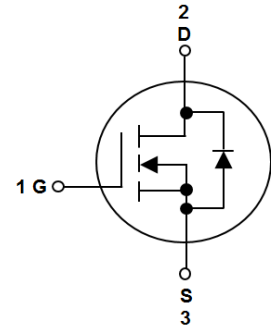


Features

- Revolutionary semiconductor material silicon carbide
- High blocking voltage with low on-resistance
- High-speed switching with very low switching losses
- High-speed and high robust intrinsic body diode
- RoHS compliant with Halogen-free

HF

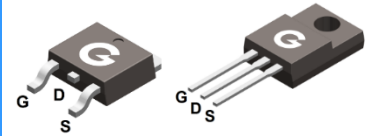


Applications

- LED driver
- PD charger
- PC adapter
- Air-conditioning
- E-bike charger

Mechanical Data

- Case: TO-252, TO-220MF
- Molding Compound: UL Flammability Classification Rating 94V-0
- Terminals: Matte tin-plated leads; solderability-per MIL-STD-202, Method 208



TO-252

TO-220MF

Ordering Information

Part Number	Package	Shipping Quantity	Marking Code
GSC65R380D	TO-252	80 pcs / Tube or 2500 pcs / Tape & Reel	65R380
GSC65R380F	TO-220MF	50 pcs / Tube	65R380

Maximum Ratings (@ T_C = 25°C unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V _{DSS}	650	V
Gate-to-Source Voltage (transient)	V _{GSS}	-10/+22	V
Gate-to-Source Voltage (static)		0/+15	
Continuous Drain Current (T _C = 25°C)	I _D	10	A
Continuous Drain Current (T _C = 100°C)		8.5	
Pulsed Drain Current (t _p = 10μs, T _C = 25°C)	I _{DM}	20	A
Single Pulse Avalanche Energy (L = 1mH) *2	E _{AS}	20	mJ
Power Dissipation (T _C = 25°C, TO-252)	P _D	50	W
Power Dissipation (T _C = 25°C, TO-220MF)		25	
Operating Junction Temperature Range	T _J	-55 ~ +175	°C
Storage Temperature Range	T _{STG}	-55 ~ +175	°C

Thermal Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal Resistance Junction-to-Case (TO-252)	R _{θJC}	-	2.5	3	°C/W
Thermal Resistance Junction-to-Case (TO-220MF)		-	-	6	
Thermal Resistance Junction-to-Air (TO-252)	R _{θJA}	-	-	62	°C/W
Thermal Resistance Junction-to- Air (TO-220MF)		-	-	75	

Electrical Characteristics (@ $T_A = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
Static Characteristics						
V _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0V, I _D = 100μA	650	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 650V, V _{GS} = 0V	-	-	20	μA
I _{GSS}	Gate-Body Leakage Current	V _{GS} = 22V, V _{DS} = 0V	-	-	250	nA
		V _{GS} = -10V, V _{DS} = 0V	-	-	-250	
On Characteristics						
R _{DS(ON)}	Drain-Source On-resistance *1	V _{GS} = 15V, I _D = 5A, T _J = 25°C	-	340	390	mΩ
		V _{GS} = 15V, I _D = 5A, T _J = 175°C	-	305	-	
		V _{GS} = 18V, I _D = 5A, T _J = 25°C	-	240	310	
		V _{GS} = 18V, I _D = 5A, T _J = 175°C	-	260	-	
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 3.5mA, T _J = 25°C	2.5	3.5	5	V
		V _{DS} = V _{GS} , I _D = 3.5mA, T _J = 175°C	-	2.6	-	
R _G	Gate Resistance	V _{GS} = 0V, f = 1MHz	-	35	-	Ω
Dynamic Characteristics						
C _{ISS}	Input Capacitance	V _{GS} = 0V	-	223	-	pF
C _{OSS}	Output Capacitance	V _{DS} = 400V	-	18	-	
C _{RSS}	Reverse Transfer Capacitance	f = 1MHz	-	1.3	-	
Switching Characteristics						
t _{d(ON)}	Turn-on Delay Time *3	V _{DD} = 400V V _{GS} = 0/15V I _D = 5A R _G = 4.3Ω L = 600μH	-	16.5	-	ns
t _r	Turn-on Rise Time *3		-	11.3	-	
t _{d(OFF)}	Turn-Off Delay Time *3		-	21.2	-	
t _f	Turn-Off Fall Time *3		-	12.7	-	
E _{on}	Turn-On Energy *3		-	47.6	-	μJ
E _{off}	Turn-Off Energy *3		-	4	-	
Q _G	Total Gate-Charge	V _{DD} = 400V	-	13.1	-	nC
Q _{GS}	Gate to Source Charge	V _{GS} = 0/15V	-	7.2	-	
Q _{GD}	Gate to Drain (Miller) Charge	I _D = 5A	-	2.2	-	
Source-Drain Diode Characteristics						
V _{SD}	Diode Forward Voltage *1	I _{SD} = 2.5A, V _{GS} = 0V, T _J = 25°C	-	3.5	-	V
		I _{SD} = 2.5A, V _{GS} = 0V, T _J = 175°C	-	3.2	-	
t _{rr}	Reverse Recovery Time	I _F = 5A, V _R = 400V dI/dt = 300A/μs	-	12	-	ns
Q _{rr}	Reverse Recovery Charge		-	10	-	nC
I _{rr}	Peak Reverse Recovery Current		-	1.5	-	A

Notes:

- The data tested by pulsed, pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$
- The E_{AS} data shows Max. rating. The test condition is $V_{DD} = 120V, V_{GS} = 15V, L = 1mH$
- Guaranteed by design, not subject to production

Ratings and Characteristics Curves (@ $T_A = 25^\circ\text{C}$ unless otherwise specified)

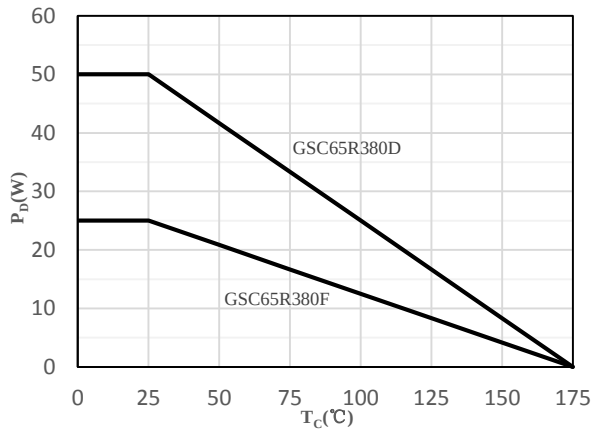


Fig 1 Power Dissipation

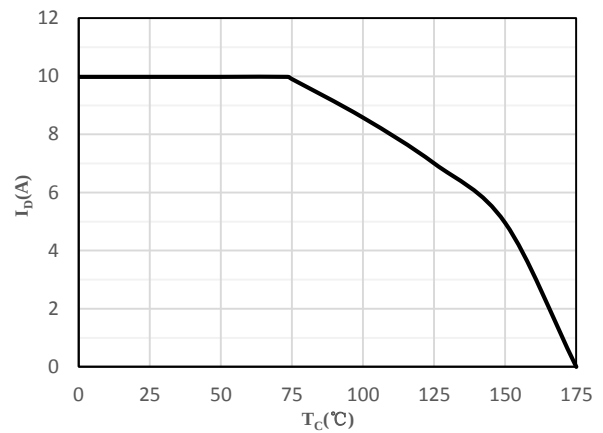


Fig 2 Drain Current

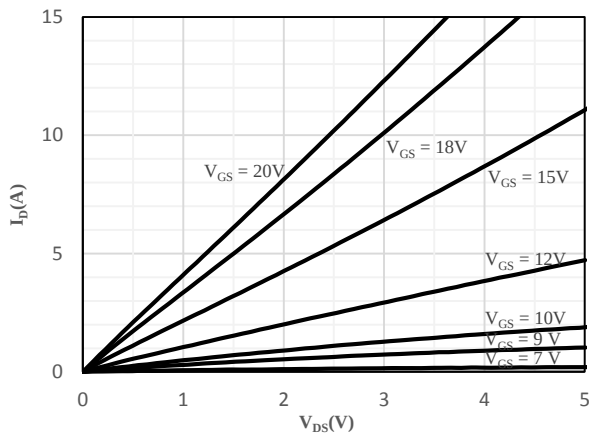


Fig 3 Typical Output Characteristics ($T_J = -55^\circ\text{C}$)

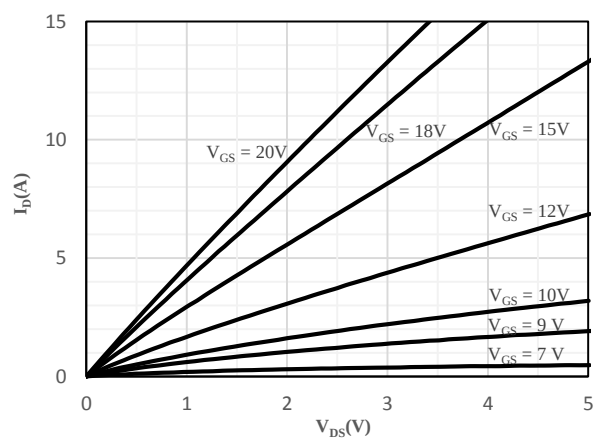


Fig 4 Typical Output Characteristics ($T_J = 25^\circ\text{C}$)

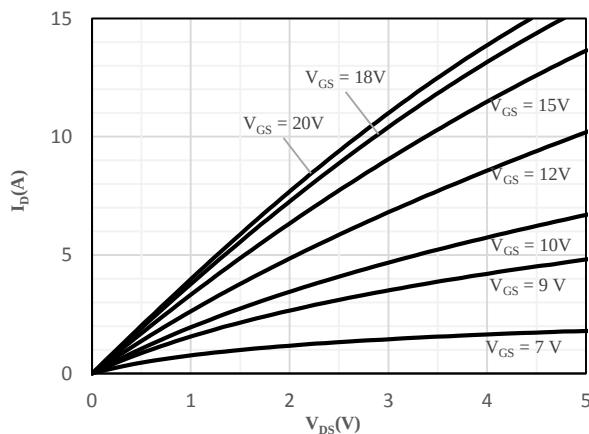


Fig 5 Typical Output Characteristics ($T_J = 175^\circ\text{C}$)

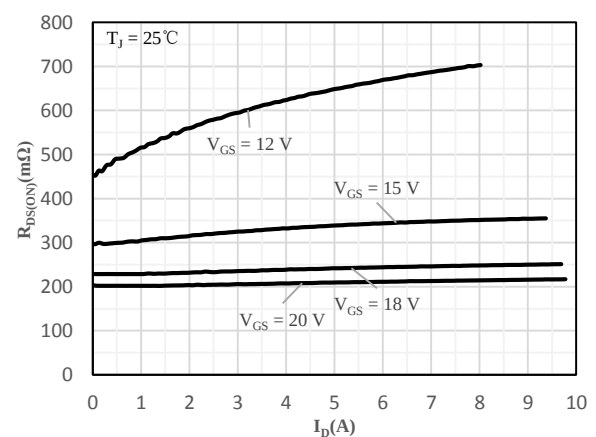


Fig 6 On-Resistance vs. Drain Current

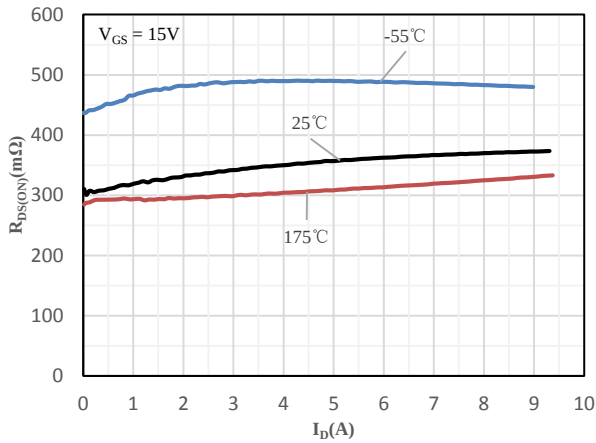


Fig 7 On-Resistance vs. Drain Current
for Various Junction Temperatures

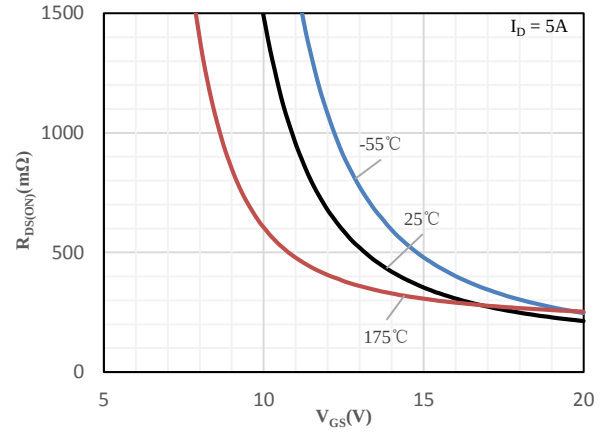


Fig 8 On-Resistance vs. Gate-Source Voltage
for Various Junction Temperatures

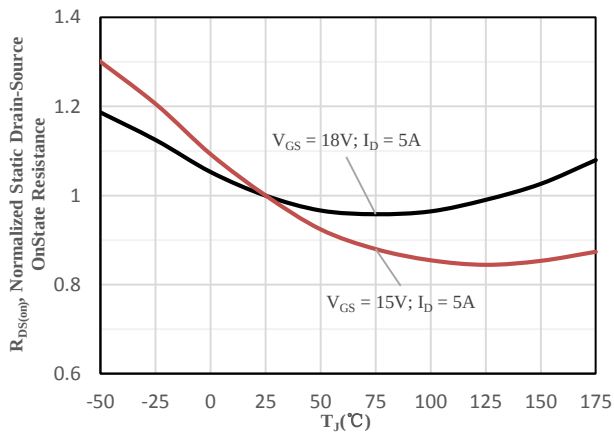


Fig 9 Normalized On-Resistance vs.
Junction Temperature

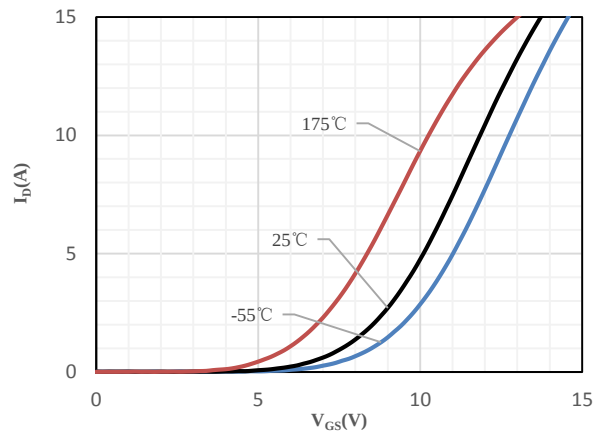


Fig 10 Transfer Characteristics
for Various Junction Temperatures

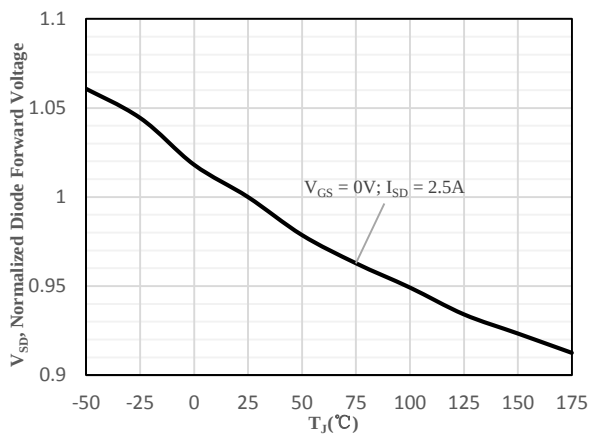


Fig 11 Normalized Diode Forward Voltage vs.
Junction Temperature

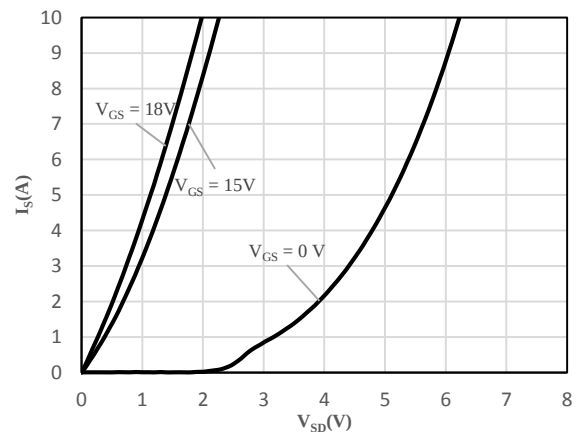


Fig 12 Body-Diode Characteristics ($T_J = -55^\circ\text{C}$)

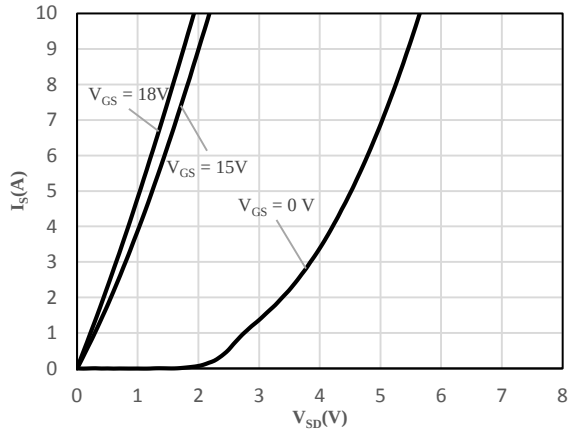


Fig 13 Body-Diode Characteristics ($T_j = 25^\circ\text{C}$)

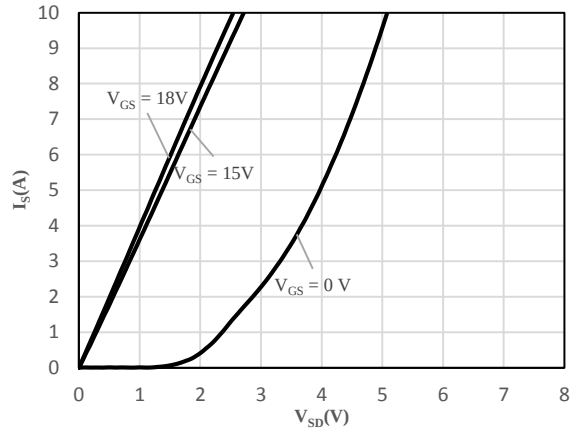


Fig 14 Body-Diode Characteristics ($T_j = 175^\circ\text{C}$)

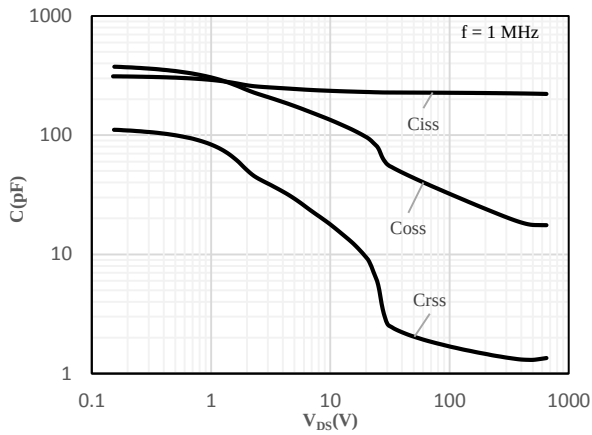


Fig 15 Capacitance Characteristics

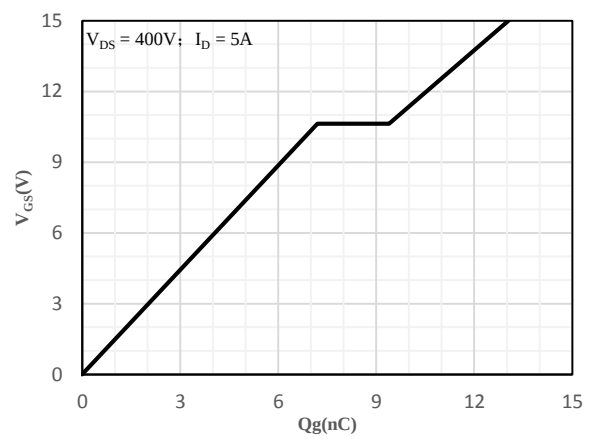


Fig 16 Gate-Charge Characteristics

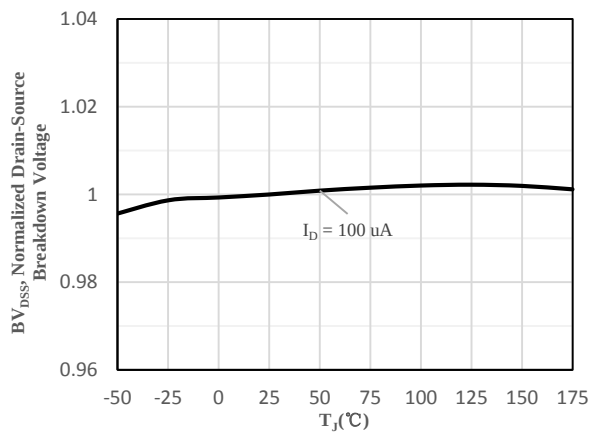


Fig 17 Normalized Breakdown Voltage vs. Junction Temperature

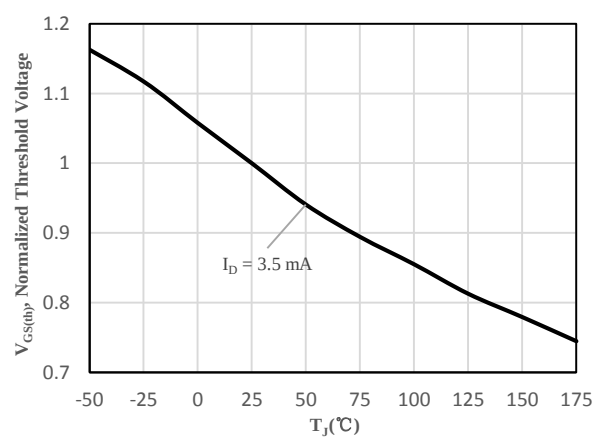


Fig 18 Normalized $V_{GS(th)}$ vs. Junction Temperature

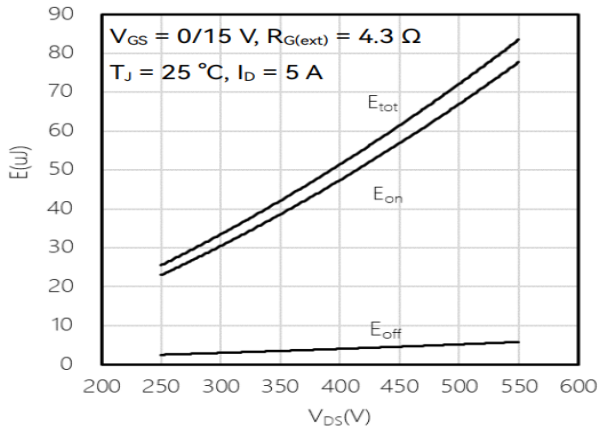


Fig 19 Clamped Inductive Switching Energy vs. V_{DS}

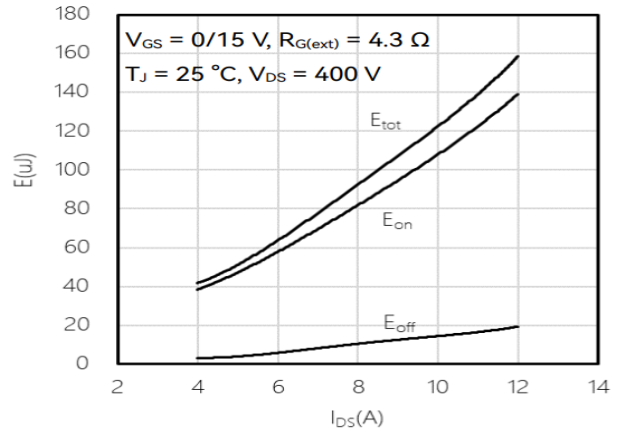


Fig 20 Clamped Inductive Switching Energy vs. Drain Current

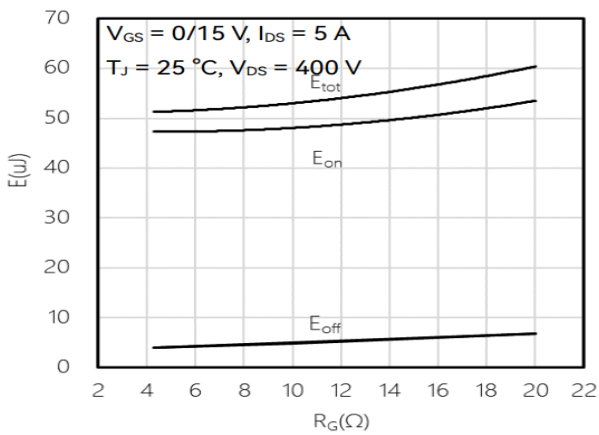


Fig 21 Clamped Inductive Switching Energy vs. R_G

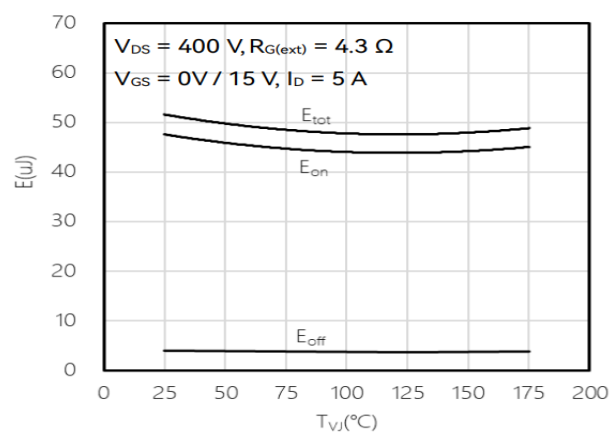


Fig 22 Clamped Inductive Switching Energy vs. Junction Temperature

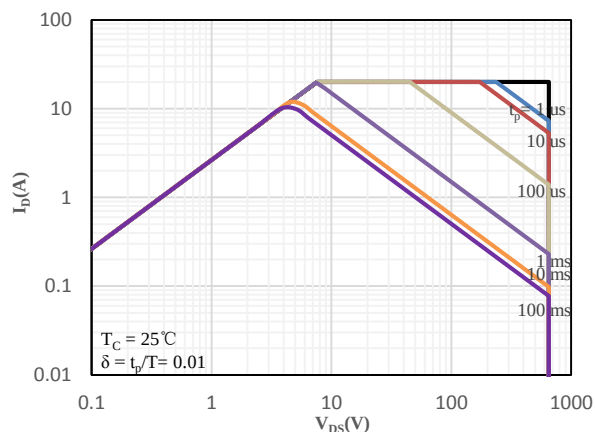


Fig 23 Safe Operating Area (TO-252)

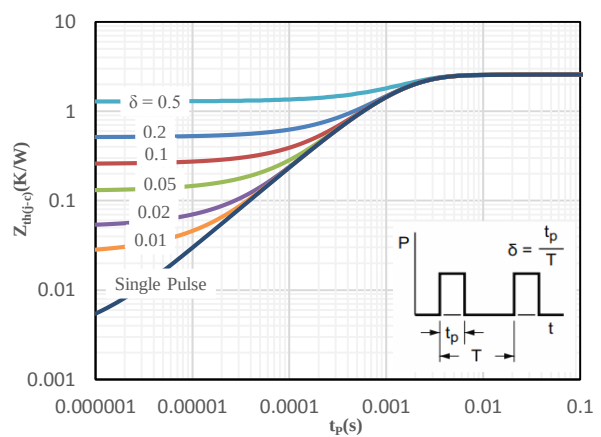
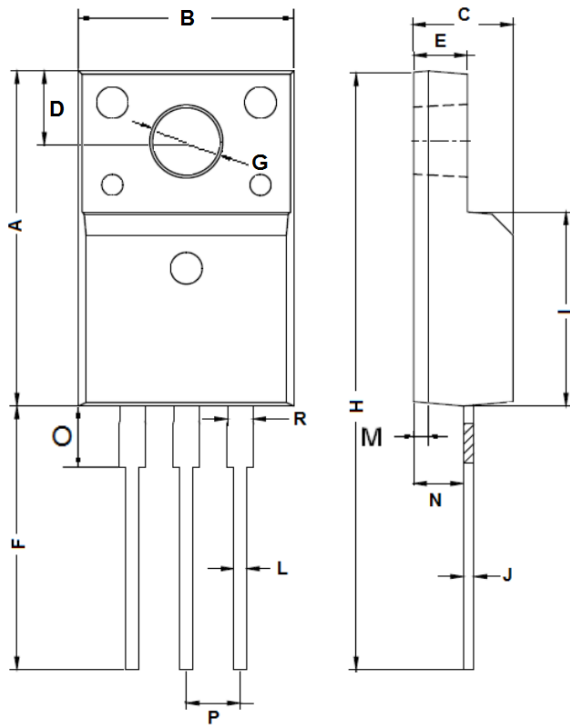
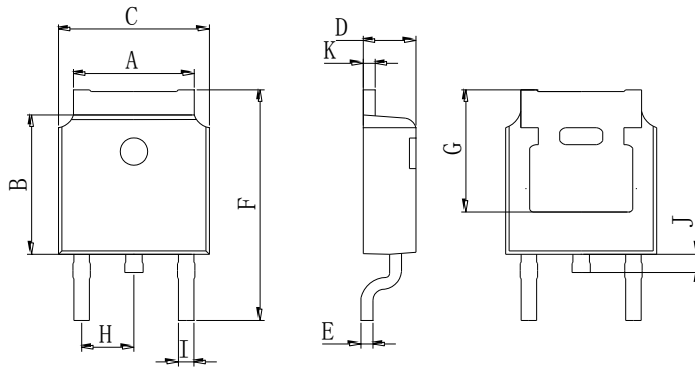


Fig 24 Maximum transient thermal impedance (TO-252)

Package Outline Dimensions (Unit: mm)



TO-220MF		
Dimension	Min.	Max.
A	15.60	16.00
B	9.90	10.30
C	4.50	4.90
D	3.00	3.60
E	2.44	2.64
F	12.20	12.60
G	3.00	3.30
H	27.80	28.60
I	8.70	9.70
J	0.40	0.60
L	0.70	0.90
M	0.55	0.75
N	2.50	2.70
O	2.70	3.10
P	2.45	2.65
R	1.10	1.30



TO-252		
Dimension	Min.	Max.
A	5.05	5.65
B	5.80	6.40
C	6.25	6.85
D	2.20	2.40
E	0.40	0.60
F	9.71	10.31
G	5.05	5.65
H	2.10	2.50
I	0.70	0.90
J	0.50	0.70
K	0.40	0.60

Mounting Pad Layout (Unit: mm)

TO-252

