1200V, 50A, N-channel SiC power MOSFET

General Description:

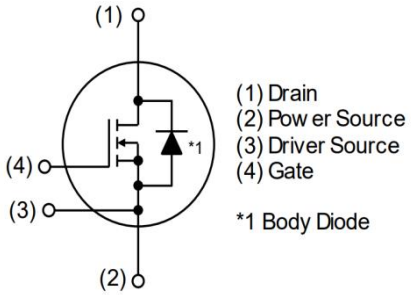
NCES120R036T4 is a SiC MOSFET that contributes to miniaturization and low power consumption of applications. This product achieves industry-leading low on-resistance without sacrificing short-circuit withstand time. This is a 4-pin package type with a driver source terminal that can maximize the high-speed switching performance that is a feature of SiC MOSFETs.

Features

- Low on-resistance
- Fast switching speed
- Fast reverse recovery
- Easy to parallel
- Simple to drive
- Pb-free lead plating ; RoHS compliant

Application

- Solar inverters
- DC/DC converters
- Switch mode power supplies
- Induction heating
- Motor drives



Schematic diagram

TO-247-4L

Package Marking and Ordering Information

Device	Device Package	Device Marking
NCES120R036T4	TO-247-4L	NCES120R036T4

Absolute Maximum Ratings (T_C=25°C unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	1200	V
Gate-Source Voltage	V_{GS}	-4 to +21	V
Drain Current-Continuous (Note 1)	I_D	50	A
Drain Current-Continuous(T_C=100℃)	I_D (100℃)	40	A
Pulsed Drain Current (Note 1)	I_{DM}	125	A
Maximum Power Dissipation	P_D	235	W
Recommended turn-on gate - source drive voltage	V_{GS_on}	+15 to +18	V
Recommended turn-off gate - source drive voltage	V_{GS_off}	0	V
Virtual junction temperature	T_{vj}	175	℃
Operating Junction and Storage Temperature Range	T_J,T_{STG}	-40 To 175	℃

Thermal Characteristic

Symbol	Parameter	Value			Units
		Min	Typ	Max	
$R_{\theta JC}$	Thermal Resistance, Junction to case		0.45	0.64	°C/W

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

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V I_D=5.3mA	1200	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=1200V,V_{GS}=0V	-	1	-	μA
Gate-Body Leakage Current	I_{GSS}	V_{GS}=-4V / +21V,V_{DS}=0V	-	-	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=10V,I_D=11.1mA	2.8	4	4.8	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=18V, I_D=25A	-	36	45	mΩ
Gate input resistance	R_G	f=1MHZ, open drain	-	2	-	Ω
Forward Transconductance	g_{FS}	V_{DS}=10V, I_D=25A		8		S
Dynamic Characteristics (Note 4)						
Input Capacitance	C_{lss}	V_{DS}=800V,V_{GS}=0V, f=1MHz	-	2520	-	pF
Output Capacitance	C_{oss}		-	74	-	pF
Reverse Transfer Capacitance	C_{rss}		-	4	-	pF
Switching Characteristics (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=800V,I_D=25A V_{GS}=+18V / 0V,R_G=3.3Ω,L=250μH	-	8.1	-	ns
Turn-on Rise Time	t_r		-	15	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	29	-	ns
Turn-Off Fall Time	t_f		-	9.6	-	ns
Total Gate Charge	Q_g	V_{DS}=800V,I_D=25A, V_{GS}=18V	-	92	-	nC
Gate-Source Charge	Q_{gs}		-	24	-	nC
Gate-Drain Charge	Q_{gd}		-	28	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V_{SD}	V_{GS}=0V,I_D=25A	-	3.5	-	V
Reverse Recovery Time	t_{rr}	T_J = 25°C, I_F =25A, V_R=800V, di/dt = 3700A/μs(Note3)	-	9.2		ns
Reverse Recovery Charge	Q_{rr}		-	140		nC
Peak reverse recovery current	I_{rrm}			31		A

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. PW ≤ 10μs, Duty cycle ≤ 1%
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production

Test Circuit

Fig.1-1 Gate Charge Measurement Circuit

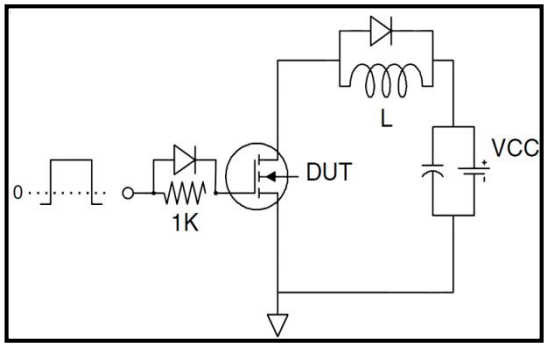


Fig.1-2 Gate Charge Waveform

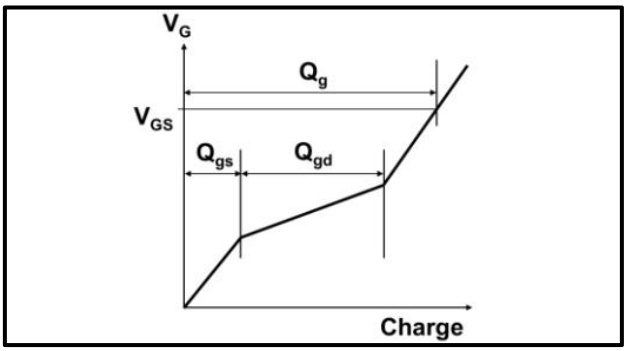


Fig.2-1 Switching Characteristics Measurement Circuit

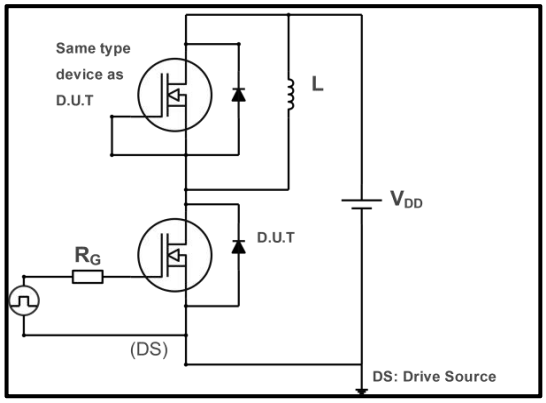
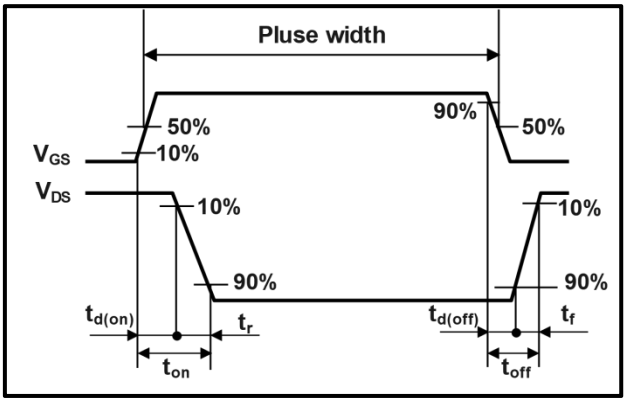


Fig.2-2 Waveforms for Switching Time



Typical Electrical and Thermal Characteristics

Fig.1 Power Dissipation Derating Curve

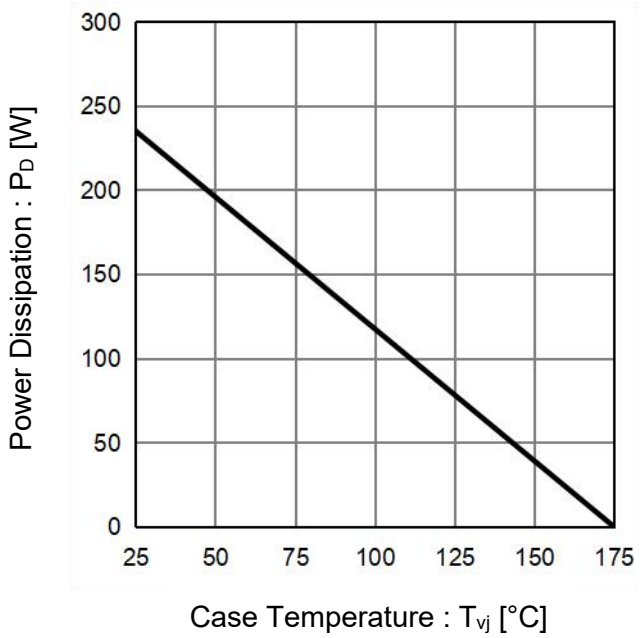


Fig.2 Maximum Safe Operating Area

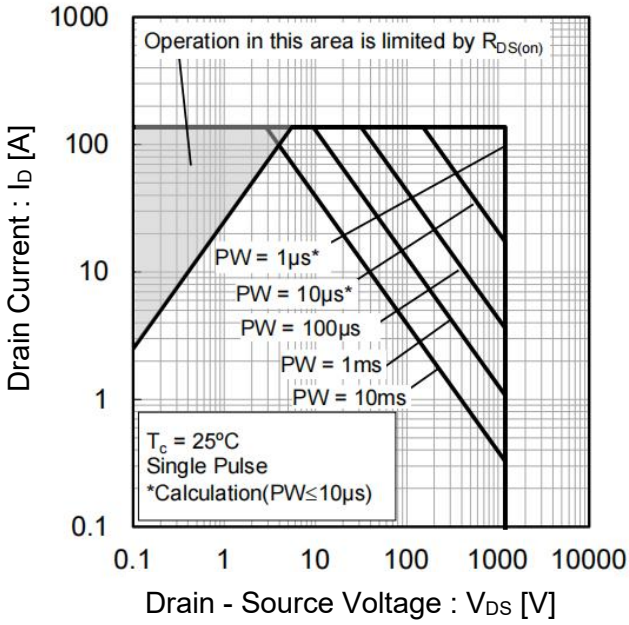


Fig.3 Typical Transient Thermal Impedance vs. Pulse Width

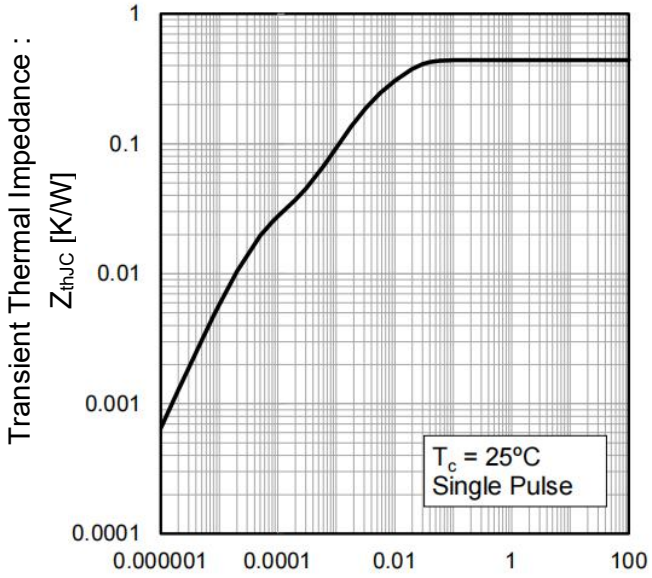


Fig.4 T_{vj} = 25° C Typical Output Characteristics

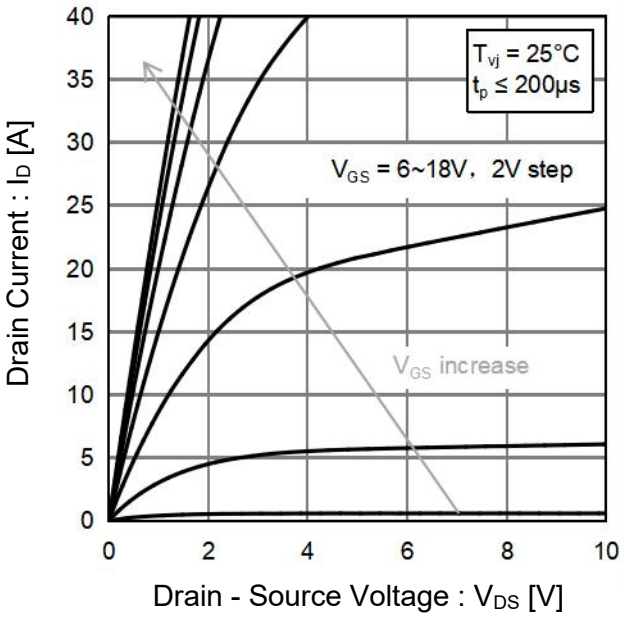


Fig.5 T_{vj} = 25ºC 3rd Quadrant Characteristics

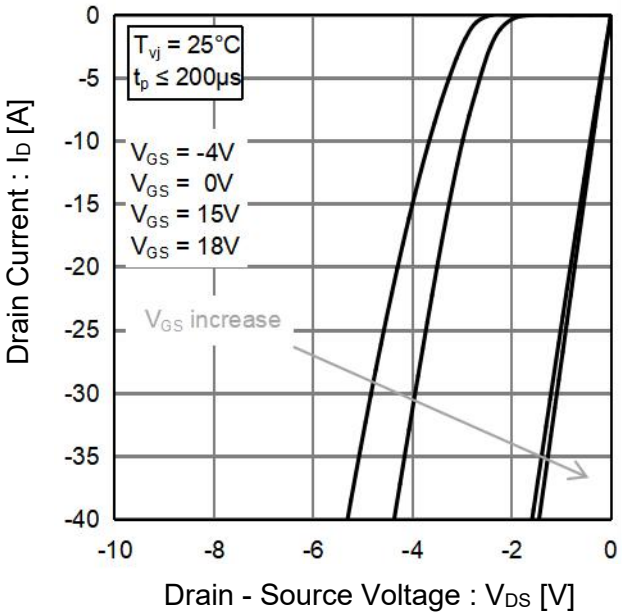


Fig.6 T_{vj} = 150° C Typical Output Characteristics

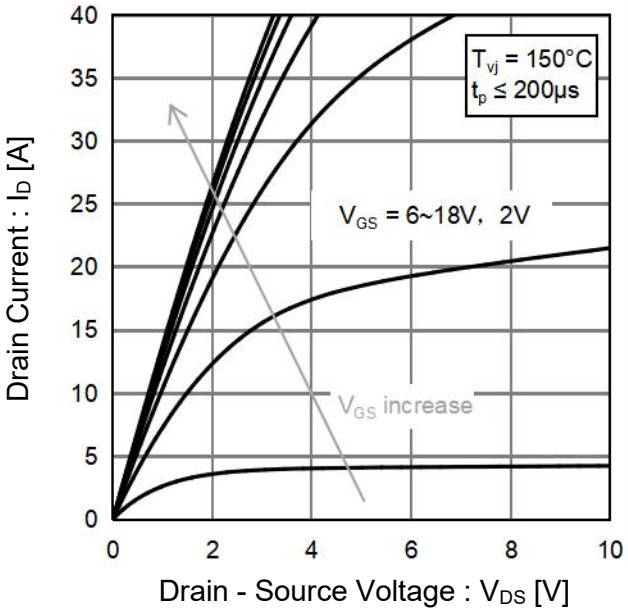


Fig.7 T_{vj} = 150ºC 3rd Quadrant Characteristics

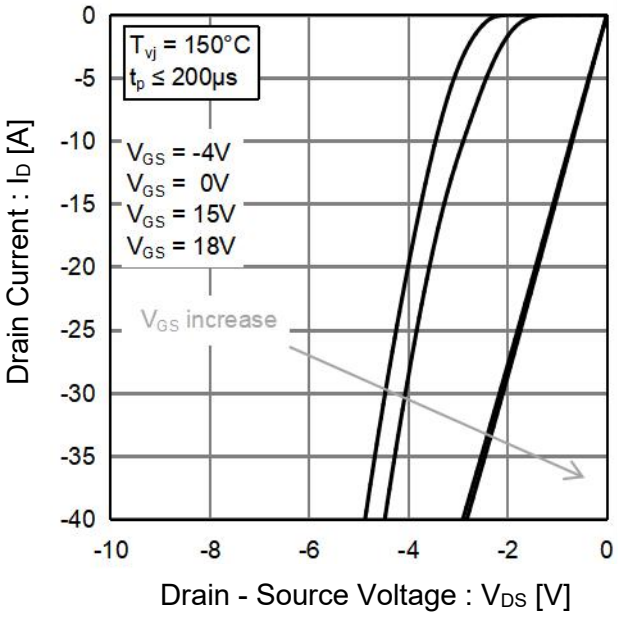


Fig.8 Typical Transfer Characteristics

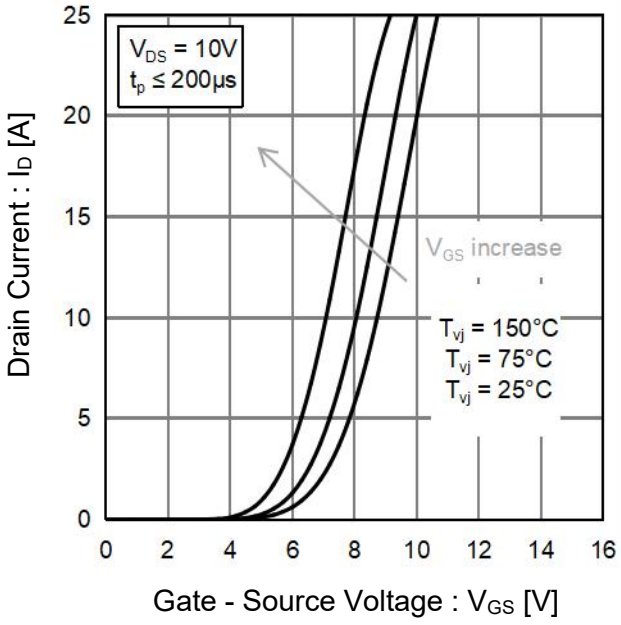


Fig.9 Body Diode Forward Voltage vs. Gate - Source Voltage

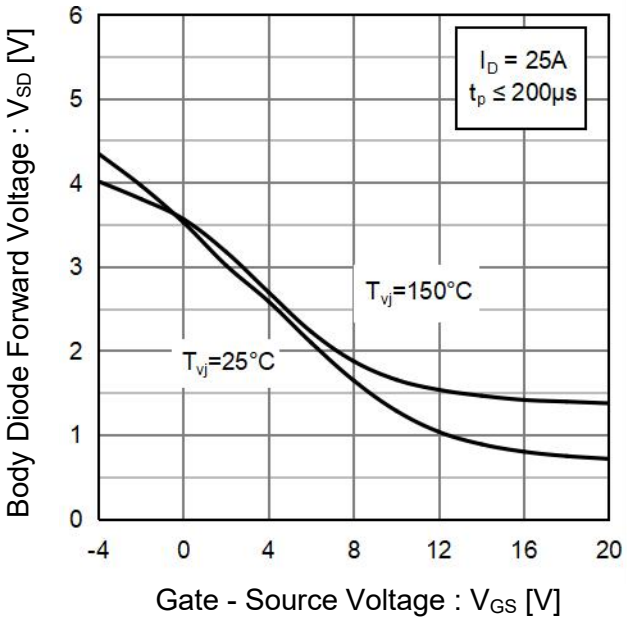


Fig.10 Gate Threshold Voltage vs. Virtual Junction Temperature

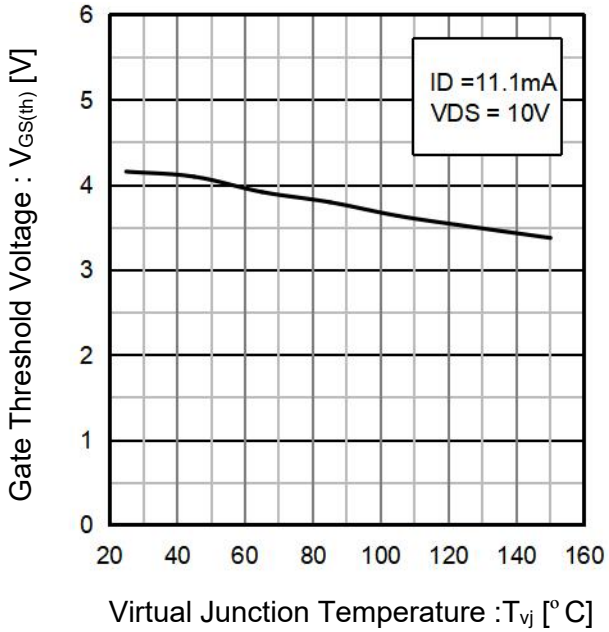


Fig.11 Static Drain - Source On - State Resistance vs. Gate - Source Voltage

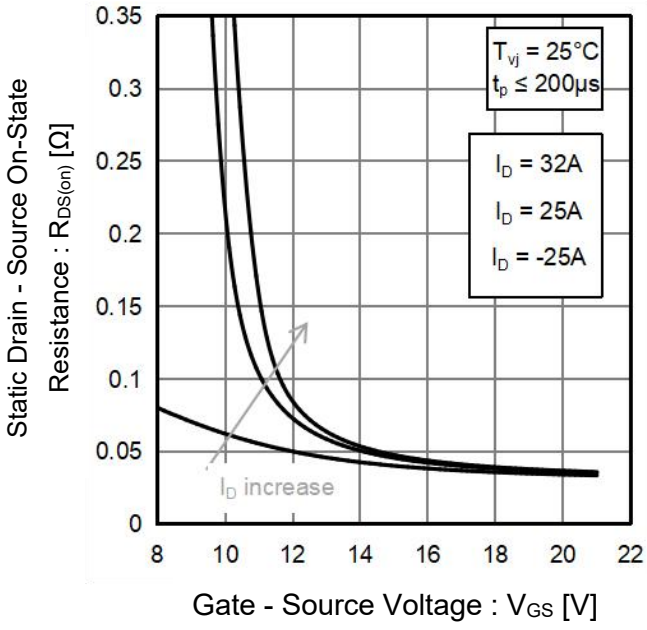


Fig.12 Static Drain - Source On - State Resistance vs. Virtual Junction Temperature

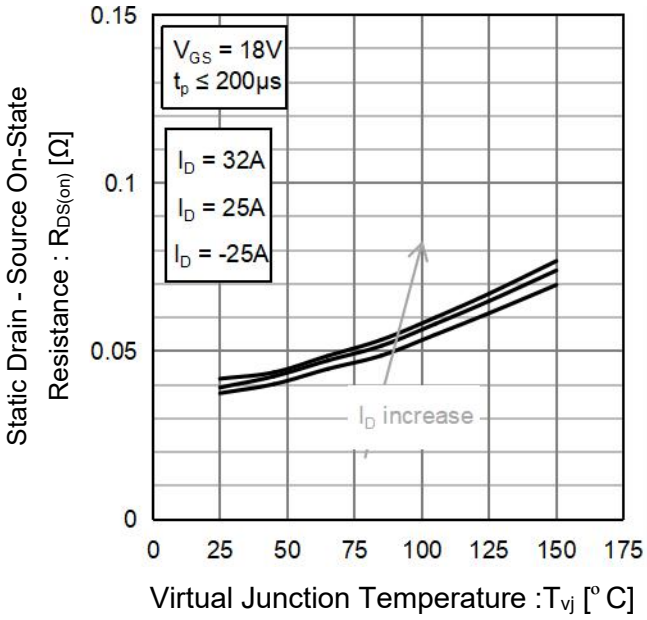


Fig.13 Static Drain - Source On - State Resistance vs. Drain Current

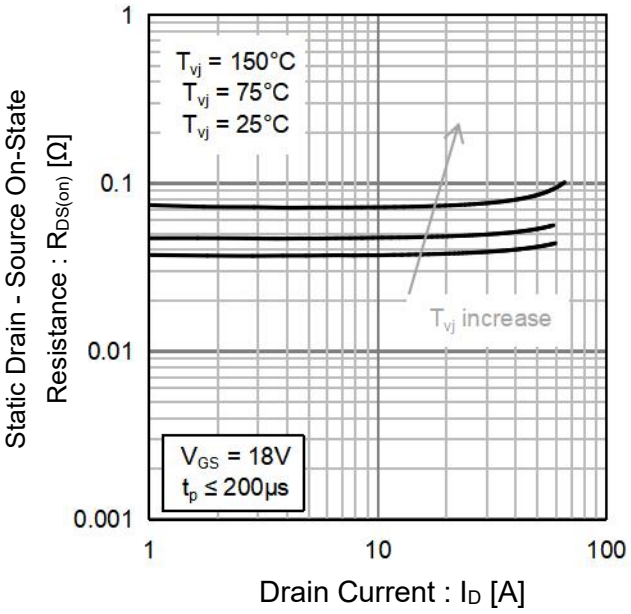


Fig.14 Typical Capacitance vs. Drain - Source Voltage

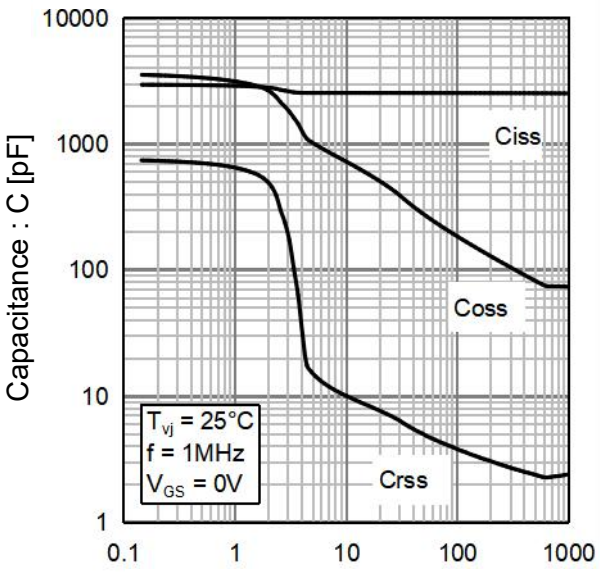
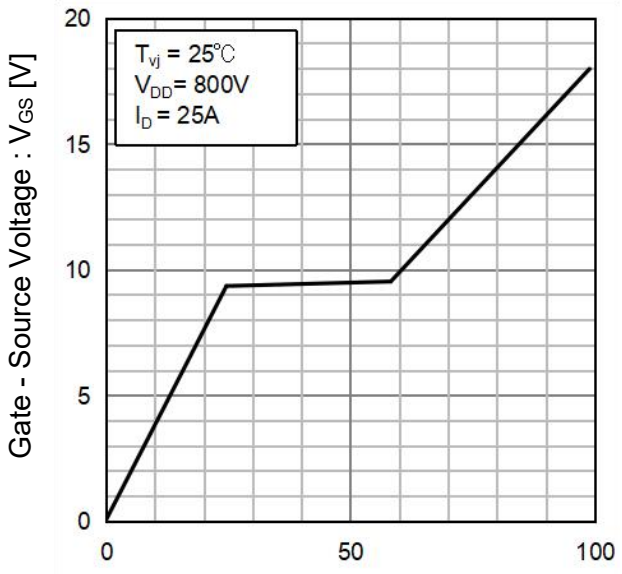
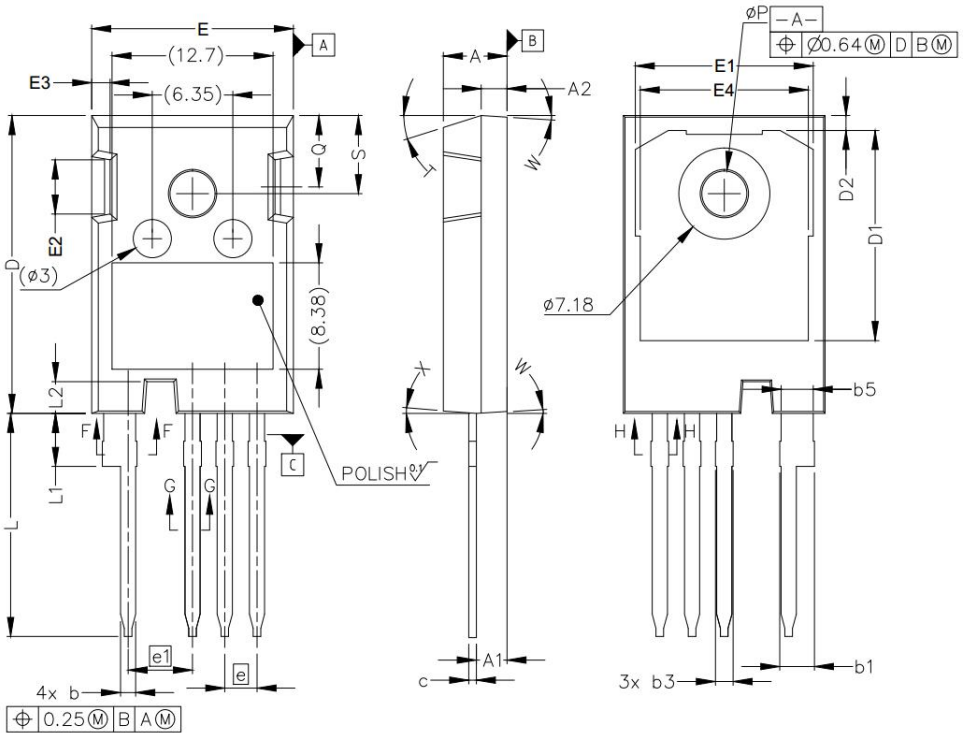


Fig.15 Dynamic Input Characteristics



TO-247-4L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.83	5.21	0.19	0.21
A1	2.29	2.54	0.09	0.10
A2	1.91	2.16	0.08	0.09
b1	2.39	2.94	0.09	0.12
b3	1.07	1.60	0.04	0.06
b5	2.39	2.69	0.09	0.11
c	0.55	0.68	0.02	0.03
D	23.30	23.60	0.92	0.93
D1	16.25	17.65	0.64	0.69
D2	0.95	1.25	0.04	0.05
E	15.75	16.13	0.62	0.64
E1	13.10	14.15	0.52	0.56
E2	3.68	5.10	0.14	0.20
E3	1.00	1.90	0.04	0.07
E4	12.38	13.43	0.49	0.53
e	2.54 BSC		0.1 BSC	
e1	5.08 BSC		0.2 BSC	
L	17.31	17.82	0.68	0.70
L1	3.97	4.37	0.16	0.17
L2	2.35	2.65	0.09	0.10
ΦP	3.51	3.65	0.14	0.14
Q	5.49	6.00	0.22	0.24
S	6.04	6.30	0.24	0.25
T	17.5° REF.		0.69° REF.	
W	3.5° REF.		0.14° REF.	
X	4.0° REF.		0.16° REF.	

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