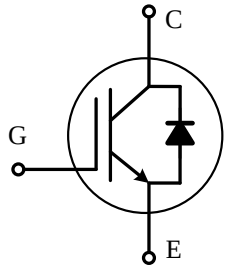
YGW40N65USA1

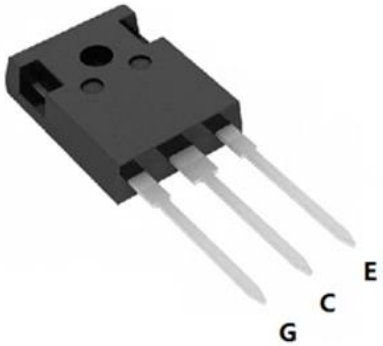
650V 40A Trench Field Stop IGBT

V_{CE}	**650**	**V**
I_C	**40**	**A**
$V_{CE(sat)}$ I_C=40A	**1.7**	**V**

FEATURES

- High breakdown voltage to 650V for improved reliability
- Trench-Stop Technology offering :
  - Very tight parameter distribution
  - High ruggedness, temperature stable behavior
  - High speed switching
  - Low switching losses
  - Low V_{CEsat}
  - Easy parallel switching capability due to positive temperature coefficient in V_{CEsat}
- Converter with high switching frequency





APPLICATION

- Inverter
- Uninterrupted Power Supply
- EV-Charging
- Welding Converters
- PFC applications

Product	Package	Packaging
YGW40N65USA1	TO247	Tube

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Breakdown Voltage, T_j ≥25℃	V_{CE}	650	V
DC collector current, limited by T_{jmax} T_C = 25°C T_C = 100°C	I_C	 80 40	A
Diode Forward current, limited by T_{jmax} T_C = 25°C T_C = 100°C	I_F	 80 40	A
Continuous Gate-emitter voltage	V_{GE}	±20	V
Transient Gate-emitter voltage (t_p≤10μs,D＜0.01)	V_{GE}	±30	V
Turn off safe operating area V_{CE} ≤650V, T_j ≤ 175°C, t_p = 1μs	-	120	A
Pulsed Collector Current, V_{GE} =15V, t_p limited by T_{jmax}	I_{CM}	120	A
Diode Pulsed Current, t_p limited by T_{jmax}	I_{Fpuls}	120	A
Power dissipation , T_C=25°C	P_{tot}	250	W
Power dissipation , T_C=100°C		125	
Max. Junction Temperature	$T_{J,max}$	175	°C
Operating junction temperature	$T_{J,op}$	-40...+175	°C
Storage temperature	T_{stg}	-55...+150	°C
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s	-	260	°C
Mounting torque, M3 screw Maximum of mounting processes: 3	M	0.6	Nm

Thermal Resistance

Parameter	Symbol	Max. Value	Unit
IGBT thermal resistance,junction - case	$R_{θ(j-c)}$	0.6	K/W
Diode thermal resistance,junction - case	$R_{θ(j-c)}$	1.1	K/W
Thermal resistance,junction - ambient	$R_{θ(j-a)}$	40	K/W

Electrical Characteristics of the IGBT（T_j= 25℃ unless otherwise specified）：

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Static						
Collector-Emitter breakdown voltage	BV_{CES} ①	V_{GE}=0V , I_C=250μA	650	-	-	V
Gate threshold voltage	$V_{GE(th)}$	V_{GE}=V_{CE}, I_C=250μA	3.9	4.7	5.5	V
Collector-Emitter Saturation voltage	$V_{CE(sat)}$	V_{GE}=15V, I_C=40A T_j = 25°C T_j = 175°C	 - -	 1.7 2.2	 2.2 -	V
Zero gate voltage collector current	I_{CES}	V_{CE}=650V, V_{GE}=0V T_j = 25°C T_j = 175°C	 - -	 - -	 40 3000	μA
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=± 20V	-	-	400	nA
Transconductance	g_{fs}	V_{CE}=20V, I_C=40A	-	33	-	S

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Dynamic						
Input capacitance	C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz	-	2510	-	pF
Output capacitance	C_{oes}		-	124	-	
Reverse transfer capacitance	C_{res}		-	22	-	
Gate charge total	Q_g	V_{CC} = 520V, I_C =40A, V_{GE} = 15V	-	90	-	nC
Gate to emitter charge	Q_{ge}		-	18	-	
Gate to collector charge	Q_{gc}		-	40	-	
Internal Gate Resistance	$R_{G,int}$	f = 1 MHz	-	3.8	-	Ω

Note：

① BVces testing without filter could damage the device. BVces is guaranteed by Ices@650V test.

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Dynamic						
Turn-on Delay Time	$t_{d(on)}$	T_j=25°C , V_{CE} = 400V, I_C = 40A, V_{GE} = 0/15V, R_g=5Ω	-	13	-	ns
Rise Time	t_r		-	87	-	ns
Turn-off Delay Time	$t_{d(off)}$		-	69	-	ns
Fall Time	t_f		-	62	-	ns
Turn-on Energy	E_{on}		-	1.5	-	mJ
Turn-off Energy	E_{off}		-	0.4	-	mJ

Electrical Characteristics of the DIODE

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_{FM}	I_F =40A T_j=25℃ T_j=175℃	-	 1.8 1.6	-	V
Reverse Recovery Time	T_{rr}	T_j=25℃ I_F= 40A, V_R = 400V, di_F/dt =610A/μs	-	65	-	ns
Reverse Recovery Current	I_{rr}		-	10	-	A
Reverse Recovery Charge	Q_{rr}		-	0.4	-	μC

Fig. 1 Output characteristic V_{CE} vs. I_C at 25℃

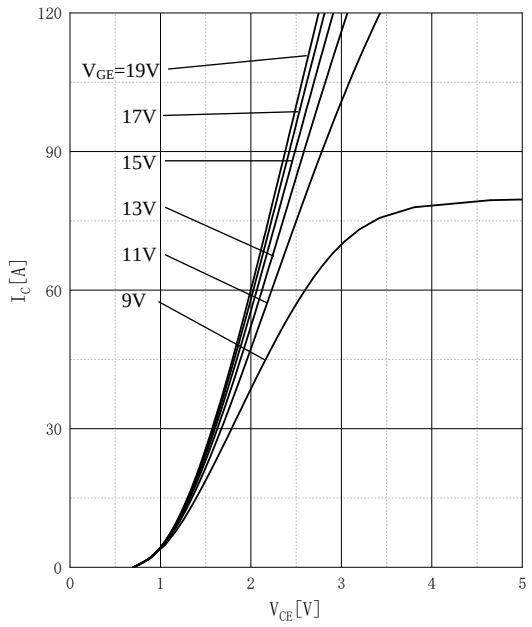


Fig. 2 Output characteristic V_{CE} vs. I_C at 175℃

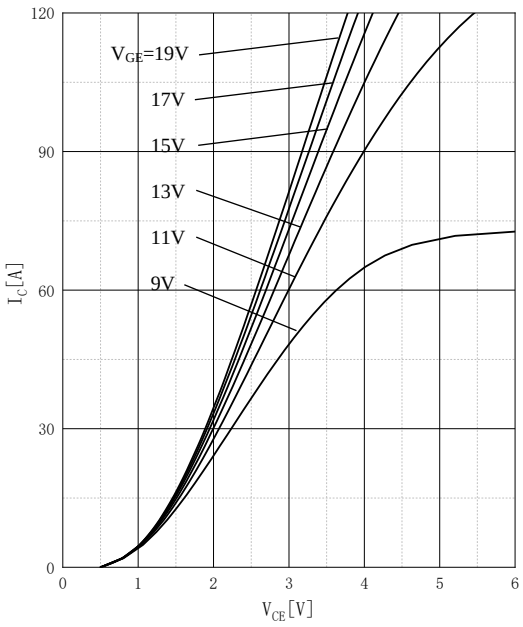


Fig. 3 Transfer characteristic V_{GE} vs. I_C

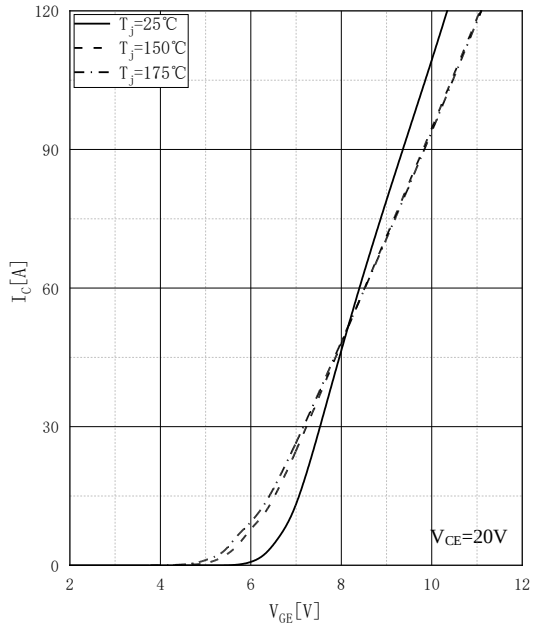


Fig. 4 Collector-emitter saturation voltage as a function of junction temperature V_{CEsat} vs. T_j

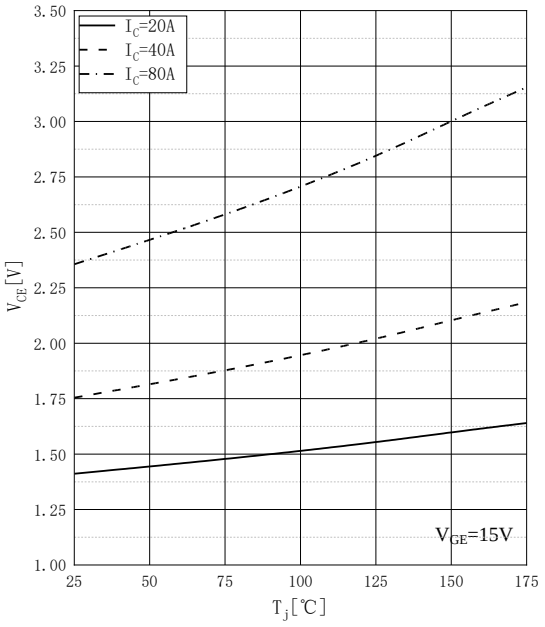


Fig. 5 Gate-emitter threshold voltage as a function of junction temperature $V_{GE(th)}$ vs. T_j

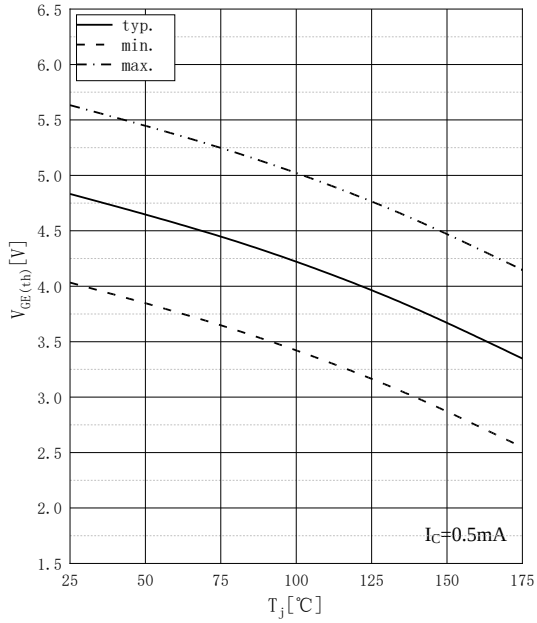


Fig. 6 Gate charge Q_G

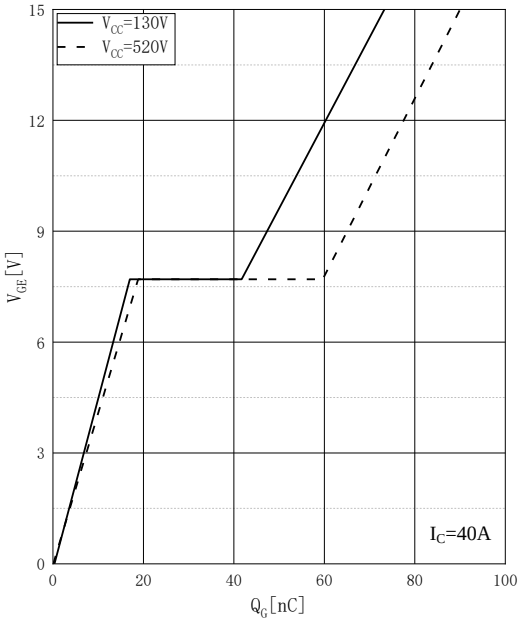


Fig. 7 Capacitance characteristic

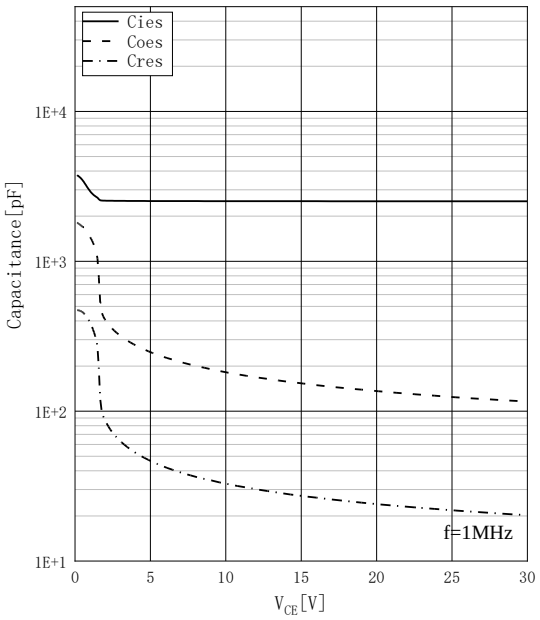


Fig. 8 Diode forward current as a function of forward voltage V_F vs. I_F

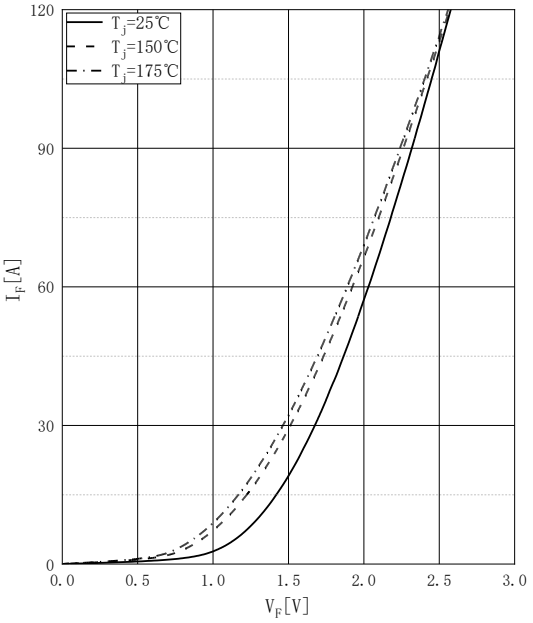


Fig. 9 Diode forward voltage as a function of junction temperature V_F vs. T_j

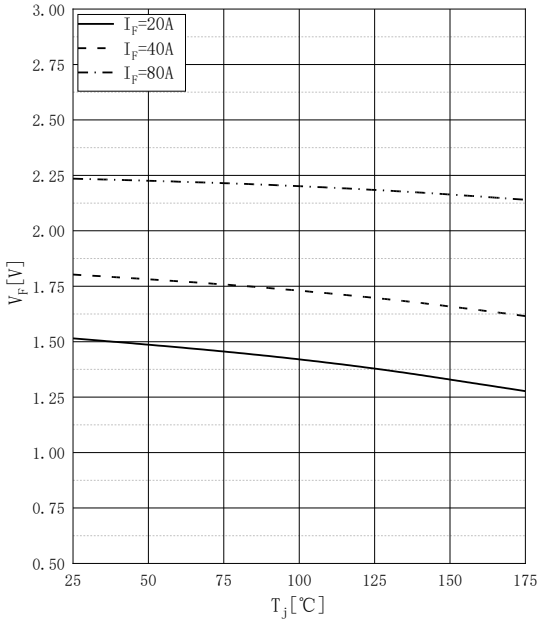


Fig. 10 Switching times vs. Collector current I_C

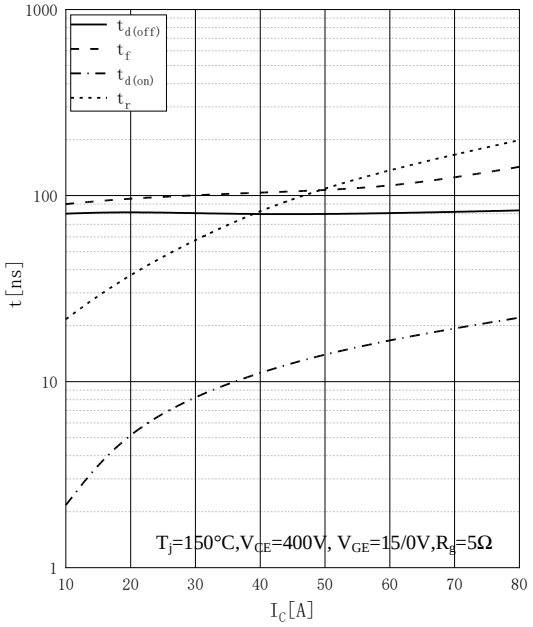


Fig. 11 Switching times vs. Gate resistor R_g

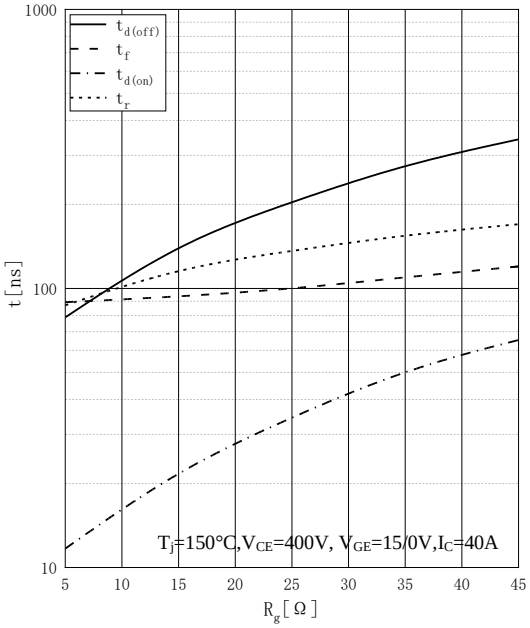


Fig. 12 Switching times vs. Junction temperature T_j

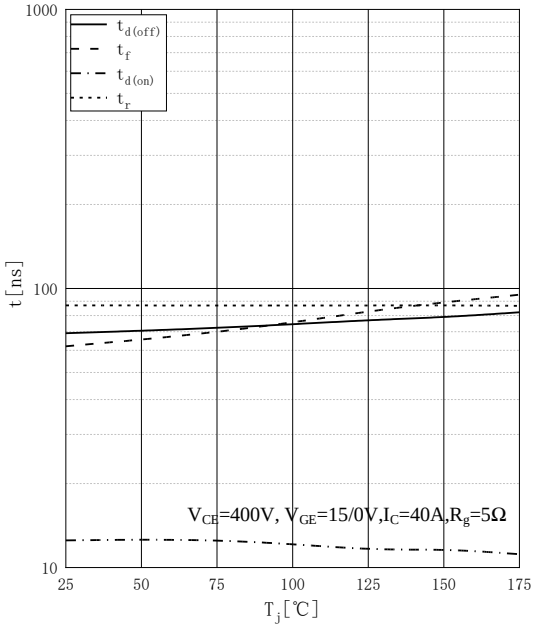


Fig. 13 Switching energy loss vs. Collector current I_C

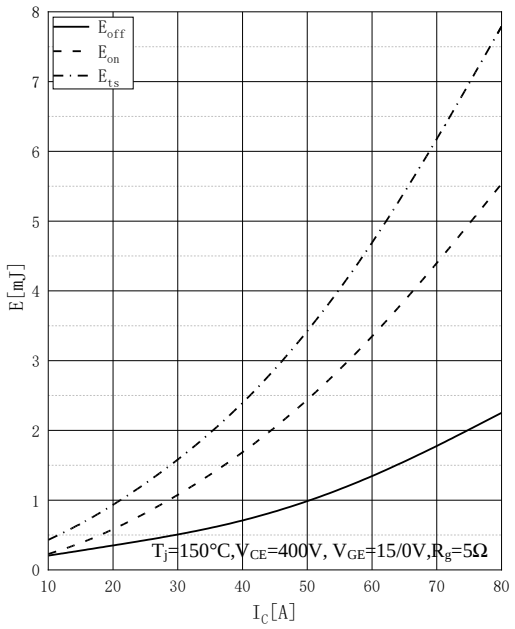


Fig. 14 Switching energy loss vs. Gate resistor R_g

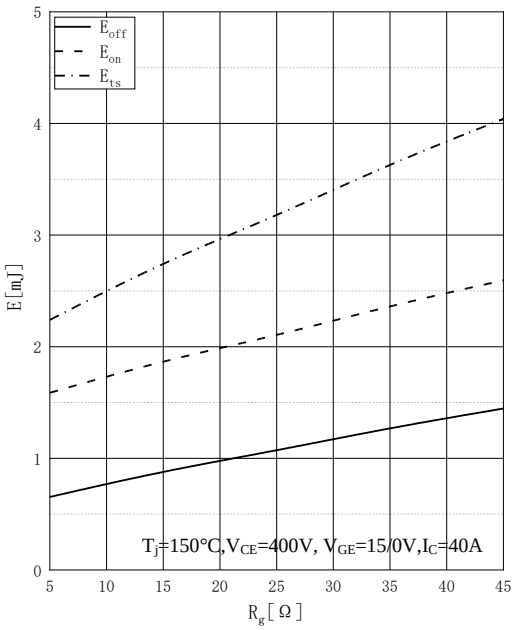


Fig. 15 Switching energy loss vs. Junction temperature T_j

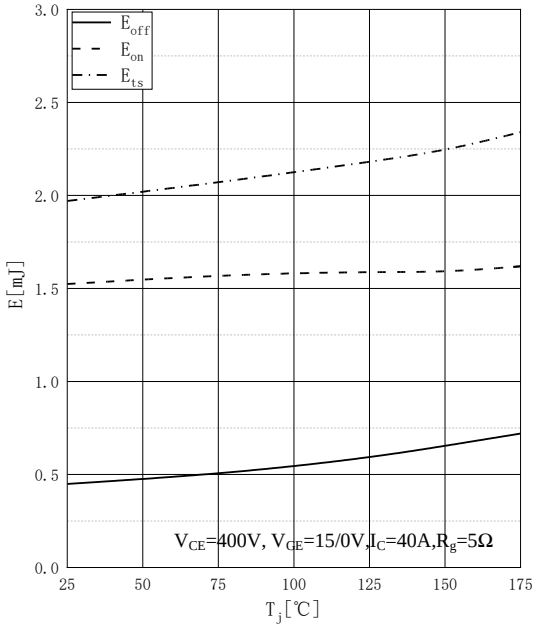


Fig. 16 Switching energy loss vs. Collector-emitter voltage V_{CE}

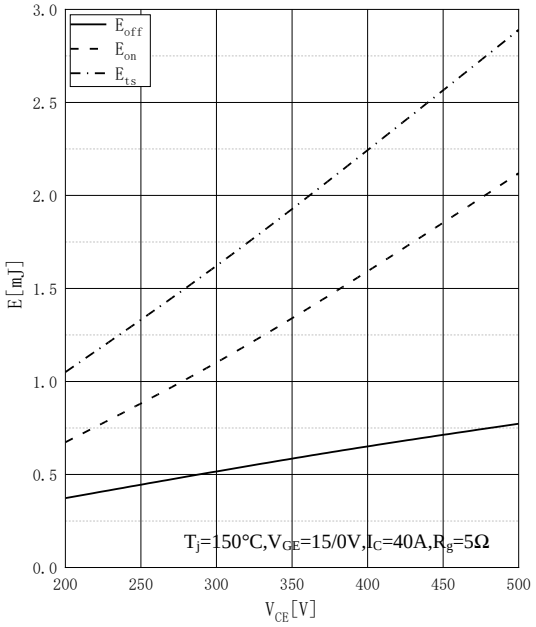


Fig. 17 Reverse recovery times as a function of diode current slope t_{rr} vs. di_F/dt

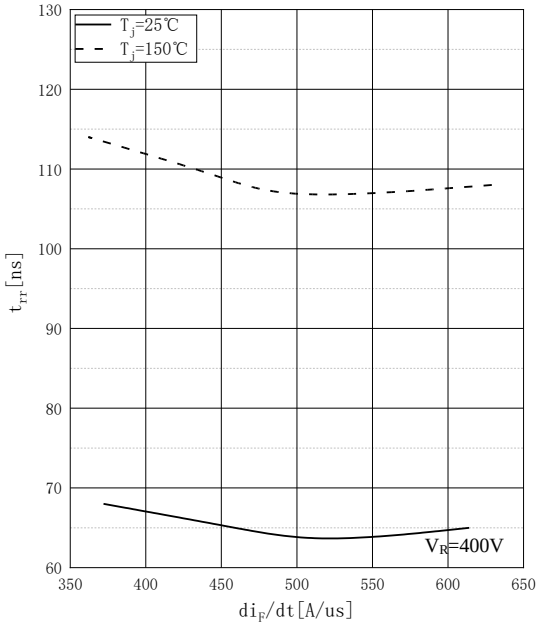


Fig. 18 Reverse recovery charge as a function of diode current slope Q_{rr} vs. di_F/dt

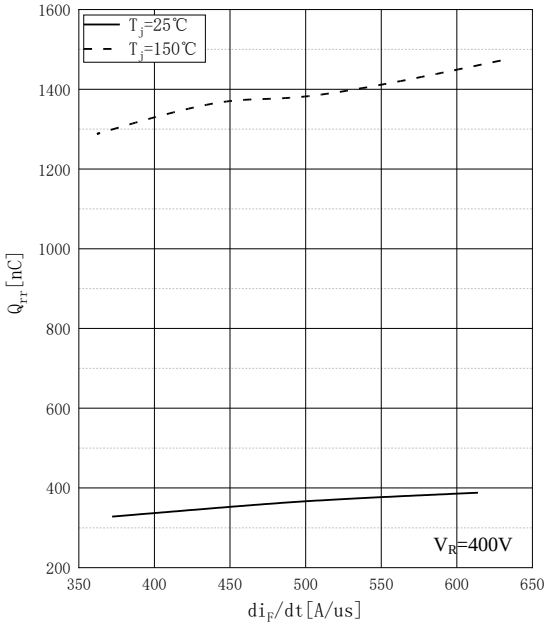


Fig. 19 Reverse recovery current as a function of diode current slope I_{rr} vs. di_F/dt

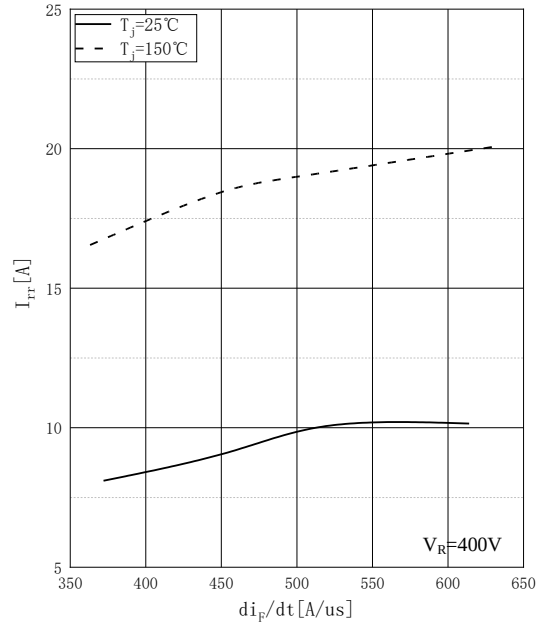


Fig. 20 Reverse recovery energy as a function of diode current slope E_{rr} vs. di_F/dt

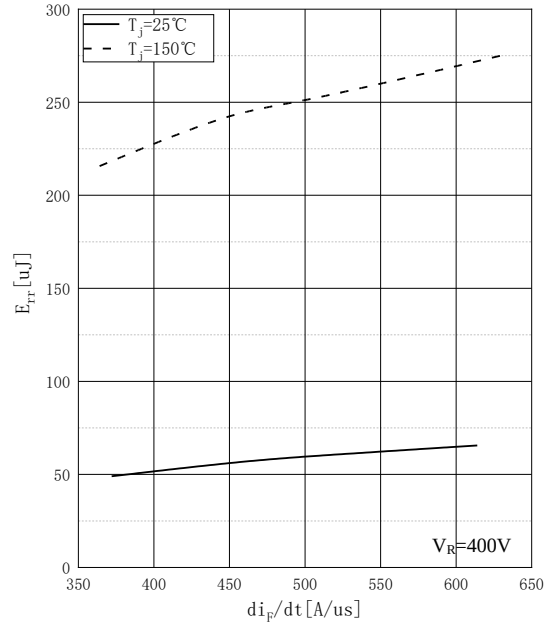


Fig. 21 Rate of Fall of reverse recovery current as a function of diode current slope dI_{rr}/dt vs. di_F/dt

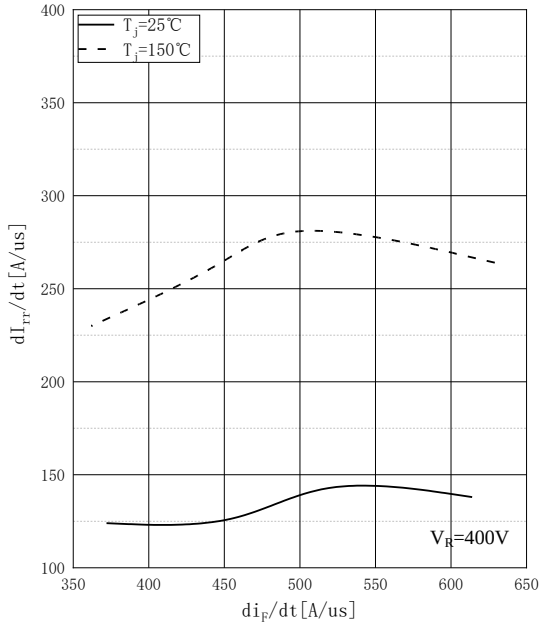


Fig. 22 FBSOA characteristic

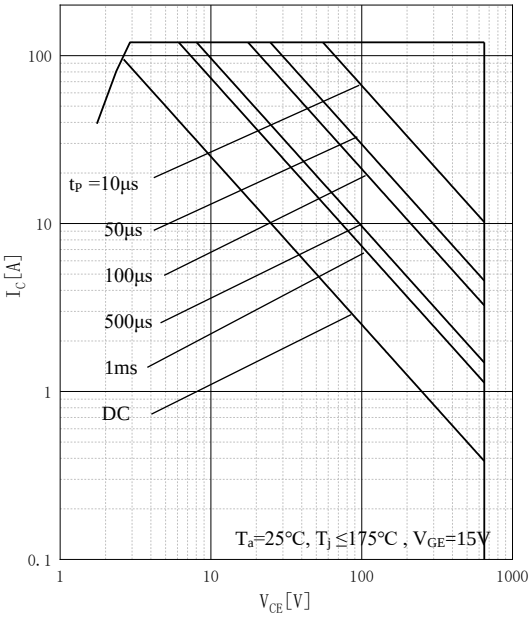


Fig. 23 Power dissipation as a function of case temperature P_{tot} vs. T_C

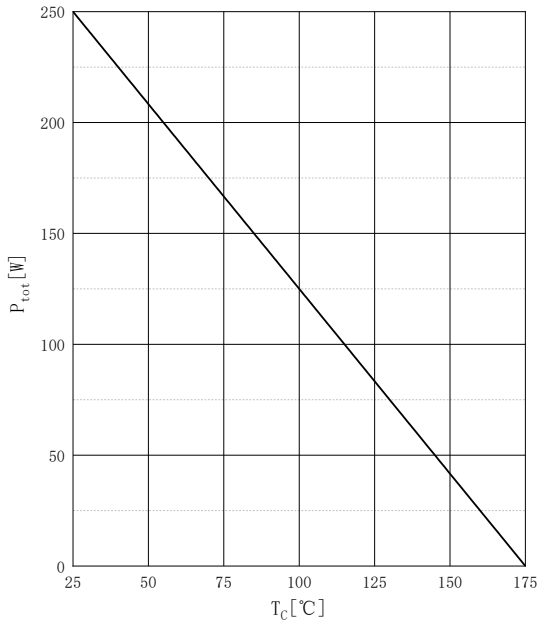


Fig. 24 IGBT transient thermal impedance Z_{thjc}

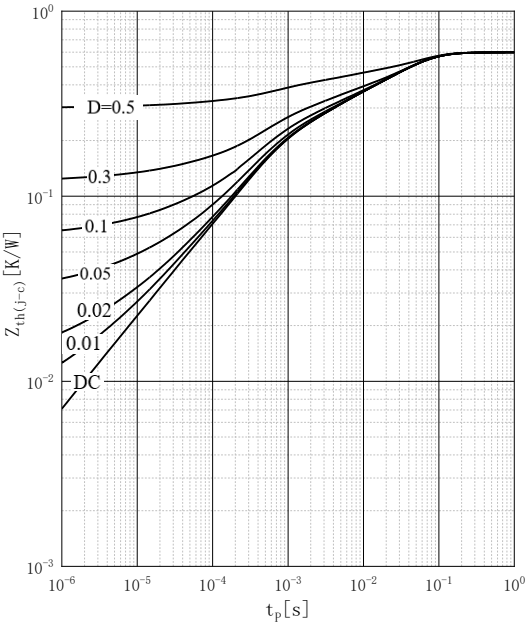
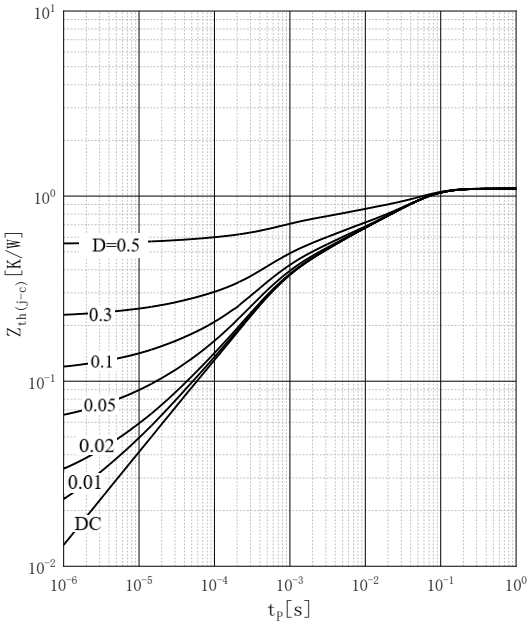
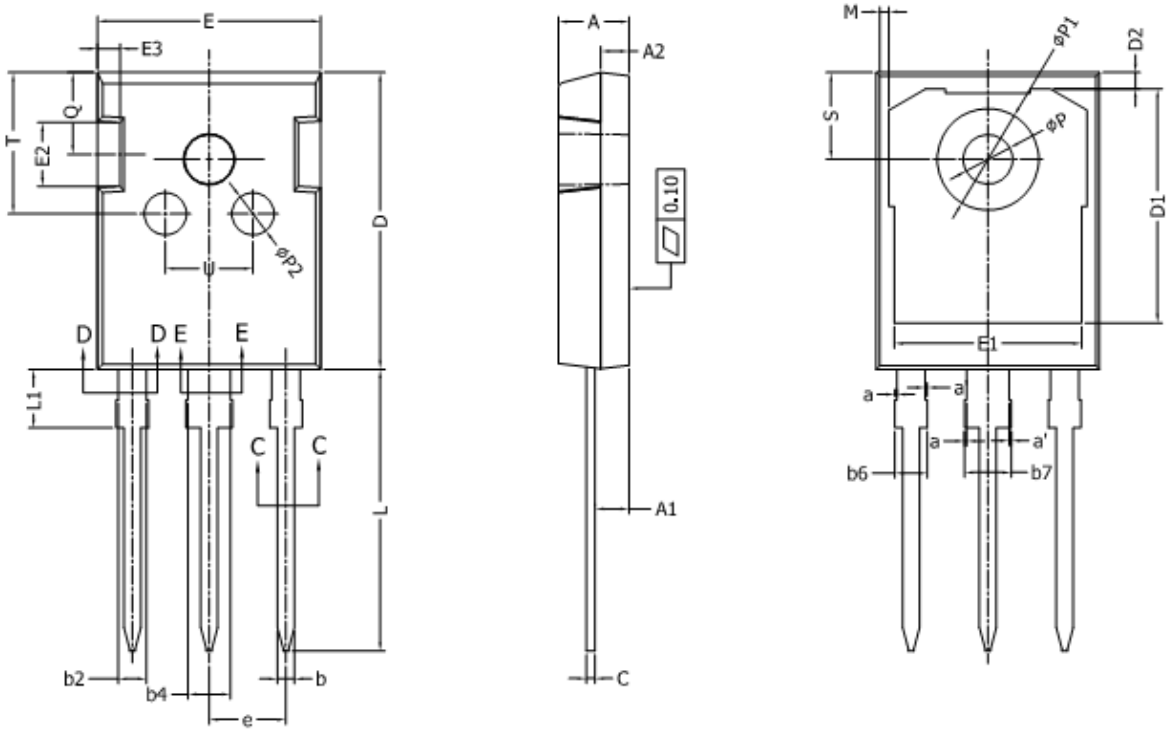
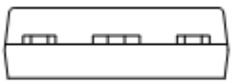


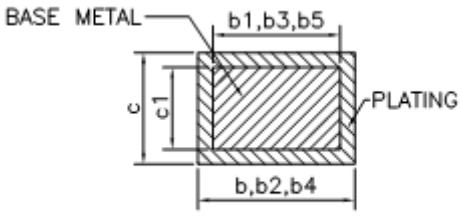
Fig. 25 Diode transient thermal impedance Z_{thjc}



TO247 package information







SECTION C-C,D-D & E-E

COMMON DIMENSIONS
(UNITS OF MEASURE =MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
a	0	---	0.15
a'	0	---	0.15
b	1.16	---	1.26
b1	1.15	1.2	1.22
b2	1.96	---	2.06
b3	1.95	2.00	2.02
b4	2.96	---	3.06
b5	2.96	3.00	3.02
b6	2.00	---	2.25
b7	3.00	---	3.25
c	0.59	---	0.66
c1	0.58	0.60	0.62
D	20.90	21.00	21.10
D1	16.25	16.55	16.85
D2	1.05	1.17	1.35
E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	4.40	4.50	4.60
E3	1.50	1.60	1.70
e	5.336	5.436	5.53
L	19.80	19.92	20.10
L1	4.10	---	4.30
M	0.35	---	0.95
P	3.40	3.50	3.60
P1	7.00	---	7.40
P2	2.40	2.50	2.60
Q	5.60	---	6.00
S	6.05	6.15	6.25
T	9.80	---	10.20
U	6.00	---	6.40

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