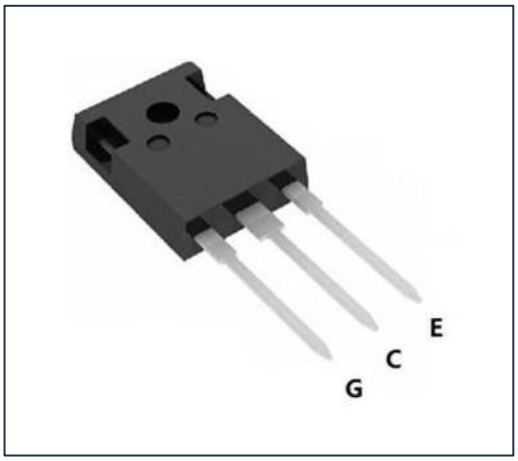
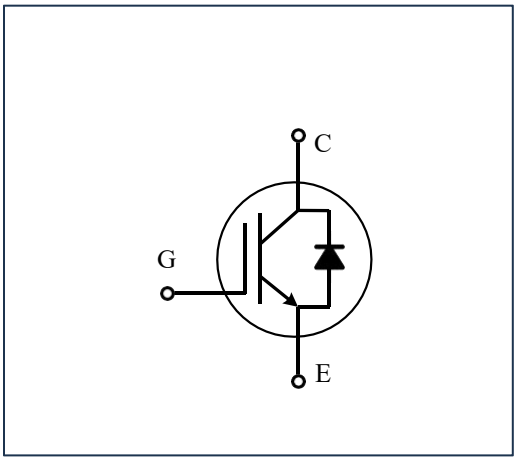
SYD40N170TMA1

1700V40AHightspeed IGBT

FEATURES

- High breakdown voltage to 1700V for improved reliability
- Trench-Stop Technology offering :
  - Very tight parameter distribution
  - High ruggedness, temperature stable behavior
  - Low VCEsat
  - Short circuit withstand time – 10 s
  - Easy parallel switching capability due to positive temperature coefficient in VCEsat
- Enhanced avalanche capability





APPLICATION

- Inverter
- Uninterrupted Power Supply
- EV-Charging
- PTC applications

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Breakdown Voltage, T_j ≥25℃	V_{CE}	1700	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	 67 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} ≤1700V, 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}	600	W
Power dissipation , T_C=100°C		300	
Max. Junction Temperature	$T_{J,max}$	175	℃
Operating junction temperature	$T_{J,op}$	-40...+175	℃
Storage temperature	T_{stg}	-55...+150	℃
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s	-	260	℃

Thermal Resistance

Parameter	Symbol	Max. Value	Unit
IGBT thermal resistance,junction - case	$R_{θ(j-c)}$	0.25	K/W
Diode thermal resistance,junction - case	$R_{θ(j-c)}$	0.5	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	1700	-	-	V
Gate threshold voltage	$V_{GE(th)}$	V_{GE}=V_{CE}, I_C=500μA	4.9	5.7	6.5	V
Collector-Emitter Saturation voltage	$V_{CE(sat)}$	V_{GE}=15V,I_C=40A T_j = 25°C T_j = 175°C	1.3 -	1.7 2.0	2.1 -	V
Zero gate voltage collector current	I_{CES}	V_{CE}=1700V,V_{GE}= 0V T_j = 25°C T_j = 175°C	- -	- -	250 5000	μA
Gate-emitter leakage current	I_{GES}	V_{CE}=0V,V_{GE}= ±20V	-	-	400	nA
Transconductance	g_{fs}	V_{CE}=20V,I_C=40A	-	32	-	S

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Dynamic						
Input capacitance	C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz	-	10200	-	pF
Output capacitance	C_{oes}		-	165	-	
Reverse transfer capacitance	C_{res}		-	51	-	
Gate charge total	Q_g	V_{CC} = 1360V, I_C =40A, V_{GE} = 15V	-	450	-	nC
Gate to emitter charge	Q_{ge}		-	116	-	
Gate to collector charge	Q_{gc}		-	200	-	

Note:

① BVces testing without filter could damage the device. BVces is guaranteed by Ices@1700V 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} = 900V, I_C = 40A, V_{GE} = 0/15V, R_g=5Ω	-	35	-	ns
Rise Time	t_r		-	72	-	ns
Turn-off Delay Time	$t_{d(off)}$		-	320	-	ns
Fall Time	t_f		-	255	-	ns
Turn-on Energy	E_{on}		-	7.2	-	mJ
Turn-off Energy	E_{off}		-	4.8	-	mJ
Turn-on Delay Time	$t_{d(on)}$	T_j=150 C , V_{CE} = 900V, I_C = 40A, V_{GE} = 0/15V, R_g=5Ω	-	32	-	ns
Rise Time	t_r		-	103	-	ns
Turn-off Delay Time	$t_{d(off)}$		-	368	-	ns
Fall Time	t_f		-	297	-	ns
Turn-on Energy	E_{on}		-	9.7	-	mJ
Turn-off Energy	E_{off}		-	6.1	-	mJ

Electrical Characteristics of the DIODE

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_{FM}	I_F =10A T_j=25℃ T_j=175℃	-	2.0	-	V

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

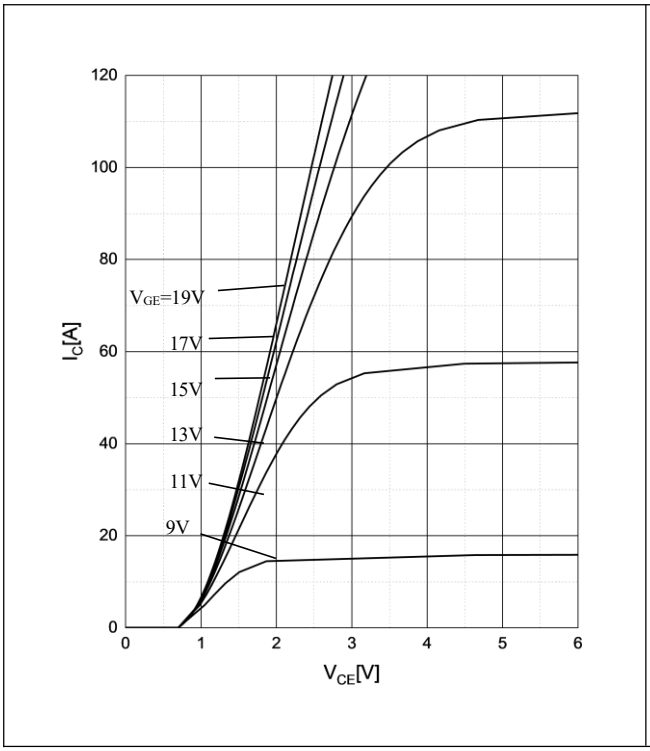


Fig. 2 Output characteristic V_{CE} vs. I_C at 175℃

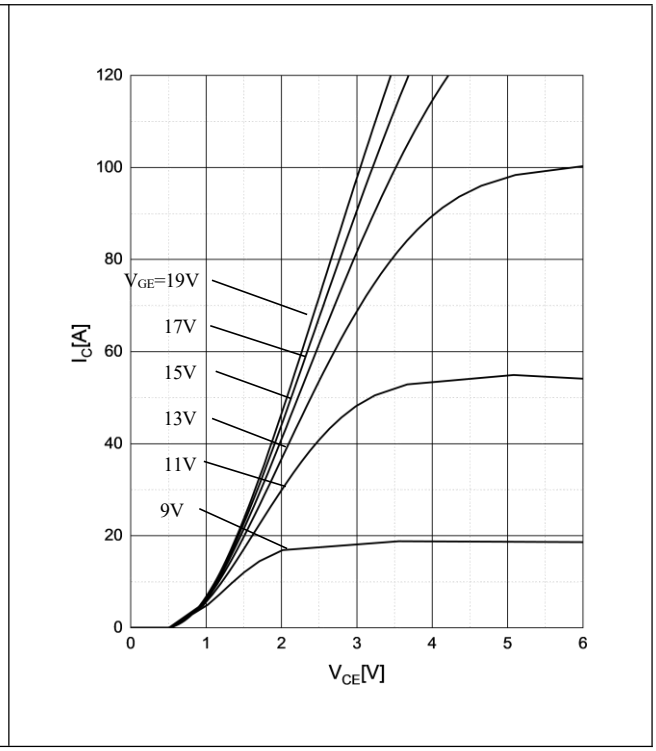


Fig. 3 Transfer characteristic V_{GE} vs. I_C

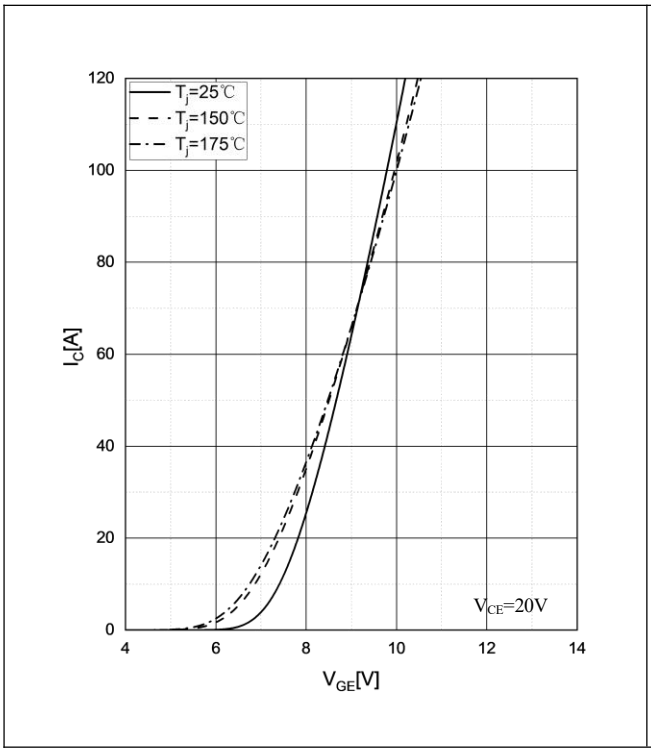


Fig. 4 Collector-emitter saturation voltage as a function of junction temperature V_{CEsat} vs. T_j

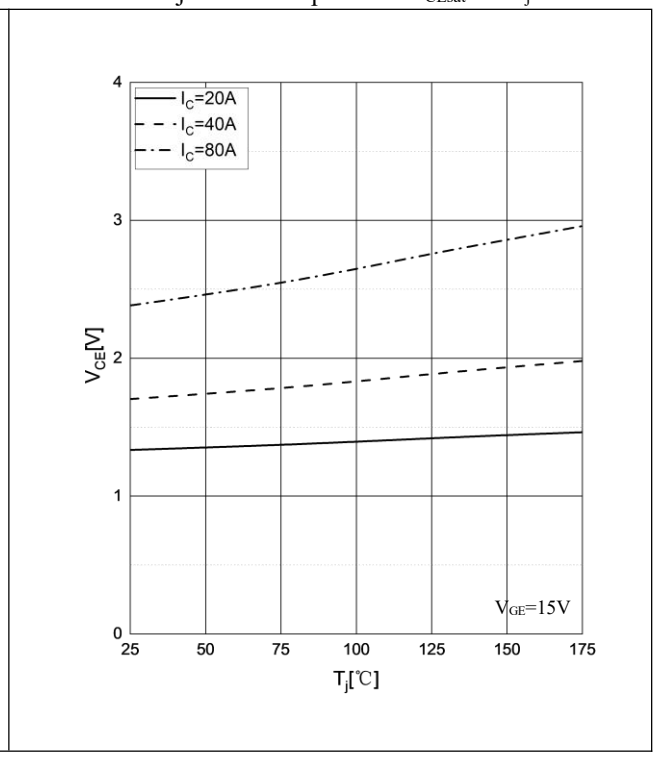


Fig. 5 Gate-emitter threshold voltage as a function of junction temperature $V_{GE(th)}$ vs. T_j

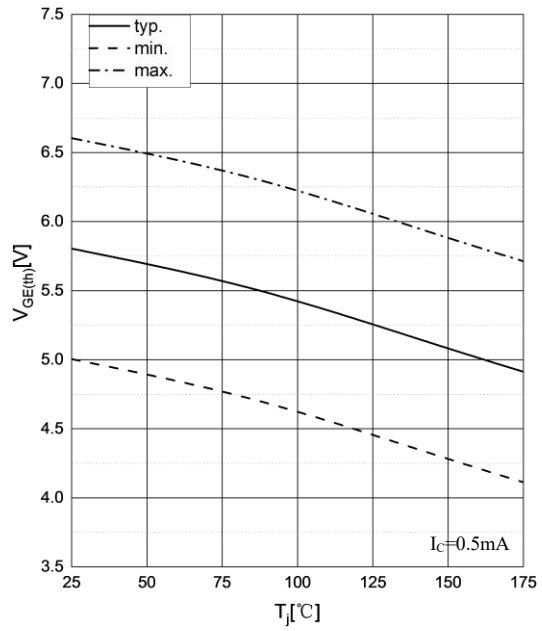


Fig. 6 Gate charge Q_G

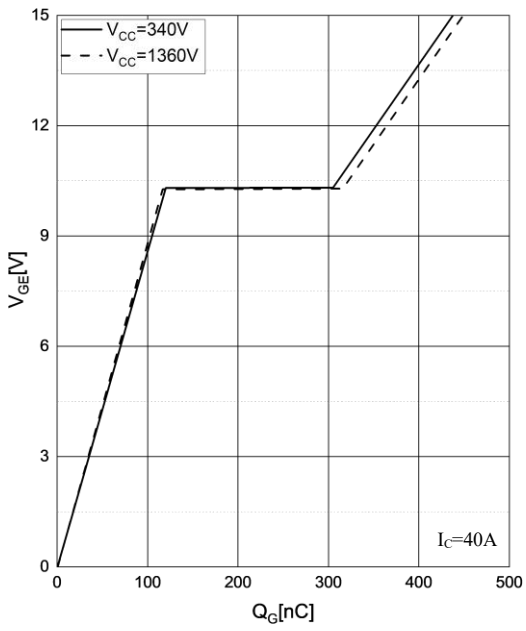


Fig. 7 Capacitance characteristic

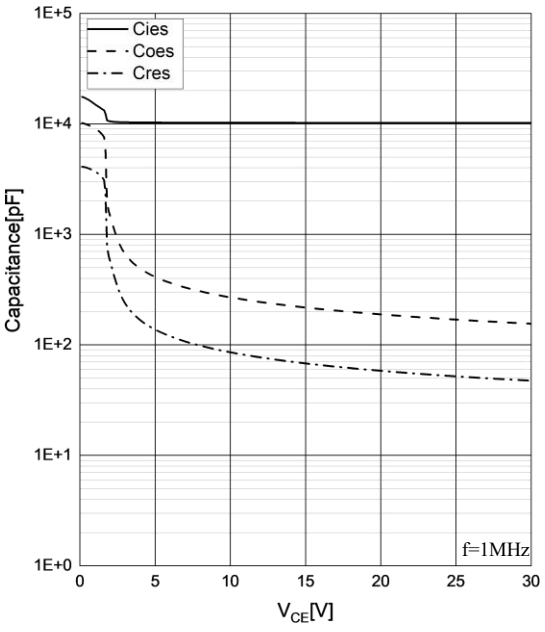


Fig. 8 Diode forward current as a function of forward voltage V_F vs. I_F

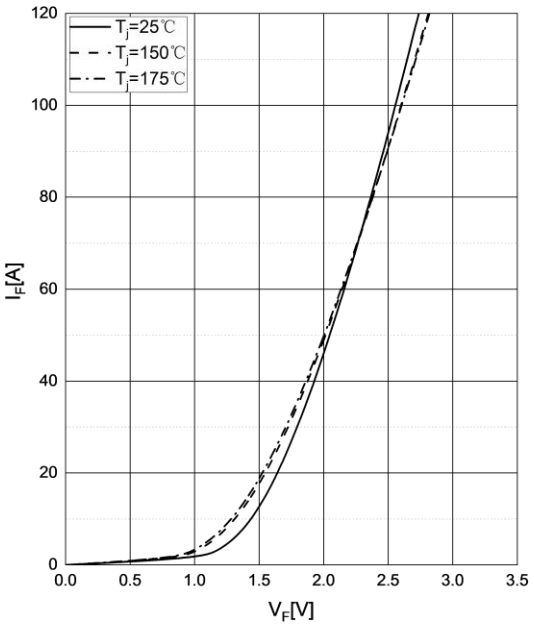


Fig. 9 Power dissipation as a function of case temperature P_{tot} vs. T_C

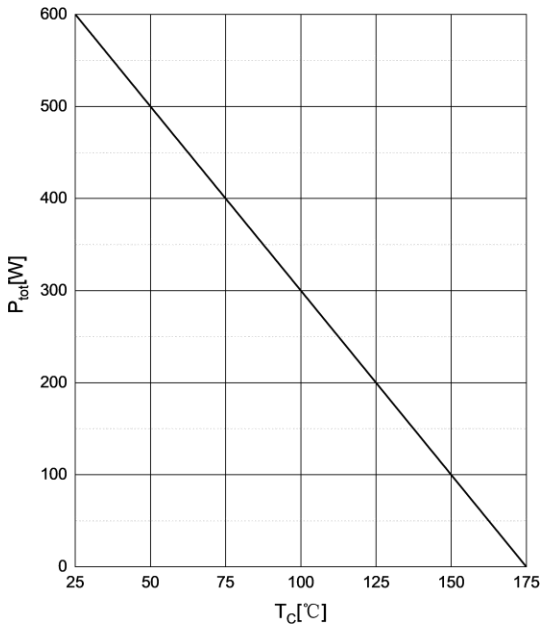


Fig. 10 Switching times vs. Collector current I_C

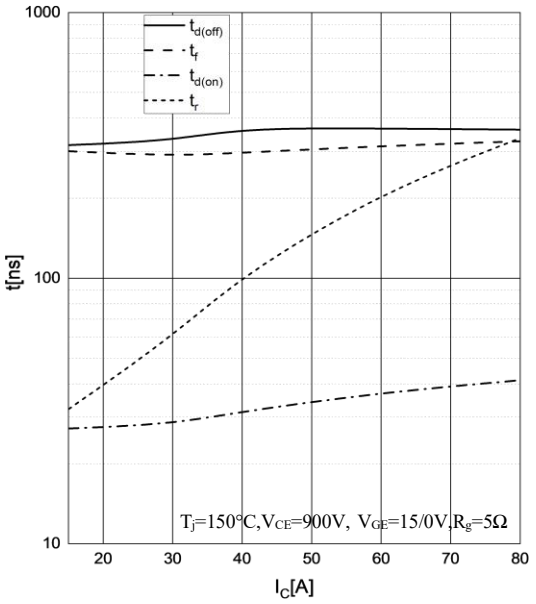


Fig. 11 Switching times vs. Gate resistor R_g

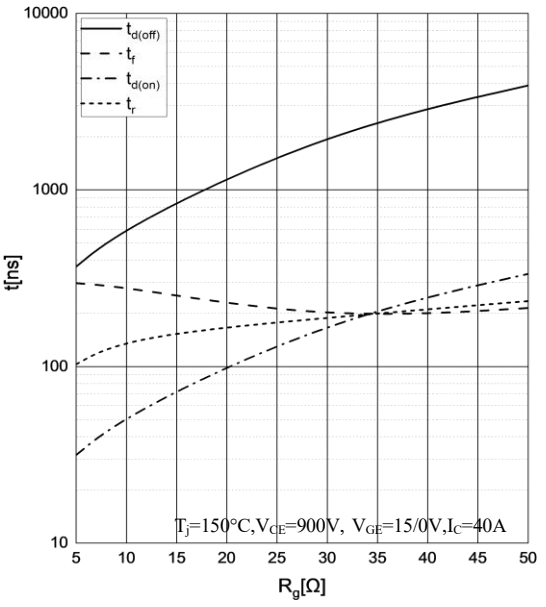


Fig. 12 Switching times vs. Junction temperature Tj

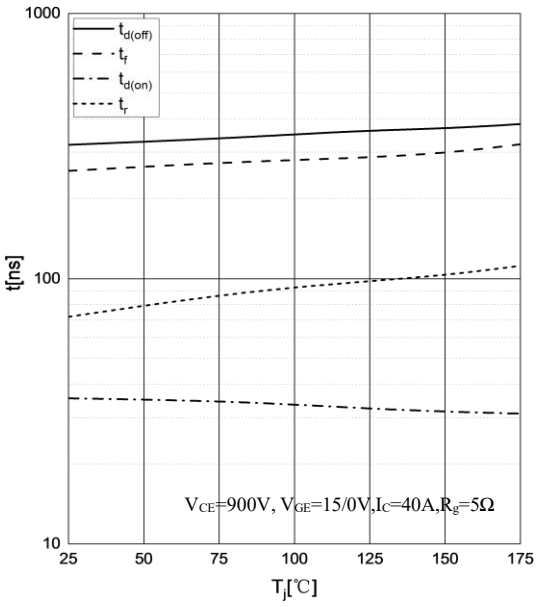


Fig. 13 Switching energy loss vs. Collector current I_C

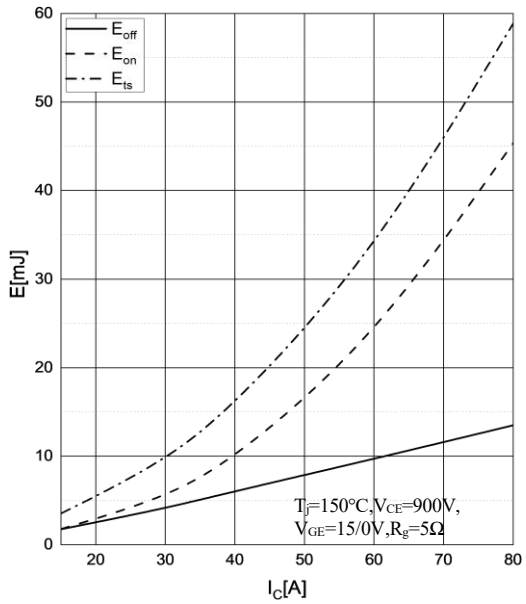


Fig. 14 Switching energy loss vs. Gate resistor R_g

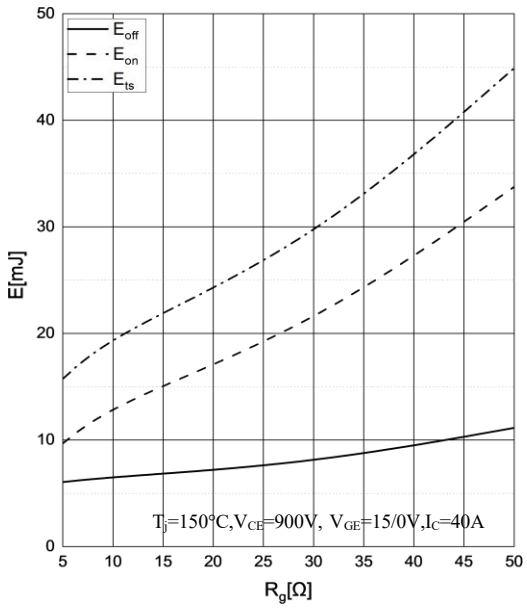


Fig.15 Switching energy loss vs. Junction temperature T_j

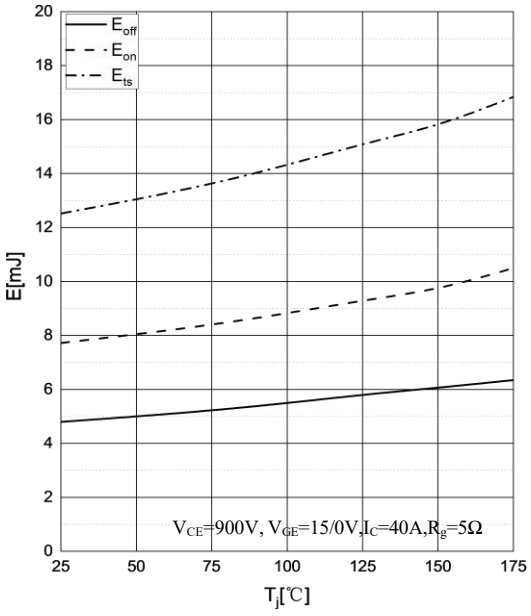


Fig. 16 Switching energy loss vs. Collector-emitter voltage V_{CE}

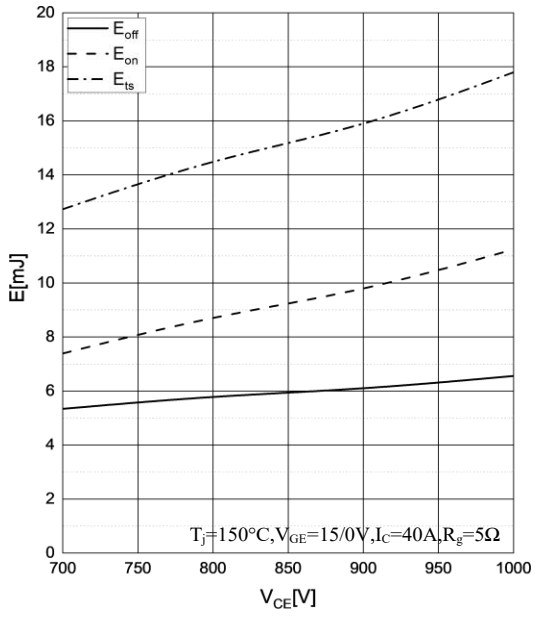


Fig. 17 FBSOA characteristic

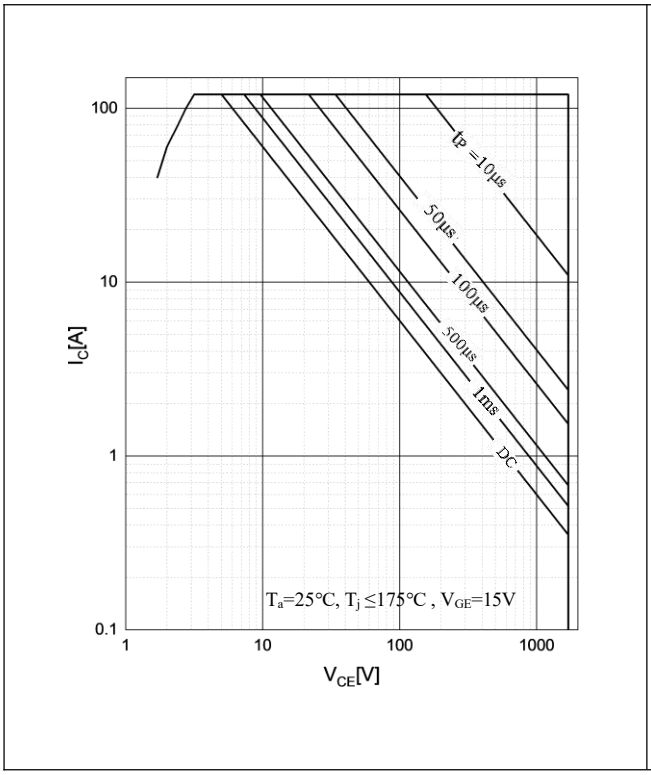


Fig. 18 IGBT transient thermal impedance Z_{thjc}

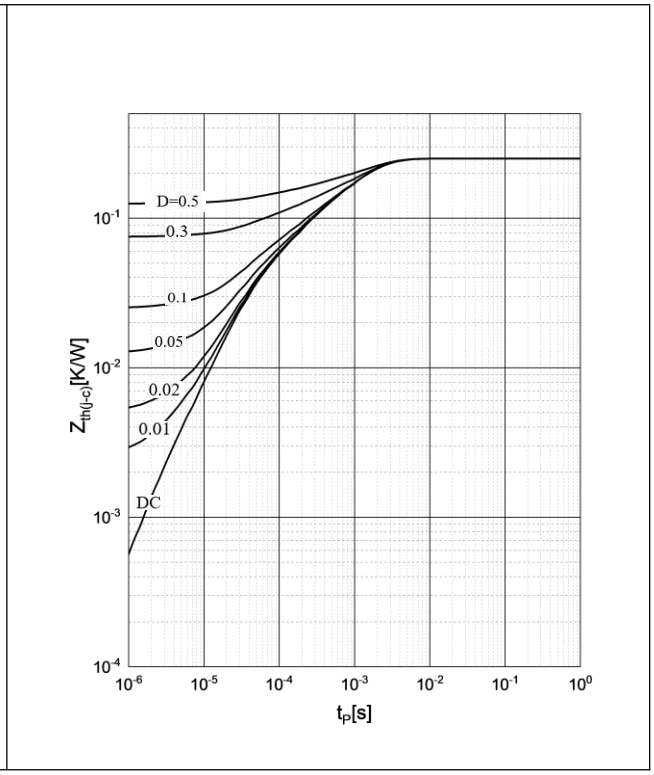
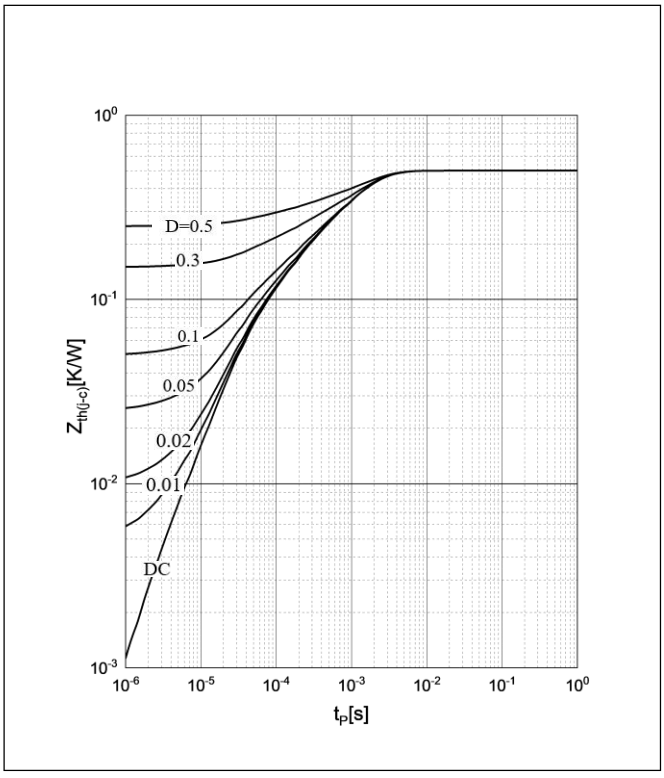
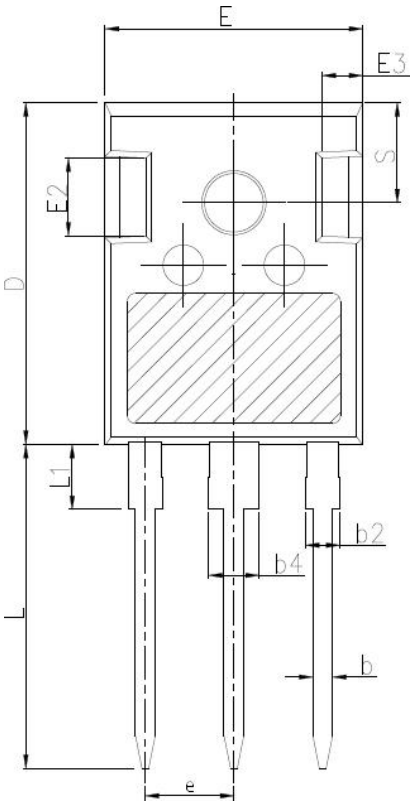
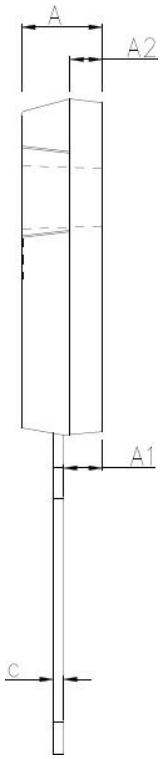


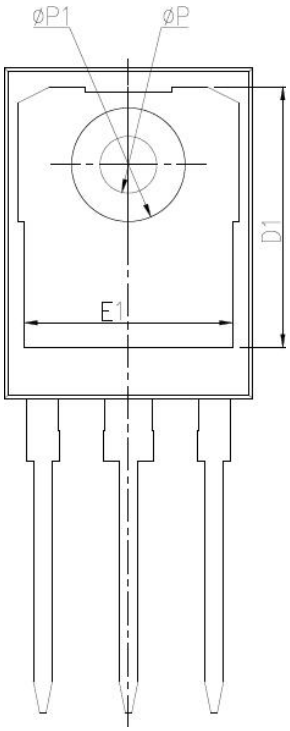
Fig. 19 Diode transient thermal impedance Z_{thjc}



TO247 Package Information







COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.59
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.80	21.00	21.30
D1	16.25	16.55	16.85
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.44BSC		
L	19.82	19.92	20.22
L1	–	–	4.30
ΦP	3.40	3.60	3.80
ΦP1	–	–	7.30
S	6.15BSC		