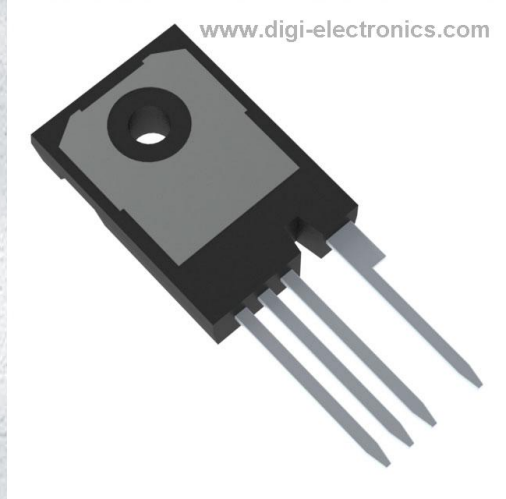
G3R60MT07K Datasheet



https://www.DiGi-Electronics.com

DiGi Electronics Part Number	G3R60MT07K-DG
Manufacturer	GeneSiC Semiconductor
Manufacturer Product Number	G3R60MT07K
Description	750V 60M TO-247-4 G3R SIC MOSFET
Detailed Description	750 V Through Hole TO-247-4

Tel: +00 852-30501935

RFQ Email: Info@DiGi-Electronics.com

Purchase and inquiry

Manufacturer Product Number:	Manufacturer:
G3R60MT07K	GeneSiC Semiconductor
Series:	Product Status:
G3R™	Active
FET Type:	Technology:
-	SiCFET (Silicon Carbide)
Drain to Source Voltage (Vdss):	Current - Continuous Drain (Id) @ 25°C:
750 V	-
Drive Voltage (Max Rds On, Min Rds On):	Rds On (Max) @ Id, Vgs:
-	-
Vgs(th) (Max) @ Id:	Vgs (Max):
-	+20V, -10V
FET Feature:	Power Dissipation (Max):
-	-
Operating Temperature:	Mounting Type:
-	Through Hole
Supplier Device Package:	Package / Case:
TO-247-4	TO-247-4

Environmental & Export classification

RoHS Status:	Moisture Sensitivity Level (MSL):
ROHS3 Compliant	1 (Unlimited)
REACH Status:	ECCN:
REACH Unaffected	EAR99
HTSUS:	
8541.29.0095	

G3R60MT07K
750V 45mΩ SiC MOSFET

Silicon Carbide MOSFET
N-Channel Enhancement Mode

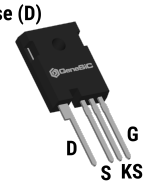
V_{DS}	= 750 V
$R_{DS(ON)}$(Typ.)(V_{GS} = 18V)	= 45 mΩ
$R_{DS(ON)}$(Typ.)(V_{GS} = 15V)	= 60 mΩ
I_D (T_C = 100°C)	= 34 A

Features

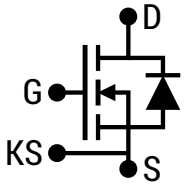
- G3R™ Technology
- Softer $R_{DS(ON)}$ v/s Temperature Dependency
- LoRing™ - Electromagnetically Optimized Design
- Smaller $R_{G(INT)}$ and Lower Q_G
- Low Device Capacitances (C_{OSS}, C_{RSS})
- Superior Cost-Performance Index
- Robust Body Diode with Low V_F and Low Q_{RR}
- 100% Avalanche (UIL) Tested

Package

Case (D)



TO-247-4



D = Drain
G = Gate
S = Source
KS = Kelvin Source

RoHS

REACH

Advantages

- Compatible with Commercial Gate Drivers
- Low Conduction Losses at all Temperatures
- Reduced Ringing
- Faster and More Efficient Switching
- Lesser Switching Spikes and Lower Losses
- Better Power Density and System Efficiency
- Ease of Paralleling without Thermal Runaway
- Superior Robustness and System Reliability

Applications

- Solar (PV) Inverters
- Server & Telecom Power Supplies
- Uninterruptible Power Supplies (UPS)
- EV / HEV Charging
- DC-DC Converters
- Switched Mode Power Supplies (SMPS)
- Energy Storage and Battery Charging
- Class D Amplifiers

Absolute Maximum Ratings (At T_C = 25°C Unless Otherwise Stated)

Parameter	Symbol	Conditions	Values	Unit	Note
Drain-Source Voltage	$V_{DS(max)}$	V_{GS} = 0 V, I_D = 100 µA	750	V	
Gate-Source Voltage (Dynamic)	$V_{GS(max)}$		-10 / +22	V	
Gate-Source Voltage (Static)	$V_{GS(op)-ON}$ $V_{GS(op)-OFF}$	Recommended Operation	+15 to +18 -5 to -3	V	
Continuous Forward Current	I_D	T_C = 25°C, V_{GS} = -5 / +18 V T_C = 100°C, V_{GS} = -5 / +18 V T_C = 135°C, V_{GS} = -5 / +18 V T_C = 25°C, V_{GS} = -5 / +15 V T_C = 100°C, V_{GS} = -5 / +15 V T_C = 135°C, V_{GS} = -5 / +15 V	49 34 25 48 34 25	A	Fig. 15
Pulsed Drain Current	$I_{D(pulse)}$	t_P ≤ 3µs, D ≤ 1%, V_{GS} = 15 V, Note 1	100	A	Fig. 14
Power Dissipation	P_D	T_c = 25°C	185	W	Fig. 16
Non-Repetitive Avalanche Energy	E_{AS}	L = 8.9 mH, I_{AS} = 7.5 A	250	mJ	
Operating and Storage Temperature	T_j , T_{stg}		-55 to 175	°C	

G3R60MT07K
750V 45mΩ SiC MOSFET

Electrical Characteristics (At T_C = 25°C Unless Otherwise Stated)

Parameter	Symbol	Conditions	Values			Unit	Note
			Min.	Typ.	Max.		
Drain-Source Breakdown Voltage	V_{DSS}	V_{GS} = 0 V, I_D = 100 µA	750			V	
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 750 V, V_{GS} = 0 V		1.0	100	µA	
Gate Source Leakage Current	I_{GSS}	V_{DS} = 0 V, V_{GS} = 22 V V_{DS} = 0 V, V_{GS} = -10 V			100 -100	nA	
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 8 mA V_{DS} = V_{GS}, I_D = 8 mA, T_j = 175°C	1.8	2.50 2.00		V	Fig. 9
Transconductance	g_{fs}	V_{DS} = 10 V, I_D = 15 A V_{DS} = 10 V, I_D = 15 A, T_j = 175°C		7.8 8.6		S	Fig. 4
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS} = 15 V, I_D = 15 A V_{GS} = 15 V, I_D = 15 A, T_j = 175°C V_{GS} = 18 V, I_D = 15 A V_{GS} = 18 V, I_D = 15 A, T_j = 175°C		60 72 45 61	62	mΩ	Fig. 5-8
Input Capacitance	C_{iss}	V_{DS} = 450 V, V_{GS} = 0 V f = 1 MHz, V_{AC} = 25mV		1136		pF	Fig. 11
Output Capacitance	C_{oss}			107			
Reverse Transfer Capacitance	C_{rss}			9.4			
C_{oss} Stored Energy	E_{oss}			12		µJ	Fig. 12
C_{oss} Stored Charge	Q_{oss}			71		nC	
Effective Output Capacitance (Energy Related)	$C_{o(er)}$			119		pF	Note 2
Effective Output Capacitance (Time Related)	$C_{o(tr)}$			158			
Gate-Source Charge	Q_{gs}	V_{DS} = 450 V, V_{GS}= -5 / +18 V I_D = 15 A Per IEC607478-4		13		nC	Fig. 10
Gate-Drain Charge	Q_{gd}			16			
Total Gate Charge	Q_g			55			
Internal Gate Resistance	$R_{G(int)}$	f = 1 MHz, V_{AC} = 25 mV		1.0		Ω	
Turn-On Switching Energy (Body Diode)	E_{On}	T_j = 25°C, V_{GS} = -5/+15V, $R_{G(ext)}$ = 3 Ω, L = 60.0 µH, I_D = 15 A, V_{DD} = 450 V		35		µJ	Fig. 22,26
Turn-Off Switching Energy (Body Diode)	E_{Off}			4			
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 450 V, V_{GS} = -5/+15V $R_{G(ext)}$ = 3 Ω, L = 60.0 µH, I_D = 15 A Timing relative to V_{DS}, Inductive load		14		ns	Fig. 24
Rise Time	t_r			7			
Turn-Off Delay Time	$t_{d(off)}$			8			
Fall Time	t_f			4			

Note 1: Pulse Width t_P Limited by $T_{j(max)}$

Note 2: $C_{o(er)}$, a lumped capacitance that gives same stored energy as C_{OSS} while V_{DS} is rising from 0 to 450V.
$C_{o(tr)}$, a lumped capacitance that gives same charging times as C_{OSS} while V_{DS} is rising from 0 to 450V.

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Reverse Diode Characteristics

Parameter	Symbol	Conditions	Values			Unit	Note
			Min.	Typ.	Max.		
Diode Forward Voltage	V_{SD}	V_{GS} = -5 V, I_{SD} = 7 A		4.2		V	Fig. 17-18
		V_{GS} = -5 V, I_{SD} = 7 A, T_j = 175°C		3.8			
Continuous Diode Forward Current	I_S	V_{GS} = -5 V, T_c = 100°C	17			A	
Diode Pulse Current	$I_{S(pulse)}$	V_{GS} = -5 V, Note 1		68		A	
Reverse Recovery Time	t_{rr}	V_{GS} = -5 V, I_{SD} = 15 A, V_R = 450 V dif/dt = 800 A/µs, T_j = 25°C		24		ns	
Reverse Recovery Charge	Q_{rr}			102		nC	
Peak Reverse Recovery Current	I_{rrm}			6.3		A	
Reverse Recovery Time	t_{rr}	V_{GS} = -5 V, I_{SD} = 15 A, V_R = 450 V dif/dt = 800 A/µs, T_j = 175°C		26		ns	
Reverse Recovery Charge	Q_{rr}			155		nC	
Peak Reverse Recovery Current	I_{rrm}			9		A	

Thermal/Package Characteristics

Parameter	Symbol	Conditions	Values			Unit	Note
			Min.	Typ.	Max.		
Thermal Resistance, Junction - Case	R_{thJC}				0.81	°C/W	Fig. 13
Weight	W_T			6.2		g	
Mounting Torque	T_M	Screws to Heatsink			1.1	Nm	

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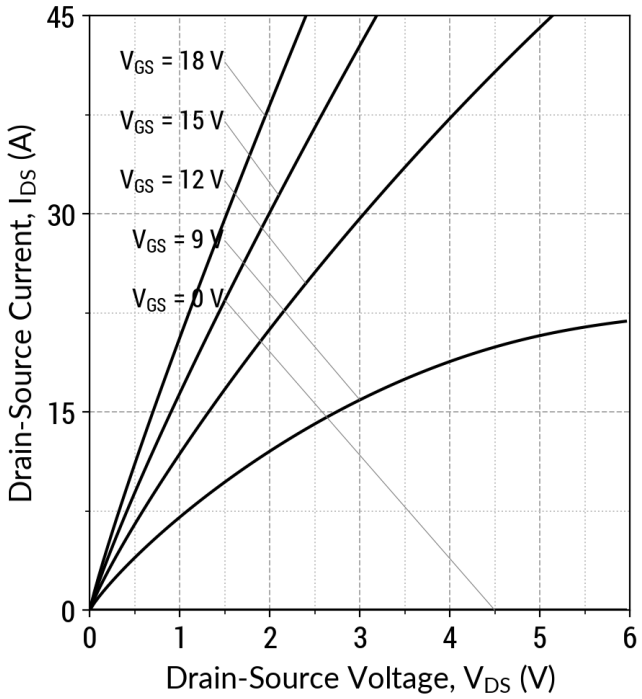
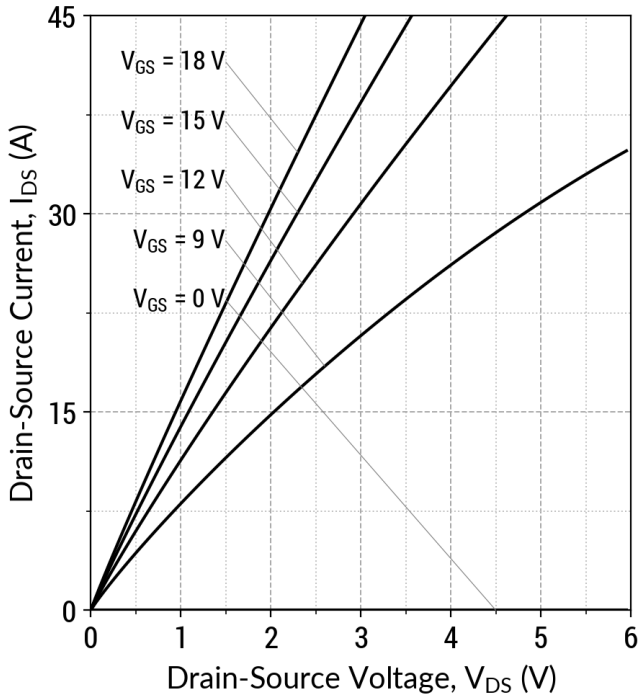
750V 45mΩ SiC MOSFET

Figure 1: Output Characteristics (T_j = 25°C)



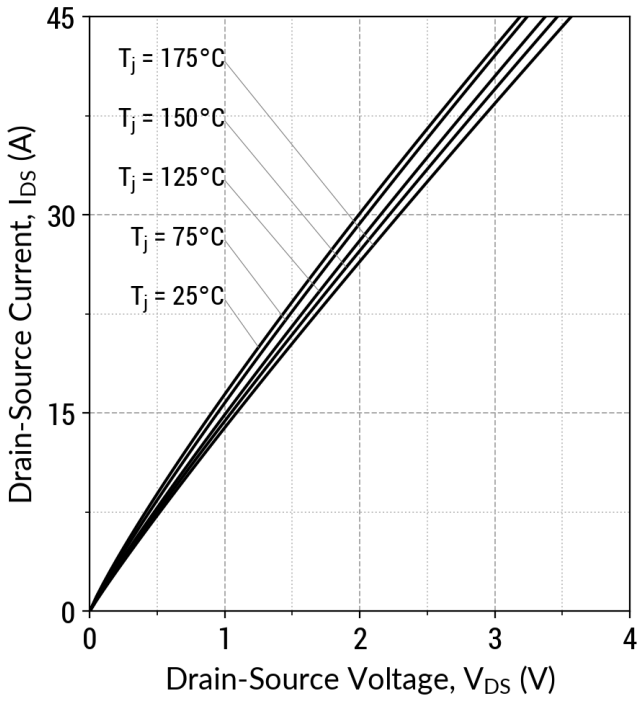
$I_D = f(V_{DS}, V_{GS})$; t_P = 250 µs

Figure 2: Output Characteristics (T_j = 175°C)



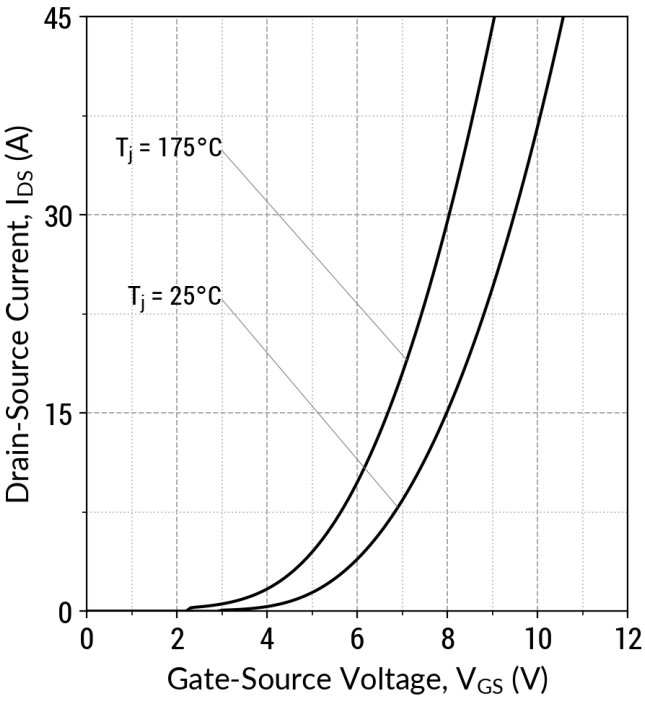
$I_D = f(V_{DS}, V_{GS})$; t_P = 250 µs

Figure 3: Output Characteristics (V_{GS} = 15 V)



$I_D = f(V_{DS}, T_j)$; t_P = 250 µs

Figure 4: Transfer Characteristics (V_{DS} = 10 V)



$I_D = f(V_{GS}, T_j)$; t_P = 100 µs

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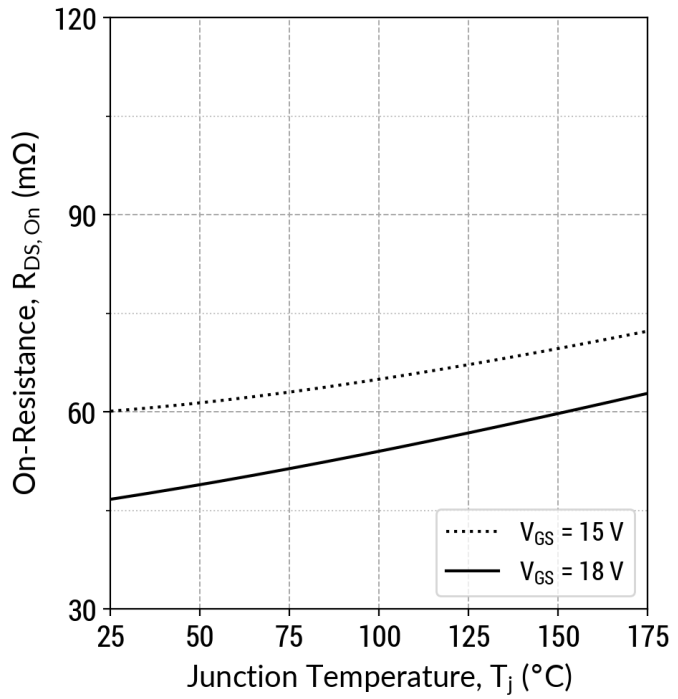
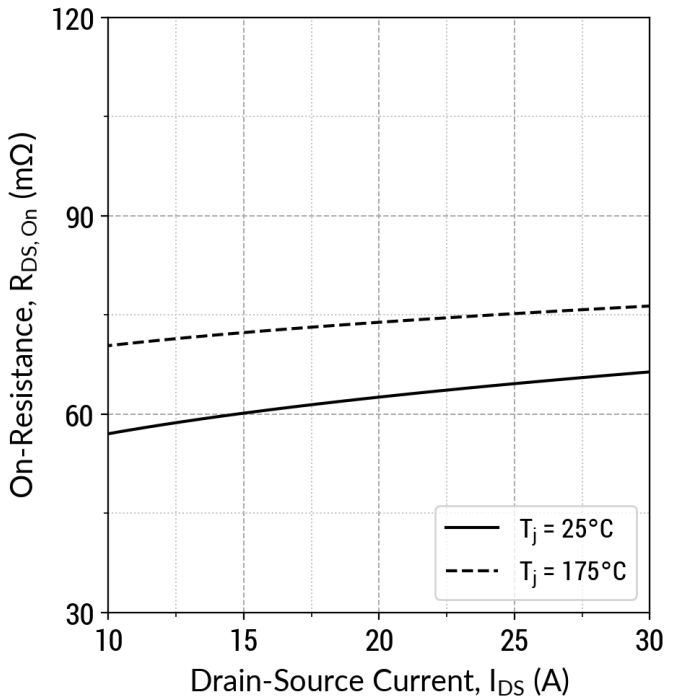
Figure 5: On-State Resistance v/s Temperature



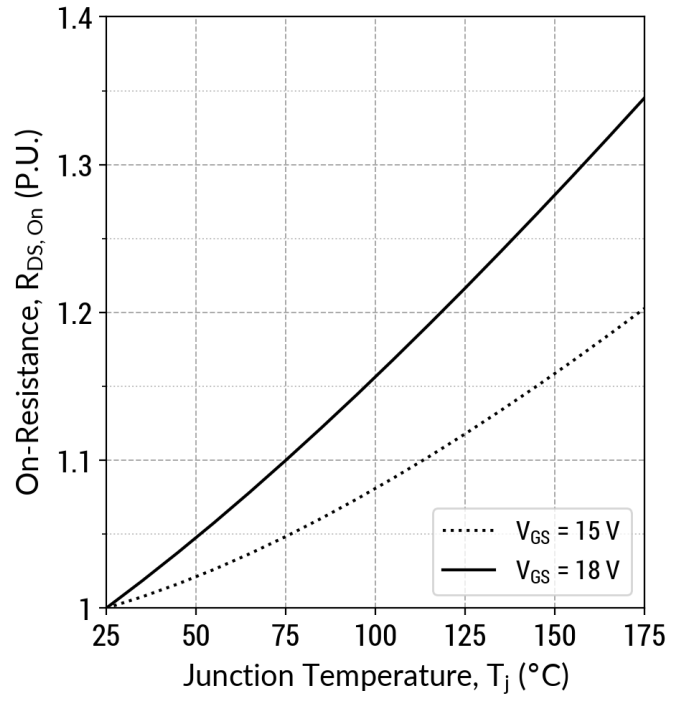
$R_{DS(ON)} = f(T_j, V_{GS})$; t_P = 250 µs; I_D = 15 A

Figure 6: On-State Resistance v/s Drain Current



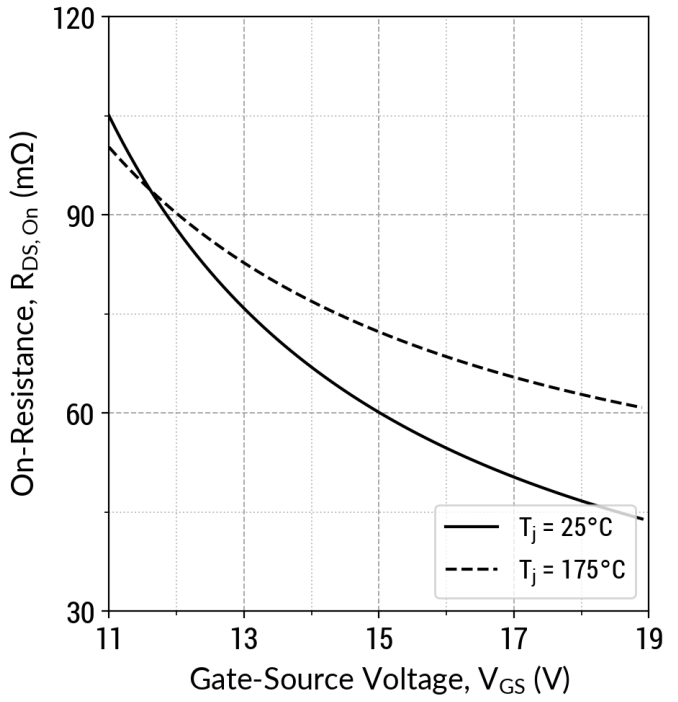
$R_{DS(ON)} = f(T_j, I_D)$; t_P = 250 µs; V_{GS} = 15 V

Figure 7: Normalized On-State Resistance v/s Temperature



$R_{DS(ON)} = f(T_j)$; t_P = 250 µs; I_D = 15 A

Figure 8: On-State Resistance v/s Gate Voltage



$R_{DS(ON)} = f(T_j, V_{GS})$; t_P = 250 µs; I_D = 15 A

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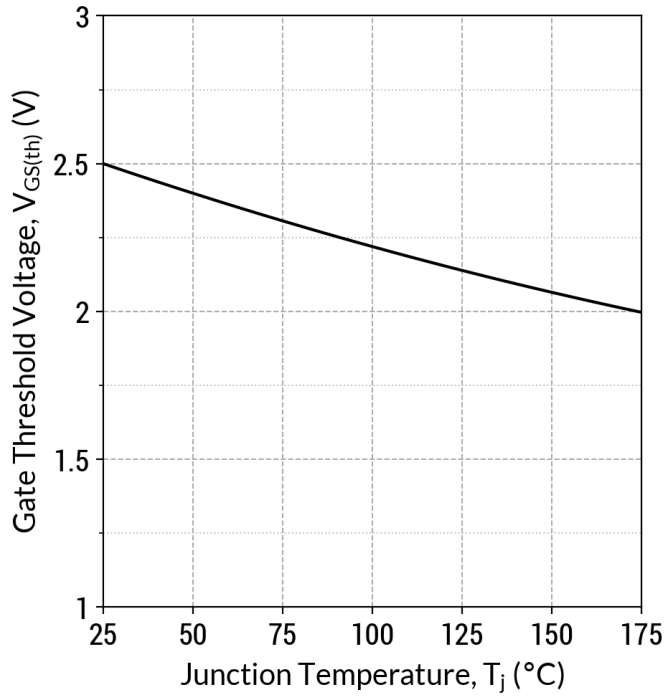
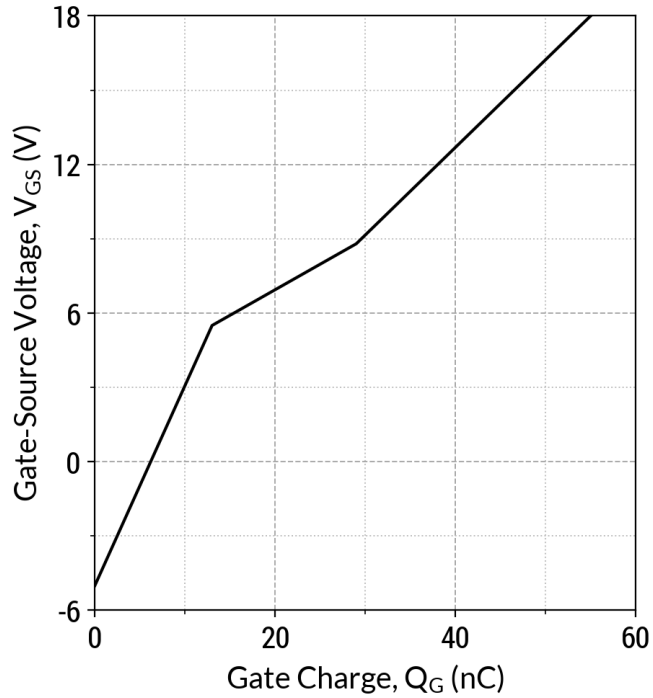
750V 45mΩ SiC MOSFET

Figure 9: Threshold Voltage Characteristics



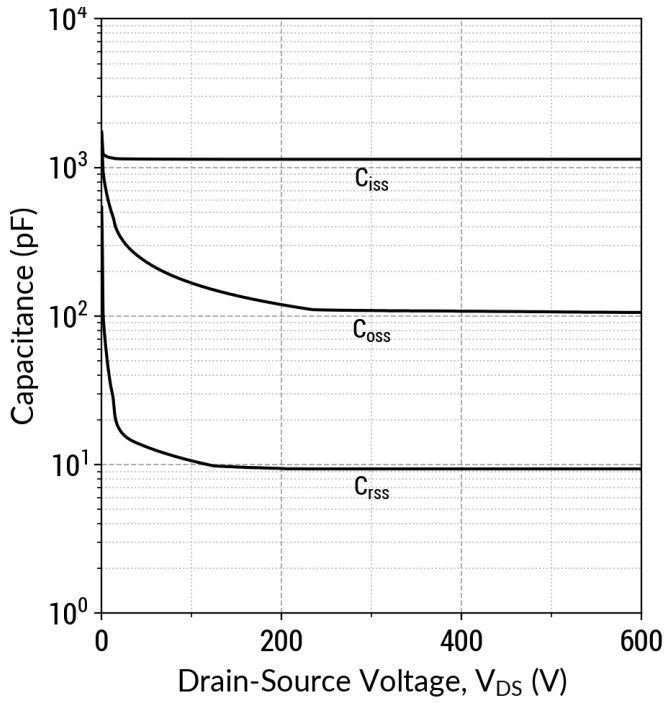
$V_{GS(th)} = f(T_j)$; $V_{DS} = V_{GS}$; I_D = 8 mA

Figure 10: Gate Charge Characteristics



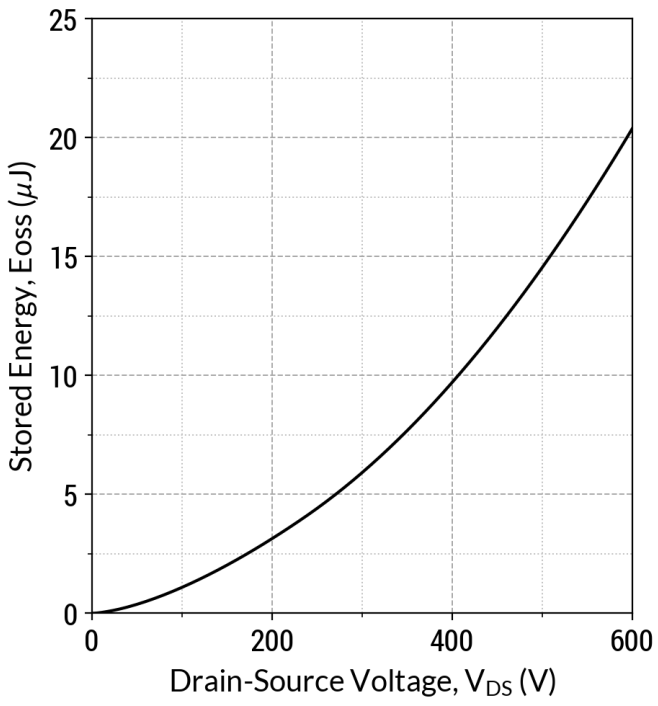
I_D = 15 A; V_{DS} = 450 V; T_c = 25°C

Figure 11: Capacitance v/s Drain-Source Voltage



f = 1 MHz; V_{AC} = 25mV

Figure 12: Output Capacitor Stored Energy



$E_{oss} = f(V_{DS})$

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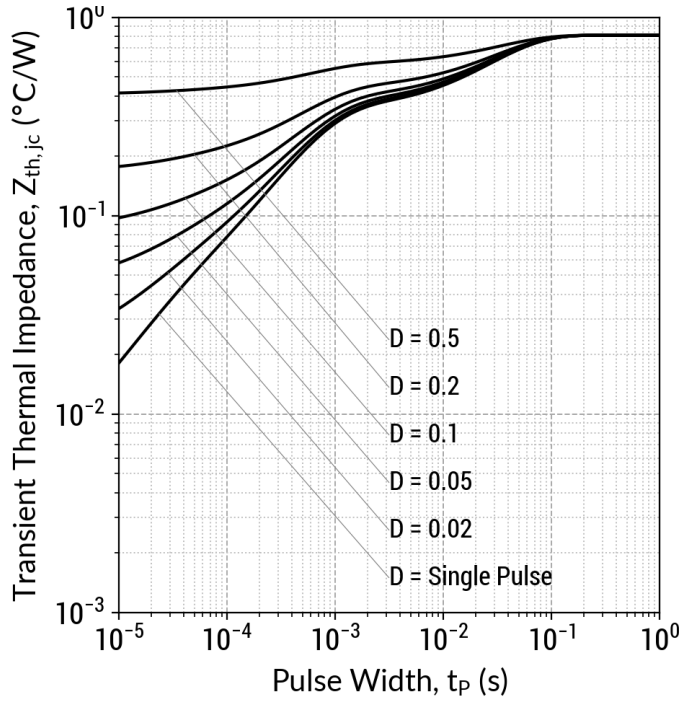
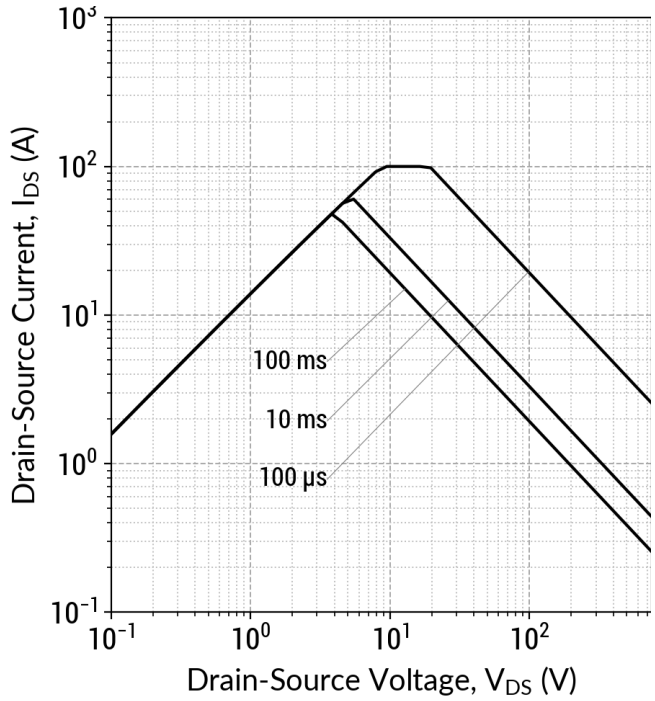
750V 45mΩ SiC MOSFET

Figure 13: Transient Thermal Impedance



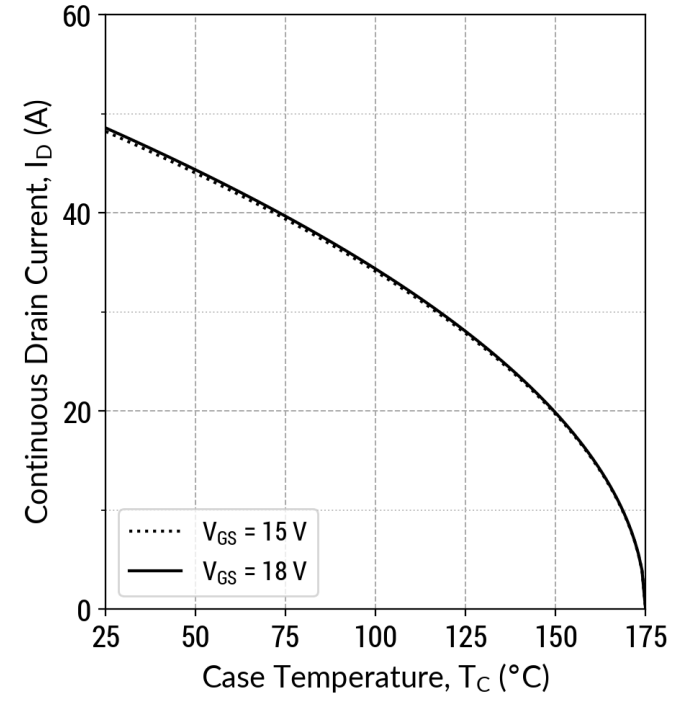
$Z_{th,jc} = f(t_P,D)$; $D = t_P/T$

Figure 14: Safe Operating Area (T_c = 25°C)



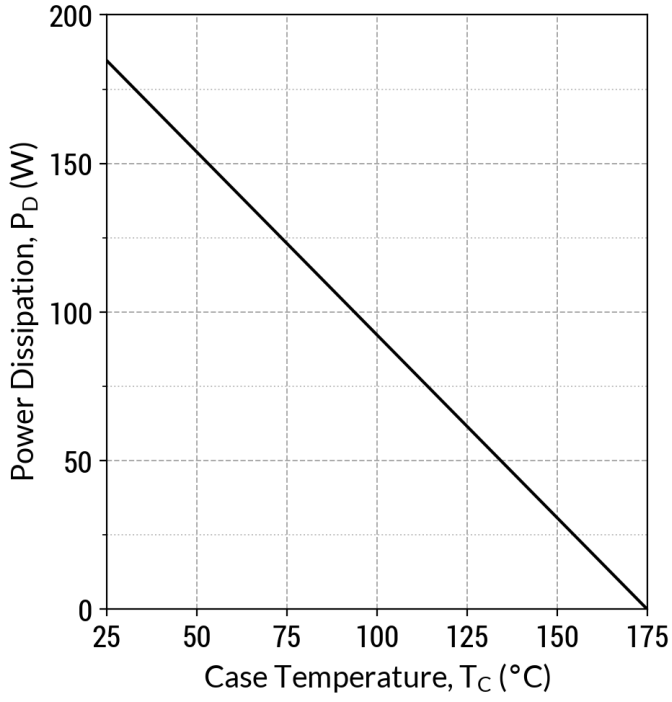
$I_D = f(V_{DS}, t_P)$; $T_j \leq 175°C$; $D = 0$

Figure 15: Current De-rating Curve



$I_D = f(T_C)$; $T_j \leq 175°C$

Figure 16: Power De-rating Curve



$P_D = f(T_C)$; $T_j \leq 175°C$

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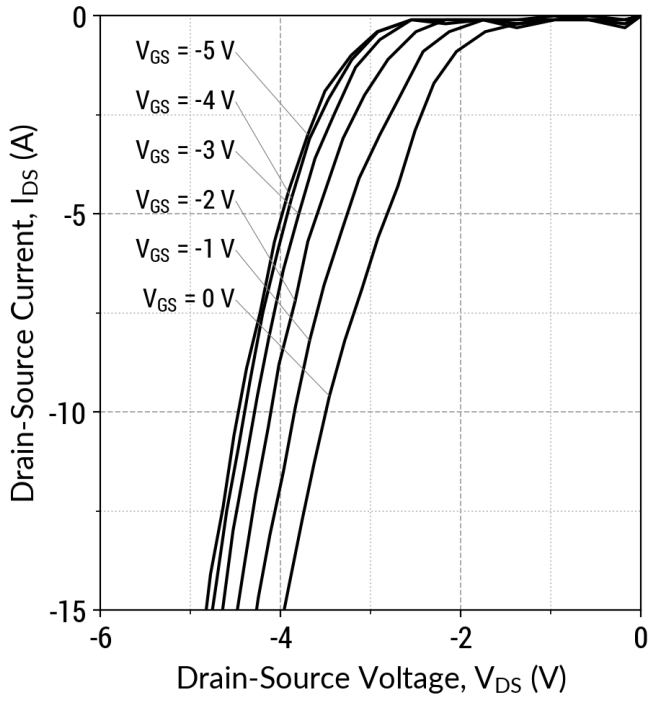
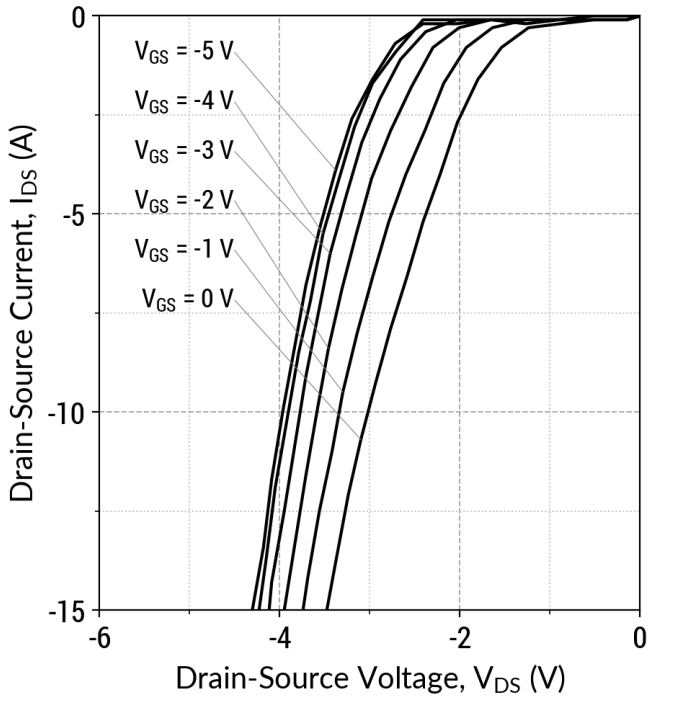
750V 45mΩ SiC MOSFET

Figure 17: Body Diode Characteristics (T_j = 25°C)



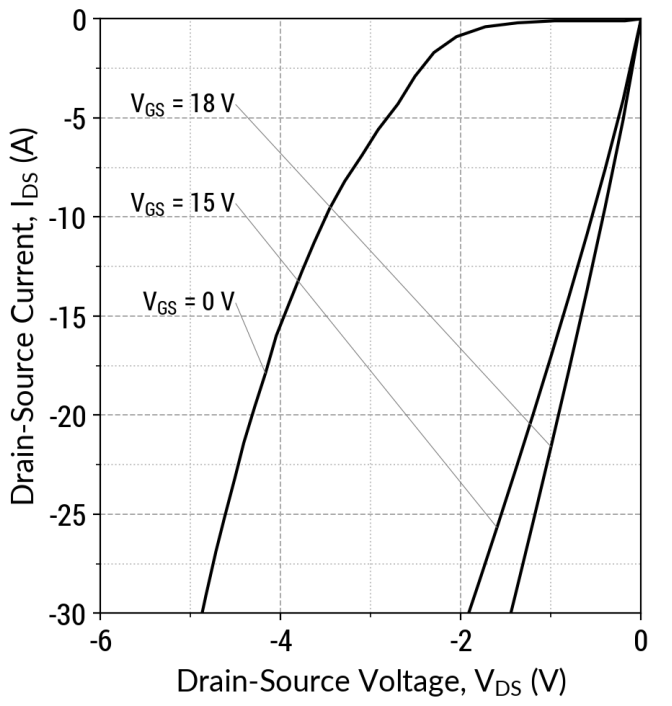
$I_D = f(V_{DS}, V_{GS})$; t_P = 250 µs

Figure 18: Body Diode Characteristics (T_j = 175°C)



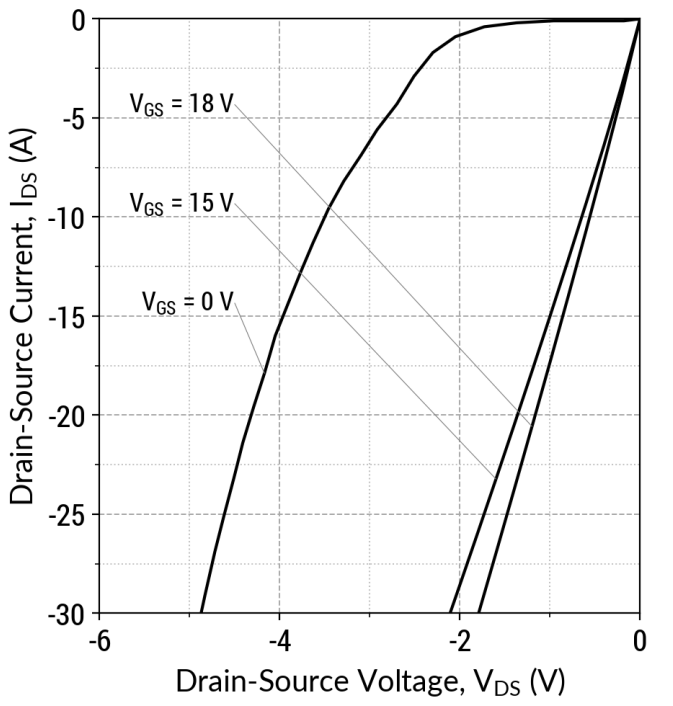
$I_D = f(V_{DS}, V_{GS})$; t_P = 250 µs

Figure 19: Third Quadrant Characteristics (T_j = 25°C)



$I_D = f(V_{DS}, V_{GS})$; t_P = 250 µs

Figure 20: Third Quadrant Characteristics (T_j = 175°C)



$I_D = f(V_{DS}, V_{GS})$; t_P = 250 µs

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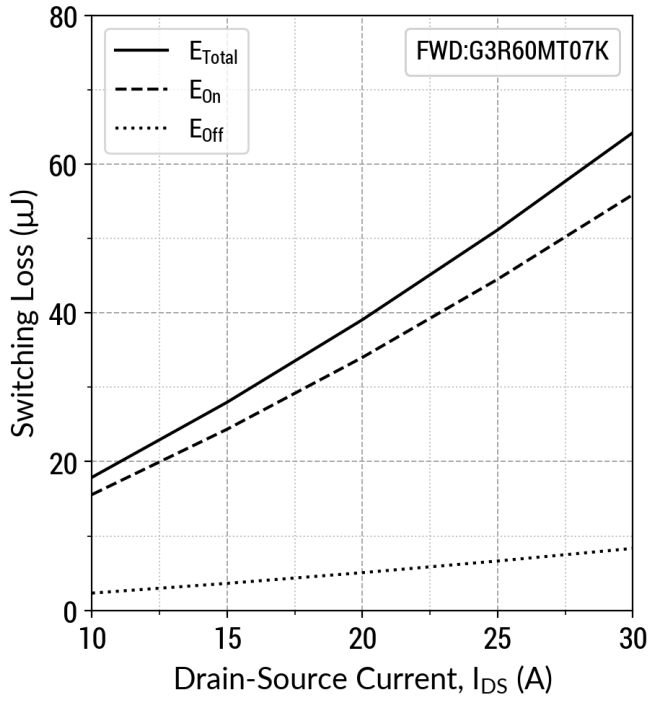
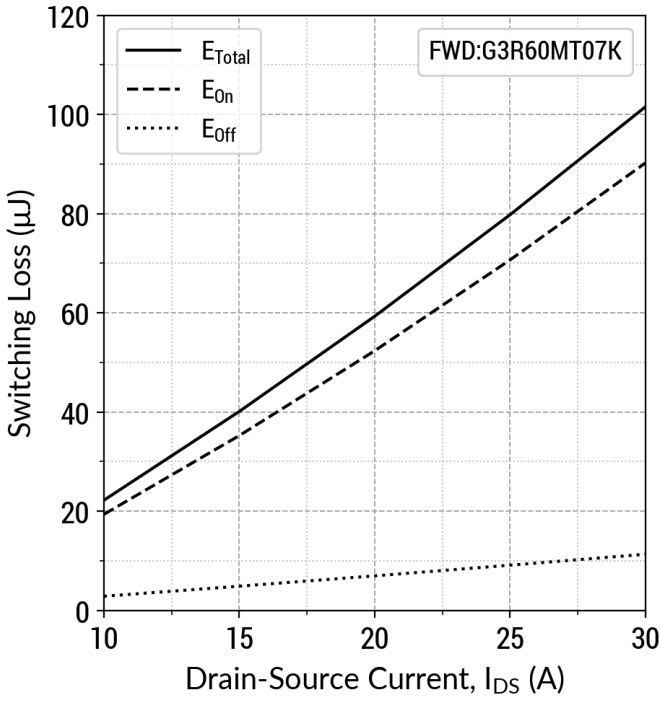
Figure 21: Inductive Switching Energy v/s Drain Current (V_{DD} = 350V)



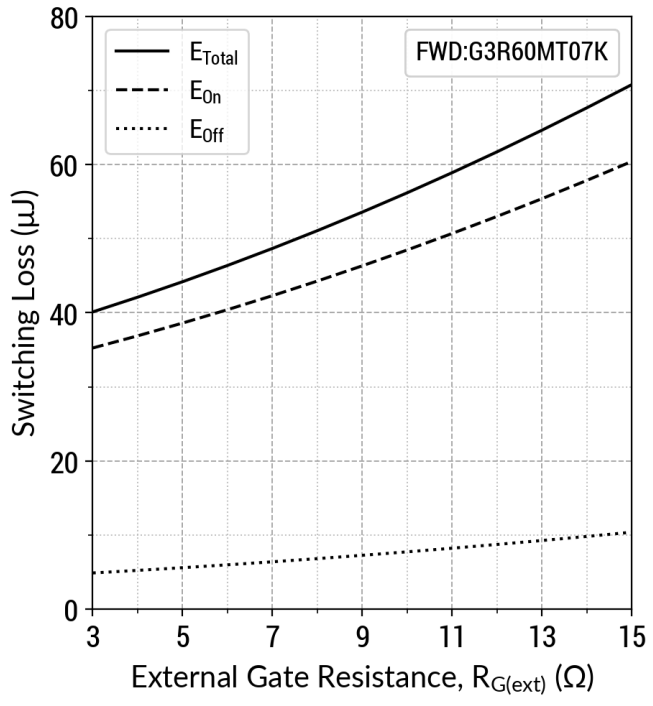
T_j = 25°C; V_{GS} = -5/+15V; $R_{G(ext)}$ = 3 Ω; L = 60.0µH

Figure 22: Inductive Switching Energy v/s Drain Current (V_{DD} = 450V)



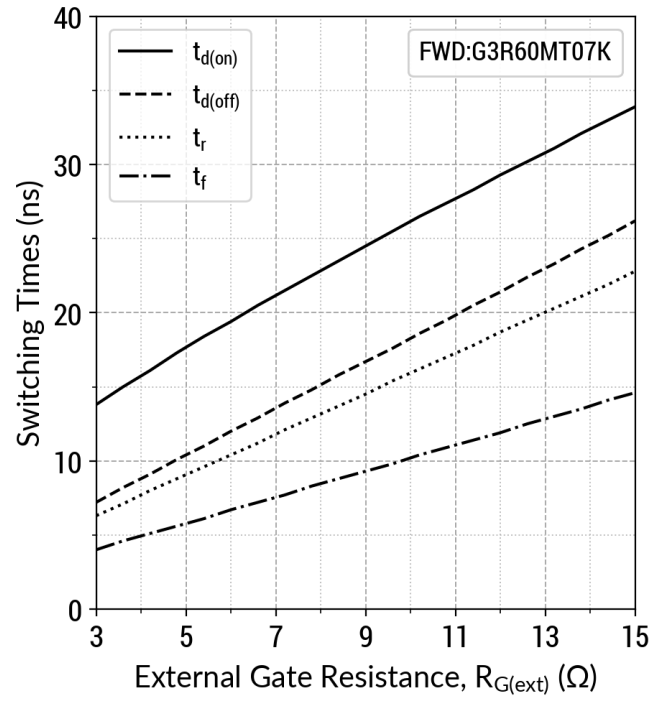
T_j = 25°C; V_{GS} = -5/+15V; $R_{G(ext)}$ = 3 Ω; L = 60.0µH

Figure 23: Inductive Switching Energy v/s $R_{G(ext)}$ (V_{DD} = 450V)



T_j = 25°C; V_{GS} = -5/+15V; I_{DS} = 15 A; L = 60.0µH

Figure 24: Switching Time v/s $R_{G(ext)}$ (V_{DD} = 450V)



T_j = 25°C; V_{GS} = -5/+15V; I_{DS} = 15 A; L = 60.0µH

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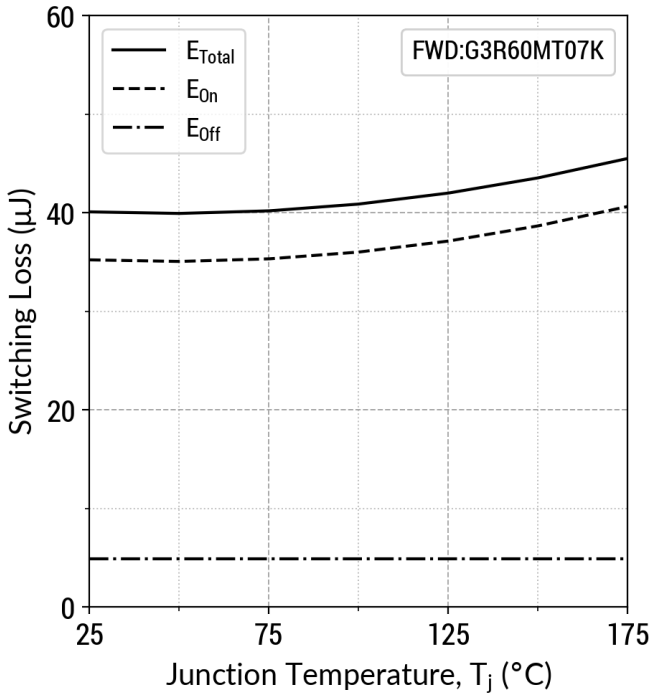
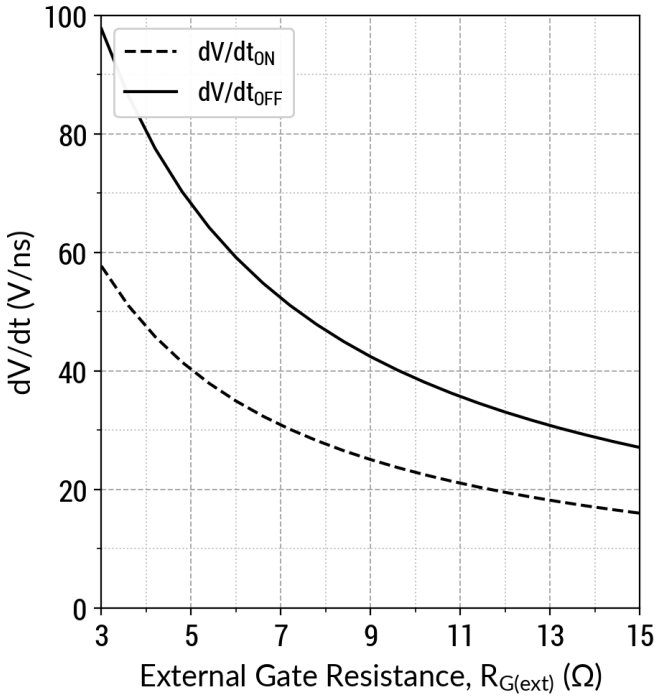
750V 45mΩ SiC MOSFET

Figure 25: Inductive Switching Energy v/s Temperature (V_{DD} = 450V)



T_j = 25°C; V_{GS} = -5/+15V; $R_{G(ext)}$ = 3 Ω; I_{DS} = 15 A; L = 60.0µH

Figure 26: dV/dt v/s $R_{G(ext)}$ (V_{DD} = 450V)



T_j = 25°C; V_{GS} = -5/+15V; I_{DS} = 15 A; L = 60.0µH

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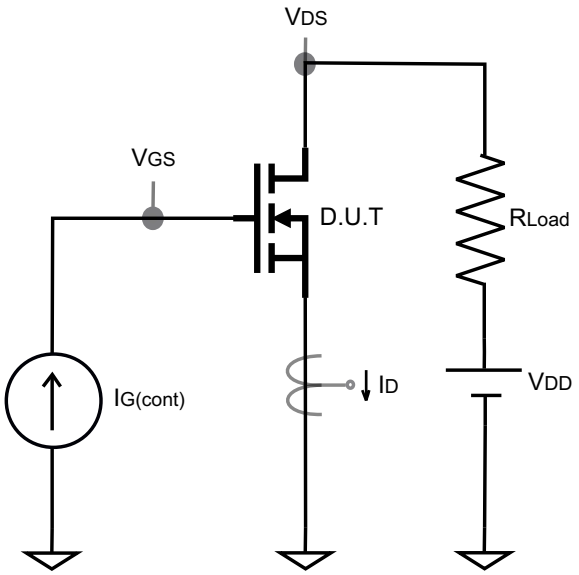
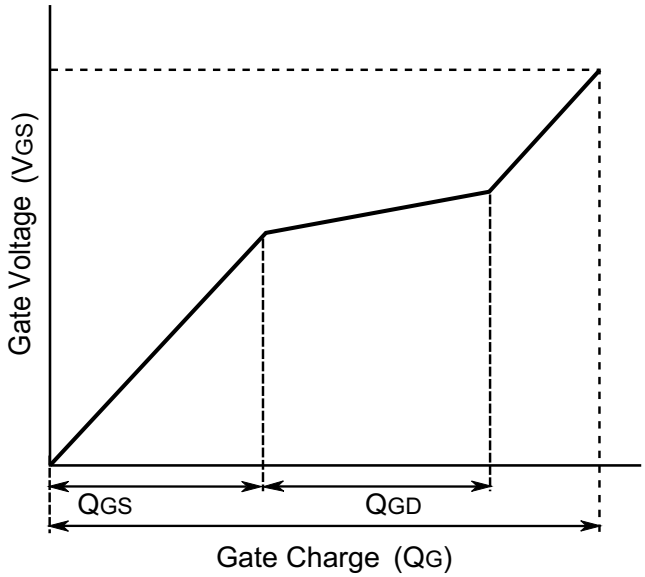
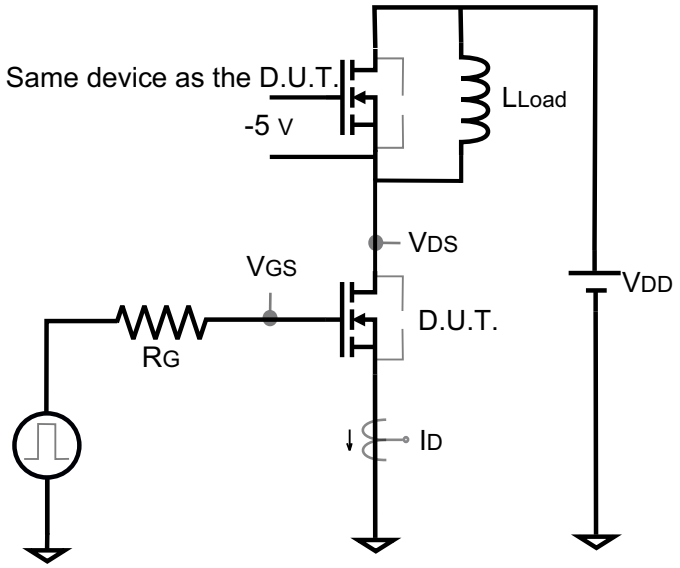
Gate Charge Circuit



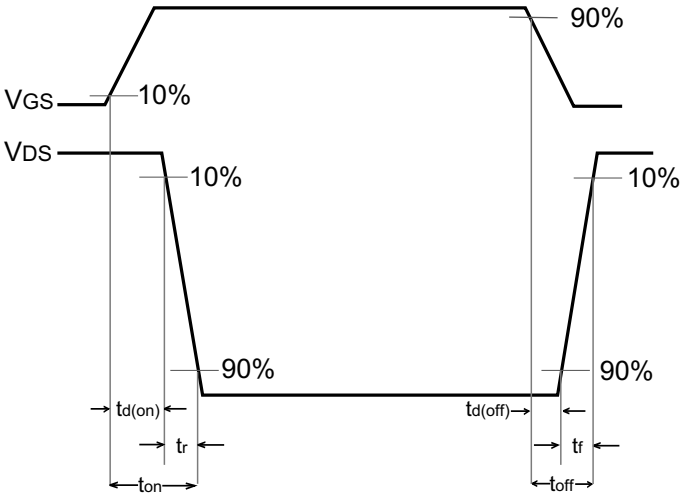
Gate Charge Waveform



Switching Time Circuit



Switching Time Waveform



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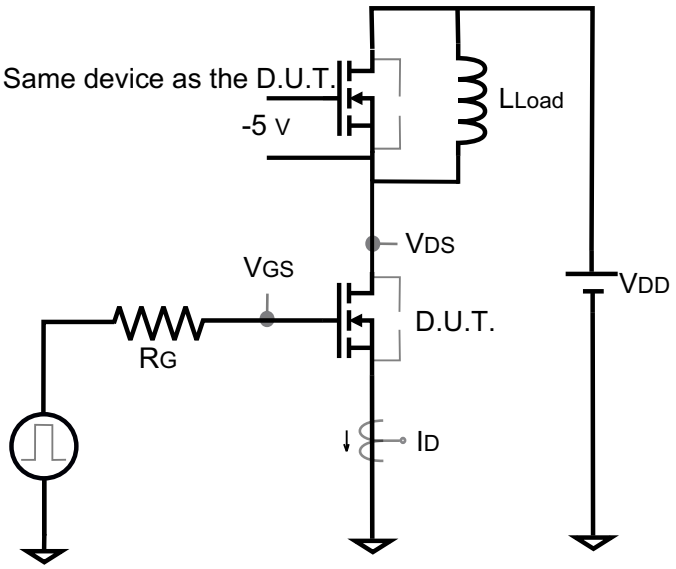
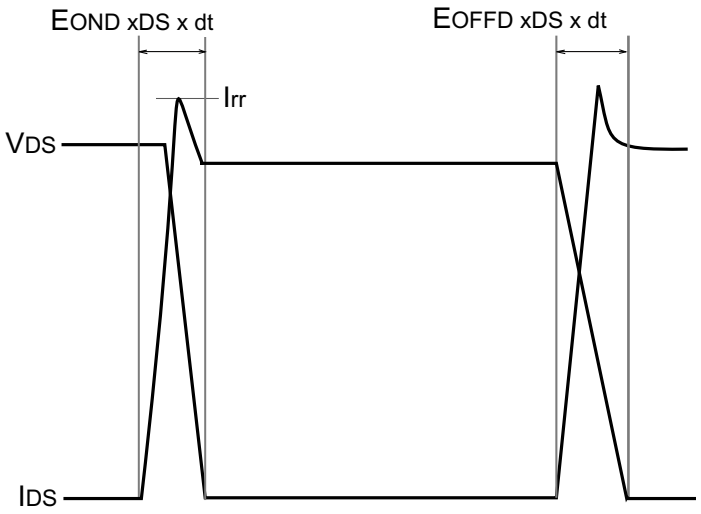
750V 45mΩ SiC MOSFET

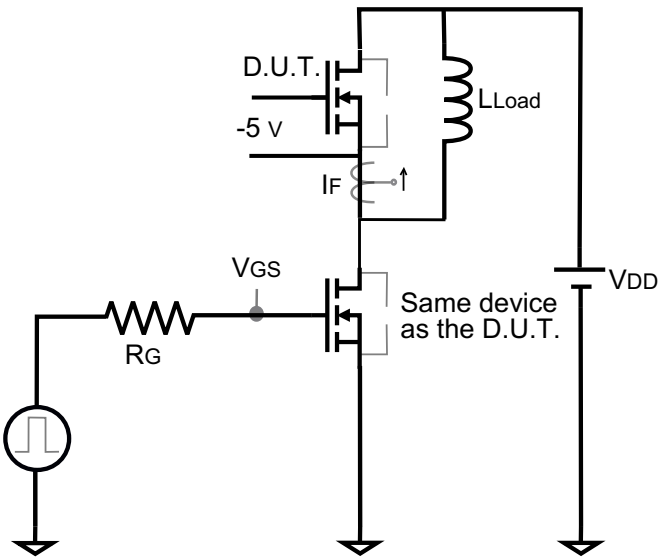
Switching Energy Circuit



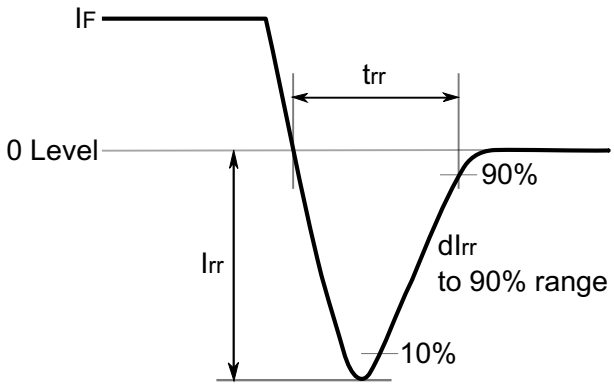
Switching Energy Waveform



Reverse Recovery Circuit



Reverse Recovery Waveform



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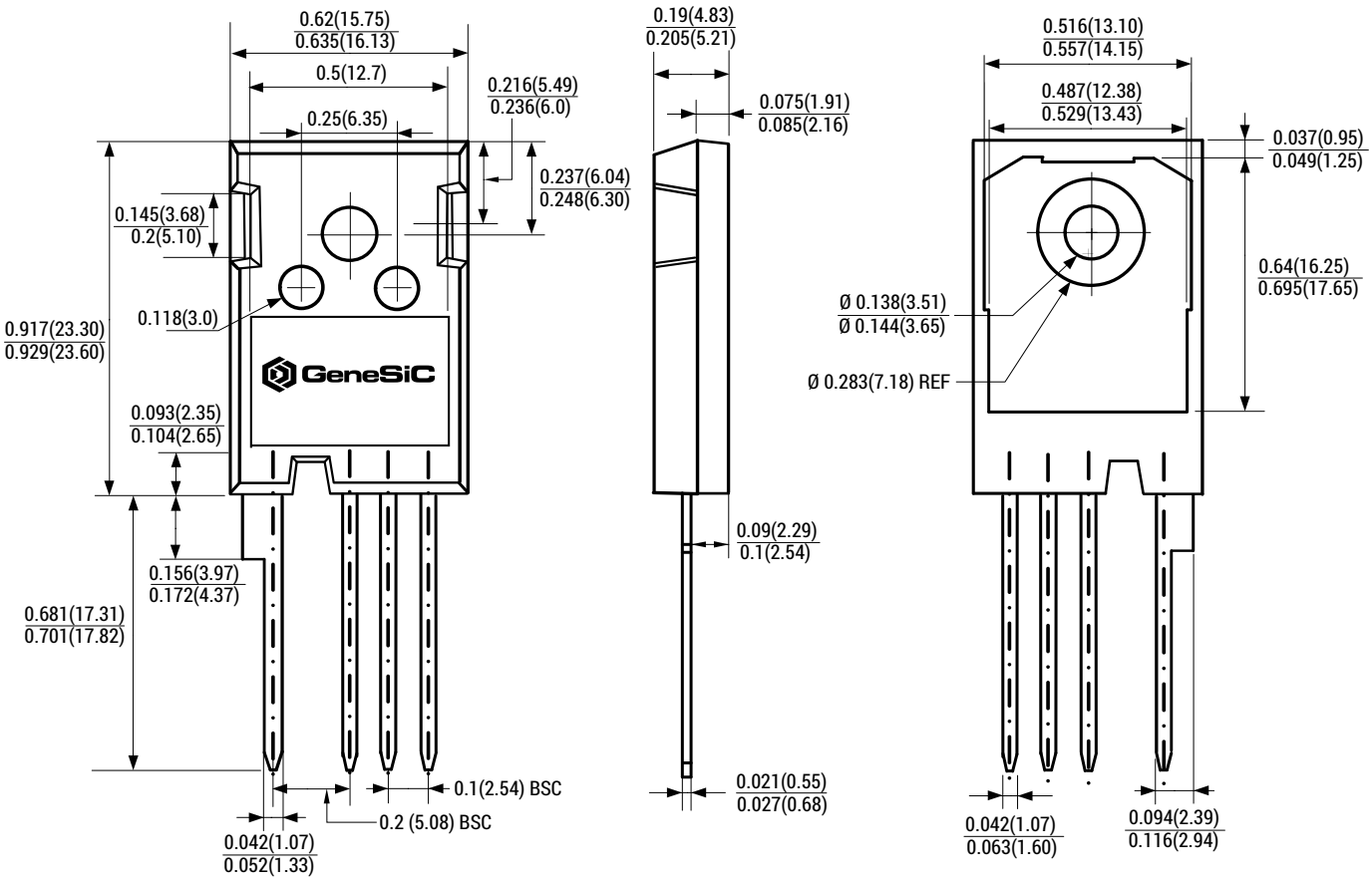
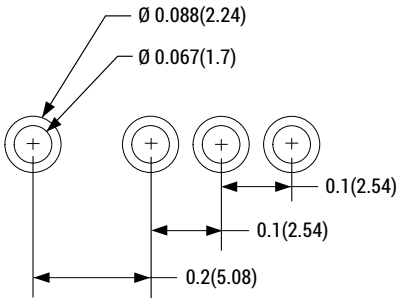
750V 45mΩ SiC MOSFET

Package Dimensions

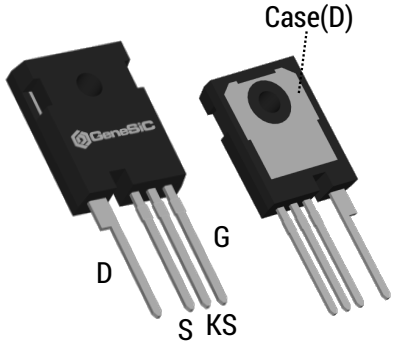
TO-247-4 Package Outline



Recommended Solder Pad Layout



Package View



NOTE

1. CONTROLLED DIMENSION IS INCH. DIMENSION IN BRACKET IS MILLIMETER.
2. DIMENSIONS DO NOT INCLUDE END FLASH, MOLD FLASH, MATERIAL PROTRUSIONS.
3. THE SOURCE AND KELVIN-SOURCE PINS ARE NOT INTERCHANGABLE. THEIR EXCHANGE MIGHT LEAD TO MALFUNCTION.

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750V 45mΩ SiC MOSFET

Compliance

RoHS Compliance

The levels of RoHS restricted materials in this product are below the maximum concentration values (also referred to as the threshold limits) permitted for such substances, or are used in an exempted application, in accordance with EU Directive 2011/65/EC (RoHS 2), as adopted by EU member states on January 2, 2013 and amended on March 31, 2015 by EU Directive 2015/863. RoHS Declarations for this product can be obtained from your GeneSiC representative.

REACH Compliance

REACH substances of high concern (SVHCs) information is available for this product. Since the European Chemical Agency (ECHA) has published notice of their intent to frequently revise the SVHC listing for the foreseeable future, please contact a GeneSiC representative to insure you get the most up-to-date REACH SVHC Declaration. REACH banned substance information (REACH Article 67) is also available upon request.

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- SPICE Models: https://www.genesicsemi.com/sic-mosfet/G3R60MT07K/G3R60MT07K_SPICE.zip
- PLECS Models: https://www.genesicsemi.com/sic-mosfet/G3R60MT07K/G3R60MT07K_PLECS.zip
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- Gate Driver Reference: https://www.genesicsemi.com/technical-support
- Evaluation Boards: https://www.genesicsemi.com/technical-support
- Reliability: https://www.genesicsemi.com/reliability
- Compliance: https://www.genesicsemi.com/compliance
- Quality Manual: https://www.genesicsemi.com/quality

Revision History

- Rev 23/Aug: Updated with Most Recent Data
- Supersedes: Rev 21/May

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Published by GeneSiC Semiconductor (Navitas Semiconductor)
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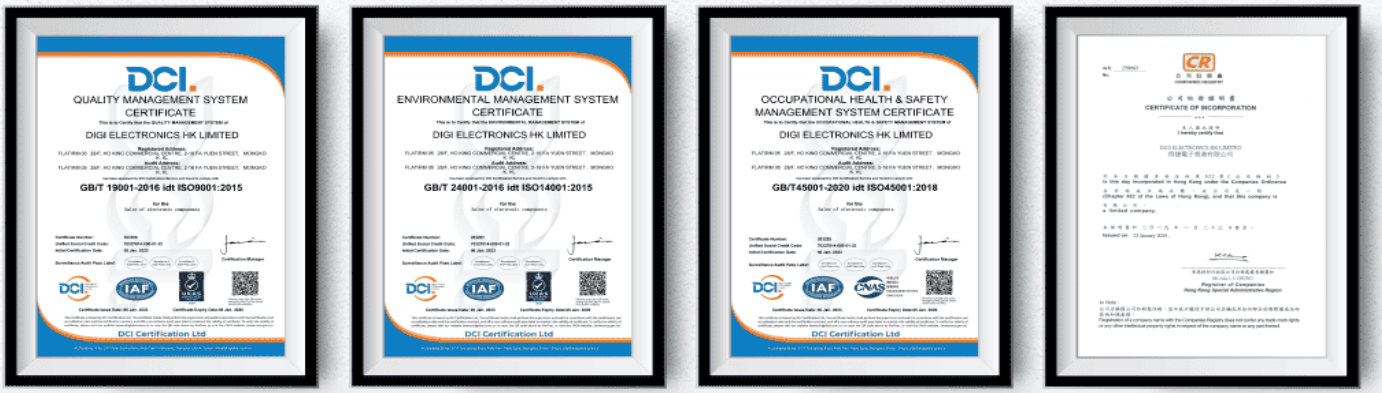

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