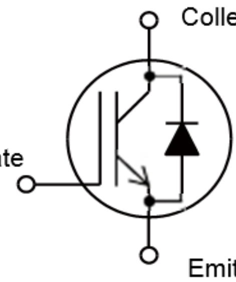
1200V 40A CoolFAST™ 7 technology IGBT

Features:

- Low switching power loss
- Low switching surge and noise
- Advanced Fieldstop technology
- Low EMI
- Maximum junction temperature 175°C
- Qualified according to JEDEC for target applications
- Pb-free lead plating, halogen-free mold compound, RoHS compliant

Applications:

- Industrial UPS
- Welding machine
- Solar converters
- Energy Storage
- Mid to high range switching frequency converters



Key Performance and Package Parameters

Type	V_{CE}	I_C	V_{CEsat}, T_{vj}=25°C	T_{vjmax}	Marking	Package
EX40N120DF7	1200V	40A	1.7V	175°C	40N120DF7	TO247-3

Maximum Ratings and Characteristics

Absolute Maximum Ratings at T_{vj}= 25°C (unless otherwise specified)

Items	Symbols	Value	Units
Collector-Emitter voltage	V_{CES}	1200	V
Gate-Emitter voltage	V_{GES}	±20	V
DC Collector Current, limited by Tvjmax Tc= 25°C Tc= 100°C	I_C	65 40	A
Pulsed Collector Current, tp limited by Tvjmax	I_{CP}	160	A
Turn-Off Safe Operating Area Vce≤ 1200V, Tj≤ 175°C, tp=1µs	-	160	A
Diode Forward Current, limited by Tvjmax Tc= 25°C Tc= 100°C	I_F	65 40	A
IGBT Max. Power Dissipation	P_{D_IGBT}	420	W
FWD Max. Power Dissipation	P_{D_FWD}	300	W
Operating Junction Temperature	T_{vj}	-40 ~ +175	°C
Storage Temperature	T_{stg}	-55 ~ +175	°C

Electrical characteristics at T_{vj}= 25°C (unless otherwise specified)

Description	Symbols	Conditions	Characteristics			Unit
			Min	Typ	Max	
Collector-emitter breakdown voltage	$V_{(BR)CES}$	V_{GE}=0V,I_C=0.50mA	1200	-	-	V
Zero Gate Voltage Collector Current	I_{CES}	V_{CE}= 1200V, V_{GE}= 0V	-	-	200	μA
Gate-Emitter Leakage Current	I_{GES}	V_{CE}= 0V, V_{GE}= ±20V	-	-	±200	nA
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	V_{CE}= V_{GE}, I_C= 250uA	5.1	5.9	6.7	V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE}= 20V, I_C= 40A Tvj= 25°C Tvj= 175°C	- -	1.7 2.4	2.0	V
Input Capacitance	C_{ies}	V_{CE}= 25V, V_{GE}= 0V f= 1MHz	-	9500	-	pF
Output Capacitance	C_{oes}		-	150	-	pF
Reverse Transfer Capacitance	C_{res}		-	86	-	pF
Gate Charge	Q_G	V_{CC}= 600V,I_C= 40A, V_{GE}= 15V	-	320	-	nC
Forward Voltage Drop	V_F	I_F= 40A Tvj= 25°C Tvj= 175°C	- -	1.7 1.5	3.0	V

Switching Characteristics at T_{vj}= 25°C

Description	Symbols	Conditions	Characteristics			Unit
			Min	Typ	Max	
IGBT Characteristics						
Turn-On Delay Time	$t_{d(on)}$	V_{CC}= 600V I_C= 40A, V_{GE}= 15V R_G= 10Ω,	-	65	-	ns
Rise Time	t_r		-	110	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	250	-	ns
Fall Time	t_f		-	75	-	ns
Turn-On Energy	E_{on}		-	2.1	-	mJ
Turn-Off Energy	E_{off}		-	1.2	-	mJ
Total switching energy	E_{ts}		-	3.3	-	mJ
Diode Characteristics						
Diode Reverse Recovery Time	t_{rr}	V_{CC}= 600V, I_F= 40A di_F/dt= 300A/μs	-	270	-	ns
Diode Reverse Recovery Charge	Q_{rr}		-	2.8	-	μC
Diode peak reverse recovery current	Irrm		-	19	-	A

Switching Characteristics T_{vj}= 175°C

Description	Symbols	Conditions	Characteristics			Unit
			Min	Typ	Max	
IGBT Characteristics						
Turn-On Delay Time	$t_{d(on)}$	V_{CC}= 600V I_C= 40A, V_{GE}= 15V R_G= 10Ω,	-	60	-	ns
Rise Time	t_r		-	100	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	360	-	ns
Fall Time	t_f		-	150	-	ns
Turn-On Energy	E_{on}		-	3.3	-	mJ
Turn-Off Energy	E_{off}		-	2.3	-	mJ
Total switching energy	E_{ts}		-	5.6	-	mJ
Diode Characteristics						
Diode Reverse Recovery Time	t_{rr}	V_{CC}= 600V, I_F= 40A di_F/dt= 300A/μs	-	440	-	ns
Diode Reverse Recovery Charge	Q_{rr}		-	8.5	-	μC
Diode peak reverse recovery current	Irrm		-	39	-	A

Thermal resistance

Items	Symbols	Characteristics			Unit
		Min	Typ	Max	
Thermal Resistance, Junction-Ambient	$R_{th(j-a)}$	-	-	50	°C /W
Thermal Resistance, IGBT Junction to Case	$R_{th(j-c)}$	-	-	0.35	
Thermal Resistance, Diodes Junction to Case	$R_{th(j-c)}$	-	-	0.5	

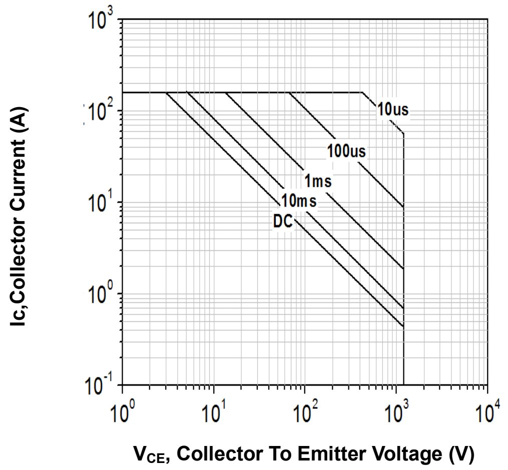


Figure 1. Forward bias safe operating area

(D=0, Tc=25℃, Tvj≤175℃; VGE=15V)

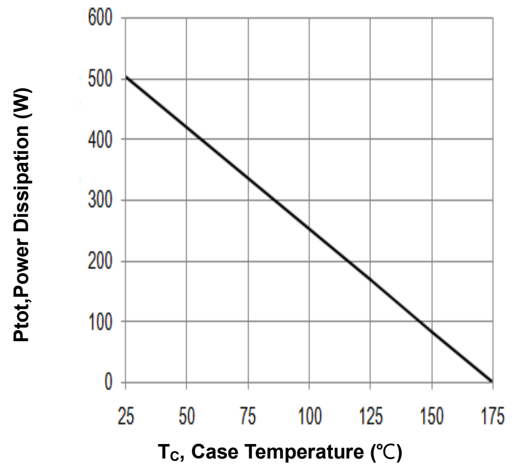


Figure 2. Power dissipation vs. case temperature

(Tvj≤175℃)

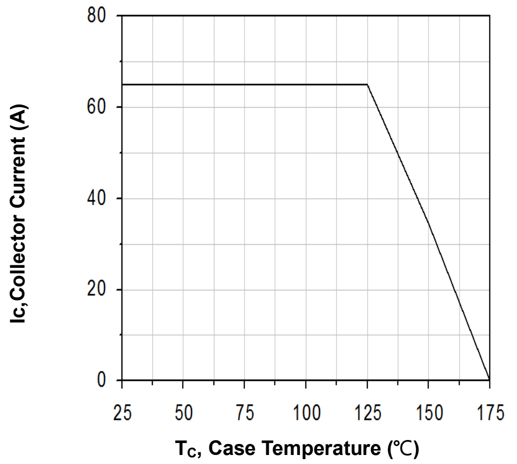


Figure 3. Collector current vs. case temperature

(VGE≤15V, Tvj≤175℃)

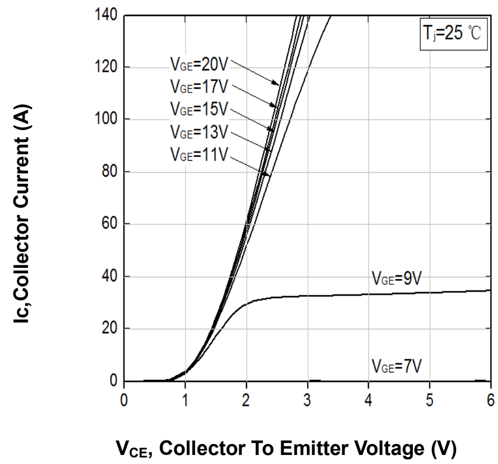


Figure 4. Typical output characteristic

(Tvj=25℃)

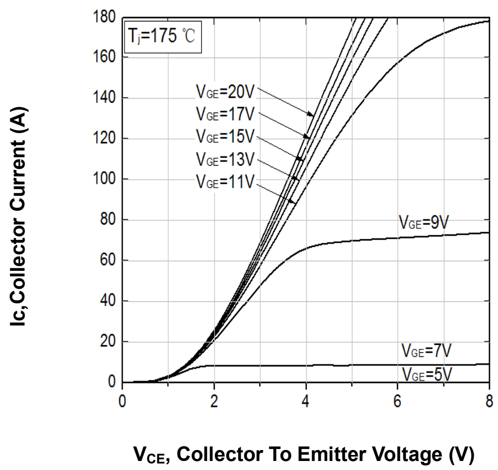


Figure 5. Typical output characteristic

(Tvj=175℃)

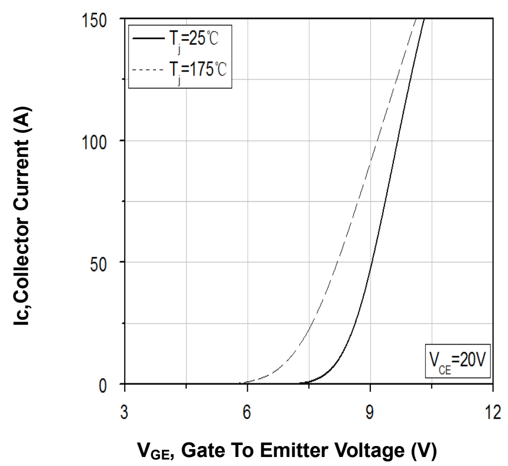


Figure 6. Typical transfer characteristic

(VCE=20V)

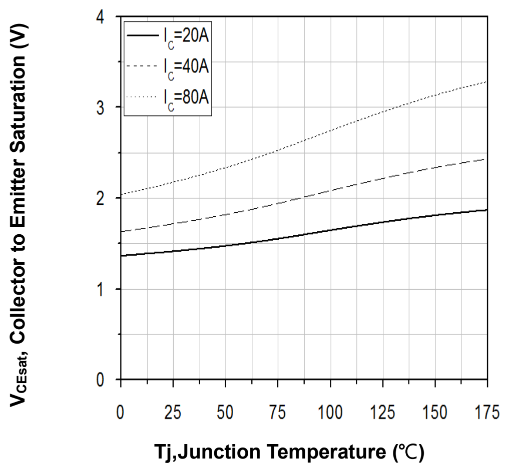


Figure 7. Typical collector-emitter saturation voltage vs. Tvj (VGE=20V)

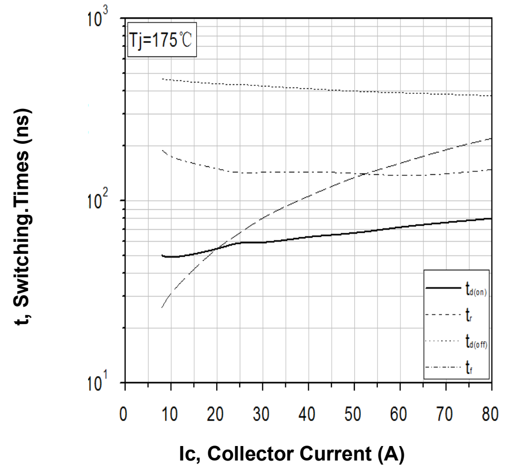


Figure 8. Typical switching times vs. collector current (Ind. load, Tvj=175℃, VCE=600V, VGE=15/0V, Rg=12Ω)

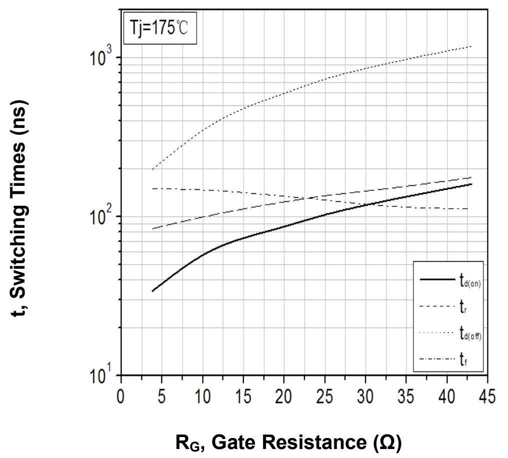


Figure 9. Typical switching times vs. gate resistor
(Ind. Load, Tvj=175℃, VCE=600V, VGE=15/0V, IC=40A)

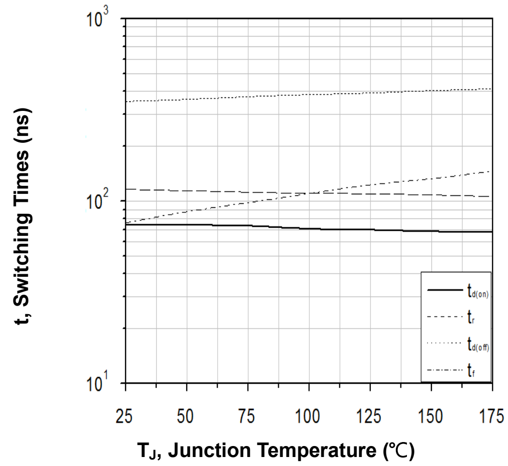


Figure 10. Typical switching times vs. Tvj
(Ind. Load, VCE=600V, VGE=15/0V, IC=40A, Rg=12Ω)

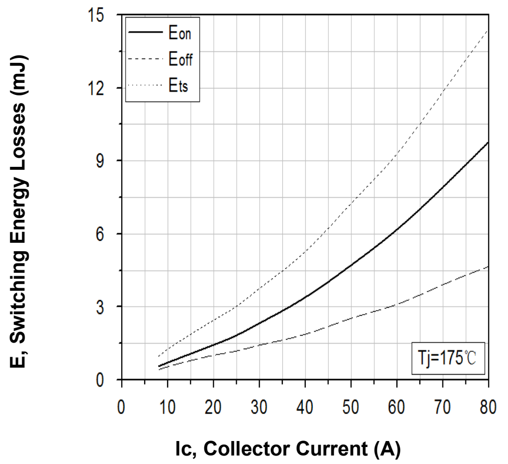


Figure 11. Typical switching energy losses vs. collector current (Ind. load, Tvj=175℃, VCE=600V, VGE=15/0V, Rg=12Ω)

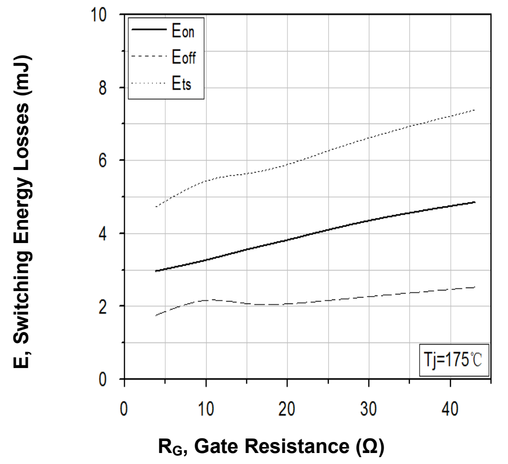


Figure 12. Typical switching energy losses vs. gate resistor (Ind. load, Tvj=175℃, VCE=600V, VGE=15/0V, IC=40A)

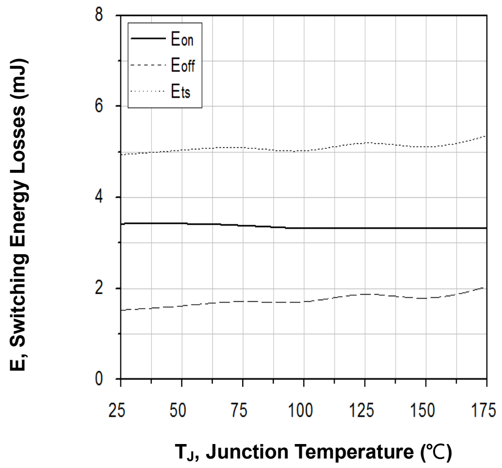


Figure 13. Typical switching energy losses vs. Tvj
(Ind load, VCE=600V, VGE=15/0V, IC=40A, Rg=12Ω)

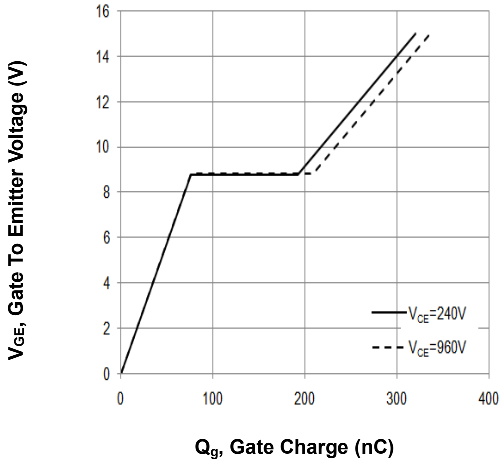


Figure 14. Typical gate charge
(IC=40A)

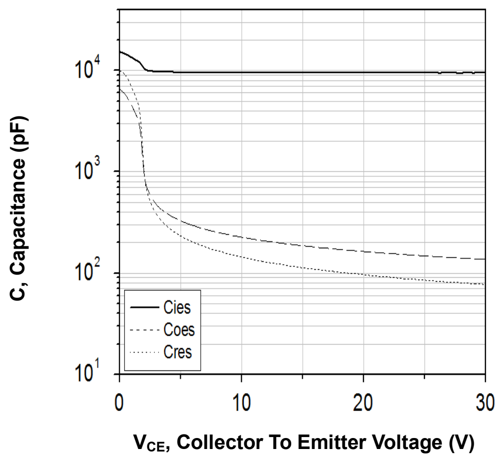


Figure 15. Typical capacitance vs. collector-emitter voltage (VGE=0V, f=1MHz)

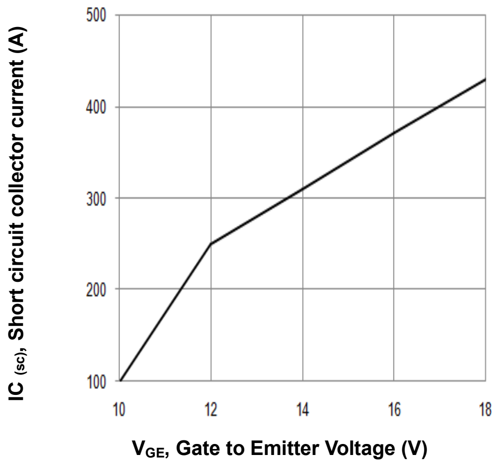


Figure 16. Typical short circuit collector current vs. gate-emitter voltage (VCE≤600V start at Tvj=25℃)

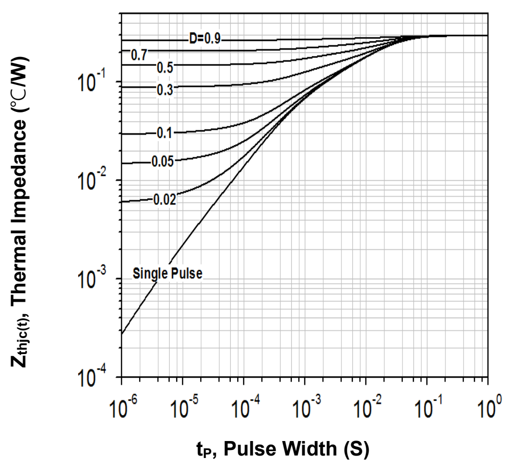


Figure 17. IGBT transient thermal impedance
(D=tp/T)

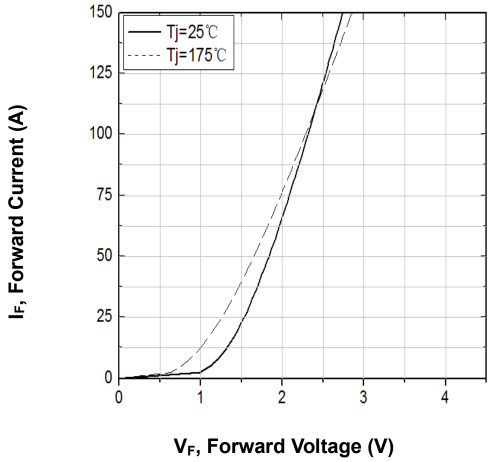


Figure 18. Typical diode forward current vs. forward voltage

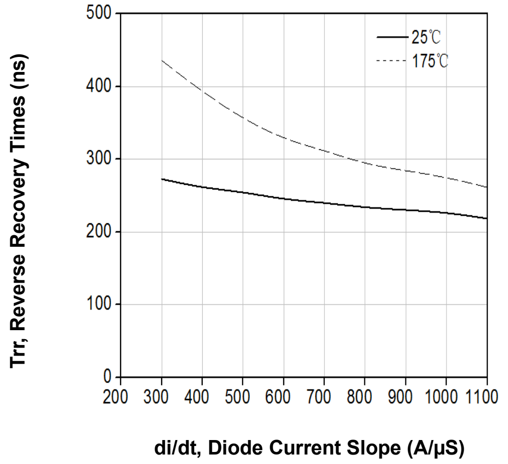


Figure 19. Typical reverse recovery time vs. diode current slope (VR=600V)

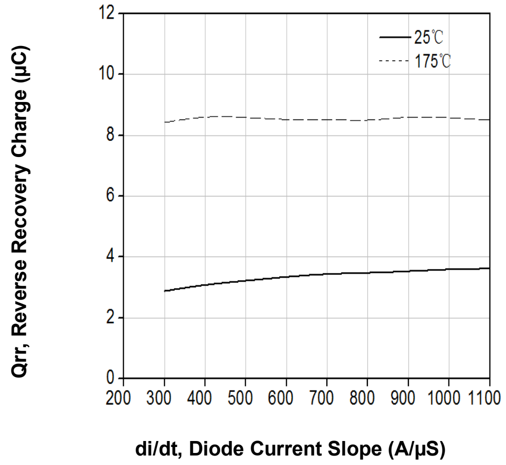


Figure 20. Typical reverse recovery charge vs. diode current slope (VR=600V)

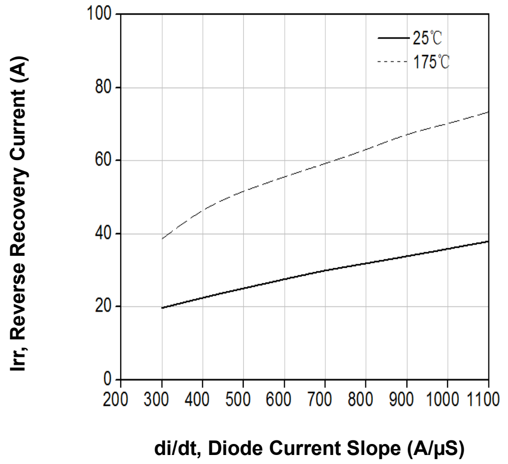
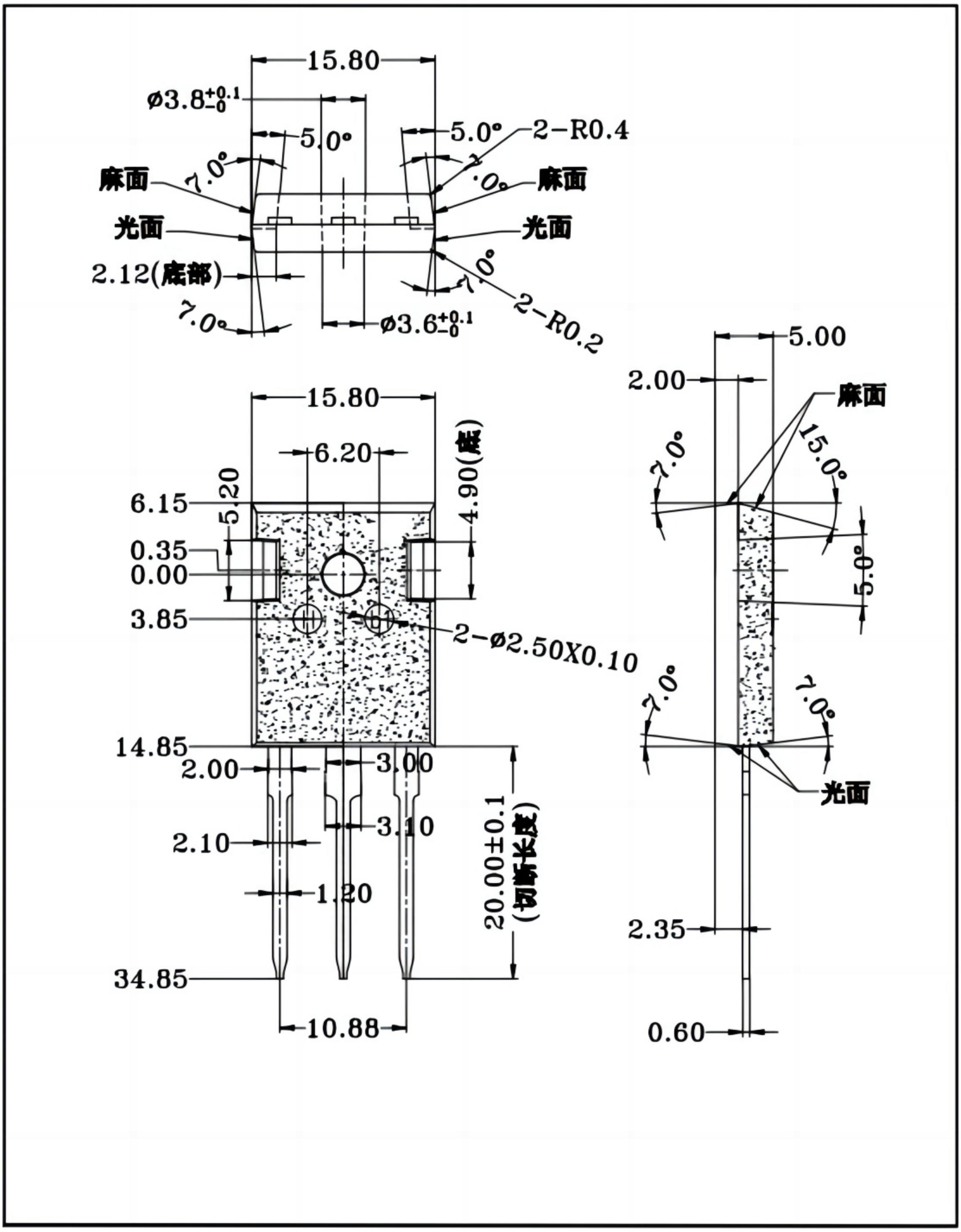


Figure 21. Typical reverse recovery current vs. diode current slope (VR=600V)

TO247-3 Package Outline



Legal Disclaimer

The information given in this document shall be for illustrative purposes only and shall in no event be regarded as a guarantee of conditions or characteristics. Existar Technologies reserves the right to change any information herein. With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Existar Technologies or its affiliates hereby make no representation or warranty of any kind, expressed or implied, as to any information provided hereunder, including without limitation as to the accuracy, completeness or non-infringement of intellectual property rights of any third party, and they assume no liability for the consequences of use of such information. In addition, any information given in this document is subject to customer's compliance with its obligations stated herein and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Existar Technologies in customer's applications. The information contained herein is exclusively intended for technically trained staff. No license is granted by implication under any patent right, copyright, mask work right, or other intellectual property right. It is customer's sole responsibility to evaluate the suitability of the product for the intended application and the completeness of the product information given herein with respect to such application. In no event shall Existar Technologies or its affiliates be liable to any party for any direct, indirect, special, punitive, incidental or consequential damages of any nature whatsoever, including but not limited to loss of profits and loss of goodwill, whether or not such damages are based on tort or negligence, warranty, breach of contract or any other legal theory.