



SUPER-SEMI



Super Junction Insulated Gate Bipolar Transistor

650V Trench and Super Junction IGBT
SI*40N65G2HP2G

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www.supersemi.com.cn

SJBT® Discrete

650V Trench and Super Junction IGBT

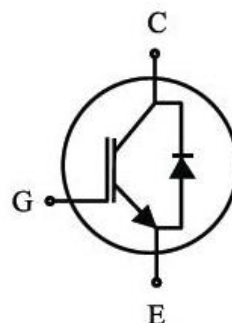
General Description

Super-Semi Trench and Super Junction IGBTs, designed according to the super junction (SJ) technology. The SJ-IGBT series provides low switching losses, high energy efficiency and high avalanche ruggedness for motor control, solar application and welding machine, etc.

V_{CE}	650	V
I_C	40	A
$V_{CE(sat)}, I_C=40A$	1.86	V

Features

- High breakdown voltage to 600V for improved reliability
- Super junction Technology offering :
 - High speed switching
 - High ruggedness, temperature stable
 - Low $V_{CE(sat)}$
 - Easy parallel switching capability due to positive temperature coefficient in $V_{CE(sat)}$
- Enhanced avalanche capability



SIW40N65G2HP2G



Applications

- Uninterruptible Power Supply(UPS)
- Power Factor Correction(PFC)
- Welding Converters
- Inverter
- Converter with high switching frequency

Absolute Maximum Ratings (T_j= 25 °C unless otherwise specified)

Symbol	Parameter	SIW40N65G2HP2G	Unit
V _{CE}	Collector-Emitter Breakdown Voltage	650	V
I _C	DC collector current* -Continuous (T _C = 25°C) -Continuous (T _C = 100°C)	80 40	A
I _F	Diode Forward current* -Continuous (T _C = 25°C) -Continuous (T _C = 100°C)	80 40	A
V _{GE}	Continuous Gate-Emitter Voltage	±20	V
	Transient Gate-Emitter Voltage	±30	V
	Turn off safe operating area V _{CE} ≤ 600V, T _j ≤ 150°C, T _p = 1μs	120	A
I _{CM}	Pulsed Collector Current, V _{GE} = 15V, tp limited by T _{jmax}	120	A
T _j	Operating junction temperature	-40 to +175	°C
T _{STG}	Storage Temperature Range	-55 to +150	°C
P _D	Power Dissipation, T _C = 25°C	130	W
M	Mounting torque (TO-220, TO-247) M3 and M3.5 screws	60	Ncm
	Mounting torque (TO-220F) M2.5 screws	50	
	Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s	260	°C

* Current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	Typ. Value	Unit
IGBT	R _{θJC} Thermal Resistance, Junction-to-Case	1.15	°C/W
	R _{θJA} Thermal Resistance, Junction-to-Ambient	40	°C/W
FRD	R _{θJC} Thermal Resistance, Junction-to-Case	1.04	°C/W
	R _{θJA} Thermal Resistance, Junction-to-Ambient	40	°C/W

Electrical Characteristics (T_j = 25 °C unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static Characteristics						
BV _{CES}	Collector-Emitter Breakdown Voltage	V _{GE} = 0V, I _C = 250μA	650	-	-	V
V _{GE(th)}	Gate Threshold Voltage	V _{GE} = V _{CE} , I _C = 250μA	4.0	5.0	6.0	V
V _{CE(sat)}	Collector-Emitter Saturation Voltage	V _{GE} = 15V, I _C = 40A -T _J = 25°C -T _J = 150°C	- -	1.86 2.56	2.3 -	V V
I _{CES}	Zero Gate Voltage Collector Current	V _{CE} = 650V, V _{GE} = 0V -T _J = 25°C -T _J = 150°C	- -	0.1 -	20 1000	μA μA
I _{GES}	Gate-Emitter Leakage Current	V _{CE} = 0V, V _{GE} = ±20V	-	-	100	nA

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Dynamic Characteristics						
C _{ies}	Input Capacitance	V _{CE} = 25V, V _{GE} = 0V, f = 1.0MHz	-	1681	-	pF
C _{oes}	Output Capacitance		-	114	-	pF
C _{res}	Reverse Transfer Capacitance		-	24	-	pF
Q _G	Gate Charge	V _{CC} = 400V, I _C = 40A, V _{GE} = 15V	-	68	-	nC

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Switching Characteristics, Inductive Load, T_j = 25°C						
t _{d(on)}	Turn-On Delay Time	V _{CC} = 400V, I _C = 40A V _{GE} = 0V/15V R _g = 10Ω	-	29	-	ns
t _r	Turn-On Rise Time		-	43	-	ns
t _{d(off)}	Turn-Off Delay Time		-	89	-	ns
t _f	Turn-Off Fall Time		-	57	-	ns
E _{on}	Turn-on Energy		-	0.94	-	mJ
E _{off}	Turn-off Energy		-	0.25	-	mJ

Electrical Characteristics (T_j= 25 °C unless otherwise specified)

Switching Characteristics, Inductive Load, T_j=150°C

td(on)	Turn-On Delay Time	V _{CC} = 400V, I _C = 40A V _{GE} = 0V/15V R _g = 10Ω	-	31	-	ns
tr	Turn-On Rise Time		-	44	-	ns
td(off)	Turn-Off Delay Time		-	91	-	ns
tf	Turn-Off Fall Time		-	109	-	ns
Eon	Turn-on Energy		-	1.14	-	mJ
Eoff	Turn-off Energy		-	0.36	-	mJ

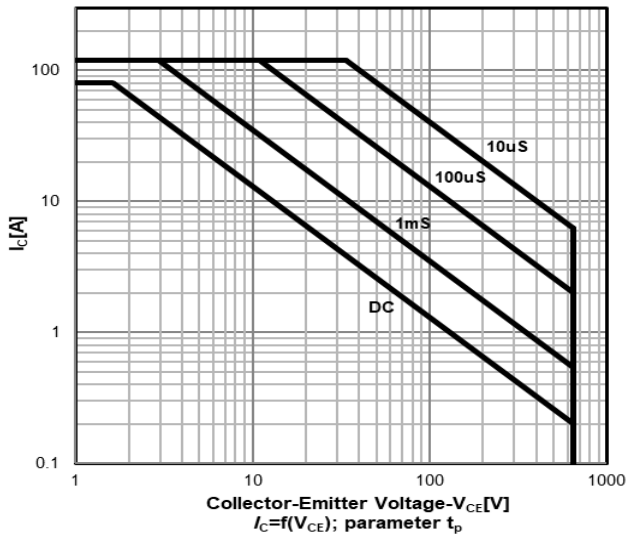
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Diode Characteristics and Maximum Ratings, T_j=25°C						
V _{FM}	Diode Forward Voltage	I _F = 20A	-	1.50	1.8	V
		I _F = 40A	-	1.77	2.1	V
T _{rr}	Reverse Recovery Time	VR = 400V, I _F = 20A dI _F /dt = 1000A/μs	-	12	-	ns
I _{rr}	Reverse Recovery Current		-	35	-	A
Q _{rr}	Reverse Recovery Charge		-	0.17	-	μC
T _{rr}	Reverse Recovery Time	VR = 400V, I _F = 40A dI _F /dt = 500A/μs	-	26	-	ns
I _{rr}	Reverse Recovery Current		-	30	-	A
Q _{rr}	Reverse Recovery Charge		-	0.30	-	μC

Diode Characteristics and Maximum Ratings, T_j=150°C

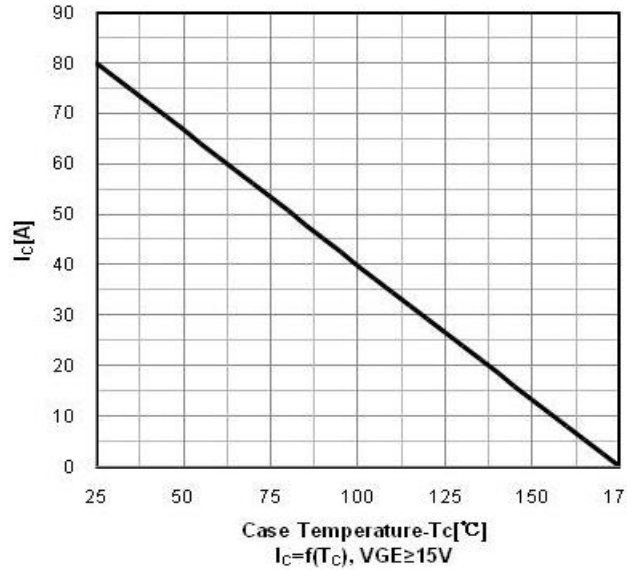
V _{FM}	Diode Forward Voltage	I _F = 20A	-	1.21	1.6	V
		I _F = 40A	-	1.52	1.9	V
T _{rr}	Reverse Recovery Time	VR = 400V, I _F = 20A dI _F /dt = 3000A/μs	-	123	-	ns
I _{rr}	Reverse Recovery Current		-	38	-	A
Q _{rr}	Reverse Recovery Charge		-	2.12	-	μC
T _{rr}	Reverse Recovery Time	VR = 400V, I _F = 40A dI _F /dt = 3000A/μs	-	164	-	ns
I _{rr}	Reverse Recovery Current		-	32	-	A
Q _{rr}	Reverse Recovery Charge		-	2.64	-	μC

Typical Performance Characteristics

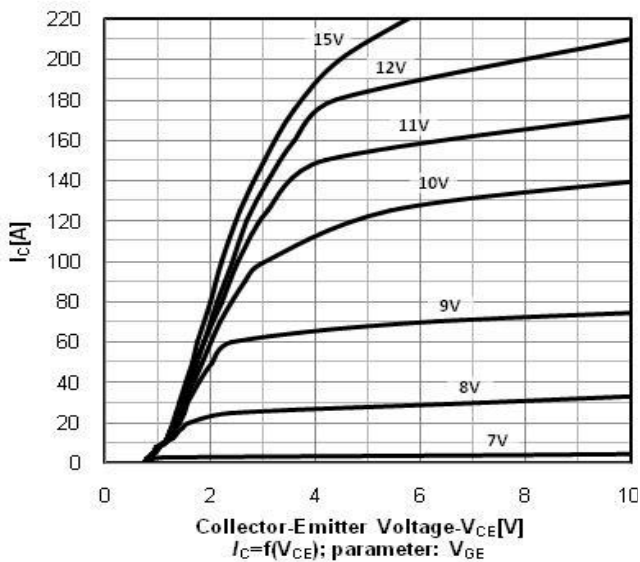
Safe operating area $T_a=25^\circ\text{C}$
Non-Full PAK



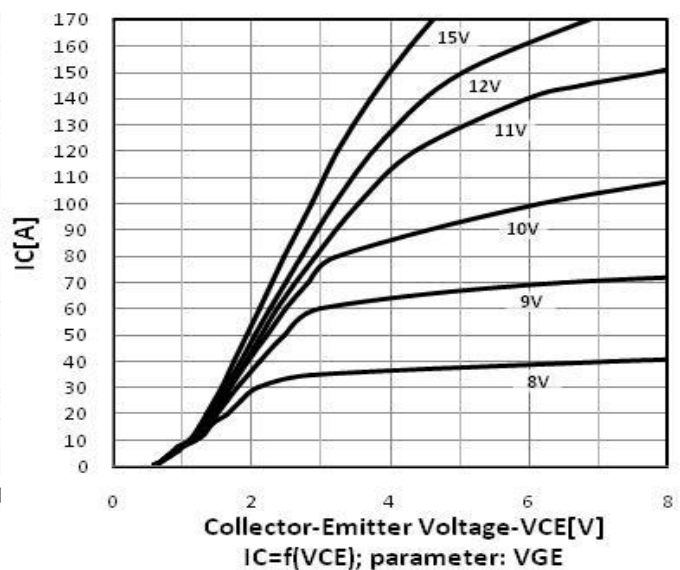
Collector current as a function of
Case temperature



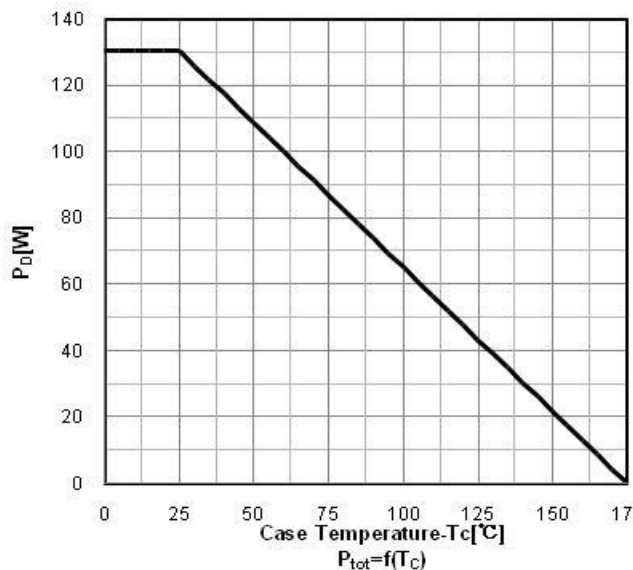
Typ. Output characteristics
 $T_j=25^\circ\text{C}$



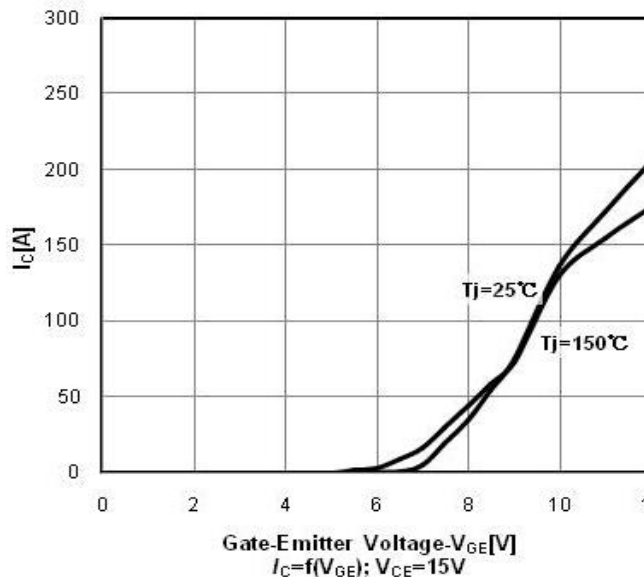
Typ. Output characteristics
 $T_j=150^\circ\text{C}$



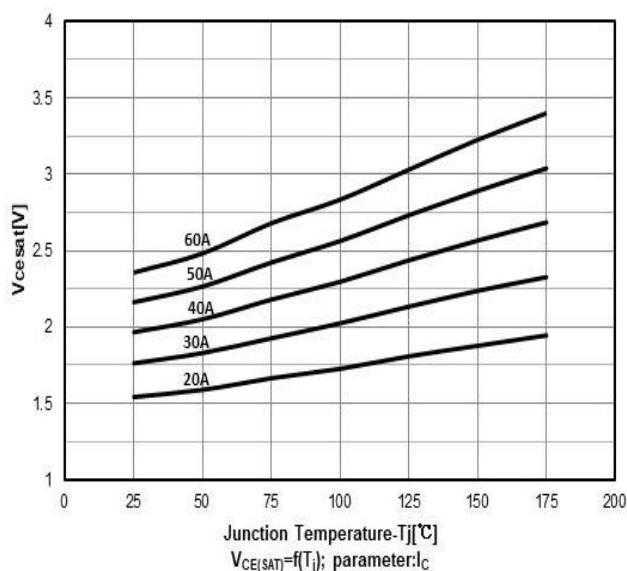
Power dissipation



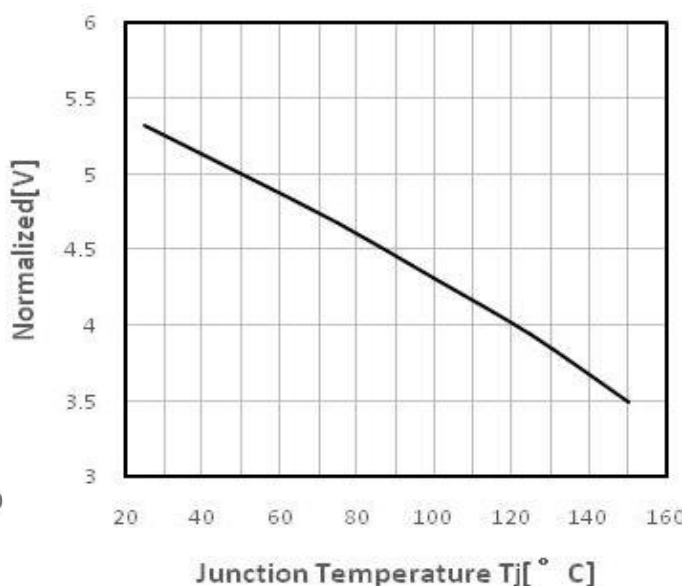
Typ. Transfer characteristics



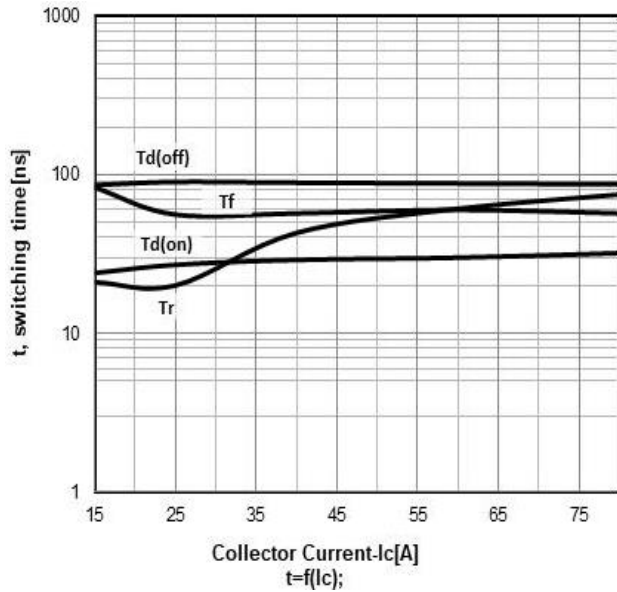
Typ. Collector-emitter saturation voltage as a function of junction temperature ($V_{GE}=15V$)



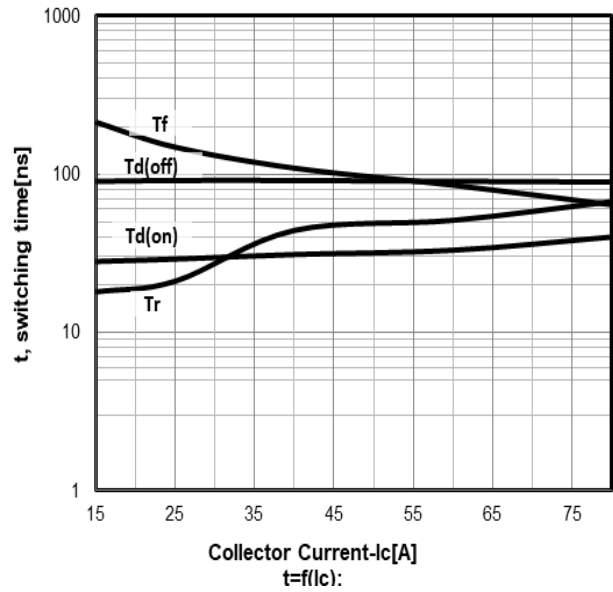
Normalized $V_{GE(th)}$ vs. temperature



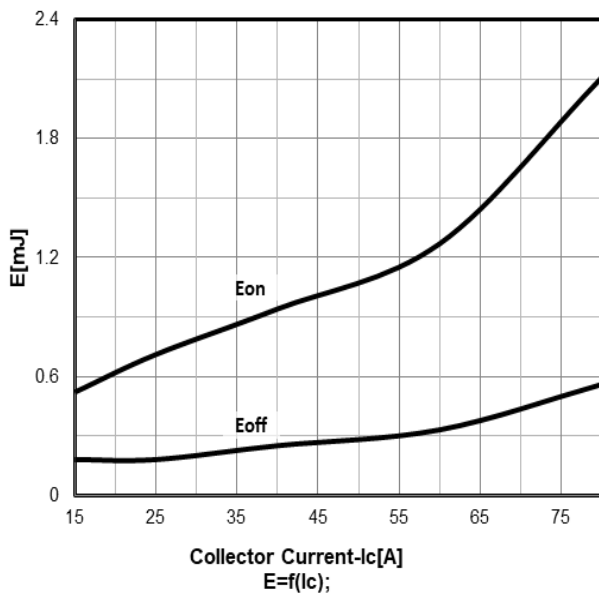
Switching times vs collector current
 $T_j=25\text{ }^{\circ}\text{C}$



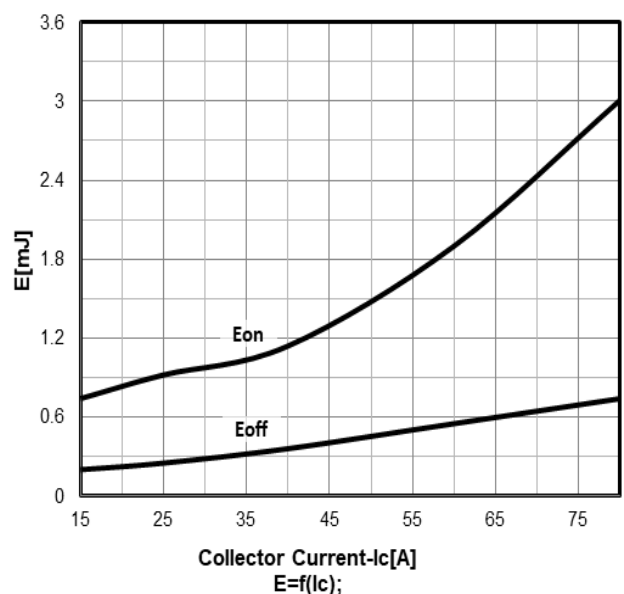
Switching times vs collector current
 $T_j=150\text{ }^{\circ}\text{C}$



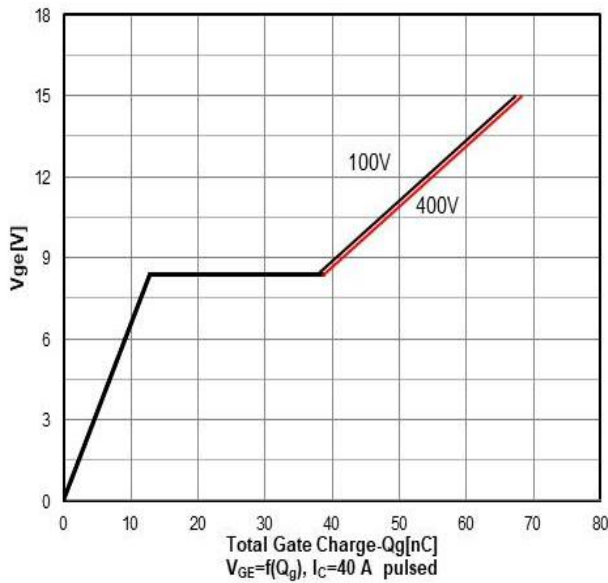
Switching energy losses vs collector current
 $T_j=25\text{ }^{\circ}\text{C}$



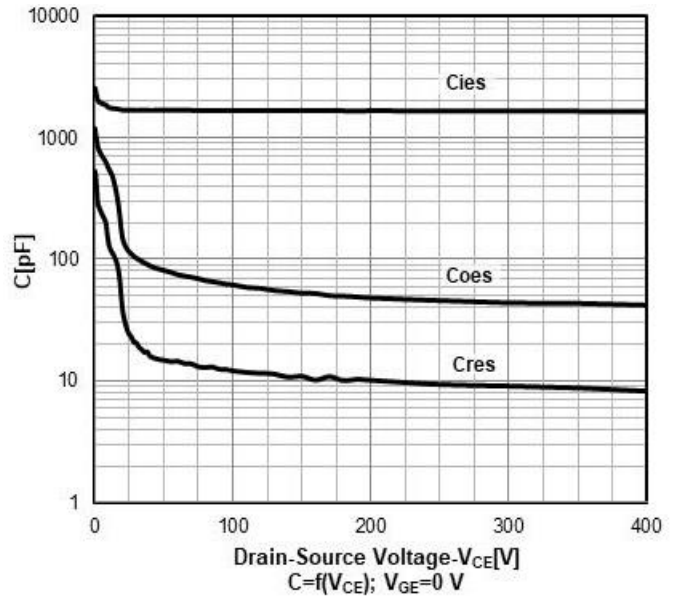
Switching energy losses vs collector current
 $T_j=150\text{ }^{\circ}\text{C}$



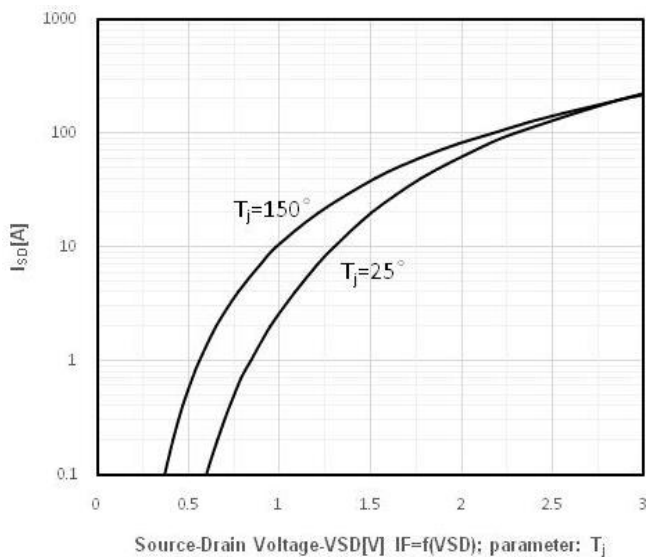
Gate charge characteristics



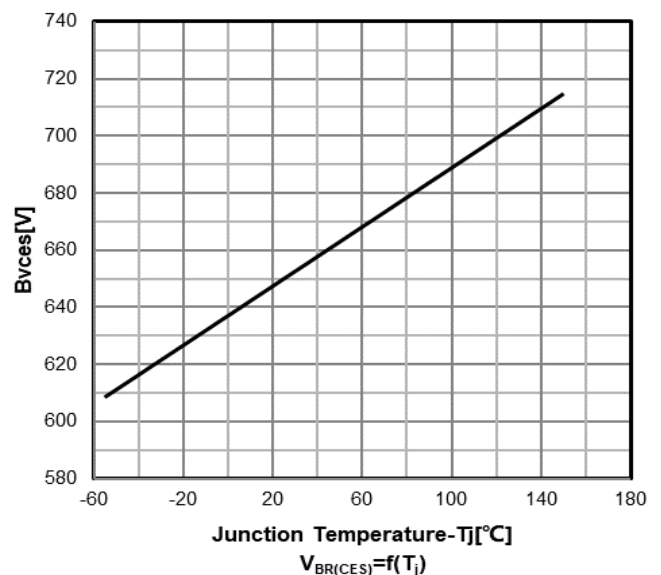
Capacitance characteristics



Diode Forward Voltage



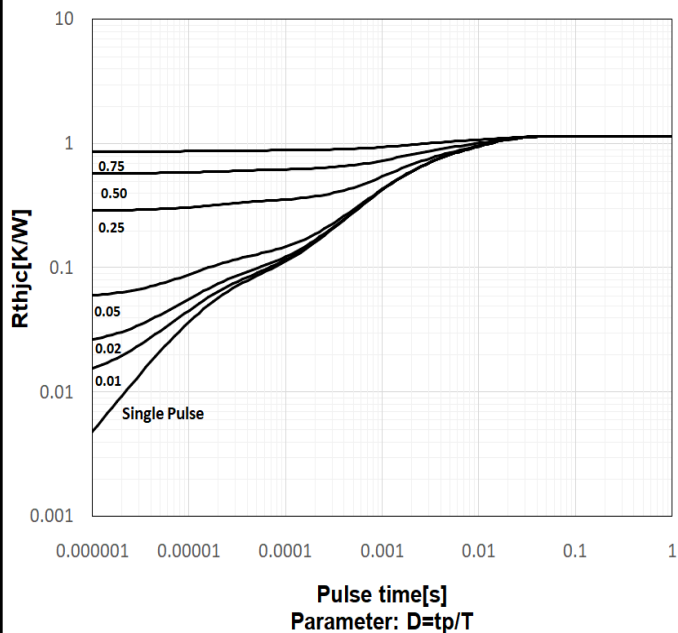
Collector-emitter breakdown voltage vs. temperature



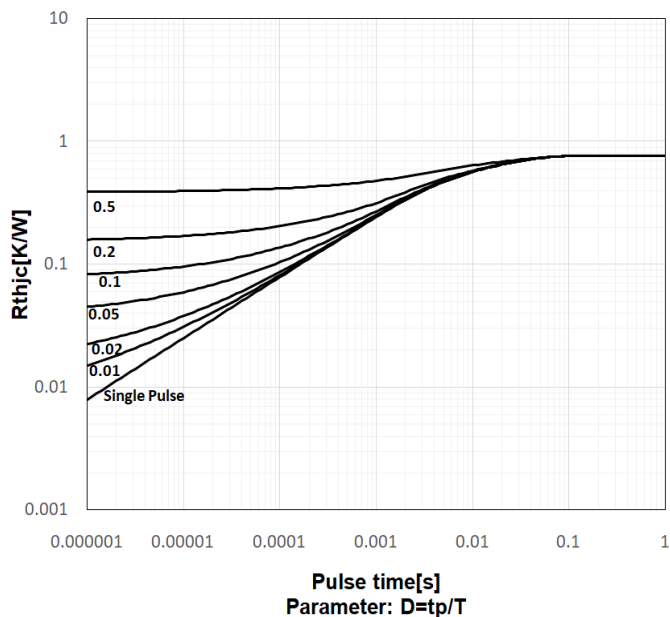


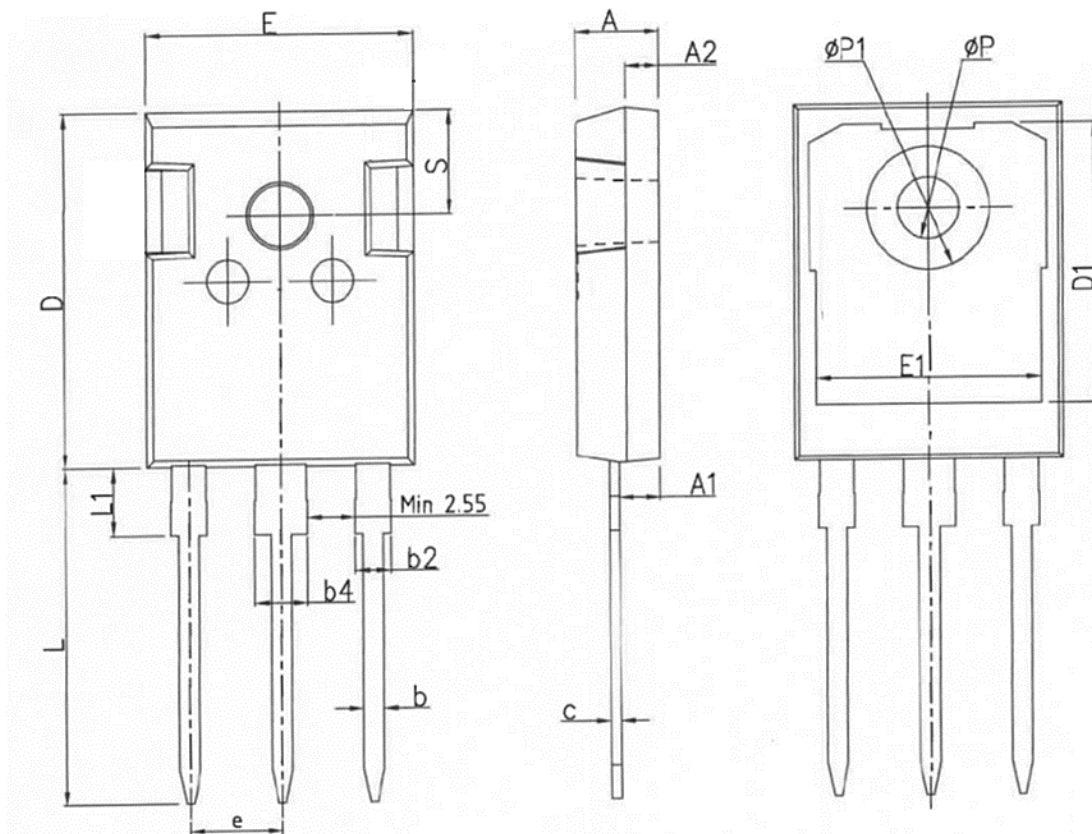
Typical Performance Characteristics

Max. transient thermal impedance
parameter: $D=tp/T$; IGBT



Max. transient thermal impedance
parameter: $D=tp/T$; Diode





COMMON DIMENSIONS

SYMBOL	UNIT(mm)		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.20	2.40	2.60
A2	1.85	2.00	2.15
b	1.10	1.20	1.35
b2	1.91	2.04	2.21
b4	2.91	3.04	3.21
c	0.50	0.60	0.75
D	20.70	21.00	21.30
D1	16.20	16.55	16.90
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
e	5.44BSC		
L	19.60	19.95	20.30
L1	-	-	4.30
ΦP	3.40	3.60	3.80
ΦP1	-	-	7.50
S	6.15BSC		



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