

Product Summary

$V_{(BR)CES}$	$V_{CE(SAT)MAX}$	$I_C(100^{\circ}C)$
650V	2V@15V	40A

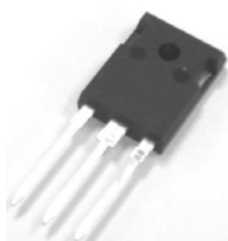
Feature

- High speed switching, low switching losses
- Tighten parameter distribution
- High ruggedness, temperature stable behavior

Application

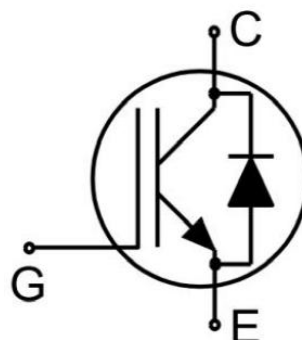
- PV power
- Three-level Solar String Inverter
- UPS
- Automotive application

Package



TO-247AB

Circuit diagram



Marking



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

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CES}	650	V
Continuous Gate- Emitter Voltage	V_{GES}	± 30	V
Collector Current	I_C	80	A
Collector Current(T _C =100°C)	$I_{C(100^\circ C)}$	40	A
Pulsed Collector Current, t _p limited by T _{jmax}	I_{Cpuls}	120	A
Turn off safe operating area, V _{CE} =650V, T _j =175°C	-	120	A
Diode Continuous Forward Current(T _C =100°C)	$I_F(100^\circ C)$	40	A
Diode Maximum Forward Current	I_{FM}	120	A
Power Dissipation	P_D	245	W
Thermal Resistance, Junction to case for IGBT	$R_{\theta JC}$	0.61	°C/W
Thermal Resistance, Junction to case for Diode	$R_{\theta JC}$	0.71	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	40	°C/W
Short circuit withstand time V _{GE} =15V, V _{CC} ≤400V, Allowed number of short circuits<1000Time between short circuits: ≥1.0s, T _j ≤150°C	t_{SC}	5	uS
Junction Temperature Range	T_{vj}	-40 ~ +175	°C
Storage Temperature Range	T_{STG}	-55 ~ +150	°C

Electrical characteristics of the IGBT (T_C=25°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 _{CE} =1mA	650			V
Collector-Emitter Leakage Current	I_{CES}	V _{GE} = 0V, V _{CE} =650V			5	uA
Gate to Emitter Leakage Current	I_{GES}	V _{GE} =±30V, V _{CE} = 0V			100	nA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V _{GE} =15V, I _C =20A, T _j =25°C		1.2		V
		V _{GE} =15V, I _C =20A, T _j =175°C		1.3		
		V _{GE} =15V, I _C =40A, T _j =25°C		1.5	2.0	
		V _{GE} =15V, I _C =40A, T _j =175°C		1.8		
Gate Threshold Voltage	$V_{GE(th)}$	V _{CE} =V _{GE} , I _C =1mA	4.50	5.25	6.00	V
Dynamic characteristics						
Input Capacitance	C_{ies}	V _{CE} =25V, V _{GE} =0V, f =1MHz		2200		pF
Output Capacitance	C_{oes}			71		
Reverse Transfer Capacitance	C_{res}			17		
Total Gate Charge	Q_g	V _{CC} =480V, V _{GE} =15V, I _C =40A		82		nC
Gate to Emitter Charge	Q_{ge}			27		
Gate to Collector Charge	Q_{gc}			25		
Internal Gate Resistance	R_g	f=1MHz		0.5		Ω
Short circuit collector current Max.1000 short circuits Time between short circuits: ≥1.0s	$I_{C(SC)}$	V _{GE} =15V, V _{CC} ≤400V, t _{SC} ≤5us, T _j ≤150°C		200		A
Turn-on delay time	$t_{d(ON)}$	V _{CC} =400V, I _C =40A, V _{GE} =0/15V, R _g =5.4Ω, Inductive Load		45		nS
Turn-on rise time	t_r			16		
Turn-off delay time	$t_{d(OFF)}$			133		
Turn-off fall time	t_f			15		
Turn-On Switching Loss	E_{on}			1.0		mJ
Turn-Off Switching Loss	E_{off}			0.4		
Total Switching Loss	E_{ts}			1.4		
Turn-On Switching Loss	E_{on}	V _{CC} =400V, I _C =40A, V _{GE} =0/15V, R _g =5.4Ω, Inductive Load, T _j =175°C		1.6		mJ
Turn-Off Switching Loss	E_{off}			0.8		
Total Switching Loss	E_{ts}			2.4		

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

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_{FM}	$I_F=40\text{A}, T_j=25^{\circ}\text{C}$		1.6	2.3	V
		$I_F=40\text{A}, T_j=175^{\circ}\text{C}$		1.4		
Reverse Recovery Time	T_{rr}	$I_F=40\text{A}, R_g=5.4\Omega$		100		nS
Diode Peak Reverse Recovery Current	I_{RRM}			25		A
Reverse Recovery Charge	Q_{rr}			0.98		uC
Reverse recovery energy	E_{rec}			0.18		mJ
Reverse Recovery Time	T_{rr}	$I_F=40\text{A}, R_g=5.4\Omega, T_j=175^{\circ}\text{C}$		150		nS
Diode Peak Reverse Recovery Current	I_{RRM}			40		A
Reverse Recovery Charge	Q_{rr}			2.45		uC
Reverse recovery energy	E_{rec}			0.27		mJ

Typical Electrical and Thermal Characteristics

Figure 1 Output Characteristics

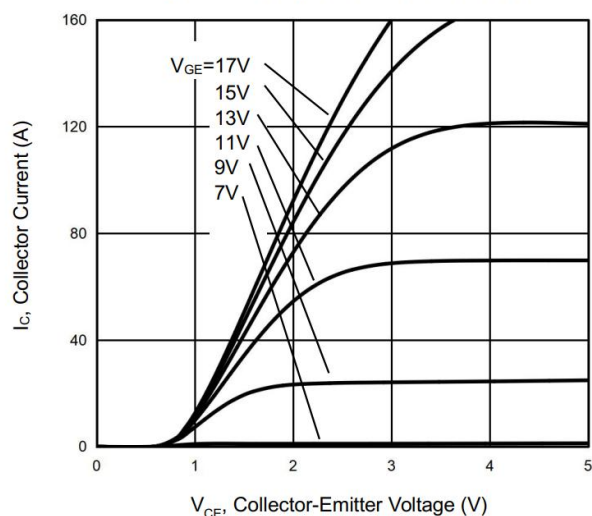


Figure 2 Transfer Characteristics

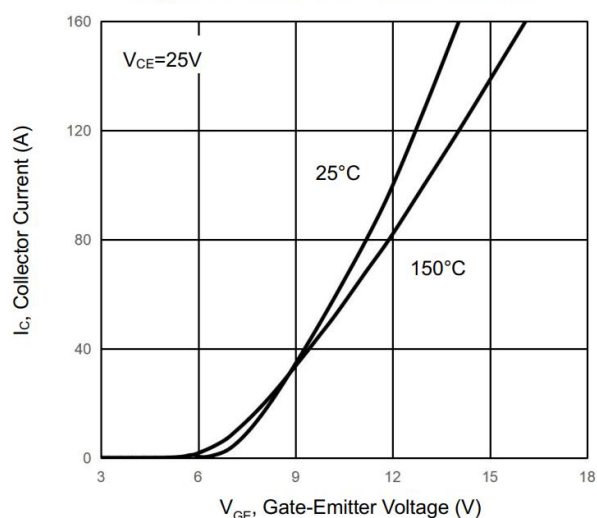


Figure 3 $V_{CE(sat)}$ vs. Temperature

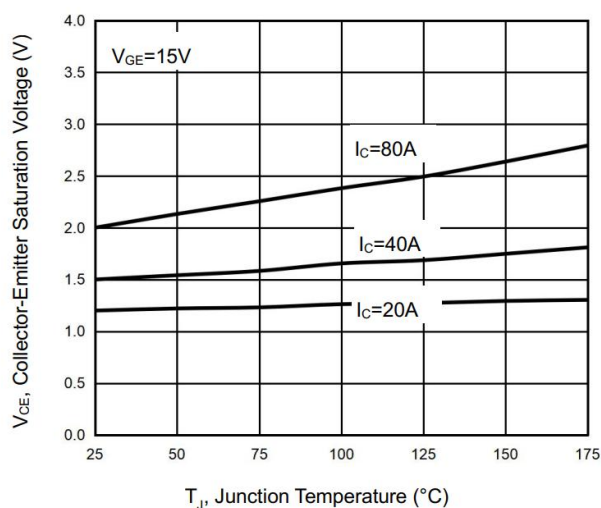


Figure 4 Saturation Voltage vs. V_{GE}

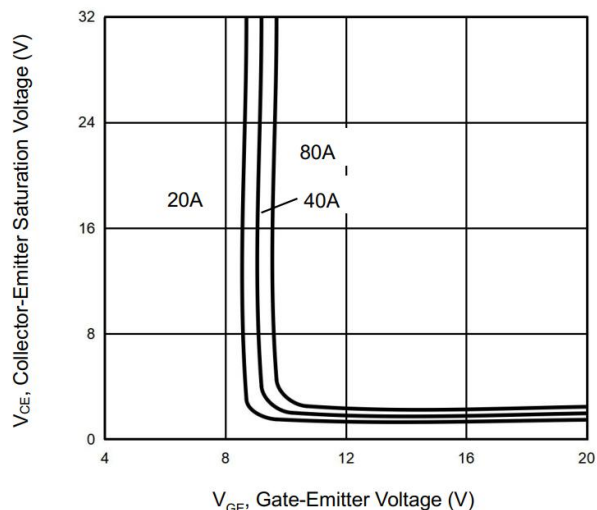


Figure 5 Capacitance Characteristics

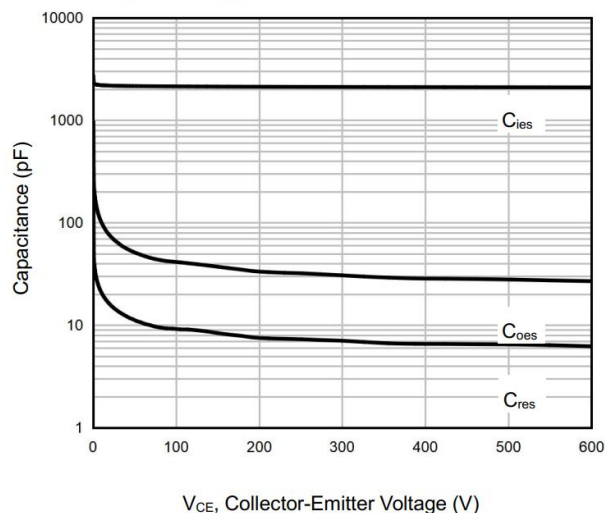
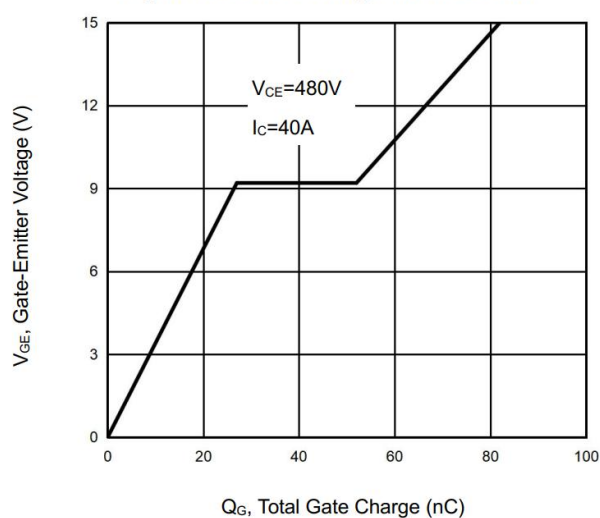


Figure 6 Gate Charge Wave Form



Typical Electrical and Thermal Characteristics

Figure 7 Forward Characteristics

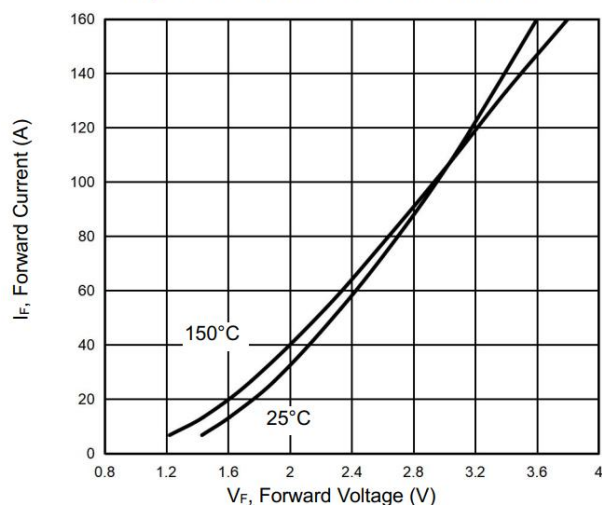


Figure 8 V_F vs. Temperature

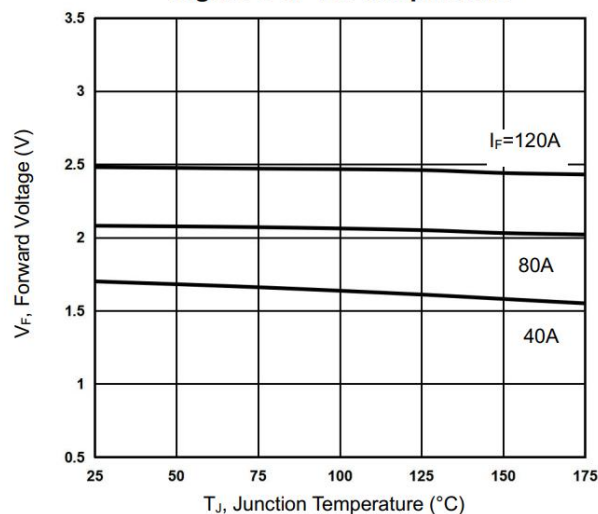


Figure 9 Switching Loss vs. R_G

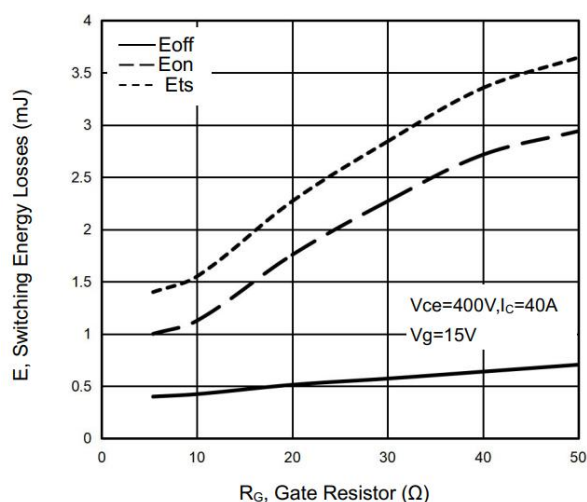


Figure 10 Switching Loss vs. Collector Current

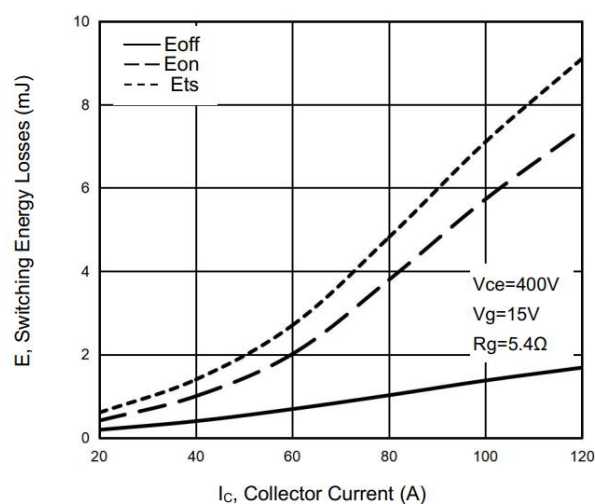


Figure 11 Gate-Emitter Threshold Voltage as a Function of Junction Temperature(Normalized)

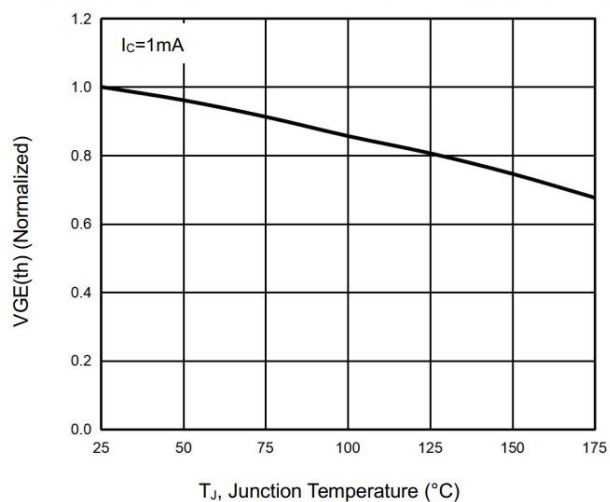
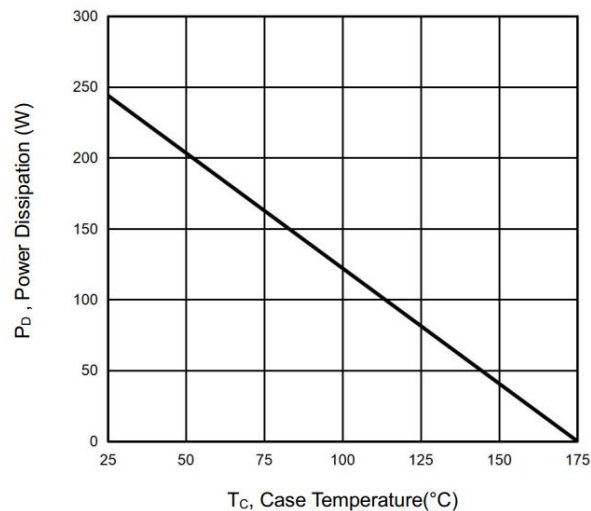


Figure 12 P_{tot} vs. Case Temperature



Typical Electrical and Thermal Characteristics

Figure 13 Switching Loss vs. Temperature

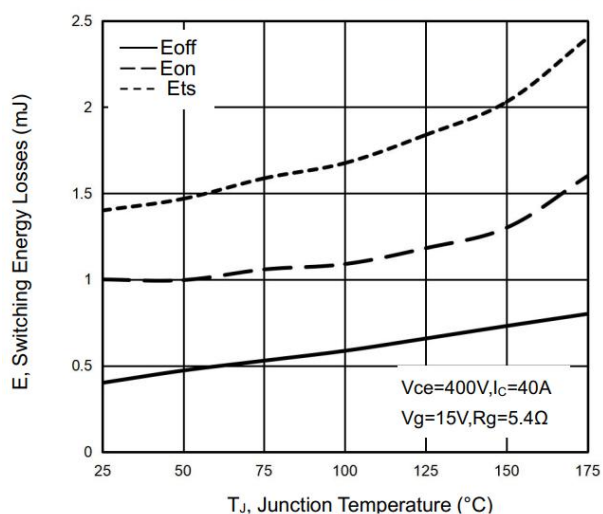


Figure 14 Switching Loss vs. V_{CE}

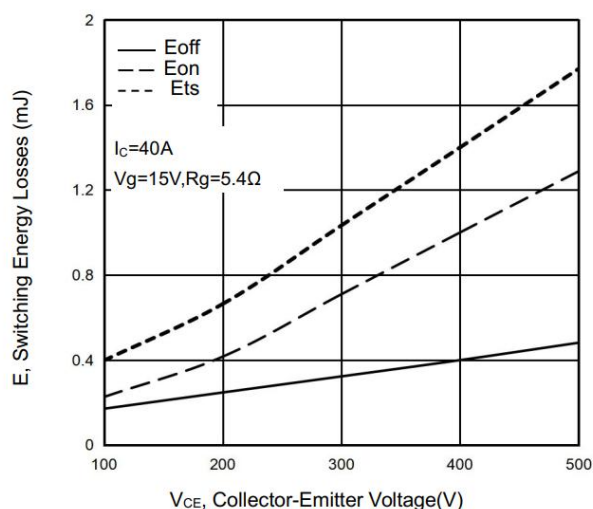


Figure 15 Gate-Emitter Threshold Voltage as a Function of Junction Temperature (Normalized)

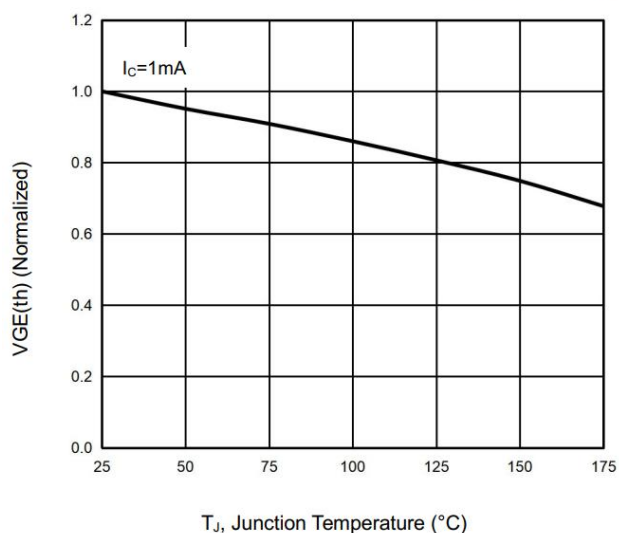


Figure 16 Typical Collector-Emitter Saturation Voltage as a Function of Collector Current (Normalized)

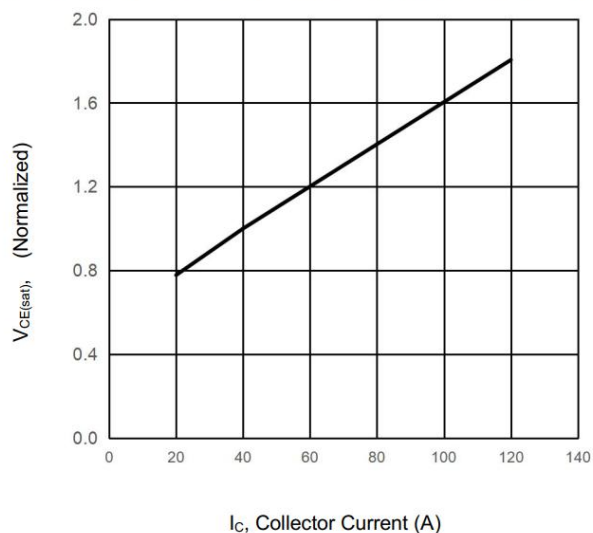


Figure 17 $V_{\text{BR(CES)}}$ vs. Temperature

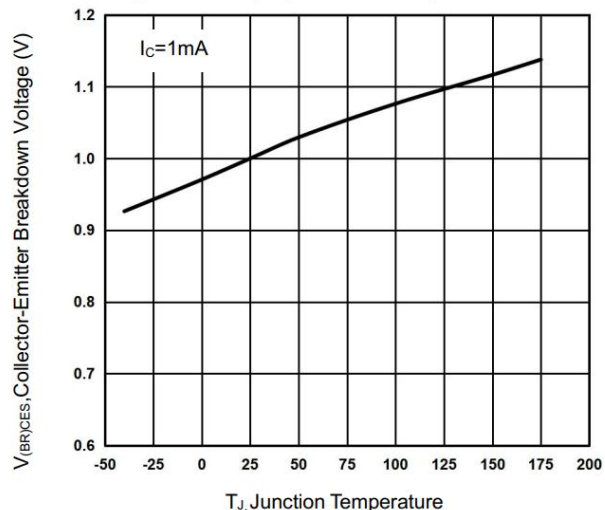
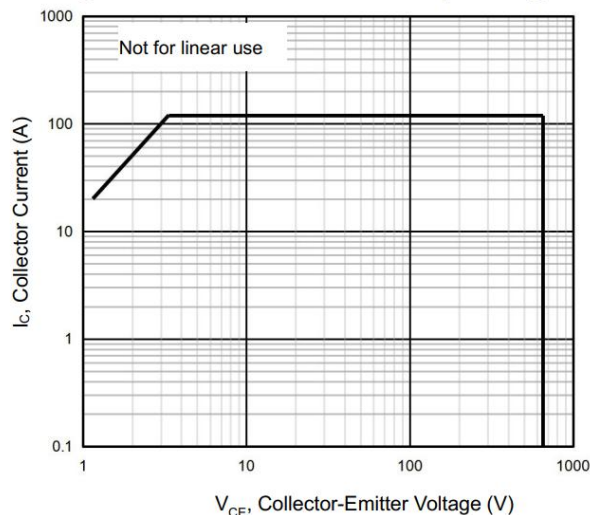
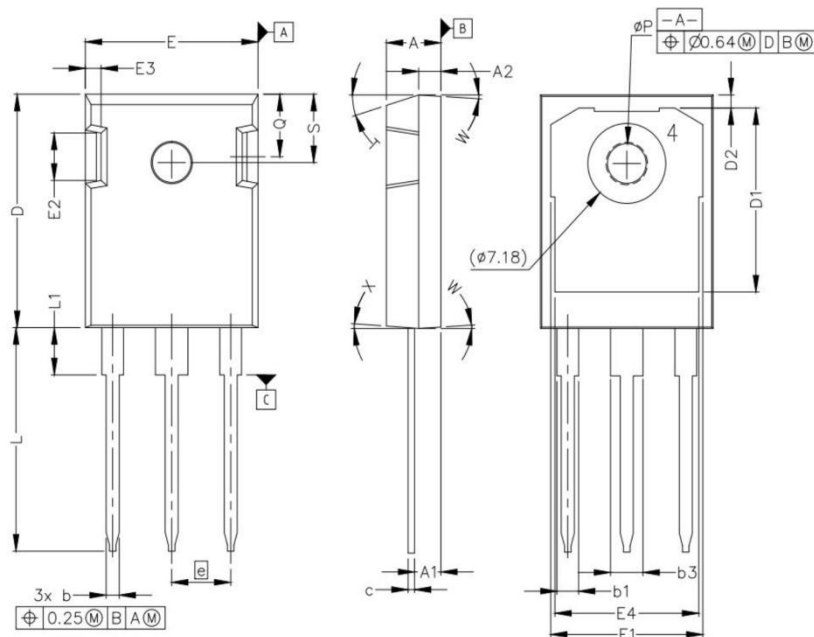


Figure 18 Forward Bias Safe Operating Area



TO-247AB Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.83	5.21	0.19	0.21
A1	2.29	2.54	0.09	0.10
A2	1.91	2.16	0.08	0.09
b	1.07	1.33	0.04	0.05
b1	1.91	2.41	0.08	0.10
b3	2.87	3.38	0.11	0.13
c	0.55	0.68	0.02	0.03
D	20.80	21.10	0.82	0.83
D1	16.25	17.65	0.64	0.70
D2	0.95	1.25	0.04	0.05
E	15.75	16.13	0.62	0.64
E1	13.10	14.15	0.52	0.56
E2	3.68	5.10	0.15	0.20
E3	1.00	1.90	0.04	0.08
E4	12.38	13.43	0.49	0.53
e	5.44 BSC.		0.21 BSC.	
L	19.81	20.32	0.78	0.80
L1	4.10	4.40	0.16	0.17
ØP	3.51	3.65	0.14	0.15
Q	5.49	6.00	0.22	0.24
S	6.04	6.30	0.24	0.25
T	17.5°REF.			
W	3.5°REF.			
X	4°REF.			