

1200V 40A Insulated Gate Bipolar Transistor

AKBK2A040WHH

Description:

Gen 2 IGBT with soft, fast recovery full current rated anti-parallel Emitter Controlled diode, providing ultra-low conduction loss . They are designed for applications such as UPS, inverters, etc.

Features:

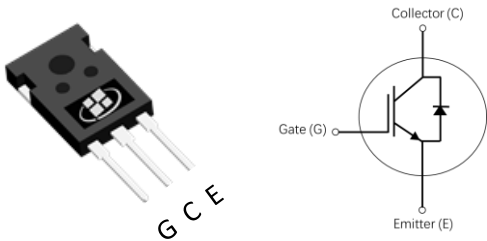
- 10μsec short circuit withstand time at $T_{VJ}=175^{\circ}\text{C}$
- Easy paralleling capability due to positive temperature coefficient in V_{CEsat}
- Low EMI
- Low Gate Charge Q_G
- Very soft, fast recovery full current anti-parallel diode
- Maximum junction temperature $T_{VJMAX}=175^{\circ}\text{C}$
- RoHS compliant ^(Note 1)
- Halogen-free ^(Note 1)

Applications:

- Industrial UPS
- Charger
- Energy Storage
- Three-phase Solar String Inverter

Key Performance Parameters:

Parameter	Value	Unit
V_{CE}	1200	V
$V_{CESAT}, T_{VJ} = 25^{\circ}\text{C}$	1.9	V
I_C	40	A



Ordering Information:

Ordering Code	Package Type	Marking Code	Form	Packing
AKBK2A040WHH	TO247-3L	BK2A040WHH	Tube	See the detail package information

Notes:

1. Contact ALKAIDSEMI sales for detail information

Maximum Ratings ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Value	Units
V_{CE}	Collector-Emitter Voltage	1200	V
I_C	Collector Current - Continuous ($T_C = 25^\circ\text{C}$) ^(Note 1)	80	A
	Collector Current - Continuous ($T_C = 100^\circ\text{C}$)	40	
I_{CM}	Collector Current - Pulsed ^(Note 2)	160	A
I_F	Diode Forward Current, Limited by T_{VJmax} ($T_C = 25^\circ\text{C}$)	80	A
	Diode Forward Current, Limited by T_{VJmax} ($T_C = 100^\circ\text{C}$)	40	
I_{FM}	Diode Pulsed Current, - Pulsed ^(Note 2)	160	A
V_{GE}	Gate-Emitter Voltage	± 20	V
	Transient Gate-Emitter Voltage ($t_p \leq 10\mu\text{s}$, $D < 0.010$)	± 30	
T_{SC}	Short Circuit Withstand Time $V_{GE} = 15.0\text{V}$, $V_{CC} \leq 400\text{V}$	10	μs
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	417	W
	Power Dissipation ($T_C = 100^\circ\text{C}$)	208	W
T_J	Operating Junction Temperature Range	-40 to +175	$^\circ\text{C}$
T_{STG}	Storage Temperature Range	-55 to +150	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	Value	Units
$R_{\theta JC}$	IGBT Thermal Resistance, Junction-to-Case, Steady-State	0.36	$^\circ\text{C/W}$
$R_{\theta JC}$	Diode Thermal Resistance, Junction-to-Case, Steady-State	0.45	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient Steady State	40	$^\circ\text{C/W}$

Notes:

1. The max collector current rating is package limited
2. Repetitive Rating: Pulse width limited by maximum junction temperature

Electrical Characteristics ($T_{VJ} = 25^{\circ}\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Static Characteristics						
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$V_{GE} = 0\text{ V}, I_C = 0.5\text{ mA}$	1200			V
V_{CESAT}	Collector-Emitter Saturation Voltage	$V_{GE} = 15\text{ V}, I_C = 40\text{ A}$	1.6	1.9	2.3	V
		$V_{GE} = 15\text{ V}, I_C = 40\text{ A}, T_{VJ} = 175^{\circ}\text{C}$		2.9		
V_F	Diode Forward Voltage	$V_{GE} = 0\text{ V}, I_F = 40\text{ A}$	1.6	1.9	2.3	V
		$V_{GE} = 0\text{ V}, I_F = 40\text{ A}, T_{VJ} = 175^{\circ}\text{C}$		1.95		
$V_{GE(TH)}$	Gate-Emitter Threshold Voltage	$V_{CE} = V_{GE}, I_C = 1.5\text{ mA}$	5.1	5.8	6.5	V
I_{CES}	Zero Gate Voltage Collector Current	$V_{CE} = 1200\text{ V}, V_{GE} = 0\text{ V}$			250	μA
		$V_{CE} = 1200\text{ V}, V_{GE} = 0\text{ V}, T_{VJ} = 175^{\circ}\text{C}$		3000		
I_{GES}	Gate-Emitter Leakage Current	$V_{GE} = \pm 20\text{ V}, V = 0\text{ V}$			± 100	nA
G_{FS}	Transconductance	$V_{GE} = 20\text{ V}, I_C = 40\text{ A}$		28		S

Dynamic Characteristics

C_{IES}	Input Capacitance	$V_{CE} = 25\text{ V}, V_{GS} = 0\text{ V},$ $F = 1\text{ MHz}$		5047		pF
C_{OES}	Output Capacitance			161		pF
C_{RES}	Reverse Transfer Capacitance			35		pF
Q_G	Total Gate Charge	$V_{CC} = 960\text{ V}, I_C = 40\text{ A},$ $V_{GE} = 15\text{ V}$		170		nC
Q_{GE}	Gate-Emitter Charge			37.5		nC
Q_{GC}	Gate-Collector Charge			68		nC
L_E	Internal Emitter Inductance			8		nH

Switching Characteristics, Inductive Load ($T_{VJ} = 25^{\circ}\text{C}$)

$T_{D(ON)}$	Turn On Delay Time	$V_{CC} = 600\text{ V}$ $I_C = 40\text{ A}$ $V_{GE} = 15\text{ V}$ $R_{Gon} = 12\ \Omega$ $R_{Goff} = 12\ \Omega$		46		ns
T_R	Rise Time			48		ns
$T_{D(OFF)}$	Turn Off Delay Time			194.4		ns
T_F	Fall Time			99		ns
E_{ON}	Turn On Energy			2.62		mJ
E_{OFF}	Turn Off Energy			1.55		mJ
E_{TOTAL}	Total Switching Energy			4.17		mJ

Diode Characteristics

T_{RR}	Reverse recovery time	$V_R = 600\text{ V}, I_R = 40\text{ A},$ $di/dt = 600\text{ A}/\mu\text{s}$		270.8		ns
Q_{RR}	Reverse recovery charge			1.7		μC
I_{RRM}	Peak Reverse Recovery Current			19.2		A
di_{rr}/dt	Diode Peak Rate of Fall of Reverse Recovery Current			-74.5		A/ μs

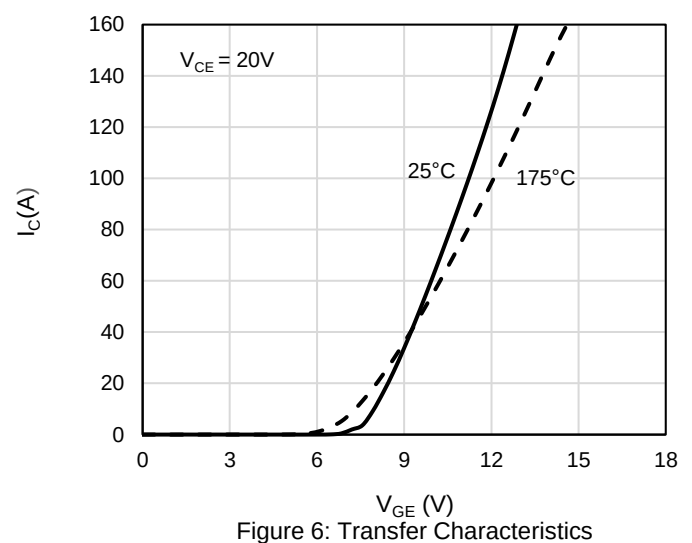
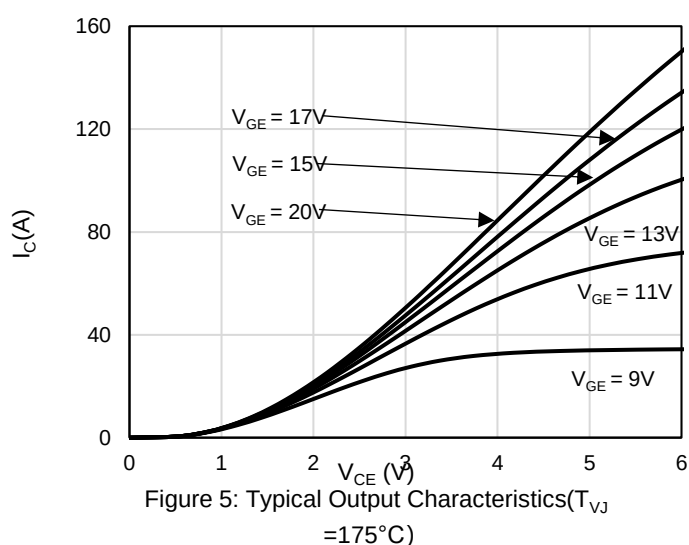
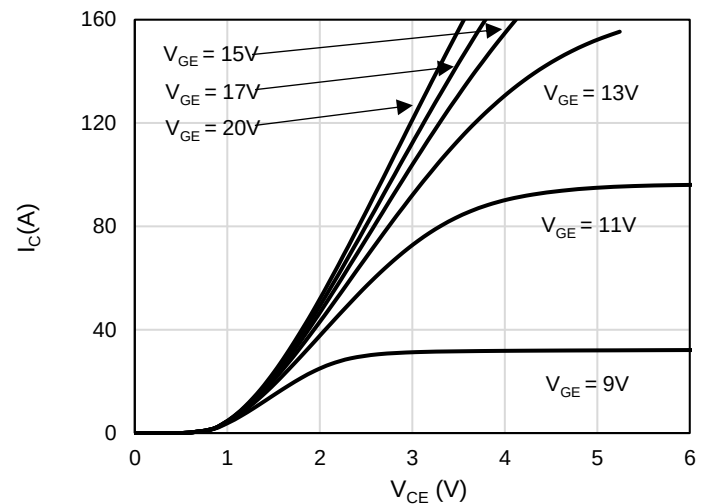
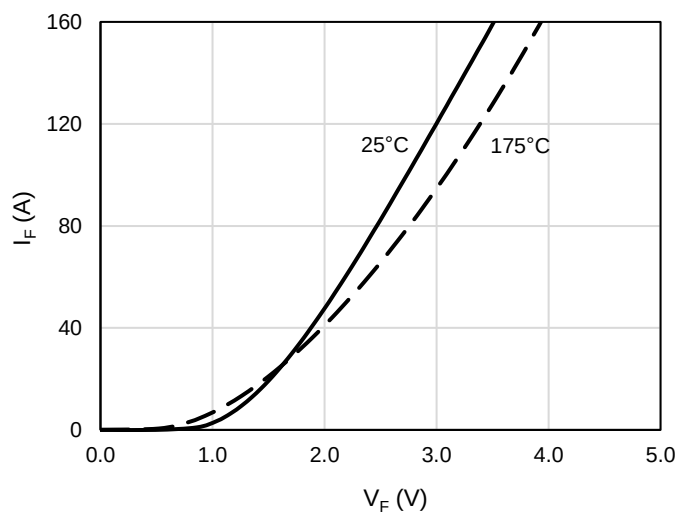
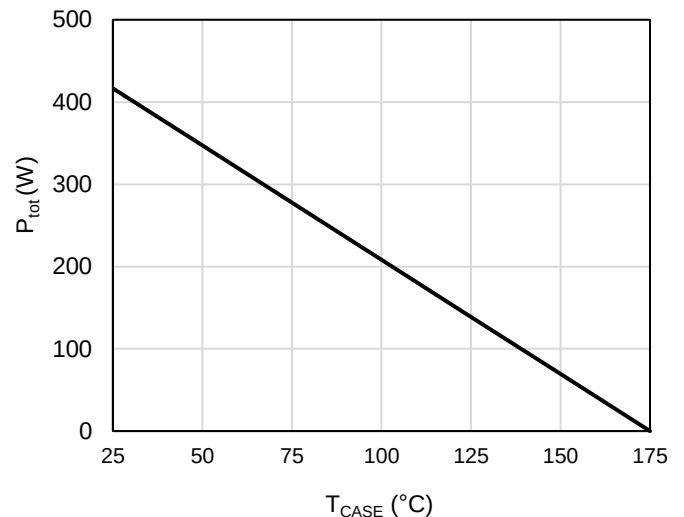
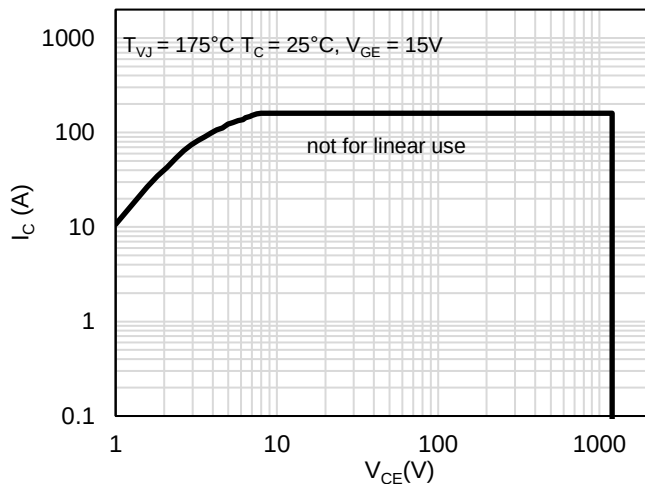
Switching Characteristics, Inductive Load ($T_{VJ} = 175^\circ\text{C}$)

$T_{D(ON)}$	Turn On Delay Time	$V_{CC} = 600\text{ V}$ $I_C = 40\text{ A}$ $V_{GE} = 15\text{ V}$ $R_{Gon} = 12\ \Omega$ $R_{Goff} = 12\ \Omega$		45		ns
T_R	Rise Time			51		ns
$T_{D(OFF)}$	Turn Off Delay Time			223.5		ns
T_F	Fall Time			141		ns
E_{ON}	Turn On Energy			4.7		mJ
E_{OFF}	Turn Off Energy			2.3		mJ
E_{TOTAL}	Total Switching Energy			7		mJ

Diode Characteristics

T_{RR}	Reverse recovery time	$V_R = 600\text{ V}, I_R = 40\text{ A},$ $di/dt = 600\text{ A}/\mu\text{s}$		418		ns
Q_{RR}	Reverse recovery charge			5		μC
I_{RRM}	Peak Reverse Recovery Current			30.5		A
di_{rr}/dt	Diode Peak Rate of Fall of Reverse Recovery Current			-74		A/ μs

Electrical Characteristics Diagrams



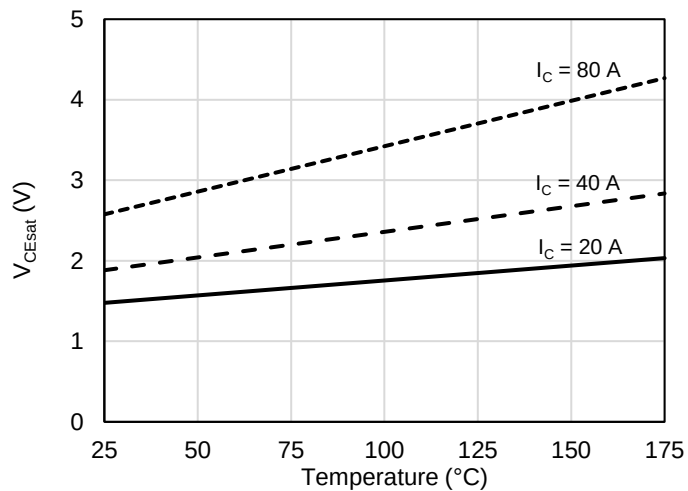


Figure 7: Collect-emitter Saturation Voltage vs. Junction Temperature

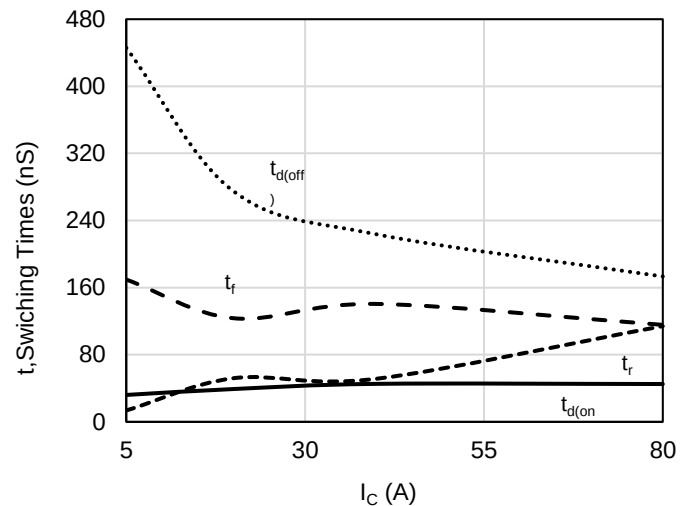


Figure 8: Switching Times vs. Collector Current

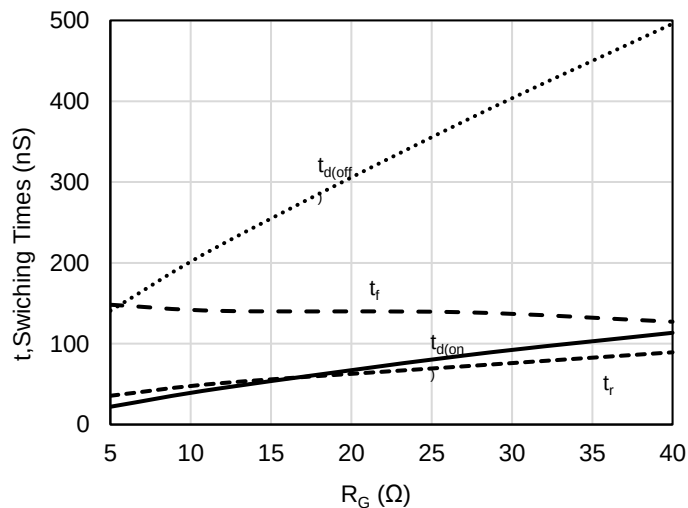


Figure 9: Switching Times vs. Gate Resistor

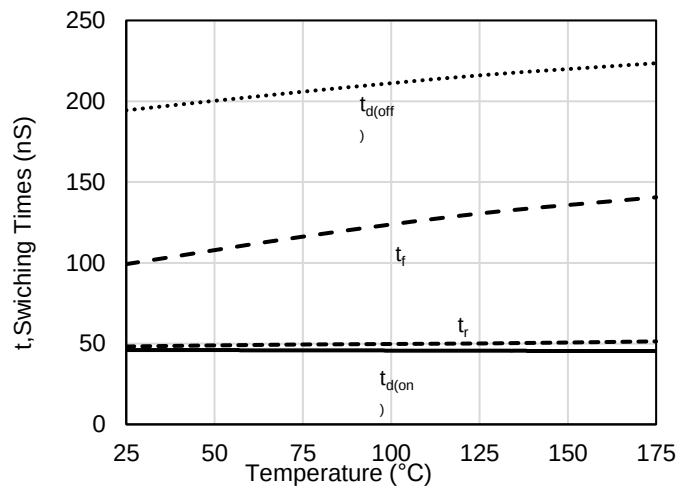


Figure 10: Switching Times vs. Junction Temperature

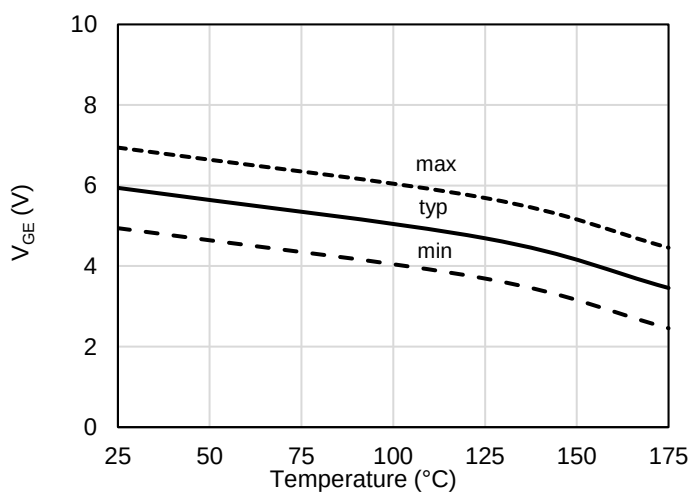


Figure 11: Threshold voltage vs. Junction Temperature

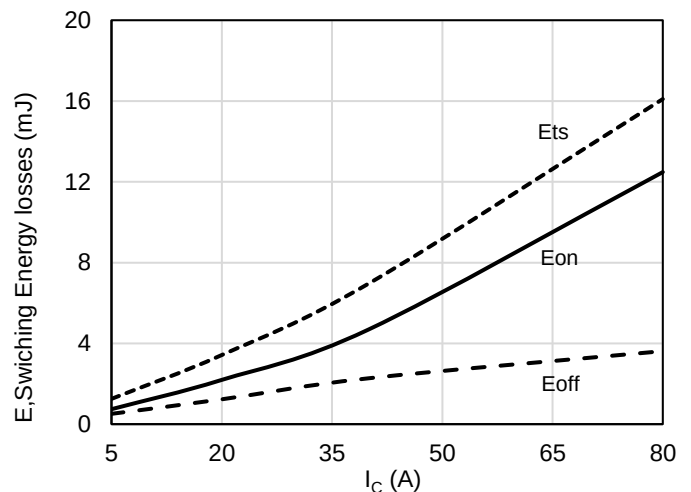
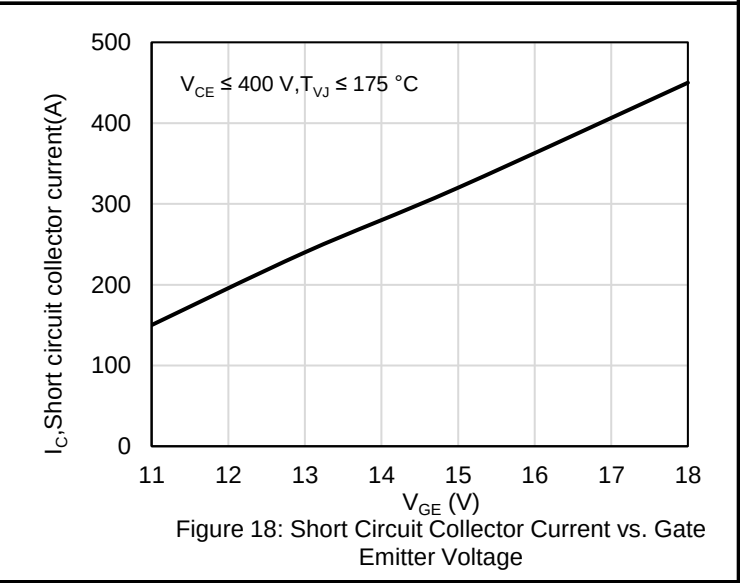
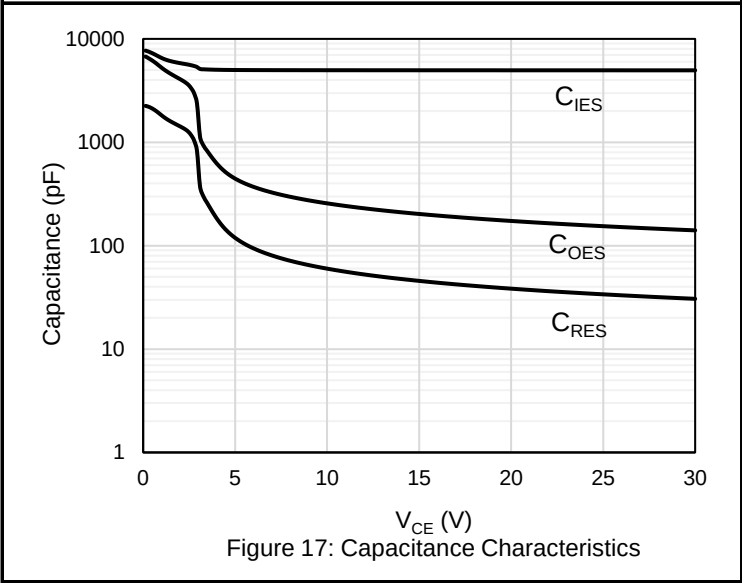
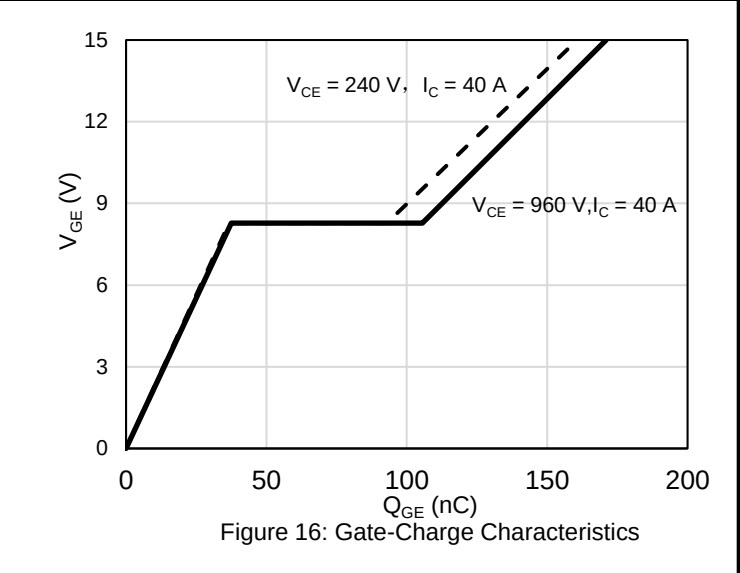
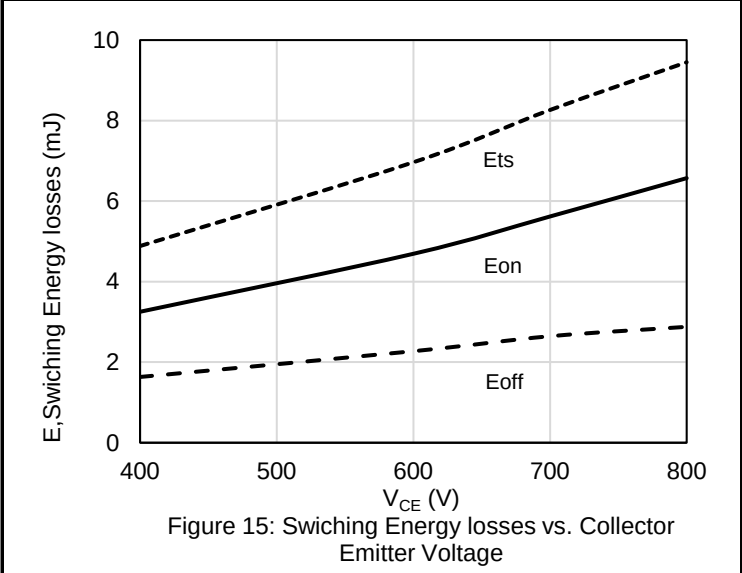
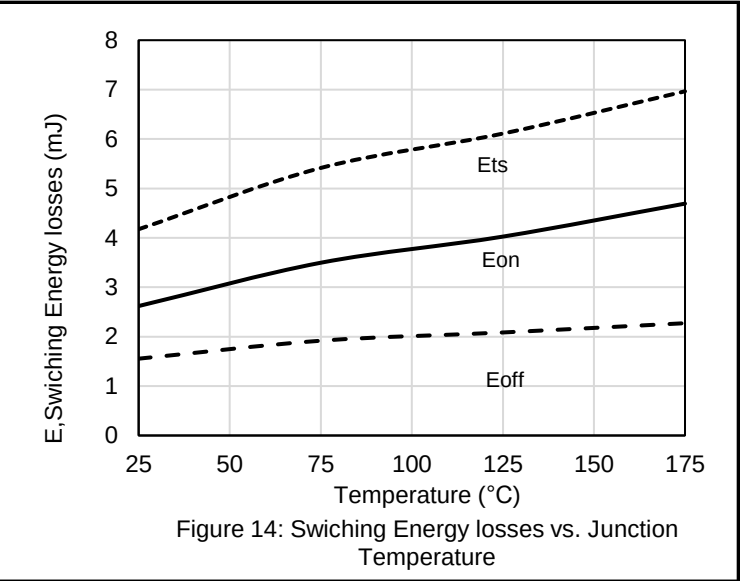
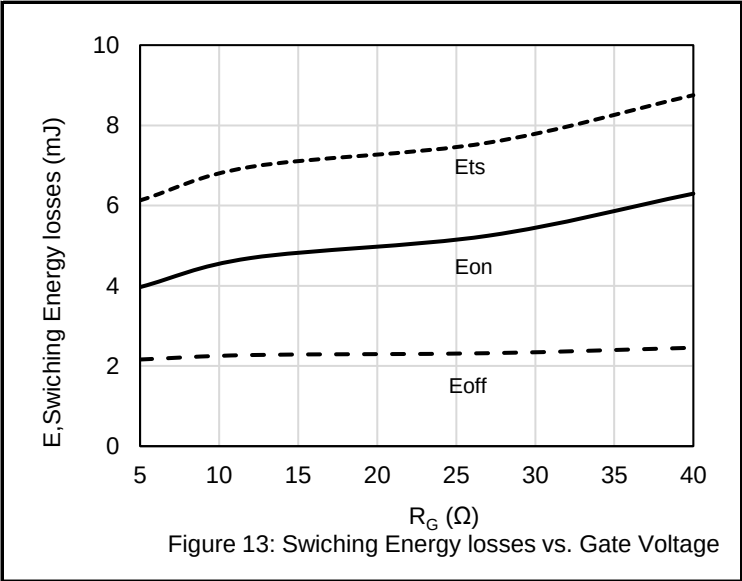


Figure 12: Switching Energy losses vs. Collector Current



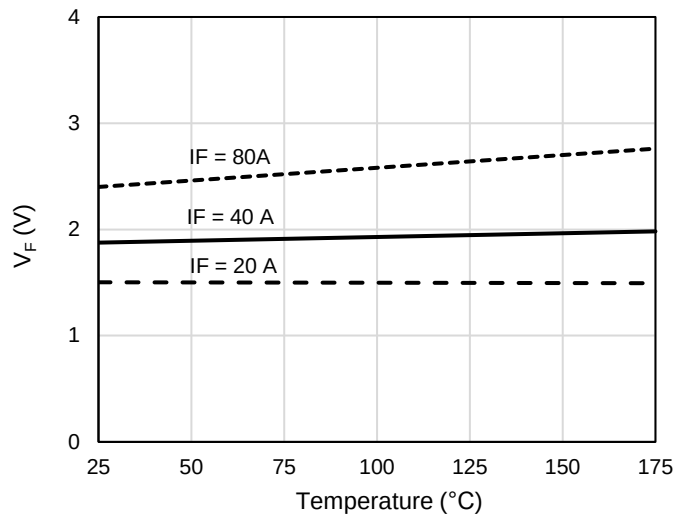


Figure 19: Diode Forward Voltage vs. Junction Temperature

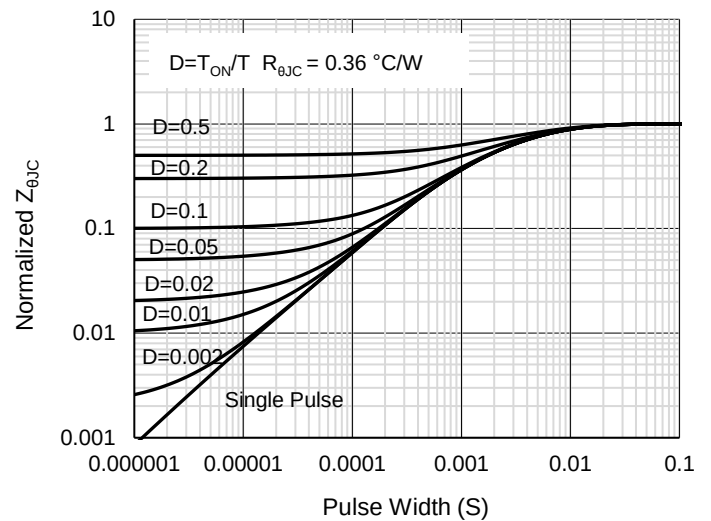


Figure 20: Normalized Maximum IGBT Transient...

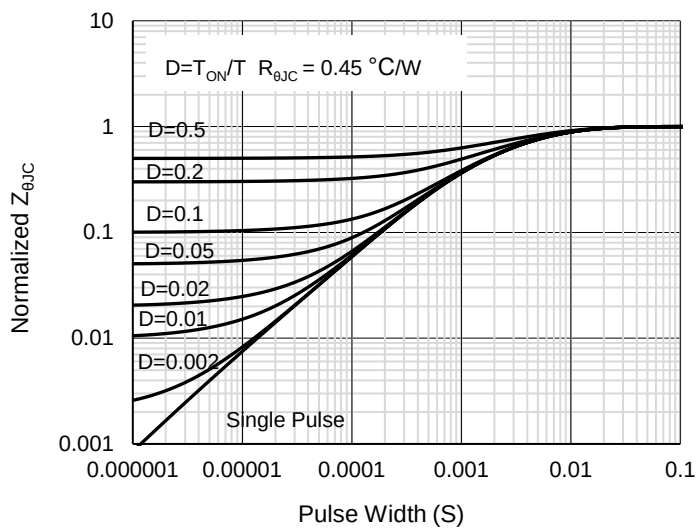


Figure 21: Normalized Maximum Diode Transient Thermal Impedance

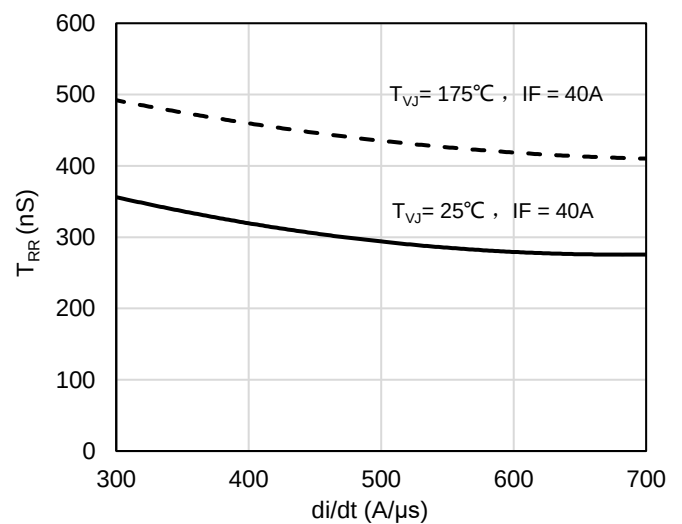


Figure 22: Reverse Recovery Time vs. Diode Current Slope

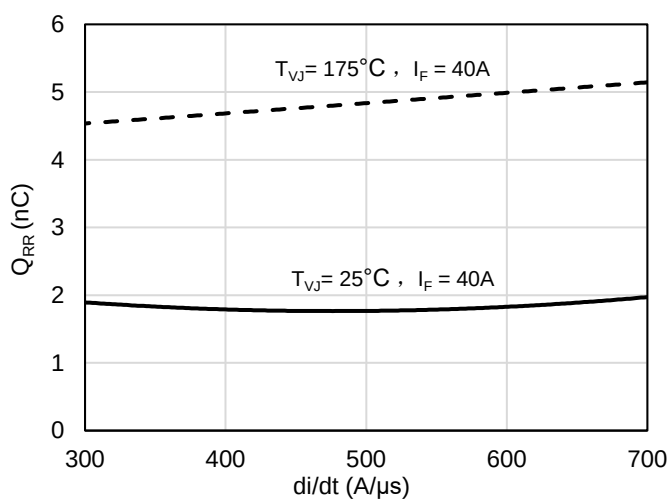


Figure 23: Reverse Recovery Charge vs. Diode Current Slope

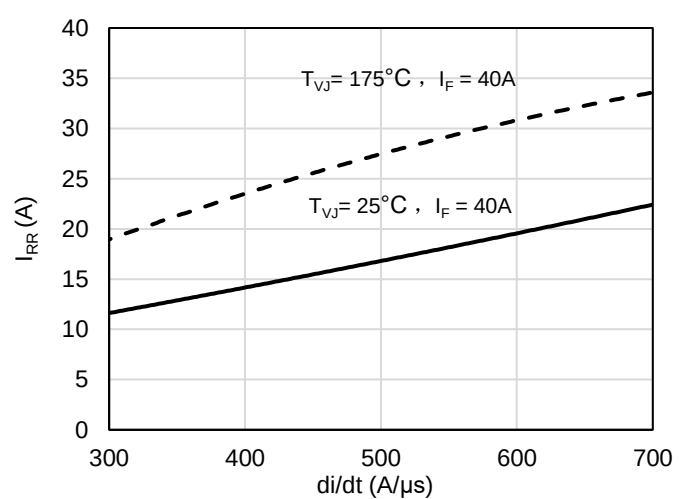
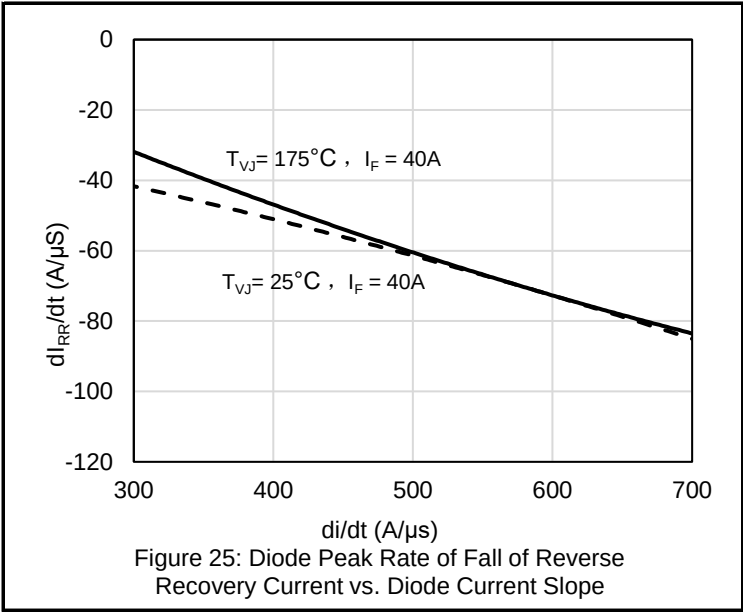
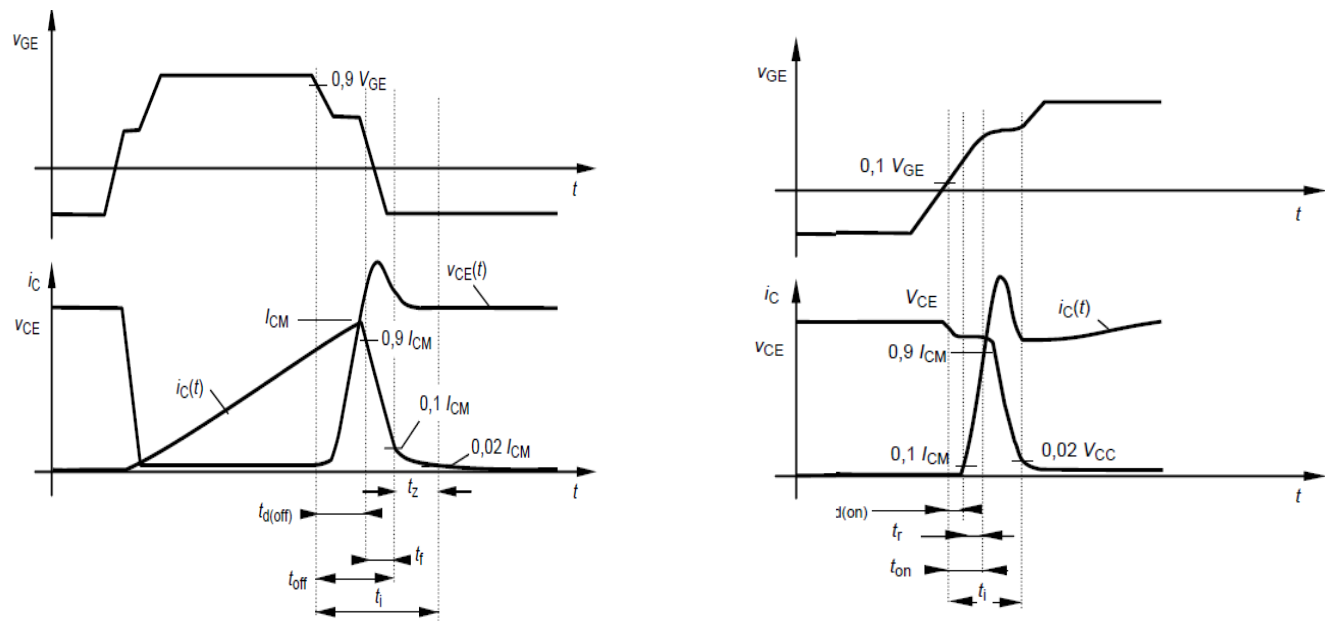


Figure 24: Reverse Recovery Current vs. Diode Current Slope

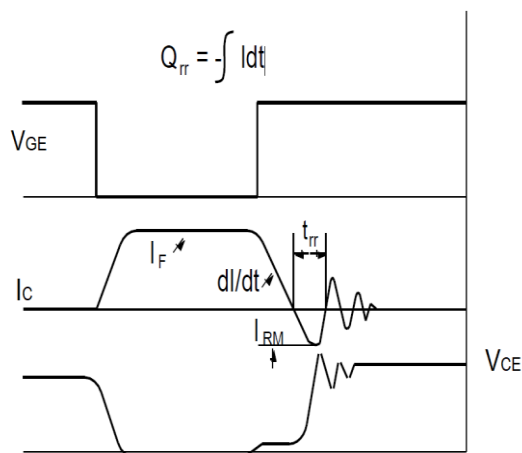
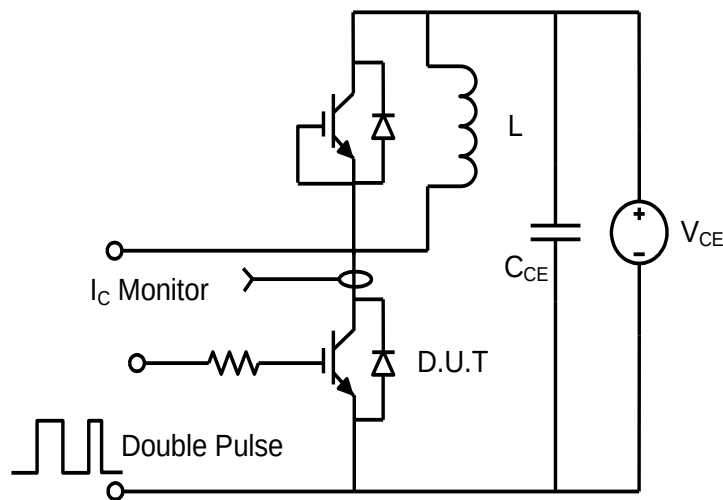


Test Circuit and Waveform

Switching Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



Revision History

Revision	Release Date	Remark
Rev.1.2	2023/03	

Disclaimer

The information given in this document describes the independent performance of the product, but similar performance is not guaranteed under other working conditions, and cannot be guaranteed when installed with other products or equipment. To achieve the required performance of the product in actual scenarios, the customer should conduct a complete application test to assess the functionality of the product.

Alkaidsemi assumes no responsibility for equipment failures result from using products at values that exceed the ratings, operating conditions, or other parameters listed in the product specifications.

The product described in this specification is not applicable for aerospace or other applications which requires high reliability. Customers using or selling these products for use in medical, life-saving, or life-sustaining applications do so at their own risk and agree to fully indemnify.

Due to product or technical improvements, the information described or contained herein may be changed without prior notice.