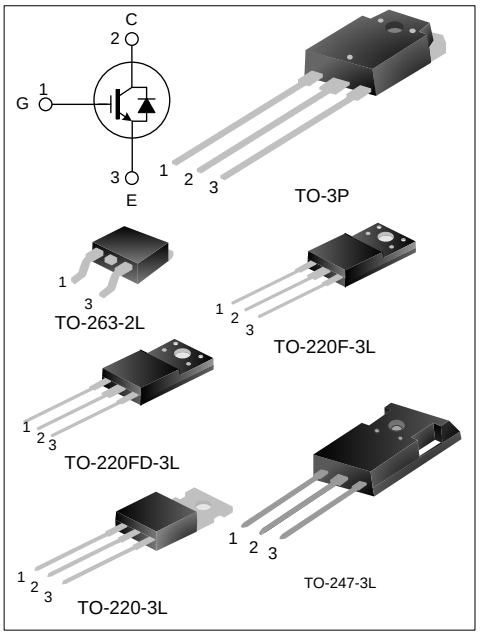
20A, 600V FIELD STOP IGBT

DESCRIPTION

The SGT20T60SD1F(S)(P7)(FD)(PN)(T) field stop IGBT adopts Silan the 3th-generation trench Field Stop technology, features low conduction loss and switching loss, positive temperature coefficient, easy parallel operation, etc. It is applicable to inverters, UPS, SMPS, and PFC.



FEATURES

- 20A, 600V, $V_{CE(sat)(typ.)}$=1.65V@I_C=20A
- Low conduction loss
- Fast switching speed
- High breakdown voltage

NOMENCLATURE

SGT 20 T 60 S D 1 P7

- IGBT series
- Current, 50: 20A
- N : N Channel
  NE : N-channel planar gate with ESD
  T : Field Stop 3/4
  U : Field Stop 4+
  V : Field Stop 5
  W: Field Stop 5+
  Y : Field Stop 5++
  A : Field Stop 6
- Voltage, 60: 600V
  120: 1200V
- L : Ultra low switching, recommended frequency ~2KHz
  Q : Low switching, recommended frequency2~20KHz
  S : Standard frequency, recommended frequency5~40KHz
  F : Fast switching, recommended frequency10~60KHz
  UF : Ultra fast switching, recommended frequency 40KHz~
  I : IGNITION
- D : Packaged with fast recovery diode
  R : RC IGBT
  Empty:Single IGBT chip
  C : SiC diode
- Blank: Standard diode
  M : Standard Diode, full range
  R : Rapid Diode
  B : Rapid Diode, full range
  S : Soft Diode, full range
- 1,2,3··· : Version No.
- Package
  P7 : TO-247-3L

ORDERING INFORMATION

Part No.	Package	Marking	Hazardous Substance Control	Packing type
SGT20T60SD1F	TO-220F-3L	20T60SD	Pb free	Tube
SGT20T60SD1S	TO-263-2L	20T60SD1S	Halogen free	Tube
SGT20T60SD1STR	TO-263-2L	20T60SD1S	Halogen free	Tape & reel
SGT20T60SD1P7	TO-247-3L	20T60SD1P7	Pb free	Tube
SGT20T60SD1FD	TO-220FD-3L	20T60SD1FD	Pb free	Tube
SGT20T60SD1PN	TO-3P	20T60SD1	Pb free	Tube
SGT20T60SD1T	TO-220-3L	20T60SD1T	Pb free	Tube

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C UNLESS OTHERWISE NOTED)

Characteristics		Symbol	Ratings				Units
			SGT20T60 SD1F/FD	SGT20T60 SD1S/T	SGT20T60 SD1P7	SGT20T60 SD1PN	
Collector to Emitter Voltage		V_{CE}	600				V
Gate to Emitter Voltage		V_{GE}	±20				V
Collector Current	T_C=25°C	I_C	40				A
	T_C=100°C		20				
Pulsed Collector Current		I_{CM}	60				A
Diode current	T_C=25°C	I_F	16				A
	T_C=100°C		8				A
Diode Pulsed Current		I_{FM}	32				A
Short-circuit time(V_{GE}=15V, V_{CC}=300V)		Tsc	10				μs
Maximum Power Dissipation (T_C=25°C)		P_D	46	178	139	139	W
Operating Junction Temperature		T_J	-55～+150				°C
Storage Temperature Range		T_{stg}	-55～+150				°C

THERMAL CHARACTERISTICS

Characteristics	Symbol	Ratings				Units
		SGT20T60SD 1F/FD	SGT20T60SD 1S/T	SGT20T60SD 1P7	SGT20T60SD 1PN	
Thermal Resistance, Junction to Case (IGBT)	$R_{th(j-C)}$	2.7	0.7	0.9	0.9	°C/W
Thermal Resistance, Junction to Case (FRD)	$R_{th(j-C)}$	3.8	1.6	1.9	2.0	°C/W

ELECTRICAL CHARACTERISTICS OF IGBT (T_J = 25°C, UNLESS OTHERWISE NOTED)

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Units
Collector - Emitter Breakdown Voltage	$V_{(BR)CES}$	V_{GE}=0V, I_C=250uA	600	--	--	V
Zero Gate Voltage Collector Current	I_{CES}	V_{CE}=600V, V_{GE}=0V	--	--	200	μA
Gate-emitter Leakage Current	I_{GES}	V_{GE}=20V, V_{CE}=0V	--	--	±400	nA
Gate-emitter Threshold Voltage	$V_{GE(th)}$	I_C=250uA, V_{CE}=V_{GE}	4.0	5.0	6.5	V
Collector-emitter Saturation Voltage	V_{CEsat}	I_C=20A,V_{GE}=15V	--	1.65	2.4	V
		I_C=20A,V_{GE}=15V,T_J=125°C	--	1.9	--	V
Input Capacitance	C_{ies}	V_{CE}=30V	--	1100	--	pF
Output Capacitance	C_{oes}	V_{GE}=0V	--	55	--	
Reverse Transfer Capacitance	C_{res}	f=1MHz	--	22	--	
Turn-On Delay Time	$T_{d(on)}$	V_{CE}=400V I_C=20A R_G =10Ω V_{GE}=15V Inductive load	--	19	--	ns
Rise Time	T_r		--	55	--	
Turn-Off Delay Time	$T_{d(off)}$		--	48	--	
Fall Time	T_f		--	115	--	
Turn-on Energy	E_{on}		--	1	--	mJ
Turn-off Energy	E_{off}		--	0.3	--	
Total Switching Energy	E_{st}		--	1.3	--	
Total Gate Charge	Q_g	V_{CE} = 400V, I_C=20A, V_{GE} = 15V	--	52	--	nC
Gate to Emitter Charge	Q_{ge}		--	15	--	
Gate to Collector Charge	Q_{gc}		--	22	--	

ELECTRICAL CHARACTERISTICS OF FRD (T_J = 25°C UNLESS OTHERWISE NOTED)

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Units
Diode Forward Voltage	V_F	I_F=8A, T_J=25°C	--	1.7	2.4	V
		I_F=8A, T_J=125°C	--	1.4	--	
Diode Reverse Recovery Time	T_{rr}	I_{ES}=8A, dI_{ES}/dt=200A/μs	--	22	--	ns
Diode Reverse Recovery Charge	Q_{rr}	I_{ES}=8A, dI_{ES}/dt=200A/μs	--	36	--	nC

TYPICAL CHARACTERISTICS CURVE

Figure 1. Typical Output Characteristics

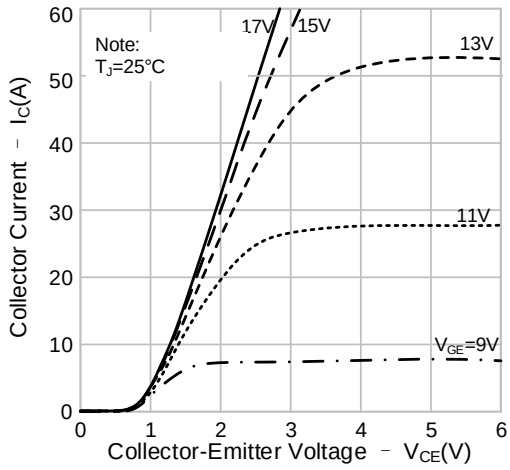


Figure 2. Typical Output Characteristics

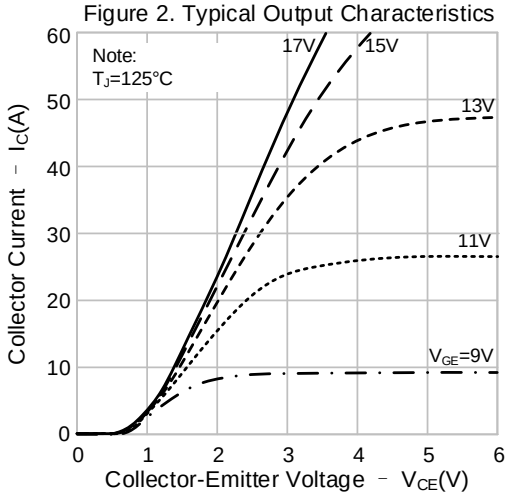


Figure 3. Typical Saturation Voltage Characteristic

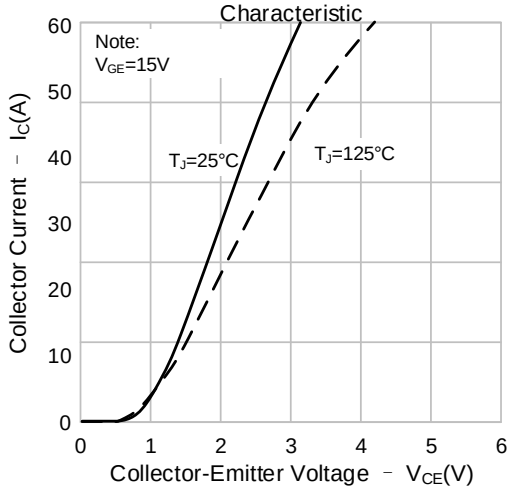


Figure 4. Transfer Characteristic

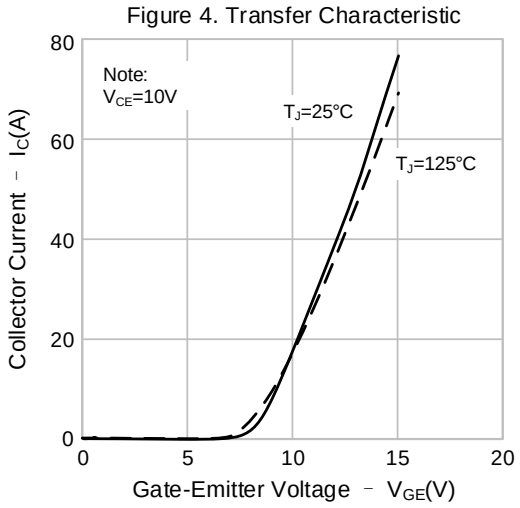


Figure 5. Saturation Voltage vs. V_{GE}

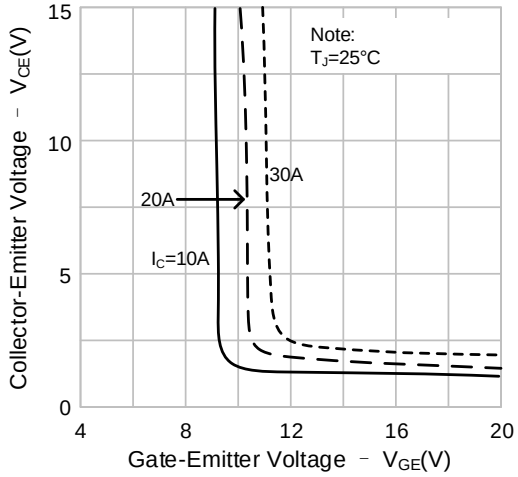
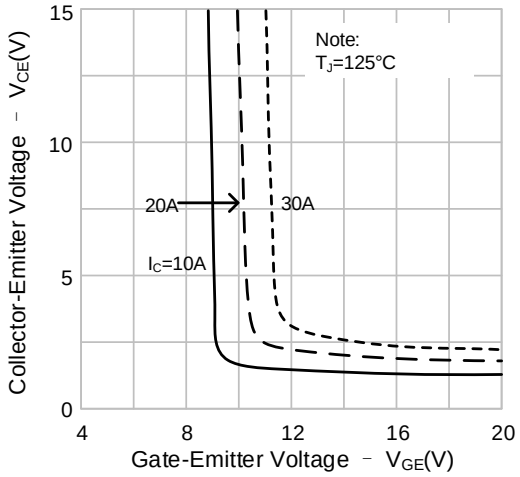


Figure 6. Saturation Voltage vs. V_{GE}



TYPICAL CHARACTERISTICS CURVE (CONTINUED)

Figure 7. Saturation Voltage vs. Temperature

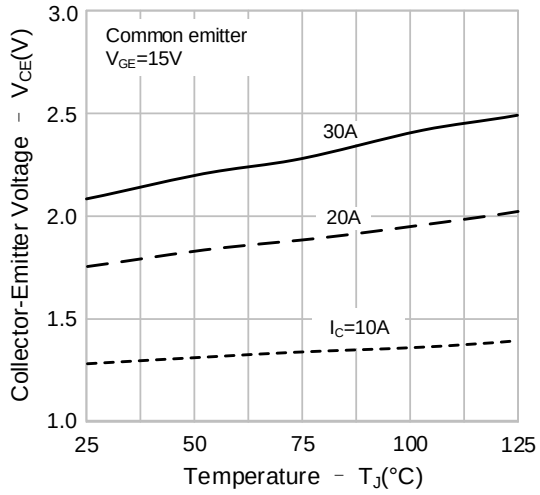


Figure 8. Capacitance Characteristic

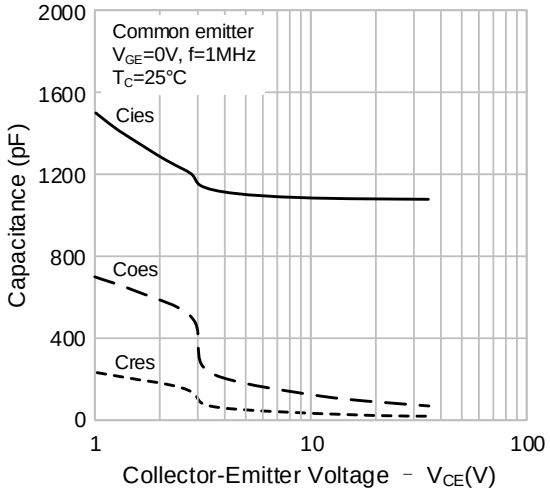


Figure 9. Gate Charge Characteristic

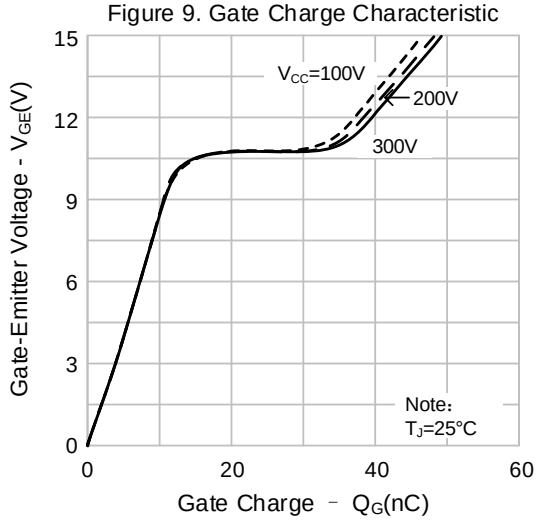


Figure 10. Turn-on Characteristic vs. Gate Resistance

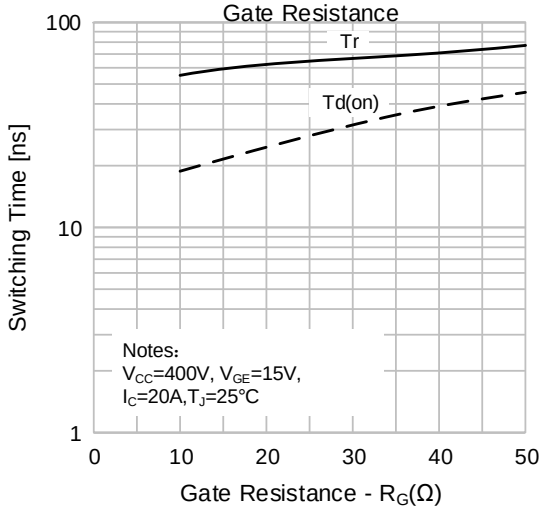


Figure 11. Turn-off Characteristic vs. Gate Resistance

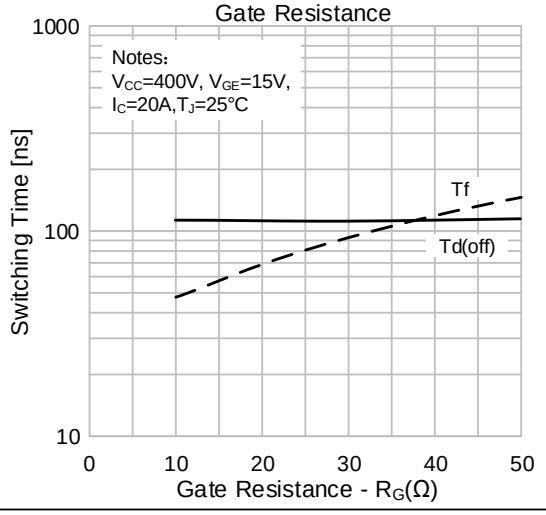
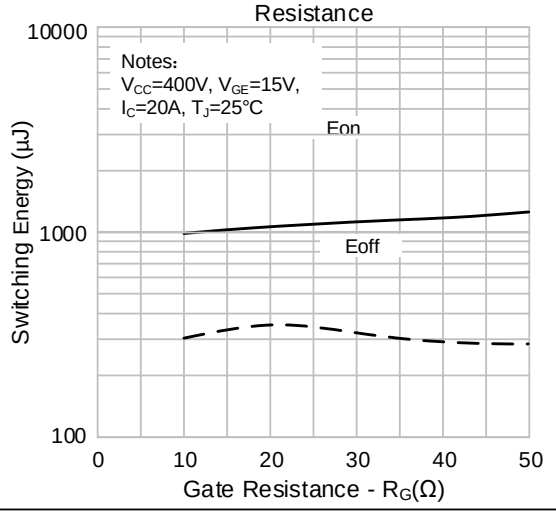


Figure 12. Switching Loss vs. Gate Resistance



TYPICAL CHARACTERISTICS CURVE (CONTINUED)

Figure 13. Turn-on Characteristic vs. Collector Current

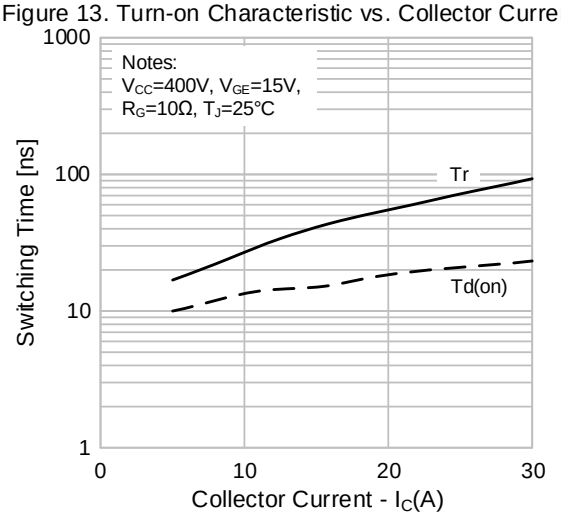


Figure 14. Turn-off Characteristic vs. Collector Current

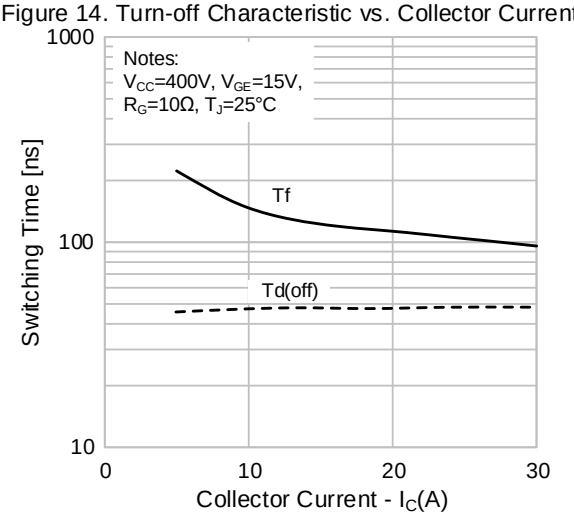


Figure 15. Turn-off Loss vs. Collector Current

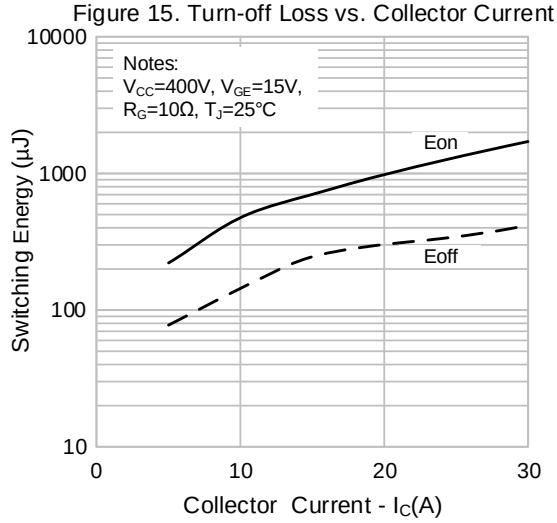


Figure 16. Forward Characteristic

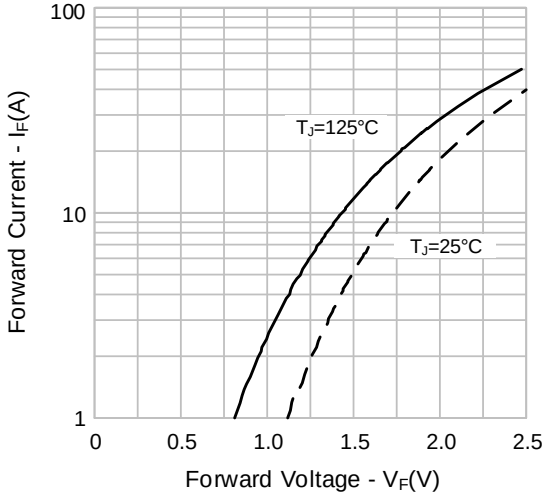


Figure 17. Reverse Recovery Time vs. Forward Current

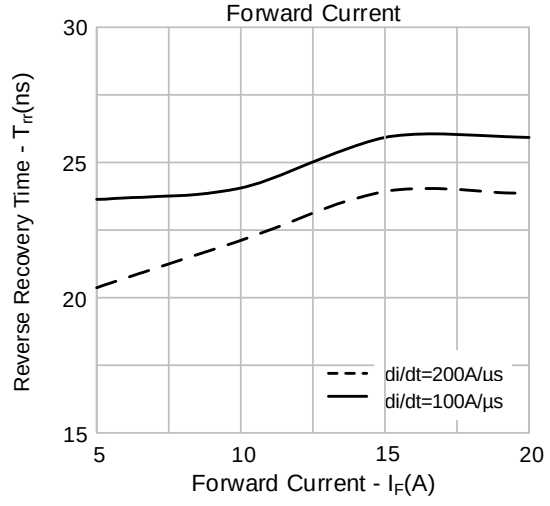
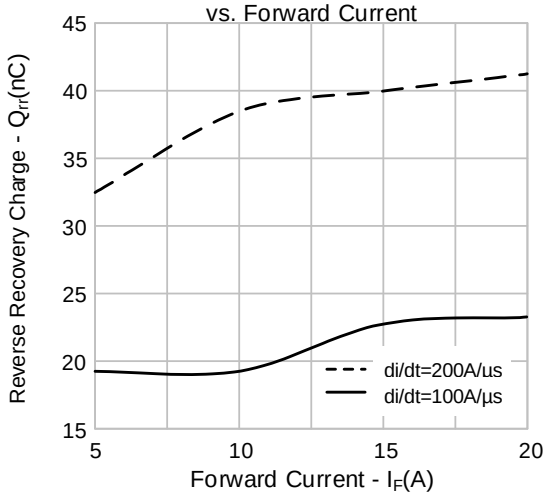


Figure 18. Reverse Recovery Charge vs. Forward Current



TYPICAL CHARACTERISTICS CURVE (CONTINUED)

Figure 19. Current Derating Case

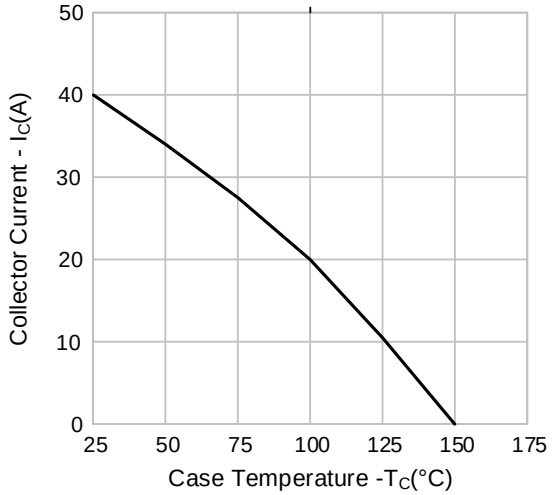


Figure 20. Max. Safe Operating Area

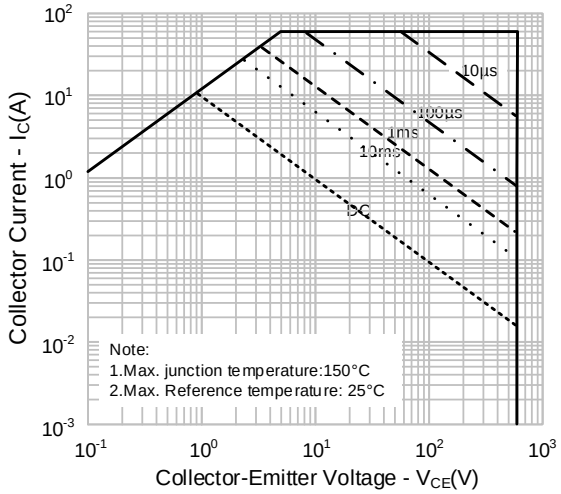
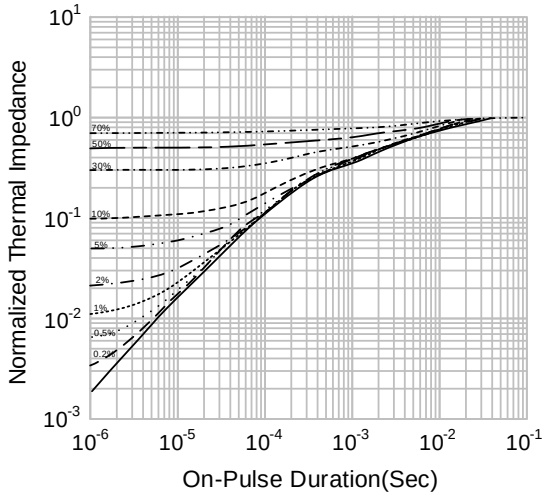
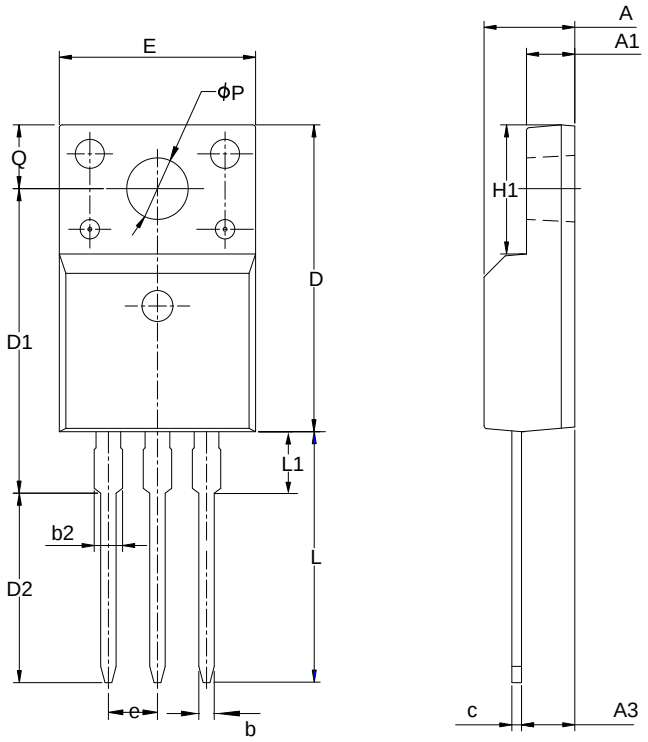


Figure 21. Transient thermal resistance (IGBT)



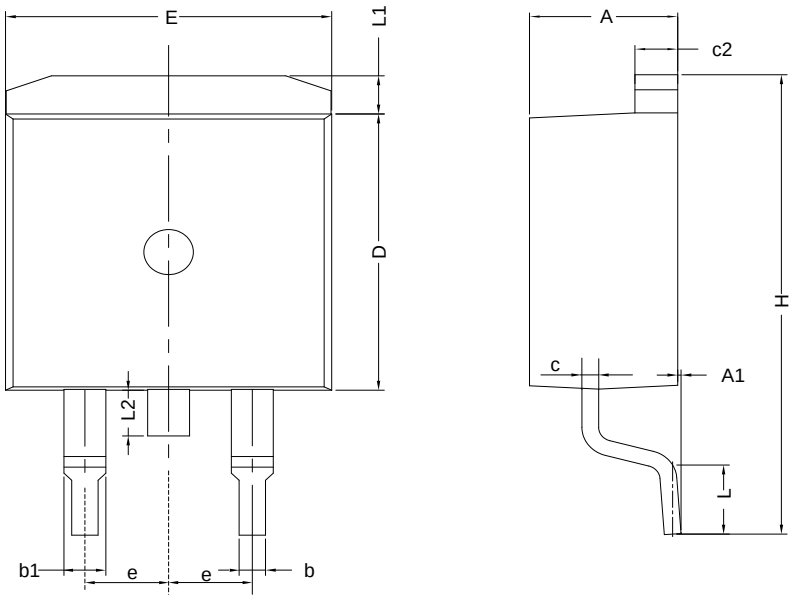
PACKAGE OUTLINE

TO-220F-3L **UNIT: mm**



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.42	4.70	5.02
A1	2.30	2.54	2.80
A3	2.50	2.76	3.10
b	0.70	0.80	0.90
b2	–	–	1.47
c	0.35	0.50	0.65
D	15.25	15.87	16.25
D1	15.30	15.75	16.30
D2	9.30	9.80	10.30
E	9.73	10.16	10.36
e	2.54BSC		
H1	6.40	6.68	7.00
L	12.48	12.98	13.48
L1	–	–	3.50
ϕP	3.00	3.18	3.40
Q	3.05	3.30	3.55

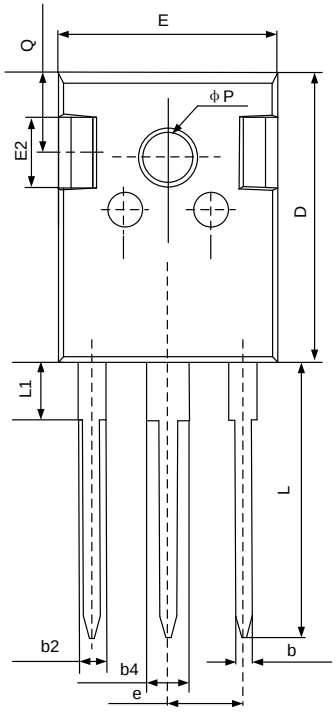
TO-263-2L **UNIT: mm**

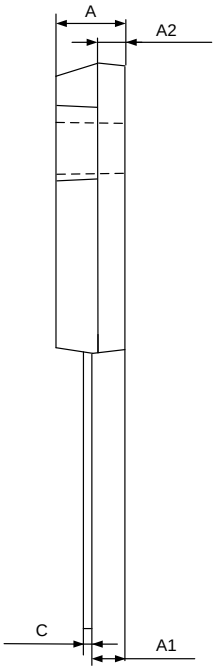


SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.30	4.57	4.72
A1	0	0.10	0.25
b	0.71	0.81	0.91
b1	1.17	—	1.50
c	0.30	—	0.60
c2	1.17	1.27	1.37
D	8.50	—	9.35
E	9.80	—	10.45
e	2.54BSC		
H	14.70	—	15.75
L	2.00	2.30	2.74
L1	1.12	1.27	1.42
L2	—	—	1.75

PACKAGE OUTLINE (CONTINUED)

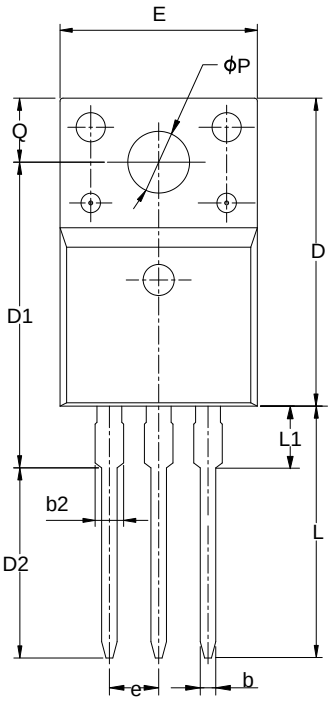
TO-247-3L **UNIT: mm**

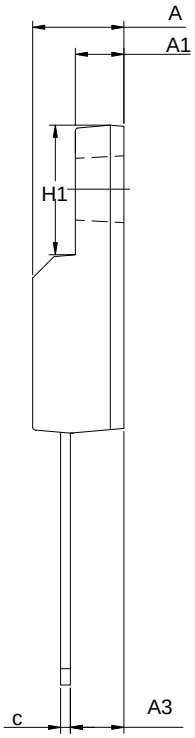




SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.59
A2	1.85	2.00	2.15
b	1.11	–	1.36
b2	1.91	–	2.25
b4	2.91	–	3.25
c	0.51	–	0.75
D	20.80	21.00	21.30
E	15.50	15.80	16.10
E2	4.40	5.00	5.20
e	5.44 BSC		
L	19.72	19.92	20.22
L1	–	–	4.30
Q	5.60	5.80	6.00
P	3.40	—	3.80

TO-220FD-3L **UNIT: mm**

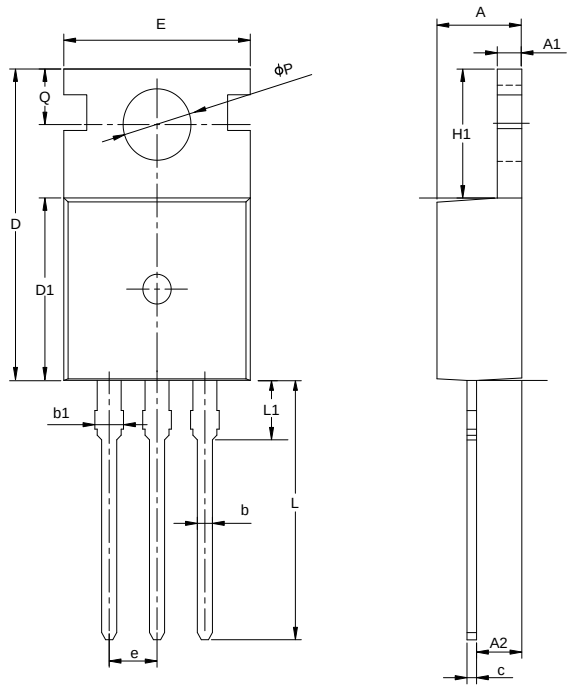




SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.42	4.70	5.02
A1	2.30	2.54	2.80
A3	2.50	2.76	3.10
b	0.70	0.80	0.90
b2	—	—	1.47
c	0.35	0.50	0.65
D	15.25	15.87	16.25
D1	15.30	15.75	16.30
D2	9.30	9.80	10.30
E	9.73	10.16	10.36
e	2.54BSC		
H1	6.40	6.68	7.00
L	12.48	12.98	13.48
L1	—	—	3.50
ϕP	3.00	3.18	3.40
Q	3.05	3.30	3.55

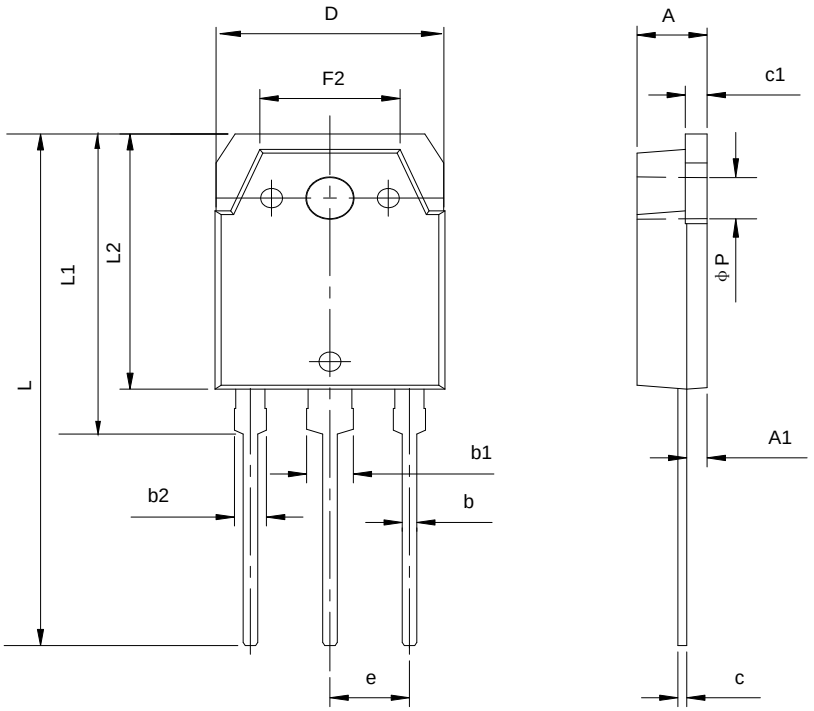
PACKAGE OUTLINE (CONTINUED)

TO-220-3L **UNIT: mm**



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.30	4.50	4.70
A1	1.00	1.30	1.50
A2	1.80	2.40	2.80
b	0.60	0.80	1.00
b1	1.00	—	1.60
c	0.30	—	0.70
D	15.10	15.70	16.10
D1	8.10	9.20	10.00
E	9.60	9.90	10.40
e	2.54BSC		
H1	6.10	6.50	7.00
L	12.60	13.08	13.60
L1	—	—	3.95
ϕP	3.40	3.70	3.90
Q	2.60	—	3.20

TO-3P **UNIT: mm**



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.4	—	5.2
c1	1.2	—	1.8
A1	1.2	—	2.0
b	0.7	1.0	1.3
b1	2.7	3.0	3.3
b2	1.7	2.0	2.3
D	15.0	15.5	16.0
c	0.4	0.6	0.8
F2	8.5	—	10.0
e	5.45 TYP		
L1	22.6	—	23.6
L	39.0	—	41.5
L2	19.5	—	21.0
P	3.0	—	3.4

Important notice :

1. Silan reserves the right to make changes of this instruction without notice.
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Rev.: 1.5

Revision History:

1. Update nomenclature and parameter names
2. Update TO-263-2L、TO-247-3L、TO-3P package outline
3. Update important notice

Rev.: 1.4

Revision History:

1. Add TO-220-3L package specification

Rev.: 1.3

Revision History:

1. Update description：（Field Stop ）to（Field Stop III）
2. Update Typ. of $V_{CE(sat)}$
3. update Diode current
4. Update Fig 18 and 19

Rev.: 1.2

Revision History:

1. Modify and Add TYPICAL CHARACTERISTICS CURVE

Rev.: 1.1

Revision History:

1. Modify ABSOLUTE MAXIMUM RATINGS

Rev.: 1.0

Revision History:

1. First release