WG25R135W1

IGBT

Rev.01 - 06 September 2024 Product data sheet

1. General description

WG25R135W1 uses advanced Fine Trench Field-stop technology IGBT with monolithic body diode in TO-247 package. This device is part of Reverse-Conducting of IGBTs, which represents an optimum compromise between conduction and switching losses to maximize the efficiency for soft commutation.

2. Features and benefits

- Reverse Conducting IGBT with Monolithic Body Diode
- Maximum Junction Temperature 175 °C
- Low Conduction Losses
- Positive Temperature efficient for Easy Parallel Operating
- EMI Improved Design

3. Applications

- Microwave ovens
- Induction heating
- Resonant converters
- Soft switching applications

4. Quick reference data

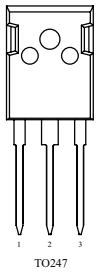
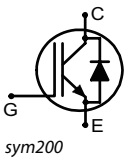
Table 1. Quick reference data

Symbol	Parameter	Notes	Value	Unit
V_{CE}	Collector-emitter voltage, $T_j \geq 25$ °C		1350	V
I_C	DC collector current, limited by $T_{j(max)}$ $T_C = 100$ °C		25	A

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15$ V; $I_C = 25$ A; $T_j = 25$ °C		-	1.85	2.4	V

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 TO247	 sym200
2	C	collector		
3	E	emitter		
mb	C	mounting base; connected to collector		

6. Ordering information

Table 3. Ordering information

Type number	Package Name	Orderable part number	Packing method	Small packing quantity	Package version	Package issue date
WG25R135W1	TO247	WG25R135W1Q	Tube	30	TO247P	09-Mar-2023

7. Marking

Table 4. Marking codes

Type number	Marking codes
WG25R135W1	G25R135 W1

8. Limiting values

Table 5. Limiting values

Symbol	Parameter	Notes	Value	Unit
V_{CE}	Collector-emitter voltage, $T_j \geq 25$ °C		1350	V
I_C	DC collector current, limited by $T_{j(max)}$ $T_C = 25$ °C $T_C = 100$ °C		 50 25	A
$I_{C(puls)}$	Pulsed collector current, t_p limited by $T_{j(max)}$		75	A
I_{CSM}	Non repetitive peak collector current[(1)]		200	A
-	Turn off safe operating area $V_{CE} \leq 1350$ V, $T_j \leq 175$ °C, $t_p = 1$ µs		75	A
I_F	Diode forward current, limited by $T_{j(max)}$ $T_C = 25$ °C $T_C = 100$ °C		 50 25	A
I_{Fpuls}	Diode pulsed current, t_p limited by $T_{j(max)}$		75	A
V_{GE}	Gate-emitter voltage		±25	V
P_{tot}	Power dissipation $T_C = 25$ °C Power dissipation $T_C = 100$ °C		300 150	W
T_{stg}	Storage temperature		-55 to +150	°C
T_{jmax}	Maximum operating junction temperature		175	°C
-	Peak soldering temperture		260	°C
M	Mounting Torque with washer		0.55	Nm

[(1)] capacitor charging saturation current limited by Tjmax < 175°C and tp < 3µs

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
$R_{th(j-c)}$	IGBT thermal resistance from junction to case			-	0.5	-	K/W
$R_{th(j-c)}$	Diode thermal resistance from junction to case			-	0.5	-	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient			-	40	-	K/W

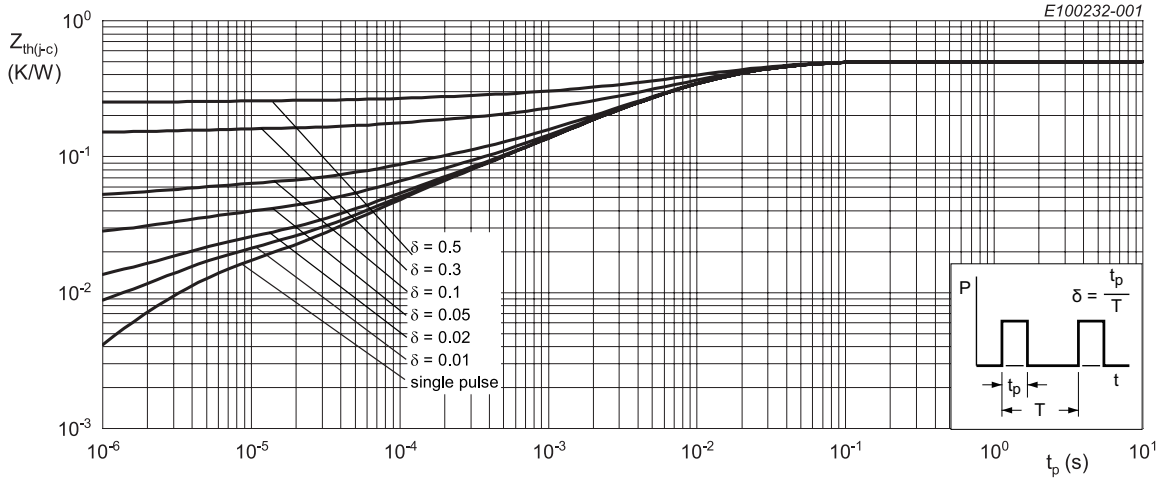


Fig. 1. Transient thermal impedance from junction to case as a function of pulse duration; IGBT

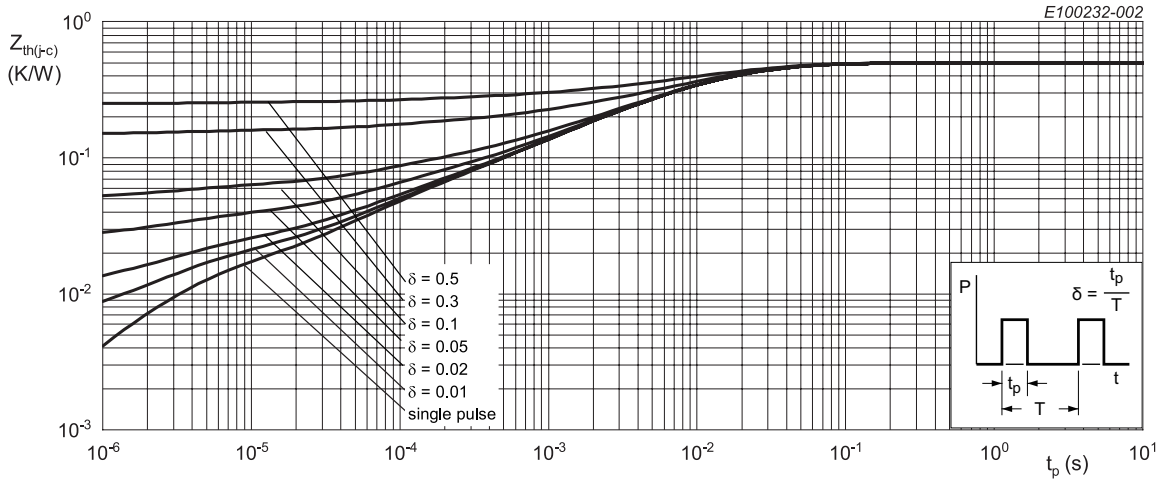


Fig. 2. Transient thermal impedance from junction to case as a function of pulse duration; Diode

10. Characteristics

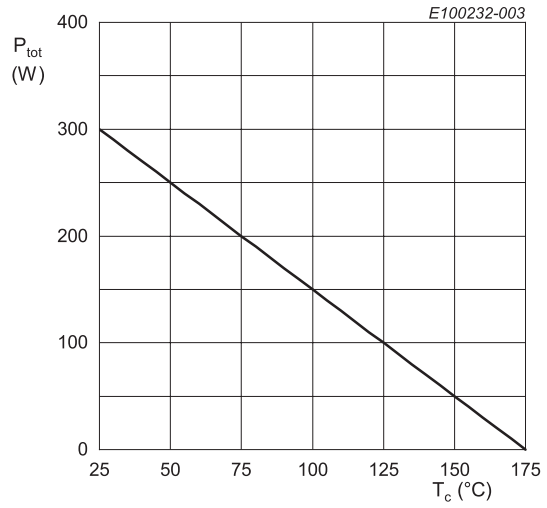
Table 7. Characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
BV_{CES}	Collector-emitter breakdown voltage	V_{GE} = 0 V; I_C = 1 mA		1350	-	-	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V; I_C = 25 A; T_j = 25 °C		-	1.85	2.4	V
		V_{GE} = 15 V; I_C = 25 A; T_j = 175 °C		-	2.45	-	V
V_F	Diode forward voltage	V_{GE} = 0 V; I_F = 25 A; T_j = 25 °C		-	2.1	-	V
		V_{GE} = 0 V; I_F = 25 A; T_j = 175 °C		-	2.45	-	V
$V_{GE(th)}$	Gate-emitter threhold voltage	I_C = 0.5 mA; V_{CE} = V_{GE}		4.5	5.5	6.5	V
I_{CES}	Zero gate voltage collector current	V_{CE} = 1350 V; V_{GE} = 0 V; T_j = 25 °C		-	-	100	μA
		V_{CE} =1350 V;V_{GE} = 0 V; T_j = 175 °C		-	0.6	-	mA
g_{fs}	Transconductance	V_{CE} = 20 V; I_C = 25 A		-	21	-	S
Dynamic characteristics							
C_{ies}	Input capacitance	V_{CE} = 30 V; V_{GE} = 0 V; f = 1 MHz; T_j = 25 °C		-	2187	-	pF
C_{oes}	Output capacitance			-	42	-	pF
C_{res}	Reverse transfer capacitance			-	22	-	pF
Q_G	Gate charge	V_{CC} = 1080 V; I_C = 25 A; V_{GE} = 15 V; T_j = 25 °C		-	98	-	nC

11. Switching Characteristics

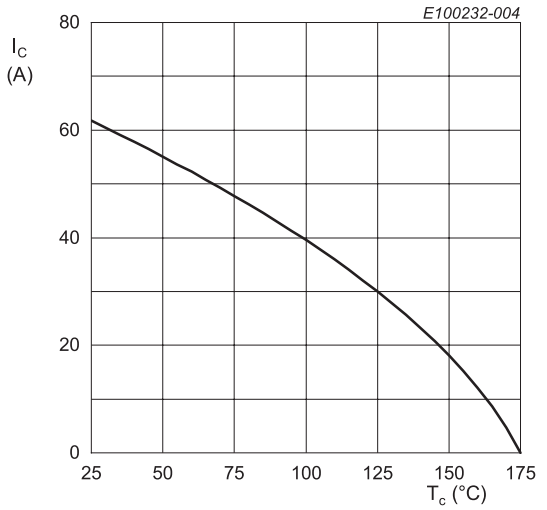
Table 8. Switching Characteristics, Inductive Load

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
IGBT characteristics							
$t_{d(off)}$	Turn-off delay time	T_j = 25 °C; I_C = 25 A; V_{GE} = 15V / 0V; R_G = 10 Ω; C_r = 300 nF; R = 2 Ω		-	89	-	nS
t_f	Fall time			-	69	-	nS
E_{off}	Turn-off energy			-	78	-	uJ
$t_{d(off)}$	Turn-off delay time	T_j = 175 °C; I_C = 25 A; V_{GE} = 15V / 0V; R_G = 10 Ω; C_r = 300 nF; R = 2 Ω		-	98	-	nS
t_f	Fall time			-	85	-	nS
E_{off}	Turn-off energy			-	167	-	uJ



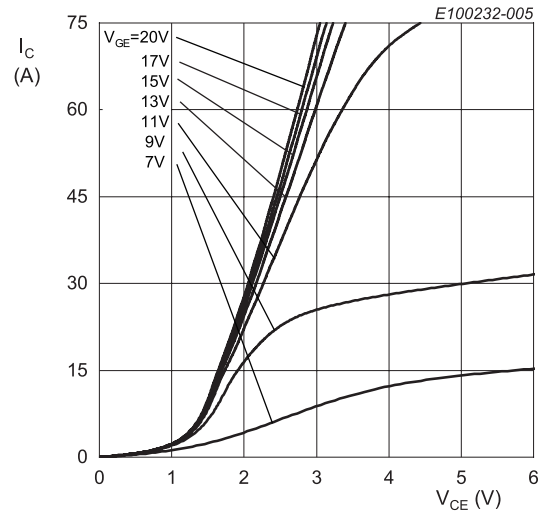
$T_j \leq 175$ °C

Fig. 3. Power dissipation as a function of case temperature



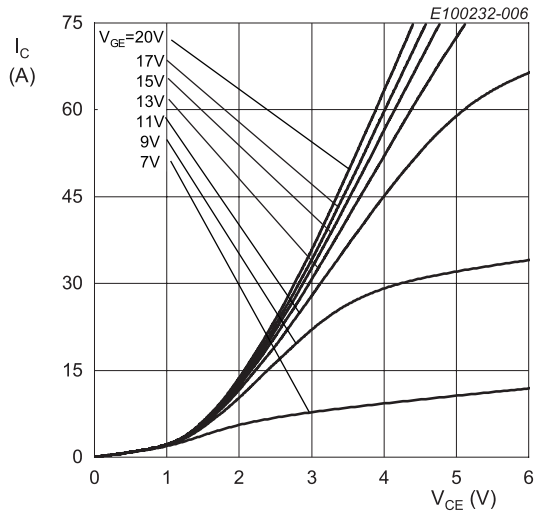
$V_{GE} \geq 15$ V; $T_j \leq 175$ °C

Fig. 4. Collector current as a function of case temperature



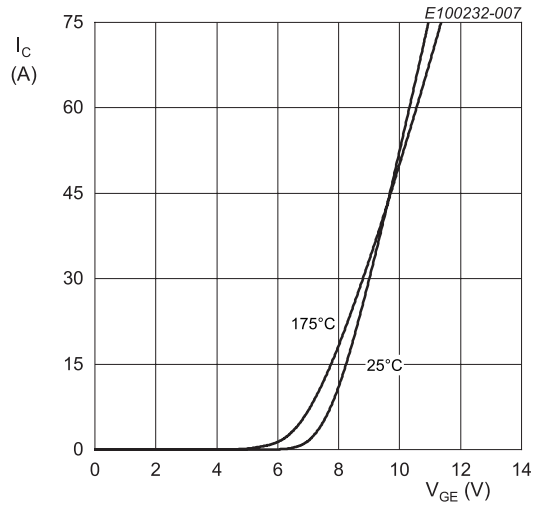
$T_j = 25$ °C

Fig. 5. Typical output characteristic



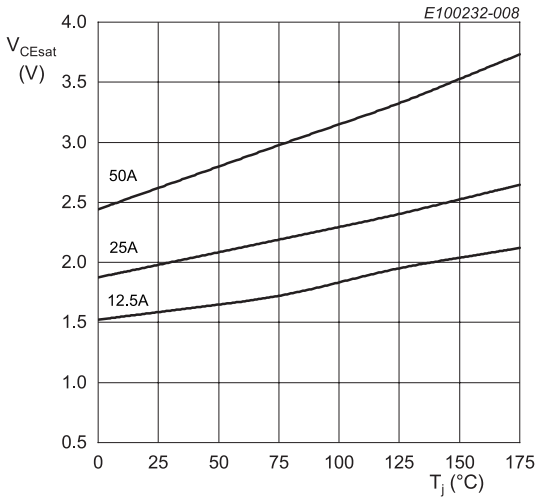
$T_j = 175$ °C

Fig. 6. Typical output characteristic



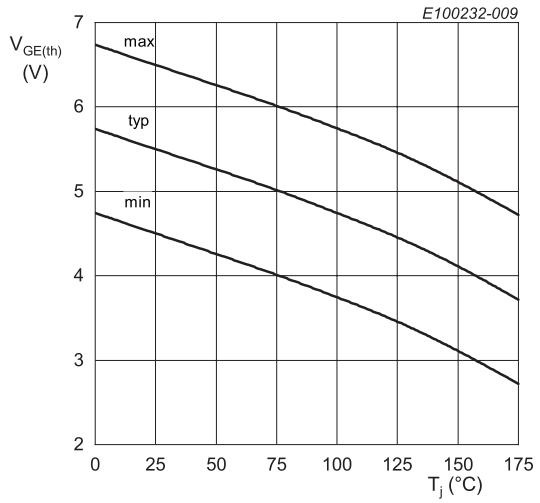
V_{CE} = 20 V

Fig. 7. Typical transfer characteristic



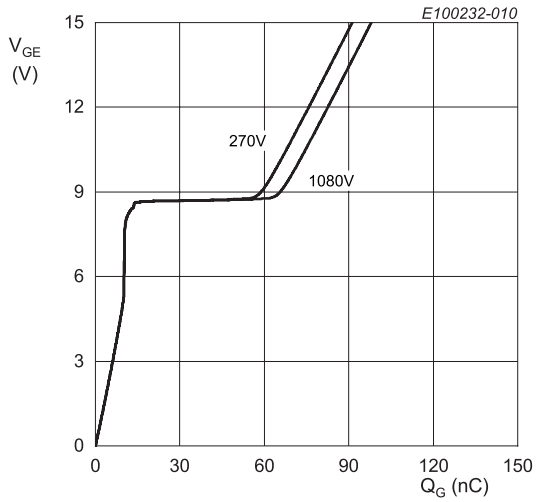
V_{GE} = 15 V

Fig. 8. Typical collector-emitter saturation voltage as a function of junction temperature



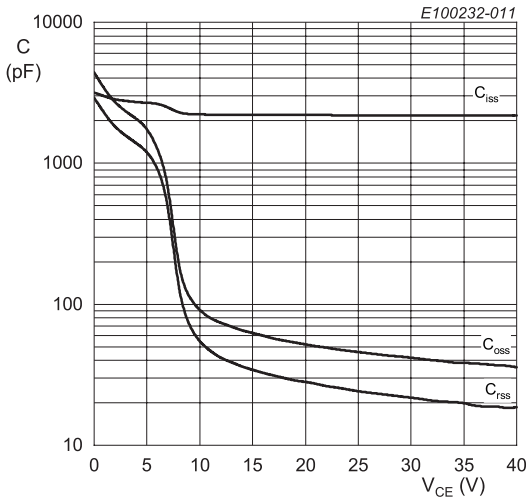
I_C = 500 µA

Fig. 9. Gate-emitter threshold voltage as a function of junction temperature



I_C = 25 A

Fig. 10. Typical gate charge



V_{GE} = 0 V; f = 1 MHz

Fig. 11. Typical capacitance as a function of collector-emitter voltage

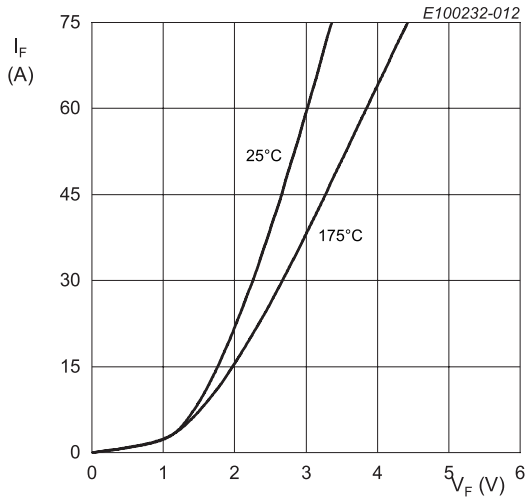
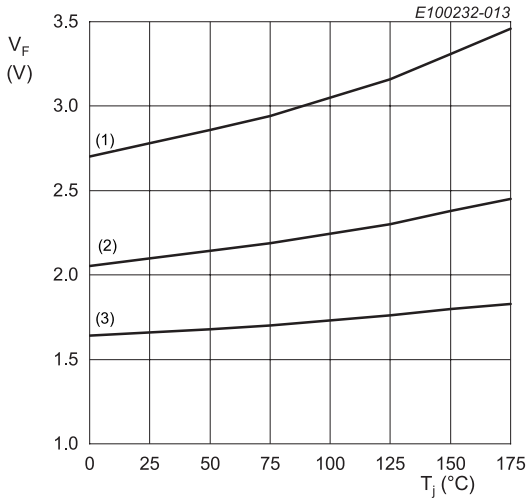
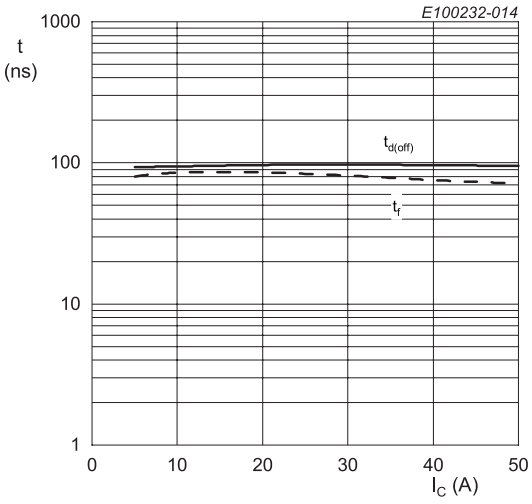


Fig. 12. Typical diode forward current as a function of forward voltage



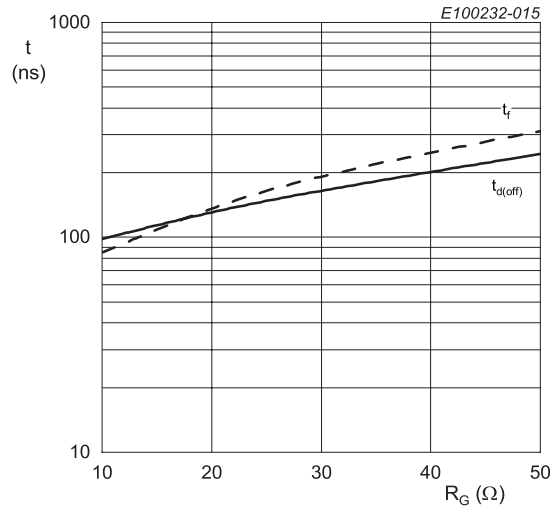
(1) I_F = 50 A
(2) I_F = 25 A
(3) I_F = 12.5 A

Fig. 13. Typical diode forward voltage as a function of junction temperature



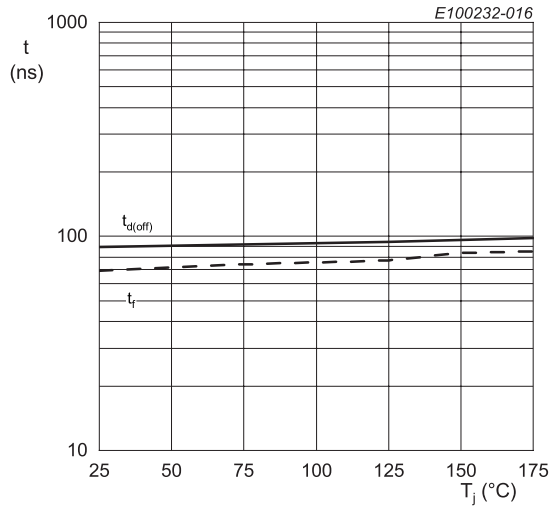
T_j = 175 °C; V_{GE} = 15V/0V; R_g = 10 Ω; C_r = 300 nF

Fig. 14. Typical switching times as a function of collector current



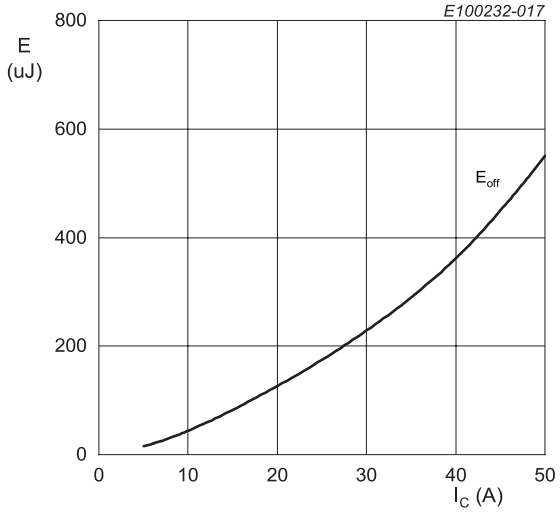
I_C = 25 A; T_j = 175 °C; V_{GE} = 15V/0V;
C_r = 300 nF

Fig. 15. Typical switching times as a function of gate resistance



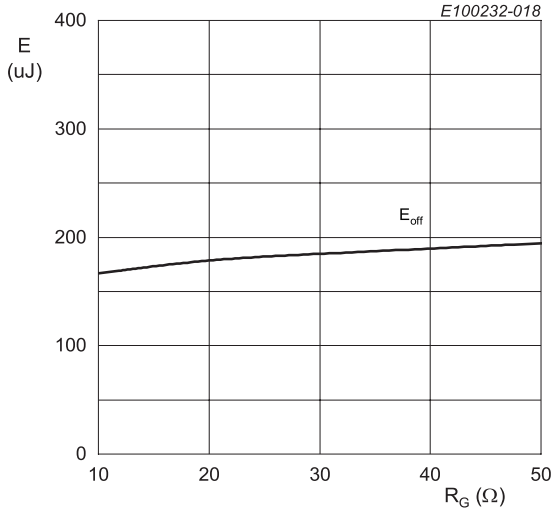
I_C = 25 A; V_{GE} = 15V/0V; R_g = 10 Ω;
C_r = 300 nF

Fig. 16. Typical switching times as a function of junction temperature



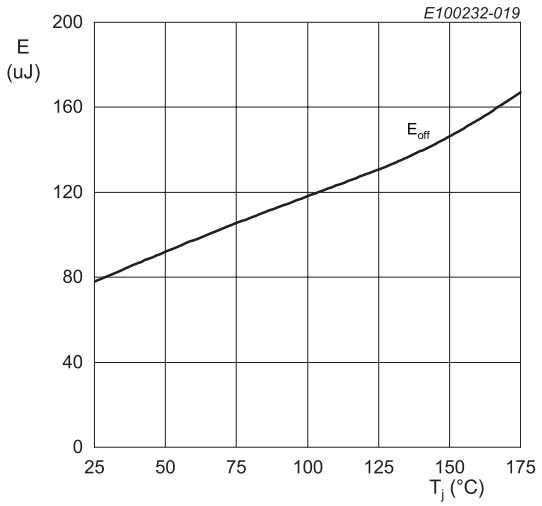
T_j = 175 °C; V_{GE} = 15V/0V; R_g = 10 Ω;
C_r = 300 nF

Fig. 17. Typical switching energy losses as a function of collector current



I_C = 25 A; T_j = 175 °C; V_{GE} = 15V/0V;
C_r = 300 nF

Fig. 18. Typical switching energy losses as a function of gate resistance



I_C = 25 A; V_{GE} = 15V/0V; R_g = 10 Ω;
C_r = 300 nF

Fig. 19. Typical switching energy losses as a function of junction temperature

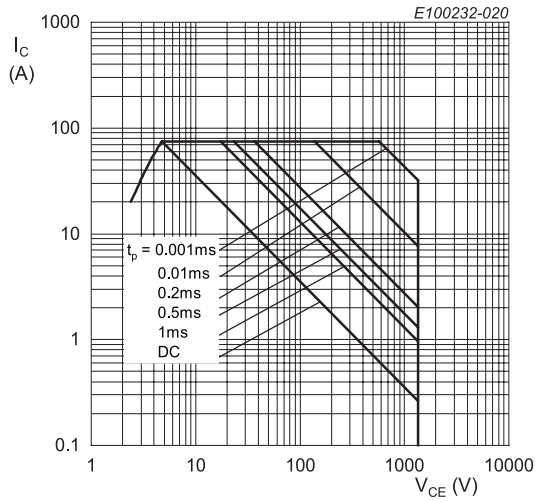
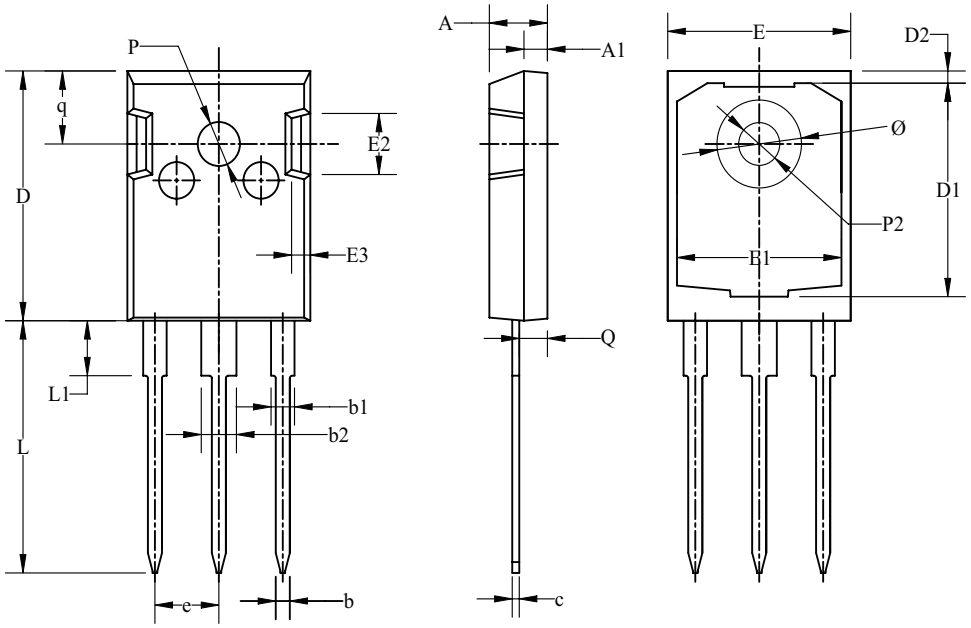


Fig. 20. Forward bias safe operating area

12. Package outline

Plastic single-ended through-hole package; headsink mounted; 1 mounting hole; 3 leads TO-247 TO247



Dim	All Dimensions in Millimeters		
	Min	Typ	Max
A	4.70	4.95	5.20
A1	1.90	2.00	2.10
b	1.00	1.20	1.40
b1	1.80	2.00	2.20
b2	2.80	3.00	3.20
c	0.50	0.60	0.70
D	20.30	20.45	20.60
D1	17.28	17.48	17.68
D2	0.80	1.00	1.20
E	15.45	15.60	15.75
E1	13.82	14.02	14.22
E2	4.80	5.00	5.20
E3	1.40	1.60	1.80
e	5.45 BSC		
L	20.40	20.65	20.90
L1	4.25	4.50	4.75
P2	3.40	3.50	3.60
P	3.50	3.60	3.70
Q	2.20	2.40	2.60
q	5.78	5.98	6.18
Ø	7.10	7.19	7.30

13. Dynamic test circuit, waveforms and definition

Dynamic test circuit, waveforms and definition

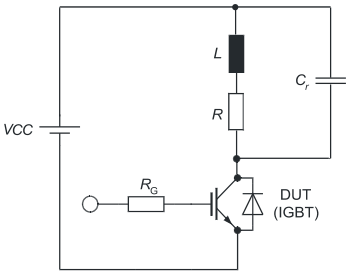


Figure A: Dynamic test circuit (Resonant capacitor, C_r; Damping resistor, R)

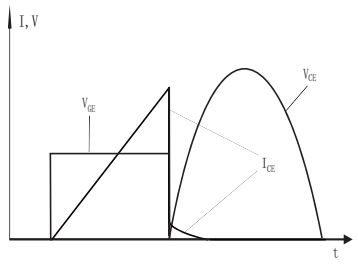
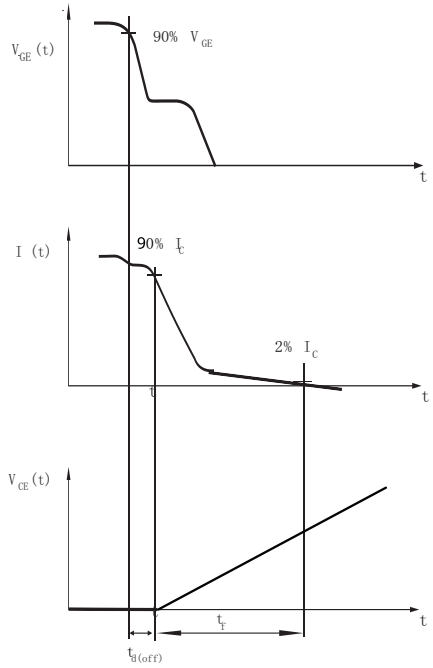


Figure B: Typical switching behavior in resonant applications



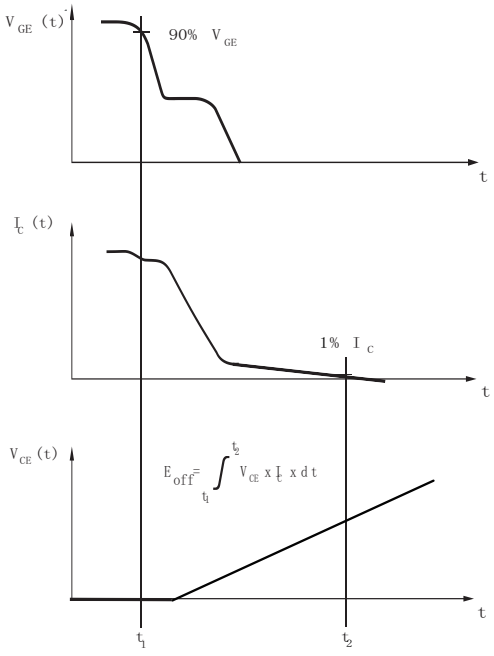


Figure C: Definition of switching time and losses

14. 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.

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
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15. Contents

For more information, please visit: http://www.ween-semi.com
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