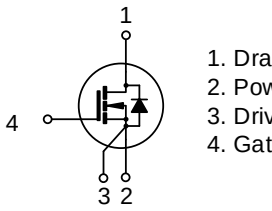
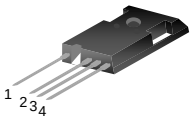
13.5mΩ, 1200V SiC MOS POWER TRANSISTOR

DESCRIPTION

SCDP120R013N2P4B is an N-channel enhancement mode high voltage power MOSFET produced using Silan's Silicon Carbide technology. It achieves low conduction loss and switching losses. It leads the design engineers to their power converters with high efficiency, high power density, and superior thermal behavior.
Furthermore, it's universal applicable, i.e., suitable for switching power supplies, inverters, and DC-DC converters.



1. Drain
2. Power Source
3. Driver Source
4. Gate



TO-247B-4L

FEATURES

- 138A, 1200V, $R_{DS(on)(typ.)}$= 13.5mΩ@V_{GS}=15V
- Silicon Carbide technology
- Low switching loss
- Low reverse recovery charge
- Reduced requirement for heat dissipation
- 100% avalanche tested
- Pb-free lead plating
- RoHS compliant

KEY PERFORMANCE PARAMETERS

Characteristics	Ratings	Unit
V_{DS}	1200	V
$V_{GS(th)}$	1.8~3.6	V
$R_{DS(on),max.}$	17	mΩ
$I_{D.pulse}$	276	A
$Q_{g.typ.}$	226	nC

ORDERING INFORMATION

Part No.	Package	Marking	Hazardous Substance Control	Packing Type
SCDP120R013N2P4B	TO-247B-4L	P120R013N2	Halogen free	Tube

ABSOLUTE MAXIMUM RATINGS (UNLESS OTHERWISE NOTED, T_J=25°C)

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Drain-source Voltage	V_{DS}	--	--	--	1200	V
Gate-source Voltage (Static)	V_{GS}	--	-4	--	15	V
Gate-source Voltage (Dynamic)	V_{GS}	AC(f>1Hz)	-8	--	19	V
Drain Current (Note 1)	I_D	V_{GS}=15V, T_C=25°C	--	--	138	A
		V_{GS}=15V, T_C=100°C	--	--	97	A
Pulsed Drain Current (Note 2)	I_{DM}	T_C=25°C	--	--	276	A
Power Dissipation (Note 3)	P_D	T_C=25°C	--	--	469	W
Single Pulsed Avalanche Energy	E_{AS}	L=5mH, V_{DD}=100V, R_G=25Ω, starting temperature T_J=25°C	--	--	1562	mJ
Single Pulsed Current	I_{AS}	--	--	--	25	A
Operation Junction Temperature Range	T_J	--	-55	--	175	°C
Storage Temperature Range	T_{stg}	--	-55	--	175	°C
Continuous Diode Forward Current	I_S	T_C=25°C, integral reverse P-N junction diode in the MOSFET	--	--	138	A
Diode Pulse Current	$I_{S,pulse}$		--	--	276	A

THERMAL CHARACTERISTICS

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Thermal Resistance, Junction-case, Bottom	$R_{\theta JC}$	--	--	--	0.32	°C/W
Thermal Resistance, Junction-ambient	$R_{\theta JA}$	--	--	--	40	°C/W
Soldering Temperature (in line)	T_{sold}	15^{+2}_{-0} sec, 1time	--	--	260	°C

ELECTRICAL CHARACTERISTICS (UNLESS OTHERWISE NOTED, T_J=25°C)

Static characteristics

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Drain-source Breakdown Voltage	BV_{DSS}	V_{GS}=0V, I_D=250μA	1200	--	--	V
Drain-source Leakage Current	I_{DSS}	V_{DS}=1200V, V_{GS}=0V, T_J=25°C	--	--	50	μA
		V_{DS}=1200V, V_{GS}=0V, T_J=150°C	--	1.0	--	μA
Gate-source Leakage Current	I_{GSS}	V_{GS}=15V, V_{DS}=0V	--	--	1.0	μA
		V_{GS}=-4V, V_{DS}=0V	--	--	-1.0	μA
Gate Threshold Voltage	$V_{GS(th)}$	V_{GS}=V_{DS}, I_D=20mA, T_J=25°C	1.8	--	3.6	V
		V_{GS}=V_{DS}, I_D=20mA, T_J=175°C	--	1.6	--	
Static Drain-source On State Resistance	$R_{DS(on)}$	V_{GS}=15V, I_D=75A	--	13.5	17.0	mΩ
Transconductance	Gfs	V_{DS}=20V, I_D=75A, T_J=25°C	--	85	--	S
		V_{DS}=20V, I_D=75A, T_J=175°C	--	63	--	
Gate Resistance	R_G	f=1MHz	--	2.9	--	Ω

Dynamic characteristics

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Input Capacitance	C_{iss}	f=1MHz, V_{GS}=0V, V_{DS}=1000V	--	6713	--	pF
Output Capacitance	C_{oss}		--	210	--	
Reverse Transfer Capacitance	C_{rss}		--	15	--	
Output Capacitance Loss	E_{oss}		--	121	--	μJ
Turn-on Switching Loss	E_{on}	V_{DS} =800V, V_{GS} =-4/15V, R_G=2.5Ω, I_D =75A, T_J=175°C	--	0.96	--	mJ
Turn-off Switching Loss	E_{off}		--	0.97	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=800V, V_{GS}=-4/15V, R_G=2.5Ω, I_D=75A, L=50μH (Notes 4,5)	--	21	--	ns
Turn-on Rise Time	t_r		--	14	--	
Turn-off Delay Time	$t_{d(off)}$		--	80	--	
Turn-off Fall Time	t_f		--	25	--	
Total Gate Charge	Q_g	V_{DD}=800V, V_{GS}=-4/15V, I_D=75A (Notes 4,5)	--	226	--	nC
Gate-source Charge	Q_{gs}		--	59	--	
Gate-drain Charge	Q_{gd}		--	50	--	

Reverse diode characteristics

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Diode Forward Voltage	V_{SD}	I_S=75A, V_{GS}=-4.0V	--	--	10	V
Reverse Recovery Time	T_{rr}	I_S=75A, V_{GS}=-4.0V, V_R=800V,	--	22	--	ns
Reverse Recovery Charge	Q_{rr}	dI_F/dt=6500A/μs, T_J=175°C	--	798	--	nC
Reverse Recovery Peak Current	I_{rrm}	(Note 4)	--	55	--	A

Notes:

1. The rated value only refers to the maximum absolute value at the case temperature of 25°C in the specification. If the case temperature is higher than 25°C, it should be derated according to the actual environmental conditions;
2. Pulse time 5μs; pulse width is limited by the maximum junction temperature;
3. The dissipation power will change with temperature, derating above 25°C: 3.13W/°C;
4. Pulse Test: Pulse width ≤300μs, Duty cycle≤2%;
5. Essentially independent of operating temperature.

TYPICAL CHARACTERISTICS

Figure 1. Output Characteristics

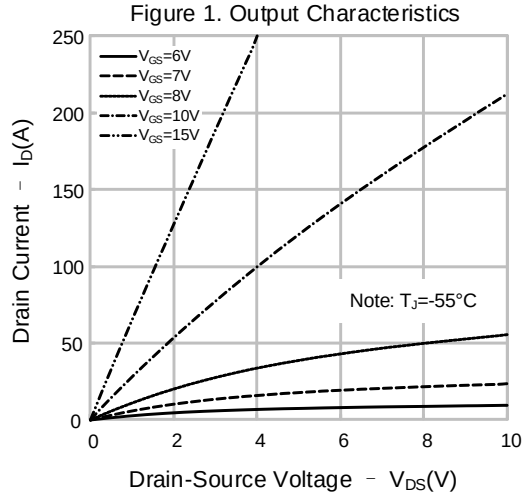


Figure 2. Output Characteristics

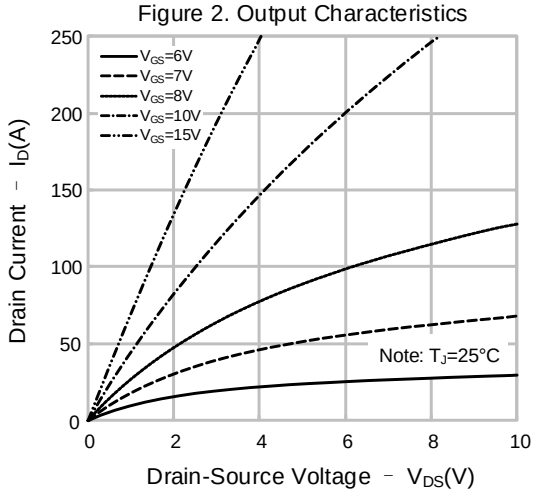


Figure 3. Output Characteristics

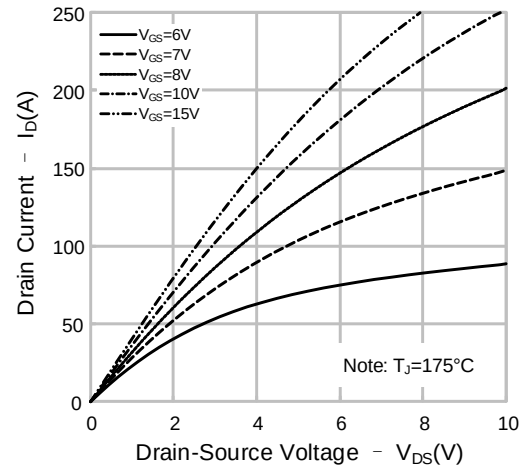


Figure 4. On-resistance Variation vs. Temperature

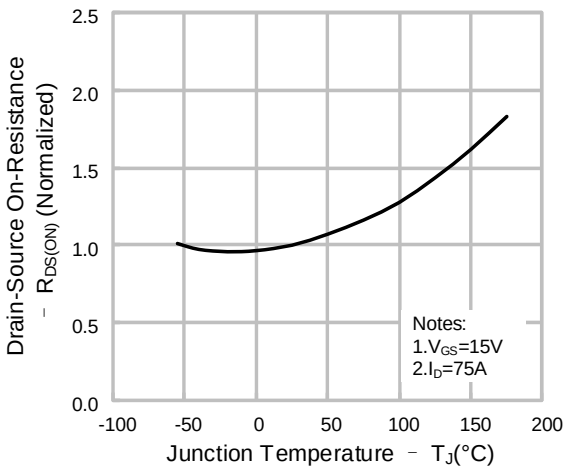


Figure 5. On-resistance vs. Drain Current

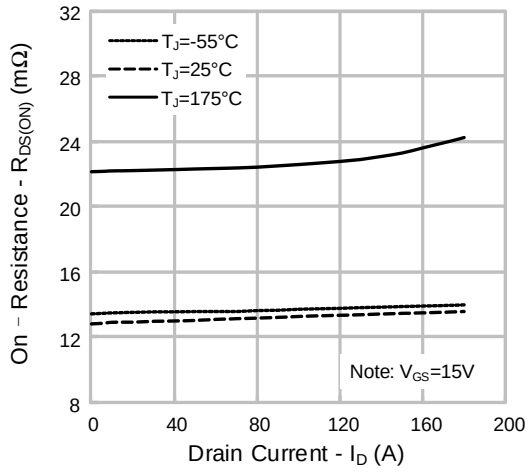
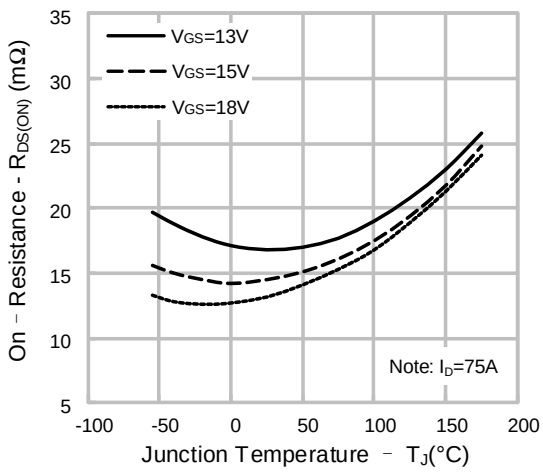


Figure 6. On-resistance vs. Junction Temperature



TYPICAL CHARACTERISTICS (CONTINUED)

Figure 7. Transfer Characteristics

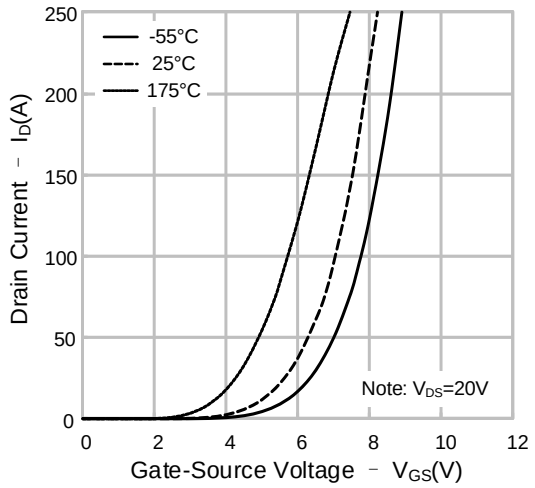


Figure 8. Body Diode Forward Voltage Variation vs. Drain Current

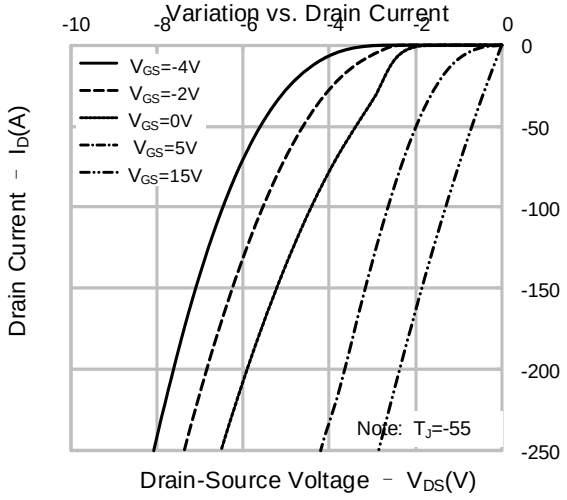


Figure 9. Body Diode Forward Voltage Variation vs. Drain Current

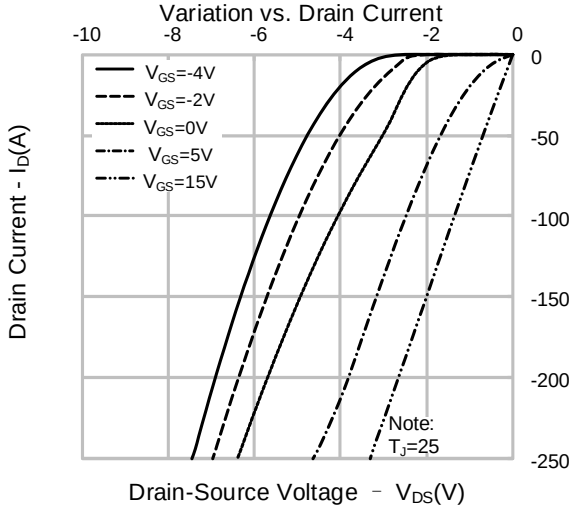


Figure 10. Body Diode Forward Voltage Variation vs. Drain Current

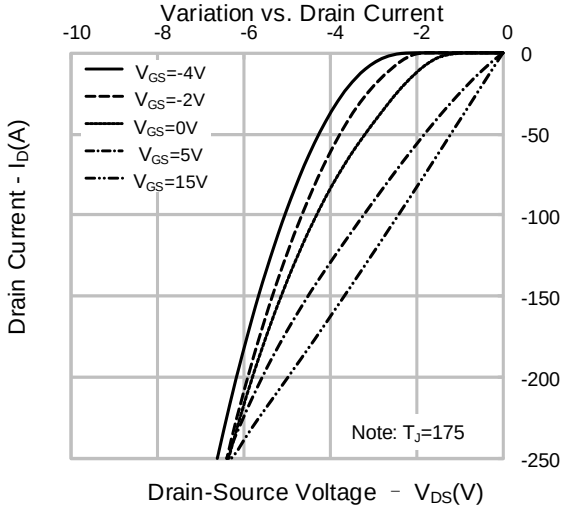


Figure 11. Turn-on Voltage vs. Temperature Characteristics

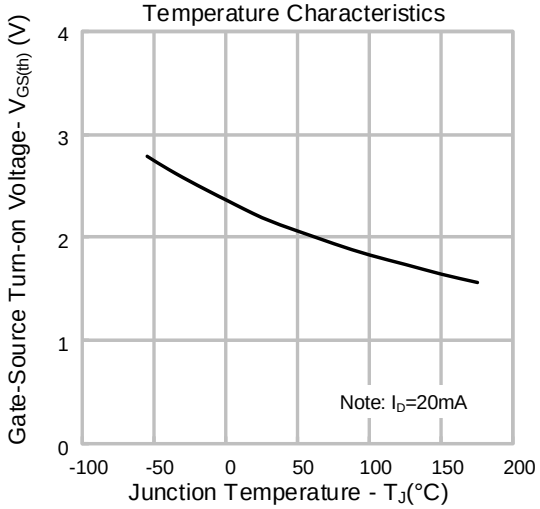
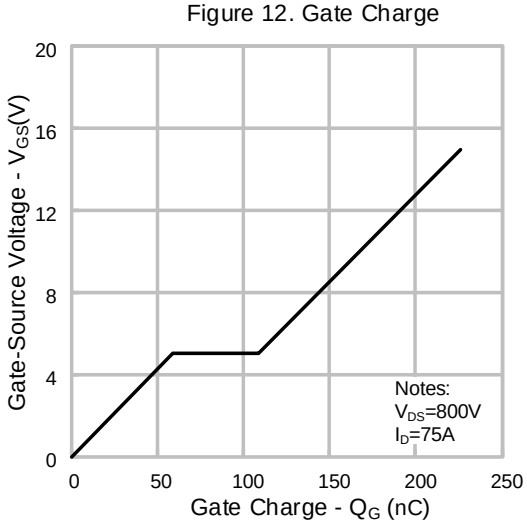


Figure 12. Gate Charge



TYPICAL CHARACTERISTICS (CONTINUED)

Figure 13. Eoss vs. Drain-Source Voltage

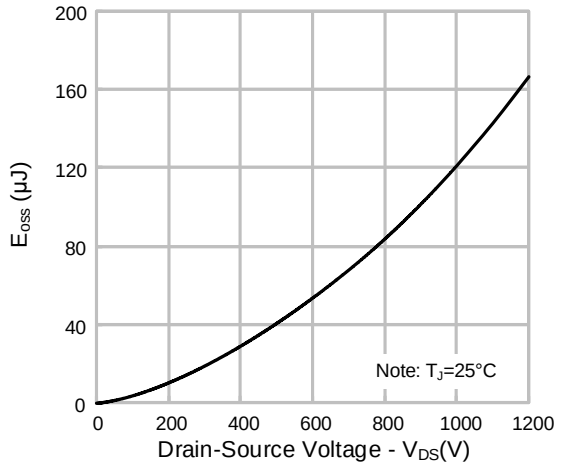


Figure 14. Capacitance Characteristics

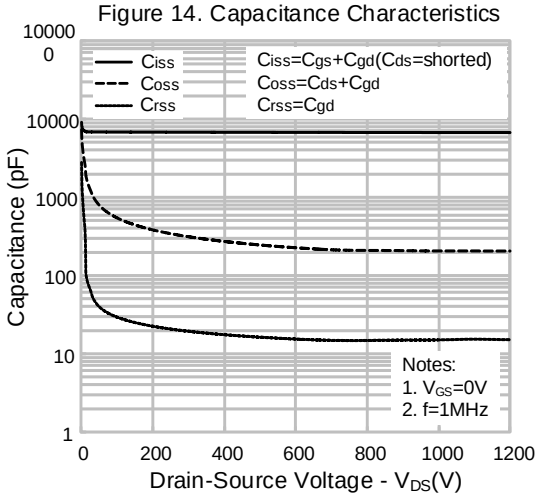


Figure 15. Capacitance Characteristics

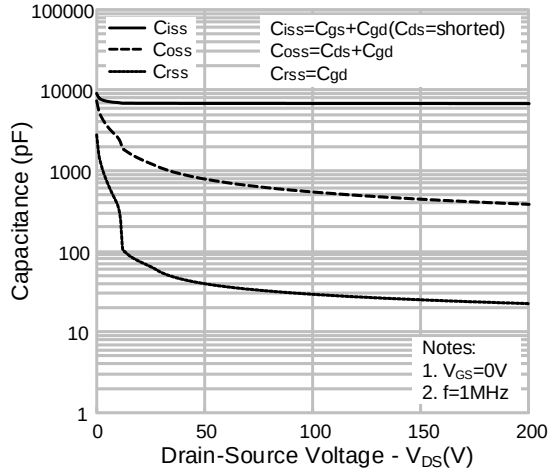


Figure 16. Drain Current vs. Case Temperature

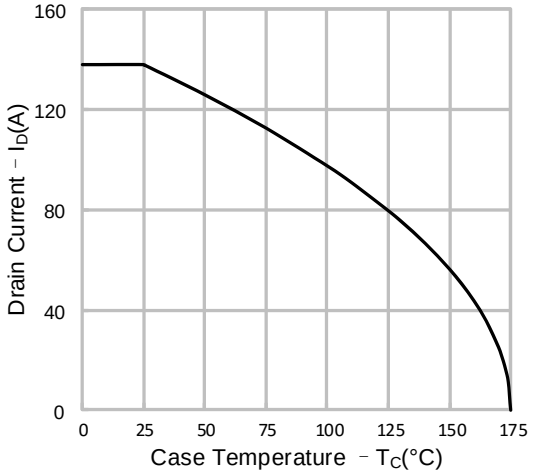


Figure 17. Power Dissipation vs. Temperature

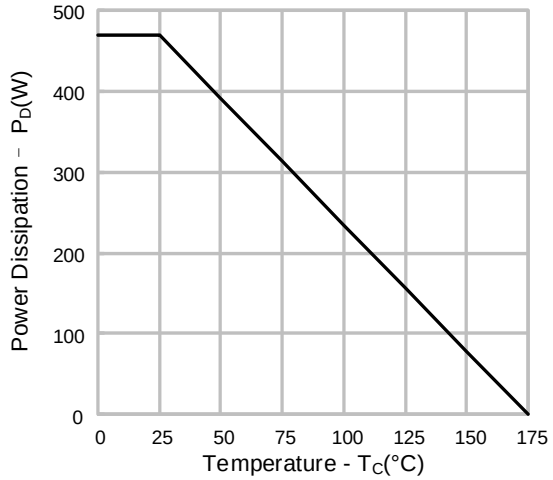
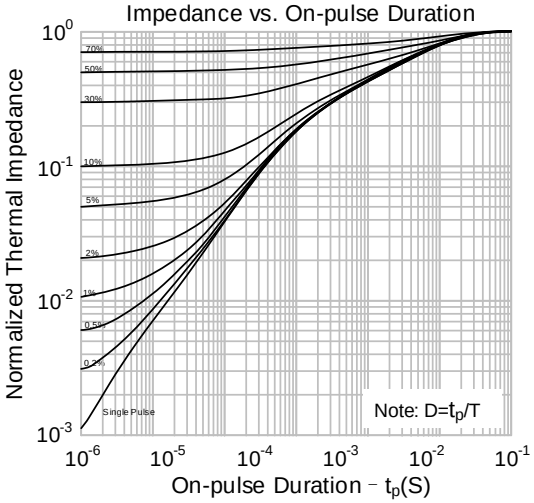


Figure 18. Transient Thermal Impedance vs. On-pulse Duration



TYPICAL CHARACTERISTICS (CONTINUED)

Figure 19. Max. Safe Operating Area

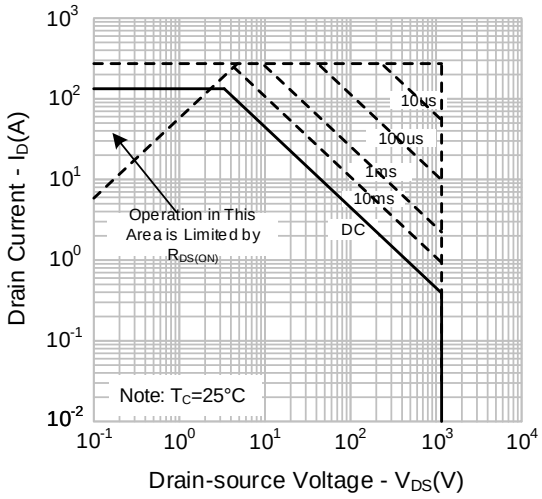


Figure 20. Switch Loss vs. Drain Current

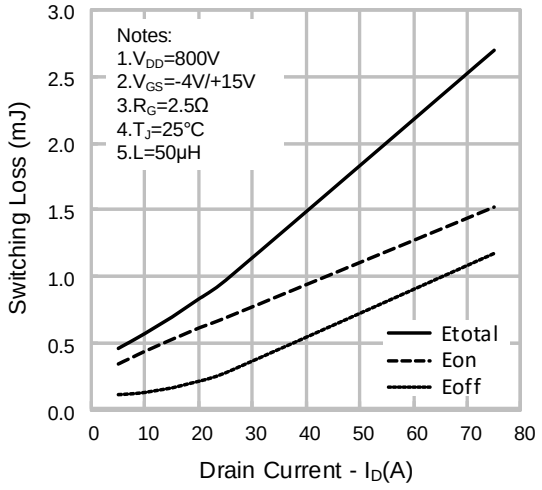


Figure 21. Switching Loss vs. Gate Resistance

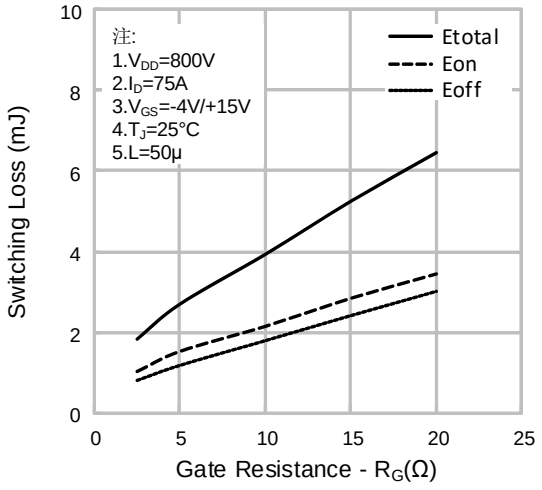


Figure 22. Switching Loss vs. Temperature

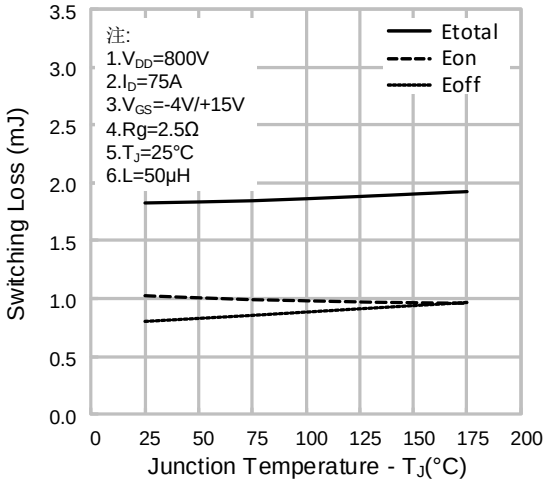
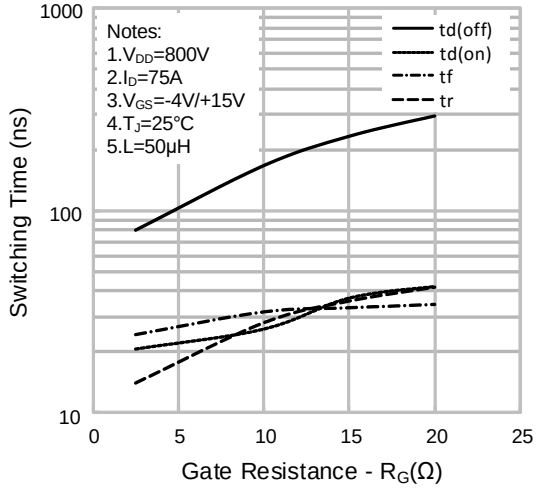
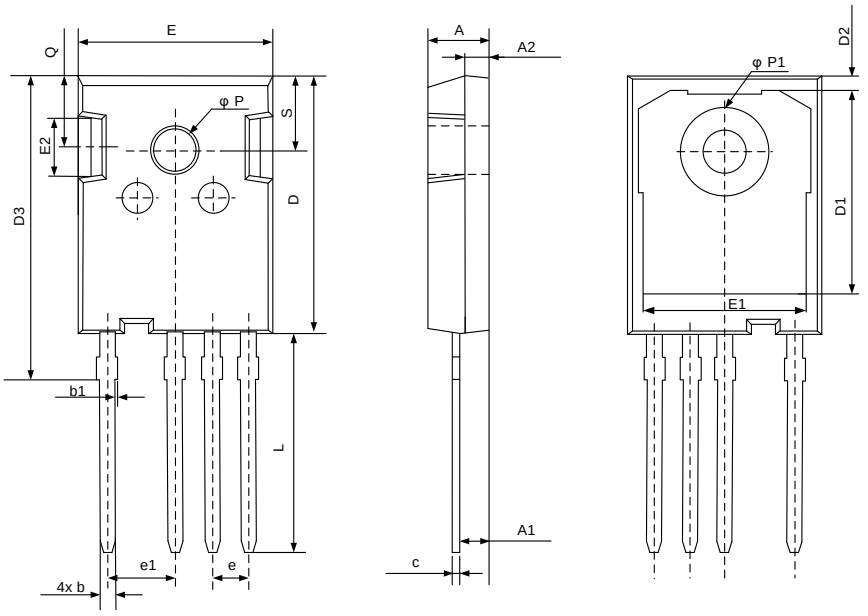


Figure 23. Switching Time vs. Gate Resistance



PACKAGE OUTLINE

TO-247B-4L **UNIT: mm**



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
b	1.16	—	1.29
b1	0	—	0.20
c	0.59	—	0.66
D	20.90	21.00	21.10
D1	16.25	16.55	16.85
D2	1.05	1.20	1.35
D3	24.97	25.12	25.27
E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	4.90	5.00	5.10
e	2.44	2.54	2.64
e1	4.98	5.08	5.18
L	19.80	19.92	20.10
P	3.50	3.60	3.70
P1	—	—	7.40
Q	5.60	—	6.00
S	6.15 BSC		

MOS DEVICES OPERATE NOTES:

Electrostatic charges may exist in many things. Please take following preventive measures to prevent effectively the MOS electric circuit as a result of the damage which is caused by discharge:

- The operator must put on wrist strap which should be earthed to against electrostatic.
- Equipment cases should be earthed.
- All tools used during assembly, including soldering tools and solder baths, must be earthed.
- MOS devices should be packed in antistatic/conductive containers for transportation.

Important notice :

1. Silan reserves the right to make changes of this instruction without notice.
2. Customers should obtain the latest relevant information when purchasing and should verify whether such information is latest and complete. Please read this instruction and application manual and related materials carefully before using products, including the circuit operation precautions, etc.
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Rev.: 1.0

Revision History:

1. First release