

Silicon Carbide Enhancement Mode MOSFET

Features

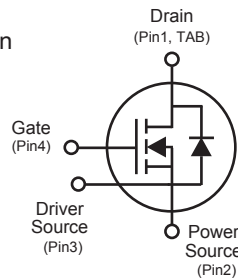
- Low On-Resistance and High Current Capability
- Low Capacitance for High Speed Switching Operation
- Ultra High Avalanche Ruggedness
- Positive Temperature Coefficient Device
- Low Impedance Kelvin Source Pin-Out
- RoHS Compliant and Halogen Free

Benefits

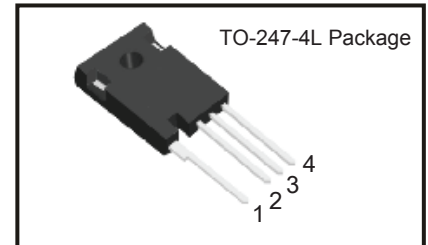
- Higher System Efficiency
- Ease of Paralleling
- Capable of 175°C High T_J Application
- Capable of High Switching Frequency Operating
- Miniaturize and Light Weight System

Applications

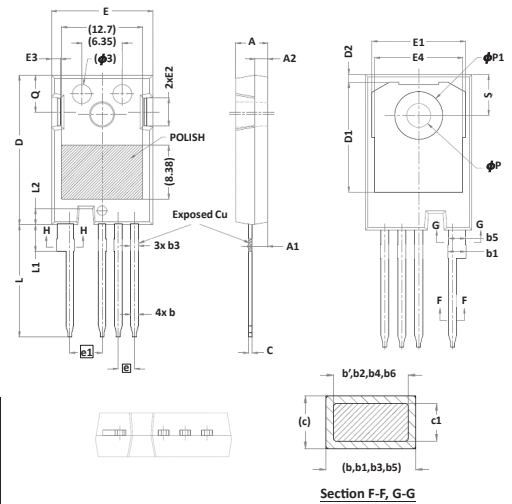
- Switching Mode Power Supply
- DC/DC Converters, UPS, and PFC
- EV Charging Station
- Motor Drives
- Power Inverters
- Solar/Wind Renewable Energy



V_{DSS}	650V
$I_D(@25^{\circ}C)$	107A
$R_{DS(ON)}$	20m Ω



Package Dimensions



Absolute Maximum Ratings

(T_c = 25°C unless otherwise specified)

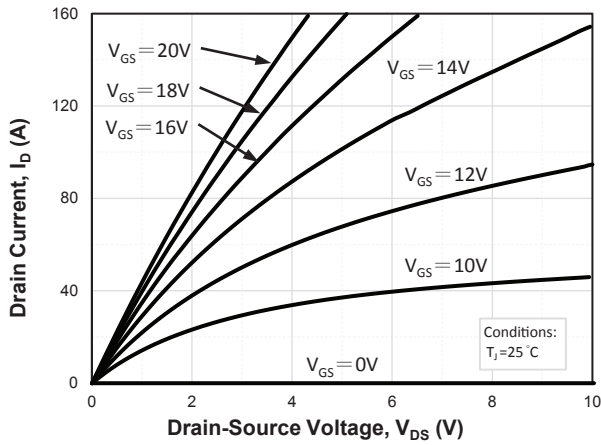
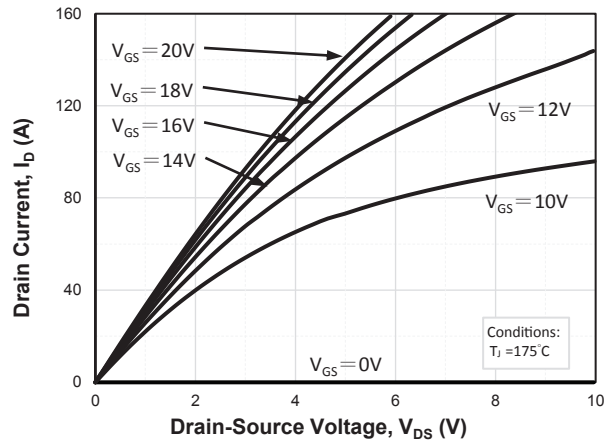
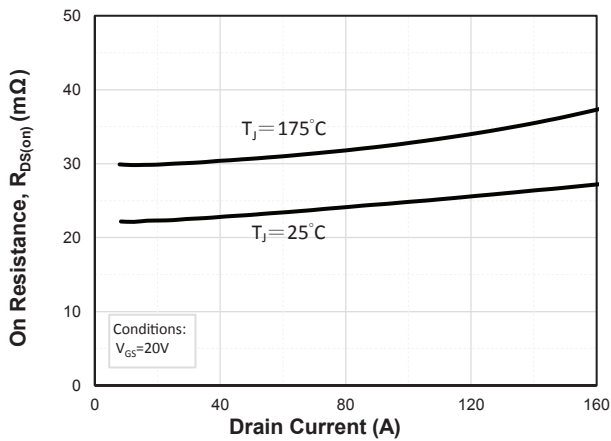
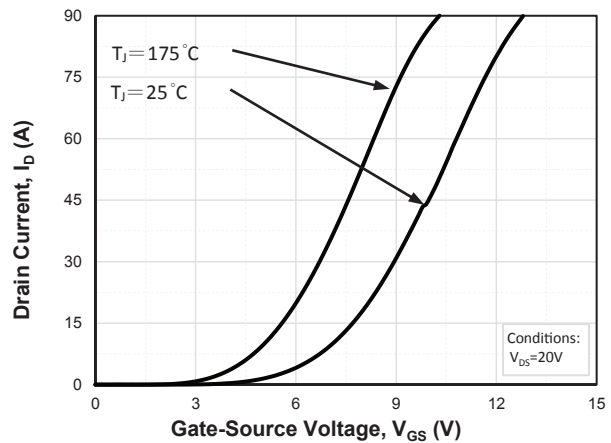
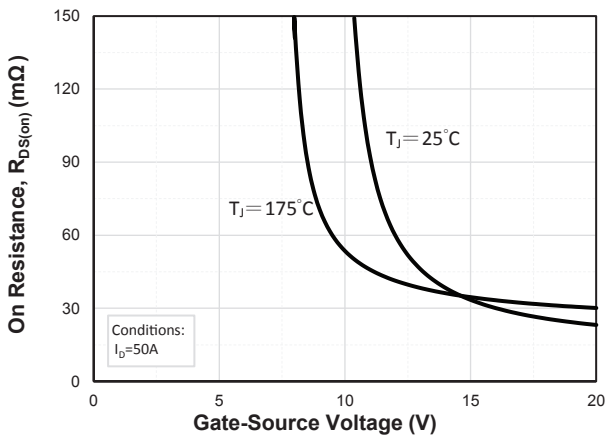
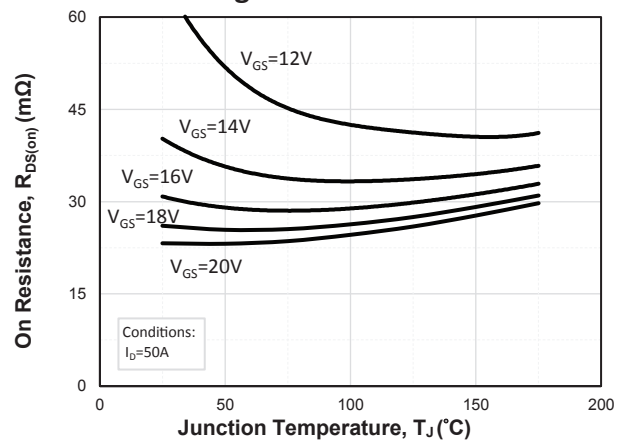
Parameter	Symbol	Ratings	Unit
Drain-Source Voltage	V_{DS}	650	V
Gate-Source Voltage	V_{GS}	-5/+20	V
Drain Current-Continuous @ T _c = 25°C @ T _c = 110°C	I_D	107 72	A
Pulse Drain Current	$I_{D,pulse}$	305	A
Power Dissipation	P_D	375	W
Avalanche Energy, Single Pulse $V_{DD}=100V$ $I_D=14A$	E_{AS}	3.2	J
Storage Temperature Range	T _{STG}	-55 to +175	°C
Operating Junction Temperature Range	T _J	-55 to +175	°C
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.4	°C/W
Mounting Torque (M3 or 6-32 screw)	M_d	1.0	N m

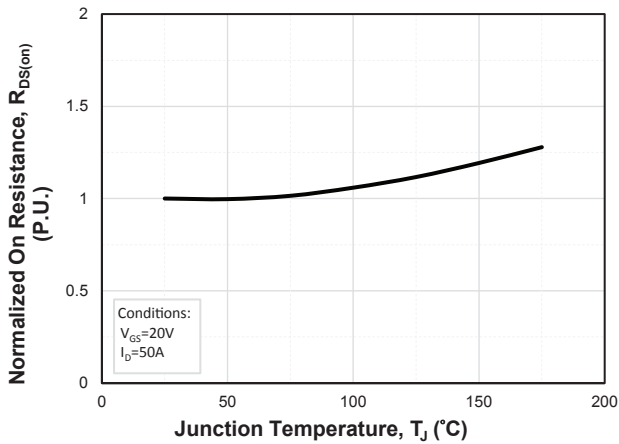
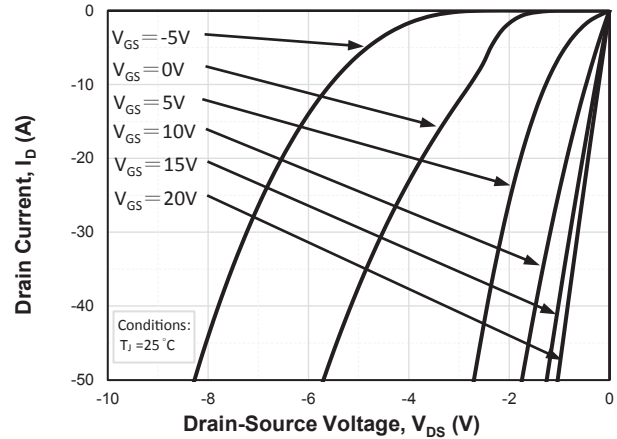
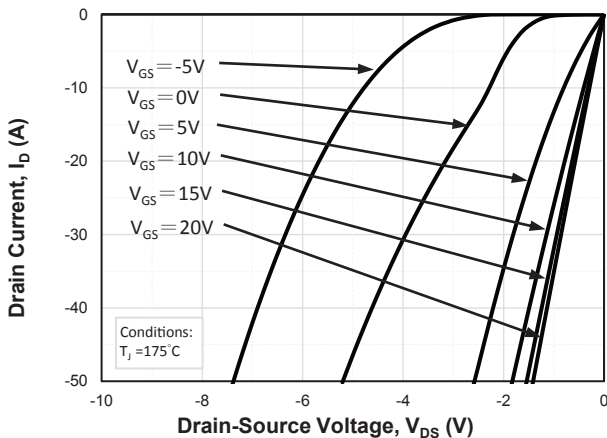
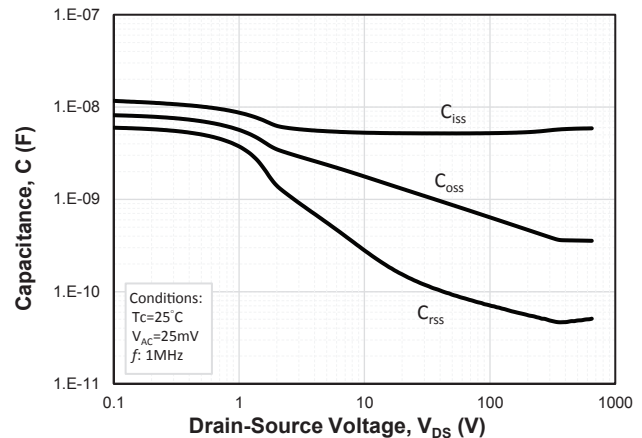
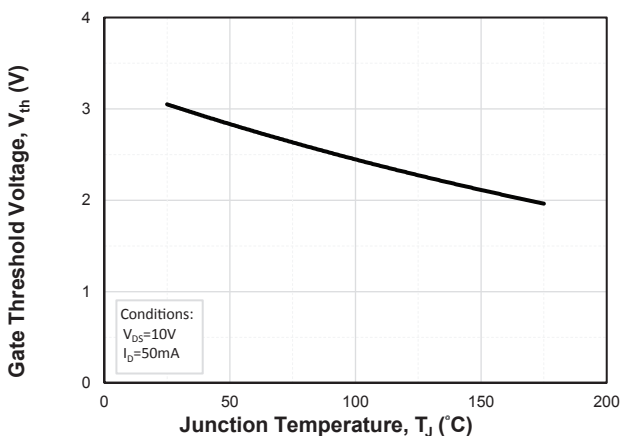
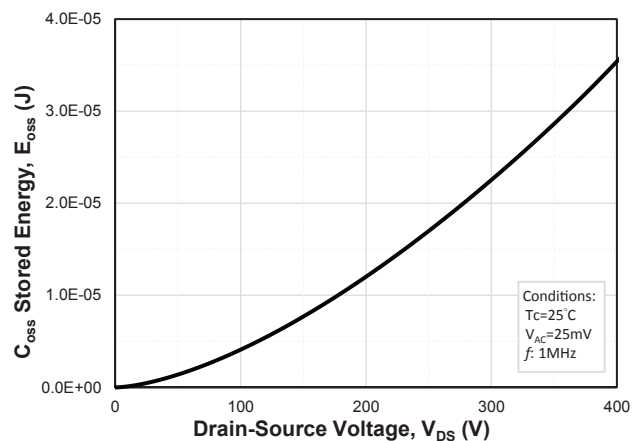
Symbol	mm		
	Min.	Typ.	Max.
A	4.83	5.02	5.21
A1	2.29	2.41	2.54
A2	1.91	2.00	2.16
b'	1.07	1.20	1.28
b	1.07	1.20	1.33
b1	2.39	2.67	2.94
b2	2.39	2.67	2.84
b3	1.07	1.30	1.60
b4	1.07	1.30	1.50
b5	2.39	2.53	2.69
b6	2.39	2.53	2.64
c	0.55	0.60	0.68
c1	0.55	0.60	0.65
D	23.30	23.45	23.60
D1	16.25	16.55	17.65
D2	0.95	1.19	1.25
E	15.75	15.94	16.13
E1	13.10	14.02	14.15
E2	3.68	4.40	5.10
E3	1.00	1.45	1.90
E4	12.38	13.26	13.43
e	2.54 BSC		
e1	5.08 BSC		
L	17.31	17.57	17.82
L1	3.97	4.19	4.37
L2	2.35	2.50	2.65
phi P	3.51	3.61	3.65
phi P1	7.19 REF.		
Q	5.49	5.79	6.00
S	6.04	6.17	6.30

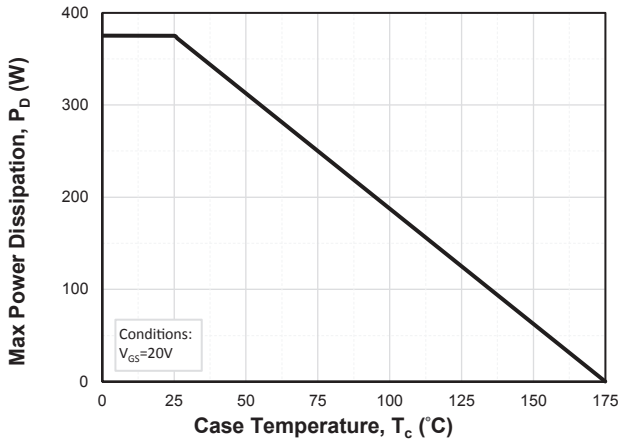
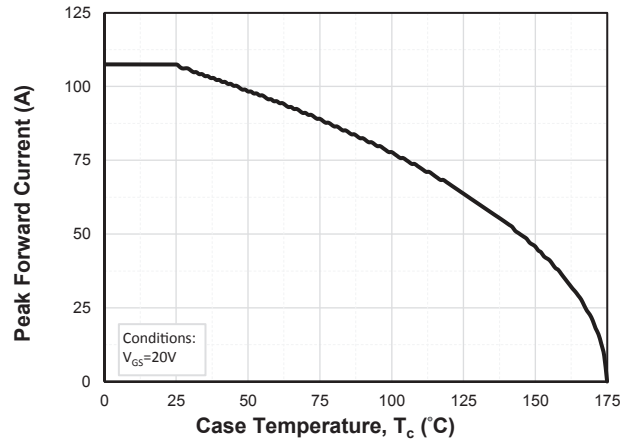
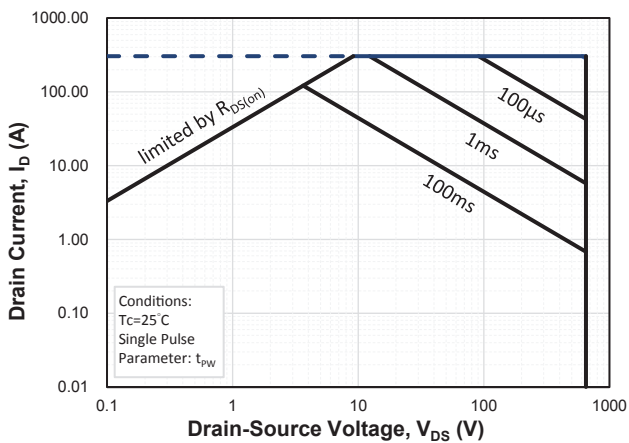
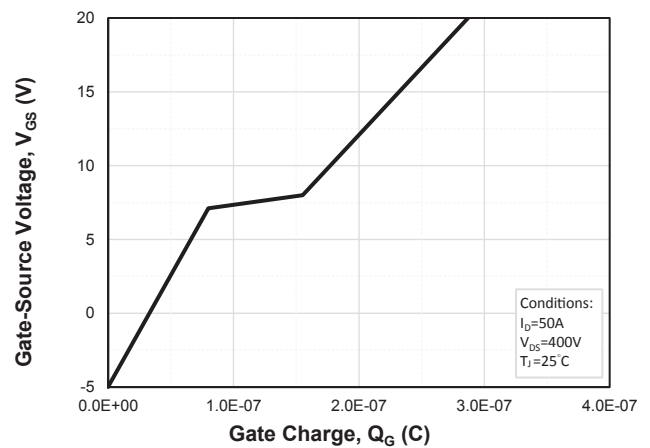
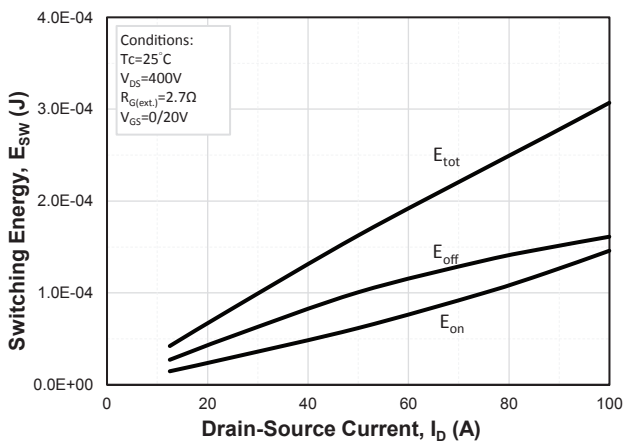
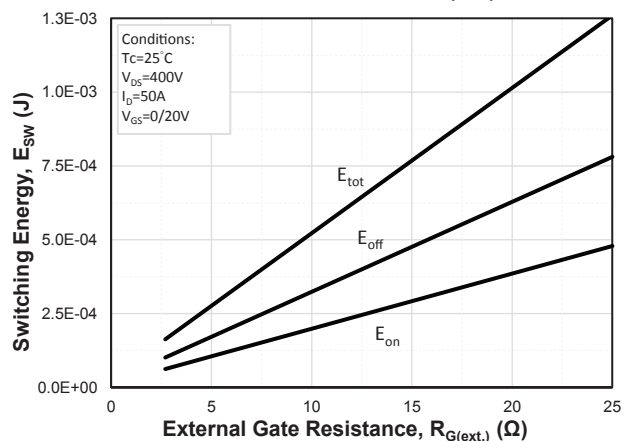
Electrical Characteristics @ $T_c = 25^\circ\text{C}$ (unless otherwise specified)

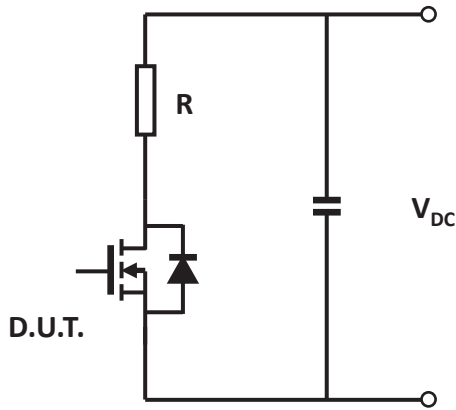
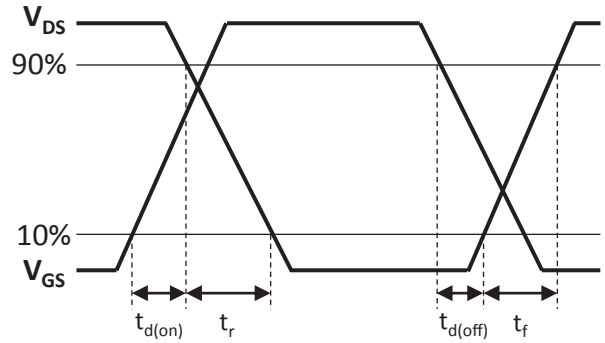
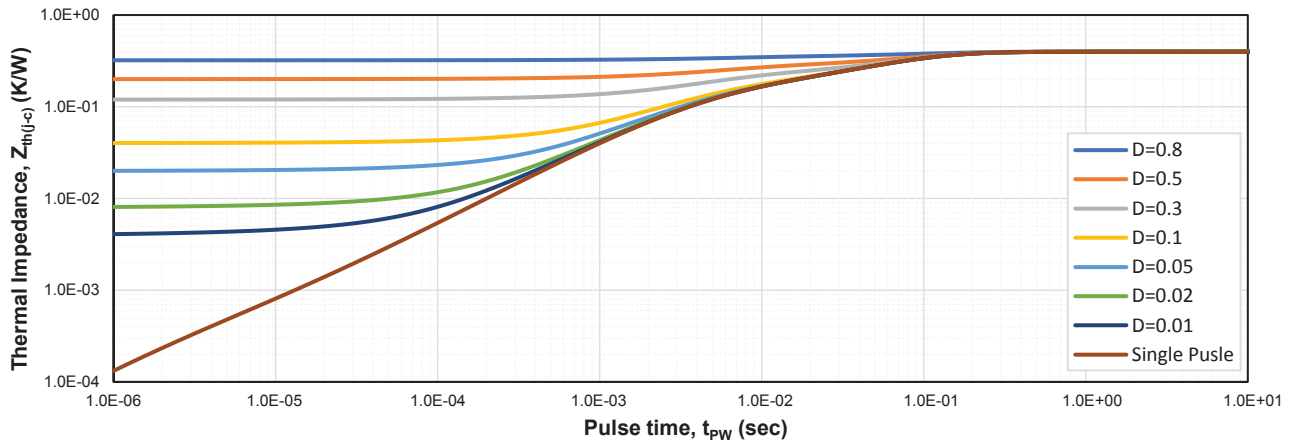
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
OFF Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_{DS}=0.1mA$	650	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS}=0V, V_{DS}=650V$	-	<1	100	μA
Gate-Source Leakage Current	I_{GSS}	$V_{GS}=20V, V_{DS}=0V$	-	-	250	nA
ON Characteristics						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=10V, I_{DS}=50mA$	-	2.6	-	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=20V, I_{DS}=50A$	-	20	26	m Ω
Internal Gate Resistance	$R_{G(int.)}$	$f=1MHz, V_{AC}=25mV$	-	0.6	-	Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	$V_{DS}=400V$	-	4838	-	pF
Output Capacitance	C_{oss}	$V_{GS}=0V$	-	359	-	
Reverse Transfer Capacitance	C_{rss}	$V_{AC}=25mV$ Freq.=1MHz	-	47	-	
C_{oss} Stored Energy	E_{oss}	$V_{GS}=0V, V_{DS}=400V$ Freq.=1MHz, $V_{AC}=25mV$	-	34	-	μJ
Turn-On Switching Energy	E_{on}	$V_{DD}=400V$ $V_{GS}=0V/+20V, I_D=50A$	-	61.7*	-	
Turn-Off Switching Energy	E_{off}	$R_{G(ext.)}=2.7\Omega$	-	101*	-	
Switching Characteristics						
Turn-On Delay Time	$t_{d(on)}$	$V_{DD}=400V$	-	29	-	ns
Rise Time	t_r	$V_{GS}=-4/+20V$	-	51	-	
Turn-Off Delay Time	$t_{d(off)}$	$I_D=35A, R_L=11.4\Omega$	-	30	-	
Fall Time	t_f	$R_{G(ext.)}=2.7\Omega$	-	16	-	
Total Gate Charge	Q_g	$V_{DS}=400V$	-	287	-	nC
Gate to Source Charge	Q_{gs}	$V_{GS}=-5/+20V$	-	80	-	
Gate to Drain Charge	Q_{gd}	$I_D=50A$	-	75	-	
Body Diode Characteristics						
Inverse Diode Forward Voltage	V_{SD}	$V_{GS}=0V, I_{SD}=10A$	-	2.9	-	V
Continuous Diode Forward Current	I_S	$V_{GS}=0V, T_c=25^\circ C$	-	61.5	-	A
Reverse Recovery Time	T_{rr}	$V_{GS}=0V$	-	77	-	ns
Reverse Recovery Charge	Q_{rr}	$I_{SD}=30A, V_{DS}=400V,$ $di/dt=300A/\mu s$	-	301	-	nC
Peak Reverse Recovery Current	I_{rrm}		-	6.9	-	A

*Based on the results of calculation, note that the energy loss caused by the reverse recovery of free-wheeling diode is not included in Eon.

Typical Device Performance
Fig.1 Forward Output Characteristics at $T_J=25^\circ\text{C}$

Fig.2 Forward Output Characteristics at $T_J=175^\circ\text{C}$

Fig.3 On-Resistance vs. Drain Current for Various T_J

Fig.4 Transfer Characteristics for Various T_J

Fig.5 On-Resistance vs. Gate Voltage for Various T_J

Fig.6 On-Resistance vs. Temperature for Various Gate Voltage


Typical Device Performance
Fig.7 Normalized On-Resistance vs. Temperature

Fig.8 Reverse Output Characteristics at $T_J = 25^\circ\text{C}$

Fig.9 Reverse Output Characteristics at $T_J = 175^\circ\text{C}$

Fig.10 Capacitances vs. Drain to Source Voltage

Fig.11 Threshold Voltage vs. Temperature

Fig.12 Output Capacitor Stored Energy


Typical Device Performance
Fig.13 Maximum Power Dissipation Derating vs. Case Temperature

Fig.14 Drain Current Derating vs. Case Temperature

Fig.15 Safe Operating Area

Fig.16 Gate Charge Characteristics

Fig.17 Clamped Inductive Switching Energy vs. Drain Current

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


Typical Device Performance
Fig.19 Schematic of Resistive Switching

Fig.20 Switching Times Definition

Fig.21 Transient Junction to Case Thermal Impedance


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