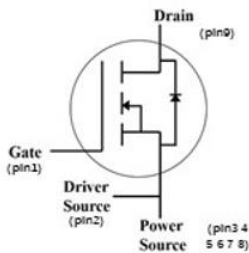
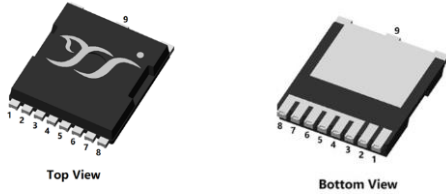


## Silicon Carbide Power MOSFET (N-Channel Enhancement)

$V_{DS}$	650V
$I_D$ (25°C)	86.5A
$R_{DS(on)}$	20mΩ



### Features

- High speed switching
- Essentially no switching losses
- Reduction of heat sink requirements
- Maximum working temperature at 175 °C
- High blocking voltage
- Fast Intrinsic diode with low recovery current
- High-frequency operation
- Halogen free, RoHS compliant

### Typical Applications

Typical applications are in power factor correction(PFC), solar inverter, uninterruptible power supply, motor drives, photovoltaic inverter, electric car and charger.

### Mechanical Data

- **Package:** TOLL
- **Terminals:** Tin plated leads
- **Polarity:** As marked

### ■Maximum Ratings ( $T_c=25^\circ\text{C}$ Unless otherwise specified)

PARAMETER	SYMBOL	UNIT	VALUE	TEST CONDITIONS	NOTE
Device marking code				D206520TLGH	
Drain source voltage @ $T_j=25^\circ\text{C}$	$V_{DS,max}$	V	650	$V_{GS}=0\text{ V}$ , $I_D=100\mu\text{A}$	
Gate source voltage @ $T_j=25^\circ\text{C}$	$V_{GS,max}$	V	-10/+25	Absolute maximum values (AC f > 1Hz, duty cycle < 1%)	Note1
Gate source voltage @ $T_j=25^\circ\text{C}$	$V_{GS,op}$	V	-5/+20	Recommended operational values	
Continuous drain current @ $T_c=25^\circ\text{C}$	$I_D$	A	86.5	$V_{GS}=20\text{V}$ , $T_c=25^\circ\text{C}$	Fig.14
Continuous drain current @ $T_c=110^\circ\text{C}$			55	$V_{GS}=20\text{V}$ , $T_c=110^\circ\text{C}$	
Pulse Drain Current	$I_{D,pulse}$	A	319	Limited by $t_{pw}$	Fig.19
Avalanche energy, Single Pulse	$E_{AS}$	J	3.2	$V_{DD}=75\text{V}$ , $L=32\mu\text{H}$	
Power Dissipation	$P_{TOT}$	W	263	$T_c=25^\circ\text{C}$ , $T_j=175^\circ\text{C}$	Fig.13
Operating junction and Storage temperature range	$T_j, T_{stg}$	$^\circ\text{C}$	-55 to +175		
Soldering temperature	$T_L$	$^\circ\text{C}$	260	1.6mm (0.063") from case for 10s	



### ■Static Electrical Characteristics (Tc=25°C unless otherwise specified)

PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Gate threshold voltage	$V_{GS(th)}$	V	1.5	2.8	4.0	$V_{DS}=V_{GS}, I_D=50mA$	Fig.7,15
Drain source breakdown voltage	$V_{(BR)DSS}$	V	650			$V_{GS}=0, I_D=100\mu A$	
Zero gate voltage drain current	$I_{DSS}$	$\mu A$		<1	100	$V_{DS}=650V, V_{GS}=0V$	
				10	500	$V_{DS}=650V, V_{GS}=0V, T_J=175^\circ C$	
Gate source leakage current	$I_{GSS}$	nA			250	$V_{GS}=20V, V_{DS}=0V$	
Current drain source on-state resistance	$R_{DS(on)}$	m $\Omega$		20	26	$V_{GS}=20V, I_D=50A$	Fig.4,5,6
				30		$V_{GS}=20V, I_D=50A, T_J=175^\circ C$	
Transconductance	$g_f$	S		23.5		$V_{DS}=20V, I_D=50A$	Fig.7

### ■Dynamic Electrical Characteristics (Tc=25°C unless otherwise specified)

PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Input capacitance	$C_{iss}$	pF		5026		$V_{DS}=400V, V_{GS}=0V, T_J=25^\circ C, f=1MHz, V_{AC}=25mV$	Fig.11
Output capacitance	$C_{oss}$			352			
Reverse capacitance	$C_{rss}$			49			
Coss stored energy	$E_{oss}$	$\mu J$		32			Fig.12
Gate source charge	$Q_{gs}$	nC		82.5		$V_{DS}=400V, V_{GS}=-5/20V, I_D=50A$	Fig.16
Gate drain charge	$Q_{gd}$			116.1			
Gate charge	$Q_g$			300.1			
Short-Circuit Withstand Time	$t_{sc}$	$\mu s$		1.6		$R_g=30\Omega, I_D=920A, V_{GS}=-5/20V, V_{DD}=400V$	
Internal Gate Resistance	$R_{G(int)}$	$\Omega$		1.7		$f=1MHz, V_{AC}=25mV$	

### ■Switching Characteristics (Tc=25°C unless otherwise specified)

PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Turn on delay time	$t_{d(on)}$	ns		47.48		$V_{DD}=400V, V_{GS}=-5/+20V, I_D=50A, L=100\mu H, R_{G(ext)}=2.7\Omega$	Fig.17,18,22
Rise time	$t_r$			21.6			
Turn off delay time	$t_{d(off)}$			16.2			
Fall time	$t_f$			38.5			
Turn on switching energy	$E_{on}$	$\mu J$		498.4			
Turn off switching energy	$E_{off}$			189.8			



■Body diode characteristics (Tc=25°C unless otherwise specified)

PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Diode forward voltage	V <sub>SD</sub>	V		2.8		V <sub>GS</sub> =0V, I <sub>SD</sub> =10A	Fig.8
Continuous diode forward current	I <sub>s</sub>	A		44.5		V <sub>GS</sub> =0V, Tc=25°C	
Reverse recovery time	t <sub>rr</sub>	nS		46		V <sub>DS</sub> =400V, V <sub>GS</sub> =0V, I <sub>SD</sub> =30A, di/dt=300A/uS	
Reverse recovery charge	Q <sub>rr</sub>	nC		208.1			
Peak reverse recovery current	I <sub>rrm</sub>	A		6.1			

Note 1: When using SiC Body Diode the maximum recommended V<sub>GS</sub> = -5V

■Thermal Characteristics (T<sub>a</sub>=25°C Unless otherwise specified)

PARAMETER	SYMBOL	UNIT	Value
Thermal resistance	R <sub>θJ-C</sub>	°C/W	0.57

■Typical Characteristics

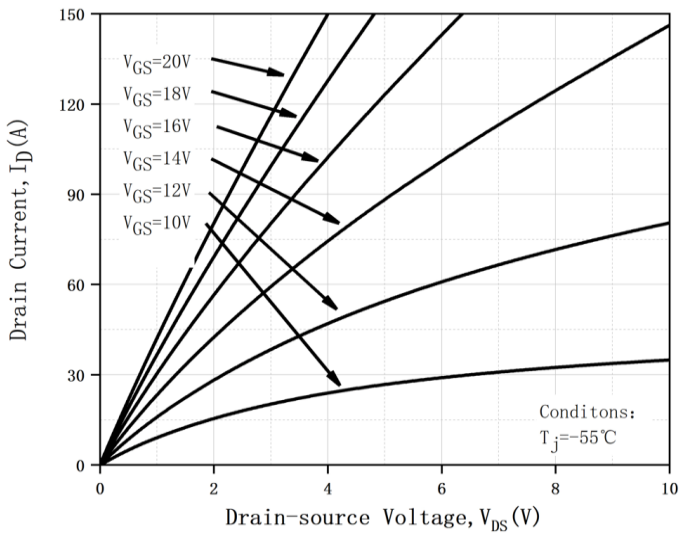


Figure 1. Output Characteristics Tj = -55°C

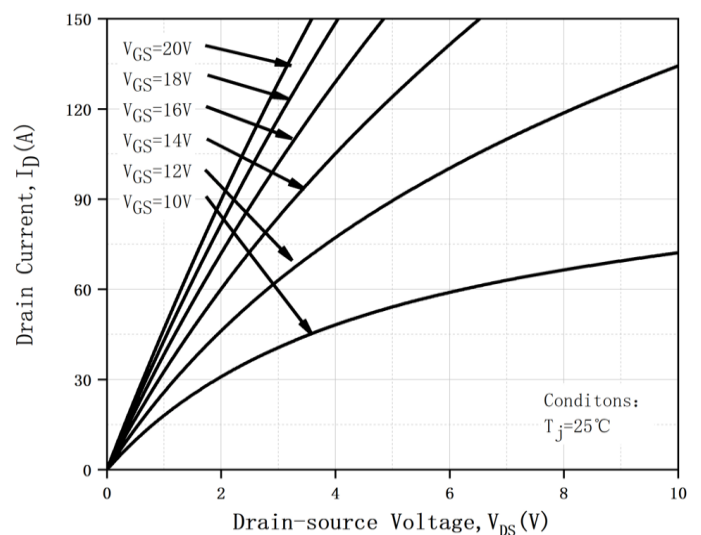


Figure 2. Output Characteristics Tj = 25°C

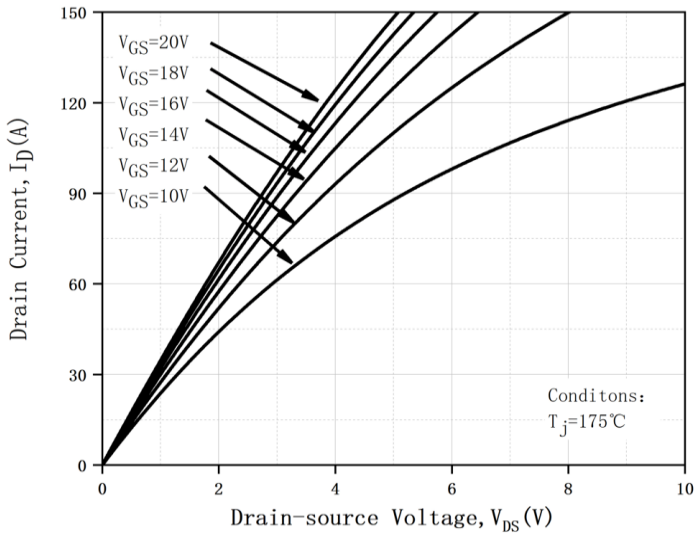


Figure 3. Output Characteristics Tj = 175°C

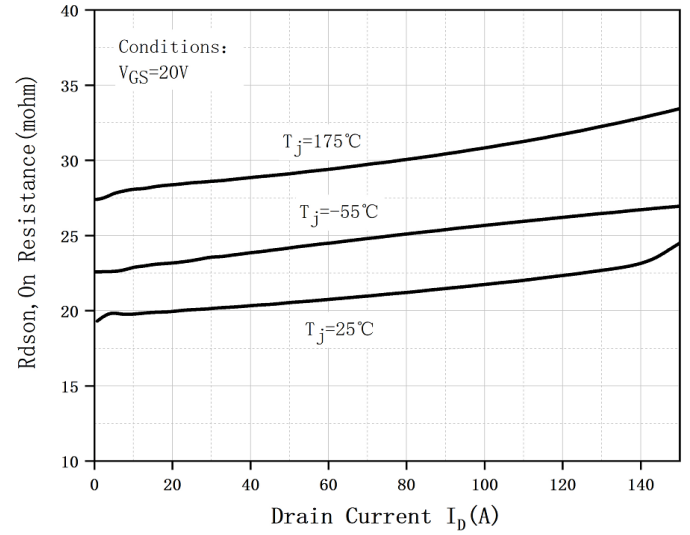


Figure 4. On-resistance vs. drain current

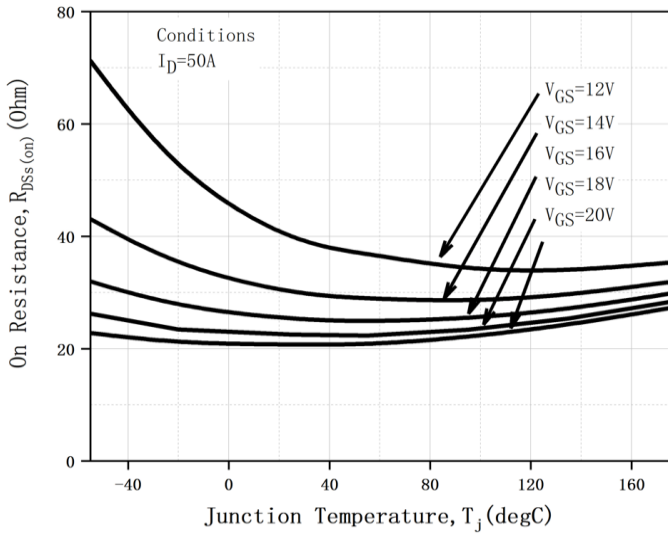


Figure 5. On-resistance vs. Tj for various gate voltage

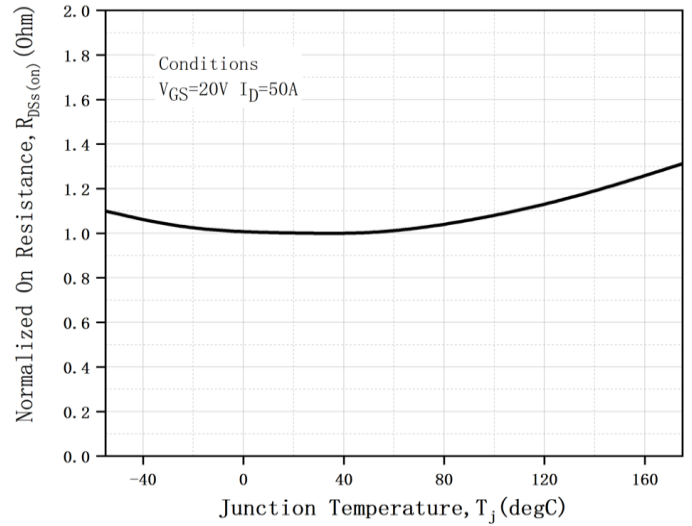


Figure 6. Normalized On-Resistance vs. Temperature

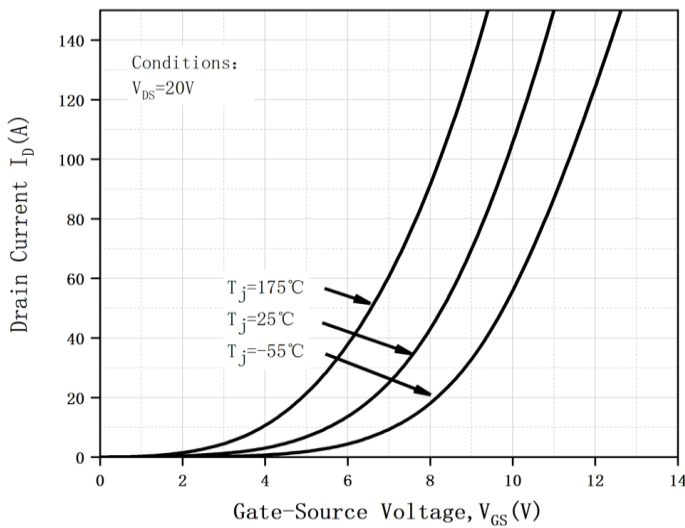


Figure 7. Transfer Characteristics for various Tj

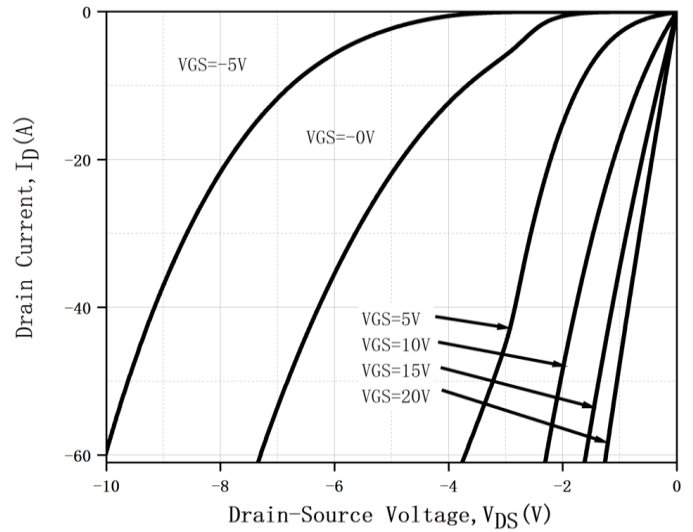


Figure 8. Reverse Output Characteristics at Tj = -55°C

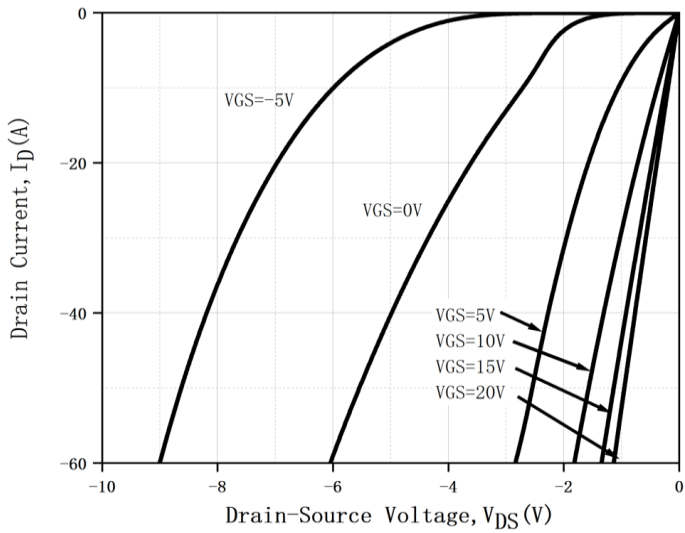


Figure 9. Reverse Output Characteristics at Tj = 25°C

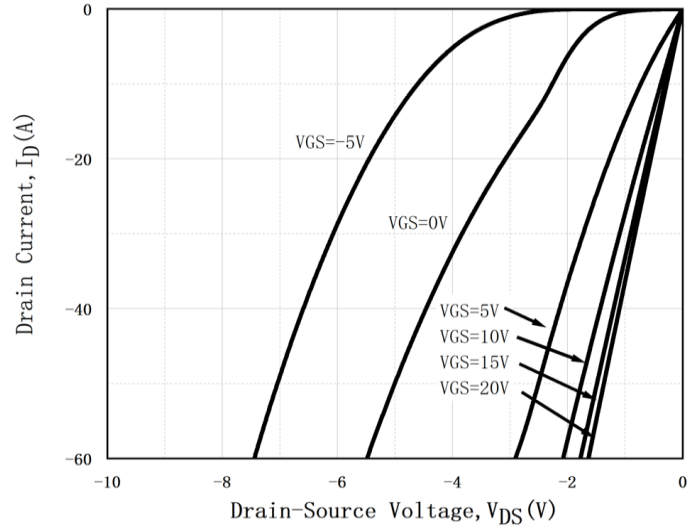


Figure 10. Reverse Output Characteristics at Tj = 175°C

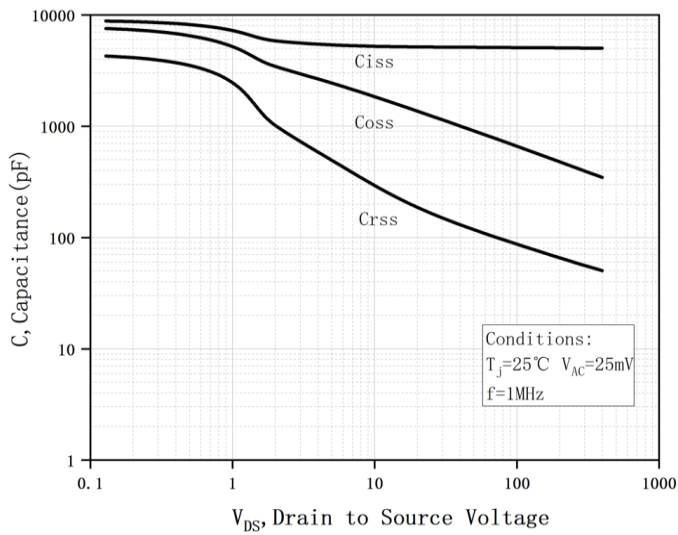


Figure 11. Capacitances vs. Drain to Source Voltage

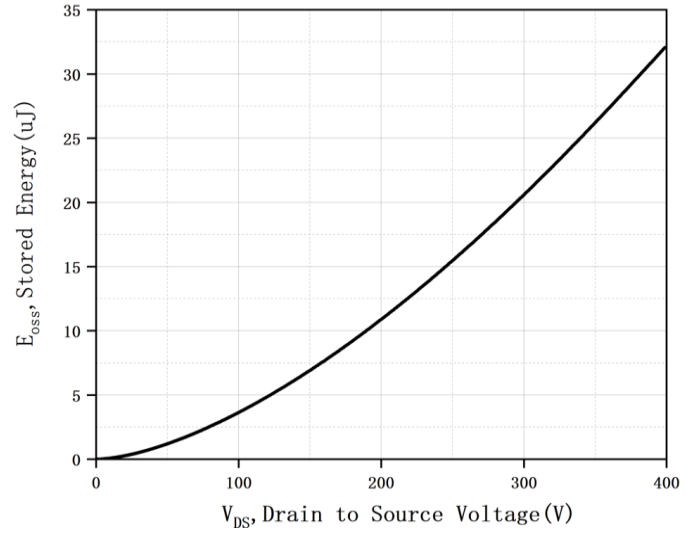


Figure 12. Output Capacitor Stored Energy

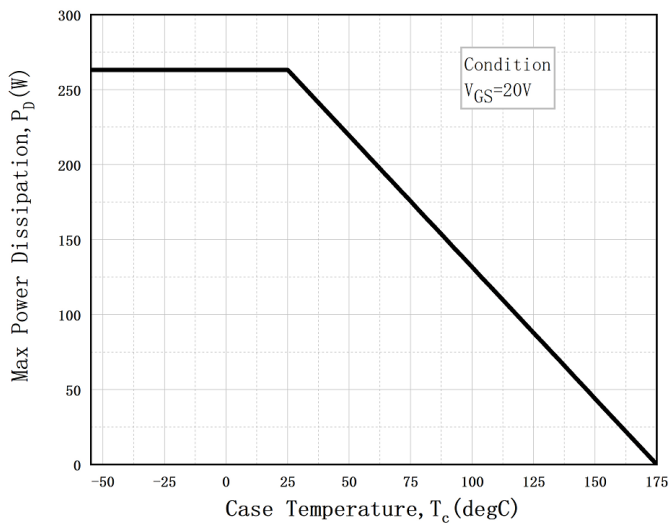


Figure 13. Maximum Power Dissipation Derating vs. Case Temperature

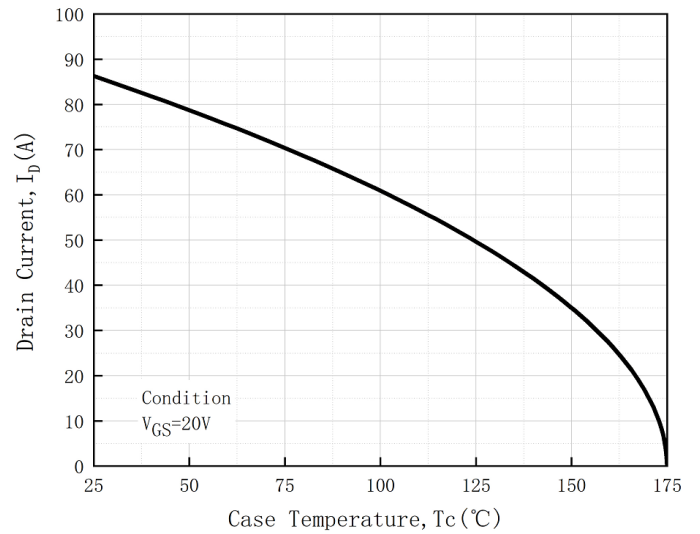


Figure 14. Drain Current vs. Case Temperature

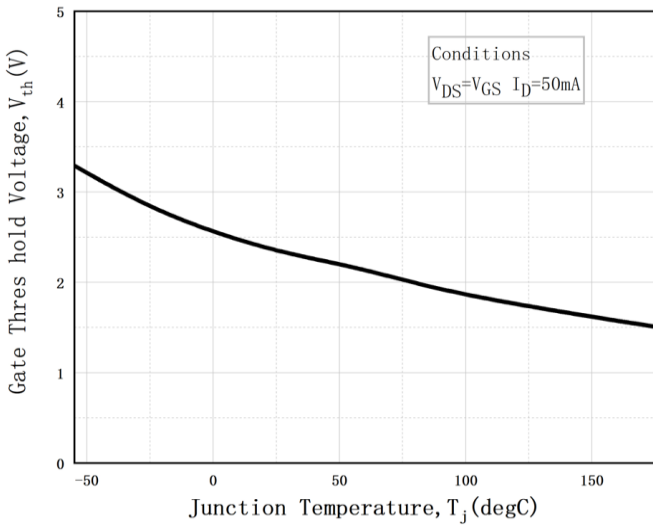


Figure 15. Threshold voltage vs.temperature

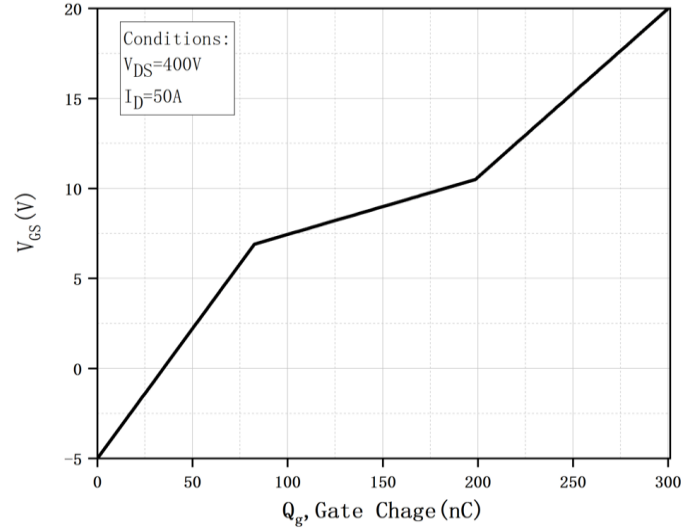


Figure 16. Gate Charge Characteristics

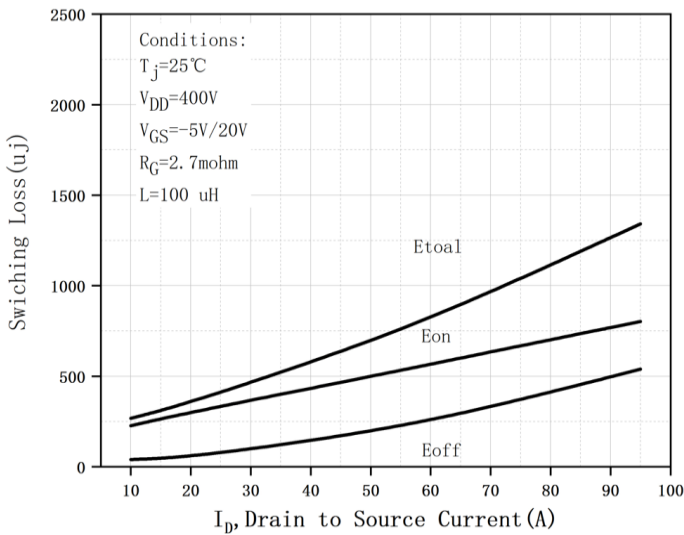


Figure 17. Clamped Inductive Switching Energy vs. Drain Current

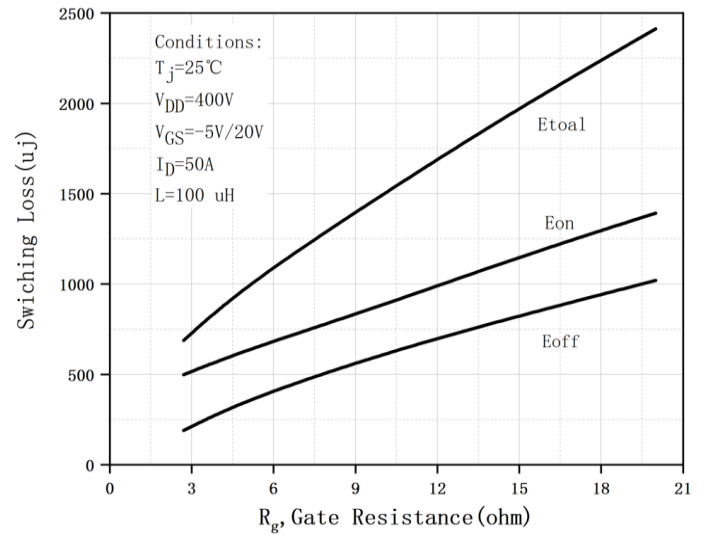


Figure 18. Clamped Inductive Switching Energy vs. External Gate Resistor ( $R_{G(ext)}$ )

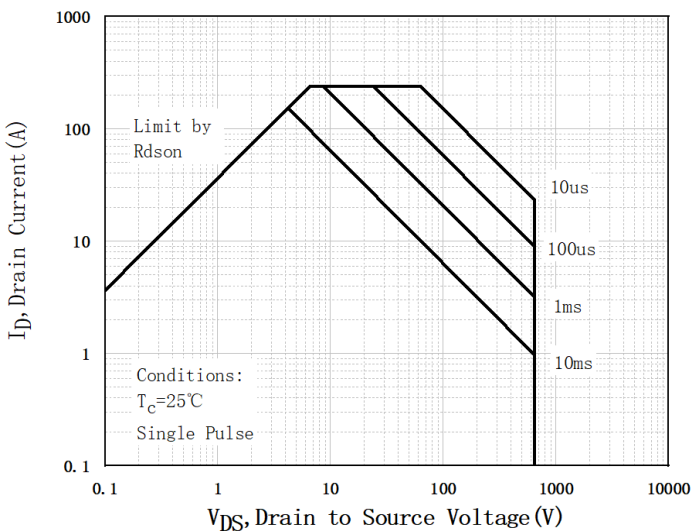


Figure 19. Safe Operating Area

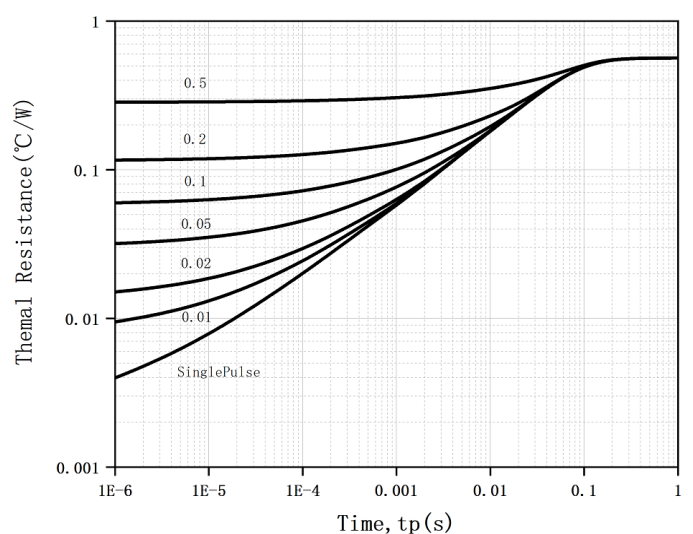


Figure 20. Transient Junction to Case Thermal Impedance

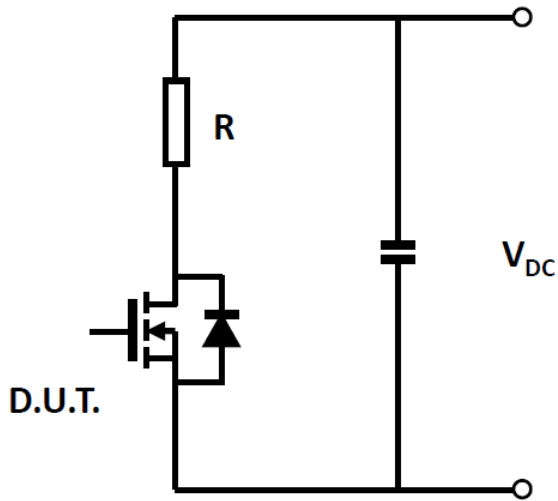


Figure 21. Schematic of Resistive Switching

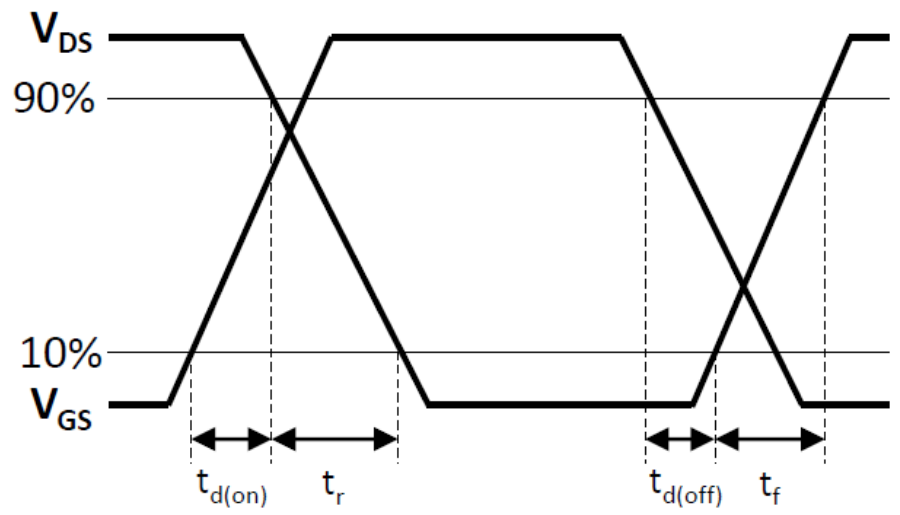
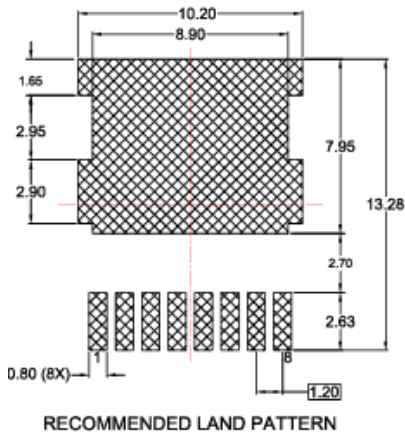
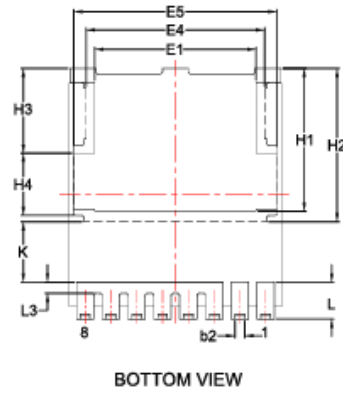
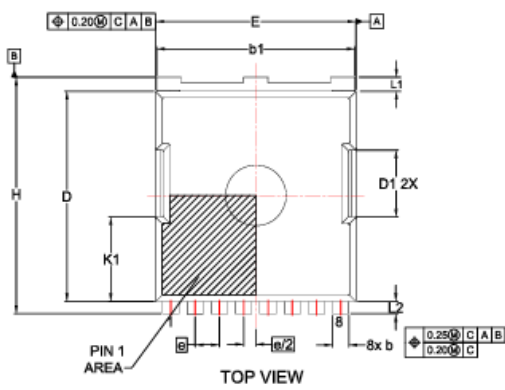


Figure 22. Switching Times Definition

## ■ Outline Dimensions



DIM	MILLIMETERS		
	MIN	NOM	MAX
A	2.20	2.3	2.40
b	0.70	0.80	0.90
b1	0.70	0.80	0.90
b2	0.36	0.46	0.56
c	0.40	0.50	0.60
D	10.28	10.38	10.48
D1	3.30		
E	9.80	9.90	10.00
E1	8.0	8.10	8.20
E4	8.40		
E5	9.40		
e	1.20 BSC		
e2	0.60 BSC		
H	11.58	11.68	11.78
H1	6.56	6.66	6.76
H2	7.05	7.15	7.25
H3	3.50		
H4	3.25		
K	2.70	2.80	2.90
K1	4.18		
L	1.63	1.73	1.83
L1	0.60	0.70	0.80
L2	0.50	0.60	0.70
L3	0.30	0.40	0.50
E	8 REF		





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