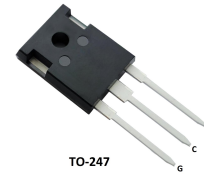


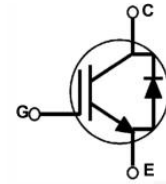
Features

- Low gate charge
- Trench FS Technology
- Saturation Voltage:
 $V_{CE(sat)} = 2.0V @ I_C = 40 A$
- RoHS Complaint



Applications

- General purpose inverters
- Welding
- UPS



Absolute Maximum Ratings

Parameter		Symbol	Value	Unit
Collector to Emitter Voltage		V_{CES}	1200	V
Gate to Emitter Voltage		V_{GES}	± 20	
Turn-off safe area		-	160	A
Collector Current	$T_C = 25^\circ C$	I_C	80	
	$T_C = 100^\circ C$		40	
Pulsed Collector Current $T_C = 25^\circ C^*$		I_{CM}	160	
Diode forward current	$T_C = 25^\circ C$	I_F	80	
	$T_C = 100^\circ C$		40	
Surge non repetitive forward current $t_p = 10$ ms sinusoidal		I_{FSM}	160	
Maximum Power Dissipation $T_C = 25^\circ C$		P_D	568	W
Operating Junction Temperature		T_J	-55 to 175	$^\circ C$
Storage Temperature Range		T_{stg}	-55 to 175	
Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds		T_L	300	

*Collector current limited by maximum junction temperature

Electrical Characteristics $T_C = 25^\circ C$ unless otherwise noted

Parameter	Symbol	Test Conditions	Min	Type	Max	Unit
On/off Characteristics						
Collector to Emitter Breakdown Voltage	BV_{CES}	$V_{GE} = 0V, I_C = 250\mu A$	1200	-	-	V
Breakdown Voltage Temperature Coefficient	$\Delta BV_{CES} / \Delta T_J$	$I_C = 0.5mA$, referenced to $25^\circ C$	-	0.6	-	$V/^\circ C$

Zero Gate Voltage Collector Current	I_{CES}	$V_{CE}=1200V, V_{GE}=0V,$ $T_C=25^{\circ}C$	-	-	0.2	mA
Zero Gate Voltage Collector Current		$V_{CE}=1200V, V_{GE}=0V,$ $T_C=125^{\circ}C$	-	-	2	
Gate-body leakage current, forward	I_{GESF}	$V_{CE}=0V, V_{GE} =20V$	-	-	200	nA
Gate-body leakage current, reverse	I_{GESR}	$V_{CE}=0V, V_{GE} =-20V$	-	-	-200	nA
On-Characteristics						
Gate Threshold Voltage	V_{TH}	$V_{CE} =V_{GE} , I_C=250\mu A$	4.5	-	6.5	V
Collector-Emitter saturation Voltage	$V_{CE(sat)}$	$V_{GE}=15V I_C=40A$ $T_C=25^{\circ}C$	-	2	3	V
Dynamic Characteristics						
Input Capacitance	C_{ies}	$V_{CE} = 25V, V_{GE} = 0V$ $f = 1MHz$	-	3626	-	pF
Output Capacitance	C_{oes}		-	232	-	
Reverse Transfer Capacitance	C_{res}		-	74	-	
Total Gate Charge	Q_g	$V_{CC} = 960V, I_C = 40A,$ $V_{GE} = 15V$	-	147.7	-	nC
Gate to Emitter Charge	Q_{ge}		-	36.1	-	
Gate to Collector Charge	Q_{gc}		-	65.2	-	
Gate resistance	R_g	$f=1\text{ MHz, open}$ collector	-	2.1	-	Ω
short current	I_{sc}	$V_{GE}=15V V_{CE}=600V$ $t_{sc}\leq 5\mu s$	-	260	-	A
Switching Characteristics						
Turn-On Delay Time	$t_{d(on)}$	$V_{CC} = 600V, I_C = 40A,$ $R_G = 12\Omega, V_{GE} = 15V,$ $T_C=25^{\circ}C$	-	42	-	ns
Rise Time	t_r		-	70	-	
Turn-Off Delay Tim	$t_{d(off)}$		-	180	-	
Fall Time	t_f		-	84	-	
Turn-On energy	E_{on}		-	1.43	-	mJ
Turn-off energy	E_{off}		-	1.48	-	
Total switching energy	E_{tot}		-	2.91	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{CC} = 600V, I_C = 40A,$ $R_G = 12\Omega, V_{GE} = 15V,$ $T_C=125^{\circ}C$	-	38	-	ns
Rise Time	t_r		-	70	-	
Turn-Off Delay Tim	$t_{d(off)}$		-	220	-	
Fall Time	t_f		-	164	-	
Turn-On energy	E_{on}		-	1.63	-	mJ

Turn-off energy	E_{off}		-	2.08	-	
Total switching energy	E_{tot}		-	3.71	-	

Electrical Characteristics of the Diode $T_C = 25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Test Conditions	Min	Type	Max	Unit
Diode Forward Voltage	V_{FM}	$I_F = 40\text{A}$	-	2.8	3.8	V
Diode Reverse Recovery Time	t_{rr}	$I_F = 30\text{A}$, $V_R = 200\text{V}$ $di_F/dt = 200\text{A}/\mu\text{s}$ $T_J = 25^\circ\text{C}$	-	43	-	ns
Diode Peak Reverse Recovery Current	I_{rr}		-	3.3	-	A
Diode Reverse Recovery Charge	Q_{rr}		-	79	-	nC
Diode Reverse Recovery Time	t_{rr}	$I_F = 30\text{A}$ $V_R = 200\text{V}$ $di_F/dt = 200\text{A}/\mu\text{s}$ $T_J = 125^\circ\text{C}$	-	207	-	ns
Diode Peak Reverse Recovery Current	I_{rr}		-	6.2	-	A
Diode Reverse Recovery Charge	Q_{rr}		-	583	-	nC

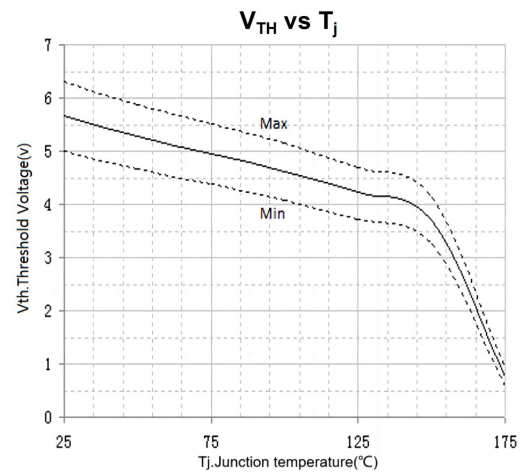
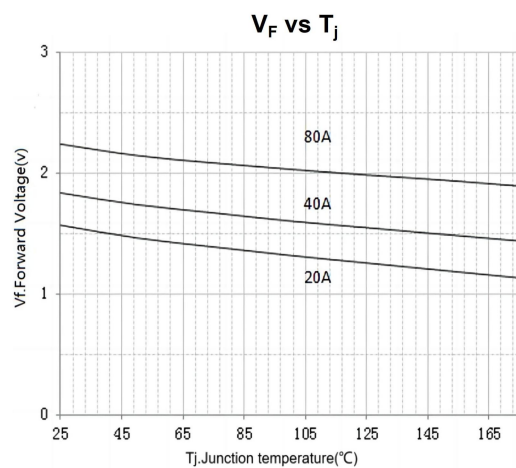
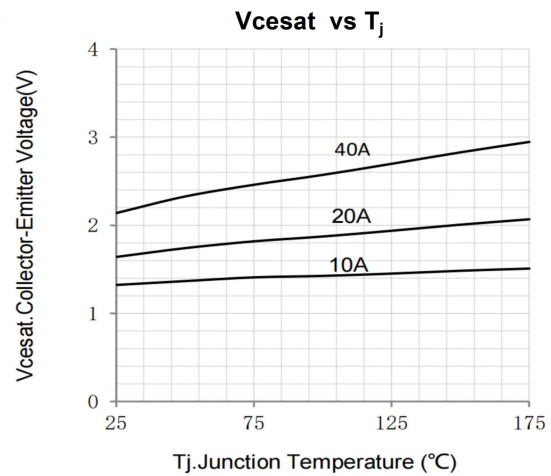
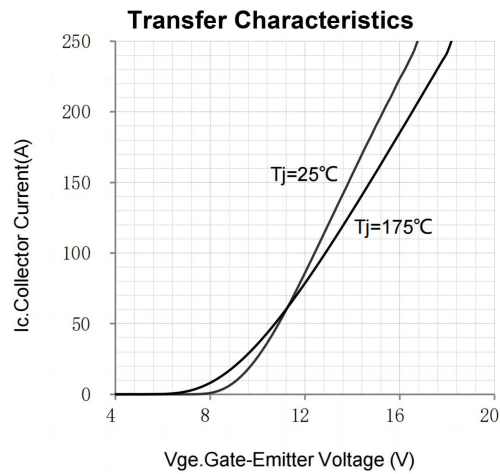
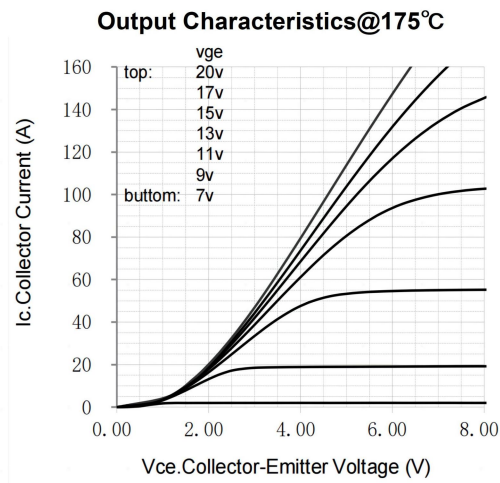
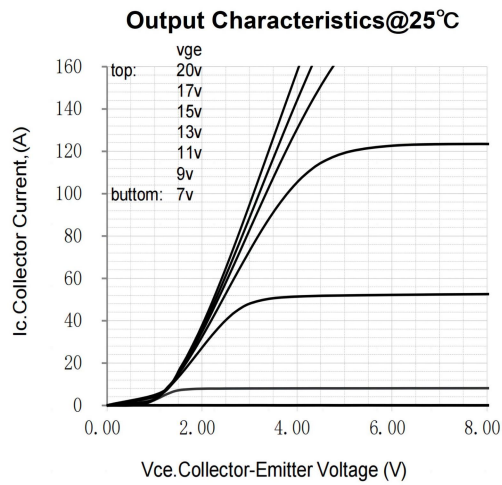
Thermal Characteristics

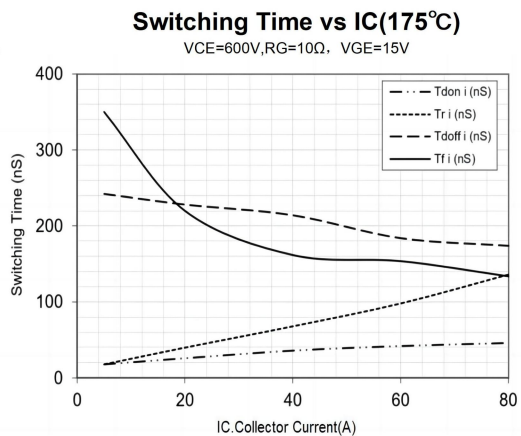
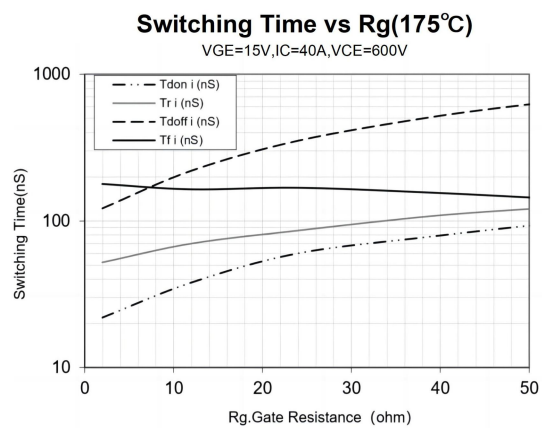
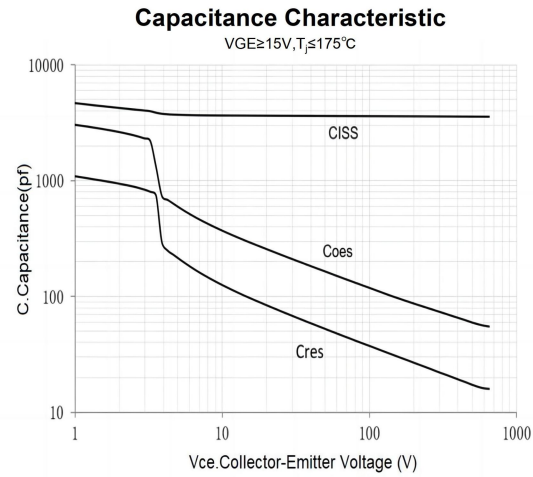
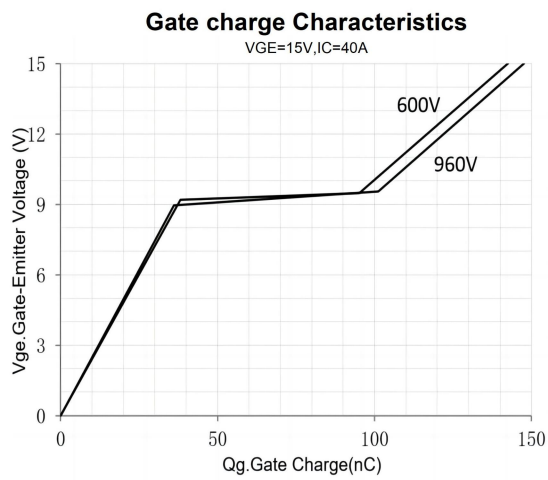
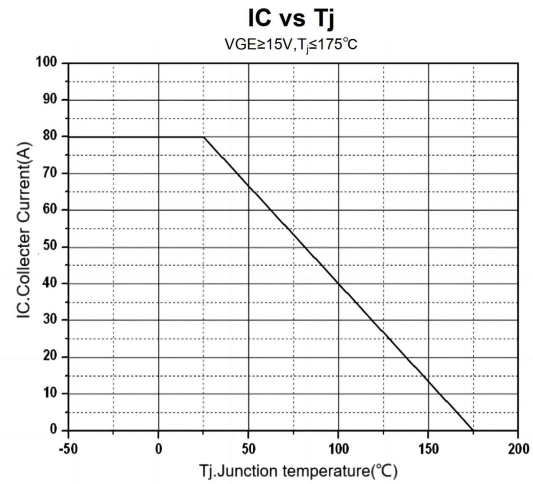
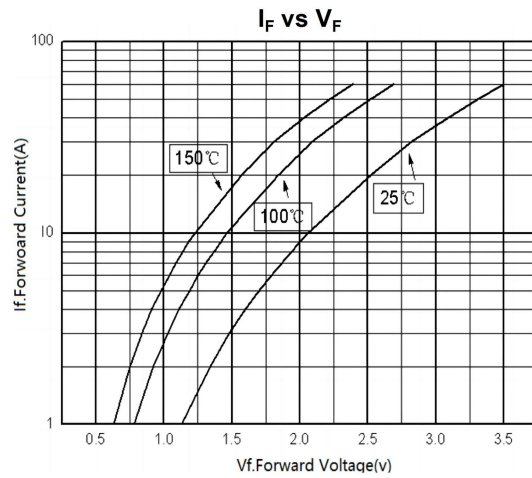
Parameter	Symbol	Typ	Unit
Thermal Resistance, Junction to Case IGBT	$R_{\theta JC_IGBT}$	0.22	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Case FRD	$R_{\theta JC_FRD}$	0.58	
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	40	

Package Marking and Ordering Information

Device Marking	Device	Package
MSG40T120FQC	MSG40T120FQC	TO-247

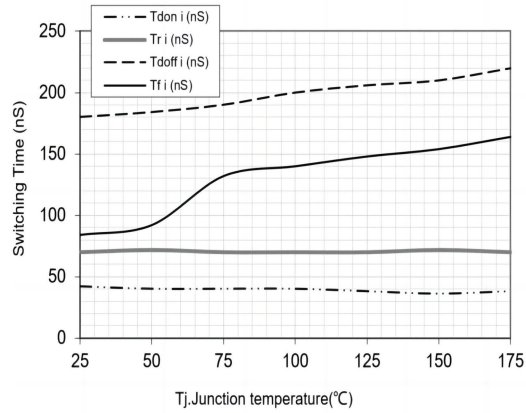
Typical Performance Characteristics





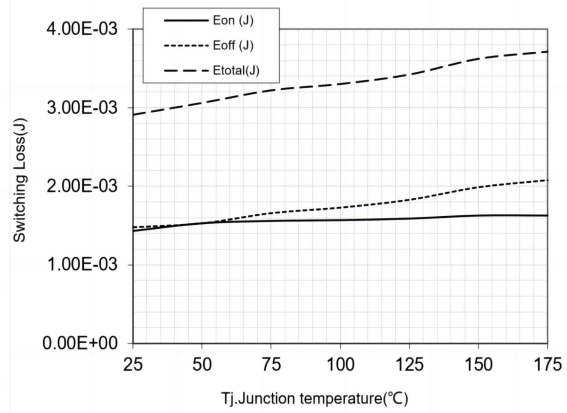
Switching Time vs Tj

VGE=15V, IC=40A, VCE=600V, Rg=12Ω



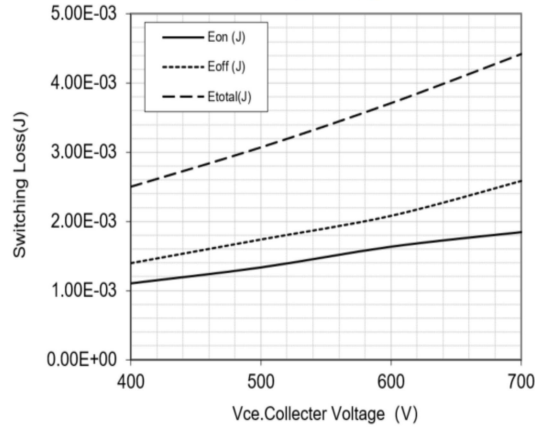
Switching Loss vs Tj

VCE=600V, VGE=15V, IC=40A, Rg=12Ω



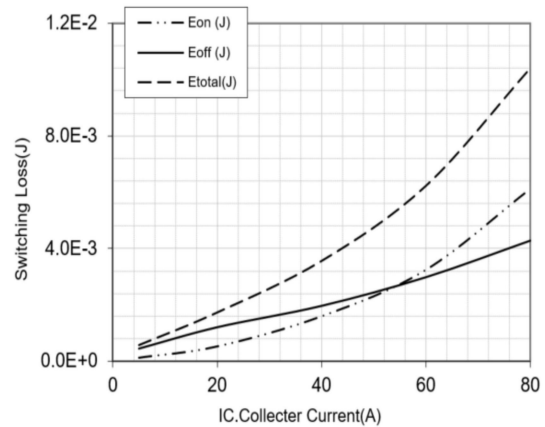
Switching Loss vs VCE(175°C)

VGE=15V, IC=40A, Rg=12Ω



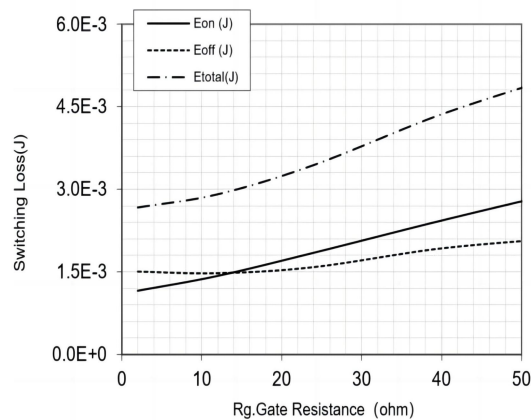
Switching Loss vs IC(175°C)

VCE=600V, VGE=15V, Rg=12Ω



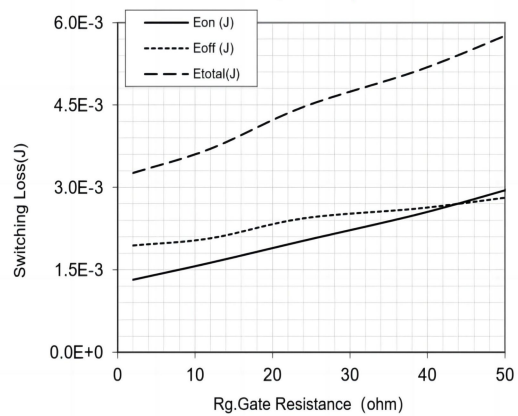
Switching Loss vs Rg(25°C)

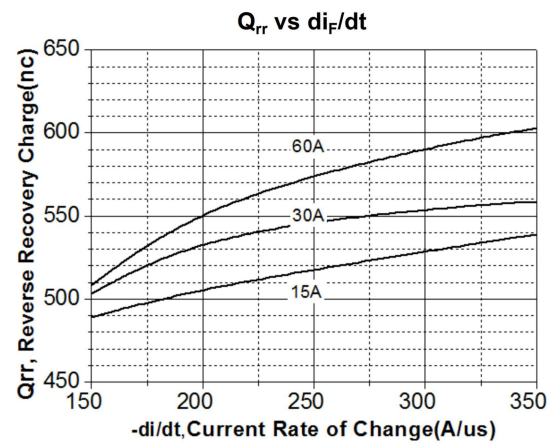
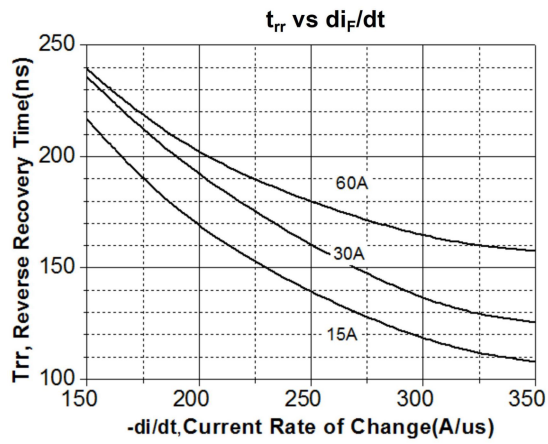
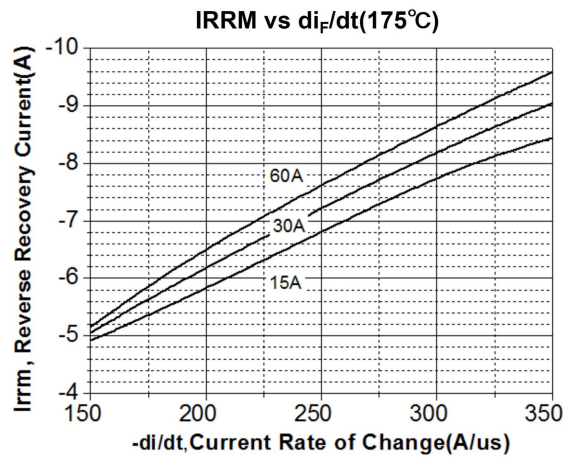
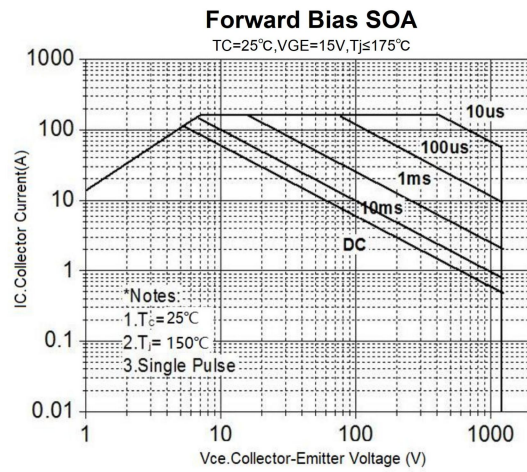
VGE=15V, IC=40A, VCE=600V



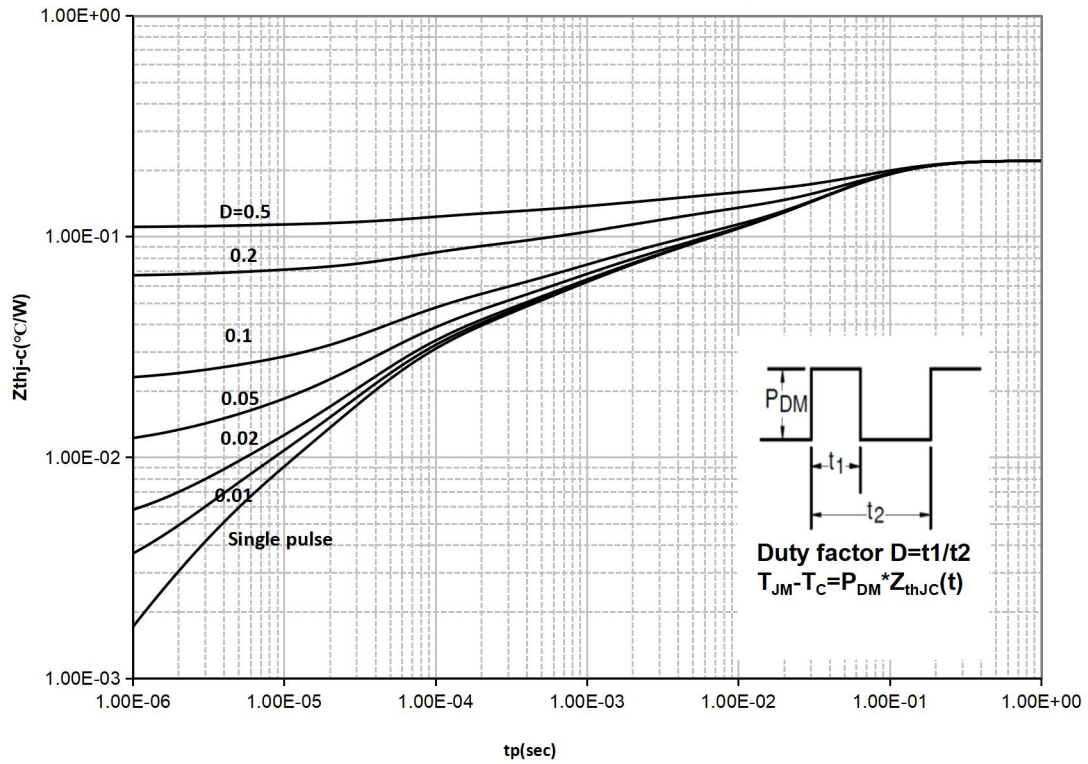
Switching Loss vs Rg(175°C)

VCE=600V, VGE=15V, IC=40A

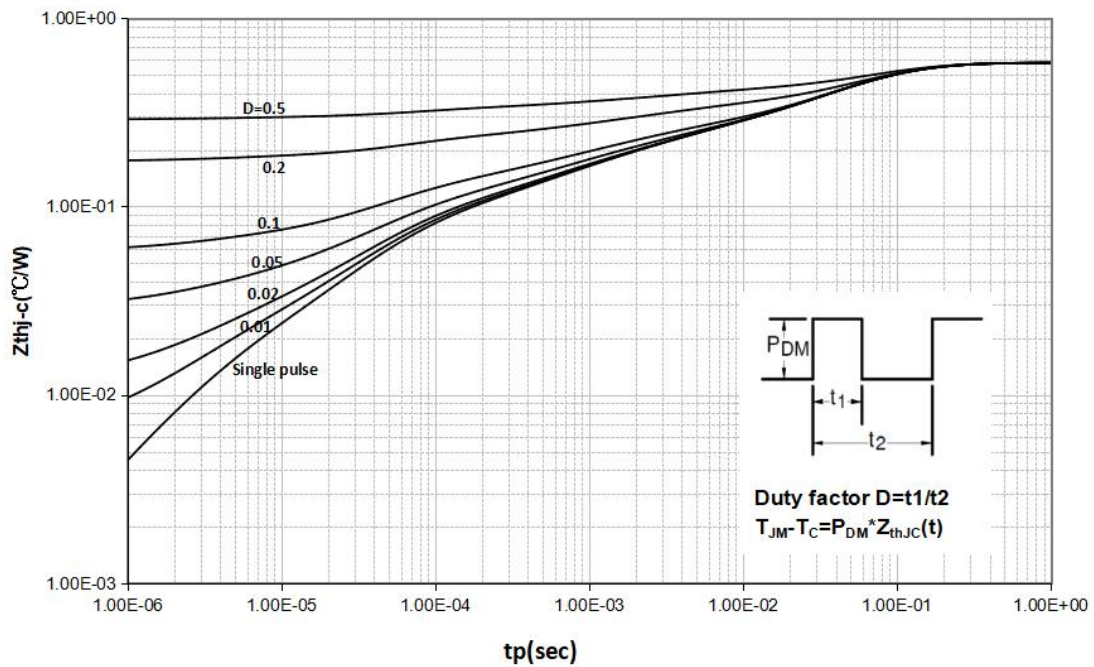




Normalized Maximum Transient Thermal Impedance for IGBT



Normalized Maximum Transient Thermal Impedance for FRD



Package outline dimension

