

#### Features

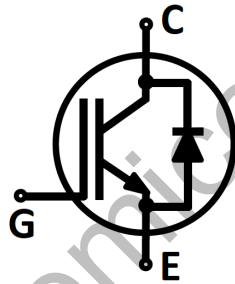
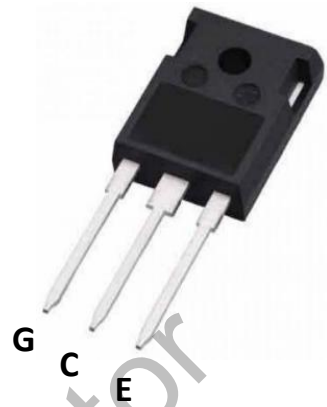
$V_{CE}=1200V$   
 $I_C=75A$   
Fast switching  
Trench FS technology

#### Potential applications

UPS  
Welding  
Induction Heating

#### Description

TO-247



## 1 Package

**Table 1 Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Storage temperature	$T_{stg}$		-55		150	°C
Soldering temperature	$T_{sold}$				260	°C
Thermal resistance, junction-ambient	$R_{th(j-a)}$				40	K/W
IGBT thermal resistance, junction-case	$R_{th(j-c)}$				0.288	K/W

## 2 IGBT

**Table 2 Maximum rated values**

Parameter	Symbol	Note or test condition	Values	Unit	
Collector-emitter voltage	$V_{CE}$	$T_{vj} \geq 25\text{ °C}$	1200	V	
DC collector current, limited by $T_{vjmax}$	$I_C$	$T_C = 100\text{ °C}$	75	A	
Pulsed collector current, $t_p$ limited by $T_{vjmax}$	$I_{Cpulse}$		300	A	
Gate-emitter voltage	$V_{GE}$		±20	V	
Power dissipation	$P_{tot}$	$T_{vj} \leq 175\text{ °C}$	$T_C = 25\text{ °C}$	520	W
			$T_C = 100\text{ °C}$	260	

**Table 3 Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CEsat}$	$I_C = 75A,$ $V_{GE} = 15 V$	$T_C = 25\text{ °C}$	1.85		V
			$T_C = 175\text{ °C}$	2.25		
Gate-emitter threshold voltage	$V_{GEth}$	$I_C = 1mA, V_{CE} = V_{GE}$		6.0		V

**Table 3 (continued) Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit	
			Min.	Typ.	Max.		
Zero gate-voltage collector current	$I_{CES}$	$V_{CE} = 1200\text{ V},$ $V_{GE} = 0\text{ V}$	$T_C = 25\text{ }^\circ\text{C}$			20	$\mu\text{A}$
			$T_C = 175\text{ }^\circ\text{C}$			5	mA
Gate-emitter leakage current	$I_{GES}$	$V_{CE} = 0\text{ V}, V_{GE} = 20\text{ V}$			200	nA	
Input capacitance	$C_{ies}$	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$		11000		pF	
Output capacitance	$C_{oes}$	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$		235		pF	
Reverse transfer capacitance	$C_{res}$	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$		52		pF	
Gate charge	$Q_G$	$I_C = 75\text{ A}, V_{GE} = 15\text{ V}, V_{CC} = 960\text{ V}$		505		nC	
Turn-on delay time (inductive load)	$t_{d(on)}$	$V_{CC} = 600\text{ V},$ $V_{GE} = 0/15\text{ V},$ $R_{G(on)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ }^\circ\text{C},$ $I_C = 75\text{ A}$		50		ns
			$T_{vj} = 175\text{ }^\circ\text{C},$ $I_C = 75\text{ A}$		52		
Rise time (inductive load)	$t_r$	$V_{CC} = 600\text{ V},$ $V_{GE} = 0/15\text{ V},$ $R_{G(on)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ }^\circ\text{C},$ $I_C = 75\text{ A}$		62		ns
			$T_{vj} = 175\text{ }^\circ\text{C},$ $I_C = 75\text{ A}$		65		
Turn-off delay time (inductive load)	$t_{d(off)}$	$V_{CC} = 600\text{ V},$ $V_{GE} = 0/15\text{ V},$ $R_{G(off)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ }^\circ\text{C},$ $I_C = 75\text{ A}$		452		ns
			$T_{vj} = 175\text{ }^\circ\text{C},$ $I_C = 75\text{ A}$		520		
Fall time (inductive load)	$t_f$	$V_{CC} = 600\text{ V},$ $V_{GE} = 0/15\text{ V},$ $R_{G(off)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ }^\circ\text{C},$ $I_C = 75\text{ A}$		45		ns
			$T_{vj} = 175\text{ }^\circ\text{C},$ $I_C = 75\text{ A}$		78		
Turn-on energy (inductive load)	$E_{on}$	$V_{CC} = 600\text{ V},$ $V_{GE} = 0/15\text{ V},$ $R_{G(on)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ }^\circ\text{C},$ $I_C = 75\text{ A}$		5.2		mJ
			$T_{vj} = 175\text{ }^\circ\text{C},$ $I_C = 75\text{ A}$		8.0		
Turn-off energy (inductive load)	$E_{off}$	$V_{CC} = 600\text{ V},$ $V_{GE} = 0/15\text{ V},$ $R_{G(off)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ }^\circ\text{C},$ $I_C = 75\text{ A}$		1.8		mJ
			$T_{vj} = 175\text{ }^\circ\text{C},$ $I_C = 75\text{ A}$		3.9		

**Table 3 (continued) Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Total switching energy (inductive load)	$E_{ts}$	$V_{CC} = 600\text{ V}$ , $V_{GE} = 0/15\text{ V}$ , $R_{G(on)} = 10\ \Omega$ , $R_{G(off)} = 10\ \Omega$	$T_{vj} = 25\ ^\circ\text{C}$ , $I_C = 75\text{ A}$		7.0	mJ
			$T_{vj} = 175\ ^\circ\text{C}$ , $I_C = 75\text{ A}$		11.9	
Operating junction temperature	$T_{vj}$		-40		175	$^\circ\text{C}$

Note: Electrical Characteristic, at  $T_{vj} = 25^\circ\text{C}$ , unless otherwise specified.

### 3 Diode

**Table 4 Maximum rated values**

Parameter	Symbol	Note or test condition	Values	Unit	
Repetitive peak reverse voltage	$V_{RRM}$	$T_{vj} \geq 25\ ^\circ\text{C}$	1200	V	
Diode forward current, limited by $T_{vjmax}$	$I_F$	$T_C = 100\ ^\circ\text{C}$	75	A	
Power dissipation	$P_{tot}$	$T_{vj} \leq 175\ ^\circ\text{C}$	$T_C = 25\ ^\circ\text{C}$	385	W
			$T_C = 100\ ^\circ\text{C}$	192	

**Table 5 Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Diode forward voltage	$V_F$	$I_F = 75\text{ A}$	$T_C = 25\ ^\circ\text{C}$		2.1	V
			$T_C = 175\ ^\circ\text{C}$		1.9	
Diode reverse recovery time	$t_{rr}$	$V_R = 600\text{ V}$ , $R_{G(on)} = 10\ \Omega$	$T_C = 25\ ^\circ\text{C}$		120	ns
			$T_C = 175\ ^\circ\text{C}$		230	
Diode reverse recovery charge	$Q_{rr}$	$V_R = 600\text{ V}$ , $R_{G(on)} = 10\ \Omega$	$T_C = 25\ ^\circ\text{C}$		2.5	$\mu\text{C}$
			$T_C = 175\ ^\circ\text{C}$		6.5	
Diode peak reverse recovery current	$I_{rrm}$	$V_R = 600\text{ V}$ , $R_{G(on)} = 10\ \Omega$	$T_C = 25\ ^\circ\text{C}$		30	A
			$T_C = 175\ ^\circ\text{C}$		52	
Operating junction temperature	$T_{vj}$		-40		175	$^\circ\text{C}$

Figure 1. Reverse bias safe operating area

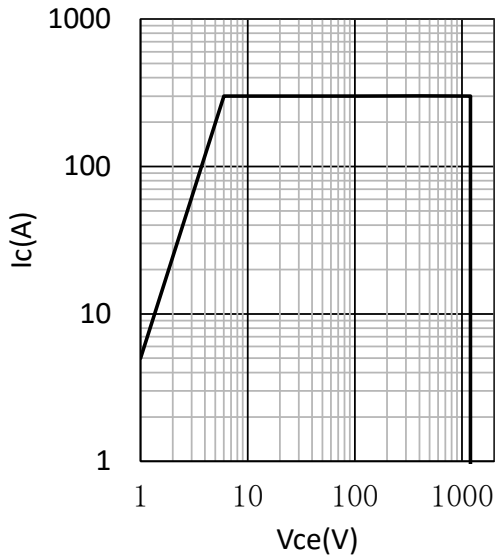


Figure 2. Maximum power dissipation as a function of case temperature ( $T_{vj} \leq 175^\circ\text{C}$ )

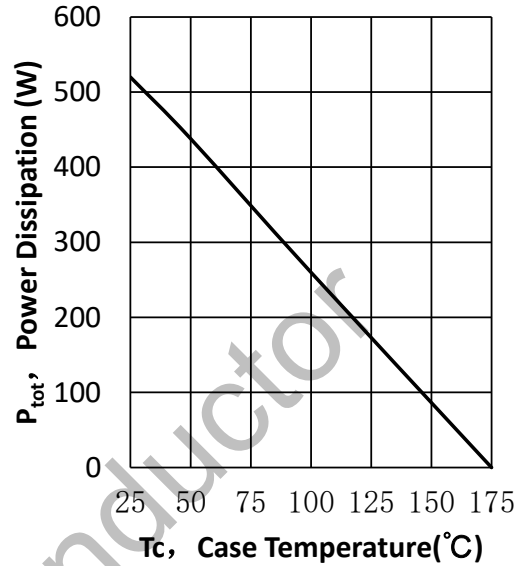


Figure 3. Typical output characteristic ( $V_{GE}=15\text{V}$ ,  $T_{vj}=25^\circ\text{C}$ )

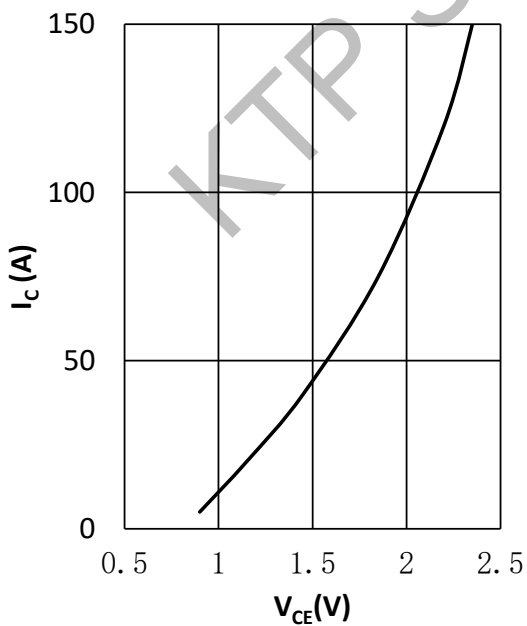


Figure 4. Typical output characteristic ( $V_{GE}=15\text{V}$ ,  $T_{vj}=175^\circ\text{C}$ )

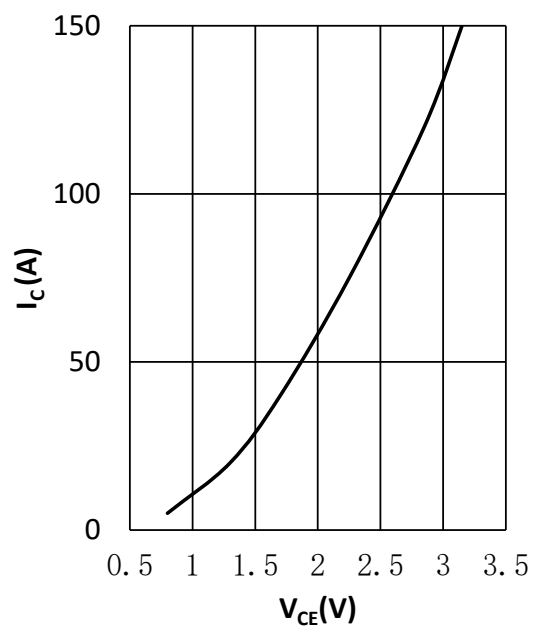


Figure 5. Typical  $V_{CE(sat)}-T_{Vj}$  characteristic ( $V_{GE}=15V$ )

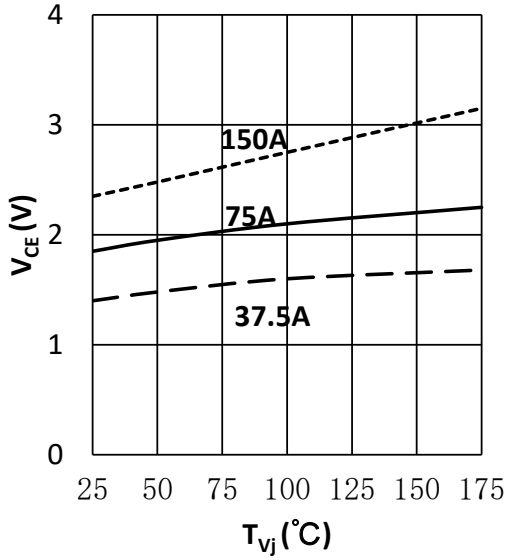


Figure 6. Typical  $V_{GE(th)}-T_{Vj}$  characteristic ( $I_C=1mA$ )

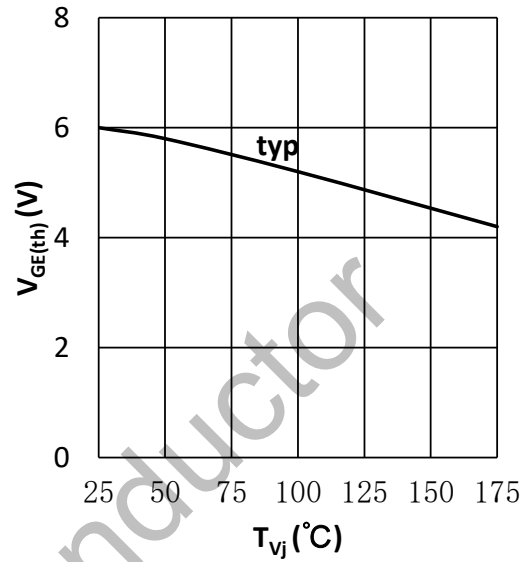


Figure 7. Typical gate charge  $V_{GE} = f(Q_G)$  ( $I_C=75A$ )

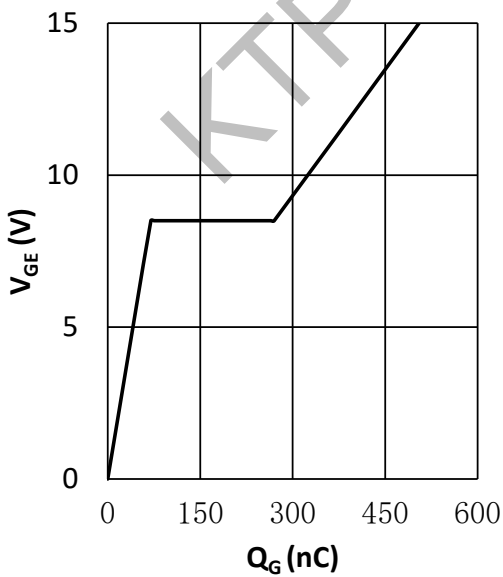


Figure 8. Typical capacitance as a function of collector-emitter voltage ( $V_{GE}=0V$ ,  $f=100$  kHz)

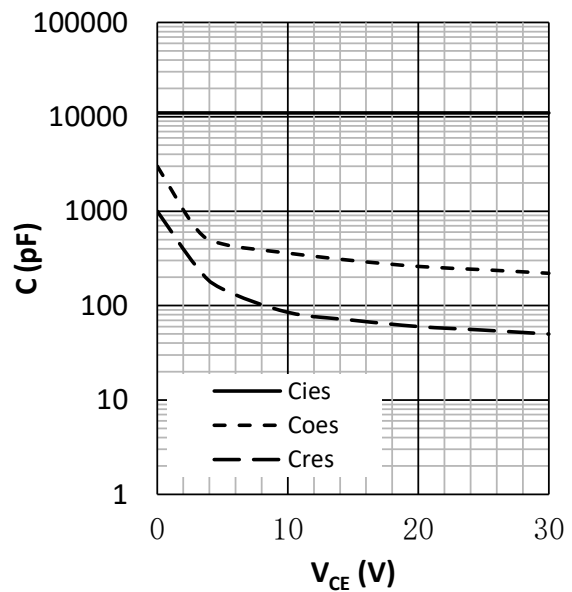


Figure 9. Typical switching energy losses as a function of junction temperature

$$E=f(T_{vj}), V_{CC}=600V, I_C=75A$$

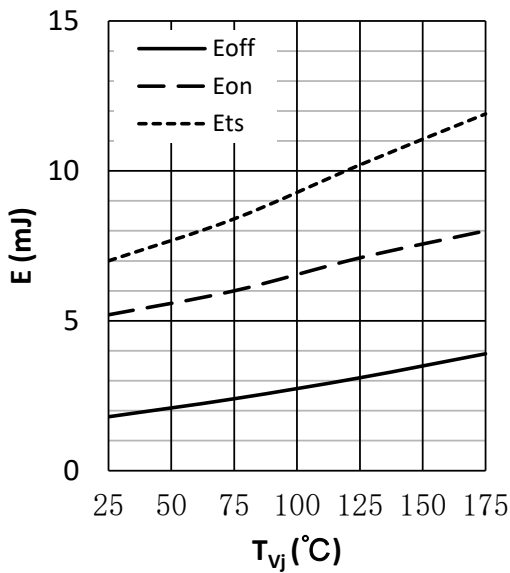


Figure 10. Typical switching energy losses as a function of collector current

$$E=f(I_C), T_{vj}=25^{\circ}C$$

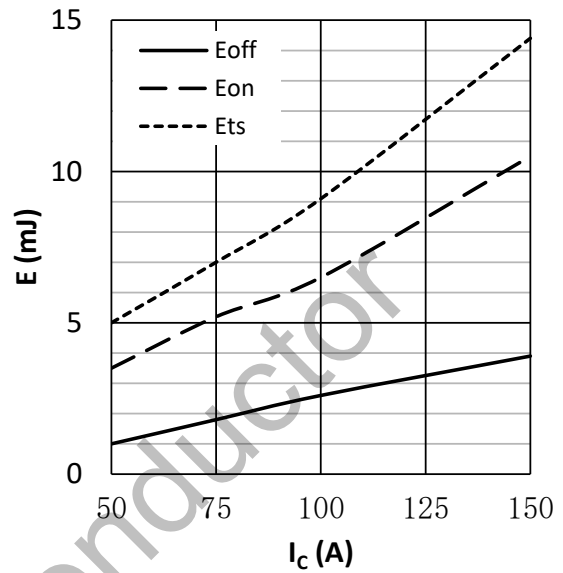


Figure 11. Typical diode forward voltage as a function of junction temperature

$$V_F=f(T_{vj})$$

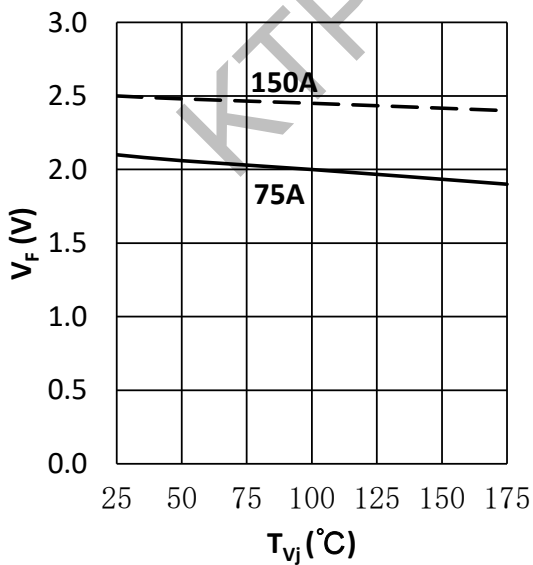
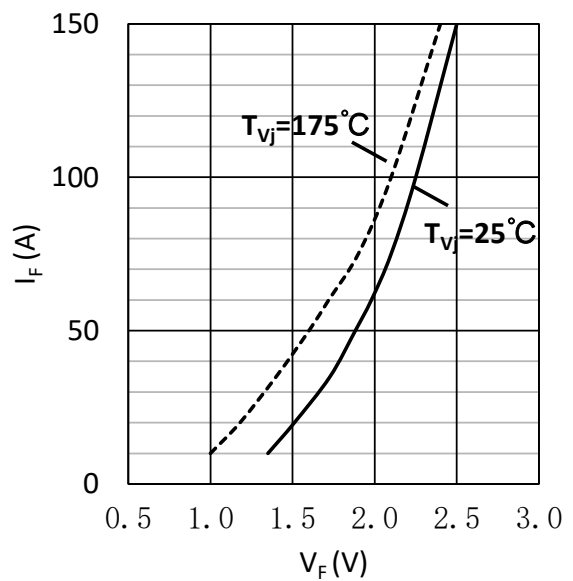
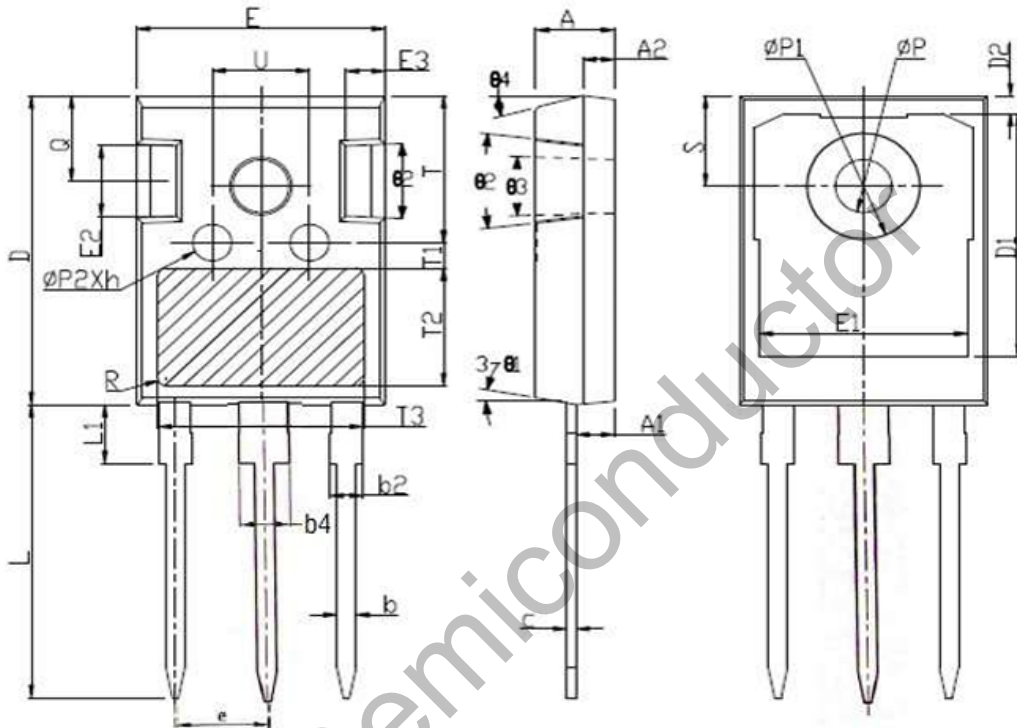


Figure 12. Forward characteristic of Diode



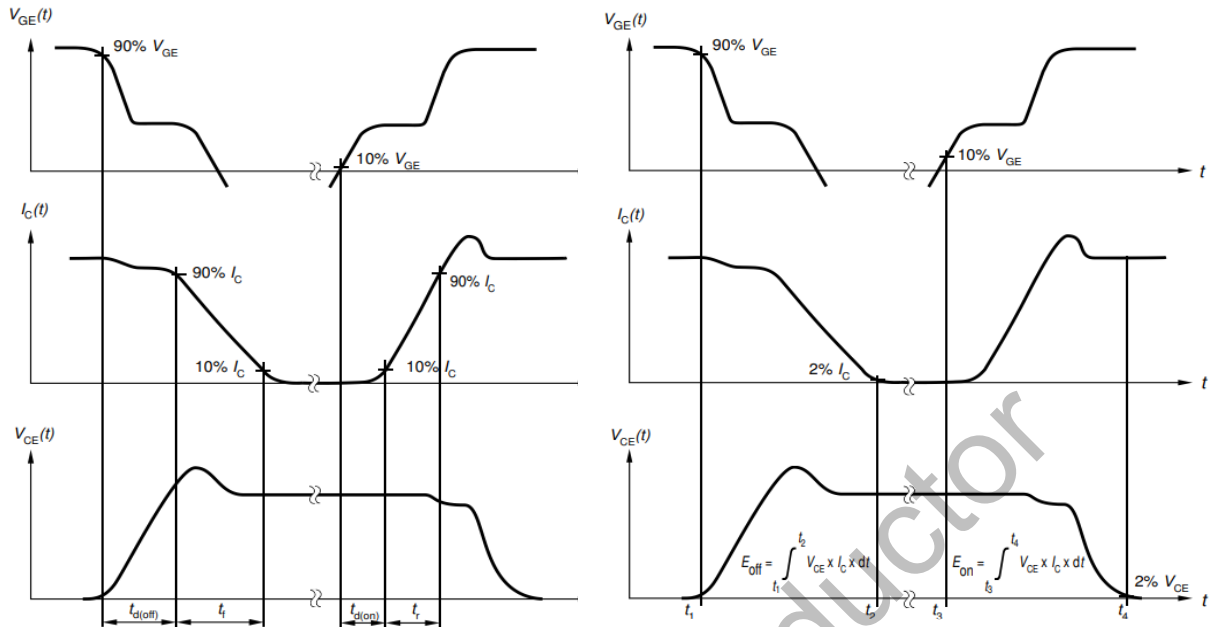
#### 4 Package outlines

#### TO-247-3L



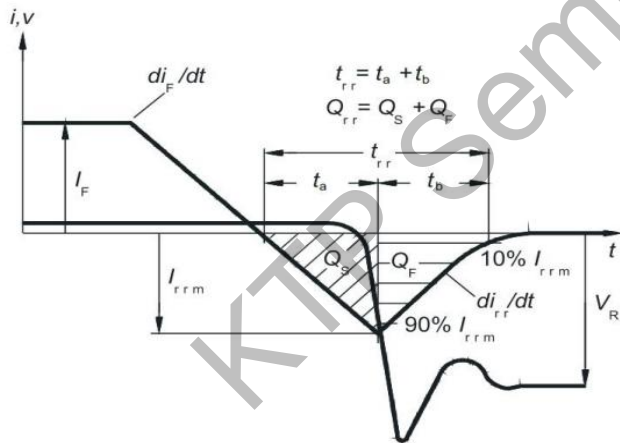
Symbol	Min	Nom	Max	Symbol	Min	Nom	Max
A	4.9	5.0	5.1	e	5.44BSC		
A1	2.3	2.4	2.5	h	0.05	0.10	0.15
A2	1.9	2.0	2.1	L	19.6	19.9	20.2
b	1.10	1.20	1.25	L1			4.3
b2	1.90	2.00	2.25	$\phi p$	3.5	3.6	3.75
b4	2.90	3.00	3.25	$\phi p1$			7.3
c	0.50	0.60	0.70	$\phi p2$	2.4	2.5	2.6
D	20.8	21.0	21.2	Q	5.3		5.9
D1	16.25	16.55	16.85	S	6.15BSC		
D2	1.05	1.20	1.35	T	9.8		10.2
E	15.6	15.8	16.0	T1	1.65REF		
E1	13.1	13.3	13.5	T2	8.0REF		
E2	4.9	5.0	5.1	T3	12.8REF		
E3	2.4	2.5	2.6	U	6.0		6.4

Unit: mm



#### A. Definition of switching times

#### B. Definition of switching losses



#### C. Definition of diode switching characteristics