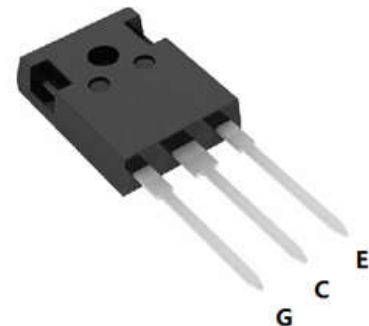
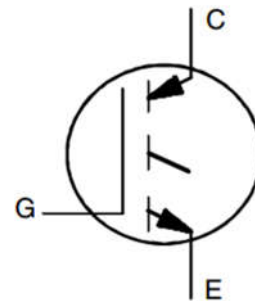


### FEATURES

- High breakdown voltage to 1200V for improved reliability
- Trench-Stop Technology offering :
  - very tight parameter distribution
  - high ruggedness, temperature stable behavior
  - Short circuit withstand time – 10 $\mu$ s
  - High ruggedness, temperature stable
  - Low  $V_{CE(SAT)}$
  - Easy parallel switching capability due to positive temperature coefficient in  $V_{CE(SAT)}$
- Enhanced avalanche capability

$V_{CE}$	1200	V
$I_C$	40	A
$V_{CE(SAT)} I_C=40A$	1.7	V



### APPLICATION

- Frequency Converters
- Motor Drive
- Specified application conditions

## Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Breakdown Voltage	$V_{CE}$	1200	V
DC collector current, limited by $T_{jmax}$ $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	$I_C$	80 40	A
Continuous Gate-emitter voltage	$V_{GE}$	$\pm 20$	V
Transient Gate-emitter voltage	$V_{GE}$	$\pm 30$	V
Turn off safe operating area $V_{CE} \leq 1200\text{V}$ , $T_j \leq 150^\circ\text{C}$	-	160	A
Pulsed Collector Current, $V_{GE} = 15\text{V}$ , $t_p$ limited by $T_{jmax}$	$I_{CM}$	160	A
Short Circuit Withstand Time, $V_{GE} = 15\text{V}$ , $V_{CE} \leq 600\text{V}$	$T_{sc}$	10	$\mu\text{s}$
Power dissipation , $T_j = 25^\circ\text{C}$	$P_{tot}$	416	W
Operating junction temperature	$T_j$	-40...+150	$^\circ\text{C}$
Storage temperature	$T_s$	-55...+150	$^\circ\text{C}$
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s	-	260	$^\circ\text{C}$

## Thermal Resistance

Parameter	Symbol	Max. Value	Unit
IGBT thermal resistance, junction - case	$R_{\theta(j-c)}$	0.3	K/W
Diode thermal resistance, junction - case	$R_{\theta(j-c)}$	0.6	K/W
Thermal resistance, junction - ambient	$R_{\theta(j-a)}$	40	K/W

**Electrical Characteristics of the IGBT** ( $T_j = 25^\circ\text{C}$  unless otherwise specified) :

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>Static</b>						
Collector-Emitter breakdown voltage	$BV_{CES}$	$V_{GE}=0V, I_C=250\mu A$	1200	1300	-	V
Gate threshold voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=250\mu A$	5.1	5.8	6.4	V
Collector-Emitter Saturation voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=40A$ $T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	- -	1.7 2.1	2.1 -	V
Zero gate voltage collector current	$I_{CES}$	$V_{CE} = 1200V, V_{GE} = 0V$ $T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	- -	- -	10 2500	$\mu A$
Gate-emitter leakage current	$I_{GES}$	$V_{CE} = 0V, V_{GE} = \pm 20V$	-	-	100	nA
Transconductance	$g_{fs}$	$V_{CE}=20V, I_C=15A$	-	15	-	S

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>Dynamic</b>						
Input capacitance	$C_{ies}$	$V_{CE} = 25V, V_{GE} = 0V,$ $f = 1\text{MHz}$	-	4400	-	pF
Output capacitance	$C_{oes}$		-	180	-	
Reverse transfer capacitance	$C_{res}$		-	100	-	
Gate charge	$Q_G$	$V_{CC} = 960V, I_C = 40A,$ $V_{GE} = 15V$	-	270	-	nC
Short circuit collector current	$I_{C(SC)}$	$V_{GE}=15V, t_{sc}\leq 10\mu s$ $V_{CC}=600V,$ $T_{j, start}=25^\circ\text{C}$	-	240	-	A



# HG40N120T1

1200V /40A Trench Field Stop IGBT

## Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>Dynamic , at <math>T_j = 25^\circ \text{C}</math></b>						
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 600\text{V}, I_C = 40\text{A},$ $V_{GE} = 0/15\text{V},$ $R_g = 12\Omega$	-	55	-	ns
Rise time	$t_r$		-	20	-	ns
Turn-on energy	$E_{on}$		-	2.4	-	mJ
Turn-off delay time	$t_{d(off)}$		-	230	-	ns
Fall time	$t_f$		-	100	-	ns
Turn-off energy	$E_{off}$		-	1.5	-	mJ

Fig. 1 FBSOA characteristics

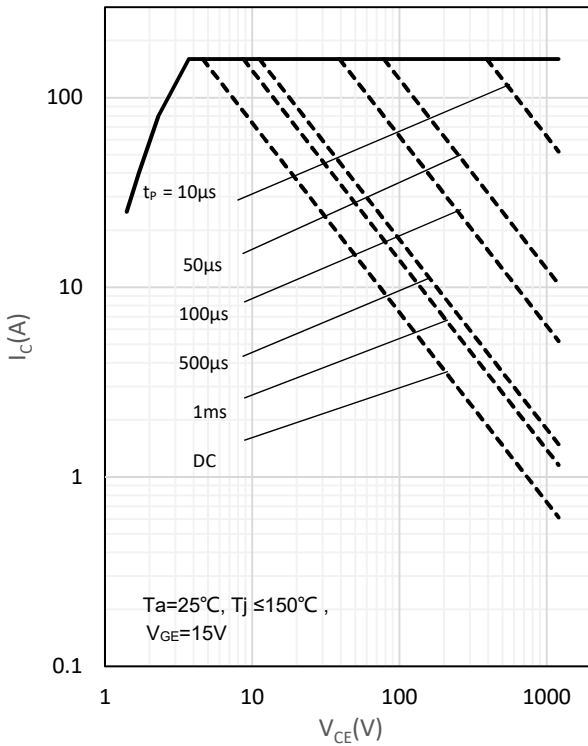


Fig. 2 Load Current vs. Frequency

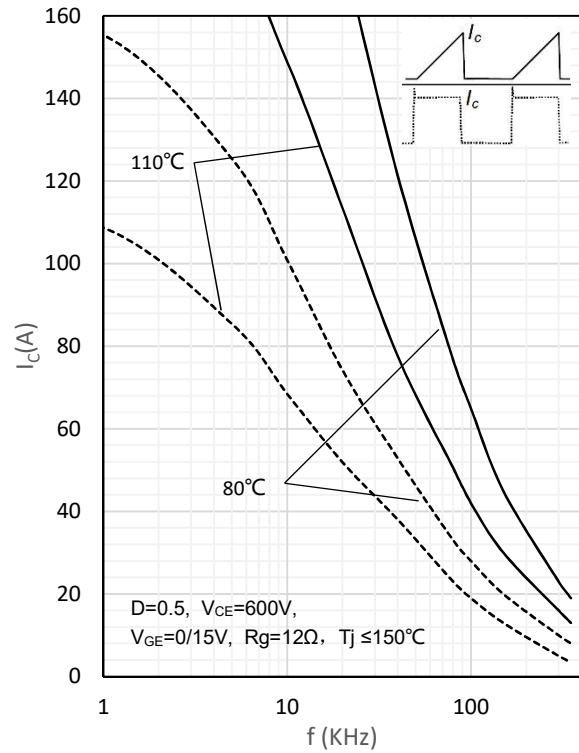


Fig. 3 Power dissipation as a function of  $T_C$

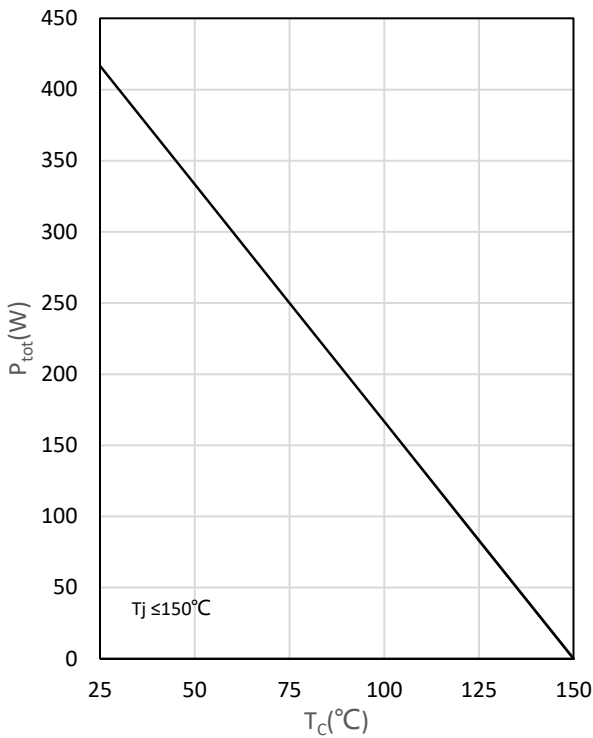


Fig. 4 Short circuit time and current vs.  $V_{GE}$

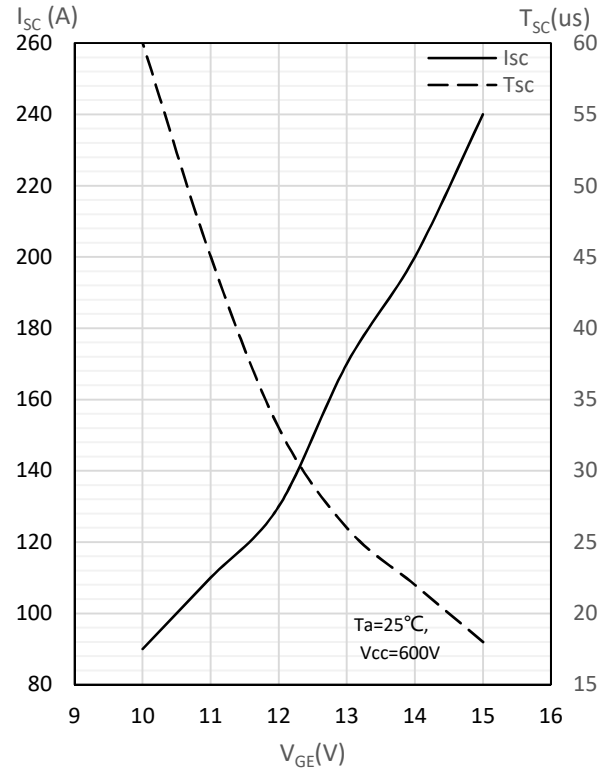


Fig. 5 Output characteristics

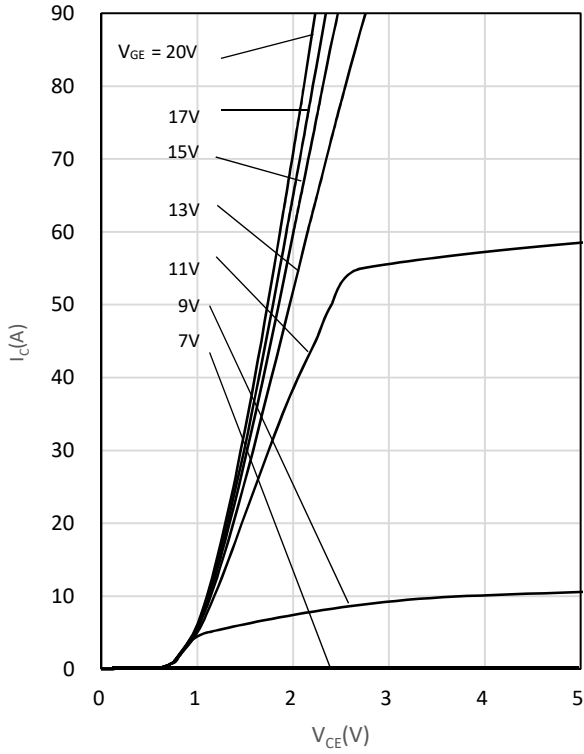


Fig. 6 Saturation voltage characteristics

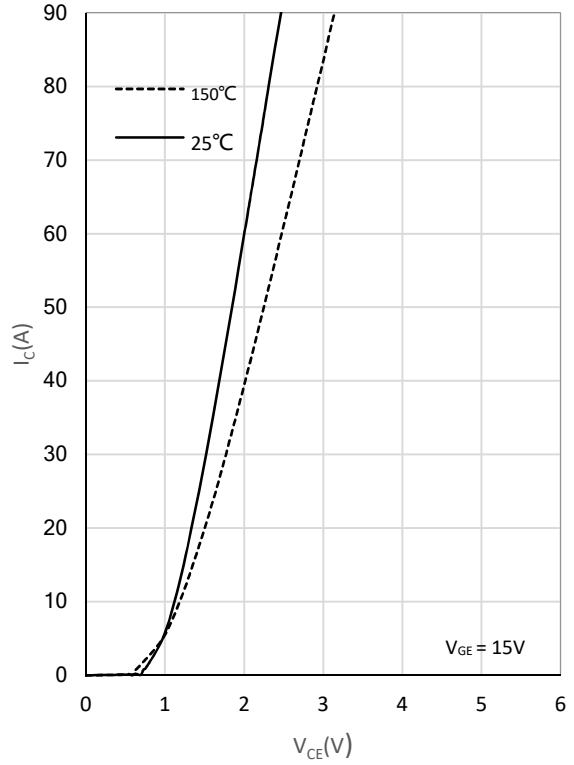


Fig. 7 Switching times vs. gate resistor

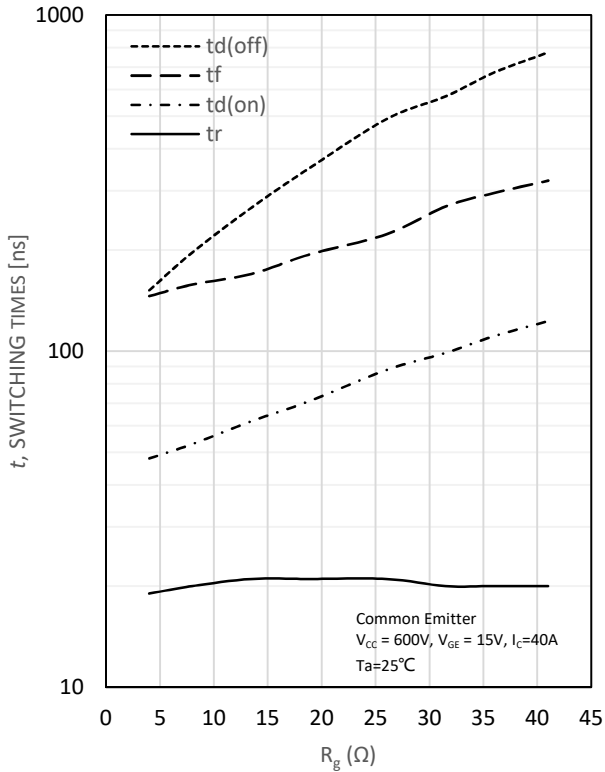


Fig. 8 Switching times vs. collector current

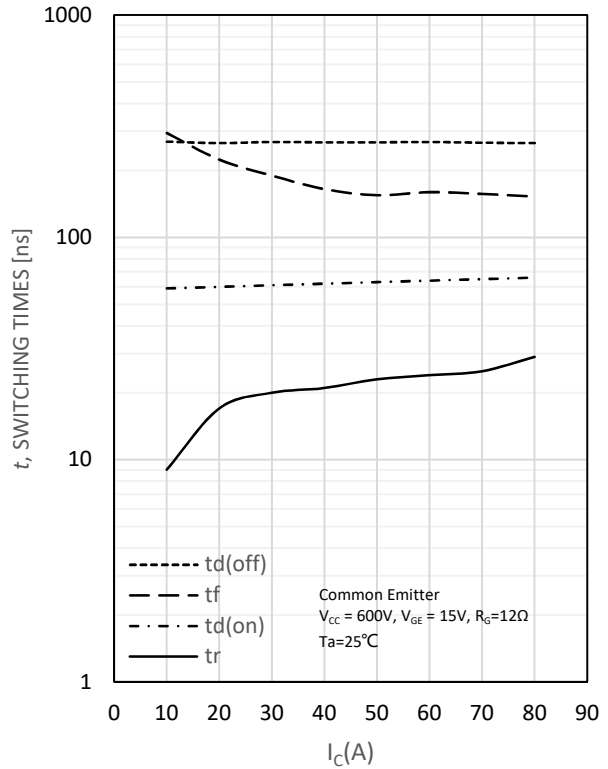


Fig. 9 Switching loss vs. gate resistor

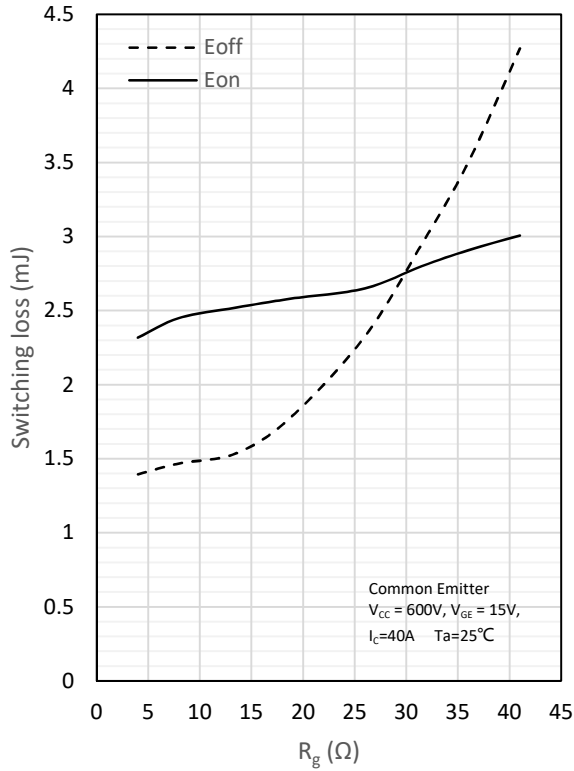


Fig. 10 Switching loss vs. collector current

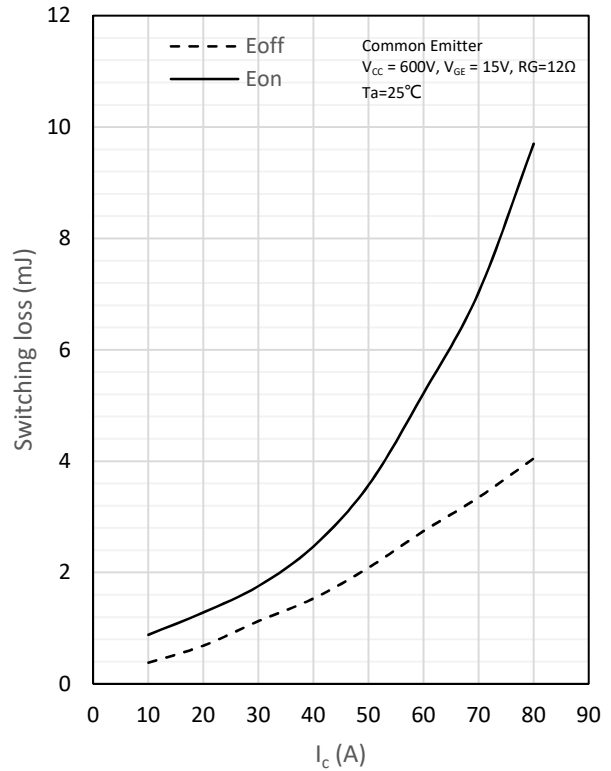


Fig. 11 Gate charge characteristics

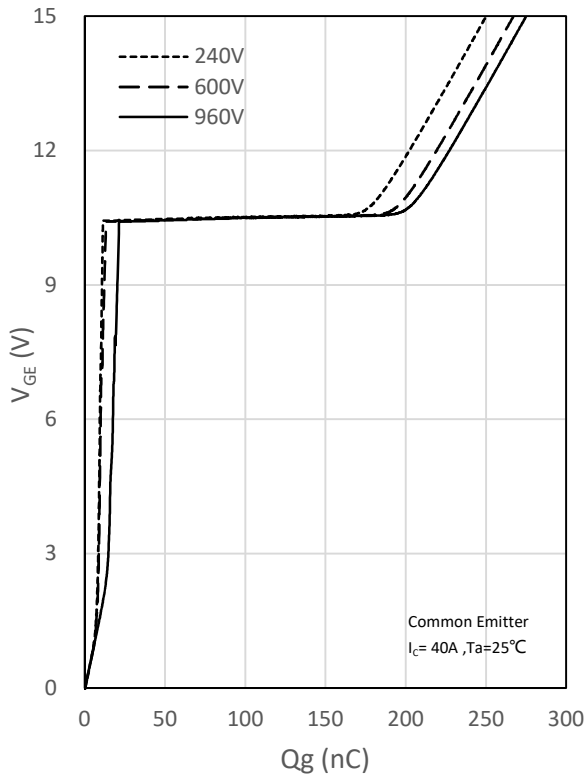
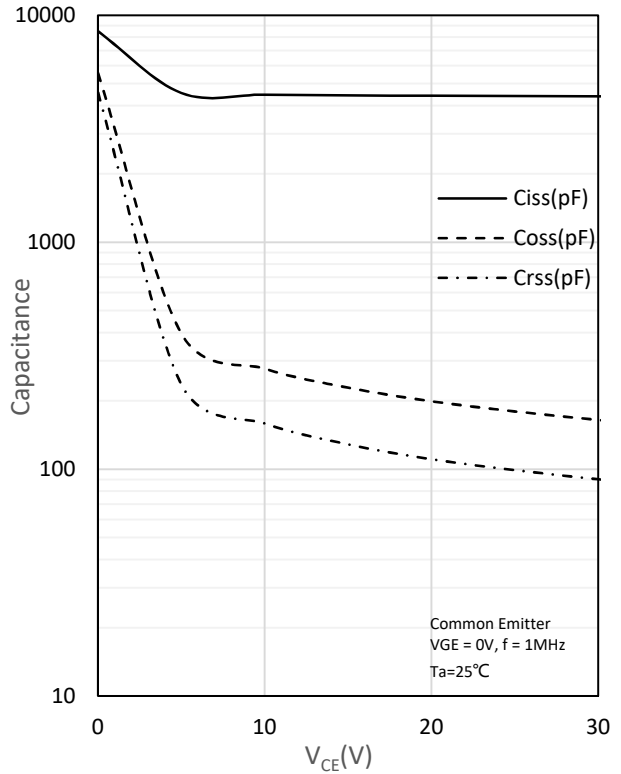
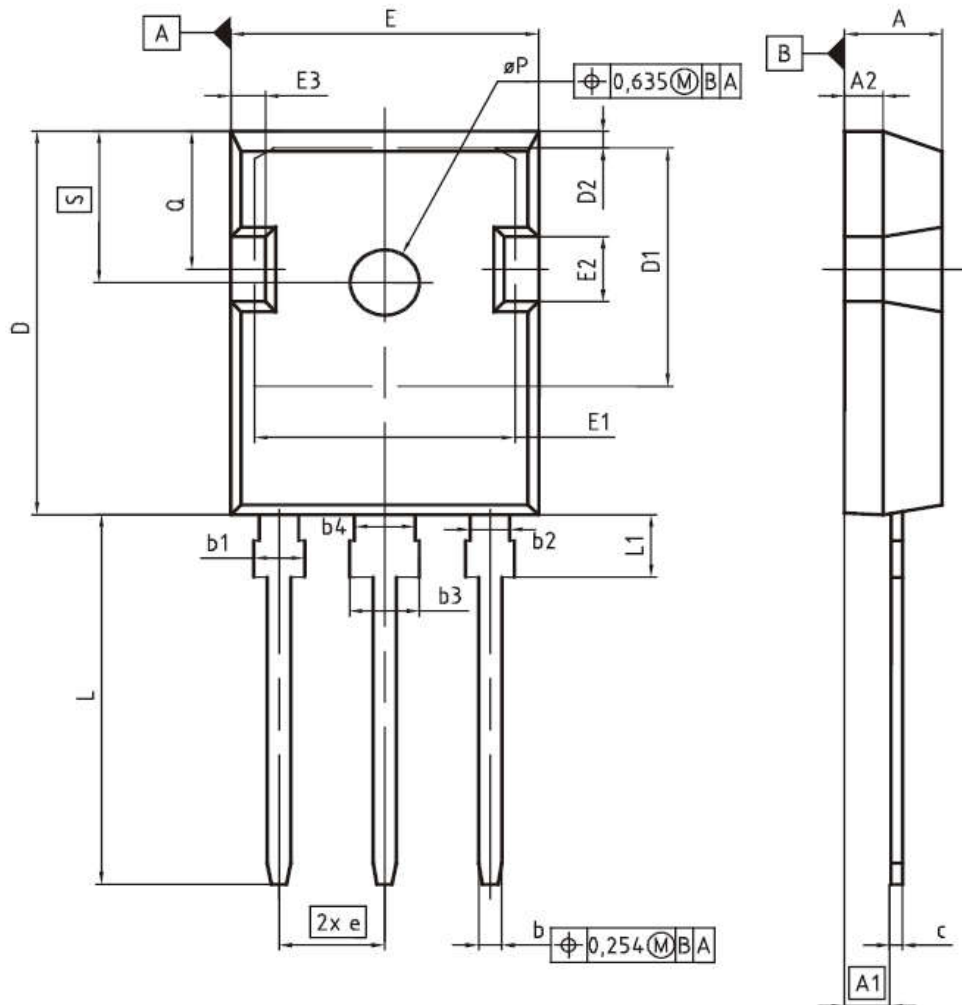


Fig. 12 Capacitance characteristics



## PG-TO247-3



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4,83	5,21	0,190	0,205
A1	2,27	2,54	0,089	0,100
A2	1,85	2,16	0,073	0,085
b	1,07	1,33	0,042	0,052
b1	1,90	2,41	0,075	0,095
b2	1,90	2,16	0,075	0,085
b3	2,87	3,38	0,113	0,133
b4	2,87	3,13	0,113	0,123
c	0,55	0,68	0,022	0,027
D	20,80	21,10	0,819	0,831
D1	16,25	17,65	0,640	0,695
D2	0,95	1,35	0,037	0,053
E	15,70	16,13	0,618	0,635
E1	13,10	14,15	0,516	0,557
E2	3,68	5,10	0,145	0,201
E3	1,00	2,60	0,039	0,102
e	5,44 (BSC)		0,214 (BSC)	
N	3		3	
L	19,80	20,32	0,780	0,800
L1	4,10	4,47	0,161	0,176
$\phi P$	3,50	3,70	0,138	0,146
Q	5,49	6,00	0,216	0,236
S	6,04	6,30	0,238	0,248