



SK04N65B-TF

650V N-ch Planar MOSFET

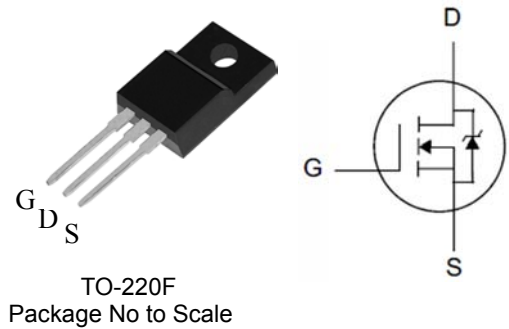
General Features

- RoHS Compliant
- $R_{DS(ON),typ.}=2.1\ \Omega @ V_{GS}=10V$
- Low Gate Charge Minimize Switching Loss
- Fast Recovery Body Diode

Applications

- Adaptor
- Charger
- SMPS Standby Power

BV_{DSS}	$R_{DS(ON),typ.}$	I_D
650V	2.1 Ω	4.0A



Absolute Maximum Ratings

$T_C=25^{\circ}C$ unless otherwise specified

Symbol	Parameter	SK04N65B-TF	Unit
V_{DSS}	Drain-to-Source Voltage	650	V
V_{GSS}	Gate-to-Source Voltage	± 30	
I_D	Continuous Drain Current	4.0	A
I_{DM}	Pulsed Drain Current at $V_{GS}=10V$	16	
E_{AS}	Single Pulse Avalanche Energy	250	mJ
P_D	Power Dissipation	30	W
	Derating Factor above $25^{\circ}C$	0.24	W/ $^{\circ}C$
T_L	Soldering Temperature Distance of 1.6mm from case for 10 seconds	300	$^{\circ}C$
$T_J \& T_{STG}$	Operating and Storage Temperature Range	-55 to 150	

Caution: Stresses greater than those listed in the "Absolute Maximum Ratings" may cause permanent damage to the device.

Thermal Characteristics

Symbol	Parameter	SK04N65B-TF	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	4.17	$^{\circ}C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	100	



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Electrical Characteristics

OFF Characteristics

$T_J = 25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	650	--	--	V	$V_{GS}=0V, I_D=250\mu A$
I_{DSS}	Drain-to-Source Leakage Current	--	--	1	μA	$V_{DS}=650V, V_{GS}=0V$
		--	--	100		$V_{DS}=520V, V_{GS}=0V, T_J=125^\circ\text{C}$
I_{GSS}	Gate-to-Source Leakage Current	--	--	+10	μA	$V_{GS}=+20V, V_{DS}=0V$
		--	--	-10		$V_{GS}=-20V, V_{DS}=0V$

ON Characteristics

$T_J = 25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$R_{DS(ON)}$	Static Drain-to-Source On-Resistance	--	2.1	2.5	Ω	$V_{GS}=10V, I_D=2.0A$
$V_{GS(TH)}$	Gate Threshold Voltage	2.0	--	4.0	V	$V_{DS}=V_{GS}, I_D=250\mu A$
gfs	Forward Transconductance	--	5.0	--	S	$V_{DS}=15V, I_D=2.0A$

Dynamic Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
C_{iss}	Input Capacitance	--	450	--	pF	$V_{GS}=0V, V_{DS}=25V, f=1.0MHz$
C_{rss}	Reverse Transfer Capacitance	--	6.0	--		
C_{oss}	Output Capacitance	--	50	--		
Q_g	Total Gate Charge	--	8.5	--	nC	$V_{DD}=325V, I_D=4A, V_{GS}=0 \text{ to } 10V$
Q_{gs}	Gate-to-Source Charge	--	2.8	--		
Q_{gd}	Gate-to-Drain (Miller) Charge	--	2.5	--		

Resistive Switching Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{d(ON)}$	Turn-on Delay Time	--	9.0	--	nS	$V_{DD}=325V, I_D=4A, V_{GS}=10V, R_g=4.7\Omega$
t_{rise}	Rise Time	--	7.0	--		
$t_{d(OFF)}$	Turn-Off Delay Time	--	22	--		
t_{fall}	Fall Time	--	9.0	--		



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Source-Drain Body Diode Characteristics

$T_J=25^{\circ}\text{C}$ unless otherwise specified

Symbol	Parameter	Min	Typ.	Max.	Unit	Test Conditions
I_{SD}	Continuous Source Current ^[2]	--	--	4.0	A	Integral pn-diode in MOSFET
I_{SM}	Pulsed Source Current ^[2]	--	--	16		
V_{SD}	Diode Forward Voltage	--	--	1.5	V	$I_S=4\text{A}$, $V_{GS}=0\text{V}$
t_{rr}	Reverse Recovery Time	--	235	--	ns	$V_{GS}=0\text{V}$ $I_F=I_S$, $di/dt=100\text{A}/\mu\text{s}$
Q_{rr}	Reverse Recovery Charge	--	750	--	nC	

Note:

[1] $T_J=+25^{\circ}\text{C}$ to $+150^{\circ}\text{C}$

[2] Pulse width $\leq 380\mu\text{s}$; duty cycle $\leq 2\%$.

Typical Characteristics

Figure 1. Maximum Transient Thermal Impedance

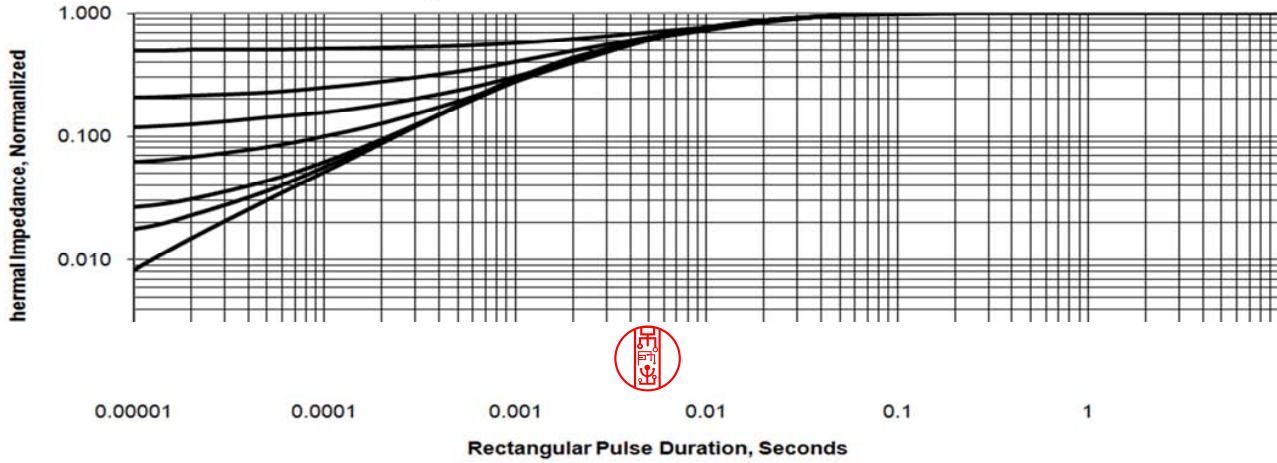


Figure 2. Maximum Power Dissipation vs Case Temperature

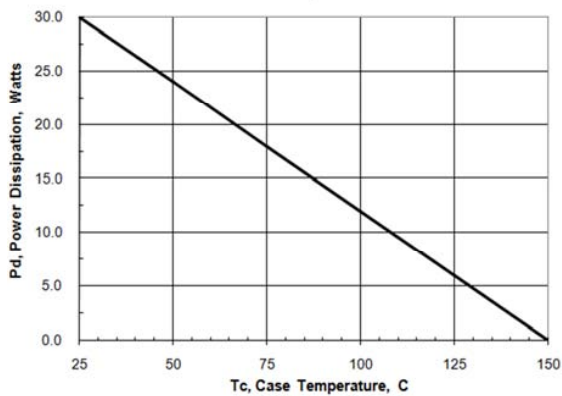


Figure 3. Maximum Continuous Drain Current vs Case Temperature

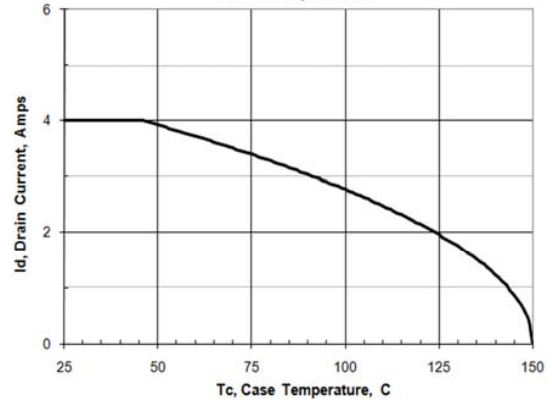


Figure 4. Typical Output Characteristics

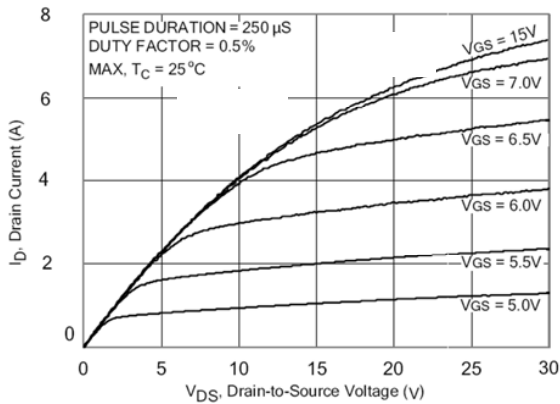
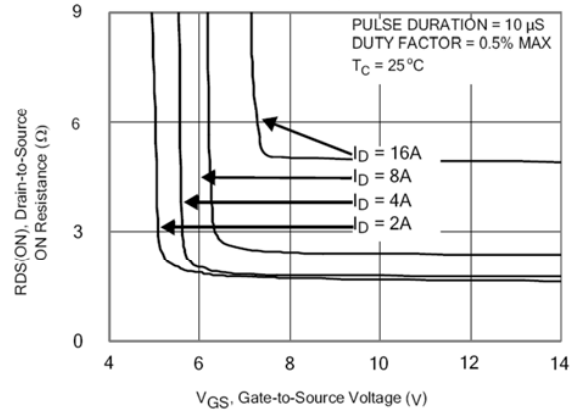


Figure 5. Typical Drain-to-Source ON Resistance vs Gate Voltage and Drain Current



Typical Characteristics(Cont.)

Figure 6. Maximum Peak Current Capability

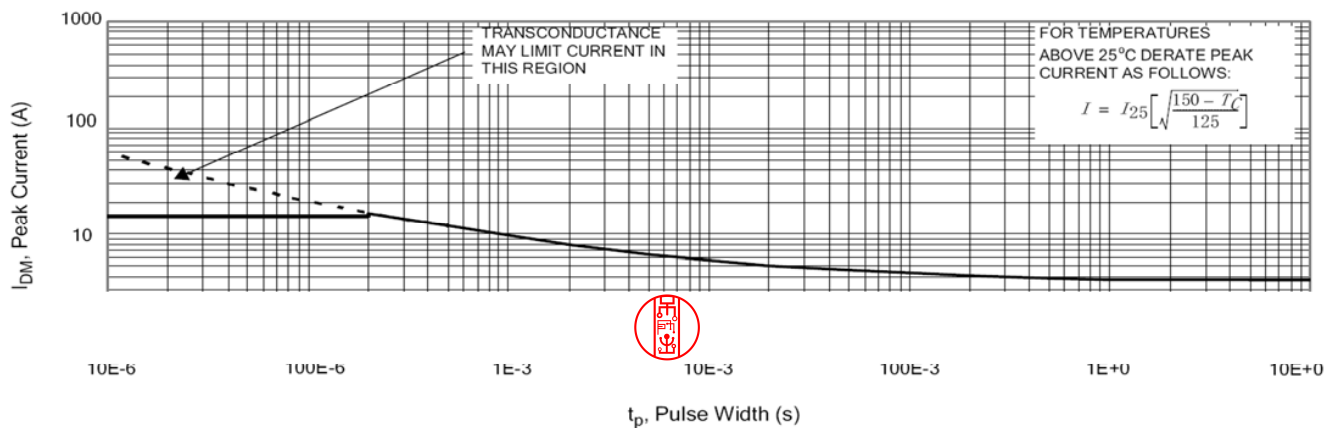


Figure 7. Typical Transfer Characteristics

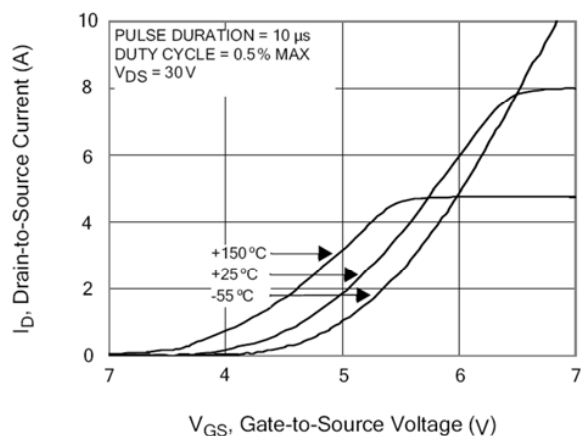


Figure 8. Unclamped Inductive Switching Capability

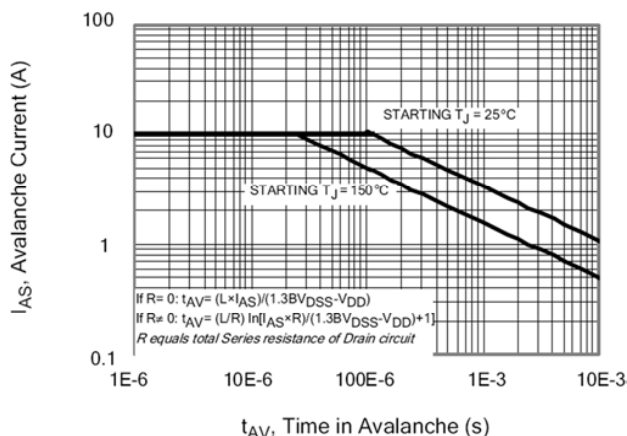


Figure 9. Typical Drain-to-Source ON Resistance vs Drain Current

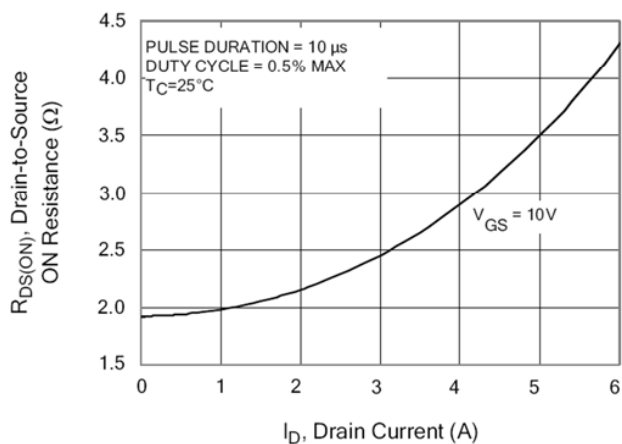
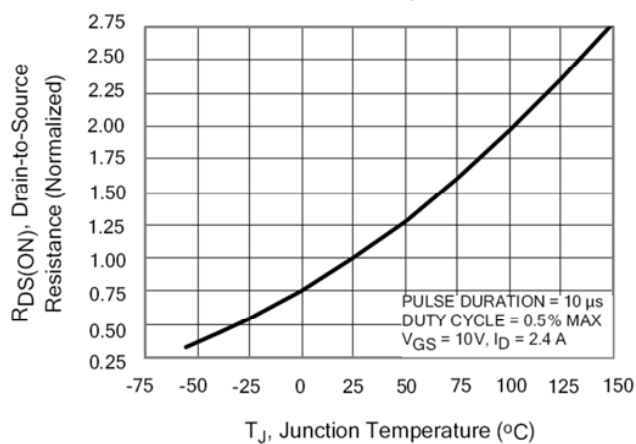


Figure 10. Typical Drain-to-Source ON Resistance vs Junction Temperature





Typical Characteristics(Cont.)

Figure 11. Typical Breakdown Voltage vs Junction Temperature

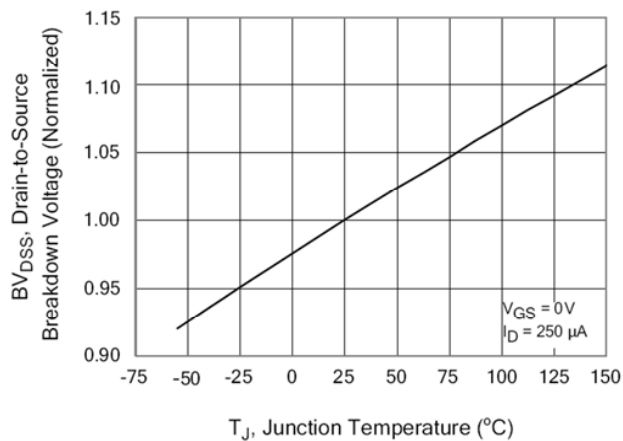


Figure 12. Typical Threshold Voltage vs Junction Temperature

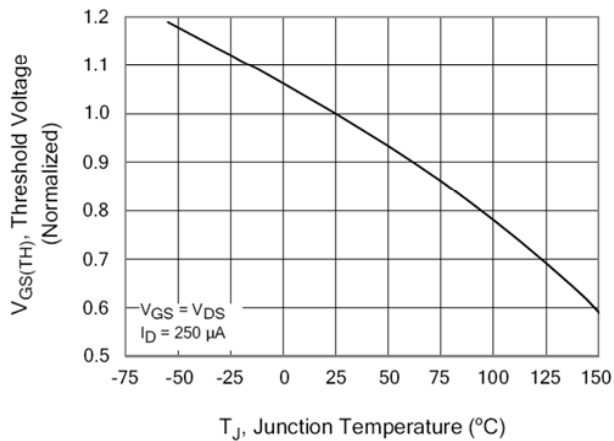


Figure 13. Maximum Safe Operating Area

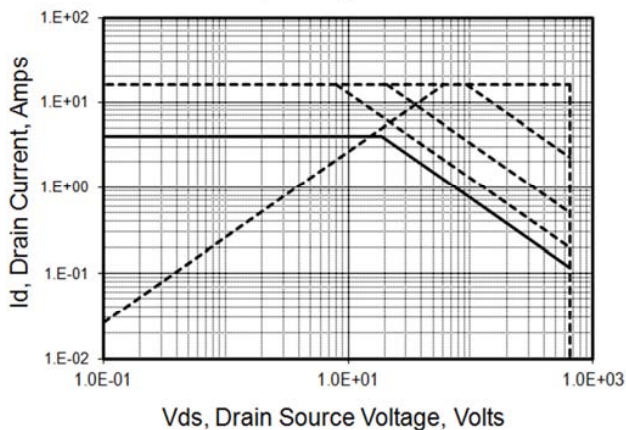


Figure 14. Typical Capacitance vs Drain-to-Source Voltage

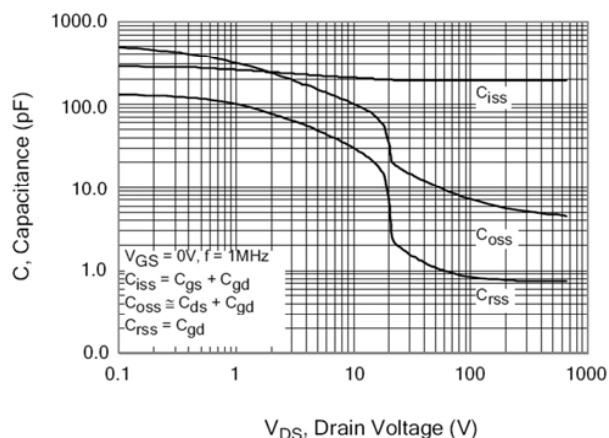


Figure 15. Typical Gate Charge

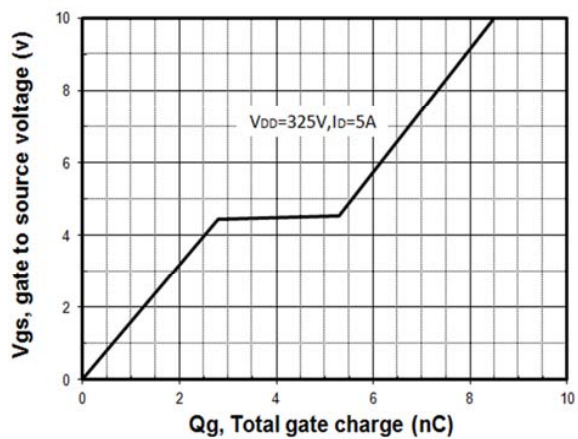
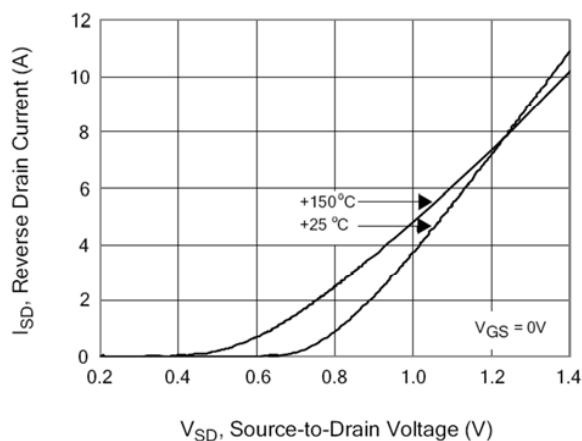
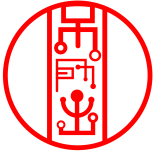


Figure 16. Typical Body Diode Transfer Characteristics





Test Circuits and Waveforms

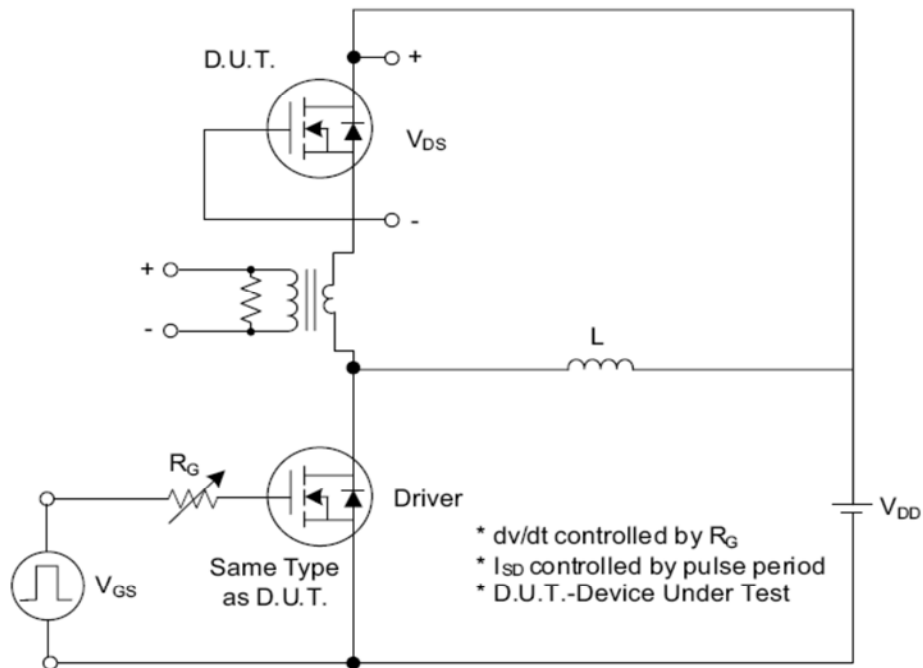


Fig. 1.1 Peak Diode Recovery dv/dt Test Circuit

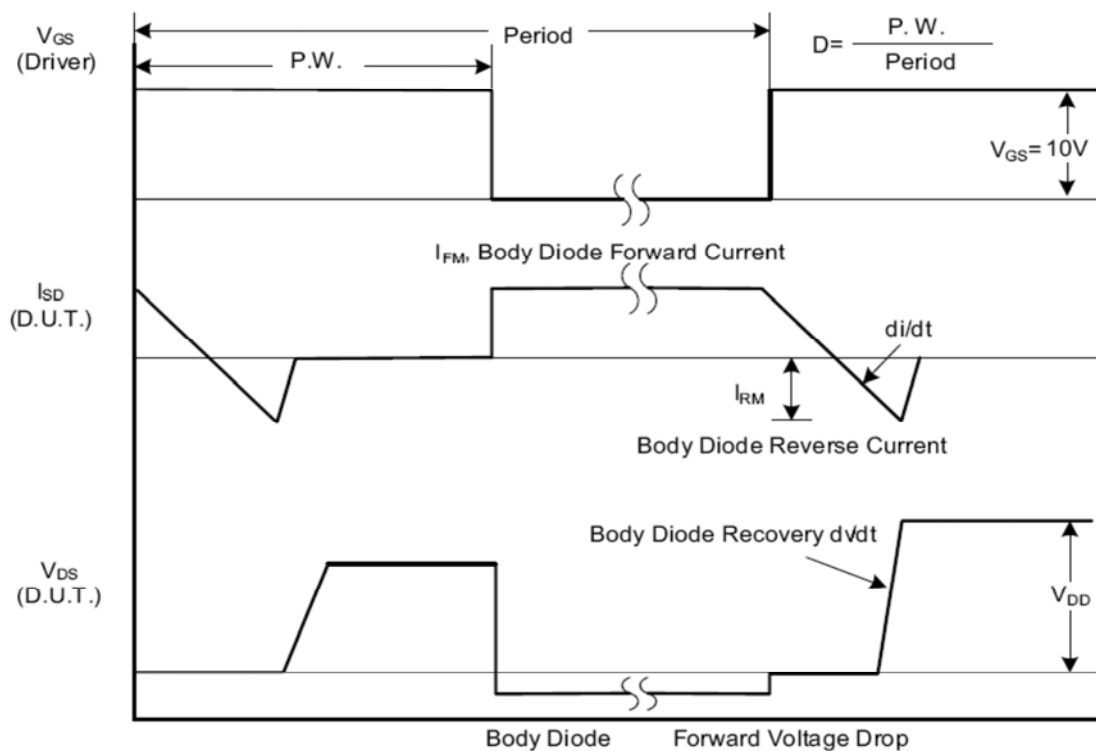
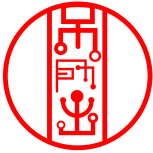


Fig. 1.2 Peak Diode Recovery dv/dt Waveforms



Test Circuits and Waveforms (Cont.)

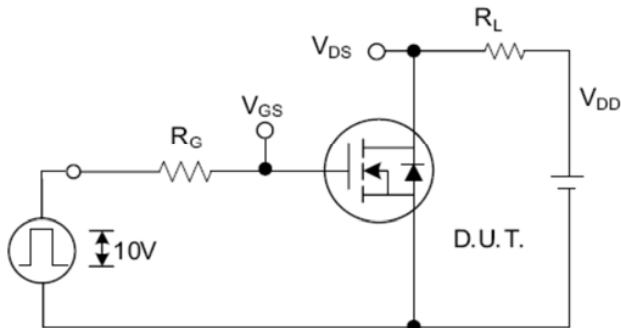


Fig. 2.1 Switching Test Circuit

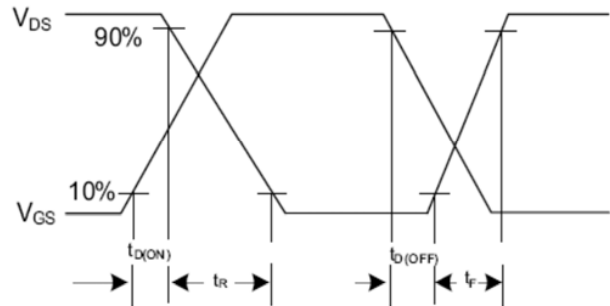


Fig. 2.2 Switching Waveforms

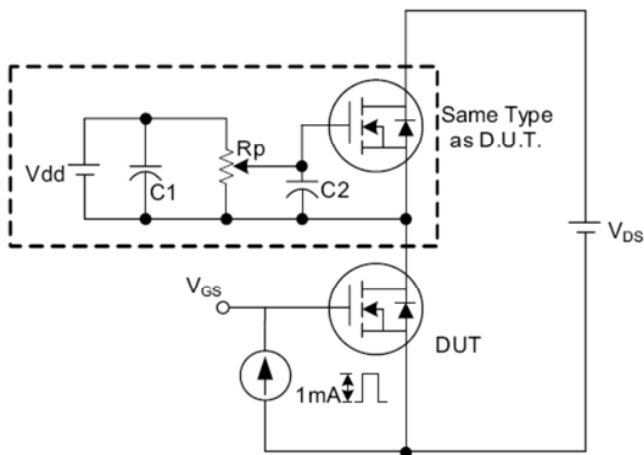


Fig. 3.1 Gate Charge Test Circuit

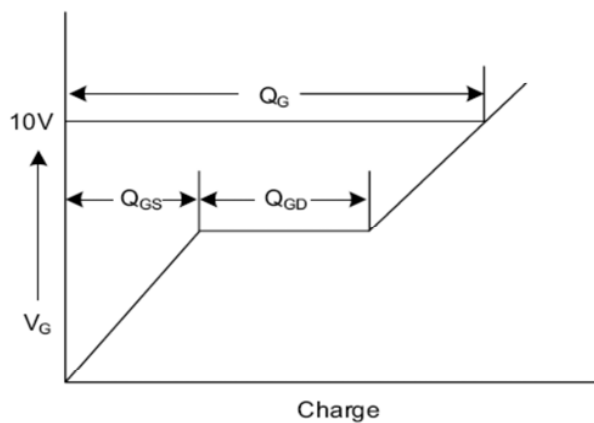


Fig. 3.2 Gate Charge Waveform

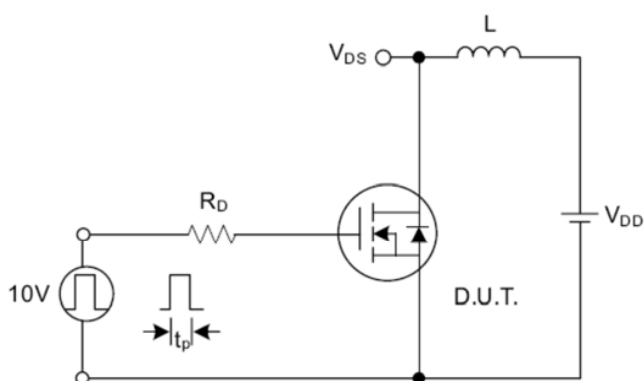


Fig. 4.1 Unclamped Inductive Switching Test Circuit

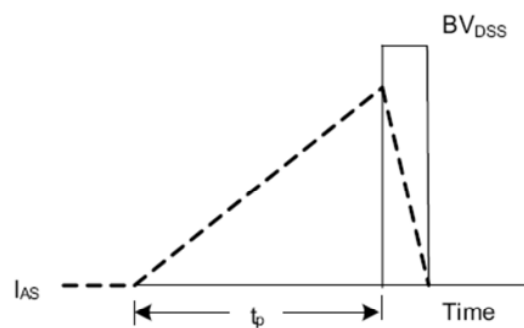


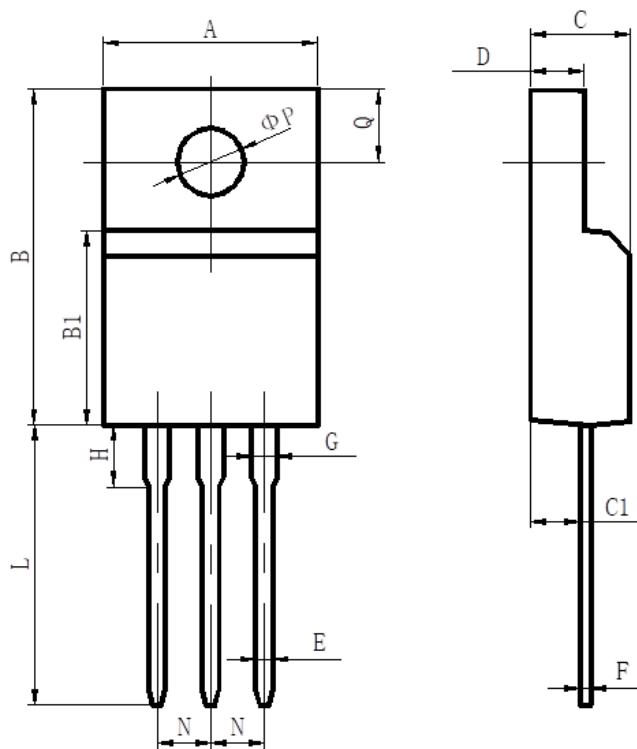
Fig. 4.2 Unclamped Inductive Switching Waveforms



SK04N65B-TF

PACKAGE OUTLINE

TO-220F



	Unit (mm)	
	MIN	MAX
A	9.70	10.30
B	15.50	16.10
B1	8.99	9.39
C	4.40	4.80
C1	2.15	2.55
D	2.50	2.90
E	0.70	0.90
F	0.40	0.60
G	1.12	1.42
H	3.40	3.80
L	12.6	13.6
N	2.34	2.74
Q	3.15	3.55
ΦP	3.00	3.30