

HMM40N65T

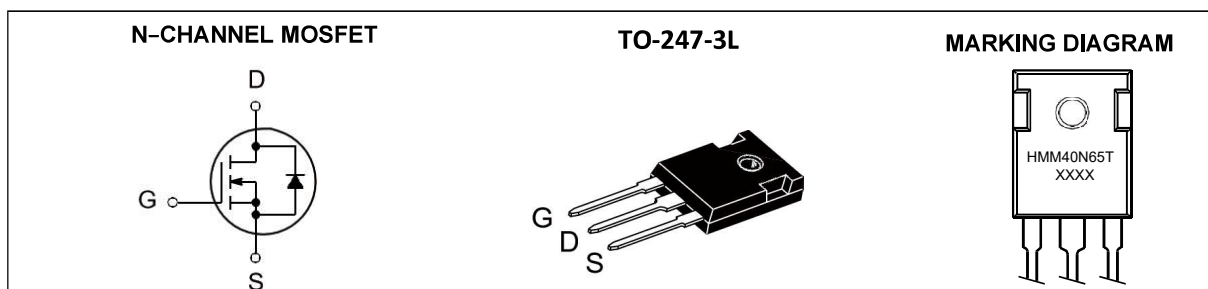
Features

- Typ. $R_{DS(on)} = 60 \text{ m}\Omega$
- Ultra Low Gate Charge ($Q_{G(tot)} = 46 \text{ nC}$)
- Capacitance ($C_{oss} = 80 \text{ pF}$)
- 100% UIL Tested

Typical Applications

- UPS
- DC/DC Converter
- EV charging
- Solar PV inverters

$V_{(BR)DSS}$	$R_{DS(on)}$	$I_D \text{ MAX}$
650 V	60 mΩ	99 A



Maximum Ratings ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Conditions		Value	Unit
Drain-Source Voltage	V _{DSS}	T _J = −55...175°C; T _c = 25°C		650	V
Gate-Source Voltage	V _{GS}	Under transient events < 100 ns		−8/19	V
Recommended Turn on Gate-Source Voltage	V _{GS, on}	T _C < 175°C		15	V
Recommended Turn off Gate-Source Voltage	V _{GS, off}			−4	V
Continuous DC Drain Current for R _{th(j-c, max)}	I _{DDC}	V _{GS} = 15 V	T _C = 25°C	40	A
			T _C = 100°C	20	A
Pulsed Drain Current,Pulse width t _p limited by T _{Jmax}	I _{DM}	V _{GS} = 18 V, T _C = 25°C		99	A
Power Dissipation	P _{tot}	T _C = 25°C, T _J =175°C		150	W
Operating Junction and Storage Temperature Range	T _J , T _{stg}			−40 to +175	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

Thermal Resistance Maximum Ratings

Parameter	Symbol	Value	Unit
Junction-to-Case (Note 1)	$R_{\theta JC}$	0.99	$^{\circ}\text{C/W}$
Junction-to-Ambient (Note 2)	$R_{\theta JA}$	40	$^{\circ}\text{C/W}$

- 1.The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2.Repetitive rating, limited by max junction temperature

Static Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 100\text{ }\mu\text{A}$	650			V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 650\text{ V}$		1	50	μA
Forward Transconductance	g_{fs}	$V_{DS} = 20\text{ V}, I_D = 13.2\text{ A}$	$T_J = 25\text{ }^{\circ}\text{C}$	10		S
			$T_J = 175\text{ }^{\circ}\text{C}$	9		
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 15\text{ V}, I_D = 13.2\text{ A}$	$T_J = 25\text{ }^{\circ}\text{C}$	42	60	m Ω
			$T_J = 175\text{ }^{\circ}\text{C}$		81	
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS} = V_{DS}, I_D = 5\text{ mA}$	$T_J = 25\text{ }^{\circ}\text{C}$	1.8	2.3	V
			$T_J = 175\text{ }^{\circ}\text{C}$		1.9	
Gate-Source Leakage Current	I_{GSS}	$V_{GS} = 15\text{ V}, V_{DS} = 0\text{ V}$		10	250	nA
Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, V_{DS} = 600\text{ V},$ $f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$		1020		pF
Output Capacitance	C_{OSS}			80		
Reverse Transfer Capacitance	C_{RSS}			9		
Coss Stored Energy	E_{OSS}			15		

Dynamic Electrical Characteristics

Parameter	Symbol	Test Conditions		Typ	Unit
Turn-On Switching Energy (Body Diode)	E _{ON}	V _{GS} = -4/15 V, V _{DS} = 400 V, I _D = 13.2 A, R _{G(ext)} = 2.5 Ω, L=135uH	T _J = 175 °C	110	μJ
Turn-On Switching Energy (Body Diode)	E _{OFF}	V _{GS} = -4/15 V, V _{DS} = 400 V, I _D = 13.2 A, R _{G(ext)} = 2.5 Ω, L=135uH	T _J = 175 °C	22	
Turn-On Delay Time	t _{d(on)}	V _{GS} = -4/15 V, V _{DS} = 400 V, I _D = 13.2 A, R _{G(ext)} = 2.5 Ω, L=135uH, Timing relative to V _{DS} Inductive load	T _J = 25 °C	9	ns
Rise Time	t _r	V _{GS} = -4/15 V, V _{DS} = 400 V, I _D = 13.2 A, R _{G(ext)} = 2.5 Ω, L=135uH, Timing relative to V _{DS} Inductive load	T _J = 25 °C	20	ns
Turn-Off Delay Time	t _{d(off)}	V _{GS} = -4/15 V, V _{DS} = 400 V, I _D = 13.2 A, R _{G(ext)} = 2.5 Ω, L=135uH, Timing relative to V _{DS} Inductive load	T _J = 25 °C	17	ns
Fall Time	t _f	V _{GS} = -4/15 V, V _{DS} = 400 V, I _D = 13.2 A, R _{G(ext)} = 2.5 Ω, L=135uH, Timing relative to V _{DS} Inductive load	T _J = 25 °C	8	ns
Total Gate Charge	Q _{G(tot)}	V _{GS} = -4/15 V, V _{DS} = 400 V, I _D = 13.2 A, Per IEC60747-8-4		46	nC
Gate-Source Charge	Q _{GS}			14	
Gate-Drain Charge	Q _{GD}			14	
Internal Gate Resistance	R _{G,int}	f = 1 MHz, V _{AC} = 25 mV		3	Ω

Reverse Diode Characteristic

Parameter	Symbol	Test Conditions		Typ	Unit
Drain-Source Reverse Voltage	V _{SD}	V _{GS} = -4 V, I _{SD} = 6.6 A	T _J = 25 °C	5.1	V
			T _J = 175 °C	4.8	
Continuous Reverse Drain Current for R _{th(j-c, max)}	I _{SDC}	V _{GS} = -4 V, T _c = 25 °C	T _J = 25 °C	40	A
Peak Reverse Drain Current	I _{SM}	V _{GS} = -4 V, T _J = 25 °C, Pulse width t _p limited by T _{Jmax}		99	A
Reverse Recovery Time	t _{RR}	V _{GS} = -4 V, I _{SD} = 13.2 A, V _R = 400 V, di/dt = 750 A/μs, T _J = 175 °C		29	ns
Reverse Recovery Charge	Q _{RR}			181	nC
Peak Reverse Recovery Current	I _{RRM}			9	A

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

Typical Performance

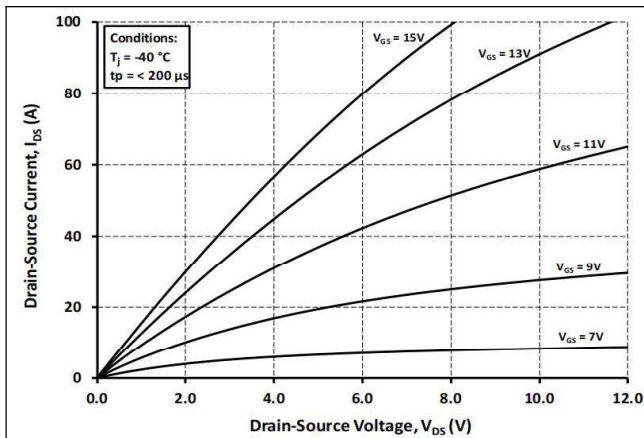


Figure 1. Output characteristics, $T_J = -40^\circ\text{C}$

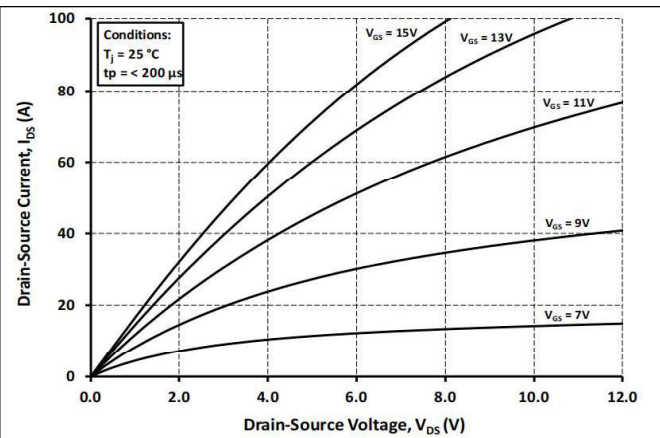


Figure 2. Output characteristics, $T_J = 25^\circ\text{C}$

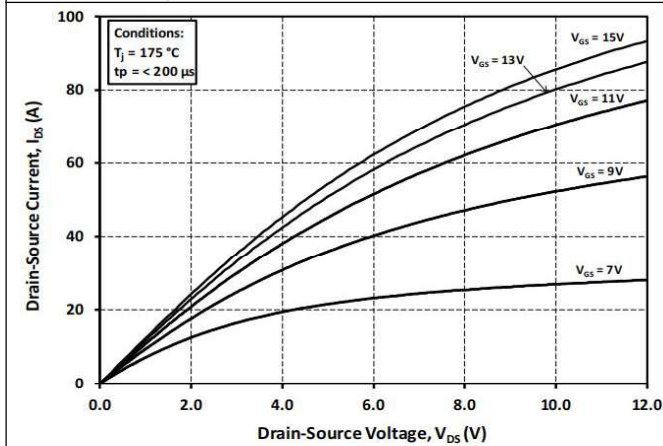


Figure 3. Output characteristics, $T_J = 175^\circ\text{C}$

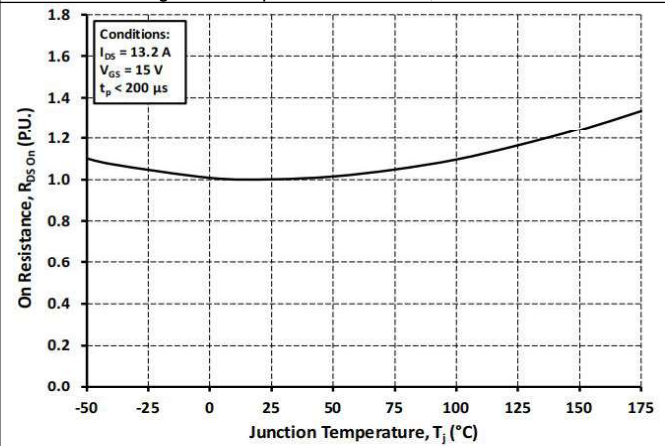


Figure 4. Normalized on-resistance vs. temperature

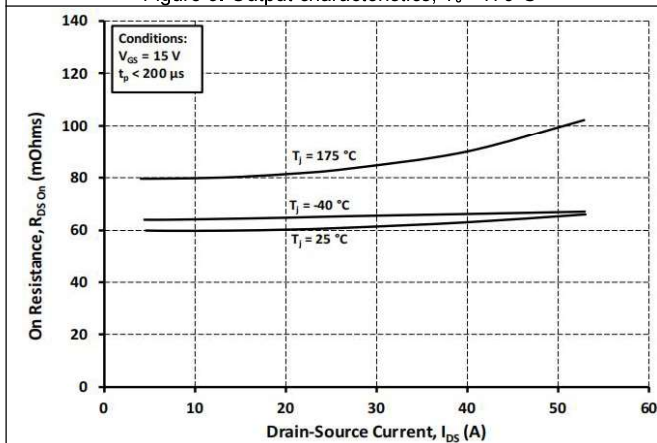


Figure 5. On-resistance vs. drain current
For Various Temperatures

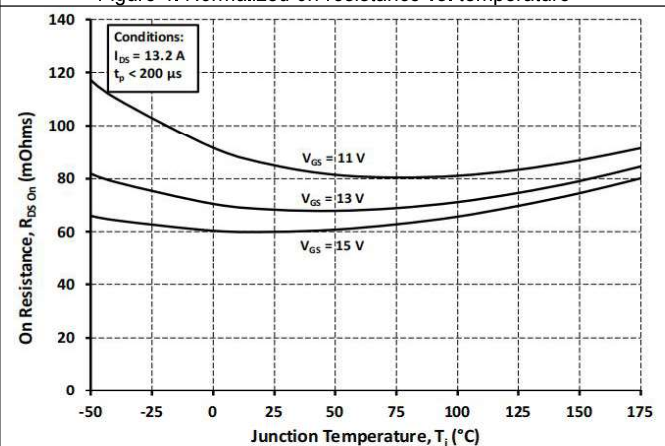


Figure 6. On-resistance vs. Temperature
for various gate voltage

Typical Performance

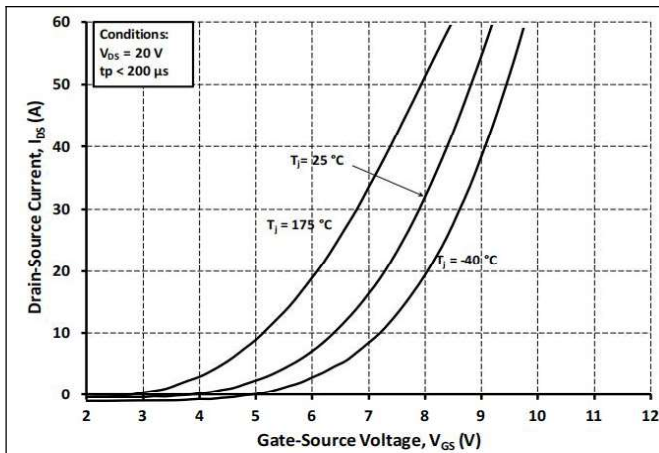


Figure 7. Transfer characteristic for various junction temperatures

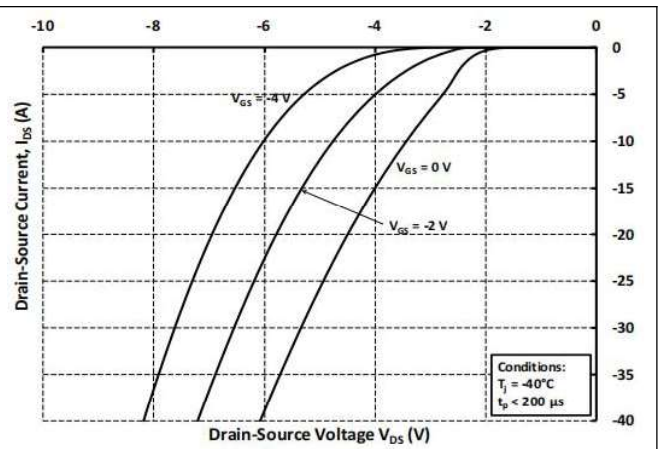


Figure 8. Body diode characteristic at $T_J = -40\text{ °C}$

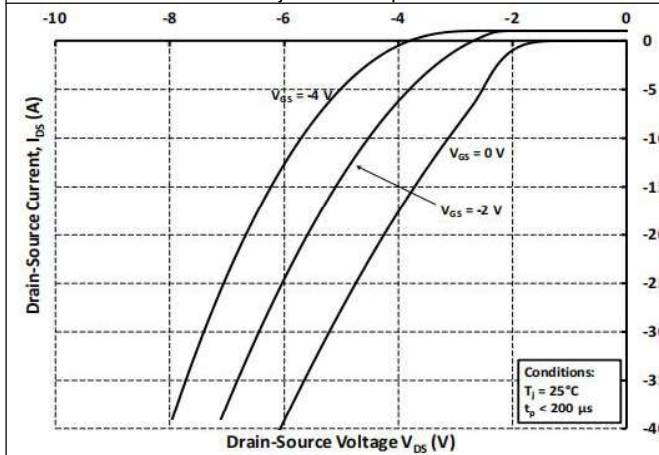


Figure 9. Body diode characteristic at $T_J = 25\text{ °C}$

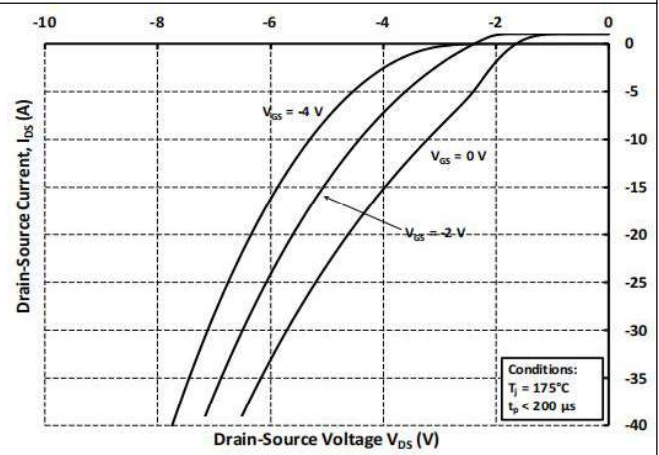


Figure 10. Body diode characteristic at $T_J = 175\text{ °C}$

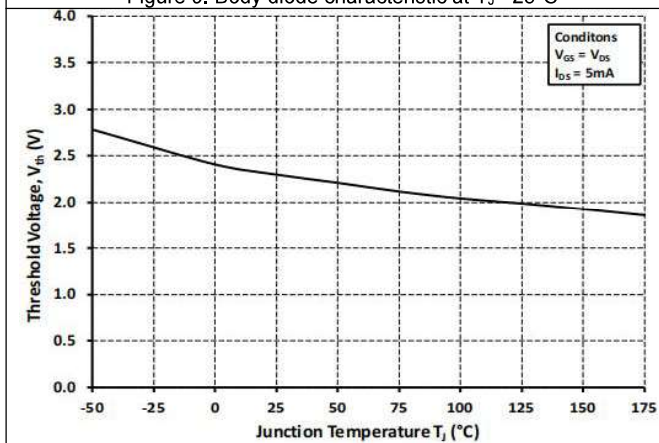


Figure 11. Threshold voltage vs. temperature

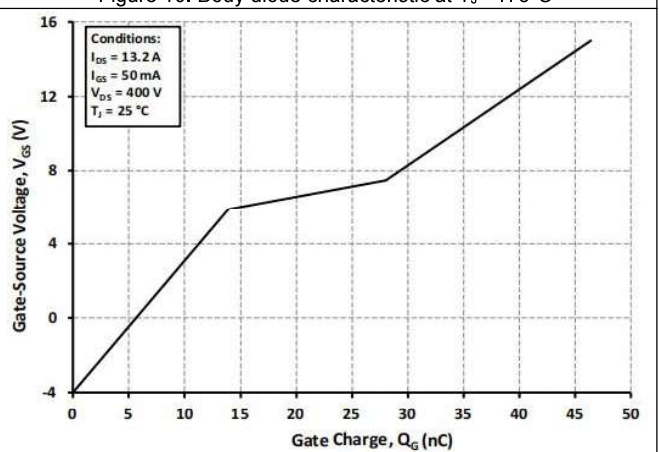


Figure 12. Gate charge characteristic

Typical Performance

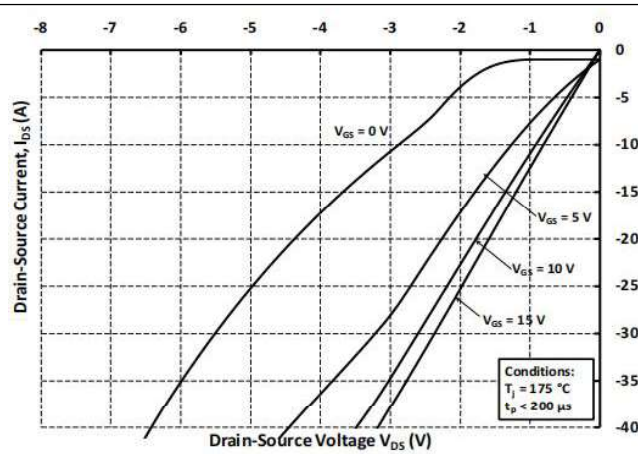


Figure 13. 3rd Quadrant Characteristic at $T_j = 175^\circ\text{C}$

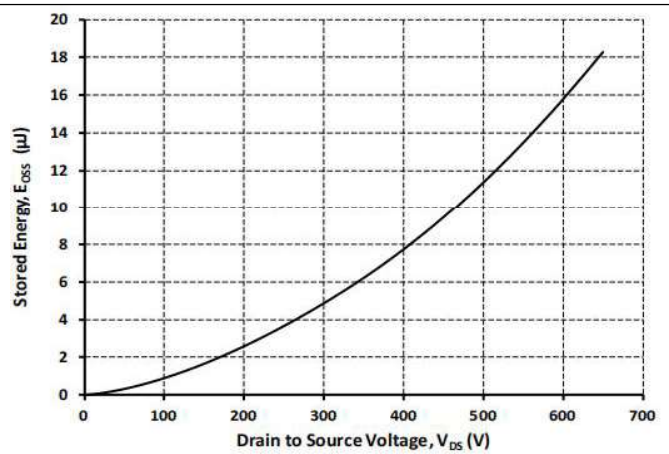


Figure 14. Output capacitor stored energy

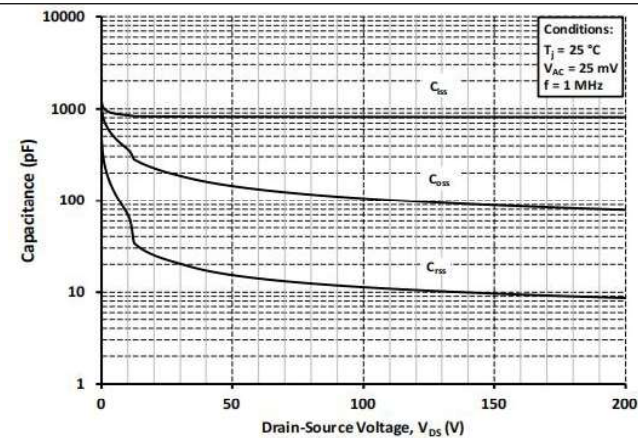


Figure 15. Capacitances vs. drain-source voltage

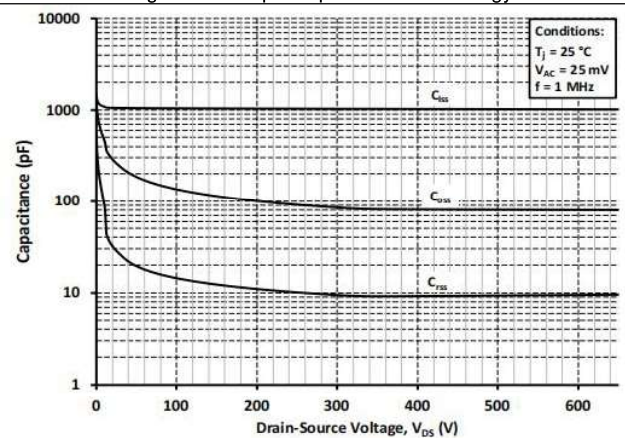


Figure 16. Capacitances vs. drain-source voltage

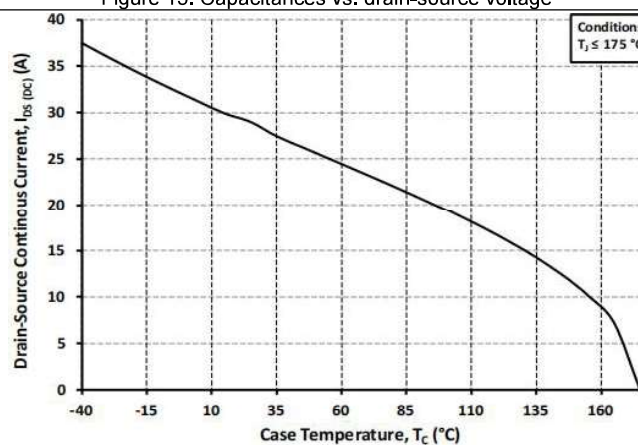


Figure 17. Continuous drain current derating vs. case temperature

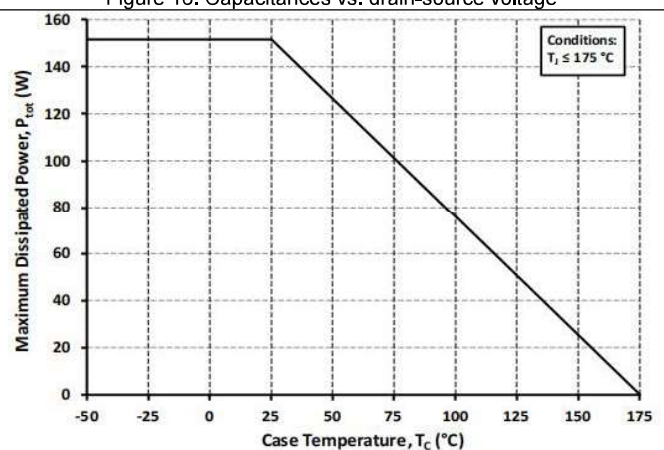


Figure 18. Maximum power dissipation derating vs. case temperature

Typical Performance

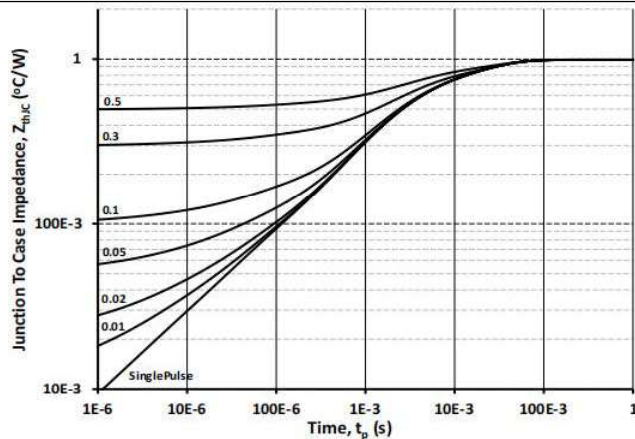


Figure 19. Transient thermal impedance (junction - case)

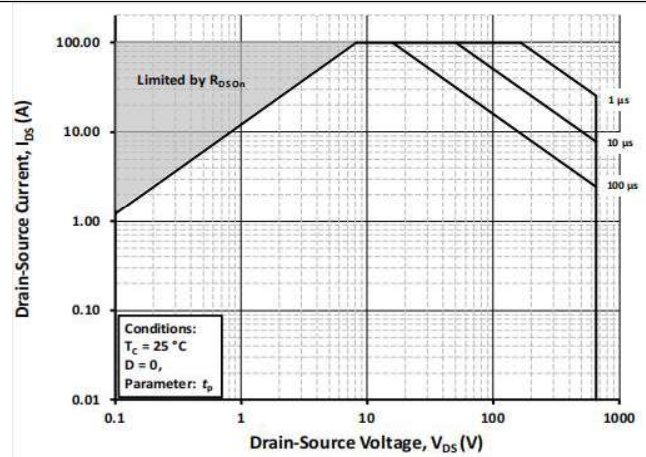


Figure 20. Safe operating area

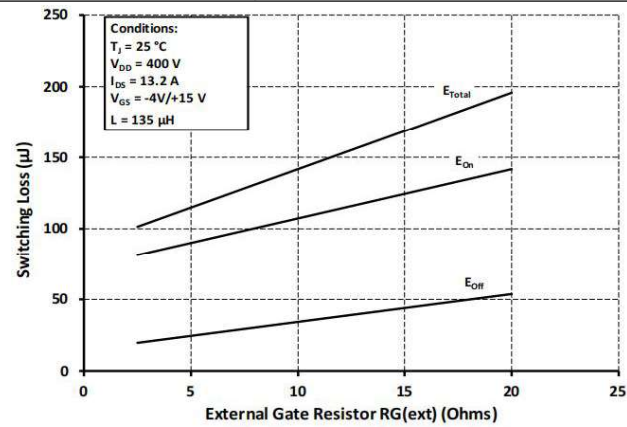


Figure 21. Clamped inductive switching energy vs. $R_G(\text{ext})$

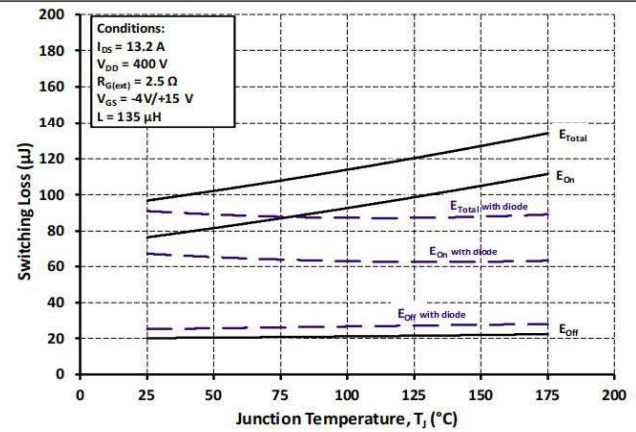


Figure 22. Clamped inductive switching energy vs. temperature

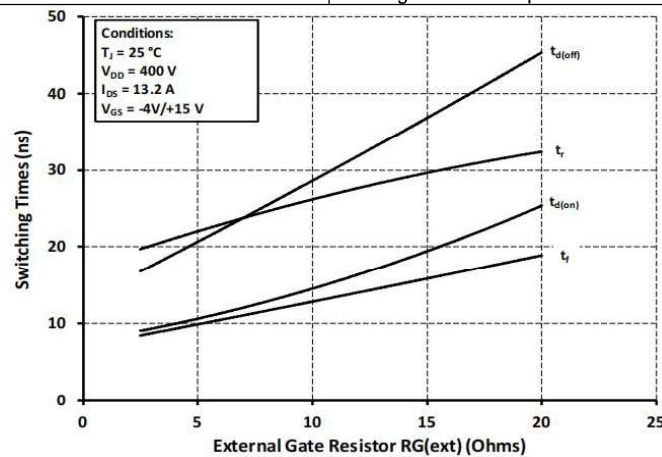
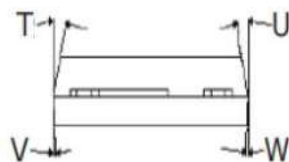
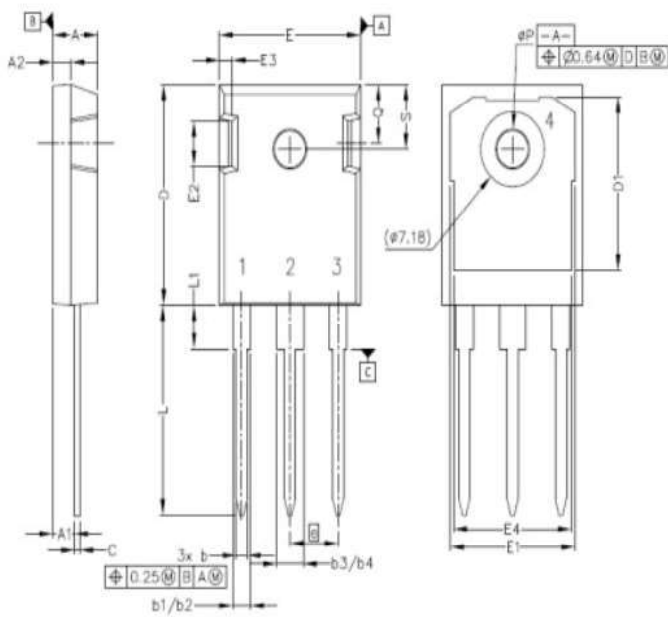


Figure 23. Switching times vs. $R_G(\text{ext})$

Package Marking And Ordering Information

Part Number	Top Marking	Package	Packing Method	Reel Size	Tape Width	Quantity
HMM40N65T	HMM40N65T XXXX	TO-247 Long Lead	Tube	N/A	N/A	30 Units

Package Dimensions: TO-247-3



Pinout Information:

- Pin 1 = Gate
- Pin 2, 4 = Drain
- Pin 3 = Source

POS	Inches		Millimeters	
	Min	Max	Min	Max
A	.190	.205	4.83	5.21
A1	.090	.100	2.29	2.54
A2	.075	.085	1.91	2.16
b	.042	.052	1.07	1.33
b1	.075	.095	1.91	2.41
b2	.075	.085	1.91	2.16
b3	.113	.133	2.87	3.38
b4	.113	.123	2.87	3.13
c	.022	.027	0.55	0.68
D	.819	.831	20.80	21.10
D1	.640	.695	16.25	17.65
D2	.037	.049	0.95	1.25
E	.620	.635	15.75	16.13
E1	.516	.557	13.10	14.15
E2	.145	.201	3.68	5.10
E3	.039	.075	1.00	1.90
E4	.487	.529	12.38	13.43
e	.214 BSC		5.44 BSC	
N	3		3	
L	.780	.800	19.81	20.32
L1	.161	.173	4.10	4.40
ØP	.138	.144	3.51	3.65
Q	.216	.236	5.49	6.00
S	.238	.248	6.04	6.30
T	9°	11°	9°	11°
U	9°	11°	9°	11°
V	2°	8°	2°	8°
W	2°	8°	2°	8°