



## Features

- Wide bandgap SiC MOSFET technology
- Low On-Resistance with High Blocking Voltage
- Low Capacitances with High-Speed switching
- Low reverse recovery(Qrr)
- Halogen free, RoHs compliant

## Benefits

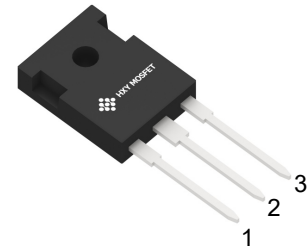
- Reduce switching losses
- Increased system Switching Frequency
- Increased power density
- Reduction of heat sink requirements

## Applications

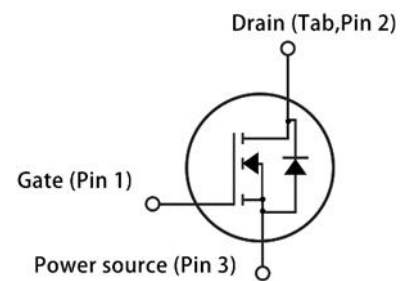
- Switch mode power supplies
- Renewable energy
- On Board Charger
- High Voltage DC/DC Converters



Ordering Part Number	Package	Brand
STWA50N65DM2AG	TO-247	HXY MOSFET



TO-247



## Maximum Ratings (T<sub>C</sub> = 25 °C unless otherwise specified)

Symbol	Parameter	Test conditions	Value	Unit	Note
V <sub>DSmax</sub>	Drain-Source Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 100μA	650	V	
V <sub>GS</sub>	Gate-Source voltage (transient)	t <sub>p</sub> ≤ 500ns, duty cycle ≤ 1%	-8/+20	V	
V <sub>GSop</sub>	Recommend Gate-Source Voltage	Static	-4/+18	V	
I <sub>D</sub>	Continuous Drain current	V <sub>GS</sub> = 18V, T <sub>C</sub> = 25°C	36	A	Fig. 14
		V <sub>GS</sub> = 18V, T <sub>C</sub> = 100°C	25		
I <sub>D,pulse</sub>	Pulsed Drain Current	Pulse with t <sub>p</sub> limited by T <sub>jmax</sub>	57	A	
P <sub>D</sub>	Power Dissipation	T <sub>C</sub> = 25°C, T <sub>j</sub> = 175°C	127	W	Fig.16
T <sub>j</sub>	Operating junction temperature		-55~175	°C	
T <sub>stg</sub>	Storage temperature		-55~175	°C	



### Thermal Characteristics

Symbol	Parameter	Value			Unit	Note
		Min.	Typ.	Max.		
$R_{th(jc)}$	Thermal resistance from Junction to Case		1.18		K/W	Fig. 15
$R_{th(ja)}$	Thermal resistance from Junction to Ambient		40		K/W	

### Electrical Characteristics (T<sub>c</sub> = 25°C unless other wise specified)

#### Static Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
$V_{(BR)DSS}$	Drain-Source Breakdown voltage	$V_{GS} = 0V, I_D = 100\mu A$	650			V	
$V_{GS(th)}$	Gate Threshold voltage	$V_{GS} = V_{DS}, I_D = 5mA$		2.3		V	Fig. 9
		$V_{GS} = V_{DS}, I_D = 5mA, T_j = 175^\circ C$		1.6			
$I_{GSS}$	Gate-Source Leakage current	$V_{GS} = 18V, V_{DS} = 0V$			250	nA	
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 650V, V_{GS} = 0V, T_j = 25^\circ C$		1	50	$\mu A$	
$R_{DS(on)}$	Drain-Source On-state Resistance	$V_{GS} = 15V, I_D = 15A$ $V_{GS} = 18V, I_D = 15A$		90 75	105	m $\Omega$	Fig. 3, 4, 5
		$V_{GS} = 15V, I_D = 15A, T_j = 175^\circ C$ $V_{GS} = 18V, I_D = 15A, T_j = 175^\circ C$		112 105			
$g_{fs}$	Transconductance	$V_{DS} = 15V, I_D = 15A$		10		S	Fig. 6
		$V_{DS} = 15V, I_D = 15A, T_j = 175^\circ C$		9			



### Gate Charge Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
$Q_{GS}$	Gate to Source Charge	$V_{DS} = 400V$ $I_D = 15A$ $V_{GS} = -4V/18V$		11.3		nC	Fig. 10
$Q_{GD}$	Gate to Drain Charge			10.4			
$Q_G$	Total Gate Charge			32			

### AC Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
$C_{iss}$	Input Capacitance	$V_{GS} = 0V, V_{DS} = 600V$ $f = 1\text{ MHz}$ $V_{AC} = 25mV$		721		pF	Fig. 13
$C_{oss}$	Output Capacitance			60		pF	
$C_{rss}$	Reverse Transfer Capacitance			4.9		pF	
$R_{G(int)}$	Internal Gate Resistance	$f = 1\text{ MHz}, V_{AC} = 25mV$		3.8		$\Omega$	



### Reverse Diode Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
$V_{SD}$	Diode Forward Voltage	$V_{GS} = -4V, I_{SD} = 7.5 A$		4.4		V	Fig. 7,8
		$V_{GS} = -4V, I_{SD} = 7.5 A, T_J = 175^{\circ}C$		3.8			
$I_S$	Continuous Diode Forward Current	$V_{GS} = -4V, T_C = 25^{\circ}C$		26		A	
$I_{S, pulse}$	Diode pulse Current	$V_{GS} = -4V$ , pulse width $t_p$ limited by $T_{jmax}$		57		A	
$t_{rr}$	Reverse Recovery Time	$V_{GS} = -4V, I_{SD} = 15 A, V_R = 400V$ $diff/dt = 1000A/us$		17		nS	
$Q_{rr}$	Reverse Recovery Charge			64		nC	
$I_{rrm}$	Peak Reverse Recovery Current			4.9		A	

### Switching Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
$t_{d(on)}$	Turn-On Delay Time	$V_{DS} = 400V, V_{GS} = -4/+18V$ $I_D = 15 A, R_{G(ext)} = 5\Omega$ $L = 200\mu H$		2		nS	Fig.21
$t_r$	Rise Time			14		nS	
$t_{d(off)}$	Turn-Off Delay Time			11		nS	
$t_f$	Fall Time			3.5		nS	
$E_{on}$	Turn-On Energy			44		$\mu J$	Fig.19
$E_{off}$	Turn-Off Energy			16		$\mu J$	
$E_{tot}$	Total switching energy			60		$\mu J$	



## Typical Performance

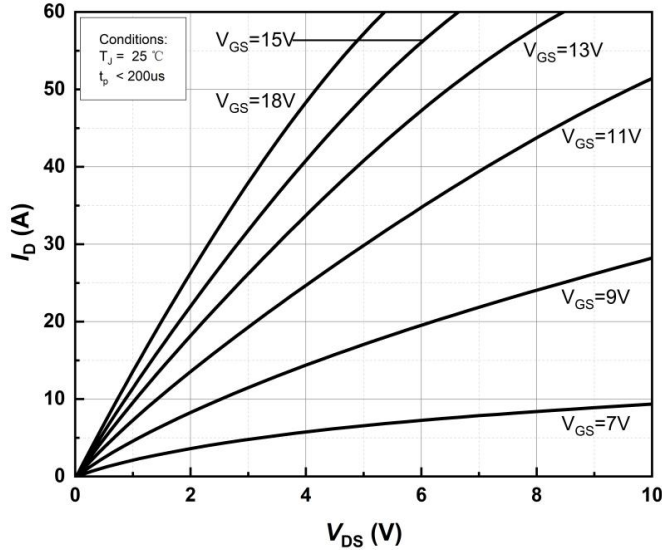


Figure 1. Output characteristics at  $T_j=25^\circ\text{C}$

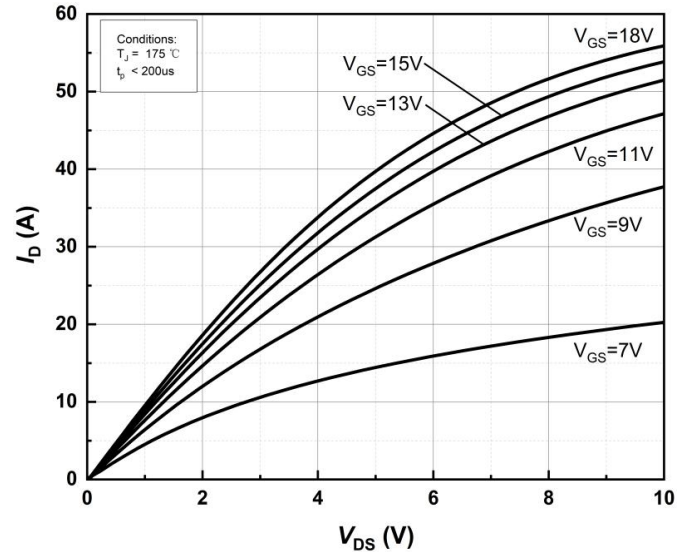


Figure 2. Output characteristics at  $T_j=175^\circ\text{C}$

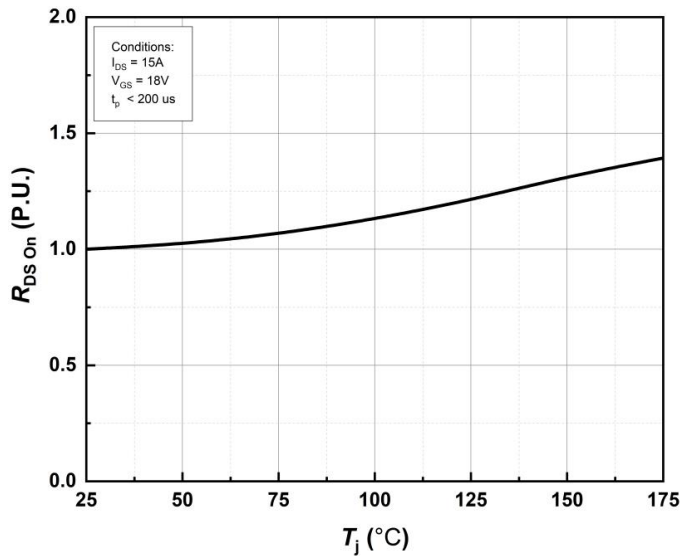


Figure 3. Normalized On-Resistance vs. Temperature

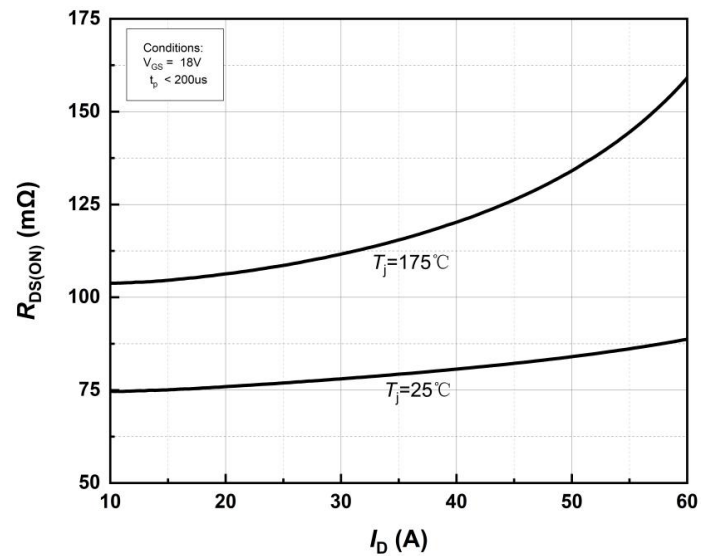


Figure 4. On-Resistance vs. Drain current for Various Temperature

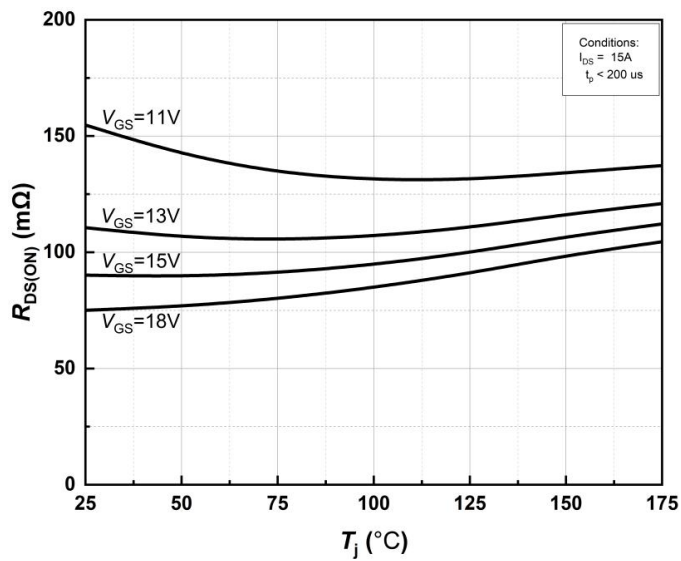


Figure 5. On-Resistance vs. Temperature for Various Gate Voltage

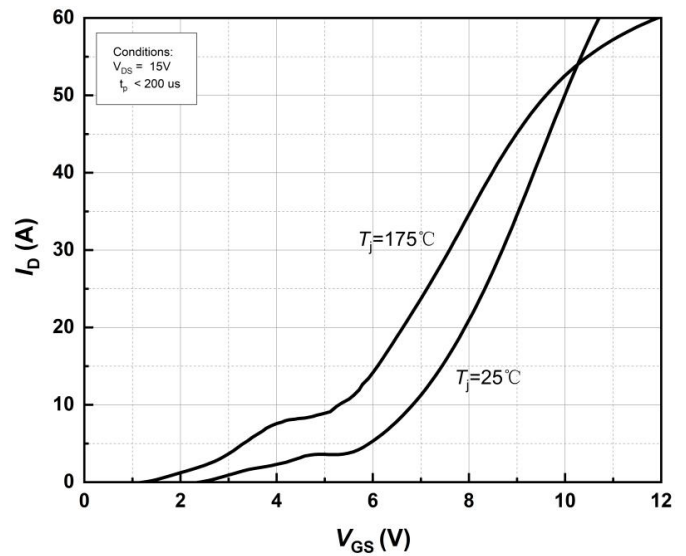


Figure 6. Transfer Characteristics for Various Junction Temperatures

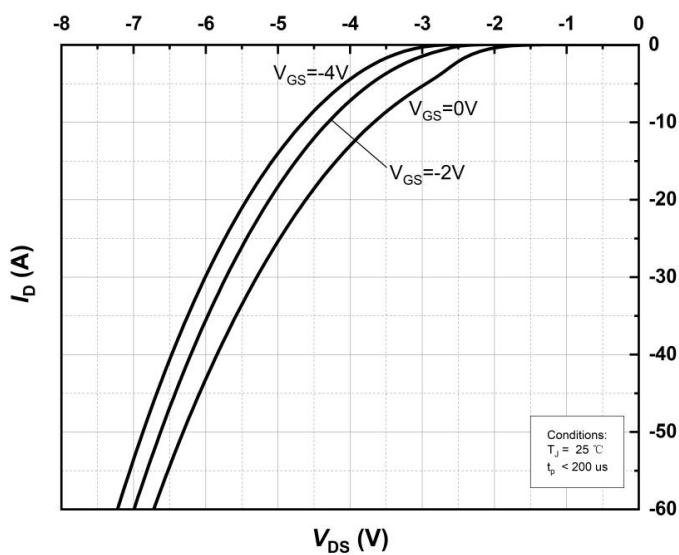


Figure 7. Body Diode Characteristics at  $T_j=25^\circ C$

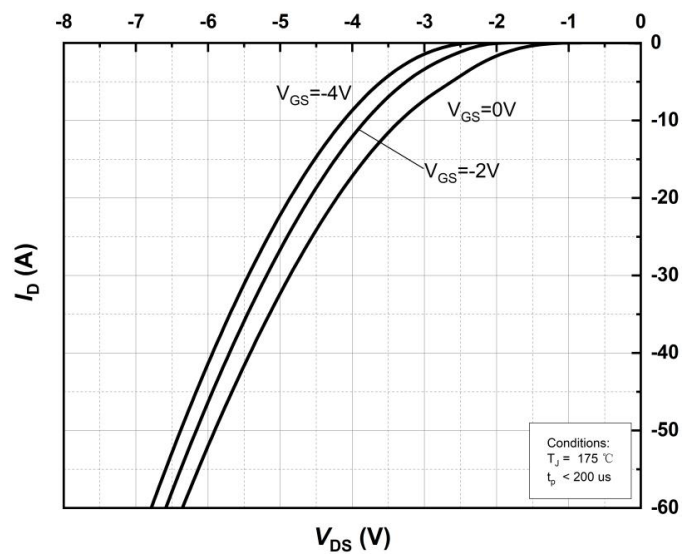


Figure 8. Body Diode Characteristics at  $T_j=175^\circ C$

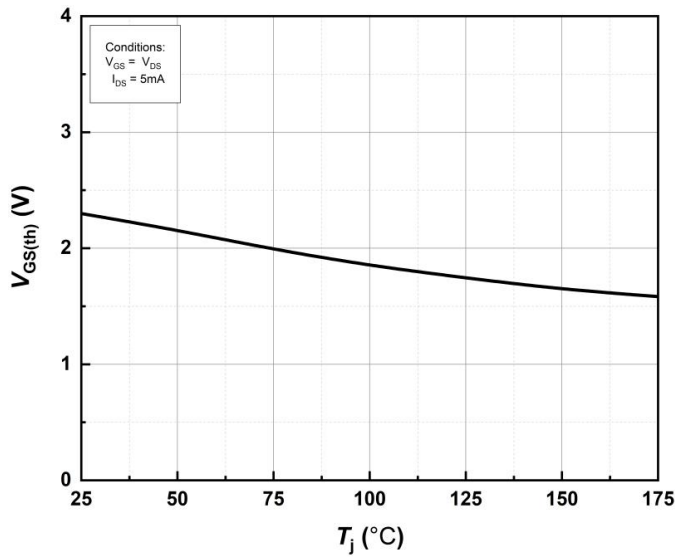


Figure 9. Threshold Voltage vs. Temperature

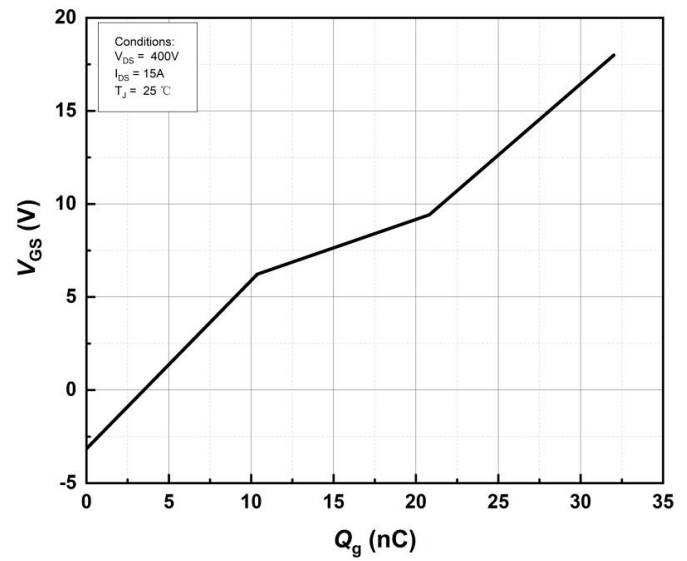


Figure 10 Gate Charge Characteristics

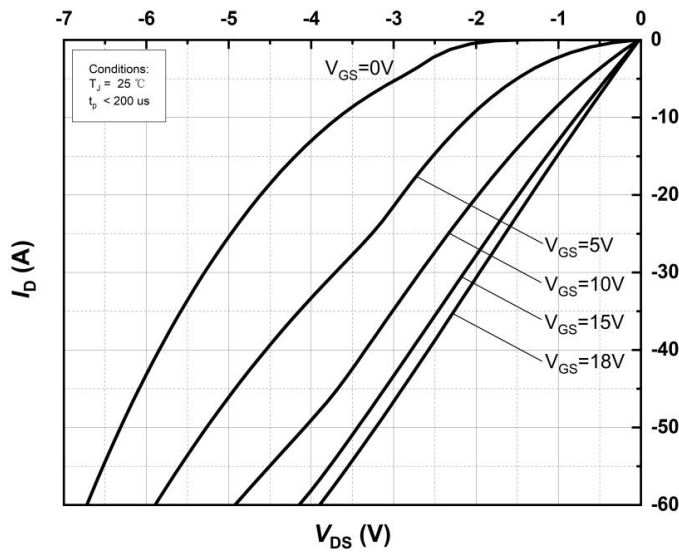


Figure 11. 3rd Quadrant Characteristic at  $T_J=25^{\circ}C$

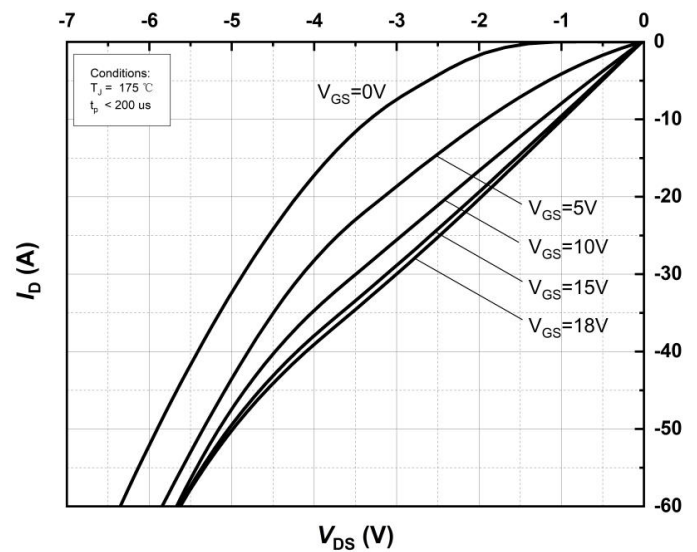


Figure 12. 3rd Quadrant Characteristic at  $T_J=175^{\circ}C$

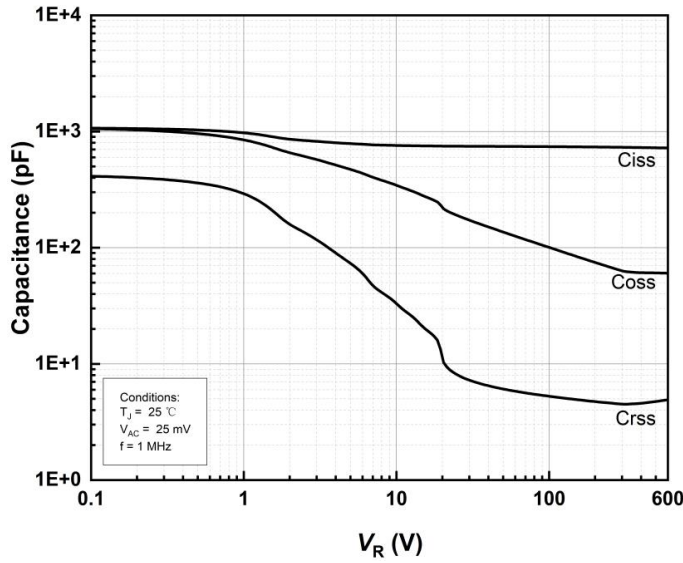


Figure 13. Capacitances vs. Drain-Source Voltage (0 – 600V)

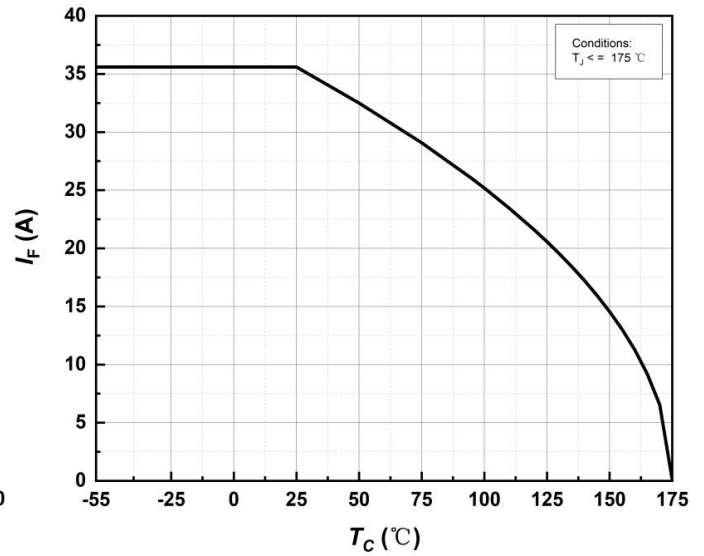


Figure 14. Continuous Drain Current Derating vs Case Temperature

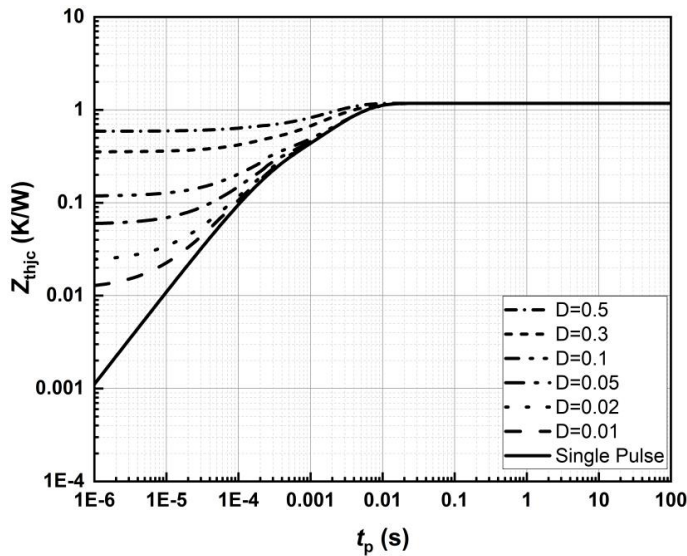


Figure 15. Transient Thermal Impedance (Junction – Case)

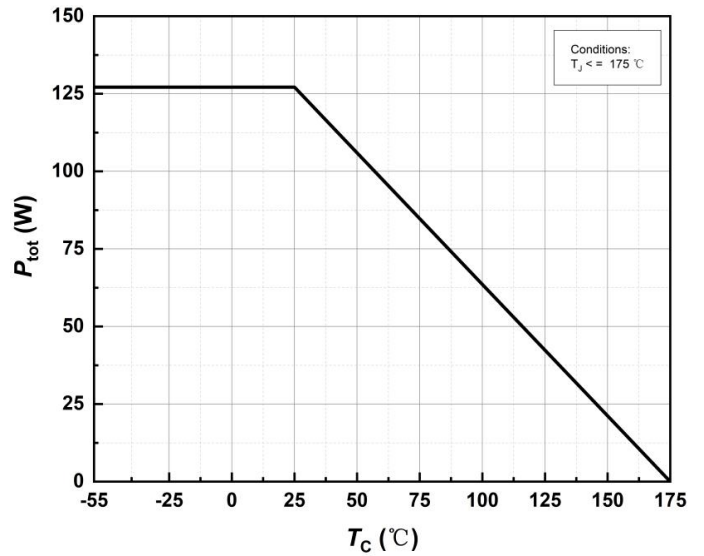


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature



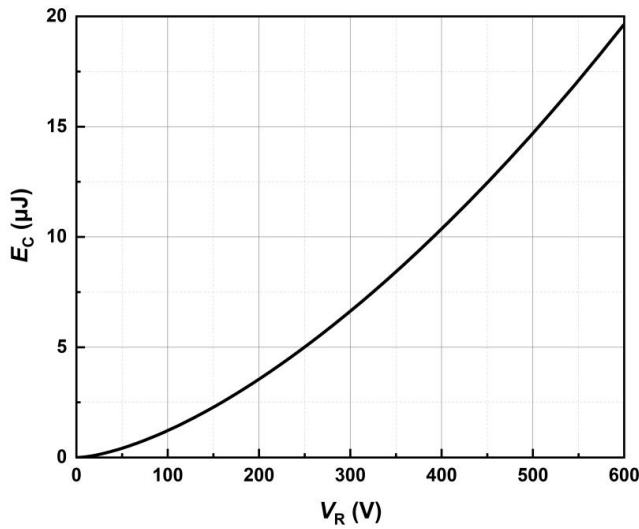


Figure 17. Output Capacitor Stored Energy

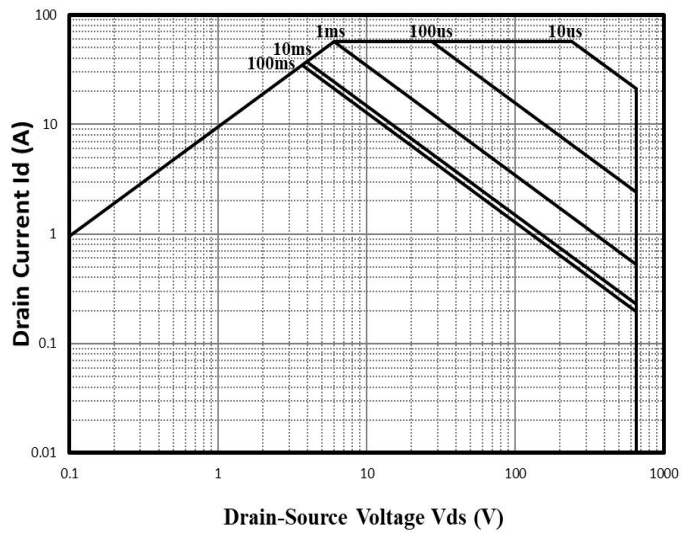


Figure 18. Safe Operating Area

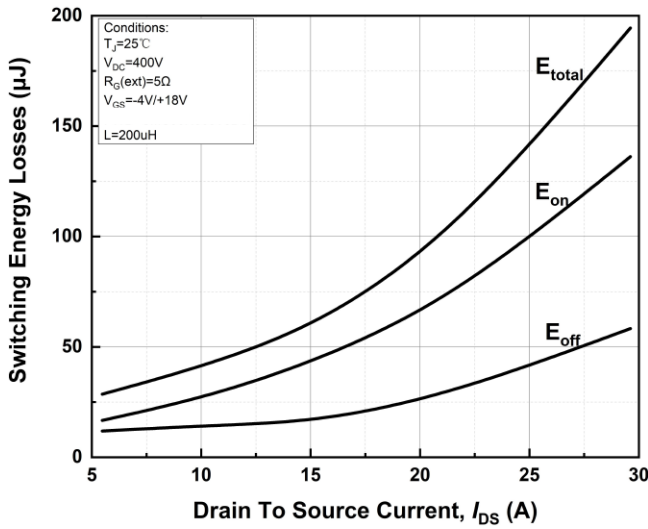


Figure 19. Clamped Inductive Switching Energy vs. Drain Current( $V_{DD} = 400V$ )

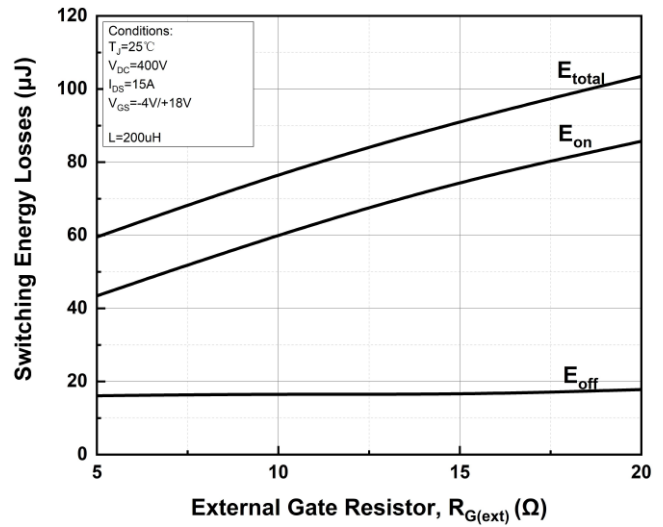


Figure 20. Clamped Inductive Switching Energy vs.  $R_{G(ext)}$

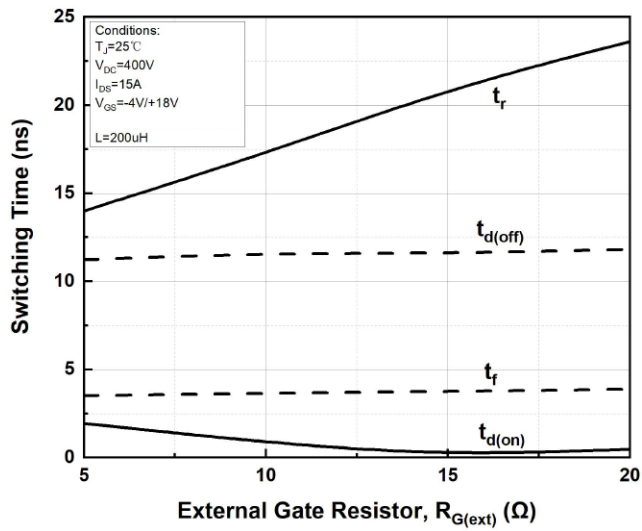
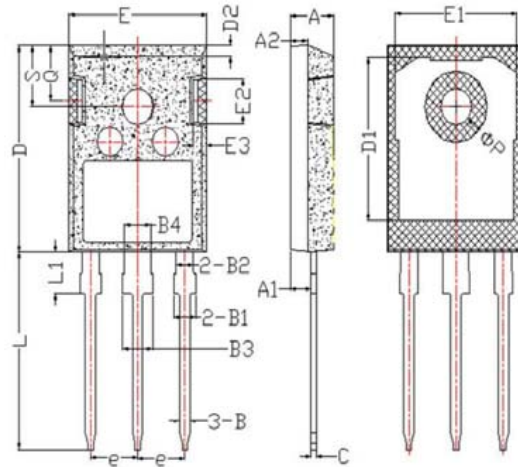


Figure 21. Switching Times vs.  $R_{G(\text{ext})}$



## Package Dimensions

Package TO-247



Items	Values(mm)	
	MIN	MAX
A	4.6	5.2
A1	2.2	2.6
B	0.9	1.4
B1	1.75	2.35
B2	1.75	2.15
B3	2.8	3.35
B4	2.8	3.15
C	0.5	0.7
D	20.6	21.3
D1	16	18
E	15.5	16.1
E1	13	14.7
E2	3.8	5.3
E3	0.8	2.6
e	5.2	5.2
L	19	20.5
L1	3.9	4.6
Φp	3.3	3.7
Q	5.2	6
S	5.8	6.6



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