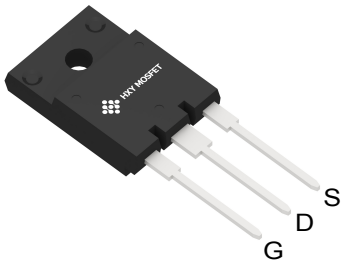
2SK3746-1E

SiC Power MOSFET N-Channel Enhancement Mode

Features

- Low on-resistance
- Fast switching speed
- Long creepage distance
- Simple to drive
- Pb-free lead plating; RoHS compliant

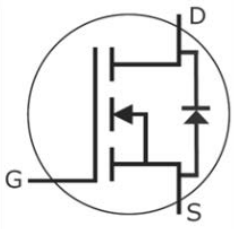


TO-3PF

Applications

- Auxilialy power supplies
- Switch mode power supplies

Ordering Part Number	Package	Brand
2SK3746-1E	TO-3PF	HXY MOSFET



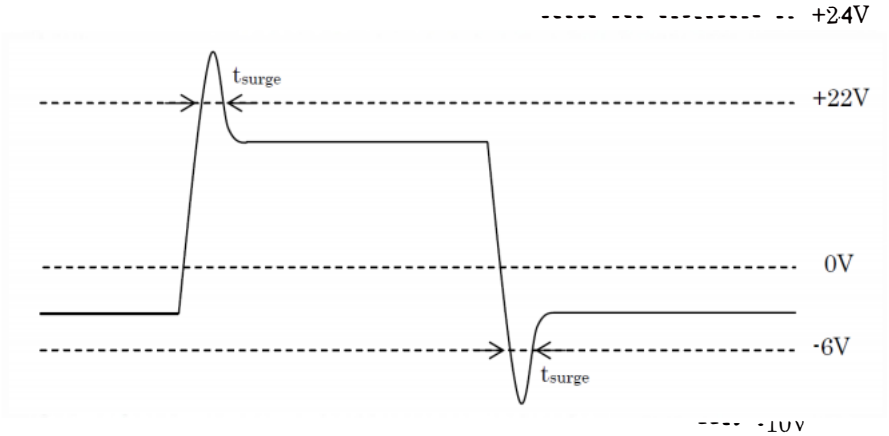
Absolute Maximum Ratings (T_C = 25˚C unless otherwise specified)

Parameter		Symbol	Value	Unit
Drain - Source voltage		V_{DSS}	1500	V
Continuous drain current	T_c = 25°C	I_D *1	3.7	A
	T_c = 100°C	I_D *1	2.6	A
Pulsed drain current		$I_{D,pulse}$ *2	9.2	A
Gate - Source voltage (DC)		V_{GSS}	-4 to 20	V
Gate - Source surge voltage (t_{surge}<300nsec)		V_{GSS_surge} *3	-10 to 22	V
Power dissipation (T_c = 25°C)		P_D	35	W
Virtual Junction temperature		T_{vj}	175	°C
Range of storage temperature		T_{stg}	-55 to +175	°C

Electrical Characteristics (T_C=25°C unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain-Source breakdown voltage	$V_{(BR)DSS}$	V_{GS}=0V,I_D=1mA	1500			V
Zero gate voltage drain current	I_{DSS}	V_{DS}=1500V,V_{GS}=0V Tvj=25°C Tvj=150°C		0.1 0.2	10	μA
Gate-Source leakage current	I_{GSS+}	V_{GS}=+20V,V_{DS}=0V			100	nA
Gate- Source leakage current	I_{GSS-}	V_{GS}=-4V,V_{DS}=0V			-100	nA
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, Io=0.41mA	1.8	2.8	4.0	V

⋆1 Limited by maximum T_{vj} and for Max.R_{thJC}
⋆2 PW≤10us, Duty cycle≤ 1%
⋆3 Example of acceptable V_{GS} waveform



*4 Pulsed

Electrical Characteristics (T_C=25°C unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Static drain - source on - state resistance	$R_{DS(on)}$ *4	V_{GS} = 18V, I_D = 1.1A				Ω
		T_{vj} = 25°C	-	1.15	1.50	
		T_{vj} = 125°C	-	1.71	-	
Gate input resistance	R_G	f = 1MHz, open drain	-	64	-	Ω
Transconductance	g_{fs} *4	V_{DS} = 10V, I_D = 1.1A	-	0.4	-	S
Input capacitance	C_{iss}	V_{GS} = 0V	-	184	-	pF
Output capacitance	C_{oss}	V_{DS} = 800V	-	16	-	
Reverse transfer capacitance	C_{rss}	f = 1MHz	-	6	-	
Effective output capacitance, energy related	$C_{o(er)}$	V_{GS} = 0V V_{DS} = 0V to 800V	-	17	-	pF
Turn - on delay time	$t_{d(on)}$ *4	V_{DD} = 500V, I_D = 1.1A	-	16	-	ns
Rise time	t_r *4	V_{GS} = 18V/0V	-	21	-	
Turn - off delay time	$t_{d(off)}$ *4	R_L = 455Ω	-	35	-	
Fall time	t_f *4	R_G = 0Ω	-	74	-	
Turn - on switching loss	E_{on} *4	V_{DD} = 800V, I_D=1.1A V_{GS} = 18V/0V R_G = 0Ω, L=2mH *E_{on} includes diode reverse recovery	-	57	-	μJ
Turn - off switching loss	E_{off} *4		-	32	-	

Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	R_{thJC}	-	3.32	4.32	K/W

Gate Charge Characteristics (T_C=25°C unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q_g *4	V_{DD} = 500V	-	14	-	nC
Gate - Source charge	Q_{gs} *4	I_D = 1A	-	4	-	
Gate - Drain charge	Q_{gd} *4	V_{GS} = 18V	-	5	-	
Gate plateau voltage	$V_{(plateau)}$	V_{DD} = 500V, I_D = 1A	-	10.5	-	V

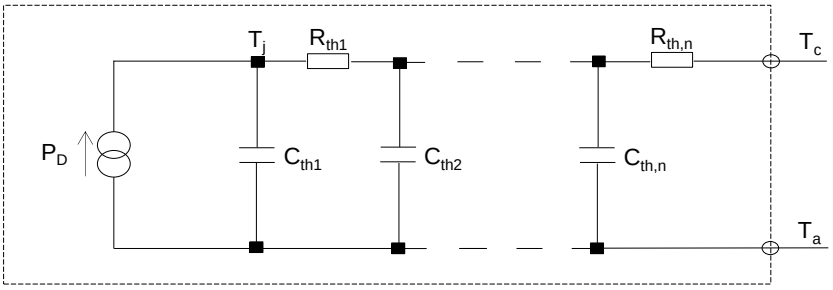
Body diode electrical Characteristics (Source-Drain) (T_C=25°C unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Inverse diode continuous, forward current	I_S *1	T_c = 25°C	-	-	3.7	A
Inverse diode direct current, pulsed	I_{SM} *2		-	-	9.2	A
Forward voltage	V_{SD} *4	V_{GS} = 0V, I_S = 1.1A	-	4.3	-	V
Reverse recovery time	t_{rr} *4	I_F = 1.1A, V_R = 800V di/dt = 300A/µs	-	21	-	ns
Reverse recovery charge	Q_{rr} *4		-	13	-	nC
Peak reverse recovery current	I_{rrm} *4		-	1.1	-	A

Typical Transient Thermal Characteristics

Symbol	Value	Unit
R_{th1}	816m	K/W
R_{th2}	1939m	
R_{th3}	567m	

Symbol	Value	Unit
C_{th1}	127µ	Ws/K
C_{th2}	1.64m	
C_{th3}	64.5m	



Typical Performance

Fig.1 Power Dissipation Derating Curve

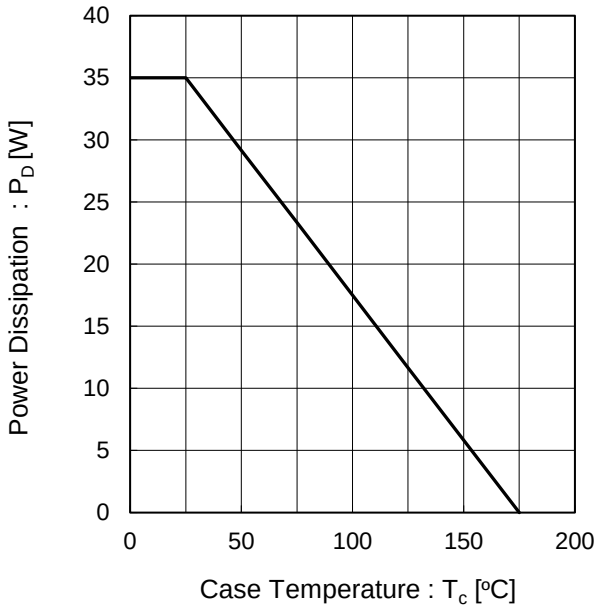


Fig.2 Maximum Safe Operating Area

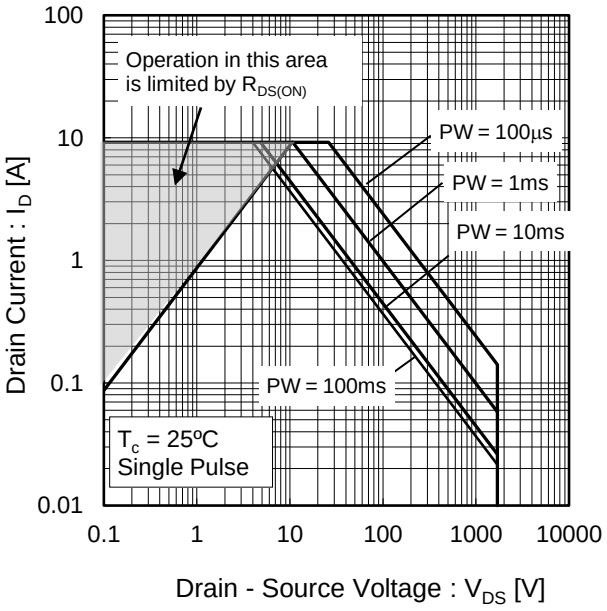
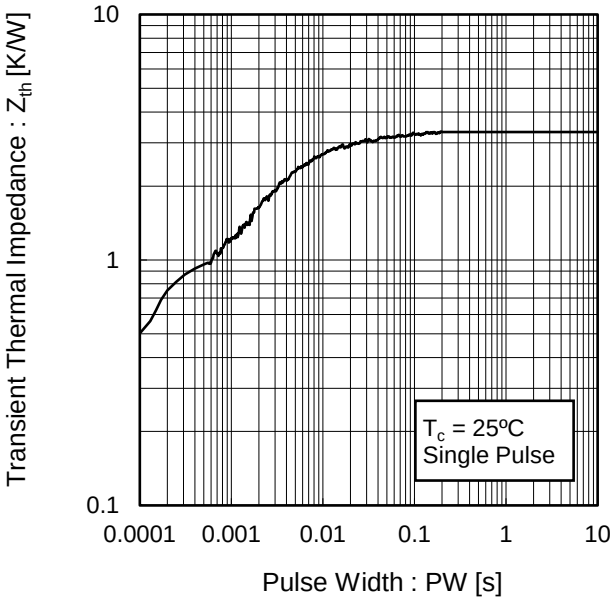


Fig.3 Typical Transient Thermal Impedance vs. Pulse Width



Electrical Characteristic Curves

Fig.4 Typical Output Characteristics(I)

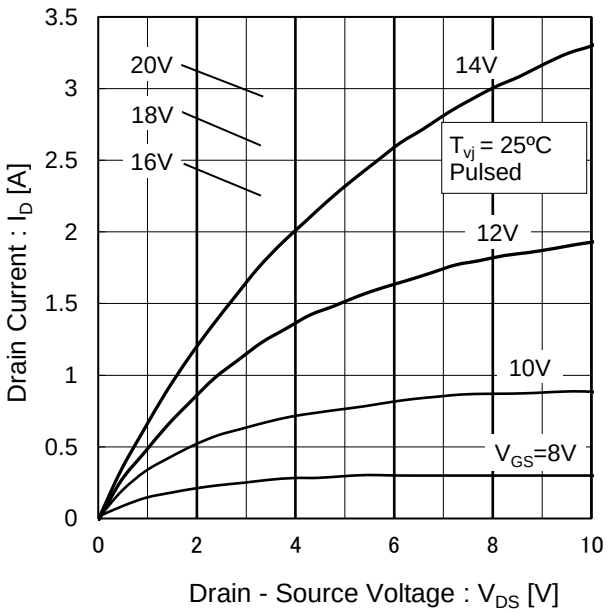


Fig.5 Typical Output Characteristics(II)

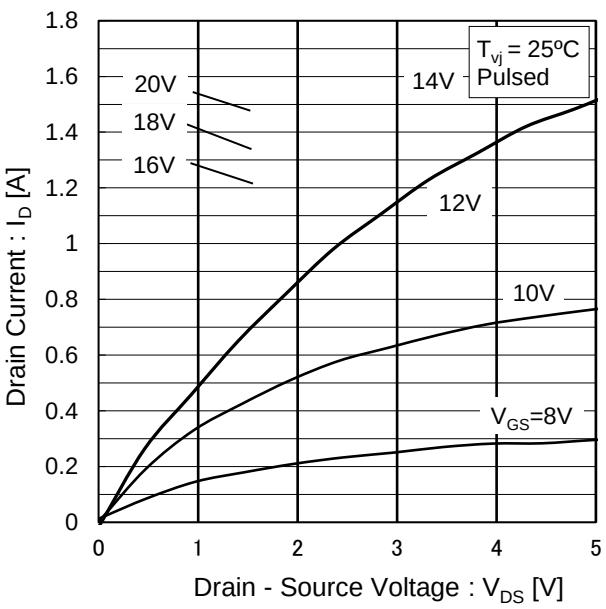


Fig.6 T_{vj} = 150ºC Typical Output Characteristics(I)

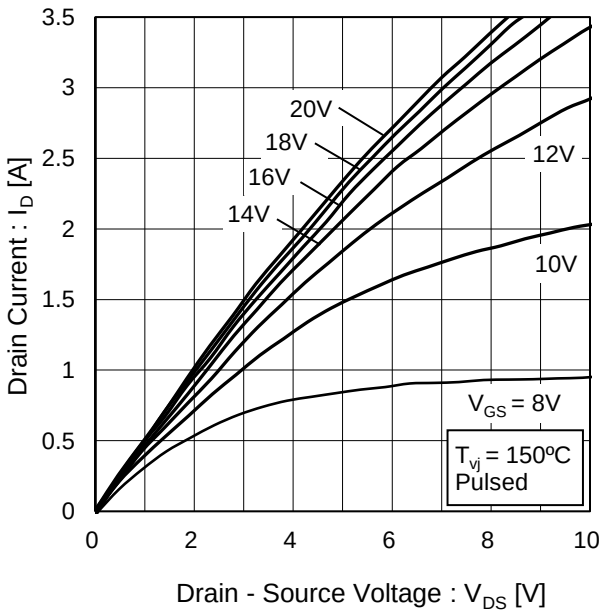


Fig.7 T_{vj} = 150ºC Typical Output Characteristics(II)

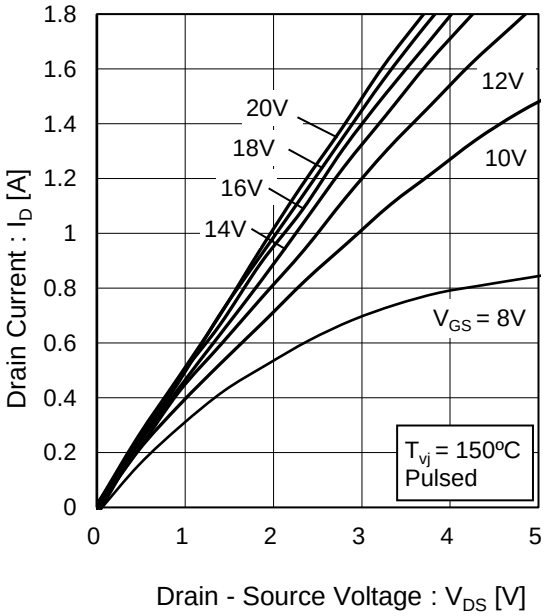


Fig.8 Typical Transfer Characteristics (I)

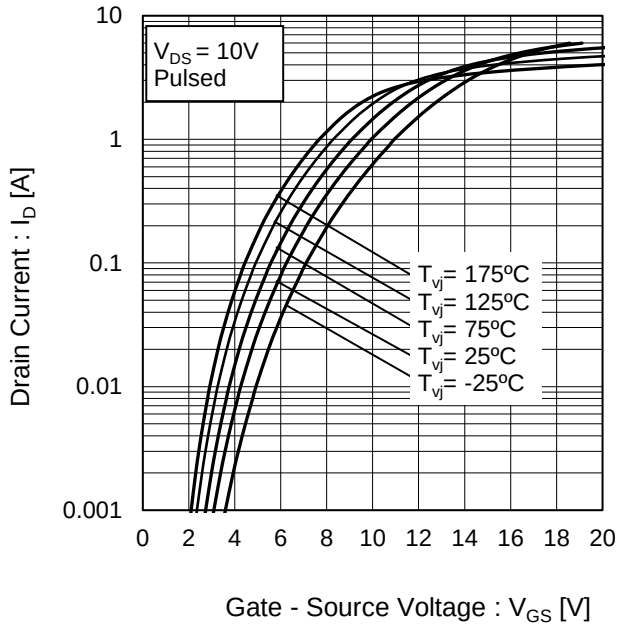


Fig.9 Typical Transfer Characteristics (II)

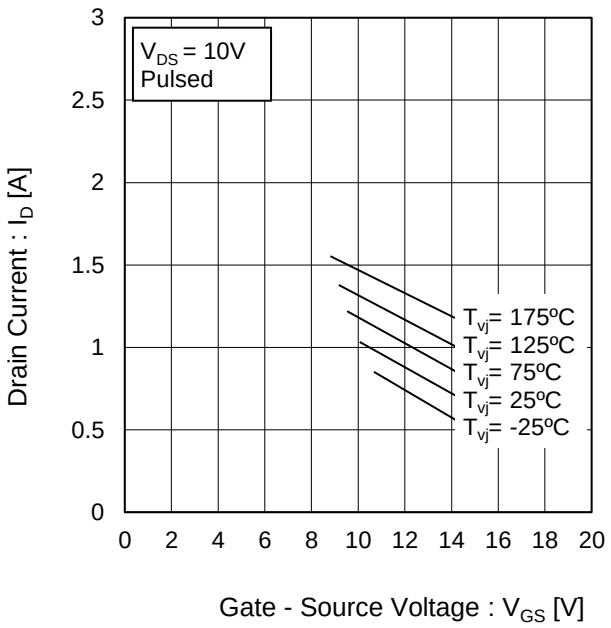


Fig.10 Gate Threshold Voltage
vs. Virtual Junction Temperature

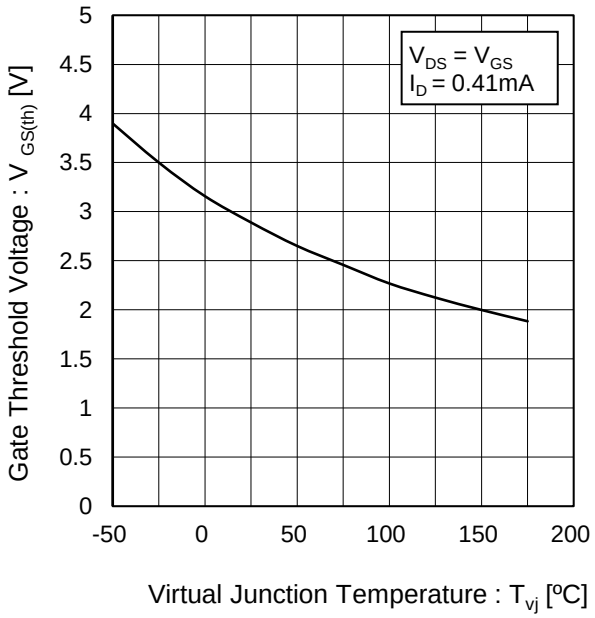


Fig.11 Transconductance
vs. Drain Current

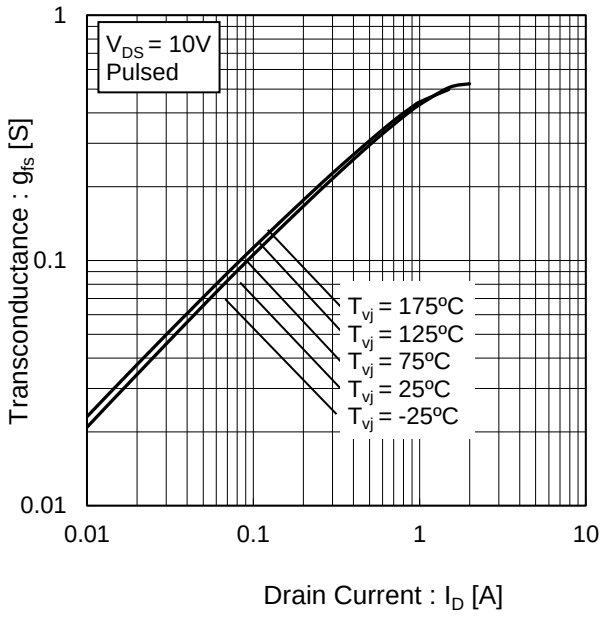


Fig.12 Static Drain - Source On - State Resistance vs. Gate - Source Voltage

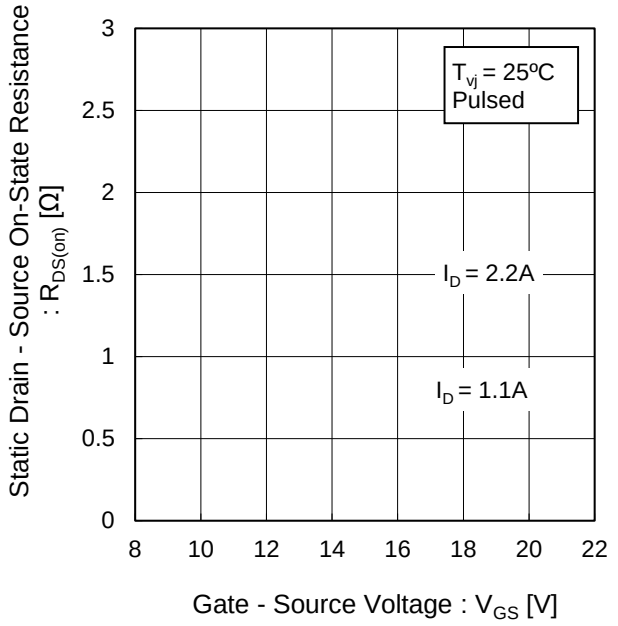


Fig.13 Static Drain - Source On - State Resistance vs. Virtual Junction Temperature

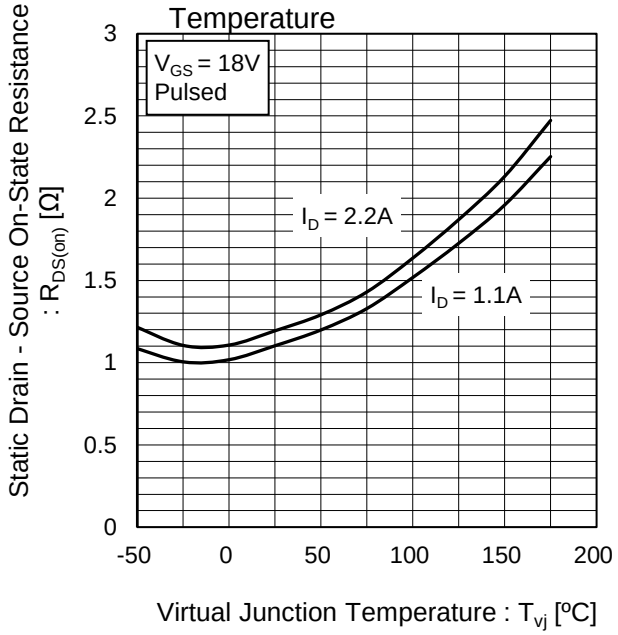


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current

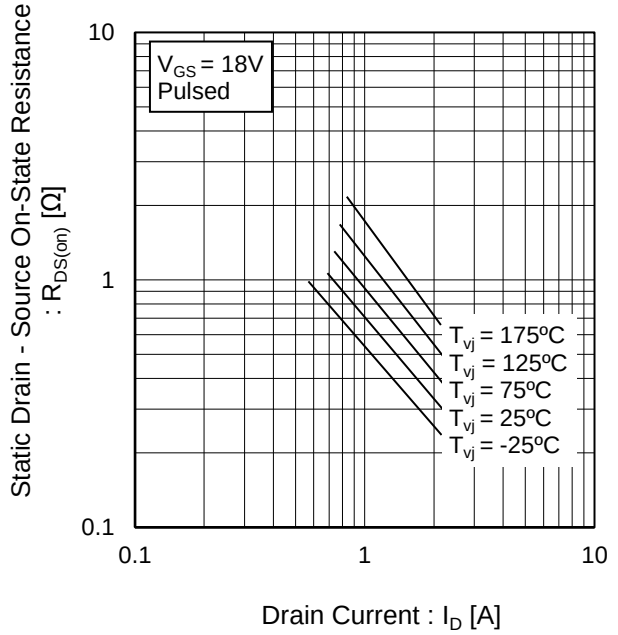


Fig.15 Typical Capacitance vs. Drain - Source Voltage

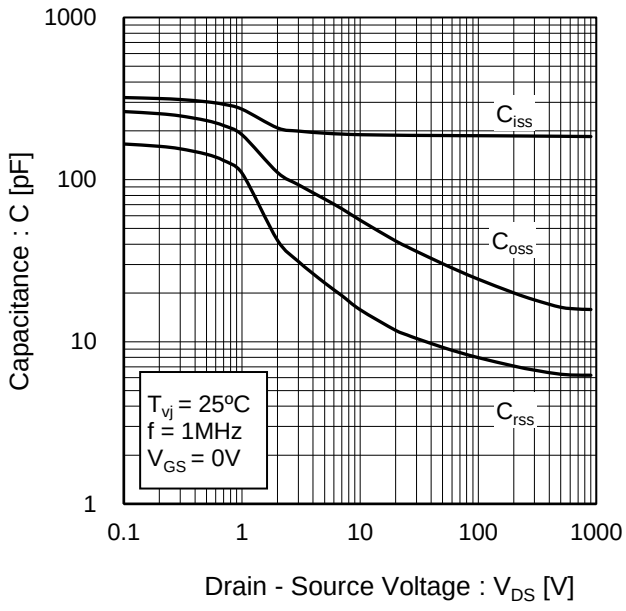


Fig.16 Coss Stored Energy

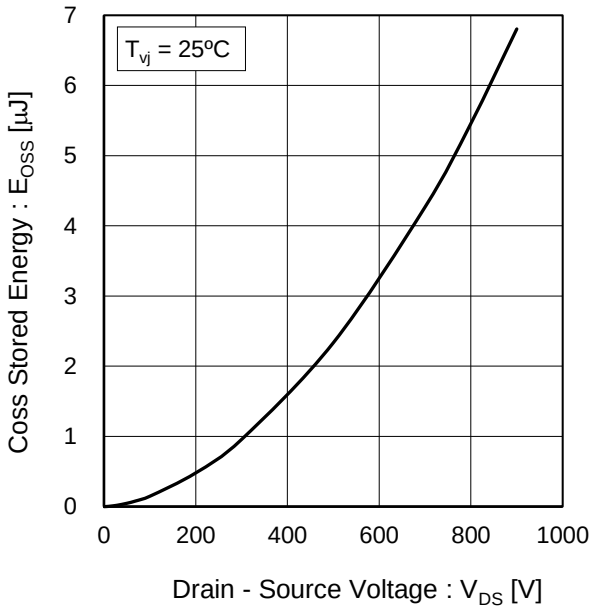


Fig.17 Switching Characteristics

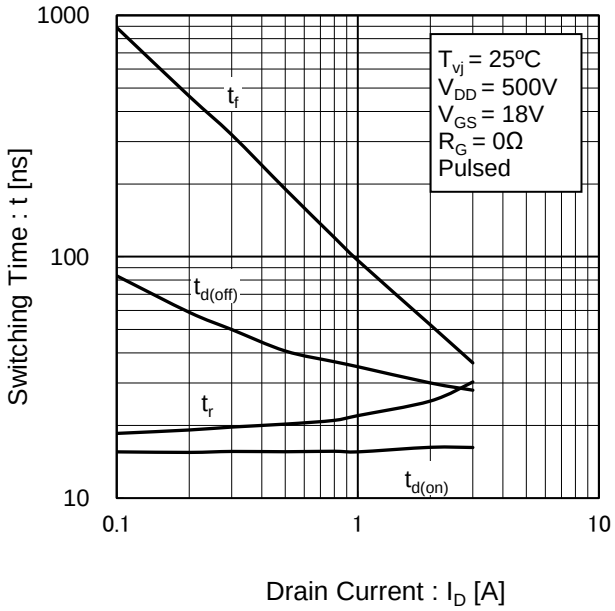


Fig.18 Dynamic Input Characteristics

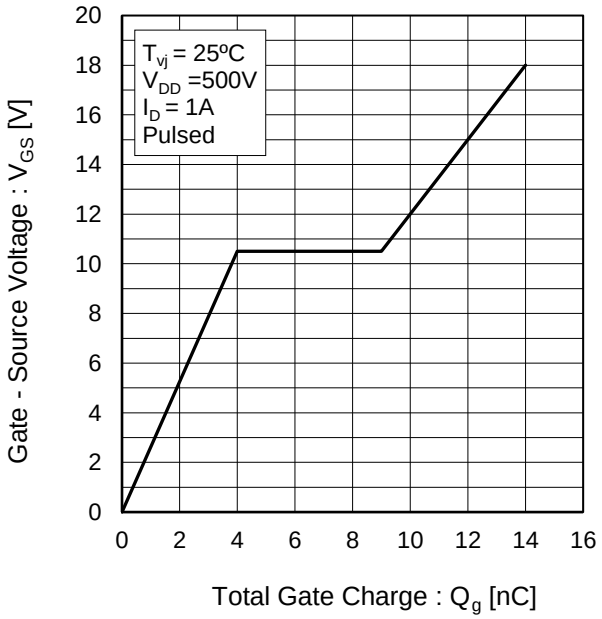


Fig.19 Typical Switching Loss
vs. Drain - Source Voltage

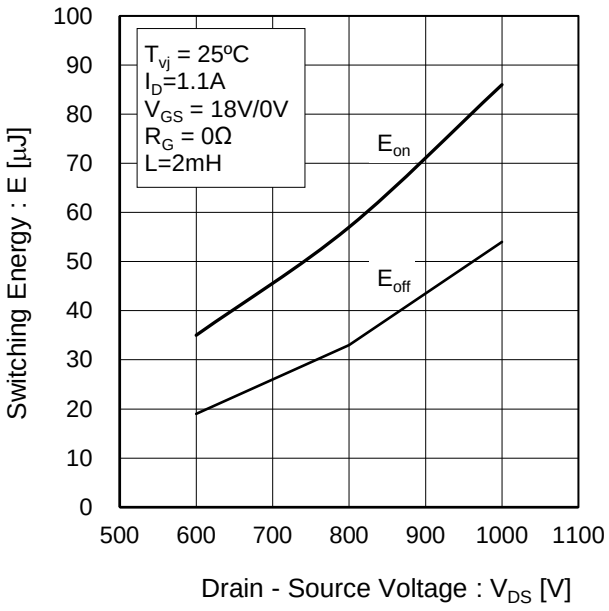


Fig.20 Typical Switching Loss vs. Drain Current

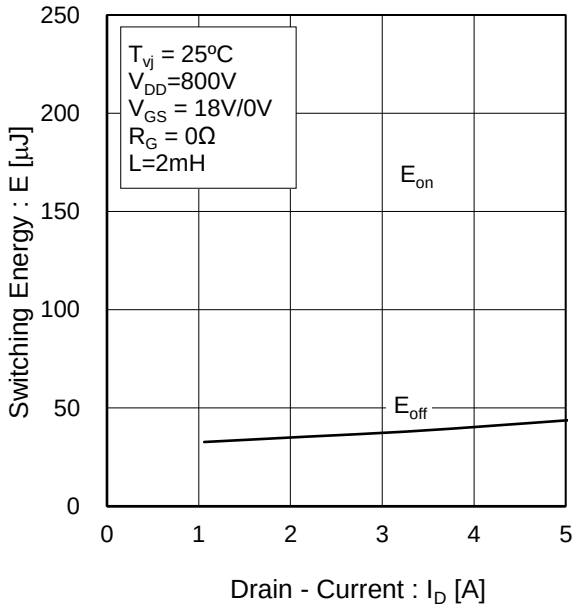


Fig.21 Typical Switching Loss vs. External Gate Resistance

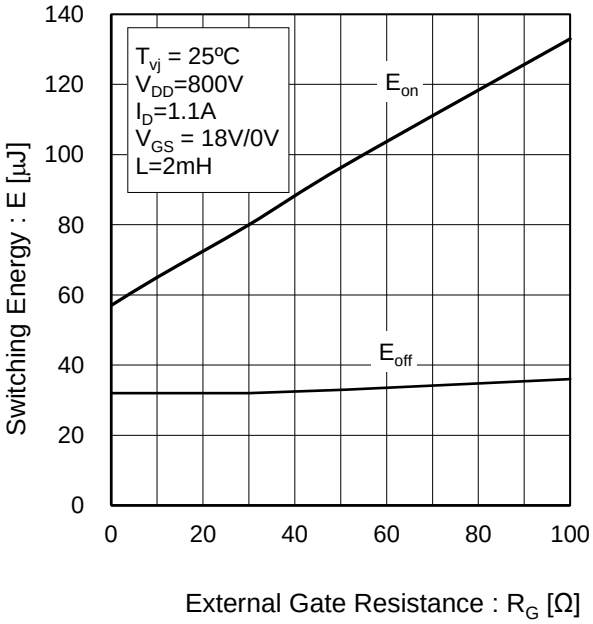


Fig.22 Inverse Diode Forward Current vs. Source - Drain Voltage

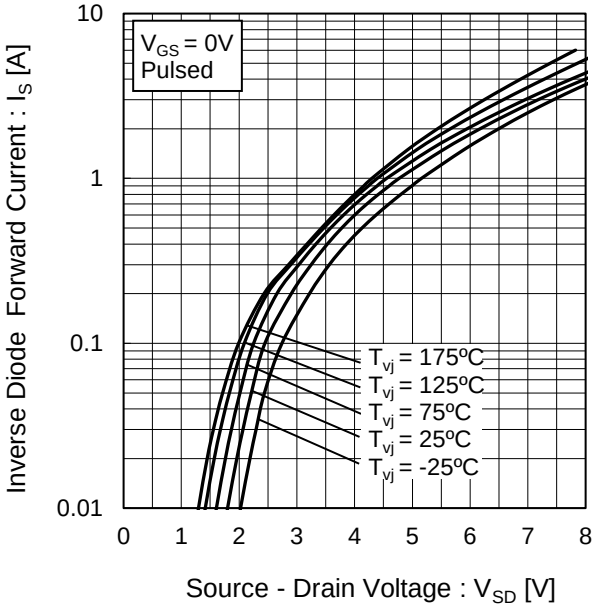
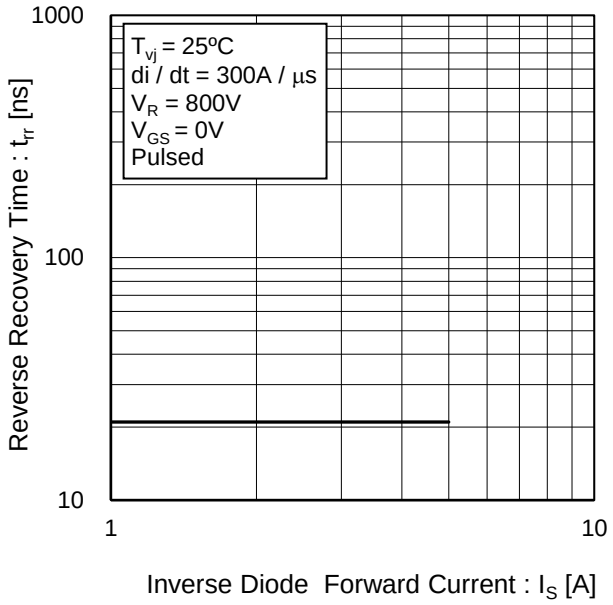


Fig.23 Reverse Recovery Time vs.Inverse Diode Forward Current



Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

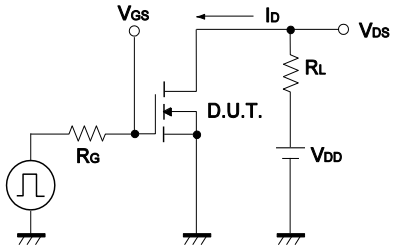


Fig.1-2 Switching Waveforms

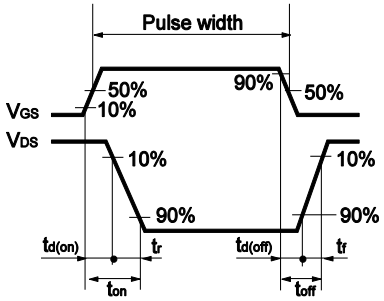


Fig.2-1 Gate Charge Measurement Circuit

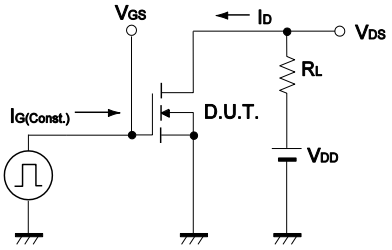


Fig.2-2 Gate Charge Waveform

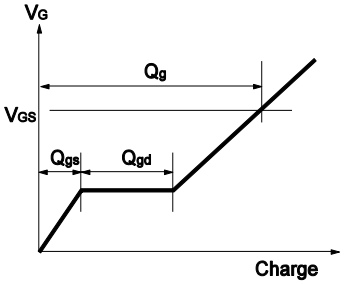


Fig.3-1 Switching Energy Measurement Circuit

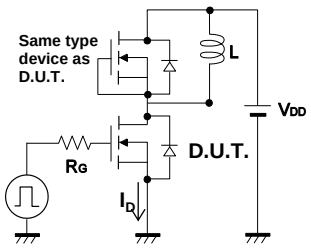


Fig.3-2 Switching Waveforms

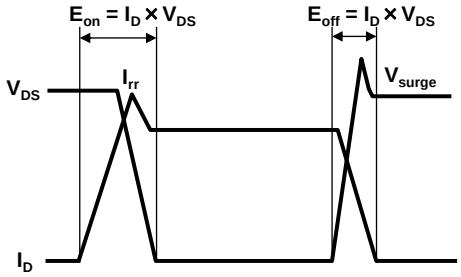


Fig.4-1 Reverse Recovery Time Measurement Circuit

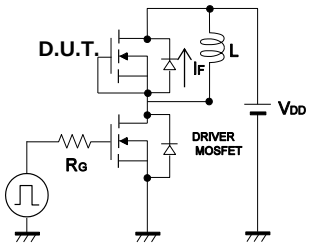
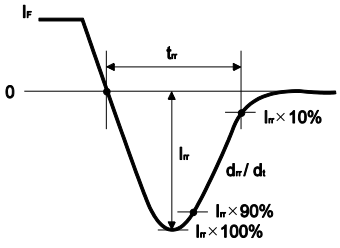
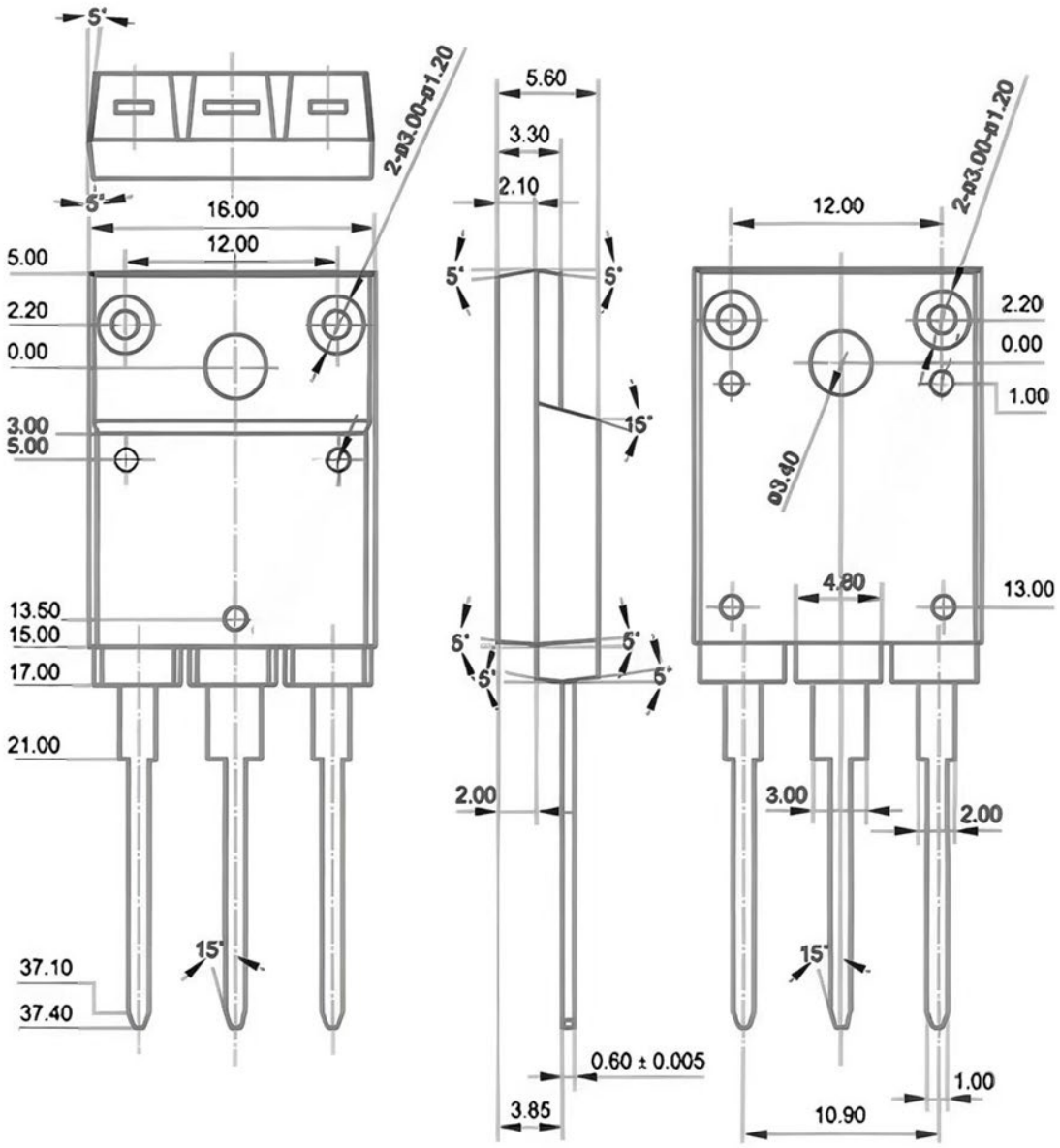


Fig.4-2 Reverse Recovery Waveform



Package Dimensions

Package TO-3PF



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