Product Summary

V_{CE}	$V_{CE(sat)}$	I_C(Tc=100℃)
650V	1.6V	20A

合肥矽普半导体
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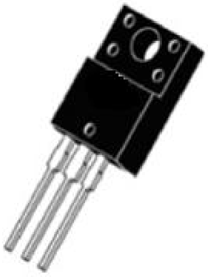
Feature

- High ruggedness performance
- 10μs short circuit capability
- Positive VCE (sat) temperature coefficient
- High efficiency for motor control
- Excellent current sharing in parallel operation

Applications

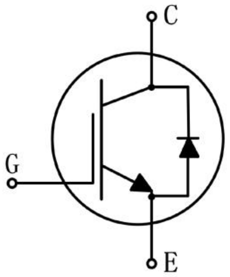
- Home appliances
- Motor drives
- General inverter

Package

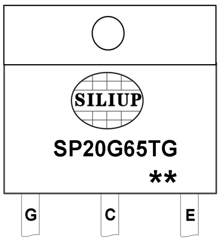


TO-220F(1:G 2:C 3:E)

Circuit diagram



Marking



SP20G65TG :Device Code
** :Week Code

Order Information

Device	Package	Unit/Tape
SP20G65TG	TO-220F	50

Maximum ratings

Symbol	Parameter	Values	Unit
V_{CES}	Collector-emitter voltage	650	V
V_{GES}	Gate-emitter voltage	±20	V
I_C	Continuous collector current (T_C=25℃)	40	A
	Continuous collector current (T_C=100℃)	20	A
I_{CM}	Pulsed collector current, t_p limited by T_{vjmax}	80	A
I_F	Diode continuous forward current (T_C=100℃)	20	A
I_{FM}	Diode maximum current, t_p limited by T_{vjmax}	80	A
t_{sc}	Short circuit withstand time	10	μs
P_{tot}	Power dissipation (T_C=25℃)	53	W
	Power dissipation (T_C=100℃)	26	W
T_{vj}	Operating junction temperature range	-40 to +175	℃
T_{stg}	Storage temperature range	-55 to +150	℃

Thermal characteristics

Symbol	Parameter	Values		Unit
		Typ.	Max.	
$R_{th(j-c)}$	Thermal resistance, junction to case for IGBT	-	2.8	K/ W
$R_{th(j-c)}$	Thermal resistance, junction to case for Diode	-	4.1	K/ W
$R_{th(j-a)}$	Thermal resistance, junction to ambient	-	50	K/ W

Electrical characteristics of IGBT (T_{vj}=25℃ unless otherwise specified)

Static characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
BV_{CES}	Collector-emitter breakdown voltage	V_{GE}=0V , I_C=250μA	650	-	-	V
I_{CES}	Collector-emitter leakage current	V_{CE}=650V , V_{GE}=0V	-	-	50	μA
I_{GES}	Gate leakage current, forward	V_{GE}=20V , V_{CE}=0V	-	-	100	nA
	Gate leakage current, reverse	V_{GE}=-20V , V_{CE}=0V	-	-	-100	nA
$V_{GE(th)}$	Gate-emitter threshold voltage	V_{GE}=V_{CE} , I_C=1mA	5.2	5.7	6.2	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE}=15V , I_C=20A	-	1.6	-	V
		V_{GE}=15V , I_C=20A , T_{vj}=175℃	-	2.0	-	V

Dynamic characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
C_{ies}	Input capacitance	V_{CE}=30V V_{GE}=0V f=1MHz	-	1700	-	pF
C_{oes}	Output capacitance		-	72	-	pF
C_{res}	Reverse transfer capacitance		-	13	-	pF
Q_g	Total gate charge	V_{CC}=520V V_{GE}=15V I_C=20A	-	71	-	nC

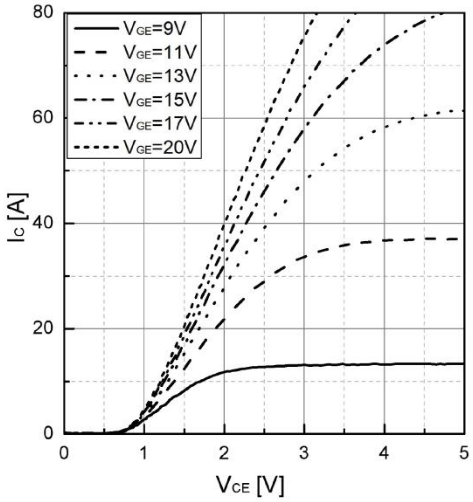
Switching characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-on delay time	V_{CC}=400V V_{GE}=0/15V I_C=20A R_G=10Ω Inductive load	-	21	-	ns
t_r	Rise time		-	23	-	ns
$t_{d(off)}$	Turn-off delay time		-	120	-	ns
t_f	Fall time		-	63	-	ns
E_{on}	Turn-on energy		-	0.37	-	mJ
E_{off}	Turn-off energy		-	0.46	-	mJ
E_{ts}	Total switching energy		-	0.83	-	mJ
$t_{d(on)}$	Turn-on delay time	V_{CC}=400V V_{GE}=0/15V I_C=20A R_G=10Ω Inductive load T_{vj}=175℃	-	21	-	ns
t_r	Rise time		-	23	-	ns
$t_{d(off)}$	Turn-off delay time		-	141	-	ns
t_f	Fall time		-	108	-	ns
E_{on}	Turn-on energy		-	0.59	-	mJ
E_{off}	Turn-off energy		-	0.67	-	mJ
E_{ts}	Total switching energy		-	1.26	-	mJ

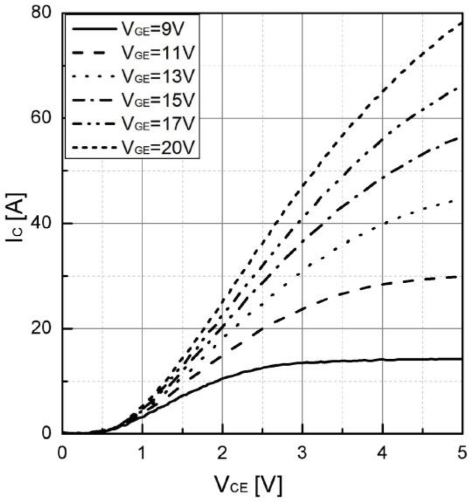
Electrical characteristics of Diode (T_{vj}=25℃ unless otherwise specified)

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
V_F	Diode forward voltage	I_F=20A	-	1.6	-	V
		I_F=20A , T_{vj}= 175℃	-	1.2	-	V
t_{rr}	Diode reverse recovery time	V_R=400V I_F=20A di_F/dt=-500A/μs	-	62	-	ns
I_{rrm}	Diode peak reverse recovery current		-	12	-	A
Q_{rr}	Diode reverse recovery charge		-	472	-	nC
t_{rr}	Diode reverse recovery time	V_R=400V I_F=20A di_F/dt=-500A/μs T_{vj}=175℃	-	90	-	ns
I_{rrm}	Diode peak reverse recovery current		-	19	-	A
Q_{rr}	Diode reverse recovery charge		-	1130	-	nC

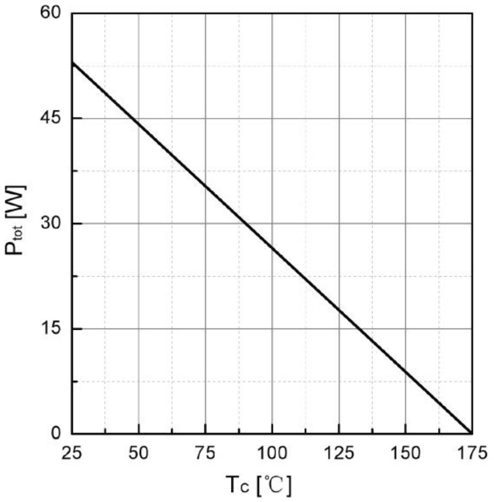
Typical performance characteristics



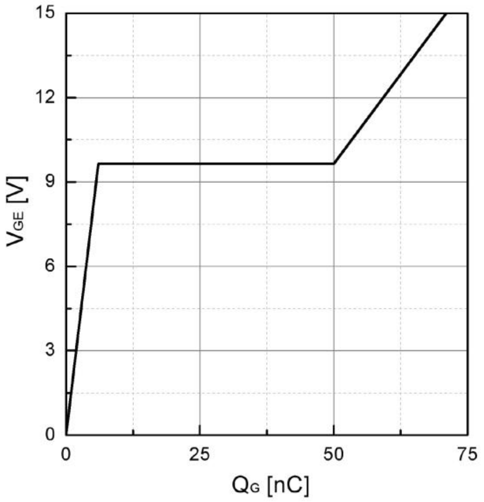
Typical output characteristic (T_{vj}=25℃)



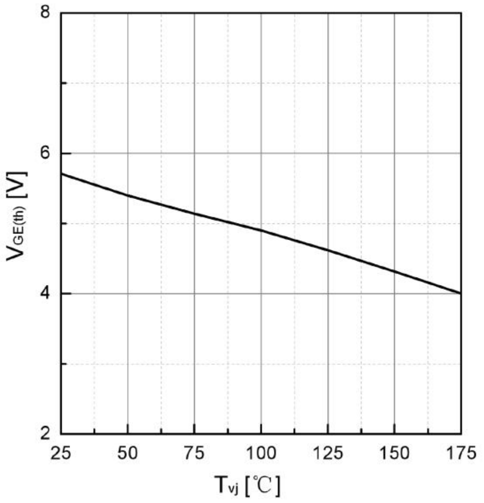
Typical output characteristic(T_{vj}=175℃)



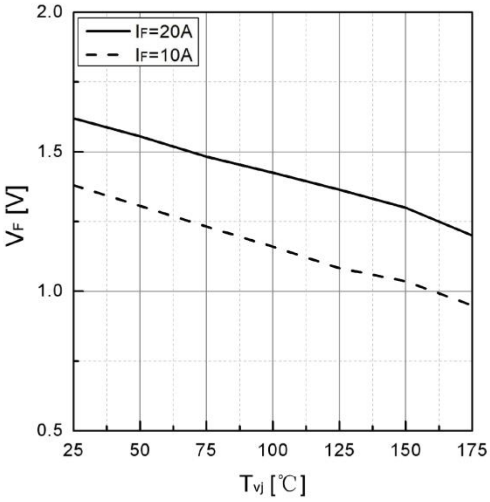
Power dissipation as a function of T_C



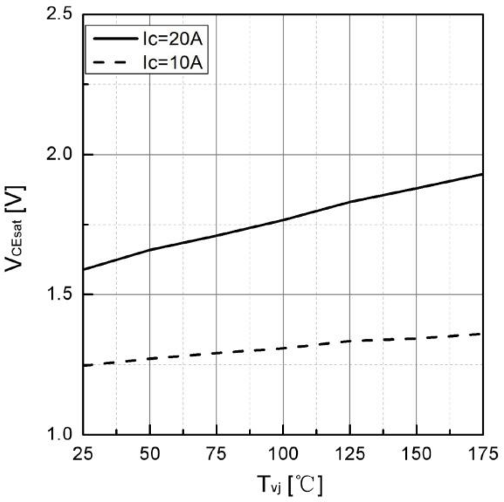
Typical Gate charge



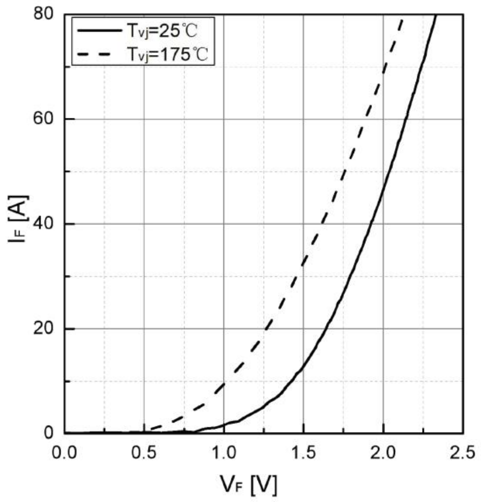
Typical $V_{GE(th)}$ as a function of T_{vj}
(I_C=1mA)



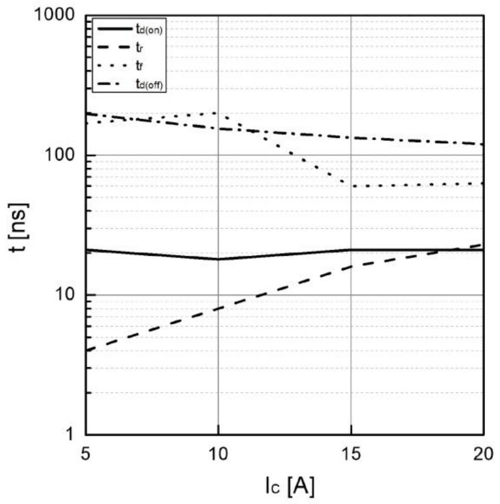
Typical V_F as a function of T_{vj}



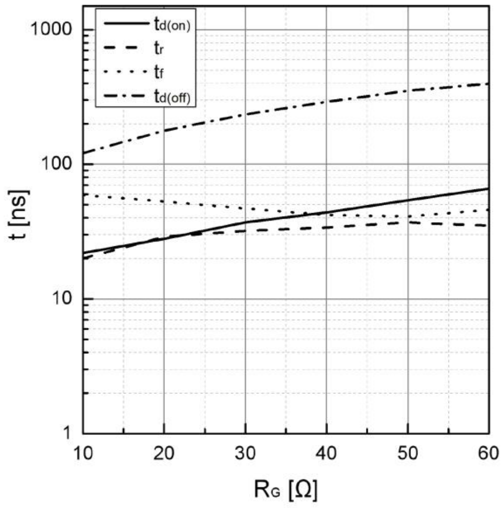
Typical V_{CEsat} as a function of T_{vj}



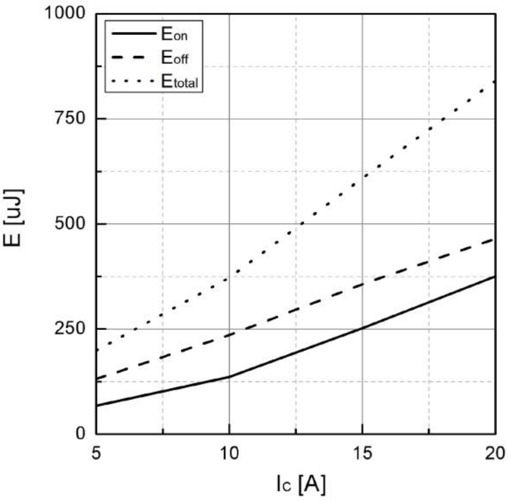
Typical I_F as a function of V_F



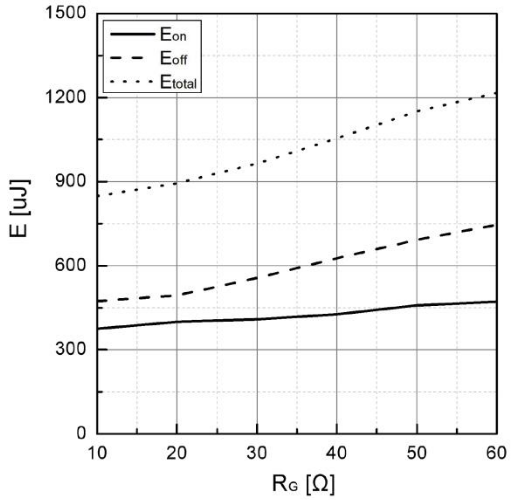
Typical switching time as a function of I_C



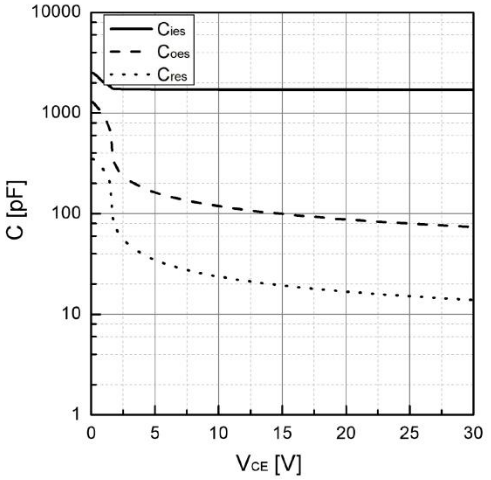
Typical switching times as a function of R_G



Typical switching energy losses as a function of I_C

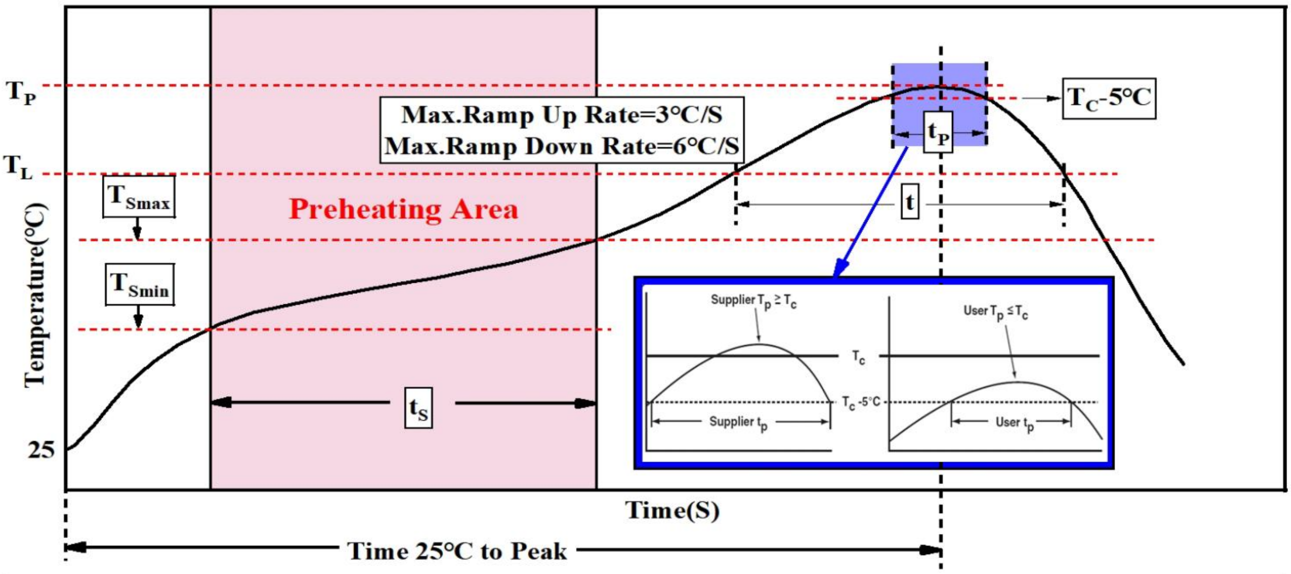


Typical switching energy losses as a function of R_G



Typical capacitance as a function of V_{CE}
(f=1Mhz, V_{GE}=0V)

Temperature Profile for IR Reflow Soldering



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat & Soak Temperature min (Tsmin) Temperature max (Tsmax) Time (Tsmin to Tsmax) (ts)	100°C 150°C 60-120 seconds	150°C 200°C 60-120 seconds
Average ramp-up rate (Tsmax to Tp)	3 °C/second max.	3°C/second max.
Liquidous temperature (TL) Time at liquidous (tL)	183 °C 60-150 seconds	217°C 60-150 seconds
Peak package body Temperature e (Tp)*	See Classification Temp in table 1	See Classification Temp in table 2
Time (tp)** within 5°C of the specified classification temperature (Tc)	20** seconds	30** seconds
Average ramp-down rate (Tp to Tsmax)	6 °C/second max.	6 °C/second max.
Time 25°C to peak temperature	6 minutes max.	8 minutes max.

* Tolerance for peak profile Temperature (Tp) is defined as a supplier minimum and a user maximum.
** Tolerance for time at peak profile temperature (tp) is defined as a supplier minimum and a user maximum

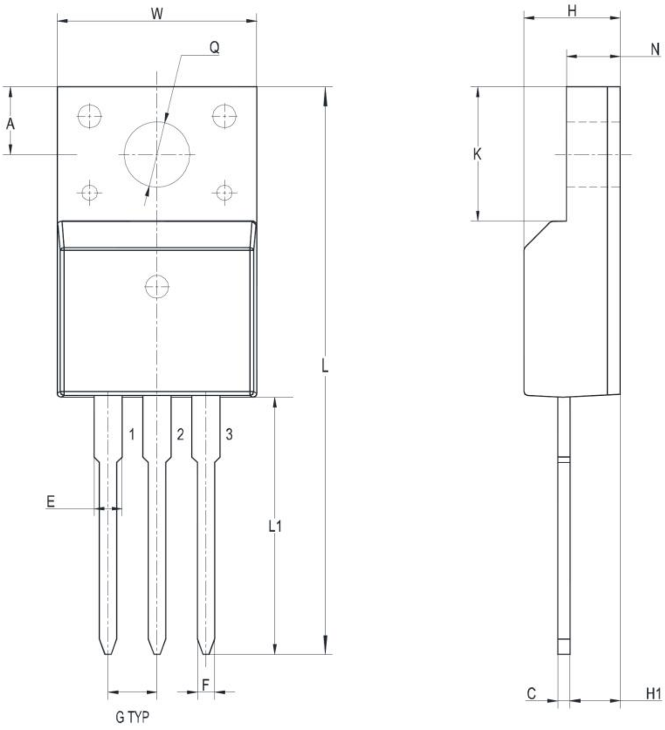
Table 1. SnPb Eutectic Process – Classification Temperatures (Tc)

Package Thickness	Volume mm^3 <350	Volume mm^3 ≥350
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

Table 2. Pb-free Process – Classification Temperatures (Tc)

Package Thickness	Volume mm^3 <350	Volume mm^3 350-2000	Volume mm^3 >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm – 2.5 mm	260 °C	250 °C	245 °C
≥2.5 mm	250 °C	245 °C	245 °C

TO-220F Package Information



Symbol	Dimensions In Millimeters	
	Min.	Max.
A	2.80	3.50
C	0.40	0.60
E	1.15	1.45
F	0.70	0.90
G	2.54 TYP.	
W	9.50	10.50
H	4.50	4.90
H1	2.50	2.95
Q	2.90	3.55
L	28.00	29.50
L1	12.50	13.50
K	6.20	6.77
N	2.30	2.80