

Product Summary

$V_{(BR)CES}$	$V_{CE(SAT)TYP}$	$I_C(100^{\circ}C)$
650V	1.55V@15V	160A

Feature

- High speed smooth switching device for hard & soft switching
- Maximum junction temperature 175°C
- Positive temperature coefficient
- High ruggedness, temperature stable

Application

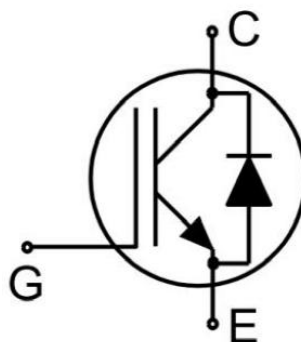
- Energy storage inverter
- Uninterruptible power supplies
- Solar inverters

Package

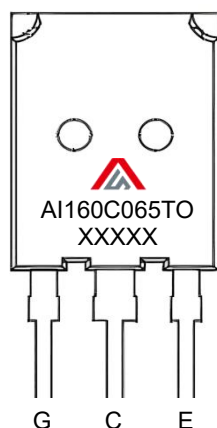


TO-247 PLUS

Circuit diagram



Marking



Absolute maximum ratings ($T_C=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CES}	650	V
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
Collector Current, limited by T_{jmax}	I_C	180	A
Collector Current, limited by T_{jmax} ($T_C = 100^{\circ}\text{C}$)	$I_C(100^{\circ}\text{C})$	160	A
Pulsed Collector Current, t_p limited by T_{jmax} ($V_{GE} = 15\text{V}$)	I_{CM}	320	A
Diode Continuous Forward Current, limited by T_{jmax}	I_F	180	A
Diode Continuous Forward Current, limited by T_{jmax} ($T_C = 100^{\circ}\text{C}$)	$I_F(100^{\circ}\text{C})$	160	A
Diode Pulsed Current, t_p limited by T_{jmax}	I_{Fpuls}	320	A
Turn off Safe Operating Area ($V_{CE} \leq 650\text{V}, T_J \leq 150^{\circ}\text{C}$)	-	320	A
Power Dissipation ($T_J = 175^{\circ}\text{C}$)	P_D	714	W
Thermal Resistance, Junction to case for Diode	$R_{\theta JC}$	0.25	$^{\circ}\text{C/W}$
Thermal Resistance, Junction to case for IGBT	$R_{\theta JC}$	0.21	$^{\circ}\text{C/W}$
Operating junction temperature range	T_J	$-40 \sim +175$	$^{\circ}\text{C}$
Storage Temperature Range	T_{STG}	$-55 \sim +175$	$^{\circ}\text{C}$

Electrical characteristics of the IGBT ($T_J=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Static Characteristics						
Collector-Emitter Breakdown Voltage	V _{(BR)CES}	V _{GE} =0V, I _C =250μA	650			V
Collector-Emitter Leakage Current	I _{CES}	V _{GE} =0V, V _{CE} =650V			0.25	mA
		V _{GE} =0V, V _{CE} =650V, T _J =150°C			3	
Gate to Emitter Leakage Current	I _{GES}	V _{GE} =20V, V _{CE} =0V			100	nA
Gate Threshold Voltage	V _{GE(th)}	V _{GE} =V _{CE} , I _C =1mA	3.2	4	4.8	V
Collector-Emitter Saturation Voltage	V _{CE(sat)}	V _{GE} =15V, I _C =160A		1.55	1.85	V
		V _{GE} =15V, I _C =160A, T _J =125°C		1.75		
		V _{GE} =15V, I _C =160A, T _J =150°C		1.85		
Dynamic characteristics						
Input Capacitance	C _{ies}	V _{CE} =25V, V _{GE} =0V, f =1MHz		6.93		nF
Reverse Transfer Capacitance	C _{res}			0.07		
Total Gate Charge	Q _g	V _{CC} =400V, V _{GE} =-5V~15V I _C =160A		0.35		μC
Turn-on delay time	t _{d(on)}	V _{CC} =400V, V _{GE} =-5V~15V I _C =160A, R _G =10Ω Inductive Load		47		nS
Turn-on rise time	t _r			103		
Turn-off delay time	t _{d(off)}			210		
Turn-off fall time	t _f			74		
Turn-On Switching Loss	E _{on}			5.75		mJ
Turn-Off Switching Loss	E _{off}			3.69		

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Dynamic characteristics						
Turn-on delay time	$t_{d(on)}$	$V_{CC}=400V$, $V_{GE}=-5V\sim 15V$ $I_C=160A$, $R_G=10\Omega$ Inductive Load $T_J=125^\circ C$		42		nS
Turn-on rise time	t_r			109		
Turn-off delay time	$t_{d(off)}$			214		
Turn-off fall time	t_f			75		
Turn-On Switching Loss	E_{on}			8.36		mJ
Turn-Off Switching Loss	E_{off}			4.42		
Turn-on delay time	$t_{d(on)}$	$V_{CC}=400V$, $V_{GE}=-5V\sim 15V$ $I_C=160A$, $R_G=10\Omega$ Inductive Load $T_J=150^\circ C$		41		nS
Turn-on rise time	t_r			113		
Turn-off delay time	$t_{d(off)}$			217		
Turn-off fall time	t_f			76		
Turn-On Switching Loss	E_{on}			9.08		mJ
Turn-Off Switching Loss	E_{off}			4.67		

Electrical characteristics of the Diode ($T_J=25^\circ C$ unless otherwise noted)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_F	$I_F=160A$		2.1	2.6	V
		$I_F=160A$, $T_J=125^\circ C$		1.95		
		$I_F=160A$, $T_J=150^\circ C$		1.9		
Reverse Recovery Current	I_{rrm}	$V_R=400V$, $I_F=160A$ $di/dt=-1200A/\mu s$		30		A
Reverse Recovery Charge	Q_{rr}			1.05		uC
Reverse Recovery Time	t_{rr}			55		nS
Reverse Recovery Energy	E_{rec}			0.15		mJ
Reverse Recovery Current	I_{rrm}	$V_R=400V$, $I_F=160A$ $di/dt=-1200A/\mu s$ $T_J=125^\circ C$		69		A
Reverse Recovery Charge	Q_{rr}			4.97		uC
Reverse Recovery Time	t_{rr}			104		nS
Reverse Recovery Energy	E_{rec}			0.88		mJ
Reverse Recovery Current	I_{rrm}	$V_R=400V$, $I_F=160A$ $di/dt=-1200A/\mu s$ $T_J=150^\circ C$		89		A
Reverse Recovery Charge	Q_{rr}			6.93		uC
Reverse Recovery Time	t_{rr}			131		nS
Reverse Recovery Energy	E_{rec}			1.27		mJ

Typical Characteristics

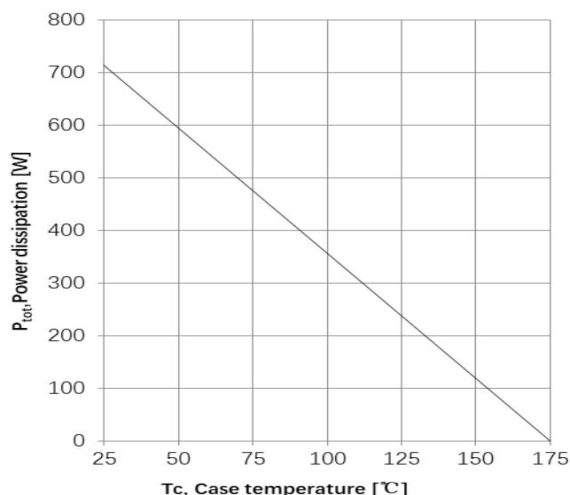


Fig1. Power dissipation as a function of case temperature ($T_j \leq 175^\circ\text{C}$)

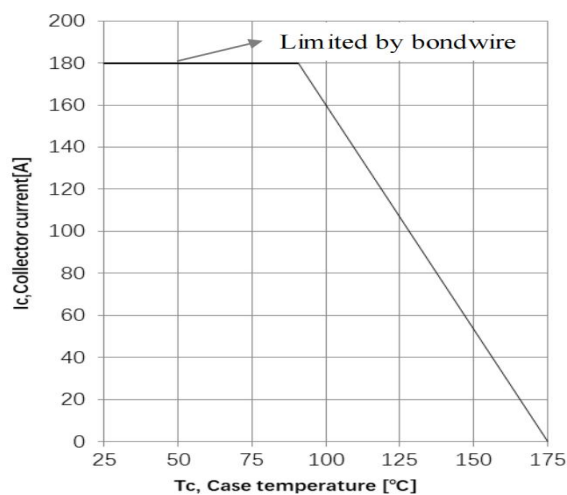


Fig2. Collector current as a function of case temperature ($V_{ge} \geq 15\text{V}$, $T_j \leq 175^\circ\text{C}$)

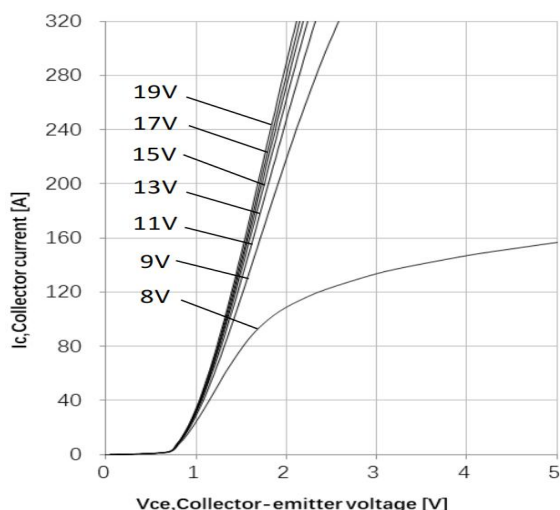


Fig3. Typical output characteristic ($T_j = 25^\circ\text{C}$)

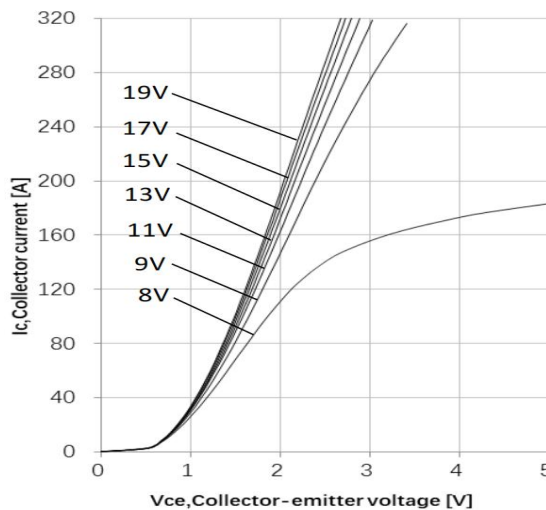


Fig4. Typical output characteristic ($T_j = 150^\circ\text{C}$)

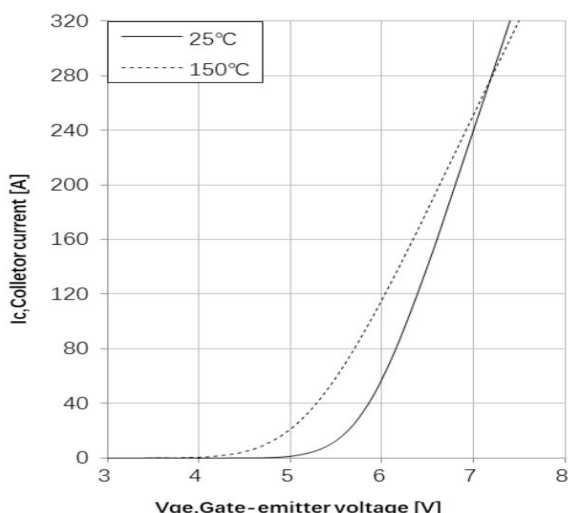


Fig5. Typical transfer characteristic ($V_{ce} = 20\text{V}$)

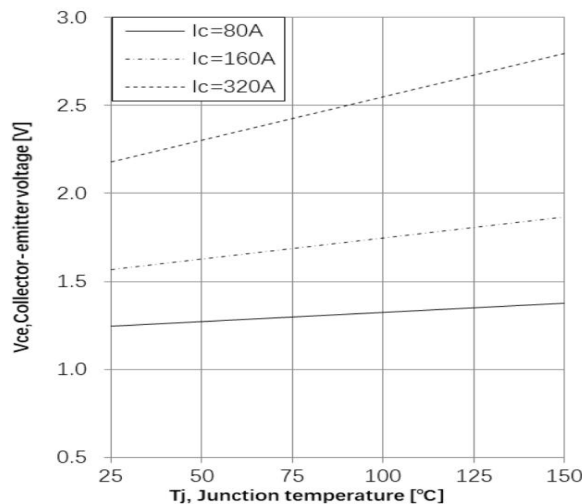
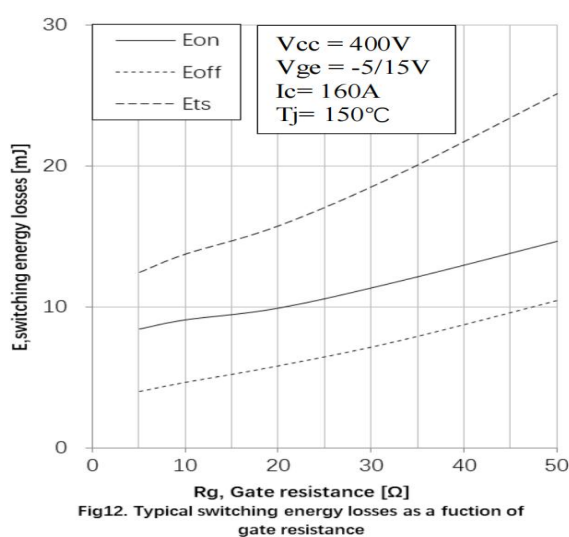
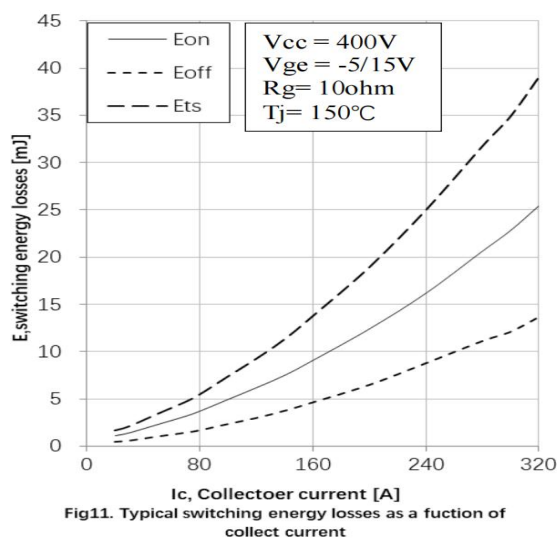
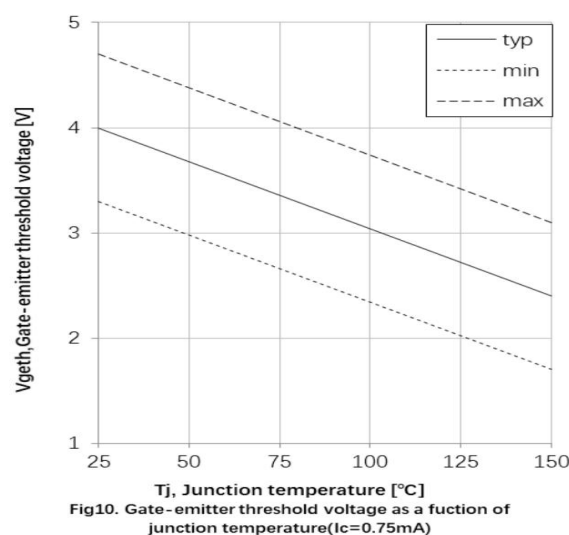
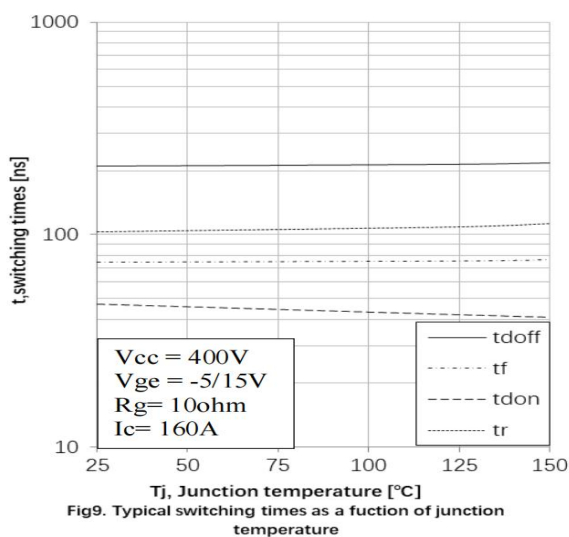
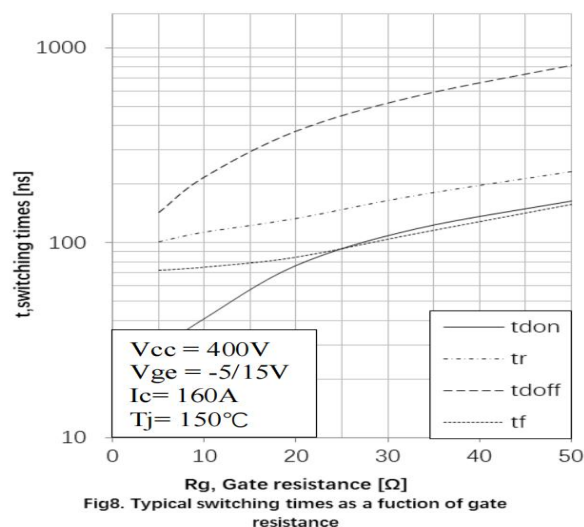
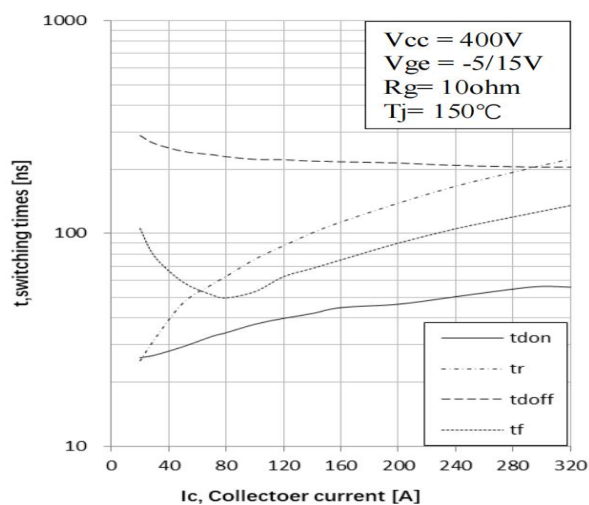
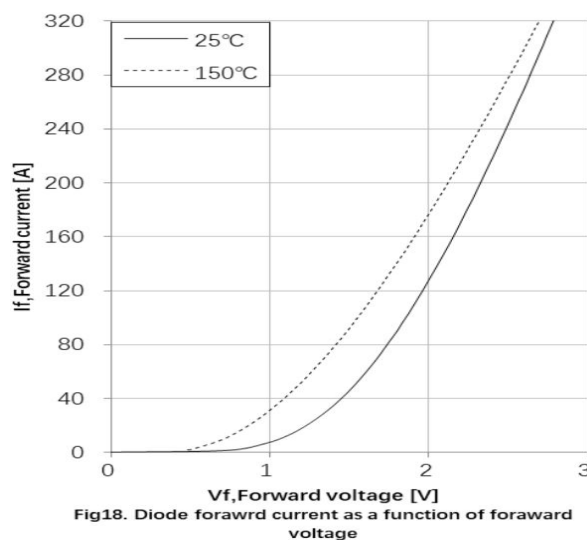
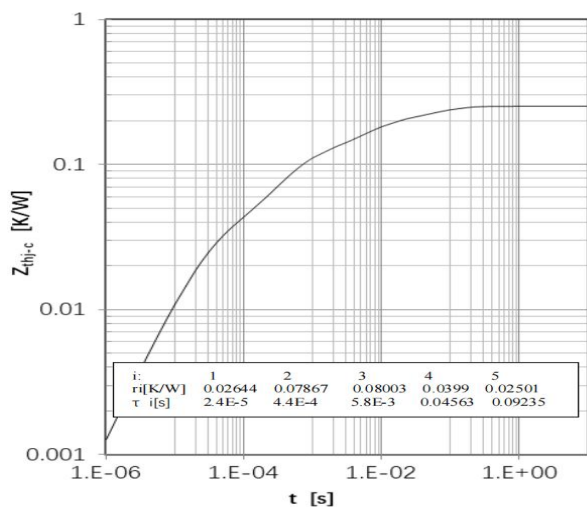
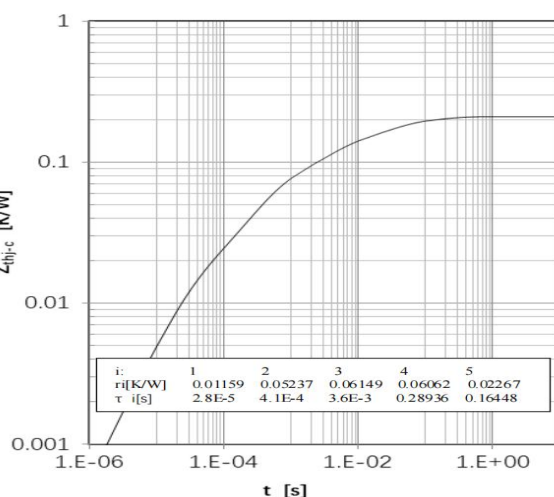
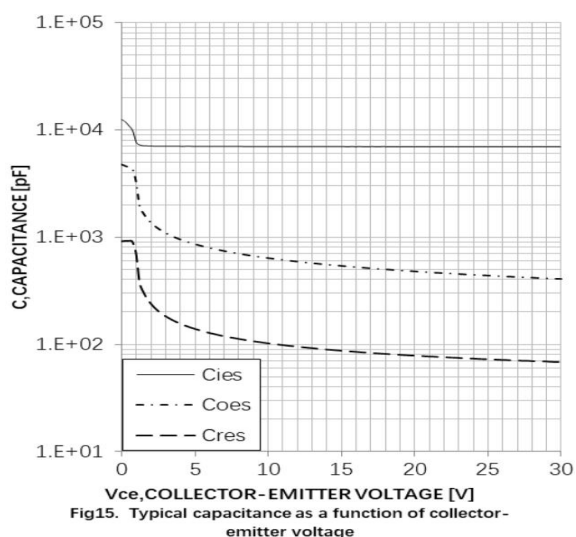
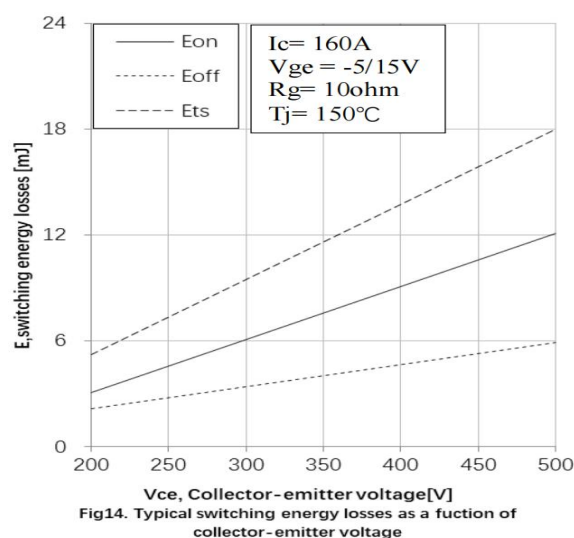
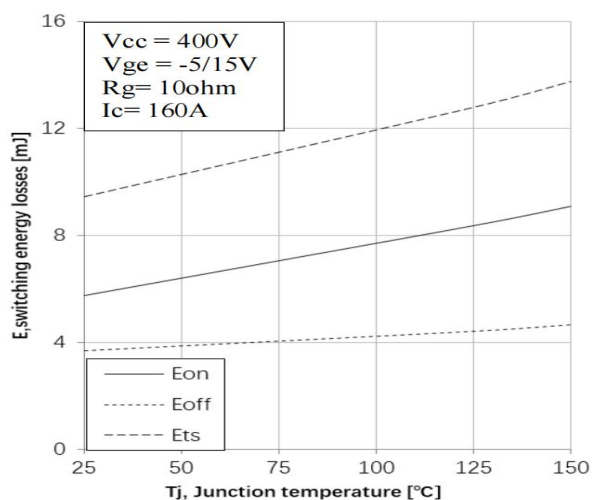


Fig6. Typical collector-emitter saturation voltage as a function of junction temperature ($V_{ge} = 15\text{V}$)

Typical Characteristics



Typical Characteristics



Typical Characteristics

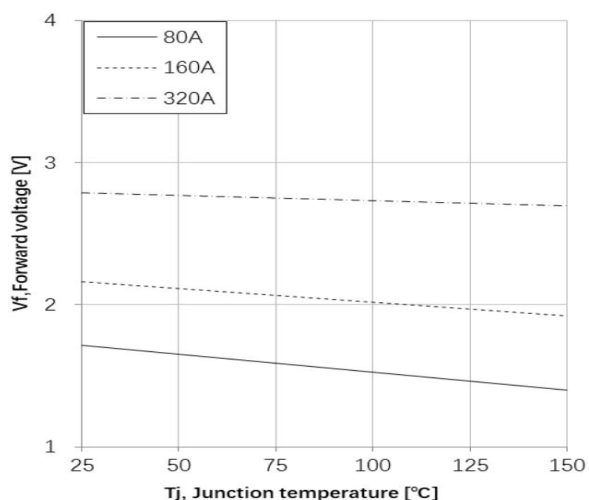
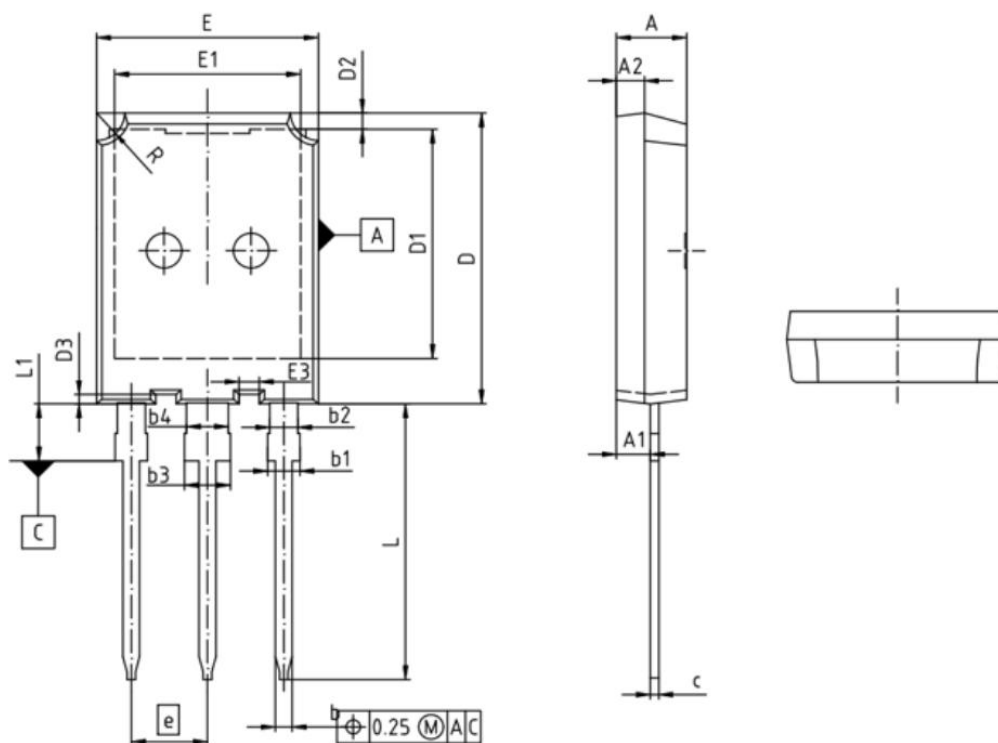


Fig19. Diode forward voltage as a function of junction temperature

TO-247 PLUS 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