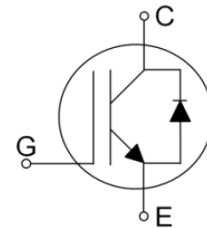
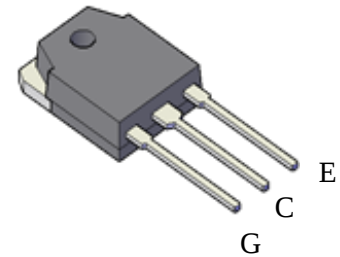


FEATURES

- High breakdown voltage to 650V for improved reliability
- Trench-Stop Technology offering :
 - High speed switching
 - High ruggedness, temperature stable
 - Short circuit withstand time – 5μs
 - Low V_{CEsat}
 - Easy parallel switching capability due to positive temperature coefficient in V_{CEsat}

V_{CE}	650	V
I_C	40	A
$V_{CE(SAT)} \quad I_C=40A$	1.85	V



APPLICATION

- Uninterruptible Power Supplies
- Inverter
- Welding Converters
- PFC applications
- Converter with high switching frequency

Product	Package	Packaging
YGD40N65FFA1	TO-3P	Tube

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Breakdown Voltage, $T_j \geq 25^\circ\text{C}$	V_{CE}	650	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
Diode Forward current, limited by T_{jmax} $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	I_F	38 18	A
Continuous Gate-emitter voltage	V_{GE}	± 20	V
Transient Gate-emitter voltage ($t_p \leq 10\mu\text{s}, D < 0.01$)	V_{GE}	± 30	V
Turn off safe operating area $V_{CE} \leq 650\text{V}$, $T_j \leq 175^\circ\text{C}$, $t_p = 1\mu\text{s}$	-	120	A
Pulsed Collector Current, $V_{GE} = 15\text{V}$, t_p limited by T_{jmax}	I_{CM}	120	A
Diode Pulsed Current, t_p limited by T_{jmax}	I_{Fpuls}	80	A
Short Circuit Withstand Time, $V_{GE} = 15\text{V}$, $V_{CE} \leq 600\text{V}$, $T_j = 25^\circ\text{C}$	T_{sc}	5	μs
Power dissipation, $T_C = 25^\circ\text{C}$	P_{tot}	250	W
Max. Junction Temperature	$T_{j,max}$	175	$^\circ\text{C}$
Operating junction temperature	$T_{j,op}$	$-40 \dots +175$	$^\circ\text{C}$
Storage temperature	T_s	$-55 \dots +150$	$^\circ\text{C}$
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s	-	260	$^\circ\text{C}$
Mounting torque, M3 screw Maximum of mounting processes: 3	M	0.6	Nm

Thermal Resistance

Parameter	Symbol	Max. Value	Unit
IGBT thermal resistance, junction - case	$R_{\theta(j-c)}$	0.6	K/W
Diode thermal resistance, junction - case	$R_{\theta(j-c)}$	3.0	K/W
Thermal resistance, junction – ambient	$R_{\theta(j-a)}$	35.5	K/W

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Static						
Collector-Emitter breakdown voltage	$BV_{CES}^{①}$	$V_{GE}=0V, I_C=250\mu A$	650		-	V
Gate threshold voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=250\mu A$	4.2	5.0	5.8	V
Collector-Emitter Saturation voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=40A$ $T_j = 25^\circ\text{C}$ $T_j = 175^\circ\text{C}$	- -	1.8 2.3	2.4 -	V
Zero gate voltage collector current	I_{CES}	$V_{CE}=650V, V_{GE}=0V$ $T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	- -	-	250 2500	μA
Gate-emitter leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$	-	-	400	nA
Transconductance	g_{fs}	$V_{CE}=20V, I_C=40A$	-	28	-	S

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Dynamic						
Input capacitance	C_{ies}	$V_{CE} = 30V, V_{GE} = 0V,$ $f = 1MHz$	-	1980	-	pF
Output capacitance	C_{oes}		-	70	-	
Reverse transfer capacitance	C_{res}		-	37	-	
Gate charge total	Q_g	$V_{CC} = 520V, I_C = 40A,$ $V_{GE} = 15V$	-	90	-	nC
Gate to emitter charge	Q_{ge}			41		
Gate to collector charge	Q_{gc}			16		
Short circuit collector current	$I_{C(SC)}$	$V_{GE}=15V, t_{SC}\leq 5\mu s$ $V_{CC}=400V,$ $T_{j, start}=25^\circ\text{C}$	-	220	-	A

Note:

 ① BV_{CES} testing without filter could damage the device. BV_{CES} is guaranteed by $I_{CES}@650V$ test.

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Dynamic						
Turn-on Delay Time	$t_{d(on)}$	$T_j=25^{\circ}\text{C}$, $V_{CC} = 400\text{V}$, $I_C = 40\text{A}$, $V_{GE} = 0/15\text{V}$, $R_G=20\Omega$	-	53	-	ns
Rise Time	t_r		-	85	-	ns
Turn-off Delay Time	$t_{d(off)}$		-	147	-	ns
Fall Time	t_f		-	60	-	ns
Turn-on Energy	E_{on}		-	1.4	-	mJ
Turn-off Energy	E_{off}		-	0.9	-	mJ

Electrical Characteristics of the DIODE

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Dynamic						
Diode Forward Voltage	V_{FM}	$I_F = 40\text{A}$ $T_j=25^{\circ}\text{C}$ $T_j=175^{\circ}\text{C}$	-	2.3 2.1	-	V
Reverse Recovery Time	T_{rr}	$T_j=25^{\circ}\text{C}$	-	106	-	ns
Reverse Recovery Current	I_{rr}	$I_F= 40\text{A}$, $V_R = 400\text{V}$, $di/dt = 400\text{A}/\mu\text{s}$	-	9.0	-	A
Reverse Recovery Charge	Q_{rr}		-	0.5	-	μC

Fig. 1 Output characteristics

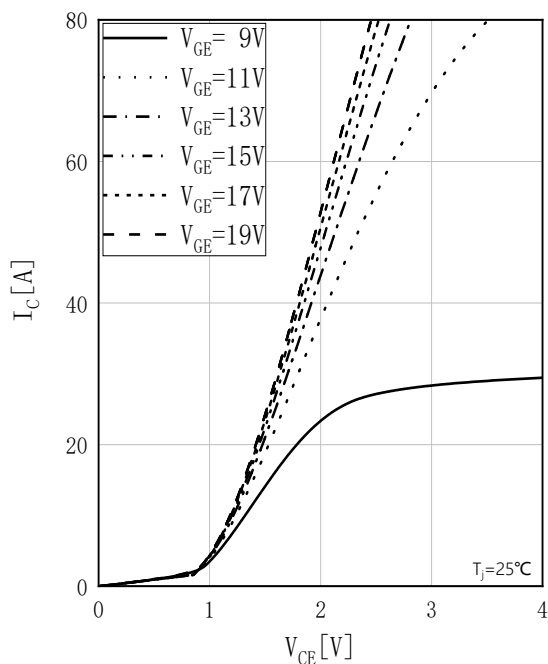


Fig. 2 Output characteristics

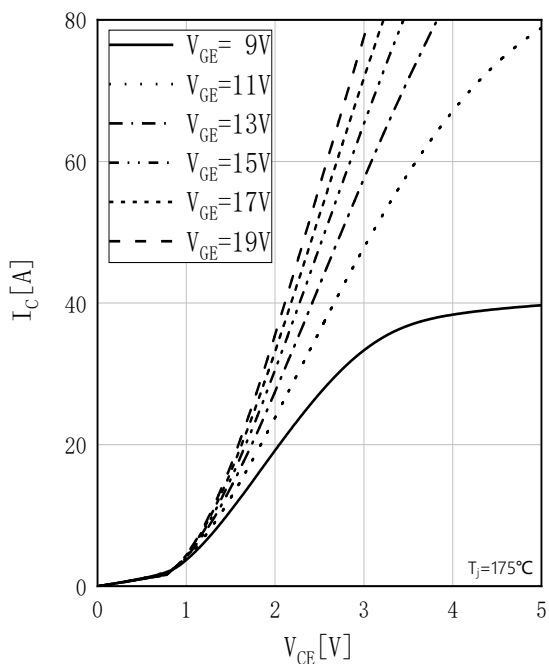


Fig. 3 Saturation voltage characteristics

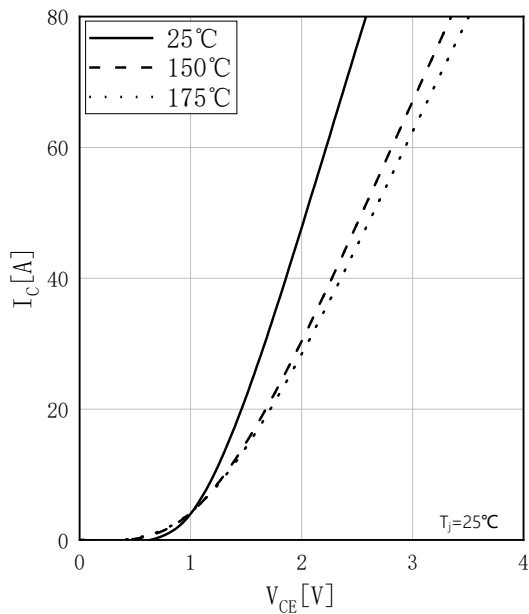


Fig. 4 Transfer characteristics

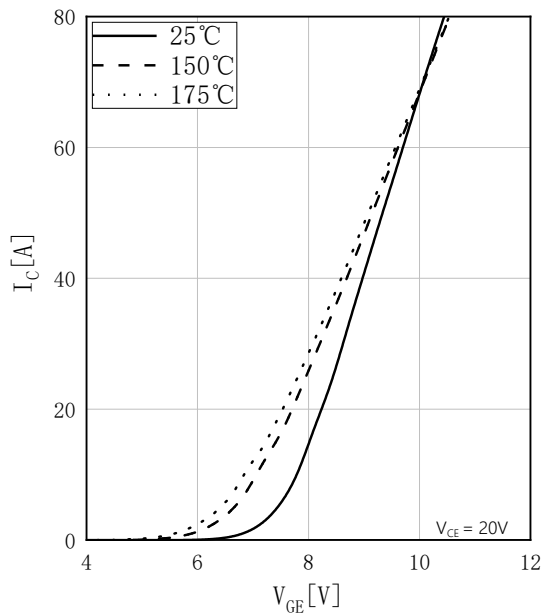


Fig. 5 Switching times vs. gate resistor

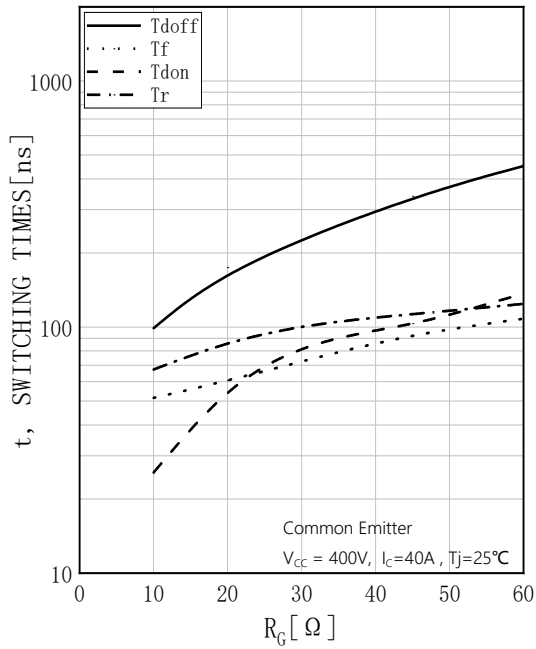


Fig. 6 Switching times vs. collector current

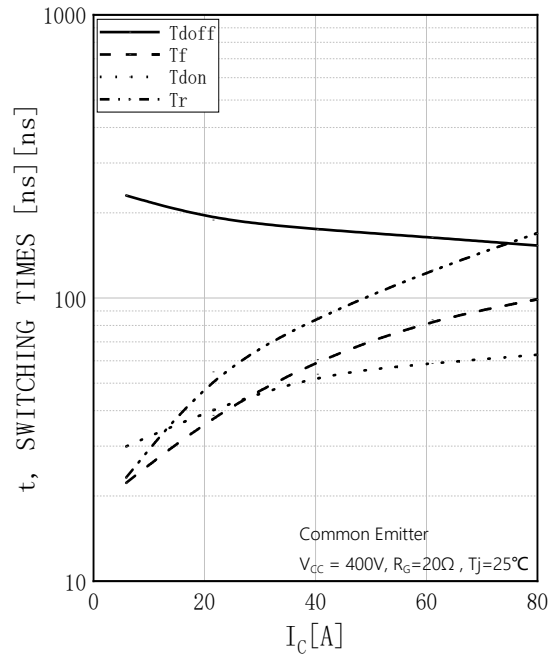


Fig. 7 Switching loss vs. gate resistor

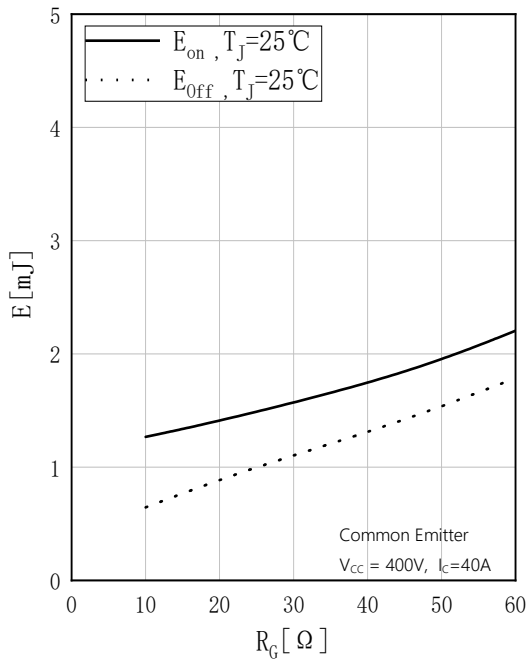


Fig. 8 Switching loss vs. collector current

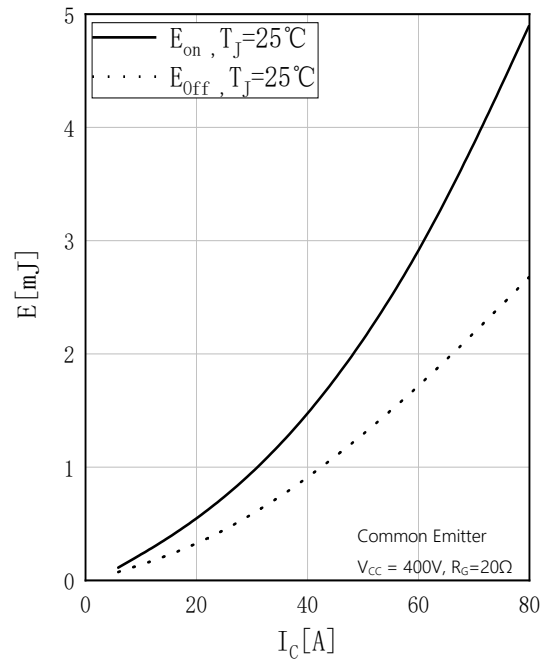


Fig.9 Capacitance characteristics

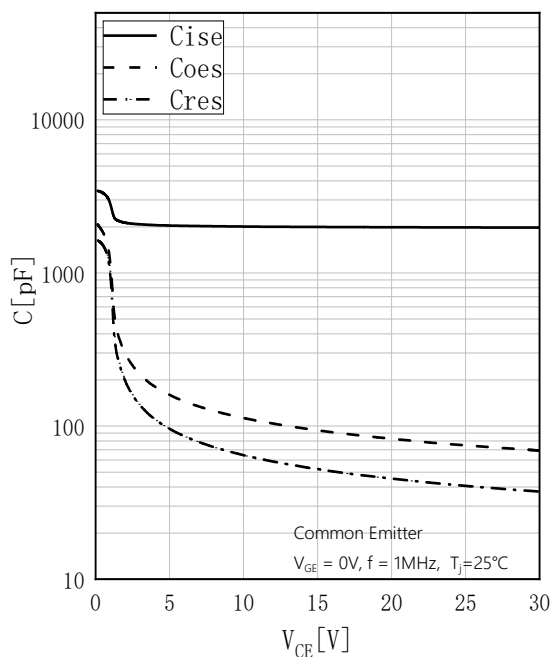


Fig. 10 Gate charge characteristics

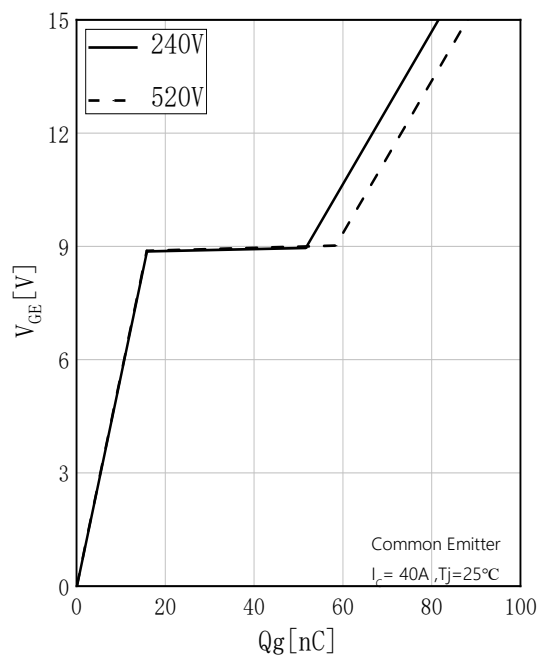


Fig.11 Diode forward current as a function of V_f

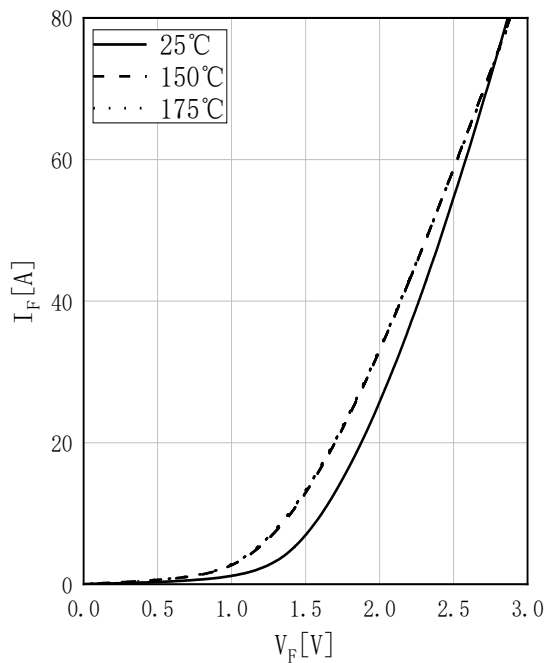


Fig. 12 Typical reverse energy loss vs. forward current

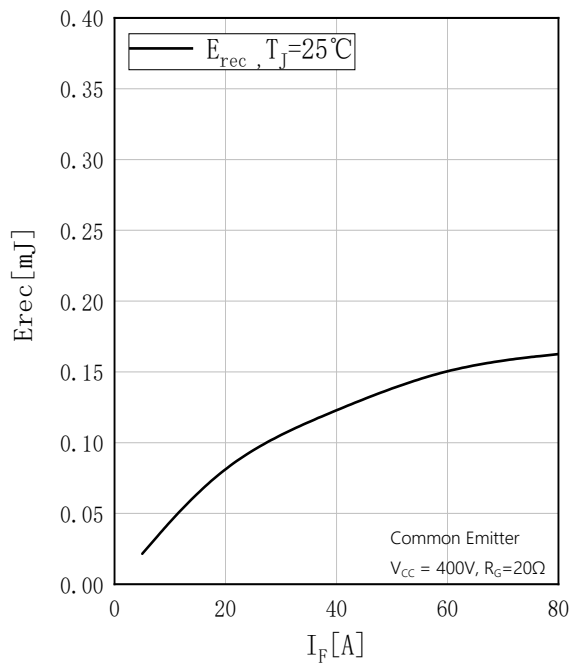
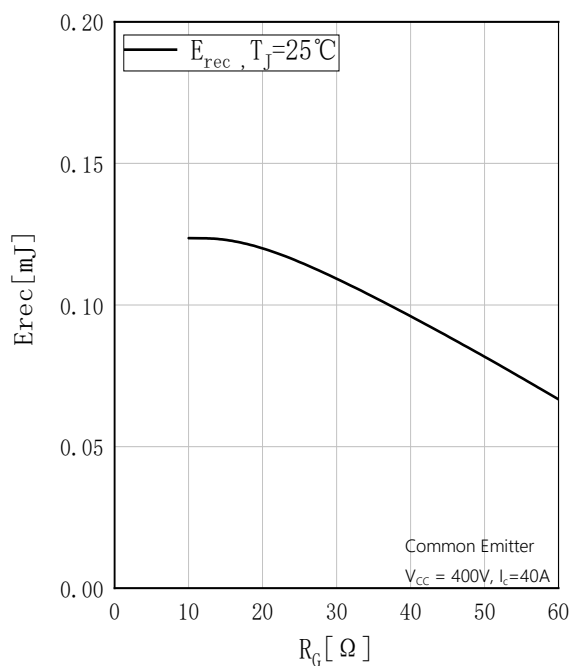
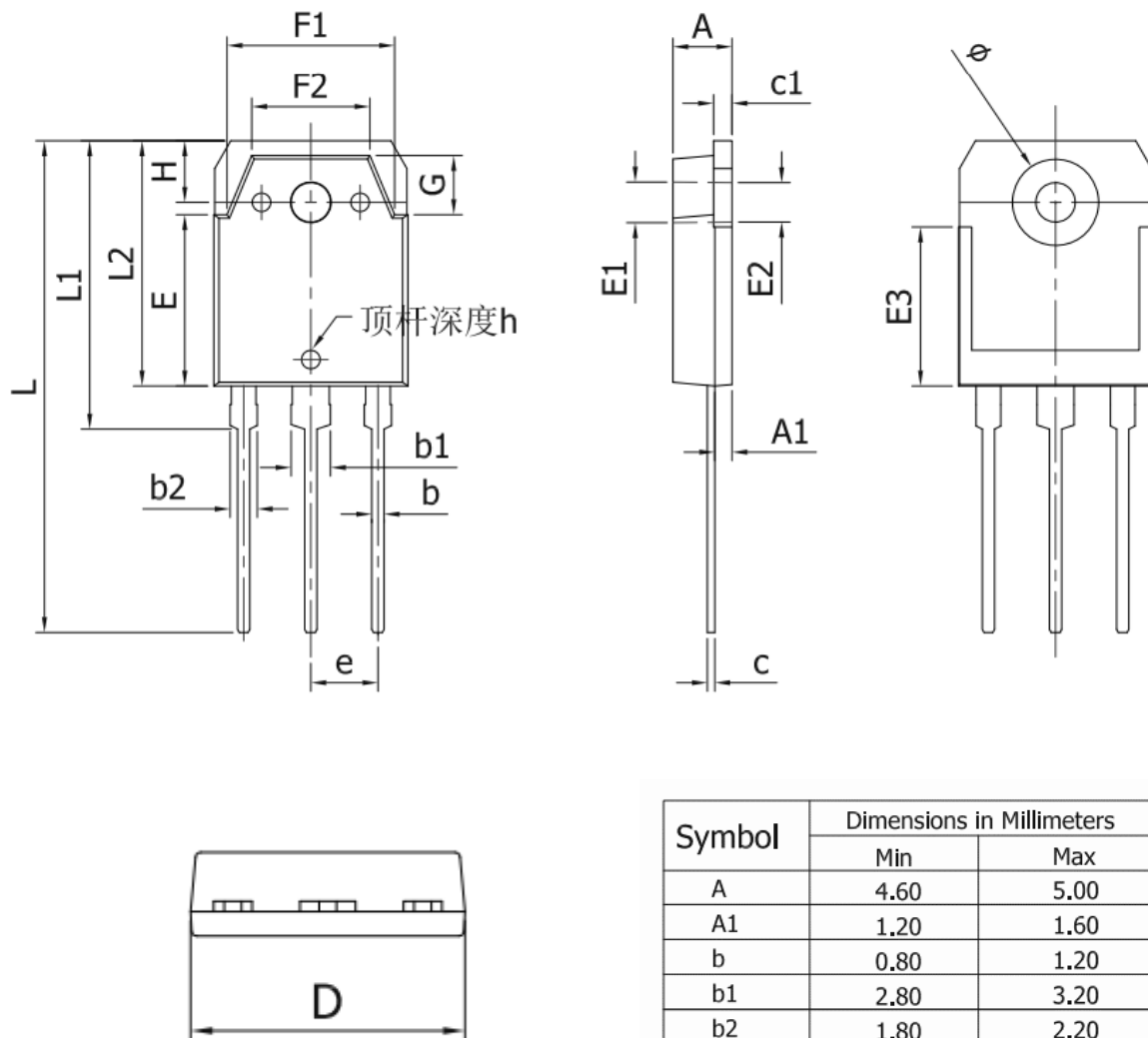


Fig. 13 Typical reverse energy loss vs. gate resistor



TO-3P package information



Symbol	Dimensions in Millimeters	
	Min	Max
A	4.60	5.00
A1	1.20	1.60
b	0.80	1.20
b1	2.80	3.20
b2	1.80	2.20
c	0.50	0.70
c1	1.45	1.65
D	15.45	15.85
E	13.70	14.10
E1	3.30REF	
E2	3.20REF	
E3	12.90REF	
F1	13.40	13.80
F2	9.40	9.80
L	39.70	40.10
L1	23.20	23.60
L2	19.70	20.10
□	6.90	7.10
G	4.60	5.00
e	5.45TYP	
H	5.00REF	
h	0.00	0.30

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