

Silicon Carbide MOSFET

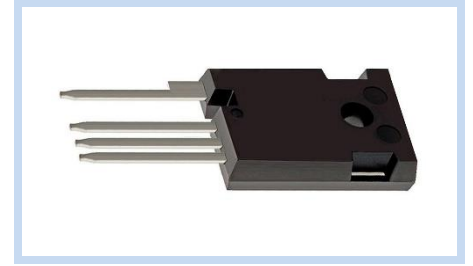
N-Channel 650V 54A TO-247-4

MFTC65N54T2474

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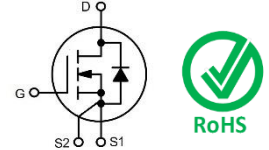
FEATURE

- $R_{DS(ON)} < 80m\Omega$ at $V_{GS}=18V$, $I_D=15A$
- Low On-Resistance with High Blocking Voltage
- Low Capacitances with High-Speed switching
- Low Reverse Recovery Charge
- Applications: High Voltage DC-DC Converter, Switching Mode Power Supplier, EV Battery Chargers, Renewable Energy



MECHANICAL DATA

- Case: TO-247-4 Package
- Terminals: Solderable per MIL-STD-750, Method 2026



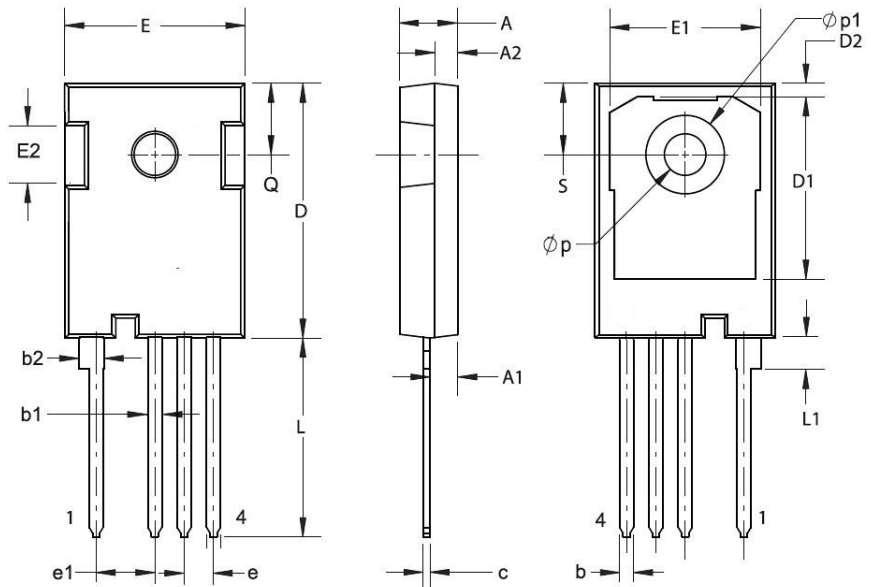
MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	650	V
Gate-Source Voltage	Dynamic (f >1Hz)	-10/+25	V
	Static	-4/+18	
Continuous Drain Current	I_D	$V_{GS}=18V$, $T_C=25^\circ C$	54
		$V_{GS}=18V$, $T_C=100^\circ C$	38
Drain Current – Pulse with t_p Limited by T_{jmax}	I_{DM}	at 1ms	93
		at 100 μs	231
Power Dissipation	P_D	203	W
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.74	$^\circ C / W$
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 175	$^\circ C$

DIMENSIONS

TO-247-4	Min (mm)	Max (mm)
A	4.80	5.21
A1	2.21	2.61
A2	1.80	2.20
b	1.06	1.36
b1	1.07	1.60
b2	2.33	2.94
c	0.51	0.75
D	23.30	23.60
D1	16.25	17.65
e	2.54 BSC	
e1	5.08 BSC	
E	15.74	16.14
E1	13.10	14.32
L	17.27	17.87
L1	3.97	4.39
p	3.40	3.80
p1	7.19 REF	
Q	5.49	6.09

Note: 1:Drain(D), 2:Source(S2), 3:Source(S1), 4:Gate(G)



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ELECTRICAL CHARACTERISTICS

Off Characteristics	Conditions	Symbol	Min	Typ.	Max	Unit	
Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=100\mu A$	BV_{DSS}	650	--	--	V	
Zero Gate Voltage Drain Current	$V_{DS}=650V, V_{GS}=0V$	I_{DSS}	--	1	50	μA	
Gate-Body Leakage Current	$V_{GS}=18V, V_{DS}=0V$	I_{GSS}	--	--	250	nA	
On Characteristics	Conditions	Symbol	Min	Typ.	Max	Unit	
Static Drain-Source On-Resistance	$V_{GS}=18V, I_D=15A$	$R_{DS(on)}$	--	55	80	m Ω	
	$V_{GS}=18V, I_D=15A, T_J=175^\circ C$		--	90	--		
Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=5mA$	$V_{GS(th)}$	--	2.8	--	V	
	$V_{GS}=V_{DS}, I_D=5mA, T_J=175^\circ C$		--	1.8	--		
Transconductance	$V_{GS}=18V, I_D=15A$	g_{fs}	--	18	--	S	
	$V_{GS}=18V, I_D=15A, T_J=175^\circ C$		--	11	--		
Dynamic Characteristics	Conditions	Symbol	Min	Typ.	Max	Unit	
Total Gate Charge	$V_{DS}=400V, I_D=15A, V_{GS}=-4/+18V$	Q_g	--	54	--	nC	
Gate-Source Charge		Q_{gs}	--	14	--		
Gate-Drain Charge		Q_{gd}	--	11	--		
Turn-On Delay Time	$V_{DS}=400V, I_D=20A, L=276\mu H$ $V_{GS}=-4/+18V, R_{GEN}=5\Omega,$	$T_{d(on)}$	--	10.3	--	nS	
Rise Time		T_r	--	8.9	--		
Turn-Off Delay Time		$T_{d(off)}$	--	16.3	--		
Fall Time		T_f	--	8	--	μJ	
Turn-On Switching Loss		E_{ON}	--	47.9	--		
Turn-Off Switching Loss		E_{OFF}	--	45.8	--		
Total Switching Energy		E_{TOT}	--	93.7	--		
Input Capacitance		$V_{DS}=600V, V_{GS}=0V, V_{AC}=25mV$ $f=1MHz$	C_{iss}	--	1410	--	pF
Output Capacitance			C_{oss}	--	119	--	
Reverse Transfer Capacitance	C_{rss}		--	4	--		
Drain-Source Body Diode	Conditions	Symbol	Min	Typ.	Max	Unit	
Drain-Source Diode Forward Voltage	$V_{GS}=-4V, I_{SD}=8.8A$	V_{SD}	--	3.9	--	V	
	$V_{GS}=-4V, I_{SD}=8.8A, T_J=175^\circ C$		--	3.2	--		
Diode Forward Current - Continuous	$V_{GS}=-4V, T_C=25^\circ C$	I_S	--	45	--	A	
Peak Reverse Recovery Current	$V_R=400V, I_{SD}=20A, V_{GS}=-4V,$ $dif/dt = 2500A/\mu s$	I_{rm}	--	11.6	--	A	
Reverse Recovery Time		T_{rr}	--	31.7	--	nS	
Reverse Recovery Charge		Q_{rr}	--	188.5	--	nC	

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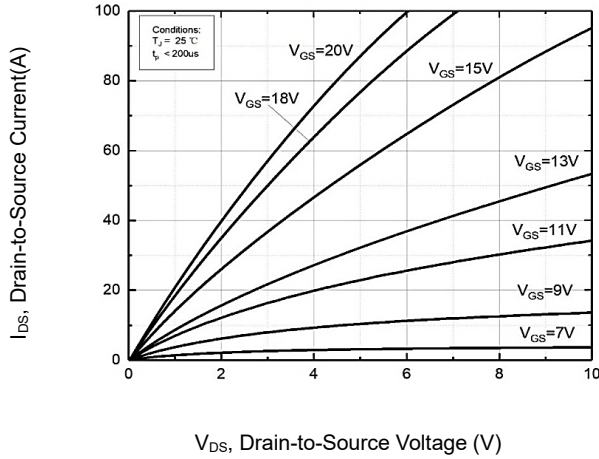
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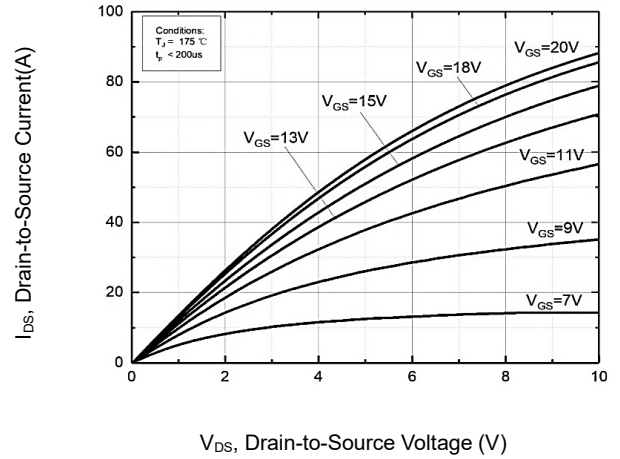
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CHARACTERISTIC CURVES

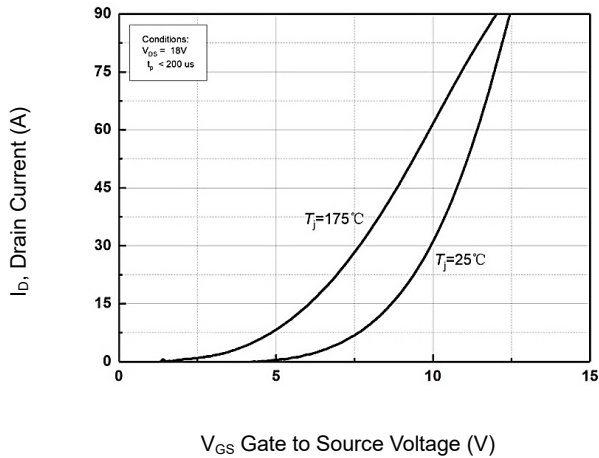
Output Characteristics



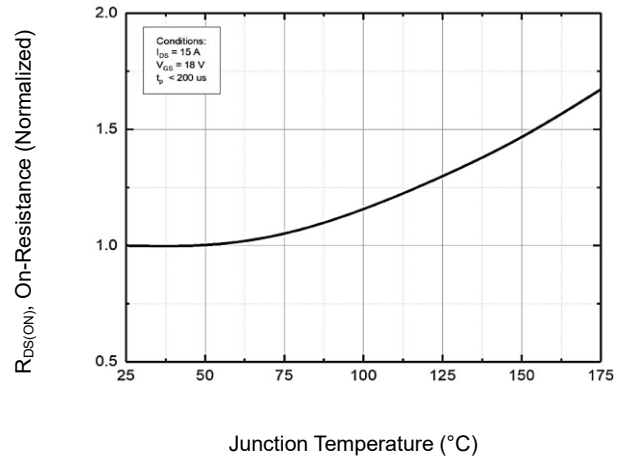
Output Characteristics



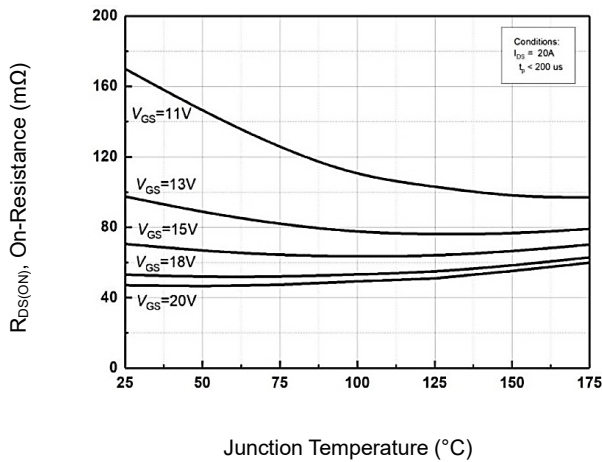
Transfer Characteristic



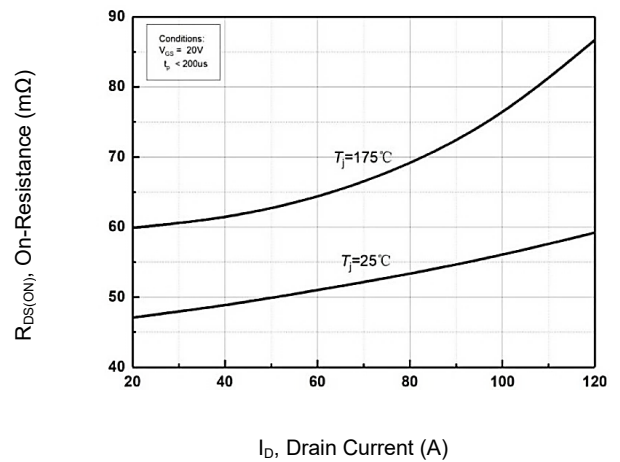
Normalized On-Resistance vs. Junction temperature



On-Resistance vs. Junction temperature for V_{GS}

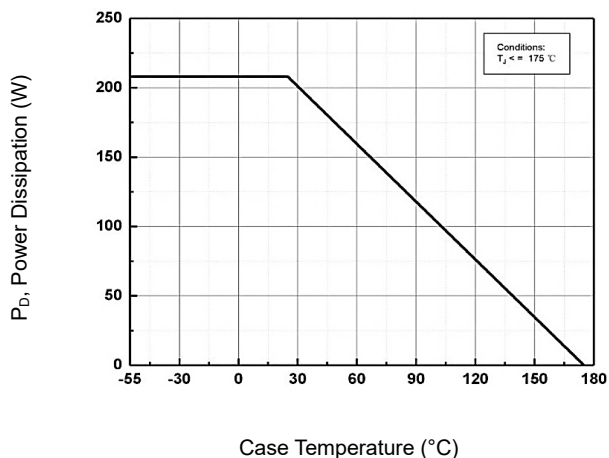


On-Resistance vs. Drain Current

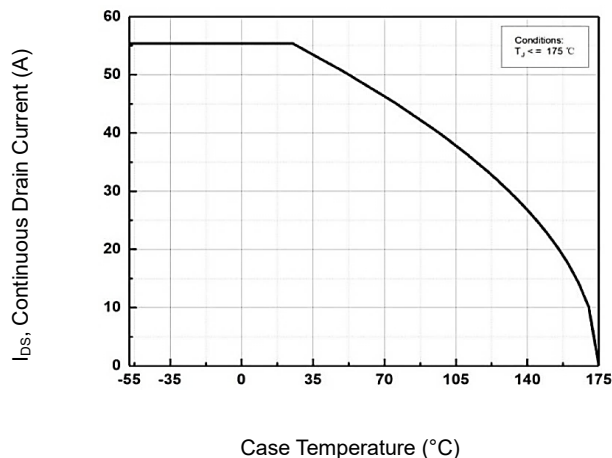


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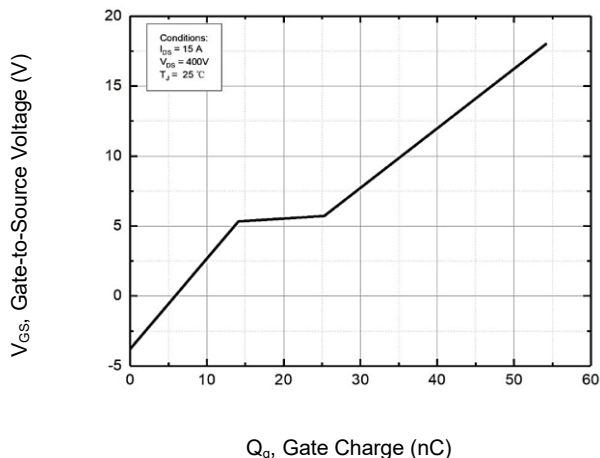
Maximum Power Dissipation Derating



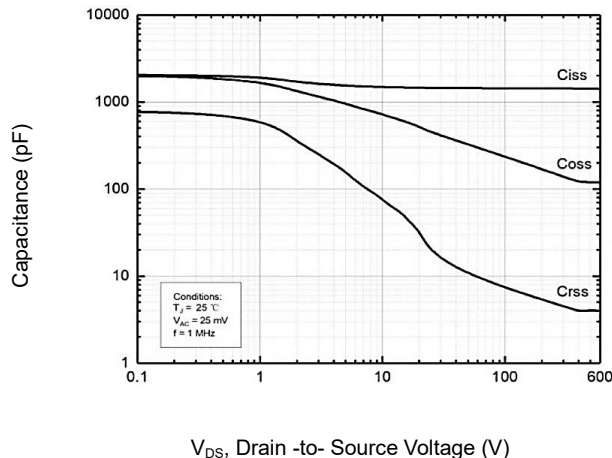
Continuous Drain Current vs. Case Temperature



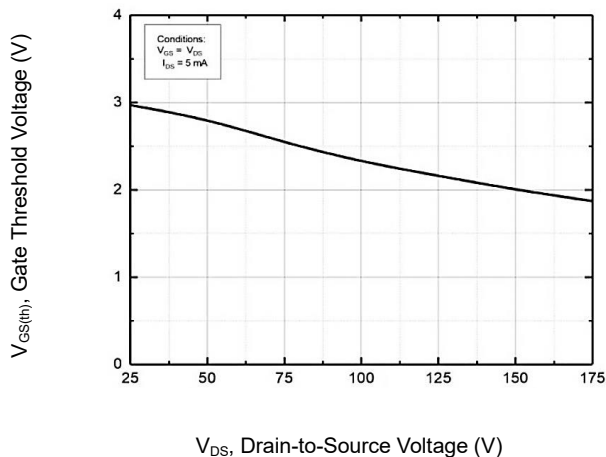
Gate-Charge Characteristics



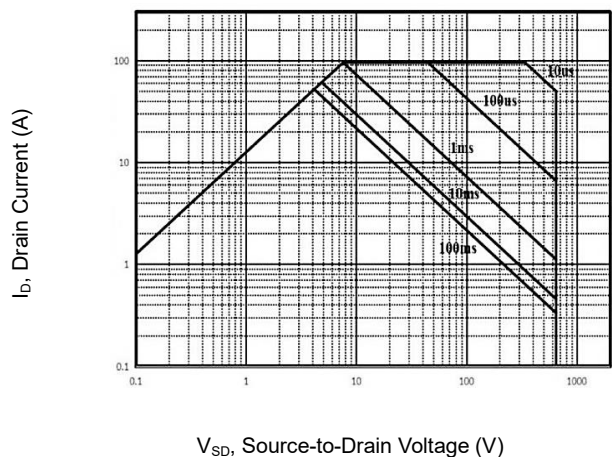
Capacitance vs. Drain-Source Voltage



Threshold Voltage vs. Junction temperature

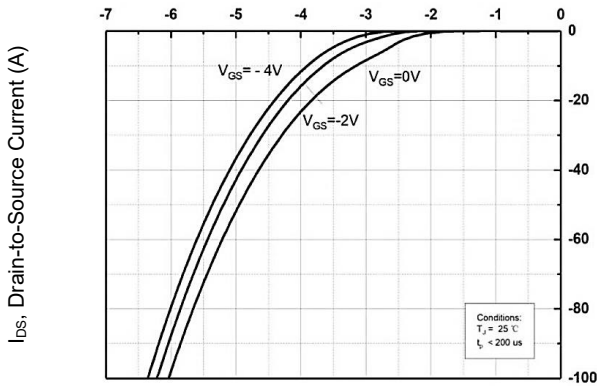


Safe Operating Area



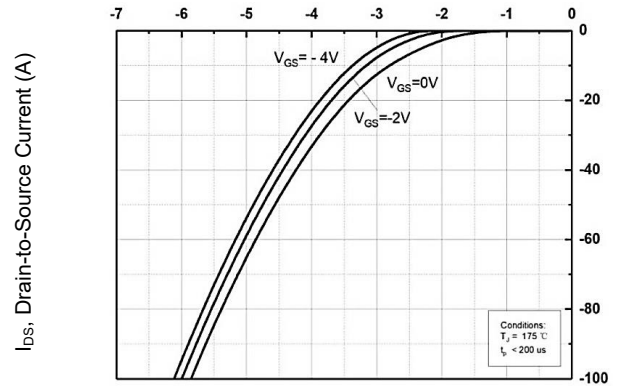
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Body Diode Characteristics



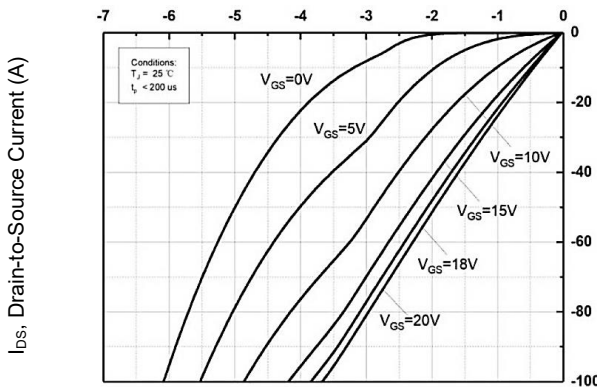
V_{DS} , Drain -to- Source Voltage (V)

Body Diode Characteristics



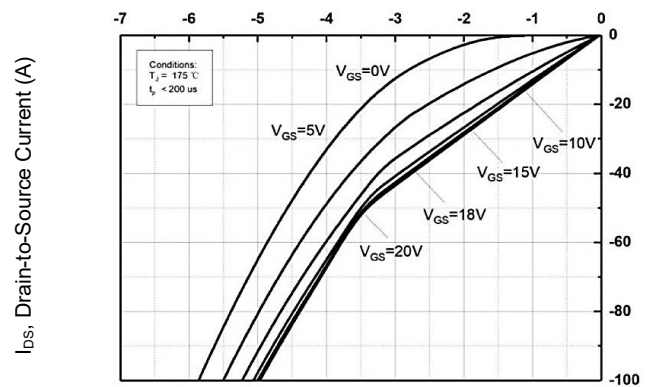
V_{DS} , Drain -to- Source Voltage (V)

3rd Quadrant Characteristics



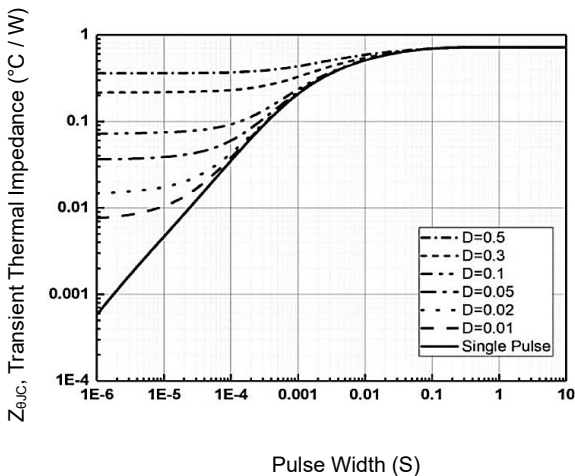
V_{DS} , Drain -to- Source Voltage (V)

3rd Quadrant Characteristics

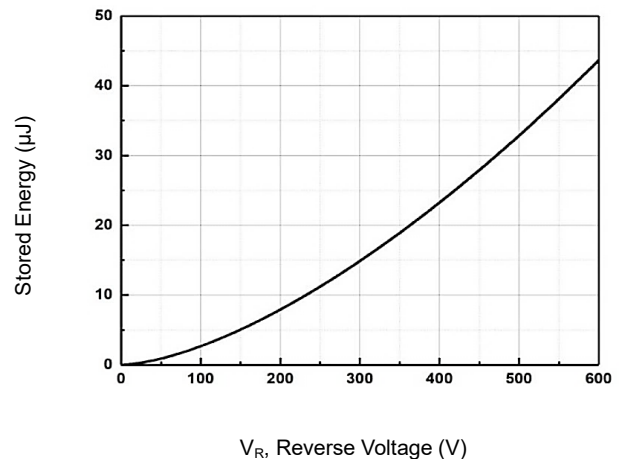


V_{DS} , Drain -to- Source Voltage (V)

Transient Thermal Impedance

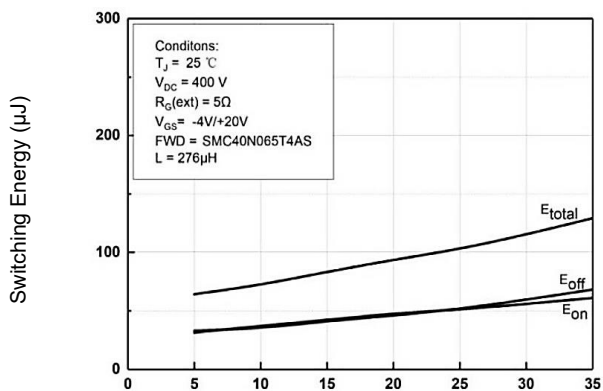


Output Capacitor Stored Energy



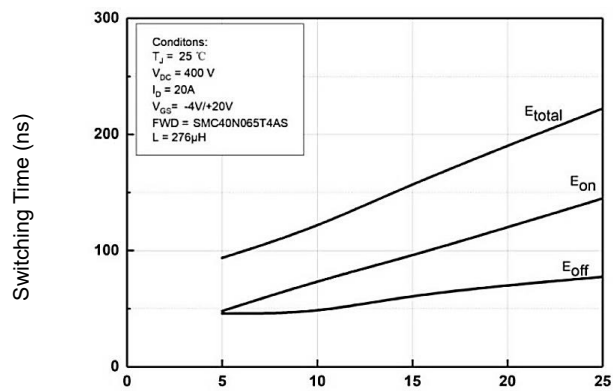
CHARACTERISTIC CURVES

Clamped Inductive Switching Energy vs $R_{G(EXT)}$



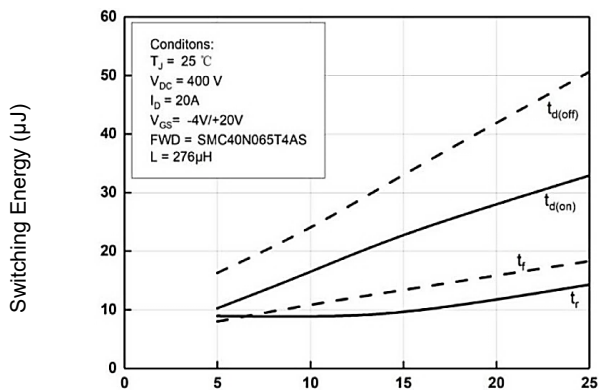
$R_{G(EXT)}$, External Gate Resistor (Ω)

Switching Time vs $R_{G(EXT)}$



$R_{G(EXT)}$, External Gate Resistor (Ω)

Clamped Inductive Switching Energy vs Drain current



I_{DS} , Drain-to-Source Current (A)