

BKW65N050HS1

650V 50A Trench FS IGBT



Description

The BKW65N050HS1 is a Trench FS IGBT utilizing bestirpower's advanced technology, which achieves an exceptionally low gate charge. It achieves significantly higher efficiency through optimized gate charge management, while its user-friendly design offers designers advantages such as low EMI and reduced switching losses.

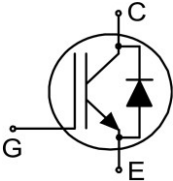
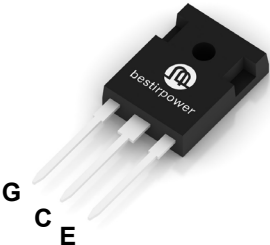
V_{CE}	I_C ($T_C = 100^{\circ}C$)	V_{CEsat}	$Q_{g,typ}$
650 V	50 A	1.4 V	135 nC

Applications

- Resonant converters
- Uninterruptible power supplies
- Welding converters

Features

- Maximum junction temperature $T_{Jmax} = 175^{\circ}C$
- Low saturation voltage $V_{CEsat} = 1.4$ V at $T_J = 25^{\circ}C$
 V_{CEsat} is a positive temperature coefficient, suitable for parallel applications



Absolute Maximum Ratings

Symbol	Parameter		Value max	Unit	Note
V_{CE}	Collector-emitter voltage ($T_J \geq 25^{\circ}C$)		650	V	
V_{GE}	Gate-emitter voltage		± 20	V	
I_C	DC collector current, limited by T_{Jmax}	$T_C = 25^{\circ}C$	80	A	
		$T_C = 100^{\circ}C$	50	A	
$I_{C,pulse}$	Pulsed collector current, t_p limited by T_{Jmax}		200	A	
I_F	Diode forward current, limited by T_{Jmax}	$T_C = 25^{\circ}C$	80	A	
		$T_C = 100^{\circ}C$	50	A	
$I_{F,pulse}$	Diode pulsed current, t_p limited by T_{Jmax}		200	A	
P_{tot}	Power Dissipation	$T_C = 25^{\circ}C$	403	W	Fig.8
		$T_C = 100^{\circ}C$	161		
T_J	Junction temperature range		-40 ~ 175	$^{\circ}C$	
T_{STG}	Storage temperature range		-40 ~ 150	$^{\circ}C$	

Thermal Resistance

Symbol	Parameter	Value	Unit
R_{thJC}	IGBT thermal resistance, junction-case	0.35	$^{\circ}C/W$
R_{thJC}	Diode thermal resistance, junction-case	1.57	$^{\circ}C/W$
R_{thJA}	Thermal resistance, junction-to-ambient	31.42	$^{\circ}C/W$
T_{sold}	Soldering temperature, wave soldering only allowed at leads	260	$^{\circ}C$

Electrical Characteristics (T_J= 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit	Note
Statistic Characteristics								
V _{(BR)CES}	Collector-emitter Breakdown Voltage	V _{GE} =0V, I _C =200μA		650	-	-	V	
I _{CES}	Collector Cut-off Current	V _{CE} =650V, V _{GS} =0V		-	-	50	μA	
I _{GES}	Gate-emitter Leakage Current	V _{GE} =±20V, V _{GE} =0V		-	-	±100	nA	
V _{GE(TH)}	Gate Threshold Voltage	V _{CE} =V _{GE} , I _C =500μA		3.2	4.0	4.8	V	Fig.5
V _{CE(sat)}	Collector-Emitter Saturation Voltage	V _{GE} =15V I _C =50A	T _J =25°C	-	1.4	1.75	V	Fig.4
			T _J =150°C	-	1.8	-		
Dynamic Characteristics								
C _{ies}	Input Capacitance	V _{CE} =25V, V _{GE} =0V, f=1MHz		-	4146	-	pF	Fig.6
C _{oes}	Output Capacitance			-	166	-		
C _{res}	Reverse Transfer Capacitance			-	9.7	-		
Switching Parameters								
t _{d(on)}	Turn-on Delay Time	V _{CE} =400V, I _{DC} =50A, R _G =8Ω, V _{GE} =0/+15V	T _J =25°C	-	20.5	-	ns	Fig.23
			T _J =150°C	-	20	-	ns	
t _r	Rise Time		T _J =25°C	-	29.8	-	ns	Fig.23
			T _J =150°C	-	31	-	ns	
t _{d(off)}	Turn-off Delay Time		T _J =25°C	-	155.4	-	ns	Fig.23
			T _J =150°C	-	184.2	-	ns	
t _f	Fall Time		T _J =25°C	-	52	-	ns	Fig.23
			T _J =150°C	-	90	-	ns	
E _{on}	Turn-on Switching Energy		T _J =25°C	-	1.3	-	mJ	Fig.24
			T _J =150°C	-	1.44	-	mJ	
E _{off}	Turn-off Switching Energy		T _J =25°C	-	0.75	-	mJ	Fig.24
			T _J =150°C	-	1.13	-	mJ	
T _{rr}	Diode Reverse Recovery Time	V _R =400V, R _G =3.3Ω, I _F =50A, di/dt=400A/μs		-	73.8	-	ns	
Q _{rr}	Diode Reverse Recovery Charge			-	0.95	-	uC	
I _{rrm}	Diode Peak Reverse Recovery Current			-	19	-	A	

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Gate Charge Characteristics

Q_g	Gate Charge Total	$V_{CC}=520V, I_C=50A$ $V_{GE}=0$ to $15V$	-	135	-	nC	Fig.7
Q_{gc}	Gate-emitter charge		-	22	-		
Q_{ge}	Gate-collector charge		-	35	-		

Typical Performance Characteristics

Fig 1. Typical output characteristics

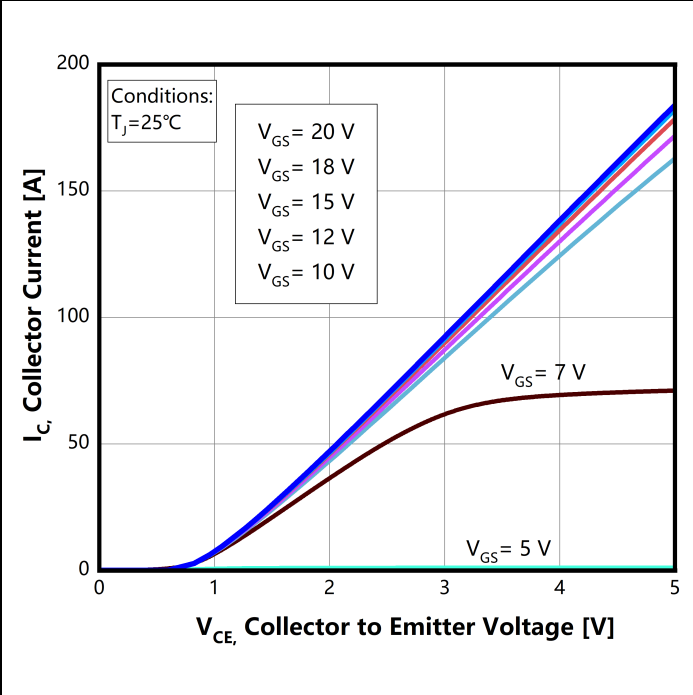


Fig 2. Typical Output characteristics

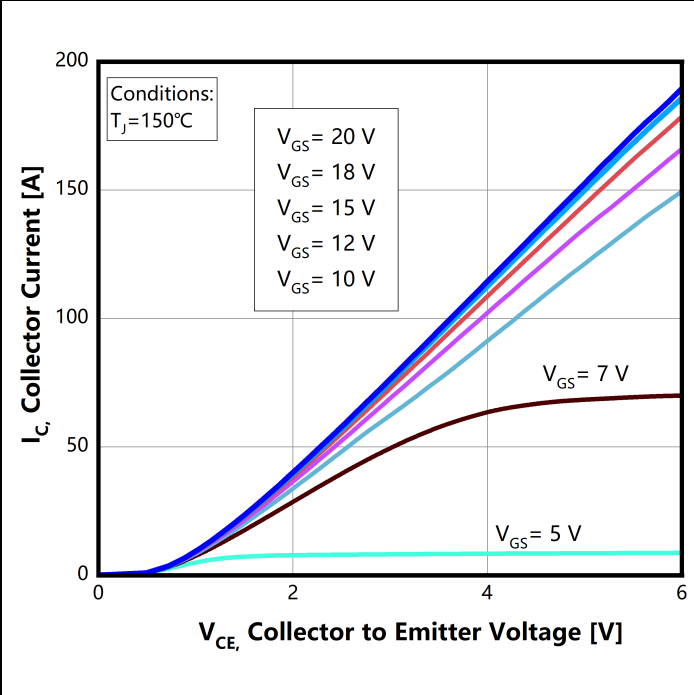


Fig 3. Typical transfer characteristic

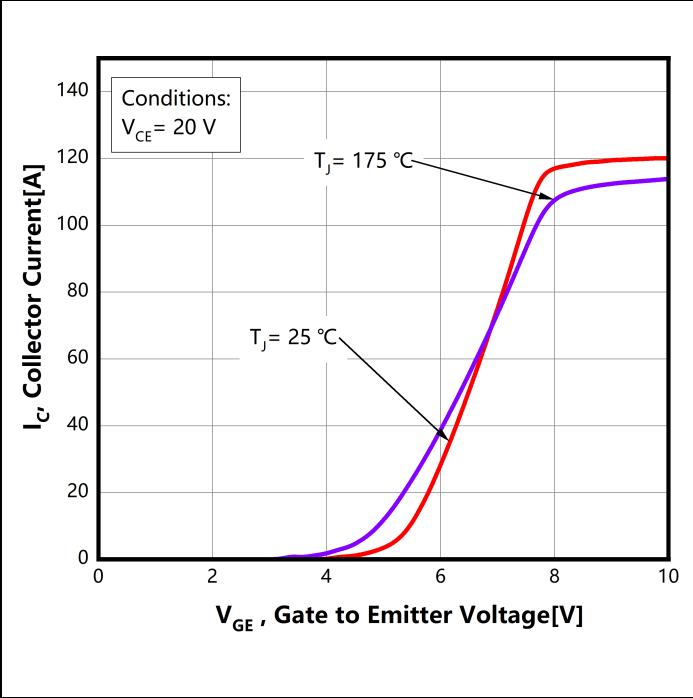
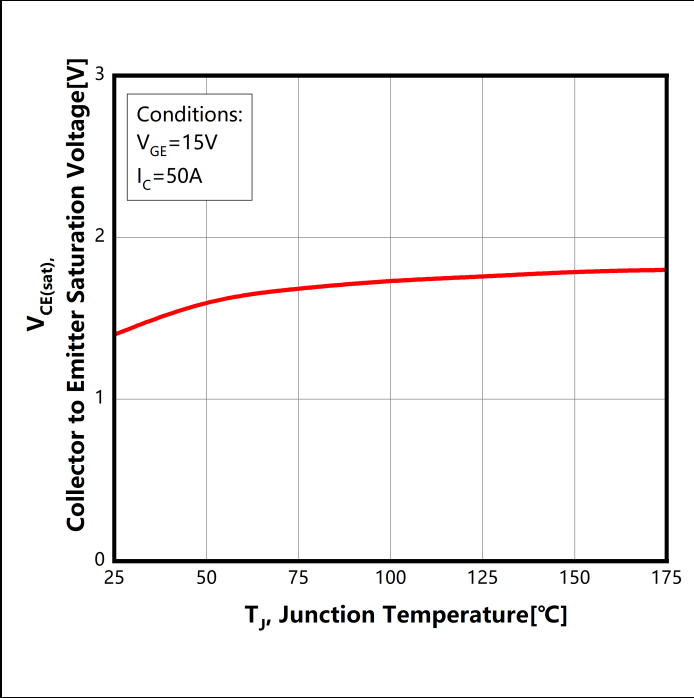


Fig 4. Typical collector-emitter saturation voltage as a function of junction temperature



Typical Performance Characteristics

Figure 5. Gate-emitter threshold voltage as a function of junction temperature

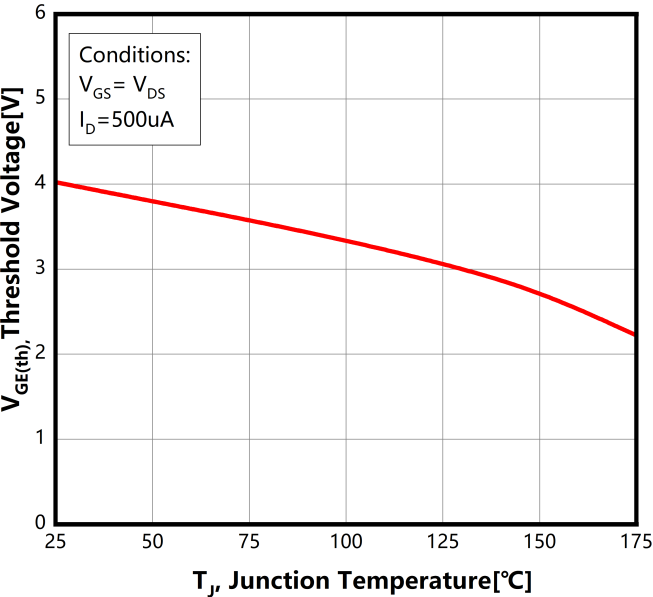


Figure 6. Typical capacitance as a function of collector-emitter voltage

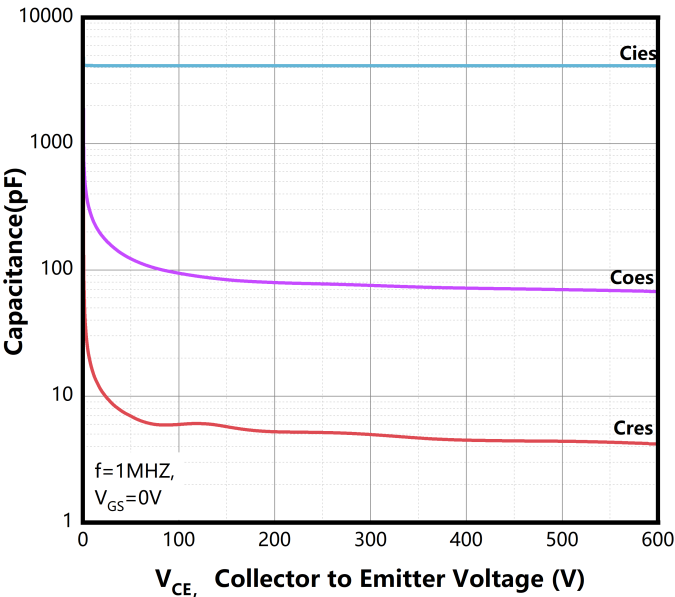


Figure 7. Typical gate charge

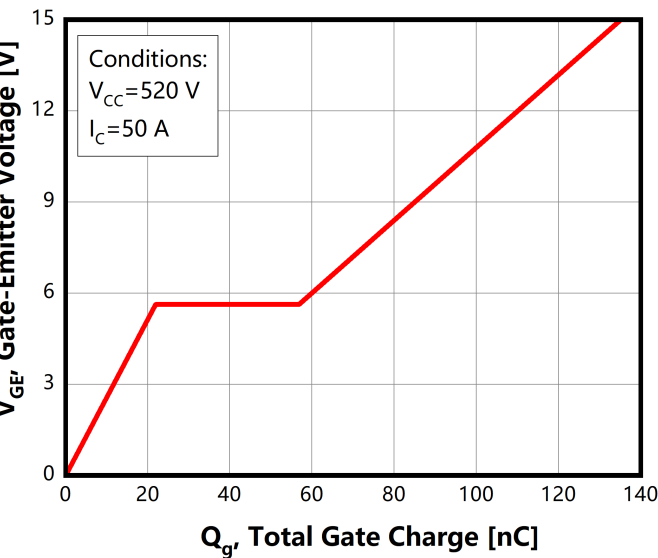
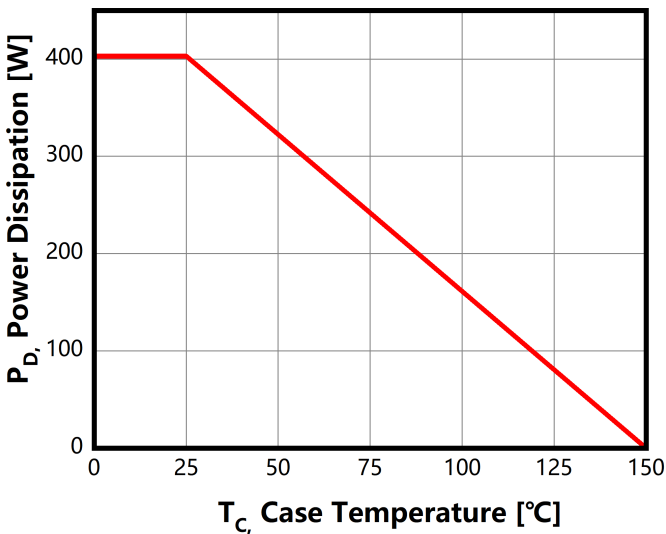


Figure 8. Power dissipation as a function of case temperature



Typical Performance Characteristics

Figure 9. IGBT transient thermal impedance as a function of pulse width

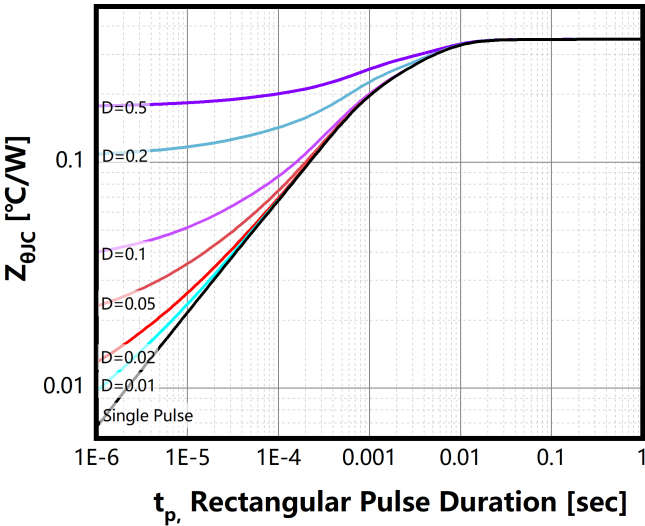


Figure 10. Diode transient thermal impedance as a function of pulse width

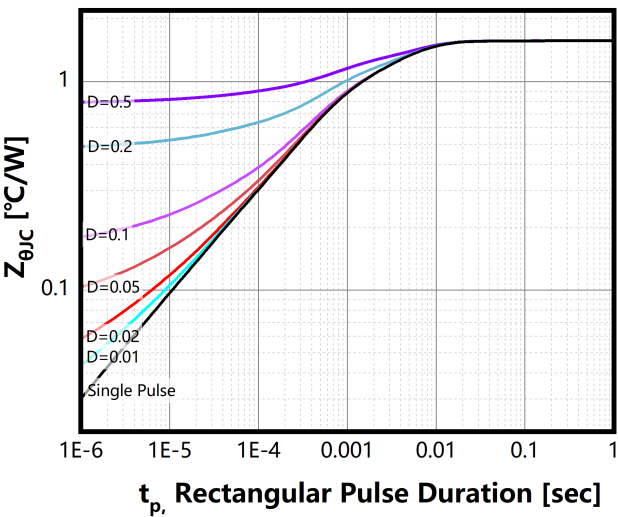


Figure 11. Typical Turn-on times as a function of collector current

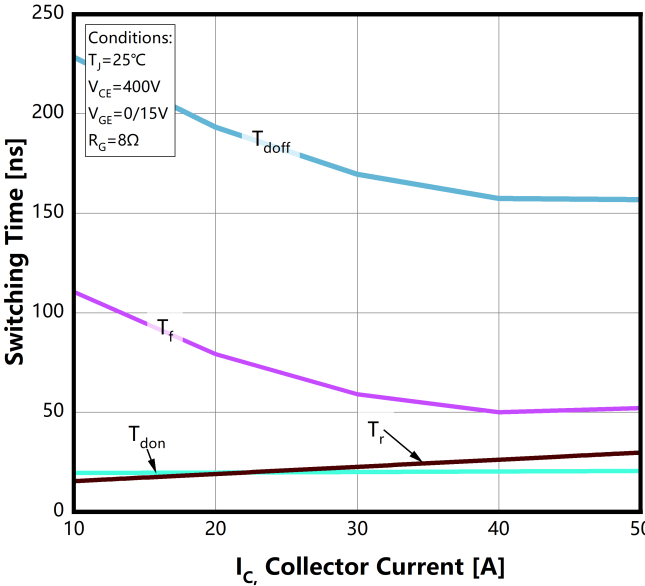
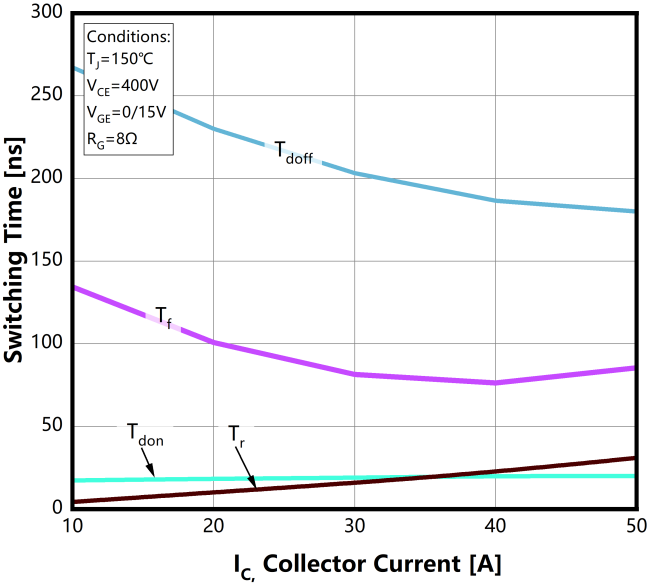


Figure 12. Typical Turn-on times as a function of collector current



Typical Performance Characteristics

Figure 13. Typical switching times as a function of collector emitter voltage

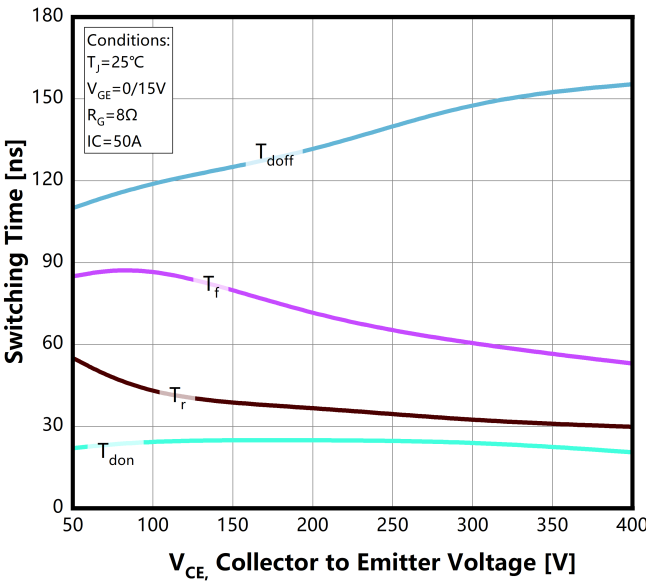


Figure 14. Typical switching times as a function of collector emitter voltage

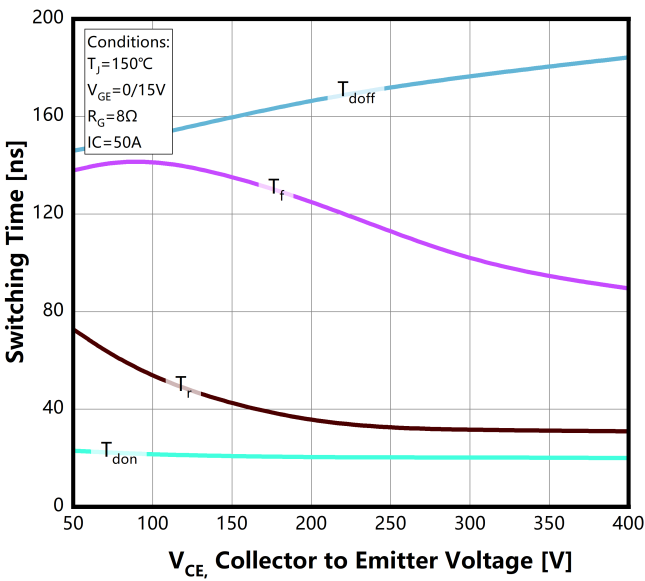


Figure 15. Typical switching times as a function of gate resistor

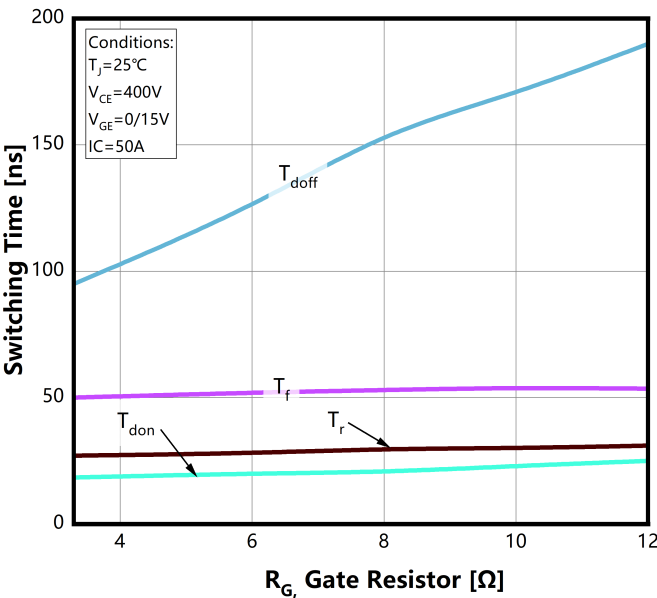
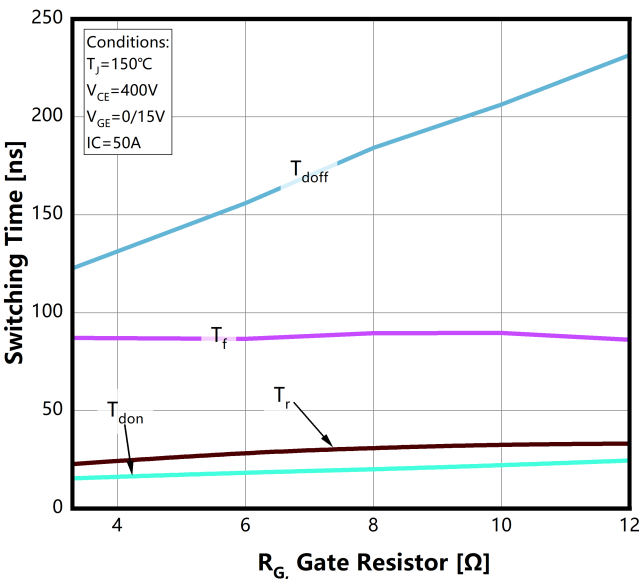


Figure 16. Typical switching times as a function of gate resistor



Typical Performance Characteristics

Figure 17. Typical switching energy losses as a function of collector current

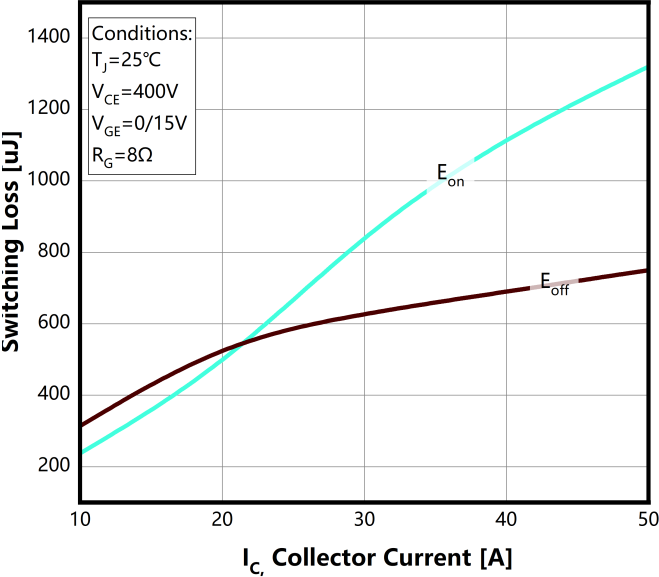


Figure 18. Typical switching energy losses as a function of collector current

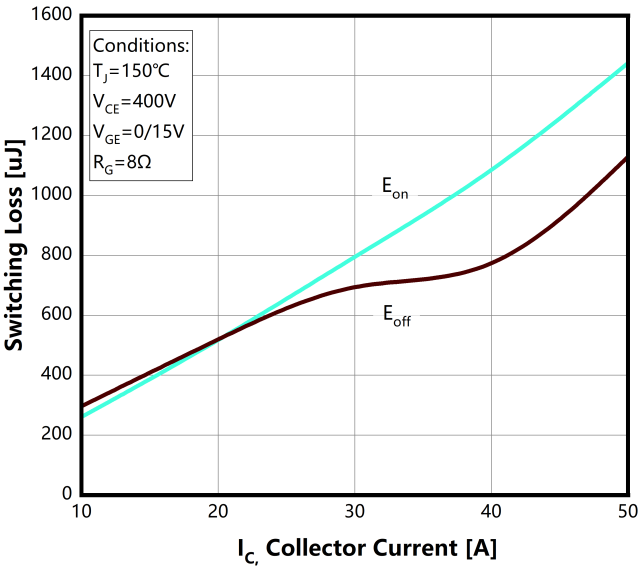


Figure 19. Typical switching energy losses as a function of collector emitter voltage

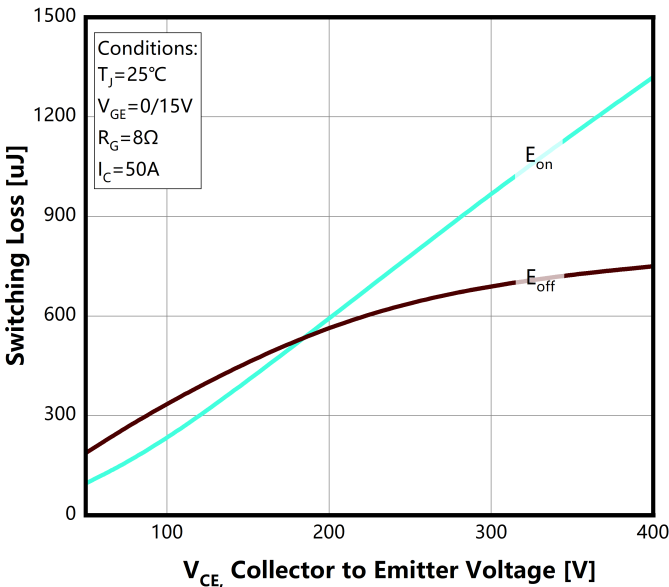
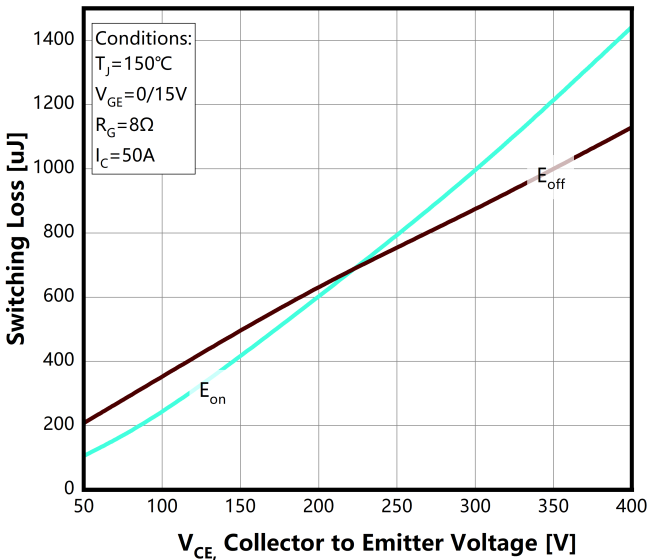


Figure 20. Typical switching energy losses as a function of collector emitter voltage



Typical Performance Characteristics

Figure 21. Typical switching energy losses as a function of gate resistor

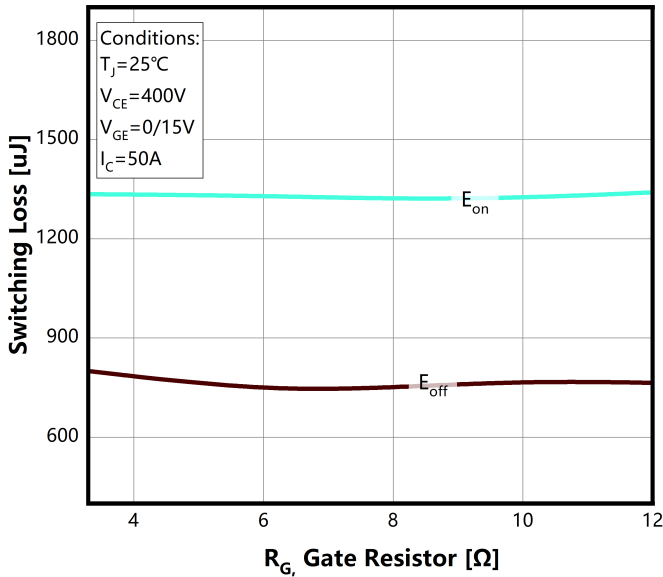


Figure 22. Typical switching energy losses as a function of gate resistor

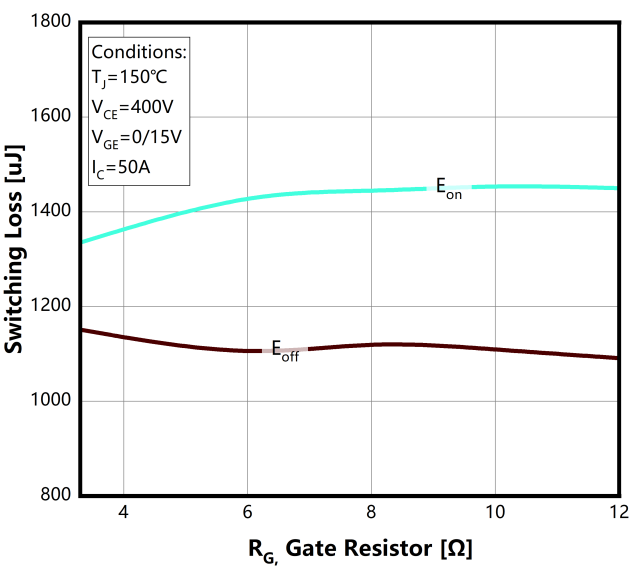


Figure 23. Typical switching times as a function of junction temperature

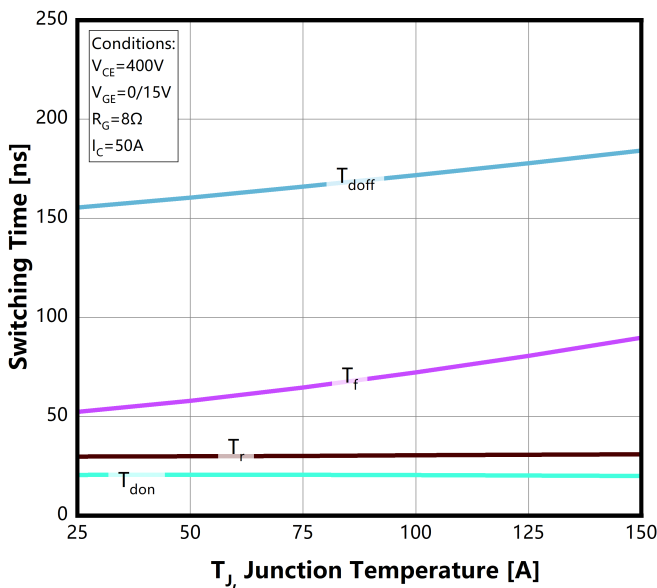
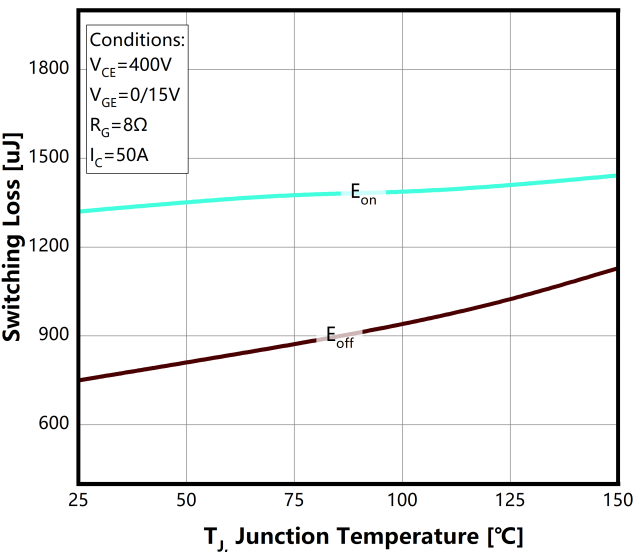


Figure 24. Typical switching energy losses as a function of junction temperature



Typical Performance Characteristics

Figure 25. Typical diode forward current as a function of forward voltage

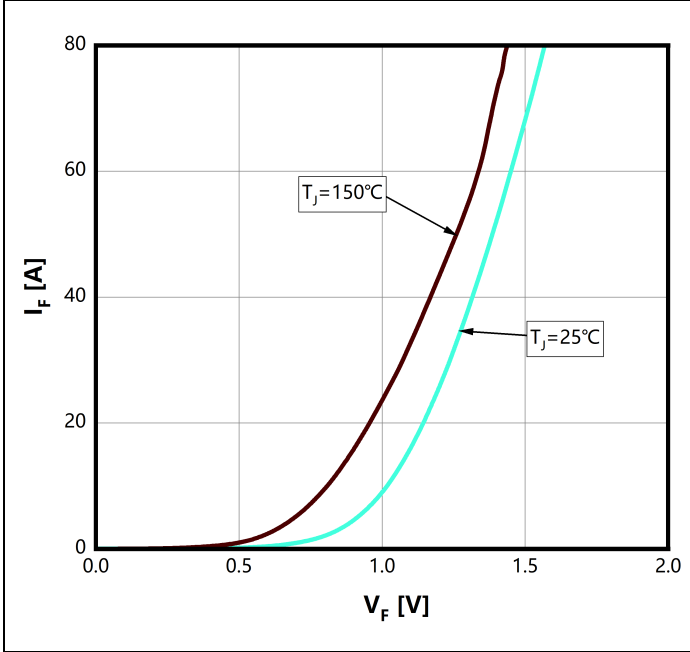
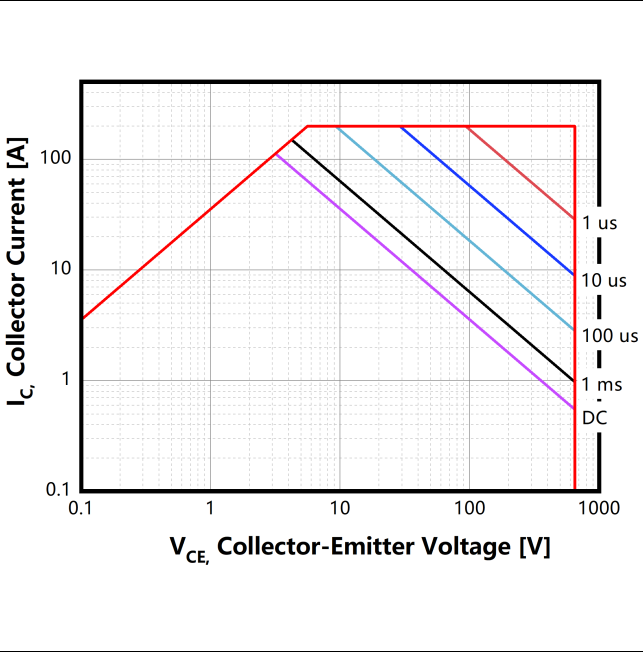


Figure 26. Reverse bias safe operating area



Typical Performance Characteristics

Figure 27. Switching time test circuit and waveforms

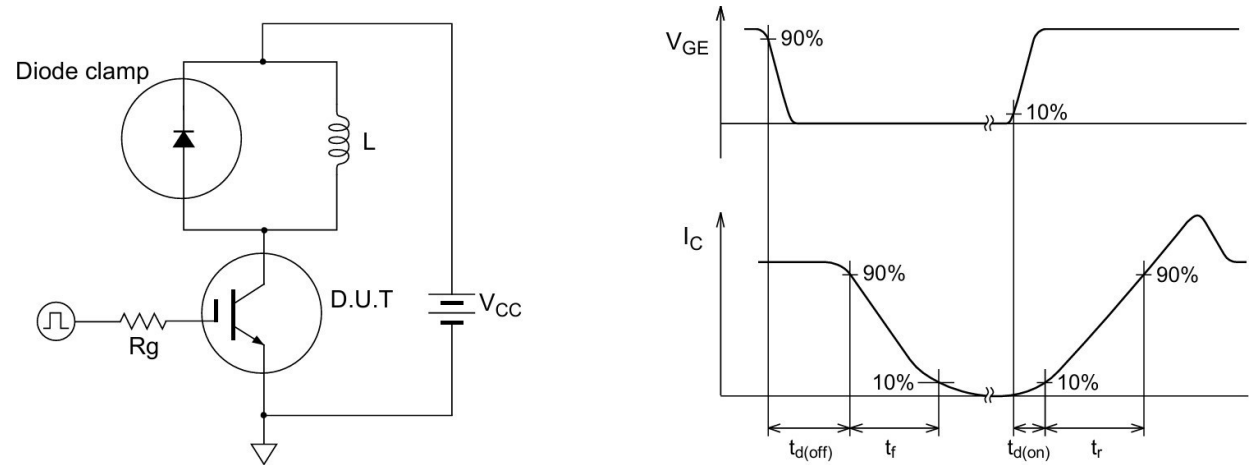
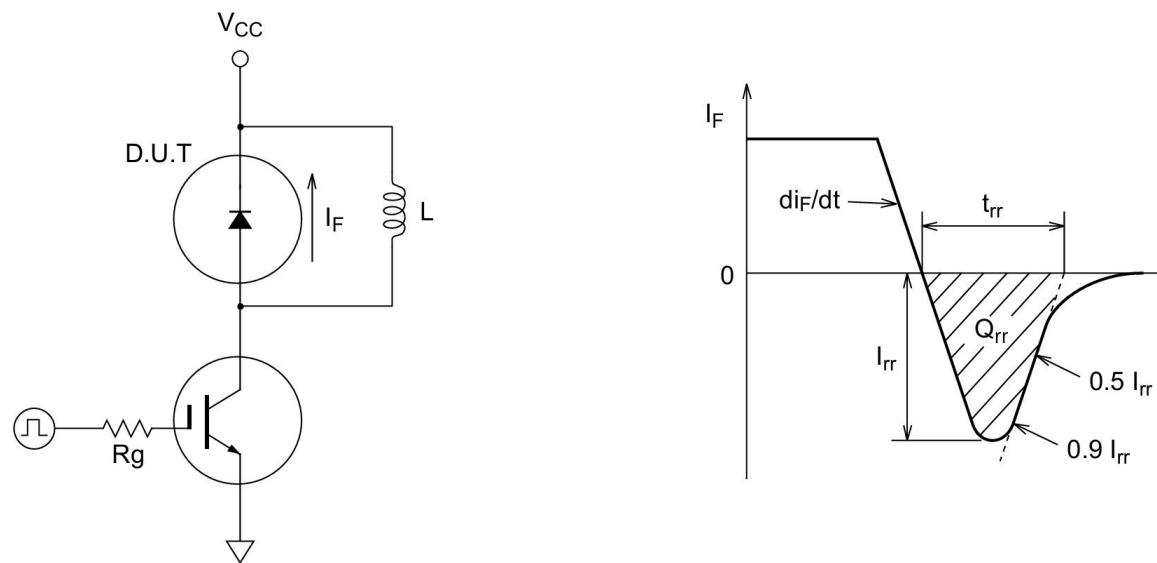
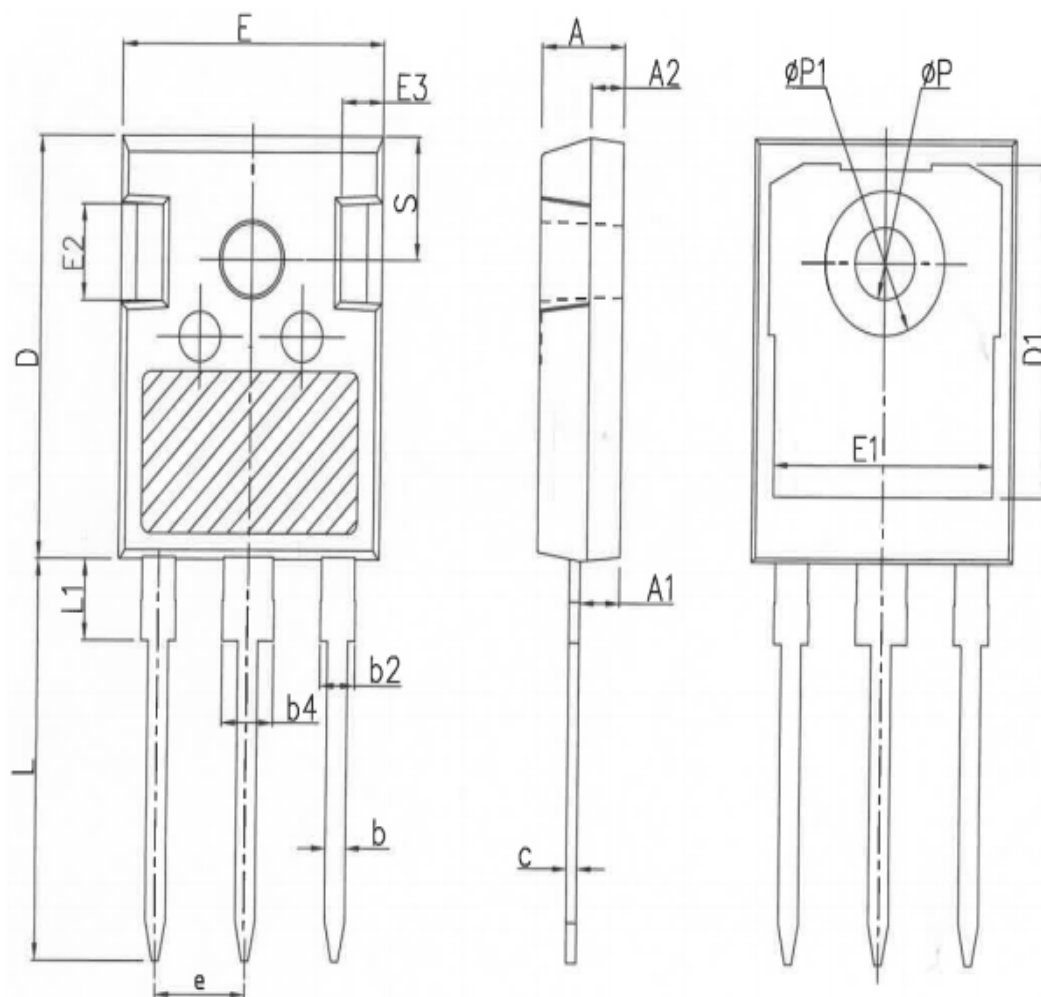


Figure 28. Reverse recovery time test circuit and waveforms



Package Outlines

TO247-3L



COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.59
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.70	21.00	21.30
D1	16.25	16.55	16.85
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.44BSC		
L	19.62	19.92	20.22
L1	—	—	4.30
ϕP	3.40	3.60	3.80
$\phi P1$	—	—	7.30
S	6.15BSC		

* Dimensions in millimeters

Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
BKW65N050HS1	BKW65N050HS1	TO247-3L	Tube	50 units

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