

BKW120N040LZ1

1200V 40A Trench FS IGBT

Description

The BKW120N040LZ1 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.

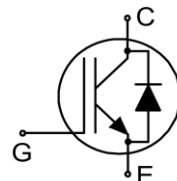
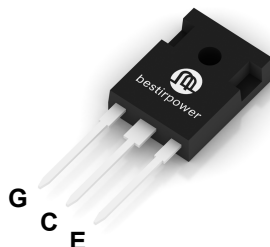
V_{CE}	I_C ($T_C = 100^\circ\text{C}$)	T_{rr}	$Q_{g,typ}$
1200 V	40 A	334ns	146 nC

Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- Uninterruptible power supply

Features

- Maximum junction temperature $T_{vjmax} = 175^\circ\text{C}$
- Low saturation voltage $V_{CEsat} = 1.7\text{ V}$ at $T_{vj} = 25^\circ\text{C}$
- 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 ($T_{vj} \geq 25^\circ\text{C}$)		1200	V	
V_{GE}	Gate-emitter voltage		± 20	V	
I_C	DC collector current, limited by T_{vjmax}	$T_C = 25^\circ\text{C}$	80	A	Fig 2
		$T_C = 100^\circ\text{C}$	40	A	
I_{Cpulse}	Pulsed collector current, t_p limited by T_{vjmax}		120	A	
I_F	Diode forward current, limited by T_{vjmax}	$T_C = 25^\circ\text{C}$	80	A	Fig 6
		$T_C = 100^\circ\text{C}$	40		
I_{Fpulse}	Diode pulsed current, t_p limited by T_{vjmax}		120	A	
P_{tot}	Power Dissipation	$T_C = 25^\circ\text{C}$	328	W	
		$T_C = 100^\circ\text{C}$	131		
T_J	Junction temperature range		$-55 \sim 175$	$^\circ\text{C}$	
T_{STG}	Storage temperature range		$-40 \sim 150$	$^\circ\text{C}$	

Thermal Resistance

Symbol	Parameter	Value	Unit
R_{thJC}	IGBT thermal resistance, junction-case	0.268	$^\circ\text{C/W}$
R_{thJC}	Diode thermal resistance, junction-case	0.415	
T_{sold}	Soldering temperature, wave soldering only allowed at leads	260	$^\circ\text{C}$

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit	Note
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Statistic Characteristics

V _{(BR)CES}	Collector-emitter Breakdown Voltage	V _{GE} =0V, I _C =250μA		1200	-	-	V	
I _{CES}	Collector Cut-off Current	V _{CE} =1200V, V _{GS} =0V		-	-	10	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 =1mA		5	5.8	6.5	V	Fig.4
V _{CE(sat)}	Collector-Emitter Saturation Voltage	V _{GE} =15V I _C =40A	T _J =25°C	-	1.7	2.1	V	Fig.3
			T _J =125°C	-	2.0	2.4		
			T _J =175°C	-	2.2	2.6		
V _F	Forward On-Voltage	I _F =40A,V _{GE} =0V		-	2.1	-	V	Fig.7

Dynamic Characteristics

C_{IES}	Input Capacitance	$V_{CE}=25V, V_{GE}=0V,$ $f=100KHz$	-	5353	-	pF	Fig.11
C_{OES}	Output Capacitance		-	130	-		
C_{RES}	Reverse Transfer Capacitance		-	22.3	-		

Switching Parameters

$t_{d(on)}$	Turn-on Delay Time	$V_{CE}=600V,$ $I_{DC}=40A$ $R_G=4.7\Omega,$ $V_{GE}=0/+15V$	$T_J=25^{\circ}C$	-	29.2	-	ns	Fig.19
			$T_J=125^{\circ}C$	-	25.84	-	ns	
			$T_J=175^{\circ}C$	-	24.65	-	ns	
t_r	Rise Time		$T_J=25^{\circ}C$	-	41.57	-	ns	Fig.19
			$T_J=125^{\circ}C$	-	49.43	-	ns	
			$T_J=175^{\circ}C$	-	48.3	-	ns	
$t_{d(off)}$	Turn-off Delay Time		$T_J=25^{\circ}C$	-	138.2	-	ns	Fig.19
			$T_J=125^{\circ}C$	-	171.9	-	ns	
			$T_J=175^{\circ}C$	-	189.3	-	ns	
t_f	Fall Time		$T_J=25^{\circ}C$	-	220.2	-	ns	Fig.19
			$T_J=125^{\circ}C$	-	325.9	-	ns	
			$T_J=175^{\circ}C$	-	383.7	-	ns	
E_{on}	Turn-on Switching Energy		$T_J=25^{\circ}C$	-	2.4	-	mJ	Fig20
			$T_J=125^{\circ}C$	-	4	-	mJ	
			$T_J=175^{\circ}C$	-	5.1	-	mJ	
E_{off}	Turn-off Switching Energy		$T_J=25^{\circ}C$	-	2.75	-	mJ	Fig.20
			$T_J=125^{\circ}C$	-	3.75	-	mJ	
			$T_J=175^{\circ}C$	-	4.25	-	mJ	

T_{rr}	Diode Reverse Recovery Time	$V_R=600\text{ V}, R_G=4.7\Omega,$ $I_F=40\text{ A}, di/dt=400\text{ A}/\mu\text{s}$	-	334	-	ns	Fig.23
Q_{rr}	Diode Reverse Recovery Charge		-	2.34	-	μC	Fig.24
I_{rrm}	Diode Peak Reverse Recovery Current		-	10.53	-	A	Fig.21
E_{rec}	Reverse Recovery Energy	$V_R=600\text{ V}, R_G=4.7\Omega, I_F=40\text{ A},$	-	0.97	-	mJ	Fig.25
I_{SC}	Short-circuit Withstand Time	$T_{vj}=25^\circ\text{C}, V_{CC}=800\text{ V},$ $V_{GE}\leq 15\text{ V}, t_p\leq 8\mu\text{s},$	-	170	-	A	

Gate Charge Characteristics

Q_g	Gate Charge Total	$V_{CC}=960\text{ V}, I_C=40\text{ A}$ $V_{GE}=0\text{ to }15\text{ V}$	-	146	-	nC	
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Typical Performance Characteristics

Figure 1.Reverse bias safe operating area

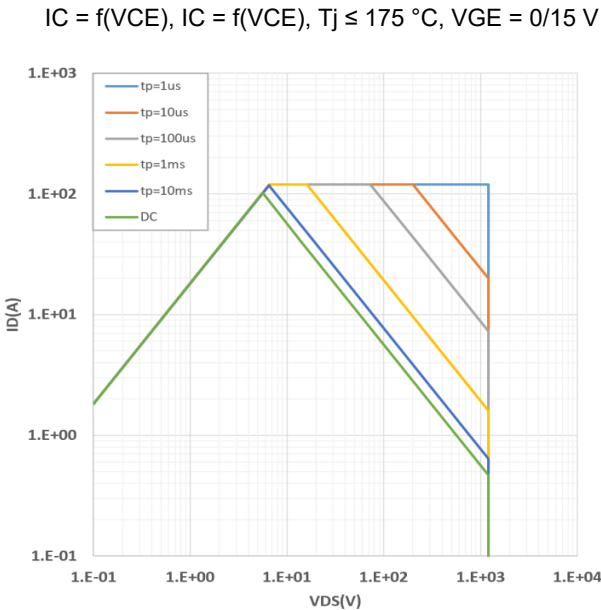


Figure 2.Typical output characteristic

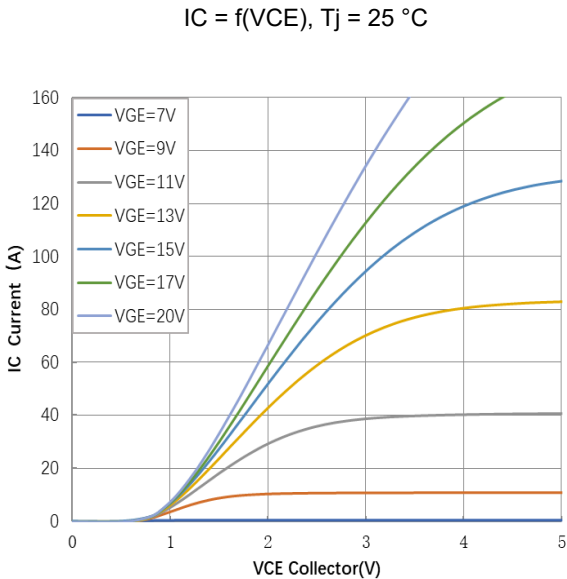


Figure 3.Typical output characteristic

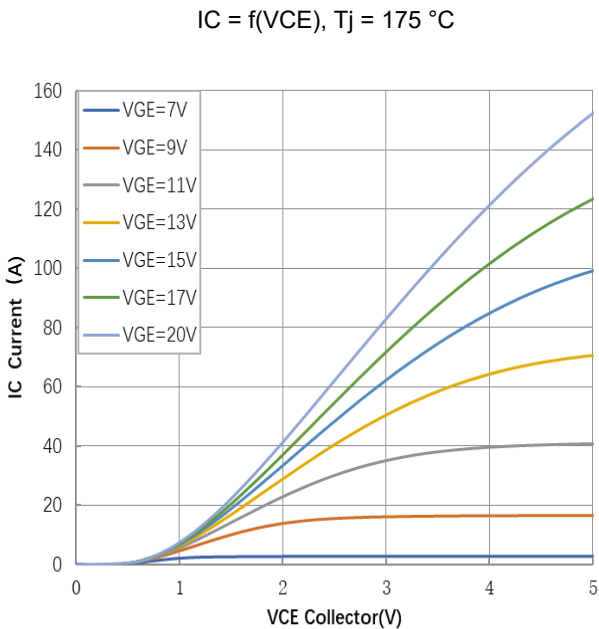
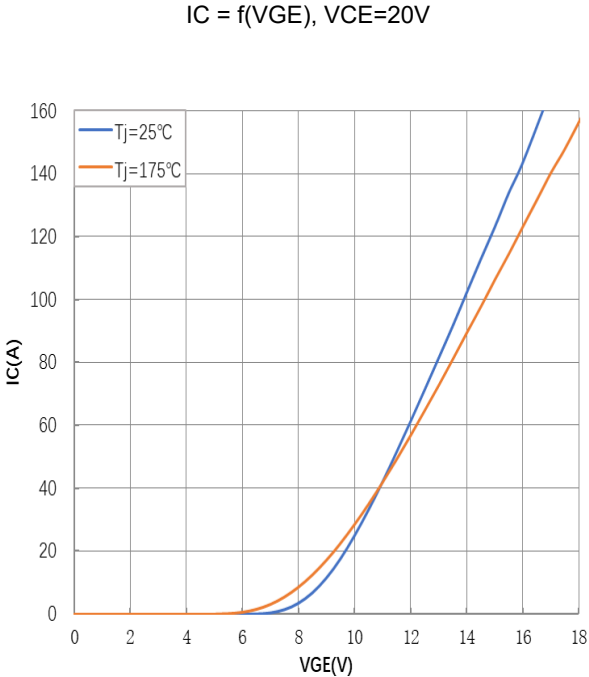
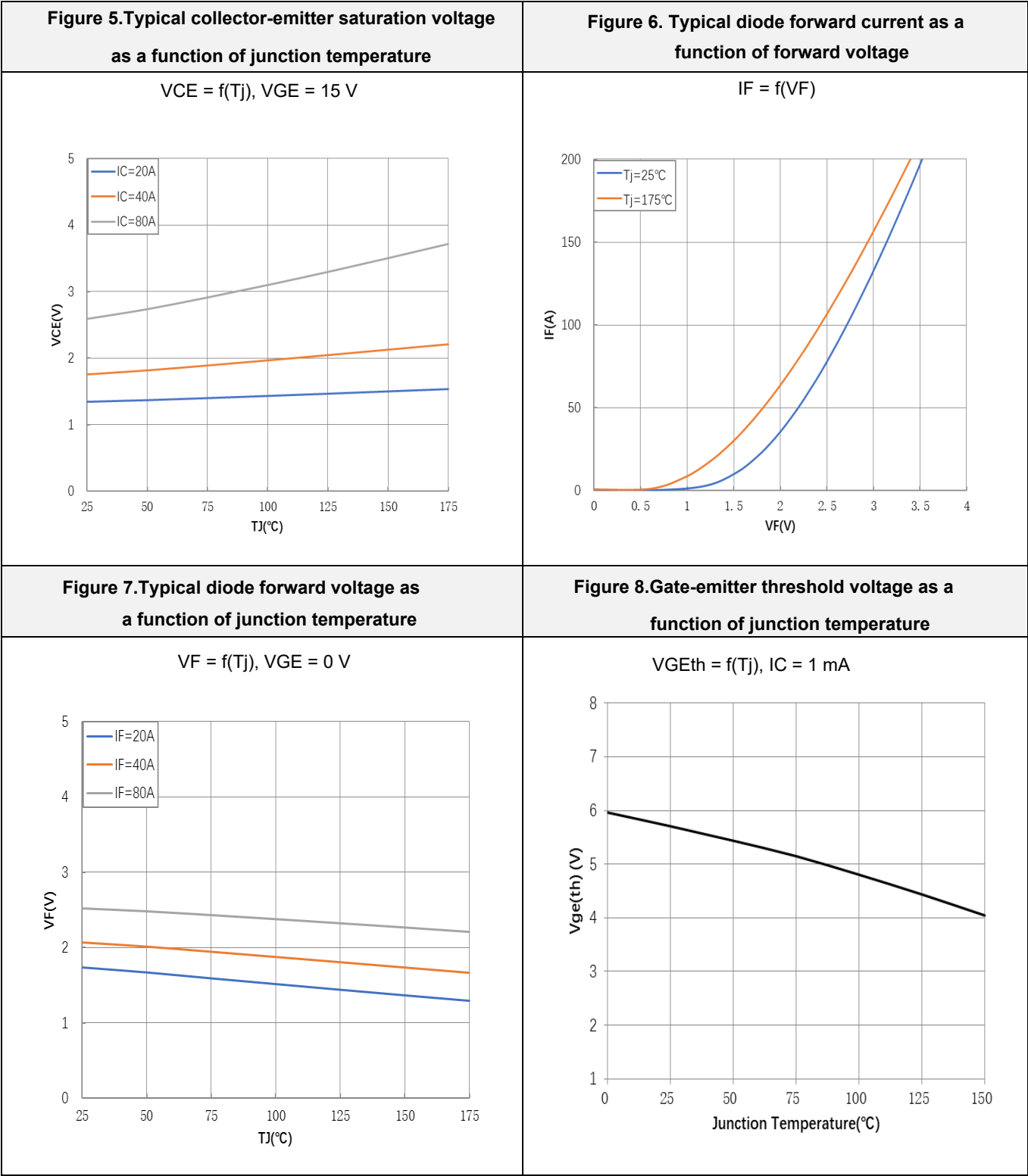


Figure 4.Typical transfer characteristic



Typical Performance Characteristics



Typical Performance Characteristics

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

$Z_{th(j-c)} = f(tp), D = tp/T$

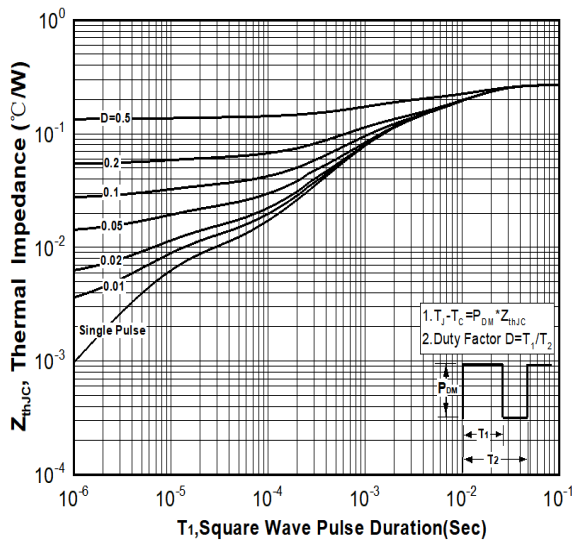


Figure 10. Diode transient thermal impedance as a function of pulse width

$Z_{th(j-c)} = f(tp), D = tp/T$

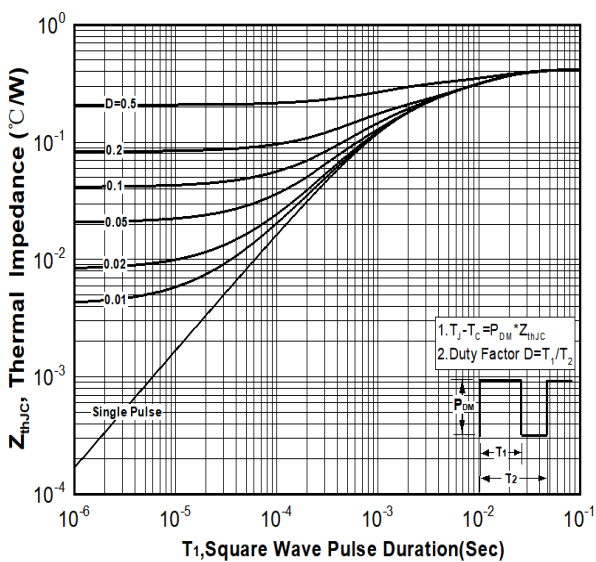


Figure 11. Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE}), f = 100 \text{ kHz}, V_{GE} = 0 \text{ V}$

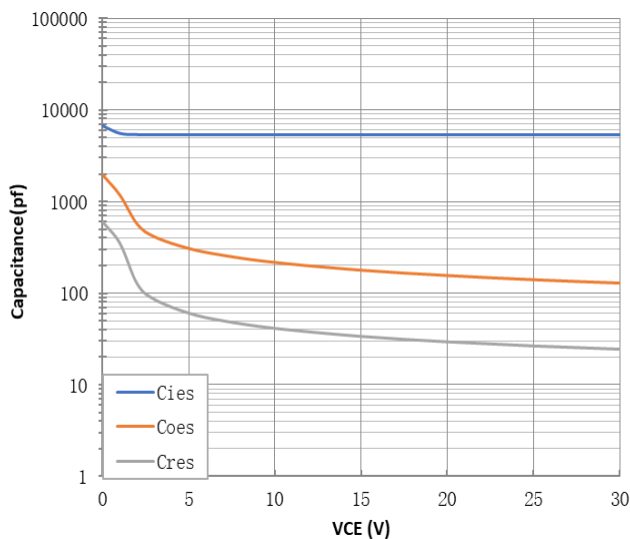
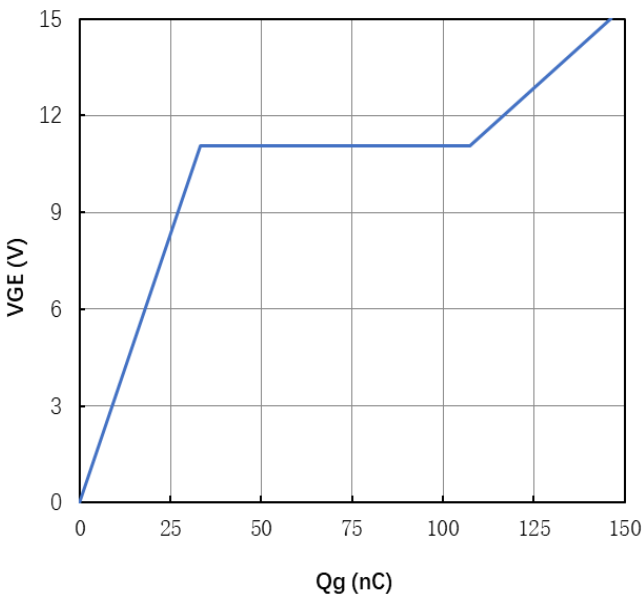
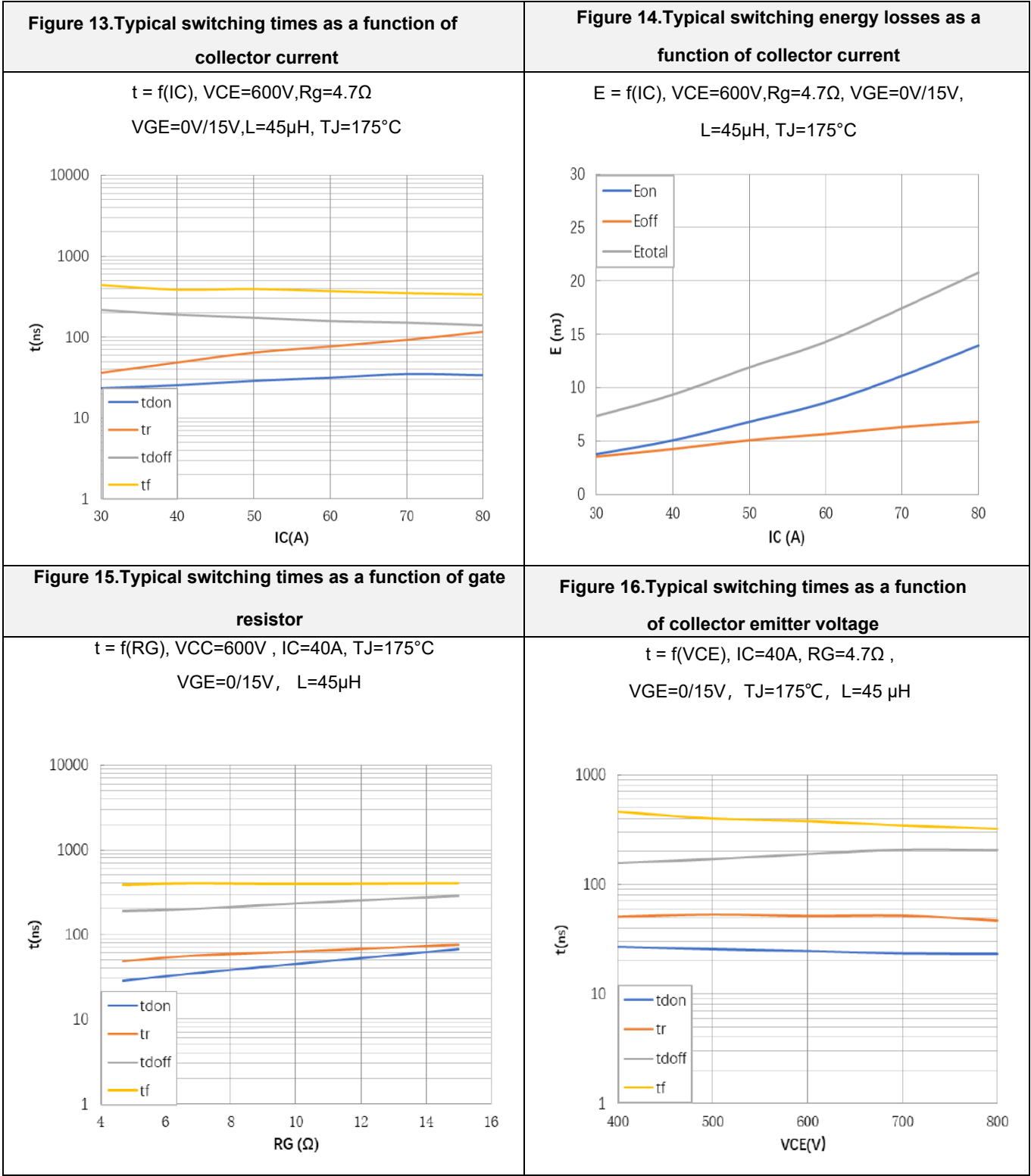


Figure 12. Typical gate charge

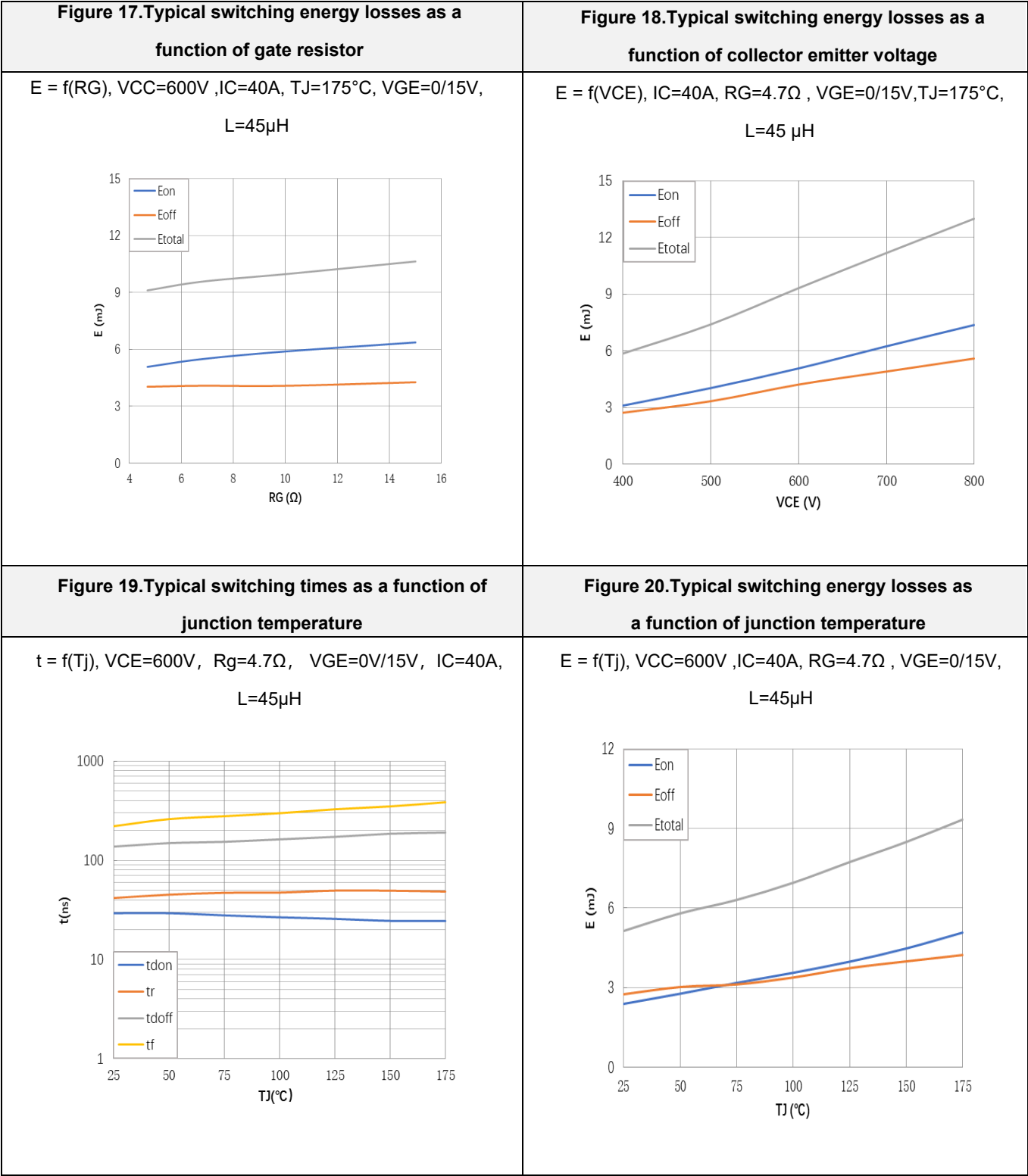
$V_{GE} = f(Q_G), V_{CE} = 960 \text{ V}, I_C = 40 \text{ A}$



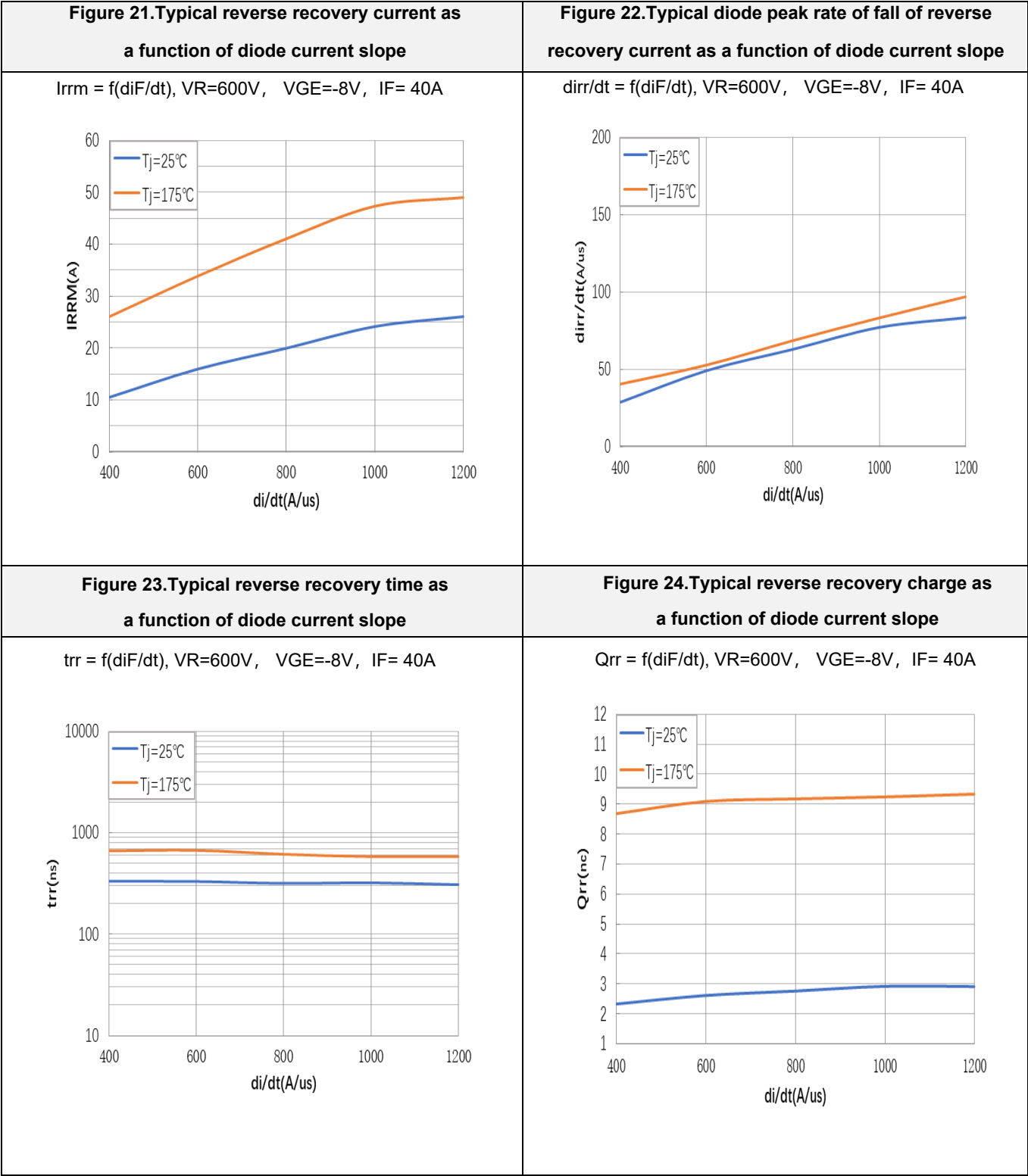
Typical Performance Characteristics



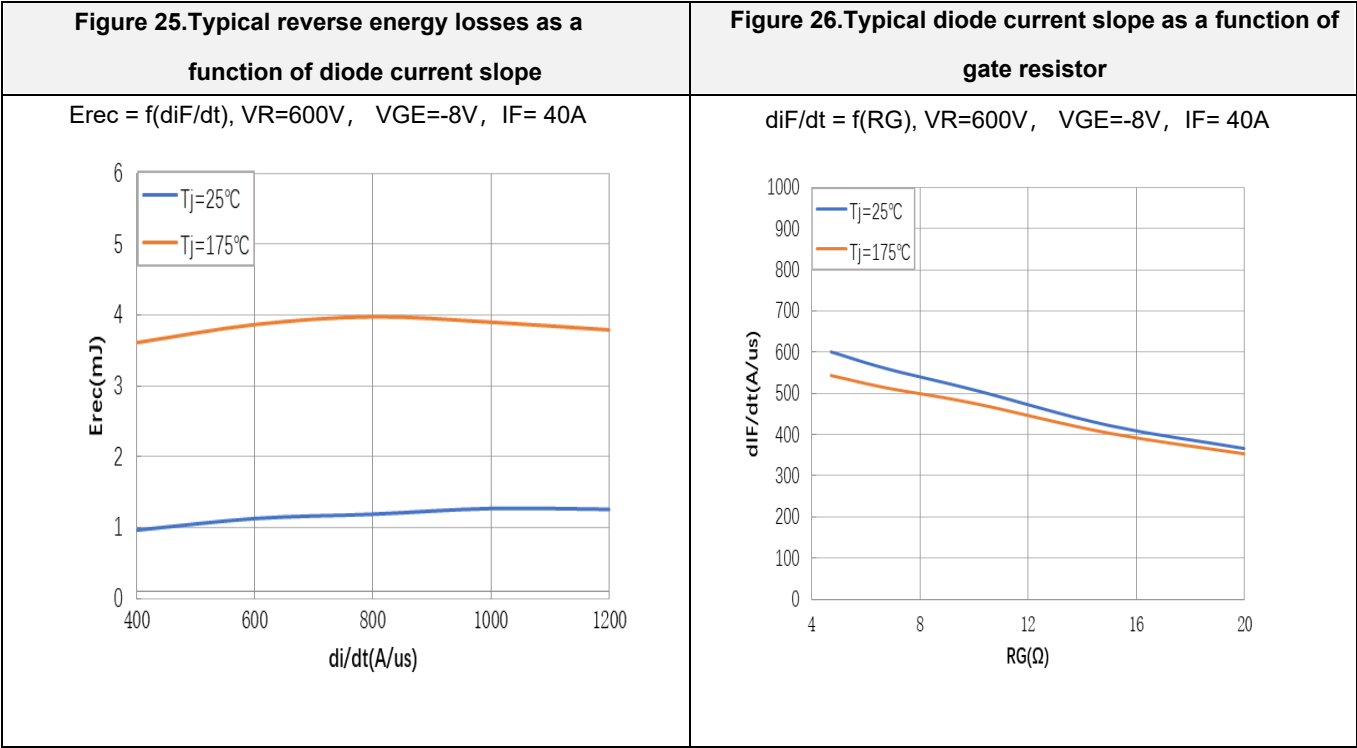
Typical Performance Characteristics



Typical Performance Characteristics



Typical Performance Characteristics



Typical Performance Characteristics

Figure 27. Switching time test circuit and waveforms

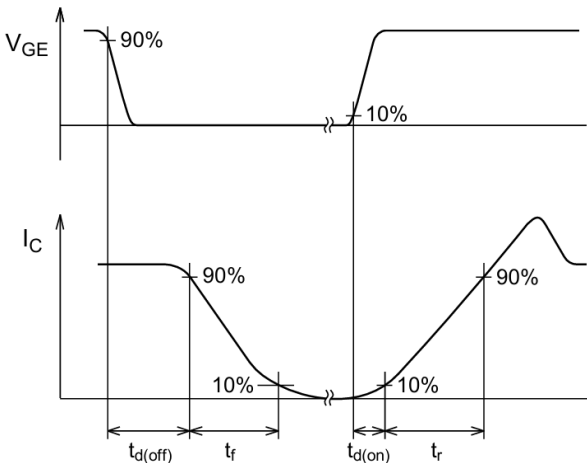
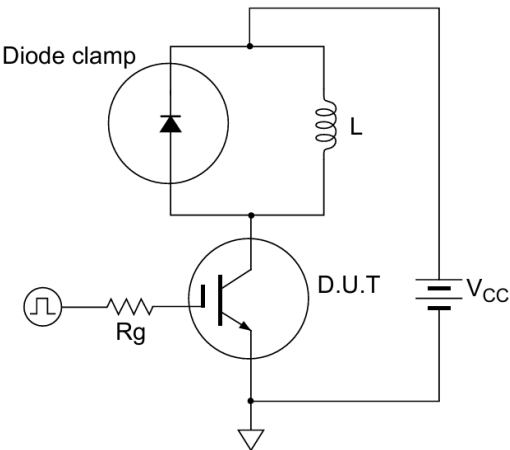
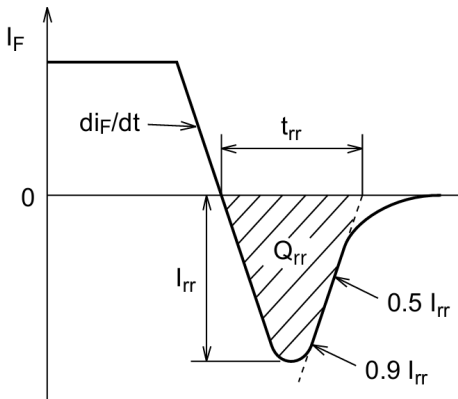
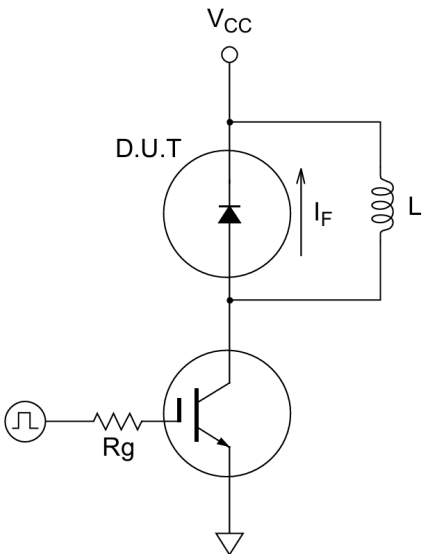
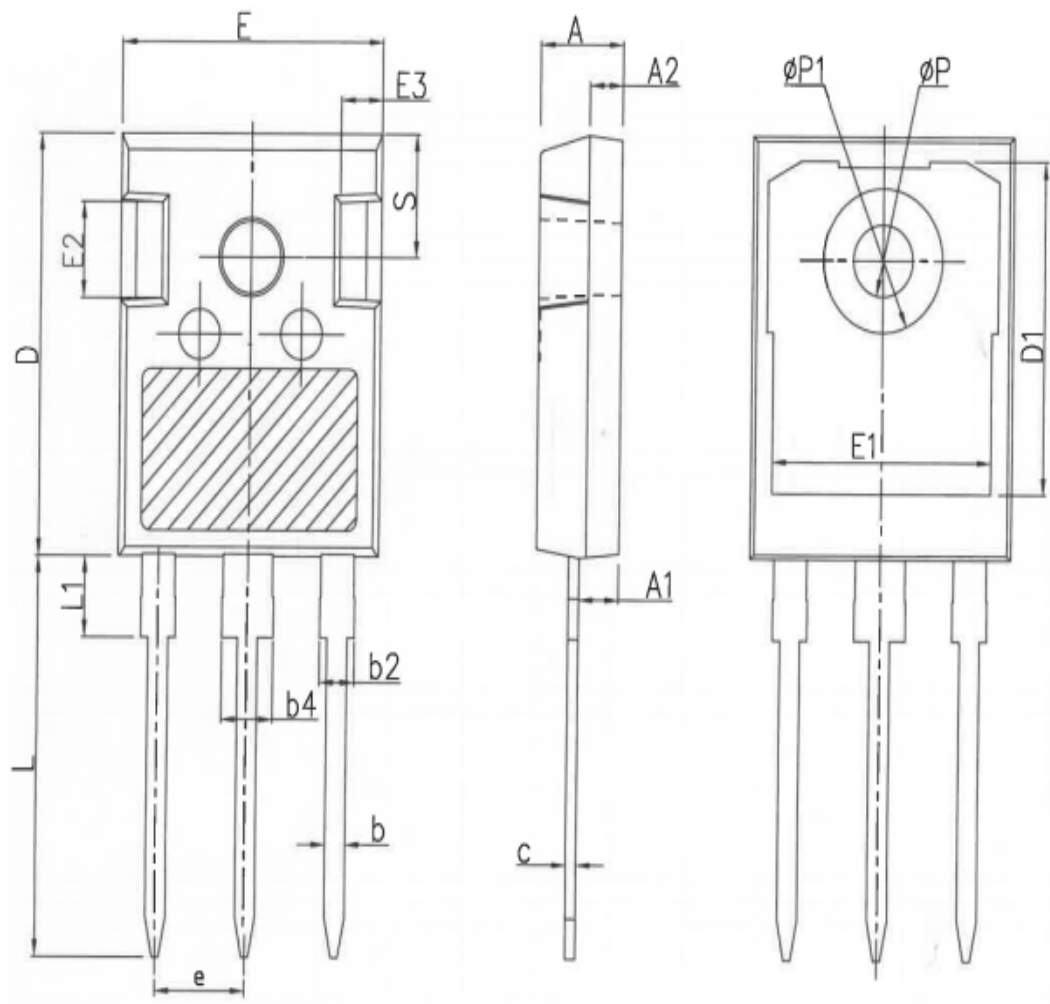


Figure 28. Diode reverse recovery time test circuit and waveforms



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
BKW120N040LZ1	BKW120N040LZ1	TO247-3L	Tube	30 units

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