

V_{DSS}	750V
$R_{DS(on)}$ (Typ.)	13mΩ
I_D^{*1}	105A
P_D	312W

● Features

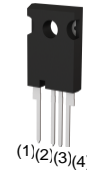
- 1) Qualified to AEC-Q101
- 2) Low on-resistance
- 3) Fast switching speed
- 4) Fast reverse recovery
- 5) Easy to parallel
- 6) Simple to drive
- 7) Pb-free lead plating ; RoHS compliant

● Application

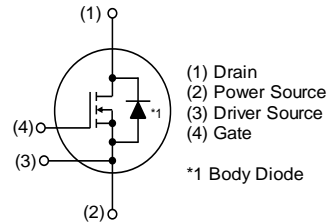
- Automobile
- Switch mode power supplies

● Outline

TO-247-4L



● Inner circuit



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

● Packaging specifications

Type	Packing	Tube
	Reel size (mm)	-
	Tape width (mm)	-
	Basic ordering unit (pcs)	30
	Taping code	C15
	Marking	SCT4013DR

● Absolute maximum ratings ($T_{vj} = 25^{\circ}\text{C}$ unless otherwise specified)

Parameter			Symbol	Value	Unit
Drain - source voltage			V_{DSS}	750	V
Continuous drain and source current	$V_{GS} = V_{GS_on}$	$T_c = 25^{\circ}C$	I_D, I_S^{*1}	105	A
		$T_c = 100^{\circ}C$		74	A
Pulsed drain current	$V_{GS} = V_{GS_on}$	$T_c = 25^{\circ}C$	$I_{D,pulse}^{*2}$	233	A
Body diode pulsed forward current		$T_c = 25^{\circ}C$	$I_{S,pulse}^{*1,*3}$	105	A
Body diode surge forward current		$V_{GS} = 0\text{ V}$	$I_{S,pulse}^{*1,*4}$	233	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	$^{\circ}C$
Range of storage temperature			T_{stg}	-40 to +175	$^{\circ}C$

● **Electrical characteristics** ($T_{vj} = 25^{\circ}\text{C}$ unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}$, $I_D = 18.6\text{mA}$ $T_{vj} = 25^\circ\text{C}$	750	-	-	V
Zero Gate voltage Drain current	I_{DSS}	$V_{GS} = 0\text{ V}$, $V_{DS} = 750\text{V}$ $T_{vj} = 25^\circ\text{C}$	-	1	80	μA
		$T_{vj} = 150^\circ\text{C}$	-	10	-	
Gate - Source leakage current	I_{GSS+}	$V_{GS} = +21\text{V}$, $V_{DS} = 0\text{V}$	-	-	100	nA
Gate - Source leakage current	I_{GSS-}	$V_{GS} = -4\text{V}$, $V_{DS} = 0\text{V}$	-	-	-100	nA
Gate threshold voltage	$V_{GS(th)}$ ^{*7}	$V_{DS} = 10\text{V}$, $I_D = 30.8\text{mA}$	2.8	-	4.8	V
Static Drain - Source on - state resistance	$R_{DS(on)}$ ^{*8}	$V_{GS} = 18\text{V}$, $I_D = 58\text{A}$ $T_{vj} = 25^\circ\text{C}$	-	13.0	16.9	$\text{m}\Omega$
		$T_{vj} = 150^\circ\text{C}$	-	22.2	-	
Gate input resistance	R_G	f = 1MHz, open drain	-	1	-	Ω

●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	R_{thJC}^{*9}	-	0.37	0.48	K/W

● Typical Transient Thermal Characteristics

Symbol	Value	Unit
R_{th1}	4.0×10^{-2}	K/W
R_{th2}	1.6×10^{-1}	
R_{th3}	1.7×10^{-1}	

Symbol	Value	Unit
C_{th1}	1.2×10^{-3}	Ws/K
C_{th2}	4.6×10^{-3}	
C_{th3}	2.6×10^{-2}	



● **Electrical characteristics** ($T_{vj} = 25^{\circ}\text{C}$ unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Transconductance	g_{fs}^{*8}	$V_{DS} = 10\text{V}, I_D = 58\text{A}$	-	32	-	S
Input capacitance	C_{iss}	$V_{GS} = 0\text{V}$	-	4580	-	pF
Output capacitance	C_{oss}	$V_{DS} = 500\text{V}$	-	203	-	
Reverse transfer capacitance	C_{rss}	$f = 1\text{MHz}$	-	10	-	
Effective output capacitance, energy related	$C_{o(er)}$	$V_{GS} = 0\text{V}$ $V_{DS} = 0\text{V to } 500\text{V}$	-	263	-	pF
Total Gate charge	Q_g^{*8}	$V_{DS} = 500\text{V}$ $I_D = 58\text{A}$	-	170	-	nC
Gate - Source charge	Q_{gs}^{*8}	$V_{GS} = 18\text{V}$	-	39	-	
Gate - Drain charge	Q_{gd}^{*8}	See Fig. 1-1, 1-2.	-	42	-	
Turn - on delay time	$t_{d(on)}^{*8}$	$V_{DS} = 500\text{V}$ $I_D = 58\text{A}$	-	17	-	ns
Rise time	t_r^{*8}	$V_{GS} = +18\text{V} / 0\text{V}$	-	32	-	
Turn - off delay time	$t_{d(off)}^{*8}$	$R_G = 6.8\Omega, L = 250\mu\text{H}$ E_{on} includes diode reverse recovery	-	82	-	
Fall time	t_f^{*8}	$L_\sigma = 50\text{nH}, C_\sigma = 10\text{pF}$	-	17	-	
Turn - on switching loss	E_{on}^{*8}	See Fig. 2-1, 2-2, 2-3.	-	500	-	μJ
Turn - off switching loss	E_{off}^{*8}		-	310	-	
Short-circuit withstand time	$V_{GS(on)} = +15\text{V}$	t_{sc}^{*10} $V_{DS} \leq 400\text{V}$ $V_{DS,peak} \leq 750\text{V}$ $T_{vj(start)} = 25^{\circ}\text{C}$ $R_G = 2.2\Omega$	-	12.0	-	μs
	$V_{GS(on)} = +18\text{V}$		-	11.5	-	μs

●Body diode electrical characteristics (Source-Drain) ($T_{vj} = 25^{\circ}\text{C}$ unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_{SD}^{*8}	$V_{GS} = 0\text{V}, I_S = 58\text{A}$	-	3.3	-	V
Reverse recovery time	t_{rr}^{*8}	$I_F = 58\text{A}$ $V_R = 500\text{V}$	-	16	-	ns
Reverse recovery charge	Q_{rr}^{*8}	$di/dt = 3300\text{A}/\mu\text{s}$	-	290	-	nC
Peak reverse recovery current	I_{rrm}^{*8}	$L_{\sigma} = 50\text{nH}, C_{\sigma} = 10\text{pF}$ See Fig. 3-1, 3-2.	-	36	-	A

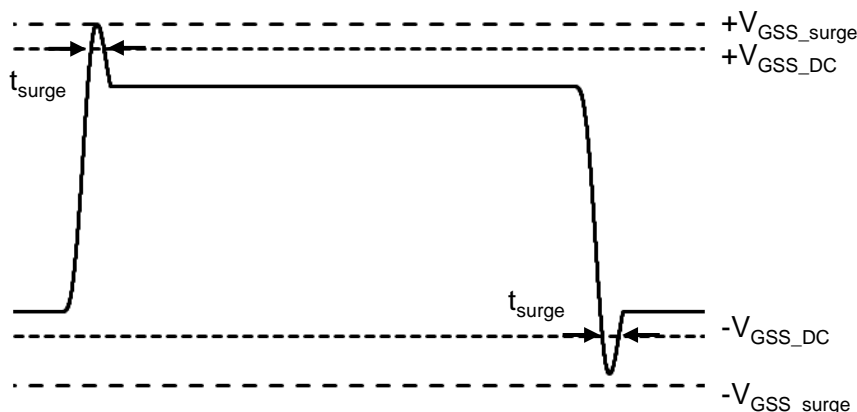
*1 Limited by maximum T_{vj} and for Max. R_{thJC} .

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

*3 Only for body-diode, Repetitive pulse, $PW \leq 1.5\mu\text{s}$, Duty cycle $\leq 5\%$

*4 When used as a protective function, $PW \leq 10\mu\text{s}$

*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 $V_{GS} = 21\text{V}$ 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

*10 Single Pulsed.

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

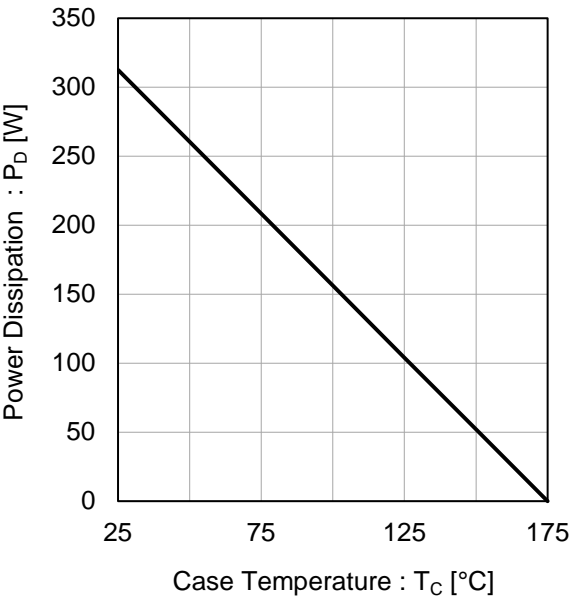


Fig.2 Maximum Safe Operating Area

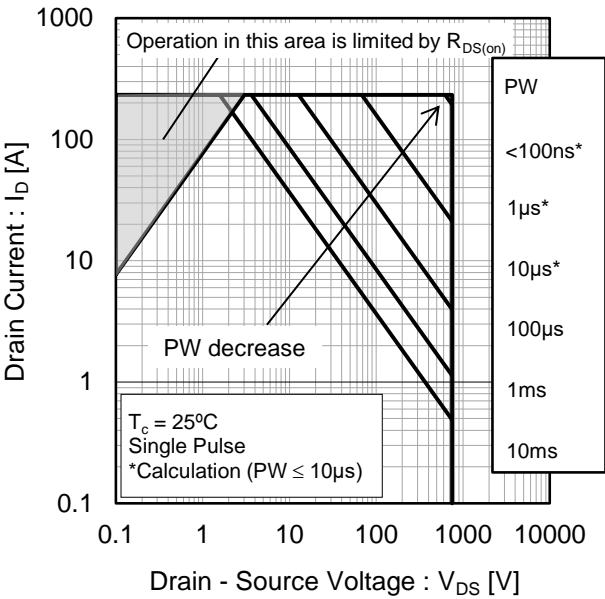
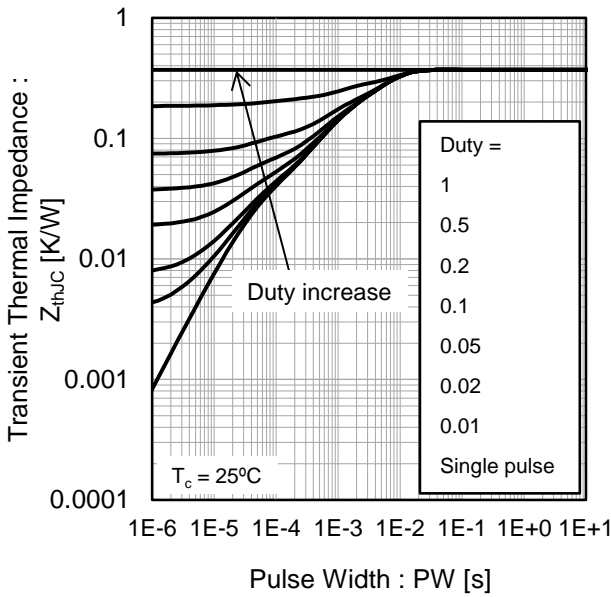


Fig.3 Typical Transient Thermal Impedance vs. Pulse Width



●Electrical characteristic curves

Fig.4 $T_{vj} = 25^{\circ}\text{C}$ Typical Output Characteristics

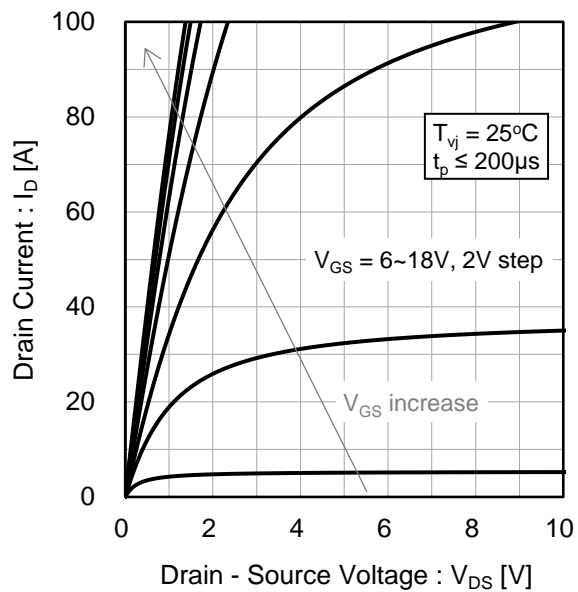
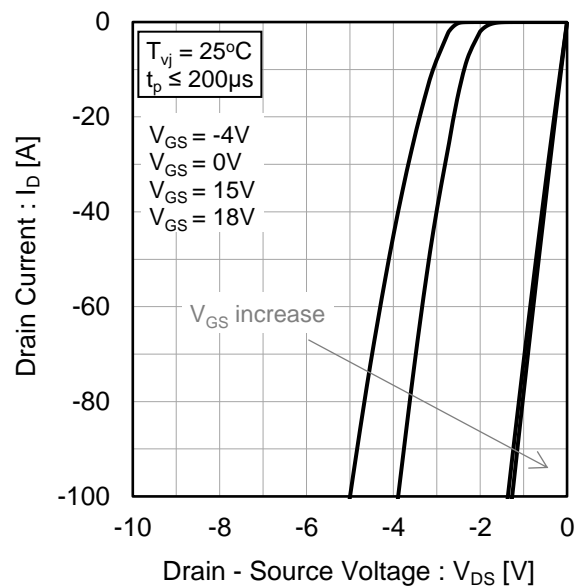


Fig.5 $T_{vj} = 25^{\circ}\text{C}$ 3rd Quadrant Characteristics



●Electrical characteristic curves

Fig.6 $T_{vj} = 150^{\circ}\text{C}$ Typical Output Characteristics

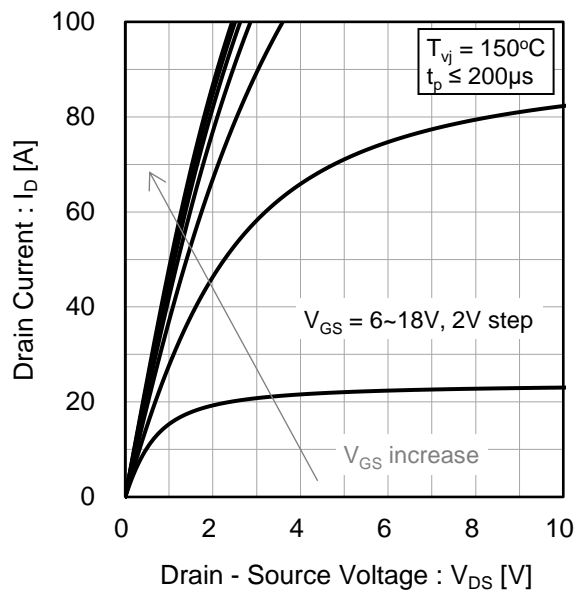


Fig.7 $T_{vj} = 150^{\circ}\text{C}$ 3rd Quadrant Characteristics

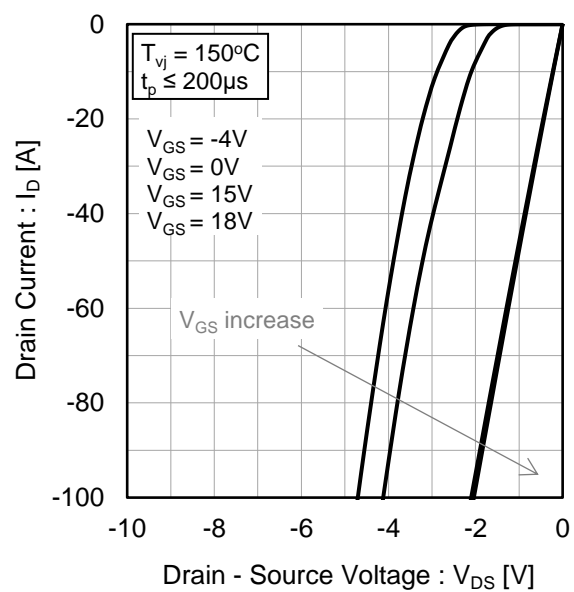
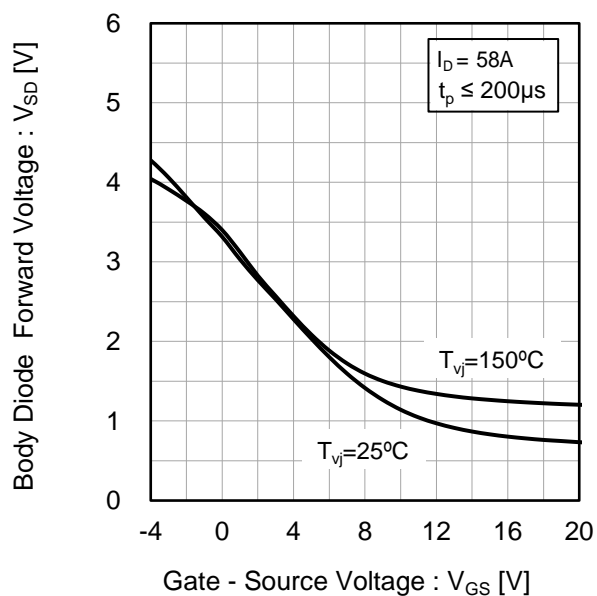


Fig.8 Body Diode Forward Voltage vs. Gate - Source Voltage



●Electrical characteristic curves

Fig.9 Typical Transfer Characteristics (I)

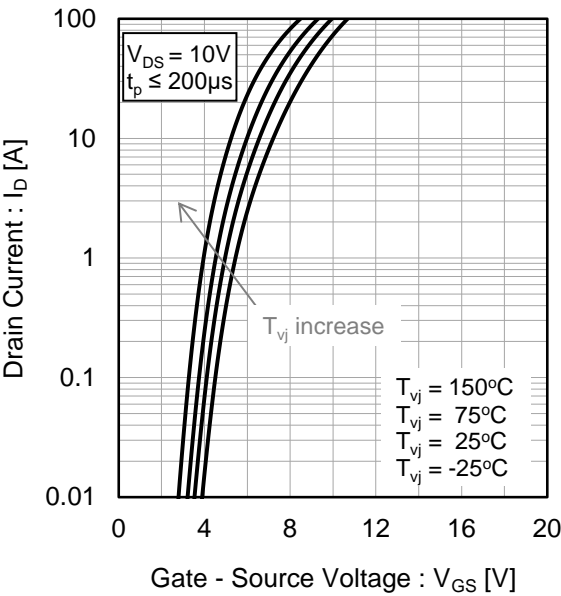


Fig.10 Typical Transfer Characteristics (II)

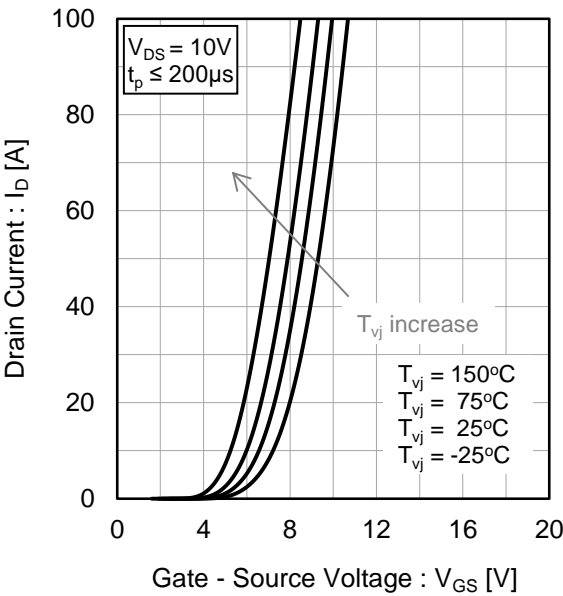


Fig.11 Gate Threshold Voltage vs. Virtual Junction Temperature

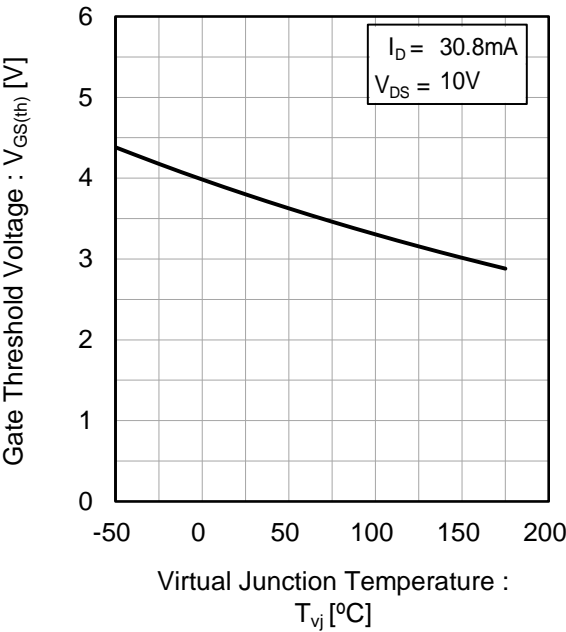
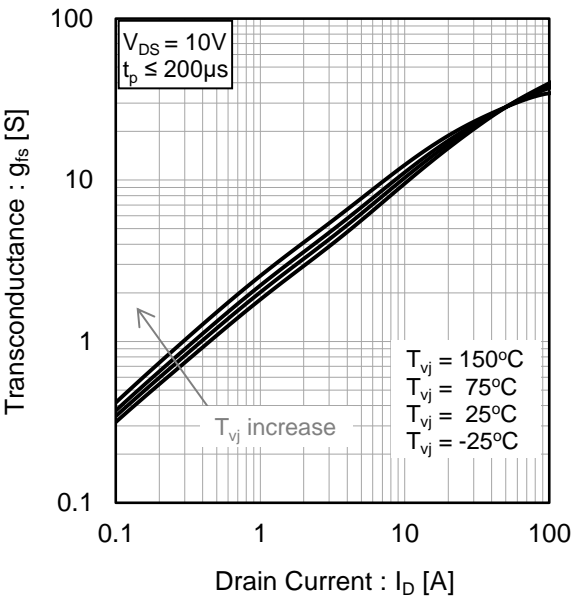


Fig.12 Transconductance vs. Drain Current



●Electrical characteristic curves

Fig.13 Static Drain - Source On - State Resistance vs. Gate - Source Voltage

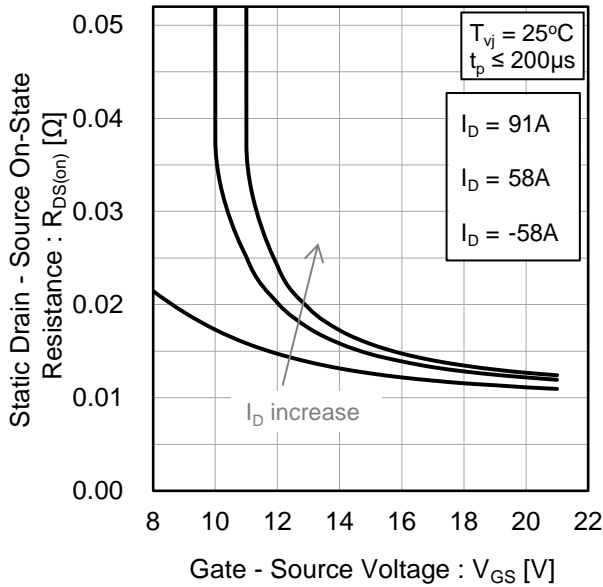


Fig.14 Static Drain - Source On - State Resistance vs. Virtual Junction Temperature

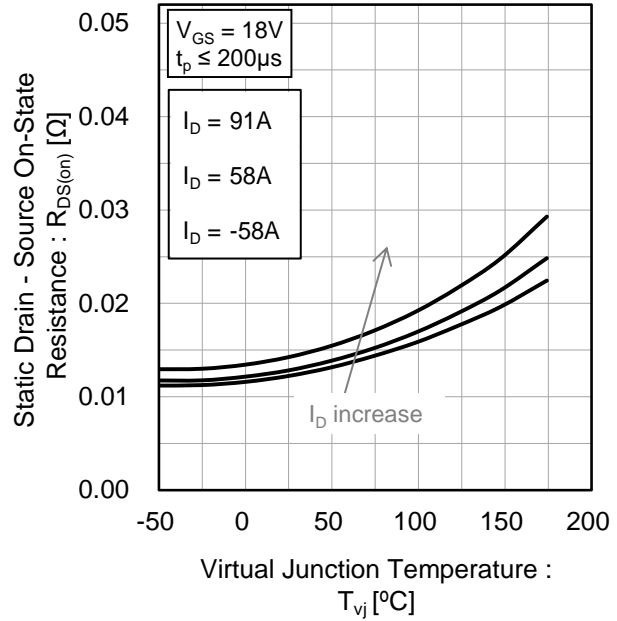


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current

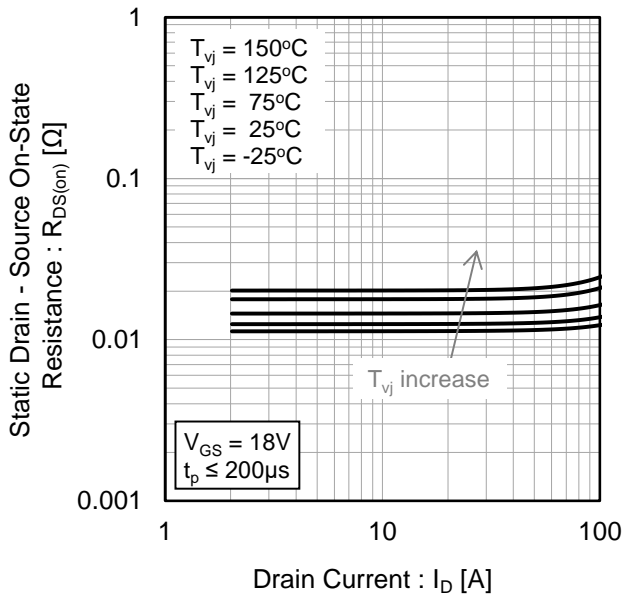
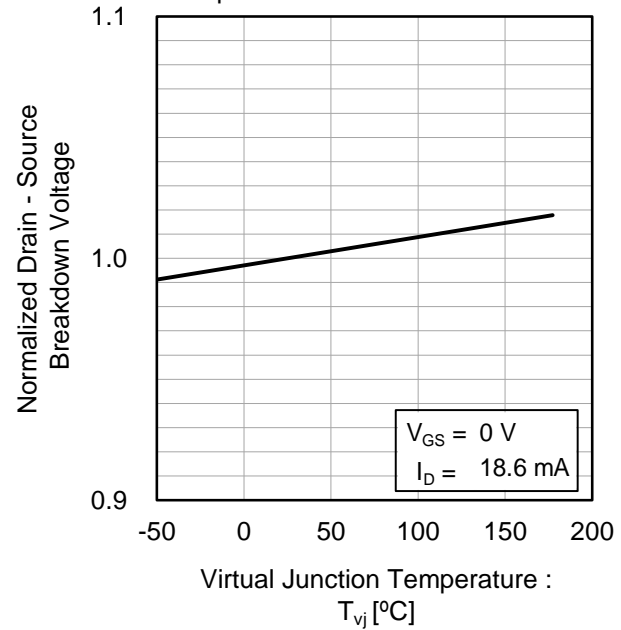


Fig.16 Normalized Drain - Source Breakdown Voltage vs. Virtual Junction Temperature



●Electrical characteristic curves

Fig.17 Typical Capacitance vs. Drain - Source Voltage

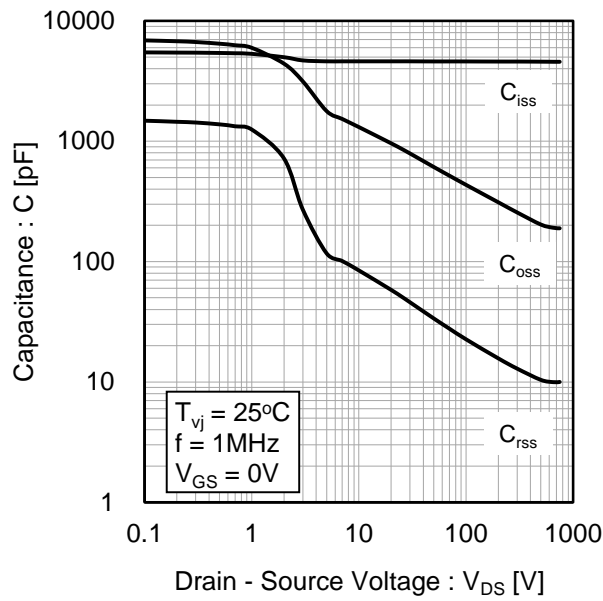


Fig.18 C_{oss} Stored Energy vs. Drain - Source Voltage

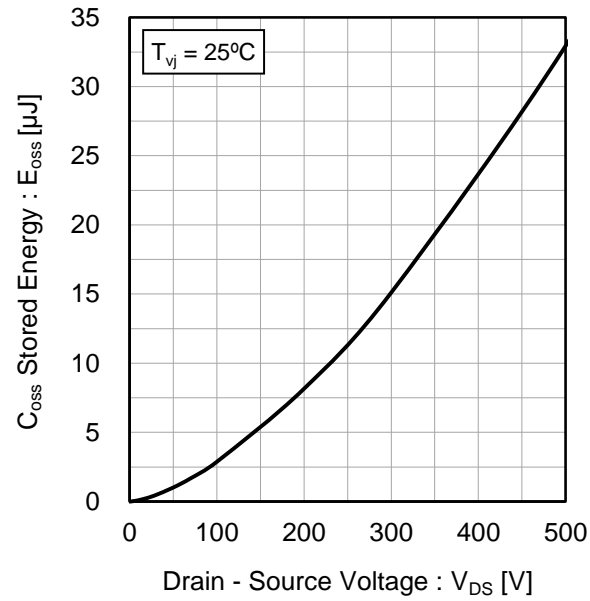
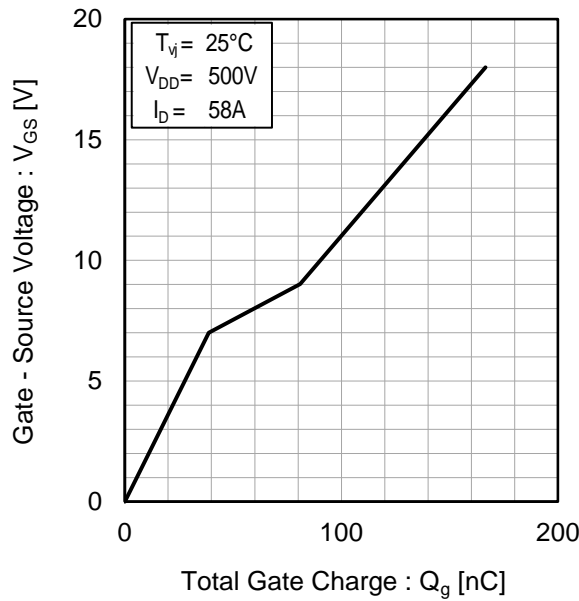


Fig.19 Dynamic Input Characteristics



●Electrical characteristic curves

Fig.20 Typical Switching Time
vs. External Gate Resistance

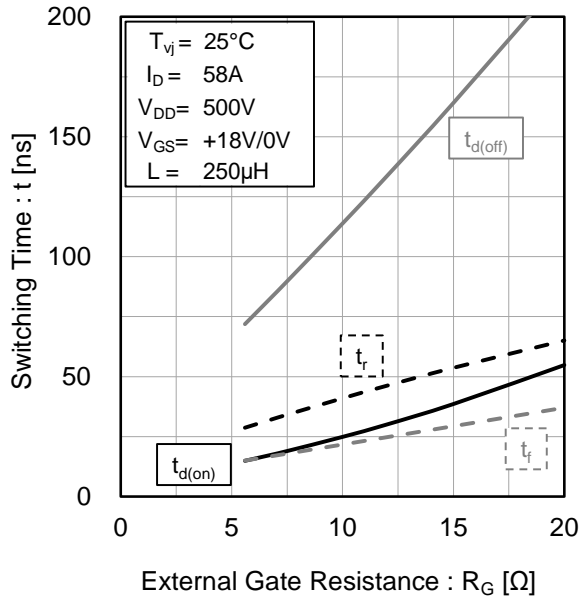


Fig.21 Typical Switching Loss
vs. Drain - Source Voltage

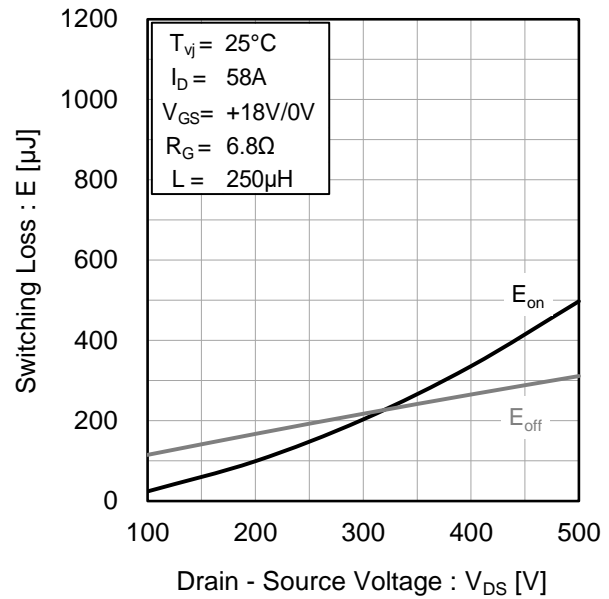


Fig.22 Typical Switching Loss
vs. Drain Current

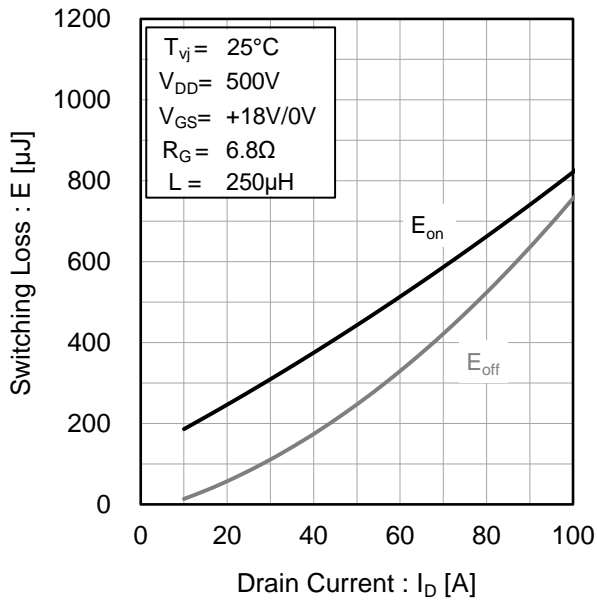
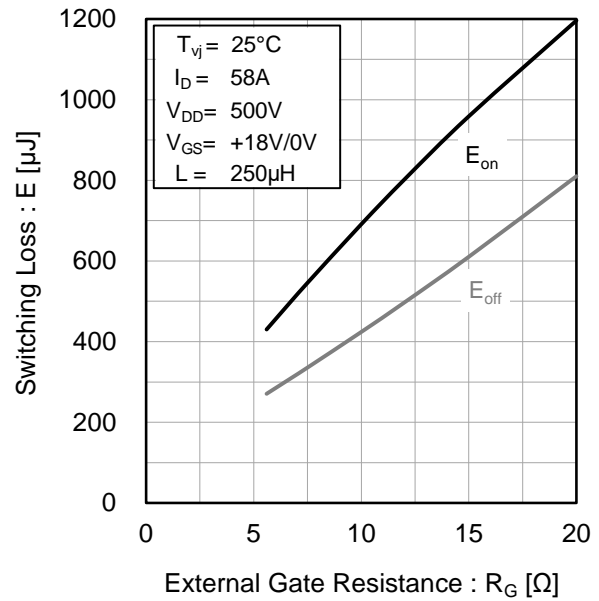


Fig.23 Typical Switching Loss
vs. External Gate Resistance



● Measurement circuits and waveforms

Fig.1-1 Gate Charge Measurement Circuit

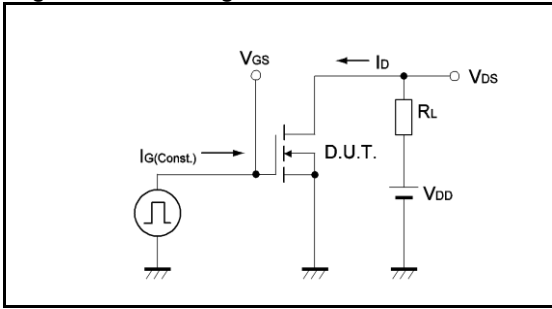


Fig.1-2 Gate Charge Waveform

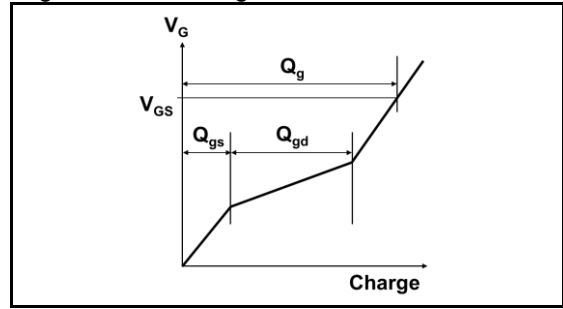


Fig.2-1 Switching Characteristics Measurement Circuit

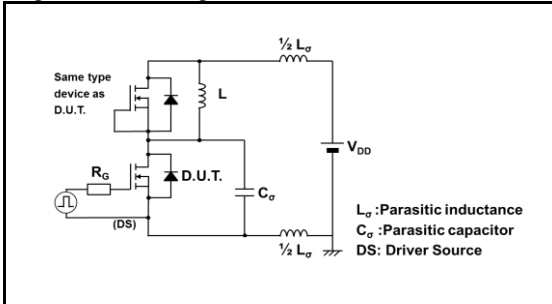


Fig.2-2 Waveforms for Switching Time

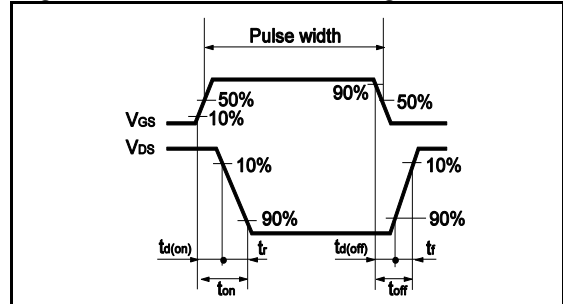


Fig.2-3 Waveforms for Switching Energy Loss

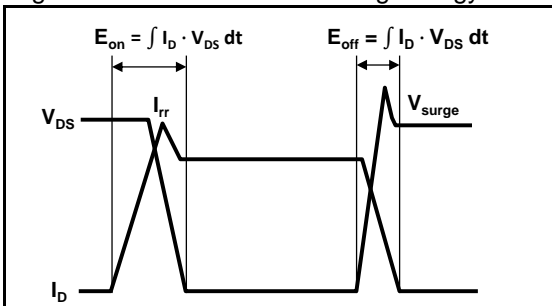


Fig.3-1 Reverse Recovery Time Measurement Circuit

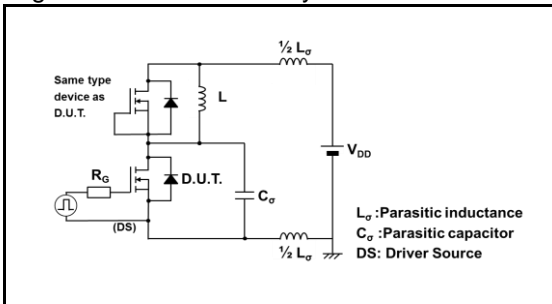
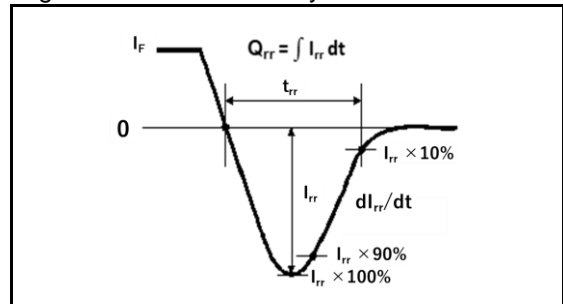
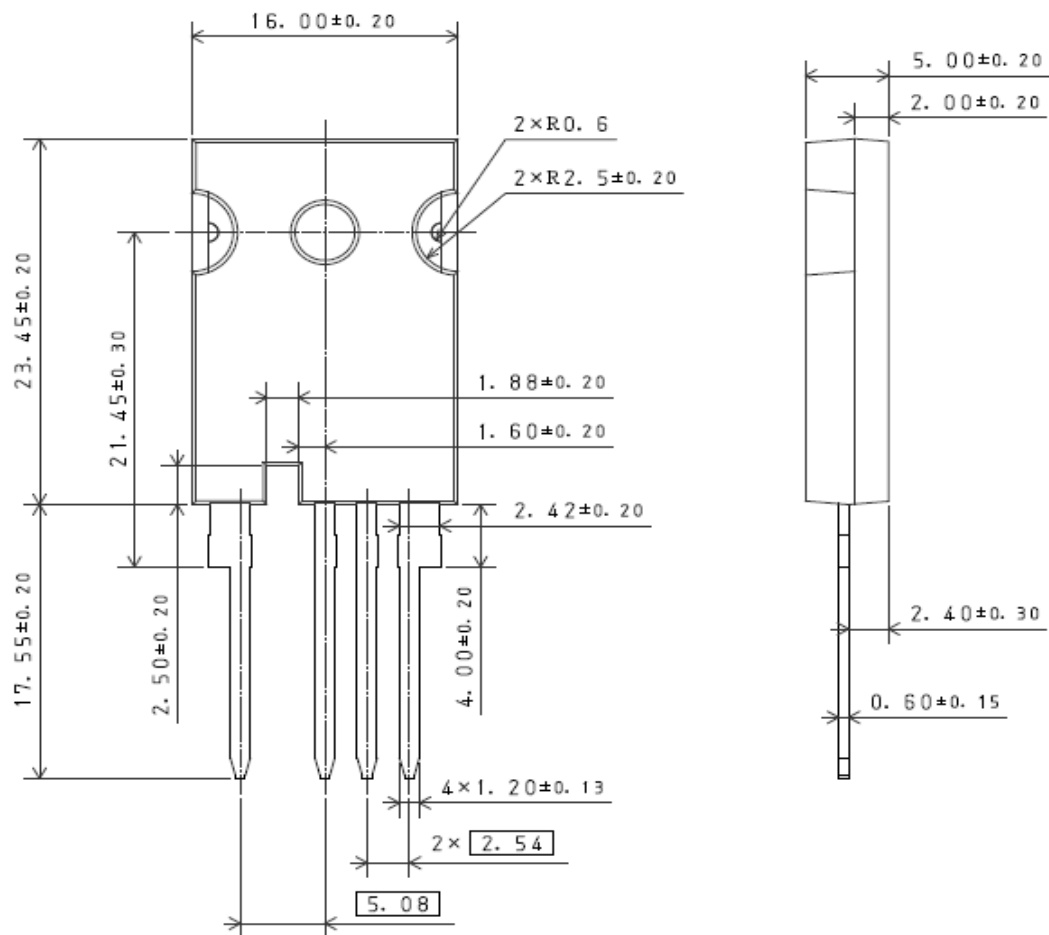


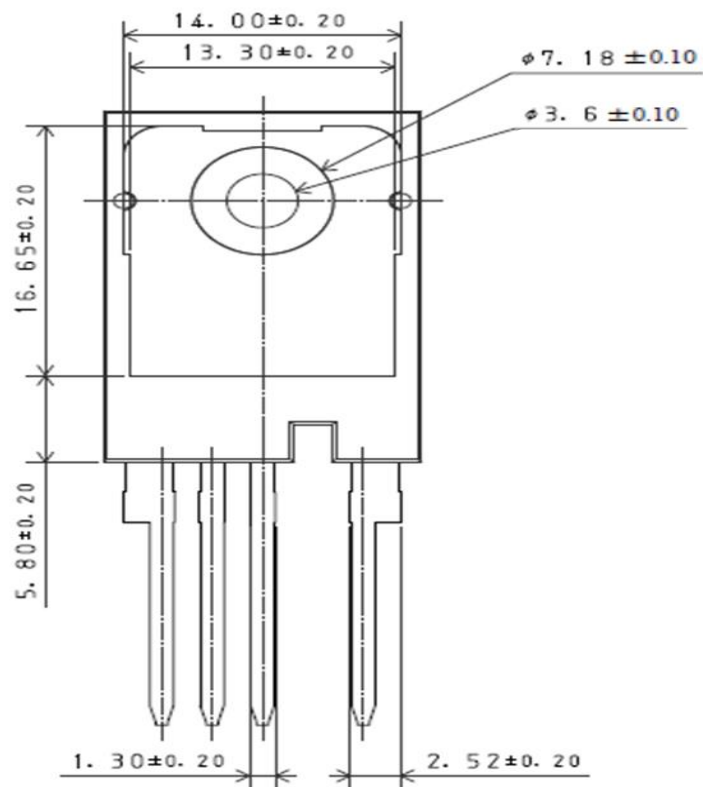
Fig.3-2 Reverse Recovery Waveform



●Package Dimensions

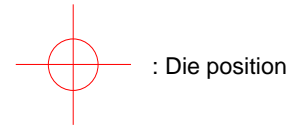
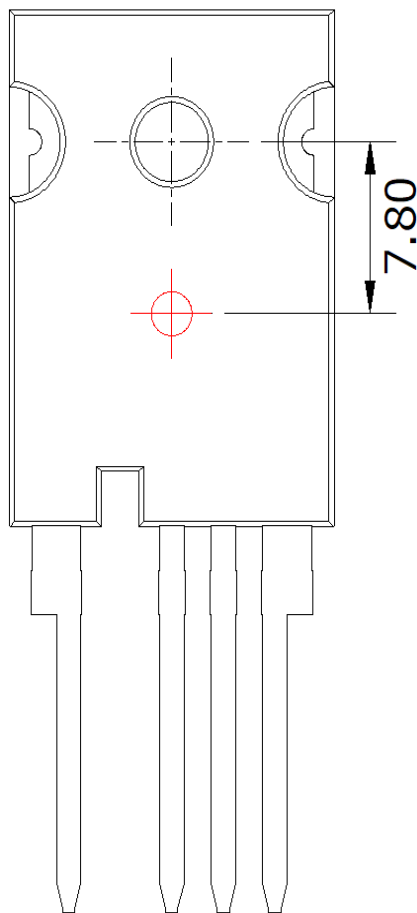


Unit: mm



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

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