MM40G3U120BX

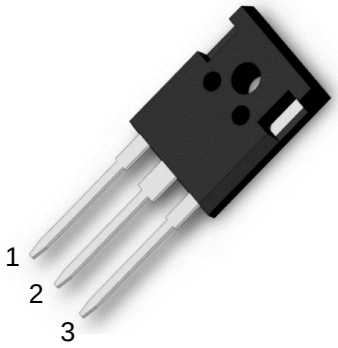
1200V 40A IGBT

July 2024

RoHS Compliant

PRODUCT FEATURES

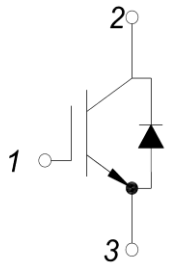
- ☐ IGBT chip in trench FS-technology
- ☐ Low switching losses
- ☐ $V_{CE(sat)}$ with positive temperature coefficient
- ☐ Fast switching and short tail current
- ☐ Free wheeling diodes with fast and soft reverse recovery



APPLICATIONS

- ☐ High frequency switching application
- ☐ Medical applications
- ☐ Motion/servo control
- ☐ UPS systems

1.Gate
2.Collector
3.Emitter



Type	V_{CES}	I_C	$V_{CE(sat)}$ T_J=25°C	T_{Jmax}	Marking	Package
MM40G3U120BX	1200V	40A	1.9V	175°C	MM40G3U120BX	TO-247

ABSOLUTE MAXIMUM RATINGS(T_C *=25°C unless otherwise specified*)

Symbol	Parameter/Test Conditions		Values	Unit
V_{CES}	Collector Emitter Voltage	T_J=25℃	1200	V
V_{GES}	Gate Emitter Voltage		±20	
	Transient Gate Emitter Voltage（tp≤10μs,D<0.01）		±30	
I_C	DC Collector Current	T_C=25℃	65	A
		T_C=110℃	40	
I_{Cpuls}	Pulsed collector current,tp limited by T_{Jmax}		160	
P_{tot}	Power Dissipation Per IGBT		455	W
V_{RRM}	Repetitive Reverse Voltage	T_J=25℃	1200	V
$I_{F(AV)}$	Average Forward Current	T_C=95℃	40	A
I_{Fpuls}	Diode pulsed current,tp limited by T_{Jmax}		160	
T_{Jmax}	Max. Junction Temperature		175	℃
T_{Jop}	Operating Temperature		-40~175	
T_{stg}	Storage Temperature		-55~150	
Torque	to heatsink	Recommended（M3）	1.1	Nm
Weight			8	g

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IGBT

ELECTRICAL CHARACTERISTICS (T_C =25°C unless otherwise specified)

Symbol	Parameter/Test Conditions			Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Emitter Threshold Voltage	$V_{CE}=V_{GE}$, I_C=1.6mA		5.2	5.8	6.5	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	I_C=40A, V_{GE}=15V, T_J=25℃			1.9	2.35	
		I_C=40A, V_{GE}=15V, T_J=125℃			2.3		
		I_C=40A, V_{GE}=15V, T_J=150℃			2.4		
I_{CES}	Collector Leakage Current	V_{CE}=1200V, V_{GE}=0V, T_J=25℃				100	μA
		V_{CE}=1200V, V_{GE}=0V, T_J=150℃				10	mA
I_{GES}	Gate Leakage Current	V_{CE}=0V,V_{GE}=±20V, T_J=25℃		-400		400	nA
Q_G	Gate Charge	V_{CE}=600V, I_C=40A , V_{GE}=15V			0.19		μC
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f =1MHz			2.5		nF
C_{res}	Reverse Transfer Capacitance				110		pF
$t_{d(on)}$	Turn on Delay Time	V_{CC}=600V,I_C=40A R_G =15Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		30		ns
			T_J=125℃		35		ns
			T_J=150℃		40		ns
t_r	Rise Time		T_J=25℃		25		ns
			T_J=125℃		30		ns
			T_J=150℃		30		ns
$t_{d(off)}$	Turn off Delay Time	V_{CC}=600V,I_C=40A R_G =15Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		190		ns
			T_J=125℃		230		ns
			T_J=150℃		250		ns
t_f	Fall Time		T_J=25℃		80		ns
			T_J=125℃		100		ns
			T_J=150℃		110		ns
E_{on}	Turn on Energy	V_{CC}=600V,I_C=40A R_G =15Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		2.1		mJ
			T_J=125℃		2.6		mJ
			T_J=150℃		2.95		mJ
E_{off}	Turn off Energy		T_J=25℃		1.5		mJ
			T_J=125℃		2		mJ
			T_J=150℃		2.2		mJ
I_{SC}	Short Circuit Current	tpsc≤10μs , V_{GE}=15V T_J=125℃,V_{CC}=600V			260		A
R_{thJC}	Junction to Case Thermal Resistance （Per IGBT）					0.33	K /W

Anti-Parallel Diode

ELECTRICAL CHARACTERISTICS (T_C =25°C unless otherwise specified)

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
V_F	Forward Voltage	I_F=40A , V_{GE}=0V, T_J =25℃		1.9	2.4	V
		I_F=40A , V_{GE}=0V, T_J =125℃		1.65		
		I_F=40A , V_{GE}=0V, T_J =150℃		1.55		
t_{rr}	Reverse Recovery Time	I_F=40A , V_R=600V dI_F/dt=-800A/μs T_J =150℃		380		ns
I_{RRM}	Max. Reverse Recovery Current			39		A
Q_{RR}	Reverse Recovery Charge			7		μC
E_{rec}	Reverse Recovery Energy			2.55		mJ
R_{thJCD}	Junction to Case Thermal Resistance （Per Diode）				0.55	K /W

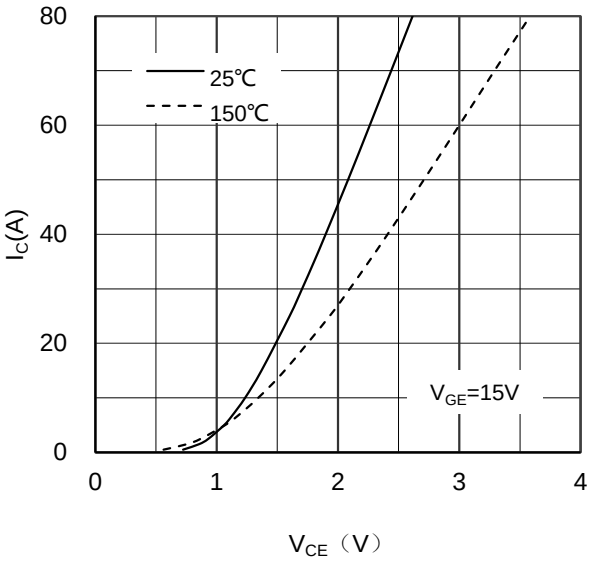


Figure 1. Typical Output Characteristics IGBT

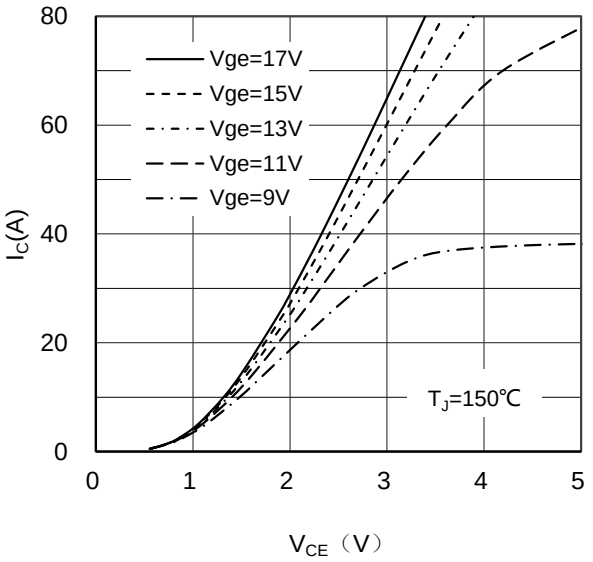


Figure 2. Typical Output Characteristics IGBT

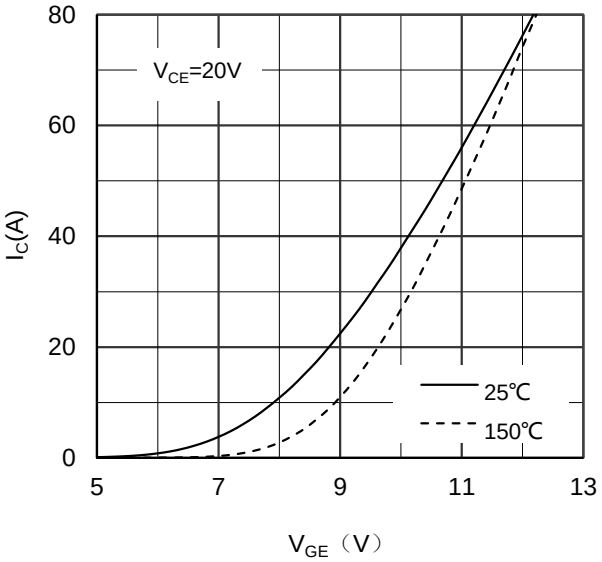


Figure 3. Typical Transfer characteristics IGBT

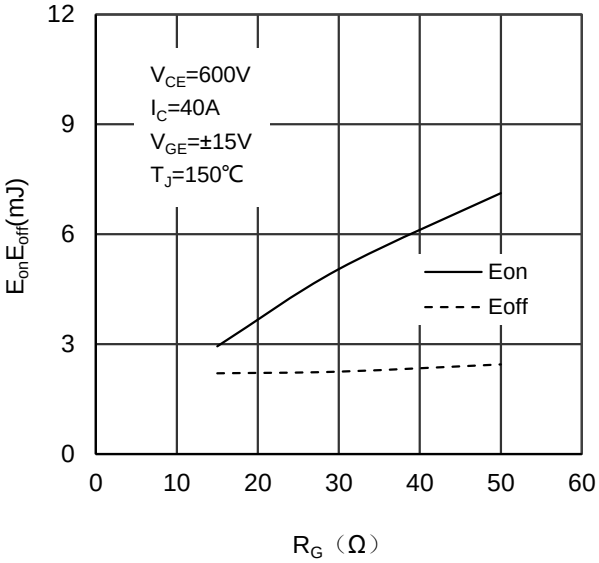


Figure 4. Switching Energy vs Gate Resistor IGBT

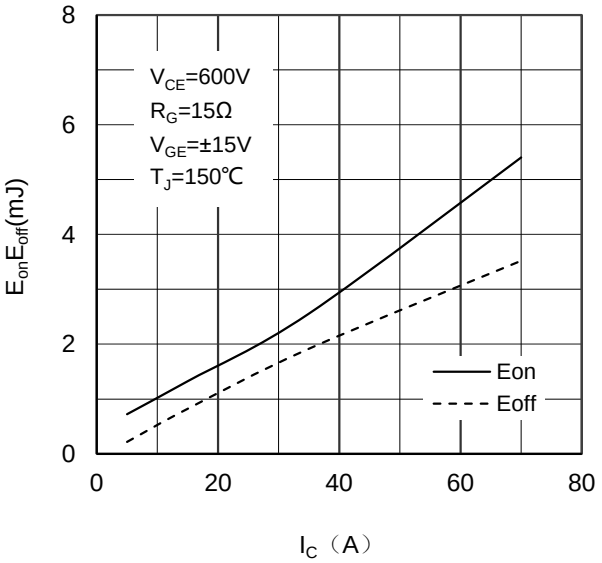


Figure 5. Switching Energy vs Collector Current IGBT

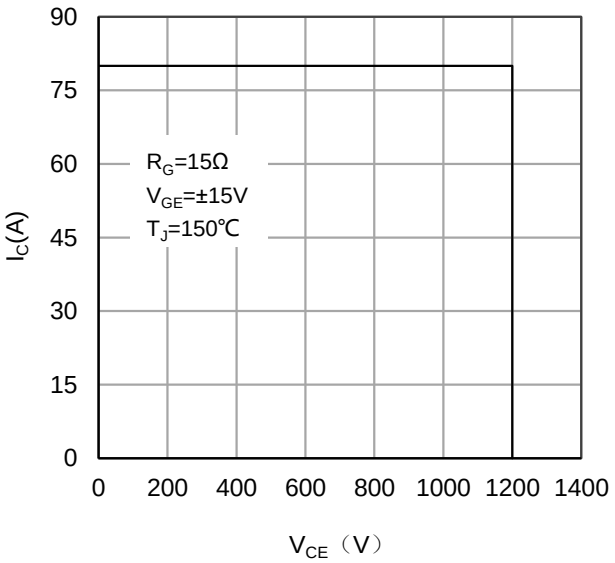


Figure 6. Reverse Biased Safe Operating Area IGBT

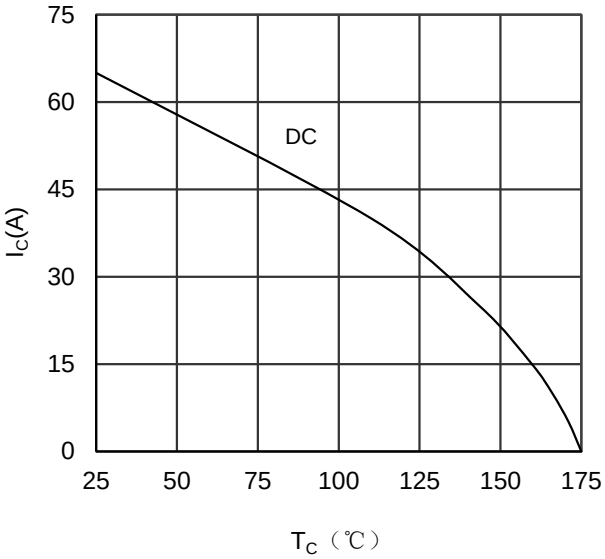


Figure 7. Collector Current vs Case temperature

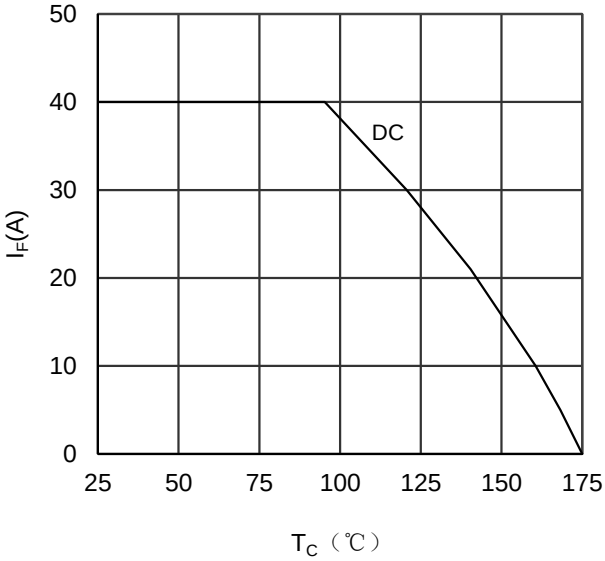


Figure 8. Forward current vs Case temperature

IGBT

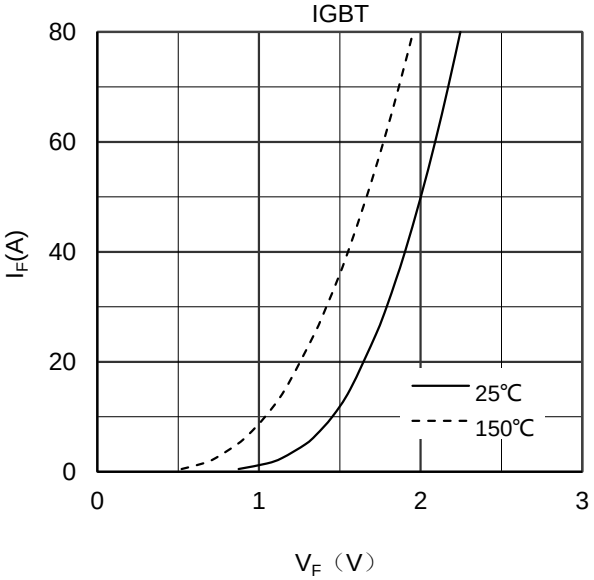


Figure 9. Diode Forward Characteristics Diode

Diode

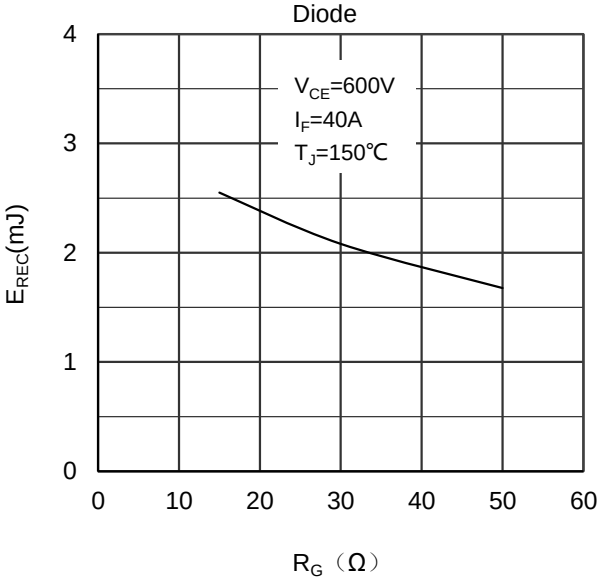


Figure 10. Switching Energy vs Gate Resistor Diode

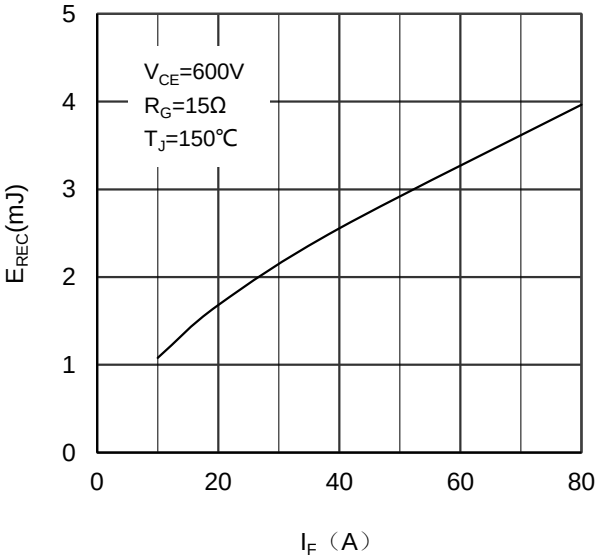


Figure 11. Switching Energy vs Forward Current Diode

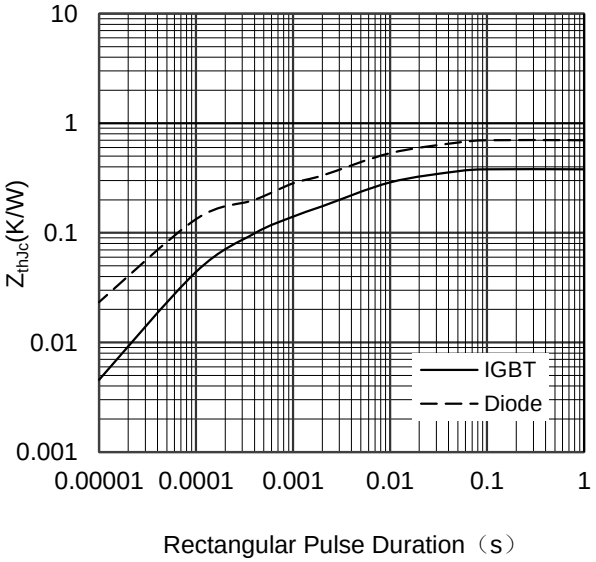


Figure 12. Transient Thermal Impedance of Diode and IGBT

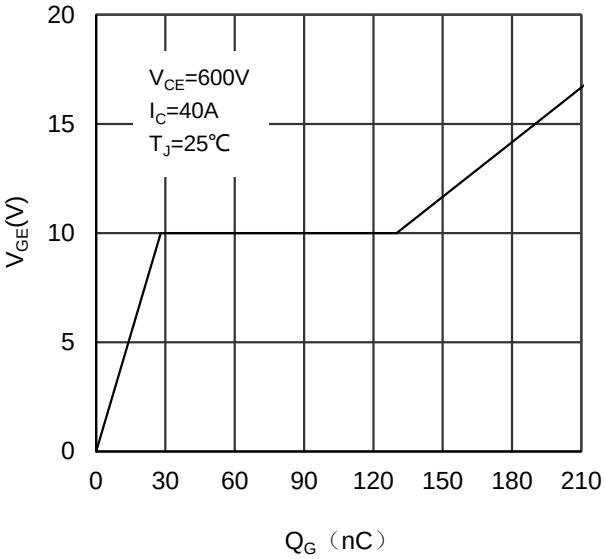


Figure 13. Gate Charge vs Gate Emitter Voltage

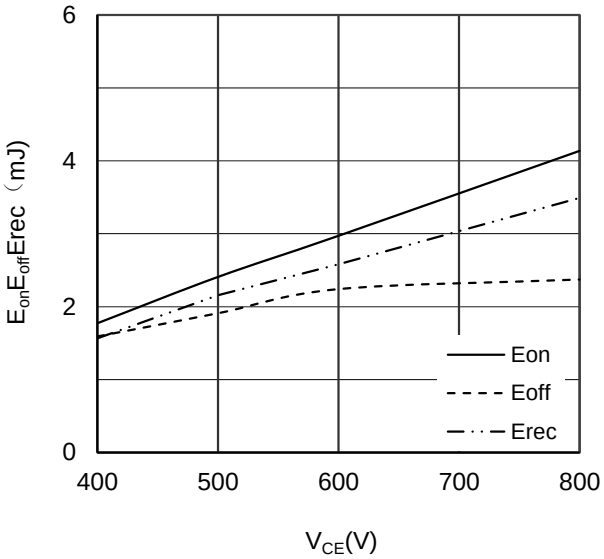
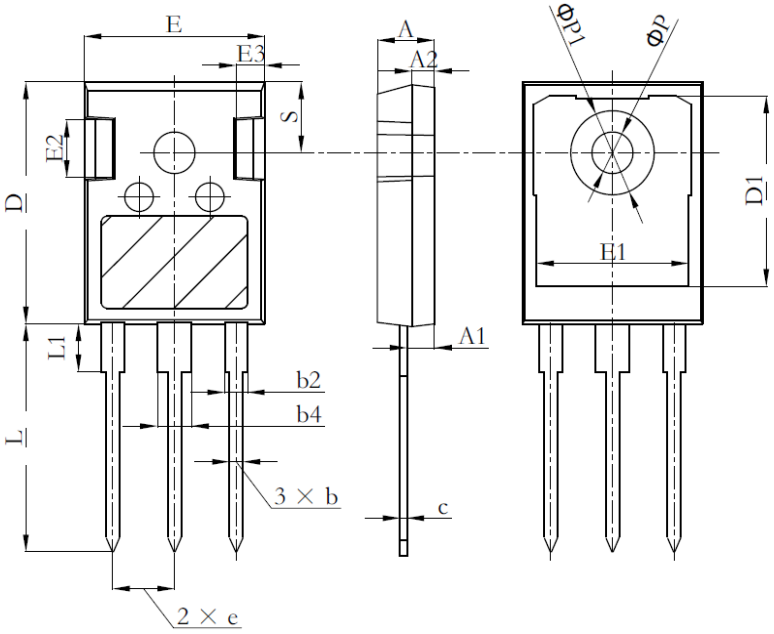


Figure 14. Switching Energy vs Collector-Emitter Voltage



Symbol	Min	Nom	Max
A	4.80	5.00	5.21
A1	2.21	2.41	2.61
A2	1.85	2.00	2.16
b	1.07	1.23	1.36
b2	1.90	2.05	2.41
b4	2.87	3.05	3.38
c	0.50	0.60	0.75
e		5.44BSC	
E	15.50	15.80	16.13
E1	12.38	13.30	13.60
E2	3.68	-	5.20
E3	1.00	-	2.70
D	20.70	21.00	21.30
D1	16.25	-	17.65
L	19.60	19.91	20.32
L1	-	-	4.40
ΦP	3.40	3.60	3.80
ΦP1	-	-	7.30
S		6.15BSC	

Dimensions in (mm)

Figure 15. Package Outline