



SMGI40H120ADB

1200V 40A Field Stop Trench IGBT

Features:

- Low $V_{CE(sat)}$ Trench IGBT Technology
- Low Switching Loss
- Low Stray Inductance
- Maximum Junction Temperature 175°C
- Positive $V_{CE(sat)}$ Temperature Coefficient

Applications:

- UPS
- Motor Driver

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_{CM}	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_{FM}	Pulse Forward Current		160	A
t_{SC}	Short Circuit Withstand Time	$V_{CC}=600\text{V}$, $V_{GE}=15\text{V}$ $T_J=150^{\circ}\text{C}$	>10	μs
P_D	Maximum Power Dissipation	$T_C=25^{\circ}\text{C}$	750	W
T_J	Maximum Junction Temperature		-40~175	$^{\circ}\text{C}$
T_{JOP}	Maximum Operating Junction Temperature Range		-40~175	$^{\circ}\text{C}$
	Soldering Temperature, for 10 sec.		260 (0.063 in. (1.6mm) from case)	$^{\circ}\text{C}$



Electrical Characteristics of IGBT ($T_J=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	$V_{GE}=0\text{V}$, $I_C=1\text{mA}$	1200			V
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1.5\text{mA}$, $V_{CE}=V_{GE}$	5.0	5.8	6.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=40\text{A}$, $V_{GE}=15\text{V}$	$T_J=25^{\circ}\text{C}$	1.95	2.25	V
			$T_J=125^{\circ}\text{C}$	2.20		V
			$T_J=150^{\circ}\text{C}$	2.30		V
I_{CES}	Collector-Emitter Leakage Current	$V_{GE}=0\text{V}$, $V_{CE}=V_{CES}$, $T_J=25^{\circ}\text{C}$			25	μA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=\pm 25\text{V}$, $V_{CE}=0\text{V}$, $T_J=25^{\circ}\text{C}$			± 200	nA
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$, $f=100\text{kHz}$		2.19		nF
C_{oes}	Output Capacitance			0.19		
C_{res}	Reverse Transfer Capacitance			0.04		

Switching Characteristics of IGBT ($T_J=25^{\circ}\text{C}$ unless otherwise specified)

t _{d(on)}	Turn-on Delay Time	V _{CC} =600V, I _C =40A, R _{Gon} =10Ω, V _{GE} =0/15V, Inductive Load	T _J =25℃		46		ns
			T _J =125℃		48		
			T _J =150℃		49		
t _r	Rise Time		T _J =25℃		51		ns
			T _J =125℃		54		
			T _J =150℃		63		
t _{d(off)}	Turn-off Delay Time	V _{CC} =600V, I _C =40A, R _{Goff} =10Ω, V _{GE} =0/15V, Inductive Load	T _J =25℃		166		ns
		T _J =125℃		170			
		T _J =150℃		172			



t _f	Fall Time	V _{CC} =600V, I _C =40A, R _{Goff} =10Ω, V _{GE} =0/15V, Inductive Load	T _J =25℃		201		ns
			T _J =125℃		217		
			T _J =150℃		220		
E _{on}	Turn-on Switching Loss	V _{CC} =600V, I _C =40A, R _{Gon} =10Ω, V _{GE} =0/15V, di/dt=586A/μs(T _J =150℃), Inductive Load	T _J =25℃		3.70		mJ
			T _J =125℃		4.35		
			T _J =150℃		4.55		
E _{off}	Turn-off Switching Loss	V _{CC} =600V, I _C =40A, R _{Goff} =10Ω, V _{GE} =0/15V, du/dt=4163V/μs(T _J =150℃), Inductive Load	T _J =25℃		1.33		mJ
			T _J =125℃		1.80		
			T _J =150℃		1.88		
Q _g	Total Gate Charge	V _{CC} =960V, I _C =40A, V _{GE} =0/15V			130		nC
Q _{ge}	Gate-Emitter Charge				25		
Q _{gc}	Gate-Collector Charge				71		
I _{sc}	V _{CC} =600V, V _{GE} =0/15V, t _p =10μs, T _J =150℃				184		A

Electrical Characteristics of Diode ($T_C=25^\circ C$ unless otherwise specified)

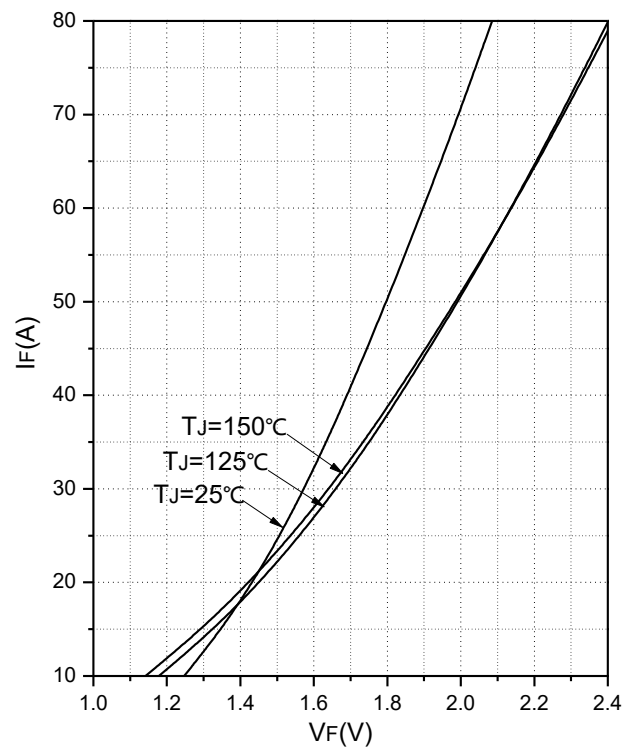
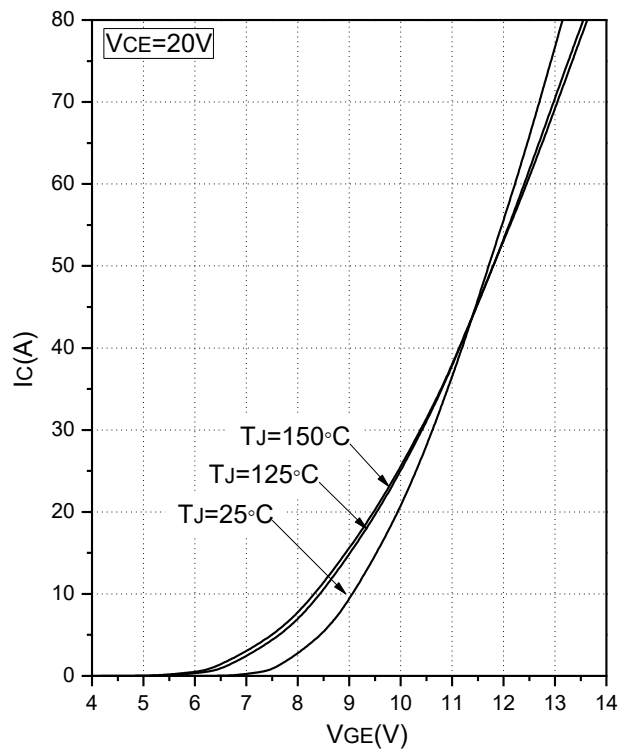
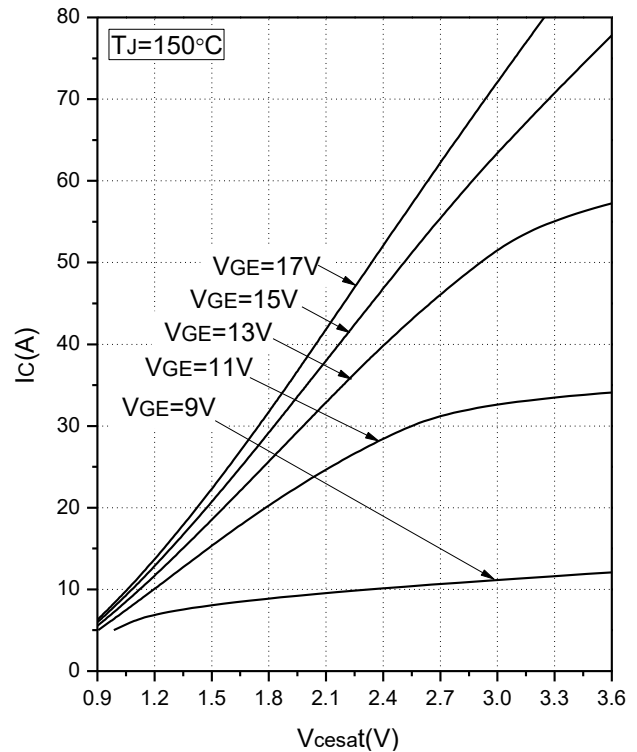
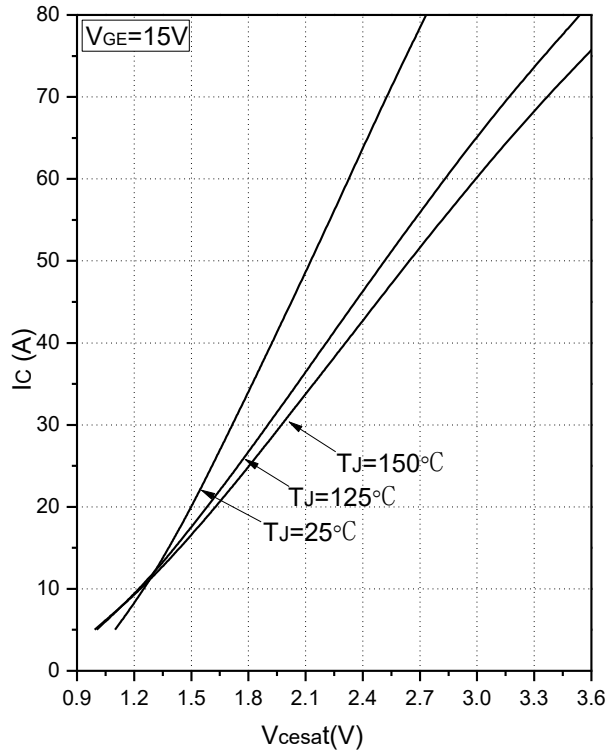
Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V _{FM}	Forward Voltage	I _F =40A	T _J =25℃		1.70		V
			T _J =125℃		1.85		
			T _J =150℃		1.85		
I _{rr}	Peak Reverse Recovery Current	I _F =40A, -di/dt=904A/μs(T _J =150℃), V _{rr} =600V, V _{GE} =0V	T _J =25℃		20.6		A
			T _J =125℃		22.0		
			T _J =150℃		23.9		
t _{rr}	Reverse Recovery Time		T _J =25℃		280		ns
			T _J =125℃		329		
			T _J =150℃		329		
dI _{rr} /dt	Peak Rate of Fall of Reverse Recovery Current during t _b		T _J =25℃		113		A/μs
			T _J =125℃		144		
			T _J =150℃		122		



Q _{rr}	Reverse Recovery Charge	I _F =40A, di/dt=904A/μs(T _J =150°C), V _{rr} =600V, V _{GE} =0V	T _J =25°C		3.36		μC
			T _J =125°C		3.99		
			T _J =150°C		4.21		
E _{rec}	Reverse Recovery Energy		T _J =25°C		1.15		mJ
			T _J =125°C		1.42		
			T _J =150°C		1.48		

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

Symbol	Description	Min.	Typ.	Max.	Units
R _{ΘJC} (IGBT)	Thermal Resistance: Junction-to-Case		0.20		°C/W
R _{ΘJC} (Diode)	Thermal Resistance: Junction-to-Case		0.40		°C/W
R _{ΘJA}	Thermal Resistance: Junction-to-Ambient (typical socket mount)			40	°C/W



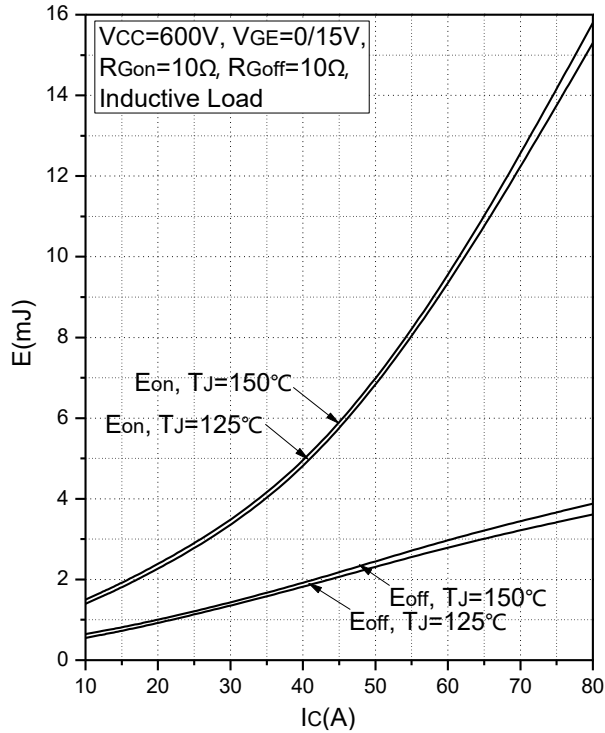


Fig.5 Typical Switching Loss vs. Collector Current

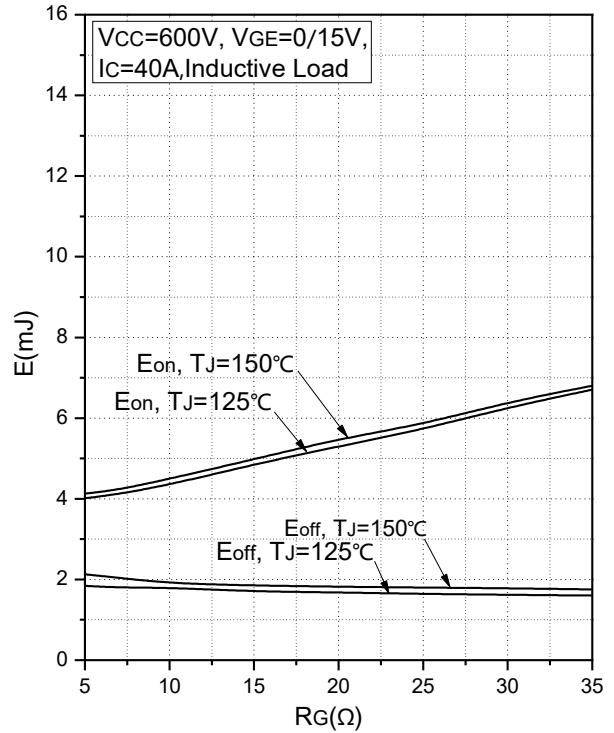


Fig.6 Typical Switching Loss vs. Gate Resistance

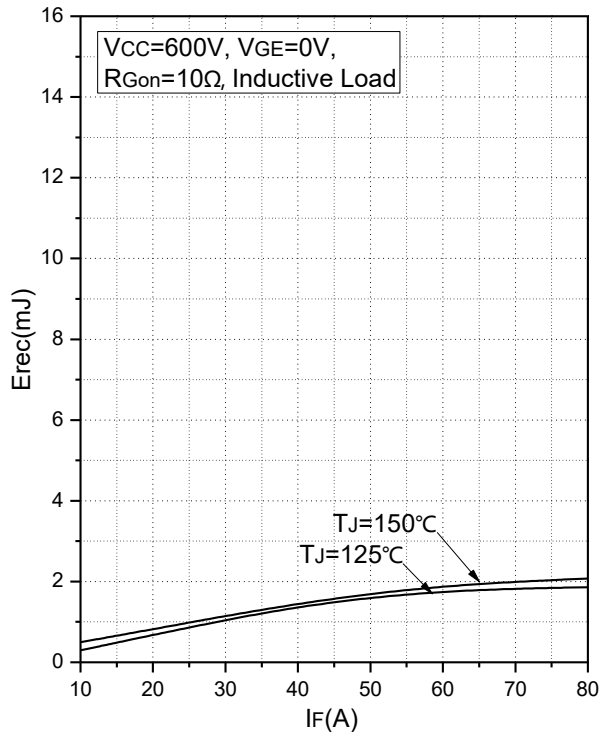


Fig.7 Typical Switching Loss vs. Forward Current

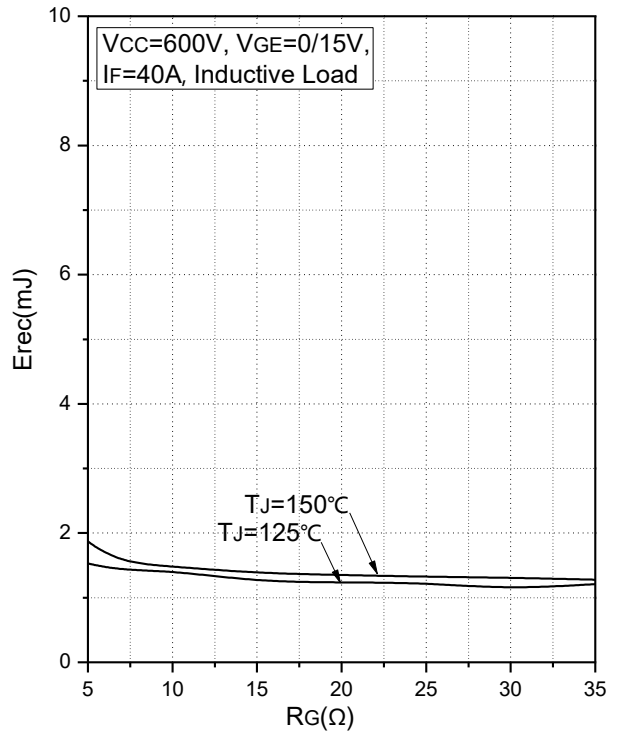
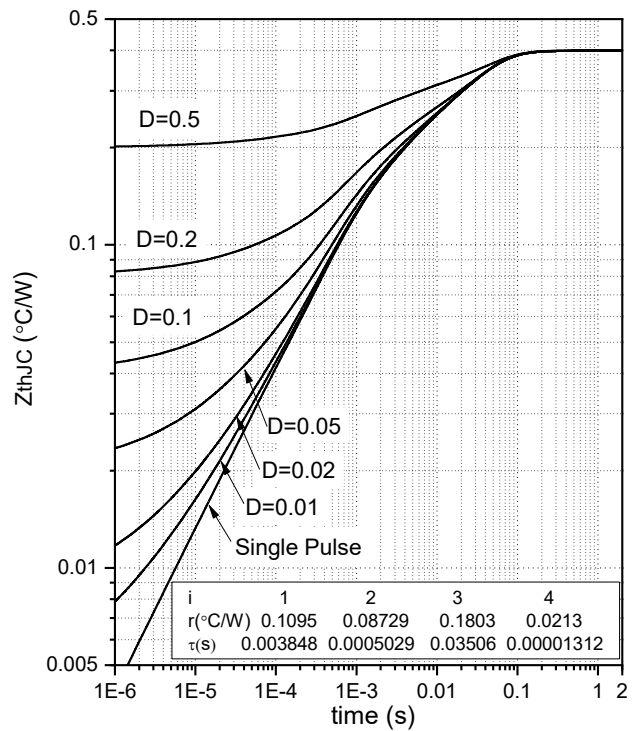
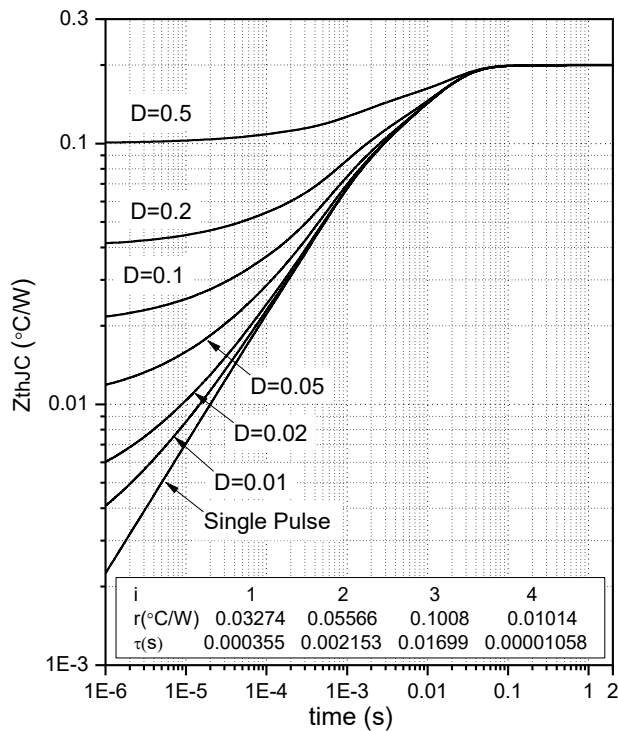
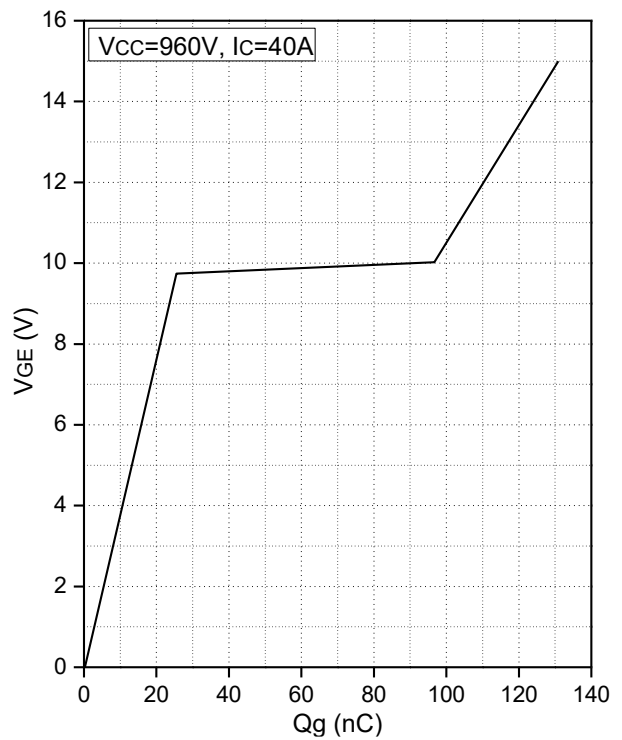
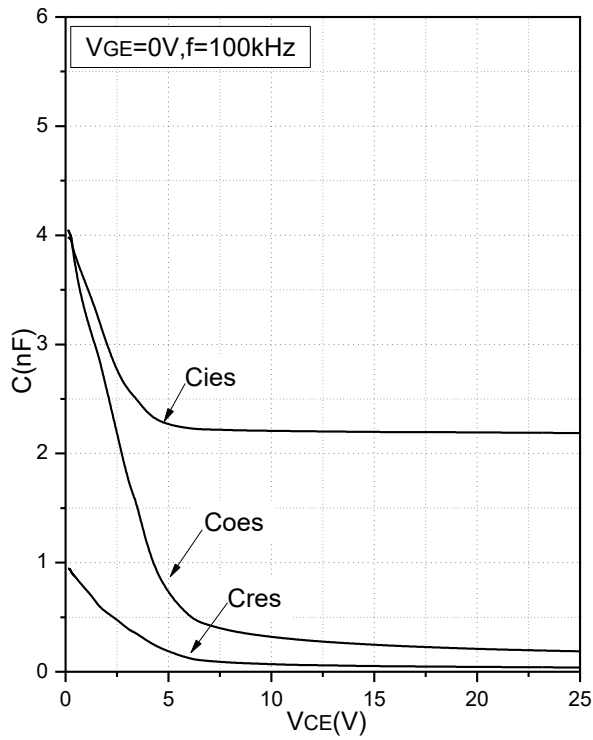


Fig.8 Typical Switching Loss vs. Gate Resistance





Test Circuit:

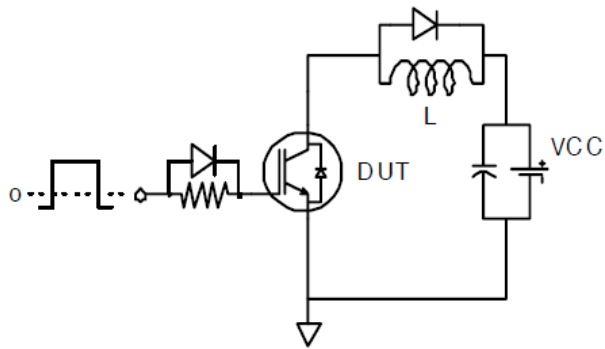


Fig.13 Gate Charge Circuit (turn-off)

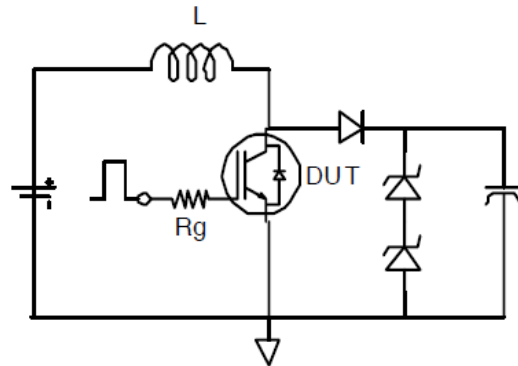


Fig.14 RBSOA Circuit

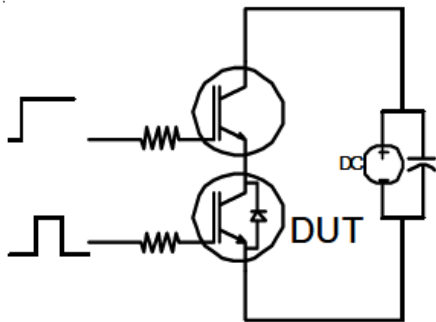


Fig.15 S.C. SOA Circuit

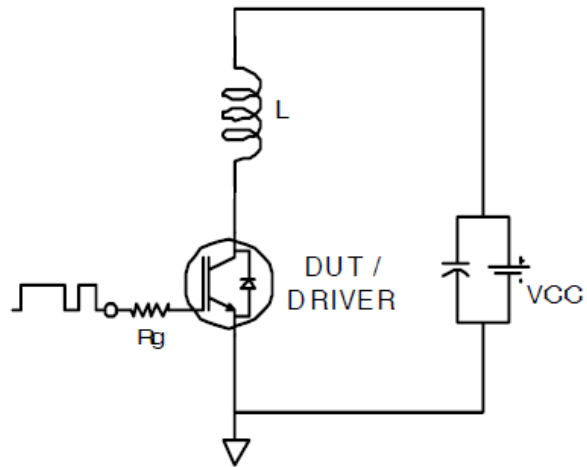


Fig.16 Switching Loss Circuit

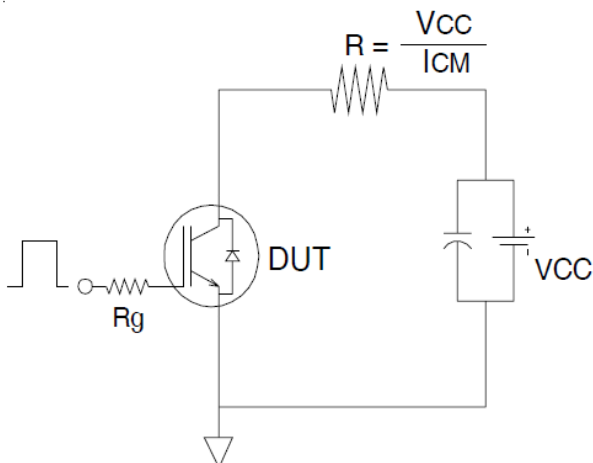


Fig.17 Resistive Load Circuit

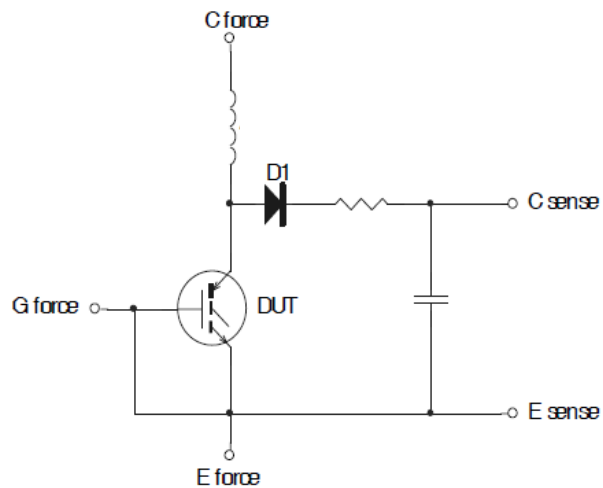
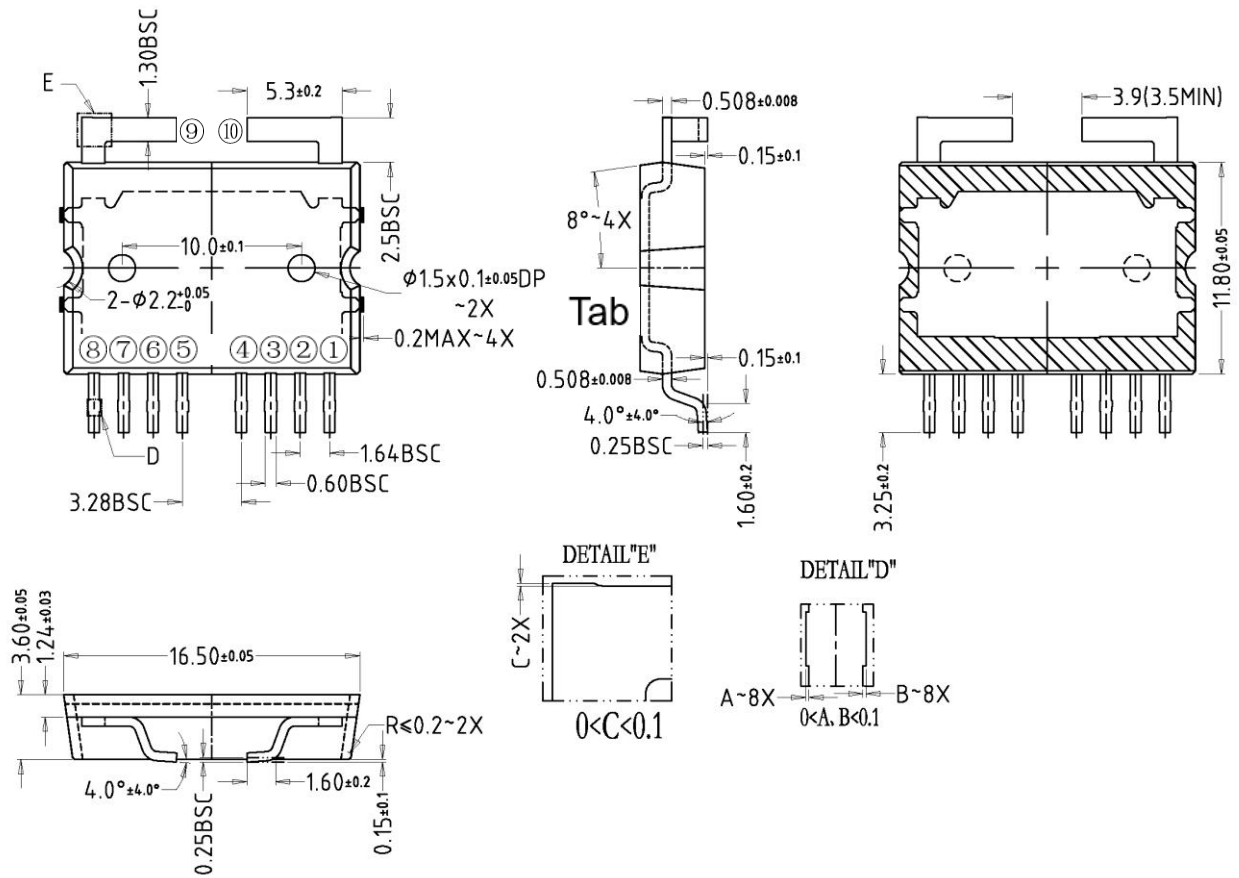


Fig.18 BVCES Filter Circuit



IP-8L Package Outline (Unit: mm):



CONNECTION

- ① GATE
- ② KELVIN EMITTER
- ③ ... ⑧ EMITTER
- ⑨/⑩/Tab COLLECTOR



Revision	Notes
01	Initial Release
02	Update Electrical Characteristics and Curves
A	Final Version

Announcement

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The datasheet with “REV.” + “Arabic numerals” is based on engineering data for initial reference purpose only.

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