

40V N-Channel MOSFET

General Features

- Proprietary New Trench Technology
- $R_{DS(ON),typ.} = 2.2m\Omega @ V_{GS}=10V$
- Low Gate Charge Minimize Switching Loss
- Fast Recovery Body Diode

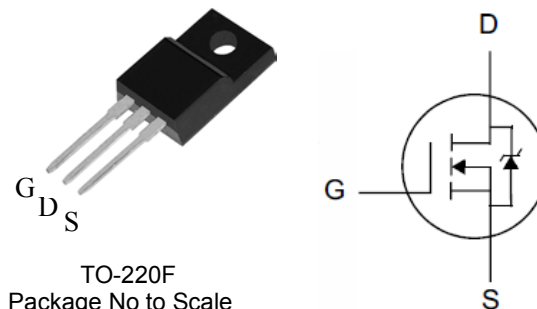
BV_{DSS}	$R_{DS(ON),typ.}$	$I_D^{[2]}$
40V	2.2m Ω	240A

Applications

- High efficiency DC/DC Converters
- Synchronous Rectification
- UPS Inverter

Ordering Information

Part Number	Package
SK240N04-TF	TO-220F



Absolute Maximum Ratings

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

Symbol	Parameter	SK240N04-TF	Unit
V_{DSS}	Drain-to-Source Voltage ^[1]	40	V
V_{GSS}	Gate-to-Source Voltage	± 20	
I_D	Continuous Drain Current ^[2]	240	A
	Continuous Drain Current ^[3]	80	
I_{DM}	Pulsed Drain Current at $V_{GS}=10V^{[2,4]}$	960	
E_{AS}	Single Pulse Avalanche Energy	1200	mJ
dv/dt	Peak Diode Recovery $dv/dt^{[3]}$	5.0	V/ns
P_D	Power Dissipation	300	W
	Derating Factor above $25^{\circ}C$	2.0	W/ $^{\circ}C$
T_L T_{PAK}	Maximum Temperature for Soldering Leads at 0.063in (1.6mm) from Case for 10 seconds, Package Body for 10 seconds	300 260	$^{\circ}C$
$T_J \& T_{STG}$	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	SK240N04-TF	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.5	$^{\circ}C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62	

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	40	--	--	V	$V_{GS}=0V, I_D=250\mu A$
I_{DSS}	Drain-to-Source Leakage Current	--	--	1	μA	$V_{DS}=40V, V_{GS}=0V$
		--	--	100		$V_{DS}=32V, V_{GS}=0V, T_J=125^\circ\text{C}$
I_{GSS}	Gate-to-Source Leakage Current	--	--	+100	nA	$V_{GS}=+20V, V_{DS}=0V$
		--	--	-100		$V_{GS}=-20V, V_{DS}=0V$

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	--	2.2	3.0	m Ω	$V_{GS}=10V, I_D=80A$ [5]
$V_{GS(TH)}$	Gate Threshold Voltage	2.0	--	4.0	V	$V_{DS}=V_{GS}, I_D=250\mu A$
gfs	Forward Transconductance	--	221	--	S	$V_{DS}=10V, I_D=80A$ [5]

Dynamic Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
C_{iss}	Input Capacitance	--	4.84	--	nF	$V_{GS}=0V, V_{DS}=25V, f=1.0MHz$
C_{rss}	Reverse Transfer Capacitance	--	0.43	--		
C_{oss}	Output Capacitance	--	0.68	--		
R_G	Gate Series Resistance	--	2.1	--	Ω	$f=1.0MHz$
Q_g	Total Gate Charge	--	95	--	nC	$V_{DD}=20V, I_D=80A, V_{GS}=0 \text{ to } 10V$
Q_{gs}	Gate-to-Source Charge	--	27	--		
Q_{gd}	Gate-to-Drain (Miller) Charge	--	28	--		

Resistive Switching Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{d(ON)}$	Turn-on Delay Time	--	21	--	ns	$V_{DD}=20V, I_D=80A, V_{GS}=10V, R_G=2.5\Omega$
t_{rise}	Rise Time	--	22	--		
$t_{d(OFF)}$	Turn-Off Delay Time	--	53	--		
t_{fall}	Fall Time	--	21	--		

Source-Drain Body Diode Characteristics

$T_J=25$ unless otherwise specified

Symbol	Parameter	Min	Typ.	Max.	Unit	Test Conditions
I_{SD}	Continuous Source Current ^[2]	--	--	240	A	Integral PN-diode in MOSFET
I_{SM}	Pulsed Source Current ^[2]	--	--	960		
V_{SD}	Diode Forward Voltage	--	0.90	1.2	V	$I_S=80A$, $V_{GS}=0V$
t_{rr}	Reverse recovery time	--	46	--	ns	$V_{GS}=0V$, $I_F=80A$, $di_F/dt=100A/\mu s$
Q_{rr}	Reverse recovery charge	--	19	--	nC	

Typical Characteristics

Figure 1. Maximum Effective Thermal Impedance, Junction-to-Case

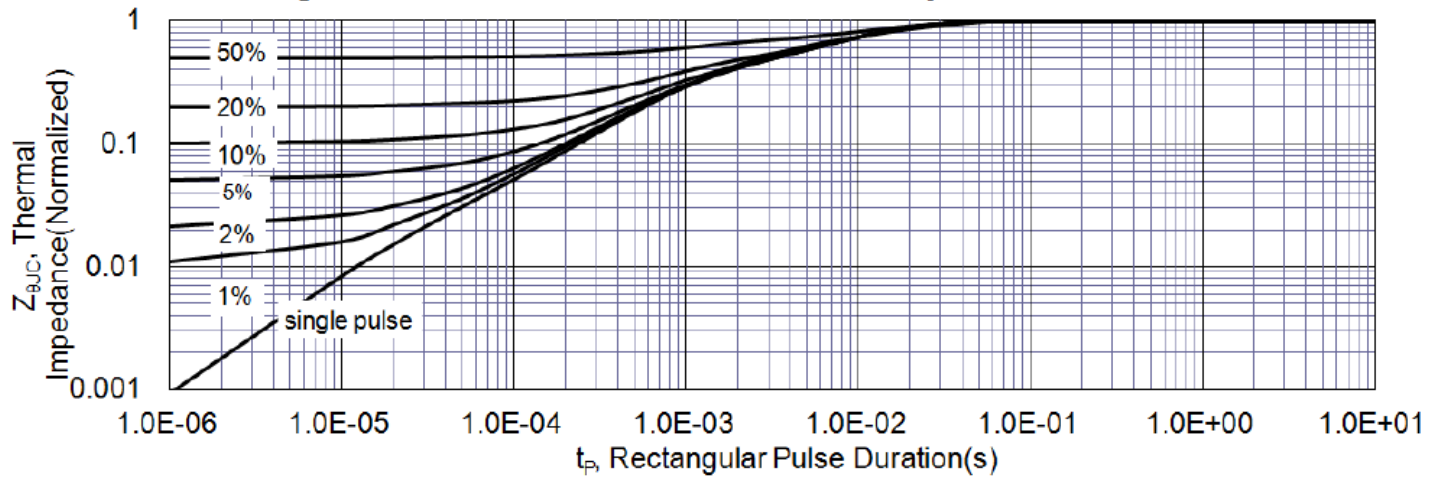


Figure 2. Maximum Power Dissipation vs Case Temperature

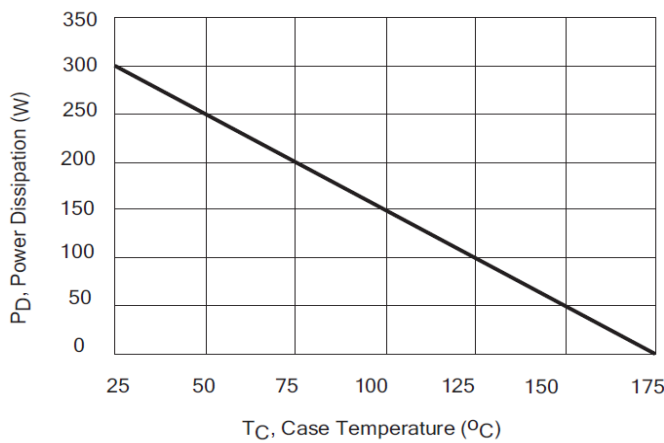


Figure3. Maximum Continuous Drain Current vs Case Temperature

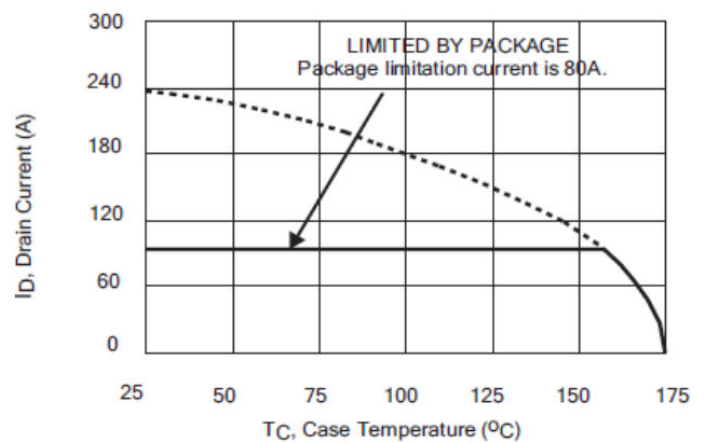


Figure 4. Typical Output Characteristics

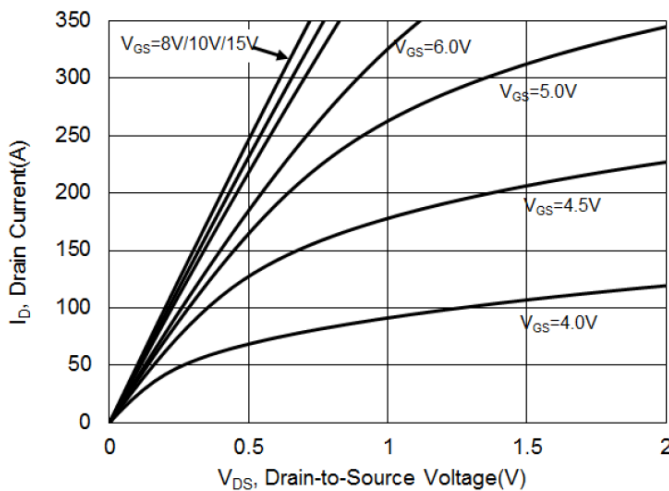
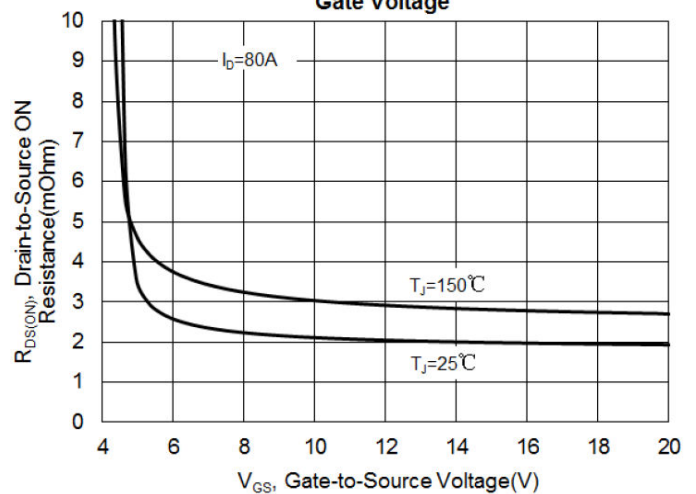


Figure 5. Typical Drain-to-Source ON Resistance vs. Gate Voltage



Typical Characteristics(Cont.)

Figure 6. Maximum Peak Current Capability

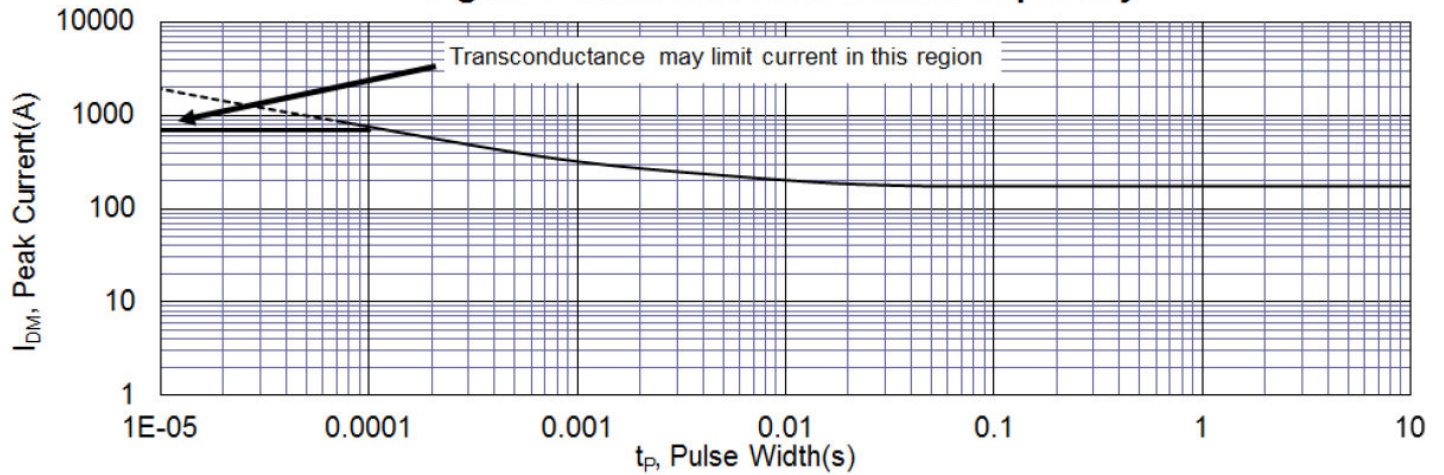


Figure 7. Typical Transfer Characteristics

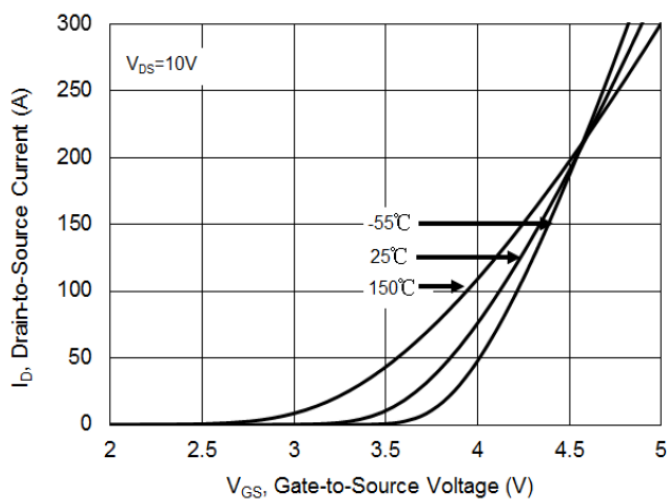


Figure 8. Unclamped Inductive Switching Capability

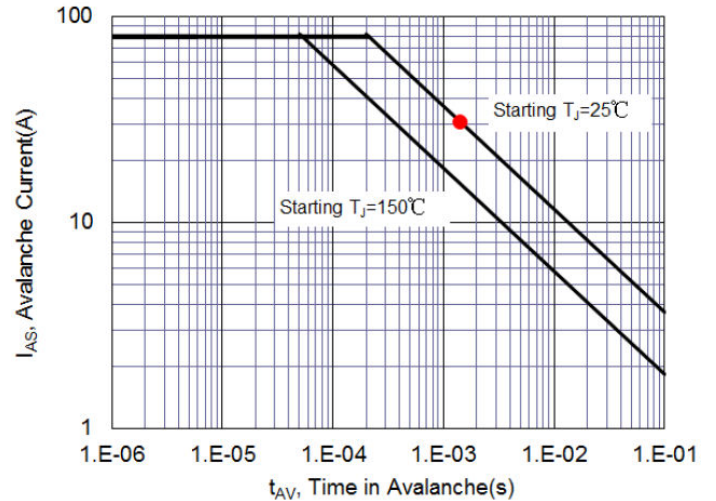


Figure 9. Typical Drain-to-Source ON Resistance

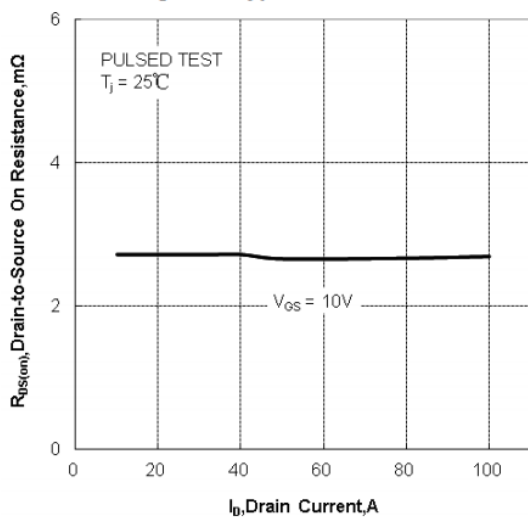
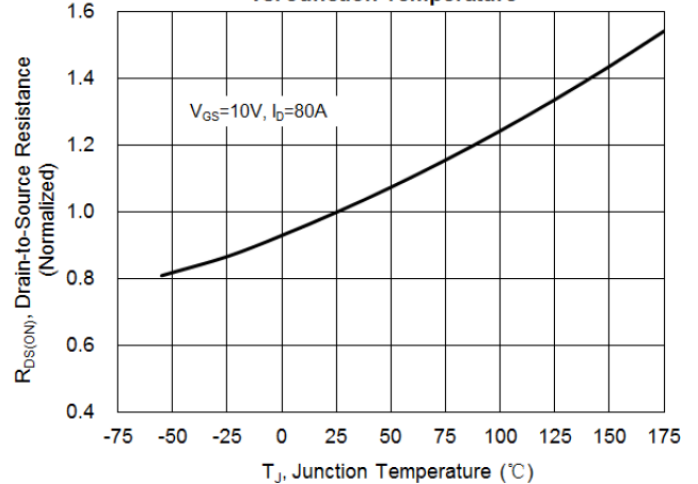


Figure 10. Typical Drain-to-Source On Resistance vs. Junction Temperature



Typical Characteristics(Cont.)

Figure 11. Typical Breakdown Voltage vs. Junction Temperature

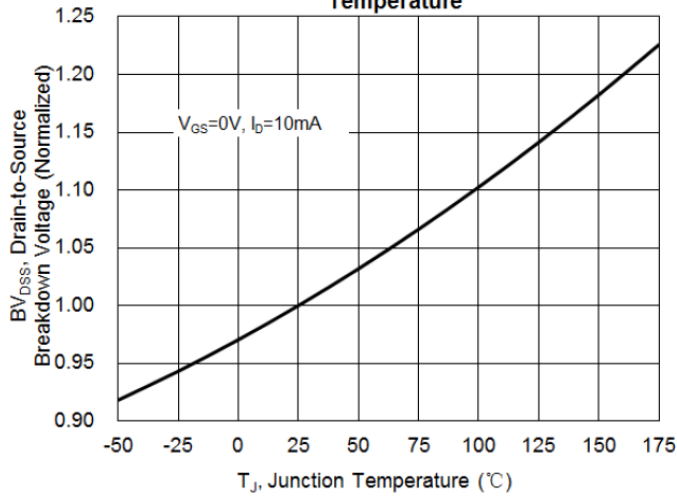


Figure 12. Typical Threshold Voltage vs. Junction Temperature

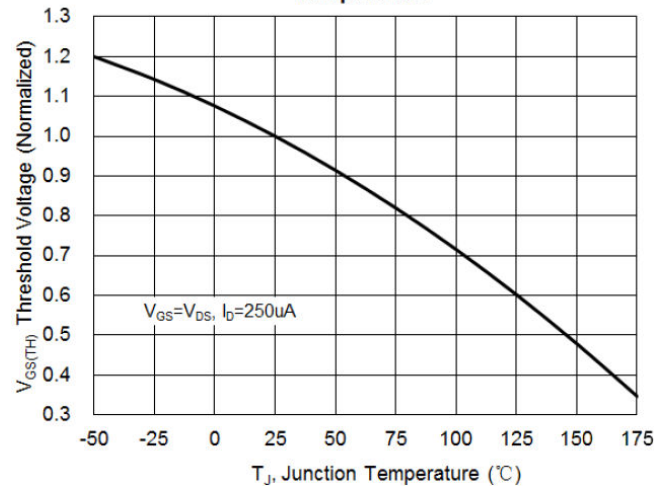


Figure 13. Maximum Forward Safe Operation Area

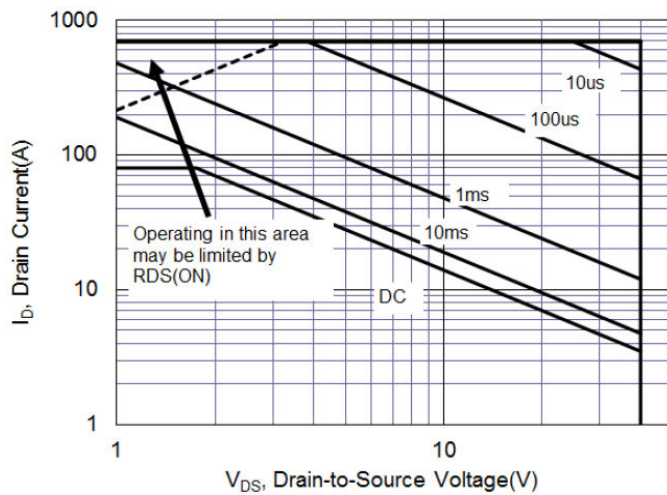


Figure 14. Typical Capacitance vs. Drain-to-Source Voltage

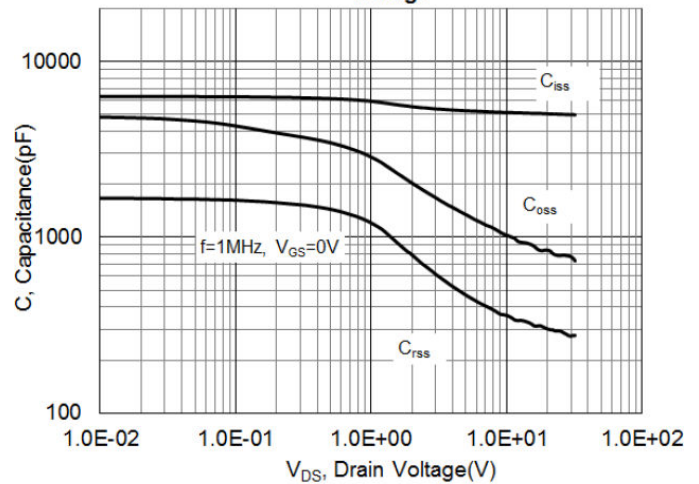


Figure 15. Typical Gate Charge vs. Gate-to-Source Voltage

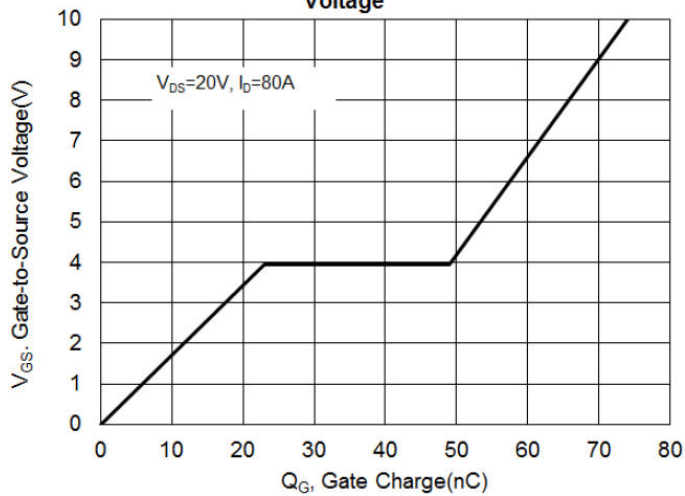
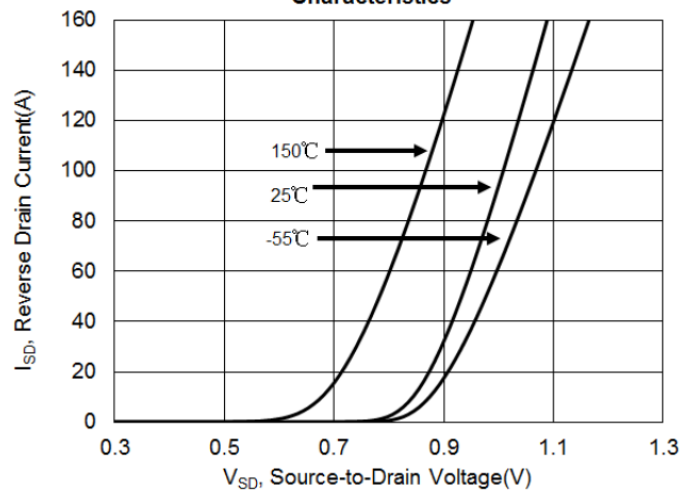


Figure 16. Typical Body Diode Transfer Characteristics



Test Circuits and Waveforms

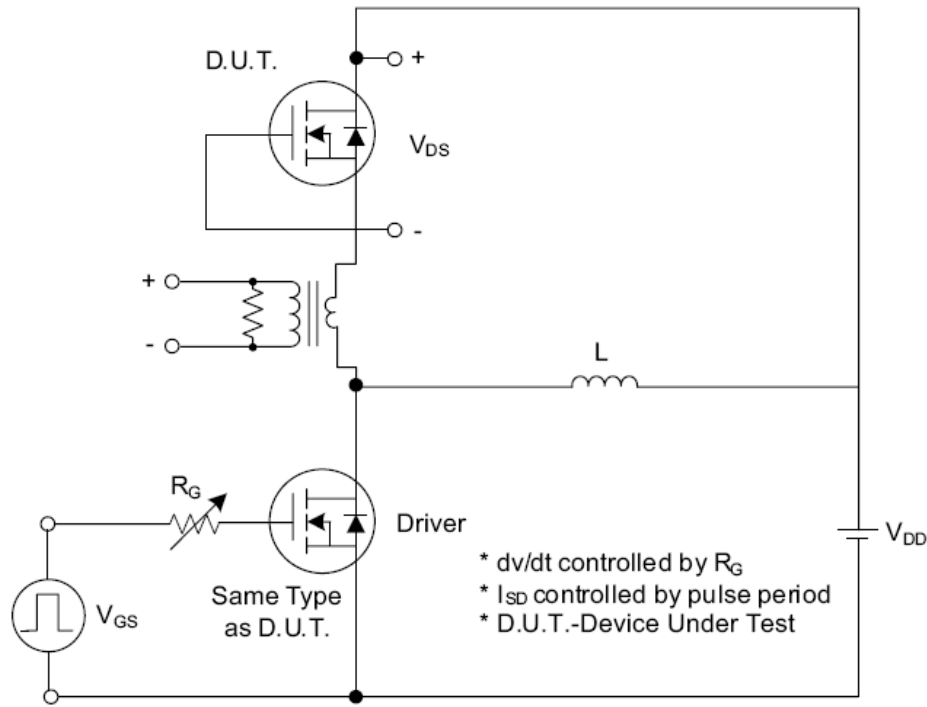


Fig. 1.1 Peak Diode Recovery dv/dt Test Circuit

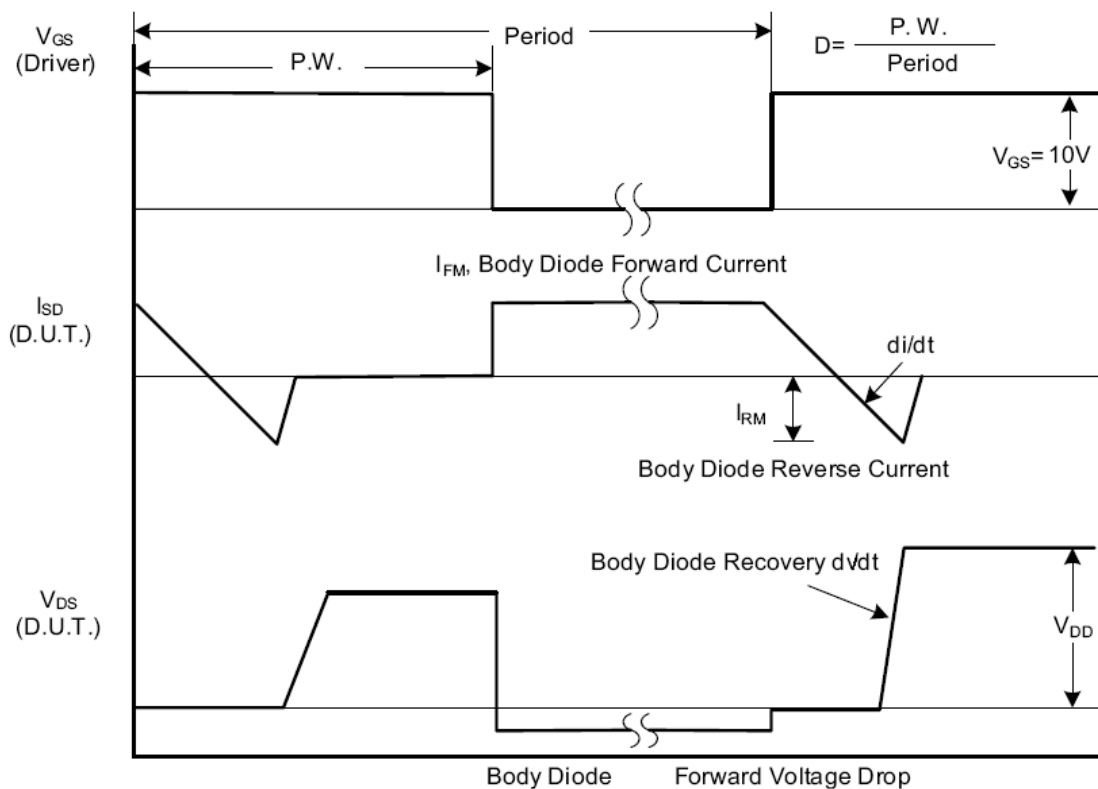


Fig. 1.2 Peak Diode Recovery dv/dt Waveforms

Test Circuits and Waveforms (Cont.)

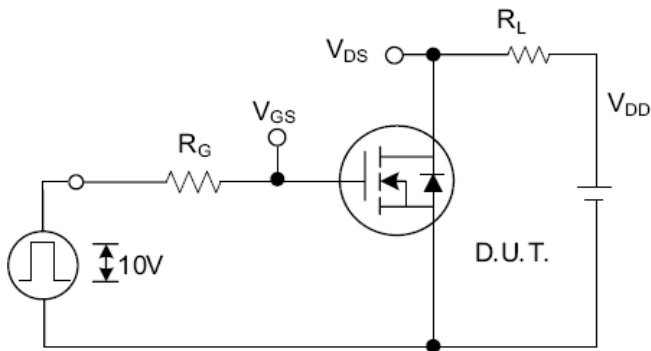


Fig. 2.1 Switching Test Circuit

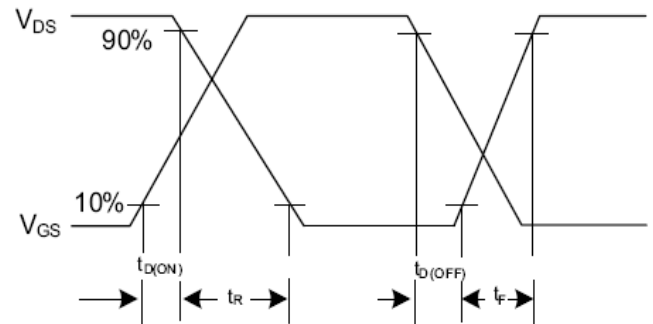


Fig. 2.2 Switching Waveforms

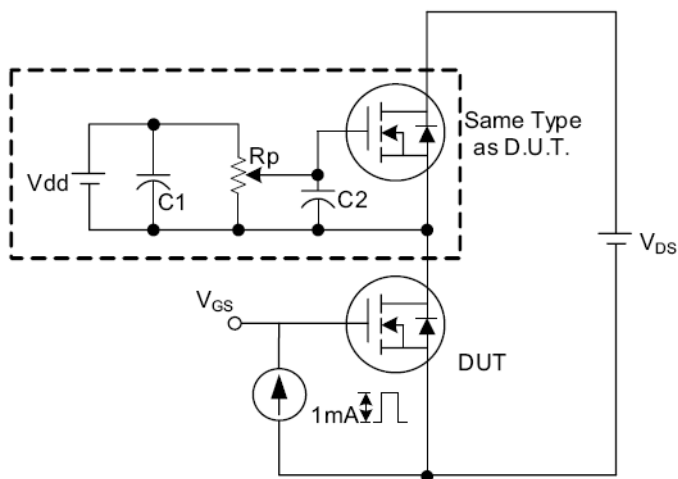


Fig. 3.1 Gate Charge Test Circuit

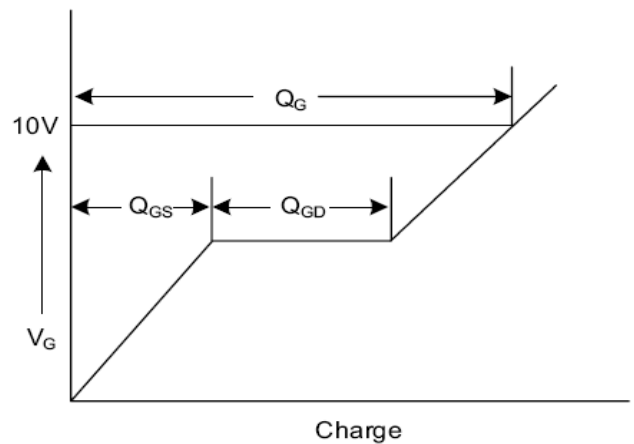


Fig. 3.2 Gate Charge Waveform

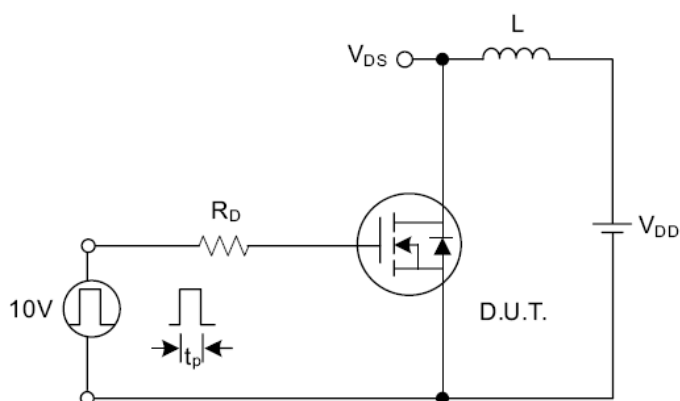


Fig. 4.1 Unclamped Inductive Switching Test Circuit

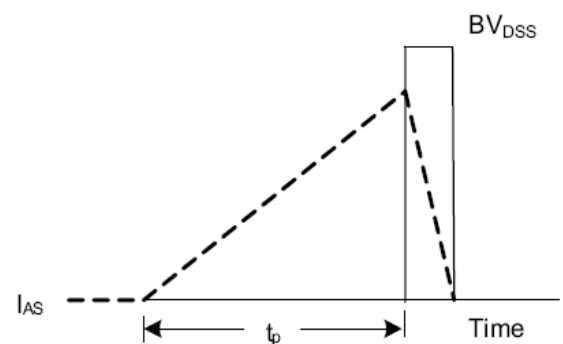
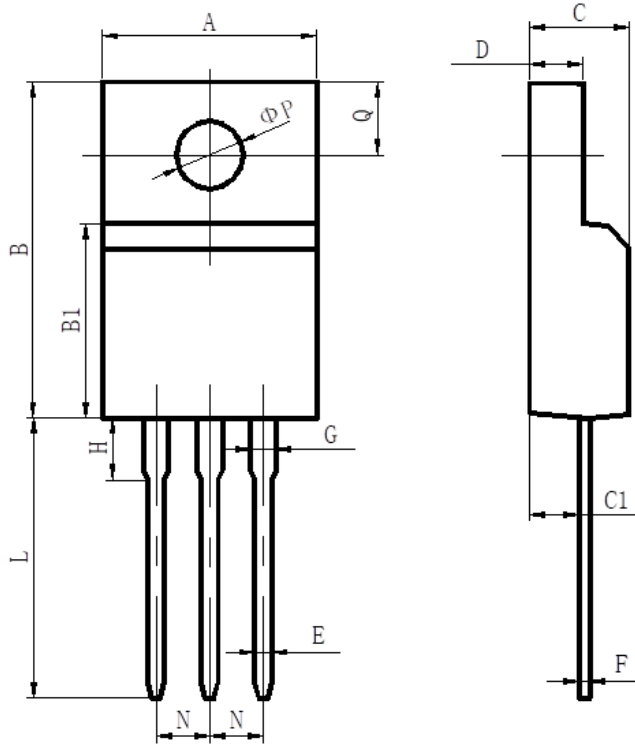


Fig. 4.2 Unclamped Inductive Switching Waveforms

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