MM40G7U120BK

1200V 40A IGBT

November 2024 Preliminary RoHS Compliant

PRODUCT FEATURES

☐ 1200V IGBT chip in trench FS-technology

☐ Low switching losses

☐ $V_{CE(sat)}$ with positive temperature coefficient

☐ Fast switching and short tail current

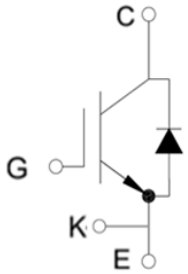
☐ Free wheeling diodes with fast and soft reverse recovery

APPLICATIONS

☐ Motor control

☐ UPS/PFC

☐ General purpose inverters



Type	V_{CES}	I_C	$V_{CE(sat)}$ T_J=25°C	T_{Jmax}	Marking	Package
MM40G7U120BK	1200V	40A	1.5V	175°C	MM40G7U120BK	TO-247

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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≤0.5μs,D<0.001）			±25	
I_C	DC Collector Current,limited by T_{Jmax}	limited by bondwire	T_C=25℃	80	A
			T_C=100℃	75	
I_{Cpulse}	Pulsed collector current,tp limited by T_{Jmax}			160	
P_{tot}	Power Dissipation Per IGBT	T_C=25℃		441	W
		T_C=100℃		221	
V_{RRM}	Repetitive Reverse Voltage	T_J=25℃		1200	V
I_F	Forward Current,limited by T_{Jmax}	T_C=25℃		75	A
		T_C=100℃		50	
I_{Fpulse}	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	
T_{SLD}	Wave Soldering 1.6mm (0.063in.) from case for 10s			260	
Torque	to heatsink	Recommended（M3）		1.1	Nm
Weight				8	g

THERMAL RESISTANCE(TC=25°C unless otherwise specified)

Symbol	Parameter/Test Conditions	Min.	Typ.	Max.	Unit
R_{thJC}	Junction to Case Thermal Resistance （ IGBT）			0.34	K /W
R_{thJC}	Junction to Case Thermal Resistance （ Diode）			0.66	
R_{thJA}	Junction to Ambient Thermal Resistance			40	

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=0.65mA		5.2	6.0	6.7	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	I_C=40A, V_{GE}=15V, T_J=25℃			1.5		V
		I_C=40A, V_{GE}=15V, T_J=175℃			1.9		
I_{CES}	Collector Leakage Current	V_{CE}=1200V, V_{GE}=0V, T_J=25℃				40	μA
		V_{CE}=1200V, V_{GE}=0V, T_J=175℃			2.6		mA
I_{GES}	Gate Leakage Current	V_{CE}=0V,V_{GE}=±20V, T_J=25℃		-200		200	nA
g_{fs}	Transconductance	V_{CE}=20V, I_C=40A, T_J=25℃			100		S
Q_G	Gate Charge	V_{CE}=600V, I_C=40A , V_{GE}=15V			263		nC
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f =100kHz			5.7		nF
C_{oes}	Output Capacitance				109		pF
C_{res}	Reverse Transfer Capacitance				29		
$t_{d(on)}$	Turn on Delay Time	V_{CC}=600V,I_C=40A R_{Gon}=R_{Goff}=10Ω, V_{GE}=0...15V	T_J=25℃		28		ns
			T_J=175℃		24		ns
t_r	Rise Time		T_J=25℃		35		ns
			T_J=175℃		31		ns
$t_{d(off)}$	Turn off Delay Time	V_{CC}=600V,I_C=40A R_{Gon}=R_{Goff}=10Ω, V_{GE}=0...15V	T_J=25℃		380		ns
			T_J=175℃		470		ns
t_f	Fall Time		T_J=25℃		70		ns
			T_J=175℃		140		ns
E_{on}	Turn on Energy	V_{CC}=600V,I_C=40A R_{Gon}=R_{Goff}=10Ω, V_{GE}=0...15V	T_J=25℃		1.12		mJ
			T_J=175℃		1.98		mJ
E_{off}	Turn off Energy		T_J=25℃		1.40		mJ
			T_J=175℃		2.57		mJ

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℃			2.2		V
		I_F=40A , V_{GE}=0V, T_J =175℃			2		
t_{rr}	Reverse Recovery Time	I_F=40A , V_R=600V T_J =175℃	T_J=25℃		109		ns
			T_J=175℃		267		ns
Q_{RR}	Reverse Recovery Charge		T_J=25℃		2.2		μC
			T_J=175℃		5.9		μC
I_{RRM}	Max. Reverse Recovery Current		T_J=25℃		75		A
			T_J=175℃		82.8		A
E_{rec}	Reverse Recovery Energy		T_J=25℃		0.82		mJ
			T_J=175℃		2.56		mJ

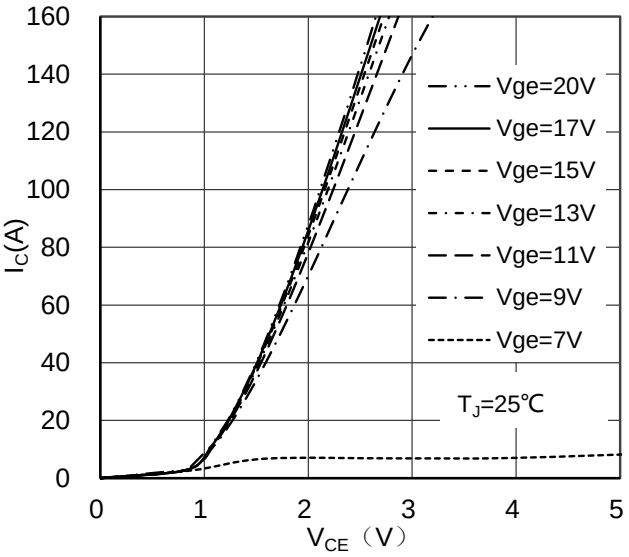


Figure 1. Typical Output Characteristics

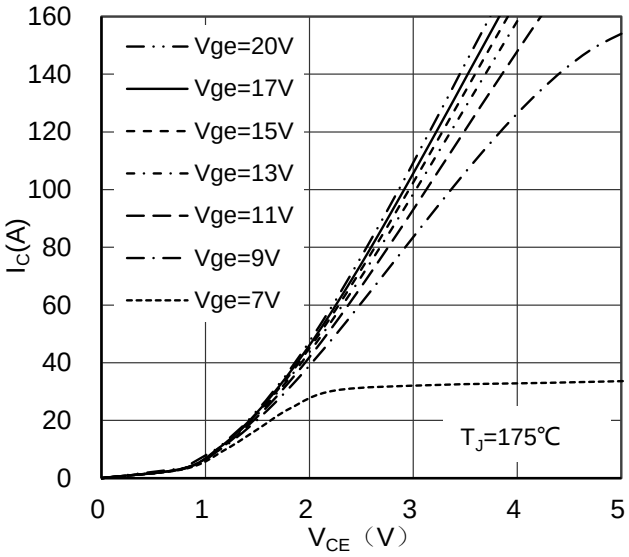


Figure 2. Typical Output Characteristics

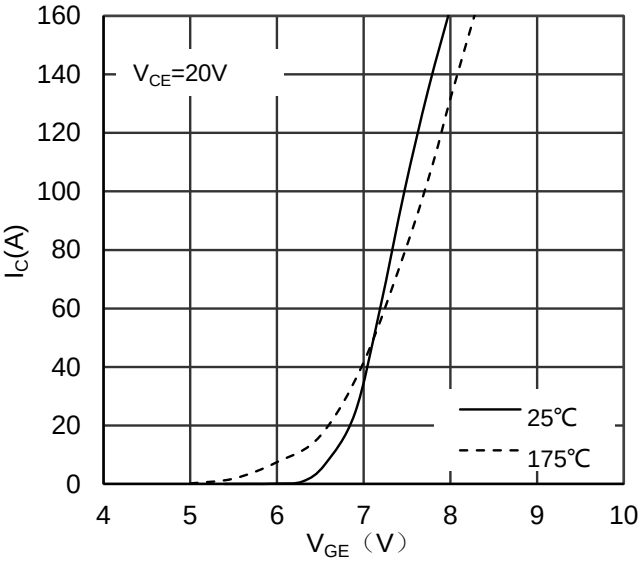


Figure 3. Typical Transfer characteristics

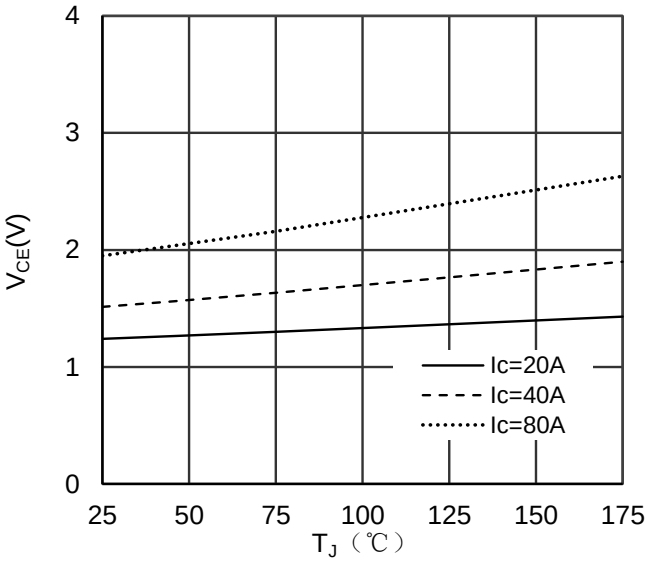


Figure 4. Collector-Emitter Voltage vs Junction temperature

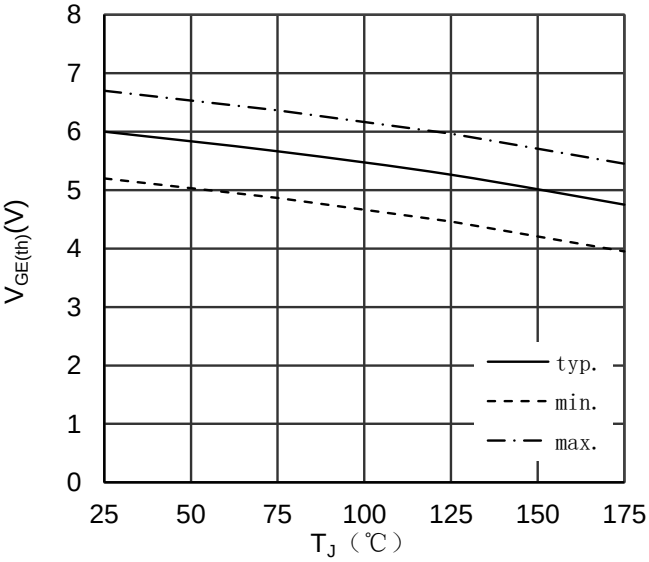


Figure 5. Gate-Emitter Threshold Voltage vs Junction temperature

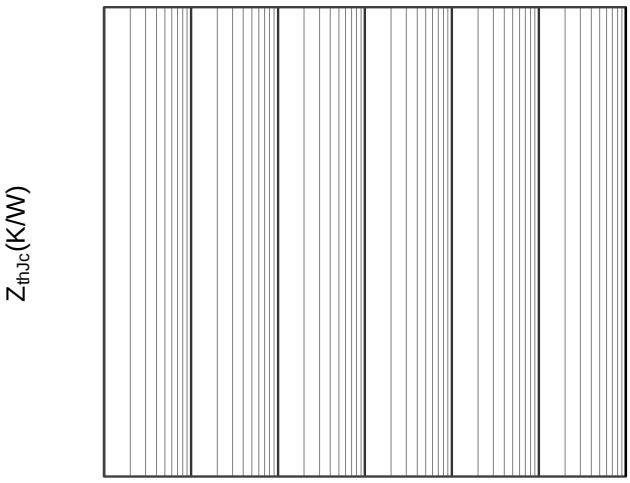


Figure 6. IGBT Transient Thermal Impedance

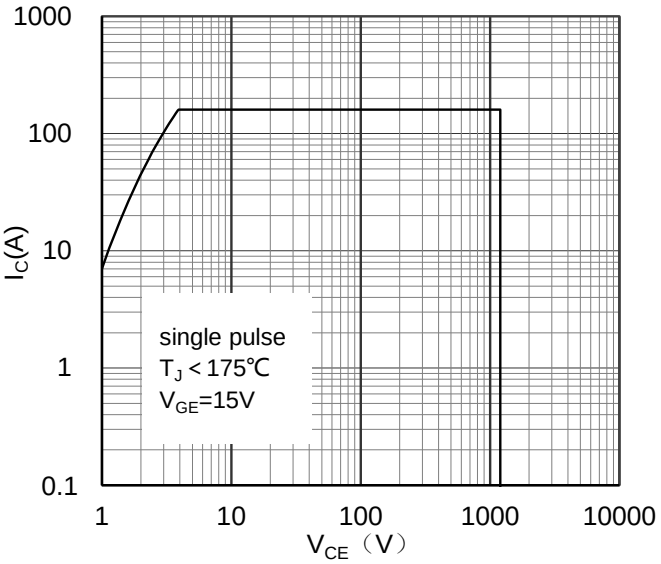


Figure 7. Forward Biased Safe Operating Area

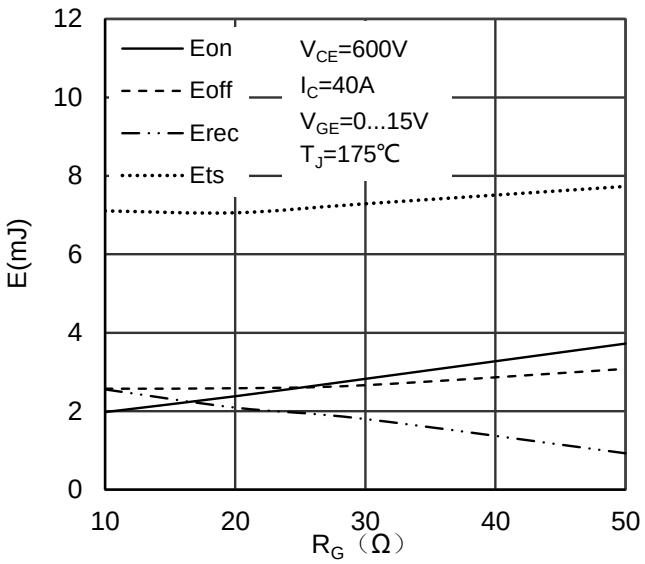


Figure 8. Switching Energy vs Gate Resistor

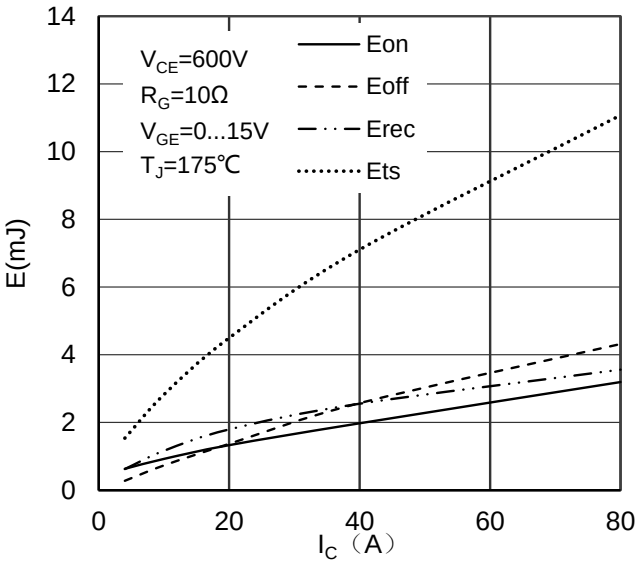


Figure 9. Switching Energy vs Collector Current

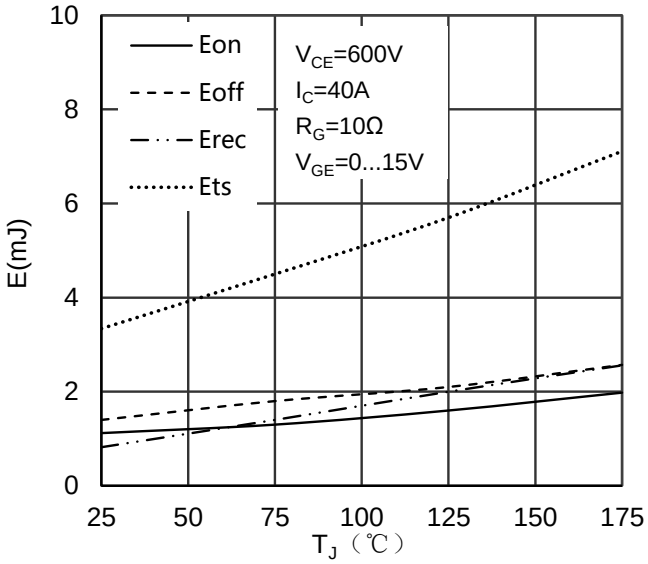


Figure10. Switching Energy vs Junction temperature

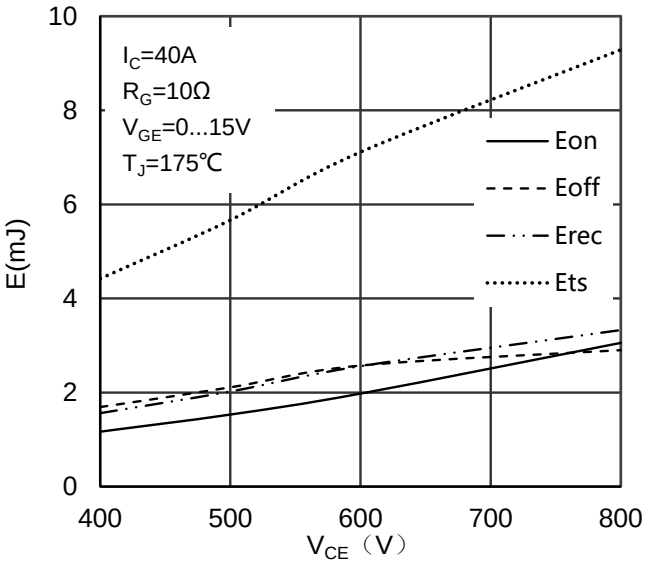


Figure 11. Switching Energy vs Collector-Emitter Voltage

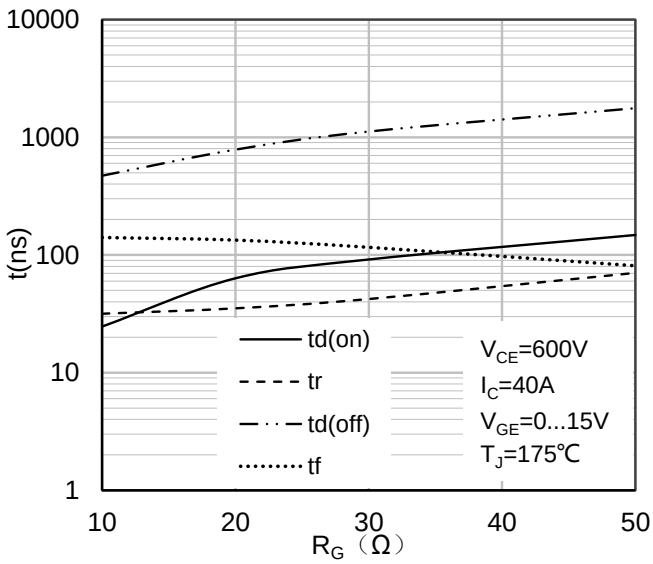


Figure 12. Switching Time vs Gate Resistor

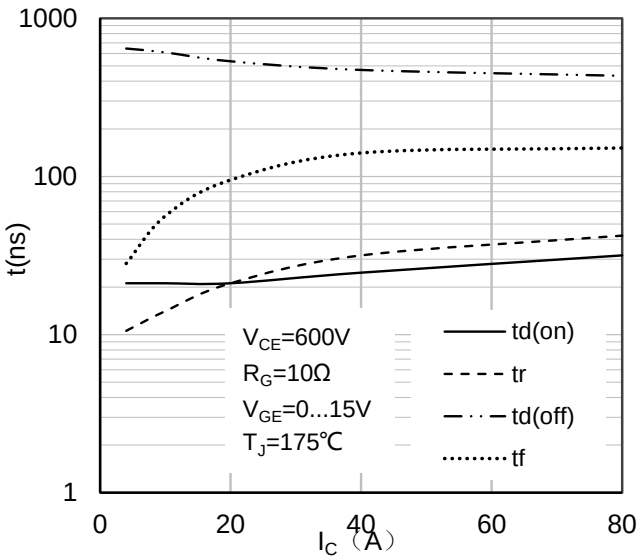


Figure 13. Switching Time vs Collector Current

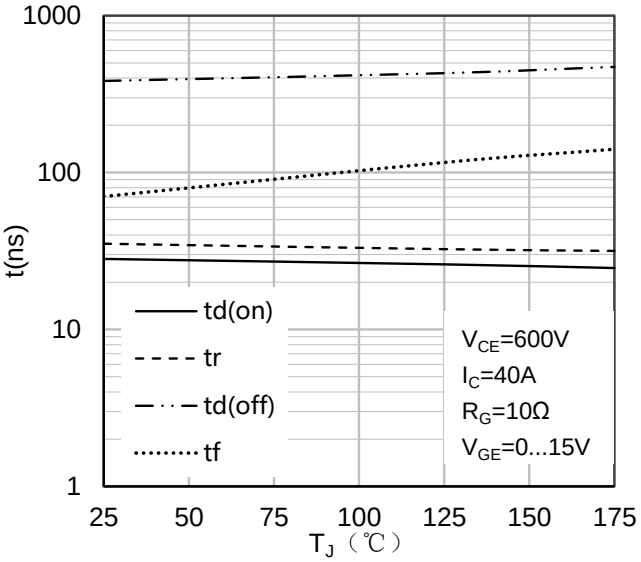


Figure14. Switching Time vs Junction temperature

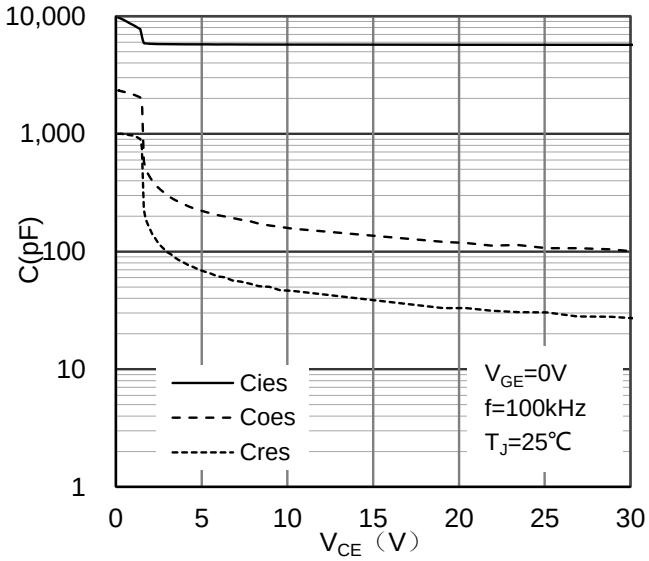


Figure 15. Typical capacitance

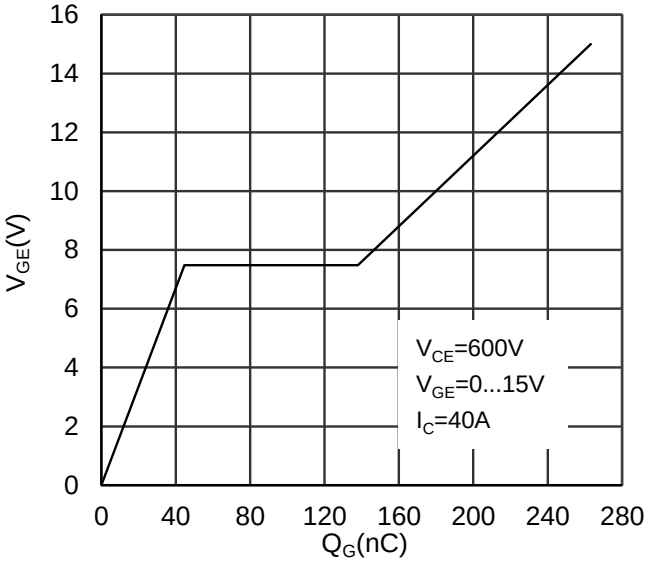


Figure 16. Typical Gate Charge

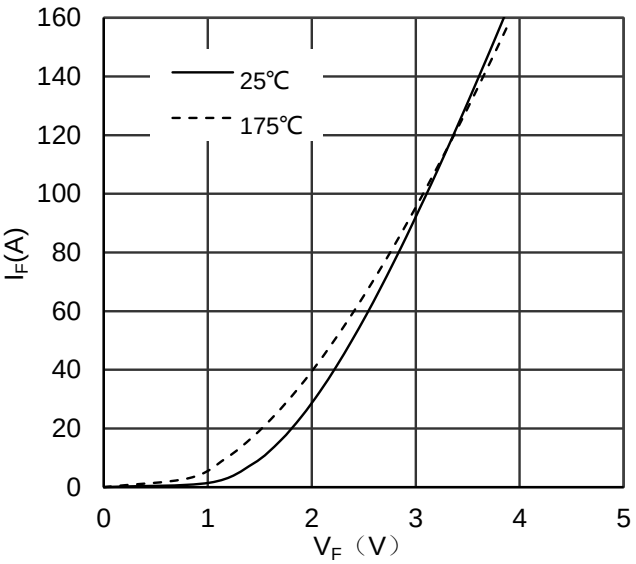


Figure 17. Diode Forward Characteristics

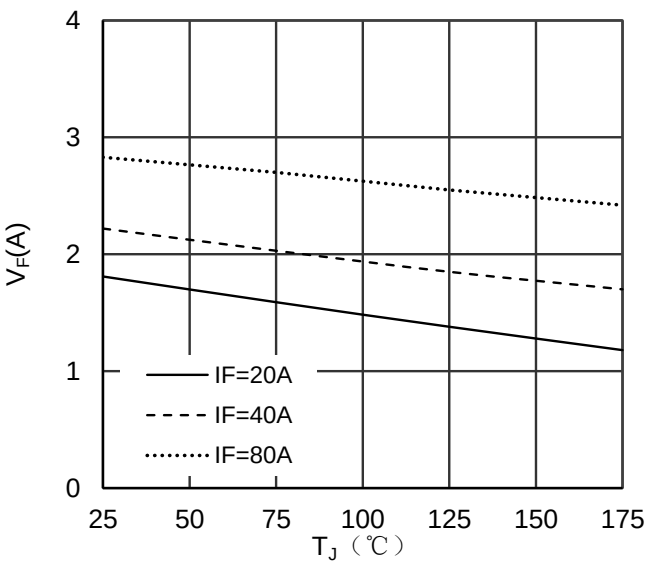


Figure 18. Forward Voltage vs Junction temperature Diode

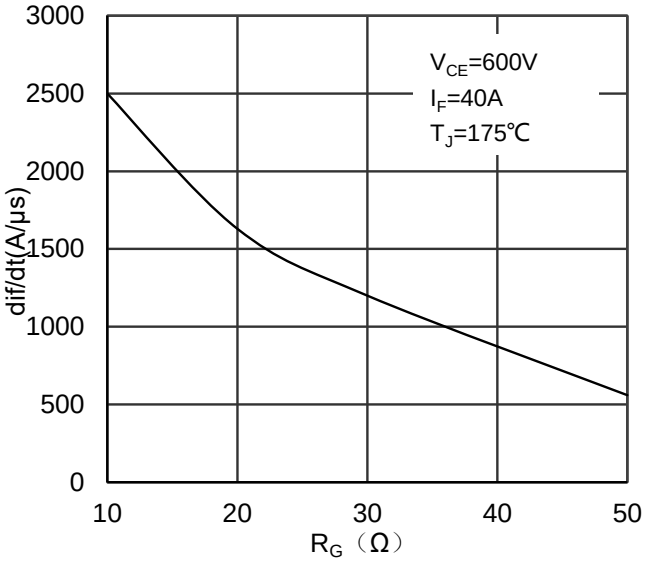


Figure 19. Typical Current Slope vs Gate Resistor Diode

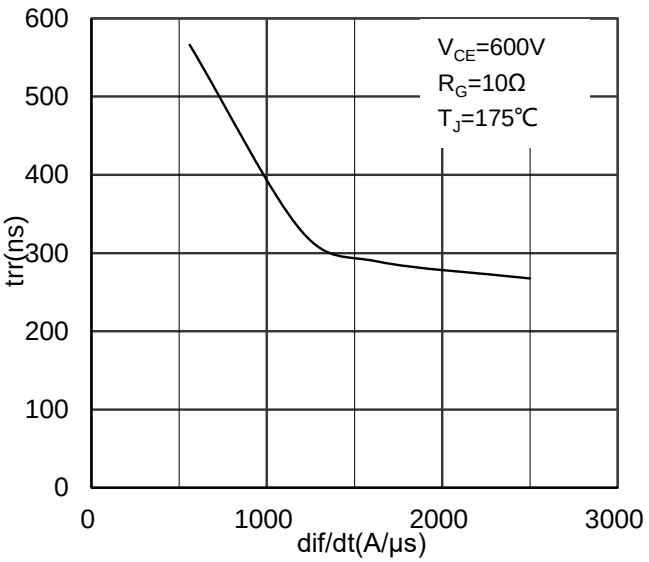


Figure 20. Typical Reverse Recovery Time vs Current Slope Diode

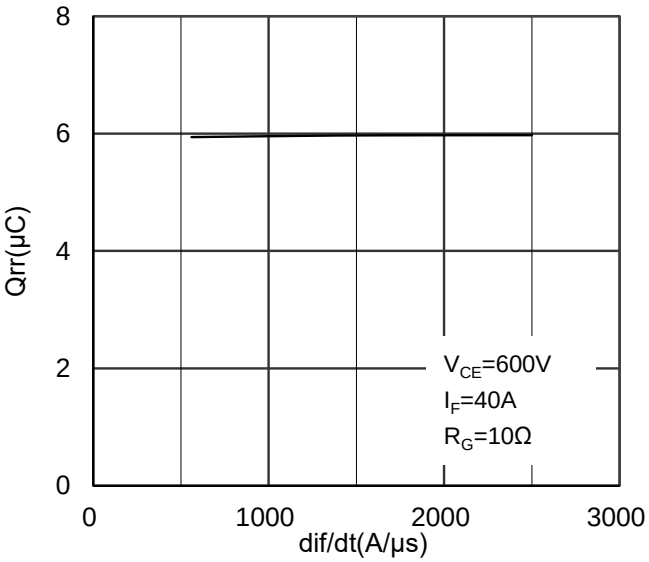


Figure 21. Typical Reverse Recovery Charge vs Current Slope Diode

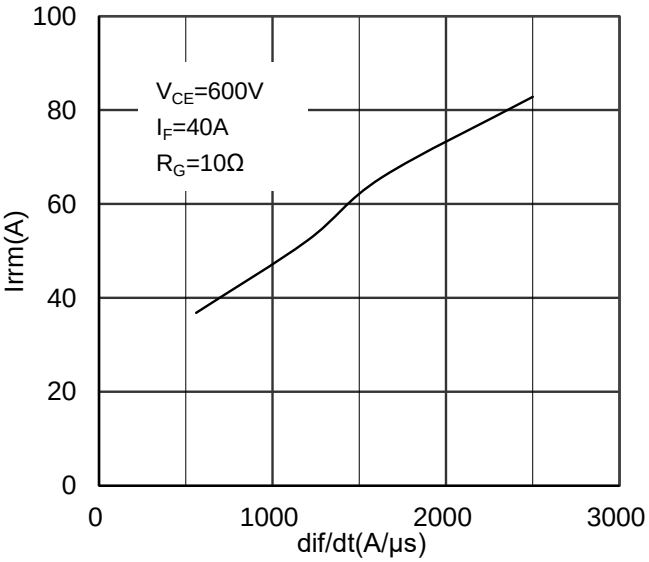


Figure 22. Typical Reverse Recovery Current vs Current Slope Diode

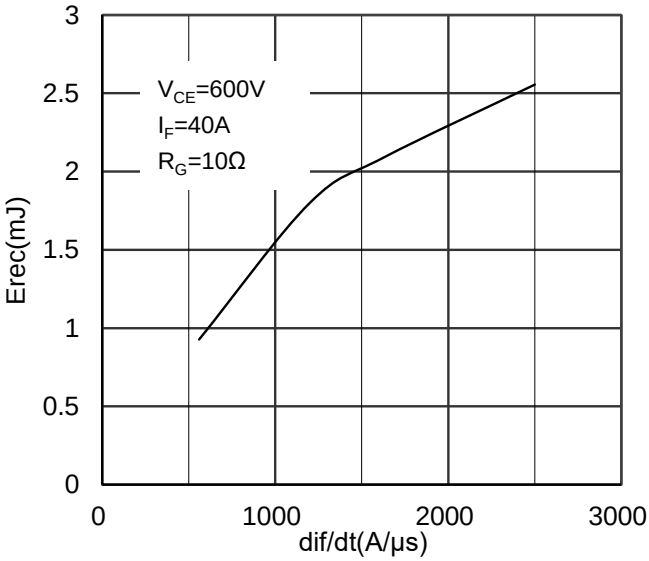


Figure 23. Typical Reverse Energy Losses vs Current Slope Diode

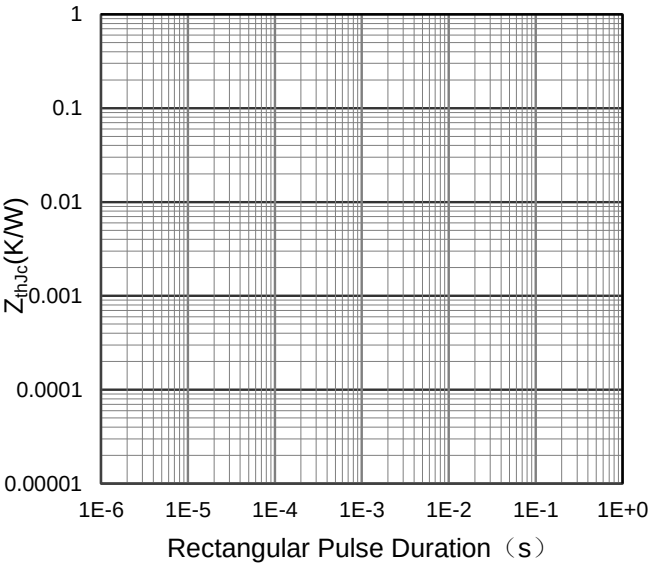
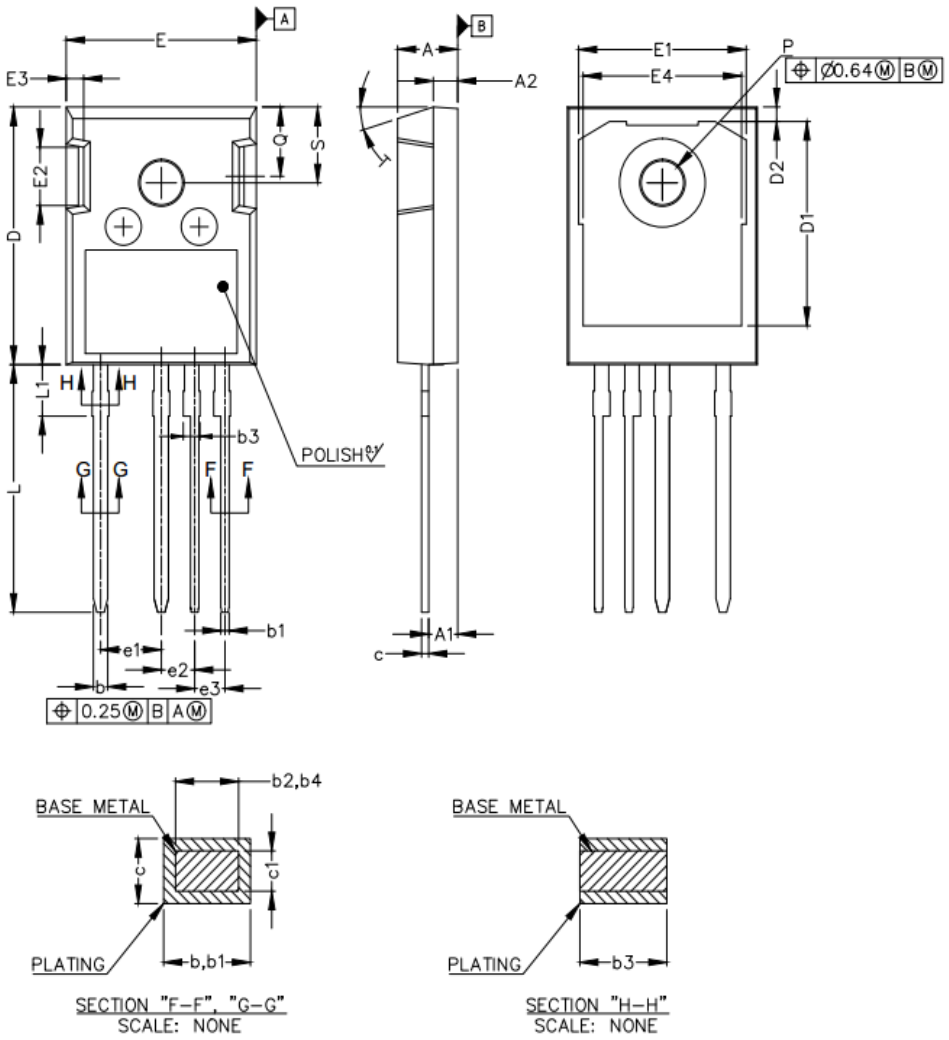


Figure 24. Diode Transient Thermal Impedance Diode



SYM	MILLIMETERS	
	MIN	MAX
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b	1.10	1.30
b1	0.65	0.79
b2	1.10	1.25
b3	1.34	1.44
b4	0.65	0.74
c	0.55	0.68
c1	0.55	0.65
D	20.80	21.10
D1	16.25	17.65
D2	0.95	1.25
E	15.75	16.13
E1	13.10	14.15
E2	4.32	5.10
E3	1.00	1.90
E4	12.38	13.43
e1	5.08 BSC	
e2	2.79 BSC	
e3	2.54 BSC	
L	19.72	20.32
L1	3.97	4.37
øP	3.51	3.65
Q	5.49	6.00
S	6.04	6.30
T	17.5° REF.	

Dimensions in (mm)

Figure 25. Package Outline