

ASC60N650MT4

650V, 60A, 30mΩ, N-Channel, Silicon Carbide MOSFET

Product Data Sheet

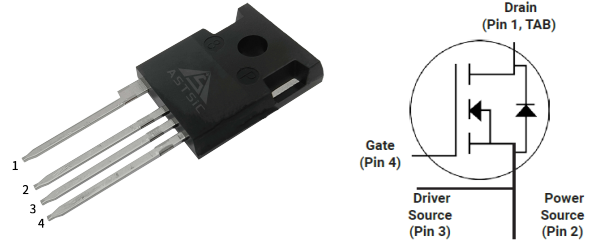
ASTC-3T04-16A A/2



爱仕特科技
AST TECHNOLOGY

General Description

The AST-MT4 series SiC MOSFET in TO-247-4L package ensures stable high-temperature operation for power-dense and energy-critical systems, enabling compact designs with reduced EMI.



Features

- 3rd Generation SiC MOSFET Technology
- High-Speed Switching with Low Capacitances
- High Blocking Voltage with Low $R_{DS(on)}$
- Optimized Package with Separate Driver Source Pin
- Easy to Parallel and Simple to Drive
- RoHS Compliant, Halogen Free



Applications

- EV Charging
- High Voltage DC/DC Converters
- Switch Mode Power Supplies
- Power Factor Correction Modules

Ordering Informations

Order Number / Marking	ASC60N650MT4
Package Type	TO-247-4L
Packing Method	Tube

Key Parameters

Symbol	Parameter	Values			Unit	Test Conditions
Absolute maximum rating						
V _{DS}	Drain-Source Voltage	650			V	T _c =25°C
I _D	Drain Current (continuous)	60			A	T _c =25°C
P _D	Power Dissipation	395			W	T _c =25°C
T _J	Junction Temperature	175			°C	
Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
Static characteristics						
R _{DS(on)}	Static Drain-Source on Resistance	-	30	38	mΩ	V _{GS} =18V; I _D =30A; T _J =25°C
Dynamic characteristics						
Q _G	Total Gate Charge	-	128	-	nC	V _{DS} =400V; V _{GS} =-5/+18V; I _D =30A; T _J =25°C
Q _{GD}	Gate-Drain Charge	-	24	-		
Source-drain diode						
Q _{rr}	Reverse Recovery Charge	-	160	-	nC	V _{GS} =-5V; I _F =15A; V _R =400V; di/dt=2400A/μs; T _J =175°C

Absolute Maximum Ratings (at $T_c=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Values	Unit
V_{DS}	Drain-source Voltage	650	V
I_D	Drain Current (continuous; $T_c=25^\circ\text{C}$)	60	A
	Drain Current (continuous; $T_c=100^\circ\text{C}$)	48	A
I_{DM}	Drain Current (pulsed)	135	A
V_{GS}	Gate-source Voltage	-10/+22	V
P_D	Power Dissipation ($T_c=25^\circ\text{C}$)	395	W
T_J, T_{stg}	Junction and Storage Temperature Range	-55 to +175	$^\circ\text{C}$

MOSFET Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
Static characteristics (at T _J =25°C unless otherwise specified)						
BV _{DSS}	Drain-Source Breakdown Voltage	650	-	-	V	I _D =250μA; V _{GS} =0V
I _{DSS}	Zero Gate Voltage Drain Current	-	5	100	μA	V _{DS} =650V; V _{GS} =0V
I _{GSS}	Gate-Body Leakage Current	-	10	100	nA	V _{GS} =-10 to 20V; V _{DS} =0V
V _{GS(th)}	Gate Threshold Voltage	2	3	4	V	V _{DS} =V _{GS} ; I _D =10mA
V _{GS(on)}	Recommended Turn-on Voltage	-	18	-	V	Static
V _{GS(off)}	Recommended Turn-off Voltage	-	-5	-		
R _{DS(on)}	Static Drain-Source on Resistance	-	30	38	mΩ	V _{GS} =18V; I _D =30A; T _J =25°C
		-	42	-		V _{GS} =18V; I _D =30A; T _J =175°C
Dynamic characteristics (at T _J =25°C unless otherwise specified)						
C _{iss}	Input Capacitance	-	2112	-	pF	V _{DS} =600V; f=1MHz; V _{AC} =25mV
C _{oss}	Output Capacitance	-	212	-		
C _{rss}	Reverse Transfer Capacitance	-	5	-		
g _{fs}	Transconductance	-	23	-	S	V _{DS} =20V; I _D =30A
E _{oss}	Coss Stored Energy	-	12	-	μJ	V _{DS} =400V; f=1MHz
E _{on}	Turn-on Energy (Body Diode)	-	65	-	μJ	V _{DS} =400V; V _{GS} =-5/+18V; I _D =30A; L=100μH; R _{G(ext)} =2.5Ω; T _J =175°C
E _{off}	Turn-off Energy (Body Diode)	-	18	-		
Q _G	Total Gate Charge	-	128	-	nC	V _{DS} =400V; V _{GS} =-5/+18V; I _D =30A
Q _{GS}	Gate-source Charge	-	33	-		
Q _{GD}	Gate-drain Charge	-	24	-		
R _{G(int)}	Internal Gate Resistance	-	4.1	-	Ω	f=1MHz; V _{AC} =25mV
t _{d(on)}	Turn-on Delay Time	-	10	-	ns	V _{DS} =400V; V _{GS} =-5/+18V; I _D =30A; R _{G(ext)} =2.5Ω; Load=100μH
t _r	Rise Time	-	12	-		
t _{d(off)}	Turn-off Delay Time	-	19	-		
t _f	Fall Time	-	7	-		

Body Diode Characteristics (at $T_J=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
V_{SD}	Diode Forward Voltage	-	3.5	6	V	$V_{GS}=0\text{V}; I_F=20\text{A}$
		-	3.0	6		$V_{GS}=0\text{V}; I_F=20\text{A}; T_J=175^{\circ}\text{C}$
I_S	Continuous Diode Forward Current	-	55	-	A	$V_{GS}=0\text{V}; T_C=25^{\circ}\text{C}$
T_{rr}	Reverse Recovery Time	-	18	-	ns	$V_{GS}=-5\text{V}; I_F=15\text{A}; V_R=400\text{V};$ $di/dt=2400\text{A}/\mu\text{s}; T_J=175^{\circ}\text{C}$
Q_{rr}	Reverse Recovery Charge	-	160	-	nC	
I_{rrm}	Peak Reverse Recovery Current	-	8.5	-	A	

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.38	$^{\circ}\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	40	$^{\circ}\text{C}/\text{W}$

The values are based on Junction-to-Case Thermal Impedance measured with the device mounted to a large heat sink, assuming a maximum junction temperature of $T_{J(max)}=175^{\circ}\text{C}$.

Typical Performance

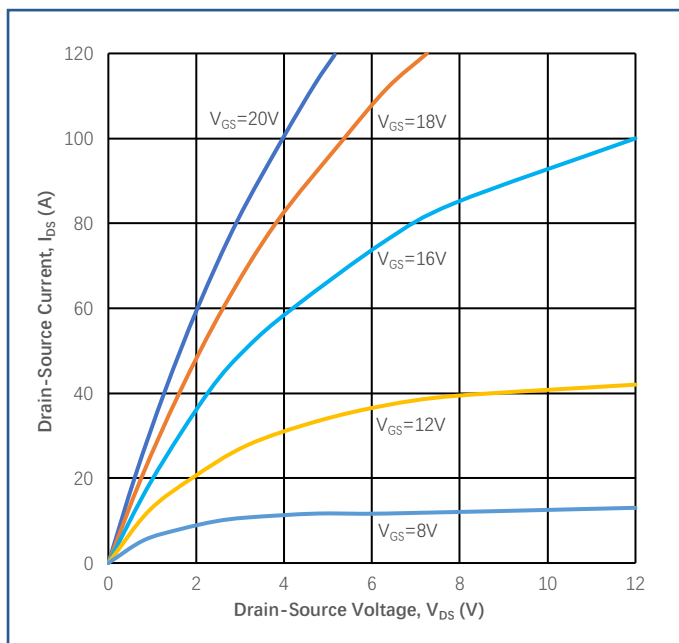


Figure 1
Output Characteristics ($T_J = 25^\circ\text{C}$)

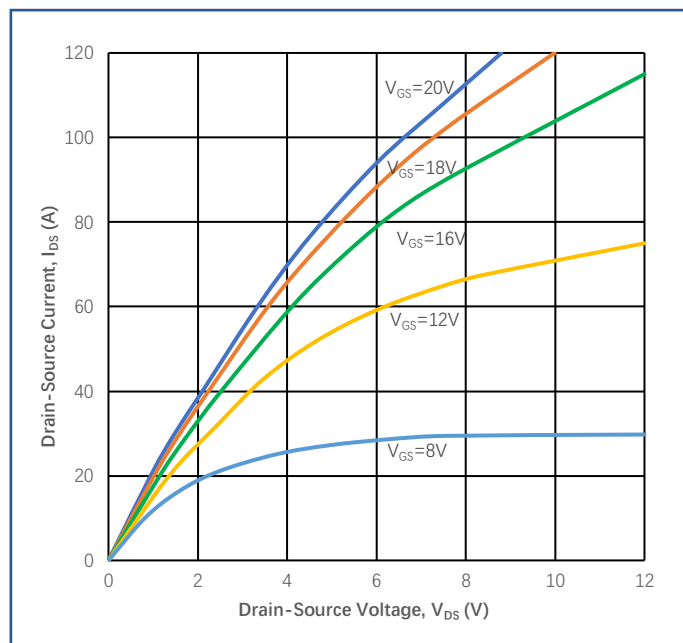


Figure 2
Output Characteristics ($T_J = 175^\circ\text{C}$)

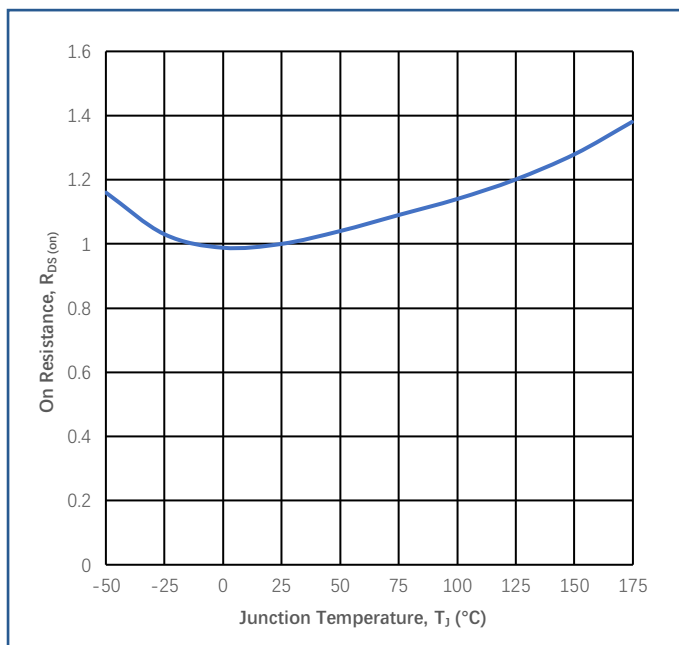


Figure 3
Normalized On-Resistance vs. Temperature

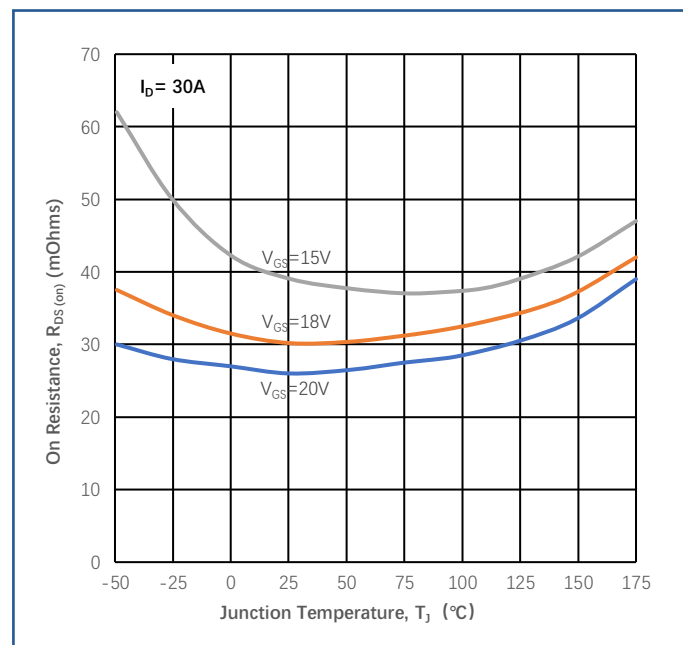


Figure 4
On-Resistance vs. Temperature

Typical Performance

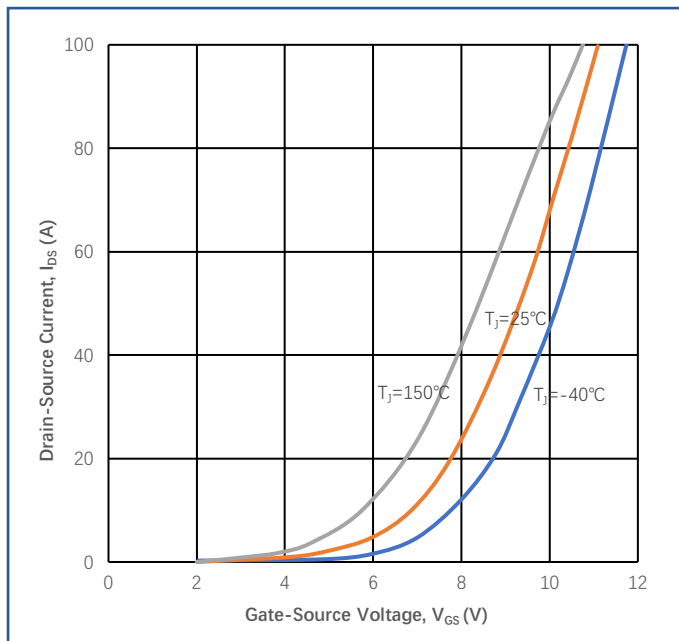


Figure 5
Transfer Characteristic

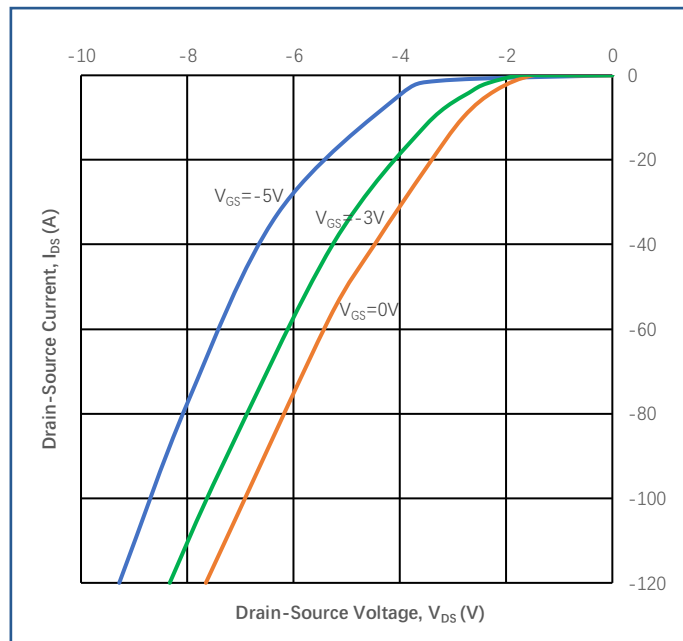


Figure 6
Body Diode Characteristic at 25°C

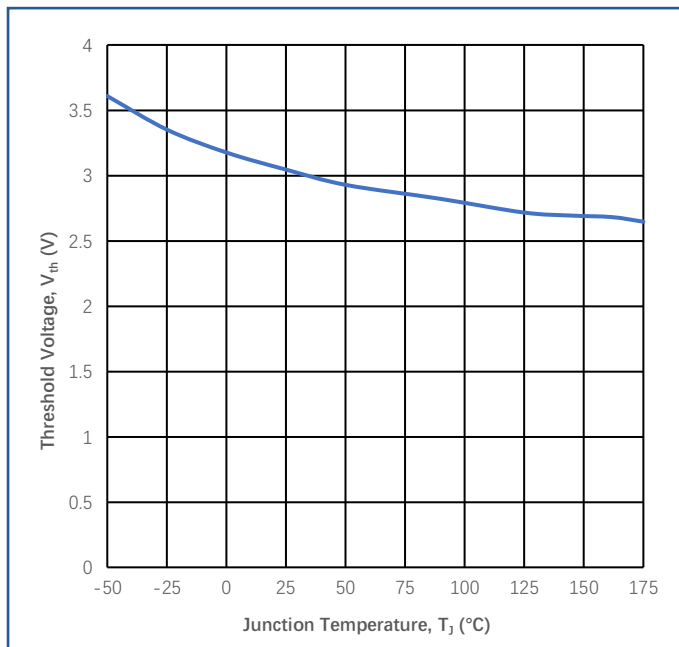


Figure 7
Threshold Voltage vs. Temperature

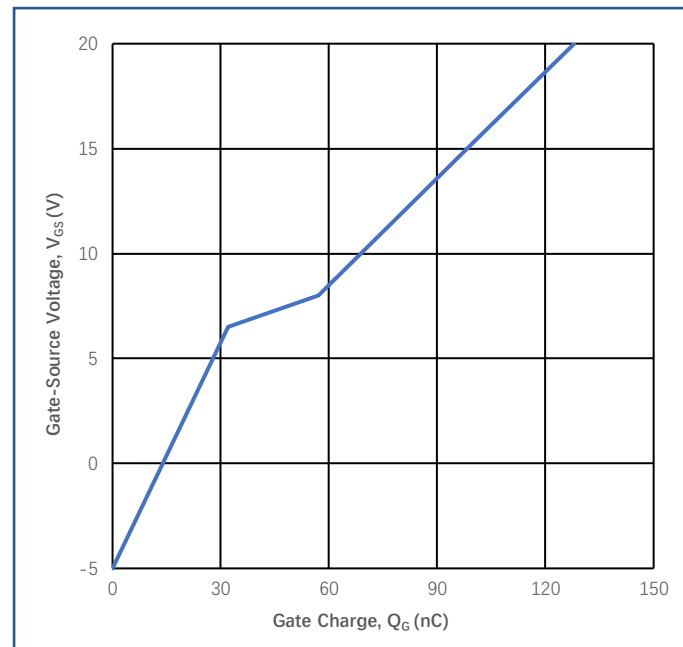


Figure 8
Gate Charge Characteristics

Typical Performance

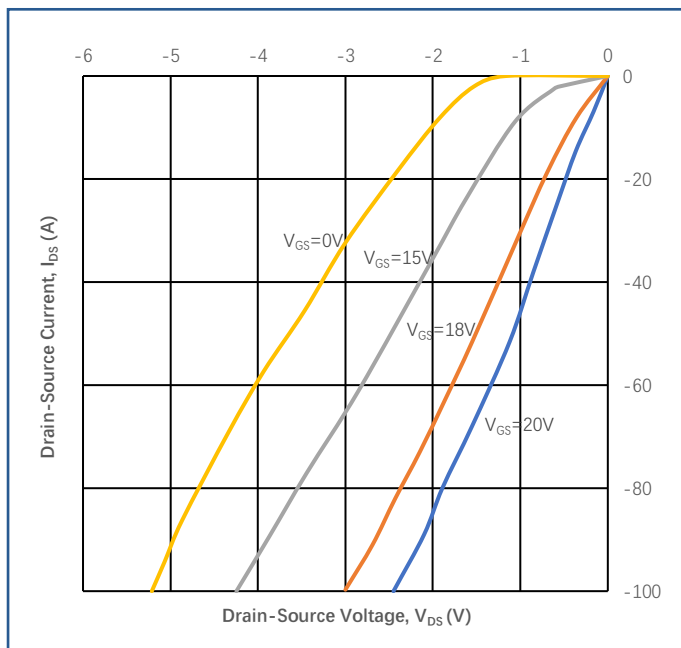


Figure 9

3rd Quadrant Characteristic at 25°C

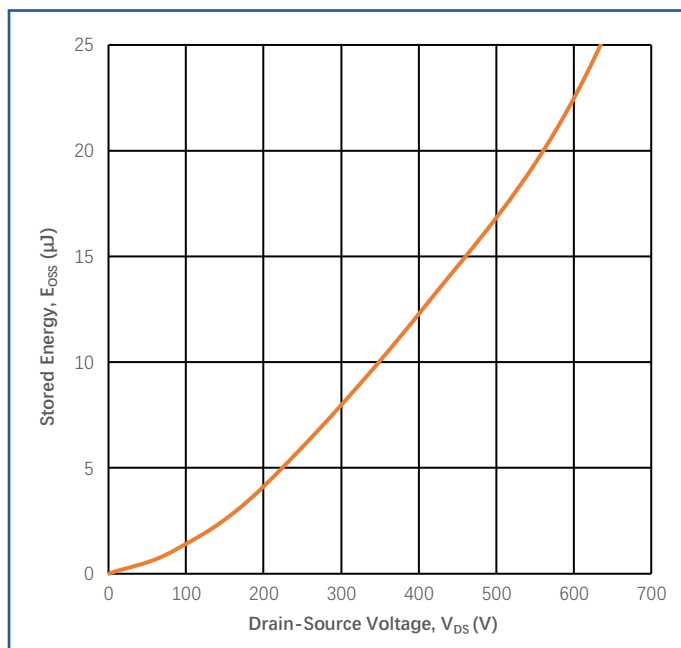


Figure 10

Output Capacitor Stored Energy

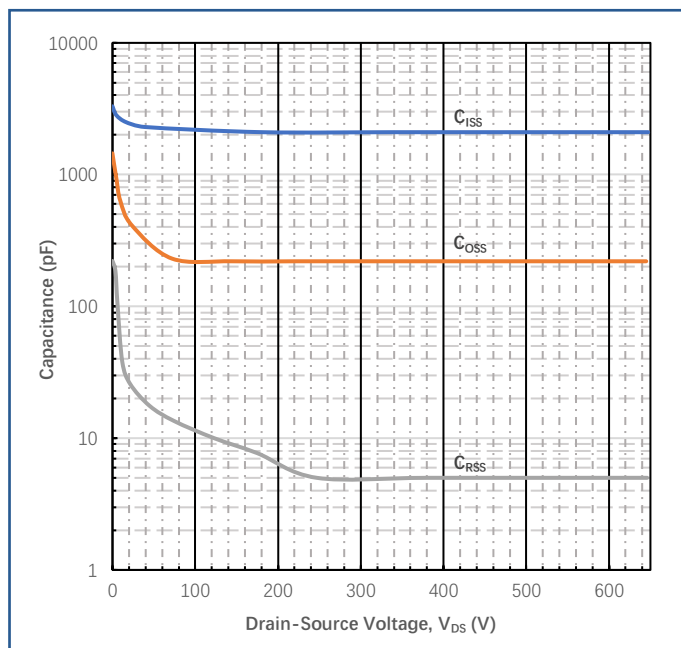


Figure 11

Capacitances vs. Drain-Source

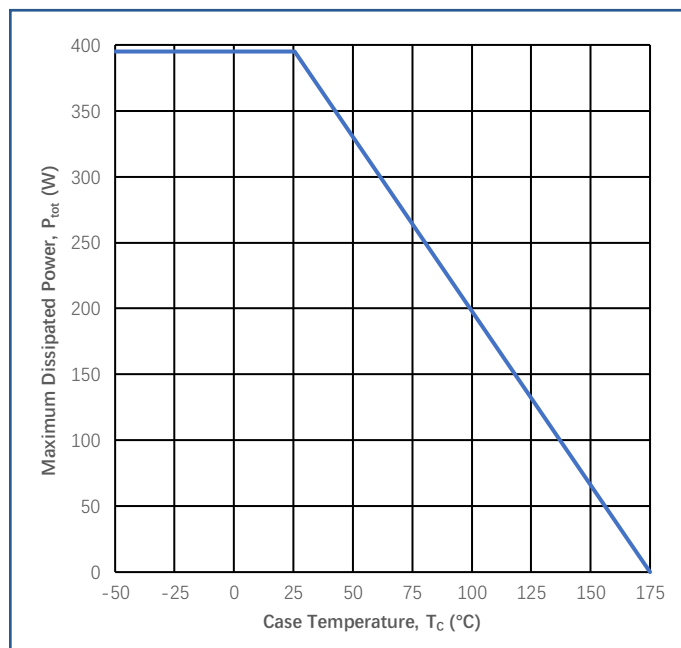


Figure 12

Max Power Dissipation Derating vs T_C

Typical Performance

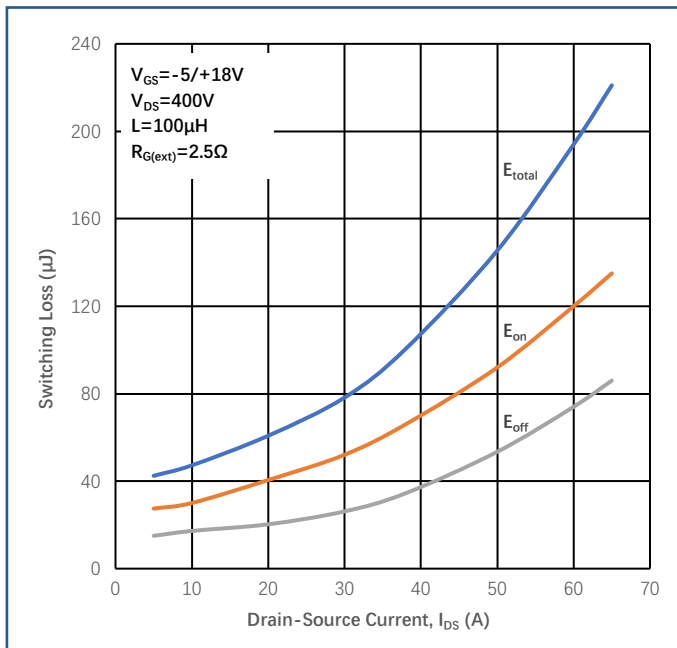


Figure 13

Switching Energy vs. Drain Current

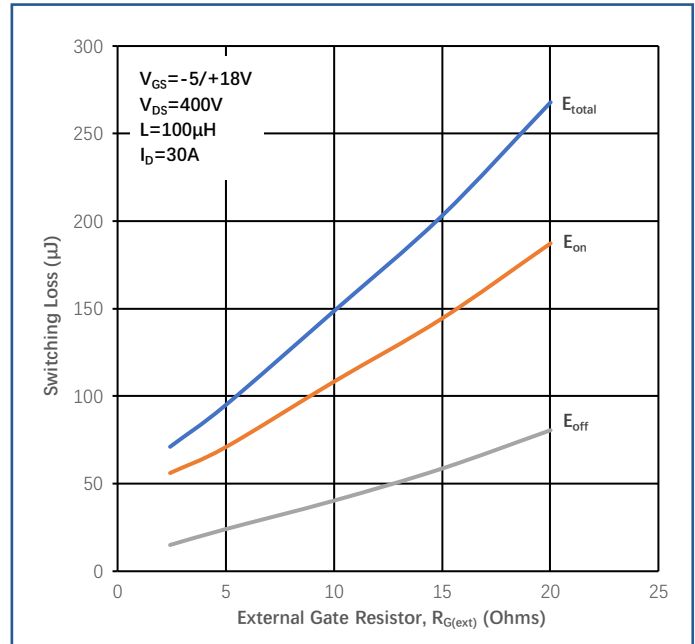


Figure 14

Switching Energy vs. $R_{G(\text{ext})}$

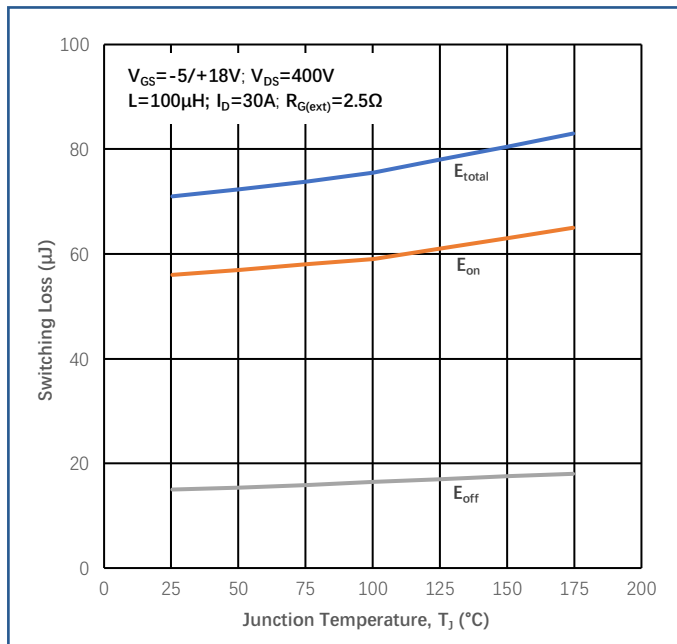


Figure 15

Switching Energy vs. Temperature

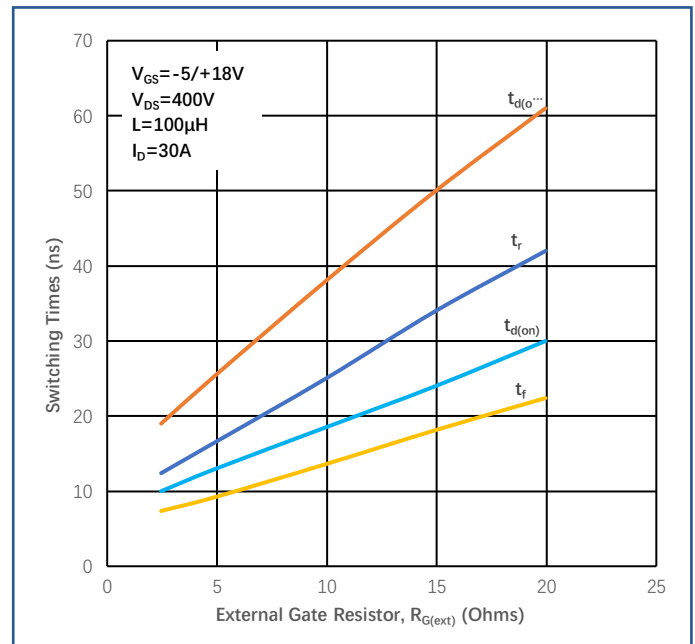


Figure 16

Switching Times vs. $R_{G(\text{ext})}$

Typical Performance

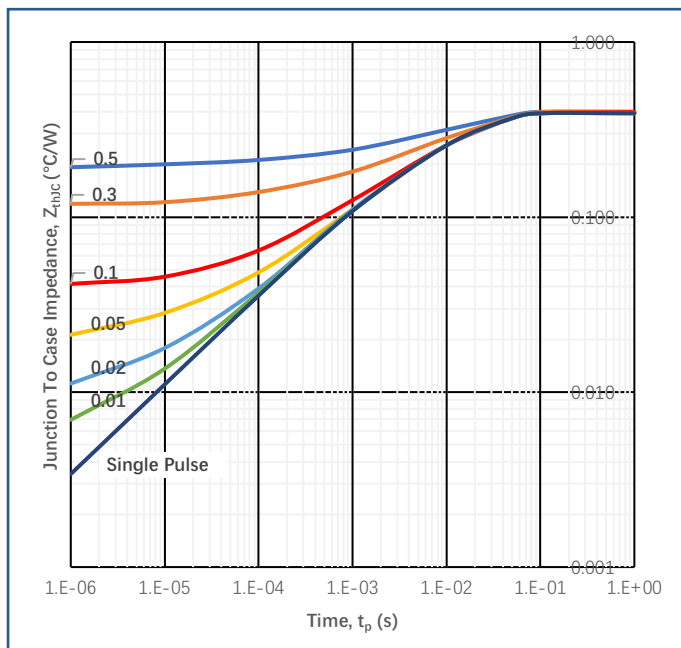


Figure 17

Transient Thermal Impedance

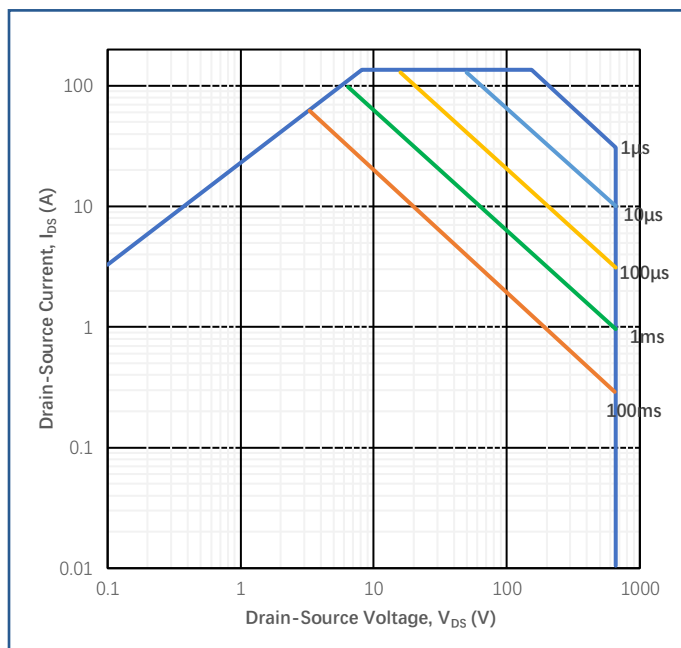
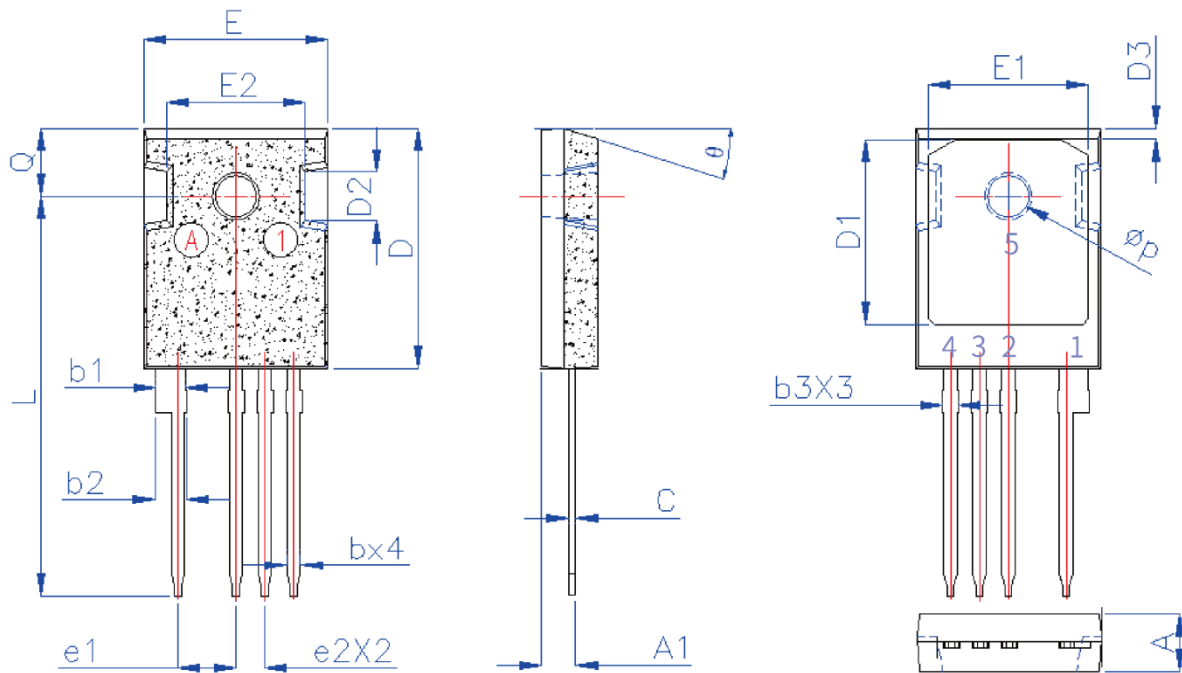


Figure 18

Safe Operating Area

Package Dimensions (mm)

Package Type: TO-247-4L



Symbol	Millimeters			Inches		
	Min.	Type.	Max.	Min.	Type.	Max.
A	4.80	5.00	5.20	0.189	0.197	0.205
A1	2.85	3.00	3.15	0.112	0.118	0.124
b	1.15	1.20	1.25	0.045	0.047	0.049
b1	2.40	2.50	2.60	0.094	0.098	0.102
b2	2.61	2.76	2.91	0.103	0.109	0.115
b3	1.30	1.42	1.57	0.051	0.056	0.062
C	0.55	0.60	0.65	0.022	0.024	0.026
D	20.80	21.00	21.20	0.819	0.827	0.835
D1	15.94	16.24	16.54	0.628	0.639	0.651
D2	4.3Type			0.169 Type		
e1	4.93	5.08	5.23	0.194	0.200	0.206
e2	2.39	2.54	2.69	0.094	0.100	0.106
E	15.95	16.15	16.35	0.628	0.636	0.644
E1	13.82	14.02	14.26	0.544	0.552	0.561
E2	12.00	12.20	12.40	0.472	0.480	0.488
L	34.65	35.05	35.45	1.364	1.380	1.396
Q	5.85	5.95	6.05	0.230	0.234	0.238
ϕP	3.45	3.60	3.75	0.136	0.142	0.148
θ	17.5°			0.689°		

Pin	Symbol	Description
1	D	Drain
2	S	Power Source
3	S	Driver Source
4	G	Gate
5	D	Mounting Base; Connected to Drain

Note:

1. All metal surfaces are Sn plated (matte), except area of cut.
2. Burr or mold flash size (0.5 mm) is not included in the dimensions.

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