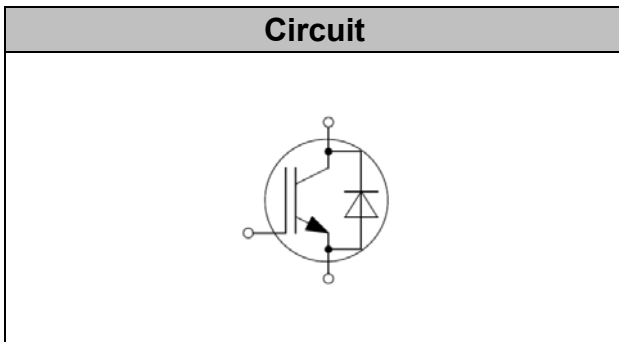




## IGBT Discrete

$V_{CE}$	650	V
$I_C$	15	A
$V_{CE(SAT)} I_C=15A$	1.65	V



## Applications

- Soft switching applications
- Airconditioning
- Motor drive inverter

## Features

- High speed smooth switching device for hard & soft switching
- Maximum junction temperature 175°C
- Positive temperature coefficient
- High ruggedness, temperature stable
- Pb-free lead plating; RoHS compliant

## Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Breakdown Voltage	$V_{CE}$	650	V
DC Collector Current, limited by $T_{jmax}$ $T_C=25^\circ C$ value limited by bondwire $T_C=100^\circ C$	$I_C$	30 15	A
Diode Forward Current, limited by $T_{jmax}$ $T_C=25^\circ C$ $T_C=100^\circ C$	$I_F$	30 15	A
Continuous Gate-Emitter Voltage	$V_{GE}$	$\pm 20$	V
Transient Gate-Emitter Voltage	$V_{GE}$	$\pm 30$	V
Turn off Safe Operating Area $V_{CE} \leq 650V$ , $T_j \leq 150^\circ C$		60	A
Pulsed Collector Current, $V_{GE}=15V$ , $t_p$ limited by $T_{jmax}$	$I_{CM}$	60	A
Short Circuit Withstand Time, $V_{GE}=15V$ , $V_{CE} \leq 400V$	$T_{sc}$	5	$\mu s$
Diode Pulsed Current, $t_p$ limited by $T_{jmax}$	$I_{Fpuls}$	60	A
Power Dissipation, $T_j=175^\circ C, T_C=25^\circ C$	$P_{tot}$	130	W



Operating Junction Temperature	$T_j$	-40...+175	°C
Storage Temperature	$T_s$	-55...+150	°C
Soldering Temperature, wave soldering 1.6mm (0.063in.) from case for 10s		260	°C

**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	$BV_{CES}$	$V_{GE}=0V, I_C=250\mu A$	650		-	V
Gate Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=250\mu A$	4.1	5.0	5.7	V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=15A$ $T_j=25^\circ\text{C}$ , $T_j=125^\circ\text{C}$ $T_j=150^\circ\text{C}$		1.65 1.95 2.05	1.95	V
Zero Gate Voltage Collector Current	$I_{CES}$	$V_{CE}=650V, V_{GE}=0V$ $T_j=25^\circ\text{C}$ , $T_j=150^\circ\text{C}$			0.25	mA
Gate-Emitter Leakage Current	$I_{GES}$	$V_{CE}=0V, V_{GE}=\pm 20V$			$\pm 200$	nA
Transconductance	$g_{fs}$	$V_{CE}=20V, I_C=15A$		10		S

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
<b>Dynamic</b>						
Input Capacitance	$C_{ies}$	$V_{CE}=25V, V_{GE}=0V,$ $f=1\text{MHz}$	-	0.99	-	nF
Output capacitance	$C_{oes}$			0.056		
Reverse Transfer Capacitance	$C_{res}$		-	0.03	-	
Gate Charge	$Q_G$	$V_{CC}=480V, I_C=15A,$ $V_{GE}=15V$	-	0.052	-	uC
Short circuit collector current	$I_{C(SC)}$	$V_{GE}=15V, t_{SC}\leq 5\mu s$ $V_{CC}=400V,$ $T_{j, start}=25^\circ\text{C}$	-	98	-	A



## Electrical Characteristics of the Diode (T<sub>j</sub>= 25°C unless otherwise specified):

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Diode Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 15A T <sub>j</sub> = 25°C, T <sub>j</sub> = 125°C T <sub>j</sub> = 150°C		1.70 1.65 1.65		V

## Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
<b>Dynamic , at T<sub>j</sub>= 25°C</b>						
Turn-on Delay Time	t <sub>d(on)</sub>	T <sub>j</sub> =25°C V <sub>CC</sub> = 400V, I <sub>C</sub> =15A, V <sub>GE</sub> =0/15V, R <sub>g</sub> =12 Ω	-	15	-	ns
Rise Time	t <sub>r</sub>		-	25	-	ns
Turn-on Energy	E <sub>on</sub>		-	0.75	-	mJ
Turn-off Delay Time	t <sub>d(off)</sub>		-	60	-	ns
Fall Time	t <sub>f</sub>		-	46	-	ns
Turn-off Energy	E <sub>off</sub>		-	0.1	-	mJ
<b>Dynamic , at T<sub>j</sub>= 125°C</b>						
Turn-on Delay Time	t <sub>d(on)</sub>	T <sub>j</sub> =25°C V <sub>CC</sub> = 400V, I <sub>C</sub> =15A, V <sub>GE</sub> =0/15V, R <sub>g</sub> =12 Ω	-	24	-	ns
Rise Time	t <sub>r</sub>		-	30	-	ns
Turn-on Energy	E <sub>on</sub>		-	1.10	-	mJ
Turn-off Delay Time	t <sub>d(off)</sub>		-	90	-	ns
Fall Time	t <sub>f</sub>		-	54	-	ns
Turn-off Energy	E <sub>off</sub>		-	0.15	-	mJ
<b>Dynamic , at T<sub>j</sub>= 150°C</b>						
Turn-on Delay Time	t <sub>d(on)</sub>	T <sub>j</sub> =25°C V <sub>CC</sub> = 400V, I <sub>C</sub> =15A, V <sub>GE</sub> =0/15V, R <sub>g</sub> =12 Ω	-	26	-	ns
Rise Time	t <sub>r</sub>		-	32	-	ns
Turn-on Energy	E <sub>on</sub>		-	1.25	-	mJ
Turn-off Delay Time	t <sub>d(off)</sub>		-	95	-	ns
Fall Time	t <sub>f</sub>		-	58	-	ns
Turn-off Energy	E <sub>off</sub>		-	0.18	-	mJ



## Electrical Characteristics of the DIODE

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
<b>Dynamic , at T<sub>j</sub>= 25°C</b>						
Reverse Recovery Current	I <sub>rr</sub>	I <sub>F</sub> =15A, V <sub>R</sub> =300V, -di/dt= 200A/μs,	-	12	-	A
Reverse Recovery Charge	Q <sub>rr</sub>		-	0.5	-	uC
Reverse Recovery Energy	E <sub>rec</sub>		-	0.06		mJ
<b>Dynamic , at T<sub>j</sub>= 125°C</b>						
Reverse Recovery Current	I <sub>rr</sub>	I <sub>F</sub> =15A, V <sub>R</sub> =300V, -di/dt= 200A/μs,	-	15	-	A
Reverse Recovery Charge	Q <sub>rr</sub>		-	0.9	-	uC
Reverse Recovery Energy	E <sub>rec</sub>		-	0.12		mJ
<b>Dynamic , at T<sub>j</sub>= 150°C</b>						
Reverse Recovery Current	I <sub>rr</sub>	I <sub>F</sub> =15A, V <sub>R</sub> =300V, -di/dt= 200A/μs,	-	16	-	A
Reverse Recovery Charge	Q <sub>rr</sub>		-	1.2	-	uC
Reverse Recovery Energy	E <sub>rec</sub>		-	0.15		mJ

## Thermal Resistance

Parameter	Symbol	Max. Value	Unit
IGBT Thermal Resistance, Junction - Case	R <sub>th(j-c)</sub>	1.15	K/W
Diode Thermal Resistance, Junction - Case	R <sub>th(j-c)</sub>	1.9	K/W
Thermal Resistance, Junction - Ambient	R <sub>th(j-a)</sub>	60	K/W



Fig. 1 FBSOA characteristics

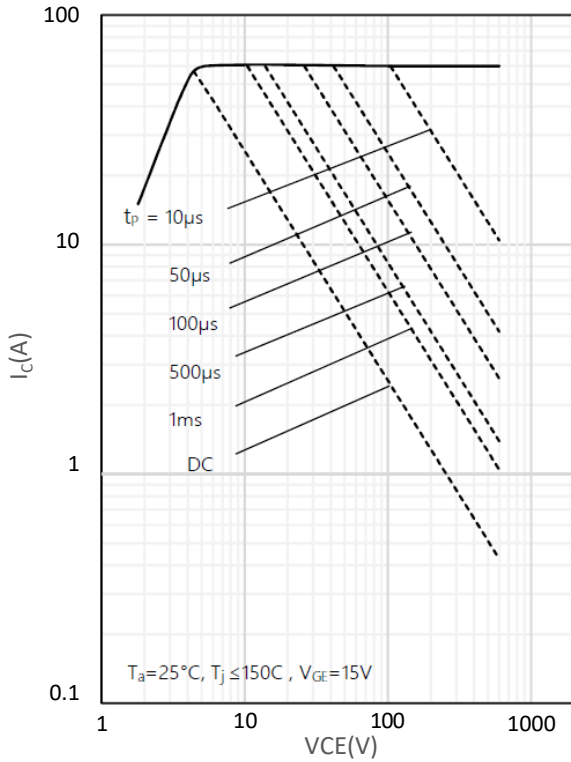


Fig. 2 Load Current vs. Frequency

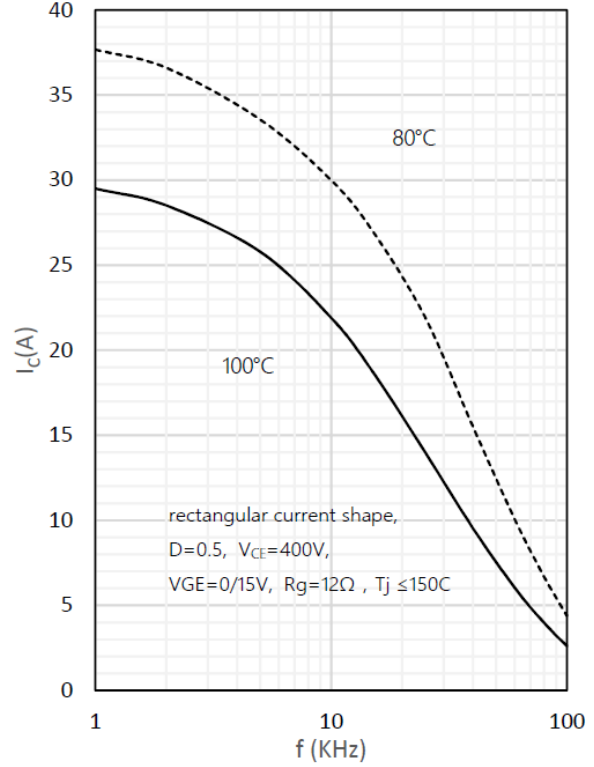


Fig. 3 Output characteristics

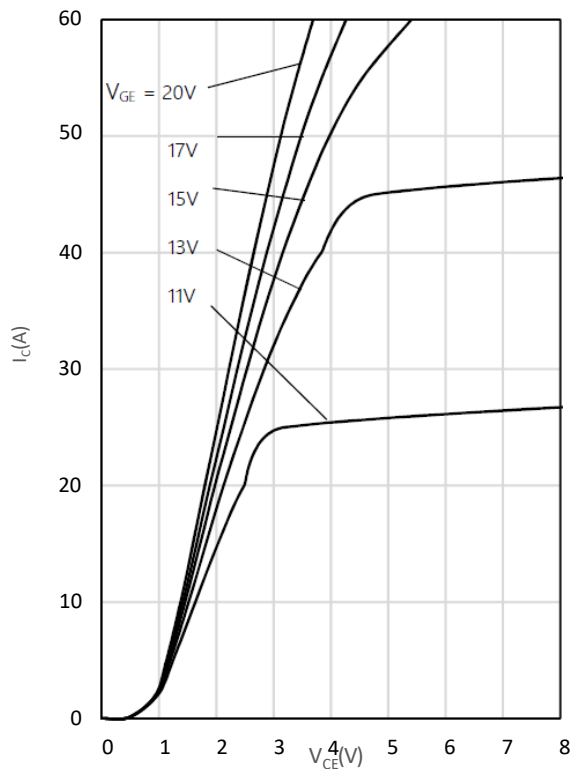
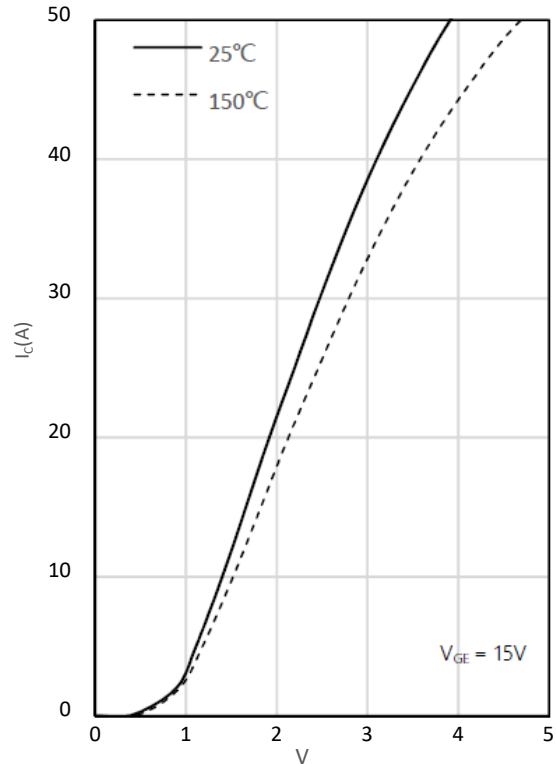


Fig. 4 Saturation voltage characteristics





$c_E(V)$

Fig. 5 Switching times vs. gate resistor

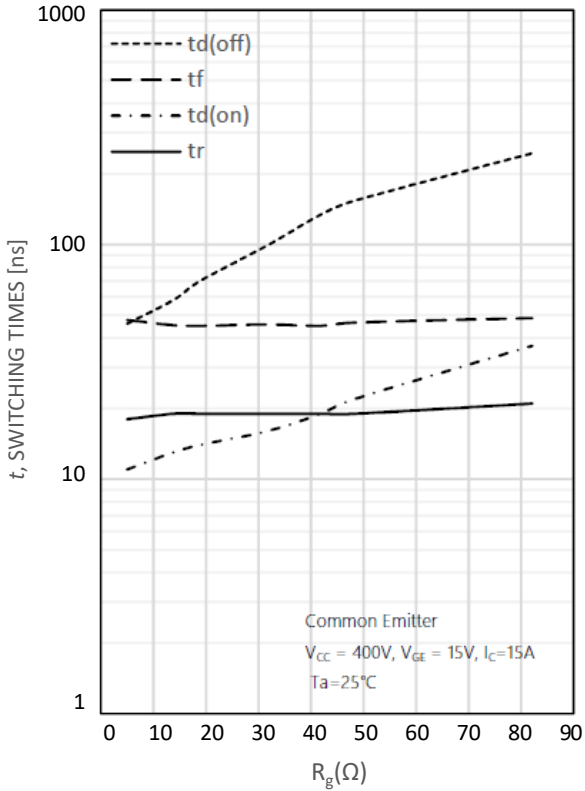


Fig. 6 Switching times vs. collector current

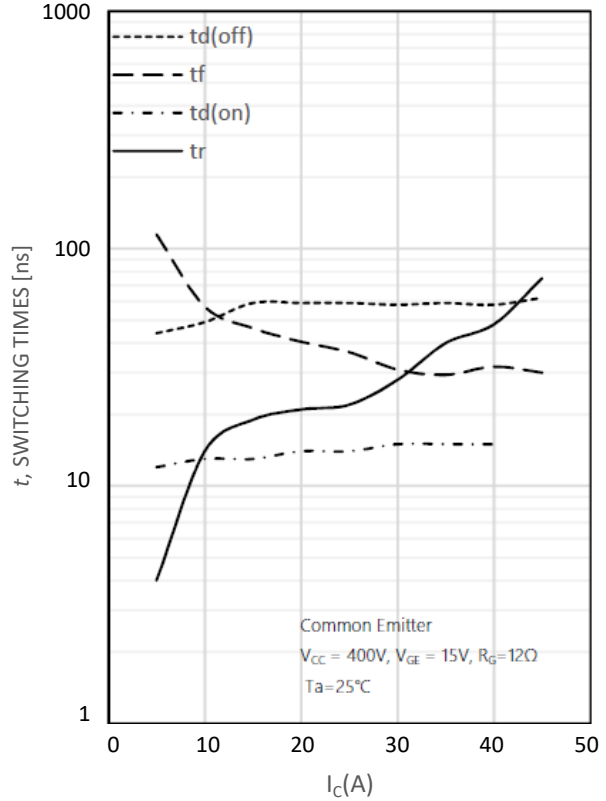


Fig. 7 Switching loss vs. gate resistor

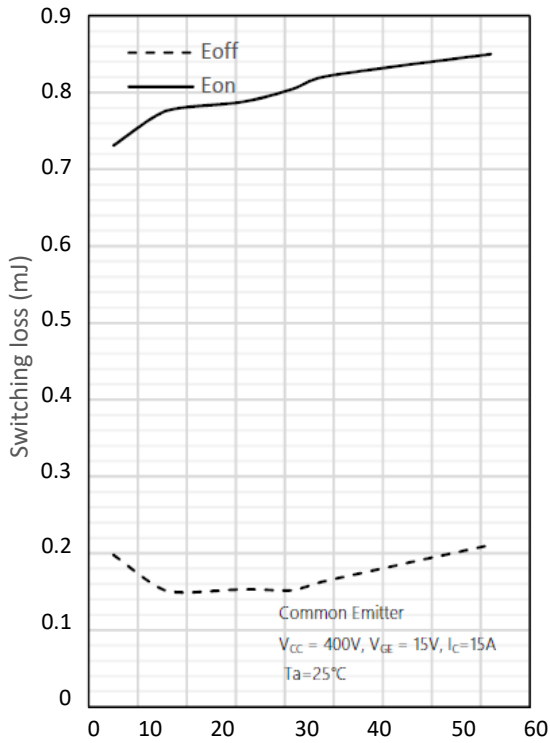
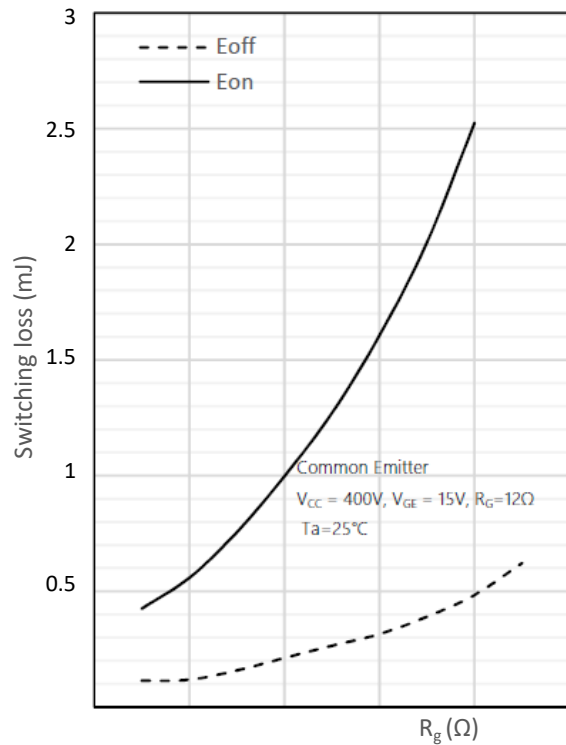


Fig. 8 Switching loss vs. collector current





0  
0 10 20 30 40 50  $I_c$  (A)

Fig. 9 Gate charge characteristics

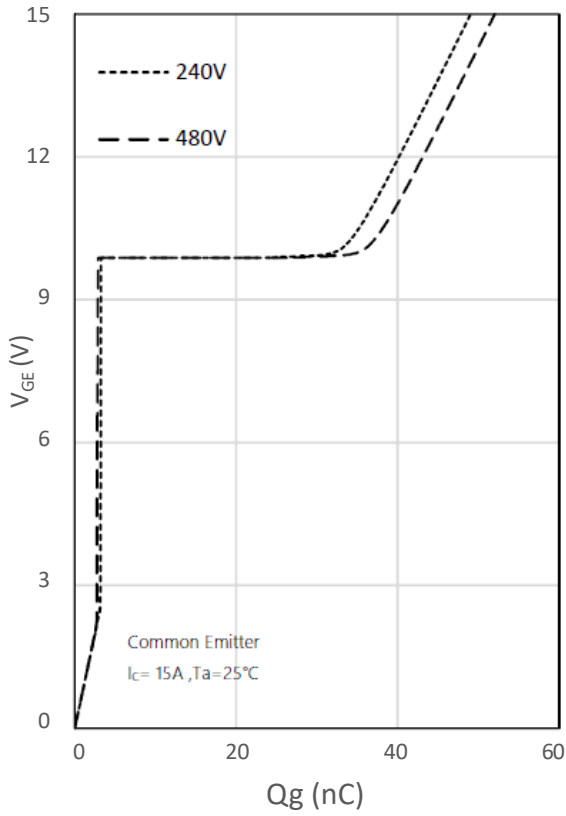
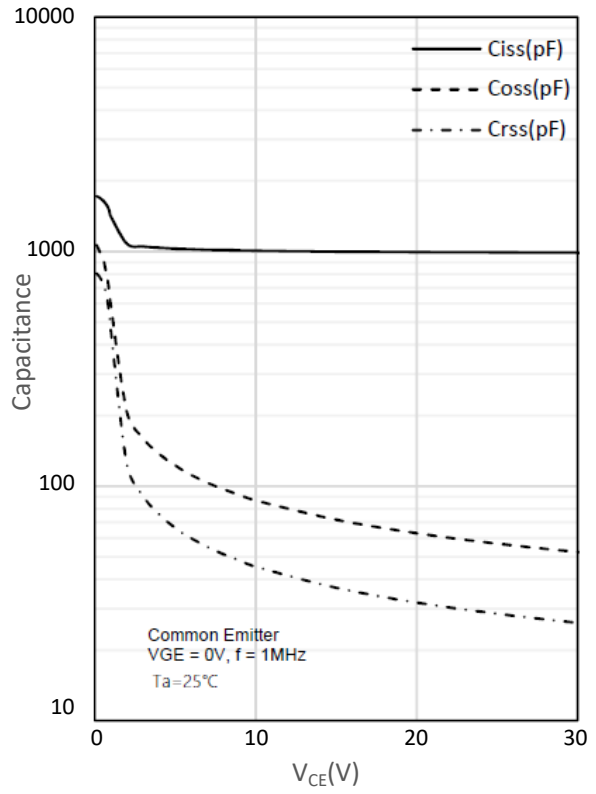
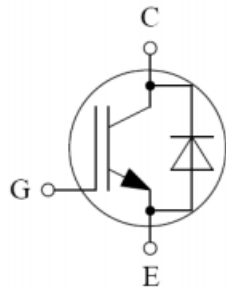


Fig. 10 Capacitance characteristics

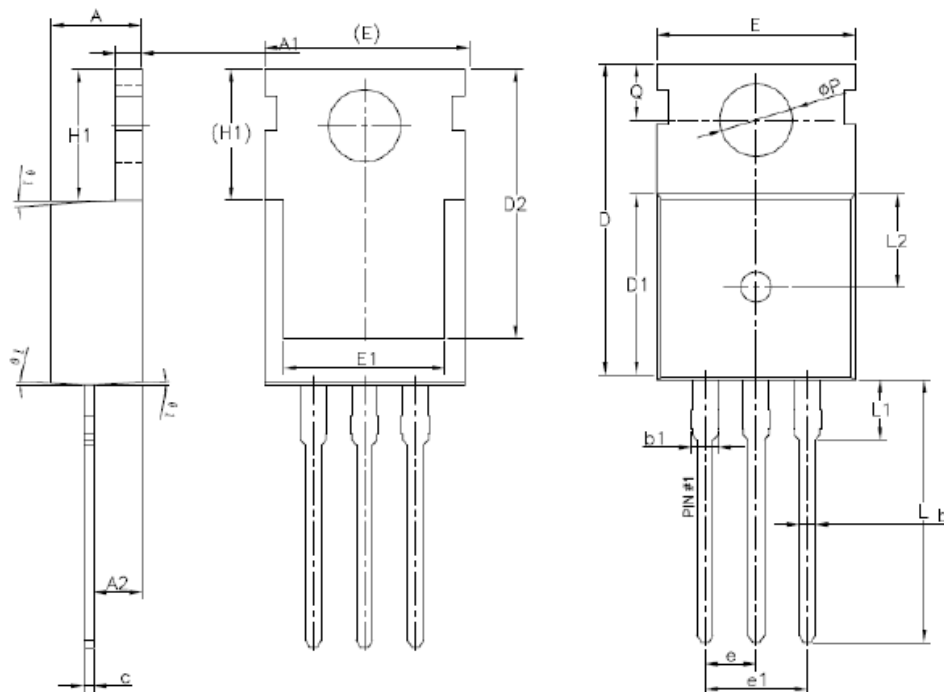


● Circuit Diagram



● Package Outline Information

**CASE: TO-220 package information**



SYMBOL	MIN	NOM	MAX
A	4.40	4.50	4.60
A1	1.27	1.30	1.33
A2	2.30	2.40	2.50
b	0.70	—	0.90
b1	1.27	—	1.40
c	0.45	0.50	0.60
D	15.30	15.70	16.10
D1	9.10	9.20	9.30
D2	13.10	—	13.70
E	9.70	9.90	10.20
E1	7.80	8.00	8.20
e	2.49	2.54	2.59
e1	5.03	5.08	5.12
H1	6.30	6.50	6.70
L	12.78	13.08	13.38
L1	3.30	—	3.50
L2	4.50	4.60	4.70
$\phi P$	3.55	3.60	3.65
Q	2.73	—	2.87
$\theta 1$	1°	3°	5°

