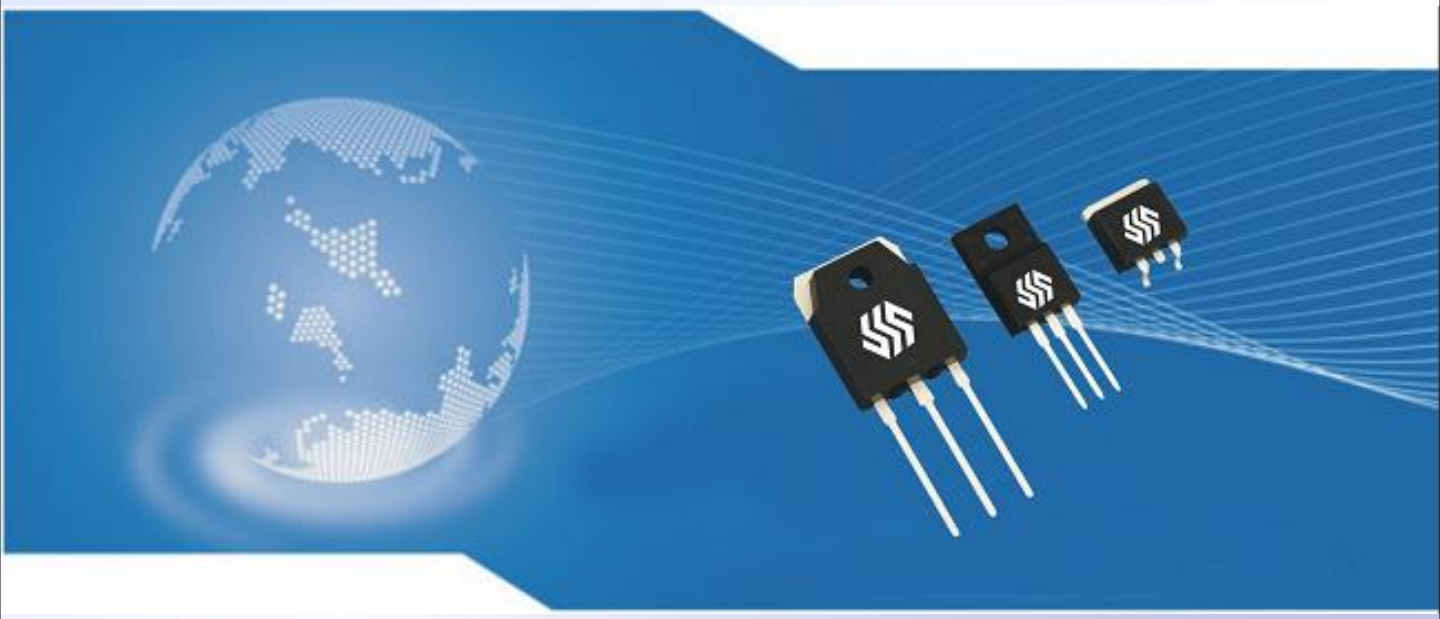
SUPER-SEMI



Super Junction Insulated Gate Bipolar Transistor

650V Trench and Super Junction IGBT
SI*50N65G2L2G

Rev. 1.0
Jan. 2024

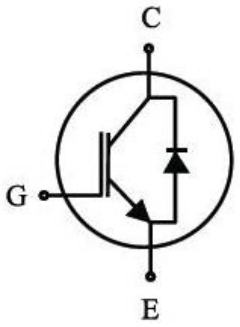
www.supersemi.com.cn

SIW50N65G2L2G
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	50	A
$V_{CE(sat)}$, I_C=50A	1.5	V



Features

- High breakdown voltage to 650V 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

SIW50N65G2L2G

TO-247

Applications

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

Absolute Maximum Ratings (Tj= 25 ℃ unless otherwise specified)

Symbol	Parameter	Value	Unit
V_{CE}	Collector-Emitter Breakdown Voltage	650	V
I_C	DC collector current* -Continuous (T_C = 25℃) , limited by bondwire -Continuous (T_C = 100℃)	80 59.7	A
I_F	Diode Forward current* -Continuous (T_C = 25℃) , limited by bondwire -Continuous (T_C = 100℃)	80 59.7	A
V_{GE}	Continuous Gate-Emitter Voltage	±20	V
	Transient Gate-Emitter Voltage	±30	V
	Turn off safe operating area V_{CE} ≤600V, Tj ≤ 150°C, Tp=1uS	200	A
I_{CM}	Pulsed Collector Current, V_{GE} =15V, tp limited by Tjmax	200	A
t_{SC}	Short Circuit Withstand Time V_{GE}= 15V, V_{CE}≤ 400V, T_C = 150℃	3	μS
T_J	Operating junction temperature	-40 to +175	℃
T_{STG}	Storage Temperature Range	-55 to +150	℃
P_D	Power Dissipation, T_C = 25℃	270	W
M	Mounting torque (TO-247) M3 and M3.5 screws	60	Ncm
	Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s	260	℃

* Current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	Max. Value	Unit
$R_{\theta JC}$ (IGBT)	IGBT Thermal Resistance, Junction-to-Case	0.8	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	40	℃/W

Electrical Characteristics (Tj= 25 ℃ 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} = 0V, I_C = 1mA	650	-	-	V
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE} = V_{CE}, I_C = 250μA	4.0	4.8	6.0	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE} = 15V, I_C = 50A -T_J = 25℃ -T_J = 150℃	 - -	 1.5 1.75	 1.8 -	 V V
I_{CES}	Zero Gate Voltage Collector Current	V_{CE} = 650V, V_{GE} = 0V -T_J = 25℃ -T_J = 150℃	 - -	 1 1000	 20 -	 μA μA
I_{GES}	Gate-Emitter Leakage Current	V_{CE} = 0V, V_{GE} = ±20V	-	-	100	nA
gFS	Forward Transconductance	V_{CE} = 20V, I_C = 50A	-	30	-	S

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Dynamic Characteristics						
Cies	Input Capacitance	V_{CE} = 50V, V_{GE} = 0V, f = 1.0MHz	-	2750	-	pF
Coes	Output Capacitance		-	116	-	pF
Cres	Reverse Transfer Capacitance		-	37	-	pF
Q_G	Gate Charge	V_{CC} = 400V, I_C = 50A, V_{GE} = 15V	-	105	-	nC
$I_{C(SC)}$	Short Circuit Collector Current	V_{GE}=15V, t_{SC}≤5us V_{CC}=400V, $T_{j,start}$=25°C	-	280	-	A

Electrical Characteristics (Tj= 25 ℃ unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Switching Characteristics, Inductive Load, Tj=25℃						
td(on)	Turn-On Delay Time	Vcc = 400V, I_C = 50A V_{GE} = 0V/15V Rg = 10Ω	-	41	-	ns
tr	Turn-On Rise Time		-	41	-	ns
td(off)	Turn-Off Delay Time		-	159	-	ns
tf	Turn-Off Fall Time		-	106	-	ns
Eon	Turn-on Energy		-	0.95	-	mJ
Eoff	Turn-off Energy		-	0.67	-	mJ

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Diode Characteristics and Maximum Ratings, Tj=25℃						
V_{FM}	Diode Forward Voltage	I_F = 20A	-	1.5	1.8	V
Trr	Reverse Recovery Time	VR = 400V, I_F = 50A dI_F/dt =1000A/μs	-	31	-	ns
Irr	Reverse Recovery Current		-	31	-	A
Qrr	Reverse Recovery Charge		-	0.35	-	μC

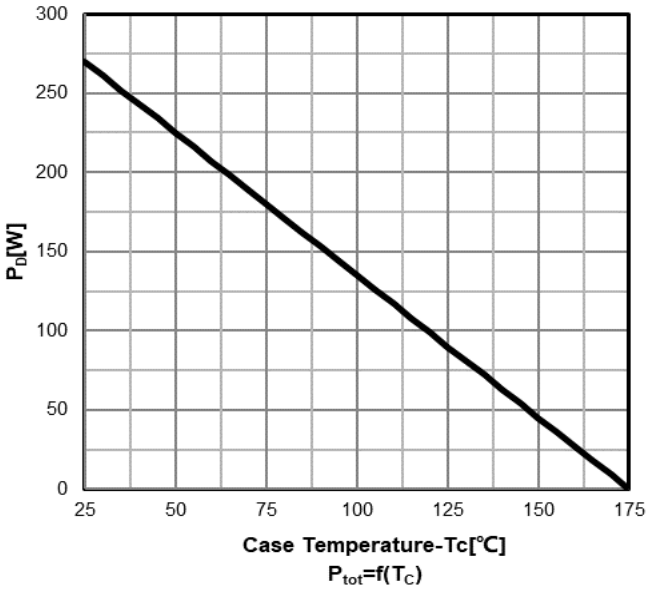
Electrical Characteristics (Tj= 150 ℃)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Switching Characteristics, Inductive Load, Tj=150℃						
td(on)	Turn-On Delay Time	Vcc = 400V, I_C = 50A V_{GE} = 0V/15V Rg = 10Ω	-	43	-	ns
tr	Turn-On Rise Time		-	41	-	ns
td(off)	Turn-Off Delay Time		-	150	-	ns
tf	Turn-Off Fall Time		-	149	-	ns
Eon	Turn-on Energy		-	1.2	-	mJ
Eoff	Turn-off Energy		-	1.09	-	mJ

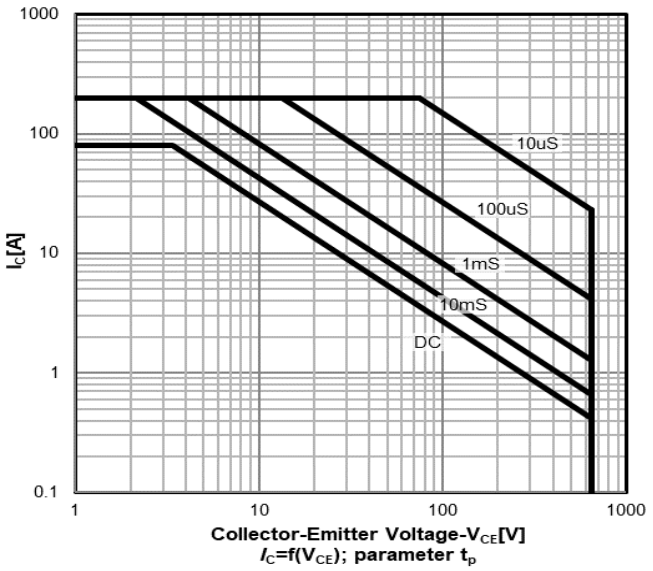
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Diode Characteristics and Maximum Ratings, Tj=150℃						
V_{FM}	Diode Forward Voltage	I_F = 20A	-	1.2	-	V
Trr	Reverse Recovery Time	VR = 400V, I_F = 50A dI_F/dt =1000A/μs	-	151	-	ns
Irr	Reverse Recovery Current		-	32	-	A
Qrr	Reverse Recovery Charge		-	2.48	-	μC

Typical Performance Characteristics

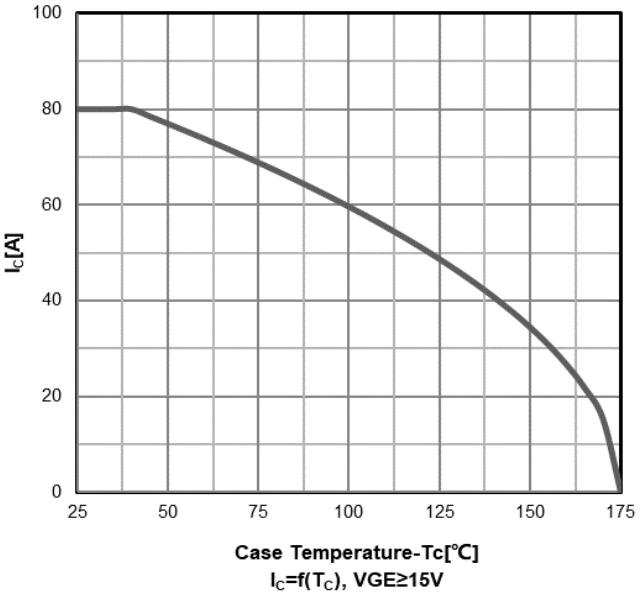
Power dissipation



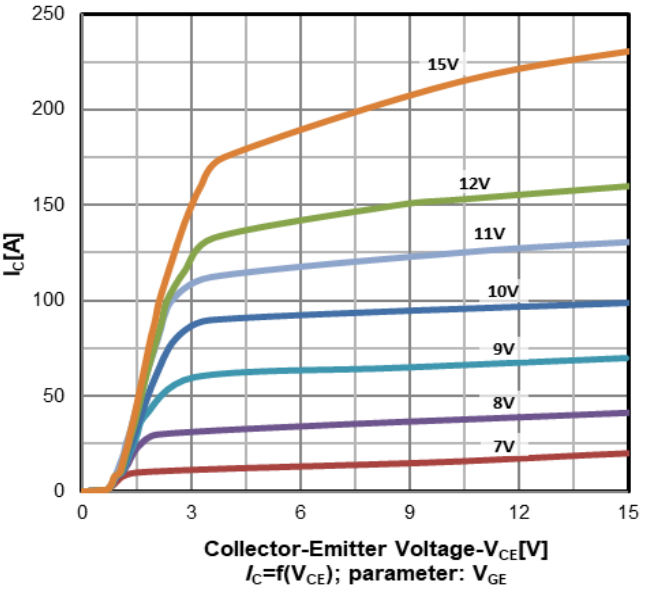
Safe operating area Ta=25 ℃



Collector current as a function of Case temperature

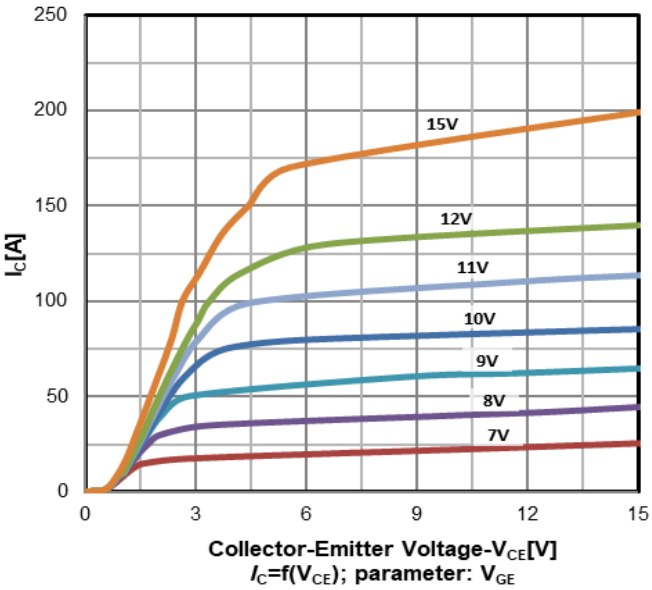


Typ. Output characteristics Tj=25 ℃

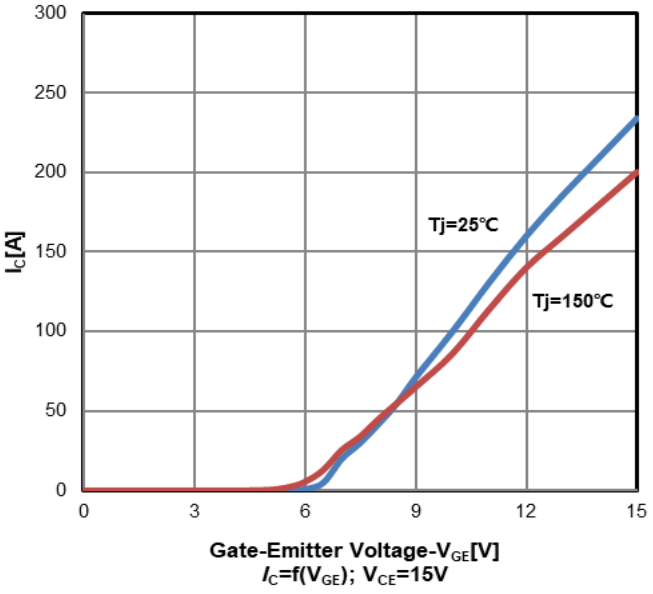


Typical Performance Characteristics

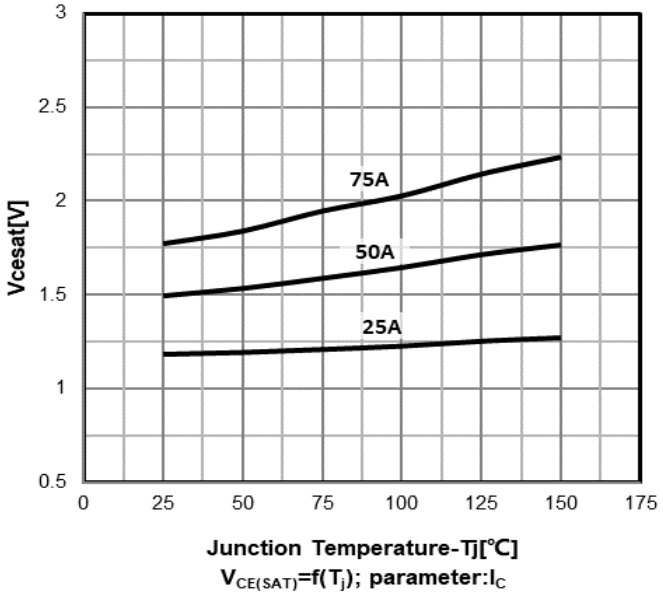
Typ. Output characteristics
Tj=150 ℃



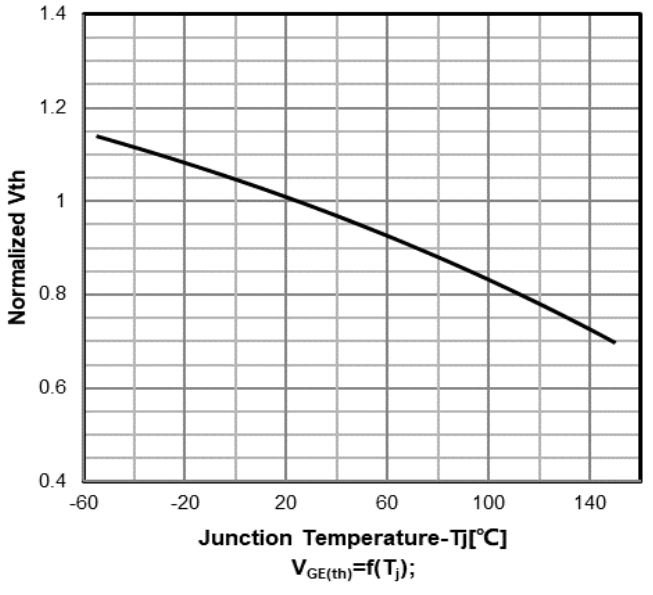
Typ. Transfer characteristics



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

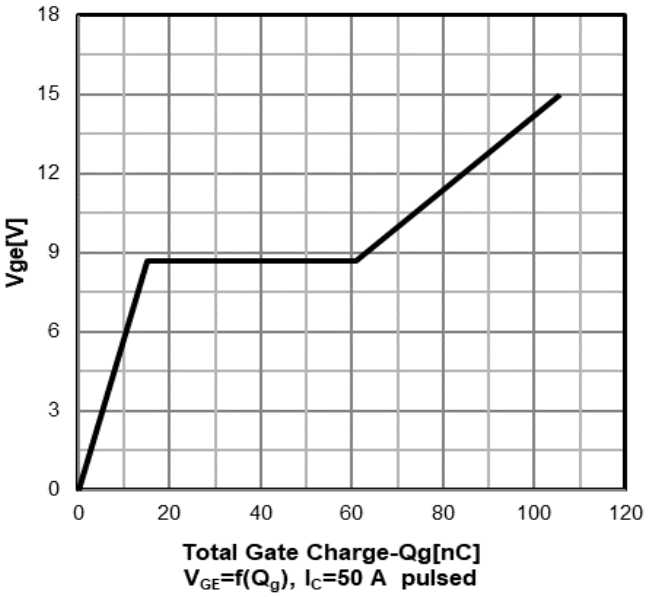


Normalized $V_{GE(th)}$ vs. temperature

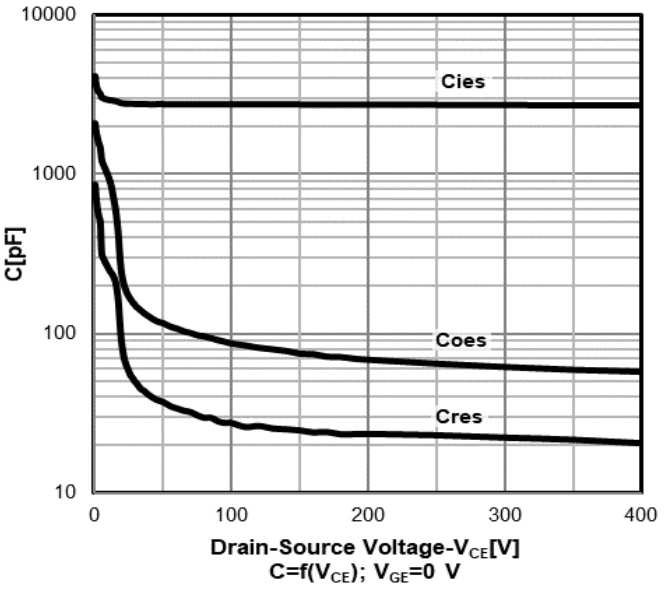


Typical Performance Characteristics

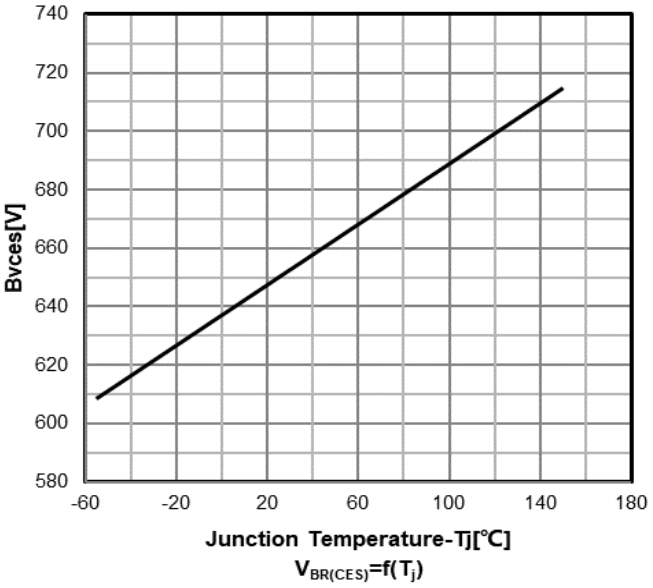
Gate charge characteristics



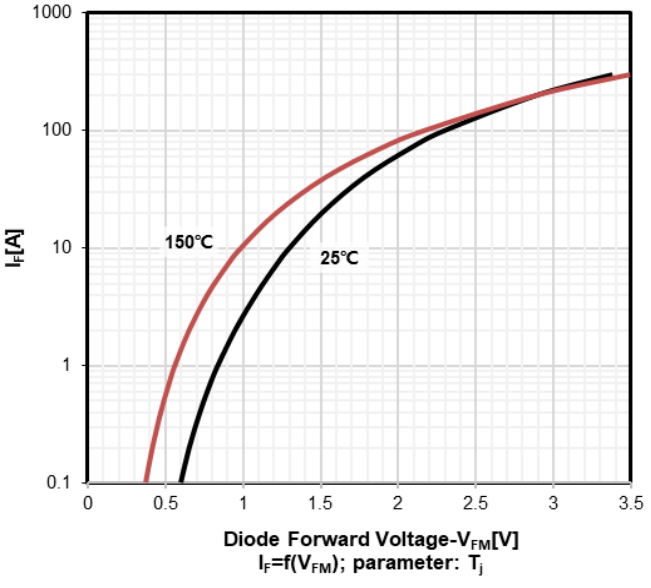
Capacitance characteristics



Collector-emitter breakdown voltage vs. temperature

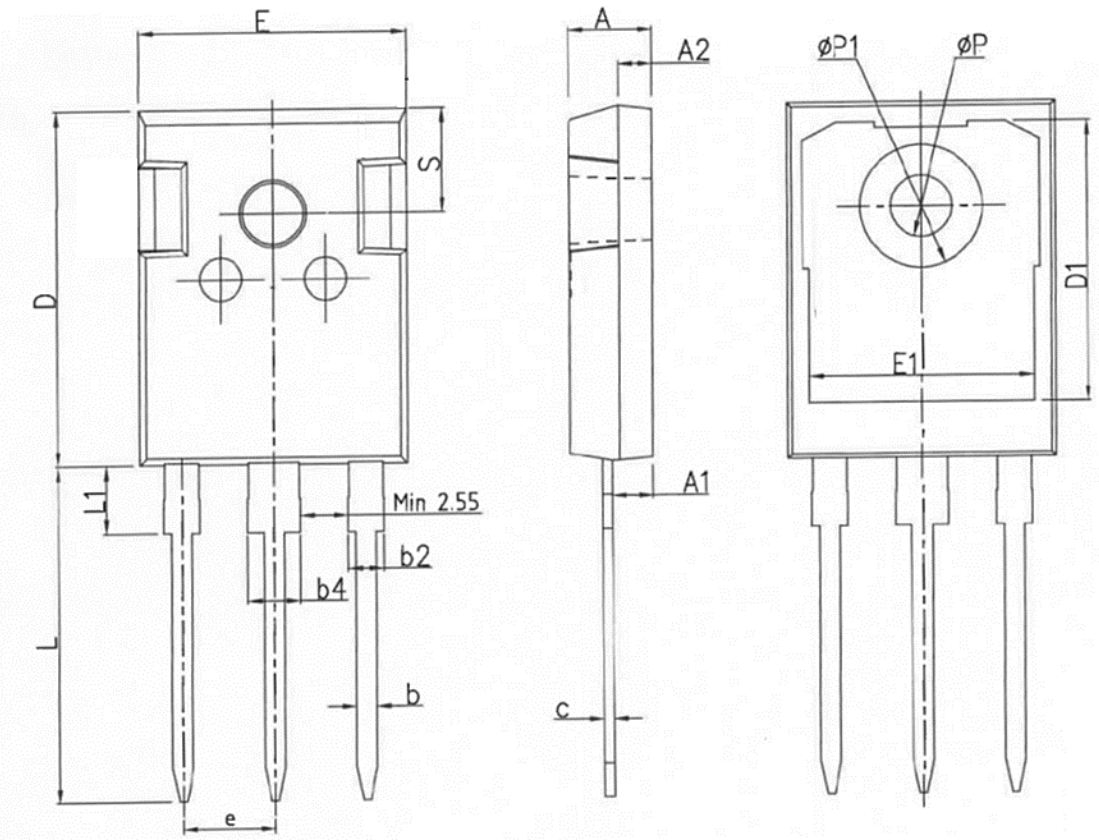


Forward characteristics of diode



Package Outline

TO-247



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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