

650V 40A Insulated Gate Bipolar Transistor
AKB65A040DHH-A

Description:

Gen 3 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. AEC-Q101 Qualified. PPAP capable.

Features:

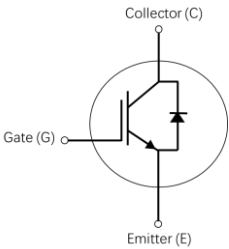
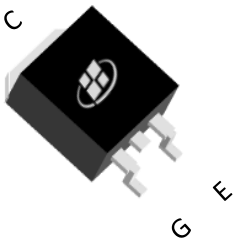
- Easy paralleling capability due to positive temperature coefficient in V_{CEsat}
- Low EMI
- Low Gate Charge
- Very soft, fast recovery full current anti-parallel diode
- Maximum junction temperature $T_{VJmax}=175^{\circ}C$
- RoHS compliant ^(Note 1)
- Halogen-free ^(Note 1)
- AEC-Q101 Qualified and PPAP capable

Applications:

- Industrial UPS
- Charger
- Energy Storage
- Three-Phase Solar String Inverter
- OBC
- HVAC
- PTC

Key Performance Parameters:

Parameter	Value	Unit
V_{CE}	650	V
$V_{CEsat}, T_{VJ} = 25^{\circ}C$	1.60	V
I_C	40	A



Ordering Information:

Ordering Code	Package Type	Marking Code	Form	Packing
AKB65A040DHH-A	TO-263	B65A040DHH	Tape Reel	1000 PCS

Notes:

1. Contact ALKAIDSEMI sales for detail information



Maximum Ratings (T_{VJ} = 25°C unless otherwise noted)

Symbol	Parameter	Value	Units
V _{CE}	Collector-Emitter Voltage	650	V
I _C	Collector Current - Continuous (T _C = 25°C) ^(Note 1)	74	A
	Collector Current - Continuous (T _C = 100°C)	46	A
I _{CM}	Collector Current - Pulsed ^(Note 2)	160	A
I _F	Diode Forward Current, Limited by T _{VJmax} (T _C = 25°C)	60	A
	Diode Forward Current, Limited by T _{VJmax} (T _C = 100°C)	40	A
I _{FM}	Diode Pulsed Current, - Pulsed ^(Note 2)	160	A
V _{GE}	Gate-Emitter Voltage	±20	V
	Transient Gate-Emitter Voltage (tp ≤ 10µs, D < 0.010)	±30	
P _D	Power Dissipation (T _C = 25°C)	250	W
	Power Dissipation (T _C = 100°C)	125	W
T _{VJ}	Operating Junction Temperature Range	-40 to +175	°C
T _{STG}	Storage Temperature Range	-55 to +150	°C

Thermal Characteristics

Symbol	Parameter	Value	Units
R _{θJC}	IGBT Thermal Resistance, Junction-to-Case, Steady-State	0.6	°C/W
R _{θJC}	Diode Thermal Resistance, Junction-to-Case, Steady-State	0.75	°C/W
R _{θJA}	Thermal Resistance, Junction-to-Ambient Steady State	50	°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°C unless otherwise noted)						
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Static Characteristics						
V _{(BR)CES}	Collector-Emitter Breakdown Voltage	V _{GE} = 0 V, I _C = 0.2 mA	650			V
V _{CESat}	Collector-Emitter Saturation Voltage	V _{GE} = 15 V, I _C = 40 A		1.60	2.10	V
		V _{GE} = 15 V, I _C = 40 A, T _{VJ} = 125°C		1.84		
		V _{GE} = 15 V, I _C = 40 A, T _{VJ} = 175°C		2.01		
V _F	Diode Forward Voltage	V _{GE} = 0 V, I _F = 40 A		1.45	1.85	V
		V _{GE} = 0 V, I _F = 40 A, T _{VJ} = 125°C		1.52		
		V _{GE} = 0 V, I _F = 40 A, T _{VJ} = 175°C		1.51		
V _{GE(th)}	Gate-Emitter Threshold Voltage	V _{CE} = V _{GE} , I _C = 0.4 mA	3.2	4.0	4.8	V
I _{CES}	Zero Gate Voltage Collector Current	V _{CE} = 650 V, V _{GE} = 0 V			50	µA
		V _{CE} = 650 V, V _{GE} = 0 V, T _{VJ} = 175°C		2000		
I _{GES}	Gate-Emitter Leakage Current	V _{GE} = ± 20 V, V _{CE} = 0 V			100	nA
g _{fs}	Transconductance	V _{GE} = 20 V, I _C = 40 A		49		S
Dynamic Characteristics						
C _{ies}	Input Capacitance	V _{CE} = 25 V, V _{GE} = 0 V, F = 1 MHz		1495		pF
C _{oes}	Output Capacitance			115		pF
C _{res}	Reverse Transfer Capacitance			14		pF
Q _G	Total Gate Charge	V _{CC} = 520 V , I _C = 40 A, V _{GE} = 15 V		56		nC
Q _{GE}	Gate-Emitter Charge			8		nC
Q _{GC}	Gate-Collector Charge			19		nC
L _E	Internal Emitter Inductance			8		nH
Switching Characteristics, Inductive Load (T _{VJ} = 25°C)						
t _{d(on)}	Turn On Delay Time	V _{CC} = 400 V I _C = 40 A V _{GE} = 15 V R _{G(on)} = 15 Ω R _{G(off)} = 15 Ω		25		ns
t _r	Rise Time			34		ns
t _{d(off)}	Turn Off Delay Time			108		ns
t _f	Fall Time			32		ns
E _{on}	Turn On Energy			1.10		mJ
E _{off}	Turn Off Energy			0.46		mJ
E _{total}	Total Switching Energy			1.56		mJ



$t_{d(on)}$	Turn On Delay Time	$V_{CC} = 400\text{ V}$ $I_C = 20\text{ A}$ $V_{GE} = 15\text{ V}$ $R_{G(on)} = 15\text{ }\Omega$ $R_{G(off)} = 15\text{ }\Omega$		16		ns
t_r	Rise Time			10		ns
$t_{d(off)}$	Turn Off Delay Time			142		ns
t_f	Fall Time			10		ns
E_{on}	Turn On Energy			0.42		mJ
E_{off}	Turn Off Energy			0.20		mJ
E_{total}	Total Switching Energy			0.62		mJ

Diode Characteristics ($T_{VJ} = 25^{\circ}\text{C}$)

t_{rr}	Reverse Recovery Time	$V_R = 400\text{ V}, I_F = 40\text{ A},$ $di/dt = 1400\text{ A}/\mu\text{s}$		138		ns
Q_{rr}	Reverse Recovery Charge			1.97		μC
I_{rrm}	Peak Reverse Recovery Current			21		A
d_{irr}/dt	Diode Peak Rate of Fall of Reverse Recovery Current			-1270		$\text{A}/\mu\text{s}$

t_{rr}	Reverse Recovery Time	$V_R = 400\text{ V}, I_F = 20\text{ A},$ $di/dt = 1400\text{ A}/\mu\text{s}$		104		ns
Q_{rr}	Reverse Recovery Charge			1.30		μC
I_{rrm}	Peak Reverse Recovery Current			22		A
d_{irr}/dt	Diode Peak Rate of Fall of Reverse Recovery Current			-1500		$\text{A}/\mu\text{s}$

Switching Characteristics, Inductive Load ($T_{VJ} = 150^{\circ}\text{C}$)

$t_{d(on)}$	Turn On Delay Time	$V_{CC} = 400\text{ V}$ $I_C = 40\text{ A}$ $V_{GE} = 15\text{ V}$ $R_{G(on)} = 15\text{ }\Omega$ $R_{G(off)} = 15\text{ }\Omega$		23		ns
t_r	Rise Time			28		ns
$t_{d(off)}$	Turn Off Delay Time			132		ns
t_f	Fall Time			33		ns
E_{on}	Turn On Energy			1.44		mJ
E_{off}	Turn Off Energy			0.50		mJ
E_{total}	Total Switching Energy			1.94		mJ



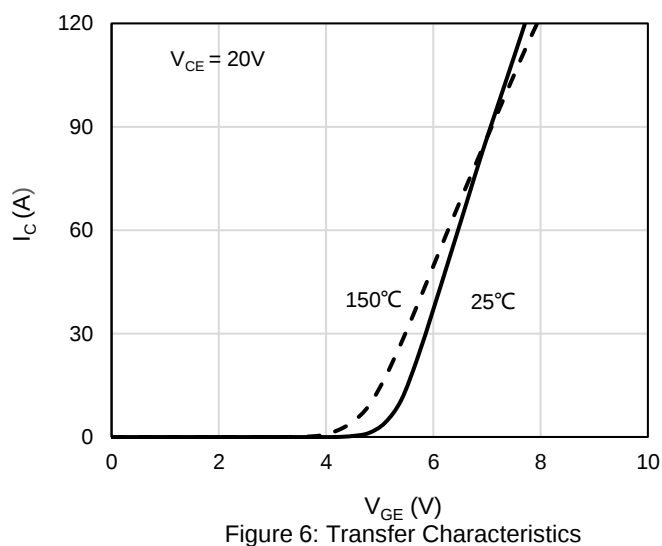
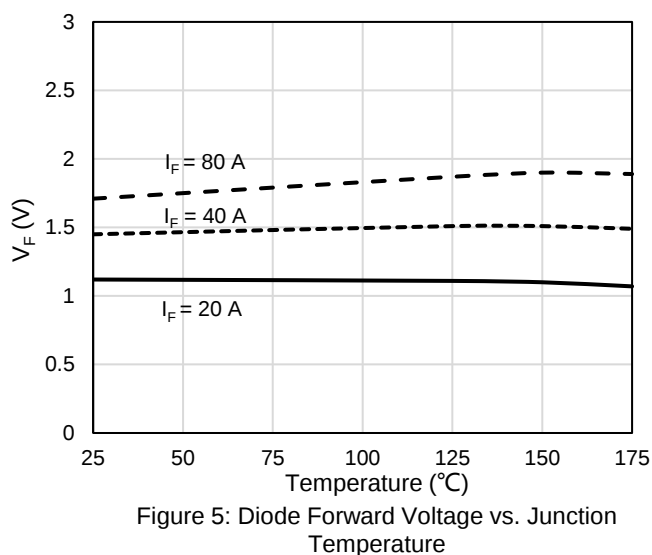
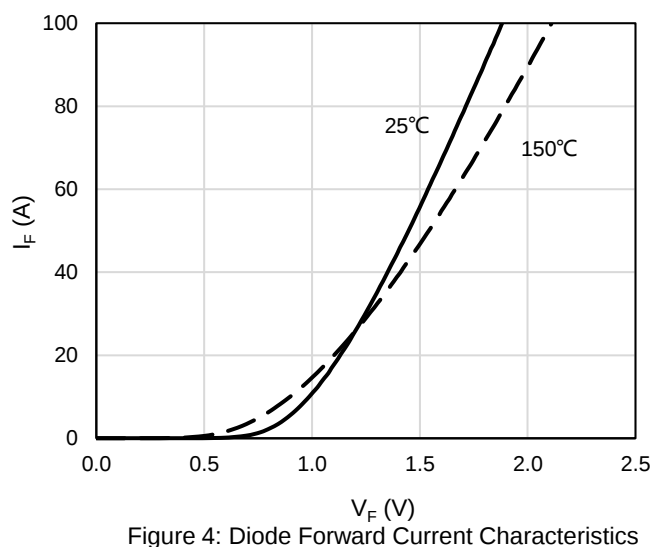
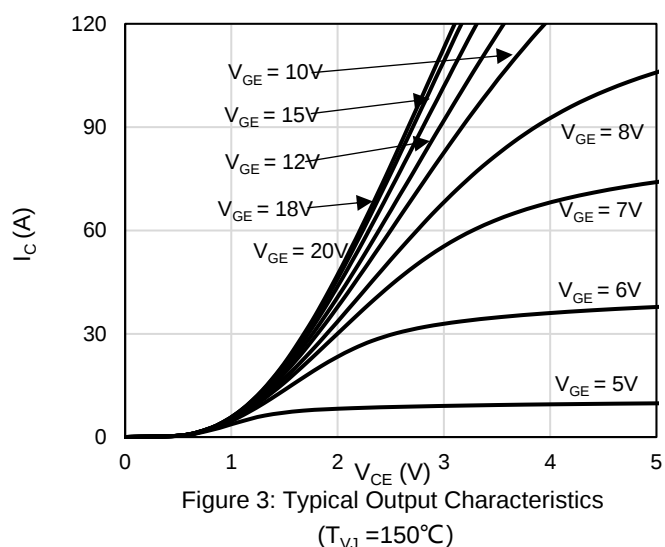
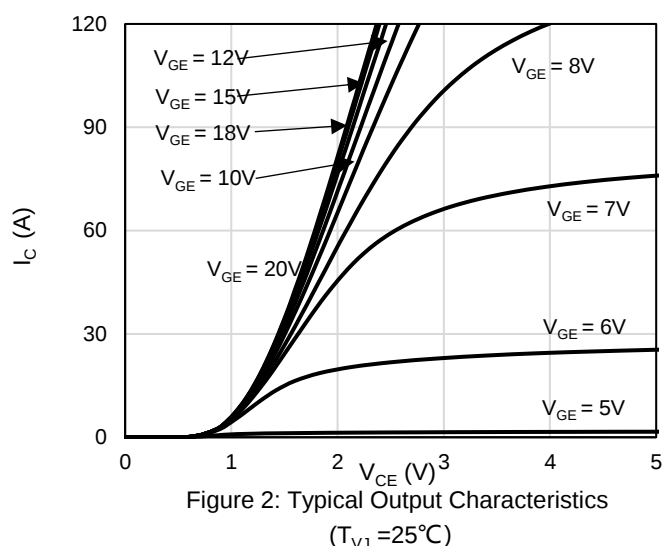
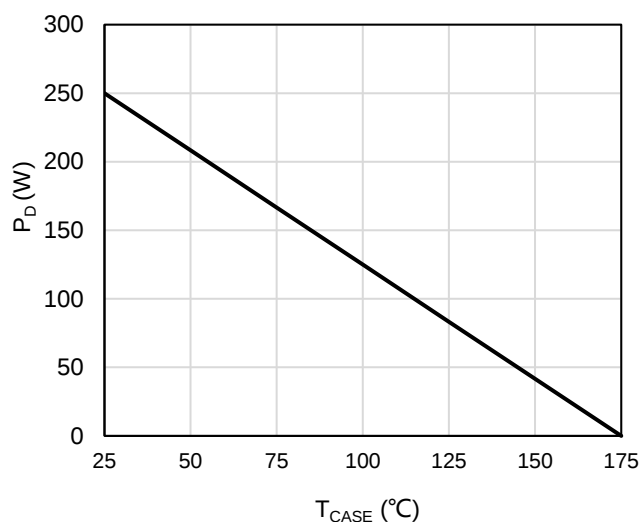
$t_{d(on)}$	Turn On Delay Time	$V_{CC} = 400\text{ V}$ $I_C = 20\text{ A}$ $V_{GE} = 15\text{ V}$ $R_{G(on)} = 15\text{ }\Omega$ $R_{G(off)} = 15\text{ }\Omega$		20		ns
t_r	Rise Time			16		ns
$t_{d(off)}$	Turn Off Delay Time			147		ns
t_f	Fall Time			59		ns
E_{on}	Turn On Energy			0.62		mJ
E_{off}	Turn Off Energy			0.23		mJ
E_{total}	Total Switching Energy			0.85		mJ

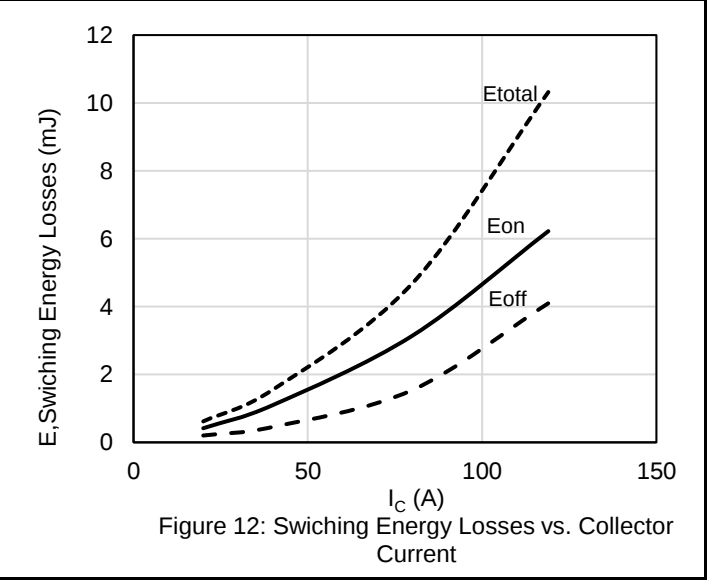
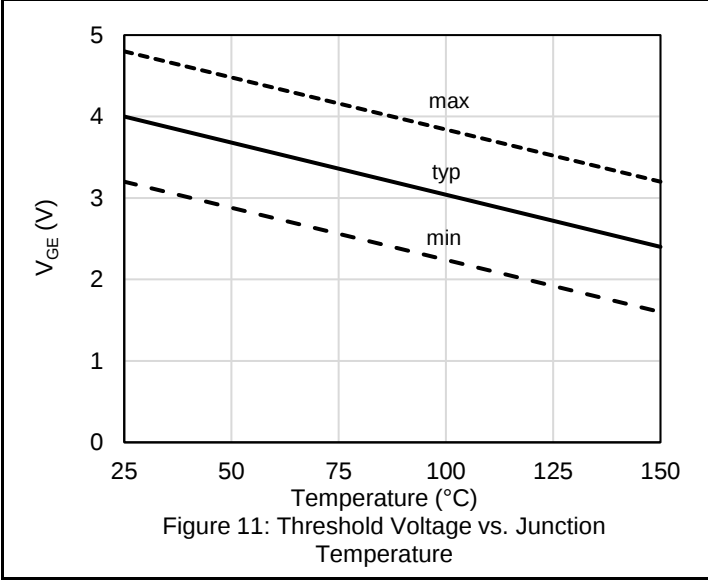
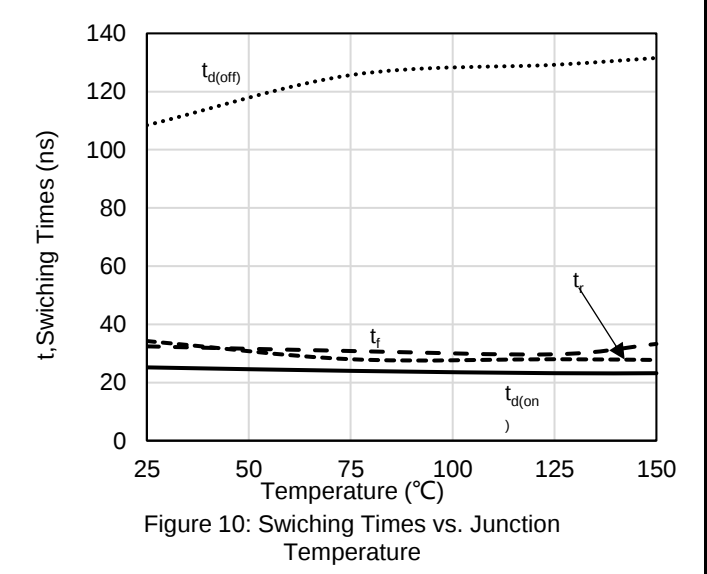
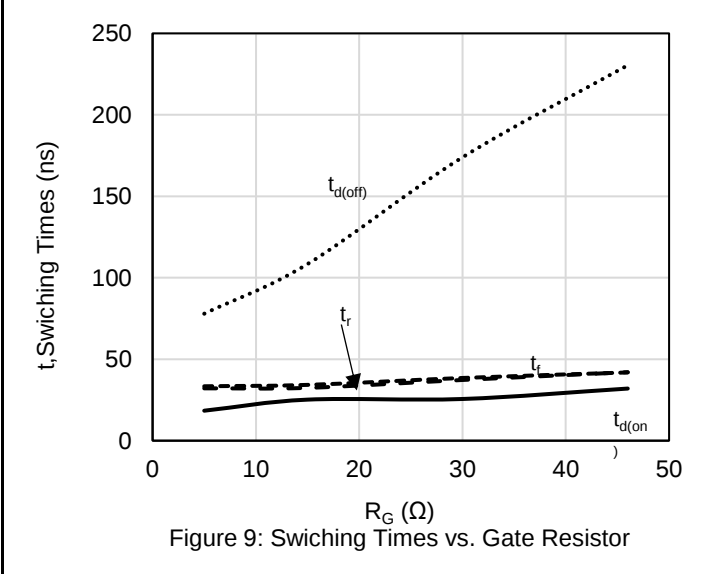
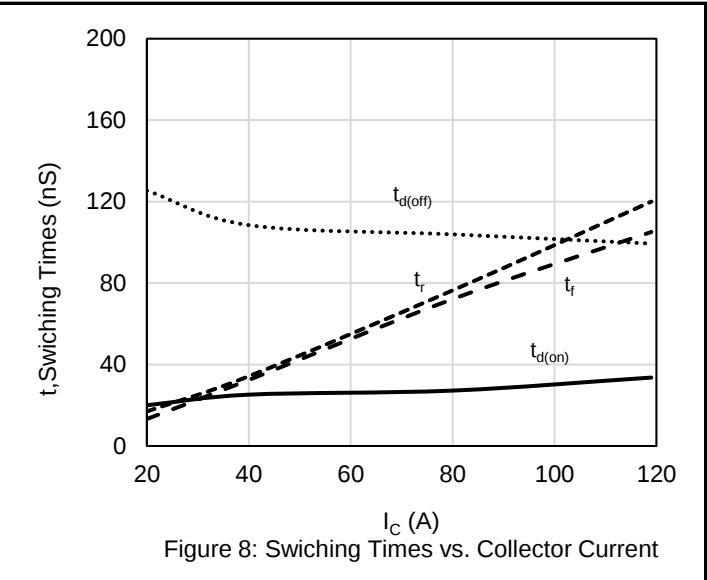
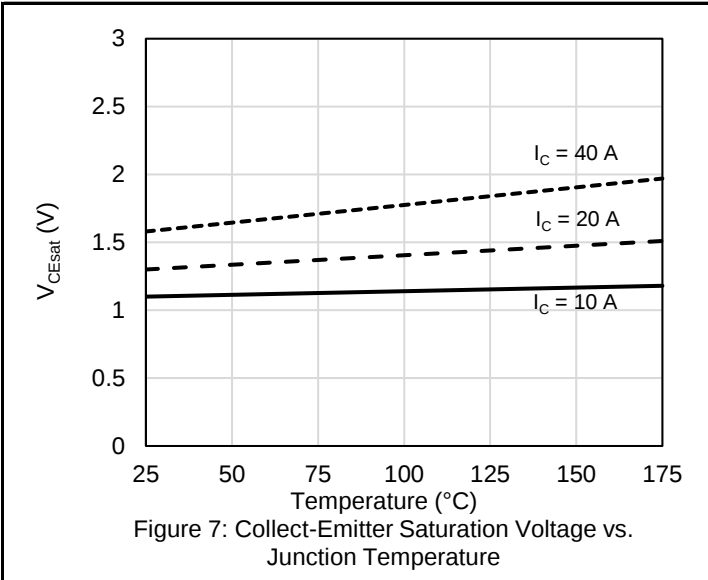
Diode Characteristics ($T_{VJ} = 150^{\circ}\text{C}$)

t_{rr}	Reverse Recovery Time	$V_R = 400\text{ V}, I_F = 40\text{ A},$ $di/dt = 1400\text{ A}/\mu\text{s}$		167		ns
Q_{rr}	Reverse Recovery Charge			2.8		μC
I_{rrm}	Peak Reverse Recovery Current			30		A
di_{rr}/dt	Diode Peak Rate of Fall of Reverse Recovery Current			-1130		$\text{A}/\mu\text{s}$

t_{rr}	Reverse Recovery Time	$V_R = 400\text{ V}, I_F = 20\text{ A},$ $di/dt = 1400\text{ A}/\mu\text{s}$		164		ns
Q_{rr}	Reverse Recovery Charge			2.0		μC
I_{rrm}	Peak Reverse Recovery Current			27		A
di_{rr}/dt	Diode Peak Rate of Fall of Reverse Recovery Current			-1270		$\text{A}/\mu\text{s}$

Electrical Characteristics Diagrams





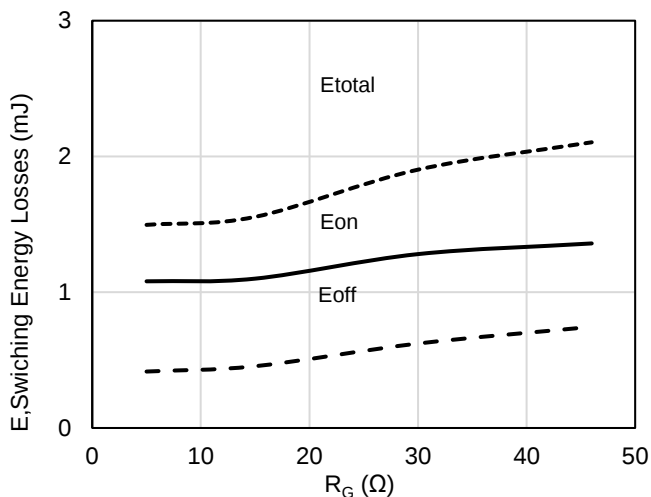


Figure 13: Switching Energy Losses vs. Gate Resistor

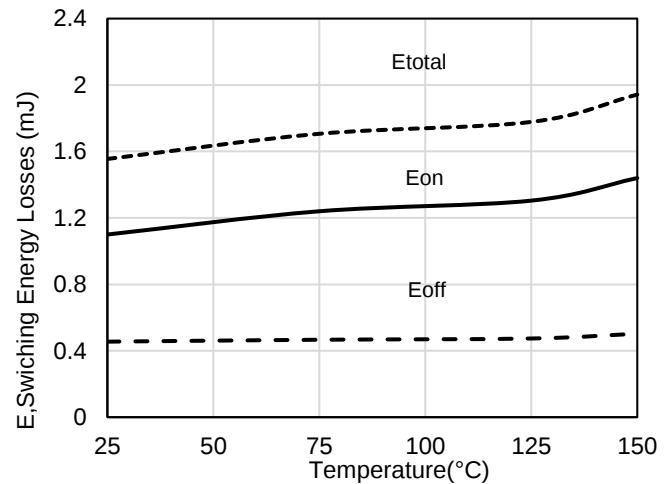


Figure 14: Switching Energy Losses vs. Junction Temperature

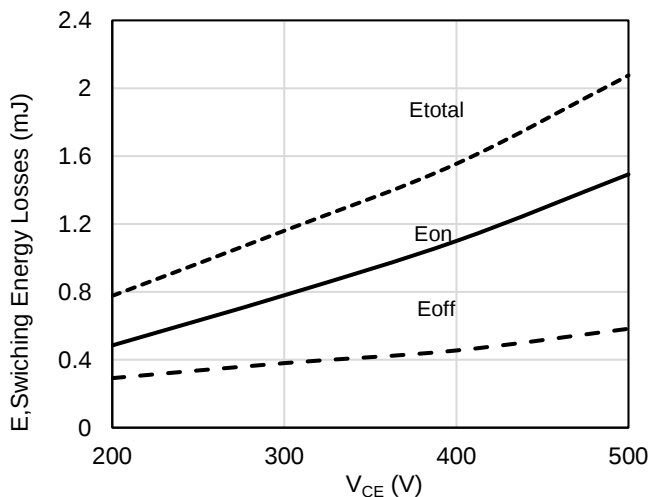


Figure 15: Switching Energy losses vs. Collector Emitter Voltage

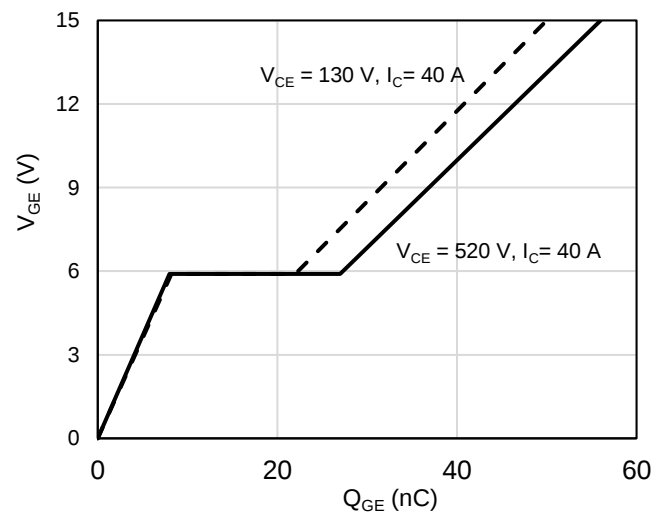


Figure 16: Gate-Charge Characteristics

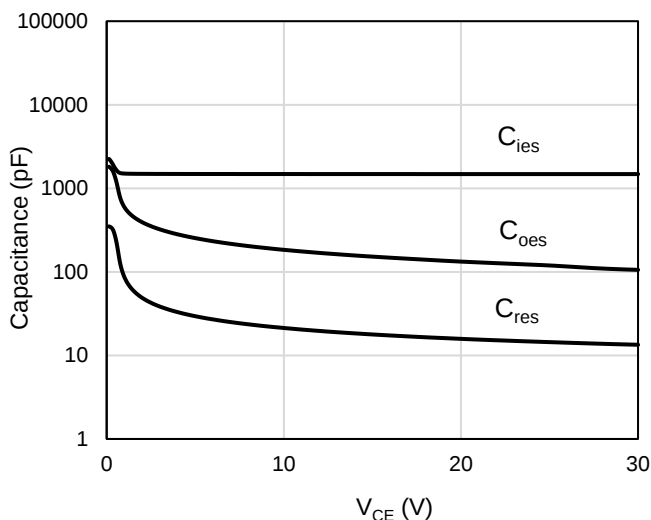


Figure 17: Capacitance Characteristics

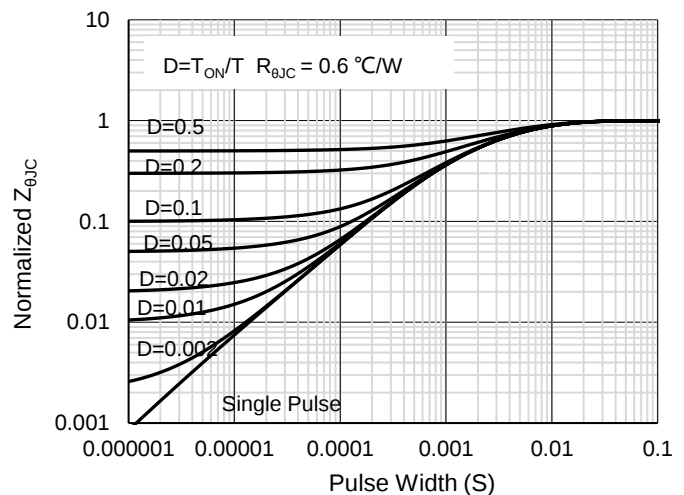
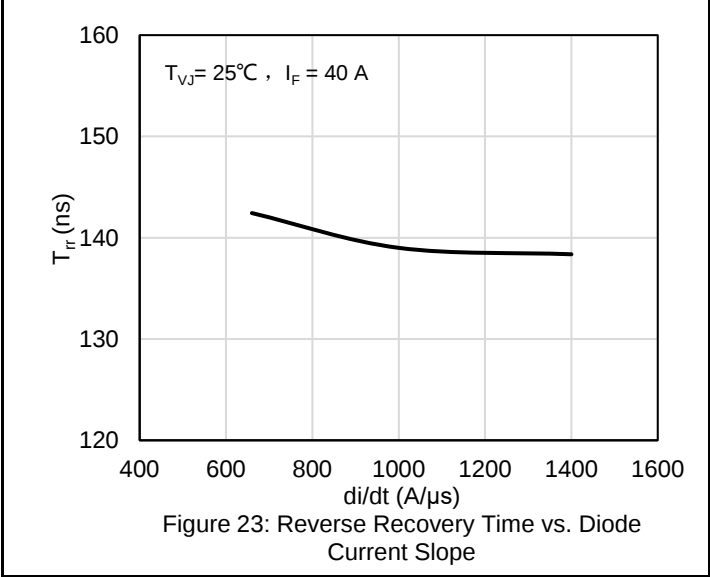
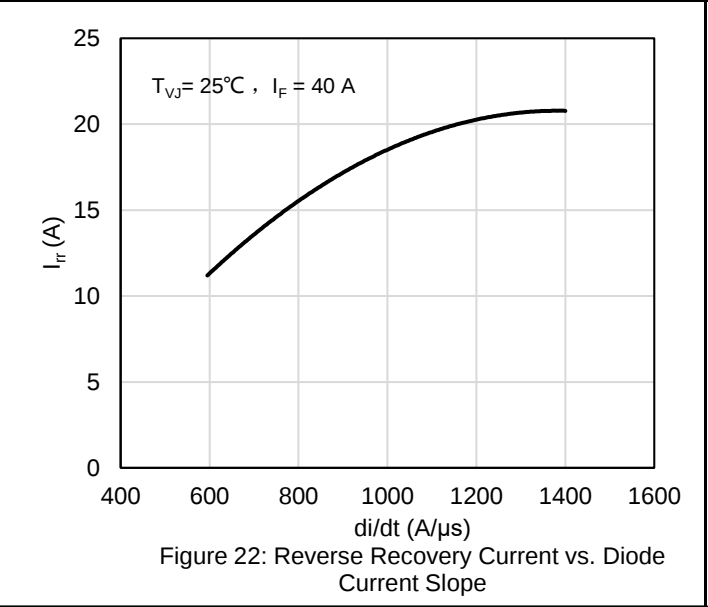
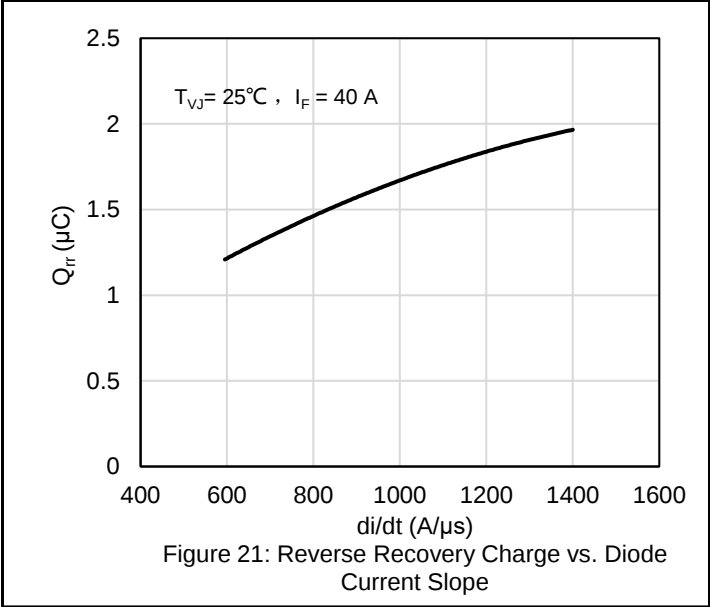
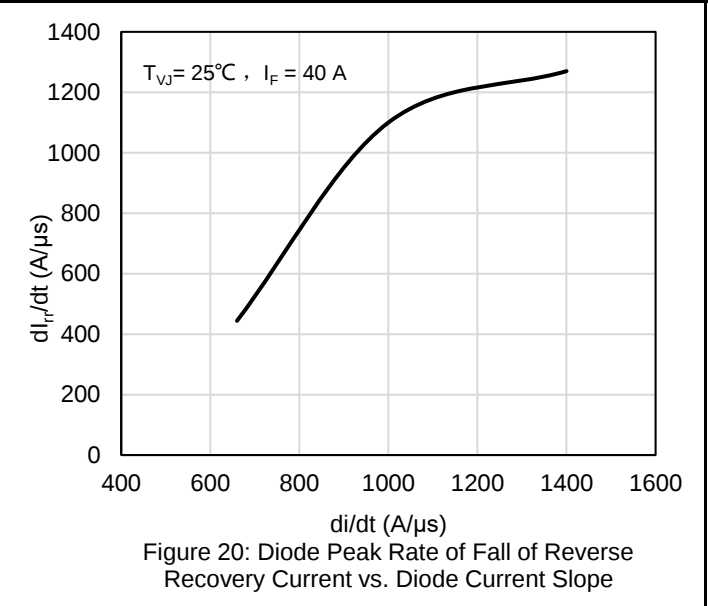
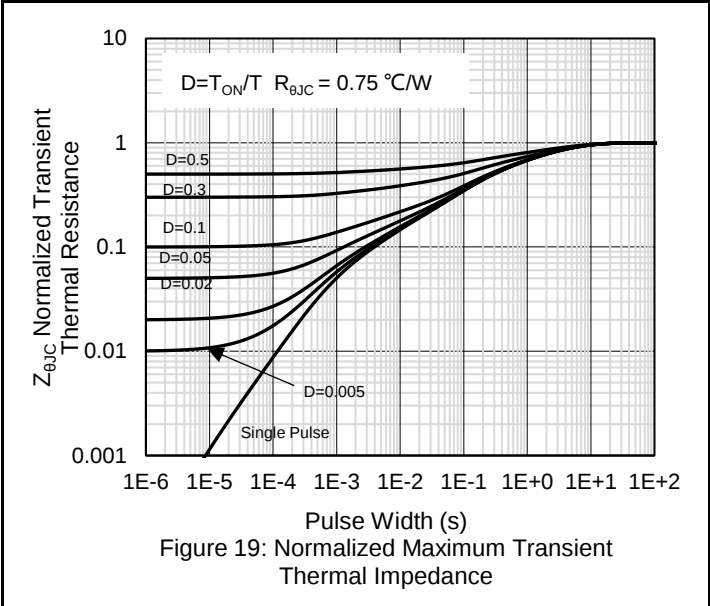
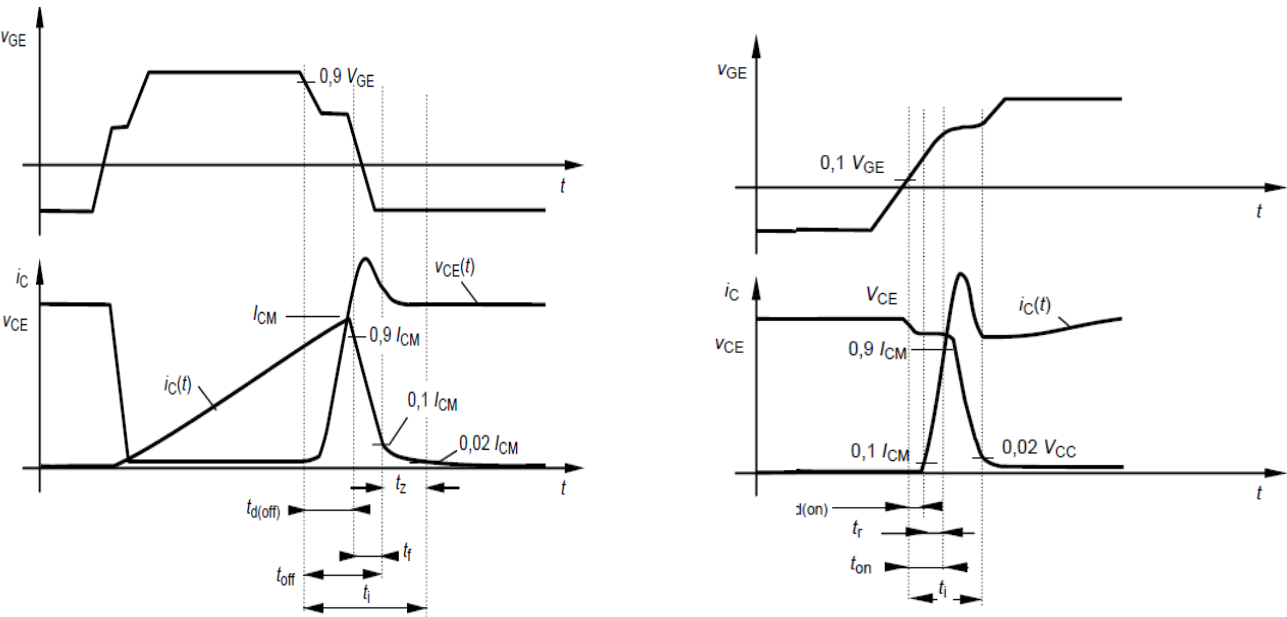


Figure 18: Normalized Maximum IGBT Transient Thermal Impedance

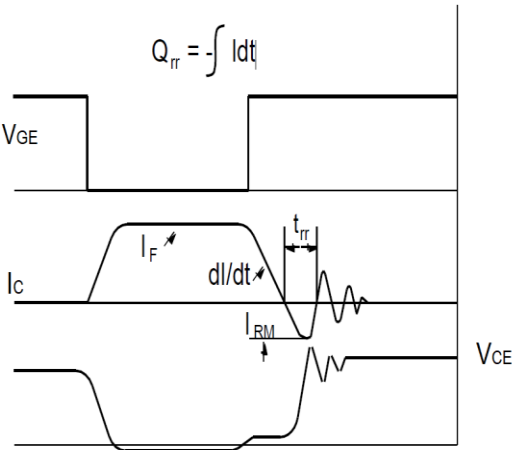
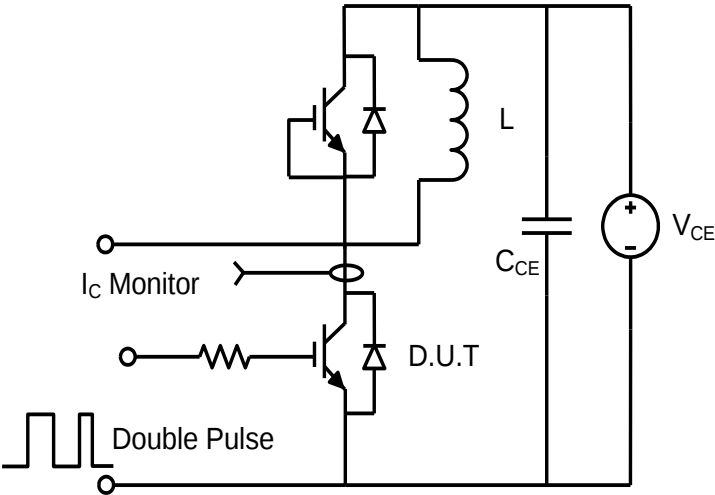


Test Circuit and Waveform

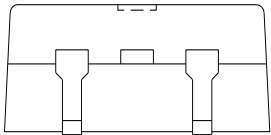
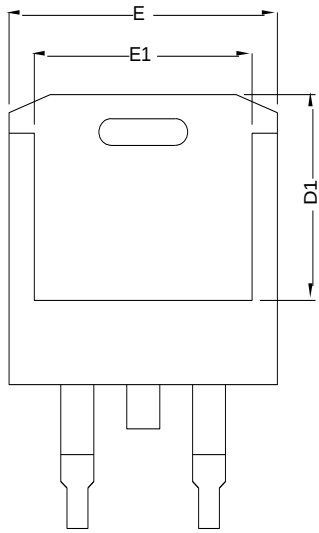
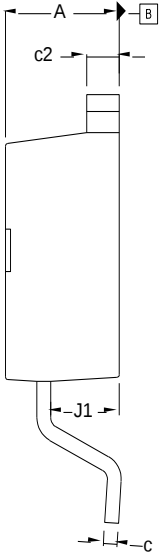
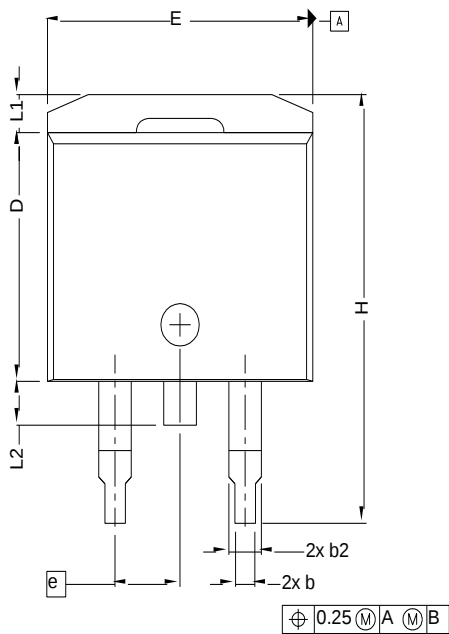
Switching Test Circuit & Waveforms



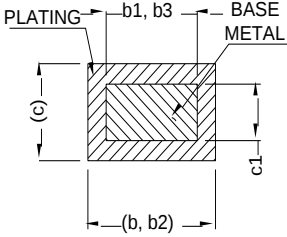
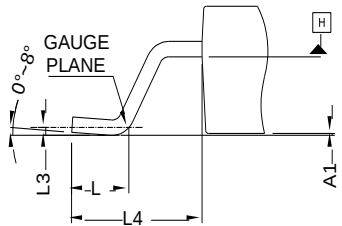
Diode Recovery Test Circuit & Waveforms



Package Outlines



OPTION 1
2 LEADS



NOTE
1.0 DIMENSIONING & TOLERANCEING CONFIRM TO ASME Y14.5M-1994.
2.0 ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
3.0 HEAT SINK SIDE FLASH IS MAX. 0.8mm.
4.0 RADIUS ON TERMINAL IS OPTIONAL.

SYMBOL	MIN.	MAX.	SYMBOL	MIN.	MAX.
A	4.36	4.56	E	10.15	10.55
A1	0	0.25	E1	8.10	8.70
b	0.70	0.90	e	2.54 BSC	
b1	0.51	0.89	H	15.00	15.60
b2	1.17	1.37	L	1.90	2.50
b3	1.17	1.37	L1	-	1.65
c	0.38	0.69	L2	-	1.78
c1	0.38	0.53	L3	0.25 TYP	
c2	1.19	1.34	L4	4.78	5.28
D	8.60	9.00	J1	2.56	2.96
D1	6.90	7.50			

Marking Information



B65A040DHH

XXXXXXX

Note:

B65A040DHH = Product Name Code

XXXXXXX = Date code

Contact ALKAIDSEMI sales for detail information



Revision History

Revision	Release Date	Remark
Rev.1.1	2024/1/30	

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.