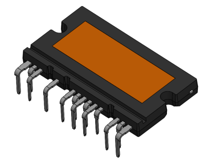
EliteSiC Power MOSFET Module 650 V, 32 mΩ H-Bridge

NXVF6532M3TG01

$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX
650 V	32 mΩ @ 18 V	31 A



AUTOMOTIVE POWER MODULE16
40.10x21.90x4.50, 1.90P
CASE 829AA

Features

- 650 V 32 mΩ SiC MOSFET Module with Al_2O_3 DBC
- H-Bridge with SIP for On-Board Charger (OBC)
- Creepage/Clearance per IEC60664-1, IEC 60950-1
- Compact Design for Low Total Module Resistance
- Module Serialization for Full Traceability
- Lead Free, ROHS and UL94V-0 Compliant
- Automotive Qualified per AEC-Q101/Q200 and AQG324

Typical Applications

- PFC/DC-DC Converter for On-Board Charger in xEV Applications

MARKING DIAGRAM

XXXX
ZZZ ATYWW
NNN

XXXX	= Specific Device Code
ZZZ	= Lot ID
AT	= Assembly & Test Location
Y	= Year
W	= Work Week
NNN	= Serial Number

ORDERING INFORMATION

Device	Package	Shipping
NXVF6532M3TG01	APM16	12 / Tube

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Parameter		Symbol	Value	Unit
Drain-to-Source Voltage		V_{DSS}	650	V
Gate-to-Source Voltage		V_{GS}	−8/+22	V
Recommended Operation Values of Gate-to-Source Voltage, $T_J \le$ 175 °C		V_{GSop}	−3/+18	V
Continuous Drain Current (Note 1)	T_C = 25 °C	I_D	31	A
Power Dissipation (Note 1)		P_D	65.2	W
Pulsed Drain Current (Note 2)	T_C = 25 °C, t_p = 100 μs	I_{DM}	165	A
Operating Junction Temperature Range		T_J	−55 to +175	°C
Storage Temperature Range		T_{stg}	−40 to +125	°C
Source Current (Body Diode)		I_S	14.5	A
Single Pulse Drain-to-Source Avalanche Energy, I_{av} = 16.7 A, L = 1 mH		E_{AS}	139	mJ

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.

1. Maximum continuous current and power, without switching losses, to reach T_J = 175 °C defined by design based on MOSFET $R_{DS(on)}$ and $R_{\theta JC}$ and not subject to production test
2. Repetitive rating limited by maximum junction temperature

THERMAL CHARACTERISTICS

Parameter	Symbol	Typ	Max	Unit
Thermal Resistance, Junction-to-Case (Note 3)	$R_{\theta JC}$	1.74	2.3	°C/W
Thermal Resistance, Junction-to-Sink (Note 4)	$R_{\theta JS}$	2.43	−	

3. Test method compliant with MIL STD 883-1012.1, Cosmetic oxidation and discoloration on the DBC surface allowed
4. Defined by thermal simulation assuming the module is mounted on a 3 mm Al-360 die casting material with 38 μm of 3.0 W/mK thermal interface material

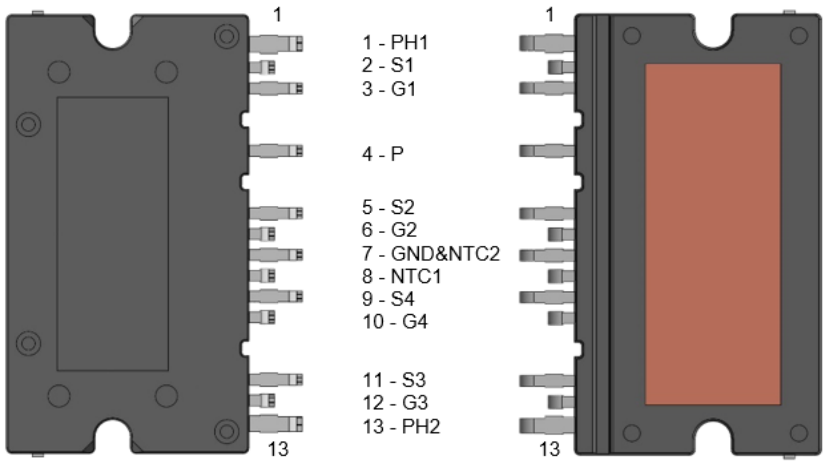


Figure 1. Pin Configuration

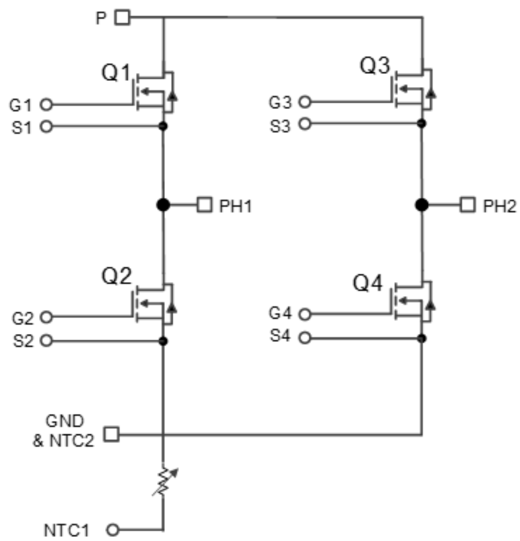


Figure 2. Schematic

PIN DESCRIPTION

Pin	Name	Pin Description
1	PH1	Phase 1 out
2	S1	SiC MOFSET Source 1
3	G1	SiC MOSFET Gate 1
4	P	DC Bus +
5	S2	SiC MOSFET Source 2
6	G2	SiC MOSFET Gate 2
7	GND&NTC2	GND and Negative Temperature Coefficient Thermistor 2
8	NTC1	Negative Temperature Coefficient Thermistor 1
9	S4	SiC MOFSET Source 4
10	G4	SiC MOSFET Gate 4
11	S3	SiC MOSFET Source 3
12	G3	SiC MOSFET Gate 3
13	PH2	Phase 2 out

ELECTRICAL CHARACTERISTICS SiC MOSFET

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
OFF CHARACTERISTICS MOSFET						
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 1 mA	650	–	–	V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS} / T_J$	I_D = 1 mA, Referenced to −55 °C to 175 °C (Note 5)	–	90	–	mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = 650 V	–	–	100	μA
Gate-to-Source Leakage Current	I_{GSS}	V_{GS} = −8/+22 V, V_{DS} = 0 V	–	–	±1	μA
ON CHARACTERISTICS SIC MOSFET (Note 5)						
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 7.5 mA	2	2.6	4	V
Recommended Gate Voltage	V_{GOP}		−3	–	+18	V
Drain-to-Source On Resistance	$R_{DS(on)}$	V_{GS} = 18 V, I_D = 15 A, T_J = 25 °C	–	32	44	mΩ
		V_{GS} = 18 V, I_D = 15 A, T_J = 175 °C (Note 5)	–	49	–	
Forward Transconductance	g_{FS}	V_{DS} = 10 V, I_D = 15 A (Note 5)	–	12	–	S
CHARGES, CAPACITANCES & GATE RESISTANCE SiC MOSFET						
Input Capacitance	C_{ISS}	V_{DS} = 400 V, V_{GS} = 0 V, f = 1 MHz (Note 5)	–	1215	–	pF
Output Capacitance	C_{OSS}		–	198	–	
Reverse Transfer Capacitance	C_{RSS}		–	9.8	–	
Total Gate Charge	$Q_{G(TOT)}$	V_{DS} = 400 V, I_D = 15 A, V_{GS} = 18 V (Note 5)	–	58	–	nC
Threshold Gate Charge	$Q_{G(TH)}$		–	8.5	–	
Gate-to-Source Charge	Q_{GS}		–	15	–	
Gate-to-Drain Charge	Q_{GD}		–	19	–	
Gate Resistance	R_G	V_{GS} = 0 V, f = 1 MHz	–	5	–	Ω
INDUCTIVE SWITCHING CHARACTERISTICS SiC MOSFET						
Turn-On Delay Time	$t_{d(ON)}$	V_{GS} = −3/18 V, V_{DS} = 400 V, I_D = 15 A, R_G = 4.7 Ω, T_J = 25 °C (Note 5)	–	9	–	ns
Rise Time	t_r		–	7.6	–	
Turn-Off Delay Time	$t_{d(OFF)}$		–	27.6	–	
Fall Time	t_f		–	7.6	–	
Turn-On Switching Loss	E_{ON}		–	12.8	–	μJ
Turn-Off Switching Loss	E_{OFF}		–	22.7	–	
Total Switching Loss	E_{tot}		–	35.5	–	
INDUCTIVE SWITCHING CHARACTERISTICS SiC MOSFET						
Turn-On Delay Time	$t_{d(ON)}$	V_{GS} = −3/18 V, V_{DS} = 400 V, I_D = 15 A, R_G = 4.7 Ω, T_J = 175 °C (Note 5)	–	8.4	–	ns
Rise Time	t_r		–	6	–	
Turn-Off Delay Time	$t_{d(OFF)}$		–	33.2	–	
Fall Time	t_f		–	9.2	–	
Turn-On Switching Loss	E_{ON}		–	11.3	–	μJ
Turn-Off Switching Loss	E_{OFF}		–	27.6	–	
Total Switching Loss	E_{tot}		–	38.9	–	

ELECTRICAL CHARACTERISTICS SiC MOSFET (continued)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
SOURCE-TO-DRAIN DIODE CHARACTERISTICS SiC MOSFET						
Forward Diode Voltage	V_{SD}	I_{SD} = 15 A, V_{GS} = −3 V, T_J = 25 °C	–	4.5	6.0	V
		I_{SD} = 15 A, V_{GS} = −3 V, T_J = 175 °C (Note 5)	–	4.1	–	
Reverse Recovery Time	t_{RR}	V_{GS} = −3 V, I_S = 15 A, dI/dt = 1000 A/μs, V_{DS} = 400 V T_J = 25 °C (Note 5)	–	17.6	–	ns
Charge Time	t_a		–	10	–	
Discharge Time	t_b		–	7.6	–	
Reverse Recovery Charge	Q_{RR}		–	91.1	–	nC
Reverse Recovery Energy	E_{REC}		–	9.3	–	μJ
Peak Reverse Recovery Current	I_{RRM}		–	10	–	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.
5. Defined by design, not subject to production test.

COMPONENTS

Component	Description	Type	Quality	Specification
NTC (Note 6)	10 kΩ, ±3% Case Size 0603	Discrete	1	B Constants B25/50 : 3590 B25/85 = 3635 B25/100 = 3650 ±

6. The value is the temperature of the thermistor itself.

ISOLATION VOLTAGE

Parameter	Symbol	Condition	Rating	Unit
Isolation Voltage	V_{ISO}	60 Hz, Sinusoidal, AC 1 minute, Connection Pins to Heat Sink Plate (Note 7)	3300	V_{rms}

7. Equivalent to 60 Hz, Sinusoidal, AC 1 second, 3960 V_{rms}

TYPICAL CHARACTERISTICS

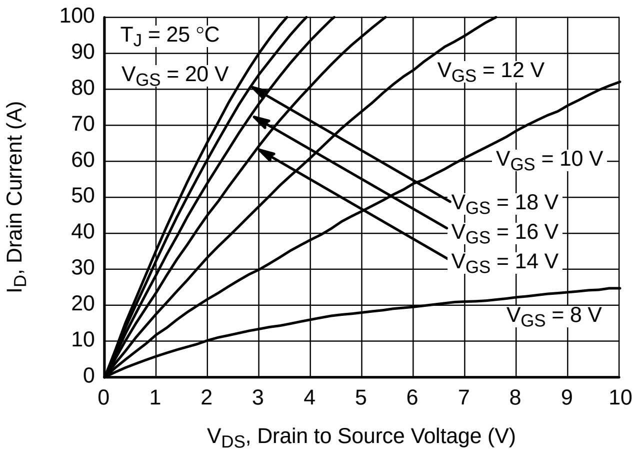


Figure 3. Output Characteristics

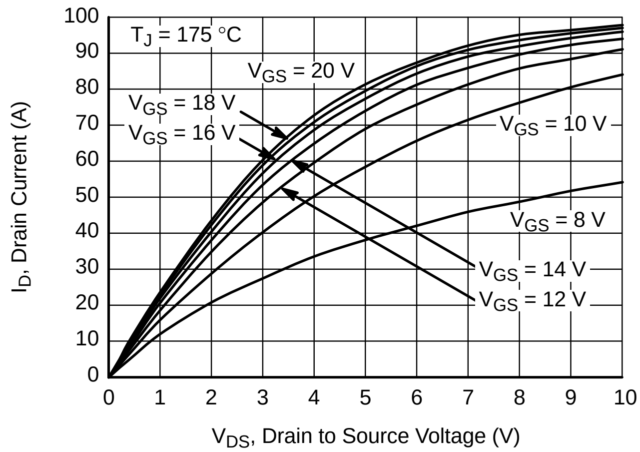


Figure 4. Output Characteristics

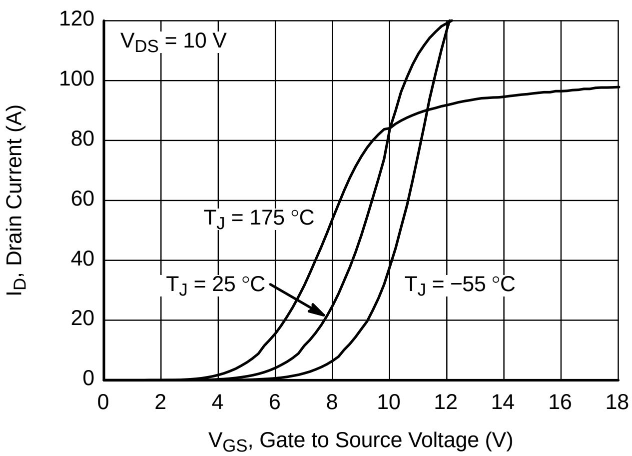


Figure 5. Transfer Characteristics

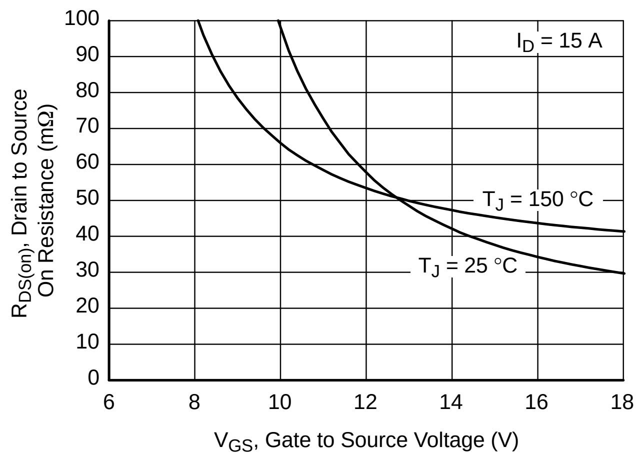


Figure 6. On-Resistance vs. Gate Voltage

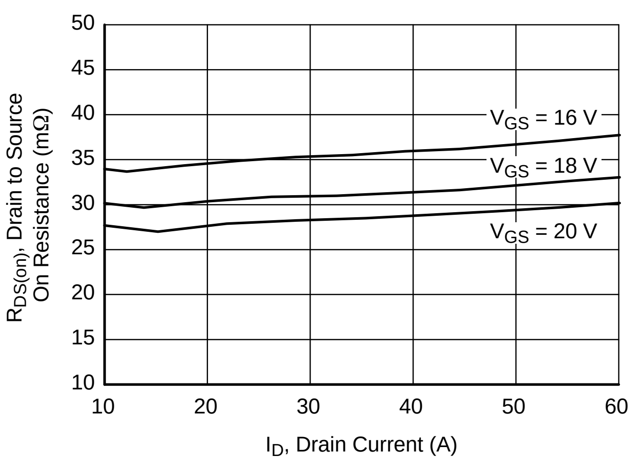


Figure 7. On-Resistance vs. Drain Current

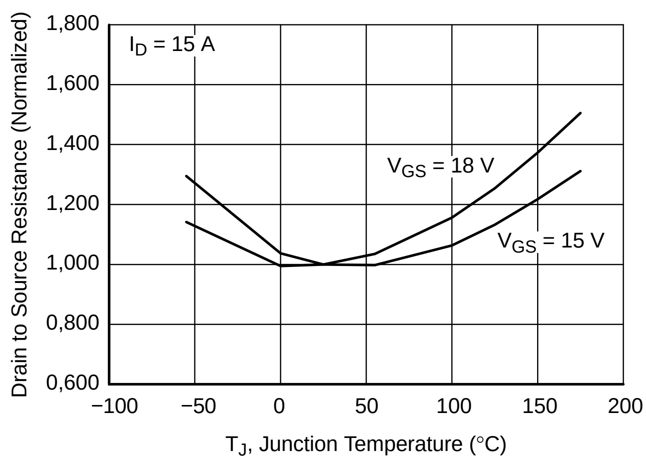


Figure 8. On-Resistance vs. Junction Temperature

TYPICAL CHARACTERISTICS (CONTINUED)

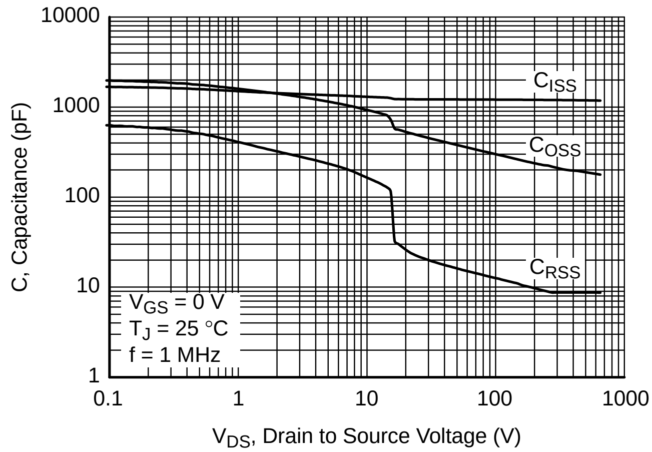


Figure 9. Capacitance Characteristics

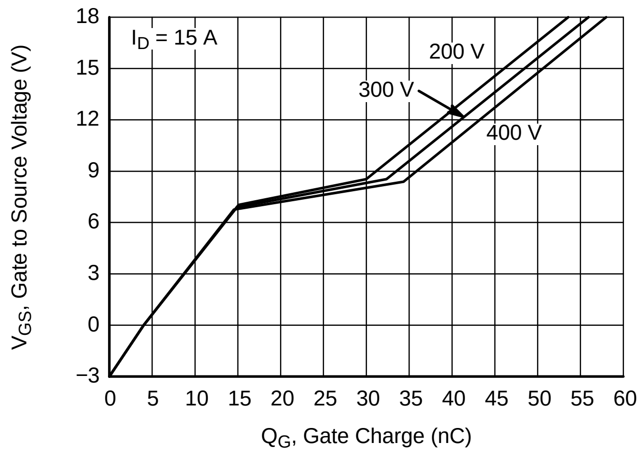


Figure 10. Gate Charge Characteristics

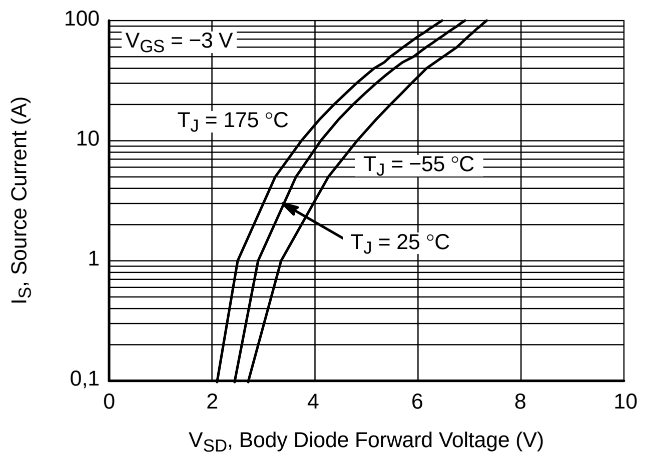


Figure 11. Reverse Conduction Characteristics

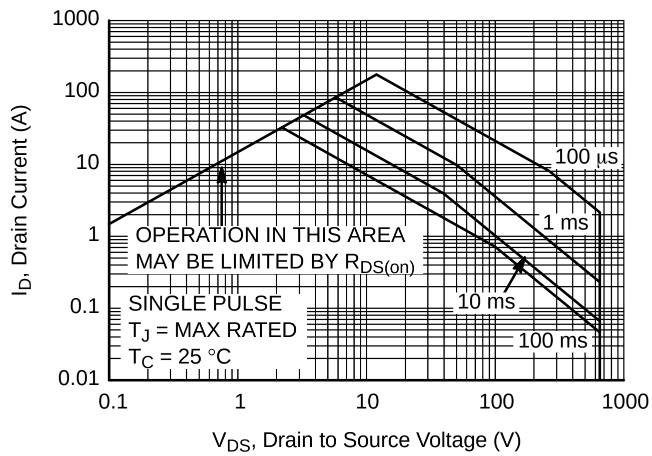


Figure 12. Safe Operating Area

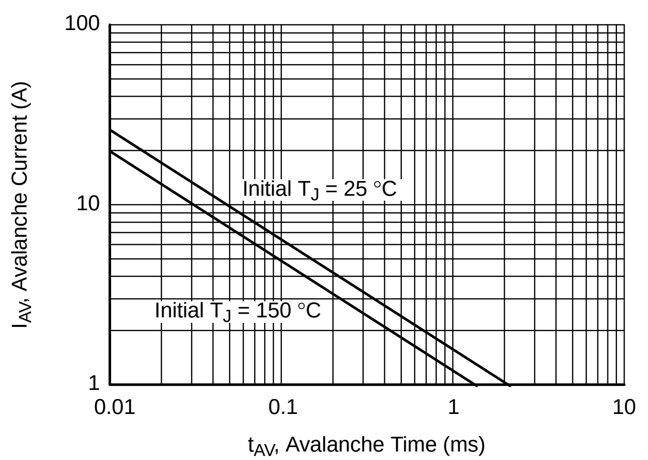


Figure 13. Avalanche Current vs. Pulse Time (UIS)

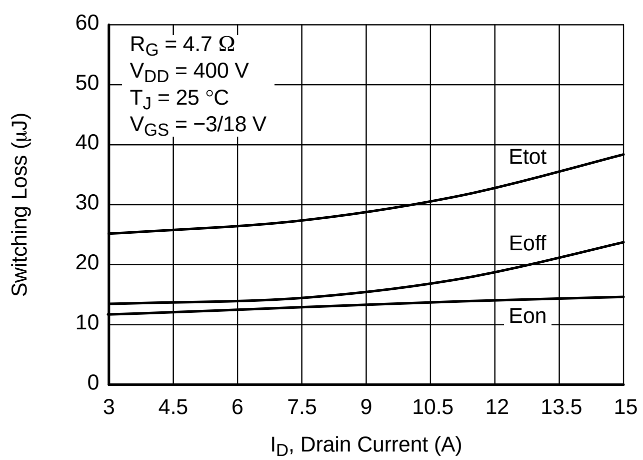


Figure 14. Inductive Switching Loss vs. Drain Current

TYPICAL CHARACTERISTICS (CONTINUED)

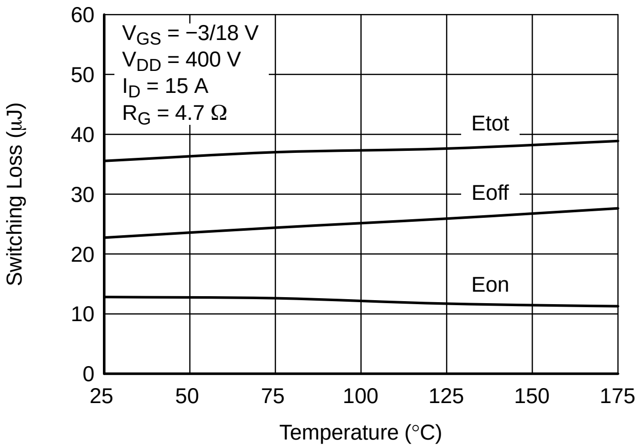


Figure 15. Inductive Switching Loss vs. T_J

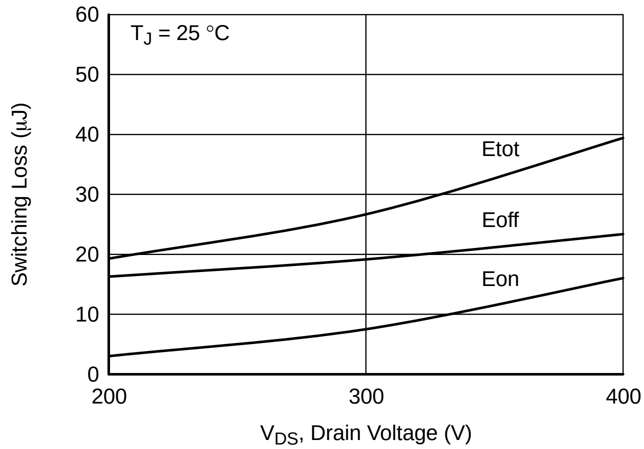


Figure 16. Inductive Switching Loss vs. Drain Voltage

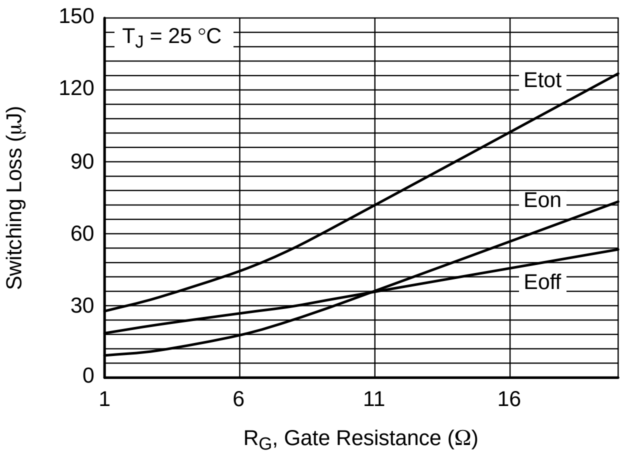


Figure 17. Inductive Switching Loss vs. Gate Resistance

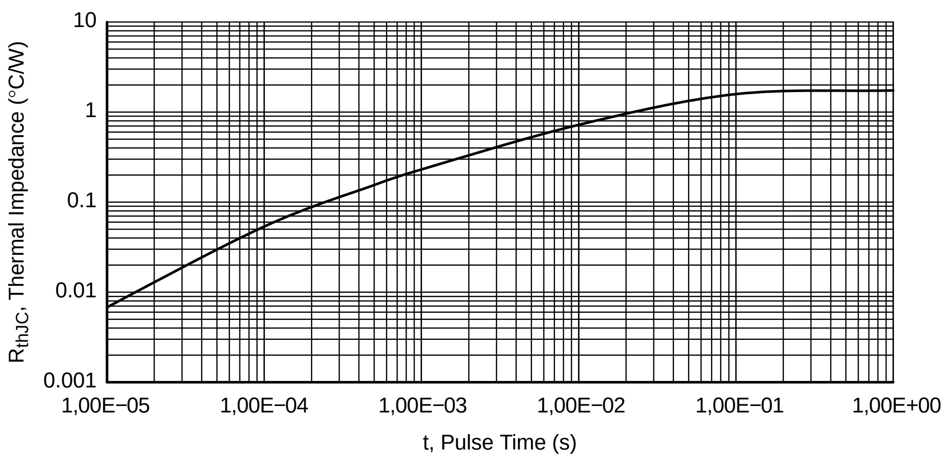
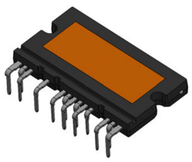
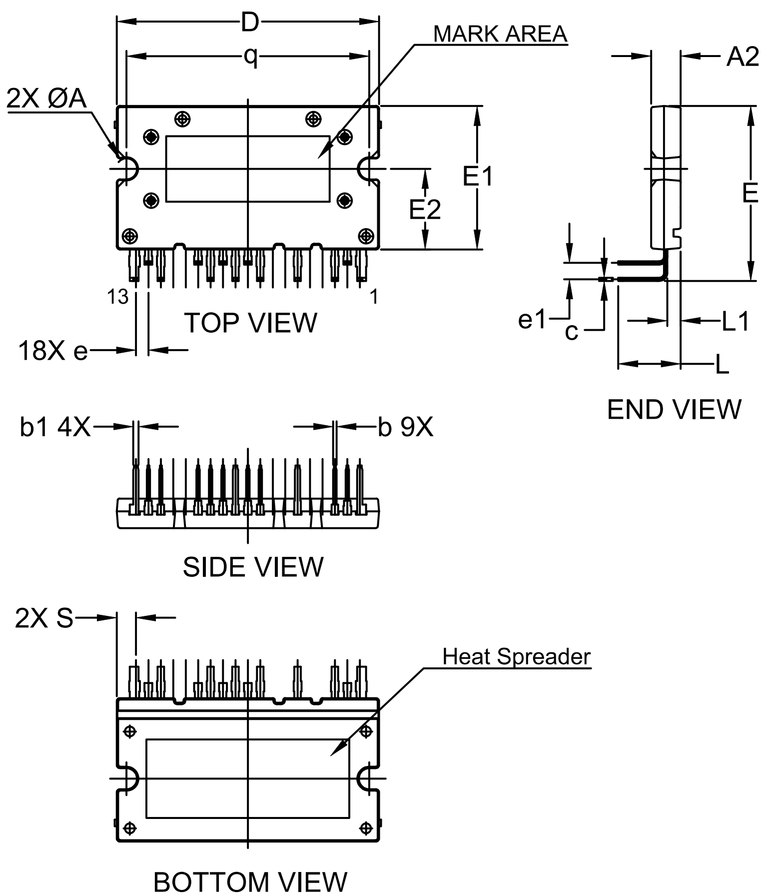


Figure 18. Thermal Response Characteristics



AUTOMOTIVE POWER MODULE16 40.10x21.90x4.50, 1.90P
CASE 829AA
ISSUE O

DATE 21 JAN 2025



NOTES:

1. DIMENSIONING AND TOLERANCING PER. ASME Y14.5M, 2018.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A2	4.30	4.50	4.70
b	0.45	0.50	0.60
b1	0.75	0.80	0.90
c	0.45	0.50	0.60
D	39.90	40.10	40.30
E	26.20	26.70	27.20
E1	21.70	21.90	22.10
E2	12.10	12.30	12.50
e	1.60	1.90	2.20
e1	2.20	2.50	2.80
L	9.20	9.55	9.90
L1	1.80	2.05	2.30
q	36.85	37.10	37.35
S	2.95 REF		
ØA	3.00	3.20	3.40

GENERIC MARKING DIAGRAM*

XXXXXXXXXXXXXXXXX
ZZZ ATYWW
NNNNNNN

XXXX = Specific Device Code
ZZZ = Lot ID
AT = Assembly & Test Location
Y = Year
WW = Work Week
NNN = Serial Number

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.

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DESCRIPTION:	**AUTOMOTIVE POWER MODULE16 40.10x21.90x4.50, 1.90P**	**PAGE 1 OF 1**

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