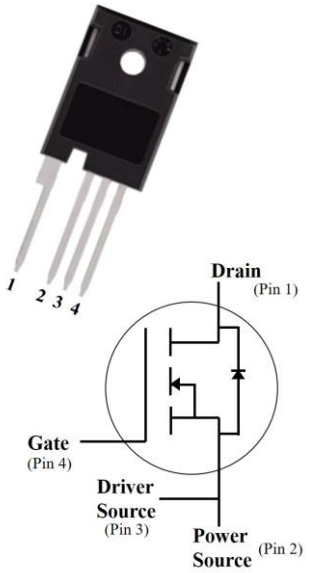
Silicon Carbide Power MOSFET （N-Channel Enhancement）

V_{DS}	1200V
$I_{D\ (25°C)}$	167A
$R_{DS(on)}$	13mΩ



Features

- High speed switching
- Essentially no switching losses
- Reduction of heat sink requirements
- Maximum working temperature at 175 °C
- High blocking voltage
- Fast Intrinsic diode with low recovery current
- High-frequency operation
- Halogen free, RoHS compliant

Typical Applications

Typical applications are in power factor correction(PFC), solar inverter, uninterruptible power supply, motor drives, photovoltaic inverter, electric car and charger.

Mechanical Data

- **Package**: TO247-4L
- **Terminals**: Tin plated leads
- **Polarity**: As marked

■Maximum Ratings (T_C=25℃ Unless otherwise specified）

D212014NCFG1

PARAMTETER	SYMBOL	UNIT	VALUE	TEST CONDITIONS	NOTE
Device marking code			D212013NCFG1		
Drain source voltage @ T_j=25°C	$V_{DS,max}$	V	1200	V_{GS}=0 V, I_D=100uA	
Gate source voltage @ T_j=25°C	$V_{GS,max}$	V	-10/+22	Absolute maximum values (AC f > 1Hz, duty cycle < 1%)	
Gate source voltage @ T_j=25°C	$V_{GS,op}$	V	-5/+18	Recommended operational values	
Continuous drain current @ T_c=25°C	I_D	A	167	V_{GS}=18V, Tc=25℃	Fig.14
Continuous drain current @ T_c=100°C			118	V_{GS}=18V, Tc=100℃	
Pulsed drain current	$I_{D(pulsed)}$	A	334	Pulse width tp limited by Tj,max	Fig.3
Power Dissipation	P_{TOT}	W	555	T_c=25°C , Tj = 175℃	Fig.13
Operating junction and Storage temperature range	Tj ,Tstg	°C	-55 to +175		
Soldering temperature	T_L	°C	260	1.6mm (0.063") from case for 10s	
Mounting torque	T_M	Nm	1.0	M3 screw Maximum of mounting process: 3	

■Static Electrical Characteristics（Tc=25℃ unless otherwise specified ）

PARAMTETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Gate threshold voltage	$V_{GS(th)}$	V	2.0	2.9	4.0	V_{DS}=V_{GS}, I_D= 20mA	Fig.11
Drain source breakdown voltage	$V_{(BR)DSS}$	V	1200			V_{GS}=0, I_D=100uA	
Zero gate voltage drain current	I_{DSS}	uA		1	100	V_{DS}=1200V, V_{GS}= 0V	
Gate source leakage current	I_{GSS}	nA		1	100	V_{GS}= 18V, V_{DS}=0V	
Current drain source on-state resistance	$R_{DS\ ON}$	mΩ		13	17	V_{GS}=18V, I_D=70A	Fig.4, 6, 7
				20		V_{GS}=18V, I_D=70A,Tj=175℃	
Transconductance	g_f	S		48		V_{DS}=20V,I_D=70A,Tj=25℃	Fig.5

■Dynamic Electrical Characteristics（Tc=25℃ unless otherwise specified ）

PARAMTETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Input capacitance	Ciss	pF		3815		V_{DS}=1200V, V_{GS}=0V, Tj=25℃, f=100K Hz, V_{AC} = 25mV	Fig.10
Output capacitance	Coss			239			
Reverse capacitance	Crss			29			
Coss stored energy	Eoss	uJ		311			Fig.12
Gate source charge	Qgs	nC		46		V_{DS}=800V, V_{GS}=-5/18V, I_D=70A	Fig.15
Gate drain charge	Qgd			100			
Gate charge	Qg			216			
Internal Gate Resistance	$R_{G(int)}$	Ω		5.2		f =1MHz, V_{AC} = 25mV	

■Switching Characteristics（Tc=25℃ unless otherwise specified ）

PARAMTETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Turn on switching energy	$t_{d(on)}$	ns		15		V_{DD}=800V, V_{GS}=-5/+18V, I_D=70A, L=150 uH, $R_{G(ext)}$ = 2.5Ω	Fig.16
Turn off switching energy	t_r			70			
Turn on delay time	$t_{d(off)}$			82			
Rise time	t_f			27			
Turn off delay time	Eon	uJ		2483			Fig.17, 18
Fall time	Eoff			1669			

■Body diode characteristics（Tc=25℃ unless otherwise specified ）

PARAMTETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Diode forward voltage	V_{SD}	V		4.7		V_{GS}=-5V,I_{SD}=37.5A	Fig.8
Continuous diode forward current	I_S	A		104		V_{GS}=-5V,Tc=25℃	Fig.9
Reverse recovery time	trr	nS		75		V_{DS}=800V, V_{GS}=-5V, I_{SD}=70A, RG(ext)=2.5Ω, T_J = 175°C	
Reverse recovery charge	Qrr	nC		2080			
Peak reverse recovery current	Irrm	A		45			

■Thermal Characteristics （Ta=25℃ Unless otherwise specified）

PARAMETER	SYMBOL	UNIT	Value
Thermal resistance	$R_{\theta J-C}$	°C /W	0.27

■Typical Characteristics

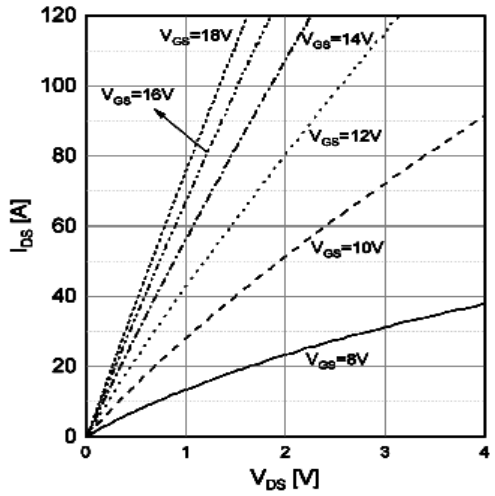


Figure 1. Output Characteristics Tj =25℃

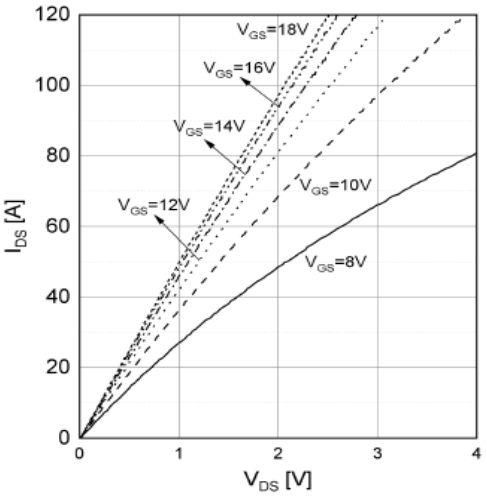


Figure2. Output Characteristics Tj = 175℃

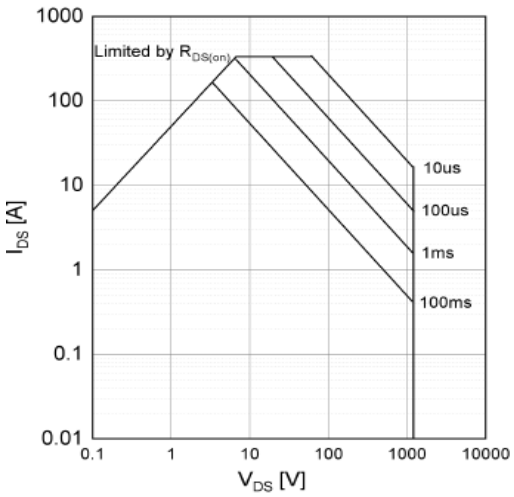


Figure 3. Safe Operating Area

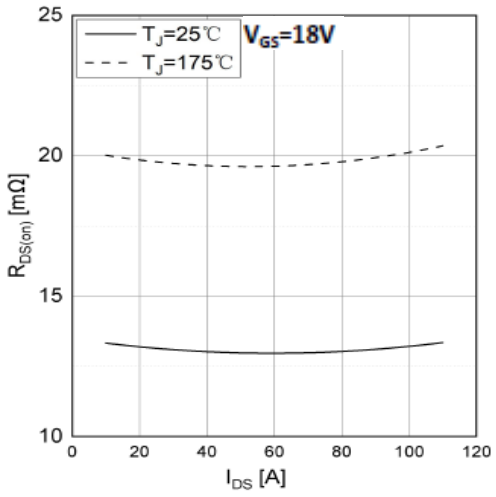


Figure 4. On-resistance vs. drain current

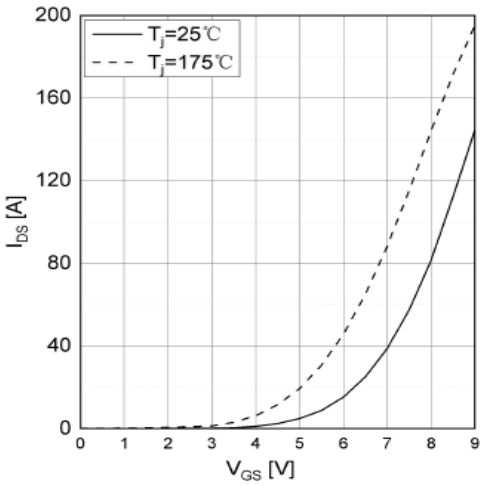


Figure 5. Transfer Characteristics for various Tj

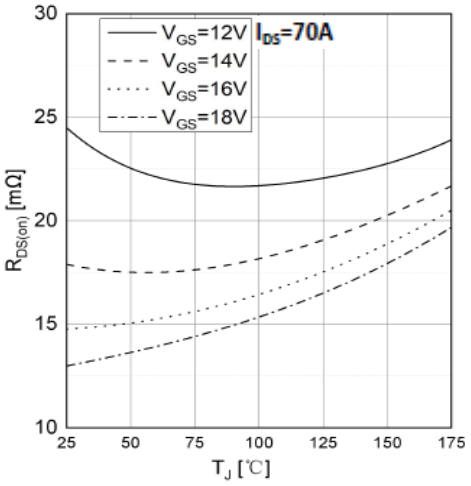


Figure 6. On-resistance vs. Temperature for various Gate voltage

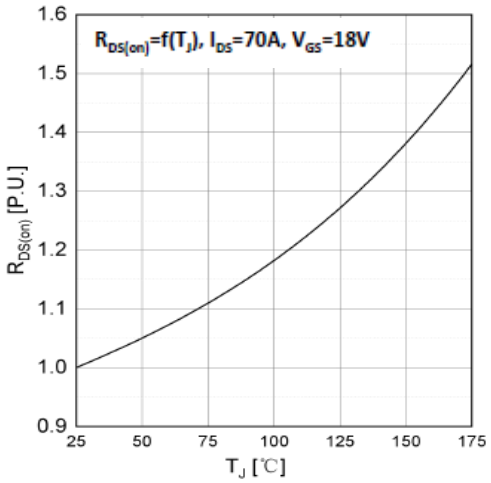


Figure 7. Normalized On-Resistance vs.Temperature

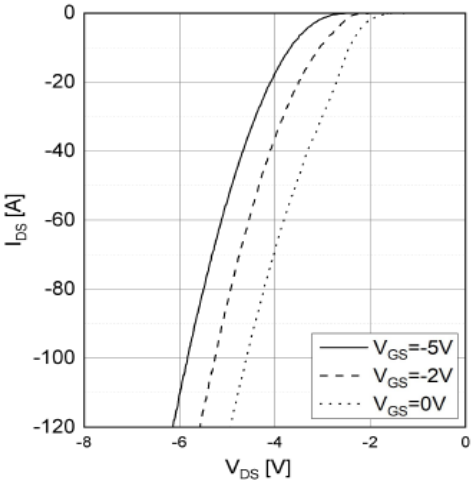


Figure 8. Reverse Output Characteristics at Tj = 25°C

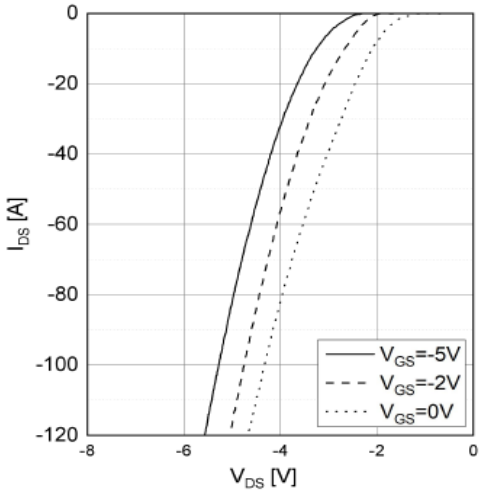


Figure 9. Reverse Output Characteristics at Tj = 175°C

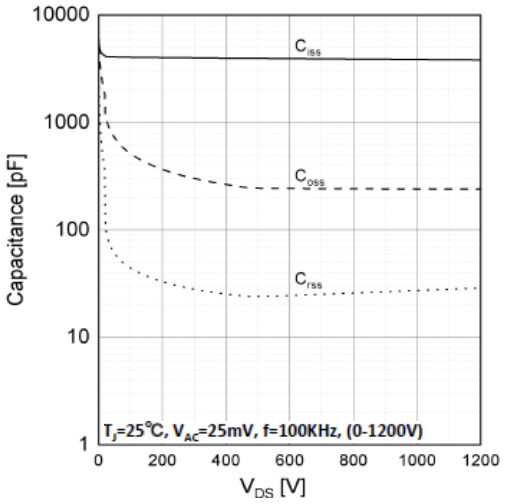


Figure 10. Capacitances vs. Drain to Source Voltage

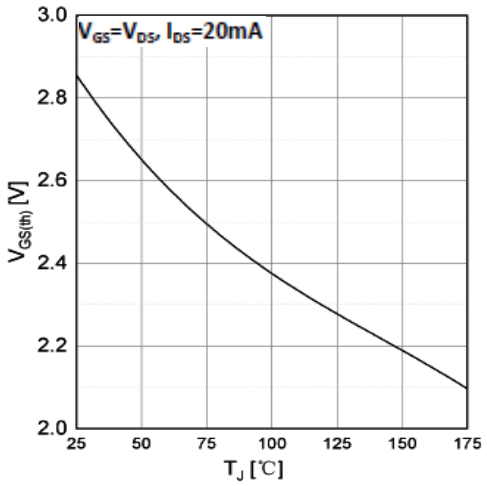


Figure 11. Threshold voltage vs.temperature

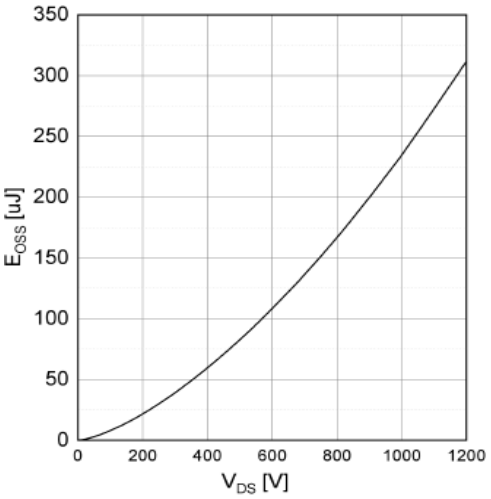


Figure 12. Output Capacitor Stored Energy

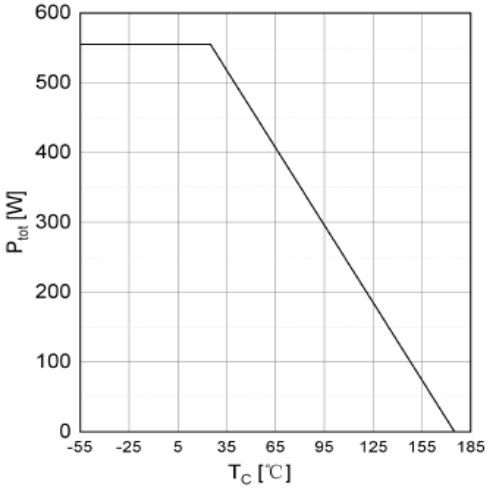


Figure 13. Maximum Power Dissipation Derating vs. Case Temperature

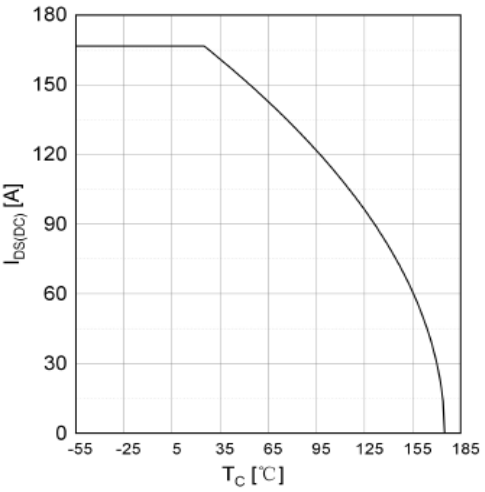


Figure 14. Drain Current Derating vs. Case Temperature

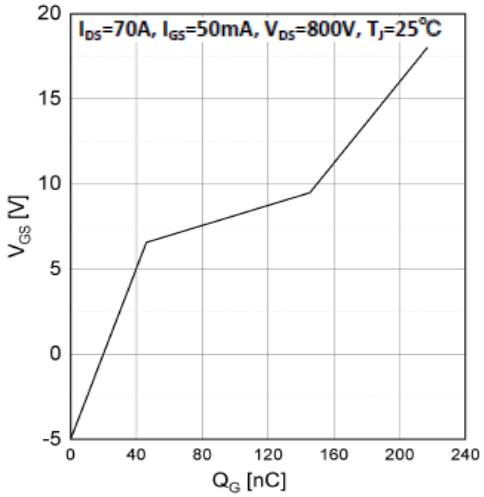


Figure 15. Gate Charge Characteristics

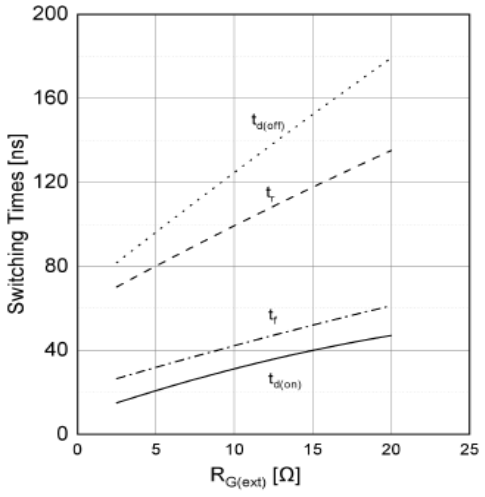


Figure 16. Clamped Inductive Switching Time vs. External Gate Resistor (R_G(ext.))

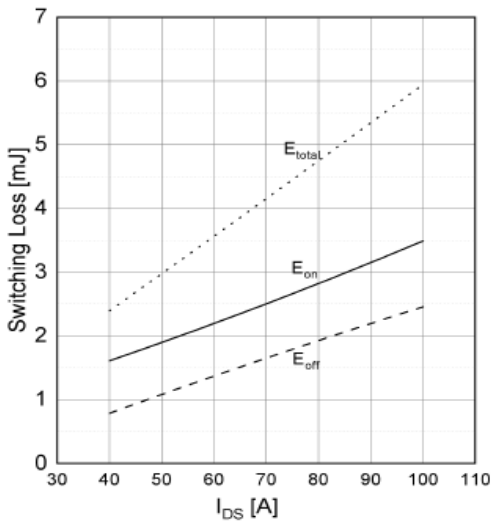


Figure 17. Clamped Inductive Switching Energy vs. Drain Current

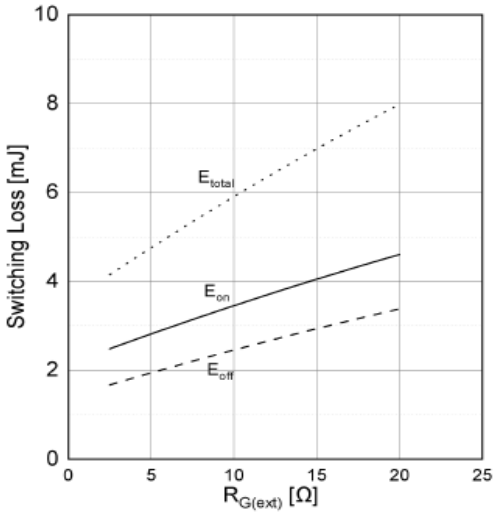


Figure 18. Clamped Inductive Switching Energy vs. External Gate Resistor (R_G(ext.))

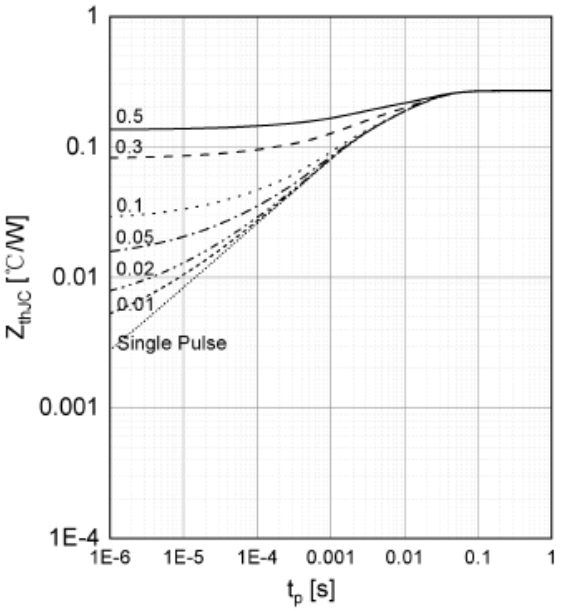


Figure 19. Transient Junction to Case Thermal Impedance

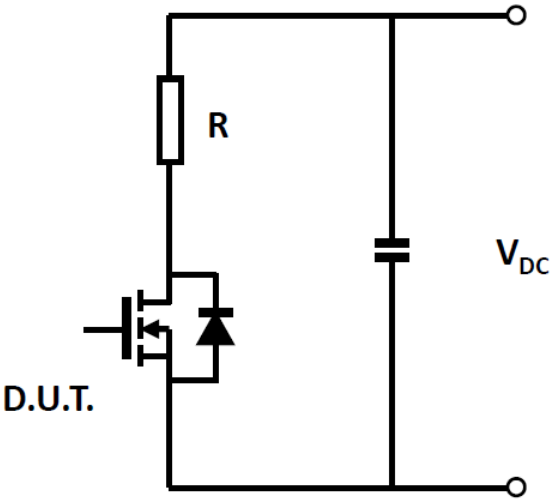


Figure 20. Schematic of Resistive Switching

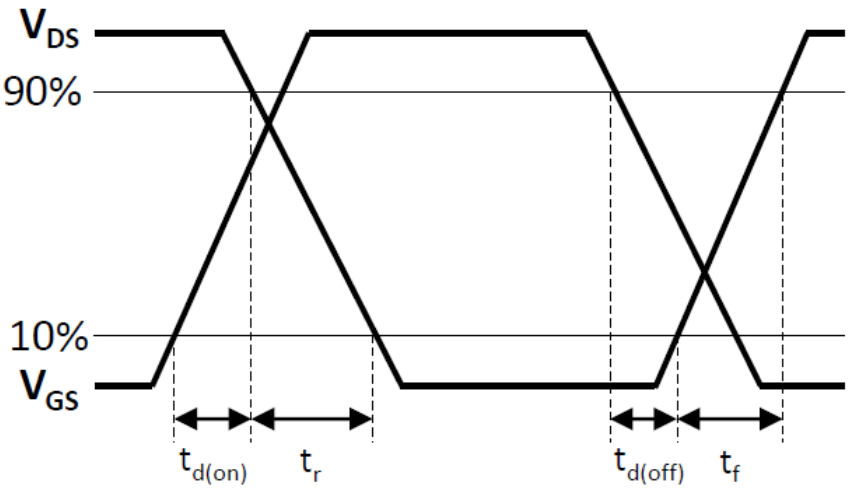
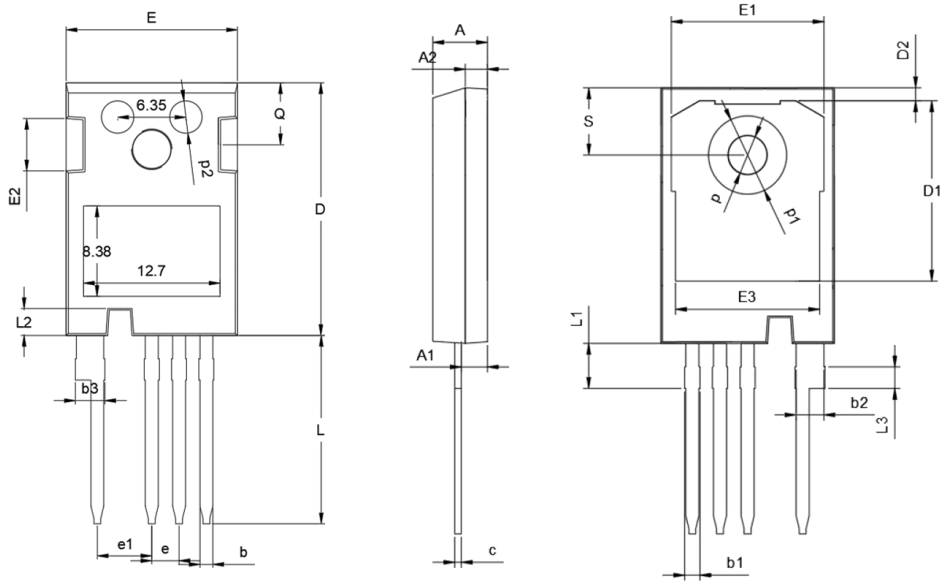


Figure 21. Switching Times Definition

■Outline Dimensions



TO247-4L			
Dim	Min	Norm	Max
A	4.80	5.00	5.20
A1	2.30	2.40	2.50
A2	1.88	1.98	2.08
b	1.10	1.20	1.30
b1	1.20	/	1.50
b2	2.35	2.55	2.75
b3	2.45	/	2.85
c	0.55	0.60	0.65
D	23.3	23.45	23.6
D1	16.25	16.55	16.85
D2	1.00	/	1.30
e	TYP2.54		
e1	TYP5.06		
E	15.75	15.90	16.05
E1	13.80	/	14.20
E2	4.40	4.75	5.10
E3	13.00	/	13.45
L	17.34	17.49	17.64
L1	4.00	/	4.30
L2	2.35	/	2.65
L3	TYP1.98		
Q	5.60	5.80	6.00
S	6.05	/	6.30
p	TYP3.58		
p1	TYP7.18		
p2	TYP3.00		

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