SCT4045DW7

N-channel SiC power MOSFET

Datasheet

V_{DSS}	750V
$R_{DS(on)}$ (Typ.)	45mΩ
I_D *1	31A
P_D	93W

● Features

1) Low on-resistance

2) Fast switching speed

3) Fast reverse recovery

4) Easy to parallel

5) Simple to drive

6) Pb-free lead plating ; RoHS compliant

● Application

・Solar inverters

・DC/DC converters

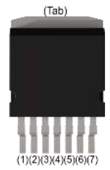
・Switch mode power supplies

・Induction heating

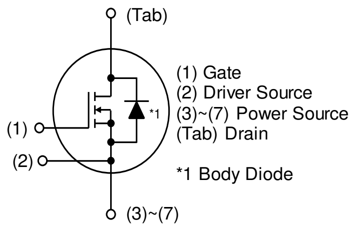
・Motor drives

●Outline

TO-263-7L



●Inner circuit



Please note Driver Source and Power Source are not exchangeable. Their exchange might lead to malfunction.

●Packaging specifications

Type	Packing	Embossed tape
	Reel size (mm)	330
	Tape width (mm)	24
	Basic ordering unit (pcs)	1000
	Taping code	TL
	Marking	SCT4045DW7

●Absolute maximum ratings (T_{vj} = 25°C unless otherwise specified.)

Parameter			Symbol	Value	Unit
Drain - source voltage			V_{DSS}	750	V
Continuous drain and source current	$V_{GS} = V_{GS\_on}$	T_c = 25°C	I_D, I_S *1	31	A
		T_c = 100°C		22	A
Pulsed drain current	$V_{GS} = V_{GS\_on}$	T_c = 25°C	$I_{D,pulse}$ *2	61	A
Body diode pulsed forward current		T_c = 25°C V_{GS} = 0 V	$I_{S,pulse}$ *1,*3	31	A
Body diode surge forward current			$I_{S,pulse}$ *1,*4	61	A
Gate - source voltage (DC)			V_{GSS_DC}	-4 to +21	V
Gate - source surge voltage (t_{surge} < 300ns)			V_{GSS_surge} *5	-4 to +23	V
Recommended turn-on gate - source drive voltage			V_{GS_on} *6	+15 to +18	V
Recommended turn-off gate - source drive voltage			V_{GS_off}	0	V
Virtual junction temperature			T_{vj}	175	°C
Range of storage temperature			T_{stg}	-40 to +175	°C

●Electrical characteristics (T_{vj} = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 5.3mA T_{vj} = 25°C	750	-	-	V
Zero Gate voltage Drain current	I_{DSS}	V_{GS} = 0 V, V_{DS} =750V T_{vj} = 25°C T_{vj} = 150°C	- -	1 10	80 -	μA
Gate - Source leakage current	I_{GSS+}	V_{GS} = +21V , V_{DS} = 0V	-	-	100	nA
Gate - Source leakage current	I_{GSS-}	V_{GS} = -4V , V_{DS} = 0V	-	-	-100	nA
Gate threshold voltage	$V_{GS(th)}$ *7	V_{DS} = 10V, I_D = 8.89mA	2.8	-	4.8	V
Static Drain - Source on - state resistance	$R_{DS(on)}$ *8	V_{GS} = 18V, I_D = 17A T_{vj} = 25°C T_{vj} = 150°C	- -	45 77	59 -	mΩ
Gate input resistance	R_G	f = 1MHz, open drain	-	4	-	Ω

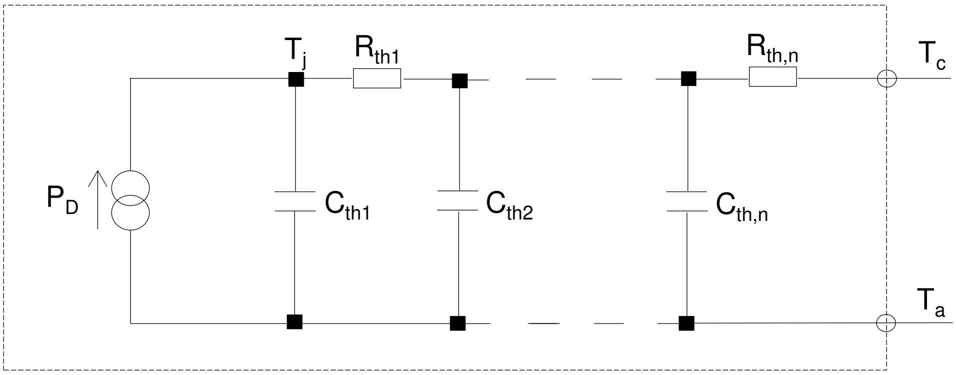
●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	R_{thJC} *9	-	1.2	1.6	K/W

●Typical Transient Thermal Characteristics

Symbol	Value	Unit
R_{th1}	8.9×10^{-2}	K/W
R_{th2}	5.7×10^{-1}	K/W
R_{th3}	5.3×10^{-1}	K/W

Symbol	Value	Unit
C_{th1}	5.3×10^{-4}	Ws/K
C_{th2}	2.8×10^{-3}	Ws/K
C_{th3}	1.5×10^{-1}	Ws/K



● **Electrical characteristics** (T_{vj} = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Transconductance	g_{fs} *8	V_{DS} = 10V, I_D = 17A	-	9.3	-	S
Input capacitance	C_{iss}	V_{GS} = 0V V_{DS} = 500V f = 1MHz	-	1460	-	pF
Output capacitance	C_{oss}		-	69	-	
Reverse transfer capacitance	C_{rss}		-	5	-	
Effective output capacitance, energy related	$C_{o(er)}$	V_{GS} = 0V V_{DS} = 0V to 500V	-	90	-	pF
Total Gate charge	Q_g *8	V_{DS} = 500V I_D = 17A V_{GS} = 18V See Fig. 1-1, 1-2.	-	63	-	nC
Gate - Source charge	Q_{gs} *8		-	14	-	
Gate - Drain charge	Q_{gd} *8		-	19	-	
Turn - on delay time	$t_{d(on)}$ *8	V_{DS} = 500V I_D = 17A V_{GS} = +18V / 0V R_G = 3.3Ω, L = 250μH E_{on} includes diode reverse recovery L_σ = 50nH, C_σ = 10pF See Fig. 2-1, 2-2, 2-3.	-	5.1	-	ns
Rise time	t_r *8		-	16	-	
Turn - off delay time	$t_{d(off)}$ *8		-	27	-	
Fall time	t_f *8		-	10	-	
Turn - on switching loss	E_{on} *8		-	112	-	μJ
Turn - off switching loss	E_{off} *8		-	17	-	

●**Body diode electrical characteristics** (Source-Drain) (T_{vj} = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_{SD} *8	V_{GS} = 0V, I_S = 17A	-	3.3	-	V
Reverse recovery time	t_{rr} *8	I_F = 17A V_R = 500V di/dt = 2900A/μs $L_σ$ = 50nH, $C_σ$ = 10pF See Fig. 3-1, 3-2.	-	9.3	-	ns
Reverse recovery charge	Q_{rr} *8		-	89	-	nC
Peak reverse recovery current	I_{rrm} *8		-	19	-	A

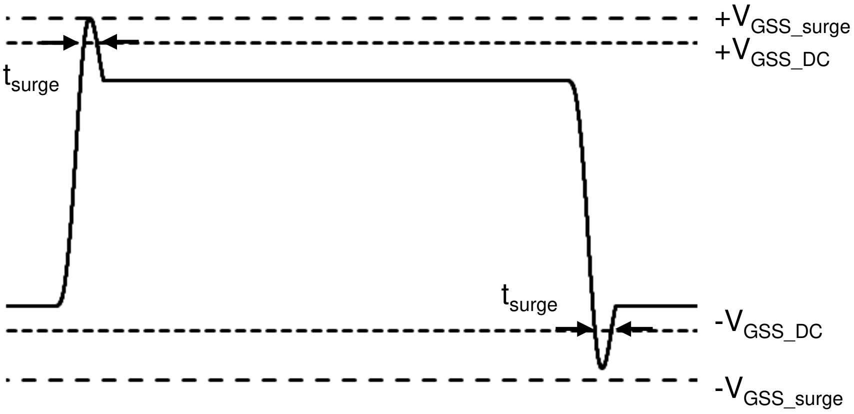
*1 Limited by maximum T_{vj} and for Max. R_{thJC}.

*2 Pulse width and duty cycle are limited by $T_{vj,max}$.

*3 Only for body-diode, Repititive pulse, PW ≤ 1.5μs, Duty cycle ≤ 5%

*4 When used as a protective function, PW ≤ 10μs

*5 Example of acceptable V_{GS} waveform



Please note especially when using driver source that V_{GSS_surge} must be in the range of absolute maximum rating.

*6 Please be advised not to use SiC-MOSFETs with V_{GS} below 10V as doing so may cause thermal runaway.

*7 Tested after applying V_{GS} = 21V for 100ms.

*8 Pulsed

*9 Measured conformable to JESD51-14.

See the application note "rthjc_measurement_and_usage_an-e.pdf". Link

URL: https://fscdn.rohm.com/en/products/databook/applinote/discrete/common/rthjc_measurement_and_usage_an-e.pdf

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

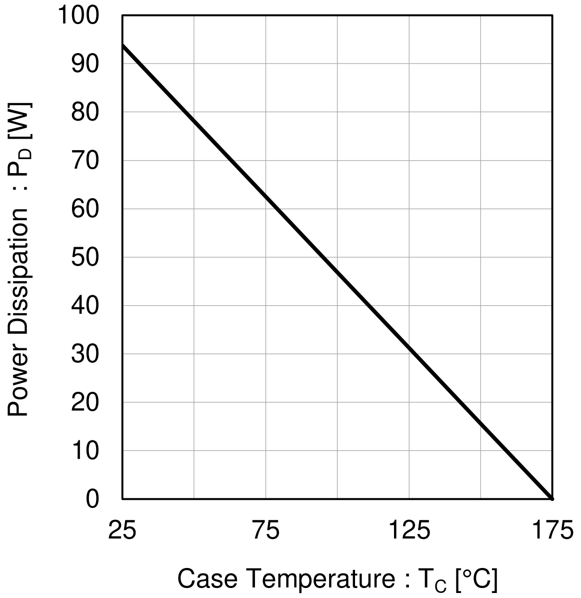


Fig.2 Maximum Safe Operating Area

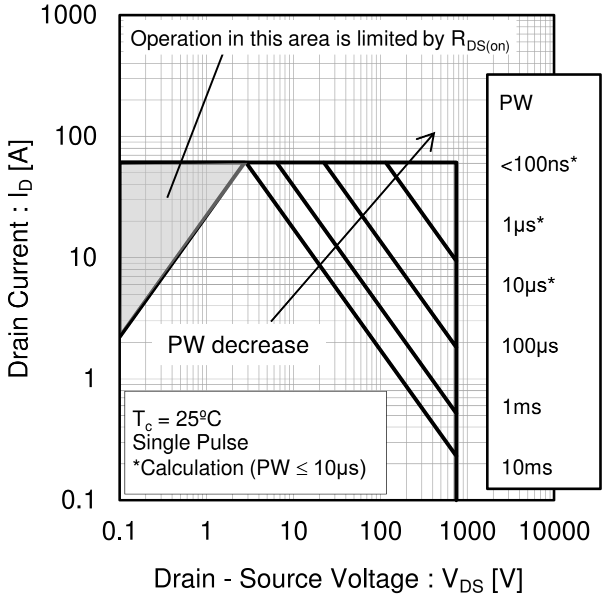
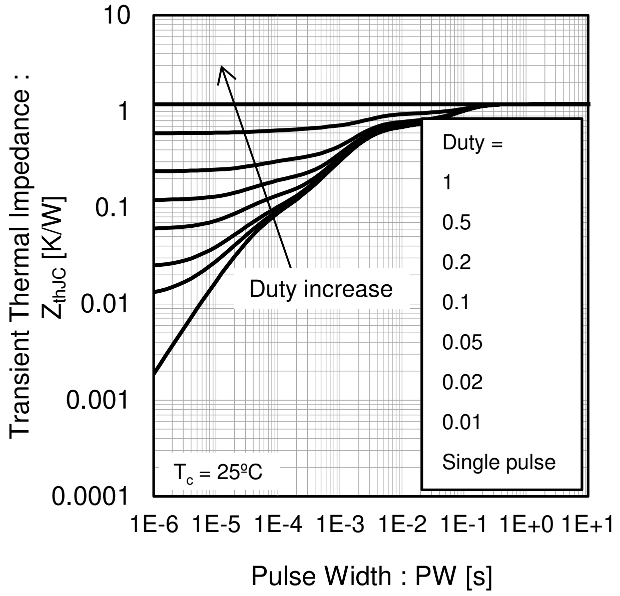


Fig.3 Typical Transient Thermal Impedance vs. Pulse Width



●Electrical characteristic curves

Fig.4 T_{vj} = 25ºC Typical Output Characteristics(I)

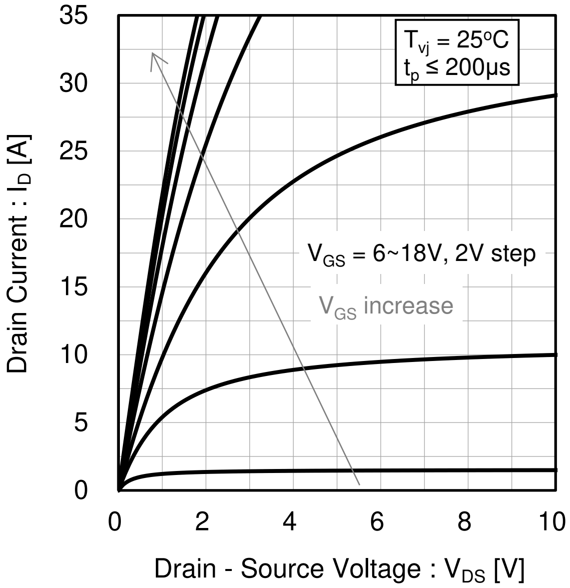


Fig.5 T_{vj} = 25ºC Typical Output Characteristics(II)

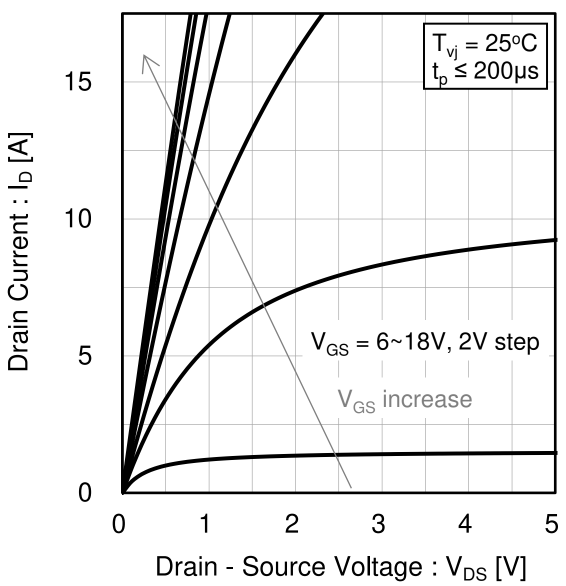
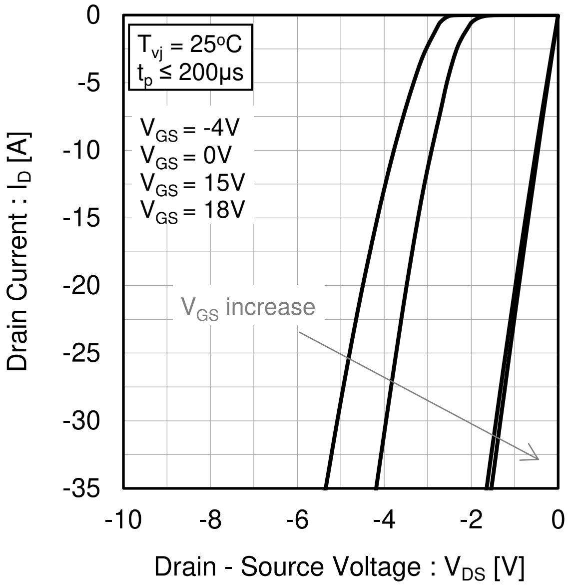


Fig.6 T_{vj} = 25ºC 3rd Quadrant Characteristics



●Electrical characteristic curves

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

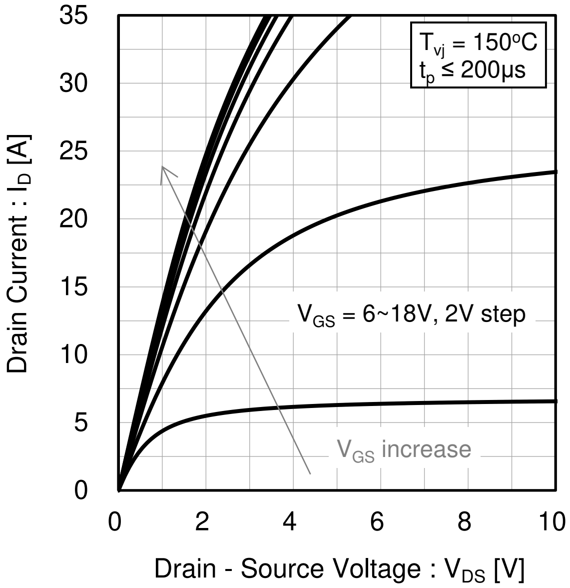


Fig.8 T_{vj} = 150ºC Typical Output Characteristics(II)

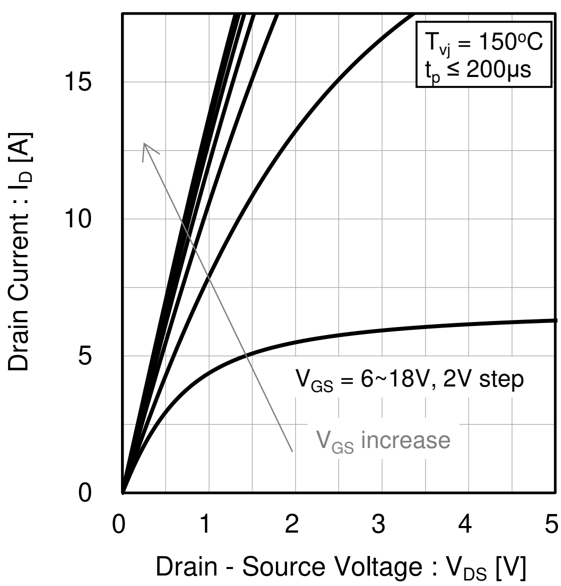


Fig.9 T_{vj} = 150ºC 3rd Quadrant Characteristics

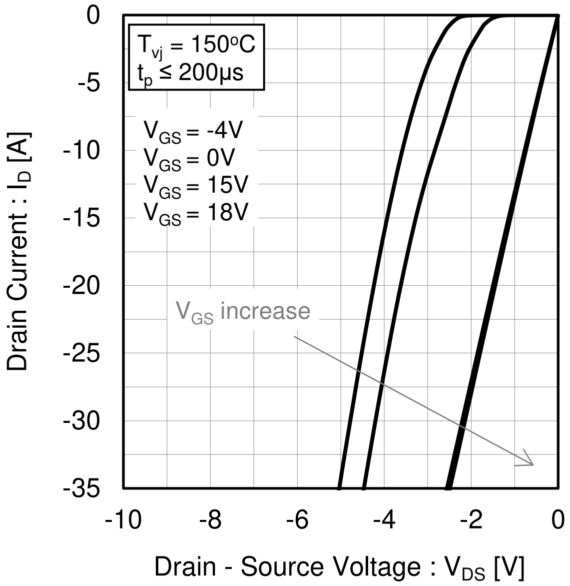
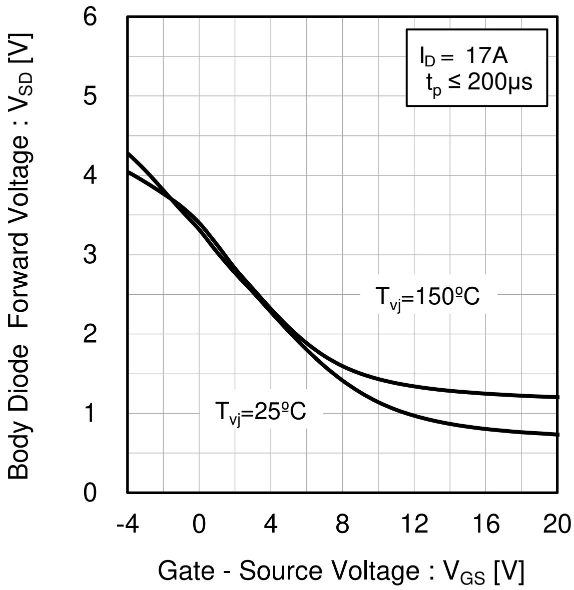


Fig.10 Body Diode Forward Voltage vs. Gate - Source Voltage



●**Electrical characteristic curves**

Fig.11 Typical Transfer Characteristics (I)

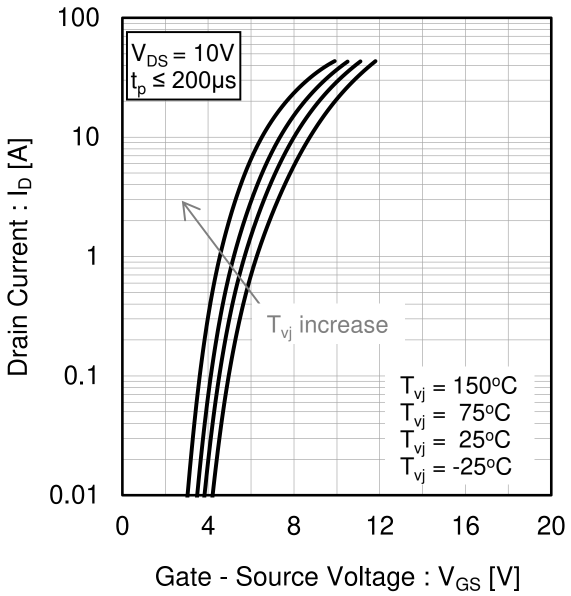


Fig.12 Typical Transfer Characteristics (II)

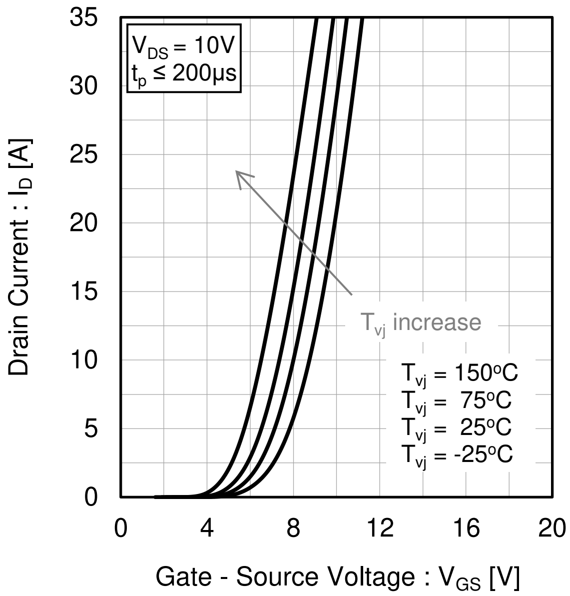


Fig.13 Gate Threshold Voltage vs. Virtual Junction Temperature

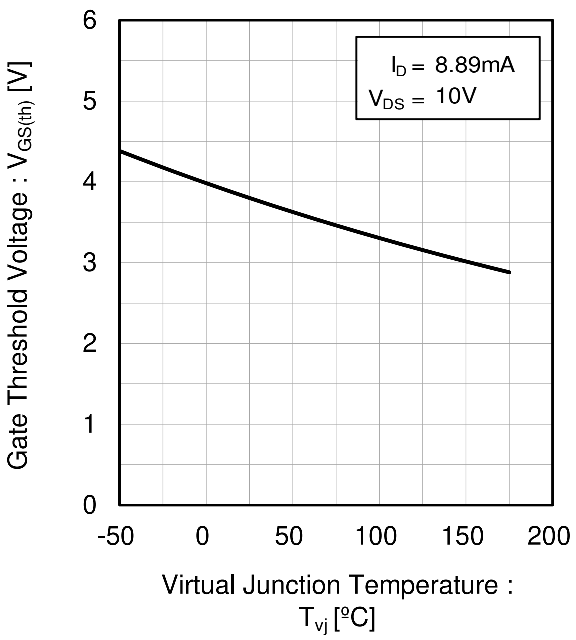
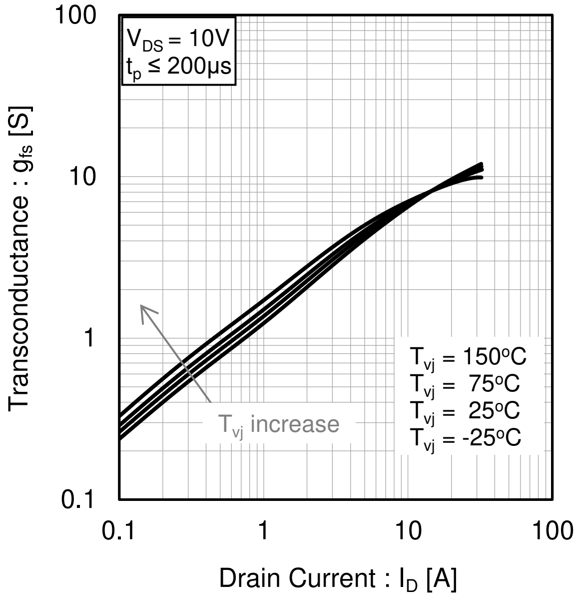


Fig.14 Transconductance vs. Drain Current



●Electrical characteristic curves

Fig.15 Static Drain - Source On - State Resistance vs. Gate - Source Voltage

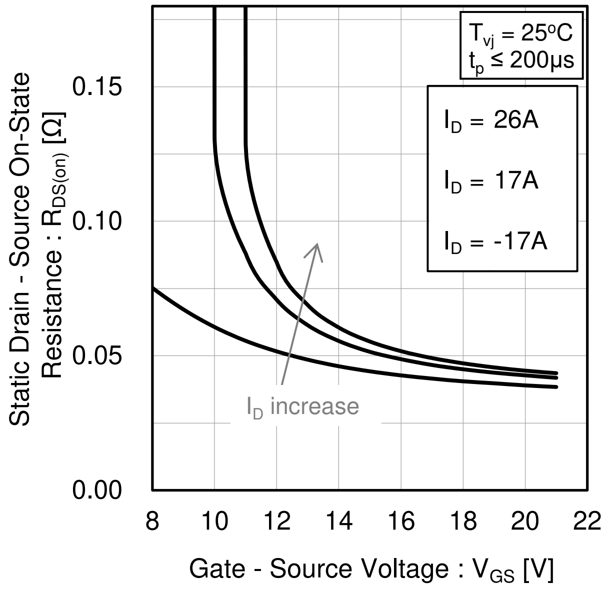


Fig.16 Static Drain - Source On - State Resistance vs. Virtual Junction Temperature

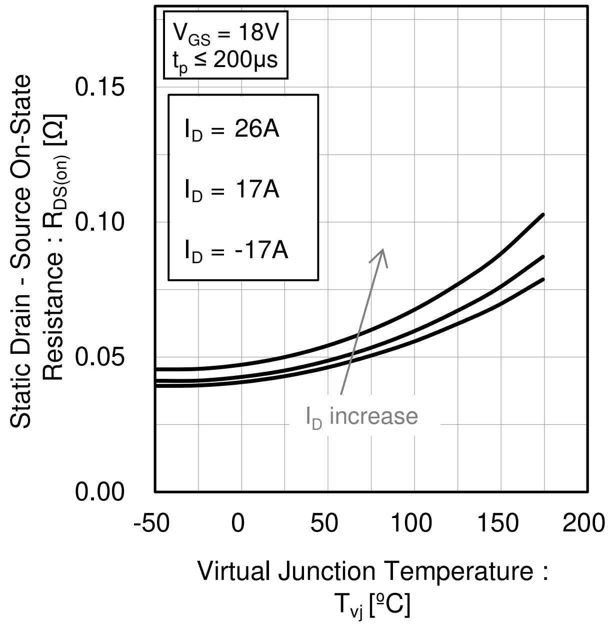


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current

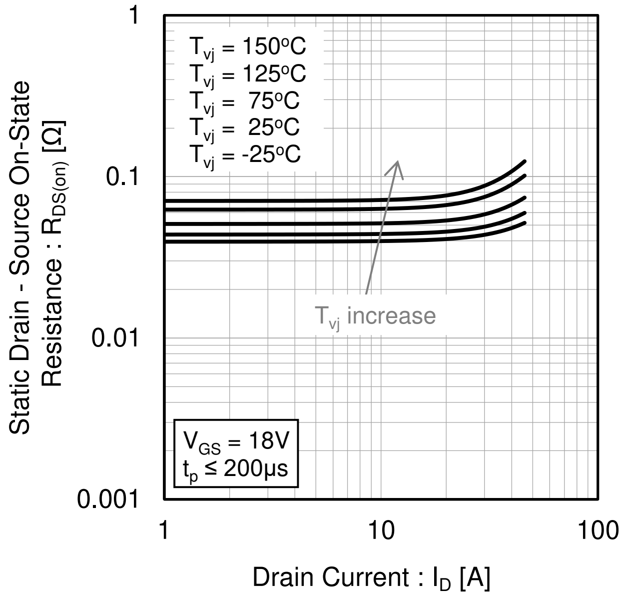
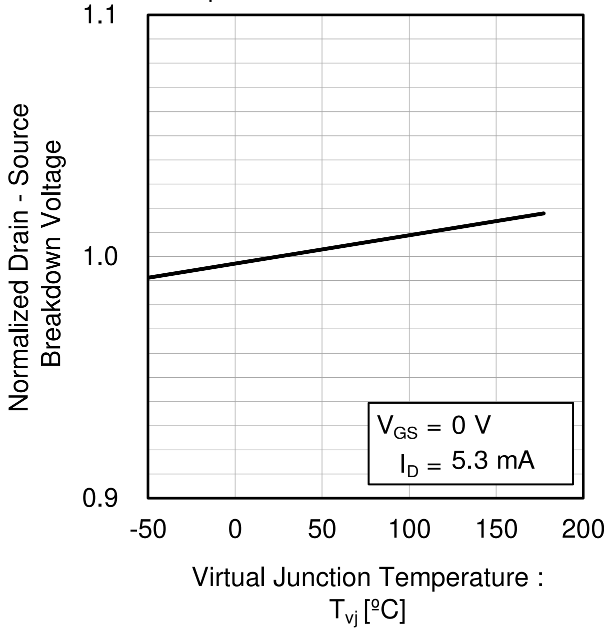


Fig.18 Normalized Drain - Source Breakdown Voltage vs. Virtual Junction Temperature



●**Electrical characteristic curves**

Fig.19 Typical Capacitance vs. Drain - Source Voltage

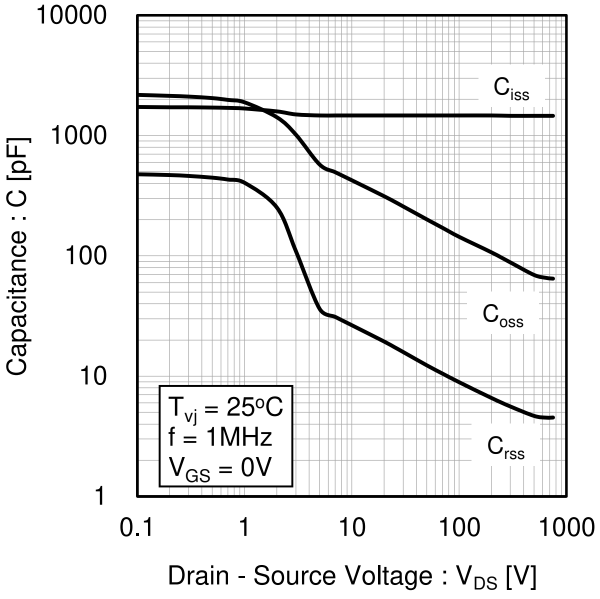


Fig.20 C_{oss} Stored Energy

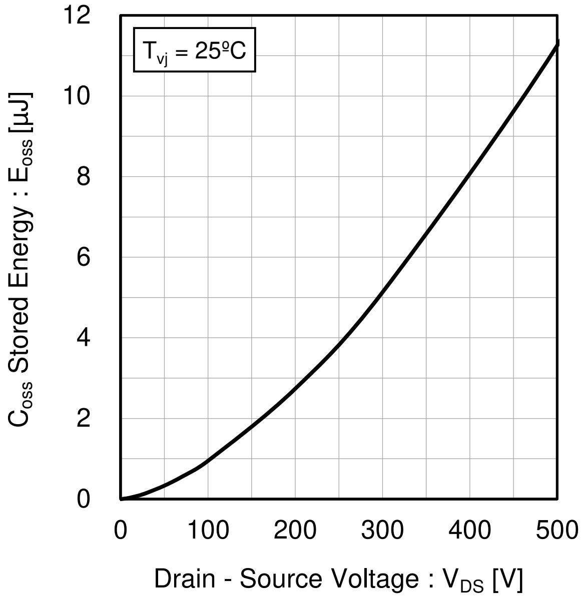
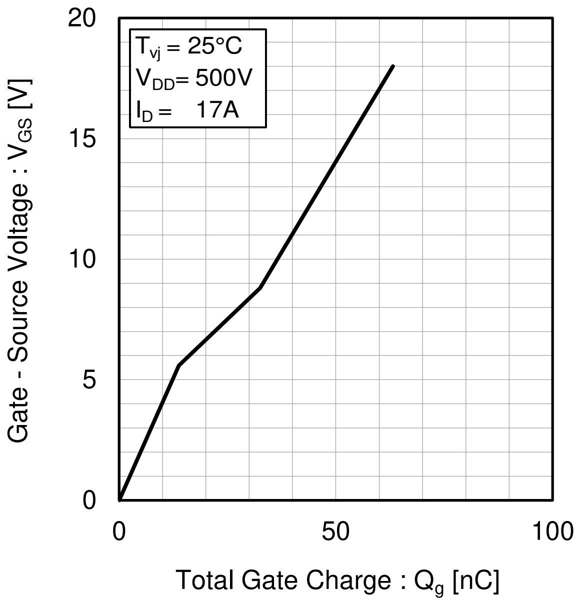


Fig.21 Dynamic Input Characteristics



●Electrical characteristic curves

Fig.22 Typical Switching Time vs. External Gate Resistance

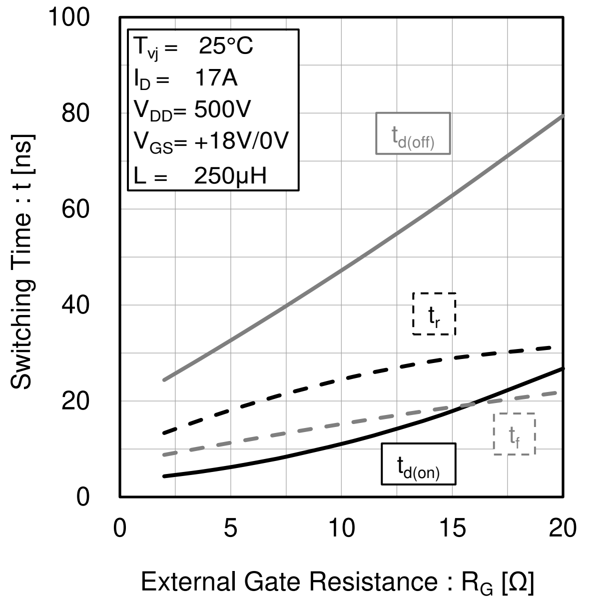


Fig.23 Typical Switching Loss vs. Drain - Source Voltage

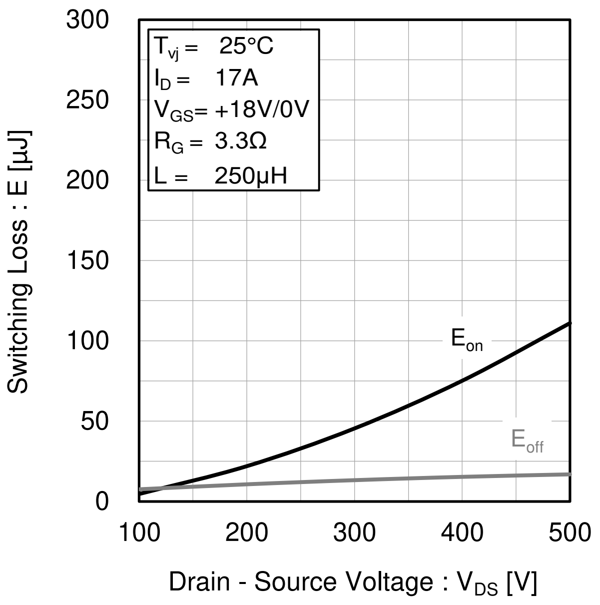


Fig.24 Typical Switching Loss vs. Drain Current

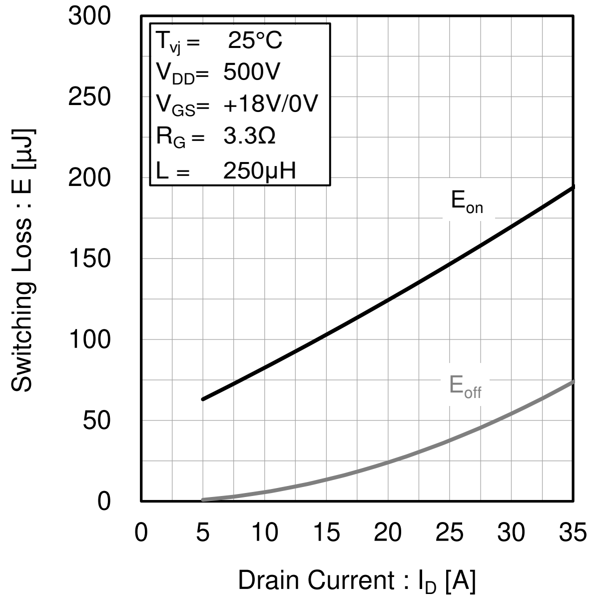
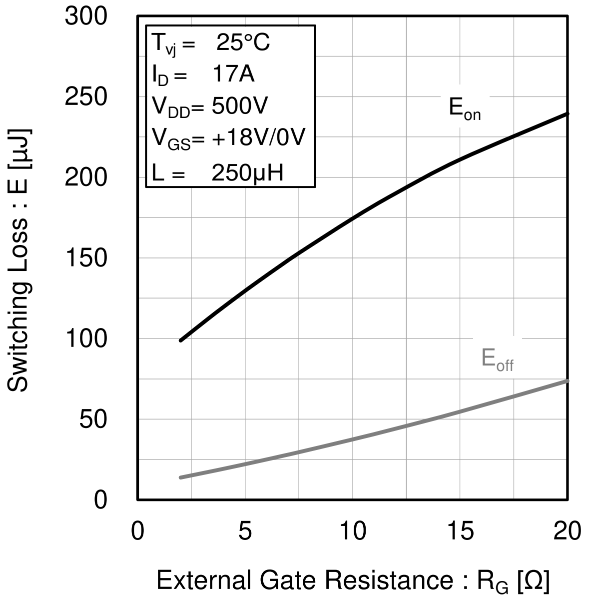


Fig.25 Typical Switching Loss vs. External Gate Resistance



●Measurement circuits and waveforms

Fig.1-1 Gate Charge Measurement Circuit

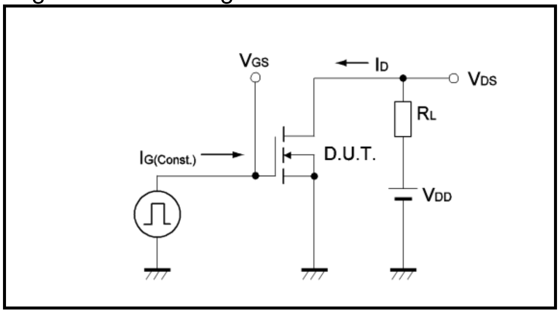


Fig.1-2 Gate Charge Waveform

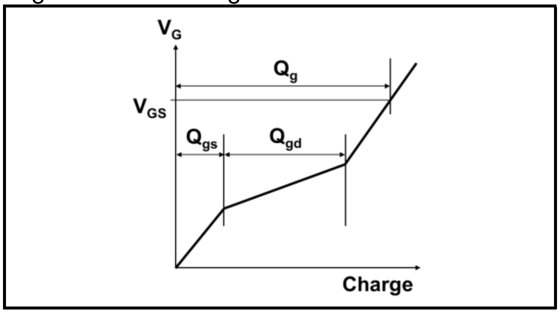


Fig.2-1 Switching Characteristics Measurement Circuit

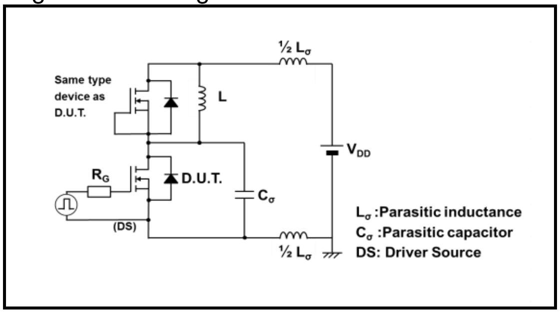


Fig.2-2 Waveforms for Switching Time

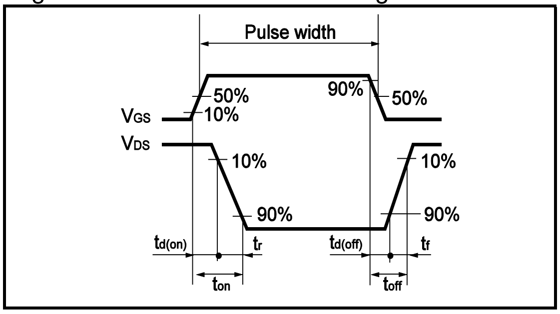


Fig.2-3 Waveforms for Switching Energy Loss

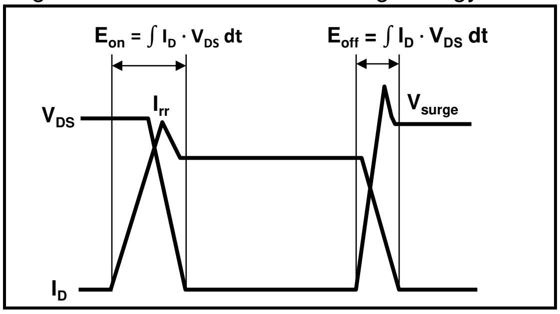


Fig.3-1 Reverse Recovery Time Measurement Circuit

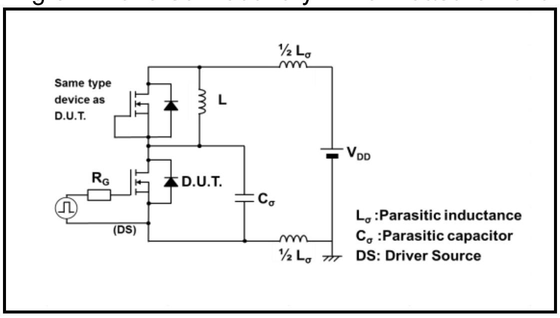
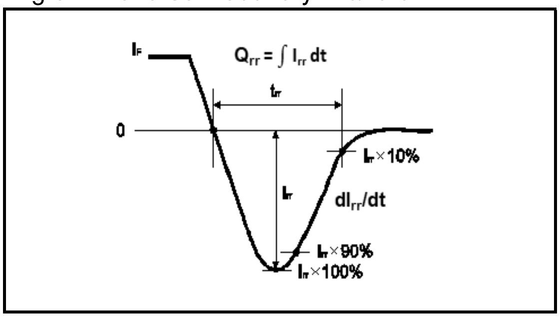
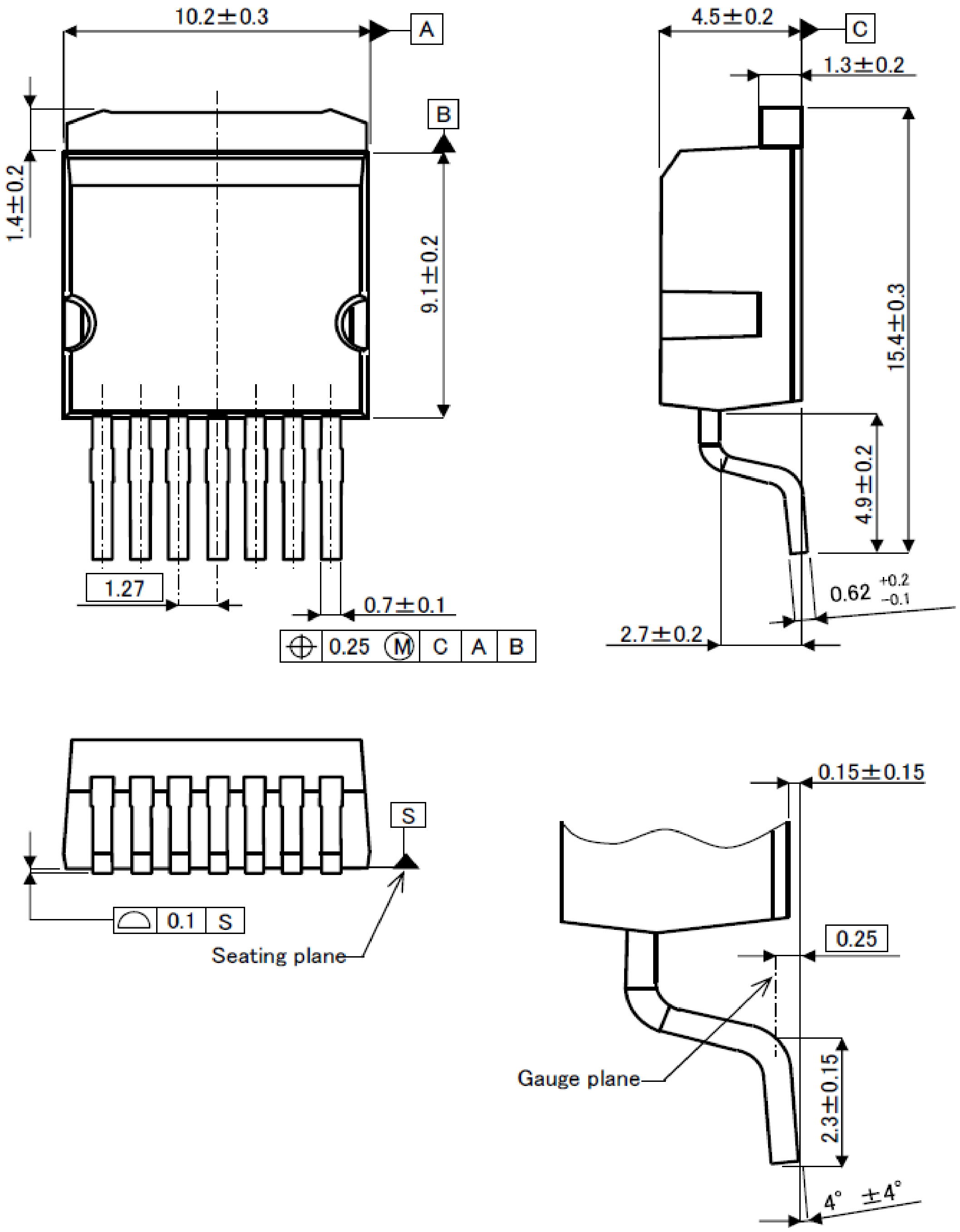


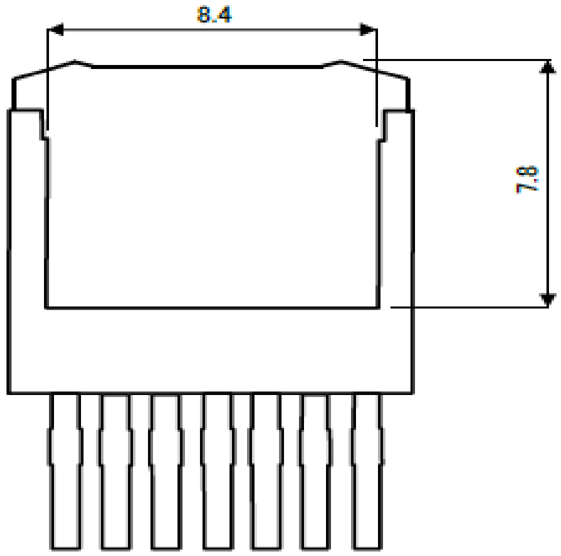
Fig.3-2 Reverse Recovery Waveform



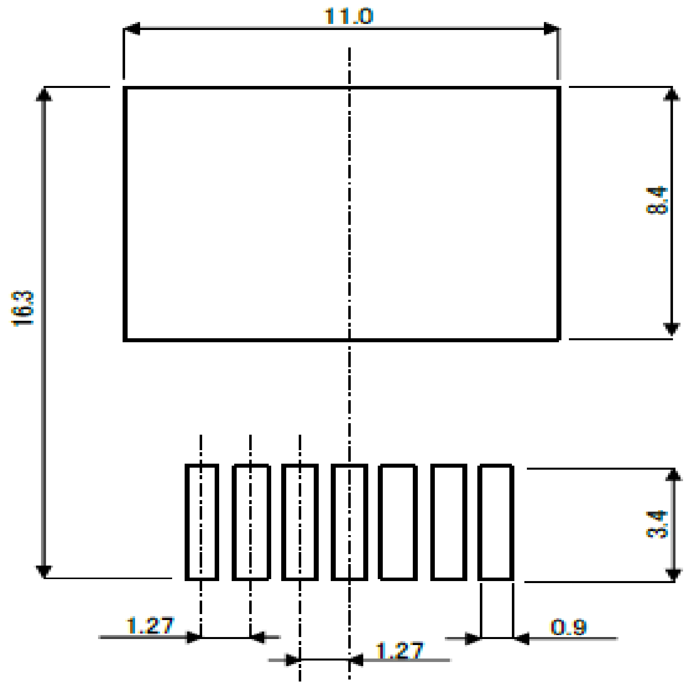
●Package Dimensions



Unit: mm

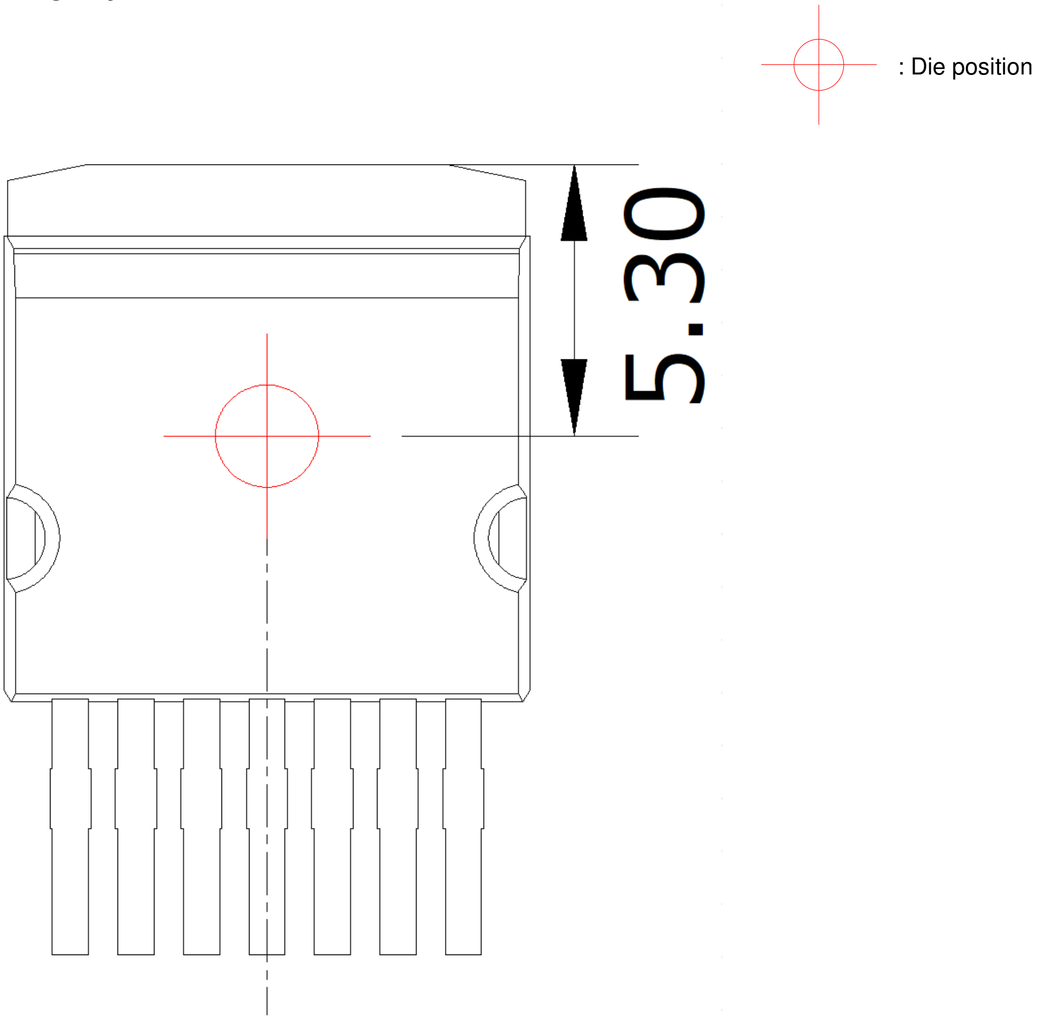


RECOMMENDED FOOTPRINT DIMENSIONS



Unit: mm

●Die Bonding Layout



・Front view of the packaging.

・Dimensions are design values.

・If the heat sink is to be installed, it should be in contact with the die bonding point.

Unit: mm

Notes

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