

### Product Summary

$V_{(BR)CES}$	$V_{CE(SAT)MAX}$	$I_C(100^{\circ}C)$
1200V	2.05V@15V	140A

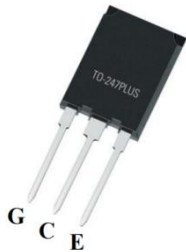
### Feature

- High breakdown voltage to improved reliability
- Positive temperature coefficient
- Including fast & soft recovery anti-parallel FWD

### Application

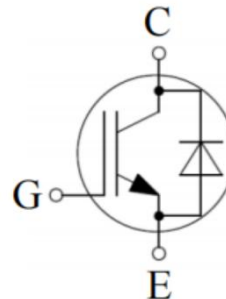
- Energy storage inverter
- Uninterruptible power supply
- Solar inverter

### Package



TO-247PLUS

### Circuit diagram



### Marking



### Absolute maximum ratings (Tc=25°C unless otherwise noted)

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V <sub>CES</sub>	1200	V
Continuous Gate- Emitter Voltage	V <sub>GES</sub>	±20	V
Transient Gate- Emitter Voltage (tp ≤ 10us, D < 0.010)	V <sub>GES</sub>	±30	V
Collector Current	I <sub>C</sub>	180	A
Collector Current(T <sub>C</sub> = 100°C)	I <sub>C</sub> (100°C)	140	A
Pulsed Collector Current, tp limited by T <sub>jmax</sub> , V <sub>GE</sub> =15V	I <sub>CM</sub>	280	A
Diode Continuous Forward Current	I <sub>F</sub>	180	A
Diode Continuous Forward Current(T <sub>C</sub> = 100°C)	I <sub>F</sub> (100°C)	140	A
Diode Forward Current, tp limited by T <sub>jmax</sub>	I <sub>Fpuls</sub>	280	A
Turn off Safe Operating Area V <sub>CE</sub> ≤ 1200V, T <sub>J</sub> ≤ 150°C	-	280	A
Power Dissipation(T <sub>J</sub> =175°C)	P <sub>D</sub>	937	W
Thermal Resistance, Junction to case for Diode	R <sub>θJC</sub>	0.26	°C/W
Thermal Resistance, Junction to case for IGBT	R <sub>θJC</sub>	0.16	°C/W
Soldering Temperature, wave soldering 1.6mm(0.063in.) from case for 10s	T <sub>L</sub>	260	°C
Junction Temperature	T <sub>J</sub>	-40 ~ +175	°C
Storage Temperature Range	T <sub>STG</sub>	-55 ~ +150	°C

### Electrical characteristics of the IGBT (T<sub>J</sub>=25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit	
<b>Static Characteristics</b>							
Collector-Emitter Breakdown Voltage	V <sub>(BR)CES</sub>	V <sub>GE</sub> = 0V, I <sub>C</sub> =250uA	1200			V	
Collector-Emitter Leakage Current	I <sub>CES</sub>	V <sub>GE</sub> = 0V, V <sub>CE</sub> =1200V			0.25	mA	
		V <sub>GE</sub> = 0V, V <sub>CE</sub> =1200V, T <sub>J</sub> =150°C			5		
Gate to Emitter Leakage Current	I <sub>GES</sub>	V <sub>GE</sub> = ±20V, V <sub>CE</sub> = 0V			100	nA	
Collector-Emitter Saturation Voltage	V <sub>CE(sat)</sub>	V <sub>GE</sub> =15V, I <sub>C</sub> =140A,		1.75	2.05	V	
		V <sub>GE</sub> =15V, I <sub>C</sub> =140A, T <sub>J</sub> =125°C		2.20			
		V <sub>GE</sub> =15V, I <sub>C</sub> =140A, T <sub>J</sub> =150°C		2.30			
Gate Threshold Voltage	V <sub>GE(th)</sub>	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> =1mA	5.4	5.9	6.4	V	
<b>Dynamic characteristics</b>							
Input Capacitance	C <sub>ies</sub>	V <sub>CE</sub> =25V, V <sub>GE</sub> =0V, f = 1MHz		11.8		nF	
Reverse Transfer Capacitance	C <sub>res</sub>			0.13			
Total Gate Charge	Q <sub>g</sub>	V <sub>CC</sub> =600V, V <sub>GE</sub> = 15V, I <sub>C</sub> =140A		0.75		uC	
Turn-on delay time	t <sub>d(on)</sub>	V <sub>CC</sub> =600V, V <sub>GE</sub> =-5V~15V, I <sub>C</sub> = 140A, R <sub>G</sub> =5.1Ω		66		nS	
Turn-on rise time	t <sub>r</sub>			132			
Turn-off delay time	t <sub>d(off)</sub>			167			
Turn-off fall time	t <sub>f</sub>			58			
Turn-on Switching Energy	E <sub>on</sub>			13.3			mJ
Turn-off Switching Energy	E <sub>off</sub>			4.9			
Turn-on delay time	t <sub>d(on)</sub>	V <sub>CC</sub> =600V, V <sub>GE</sub> =-5V~15V, I <sub>C</sub> = 140A, R <sub>G</sub> =5.1Ω, T <sub>J</sub> =125°C		64		nS	
Turn-on rise time	t <sub>r</sub>			124			
Turn-off delay time	t <sub>d(off)</sub>			173			
Turn-off fall time	t <sub>f</sub>			83			
Turn-on Switching Energy	E <sub>on</sub>			13.5			mJ
Turn-off Switching Energy	E <sub>off</sub>			5.7			
Turn-on delay time	t <sub>d(on)</sub>	V <sub>CC</sub> =600V, V <sub>GE</sub> =-5V~15V, I <sub>C</sub> = 140A, R <sub>G</sub> =5.1Ω, T <sub>J</sub> =150°C		63		nS	
Turn-on rise time	t <sub>r</sub>			120			
Turn-off delay time	t <sub>d(off)</sub>			180			
Turn-off fall time	t <sub>f</sub>			96			
Turn-on Switching Energy	E <sub>on</sub>			13.6			mJ
Turn-off Switching Energy	E <sub>off</sub>			6.1			

### Electrical characteristics of the Diode ( $T_j=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Diode Forward Voltage	$V_F$	$I_F=140\text{A}$		2.10	2.50	V
		$I_F=140\text{A}, T_j=125^\circ\text{C}$		2.25		
		$I_F=140\text{A}, T_j=150^\circ\text{C}$		2.30		
Reverse Recovery Current	$I_{rr}$	$I_F=140\text{A}, V_R=600\text{V},$ $-di/dt=850\text{A}/\mu\text{s}$		48		A
Reverse Recovery Charge	$Q_{rr}$			5.9		$\mu\text{C}$
Diode Reverse Recovery Time	$t_{rr}$			288		nS
Reverse Recovery Energy	$E_{rec}$			2.3		mJ
Reverse Recovery Current	$I_{rr}$	$I_F=140\text{A}, V_R=600\text{V},$ $-di/dt=850\text{A}/\mu\text{s}, T_j=125^\circ\text{C}$		61		A
Reverse Recovery Charge	$Q_{rr}$			10.7		$\mu\text{C}$
Diode Reverse Recovery Time	$t_{rr}$			371		nS
Reverse Recovery Energy	$E_{rec}$			4.4		mJ
Reverse Recovery Current	$I_{rr}$	$I_F=140\text{A}, V_R=600\text{V},$ $-di/dt=850\text{A}/\mu\text{s}, T_j=150^\circ\text{C}$		67		A
Reverse Recovery Charge	$Q_{rr}$			13.1		$\mu\text{C}$
Diode Reverse Recovery Time	$t_{rr}$			413		nS
Reverse Recovery Energy	$E_{rec}$			5.5		mJ

### Typical Characteristics

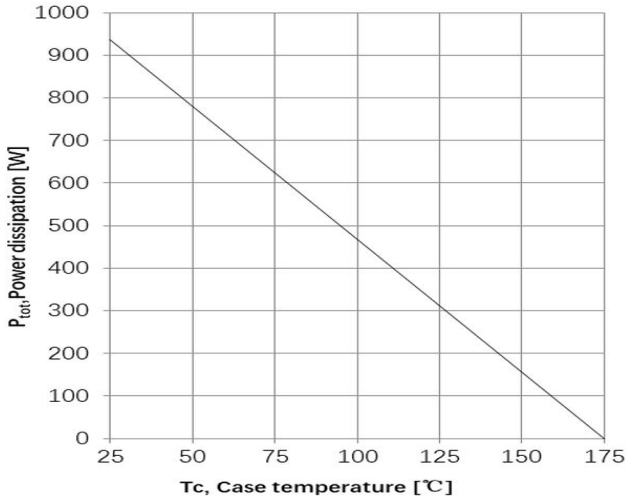


Fig1. Power dissipation as a function of case

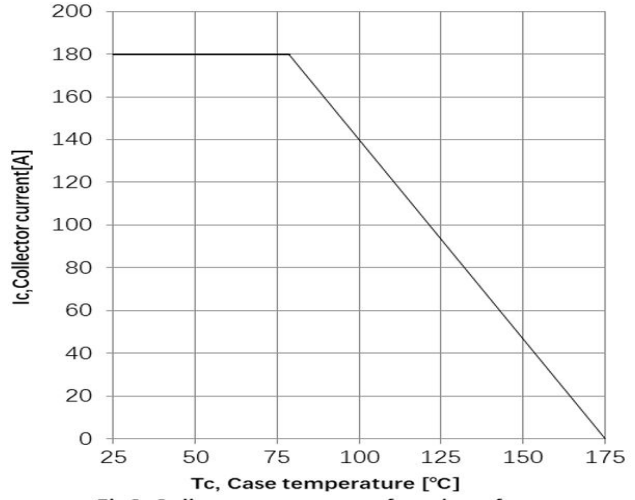


Fig2. Collector current as a function of case

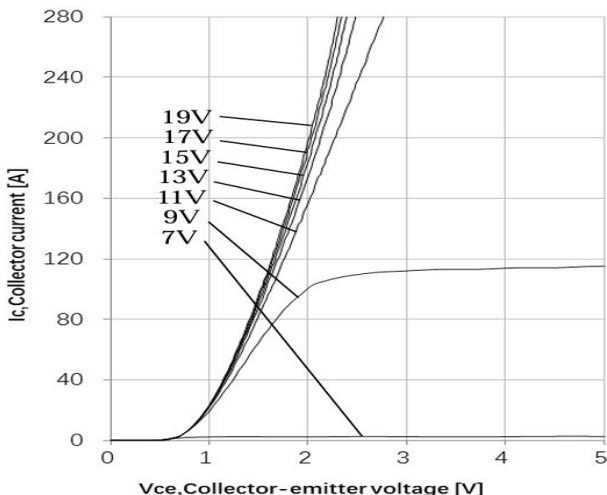


Fig3. Typical output characteristic (Tj=25°C)

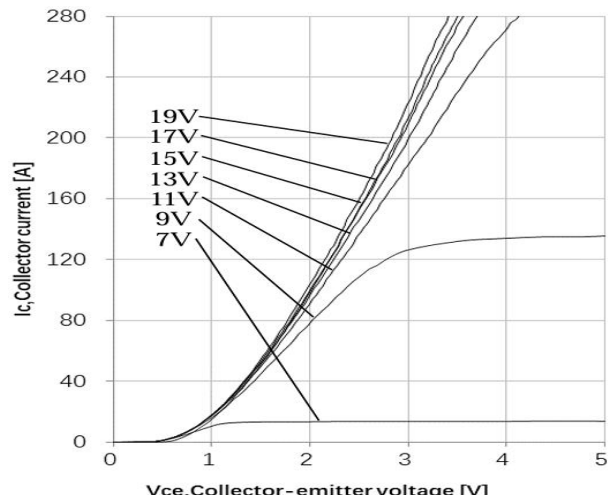


Fig4. Typical output characteristic (Tj=150°C)

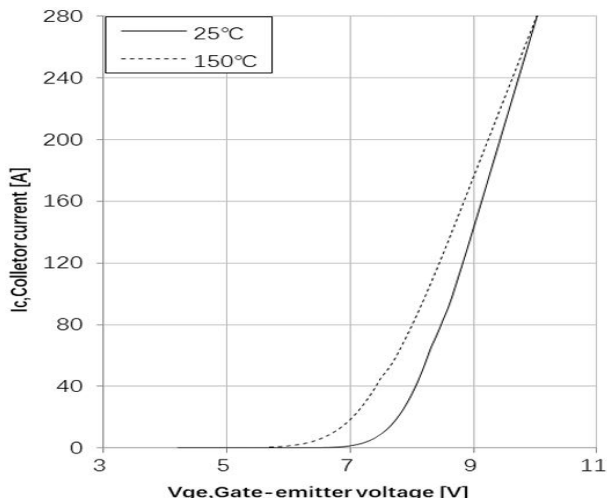


Fig5. Typical transfer characteristic (Vce=20V)

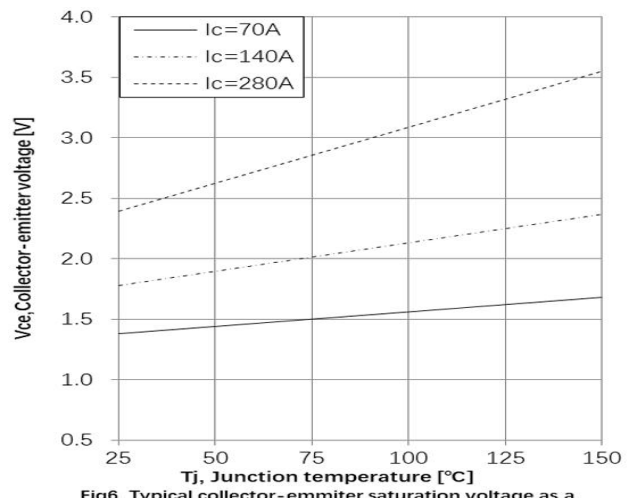


Fig6. Typical collector-emitter saturation voltage as a function of junction temperature (Vge=15V)

### Typical Characteristics

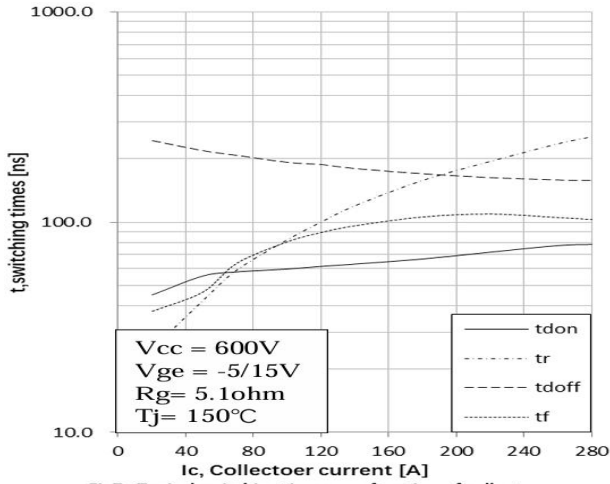


Fig7. Typical switching times as a function of collector current

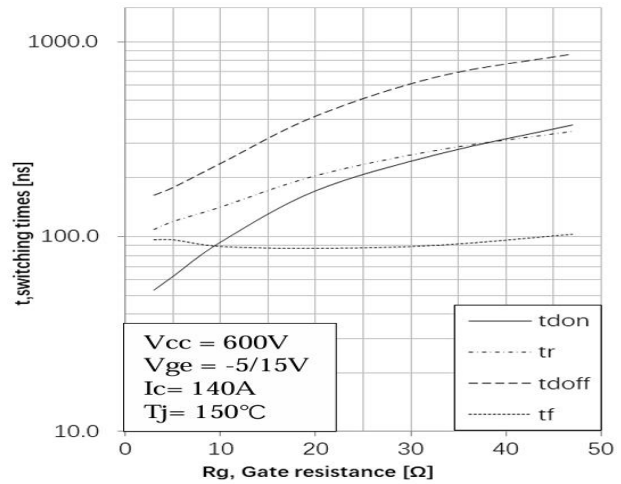


Fig8. Typical switching times as a function of gate resistance

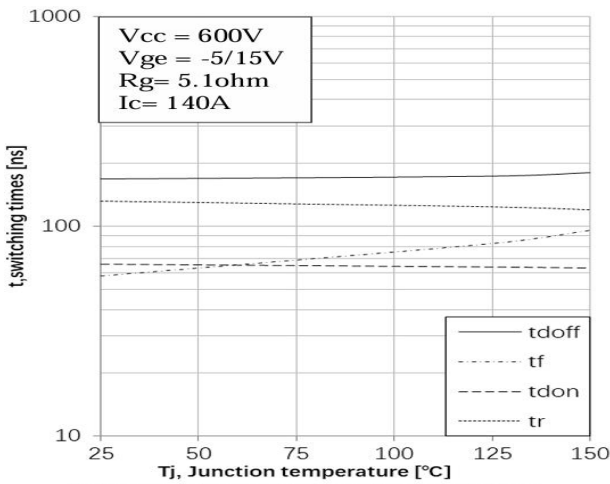


Fig9. Typical switching times as a function of junction temperature

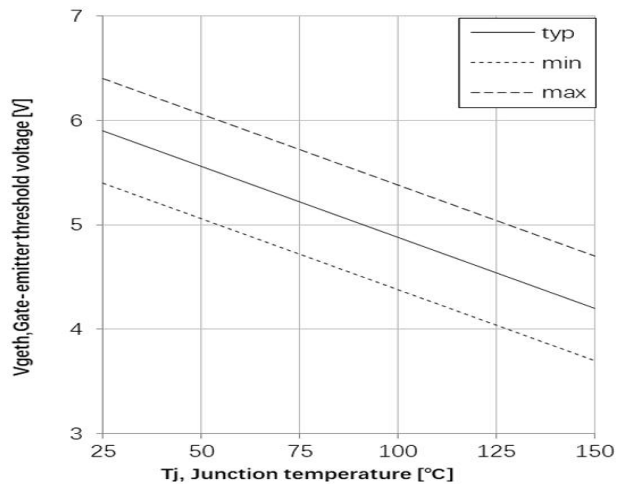


Fig10. Gate-emitter threshold voltage as a function of junction temperature ( $I_c = 1mA$ )

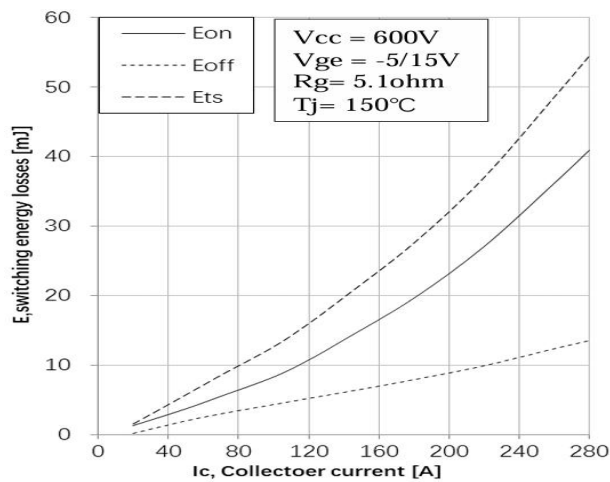


Fig11. Typical switching energy losses as a function of collector current

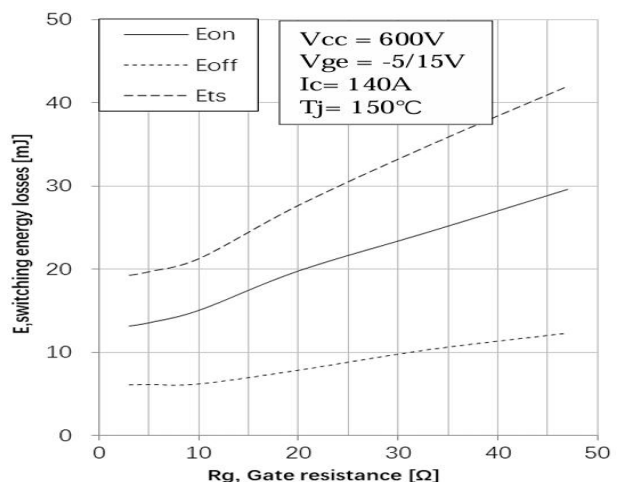
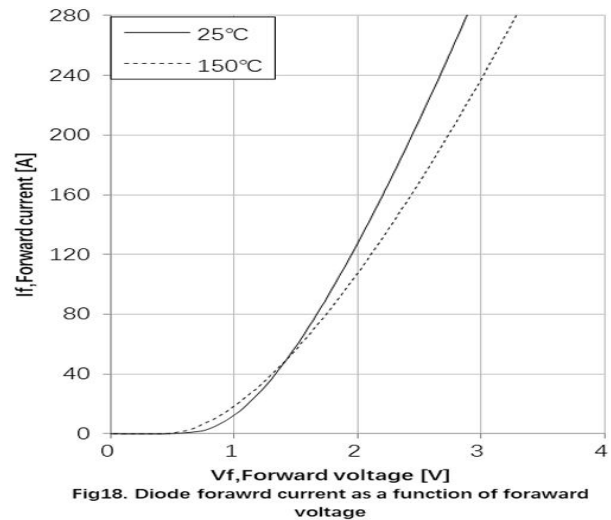
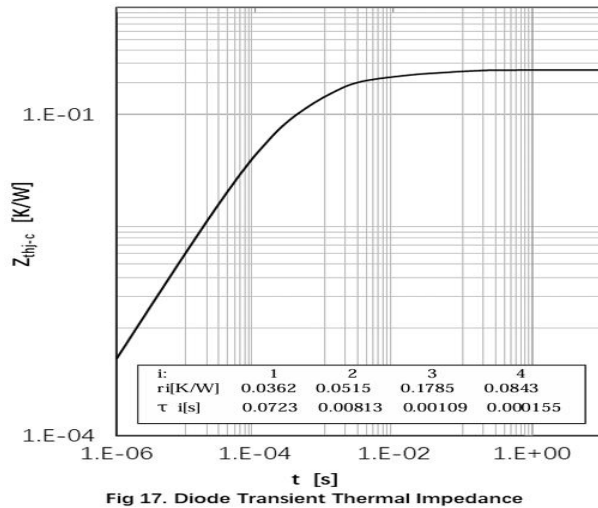
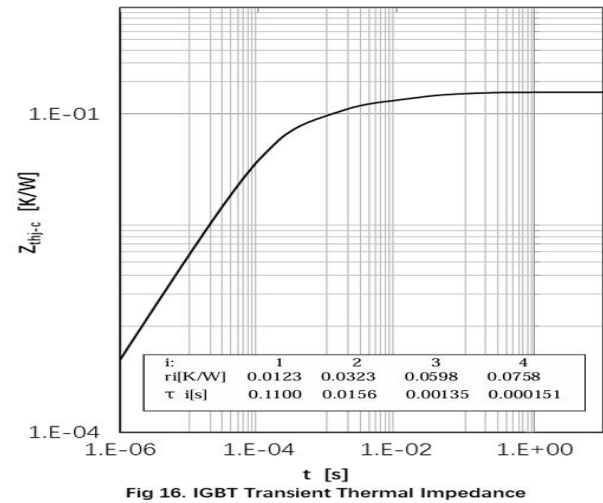
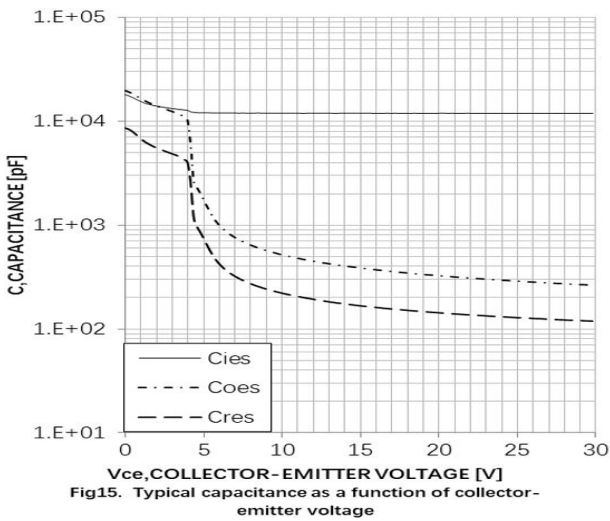
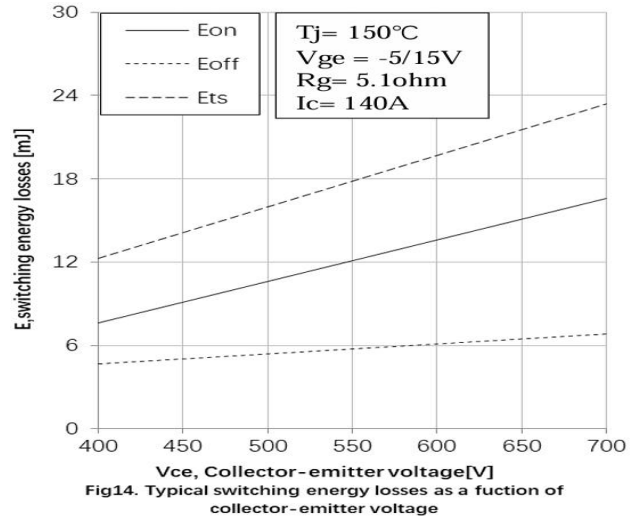
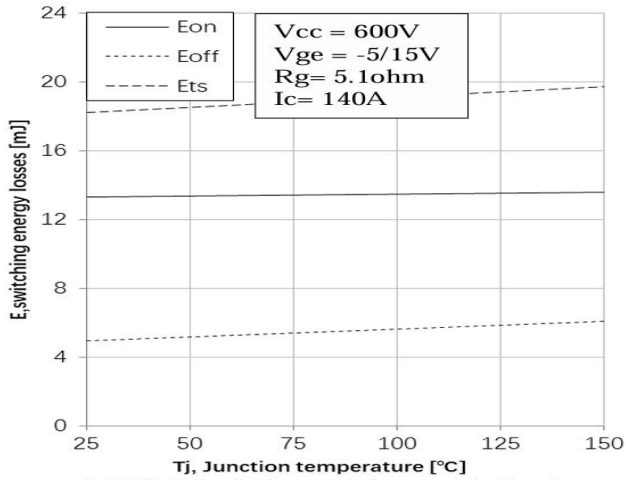


Fig12. Typical switching energy losses as a function of gate resistance

### Typical Characteristics



## Typical Characteristics

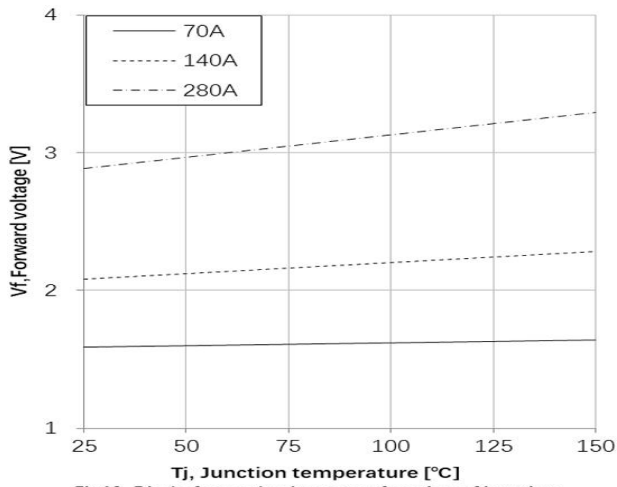
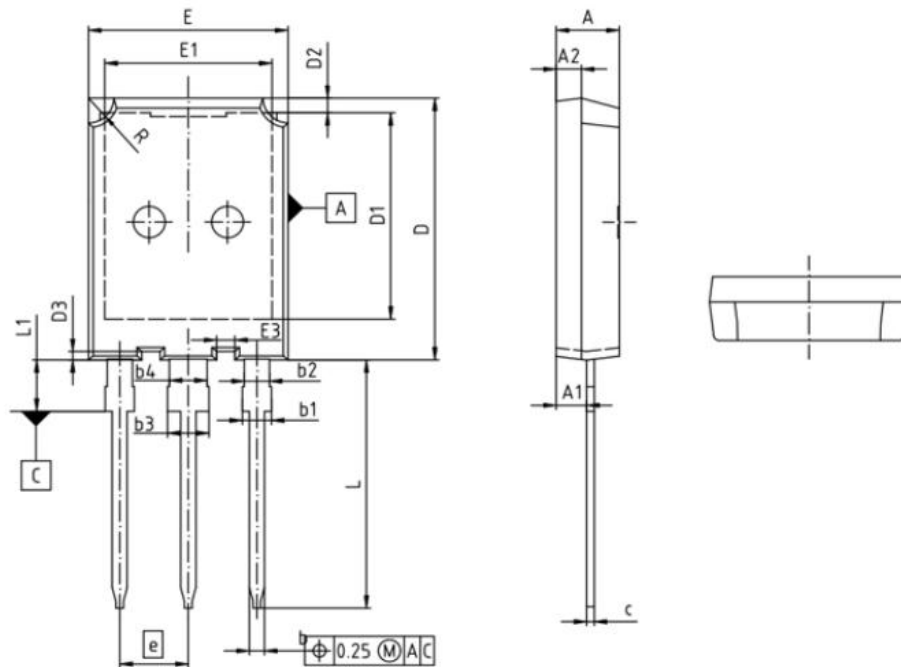


Fig19. Diode forward voltage as a function of junction temperature

### TO-247PLUS Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.900	5.100	0.193	0.201
A1	2.310	2.510	0.091	0.099
A2	1.900	2.100	0.075	0.083
b	1.160	1.260	0.046	0.050
b1	1.860	2.160	0.073	0.085
b2	1.960	2.060	0.077	0.081
c	0.580	0.640	0.023	0.025
D	20.900	21.100	0.823	0.831
D1	16.250	16.850	0.640	0.663
D2	1.050	1.350	0.041	0.053
D3	0.580	0.780	0.023	0.031
E	15.700	15.900	0.618	0.626
E1	13.100	13.500	0.516	0.531
E3	1.350	1.550	0.053	0.061
e	5.440 (BSC)		0.214 (BSC)	
L	19.780	20.080	0.779	0.791
L1	4.030	4.230	0.159	0.167
R	1.900	2.100	0.075	0.083