



SMGW40H120FHB

1200V 40A Field Stop Trench IGBT

Preliminary Data

Features:

- Maximum Junction Temperature: $T_J=175^{\circ}\text{C}$
- High Speed Switching Series
- Minimized Tail Current
- Safe Paralleling
- Very Fast Recovery Antiparallel Diode
- Low Thermal Resistance

Applications:

- Uninterruptible Power Supply
- Induction Heating
- Photovoltaic Inverters
- Power Factor Correction
- High Frequency Converters

Absolute Maximum Rated Values ($T_J=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Description	Conditions	Values	Units
V_{CES}	Collector-Emitter Blocking Voltage		1200	V
V_{GES}	Gate-Emitter Voltage		± 20	V
I_C	Continuous Collector Current	$T_C=100^{\circ}\text{C}$	40	A
		$T_C=25^{\circ}\text{C}$	80	A
I_{CP}	Pulse Collector Current		160	A
I_F	Continuous Forward Current	$T_C=100^{\circ}\text{C}$	40	A
		$T_C=25^{\circ}\text{C}$	80	A
I_{FP}	Pulse Forward Current		160	A
P_D	Maximum Power Dissipation	$T_C=25^{\circ}\text{C}$	469	W
T_J	Maximum Junction Temperature		-40~175	$^{\circ}\text{C}$



T _{JOP}	Maximum Operating Junction Temperature Range	-40~175	°C
	Soldering Temperature, for 10 sec.	260 (0.063 in. (1.6mm) from case)	°C

Electrical Characteristics of IGBT (T_J=25°C unless otherwise specified)

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
V _{(BR)CES}	Collector-Emitter Breakdown Voltage	V _{GE} =0V, I _C =1mA	1200			V
V _{GE(th)}	Gate-Emitter Threshold Voltage	I _C =1mA, V _{CE} =V _{GE}	4.0	4.7	5.5	V
V _{CE(sat)}	Collector-Emitter Saturation Voltage	I _C =40A, V _{GE} =15V	T _J =25°C	1.70	1.85	V
			T _J =125°C	2.15		V
			T _J =150°C	2.20		V
I _{CES}	Collector-Emitter Leakage Current	V _{GE} =0V, V _{CE} =V _{CES}			25	μA
I _{GES}	Gate-Emitter Leakage Current	V _{GE} =±25V, V _{CE} =0V			±200	nA
C _{ies}	Input Capacitance	V _{CE} =25V, V _{GE} =0V, f=1MHz		5.40		nF
C _{oes}	Output Capacitance			0.19		
C _{res}	Reverse Transfer Capacitance			0.05		

Switching Characteristics of IGBT (T_J=25°C unless otherwise specified)

t _{d(on)}	Turn-on Delay Time	V _{CC} =600V, I _C =40A, R _{Gon} =30Ω, V _{GE} =±15V, Inductive Load	T _J =25℃		295		ns
			T _J =125℃		305		
			T _J =150℃		306		
t _r	Rise Time		T _J =25℃		71		ns
			T _J =125℃		77		
			T _J =150℃		88		
t _{d(off)}	Turn-off Delay Time	V _{CC} =600V, I _C =40A, R _{Goff} =30Ω, V _{GE} =±15V, Inductive Load	T _J =25℃		249		ns
			T _J =125℃		261		
			T _J =150℃		266		
t _f	Fall Time		T _J =25℃		192		ns
			T _J =125℃		192		
			T _J =150℃		207		



E _{on}	Turn-on Switching Loss	V _{CC} =600V, I _C =40A, R _{Gon} =30Ω, V _{GE} =±15V, di/dt=363A/μs(T _J =150°C), Inductive Load	T _J =25°C		3.60		mJ
			T _J =125°C		4.10		
			T _J =150°C		4.25		
E _{off}	Turn-off Switching Loss	V _{CC} =600V, I _C =40A, R _{Goff} =30Ω, V _{GE} =±15V, du/dt=4844V/μs(T _J =150°C), Inductive Load	T _J =25°C		0.95		mJ
			T _J =125°C		1.20		
			T _J =150°C		1.30		
Q _g	Total Gate Charge	V _{CC} =960V, I _C =40A, V _{GE} =0V/15V			190		nC
Q _{ge}	Gate-emitter Charge				37		
Q _{gc}	Gate-collector Charge				78		

Electrical Characteristics of Diode (T_C=25°C unless otherwise specified)

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V _{FM}	Forward Voltage	I _F =40A	T _J =25℃		1.50		V
			T _J =125℃		1.60		
			T _J =150℃		1.65		
I _{rr}	Peak Reverse Recovery Current	I _F =40A, -diF/dt=610A/μs(T _J =150℃) V _{rr} =600V, V _{GE} =±15V	T _J =25℃		21.2		A
			T _J =125℃		21.9		
			T _J =150℃		23.1		
t _{rr}	Reverse Recovery Time		T _J =25℃		255		ns
			T _J =125℃		271		
			T _J =150℃		286		
Q _{rr}	Reverse Recovery Charge		T _J =25℃		3.26		μC
			T _J =125℃		3.64		
			T _J =150℃		4.05		
E _{rec}	Reverse Recovery Energy		T _J =25℃		0.9		mJ
			T _J =125℃		1.1		
			T _J =150℃		1.2		



Thermal Characteristics (T_C=25°C unless otherwise specified)

Symbol	Description	Min.	Typ.	Max.	Units
R _{ΘJC(IGBT)}	Thermal Resistance: Junction-to-Case		0.32		°C/W
R _{ΘJC(Diode)}	Thermal Resistance: Junction-to-Case		0.44		°C/W
R _{ΘJA}	Thermal Resistance: Junction-to-Ambient (typical socket mount)			40	°C/W

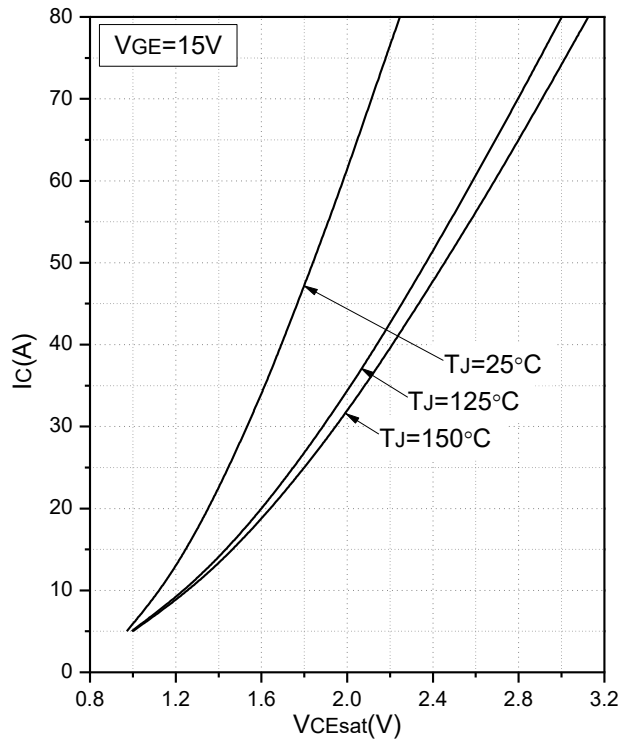


Fig.1 Typical Saturation Voltage Characteristics

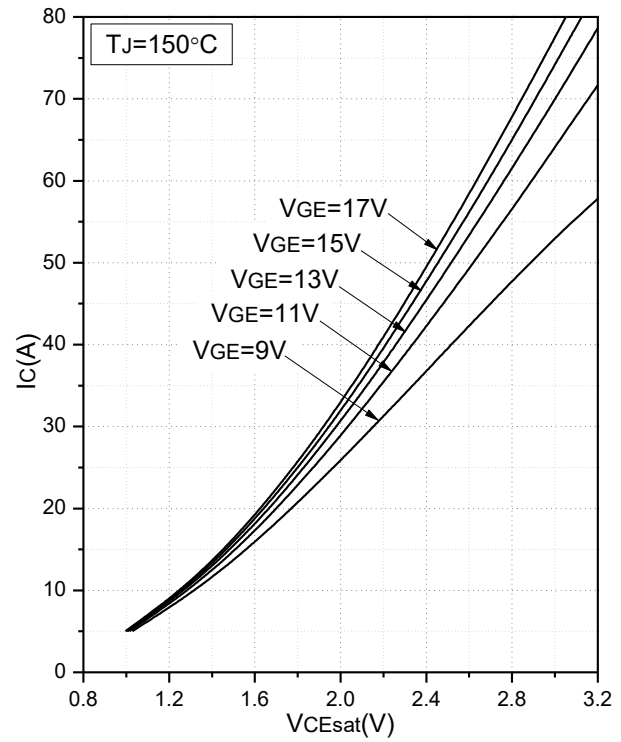


Fig.2 Typical Output Characteristics

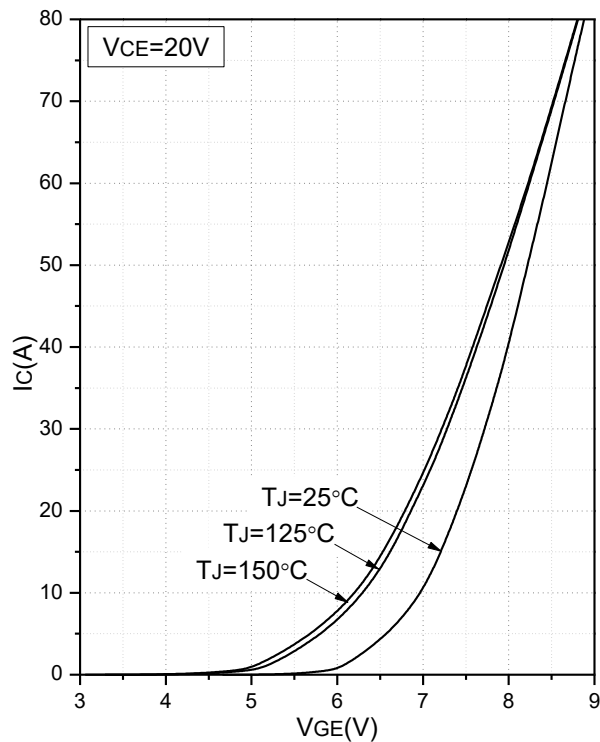


Fig.3 Transfer Characteristic

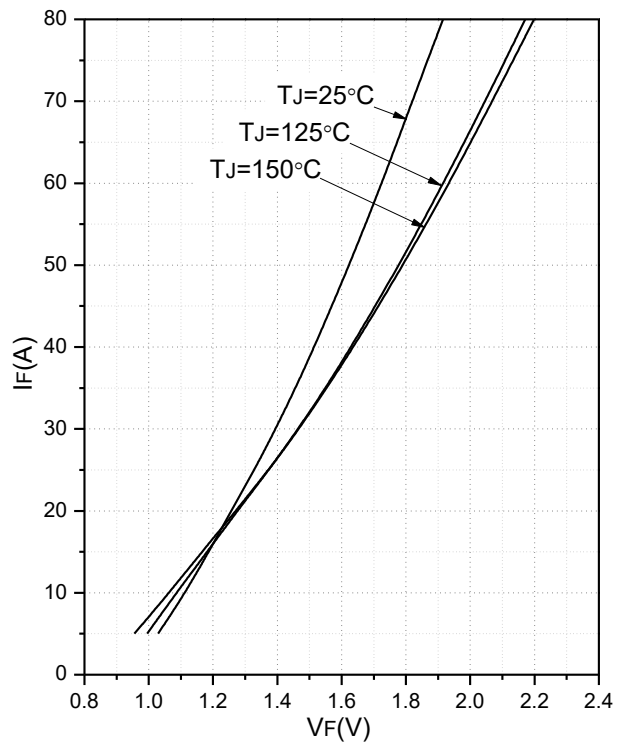


Fig.4 Forward Characteristics of Diode

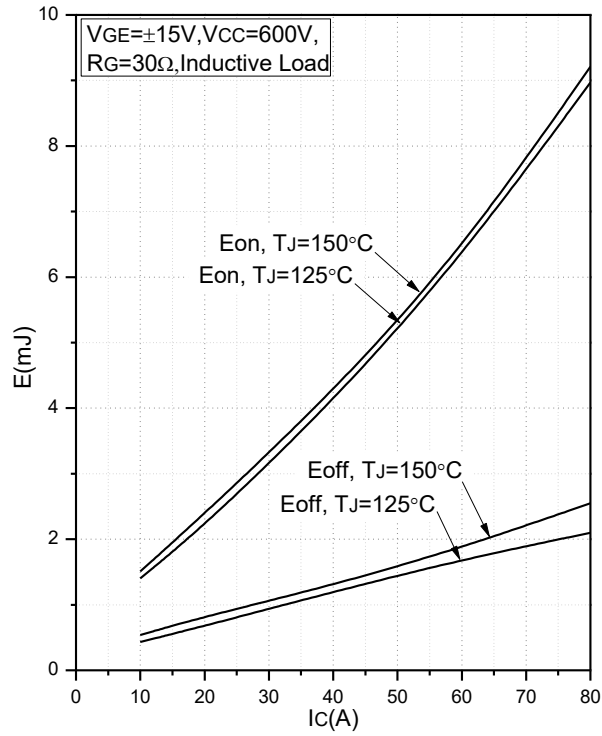


Fig.5 Typical Switching Loss vs. Collector Current

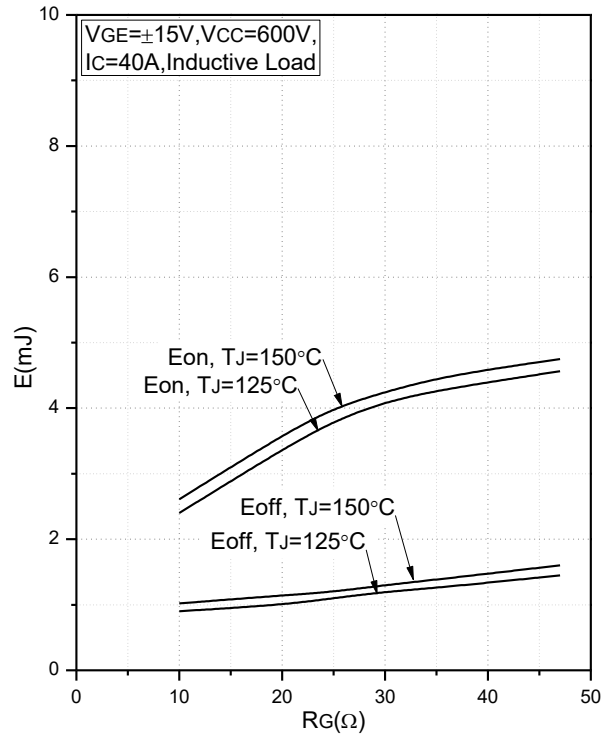


Fig.6 Typical Switching Loss vs. Gate Resistance

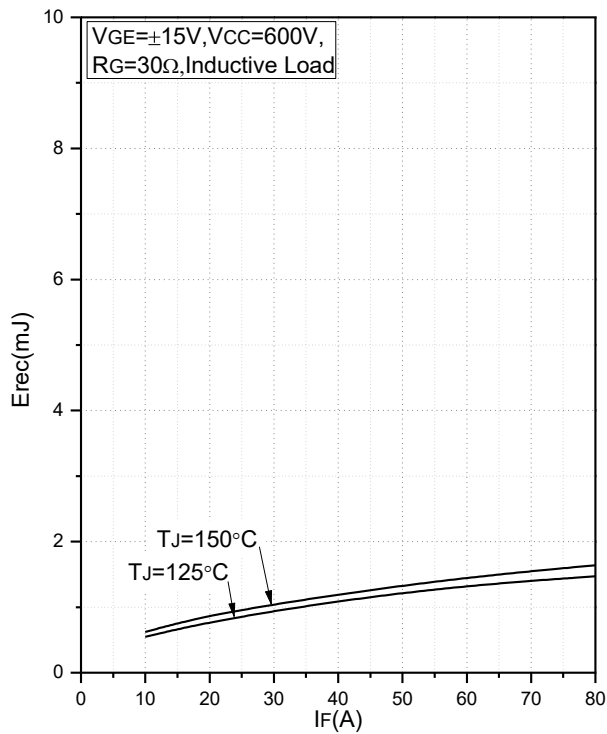


Fig.7 Typical Switching Loss vs. Forward Current

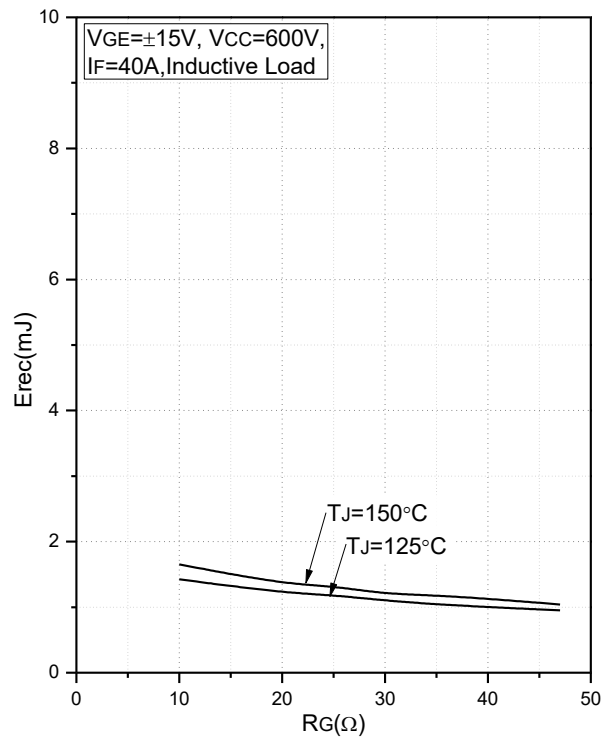
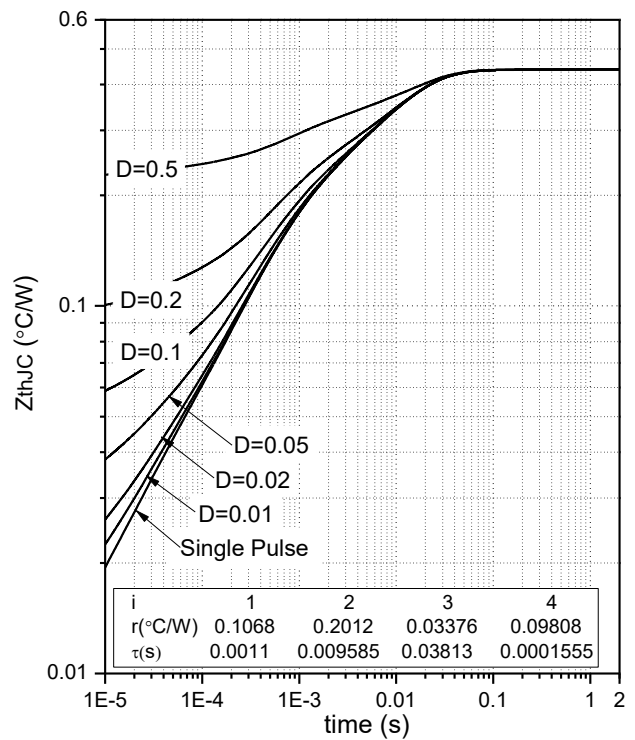
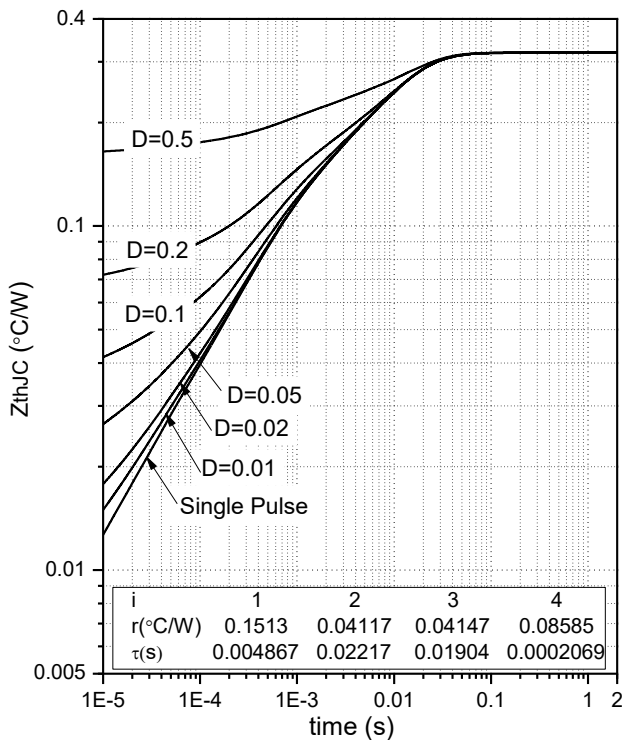
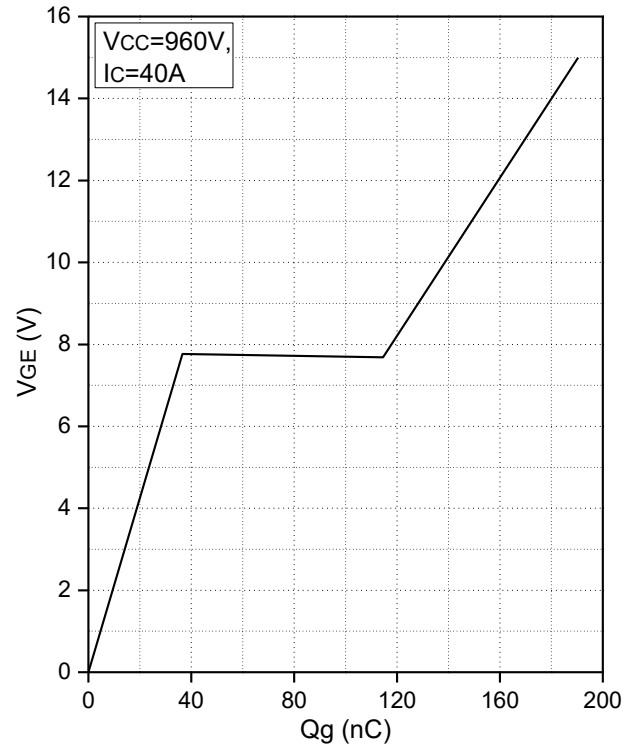
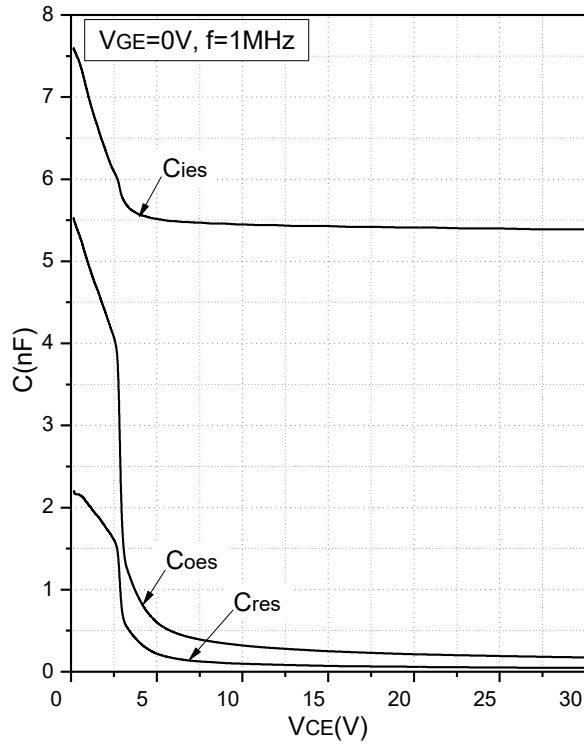


Fig.8 Typical Switching Loss vs. Gate Resistance





Test Circuit:

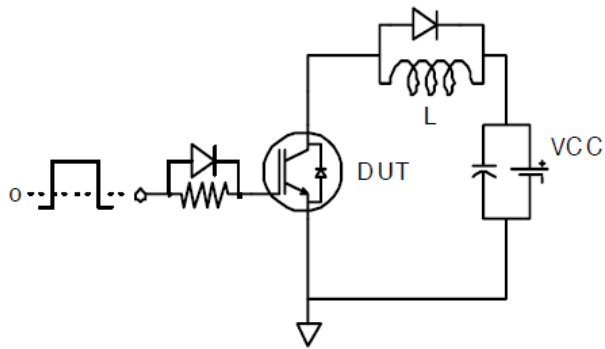


Fig.13 Gate Charge Circuit (turn-off)

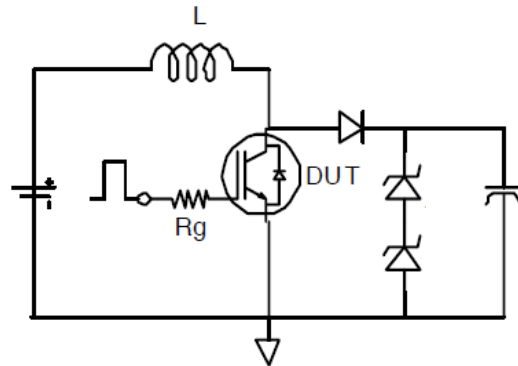


Fig.14 RBSOA Circuit

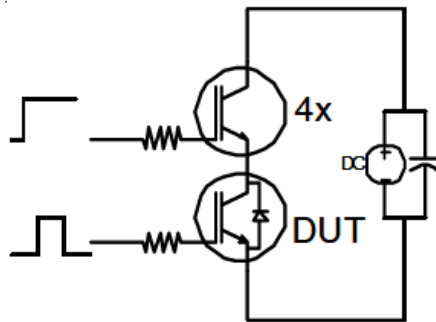


Fig.15 S.C. SOA Circuit

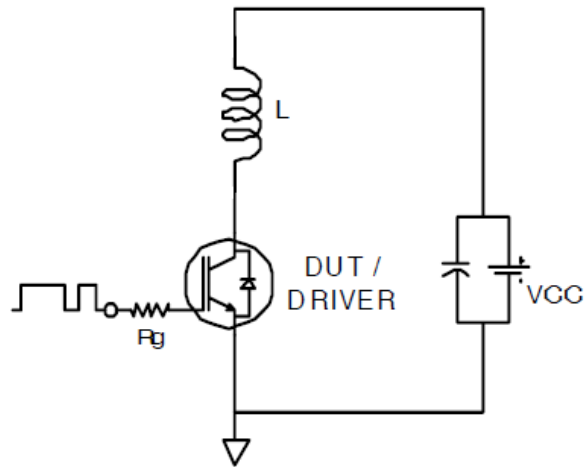


Fig.16 Switching Loss Circuit

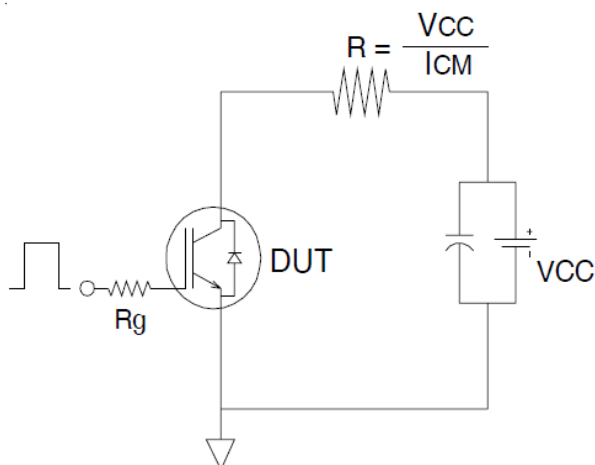


Fig.17 Resistive Load Circuit

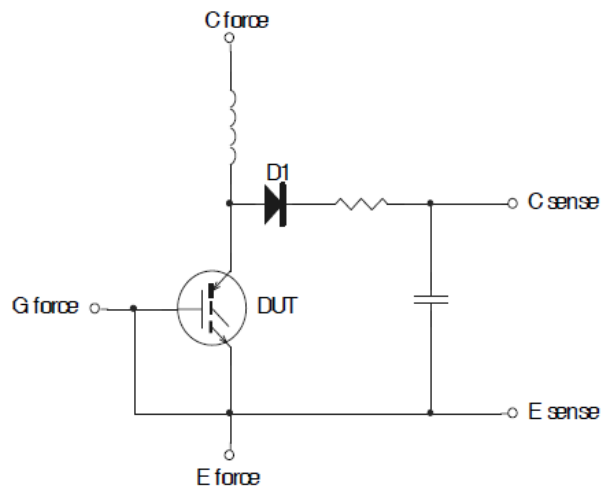
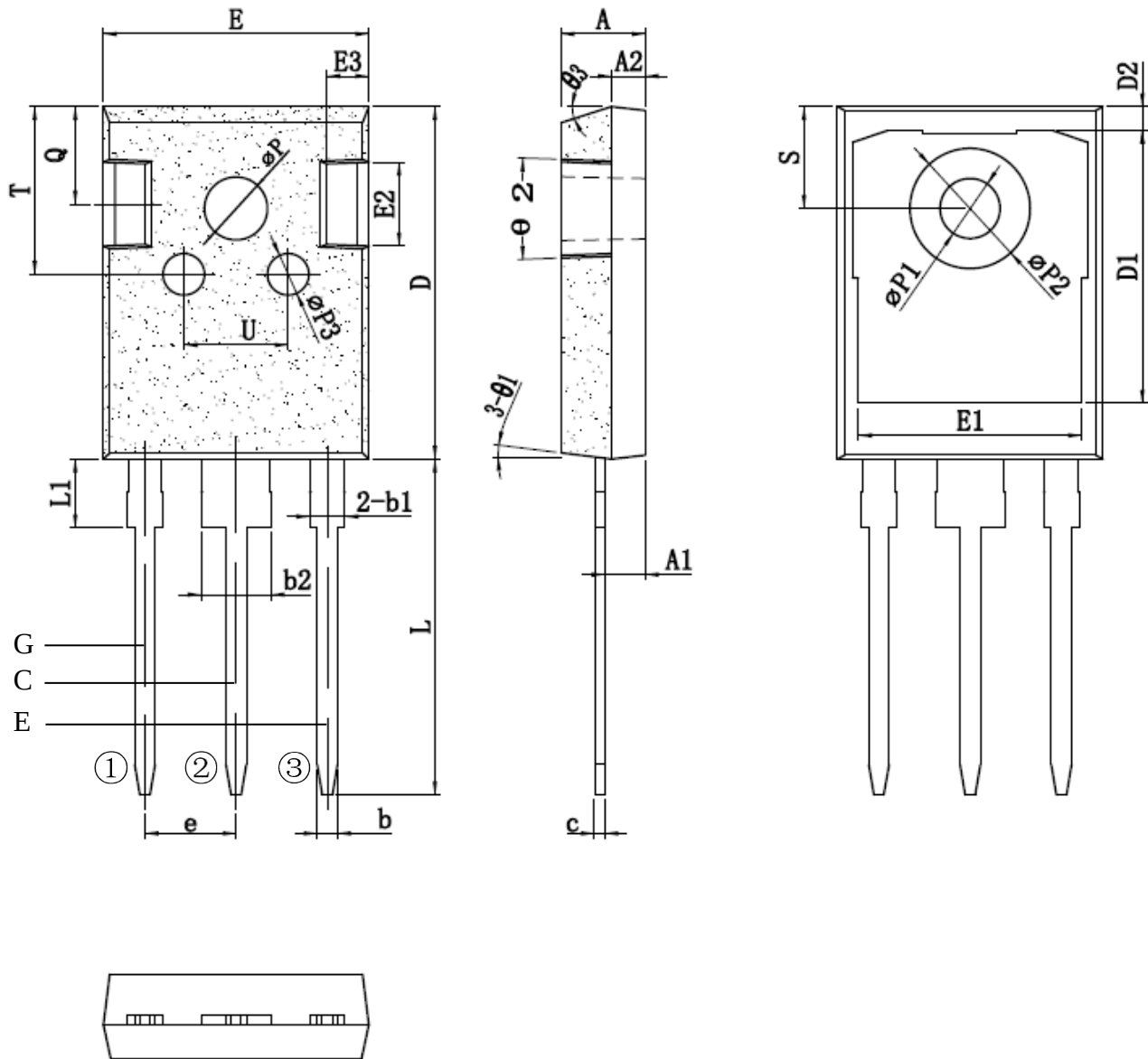


Fig.18 BVCES Filter Circuit



TO-247 Package Outline (Unit: mm):



CONNECTION

- ① GATE
- ② COLLECTOR
- ③ EMITTER



TO-247 Package Mechanical Data:

SYMBOL	mm		
	MIN	NOM	MAX
*A	4.90	5.00	5.10
*A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
*b	1.15	1.20	1.25
*b1	1.95	2.10	2.25
*b2	2.95	3.10	3.25
*C	0.55	0.60	0.65
*D	20.90	21.00	21.10
D1	16.35	16.55	16.75
D2	1.05	1.20	1.35
*E	15.70	15.80	15.90
E1	13.10	13.25	13.40
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
*e	5.40	5.44	5.48
*L	19.80	19.98	20.15
*L1	—	—	4.30
*ΦP	3.60	3.70	3.80
*ΦP1	3.45	3.55	3.65
ΦP2	7.03	7.18	7.33
ΦP3	2.40	2.50	2.60
Q	5.60	5.80	6.00
*S	6.05	6.15	6.25
T	9.80	10.00	10.20
U	6.00	6.20	6.40
θ1	5°	7°	9°
θ2	1°	3°	5°
θ3	13°	15°	17°



Revision	Notes
01	Initial Release

Announcement

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The released datasheet would be issued with “REV.” + “alphabet characters”.