HCM2G0040120K

1200V N-Channel Silicon Carbide Power MOSFET

V_{DS}	=	1200 V
$R_{DS(on)}$	=	37 mΩ
I_D	=	75 A

Features

- Optimized package with separate driver source pin
- High blocking voltage with low on-resistance
- High-speed switching with low capacitances
- Fast intrinsic diode with low reverse recovery (Q_{rr})
- Easy to parallel
- RoHS compliant

Benefits

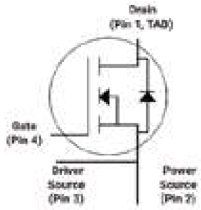
- Higher System Efficiency
- Reduce cooling requirements
- Increased power density
- Enabling higher frequency
- Minimize gate ringing
- Reduction of system complexity and cost

Applications

- Switch Mode Power Supplies
- DC/DC converters
- Solar Inverters
- Battery Chargers
- Motor Drives

Package

RoHS



Part Number	Package	Marking
HCM2G0040120K	TO-247-3	HCM2G0040120K

Maximum Ratings, at T_J = 25℃ , unless otherwise specified

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain-Source Breakdown Voltag	1200	V	V_{GS}= 0 V, I_D = 100 μA	
I_D	Continuous Drain Current	75	A	V_{GS}= 20 V, T_C = 25 ℃	Fig. 18
		53	A	V_{GS}= 20 V, T_C = 100 ℃	
$I_{D(pluse)}$	Pulsed Drain Current	84	A	Pulsed width t_p limited by T_{jmax}	Fig. 21
P_D	Power Dissipation	330	W	T_C = 25 ℃	Fig. 19
$V_{GS,op}$	Recommend Gate Source Voltage (static)	-5/+20	V		
V_{GSmax}	Maximum Gate Source Voltage (dynamic)	-10/+25	V	AC （ f>1Hz)	
T_J, T_{stg}	Operating Junction and Storage Temperature Range	-55 to +175	℃		
T_L	Soldering Temperature	260	℃		

Electrical Characteristics, at T_J = 25℃, unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
Static							
BV_{DS}	Drain-Source Breakdown Voltag	1200	--	--	V	V_{GS}= 0 V, I_D = 100 μA	
I_{DSS}	Zero Gate Voltage Drain Current	--	1	100	μA	V_{DS}= 1200 V, V_{GS}= 0 V	
I_{GSS}	Gate-Source Leakage Current	--	10	250	nA	V_{GS}= 20 V	
$V_{GS(th)}$	Gate-Source Threshold Voltage	2	2.7	4	V	I_D = 10 mA, V_{GS}= V_{DS}	Fig. 11
		--	2.0	--	V	I_D = 10 mA, V_{GS}= V_{DS}, T_J= 175 ℃	
$R_{DS(on)}$	Drain-Source On-Resistance	--	37	55	mΩ	V_{GS}= 20 V, I_D = 40 A	Fig. 7
		--	42	--	mΩ	V_{GS}= 18 V, I_D = 40 A	
		--	59	--	mΩ	V_{GS}= 15 V, I_D = 40 A	
		--	51	--	mΩ	V_{GS}= 20 V, I_D = 40 A, T_J= 175 ℃	
		--	54	--	mΩ	V_{GS}= 18 V, I_D = 40 A, T_J= 175 ℃	
		--	67	--	mΩ	V_{GS}= 15 V, I_D = 40 A, T_J= 175 ℃	
Dynamic							
C_{iss}	Input Capacitance	--	2193	--	pF	V_{GS}= 0 V, V_{DS}= 1000 V f = 1.0 MHz, V_{AC} = 25 mV	Fig. 17
C_{oss}	Output Capacitance	--	153	--			
C_{rss}	Reverse Transfer Capacitance	--	8	--			
E_{OSS}	C_{OSS} Stored Energy	--	83	--	μJ		Fig. 16
Q_g	Total Gate Charge	--	99	--	nC	V_{DS}= 800 V I_D = 40 A V_{GS}= -5/+20 V	Fig. 12
Q_{gs}	Gate-Source Charge	--	32	--			
Q_{gd}	Gate-Drain Charge	--	29	--			
$t_{d(on)}$	Turn-on Delay Time	--	13	--	ns	V_{DS}= 800 V V_{GS}= -5/+20 V I_D = 40 A $R_{G(ext)}$= 2.5 Ω	Fig. 22 Fig. 23 Fig. 24
t_r	Turn-on Rise Time	--	30	--			
$t_{d(off)}$	Turn-off Delay Time	--	27	--			
t_f	Turn-off Fall Time	--	12	--			
$R_{G(int)}$	Internal Gate Resistance	--	2.0	--	Ω	f = 1.0 MHz, V_{AC} = 25 mV	

Body Diode Characteristics, at T_J = 25℃, unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
I_S	Continuous Diode Forward Current	--	--	75	A		
$I_{S(pluse)}$	Diode pulse Current	--	--	150	A		
V_{SD}	Diode Forward Voltage	--	4.0	--	V	V_{GS}= 0 V, I_S= 20 A	Fig. 8, 9, 10
		--	3.8	--	V	V_{GS}= 0 V, I_S= 20 A, T_J= 175 ℃	
t_{rr}	Reverse Recovery Time	--	28	--	ns	I_S= 20 A, V_{DS}= 800 V V_{GS}= -5 V di/dt = 2100 A/us	
Q_{rr}	Reverse Recovery Charge	--	232	--	nC		
I_{rrm}	Peak Reverse Recovery Current	--	13	--	A		

Thermal Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Note
$R_{θJC}$	Thermal Resistance from Junction to Case	/	0.39	/	℃/W	Fig. 20

Typical Performance

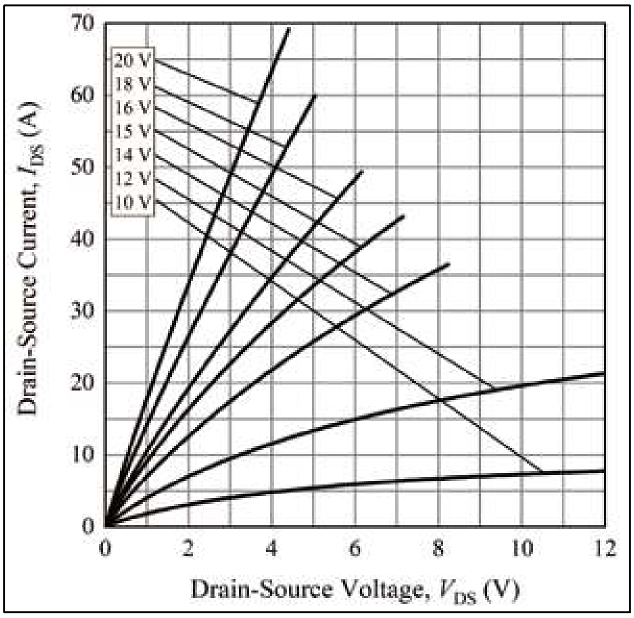


Figure 1: Typical Output Characteristics at T_J = -55 ℃

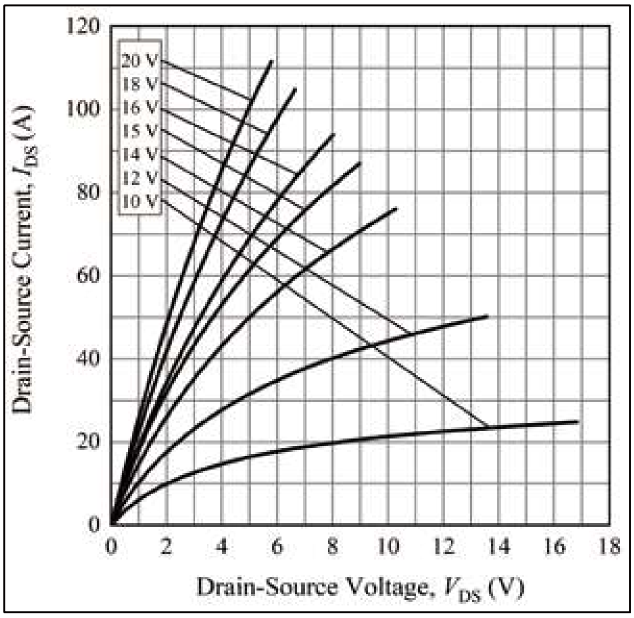


Figure 2: Typical Output Characteristics at T_J = 25 ℃

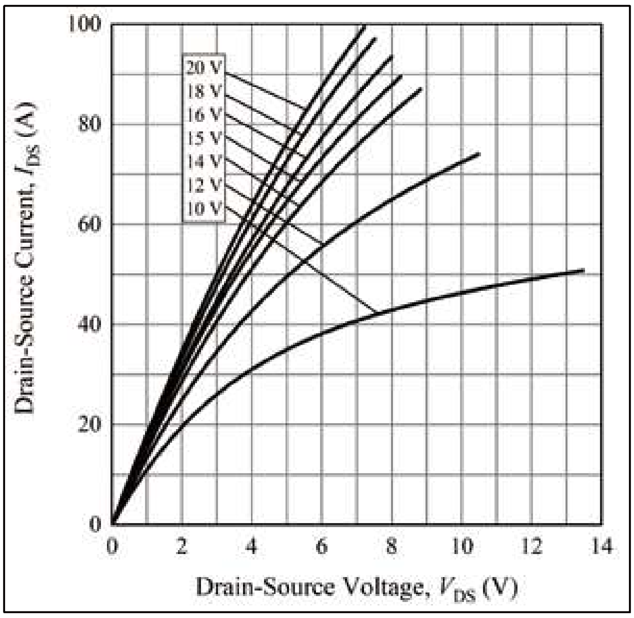


Figure 3: Typical Output Characteristics at T_J = 175 ℃

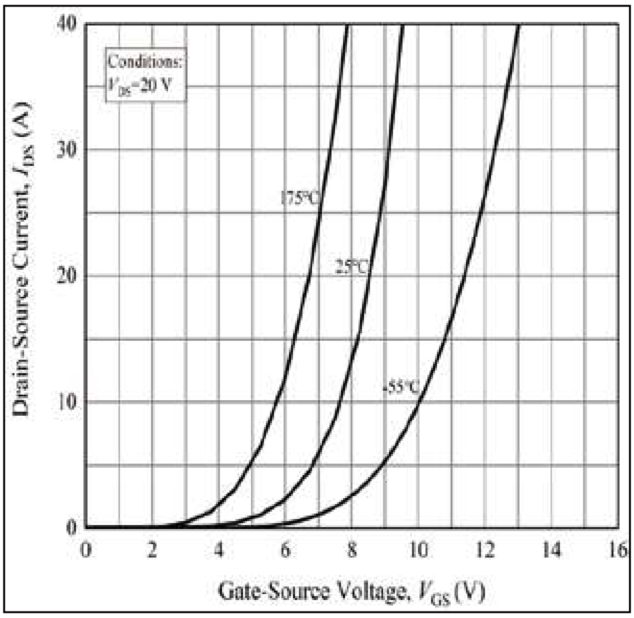


Figure 4: Typical Transfer Characteristics for Various Temperature

Typical Performance

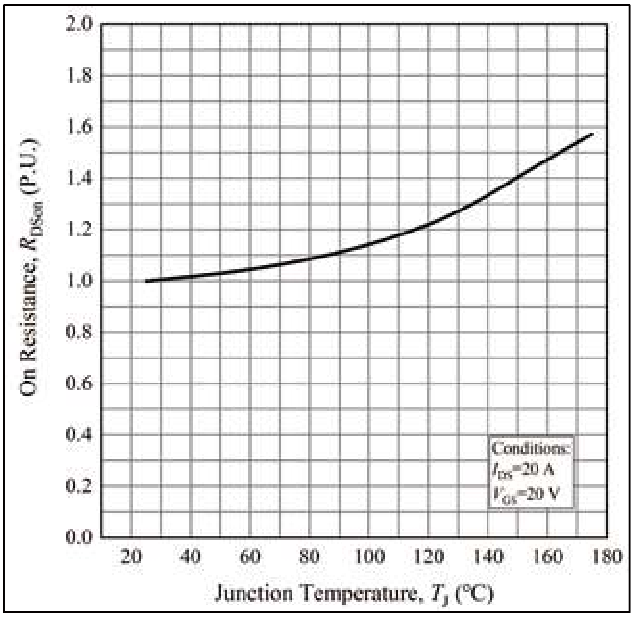


Figure 5: Normalized On-Resistance vs. Temperature

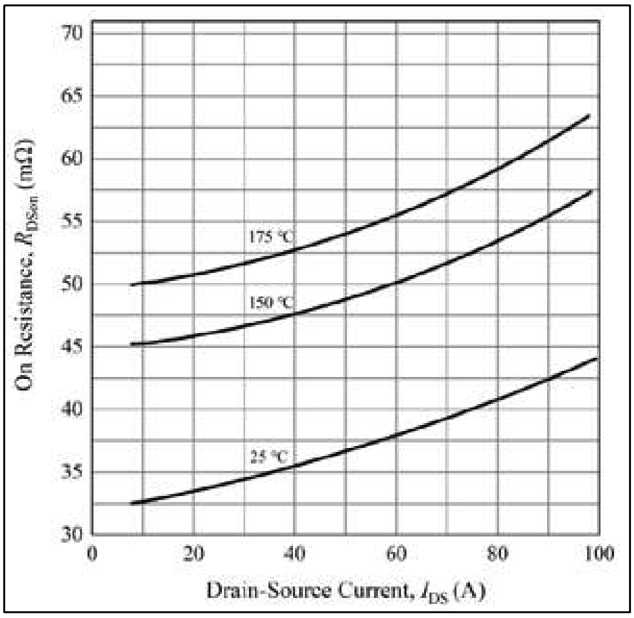


Figure 6: On-Resistance vs. Drain Current for Gate Various Temperatures

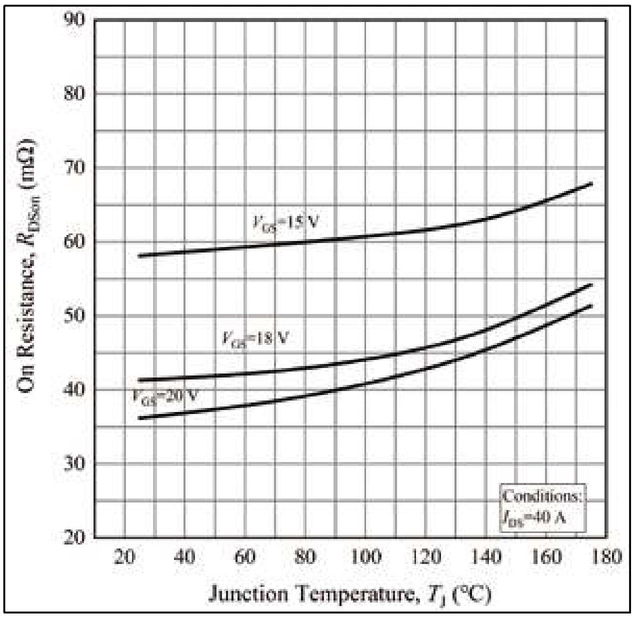


Figure 7: On-Resistance vs. Temperature for Various Voltage

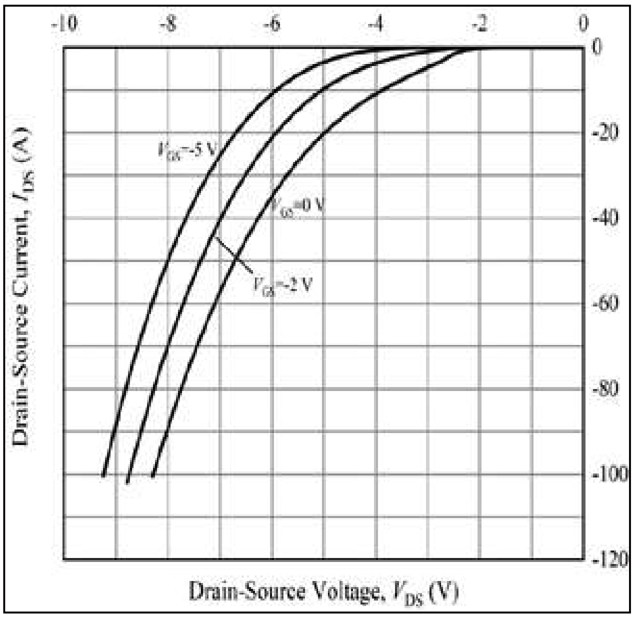


Figure 8: Typical Body Diode Characteristics at T_J = -55 ℃

Typical Performance

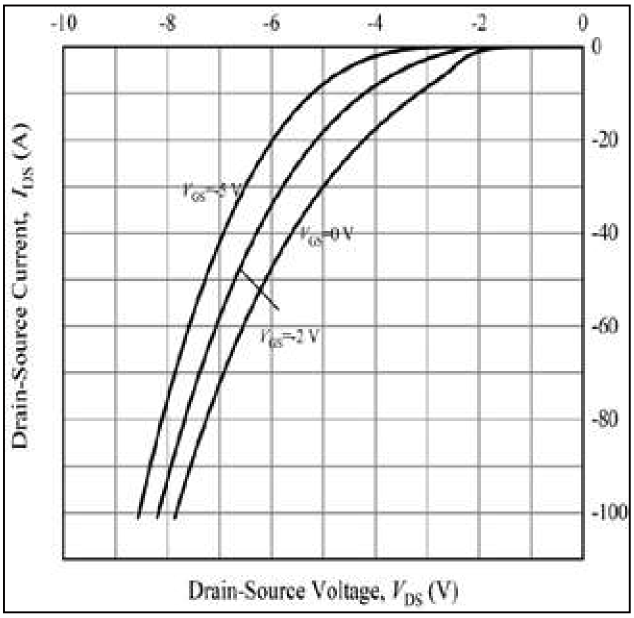


Figure 9: Typical Body Diode Characteristics at T_J= 25 ℃

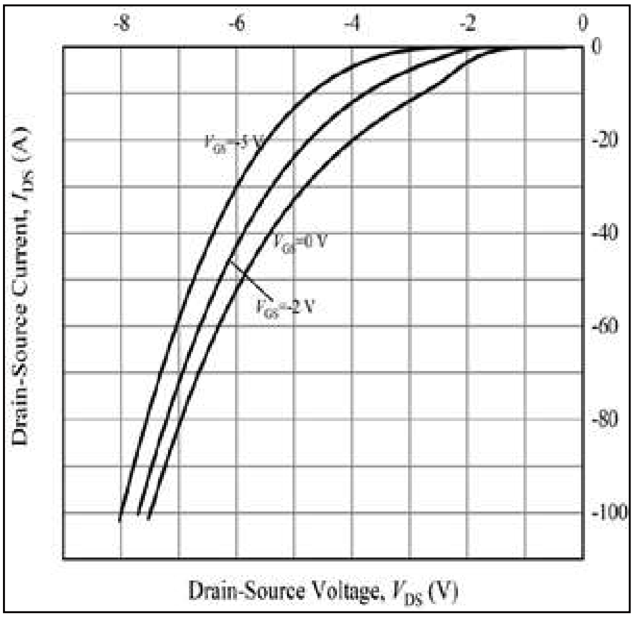


Figure 10: Typical Body Diode Characteristics at T_J= 175 ℃

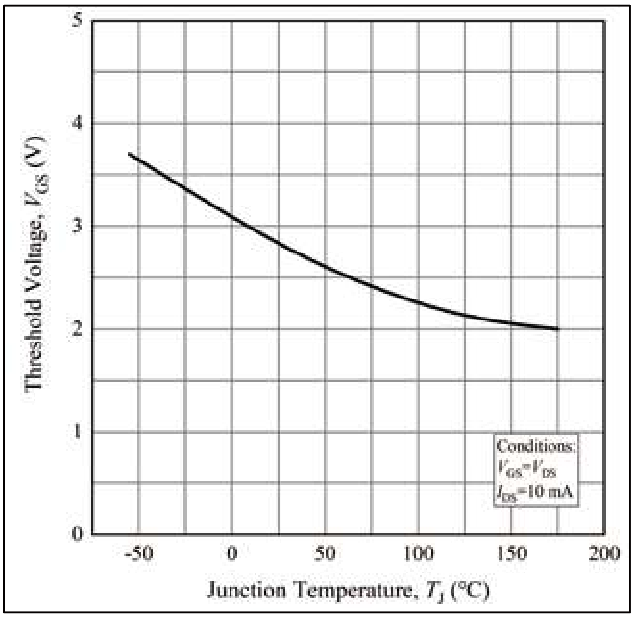


Figure 11: Typical Threshold Voltage vs. Temperature

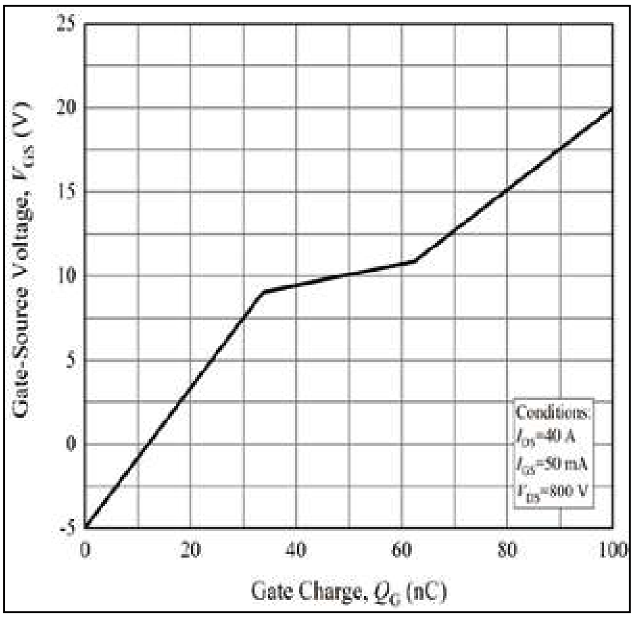


Figure 12: Typical Gate Charge Characteristics at T_J= 25 ℃

Typical Performance

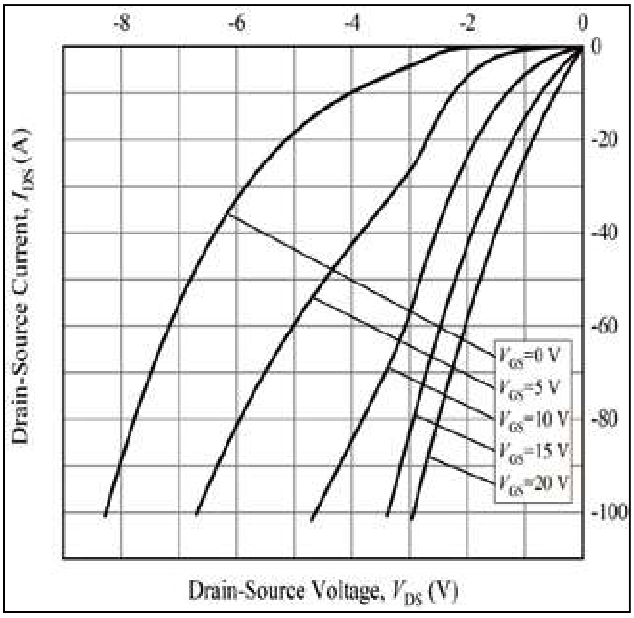


Figure 13: Typical 3rd Quadrant Characteristics
T_J= -55 ℃

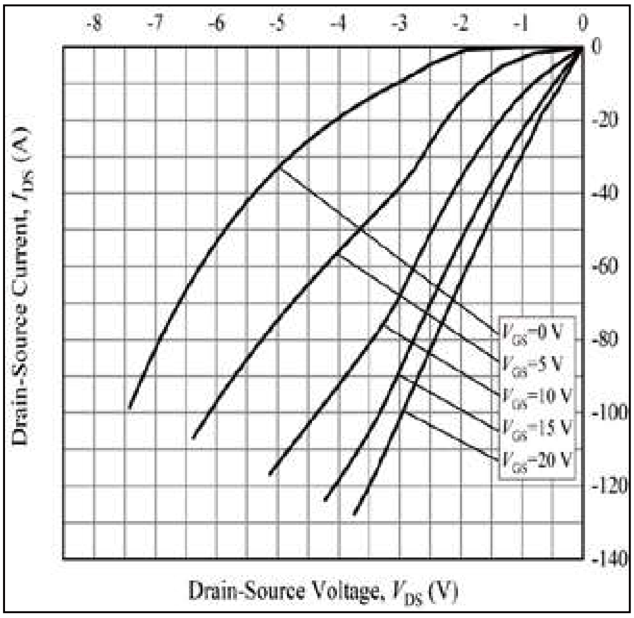


Figure 14: Typical 3rd Quadrant Characteristics at
T_J=25 ℃

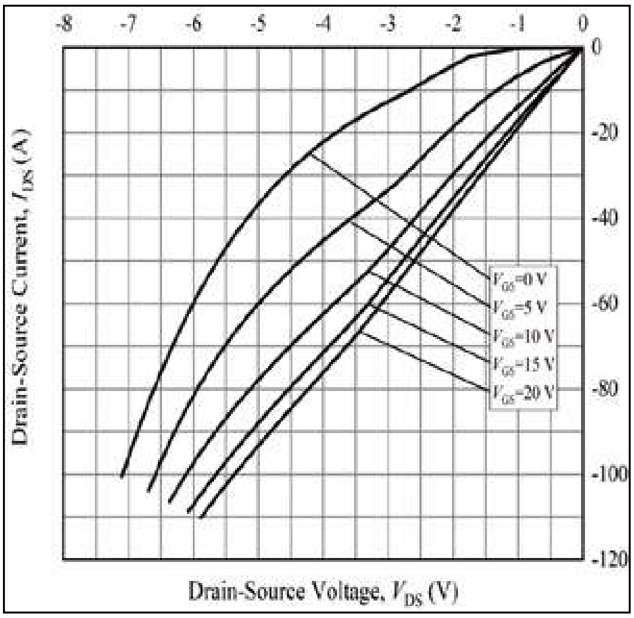


Figure 15: Typical 3rd Quadrant Characteristics
atT_J= 175 ℃

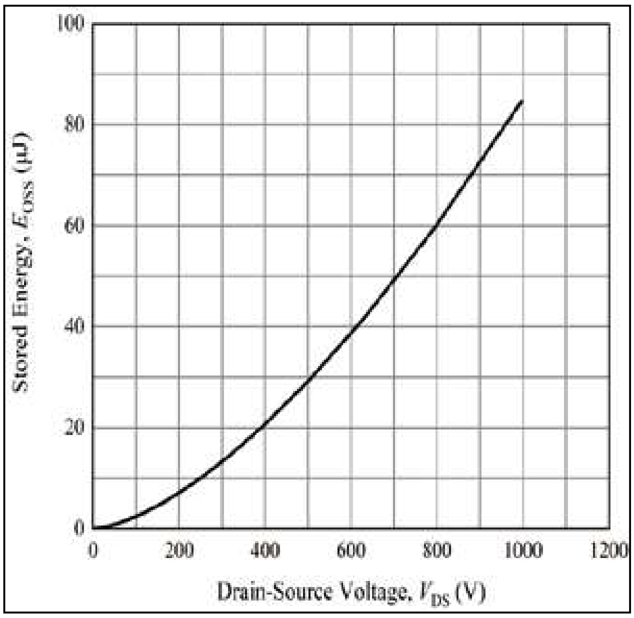


Figure 16: Typical Output Capacitor Stored Energy

Typical Performance

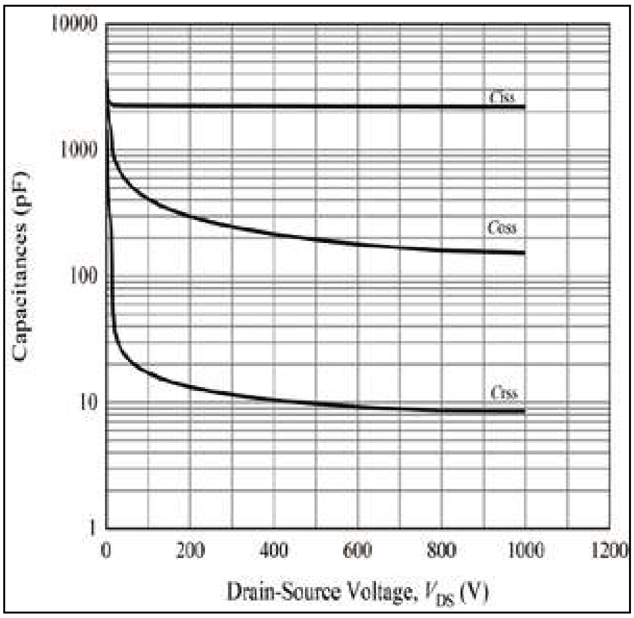


Figure 17: Typical Capacitances vs. Drain-Source Voltage

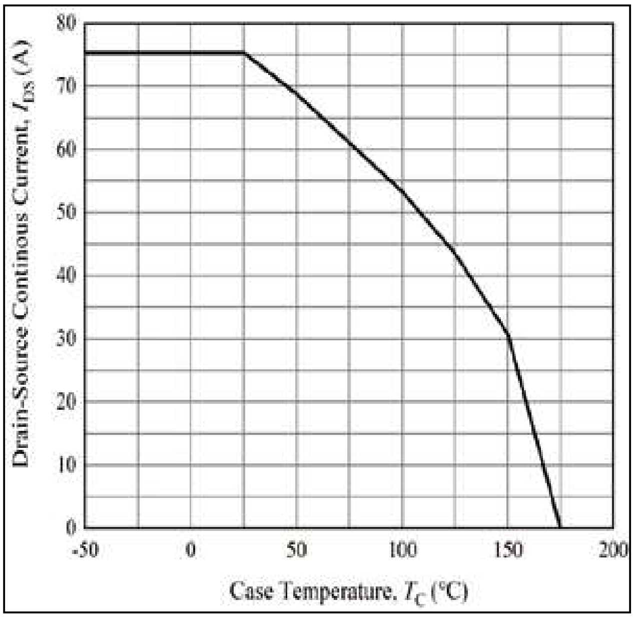


Figure 18: Continuous Drain Current Derating Curve

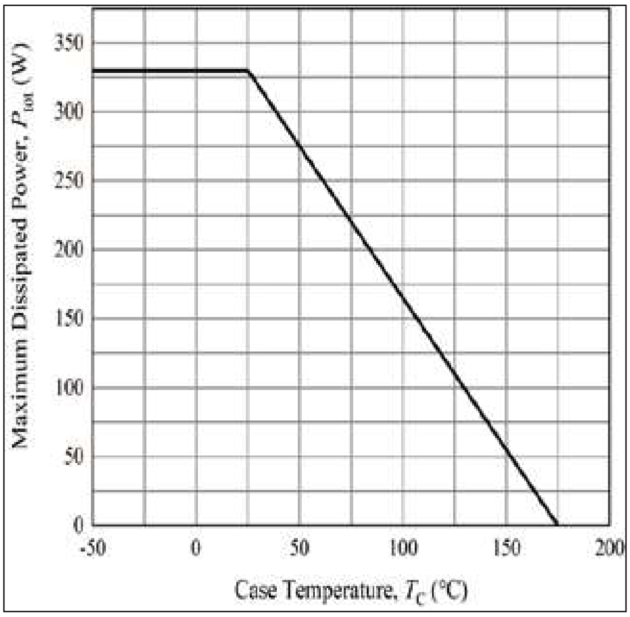


Figure 19: Power Dissipation Derating Curve

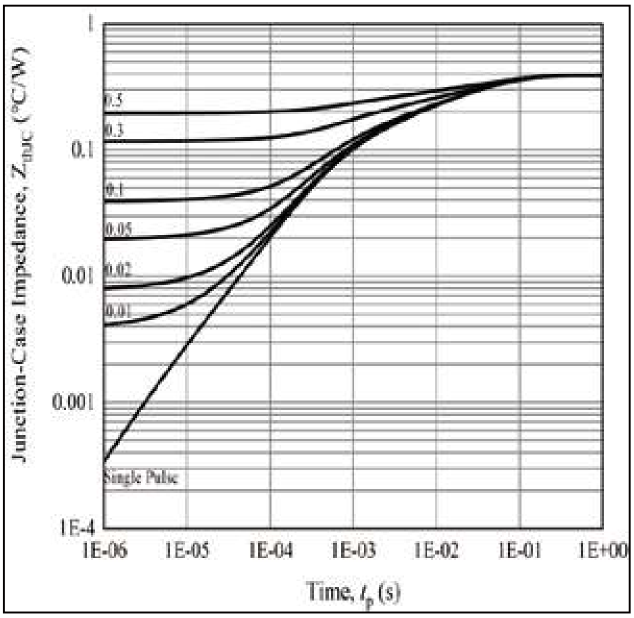


Figure 20: Typical Transient Thermal Impedance (Junction – Case) with Duty Cycle

Typical Performance

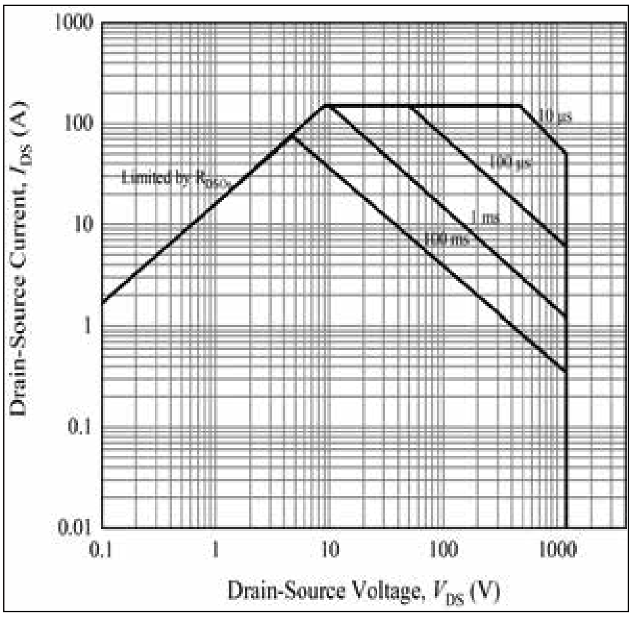


Figure 21: Safe Operate Area

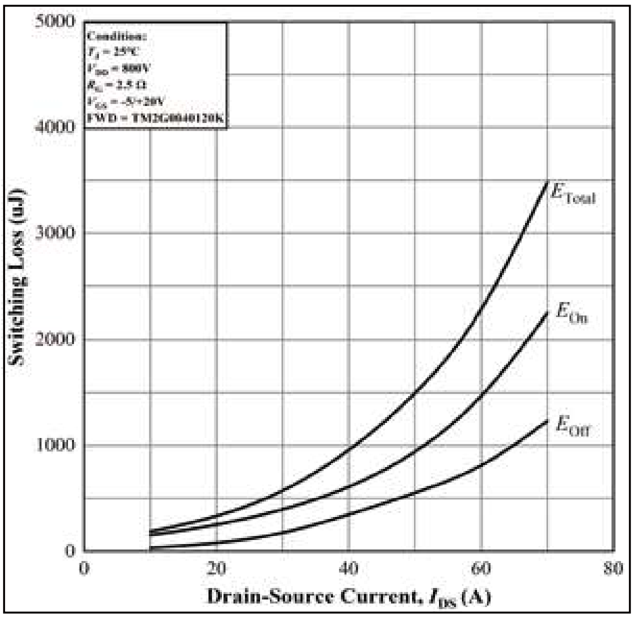


Figure 22: Resistive Switching Time Description

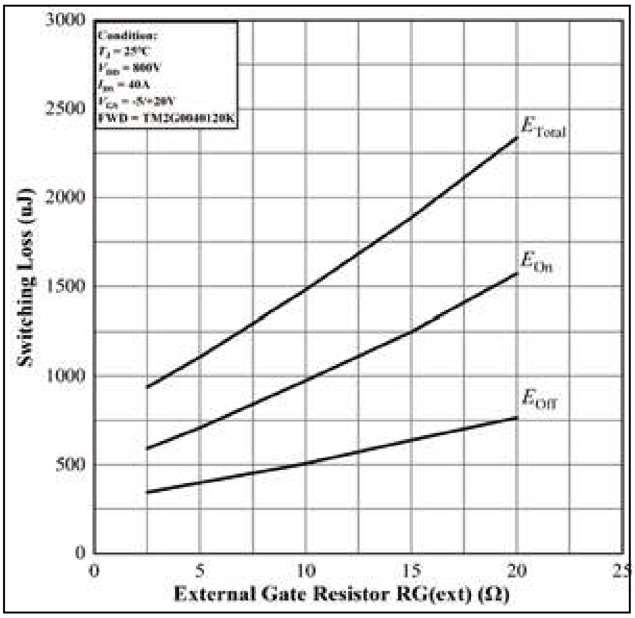


Figure 23 Clamped Inductive Switching Energy VS. $R_{G(ext)}$

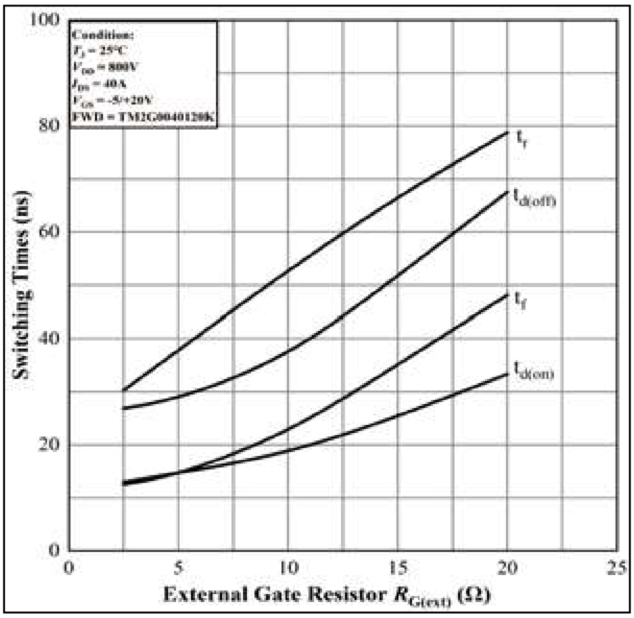


Figure 24: Switching Time VS. $R_{G(ext)}$

Package Dimensions

Package TO-247-3

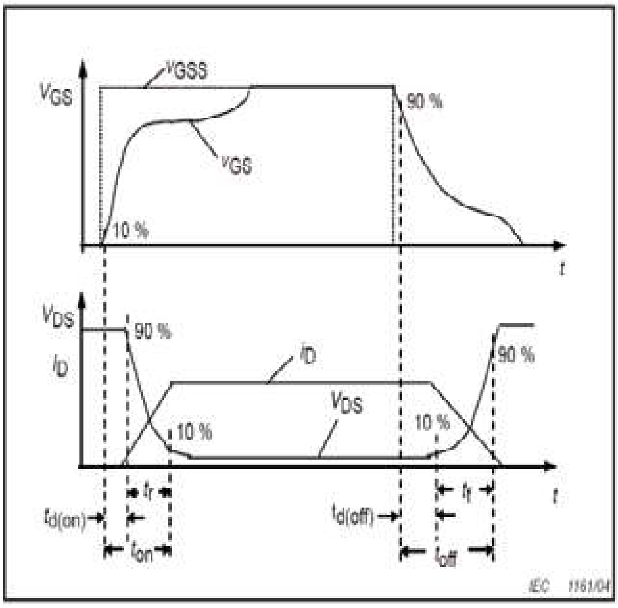


Figure 2 5 : Resistive Switching Time Description

Test Circuit Schematic

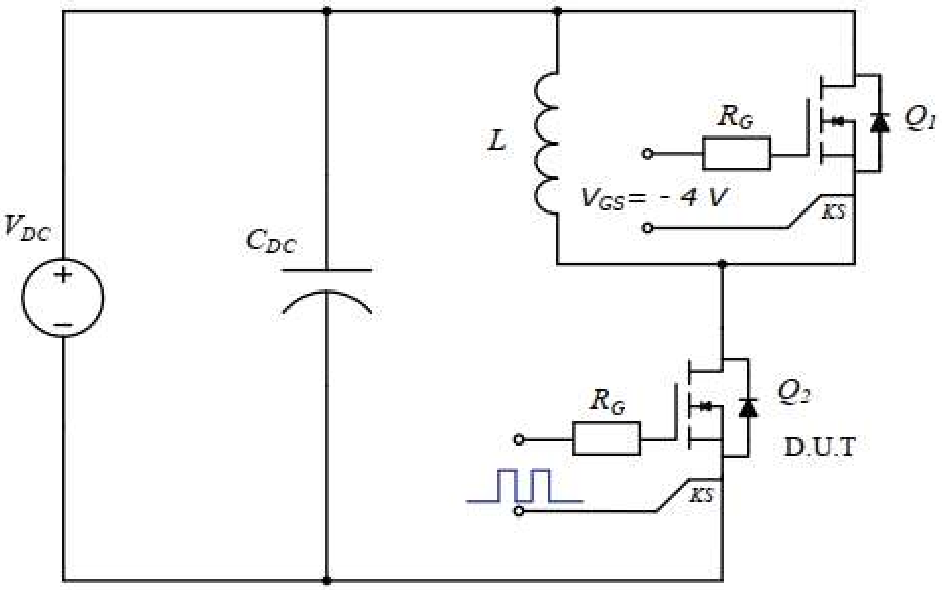
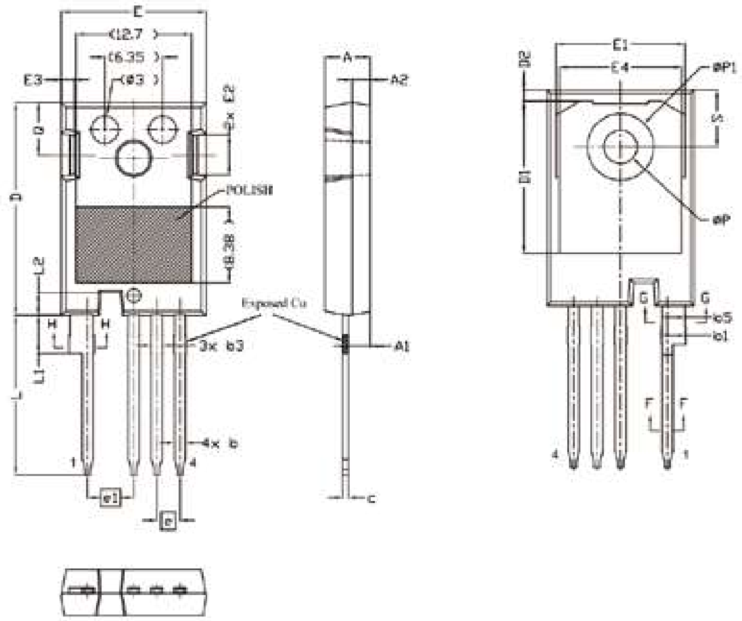
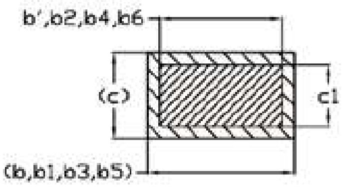


Figure 23: Clamped Inductive Switching Waveform Test Circuit

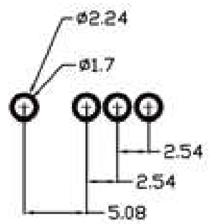
Package Dimensions

Package： TO-247-4





Section F–F, G–G, H–H



Recommended Solder Pad Layout

SYMBOL	DIMENSIONS		
	MIN.	NOM.	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
∅P	3.51	3.61	3.65
∅P1	7.19 REF.		
Q	5.49	5.79	6.00
S	6.04	6.17	6.30

Note:

1. All Dimensions Are In mm.

2.Slot Required, Notch May Be Rounded

3.Dimension D & E Do Not Include Mold Flash. Mold Flash Shall Not Exceed 0.127mm Pre Side. These Dimensions Are Measured At The Outermost Extreme Of The Plastic Body.

4.Thermal Pad Contour Optional Within Dimension D1 & E1.

5.Lead Finish Uncontrolled In L1.

6.φP To Have A Maximum Draft Angle Of 1.5° To The Top Of The Part With A Maximum Hole Diameter Of 3.9l mm.

Revision History

Document Version	Description of Changes
Rev.1.0	Released
Rev.2.0	Static parameters at different temperatures are added
Rev.21	Package Outline Updated
Rev.22	Clamped Inductive Switching Graph Updated

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