43150)

FEATURES

- 10µs Short Circuit Withstand
- High Thermal Cycling Capability
- Isolated AlSiC Base with AlN Substrates
- Pre-applied Thermal Interface Material

APPLICATIONS

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

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 DIM1200NSM17-RT500 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:

DIM1200NSM17-RT500

Note: When ordering, please use the complete part number

KEY PARAMETERS

V_{CES}		**1700V**
$V_{CE(sat)}$	**(typ)**	**1.8V**
I_C	**(max)**	**1200A**
$I_{C(PK)}$	**(max)**	**2400A**

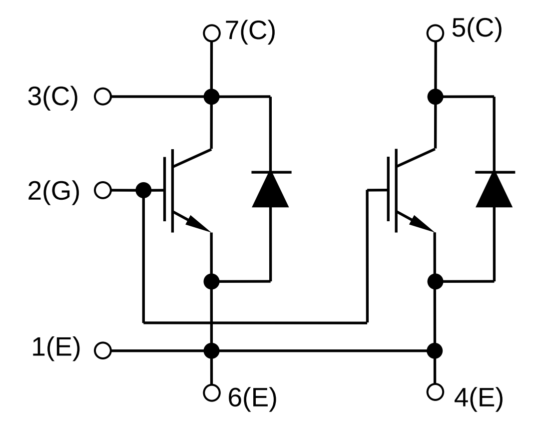


Fig. 1 Circuit configuration

Outline type code: N

(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} = 175°C	1200	A
$I_{C(PK)}$	Peak collector current	t_p = 1ms	2400	A
P_{max}	Max. transistor power dissipation	T_{case} = 25°C, T_{vj} = 175°C	8.2	kW
I^2t	Diode I^2t value	V_R = 0, t_p = 10ms, T_{vj} = 150ºC	320	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
$R_{th(j-hs)}$	Thermal resistance, junction to heatsink – IGBT	TIM mounting torque 5Nm, with pre-applied TIM	-	-	23.7	°C/kW
$R_{th(j-hs)}$	Thermal resistance, junction to heatsink – diode	TIM mounting torque 5Nm, with pre-applied TIM	-	-	27.2	°C/kW
T_j	Operating junction temperature	IGBT	-40	-	150	°C
		Diode	-40	-	150	°C
T_{stg}	Storage temperature range	-	-40	-	150	°C
M	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_{vj} = 125°C			20	mA
		V_{GE} = 0V, V_{CE} = V_{CES}, T_{vj} = 150°C			35	mA
I_{GES}	Gate leakage current	V_{GE} = ± 20V, V_{CE} = 0V			1	μA
$V_{GE(TH)}$	Gate threshold voltage	I_C = 80mA, V_{GE} = V_{CE}	5.60	6.20	6.80	V
$V_{CE(sat)}$**	Collector-emitter saturation voltage	V_{GE} = 15V, I_C = 1200A		1.80	2.20	V
		V_{GE} = 15V, I_C = 1200A, T_{vj} = 125°C		2.20		V
		V_{GE} = 15V, I_C = 1200A, T_{vj} = 150°C		2.30		V
I_F	Diode forward current	DC		1200		A
I_{FM}	Diode maximum forward current	t_p = 1ms		2400		A
V_F	Diode forward voltage	I_F = 1200A		1.75	2.20	V
		I_F = 1200A, T_{vj} = 125°C		1.80		V
		I_F = 1200A, T_{vj} = 150°C		1.80		V
C_{ies}	Input capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		179		nF
Q_g	Gate charge	±15V		12		μC
C_{res}	Reverse transfer capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		1		nF
L_M	Module inductance			9		nH
R_{CC+EE}	Module lead resistance, terminal - chip			85		μΩ
R_{INT}	Internal transistor resistance			2		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		4800		A

Note:
* L is the circuit inductance + L_M
** indicates it is given at chip level

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 = 1200A V_{GE} = ±15V V_{CE} = 900V L_S ~ 60nH	$R_{G(OFF)}$ = 5.6Ω dv/dt = 2000V/µs		2280		ns
t_f	Fall time				190		ns
E_{OFF}	Turn-off energy loss				420		mJ
$t_{d(on)}$	Turn-on delay time		$R_{G(ON)}$ = 5.6Ω di/dt = 3500A/µs		1295		ns
t_r	Rise time				310		ns
E_{ON}	Turn-on energy loss				750		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 1200A V_{CE} = 900V dI_F/dt = 3500A/µs			240		µC
I_{rr}	Diode reverse recovery current				650		A
E_{rec}	Diode reverse recovery energy				120		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 = 1200A V_{GE} = ±15V V_{CE} = 900V L_S ~ 60nH	$R_{G(OFF)}$ = 5.6Ω dv/dt = 2000V/µs		2480		ns
t_f	Fall time				380		ns
E_{OFF}	Turn-off energy loss				515		mJ
$t_{d(on)}$	Turn-on delay time		$R_{G(ON)}$ = 5.6Ω di/dt = 3500A/µs		1305		ns
t_r	Rise time				310		ns
E_{ON}	Turn-on energy loss				895		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 1200A V_{CE} = 900V dI_F/dt = 3500A/µs			310		µC
I_{rr}	Diode reverse recovery current				680		A
E_{rec}	Diode reverse recovery energy				160		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 = 1200A V_{GE} = ±15V V_{CE} = 900V L_S ~ 60nH	$R_{G(OFF)}$ = 5.6Ω dv/dt = 2000V/µs		2520		ns
t_f	Fall time				405		ns
E_{OFF}	Turn-off energy loss				530		mJ
$t_{d(on)}$	Turn-on delay time		$R_{G(ON)}$ = 5.6Ω di/dt = 3500A/µs		1325		ns
t_r	Rise time				320		ns
E_{ON}	Turn-on energy loss				910		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 1200A V_{CE} = 900V dI_F/dt = 3500A/µs			350		µC
I_{rr}	Diode reverse recovery current				700		A
E_{rec}	Diode reverse recovery energy				175		mJ

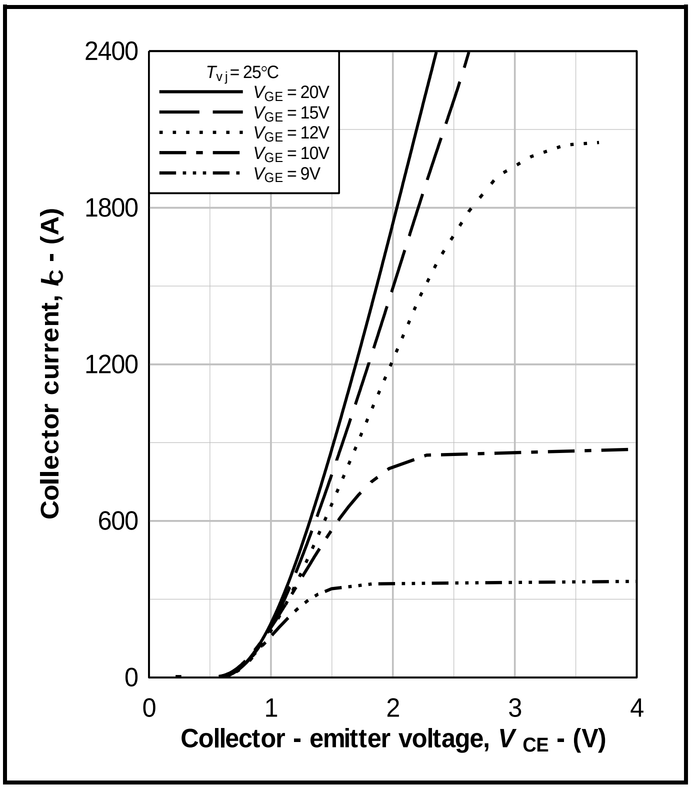


Fig. 3 Typical IGBT output characteristics

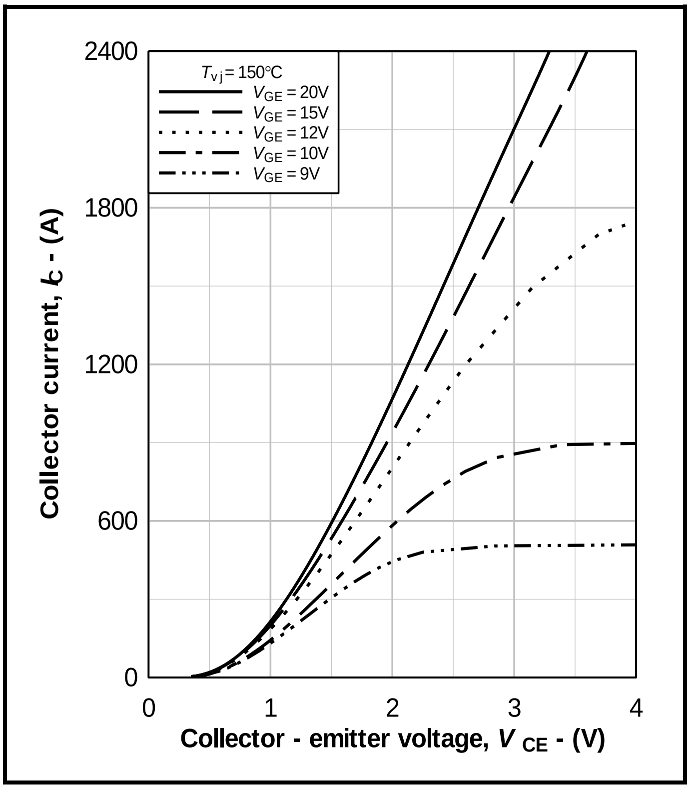


Fig. 4 Typical IGBT output characteristics

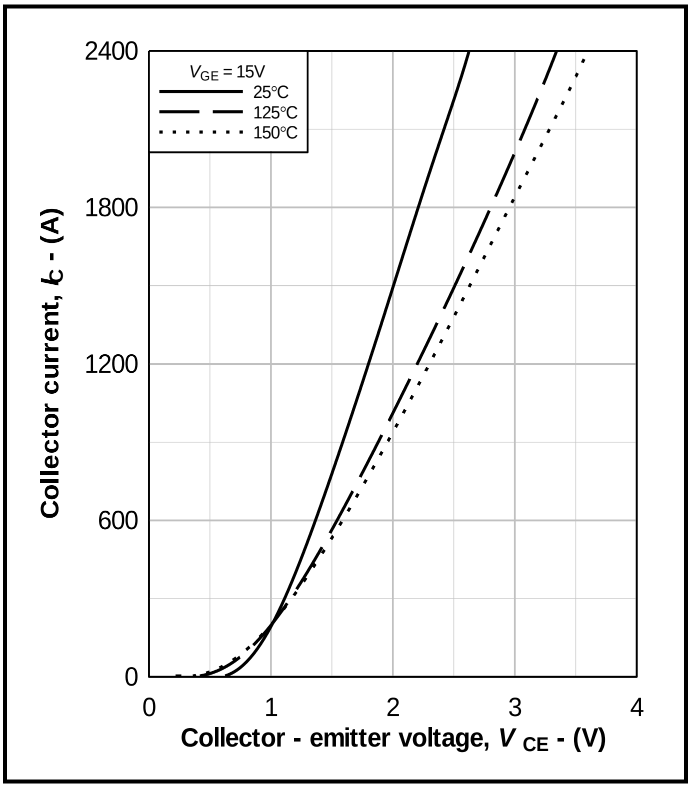


Fig. 5 Typical IGBT output characteristics, I_C = f(V_{CE})

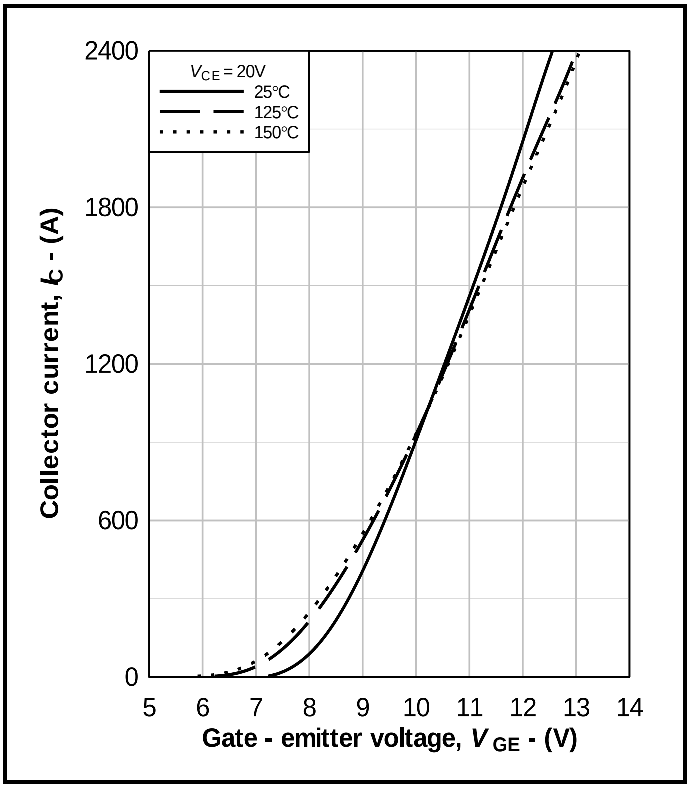


Fig. 6 Typical IGBT transfer characteristics, I_C = f(V_{GE})

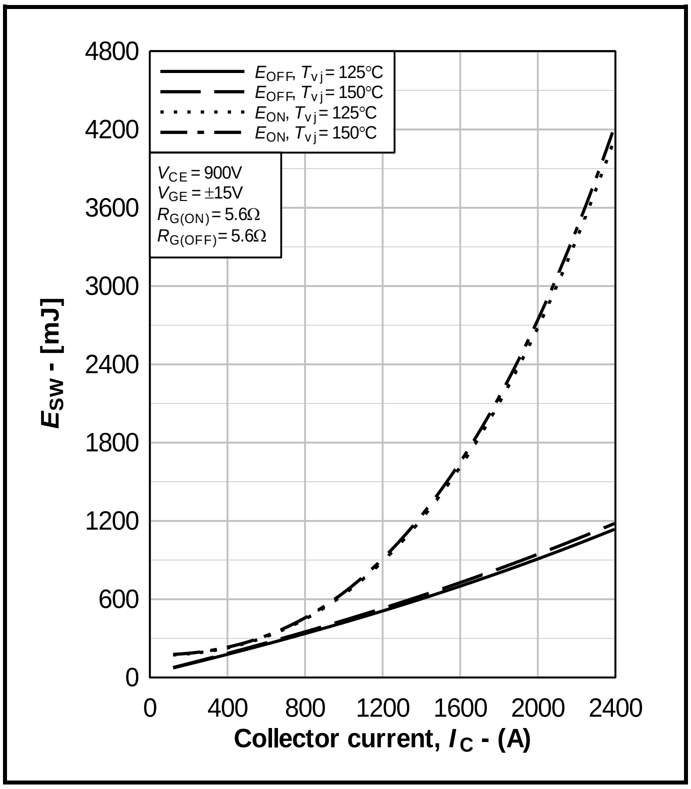


Fig. 7 Typical IGBT switching energy, E_{ON} = f(I_C), E_{OFF} = f(I_C)

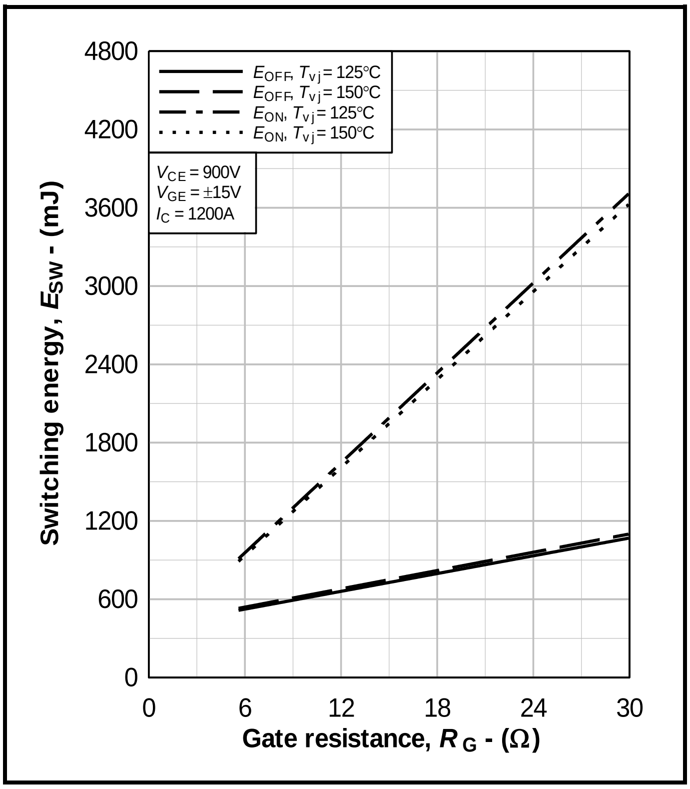


Fig. 8 Typical IGBT switching energy E_{ON} = f(R_G), E_{OFF} = fR_G)

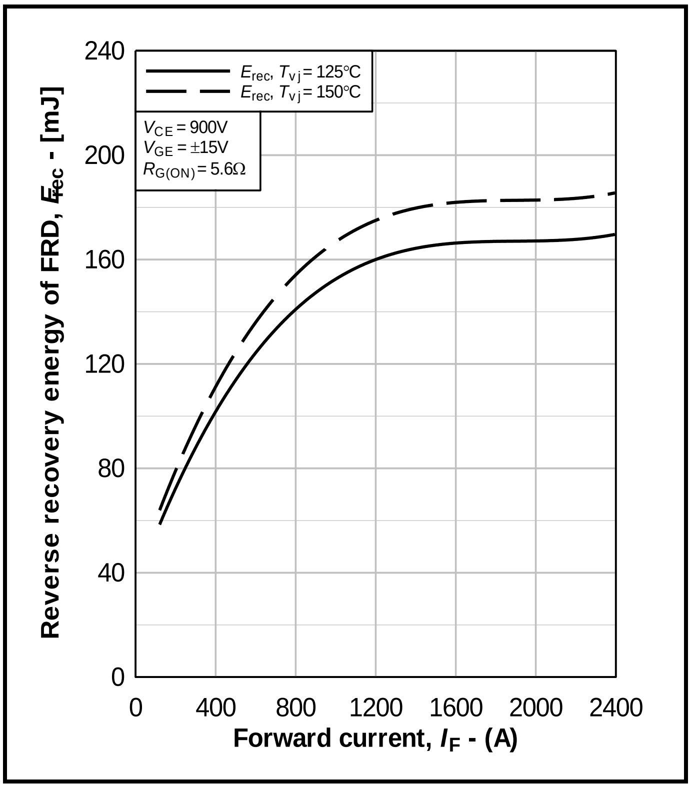


Fig. 9 Typical FRD E_{rec}, E_{rec} = f(I_F)

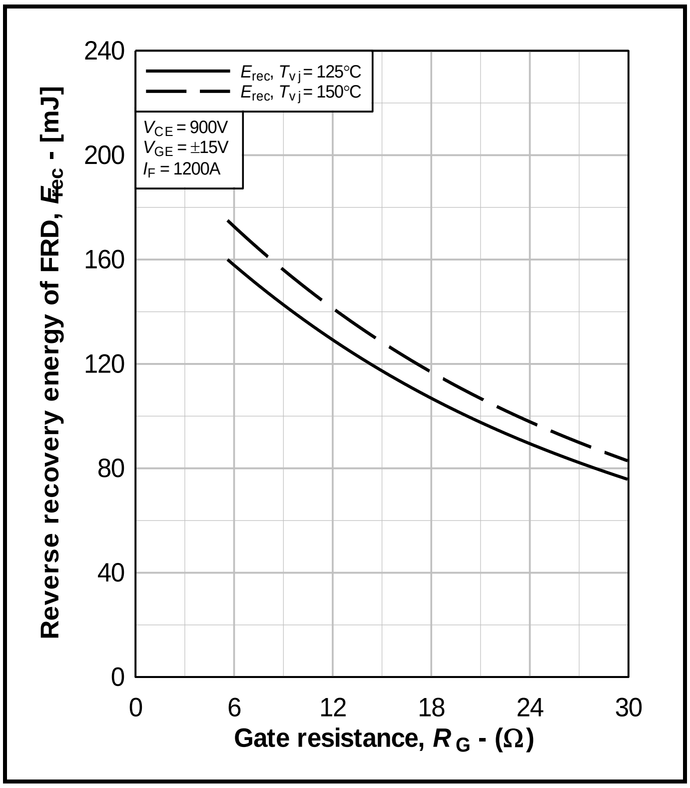


Fig. 10 Typical FRD E_{rec}, E_{rec} = f(R_G)

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

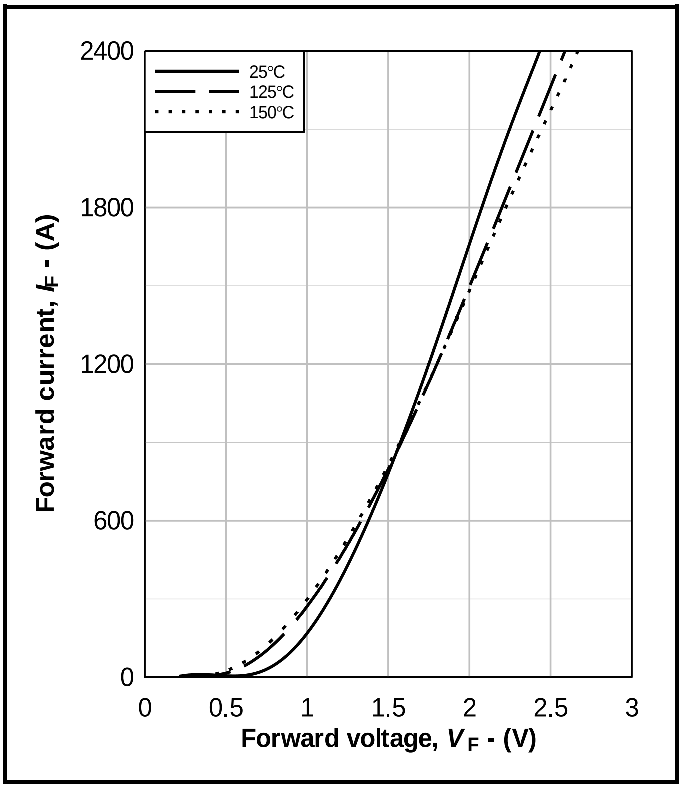


Fig. 11 Typical FRD output characteristics, I_F = f(V_F)

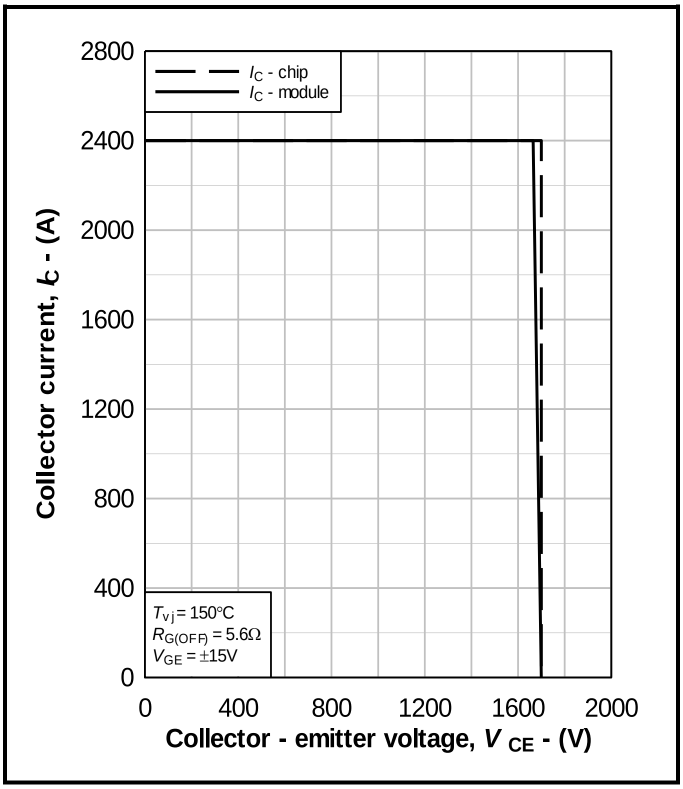


Fig. 12 Reverse bias safe operating area of IGBT, I_C = f(V_{CE})

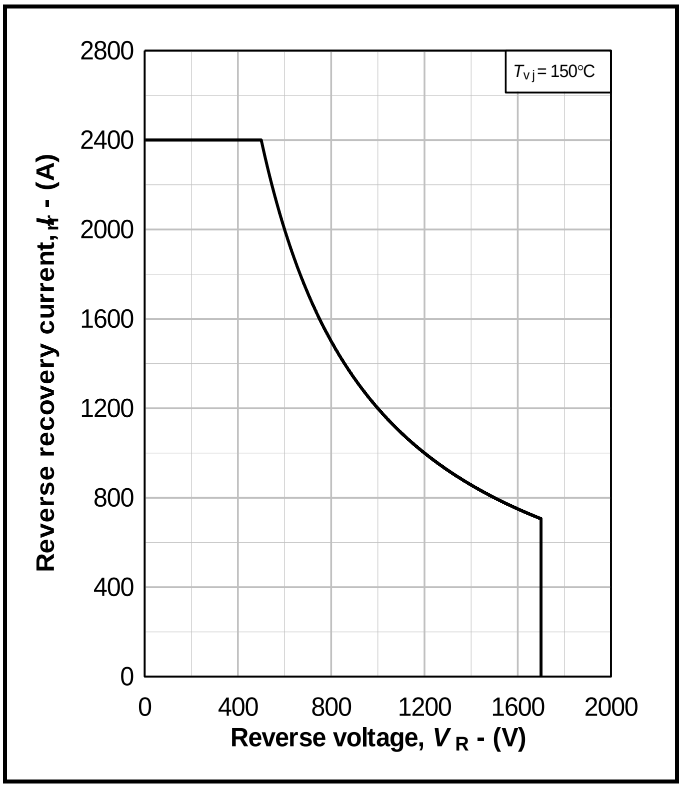


Fig. 13 Diode reverse bias safe operating area

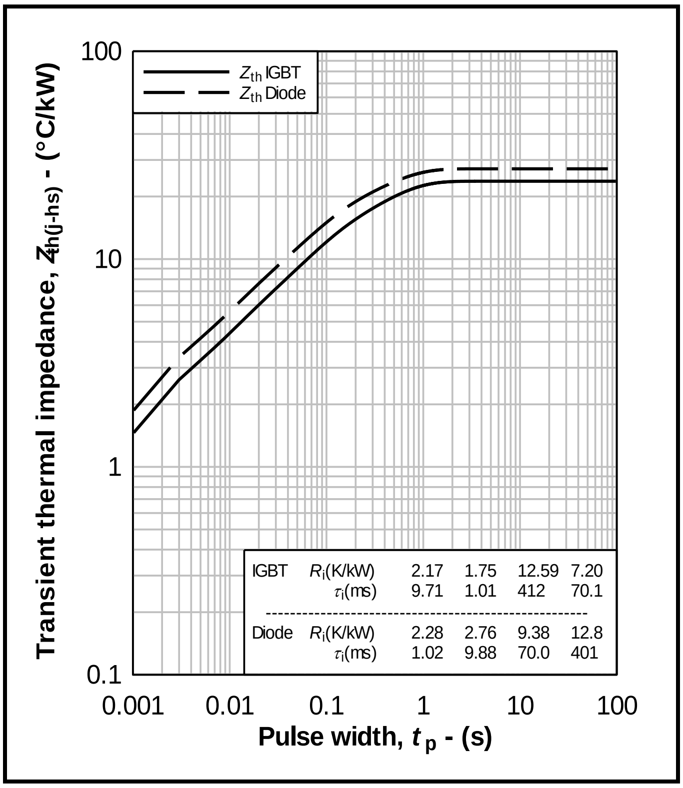


Fig. 14 Transient thermal impedance, $Z_{th(J-hs)}$ = f(t)

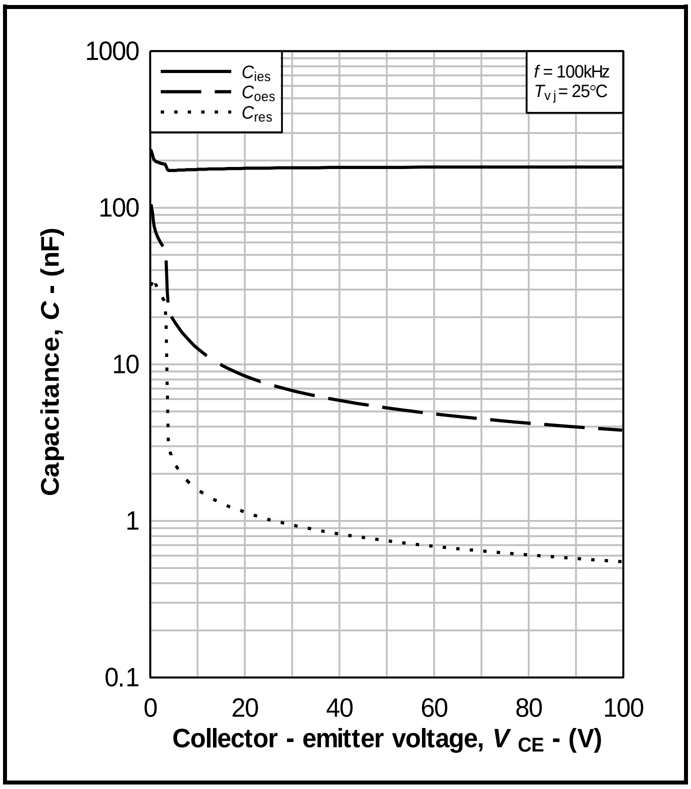


Fig. 15 Typical capacitor characteristic, C = f (V_{CE})

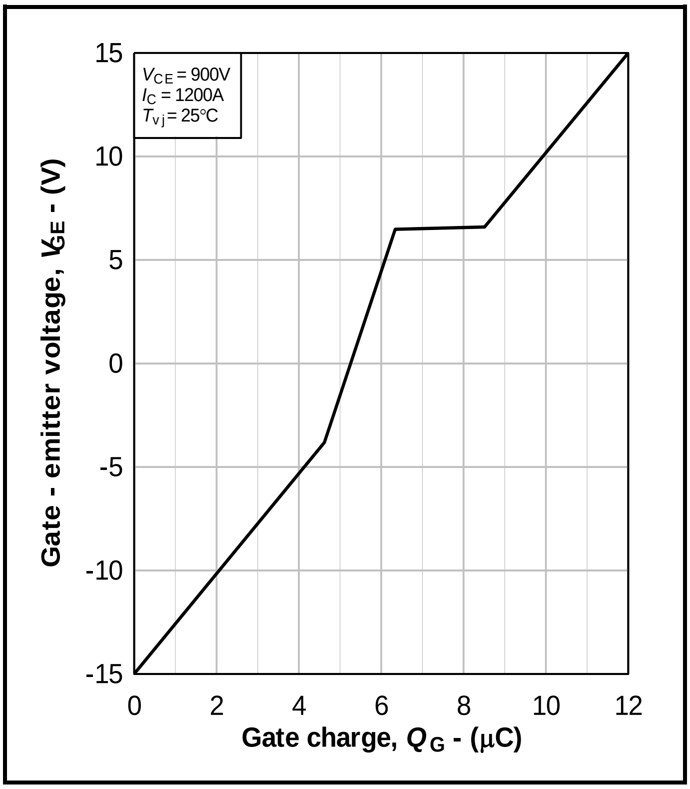
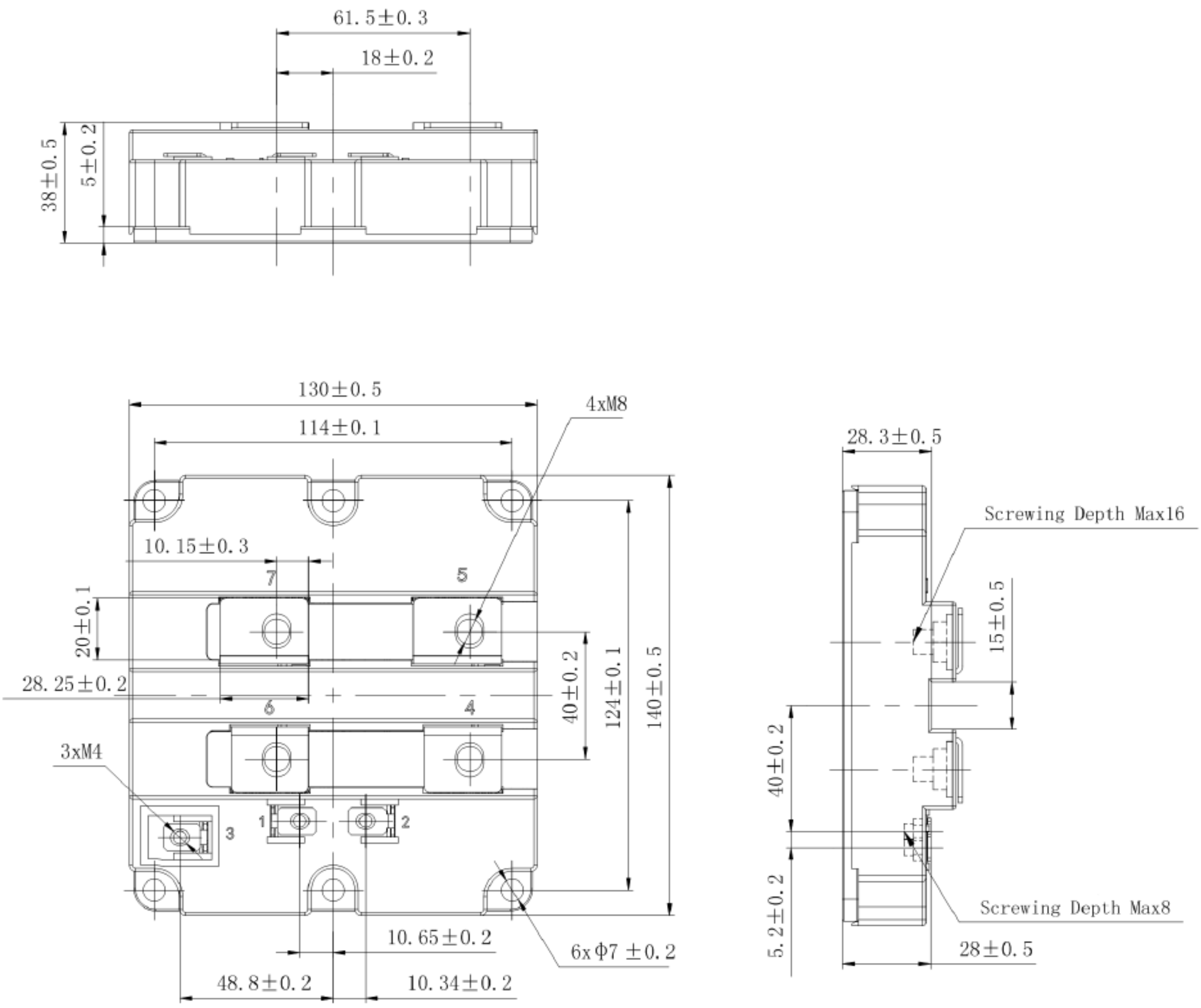


Fig. 16 Typical gate charge characteristic, V_{GE} = f (Q_G)

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

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: 740g

Module Outline Type Code: N

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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