

1200V, 158A, N-channel SiC power MOSFET

General Description:

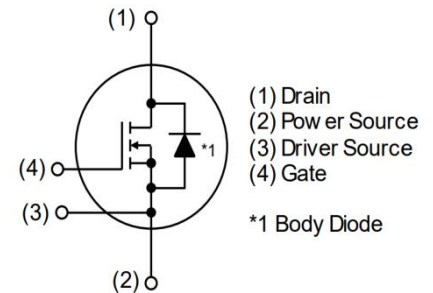
NCES120P013T4 is a SiC MOSFET that contributes to miniaturization and low power consumption of applications. This product achieves industry-leading low on-resistance without sacrificing short-circuit withstand time. This is a 4-pin package type with a driver source terminal that can maximize the high-speed 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
NCES120P013T4	TO-247-4L	NCES120P013T4

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V _{DS}	1200	V
Gate-Source Voltage,max static voltage	V _{GS}	-10 to +24	V
Gate-Source Voltage,max transient voltage (Note 1)	V _{GS}	-11 to +26	V
Drain Current-Continuous (Note 2)	I _D	158	A
Drain Current-Continuous(T _c =100°C)	I _D (100°C)	111	A
Pulsed Drain Current (Note 3)	I _{DM}	395	A
Maximum Power Dissipation	P _D	714	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}	-4 to 0	V
Virtual junction temperature	T _{vj}	175	°C
Operating Junction and Storage Temperature Range	T _J ,T _{STG}	-55 To 175	°C

Thermal Characteristic

Symbol	Parameter	Value	Units
$R_{\theta JC}$	Thermal Resistance, Junction to case	0.21	$^{\circ}\text{C/W}$

Electrical Characteristics ($T_c=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=100\mu A$	1200			V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=1200V, V_{GS}=0V$		1	80	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=-10V / +22V, V_{DS}=0V$			± 100	nA
On Characteristics (Note 4)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=16mA$	1.9	3.0	4.8	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=18V, I_D=60A$		13	17	m Ω
Gate input resistance	R_G	f=1MHZ, open drain		1.5		Ω
Forward Transconductance	g_{FS}	$V_{DS}=20V, I_D=60A$		14		S
Dynamic Characteristics (Note 5)						
Input Capacitance	C_{iss}	$V_{DS}=800V, V_{GS}=0V,$ f=1MHz		5200		pF
Output Capacitance	C_{oss}			270		pF
Reverse Transfer Capacitance	C_{riss}			12		pF
Switching Characteristics (Note 5)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=800V, I_D=60A, V_{GS}=+18V /$ $-3V, R_G=2.7\Omega, L=200\mu H$		19.1		ns
Turn-on Rise Time	t_r			36		ns
Turn-Off Delay Time	$t_{d(off)}$			53		ns
Turn-Off Fall Time	t_f			14.5		ns
Total Gate Charge	Q_g	$V_{DS}=800V, I_D=60A, V_{GS}=-3/18V$		210		nC
Gate-Source Charge	Q_{gs}			65		nC
Gate-Drain Charge	Q_{gd}			41		nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 4)	V_{SD}	$V_{GS}=0V, I_D=60A$		3.4		V
Reverse Recovery Time	t_{rr}	$T_J = 25^{\circ}\text{C}, I_F = 60A, V_R=800V,$ $di/dt = 2300A/\mu S$ (Note3)		48		ns
Reverse Recovery Charge	Q_{rr}			1210		nC
Peak reverse recovery current	I_{rrm}			51.2		A

Notes:

- $t_p < 500ns, D < 0.01$
- Repetitive Rating: Pulse width limited by maximum junction temperature.
- $PW \leq 10\mu s$, Duty cycle $\leq 1\%$
- Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
- Guaranteed by design, not subject to production

Test Circuit

Fig.1-1 Gate Charge Measurement Circuit

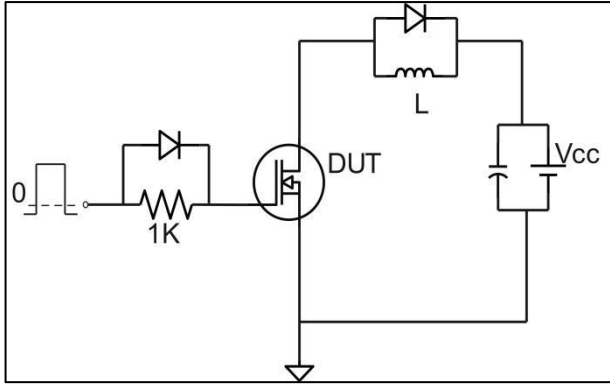


Fig.1-2 Gate Charge Waveform

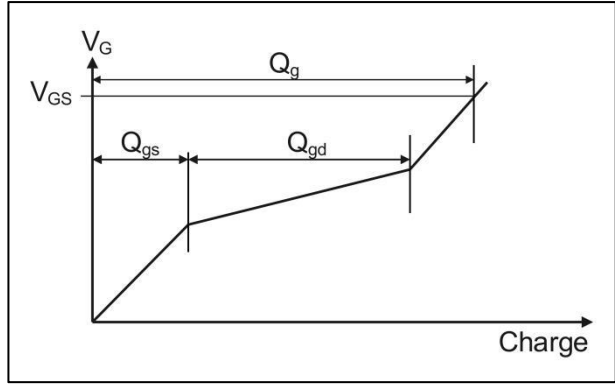


Fig.2-1 Switching Characteristics Measurement Circuit

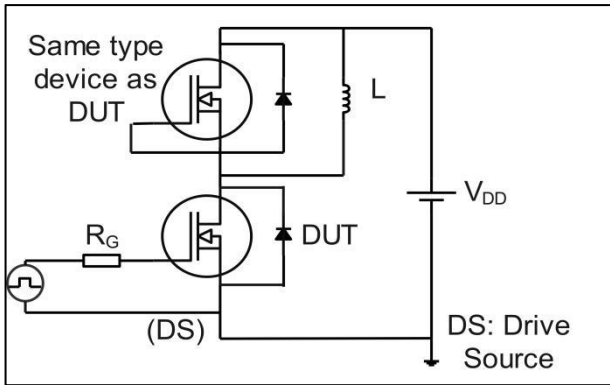
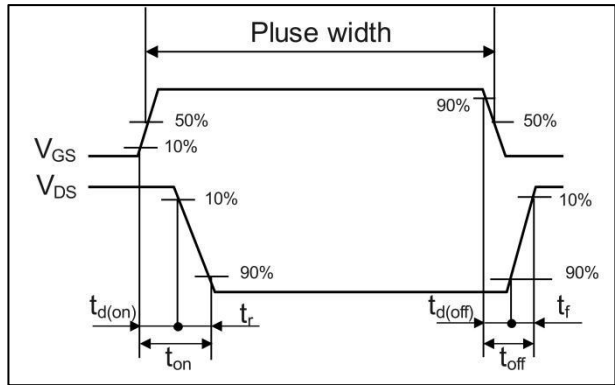


Fig.2-2 Waveforms for Switching Time



Typical Electrical and Thermal Characteristics

Fig.1 Power Dissipation Derating Curve

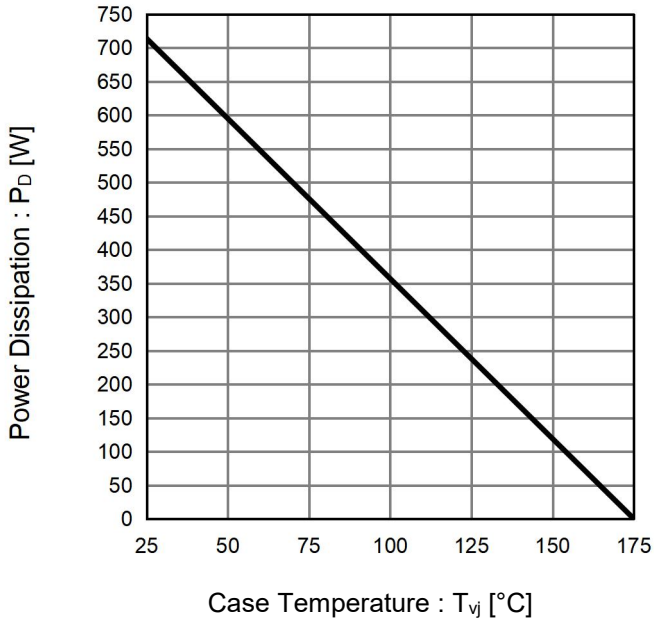


Fig.2 Maximum Safe Operating Area

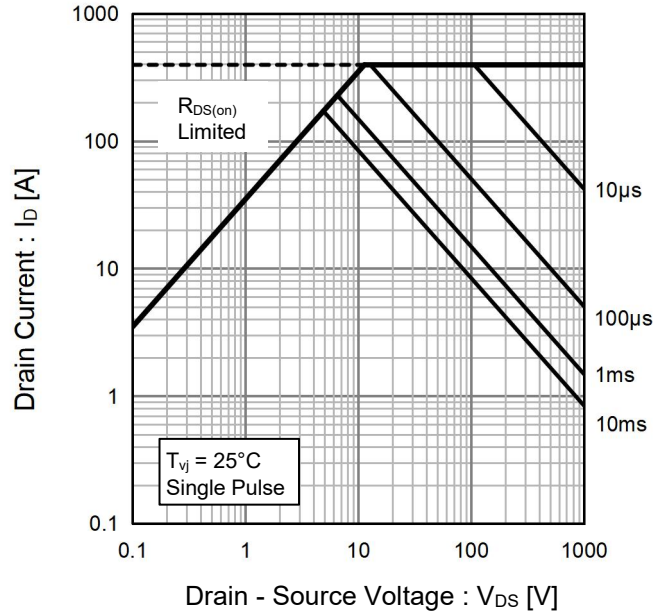


Fig.3 Typical Transient Thermal Impedance vs. Pulse Width

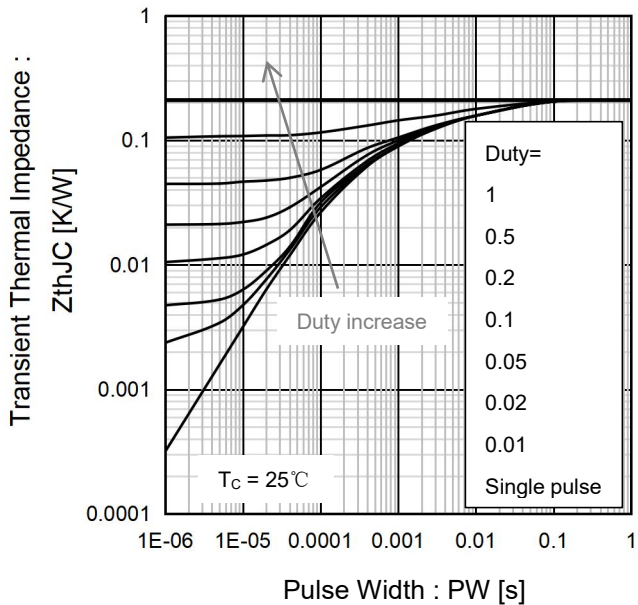


Fig.4 $T_{vj} = 25^{\circ}\text{C}$ Typical Output Characteristics

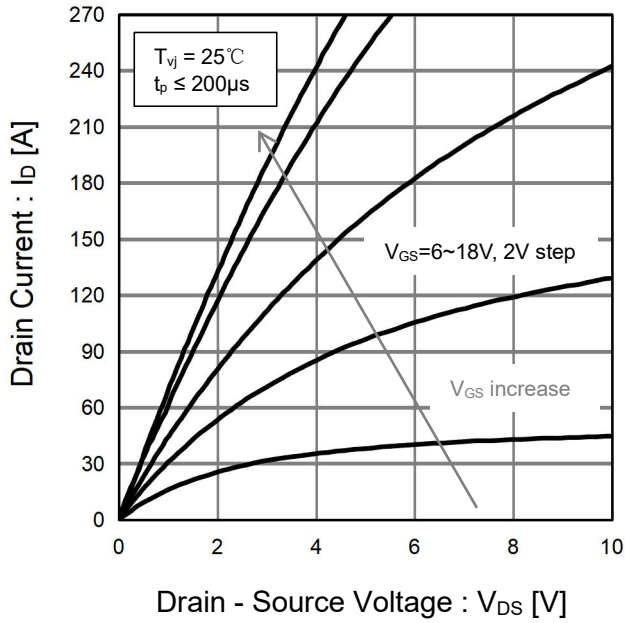


Fig.5 $T_{vj} = 25^{\circ}\text{C}$ 3rd Quadrant Characteristics

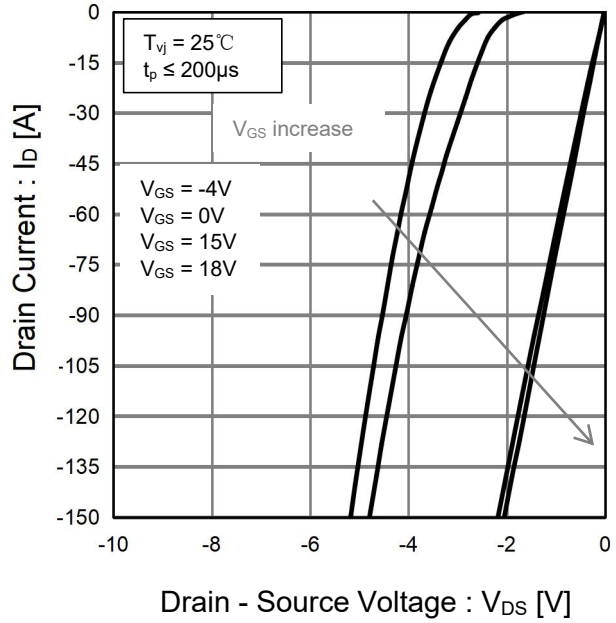


Fig.6 $T_{vj} = 175^{\circ}\text{C}$ Typical Output Characteristics

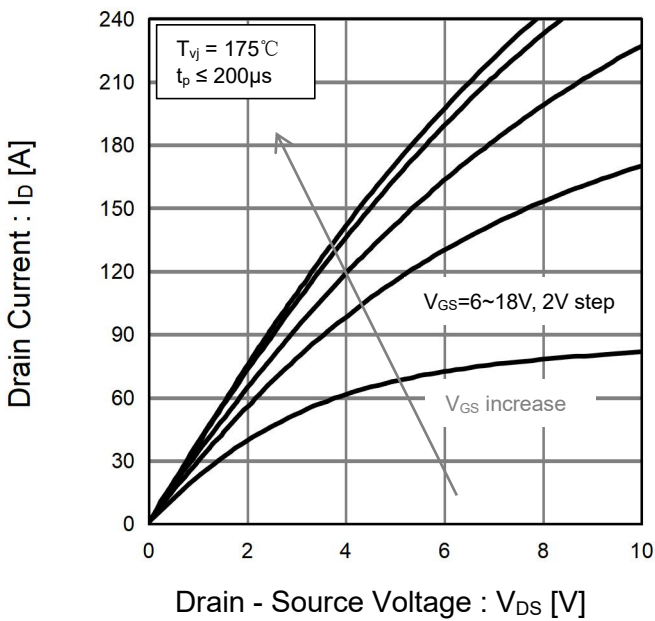


Fig.7 $T_{vj} = 175^{\circ}\text{C}$ 3rd Quadrant Characteristics

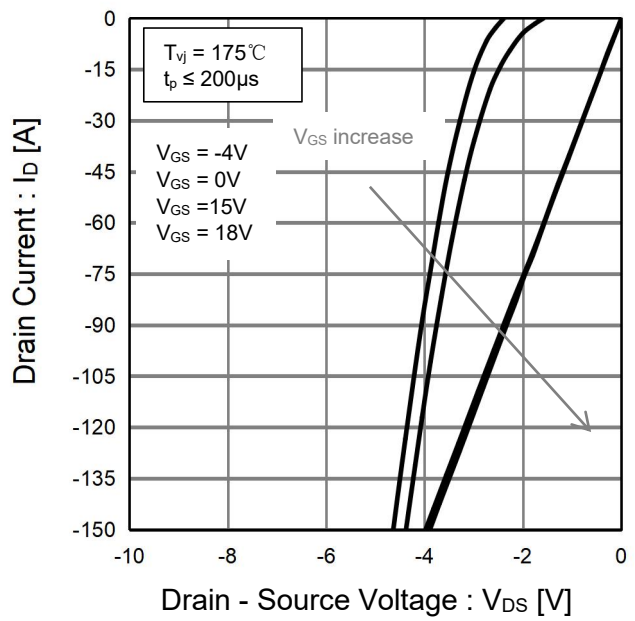


Fig.8 Typical Transfer Characteristics

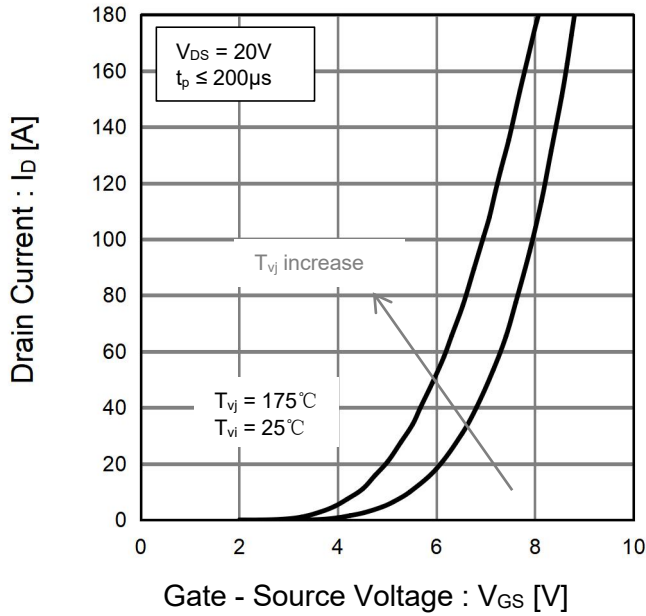


Fig.9 Gate Threshold Voltage vs. Virtual Junction Temperature

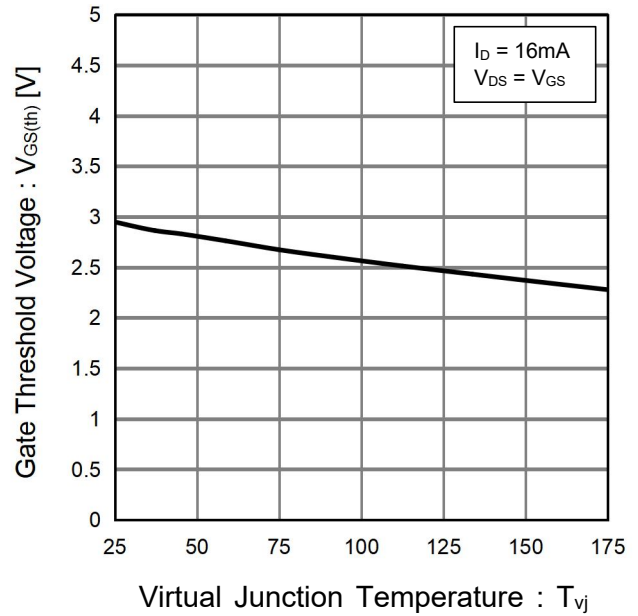


Fig.10 Static Drain - Source On - State Resistance vs. Drain Current

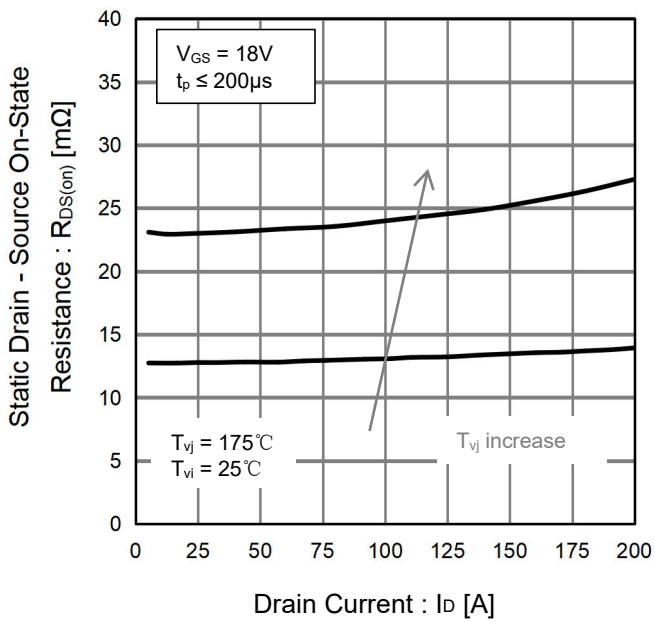


Fig.11 Static Drain - Source On - State Resistance vs. Virtual Junction Temperature

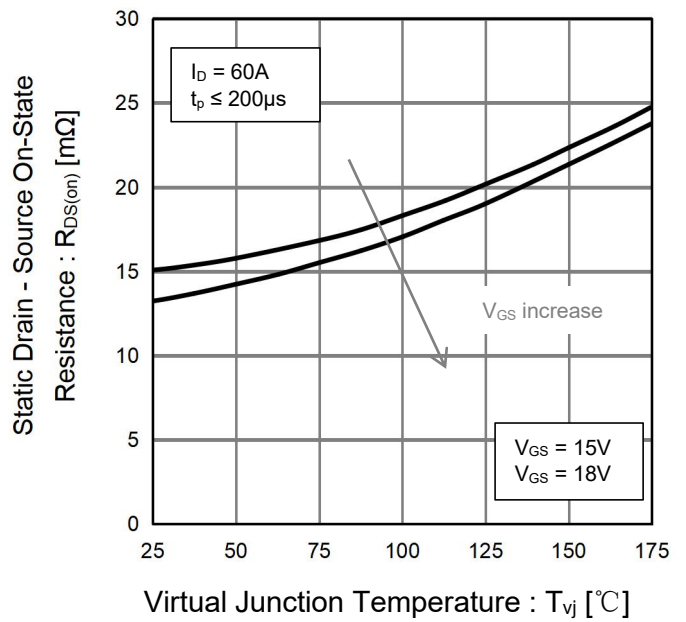


Fig.12 Typical Capacitance vs. Drain - Source Voltage

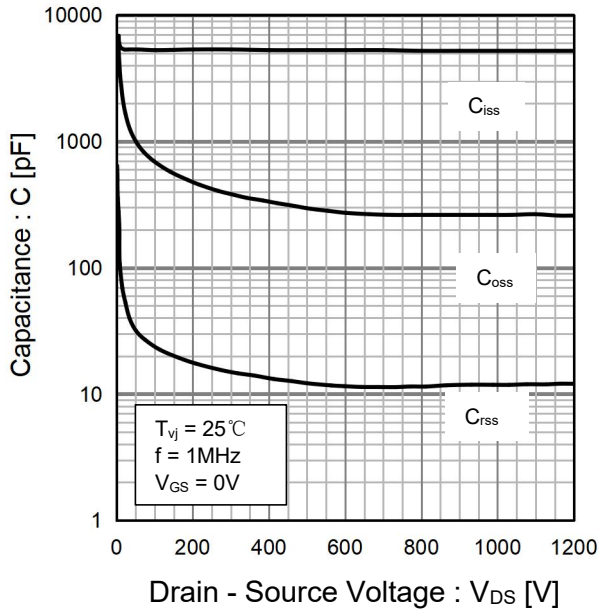
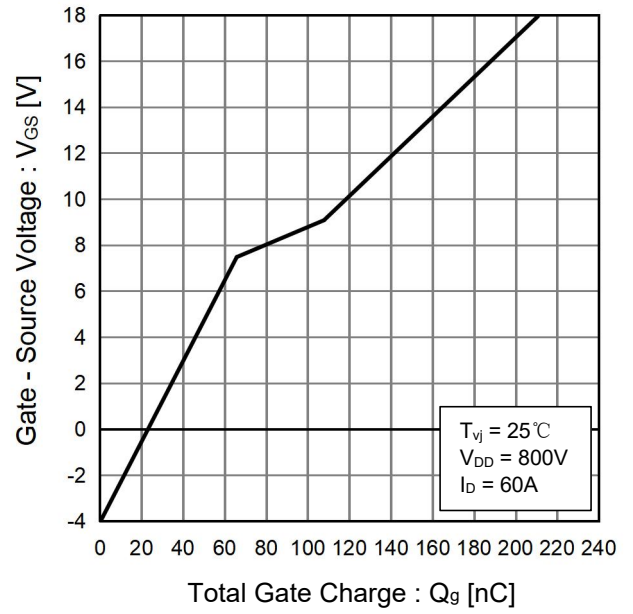
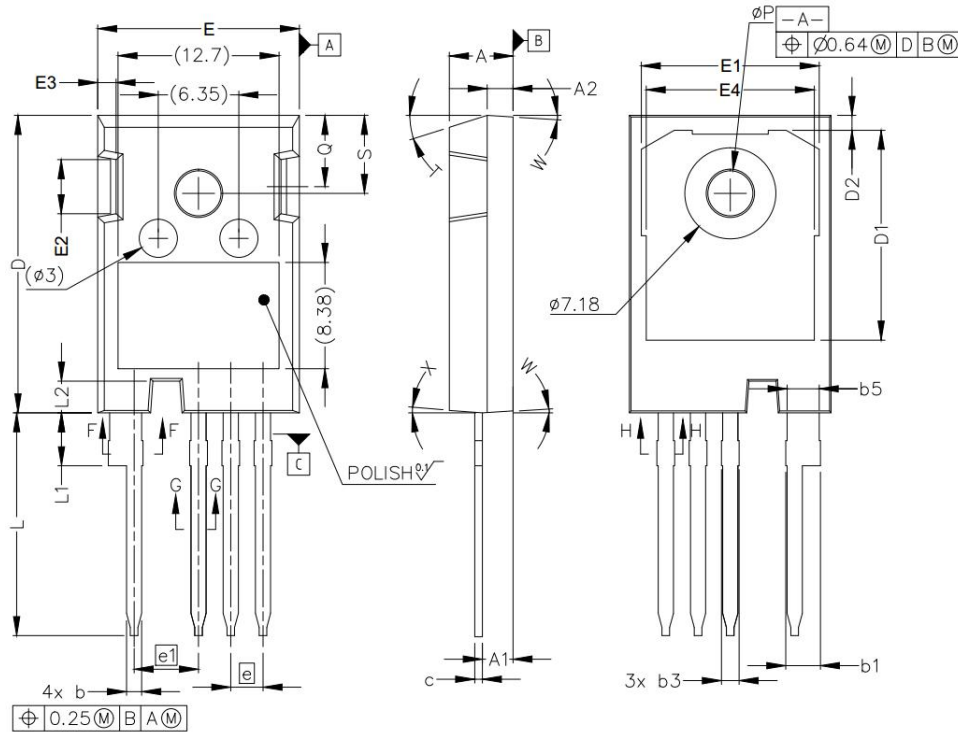


Fig.13 Dynamic Input Characteristics



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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