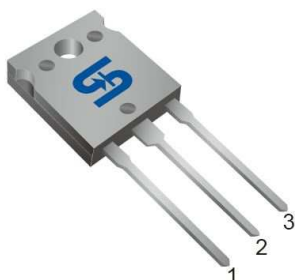


TO-264



Pin Definition:

1. Gate
2. Collector
3. Emitter

### PRODUCT SUMMARY

$V_{CES}$ (V)	$V_{GES}$ (V)	$I_C$ (A)
1000	$\pm 20$	60

### General Description

The TSG60N100CE using proprietary trench design and advanced NPT technology, the 1000V NPT IGBT offers superior conduction and switching performances, high avalanche ruggedness and easy parallel operation. This device is well suited for the resonant or soft switching application such as induction heating, microwave oven, etc.

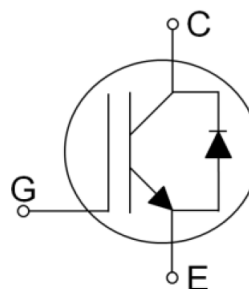
### Features

- 1000V NPT Trench Technology
- High Speed Switching
- Low Conduction Loss

### Ordering Information

Part No.	Package	Packing
TSG60N100CE C0	TO-264	25pcs / Tube

### Block Diagram



NPT Trench IGBT

### Absolute Maximum Rating ( $T_A=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Limit	Unit	
Collector-Emitter Voltage	$V_{CES}$	1000	V	
Gate-Emitter Voltage	$V_{GES}$	$\pm 20$	V	
Continuous Current	$I_C$	$T_C=25^\circ\text{C}$	60	A
		$T_C=100^\circ\text{C}$	42	A
Pulsed Collector Current *	$I_{CM}$	200	A	
Diode Continuous Forward Current ( $T_C=100^\circ\text{C}$ )	$I_F$	15	A	
Max Power Dissipation	$P_D$	$T_J=25^\circ\text{C}$	208	W
		$T_J=100^\circ\text{C}$	83	
Operating Junction Temperature	$T_J$	-55 to +150	$^\circ\text{C}$	
Storage Temperature Range	$T_{STG}$	-55 to +150	$^\circ\text{C}$	

\* Repetitive rating: Pulse width limited by max. junction temperature

### Thermal Performance

Parameter	Symbol	Limit	Unit
Thermal Resistance - Junction to Case	IGBT	0.6	°C/W
	DIODE	2.2	
Thermal Resistance - Junction to Ambient	$R\theta_{JA}$	25	

### Electrical Specifications (T<sub>C</sub>=25°C unless otherwise noted)

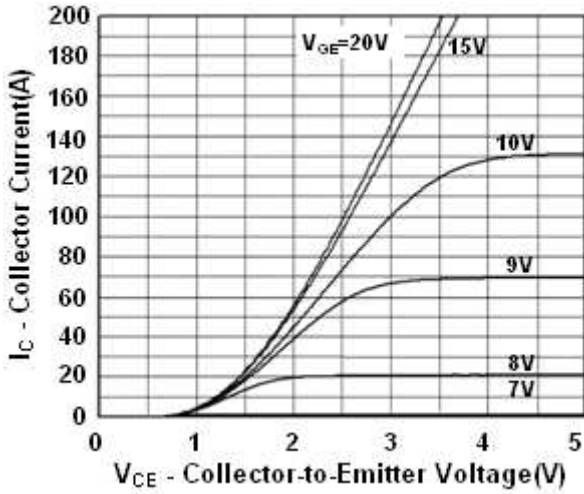
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
<b>Static</b>						
Collector-Emitter Breakdown Voltage	V <sub>GE</sub> = 0V, I <sub>C</sub> = 1mA	BV <sub>CES</sub>	1000	--	--	V
Zero Gate Voltage Collector Current	V <sub>CE</sub> = 1000V, V <sub>GE</sub> = 0V	I <sub>CES</sub>	--	--	1	mA
Gate-Emitter Leakage Current	V <sub>GE</sub> = 20V, V <sub>CE</sub> = 0V	I <sub>GES</sub>	--	--	±250	nA
Gate-Emitter Threshold Voltage	V <sub>GE</sub> = V <sub>CE</sub> , I <sub>C</sub> = 60mA	V <sub>GE(TH)</sub>	3.5	5.5	7.5	V
Collector-Emitter Saturation Voltage	V <sub>GE</sub> = 15V, I <sub>C</sub> = 60A, T <sub>J</sub> = 25°C	V <sub>CE(SAT)</sub>	--	2.1	2.5	V
	V <sub>GE</sub> = 15V, I <sub>C</sub> = 60A, T <sub>J</sub> = 125°C	V <sub>CE(SAT)</sub>	--	2.6	--	V
<b>Dynamic</b>						
Input Capacitance	V <sub>CE</sub> = 30V, V <sub>GE</sub> = 0V, f = 1.0MHz	C <sub>IES</sub>	--	5600	--	pF
Output Capacitance		C <sub>OES</sub>	--	150	--	
Reverse Transfer Capacitance		C <sub>RES</sub>	--	115	--	
<b>Switching</b>						
Turn-On Delay Time	V <sub>CC</sub> = 600V, I <sub>C</sub> = 60A, R <sub>G</sub> = 10Ω, V <sub>GE</sub> = 15V Inductive Load, T <sub>J</sub> = 25°C	t <sub>d(on)</sub>	--	230	--	nS
Rise Time		t <sub>r</sub>	--	210	--	
Turn-Off Delay Time		t <sub>d(off)</sub>	--	1250	--	
Fall Time		t <sub>f</sub>	--	120	230	mJ
Turn-On Switching Loss		E <sub>on</sub>	--	14.5	22	
Turn-Off Switching Loss		E <sub>off</sub>	--	7.0	11	
Total Switching Loss	E <sub>ts</sub>	--	21.5	33		
Turn-On Delay Time	V <sub>CC</sub> = 600V, I <sub>C</sub> = 60A, R <sub>G</sub> = 10Ω, V <sub>GE</sub> = 15V Inductive Load, T <sub>J</sub> = 125°C	t <sub>d(on)</sub>	--	210	--	nS
Rise Time		t <sub>r</sub>	--	260	--	
Turn-Off Delay Time		t <sub>d(off)</sub>	--	1350	--	
Fall Time		t <sub>f</sub>	--	160	--	mJ
Turn-On Switching Loss		E <sub>on</sub>	--	16	24	
Turn-Off Switching Loss		E <sub>off</sub>	--	8.0	12	
Total Switching Loss	E <sub>ts</sub>	--	24	36		
Total Gate Charge	V <sub>CC</sub> = 600V, I <sub>C</sub> = 60A, V <sub>GE</sub> = 15V	Q <sub>g</sub>	--	270	405	nC
Gate-Emitter Charge		Q <sub>ge</sub>	--	45	68	
Gate-Collector Charge		Q <sub>gc</sub>	--	100	150	

**Electrical Specifications of the DIODE** ( $T_c=25^\circ\text{C}$  unless otherwise noted)

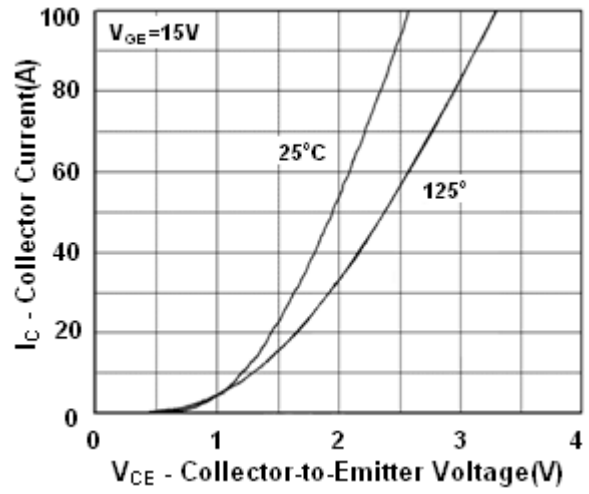
Parameter	Conditions		Symbol	Min	Typ	Max	Unit
Diode Forward Voltage	$I_F = 60\text{A}$ ,	$T_J=25^\circ\text{C}$	$V_{FM}$	--	2.9	3.4	V
		$T_J=125^\circ\text{C}$		--	3.3	--	V
Reverse Recovery Time	$I_F = 60\text{A}$ , $di/dt=200\text{A}/\mu\text{s}$	$T_J=25^\circ\text{C}$	$t_{fr}$	--	310	465	ns
		$T_J=125^\circ\text{C}$		--	320	--	
Reverse Recovery Current		$T_J=25^\circ\text{C}$	$I_{fr}$	--	34	51	A
		$T_J=125^\circ\text{C}$		--	35	--	
Reverse Recovery Charge		$T_J=25^\circ\text{C}$	$Q_{fr}$	--	5270	7900	nC
		$T_J=125^\circ\text{C}$		--	5600	--	

**Electrical Characteristics Curve** ( $T_c = 25^\circ\text{C}$ , unless otherwise noted)

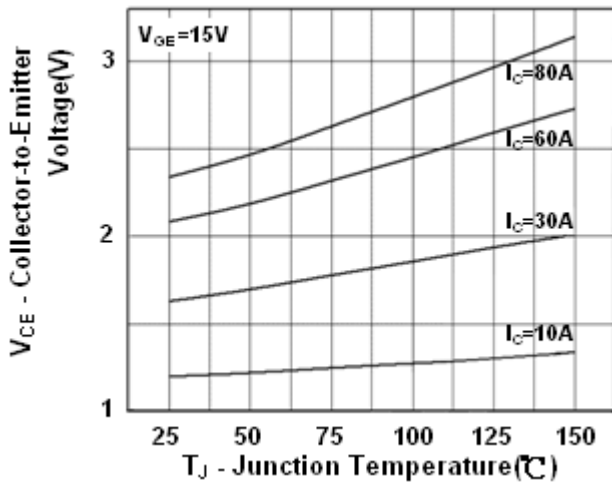
**Output Characteristics**



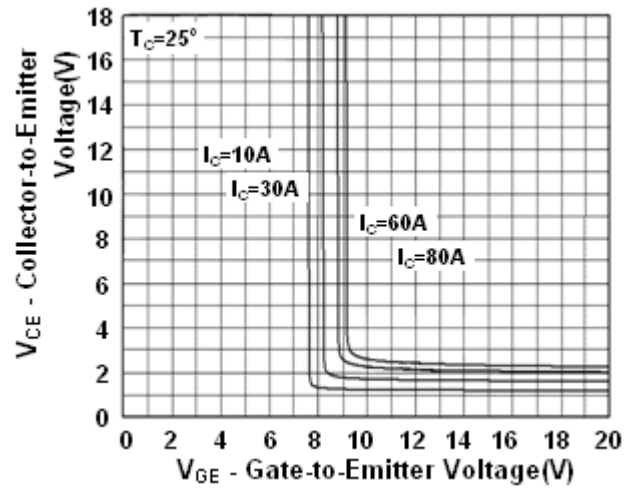
**Saturation voltage characteristics**



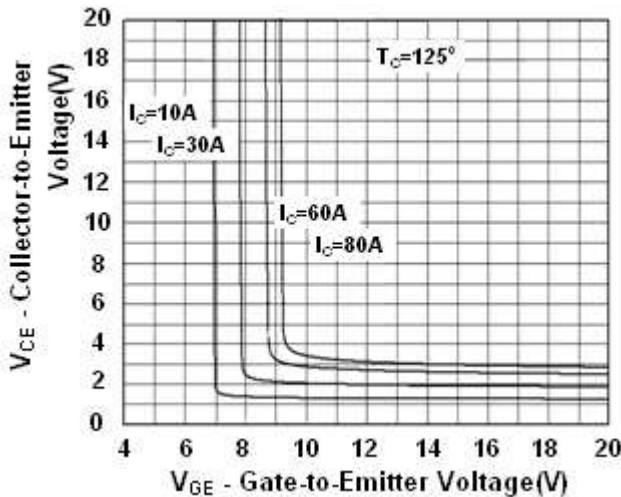
**Saturation voltage vs. collector current**



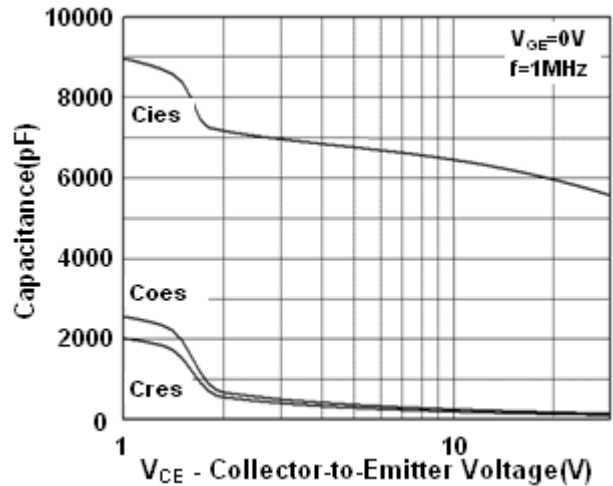
**Saturation voltage vs. gate bias**



**Saturation voltage vs. gate bias**

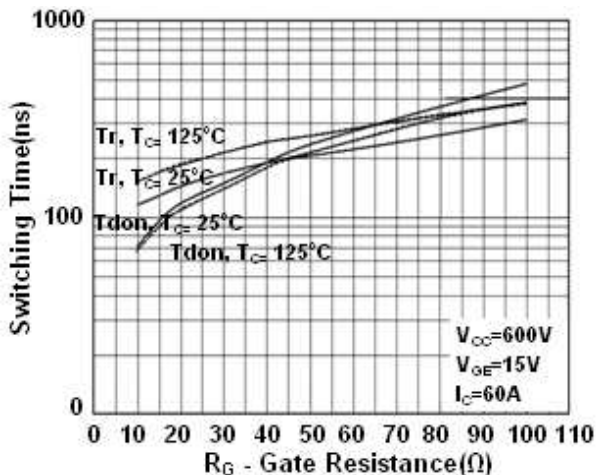


**Capacitance characteristics**

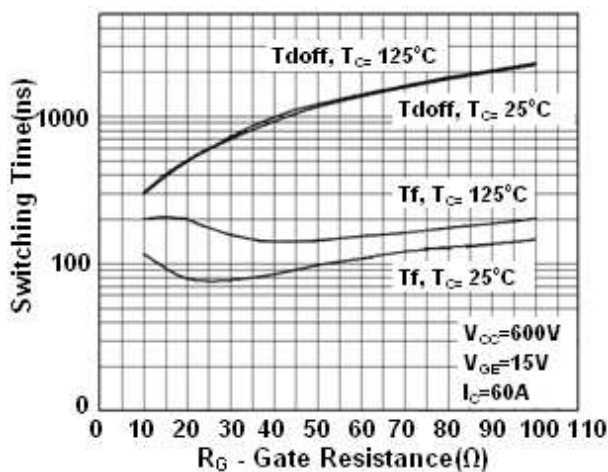


**Electrical Characteristics Curve** ( $T_a = 25^\circ\text{C}$ , unless otherwise noted)

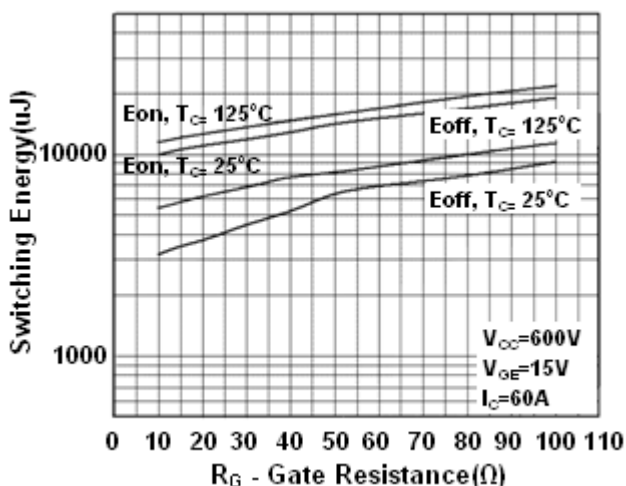
Turn on time vs. gate resistance



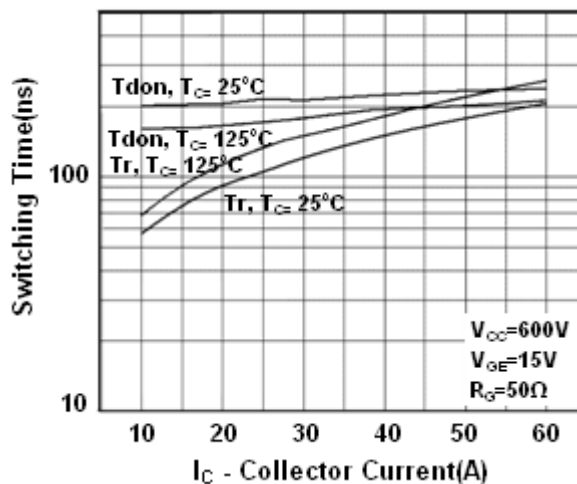
Turn off time vs. gate resistance



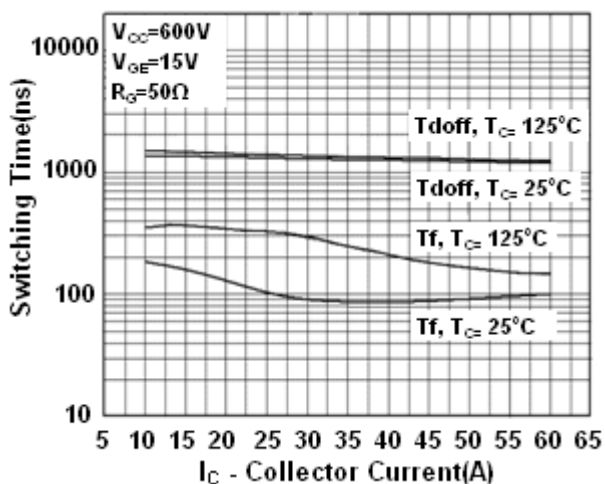
Switching loss vs. gate resistance



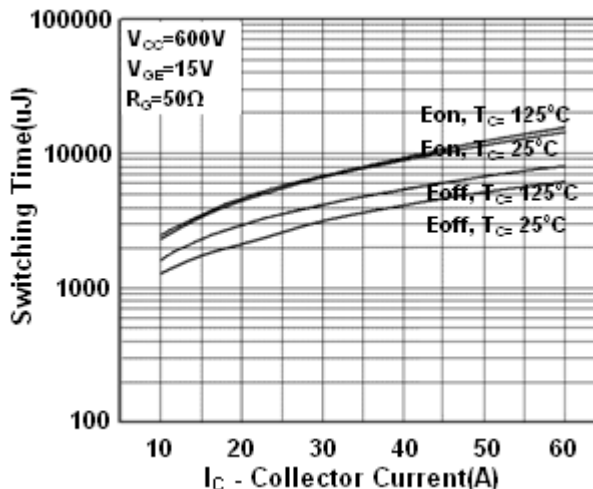
Turn on time vs. collector current



Turn off time vs. collector current

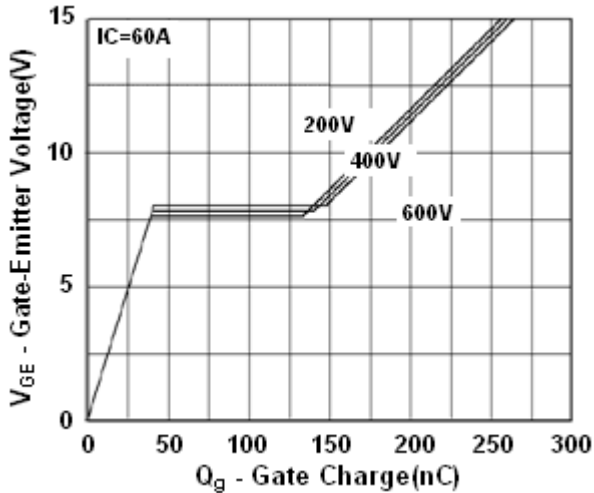


Switching loss vs. collector current

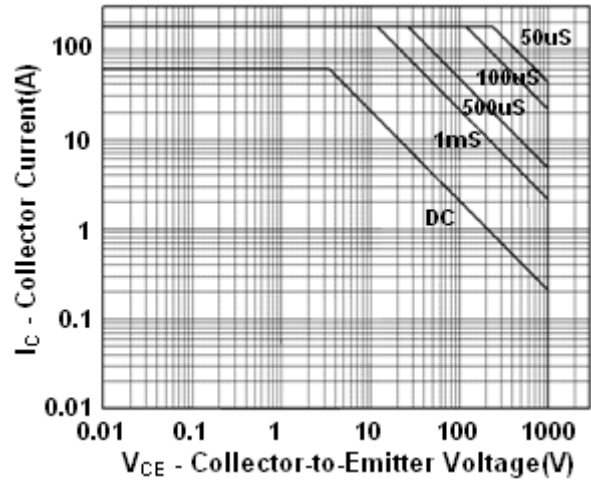


**Electrical Characteristics Curve** ( $T_c = 25^\circ\text{C}$ , unless otherwise noted)

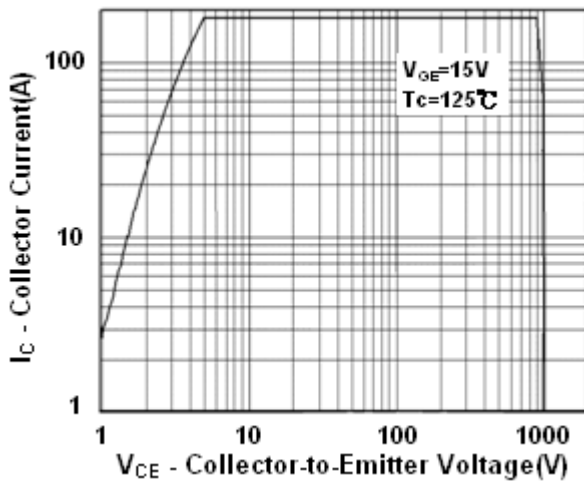
**Gate charge characteristics**



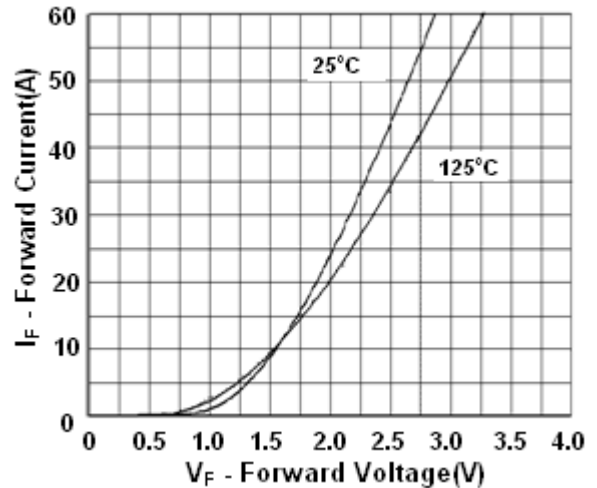
**SOA Characteristics**



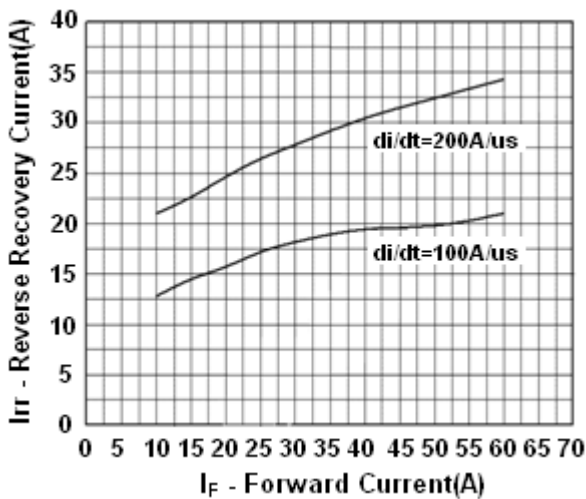
**RBSOA**



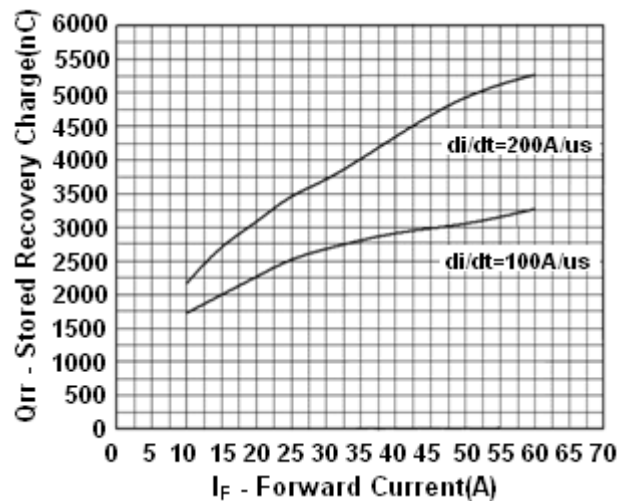
**Conduction characteristics**



**Reverse recovery current vs. forward current**



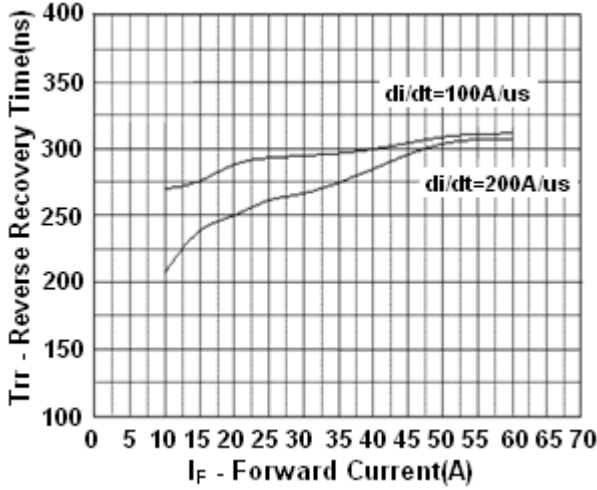
**Stored recovery charge vs. forward current**



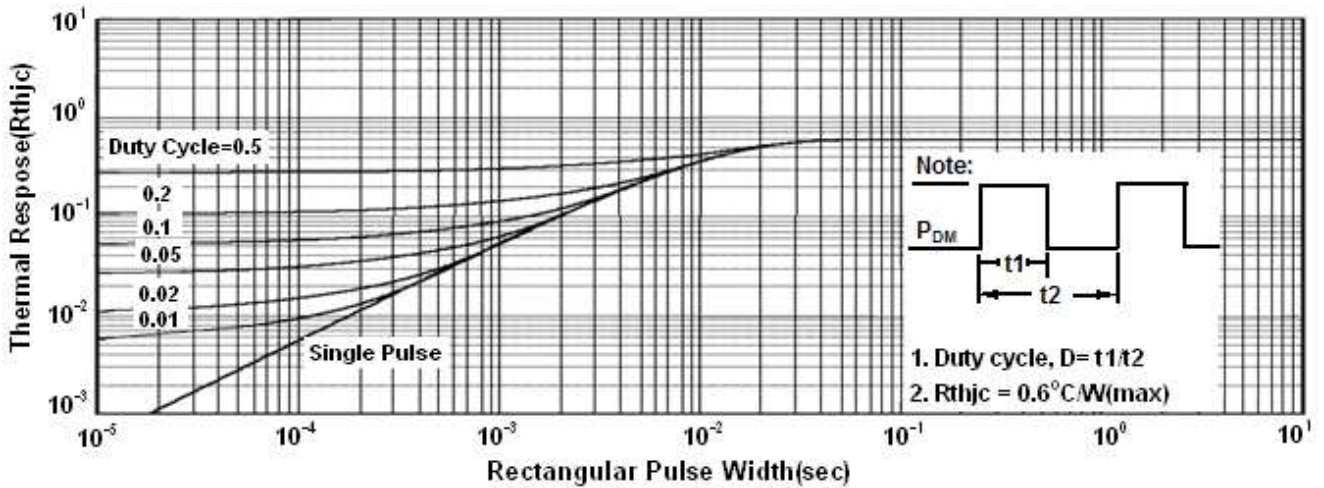


**Electrical Characteristics Curve** ( $T_a = 25^\circ\text{C}$ , unless otherwise noted)

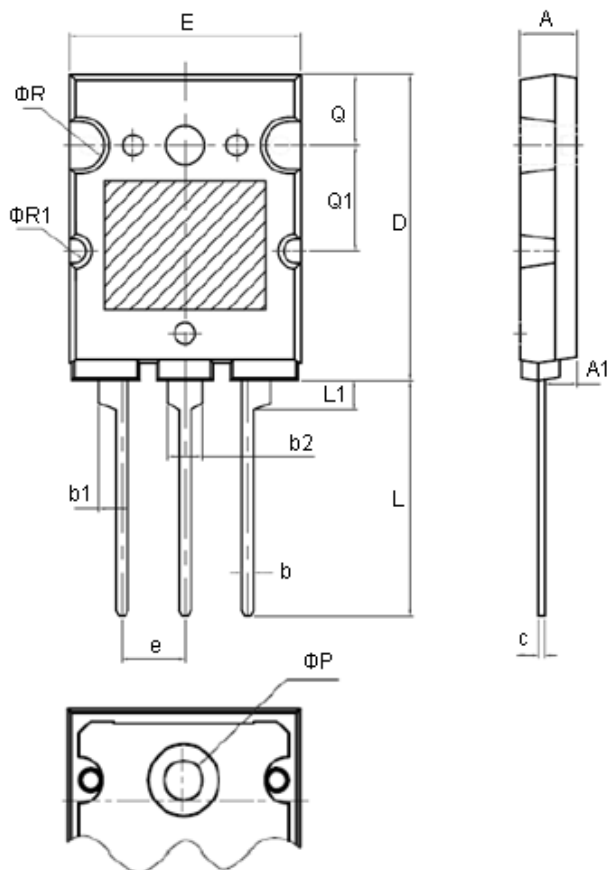
Reverse recovery time vs. forward current



Normalized Thermal Transient Impedance, Junction-to-Ambient



**TO-264 Mechanical Drawing**



TO-264 DIMENSION						
DIM	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	4.8	5.0	5.2	0.189	0.197	0.205
A1	2.5	2.8	3.1	0.098	0.110	0.122
b	0.90	1.00	1.25	0.035	0.039	0.049
b1	2.3	2.5	2.7	0.091	0.098	0.106
b2	2.8	3.0	3.2	0.110	0.118	0.126
c	0.50	0.60	0.85	0.020	0.024	0.033
D	25.58	26.09	26.59	1.007	1.027	1.047
E	19.30	19.81	20.29	0.760	0.780	0.799
e	5.15	5.45	5.75	0.203	0.215	0.226
L	19.5	20.0	20.5	0.768	0.787	0.807
L1	2.4	2.5	2.6	0.094	0.098	0.102
$\Phi P$	3.10	3.30	3.51	0.122	0.130	0.138
Q	5.8	6.0	6.2	0.228	0.236	0.244
Q1	8.8	9.0	9.2	0.346	0.354	0.362
$\Phi R$	--	2.0	--	--	0.079	--
$\Phi R1$	--	1.0	--	--	0.039	--



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