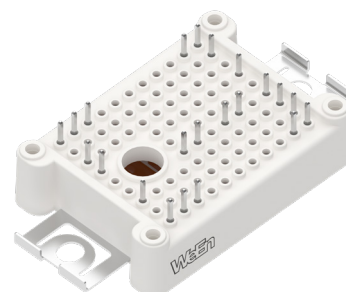


1. General description

WMG50S06B1S is a six-pack module consisting of six 50A, 650 V IGBTs with inverse diodes and an NTC thermistor, which excels in providing high current density. The integrated field stop trench IGBTs and FRDs provide lower conduction losses and switching losses, enabling designers to achieve high efficiency and superior reliability.



2. Features and benefits

- Six-pack topology
- Low switching losses
- Low Vcesat
- Compact design
- Solder pin
- Integrated NTC temperature sensor
- Al₂O₃ substrate with low thermal resistance

3. Applications

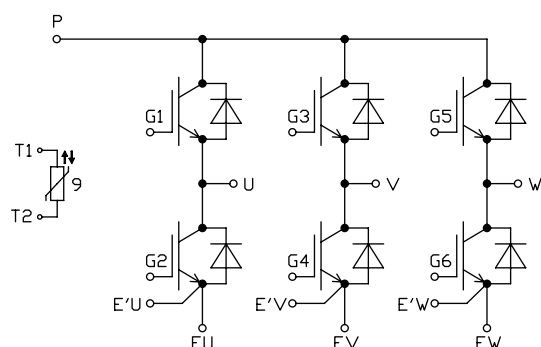
- Air Conditioning
- Motor Drives
- Servo Drives
- UPS Systems

4. Ordering information

Table 1. Ordering information

Type number	Package Name	Orderable part number	Packing method	Small packing quantity	Package version	Package issue date
WMG50S06B1S	WeEnPACK-B1	WMG50S06B1ST	Tray	16	WeEnPACK-B1PSB-A	28-Jun-2024

5. Circuit diagram



6. Limiting values

Table 2. Limiting values

Symbol	Parameter	Test Condition	Value	Unit
IGBT				
V_{CE}	Collector-emitter voltage		650	V
V_{GE}	Gate-emitter voltage		± 20	V
I_C	Continuous collector current	$T_C = 80\text{ }^{\circ}\text{C}$, limited by T_{jmax}	50	A
I_{Cpulse}	Pulsed collector current	tp limited by T_{jmax}	150	A
P_{tot}	Total power dissipation	$T_C = 80\text{ }^{\circ}\text{C}$	152	W
t_{sc}	Short circuit withstand time	$V_{GE} = 15\text{ V}$; $V_{CC} = 400\text{ V}$; $T_J = 150\text{ }^{\circ}\text{C}$	5	μs
T_{jmax}	Maximum junction temperature		175	$^{\circ}\text{C}$
Diode				
V_{RRM}	Diode repetitive peak reverse voltage		650	V
I_F	Diode continuous forward current	$T_C = 80\text{ }^{\circ}\text{C}$, limited by T_{jmax}	42	A
I_{FRM}	Diode repetitive peak forward current	tp limited by T_{jmax}	126	A
P_{tot}	Total power dissipation	$T_C = 80\text{ }^{\circ}\text{C}$	64	W
T_{jmax}	Maximum junction temperature		175	$^{\circ}\text{C}$

7. Module package thermal & insulation properties

Table 3. Thermal & Insulation properties

Symbol	Parameter	Test Condition	Value	Unit
V_{ISOL}	RMS isolation voltage	$T_J = 25\text{ }^{\circ}\text{C}$, all terminals shorted, $f = 50\text{ Hz}$, $t = 1\text{ min}$	2500	V
d_{Creep}	Creepage distance	terminal to heatsink	11.5	mm
d_{Clear}	Clearance	terminal to heatsink	10	mm
CTI	Comperative tracking index		> 200	
T_{stg}	Storage temperature		-40 to 125	$^{\circ}\text{C}$

8. Electrical characteristics

Table 4. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
IGBT characteristics						
V_{CEsat}	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}; I_C = 50\text{ A}; T_J = 25\text{ }^{\circ}\text{C}$	-	1.55	-	V
		$V_{GE} = 15\text{ V}; I_C = 50\text{ A}; T_J = 150\text{ }^{\circ}\text{C}$	-	2.0	-	V
$V_{GE(th)}$	Gate-emitter threshold voltage	$I_C = 0.5\text{ mA}; V_{CE} = V_{GE}; T_J = 25\text{ }^{\circ}\text{C}$	4	5	6	V
I_{CES}	Zero gate voltage collector current	$V_{CE} = 650\text{ V}; V_{GE} = 0\text{ V}; T_J = 25\text{ }^{\circ}\text{C}$	-	-	40	μA
I_{GES}	Gate leakage current	$V_{GE} = 20\text{ V}; V_{CE} = 0\text{ V}; T_J = 25\text{ }^{\circ}\text{C}$	-	-	400	nA
Q_G	Gate charge	$V_{CC} = 300\text{ V}; I_C = 50\text{ A}; V_{GE} = \pm 15\text{ V}$	-	204	-	nC
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}; V_{GE} = 0\text{ V}; f = 1\text{ MHz}; T_J = 25\text{ }^{\circ}\text{C}$	-	3477	-	pF
C_{oes}	Output capacitance		-	184	-	pF
C_{res}	Reverse transfer capacitance		-	44	-	pF
$t_{d(on)}$	Turn-on delay time	$T_J = 25\text{ }^{\circ}\text{C}$ $V_{CC} = 300\text{ V}; I_C = 50\text{ A}; V_{GE} = \pm 15\text{ V}; R_g = 10\text{ }\Omega$	-	30	-	nS
t_r	Rise time		-	29	-	nS
$t_{d(off)}$	Turn-off delay time		-	107	-	nS
t_f	Fall time		-	54	-	nS
E_{on}	Turn-on energy		-	0.56	-	mJ
E_{off}	Turn-off energy		-	0.69	-	mJ
$t_{d(on)}$	Turn-on delay time	$T_J = 150\text{ }^{\circ}\text{C}$ $V_{CC} = 300\text{ V}; I_C = 50\text{ A}; V_{GE} = \pm 15\text{ V}; R_g = 10\text{ }\Omega$	-	30	-	nS
t_r	Rise time		-	33	-	nS
$t_{d(off)}$	Turn-off delay time		-	120	-	nS
t_f	Fall time		-	81	-	nS
E_{on}	Turn-on energy		-	1	-	mJ
E_{off}	Turn-off energy		-	0.9	-	mJ
R_{thJC}	Thermal resistance, junction to case	per IGBT	-	0.46	-	K/W
T_{jop}	Operation temperature		-40	-	150	$^{\circ}\text{C}$
Inverter Diode characteristics						
V_F	Diode forward voltage	$I_F = 50\text{ A}; T_J = 25\text{ }^{\circ}\text{C}$	-	2.3	-	V
		$I_F = 50\text{ A}; T_J = 150\text{ }^{\circ}\text{C}$	-	1.9	-	V
Q_{rr}	Reverse recovery charge	$T_J = 25\text{ }^{\circ}\text{C}$ $V_R = 300\text{ V}; I_F = 50\text{ A};$ $di/dt = 500\text{ A}/\mu\text{s};$	-	341	-	nC
I_{rrm}	Peak reverse recovery current		-	10.5	-	A
E_{rr}	Reverse recovery energy		-	0.04	-	mJ
Q_{rr}	Reverse recovery charge	$T_J = 150\text{ }^{\circ}\text{C}$ $V_R = 300\text{ V}; I_F = 50\text{ A};$ $di/dt = 500\text{ A}/\mu\text{s};$	-	1488	-	nC
I_{rrm}	Peak reverse recovery current		-	18	-	A
E_{rr}	Reverse recovery energy		-	0.18	-	mJ
R_{thJC}	Thermal resistance, junction to case	per diode	-	0.9	-	K/W
T_{jop}	Operation temperature		-40	-	150	$^{\circ}\text{C}$

9. NTC - thermistor

Table 5. NTC - Thermistor

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
R ₂₅	Rated resistance	T _c = 25 °C	-	5000	-	Ω
R ₁₀₀		T _c = 100 °C	465±5%			Ω
B _{25/50}	B-value	$R_2=R_{25} \exp.[B_{25/50}(1/T_2-1(298.15K))]$	3380±5%			K

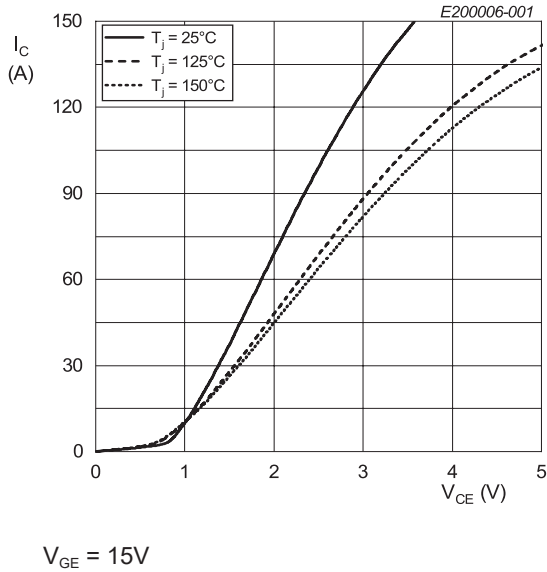


Fig. 1. IGBT typical output characteristics

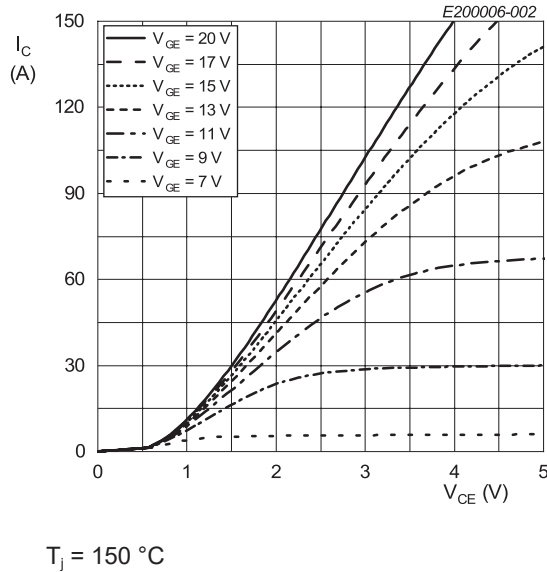


Fig. 2. IGBT typical output characteristics

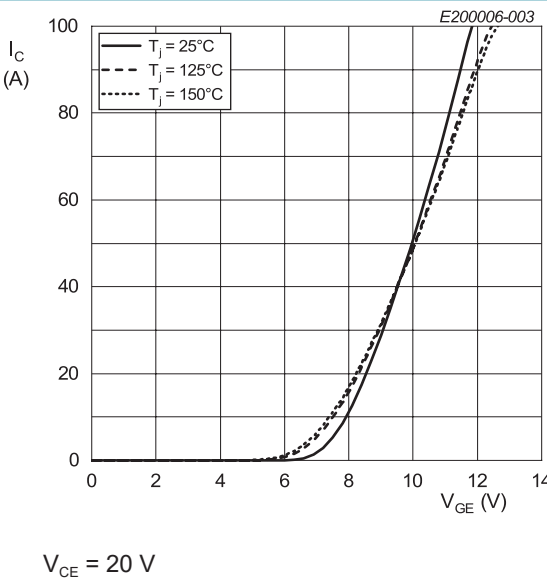


Fig. 3. IGBT typical transfer characteristics

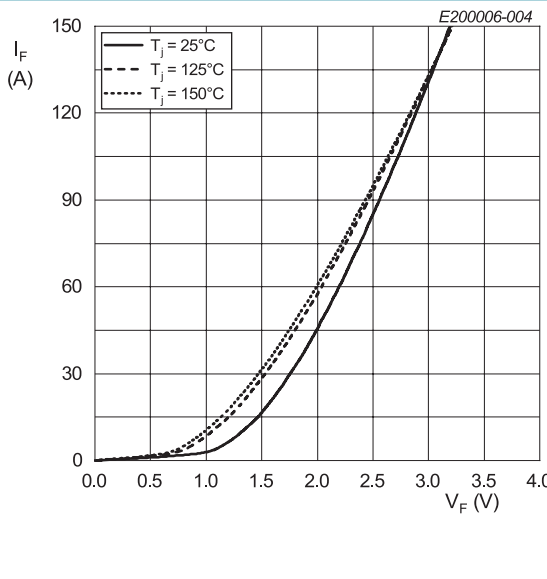
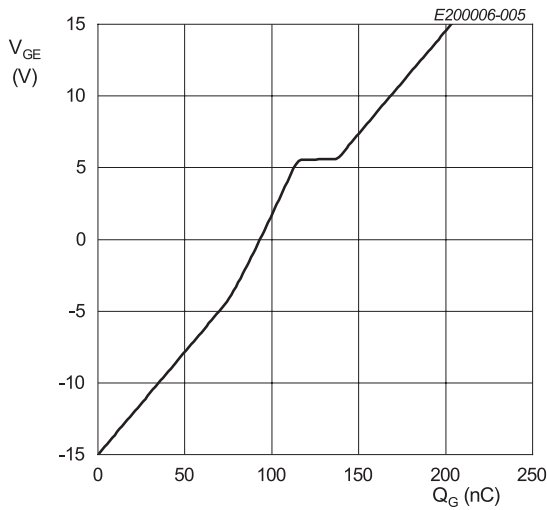
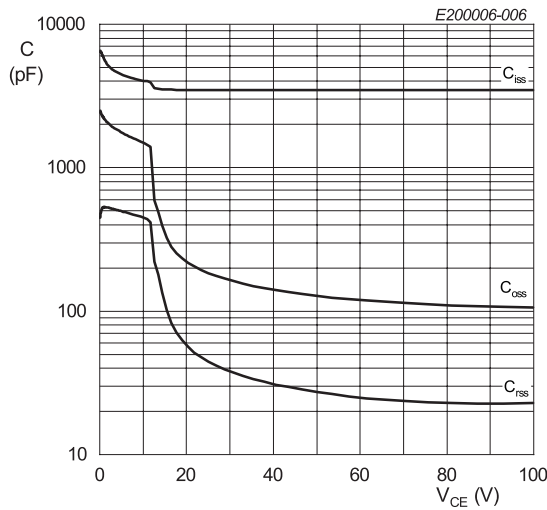


Fig. 4. Diode typical forward characteristics



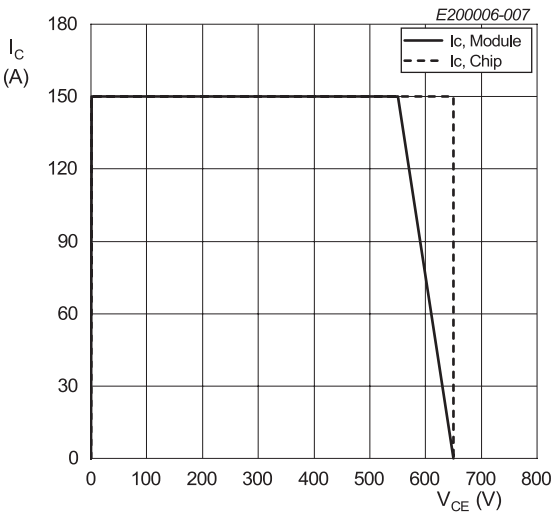
$I_C = 50\text{ A}$; $V_{CC} = 300\text{ V}$; $T_J = 25\text{ }^\circ\text{C}$

Fig. 5. Typical gate charge



$V_{GE} = 0$; $f = 1\text{ MHz}$; $T_J = 25\text{ }^\circ\text{C}$

Fig. 6. Typical capacitance as a function of collector emitter voltage



$R_g = 10\text{ }\Omega$; $V_{GE} = \pm 15\text{ V}$; $T_J = 150\text{ }^\circ\text{C}$

Fig. 7. Reverse bias safe operating area

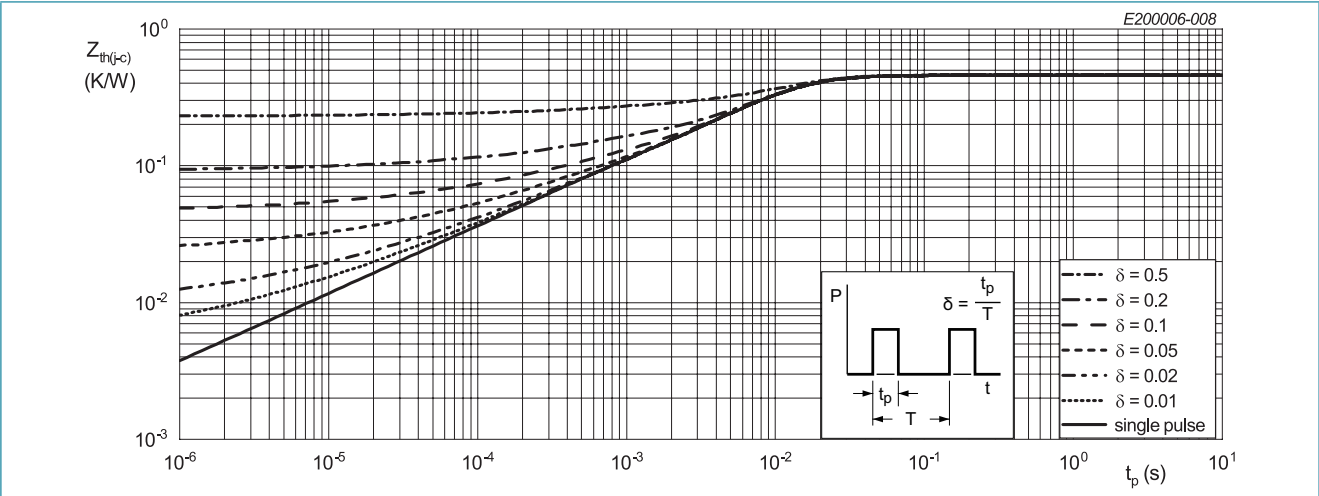


Fig. 8. Typical Transient thermal impedance IGBT

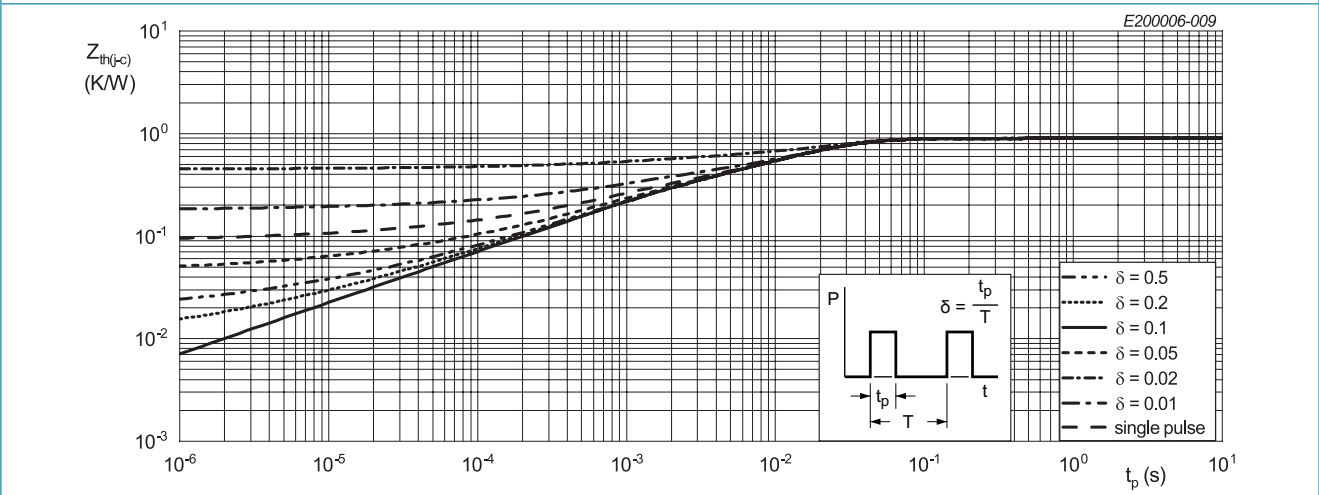
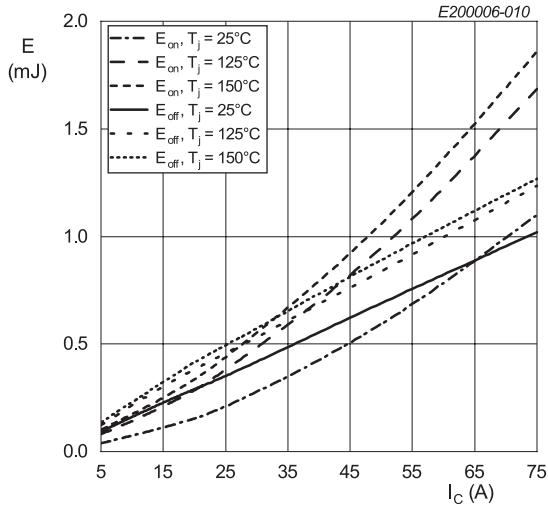
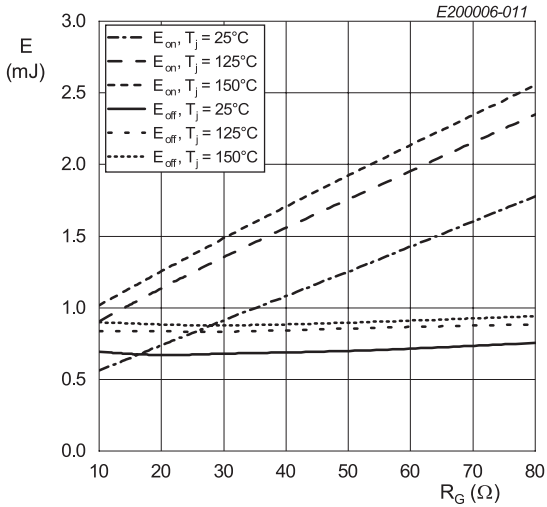


Fig. 9. Typical Transient thermal impedance Diode



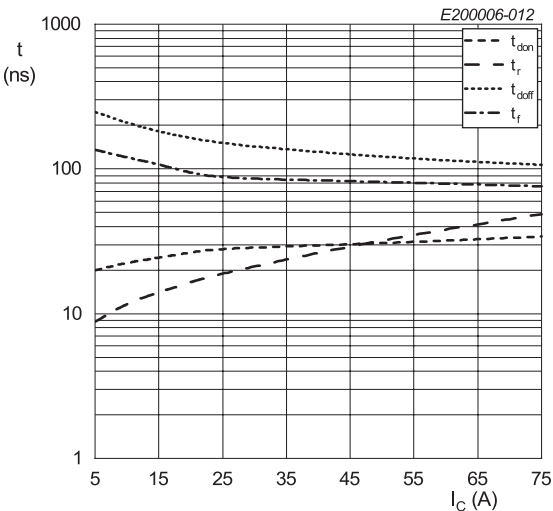
$R_g = 10\ \Omega$; $V_{GE} = \pm 15\text{V}$;
 $V_{CE} = 300\text{V}$; inductive load

Fig. 10. Typical switching energy loss as a function of collector current



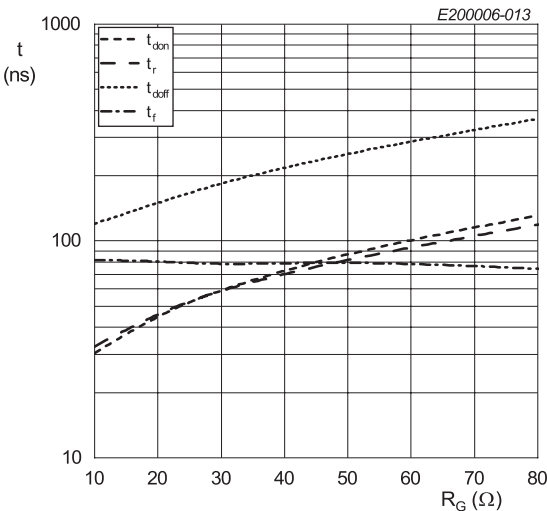
$I_C = 50\text{A}$; $V_{GE} = \pm 15\text{V}$;
 $V_{CE} = 300\text{V}$; inductive load

Fig. 11. Typical switching energy loss as a function of gate resistance



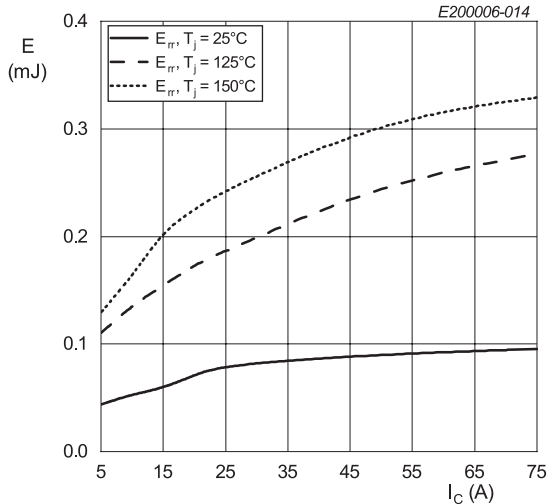
$R_g = 10\ \Omega$; $V_{GE} = \pm 15\text{V}$; $T_j = 150^\circ\text{C}$;
 $V_{CE} = 300\text{V}$; inductive load

Fig. 12. Typical switching times as a function of collector current



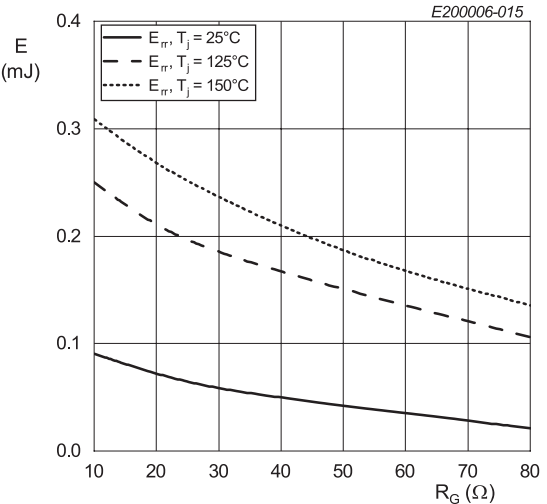
$I_C = 50\text{A}$; $V_{GE} = \pm 15\text{V}$; $T_j = 150^\circ\text{C}$;
 $V_{CE} = 300\text{V}$; inductive load

Fig. 13. Typical switching times as a function of gate resistance



$R_g = 10\ \Omega$; $V_{CE} = 300\ \text{V}$;
inductive load

Fig. 14. Typical reverse recovered energy loss as a function of collector current



$I_F = 50\ \text{A}$; $V_{CE} = 300\ \text{V}$;
inductive load

Fig. 15. Typical reverse recovered energy loss as a function of gate resistance

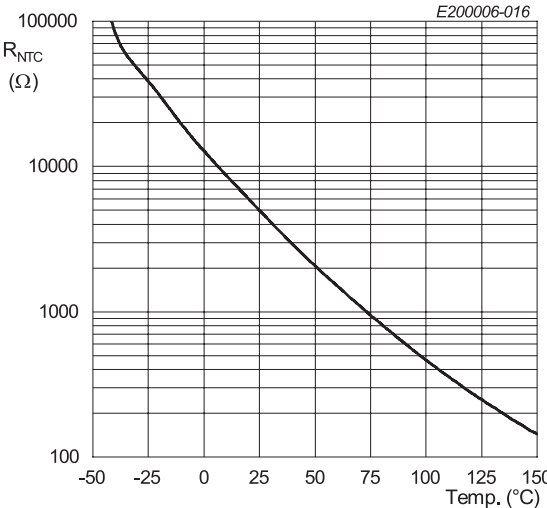
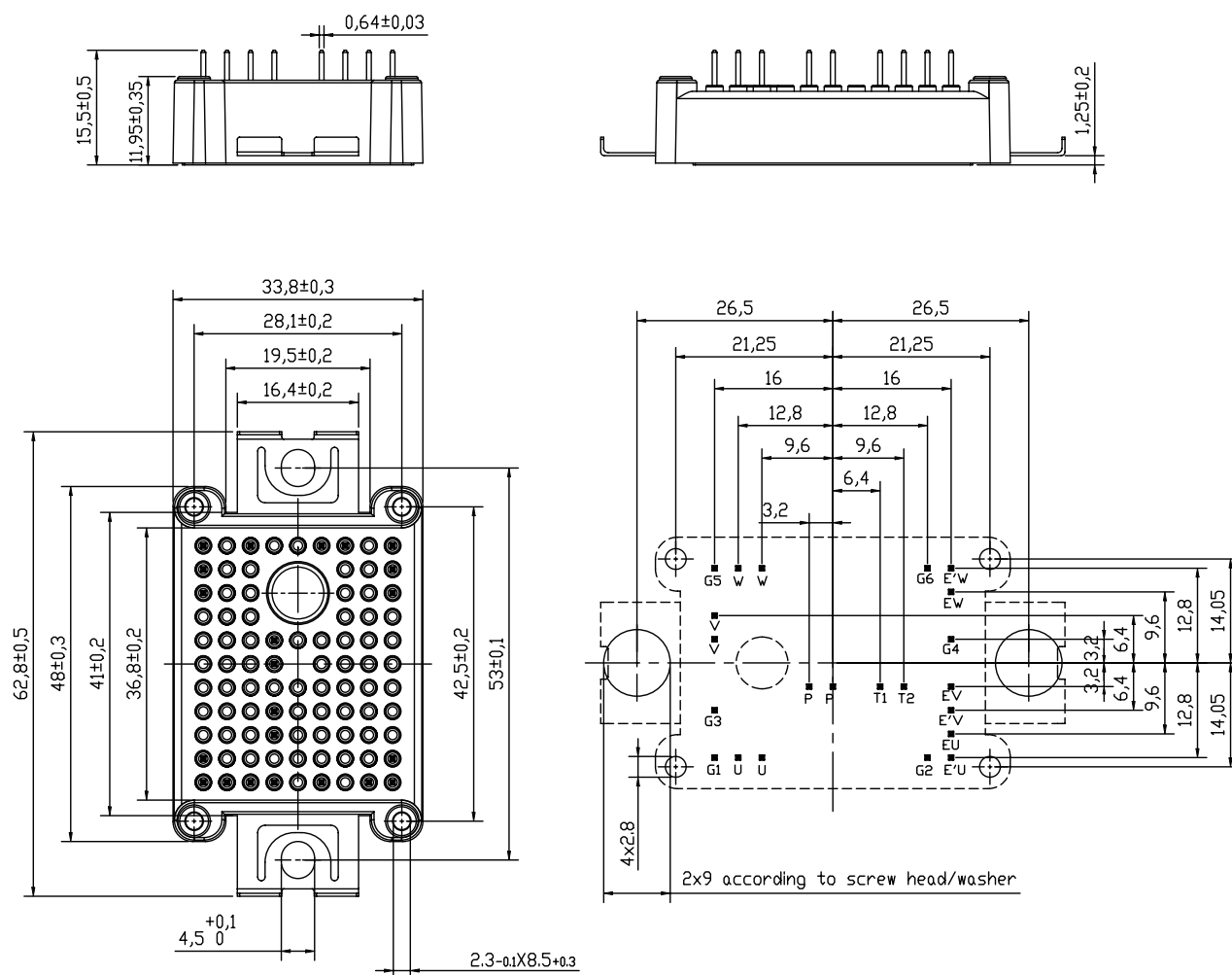


Fig. 16. Typical NTC characteristic as a function of temperature

10. Package outline

WeEnPACK-B1PSB-A

Package Outline



11. Legal information

Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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- [2] The term 'short data sheet' is explained in section "Definitions".
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