



SUPER-SEMI



Super Junction Insulated Gate Bipolar Transistor

600V Trench and Super Junction IGBT
SI*30N60G21B

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SIF30N60G21B/SIP30N60G21B/SIW30N60G21B/ SIB30N60G21B 600V Trench and Super Junction IGBT

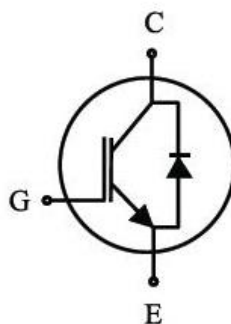
General Description

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}	600	V
I_C	30	A
$V_{CE(sat)}, I_C=30A$	1.7	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



SIF30N60G21B



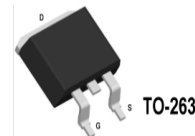
SIP30N60G21B



SIW30N60G21B



SIB30N60G21B



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	Non-FullPAK	Full PAK	Unit
V _{CE}	Collector-Emitter Breakdown Voltage	600		V
I _C	DC collector current* -Continuous (T _C = 25°C) -Continuous (T _C = 100°C)	60 30		A
I _F	Diode Forward current* -Continuous (T _C = 25°C) -Continuous (T _C = 100°C)	60 30		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	90		A
I _{CM}	Pulsed Collector Current, V _{GE} =15V, t _p limited by T _{jmax}	90		A
T _{SC}	Short Circuit Withstand Time V _{GE} = 15V, V _{CE} ≤ 400V -T _C = 25°C -T _C = 150°C	5 3		μS
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	170	31	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	Max. Value		Unit
R _{θJC} (IGBT)	IGBT Thermal Resistance, Junction-to-Case	0.88	4.8	°C/W
R _{θJA}	Thermal Resistance, Junction-to-Ambient	40	80	°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	600	-	-	V
		V _{GE} = 0V, I _C = 1mA	600	-	-	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 = 30A	-	1.7	2.0	V
		-T _J = 25°C -T _J = 150°C	-	2.1	-	V
I _{CES}	Zero Gate Voltage Collector Current	V _{CE} = 600V, V _{GE} = 0V	-	0.1	20	μA
		-T _J = 25°C -T _J = 150°C	-	-	1000	μA
I _{GES}	Gate-Emitter Leakage Current	V _{CE} = 0V, V _{GE} = ±20V	-	-	100	nA
g _{FS}	Forward Transconductance	V _{CE} = 20V, I _C = 30A	-	16	-	S

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Dynamic Characteristics						
C _{ies}	Input Capacitance	V _{CE} = 25V, V _{GE} = 0V, f = 1.0MHz	-	1770	-	pF
C _{oes}	Output Capacitance		-	82	-	pF
C _{res}	Reverse Transfer Capacitance		-	12	-	pF
Q _G	Gate Charge	V _{CC} = 400V, I _C = 30A, V _{GE} = 15V	-	60	-	nC
I _{C(SC)}	Short Circuit Collector Current	V _{GE} = 15V, t _{SC} ≤ 5us V _{CC} = 400V, T _{j,start} = 25°C	-	120	-	A

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 = 30A V _{GE} = 0V/15V R _g = 10Ω	-	28	-	ns
t _r	Turn-On Rise Time		-	41	-	ns
t _{d(off)}	Turn-Off Delay Time		-	87	-	ns
t _f	Turn-Off Fall Time		-	148	-	ns
E _{on}	Turn-on Energy		-	0.89	-	mJ
E _{off}	Turn-off Energy		-	0.41	-	mJ

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

Switching Characteristics, Inductive Load, Tj=150°C

td(on)	Turn-On Delay Time	V _{CC} = 400V, I _C = 30A V _{GE} = 0V/15V R _g = 10Ω	-	32	-	ns
tr	Turn-On Rise Time		-	40	-	ns
td(off)	Turn-Off Delay Time		-	79	-	ns
tf	Turn-Off Fall Time		-	184	-	ns
Eon	Turn-on Energy		-	1.18	-	mJ
Eoff	Turn-off Energy		-	0.65	-	mJ

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
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Diode Characteristics and Maximum Ratings, Tj=25°C

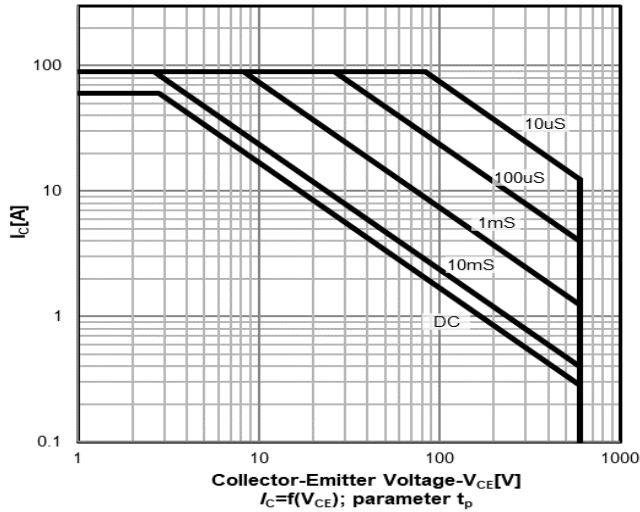
V _{FM}	Diode Forward Voltage	I _F = 15A	-	1.4	1.7	V
		I _F = 30A	-	1.5	1.9	V
T _{rr}	Reverse Recovery Time	VR = 400V, I _F = 15A dI _F /dt = 100A/μs	-	32	-	ns
I _{rr}	Reverse Recovery Current		-	27	-	A
Q _{rr}	Reverse Recovery Charge		-	0.41	-	μC
T _{rr}	Reverse Recovery Time	VR = 400V, I _F = 30A dI _F /dt = 100A/μs	-	32	-	ns
I _{rr}	Reverse Recovery Current		-	18	-	A
Q _{rr}	Reverse Recovery Charge		-	0.28	-	μC

Diode Characteristics and Maximum Ratings, Tj=150°C

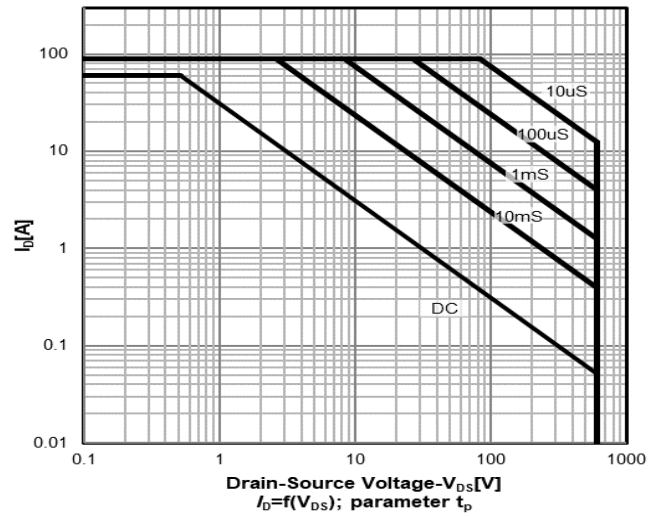
V _{FM}	Diode Forward Voltage	I _F = 15A	-	1.2	1.5	V
		I _F = 30A	-	1.35	1.7	V
T _{rr}	Reverse Recovery Time	VR = 400V, I _F = 15A dI _F /dt = 100A/μs	-	45	-	ns
I _{rr}	Reverse Recovery Current		-	26	-	A
Q _{rr}	Reverse Recovery Charge		-	0.66	-	μC
T _{rr}	Reverse Recovery Time	VR = 400V, I _F = 30A dI _F /dt = 100A/μs	-	117	-	ns
I _{rr}	Reverse Recovery Current		-	19	-	A
Q _{rr}	Reverse Recovery Charge		-	1.37	-	μC

Typical Performance Characteristics

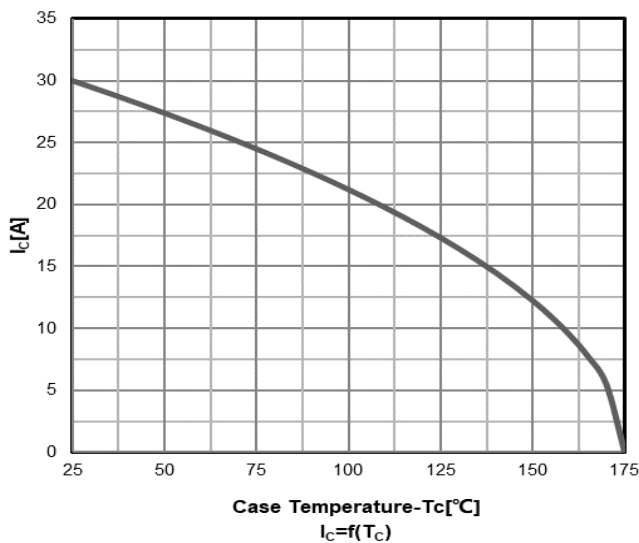
Safe operating area $T_a=25^\circ\text{C}$
Non-Full PAK



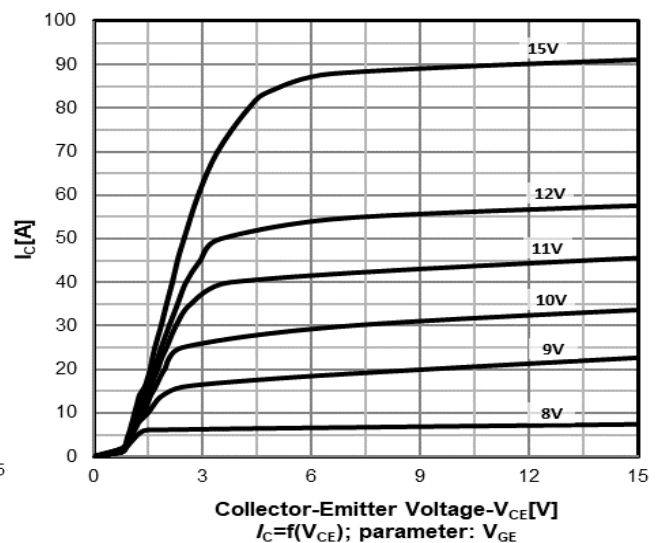
Safe operating area $T_a=25^\circ\text{C}$
Full PAK



Collector current as a function of
Case temperature

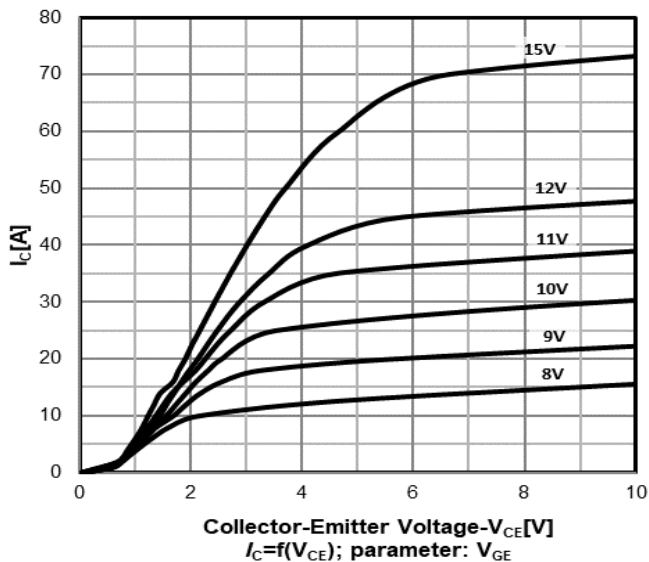


Typ. Output characteristics
 $T_J=25^\circ\text{C}$

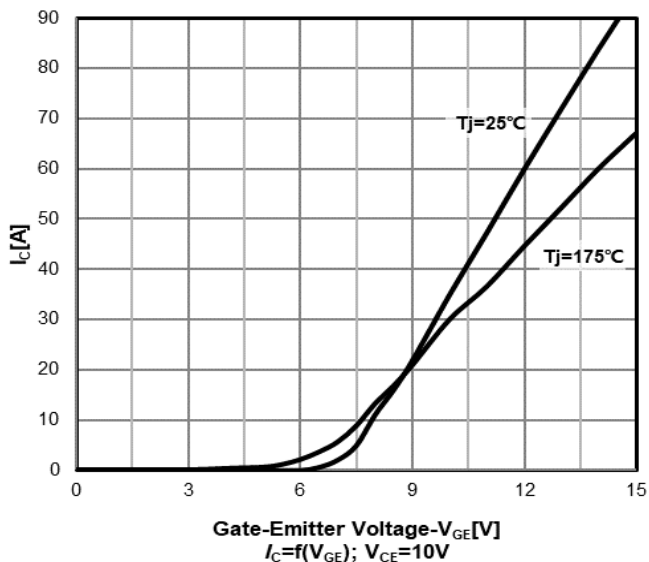


Typical Performance Characteristics

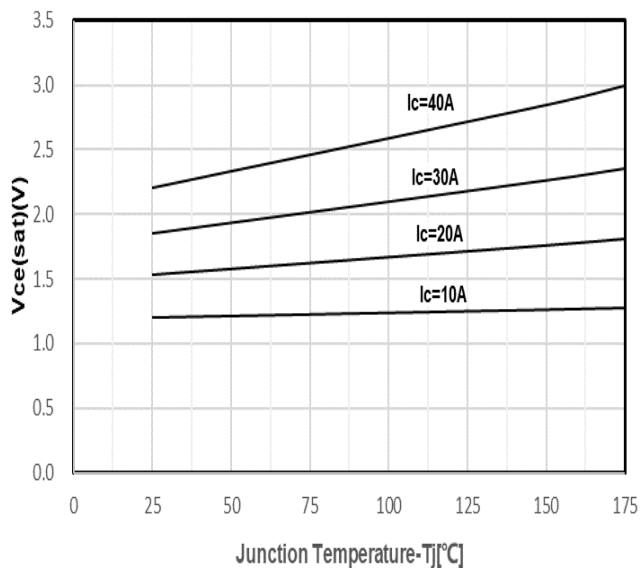
Typ. Output characteristics
 $T_j=175^\circ\text{C}$



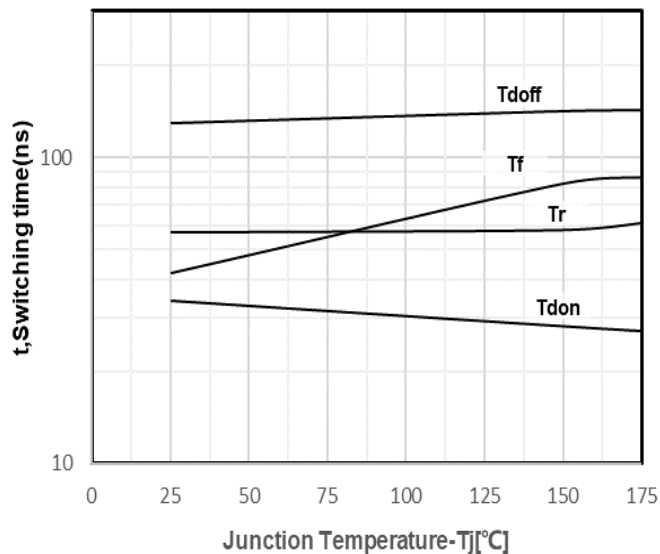
Typ. Transfer characteristics



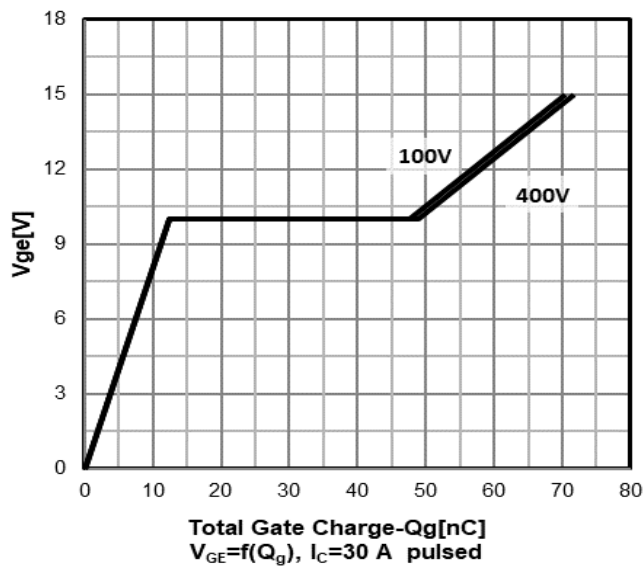
Typ. Collector-emitter saturation voltage as a function of junction temperature ($V_{GE}=15\text{V}$)



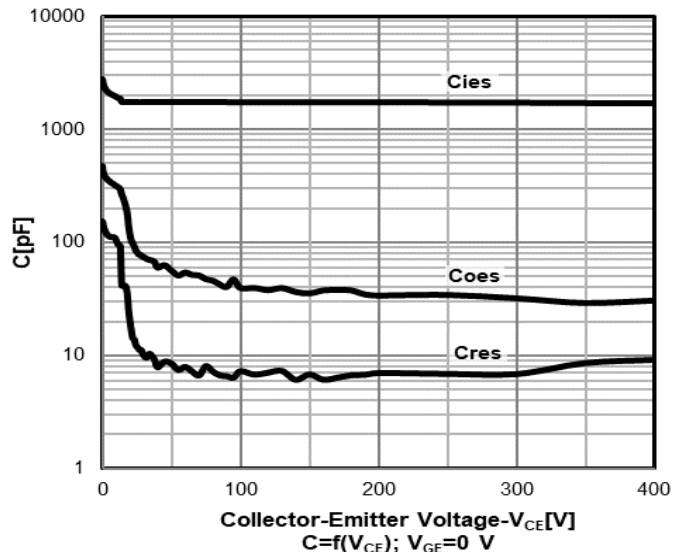
Typ. Switching times as a function of junction temperature (inductive load, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=10\Omega$)



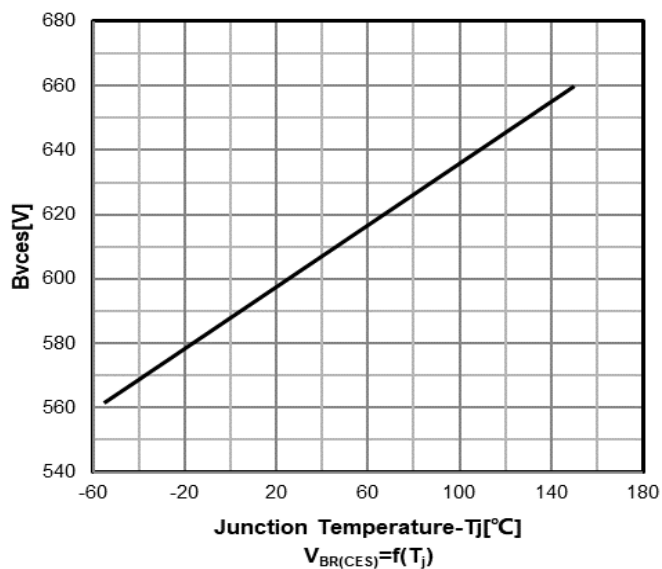
Gate charge characteristics



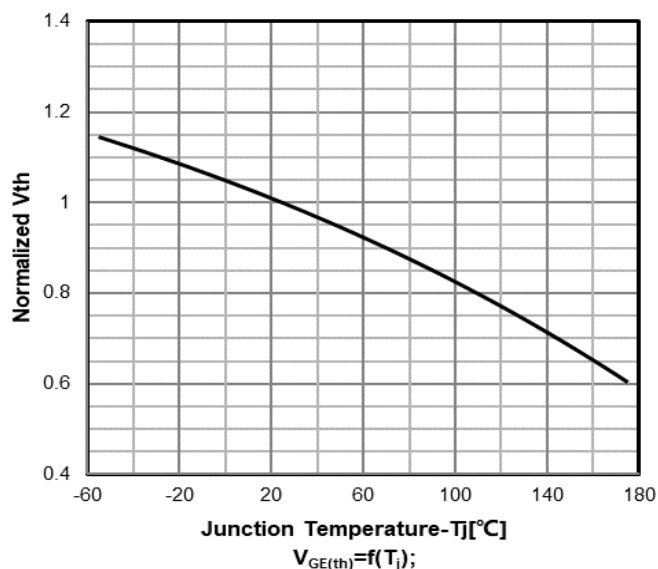
Capacitance characteristics



Collector-emitter breakdown voltage vs. temperature



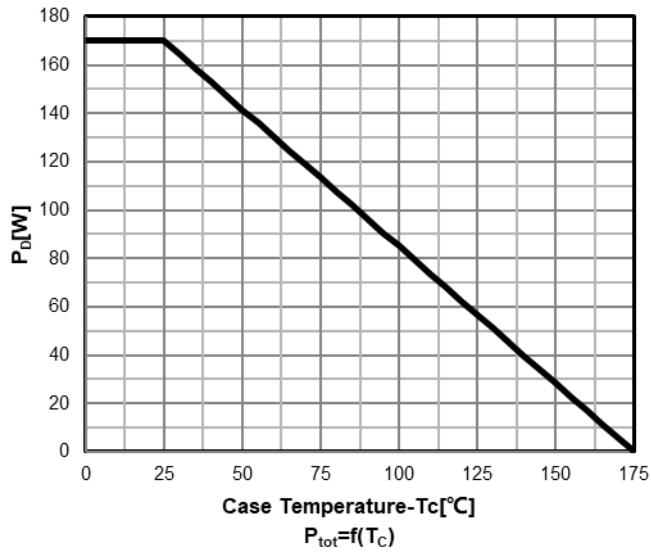
Normalized $V_{GE(th)}$ vs. temperature

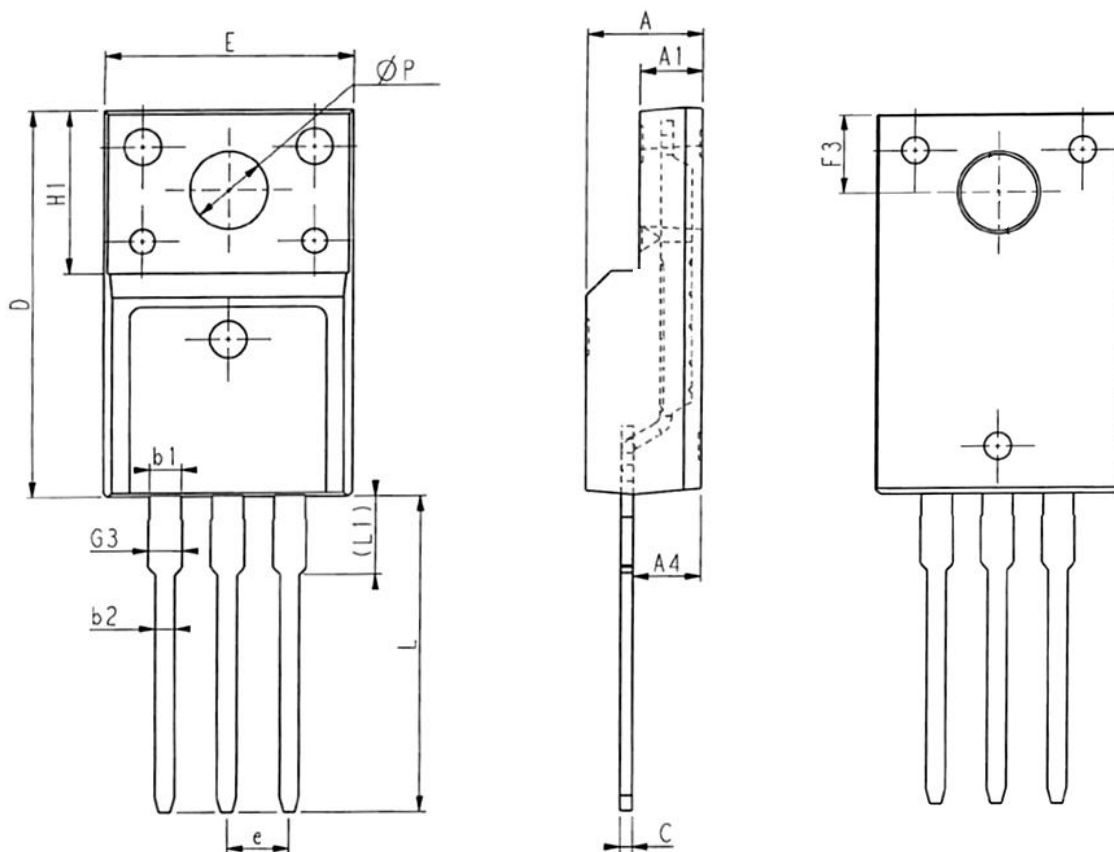




Typical Performance Characteristics

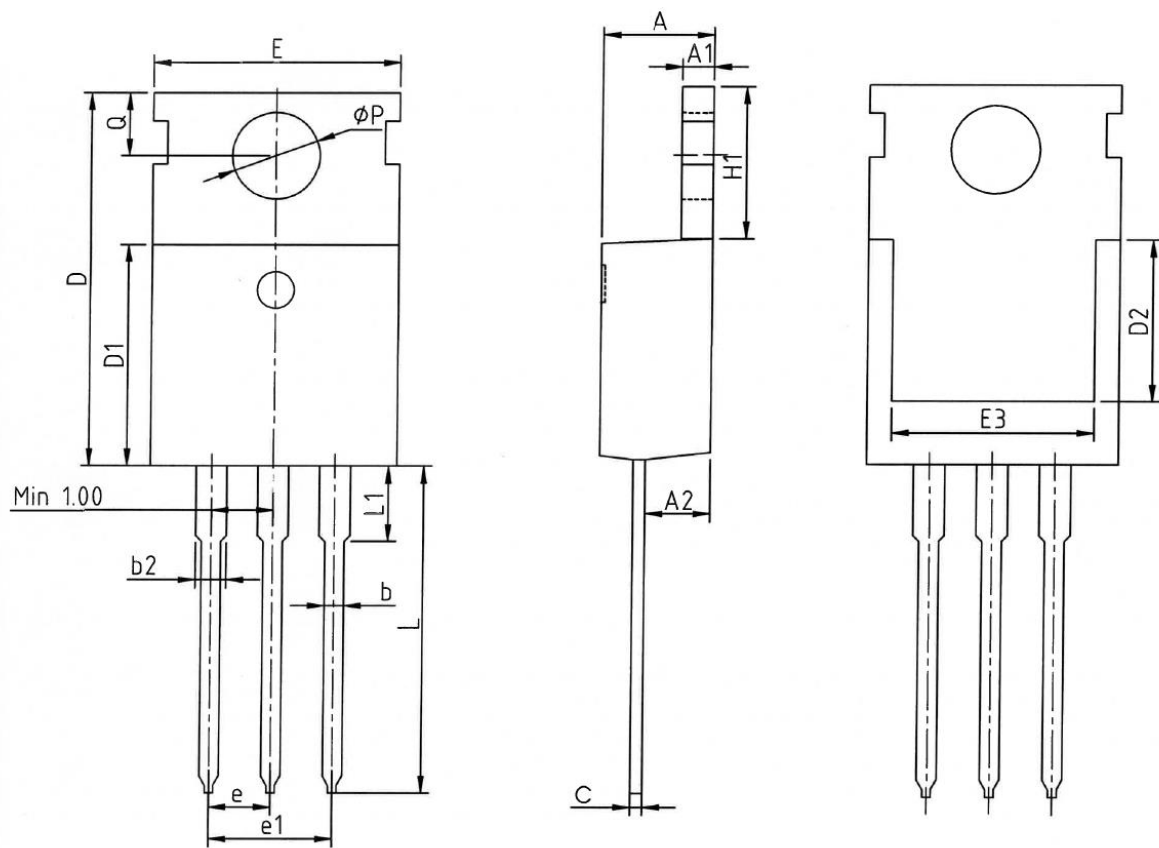
Power dissipation





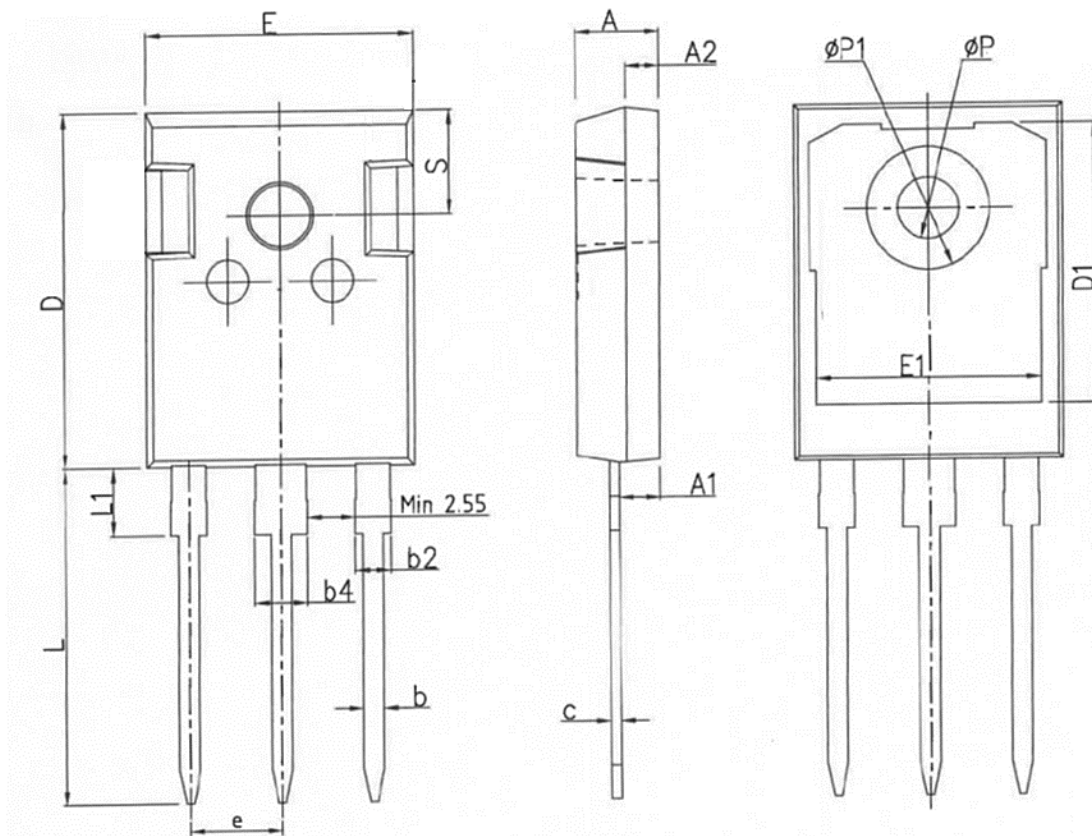
COMMON DIMENSIONS

SYMBOL	UNIT(mm)		
	MIN	NOM	MAX
E	9.86	10.16	10.36
A	4.50	4.70	4.90
A1	2.34	2.54	2.84
A4	2.56	2.76	2.96
C	0.35	0.50	0.65
D	15.50	15.87	16.25
H1	6.70REF		
e	2.54BSC		
L	12.60	12.98	13.35
L1	3.03	3.23	3.43
ΦP	3.00	3.20	3.40
F3	3.10	3.30	3.50
G3	1.20	1.35	1.60
b1	1.18	1.28	1.43
b2	0.70	0.80	0.95



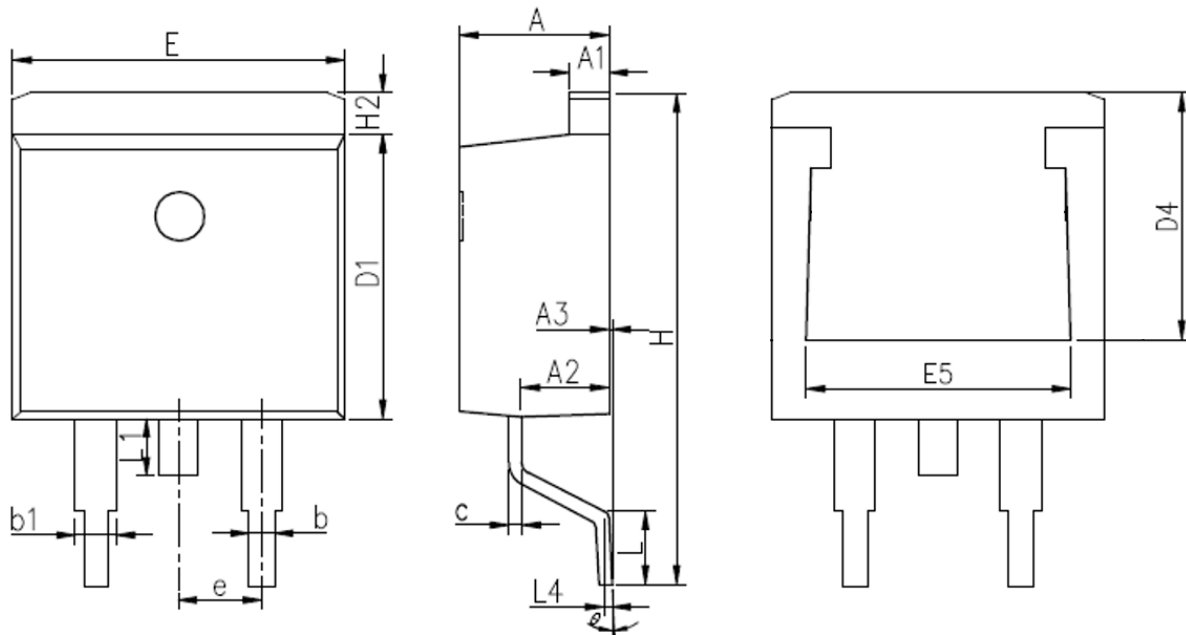
COMMON DIMENIONS

SYMBOL	MIN	NOM	MAX
A	4.37	4.57	4.70
A1	1.25	1.30	1.40
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b2	1.17	1.27	1.47
c	0.45	0.50	0.60
D	15.10	15.60	16.10
D1	8.80	9.10	9.40
D2	5.50	6.30	7.10
E	9.70	10.00	10.30
E3	7.00	7.80	8.60
e	2.54 BSC		
e1	5.08 BSC		
H1	6.25	6.50	6.85
L	12.75	13.50	13.80
L1	-	3.10	3.40
ΦP	3.40	3.60	3.80
Q	2.60	2.80	3.00



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		



COMMON DIMENSIONS

SYMBOL	MM		
	MIN	NOM	MAX
A	4.37	4.57	4.77
A1	1.22	1.27	1.42
A2	2.49	2.69	2.89
A3	0.00	0.13	0.25
b	0.70	0.81	0.96
b1	1.17	1.27	1.47
c	0.30	0.38	0.53
D1	8.50	8.70	8.90
D4	6.60	-	-
E	9.86	10.16	10.36
E5	7.06	-	-
e	2.54 BSC		
H	14.70	15.10	15.50
H2	1.07	1.27	1.47
L	2.00	2.30	2.60
L1	1.40	1.55	1.70
L4	0.25 BSC		
θ	0°	5°	9°



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