

ASC20N650MF3C

650V, 20A, 180mΩ, N-Channel, Silicon Carbide MOSFET

Product Data Sheet

ASTC-3T04-104A 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

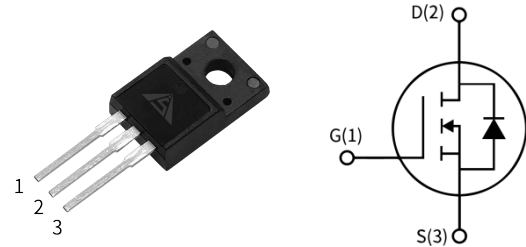
- 3rd Generation SiC MOSFET Technology
- High Speed Switching with Low Capacitances
- High Blocking Voltage with Low $R_{DS(on)}$
- RoHS Compliant, Halogen Free

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)	20			A	T _C =25°C
P _D	Power Dissipation	87			W	T _C =25°C
T _{J; Max}	Junction Temperature	175			°C	
Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
Static characteristics						
R _{DS(on)}	Static Drain-Source on Resistance	-	300	375	mΩ	V _{GS} =12V; I _D =7A; T _J =25°C
		-	180	215		V _{GS} =15V; I _D =7A; T _J =25°C
		-	130	-		V _{GS} =18V; I _D =7A; T _J =25°C
Dynamic characteristics						
Q _G	Total Gate Charge	-	15.2	-	nC	V _{DS} =400V; V _{GS} =0/+15V; I _D =7A
Q _{GD}	Gate-Drain Charge	-	2.6	-		
Source-drain diode						
Q _{rr}	Reverse Recovery Charge	-	68	-	nC	V _{GS} =0V; I _{SD} =7A; V _R =400V; di/dt=2000A/μs; T _J =175°C



Ordering Informations

Order Number	ASC20N650MF3C
Marking	ASC20N650MF3
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; $T_c=25^\circ\text{C}$)	20	A
	Drain Current (continuous; $T_c=100^\circ\text{C}$)	14	
I_{DM}	Drain Current (pulsed)	38	A
V_{GS}	Gate-Source Voltage	-10/+22	V
P_D	Power Dissipation ($T_c=25^\circ\text{C}$)	87	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 to 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	-	300	375	mΩ	V _{GS} =12V; I _D =7A; T _J =25°C
		-	255	-		V _{GS} =12V; I _D =7A; T _J =175°C
		-	180	215		V _{GS} =15V; I _D =7A; T _J =25°C
		-	165	-		V _{GS} =15V; I _D =7A; T _J =175°C
		-	130	-		V _{GS} =18V; I _D =7A; T _J =25°C
		-	143	-		V _{GS} =18V; I _D =7A; T _J =175°C
Dynamic characteristics (at T _J =25°C unless otherwise specified)						
C _{iss}	Input Capacitance	-	431	-	pF	V _{GS} =0V; V _{DS} =650V; f=1MHz
C _{oss}	Output Capacitance	-	32	-		
C _{rss}	Reverse Transfer Capacitance	-	4.2	-		
g _{fs}	Transconductance	-	5	-	S	V _{DS} =20V; I _D =7A
Q _G	Total Gate Charge	-	15.2	-	nC	V _{DS} =400V; V _{GS} =0V/+15V; I _D =7A
Q _{GS}	Gate-Source Charge	-	5.5	-		
Q _{GD}	Gate-Drain Charge	-	2.6	-		
R _{G(int)}	Internal Gate Resistance	-	22	-	Ω	f=1MHz; V _{AC} =25mV
E _{on}	Turn-on Energy (Body Diode)	-	70	-	μJ	V _{DS} =400V; V _{GS} =0/+15V; I _D =7A; L=600μH; R _{G(ext)} =5.0Ω; T _J =175°C
E _{off}	Turn-off Energy (Body Diode)	-	12	-		
t _{d(on)}	Turn-on Delay Time	-	29	-	ns	V _{DS} =400V; V _{GS} =0/+15V; I _D =7A; L=600μH; R _{G(ext)} =5.0Ω
t _r	Rise Time	-	15	-		
t _{d(off)}	Turn-off Delay Time	-	43	-		
t _f	Fall Time	-	12	-		

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	-	3.6	6	V	$V_{GS}=0V$; $I_F=3.5A$; $T_J=25^\circ\text{C}$
		-	3.3	6		$V_{GS}=0V$; $I_F=3.5A$; $T_J=175^\circ\text{C}$
I_S	Continuous Diode Forward Current	-	20	-	A	$V_{GS}=0V$; $T_J=25^\circ\text{C}$
t_{rr}	Reverse Recovery Time	-	26	-	ns	$V_{GS}=0V$; $I_{SD}=7A$; $V_R=400V$; $di/dt=2000A/\mu s$; $T_J=175^\circ\text{C}$
Q_{rr}	Reverse Recovery Charge	-	68	-	nC	
I_{rrm}	Peak Reverse Recovery Current	-	5.6	-	A	

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.72	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	40	$^\circ\text{C/W}$

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

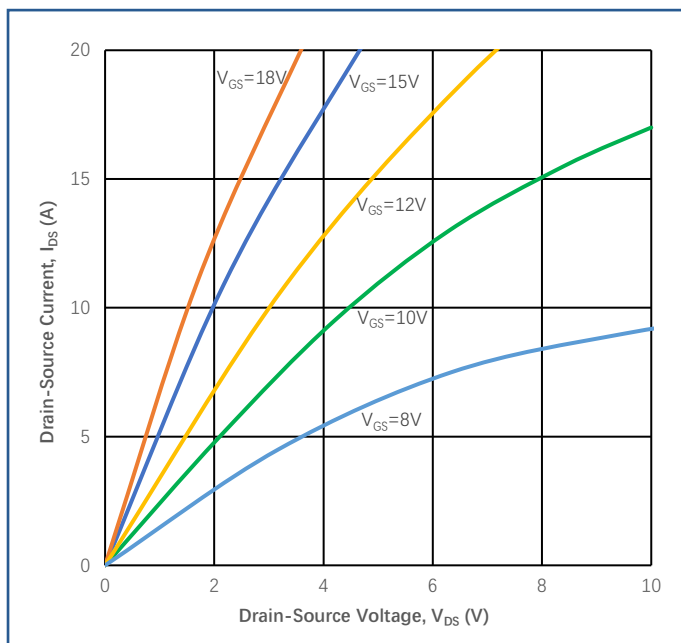


Figure 1
Output Characteristics ($T_J = 25^\circ\text{C}$)

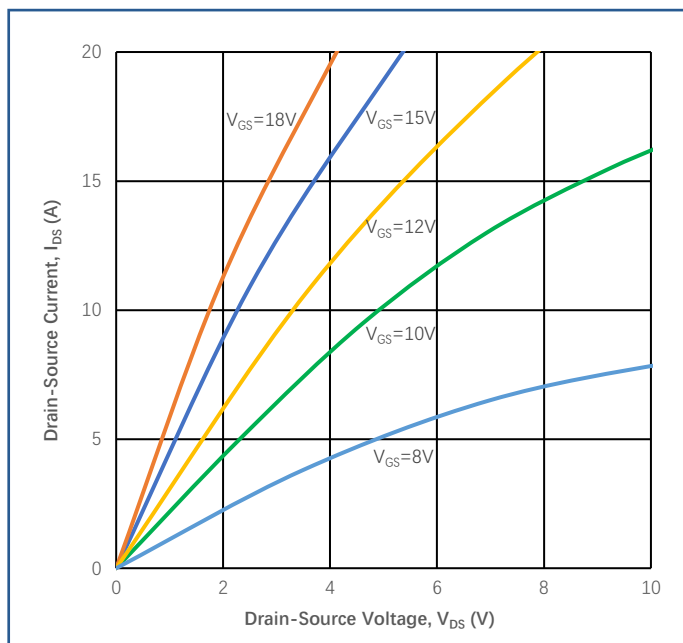


Figure 2
Output Characteristics ($T_J = 175^\circ\text{C}$)

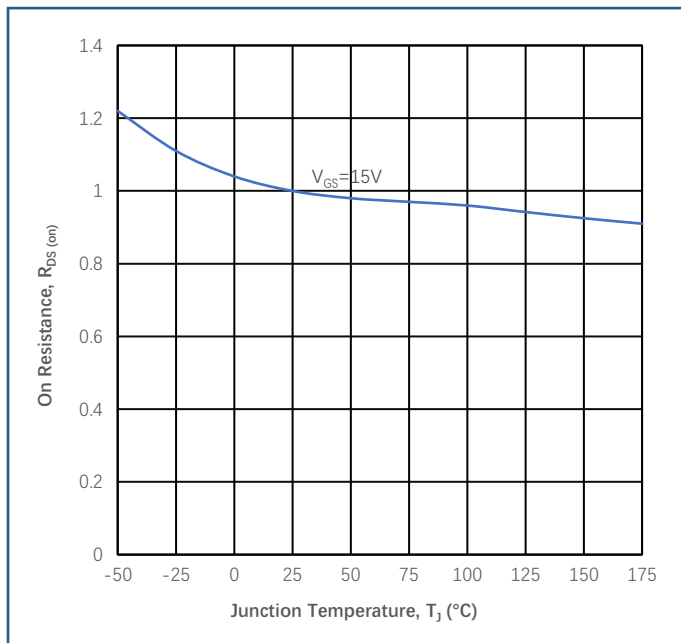


Figure 3
Normalized On-Resistance vs. Temperature

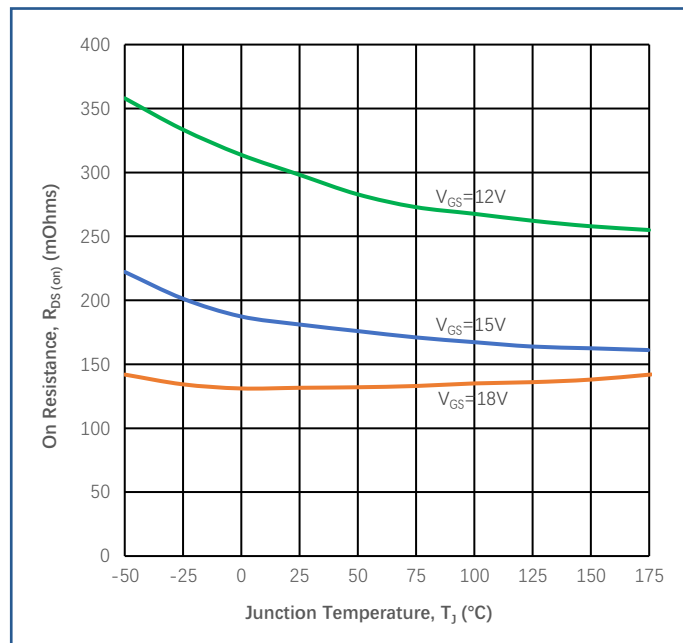


Figure 4
On-Resistance vs. Temperature

Typical Performance

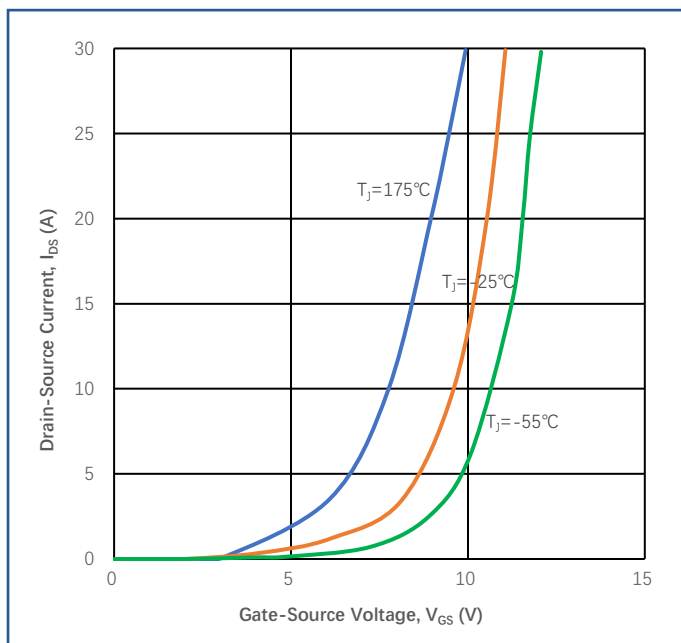


Figure 5
Transfer Characteristic

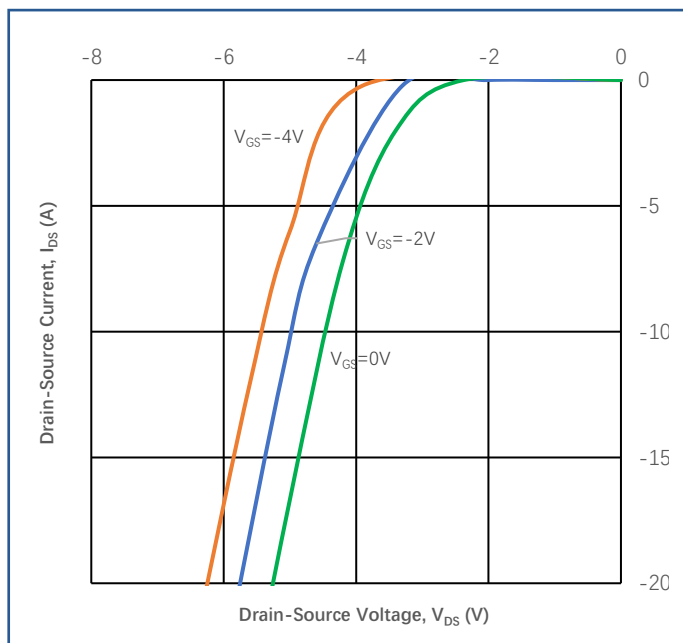


Figure 6
Body Diode Characteristic at 25°C

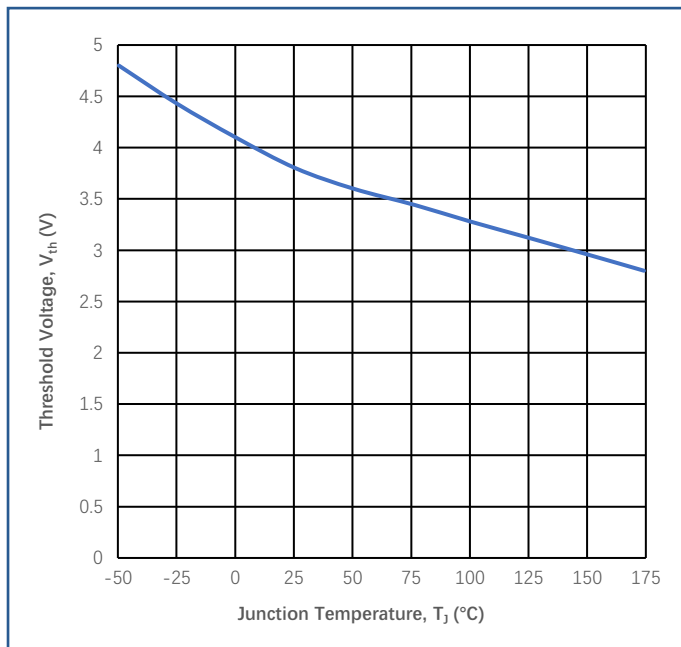


Figure 7
Threshold Voltage vs. Temperature

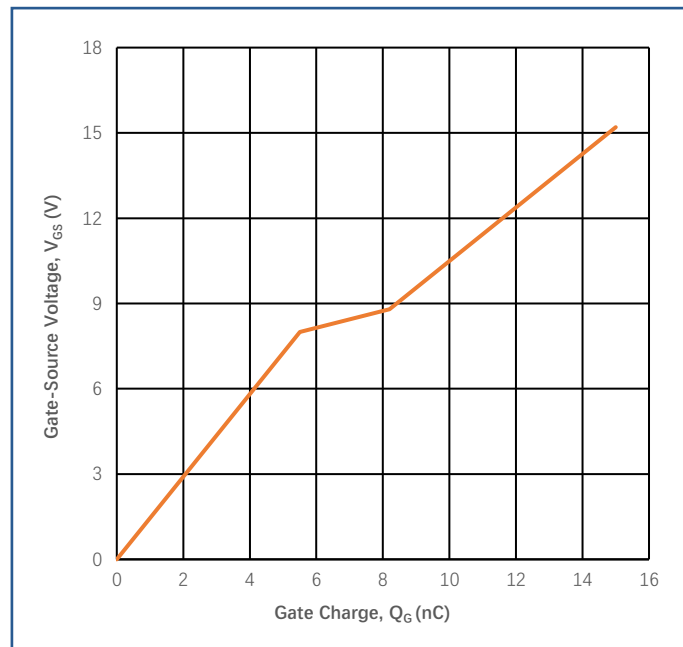


Figure 8
Gate Charge Characteristics

Typical Performance

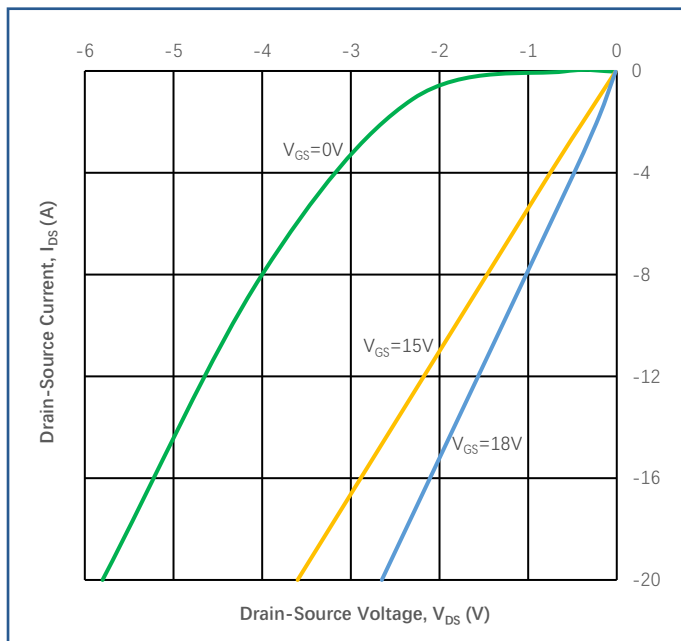


Figure 9
Transfer Characteristic

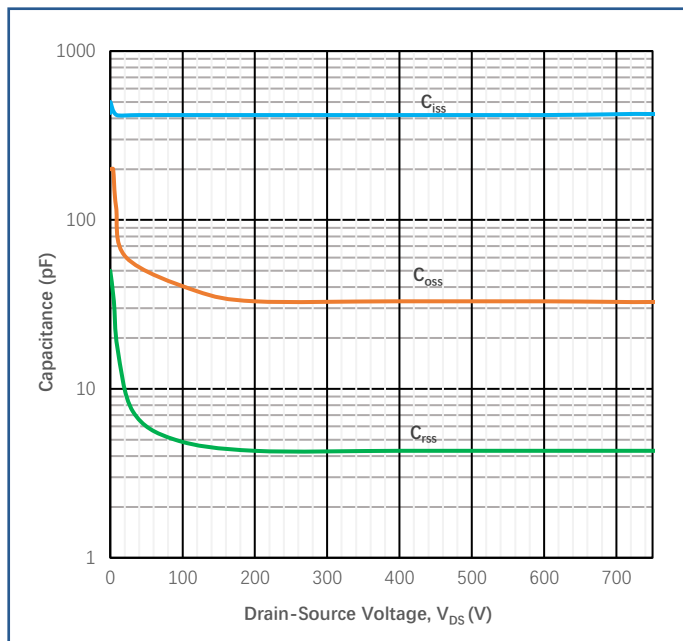


Figure 10
Capacitances vs. Drain-Source

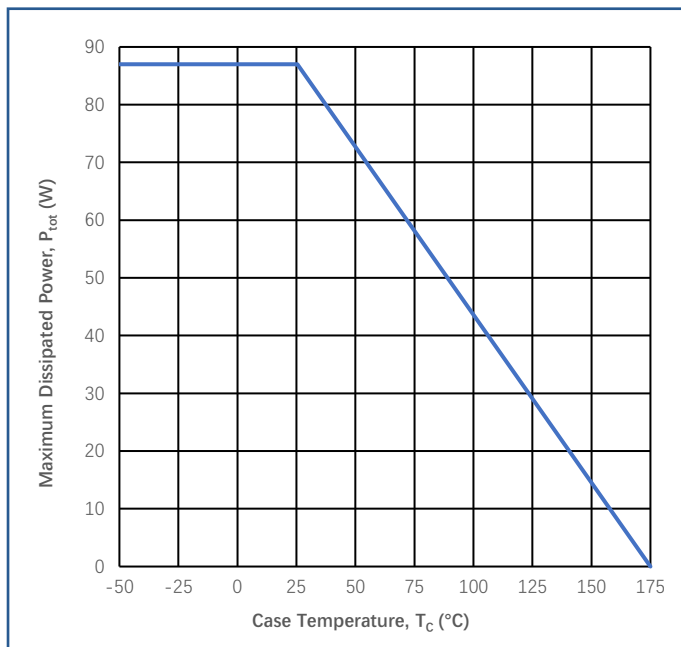


Figure 11
Max Power Dissipation Derating vs T_C

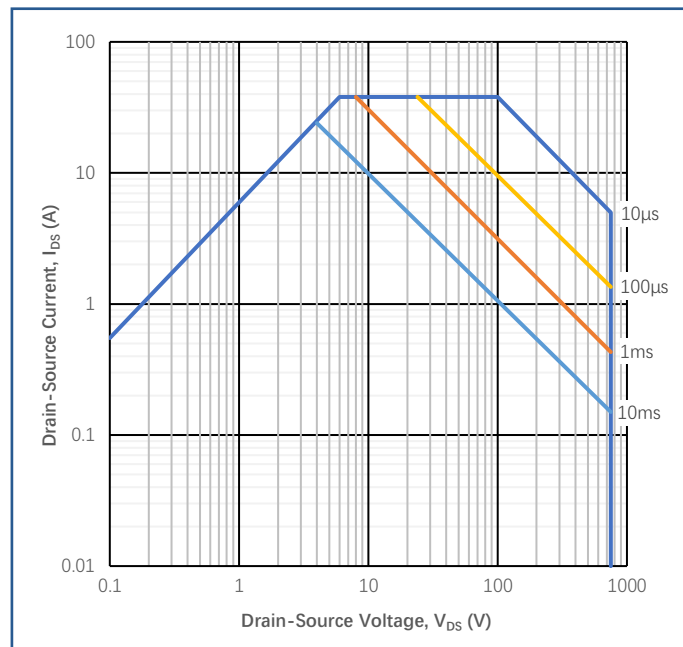


Figure 12
Safe Operating Area

Typical Performance

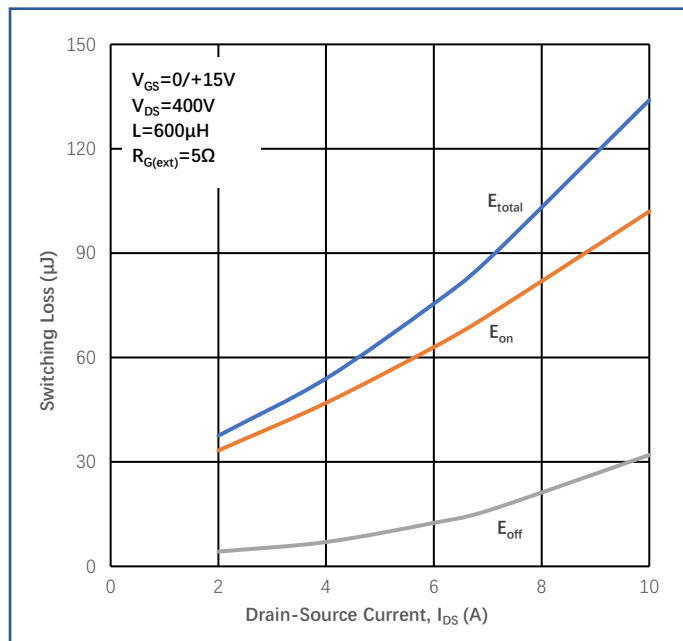


Figure 13

Switching Energy vs. Drain Current

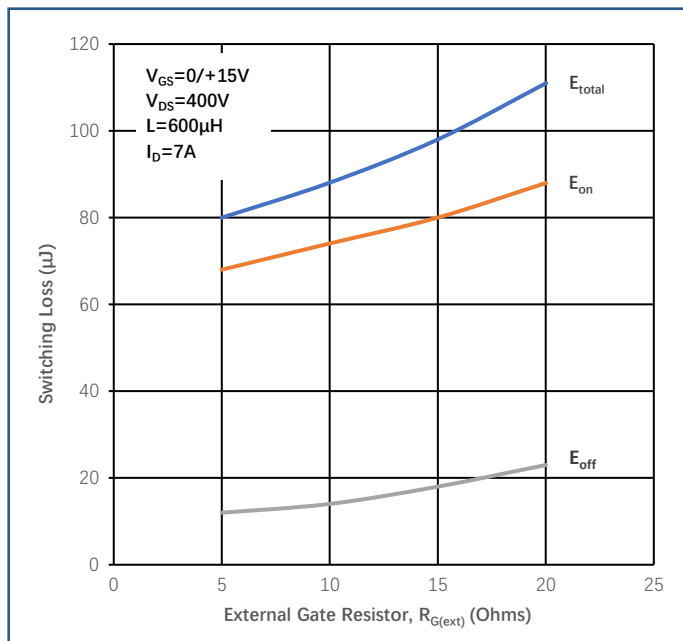


Figure 14

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

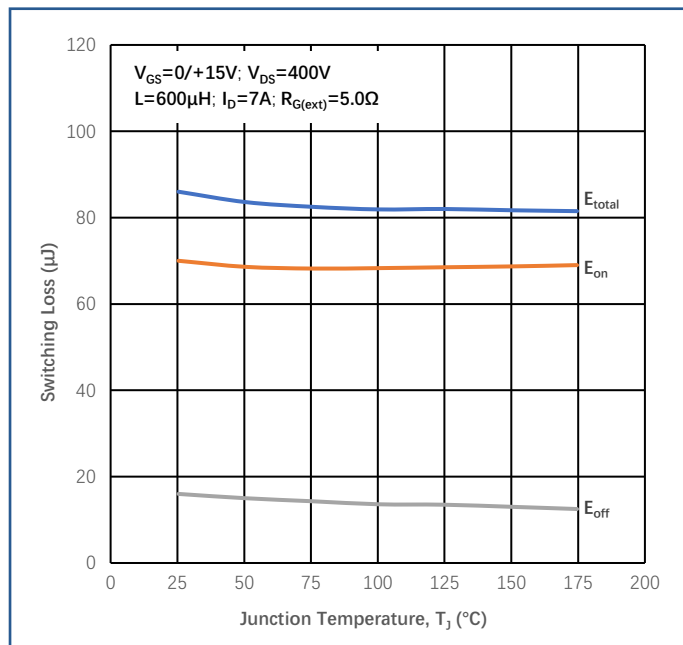


Figure 15

Switching Energy vs. Temperature

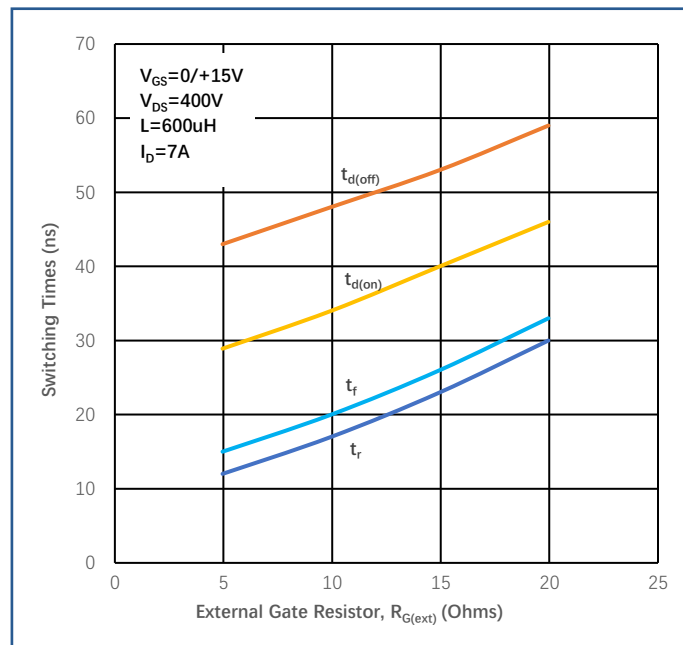


Figure 16

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

Typical Performance

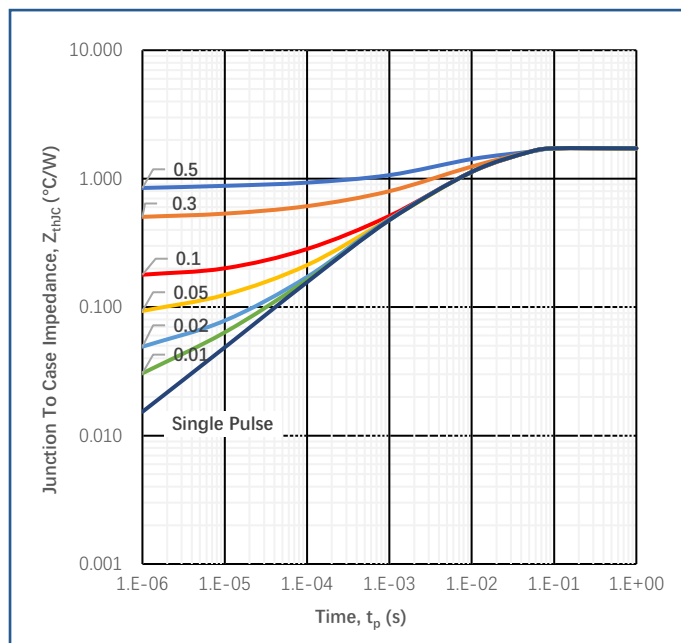
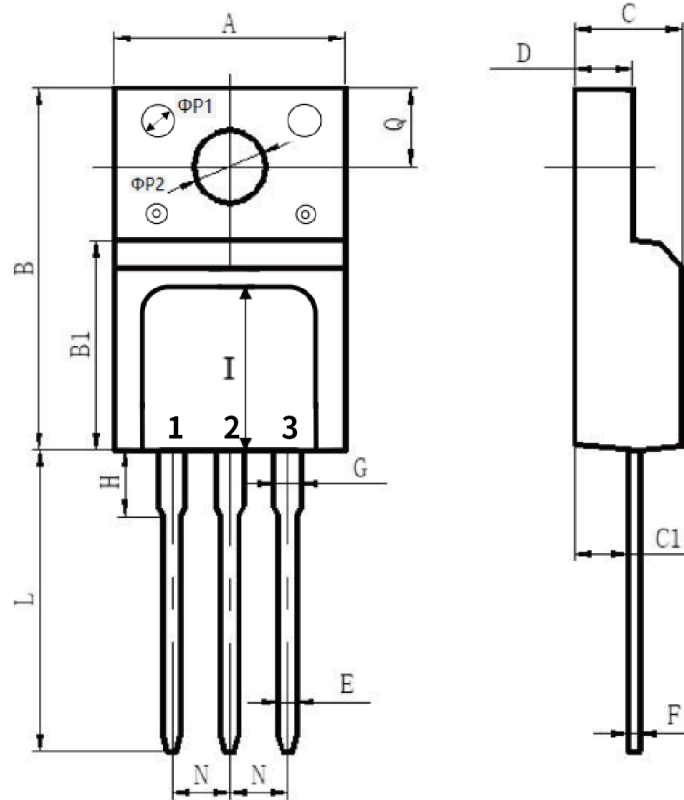


Figure 17

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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