

ASC15N650MF3C

650V, 15A, 260mΩ, N-Channel, Silicon Carbide MOSFET

Product Data Sheet

ASTC-3T04-106A A/1



爱仕特科技
AST TECHNOLOGY

General Description

The AST-MF3 series SiC MOSFET in TO-220F package ensures stable high-temperature operation for power-dense and energy-critical systems, enabling compact designs with reduced EMI.

Features

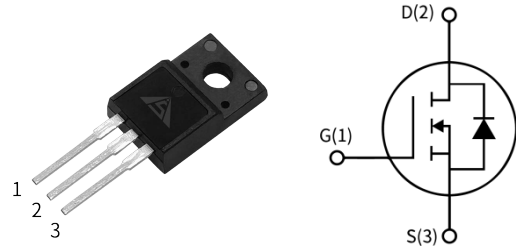
- 3rd Generation SiC MOSFET Technology
- High Speed Switching with Low Capacitances
- High Blocking Voltage with Low $R_{DS(on)}$
- RoHS Compliant, Halogen Free

Applications

- LED Driver
- PD Charger
- PC Adapter
- Air-Conditioning
- E-Bike Charger

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)	15			A	T _C =25°C
P _D	Power Dissipation	76			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	-	450	540	mΩ	V _{GS} =12V; I _D =5A; T _J =25°C
		-	260	312		V _{GS} =15V; I _D =5A; T _J =25°C
		-	185	-		V _{GS} =18V; I _D =5A; T _J =25°C
Dynamic characteristics						
Q _G	Total Gate Charge	-	12.5	-	nC	V _{DS} =400V; V _{GS} =0/+15V; I _D =5A
Q _{GD}	Gate-Drain Charge	-	1.6	-		
Source-drain diode						
Q _{rr}	Reverse Recovery Charge	-	36	-	nC	V _{GS} =0V; I _{SD} =5A; V _R =400V; di/dt=1600A/us; T _J =175°C



Ordering Informations

Order Number	ASC15N650MF3C
Marking	ASC15N650MF3
Package Type	TO-220F
Packing Method	Tube

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; $T_c=25^\circ\text{C}$)	15	A
	Drain Current (continuous; $T_c=100^\circ\text{C}$)	11	
I_{DM}	Drain Current (pulsed)	30	A
V_{GS}	Gate-Source Voltage	-10/+22	V
P_D	Power Dissipation ($T_c=25^\circ\text{C}$)	76	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 _{DS}	Drain-Source Breakdown Voltage	750	-	-	V	I _D =100μA; V _{GS} =0V
I _{DSS}	Zero Gate Voltage Drain Current	-	0.1	20	μA	V _{DS} =750V; V _{GS} =0V
I _{GSS}	Gate-Body Leakage Current	-	-	±250	nA	V _{GS} =-10/+20V; V _{DS} =0V
V _{GS(th)}	Gate Threshold Voltage	3.0	3.8	4.6	V	V _{DS} =V _{GS} ; I _D =10mA
V _{GS(on)}	Recommended Turn-on Voltage	-	12/15/18	-	V	Static
V _{GS(off)}	Recommended Turn-off Voltage	-	0	-		
R _{DS(on)}	Static Drain-Source on Resistance		450	540	mΩ	V _{GS} =12V; I _D =5A; T _J =25°C
			352	-		V _{GS} =12V; I _D =5A; T _J =175°C
		-	260	312		V _{GS} =15V; I _D =5A; T _J =25°C
		-	236	-		V _{GS} =15V; I _D =5A; T _J =175°C
		-	185	-		V _{GS} =18V; I _D =5A; T _J =25°C
		-	200	-		V _{GS} =18V; I _D =5A; T _J =175°C
Dynamic characteristics (at T _J =25°C unless otherwise specified)						
C _{iss}	Input Capacitance	-	294	-	pF	V _{GS} =0V; V _{DS} =650V; f=1MHz
C _{oss}	Output Capacitance	-	25	-		
C _{rss}	Reverse Transfer Capacitance	-	4.0	-		
g _{fs}	Transconductance	-	4	-	S	V _{DS} =20V; I _D =5A
Q _G	Total Gate Charge	-	12.5	-	nC	V _{DS} =400V; V _{GS} =0/+15V; I _D =5A
Q _{GS}	Gate-Source Charge	-	4.3	-		
Q _{GD}	Gate-Drain Charge	-	1.6	-		
R _{G(int)}	Internal Gate Resistance	-	25	-	Ω	f=1MHz; V _{AC} =25mV
E _{on}	Turn-on Energy (Body Diode)	-	41	-	μJ	V _{DS} =400V; V _{GS} =0/+15V; I _D =5A; L=600μH; R _{G(ext)} =5.0Ω; T _J =175°C
E _{off}	Turn-off Energy (Body Diode)	-	5.2	-		
t _{d(on)}	Turn-on Delay Time	-	6	-	ns	V _{DS} =400V; V _{GS} =0/+15V; I _D =5A; L=600μH; R _{G(ext)} =5.0Ω
t _r	Rise Time	-	11	-		
t _{d(off)}	Turn-off Delay Time	-	18	-		
t _f	Fall Time	-	13	-		

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	-	3.9	6	V	$V_{GS}=0\text{V}; I_F=2.5\text{A}; T_J=25^{\circ}\text{C}$
		-	3.6	6		$V_{GS}=0\text{V}; I_F=2.5\text{A}; T_J=175^{\circ}\text{C}$
I_S	Continuous Diode Forward Current	-	15	-	A	$V_{GS}=0\text{V}; T_J=25^{\circ}\text{C}$
t_{rr}	Reverse Recovery Time	-	9.2	-	ns	$V_{GS}=0\text{V}; I_{SD}=5\text{A}; V_R=400\text{V};$ $di/dt=1600\text{A}/\mu\text{s}; T_J=175^{\circ}\text{C}$
Q_{rr}	Reverse Recovery Charge	-	36	-	nC	
I_{rrm}	Peak Reverse Recovery Current	-	4.2	-	A	

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.97	$^{\circ}\text{C}/\text{W}$
$R_{\theta JA}$	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

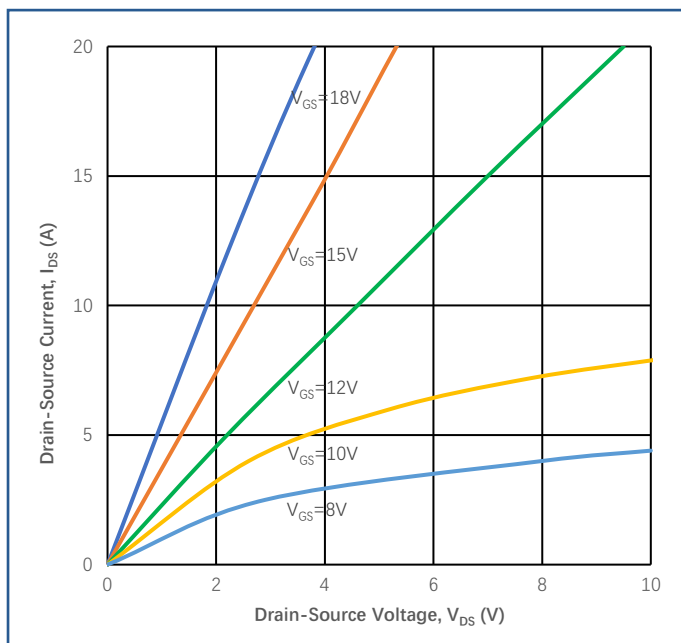


Figure 1

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

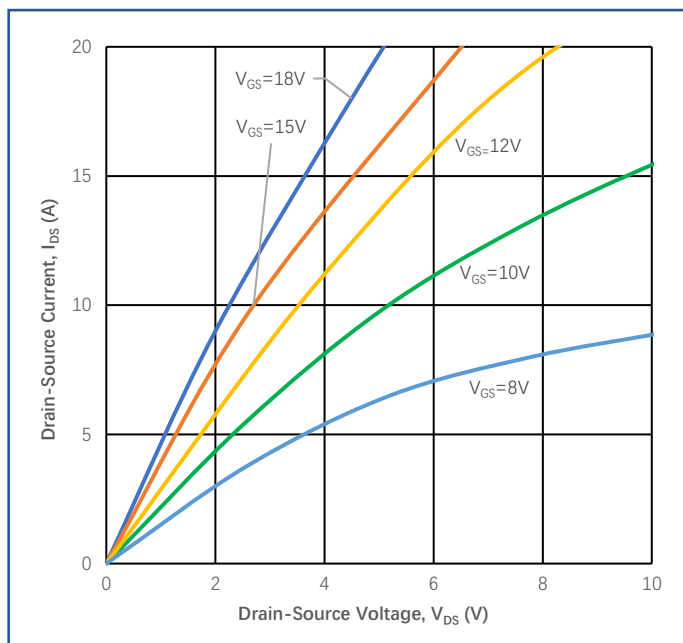


Figure 2

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

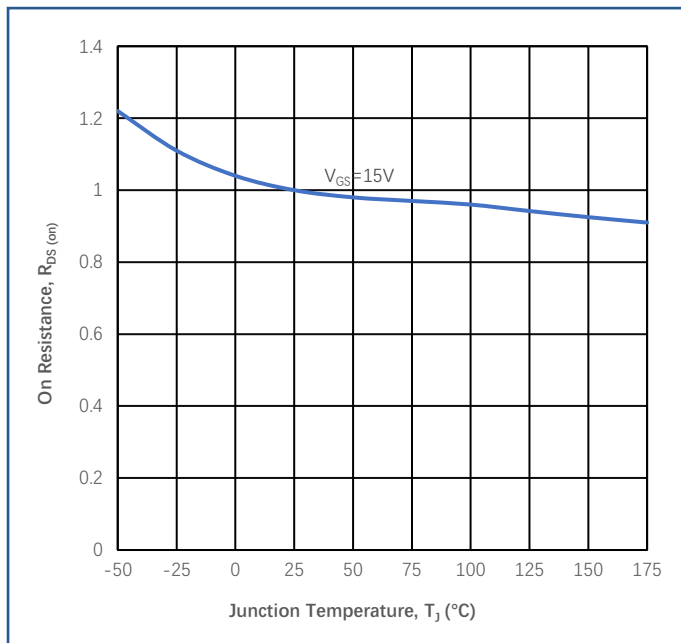


Figure 3

Normalized On-Resistance vs. Temperature

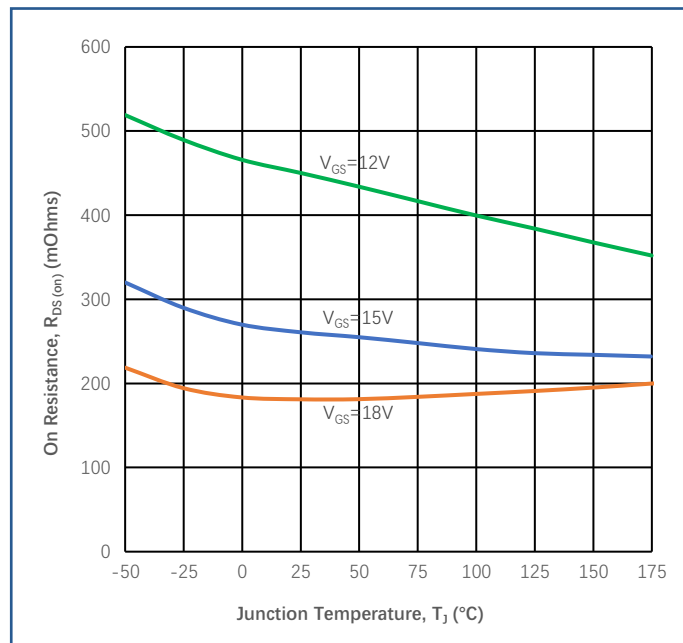


Figure 4

On-Resistance vs. Temperature

Typical Performance

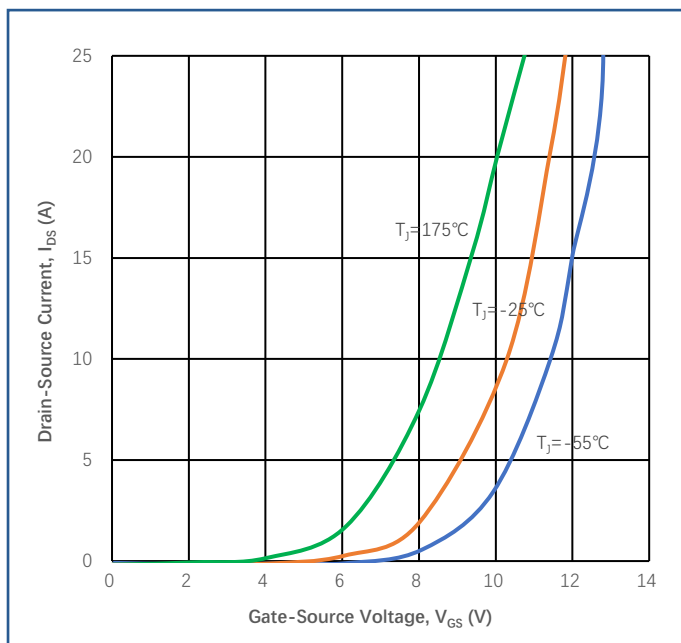


Figure 5
Transfer Characteristic

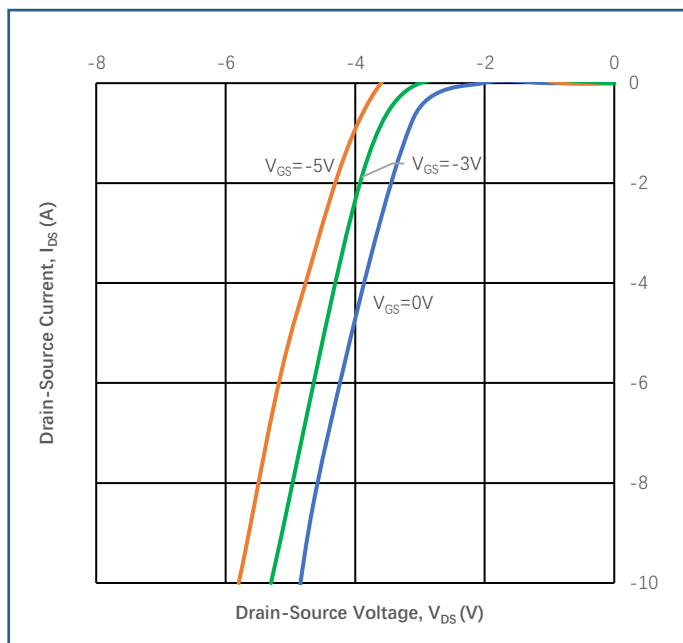


Figure 6
Body Diode Characteristic at 25°C

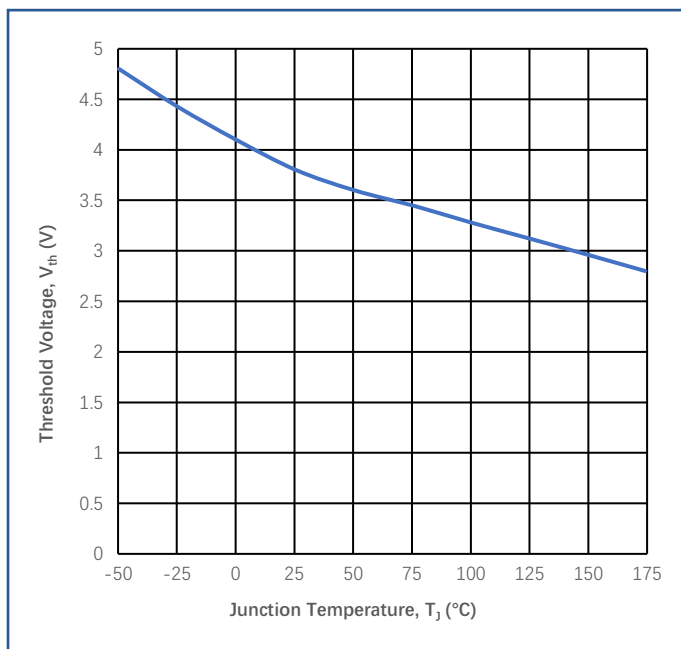


Figure 7
Threshold Voltage vs. Temperature

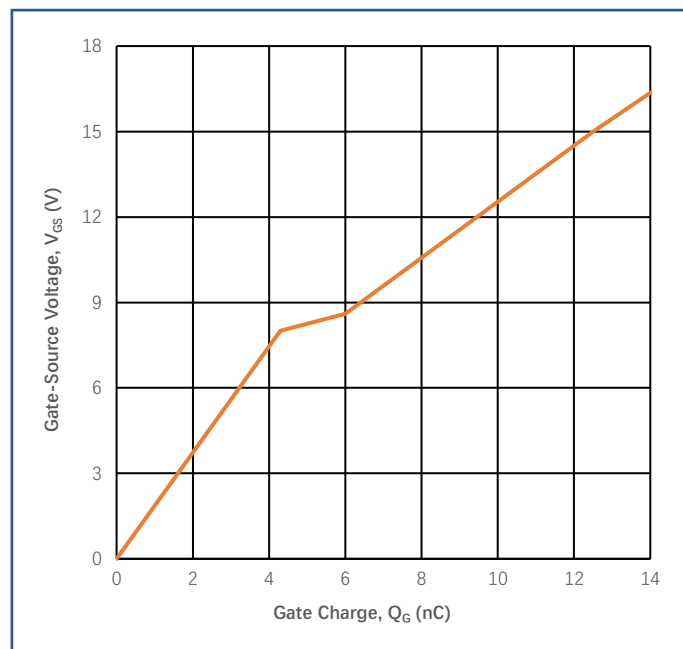


Figure 8
Gate Charge Characteristics

Typical Performance

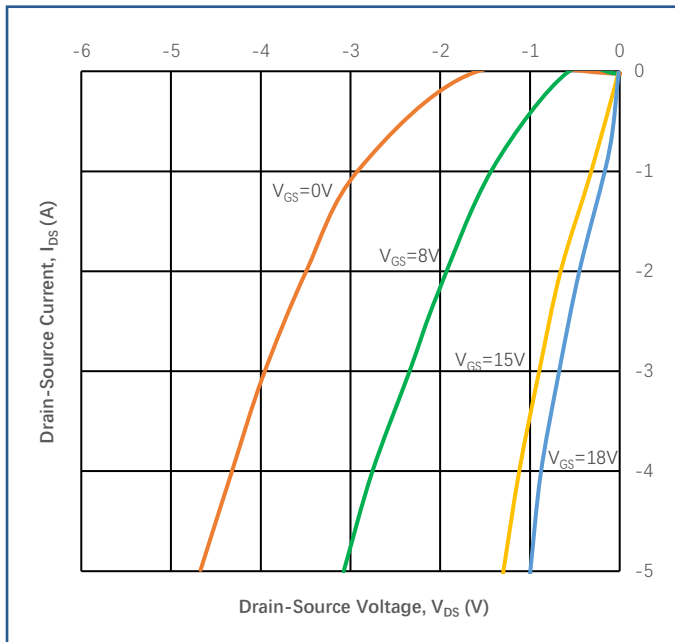


Figure 9

Transfer Characteristic

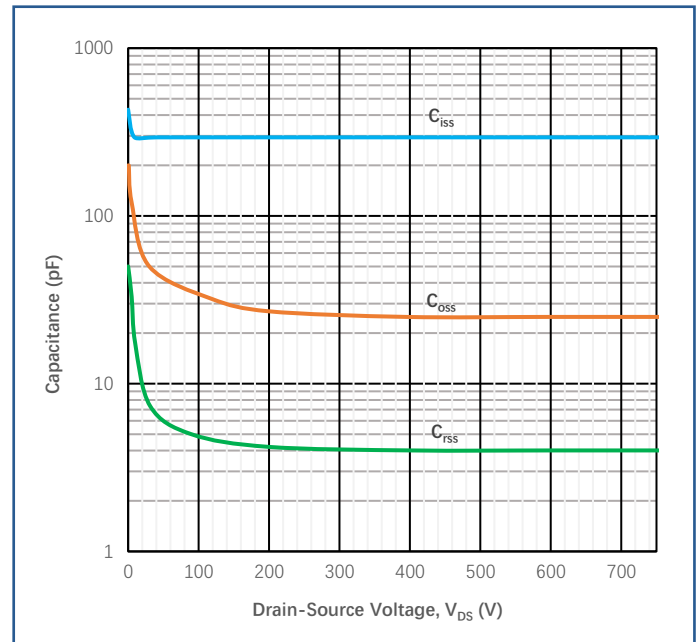


Figure 10

Capacitances vs. Drain-Source

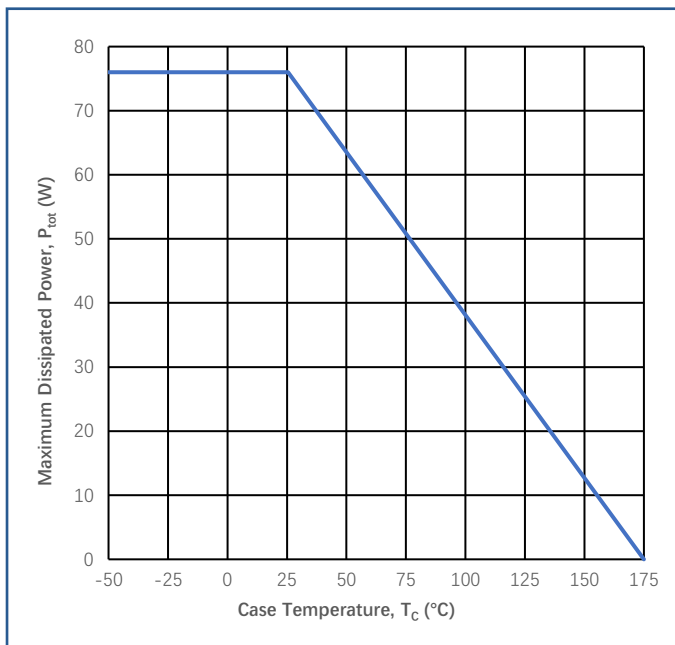


Figure 11

Max Power Dissipation Derating vs T_C

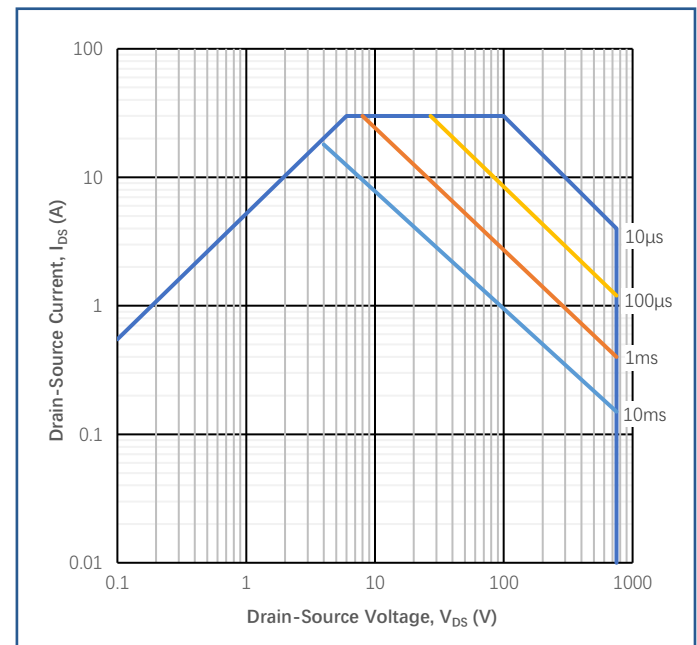


Figure 12

Safe Operating Area

Typical Performance

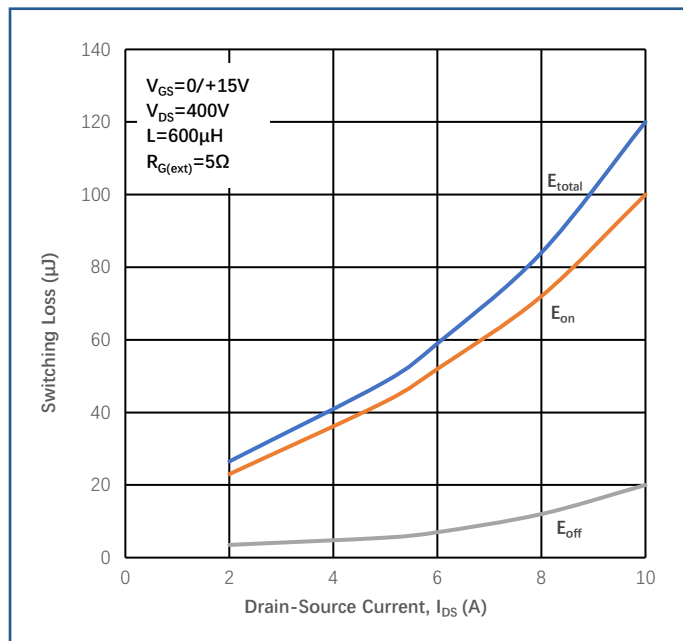


Figure 13

Switching Energy vs. Drain Current

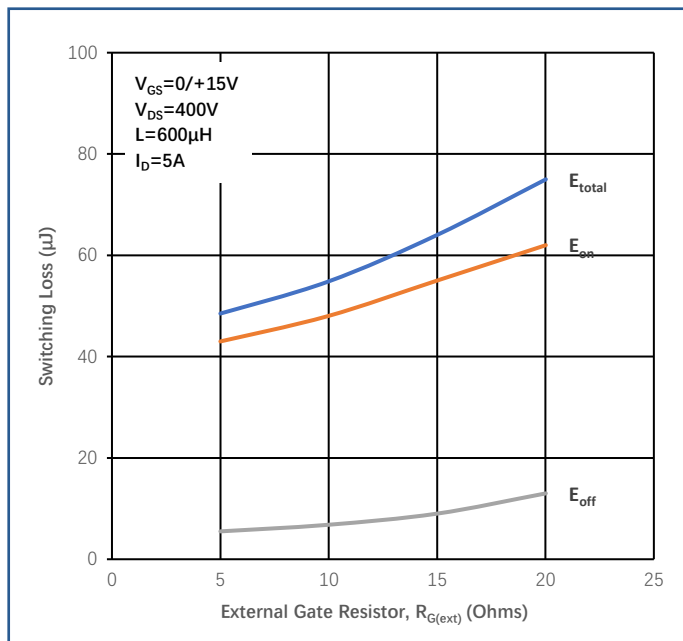


Figure 14

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

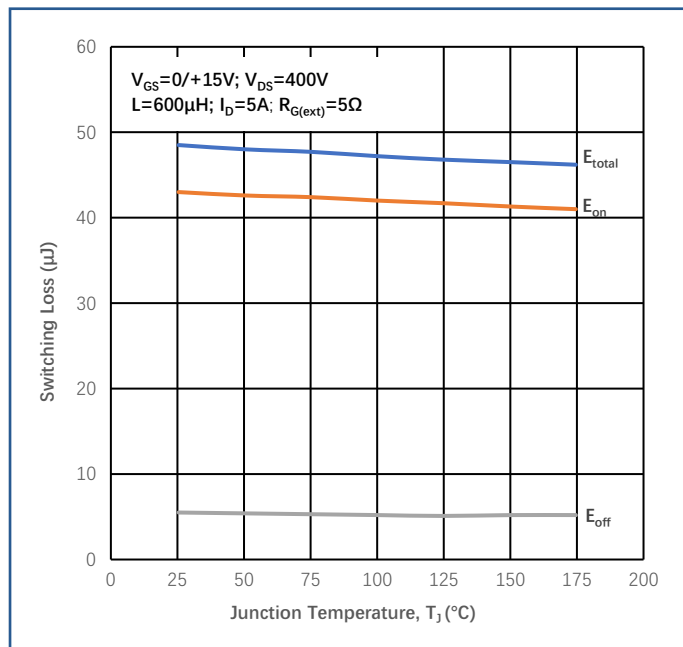


Figure 15

Switching Energy vs. Temperature

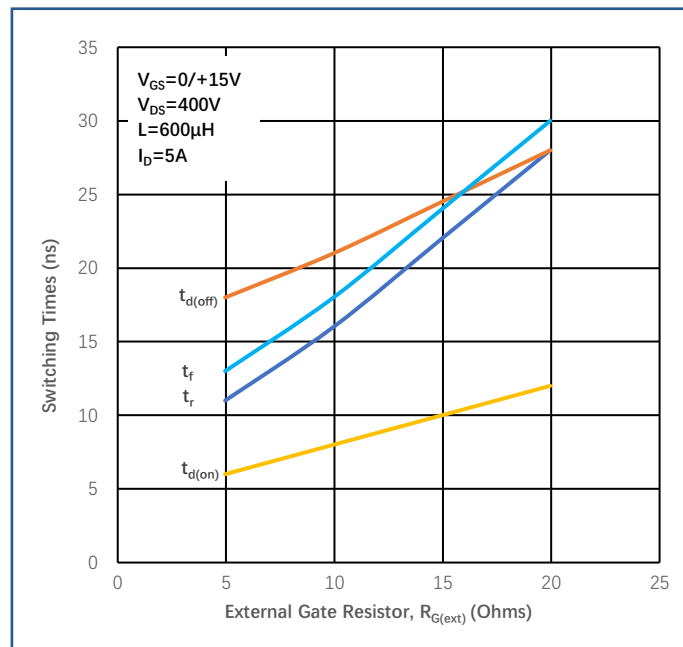


Figure 16

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

Typical Performance

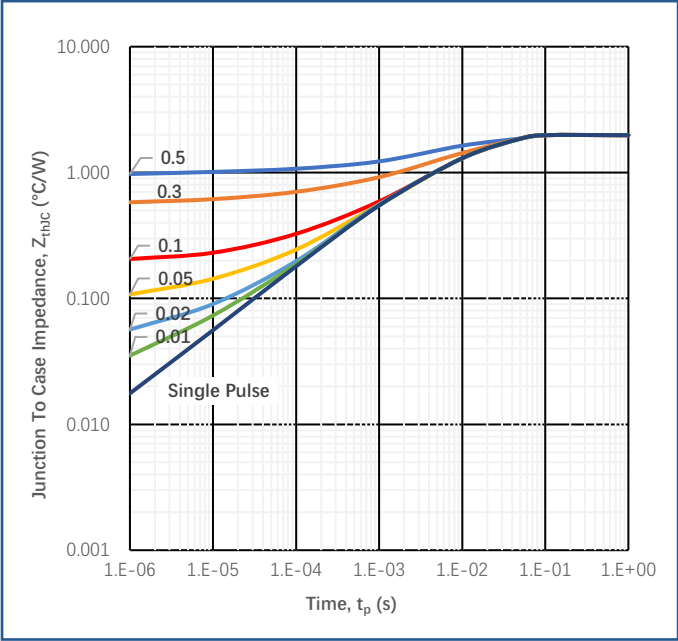
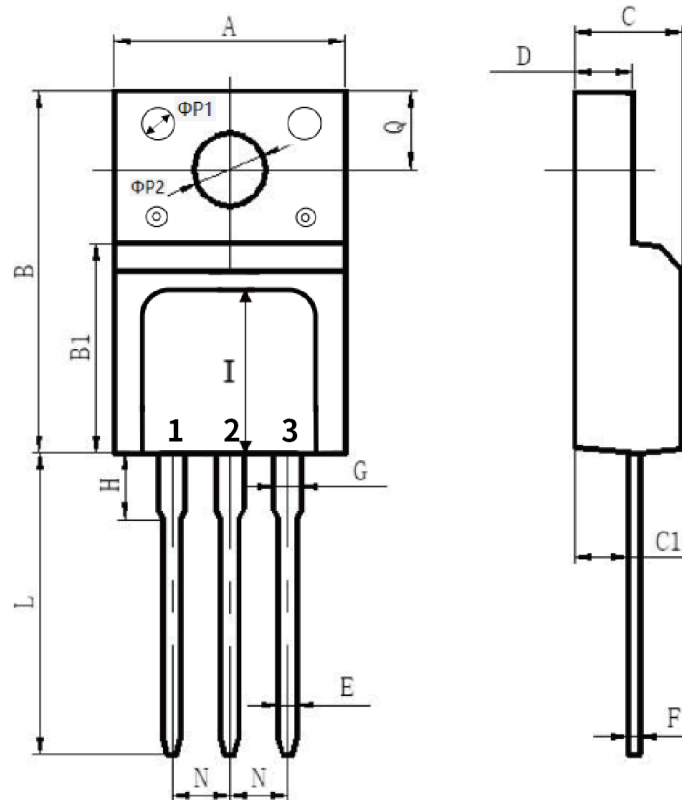


Figure 17
Transient Thermal Impedance

Package Dimensions (mm)

Package Type: TO-220F



Symbol	Millimeters	
	Min.	Max.
A	9.70	10.30
B	15.50	16.10
B1	8.99	9.39
C	4.40	4.80
C1	2.15	2.55
D	2.44	2.64
E	0.70	0.90
F	0.40	0.60
G	1.12	1.42
H	3.40	3.80
I	7.40	7.60
L	12.60	13.6
N	2.34	2.74
Q	3.15	3.55
ΦP1	1.40	1.60
ΦP2	3.00	3.30

Pin	Symbol	Description
1	G	Gate
2	D	Drain
3	S	Source

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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