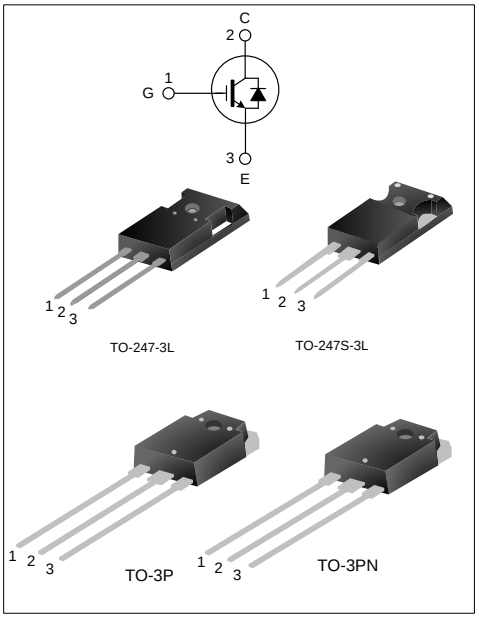
60A, 600V FIELD STOP IGBT

DESCRIPTION

SGT60N60FD1PN/P7/PS/PT adopts Field Stop IGBT technology, offer the optimum performance for induction Heating,UPS,SMPS and PFC application.



FEATURES

- 60A, 600V, $V_{CE(sat)(typ.)}$=2.2V@I_C=60A
- Low conduction loss
- Fast switching
- High input impedance

NOMENCLATURE

SGT 60 N 60 F D 1 PN

- IGBT series
- Current, 60: 60A
- 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, 65: 650V
  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
  PN : TO-3P

ORDERING INFORMATION

Part No.	Package	Marking	Hazardous Substance Control	Packing Type
SGT60N60FD1PN	TO-3P	60N60FD1	Pb free	Tube
SGT60N60FD1P7	TO-247-3L	60N60FD1	Pb free	Tube
SGT60N60FD1PS	TO-247S-3L	60N60D1	Pb free	Tube
SGT60N60FD1PT	TO-3PN	60N60FD1	Pb free	Tube

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

Characteristics		Symbol	Ratings	Units
Collector - Emitter Voltage		V_{CE}	600	V
Gate - Emitter Voltage		V_{GE}	±20	V
Collector Current	T_C=25°C	I_C	120	A
	T_C=100°C		60	
Pulsed Collector Current		I_{CM}	180	A
Maximum Power Dissipation (T_C=25°C)		P_{tot}	321	W
Operating Junction Temperature		T_J	-55～+150	°C
Storage Temperature Range		T_{stg}	-55～+150	°C

THERMAL CHARACTERISTICS

Characteristics	Symbol	Ratings	Units
Thermal Resistance, Junction to Case (IGBT)	$R_{th(j-C)}$	0.39	°C/W
Thermal Resistance, Junction to Case (FRD)	$R_{th(j-C)}$	1.10	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	40	°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=250μA	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=250μA, V_{CE}=V_{GE}	4.0	5.0	6.5	V
Collector-emitter Saturation Voltage	V_{CEsat}	I_C=60A,V_{GE}=15V,T_J=25°C	--	2.2	2.7	V
		I_C=60A,V_{GE}=15V,T_J=125°C	--	2.6	--	V
Input Capacitance	C_{ies}	V_{CE}=30,V_{GE}=0V,f=1MHz	--	2850	--	pF
Output Capacitance	C_{oes}		--	294	--	
Reverse Transfer Capacitance	C_{res}		--	85	--	
Turn-On Delay Time	$T_{d(on)}$	V_{CE}=400V I_C=60A R_g=10Ω V_{GE}=15V Inductive Load T_J=25°C	--	36	--	ns
Rise Time	T_r		--	142	--	
Turn-Off Delay Time	$T_{d(off)}$		--	193	--	
Fall Time	T_f		--	136	--	
Turn-On Energy	E_{on}		--	3.72	--	mJ
Turn-Off Energy	E_{off}		--	1.77	--	
Total Switching Energy	E_{st}		--	5.49	--	
Total Gate Charge	Q_g	V_{CE}=400V, I_C=60A, V_{GE}=15V	--	179	--	nC
Gate to Emitter Charge	Q_{ge}		--	23	--	
Gate to Collector Charge	Q_{gc}		--	100	--	

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=30A, T_J=25°C	--	1.9	2.6	V
		I_F=30A, T_J=125°C	--	1.5	--	
Diode Reverse Recovery Time	T_{rr}	I_{ES}=30A, dI_{ES}/dt=200A/μs	--	38	--	ns
Diode Reverse Recovery Charge	Q_{rr}	I_{ES}=30A, dI_{ES}/dt=200A/μs	--	85	--	nC

TYPICAL CHARACTERISTICS CURVE

Figure 1. Typical Output Characteristics

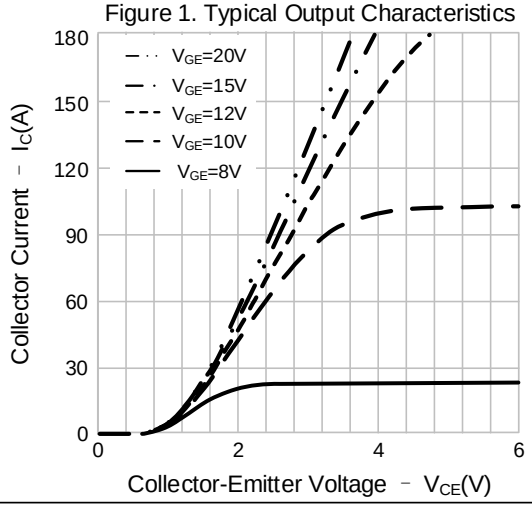


Figure 2. Transfer Characteristic

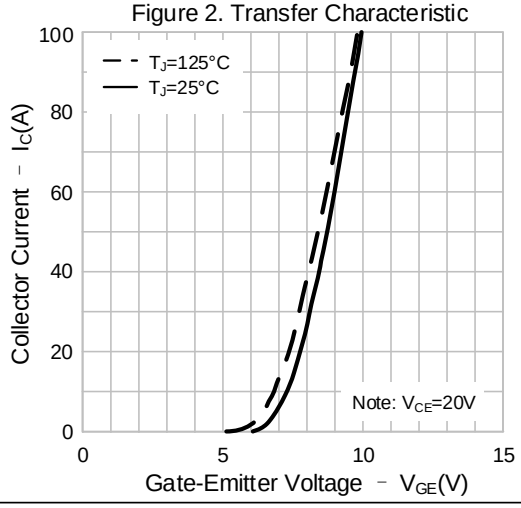


Figure 3. Typical Saturation Voltage Characteristic

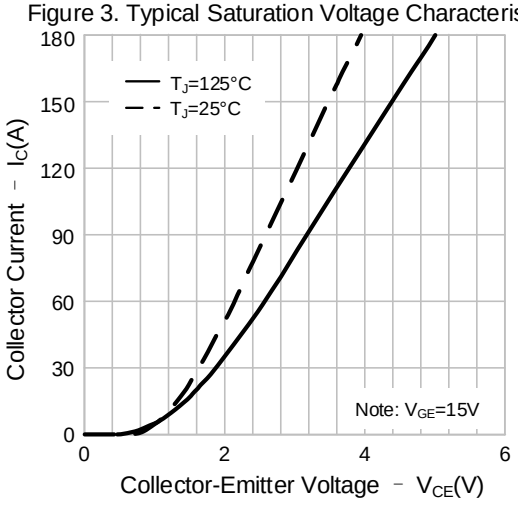


Figure 4. Saturation Voltage vs. V_{GE}

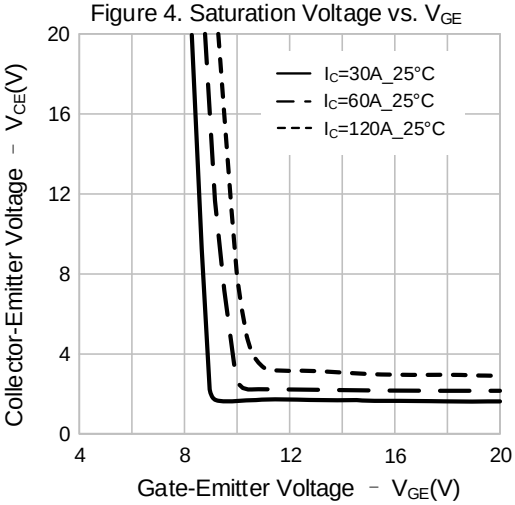


Figure 5. Saturation Voltage vs. V_{GE}

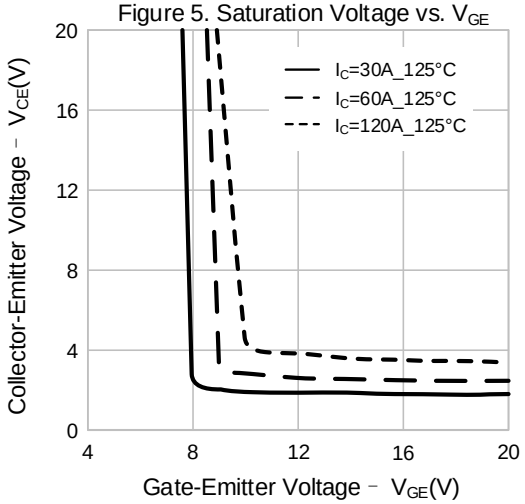
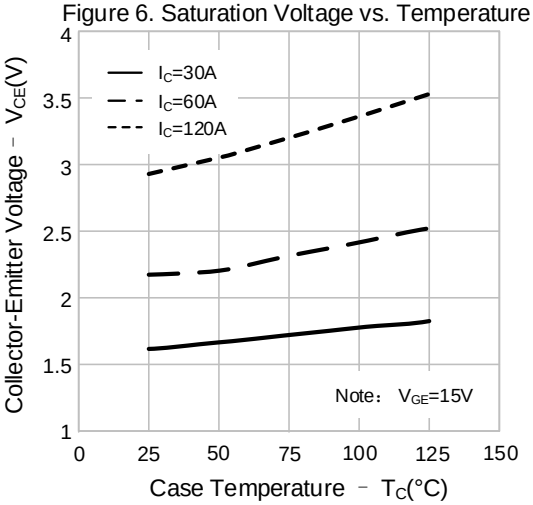


Figure 6. Saturation Voltage vs. Temperature



TYPICAL CHARACTERISTICS CURVE (CONTINUED)

Figure 7. Capacitance Characteristic

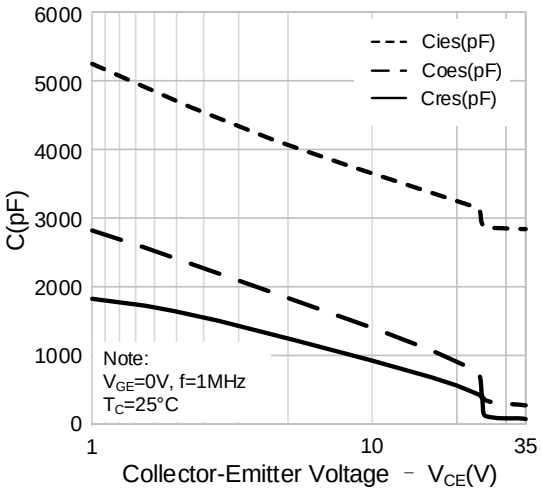


Figure 8. Gate Charge Characteristic

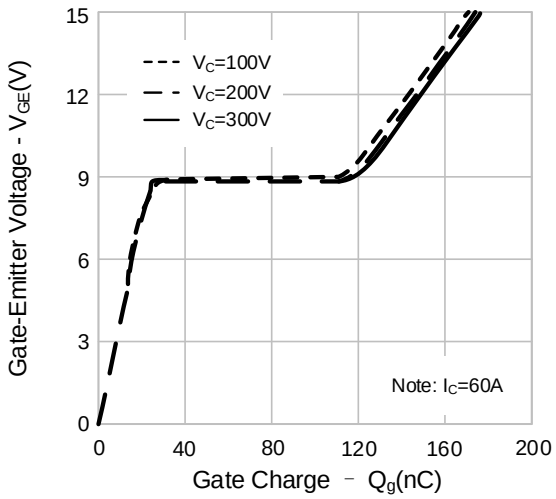


Figure 9. Turn-on Characteristic vs. Gate Resistance

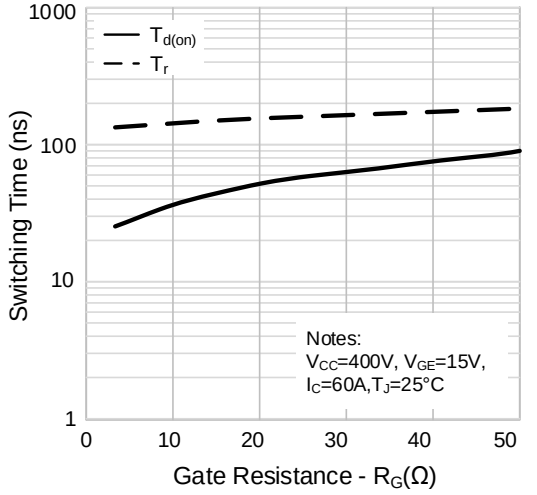


Figure 10. Turn-off Characteristic vs. Gate Resistance

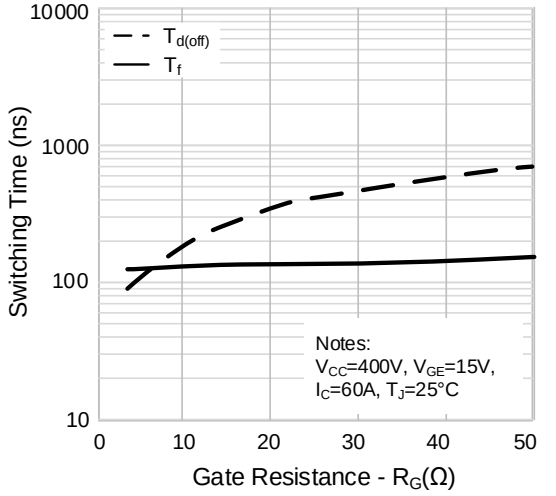


Figure 11. Switching Loss vs. Gate Resistance

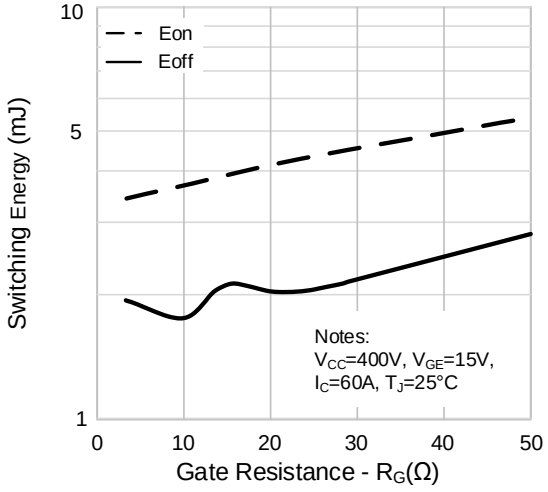
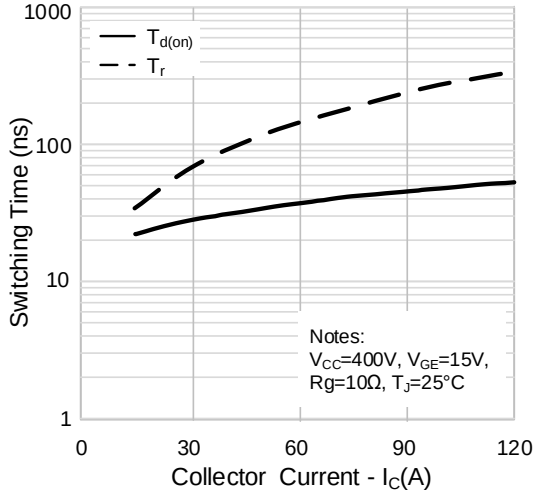


Figure 12. Turn-on Characteristic vs. Collector Current



TYPICAL CHARACTERISTICS CURVE (CONTINUED)

Figure 13. Turn-off Characteristic vs. Collector Current

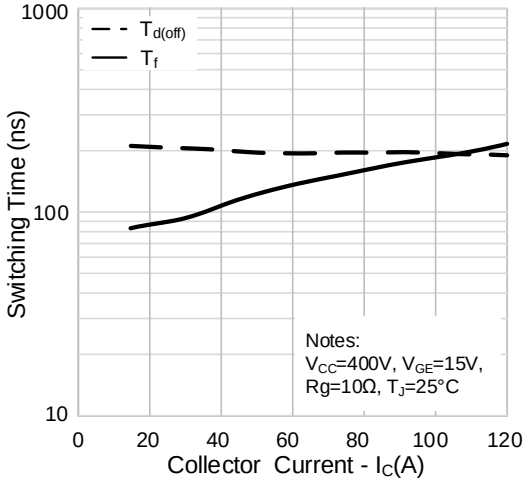


Figure 14. Switching Loss vs. Collector Current

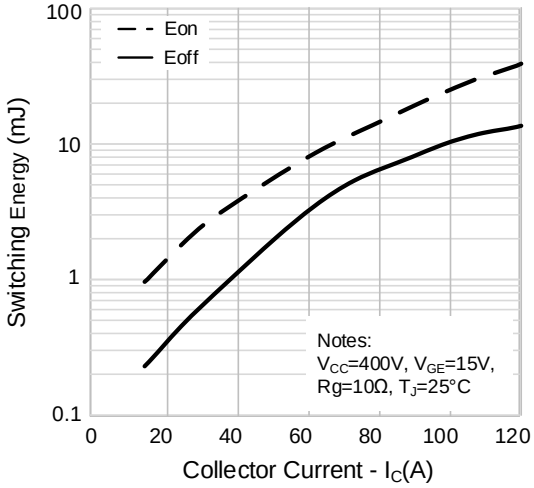


Figure 15. Forward Characteristic

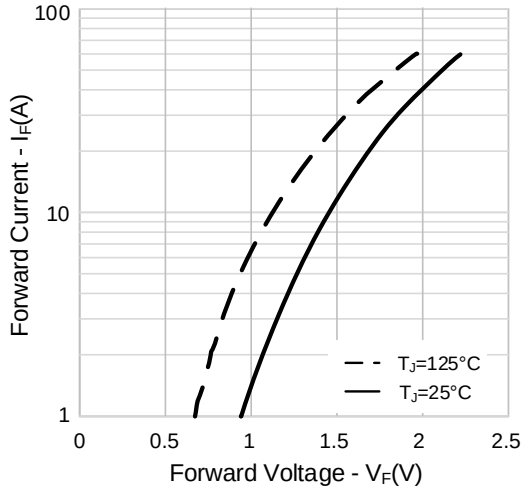


Figure 16. Reverse Recovery Time vs. Forward Current

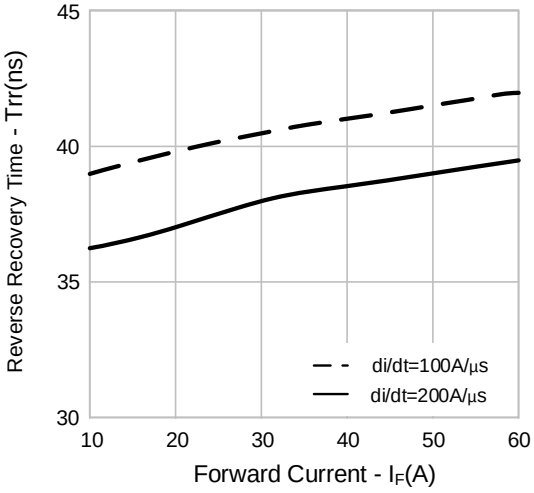


Figure 17. Reverse Recovery Charge vs. Forward Current

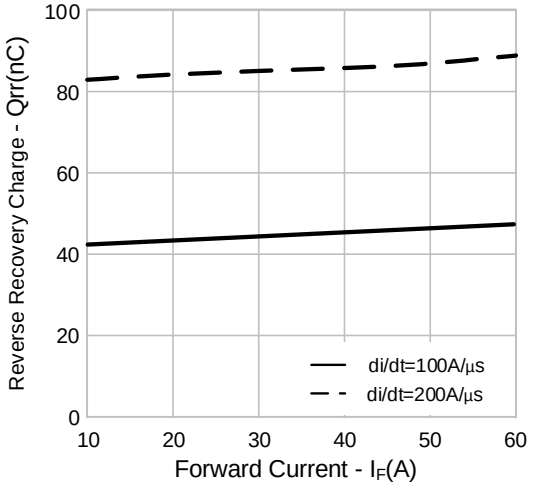
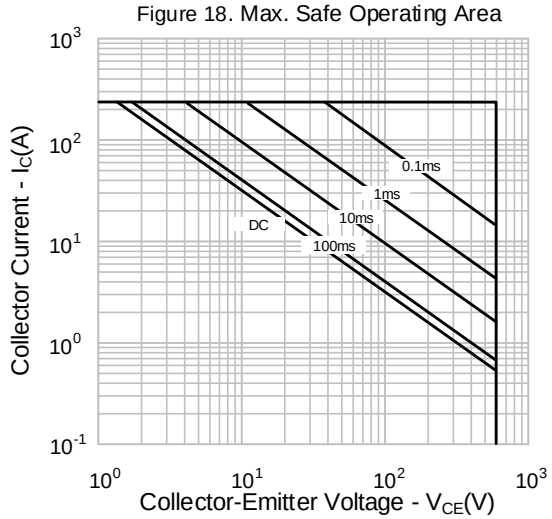


Figure 18. Max. Safe Operating Area



TYPICAL CHARACTERISTICS CURVE (CONTINUED)

Figure 19. Square Wave Impedance Simulation (IGBT)

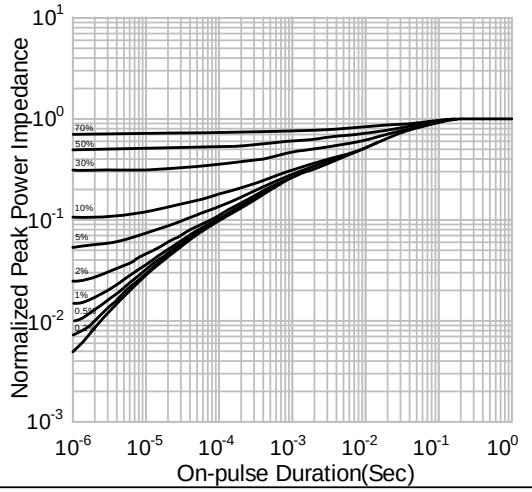
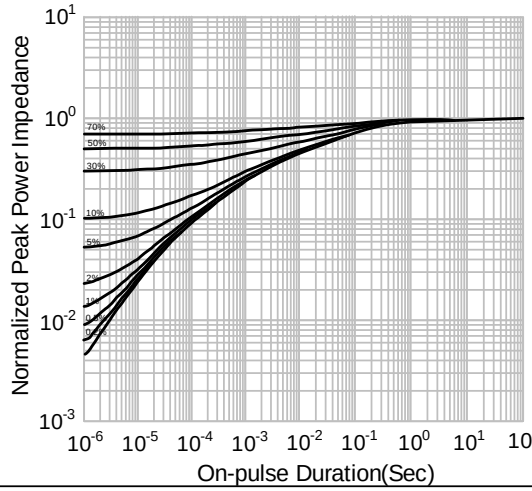


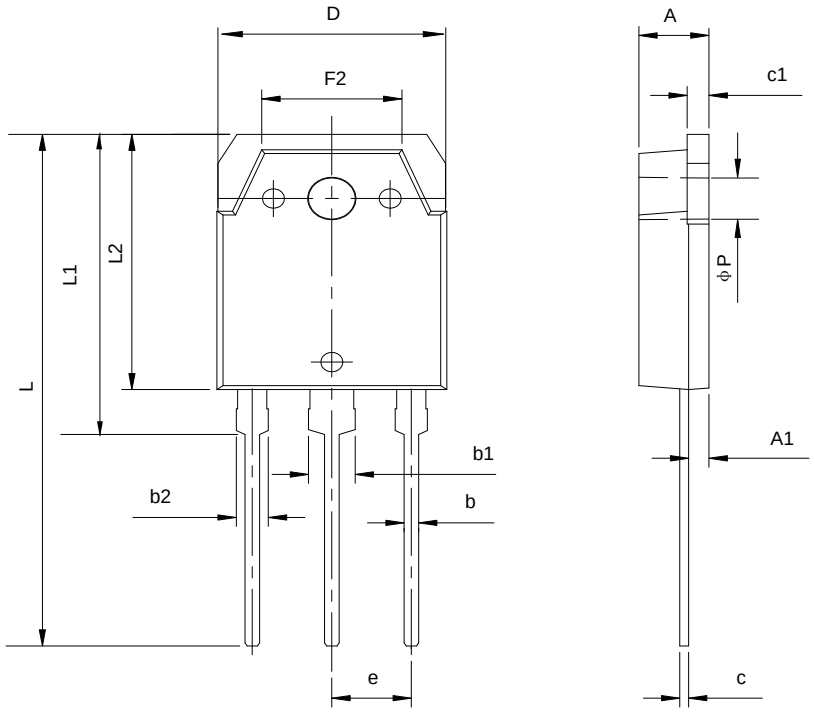
Figure 20. Square Wave Impedance Simulation (FRD)



PACKAGE OUTLINE

TO-3P

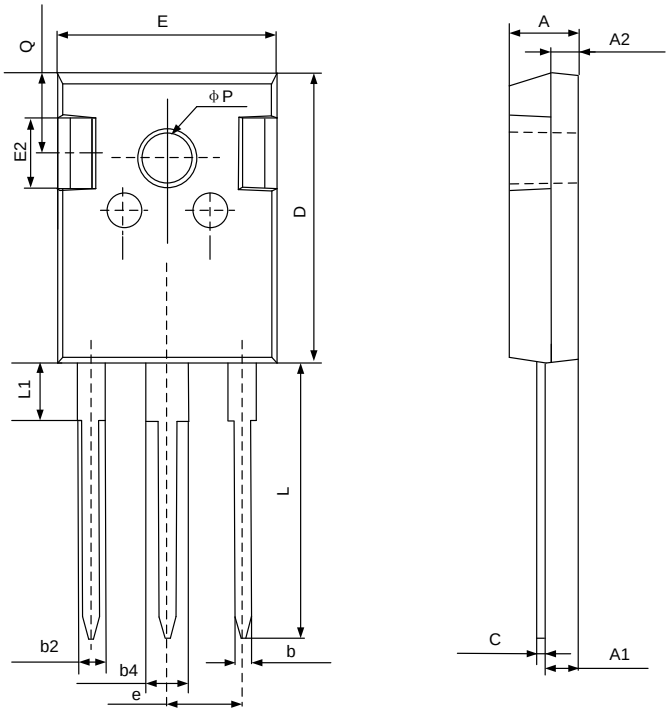
UNIT: mm



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

TO-247-3L

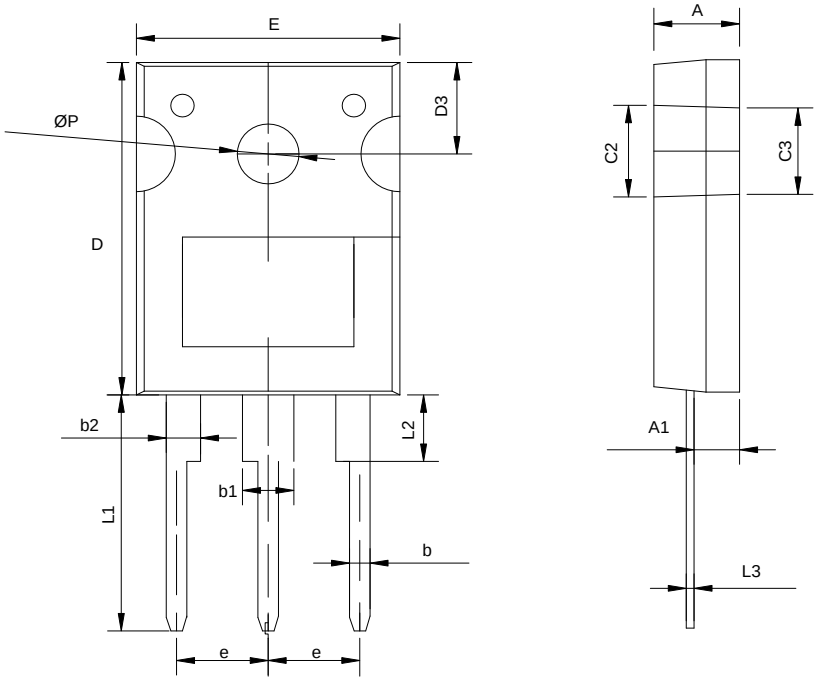
UNIT: mm



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

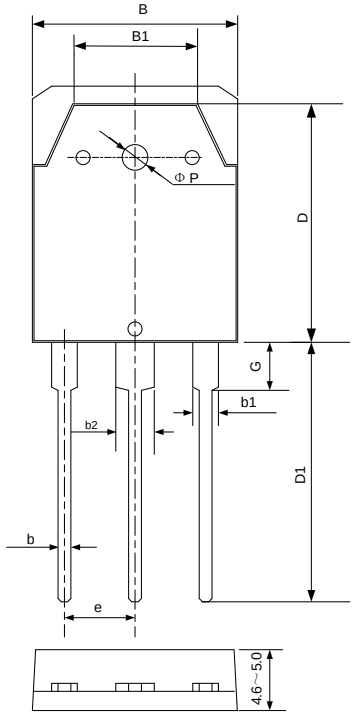
PACKAGE OUTLINE (CONTINUED)

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



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.30	2.50	2.70
b	1.10	1.20	1.30
b1	2.90	3.10	3.30
b2	1.90	2.10	2.30
c2	5.50	6.00	6.50
c3	4.95	5.10	5.25
D	19.00	20.00	21.00
D3	5.30	5.50	5.70
e	5.34	5.44	5.54
E	15.40	15.60	15.80
L1	14.40	14.60	14.80
L2	3.85	4.00	4.15
L3	0.35	0.50	0.65
ØP	3.40	3.60	3.80

TO-3PN **UNIT: mm**



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.60	4.80	5.00
A1	1.30	1.50	1.70
A2	2.20	2.40	2.60
b	0.80	1.00	1.20
b1	1.80	2.00	2.20
b2	2.90	3.10	3.30
B	15.20	15.60	16.00
B1	9.10	9.30	9.50
c	0.50	0.60	0.70
D	18.30	18.50	18.70
D1	19.00	19.50	20.00
e	5.25	5.45	5.65
G	2.80	3.00	3.20
ØP	3.00	3.20	3.40

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8. Product promotion is endless, our company will wholeheartedly provide customers with better products!
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Rev.: 1.9

Revision History:

1. Update nomenclature and parameter names
2. Update important notice

Rev.: 1.8

Revision History:

1. Modify operating junction temperature and storage temperature range
2. Update package outline

Rev.: 1.7

Revision History:

1. Add package outline of TO-3PN

Rev.: 1.6

Revision History:

1. Add package outline of TO-247S-3L

Rev.: 1.5

Revision History:

1. Modify Package stereogram and Important notice

Rev.: 1.4

Revision History:

1. Update the package outline of TO-247-3L

Rev.: 1.3

Revision History:

1. Modify the Max Value of Junction Temperature

Rev.: 1.2

Revision History:

1. Modify annotation of Fig.13

Rev.: 1.1

Revision History:

1. Modify the characteristics

Rev.: 1.0

Revision History:

1. First release